City of Yelm
EST. 1924
WASHINGTON

SEPA #: 2022.0108

DETERMINATION OF NON-SIGNIFICANCE

Proponent:	South Puget Sound Habitat for Humanity
Description of Proposal:	Subdivide a 2.3-acre lot into 22 lots through PRD process
Location of the Proposal:	407 Longmire St NW, Yelm, WA 98597
Threshold Determination:	The City of Yelm as lead agency for this action has determined that this proposal does not have a probable significant adverse impact on the environment. Therefore, an environmental impact statement (EIS) will not be required under RCW 43.21C.030 (2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request. This DNS is issued under WAC 197-11-340(2); the City of Yelm will not act on this proposal for 14 days from the date below. July 20, 2023 Comments must be submitted by August 3, 2023 to planning@yelmwa.gov by 5:00 P.M.
Lead agency:	City of Yelm
Responsible Official:	Gary Cooper, Planning and Building Manager
Phone:	360-458-8408
Address:	901 Rhoton Rd. NW. Yelm, WA 98597
Date of Issue:	July 20, 2023
Comment Deadline:	August 3, 2023

Gary Cooper

Gary Cooper, Planning and Building Manager

Posted: City of Yelm Website, www.yelmwa.gov : July 20, 2023
Posted on Nisqually Valley News (website): July 20, 2023
Published: Nisqually Valley News: July 27, 2023
Copies to: All agencies/citizens on SEPA mailing list Dept. of Ecology w/checklist

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non- projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

1. Name of proposed project, if applicable:

   Habitat for Humanity Yelm PRD

2. Name of applicant:

   South Puget Sound Habitat for Humanity

3. Address and phone number of applicant and contact person:

   Contact Person: **Ben Fransua**
   Address: **711 Capitol Way South, Suite 401**
   Olympia, WA 98501
   Phone Number: **360-956-3456**
   Email: **ben@spshabitat.org**

4. Date checklist prepared:

   May 13, 2022

5. Agency requesting checklist:

   City of Yelm

6. Proposed timing or schedule (including phasing, if applicable):

   Construction start date: **Fall 2022**
   Construction end date: **Spring 2023**

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   Not at this time

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.
   Drainage Report prepared by LDC, Inc (05/12/2022)
   Geotechnical Report, prepared by LANDAU Associates (08/03/2021)
   Mazama Pocket Gopher Study, prepared by West Fork environmental (07/21/2021)

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

   There are no pending applications awaiting governmental approvals of other proposals directly affecting the project site.

10. List any government approvals or permits that will be needed for your proposal, if known.

Preliminary Plat
Planned Residential Development
Construction Review
General Stormwater Permit (NPDES)
Right-of-Way Permits
Building Permits
Final Plat

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The proposed Habitat for Humanity Yelm PRD project is located at 407 Longmire Street SE in Yelm, WA (parcel # 22719230700). The site is approximately 2.3 acres (100,188 square feet) and is zoned Moderate Density Residential (R-6). The project will include subdividing the project site into 22 lots. On 16 of the proposed lots, a townhome unit will be constructed on 6 of the lots a detached single-family house will be constructed. The project will also include the construction of new internal ~~private~~ road, frontage improvements along Longmire St SE, utility extensions, stormwater facilities, and open space.

Public road

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

Address:	**407 Longmire Street, Yelm, WA 98597**
Parcel #:	**22719230700**
Section:	**19**
Township:	**24**
Range:	**2E**

B. Environmental Elements [HELP]

1. *Earth* [help]

a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _

b. What is the steepest slope on the site (approximate percent slope)?

The steepest slope on the project site is less than 10%

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Per the USGS Web Soil Survey map, the general soils found on the site are gravelly sandy loam.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

There are no surface indicators or history of unstable soils on the project site or in its immediate vicinity.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

The total area that the project will disturbed is 108,900 square feet. Grading activities for the project will also include 1,085 cubic yards of fill and 1,620 cubic yards of cut. Fill will come from local sources.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Due to the wet seasons and high moisture sensitivity of the subsurface soils, erosion could occur as a result of construction. However, onsite temporary erosion controls will be taken to mitigate the threat of any erosion during storm events.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 44% of the site will be covered in impervious surface.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Temporary measures to control erosion could include sedimentation ponds, filter fences, and diversion swales. Permanent measures could include landscaping, piping, and armoring of outfall areas.

2. *Air* [help]

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Emissions that are associated with residential construction will be produced. During construction activities there would be increased exhaust and dust particle emissions to the ambient air during dry weather. Objectionable odors could be caused by the roofing of homes or the paving of roadways and driveways. After construction, the principal source of pollution would be in exhaust from vehicular traffic. The increase in automobiles associated with the development would contribute CO, NO, and SO2 emissions to the ambient air. All emissions must comply with current regulations governed by the Puget Sound Clean Air Agency (PSCAA).

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

There are no off-site sources of emissions or odor that may affect the proposal.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

No measures to reduce or control emissions are proposed. Automobile and fireplace emission standards are regulated by the State of Washington.

3. *Water* [help]

a. Surface Water: [help]

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

There are no waterbodies on the site or in its immediate vicinity

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

The project will not require any work on or adjacent to any waterbodies.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

There will be no fill or dredge materials placed or removed from surface

waterbodies or wetlands as part of this project.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

The proposal will not require any surface water withdrawals or diversions.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Per FEMA FIRM flood map #53067C0353E, the site is not within a 100-year floodplain.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No, the proposal does not involve any discharges of waste materials to surface waters.

b. Ground Water: [help]

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No, groundwater will not be withdrawn from a well for drinking water or other purposes. The proposed units will be connected to the City of Yelm's water system.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

There will be no waste materials discharged into the ground. The proposed units will be connected to the City of Yelm's sewer system.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Source of runoff to mainly include surface water runoff from developed hard surfaces on-site. Developed stormwater to be captured with an underground storm system and routed to a stormwater detention facility in the site's western corner. Basic water quality treatment to be provided by infiltration of runoff through bioretention soil mix per the 2019 Department of Ecology Stormwater Management Manual of Western Washington.

2) Could waste materials enter ground or surface waters? If so, generally describe.

It is unlikely that waste materials will enter ground or surface waters. Waste materials deposited by automobiles on interior roadways and driveways will be collected in a subsurface (piped) system and conveyed to the detention facility. Pollutants will be separated and filtered prior to release. Yard and rooftop drainage will be relatively clean and free of waste material.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

Drainage patterns surrounding the site will not be altered with the construction of this project. The site currently sheet flows to the northeast

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

All adopted development and engineering requirements imposed by the City to control hydrologic impacts on adjacent properties will be incorporated into final construction plans and implemented by the proponent. Storm drainage facilities will be designed in accordance with versions of the DOE Storm Water Manual, and City of Yelm engineering standards, as were in effect at the time of complete application

4. *Plants* [help]

a. Check the types of vegetation found on the site:

___deciduous tree: alder, maple, aspen, other
_X_evergreen tree: fir, cedar, pine, other
_X_shrubs
_X_grass
___pasture
___crop or grain
____Orchards, vineyards or other permanent crops.
____wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
___water plants: water lily, eelgrass, milfoil, other
___other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

All vegetation that is within the sites grading boundaries will be removed.

c. List threatened and endangered species known to be on or near the site.

There are no threatened or endangered species know to be on the site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance

vegetation on the site, if any:

There are no proposed landscaping measures to preserve or enhance vegetation on the site.

e. List all noxious weeds and invasive species known to be on or near the site.

There are no known noxious weeds and invasive species known to be on or near the site.

5. *Animals* [help]

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

birds: songbirds,
mammals: squirrels

b. List any threatened and endangered species known to be on or near the site.

There are no proposed landscaping measures to preserve or enhance vegetation on the site. West Fork Environmental, reviewed the site for mazama pocket gophers and determined that there are mazama pocket gophers on the site.

c. Is the site part of a migration route? If so, explain.

The site is located within the Pacific Flyway Migration Route, which covers the majority of western Washington.

d. Proposed measures to preserve or enhance wildlife, if any:

There are no proposed measures in place to preserve or enhance wildlife.

e. List any invasive animal species known to be on or near the site.

There are no invasive animal species known to be on or near the site.

6. *Energy and Natural Resources* [help]

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electric and natural gas will be used to meet the completed project's energy demands. Electric or natural heat will be used to heat the proposed dwellings.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

The project will not have any effect on the potential use of solar energy by adjacent properties.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

There are currently no energy conservation features included in the plans of this proposal. Energy conservation would be up to individual homeowners.

7. *Environmental Health* [help]

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

1) Describe any known or possible contamination at the site from present or past uses.

There are no known or possible contaminations on the site from present or past use.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

There are no existing hazardous chemicals or conditions that might affect the project development and design.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

There are no toxic hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

4) Describe special emergency services that might be required.

Other than normal police, emergency aid unit, and fire protection services, no special emergency services are anticipated

5) Proposed measures to reduce or control environmental health hazards, if any:

There are no proposed measures needed to reduce or control environmental health hazards.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

There is no existing noise from the uses surrounding the site that would affect the project.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indi- cate what hours noise would come from the site.

Noise levels would be intermittently high throughout construction but should be limited to City working hours. The Applicant may request to bring fill material onto the site at night to help with traffic. On a permanent basis, residential activity and traffic noise created by daily vehicular trips would increase ambient noise levels in the vicinity.

3) Proposed measures to reduce or control noise impacts, if any:

Work will only happen outside of the City's designated quite hours.

8. *Land and Shoreline Use* [help]

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The proposal will not affect any of the surround or adjacent properties. The current uses surrounding properties are:

- **North: Detached single-family homes in the Moderate Density Residential (R-6) zone**
- **East: Detached single-family homes in the Moderate Density Residential (R-6) zone**
- **South: Detached single-family homes in the Moderate Density Residential (R-6) zone**
- **West: Assisted living facility in the Commercial (C-1) zone**

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

The project has not been used as working farmland or working forest land.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

The proposal will not have any affect or be affected by surrounding farmland.

c. Describe any structures on the site.

Currently, there is a detached single-family home and detached garage on the

site.

d. Will any structures be demolished? If so, what?

All structures on the site will be demolished as part of this proposal.

e. What is the current zoning classification of the site?

The site is zoned Moderate Density Residential (R-6)

f. What is the current comprehensive plan designation of the site?

The site's comprehensive plan designation is Moderate Density Residential.

g. If applicable, what is the current shoreline master program designation of the site?

The site is not within a shoreline

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

No part of the site has been classified as a critical rea (area) by the City of Yelm or Thurston County.

i. Approximately how many people would reside or work in the completed project?

Assuming an average household size of 3.19 people (ACS, 2016-2020), there will be approximately 67 people residing in the completed project.

j. Approximately how many people would the completed project displace?

Assuming an average household size of 3.19 people (ACS, 2016-2020), the project will displace 3-4 people.

k. Proposed measures to avoid or reduce displacement impacts, if any:

There are no proposed measures to avoid or reduce displacement.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed project meets the standards set forth in the City of Yelm's Unified Development Code (YMC Title 18) and engineering design standards.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

There are no proposed measures to reduce or control the impacts to agricultural and forest lands of long-term commercial significance

9. *Housing* [help]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

The proposal will provide ~~15~~ 16 low-income townhome units and 6 low-income detached single-family homes for a total of ~~21~~ 22 homes.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

One middle-income, detached single-family home will be eliminated.

c. Proposed measures to reduce or control housing impacts, if any:

The proposed development is consistent with the City of Yelm's Unified Development Code.

10. *Aesthetics* [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The proposed townhomes will be the tallest buildings on the site with a height of just over 21-feet.

b. What views in the immediate vicinity would be altered or obstructed?

No views in the immediate vicinity will be altered or obstructed.

c. Proposed measures to reduce or control aesthetic impacts, if any:

All buildings will be consistent with the City of Yelm's Unified Development Code (YMC Title 18).

11. *Light and Glare* [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

The proposal would produce light from automobile headlights, street lighting, and home lighting, primarily at night.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Light and glare from the finished project should not be a safety hazard or

interfere with views.

c. What existing off-site sources of light or glare may affect your proposal?

There are no existing off-site sources of light or glare that would affect the proposal.

d. Proposed measures to reduce or control light and glare impacts, if any:

No special measures to reduce or control light and glare impacts are proposed nor are they expected to be necessary.

12. *Recreation* [help]

a. What designated and informal recreational opportunities are in the immediate vicinity?

Yelm Middle Schools, recreation facilities are approximately 1,000 feet away from the project site. Also, the Tahoma Valley Golf Course is 0.5 miles from the project site.

b. Would the proposed project displace any existing recreational uses? If so, describe.

The proposed project would not displace any existing recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

The proposed project includes an open space area in the western corner of the project site.

13. *Historic and cultural preservation* [help]

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers ? If so, specifically describe.

The existing house on the site was built in 1923 but has no historic significant value.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

There are no known landmarks, features, or other evidence of Indian or historic use or occupation on the project site.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the

department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Site walks and consultation of Washington State's Department of Archology and Historic Preservation's WISAARD Online GIS map were used to assess the potential impacts to cultural and historic resources on and near the project site.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

Construction will be temporarily halted should evidence of historic, archeological, scientific, or cultural importance be discovered. Local tribes would be notified.

14. *Transportation* [help]

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

The site will be served by NW Longmire St.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

The project site is not currently served by public transit. The closest transit stop is the Yelm Ave at Longmire St Inner Transit stop, which is approximately 1,000 feet to the south of the project site.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

The proposed project will include approximately ~~30 new parking~~ spaces.

44 parking spaces on the driveways will be provided

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

Public

A new ~~private~~ road will be constructed as part of this project. Also frontage improvements will be constructed along the project site's boundaries with Longmire St NW.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The project will not use water, rail or air transportation.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

Based on the 10th edition of the ITE Trip Generation Manual, approximately 23 daily vehicular trips will be produced by the completed project.

Per submitted TIA dated April 20, 2023, the 22 proposed dwelling units are estimated to add 158 daily trips and 13 PM peak hour trips.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

The proposal will not interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area.

h. Proposed measures to reduce or control transportation impacts, if any:

The developer will pay or any required traffic impact fees.

15. *Public Services* [help]

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

The proposal will add a greater demand for service such as fire protection, police protection, public transit, health care, schools, etc.

b. Proposed measures to reduce or control direct impacts on public services, if any.

The proposal will pay all required impact fees

16. *Utilities* [help]

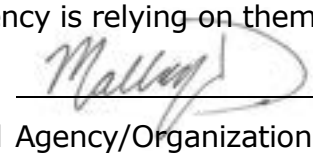
a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other _____

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Electricity will be provided by PSE. Gas will be provided by PSE. Water will be provided by the City of Yelm. Wastewater will be served by the City of Yelm. Phone/cable will be provided by Comcast.

C. Signature [HELP]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature:  Name of signee Mallory Dobbs

Position and Agency/Organization Civil Project Manager, LDC Inc.

Date Submitted: 05/13/2022

D. ***Supplemental sheet for nonproject actions*** [HELP]

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   Proposed measures to avoid or reduce such increases are:

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

3. How would the proposal be likely to deplete energy or natural resources?

   Proposed measures to protect or conserve energy and natural resources are:

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   Proposed measures to protect such resources or to avoid or reduce impacts are:

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

Proposed measures to avoid or reduce shoreline and land use impacts are:

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

Proposed measures to reduce or respond to such demand(s) are:

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

LDC Surveying Engineering Planning

Memo

To: Maryam Moeinian, Associate Planner, City of Yelm

From: Mallory Dobbs, PE, LDC, Inc.

Date: June 29, 2023

Re: Habitat for Humanity, Yelm 22 Lot Plat, Administrative Subdivision

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This memo is to provide justification for the proposed subdivision and how it will meet the intent of the City of Yelm Municipal Code Section 18.64.020.

18.64.020 Planned residential development.

A planned residential development encourages imaginative design and the creation of permanent open space by preserving or creating environmental amenities superior to those generally found in conventional developments, and by preserving to the greatest possible extent the natural characteristics of the land, including topography, natural vegetation, waterways, and views. For single-family residential developments, the inclusion of a variety of housing types such as duplexes or townhomes may qualify for density bonuses listed below.

> **Justification:** *The proposed subdivision will primarily be providing innovation through the variety of housing within the project, and the affordable housing that organizations such as Habitat for Humanity can provide to the community. The project will construct 6 detached single-family homes and 16 attached townhomes. All the homes within this development will be sold at 30-50% area median income (AMI). Providing housing at this income level is a large benefit to the community as this allows individuals such as schoolteachers, police officers, and other median income earners to afford owning a home in the communities they work and recreate within. Additionally, permanent open space with a low-impact development stormwater system will provide ample space for families to gather. The cul-de-sac design will provide safety, security, and a sense of a small private community even in the heart of the city. The site has been previously cleared and barren with a single-family home. The proposed landscape within the site will provide a much more appealing vegetative state throughout the community.*

A. Density Bonus. The city may approve an increase in the dwelling unit density up to:

1. In the low density district, 15 percent, rounded to the nearest whole number.

2. In the moderate density district, 20 percent, rounded to the nearest whole number.

3. In the high density district, 25 percent, rounded to the nearest whole number.

Justification: *The proposed project is located within a Moderate Density Residential (R-6). Per the pre-submission conference notes dated December 18, 2019 the project area of 2.9-acres would allow between 9 and 18 dwelling units. With the 20% increase in the dwelling unit density, this would increase the number of lots on-site from 22.*

HQ: 20210 142nd Avenue NE, Woodinville, WA 98072 • Kent: 1851 Central Place South, Suite 101, Kent, WA 98032

B. Subdivision Requirements. A planned residential development shall be exempt from the specific design requirements of a standard subdivision, except that when any parcel of land in a planned residential development is intended for individual ownership, sale, or public dedication, procedural and applicable state laws pertaining to the subdivision and conveyance of land and the preparation of maps shall be followed.

> ***Justification:*** *The proposed planned residential development will meet all standard subdivision requirements to the maximum extent feasible. Each lot will provide 2 parking stalls on-site, water, sewer and storm will be provided meeting all city requirements. Preparation of the maps per the City of Yelm requirements have been provided.*

C. Relationship of Planned Residential Development Site to Adjacent Areas. The design of a planned residential development shall take into account the relationship of the site to the surrounding areas. The perimeter of the planned residential development shall be designed to minimize undesirable impact of the planned residential development on adjacent properties and, conversely, to minimize undesirable impact of adjacent land use and development characteristics on the planned residential development.

> ***Justification:*** *The proposed project will not disturb the existing roadway design and location to the north and west of the parcel. Roadway improvements per the Local Access Residential standard will be provided. This includes an 11' travel lane, a 7.5' parking lane, a 6' planter strip, and a 5' sidewalk. The adjacent subdivision to the southwest will not be affected with the proposed improvements, the existing fence and trees to the south of the property line will remain. The proposed subdivision will be similar to other subdivisions surrounding the development.*

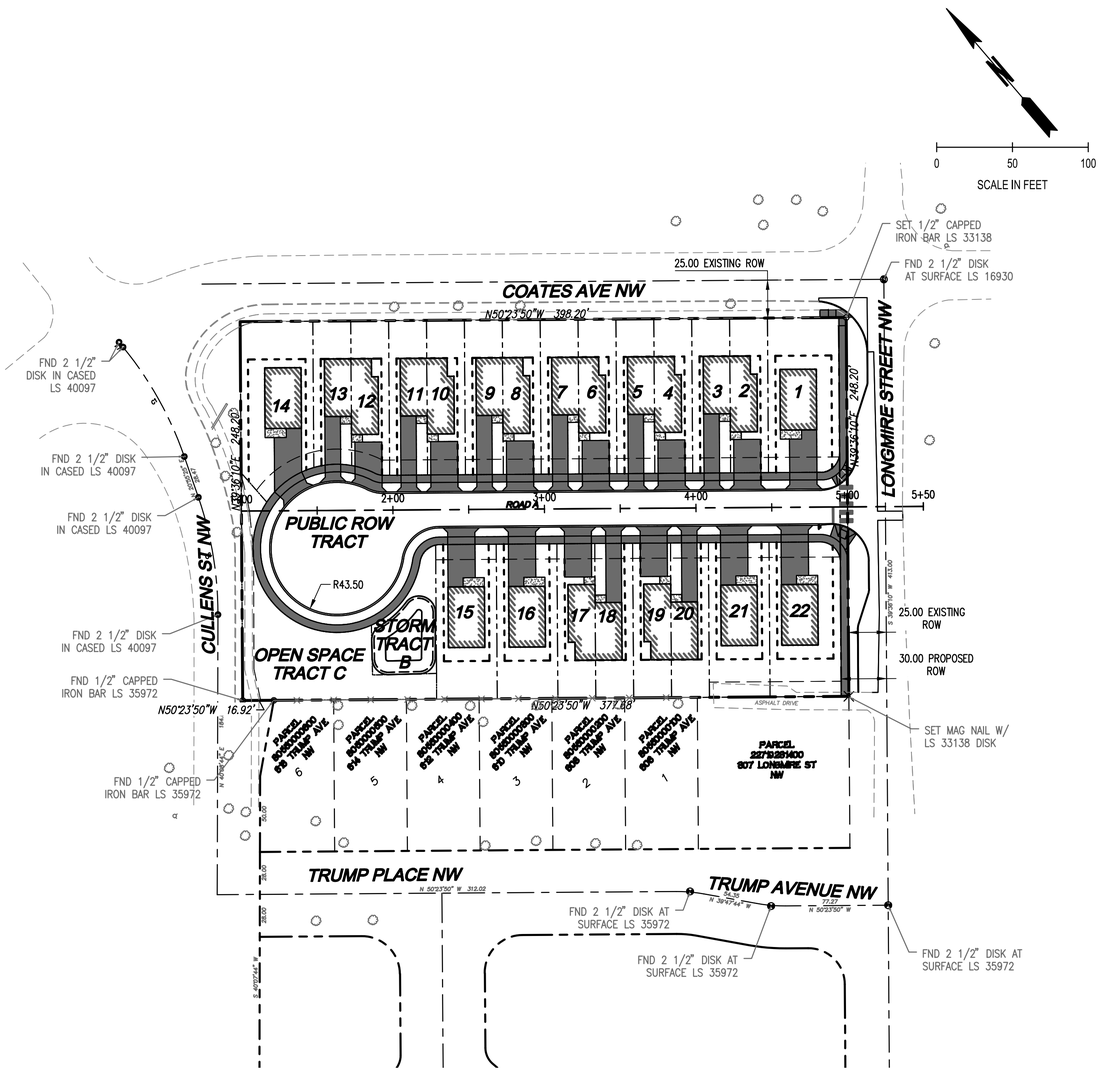
D. Buildings may have common walls and, therefore, be built to the property line as in townhouse construction. Wherever buildings are separated, a minimum distance of 10 feet shall be maintained between such buildings.

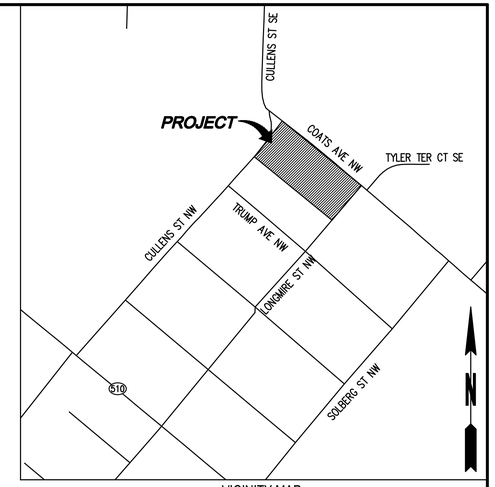
> ***Justification:*** *Townhomes will share common walls, with a minimum of 15' between townhome units. All other detached single-family residences will have a minimum of 15' feet maintained between them.*

E. Landscaping. Natural landscape features which are to be preserved, such as existing trees, drainage ways, rock outcroppings, etc., may be accepted as part of the landscaping plan when such natural features contribute to the attractiveness of the proposed development. (Ord. 1057 § 9, 2019; Ord. 995 § 12 (Exh. A), 2015).

> ***Justification:*** *The site is largely cleared and developed with a single-family home. There are no natural features located on-site. All existing trees outside of the project parcel to include frontage trees will remain with the construction of this project. The proposed on-site landscaping has been designed to meet or exceed all City of Yelm standards.*

A PORTION OF SEC 19/24, TWN 17 N, RGE 2 E, W.M., CITY OF YELM, WASHINGTON





VICINITY MAP
SCALE: 1"=300'

SURVEY

TOPOGRAPHIC AND BOUNDARY SURVEY INFORMATION WAS PROVIDED BY BRACY & THOMAS PROFESSIONAL LAND SURVEYORS. THIS SURVEY INFORMATION WAS NOT FIELD VERIFIED BY LDC, INC.

GRADING QUANTITIES:

CUT: 1,085 C.Y.
FILL: 1,620 C.Y.
NET: 535 C.Y. (FILL)

THESE GRADING QUANTITIES ARE STRICTLY FOR PERMITTING PURPOSES AND SHALL NOT BE USED BY THE CONTRACTOR FOR BIDDING PURPOSES.

IMPERVIOUS SURFACE CALCULATIONS:

PROPOSED ROOF AREA:	18,295 SF (0.42 ACRES)
PROPOSED ROADWAY AREA:	17,424 (0.40 ACRES)
OTHER IMPERVIOUS AREA:	8,712 SF (0.20 ACRES)

OPEN SPACE CALCULATIONS:

GROSS SITE AREA:	2.90 ACRES
REQUIRED MIN. USABLE OPEN SPACE:	5% SITE – 0.14 ACRES
TOTAL OPEN SPACE PROVIDED:	6% – 0.14 ACRES

PROJECT INFORMATION:

OWNER/APPLICANT:	SOUTH PUGET SOUND HABITAT FOR HUMANITY
TPN:	22719230700
SITE ADDRESS:	407 LONGMIRE STREET SE
PARCEL SIZE:	100,188 SF (2.30 ACRES)
STORMWATER TRACT:	NONE
GRADING: (FOR APPLICATION PURPOSES ONLY)	1,085 CY CUT 1,620 CY FILL
IMPERVIOUS SURFACES AREA COVERAGE:	+/–0.40 ACRES AC ROADWAY +/–0.20 ACRES CONC. SIDEWALK/DRIVEWAY
ROADWAY AREA/LENGTH:	+/–0.40 ACRES / 330 LF
SOILS:	SPANAWAY GRAVELLY SANDY LOAM
SANITARY SEWER/WATER:	CITY OF YELM
POWER/GAS	PUGET SOUND ENERGY
TELEPHONE/FIBER:	CENTURY LINK
CABLE/TV:	COMCAST
FIRE DISTRICT:	SE THURSTON FIRE
SCHOOL DISTRICT:	YELM
FEMA FIRM DESCRIPTION:	ZONE X (PANEL #53067C0353E)
EXISTING WELLS:	NO WELLS LOCATED ON THE SITE
ZONING DESIGNATION	MODERATE DENSITY RESIDENTIAL (R–6)
SUBDIVISION APPLICATION	PRELIMINARY PLAT, PLANNED RESIDENTIAL DEVELOPMENT (PRD)
MAXIMUM ALLOWABLE (GROSS) DENSITY	3–6 UNITS PER ACRE
MAXIMUM DWELLING UNITS ALLOWED	18 DU
PROPOSED NO. DWELLING UNITS	22 DU, AS ALLOWED THROUGH PRD PROCESS
PROPOSED RESIDENTIAL DENSITY	8.2 DU/ACRE
MINIMUM LOT SIZE	NONE
PROPOSED AVERAGE (INDIVIDUAL) LOT SIZE	2,777 SF (0.06 ACRES)
PROPOSED MINIMUM (INDIVIDUAL) LOT SIZE	2,375 SF (0.055 ACRES)
MINIMUM LOT WIDTH	NONE
PROPOSED MINIMUM (INDIVIDUAL) LOT WIDTH	25 FT.
FRONT YARD SETBACK, FROM LOCAL STREET	15 FT.
REAR YARD SETBACK	25 FT.
SIDE YARD SETBACK (TOWNHOMES)	15'; 0' ALLOWED FOR TOWNHOMES
SIDE YARD SETBACK (PROPOSED)	5 FT.
MAXIMUM BUILDING HEIGHT	35 FT.
MAXIMUM LOT COVERAGE	NONE

SHEET INDEX

SHEET #	SHEET TITLE	SHEET DESCRIPTION
1	PP–01	PRELIMINARY PLAT MAP
2	PP–01A	PRELIMINARY PLAT MAP
3	PP–02	PRELIMINARY PLAT GRADING AND DRAINAGE
4	PP–03	PRELIMINARY PLAT WATER AND SEWER PLAN
5	PP–04	PRELIMINARY PLAT NOTES AND DETAILS
6	PP–05	PRELIMINARY PLAT NOTES AND DETAILS

DISCLAIMER

TOPOGRAPHIC SURVEY INFORMATION CONTAINED ON THESE PLANS HAS BEEN PROVIDED BY BRACY & THOMAS, P.L.S. LDC, INC. (LAND DEVELOPMENT CONSULTANTS, INC.) ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

UTILITY NOTE

THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. AGENCIES INVOLVED SHALL BE NOTIFIED WITHIN A REASONABLE TIME PRIOR TO THE START OF CONSTRUCTION.

Call 2 Business Days Before You Dig
811 or 1-800-424-5555
Utilities Underground Location Center

REVISIONS

NO.	DATE	DESCRIPTION	BY

LDC
Surveying
Engineering
Planning
Woodinville
Kent
Olympia
1411 State Avenue NE, #200
Olympia, WA 98506
T 425.806.1869
F 425.482.2893
www.LDCorp.com

HABITAT FOR HUMANITY

YELM PRD
407 LONGMIRE STREET NW

PRELIMINARY PLAT MAP

MALLORY K. DOBBS
STATE OF WASHINGTON
20122771
REGISTERED
PROFESSIONAL ENGINEER

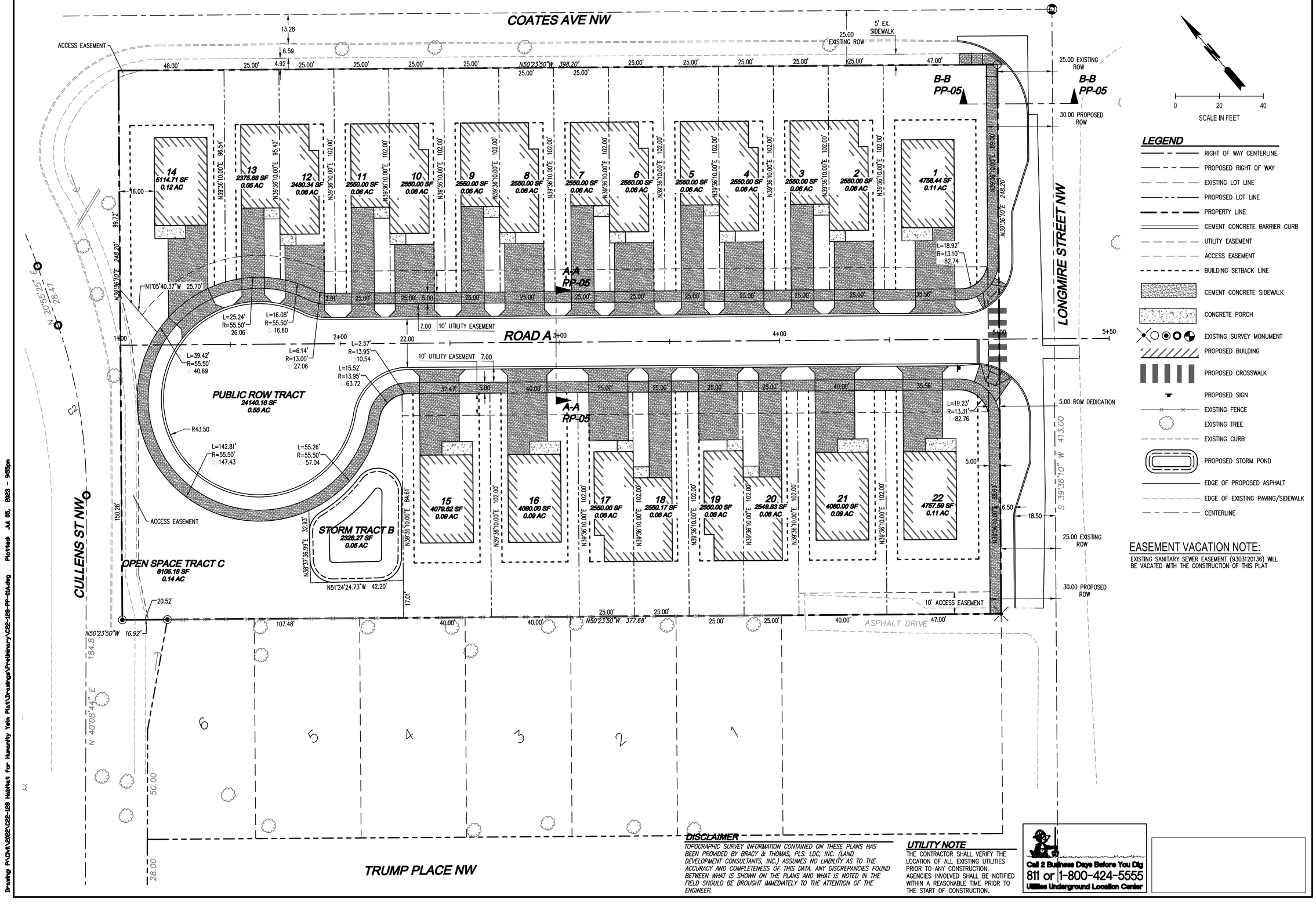
JOB NUMBER:	C22–128
DRAWING NAME:	C22–128–PP–01
DESIGNER:	M. DOBBS
DRAFTING BY:	M. DOBBS
DATE:	JUNE, 2023
SCALE:	1"=50'
JURISDICTION:	CITY OF YELM

PP–01

SHEET 1 OF 5

Drawing: P:\Civil\2022\C22-128 Habitat for Humanity Yelm Plat\Drawings\Preliminary\C22-128-pp-01.dwg Plotted: Jul 05, 2023 - 10:02pm

A PORTION OF SEC 19/24, TWN 17 N, RGE 2 E, W.M., CITY OF YELM, WASHINGTON



LEGEND

- RIGHT OF WAY CENTERLINE
- PROPOSED RIGHT OF WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- PROPERTY LINE
- CEMENT CONCRETE BARRIER CURB
- UTILITY EASEMENT
- ACCESS EASEMENT
- BUILDING SETBACK LINE
- CEMENT CONCRETE SIDEWALK
- CONCRETE PORCH
- EXISTING SURVEY MONUMENT
- PROPOSED BUILDING
- PROPOSED CROSSWALK
- PROPOSED SIGN
- EXISTING FENCE
- EXISTING TREE
- EXISTING CURB
- PROPOSED STORM POND
- EDGE OF PROPOSED ASPHALT
- EDGE OF EXISTING PAVING/SIDEWALK
- CENTERLINE

EASEMENT VACATION NOTE:

EXISTING SANITARY SEWER EASEMENT (9303120136) WILL BE VACATED WITH THE CONSTRUCTION OF THIS PLAT

DISCLAIMER

TOPOGRAPHIC SURVEY INFORMATION CONTAINED ON THESE PLANS HAS BEEN PROVIDED BY BRACY & THOMAS, PLS. LDC, INC. (LAND DEVELOPMENT CONSULTANTS, INC.) ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

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REVISIONS			
NO.	DATE	DESCRIPTION	BY

LDC | Surveying Engineering Planning
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T 425.806.1869 | F 425.482.2893
www.LDCorp.com

HABITAT FOR HUMANITY

YELM PRD
407 LONGMIRE STREET NW

PRELIMINARY PLAT MAP

MALLORY K. DOBBS
STATE OF WASHINGTON
20122771
REGISTERED PROFESSIONAL ENGINEER

JOB NUMBER:	C22-128
DRAWING NAME:	C22-128-PP-01A
DESIGNER:	M. DOBBS
DRAFTING BY:	M. DOBBS
DATE:	JUNE, 2023
SCALE:	1"=20'
JURISDICTION:	CITY OF YELM

PP-01A

SHEET 2 OF 5

Subject: Results of 2021 Mazama Pocket Gopher Study

Report Date: July 21, 2021

Landowner: South Puget Sound Habitat for Humanity (contact: Ben Fransua)

Address: 407 Longmire Street NW, Yelm, WA

Consultant: West Fork Environmental (Heidy Barnett)

Study Purpose

A Mazama pocket gopher (MPG) study was requested to support permitting for housing as part of a South Puget Sound Habitat for Humanity project. On June 18 and July 19, 2021, West Fork Environmental conducted a survey to detect activity of MPG on parcel 22719230700 (2.3 acres) in Yelm, Washington (Figure 1).

Methods and Site Conditions

Survey methods followed the Thurston County MPG detection protocol and survey guidance provided by United States Fish and Wildlife Service (USFWS April 2018). The soil type on the parcel was Spanaway gravelly sandy loam 0 to 3% slopes (more preferred by MPG) based on the data obtained from Thurston County GeoData (Figure 1). The WDFW PHS database did not show MPG detections within 600 feet of the parcel (Figure 4). The City of Yelm required two site visits for permitting purposes. The USFWS survey guidance recommended three site visits be performed on this parcel due to the presence of more preferred MPG soils, but only two were conducted to satisfy requirements for the gopher study.

The parcel has a single-family home and detached garage in the northeastern corner. A fence yard surrounds the home, and some scattered trees are in that corner of the parcel. The remainder of the parcel is unmaintained and contained some prairie grasses as well as pasture grasses. Surrounding parcels have single-family homes.

MPG Survey Methods

During the survey West Fork Environmental staff surveyed the parcel following the methods described under the USFWS recommended MPG survey protocol (Figure 2 and 3).

Results

Mazama Pocket Gopher

During the surveys, no MPG mounds were identified on the parcel (see datasheets). Three weathered mounds were identified as likely mole mounds on the first survey. Likely mole mounds were identified by circular shape and a linear pattern following the driveway.

Habitat

No mima mounds and no oak trees (*Quercus garryana*) were observed. Several of the CAO target prairie plant species identified in the Thurston County CAO were observed scattered on the parcel – common camas, California oatgrass, prairie lupine, and Roemer's fescue. Garden beds and routinely mowed lawn surround the home. Other species observed included:

Table 1. Plant species observed on the parcel.

Common Name	***Scientific Name***	**Common Name**	***Scientific Name***
Douglas-fir	*Pseudotsuga menziesii*	Ribwort	*Plantago lanceolata*
St. John's wort	*Hypericum perforatum*	Red clover	*Trifolium pratense*
Yarrow	*Achillea millefolium*	Sheep sorel	*Rumex acetosella*
Oxeye daisy	*Leucanthemum vulgare*	Catsear	*Hypochaeris radicata*
Queen Anne's Lace	*Daucus carota*	White clover	*Trifolium repens*
Himalayan blackberry	*Rubus armeniacus*	Velvet grass	*Holcus lanatus*
English ivy	*Hedera helix*	Colonial bentgrass	*Agrostis capillaris*
English holly	*Ilex aquifolium*	Quackgrass	*Elymus repens*
Scots broom	*Cytisus scoparius*	Red fescue	*Festuca rubra*
Kentucky bluegrass	*Poa pratensis*	Orchard grass	*Dactylis glomerata*

Conclusions

No MPG mounds were observed on the parcel on either site visit. The results of this survey are based on standardized methodologies and follow guidance provided by the USFWS and the Washington Department of Fish and Wildlife provided during June 2018 training. The 2021 City of Yelm Inspection Protocol and Procedures required two site visits for permitting purposes. While USFWS guidance suggested three site visits due to the presence of more preferred MPG soils, only two were performed to satisfy permitting requirements and are summarized in this report. All findings presented within this report are subject to the final review and approval of City of Yelm gopher review. If you have any questions regarding the information provided within this document, please contact our office at (360) 753-0485.

Sincerely,

Heidy Barnett
Biologist

Attachments: Representative site photos, survey transects, datasheets (Thurston County MPG datasheet)

Site Photos



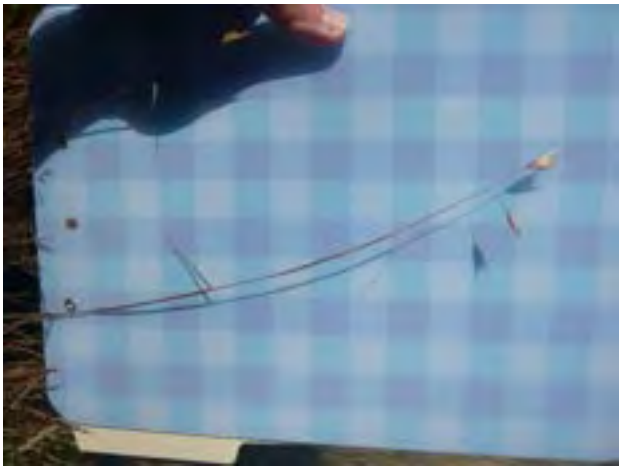
Single family home and detached garage.





Representative habitat.


Left – prairie lupine (a few scattered). Right – common camas seed pods (scattered in SW and under fruit trees) .

Left – Roemer's fescue (scattered in west). Right – California oatgrass (in SW corner).

Figure 1. Parcel location and soil types.

Figure 2. Survey tracks from June 18, 2021.

Figure 3. Survey tracks from July 19, 2021.

Figure 4. Results of Washington Department of Fish and Wildlife Prioirty Habitats and Species database report (areas withing 600 feet of the parcel).

Priority Habitats and Species on the Web

Buffer radius: 600 Feet

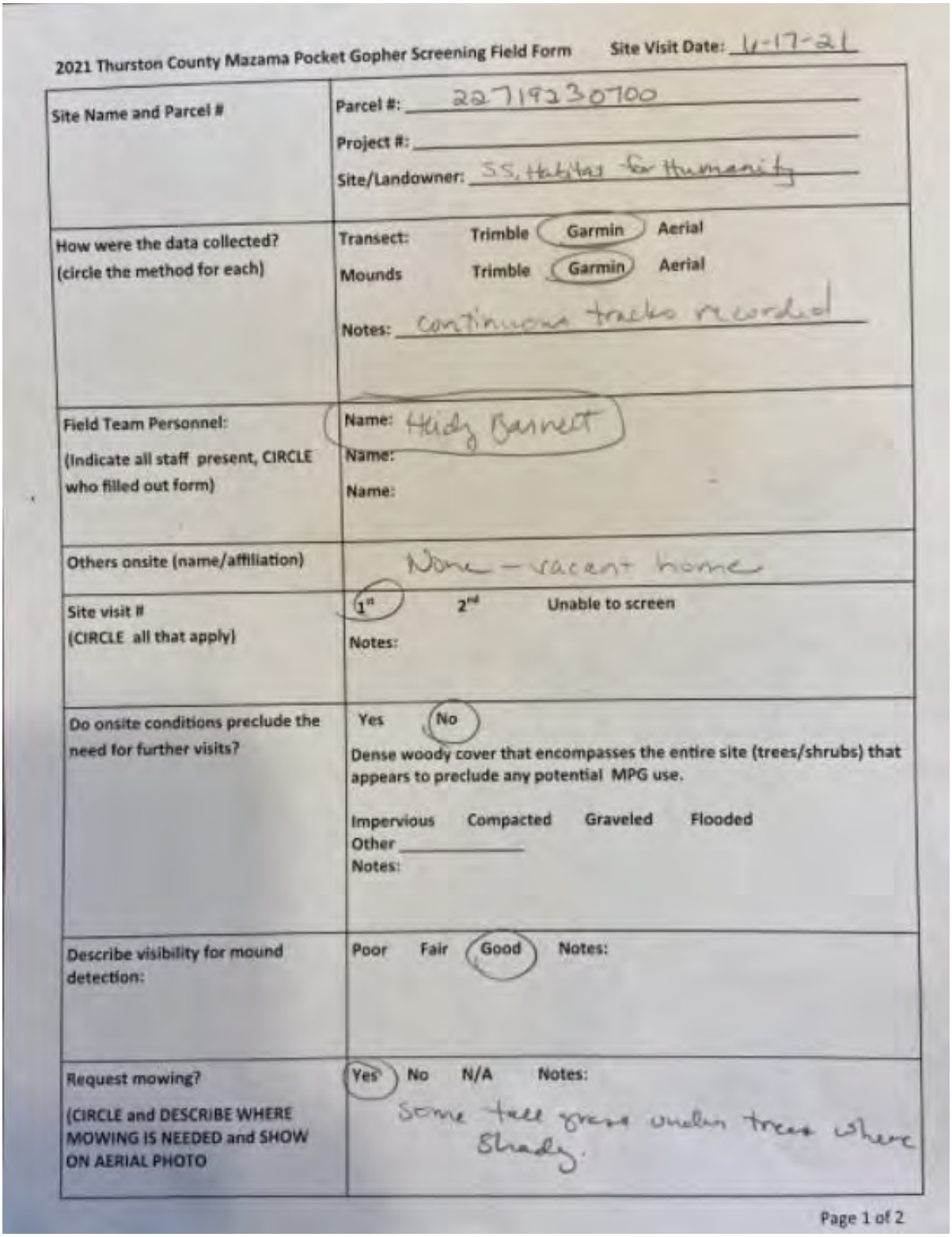
Report Date: 06/15/2021, Parcel ID: 22719230700

PHS Species/Habitats Overview:

Occurence Name	Federal Status	State Status	Generalized Location
Freshwater Forested/Shrub Wetland	N/A	N/A	No
Little Brown Bat	N/A	N/A	Yes
Townsend's Big-eared Bat	N/A	Candidate	Yes
Yuma myotis	N/A	N/A	Yes

PHS Species/Habitats Details:

Datasheets



2021 Thurston County Mazama Pocket Gopher Screening Field Form Site Visit Date: 1-17-21

Site Name and Parcel #	Parcel #: 22719230700 Project #: Site/Landowner: SS. Habitat for Humanity
How were the data collected? (circle the method for each)	Transect: Trimble (Garmin) Aerial Mounds Trimble (Garmin) Aerial Notes: continuous tracks recorded
Field Team Personnel: (Indicate all staff present, CIRCLE who filled out form)	(Name: Heidy Barnett) Name: Name:
Others onsite (name/affiliation)	None – vacant home
Site visit # (CIRCLE all that apply)	(1st) 2nd Unable to screen Notes:
Do onsite conditions preclude the need for further visits?	Yes (No) Dense woody cover that encompasses the entire site (trees/shrubs) that appears to preclude any potential MPG use. Impervious Compacted Graveled Flooded Other _____ Notes:
Describe visibility for mound detection:	Poor Fair (Good) Notes:
Request mowing? (CIRCLE and DESCRIBE WHERE MOWING IS NEEDED and SHOW ON AERIAL PHOTO	(Yes) No N/A Notes: Some tall grass under trees where shady.

Page 1 of 2

6-17-21

Mounds observed over the whole site are characteristic of:	MPG Mounds	Likely MPG Mounds	Indeterminate	Likely Mole Mounds	Mole Mounds
Quantify or describe amount of each type and approx. # of mounds *Group = 3 mounds or more*	0	0	0	III (3) circular weathered	8
	No MPG mounds (circle)				
MPG mounds in GPS? (CIRCLE and DESCRIBE) If MPG mounds present, entered in GPS?	(None) All Most Some Notes: No MPG mounds observed Yes No N/A				
Does woody vegetation onsite match aerial photo?	(Yes) No - describe differences and show on parcel map/aerial:				
What portion(s) of the property was screened? (CIRCLE and DESCRIBE)	(All) Part - describe and show on parcel map/aerial:				
Notes -	Describe, and show on parcel map/aerial if applicable:				
Team reviewed and agreed to data recorded on form? (CIRCLE, and EXPLAIN if "No")	(Yes) No Reviewed by initials: HB ___ ___ ___ Notes:				

Information provided by Thurston County Government

Page 2 of 2

2021 Thurston County Mazama Pocket Gopher Screening Field Form Site Visit Date: 7-19-21

Site Name and Parcel #	Parcel #: 22719230700 Project #: _____ Site/Landowner: SS. Habitat for Humanity
How were the data collected? (circle the method for each)	Transect: Trimble (Garmin) Aerial Mounds Trimble (Garmin) Aerial Notes: Continuous tracks recorded
Field Team Personnel: (Indicate all staff present, CIRCLE who filled out form)	Name: (Heidy Garnett) Name: Name:
Others onsite (name/affiliation)	—
Site visit # (CIRCLE all that apply)	1st (2nd) Unable to screen Notes:
Do onsite conditions preclude the need for further visits?	Yes (No) Dense woody cover that encompasses the entire site (trees/shrubs) that appears to preclude any potential MPG use. Impervious Compacted Graveled Flooded Other _____ Notes:
Describe visibility for mound detection:	Poor Fair (Good) Notes:
Request mowing? (CIRCLE and DESCRIBE WHERE MOWING IS NEEDED and SHOW ON AERIAL PHOTO	Yes (No) N/A Notes:

Page 1 of 2

7-19-21

Mounds observed over the whole site are characteristic of: Quantify or describe amount of each type and approx. # of mounds *Group = 3 mounds or more*	MPG Mounds	Likely MPG Mounds	Indeterminate	Likely Mole Mounds	Mole Mounds
	0	0	0	0	0
	No MPG mounds (circle)				
MPG mounds in GPS? (CIRCLE and DESCRIBE) If MPG mounds present, entered in GPS?	None All Most Some Notes: No MPG mounds observed Yes No N/A				
Does woody vegetation onsite match aerial photo?	Yes	No - describe differences and show on parcel map/aerial:			
What portion(s) of the property was screened? (CIRCLE and DESCRIBE)	All	Part - describe and show on parcel map/aerial:			
Notes -	Describe, and show on parcel map/aerial if applicable: pere holes dug + filled back in				
Team reviewed and agreed to data recorded on form? (CIRCLE, and EXPLAIN if "No")	Yes	No	Reviewed by initials: HR ___ ___ ___ Notes:		

Information provided by Thurston County Government

Page 2 of 2

LDC Surveying Engineering Planning

Memo

To: Sara Williams, Assistant Planner, City of Yelm

From: Mallory Dobbs, Civil Engineer, LDC, Inc.

Date: July 28, 2022

Re: Habitat for Humanity Yelm Plat Critical Area Report

Introduction

According to the City of Yelm Municipal Code (YMC) 18.21.010.G, critical aquifer recharge areas are considered critical areas. Per YMC 18.21.070.B, the entire city of Yelm and its urban growth area is identified as a highly susceptible critical aquifer recharge area. The purpose of this Critical Area Report is to use scientifically valid methods and studies and field reconnaissance to evaluate the project proposal and all probable impacts to critical areas.

The proposed Habitat for Humanity Yelm PRD project is located at 407 Longmire Street SE in Yelm, WA (Thurston County Tax Parcel No. 22719230700). The site is approximately 2.30 acres (100,188 square feet) and is zoned Moderate Density Residential (R-6). The project will include subdividing the project site into 22 lots and on 16 of the new lots a townhome unity will be constructed on 6 of the lots a detached single-family house will be constructed. The project will also include the construction of a new internal private road, frontage improvements along Longmire St SE, utility extensions, stormwater facilities, and open space.

Per YMC 13.16.020, the city of Yelm utilizes the manual adopted by reference and prepared by the Department of Ecology that contains BMPs to prevent or reduce pollution (or a technically equivalent manual approved by the Department of Ecology). Therefore, the proposed project will utilize the 2019 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) for the proposed stormwater improvements thus protecting the critical aquifer recharge area. No other critical areas are located on the proposed project site.

Stormwater Design

Per Thurston County GIS, the entire parcel is located within the Category 1 Critical Aquifer Recharge Area (CARA). Per Volume I Section 4.10 of the SWMMWW, at a minimum, basic treatment to remove solids prior to discharge to an infiltration facility is required. Additionally, it is important to note that according to the Washington State Department of Health Well Construction Map, there are no wells within 100' of the proposed stormwater facilities. The proposed project will create over 5,000 s.f. of new impervious surfaces and therefore will trigger Minimum Requirements #1-9 for the new and replaced hard surface and the land disturbed. Source control BMPs will be implemented to prevent any potential pollution to the aquifer, however, the use of the site is residential and therefore is not anticipated to have pollution generating activities on-site. The stormwater system for the proposed project will consist of catch basins located through the private roadway to collect the stormwater runoff from the majority of the project parcel. The stormwater runoff will then be conveyed to a bioretention pond that will provide the stormwater runoff with enhanced treatment prior to infiltrating into the ground. Per Minimum Requirement #5, the proposed roof areas will utilize individual drywells located on each lot. The roof areas will not be metal or be considered a pollution generating impervious surface and therefore is safe to infiltrate within the CARA. The proposed utility plan and critical areas map has been provided as Attachment 1 of this document. The preliminary drainage report prepared by LDC, Inc. dated July 2022 provides additional information regarding the proposed project improvements.

Conclusion

This report assumes that all proposed improvements will be built per the construction drawings.
The proposed stormwater improvements meet the requirements of the Department of Ecology and therefore adverse affects to the critical aquifer recharge area are not anticipated with the construction of this project.

HABITAT FOR HUMANITY

Yelm, WA

TRAFFIC IMPACT ASSESSMENT (TIA)

April 20, 2023

HEATH & ASSOCIATES

Transportation Planning & Engineering

HABITAT FOR HUMANITY
TRAFFIC IMPACT ANALYSIS

Prepared for:

South Puget Sound Habitat for Humanity
Attn: Ben Fransua
711 Capital Way South, Suite 401
Olympia, WA 98501
c/o LDC Engineering

Prepared by:

Heath & Associates
PO Box 397
Puyallup, WA 98371
(253) 770 1401
Heathtraffic.com

License:

04/20/2023

HABITAT FOR HUMANITY
TRAFFIC IMPACT ANALYSIS

CONTENTS

TABLES

FIGURES

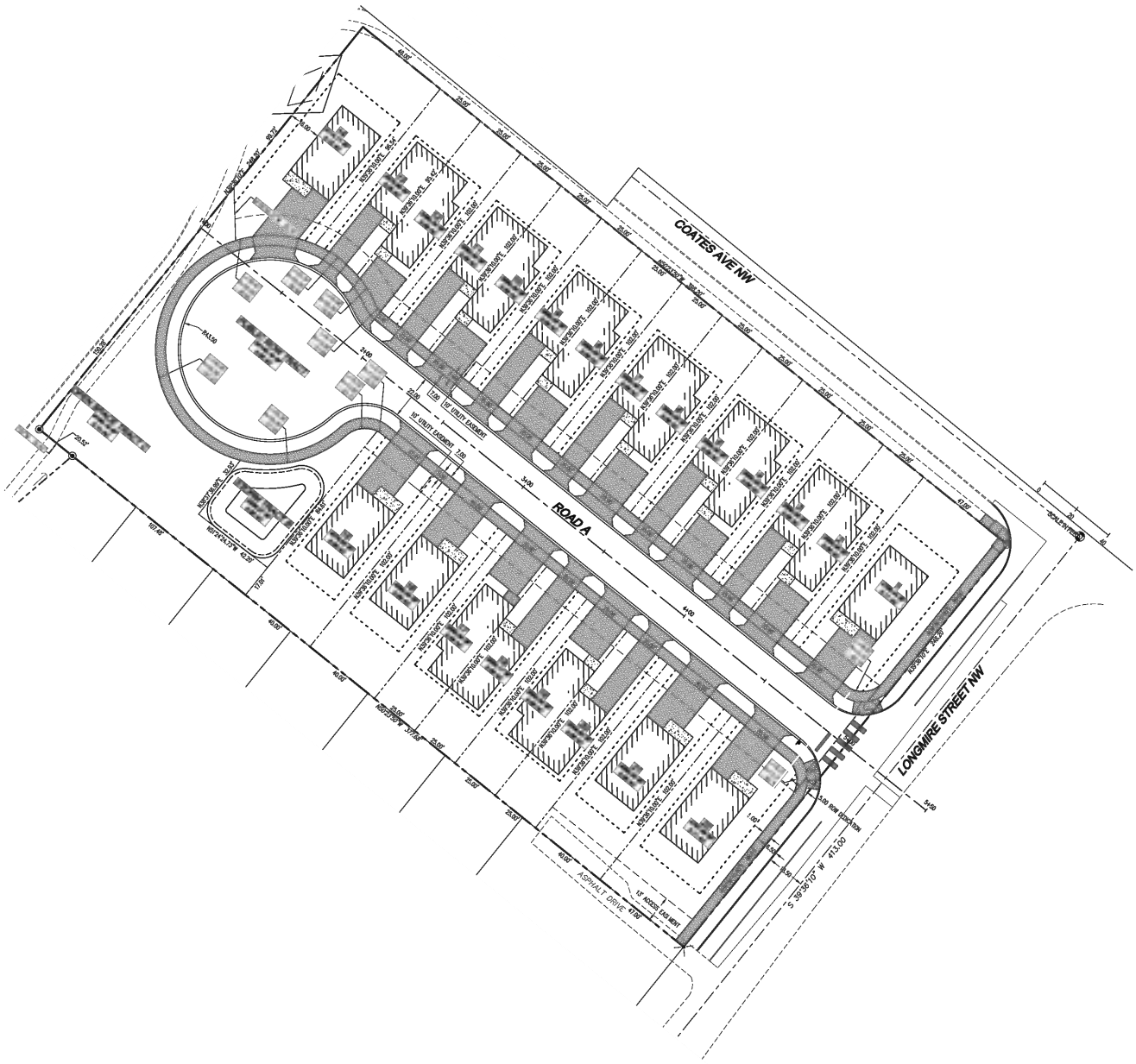
HABITAT FOR HUMANITY
TRAFFIC IMPACT ANALYSIS

1. INTRODUCTION

Heath & Associates has been retained to prepare a Traffic Impact Analysis (TIA) for a proposed residential development within the city of Yelm limits. This analysis will evaluate baseline conditions within the study area, project new trips created from the development, and reevaluate operations to ensure mobility standards meet adopted Level of Service (LOS) standards.

2. PROJECT DESCRIPTION

Habitat for Humanity – Yelm is a proposed residential project comprised of 22 income-restricted single-family dwelling units located within the city of Yelm. The subject site has a site address of 407 Longmire Street NW and is comprised of 2.3-acres within tax parcel #: 22719230700. Units are a mix of cottage to duplex as illustrated in the provided site plan. Access is proposed via a single private driveway from Longmire Street NW. However, the City requested examination of additional access scenarios including: a single access to Cullens Road; and a new public roadway through the site whereby access to both Cullens Road and Longmire Street would be achieved. A vicinity map is provided below which highlights the subject site in red. Figure 2 on the following page illustrates the proposed site plan with the preferred access alternative (Longmire Street).



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Transportation Planning & Engineering

HABITAT FOR HUMANITY - YELM

SITE PLAN
FIGURE 2

3. EXISTING CONDITIONS

3.1 Existing Street System

The primary roadways serving the project are described below.

Cullens Road SE: is a north-south, two-lane neighborhood collector bordering the subject site to the west. The roadway's cross-section consists of one travel lane in each direction and a four-foot shoulder along the east side. Sidewalks are discontinuous but are available along the subject frontage. The posted speed limit is 25-mph.

Coates Road SE: is an east-west, two-lane neighborhood collector bordering the subject site to the north. The roadways cross section consists of one travel lane in each direction and four-foot paved shoulders along either side. Curb, gutter, and sidewalk is provided along either side of the roadway east of the intersection with Cullens Road SE. The posted speed limit is 25-mph.

NW Longmire Street: is a northeast-southwest, two-lane local access residential roadway bordering the subject site to the east. The posted speed limit is 25-mph. Sidewalk is generally unavailable with the exception of a short ~300-foot segment along the west side between Coates Avenue NW and SR 510.

3.2 Roadway Improvements

The city of Yelm's most recent (2022-2027) Transportation Improvement Plan and the Washington State STIP (Statewide Transportation Improvement program) (2023-2026) were both reviewed and indicates improvements are planned in the vicinity of the project. Each project is listed and describes below.

City of Yelm:

Coates Ave NW (ID #: WA-10293): This project entails the reconstruction of Coates Road SE from Cullens Road to Killion Road. The roadway will include sidewalks, curb, gutter, full utilities, streetlights, stormwater, water, sewer, septic, power, gas, and future fiber system.

Longmire / SR 510 Intersection (ID #: Yelm5B 16): This project entails the construction of a signal at the intersection of Longmire Street SE & SR 510.

3.3 Transit Service

A review of the Intercity Transit regional bus schedule indicates that transit is available within walking distance (under 1.0-mile) for future project residents. The closest stop in relation to the subject site is located along SR 510 between Cullens Street and Longmire Street at approximately 1,200 feet measured via walking routes.

The bus route served at the intersection is Route 94 – Boulevard Road/Yelm. Route 94 provides service from the Olympia Transit Center to the Yelm Walmart. Weekday service is provided from 6:04 AM – 9:45 PM with approximately 60-minute headways during peak travel times. Weekend service is provided from 7:15 AM – 9:45 PM with approximately 60-minute headways. Refer to the Intercity Transit website for more detailed information.

3.4 Existing Peak Hour Volumes and Travel Patterns

Field data for this study were collected in April 2023 at the following study intersections:

1. Cullens Road & Coates Avenue
2. Longmire Street & Coates Avenue

Counts were administered between the commute peak period from 4:00-6:00 p.m. to establish baseline volume conditions in the vicinity.

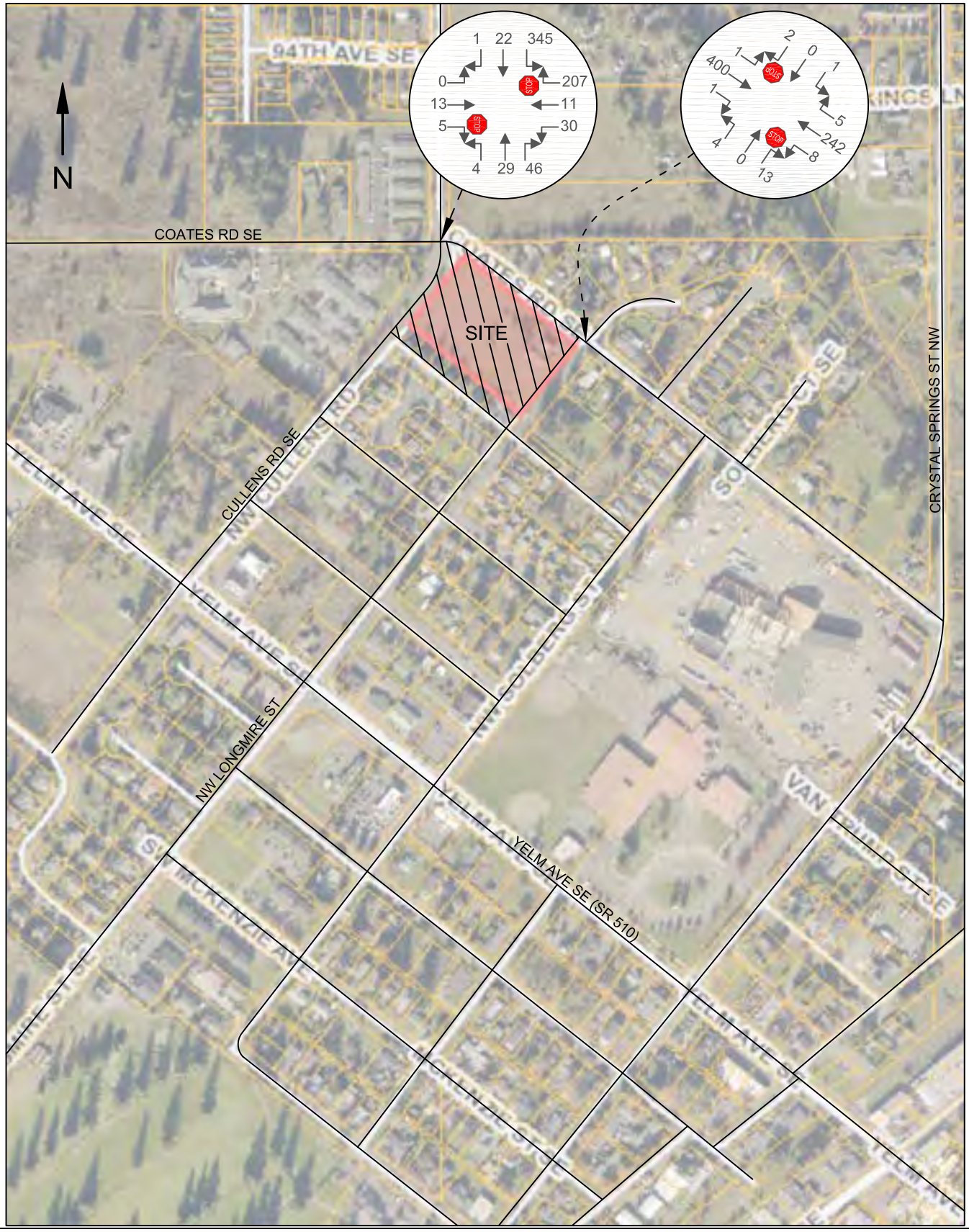
Table 1: Existing PM Peak Hour Volumes

Intersection	Control Type	Peak Hour	Total Entering Volumes
Cullens Road & Coates Avenue	Two-way Stop	4:00-5:00 p.m.	713
Longmire Street & Coates Avenue	Two-way Stop	4:00-5:00 p.m.	677

Figure 3 on the following page illustrates the turning movement volumes for each study intersection. Full count sheets are available within the appendix.

3.5 Non-Motorist Activity

Pedestrian and bicycle activity were observed at the study intersection studied for this project during routine PM peak hour field counts. Pedestrians were noted crossing each study intersection. No bicycles were observed traversing the intersection. See Figure 4 for pedestrian activity at the two outlying study intersections.



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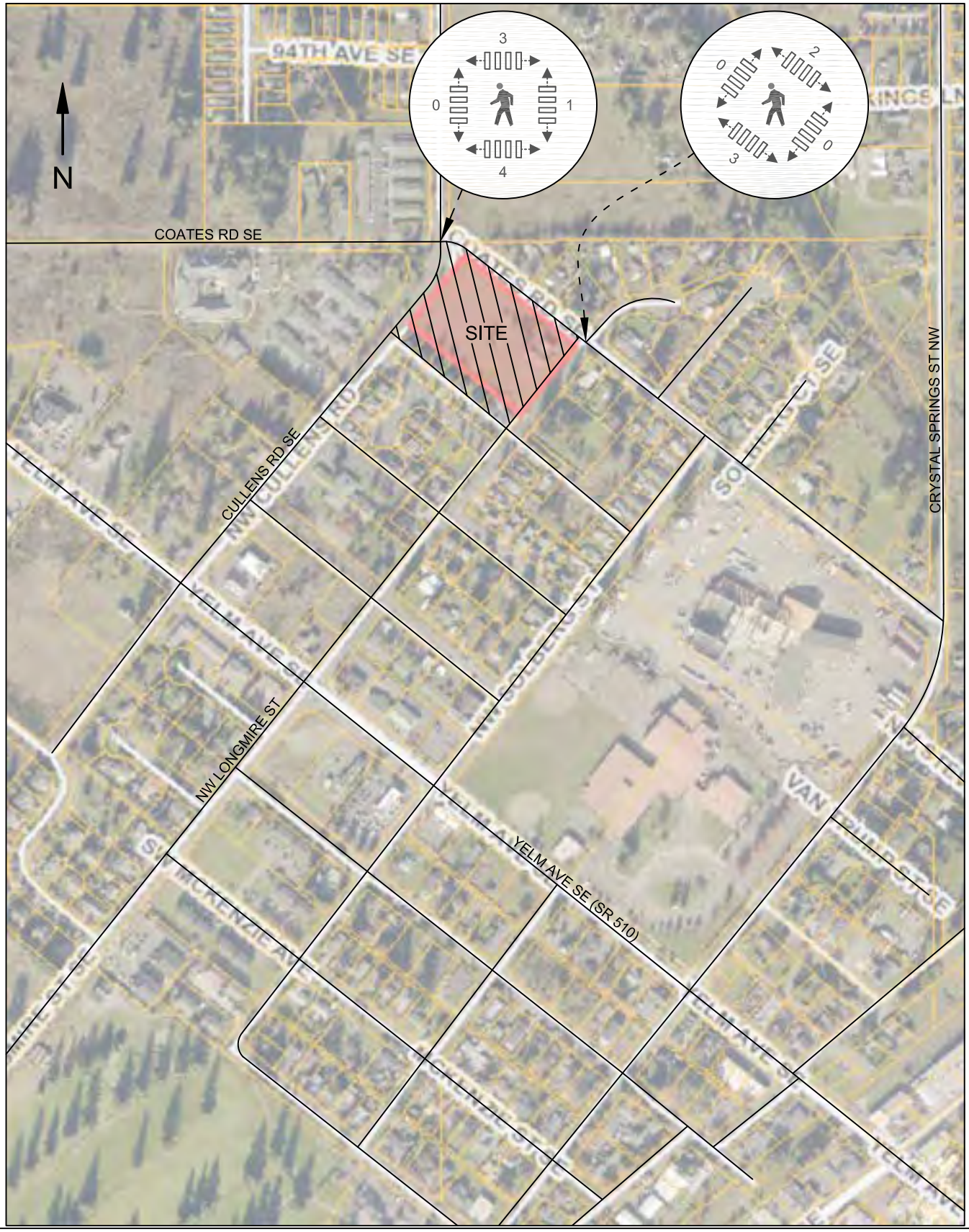
HABITAT FOR HUMANITY - YELM

EXISTING PM PEAK HOUR VOLUMES
FIGURE 3



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HABITAT FOR HUMANITY - YELM

PM PEAK HOUR PEDESTRIAN VOLUMES
FIGURE 4

3.6 Existing Level of Service

Peak hour delays were determined through methodologies prescribed in the *Highway Capacity Manual* 6th Edition. Capacity analysis is used to determine level of service (LOS) which is an established measure of congestion for transportation facilities. The range[1] for intersection level of service is LOS A to LOS F with the former indicating the best operating conditions with low control delays and the latter indicating saturated conditions with heavy control delays. Detailed descriptions of intersection LOS are given in the 2016 Highway Capacity Manual. Level of service calculations were made through the use of the *Synchro 11* analysis program. For side-street stop-controlled intersections, LOS is determined by the movement with the highest delay. Table 2 below summarizes existing LOS delays for the study intersection.

Table 2: Existing PM Peak Hour Level of Service

Delays Given in Seconds per Vehicle

Intersection	Control	Critical Movement	LOS	Delay
Cullens Rd & Coates Ave	Two-Way Stop	EB	C	19.3
		WB	B	14.8
Longmire St & Coates Ave	Two-Way Stop	NB	B	12.3
		SB	B	11.9

City Level of Service Standards[2]: Yelm has an adopted a Level of Service Standard D.

Existing PM peak hour level of service is shown to meet city standards operating with LOS B conditions.

---

[1] *Signalized Intersections - Level of Service*

Level of Service	Control Delay per Vehicle (sec)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

Stop Controlled Intersections – Level of Service

Level of Service	Control Delay per Vehicle (sec)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Highway Capacity Manual, 6th Edition

[2] Yelm Comprehensive Plan.

4. FORECAST TRAFFIC DEMAND & ANALYSIS

4.1 Project Trip Generation

Trip generation is defined as the number of vehicle movements that enter or exit the respective project site during a designated time period, such as a specific peak hour (AM or PM) or an entire day. Trip estimates for the project have been derived through the Institute of Transportation Engineers (ITE) publication, *Trip Generation Manual,* 11th Edition. Land Use Code (LUC) 215 – Single-Family Attached Housing was applied given the townhouse style units being proposed. It should also be taken into consideration that the units will all be income-restricted which could influence trip rates potentially lower. Average rates were applied against the number of proposed dwelling units (22). Table 3 below summarizes the trip generation.

Table 3: Project Trip Generation

Land Use	Dwelling Units	AWDT	AM Peak-Hour Trips			PM Peak-Hour Trips		
			In	Out	Total	In	Out	Total
LUC – 215 Single-Family Attached	22	158	3	8	**11**	7	6	**13**

Based on ITE data, the project is estimated to generate 158 average weekday daily trips with 11 trips occurring in the AM peak hour and 13 trips occurring in the PM peak hour.

4.2 Site Access

Per the provided site plan, a single access is proposed via a new private roadway extending west from Longmire Street. The City has requested examination of additional access scenarios which include: access solely to Cullens Road; and a new east/west public roadway providing access to both Longmire Street and Cullens Road.

Functional Classification

Typically, access connections are provided to the lowest classified fronting roadway whenever possible. Between the two options, Longmire Street, a local access, is functionally lower classified when compared to Coates Street, a neighborhood collector.

Advantage: Longmire Street

Intersection Spacing

Per City of Yelm Engineering Standards, the following intersections spacing requirements are identified:

Neighborhood Collector (Cullens) – 200 feet

Local Access (Longmire) – 150 feet

Advantage: Longmire Street

Sight Distance

Both Longmire Street and Cullens Road have posted speed limits of 25-mph. Per AASHTO Standards[3], a minimum of 280 feet of unobstructed view is needed to meet entering sight distance (ESD) and 155-feet of stopping sight distance (SSD). Preliminary review of the access points indicates sight distance requirements appear to be met under either scenario.

Advantage: Tie

4.2 Distribution & Assignment

Trip distribution describes the process by which project generated trips are dispersed on the roadway network surrounding the site. Trip distribution percentages are based on Thurston Regional Planning Council (TRPC) TAZ Map 744. The following scenarios have been included:

1. Access to Longmire Street Only (Preferred Alternative) (A)
2. Access to Cullens Road Only (B)
3. New Local Roadway Providing Connectivity Between Longmire & Cullens (C)

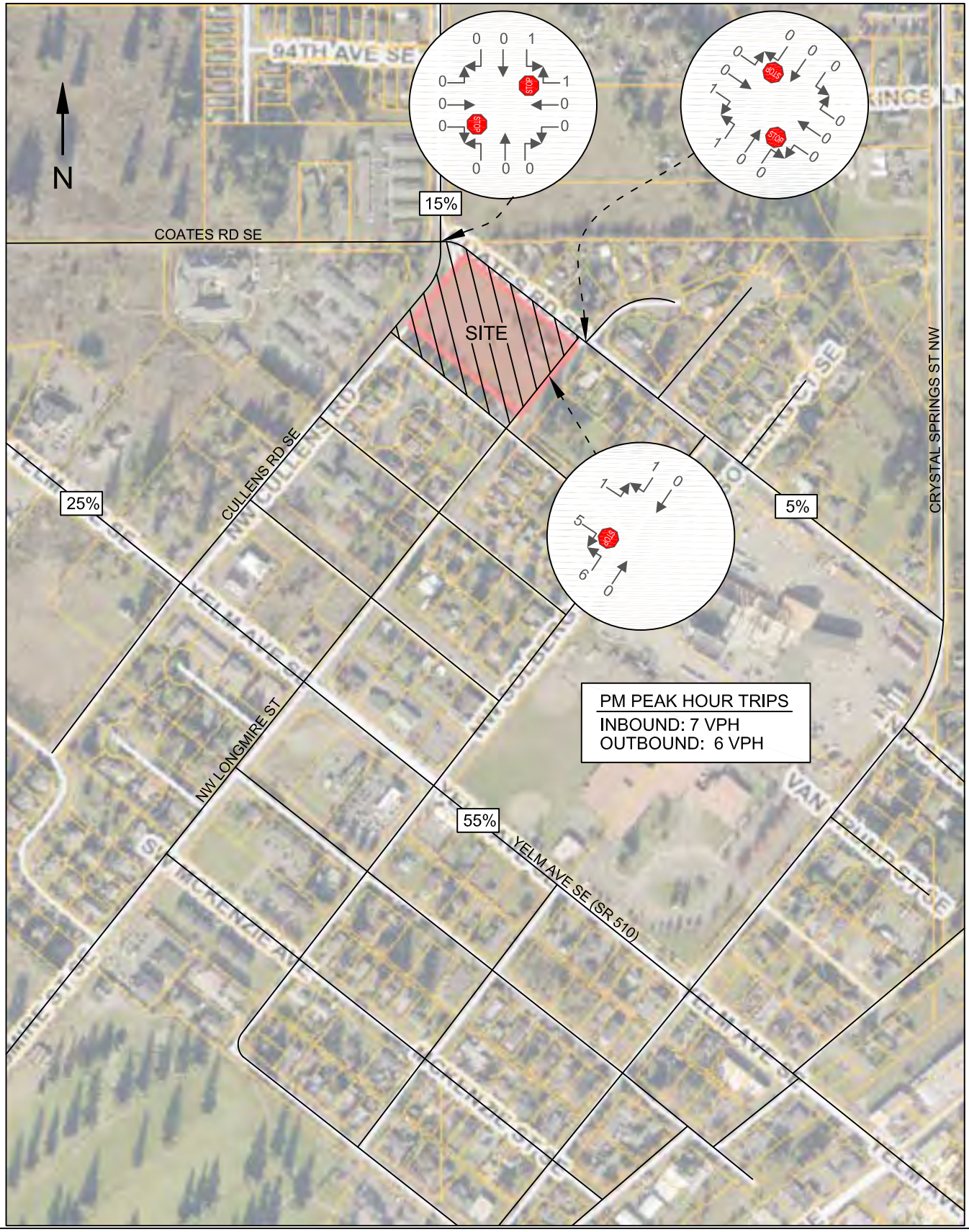
Figures 5A, 5B, and 5C reflect the trip assignment for respective access scenarios above. Scenario 3 with a new east/west public route may generate some background traffic. However, given the existing volumes along both Cullens and Longmire, background traffic is estimated to be minimal. Background volumes using the new connection have been inserted to present conservative analysis.

4.3 Future Peak Hour Volumes

A 3-year horizon of 2026 was used for future traffic delay analysis. Forecast 2026 background traffic volumes were derived by applying a one percent compound annual growth rate to the existing volumes shown in Figure 3. This growth rate is considered conservative as WSDOT volumes along SR 510 just northwest of NW 1st Street are shown to decrease from 2016 (ADT – 17,000) to 2019 (ADT – 16,000) (pre-COVID conditions). Moreover, also taken into consideration are in-process developments within the city which includes: The Hutch, Durant Street Plat, Alpine Estates, Tahoma Boulevard Apartments, El Rey Burro, The Summit at Thompson Creek, and Samantha Ridge. Each development was examined and accounted for; however, given the site's location, pipeline traffic is expected to be nominal as shown in Figure 5.

Forecast 2026 PM peak hour volumes without the project (background growth plus pipeline) are shown in Figure 6 while Figure 7 illustrates forecast 2026 volumes with the addition of project-generated traffic.

[3] AASHTO Green Book (pg. 4.13)



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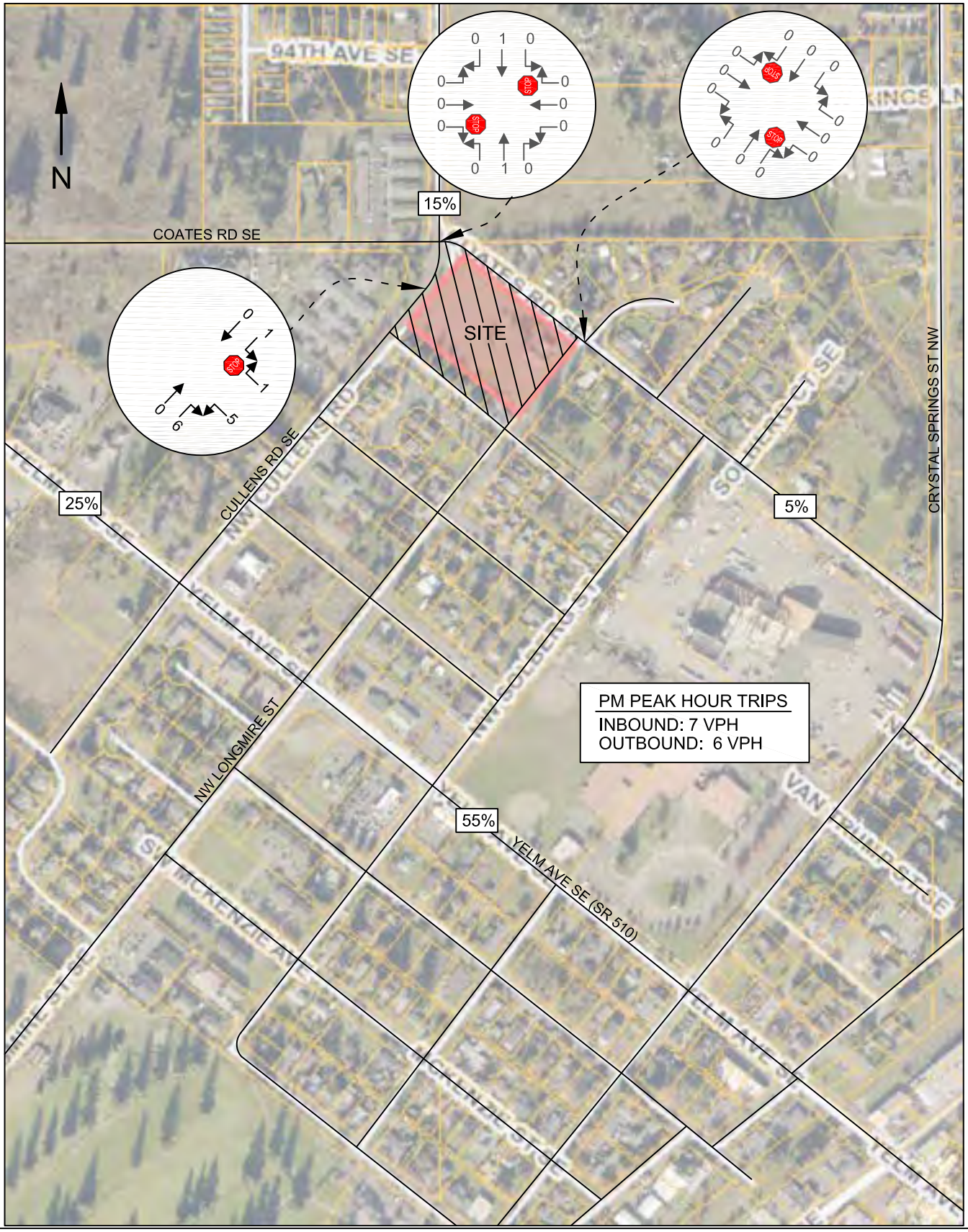
HABITAT FOR HUMANITY - YELM

PM PEAK HOUR TRIP DISTRIBUTION & ASSIGNMENT - SCENARIO 1
FIGURE 5A



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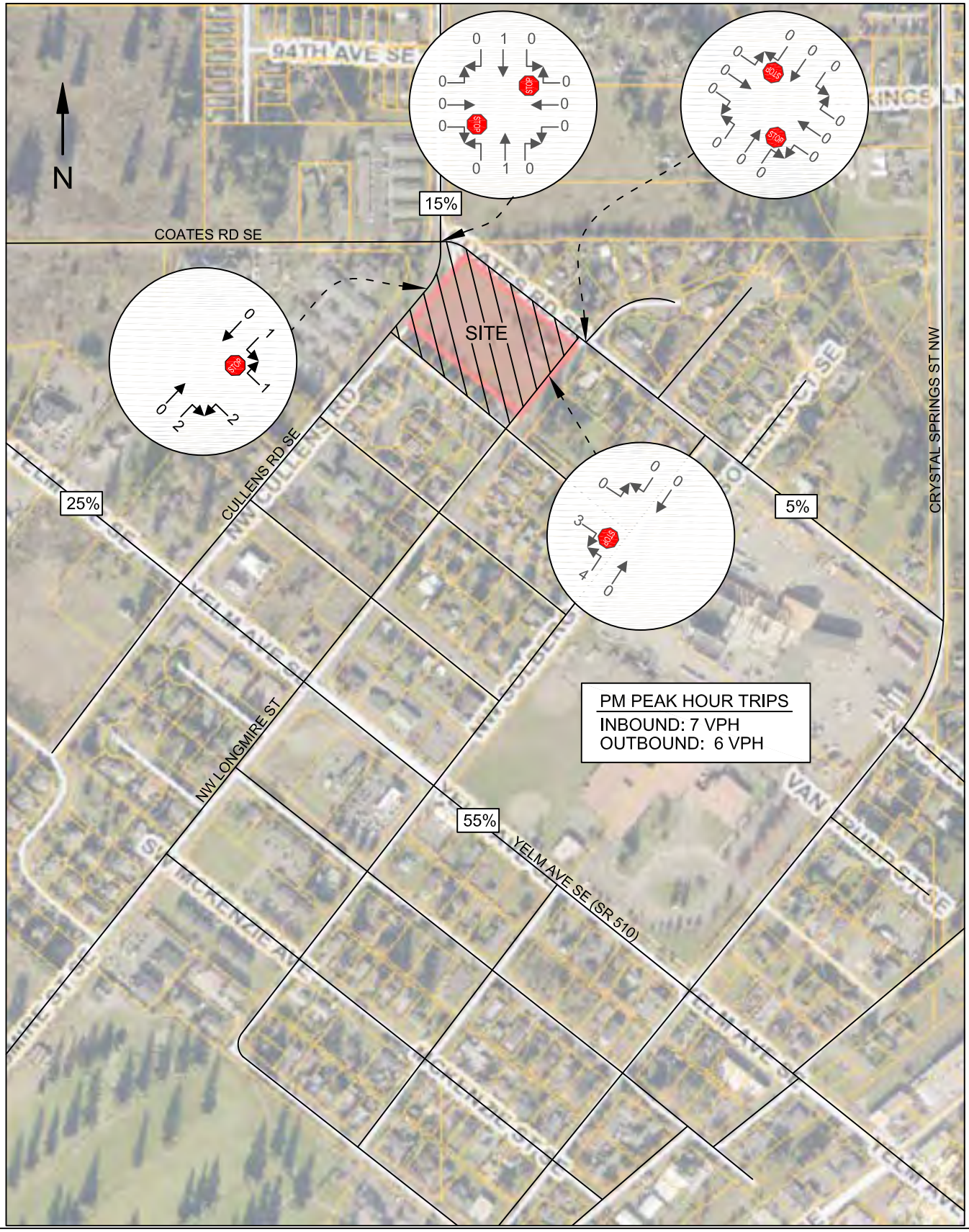
PM PEAK HOUR TRIP DISTRIBUTION & ASSIGNMENT - SCENARIO 2
FIGURE 5B



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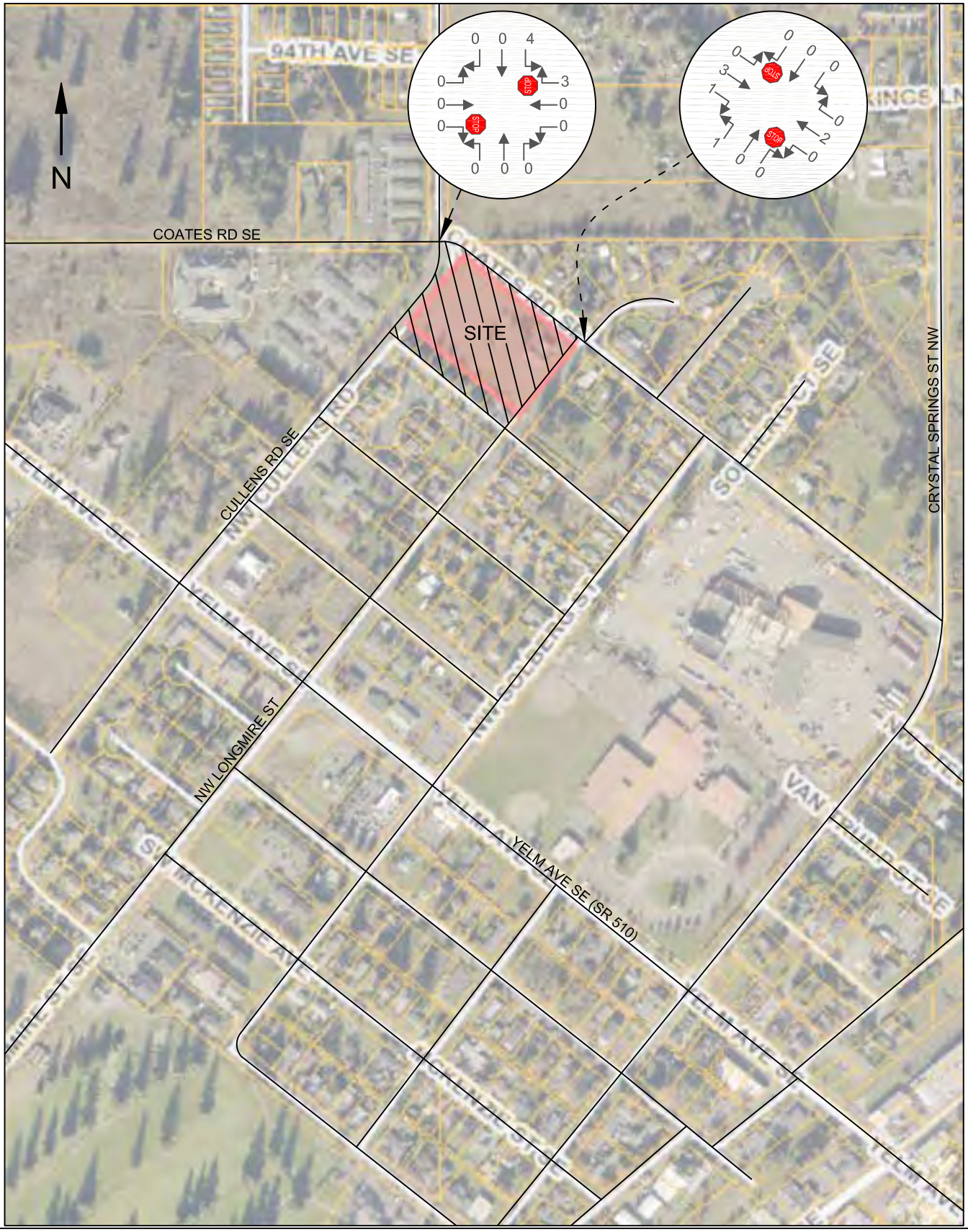
HABITAT FOR HUMANITY - YELM

PM PEAK HOUR TRIP DISTRIBUTION & ASSIGNMENT - SCENARIO 2
FIGURE 5B



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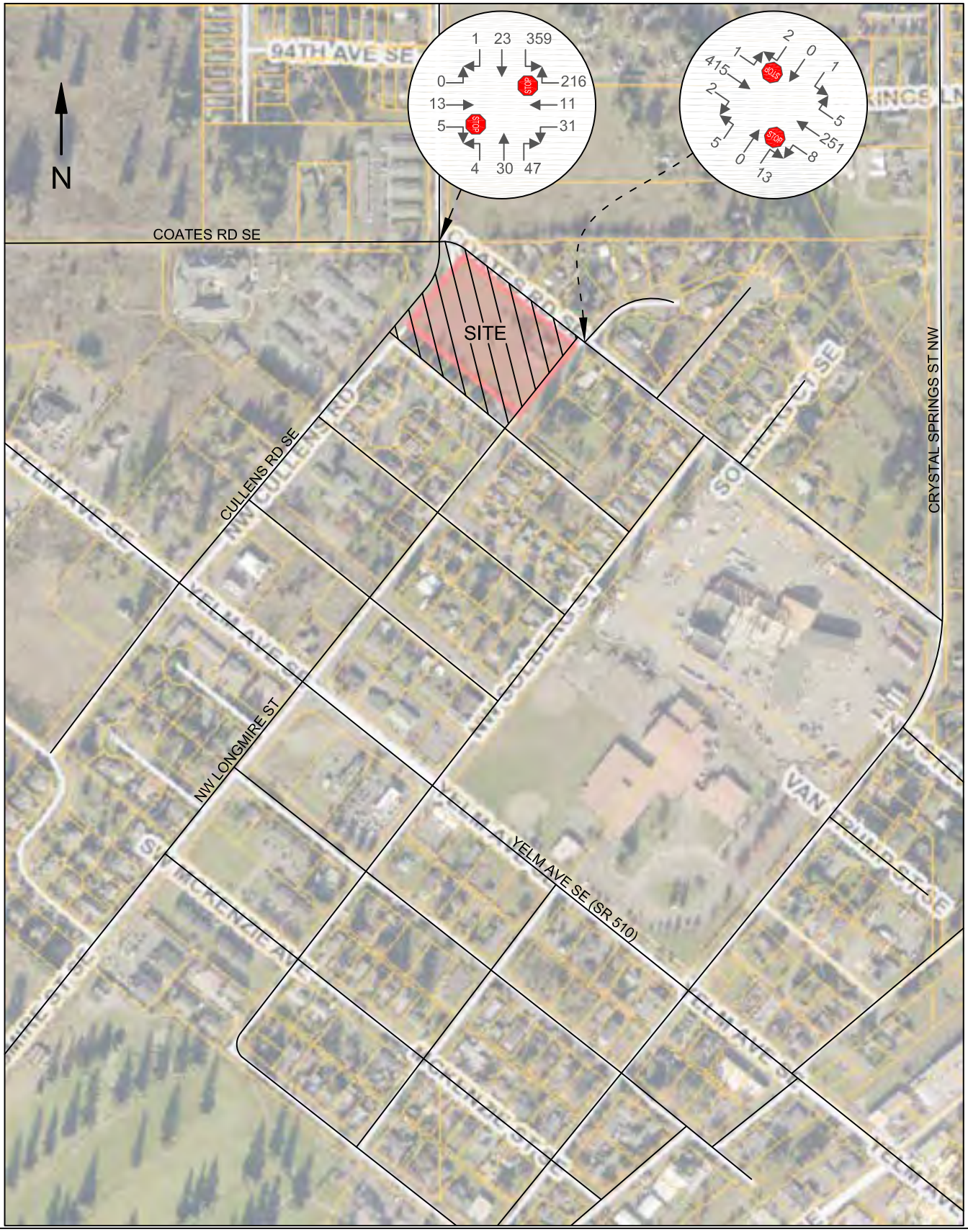
HABITAT FOR HUMANITY - YELM

PM PEAK HOUR PIPELINE VOLUMES
FIGURE 6



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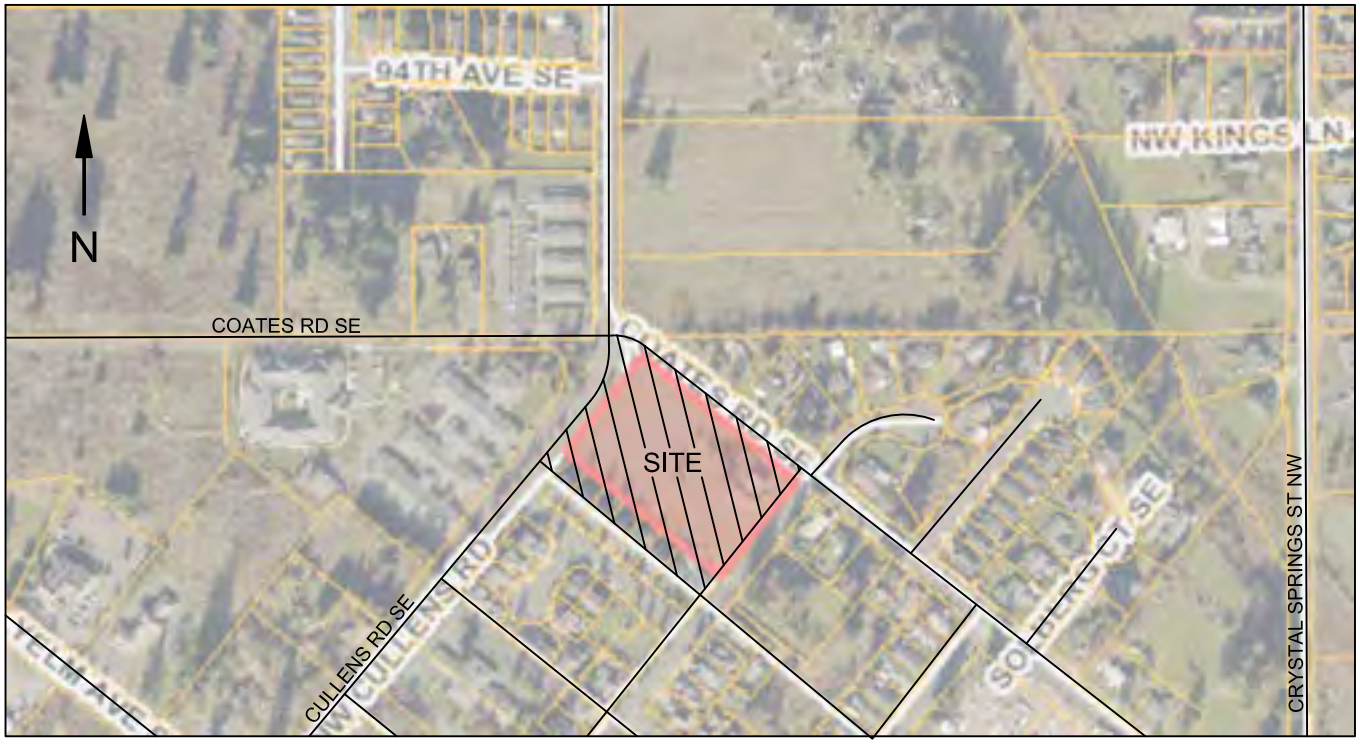
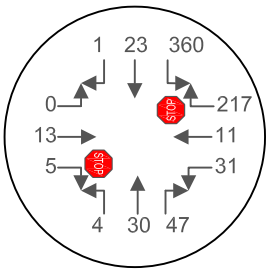
HABITAT FOR HUMANITY - YELM

FORECAST 2026 PM PEAK HOUR VOLUMES WITHOUT PROJECT
FIGURE 7

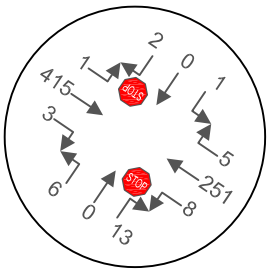


SCENARIO 1
LONGMIRE ACCESS

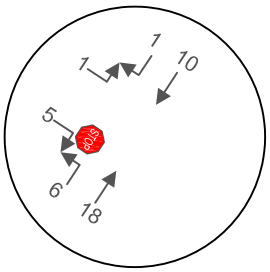
CULLEN RD SE & COATES RD SE



NW LONGMIRE ST & COATES RD SE

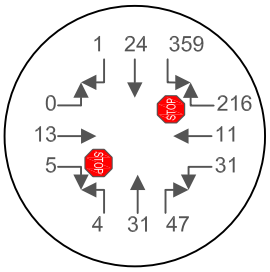


NW LONGMIRE ST & ACCESS

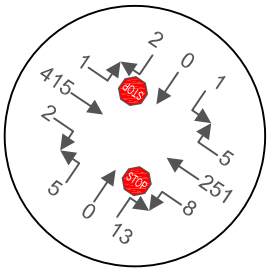


SCENARIO 2
CULLENS ACCESS

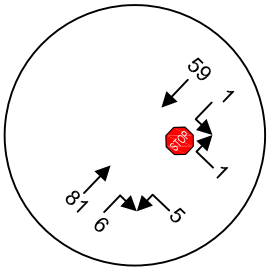
CULLEN RD SE & COATES RD SE



NW LONGMIRE ST & COATES RD SE

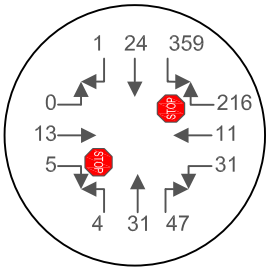


CULLENS RD SE & ACCESS

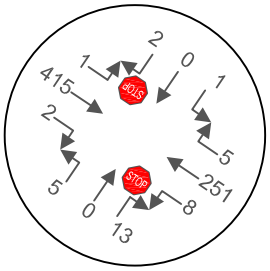


SCENARIO 3
LONGMIRE + CULLENS ACCESS

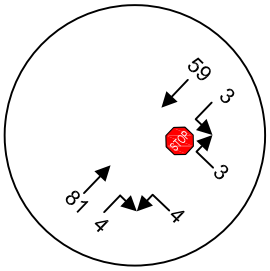
CULLEN RD SE & COATES RD SE



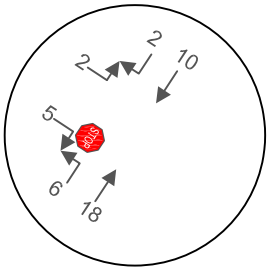
NW LONGMIRE ST & COATES RD SE



CULLENS RD SE & ACCESS



NW LONGMIRE ST & ACCESS



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HABITAT FOR HUMANITY - YELM

FORECAST 2026 PM PEAK HOUR VOLUMES WITH PROJECT
FIGURE 8

4.4 Future Level of Service

Level of service analyses were made of the future peak hour volumes without (background) and with project related trips added to the key roadways and intersections. This analysis once again involved the use of the *Synchro 11* analysis program. Delays for the study and access intersections under future 2026 PM peak hour conditions without project generated traffic are shown below in Table 4. Table 5 displays the forecast 2026 PM peak hour volumes with the project generated traffic doe each access scenario.

Table 4: Forecast 2026 Weekday PM Peak Hour Level of Service Without Project

Delays Given in Seconds per Vehicle

Intersection	Control	Critical Movement	LOS	Delay
Cullens Rd & Coates Ave	Two-Way Stop	EB	C	20.2
		WB	C	15.6
Longmire St & Coates Ave	Two-Way Stop	NB	B	12.8
		SB	B	12.1

Table 5: Forecast 2026 Weekday PM Peak Hour Level of Service With Project

Delays Given in Seconds per Vehicle

Intersection	Control	Scenario	Critical Movement	LOS	Delay
Cullens Rd & Coates Ave	Two-Way Stop	Scenario 1	EB	C	20.2
			WB	C	15.6
		Scenario 2	EB	C	20.3
			WB	C	15.6
		Scenario 3	EB	C	20.3
			WB	C	15.6
Longmire St & Coates Ave	Two-Way Stop	Scenario 1	NB	B	13.1
			SB	B	12.1
		Scenario 2	NB	B	12.8
			SB	B	12.1
		Scenario 3	NS	B	12.8
			SB	B	12.1
NW Longmire St & Access	One-Way Stop	Scenario 1	EB	A	8.5
		Scenario 3	EB	A	8.5
Cullens Rd SE & Access	One-Way Stop	Scenario 2	WB	A	9.7
		Scenario 3	WB	A	9.4

Forecast 2026 PM peak hour level of service (LOS) is shown to operate with LOS C conditions or better with or without project generated traffic for either scenario. All LOS analysis is shown to meet City LOS standards. Given the relatively minor trip generation from the project (13 peak hour trips), no significant impact is identified and each scenario results in only modest changes in delay.

4.5 Left-Turn Warrant Analysis

Left turn lanes are a means of providing necessary storage space for left turning vehicles at intersections. Based on low volumes along both Cullens Road SE and NW Longmire Street at the point of each proposed access, a left turn lane would not be warranted at either access during any forecast 2026 PM peak hour scenario.

5. CONCLUSIONS & MITIGATION

Habitat For Humanity is proposing for the construction of 22 single-family, income-restricted dwelling units within the city of Yelm. The subject property is bounded to the north by Coates Avenue, to the east by Longmire Street, and to the east by Cullens Road. The site is contained within 2.3-acres. Access is proposed via a single private roadway from Longmire Street. However, additional scenarios were examined which includes access to Cullens Street only and access to both Longmire and Cullens via a new public roadway.

Baseline conditions for the study intersections of Coates Avenue intersecting with Cullens Road and Longmire Street operate and LOS C and LOS B, respectively. Accounting for in-process development and general background growth, the intersections are anticipated to continue operating LOS C and LOS B conditions under the forecast 2026 horizon year without project traffic. Per ITE data, the 22 proposed dwelling units are estimated to add 158 daily trips and 13 PM peak hour trips. Adding project-generated traffic to the study intersection under forecast 2026 PM peak hour scenario indicates minimal change in LOS.

Taking into consideration the functional classification, traffic volumes, and intersection spacing, this analysis supports the access scenario to Longmire Street.

Based on the analysis above, recommended mitigation is as follows:

1. The subject development would be subject for Transportation Facilities Charge per city of Yelm requirements. The city imposes a fee of $1,497.00 per PM peak hour trip. Initial fees are estimated as follows:

   13 PM Peak Hour Trips x $1,497.00 = $19,461.00.

Please feel free to contact me should you have any questions.

Aaron Van Aken, P.E., PTOE

HABITAT FOR HUMANITY
TRAFFIC IMPACT ANALYSIS

APPENDIX

Heath & Associates

File Name : 5119a
Site Code : 00005119
Start Date : 4/11/2023
Page No : 1

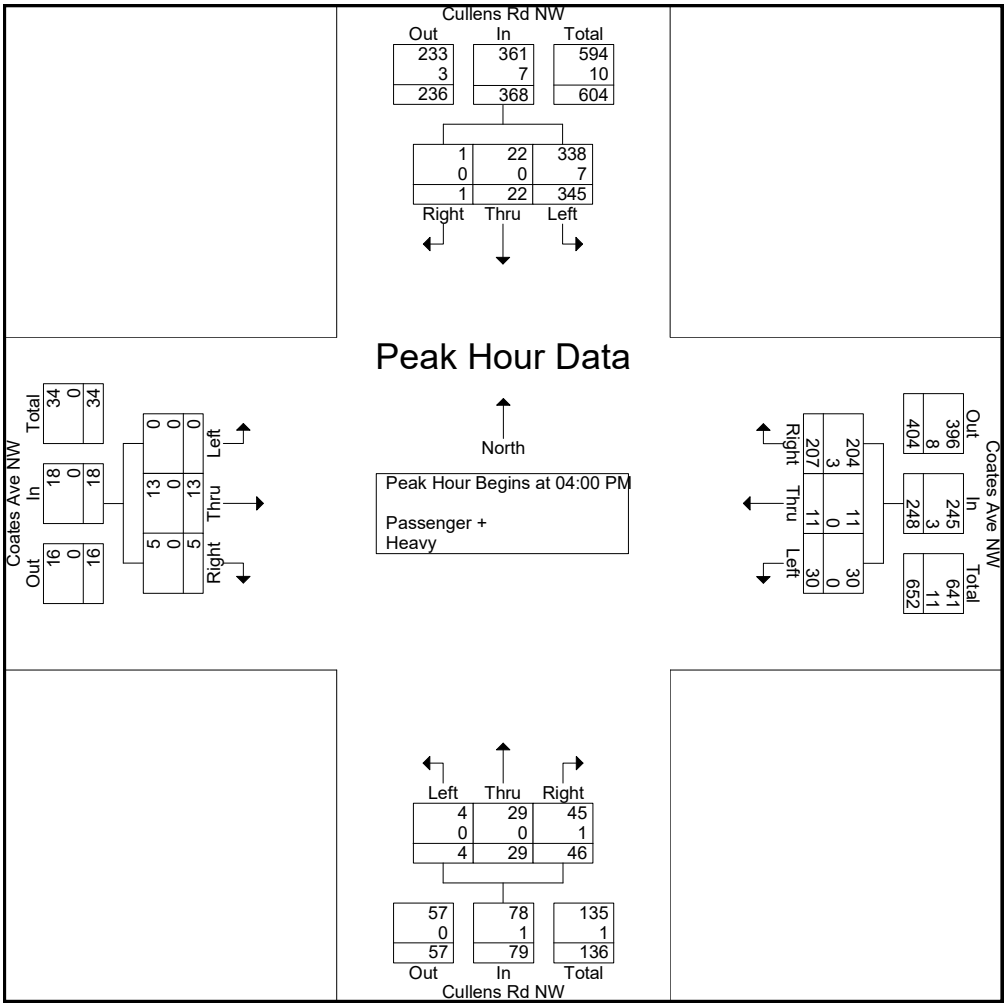
Groups Printed- Passenger + - Heavy

	Cullens Rd NW Southbound				Coates Ave NW Westbound				Cullens Rd NW Northbound				Coates Ave NW Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
04:00 PM	0	5	90	95	68	1	7	76	12	11	1	24	0	4	0	4	199
04:15 PM	0	6	79	85	51	4	5	60	12	4	1	17	2	2	0	4	166
04:30 PM	1	7	93	101	39	3	9	51	7	8	1	16	2	0	0	2	170
04:45 PM	0	4	83	87	49	3	9	61	15	6	1	22	1	7	0	8	178
Total	1	22	345	368	207	11	30	248	46	29	4	79	5	13	0	18	713
05:00 PM	0	6	86	92	43	2	1	46	10	8	1	19	0	1	0	1	158
05:15 PM	0	1	90	91	43	4	4	51	9	11	0	20	0	1	0	1	163
05:30 PM	1	2	90	93	34	1	5	40	4	6	0	10	1	3	0	4	147
05:45 PM	1	2	92	95	44	10	5	59	7	6	1	14	0	1	0	1	169
Total	2	11	358	371	164	17	15	196	30	31	2	63	1	6	0	7	637
Grand Total	3	33	703	739	371	28	45	444	76	60	6	142	6	19	0	25	1350
Apprch %	0.4	4.5	95.1		83.6	6.3	10.1		53.5	42.3	4.2		24	76	0		
Total %	0.2	2.4	52.1	54.7	27.5	2.1	3.3	32.9	5.6	4.4	0.4	10.5	0.4	1.4	0	1.9	
Passenger +	3	33	692	728	368	28	45	441	74	60	6	140	6	19	0	25	1334
% Passenger +	100	100	98.4	98.5	99.2	100	100	99.3	97.4	100	100	98.6	100	100	0	100	98.8
Heavy	0	0	11	11	3	0	0	3	2	0	0	2	0	0	0	0	16
% Heavy	0	0	1.6	1.5	0.8	0	0	0.7	2.6	0	0	1.4	0	0	0	0	1.2

Heath & Associates

File Name : 5119a
Site Code : 00005119
Start Date : 4/11/2023
Page No : 2

	Cullens Rd NW Southbound				Coates Ave NW Westbound				Cullens Rd NW Northbound				Coates Ave NW Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	5	90	95	68	1	7	76	12	11	1	24	0	4	0	4	199
04:15 PM	0	6	79	85	51	4	5	60	12	4	1	17	2	2	0	4	166
04:30 PM	1	7	93	101	39	3	9	51	7	8	1	16	2	0	0	2	170
04:45 PM	0	4	83	87	49	3	9	61	15	6	1	22	1	7	0	8	178
Total Volume	1	22	345	368	207	11	30	248	46	29	4	79	5	13	0	18	713
% App. Total	0.3	6	93.8		83.5	4.4	12.1		58.2	36.7	5.1		27.8	72.2	0		
PHF	.250	.786	.927	.911	.761	.688	.833	.816	.767	.659	1.00	.823	.625	.464	.000	.563	.896
Passenger +	1	22	338	361	204	11	30	245	45	29	4	78	5	13	0	18	702
% Passenger +	100	100	98.0	98.1	98.6	100	100	98.8	97.8	100	100	98.7	100	100	0	100	98.5
Heavy	0	0	7	7	3	0	0	3	1	0	0	1	0	0	0	0	11
% Heavy	0	0	2.0	1.9	1.4	0	0	1.2	2.2	0	0	1.3	0	0	0	0	1.5



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File Name : 5119a
Site Code : 00005119
Start Date : 4/11/2023
Page No : 1

Groups Printed- Passenger + - Heavy

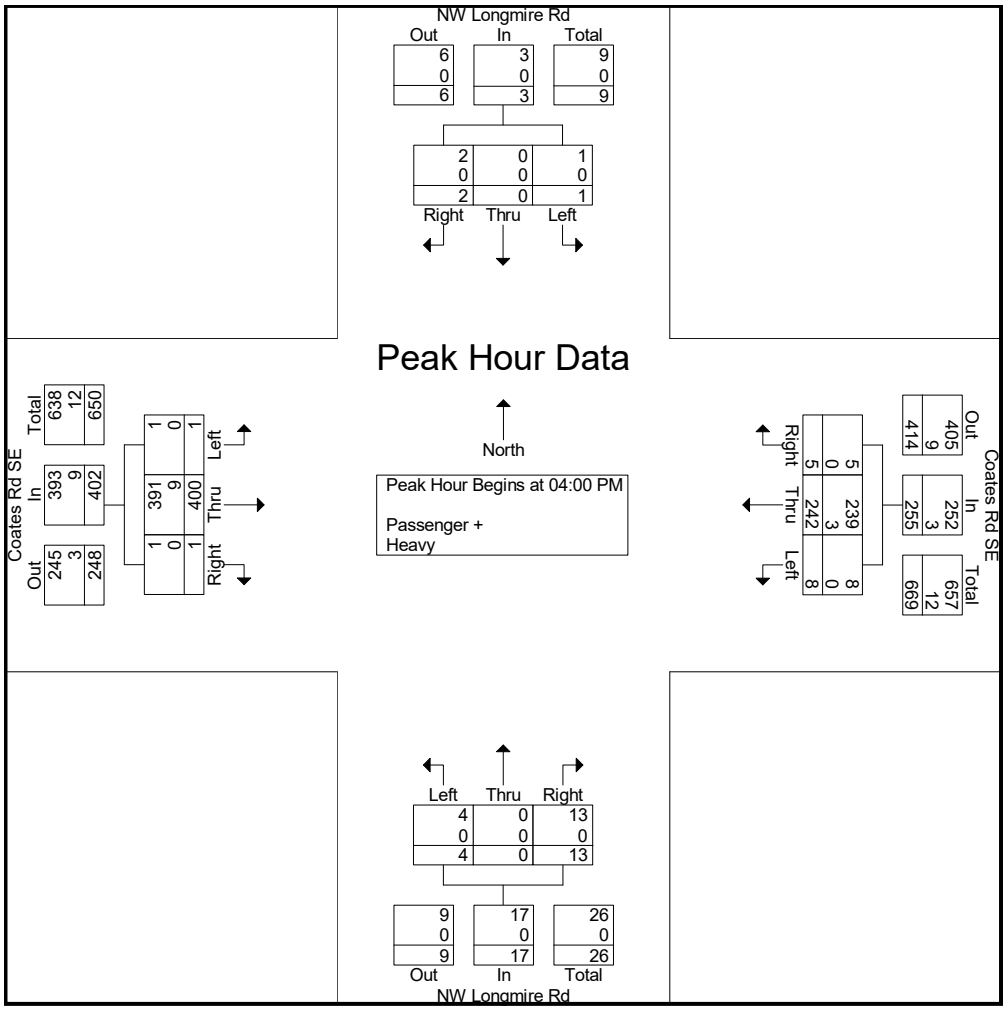
	NW Longmire Rd Southbound				Coates Rd SE Westbound				NW Longmire Rd Northbound				Coates Rd SE Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
04:00 PM	1	0	0	1	2	77	1	80	2	0	1	3	0	104	0	104	188
04:15 PM	0	0	0	0	0	56	1	57	4	0	0	4	1	89	0	90	151
04:30 PM	1	0	0	1	2	49	3	54	4	0	1	5	0	103	0	103	163
04:45 PM	0	0	1	1	1	60	3	64	3	0	2	5	0	104	1	105	175
Total	2	0	1	3	5	242	8	255	13	0	4	17	1	400	1	402	677
05:00 PM	0	0	3	3	0	45	0	45	2	0	0	2	0	100	0	100	150
05:15 PM	0	0	0	0	0	47	3	50	4	0	1	5	0	95	0	95	150
05:30 PM	0	0	0	0	1	40	0	41	2	0	0	2	0	93	1	94	137
05:45 PM	0	0	0	0	0	59	0	59	0	0	0	0	0	99	0	99	158
Total	0	0	3	3	1	191	3	195	8	0	1	9	0	387	1	388	595
Grand Total	2	0	4	6	6	433	11	450	21	0	5	26	1	787	2	790	1272
Apprch %	33.3	0	66.7		1.3	96.2	2.4		80.8	0	19.2		0.1	99.6	0.3		
Total %	0.2	0	0.3	0.5	0.5	34	0.9	35.4	1.7	0	0.4	2	0.1	61.9	0.2	62.1	
Passenger +	2	0	4	6	6	430	11	447	21	0	5	26	1	769	2	772	1251
% Passenger +	100	0	100	100	100	99.3	100	99.3	100	0	100	100	100	97.7	100	97.7	98.3
Heavy	0	0	0	0	0	3	0	3	0	0	0	0	0	18	0	18	21
% Heavy	0	0	0	0	0	0.7	0	0.7	0	0	0	0	0	2.3	0	2.3	1.7

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5119a
Site Code : 00005119
Start Date : 4/11/2023
Page No : 2

	NW Longmire Rd Southbound				Coates Rd SE Westbound				NW Longmire Rd Northbound				Coates Rd SE Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	**1**	0	0	**1**	**2**	**77**	1	**80**	2	0	1	3	0	**104**	0	104	**188**
04:15 PM	0	0	0	0	0	56	1	57	**4**	0	0	4	**1**	89	0	90	151
04:30 PM	1	0	0	1	2	49	**3**	54	4	0	1	**5**	0	103	0	103	163
04:45 PM	0	0	**1**	1	1	60	3	64	3	0	**2**	5	0	104	**1**	**105**	175
Total Volume	2	0	1	3	5	242	8	255	13	0	4	17	1	400	1	402	677
% App. Total	66.7	0	33.3		2	94.9	3.1		76.5	0	23.5		0.2	99.5	0.2		
PHF	.500	.000	.250	.750	.625	.786	.667	.797	.813	.000	.500	.850	.250	.962	.250	.957	.900
Passenger +	2	0	1	3	5	239	8	252	13	0	4	17	1	391	1	393	665
% Passenger +	100	0	100	100	100	98.8	100	98.8	100	0	100	100	100	97.8	100	97.8	98.2
Heavy	0	0	0	0	0	3	0	3	0	0	0	0	0	9	0	9	12
% Heavy	0	0	0	0	0	1.2	0	1.2	0	0	0	0	0	2.3	0	2.2	1.8



Single-Family Attached Housing
(215)

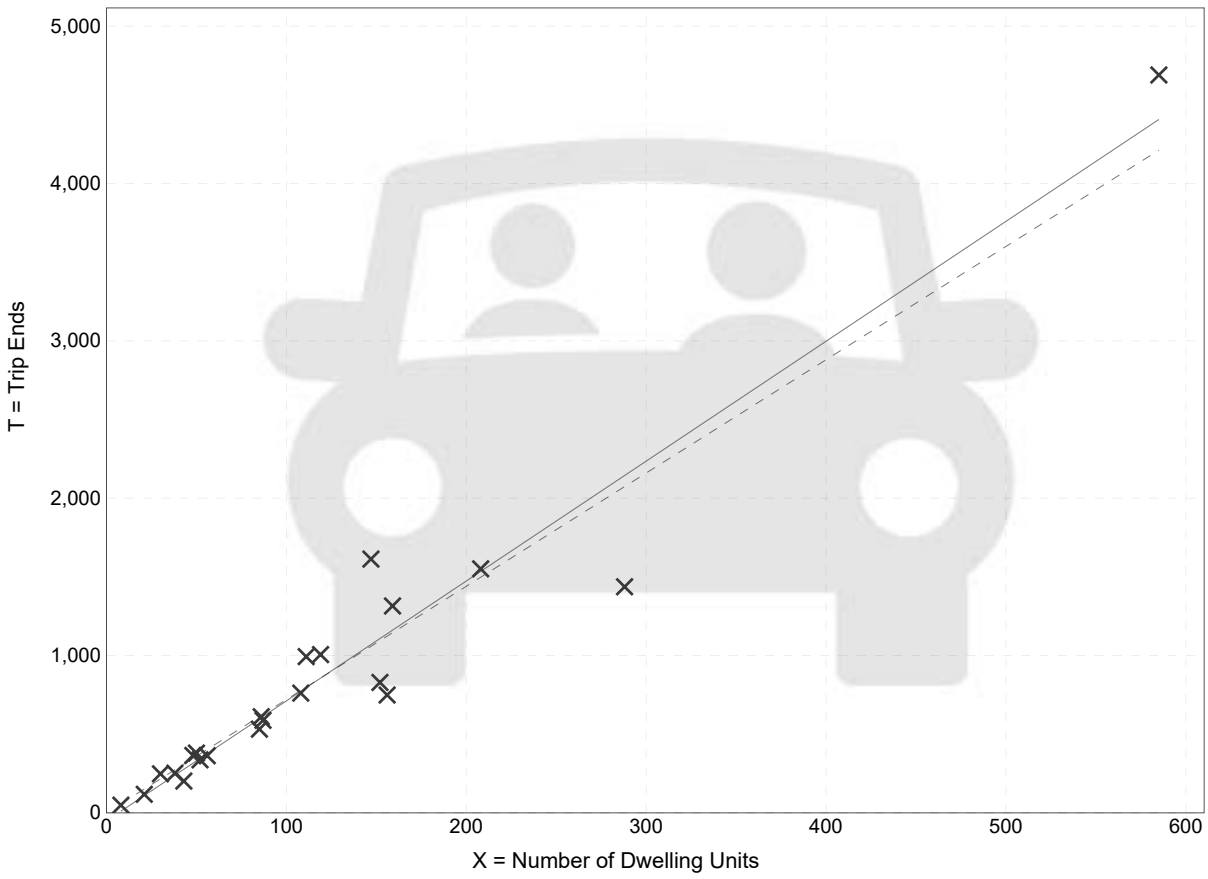
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 22
Avg. Num. of Dwelling Units: 120
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.20	4.70 - 10.97	1.61

Data Plot and Equation



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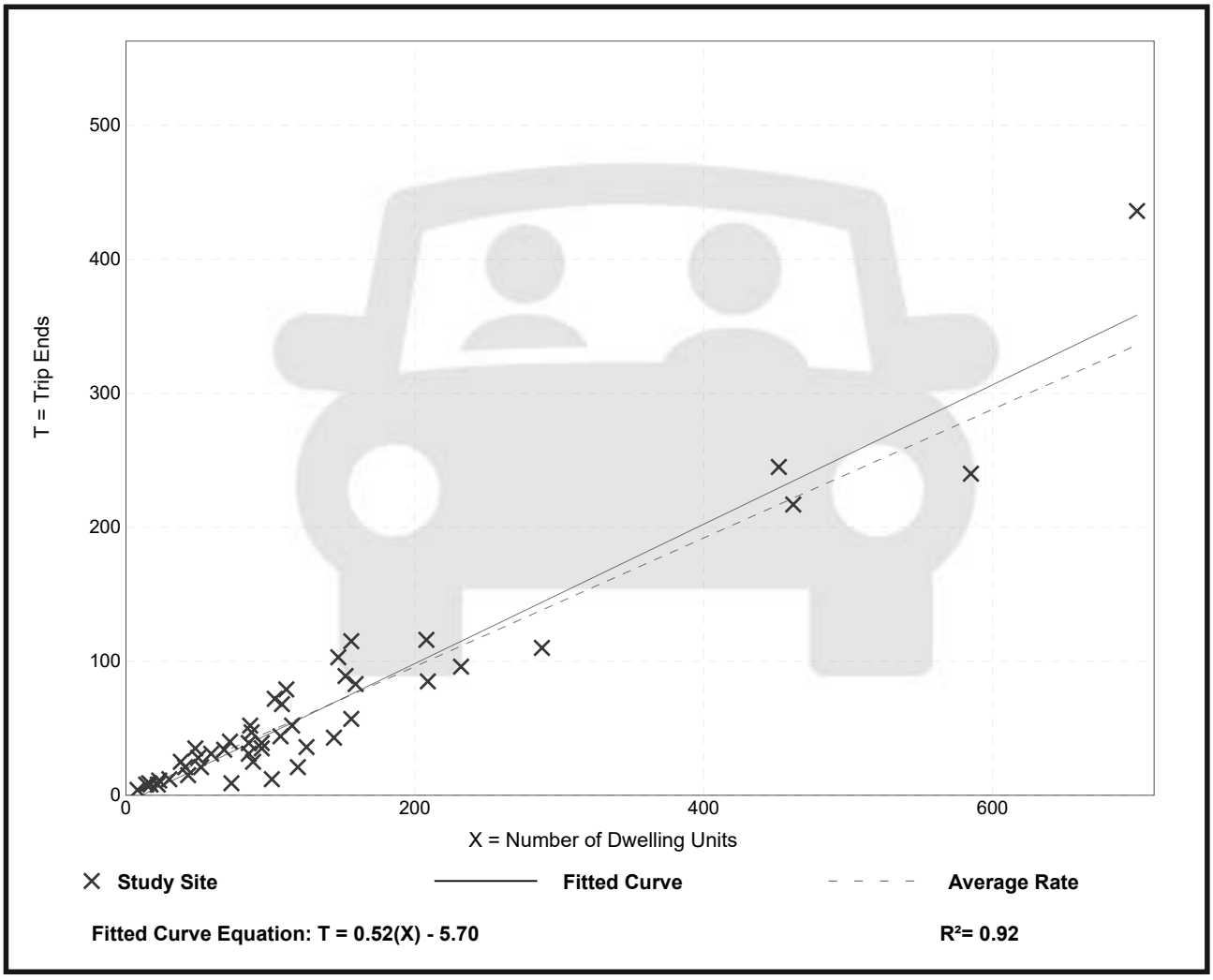
Single-Family Attached Housing
(215)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 46
Avg. Num. of Dwelling Units: 135
Directional Distribution: 31% entering, 69% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.48	0.12 - 0.74	0.14

Data Plot and Equation



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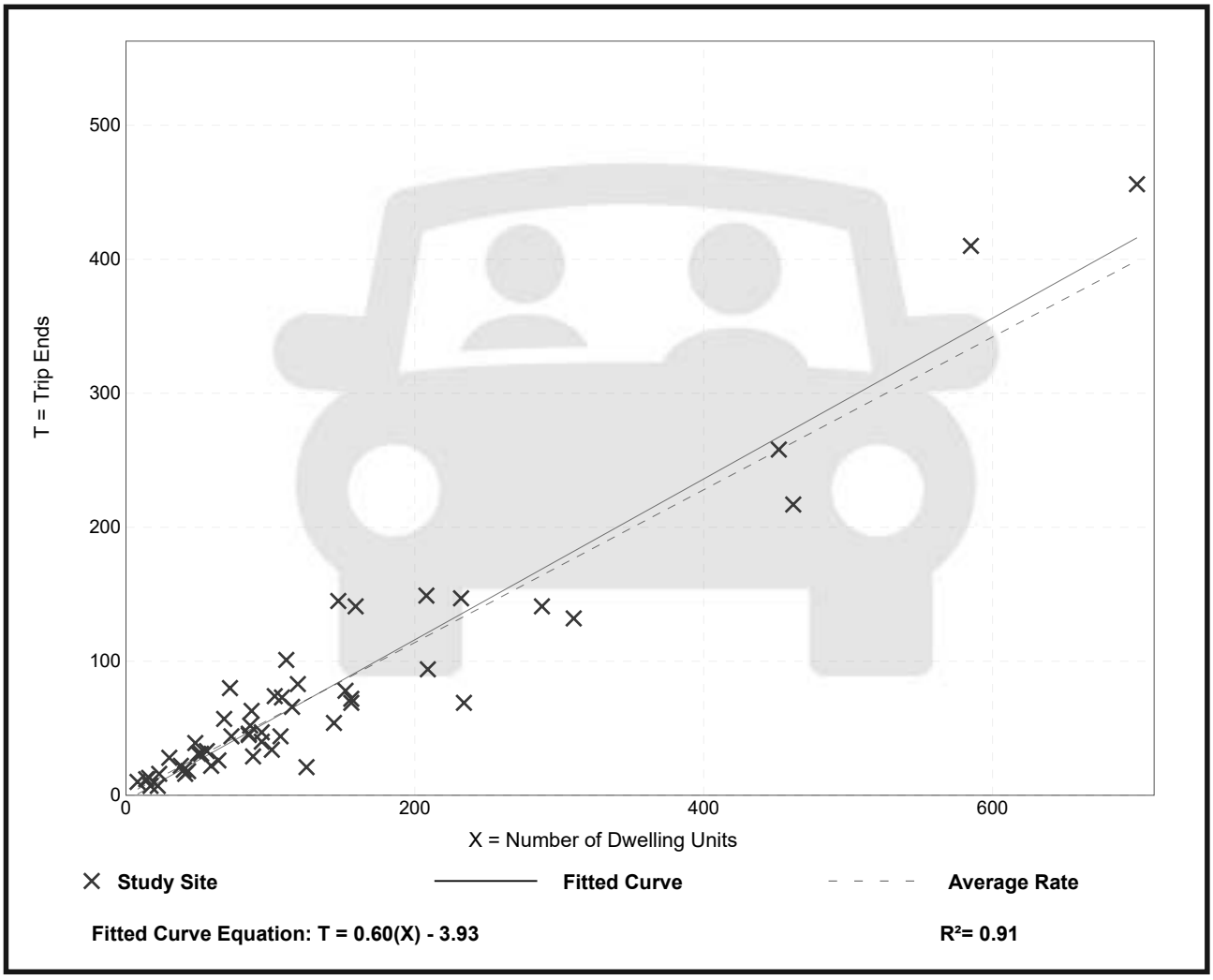
Single-Family Attached Housing
(215)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 51
Avg. Num. of Dwelling Units: 136
Directional Distribution: 57% entering, 43% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.57	0.17 - 1.25	0.18

Data Plot and Equation



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Coates Rd SE & Cullen Rd SE

PM Peak Hour
Pipeline Volume Summations

1. The Hutch												
2. Durant St Plat												
3. Alpine Estates												
4. Tahoma Blvd Apartments												
5. El Rey Burro			1	1								
6. The Summit At Thompson Creek												
7. Samantha Ridge			3	2								
Totals	0	0	4	3	0	0	0	0	0	0	0	0

Coates Rd SE & NW Longmire St

PM Peak Hour
Pipeline Volume Summations

1. The Hutch												
2. Durant St Plat												
3. Alpine Estates												
4. Tahoma Blvd Apartments												
5. El Rey Burro									1	1		
6. The Summit At Thompson Creek												
7. Samantha Ridge					2						3	
Totals	0	0	0	0	2	0	0	0	1	1	3	0

Heath & Associates, Inc
Habitat for Humanity TIA 4-20-2023

PM Peak Hour Forecast Intersection Volumes

Annual Growth Rate: 1 %
# of Years to Horizon: 3
2026

Scenario 1

1. Cullens Rd SE & Coates Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	1	22	345	207	11	30	46	29	4	5	13	0
Project Trips	0	0	1	1	0	0	0	0	0	0	0	0
Pipeline	0	0	4	3	0	0	0	0	0	0	0	0
Without	1	23	359	216	11	31	47	30	4	5	13	0
With	1	23	360	217	11	31	47	30	4	5	13	0

2. NW Longmire St & Coates Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	2	0	1	5	242	8	13	0	4	1	400	1
Project Trips	0	0	0	0	0	0	0	0	1	1	0	0
Pipeline	0	0	0	0	2	0	0	0	1	1	3	0
Without	2	0	1	5	251	8	13	0	5	2	415	1
With	2	0	1	5	251	8	13	0	6	3	415	1

Pipeline Projects

1. The Hutch - No trips anticipated to pass study intersection
2. Durant Street Plat - No trips anticipated to pass study intersection
3. Apline Estates - No trips anticipated to pass study intersection
4. Tahoma Blvd Apartments - No trips anticipated to pass study intersection
5. El Rey Burro - 2 trips anticipated to pass study & access intersection
6. The Summit At thompson Creek - No trips anticipated to pass study intersection
7. Samantha Ridge - 5 trips anticipated to use study intersection

Scenario 2

1. Cullens Rd SE & Coates Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	1	22	345	207	11	30	46	29	4	5	13	0
Project Trips	0	1	0	0	0	0	0	1	0	0	0	0
Pipeline	0	0	4	3	0	0	0	0	0	0	0	0
Without	1	23	359	216	11	31	47	30	4	5	13	0
With	1	24	359	216	11	31	47	31	4	5	13	0

2. NW Longmire St & Coates Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	2	0	1	5	242	8	13	0	4	1	400	1
Project Trips	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline	0	0	0	0	2	0	0	0	1	1	3	0
Without	2	0	1	5	251	8	13	0	5	2	415	1
With	2	0	1	5	251	8	13	0	5	2	415	1

Scenario 3

1. Cullens Rd SE & Coates Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	1	22	345	207	11	30	46	29	4	5	13	0
Project Trips	0	1	0	0	0	0	0	1	0	0	0	0
Pipeline	0	0	4	3	0	0	0	0	0	0	0	0
Without	1	23	359	216	11	31	47	30	4	5	13	0
With	1	24	359	216	11	31	47	31	4	5	13	0

2. NW Longmire St & Coates Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	2	0	1	5	242	8	13	0	4	1	400	1
Project Trips	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline	0	0	0	0	2	0	0	0	1	1	3	0
Without	2	0	1	5	251	8	13	0	5	2	415	1
With	2	0	1	5	251	8	13	0	5	2	415	1

Intersection	
Int Delay, s/veh	9.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	5	30	11	207	4	29	46	345	22	1
Future Vol, veh/h	0	13	5	30	11	207	4	29	46	345	22	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	-	-	-	-	-	60	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	6	33	12	230	4	32	51	383	24	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	978	882	25	841	831	32	25	0	0	83	0	0
Stage 1	791	791	-	40	40	-	-	-	-	-	-	-
Stage 2	187	91	-	801	791	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	230	285	1051	284	305	1042	1589	-	-	1514	-	-
Stage 1	383	401	-	975	862	-	-	-	-	-	-	-
Stage 2	815	820	-	378	401	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	138	211	1051	215	226	1042	1589	-	-	1514	-	-
Mov Cap-2 Maneuver	138	211	-	215	226	-	-	-	-	-	-	-
Stage 1	382	298	-	972	859	-	-	-	-	-	-	-
Stage 2	624	818	-	266	298	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.3	14.8	0.4	7.7
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1589	-	-	-	271	641	1514	-	-
HCM Lane V/C Ratio	0.003	-	-	-	0.074	0.43	0.253	-	-
HCM Control Delay (s)	7.3	0	-	0	19.3	14.8	8.2	0	-
HCM Lane LOS	A	A	-	A	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.2	2.2	1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	1	400	1	8	242	5	4	0	13	1	0	2
Future Vol, veh/h	1	400	1	8	242	5	4	0	13	1	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	444	1	9	269	6	4	0	14	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	275	0	0	445	0	0	738	740	445	744	737	272
Stage 1	-	-	-	-	-	-	447	447	-	290	290	-
Stage 2	-	-	-	-	-	-	291	293	-	454	447	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1288	-	-	1115	-	-	334	345	613	331	346	767
Stage 1	-	-	-	-	-	-	591	573	-	718	672	-
Stage 2	-	-	-	-	-	-	717	670	-	586	573	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1288	-	-	1115	-	-	330	341	613	320	342	767
Mov Cap-2 Maneuver	-	-	-	-	-	-	330	341	-	320	342	-
Stage 1	-	-	-	-	-	-	590	572	-	717	665	-
Stage 2	-	-	-	-	-	-	708	663	-	572	572	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	12.3	11.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	510	1288	-	-	1115	-	-	523
HCM Lane V/C Ratio	0.037	0.001	-	-	0.008	-	-	0.006
HCM Control Delay (s)	12.3	7.8	0	-	8.3	0	-	11.9
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	10

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	5	31	11	216	4	30	47	359	23	1
Future Vol, veh/h	0	13	5	31	11	216	4	30	47	359	23	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	-	-	-	-	-	60	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	6	34	12	240	4	33	52	399	26	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1018	918	27	876	866	33	27	0	0	85	0	0
Stage 1	825	825	-	41	41	-	-	-	-	-	-	-
Stage 2	193	93	-	835	825	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	216	272	1048	269	291	1041	1587	-	-	1512	-	-
Stage 1	367	387	-	974	861	-	-	-	-	-	-	-
Stage 2	809	818	-	362	387	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	126	199	1048	201	212	1041	1587	-	-	1512	-	-
Mov Cap-2 Maneuver	126	199	-	201	212	-	-	-	-	-	-	-
Stage 1	366	283	-	971	858	-	-	-	-	-	-	-
Stage 2	612	816	-	250	283	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.2	15.6	0.4	7.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1587	-	-	-	257	624	1512	-	-
HCM Lane V/C Ratio	0.003	-	-	-	0.078	0.459	0.264	-	-
HCM Control Delay (s)	7.3	0	-	0	20.2	15.6	8.2	0	-
HCM Lane LOS	A	A	-	A	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	2.4	1.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	415	2	8	251	5	5	0	13	1	0	2
Future Vol, veh/h	1	415	2	8	251	5	5	0	13	1	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	461	2	9	279	6	6	0	14	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	285	0	0	463	0	0	765	767	462	771	765	282
Stage 1	-	-	-	-	-	-	464	464	-	300	300	-
Stage 2	-	-	-	-	-	-	301	303	-	471	465	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1277	-	-	1098	-	-	320	332	600	317	333	757
Stage 1	-	-	-	-	-	-	578	564	-	709	666	-
Stage 2	-	-	-	-	-	-	708	664	-	573	563	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1277	-	-	1098	-	-	316	328	600	307	329	757
Mov Cap-2 Maneuver	-	-	-	-	-	-	316	328	-	307	329	-
Stage 1	-	-	-	-	-	-	577	563	-	708	659	-
Stage 2	-	-	-	-	-	-	699	657	-	559	562	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	12.8	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	480	1277	-	-	1098	-	-	509
HCM Lane V/C Ratio	0.042	0.001	-	-	0.008	-	-	0.007
HCM Control Delay (s)	12.8	7.8	0	-	8.3	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	10

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	5	31	11	217	4	30	47	360	23	1
Future Vol, veh/h	0	13	5	31	11	217	4	30	47	360	23	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	-	-	-	-	-	60	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	6	34	12	241	4	33	52	400	26	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1021	920	27	878	868	33	27	0	0	85	0	0
Stage 1	827	827	-	41	41	-	-	-	-	-	-	-
Stage 2	194	93	-	837	827	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	215	271	1048	268	290	1041	1587	-	-	1512	-	-
Stage 1	366	386	-	974	861	-	-	-	-	-	-	-
Stage 2	808	818	-	361	386	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	125	198	1048	200	211	1041	1587	-	-	1512	-	-
Mov Cap-2 Maneuver	125	198	-	200	211	-	-	-	-	-	-	-
Stage 1	365	282	-	971	858	-	-	-	-	-	-	-
Stage 2	610	816	-	249	282	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.3	15.6	0.4	7.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1587	-	-	-	256	623	1512	-	-
HCM Lane V/C Ratio	0.003	-	-	-	0.078	0.462	0.265	-	-
HCM Control Delay (s)	7.3	0	-	0	20.3	15.6	8.2	0	-
HCM Lane LOS	A	A	-	A	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	2.4	1.1	-	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	5	6	18	10	1
Future Vol, veh/h	1	5	6	18	10	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	5	7	20	11	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	46	12	12	0	-	0
Stage 1	12	-	-	-	-	-
Stage 2	34	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	964	1069	1607	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	988	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	960	1069	1607	-	-	-
Mov Cap-2 Maneuver	960	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	988	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.5	1.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1607	-	1049	-	-
HCM Lane V/C Ratio	0.004	-	0.006	-	-
HCM Control Delay (s)	7.2	0	8.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	1	415	3	8	251	5	6	0	13	1	0	2
Future Vol, veh/h	1	415	3	8	251	5	6	0	13	1	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	461	3	9	279	6	7	0	14	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	285	0	0	464	0	0	766	768	463	772	766	282
Stage 1	-	-	-	-	-	-	465	465	-	300	300	-
Stage 2	-	-	-	-	-	-	301	303	-	472	466	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1277	-	-	1097	-	-	320	332	599	317	333	757
Stage 1	-	-	-	-	-	-	578	563	-	709	666	-
Stage 2	-	-	-	-	-	-	708	664	-	573	562	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1277	-	-	1097	-	-	316	328	599	307	329	757
Mov Cap-2 Maneuver	-	-	-	-	-	-	316	328	-	307	329	-
Stage 1	-	-	-	-	-	-	577	562	-	708	659	-
Stage 2	-	-	-	-	-	-	699	657	-	559	561	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	13.1	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	467	1277	-	-	1097	-	-	509
HCM Lane V/C Ratio	0.045	0.001	-	-	0.008	-	-	0.007
HCM Control Delay (s)	13.1	7.8	0	-	8.3	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	9.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	5	31	11	216	4	31	47	359	24	1
Future Vol, veh/h	0	13	5	31	11	216	4	31	47	359	24	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	-	-	-	-	-	60	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	6	34	12	240	4	34	52	399	27	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1020	920	28	878	868	34	28	0	0	86	0	0
Stage 1	826	826	-	42	42	-	-	-	-	-	-	-
Stage 2	194	94	-	836	826	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	215	271	1047	268	290	1039	1585	-	-	1510	-	-
Stage 1	366	387	-	972	860	-	-	-	-	-	-	-
Stage 2	808	817	-	362	387	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	125	198	1047	200	212	1039	1585	-	-	1510	-	-
Mov Cap-2 Maneuver	125	198	-	200	212	-	-	-	-	-	-	-
Stage 1	365	283	-	969	857	-	-	-	-	-	-	-
Stage 2	611	815	-	250	283	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.3	15.6	0.4	7.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1585	-	-	-	256	622	1510	-	-
HCM Lane V/C Ratio	0.003	-	-	-	0.078	0.461	0.264	-	-
HCM Control Delay (s)	7.3	0	-	0	20.3	15.6	8.2	0	-
HCM Lane LOS	A	A	-	A	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	2.4	1.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	1	415	2	8	251	5	5	0	13	1	0	2
Future Vol, veh/h	1	415	2	8	251	5	5	0	13	1	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	461	2	9	279	6	6	0	14	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	285	0	0	463	0	0	765	767	462	771	765	282
Stage 1	-	-	-	-	-	-	464	464	-	300	300	-
Stage 2	-	-	-	-	-	-	301	303	-	471	465	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1277	-	-	1098	-	-	320	332	600	317	333	757
Stage 1	-	-	-	-	-	-	578	564	-	709	666	-
Stage 2	-	-	-	-	-	-	708	664	-	573	563	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1277	-	-	1098	-	-	316	328	600	307	329	757
Mov Cap-2 Maneuver	-	-	-	-	-	-	316	328	-	307	329	-
Stage 1	-	-	-	-	-	-	577	563	-	708	659	-
Stage 2	-	-	-	-	-	-	699	657	-	559	562	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	12.8	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	480	1277	-	-	1098	-	-	509
HCM Lane V/C Ratio	0.042	0.001	-	-	0.008	-	-	0.007
HCM Control Delay (s)	12.8	7.8	0	-	8.3	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	1	81	6	59	1
Future Vol, veh/h	5	1	81	6	59	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	1	88	7	64	1

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	221	92	0	0	95	0
Stage 1	92	-	-	-	-	-
Stage 2	129	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	767	965	-	-	1499	-
Stage 1	932	-	-	-	-	-
Stage 2	897	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	734	965	-	-	1499	-
Mov Cap-2 Maneuver	734	-	-	-	-	-
Stage 1	932	-	-	-	-	-
Stage 2	858	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	7.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	765	1499	-
HCM Lane V/C Ratio	-	-	0.009	0.043	-
HCM Control Delay (s)	-	-	9.7	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0.1	-

Intersection	
Int Delay, s/veh	9.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	5	31	11	216	4	31	47	359	24	1
Future Vol, veh/h	0	13	5	31	11	216	4	31	47	359	24	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	-	-	-	-	-	60	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	6	34	12	240	4	34	52	399	27	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1020	920	28	878	868	34	28	0	0	86	0	0
Stage 1	826	826	-	42	42	-	-	-	-	-	-	-
Stage 2	194	94	-	836	826	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	215	271	1047	268	290	1039	1585	-	-	1510	-	-
Stage 1	366	387	-	972	860	-	-	-	-	-	-	-
Stage 2	808	817	-	362	387	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	125	198	1047	200	212	1039	1585	-	-	1510	-	-
Mov Cap-2 Maneuver	125	198	-	200	212	-	-	-	-	-	-	-
Stage 1	365	283	-	969	857	-	-	-	-	-	-	-
Stage 2	611	815	-	250	283	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.3	15.6	0.4	7.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1585	-	-	-	256	622	1510	-	-
HCM Lane V/C Ratio	0.003	-	-	-	0.078	0.461	0.264	-	-
HCM Control Delay (s)	7.3	0	-	0	20.3	15.6	8.2	0	-
HCM Lane LOS	A	A	-	A	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	2.4	1.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	415	2	8	251	5	5	0	13	1	0	2
Future Vol, veh/h	1	415	2	8	251	5	5	0	13	1	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	461	2	9	279	6	6	0	14	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	285	0	0	463	0	0	765	767	462	771	765	282
Stage 1	-	-	-	-	-	-	464	464	-	300	300	-
Stage 2	-	-	-	-	-	-	301	303	-	471	465	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1277	-	-	1098	-	-	320	332	600	317	333	757
Stage 1	-	-	-	-	-	-	578	564	-	709	666	-
Stage 2	-	-	-	-	-	-	708	664	-	573	563	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1277	-	-	1098	-	-	316	328	600	307	329	757
Mov Cap-2 Maneuver	-	-	-	-	-	-	316	328	-	307	329	-
Stage 1	-	-	-	-	-	-	577	563	-	708	659	-
Stage 2	-	-	-	-	-	-	699	657	-	559	562	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	12.8	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	480	1277	-	-	1098	-	-	509
HCM Lane V/C Ratio	0.042	0.001	-	-	0.008	-	-	0.007
HCM Control Delay (s)	12.8	7.8	0	-	8.3	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	6	18	10	2
Future Vol, veh/h	2	5	6	18	10	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	5	7	20	11	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	46	12	13	0	-	0
Stage 1	12	-	-	-	-	-
Stage 2	34	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	964	1069	1606	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	988	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	960	1069	1606	-	-	-
Mov Cap-2 Maneuver	960	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	988	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.5	1.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1606	-	1035	-	-
HCM Lane V/C Ratio	0.004	-	0.007	-	-
HCM Control Delay (s)	7.3	0	8.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	3	81	4	59	3
Future Vol, veh/h	4	3	81	4	59	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	3	88	4	64	3

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	221	90	0	0	92	0
Stage 1	90	-	-	-	-	-
Stage 2	131	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	767	968	-	-	1503	-
Stage 1	934	-	-	-	-	-
Stage 2	895	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	734	968	-	-	1503	-
Mov Cap-2 Maneuver	734	-	-	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	857	-	-	-	-	-

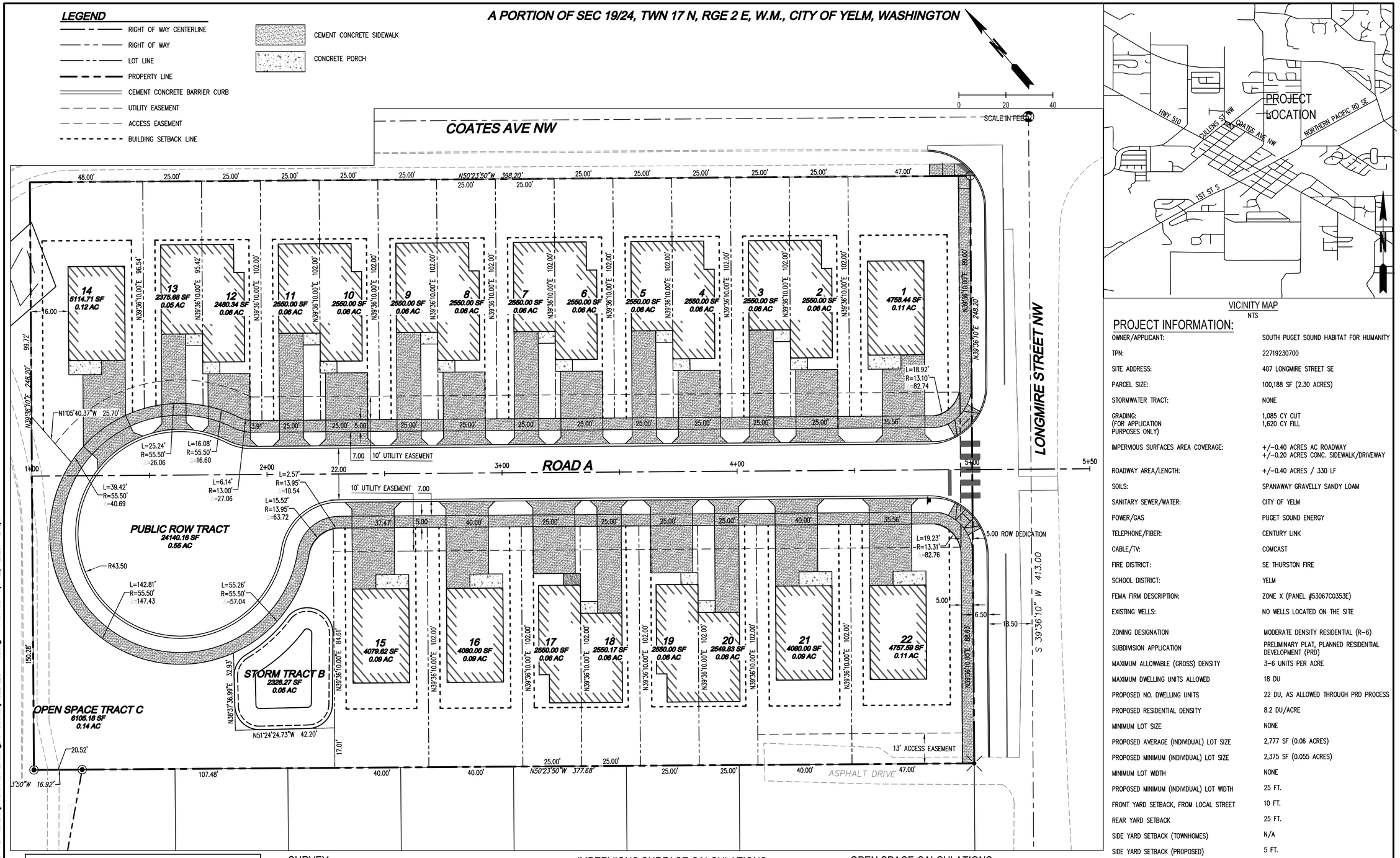
Approach	WB	NB	SB
HCM Control Delay, s	9.4	0	7.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	819	1503	-
HCM Lane V/C Ratio	-	-	0.009	0.043	-
HCM Control Delay (s)	-	-	9.4	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0.1	-

A PORTION OF SEC 19/24, TWN 17 N, RGE 2 E, W.M., CITY OF YELM, WASHINGTON

LEGEND

- RIGHT OF WAY CENTERLINE
- RIGHT OF WAY
- LOT LINE
- PROPERTY LINE
- CEMENT CONCRETE BARRIER CURB
- UTILITY EASEMENT
- ACCESS EASEMENT
- BUILDING SETBACK LINE
- CEMENT CONCRETE SIDEWALK
- CONCRETE PORCH



VICINITY MAP
NTS

PROJECT INFORMATION:

OWNER/APPLICANT:	SOUTH PUGET SOUND HABITAT FOR HUMANITY
TPN:	22719230700
SITE ADDRESS:	407 LONGMIRE STREET SE
PARCEL SIZE:	100,188 SF (2.30 ACRES)
STORMWATER TRACT:	NONE
GRADING: (FOR APPLICATION PURPOSES ONLY)	1,085 CY CUT 1,620 CY FILL
IMPERVIOUS SURFACES AREA COVERAGE:	+/–0.40 ACRES AC ROADWAY +/–0.20 ACRES CONC. SIDEWALK/DRIVEWAY
ROADWAY AREA/LENGTH:	+/–0.40 ACRES / 330 LF
SOILS:	SPANAWAY GRAVELLY SANDY LOAM
SANITARY SEWER/WATER:	CITY OF YELM
POWER/GAS	PUGET SOUND ENERGY
TELEPHONE/FIBER:	CENTURY LINK
CABLE/TV:	COMCAST
FIRE DISTRICT:	SE THURSTON FIRE
SCHOOL DISTRICT:	YELM
FEMA FIRM DESCRIPTION:	ZONE X (PANEL #53067C0353E)
EXISTING WELLS:	NO WELLS LOCATED ON THE SITE
ZONING DESIGNATION	MODERATE DENSITY RESIDENTIAL (R-6)
SUBDIVISION APPLICATION	PRELIMINARY PLAT, PLANNED RESIDENTIAL DEVELOPMENT (PRD)
MAXIMUM ALLOWABLE (GROSS) DENSITY	3–6 UNITS PER ACRE
MAXIMUM DWELLING UNITS ALLOWED	18 DU
PROPOSED NO. DWELLING UNITS	22 DU, AS ALLOWED THROUGH PRD PROCESS
PROPOSED RESIDENTIAL DENSITY	8.2 DU/ACRE
MINIMUM LOT SIZE	NONE
PROPOSED AVERAGE (INDIVIDUAL) LOT SIZE	2,777 SF (0.06 ACRES)
PROPOSED MINIMUM (INDIVIDUAL) LOT SIZE	2,375 SF (0.055 ACRES)
MINIMUM LOT WIDTH	NONE
PROPOSED MINIMUM (INDIVIDUAL) LOT WIDTH	25 FT.
FRONT YARD SETBACK, FROM LOCAL STREET	10 FT.
REAR YARD SETBACK	25 FT.
SIDE YARD SETBACK (TOWNHOMES)	N/A
SIDE YARD SETBACK (PROPOSED)	5 FT.
MAXIMUM BUILDING HEIGHT	35 FT.
MAXIMUM LOT COVERAGE	NONE

SHEET INDEX

SHEET #	SHEET TITLE	SHEET DESCRIPTION
1	PP-01	PRELIMINARY PLAT MAP
2	PP-02	PRELIMINARY PLAT GRADING AND DRAINAGE
3	PP-03	PRELIMINARY PLAT WATER AND SEWER PLAN
4	PP-04	PRELIMINARY PLAT NOTES AND DETAILS

SURVEY

TOPOGRAPHIC AND BOUNDARY SURVEY INFORMATION WAS PROVIDED BY BRACY & THOMAS PROFESSIONAL LAND SURVEYORS. THIS SURVEY INFORMATION WAS NOT FIELD VERIFIED BY LDC, INC.

GRADING QUANTITIES:

CUT: 1,085 C.Y.
FILL: 1,620 C.Y.
NET: 535 C.Y. (FILL)

THESE GRADING QUANTITIES ARE STRICTLY FOR PERMITTING PURPOSES AND SHALL NOT BE USED BY THE CONTRACTOR FOR BIDDING PURPOSES.

IMPERVIOUS SURFACE CALCULATIONS:

PROPOSED ROOF AREA:	18,295 SF (0.42 ACRES)
PROPOSED ROADWAY AREA:	17,424 (0.40 ACRES)
OTHER IMPERVIOUS AREA:	8,712 SF (0.20 ACRES)

OPEN SPACE CALCULATIONS:

GROSS SITE AREA:	2.90 ACRES
REQUIRED MIN. USABLE OPEN SPACE:	5% SITE – 0.14 ACRES
TOTAL OPEN SPACE PROVIDED:	6% – 0.14 ACRES

DISCLAIMER

TOPOGRAPHIC SURVEY INFORMATION CONTAINED ON THESE PLANS HAS BEEN PROVIDED BY BRACY & THOMAS, PLS. LDC, INC. (LAND DEVELOPMENT CONSULTANTS, INC.) ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

UTILITY NOTE

THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. AGENCIES INVOLVED SHALL BE NOTIFIED WITHIN A REASONABLE TIME PRIOR TO THE START OF CONSTRUCTION.

Call 2 Business Days Before You Dig
811 or 1-800-424-5555
Utilities Underground Location Center

REVISIONS		
NO.	DATE	DESCRIPTION
		BY

LDC | Surveying Engineering Planning
Woodinville | Olympia | Kent
1411 State Avenue NE, #200
Olympia, WA 98506
T 425.806.1869 | F 425.482.2893
www.LDCcorp.com

HABITAT FOR HUMANITY

YELM PRD
407 LONGMIRE STREET NW

PRELIMINARY PLAT MAP

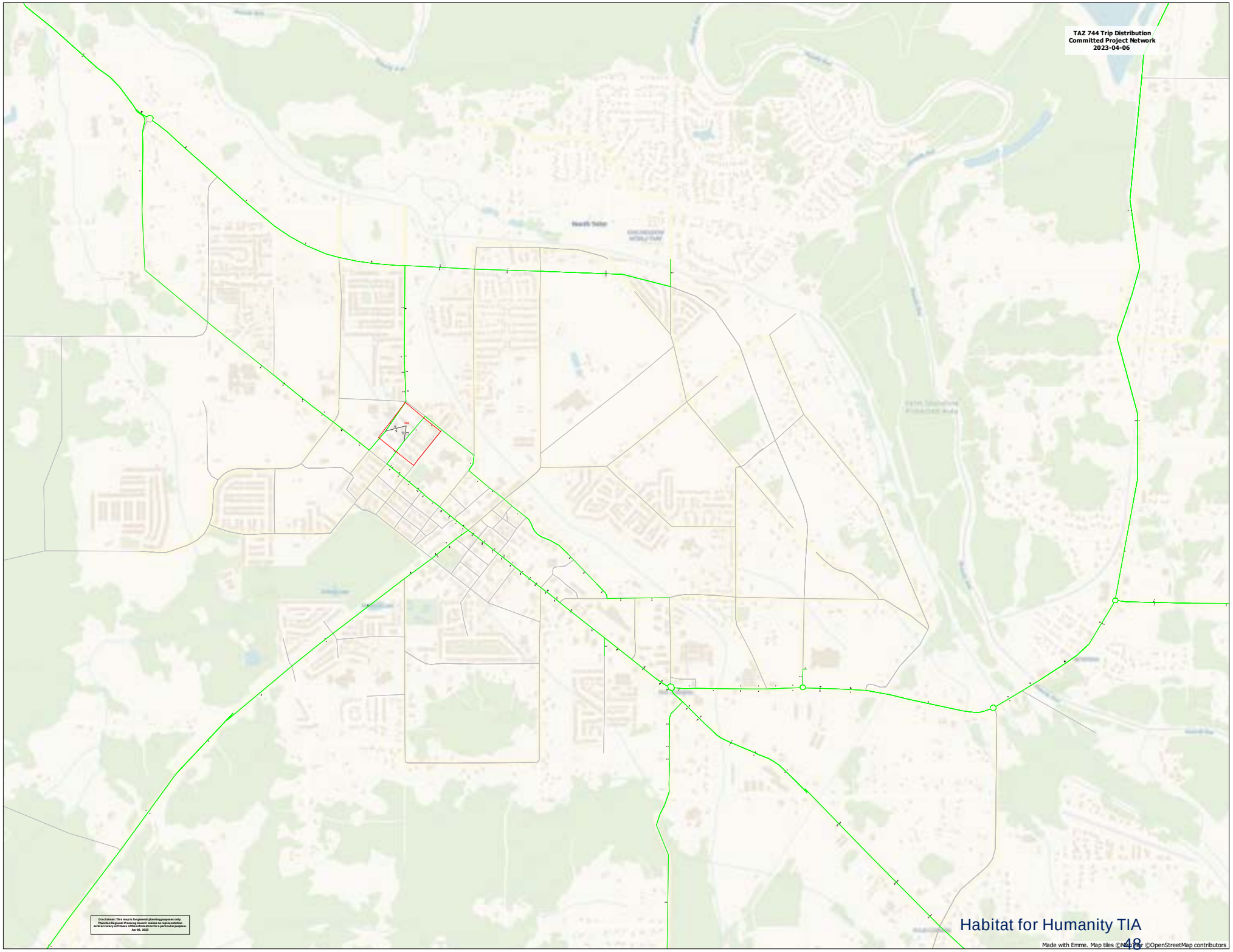
MALLORY K. DOBBS
STATE OF WASHINGTON
20122771
REGISTERED PROFESSIONAL ENGINEER

JOB NUMBER:	C22-128
DRAWING NAME:	C22-128-PP-01
DESIGNER:	M. DOBBS
DRAFTING BY:	M. DOBBS
DATE:	APRIL, 2023
SCALE:	1"=20'
JURISDICTION:	CITY OF YELM

PP-01

SHEET 1 OF 4

Drawing P:\Civil\2022\C22-128 Habitat for Humanity Yelm Plat\Drawings\Preliminary\C22-128-PP-01.dwg Plotted: Apr 12, 2023 - 8:41pm


TAZ 744 Trip Distribution
Committed Project Network
2023-04-06
744
Disclaimer: This map is for general planning purposes only.
Thunder Regional Planning Council makes no representation
as to accuracy or fitness of the information for a particular purpose.
April 06, 2023
Made with Emme. Map tiles ©Mapbox ©OpenStreetMap contributors

2.3352	0.0352	0.0385	0.0000	0.2335	0.0627
2.3791	0.0358	0.0400	0.0000	0.2379	0.0661
2.4231	0.0363	0.0416	0.0000	0.2423	0.0695
2.4670	0.0368	0.0432	0.0000	0.2467	0.0729
2.5110	0.0373	0.0449	0.0000	0.2511	0.0763
2.5549	0.0379	0.0465	0.0000	0.2555	0.0797
2.5989	0.0384	0.0482	0.0000	0.2599	0.0832
2.6429	0.0389	0.0499	0.0000	0.2643	0.0866
2.6868	0.0395	0.0516	0.0000	0.2687	0.0901
2.7308	0.0400	0.0533	0.0000	0.2731	0.0936
2.7747	0.0405	0.0551	0.0000	0.2775	0.0972
2.8187	0.0411	0.0569	0.0000	0.2819	0.1007
2.8626	0.0416	0.0587	0.0000	0.2863	0.1043
2.9066	0.0422	0.0606	0.0000	0.2907	0.1079
2.9505	0.0428	0.0624	0.0000	0.2951	0.1115
2.9945	0.0433	0.0643	0.0000	0.2995	0.1152
3.0385	0.0439	0.0662	0.0000	0.3038	0.1188
3.0824	0.0444	0.0682	0.0000	0.3082	0.1225
3.1264	0.0450	0.0702	0.0000	0.3126	0.1262
3.1703	0.0456	0.0721	0.0000	0.3170	0.1300
3.2143	0.0462	0.0742	0.0000	0.3214	0.1337
3.2582	0.0468	0.0762	0.0000	0.3258	0.1375
3.3022	0.0473	0.0783	0.0000	0.3302	0.1413
3.3462	0.0479	0.0804	0.0000	0.3346	0.1451
3.3901	0.0485	0.0825	0.0000	0.3390	0.1489
3.4341	0.0491	0.0846	0.0000	0.3434	0.1527
3.4780	0.0497	0.0868	0.0000	0.3478	0.1566
3.5220	0.0503	0.0890	0.0173	0.3500	0.1605
3.5659	0.0509	0.0912	0.0887	0.3500	0.1644
3.6099	0.0515	0.0935	0.1822	0.3500	0.1683
3.6538	0.0521	0.0958	0.2743	0.3500	0.1723
3.6978	0.0527	0.0981	0.3438	0.3500	0.1763
3.7418	0.0533	0.1004	0.3840	0.3500	0.1802
3.7857	0.0540	0.1027	0.4209	0.3500	0.1843
3.8297	0.0546	0.1051	0.4521	0.3500	0.1883
3.8736	0.0552	0.1075	0.4813	0.3500	0.1923
3.9176	0.0558	0.1100	0.5088	0.3500	0.1964
3.9615	0.0565	0.1125	0.5349	0.3500	0.2000
4.0000	0.0570	0.1146	0.5598	0.3500	0.0000

Name : Surface retention 1

Element Flows To:

Outlet 1	**Outlet 2**
Bioretention 1	

ANALYSIS RESULTS

Stream Protection Duration

Habitat for Humanity
Yelm Plat

Technical Information Report

Prepared for

South Puget Sound Habitat for Humanity
PO BOX 2225
Olympia WA 98507
(360) 956-3456

Prepared by

LDC, Inc.
20210 142nd Ave NE
Woodinville, WA 98072
(425) 806-1869

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PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Stormwater Site Plan for the Habitat for Humanity Yelm Plat Project has been prepared by me or under my supervision and meets the minimum standards of the City of Yelm and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

07/20/2022

Prepared by: Ryan Ferguson, EIT — Date
rferguson@ldccorp.com
(425) 892-9514

07/20/2022

Approved by: Mallory Dobbs, PE — Date
MDobbs@ldccorp.com
(360) 634-2067

SECTION 1: PROJECT OVERVIEW

The following report was prepared for the Habitat for Humanity Plat project in Yelm, WA. This report was prepared to comply with the minimum technical standards and requirements that are set forth in the 2019 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW).

Project Proponent:	South Puget Sound Habitat for Humanity
Parcel Numbers:	22719230700
Total Parcel Area:	2.30 AC
Current Zoning:	R-6 Moderate Density Residential
Required Permits:	Grading, Utility, Paving, Building, etc.
Site Address:	407 Longmire St NW, Yelm WA 98597
Section, Township, Range:	Section 19 / 24 Township 17 Range 2E

The Habitat for Humanity project proposes the development of 22 lots with single family homes and townhomes on one 2.3 acre parcel. The site address is at 407 Longmire Street SE Yelm, WA. The project site consists of parcel TPN 22719230700 and lies within the north-west quarter of Section 29, Township 17 N, Range 2 E within the City of Yelm. See Vicinity Map in Appendix 1 for relative location. The proposed construction activities include the following:

- Site preparation, grading, and erosion control activities
- Installation of stormwater, water, and sewer utilities
- Construction of drive aisle and sidewalks
- Construction of homes and townhomes

A site vicinity map of the proposed project is enclosed herein as Appendix 1. A worksheet for determining the number of Minimum Requirements for this project per the SWMMWW has been prepared and enclosed herein as Appendix 2. The proposed project site has one home and garage that account for less than 35% of the site area. As such, the project will be considered a new development that triggers all of the minimum requirements.

1.1 SUMMARY OF ONSITE COMPLIANCE

The stormwater design complies with the 9 minimum requirements as follows:

Minimum Requirement #1: Preparation of Stormwater Site Plans: This report along with the construction plans satisfies this minimum requirement.

Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP): A pollution prevention will be included at the time of the civil permit submittal as Appendix 7. Further, an erosion control plan is included as part of the engineering construction plan set in appendix 4.

Minimum Requirement #3: Source Control of Pollution: BMPs listed below are the minimum required for the site, additional BMPs not listed here may need to be implemented to meet the minimum requirements discussed in the 2019 SWMMWW.

- S411 BMPs for Landscaping and Lawn/Vegetation Management
- S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls:
Currently, the stormwater runoff within the parcel sheet flows to the northeast towards Coates Street NW where it is intercepted by the existing storm drain system. However, due to site soil conditions, most of the onsite stormwater runoff likely infiltrates to the groundwater table. In the proposed condition all onsite stormwater runoff will infiltrate to native soils. Stormwater runoff patterns within the vicinity of the project will remain similar to their current condition. All downstream conveyance systems are not anticipated to be adversely affected.

Minimum Requirement #5: Onsite Stormwater Management:
In accordance with Minimum requirement #7, this project is not flow control exempt. Using Table I-2.5.1: On-Site Stormwater Management Requirements for Projects Triggering Minimum Requirements #1-9, the proposed project is a new development located in the UGA on a parcel smaller than 5 acres, therefore the project shall employ On-Site Stormwater Management BMPs in accordance with the Low Impact Performance Standard or List #2. The project will demonstrate compliance with List #2, see below.

Lawn and Landscaped Areas:

- Per the 2019 SWMMWW, BMP T5.13: Post Construction Soil Quality and Depth will be utilized to the maximum extent practicable. See landscape plans for details.

Roofs:

- Full Dispersion in Volume V, Section 7.2, or Downspout Infiltration in Volume V, Section 15.3: Full Dispersion requires that the project protect at least 65% of the site in a forested or native condition. For this reason, Full Dispersion is infeasible. The geotechnical analysis of the site determined that infiltration of stormwater is possible with native soils, so Downspout Infiltration is feasible. Each home will utilize a downspout infiltration trench sized to the requirements of this BMP.

Other Hard Surfaces:

- Full Dispersion in Volume V, Section 7.2: Full Dispersion is not feasible for this project for the reasons mentioned in the section above.
- Permeable Pavement in Volume V, Chapter 11: Based on the proposed use of the site, basic treatment is required for the stormwater runoff, prior to infiltration. A permeable pavement system would not allow for the stormwater runoff to be treated prior to infiltration into the soils.
- Bioretention in Volume V, Chapter 9: Bioretention facilities are feasible for the reasons mentioned in the section above and will be utilized for the proposed project to meet Minimum requirements #5, #6, and #7. See section 4 of this report for more information.

Minimum Requirement #6: Runoff Treatment: The proposed project will construct over 5,000 S.F. of pollution generating impervious surface, therefore a stormwater treatment facility is required. The project is not considered a high use site or a commercial/industrial project. However, the project is located within a Category 1 Critical Aquifer Recharge Area and therefore enhanced treatment is required. All of the stormwater runoff from the pollution generating impervious surfaces will be treated per the SWMMWW to avoid potential groundwater contamination. Enhanced treatment will be provided for this project through the use of a bioretention facility. Additionally, an operation and maintenance manual will be provided at the time of the permit submittal. The proposed project will not construct any storage tanks or provide any vehicle repair and servicing on-site.

Minimum Requirement #7: Flow Control: The proposed project will construct over 10,000 SF of impervious surface and does not discharge to a flow control exempt water body, therefore flow control is required. Flow control will be provided for the site through full infiltration onsite within a bioretention facility.

Minimum Requirement #8: Wetlands Protection: Per Thurston County GIS data, no wetlands were identified on or near the site.

Minimum Requirement #9: Operation and Maintenance: See Operations and Maintenance in Section 8 of this report.

SECTION 2: EXISTING CONDITIONS SUMMARY

2.1 EXISTING ON-SITE CONDITIONS

The subject site is +/- 2.30 acres in size. Topography within the property generally flat throughout the site and slopes from southwest to northeast at slopes ranging from 0 to 3 percent. The entire project parcel is located within a Category 1 Critical Aquifer Recharge Area. There are no known storage tanks or vehicle repair and servicing occurring on-site. The site is currently cleared/predominantly grass and developed with a single-family residence. The site appears to have remained unchanged between 1990 and 2021. See the figures below:

Figure 1: Existing Conditions (1990)

Figure 2: Existing Conditions (2021)

2.1.1 FLOOD HAZARD ZONE

Flood Zones: The project parcel is located within Federal Emergency Management Ageny (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 53067C0353E. According to the map, the project site is located within Zone X which is determined to be an area of minimal flood hazard. See appendix 8 for the FIRM map.

2.1.2 ON-SITE SOILS INFORMATION

A geotechnical investigation was conducted by Landau Associates in July, 2021 for the Habitat for Humanity Yelm Plat. Six test pits were conducted to depths of approximately 10 to 12 feet below ground surface. The soils generally encountered were a recessional outwash beneath about 9 inches of topsoil. The recessional outwash typically consisted of grayish-brown to brown, sandy gravel or gravelly sand with variable silt, cobble, and boulder content in a medium dense to dense condition. All six test were terminated following moderate to severe caving and before reaching groundwater. The site was determined to have an infiltration rate of 6.4 inches per hour in the west corner of the site at test pit 5, where an infiltration pond is being proposed. Groundwater mounding is not of concern and the

recommended groundwater elevation for designing infiltration BMPs is 20 ft below ground surface. See **Appendix 5** for geotechnical report.

SECTION 3: OFFSITE ANALYSIS REPORT

3.1 QUALTITATIVE UPSTREAM ANALYSIS

Due to the adjacent roadways and existing development, there are no upstream areas with stormwater run-on onto the parcel.

3. 2 QUALITATIVE DONSTREAM ANALYSIS

All of the stormwater runoff generated by the disturbed developed area of the parcel will be collected, treated, and infiltrated on-site. The site currently infiltrates the stormwater runoff on-site and will not change the downstream runoff flows. Therefore, there are no anticipated adverse affects to the downstream system.

SECTION 4: PERMANENT STORMWATER CONTROL PLAN

4.1 SUMMARY SECTION

The proposed project follows the requirements stated in the 2019 SWMMWW. Following Figure I-3.1 (See **Appendix 2**), this project classifies as a new development that triggers all of the minimum requirements. The site does not have 35% of more of existing impervious coverage, and the project will add more than 5,000 S.F. of new impervious surfaces. See Appendix 4 for the proposed stormwater facility locations and details. Table 1:

Land Type Designations Existing vs. Proposed below illustrates the existing and proposed impervious and pervious areas of the disturbed areas (See Appendix 3 for the basin map).

LAND TYPE DESIGNATIONS	AREA (ACRES)	% OF TOTAL AREA
Existing Site	**2.30**	**100.0%**
Roof	0.03	1.3%
Road	0.02	0.9%
Sidewalk	0.02	0.9%
Landscape	2.23	97.0%
Proposed Areas	**2.30**	**100.0%**
Roof	0.42	18.1%
Road	0.40	17.4%
Sidewalk	0.20	8.7%
Landscape	1.22	53.2%
Pond	0.06	2.6%

Table 1: Land Type Designations Existing vs. Proposed

4.1.1 PERFORMANCE STANDARDS AND GOALS

Following Figure I-3.1 – Flow Chart for Determining Requirements for New Development, the project site is considered a new development and triggers the Minimum Requirements #1-9. All of the stormwater runoff from the disturbed area of the project parcel will be collected, treated, and infiltrated on-site. Basic Treatment will be provided for all of the pollution generating impervious surfaces through the use of a Bioretention layer at the bottom of the proposed infiltration pond.

4.1.2 FLOW CONTROL SYSTEM

Flow control is required for the proposed development and will be provided through an infiltration pond in the west corner of the site and dry wells for the roof area of each individual lot. The 2012 Western Washington Hydrology Model (WWHM) was used to size the infiltration pond so that it meets Minimum

requirement #7. The pond will fully infiltrate runoff generated from all surfaces onsite, with the exception of the 0.42 aces of roof area. According to WWHM, the 1.88 acres served by the infiltration pond, will require a bottom pond area of 540 square feet (12 ft x 45 ft), 2 feet storage depth with 0.5 feet of freeboard, and 3:1 side slopes. The infiltration rate of 6.4 in/hr used to size the pond in WWHM was taken from a Geotechnical Report prepared by Landau Associates. This rate was calculated from test pit 5, which was excavated in the same location as the proposed infiltration pond. Runoff generated from the roof areas will be infiltrated through individual dry wells on each lot. The dry wells will be sized per the requirements of BMP T5.10C Perforated Stub-Out Connections. Dry wells have not been sized for the preliminary plans, as exact roof areas are unknown.

4.1.3 WATER QUALITY SYSTEM

Water quality treatment designs have been performed in accordance with Volume 5 of the 2019 DOE manual. The proposed infiltration pond will provide enhanced treatment for all pollution generating impervious surfaces through the use of bioretention layer per BMP T7.30 Bioretention will consist of an 18" amended media layer demonstrating a cation exchange capacity of at least 5 milliequivalents/100 g of dry soil in accordance with the 2019 SWMMWW. According to WWHM, 100% of the stormwater runoff from the proposed site improvements will infiltrate within this facility and will therefore provide the required treatment for the project.

4.1.4 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

All stormwater conveyance systems will be sized to convey the 24-hour 25-year storm within the pipe. All proposed stormwater pipe are a minimum of 12" at a minimum slope of 0.50%. Additional conveyance analysis and system design will be provided in a future submittal.

SECTION 5: CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (C-SWPPP)

A SWPPP will be prepared and attached herein as Appendix 7 at the time of the civil permit submittal.

SECTION 6: SPECIAL REPORTS AND STUDIES

See Appendix 5 for the geotechnical report. No other special reports of studies were required for this project.

SECTION 7: OTHER PERMITS

Utility, paving, building, and grading permits may need to be secured prior to beginning construction activities.

SECTION 8: OPERATION AND MAINTENANCE MANUAL

The owner of the property will be responsible for maintaining all stormwater facilities on-site. An operation and maintenance manual will be completed and included herein as Appendix 6 at the time of the civil permit submittal.

END OF STORMWATER SITE PLAN

APPENDIX 1

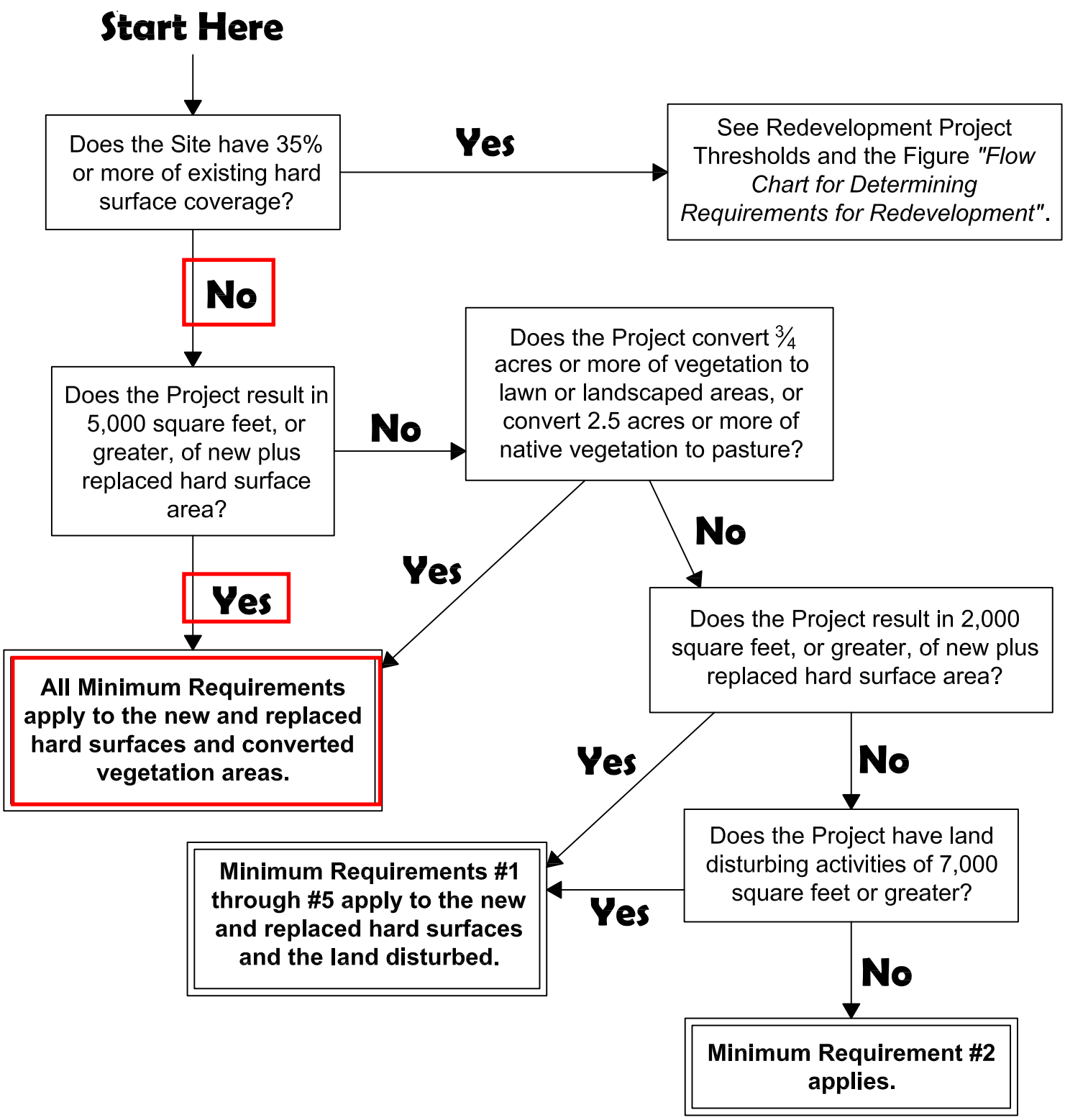
SITE VICINITY MAP


PROJECT LOCATION
North Yelm
Nisqually Pines Offices
Yelm High School
Yelm
Walmart Supercenter
Safeway


PROJECT LOCATION

APPENDIX 2

DETERMINATION OF MINIMUM REQUIREMENTS WORKSHEET



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for New Development

Revised March 2019

APPENDIX 3

BASIN MAP EXHIBITS

SEC. 19 / 24, T17N., R2E., W.M.

COATS STREET NW

N 50°23'50" W

400.00

SHED

RESIDENCE

PLANTER

CONCRETE

GARAGE

GRAVEL DRIVE

LONGMIRE STREET NW

250.00

S 39°36'10" W 413.00

N 39°36'10" E 250.00

C2

CULLENS STREET NW

184.81

N 50°23'50" W 400.00

379.48

ASPHALT DRIVE

2.3 ac

0 20 40

SCALE IN FEET

EXISTING BASIN AREAS	
ROOF AREAS:	0.03 AC
ROAD AREAS:	0.02 AC
SIDEWALK AREAS:	0.02 AC
PERVIOUS AREAS:	2.23 AC
TOTAL:	2.30 AC

EXISTING BASIN AREAS

Drawing: C:\Users\VFerguson\OneDrive - LDC Inc\Desktop_CAD-LDC-XSURV.dwg Plotted: May 04, 2022 - 2:42pm

REVISIONS

NO.	DATE	DESCRIPTION	BY

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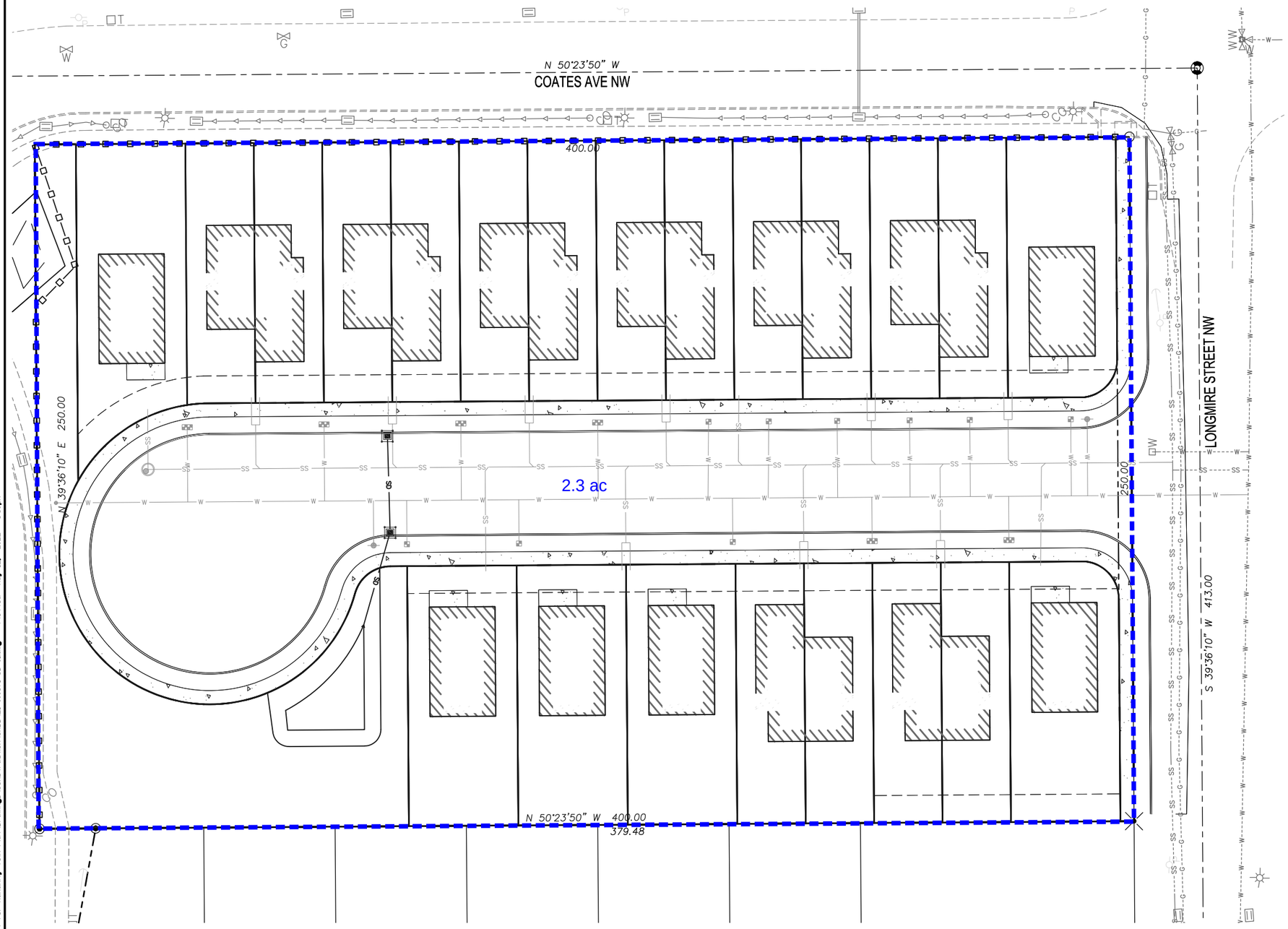
HABITAT FOR HUMANITY

YELM PLAT
407 LONGMIRE STREET NW
EXISTING BASIN AREAS

JOB NUMBER:	
DRAWING NAME:	
DESIGNER:	M. DOBBS
DRAFTING BY:	M. DOBBS
DATE:	APRIL, 2022
SCALE:	1"=20'
JURISDICTION:	CITY OF YELM

SEC. 19 / 24, T17N., R2E., W.M.



0 20 40
SCALE IN FEET

DEVELOPED BASIN AREAS	
ROOF AREAS:	0.42 AC
ROAD AREAS:	0.40 AC
DRIVEWAY AREAS:	0.20 AC
SIDEWALK AREAS:	0.14 AC
POND AREAS:	0.07 AC
PERVIOUS AREAS:	1.07 AC
TOTAL:	2.30 AC

DEVELOPED BASIN AREAS

REVISIONS

NO.	DATE	DESCRIPTION	BY

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HABITAT FOR HUMANITY

YELM PLAT
407 LONGMIRE STREET NW
DEVELOPED BASIN AREAS

JOB NUMBER:	
DRAWING NAME:	21-000371-SD-01
DESIGNER:	M. DOBBS
DRAFTING BY:	M. DOBBS
DATE:	APRIL, 2022
SCALE:	1"=20'
JURISDICTION:	CITY OF YELM

APPENDIX 4

CONSTRUCTION PLANS

APPENDIX 5

GEOTECHNICAL REPORTS

Draft Technical Memorandum

TO:	Ben Fransua, Director of Construction, South Puget Sound Habitat for Humanity
FROM:	Lance Levine, PE, and Calvin McCaughan, PE
DATE:	August 3, 2021
RE:	**Summary of Geotechnical Engineering Services** **Longmire Development** **Yelm, Washington** **Project No. 1592003.010.011**

Introduction

This memorandum summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (LAI) in support of the Longmire Development project, located at 407 Longmire Street Northwest in Yelm, Washington (site; Figure 1).

This memorandum was prepared with information provided by South Puget Sound Habitat for Humanity (SPSH4H; project owner) and with data collected during LAI's geotechnical field exploration and laboratory testing programs.

Project Understanding

SPSH4H proposes to develop the site with single-family residences, associated utilities, stormwater infiltration facilities, and a paved access road and driveways. The residences will be supported on shallow foundations. The access road and driveways likely will be constructed with pervious surfaces.

Site Conditions

The site consists of an 8.46-acre parcel (Thurston County parcel number 22719230700), currently developed with a single-family residence, garage, storage shed, and septic drainfield. Undeveloped portions of the site are vegetated with grass and several fruit trees. The site is bordered by Longmire Street Northwest to the southeast, by Coates Avenue Northwest to the northeast, by Cullens Street Northwest to the northwest and by single-family residences to the southwest. The site slopes gently to the north, with a total relief of 4 feet (ft).

Geologic Setting

Geologic information for the site and the surrounding area was obtained from the G*eologic Map of the Centralia Quadrangle, Washington* (Schasse 1987). Subsurface deposits in the vicinity of the site are mapped as Vashon age outwash gravel (Qdvg). This unit typically consists of medium dense to dense, proglacial and recessional, stratified gravel, cobbles, and boulders deposited in meltwater streams and deltas. The soils observed in LAI's July 2021 explorations were generally consistent with the mapped geology.

Subsurface Explorations

On July 6, 2021, LAI explored site subsurface conditions by excavating six test pits (TP-1 through TP-6) 10.0 to 12.0 ft below ground surface (bgs). The test pits were excavated at the approximate locations shown on Figure 2.

LAI personnel monitored the field explorations, collected representative soil samples, and maintained detailed logs of the subsurface soil and groundwater conditions observed. Subsurface conditions were described using the soil classification system shown on Figure 3, in general accordance with ASTM International (ASTM) standard test method D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).* Summary logs of the explorations are presented on Figures 4 through 6.

Samples were transported to LAI's soils laboratory for further examination and classification. Natural moisture content determinations were performed on select soil samples in accordance with ASTM standard test method D2216, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.* The natural moisture content is shown as W = xx (i.e., percentage of dry weight) in the "Test Data" column on Figures 4 through 6. Grain size analyses were performed in accordance with ASTM standard test method D422, *Standard Test Method for Particle-Size Analysis of Soils.* Samples selected for grain size analysis are designated with a "GS" in the "Test Data" column on Figures 4 through 6. The results of the grain size analyses are presented on Figures 7 through 9.

Soil Conditions

The soils observed underlying existing surface conditions (i.e., topsoil) were categorized into one general unit:

- **Recessional outwash:** Recessional outwash was observed beneath the topsoil in all six test pits. The recessional outwash typically consisted of grayish-brown to brown, sandy gravel or gravelly sand with variable silt, cobble, and boulder content in a medium dense to dense condition. All six test pits were terminated following moderate to severe caving in the recessional outwash unit.

Groundwater Conditions

No groundwater or groundwater seepage was observed in LAI's July 2021 explorations. The groundwater conditions reported herein are for the specific locations and date indicated and may not be representative of other locations and/or times. Groundwater conditions will vary depending on local subsurface conditions, weather conditions, and other factors. Site groundwater levels are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring.

Conclusions and Recommendations

The near-surface soils observed in LAI's explorations will provide adequate support of the proposed shallow foundations and pavement sections. LAI recommends stripping approximately 9 inches of topsoil to expose sand and gravel soils that are suitable for reuse as structural fill. Site soils are suitable for stormwater infiltration. The following geotechnical recommendations should be incorporated into the project design.

Seismic Design Considerations

LAI understands that seismic design will be completed using *2018 International Building Code* standards (ICC 2017). The parameters in Table 1 can be used to compute seismic base shear forces.

Table 1. *2018 International Building Code* Seismic Design Parameters

Spectral response acceleration at short periods (S_S) = 1.292g
Spectral response acceleration at 1-second periods (S_1) = 0.466g
Site class = D
Site coefficient (F_a) = 1.0
Site coefficient (F_v) = 1.834[(a)]

(a) When using the coefficient F_v = 1.834, adhere to Exception 2 requirements for a ground motion hazard analysis. See Section 11.4.8 of the American Society of Civil Engineers' *Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16).*

F_a, F_v = acceleration (0.2-second period) and velocity (1.0-second period) site coefficients, respectively

g = force of gravity

S_s, S_1 = 0.2-second and 1.0-second period spectral accelerations, respectively

Based on the subsurface conditions observed in LAI's explorations, there is a low risk that seismically induced soil liquefaction will occur at the site following the design-level earthquake. Given the distance between the site and the nearest known active crustal fault, the risk of ground rupture due to surface faulting is low.

Foundation Support

Shallow foundations should be constructed on recessional outwash soil or on structural fill extending to such soil. The design parameters in Table 2 should be used in conjunction with the complete recommendations in this memorandum.

Table 2. Summary of Design Parameters for Shallow Foundations

Allowable soil bearing pressure = 3,500 psf
Friction coefficient (factored) = 0.35
Passive earth pressure = 330 pcf
Minimum foundation width = 18 inches (continuous), 24 inches (isolated)

pcf = pounds per cubic foot
psf = pounds per square foot

When developing design parameters, LAI assumed that shallow foundations would be established on medium dense to dense subgrades prepared as recommended herein. The geotechnical engineer should evaluate prepared subgrades prior to placement of structural fill.

The allowable soil bearing pressure in Table 2 applies to long-term dead and live loads, exclusive of the weight of the footing and any overlying backfill. The bearing pressure can be increased by one-third for transient loads, such as those induced by wind and seismic forces.

For frost protection, perimeter footings should be embedded at least 12 inches below the lowest adjacent grade, where the ground is flat. Interior footings should be embedded at least 6 inches below the nearest adjacent grade. LAI estimates that continuous and isolated foundations will settle 1 inch or less if constructed as recommended. Differential settlement between similarly loaded foundation elements is estimated to be on the order of ½ inch or less. Settlement is expected to occur as building loads are applied during construction.

An allowable coefficient of sliding resistance of 0.35, applied to vertical dead loads only, can be used to compute frictional resistance acting on the base of footings. This coefficient includes a factor of safety of 1.5 on the calculated ultimate value.

The passive resistance of properly compacted structural fill placed against the sides of foundations can be considered equivalent to a fluid with a density of 330 pounds per cubic foot. The foundation passive earth pressure has been reduced by a factor of 1.5 to limit deflections to less than 2 percent of the embedded depth. The passive earth pressure and friction components can be combined, provided the passive component does not exceed two-thirds of the total. The top foot of soil should be excluded from the calculation, unless the foundation perimeter will be covered by slab-on-grade or pavement.

Slabs-On-Grade

Slabs-on-grade should be installed on a uniformly firm, unyielding subgrade that consists of sand and/or gravel. A modulus of vertical subgrade reaction (subgrade modulus) can be used to design slabs-on-grade. The subgrade modulus will vary based on the dimensions of the slab and the

magnitude of applied loads on the slab surface; slabs with larger dimensions and loads are influenced by soils to a greater depth. LAI recommends using a subgrade modulus of 220 pounds per cubic inch to design on-grade floor slabs. This subgrade modulus is for a 1-ft-by-1-ft square plate and is not the overall modulus of a larger area.

Interior slabs-on-grade should include a vapor barrier and a capillary break layer, designed and installed in accordance with industry standards.

Hot-Mix Asphalt Pavements

The asphalt pavement section should be constructed on compacted subgrade (i.e., on existing sand and gravel) prepared as recommended herein. When developing the recommendations in Table 3, LAI assumed a 20-year design life and a maximum equivalent single-axle load of 50,000 for the private roadway local access residential pavement section and 500,000 for the neighborhood collector section. The recommendations in Table 3 accord with the City of Yelm's minimum street design standards (2019).

Table 3. Recommended Asphalt Pavement Design Section[(a)]

Pavement Section Type	Asphalt Concrete Pavement Thickness	Crushed Surfacing Top Course Thickness	Ballast
Neighborhood Collector	3 inches	2 inches	8 inches
Private Roadway Local Access Residential	2 inches	2 inches	8 inches

(a) Refer to *Yelm Engineering Specifications and Standard Details* (City of Yelm 2019).

Ballast and top course material should be compacted to at least 95 percent of the maximum dry density, determined in accordance with ASTM standard test method D1557, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).*

Compacted ballast should meet the requirements for Ballast in Section 9-03.9(1) of the Washington State Department of Transportation's 2021 *Standard Specifications for Road, Bridge, and Municipal Construction* (*2021 WSDOT Standard Specifications*). Alternatively, ballast may meet the requirements for Permeable Ballast in Section 9-03.9(2). Compacted top course should meet the requirements for Crushed Surfacing Top Course in Section 9-03.9(3) of the *2021 WSDOT Standard Specifications.* Prevention of road-base saturation is essential for pavement durability; efforts should be made to limit the amount of water entering the ballast and top course.

Asphalt concrete should be Class B aggregate material or hot-mix asphalt (HMA), class ½ inch and PG58H-22 binder. Asphalt should conform to the requirements in Section 5-04 of the 2*021 WSDOT Standard Specifications* and be compacted to at least 91 percent of the Rice density.

Permeable Pavement

Permeable pavements will consist of [permeable] HMA or a concrete wearing surface, an aggregate storage layer, and subgrade soil. The subgrade soil should have the infiltration capacity to drain water from the aggregate storage layer.

Permeable pavement is suited for very low-volume, slow-speed locations with infrequent truck traffic (WSDOT 2018), including:

- Sidewalks, bicycle trails, community trail/pedestrian path systems, or other pedestrian-accessible paved areas (e.g., traffic islands).
- Light vehicle-access areas, such as maintenance/enforcement areas on divided highways.
- Parking lots, including perimeter and overflow parking areas.
- Driveways.

To promote infiltration, compaction of permeable pavement subgrades should be avoided. Minimum permeable pavement thicknesses are recommended in Table 4.

Table 4. Recommended Permeable Pavement Design Sections

Facility	Hot-Mix Asphalt	Portland Cement Concrete Pavement
Light vehicle-access areas	6 inches permeable HMA 12 inches (permeable base)	9 inches undoweled, permeable PCCP 12 inches (permeable base)
Parking	6 inches permeable HMA 12 inches (permeable base)	9 inches undoweled, permeable PCCP 12 inches (permeable base)
Pedestrian sidewalks and trails	3 inches permeable HMA 12 inches (permeable base)	4.5 inches undoweled, permeable PCCP 12 inches (permeable base)

HMA = hot-mix asphalt
PCCP = Portland cement concrete pavement

LAI recommends that permeable base meets the requirements for Permeable Ballast in Section 9-03.9(2) of the *2021 WSDOT Standard Specifications.* Asphalt concrete should be Class B aggregate material or HMA, class ½ inch and PG58H-22 binder. HMA should conform to the requirements in Section 5-04 of the *2021 WSDOT Standard Specifications*, and the binder should be 6.0 to 7.0 percent by total weight. Separation fabric should be placed between native soils and the permeable base. The fabric should satisfy the criteria in Table 2, Section 9-33.2(1) of the *2021 WSDOT Standard Specifications.*

A maintenance plan, approved by the City of Yelm, will be required for permeable pavements. Maintenance standards are provided in the Washington State Department of Ecology's 2019 *Stormwater Management Manual for Western Washington* (*2019 SWMMWW*).

Stormwater Infiltration

Groundwater and soil mottling were not observed in LAI's July 2021 explorations, which extended to a maximum depth of 12.0 ft bgs. LAI recommends that a seasonal high groundwater elevation of 20 ft bgs is used to design stormwater facilities. Site groundwater levels are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring.

The stormwater infiltration facilities will be constructed in accordance with the *2019 SWMMWW.* The site is underlain by soils belonging to hydrologic soil group A (USDA NRCS, accessed July 16, 2021). As such, the infiltration rates in Table 5 were developed using the results of LAI's geotechnical laboratory tests (Figures 7 through 9) and the soil grain size analysis method. In LAI's opinion, stormwater generated on site will disperse rapidly, and there is a low risk of groundwater mounding.

The following correction factors were applied to the infiltration rates to account for site variability (CF_v=0.8), testing method (CF_t=0.4), and maintenance (CF_m=0.9). When calculating infiltration rates, LAI assumed a depth-to-groundwater of 16 ft bgs, measured from the base of the infiltration facility.

Table 5. Preliminary Infiltration Rates

Exploration	Depth Interval (ft)	Factored Infiltration Rate (in/hr)
TP-1	1–7	1.8
TP-1	7–10.5	7.5
TP-2	1–8	3.6
TP-2	8–10	9.4
TP-3	1–5	2.0
TP-3	5–10.5	3.9
TP-4	1–6	5.9
TP-4	6–12	1.4
TP-5	1–7	6.4
TP-5	7–10	5.4
TP-6	1–2.5	0.4
TP-6	2.5–10.5	2.2

ft = foot/feet
in/hr = inches per hour

Site Drainage

LAI recommends that perimeter foundation footing drains are included in the design of structures. Landscape and hardscape should slope away from structures at a grade of at least 2 percent.

Construction Considerations

The following key points should be considered when developing project plans and specifications:

- **Stripping:** Approximately 9 inches of topsoil (dark brown, gravelly sand with silt) should be stripped from areas designated for development (i.e., the proposed locations of footings, slabs-on-grade, and pavement sections). Topsoil is not considered suitable for reuse as structural fill.
- **Subgrade preparation:** Before structural fill, formwork, or pavement base course is placed, the prepared subgrade should be proof-rolled in the presence of a qualified geotechnical engineer, who is familiar with the site and can check for soft/disturbed areas. Areas of limited access can be evaluated with a steel T-probe. If probing or proof-rolling reveals loose and/or disturbed subgrades, the upper 1 ft of subgrade should be scarified; moisture-conditioned; and compacted to a firm, unyielding condition. Alternatively, unsuitable soils can be overexcavated and replaced with compacted structural fill.
- **Utility trench excavation and backfill:** LAI anticipates that utility trenches will be excavated in medium dense to dense outwash soils. Caving may occur in outwash soils. A heavy-duty hydraulic excavator should be able to reach the required trench depths. A smooth-bladed bucket should be used to remove loose and/or disturbed soil from the trench bottom. The final trench bottom should be firm and free of roots, topsoil, lumps of silt and clay, and organic and inorganic debris.
- **Site soil:** If site soils will be reused as structural fill, material larger than 6 inches in diameter (e.g., large cobbles and boulders) should be removed or screened.
- **Import structural fill:** Gravel Borrow, as described in Section 9-03.14(1) of the *2021 WSDOT Standard Specifications,* is a suitable source of import structural fill. During periods of wet weather, the fines content should not exceed 5 percent, based on the minus ¾-inch fraction.
- **Fill placement and compaction:** Structural fill should be placed on an approved subgrade that consists of uniformly firm, unyielding, inorganic native soils or of compacted structural fill that extends to such soils. Structural fill should be placed and compacted in accordance with the requirements in Section 2-03.3(14)C, Method C of the *2021 WSDOT Standard Specifications.* Method A is appropriate for non-structural areas, such as landscaping. Each layer of structural fill should be compacted to at least 95 percent of the maximum dry density, determined in accordance with Section 2-03.3(14)D of the *2021 WSDOT Standard Specifications.* Alternatively, the maximum dry density can be determined using ASTM standard test method D1557.

- **Construction dewatering:** Though not observed in LAI's test pit explorations, zones of perched groundwater may be encountered during the wet season (typically late October through June). Temporary excavations should be dewatered to allow construction to be completed in the dry. Where groundwater seepage is encountered, conventional sumps and pumps should be sufficient to dewater excavations. The contractor should be responsible for the design, monitoring, and maintenance of dewatering systems.
- **Temporary slopes:** Temporary excavations should be completed in accordance with the requirements in Section 2-09 of the *2021 WSDOT Standard Specifications.* Temporary excavations in excess of 4 ft should be shored or sloped in accordance with the requirements outlined in Safety Standards for Construction Work, Part N (Washington Administrative Code Chapter 296-155). The soil likely to be exposed in construction excavations should be considered Type C, with a maximum allowable excavation inclination of 1½ horizontal to 1 vertical (1½H:1V).

  The contractor should be responsible for actual excavation configurations and the maintenance of safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed.
- **Permanent slopes:** Permanent cut-and-fill slopes should be no steeper than 2H:1V. This design recommendation does not apply to stormwater pond slopes, which are typically 3H:1V or flatter. Stormwater pond slopes should be designed in accordance with local stormwater codes. Permanent and temporary slopes should be protected from erosion and reseeded or revegetated as soon as practical.

Use of This Technical Memorandum

Landau Associates has prepared this technical memorandum for the exclusive use of South Puget Sound Habitat for Humanity and its design team for specific application to the Longmire Development project in Yelm, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Reuse of the information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk.

Landau Associates warrants that, within the limitations of scope, schedule, and budget, its services have been provided in a manner consistent with that level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality, under similar conditions as this project. Landau Associates makes no other warranty, either express or implied.

Closing

We appreciate the opportunity to assist you with this project. If you have questions or comments, please contact Lance Levine at 360.791.3178 or at llevine@landauinc.com.

LANDAU ASSOCIATES, INC.

Lance Levine, PE
Senior Project Engineer

Calvin McCaughan, PE
Principal

LGL/CAM/mcs
[\\OLYMPIA1\PROJECTS\1592\003.010\R\LONGMIRE DEVELOPMENT DRAFT TECHNICAL MEMORANDUM 8.3.2021.DOCX]

Attachments: Figure 1. Vicinity Map
Figure 2. Site and Exploration Location Plan
Figure 3. Soil Classification System and Key
Figures 4–6. Logs of Test Pits TP-1 through TP-6
Figures 7–9. Grain Size Distribution

References

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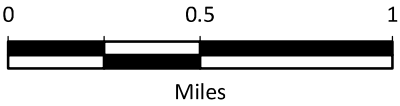

Data Source: Esri.

G:\Projects\1592\003\010\011\VE01VicMap.mxd 7/9/2021

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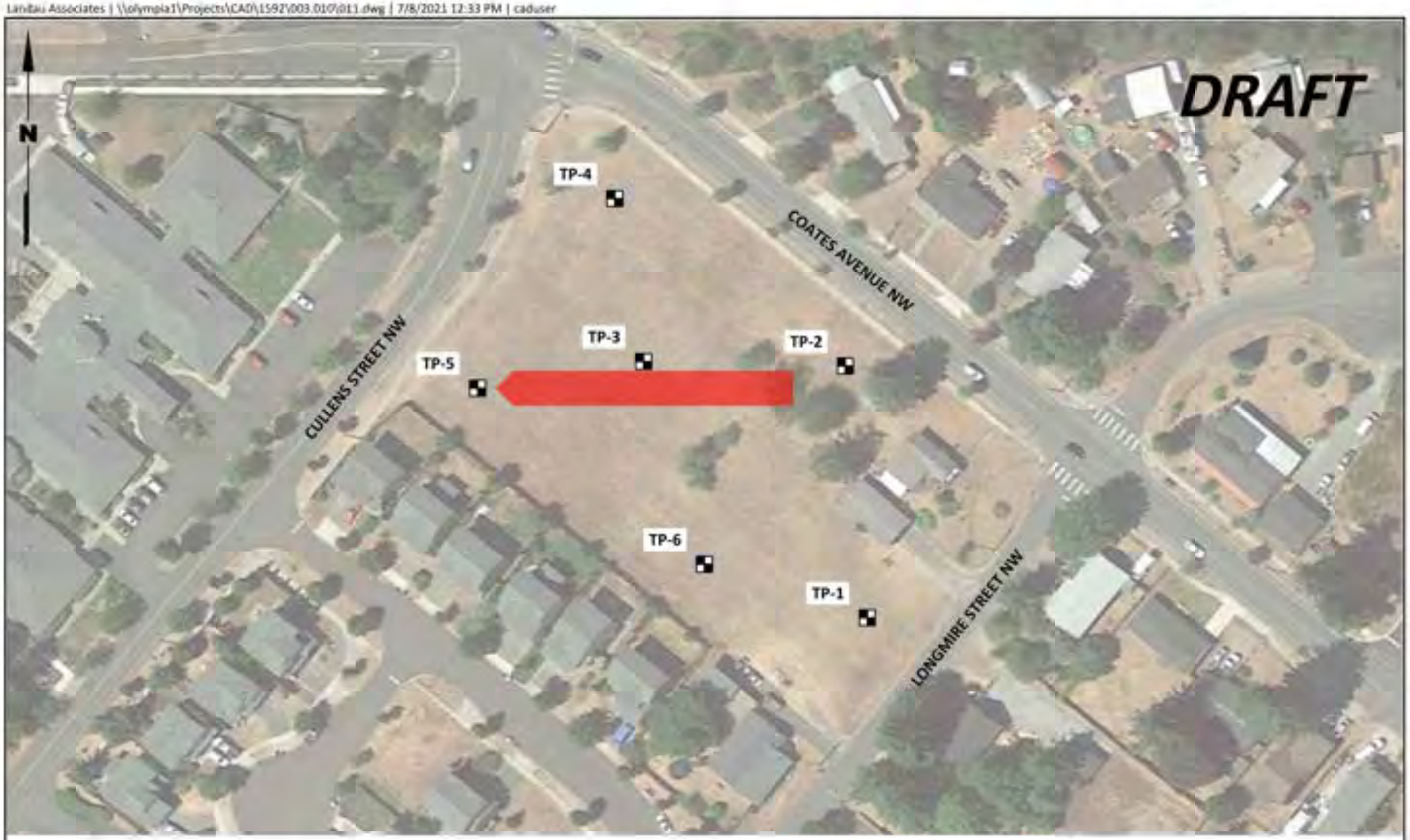
Longmire Development Yelm, Washington	**Vicinity Map**	Figure 1



Legend

TP-1 Approximate Test Pit Location and Designation

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Google Imagery 2018

0 100 200

Scale in Feet

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Longmire Development
Yelm, Washington

Site and Exploration Location Plan

Figure
2

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30% - "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15% - "with gravel," "with sand," "with silt," etc.
	≤ 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

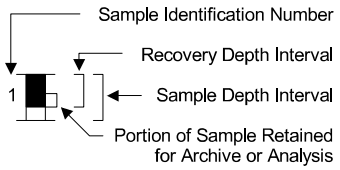
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)

▼ Approximate water level at time after drilling/excavation/well

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Yelm, Washington

Soil Classification System and Key

Figure 3

TP-1

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL	
0					SP-SM GP	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(TOPSOIL)**	Groundwater not encountered.
2	S-1	d				Brown, very sandy, fine to coarse GRAVEL (medium dense, damp) **(OUTWASH)**	
4	S-2	d	W = 4 GS			Minor caving	
6						Grades to light brown and with cobbles and boulders	
8						Grades to with sand, dense, and moist	
10	S-3	d	W = 4 GS			Severe caving	
12							
14							

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.5 ft.

TP-2

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL	
0					SP-SM GP	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(TOPSOIL)**	Groundwater not encountered.
2	S-1	d				Brown, very sandy, fine to coarse GRAVEL (medium dense, damp) **(OUTWASH)**	
4	S-2	d	W = 3 GS			Grades to light brown and with cobbles and boulders	
6						Minor caving	
8						Grades to very dense	
10	S-3	d	W = 2 GS			Moderate caving Grades to brown, sandy, dense, and moist	
12							
14							

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pits

Figure 4

TP-3

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL	
0					SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	Groundwater not encountered.
2	S-1	d			GP	**(TOPSOIL)**	
4	S-2	d	W = 3 GS			Brown, very sandy, fine to coarse GRAVEL (medium dense, damp) **(OUTWASH)**	
6						Grades to light brown with cobbles and boulders Moderate caving	
8	S-3	d	W = 3 GS			Grades to sandy	
10						Grades to brown, without boulders, dense, and moist	
12							
14							

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.5 ft.

TP-4

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL	
0					SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	Groundwater not encountered.
2	S-1	d			SP-SM	**(TOPSOIL)**	
4	S-2	d	W = 2 GS		GP	Brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(OUTWASH)**	
6					SP	Grayish-brown, very sandy, fine to coarse GRAVEL with cobbles and boulders (medium dense, damp)	
8	S-3	d	W = 5 GS			Light brown, very gravelly, fine to coarse SAND with cobbles and boulders (dense, damp)	
10						Moderate caving Grades to without boulders and moist	
12	S-4	d					
14							

Test Pit Completed 07/06/21
Total Depth of Test Pit = 12.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pits

Figure 5

TP-5

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL	
0						SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	Groundwater not encountered.
2		S-1	d			SP-SM	(TOPSOIL)	
4		S-2	d	W = 3 GS		GW	Brown, gravelly, fine to coarse SAND with silt (medium dense, damp) (OUTWASH)	
6							Grayish-brown, sandy, fine to coarse GRAVEL with cobbles and boulders (medium dense, damp)	
8		S-3	d	W = 5 GS		GP-GM	Moderate caving Grayish-brown, sandy, fine to coarse GRAVEL with silt (dense, moist)	
10							Severe caving	
12								
14								

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.0 ft.

TP-6

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL	
0						SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	Groundwater not encountered.
2		S-1	d			SP-SM	(TOPSOIL)	
4		S-2	d			GP	Dark brown, gravelly, fine to coarse SAND with silt and cobbles (medium dense, damp) (OUTWASH)	
6							Brown, very sandy, fine to coarse GRAVEL (medium dense, moist) Grades to with cobbles and boulders	
8		S-3	d	W = 4 GS			Severe caving Grades to gray, gravelly, and very dense	
10								
12								
14								

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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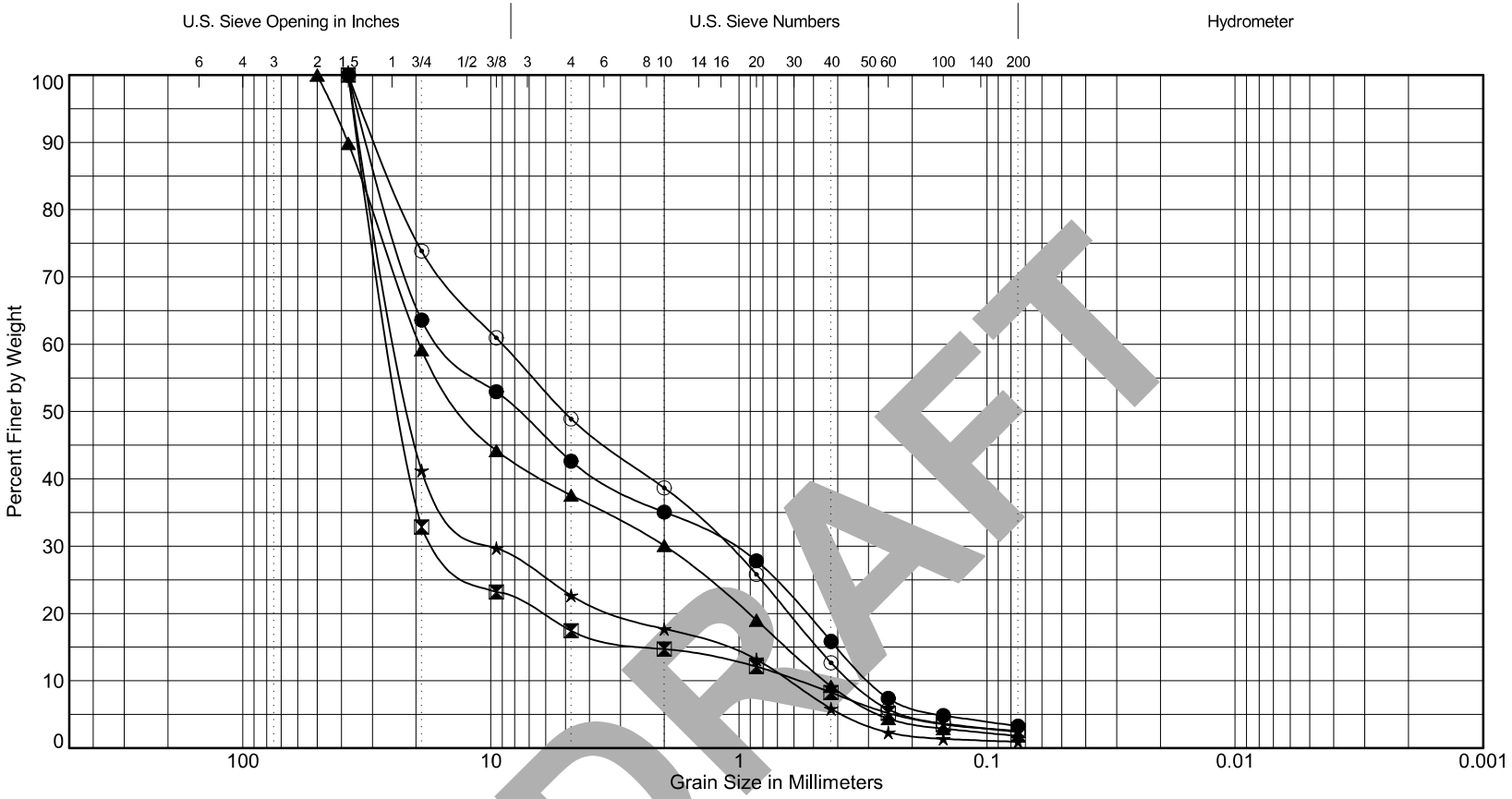
Log of Test Pits

Figure 6



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Exploration Number	Sample Number	Depth (ft)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-1	S-2	3.0	4	Very sandy, fine to coarse GRAVEL	GP
⊠	TP-1	S-3	9.0	4	Fine to coarse GRAVEL with sand	GP
▲	TP-2	S-2	3.0	3	Very sandy, fine to coarse GRAVEL	GP
★	TP-2	S-3	9.0	2	Sandy, fine to coarse GRAVEL	GP
⊙	TP-3	S-2	3.0	3	Very sandy, fine to coarse GRAVEL	GP

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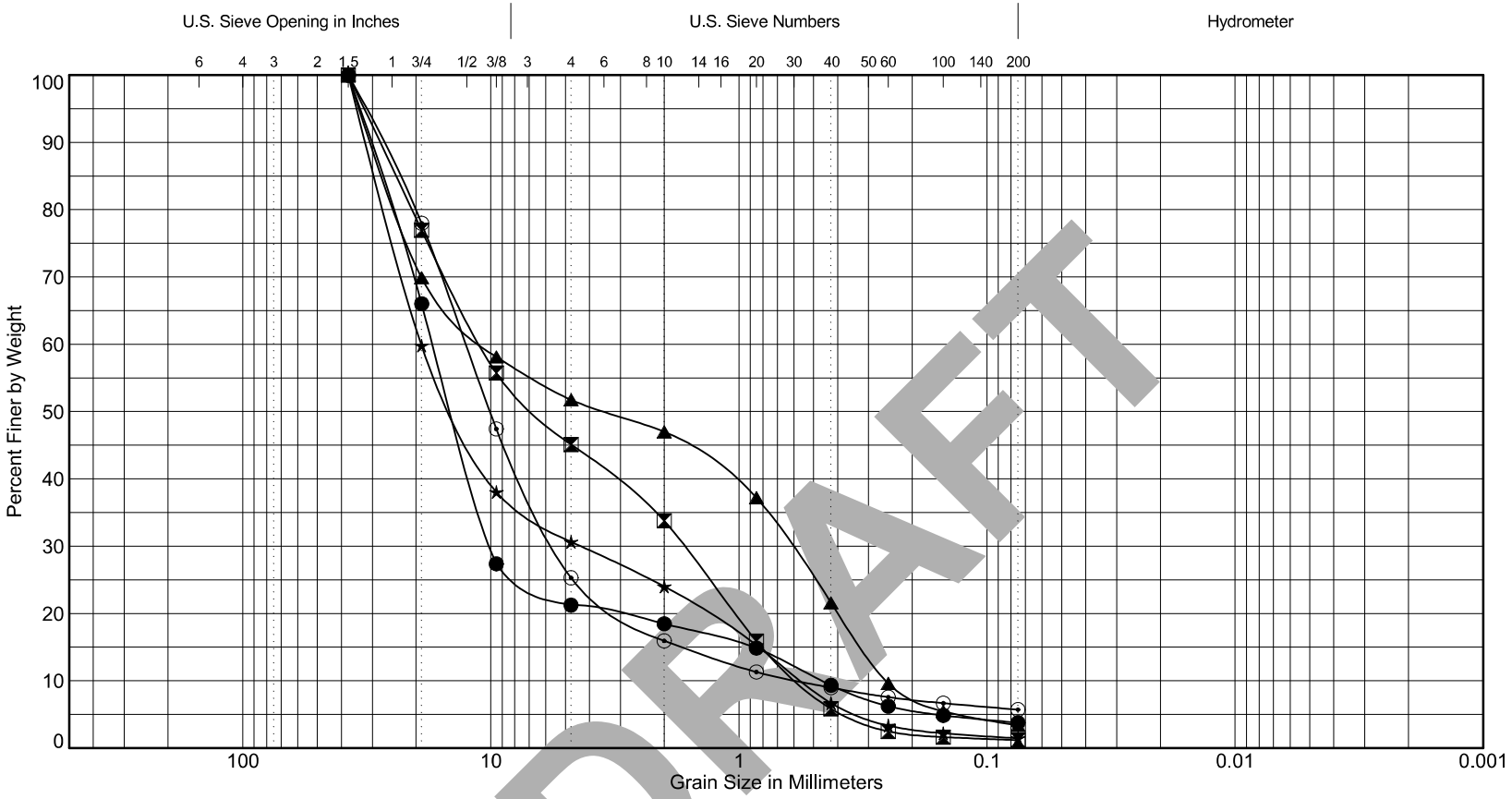
Grain Size Distribution

Figure 7



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Exploration Number	Sample Number	Depth (ft)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-3	S-3	7.0	3	Sandy, fine to coarse GRAVEL	GP
⧓	TP-4	S-2	3.0	2	Very sandy, fine to coarse GRAVEL	GP
▲	TP-4	S-3	8.0	5	Very gravelly, fine to coarse SAND	SP
★	TP-5	S-2	3.5	3	Sandy, well-graded GRAVEL	GW
⊙	TP-5	S-3	7.5	5	Sandy, fine to coarse GRAVEL with silt	GP-GM

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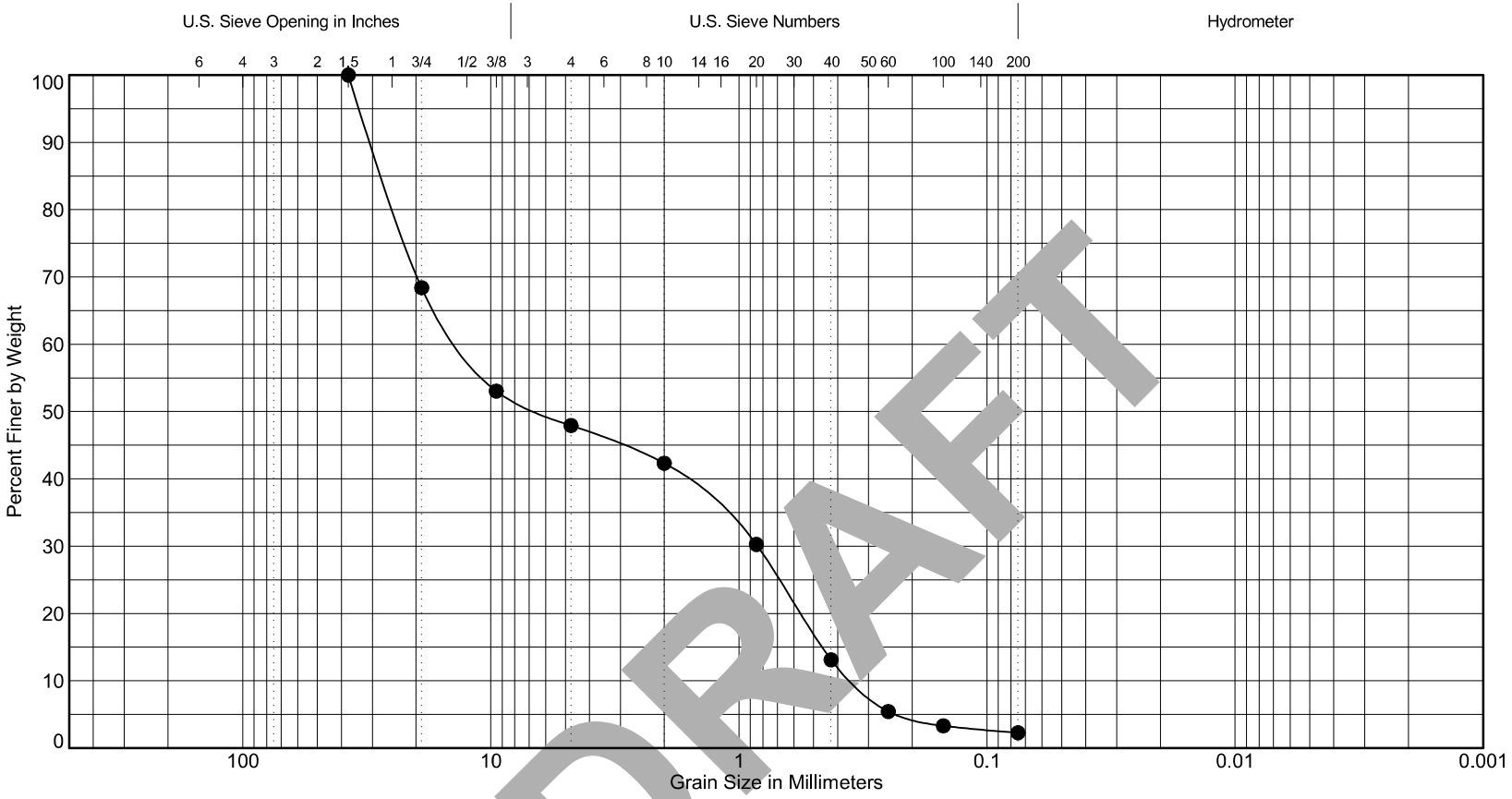
Yelm, Washington

Grain Size Distribution

Figure
8



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Exploration Number	Sample Number	Depth (ft)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-6	S-3	8.0	4	Very sandy, fine to coarse GRAVEL	GP

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Yelm, Washington

Grain Size Distribution

Figure
9

APPENDIX 6

OPERATIONS AND MAINTENANCE MANUAL

Section to be added in future submittal.

APPENDIX 7

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

Section to be added in future submittal.

APPENDIX 8

FEMA FLOOD INSURANCE MAP

National Flood Hazard Layer FIRMette

122°37'1"W 46°57'1"N

122°36'24"W 46°56'36"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/4/2022 at 11:24 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX 9

DESIGN CALCULATIONS AND COMPUTATIONS

WWHM2012
PROJECT REPORT

Project Name: Bioretention 20220504
Site Name:
Site Address:
City :
Report Date: 5/5/2022
Gage : Lake Lawrence
Data Start : 1955/10/01
Data End : 2008/09/30
Precip Scale: 0.86
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Flat	1.88
Pervious Total	1.88

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.88

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Pasture, Flat	1.22
Pervious Total	1.22

Impervious Land Use	acre
ROADS FLAT	0.4
SIDEWALKS FLAT	0.2
POND	0.06
Impervious Total	0.66
Basin Total	1.88

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Name : Bioretention 1
Bottom Length: 12.00 ft.
Bottom Width: 45.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0
Material type for second layer: SMMWW
Material thickness of third layer: 0
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 6.4
Infiltration safety factor: 1
Wetted surface area On
Total Volume Infiltrated (ac-ft.): 117.97
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 117.97
Percent Infiltrated: 100
Total Precip Applied to Facility: 2.839
Total Evap From Facility: 1.127
Underdrain not used
Discharge Structure
Riser Height: 2 ft.
Riser Diameter: 6 in.

Element Flows To:

Outlet 1	Outlet 2

Bioretention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0260	0.0000	0.0000	0.0000

0.0440	0.0260	0.0003	0.0000	0.0000
0.0879	0.0255	0.0005	0.0000	0.0000
0.1319	0.0251	0.0008	0.0000	0.0000
0.1758	0.0246	0.0011	0.0000	0.0008
0.2198	0.0242	0.0013	0.0000	0.0014
0.2637	0.0237	0.0016	0.0000	0.0023
0.3077	0.0233	0.0019	0.0000	0.0035
0.3516	0.0229	0.0022	0.0000	0.0050
0.3956	0.0224	0.0025	0.0000	0.0068
0.4396	0.0220	0.0028	0.0000	0.0091
0.4835	0.0216	0.0032	0.0000	0.0118
0.5275	0.0212	0.0035	0.0000	0.0149
0.5714	0.0208	0.0038	0.0000	0.0186
0.6154	0.0203	0.0042	0.0000	0.0229
0.6593	0.0199	0.0046	0.0000	0.0278
0.7033	0.0195	0.0049	0.0000	0.0334
0.7473	0.0191	0.0053	0.0000	0.0397
0.7912	0.0187	0.0057	0.0000	0.0467
0.8352	0.0183	0.0061	0.0000	0.0546
0.8791	0.0179	0.0065	0.0000	0.0633
0.9231	0.0175	0.0069	0.0000	0.0729
0.9670	0.0172	0.0073	0.0000	0.0835
1.0110	0.0168	0.0077	0.0000	0.0952
1.0549	0.0164	0.0081	0.0000	0.1079
1.0989	0.0160	0.0086	0.0000	0.1218
1.1429	0.0156	0.0090	0.0000	0.1369
1.1868	0.0153	0.0095	0.0000	0.1476
1.2308	0.0149	0.0099	0.0000	0.1504
1.2747	0.0145	0.0104	0.0000	0.1533
1.3187	0.0142	0.0109	0.0000	0.1561
1.3626	0.0138	0.0114	0.0000	0.1589
1.4066	0.0134	0.0119	0.0000	0.1618
1.4505	0.0131	0.0124	0.0000	0.1647
1.4945	0.0127	0.0129	0.0000	0.1676
1.5000	0.0124	0.0130	0.0000	0.1680

Surface retention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
1.5000	0.0260	0.0130	0.0000	0.1500	0.0029
1.5440	0.0265	0.0141	0.0000	0.1500	0.0059
1.5879	0.0269	0.0153	0.0000	0.1588	0.0089
1.6319	0.0274	0.0165	0.0000	0.1632	0.0119
1.6758	0.0279	0.0177	0.0000	0.1676	0.0149
1.7198	0.0283	0.0189	0.0000	0.1720	0.0180
1.7637	0.0288	0.0202	0.0000	0.1764	0.0210
1.8077	0.0293	0.0215	0.0000	0.1808	0.0241
1.8516	0.0298	0.0228	0.0000	0.1852	0.0272
1.8956	0.0302	0.0241	0.0000	0.1896	0.0303
1.9396	0.0307	0.0254	0.0000	0.1940	0.0335
1.9835	0.0312	0.0268	0.0000	0.1984	0.0366
2.0275	0.0317	0.0282	0.0000	0.2027	0.0398
2.0714	0.0322	0.0296	0.0000	0.2071	0.0430
2.1154	0.0327	0.0310	0.0000	0.2115	0.0463
2.1593	0.0332	0.0325	0.0000	0.2159	0.0495
2.2033	0.0337	0.0339	0.0000	0.2203	0.0528
2.2473	0.0342	0.0354	0.0000	0.2247	0.0561
2.2912	0.0347	0.0369	0.0000	0.2291	0.0594

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.88
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:1.22
Total Impervious Area:0.66

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.002852
5 year	0.007913
10 year	0.014589
25 year	0.029793
50 year	0.04892
100 year	0.078251

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.009	0.000
1957	0.002	0.000
1958	0.001	0.000
1959	0.002	0.000
1960	0.002	0.000
1961	0.007	0.000
1962	0.001	0.000
1963	0.002	0.000
1964	0.002	0.000
1965	0.001	0.000
1966	0.002	0.000
1967	0.002	0.000
1968	0.002	0.000
1969	0.002	0.000
1970	0.002	0.000
1971	0.012	0.000
1972	0.020	0.000
1973	0.001	0.000
1974	0.005	0.000
1975	0.001	0.000
1976	0.002	0.000
1977	0.001	0.000
1978	0.002	0.000
1979	0.001	0.000
1980	0.001	0.000

1981	0.004	0.000
1982	0.004	0.000
1983	0.002	0.000
1984	0.002	0.000
1985	0.001	0.000
1986	0.003	0.000
1987	0.003	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.011	0.000
1991	0.016	0.000
1992	0.001	0.000
1993	0.001	0.000
1994	0.001	0.000
1995	0.009	0.000
1996	0.023	0.000
1997	0.015	0.000
1998	0.004	0.000
1999	0.001	0.000
2000	0.002	0.000
2001	0.001	0.000
2002	0.010	0.000
2003	0.001	0.000
2004	0.095	0.000
2005	0.015	0.000
2006	0.068	0.000
2007	0.030	0.000
2008	0.002	0.000

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0952	0.0000
2	0.0684	0.0000
3	0.0295	0.0000
4	0.0227	0.0000
5	0.0199	0.0000
6	0.0162	0.0000
7	0.0153	0.0000
8	0.0150	0.0000
9	0.0123	0.0000
10	0.0107	0.0000
11	0.0097	0.0000
12	0.0093	0.0000
13	0.0093	0.0000
14	0.0067	0.0000
15	0.0052	0.0000
16	0.0039	0.0000
17	0.0036	0.0000
18	0.0035	0.0000
19	0.0035	0.0000
20	0.0032	0.0000
21	0.0024	0.0000
22	0.0021	0.0000
23	0.0021	0.0000
24	0.0021	0.0000

25	0.0015	0.0000
26	0.0015	0.0000
27	0.0015	0.0000
28	0.0015	0.0000
29	0.0015	0.0000
30	0.0015	0.0000
31	0.0015	0.0000
32	0.0015	0.0000
33	0.0015	0.0000
34	0.0015	0.0000
35	0.0015	0.0000
36	0.0015	0.0000
37	0.0015	0.0000
38	0.0015	0.0000
39	0.0015	0.0000
40	0.0015	0.0000
41	0.0015	0.0000
42	0.0015	0.0000
43	0.0015	0.0000
44	0.0015	0.0000
45	0.0015	0.0000
46	0.0015	0.0000
47	0.0015	0.0000
48	0.0015	0.0000
49	0.0015	0.0000
50	0.0014	0.0000
51	0.0014	0.0000
52	0.0014	0.0000
53	0.0013	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0014	686	0	0	Pass
0.0019	148	0	0	Pass
0.0024	120	0	0	Pass
0.0029	98	0	0	Pass
0.0033	80	0	0	Pass
0.0038	61	0	0	Pass
0.0043	51	0	0	Pass
0.0048	48	0	0	Pass
0.0053	44	0	0	Pass
0.0057	38	0	0	Pass
0.0062	37	0	0	Pass
0.0067	33	0	0	Pass
0.0072	32	0	0	Pass
0.0077	30	0	0	Pass
0.0081	29	0	0	Pass
0.0086	27	0	0	Pass
0.0091	26	0	0	Pass
0.0096	22	0	0	Pass
0.0101	19	0	0	Pass

0.0105	18	0	0	Pass
0.0110	16	0	0	Pass
0.0115	16	0	0	Pass
0.0120	14	0	0	Pass
0.0125	13	0	0	Pass
0.0129	11	0	0	Pass
0.0134	9	0	0	Pass
0.0139	9	0	0	Pass
0.0144	9	0	0	Pass
0.0149	9	0	0	Pass
0.0153	8	0	0	Pass
0.0158	6	0	0	Pass
0.0163	5	0	0	Pass
0.0168	5	0	0	Pass
0.0173	5	0	0	Pass
0.0177	5	0	0	Pass
0.0182	5	0	0	Pass
0.0187	5	0	0	Pass
0.0192	5	0	0	Pass
0.0197	5	0	0	Pass
0.0201	4	0	0	Pass
0.0206	4	0	0	Pass
0.0211	4	0	0	Pass
0.0216	4	0	0	Pass
0.0221	4	0	0	Pass
0.0225	4	0	0	Pass
0.0230	3	0	0	Pass
0.0235	3	0	0	Pass
0.0240	3	0	0	Pass
0.0245	3	0	0	Pass
0.0249	3	0	0	Pass
0.0254	3	0	0	Pass
0.0259	3	0	0	Pass
0.0264	3	0	0	Pass
0.0269	3	0	0	Pass
0.0273	3	0	0	Pass
0.0278	3	0	0	Pass
0.0283	3	0	0	Pass
0.0288	3	0	0	Pass
0.0293	3	0	0	Pass
0.0297	2	0	0	Pass
0.0302	2	0	0	Pass
0.0307	2	0	0	Pass
0.0312	2	0	0	Pass
0.0316	2	0	0	Pass
0.0321	2	0	0	Pass
0.0326	2	0	0	Pass
0.0331	2	0	0	Pass
0.0336	2	0	0	Pass
0.0340	2	0	0	Pass
0.0345	2	0	0	Pass
0.0350	2	0	0	Pass
0.0355	2	0	0	Pass
0.0360	2	0	0	Pass
0.0364	2	0	0	Pass
0.0369	2	0	0	Pass
0.0374	2	0	0	Pass

0.0379	2	0	0	Pass
0.0384	2	0	0	Pass
0.0388	2	0	0	Pass
0.0393	2	0	0	Pass
0.0398	2	0	0	Pass
0.0403	2	0	0	Pass
0.0408	2	0	0	Pass
0.0412	2	0	0	Pass
0.0417	2	0	0	Pass
0.0422	2	0	0	Pass
0.0427	2	0	0	Pass
0.0432	2	0	0	Pass
0.0436	2	0	0	Pass
0.0441	2	0	0	Pass
0.0446	2	0	0	Pass
0.0451	2	0	0	Pass
0.0456	2	0	0	Pass
0.0460	2	0	0	Pass
0.0465	2	0	0	Pass
0.0470	2	0	0	Pass
0.0475	2	0	0	Pass
0.0480	2	0	0	Pass
0.0484	2	0	0	Pass
0.0489	2	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Percent Water Quality	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration	Percent Volume Infiltrated	Water Quality Treated	Comment
retention 1 POC	N	107.35			N	100.00		
Total Volume Infiltrated		107.35	0.00	0.00		100.00	0.00	0%
No Treat. Credit								

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

Draft Technical Memorandum

TO: Ben Fransua, Director of Construction, South Puget Sound Habitat for Humanity

FROM: Lance Levine, PE, and Calvin McCaughan, PE

DATE: August 3, 2021

RE: **Summary of Geotechnical Engineering Services**
Longmire Development
Yelm, Washington
Project No. 1592003.010.011

Introduction

This memorandum summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (LAI) in support of the Longmire Development project, located at 407 Longmire Street Northwest in Yelm, Washington (site; Figure 1).

This memorandum was prepared with information provided by South Puget Sound Habitat for Humanity (SPSH4H; project owner) and with data collected during LAI's geotechnical field exploration and laboratory testing programs.

Project Understanding

SPSH4H proposes to develop the site with single-family residences, associated utilities, stormwater infiltration facilities, and a paved access road and driveways. The residences will be supported on shallow foundations. The access road and driveways likely will be constructed with pervious surfaces.

Site Conditions

The site consists of an 8.46-acre parcel (Thurston County parcel number 22719230700), currently developed with a single-family residence, garage, storage shed, and septic drainfield. Undeveloped portions of the site are vegetated with grass and several fruit trees. The site is bordered by Longmire Street Northwest to the southeast, by Coates Avenue Northwest to the northeast, by Cullens Street Northwest to the northwest and by single-family residences to the southwest. The site slopes gently to the north, with a total relief of 4 feet (ft).

Geologic Setting

Geologic information for the site and the surrounding area was obtained from the G*eologic Map of the Centralia Quadrangle, Washington* (Schasse 1987). Subsurface deposits in the vicinity of the site are mapped as Vashon age outwash gravel (Qdvg). This unit typically consists of medium dense to dense, proglacial and recessional, stratified gravel, cobbles, and boulders deposited in meltwater streams and deltas. The soils observed in LAI's July 2021 explorations were generally consistent with the mapped geology.

Subsurface Explorations

On July 6, 2021, LAI explored site subsurface conditions by excavating six test pits (TP-1 through TP-6) 10.0 to 12.0 ft below ground surface (bgs). The test pits were excavated at the approximate locations shown on Figure 2.

LAI personnel monitored the field explorations, collected representative soil samples, and maintained detailed logs of the subsurface soil and groundwater conditions observed. Subsurface conditions were described using the soil classification system shown on Figure 3, in general accordance with ASTM International (ASTM) standard test method D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).* Summary logs of the explorations are presented on Figures 4 through 6.

Samples were transported to LAI's soils laboratory for further examination and classification. Natural moisture content determinations were performed on select soil samples in accordance with ASTM standard test method D2216, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.* The natural moisture content is shown as W = xx (i.e., percentage of dry weight) in the "Test Data" column on Figures 4 through 6. Grain size analyses were performed in accordance with ASTM standard test method D422, *Standard Test Method for Particle-Size Analysis of Soils.* Samples selected for grain size analysis are designated with a "GS" in the "Test Data" column on Figures 4 through 6. The results of the grain size analyses are presented on Figures 7 through 9.

Soil Conditions

The soils observed underlying existing surface conditions (i.e., topsoil) were categorized into one general unit:

- **Recessional outwash:** Recessional outwash was observed beneath the topsoil in all six test pits. The recessional outwash typically consisted of grayish-brown to brown, sandy gravel or gravelly sand with variable silt, cobble, and boulder content in a medium dense to dense condition. All six test pits were terminated following moderate to severe caving in the recessional outwash unit.

Groundwater Conditions

No groundwater or groundwater seepage was observed in LAI's July 2021 explorations. The groundwater conditions reported herein are for the specific locations and date indicated and may not be representative of other locations and/or times. Groundwater conditions will vary depending on local subsurface conditions, weather conditions, and other factors. Site groundwater levels are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring.

Conclusions and Recommendations

The near-surface soils observed in LAI's explorations will provide adequate support of the proposed shallow foundations and pavement sections. LAI recommends stripping approximately 9 inches of topsoil to expose sand and gravel soils that are suitable for reuse as structural fill. Site soils are suitable for stormwater infiltration. The following geotechnical recommendations should be incorporated into the project design.

Seismic Design Considerations

LAI understands that seismic design will be completed using *2018 International Building Code* standards (ICC 2017). The parameters in Table 1 can be used to compute seismic base shear forces.

Table 1. *2018 International Building Code* Seismic Design Parameters

Spectral response acceleration at short periods (S_S) = 1.292g
Spectral response acceleration at 1-second periods (S_1) = 0.466g
Site class = D
Site coefficient (F_a) = 1.0
Site coefficient (F_v) = 1.834[(a)]

(a) When using the coefficient F_v = 1.834, adhere to Exception 2 requirements for a ground motion hazard analysis. See Section 11.4.8 of the American Society of Civil Engineers' *Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16).*

F_a, F_v = acceleration (0.2-second period) and velocity (1.0-second period) site coefficients, respectively

g = force of gravity

S_s, S_1 = 0.2-second and 1.0-second period spectral accelerations, respectively

Based on the subsurface conditions observed in LAI's explorations, there is a low risk that seismically induced soil liquefaction will occur at the site following the design-level earthquake. Given the distance between the site and the nearest known active crustal fault, the risk of ground rupture due to surface faulting is low.

Foundation Support

Shallow foundations should be constructed on recessional outwash soil or on structural fill extending to such soil. The design parameters in Table 2 should be used in conjunction with the complete recommendations in this memorandum.

Table 2. Summary of Design Parameters for Shallow Foundations

Allowable soil bearing pressure = 3,500 psf
Friction coefficient (factored) = 0.35
Passive earth pressure = 330 pcf
Minimum foundation width = 18 inches (continuous), 24 inches (isolated)

pcf = pounds per cubic foot
psf = pounds per square foot

When developing design parameters, LAI assumed that shallow foundations would be established on medium dense to dense subgrades prepared as recommended herein. The geotechnical engineer should evaluate prepared subgrades prior to placement of structural fill.

The allowable soil bearing pressure in Table 2 applies to long-term dead and live loads, exclusive of the weight of the footing and any overlying backfill. The bearing pressure can be increased by one-third for transient loads, such as those induced by wind and seismic forces.

For frost protection, perimeter footings should be embedded at least 12 inches below the lowest adjacent grade, where the ground is flat. Interior footings should be embedded at least 6 inches below the nearest adjacent grade. LAI estimates that continuous and isolated foundations will settle 1 inch or less if constructed as recommended. Differential settlement between similarly loaded foundation elements is estimated to be on the order of ½ inch or less. Settlement is expected to occur as building loads are applied during construction.

An allowable coefficient of sliding resistance of 0.35, applied to vertical dead loads only, can be used to compute frictional resistance acting on the base of footings. This coefficient includes a factor of safety of 1.5 on the calculated ultimate value.

The passive resistance of properly compacted structural fill placed against the sides of foundations can be considered equivalent to a fluid with a density of 330 pounds per cubic foot. The foundation passive earth pressure has been reduced by a factor of 1.5 to limit deflections to less than 2 percent of the embedded depth. The passive earth pressure and friction components can be combined, provided the passive component does not exceed two-thirds of the total. The top foot of soil should be excluded from the calculation, unless the foundation perimeter will be covered by slab-on-grade or pavement.

Slabs-On-Grade

Slabs-on-grade should be installed on a uniformly firm, unyielding subgrade that consists of sand and/or gravel. A modulus of vertical subgrade reaction (subgrade modulus) can be used to design slabs-on-grade. The subgrade modulus will vary based on the dimensions of the slab and the

magnitude of applied loads on the slab surface; slabs with larger dimensions and loads are influenced by soils to a greater depth. LAI recommends using a subgrade modulus of 220 pounds per cubic inch to design on-grade floor slabs. This subgrade modulus is for a 1-ft-by-1-ft square plate and is not the overall modulus of a larger area.

Interior slabs-on-grade should include a vapor barrier and a capillary break layer, designed and installed in accordance with industry standards.

Hot-Mix Asphalt Pavements

The asphalt pavement section should be constructed on compacted subgrade (i.e., on existing sand and gravel) prepared as recommended herein. When developing the recommendations in Table 3, LAI assumed a 20-year design life and a maximum equivalent single-axle load of 50,000 for the private roadway local access residential pavement section and 500,000 for the neighborhood collector section. The recommendations in Table 3 accord with the City of Yelm's minimum street design standards (2019).

Table 3. Recommended Asphalt Pavement Design Section[(a)]

Pavement Section Type	Asphalt Concrete Pavement Thickness	Crushed Surfacing Top Course Thickness	Ballast
Neighborhood Collector	3 inches	2 inches	8 inches
Private Roadway Local Access Residential	2 inches	2 inches	8 inches

(a) Refer to *Yelm Engineering Specifications and Standard Details* (City of Yelm 2019).

Ballast and top course material should be compacted to at least 95 percent of the maximum dry density, determined in accordance with ASTM standard test method D1557, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).*

Compacted ballast should meet the requirements for Ballast in Section 9-03.9(1) of the Washington State Department of Transportation's 2021 *Standard Specifications for Road, Bridge, and Municipal Construction* (*2021 WSDOT Standard Specifications*). Alternatively, ballast may meet the requirements for Permeable Ballast in Section 9-03.9(2). Compacted top course should meet the requirements for Crushed Surfacing Top Course in Section 9-03.9(3) of the *2021 WSDOT Standard Specifications.* Prevention of road-base saturation is essential for pavement durability; efforts should be made to limit the amount of water entering the ballast and top course.

Asphalt concrete should be Class B aggregate material or hot-mix asphalt (HMA), class ½ inch and PG58H-22 binder. Asphalt should conform to the requirements in Section 5-04 of the 2*021 WSDOT Standard Specifications* and be compacted to at least 91 percent of the Rice density.

Permeable Pavement

Permeable pavements will consist of [permeable] HMA or a concrete wearing surface, an aggregate storage layer, and subgrade soil. The subgrade soil should have the infiltration capacity to drain water from the aggregate storage layer.

Permeable pavement is suited for very low-volume, slow-speed locations with infrequent truck traffic (WSDOT 2018), including:

- Sidewalks, bicycle trails, community trail/pedestrian path systems, or other pedestrian-accessible paved areas (e.g., traffic islands).
- Light vehicle-access areas, such as maintenance/enforcement areas on divided highways.
- Parking lots, including perimeter and overflow parking areas.
- Driveways.

To promote infiltration, compaction of permeable pavement subgrades should be avoided. Minimum permeable pavement thicknesses are recommended in Table 4.

Table 4. Recommended Permeable Pavement Design Sections

Facility	Hot-Mix Asphalt	Portland Cement Concrete Pavement
Light vehicle-access areas	6 inches permeable HMA 12 inches (permeable base)	9 inches undoweled, permeable PCCP 12 inches (permeable base)
Parking	6 inches permeable HMA 12 inches (permeable base)	9 inches undoweled, permeable PCCP 12 inches (permeable base)
Pedestrian sidewalks and trails	3 inches permeable HMA 12 inches (permeable base)	4.5 inches undoweled, permeable PCCP 12 inches (permeable base)

HMA = hot-mix asphalt
PCCP = Portland cement concrete pavement

LAI recommends that permeable base meets the requirements for Permeable Ballast in Section 9-03.9(2) of the *2021 WSDOT Standard Specifications.* Asphalt concrete should be Class B aggregate material or HMA, class ½ inch and PG58H-22 binder. HMA should conform to the requirements in Section 5-04 of the *2021 WSDOT Standard Specifications*, and the binder should be 6.0 to 7.0 percent by total weight. Separation fabric should be placed between native soils and the permeable base. The fabric should satisfy the criteria in Table 2, Section 9-33.2(1) of the *2021 WSDOT Standard Specifications.*

A maintenance plan, approved by the City of Yelm, will be required for permeable pavements. Maintenance standards are provided in the Washington State Department of Ecology's 2019 *Stormwater Management Manual for Western Washington* (*2019 SWMMWW*).

Stormwater Infiltration

Groundwater and soil mottling were not observed in LAI's July 2021 explorations, which extended to a maximum depth of 12.0 ft bgs. LAI recommends that a seasonal high groundwater elevation of 20 ft bgs is used to design stormwater facilities. Site groundwater levels are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring.

The stormwater infiltration facilities will be constructed in accordance with the *2019 SWMMWW.* The site is underlain by soils belonging to hydrologic soil group A (USDA NRCS, accessed July 16, 2021). As such, the infiltration rates in Table 5 were developed using the results of LAI's geotechnical laboratory tests (Figures 7 through 9) and the soil grain size analysis method. In LAI's opinion, stormwater generated on site will disperse rapidly, and there is a low risk of groundwater mounding.

The following correction factors were applied to the infiltration rates to account for site variability (CF_v=0.8), testing method (CF_t=0.4), and maintenance (CF_m=0.9). When calculating infiltration rates, LAI assumed a depth-to-groundwater of 16 ft bgs, measured from the base of the infiltration facility.

Table 5. Preliminary Infiltration Rates

Exploration	Depth Interval (ft)	Factored Infiltration Rate (in/hr)
TP-1	1–7	1.8
TP-1	7–10.5	7.5
TP-2	1–8	3.6
TP-2	8–10	9.4
TP-3	1–5	2.0
TP-3	5–10.5	3.9
TP-4	1–6	5.9
TP-4	6–12	1.4
TP-5	1–7	6.4
TP-5	7–10	5.4
TP-6	1–2.5	0.4
TP-6	2.5–10.5	2.2

ft = foot/feet
in/hr = inches per hour

Site Drainage

LAI recommends that perimeter foundation footing drains are included in the design of structures. Landscape and hardscape should slope away from structures at a grade of at least 2 percent.

Construction Considerations

The following key points should be considered when developing project plans and specifications:

- **Stripping:** Approximately 9 inches of topsoil (dark brown, gravelly sand with silt) should be stripped from areas designated for development (i.e., the proposed locations of footings, slabs-on-grade, and pavement sections). Topsoil is not considered suitable for reuse as structural fill.
- **Subgrade preparation:** Before structural fill, formwork, or pavement base course is placed, the prepared subgrade should be proof-rolled in the presence of a qualified geotechnical engineer, who is familiar with the site and can check for soft/disturbed areas. Areas of limited access can be evaluated with a steel T-probe. If probing or proof-rolling reveals loose and/or disturbed subgrades, the upper 1 ft of subgrade should be scarified; moisture-conditioned; and compacted to a firm, unyielding condition. Alternatively, unsuitable soils can be overexcavated and replaced with compacted structural fill.
- **Utility trench excavation and backfill:** LAI anticipates that utility trenches will be excavated in medium dense to dense outwash soils. Caving may occur in outwash soils. A heavy-duty hydraulic excavator should be able to reach the required trench depths. A smooth-bladed bucket should be used to remove loose and/or disturbed soil from the trench bottom. The final trench bottom should be firm and free of roots, topsoil, lumps of silt and clay, and organic and inorganic debris.
- **Site soil:** If site soils will be reused as structural fill, material larger than 6 inches in diameter (e.g., large cobbles and boulders) should be removed or screened.
- **Import structural fill:** Gravel Borrow, as described in Section 9-03.14(1) of the *2021 WSDOT Standard Specifications,* is a suitable source of import structural fill. During periods of wet weather, the fines content should not exceed 5 percent, based on the minus ¾-inch fraction.
- **Fill placement and compaction:** Structural fill should be placed on an approved subgrade that consists of uniformly firm, unyielding, inorganic native soils or of compacted structural fill that extends to such soils. Structural fill should be placed and compacted in accordance with the requirements in Section 2-03.3(14)C, Method C of the *2021 WSDOT Standard Specifications.* Method A is appropriate for non-structural areas, such as landscaping. Each layer of structural fill should be compacted to at least 95 percent of the maximum dry density, determined in accordance with Section 2-03.3(14)D of the *2021 WSDOT Standard Specifications.* Alternatively, the maximum dry density can be determined using ASTM standard test method D1557.

- **Construction dewatering:** Though not observed in LAI's test pit explorations, zones of perched groundwater may be encountered during the wet season (typically late October through June). Temporary excavations should be dewatered to allow construction to be completed in the dry. Where groundwater seepage is encountered, conventional sumps and pumps should be sufficient to dewater excavations. The contractor should be responsible for the design, monitoring, and maintenance of dewatering systems.
- **Temporary slopes:** Temporary excavations should be completed in accordance with the requirements in Section 2-09 of the *2021 WSDOT Standard Specifications.* Temporary excavations in excess of 4 ft should be shored or sloped in accordance with the requirements outlined in Safety Standards for Construction Work, Part N (Washington Administrative Code Chapter 296-155). The soil likely to be exposed in construction excavations should be considered Type C, with a maximum allowable excavation inclination of 1½ horizontal to 1 vertical (1½H:1V).

  The contractor should be responsible for actual excavation configurations and the maintenance of safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed.
- **Permanent slopes:** Permanent cut-and-fill slopes should be no steeper than 2H:1V. This design recommendation does not apply to stormwater pond slopes, which are typically 3H:1V or flatter. Stormwater pond slopes should be designed in accordance with local stormwater codes. Permanent and temporary slopes should be protected from erosion and reseeded or revegetated as soon as practical.

Use of This Technical Memorandum

Landau Associates has prepared this technical memorandum for the exclusive use of South Puget Sound Habitat for Humanity and its design team for specific application to the Longmire Development project in Yelm, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Reuse of the information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk.

Landau Associates warrants that, within the limitations of scope, schedule, and budget, its services have been provided in a manner consistent with that level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality, under similar conditions as this project. Landau Associates makes no other warranty, either express or implied.

Closing

We appreciate the opportunity to assist you with this project. If you have questions or comments, please contact Lance Levine at 360.791.3178 or at llevine@landauinc.com.

LANDAU ASSOCIATES, INC.

Lance Levine, PE
Senior Project Engineer

Calvin McCaughan, PE
Principal

LGL/CAM/mcs
[\\OLYMPIA1\PROJECTS\1592\003.010\R\LONGMIRE DEVELOPMENT DRAFT TECHNICAL MEMORANDUM 8.3.2021.DOCX]

Attachments: Figure 1. Vicinity Map
Figure 2. Site and Exploration Location Plan
Figure 3. Soil Classification System and Key
Figures 4–6. Logs of Test Pits TP-1 through TP-6
Figures 7–9. Grain Size Distribution

References

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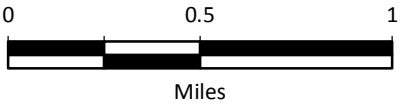

Data Source: Esri.

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Longmire Development Yelm, Washington	**Vicinity Map**	Figure 1

Legend

TP-1 Approximate Test Pit Location and Designation

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Google Imagery 2018

0 100 200

Scale in Feet

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Site and Exploration Location Plan

Figure
2

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30% - "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15% - "with gravel," "with sand," "with silt," etc.
	≤ 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

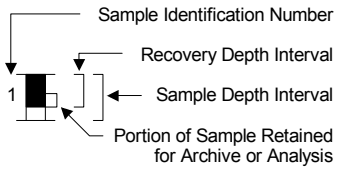
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)

▼ Approximate water level at time after drilling/excavation/well

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Soil Classification System and Key

Figure 3

TP-1

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM / GP	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(TOPSOIL)**	Groundwater not encountered.
2		S-1	d					
4		S-2	d	W = 4 GS			Brown, very sandy, fine to coarse GRAVEL (medium dense, damp) **(OUTWASH)** Minor caving	
6							Grades to light brown and with cobbles and boulders	
8							Grades to with sand, dense, and moist Severe caving	
10		S-3	d	W = 4 GS				
12								
14								

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.5 ft.

TP-2

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM / GP	Excavation Method: Tracked Excavator Ground Elevation (ft): Not Measured Excavated By: Howards Construction & Excvtg Logged By: LGL Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(TOPSOIL)**	Groundwater not encountered.
2		S-1	d					
4		S-2	d	W = 3 GS			Brown, very sandy, fine to coarse GRAVEL (medium dense, damp) **(OUTWASH)**	
6							Grades to light brown and with cobbles and boulders	
8							Minor caving Grades to very dense	
10		S-3	d	W = 2 GS			Moderate caving Grades to brown, sandy, dense, and moist	
12								
14								

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

TP-3

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM / GP	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(TOPSOIL)**	Groundwater not encountered.
2		S-1	d					
		S-2	d	W = 3 GS			Brown, very sandy, fine to coarse GRAVEL (medium dense, damp) **(OUTWASH)**	
4							Grades to light brown with cobbles and boulders	
6							Moderate caving	
		S-3	d	W = 3 GS			Grades to sandy	
8								
10							Grades to brown, without boulders, dense, and moist	
12								
14								

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not Measured
Excavated By: Howards Construction & Excvtg
Logged By: LGL

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.5 ft.

TP-4

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(TOPSOIL)**	Groundwater not encountered.
2		S-1	d			SP-SM / GP		
		S-2	d	W = 2 GS			Brown, gravelly, fine to coarse SAND with silt (medium dense, damp) **(OUTWASH)**	
4							Grayish-brown, very sandy, fine to coarse GRAVEL with cobbles and boulders (medium dense, damp)	
6						SP		
		S-3	d	W = 5 GS			Light brown, very gravelly, fine to coarse SAND with cobbles and boulders (dense, damp)	
8							Moderate caving	
10							Grades to without boulders and moist	
		S-4	d					
12								
14								

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not Measured
Excavated By: Howards Construction & Excvtg
Logged By: LGL

Test Pit Completed 07/06/21
Total Depth of Test Pit = 12.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pits

Figure 5

TP-5

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	Groundwater not encountered.
							(TOPSOIL)	
2		S-1	d			SP-SM		
						GW	Brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	
4		S-2	d	W = 3 GS			**(OUTWASH)**	
							Grayish-brown, sandy, fine to coarse GRAVEL with cobbles and boulders (medium dense, damp)	
6								
						GP-GM	Moderate caving	
8		S-3	d	W = 5 GS			Grayish-brown, sandy, fine to coarse GRAVEL with silt (dense, moist)	
10							Severe caving	
12								
14								

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not Measured
Excavated By: Howards Construction & Excvtg
Logged By: LGL

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.0 ft.

TP-6

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol		
0						SP-SM	Dark brown, gravelly, fine to coarse SAND with silt (medium dense, damp)	Groundwater not encountered.
							(TOPSOIL)	
2		S-1	d			SP-SM		
						GP	Dark brown, gravelly, fine to coarse SAND with silt and cobbles (medium dense, damp)	
4		S-2	d				**(OUTWASH)**	
							Brown, very sandy, fine to coarse GRAVEL (medium dense, moist)	
6							Grades to with cobbles and boulders	
							Severe caving	
8		S-3	d	W = 4 GS			Grades to gray, gravelly, and very dense	
10								
12								
14								

Excavation Method: Tracked Excavator
Ground Elevation (ft): Not Measured
Excavated By: Howards Construction & Excvtg
Logged By: LGL

Test Pit Completed 07/06/21
Total Depth of Test Pit = 10.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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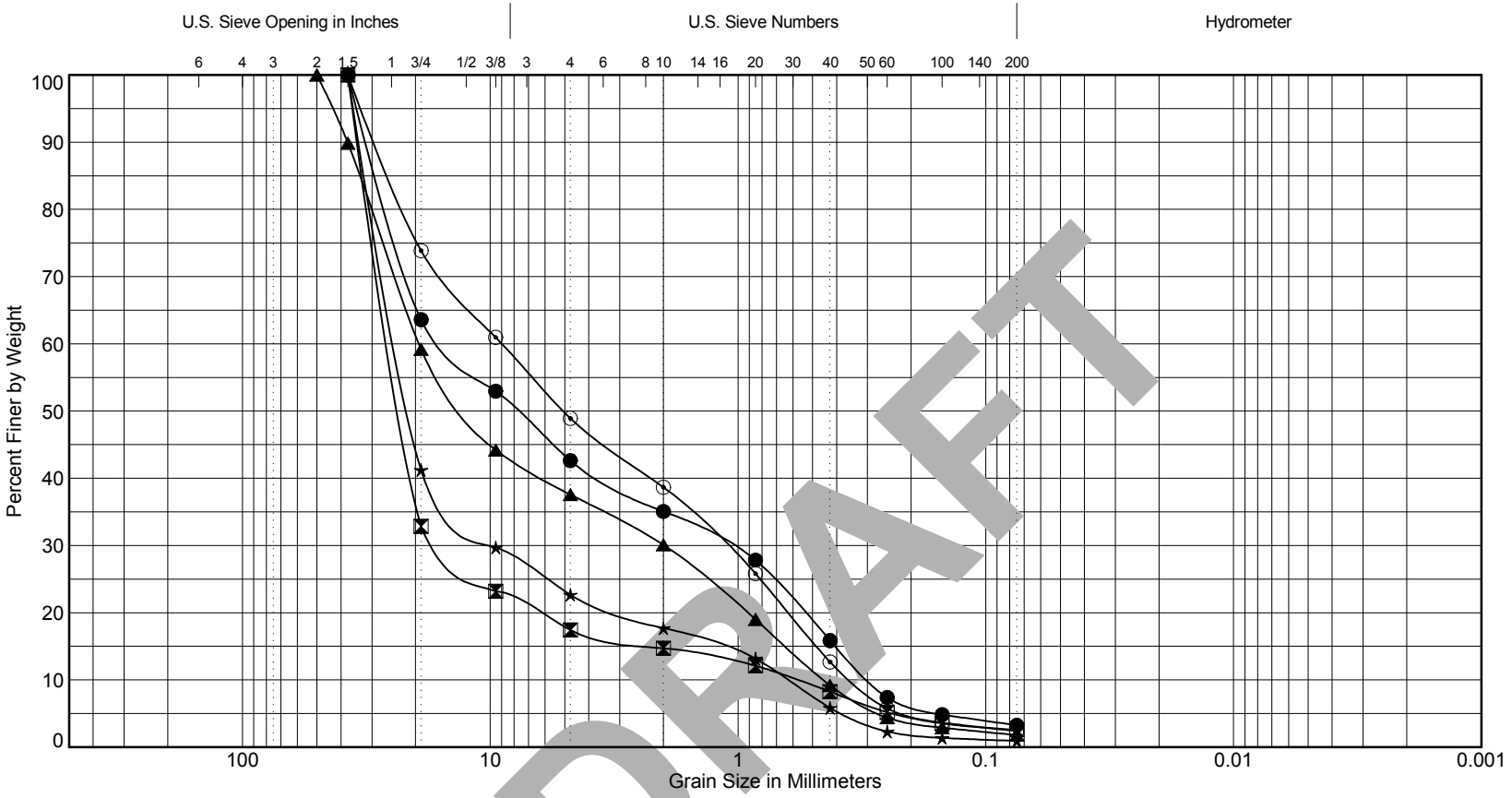
Log of Test Pits

Figure 6



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Exploration Number	Sample Number	Depth (ft)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-1	S-2	3.0	4	Very sandy, fine to coarse GRAVEL	GP
⧓	TP-1	S-3	9.0	4	Fine to coarse GRAVEL with sand	GP
▲	TP-2	S-2	3.0	3	Very sandy, fine to coarse GRAVEL	GP
★	TP-2	S-3	9.0	2	Sandy, fine to coarse GRAVEL	GP
⊙	TP-3	S-2	3.0	3	Very sandy, fine to coarse GRAVEL	GP

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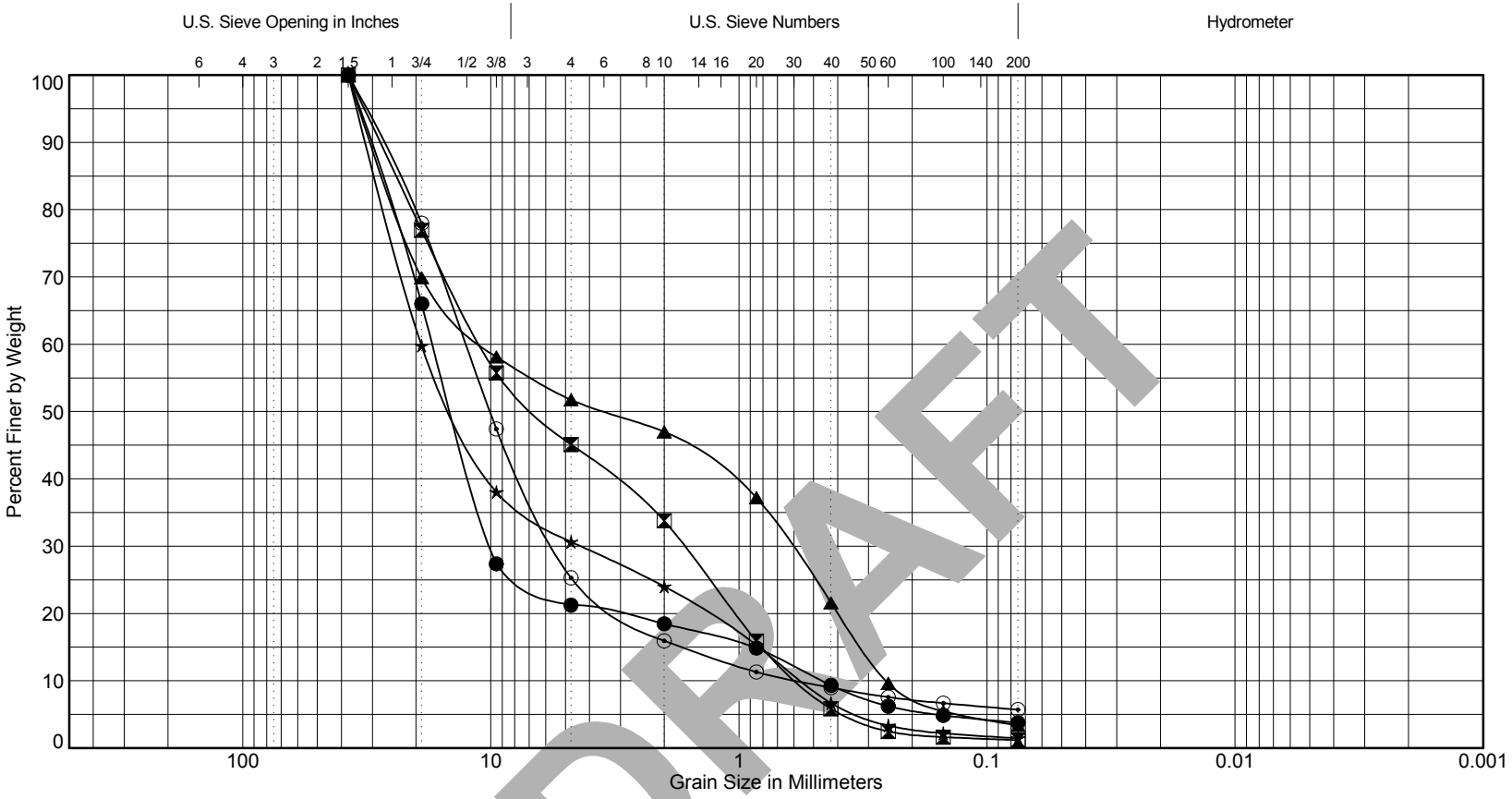
Grain Size Distribution

Figure
7



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Exploration Number	Sample Number	Depth (ft)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-3	S-3	7.0	3	Sandy, fine to coarse GRAVEL	GP
⧓	TP-4	S-2	3.0	2	Very sandy, fine to coarse GRAVEL	GP
▲	TP-4	S-3	8.0	5	Very gravelly, fine to coarse SAND	SP
★	TP-5	S-2	3.5	3	Sandy, well-graded GRAVEL	GW
⊙	TP-5	S-3	7.5	5	Sandy, fine to coarse GRAVEL with silt	GP-GM

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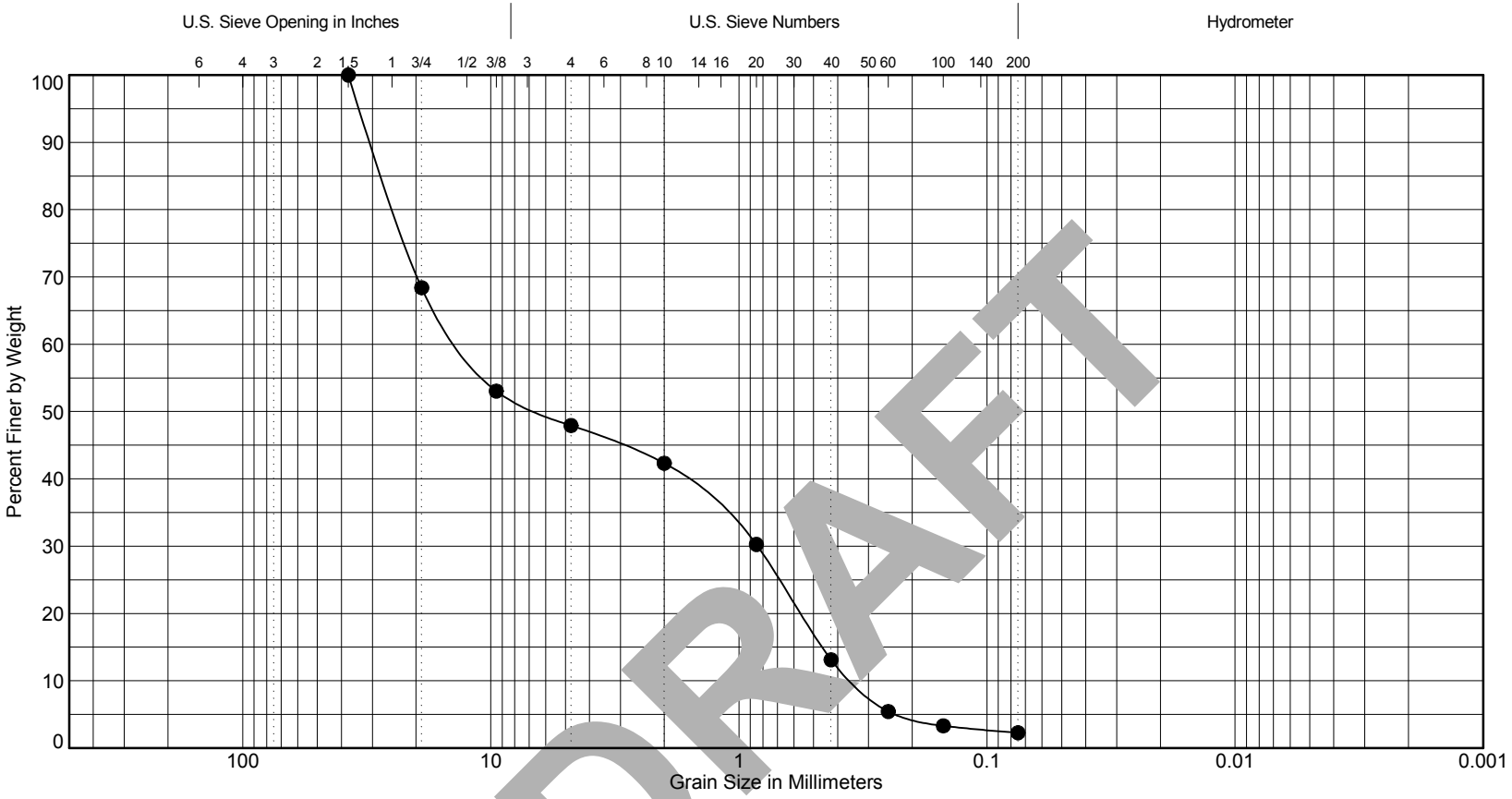
Grain Size Distribution

Figure
8



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Exploration Number	Sample Number	Depth (ft)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-6	S-3	8.0	4	Very sandy, fine to coarse GRAVEL	GP

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Grain Size Distribution

Figure
9