Land Use Application
For a Subdivision

Date: August 16, 2016

Submitted to: City of North Plains
31360 NW Commercial Street
North Plains, OR 97133

Applicant: Biggi Construction, LLC
11605 SW Normandy Lane
Wilsonville, OR 97070
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Exhibits
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Exhibit D: Neighborhood Meeting Documentation
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Planning Department
31360 NW Commercial Street
North Plains, OR 97133

Applicant: Biggi Construction, LLC
11605 SW Normandy Lane
Wilsonville, OR 97070

Property Owners: Mark and Lori Perkins
32370 NW North Avenue
North Plains, OR 97133

Applicant’s Consultant: AKS Engineering & Forestry, LLC
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Site Location: 32370 NW North Avenue, North Plains, OR

County Tax Map: 1N 3 01BC Tax Lot 201

Site Size: ±2.14 Acres

Land Use Districts: R-2.5
I. Executive Summary
AKS Engineering & Forestry, LLC is pleased to submit this application for a 16-lot Subdivision to the City of North Plains on behalf of Biggi Construction, LLC (Applicant). The application includes 16 lots which range in size from 4,234- to 5,512 square feet, and which are intended for future construction of single-family detached residences. In addition to new single-family residential lots, the application will also result in a new local street connection (shown as “A” Terrace in Exhibit A) between NW Wascoe Street and NW North Avenue and new street improvements to NW Wascoe Street and NW North Avenue consistent with the City’s adopted Transportation System Plan (TSP) and Public Works Design Standards.

This application includes the City application forms, written materials, and preliminary plans necessary for City staff to review and determine compliance with the applicable approval criteria. The evidence is substantial and supports the City’s approval of the application.

II. Site Description/Setting
The subject site is approximately 2.14 acres in size and is comprised of a single parcel located in the northwest corner of the City of North Plains’ corporate limit. This site is currently in use as a single-family residence and is flanked by a single-family residence on the abutting property to the west, North Plains Elementary School to the east, the recently approved Sunset Terrace Subdivision to the south, and NW North Avenue to the north. The site slopes at an average grade of five-and-one-half percent to the south- and northwest corners of the property with a high point slightly south and east of the center of the property.

The property is located in the City’s R-2.5 Zoning District and, per the City’s adopted Transportation System Plan, is planned to host a new local street connection between NW Wascoe Street and NW North Avenue.

III. Applicable Review Criteria
CITY OF NORTH PLAINS MUNICIPAL CODE
Chapter 16 Zoning and Development
Chapter 16.030 ZONING DISTRICT R-2.5
16.030.005 Permitted Uses
Permitted uses are subject to the requirements of Chapter 16.175, Design Review, if applicable. Refer to Zoning Code Use Table.
A. Single family detached dwelling

Response: Although this application does not include a request to construct homes on the 16 residential lots in this subdivision, the Applicant intends that these lots will host single-family detached dwellings. The criterion can be met.

16.030.015 Dimensional Standards
The following dimensional standards are the minimum requirements for all development in the R-2.5 District except for modifications permitted under the Lot, Building, & Yard Exceptions, Chapter 16.115, or Planned Unit Development, Chapter 16.140.
A. Lot/Parcel Size
1. Lots created by plat shall have a maximum lot size of 6,000 per dwelling unit
2. Single-family dwelling shall have a 4,000 square feet minimum
3. Two-family dwelling (duplexes), Triplexes & attached single family dwellings: 2,500 square feet per dwelling unit
4. Multi-family dwellings (greater than 3 units): 2,000 square feet per dwelling unit
5. All other uses 4,000 square feet minimum

B. Lot/Parcel Depth and Width

• No minimum lot width or depth.

Response: Although this application does not include a request to construct homes on the 16 residential lots in this subdivision, the Applicant intends that these lots will host single-family detached dwellings. Subsequently, the 16 lots included in this application range in size from 4,234 square feet to 5,512 square feet and are within the allowable lot size for single-family detached dwellings in the District (see Exhibit A, Sheet P03). The criteria are met.

C. Setback Requirements

Principle structures, accessory dwellings and accessory structures with a floor area greater than 200 square feet shall maintain the following minimum yard setbacks.

1. Front Yard
   • For all structures: 10 feet
   • Garage: 20 feet

Garages, carports and accessory structures shall be accessed from the rear of the building via an alley where appropriate and feasible. If front access garages are proposed, the applicant must provide justification as to why rear access garages are not appropriate or feasible.

Garages, carports, accessory dwellings and accessory structures with front access shall be flush with, or recessed behind, the front building elevation of the principle structure.

2. Rear Yard:
   • street-access lots - 10 feet
   • alley-access lots - 6 feet
   • Accessary Structures and Accessary Dwellings - 5 feet.

3. Side Yard:
   • Side yards should be established to create separation between structures and meet fire codes and provide space for pervious surface area
   • Single family dwellings created by plats must have at least one side yard
   • Adjacent to street - 10 feet plus additional space necessary to comply with the standards of chapter 16.160, Clear Vision Areas.
   • Accessory Structures and Accessory Dwellings - 5 foot Adjacent to street setback, except as provided for in
Chapter 16.105, Accessory Use, Structures and Dwellings

Response: As shown in Exhibit A, Sheet P04, all lots can accommodate the 10-foot front, rear, and street side (corner) yard setback, the 20-foot garage setback, and the 3-foot side yard setback as applicable to this site. The criteria are met.

4. Flag lots approved:
   - Flag lots are subject to Chapter 16.125 Lot Development Standards.

Response: The application does not include any flag lots. The criteria do not apply.

5. Height of Buildings
   - Buildings shall not exceed a height, measured from grade, of 35 feet.
   - Accessory dwellings and accessory structures shall not exceed 25 feet.

6. Lot/Parcel Coverage
   In the R-2.5 District, the maximum lot coverage for impervious surfaces shall not exceed 65%.

Response: Although this application does not include a request to construct homes on the 16 residential lots in this subdivision, the Applicant is aware of the maximum height and lot coverage provisions of this section. At time of building permit submittal, the City will ensure the applicable building height and lot coverage standards are met. The criteria can be met.

16.030.020 Parking Requirements
   Parking requirements are specified in Chapter 16.155, Off Street Parking and Loading.

Response: Chapter 16.155 requires two off-street parking spaces per single-family detached dwelling. Although homes are not proposed in this application, the Applicant anticipates that each lot will provide a minimum of two off-street parking spaces via a garage and driveway. At time of building permit submittal, the City will ensure that these off-street parking standards have been met. The criterion can be met.

16.030.025 Development Standards
   The following standards will be applied to all dwellings:
   A. All units shall utilize at least two of the following design features to provide visual relief along the front of the home:
      A. dormers;
      B. gables;
      C. recessed entries;
      D. covered porch entries;
      E. cupolas;
      F. pillars or posts;
      G. bay or bow windows;
      H. eaves (minimum 6” projection);
I. offsets on building face or roof (minimums 16”);

Response: As mentioned above, this application does not include new home construction and subsequently the architectural details that will be used on future homes is also not part of this application. At time of building permit submittal, the City will ensure that single-family detached dwellings on each of these 16 lots utilize at least two of the features listed in A. above. The criterion can be met.

Chapter 16.125 Lot Development Standards

16.125.010 Standards for Lots

A. Minimum lot area: Minimum lot area shall conform to the requirements of the zoning district in which the lot is located.

Response: As detailed above, all 16 lots exceed the 4,000 square foot minimum lot area required for single-family detached dwellings in the R-2.5 District. The criterion is met.

B. Access: All lots created after the effective date of this Ordinance shall provide a minimum of 20 feet of frontage on an existing or proposed public street, with the following exception:

Flag lots, accessed by a private driveway, may be permitted by the Planning Commission when any of the following conditions are met:

1. The subject property is surrounded by developed properties and the terrain, shape of the parcel, or the location of existing structures precludes accessing the property with a public street.

2. The proposed flag lot(s) front on the arc of a cul-de-sac and the use of flag lots would result in a better lot pattern around the cul-de-sac than that which might otherwise result.

3. The subject property is located in the Commercial or Industrial Zoning District and the Planning Commission finds that full frontage on a public street is unnecessary to the logical development of the property.

4. The Planning Commission finds that the use of flag lots is necessary due to conditions of terrain or other physical features of the property.

5. The Planning Commission finds that the use of flag lots accessing from a collector or local street is preferable to direct access from an arterial street.

Response: As shown in Exhibit A, Sheet P03, all 16 lots will provide at least 43 feet of frontage on NW North Avenue, NW Wascoe Street or the proposed public “A” Terrace. Additionally, the application does not include any flag lots. The applicable criteria are met.

C. Flag Lots: When authorized by the Planning Commission pursuant to the access requirements of Subsection Chapter 16.125.010 (B)(1), flag lots shall be subject to the following development standards:

1. The access strip shall be a minimum of 15 feet in width, except as required by the Uniform Fire Code. The improved surface shall be a minimum of 12 feet in width, except as required by the Uniform Fire Code. A three-foot wide landscaped planter strip shall be provided between the access strip and the side lot line of the neighboring lot.

2. The access strip shall not be included in the calculation of lot area for purposes of determining compliance with any minimum lot size provision of this Ordinance.
3. The access strip shall be in fee ownership of the property provided access and shall not be as an easement. In the case of multiple lots having the same access strip, all lots served shall have ownership of an equal amount of the access strip. There shall be provided an easement over the remainder of the access strip for each property served.

4. The length of the access strip is subject to the requirements of the Uniform Fire Code, but shall not exceed 200 feet.

5. Where more than one flag lots abut, access shall be via a shared drive wherever possible. The shared drive access strip shall be a minimum of 20 feet in width for two lots, and increased by 5 foot increments for each additional lot, with a maximum of four lots having access off of one access strip, except as required by the Uniform Fire Code. The improved surface shall be a minimum of 16 feet in width for two lots and increased by four feet for each additional lot, except as required by the Uniform Fire Code. A two foot wide vegetated planter strip shall be provided between the access strip and the abutting side lot lines.

6. Setbacks in Residential Zoning Districts. Subsequent development on flag lots in the R-7.5, R-5 and R-2.5 zoning districts shall provide minimum front, rear and side yard setbacks of 10 feet, except that the yard facing the garage door or carport entrance shall be a minimum of 20 feet.

Response: As shown in Exhibit A, Sheet P03, the application does not include any flag lots. The criteria do not apply.

D. Through Lots: Through lots shall be avoided except where essential to provide separation of residential development from major traffic arteries, adjacent nonresidential activities, or to overcome specific disadvantages of topography and orientation. Screening or buffering may be required by the Planning Commission during the review of the land division request.

Response: As shown in Exhibit A, Sheet P03, the application does not include any through lots. The criteria do not apply.

E. Lot Side Lines: The side lines of lots, as far as practicable, shall run at right angles to the street upon which the lots face.

Response: As shown in Exhibit A, Sheet P03, the side lines of all lots (except those which directly abut NW North Avenue which is not perpendicular to “A” Terrace) run at right angles to ‘Road A.’ The criterion is met.

F. Lot Grading: Lot grading shall conform to the requirements of Chapter 70 of the Uniform Building Code, hereby adopted by reference, and to the following standards unless physical conditions demonstrate the propriety of other standards:

1. Cut slopes shall not exceed one and one-half feet horizontally to one foot vertically.

2. Fill slopes shall not exceed two feet horizontally to one foot vertically.

3. The character of soil for fill and the characteristics of lots and parcels made usable by fill shall be suitable for the purpose intended.
Response: As shown in Exhibit A, Sheet P07, proposed cut and fill slopes are within the allowable range specified here. Additionally, fills will be achieved through regrading on-site soil only. The criteria are met.

G. Large Lots: In dividing tracts into large lots which at some future time are likely to be re-divided, the applicant’s tentative plan shall also demonstrate that any redevelopment or re-subdivision may readily take place at the planned residential density without violating the requirements of this ordinance.

The Planning Commission may require that the blocks be of such size and shape, be so divided into building sites and contain such site restrictions as will provide for extension and opening of streets at intervals which will permit a subsequent division of any tract into lots of smaller size.

Response: As shown in Exhibit A, Sheet P03, the 16 lots included in this application range in size from 4,234 square feet to 5,512 square feet and may not be further divided per the existing dimensional standards in the R-2.5 District. The criteria do not apply.

H. Land for Public Purposes: Where a proposed park, school or other public use indicated on the Comprehensive Plan is located in whole or in part within a subdivision, the sub-divider shall dedicate and reserve said area for such purpose. Where the City or other public authority has declared its intention to acquire said area, it shall proceed to perfect the title or a contract right to the same within three (3) years from the date of platting, and failing such, this reservation shall automatically expire. The public body shall expeditiously proceed, within its financial ability, to consummate such acquisitions.

Response: The Comprehensive Plan does not propose a park or another public use on the site of this subdivision. The criterion does not apply.

16.125.015 Standards for Blocks

A. General: The length, width, and shape of blocks shall take into account the need for adequate building site size and street width and shall recognize the limitations of the topography.

B. Sizes: Residential Districts shall have a maximum 600 foot block length, a minimum 160 foot street adjacent lot depth, and a 1,600 foot perimeter.

Response: The application includes a new street connection, approximately 380 feet in length, between NW Wascoe Street and NW North Avenue that will improve mobility for pedestrians, bicyclists, and motor vehicles traveling to and through this area. This new street connection creates a block that is bound by NW North Avenue, NW Gordon Road, NW Wascoe Street, and “A” Terrace. The perimeter of this new block measures approximately 1,560 feet. The criteria are met.

16.125.020 Easements

A. Utility Lines: Minimum 5 foot wide easements for sewers, water mains, electric lines, or other public utilities shall be dedicated along the front, side, and rear lot or parcel lines of each lot. Easements shall be centered on lot lines.

B. Water Courses: If a tract is traversed by a water course such as a drainage way, channel or stream, a storm water easement or drainage right-of-way shall be provided which substantially parallels the lines of the water course.
C. Pedestrian and Bicycle Ways: When desirable for public convenience and access, a pedestrian or bicycle way easement may be required to connect to a cul-de-sac or to pass through an unusually long or oddly spaced block, or to otherwise provide appropriate circulation.

Response: Exhibit A, Sheet P04, shows the location of all future public utility easements on the site. The site is not traversed by a water course. Additionally, pedestrian and bicycle access through the site will be accommodated by “A” Terrace, which will include 5-foot-wide sidewalks and 17-foot-wide shared travel and parking lanes on the east and west sides of this street. Stand-alone pedestrian and bicycle ways are not proposed. The applicable criteria are met.

16.125.025 Improvement Requirements

...B. Subdivisions: The following improvements shall be required for all subdivisions in the City of North Plains.

1. Frontage improvements: Street improvements to full City Standards shall be required for all public streets on which a proposed subdivision fronts. Such improvements shall be blended to match with existing improved surfaces across the centerline and for a reasonable distance beyond the frontage of the property. Additional frontage improvements shall include: sidewalks, curbing, storm sewer, sanitary sewer, waterlines, other public utilities as necessary, and such other improvements as the City shall determine to be reasonably necessary to serve the development or the immediate neighborhood.

Response: Exhibit A, Sheet P09, shows street improvements along the site’s NW North Avenue and NW Wascoe Street frontages consistent with these standards. The criteria are met.

2. Proposed Streets: All public streets within the subdivision shall be constructed as required by the provisions of the Street Standards section of this chapter.

Response: Exhibit A, Sheet P09, illustrates a new “A” Terrace local street within the subdivision. This new local street has been designed in accordance with applicable street standards. The criterion is met.

3. Monuments: Upon completion of street improvements, monuments shall be reestablished and protected in monument boxes at every street intersection and all points of curvature and points of tangency of street center lines. Elevation bench marks shall be established at each street intersection monument with elevations to U.S. Geological Survey datum.

Response: At time of final plat approval, the City will ensure that monuments are reestablished and protected in monument boxes and that elevation bench marks are established at the intersections of “A” Terrace/NW Wascoe St and “A” Terrace/NW North Avenue. The criterion can be met.
4. Sanitary Sewers: Sanitary sewers shall be installed to serve the subdivision and to connect the subdivision to existing mains both on and off the property being subdivided. If the required sewer facilities will, without further sewer construction, directly serve property outside the subdivision, the Planning Commission may recommend to the City Council construction as an assessment project with such arrangement with the sub-divider as is desirable to assure financing his share of the construction. The City may require that the sub-divider construct sewage lines of a size in excess of that necessary to adequately serve the development in question, where such facilities are or will be necessary to serve the entire area within which the development is located when the area is ultimately developed. The City may also require that the construction take place as an assessment project with such arrangement with the sub-divider as is desirable to assure his share of the construction.

Response: As shown in Exhibit A, Sheet P08, a new 8-inch sanitary line in “A” Terrace will convey sanitary sewage from the 16 lots in this subdivision to the exiting sanitary main in NW Wascoe Street. The new 8-inch sewer line in “A” Terrace will not, without further sewer construction, directly serve property outside the subdivision. The criterion is met.

5. Water System: Water lines with valves and fire hydrants serving the subdivision and connecting the subdivision to the city mains shall be installed. The design shall take into account provisions for extension beyond the subdivision to adequately grid the City system and to serve the area within which the development is located when the area is ultimately developed.

Response: As shown in Exhibit A, Sheet P08, a new 6-inch water line in “A” Terrace and in NW North Avenue (along the site frontage) will connect to existing mains in NW Wascoe Street and NW North Avenue to provide water service to the 16 lots included in this application. This configuration provides a future water connection for development west of the site. The criterion is met.

6. Street Lights and Street Trees: The installation of street lights and street trees is required at locations and of a type established by City standards.

7. Street Signs: The installation of street name signs and traffic control signs is required at locations determined to be appropriate by the City and shall be of a type established by City standards.

All improvements required under this subsection shall be completed to City standards, or assured through an irrevocable letter of credit, assignment of bank account, performance bond or other instrument acceptable to the City Attorney, prior to the approval of the Final Plat of the subdivision.

Response: At time of final plat approval, the City will ensure that street trees, street lights, and street signage has been installed in accordance with all applicable standards. The criteria can be met.
Chapter 16.135 Subdivisions

16.135.005 General Provisions
A. All subdivisions shall conform to applicable Zoning District Standards, Development Standards of this ordinance and the comprehensive plan.
B. A master plan for development shall be required for any application which leaves a portion of the subject property capable of redevelopment.
C. Pre-application conferences shall be required prior to the submittal of all subdivision applications. The City Manager may waive this requirement.

Response: As detailed above, the Application satisfies all applicable provisions in the R-2.5 District and elsewhere. Also as mentioned above, the site will not result in parcels that are capable of redevelopment under the current development regulations. Finally, the Applicant, along with their consultant, attended a pre-application conference with City Staff on April 28, 2016. The criteria are met.

16.135.010 Submittal Requirements for Tentative Subdivision Plans
A. All Subdivision applications shall be submitted on forms provided by the City and accompanied by the appropriate filing fee.
B. Each application shall include one (1) copy of the tentative subdivision plan drawn on a sheet of 24 x 36 inches in size at a scale of 1 inch equals 100 feet and one (1) copy in electronic form.
C. Should include copy of the letters of tentative approval of all Service Providers.
D. The following information shall be shown on the tentative subdivision plan:
   1. Proposed name of the subdivision. This name shall not duplicate or resemble the name of any other subdivision in the county and shall be approved by the Planning Commission and the County Surveyor.
   2. Date, north point and scale of drawing.
   3. Appropriate identification of the drawing as a tentative plan.
   4. Description of the subdivision sufficient to define its location and boundaries and legal description of the land proposed to be subdivided.
   5. Names and addresses of the owner and subdivider applicant.
   6. The location, widths and names of existing improved and unimproved streets within or adjacent to the tract. Add the location and width of existing easements within or adjacent to the tract.
   7. The location, width, names, approximate grades and radii of curves of proposed streets as shown on any development plan and any proposed easements.
   8. Contour lines related to some established bench mark or other datum approved by the city engineer and having minimum intervals as follows:
      a. For slopes of less than five per cent: two feet, together with not less than four spot elevations per acre, evenly distributed, if necessary.
      b. For slopes of five percent to 15 percent: five feet.
      c. For slopes of 15 percent to 20 percent: ten feet.
      d. For slopes of over 20 percent: 20 feet.
   9. The location of at least one temporary bench mark within the subdivision boundaries pursuant to ORS 96.060.
10. The location and direction of water courses and the location of areas subject to flooding and/or within the most current designated 100-year flood plain.

11. Natural features such as rock outcroppings, marshes, wooded areas and isolated preservable trees having a caliper (diameter) of 6 inches or greater at 4 feet above grade.

12. Existing uses of the property and location of existing structures designated historic and cultural resources on the site and structures to remain on the property after platting.

13. A vicinity map showing existing subdivisions and unsubdivided land ownerships adjacent to the proposed subdivision and showing how proposed streets and utilities may be extended to connect to existing streets and utilities.

14. Proposed deed restrictions, if any, in outline form.

15. The location of existing sewage disposal facilities, water mains, culverts, storm drainage facilities and electric lines within and adjacent to the subdivision.

16. Dimensions and area of each proposed lot.

17. Proposed lot and tract numbers.

18. Proposed sites, if any, allocated for development.

19. All subdivisions must show how layout of streets will interface with and accommodate all adjacent properties.

20. Any of the following may be required by the City or Planning Commission to supplement the tentative subdivision plan:
   a. Approximate center line profiles with extensions for a reasonable distance beyond the limits of the proposed subdivision showing the finished grade of streets and sidewalks and the nature and extent of street construction.
   b. A schematic plan for domestic water supply lines and related water service and sewage disposal facilities.
   c. Proposals for storm water drainage and flood control, including profiles of proposed drainage ways.
   d. If lot areas are to be graded or filled, a plan showing the nature of cuts and fills and information on the character of the soil.
   e. Proposals for other improvements such as electric utilities.

**Response:** This application, its narrative, and all accompanying exhibits include the relevant documents and material as required above. The criteria are met.

16.135.011 Preliminary Plat Approval Criteria

The City may approve, approve with conditions or deny a preliminary plat based on the following approval criteria:

A. The proposed preliminary plat complies with the applicable Development Code chapters and all other applicable ordinances and regulations. At a minimum, the provisions of this section and the applicable sections of this chapter including Zoning Districts, Development Standards, and Streets and Facilities shall apply.

Where a variance is necessary to receive preliminary plat approval, the application shall also comply with the Variance section of chapter 16.185;
Response: As detailed above, the Application satisfies all applicable provisions in the R-2.5 District and elsewhere. The application does not include a request for any variances. The criteria are met.

B. The proposed streets, roads, sidewalks, bicycle lanes, pathways, utilities, and surface water management facilities are laid out so as to conform or transition to the plats of subdivision and maps of major partitions already approved for adjoining property as to width, general direction and in all other respects. All proposed public improvements and dedications are identified on the preliminary plat;

Response: As illustrated throughout Exhibit A, streets, sidewalks, utilities, and surface water management facilities have been designed to transition to abutting properties that have been approved for development and/or that are likely to undergo development at some time in the near future. Further, all public improvements and dedications are shown in Exhibit A. The criteria are met.

C. All proposed private common areas and improvements (e.g. homeowners association property) are identified on the preliminary plat;

Response: The application does not include any private common areas. The criterion does not apply.

D. Evidence that any required State and federal permits have been obtained, or shall be obtained before approval of the final plat;

Response: At this time, the Applicant is not aware of any State or federal permits that apply to this subdivision. Prior to final plat approval, the Applicant will ensure that all State and federal permits, where required, have been obtained. Where it applies, this criterion can be met.

E. Evidence the improvements or conditions required by the City, road authority, Washington County, Clean Water Services, special districts, utilities, and/or other service providers, as applicable to the project, have been or shall be met;

Response: Prior to final plat approval, the City will ensure that all public improvements and any conditions of subdivision approval applied during the preliminary plat approval, have been implemented. The criterion can be met.

F. A Traffic Impact Study (TIS) has been provided, if applicable, in accordance with the provisions of Chapter 16.170; and

G. If any part of the site is located within a Specific Area Plan District, Overlay District, or previously approved Master Planned Development, it shall conform to the applicable regulations and/or conditions.

Response: The application does not meet any of the TIS threshold criteria listed in Section 16.170.003.A nor is the site located within a Specific Area Plan District. A TIS is not required. The criteria do not apply.


In addition to the provisions of this chapter, all lots and parcels shall conform to the specific requirements below, as applicable:

A. In conformance with the Uniform Fire Code (UFC), a 20-foot wide fire apparatus drive shall be provided to serve all portions of a building that are located more than 150 feet from a public right-of-way or approved access drive.
Response: As shown in Exhibit A, Sheet P09, all points of future homes on each of the 16 lots included in this application will be located less than 150-feet from “A” Terrace which will include a total paved travel lane width of 34-feet. The criterion does not apply.

B. When a common drive is to be provided to serve more than one lot, a reciprocal easement which will ensure access and maintenance rights shall be recorded with the approved subdivision. The minimum drive width shall be 10 to 15 feet, except as required by the UFC, and improved with an all-weather surface approved by the City.

Response: The application does not include any common driveways that will serve more than a single lot. The criterion does not apply.

C. Access reserve strips may be required to be granted to the City for the purpose of controlling access to adjoining undeveloped properties.

Response: The application does not include any access reserve strips. The criterion does not apply.

D. Street and building placement and alignment shall be designed so that all future street connections can be made as surrounding properties develop.

Response: The application includes a new street connection (“A” Terrace) between NW Wascoe Street and NW North Avenue. This new street connection is identified in the City’s Transportation Systems Plan and is a logical connection given the configuration of adjacent streets and pre-existing development. Further, this street connection does not preclude any future street connections during future development of adjacent properties. The criterion is met.

16.135.013 Flag Lot

Flag lots may be created only when a through street or mid-block lanes cannot be extended to serve abutting uses or future development. A flag lot driveway (“flag pole”) may serve no more than two (2) dwellings units, including accessory dwellings and dwellings on individual lots, unless Uniform Fire Code (UFC) standards are met for more units. A driveway serving more than one lot shall be a minimum of 15 feet wide, except as required by the UFC, and have a reciprocal access and maintenance easement recorded for all lots. No fence, structure or other obstacle shall be placed within the drive area. The Fire Marshal may require an emergency turn-around. Fire sprinklers may also be required for buildings that cannot be fully served by fire hydrants due to distance from a hydrant of insufficient fire flow.

Response: The application does not include the creation of any flag lots. The criteria do not apply.

...
B. Development proposals shall provide for the continuation of existing principal streets where necessary to promote appropriate traffic circulation in the vicinity of the development.

Response: The application includes a new street connection ("A" Terrace) between NW Wascoe Street and NW North Avenue. This connection is identified in the City’s TSP and provides a logical connection to existing and planned roadways in the site vicinity. The criteria are met.

C. Reserve strips: Reserve strips or street plugs controlling the access to streets will not be approved unless necessary for the protection of the public welfare or of substantial property rights, and in these cases they may be required. The control and disposal of the land composing such strips shall be placed within the jurisdiction of the City under conditions approved by the Planning Commission.

Response: The application does not include any reserve strips. The criteria do not apply.

D. Alignment: All streets other than minor streets or cul-de-sacs, as far as practical, shall be in alignment with existing streets by continuation of the center lines thereof. The staggering of street alignments resulting in "T" intersections shall, wherever practical, leave a minimum distance of 200 feet between the center lines of streets having approximately the same direction and otherwise shall not be less than 100 feet.

Response: As shown in Exhibit A, Sheet P09, "A" Terrace intersects with the existing NW Wascoe Street at a T-intersection. While this new street connection creates a new block and does not result in a series of staggered intersections, the centerline of NW Wascoe Street is more than 200 feet from the centerline of NW North Avenue at its intersection with 'Road A.' To the extent this criterion applies, it is met.

E. Future extension of streets: Where necessary to give access to or permit a satisfactory future development of adjoining land, streets shall be extended to the boundary of a tract being developed and the resulting dead-end streets may be approved without turnarounds. Reserve strips and street plugs may be required to preserve the objectives of street extensions.

Response: Abutting parcels to the south and east of the subject site are developed. The parcel to the west of this site does have potential for future development and can be served by public access from NW Wascoe Street as shown in Exhibit A, Sheet P11. The application does not include any reserve strips. The applicable criteria are met.

F. Intersection angles: Streets shall be laid out to intersect at angles as near to right angles as practical, except where topography requires lesser angle, but in no case shall the acute angle be less than 80 degrees unless there is a special intersection design. An arterial or collector street intersecting with another street shall have at least 100 feet of centerline tangent adjacent to the intersection unless topography requires a lesser distance. Other streets, except alleys, shall have at least 50 feet of tangent adjacent to the intersection unless topography requires a lesser distance. Intersections which contain an acute angle of less than 80 degrees or which include an arterial or collector street shall have a minimum corner radius sufficient to allow for a roadway radius of 20 feet and maintain a uniform width between the roadway and the right-of-way line. All other intersections shall have a minimum corner radius sufficient to allow for a roadway radius of 10 feet and maintain a uniform width...
between the roadway and the right-of-way line. Ordinarily, the intersection of more than two streets at any one point will not be approved.

Response: As shown in Exhibit A, Sheet P09, “A” Terrace will form a 90-degree intersection with NW Wascoe Street and an 84-degree intersection with NW North Avenue. This slightly-less-than-perpendicular intersection with NW North Avenue is a result of the existing orientation of NW North Avenue. The applicable criteria are met.

G. Existing streets: Whenever existing public streets adjacent to or within a tract are of inadequate width, additional right-of-way shall be provided at the time of subdivision or development.

Response: As shown in Exhibit A, Sheet P09, the application includes street improvements along the site’s NW North Avenue and NW Wascoe Street frontages consistent with the City’s planned sections for these roadways. The criterion is met.

H. Cul-de-sacs: Cul-de-sacs shall be as short as possible, and shall have maximum lengths of 600 feet and shall not serve more than 20 dwelling units. All cul-de-sacs shall terminate with circular turnarounds. Commercial and industrial cul-de-sacs shall have a minimum 55’ bulb radius. Additional cul-de-sac specifications, including specifications for residential cul-de-sacs, are contained within the most recently adopted public works/street standards of the City of North Plains and/or Washington County development standards.

Response: The application does not include any cul-de-sacs. The criteria do not apply.

I. Street names: No street names shall be used which will duplicate or be confused with the names of existing streets, except for extensions of existing streets. Street names and number shall conform to the established pattern in the City and shall be subject to the approval of the Planning Commission.

Response: The new street connection serving this subdivision, between NW Wascoe Street and NW North Avenue, is referred to as “A” Terrace throughout this narrative and its accompanying exhibits. This name is a placeholder and a permanent name which conforms to the City’s street naming standards will replace “A” Terrace prior to final plat approval. The criterion can be met.

J. Grades and curves: Grades shall not exceed 6 percent on arterials, 10 percent on collector streets or 12 percent on any other street. Center line radii of curves shall not be less than 300 feet on arterials, 200 feet on collectors or 100 feet on other streets, and shall be to an even 10 feet. Where existing conditions, particularly topography, make it otherwise impractical to provide buildable sites, the Planning Commission may accept steeper grades and sharper curves. In flat areas, allowance shall be made for finished street grades having a minimum slope of 0.5 percent.

Response: Per the City’s adopted TSP, “A” Terrace will be classified as a local street. As shown in Exhibit A, Sheet P10, “A” Terrace will not exceed a grade of 5 percent. The applicable criteria are met.

K. Marginal access streets: If a development abuts or contains an existing or proposed arterial street, the Planning Commission may require marginal access streets, reverse frontage lots with suitable depth, screen planting contained in a non-access reservation along the rear or side property line, or such other treatment as may be necessary for adequate protection of residential properties and to afford separation of through and local traffic.
**Response:** The applicant’s site does not but an existing or proposed arterial street. The criterion does not apply.

**L.** Alleys: Alleys shall be provided in commercial and industrial districts unless other permanent provisions for access to off-street parking and loading facilities are made as approved by the Planning Commission. While alley intersections and sharp changes in alignment shall be avoided, the corners of necessary alley intersections shall have radii of not less than 10 feet.

**Response:** The applicant’s site is located in the R-2.5 District, which is a residential district in the City of North Plains. The criterion does not apply.

**M.** Sidewalks shall be a minimum of five feet in width. Curbs and sidewalks shall be required along both sides of all public streets. All new development upon lots, tracts or parcels of land adjacent to a public street will be required to construct curbs and sidewalks.

**Response:** As shown in Exhibit A, Sheet P09, “A” Terrace includes 5-foot-wide sidewalks and curbs on the east and west sides of the street. Additionally, street improvements along the site’s NW North Avenue and NW Wascoe Street frontages also include 5-foot-wide sidewalks and curbs.

**N.** Street trees, where provided, shall not be of a species which has a shallow spreading root system which is likely to disturb sidewalk or street improvements.

**Response:** Prior to final plat approval, the Applicant will work with the City to install the appropriate number and type of street trees. The criterion can be met.

**O.** Access Spacing Standards shall, to the greatest extent possible, comply with Washington County’s standards and the most recently adopted public works/street standards of the City of North Plains. Washington County’s access spacing standards by street functional classification are as follows:

- Major Arterial: 1,000 feet
- Minor Arterial: 600 feet
- Major Collector: 150 feet
- Minor Collector: 50 feet
- Local Street: 10 feet

**Response:** “A” Terrace intersects NW North Avenue (Collector) approximately 345 feet east of the intersection of NW North Avenue/NW Gordon Road and intersects NW Wascoe Street (Local Street) 385 feet east of the intersection of NW Wascoe Street/NW Gordon Road. This distance exceeds the minimum spacing required for new intersections along a collector roadway as specified above. The criterion is met.

16.150.015 General Right-of-Way and Improvement Widths

Construction specifications for all street and right-of-way improvement widths shall comply with the criteria of the most recently adopted North plains public works standards. These standards shall be the minimum requirements for all streets, except where modifications are permitted under this chapter or the Street Standard adopted by the City Council of North Plains, whichever is less restrictive. Refer to Figures 5-2A-5-2P in the Transportation System Plan for detailed diagrams depicting street right-of-
way, improved, and roadway width requirements. Washington County roads are subject to County roadway standards.

**Response:** As illustrated in Exhibit A, Sheet P09, “A” Terrace and the improvements to NW North Avenue and NW Wascoe Street have been designed in accordance with the City of North Plains Public Works Standards. Specifically, and as shown in Exhibit A, Sheet P09, “A” Terrace includes a 52-foot wide right-of-way consisting of a five-foot-wide concrete sidewalk, 3.5-foot wide landscape strip and a 17-foot wide shared travel/parking lane on either side of the centerline. A new six-inch curb, 3.5-foot wide landscape strip and five-foot-wide concrete sidewalk will also be added along the property’s NW Wascoe Street frontage. Finally, the application includes additional travel lane width, a six-foot-wide bike lane, a 4.5-foot wide planter strip, and a five-foot-wide sidewalk along the property’s NW North Avenue frontage.

16.150.020 Modification of Right-of-Way and Improvement Width

The Planning Commission may allow modification to the public street standards of this chapter when both of the following criteria are satisfied.

A. The modification is necessary to provide design flexibility in instances where:
   1. Unusual topographic conditions require a reduced width or grade separation of improved surfaces; or
   2. Parcel shape or configuration precludes accessing a proposed development with a street which meets the full standards of the City of North Plains or
   3. A modification is necessary to preserve trees or other natural features determined by the Planning Commission to be significant to the aesthetic character of the area; or
   4. A Planned Unit Development is proposed and the modification of street standards is necessary to provide greater privacy or aesthetic quality to the development.

B. Modification of the Street Standards of this chapter shall only be approved if the Planning Commission finds that the specific design proposed provides adequate vehicular access based on anticipated traffic volumes. If there is insufficient area of on-street parking, the Planning Commission may require additional off-street parking and require that the street be posted to prohibit parking along one or both sides of the street.

**Response:** The application does not request a modification to any standard right-of-way improvement widths. The criteria do not apply.

16.150.025 Construction Specifications

Construction specifications for all public improvements shall comply with the criteria of the most recently adopted public works/street standards of the City of North Plains.

**Response:** At time of public works permit review, the City will ensure that all construction specifications for public improvements comply with the applicable criteria in the City of North Plains Public Works Standards. The criterion can be met.

16.31.070 Bikeways and Sidewalks Required on Arterials and Collectors

C. North Avenue: On the near term a sidewalk should be constructed on the south side of North Avenue to connect the existing sidewalk to Gordon Road. Sidewalks should also be added on the south side of North Avenue between
NW 309th Avenue and Glencoe Road. These improvements would complete a system of sidewalks on North Avenue in addition to providing connectivity to the adjacent street system. In the Long term sidewalks should be added to the north side of North Avenue also.

**Response:** As shown in Exhibit A, Sheet P09, the application includes sidewalks on the south side of NW North Avenue for the distance of the property frontage along this roadway. The criterion is met.

**Chapter 16.155 Off-Street Parking and Loading**

16.155.015 Automotive Parking Requirements

A. Residential

1. Detached single family Two (2) spaces per dwelling unit

**Response:** Although new homes are not included in this application, the applicant anticipates that a minimum of two off street parking spaces per lot will be provided via a garage and driveway on each of the 16 lots. The criterion can be met.

**Chapter 16.160 Clear Vision Areas**

16.160.000 Requirements

Except in the C-1 zone, a clear vision area shall be maintained on the corners of all property adjacent to the intersection of two streets, a street and a railroad, or a driveway providing vehicular access to a public street, including alleys.

A. Lots or parcels on street corners (public and/or private) shall maintain a sight triangle with no sight obstruction between three (3) feet and ten (10) feet in height as measured from street grade. Sight obstructions include, but are not limited to, fences, vegetation, berms, signs and structures. The sight triangle shall be measured from the street corner (apex), to a distance of twenty (20) feet along each street side (see Figure 1). For the purpose of this Section, a street corner is defined as that point where the extended edges of the road surface of two intersecting streets meet. The City may require additional vision clearance based on a hazard identified by the City. However, tree trunks and sign poles not exceeding 12 inches in diameter may be located within the vision clearance area, provided the diameter does not exceed 24 inches.

B. A private access shall be treated as a public street for the purpose of this section. The vision clearance area shall be determined in the manner set forth in Chapter 16.160.000.010(A). The edge of the paved surface area of the private access, be it roadway, curb or sidewalk, shall be treated as the right-of-way line in determining the vision clearance area.

**Response:** Exhibit A, Sheet P09, illustrates a corner vision triangle at all street corners consistent with the applicable provisions above. The application does not include any private access streets. The applicable criteria are met.

**IV. Conclusion**

The required findings have been made and this written narrative and accompanying documentation demonstrate that the application is consistent with the applicable provisions of the North Plains Zoning and Development Code. The evidence in the record is substantial and supports approval of the application. Therefore, the Applicant respectfully requests that the City approve this Subdivision application.
Exhibit A: Preliminary Development Plans
**NORTH AVENUE SUBDIVISION**

**SUBDIVISION APPLICATION**

**VICINITY MAP**

**SITE MAP**

**SHEET INDEX**

**PROJECT LOCATION:** 33330 NW NORTH AVENUE
NORTH PLAINS, OR 97133

**PROPERTY DESCRIPTION:** TAX LOT 201 (WASHINGTON COUNTY TAX MAP IN 3.150) LOCATED IN THE SOUTHEAST ¼ OF THE NORTHWEST QUARTER SECTION 31, TOWNSHIP 1 NORTH, RANGE 2 WEST, MULTNOMAH COUNTY, OREGON

**EXISTING LAND USE:** SINGLE-FAMILY RESIDENTIAL HOME AND VACANT LAND

**PROJECT PURPOSE:** SINGLE-FAMILY ATTACHED RESIDENTIAL 15 LOTS SUBDIVISION IN THE H-2.5 DISTRICT

**VERTICAL DATUM:** ELEVATIONS ARE BASED ON WASHINGTON COUNTY OSNO NAD 83.000 GRS 1983

---

**LEGEND**

- Existing
- Planned
- Proposed

**FEATURES**

- Utilities
- Survey
- Grade
- Crushed Stone
- Concrete
- Easement
- Street
- Drainage
- Utility Line
- Storm Sewer
- Fire Hydrant
- Street Light
- Street Tree

**PROJECTING FIRM**

ARCS ENGINEERING & LANDSCAPE

**PLANNING/ENGINEERING/SURVEYING/ LANDSCAPE ARCHITECTURE FIRM**

ARCS ENGINEERING & LANDSCAPE

**APPLICANT**

BAKER CONSTRUCTION, LLC
11028 SE HAMMOND LANE
WILSONVILLE, OREGON 97070

**CONTACT:** MARK DUKAS, AEP, PLA
2901 DIAMOND ROAD, SUITE 100
TUALATIN, OR 97062

**PHONE:** 503-683-6131
**FAX:** 503-683-6132

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**COVER SHEET WITH VICINITY AND SITE MAP**

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**PROJECT WRAP**

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**APPENDIX**

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**ANALYSIS**

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**REFERENCE**

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THE PURPOSE OF THIS PRELIMINARY PLAT IS TO SHOW THE PROPOSED LOT DIVISIONS FOR PLANNING PURPOSES. THIS IS NOT A FINAL PLAT AND IS NOT TO BE USED FOR SURVEY PURPOSES.
LAND USE APPLICATION (TYPE 2, 3, or 4)

Applicant General Information

Applicant Name: Biggi Construction, LLC
Mailing Address: 11605 SW Normandy Lane
Street: Wilsonville
City: OR 97070
Email Address: Please contact applicant's representative
Phone: ( ) -

Property Owner: Mark and Lori Perkins
Mailing Address: 32370 NW North Avenue
Street: North Plains
City: OR 97133
Email Address: Please contact applicant's consultant
Phone: ( ) -

Property Description

Address: 32370 NW North Avenue
Street: North Plains
City: OR 97133
Tax Lot ID: 1N 3 01BC Tax Lot 201
Existing Zoning: R-2.5
Property Area: 2.14 acres
Existing Land Use: High-density Residential
General Development Description: 16-Lot Subdivision for future construction of single-family detached homes

Fees - Check all that apply (Deposits effective 07/01/16)

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*Please refer to the current fee schedule or municipal code for clarification
Information to Include with Your Application

- Application Form
- Fee
- **Narrative** describing the Development Proposal and addressing the Decision Criteria. All applications will be reviewed based on the criteria of [Chapter 16 of the North Plains Municipal Code](www.northplains.org), which is available at www.northplains.org. A sample narrative is also on website.
- **Site plans** drawn to scale; one hard copy and PDF document (flash drive or email/file share). Plans should show:
  - All property boundaries in which development is occurring
  - All adjacent roads (with names and dimensions)
  - Location and dimensions of all existing and proposed access ways/alleys/driveways
  - Location, number, dimensions, setbacks
  - All easements (including utilities)
  - Location of all existing and proposed fire hydrants
  - Location, size (area), and setbacks of all existing and proposed buildings and structures
  - Location, size (area), and layout of existing and proposed landscaping
  - Location, number and dimensions of existing and proposed parking areas, including handicapped spaces
  - Location, number and dimensions of existing and proposed loading areas
  - Location, number, dimensions, and types of existing and proposed lighting
  - Location, number, dimensions, setbacks, and types of existing and proposed fencing and or/screening
  - Location, number, dimensions, setbacks, and types of existing and proposed mechanical equipment, such as rooftop equipment and transformer boxes. Show any screening of proposed equipment.
  - Delineate flood plains and water courses
  - Significant vegetation

- **Stamped envelopes with mailing labels** attached for all property owners and residents within 250 feet of the subject property or properties. (A list of property owners/site addresses may be obtained from Washington County or a title insurance company.)

- **Clean Water Services, Service Provider Letter or determination that letter is not needed** from CWS website: [https://www.cleanwaterservices.org/documents-forms/pre-screen-form/](https://www.cleanwaterservices.org/documents-forms/pre-screen-form/)

- A **traffic study** for any project generating more than 300 trips per day.

- Other reports related to specific permit types □ flood plain □ significant natural resources □ historic overlay □ title report for land division □ Other

*After initial review, the City may require additional information.*

Additional Information

In order to expedite and complete the processing of this application, the City of North Plains requires that all pertinent material required for review of this application be submitted at the time application is made. If the application is found to be incomplete, review and processing of the application will not begin until the application is made complete.

I certify that the statements made in this application are complete and true to the best of my knowledge. I understand that any false statements may result in denial of this application.

I understand that there may be additional costs of processing this application including, but not limited to, planning, engineering, city attorney and administration. The City will notify the applicant if there will be additional costs.

Date: 8-12-16  
Signature of Applicant: [Signature]

Date: 5-12-16  
Signature of Property Owner: [Signature]

FOR OFFICE USE

Received by: ___________________________  
Date: ___________________________

Fee paid: __________  
Receipt No. __________  
Application No. __________

Updated 5/23/16
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City
OR 97133
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  - Location and dimensions of all existing and proposed access ways/alleys/driveways
  - Location, number, dimensions, setbacks
  - All easements (including utilities)
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  - Location, size (area), and layout of existing and proposed landscaping
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  - Delineate flood plains and water courses
  - Significant vegetation
- **Stamped envelopes with mailing labels** attached for all property owners and residents within 250 feet of the subject property or properties. (A list of property owners/site addresses may be obtained from Washington County or a title insurance company.)
- **Clean Water Services, Service Provider Letter** or determination that letter is not needed from CWS website: https://www.cleanwaterservices.org/documents-forms/pre-screen-form/

N/A A traffic study for any project generating more than 300 trips per day.

Other reports related to specific permit types [ ] flood plain [ ] significant natural resources [ ] historic overlay [ ] other

**For Office Use**

Received by: ________________________________ Date: _________________

Fee paid: _______________ Receipt No. _______________ Application No. ______

Updated 5/23/16
Exhibit C: Property Ownership Information
OWNERSHIP INFORMATION
Owner: Mark & Lori Perkins
Parcel #: R728662
Coowner:
Ref Parcel #: 1N301BC00201
Site: 32370 NW North Ave North Plains 97133
TRS: T: 01N R: 03W S: 01 Q: NW
Mail: 32370 NW North Ave North Plains OR 97133
County: Washington

PROPERTY DESCRIPTION
Map Grid: 563-A1
Census Tract: 032700 Block: 2011
Neighborhood: CPO 8
School Dist: 1J HILLSBORO
Subdiv/Plat:
Impr Type: R1 Residence Single Family
Land Use: RMSC RESIDENTIAL MISCELLANEOUS
Zoning: North Plains-R2.5 Multi-Family Residential
Watershed: Daisy Creek
Legal: ACRES 2.14

ASSESSMENT AND TAXATION
Market Land: $444,040
Market Impro: $91,010
% Improved: 17
Assessed Total: $271,950 (2015)
Levy Code: 070.14
Tax: $4,007.36 (2015)
Millage Rate: 14.7356

PROPERTY CHARACTERISTICS
Bedrooms: 3
Baths, Total: 2.00
Baths, Full:
Baths, Half:
Total Units: 1
# Stories: 0.00
# Fireplaces:
Cooling: No
Heating: Forced Air
Ext Walls: Siding
Building Area: 1,820 SqFt
First Floor: 1,820 SqFt
Second Floor:
Baseline Fin:
Baseline Unfin:
Basement Total:
Attic Fin:
Attic Unfin:
Attic Total:
Garage: Garage 420 SqFt

SALES AND LOAN INFORMATION
Owner
Date
Doc #
Sale Price
Deed Type
Loan Amt
Loan Type
SUNSET TERRACE 55 LLC
09/29/15
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Trust
$550,000
PERKINS, MARK & LORI
06/08/15
0000044834
Trust
$40,000
PERKINS, MARK & LORI
05/08/13
0000041747
Trust
$168,736
KKNW LLC
12/24/12
0000109241
$350,000 Warranty
Conv/Unk
PERKINS, MARK & LORI
02/26/07
0000020811
Trust
$37,000 Conv/Unk
PERKINS, MARK & LORI
02/22/05
0000017939
Trust
$21,000 Conv/Unk
This map/plan is being furnished as an aid in locating the herein described land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.
ParcelId: R728662

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STATE OF OREGON  SS
County of Washington

I, Jerry R. Hanson, Director of Assessment and Taxation and Ex-Officio County Clerk for said county, do hereby certify that the within instrument of writing was received and recorded in book of records of said county.

Jerry R. Hanson, Director of Assessment and Taxation, Ex-Officio County Clerk

Doc: 96025764
Rect: 161392  239.00
03/26/1996  02:31:55PM
WARRANTY DEED - STATUTORY FORM
individual/corporate

Escrow Number: 1014423

Kaung-Fen Chau and Karen Chin-Ying Chau, Husband and Wife
Grantor, conveys and warrants to
Mark Perkins and Lori Perkins, Husband and Wife
Grantee, the following described real property free of encumbrances except as
specifically set forth herein situated in Washington County, Oregon:

See Attached Legal Description Exhibit "A".

The above described property is free from encumbrances except
restrictions, rights of way, easements and reservations now of record.

The true and actual consideration for this conveyance is $ 195,500.00

Dated this 21st day of March, 1996, if this deed is given by a corporate grantor, its name is signed by its
authorized officers by authority of the Board of Directors.

[Signature]
Kaung-Fen Chau

[Signature]
Karen Chin-Ying Chau

STATE OF OREGON, County of Multnomah
Personally appeared

and Karen Chin-Ying Chau

Before me:

[Signature]
Notary Public for Oregon
My commission expires: 5/31/97

After recording return to:

Mr. and Mrs. Mark Perkins
32370 NW North Avenue
North Plains, OR 97136

STATE OF OREGON.

County of

I certify that the within instrument was received for record on the
___ day of _19_,
at ___ o'clock ___ M., and recorded in book/reel/Volume No. ___ on page ___ of said book, as fee simple instrument/microfilm/recording No._

Records of Deeds of said county.

Witness my hand and seal of

By ______ Title __________

Deputy

Form No. 500-Computar
DESCRIPTION:

A portion of Lots 18 and 19, Block 1, NORTH PLAINS, in the City of North Plains, County of Washington and State of Oregon, more particularly described as follows:

Beginning at the Northeast corner of Lot 19; thence South 6°48' West along the East line thereof and the East line of Lot 18, a distance of 360 to a point; thence Westerly parallel with the North line of Lot 18, a distance of 250 feet to a point; thence North 6°48' East to the North line of Lot 19, thence South 76°38' East along the South line of North Avenue to the point of beginning.
Exhibit D: Neighborhood Meeting Documentation
AFFIDAVIT OF MAILING

STATE OF OREGON    
) ss
COUNTY OF Washington

I, Jacki Herb, being duly sworn, depose and say that on August 4, 2016, I caused to have mailed to each of the persons on the attached list a notice of a meeting to discuss a proposed development located at 32370 nw North Avenue, a copy of which notice so mailed is attached hereto and made a part of hereof.

I further state that said notices were enclosed in envelopes plainly addressed to said persons and were deposited on the date indicated above in the United States Post Office with postage prepaid thereon.

[Signature]

Subscribed and sworn to, or affirmed, before me this 5th day of August, 2016.

[Signature]
Notary Public for the State of Oregon
My Commission Expires 05/17/2020
August 4, 2016

RE: Neighborhood Review Meeting
    Planned Subdivision

Dear Property Owner/Neighbor:

AKS Engineering & Forestry, LLC is holding a neighborhood meeting regarding a ±2.14 acre property located at 32370 NW North Avenue, North Plains, OR, County Assessor’s Map 1N3 01BC, tax lot 201; more specifically shown by the attached map. The project involves a planned subdivision with approximately 16 lots. Prior to applying to the City of North Plains, we would like to take the opportunity to discuss the project with you in more detail.

The purpose of this meeting is to provide a forum for surrounding property owners/residents to review and discuss the project before the application is submitted to the City. This meeting gives you the opportunity to share with us any special information you know about the property involved. We will attempt to answer questions which may be relevant to meeting development standards consistent with the City of North Plains Zoning and Development Code.

Pursuant to City of North Plains Chapter 16.170.002, you are invited to attend a meeting on:

Thursday, August 18, 2016 at 5:30 p.m.
Jessie Mays Community Hall
30975 NW Hillcrest Street, North Plains, OR 97133

Please note this meeting will be an informational meeting on preliminary plans. These plans may be altered prior to submittal of the application to the City. Depending upon the type of land use action required, you may receive official notice from the City of North Plains for you to either participate with written comments and/or an opportunity to attend a public hearing.

I look forward to discussing this project with you. If you have questions, but will be unable to attend, please feel free to call me at 503-563-6151.

Sincerely,

AKS ENGINEERING & FORESTRY, LLC

Mimi Doukas, AICP, RLA

Attachments: County Assessor's Map
Maps are intended for informational purposes only. Some information has been procured from third-party sources and has not been independently verified. Independent parts are owned by their respective copyright owners and not by First American. First American Title Company makes no express or implied warranty respecting the information presented and assumes no responsibility for errors or omissions.
Site Assessment

Date: August 10, 2016

To: Clean Water Services, Environmental Review
2550 SW Hillsboro Highway
Hillsboro, Oregon 97123

Cc: Vince Biggi
Biggi Construction LLC

From: Lindsey Obermiller, Natural Resources Specialist
Stacey Reed, Senior Wetland Scientist

Subject: North Avenue Subdivision

CWS File No: 16-002932

Site Location: 32370 NW North Avenue
North Plains, Oregon 97123
Tax Lot 201 of Tax Map 1N 3 01BC

Introduction
The applicant (Vince Biggi, Biggi Construction LLC) contracted AKS Engineering & Forestry, LLC (AKS) to submit a request for a Service Provider Letter (SPL) from Clean Water Services (CWS) for a residential subdivision located at 32370 NW North Avenue, North Plains, Washington County, Oregon. AKS submitted a Sensitive Areas Pre-Screening Site Assessment to CWS on behalf of the applicant. The Pre-Screen was returned requesting a Site Assessment, as potentially jurisdictional Sensitive Areas were determined to potentially exist on site or within 200 feet of the subject property.

The subject property is located south of NW North Avenue and east of NW Gordon Road. This property is developed with one single-family dwelling and a shop located in the south. No wetlands were determined present on the site. Wetlands were determined present on the adjacent site to the south per SPL CWS File No. 13-003177. According to the SPL, the vegetated corridor limits associated with off-site wetlands do not extend onto the subject property. Therefore, the project will not impact vegetated corridor or Water Quality Sensitive Areas. This memorandum has been prepared to meet the requirements listed under Chapter 3 of CWS’ Design and Construction Standards, R&O 07-20, June 2007.

Site Assessment
A database search from the Oregon Department of State Lands (DSL) did not reveal any documented DSL wetland delineation concurrences for the site. A natural resource assessment was submitted for the adjacent property to the south and received an SPL in 2014 (CWS File No. 13-003177). This report
concluded that the slopes adjacent to the off-site wetland are less than 25%, requiring a vegetated corridor of 50-feet-wide, which does not extend onto the subject site.

Lindsey Obermiller, Natural Resources Specialist with AKS, conducted a site visit on August 5, 2016, to determine whether any water quality sensitive areas were present on site. No wetlands were determined present on the site. The property consists of one home located in the south at the end of a long graveded driveway. The yard adjacent to the driveway is vegetated with domestic fruit and filbert trees, with Douglas-fir (Pseudotsuga menziesii, FACU) and Scots pine (Pinus sylvestris, NOL) bordering the northern property line. The remainder of the property contains some ornamental maple trees and an open grassland dominant in colonial bent (Agrostis capillaris, FAC), tall false rye grass (Schedonorus arundinaceus, FAC), Queen-Ann’s lace (Daucus carota, FACU), and English plantain (Plantago lanceolata, FACU). The surrounding land use is residential. The site immediately north (across NW North Avenue) contains an undeveloped field. Topography on the site is generally flat (less than 3% slope). According to the Natural Resources Conservation Service (NRCS) Washington County, Oregon, Area Soils Map, hydric soils are mapped on the subject site along the northern boundary (Figure 3).

The methodology used for determining the presence of wetlands followed the U.S. Army Corps of Engineers’ (Corps’) Wetlands Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0). Data were collected during the August 5, 2016, site visit in the vicinity of NRCS-mapped hydric soils. Plot 1 (located in the northeast corner of the site, west of the driveway, and adjacent to the roadside ditch along NW North Avenue) consisted of a non-hyrophytic plant community dominant in Scots pine, Douglas-fir, Himalayan blackberry (Rubus armeniacus, FAC), velvet grass (Holcus lanatus, FAC), and common dandelion (Taraxacum officinale, FACU). Plot 2 (located in the northwest corner of the site) consisted of a non-hyrophytic plant community dominant in English plantain and colonial bent with Queen Ann’s-lace and common dandelion. Non-hydric soils lacking redoximorphic features and a lack of wetland hydrology indicators were documented at Plots 1 and 2. The locations of the sample plots are shown on attached Figure 4 (Existing Condition Map). Representative photographs of on-site conditions and data sheets are attached. The Preliminary Site Plan is included as Figure 5.

Attachments
Figure 1. Vicinity Map
Figure 2. Tax Lot Map
Figure 3. Soils Map
Figure 4. Existing Conditions Map
Figure 5. Preliminary Site Plan
Wetland Determination Data Forms (Plots 1 and 2)
Representative Site Photographs
Sensitive Areas Certification Form
NRCS WEB SOIL SURVEY FOR
WASHINGTON COUNTY
**WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region**

Project/Site: North Avenue Subdivision  
City/County: North Plains/Washington  
Sampling Date: 8/5/2016

Applicant/Owner: Biggi Construction, LLC  
State: OR  
Sampling Point: 1

Investigator(s): Lindsey Obermiller  
Section, Township, Range: Sec. 01BC T.1N R.3W

Landform (hillslope, terrace, etc.): Hillslope  
Local relief (concave, convex, none): Sl. Concave  
Slope (%): <3%

Subregion (LRR): A, Northwest Forests and Coast  
Lat._________________________  
Long._________________________  
Datum:_________________________

Soil Map Unit Name: (Unit 42) Verboort Silty Clay Loam  
NWI classification:_________________________

Are climatic / hydrologic conditions on the site typical for this time of year?  
Yes X No  
(If no, explain in Remarks)

Are Vegetation, Soil, or Hydrology significantly disturbed?  
Are "Normal Circumstances" present?  
Yes X No  
(If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

<table>
<thead>
<tr>
<th>Hydrophytic Vegetation Present?</th>
<th>Yes</th>
<th>No</th>
<th>X</th>
<th>Is the Sampled Area within a Wetland?</th>
<th>Yes</th>
<th>No</th>
<th>X</th>
</tr>
</thead>
</table>

Precipitation: According to the NWS Hillsboro station, 0.00 inches of rainfall was received on the day of the site visit and 0.03 inches within the two weeks prior.

Remarks: Plot located in low lying topography in mapped hydric soils.

**VEGETATION**

<table>
<thead>
<tr>
<th>Tree Stratum (Plot size: <strong>30' r</strong>)</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Status</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pinus sylvestris</td>
<td>45%</td>
<td>Yes</td>
<td>NOL</td>
<td></td>
</tr>
<tr>
<td>2. Pseudotsuga menziesii</td>
<td>20%</td>
<td>Yes</td>
<td>FACU</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>65% = Total Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sapling/Shrub Stratum (Plot size: <strong>10' r</strong>)</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rubus armeniacus</td>
<td>15%</td>
<td>Yes</td>
<td>FAC</td>
</tr>
<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>15% = Total Cover</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Herb Stratum (Plot size: <strong>5' r</strong>)</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Holcus lanatus</td>
<td>30%</td>
<td>Yes</td>
<td>FAC</td>
</tr>
<tr>
<td>2. Agrostis capillaris</td>
<td>20%</td>
<td>Yes</td>
<td>FAC</td>
</tr>
<tr>
<td>3. Hypochaeris radicata</td>
<td>20%</td>
<td>Yes</td>
<td>FACU</td>
</tr>
<tr>
<td>4. Schedonorus arundinaceus</td>
<td>15%</td>
<td>No</td>
<td>FAC</td>
</tr>
<tr>
<td>5. Daucus carota</td>
<td>5%</td>
<td>No</td>
<td>FACU</td>
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<td>6.</td>
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<td>7.</td>
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<td>8.</td>
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<td>9.</td>
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<td>10.</td>
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<tr>
<td>11.</td>
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<td></td>
<td>90% = Total Cover</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Woody Vine Stratum (Plot size: <strong>10' r</strong>)</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<tr>
<td></td>
<td>0% = Total Cover</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>% Bare Ground in Herb Stratum</th>
<th>10%</th>
</tr>
</thead>
</table>

Remarks:

**Dominance Test worksheet:**

Number of Dominant Species: That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species: That Are OBL, FACW, or FAC: 50% (A/B)

**Prevalence Index worksheet:**

<table>
<thead>
<tr>
<th></th>
<th>Total % Cover of:</th>
<th>Multiply by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBL species</td>
<td>0 x 1 = 0</td>
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<tr>
<td>FACW species</td>
<td>0 x 2 = 0</td>
<td></td>
</tr>
<tr>
<td>FAC species</td>
<td>80 x 3 = 240</td>
<td></td>
</tr>
<tr>
<td>FACU species</td>
<td>45 x 4 = 180</td>
<td></td>
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<tr>
<td>UPL species</td>
<td>45 x 5 = 225</td>
<td></td>
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</tbody>
</table>

Column Totals: 170 (A) 645 (B)

Prevalence Index = B/A = 3.79

**Hydrophytic Vegetation Indicators:**

1 - Rapid Test for Hydrophytic Vegetation
2 - Dominance Test is >50%
3 - Prevalence Index is ≤3.0
4 - Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
5 - Wetland Non-Vascular Plants¹
Problematic Hydrophytic Vegetation¹ (Explain)

¹Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No

Remarks:
**SOIL**

**Profile Description:** (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Color (moist)</th>
<th>%</th>
<th>Color (moist)</th>
<th>%</th>
<th>Type</th>
<th>Loc</th>
<th>Texture</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12+</td>
<td>10YR 3/2</td>
<td>100</td>
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<td>SICL</td>
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</table>

1 Type: C=Concentration, D=Depletion, RM=Reduced Matrix CS=Covered or Coated Sand Grains.  
2 Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:** (Applicable to all LRRs, unless otherwise noted.)

<table>
<thead>
<tr>
<th>Indicators for Problematic Hydric Soils³:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Histosol (A1)</td>
</tr>
<tr>
<td>2 Histic Epipedon (A2)</td>
</tr>
<tr>
<td>3 Black Histic (A3)</td>
</tr>
<tr>
<td>4 Hydrogen Sulfide (A4)</td>
</tr>
<tr>
<td>5 Depleted Below Dark Surface (A11)</td>
</tr>
<tr>
<td>6 Thick Dark Surface (A12)</td>
</tr>
<tr>
<td>7 Sandy Mucky Mineral (S1)</td>
</tr>
<tr>
<td>8 Sandy Gleyed Matrix (S4)</td>
</tr>
<tr>
<td>9 Sandy Redox (S5)</td>
</tr>
<tr>
<td>10 Stripped Matrix (S6)</td>
</tr>
<tr>
<td>11 Loamy Mucky Mineral (F1)</td>
</tr>
<tr>
<td>12 Loamy Gleyed Matrix (F2)</td>
</tr>
<tr>
<td>13 Depleted Matrix (F3)</td>
</tr>
<tr>
<td>14 Redox Dark Surface (F6)</td>
</tr>
<tr>
<td>15 Redox Depressions (F8)</td>
</tr>
</tbody>
</table>

**Restrictive Layer (if present):**

<table>
<thead>
<tr>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (inches):</td>
</tr>
<tr>
<td>---------</td>
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</tbody>
</table>

Remarks:

**HYDROLOGY**

**Wetland Hydrology Indicators:**

<table>
<thead>
<tr>
<th>Primary Indicators (minimum of one required; check all that apply)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water (A1)</td>
</tr>
<tr>
<td>High Water Table (A2)</td>
</tr>
<tr>
<td>Saturation (A3)</td>
</tr>
<tr>
<td>Water Marks (B1)</td>
</tr>
<tr>
<td>Sediment Deposits (B2)</td>
</tr>
<tr>
<td>Drift Deposits (B3)</td>
</tr>
<tr>
<td>Algal Mat or Crust (B4)</td>
</tr>
<tr>
<td>Iron Deposits (B5)</td>
</tr>
<tr>
<td>Surface Soil Cracks (B6)</td>
</tr>
<tr>
<td>Inundation Visible on Aerial Imagery (B7)</td>
</tr>
<tr>
<td>Sparsely Vegetated Concave Surface (B8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)</td>
</tr>
<tr>
<td>Salt Crust (B11)</td>
</tr>
<tr>
<td>Aquatic Invertebrates (B13)</td>
</tr>
<tr>
<td>Hydrogen Sulfide Odor (C1)</td>
</tr>
<tr>
<td>Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Recent Iron Reduction in Tilled Soils (C6)</td>
</tr>
<tr>
<td>Stunted or Stressed Plants (D1) (LRR A)</td>
</tr>
<tr>
<td>Other (Explain in Remarks)</td>
</tr>
<tr>
<td>Other (Explain in Remarks)</td>
</tr>
</tbody>
</table>

**Field Observations:**

<table>
<thead>
<tr>
<th>Surface Water Present?</th>
<th>Yes</th>
<th>No</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Table Present?</td>
<td>Yes</td>
<td>No</td>
<td>X</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes</td>
<td>No</td>
<td>X</td>
</tr>
</tbody>
</table>

Depth (inches):  
Wetland Hydrology Present?  
Yes | No | X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soils very dry throughout.
### VEGETATION

#### Tree Stratum

<table>
<thead>
<tr>
<th>Species</th>
<th>% Cover</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudotsuga menziesii</td>
<td>10%</td>
<td>Yes</td>
</tr>
</tbody>
</table>

#### Sapling/Shrub Stratum

<table>
<thead>
<tr>
<th>Species</th>
<th>% Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantago lanceolata</td>
<td>25%</td>
</tr>
</tbody>
</table>

#### Herb Stratum

<table>
<thead>
<tr>
<th>Species</th>
<th>% Cover</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumex acetosella</td>
<td>10%</td>
<td>No</td>
</tr>
</tbody>
</table>

#### Woody Vine Stratum

<table>
<thead>
<tr>
<th>Species</th>
<th>% Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

#### Dominance Test worksheet:

- **Number of Dominant Species**: That Are OBL, FACW, or FAC: 1 (A)
- **Total Number of Dominant Species Across All Strata**: 3 (B)
- **Percent of Dominant Species**: That Are OBL, FACW, or FAC: 33% (A/B)

#### Prevalence Index worksheet:

- **Total % Cover of OBL species**: 0
- **Multiply by 1**: 0
- **Total % Cover of FACW species**: 0
- **Multiply by 2**: 0
- **Total % Cover of FAC species**: 60
- **Multiply by 3**: 3
- **Total % Cover of FACU species**: 220
- **Multiply by 4**: 280
- **Column Totals**: 75 (A) 280 (B)

#### Hydrophytic Vegetation Indicators:

1. Rapid Test for Hydrophytic Vegetation
2. Dominance Test is >50%
3. Prevalence Index is ≤3.0
4. Morphological Adaptations
5. Wetland Non-Vascular Plants

#### Hydrophytic Vegetation Present?

Yes X No X

### SUMMARY OF FINDINGS

- **Hydrophytic Vegetation Present?**: Yes X No X
- **Hydric Soil Present?**: Yes X No X
- **Wetland Hydrology Present?**: Yes X No X
- **Are climatic/hydrologic conditions on the site typical for this time of year?**: Yes X No (If no, explain in Remarks)
- **Are Vegetation, Soil, or Hydrology significantly disturbed?**: Are "Normal Circumstances" present? Yes X No (If needed, explain any answers in Remarks.)

### Hydrophytic Vegetation Indicators:

1. Rapid Test for Hydrophytic Vegetation
2. Dominance Test is >50%
3. Prevalence Index is ≤3.0
4. Morphological Adaptations
5. Wetland Non-Vascular Plants

### Hydrophytic Vegetation Present?

Yes X No X

### Precipitation:

According to the NWS Hillsboro station, 0.00 inches of rainfall was received on the day of the site visit and 0.03 inches within the two weeks prior.

### Remarks:

Plot located in low lying topography in mapped hydric soils, adjacent to apple orchard.
**SOIL**

**Profile Description:** (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Color (moist)</th>
<th>%</th>
<th>Color (moist)</th>
<th>%</th>
<th>Type</th>
<th>Loc</th>
<th>Texture</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12+</td>
<td>10YR 3/2</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

1Type: C=Concentration, D=Depletion, RM=Reduced Matrix CS=Covered or Coated Sand Grains.  
2Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:** (Applicable to all LRRs, unless otherwise noted.)

- **Histosol (A1)**
- **Histic Epipedon (A2)**
- **Black Histic (A3)**
- **Hydrogen Sulfide (A4)**
- **Depleted Below Dark Surface (A11)**
- **Sandy Mucky Mineral (S1)**
- **Sandy Gleyed Matrix (S4)**

**Indicators for Problematic Hydric Soils**:  
2 cm Muck (A10), Red Parent Material (TF2), Very Shallow Dark Surface (TF12), Other (Explain in Remarks)

**Restrictive Layer (if present):**

<table>
<thead>
<tr>
<th>Type:</th>
<th>Depth (inches):</th>
</tr>
</thead>
</table>

**Hydric Soil Present?** Yes [ ] No [x ]

**Remarks:**

**HYDROLOGY**

**Wetland Hydrology Indicators:**

- **Primary Indicators (minimum of one required; check all that apply)**
  - Surface Water (A1)
  - High Water Table (A2)
  - Saturation (A3)
  - Water Marks (B1)
  - Sediment Deposits (B2)
  - Drift Deposits (B3)
  - Algal Mat or Crust (B4)
  - Iron Deposits (B5)
  - Surface Soil Cracks (B6)
  - Inundation Visible on Aerial Imagery (B7)
  - Sparsely Vegetated Concave Surface (B8)

- **Secondary Indicators (2 or more required)**
  - Water-Stained Leaves (B9)
  - Salt Crust (B11)
  - Aquatic Invertebrates (B13)
  - Hydrogen Sulfide Odor (C1)
  - Oxidized Rhizospheres along Living Roots (C3)
  - Presence of Reduced Iron (C4)
  - Recent Iron Reduction in Tilled Soils (C6)
  - Stunted or Stressed Plants (D1)
  - Other (Explain in Remarks)
  - Shallow Aquitard (D3)
  - FAC-Neutral Test (D5)
  - Raised Ant Mounds (D6)
  - Frost-Heave Hummocks (D7)

**Field Observations:**

<table>
<thead>
<tr>
<th>Surface Water Present?</th>
<th>Yes [ ] No [x ] Depth (inches):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Table Present?</td>
<td>Yes [ ] No [x ] Depth (inches):</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes [ ] No [x ] Depth (inches):</td>
</tr>
</tbody>
</table>

**Wetland Hydrology Present?** Yes [ ] No [x ]

**Remarks:** Soils very dry throughout.

AKS Job # 5248

USACE Western Mountains, Valleys and Coast - Version 2.0
**Photo A.** View south of Plot 1 location, near NW North Avenue in vicinity of mapped hydric soils.

**Photo B.** View west adjacent to Plot 1 along roadside ditch.

**Photo C.** View north of Plot 2 in vicinity of mapped hydric soils.

**Photo D.** View west of north end of property in vicinity of Plots 1 and 2.

*Photos taken by Lindsey Obermiller, August 5, 2016*
Sensitive Areas Certification Form (continued)

9. An on-site, water quality sensitive area reconnaissance was completed on:
   Date           By               Title                     Company
   August 5, 2016 Lindsey Obermiller Natural Resource Specialist AKS Engineering & Forestry LLC

10. Existence of Water Quality Sensitive Areas (check all appropriate boxes)
    As defined in the Districts Design and Construction Standards:
    A. Water-quality-sensitive areas □ do    □ do not exist on the tax lot.
    B. Water-quality-sensitive areas □ do    □ do not exist within 200' on adjacent properties, or    □ unable to evaluate
       adjacent property.
    C. Vegetated corridors □ do ( __________ SF) □ do not exist on the tax lot.
    D. Vegetated corridors □ do    □ do not exist within 200' on adjacent properties, or □ unable to evaluate adjacent property.
    E. Impacts to sensitive areas and/or vegetated corridors will occur □ On-site □ Off-site □ None proposed at this time.
    F. If impacts, mitigation is □ On-site □ Off-site □ Other ____________________

11. Simplified Site Assessment containing the following information: (check only items submitted).
    Please refer to Design and Construction Standards 07-20 section 3.02.2 for application requirements.
    □ Complete Certification Form (2 pages)
    □ Written description of the site and proposed activity.
    □ Site plan of the entire property.
    □ Photographs of the site labeled and keyed to the site plan.

12. Standard Site Assessment containing the following information: (check only items submitted).
    Please refer to Design and Construction Standards 07-20 section 3.02.2 for application requirements.
    □ Complete Certification Form (2 pages)
    □ Written description per Design and Construction Standards 07-20 section 3.13.3 b. 1
    □ Wetland Data sheets
    □ Vegetated Corridor Data sheets
    □ Existing Site Condition Figures
    □ Proposed Development Figures

By signing this form the Owner, or Owner's authorized agent or representative, acknowledges and agrees that employees of Clean Water Services have authority to enter the project site at all reasonable times for the purpose of inspecting project site conditions and gathering information related to the project site.

I certify that I am familiar with the information contained in this document, and to the best of my knowledge and belief, this information is true, complete, and accurate.

Applicant: [Signature]
Owner: [Signature]
Print/Type Name
Print/Type Title
Date

2550 SW Hillsboro Highway • Hillsboro, Oregon 97123 • Phone: (503) 681-5100 • Fax: (503) 681-4439 • www.cleanwaterservices.org
# Sensitive Areas Certification Form

## 1. Property Information (example 1S234AB01400)
- **Tax lot ID(s):**
- **Tax Map:** 1N31BC; **Tax Lot:** 201
- **Site Address:** 32370 NW North Avenue.
- **City, State, Zip:** North Plains, OR 97133
- **Nearest Cross Street:** NW Gordon Road

## 2. Owner Information
- **Name:**
- **Company:**
- **Address:**
- **City, State, Zip:**
- **Phone/Fax:**
- **E-Mail:**

## 3. Development Activity (check all that apply)
- [ ] Addition to Single Family Residence (rooms, deck, garage)
- [ ] Lot Line Adjustment
- [ ] Residential Condominium
- [x] Residential Subdivision
- [ ] Single Lot Commercial
- [ ] Other ________

## 4. Applicant Information
- **Name:** Stacey Reed
- **Company:** AKS Engineering & Forestry, LLC
- **Address:** 12965 SW Herman Road, Ste 100
- **City, State, Zip:** Tualatin, OR 97062
- **Phone/Fax:** 503-563-6151
- **E-Mail:** staceyr@aks-eng.com

## 5. Check any of the following that apply to this project.
- [ ] Adds less than 500 square feet of impervious surface.
- [ ] Does not encroach closer to the Sensitive Area than existing development on the property.
- [x] Is not located on a slope greater than 25%.

## 6. Applicant Information
- **Name:** Vince Biggi
- **Company:** Biggi Construction LLC
- **Address:** 11605 SW Normandy Lane
- **City, State, Zip:** Wilsonville, OR
- **Phone/Fax:**
- **E-Mail:** biggicon@gmail.com

## 7. Will the project involve any off-site work?  [ ] Yes  [x] No  [ ] Unknown  *(check appropriate box)*

If yes, location and description of off-site work:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

## 8. Additional comments or information that may be needed to understand your project:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

---

2550 SW Hillsboro Highway • Hillsboro, Oregon 97123 • Phone: (503) 681-5100 • Fax: (503) 681-4439 • www.cleanwaterservices.org

Revised 5/08
Exhibit F: Preliminary Stormwater Management Memo
Preliminary Stormwater Management Memo

Date: 8-16-2016

To: Attn: Blake Boyles
City of North Plains Public Works Department
31360 NW Commercial Street
North Plains, OR 97133

From: Paul Sellke
AKS Engineering & Forestry, LLC
12965 SW Herman Road, Suite 100
Tualatin, OR 97062

Project: North Avenue Subdivision

Site Location: 32370 NW North Ave, North Plains, OR 97133

Introduction
The purpose of this memorandum is to summarize the stormwater management design for the proposed North Avenue Subdivision. The subject site is located at 32370 NW North Avenue, North Plains, Oregon 97133. This project proposes a new 16 lot subdivision with street improvements from NW Wascoe Street to NW North Avenue.

The subject site is east of the intersection between NW Gordon Road and NW North Avenue in North Plains, Oregon. Tax Lot 201 (Washington County Tax Map 1N 3 01BC) covers approximately 2.14 acres.

The proposed project includes the creation of a 16 lot subdivision for single-family detached residential homes. The site improvements include the construction of a public road through the site, half-street improvements for NW North Avenue and a connection to the Sunset Terrace subdivision neighboring to the south. Underground utilities include a stormwater collection and conveyance system.

Water Quality
Stormwater quality management for this project will be provided by the existing stormwater swale constructed as part of the Sunset Terrace Subdivision, located to the southwest of the proposed site. The existing regional stormwater facility (vegetated swale) was constructed to be 4 feet wide by 193.5 feet long. Based on the constructed length and width of the vegetated swale, AKS back-calculated that the existing stormwater facility is capable of proving treatment to 316,800 square feet (sf) of impervious area.
Per the Final Storm Drainage Report for Sunset Terrace (dated June 2014 by SFA Design Group) 220,922 sf of impervious area is currently being conveyed to the existing stormwater facility. The proposed development of the North Avenue Subdivision adds an additional 64,370 sf of impervious area which results in a peak water quality flow depth of 0.47 feet and a minimum residence time of 15.5 minutes. This facility has been evaluated and will continue to meet the requirements of the Clean Water Services Design and Construction Standards for Sanitary Sewer and Surface Water Management (R&O 07-20) after the addition of stormwater runoff from the North Avenue Subdivision.

The subject site will convey stormwater runoff from the majority of the proposed impervious surfaces towards the existing stormwater facility. Due to existing topography stormwater runoff from the proposed western NW North Avenue street improvements cannot be conveyed towards the existing stormwater facility. In compensation, existing untreated stormwater runoff from the eastern site of NW North Avenue will be collected and conveyed towards the existing stormwater facility. The remaining untreatable area shall be addressed by paying a fee-in-lieu of providing stormwater treatment (See Figure 4).

**Water Quantity/ Detention**
A downstream analysis incorporating the subject site has been performed, per CWS standards, as part of the Sunset Terrace Final Storm Drainage Report by SFA Design Group. Per the Sunset Terrace stormwater report, the downstream analysis identified available floodplain storage which will detain the flows from the regional stormwater facility. Therefore, stormwater detention for the subject site is not required at this time.

The majority of the site’s runoff from impervious surfaces is directed to the existing stormwater facility within the Sunset Terrace Subdivision. Approximately 2,313 square feet of new impervious area (Basin 20S and 40S) stormwater runoff will be conveyed towards a new curb inlet on NW North Avenue that directs the water to an existing culvert passing under NW North Avenue to the west of the subject site. Approximately 945 square feet of runoff from the proposed widened section and sidewalk fronting NW Wascoe Street will be directed towards the existing catch basins to the west (Basin 00S). A downstream analysis of the NW North Avenue and NW Wascoe Street storm systems is not required since the new impervious area is less than 5,280 square feet (per CWS Section 2.04.2, subsection m.3A).

**Stormwater System Conveyance Analysis**
The proposed onsite curb inlets and storm drain pipe sizes will be evaluated and addressed within the final stormwater report.

As part of this analysis, the existing storm drain mains located within NW Wascoe Street were evaluated by incorporating the anticipated runoff from the proposed North Avenue subdivision site. The existing storm drain was evaluated utilizing Manning’s equation to convey the peak flow from the 25-year storm event. The existing downstream storm conveyance system is adequate in conveying the existing and proposed stormwater runoff.

Should you have any questions regarding this project, feel free to call me at (503) 563-6151 x 219 or email me at PaulS@aks-eng.com.

Paul S. Westfall, P.E.
Sincerely,
AKS ENGINEERING & FORESTRY, LLC

Paul Sellke, PE, GE
Project Engineer

Attached
Figure 1: Vicinity Map
Figure 2: Pre-Developed Basin Delineation
Figure 3: Post-Developed Basin Delineation
Figure 4: Treatment Map

Appendix A: Back-Calculated Maximum Impervious Area
Appendix B: Water Quality Calculations
Appendix B: HydroCAD Analysis, Pre-Developed Site 25-Year Storm Event Analysis
Appendix C: HydroCAD Analysis, Post-Developed Site and Downstream, 25-Year Storm Event Analysis
Appendix D: USDA-NRCS Soil Resource Report
Appendix E: Sunset Terrace Final Storm Drainage Report (Narrative Only)
NW NORTH AVE
SUNSET TERRACE SUBDIVISION

POST-DEVELOPED IMPERVIOUS AREA TABLE

PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT 62,475 SF
PROPOSED UNTREATABLE IMPERVIOUS AREA 3,257 SF
EXISTING UNTREATED IMPERVIOUS AREA RECEIVING TREATMENT WITHIN PROPOSED FACILITY 1,895 SF
REQUIRED IMPERVIOUS AREA TO TREAT 65,722 SF
IMPERVIOUS AREA TREATMENT PROVIDED 64,370 SF
NET TOTAL -1362 SF

TAX LOT 202
TAX MAP IN 3 1BC

TREATMENT MAP

SCALE 1" = 100 FEET

DATE: 08-15-2016

NORTH AVENUE SUBDIVISION

TREATMENT MAP

AKS ENGINEERING & FORESTRY, LLC
12985 SW HERMAN RD, STE 100
TUALATIN, OR 97062
P: 503.563.6151 F: 503.563.6152 aks-eng.com

FIGURE 4
APPENDIX A
BACK-CALCULATED MAXIMUM IMPERVIOUS AREA
EXISTING STORMWATER FACILITY

Trapezoidal
- Bottom Width (ft) = 4.00
- Side Slopes (z:1) = 4.00, 4.00
- Total Depth (ft) = 0.50
- Invert Elev (ft) = 100.00
- Slope (%) = 0.50
- N-Value = 0.240

Highlighted
- Depth (ft) = 0.50
- Q (cfs) = 0.660
- Area (sqft) = 3.00
- Velocity (ft/s) = 0.22
- Wetted Perim (ft) = 8.12
- Crit Depth, Yc (ft) = 0.10
- Top Width (ft) = 8.00
- EGL (ft) = 0.50

Calculations
Compute by: Known Q
Known Q (cfs) = 0.66
WATER QUALITY FLOW (WQF)
(Per CWS 4.05.6b - R&O 07-20)

0.66 cfs
* flow at 0.5 ft depth

WATER QUALITY VOLUME (WQV)
(Per CWS 4.05.6b - R&O 07-20)

WQV = WQF * 14,400 sec. = 9504 cubic feet

MAXIMUM IMPERVIOUS AREA

AREA = \( \frac{WQV \times 12'' \text{ per ft}}{.36''} \) = 316,800 square feet
APPENDIX B
WATER QUALITY CALCULATIONS
STORMWATER QUALITY CALCULATIONS

Client: Biggi Construction LLC  
Project: North Avenue Subdivision  
AKS Job No.: 5248  
Date: August 16, 2016  
Done By: DS  
Checked By: PAS

---

**IMPERVIOUS AREA**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Site Area:</td>
<td>2.14 acres</td>
</tr>
<tr>
<td>Total Site Area:</td>
<td>93,218 sf</td>
</tr>
<tr>
<td>Number of Lots:</td>
<td>16</td>
</tr>
<tr>
<td>Impervious Area Per SFA:</td>
<td>220,922</td>
</tr>
<tr>
<td>Total Impervious Lot Area:</td>
<td>42,240 sf</td>
</tr>
<tr>
<td>Road &amp; Sidewalk Impervious Area:</td>
<td>22,130 sf</td>
</tr>
<tr>
<td>Total Impervious Area:</td>
<td>285,292 sf</td>
</tr>
</tbody>
</table>

---

**WATER QUALITY VOLUME (WQV)**  
(Per CWS 4.05.6b - R&O 07-20)

\[
WQV = \frac{0.36'' \times \text{Area (ft)}}{12'' \text{ per ft}} = 8559 \text{ cubic feet}
\]

---

**WATER QUALITY FLOW (WQF)**  
(Per CWS 4.05.6b - R&O 07-20)

\[
WQF = \frac{WQV \text{ (sf)}}{14,400 \text{ seconds}} = 0.59 \text{ cfs}
\]
VEGETATED SWALE, WATER QUALITY FLOW DESIGN & CALCULATIONS

Hydraulic Design Criteria (Per CWS 4.06.2 - R&O 07-20)

Design Flow: Water Quality Flow
Minimum Hydraulic Residence Time: 9 minutes
Maximum Water Design Depth: 0.5-ft
Minimum Freeboard: 1.0 foot (for facilities not protected from high flows)
Manning's "n" Value: 0.24
Maximum Velocity: 2.0 fps based on the 25-YR flow

Swale Sizing Assumptions:

<table>
<thead>
<tr>
<th>Slope</th>
<th>Bottom Width</th>
<th>Manning's #</th>
<th>Side Slope</th>
<th>Depth of Swale</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ft/ft)</td>
<td>(ft)</td>
<td>&quot;n&quot;</td>
<td>H:V</td>
<td>(ft)</td>
<td>(ft)</td>
</tr>
<tr>
<td>0.005</td>
<td>4</td>
<td>0.24</td>
<td>4</td>
<td>5</td>
<td>196</td>
</tr>
</tbody>
</table>

Water Quality Flow Hydraulic Calculations (See Hydraflow Printouts):

<table>
<thead>
<tr>
<th>Q (cfs)</th>
<th>Flow Depth (ft)</th>
<th>Flow Area (sf)</th>
<th>Wp (ft)</th>
<th>R (ft)</th>
<th>Velocity (fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.59</td>
<td>0.47</td>
<td>2.76</td>
<td>7.88</td>
<td>0.35</td>
<td>0.21</td>
</tr>
</tbody>
</table>

25-Year Flow Hydraulic Calculations (See HydroCAD Printouts):

<table>
<thead>
<tr>
<th>Q (cfs)</th>
<th>Flow Depth (ft)</th>
<th>Velocity (fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.97</td>
<td>2.01</td>
<td>0.52</td>
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</table>

Check Against Design Criteria:

<table>
<thead>
<tr>
<th>Calculated</th>
<th>CWS Criteria</th>
<th>Meet CWS Criteria?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Hydraulic Residence Time: 15.5 minutes</td>
<td>&gt; 9 minutes</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum Water Quality Design Depth: 0.47 feet</td>
<td>&lt; 0.5 feet</td>
<td>Yes</td>
</tr>
<tr>
<td>Minimum Freeboard: 2.99 feet</td>
<td>&gt; 1 foot</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum Velocity: 0.52 fps</td>
<td>&lt; 2 fps</td>
<td>Yes</td>
</tr>
<tr>
<td>Minimum Length: 195.87 feet</td>
<td>≥ 100 feet</td>
<td>Yes</td>
</tr>
</tbody>
</table>
EXISTING STORMWATER FACILITY

**Trapezoidal**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom Width (ft)</td>
<td>4.00</td>
</tr>
<tr>
<td>Side Slopes (z:1)</td>
<td>4.00, 4.00</td>
</tr>
<tr>
<td>Total Depth (ft)</td>
<td>0.50</td>
</tr>
<tr>
<td>Invert Elev (ft)</td>
<td>100.00</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>0.50</td>
</tr>
<tr>
<td>N-Value</td>
<td>0.240</td>
</tr>
</tbody>
</table>

**Highlighted**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (ft)</td>
<td>0.47</td>
</tr>
<tr>
<td>Q (cfs)</td>
<td>0.590</td>
</tr>
<tr>
<td>Area (sqft)</td>
<td>2.76</td>
</tr>
<tr>
<td>Velocity (ft/s)</td>
<td>0.21</td>
</tr>
<tr>
<td>Wetted Perim (ft)</td>
<td>7.88</td>
</tr>
<tr>
<td>Crit Depth, Yc (ft)</td>
<td>0.09</td>
</tr>
<tr>
<td>Top Width (ft)</td>
<td>7.76</td>
</tr>
<tr>
<td>EGL (ft)</td>
<td>0.47</td>
</tr>
</tbody>
</table>

**Calculations**

- Compute by: Known Q
- Known Q (cfs) = 0.59
APPENDIX C

PRE-DEVELOPED SITE

25-YEAR STORM EVENT ANALYSIS
Pre-Developed Site
## Area Listing (all nodes)

<table>
<thead>
<tr>
<th>Area (acres)</th>
<th>CN</th>
<th>Description</th>
<th>Subcatchment-numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.186</td>
<td>58</td>
<td>Woods/grass comb., Good, HSG B</td>
<td>1S</td>
</tr>
<tr>
<td>1.417</td>
<td>72</td>
<td>Woods/grass comb., Good, HSG C</td>
<td>1S</td>
</tr>
<tr>
<td>0.261</td>
<td>79</td>
<td>Woods/grass comb., Good, HSG D</td>
<td>1S</td>
</tr>
<tr>
<td>0.146</td>
<td>89</td>
<td>Compacted Gravel onsite</td>
<td>(1S)</td>
</tr>
<tr>
<td>0.094</td>
<td>98</td>
<td>Existing Buildings onsite</td>
<td>(1S)</td>
</tr>
<tr>
<td>0.035</td>
<td>98</td>
<td>Impervious Area onsite</td>
<td>(1S)</td>
</tr>
<tr>
<td><strong>2.140</strong></td>
<td></td>
<td><strong>TOTAL AREA</strong></td>
<td></td>
</tr>
</tbody>
</table>
Subcatchment 1S: Pre-Developed Site

- Runoff Area: 93,219 sf
- 6.06% Impervious
- Runoff Depth > 1.57"
- Flow Length: 225’
- Slope: 0.0550 \(^\prime\) / \(^\prime\)
- Tc: 20.6 min
- CN: 73/98
- Runoff: 0.55 cfs
- 0.280 af

Total Runoff Area = 2.140 ac
Runoff Volume = 0.280 af
Average Runoff Depth = 1.57"
93.94% Pervious = 2.010 ac
6.06% Impervious = 0.130 ac
Summary for Subcatchment 1S: Pre-Developed Site

Runoff = 0.55 cfs @ 8.05 hrs, Volume = 0.280 af, Depth > 1.57"

Runoff by SBUH method, Split Pervious/Imperv., Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall = 3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 4,105</td>
<td>98</td>
<td>Existing Buildings onsite</td>
</tr>
<tr>
<td>* 1,541</td>
<td>98</td>
<td>Impervious Area onsite</td>
</tr>
<tr>
<td>* 6,367</td>
<td>89</td>
<td>Compacted Gravel onsite</td>
</tr>
<tr>
<td>11,369</td>
<td>79</td>
<td>Woods/grass comb., Good, HSG D</td>
</tr>
<tr>
<td>61,716</td>
<td>72</td>
<td>Woods/grass comb., Good, HSG C</td>
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<tr>
<td>8,121</td>
<td>58</td>
<td>Woods/grass comb., Good, HSG B</td>
</tr>
<tr>
<td>93,219</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>87,573</td>
<td>73</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>5,646</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc | Length | Slope | Velocity | Capacity | Description       |
---|--------|-------|----------|----------|-------------------|
20.6 | 225 | 0.0550 | 0.18 |         | Sheet Flow,       |
|      |      |        |         |          | Grass: Dense n= 0.240 P2= 2.50" |

Subcatchment 1S: Pre-Developed Site

Type IA 24-hr 25-YEAR Rainfall = 3.90"
Runoff Area = 93,219 sf
Runoff Volume = 0.280 af
Runoff Depth > 1.57"
Flow Length = 225'
Slope = 0.0550 '/'
Tc = 20.6 min
CN = 73/98
APPENDIX D
POST-DEVELOPED SITE AND DOWNSTREAM
25-YEAR STORM EVENT ANALYSIS
### Area Listing (all nodes)

<table>
<thead>
<tr>
<th>Area (acres)</th>
<th>CN</th>
<th>Description</th>
<th>Subcatchment-numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.072</td>
<td>61</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
<td>(10S)</td>
</tr>
<tr>
<td>6.193</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
<td>(00S,10S,D1,D2,F1,G1,H1,J1,K1,L1)</td>
</tr>
<tr>
<td>0.124</td>
<td>80</td>
<td>&gt;75% Grass cover, Good, HSG D</td>
<td>(10S,20S,30S)</td>
</tr>
<tr>
<td>0.970</td>
<td>98</td>
<td>16 lots @ 2,640 SF per lot</td>
<td>(10S)</td>
</tr>
<tr>
<td>8.380</td>
<td>98</td>
<td>Impervious Area</td>
<td>(D1,D2,F1,G1,H1,J1,K1,L1)</td>
</tr>
<tr>
<td>0.172</td>
<td>98</td>
<td>Paved ROW</td>
<td>(00S,20S,30S,40S)</td>
</tr>
<tr>
<td>0.423</td>
<td>98</td>
<td>Sidewalk/ driveway/ road</td>
<td>(10S)</td>
</tr>
<tr>
<td><strong>16.334</strong></td>
<td></td>
<td><strong>TOTAL AREA</strong></td>
<td></td>
</tr>
</tbody>
</table>
5248- Downstream
Prepared by AKS ENGINEERING
Printed 8/16/2016
HydroCAD® 8.50 s/n 005096 © 2007 HydroCAD Software Solutions LLC
Page 3

Type IA 24-hr 25-YEAR Rainfall=3.90"

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 00S: NW Wascoe Street
Runoff Area=1,323 sf  71.43% Impervious  Runoff Depth>3.05"
Tc=0.0 min  CN=74/98  Runoff=0.02 cfs  0.008 af

Subcatchment 10S: Post-Developed Site
Runoff Area=91,895 sf  66.04% Impervious  Runoff Depth>2.93"
Tc=5.0 min  CN=74/98  Runoff=1.50 cfs  0.516 af

Subcatchment 20S: North Ave- West Portion
Runoff Area=3,266 sf  82.42% Impervious  Runoff Depth>3.36"
Tc=5.0 min  CN=80/98  Runoff=0.06 cfs  0.021 af

Subcatchment 30S: North Ave- East Portion
Runoff Area=3,715 sf  87.83% Impervious  Runoff Depth>3.45"
Tc=5.0 min  CN=80/98  Runoff=0.07 cfs  0.025 af

Subcatchment 40S: NW North Ave- East AC
Runoff Area=605 sf  100.00% Impervious  Runoff Depth>3.67"
Tc=0.0 min  CN=0/98  Runoff=0.01 cfs  0.004 af

Subcatchment D1: D 1 (PER SFA REPORT)
Runoff Area=20,908 sf  60.42% Impervious  Runoff Depth>2.81"
Tc=5.0 min  CN=74/98  Runoff=0.32 cfs  0.112 af

Subcatchment D2: D 2 (PER SFA)
Runoff Area=436,906 sf  59.72% Impervious  Runoff Depth>2.80"
Tc=5.0 min  CN=74/98  Runoff=6.73 cfs  2.338 af

Subcatchment F1: F 1 (PER SFA REPORT)
Runoff Area=16,117 sf  59.46% Impervious  Runoff Depth>2.79"
Tc=5.0 min  CN=74/98  Runoff=0.25 cfs  0.086 af

Subcatchment G1: G 1 (PER SFA REPORT)
Runoff Area=60,984 sf  60.00% Impervious  Runoff Depth>2.80"
Tc=5.0 min  CN=74/98  Runoff=0.94 cfs  0.327 af

Subcatchment H1: H 1 (PER SFA REPORT)
Runoff Area=11,762 sf  59.26% Impervious  Runoff Depth>2.79"
Tc=5.0 min  CN=74/98  Runoff=0.18 cfs  0.063 af

Subcatchment J1: J 1 (PER SFA REPORT)
Runoff Area=7,405 sf  58.83% Impervious  Runoff Depth>2.78"
Tc=5.0 min  CN=74/98  Runoff=0.11 cfs  0.039 af

Subcatchment K1: K 1 (PER SFA REPORT)
Runoff Area=18,731 sf  60.47% Impervious  Runoff Depth>2.81"
Tc=5.0 min  CN=74/98  Runoff=0.29 cfs  0.101 af

Subcatchment L1: L 1 (PER SFA REPORT)
Runoff Area=37,897 sf  59.77% Impervious  Runoff Depth>2.80"
Tc=5.0 min  CN=74/98  Runoff=0.58 cfs  0.203 af

Reach 01C: Swale
Avg. Depth=2.01'  Max Vel=0.52 fps  Inflow=10.97 cfs  3.806 af
n=0.240  L=195.9'  S=0.0050 '/'  Capacity=76.61 cfs  Outflow=10.76 cfs  3.788 af

Reach 02D: 24"
Avg. Depth=1.55'  Max Vel=4.20 fps  Inflow=10.97 cfs  3.807 af
D=24.0"  n=0.013  L=38.1'  S=0.0026 '/'  Capacity=11.59 cfs  Outflow=10.97 cfs  3.806 af

Reach 03F: 18"
Avg. Depth=0.97'  Max Vel=3.23 fps  Inflow=3.92 cfs  1.357 af
D=18.0"  n=0.013  L=65.6'  S=0.0024 '/'  Capacity=5.19 cfs  Outflow=3.92 cfs  1.356 af
Reach 03G: 16"
Avg. Depth=1.04'  Max Vel=3.14 fps  Inflow=3.67 cfs  1.271 af
D=16.0"  n=0.013  L=71.4'  S=0.0025 '/'  Capacity=3.85 cfs  Outflow=3.67 cfs  1.271 af

Reach 03H: 16"
Avg. Depth=0.83'  Max Vel=2.98 fps  Inflow=2.74 cfs  0.945 af
D=16.0"  n=0.013  L=187.9'  S=0.0025 '/'  Capacity=3.84 cfs  Outflow=2.73 cfs  0.944 af

Reach 03J: 14"
Avg. Depth=0.92'  Max Vel=2.83 fps  Inflow=2.56 cfs  0.882 af
D=14.0"  n=0.013  L=57.5'  S=0.0024 '/'  Capacity=2.65 cfs  Outflow=2.55 cfs  0.882 af

Reach 03K: 14"
Avg. Depth=0.87'  Max Vel=2.79 fps  Inflow=2.44 cfs  0.843 af
D=14.0"  n=0.013  L=43.3'  S=0.0025 '/'  Capacity=2.71 cfs  Outflow=2.44 cfs  0.843 af

Reach 03L: 14"
Avg. Depth=0.79'  Max Vel=2.79 fps  Inflow=2.15 cfs  0.743 af
D=14.0"  n=0.013  L=108.4'  S=0.0025 '/'  Capacity=2.68 cfs  Outflow=2.15 cfs  0.742 af

Reach 03M: 14"
Avg. Depth=0.64'  Max Vel=2.62 fps  Inflow=1.57 cfs  0.540 af
D=14.0"  n=0.013  L=107.0'  S=0.0025 '/'  Capacity=2.70 cfs  Outflow=1.57 cfs  0.540 af

Total Runoff Area = 16.334 ac  Runoff Volume = 3.842 af  Average Runoff Depth = 2.82"  
39.11% Pervious = 6.389 ac  60.89% Impervious = 9.945 ac
Summary for Subcatchment 00S: NW Wascoe Street Improvements

Runoff = 0.02 cfs @ 7.83 hrs, Volume = 0.008 af, Depth > 3.05"

Runoff by SBUH method, Split Pervious/Imperv., Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall = 3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>945</td>
<td>98</td>
<td>Paved ROW</td>
</tr>
<tr>
<td>378</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>1,323</td>
<td>91</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>378</td>
<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>945</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Subcatchment 00S: NW Wascoe Street Improvements

Type IA 24-hr 25-YEAR Rainfall = 3.90"
Runoff Area = 1,323 sf
Runoff Volume = 0.008 af
Runoff Depth > 3.05"
Tc = 0.0 min
CN = 74/98
Summary for Subcatchment 10S: Post-Developed Site

Runoff = 1.50 cfs @ 7.92 hrs, Volume = 0.516 af, Depth > 2.93"

Runoff by SBUH method, Split Pervious/Imperv., Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall = 3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 42,240</td>
<td>98</td>
<td>16 lots @ 2,640 SF per lot</td>
</tr>
<tr>
<td>* 18,445</td>
<td>98</td>
<td>Sidewalk/ driveway/ road</td>
</tr>
<tr>
<td>4,370</td>
<td>80</td>
<td>&gt;75% Grass cover, Good, HSG D</td>
</tr>
<tr>
<td>23,719</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>3,121</td>
<td>61</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>91,895</td>
<td>90</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>31,210</td>
<td>74</td>
<td>Pervious Area</td>
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<tr>
<td>60,685</td>
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<td>Impervious Area</td>
</tr>
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</table>

Tc (min) Length (feet) Slope (ft/ft) Velocity (ft/sec) Capacity (cfs) Description
5.0 Direct Entry,

Subcatchment 10S: Post-Developed Site

Type IA 24-hr 25-YEAR Rainfall = 3.90"
Runoff Area = 91,895 sf
Runoff Volume = 0.516 af
Runoff Depth > 2.93"
Tc = 5.0 min
CN = 74/98
Summary for Subcatchment 20S: North Ave- West Portion

Runoff = 0.06 cfs @ 7.91 hrs, Volume= 0.021 af, Depth> 3.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 2,692</td>
<td>98</td>
<td>Paved ROW</td>
</tr>
<tr>
<td>574</td>
<td>80</td>
<td>&gt;75% Grass cover, Good, HSG D</td>
</tr>
<tr>
<td>3,266</td>
<td>95</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>574</td>
<td>80</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>2,692</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Subcatchment 20S: North Ave- West Portion

Hydrograph

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=3,266 sf
Runoff Volume=0.021 af
Runoff Depth>3.36"
Tc=5.0 min
CN=80/98
Summary for Subcatchment 30S: North Ave- East Portion

Runoff = 0.07 cfs @ 7.90 hrs, Volume= 0.025 af, Depth> 3.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,263</td>
<td>98</td>
<td>Paved ROW</td>
</tr>
<tr>
<td>452</td>
<td>80</td>
<td>&gt;75% Grass cover, Good, HSG D</td>
</tr>
<tr>
<td>3,715</td>
<td>96</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>452</td>
<td>80</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>3,263</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Subcatchment 30S: North Ave- East Portion

Hydrograph

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=3,715 sf
Runoff Volume=0.025 af
Runoff Depth>3.45"
Tc=5.0 min
CN=80/98
Summary for Subcatchment 40S: NW North Ave- East AC Taper

Runoff = 0.01 cfs @ 7.80 hrs, Volume= 0.004 af, Depth> 3.67"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
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<td>605</td>
<td>98</td>
<td>Paved ROW</td>
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<tr>
<td>605</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Subcatchment 40S: NW North Ave- East AC Taper

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=605 sf
Runoff Volume=0.004 af
Runoff Depth>3.67"
Tc=0.0 min
CN=0/98
Summary for Subcatchment D1: D 1 (PER SFA REPORT)

Runoff = 0.32 cfs @ 7.93 hrs, Volume = 0.112 af, Depth > 2.81"

Runoff by SBUH method, Split Pervious/Imperv., Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall = 3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
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<tbody>
<tr>
<td>* 12,632</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
<tr>
<td>8,276</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
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<tr>
<td>20,908</td>
<td>89</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>8,276</td>
<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>12,632</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Direct Entry,

Subcatchment D1: D 1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall = 3.90"
Runoff Area = 20,908 sf
Runoff Volume = 0.112 af
Runoff Depth > 2.81"
Tc = 5.0 min
CN = 74/98
Summary for Subcatchment D2: D 2 (PER SFA REPORT)

Runoff = 6.73 cfs @ 7.93 hrs, Volume= 2.338 af, Depth> 2.80"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 260,924</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
<tr>
<td>175,982</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>436,906</td>
<td>88</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>175,982</td>
<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>260,924</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc Length Slope Velocity Capacity Description
5.0 (min) (feet) (ft/ft) (ft/sec) (cfs) Direct Entry,

Subcatchment D2: D 2 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=436,906 sf
Runoff Volume=2.338 af
Runoff Depth>2.80"
Tc=5.0 min
CN=74/98
Summary for Subcatchment F1: F 1 (PER SFA REPORT)

Runoff = 0.25 cfs @  7.93 hrs, Volume = 0.086 af, Depth > 2.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall =3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 9,583</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
<tr>
<td>6,534</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>16,117</td>
<td>88</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>6,534</td>
<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>9,583</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc = 5.0 min
Length (feet) 5.0
Slope (ft/ft) 5.0
Velocity (ft/sec) 5.0
Capacity (cfs) 5.0

Direct Entry,

Subcatchment F1: F 1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall = 3.90"
Runoff Area = 16,117 sf
Runoff Volume = 0.086 af
Runoff Depth > 2.79"
Tc = 5.0 min
CN = 74/98
Summary for Subcatchment G1: G 1 (PER SFA REPORT)

Runoff = 0.94 cfs @ 7.93 hrs, Volume= 0.327 af, Depth> 2.80"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
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<tbody>
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<td>Impervious Area</td>
</tr>
<tr>
<td>24,394</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
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<tr>
<td>60,984</td>
<td>88</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>24,394</td>
<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>36,590</td>
<td>98</td>
<td>Impervious Area</td>
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</tbody>
</table>

Tc Length Slope Velocity Capacity Description
5.0 (min) (feet) (ft/ft) (ft/sec) (cfs) Direct Entry,

Subcatchment G1: G 1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=60,984 sf
Runoff Volume=0.327 af
Runoff Depth>2.80"
Tc=5.0 min
CN=74/98
Summary for Subcatchment H1: H 1 (PER SFA REPORT)

Runoff = 0.18 cfs @ 7.93 hrs, Volume = 0.063 af, Depth > 2.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall = 3.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
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<tbody>
<tr>
<td>6,970</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
<tr>
<td>4,792</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>11,762</td>
<td>88</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>4,792</td>
<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>6,970</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Subcatchment H1: H 1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall = 3.90"
Runoff Area = 11,762 sf
Runoff Volume = 0.063 af
Runoff Depth > 2.79"
Tc = 5.0 min
CN = 74/98
Summary for Subcatchment J1: J 1 (PER SFA REPORT)

Runoff = 0.11 cfs @ 7.93 hrs, Volume= 0.039 af, Depth> 2.78"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
<tr>
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<th>Description</th>
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<tr>
<td>* 4,356</td>
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<tr>
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<tr>
<td>4,356</td>
<td>98</td>
<td>Impervious Area</td>
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Tc = 5.0 min

Subcatchment J1: J 1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=7,405 sf
Runoff Volume=0.039 af
Runoff Depth>2.78"
Tc=5.0 min
CN=74/98
Summary for Subcatchment K1: K1 (PER SFA REPORT)

Runoff = 0.29 cfs @ 7.93 hrs, Volume= 0.101 af, Depth> 2.81" 

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs 
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
<thead>
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<th>Area (sf)</th>
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<td>11,326</td>
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<td>Impervious Area</td>
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<tr>
<td>7,405</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>18,731</td>
<td>89</td>
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<tr>
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<td>74</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>11,326</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc=5.0 min

Subcatchment K1: K1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=18,731 sf
Runoff Volume=0.101 af
Runoff Depth>2.81"
Tc=5.0 min
CN=74/98
Summary for Subcatchment L1: L 1 (PER SFA REPORT)

Runoff = 0.58 cfs @ 7.93 hrs, Volume= 0.203 af, Depth> 2.80"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

<table>
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<th>CN</th>
<th>Description</th>
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<td>98</td>
<td>Impervious Area</td>
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<tr>
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<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
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<tr>
<td>37,897</td>
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<tr>
<td>15,246</td>
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<td>Pervious Area</td>
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<tr>
<td>22,651</td>
<td>98</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Direct Entry,

Subcatchment L1: L 1 (PER SFA REPORT)

Type IA 24-hr 25-YEAR Rainfall=3.90"
Runoff Area=37,897 sf
Runoff Volume=0.203 af
Runoff Depth>2.80"
Tc=5.0 min
CN=74/98
Summary for Reach 01C: Swale

Inflow Area = 16.215 ac, 60.73% Impervious, Inflow Depth > 2.82” for 25-YEAR event
Inflow = 10.97 cfs @ 7.94 hrs, Volume = 3.806 af
Outflow = 10.76 cfs @ 8.00 hrs, Volume = 3.788 af, Atten= 2%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.52 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 10.9 min

Peak Storage= 4,083 cf @ 8.00 hrs, Average Depth at Peak Storage= 2.01'
Bank-Full Depth= 5.00', Capacity at Bank-Full= 76.61 cfs

Custom cross-section, Length= 195.9'  Slope= 0.0050 '/'
Constant n= 0.240
Inlet Invert= 174.81', Outlet Invert= 173.83'

<table>
<thead>
<tr>
<th>Offset (feet)</th>
<th>Elevation (feet)</th>
<th>Chan. Depth (feet)</th>
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<tr>
<td>-14.00</td>
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<td>-9.00</td>
<td>177.31</td>
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<tr>
<td>9.00</td>
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<td>2.50</td>
</tr>
<tr>
<td>14.00</td>
<td>179.81</td>
<td>0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>End Area (sq-ft)</th>
<th>Perim. (feet)</th>
<th>Storage (cubic-feet)</th>
<th>Discharge (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.0</td>
<td>4.0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>0.50</td>
<td>3.0</td>
<td>8.1</td>
<td>588</td>
<td>0.68</td>
</tr>
<tr>
<td>2.50</td>
<td>29.0</td>
<td>18.9</td>
<td>5,681</td>
<td>16.90</td>
</tr>
<tr>
<td>5.00</td>
<td>86.5</td>
<td>30.1</td>
<td>16,945</td>
<td>76.61</td>
</tr>
</tbody>
</table>
Reach 01C: Swale

Hydrograph

Inflow Area = 16.215 ac
Avg. Depth = 2.01'
Max Vel = 0.52 fps
n = 0.240
L = 195.9'
S = 0.0050 '/'
Capacity = 76.61 cfs
Summary for Reach 02D: 24"

Inflow Area = 16.215 ac, 60.73% Impervious, Inflow Depth > 2.82" for 25-YEAR event
Inflow = 10.97 cfs @ 7.94 hrs, Volume= 3.807 af
Outflow = 10.97 cfs @ 7.94 hrs, Volume= 3.806 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.20 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.62 fps, Avg. Travel Time= 0.2 min

Peak Storage= 100 cf @ 7.94 hrs, Average Depth at Peak Storage= 1.55'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 11.59 cfs

24.0" Diameter Pipe, n= 0.013
Length= 38.1'  Slope= 0.0026 '/'
Inlet Invert= 177.58', Outlet Invert= 177.48'

Reach 02D: 24"

Hydrograph

Inflow Area=16.215 ac
Avg. Depth=1.55'
Max Vel=4.20 fps
D=24.0"
n=0.013
L=38.1'
S=0.0026 '/'
Capacity=11.59 cfs
Summary for Reach 03F: 18"

Inflow Area = 5.705 ac, 62.54% Impervious, Inflow Depth > 2.85" for 25-YEAR event
Inflow = 3.92 cfs @ 7.95 hrs, Volume= 1.357 af
Outflow = 3.92 cfs @ 7.96 hrs, Volume= 1.356 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.23 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.96 fps, Avg. Travel Time= 0.6 min

Peak Storage= 80 cf @ 7.96 hrs, Average Depth at Peak Storage= 0.97'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 5.19 cfs

18.0" Diameter Pipe, n= 0.013
Length= 65.6’ Slope= 0.0024 '/'
Inlet Invert= 177.84', Outlet Invert= 177.68'

Reach 03F: 18"

Inflow Area=5.705 ac
Avg. Depth=0.97'
Max Vel=3.23 fps
D=18.0"
n=0.013
L=65.6'
S=0.0024 '/'
Capacity=5.19 cfs
Summary for Reach 03G: 16"

Inflow Area = 5.335 ac, 62.76% Impervious, Inflow Depth > 2.86" for 25-YEAR event
Inflow = 3.67 cfs @ 7.95 hrs, Volume= 1.271 af
Outflow = 3.67 cfs @ 7.95 hrs, Volume= 1.271 af, Attenuation= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.14 fps, Min. Travel Time= 0.4 min
Avg. Velocity= 1.96 fps, Avg. Travel Time= 0.6 min

Peak Storage= 84 cf @ 7.95 hrs, Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 1.33', Capacity at Bank-Full= 3.85 cfs

16.0" Diameter Pipe, n= 0.013
Length= 71.4' Slope= 0.0025 '/'
Inlet Invert= 178.12', Outlet Invert= 177.94'

Reach 03G: 16"

Inflow Area=5.335 ac
Avg. Depth=1.04'
Max Vel=3.14 fps
D=16.0"

n=0.013
L=71.4'
S=0.0025 '/'

Capacity=3.85 cfs
Summary for Reach 03H: 16"

Inflow Area = 3.935 ac, 63.74% Impervious, Inflow Depth > 2.88" for 25-YEAR event
Inflow = 2.74 cfs @ 7.94 hrs, Volume= 0.945 af
Outflow = 2.73 cfs @ 7.96 hrs, Volume= 0.944 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.98 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 1.7 min

Peak Storage= 172 cf @ 7.96 hrs, Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 1.33', Capacity at Bank-Full= 3.84 cfs

16.0" Diameter Pipe, n= 0.013
Length= 187.9' Slope= 0.0025 '/'
Inlet Invert= 178.69', Outlet Invert= 178.22'

Reach 03H: 16"

Inflow Area=3.935 ac
Avg. Depth=0.83'
Max Vel=2.98 fps
D=16.0"
n=0.013
L=187.9'
S=0.0025 '/'
Capacity=3.84 cfs
Summary for Reach 03J: 14"

Inflow Area = 3.665 ac, 64.07% Impervious, Inflow Depth > 2.89" for 25-YEAR event
Inflow = 2.56 cfs @ 7.94 hrs, Volume = 0.882 af
Outflow = 2.55 cfs @ 7.94 hrs, Volume = 0.882 af, Atten = 0%, Lag = 0.3 min

Routing by Dyn-Stor-Ind method, Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
Max. Velocity = 2.83 fps, Min. Travel Time = 0.3 min
Avg. Velocity = 1.77 fps, Avg. Travel Time = 0.5 min

Peak Storage = 52 cf @ 7.94 hrs, Average Depth at Peak Storage = 0.92'
Bank-Full Depth = 1.17', Capacity at Bank-Full = 2.65 cfs

14.0" Diameter Pipe, n = 0.013
Length = 57.5' Slope = 0.0024 '/'
Inlet Invert = 178.93', Outlet Invert = 178.79'

Reach 03J: 14"

Hydrograph

Inflow Area = 3.665 ac
Avg. Depth = 0.92'
Max Vel = 2.83 fps
D = 14.0"
n = 0.013
L = 57.5'
S = 0.0024 '/'
Capacity = 2.65 cfs
Summary for Reach 03K: 14"

Inflow Area = 3.495 ac, 64.32% Impervious, Inflow Depth > 2.89" for 25-YEAR event
Inflow = 2.44 cfs @ 7.93 hrs, Volume= 0.843 af
Outflow = 2.44 cfs @ 7.94 hrs, Volume= 0.843 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.87 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.78 fps, Avg. Travel Time= 0.4 min

Peak Storage= 37 cf @ 7.94 hrs, Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 1.17', Capacity at Bank-Full= 2.71 cfs

14.0" Diameter Pipe, n= 0.013
Length= 43.3' Slope= 0.0025 '/'
Inlet Invert= 179.14', Outlet Invert= 179.03'

Reach 03K: 14"

Hydrograph

Inflow Area=3.495 ac
Avg. Depth=0.87'
Max Vel=2.87 fps
D=14.0''
n=0.013
L=43.3'
S=0.0025 '/'
Capacity=2.71 cfs
Summary for Reach 03L: 14"

Inflow Area = 3.065 ac, 64.86% Impervious, Inflow Depth > 2.91" for 25-YEAR event
Inflow = 2.15 cfs @ 7.93 hrs, Volume= 0.743 af
Outflow = 2.15 cfs @ 7.94 hrs, Volume= 0.742 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.79 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 1.1 min

Peak Storage= 84 cf @ 7.94 hrs, Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 1.17', Capacity at Bank-Full= 2.68 cfs

14.0" Diameter Pipe, n= 0.013
Length= 108.4’ Slope= 0.0025 '/'
Inlet Invert= 179.51', Outlet Invert= 179.24'

Reach 03L: 14"

Inflow Area=3.065 ac
Avg. Depth=0.79'
Max Vel=2.79 fps
D=14.0"
n=0.013
L=108.4'
S=0.0025 '/'
Capacity=2.68 cfs
Summary for Reach 03M: 14"

Inflow Area = 2.195 ac, 66.88% Impervious, Inflow Depth > 2.95" for 25-YEAR event
Inflow = 1.57 cfs @ 7.92 hrs, Volume= 0.540 af
Outflow = 1.57 cfs @ 7.93 hrs, Volume= 0.540 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.56 fps, Avg. Travel Time= 1.1 min

Peak Storage= 64 cf @ 7.93 hrs, Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.17', Capacity at Bank-Full= 2.70 cfs

14.0" Diameter Pipe, n= 0.013
Length= 107.0' Slope= 0.0025 '/'
Inlet Invert= 179.89', Outlet Invert= 179.62'

Reach 03M: 14"

Inflow Area=2.195 ac
Avg. Depth=0.64'
Max Vel=2.62 fps
D=14.0"
n=0.013
L=107.0'
S=0.0025 '/'
Capacity=2.70 cfs
The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Coordinate System: Web Mercator (EPSG:3857)
Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 13, Sep 18, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
# Hydrologic Soil Group

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
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<td>42</td>
<td>Verboort silty clay loam</td>
<td>D</td>
<td>12.1</td>
<td>20.9%</td>
</tr>
<tr>
<td>44A</td>
<td>Willamette silt loam, 0 to 3 percent slopes</td>
<td>B</td>
<td>16.9</td>
<td>29.2%</td>
</tr>
<tr>
<td>44B</td>
<td>Willamette silt loam, 3 to 7 percent slopes</td>
<td>B</td>
<td>6.6</td>
<td>11.4%</td>
</tr>
<tr>
<td>45A</td>
<td>Woodburn silt loam, 0 to 3 percent slopes</td>
<td>C</td>
<td>5.0</td>
<td>8.7%</td>
</tr>
<tr>
<td>45B</td>
<td>Woodburn silt loam, 3 to 7 percent slopes</td>
<td>C</td>
<td>17.3</td>
<td>29.8%</td>
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**Totals for Area of Interest**

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<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
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<td>57.9</td>
<td>100.0%</td>
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</table>

---

*Hydrologic Soil Group—Summary by Map Unit—Washington County, Oregon (OR067)*

Natural Resources Conservation Service

Web Soil Survey National Cooperative Soil Survey

8/15/2016 Page 3 of 4
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher
APPENDIX F

SUNSET TERRACE FINAL STORM DRAINAGE REPORT (NARRATIVE ONLY)
Final Storm Drainage Report

Sunset Terrace

Washington County, Oregon
City of North Plains Casefile No. SD/FPP-06-0009

VALID THROUGH 12-31-14

Date: October 30, 2013
Revised: June 5, 2014

By: Luke R. Lappin, P.E.

SFA Job No. 141-013

Applicant: Mark Crandall
1800 NW 167th Place, Suite #150
Beaverton, OR 97006
(503) 645-7433

Engineer: SFA Design Group, LLC
9020 SW Washington Sq. Dr., Suite 505
Portland, OR 97223
(503) 641-8311
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APPENDIX 'D' – 25 YEAR BASE FLOOD ELEVATION DETERMINATION
APPENDIX 'E' – HYDRAULIC GRADE LINE CALCULATIONS
APPENDIX 'F' – AERIAL PHOTOGRAPHS
This report represents the final storm drainage and stormwater analysis for the Sunset Terrace Subdivision project. The basis of this report is to comply with the City of North Plains, Washington County, Clean Water Services (CWS), and the State of Oregon’s regulations and engineering standards as well as the latest edition of the Oregon Plumbing Specialty Code (OSPC). Compiled in this report are the design criteria for the site, the hydrologic methodology, and the final drainage analysis.

SITE DESCRIPTION AND LOCATION

Originally approved as the Wascoe Subdivision, the proposed development is a 55-lot detached single family subdivision located on the east side of NW Gordon Road at NW Hillcrest Avenue in North Plains, Washington County, Oregon. The subject site is approximately 12.7 acres and is specifically identified as tax lots 200 and 300 of Tax Map 1N3 01BC.

There is an existing +/- 5.0 acre environmental area in the southwest corner of the property which will be dedicated as open space to preserve wetlands, buffers and a perennial stream/pond. This significant natural resource area will not be developed with the project and is not considered as contributing to the increase in stormwater runoff generated as a result of the proposed development. Therefore, only +/- 7.98 acres of the site will be included in the storm drainage calculations for the property. This area also includes required offsite improvements.

EXISTING CONDITIONS

The subject site has been partially cleared with the removal of an existing junk yard near the western boundary of the property. The eastern half of the site is an open field with overgrown weeds and brush. The topography of the northwestern half of the property slopes southerly at approximately 2-7% towards an existing onsite pond. The eastern half of the site slopes to the west at approximately 2-5% into an existing wetland that ultimately is conveyed in a stream draining into the pond. The stream exits the site at a relative low point located along the western end of the southerly boundary line at an elevation of 173 feet. The relative high point of the site is found in the southeast corner of the property at an elevation 199 feet.

The property is bounded to the north by large properties with individual home sites and the North Plains Elementary School. The Vanrodison Heritage Estates subdivision and single family homes border the site to the east. The existing wetlands and stream enter the site from the west and various commercial sites are to the south.

The predominant soils found on site are Verboot (42) and Woodburn (45A/B) each with a corresponding hydrologic soil group designation “C” as shown on the attached Natural Resources Conservation Service (NRCS) soil survey for Washington County.

June 5, 2014
SFA Project #: 141-013
RUNOFF CURVE NUMBERS

Predevelopment pervious areas represent a runoff curve number of 71 for “Meadows” cover type while post development pervious areas will use a runoff curve number of 74 corresponding to “Open Space” cover type in good condition. A runoff curve number of 98 will be used for all predeveloped and developed impervious areas (refer to the SCS Runoff Curve Numbers exhibit).

<table>
<thead>
<tr>
<th>Land Description</th>
<th>Existing RCN</th>
<th>Proposed RCN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meadows</td>
<td>71</td>
<td>---</td>
</tr>
<tr>
<td>Open Space, Good Condition</td>
<td>---</td>
<td>74</td>
</tr>
<tr>
<td>Impervious</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

PROPOSED IMPROVEMENTS

We will be constructing impervious surfaces as a result of the public streets and private drives along with the eventual homes and sidewalks. Public utilities will be extended throughout the site for the use of the proposed lots. The site will treat its collected runoff in a water quality swale located near the midpoint of the southerly boundary line and discharge the contributing stormwater into an existing pond in the southwest corner of the site. A portion of the site, lots 27-30 and NW Sunset Way is not conveyed to the project’s water quality facility because of topographic constraints. We propose to mitigate for the uncollected basin by treating an offsite area from the Vanrodison Heritage Estates subdivision (NW Timeeric St.).

It should be noted that our report and the analysis listed herein were produced in conjunction with two stormwater studies prepared by LDC Design Group, LLC and CWK2 Land Development Consultants for the previously approved Wascoe subdivision. The first, “100-Year Base Flood Elevation Determination” prepared June 16, 2006 by LDC, analyzed and determined the 100-year BFE for an unnamed tributary adjacent to the proposed development. The second study, “Proposed Floodplain Alteration for Wascoe Subdivision” prepared January 24, 2007 by CWK2, evaluated the effects of the former project’s floodplain alterations. We have reviewed the two reports and concur with their findings, exhibits, and calculations. The results of both studies have been incorporated into this storm drainage report and have been used to support our analysis. We have also verified the drainage basins used in the LDC study have not substantially changed since the original report was prepared. Aerial photographs are attached in the Appendix ‘F’ to validate our conclusion.
HYDROLOGY/HYDRAULIC METHODOLOGY

Using the Santa Barbara Urban Hydrograph (SBUH) method based on a Type 1A rainfall distribution, the site has been analyzed to determine the proposed peak runoff rates for the water quality, 2, 10, and 25-year 24-hour storm events. The SBUH method uses runoff curve numbers in conjunction with the site’s hydrologic soil group to model the site’s permeability.

A pre-developed time of concentration of 37.89 minutes and developed time of concentration of 10.8 minutes were calculated using the methodology outlined in the TR-55 technical manual (refer to the Time of Concentration exhibits).

Rainfall depths for all storm events used in the calculations and design of the proposed storm drainage system are found in latest edition of Clean Water Services (CWS) Design and Construction Standards and as shown below.

<table>
<thead>
<tr>
<th>Recurrence Interval, Years</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-Hour Depths, Inches</td>
<td>2.50</td>
<td>3.10</td>
<td>3.45</td>
<td>3.90</td>
<td>4.50</td>
</tr>
</tbody>
</table>

WATER QUALITY

As required by Clean Water Services, we will treat runoff from any new impervious surface created as a result of the proposed development. All water quality structures shall be designed to treat storm water generated by 0.36 inches of precipitation falling in 4 hours with an average storm return period of 96 hours. The water quality facilities, in conjunction with the sumped catch basins, will remove a minimum of 65% of the Total Phosphorous (TP) from the storm water runoff.

Runoff from the site is conveyed into a proposed water quality swale providing treatment for all impervious surfaces relevant to the proposed development in accordance with CWS Design and Construction Standards 4.05 and 4.06 (R&O 07-20). We will mitigate for the untreated subbasin adjacent to lots 27-30 (approximately 0.65 acres of impervious area) by collecting and treating an equal amount of stormwater from the Vanrodison Heritage Estates subdivision.

The following summarizes the water quality requirements for the development:

- **WQ Swale**
  - Min. Swale length = 106.57 ft (See WQ Swale Calculations)
  - Design length = 193.48 ft
- **Design width** = 4.0 ft
- **Velocity** = 0.20 ft/s
- **Depth** = 0.39 ft
- **Residence Time** = 9.0 min.
- **25-year storm event depth** = 1.91 ft

**DETENTION**

Water quantity control (detention) is not provided as part of this project. Per CWS Design and Construction Standards 2.04.2.m3.B&C (R&O 07-20), the additional flow from the proposed development constitutes less than 5% of the total tributary drainage flow as it leaves the property boundary. As shown in the *Santa Barbara Urban Hydrograph* spreadsheet, the 25-year post-developed discharge is 5.32 cfs. **Appendix ‘D’ – 25-Year Base Flood Elevation Determination**, has calculated a 25-year discharge rate of 223.94 cfs generated using the tributary Basin Map from the “100-Year Base Flood” study produced by LDC. The “Downstream Analysis” section below describes the existing storm drain system beyond the subject property and the effects of the proposed development on the conveyance elements.

**CONVEYANCE**

The conveyance system for the project consists of an underground pipe system with sumped and flow through catch basins. Storm water will be conveyed through the site via a series of pipes and routed through the proposed water quality facility before being discharged into the existing wetland area. A pollution control manhole has been installed upstream of the water quality swale. The drainage system is designed to convey the 25-year storm event per the requirements of Clean Water Services (CWS).

Using a Manning’s ‘n’ value of 0.013, the minimum slope required to convey the 25-year storm event through the site is shown in the attached *Stormwater Conveyance Calculations*.

**25-YEAR BASE FLOOD ELEVATION (HGL)**

We used the basin data provided in the LDC study to calculate the 25-year base flood elevation in regards to the conveyance system of the proposed development. The hydrologic information was entered into the *Intellisolve Hydrograph Hydroflow* software program were it modeled the conditions of the specific storm event. Results of our analysis indicate the 25-year BFE at 178.10 ft. *(see Appendix ‘D’ – 25-year Base Flood Elevation)*.

Per section 5.05.2 A&B (R&O 07-20), we have shown the hydraulic grade line (HGL) on the storm sewer profiles for NW Wascoe St and demonstrated a minimum 1 foot freeboard
between the HGL and the top of any structure. Due to downstream restrictions on the existing floodplain, we are unable to achieve this requirement for western half of NW Sunset Way. We have also specified minimum crawl space elevations to be set at 178.50 ft. for all lots in the proposed development to prevent flooding in any portion of a habitable structure.

DOWNSTREAM ANALYSIS

The "100-year Base Flood Elevation (BFE)" study prepared LDC provided a basis of comparison with the BFE as currently mapped by the Federal Emergency Management Agency (FEMA) for this area. As indicated by the study, the BFE calculated by LDC was 178.60 as compared to 179/180 per the FEMA mapping. For the proposed project, we have assumed the more conservative 180 foot elevation shown on the FEMA map as the design 100-year BFE. Documentation of the City's floodplain elevation acceptance has been included with this report as well as the latest Flood Insurance Rate Map.

The BFE study also identified a primary downstream restriction of the existing conveyance system at the railroad embankment culvert crossing. At this point, there are a number of culverts of varying sizes and a junction box conveying runoff through a 72" cmp culvert under the railroad. During multiple rain events, stormwater is backed up into the floodplain adjacent to the development and through the culvert on NW Gordon Rd.

In conjunction with the 100-YR BFE report, the "Proposed Floodplain Alteration" by CWK2 concluded that the floodplain functioned primarily as a storage facility and not a flood conveyance channel. The report also noted very low storage velocities through this reach and an extremely flat hydraulic gradient across the floodplain.

Furthermore, the current project proposes to balance fill activities in the floodplain by removing an equal or larger volume of material also in the floodplain. The exhibit shows the proposed project displacing 1,691 cubic yards of volume but removing or overcompensating with 2,095 cubic yards of storage. The additional 400 cubic yards, or 10,800 cubic feet of storage will provide adequate detention for the increase in storm water to the drainage basin which will meet the requirements of CWS and NOAA.

Lastly, the 100-year floodplain volume was determined to be 1,061,295 cubic feet upstream of the railroad crossing as calculated in the LDC study. The amount of displaced volume by the proposed project is approximately 4.3% of the total floodplain storage. By overcompensating with a volume of material greater than that being displaced, there should be no net rise in the BFE for this reach. This conclusion is substantiated by the findings in the LDC study and corroborated by CWK2’s report.
CONCLUSION

Based on the supporting stormwater calculations and attached analysis, it is the opinion of SFA Design Group that the development of the proposed Sunset Terrace subdivision will not adversely affect the existing downstream drainage system or adjacent property owners. We have provided water quality treatment for the development and demonstrated that detention is not required. Furthermore, a separate 100-year Base Flood Elevation study was performed on reach adjacent to the property confirming the FEMA floodplain elevation for the proposed development. As shown in the construction documents, no habitable structures have been placed within the identified 100-yr flood elevation or 25-yr base flood elevation. In addition, we have compensated for the displaced floodplain volume by creating an onsite area inside the floodplain with a larger volume of storage. Therefore, all the requirements associated with Clean Water Services' design and construction standards, the City of North Plains, and Washington County have been met for this project.