

BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF APPROVING THE ) RESOLUTION NO. 13-4483  
ORENCO WOODS NATURE PARK MASTER )  
PLAN AND THE NAME OF THE ORENCO ) Introduced by Chief Operating Officer Martha  
WOODS NATURE PARK ) Bennett in concurrence with Council  
) President Tom Hughes

WHEREAS, at the general election held on November 7, 2006, the voters of the Metro region approved Ballot Measure 26-80, authorizing Metro to issue \$227.4 million of general obligation bonds to fund natural area acquisitions and water quality protection (the “Natural Areas Program”); and

WHEREAS, on September 6, 2007, the Metro Council adopted Resolution No. 07-3834, “Approving the Natural Areas Acquisition Refinement Plan for the Rock Creek Headwaters and Greenway Target Area,” and on November 17, 2011, the Council adopted Resolution No. 11-4297, “For the Purpose of Amending the Natural Areas Acquisition Refinement Plan in the Rock Creek Headwaters and Greenway Target Area, Authorizing the Chief Operating Officer to Acquire Land Subject to Unusual Circumstances, and Approval of an Intergovernmental Agreement with the City of Hillsboro”; and

WHEREAS, the foregoing actions authorized the joint acquisition by Metro and the City of Hillsboro of the 42-acre former Orenco Woods golf course and authorized the net proceeds from the sale of an approximate 11-acre portion of the property at the southeast corner to be used for the planning and development of a nature park on the remainder of the site; and

WHEREAS, on January 15, 2013, Metro and Hillsboro entered into an agreement with Polygon Northwest Company, LLC, as the potential buyer of the development parcel; and

WHEREAS, in August 2012, Hillsboro issued a Request for Proposals for a planning consultant to help master plan the future nature park, resulting in the commencement of the planning process for the new nature park; and

WHEREAS, several community outreach events regarding the future park have been held, Hillsboro formed of a Citizens Advisory Committee to assist with determining the program elements that were appropriate for the nature park as well as to provide feedback on conceptual design alternatives, and information on the master planning process has been posted on Hillsboro’s web site and sent out via email to those stakeholders asking to stay informed; and

WHEREAS, three well-attended open houses on the nature park master plan have been held, and at the final open house, there was significant public support for the current draft master plan attached as Exhibit A to this Resolution, which master plan includes the following goals and elements: (a) utilize context sensitive design to balance recreational opportunities with habitat protection, restoration and enhancement of the site’s natural areas; (b) creation of unique park that honors and respects the site’s natural, cultural and historical attributes and setting; (c) nature-related recreational experiences compatible with the nature park, and neighborhood park elements as appropriate; (d) welcoming park access that accommodates both community and neighborhood uses; (e) sustainable, low impact development principles; and (f) extension of the Rock Creek Trail through the site; and

WHEREAS, in June 2013, the Hillsboro Parks & Recreation Commission approved the draft master plan concept for the Orenco Woods Nature Park, and in a Metro Council work session on September 24, 2013, Metro staff gave an overview of the draft master plan; and

WHEREAS, there is no known opposition to the draft master plan; and

WHEREAS, the draft Orenco Woods Nature Park Master Plan meets the intent of the Natural Areas Program and the Rock Creek Headwaters and Greenway Target Area Refinement Plan; and

WHEREAS, the name of the future Orenco Woods Nature Park reflects the park's function and purpose as a nature park, and honors the history of the site, given that the name "Orenco" has significance in the local area as a composite of the initials of the former Oregon Nursery Company which owned the land; now therefore,

BE IT RESOLVED that the Metro Council hereby approves the draft Orenco Woods Nature Park Master Plan, attached to this Resolution as Exhibit A, and approves the name of the future nature park, the "Orenco Woods Nature Park."

ADOPTED by the Metro Council this 21 day of November 2013



Tom Hughes, Council President

Approved as to Form:

Alison R. Kean, Metro Attorney

# ORENCO WOODS NATURE PARK

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Hillsboro Parks & Recreation | Metro

*draft MASTER PLAN REPORT OCTOBER 23, 2013*



## Acknowledgments:

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## EXECUTIVE SUMMARY

## Executive summary

The Orenco Woods Nature Park site was purchased for use as a nature park in December 2011, a joint effort of Metro and Hillsboro in preserving one of the largest remaining open spaces along the Rock Creek Greenway corridor. The site was formerly a rustic golf course, with a scenic mix of open and wooded areas. It is located north of Quatama Road, and west of Cornelius Pass Road, and is within the 65 square mile Rock Creek Watershed that drains into the Tualatin River at Rood Bridge Park.

The jointly purchased 42-acre property adjoins an 11-acre parcel in the southwest corner of the site previously purchased by the City of Hillsboro (COH) for a neighborhood park. Approximately 10-acres of the jointly purchased tract will be sold to assist with planning and development costs for the park. The sale area is open, level land without significant habitat values and is adjacent to two major streets. This master plan addresses both the previously purchased property owned by the COH and the jointly purchased property as a single park.

The existing site consists of rolling hills with rows of mature conifers and forested areas adjacent to Rock Creek. Rock Creek enters the site at the northeast corner and meanders through the property before exiting at the southwest corner of the site. The site has been largely unused since the golf course closed, and has become habitat for a variety of birds and wildlife. Within the region, many sites like this have been lost to urban development, fragmented into narrow greenway corridors that have lost much of their habitat value. The size and variety of terrain at Orenco Woods results in a unique opportunity to provide close to home experiences with nature, balancing protection of habitat areas for wildlife with appropriate recreational opportunities for people. The Orenco Woods Nature Park will provide a living environmental legacy that can be enjoyed today and by future generations.

The planning process was guided by Hillsboro Parks and Recreation (HP&R), Metro and a citizen advisory committee (CAC) comprised of local residents. The master plan establishes the overall vision and programming for Orenco Woods Nature Park. The master plan will guide the development of the Nature Park. During the master plan process, the team analyzed existing site conditions and established the program to inform the master plan. Early stages in the planning process identified five goals used to guide the planning process:

- 1. Utilize context sensitive design to balance recreational opportunities with habitat protection, restoration and enhancement of the site's natural areas.*
- 2. Create a unique park that honors and respects the site's natural, cultural and historical attributes and setting.*
- 3. Provide for nature-related recreation experiences compatible with the Nature Park, and neighborhood park elements as appropriate.*
- 4. Provide welcoming park access that accommodates both community and neighborhood uses.*
- 5. Incorporate sustainable, low impact development principles into the park plan.*

The planning effort examined alternatives for internal trail alignments as well as the Rock Creek Regional Trail, vehicular access and parking, viewpoints, nature play areas, picnic areas, and habitat restoration. A focus was paid to determining places for education, interpretation and passive recreational enjoyment. Based on the site analysis, and CAC and public input, opportunities and constraints were identified for the site and used to develop alternatives.





Environmental Station 1



Environmental Station 2



Forest Canopy Bridge

The plan envisions vehicular access and a 30-car parking lot in the northwest corner of the site at the intersection of Birch St. and NW 225th Avenue. There is potential to expand the parking lot in the future if there is a need. On street parking is also proposed within the future neighborhood adjacent to Cornelius Pass Road. The picnic shelter, restrooms and nature play elements are sited on relatively flat topography in close proximity to the parking lot. This area is envisioned to provide a neighborhood park like setting with lawn to accommodate more active day use and small gatherings. The historic McDonald House located within the site has been purchased by the city and is anticipated to be utilized for public use. A separate planning process will develop the site plan and programming for this important resource; a time frame for this effort has not been established. The majority of the park is comprised of restored habitats, trails, nature play opportunities, environmental learning stations and places for passive enjoyment of this unique environment. The Rock Creek Regional Trail is proposed along the northern boundary of the sale parcel and crosses Rock Creek at the southeast corner of the site. The trail traverses restored forest habitat and oak savannah before exiting the site at NW Dogwood Street. Future planning studies will determine the trail alignment west of Orenco Woods

Nature Park.

The internal park circulation is a network of looped trails that weave their way through the site providing users with a variety of experiences. Located along the trails are a series of scenic viewpoints and environmental stations that provide educational opportunities about the restored habitat and wildlife found in the area. Three trail bridges are planned for the site. Two of the proposed bridges will cross Rock Creek, including the primary bridge serving the Rock Creek Regional Trail and a secondary bridge on the east side of the park to provide a looped trail network. A forest canopy bridge will cross the tributary to Rock Creek toward the north end of the site. Three primary habitat types (oak savannah, mixed conifer hardwood forest and riparian forest) will be restored based on the site's characteristics and target conservation species. The park will provide neighborhood park and nature based recreational opportunities. The nature park will be a valuable community resource and a true gem in Hillsboro as well as Metro's regional park system.



Figure 1 - Orenco Woods Nature Park Master Plan





## INTRODUCTION

## Project Background

Surrounded by urban development, the Orenco Woods site is a significant regional property because of its accessibility and natural features. It will provide restorative opportunities and be a welcome refuge from the urbanized environment for both people and wildlife. The site was jointly acquired in 2011 by Hillsboro Parks & Recreation (HP&R) and Metro to develop a nature park. The existing site is a rolling landscape with both forested areas and open meadows. Two streams meander through the site, Rock Creek and an unnamed tributary. The site shows signs of its past as a golf course use with expansive linear views down former fairways that are framed by rows of mature trees. Since the closure of the golf course, the site has remained open and not maintained, attracting wildlife and some informal public use.

The master plan establishes a long-term vision for the site and will guide the future development of the park. The plan proposes an overall layout for the desired elements and habitat restoration areas as determined by the citizens advisory committee (CAC), HP&R and Metro based on their compatibility to the overall goals for the park development.

### *Proposed Park elements:*

- *Vehicular and Pedestrian Access and Parking*
- *Network of Trails & Bridges*
- *Viewpoints/Environmental Stations*
- *Restrooms and Picnic Shelters*
- *Nature Based Play Experiences and Adventure Play*
- *Open Space*
- *Habitat Restoration Areas*

The master plan for the Orenco Woods Nature Park

preserves and enhances habitat and provides passive recreational opportunities for visitors. The plan establishes a long term development strategy that will be implemented as funding becomes available. The first phase of park development is anticipated to begin in 2013/2014 with a variety of habitat restoration projects and removal of dilapidated structures.



Figure 2 - 2011 site aerial

## History

The site was first developed by Malcolm McDonald in 1912. McDonald, co-founder of the Oregon Nursery Company (Orenco), built his house on the property in 1912. The house and surrounding property were later acquired by the Hillsboro Elks Lodge which operated a 9-hole golf course on the property from 1953 until 2006, when the land was sold for development.

Venture Properties acquired the property from the Elks Lodge and planned a single family subdivision on the property. The planned neighborhood was expected to add approximately 250 homes to the area. In 2007, Hillsboro purchased 11-acres from the developer to provide a neighborhood park. After years of delay, the development plan was abandoned during an economic downturn and the property returned to bank ownership. The City of Hillsboro & Metro purchased the remaining 42-acre property in 2011 with the intent of developing the site as a nature park.

This master plan incorporates both the Hillsboro owned site and the jointly purchased large site as one park.

The southeast 10-acres are slated for development to assist with funding the construction of the park. After the sale, the total park acreage will be approximately 42-acres.

The historic McDonald House is located on a 0.7-acre parcel located inside the boundaries of the park site. The house is a significant historic site in Hillsboro. The City of Hillsboro purchased the house from the Elks in May, 2013. The master plan recognizes the future of the McDonald House as a publicly accessible facility within the park. The planning process for specific restoration and uses of the McDonald house will be conducted separately from this master plan.



Historic McDonald House located within the Orenco Woods Nature Park site



## Public Involvement

In addition to the project goals and objectives developed by HP&R and Metro, the CAC was formed to help guide the master plan as well as ensure citizen involvement throughout the planning process. The CAC was comprised of a diverse group of citizens from the Hillsboro area.

The role of the CAC was to work with HP&R, Metro and the Walker Macy team to help guide the master planning process. The CAC assisted with determining the program elements that were appropriate for the park as well as provided feedback on the conceptual design alternatives. They reviewed preliminary plan drafts, participated in community outreach efforts and served as a sounding board for community input. The committee ultimately recommended the preferred master plan to the Hillsboro Parks & Recreation Commission and Metro Council for approval and adoption.

In addition to the CAC meetings, three open houses were held for community input. The first open house was held on-site and included a site tour and a presentation of existing conditions of the site. At the second open house, the community was shown four conceptual design alternatives for the park. Based on responses and suggestions, a draft master plan was developed incorporating aspects of prior alternatives and presented to the public at the final open house. After each open house, comments were received and incorporated into the planning process. At the final open house there was significant public support for the master plan.

Information on the park planning process was posted digitally to the project website located on the HP&R website. Over the course of the planning, a contact list of more than 150 interested persons was developed and used to keep people informed of meetings, web site updates and progress on the park plan. A public comment period followed each open house. Comments are summarized in the appendix.

Metro and Hillsboro utilized an RFP process to select a purchaser for the southeast sale parcel during the park planning process to ensure the future development would be compatible with the park and regional trail. The prospective purchaser attended several public meetings and met with the CAC to discuss preliminary plans. Community feedback requested that the development provide access to the park and trail through the future subdivision, including public parking to serve park and trail users, and visual access / views into the park through orientation of streets and homes.

The master plan was approved by the Hillsboro Parks & Recreation Commission in June, 2013. Metro Council adopted the Orengo Woods Nature Park master plan on **XXXX, XX, 2013**.



Open house presentation



Open house site walk





## SITE ASSESSMENT AND ANALYSIS

## Regional and Recreational Context

The site is located in Hillsboro, Oregon and will be part of a network of natural areas within the Portland metropolitan area. Within the Hillsboro Parks system there are 24 city parks, 3 of which are within a 2-mile radius of the Orenco Woods site. The 20-acre Orchard Park is located approximately 1.75-miles to the northeast and the 37-acre Noble Woods Park is located approximately 1.5-miles to the southwest. Both parks are located along Rock Creek, feature natural areas including trails and are part of the Rock Creek greenway corridor. Orchard Park also has a disc golf course, play area and some picnic opportunities. Noble Woods Park is primarily a nature park with looped trails, viewpoints, a small picnic shelter and restrooms, but no developed play areas. In addition, 53rd Avenue Community Park is approximately 2-miles west of Orenco Woods and has developed park features including two artificial turf sports fields for soccer and lacrosse, a playground and large splash pad. Future expansion of 53rd Avenue Park will include a recreation center, picnicking and a large play area. Other nature parks and natural areas nearby include the Tualatin Hills Nature Park and the Jackson Bottom Wetlands Preserve; both sites are about 6 miles away from Orenco Woods Nature Park.

Orenco Woods Nature Park is immediately adjacent to the Orenco Elementary School, a 12-acre site serving up to 650 students. The school has a playground for children age 5-12 years, covered hard court area, and large grass playfields including softball and soccer areas. Outdoor school facilities are available for public use when not in use by the school or other scheduled activities.

## Land Use

The surrounding land use includes educational and residential use. The western edge of the property is adjacent to the historic Orenco Townsite neighborhood. Orenco Elementary School is at the eastern edge of the neighborhood. The south edge of the site is adjacent to a single family residential neighborhood and the Hillsboro Elks Lodge. The sale parcel located in the SE corner of the site is planned to be a single family residential neighborhood. The eastern edge of the property is bound by Cornelius Pass Rd. Across Cornelius Pass Rd, the adjacent parcels are zoned Station Community - Industrial. The north edge is bound by the MAX light rail tracks with primarily medium density residential directly north of the tracks.

## Existing Conditions

The site is comprised of rolling hills with expansive views framed with long tree rows reminiscent of the past golf course. Rock Creek enters the site at the northeast corner and meanders through the site before exiting at the southwest corner of the property. The stream is forested along the edges with adjacent wetlands located within the floodplain. The former club house for the golf course is located in the northwest corner of the site. Remnant cart paths from the golf course are evident throughout the site and have been used by residents to navigate the property. In addition there were seven bridges that cross Rock Creek and its tributary, four of which have been removed. The condition of the remaining bridges varies. A weir within Rock Creek's main channel routes water to a man-made pond which was once used as a water source for golf course irrigation.

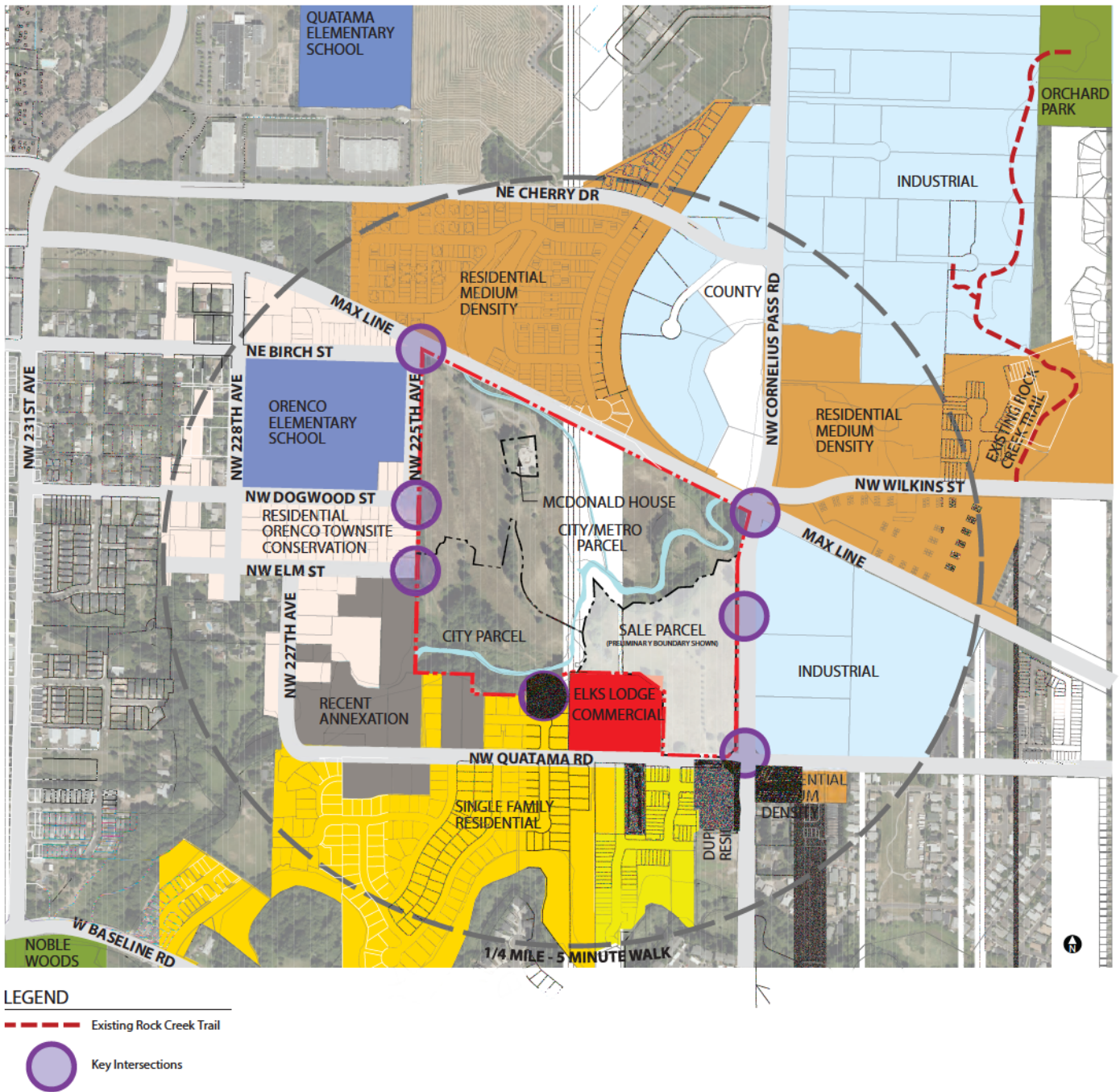


Figure 3 - Zoning Diagram

## Traffic and Access

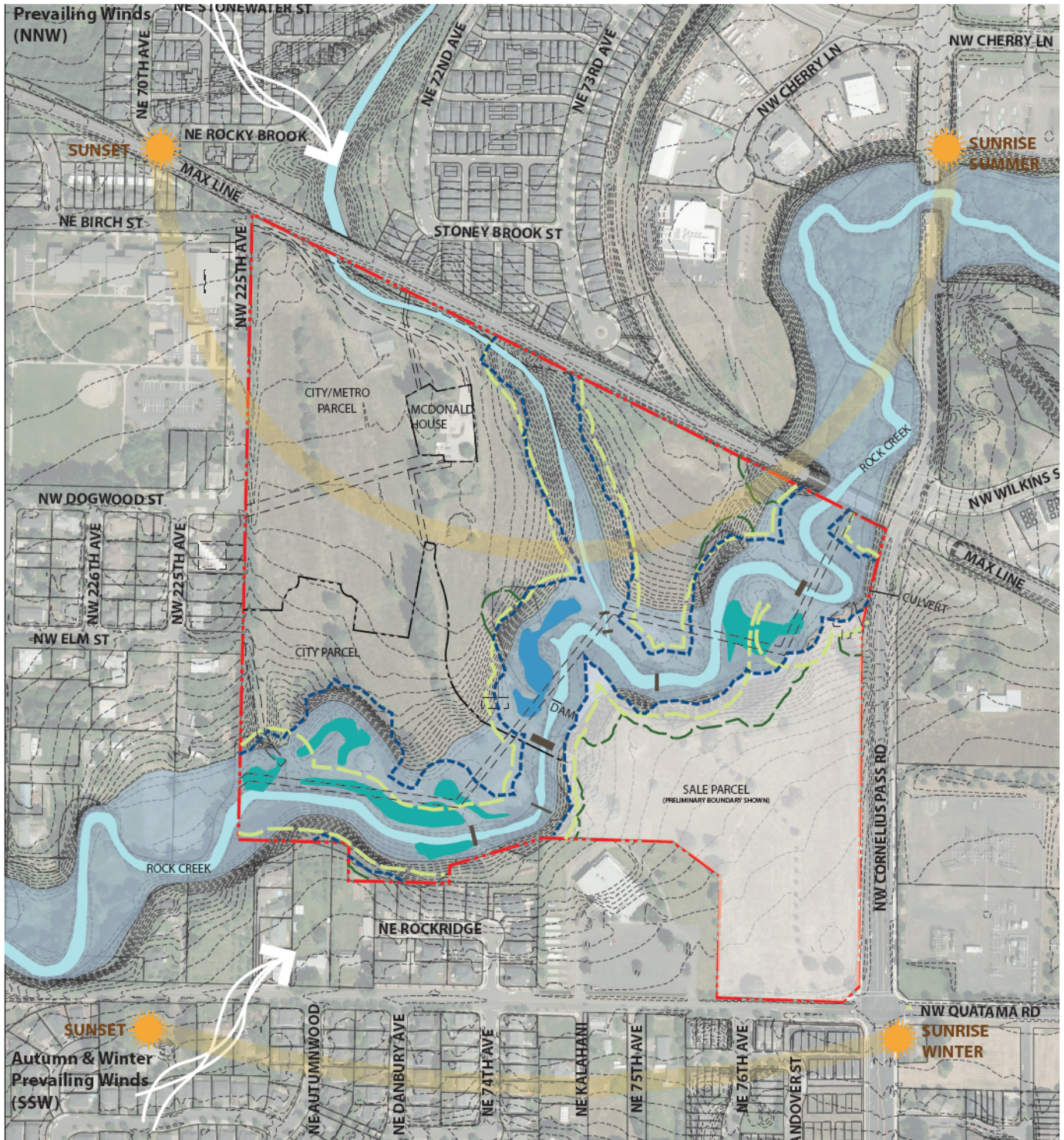
The primary vehicular access to the site is from Birch Street. The road leads the visitor to an asphalt parking area and continues as a gravel road to the McDonald house. Currently there is no formal pedestrian access on the site.

A traffic analysis for the proposed development was completed in July, 2013. The analysis examined key intersections located adjacent to the Orengo Woods site and found that the proposed nature park development would generate approximately 991 trips per day and that all study intersections would operate at acceptable levels. Additional off-site improvements at the study intersections are not recommended.

## Natural Systems & Climate

Within the site there are 3 environmentally regulated zones: the vegetated corridor regulated by Clean Water Services, the 100-year floodplain and delineated wetlands which are regulated by the Oregon Department of State Lands (DSL) and Army Core of Engineers (ACOE). The vegetated corridor is intended as a buffer along Rock Creek with limited development allowed within the boundaries. Trails, stream crossings, and viewpoints are permitted, but mitigation and enhancement are required. Within the 100-year floodplain, proposed developments are to be modeled with the Hydrologic Engineering Centers River Analysis System (HEC-RAS) to indicate that a zero net flood level rise has occurred. Several delineated wetlands are located within the vegetated corridor. The master plan does not propose any development within the designated wetlands

The site features large open meadows which have good solar exposure with south facing slopes. Prevailing summer winds are from the northwest.



**LEGEND**

- - - - - Clean Water Services Vegetated Corridor
- 100 Year Floodplain
- Significant Natural Resource Overlay - 75' Impact Area
- Significant Natural Resource Overlay - 25' Upland Area
- Existing Pond
- Existing Wetland
- Access & Utility Easements
- Golf Course Creek Crossing

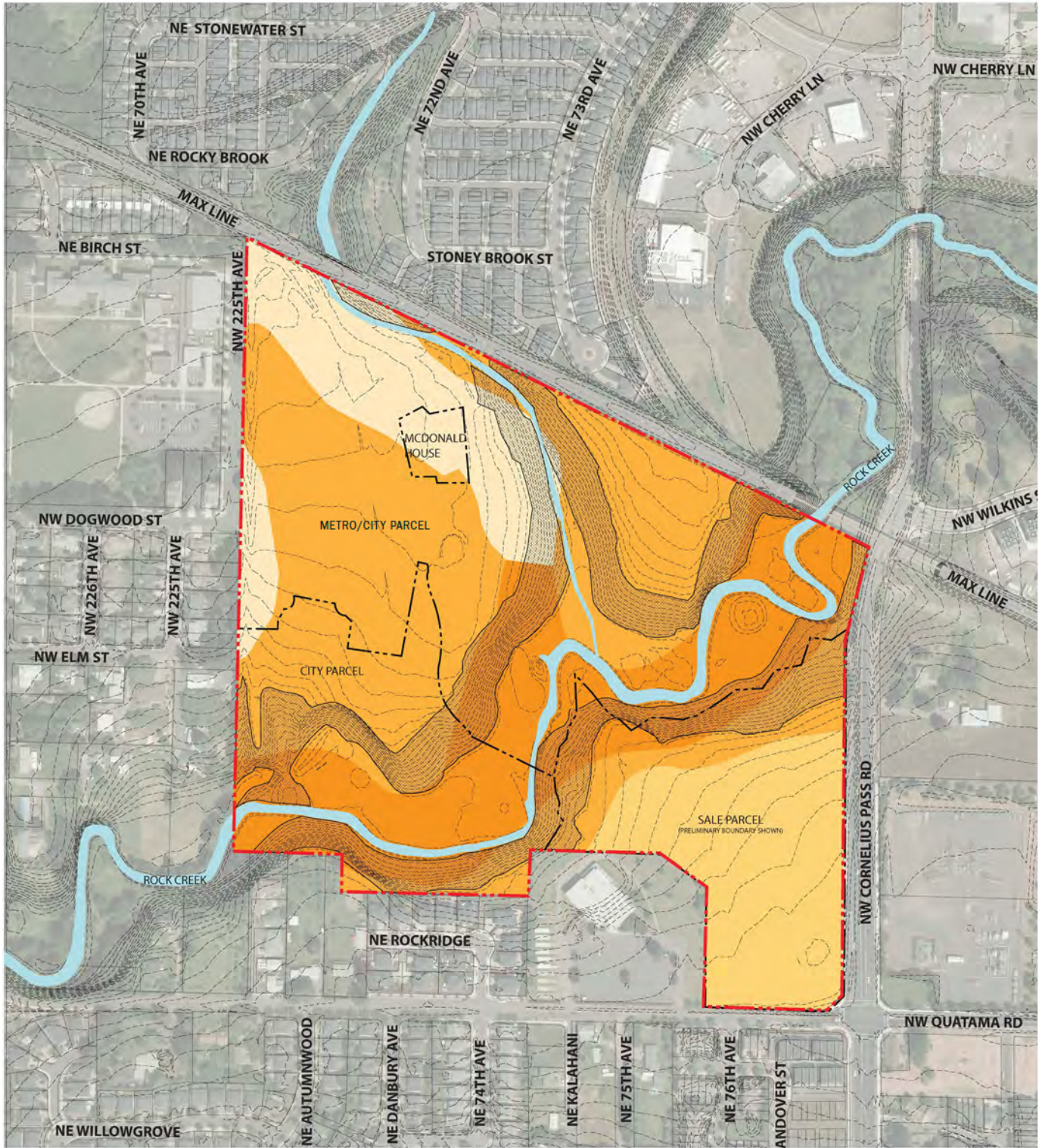
Figure 4 - Natural Systems Diagram

## **Soils & Topography**

There are four different types of soils found on the site varying from poorly drained to moderately drained soils. The Wapato Silty Clay Loam soils are found adjacent to Rock Creek and are indicative of areas within a flood plain. The soils are poorly drained with moderately slow permeability. The on-site soils most conducive for development are the Quatama Loam soils which are located in the northwest area of the site. These soils have better drainage and faster permeability than the soils found in the floodplain adjacent to Rock Creek.

The steepest slopes on the site, greater than 10%, are located adjacent to Rock Creek and its tributary and follow the 100-year flood plain. Slopes greater than 10% provide grading challenges for proposed trails and are not conducive for proposed structures. The site generally slopes from north to south toward Rock Creek.





LEGEND		PERMEABILITY	DRAINAGE
	Soil - Huberly Silt Loam	Slow	Poorly Drained
	Soil - Aloha Silt Loam	Moderately Slow	Somewhat Poorly Drained
	Soil - Quatama Loam	Moderately Slow	Moderately Well Drained
	Soil - Wapato Silty Clay Loam	Moderately Slow	Poorly Drained
	Slopes >10%		

Figure 5 - Soils & Topography Diagram

## Vegetation

The existing vegetation on site is a mix of forested areas and open meadows. The majority of the forested area on site is located along the banks of Rock Creek and its tributary. The areas of the site that were previously used for golf course fairways are open meadows with un-irrigated grasses separated by rows of mature conifer trees. Invasive species, such as Himalayan Blackberry and English Ivy, have established on the site. During the master planning process Metro and City of Hillsboro natural resource staff managed the site for the removal of invasive species. Metro and Hillsboro natural resource staff also began a process of planning the site restoration and improvements to meet Clean Water Services regulated Vegetated Corridor. Native tree and shrub plantings are planned for 2014 - 2016.

## Opportunities and Constraints

Based on the analysis of the existing site conditions, opportunities and constraints were determined. The site was divided into three zones and designated graphically with yellow, green and blue. The yellow zone is the northwest portion of the property and is characterized with vast open space, adjacency to a public street, has existing framed views, slopes less than 5%, contains the McDonald House and is outside of the regulated vegetated corridor. Within this zone there is an opportunity for the following program elements to occur:

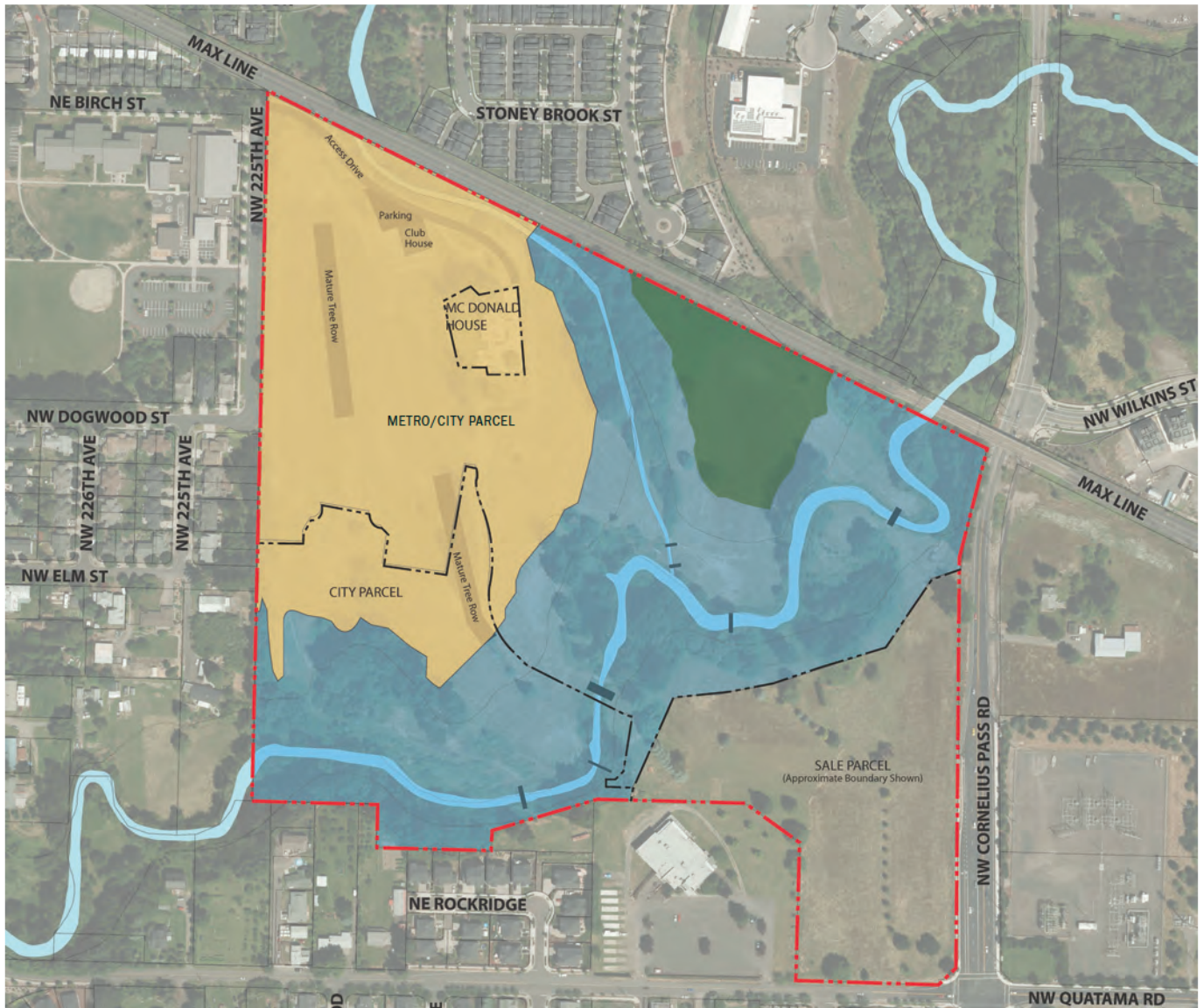
- parking and access, restrooms, picnic shelter, trails, viewpoints, nature play, interpretive opportunities and open space for unstructured play.

The green zone has many of the same attributes as the yellow zone, but is isolated and not adjacent to a public street. For this reason, the only program elements that are suitable for this area are trails and viewpoints.

The blue zone includes a variety of natural features that shape the character of this area: slopes up to 10%, forested areas, existing wetlands and the regulated vegetated corridor. The topography and forest canopy create a sense of enclosure, a delightful contrast to the wide open spaces of the yellow zone. The program elements suitable in this zone are:

- habitat restoration, trails, viewpoints, interpretive opportunities and nature play.

The organization for the park elements are based on the opportunities and constraints identified for the site.



	YELLOW ZONE	GREEN ZONE	BLUE ZONE
EXISTING CHARACTERISTICS			
SLOPE 5-10%			X
REGULATED VEGETATED CORRIDOR			X
OPEN SPACE	X	X	
FORESTED			X
EXISTING WETLANDS			X
100 YEAR FLOODPLAIN			X
ADJACENT TO PUBLIC STREET	X		X
EXISTING VIEWS	X	X	X
ROCK CREEK			X
FRAMED VIEWS	X	X	X
SENSE OF ENCLOSURE		X	X
MC DONALD HOUSE	X		
POTENTIAL PROGRAM ELEMENTS			
PICNIC SHELTER			PRESERVE & ENHANCE NATURAL HABITATS
TRAIL NETWORK		TRAIL NETWORK	TRAIL NETWORK
POTENTIAL OFF-SITE ACCESS		VIEW POINTS	INTERPRETIVE OPPORTUNITIES
PARKING			VIEWPOINTS
RESTROOMS			NATURE PLAY
OPEN SPACE FOR UNSTRUCTURED RECREATION			
VIEW POINTS			
INTERPRETIVE OPPORTUNITIES			
NATURE PLAY			

Figure 5 - Opportunities and Constraints

## Special Places

The opportunities and constraints identified quantifiable characteristics of the site. In order to assess qualitative characteristics, a series of special places were identified. The following special places were accounted for in the final master plan:

- **Open Meadow** - This area is in the northwest portion of the site and is a large open area with long views framed by rows of mature evergreen trees.
- **Closed Transition**, meadow to riparian – as one leaves the open meadow a trail leads downhill into a closed forest condition.
- **Riparian Area 1** – Adjacent to Rock Creek is a lowland area that is surrounded by forested areas. In contrast to the open meadow which feels expansive, this area provides a sense of enclosure.

- **Sledding Hill** – Many of the residents spoke fondly of the steep hill that transitions from the open meadow to the riparian area. They reported using this hill to toboggan down during snow events.

- **Open Water** – An irrigation pond that was built for the golf course in an old meander bend of Rock Creek remains on site. The pond is potential habitat for native species. Children living in the adjacent neighborhoods reported this pond as a common destination of their site visits.

- **Riparian Area 2** – The second riparian area is also located adjacent to Rock Creek and is in a low area of the site. From this vantage point visitors have glimpses of the rolling hills of the Open Meadow and of the McDonald House.



Open Meadow

Closed Transition

Riparian Area 1

Sledding Hill

### Special Places

• **Open Meadow 2** – Perched on a high point in the site, this meadow is in a more secluded area of the site and provides more expansive views towards the south.

• **McDonald House** – Historic house built by Malcolm McDonald in 1912. The City of Hillsboro acquired the property in 2013 for future public use.



Open Water



Riparian Area 2



Open Meadow 2



McDonald House





MASTER PLAN

## Goals & Objectives

Metro and HP&R, with feedback from the CAC and the public, developed goals and objectives for the future nature park early in the planning process. The goals are defined as the overall purpose and general intention for the park. The objectives are more specific and measurable characteristics that are desired.

### Goals:

- 1. Utilize context sensitive design to balance recreational opportunities with habitat protection, restoration and enhancement of the site's natural areas.*
- 2. Create a unique park that honors and respects the site's natural, cultural and historical attributes and setting.*
- 3. Provide for nature-related recreation experiences compatible with the Nature Park, and neighborhood park elements as appropriate.*
- 4. Provide welcoming park access that accommodates both community and neighborhood uses.*
- 5. Incorporate sustainable, low impact development principles into the park plan.*

### Objectives:

- 1. Provide for an extension of the Rock Creek Regional Trail through the park*
- 2. Preserve and enhance the variety of views and vistas of the site to create diverse experiences*
- 3. Provide for a variety of trails, including looped trails, with viewpoints and seating areas where appropriate.*
- 4. Provide park access from a variety of neighborhood locations with an emphasis on encouraging pedestrian and bicycle access.*
- 5. Provide open area for informal play or gatherings*

*6. Provide for nature based play experiences that engage children in interactions with the natural world and with each other.*

*7. Provide for interpretive and educational opportunities at the site related to the site's natural, historic and cultural heritage. In particular, anticipate the use of the nature park by elementary school children for outdoor, educational purposes.*

*8. Provide support facilities for the nature park including restrooms, picnic areas / picnic shelter, access and parking.*

*9. Protect water quality by improving native tree and shrub buffers along stream and wetlands, and improving connectivity of the stream to the floodplain.*

*10. Conserve natural habitats, with an emphasis on the riparian and Oregon white oak savanna habitats, reflecting habitat Conservation targets for the site.*

*11. Provide improved habitat for native birds, fish and turtles, reflecting species Conservation targets for the site.*

*12. Ensure access to the McDonald House is maintained.*

*13. Provide a context for the McDonald House within the park, preserving its sense of history and setting within, yet apart, from the Nature Park.*

*14. If the McDonald House is acquired for public purposes, provide space for support facilities such as access, parking, and open lawn for possible outdoor gatherings, events or programs.*

*15. If McDonald House is acquired for public purposes, provide for a landscape that reflects its historic and cultural context.*



## Initial Concepts

The overall intent for the Orenco Woods Nature Park master plan is to preserve and enhance nature and to provide passive recreational opportunities where appropriate. The master plan calls for a network of looped trails, restored habitat areas, viewpoints, and neighborhood park elements including nature based play area(s), picnic shelter, and limited irrigated lawn areas for open play. Based on the goals and objectives four concept plans were developed to illustrate options for the Nature Park. The concepts were presented to the CAC and to the public for input.

All four concepts provide pedestrian and vehicular access with limited on-site parking to encourage walking and biking to the park, nature play elements in lieu of traditional playground equipment, the Rock Creek Regional Trail, looped park trails (both paved and soft surface), educational and interpretive opportunities, and habitat restoration.



Ideas for the nature park - Orenco woods elementary school student drawings

## Concept A

### Summary of Elements:

- Parking and vehicular access located from NW Dogwood St.
- Rock Creek Regional Trail enters the site from Cornelius Pass Rd and exits the site at NW Dogwood St.
- Restrooms and picnic shelter are located adjacent to the parking area in the central portion of the park.
- Two paved looped trails are located around the oak savannah habitats
- Soft surface trail through the riparian habitat and adjacent to the existing pond.
- Nature play nodes are located along the paved trail
- Three viewpoints are located in key areas of interest

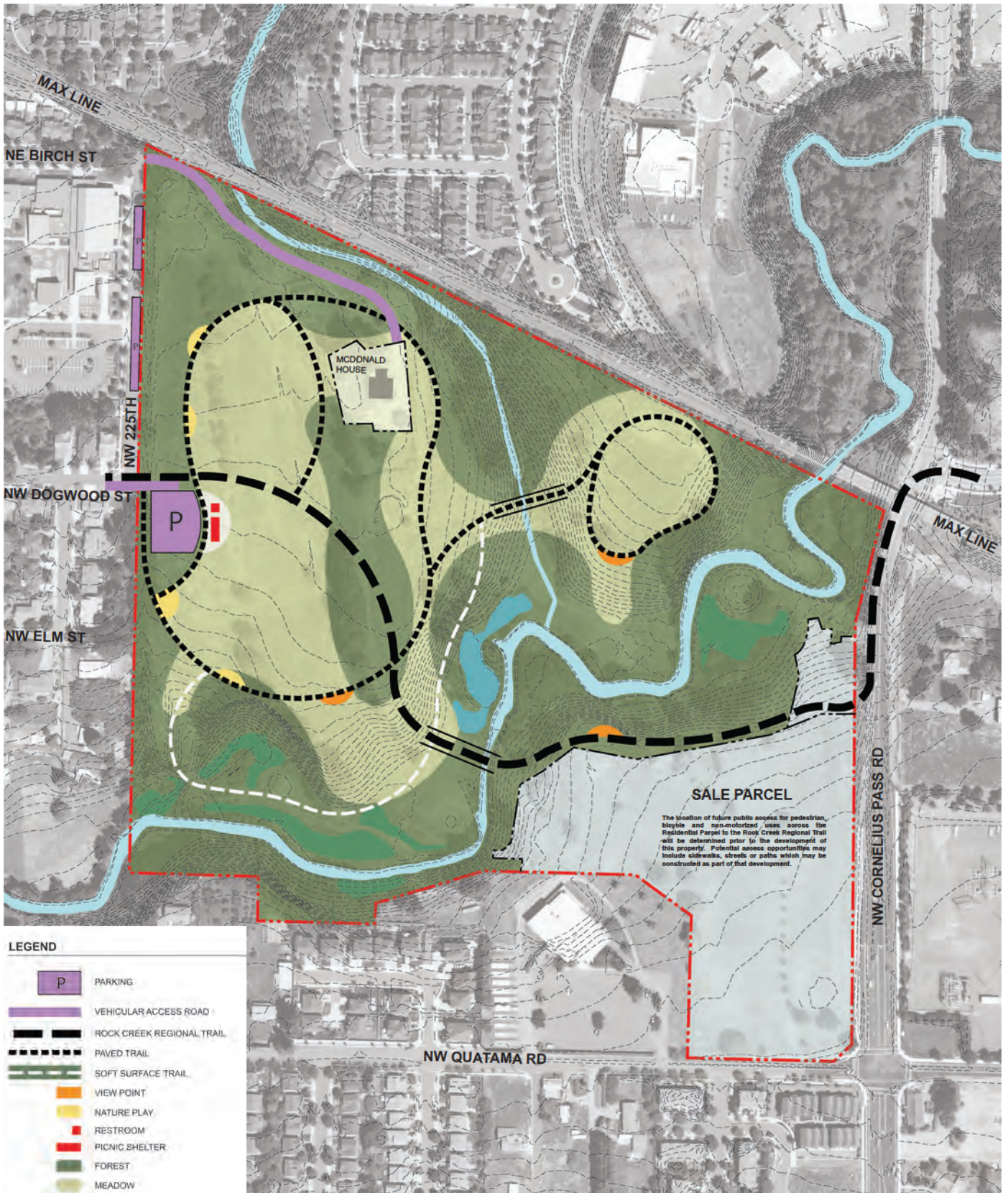


Figure 6 - Initial Concept A

## Concept B

### Summary of Elements:

- Parking and vehicular access is from NE Birch St.
- The Rock Creek Regional Trail enters the site from Cornelius Pass Rd and loops around the park, with three narrower paved trails exiting the site at NW Dogwood St., NW Elm St., and NW 225th Ave.
- Restrooms and picnic shelter are located adjacent to the parking area in the northern portion of the park
- A paved trail provides ADA access to the oak savannah knoll across the Rock Creek tributary
- Soft surface trail meanders through the riparian area, around the existing pond, and up to the oak savannah knoll where it connects to the paved trail.
- Nature Play nodes are located at the terminus of NW Dogwood St., NW Elm St., and off NW 225th Ave.
- Four viewpoints are located at key areas of interest



Figure 7 - Initial Concept B

## Concept C

### Summary of Elements:

- Parking and vehicular access are from NE Birch St.
- The Rock Creek Regional Trail enters the site from Cornelius Pass Rd. and exits the site at NE Birch St.
- Restrooms and picnic shelter are located adjacent to the parking area in the northern portion of the park
- A paved trail leaves the parking area heading south through the restored oak savannah where it becomes a soft surface trail through the riparian area, crossing Rock Creek twice, before heading up the hill to the oak savannah knoll.
- A second paved trail loops around the oak savannah knoll, crosses the Rock Creek tributary and adjoins with the Rock Creek Regional Trail
- Three nature play nodes are located along the edge between the restored oak savannah and the restored hardwood forest
- Three viewpoints are located in key areas of interest

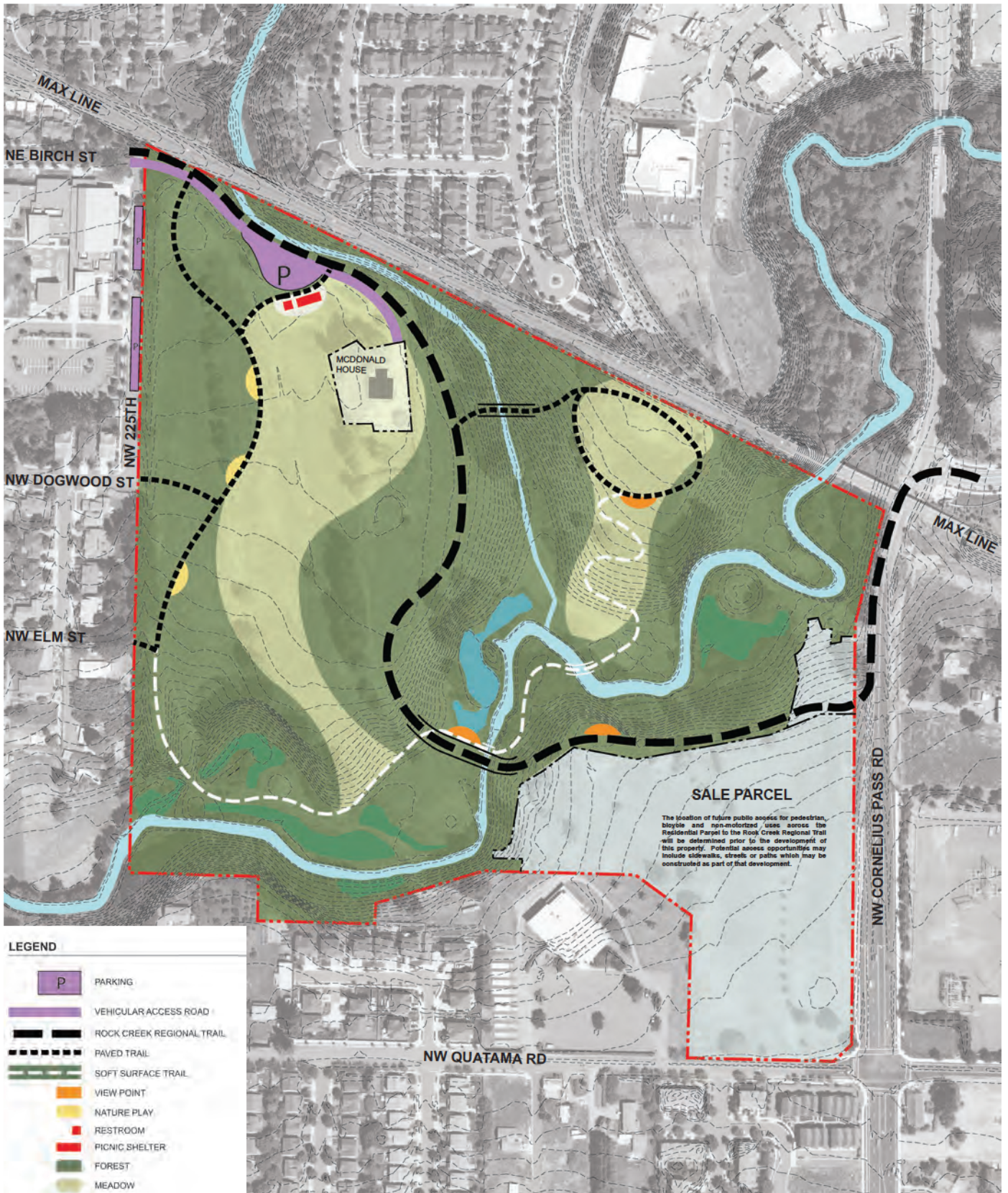


Figure 8 - Initial Concept C

## Concept D

### Summary of Elements:

- Parking and vehicular access are located off of NW Dogwood St.
- The Rock Creek Regional Trail enters the site from Cornelius Pass Rd. and exits the site at NW Elm St.
- Restrooms and the picnic shelter are located adjacent to the parking area between NW Dogwood and NW Elm St.
- Two paved trails loop around the upland portion of the park
- Two soft surface trails loop through the riparian habitat, and cross Rock Creek twice.
- Viewpoints are located in key areas of interest



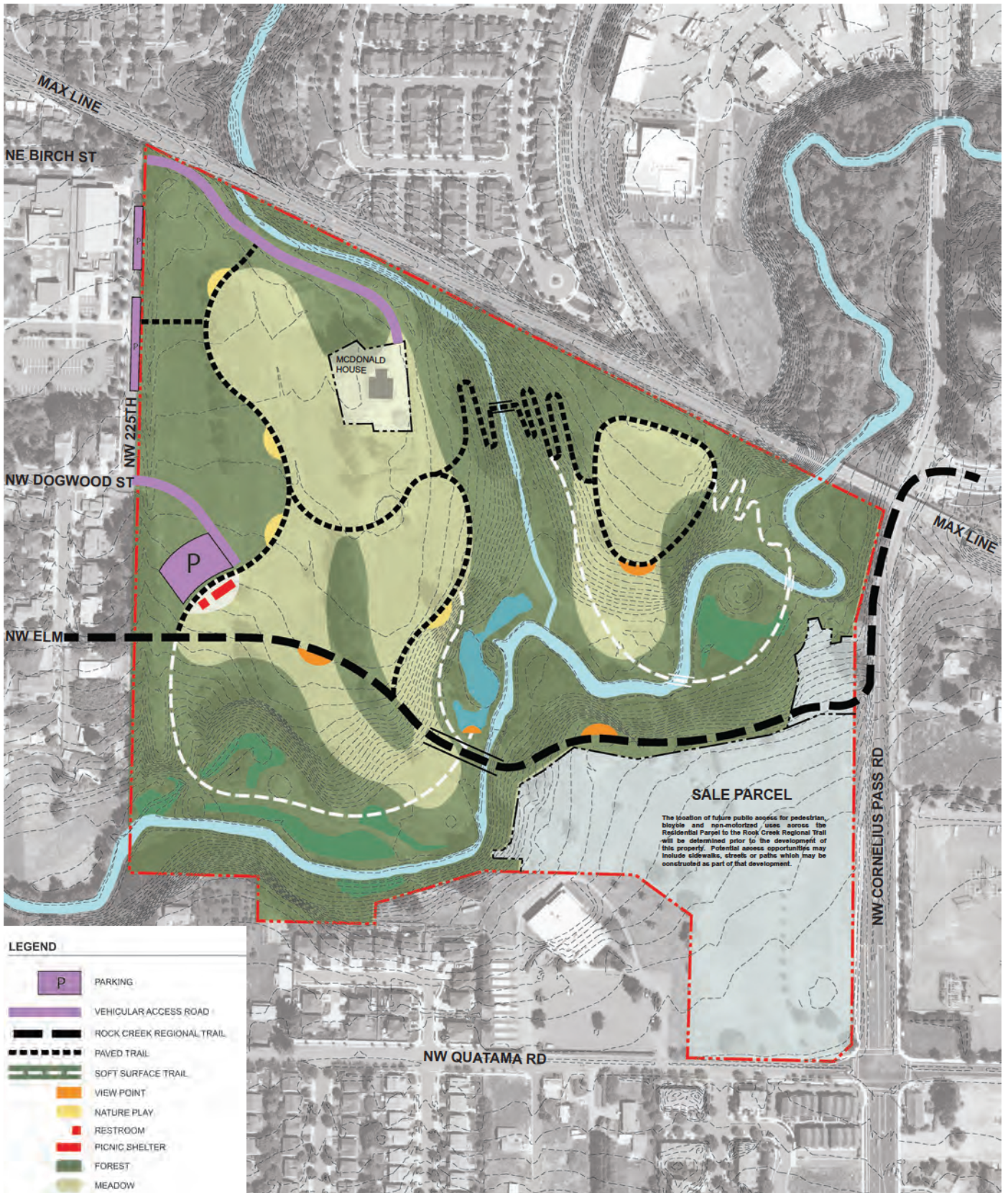


Figure 9 - Initial Concept D

## Master Plan

Through the public open house process and meetings with the CAC, HP&R and Metro staff, the master plan for the Orenco Woods Nature Park was developed. It is based on the key attributes of the initial concepts and includes park improvements and habitat restoration that are designed to enhance the sites natural areas as well as provide passive recreational opportunities.

Within the region, many sites with similar size and character have been lost to urban development, fragmented into narrow greenway corridors which have lost much of their habitat value. The size and variety of terrain at Orenco Woods results in a unique opportunity to provide close to home experiences with nature, balancing protection of habitat areas for wildlife with appropriate recreational opportunities for people. The Orenco Woods Nature Park will provide a living environmental legacy that can be enjoyed today and by future generations.

*The plan is comprised of 9 elements:*

- *vehicular and pedestrian access*
- *parking*
- *looped trail network*
- *bridges*
- *viewpoints*
- *structures (restrooms, picnic shelters, and maintenance buildings)*
- *nature and adventure based play*
- *open space*
- *habitat restoration*



Figure 10 - Orengo Woods Master Plan

## **Access & Parking**

The vehicular access and parking lot is accessed from NE Birch St. The driveway alignment has been designed to provide a sense of arrival as one enters the park. An entrance gate and sign will demarcate the entrance to the park. The driveway meanders between the forest canopies before orienting the visitor to the long open view down the restored oak savannah meadow. A 30-car parking lot loop with two bus parking spaces is located southwest of the entry drive. The parking lot is screened from the entry drive by a buffer of mixed conifer and hardwood forest plantings. An additional 11 on-street parking spaces are proposed along NW 225th Ave and additional parking is proposed within the sale-parcel development to the Southeast. A modest number of parking spaces are provided within the park boundary to encourage walking and biking to the park. The plan reserves space for overflow parking should it be deemed necessary in the future. Additionally, for larger events held outside of school hours there is potential to share parking with the Orengo Elementary School located directly across NW 225th Avenue



Figure 11 - Parking Diagram

## Trails and Bridges

There is a hierarchy of trails proposed for the nature park which will help to separate users and avoid conflicts. The Rock Creek Regional Trail is proposed to parallel the southeastern boundary of the site between the park and the proposed development parcel and cross Rock Creek as it heads northwest into the site. The proposed bridge will span the 100-year flood plain to allow for year-round use. After crossing Rock Creek, the trail meanders up the hill navigating restored Oak Savannah habitat before exiting the site at NW Dogwood St. The trail will be a 10' wide asphalt trail with 2' gravel shoulders.

The interior park trails, also known as local trails, are divided into two groups; paved and soft surface. The paved trails are 6'-8' wide asphalt trails that are primarily located in the upland portion of the site. These trails are ADA accessible and provide users access to the majority of the park. All of the trails that are located within the vegetated corridor are 5'-6' wide gravel or wood chip soft surface trails. These trails are intended for individuals with greater mobility and provide users access to the riparian portion of the site with minimal environmental impact.

There are three trail bridges proposed in the master plan. The primary bridge spans Rock Creek for the Rock Creek Regional Trail. It is designed to be above the 100-year flood plain elevation and allow water to flow beneath the bridge during a flood event, and will provide dramatic views of the riparian corridor. The bridge will be designed for pedestrian and bicycle use. The soft surface trail leading to the pond crosses beneath this trail bridge; a minimum 12' clearance will be required at this point along the trail. On the east side of the park an existing bridge originally built for the golf course will be replaced to provide a looped trail connection. This bridge is intended for pedestrian use only and will be narrower than the regional trail bridge.

The forest canopy bridge crosses the Rock Creek Tributary at the north end of the site. The bridge is intended to give the user the experience of walking in the canopy of the trees over the tributary ravine. The bridge will be approximately 20' above the tributary and ADA accessible. The bridge provides pedestrian access to the oak savanna knoll on the northeast portion of the site. Paved park trails approach the bridge on either side. Motorized use of the bridges is not intended with the exception of small park maintenance vehicles such as a Gator or lawn mower.



Soft surface trail



Paved park trail

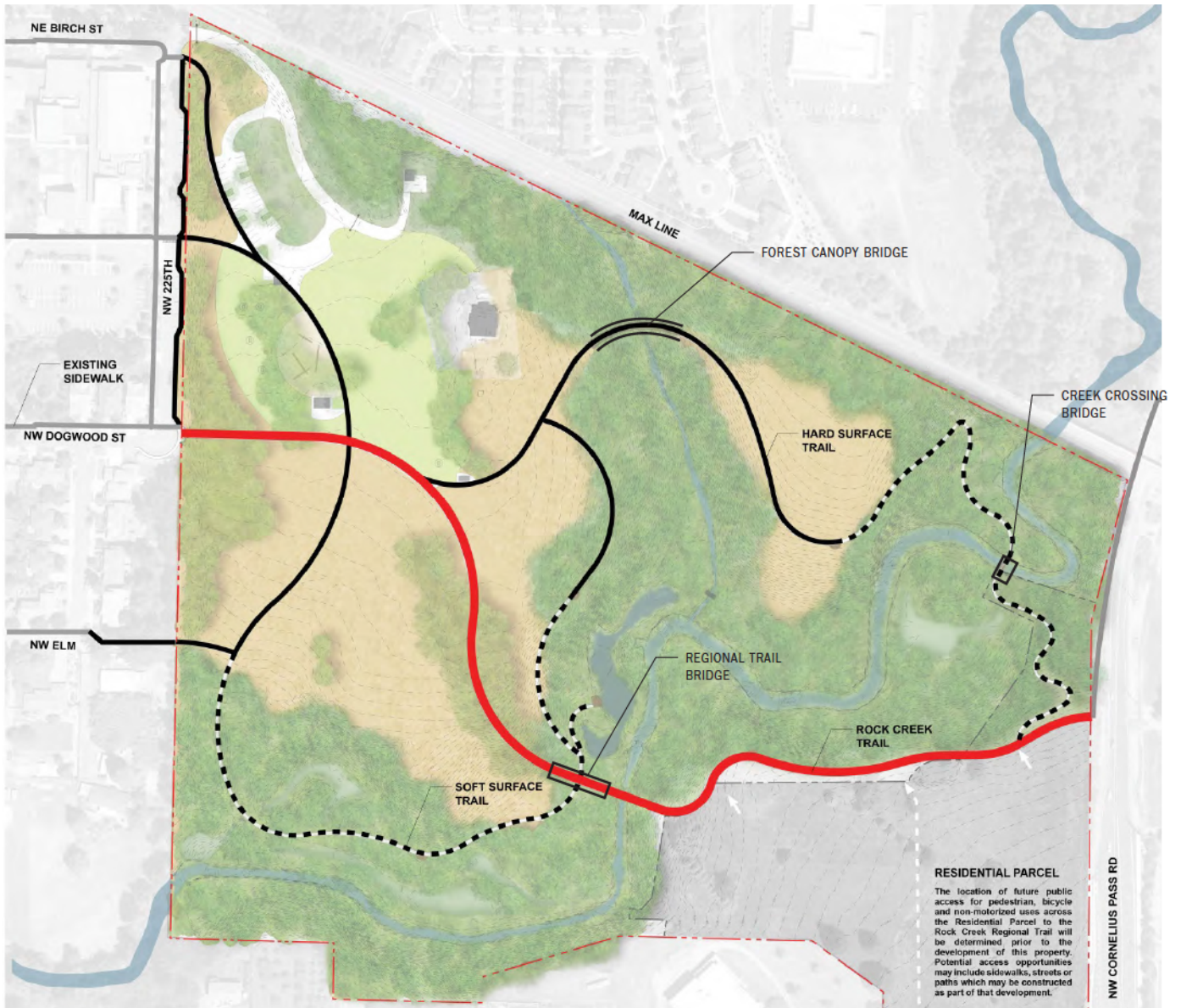


Figure 12 - Trail Diagram



Forest Canopy Bridge

## Environmental Stations

There are five viewpoints located throughout the park, three of which are designated environmental stations. These locations take advantage of existing views on the site. They provide a place along the trail for pause, interpretation and reflection. The design concept for the viewpoints is a semi-circular form with a low concrete or stone seat wall. The viewpoints are located directly adjacent to the trails.

The environmental stations are located in the three primary habitat types and are intended for visitors to pause, observe their surroundings and possibly see wildlife. Environmental station 1 is located in the riparian habitat adjacent to an existing wetland. Environmental station 2 is a platform that provides access to the existing pond on the site. The pond provides habitat for amphibians and is a destination for environmental education classes to visit and learn about aquatic habitats. Environmental station 3 is located on the knoll in the oak savannah habitat. From this location the visitor will enjoy expansive views of the site overlooking the riparian habitat.



Vignette key plan





Environmental Station 1



Environmental Station 2



Environmental Station 3

## Restrooms and Picnic Shelters

One permanent restroom building is located in the site adjacent to the proposed parking area. The restroom is sited next to a small entry plaza that will function as a gateway into the park. Seating and bike racks are also proposed in this space. The architectural character of the restroom building should reflect the agrarian history of the site and be designed to blend with the site environment.

There are two picnic shelters proposed for the site. A large reservable shelter that can accommodate 50-people is proposed in close proximity to the parking and restrooms and adjacent to the nature play area. A second smaller shelter that would be used on a first-come first-serve basis is sited in the southeast corner of the lawn area nestled amidst the trees. Both shelters are located in areas where there are clear site lines from the entrance drive and parking area to the shelters to minimize safety concerns. The shelters are accessed from ADA accessible paved paths. There may be opportunities to re-use timbers from the golf course club house within the park structures or furnishings as a remembrance of the previous use.

## Nature Play and Adventure Play

The new nature park is located directly across NW 225th from the Orenco Woods Elementary School. There is traditional playground equipment available for use at the school site during non school hours. In order to not duplicate functions in close proximity and given that the site is designated a nature park, nature play features and nature themed play items are proposed in lieu of traditional playground equipment. The nature play area is sited between the restroom and the picnic table adjacent to the paved trail. The area is surrounded by lawn and a mixture of existing large evergreen trees and proposed shade trees. The nature play elements will be designed in keeping with the qualities of the Orenco Woods site and provide play opportunities for a variety of age groups.



Precedent nature play

In addition to the nature based play area, there is also potential for adventure play features. The adventure play is proposed in the vicinity of the existing sledding hill. The adventure play is intended to use the site in interesting ways such as an at-grade slide that traverses the hillside or raised platforms for play. The potential for adventure play at this location will be explored further in the detailed design phase.

### Open Space

Open space for unstructured play is also a valuable attribute of the plan. The park provides two primary types of open space, lawn and meadow. In the northwest portion of the site there is an area of lawn that will be maintained for unstructured play. Picnic tables are located throughout the lawn area to provide informal picnic spots. The neighborhood park elements are also located within this area.

There are large areas of oak savannah habitat which is a meadow environment with scattered Oregon White Oak Trees planted at 25-trees per acre. The meadow will also be available to visitors for unstructured play. The maintenance regime will vary significantly from the lawn and will only be mown a few times per year. The open meadows provide for delightful vistas as well as opportunity to enjoy birds, butterflies and other wildlife, and provide contrast to the forested portions of the site.



Open space for unstructured play



Example of oak savanna habitat



Example of mixed-conifer hardwood forest



Example of healthy riparian forest

## Habitat Restoration

Metro and Hillsboro natural resource staff are in the process of developing a site conservation plan for the Orenco Woods Nature Park site. This plan will further define the conservation targets, strategic restoration actions and ecological monitoring at the site.

The site includes three primary habitat types to be restored; Oregon white oak savanna, mixed conifer hardwood forest, and riparian forest. The desired future conditions of these habitat types were determined based on topography and historical ranges. The riparian forest is located adjacent to Rock Creek in the lowest elevations of the site. The riparian forest transitions into the mixed conifer hardwood forest moving higher in elevation and out of the 100-year flood plain. The upland portions of the site are oak savannah meadows.

In addition to the habitat conservation targets, native fish have been identified as a species conservation target for the site. Rock Creek provides important native fish habitat for pacific and brook lamprey, cutthroat trout and steelhead. The riparian forest is a buffer between the adjacent developed areas and Rock Creek which helps protect the creek from run-off and improves the fish habitat.



Figure 13 - Desired Future Conditions Habitat Diagram

## Phasing & Next Steps

Metro began site preparation work for habitat restoration within the vegetated corridor in 2012, beginning with removal of invasive plants. Restoration plantings will begin in early 2014. Removal of invasive species and restoration plantings will be an on-going management process.

The design and development of the park will begin following the completion of the sale of the southeast parcel. It is intended that the design and permitting process will begin in 2013/2014. The park may be developed in phases, depending on funding availability.

Cost estimates for park development have not yet been prepared, and will be developed during the design development phase. Very preliminary assessments of site development costs range from \$3 million - \$4 million.

The McDonald House was purchased in 2013 by the City of Hillsboro. A separate planning process will be initiated for the site design and program for the house and property. A timeline for the planning for the McDonald House has not yet been determined.









# MEETING MINUTES

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**Time:** 6pm – 8pm

**Topic:** Open house #1 – On site tour and presentation of existing conditions and analysis

**Meeting Date:** 9/19/2012

**Location:** Orenco Woods Site

**Project:** Orenco Woods Nature Park

**Project #:** 1228

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## TRAFFIC & ACCESS

- Cornelius Pass Road is a major connection
- Chain link fence to remain?
- Where will parking be located?
- Provide alternative vehicle infrastructure (e.g. Electrical vehicle charging station)
- Road access & Parking
- All parking should be located off of Cornelius Pass Rd.
- Provide access from south end of park

## PROGRAM

- No dog park
- (2) play areas instead of (1)
- Provide a disc golf course
- Water feature similar to Jamison Square not 53<sup>rd</sup> St. park
- Play structure appropriate for 2-5yr age group (similar to Magnolia Park)
- Use rubber safety surfacing instead of bark mulch at play areas
- Hands on garden for children
- Walking and biking path around the exterior
- Cover the play area for year round use
- Keep sledding hills as is in the park
- Pool
- Indoor area for activities like gymnastics and dance
- Enhance views
- Add lots of bike racks
- Utilize alternative energy systems (e.g. solar)

### **WILDLIFE & HABITAT**

- Save the coyote family den on site
- Take into consideration the “critical overlays” completed by the City of Hillsboro years ago re: Flora and Fauna
- Provide fencing to control dogs & coyotes but let indigenous rabbits through

### **SALE PARCEL**

- Buffer between park and sale parcel
- What is the new zoning of the sale parcel?
- Coffee shop at sale parcel
- No retaining walls in sale parcel

# MEETING MINUTES

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**Time:** 6pm – 8pm

**Topic:** Open house #2 – Review of alternative concept plans

**Meeting Date:** 11/19/2012

**Location:** Orenco Elementary School

**Project:** Orenco Woods Nature Park

**Project #:** 1228

---

## TRAFFIC, PARKING & ACCESS

- It is most cost effective and will have the least resistance from neighbors to keep the access located off of Birch St.
- Vehicular access from Dogwood is not ideal because the road is too narrow.
- Prefer the parking option that uses the existing lot.
- Existing parking lot is in a good location and should be reused
- Provide pedestrian access at Dogwood and vehicular entry at Birch
- Prefer the parking scenario of concept 'B' that maintains the existing parking lot.
- Parking at Birch or Dogwood are both good options – the one neighbor who continues stating the entire neighborhood does not want sidewalks and curbs and does not want any connections to the park is speaking only for himself and not the entire neighborhood.
- Do not provide parking off of Dogwood, Birch is a better option
- School parking lot will be available on nights and weekends and during the summer days
- Traffic on Birch conflicts with the school and children's safety.
- If the Birch access is used it needs to be fed from Alder (refer to the PSU study and zoning ordinance).
- Do not like the parking located off of Dogwood.
- Access and parking are key issues and it is evident that these issues have not yet been adequately solved. Expecting primary access to be through a residential neighborhood with non-standard streets and concerned residents is not adequate. Additionally, parking areas appear too limited for a regional park. Planners should consider the carrying capacity of the park and the required parking.
- Comments re access from the south
- Absolutely need a connection from Quatama to the Orenco school
- Include an access point from the south side of the park – 74th avenue would be perfect and provides access to the sledding hill and pond areas.
- Is it possible for the Rock Creek Trail to connect at 74th avenue?
- Access from Quatama is poor in all concepts and needs to be improved.
- Access along Quatama is not safe because of a lack of sidewalks in front of the Elks property. Access from 74th would be a safer option.
- If access is provided from Quatama, the sidewalks need to be improved for residents of the Danbury neighborhood.

- There is concern with the access option from the south. If the only option is through the sale parcel, Quatama sidewalks need to be improved. It is currently very dangerous along Quatama because you have to walk in the traffic lanes.
- Please provide better access from the south.
- Provide access to the park from 74th street because access off of Quatama is not a safe option.
- Consider access off of 74th to provide access to the 160 homes south of Quatama
- Sidewalk improvements are needed off of Quatama to get access into the sale parcel and the park

## **PROGRAM**

- Provide historical placards about the McDonald House, the property and the Orenco town.
- Provide new bridges across the creek.
- Prefer the trails in concept 'D', except move the regional trail from Elm to Birch as shown in plan 'C'.
- Please provide Disc golf because it is a great activity for families and young children in the community.
- Concept 'C' needs an upper loop connection around the meadow.
- Elm is not a good option for trails because burglars currently hide out in that area.
- The regional trail east of the McDonald House is desired and access off of Birch connects with the "Picnic Park".
- The south side of the park is unsecure.
- Utilize nature play as the gateway to the park.
- People walk and drive in the middle of the roads in old Orenco; need to recognize and maintain the rural character of the area.
- Take a second look at the club house – what are the possibilities (shade shelter)?
- Review the walkway plan at Orenco.
- Provide an informal trail system. Concept 'B' is too formal.
- Elm St. is used by burglars.
- Prefer concept 'C' with the regional trail around the McDonald House.
- The more trails the better
- The loop trail may lead to high speed biking
- Prefer paths on concept 'D'.
- Un-mowed areas are as valuable as lawn and are important for wildlife habitat and the nature experience.
- Concept A & B – minimize paths.
- Concept C is great if the loop on the south side can be connected with a black trail instead of a white trail.
- The oval loop in concept B is boring.
- The more trails the better.
- Good idea to keep a meadow in the NE corner to walk through.
- It would be nice to have an open space for flying R/C planes in the park.
- Like the looped trail with multiple entry points and smaller trails near the riparian zone.

- Prefer the Regional Trail to exit at Birch as long as Birch is adequate for handling the increased traffic.
- Love the ideas for nature based play, animal habitat, hiking, biking etc. – Would love to have such a park in my neighborhood, but I hope that traffic flow is well planned.
- Safety is important. I would like to have safe park trails. It would be good to have areas of trail that are not surrounded by trees and vegetation. A good mix of open trails and trails in the woods would be ideal.
- It's very important to keep an open mind with considering the uses of the existing clubhouse structure. I challenge the report that states it would be less expensive to tear it down and rebuild. I challenge the conclusion with the question – compared to what? This issue should be discussed with local citizens involved in the design conversation.
- Public tours of the McDonald House would be nice.
- Could the McDonald House be a McMenamins brew pub?
- No horses on the trails or in the park.
- Large flat area could be a new soccer/football field.
- Prefer the wide open meadow of concept 'B'.
- Remember to construct bridges so they tolerate high water.
- Don't overdevelop this nature area and lose the beauty with paths and viewpoints. Eliminate all paths/viewpoints except for the Rock Creek Trail.
- Wonderful ideas – I prefer concept 'C', but please include some type of parking or quality entry from Quatama.
- I prefer the general layout of plan 'A' with the parking of plan "B" because it makes sense to reuse existing parking instead of creating a new parking area.
- My children loved the natural play area images and the wooden structure/viewpoint.
- Save the club house for park use.
- Use the McDonald House for a Hillsboro/Washington County museum.
- Programming efforts should look further into the potential for a specific activity that would be a strong asset for the region and the park. For example an amphitheater would provide a special place with potential for a variety of uses, both casual and formal. Explore other opportunities for special places throughout the park.
- There is concern that the "regional park" does not reflect the entire "region" and only the immediate neighborhood. For example – The planners should engage school children at other elementary schools in the region in addition to Orenco Elementary.
- The concepts were lacking a single overriding idea or theme. As of now, the park has all the right components but no identity. The park planning should embody the rich aspects of Hillsboro.
- There was no mention of the intent to honor the historic nature of the property.

#### **WILDLIFE AND HABITAT**

- Keep the area as natural as possible with trails so we can enjoy the beauty of the area.
- Leave all existing trees on the site.
- Will a vegetation assessment be conducted? Much of the planning seems to be dependent on the survival of the existing vegetation – that should be confirmed.

### **SALE PARCEL**

- Please do not sell the sale parcel in the SE corner. This property is rare due to its size and once the parcel is sold it cannot be bought back.
- Please consider a plan that includes the SE corner of the property. This is a better area for parking and this corner presents a view of the park from Cornelius Pass. It's a shame to sell this property when we are short on parks.
- Consider a scenario that includes the sale parcel because parkland is vital to livability.
- There should be a visual transition between the sale parcel and the park – no big walls.
- Parking suggestion – consider an access road from the south leading into the property just south of the regional trail. Perhaps this could be accomplished through an access easement agreement in the sale parcel conditions.
- Add public parking at the sale parcel
- Are there any options for parking off of Cornelius Pass?
- The existing neighbors should get priority over the new neighbors in the sale parcel (in terms of access).

# MEETING MINUTES

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**Time:** 6pm – 8pm

**Topic:** Open house #3 – Presentation of draft master plan

**Meeting Date:** 4/24/2013

**Location:** Orenco Elementary School

**Project:** Orenco Woods Nature Park

**Project #:** 1228

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## PUBLIC COMMENTS

- I love the nature play area. I like the idea of making the “playground” area different from other Hillsboro parks. A tall or large wooden fort would be great for kids to play in. Thank you for all of the work you have done.
- I would terminate Rock Creek Trail just after it crosses Rock Creek (If the trail is intended to follow the north side of the creek for its next portion on its way to Noble Woods) or terminate it before it hits Rock Creek (If the future trail is on the southern side of Rock Creek). Hate to see another paved path further dividing this beautiful property.
- Please, If the SE corner is sold off, be sure some parking is south of Rock Creek. (Not just on streets as that will be used by residents of the new development).
- Don't sell the SE corner. We're so short of park acreage. We will never get 10-acres/1000 residents if we don't keep the land we have.
- Adventure play: There was a very imaginative nature play area across from Knotts Berry Farm in California. I will try to find information for you, but it was very creative and kids loved it. Tunnels, climbing, logs, etc.
- Please make the paths as long as possible.
- Lay conduits for wiring in case there is a future need for security cameras.
- Parking should be near Quatama and Cornelius Pass and not at the edge of old Orenco. Too much traffic would go through Old Orenco.
- I don't think a hill slide (built in) is compatible with a nature park. This is not an amusement park.
- One of the uses of the McDonald House should be education about local history.
- Please be sure to have walking trail entries on both Quatama and Cornelius Pass.
- On-street parking in the new neighborhood probably would be used by residents and not be available for park users.
- Suggest we provide a parking lot on undeveloped property next to Cherry Lane Fire Station and provide a trail crossing under the Max bridge next to Cornelius Pass. The fire station is already in public ownership and is staffed 24/7. This could help alleviate traffic concerns regarding the parking lot location proposed off of Birch Street (Fire department may not be agreeable to this).
- Replace some of turf lawn grass with native grasses.



- Be careful to protect kids from falling into the Creek.
- Keep side trails soft surface.
- Along Rock Creek Trail and other paths benches and places to rest would be nice. Helps with tired feet both little and big.
- Phase the Rock Creek Trail west link after the extension is determined.
- Dog policy
- Trail use: Rock Creek Trail alignment
- Parking – Would like to see “designated” parking lot for park users at residential sale parcel. Make it a condition of the sale.
- Bicycle use on NW dogwood is dangerous – concerns for safety (Birch and Dogwood are worst).
- Seasonal max stop – limited.
- General support for no dogs except on the regional trail and on leash.
- There was concern for the safety on Birch and having that as the main entry road. The same concern applies to Dogwood.
- Request a formal dedicated parking lot in the SE residential sale parcel for park users.
- Inquire about the potential to add a “seasonal” max stop that stops at the park during peak use.
- Liked the nature play concept; envisioned play stations along the trail; i.e. hop on a log here for a balance beam, sit on a rock, etc. Idea of a tracking box similar to Cooper Mountain.
- General support for the vision, just wished it could happen quicker.
- Further discussion is needed regarding the trail surfacing.
- McDonald House programming and required parking will need to be discussed prior to beginning extensive site restoration in that area.
- Use part of the McDonald House to display history of Orenco.
- 2007 traffic study indicated that access from the west side was not possible.
- Adventure play: provide a monkey bridge between structures.
- Provide a bird blind at backside of pond and at upper meadow to view wildlife.
- Provide a tower with a scope for viewing wildlife
- Traffic calming (speed bump) is needed at Dogwood to reduce speed of cut-through vehicles.

# Orenco Woods Concept Development Plan

## Traffic Impact Study



Prepared for



Prepared by



July 2013



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July 15, 2013

Lisa Goorjian  
City of Hillsboro  
Parks and Recreation Department  
Hillsboro, OR 97124

**Subject: Orenco Woods Concept Development Plan Transportation Impact Study**

Dear Lisa:

DKS Associates is pleased to submit this transportation impact analysis for the Orenco Woods Concept Development Plan in Hillsboro, Oregon. Please feel free to call if you have any questions or comments regarding this study.

Sincerely,  
**DKS Associates**

A handwritten signature in cursive script that reads "Reah Flisakowski".

Reah Flisakowski, P.E.  
Transportation Engineer

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# CHAPTER 1: INTRODUCTION AND SUMMARY

This study evaluates the transportation impacts for the proposed Orenco Woods Concept Development Plan (CDP) in Hillsboro, Oregon. The roughly 55-acre parcel of land is the former Orenco Woods Golf Course. There is one single-family home (historic McDonald House) which sits on a 0.7-acre lot on the north end of the parcel. The house was most recently used as a group home by a local non-profit. The Orenco Woods CDP would develop a 44-acre nature park on the north portion of the site and renovate the McDonald House for office use and special occasions. Approximately 10 acres on the southern portion of the property will be sold and developed into no more than 75 single-family homes.

The purpose of this transportation impact analysis (TIA) is to identify potential mitigation measures needed to offset transportation impacts the proposed CDP may have on the nearby transportation network. The impact analysis is focused on the following study intersections which are also shown in Figure 1 on the next page:

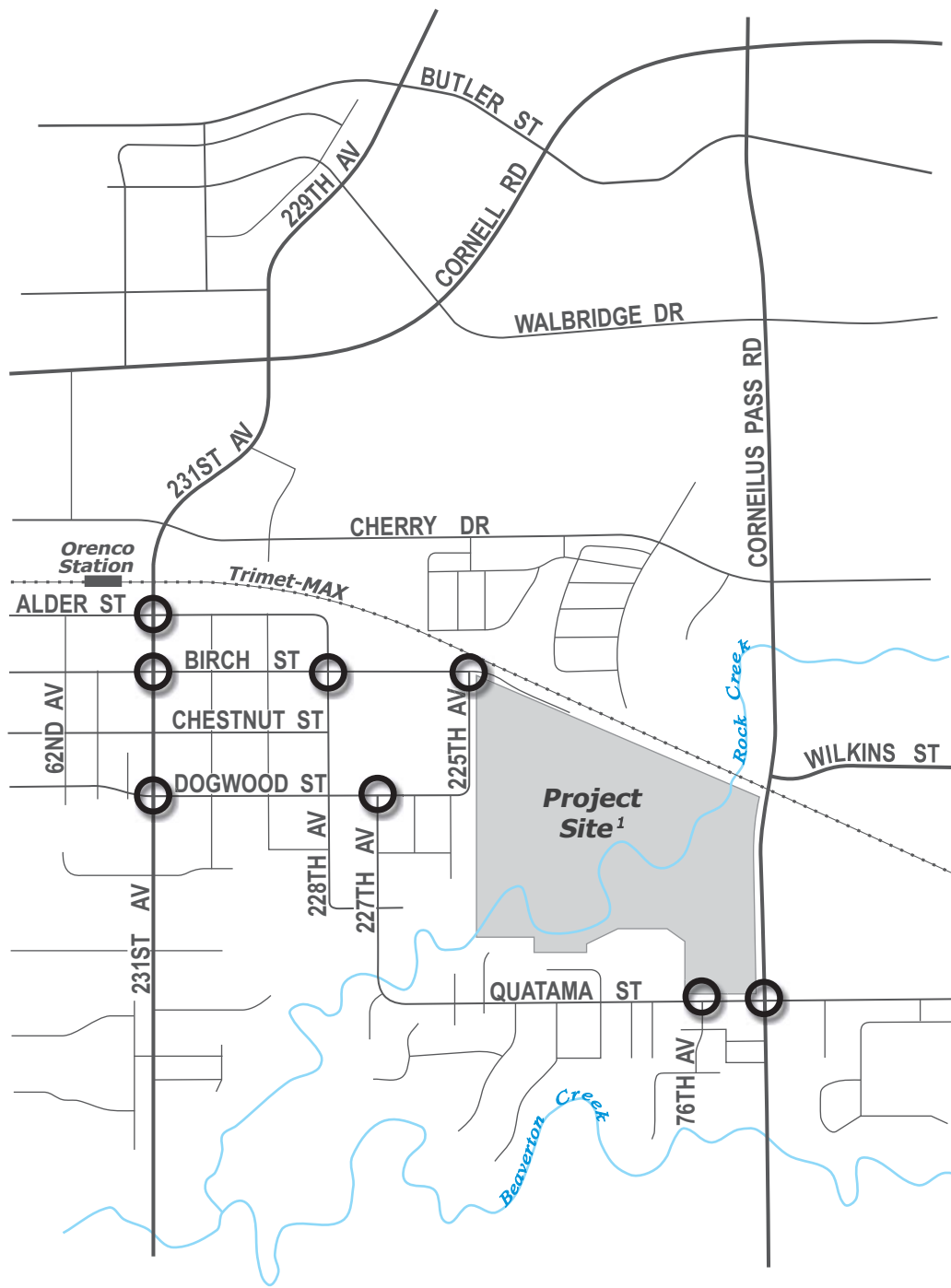
- 231<sup>st</sup> Avenue/Alder Street
- 231<sup>st</sup> Avenue/Birch Street
- 231<sup>st</sup> Avenue/Dogwood Street
- 228<sup>th</sup> Avenue/Birch Street
- 225<sup>th</sup> Avenue (site access)/Birch Street
- 227<sup>th</sup> Avenue/Dogwood Street
- 76<sup>th</sup> Avenue (access)/Quatama Road
- Cornelius Pass Road/Quatama Road

This chapter provides an introduction to the proposed development and the steps taken to analyze the associated impacts on the transportation network. It highlights important elements of the remaining chapters, including a description of the project site and development and the findings of the transportation analysis. Table 1 lists important characteristics of the study area and proposed project.

**Table 1: Key Study Area and Proposed Development Characteristics**

Characteristics	Information
<b>Study Area</b>	
Number of Study Intersections	Eight
Analysis Period	Weekday AM and PM Peak Hours
Analysis Scenarios	Existing (2013) Future (2016) Background Future (2016) Background with Project
<b>Project Site</b>	
Existing Land Use	Formerly used as a golf course, currently vacant except for one single-family home (McDonald House).
Proposed Development	44-acre nature park, up to 75 single family homes, and re-use of the vacant McDonald House for staff offices, programs, and special events
Project Access	Access and parking for the nature park and McDonald House would be provided at the existing driveway connection to Birch Street. Access to the residential development would be provided from Quatama Road as an extension of 76 <sup>th</sup> Avenue. <sup>1</sup>

<sup>1</sup> The residential development has applied for an additional access to Cornelius Pass Road. For analysis, all residential traffic was assumed to access the site from Quatama Road based on conversations with City of Hillsboro Parks and Recreation staff.



<sup>1</sup> See appendix for site plan.

**LEGEND**

○ - Study Intersection

**DKS**



No Scale

caOieÉ **N**

**STUDY AREA**

## Existing Intersection Operations

Existing traffic operations at the study intersections were determined for the a.m. and p.m. peak hours based on the 2000 Highway Capacity Manual methodology<sup>2</sup> for signalized and unsignalized intersections. The estimated LOS and v/c ratio of each study intersection is shown in Table 2. As shown, all study intersections meet operating standards.

**Table 2: Existing Study Intersection Operations**

Intersection	Jurisdiction	Operating Standard	A.M. Peak Hour		P.M. Peak Hour	
			LOS	V/C	LOS	V/C
Signalized						
Cornelius Pass Road/ Quatama Road	Washington County	0.90 V/C	B	0.56	B	0.67
Two-Way Stop						
231 <sup>st</sup> Avenue/ Alder Street	City of Hillsboro	LOS D	A/C	0.42	A/C	0.45
231 <sup>st</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/C	0.43	A/B	0.42
231 <sup>st</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	A/C	0.38	A/B	0.38
228 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/B	0.14	A/A	0.02
Quatama Road/ 76 <sup>th</sup> Avenue	Washington County	0.90 V/C	A/B	0.15	A/A	0.06
All-Way Stop						
227 <sup>th</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	B	0.40	A	0.11
Uncontrolled (Yield)						
225 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A	0.24	A	0.01

Signalized:

LOS = Level of Service of Intersection  
V/C = Volume-to-Capacity Ratio of Intersection

All-Way Stop and Uncontrolled:

LOS = Level of Service of Worst Approach  
V/C = Volume-to-Capacity Ratio of Worst Movement

Two-Way Stop:

LOS = Level of Service of Major Street/Minor Street  
V/C = Volume-to-Capacity Ratio of Worst Movement

## Proposed Development

Located in Hillsboro, Oregon, the Orenco Woods Nature Park site includes 11 acres purchased by the City of Hillsboro in 2007 and 43 acres purchased jointly by Metro and Hillsboro in 2011. Once complete, the park will include areas for picnicking, a small picnic shelter, play area with nature themes, restrooms, and open lawn areas. Paths, both hard and soft surfaced, will provide access from the Orenco Elementary School and neighborhoods on the west with links from Birch Street, Dogwood Street, and Elm Street. A new segment of the Rock Creek Regional Trail will extend through the park from Dogwood

<sup>2</sup> 2000 Highway Capacity Manual, Transportation Research Board, Washington DC, 2000.



Street to Cornelius Pass Road, where bike lanes and sidewalks will connect to its recent extension on Wilkins Street.

The City of Hillsboro has purchased the historic McDonald House and the 0.7-acre site it is located on. The McDonald House is intended for potential future uses that include staff offices, environmental and cultural programming, and rentable events (e.g., weddings).

Metro and the City of Hillsboro plan to sell approximately 10 acres in the southeast corner for residential development with the proceeds used to pay for costs associated with planning and developing the park. The proposed development will include 75 single-family homes.

Table 3 summarizes the estimated trips generated for each land use within the Orenco Woods site.

**Table 3: Trip Generation Summary**

Land Use	A.M. Peak Hr. Trips			P.M. Peak Hr. Trips			Daily Trips
	In	Out	Total	In	Out	Total	
Residential Development	16	46	62	51	30	81	806
McDonald House	11	1	12	2	9	11	85
Nature Park	5	5	10	10	10	20	100
<b>Total:</b>	<b>32</b>	<b>52</b>	<b>84</b>	<b>63</b>	<b>49</b>	<b>112</b>	<b>991</b>

## Project Traffic Impact

This analysis assumes that construction of the proposed Orenco Wood CDP would be completed in 2016. To determine whether the proposed project will result in off-site traffic impacts, future traffic volumes were estimated and intersection operations were evaluated for the following scenarios:

- 2016 No Build (AM and PM peak hour)
- 2016 with Project (AM and PM peak hour)

Table 4 lists the study intersection operating conditions for the AM and PM peak hours after accounting for project trips. As listed, all study intersections are expected to operate at acceptable levels and no mitigations are necessary.

**Table 4: 2016 “with Project” Intersection Operations**

Intersection	Jurisdiction	Operating Standard	A.M. Peak Hour		P.M. Peak Hour	
			LOS	V/C	LOS	V/C
Signalized						
Cornelius Pass Road/ Quatama Road	Washington County	0.90 V/C	B	0.68	C	0.78
Two-Way Stop						
231 <sup>st</sup> Avenue/ Alder Street	City of Hillsboro	LOS D	A/D	0.57	A/C	0.60
231 <sup>st</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/D	0.59	A/C	0.55
231 <sup>st</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	A/D	0.54	A/C	0.52
228 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/B	0.20	A/A	0.05
Quatama Road/ 76 <sup>th</sup> Avenue	Washington County	0.90 V/C	A/B	0.11	A/B	0.06
All-Way Stop						
227 <sup>th</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	B	0.45	A	0.14
Uncontrolled (Yield)						
225 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A	0.30	A	0.03

Signalized:

LOS = Level of Service of Intersection  
 V/C = Volume-to-Capacity Ratio of Intersection

Two-Way Stop:

LOS = Level of Service of Major Street/Minor Street  
 V/C = Volume-to-Capacity Ratio of Worst Movement

All-Way Stop and Uncontrolled:

LOS = Level of Service of Worst Approach  
 V/C = Volume-to-Capacity Ratio of Worst Movement

## Project Impact Summary

The following list summarizes the key transportation impacts findings associated with the proposed Orenco Woods Concept Development Plan:

- The project site would generate approximately 991 daily trips, including 84 (32 in, 52 out) a.m. peak hour trips and 112 (63 in, 49 out) p.m. peak hour trips.
- All study intersections would operate at acceptable levels under the future (2016) “with Project” scenario.
- No off-site improvements at the study intersections are recommended with the proposed CDP.

## CHAPTER 2: EXISTING CONDITIONS

This chapter provides documentation of existing study area conditions, including the project site, study area roadway network, pedestrian and bicycle facilities, and existing traffic volumes and operations. Supporting details are provided in the appendix.

### Project Site

Located in Hillsboro, Oregon, the roughly 55-acre Orenco Woods Nature Park site was previously the Orenco Woods Golf Course, owned by the Hillsboro Elks. There is an existing access road from the 225<sup>th</sup> Avenue/Birch Street intersection that is currently gated shut, and Rock Creek meanders through the site. A single-family home (the historic McDonald House) sits on a 0.7-acre lot on the north end of the parcel.

### Study Area Roadway Network

The project site is located in an area bound generally by NW 225<sup>th</sup> Avenue to the west, MAX light rail right-of-way to the north, NW Cornelius Pass Road to the east, and Quatama Road to the south (see appendix for site plan). Key roadways in the study area are summarized in Table 5 along with their existing roadway characteristics.

**Table 5: Study Area Roadway Characteristics**

Roadway	Classification	Number of Lanes	Posted Speed	Sidewalks	Bike Lanes	On-Street Parking
Cornelius Pass Road	Arterial	Varies	45 mph	Both Sides	Yes	No
Quatama Road	Collector	2	25 mph	Some	Some	Some
231 <sup>st</sup> Street	Collector	3 (including TWLTL)	35 mph	West Side	Yes	No
228 <sup>th</sup> Avenue	Neighborhood Route	2	25 mph	Some	No	No
227 <sup>th</sup> Avenue	Collector	2	25 mph	Some	No	No
Birch Street	Local	2	25 mph	No	No	No
Alder Street	Neighborhood Route	2	25 mph	No	No	No
Dogwood Street	Local	2	25 mph	Some	No	No

<sup>a</sup> TWLTL = Two-way left-turn lane

## Pedestrian and Bicycle Facilities

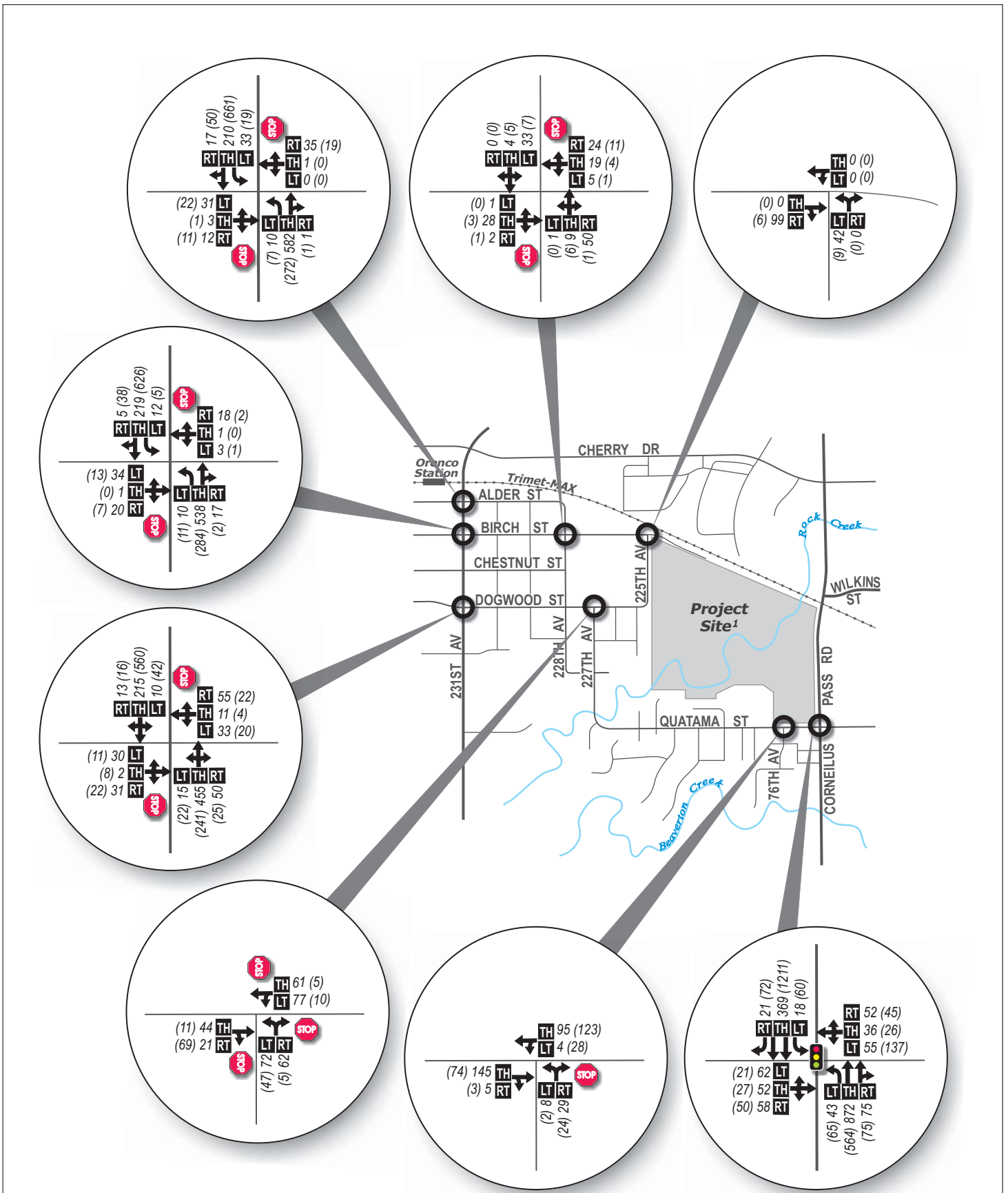
Cornelius Pass Road has bike lanes and sidewalks adjacent to the southern portion of the site, and a shared-use path along the east side extending north from the termination of the sidewalks and bike lanes. Quatama Road has intermittent sidewalks (generally associated with newer developments) and no bike lanes. West of the project site, 231<sup>st</sup> Avenue has bike lanes in both directions and sidewalks along the west side of the roadway. There is a painted crosswalk with a Rectangular Rapid Flashing Beacon (RRFB) across 231<sup>st</sup> Avenue just north of Alder Street. Intersection counts show a high number of pedestrians using the crosswalk, particularly during the a.m. peak hour. There are sidewalks around the Orenco Elementary School, however many roadways through the residential area do not have sidewalks or curbs (including Alder Street, Birch Street, Dogwood Street, 225<sup>th</sup> Avenue, 228<sup>th</sup> Avenue, and 227<sup>th</sup> Avenue).

## Existing Traffic Volumes and Operations

Existing a.m. and p.m. peak hour traffic operations were analyzed at the following study intersections:

- 231<sup>st</sup> Avenue/Alder Street
- 231<sup>st</sup> Avenue/Birch Street
- 231<sup>st</sup> Avenue/Dogwood Street
- 228<sup>th</sup> Avenue/Birch Street
- 225<sup>th</sup> Avenue (site access)/Birch Street
- 227<sup>th</sup> Avenue/Dogwood Street
- 76<sup>th</sup> Avenue (access)/Quatama Road
- Cornelius Pass Road/Quatama Road

To perform the intersection analysis, a.m. and p.m. peak hour traffic counts were collected during the peak periods on Wednesday, June 12 and Thursday, June 13, 2013. The peak hour traffic volumes analyzed under existing conditions are shown on the following page in Figure 2, with the detailed two-hour traffic counts are included in the appendix.



<sup>1</sup> See appendix for site plan.

**LEGEND**

- Study Intersection
- Stop Sign
- Traffic Signal
- Lane Configuration
- AM (PM) - Peak Hour Traffic Volumes
- Volume Turn Movement  
Left • Thru • Right

**DKS**

No Scale

**EXISTING (2013)  
AM/PM PEAK HOUR  
TRAFFIC VOLUMES**

The purpose of intersection analysis is to ensure that the transportation network remains within desired performance levels as required by City code. Intersections are the focus of the analysis because they are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinity.

Before the analysis results of the study intersections are presented, discussion is provided for two important analysis issues: intersection performance measures (definitions of typical measures) and required operating standards (as specified by the agency with roadway jurisdiction).

### ***Intersection Performance Measures***

Level of service (LOS) ratings and volume-to-capacity (v/c) ratios are two commonly used performance measures that provide a good picture of intersection operations. In addition, they are often incorporated into agency mobility standards.

- **Level of service (LOS):** A “report card” rating (A through F) based on the average delay experienced by vehicles at the intersection.<sup>3</sup> LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity.
- **Volume-to-capacity (v/c) ratio:** A decimal representation (typically between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. It is determined by dividing the peak hour traffic volume by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 1.00, congestion increases and performance is reduced. If the ratio is greater than 1.00, the turn movement, approach leg, or intersection is oversaturated and usually results in excessive queues and long delays.

### ***Required Operating Standards***

Washington County targets a v/c ratio of 0.90 or less for intersections in urban areas. The City of Hillsboro identifies LOS “D” as an acceptable operating standard.

### ***Existing Operating Conditions***

Existing traffic operations at the study intersections were determined for the a.m. and p.m. peak hours based on the 2000 Highway Capacity Manual methodology<sup>4</sup> for signalized and unsignalized intersections. The estimated LOS and v/c ratio of each study intersection is shown in Table 6. As shown, all study intersections currently meet operating standards.

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<sup>3</sup> A description of Level of Service (LOS) is provided in the appendix and includes a list of the delay values (in seconds) that correspond to each LOS designation.

<sup>4</sup> 2000 *Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.

**Table 6: Existing Study Intersection Operations**

Intersection	Jurisdiction	Operating Standard	A.M. Peak Hour		P.M. Peak Hour	
			LOS	V/C	LOS	V/C
Signalized						
Cornelius Pass Road/ Quatama Road	Washington County	0.90 V/C	B	0.56	B	0.67
Two-Way Stop						
231 <sup>st</sup> Avenue/ Alder Street	City of Hillsboro	LOS D	A/C	0.42	A/C	0.45
231 <sup>st</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/C	0.43	A/B	0.42
231 <sup>st</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	A/C	0.38	A/B	0.38
228 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/B	0.14	A/A	0.02
Quatama Road/ 76 <sup>th</sup> Avenue	Washington County	0.90 V/C	A/B	0.15	A/A	0.06
All-Way Stop						
227 <sup>th</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	B	0.40	A	0.11
Uncontrolled (Yield)						
225 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A	0.24	A	0.01

Signalized:

LOS = Level of Service of Intersection  
V/C = Volume-to-Capacity Ratio of Intersection

Two-Way Stop:

LOS = Level of Service of Major Street/Minor Street  
V/C = Volume-to-Capacity Ratio of Worst Movement

All-Way Stop and Uncontrolled:

LOS = Level of Service of Worst Approach  
V/C = Volume-to-Capacity Ratio of Worst Movement

## Field Observations

The project area was observed during peak conditions to identify unique intersection characteristics and to verify intersection operations are consistent with model outputs. The only location where queues of multiple vehicles were observed during the p.m. peak period was at the Cornelius Pass Road/Quatama Road intersection, and these queues cleared the intersection during each cycle. The observed levels of delay are consistent with existing intersection operations reported previously in Table 5.

## Collision Analysis

Three years of collision records (2009-2011) for the study area were obtained from Oregon Department of Transportation (ODOT)'s online database. As shown in Table 7, there were collisions reported at three of the study intersections, including 11 injury collisions, 13 property damage only (PDO) collisions, and no fatalities.

For intersections, a collision rate greater than or equal to 1.0 collision per million entering vehicles (MEV) generally indicates a higher than average collision rate and that additional collision analysis should be performed. However, none of the study intersections had a collision rate in excess of 1.0 collision per MEV.

The highest number of collisions occurred at the intersection of Cornelius Pass Road and Quatama Road, where there appears to be a decreasing trend in the number of collisions occurring each year. This trend could be explained by the recent improvements along Cornelius Pass Road, as well as the absence of traffic for parts of 2010 and 2011 during construction of these improvements.

There appears to be a significant increase in collisions at the 231<sup>st</sup> Avenue/Alder Street intersection in 2011, 60% of which were rear-end collisions. Based on discussion with Hillsboro Parks and Recreation Staff,<sup>5</sup> a number of contributing factors were identified. A Rectangular Rapid Flashing Beacon (RRFB) was installed late in 2010 on 231<sup>st</sup> Avenue just north of its intersection with Alder Street. It is likely that increased driver compliance to pedestrian crossings contributed to the increased number of rear-end collisions at this location. In addition, it is believed an increase in traffic volumes along 231<sup>st</sup> Avenue during 2011 due to Cornelius Pass Road being closed for construction contributed to the observed increase in collisions at this location.

**Table 7: Collision History**

Intersection	Collisions (by Severity)				Collisions Per year			Collision Rate <sup>b</sup>
	Fatal	Injury	PDO <sup>a</sup>	Total	2009	2010	2011	
Cornelius Pass Road/Quatama Road	0	7	7	14	7	4	3	0.54
231 <sup>st</sup> Avenue/Alder Street	0	2	5	7	1	1	5	0.60
231 <sup>st</sup> Avenue/Dogwood Street	0	2	1	3	0	2	1	0.28

<sup>a</sup> PDO = Property damage only.

<sup>b</sup> Collision rate for intersections= average annual collisions per million entering vehicles (MEV); MEV estimates based on p.m. peak-hour traffic count and applicable factors.

<sup>5</sup> Phone conversation with Mary Ordal, City of Hillsboro Parks and Recreation, on June 22, 2013



## CHAPTER 3: PROJECT IMPACTS

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This chapter reviews the impacts that the proposed nature park and residential development would have on the study area transportation system. This analysis includes trip generation, trip distribution, future year traffic volumes and operating conditions, and a preliminary signal warrant analysis. Future operating conditions at the previously identified study intersections are presented for the following scenarios:

- 2016 No Build (AM and PM peak hour)
- 2016 with Project (AM and PM peak hour)

### Proposed Development

The project site includes 11 acres purchased by the City of Hillsboro in 2007 and 43 acres purchased jointly by Metro and Hillsboro in 2011. Once complete, the park will include areas for picnicking, a small picnic shelter, play area with nature themes, restrooms, and open lawn areas. Paths, both hard and soft surfaced, will provide access from the school and neighborhoods on the west with links from Birch Street, Dogwood Street, and Elm Street. An extension of the Rock Creek Regional Trail will connect from Dogwood Street to Cornelius Pass Road, where sidewalks and bike lanes provide a connection to the existing Rock Creek Trail along Wilkins Street.

The City of Hillsboro has purchased the historic McDonald House and the 0.7-acre site it is located on. The McDonald House is intended for potential future uses that include staff offices, environmental and cultural programming, and rentable events (e.g., weddings).

Metro and the City of Hillsboro plan to sell approximately 10 acres in the southeast corner for residential development with the proceeds used to pay for costs associated with planning and developing the park. The proposed development will include 75 single-family homes.

In 2006, the City of Hillsboro approved rezoning the entire Orenco Woods property to include 252 residential dwelling units. A traffic study completed in March, 2013, found the currently proposed land uses would generate less trips than what was previously approved.<sup>6</sup> The preliminary site plan<sup>7</sup> currently shows 71 single family homes, but this could change before final approval. Therefore this analysis assumes the maximum number of single-family units allowed by zoning laws (75) will be constructed.

### Trip Generation

Trip generation is the method used to estimate the number of vehicles added to site driveways and the adjacent roadway network by a development during a specified period (i.e., such as the p.m. peak hour). The number of peak hour trips associated with the McDonald House and proposed residential development were based on trip rates surveyed at similar land uses, as provided by the Institute of Transportation Engineers (ITE).<sup>8</sup> Trip rates for the nature park were estimated using recent driveway counts taken at the nearby Noble Woods park, which is similar to the proposed Orenco Woods park.

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<sup>6</sup> *Rock Creek Nature Park/Orenco Woods Residential Transportation Analysis*, Kittelson & Associates, Inc., March 2013

<sup>7</sup> See appendix for preliminary Orenco Woods Site Plan

<sup>8</sup> *Trip Generation, 9<sup>th</sup> Edition*, Institute of Transportation Engineers, 2012.

Table 8 lists the vehicle trip generation estimates for the project site. It is estimated that the project site would generate 991 daily trips including 84 (32 in, 52 out) a.m. peak hour trips and 112 (63 in, 49 out) p.m. peak hour trips. These trips were added to the roadway network for the future operations analysis to determine whether traffic from the proposed site would impact the study intersections.

**Table 8: Orenco Woods Park Trip Generation Summary**

Land Use (ITE Code)	Size	A.M. Peak Trip Rate	P.M. Peak Trip Rate	A.M. Peak Hr. Trips			P.M. Peak Hr. Trips			Daily Trips
				In	Out	Total	In	Out	Total	
Residential (Single Family Detached Housing – Code 210)	75 units	0.83 trips/ unit <sup>a</sup>	1.08 trips/ unit <sup>a</sup>	16	46	62	51	30	81	806
McDonald House (General Office – Code 710)	7.7 KSF <sup>b</sup>	1.56 trips/ KSF <sup>b</sup>	1.49 trips/ KSF <sup>b</sup>	11	1	12	2	9	11	85
Nature Park	44 acres	0.19 trips/ acre	0.41 trips/ acre	5	5	10	10	10	20	100
<b>Total:</b>				<b>32</b>	<b>52</b>	<b>84</b>	<b>63</b>	<b>49</b>	<b>112</b>	<b>991</b>

<sup>a</sup> The project trip generation estimates were based on ITE equations, with a back-calculated trip rate provided for comparison purposes (though this trip rate may change as number of units changes). The equation was used instead of the average rate to ensure conservative results.

<sup>b</sup> KSF = 1,000 square feet

## Trip Distribution

Trip distribution provides an estimation of where project trips would be coming from and going to. It is given as percentages at key gateways to the study area and is used to route project trips through the study intersections. The trip distribution for the proposed project site was estimated based on existing traffic patterns in the area. Distinctly different traffic patterns are expected for the proposed residential development and nature park, so trip distribution was performed separately for each portion of the development. The trip distribution percentages and resulting project volumes are shown in Figure 3.

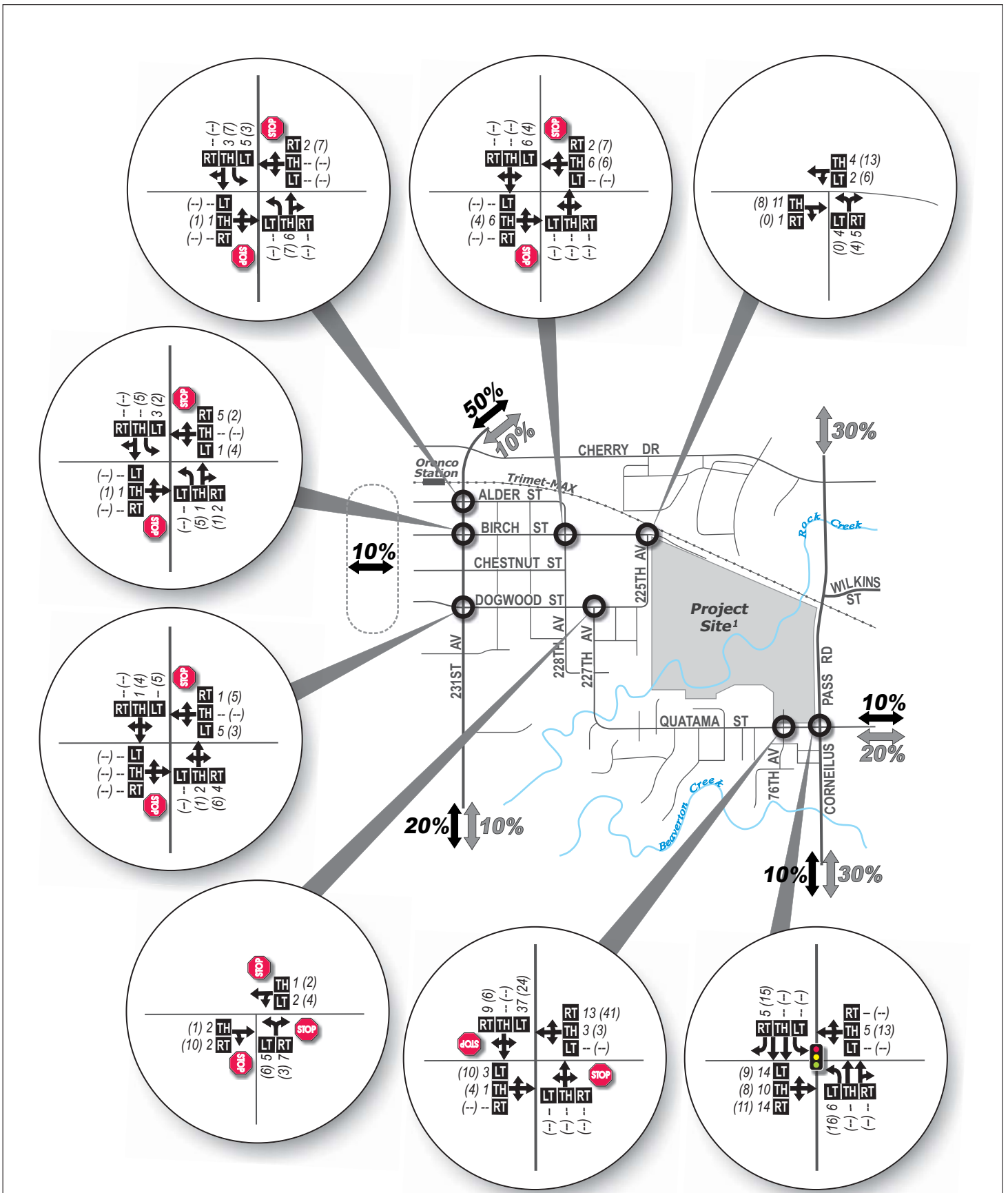
## Future Traffic Volumes and Operating Conditions

It is expected that development of the Orenco Woods CDP would be completed by 2016. Two nearby developments have been approved that will generate additional traffic along 231<sup>st</sup> Avenue and Cornelius Pass Road. These developments, located north of the Orenco Woods project site, include several new buildings on the Ronler Acres Campus as well as development of four vacant sites within Orenco Station (a mixture of residential and commercial use). Findings from the respective traffic studies<sup>9,10</sup> were used to account for these developments and estimate the number of additional trips at study intersections.

To account for general background growth, a 1% yearly linear growth rate was also applied to determine the future background traffic volumes (i.e., the “No Build” scenario). Future (2016) traffic volumes for both the “No Build” and “with Project” scenarios are shown in Figures 4 and 5.

<sup>9</sup> *Transportation Impact Analysis: Intel Ronler Acres*, Group Mackenzie, January 2013

<sup>10</sup> *Transportation Impact Analysis: Holland Partners Orenco Station Developments*, Kittelson & Associates, Inc., April 2012



<sup>1</sup> See appendix for site plan.

**LEGEND**

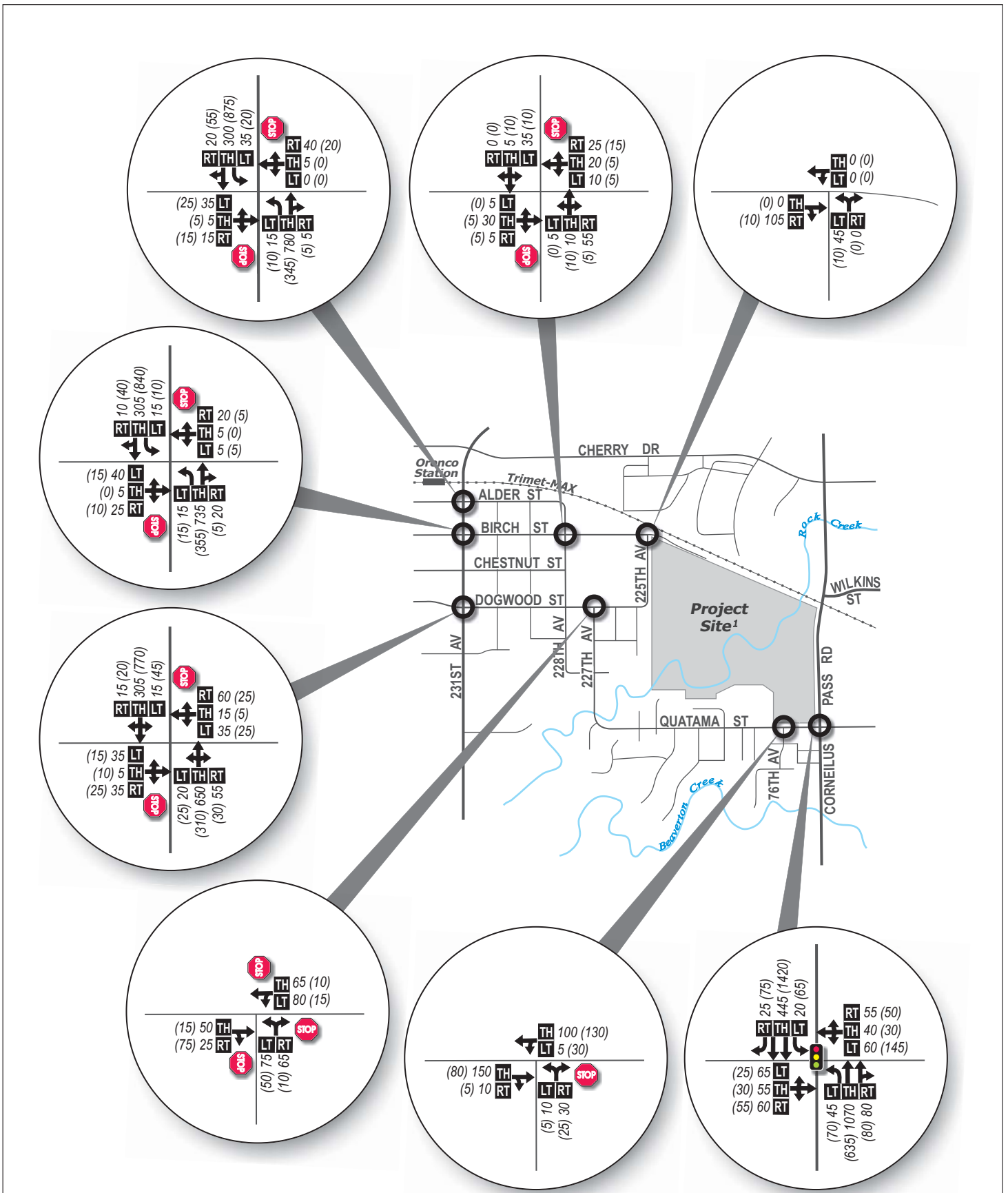
- - Study Intersection
- - Stop Sign
- 🚦 - Traffic Signal
- ← - Lane Configuration
- AM (PM) - Peak Hour Traffic Volumes
- - Volume Not Applicable
- LT TH RT - Volume Turn Movement (Left-Thru-Right)
- 0% - Park/McDonald House Trip Distribution
- 0% - Residential Trip Distribution

**DKS**

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No Scale

**PROJECT VOLUMES (AM/PM) & TRIP DISTRIBUTION**



<sup>1</sup> See appendix for site plan.

**LEGEND**

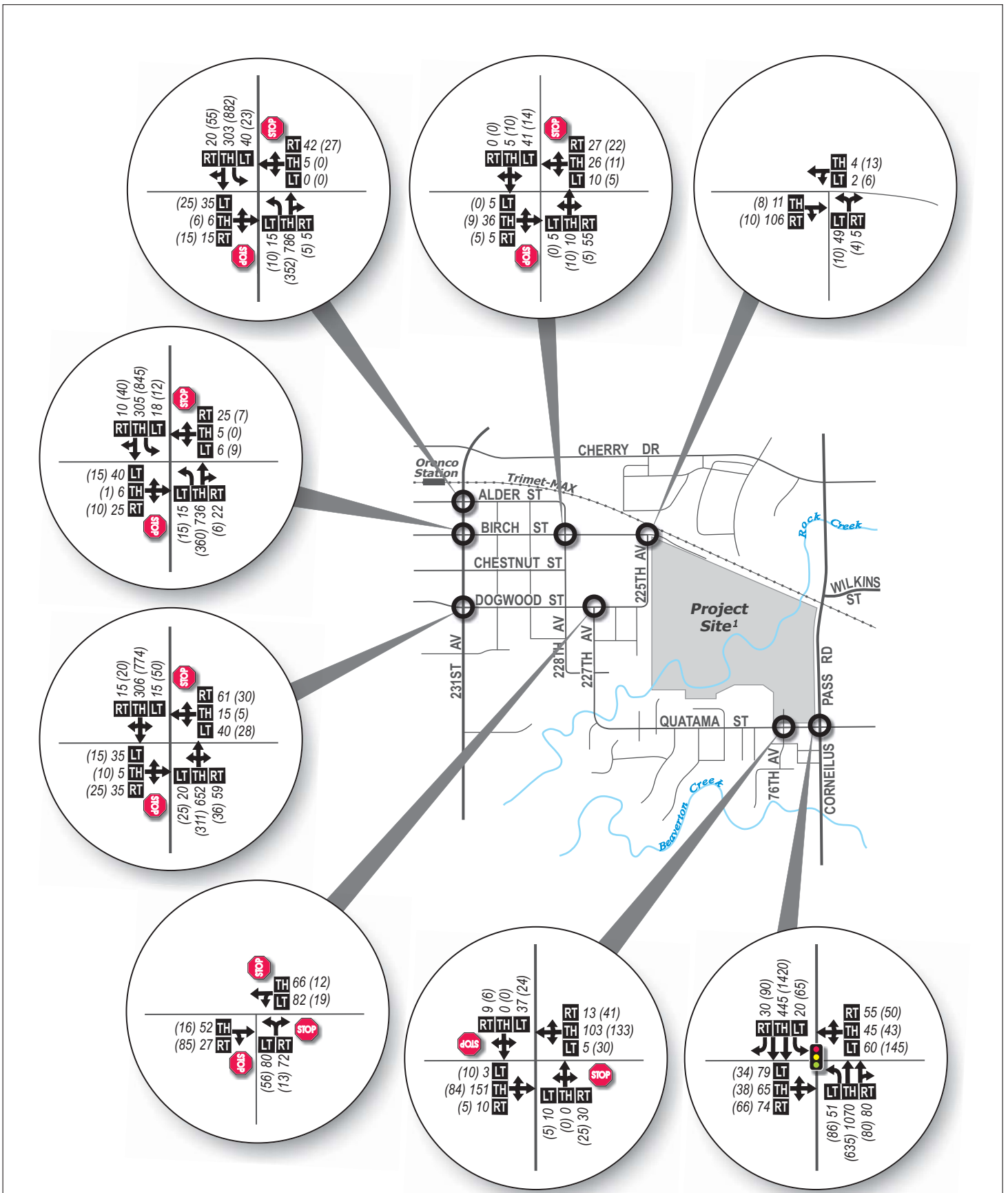
- Study Intersection
- Stop Sign
- Traffic Signal
- Lane Configuration
- AM (PM) - Peak Hour Traffic Volumes
- Volume Turn Movement  
Left • Thru • Right

**DKS**

No Scale

**2016 BACKGROUND AM/PM PEAK HOUR TRAFFIC VOLUMES**

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<sup>1</sup> See appendix for site plan.

**LEGEND**

- Study Intersection
- Stop Sign
- Traffic Signal
- Lane Configuration
- AM (PM) - Peak Hour Traffic Volumes
- Volume Turn Movement
- Left • Thru • Right

**DKS**

No Scale

**2016 WITH PROJECT**

**AM/PM PEAK HOUR**

**TRAFFIC VOLUMES**

**caOieÉ R**

## Intersection Operations

Future operating conditions at the previously identified study intersections are presented for the following scenarios:

- 2016 No Build (AM and PM peak hour)
- 2016 with Project (AM and PM peak hour)

### 2016 No Build (AM and PM Peak Hour)

Analysis was performed based on *2000 Highway Capacity Manual*<sup>11</sup> methodology to determine intersection operations that reflect background growth in the area. Table 9 lists intersection operations after accounting for the assumed traffic volume growth. As shown, all study intersections are expected to operate at acceptable levels under future (2016) background conditions.

**Table 9: 2016 “No Build” Intersection Operations**

Intersection	Jurisdiction	Operating Standard	A.M. Peak Hour		P.M. Peak Hour	
			LOS	V/C	LOS	V/C
Signalized						
Cornelius Pass Road/ Quatama Road	Washington County	0.90 V/C	B	0.65	C	0.76
Two-Way Stop						
231 <sup>st</sup> Avenue/ Alder Street	City of Hillsboro	LOS D	A/D	0.57	A/C	0.59
231 <sup>st</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/C	0.58	A/C	0.55
231 <sup>st</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	A/D	0.46	A/C	0.52
228 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/B	0.15	A/A	0.03
Quatama Road/ 76 <sup>th</sup> Avenue	Washington County	0.90 V/C	A/B	0.17	A/A	0.06
All-Way Stop						
227 <sup>th</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	B	0.43	A	0.12
Uncontrolled (Yield)						
225 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A	0.26	A	0.02

Signalized:

LOS = Level of Service of Intersection  
V/C = Volume-to-Capacity Ratio of Intersection

Two-Way Stop:

LOS = Level of Service of Major Street/Minor Street  
V/C = Volume-to-Capacity Ratio of Worst Movement

All-Way Stop and Uncontrolled:

LOS = Level of Service of Worst Approach  
V/C = Volume-to-Capacity Ratio of Worst Movement

<sup>11</sup> *2000 Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.

### 2016 with Project (AM and PM Peak Hour)

Table 10 lists the study intersection operating conditions for the AM and PM peak hours after accounting for project trips. As listed, all study intersections are expected to operate at acceptable levels and no mitigations are necessary.

**Table 10: 2016 “with Project” Intersection Operations**

Intersection	Jurisdiction	Operating Standard	AM Peak Hour		PM Peak Hour	
			LOS	V/C	LOS	V/C
Signalized						
Cornelius Pass Road/ Quatama Road	Washington County	0.90 V/C	B	0.68	C	0.78
Two-Way Stop						
231 <sup>st</sup> Avenue/ Alder Street	City of Hillsboro	LOS D	A/D	0.57	A/C	0.60
231 <sup>st</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/D	0.59	A/C	0.55
231 <sup>st</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	A/D	0.54	A/C	0.52
228 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A/B	0.20	A/A	0.05
Quatama Road/ 76 <sup>th</sup> Avenue	Washington County	0.90 V/C	A/B	0.11	A/B	0.06
All-Way Stop						
227 <sup>th</sup> Avenue/ Dogwood Street	City of Hillsboro	LOS D	B	0.45	A	0.14
Uncontrolled (Yield)						
225 <sup>th</sup> Avenue/ Birch Street	City of Hillsboro	LOS D	A	0.30	A	0.03

Signalized:

LOS = Level of Service of Intersection  
V/C = Volume-to-Capacity Ratio of Intersection

All-Way Stop and Uncontrolled:

LOS = Level of Service of Worst Approach  
V/C = Volume-to-Capacity Ratio of Worst Movement

Two-Way Stop:

LOS = Level of Service of Major Street/Minor Street  
V/C = Volume-to-Capacity Ratio of Worst Movement

## Trip Generation Sensitivity Analysis

The trip generation estimate for the McDonald House was based on its proposed use as staff offices. However, it is anticipated this building will also host special events, including corporate retreats, educational and cultural programs, and larger events such as weddings. Because the future uses of this building are not clearly identified at this point, it is difficult to estimate the number of trips generated by these events. Therefore, a sensitivity analysis was performed to determine the number of additional trips that could be accommodated by the surrounding roadways before mitigation would be required. It was determined that the McDonald House could generate an additional 30 trips (beyond estimates shown in Table 8) before mitigation would be required. More than 30 additional project trips during the A.M. peak hour would cause the intersection of 231<sup>st</sup> Avenue and Alder Street to exceed the LOS “D” standard.

## Preliminary Traffic Signal Warrants

Preliminary signal warrant analysis was performed at the intersection of 231<sup>st</sup> Avenue and Dogwood Street to evaluate the potential need for a new traffic signal. This intersection was selected for analysis because, out of the unsignalized study intersections, it would be most likely to meet signal warrants based on the combination of major street and minor street traffic volumes.

ODOT’s Transportation Planning Analysis Unit (TPAU) has developed a preliminary warrant analysis to quickly identify intersections that are likely candidates for installation of a new traffic signal. This analysis was applied to the 231<sup>st</sup> Avenue/Dogwood Street intersection and the results are shown in Table 11. For a traffic signal to be warranted, both minor and major street traffic volumes need to be above the specified thresholds for either Case A or Case B. As shown, major street traffic volumes are above the required threshold for Case A, however the minor street volumes are well below the warrant threshold. Both major and minor streets volumes are below warrant thresholds for Case B. This finding is consistent with the intersection operations reported above (Table 9) that indicates this intersection operates with acceptable levels of delay under 2016 project traffic conditions. Because preliminary signal warrants are not met at this intersection, analysis was not performed at the remaining unsignalized study intersections with lower minor street traffic volumes.

**Table 11: Preliminary Warrant Analysis (AM Peak Hour)**

Warrant Case	Approach	Warrant Threshold	Daily Approach Volumes	Warrant Met?
Case A	Major	8,850	10,670	No
	Minor	2,650	550	
Case B	Major	13,300	10,670	No
	Minor	1,350	550	

## Project Impact Summary

The following list summarizes the key transportation impact findings associated with the proposed Orenco Woods Concept Development Plan:

- The project site would generate approximately 991 daily trips including 84 (32 in, 52 out) a.m. peak hour trips and 112 (63 in, 49 out) p.m. peak hour trips.
- All study intersections would operate at acceptable levels under the future (2016) “with Project” scenario.
- No off-site improvements at the study intersections are recommended with the proposed CDP.



# Appendix

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**Site Information**

**Weekday Peak Hour Traffic Counts**

**Collision Data**

**Level of Service Descriptions**

**HCM Analysis – Existing**

**HCM Analysis – Background**

**HCM Analysis – Project**

## Site Information

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**RESIDENTIAL PARCEL**  
 The location of future public access for pedestrian, bicycle and non-motorized uses across the Residential Parcel to the Rock Creek Regional Trail will be determined prior to the development of this property. Potential access opportunities may include sidewalks, streets or paths which may be constructed as part of that development.



**DRAFT MASTER PLAN**  
 APRIL 2013

**ORENCO WOODS NATURE PARK**



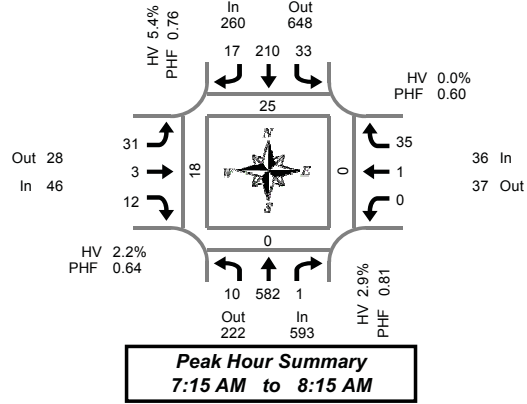
# **Weekday Peak Hour Traffic Counts**

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# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Alder St

Thursday, June 13, 2013  
7:00 AM to 9:00 AM

### 5-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Interval Total	Pedestrians Crosswalk						
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West			
7:00 AM	0	43	0	0	2	6	1	0	4	0	0	0	0	0	0	0	0	0	0	56	4	0	0	3
7:05 AM	0	39	0	0	1	7	1	0	2	0	0	0	0	0	0	0	0	0	0	50	0	0	0	3
7:10 AM	0	37	0	1	0	4	1	1	2	0	1	0	0	0	0	0	0	0	0	45	2	0	0	3
7:15 AM	0	43	0	0	2	7	1	0	3	1	4	0	0	0	0	2	0	0	0	63	0	0	0	3
7:20 AM	0	55	0	0	3	17	1	0	4	0	1	0	0	0	1	0	0	0	82	4	0	0	3	
7:25 AM	0	51	0	0	3	18	1	0	2	1	2	0	0	0	0	4	0	0	82	3	0	0	1	
7:30 AM	1	39	0	0	4	20	0	1	4	0	1	0	0	0	0	3	0	0	72	1	0	0	1	
7:35 AM	0	42	0	0	4	16	1	0	3	0	1	0	0	0	4	0	0	0	71	5	0	0	2	
7:40 AM	1	42	0	0	5	14	3	0	2	0	0	1	0	0	0	0	0	0	67	6	0	0	5	
7:45 AM	0	58	0	1	4	22	1	0	3	0	0	0	0	0	6	0	0	0	94	1	0	0	0	
7:50 AM	2	52	0	0	4	15	4	0	4	1	0	0	0	0	4	1	0	0	86	0	0	0	1	
7:55 AM	2	61	1	1	2	31	3	0	3	0	0	0	0	0	5	0	0	0	108	1	0	0	1	
8:00 AM	2	62	0	1	2	23	2	0	2	0	0	0	0	1	2	0	0	0	96	1	0	0	0	
8:05 AM	1	45	0	2	0	15	0	0	0	0	2	0	0	0	4	0	0	0	67	3	0	0	0	
8:10 AM	1	32	0	0	0	12	0	0	1	0	1	0	0	0	0	0	0	0	47	0	0	0	1	
8:15 AM	0	34	0	0	1	20	1	0	1	0	1	0	0	0	1	0	0	0	59	1	0	0	1	
8:20 AM	0	32	0	0	0	13	0	0	4	0	1	0	0	0	1	0	0	0	51	0	0	0	0	
8:25 AM	0	27	0	0	1	9	0	0	3	0	0	0	0	0	1	0	0	0	41	0	0	0	2	
8:30 AM	2	44	0	0	3	18	0	0	2	0	2	0	0	0	0	0	0	0	71	0	0	0	3	
8:35 AM	0	33	0	0	1	15	0	0	1	0	0	0	0	0	0	0	0	0	50	1	0	0	0	
8:40 AM	0	29	0	1	2	10	3	0	0	0	0	0	0	0	0	0	0	0	44	1	0	0	2	
8:45 AM	0	36	0	0	1	12	4	0	4	0	0	0	0	0	2	0	0	0	59	0	0	1	1	
8:50 AM	1	45	0	0	3	22	1	0	4	0	0	0	0	0	0	0	0	0	76	0	0	0	0	
8:55 AM	1	31	0	0	4	12	3	0	1	0	0	0	0	0	0	0	0	0	52	1	0	0	0	
Total Survey	14	1,012	1	7	52	358	32	2	59	3	17	1	0	1	40	1	0	0	1,589	35	0	1	33	

### 15-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Interval Total	Pedestrians Crosswalk					
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West		
7:00 AM	0	119	0	1	3	17	3	1	8	0	1	0	0	0	0	0	0	0	151	6	0	0	6
7:15 AM	0	149	0	0	8	42	3	0	9	2	7	0	0	0	7	0	0	0	227	7	0	0	7
7:30 AM	2	123	0	0	13	50	4	1	9	0	2	1	0	0	7	0	0	0	210	12	0	0	8
7:45 AM	4	171	1	2	10	68	8	0	10	1	0	0	0	0	15	1	0	0	288	2	0	0	2
8:00 AM	4	139	0	3	2	50	2	0	3	0	3	0	0	1	6	0	0	0	210	4	0	0	1
8:15 AM	0	93	0	0	2	42	1	0	8	0	2	0	0	0	3	0	0	0	151	1	0	0	3
8:30 AM	2	106	0	1	6	43	3	0	3	0	2	0	0	0	0	0	0	0	165	2	0	0	5
8:45 AM	2	112	0	0	8	46	8	0	9	0	0	0	0	0	2	0	0	0	187	1	0	1	1
Total Survey	14	1,012	1	7	52	358	32	2	59	3	17	1	0	1	40	1	0	0	1,589	35	0	1	33

### Peak Hour Summary 7:15 AM to 8:15 AM

By Approach	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Total	Pedestrians Crosswalk					
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West		
Volume	593	222	815	5	260	648	908	1	46	28	74	1	36	37	73	1	0	0	935	25	0	0	18
%HV	2.9%				5.4%				2.2%				0.0%				3.4%						
PHF	0.81				0.76				0.64				0.60				0.81						

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Total		
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total			
Volume	10	582	1	593	33	210	17	260	31	3	12	46	0	1	35	36	0	0	935
%HV	10.0%	2.6%	###	2.9%	0.0%	6.7%	0.0%	5.4%	0.0%	0.0%	8.3%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%
PHF	0.42	0.83	0.25	0.81	0.63	0.76	0.47	0.76	0.78	0.38	0.43	0.64	0.00	0.25	0.58	0.60	0.00	0.00	0.81

### Rolling Hour Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Interval Total	Pedestrians Crosswalk					
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West		
7:00 AM	6	562	1	3	34	177	18	2	36	3	10	1	0	0	29	1	0	0	876	27	0	0	23
7:15 AM	10	582	1	5	33	210	17	1	31	3	12	1	0	1	35	1	0	0	935	25	0	0	18
7:30 AM	10	526	1	5	27	210	15	1	30	1	7	1	0	1	31	1	0	0	859	19	0	0	14
7:45 AM	10	509	1	6	20	203	14	0	24	1	7	0	0	1	24	1	0	0	814	9	0	0	11
8:00 AM	8	450	0	4	18	181	14	0	23	0	7	0	0	1	11	0	0	0	713	8	0	1	10



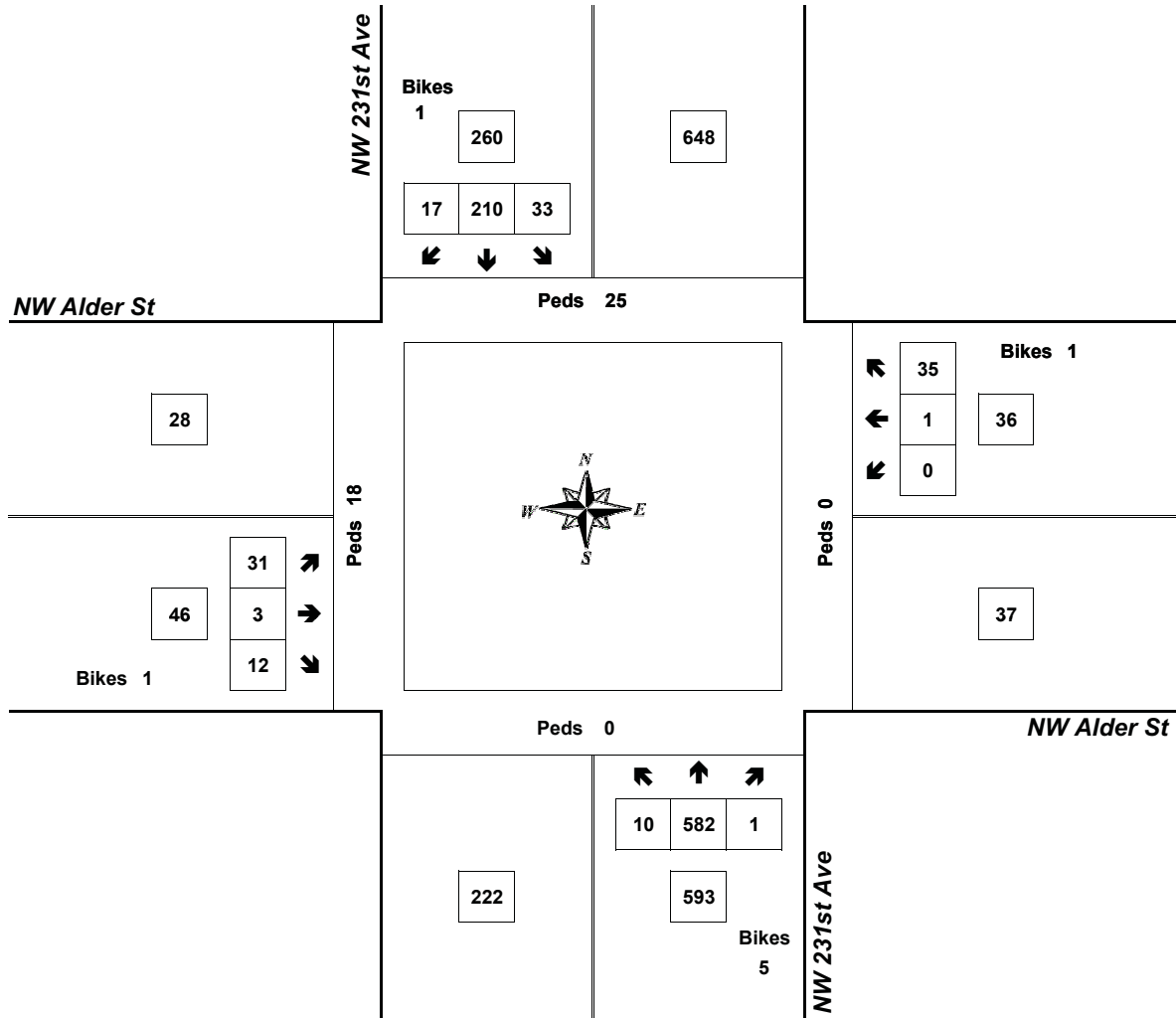
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 231st Ave & NW Alder St

7:15 AM to 8:15 AM  
Thursday, June 13, 2013



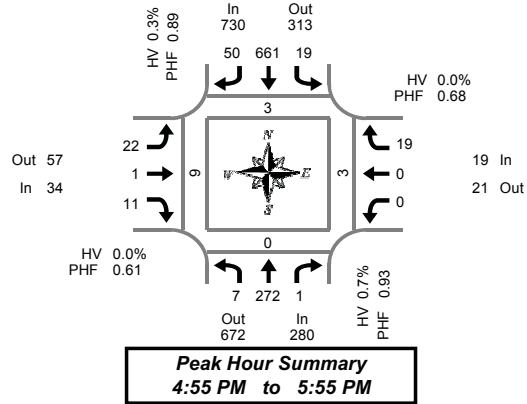
Approach	PHF	HV%	Volume
EB	0.64	2.2%	46
WB	0.60	0.0%	36
NB	0.81	2.9%	593
SB	0.76	5.4%	260
<b>Intersection</b>	<b>0.81</b>	<b>3.4%</b>	<b>935</b>

Count Period: 7:00 AM to 9:00 AM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Alder St

Wednesday, June 12, 2013

4:00 PM to 6:00 PM

### 5-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Interval Total	Pedestrians Crosswalk				
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West	
4:00 PM	0	19	0	0	2	42	2	0	2	0	0	0	0	0	0	1	0	68	3	0	0	0
4:05 PM	0	15	0	1	2	34	1	0	1	0	0	0	0	0	2	0	55	0	0	0	0	
4:10 PM	0	25	0	0	1	46	2	2	1	0	0	1	0	0	1	0	76	0	0	0	1	
4:15 PM	1	27	0	0	2	55	2	0	0	0	1	0	0	1	0	89	6	0	0	4		
4:20 PM	0	25	1	0	1	46	6	0	1	0	0	0	0	1	1	0	82	0	0	0	0	
4:25 PM	0	26	0	0	0	57	2	1	2	0	0	0	0	0	0	0	87	0	0	0	2	
4:30 PM	0	20	0	0	3	52	1	2	4	0	0	0	0	0	0	0	80	2	0	0	1	
4:35 PM	3	23	0	0	0	61	0	0	2	0	0	0	1	0	0	0	90	0	0	0	0	
4:40 PM	1	25	2	0	1	56	4	0	0	0	1	0	0	0	1	0	91	0	0	0	0	
4:45 PM	0	27	0	0	3	45	3	1	2	0	0	0	0	0	0	0	80	1	0	0	3	
4:50 PM	0	14	0	1	1	42	5	1	2	0	1	0	1	0	1	0	67	0	0	0	0	
4:55 PM	0	22	0	1	0	51	6	0	2	0	0	0	0	0	0	0	81	0	0	0	1	
5:00 PM	0	26	0	0	4	53	2	0	3	0	2	0	0	0	0	0	90	0	0	0	0	
5:05 PM	1	20	1	0	2	54	2	0	3	0	2	0	0	0	2	0	87	0	0	0	1	
5:10 PM	0	27	0	0	2	55	3	1	1	0	3	0	0	0	0	0	91	0	0	1	0	
5:15 PM	2	19	0	0	0	50	4	1	1	0	1	0	0	0	2	0	79	0	0	0	0	
5:20 PM	1	22	0	0	1	43	5	0	2	0	0	0	0	0	2	0	76	0	0	0	3	
5:25 PM	2	21	0	0	1	66	5	1	3	0	1	0	0	0	2	0	101	1	0	0	1	
5:30 PM	1	25	0	0	2	50	7	0	0	0	1	0	0	0	3	0	89	0	0	0	0	
5:35 PM	0	19	0	0	2	68	3	2	4	0	0	0	0	0	2	0	98	2	0	0	0	
5:40 PM	0	26	0	0	1	58	3	1	0	1	0	0	0	0	0	0	89	0	0	0	0	
5:45 PM	0	18	0	0	2	55	4	2	1	0	1	0	0	0	3	0	84	0	0	1	1	
5:50 PM	0	27	0	0	2	58	6	0	2	0	0	0	0	0	3	0	98	0	0	1	2	
5:55 PM	0	19	0	1	0	52	3	3	3	0	0	0	0	0	2	0	79	0	0	0	0	
Total Survey	12	537	4	4	35	1,249	81	18	42	1	14	1	2	1	29	0	2,007	15	0	3	20	

### 15-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	59	0	1	5	122	5	2	4	0	0	1	0	0	4	0	199	3	0	0	1
4:15 PM	1	78	1	0	3	158	10	1	3	0	1	0	0	1	2	0	258	6	0	0	6
4:30 PM	4	68	2	0	4	169	5	2	6	0	1	0	0	1	0	0	261	2	0	0	1
4:45 PM	0	63	0	2	4	138	14	2	6	0	1	0	1	0	1	0	228	1	0	0	4
5:00 PM	1	73	1	0	8	162	7	1	7	0	7	0	0	0	2	0	268	0	0	1	1
5:15 PM	5	62	0	0	2	159	14	2	6	0	2	0	0	0	6	0	256	1	0	0	4
5:30 PM	1	70	0	0	5	176	13	3	4	1	1	0	0	0	5	0	276	2	0	0	0
5:45 PM	0	64	0	1	4	165	13	5	6	0	1	0	0	0	8	0	261	0	0	2	3
Total Survey	12	537	4	4	35	1,249	81	18	42	1	14	1	2	1	29	0	2,007	15	0	3	20

### Peak Hour Summary

4:55 PM to 5:55 PM

By Approach	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	280	672	952	1	730	313	1,043	8	34	57	91	0	19	21	40	0	1,063	3	0	3	9
%HV	0.7%				0.3%				0.0%				0.0%				0.4%				
PHF	0.93				0.89				0.61				0.68				0.92				

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	7	272	1	280	19	661	50	730	22	1	11	34	0	0	19	19	1,063
%HV	0.0%	0.7%	0.0%	0.7%	0.0%	0.3%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
PHF	0.35	0.93	0.25	0.93	0.59	0.90	0.74	0.89	0.69	0.25	0.39	0.61	0.00	0.00	0.68	0.68	0.92

### Rolling Hour Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Alder St				Westbound NW Alder St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	5	268	3	3	16	587	34	7	19	0	3	1	2	1	8	0	946	12	0	0	12
4:15 PM	6	282	4	2	19	627	36	6	22	0	10	0	2	1	6	0	1,015	9	0	1	12
4:30 PM	10	266	3	2	18	628	40	7	25	0	11	0	2	0	10	0	1,013	4	0	1	10
4:45 PM	7	268	1	2	19	635	48	8	23	1	11	0	1	0	14	0	1,028	4	0	1	9
5:00 PM	7	269	1	1	19	662	47	11	23	1	11	0	0	0	21	0	1,061	3	0	3	8





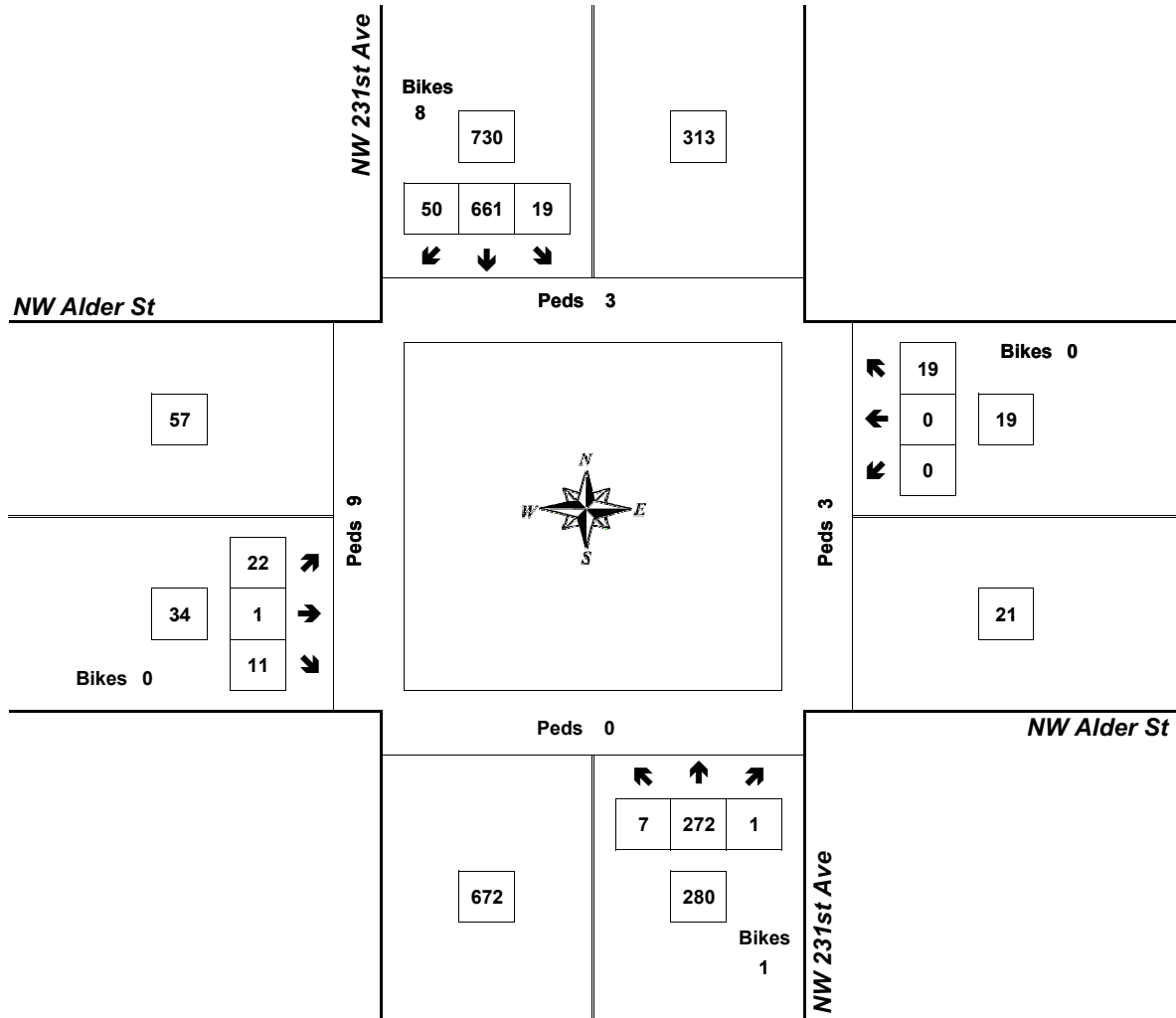
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 231st Ave & NW Alder St

4:55 PM to 5:55 PM  
Wednesday, June 12, 2013



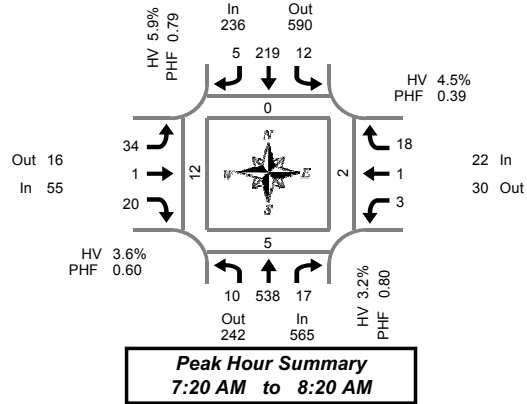
Approach	PHF	HV%	Volume
EB	0.61	0.0%	34
WB	0.68	0.0%	19
NB	0.93	0.7%	280
SB	0.89	0.3%	730
<b>Intersection</b>	<b>0.92</b>	<b>0.4%</b>	<b>1,063</b>

Count Period: 4:00 PM to 6:00 PM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Birch St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

**Peak Hour Summary**  
7:20 AM to 8:20 AM

### 5-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	0	39	0	1	1	6	0	0	0	0	1	0	2	0	0	0	0	0	0	2	
7:05 AM	0	39	0	0	0	7	1	0	3	0	0	0	0	0	1	0	0	0	0	0	
7:10 AM	0	31	0	1	1	3	0	1	6	0	1	0	0	0	0	0	0	0	0	0	
7:15 AM	0	38	0	0	0	10	0	0	3	0	0	0	0	0	0	0	0	1	0	2	
7:20 AM	0	53	0	0	1	17	1	0	2	0	0	0	0	0	0	0	0	2	0	1	
7:25 AM	2	48	0	0	0	14	1	0	4	0	0	0	0	0	1	0	0	0	0	0	
7:30 AM	1	39	1	0	2	23	1	0	2	0	1	0	0	0	0	0	0	1	1	0	
7:35 AM	0	37	1	0	0	19	0	1	2	1	1	0	0	0	2	0	0	0	0	3	
7:40 AM	0	39	1	0	3	12	0	0	2	0	3	0	1	0	1	0	0	0	0	4	
7:45 AM	0	50	5	1	1	18	0	0	3	0	1	0	0	0	3	0	0	0	0	0	
7:50 AM	2	52	4	0	1	18	0	0	6	0	3	0	1	1	2	0	0	1	0	0	
7:55 AM	1	51	2	1	2	27	0	0	3	0	2	0	1	0	6	0	0	0	0	1	
8:00 AM	1	62	2	2	2	23	2	0	6	0	3	0	0	0	2	0	0	0	0	1	
8:05 AM	0	43	0	1	0	15	0	0	2	0	2	0	0	0	1	0	0	0	0	0	
8:10 AM	2	36	1	1	0	13	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
8:15 AM	1	28	0	0	0	20	0	0	1	0	3	0	0	0	0	0	1	0	0	1	
8:20 AM	1	32	0	0	0	15	0	0	2	0	2	0	1	0	0	0	0	0	0	0	
8:25 AM	1	29	0	0	0	9	0	0	2	0	4	0	0	0	0	0	0	0	0	4	
8:30 AM	0	37	1	0	0	15	1	0	3	1	4	0	0	0	0	0	0	0	0	0	
8:35 AM	1	31	0	0	0	18	1	0	3	0	1	0	0	0	0	0	0	0	0	1	
8:40 AM	0	23	1	1	0	5	0	0	3	0	0	0	1	0	1	0	0	0	0	1	
8:45 AM	0	32	0	0	0	13	1	0	5	0	1	0	0	0	1	0	0	0	0	1	
8:50 AM	1	43	0	0	2	22	0	0	3	0	1	0	0	0	0	0	0	0	0	2	
8:55 AM	0	31	1	0	0	11	2	0	1	0	0	0	0	0	0	0	0	0	0	0	
Total Survey	14	943	20	9	16	353	11	2	68	2	35	0	7	1	21	0	0	7	3	25	

### 15-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	0	109	0	2	2	16	1	1	9	0	2	0	2	0	1	0	0	0	0	2	
7:15 AM	2	139	0	0	1	41	2	0	9	0	0	0	0	0	1	0	0	3	0	3	
7:30 AM	1	115	3	0	5	54	1	1	6	1	5	0	1	0	3	0	0	1	1	7	
7:45 AM	3	153	11	2	4	63	0	0	12	0	6	0	2	1	11	0	0	1	0	1	
8:00 AM	3	141	3	4	2	51	2	0	9	0	6	0	0	0	3	0	0	1	2	2	
8:15 AM	3	89	0	0	0	44	0	0	5	0	9	0	1	0	0	0	0	2	0	5	
8:30 AM	1	91	2	1	0	38	2	0	9	1	5	0	1	0	1	0	0	0	0	2	
8:45 AM	1	106	1	0	2	46	3	0	9	0	2	0	0	0	1	0	0	1	0	3	
Total Survey	14	943	20	9	16	353	11	2	68	2	35	0	7	1	21	0	0	7	3	25	

### Peak Hour Summary

7:20 AM to 8:20 AM

By Approach	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	565	242	807	6	236	590	826	1	55	16	71	0	22	30	52	0	0	0	5	12	
%HV	3.2%				5.9%				3.6%				4.5%				4.0%				
PHF	0.80				0.79				0.60				0.39				0.76				

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	10	538	17	565	12	219	5	236	34	1	20	55	3	1	18	22	878
%HV	10.0%	3.0%	5.9%	3.2%	0.0%	6.4%	0.0%	5.9%	5.9%	0.0%	0.0%	3.6%	33.3%	0.0%	0.0%	4.5%	4.0%
PHF	0.63	0.82	0.39	0.80	0.60	0.81	0.42	0.79	0.57	0.25	0.63	0.60	0.38	0.25	0.41	0.39	0.76

### Rolling Hour Summary

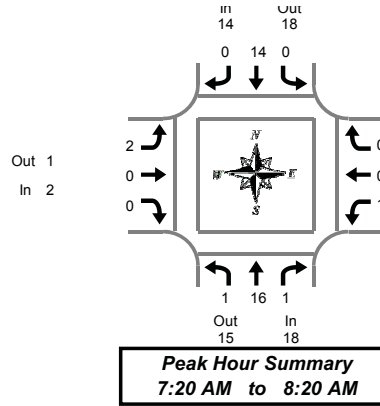
7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	6	516	14	4	12	174	4	2	36	1	13	0	5	1	16	0	0	5	1	13	
7:15 AM	9	548	17	6	12	209	5	1	36	1	17	0	3	1	18	0	0	5	2	13	
7:30 AM	10	498	17	6	11	212	3	1	32	1	26	0	4	1	17	0	0	4	2	15	
7:45 AM	10	474	16	7	6	196	4	0	35	1	26	0	4	1	15	0	0	3	1	10	
8:00 AM	8	427	6	5	4	179	7	0	32	1	22	0	2	0	5	0	0	2	2	12	

# Heavy Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Birch St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

### Heavy Vehicle 5-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
7:05 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
7:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:20 AM	0	1	0	1	0	2	0	2	0	0	0	0	0	0	0	0	3
7:25 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
7:30 AM	0	2	0	2	0	2	0	2	0	0	0	0	0	0	0	0	4
7:35 AM	0	2	1	3	0	0	0	0	1	0	0	1	0	0	0	0	4
7:40 AM	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	3
7:45 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
7:50 AM	1	0	0	1	0	3	0	3	0	0	0	0	1	0	0	1	5
7:55 AM	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	3
8:00 AM	0	3	0	3	0	1	0	1	1	0	0	1	0	0	0	0	5
8:05 AM	0	3	0	3	0	1	0	1	0	0	0	0	0	0	0	0	4
8:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
8:20 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
8:25 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
8:35 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:40 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
8:45 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
8:50 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
8:55 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
Total Survey	1	22	1	24	0	19	0	19	2	0	0	2	1	0	0	1	46

### Heavy Vehicle 15-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
7:15 AM	0	1	0	1	0	3	0	3	0	0	0	0	0	0	0	0	4
7:30 AM	0	6	1	7	0	3	0	3	1	0	0	1	0	0	0	0	11
7:45 AM	1	2	0	3	0	5	0	5	0	0	0	1	0	0	1	0	9
8:00 AM	0	6	0	6	0	2	0	2	1	0	0	1	0	0	0	0	9
8:15 AM	0	1	0	1	0	2	0	2	0	0	0	0	0	0	0	0	3
8:30 AM	0	3	0	3	0	1	0	1	0	0	0	0	0	0	0	0	4
8:45 AM	0	2	0	2	0	2	0	2	0	0	0	0	0	0	0	0	4
Total Survey	1	22	1	24	0	19	0	19	2	0	0	2	1	0	0	1	46

### Heavy Vehicle Peak Hour Summary 7:20 AM to 8:20 AM

By Approach	Northbound NW 231st Ave			Southbound NW 231st Ave			Eastbound NW Birch St			Westbound NW Birch St			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	18	15	33	14	18	32	2	1	3	1	1	2	35
PHF	0.56			0.70			0.50			0.25			0.67

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	1	16	1	18	0	14	0	14	2	0	0	2	1	0	0	1	35
PHF	0.25	0.50	0.25	0.56	0.00	0.70	0.00	0.70	0.50	0.00	0.00	0.50	0.25	0.00	0.00	0.25	0.67

### Heavy Vehicle Rolling Hour Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	1	10	1	12	0	12	0	12	1	0	0	1	1	0	0	1	26
7:15 AM	1	15	1	17	0	13	0	13	2	0	0	2	1	0	0	1	33
7:30 AM	1	15	1	17	0	12	0	12	2	0	0	2	1	0	0	1	32
7:45 AM	1	12	0	13	0	10	0	10	1	0	0	1	1	0	0	1	25
8:00 AM	0	12	0	12	0	7	0	7	1	0	0	1	0	0	0	0	20

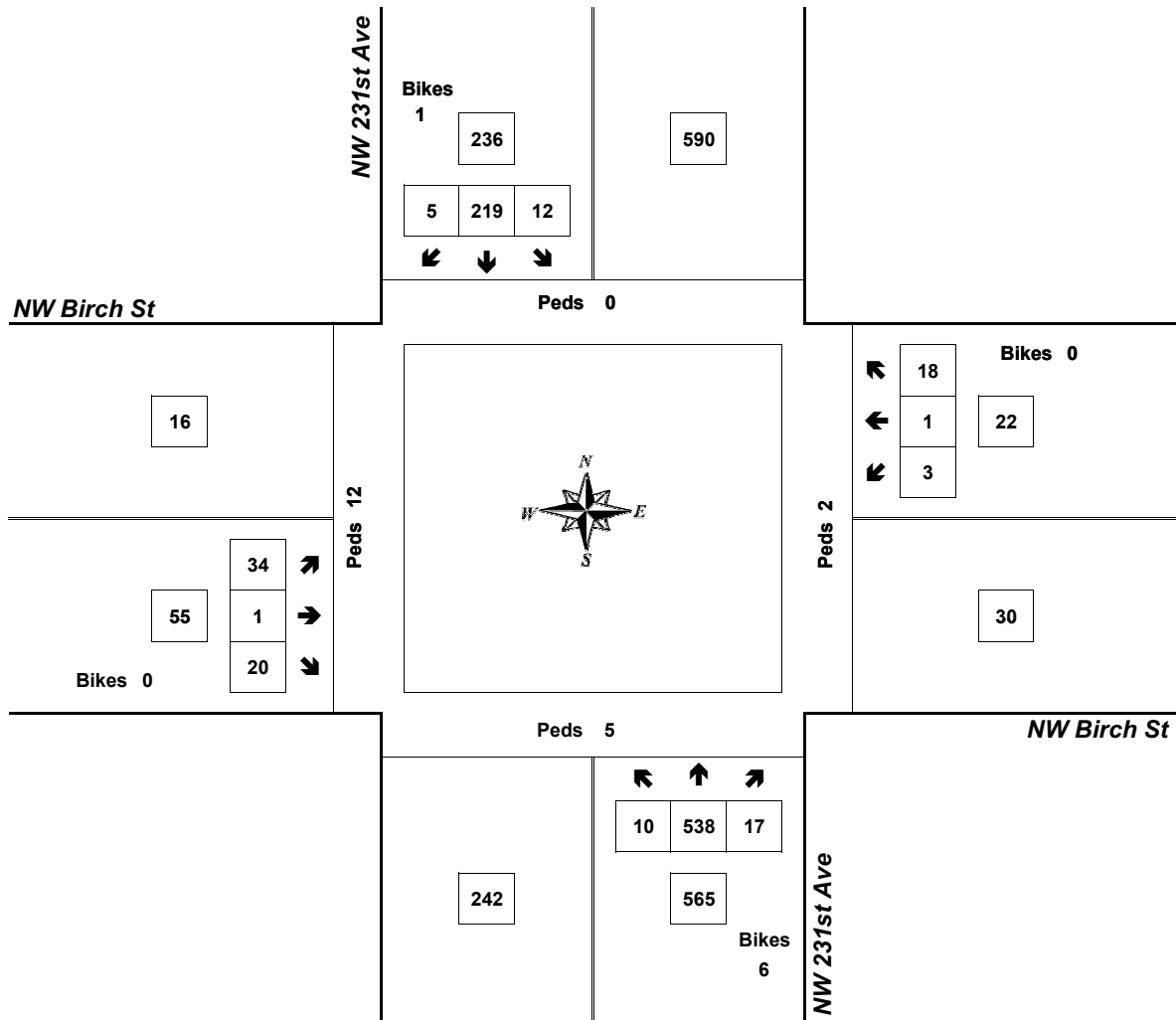
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 231st Ave & NW Birch St

7:20 AM to 8:20 AM  
Thursday, June 13, 2013



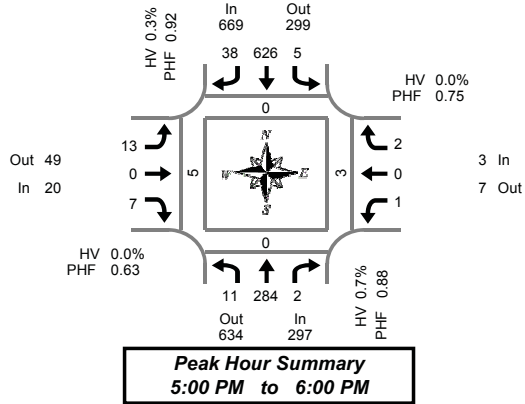
Approach	PHF	HV%	Volume
EB	0.60	3.6%	55
WB	0.39	4.5%	22
NB	0.80	3.2%	565
SB	0.79	5.9%	236
<b>Intersection</b>	<b>0.76</b>	<b>4.0%</b>	<b>878</b>

Count Period: 7:00 AM to 9:00 AM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Birch St

Wednesday, June 12, 2013

4:00 PM to 6:00 PM

### 5-Minute Interval Summary 4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	3	16	0	0	0	36	1	0	1	0	0	0	0	0	0	0	0	0	0	0	
4:05 PM	1	14	0	1	1	38	1	0	1	0	0	0	0	0	0	0	0	0	0	0	
4:10 PM	0	19	0	0	0	33	2	1	0	0	0	0	0	0	1	0	0	0	0	0	
4:15 PM	0	23	0	0	0	62	2	0	0	0	1	1	0	0	0	0	0	0	0	2	
4:20 PM	0	26	0	0	0	53	2	0	3	0	0	0	0	0	0	0	0	0	0	0	
4:25 PM	1	22	0	0	0	51	4	1	2	0	2	0	0	0	0	0	0	0	0	2	
4:30 PM	1	17	0	0	0	41	5	1	1	0	0	0	0	0	1	0	0	0	0	2	
4:35 PM	0	22	0	0	1	57	2	2	1	0	0	0	1	0	0	0	0	0	0	0	
4:40 PM	0	22	1	0	1	59	3	0	1	0	4	0	0	0	1	0	0	0	0	0	
4:45 PM	1	27	0	0	0	45	1	0	1	0	0	0	1	0	0	0	0	0	0	1	
4:50 PM	2	13	0	1	0	46	3	1	0	0	0	1	0	0	0	0	0	0	0	1	
4:55 PM	1	16	0	1	3	42	3	0	1	0	0	0	1	0	0	0	0	0	0	2	
5:00 PM	2	27	0	0	0	40	4	0	2	0	0	0	0	0	0	0	0	0	0	0	
5:05 PM	1	22	1	0	1	58	7	0	0	0	0	0	0	0	1	0	0	0	0	1	
5:10 PM	1	30	0	0	0	52	3	1	0	0	1	0	0	0	0	0	0	0	0	0	
5:15 PM	1	21	0	0	0	55	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
5:20 PM	1	25	0	0	0	36	3	0	1	0	2	0	0	0	0	0	0	0	0	2	
5:25 PM	0	26	0	0	0	55	3	1	1	0	0	0	1	0	0	0	0	0	0	1	
5:30 PM	1	27	0	0	1	62	2	0	2	0	2	0	0	0	0	0	0	0	0	0	
5:35 PM	2	17	0	0	0	59	0	2	2	0	0	0	0	0	0	0	0	0	0	0	
5:40 PM	1	21	0	0	1	54	2	1	1	0	1	0	0	0	1	0	0	0	0	0	
5:45 PM	0	23	0	0	0	42	5	2	0	0	0	0	0	0	0	0	0	0	0	0	
5:50 PM	1	21	0	0	1	60	5	0	3	0	1	0	0	0	0	0	0	0	0	0	
5:55 PM	0	24	1	1	1	53	3	3	0	0	0	0	0	0	0	0	0	0	0	0	
Total Survey	21	521	3	4	11	1,189	67	17	25	0	14	2	4	0	5	0	1,860	0	0	3	15

### 15-Minute Interval Summary 4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	4	49	0	1	1	107	4	1	2	0	0	0	0	0	1	0	168	0	0	0	0
4:15 PM	1	71	0	0	0	166	8	1	5	0	3	1	0	0	0	0	254	0	0	0	4
4:30 PM	1	61	1	0	2	157	10	3	3	0	4	0	1	0	2	0	242	0	0	0	2
4:45 PM	4	56	0	2	3	133	7	1	2	0	0	1	2	0	0	0	207	0	0	0	4
5:00 PM	4	79	1	0	1	150	14	1	2	0	1	0	0	0	1	0	253	0	0	1	1
5:15 PM	2	72	0	0	0	146	7	2	3	0	2	0	1	0	0	0	233	0	0	0	3
5:30 PM	4	65	0	0	2	175	4	3	5	0	3	0	0	0	1	0	259	0	0	0	0
5:45 PM	1	68	1	1	2	155	13	5	3	0	1	0	0	0	0	0	244	0	0	2	1
Total Survey	21	521	3	4	11	1,189	67	17	25	0	14	2	4	0	5	0	1,860	0	0	3	15

### Peak Hour Summary 5:00 PM to 6:00 PM

By Approach	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	297	634	931	1	669	299	968	11	20	49	69	0	3	7	10	0	989	0	0	3	5
%HV	0.7%				0.3%				0.0%				0.0%				0.4%				
PHF	0.88				0.92				0.63				0.75				0.94				

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	11	284	2	297	5	626	38	669	13	0	7	20	1	0	2	3	989
%HV	0.0%	0.7%	0.0%	0.7%	0.0%	0.3%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
PHF	0.69	0.90	0.50	0.88	0.63	0.89	0.68	0.92	0.65	0.00	0.44	0.63	0.25	0.00	0.50	0.75	0.94

### Rolling Hour Summary 4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	10	237	1	3	6	563	29	6	12	0	7	2	3	0	3	0	871	0	0	0	10
4:15 PM	10	267	2	2	6	606	39	6	12	0	8	2	3	0	3	0	956	0	0	1	11
4:30 PM	11	268	2	2	6	586	38	7	10	0	7	1	4	0	3	0	935	0	0	1	10
4:45 PM	14	272	1	2	6	604	32	7	12	0	6	1	3	0	2	0	952	0	0	1	8
5:00 PM	11	284	2	1	5	626	38	11	13	0	7	0	1	0	2	0	989	0	0	3	5



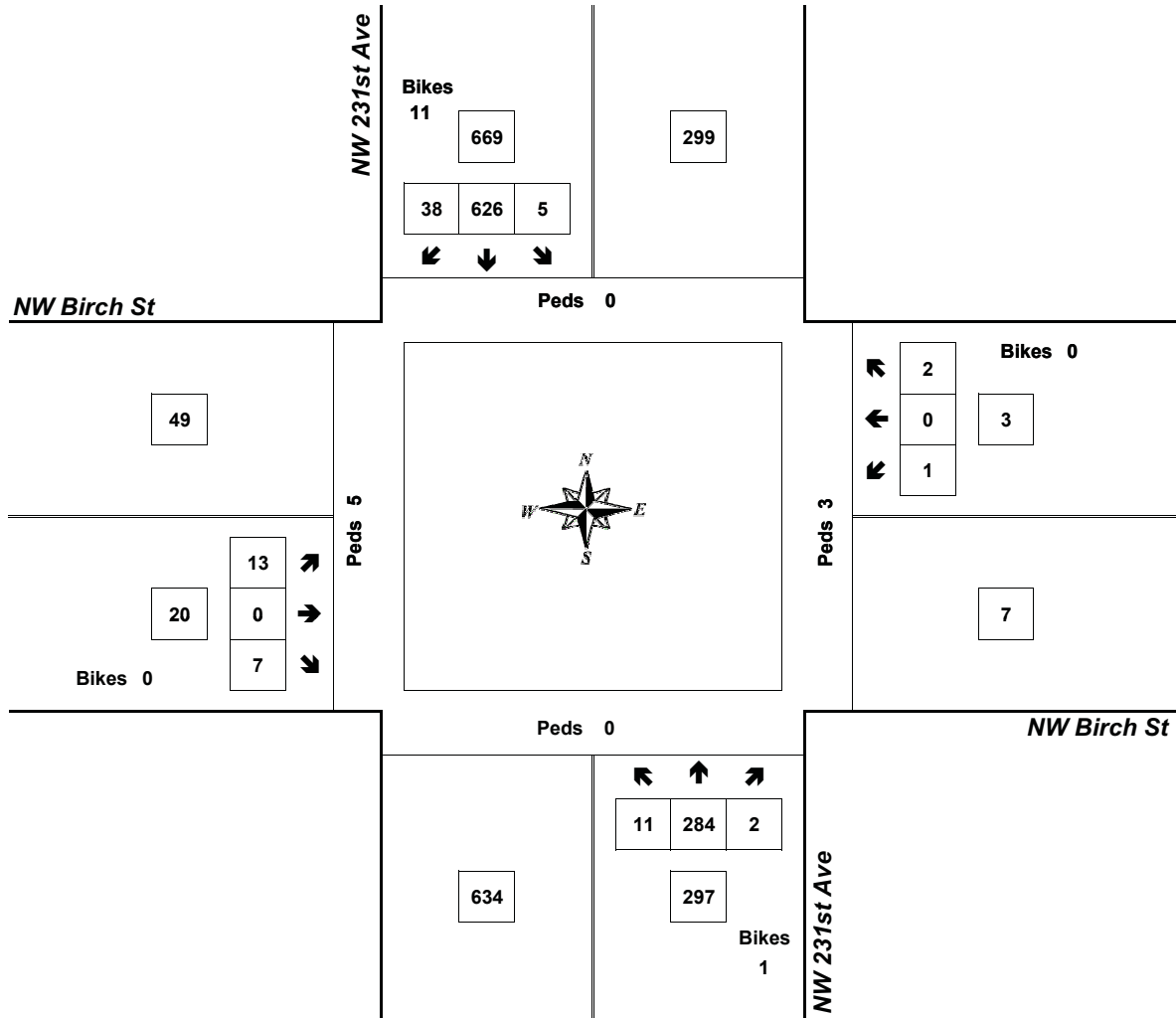
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 231st Ave & NW Birch St

5:00 PM to 6:00 PM  
Wednesday, June 12, 2013



Approach	PHF	HV%	Volume
EB	0.63	0.0%	20
WB	0.75	0.0%	3
NB	0.88	0.7%	297
SB	0.92	0.3%	669
<b>Intersection</b>	<b>0.94</b>	<b>0.4%</b>	<b>989</b>

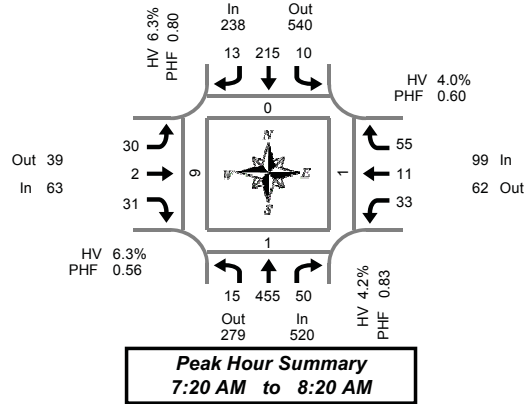
Count Period: 4:00 PM to 6:00 PM



# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Dogwood St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

### 5-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total	Pedestrians Crosswalk						
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West			
7:00 AM	0	35	0	0	0	8	0	0	0	0	2	0	0	0	0	3	0	0	0	48	0	0	0	1
7:05 AM	0	25	0	1	0	7	0	0	3	0	0	0	0	0	2	0	0	1	37	0	0	0	1	
7:10 AM	0	36	2	0	0	6	0	1	2	0	2	0	2	0	1	0	1	0	51	0	0	0	2	
7:15 AM	2	42	0	0	1	7	0	0	2	0	2	0	1	0	0	0	0	57	0	0	0	1		
7:20 AM	0	45	3	0	0	17	0	0	0	0	3	0	1	0	5	0	0	74	0	0	0	0		
7:25 AM	0	37	1	0	1	14	1	0	4	0	3	0	0	0	3	0	0	64	0	0	0	1		
7:30 AM	1	40	8	0	1	22	1	0	0	0	2	0	0	0	1	0	0	76	0	0	0	1		
7:35 AM	2	40	8	0	0	19	1	1	2	1	0	0	2	0	0	0	0	75	0	0	0	1		
7:40 AM	0	29	10	0	1	14	0	0	2	0	3	0	3	1	7	0	0	70	0	0	0	3		
7:45 AM	1	42	4	0	0	18	2	0	8	0	3	0	5	0	8	0	0	91	0	0	0	1		
7:50 AM	2	45	6	0	1	15	4	0	4	1	7	0	6	3	5	1	0	99	0	0	0	0		
7:55 AM	4	47	5	1	2	27	2	0	2	0	1	0	4	2	8	0	0	104	0	0	0	0		
8:00 AM	1	46	1	0	1	21	1	0	1	0	4	0	6	0	5	1	0	87	0	0	0	0		
8:05 AM	1	32	1	1	1	14	0	0	3	0	1	0	3	2	5	0	0	63	0	0	1	1		
8:10 AM	2	24	1	0	1	13	0	0	2	0	2	0	2	3	2	0	0	52	0	1	0	1		
8:15 AM	1	28	2	0	1	21	1	0	2	0	2	0	1	0	6	0	0	65	0	0	0	0		
8:20 AM	0	24	1	0	3	13	1	0	1	0	1	0	1	0	6	0	0	51	0	0	0	0		
8:25 AM	0	25	0	0	2	11	0	0	7	0	3	0	1	0	2	0	0	51	0	0	0	2		
8:30 AM	0	31	3	0	1	19	0	0	1	1	0	0	1	0	3	0	0	60	0	0	0	0		
8:35 AM	0	24	4	1	1	15	2	0	0	1	1	0	3	0	6	0	0	57	0	0	0	1		
8:40 AM	1	21	0	0	0	7	1	0	1	0	0	0	0	1	2	0	0	34	0	0	1	0		
8:45 AM	1	27	0	0	1	11	0	0	1	0	3	0	2	1	1	0	0	48	0	0	0	1		
8:50 AM	3	37	4	0	1	19	1	0	5	0	1	0	1	0	3	0	0	75	0	0	0	2		
8:55 AM	2	27	0	0	2	9	1	0	2	0	5	0	1	0	2	0	0	51	0	0	0	0		
Total Survey	24	809	64	4	22	347	19	2	55	4	51	0	46	13	86	2	0	1,540	0	1	2	20		

### 15-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total	Pedestrians Crosswalk				
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West	
7:00 AM	0	96	2	1	0	21	0	1	5	0	4	0	2	0	6	0	0	136	0	0	0	4
7:15 AM	2	124	4	0	2	38	1	0	6	0	8	0	2	0	8	0	0	195	0	0	0	2
7:30 AM	3	109	26	0	2	55	2	1	4	1	5	0	5	1	8	0	0	221	0	0	0	5
7:45 AM	7	134	15	1	3	60	8	0	14	1	11	0	15	5	21	1	0	294	0	0	0	1
8:00 AM	4	102	3	1	3	48	1	0	6	0	7	0	11	5	12	1	0	202	0	1	1	2
8:15 AM	1	77	3	0	6	45	2	0	10	0	6	0	3	0	14	0	0	167	0	0	0	2
8:30 AM	1	76	7	1	2	41	3	0	2	2	1	0	4	1	11	0	0	151	0	0	1	1
8:45 AM	6	91	4	0	4	39	2	0	8	0	9	0	4	1	6	0	0	174	0	0	0	3
Total Survey	24	809	64	4	22	347	19	2	55	4	51	0	46	13	86	2	0	1,540	0	1	2	20

### Peak Hour Summary

7:20 AM to 8:20 AM

By Approach	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total	Pedestrians Crosswalk				
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West	
Volume	520	279	799	2	238	540	778	1	63	39	102	0	99	62	161	2	0	920	0	1	1	9
%HV	4.2%				6.3%				6.3%				4.0%				4.9%					
PHF	0.83				0.80				0.56				0.60				0.78					

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	15	455	50	520	10	215	13	238	30	2	31	63	33	11	55	99	920
%HV	6.7%	2.9%	16.0%	4.2%	10.0%	6.0%	7.7%	6.3%	6.7%	0.0%	6.5%	6.3%	3.0%	0.0%	5.5%	4.0%	4.9%
PHF	0.54	0.82	0.48	0.83	0.63	0.85	0.41	0.80	0.54	0.50	0.60	0.56	0.52	0.55	0.65	0.60	0.78

### Rolling Hour Summary

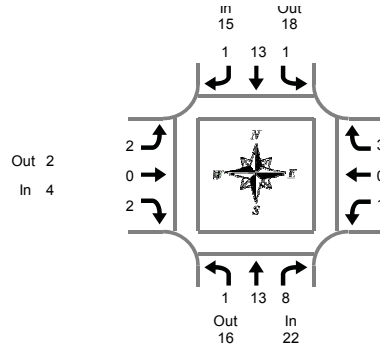
7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	12	463	47	2	7	174	11	2	29	2	28	0	24	6	43	1	846	0	0	0	12
7:15 AM	16	469	48	2	10	201	12	1	30	2	31	0	33	11	49	2	912	0	1	1	10
7:30 AM	15	422	47	2	14	208	13	1	34	2	29	0	34	11	55	2	884	0	1	1	10
7:45 AM	13	389	28	3	14	194	14	0	32	3	25	0	33	11	58	2	814	0	1	2	6
8:00 AM	12	346	17	2	15	173	8	0	26	2	23	0	22	7	43	1	694	0	1	2	8

# Heavy Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Dogwood St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

**Peak Hour Summary**  
7:20 AM to 8:20 AM

### Heavy Vehicle 5-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:05 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
7:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
7:20 AM	0	1	1	2	0	1	0	1	0	0	0	0	0	0	0	0	0
7:25 AM	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0
7:30 AM	0	3	1	4	0	2	0	2	0	0	0	0	0	0	0	0	0
7:35 AM	0	2	3	5	0	0	0	0	2	0	0	2	0	0	0	0	0
7:40 AM	0	1	2	3	0	1	0	1	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	1	1	0	1	0	1	0	0	0	0	1	0	1	2	4
7:50 AM	0	0	0	0	0	4	0	4	0	0	1	1	0	0	0	0	0
7:55 AM	1	1	0	2	0	1	0	1	0	0	0	0	0	0	2	2	5
8:00 AM	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0
8:05 AM	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0
8:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	1	0	1	0	1	1	2	0	0	0	0	0	0	0	0	0
8:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:25 AM	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:35 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:40 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
8:50 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
8:55 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
Total Survey	1	17	8	26	1	18	1	20	3	0	2	5	2	0	3	5	56

### Heavy Vehicle 15-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
7:15 AM	0	2	1	3	1	2	0	3	0	0	1	1	0	0	0	0	0
7:30 AM	0	6	6	12	0	3	0	3	2	0	0	2	0	0	0	0	0
7:45 AM	1	1	1	3	0	6	0	6	0	0	1	1	1	0	3	4	14
8:00 AM	0	4	0	4	0	2	0	2	0	0	0	0	0	0	0	0	0
8:15 AM	0	2	0	2	0	1	1	2	1	0	0	1	0	0	0	0	0
8:30 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
8:45 AM	0	1	0	1	0	2	0	2	0	0	0	0	1	0	0	1	4
Total Survey	1	17	8	26	1	18	1	20	3	0	2	5	2	0	3	5	56

### Heavy Vehicle Peak Hour Summary 7:20 AM to 8:20 AM

By Approach	Northbound NW 231st Ave			Southbound NW 231st Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	22	16	38	15	18	33	4	2	6	4	9	13	45
PHF	0.46			0.63			0.33			0.25			0.66

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	1	13	8	22	1	13	1	15	2	0	2	4	1	0	3	4	45
PHF	0.25	0.54	0.33	0.46	0.25	0.54	0.25	0.63	0.25	0.00	0.50	0.33	0.25	0.00	0.25	0.25	0.66

### Heavy Vehicle Rolling Hour Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	1	9	8	18	1	12	0	13	2	0	2	4	1	0	3	4	39
7:15 AM	1	13	8	22	1	13	0	14	2	0	2	4	1	0	3	4	44
7:30 AM	1	13	7	21	0	12	1	13	3	0	1	4	1	0	3	4	42
7:45 AM	1	8	1	10	0	10	1	11	1	0	1	2	1	0	3	4	27
8:00 AM	0	8	0	8	0	6	1	7	1	0	0	1	1	0	0	1	17

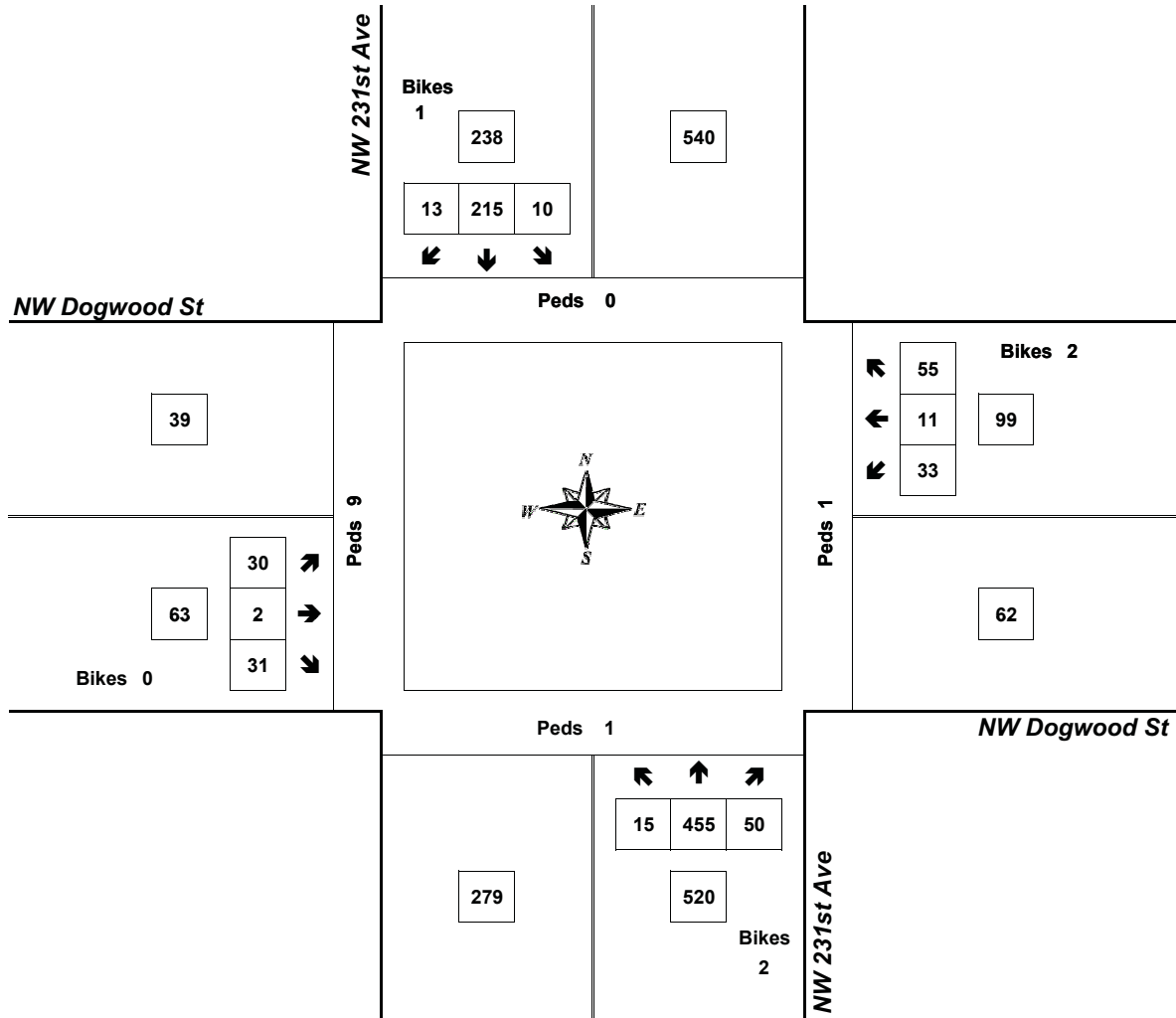
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 231st Ave & NW Dogwood St

7:20 AM to 8:20 AM  
Thursday, June 13, 2013



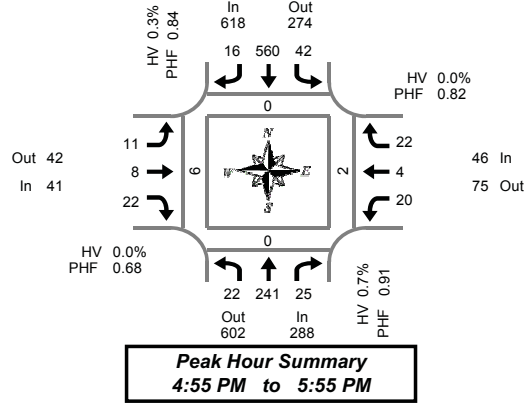
Approach	PHF	HV%	Volume
EB	0.56	6.3%	63
WB	0.60	4.0%	99
NB	0.83	4.2%	520
SB	0.80	6.3%	238
<b>Intersection</b>	<b>0.78</b>	<b>4.9%</b>	<b>920</b>

Count Period: 7:00 AM to 9:00 AM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 231st Ave & NW Dogwood St

Wednesday, June 12, 2013

4:00 PM to 6:00 PM

### 5-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	1	17	1	1	1	37	1	0	0	0	4	0	1	1	1	0	65	0	0	0	0
4:05 PM	1	17	1	0	1	35	1	0	0	1	1	0	0	0	5	0	63	0	0	1	0
4:10 PM	1	16	0	0	3	37	1	1	1	1	0	0	2	0	3	0	65	0	0	0	0
4:15 PM	0	21	2	0	2	48	4	0	0	0	0	0	4	0	3	0	84	0	0	0	2
4:20 PM	1	20	1	0	2	42	0	0	0	0	2	0	3	0	3	2	74	0	0	0	0
4:25 PM	1	24	3	0	1	50	2	1	0	0	1	0	3	0	2	0	87	0	0	1	0
4:30 PM	1	18	5	0	3	39	2	1	1	1	2	1	1	0	2	0	75	0	0	0	1
4:35 PM	1	20	1	0	4	53	0	1	0	0	1	0	2	0	0	0	82	0	0	0	1
4:40 PM	1	24	1	0	0	58	0	0	2	1	4	0	1	0	2	0	94	0	0	0	0
4:45 PM	1	22	2	0	3	38	1	0	0	1	1	0	2	0	4	0	75	0	0	0	1
4:50 PM	0	14	2	0	3	37	3	1	0	0	5	0	0	0	0	0	64	0	0	0	2
4:55 PM	3	23	4	1	4	37	1	0	1	0	4	0	0	0	4	0	81	0	0	0	1
5:00 PM	2	17	1	0	3	40	1	0	2	0	3	0	2	0	1	0	72	0	0	0	1
5:05 PM	3	23	3	0	1	53	1	0	0	1	0	0	1	2	3	0	91	0	0	0	0
5:10 PM	1	20	4	0	4	49	1	1	1	1	2	0	1	0	0	0	84	0	0	1	0
5:15 PM	1	18	1	0	1	48	0	1	1	0	2	0	1	0	4	0	77	0	0	0	1
5:20 PM	2	18	2	0	1	34	0	0	0	0	4	0	3	0	1	0	65	0	0	0	1
5:25 PM	2	15	1	0	4	63	2	0	0	1	2	0	0	0	3	0	93	0	0	0	1
5:30 PM	2	21	0	0	4	47	1	0	1	3	4	0	1	1	2	0	87	0	0	0	0
5:35 PM	1	22	5	0	10	53	0	2	1	1	0	0	5	0	1	0	99	0	0	0	0
5:40 PM	2	25	0	0	5	49	3	1	0	1	1	0	1	1	1	0	89	0	0	1	0
5:45 PM	0	17	0	0	1	39	3	2	1	0	0	0	4	0	1	0	66	0	0	0	1
5:50 PM	3	22	4	1	4	48	3	0	3	0	0	0	1	0	1	0	89	0	0	0	0
5:55 PM	1	17	2	0	4	38	4	3	1	1	0	0	0	1	1	0	70	0	0	1	0
Total Survey	32	471	46	3	69	1,072	35	15	16	14	43	1	39	6	48	2	1,891	0	0	5	13

### 15-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	3	50	2	1	5	109	3	1	1	2	5	0	3	1	9	0	193	0	0	1	0
4:15 PM	2	65	6	0	5	140	6	1	0	0	3	0	10	0	8	2	245	0	0	1	2
4:30 PM	3	62	7	0	7	150	2	2	3	2	7	1	4	0	4	0	251	0	0	0	2
4:45 PM	4	59	8	1	10	112	5	1	1	1	10	0	2	0	8	0	220	0	0	0	4
5:00 PM	6	60	8	0	8	142	3	1	3	2	5	0	4	2	4	0	247	0	0	1	1
5:15 PM	5	51	4	0	6	145	2	1	1	1	8	0	4	0	8	0	235	0	0	0	3
5:30 PM	5	68	5	0	19	149	4	3	2	5	5	0	7	2	4	0	275	0	0	1	0
5:45 PM	4	56	6	1	9	125	10	5	5	1	0	0	5	1	3	0	225	0	0	1	1
Total Survey	32	471	46	3	69	1,072	35	15	16	14	43	1	39	6	48	2	1,891	0	0	5	13

### Peak Hour Summary

4:55 PM to 5:55 PM

By Approach	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	288	602	890	2	618	274	892	7	41	42	83	0	46	75	121	0	993	0	0	2	6
%HV	0.7%				0.3%				0.0%				0.0%				0.4%				
PHF	0.91				0.84				0.68				0.82				0.89				

By Movement	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	22	241	25	288	42	560	16	618	11	8	22	41	20	4	22	46	993
%HV	0.0%	0.8%	0.0%	0.7%	0.0%	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
PHF	0.69	0.89	0.78	0.91	0.55	0.86	0.44	0.84	0.69	0.40	0.55	0.68	0.50	0.50	0.69	0.82	0.89

### Rolling Hour Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 231st Ave				Southbound NW 231st Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	12	236	23	2	27	511	16	5	5	5	25	1	19	1	29	2	909	0	0	2	8
4:15 PM	15	246	29	1	30	544	16	5	7	5	25	1	20	2	24	2	963	0	0	2	9
4:30 PM	18	232	27	1	31	549	12	5	8	6	30	1	14	2	24	0	953	0	0	1	10
4:45 PM	20	238	25	1	43	548	14	6	7	9	28	0	17	4	24	0	977	0	0	2	8
5:00 PM	20	235	23	1	42	561	19	10	11	9	18	0	20	5	19	0	982	0	0	3	5



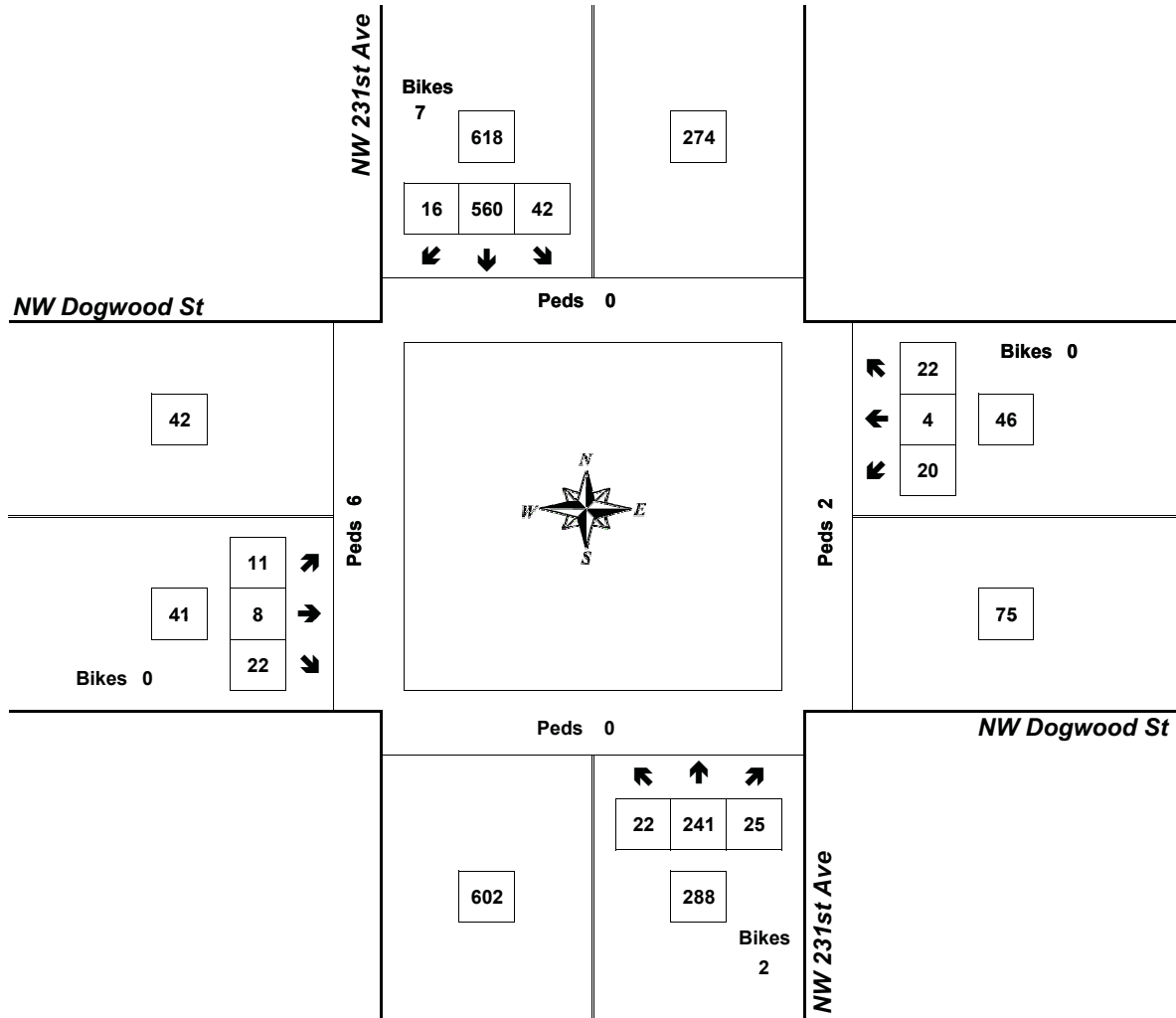
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 231st Ave & NW Dogwood St

4:55 PM to 5:55 PM  
Wednesday, June 12, 2013



Approach	PHF	HV%	Volume
EB	0.68	0.0%	41
WB	0.82	0.0%	46
NB	0.91	0.7%	288
SB	0.84	0.3%	618
<b>Intersection</b>	<b>0.89</b>	<b>0.4%</b>	<b>993</b>

Count Period: 4:00 PM to 6:00 PM







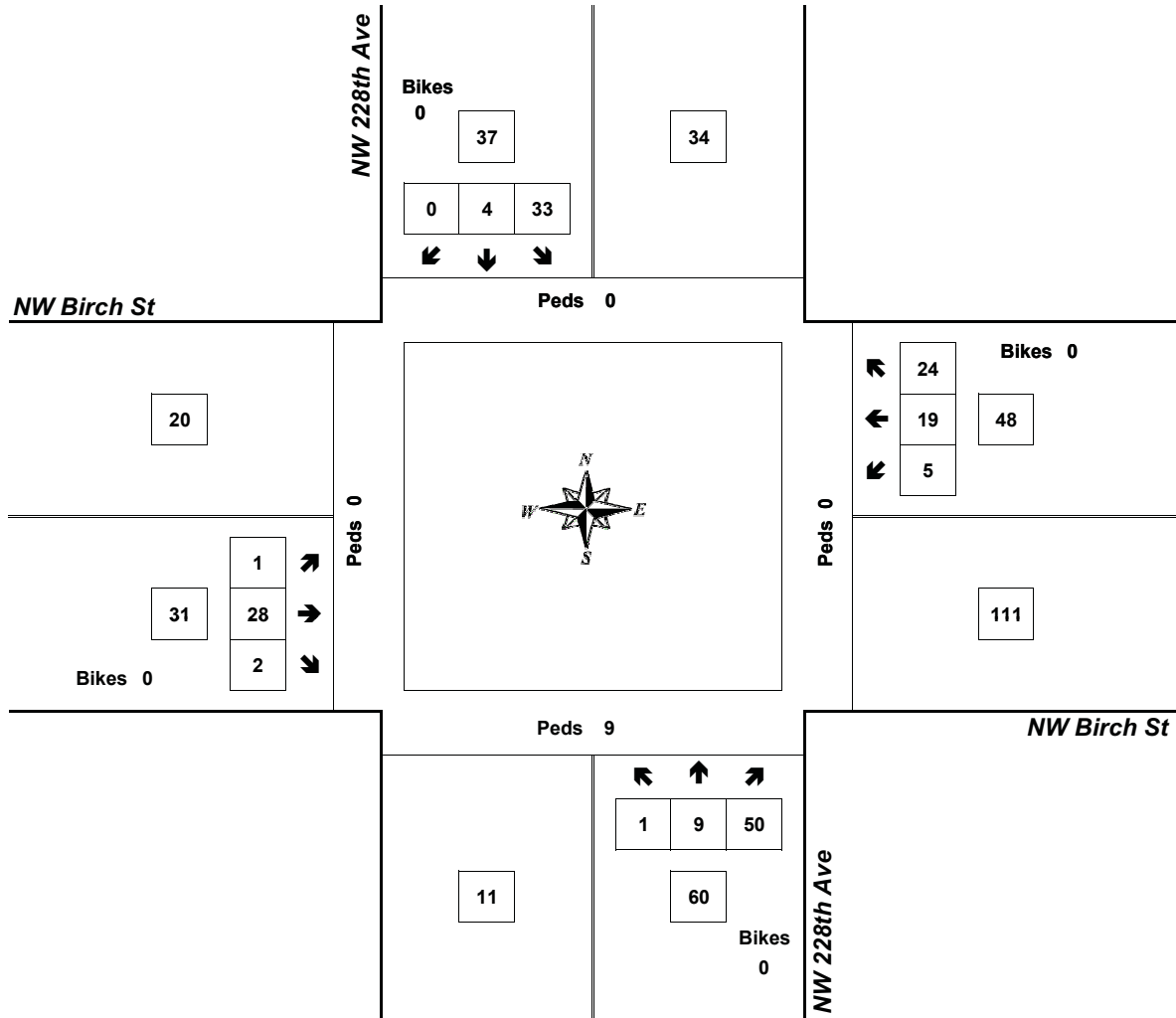
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 228th Ave & NW Birch St

7:05 AM to 8:05 AM  
Thursday, June 13, 2013



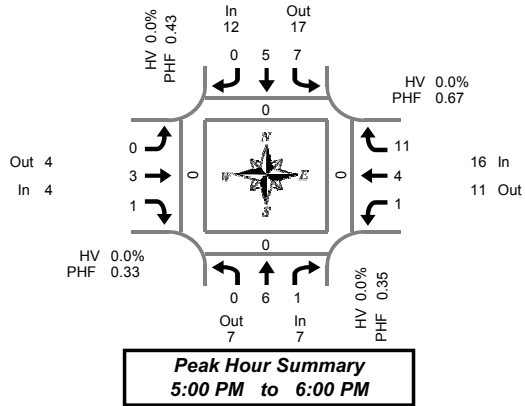
Approach	PHF	HV%	Volume
EB	0.48	3.2%	31
WB	0.44	2.1%	48
NB	0.38	1.7%	60
SB	0.62	2.7%	37
<b>Intersection</b>	<b>0.46</b>	<b>2.3%</b>	<b>176</b>

Count Period: 7:00 AM to 9:00 AM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 228th Ave & NW Birch St

Wednesday, June 12, 2013

4:00 PM to 6:00 PM

### 5-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 228th Ave				Southbound NW 228th Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4:05 PM	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	
4:10 PM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
4:15 PM	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
4:20 PM	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
4:25 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
4:30 PM	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
4:35 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	
4:40 PM	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	
4:45 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
4:50 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
4:55 PM	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
5:00 PM	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	
5:05 PM	0	0	0	0	1	2	0	0	0	1	1	0	0	1	1	0	0	0	0	0	
5:10 PM	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	
5:20 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5:25 PM	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	
5:30 PM	0	2	0	0	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	
5:35 PM	0	2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
5:40 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
5:45 PM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
5:50 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	
5:55 PM	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	
Total Survey	0	7	3	0	11	12	1	0	0	5	2	1	2	8	14	0	65	1	1	0	1

### 15-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 228th Ave				Southbound NW 228th Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	1	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	
4:15 PM	0	0	1	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	
4:30 PM	0	0	1	0	1	2	1	0	0	1	0	0	0	2	1	0	0	0	0	0	
4:45 PM	0	0	0	0	0	4	0	0	0	0	1	0	0	1	1	0	0	0	0	0	
5:00 PM	0	0	0	0	4	3	0	0	0	2	1	0	0	1	2	0	0	0	0	0	
5:15 PM	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	
5:30 PM	0	4	0	0	2	2	0	0	0	0	0	1	1	1	1	0	0	0	0	0	
5:45 PM	0	0	1	0	1	0	0	0	0	1	0	0	0	0	6	0	0	0	0	0	
Total Survey	0	7	3	0	11	12	1	0	0	5	2	1	2	8	14	0	65	1	1	0	1

### Peak Hour Summary

5:00 PM to 6:00 PM

By Approach	Northbound NW 228th Ave				Southbound NW 228th Ave				Eastbound NW Birch St				Westbound NW Birch St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	7	7	14	0	12	17	29	0	4	4	8	1	16	11	27	0	39	0	0	0	0
%HV	0.0%				0.0%				0.0%				0.0%				0.0%				
PHF	0.35				0.43				0.33				0.67				0.75				

By Movement	Northbound NW 228th Ave				Southbound NW 228th Ave				Eastbound NW Birch St				Westbound NW Birch St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	0	6	1	7	7	5	0	12	0	3	1	4	1	4	11	16	39
%HV	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PHF	0.00	0.30	0.25	0.35	0.44	0.42	0.00	0.43	0.00	0.38	0.25	0.33	0.25	0.50	0.46	0.67	0.75

### Rolling Hour Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 228th Ave				Southbound NW 228th Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	Pedestrians Crosswalk				
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West	
4:00 PM	0	1	2	0	4	7	1	0	0	2	1	0	0	1	4	3	0	26	1	1	0	1
4:15 PM	0	0	2	0	7	9	1	0	0	3	2	0	0	1	5	4	0	34	0	0	0	1
4:30 PM	0	2	1	0	5	9	1	0	0	3	2	0	0	6	6	0	0	35	0	0	0	0
4:45 PM	0	6	0	0	6	9	0	0	0	2	2	1	1	5	6	0	0	37	0	0	0	0
5:00 PM	0	6	1	0	7	5	0	0	0	3	1	1	1	4	11	0	0	39	0	0	0	0



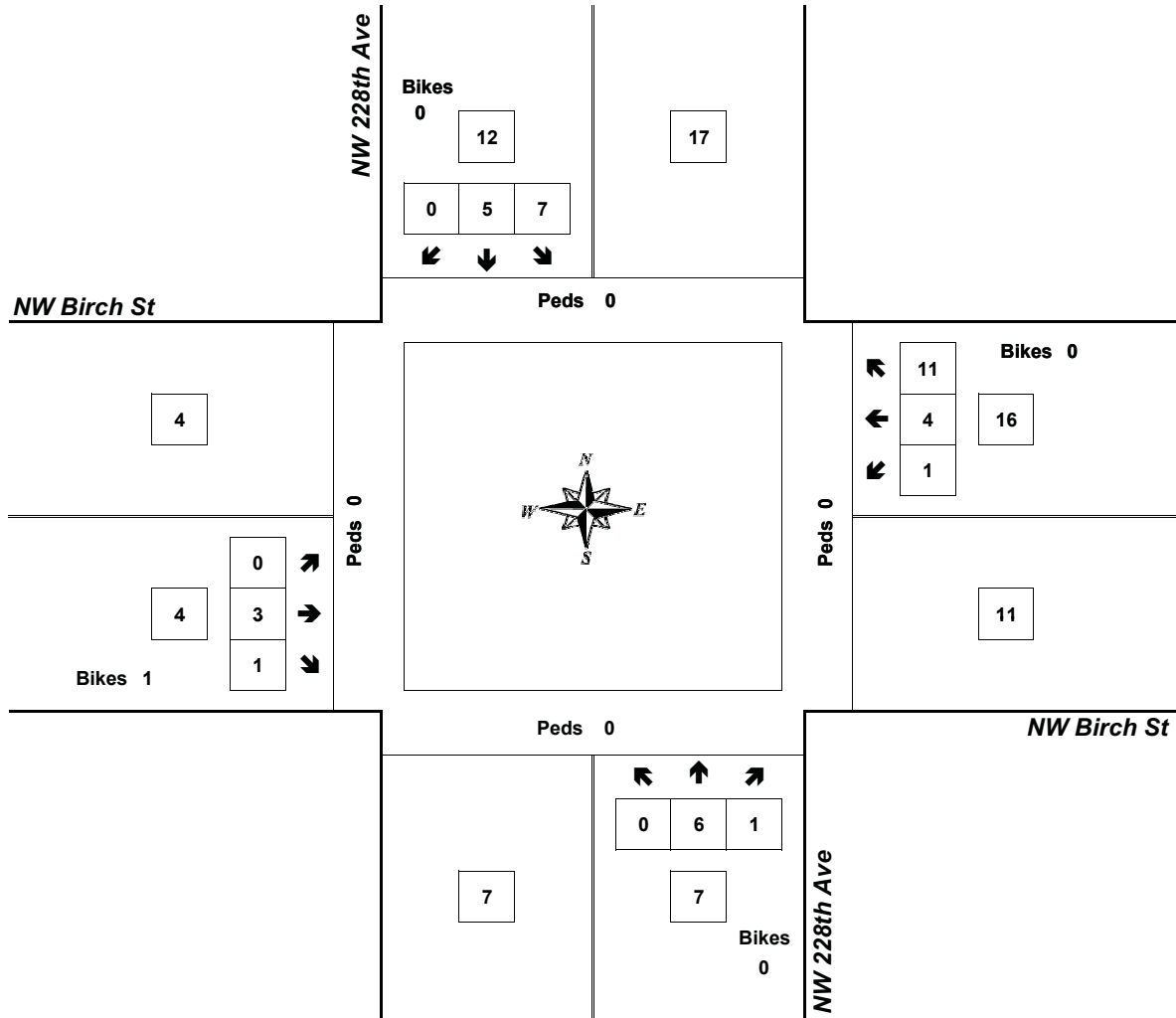
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 228th Ave & NW Birch St

5:00 PM to 6:00 PM  
Wednesday, June 12, 2013



Approach	PHF	HV%	Volume
EB	0.33	0.0%	4
WB	0.67	0.0%	16
NB	0.35	0.0%	7
SB	0.43	0.0%	12
<b>Intersection</b>	<b>0.75</b>	<b>0.0%</b>	<b>39</b>

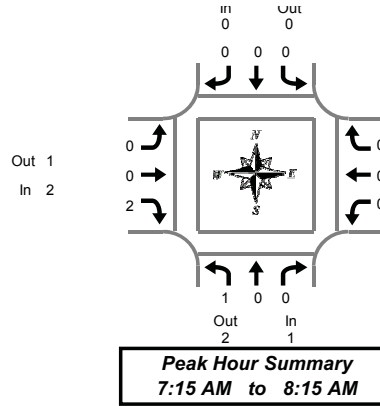
Count Period: 4:00 PM to 6:00 PM



# Heavy Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 225th Ave & NW Birch St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

### Heavy Vehicle 5-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 225th Ave				Southbound NW 225th Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:05 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:25 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:35 AM	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:40 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:50 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:55 AM	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:05 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:25 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:35 AM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
8:40 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:50 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:55 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Survey	1	0	0	1	0	0	0	0	0	0	3	3	0	0	0	0	0	4

### Heavy Vehicle 15-Minute Interval Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 225th Ave				Southbound NW 225th Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total	
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:45 AM	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Survey	1	0	0	1	0	0	0	0	0	0	3	3	0	0	0	0	0	4

### Heavy Vehicle Peak Hour Summary 7:15 AM to 8:15 AM

By Approach	Northbound NW 225th Ave			Southbound NW 225th Ave			Eastbound NW Birch St			Westbound NW Birch St			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	1	2	3	0	0	0	2	1	3	0	0	0	3
PHF	0.25			0.00			0.25			0.00			0.38

By Movement	Northbound NW 225th Ave				Southbound NW 225th Ave				Eastbound NW Birch St				Westbound NW Birch St				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	1	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	3
PHF	0.25	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.38

### Heavy Vehicle Rolling Hour Summary 7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 225th Ave				Southbound NW 225th Ave				Eastbound NW Birch St				Westbound NW Birch St				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	1	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	3
7:15 AM	1	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	3
7:30 AM	1	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	3
7:45 AM	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	3
8:00 AM	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1

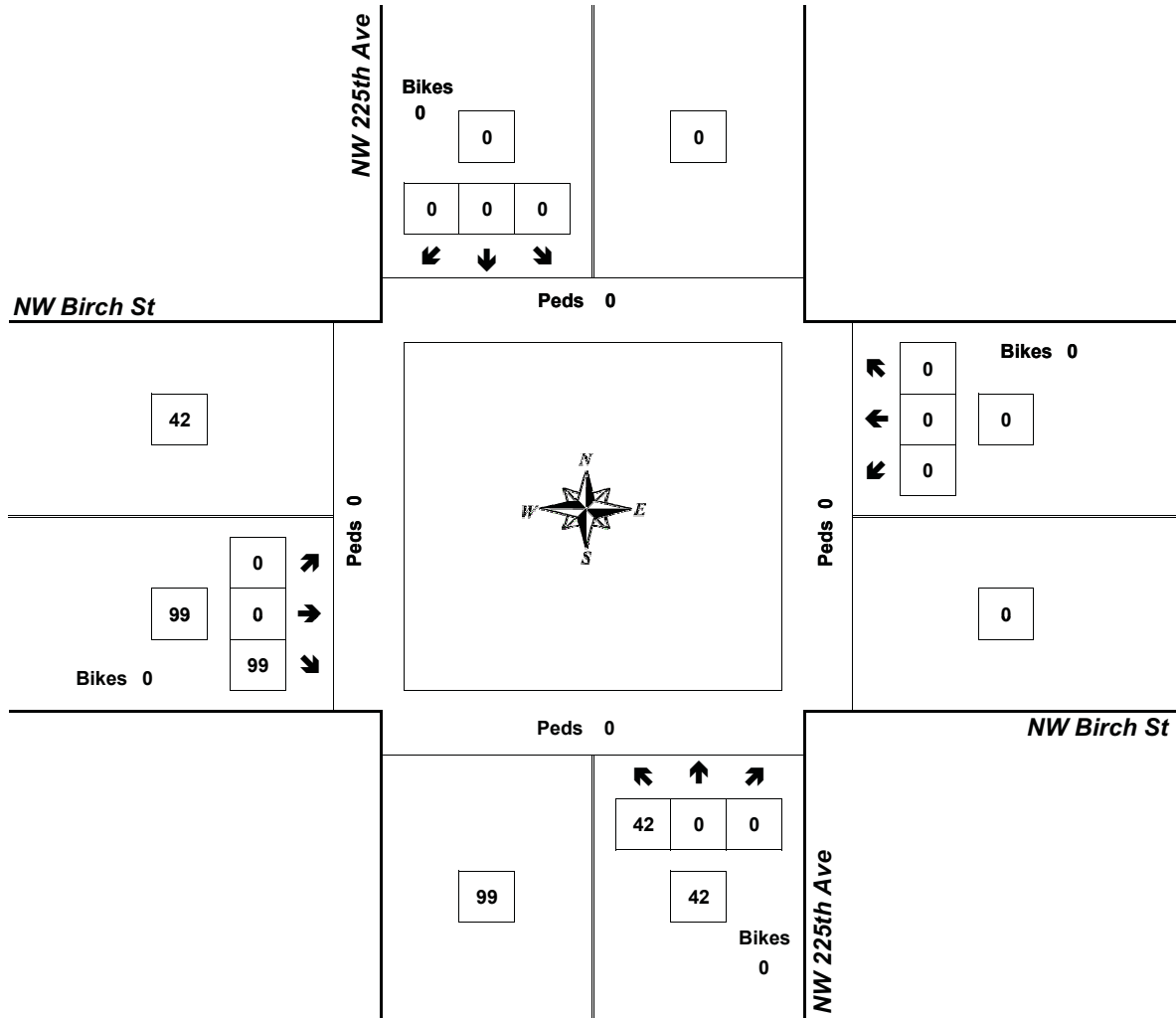
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 225th Ave & NW Birch St

7:15 AM to 8:15 AM  
Thursday, June 13, 2013



Approach	PHF	HV%	Volume
EB	0.39	2.0%	99
WB	0.00	0.0%	0
NB	0.44	2.4%	42
SB	0.00	0.0%	0
<b>Intersection</b>	<b>0.41</b>	<b>2.1%</b>	<b>141</b>

Count Period: 7:00 AM to 9:00 AM







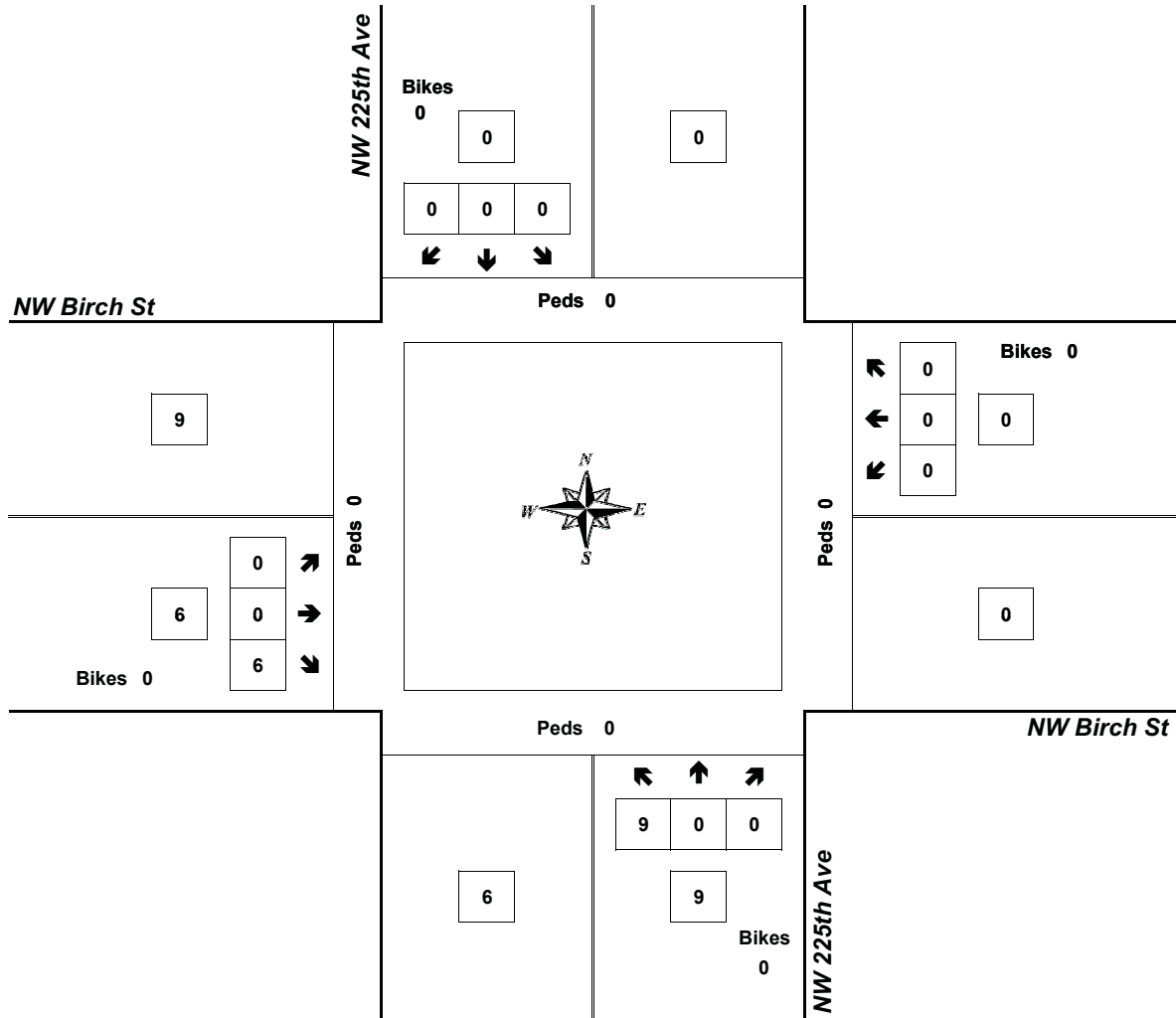
# Peak Hour Summary



Clay Carney  
(503) 833-2740

## NW 225th Ave & NW Birch St

4:55 PM to 5:55 PM  
Wednesday, June 12, 2013



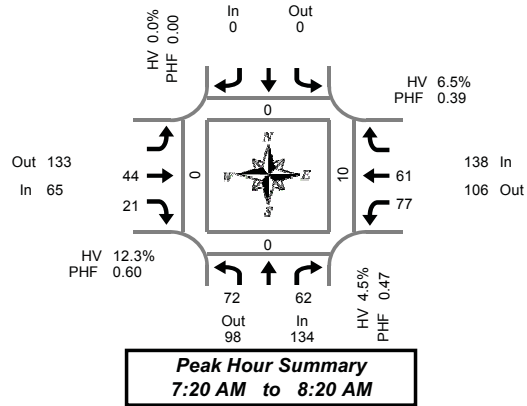
Approach	PHF	HV%	Volume
EB	0.75	0.0%	6
WB	0.00	0.0%	0
NB	0.75	0.0%	9
SB	0.00	0.0%	0
<b>Intersection</b>	<b>0.75</b>	<b>0.0%</b>	<b>15</b>

Count Period: 4:00 PM to 6:00 PM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 227th Ave & NW Dogwood St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

### 5-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total	Pedestrians Crosswalk			
	L	R	Bikes			Bikes	T	R	Bikes	L	T	Bikes		North	South	East	West
7:00 AM	2	2	0			0	0	0	0	0	0	0	4	0	0	0	0
7:05 AM	1	1	0			0	0	0	0	0	0	0	2	0	0	0	0
7:10 AM	3	1	0			0	1	1	0	0	0	0	6	0	0	0	0
7:15 AM	4	2	0			0	0	2	0	0	0	0	8	0	0	0	0
7:20 AM	1	1	0			0	3	1	0	1	0	0	7	0	0	0	0
7:25 AM	1	1	0			0	3	1	0	0	0	0	6	0	0	0	0
7:30 AM	6	7	0			0	11	3	0	2	2	0	31	0	0	0	0
7:35 AM	2	9	0			0	5	0	0	7	9	0	32	0	0	0	0
7:40 AM	8	9	0			0	8	0	0	2	6	0	33	0	0	1	0
7:45 AM	12	16	0			0	4	4	0	17	9	0	62	0	0	3	0
7:50 AM	17	10	1			0	4	2	0	22	14	0	69	0	0	6	0
7:55 AM	7	6	0			0	3	4	0	16	10	2	46	0	0	0	0
8:00 AM	5	2	0			0	1	1	0	5	4	0	18	0	0	0	0
8:05 AM	5	0	0			0	1	2	0	2	4	0	14	0	0	0	0
8:10 AM	4	1	0			0	0	1	0	0	2	0	8	0	0	0	0
8:15 AM	4	0	0			0	1	2	0	3	1	0	11	0	0	0	0
8:20 AM	2	0	0			0	1	0	0	0	1	0	4	0	0	0	0
8:25 AM	3	2	0			0	0	3	0	0	0	0	8	0	0	0	1
8:30 AM	2	4	0			0	2	2	0	1	2	0	13	0	0	0	0
8:35 AM	5	2	0			0	1	3	0	2	0	0	13	0	0	0	0
8:40 AM	3	0	0			0	0	1	0	0	2	0	6	0	0	0	0
8:45 AM	0	1	0			0	1	1	0	0	1	0	4	0	0	0	0
8:50 AM	3	4	0			0	2	0	0	0	0	0	9	0	0	0	0
8:55 AM	5	6	0			0	2	1	0	0	1	0	15	0	0	0	0
Total Survey	105	87	1			0	54	35	0	80	68	2	429	0	0	10	1

### 15-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total	Pedestrians Crosswalk			
	L	R	Bikes			Bikes	T	R	Bikes	L	T	Bikes		North	South	East	West
7:00 AM	6	4	0			0	1	1	0	0	0	0	12	0	0	0	0
7:15 AM	6	4	0			0	6	4	0	1	0	0	21	0	0	0	0
7:30 AM	16	25	0			0	24	3	0	11	17	0	96	0	0	1	0
7:45 AM	36	32	1			0	11	10	0	55	33	2	177	0	0	9	0
8:00 AM	14	3	0			0	2	4	0	7	10	0	40	0	0	0	0
8:15 AM	9	2	0			0	2	5	0	3	2	0	23	0	0	0	1
8:30 AM	10	6	0			0	3	6	0	3	4	0	32	0	0	0	0
8:45 AM	8	11	0			0	5	2	0	0	2	0	28	0	0	0	0
Total Survey	105	87	1			0	54	35	0	80	68	2	429	0	0	10	1

### Peak Hour Summary

7:20 AM to 8:20 AM

By Approach	Northbound NW 227th Ave				Southbound NW 227th Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	134	98	232	1	0	0	0	0	65	133	198	0	138	106	244	2	337	0	0	10	0
%HV	4.5%				0.0%				12.3%				6.5%				6.8%				
PHF	0.47				0.00				0.60				0.39				0.48				

By Movement	Northbound NW 227th Ave				Southbound NW 227th Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total
	L	R	Total	Bikes			Total	Bikes	T	R	Total	Bikes	L	T	Total	Bikes	
Volume	72	62	134	1			0	0	44	21	65	0	77	61	138	2	337
%HV	4.2%	NA	4.8%	4.5%	NA	NA	NA	0.0%	NA	13.6%	9.5%	12.3%	7.8%	4.9%	NA	6.5%	6.8%
PHF	0.49		0.44	0.47			0.00		0.46	0.53	0.60		0.35	0.46	0.39	0.48	

### Rolling Hour Summary

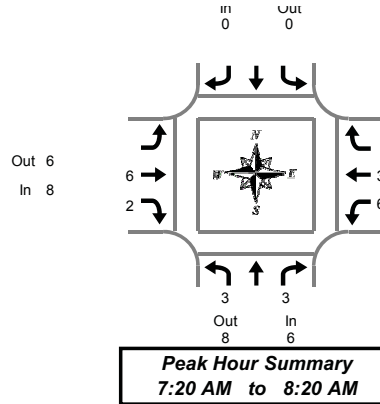
7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total	Pedestrians Crosswalk			
	L	R	Bikes			Bikes	T	R	Bikes	L	T	Bikes		North	South	East	West
7:00 AM	64	65	1			0	42	18	0	67	50	2	306	0	0	10	0
7:15 AM	72	64	1			0	43	21	0	74	60	2	334	0	0	10	0
7:30 AM	75	62	1			0	39	22	0	76	62	2	336	0	0	10	1
7:45 AM	69	43	1			0	18	25	0	68	49	2	272	0	0	9	1
8:00 AM	41	22	0			0	12	17	0	13	18	0	123	0	0	0	1

# Heavy Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 227th Ave & NW Dogwood St

Thursday, June 13, 2013

7:00 AM to 9:00 AM

**Peak Hour Summary**  
7:20 AM to 8:20 AM

### Heavy Vehicle 5-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total
	L	R	Total			Total	T	R	Total	L	T	Total	
7:00 AM	0	0	0			0	0	0	0	0	0	0	0
7:05 AM	0	0	0			0	0	0	0	0	0	0	0
7:10 AM	0	0	0			0	0	0	0	0	0	0	0
7:15 AM	0	0	0			0	0	0	0	0	0	0	0
7:20 AM	0	0	0			0	1	0	1	1	0	1	2
7:25 AM	0	0	0			0	0	1	1	0	0	0	1
7:30 AM	0	0	0			0	2	0	2	0	0	0	2
7:35 AM	0	2	2			0	3	0	3	0	0	0	5
7:40 AM	0	0	0			0	0	0	0	0	1	1	1
7:45 AM	0	0	0			0	0	1	1	2	1	3	4
7:50 AM	2	1	3			0	0	0	0	1	0	1	4
7:55 AM	1	0	1			0	0	0	0	2	1	3	4
8:00 AM	0	0	0			0	0	0	0	0	0	0	0
8:05 AM	0	0	0			0	0	0	0	0	0	0	0
8:10 AM	0	0	0			0	0	0	0	0	0	0	0
8:15 AM	0	0	0			0	0	0	0	0	0	0	0
8:20 AM	0	0	0			0	0	0	0	0	0	0	0
8:25 AM	0	0	0			0	0	0	0	0	0	0	0
8:30 AM	0	0	0			0	0	0	0	0	0	0	0
8:35 AM	0	0	0			0	0	0	0	0	0	0	0
8:40 AM	0	0	0			0	0	0	0	0	1	1	1
8:45 AM	0	0	0			0	0	0	0	0	0	0	0
8:50 AM	0	0	0			0	0	0	0	0	0	0	0
8:55 AM	0	0	0			0	0	0	0	0	0	0	0
Total Survey	3	3	6			0	6	2	8	6	4	10	24

### Heavy Vehicle 15-Minute Interval Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total
	L	R	Total			Total	T	R	Total	L	T	Total	
7:00 AM	0	0	0			0	0	0	0	0	0	0	0
7:15 AM	0	0	0			0	1	1	2	1	0	1	3
7:30 AM	0	2	2			0	5	0	5	0	1	1	8
7:45 AM	3	1	4			0	0	1	1	5	2	7	12
8:00 AM	0	0	0			0	0	0	0	0	0	0	0
8:15 AM	0	0	0			0	0	0	0	0	0	0	0
8:30 AM	0	0	0			0	0	0	0	0	1	1	1
8:45 AM	0	0	0			0	0	0	0	0	0	0	0
Total Survey	3	3	6			0	6	2	8	6	4	10	24

### Heavy Vehicle Peak Hour Summary

7:20 AM to 8:20 AM

By Approach	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	6	8	14	0	0	0	8	6	14	9	9	18	23
PHF	0.38			0.00			0.33			0.32			0.48

By Movement	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Total
	L	R	Total			Total	T	R	Total	L	T	Total	
Volume	3	3	6			0	6	2	8	6	3	9	23
PHF	0.25	0.38	0.38			0.00	0.30	0.50	0.33	0.30	0.38	0.32	0.48

### Heavy Vehicle Rolling Hour Summary

7:00 AM to 9:00 AM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total
	L	R	Total			Total	T	R	Total	L	T	Total	
7:00 AM	3	3	6			0	6	2	8	6	3	9	23
7:15 AM	3	3	6			0	6	2	8	6	3	9	23
7:30 AM	3	3	6			0	5	1	6	5	3	8	20
7:45 AM	3	1	4			0	0	1	1	5	3	8	13
8:00 AM	0	0	0			0	0	0	0	0	1	1	1

# Peak Hour Summary



Clay Carney  
(503) 833-2740

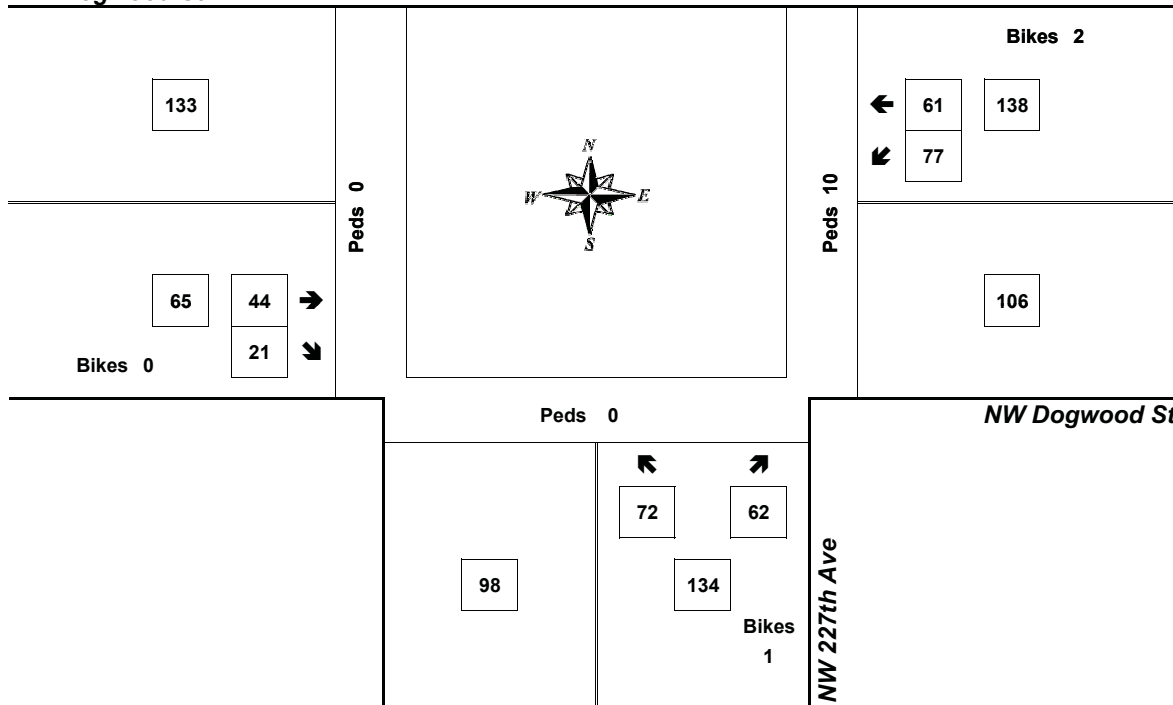
## NW 227th Ave & NW Dogwood St

7:20 AM to 8:20 AM  
Thursday, June 13, 2013

Bikes  
0

NW Dogwood St

Peds 0



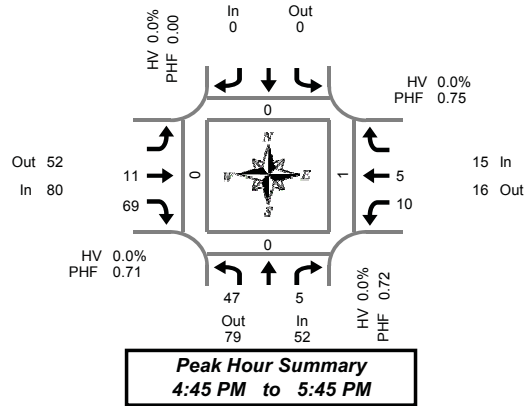
Approach	PHF	HV%	Volume
EB	0.60	12.3%	65
WB	0.39	6.5%	138
NB	0.47	4.5%	134
SB	0.00	0.0%	0
<b>Intersection</b>	<b>0.48</b>	<b>6.8%</b>	<b>337</b>

Count Period: 7:00 AM to 9:00 AM

# Total Vehicle Summary



Clay Carney  
(503) 833-2740



## NW 227th Ave & NW Dogwood St

Wednesday, June 12, 2013

4:00 PM to 6:00 PM

### 5-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total	Pedestrians Crosswalk			
	L	R	Bikes			Bikes	T	R	Bikes	L	T	Bikes		North	South	East	West
4:00 PM	0	0	0			0	0	0	0	0	1	0	1	0	0	0	0
4:05 PM	6	0	0			0	0	3	0	1	1	0	11	0	0	0	0
4:10 PM	4	1	1			0	0	5	0	0	1	0	11	0	0	0	0
4:15 PM	2	1	0			0	0	0	0	0	6	0	9	0	0	0	0
4:20 PM	2	0	0			0	0	3	0	0	0	0	5	0	0	0	0
4:25 PM	3	0	0			0	0	2	1	0	0	0	5	0	0	1	0
4:30 PM	4	1	0			0	1	5	0	2	1	0	14	0	0	0	0
4:35 PM	1	1	0			0	0	3	0	0	0	0	5	0	0	0	0
4:40 PM	4	0	0			0	1	0	0	1	1	0	7	0	0	0	0
4:45 PM	1	0	0			0	3	6	0	1	0	0	11	0	0	0	0
4:50 PM	3	0	0			0	0	8	0	1	0	0	12	0	0	1	0
4:55 PM	4	1	0			0	1	5	0	1	0	0	12	0	0	0	0
5:00 PM	5	0	0			0	2	2	0	2	0	0	9	0	0	0	0
5:05 PM	2	0	0			0	2	8	0	0	0	0	12	0	0	0	0
5:10 PM	3	1	0			0	1	4	0	0	1	0	10	0	0	0	0
5:15 PM	6	0	0			0	0	5	0	2	1	0	14	0	0	0	0
5:20 PM	3	0	0			0	0	3	0	1	0	0	7	0	0	0	0
5:25 PM	7	0	0			0	1	5	0	0	0	0	13	0	0	0	0
5:30 PM	5	1	0			0	1	8	0	1	1	0	17	0	0	0	0
5:35 PM	4	1	0			0	2	11	0	0	1	0	19	0	0	0	0
5:40 PM	4	1	0			0	0	4	0	1	1	0	11	0	0	0	0
5:45 PM	2	0	0			0	0	4	0	0	0	0	6	0	0	0	0
5:50 PM	3	0	0			0	0	7	0	0	0	0	10	0	0	0	0
5:55 PM	3	0	0			0	0	8	0	1	0	0	12	0	0	0	0
Total Survey	81	9	1			0	13	109	1	15	16	0	243	0	0	2	0

### 15-Minute Interval Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total	Pedestrians Crosswalk			
	L	R	Bikes			Bikes	T	R	Bikes	L	T	Bikes		North	South	East	West
4:00 PM	10	1	1			0	0	8	0	1	3	0	23	0	0	0	0
4:15 PM	7	1	0			0	0	5	1	0	6	0	19	0	0	1	0
4:30 PM	9	2	0			0	2	8	0	3	2	0	26	0	0	0	0
4:45 PM	8	1	0			0	4	19	0	3	0	0	35	0	0	1	0
5:00 PM	10	1	0			0	3	14	0	2	1	0	31	0	0	0	0
5:15 PM	16	0	0			0	1	13	0	3	1	0	34	0	0	0	0
5:30 PM	13	3	0			0	3	23	0	2	3	0	47	0	0	0	0
5:45 PM	8	0	0			0	0	19	0	1	0	0	28	0	0	0	0
Total Survey	81	9	1			0	13	109	1	15	16	0	243	0	0	2	0

### Peak Hour Summary

4:45 PM to 5:45 PM

By Approach	Northbound NW 227th Ave				Southbound NW 227th Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	52	79	131	0	0	0	0	0	80	52	132	0	15	16	31	0	147	0	0	1	0
%HV	0.0%				0.0%				0.0%				0.0%				0.0%				
PHF	0.72				0.00				0.71				0.75				0.75				

By Movement	Northbound NW 227th Ave				Southbound NW 227th Ave				Eastbound NW Dogwood St				Westbound NW Dogwood St				Total
	L	R	Total	Bikes	L	R	Total	Bikes	T	R	Total	Bikes	L	T	Total	Bikes	
Volume	47	5	52	0			0		11	69	80	0	10	5	15	0	147
%HV	0.0%	NA	0.0%	0.0%	NA	NA	NA	0.0%	NA	0.0%	0.0%	0.0%	0.0%	0.0%	NA	0.0%	0.0%
PHF	0.73		0.42	0.72			0.00		0.69	0.72	0.71		0.63	0.42	0.75		0.75

### Rolling Hour Summary

4:00 PM to 6:00 PM

Interval Start Time	Northbound NW 227th Ave			Southbound NW 227th Ave			Eastbound NW Dogwood St			Westbound NW Dogwood St			Interval Total	Pedestrians Crosswalk			
	L	R	Bikes			Bikes	T	R	Bikes	L	T	Bikes		North	South	East	West
4:00 PM	34	5	1			0	6	40	1	7	11	0	103	0	0	2	0
4:15 PM	34	5	0			0	9	46	1	8	9	0	111	0	0	2	0
4:30 PM	43	4	0			0	10	54	0	11	4	0	126	0	0	1	0
4:45 PM	47	5	0			0	11	69	0	10	5	0	147	0	0	1	0
5:00 PM	47	4	0			0	7	69	0	8	5	0	140	0	0	0	0



# Peak Hour Summary



Clay Carney  
(503) 833-2740

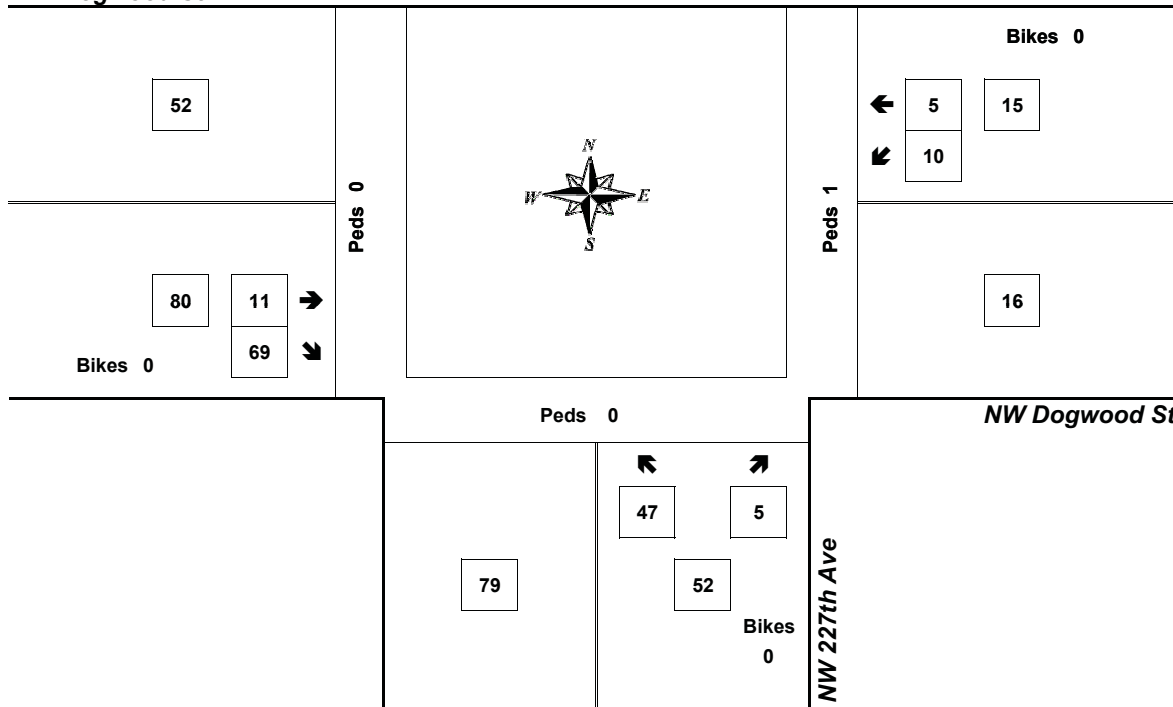
## NW 227th Ave & NW Dogwood St

4:45 PM to 5:45 PM  
Wednesday, June 12, 2013

Bikes  
0

NW Dogwood St

Peds 0



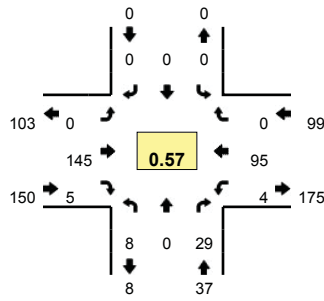
Approach	PHF	HV%	Volume
EB	0.71	0.0%	80
WB	0.75	0.0%	15
NB	0.72	0.0%	52
SB	0.00	0.0%	0
<b>Intersection</b>	<b>0.75</b>	<b>0.0%</b>	<b>147</b>

Count Period: 4:00 PM to 6:00 PM

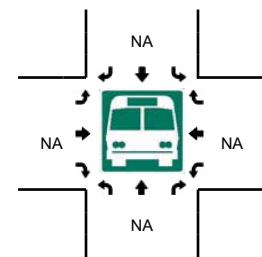
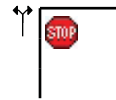
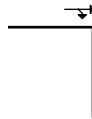
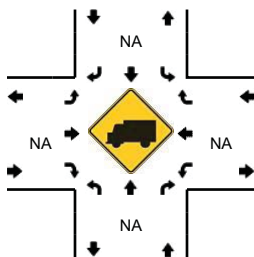
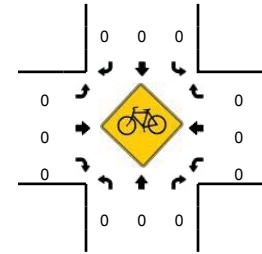
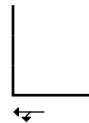
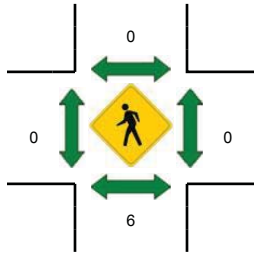
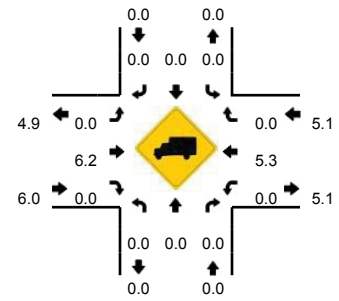


**LOCATION:** NE 76th Ave -- NW Quatama Rd  
**CITY/STATE:** Hillsboro, OR

**QC JOB #:** 11079804  
**DATE:** Thu, Jun 13 2013



**Peak-Hour: 7:15 AM -- 8:15 AM**  
**Peak 15-Min: 7:45 AM -- 8:00 AM**

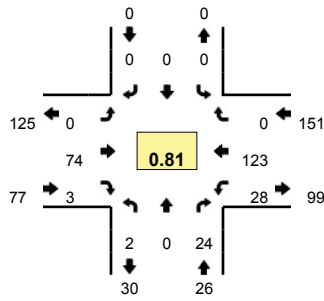


5-Min Count Period Beginning At	NE 76th Ave (Northbound)				NE 76th Ave (Southbound)				NW Quatama Rd (Eastbound)				NW Quatama Rd (Westbound)				Total	Hourly Totals	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
7:00 AM	0	0	2	0	0	0	0	0	0	0	3	0	0	0	2	0	0	7	
7:05 AM	0	0	4	0	0	0	0	0	0	0	5	0	0	0	2	0	0	11	
7:10 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	6	
7:15 AM	0	0	3	0	0	0	0	0	0	0	6	0	0	0	4	0	0	13	
7:20 AM	0	0	2	0	0	0	0	0	0	0	5	0	0	0	1	0	0	8	
7:25 AM	1	0	3	0	0	0	0	0	0	0	11	0	0	0	2	0	0	17	
7:30 AM	1	0	2	0	0	0	0	0	0	0	5	0	0	0	8	0	1	17	
7:35 AM	0	0	3	0	0	0	0	0	0	0	15	0	0	1	9	0	0	28	
7:40 AM	0	0	4	0	0	0	0	0	0	0	8	0	0	0	10	0	0	22	
7:45 AM	1	0	5	0	0	0	0	0	0	0	12	0	0	1	19	0	0	38	
7:50 AM	4	0	1	0	0	0	0	0	0	0	12	0	0	0	25	0	0	42	
7:55 AM	0	0	1	0	0	0	0	0	0	0	37	2	0	0	5	0	0	45	254
8:00 AM	1	0	1	0	0	0	0	0	0	0	14	0	0	0	5	0	0	21	268
8:05 AM	0	0	3	0	0	0	0	0	0	0	16	1	0	0	3	0	0	23	280
8:10 AM	0	0	1	0	0	0	0	0	0	0	4	2	0	1	4	0	0	12	286
8:15 AM	1	0	2	0	0	0	0	0	0	0	7	0	0	0	5	0	0	15	288
8:20 AM	0	0	1	0	0	0	0	0	0	0	6	1	0	0	3	0	0	11	291
8:25 AM	0	0	3	0	0	0	0	0	0	0	4	0	0	0	5	0	0	12	286
8:30 AM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	6	0	0	10	279
8:35 AM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	2	0	0	8	259
8:40 AM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6	0	0	12	249
8:45 AM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	0	0	6	217
8:50 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	0	0	6	181
8:55 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	7	0	0	9	145
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total		
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
All Vehicles	20	0	28	0	0	0	0	0	0	0	244	8	0	4	196	0	0	500	
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	20	0	0	0	12	0	0	32	
Pedestrians		8				0					0				0			8	
Bicycles	0	0	0		0	0	0			0	0	0		0	0	0		0	
Railroad																			
Stopped Buses																			

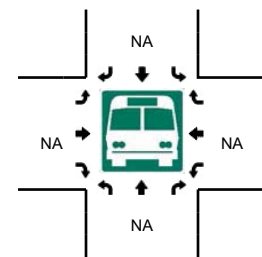
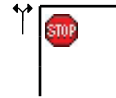
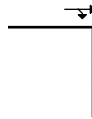
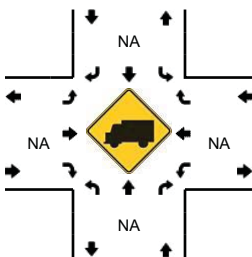
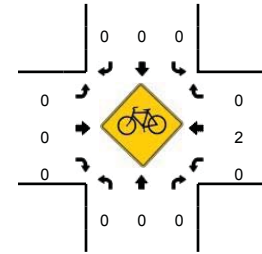
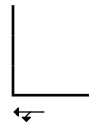
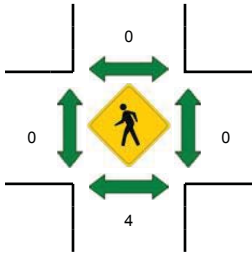
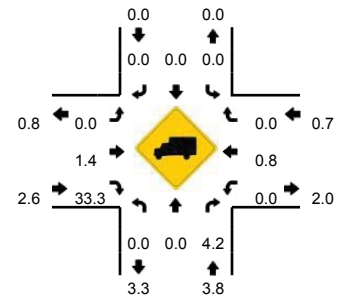
Comments:

**LOCATION:** NE 76th Ave -- NW Quatama Rd  
**CITY/STATE:** Hillsboro, OR

**QC JOB #:** 11079806  
**DATE:** Wed, Jun 12 2013



**Peak-Hour: 5:00 PM -- 6:00 PM**  
**Peak 15-Min: 5:30 PM -- 5:45 PM**

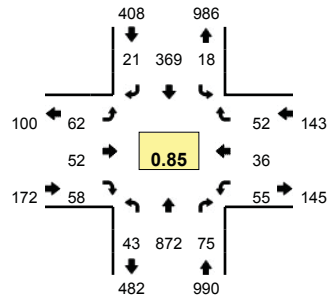


5-Min Count Period Beginning At	NE 76th Ave (Northbound)				NE 76th Ave (Southbound)				NW Quatama Rd (Eastbound)				NW Quatama Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
5:00 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	5	0	0	6	
5:05 PM	0	0	0	0	0	0	0	0	0	8	0	0	3	8	0	0	19	
5:10 PM	0	0	2	0	0	0	0	0	0	8	0	0	3	8	0	0	21	
5:15 PM	0	0	1	0	0	0	0	0	0	5	0	0	3	13	0	1	23	
5:20 PM	0	0	0	0	0	0	0	0	0	6	0	0	1	8	0	0	15	
5:25 PM	1	0	3	0	0	0	0	0	0	4	2	0	4	16	0	0	30	
5:30 PM	0	0	4	0	0	0	0	0	0	9	0	0	0	13	0	0	26	
5:35 PM	0	0	1	0	0	0	0	0	0	5	0	0	4	10	0	0	20	
5:40 PM	0	0	7	0	0	0	0	0	0	8	1	0	3	13	0	0	32	
5:45 PM	0	0	1	0	0	0	0	0	0	3	0	0	4	8	0	0	16	
5:50 PM	0	0	2	0	0	0	0	0	0	8	0	0	1	9	0	0	20	
5:55 PM	1	0	2	0	0	0	0	0	0	10	0	0	1	12	0	0	26	254
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	248
6:05 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	229
6:10 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	208
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	185
6:20 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170
6:25 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114
6:35 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94
6:40 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
6:50 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
6:55 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
All Vehicles	0	0	48	0	0	0	0	0	0	88	4	0	28	144	0	0	312	
Heavy Trucks	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad																		
Stopped Buses																		

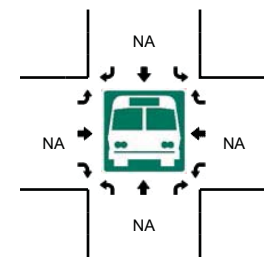
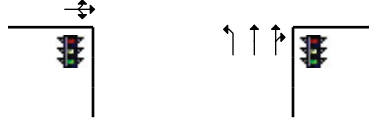
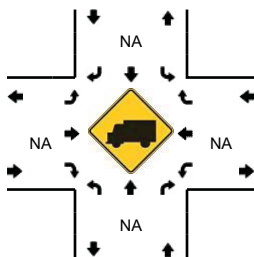
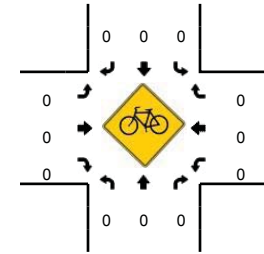
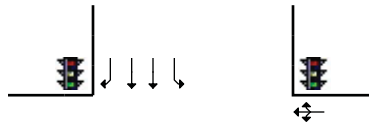
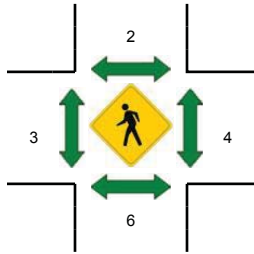
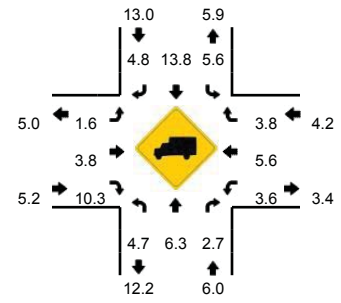
Comments:

**LOCATION:** NW Cornelius Pass Rd -- NW Quatama Rd  
**CITY/STATE:** Hillsboro, OR

**QC JOB #:** 11079801  
**DATE:** Thu, Jun 13 2013



**Peak-Hour: 7:15 AM -- 8:15 AM**  
**Peak 15-Min: 7:45 AM -- 8:00 AM**

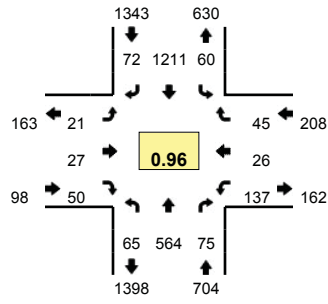


5-Min Count Period Beginning At	NW Cornelius Pass Rd (Northbound)				NW Cornelius Pass Rd (Southbound)				NW Quatama Rd (Eastbound)				NW Quatama Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	2	59	6	0	1	26	1	0	3	1	1	0	2	0	5	0	107	
7:05 AM	1	63	5	0	0	22	0	0	5	1	1	0	7	0	5	0	110	
7:10 AM	2	55	9	0	0	18	2	0	2	0	2	0	2	0	5	0	97	
7:15 AM	3	77	6	0	1	26	1	0	2	2	3	0	4	0	2	0	127	
7:20 AM	0	73	6	0	3	27	0	0	5	3	0	0	4	1	4	0	126	
7:25 AM	2	52	5	0	0	27	1	0	3	6	4	0	5	0	7	0	112	
7:30 AM	2	59	4	0	2	32	3	0	4	2	2	0	9	4	7	0	130	
7:35 AM	1	61	5	0	1	36	2	0	8	5	6	0	4	6	2	0	137	
7:40 AM	8	102	5	0	3	38	1	0	4	2	6	0	2	3	4	0	178	
7:45 AM	10	88	4	0	1	36	3	0	3	2	9	0	4	6	5	0	171	
7:50 AM	9	87	8	0	1	24	4	0	5	5	6	0	5	12	3	0	169	
7:55 AM	2	80	13	0	0	25	1	0	10	13	12	0	4	2	4	0	166	1630
8:00 AM	2	73	5	0	0	28	4	0	8	6	2	0	3	0	3	0	134	1657
8:05 AM	1	69	6	0	4	31	0	0	7	5	7	0	6	1	6	0	143	1690
8:10 AM	3	51	8	0	2	39	1	0	3	1	1	0	5	1	5	0	120	1713
8:15 AM	2	60	7	0	0	29	3	0	1	2	4	0	2	0	2	0	112	1698
8:20 AM	0	58	1	0	2	44	3	0	1	3	4	0	3	0	2	0	121	1693
8:25 AM	2	63	5	0	1	33	3	0	3	1	4	0	7	1	4	0	127	1708
8:30 AM	2	65	9	0	0	26	1	0	3	0	1	0	3	1	3	0	114	1692
8:35 AM	1	48	4	0	1	20	0	0	1	3	2	0	2	1	4	0	87	1642
8:40 AM	1	70	5	0	2	22	4	0	3	3	0	0	2	1	6	0	119	1583
8:45 AM	0	45	6	0	4	31	2	0	2	0	1	0	0	1	10	0	102	1514
8:50 AM	1	55	3	0	2	30	1	0	2	0	1	0	4	2	5	0	106	1451
8:55 AM	2	38	4	0	5	27	2	0	2	0	0	0	0	4	1	0	85	1370
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	84	1020	100	0	8	340	32	0	72	80	108	0	52	80	48	0	2024	
Heavy Trucks	4	48	4		0	44	4		4	0	16		0	4	0		128	
Pedestrians		12				0				4				4			20	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Railroad																		
Stopped Buses																		

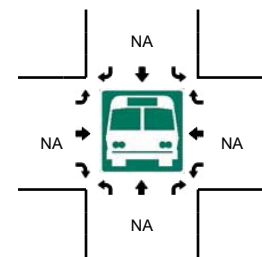
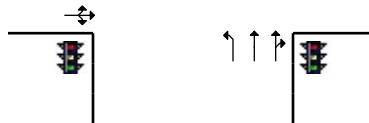
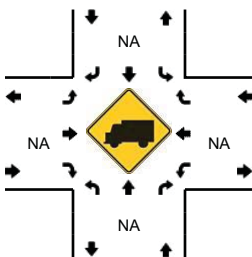
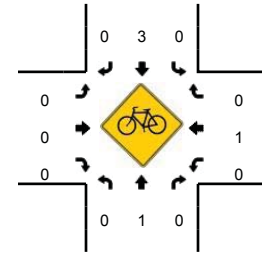
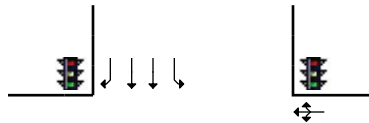
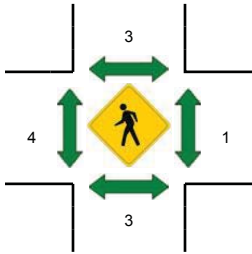
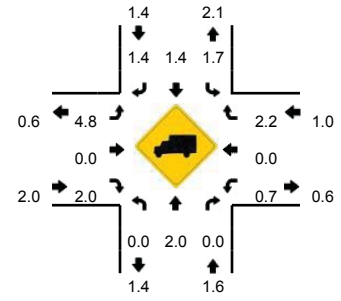
Comments:

**LOCATION:** NW Cornelius Pass Rd -- NW Quatama Rd  
**CITY/STATE:** Hillsboro, OR

**QC JOB #:** 11079803  
**DATE:** Wed, Jun 12 2013



**Peak-Hour: 5:00 PM -- 6:00 PM**  
**Peak 15-Min: 5:30 PM -- 5:45 PM**



5-Min Count Period Beginning At	NW Cornelius Pass Rd (Northbound)				NW Cornelius Pass Rd (Southbound)				NW Quatama Rd (Eastbound)				NW Quatama Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
5:00 PM	6	43	3	0	5	118	5	0	0	1	1	0	14	2	1	0	199	
5:05 PM	5	45	6	0	1	115	5	0	1	0	5	0	11	1	3	0	198	
5:10 PM	5	38	6	0	3	100	6	0	3	3	5	0	9	1	2	0	181	
5:15 PM	9	49	5	0	6	109	6	0	1	1	5	0	8	1	3	0	203	
5:20 PM	4	50	5	0	1	108	4	0	3	3	1	0	8	1	4	0	192	
5:25 PM	9	44	5	0	5	88	8	0	2	1	4	0	15	4	4	0	189	
5:30 PM	1	41	7	0	7	106	7	0	2	3	6	0	11	4	7	0	202	
5:35 PM	7	55	10	0	7	90	5	0	1	1	6	0	13	4	4	0	203	
5:40 PM	4	51	7	0	8	101	11	0	3	3	5	0	8	3	4	0	208	
5:45 PM	6	58	4	0	1	101	4	0	3	2	3	0	18	3	6	0	209	
5:50 PM	5	46	9	0	7	78	3	0	1	4	5	0	10	1	3	0	172	
5:55 PM	4	44	8	0	9	97	8	0	1	5	4	0	12	1	4	0	197	2353
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2154
6:05 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1956
6:10 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1775
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1572
6:20 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1380
6:25 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1191
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	989
6:35 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	786
6:40 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	578
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	369
6:50 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	197
6:55 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	48	588	96	0	88	1188	92	0	24	28	68	0	128	44	60	0	2452	
Heavy Trucks	0	0	0	0	0	20	0	0	0	0	4	0	0	0	0	0	24	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	
Railroad																		
Stopped Buses																		

Comments:

# **Collision Data**

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17	Washington Hillsboro	231st Ave	Alder St	216 N	8	45.530	-122.915	STRGHT	S-1STOP	REAR	INJ	CLEAR	DRY	DAYLIGHT	LIGHT RAIL FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
13	Washington Hillsboro	231st Ave	Alder St	0 N	6	45.530	-122.915	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	PEDESTAL INVOLV FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	S to N	
7	Washington Hillsboro	231st Ave	Alder St	0 N	5	45.530	-122.915	INTER	FIX OBJ	FIX	PDO	UNKNOWN	UNKNOWN	DAWN	POLE-ST LK OTHR IMPROPER DRIVING	PSNGR CAFSTRGHT	S to N	
12	Washington Hillsboro	231st Ave	Alder St	15 N	6	45.530	-122.915	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
18	Washington Hillsboro	231st Ave	Alder St	0 CN	1	45.530	-122.915	INTER	S-1TURN	TURN	INJ	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
18	Washington Hillsboro	231st Ave	Alder St	0 S	6	45.530	-122.915	INTER	S-1STOP	REAR	PDO	RAIN	WET	DUSK	FORCED BY FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	S to N	
13	Washington Hillsboro	231st Ave	Alder St	182 N	8	45.530	-122.915	CURVE	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
22	Washington Hillsboro	231st Ave	Dogwood St	0 CN	2	45.527	-122.915	INTER	ANGLOTH ANGL	ANGL	INJ	CLEAR	DRY	DARK-NO SCUT	SLOPE NO YIELD	PSNGR CAFSTRGHT	S to N	
18	Washington Hillsboro	231st Ave	Dogwood St	0 S	5	45.527	-122.915	INTER	FIX OBJ	FIX	INJ	CLEAR	DRY	DUSK	POLE-UTIL CARELESS	INATTENTIVE	FATIGUE	
15	Washington Hillsboro	231st Ave	Dogwood St	0 CN	1	45.527	-122.915	INTER	ANGLOTH ANGL	ANGL	PDO	RAIN	WET	DAYLIGHT	NO YIELD	PSNGR CAFSTRGHT	E to W	
13	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	926 N	7	45.526	-122.900	GRADE	O-STRGHT	HEAD	INJ	RAIN	WET	DAYLIGHT	PHANTOM IMPROPER PHANTOM VEHICLE	PSNGR CAFSTRGHT	N to S	
13	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	150 N	8	45.524	-122.900	GRADE	S-1STOP	REAR	INJ	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
11	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	100 N	8	45.523	-122.900	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
15	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	50 N	6	45.523	-122.900	STRGHT	S-1STOP	REAR	INJ	CLEAR	DRY	DAYLIGHT	CARELESS	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S
18	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	35 N	6	45.523	-122.900	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FORCED BY FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
8	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	0 CN	2	45.523	-122.900	INTER	O-1TURN	TURN	PDO	CLEAR	DRY	DAYLIGHT	NO YIELD	PSNGR CAFSTRGHT	N to S	
17	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	0 CN	4	45.523	-122.900	INTER	O-1TURN	TURN	PDO	RAIN	WET	DARK-NO ST	LIGHTS	PSNGR CAFSTRGHT	W to E	
16	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	300 N	7	45.524	-122.900	STRGHT	S-1STOP	REAR	INJ	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	S to N	
15	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	300 N	8	45.524	-122.900	STRGHT	S-1STOP	REAR	INJ	CLEAR	DRY	DAYLIGHT	FORCED BY FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
14	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	0 S	5	45.523	-122.900	INTER	S-1STOP	REAR	INJ	RAIN	WET	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	N to S	
13	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	100 S	8	45.523	-122.900	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAFSTRGHT	S to N	
16	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	0 CN	4	45.523	-122.900	INTER	O-1TURN	TURN	INJ	CLEAR	DRY	DAYLIGHT	NO YIELD	PSNGR CAFSTRGHT	S to N	
15	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	300 N	7	45.524	-122.900	GRADE	S-1STOP	REAR	PDO	CLOUDY	DRY	DAYLIGHT	FORCED BY CARELESS	FOLLOW TOO	INATTENTIVE	
16	Washington Hillsboro	Cornelius Pass Rd	Quatama Rd	0 CN	3	45.523	-122.900	INTER	O-1TURN	TURN	PDO	CLEAR	DRY	DAYLIGHT	NO YIELD	PSNGR CAFSTRGHT	S to N	

# **Level of Service Descriptions**

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## TRAFFIC LEVELS OF SERVICE

Analysis of traffic volumes is useful in understanding the general nature of traffic in an area, but by itself indicates neither the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of *level of service* has been developed to subjectively describe traffic performance. Level of service can be measured at intersections and along key roadway segments.

Level of service categories are similar to report card ratings for traffic performance. Intersections are typically the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is generally diminished in their vicinities. Levels of Service A, B and C indicate conditions where traffic moves without significant delays over periods of peak travel demand. Level of service D and E are progressively worse peak hour operating conditions and F conditions represent where demand exceeds the capacity of an intersection. Most urban communities set level of service D as the minimum acceptable level of service for peak hour operation and plan for level of service C or better for all other times of the day. The *Highway Capacity Manual* provides level of service calculation methodology for both intersections and arterials.<sup>1</sup> The following two sections provide interpretations of the analysis approaches.

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<sup>1</sup> 2000 *Highway Capacity Manual*, Transportation Research Board, Washington D.C., 2000, Chapters 16 and 17.



## UNSIGNALIZED INTERSECTIONS (Two-Way Stop Controlled)

Unsignalized intersection level of service is reported for the major street and minor street (generally, left turn movements). The method assesses available and critical gaps in the traffic stream which make it possible for side street traffic to enter the main street flow. The *2000 Highway Capacity Manual* describes the detailed methodology. It is not unusual for an intersection to experience level of service E or F conditions for the minor street left turn movement. It should be understood that, often, a poor level of service is experienced by only a few vehicles and the intersection as a whole operates acceptably.

Unsignalized intersection levels of service are described in the following table.

Level of Service	Expected Delay	(Sec/Veh)
A	Little or no delay	0-10.0
B	Short traffic delay	>10.1-15.0
C	Average traffic delays	>15.1-25.0
D	Long traffic delays	>25.1-35.0
E	Very long traffic delays	>35.1-50.0
F	Extreme delays potentially affecting other traffic movements in the intersection	> 50

Source: 2000 *Highway Capacity Manual*, Transportation Research Board Washington, D.C.

## SIGNALIZED INTERSECTIONS

For signalized intersections, level of service is evaluated based upon average vehicle delay experienced by vehicles entering an intersection. Control delay (or signal delay) includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. In previous versions of this chapter of the HCM (1994 and earlier), delay included only stopped delay. As delay increases, the level of service decreases. Calculations for signalized and unsignalized intersections are different due to the variation in traffic control. The *2000 Highway Capacity Manual* provides the basis for these calculations.

Level of Service	Delay (secs.)	Description
A	$\leq 10.00$	<b>Free Flow/Insignificant Delays:</b> No approach phase is fully utilized by traffic and no vehicle waits longer than one red indication. Most vehicles do not stop at all. Progression is extremely favorable and most vehicles arrive during the green phase.
B	10.1-20.0	<b>Stable Operation/Minimal Delays:</b> An occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles. This level generally occurs with good progression, short cycle lengths, or both.
C	20.1-35.0	<b>Stable Operation/Acceptable Delays:</b> Major approach phases fully utilized. Most drivers feel somewhat restricted. Higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, and the number of vehicles stopping is significant.
D	35.1-55.0	<b>Approaching Unstable/Tolerable Delays:</b> The influence of congestion becomes more noticeable. Drivers may have to wait through more than one red signal indication. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. The proportion of vehicles not stopping declines, and individual cycle failures are noticeable.
E	55.1-80.0	<b>Unstable Operation/Significant Delays:</b> Volumes at or near capacity. Vehicles may wait through several signal cycles. Long queues form upstream from intersection. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are a frequent occurrence.
F	$\geq 80.0$	<b>Forced Flow/Excessive Delays:</b> Represents jammed conditions. Queues may block upstream intersections. This level occurs when arrival flow rates exceed intersection capacity, and is considered to be unacceptable to most drivers. Poor progression, long cycle lengths, and v/c ratios approaching 1.0 may contribute to these high delay levels.

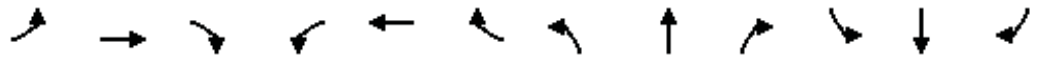
Source: *2000 Highway Capacity Manual*, Transportation Research Board, Washington D.C.

# HCM Analysis – Existing

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HCM Unsignalized Intersection Capacity Analysis  
1: Alder St & 231st Ave

Existing AM Peak  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	31	3	12	0	1	35	10	582	1	33	210	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	38	4	15	0	1	43	12	719	1	41	259	21
Pedestrians					18						25	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					4.0						4.0	
Percent Blockage					1						2	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage (veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1163	1114	270	1119	1124	762	280			738		
vC1, stage 1 conf vol	351	351		762	762							
vC2, stage 2 conf vol	812	762		357	362							
vCu, unblocked vol	1163	1114	270	1119	1124	762	280			738		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	86	99	98	100	100	89	99			95		
cM capacity (veh/h)	268	339	755	349	363	394	1238			864		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	57	44	12	720	41	280
Volume Left	38	0	12	0	41	0
Volume Right	15	43	0	1	0	21
cSH	327	393	1238	1700	864	1700
Volume to Capacity	0.17	0.11	0.01	0.42	0.05	0.16
Queue Length 95th (ft)	15	9	1	0	4	0
Control Delay (s)	18.3	15.3	7.9	0.0	9.4	0.0
Lane LOS	C	C	A		A	
Approach Delay (s)	18.3	15.3	0.1		1.2	
Approach LOS	C	C				

Intersection Summary		
Average Delay		1.9
Intersection Capacity Utilization	46.8%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis  
2: Birch St & 231st Ave

Existing AM Peak  
Orenco Woods TIA



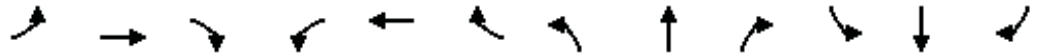
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	34	1	20	3	1	18	10	538	17	12	219	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	45	1	26	4	1	24	13	708	22	16	288	7
Pedestrians		2			12			5				
Lane Width (ft)		12.0			12.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			1			0				
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage (veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1084	1094	298	1109	1086	731	297			742		
vC1, stage 1 conf vol	325	325		757	757							
vC2, stage 2 conf vol	759	769		352	328							
vCu, unblocked vol	1084	1094	298	1109	1086	731	297			742		
tC, single (s)	7.2	6.5	6.2	7.4	6.5	6.2	4.2			4.1		
tC, 2 stage (s)	6.2	5.5		6.4	5.5							
tF (s)	3.6	4.0	3.3	3.8	4.0	3.3	2.3			2.2		
p0 queue free %	86	100	96	99	100	94	99			98		
cM capacity (veh/h)	327	360	741	313	374	421	1218			865		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	72	29	13	730	16	295
Volume Left	45	4	13	0	16	0
Volume Right	26	24	0	22	0	7
cSH	411	400	1218	1700	865	1700
Volume to Capacity	0.18	0.07	0.01	0.43	0.02	0.17
Queue Length 95th (ft)	16	6	1	0	1	0
Control Delay (s)	15.6	14.7	8.0	0.0	9.2	0.0
Lane LOS	C	B	A		A	
Approach Delay (s)	15.6	14.7	0.1		0.5	
Approach LOS	C	B				

Intersection Summary		
Average Delay		1.6
Intersection Capacity Utilization	46.6%	ICU Level of Service A
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
 3: Dogwood St & 231st Ave

Existing AM Peak  
 Orencia Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	30	2	31	33	11	55	15	455	50	10	215	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	38	3	40	42	14	71	19	583	64	13	276	17
Pedestrians		1			9			1				
Lane Width (ft)		12.0			12.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			1			0				
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1010	1006	286	1006	982	624	293			656		
vC1, stage 1 conf vol	311	311		663	663							
vC2, stage 2 conf vol	699	695		343	319							
vCu, unblocked vol	1010	1006	286	1006	982	624	293			656		
tC, single (s)	7.2	6.5	6.3	7.1	6.5	6.2	4.2			4.2		
tC, 2 stage (s)	6.2	5.5		6.1	5.5							
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	88	99	95	89	97	85	98			99		
cM capacity (veh/h)	312	391	742	386	408	476	1239			887		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	81	127	19	647	13	292
Volume Left	38	42	19	0	13	0
Volume Right	40	71	0	64	0	17
cSH	440	434	1239	1700	887	1700
Volume to Capacity	0.18	0.29	0.02	0.38	0.01	0.17
Queue Length 95th (ft)	17	30	1	0	1	0
Control Delay (s)	15.0	16.7	8.0	0.0	9.1	0.0
Lane LOS	C	C	A		A	
Approach Delay (s)	15.0	16.7	0.2		0.4	
Approach LOS	C	C				

Intersection Summary		
Average Delay		3.1
Intersection Capacity Utilization	40.3%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis  
4: Birch St & 228th Ave

Existing AM Peak  
Orenco Woods TIA



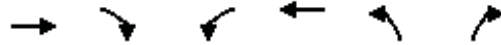
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	28	2	5	19	24	1	9	50	33	4	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Hourly flow rate (vph)	2	61	4	11	41	52	2	20	109	72	9	0
Pedestrians								9				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								1				
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	303	285	18	274	230	74	9			128		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	303	285	18	274	230	74	9			128		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	90	100	98	93	95	100			95		
cM capacity (veh/h)	566	590	1059	598	631	993	1625			1470		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	67	104	130	80
Volume Left	2	11	2	72
Volume Right	4	52	109	0
cSH	606	766	1625	1470
Volume to Capacity	0.11	0.14	0.00	0.05
Queue Length 95th (ft)	9	12	0	4
Control Delay (s)	11.7	10.4	0.1	6.8
Lane LOS	B	B	A	A
Approach Delay (s)	11.7	10.4	0.1	6.8
Approach LOS	B	B		

Intersection Summary			
Average Delay		6.4	
Intersection Capacity Utilization	21.3%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
5: Birch St & 225th Ave

Existing AM Peak  
Orengo Woods TIA

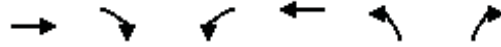


Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔		
Sign Control	Yield			Yield		Yield
Volume (vph)	0	99	0	0	42	0
Peak Hour Factor	0.41	0.41	0.41	0.41	0.41	0.41
Hourly flow rate (vph)	0	241	0	0	102	0
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	241	0	102			
Volume Left (vph)	0	0	102			
Volume Right (vph)	241	0	0			
Hadj (s)	-0.57	0.00	0.23			
Departure Headway (s)	3.6	4.4	4.6			
Degree Utilization, x	0.24	0.00	0.13			
Capacity (veh/h)	977	801	741			
Control Delay (s)	7.7	7.4	8.3			
Approach Delay (s)	7.7	0.0	8.3			
Approach LOS	A	A	A			
Intersection Summary						
Delay			7.9			
HCM Level of Service			A			
Intersection Capacity Utilization			16.1%	ICU Level of Service	A	
Analysis Period (min)			15			



HCM Unsignalized Intersection Capacity Analysis  
 6: Dogwood St & 227th Ave

Existing AM Peak  
 Orengo Woods TIA






















Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Sign Control	Stop			Stop	Stop	
Volume (vph)	44	21	77	61	72	62
Peak Hour Factor	0.48	0.48	0.48	0.48	0.48	0.48
Hourly flow rate (vph)	92	44	160	127	150	129

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total (vph)	135	288	279
Volume Left (vph)	0	160	150
Volume Right (vph)	44	0	129
Hadj (s)	0.02	0.23	-0.09
Departure Headway (s)	5.1	5.0	4.9
Degree Utilization, x	0.19	0.40	0.38
Capacity (veh/h)	661	678	695
Control Delay (s)	9.2	11.4	10.8
Approach Delay (s)	9.2	11.4	10.8
Approach LOS	A	B	B

Intersection Summary		
Delay		10.8
HCM Level of Service		B
Intersection Capacity Utilization	28.6%	ICU Level of Service A
Analysis Period (min)		15

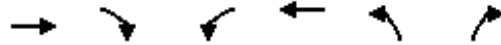
HCM Signalized Intersection Capacity Analysis  
7: Quatama Rd & Cornelius Pass Rd

Existing AM Peak  
Orenco Woods TIA

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	52	58	55	36	52	43	872	75	18	369	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frbp, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.95			0.95		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1683			1687		1717	3367		1703	3167	1501
Flt Permitted		0.84			0.82		0.46	1.00		0.17	1.00	1.00
Satd. Flow (perm)		1445			1410		838	3367		308	3167	1501
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	73	61	68	65	42	61	51	1026	88	21	434	25
RTOR Reduction (vph)	0	25	0	0	28	0	0	7	0	0	0	14
Lane Group Flow (vph)	0	177	0	0	140	0	51	1107	0	21	434	11
Confl. Peds. (#/hr)	2		6	6		2	4		3	3		4
Heavy Vehicles (%)	2%	4%	10%	4%	6%	4%	5%	6%	3%	6%	14%	5%
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		13.5			13.5		28.3	25.1		24.7	23.3	23.3
Effective Green, g (s)		13.5			13.5		28.3	25.1		24.7	23.3	23.3
Actuated g/C Ratio		0.25			0.25		0.51	0.46		0.45	0.42	0.42
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		355			346		482	1537		174	1342	636
v/s Ratio Prot							c0.01	c0.33		0.00	0.14	
v/s Ratio Perm		c0.12			0.10		0.05			0.05		0.01
v/c Ratio		0.50			0.40		0.11	0.72		0.12	0.32	0.02
Uniform Delay, d1		17.8			17.4		6.7	12.1		9.0	10.6	9.2
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.1			0.8		0.1	1.7		0.3	0.1	0.0
Delay (s)		18.9			18.2		6.8	13.8		9.3	10.7	9.2
Level of Service		B			B		A	B		A	B	A
Approach Delay (s)		18.9			18.2			13.5			10.6	
Approach LOS		B			B			B			B	
<b>Intersection Summary</b>												
HCM Average Control Delay			13.7				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			55.0				Sum of lost time (s)			10.0		
Intersection Capacity Utilization			58.9%				ICU Level of Service			B		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Unsignalized Intersection Capacity Analysis  
8: Quatama Rd & 76th Ave

Existing AM Peak  
Orenco Woods TIA



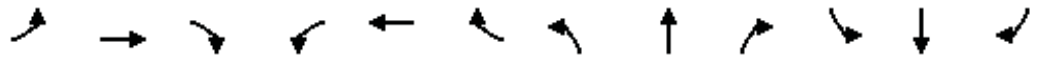
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (veh/h)	145	5	4	95	8	29
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.57	0.57	0.57	0.57	0.57	0.57
Hourly flow rate (vph)	254	9	7	167	14	51
Pedestrians					6	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				363		
pX, platoon unblocked						
vC, conflicting volume			269		445	265
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			269		445	265
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	93
cM capacity (veh/h)			1300		568	775

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	263	174	65
Volume Left	0	7	14
Volume Right	9	0	51
cSH	1700	1300	718
Volume to Capacity	0.15	0.01	0.09
Queue Length 95th (ft)	0	0	7
Control Delay (s)	0.0	0.4	10.5
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	10.5
Approach LOS			B

Intersection Summary			
Average Delay		1.5	
Intersection Capacity Utilization		18.9%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
1: Alder St & 231st Ave

Existing PM Peak  
Orenco Woods TIA



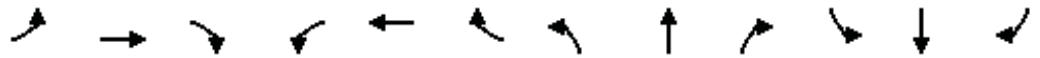
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	22	1	11	0	0	19	7	272	1	19	661	50
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	24	1	12	0	0	21	8	296	1	21	718	54
Pedestrians		3			9							3
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			1						0	
Right turn flare (veh)												
Median type							TWLTL				None	
Median storage (veh)							2					
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1124	1111	749	1093	1138	308	776			306		
vC1, stage 1 conf vol	790	790		320	320							
vC2, stage 2 conf vol	335	321		772	817							
vCu, unblocked vol	1124	1111	749	1093	1138	308	776			306		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	100	97	100	100	97	99			98		
cM capacity (veh/h)	346	363	414	343	350	729	847			1257		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	37	21	8	297	21	773
Volume Left	24	0	8	0	21	0
Volume Right	12	21	0	1	0	54
cSH	366	729	847	1700	1257	1700
Volume to Capacity	0.10	0.03	0.01	0.17	0.02	0.45
Queue Length 95th (ft)	8	2	1	0	1	0
Control Delay (s)	15.9	10.1	9.3	0.0	7.9	0.0
Lane LOS	C	B	A		A	
Approach Delay (s)	15.9	10.1	0.2		0.2	
Approach LOS	C	B				

Intersection Summary		
Average Delay		0.9
Intersection Capacity Utilization	53.1%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis  
2: Birch St & 231st Ave

Existing PM Peak  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↘		↗	↘	
Volume (veh/h)	13	0	7	1	0	2	11	284	2	5	626	38
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	14	0	7	1	0	2	12	302	2	5	666	40
Pedestrians		3			5							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type							TWLTL			TWLTL		
Median storage (veh)							2			2		
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1027	1032	689	1016	1052	308	709			309		
vC1, stage 1 conf vol	700	700		332	332							
vC2, stage 2 conf vol	328	333		684	720							
vCu, unblocked vol	1027	1032	689	1016	1052	308	709			309		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	98	100	100	100	99			100		
cM capacity (veh/h)	391	399	448	385	385	733	897			1257		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	21	3	12	304	5	706
Volume Left	14	1	12	0	5	0
Volume Right	7	2	0	2	0	40
cSH	409	564	897	1700	1257	1700
Volume to Capacity	0.05	0.01	0.01	0.18	0.00	0.42
Queue Length 95th (ft)	4	0	1	0	0	0
Control Delay (s)	14.3	11.4	9.1	0.0	7.9	0.0
Lane LOS	B	B	A		A	
Approach Delay (s)	14.3	11.4	0.3		0.1	
Approach LOS	B	B				

Intersection Summary		
Average Delay		0.5
Intersection Capacity Utilization	45.3%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis  
3: Dogwood St & 231st Ave

Existing PM Peak  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	11	8	22	20	4	22	22	241	25	42	560	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	12	9	25	22	4	25	25	271	28	47	629	18
Pedestrians		2			6							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			1							
Right turn flare (veh)												
Median type							TWLTL			TWLTL		
Median storage (veh)							2			2		
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1082	1089	640	1093	1084	291	649			305		
vC1, stage 1 conf vol	735	735		340	340							
vC2, stage 2 conf vol	347	354		753	744							
vCu, unblocked vol	1082	1089	640	1093	1084	291	649			305		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	98	95	93	99	97	97			96		
cM capacity (veh/h)	354	367	478	316	354	749	945			1261		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	46	52	25	299	47	647
Volume Left	12	22	25	0	47	0
Volume Right	25	25	0	28	0	18
cSH	415	442	945	1700	1261	1700
Volume to Capacity	0.11	0.12	0.03	0.18	0.04	0.38
Queue Length 95th (ft)	9	10	2	0	3	0
Control Delay (s)	14.8	14.2	8.9	0.0	8.0	0.0
Lane LOS	B	B	A		A	
Approach Delay (s)	14.8	14.2	0.7		0.5	
Approach LOS	B	B				

Intersection Summary		
Average Delay		1.8
Intersection Capacity Utilization	46.0%	ICU Level of Service A
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
4: Birch St & 228th Ave

Existing PM Peak  
Orenco Woods TIA



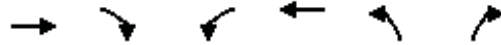
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	0	3	1	1	4	11	0	6	1	7	5	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	0	4	1	1	5	15	0	8	1	9	7	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	51	35	7	37	34	9	7			9		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	51	35	7	37	34	9	7			9		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	99	99	100			99		
cM capacity (veh/h)	931	857	1082	964	858	1079	1627			1624		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	21	9	16
Volume Left	0	1	0	9
Volume Right	1	15	1	0
cSH	904	1007	1627	1624
Volume to Capacity	0.01	0.02	0.00	0.01
Queue Length 95th (ft)	0	2	0	0
Control Delay (s)	9.0	8.7	0.0	4.2
Lane LOS	A	A		A
Approach Delay (s)	9.0	8.7	0.0	4.2
Approach LOS	A	A		

Intersection Summary			
Average Delay		5.8	
Intersection Capacity Utilization	16.5%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
5: Birch St & 225th Ave

Existing PM Peak  
Orencia Woods TIA

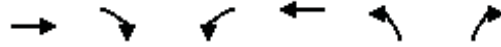


Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↷			↶	↷	
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	6	0	0	9	0
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	0	8	0	0	12	0
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	8	0	12			
Volume Left (vph)	0	0	12			
Volume Right (vph)	8	0	0			
Hadj (s)	-0.60	0.00	0.20			
Departure Headway (s)	3.3	3.9	4.1			
Degree Utilization, x	0.01	0.00	0.01			
Capacity (veh/h)	1070	900	860			
Control Delay (s)	6.4	6.9	7.2			
Approach Delay (s)	6.4	0.0	7.2			
Approach LOS	A	A	A			
Intersection Summary						
Delay			6.8			
HCM Level of Service			A			
Intersection Capacity Utilization			13.3%	ICU Level of Service	A	
Analysis Period (min)			15			



HCM Unsignalized Intersection Capacity Analysis  
 6: Dogwood St & 227th Ave

Existing PM Peak  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	←
Sign Control	Stop			Stop	Stop	
Volume (vph)	11	69	10	5	47	5
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	15	92	13	7	63	7
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	107	20	69			
Volume Left (vph)	0	13	63			
Volume Right (vph)	92	0	7			
Hadj (s)	-0.52	0.13	0.12			
Departure Headway (s)	3.6	4.3	4.3			
Degree Utilization, x	0.11	0.02	0.08			
Capacity (veh/h)	986	819	812			
Control Delay (s)	7.0	7.4	7.6			
Approach Delay (s)	7.0	7.4	7.6			
Approach LOS	A	A	A			
Intersection Summary						
Delay			7.3			
HCM Level of Service			A			
Intersection Capacity Utilization			17.5%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
7: Quatama Rd & Cornelius Pass Rd

Existing PM Peak  
Orenco Woods TIA



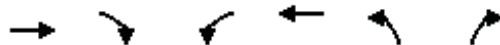
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕↔		↕	↕↕	↕
Volume (vph)	21	27	50	137	26	45	65	564	75	60	1211	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frbp, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.93			0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1702			1759		1805	3475		1769	3574	1565
Flt Permitted		0.92			0.79		0.13	1.00		0.35	1.00	1.00
Satd. Flow (perm)		1580			1427		251	3475		652	3574	1565
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	22	28	52	143	27	47	68	588	78	62	1261	75
RTOR Reduction (vph)	0	40	0	0	14	0	0	10	0	0	0	41
Lane Group Flow (vph)	0	62	0	0	203	0	68	656	0	62	1261	34
Confl. Peds. (#/hr)	3		3	3		3	1		4	4		1
Heavy Vehicles (%)	5%	0%	2%	1%	0%	2%	0%	2%	0%	2%	1%	1%
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		15.6			15.6		35.5	30.3		35.5	30.3	30.3
Effective Green, g (s)		15.6			15.6		35.5	30.3		35.5	30.3	30.3
Actuated g/C Ratio		0.24			0.24		0.54	0.46		0.54	0.46	0.46
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		373			337		257	1593		438	1638	717
v/s Ratio Prot							c0.02	0.19		0.01	c0.35	
v/s Ratio Perm		0.04			c0.14		0.12			0.06		0.02
v/c Ratio		0.17			0.60		0.26	0.41		0.14	0.77	0.05
Uniform Delay, d1		20.1			22.5		9.6	11.9		7.5	15.0	9.9
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.2			3.0		0.6	0.2		0.1	2.2	0.0
Delay (s)		20.3			25.5		10.1	12.1		7.6	17.2	9.9
Level of Service		C			C		B	B		A	B	A
Approach Delay (s)		20.3			25.5			11.9			16.4	
Approach LOS		C			C			B			B	

Intersection Summary

HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	66.1	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
8: Quatama Rd & 76th Ave

Existing PM Peak  
Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	↔
Volume (veh/h)	74	3	28	123	2	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	91	4	35	152	2	30
Pedestrians					4	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)					363	
pX, platoon unblocked						
vC, conflicting volume			99		318	97
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			99		318	97
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	97
cM capacity (veh/h)			1501		661	950

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	95	186	32
Volume Left	0	35	2
Volume Right	4	0	30
cSH	1700	1501	919
Volume to Capacity	0.06	0.02	0.03
Queue Length 95th (ft)	0	2	3
Control Delay (s)	0.0	1.5	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	1.5	9.1
Approach LOS			A

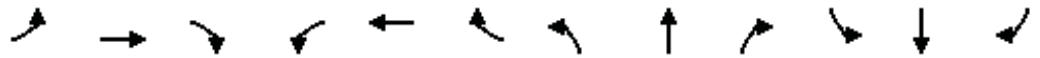
Intersection Summary			
Average Delay		1.8	
Intersection Capacity Utilization	24.7%		ICU Level of Service A
Analysis Period (min)		15	

# **HCM Analysis – Background**

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HCM Unsignalized Intersection Capacity Analysis  
 1: Alder St & 231st Ave

2016 AM Peak (Background)  
 Orengo Woods TIA



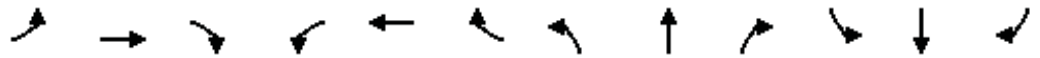
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	35	5	15	0	5	40	15	780	5	35	300	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	43	6	19	0	6	49	19	963	6	43	370	25
Pedestrians					18						25	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					4.0						4.0	
Percent Blockage					1						2	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage (veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1547	1493	383	1499	1503	1009	395			987		
vC1, stage 1 conf vol	469	469		1021	1021							
vC2, stage 2 conf vol	1077	1024		478	481							
vCu, unblocked vol	1547	1493	383	1499	1503	1009	395			987		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	73	97	97	100	98	83	98			94		
cM capacity (veh/h)	158	243	652	248	272	284	1121			697		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	68	56	19	969	43	395
Volume Left	43	0	19	0	43	0
Volume Right	19	49	0	6	0	25
cSH	208	282	1121	1700	697	1700
Volume to Capacity	0.33	0.20	0.02	0.57	0.06	0.23
Queue Length 95th (ft)	34	18	1	0	5	0
Control Delay (s)	30.5	20.8	8.3	0.0	10.5	0.0
Lane LOS	D	C	A		B	
Approach Delay (s)	30.5	20.8	0.2		1.0	
Approach LOS	D	C				

Intersection Summary		
Average Delay		2.5
Intersection Capacity Utilization	57.8%	ICU Level of Service B
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
 2: Birch St & 231st Ave

2016 AM Peak (Background)  
 Orengo Woods TIA



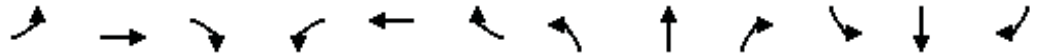
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	40	5	25	5	5	20	15	735	20	15	305	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	53	7	33	7	7	26	20	967	26	20	401	13
Pedestrians		2			12			5				
Lane Width (ft)		12.0			12.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			1			0				
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1486	1494	415	1514	1488	992	416			1005		
vC1, stage 1 conf vol	449	449		1032	1032							
vC2, stage 2 conf vol	1036	1045		482	456							
vCu, unblocked vol	1486	1494	415	1514	1488	992	416			1005		
tC, single (s)	7.2	6.5	6.2	7.4	6.5	6.2	4.2			4.1		
tC, 2 stage (s)	6.2	5.5		6.4	5.5							
tF (s)	3.6	4.0	3.3	3.8	4.0	3.3	2.3			2.2		
p0 queue free %	75	97	95	97	98	91	98			97		
cM capacity (veh/h)	208	259	638	214	275	298	1099			690		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	92	39	20	993	20	414
Volume Left	53	7	20	0	20	0
Volume Right	33	26	0	26	0	13
cSH	279	276	1099	1700	690	1700
Volume to Capacity	0.33	0.14	0.02	0.58	0.03	0.24
Queue Length 95th (ft)	35	12	1	0	2	0
Control Delay (s)	24.1	20.2	8.3	0.0	10.4	0.0
Lane LOS	C	C	A		B	
Approach Delay (s)	24.1	20.2	0.2		0.5	
Approach LOS	C	C				

Intersection Summary		
Average Delay		2.1
Intersection Capacity Utilization	57.8%	ICU Level of Service
Analysis Period (min)		15
		B

HCM Unsignalized Intersection Capacity Analysis  
 3: Dogwood St & 231st Ave

2016 AM Peak (Background)  
 Orengo Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	35	5	35	35	15	60	20	650	55	15	305	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	45	6	45	45	19	77	26	833	71	19	391	19
Pedestrians		1			9			1				
Lane Width (ft)		12.0			12.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			1			0				
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1411	1404	403	1407	1379	878	411			913		
vC1, stage 1 conf vol	440	440		929	929							
vC2, stage 2 conf vol	971	964		479	450							
vCu, unblocked vol	1411	1404	403	1407	1379	878	411			913		
tC, single (s)	7.2	6.5	6.3	7.1	6.5	6.2	4.2			4.2		
tC, 2 stage (s)	6.2	5.5		6.1	5.5							
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	76	98	93	83	94	77	98			97		
cM capacity (veh/h)	184	282	638	269	302	340	1120			709		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	96	141	26	904	19	410
Volume Left	45	45	26	0	19	0
Volume Right	45	77	0	71	0	19
cSH	285	309	1120	1700	709	1700
Volume to Capacity	0.34	0.46	0.02	0.53	0.03	0.24
Queue Length 95th (ft)	36	57	2	0	2	0
Control Delay (s)	23.9	26.1	8.3	0.0	10.2	0.0
Lane LOS	C	D	A		B	
Approach Delay (s)	23.9	26.1	0.2		0.5	
Approach LOS	C	D				

Intersection Summary		
Average Delay		4.0
Intersection Capacity Utilization	51.5%	ICU Level of Service A
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
4: Birch St & 228th Ave

2016 AM Peak (Background)  
Orencia Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	5	30	5	10	20	25	5	10	55	35	5	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Hourly flow rate (vph)	11	65	11	22	43	54	11	22	120	76	11	0
Pedestrians								9				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								1				
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	342	326	20	319	266	82	11			141		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	342	326	20	319	266	82	11			141		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	88	99	96	93	94	99			95		
cM capacity (veh/h)	525	554	1056	545	597	984	1622			1454		

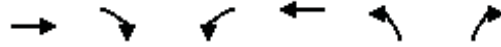
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	87	120	152	87
Volume Left	11	22	11	76
Volume Right	11	54	120	0
cSH	585	712	1622	1454
Volume to Capacity	0.15	0.17	0.01	0.05
Queue Length 95th (ft)	13	15	1	4
Control Delay (s)	12.2	11.1	0.6	6.7
Lane LOS	B	B	A	A
Approach Delay (s)	12.2	11.1	0.6	6.7
Approach LOS	B	B		

Intersection Summary			
Average Delay		6.9	
Intersection Capacity Utilization	21.5%		ICU Level of Service A
Analysis Period (min)		15	



HCM Unsignalized Intersection Capacity Analysis  
 5: Birch St & 225th Ave

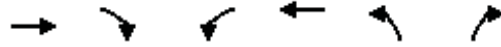
2016 AM Peak (Background)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔		
Sign Control	Yield			Yield		Yield
Volume (vph)	0	105	0	0	45	0
Peak Hour Factor	0.41	0.41	0.41	0.41	0.41	0.41
Hourly flow rate (vph)	0	256	0	0	110	0
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	256	0	110			
Volume Left (vph)	0	0	110			
Volume Right (vph)	256	0	0			
Hadj (s)	-0.57	0.00	0.23			
Departure Headway (s)	3.6	4.4	4.6			
Degree Utilization, x	0.26	0.00	0.14			
Capacity (veh/h)	971	793	735			
Control Delay (s)	7.8	7.4	8.4			
Approach Delay (s)	7.8	0.0	8.4			
Approach LOS	A	A	A			
Intersection Summary						
Delay			8.0			
HCM Level of Service			A			
Intersection Capacity Utilization			16.5%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 6: Dogwood St & 227th Ave

2016 AM Peak (Background)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Sign Control	Stop			Stop	Stop	
Volume (vph)	50	25	80	65	75	65
Peak Hour Factor	0.48	0.48	0.48	0.48	0.48	0.48
Hourly flow rate (vph)	104	52	167	135	156	135
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	156	302	292			
Volume Left (vph)	0	167	156			
Volume Right (vph)	52	0	135			
Hadj (s)	0.02	0.22	-0.10			
Departure Headway (s)	5.1	5.1	5.0			
Degree Utilization, x	0.22	0.43	0.40			
Capacity (veh/h)	652	668	671			
Control Delay (s)	9.6	11.9	11.3			
Approach Delay (s)	9.6	11.9	11.3			
Approach LOS	A	B	B			
Intersection Summary						
Delay			11.2			
HCM Level of Service			B			
Intersection Capacity Utilization			29.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
7: Quatama Rd & Cornelius Pass Rd

2016 AM Peak (Background)  
Orenco Woods TIA



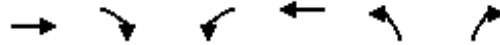
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	↕
Volume (vph)	65	55	60	60	40	55	45	1070	80	20	445	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frbp, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.95			0.95		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1683			1688		1718	3371		1703	3167	1500
Flt Permitted		0.81			0.77		0.41	1.00		0.14	1.00	1.00
Satd. Flow (perm)		1382			1317		735	3371		250	3167	1500
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	76	65	71	71	47	65	53	1259	94	24	524	29
RTOR Reduction (vph)	0	26	0	0	28	0	0	5	0	0	0	16
Lane Group Flow (vph)	0	186	0	0	155	0	53	1348	0	24	524	13
Confl. Peds. (#/hr)	2		6	6		2	4		3	3		4
Heavy Vehicles (%)	2%	4%	10%	4%	6%	4%	5%	6%	3%	6%	14%	5%
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		13.6			13.6		36.6	31.0		32.0	28.7	28.7
Effective Green, g (s)		13.6			13.6		36.6	31.0		32.0	28.7	28.7
Actuated g/C Ratio		0.22			0.22		0.58	0.49		0.51	0.46	0.46
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		299			285		515	1661		203	1445	684
v/s Ratio Prot							c0.01	c0.40		0.01	0.17	
v/s Ratio Perm		c0.13			0.12		0.05			0.05		0.01
v/c Ratio		0.62			0.54		0.10	0.81		0.12	0.36	0.02
Uniform Delay, d1		22.3			21.9		5.8	13.5		9.2	11.1	9.4
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		4.0			2.1		0.1	3.1		0.3	0.2	0.0
Delay (s)		26.3			24.0		5.9	16.6		9.5	11.3	9.4
Level of Service		C			C		A	B		A	B	A
Approach Delay (s)		26.3			24.0			16.2			11.1	
Approach LOS		C			C			B			B	

Intersection Summary

HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
 8: Quatama Rd & 76th Ave

2016 AM Peak (Background)  
 Orengo Woods TIA



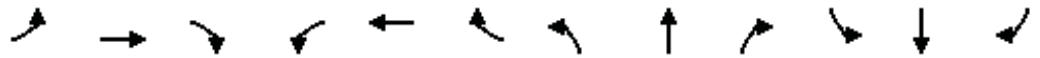
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (veh/h)	150	10	5	100	10	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.57	0.57	0.57	0.57	0.57	0.57
Hourly flow rate (vph)	263	18	9	175	18	53
Pedestrians					6	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				363		
pX, platoon unblocked						
vC, conflicting volume			287		471	278
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			287		471	278
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	93
cM capacity (veh/h)			1281		548	762

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	281	184	70
Volume Left	0	9	18
Volume Right	18	0	53
cSH	1700	1281	694
Volume to Capacity	0.17	0.01	0.10
Queue Length 95th (ft)	0	1	8
Control Delay (s)	0.0	0.4	10.8
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	10.8
Approach LOS			B

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization		19.4%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
1: Alder St & 231st Ave

2016 PM Peak (Background)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	25	5	15	0	0	20	10	345	5	20	875	55
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	5	16	0	0	22	11	375	5	22	951	60
Pedestrians		3			9							3
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			1						0	
Right turn flare (veh)												
Median type								TWLTL				None
Median storage (veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1449	1439	984	1422	1466	390	1014			389		
vC1, stage 1 conf vol	1027	1027		408	408							
vC2, stage 2 conf vol	421	411		1014	1057							
vCu, unblocked vol	1449	1439	984	1422	1466	390	1014			389		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	98	95	100	100	97	98			98		
cM capacity (veh/h)	256	281	303	238	267	656	690			1171		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	49	22	11	380	22	1011
Volume Left	27	0	11	0	22	0
Volume Right	16	22	0	5	0	60
cSH	273	656	690	1700	1171	1700
Volume to Capacity	0.18	0.03	0.02	0.22	0.02	0.59
Queue Length 95th (ft)	16	3	1	0	1	0
Control Delay (s)	21.1	10.7	10.3	0.0	8.1	0.0
Lane LOS	C	B	B		A	
Approach Delay (s)	21.1	10.7	0.3		0.2	
Approach LOS	C	B				

Intersection Summary		
Average Delay		1.0
Intersection Capacity Utilization	65.3%	ICU Level of Service C
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
2: Birch St & 231st Ave

2016 PM Peak (Background)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	15	0	10	5	0	5	15	355	5	10	840	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	16	0	11	5	0	5	16	378	5	11	894	43
Pedestrians		3			5							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type							TWLT			TWLT		
Median storage (veh)							2			2		
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1354	1359	918	1343	1378	385	939			388		
vC1, stage 1 conf vol	939	939		417	417							
vC2, stage 2 conf vol	415	420		926	960							
vCu, unblocked vol	1354	1359	918	1343	1378	385	939			388		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	100	97	98	100	99	98			99		
cM capacity (veh/h)	288	308	331	274	292	664	736			1177		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	27	11	16	383	11	936
Volume Left	16	5	16	0	11	0
Volume Right	11	5	0	5	0	43
cSH	304	388	736	1700	1177	1700
Volume to Capacity	0.09	0.03	0.02	0.23	0.01	0.55
Queue Length 95th (ft)	7	2	2	0	1	0
Control Delay (s)	18.0	14.5	10.0	0.0	8.1	0.0
Lane LOS	C	B	A		A	
Approach Delay (s)	18.0	14.5	0.4		0.1	
Approach LOS	C	B				

Intersection Summary		
Average Delay		0.6
Intersection Capacity Utilization	56.6%	ICU Level of Service B
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
3: Dogwood St & 231st Ave

2016 PM Peak (Background)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	15	10	25	25	5	25	25	310	30	45	770	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	17	11	28	28	6	28	28	348	34	51	865	22
Pedestrians		2			6							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			1							
Right turn flare (veh)												
Median type							TWLTL			TWLTL		
Median storage veh							2			2		
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1415	1424	878	1427	1418	371	890			388		
vC1, stage 1 conf vol	980	980		427	427							
vC2, stage 2 conf vol	435	444		1000	991							
vCu, unblocked vol	1415	1424	878	1427	1418	371	890			388		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	96	92	87	98	96	96			96		
cM capacity (veh/h)	259	282	349	211	264	676	769			1176		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	56	62	28	382	51	888
Volume Left	17	28	28	0	51	0
Volume Right	28	28	0	34	0	22
cSH	303	315	769	1700	1176	1700
Volume to Capacity	0.19	0.20	0.04	0.22	0.04	0.52
Queue Length 95th (ft)	17	18	3	0	3	0
Control Delay (s)	19.6	19.2	9.9	0.0	8.2	0.0
Lane LOS	C	C	A		A	
Approach Delay (s)	19.6	19.2	0.7		0.4	
Approach LOS	C	C				

Intersection Summary		
Average Delay		2.0
Intersection Capacity Utilization	53.5%	ICU Level of Service
Analysis Period (min)	15	A

HCM Unsignalized Intersection Capacity Analysis  
4: Birch St & 228th Ave

2016 PM Peak (Background)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	0	5	5	5	5	15	0	10	5	10	10	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	0	7	7	7	7	20	0	13	7	13	13	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	80	60	13	67	57	17	13			20		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	80	60	13	67	57	17	13			20		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	99	99	99	98	100			99		
cM capacity (veh/h)	885	828	1073	914	831	1068	1618			1609		

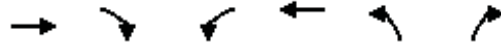
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	13	33	20	27
Volume Left	0	7	0	13
Volume Right	7	20	7	0
cSH	935	979	1618	1609
Volume to Capacity	0.01	0.03	0.00	0.01
Queue Length 95th (ft)	1	3	0	1
Control Delay (s)	8.9	8.8	0.0	3.7
Lane LOS	A	A		A
Approach Delay (s)	8.9	8.8	0.0	3.7
Approach LOS	A	A		

Intersection Summary			
Average Delay		5.5	
Intersection Capacity Utilization	20.3%		ICU Level of Service
Analysis Period (min)		15	A



HCM Unsignalized Intersection Capacity Analysis  
 5: Birch St & 225th Ave

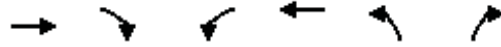
2016 PM Peak (Background)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔		
Sign Control	Yield			Yield		Yield
Volume (vph)	0	10	0	0	10	0
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	0	13	0	0	13	0
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	13	0	13			
Volume Left (vph)	0	0	13			
Volume Right (vph)	13	0	0			
Hadj (s)	-0.60	0.00	0.20			
Departure Headway (s)	3.3	3.9	4.1			
Degree Utilization, x	0.01	0.00	0.02			
Capacity (veh/h)	1069	900	857			
Control Delay (s)	6.4	6.9	7.2			
Approach Delay (s)	6.4	0.0	7.2			
Approach LOS	A	A	A			
Intersection Summary						
Delay			6.8			
HCM Level of Service			A			
Intersection Capacity Utilization			13.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 6: Dogwood St & 227th Ave

2016 PM Peak (Background)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			→	←	→
Sign Control	Stop			Stop	Stop	
Volume (vph)	15	75	15	10	50	10
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	20	100	20	13	67	13

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total (vph)	120	33	80
Volume Left (vph)	0	20	67
Volume Right (vph)	100	0	13
Hadj (s)	-0.50	0.12	0.07
Departure Headway (s)	3.6	4.3	4.3
Degree Utilization, x	0.12	0.04	0.09
Capacity (veh/h)	968	812	808
Control Delay (s)	7.1	7.5	7.7
Approach Delay (s)	7.1	7.5	7.7
Approach LOS	A	A	A

Intersection Summary		
Delay		7.4
HCM Level of Service		A
Intersection Capacity Utilization	18.1%	ICU Level of Service A
Analysis Period (min)		15

HCM Signalized Intersection Capacity Analysis  
7: Quatama Rd & Cornelius Pass Rd

2016 PM Peak (Background)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕↔		↕	↕↕	↕
Volume (vph)	25	30	55	145	30	50	70	635	80	65	1420	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frbp, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.93			0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1702			1759		1805	3478		1769	3574	1565
Flt Permitted		0.91			0.77		0.12	1.00		0.33	1.00	1.00
Satd. Flow (perm)		1567			1399		225	3478		616	3574	1565
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	31	57	151	31	52	73	661	83	68	1479	78
RTOR Reduction (vph)	0	44	0	0	15	0	0	9	0	0	0	40
Lane Group Flow (vph)	0	70	0	0	219	0	73	735	0	68	1479	38
Confl. Peds. (#/hr)	3		3	3		3	1		4	4		1
Heavy Vehicles (%)	5%	0%	2%	1%	0%	2%	0%	2%	0%	2%	1%	1%
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		16.5			16.5		41.3	33.8		37.3	31.8	31.8
Effective Green, g (s)		16.5			16.5		41.3	33.8		37.3	31.8	31.8
Actuated g/C Ratio		0.23			0.23		0.58	0.48		0.53	0.45	0.45
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		365			326		299	1660		414	1605	703
v/s Ratio Prot							c0.03	0.21		0.01	c0.41	
v/s Ratio Perm		0.04			c0.16		0.12			0.07		0.02
v/c Ratio		0.19			0.67		0.24	0.44		0.16	0.92	0.05
Uniform Delay, d1		21.8			24.7		11.8	12.3		8.3	18.3	11.0
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.3			5.4		0.4	0.2		0.2	9.1	0.0
Delay (s)		22.1			30.1		12.2	12.4		8.5	27.5	11.0
Level of Service		C			C		B	B		A	C	B
Approach Delay (s)		22.1			30.1			12.4			25.9	
Approach LOS		C			C			B			C	

Intersection Summary

HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	70.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
8: Quatama Rd & 76th Ave

2016 PM Peak (Background)  
Orenco Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	←
Volume (veh/h)	80	5	30	130	5	25
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	99	6	37	160	6	31
Pedestrians					4	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				363		
pX, platoon unblocked						
vC, conflicting volume			109		340	106
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			109		340	106
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		99	97
cM capacity (veh/h)			1489		641	940

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	105	198	37
Volume Left	0	37	6
Volume Right	6	0	31
cSH	1700	1489	872
Volume to Capacity	0.06	0.02	0.04
Queue Length 95th (ft)	0	2	3
Control Delay (s)	0.0	1.6	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	1.6	9.3
Approach LOS			A

Intersection Summary			
Average Delay		1.9	
Intersection Capacity Utilization		25.2%	ICU Level of Service A
Analysis Period (min)		15	

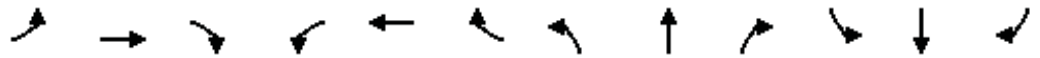


# HCM Analysis – Project

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HCM Unsignalized Intersection Capacity Analysis  
 1: Alder St & 231st Ave

2016 AM Peak (With Project)  
 Orengo Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	35	6	15	0	5	42	15	786	5	40	303	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	43	7	19	0	6	52	19	970	6	49	374	25
Pedestrians					18						25	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					4.0						4.0	
Percent Blockage					1						2	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage (veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1573	1517	386	1524	1526	1016	399			995		
vC1, stage 1 conf vol	485	485		1028	1028							
vC2, stage 2 conf vol	1087	1032		495	498							
vCu, unblocked vol	1573	1517	386	1524	1526	1016	399			995		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	71	97	97	100	98	82	98			93		
cM capacity (veh/h)	147	235	648	244	268	281	1118			693		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	69	58	19	977	49	399
Volume Left	43	0	19	0	49	0
Volume Right	19	52	0	6	0	25
cSH	196	279	1118	1700	693	1700
Volume to Capacity	0.35	0.21	0.02	0.57	0.07	0.23
Queue Length 95th (ft)	37	19	1	0	6	0
Control Delay (s)	33.1	21.2	8.3	0.0	10.6	0.0
Lane LOS	D	C	A		B	
Approach Delay (s)	33.1	21.2	0.2		1.2	
Approach LOS	D	C				

Intersection Summary						
Average Delay			2.7			
Intersection Capacity Utilization		58.2%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
 2: Birch St & 231st Ave

2016 AM Peak (With Project)  
 Orengo Woods TIA



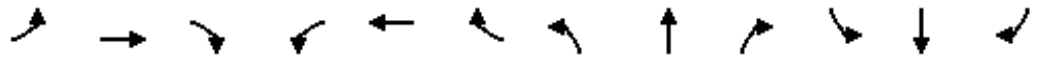
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	40	6	25	6	5	25	15	736	22	18	305	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	53	8	33	8	7	33	20	968	29	24	401	13
Pedestrians		2			12			5				
Lane Width (ft)		12.0			12.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			1			0				
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage (veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1501	1506	415	1525	1498	995	416			1009		
vC1, stage 1 conf vol	457	457		1034	1034							
vC2, stage 2 conf vol	1044	1049		491	464							
vCu, unblocked vol	1501	1506	415	1525	1498	995	416			1009		
tC, single (s)	7.2	6.5	6.2	7.4	6.5	6.2	4.2			4.1		
tC, 2 stage (s)	6.2	5.5		6.4	5.5							
tF (s)	3.6	4.0	3.3	3.8	4.0	3.3	2.3			2.2		
p0 queue free %	73	97	95	96	98	89	98			97		
cM capacity (veh/h)	197	254	638	212	273	297	1099			688		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	93	47	20	997	24	414
Volume Left	53	8	20	0	24	0
Volume Right	33	33	0	29	0	13
cSH	267	275	1099	1700	688	1700
Volume to Capacity	0.35	0.17	0.02	0.59	0.03	0.24
Queue Length 95th (ft)	38	15	1	0	3	0
Control Delay (s)	25.6	20.8	8.3	0.0	10.4	0.0
Lane LOS	D	C	A		B	
Approach Delay (s)	25.6	20.8	0.2		0.6	
Approach LOS	D	C				

Intersection Summary		
Average Delay		2.4
Intersection Capacity Utilization	58.0%	ICU Level of Service
Analysis Period (min)		15
		B

HCM Unsignalized Intersection Capacity Analysis  
 3: Dogwood St & 231st Ave

2016 AM Peak (With Project)  
 Orengo Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	35	5	35	40	15	61	20	652	59	15	306	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	45	6	45	51	19	78	26	836	76	19	392	19
Pedestrians		1			9			1				
Lane Width (ft)		12.0			12.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			1			0				
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage (veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1416	1413	404	1414	1385	883	413			921		
vC1, stage 1 conf vol	441	441		934	934							
vC2, stage 2 conf vol	975	972		480	451							
vCu, unblocked vol	1416	1413	404	1414	1385	883	413			921		
tC, single (s)	7.2	6.5	6.3	7.1	6.5	6.2	4.2			4.2		
tC, 2 stage (s)	6.2	5.5		6.1	5.5							
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	75	98	93	81	94	77	98			97		
cM capacity (veh/h)	182	280	637	267	300	338	1119			704		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	<b>SB 2</b>						
Volume Total	96	149	26	912	19	412						
Volume Left	45	51	26	0	19	0						
Volume Right	45	78	0	76	0	19						
cSH	282	305	1119	1700	704	1700						
Volume to Capacity	0.34	0.49	0.02	0.54	0.03	0.24						
Queue Length 95th (ft)	36	63	2	0	2	0						
Control Delay (s)	24.2	27.5	8.3	0.0	10.3	0.0						
Lane LOS	C	D	A		B							
Approach Delay (s)	24.2	27.5	0.2		0.5							
Approach LOS	C	D										
<b>Intersection Summary</b>												
Average Delay			4.2									
Intersection Capacity Utilization			52.4%		ICU Level of Service					A		
Analysis Period (min)			15									



HCM Unsignalized Intersection Capacity Analysis  
4: Birch St & 228th Ave

2016 AM Peak (With Project)  
Orencia Woods TIA



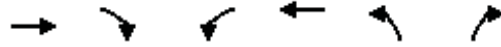
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Volume (veh/h)	5	36	5	10	26	27	5	10	55	41	5	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Hourly flow rate (vph)	11	78	11	22	57	59	11	22	120	89	11	0
Pedestrians								9				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								1				
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	379	352	20	351	292	82	11			141		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	379	352	20	351	292	82	11			141		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	85	99	96	90	94	99			94		
cM capacity (veh/h)	480	531	1056	502	572	984	1622			1454		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	100	137	152	100
Volume Left	11	22	11	89
Volume Right	11	59	120	0
cSH	555	679	1622	1454
Volume to Capacity	0.18	0.20	0.01	0.06
Queue Length 95th (ft)	16	19	1	5
Control Delay (s)	12.9	11.6	0.6	6.9
Lane LOS	B	B	A	A
Approach Delay (s)	12.9	11.6	0.6	6.9
Approach LOS	B	B		

Intersection Summary			
Average Delay		7.5	
Intersection Capacity Utilization	21.8%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 5: Birch St & 225th Ave

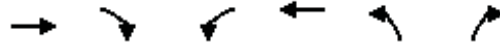
2016 AM Peak (With Project)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔		↔
Sign Control	Yield			Yield		Yield
Volume (vph)	11	106	2	4	49	5
Peak Hour Factor	0.41	0.41	0.41	0.41	0.41	0.41
Hourly flow rate (vph)	27	259	5	10	120	12
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	285	15	132			
Volume Left (vph)	0	5	120			
Volume Right (vph)	259	0	12			
Hadj (s)	-0.51	0.07	0.16			
Departure Headway (s)	3.7	4.6	4.7			
Degree Utilization, x	0.30	0.02	0.17			
Capacity (veh/h)	936	743	728			
Control Delay (s)	8.3	7.7	8.6			
Approach Delay (s)	8.3	7.7	8.6			
Approach LOS	A	A	A			
Intersection Summary						
Delay			8.4			
HCM Level of Service			A			
Intersection Capacity Utilization			17.1%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 6: Dogwood St & 227th Ave

2016 AM Peak (With Project)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	←
Sign Control	Stop			Stop	Stop	
Volume (vph)	52	27	82	66	80	72
Peak Hour Factor	0.48	0.48	0.48	0.48	0.48	0.48
Hourly flow rate (vph)	108	56	171	138	167	150
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	165	308	317			
Volume Left (vph)	0	171	167			
Volume Right (vph)	56	0	150			
Hadj (s)	0.01	0.22	-0.10			
Departure Headway (s)	5.2	5.2	5.0			
Degree Utilization, x	0.24	0.45	0.44			
Capacity (veh/h)	640	655	667			
Control Delay (s)	9.8	12.4	11.9			
Approach Delay (s)	9.8	12.4	11.9			
Approach LOS	A	B	B			
Intersection Summary						
Delay			11.7			
HCM Level of Service			B			
Intersection Capacity Utilization			30.2%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
7: Quatama Rd & Cornelius Pass Rd

2016 AM Peak (With Project)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	↕
Volume (vph)	79	65	74	60	45	55	51	1070	80	20	445	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frbp, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.95			0.95		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1681			1692		1718	3371		1703	3167	1499
Flt Permitted		0.80			0.76		0.40	1.00		0.14	1.00	1.00
Satd. Flow (perm)		1368			1307		726	3371		247	3167	1499
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	93	76	87	71	53	65	60	1259	94	24	524	35
RTOR Reduction (vph)	0	26	0	0	26	0	0	5	0	0	0	19
Lane Group Flow (vph)	0	230	0	0	163	0	60	1348	0	24	524	16
Confl. Peds. (#/hr)	2		6	6		2	4		3	3		4
Heavy Vehicles (%)	2%	4%	10%	4%	6%	4%	5%	6%	3%	6%	14%	5%
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		15.7			15.7		36.8	31.3		32.2	29.0	29.0
Effective Green, g (s)		15.7			15.7		36.8	31.3		32.2	29.0	29.0
Actuated g/C Ratio		0.24			0.24		0.56	0.48		0.49	0.44	0.44
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		329			315		493	1618		193	1409	667
v/s Ratio Prot							c0.01	c0.40		0.01	0.17	
v/s Ratio Perm		c0.17			0.12		0.06			0.06		0.01
v/c Ratio		0.70			0.52		0.12	0.83		0.12	0.37	0.02
Uniform Delay, d1		22.6			21.5		6.5	14.7		10.3	12.0	10.2
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		6.4			1.4		0.1	3.8		0.3	0.2	0.0
Delay (s)		29.0			22.9		6.6	18.5		10.5	12.2	10.2
Level of Service		C			C		A	B		B	B	B
Approach Delay (s)		29.0			22.9			18.0			12.0	
Approach LOS		C			C			B			B	

Intersection Summary

HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	65.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
8: Quatama Rd & 76th Ave

2016 AM Peak (With Project)  
Orencia Woods TIA



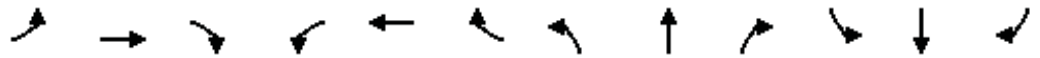
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	3	151	10	5	103	13	10	0	30	37	0	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.57	0.57	0.57	0.57	0.92	0.57	0.92	0.57	0.92	0.92	0.92
Hourly flow rate (vph)	3	265	18	9	181	14	18	0	53	40	0	10
Pedestrians								6				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								1				
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					363							
pX, platoon unblocked												
vC, conflicting volume	195			288			501	499	280	538	500	188
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	195			288			501	499	280	538	500	188
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			96	100	93	90	100	99
cM capacity (veh/h)	1378			1279			470	467	760	418	466	854

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	286	204	70	50
Volume Left	3	9	18	40
Volume Right	18	14	53	10
cSH	1378	1279	659	464
Volume to Capacity	0.00	0.01	0.11	0.11
Queue Length 95th (ft)	0	1	9	9
Control Delay (s)	0.1	0.4	11.1	13.7
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.4	11.1	13.7
Approach LOS			B	B

Intersection Summary			
Average Delay		2.6	
Intersection Capacity Utilization	23.9%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 1: Alder St & 231st Ave

2016 PM Peak (With Project)  
 Orengo Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Volume (veh/h)	25	6	15	0	0	27	10	352	5	23	882	55
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	7	16	0	0	29	11	383	5	25	959	60
Pedestrians		3			9							3
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			1						0	
Right turn flare (veh)												
Median type								TWLTL				None
Median storage (veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1478	1460	992	1444	1488	397	1021			397		
vC1, stage 1 conf vol	1042	1042		416	416							
vC2, stage 2 conf vol	437	419		1028	1071							
vCu, unblocked vol	1478	1460	992	1444	1488	397	1021			397		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	98	95	100	100	95	98			98		
cM capacity (veh/h)	249	276	300	232	262	650	686			1164		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	50	29	11	388	25	1018
Volume Left	27	0	11	0	25	0
Volume Right	16	29	0	5	0	60
cSH	267	650	686	1700	1164	1700
Volume to Capacity	0.19	0.05	0.02	0.23	0.02	0.60
Queue Length 95th (ft)	17	4	1	0	2	0
Control Delay (s)	21.5	10.8	10.3	0.0	8.2	0.0
Lane LOS	C	B	B		A	
Approach Delay (s)	21.5	10.8	0.3		0.2	
Approach LOS	C	B				

Intersection Summary		
Average Delay		1.1
Intersection Capacity Utilization	65.7%	ICU Level of Service C
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
2: Birch St & 231st Ave

2016 PM Peak (With Project)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	15	1	10	9	0	7	15	360	6	12	845	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	16	1	11	10	0	7	16	383	6	13	899	43
Pedestrians		3			5							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage (veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1371	1375	923	1359	1393	391	944			394		
vC1, stage 1 conf vol	949	949		423	423							
vC2, stage 2 conf vol	422	426		936	970							
vCu, unblocked vol	1371	1375	923	1359	1393	391	944			394		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	100	97	96	100	99	98			99		
cM capacity (veh/h)	283	304	329	269	288	659	733			1170		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	28	17	16	389	13	941
Volume Left	16	10	16	0	13	0
Volume Right	11	7	0	6	0	43
cSH	300	363	733	1700	1170	1700
Volume to Capacity	0.09	0.05	0.02	0.23	0.01	0.55
Queue Length 95th (ft)	8	4	2	0	1	0
Control Delay (s)	18.2	15.4	10.0	0.0	8.1	0.0
Lane LOS	C	C	B		A	
Approach Delay (s)	18.2	15.4	0.4		0.1	
Approach LOS	C	C				

Intersection Summary		
Average Delay		0.7
Intersection Capacity Utilization	56.9%	ICU Level of Service B
Analysis Period (min)		15

HCM Unsignalized Intersection Capacity Analysis  
3: Dogwood St & 231st Ave

2016 PM Peak (With Project)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (veh/h)	15	10	25	28	5	30	25	311	36	50	774	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	17	11	28	31	6	34	28	349	40	56	870	22
Pedestrians		2			6							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			1							
Right turn flare (veh)												
Median type							TWLTL			TWLTL		
Median storage (veh)							2			2		
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1437	1447	883	1448	1438	376	894			396		
vC1, stage 1 conf vol	995	995		432	432							
vC2, stage 2 conf vol	442	452		1016	1006							
vCu, unblocked vol	1437	1447	883	1448	1438	376	894			396		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	96	92	85	98	95	96			95		
cM capacity (veh/h)	252	275	347	205	258	672	766			1168		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	<b>SB 2</b>						
Volume Total	56	71	28	390	56	892						
Volume Left	17	31	28	0	56	0						
Volume Right	28	34	0	40	0	22						
cSH	298	314	766	1700	1168	1700						
Volume to Capacity	0.19	0.23	0.04	0.23	0.05	0.52						
Queue Length 95th (ft)	17	21	3	0	4	0						
Control Delay (s)	19.9	19.8	9.9	0.0	8.2	0.0						
Lane LOS	C	C	A		A							
Approach Delay (s)	19.9	19.8	0.7		0.5							
Approach LOS	C	C										
<b>Intersection Summary</b>												
Average Delay			2.2									
Intersection Capacity Utilization			54.4%		ICU Level of Service					A		
Analysis Period (min)			15									



HCM Unsignalized Intersection Capacity Analysis  
4: Birch St & 228th Ave

2016 PM Peak (With Project)  
Orengo Woods TIA



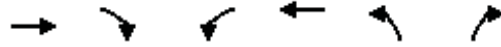
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	0	9	5	5	11	22	0	10	5	14	10	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	0	12	7	7	15	29	0	13	7	19	13	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	104	71	13	80	67	17	13			20		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	104	71	13	80	67	17	13			20		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	99	99	98	97	100			99		
cM capacity (veh/h)	838	814	1073	889	818	1068	1618			1609		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	19	51	20	32
Volume Left	0	7	0	19
Volume Right	7	29	7	0
cSH	891	958	1618	1609
Volume to Capacity	0.02	0.05	0.00	0.01
Queue Length 95th (ft)	2	4	0	1
Control Delay (s)	9.1	9.0	0.0	4.3
Lane LOS	A	A		A
Approach Delay (s)	9.1	9.0	0.0	4.3
Approach LOS	A	A		

Intersection Summary			
Average Delay		6.3	
Intersection Capacity Utilization	21.2%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 5: Birch St & 225th Ave

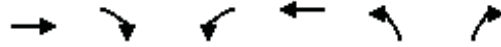
2016 PM Peak (With Project)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	➔			➔	➔	
Sign Control	Yield			Yield	Yield	
Volume (vph)	8	10	6	13	10	4
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	11	13	8	17	13	5
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	24	25	19			
Volume Left (vph)	0	8	13			
Volume Right (vph)	13	0	5			
Hadj (s)	-0.33	0.06	-0.03			
Departure Headway (s)	3.6	4.0	4.0			
Degree Utilization, x	0.02	0.03	0.02			
Capacity (veh/h)	978	885	883			
Control Delay (s)	6.7	7.1	7.1			
Approach Delay (s)	6.7	7.1	7.1			
Approach LOS	A	A	A			
Intersection Summary						
Delay			7.0			
HCM Level of Service			A			
Intersection Capacity Utilization			16.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 6: Dogwood St & 227th Ave

2016 PM Peak (With Project)  
 Orengo Woods TIA



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	
Sign Control	Stop			Stop	Stop	
Volume (vph)	16	85	19	12	56	13
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	21	113	25	16	75	17
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	135	41	92			
Volume Left (vph)	0	25	75			
Volume Right (vph)	113	0	17			
Hadj (s)	-0.50	0.12	0.05			
Departure Headway (s)	3.7	4.4	4.3			
Degree Utilization, x	0.14	0.05	0.11			
Capacity (veh/h)	957	801	800			
Control Delay (s)	7.2	7.6	7.8			
Approach Delay (s)	7.2	7.6	7.8			
Approach LOS	A	A	A			
Intersection Summary						
Delay			7.5			
HCM Level of Service			A			
Intersection Capacity Utilization			18.9%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
7: Quatama Rd & Cornelius Pass Rd

2016 PM Peak (With Project)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕↔		↕	↕↕	↕
Volume (vph)	34	38	66	145	43	50	86	635	80	65	1420	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frbp, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.94			0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1706			1766		1805	3478		1769	3574	1565
Flt Permitted		0.89			0.74		0.12	1.00		0.33	1.00	1.00
Satd. Flow (perm)		1541			1345		224	3478		610	3574	1565
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	35	40	69	151	45	52	90	661	83	68	1479	94
RTOR Reduction (vph)	0	45	0	0	13	0	0	10	0	0	0	48
Lane Group Flow (vph)	0	99	0	0	235	0	90	734	0	68	1479	46
Confl. Peds. (#/hr)	3		3	3		3	1		4	4		1
Heavy Vehicles (%)	5%	0%	2%	1%	0%	2%	0%	2%	0%	2%	1%	1%
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		17.6			17.6		41.4	33.9		37.4	31.9	31.9
Effective Green, g (s)		17.6			17.6		41.4	33.9		37.4	31.9	31.9
Actuated g/C Ratio		0.24			0.24		0.57	0.47		0.52	0.44	0.44
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		377			329		293	1638		405	1583	693
v/s Ratio Prot							c0.03	0.21		0.01	c0.41	
v/s Ratio Perm		0.06			c0.17		0.14			0.07		0.03
v/c Ratio		0.26			0.71		0.31	0.45		0.17	0.93	0.07
Uniform Delay, d1		22.0			24.9		12.5	12.8		8.7	19.1	11.5
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4			7.2		0.6	0.2		0.2	10.6	0.0
Delay (s)		22.3			32.1		13.1	13.0		8.9	29.6	11.5
Level of Service		C			C		B	B		A	C	B
Approach Delay (s)		22.3			32.1			13.0			27.7	
Approach LOS		C			C			B			C	

Intersection Summary

HCM Average Control Delay	23.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
8: Quatama Rd & 76th Ave

2016 PM Peak (With Project)  
Orenco Woods TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	10	84	5	30	133	41	5	0	25	24	0	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.81	0.81	0.81	0.81	0.92	0.81	0.92	0.81	0.92	0.92	0.92
Hourly flow rate (vph)	11	104	6	37	164	45	6	0	31	26	0	7
Pedestrians								4				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					363							
pX, platoon unblocked												
vC, conflicting volume	209			114			400	415	111	420	396	186
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	209			114			400	415	111	420	396	186
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			99	100	97	95	100	99
cM capacity (veh/h)	1362			1483			543	509	934	511	521	856
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	121	246	37	33								
Volume Left	11	37	6	26								
Volume Right	6	45	31	7								
cSH	1362	1483	834	556								
Volume to Capacity	0.01	0.02	0.04	0.06								
Queue Length 95th (ft)	1	2	3	5								
Control Delay (s)	0.7	1.3	9.5	11.9								
Lane LOS	A	A	A	B								
Approach Delay (s)	0.7	1.3	9.5	11.9								
Approach LOS			A	B								
<b>Intersection Summary</b>												
Average Delay			2.6									
Intersection Capacity Utilization			29.4%		ICU Level of Service				A			
Analysis Period (min)			15									

## **STAFF REPORT**

### **IN CONSIDERATION OF RESOLUTION NO. 13-4483, FOR THE PURPOSE OF APPROVING THE ORENCO WOODS NATURE PARK MASTER PLAN AND THE NAME OF THE ORENCO WOODS NATURE PARK**

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Date: November 21, 2013

Prepared by: Kathleen Brennan-Hunter, 503-797-1948

## **BACKGROUND**

On September 6, 2007, Metro Council adopted Resolution No. 07-3834, “Approving the Natural Areas Acquisition Refinement Plan for the Rock Creek Headwaters and Greenway Target Area.” On November 17, 2011, the Council adopted Resolution No. 11-4297, “For the Purpose of Amending the Natural Areas Acquisition Refinement Plan in the Rock Creek Headwaters and Greenway Target Area, Authorizing the Chief Operating Officer to Acquire Land Subject to Unusual Circumstances, and Approval of an Intergovernmental Agreement (IGA) with the City of Hillsboro.” This resolution authorized the December 2011 joint acquisition by Metro and the City of Hillsboro of the 42-acre former Orenco Woods golf course. The resolution also authorized the net proceeds from the sale of an approximate 11-acre SE corner Remainder Parcel to be “used for the planning and development of a nature park on the approximate 31-acre NW portion of the former Orenco Woods site, as set forth in the IGA.” On January 15, 2013, Metro and the City of Hillsboro entered into an agreement with Polygon Northwest Company, LLC as the buyer for the Remainder Parcel, and the transaction is scheduled to close in early 2014.

In August 2012, a Request for Proposals for a planning consultant to help master plan the future park resulted in the hiring of planning and design firm, Walker Macy. Since that time several community outreach events have occurred, including the formation of a Citizens Advisory Committee to assist with determining the program elements that were appropriate for the park as well as to provide feedback on conceptual design alternatives. Information on the master planning process has been posted on the City of Hillsboro’s website and sent out via email, to those asking to stay informed. Three well-attended open houses were held for community input. At the final open house, there was significant public support for the draft Orenco Woods Nature Park Master Plan (the “Master Plan”), including the following goals and elements:

The goals for the park plan include:

- Utilizing context sensitive design to balance recreational opportunities with habitat protection, restoration and enhancement of the site’s natural areas
- Creating a unique park that honors and respects the site’s natural, cultural and historical attributes and setting
- Providing for nature-related recreational experiences compatible with the nature park, and neighborhood park elements as appropriate
- Providing welcoming park access that accommodates both community and neighborhood uses
- Incorporate sustainable, low impact development principles into the park plan

Key features of the plan include:

- Extension of the Rock Creek Trail through the site
- On-site parking, picnic shelters, restroom, nature-based play area, park maintenance support facilities, and viewpoint stations for environmental learning
- Creation of a network of looped trails offering a variety of views and landscape experiences as well as connections to the adjacent neighborhoods
- Enhancement of natural areas including riparian forest, wetlands and oak savannah

In June 2013, the Hillsboro Parks & Recreation Commission approved the master plan concept for the Orenco Woods Nature Park. In a Metro Council Work Session on September 24, 2013, Metro staff gave an overview of the draft Master Plan. The final draft Orenco Woods Nature Park Master Plan is attached to Resolution 13-4483, as Exhibit A.

The name of the future Orenco Woods Nature Park primarily reflects the park's function and purpose as a nature park. The name "Orenco Woods" honors the history of the site, "Orenco" having significance in the local area as a composite of the initials of the Oregon Nursery Company, which owned hundreds of acres in this community.

In the coming months, a variety of land use applications are coming before the City of Hillsboro planning committees and the City Council that are related to changing the use of the site from the former Orenco Crossings subdivision to a nature park, and partitioning the southeast corner for surplus to be developed. By adoption of this resolution, the Metro Council names the Orenco Woods Nature Park and establishes the Orenco Woods Nature Park Master Plan for its development.

## **ANALYSIS/INFORMATION**

### **1. Known Opposition**

There is no known opposition.

### **2. Legal Antecedents**

Resolution No. 06-3672B, "For the Purpose of Submitting to the Voters of the Metro Area a General Obligation Bond Indebtedness in the Amount of \$227.4 Million to Fund Natural Area Acquisitions and Water Quality Protection," was adopted on March 9, 2006.

The voters' approved Metro's 2006 Natural Areas Bond Measure at the general election held on November 6, 2006.

Resolution No. 07-3834, "Approving the Natural Areas Acquisition Refinement Plan for the Rock Creek Headwaters and Greenway Target Area," was adopted on September 6, 2007, and its confidential tax map was amended on September 22, 2011, by Resolution No. 11-4293.

Resolution No. 07-3766A, "Authorizing the Chief Operating Officer to Purchase Property With Accepted Acquisition Guidelines as Outlined in the Natural Areas Implementation Work Plan," was adopted by the Metro Council on March 1, 2007, and established the Acquisition Parameters and Due Diligence Guidelines for the purchase of properties as part of the 2006 Natural Areas Bond Program.

Resolution No. 11-4297, "For the Purpose of Amending the Natural Areas Acquisition Refinement Plan in the Rock Creek Headwaters and Greenway Target Area, Authorizing the Chief Operating Officer to Acquire Land Subject to Unusual Circumstances, and Approval of an Intergovernmental Agreement with the City of Hillsboro" was adopted on November 17, 2011, authorizing the acquisition of the Orenco Woods site, the sale of an 11-acre Remainder Parcel, and the use of the net proceeds for the planning and implementation of a nature park on the remainder of the site.

Ordinance No. 13-1319, "For the Purpose of Amending Metro Code Chapter 2.16 (naming of facilities)," adopted on October 31, 2013.

### **3. Anticipated Effects**

This resolution will allow Metro and the City of Hillsboro to finalize the Orenco Woods Nature Park Master Plan document and formalizes the name of the future nature park. After the Remainder Parcel

sale closes in early 2014, the Master Plan will be implemented by seeking bidders to build the park according to the Master Plan. Construction is anticipated to start in 2015. The park will be managed by the City of Hillsboro Parks and Recreation Department under a future Intergovernmental Agreement with Metro.

**4. Budget Impacts**

The net proceeds from the sale will be used to pay for the Master Plan work done thus far, and to implement the rest of the design and construction of the park.

**RECOMMENDED ACTION**

The Chief Operating Officer recommends passage of Resolution No. 13-4483.