KNUTZEN ENGINEERING

# Upstream Watershed Analysis

## Viking Homes – Prosser Subdivision

*Prepared For:*

Viking Homes LLC
19425 E Broadway
Spokane Valley, WA 99016

*Prepared By:*

Nathan Machiela, PE
Levi Gilbert, EIT
Project No. 19155

*Preparation Date:*

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# 1.0 PROJECT AND SITE INFORMATION

The proposed subdivision by Viking Homes is located approximately 2.0 miles southwest of downtown Prosser, Washington on Benton County Parcel #:1-1084-400-0006-000, as shown in Figure 1 and 2 below. The parcel is 138 acres and is currently undeveloped with native vegetation. The proposal includes rezoning the property and constructing improvements for nearly 300 residential lots including single family residences, roadways, and infrastructure improvements to serve the future homes. This site is located on the downhill side of an approximately 550-acre watershed that produces approximately 8.2 acre-feet of stormwater runoff during a design event. The site generally drains towards the Yakima River which is located approximately 1/3 of a mile north of the site.

*Figure 1. Vicinity Map.*
(Google Maps Image)

*Figure 2. Existing Site Conditions.*
(Google Earth Image)

The NRCS Web Soil Survey classifies the site soil as a variation of either stony loam or silty loam depending on the location. These soils have a saturated hydraulic conductivity ranging from as low as 1.28 in/hr and as high as 42.6 in/hr. However, during the evaluation of the watershed it was assumed that no infiltration occurred prior to the stormwaters arrival to the proposed conveyance system. The soil type is classified as a type C soil with grass cover which yields a CN value of 74. South of the basin line shown in figure 3, the topography slopes to the south with a distinct basin line at the top of slope.

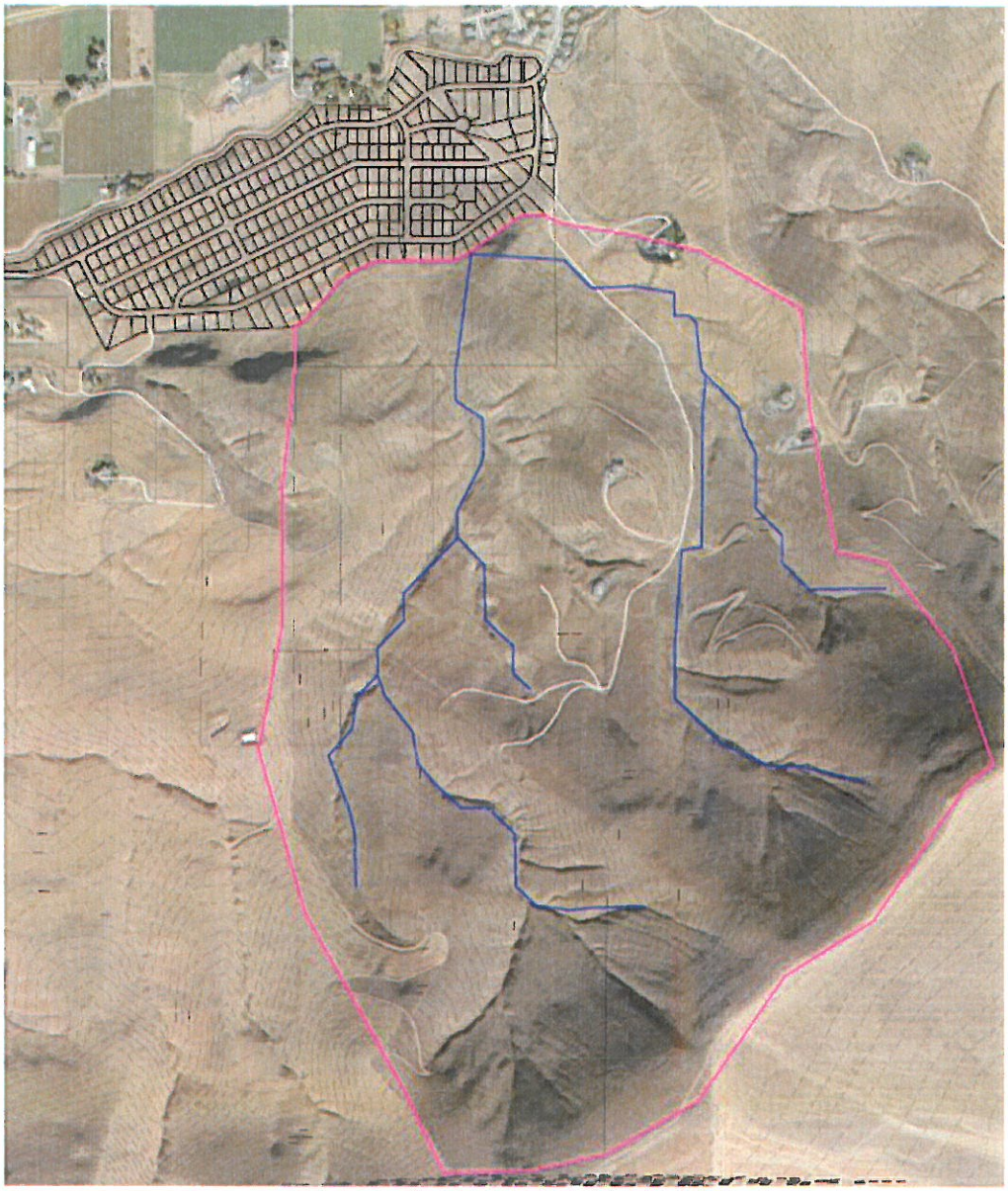


*Figure 3. Upstream Watershed Map.*

*Table 1. Watershed Map Legend.*

| Line Type | Description |
|---|---|
| | Upper Ridgeline of Watershed |
| | Channel Locations within Watershed |

## 2.0 METHODOLOGY

The Watershed Analysis was developed in accordance with the Stormwater Management Manual for Eastern Washington (SMMEW).

The Stormwater modeling was performed using HydroCAD 10.0 and all Stormwater calculations were completed utilizing the SCS TR-20 method. The Watershed design storm event was the 25-Year, Type IA Design Storm having a 24-hour rainfall total of 1.6 inches per the 25-Year 24-Hour Isopluvials by NOAA Atlas 2 as referenced in the SMMEW.

This design was based on the following assumptions:

1. Sheet flow would occur from any exterior ridge or isolated high point within the watershed and would remain as a sheet flow for a maximum of 300-feet. These sheet flow areas were assumed to be passing over range type areas.
2. After 300-feet, the sheet flow would transition to shallow concentrated flow until the stormwater runoff reached a defined open channel. These shallow concentrated flows were assumed to be passing over short grass pastures.
3. Open channels were defined as channels visible on aerial photographs and were assumed to be Earth channels that were clean and winding.

## 3.0 WATERSHED ANALYSIS AND CONVEYANCE DESIGN

The stormwater produced by the design storm event will be conveyed through the proposed residential subdivision using corrugated metal pipe (CMP) or an equivalent storm pipe material and constructed open channels. The stormwater runoff from the watershed will be directed to a consolidation location in order to convey the flow through the proposed development. The design of the CMP was determined by using specified times of concentration and average slopes based on the type of flow (see Table 2).

Additionally, this design focused on the use of a CMP, if the future development is to use open channel for any portion of the conveyance system further analysis will be required.

Refer to Appendix A for the stormwater calculations in the HydroCAD Report. The scope of this report includes stormwater runoff only.
The downstream outfall is expected to stay the same in the post developed condition. Additional on-site analysis should take place with site specific engineering to further evaluate the downstream condition.

*Table 2. Flow and Capacity.*

| Flow Type | Time of Concentration (min) | Average Slope (ft/ft) | Flow Length (ft) | CMP Diameter (in) | Available Capacity | Peak Capacity | Peak Depth |
|---|---|---|---|---|---|---|---|
| Sheet | 14.2 | 0.23 | 300 | 18 | 11.88 cfs | 7.28 cfs | 0.85' |
| Shallow Concentrated Flow | 6.5 | 0.23 | 1,300 | | | | |
| Open Channel | 7.8 | 0.11 | 6,236 | | | | |

# APPENDIX A
## HydroCAD Report

Subcat Reach Pond Link

**Routing Diagram for 19155-Watershed**
Prepared by Knutzen Engineering, Printed 11/6/2019
HydroCAD® 10.00-25 s/n 09152 © 2019 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 546.650 | 74 | >75% Grass cover, Good, HSG C (1S) |
| **546.650** | **74** | **TOTAL AREA** |

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Watershed** Runoff Area=546.650 ac 0.00% Impervious Runoff Depth=0.18"
Flow Length=7,836' Tc=28.5 min CN=74 Runoff=7.28 cfs 8.315 af

**Reach 2R: Conveyance Pipe** Avg. Flow Depth=0.85' Max Vel=7.06 fps Inflow=7.28 cfs 8.315 af
18.0" Round Pipe n=0.025 L=1,116.0' S=0.0473 '/' Capacity=11.88 cfs Outflow=7.28 cfs 8.315 af

**Total Runoff Area = 546.650 ac Runoff Volume = 8.315 af Average Runoff Depth = 0.18"**
**100.00% Pervious = 546.650 ac 0.00% Impervious = 0.000 ac**

## Summary for Subcatchment 1S: Watershed

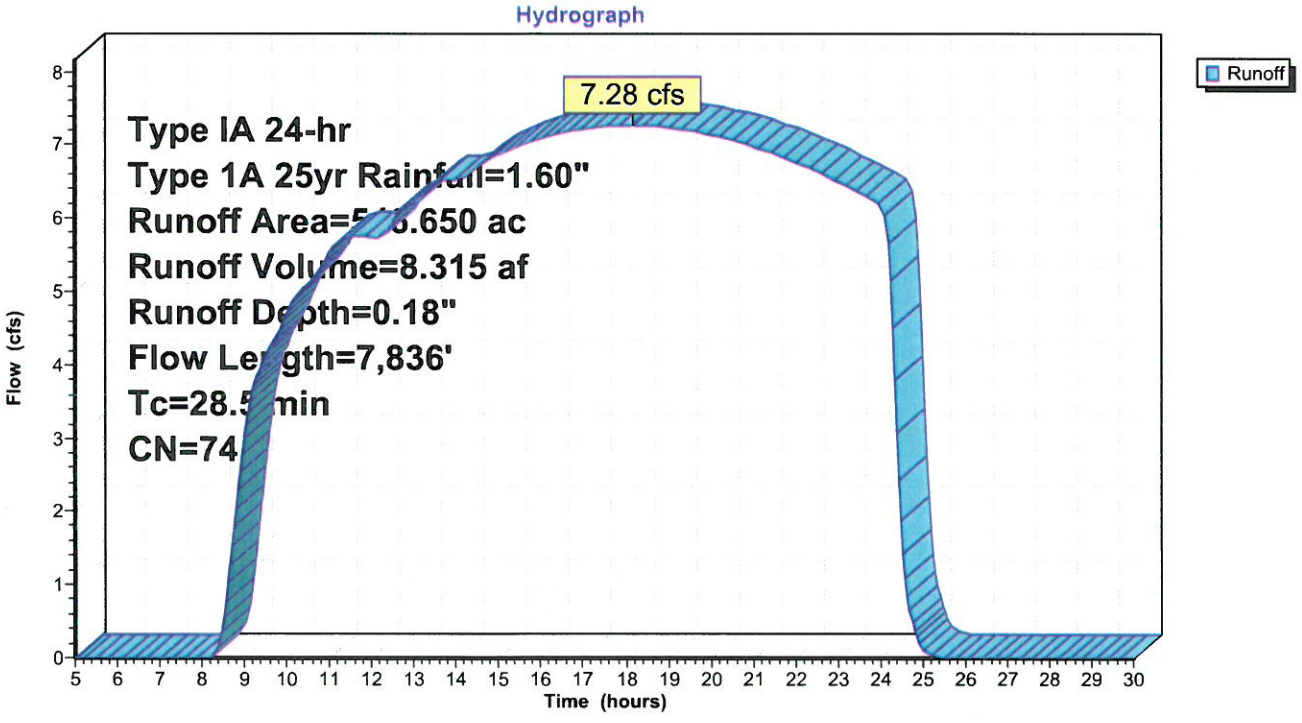
Runoff = 7.28 cfs @ 18.16 hrs, Volume= 8.315 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type IA 24-hr Type 1A 25yr Rainfall=1.60"

| Area (ac) | CN | Description |
|---|---|---|
| 546.650 | 74 | >75% Grass cover, Good, HSG C |
| 546.650 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.2 | 300 | 0.2300 | 0.35 | | **Sheet Flow,** Range n= 0.130 P2= 1.00" |
| 6.5 | 1,300 | 0.2300 | 3.36 | | **Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps |
| 7.8 | 6,236 | 0.1100 | 13.32 | 33.31 | **Channel Flow,** Area= 2.5 sf Perim= 4.5' r= 0.56' n= 0.025 Earth, clean & winding |
| 28.5 | 7,836 | Total | | | |

## Subcatchment 1S: Watershed



## Hydrograph for Subcatchment 1S: Watershed

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 5.00 | 0.25 | 0.00 | 0.00 |
| 5.25 | 0.27 | 0.00 | 0.00 |
| 5.50 | 0.29 | 0.00 | 0.00 |
| 5.75 | 0.31 | 0.00 | 0.00 |
| 6.00 | 0.33 | 0.00 | 0.00 |
| 6.25 | 0.35 | 0.00 | 0.00 |
| 6.50 | 0.38 | 0.00 | 0.00 |
| 6.75 | 0.40 | 0.00 | 0.00 |
| 7.00 | 0.43 | 0.00 | 0.00 |
| 7.25 | 0.46 | 0.00 | 0.00 |
| 7.50 | 0.50 | 0.00 | 0.00 |
| 7.75 | 0.59 | 0.00 | 0.00 |
| 8.00 | 0.68 | 0.00 | 0.00 |
| 8.25 | 0.73 | 0.00 | 0.01 |
| 8.50 | 0.77 | 0.00 | 0.58 |
| 8.75 | 0.80 | 0.00 | 1.81 |
| 9.00 | 0.83 | 0.00 | 3.01 |
| 9.25 | 0.86 | 0.01 | 3.77 |
| 9.50 | 0.88 | 0.01 | 4.13 |
| 9.75 | 0.90 | 0.01 | 4.39 |
| 10.00 | 0.92 | 0.01 | 4.73 |
| 10.25 | 0.94 | 0.02 | 4.98 |
| 10.50 | 0.96 | 0.02 | 5.12 |
| 10.75 | 0.98 | 0.02 | 5.31 |
| 11.00 | 1.00 | 0.02 | 5.56 |
| 11.25 | 1.02 | 0.03 | 5.71 |
| 11.50 | 1.03 | 0.03 | 5.78 |
| 11.75 | 1.05 | 0.03 | 5.78 |
| 12.00 | 1.06 | 0.03 | 5.72 |
| 12.25 | 1.08 | 0.04 | 5.76 |
| 12.50 | 1.09 | 0.04 | 5.94 |
| 12.75 | 1.11 | 0.04 | 6.19 |
| 13.00 | 1.12 | 0.04 | 6.21 |
| 13.25 | 1.14 | 0.05 | 6.31 |
| 13.50 | 1.15 | 0.05 | 6.50 |
| 13.75 | 1.16 | 0.05 | 6.53 |
| 14.00 | 1.18 | 0.06 | 6.53 |
| 14.25 | 1.19 | 0.06 | 6.59 |
| 14.50 | 1.20 | 0.06 | 6.71 |
| 14.75 | 1.22 | 0.07 | 6.80 |
| 15.00 | 1.23 | 0.07 | 6.88 |
| 15.25 | 1.24 | 0.07 | 6.95 |
| 15.50 | 1.26 | 0.08 | 7.01 |
| 15.75 | 1.27 | 0.08 | 7.06 |
| 16.00 | 1.28 | 0.08 | 7.11 |
| 16.25 | 1.29 | 0.09 | 7.15 |
| 16.50 | 1.31 | 0.09 | 7.18 |
| 16.75 | 1.32 | 0.09 | 7.21 |
| 17.00 | 1.33 | 0.09 | 7.24 |
| 17.25 | 1.34 | 0.10 | 7.26 |
| 17.50 | 1.35 | 0.10 | 7.27 |
| 17.75 | 1.36 | 0.10 | 7.28 |
| 18.00 | 1.38 | 0.11 | **7.28** |
| 18.25 | 1.39 | 0.11 | **7.28** |
| 18.50 | 1.40 | 0.11 | 7.28 |
| 18.75 | 1.41 | 0.12 | 7.27 |
| 19.00 | 1.42 | 0.12 | 7.25 |
| 19.25 | 1.43 | 0.12 | 7.23 |
| 19.50 | 1.44 | 0.13 | 7.21 |
| 19.75 | 1.45 | 0.13 | 7.19 |
| 20.00 | 1.46 | 0.13 | 7.15 |
| 20.25 | 1.47 | 0.14 | 7.12 |
| 20.50 | 1.48 | 0.14 | 7.08 |
| 20.75 | 1.49 | 0.14 | 7.04 |
| 21.00 | 1.50 | 0.15 | 7.00 |
| 21.25 | 1.51 | 0.15 | 6.95 |
| 21.50 | 1.52 | 0.15 | 6.90 |
| 21.75 | 1.53 | 0.16 | 6.84 |
| 22.00 | 1.53 | 0.16 | 6.78 |
| 22.25 | 1.54 | 0.16 | 6.72 |
| 22.50 | 1.55 | 0.17 | 6.65 |
| 22.75 | 1.56 | 0.17 | 6.59 |
| 23.00 | 1.57 | 0.17 | 6.52 |
| 23.25 | 1.58 | 0.17 | 6.44 |
| 23.50 | 1.58 | 0.18 | 6.37 |
| 23.75 | 1.59 | 0.18 | 6.29 |
| 24.00 | **1.60** | **0.18** | 6.21 |
| 24.25 | 1.60 | 0.18 | 5.18 |
| 24.50 | 1.60 | 0.18 | 1.88 |
| 24.75 | 1.60 | 0.18 | 0.51 |
| 25.00 | 1.60 | 0.18 | 0.14 |
| 25.25 | 1.60 | 0.18 | 0.03 |
| 25.50 | 1.60 | 0.18 | 0.00 |
| 25.75 | 1.60 | 0.18 | 0.00 |
| 26.00 | 1.60 | 0.18 | 0.00 |
| 26.25 | 1.60 | 0.18 | 0.00 |
| 26.50 | 1.60 | 0.18 | 0.00 |
| 26.75 | 1.60 | 0.18 | 0.00 |
| 27.00 | 1.60 | 0.18 | 0.00 |
| 27.25 | 1.60 | 0.18 | 0.00 |
| 27.50 | 1.60 | 0.18 | 0.00 |
| 27.75 | 1.60 | 0.18 | 0.00 |
| 28.00 | 1.60 | 0.18 | 0.00 |
| 28.25 | 1.60 | 0.18 | 0.00 |
| 28.50 | 1.60 | 0.18 | 0.00 |
| 28.75 | 1.60 | 0.18 | 0.00 |
| 29.00 | 1.60 | 0.18 | 0.00 |
| 29.25 | 1.60 | 0.18 | 0.00 |
| 29.50 | 1.60 | 0.18 | 0.00 |
| 29.75 | 1.60 | 0.18 | 0.00 |
| 30.00 | 1.60 | 0.18 | 0.00 |

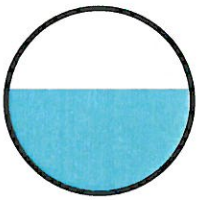
## Summary for Reach 2R: Conveyance Pipe

Inflow Area = 546.650 ac, 0.00% Impervious, Inflow Depth = 0.18" for Type 1A 25yr event
Inflow = 7.28 cfs @ 18.16 hrs, Volume= 8.315 af
Outflow = 7.28 cfs @ 18.23 hrs, Volume= 8.315 af, Atten= 0%, Lag= 4.5 min

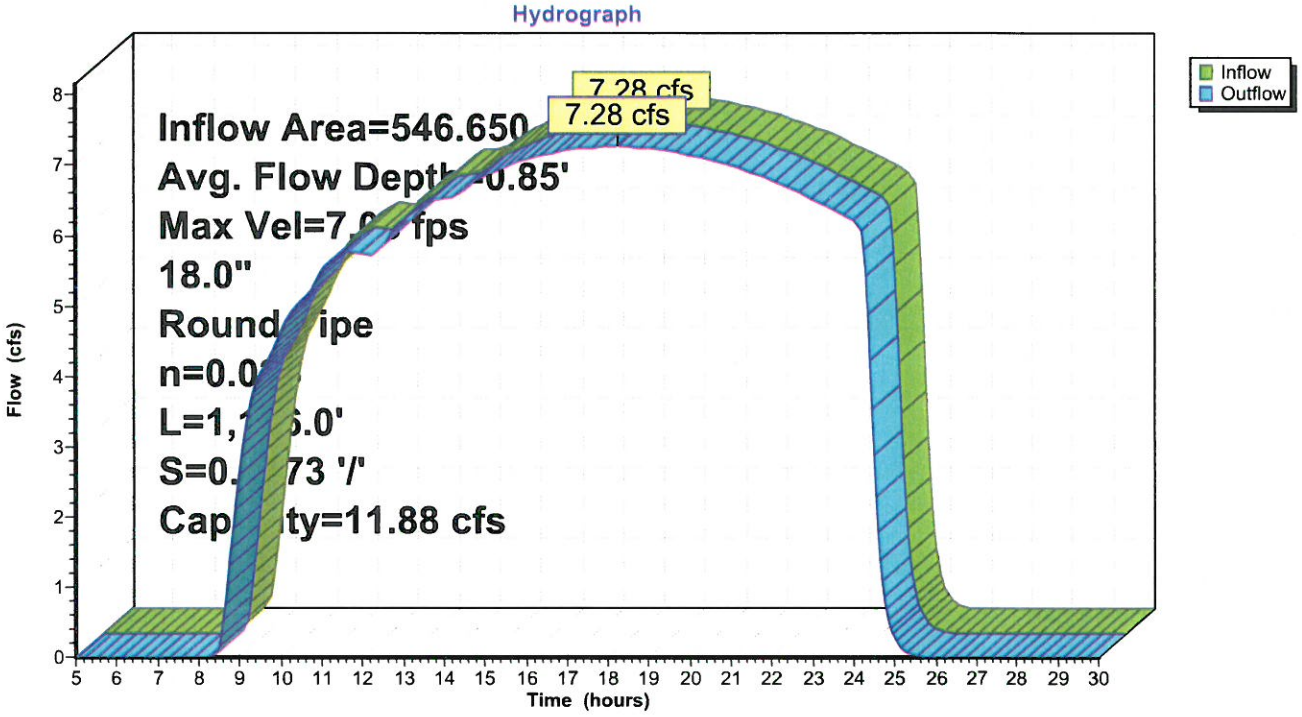
Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.06 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 5.73 fps, Avg. Travel Time= 3.2 min

Peak Storage= 1,151 cf @ 18.19 hrs
Average Depth at Peak Storage= 0.85'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 11.88 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 1,116.0' Slope= 0.0473 '/'
Inlet Invert= 781.40', Outlet Invert= 728.60'



## Reach 2R: Conveyance Pipe



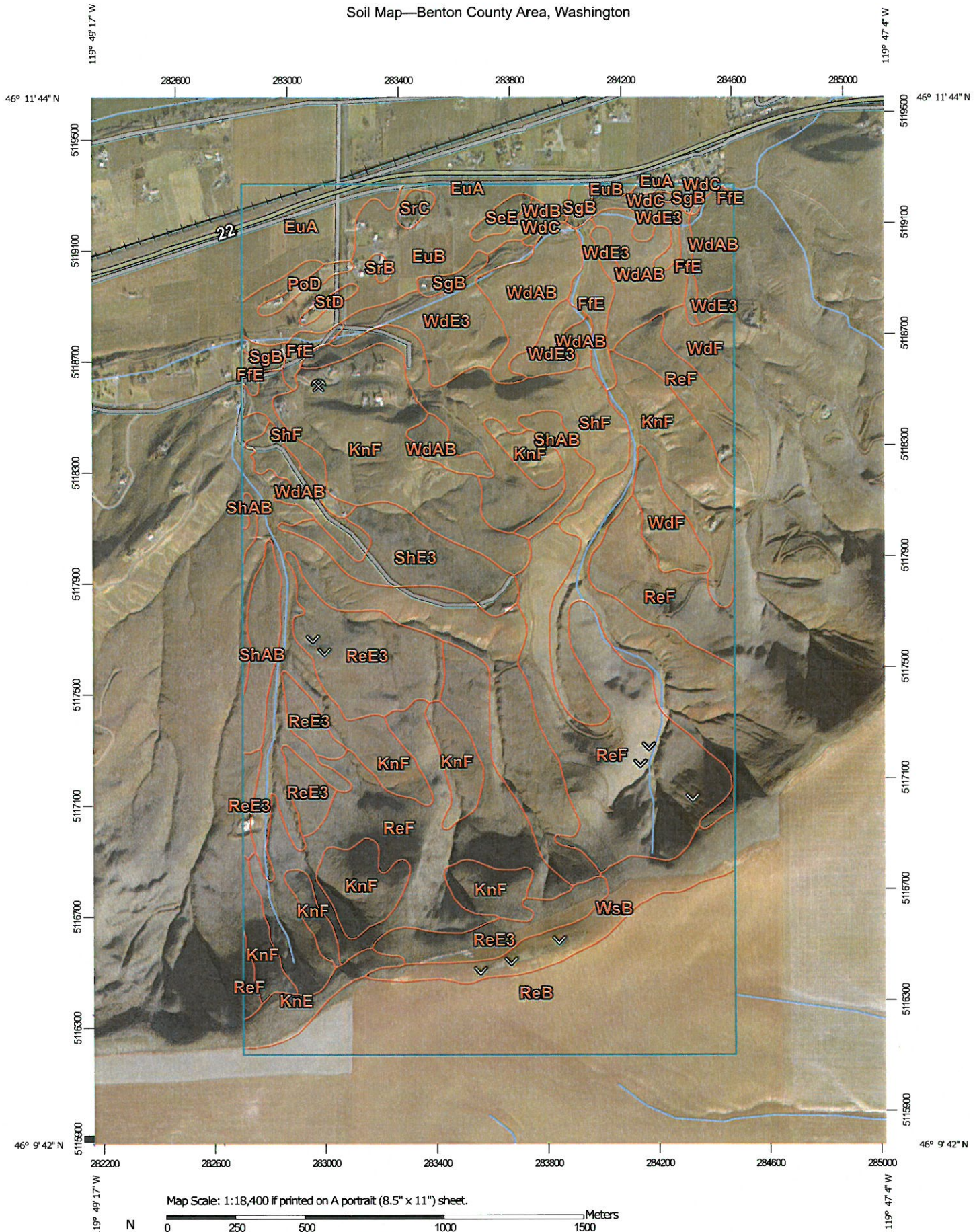
## Hydrograph for Reach 2R: Conveyance Pipe

| Time (hours) | Inflow (cfs) | Storage (cubic-feet) | Elevation (feet) | Outflow (cfs) |
|---|---|---|---|---|
| 5.00 | 0.00 | 0 | 781.40 | 0.00 |
| 5.50 | 0.00 | 0 | 781.40 | 0.00 |
| 6.00 | 0.00 | 0 | 781.40 | 0.00 |
| 6.50 | 0.00 | 0 | 781.40 | 0.00 |
| 7.00 | 0.00 | 0 | 781.40 | 0.00 |
| 7.50 | 0.00 | 0 | 781.40 | 0.00 |
| 8.00 | 0.00 | 0 | 781.40 | 0.00 |
| 8.50 | 0.58 | 119 | 781.57 | 0.18 |
| 9.00 | 3.01 | 573 | 781.90 | 2.63 |
| 9.50 | 4.13 | 748 | 782.01 | 4.04 |
| 10.00 | 4.73 | 827 | 782.05 | 4.63 |
| 10.50 | 5.12 | 881 | 782.09 | 5.08 |
| 11.00 | 5.56 | 935 | 782.12 | 5.49 |
| 11.50 | 5.78 | 965 | 782.14 | 5.76 |
| 12.00 | 5.72 | 960 | 782.13 | 5.74 |
| 12.50 | 5.94 | 982 | 782.15 | 5.87 |
| 13.00 | 6.21 | 1,020 | 782.17 | 6.21 |
| 13.50 | 6.50 | 1,054 | 782.19 | 6.46 |
| 14.00 | 6.53 | 1,059 | 782.19 | 6.53 |
| 14.50 | 6.71 | 1,079 | 782.21 | 6.68 |
| 15.00 | 6.88 | 1,101 | 782.22 | 6.86 |
| 15.50 | 7.01 | 1,116 | 782.23 | 6.99 |
| 16.00 | 7.11 | 1,129 | 782.24 | 7.09 |
| 16.50 | 7.18 | 1,138 | 782.24 | 7.17 |
| 17.00 | 7.24 | 1,145 | 782.25 | 7.23 |
| 17.50 | 7.27 | 1,149 | 782.25 | 7.27 |
| 18.00 | **7.28** | **1,151** | **782.25** | **7.28** |
| 18.50 | **7.28** | **1,150** | **782.25** | **7.28** |
| 19.00 | 7.25 | 1,147 | 782.25 | 7.26 |
| 19.50 | 7.21 | 1,143 | 782.24 | 7.22 |
| 20.00 | 7.15 | 1,136 | 782.24 | 7.16 |
| 20.50 | 7.08 | 1,127 | 782.23 | 7.09 |
| 21.00 | 7.00 | 1,117 | 782.23 | 7.01 |
| 21.50 | 6.90 | 1,105 | 782.22 | 6.91 |
| 22.00 | 6.78 | 1,091 | 782.21 | 6.80 |
| 22.50 | 6.65 | 1,075 | 782.20 | 6.68 |
| 23.00 | 6.52 | 1,058 | 782.19 | 6.54 |
| 23.50 | 6.37 | 1,040 | 782.18 | 6.39 |
| 24.00 | 6.21 | 1,021 | 782.17 | 6.23 |
| 24.50 | 1.88 | 502 | 781.85 | 2.88 |
| 25.00 | 0.14 | 94 | 781.54 | 0.27 |
| 25.50 | 0.00 | 18 | 781.45 | 0.03 |
| 26.00 | 0.00 | 4 | 781.42 | 0.00 |
| 26.50 | 0.00 | 2 | 781.41 | 0.00 |
| 27.00 | 0.00 | 1 | 781.40 | 0.00 |
| 27.50 | 0.00 | 0 | 781.40 | 0.00 |
| 28.00 | 0.00 | 0 | 781.40 | 0.00 |
| 28.50 | 0.00 | 0 | 781.40 | 0.00 |
| 29.00 | 0.00 | 0 | 781.40 | 0.00 |
| 29.50 | 0.00 | 0 | 781.40 | 0.00 |
| 30.00 | 0.00 | 0 | 781.40 | 0.00 |

## Stage-Discharge for Reach 2R: Conveyance Pipe

| Elevation (feet) | Velocity (ft/sec) | Discharge (cfs) |
|---|---|---|
| 781.40 | 0.00 | 0.00 |
| 781.41 | 0.40 | 0.00 |
| 781.42 | 0.71 | 0.00 |
| 781.43 | 0.95 | 0.01 |
| 781.44 | 1.14 | 0.02 |
| 781.45 | 1.32 | 0.02 |
| 781.46 | 1.49 | 0.04 |
| 781.47 | 1.65 | 0.05 |
| 781.48 | 1.80 | 0.07 |
| 781.49 | 1.94 | 0.08 |
| 781.50 | 2.08 | 0.11 |
| 781.51 | 2.21 | 0.13 |
| 781.52 | 2.34 | 0.15 |
| 781.53 | 2.46 | 0.18 |
| 781.54 | 2.58 | 0.22 |
| 781.55 | 2.70 | 0.25 |
| 781.56 | 2.81 | 0.28 |
| 781.57 | 2.92 | 0.32 |
| 781.58 | 3.03 | 0.36 |
| 781.59 | 3.13 | 0.41 |
| 781.60 | 3.23 | 0.45 |
| 781.61 | 3.33 | 0.50 |
| 781.62 | 3.43 | 0.55 |
| 781.63 | 3.52 | 0.60 |
| 781.64 | 3.61 | 0.66 |
| 781.65 | 3.71 | 0.72 |
| 781.66 | 3.79 | 0.78 |
| 781.67 | 3.88 | 0.84 |
| 781.68 | 3.97 | 0.90 |
| 781.69 | 4.05 | 0.97 |
| 781.70 | 4.14 | 1.04 |
| 781.71 | 4.22 | 1.11 |
| 781.72 | 4.30 | 1.19 |
| 781.73 | 4.37 | 1.26 |
| 781.74 | 4.45 | 1.34 |
| 781.75 | 4.53 | 1.42 |
| 781.76 | 4.60 | 1.50 |
| 781.77 | 4.67 | 1.59 |
| 781.78 | 4.75 | 1.67 |
| 781.79 | 4.82 | 1.76 |
| 781.80 | 4.89 | 1.85 |
| 781.81 | 4.96 | 1.94 |
| 781.82 | 5.02 | 2.03 |
| 781.83 | 5.09 | 2.13 |
| 781.84 | 5.15 | 2.23 |
| 781.85 | 5.22 | 2.33 |
| 781.86 | 5.28 | 2.43 |
| 781.87 | 5.34 | 2.53 |
| 781.88 | 5.40 | 2.63 |
| 781.89 | 5.46 | 2.74 |
| 781.90 | 5.52 | 2.85 |
| 781.91 | 5.58 | 2.96 |
| 781.92 | 5.64 | 3.07 |
| 781.93 | 5.70 | 3.18 |
| 781.94 | 5.75 | 3.29 |
| 781.95 | 5.81 | 3.41 |
| 781.96 | 5.86 | 3.53 |
| 781.97 | 5.91 | 3.64 |
| 781.98 | 5.96 | 3.76 |
| 781.99 | 6.02 | 3.88 |
| 782.00 | 6.07 | 4.00 |
| 782.01 | 6.11 | 4.13 |
| 782.02 | 6.16 | 4.25 |
| 782.03 | 6.21 | 4.37 |
| 782.04 | 6.26 | 4.50 |
| 782.05 | 6.30 | 4.63 |
| 782.06 | 6.35 | 4.76 |
| 782.07 | 6.39 | 4.88 |
| 782.08 | 6.44 | 5.01 |
| 782.09 | 6.48 | 5.14 |
| 782.10 | 6.52 | 5.28 |
| 782.11 | 6.56 | 5.41 |
| 782.12 | 6.61 | 5.54 |
| 782.13 | 6.65 | 5.67 |
| 782.14 | 6.68 | 5.81 |
| 782.15 | 6.72 | 5.94 |
| 782.16 | 6.76 | 6.08 |
| 782.17 | 6.80 | 6.21 |
| 782.18 | 6.83 | 6.35 |
| 782.19 | 6.87 | 6.48 |
| 782.20 | 6.90 | 6.62 |
| 782.21 | 6.94 | 6.75 |
| 782.22 | 6.97 | 6.89 |
| 782.23 | 7.00 | 7.03 |
| 782.24 | 7.04 | 7.16 |
| 782.25 | 7.07 | 7.30 |
| 782.26 | 7.10 | 7.44 |
| 782.27 | 7.13 | 7.57 |
| 782.28 | 7.15 | 7.71 |
| 782.29 | 7.18 | 7.85 |
| 782.30 | 7.21 | 7.98 |
| 782.31 | 7.24 | 8.12 |
| 782.32 | 7.26 | 8.25 |
| 782.33 | 7.29 | 8.39 |
| 782.34 | 7.31 | 8.52 |
| 782.35 | 7.34 | 8.66 |
| 782.36 | 7.36 | 8.79 |
| 782.37 | 7.38 | 8.92 |
| 782.38 | 7.40 | 9.05 |
| 782.39 | 7.42 | 9.18 |
| 782.40 | 7.44 | 9.31 |
| 782.41 | 7.46 | 9.44 |
| 782.42 | 7.48 | 9.57 |
| 782.43 | 7.50 | 9.70 |
| 782.44 | 7.51 | 9.82 |
| 782.45 | 7.53 | 9.95 |
| 782.46 | 7.54 | 10.07 |
| 782.47 | 7.56 | 10.19 |
| 782.48 | 7.57 | 10.31 |
| 782.49 | 7.58 | 10.43 |
| 782.50 | 7.60 | 10.55 |
| 782.51 | 7.61 | 10.66 |
| 782.52 | 7.62 | 10.78 |
| 782.53 | 7.62 | 10.89 |
| 782.54 | 7.63 | 11.00 |
| 782.55 | 7.64 | 11.11 |
| 782.56 | 7.65 | 11.21 |
| 782.57 | 7.65 | 11.32 |
| 782.58 | 7.66 | 11.42 |
| 782.59 | 7.66 | 11.52 |
| 782.60 | 7.66 | 11.61 |
| 782.61 | 7.66 | 11.71 |
| 782.62 | **7.66** | 11.80 |
| 782.63 | 7.66 | 11.89 |
| 782.64 | 7.66 | 11.97 |
| 782.65 | 7.66 | 12.05 |
| 782.66 | 7.66 | 12.13 |
| 782.67 | 7.65 | 12.21 |
| 782.68 | 7.64 | 12.28 |
| 782.69 | 7.64 | 12.35 |
| 782.70 | 7.63 | 12.41 |
| 782.71 | 7.62 | 12.47 |
| 782.72 | 7.60 | 12.53 |
| 782.73 | 7.59 | 12.57 |
| 782.74 | 7.58 | 12.62 |
| 782.75 | 7.56 | 12.66 |
| 782.76 | 7.54 | 12.70 |
| 782.77 | 7.52 | 12.73 |
| 782.78 | 7.50 | 12.75 |
| 782.79 | 7.47 | 12.77 |
| 782.80 | 7.44 | 12.78 |
| 782.81 | 7.41 | **12.78** |
| 782.82 | 7.38 | 12.77 |
| 782.83 | 7.34 | 12.75 |
| 782.84 | 7.30 | 12.73 |
| 782.85 | 7.25 | 12.68 |
| 782.86 | 7.20 | 12.63 |
| 782.87 | 7.14 | 12.55 |
| 782.88 | 7.06 | 12.44 |
| 782.89 | 6.92 | 12.21 |
| 782.90 | 6.72 | 11.88 |

# APPENDIX B
## USDA NRCS Web Soil Results




Map Scale: 1:18,400 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| EuA | Esquatzel silt loam, 0 to 2 percent slopes | 37.4 | 2.7% |
| EuB | Esquatzel silt loam, 2 to 5 percent slopes | 58.0 | 4.2% |
| FfE | Finley stony fine sandy loam, 0 to 30 percent slopes | 22.2 | 1.6% |
| KnE | Kiona very stony silt loam, 0 to 30 percent slopes | 14.6 | 1.1% |
| KnF | Kiona very stony silt loam, 30 to 65 percent slopes | 371.5 | 26.9% |
| PoD | Prosser silt loam, 5 to 15 percent slopes | 3.9 | 0.3% |
| ReB | Ritzville silt loam, 0 to 5 percent slopes | 145.5 | 10.5% |
| ReE3 | Ritzville silt loam, 15 to 30 percent slopes, severely eroded | 84.3 | 6.1% |
| ReF | Ritzville silt loam, 30 to 65 percent slopes | 269.6 | 19.5% |
| SeE | Scooteney stony silt loam, 0 to 30 percent slopes | 4.2 | 0.3% |
| SgB | Scooteney gravelly silt loam, 2 to 5 percent slopes | 11.0 | 0.8% |
| ShAB | Shano silt loam, 0 to 5 percent slopes | 28.3 | 2.0% |
| ShE3 | Shano silt loam, 15 to 30 percent slopes, severely eroded | 35.1 | 2.5% |
| ShF | Shano silt loam, 30 to 65 percent slopes | 74.6 | 5.4% |
| SrB | Starbuck silt loam, 0 to 5 percent slopes | 1.3 | 0.1% |
| SrC | Starbuck silt loam, 5 to 8 percent slopes | 3.2 | 0.2% |
| StD | Starbuck stony silt loam, 0 to 15 percent slopes | 2.3 | 0.2% |
| WdAB | Warden silt loam, 0 to 5 percent slopes | 84.5 | 6.1% |
| WdB | Warden silt loam, 2 to 5 percent slopes | 2.0 | 0.1% |
| WdC | Warden silt loam, 5 to 8 percent slopes | 6.8 | 0.5% |
| WdE3 | Warden silt loam, 15 to 30 percent slopes, severely eroded | 52.2 | 3.8% |

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| WdF | Warden silt loam, 30 to 65 percent slopes | 29.0 | 2.1% |
| WsB | Willis silt loam, 0 to 5 percent slopes | 38.6 | 2.8% |
| **Totals for Area of Interest** | | **1,380.0** | **100.0%** |

# Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| EuA—Esquatzel silt loam, 0 to 2 percent slopes | | | | | | | | | | | | | | |
| Esquatzel | 90 | B | 0-11 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-83-90 | 0-5 -10 | NP |
| | | | 11-44 | Silt loam, very fine sandy loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 85-93-1 00 | 65-80-95 | 20-25 -30 | NP-3 -5 |
| | | | 44-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 60-75-90 | 20-25 -30 | NP-3 -5 |
| EuB—Esquatzel silt loam, 2 to 5 percent slopes | | | | | | | | | | | | | | |
| Esquatzel | 90 | B | 0-11 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-83-90 | 0-5 -10 | NP |
| | | | 11-44 | Silt loam, very fine sandy loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 85-93-1 00 | 65-80-95 | 20-25 -30 | NP-3 -5 |
| | | | 44-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 60-75-90 | 20-25 -30 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| FfE—Finley stony fine sandy loam, 0 to 30 percent slopes | | | | | | | | | | | | | | |
| Finley | 90 | A | 0-3 | Stony fine sandy loam | SM | A-2, A-4 | 0- 3- 5 | 5-15- 25 | 75-80-85 | 70-75-80 | 55-58-60 | 25-33-40 | 15-20 -25 | NP-3 -5 |
| | | | 3-13 | Fine sandy loam, gravelly loam, gravelly sandy loam | GM, SM | A-1, A-2, A-4 | 0- 0- 0 | 0- 5- 10 | 60-73-85 | 50-65-80 | 40-50-60 | 20-35-50 | 15-20 -25 | NP-3 -5 |
| | | | 13-28 | Very gravelly loam, very cobbly sandy loam, extremely cobbly fine sandy loam | GM, SM | A-1, A-2 | 0- 1- 2 | 35-45-55 | 40-55-70 | 25-43-60 | 20-30-40 | 10-20-30 | 15-20 -25 | NP-3 -5 |
| | | | 28-60 | Very cobbly loamy sand, extremely gravelly loamy sand, extremely cobbly loamy sand | GP-GM | A-1 | 0- 1- 2 | 35-45-55 | 20-35-50 | 15-30-45 | 5- 8- 10 | 0- 5- 10 | 0-5 -10 | NP |
| KnE—Kiona very stony silt loam, 0 to 30 percent slopes | | | | | | | | | | | | | | |
| Kiona | 100 | B | 0-4 | Very stony silt loam | ML | A-4 | 25-30-35 | 0- 5- 10 | 70-78-85 | 60-70-80 | 55-65-75 | 50-60-70 | 20-25 -30 | NP-3 -5 |
| | | | 4-20 | Very stony silt loam, very cobbly loam, cobbly very fine sandy loam | GM, ML, SM | A-4 | 0- 0- 0 | 30-35-40 | 60-73-85 | 60-68-75 | 45-58-70 | 35-50-65 | 20-25 -30 | NP-3 -5 |
| | | | 20-60 | Very gravelly loam, very cobbly silt loam, very cobbly sandy loam | GM | A-1, A-2, A-4 | 0- 0- 0 | 35-45-55 | 45-58-70 | 35-48-60 | 35-43-50 | 15-30-45 | 15-20 -25 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| KnF—Kiona very stony silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Kiona | 100 | B | 0-4 | Very stony silt loam | ML | A-4 | 25-30-35 | 0- 5- 10 | 70-78-85 | 60-70-80 | 55-65-75 | 50-60-70 | 20-25-30 | NP-3 -5 |
| | | | 4-20 | Very stony silt loam, very cobbly loam, cobbly very fine sandy loam | GM, ML, SM | A-4 | 0- 0- 0 | 30-35-40 | 60-73-85 | 60-68-75 | 45-58-70 | 35-50-65 | 20-25-30 | NP-3 -5 |
| | | | 20-60 | Very gravelly loam, very cobbly silt loam, very cobbly sandy loam | GM | A-1, A-2, A-4 | 0- 0- 0 | 35-45-55 | 45-58-70 | 35-48-60 | 35-43-50 | 15-30-45 | 15-20-25 | NP-3 -5 |
| PoD—Prosser silt loam, 5 to 15 percent slopes | | | | | | | | | | | | | | |
| Prosser | 100 | C | 0-3 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 95-98-100 | 85-90-95 | 50-70-90 | 20-25-30 | NP-3 -5 |
| | | | 3-28 | Very fine sandy loam, silt loam | ML | A-4 | 0- 0- 0 | 0- 3- 5 | 95-98-100 | 90-95-100 | 80-85-90 | 50-65-80 | 20-25-30 | NP-3 -5 |
| | | | 28-34 | Unweathered bedrock | — | — | — | — | — | — | — | — | — | — |
| ReB—Ritzville silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Ritzville | 100 | B | 0-6 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 95-98-100 | 95-98-100 | 70-80-90 | 15-20-25 | NP-3 -5 |
| | | | 6-36 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 100-100-100 | 95-98-100 | 80-85-90 | 15-20-25 | NP-3 -5 |
| | | | 36-60 | Silt loam, fine sandy loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 100-100-100 | 95-98-100 | 75-83-90 | 15-20-25 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| ReE3—Ritzville silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | | | | | | | |
| Ritzville | 100 | B | 0-2 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 95-98-1 00 | 95-98-1 00 | 70-80- 90 | 15-20 -25 | NP-3 -5 |
| | | | 2-36 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| | | | 36-60 | Silt loam, fine sandy loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-83- 90 | 15-20 -25 | NP-3 -5 |
| ReF—Ritzville silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Ritzville | 100 | B | 0-6 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 95-98-1 00 | 95-98-1 00 | 70-80- 90 | 15-20 -25 | NP-3 -5 |
| | | | 6-36 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| | | | 36-60 | Silt loam, fine sandy loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-83- 90 | 15-20 -25 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| SeE—Scooteney stony silt loam, 0 to 30 percent slopes | | | | | | | | | | | | | | |
| Scooteney | 100 | B | 0-4 | Stony silt loam | ML, SM | A-4 | 2- 4- 5 | 5-10- 15 | 90-95-100 | 75-80-85 | 70-75-80 | 40-50-60 | 20-25-30 | NP-3 -5 |
| | | | 4-21 | Loam, very fine sandy loam, silt loam | ML, SM | A-4 | 0- 0- 0 | 0- 3- 5 | 90-95-100 | 75-85-95 | 70-80-90 | 40-50-60 | 20-25-30 | NP-3 -5 |
| | | | 21-38 | Gravelly silt loam, gravelly fine sandy loam, cobbly loam | SM | A-2, A-4 | 0- 3- 5 | 5-10- 15 | 75-80-85 | 60-68-75 | 60-65-70 | 30-40-50 | 20-25-30 | NP-3 -5 |
| | | | 38-60 | Very gravelly sandy loam, very cobbly sandy loam, very gravelly loam | GM, SM | A-1, A-2 | 0- 5- 10 | 20-38-55 | 55-73-90 | 50-55-60 | 30-40-50 | 15-25-35 | 15-20-25 | NP-3 -5 |
| SgB—Scooteney gravelly silt loam, 2 to 5 percent slopes | | | | | | | | | | | | | | |
| Scooteney | 100 | B | 0-4 | Gravelly silt loam | SM | A-4 | 0- 0- 0 | 0- 3- 5 | 80-85-90 | 60-68-75 | 50-55-60 | 40-45-50 | 20-25-30 | NP-3 -5 |
| | | | 4-21 | Loam, very fine sandy loam, silt loam | ML, SM | A-4 | 0- 0- 0 | 0- 3- 5 | 90-95-100 | 75-85-95 | 70-80-90 | 40-53-65 | 20-25-30 | NP-3 -5 |
| | | | 21-38 | Gravelly silt loam, gravelly fine sandy loam, cobbly loam | SM | A-2, A-4 | 0- 3- 5 | 0-10- 20 | 80-90-100 | 60-78-95 | 55-65-75 | 30-40-50 | 20-25-30 | NP-3 -5 |
| | | | 38-60 | Very gravelly fine sandy loam, very cobbly sandy loam, very gravelly loam | SM | A-1, A-2 | 0- 5- 10 | 20-33-45 | 70-80-90 | 40-48-55 | 40-45-50 | 15-25-35 | 15-20-25 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| ShAB—Shano silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Shano | 100 | B | 0-6 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-80- 85 | 15-20 -25 | NP-3 -5 |
| | | | 6-28 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| | | | 28-60 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| ShE3—Shano silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | | | | | | | |
| Shano | 100 | B | 0-6 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-80- 85 | 15-20 -25 | NP-3 -5 |
| | | | 6-21 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| | | | 21-60 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| ShF—Shano silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Shano | 100 | B | 0-8 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 75-80- 85 | 15-20 -25 | NP-3 -5 |
| | | | 8-33 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |
| | | | 33-60 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100 -100 | 100-100 -100 | 95-98-1 00 | 80-85- 90 | 15-20 -25 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| SrB—Starbuck silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Starbuck | 90 | D | 0-12 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 3- 5 | 100-100 -100 | 90-95-1 00 | 80-85- 90 | 70-75- 80 | 20-25 -30 | NP-3 -5 |
| | | | 12-17 | Silt loam, fine sandy loam, very gravelly silt loam | GM, ML, SM | A-2, A-4 | 0- 0- 0 | 0- 8- 15 | 65-83-1 00 | 60-78- 95 | 50-60- 70 | 30-50- 70 | 20-25 -30 | NP-3 -5 |
| | | | 17-21 | Unweathered bedrock | — | — | — | — | — | — | — | — | — | — |
| SrC—Starbuck silt loam, 5 to 8 percent slopes | | | | | | | | | | | | | | |
| Starbuck | 90 | D | 0-12 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 3- 5 | 100-100 -100 | 90-95-1 00 | 80-85- 90 | 70-75- 80 | 20-25 -30 | NP-3 -5 |
| | | | 12-17 | Silt loam, fine sandy loam, very gravelly silt loam | GM, ML, SM | A-2, A-4 | 0- 0- 0 | 0- 8- 15 | 65-83-1 00 | 60-78- 95 | 50-60- 70 | 30-50- 70 | 20-25 -30 | NP-3 -5 |
| | | | 17-21 | Unweathered bedrock | — | — | — | — | — | — | — | — | — | — |
| StD—Starbuck stony silt loam, 0 to 15 percent slopes | | | | | | | | | | | | | | |
| Starbuck | 90 | D | 0-12 | Stony silt loam | ML | A-4 | 2- 4- 5 | 6-11- 15 | 90-95-1 00 | 85-90- 95 | 80-85- 90 | 55-68- 80 | 15-20 -25 | NP-3 -5 |
| | | | 12-17 | Gravelly loam, fine sandy loam, silt loam | ML, SM | A-2, A-4 | 0- 0- 0 | 0- 8- 15 | 80-85- 90 | 60-75- 90 | 50-55- 60 | 30-45- 60 | 20-23 -25 | NP-3 -5 |
| | | | 17-21 | Unweathered bedrock | — | — | — | — | — | — | — | — | — | — |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| WdAB—Warden silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Warden | 100 | B | 0-9 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 85-93-100 | 70-75-80 | 25-28-30 | NP-3 -5 |
| | | | 9-19 | Very fine sandy loam, silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| | | | 19-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| WdB—Warden silt loam, 2 to 5 percent slopes | | | | | | | | | | | | | | |
| Warden | 90 | B | 0-9 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 85-93-100 | 70-75-80 | 25-28-30 | NP-3 -5 |
| | | | 9-19 | Very fine sandy loam, silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| | | | 19-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| WdC—Warden silt loam, 5 to 8 percent slopes | | | | | | | | | | | | | | |
| Warden | 100 | B | 0-9 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 85-93-100 | 70-75-80 | 25-28-30 | NP-3 -5 |
| | | | 9-19 | Very fine sandy loam, silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| | | | 19-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |

| Engineering Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| WdE3—Warden silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | | | | | | | |
| Warden | 100 | B | 0-2 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 85-93-100 | 70-75-80 | 25-28-30 | NP-3 -5 |
| | | | 2-12 | Very fine sandy loam, silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| | | | 12-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| WdF—Warden silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Warden | 100 | B | 0-9 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 85-93-100 | 70-75-80 | 25-28-30 | NP-3 -5 |
| | | | 9-19 | Very fine sandy loam, silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| | | | 19-60 | Stratified very fine sandy loam to silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 75-83-90 | 25-28-30 | NP-3 -5 |
| WsB—Willis silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Willis | 100 | C | 0-6 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 100-100-100 | 90-95-100 | 70-75-80 | 15-18-20 | NP-3 -5 |
| | | | 6-10 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 95-98-100 | 95-98-100 | 85-90-95 | 20-25-30 | NP-3 -5 |
| | | | 10-30 | Silt loam | ML | A-4 | 0- 0- 0 | 0- 0- 0 | 95-98-100 | 95-98-100 | 95-98-100 | 80-85-90 | 20-25-30 | NP-3 -5 |
| | | | 30-34 | Cemented material | — | — | — | — | — | — | — | — | — | — |

# Report—Physical Soil Properties

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| EuA—Esquatzel silt loam, 0 to 2 percent slopes | | | | | | | | | | | | | | |
| Esquatzel | 0-11 | -28- | -66- | 2- 6- 8 | 1.10-1.20 -1.30 | 4.00-9.00-14.00 | 0.19-0.21-0. 23 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 3 | 86 |
| | 11-44 | -21- | -69- | 5-10- 15 | 1.20-1.30 -1.40 | 4.00-9.00-14.00 | 0.19-0.21-0. 23 | 0.0- 1.5- 2.9 | 0.0- 0.5- 1.0 | .64 | .64 | | | |
| | 44-60 | -21- | -69- | 5-10- 15 | 1.25-1.40 -1.55 | 4.00-9.00-14.00 | 0.18-0.21-0. 23 | 0.0- 1.5- 2.9 | 0.0- 0.5- 1.0 | .64 | .64 | | | |
| EuB—Esquatzel silt loam, 2 to 5 percent slopes | | | | | | | | | | | | | | |
| Esquatzel | 0-11 | -28- | -66- | 2- 6- 8 | 1.10-1.20 -1.30 | 4.00-9.00-14.00 | 0.19-0.21-0. 23 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 3 | 86 |
| | 11-44 | -21- | -69- | 5-10- 15 | 1.20-1.30 -1.40 | 4.00-9.00-14.00 | 0.19-0.21-0. 23 | 0.0- 1.5- 2.9 | 0.0- 0.5- 1.0 | .64 | .64 | | | |
| | 44-60 | -21- | -69- | 5-10- 15 | 1.25-1.40 -1.55 | 4.00-9.00-14.00 | 0.18-0.21-0. 23 | 0.0- 1.5- 2.9 | 0.0- 0.5- 1.0 | .64 | .64 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| FfE—Finley stony fine sandy loam, 0 to 30 percent slopes | | | | | | | | | | | | | | |
| Finley | 0-3 | -60- | -34- | 4- 6- 7 | 1.20-1.30 -1.40 | 14.00-28.00-42.00 | 0.10-0.12-0.14 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .17 | .32 | 3 | 5 | 56 |
| | 3-13 | -66- | -27- | 4- 7- 10 | 1.30-1.40 -1.50 | 14.00-28.00-42.00 | 0.09-0.11-0.13 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .17 | .37 | | | |
| | 13-28 | -48- | -45- | 4- 7- 10 | 1.30-1.40 -1.50 | 14.00-28.00-42.00 | 0.08-0.10-0.11 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .15 | .49 | | | |
| | 28-60 | -82- | -16- | 0- 2- 4 | 1.40-1.50 -1.60 | 141.00-300.00-705.00 | 0.03-0.04-0.05 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .05 | .24 | | | |
| KnE—Kiona very stony silt loam, 0 to 30 percent slopes | | | | | | | | | | | | | | |
| Kiona | 0-4 | -33- | -56- | 7-11- 15 | 1.15-1.25 -1.35 | 4.00-9.00-14.00 | 0.14-0.16-0.17 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .20 | .49 | 5 | 7 | 38 |
| | 4-20 | -33- | -56- | 7-11- 15 | 1.30-1.40 -1.50 | 4.00-9.00-14.00 | 0.08-0.10-0.11 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .24 | .55 | | | |
| | 20-60 | -47- | -44- | 3- 9- 15 | 1.30-1.40 -1.50 | 4.00-9.00-14.00 | 0.07-0.08-0.09 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .15 | .49 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| KnF—Kiona very stony silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Kiona | 0-4 | -33- | -56- | 7-11- 15 | 1.15-1.25 -1.35 | 4.00-9.00-14.00 | 0.14-0.16-0. 17 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .20 | .49 | 5 | 7 | 38 |
| | 4-20 | -33- | -56- | 7-11- 15 | 1.30-1.40 -1.50 | 4.00-9.00-14.00 | 0.08-0.10-0. 11 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .24 | .55 | | | |
| | 20-60 | -47- | -44- | 3- 9- 15 | 1.30-1.40 -1.50 | 4.00-9.00-14.00 | 0.07-0.08-0. 09 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .15 | .49 | | | |
| PoD—Prosser silt loam, 5 to 15 percent slopes | | | | | | | | | | | | | | |
| Prosser | 0-3 | -34- | -58- | 5- 9- 12 | 1.15-1.20 -1.25 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .49 | .49 | 2 | 5 | 56 |
| | 3-28 | -34- | -58- | 5- 9- 12 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 28-34 | — | — | — | — | — | — | — | — | | | | | |
| ReB—Ritzville silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Ritzville | 0-6 | -22- | -71- | 5- 8- 10 | 1.10-1.20 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 5 | 56 |
| | 6-36 | -22- | -71- | 5- 8- 10 | 1.20-1.30 -1.40 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .64 | .64 | | | |
| | 36-60 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| ReE3—Ritzville silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | | | | | | | |
| Ritzville | 0-2 | -22- | -71- | 5- 8- 10 | 1.10-1.20 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 5 | 56 |
| | 2-36 | -22- | -71- | 5- 8- 10 | 1.20-1.30 -1.40 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .64 | .64 | | | |
| | 36-60 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| ReF—Ritzville silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Ritzville | 0-6 | -22- | -71- | 5- 8- 10 | 1.10-1.20 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 5 | 56 |
| | 6-36 | -22- | -71- | 5- 8- 10 | 1.20-1.30 -1.40 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .64 | .64 | | | |
| | 36-60 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| SeE—Scooteney stony silt loam, 0 to 30 percent slopes | | | | | | | | | | | | | | |
| Scooteney | 0-4 | -34- | -59- | 5- 8- 10 | 1.15-1.25 -1.35 | 4.00-9.00-14.00 | 0.15-0.18-0. 20 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .32 | .55 | 4 | 6 | 48 |
| | 4-21 | -34- | -59- | 5- 8- 10 | 1.20-1.33 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| | 21-38 | -34- | -59- | 5- 8- 10 | 1.30-1.38 -1.45 | 14.00-28.00-42. 00 | 0.10-0.12-0. 13 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .32 | .55 | | | |
| | 38-60 | -50- | -40- | 0-10- 10 | 1.30-1.43 -1.55 | 14.00-28.00-42. 00 | 0.05-0.07-0. 09 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .15 | .43 | | | |
| SgB—Scooteney gravelly silt loam, 2 to 5 percent slopes | | | | | | | | | | | | | | |
| Scooteney | 0-4 | -34- | -59- | 5- 8- 10 | 1.15-1.25 -1.35 | 4.00-9.00-14.00 | 0.13-0.16-0. 18 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .32 | .55 | 4 | 6 | 48 |
| | 4-21 | -34- | -59- | 5- 8- 10 | 1.20-1.33 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| | 21-38 | -34- | -59- | 5- 8- 10 | 1.30-1.38 -1.45 | 14.00-28.00-42. 00 | 0.10-0.12-0. 13 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .32 | .55 | | | |
| | 38-60 | -50- | -40- | 0-10- 10 | 1.30-1.43 -1.55 | 14.00-28.00-42. 00 | 0.05-0.07-0. 09 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .15 | .43 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| ShAB—Shano silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Shano | 0-6 | -22- | -71- | 5- 8- 10 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 5 | 56 |
| | 6-28 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| | 28-60 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| ShE3—Shano silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | | | | | | | |
| Shano | 0-6 | -22- | -71- | 5- 8- 10 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 5 | 56 |
| | 6-21 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| | 21-60 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| ShF—Shano silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Shano | 0-8 | -22- | -71- | 5- 8- 10 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 5 | 5 | 56 |
| | 8-33 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |
| | 33-60 | -22- | -71- | 5- 8- 10 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .64 | .64 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map symbol and soil name | Depth | Sand | Silt | Clay | Moist bulk density | Saturated hydraulic conductivity | Available water capacity | Linear extensibility | Organic matter | Erosion factors | | | Wind erodibility group | Wind erodibility index |
| | | | | | | | | | | Kw | Kf | T | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| SrB—Starbuck silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Starbuck | 0-12 | -32- | -56- | 5-12- 18 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .55 | .55 | 1 | 5 | 56 |
| | 12-17 | -32- | -56- | 5-12- 18 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.12-0.14-0. 15 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .32 | .64 | | | |
| | 17-21 | — | — | — | — | — | — | — | — | | | | | |
| SrC—Starbuck silt loam, 5 to 8 percent slopes | | | | | | | | | | | | | | |
| Starbuck | 0-12 | -32- | -56- | 5-12- 18 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .55 | .55 | 1 | 5 | 56 |
| | 12-17 | -32- | -56- | 5-12- 18 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.12-0.14-0. 15 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .32 | .64 | | | |
| | 17-21 | — | — | — | — | — | — | — | — | | | | | |
| StD—Starbuck stony silt loam, 0 to 15 percent slopes | | | | | | | | | | | | | | |
| Starbuck | 0-12 | -34- | -59- | 5- 7- 8 | 1.15-1.25 -1.35 | 4.00-9.00-14.00 | 0.11-0.13-0. 15 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .37 | .55 | 1 | 6 | 48 |
| | 12-17 | -33- | -57- | 5-10- 15 | 1.30-1.40 -1.50 | 4.00-9.00-14.00 | 0.12-0.16-0. 20 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .37 | .64 | | | |
| | 17-21 | — | — | — | — | — | — | — | — | | | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| WdAB—Warden silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Warden | 0-9 | -21- | -68- | 8-12- 15 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 2.0- 3.0 | .43 | .43 | 5 | 5 | 56 |
| | 9-19 | -21- | -68- | 8-12- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 19-60 | -21- | -68- | 8-12- 15 | 1.35-1.43 -1.50 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| WdB—Warden silt loam, 2 to 5 percent slopes | | | | | | | | | | | | | | |
| Warden | 0-9 | -21- | -68- | 8-12- 15 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 2.0- 3.0 | .43 | .43 | 5 | 5 | 56 |
| | 9-19 | -21- | -68- | 8-12- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 19-60 | -21- | -68- | 8-12- 15 | 1.35-1.43 -1.50 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| WdC—Warden silt loam, 5 to 8 percent slopes | | | | | | | | | | | | | | |
| Warden | 0-9 | -21- | -68- | 8-12- 15 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 2.0- 3.0 | .43 | .43 | 5 | 5 | 56 |
| | 9-19 | -21- | -68- | 8-12- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 19-60 | -21- | -68- | 8-12- 15 | 1.35-1.43 -1.50 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| WdE3—Warden silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | | | | | | | |
| Warden | 0-2 | -21- | -68- | 8-12- 15 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 2.0- 3.0 | .43 | .43 | 5 | 5 | 56 |
| | 2-12 | -21- | -68- | 8-12- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 12-60 | -21- | -68- | 8-12- 15 | 1.35-1.43 -1.50 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| WdF—Warden silt loam, 30 to 65 percent slopes | | | | | | | | | | | | | | |
| Warden | 0-9 | -21- | -68- | 8-12- 15 | 1.15-1.23 -1.30 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 2.0- 3.0 | .43 | .43 | 5 | 5 | 56 |
| | 9-19 | -21- | -68- | 8-12- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.16-0.18-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 19-60 | -21- | -68- | 8-12- 15 | 1.35-1.43 -1.50 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |

| Physical Soil Properties–Benton County Area, Washington | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| WsB—Willis silt loam, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Willis | 0-6 | -22- | -71- | 5- 8- 10 | 1.15-1.25 -1.35 | 4.00-9.00-14.00 | 0.19-0.20-0. 21 | 0.0- 1.5- 2.9 | 1.0- 1.5- 2.0 | .55 | .55 | 2 | 5 | 56 |
| | 6-10 | -14- | -73- | 10-13- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.20-0. 21 | 0.0- 1.5- 2.9 | 0.5- 0.8- 1.0 | .55 | .55 | | | |
| | 10-30 | -14- | -73- | 10-13- 15 | 1.30-1.38 -1.45 | 4.00-9.00-14.00 | 0.18-0.19-0. 20 | 0.0- 1.5- 2.9 | 0.0- 0.3- 0.5 | .55 | .55 | | | |
| | 30-34 | — | — | — | — | 0.01-0.20-0.42 | 0.00-0.00-0. 00 | — | — | | | | | |

# Data Source Information

Soil Survey Area: Benton County Area, Washington
Survey Area Data: Version 15, Sep 16, 2019

# Report—Chemical Soil Properties

| Chemical Soil Properties–Benton County Area, Washington | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Cation-exchange capacity** | **Effective cation-exchange capacity** | **Soil reaction** | **Calcium carbonate** | **Gypsum** | **Salinity** | **Sodium adsorption ratio** |
| | *In* | *meq/100g* | *meq/100g* | *pH* | *Pct* | *Pct* | *mmhos/cm* | |
| EuA—Esquatzel silt loam, 0 to 2 percent slopes | | | | | | | | |
| Esquatzel | 0-11 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 11-44 | 5.0-10 | — | 7.4-8.4 | 1-5 | 0 | 0.0-2.0 | 0 |
| | 44-60 | 5.0-10 | — | 7.4-8.4 | 1-5 | 0 | 0.0-2.0 | 0 |
| EuB—Esquatzel silt loam, 2 to 5 percent slopes | | | | | | | | |
| Esquatzel | 0-11 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 11-44 | 5.0-10 | — | 7.4-8.4 | 1-5 | 0 | 0.0-2.0 | 0 |
| | 44-60 | 5.0-10 | — | 7.4-8.4 | 1-5 | 0 | 0.0-2.0 | 0 |
| FfE—Finley stony fine sandy loam, 0 to 30 percent slopes | | | | | | | | |
| Finley | 0-3 | 5.0-10 | — | 7.4-8.4 | 0 | 0 | 0 | 0 |
| | 3-13 | 2.0-6.0 | — | 7.4-8.4 | 0 | 0 | 0 | 0 |
| | 13-28 | 2.0-6.0 | — | 7.4-8.4 | 5-20 | 0 | 0.0-2.0 | 0 |
| | 28-60 | 0.0-2.0 | — | 7.9-8.4 | 10-20 | 0 | 0.0-2.0 | 0 |
| KnE—Kiona very stony silt loam, 0 to 30 percent slopes | | | | | | | | |
| Kiona | 0-4 | 4.0-7.0 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 4-20 | 4.0-7.0 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 20-60 | 2.0-7.0 | — | 7.9-8.4 | 5-15 | 0 | 0.0-2.0 | 0 |

| Chemical Soil Properties–Benton County Area, Washington | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Cation-exchange capacity** | **Effective cation-exchange capacity** | **Soil reaction** | **Calcium carbonate** | **Gypsum** | **Salinity** | **Sodium adsorption ratio** |
| | *In* | *meq/100g* | *meq/100g* | *pH* | *Pct* | *Pct* | *mmhos/cm* | |
| KnF—Kiona very stony silt loam, 30 to 65 percent slopes | | | | | | | | |
| Kiona | 0-4 | 4.0-7.0 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 4-20 | 4.0-7.0 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 20-60 | 2.0-7.0 | — | 7.9-8.4 | 5-15 | 0 | 0.0-2.0 | 0 |
| PoD—Prosser silt loam, 5 to 15 percent slopes | | | | | | | | |
| Prosser | 0-3 | 5.0-15 | — | 6.6-7.3 | 0 | 0 | 0 | 0 |
| | 3-28 | 5.0-15 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 28-34 | — | — | — | — | — | — | — |
| ReB—Ritzville silt loam, 0 to 5 percent slopes | | | | | | | | |
| Ritzville | 0-6 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 6-36 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 36-60 | 5.0-10 | — | 7.9-8.4 | 5-15 | 0 | 0.0-2.0 | 0 |
| ReE3—Ritzville silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | |
| Ritzville | 0-2 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 2-36 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 36-60 | 5.0-10 | — | 7.9-8.4 | 5-15 | 0 | 0.0-2.0 | 0 |
| ReF—Ritzville silt loam, 30 to 65 percent slopes | | | | | | | | |
| Ritzville | 0-6 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 6-36 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 36-60 | 5.0-10 | — | 7.9-8.4 | 5-15 | 0 | 0.0-2.0 | 0 |

| Chemical Soil Properties–Benton County Area, Washington | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Cation-exchange capacity** | **Effective cation-exchange capacity** | **Soil reaction** | **Calcium carbonate** | **Gypsum** | **Salinity** | **Sodium adsorption ratio** |
| | *In* | *meq/100g* | *meq/100g* | *pH* | *Pct* | *Pct* | *mmhos/cm* | |
| SeE—Scooteney stony silt loam, 0 to 30 percent slopes | | | | | | | | |
| Scooteney | 0-4 | 4.0-9.0 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 4-21 | 3.0-6.0 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 21-38 | 3.0-6.0 | — | 7.9-8.4 | 5-10 | 0 | 0.0-2.0 | 0 |
| | 38-60 | 0.0-3.0 | — | 7.9-8.4 | 5-10 | 0 | 0.0-2.0 | 0 |
| SgB—Scooteney gravelly silt loam, 2 to 5 percent slopes | | | | | | | | |
| Scooteney | 0-4 | 4.0-9.0 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 4-21 | 3.0-6.0 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 21-38 | 3.0-6.0 | — | 7.9-8.4 | 5-10 | 0 | 0.0-2.0 | 0 |
| | 38-60 | 0.0-3.0 | — | 7.9-8.4 | 5-10 | 0 | 0.0-2.0 | 0 |
| ShAB—Shano silt loam, 0 to 5 percent slopes | | | | | | | | |
| Shano | 0-6 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 6-28 | 5.0-12 | — | 7.4-8.4 | 0 | 0 | 0.0-2.0 | 0 |
| | 28-60 | 5.0-14 | — | 7.4-9.0 | 2-15 | 0 | 0.0-2.0 | 0 |
| ShE3—Shano silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | |
| Shano | 0-6 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 6-21 | 5.0-12 | — | 7.4-8.4 | 0 | 0 | 0.0-2.0 | 0 |
| | 21-60 | 5.0-14 | — | 7.4-9.0 | 2-15 | 0 | 0.0-2.0 | 0 |

| Chemical Soil Properties–Benton County Area, Washington | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Cation-exchange capacity** | **Effective cation-exchange capacity** | **Soil reaction** | **Calcium carbonate** | **Gypsum** | **Salinity** | **Sodium adsorption ratio** |
| | *In* | *meq/100g* | *meq/100g* | *pH* | *Pct* | *Pct* | *mmhos/cm* | |
| ShF—Shano silt loam, 30 to 65 percent slopes | | | | | | | | |
| Shano | 0-8 | 5.0-10 | — | 6.6-8.4 | 0 | 0 | 0 | 0 |
| | 8-33 | 5.0-12 | — | 7.4-8.4 | 0 | 0 | 0.0-2.0 | 0 |
| | 33-60 | 5.0-14 | — | 7.4-9.0 | 2-15 | 0 | 0.0-2.0 | 0 |
| SrB—Starbuck silt loam, 0 to 5 percent slopes | | | | | | | | |
| Starbuck | 0-12 | 5.0-10 | — | 6.6-7.3 | 0 | 0 | 0 | 0 |
| | 12-17 | 5.0-10 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 17-21 | — | — | — | — | — | — | — |
| SrC—Starbuck silt loam, 5 to 8 percent slopes | | | | | | | | |
| Starbuck | 0-12 | 5.0-10 | — | 6.6-7.3 | 0 | 0 | 0 | 0 |
| | 12-17 | 5.0-10 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 17-21 | — | — | — | — | — | — | — |
| StD—Starbuck stony silt loam, 0 to 15 percent slopes | | | | | | | | |
| Starbuck | 0-12 | 2.0-6.0 | — | 6.6-7.3 | 0 | 0 | 0 | 0 |
| | 12-17 | 2.0-6.0 | — | 7.4-7.8 | 0 | 0 | 0 | 0 |
| | 17-21 | — | — | — | — | — | — | — |
| WdAB—Warden silt loam, 0 to 5 percent slopes | | | | | | | | |
| Warden | 0-9 | 5.0-15 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 9-19 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 19-60 | 5.0-10 | — | 7.9-8.4 | 10-30 | 0 | 0.0-2.0 | 0 |

| Chemical Soil Properties–Benton County Area, Washington | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Cation-exchange capacity** | **Effective cation-exchange capacity** | **Soil reaction** | **Calcium carbonate** | **Gypsum** | **Salinity** | **Sodium adsorption ratio** |
| | *In* | *meq/100g* | *meq/100g* | *pH* | *Pct* | *Pct* | *mmhos/cm* | |
| WdB—Warden silt loam, 2 to 5 percent slopes | | | | | | | | |
| Warden | 0-9 | 5.0-15 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 9-19 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 19-60 | 5.0-10 | — | 7.9-8.4 | 10-30 | 0 | 0.0-2.0 | 0 |
| WdC—Warden silt loam, 5 to 8 percent slopes | | | | | | | | |
| Warden | 0-9 | 5.0-15 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 9-19 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 19-60 | 5.0-10 | — | 7.9-8.4 | 10-30 | 0 | 0.0-2.0 | 0 |
| WdE3—Warden silt loam, 15 to 30 percent slopes, severely eroded | | | | | | | | |
| Warden | 0-2 | 5.0-15 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 2-12 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 12-60 | 5.0-10 | — | 7.9-8.4 | 10-30 | 0 | 0.0-2.0 | 0 |
| WdF—Warden silt loam, 30 to 65 percent slopes | | | | | | | | |
| Warden | 0-9 | 5.0-15 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 9-19 | 5.0-10 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 19-60 | 5.0-10 | — | 7.9-8.4 | 10-30 | 0 | 0.0-2.0 | 0 |
| WsB—Willis silt loam, 0 to 5 percent slopes | | | | | | | | |
| Willis | 0-6 | 2.0-5.0 | — | 6.6-7.8 | 0 | 0 | 0 | 0 |
| | 6-10 | 3.0-5.0 | — | 7.4-8.4 | 0 | 0 | 0 | 0 |
| | 10-30 | 2.0-4.0 | — | 7.9-8.4 | 1-10 | 0 | 0.0-2.0 | 0 |
| | 30-34 | — | — | — | — | — | — | — |