EXHIBIT 13
SUB 20-01

PACIFIC groundwater GROUP

Technical Memorandum

Peter Schwartzman

To: Bryan Desgrosellier, DD&C

From: Joe Morrice (LHG) and Peter Schwartzman (LHG), Pacific Groundwater Group

Re: Critical Aquifer Recharge Area Report – Washougal River Oaks

Date: September 3, 2020

This technical memorandum provides a critical area report and level one hydrogeologic assessment for the planned Washougal River Oaks development at 2531 NE 3rd Avenue, Camas, Washington ("the Site"). This report was prepared by a Washington-state licensed hydrogeologist to address the requirements of Chapter 16.55 (Critical Aquifer Recharge Areas) of the City of Camas (City) Code of Ordinances (COO). The COO meets the requirements of the Stormwater Management Manual for Western Washington (SMMWW) (Ecology, 2019).

The Site is comprised of five tax parcels (Clark County Parcel Numbers 89881000, 89883000, 89884000, 89875000, and 89937000) with a total area of approximately 3.2-acres. These parcels are currently developed with single family homes.

The Site is zoned MF-18, multifamily residential. Development plans call for removal of the single-family homes and construction of 23 small (less than 1,000 square foot) cottage style homes (see attached site plan, Figure 1). Development would be focused on the southern portion of the Site. The development would be served by City water and sewer. Site stormwater runoff would be collected and conveyed to an on-site pond for retention and infiltration.

Land surface at the Site ranges from about 190 feet at the north end to about 35 feet at the south end adjacent to 3rd Avenue. The Site is mapped as being within a Critical Aquifer Recharge Area (CARA) based on its location within the wellhead protection area for City Well No. 13 (well tag ALL 997, located 3,200 feet west of the site) A copy of the City's CARA map with the location of the project Site is provided in Attachment A. There are no surface-water bodies or wetlands on the Site. The Washougal River is located about 300 feet south of the Site. No other surface-water bodies are present within 1,300 feet of the Site. There are no wetlands on the Site; however, wetlands are mapped along the Washougal River south of the Site.

Under Chapter 16.55 of the City COO, construction of new structures is allowed in the CARA; however, construction that results in greater than 5 percent or 2,500 square feet of impervious surface require a CARA report with a level one hydrogeologic assessment. Further, activities that divert, alter, or reduce the flow of surface or ground waters (e.g., storm water management) also require a level one assessment. The following section presents the level one hydrogeologic assessment for the Site.

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Water Resource & Environmental Consulting

LEVEL ONE HYDROGEOLOGIC ASSESSMENT

Chapter 16.55 of the City COO specifies that a level one assessment include the following information:

- Available information regarding geologic and hydrogeologic characteristics of the Site;
- Ground water depth, flow direction and gradient;
- Available data on wells and springs within 1,300 feet of the Site;
- Location of other critical areas, including surface waters, within 1,300 feet of the Site;
- Available historic water quality data; and
- Best management practices proposed to be utilized.

The following sections provide this required information.

GEOLOGIC AND HYDROGEOLOGIC CHARACTERISTICS

The U.S. Geological Survey Geologic Map of the Camas Quadrangle (Evarts and O'Connor, 2008) indicates that the southern half of the Site is underlain by alluvial deposits while the northern half is underlain by Oligocene-age basalt bedrock. The alluvium is described as "Terrace deposits of lower Washougal River (Holocene and (or) Pleistocene)" which is comprised of "unconsolidated sandy gravel and sand underlying small terraces along Washougal River; generally less than 10 m thick" (ibid.). The Washougal later incised through these materials, allowing the Washougal to drain more freely and leaving the alluvial terraces above the present-day river elevation (ibid.). The basalt was formed by a sequence of lava flows and has a maximum thickness on the order of 2,500 feet. The basalt is regionally extensive and underlies the alluvium on the southern half of the Site.

The alluvium is coarse-grained and is expected to transmit water, both vertically (e.g., infiltration) and as horizontal flow (see discussion of test pits below). The basalt is relatively impermeable and yields only limited quantities of water, except where fractured or at the interflow zone between two basalt flows.

Weathering of the alluvium and the bedrock has resulted in two soil types at the Site. The U.S. Department of Agriculture, Natural Resource Conservation Service online soil maps (USDA, 2020) indicate the southern half of the Site (alluvium) in underlain by Hillsboro loam soil. This soil is composed of 40 to 60 percent sand, with silt and clay forming the remaining fraction. It is described as a well-drained soil and is categorized as a Group B soil with moderate infiltration rate and a moderately low runoff potential. The Hillsboro loam has a saturated hydraulic conductivity (Ksat) on the order of 10^{-3} centimeters per second (cm/s), a value typical for silty sand.

The northern half of the Site (bedrock) is underlain by Olympic stony loam soil. This soil is less sandy than the Hillsboro loam. It is described as well-drained and is categorized as a Group C soil with a slow infiltration rate and a moderately high runoff potential. This soil has a saturated hydraulic conductivity on the order of $3x10^{-4}$ cm/s.

Three test pits were excavated at the Site in August 2018 to support a geotechnical engineering study (Soil and Water Technologies, Inc., 2018). One test pit (I-1) was located at the southern Site boundary, where the proposed infiltration pond would be located. Two other test points (TP-2 and TP-3) were excavated near the middle and at the north end of Site area planned for development. Test pit TP-3 encountered about 5.5 feet of silt overlying basalt bedrock and test pit TP-2 encountered silt to the total depth of 10 feet. Test pit I-1 encountered about 2 feet of silty gravel overlying sandy gravel with cobbles to the total excavation depth of 12.5 feet. Neither groundwater nor seepage was observed in any of the test pits.

A short-term infiltration test was performed at test pit I-1 to assess suitability of soils at this location for infiltrating stormwater. The test was performed at a depth of 5.5 feet (in dense sandy gravel with cobbles) and resulted in an estimated field infiltration rate of about 4 inches per hour ($2x10^{-3}$ cm/s). This value is consistent with the Ksat value of 10^{-3} cm/s published for the Hillsboro Loam, and represents a low-to-moderate hydraulic conductivity which is slightly inconsistent with the lack of silt reported in Test Pit I-1 between depths of 2 and 12.5 feet. Although sediments lacking silt are expected to exhibit a higher infiltration rate, the geotech firm performing the test attributed the slower infiltration rate to the dense compaction of the sediments and their report concluded that soils at this location are suitable for stormwater infiltration (Soil and Water Technologies, Inc., 2018).

Overall, the sediments that occupy the floodplain in the vicinity of the Washougal and Columbia rivers are expected to be highly transmissive. As documented by PGG (2004), this area is largely occupied by the Pleistocene Alluvial Aquifer (PAA), which is highly transmissive with estimated hydraulic conductivity values on the order of about 1 cm/s.

GROUNDWATER DEPTH, FLOW DIRECTION, AND GRADIENT

Site-specific information on hydraulic gradient and flow direction are unavailable; however, flow direction and hydraulic gradient are expected to be controlled by interactions with surface-water features and by pumping drawdown associated with the City of Camas "Lower Washougal Wellfield" (LWWF) located south of the Washougal River (PGG, 2004). PGG evaluated hydrogeologic conditions in the LWWF vicinity and noted that groundwater flow directions are difficult to predict due to: 1) limited groundwater level data; 2) the likelihood of relatively flat hydraulic gradients associated with the high transmissivity of the PAA; and 3) dynamic groundwater level responses to tidal and seasonal stage fluctuations on the Columbia River. Based on general relationships between river stages and measured groundwater elevations, PGG surmised that groundwater flows in a southwest direction towards the Columbia River and may be influenced by local pumping patterns. During summer months, when pumping withdrawals are high and groundwater levels are low, PGG found that the Washougal River generally exhibits seepage losses downstream of the 3rd Avenue Bridge. This suggests that groundwater levels near the Site are below the river level during the summer season. Seepage studies were not performed during winter months when groundwater levels are expected to be higher.

The City of Camas maintains a stream gage on the Washougal River at the Washougal River Trail footbridge, about 2,100 feet downstream of the Site. The data record (2009-present) shows seasonal low river stages of around 8 feet NGVD29, extended seasonal high stages of around 15 feet

NGVD29, and elevations of up to 23 feet NGVD29 during short-term flooding events. PGG used river-stage elevations and reasonable hydrogeologic assumptions to estimate groundwater elevations beneath the site, as shown on the table below (all values in NGVD29):

8	feet Washougal River minimum @ City Gage, Footbridge
15	feet Washougal River Seasonal Extended High @ City Gage, Footbridge
23	feet Washougal River Flooded High @ City Gage, Footbridge
2100	feet between site (upstream) and Footbridge (downstream)
2.5	feet river stage gain from gage to site (Google Earth)
10.5	feet Washougal River minimum @ site
17.5	feet Washougal River Seasonal Extended High @ site
25.5	feet Washougal River Flooded High @ site
0.01	hydraulic gradient
344	feet distance from edge of river to site infiltration facility
3.4	feet water table rise between river edge and underneath infiltration facility
13.9	feet expected groundwater minimum elevation @ infiltration facility
20.9	feet expected groundwater extended seasonal high elevation @ infiltration facility
28.9	feet expected groundwater river flooded elevation @ infiltration facility
37.5	feet land surface elevation @ stormwater facility
31.0	feet bottom elevation of constructed stormwater facility

PGG estimates that river stages nearest to the site range seasonally from 10.5 to 17.5 feet NGVD29 and approach 25.5 feet NGVD29 during flooding events. During the wet season, when the PAA is expected to be hydraulically connected to the river, PGG assumes that groundwater elevations along the river are similar to river-stage elevations. We further assume a southerly component of groundwater flow towards the river at a hydraulic gradient of 0.01. (While this value may be high relative to the transmissivity of the PAA, in the absence of measured water levels, use of a conservatively high hydraulic gradient is justified.) Based on the distance between the proposed infiltration facility and the river (344 feet) and the assumed hydraulic gradient, PGG estimates that groundwater levels beneath the site may range from less than 14 feet NGVD29 (dry season) to around 21 feet NGVD29 (wet season), and could rise to about 29 feet NGVD20 during extended flooding events. Two extended (5-10 week) flooding events are noted over the 12-year data record. Given that the designed bottom of the constructed stormwater facility is at 31 feet NGVD29, about 10 feet of vertical separation would be expected during typical wet-season conditions. However, depending on *actual* (rather than assumed) response to prolonged flooding events, vertical separation during flooding could be less than 5 feet.

Flow direction and depth to water within the bedrock underlying the north half of the Site are also uncertain. Based on the test pit explorations, there does not appear to be groundwater perched on the underlying basalt where it is present at shallow depth. Groundwater flow in the bedrock is expected to relatively minimal given expected low permeability. Groundwater would likely flow southward, recharging the alluvium before ultimately discharging to the Washougal River.

WELLS AND SPRINGS

Well driller construction logs were acquired from the Ecology well log database for locations within 1,300 feet of the Site. A total of 40 well drilling logs were identified; however, only two are for water supply wells. The remaining logs are for well decommissioning (8) or resource protection monitoring wells and geotechnical borings (30). The two water supply wells include City Well No. 13 and a private well (Thomas). Copies of these well logs are provided in Attachment B.

The City well is located along the Washougal River about 3,200 feet west (cross gradient and downgradient) of the Site. This well was drilled to a total depth of 111 feet, where it encountered bedrock. The well was completed in the overlying sand and gravel alluvium with a screened interval of 80 to 98 feet below ground surface (bgs). Depth to water was about 48 feet at time of drilling in 2006 and groundwater elevation appears to be similar to the surface water elevation in the nearby Washougal River. The alluvium is highly transmissive, with a reported drawdown of 1.4 feet while pumping at a rate of nearly 1,400 gallons per minute.

The private Thomas well is located about 1,300 feet northwest of the Site. This well was drilled in 1996 to a depth of 475 feet bgs. During drilling, a thin layer of soil and clay was encountered overlying basalt bedrock to the total drilling depth. Depth to water at time of drilling was reported as 219 feet bgs.

Based on review of U.S. Geological Survey topographic maps, no springs were identified within 1,300 feet of the Site.

OTHER CRITICAL AREAS

Other surface waters and critical areas within 1,300 feet of the Site include the Washougal River and associated mapped wetlands, located about 300 feet south of the Site. Figure 2 provides a map of these critical areas developed using Clark County's "MapsOnline" website and shows the site parcels in blue.

WATER QUALITY DATA

Water quality data identified for the area are limited to surface water quality in the Washougal River as reported by Ecology and water quality data collected by the City from Well 13.

The Washougal River near the Site has generally good water quality. Ecology completes a periodic assessment of state surface waters to identify water quality-impaired surface waters. The list of impaired surface waters is called the 303(d) list. The current list indicates the Washougal River upstream of the Site is Category 2 (unconfirmed exceedance of criteria) for pH and temperature.

Groundwater quality in the area was assessed by reviewing water quality data from Well 13 reported by the City to the Department of Health. Well 13 has been monitored several times per year since 2006 for a suite of constituents, including inorganic compounds, bacteria, synthetic organic compounds, nitrate, and pesticides and herbicides. Water quality has remined consistently good, with no reported exceedances of drinking water standards.

BEST MANAGEMENT PRACTICES

Planned construction activities and residential use of the Site have the potential to cause water quality or water quantity impacts to groundwater in the alluvium underlying the southern half of the Site. Events with the potential to cause impacts during construction include accidental spills or releases of fuel that could migrate to groundwater.

Following construction, residential use of the Site has the potential to impact groundwater quantity by increasing impervious surfaces and reducing the infiltration of precipitation to groundwater. Water quality could be impacted by infiltration of precipitation that contains fuel products after contacting road or parking surfaces or gardening chemicals applied to lawns. Concerns over potential impacts to groundwater during and after construction will be addressed by implementation of applicable best management practices (BMPs) discussed below.

During construction, stormwater will be managed under Ecology's Construction Stormwater General Permit (General Permit). This permit requires a Stormwater Pollution Prevention Plan (SWPP) and that pollution prevention best management practices be implemented during construction, in accordance with the *2019 Stormwater Management Manual for Western Washington* (SWMMWW; Ecology, 2019). Section S9 of the General Permit includes requirements for the SWPP. Subsection D.9. summarizes applicable BMPs to control pollutants, including:

- Covering, containing, and protecting potentially hazardous substances from vandalism;
- Using spill prevention and control measures during equipment fueling or repair; and
- Providing secondary containment for on-site fuel storage.

Text from Section 9, subsection D.9. describing pollutant control requirements under the General Permit is included as Attachment C.

Following development, stormwater runoff at the Site will collected, conveyed to a pond and infiltrated on-site. The conveyance and infiltration system will be designed in accordance with the SWMMWW (Ecology, 2019). Construction of impervious surfaces causes reduction of aerial infiltration of precipitation recharge, although precipitation recharge may already be constrained by the occurrence of shallow bedrock and silty soils immediately below the ground surface. However, because runoff from impervious surfaces will be routed to an infiltration basin, and due to reduced evapotranspiration associated with reduced vegetative cover, groundwater recharge associated with the site is expected to increase.

CONFORMANCE WITH ECOLOGY'S SWMMWW

In reviewing the Geotech Report (Soil and Water Technologies, 2018) and considering the information discussed above, PGG notes that additional information may be needed to satisfy the guidelines of the SWMMWW. Specifically:

1. Use of an infiltration basin (BMP T7.10) to treat stormwater quality is an applicable BMP described in the SWMMWW. To provide water quality treatment, the base of the basin must be at least 5 feet above the seasonal high groundwater elevation. The SWMMWW defines

seasonal high groundwater level as "the highest annual groundwater elevation as determined by a qualified soil scientist, geohydrologist, or licensed engineer in the state of Washington based on monitoring wells or other recognized methods". Notwithstanding flooding events, PGG estimates a seasonal high water table of around 21 feet NGVD29, which provides about 10 feet of vertical separation from the bottom elevation of the infiltration basin (about 31 feet, as shown on Figure 1). During extended river flooding events (relatively rare), the 5 feet of vertical separation may not be maintained.

2. A mounding analysis may be needed to support the Infiltration BMP design. The SMMWW states: *"On projects where an infiltration BMP has a contributing drainage area exceeding 1 acre and has less than fifteen feet depth to seasonal high ground water (as measured from the elevation at which infiltration into the native soil begins) or other low permeability stratum, determine the final design infiltration rate using an analytical ground water model to investigate the effects of the local hydrologic conditions on BMP performance"*. Furthermore, the SMMWW requires that *"at sites with shallow ground water (less than 15 feet from the estimated base of the Infiltration BMP, if a ground water mounding analysis is necessary, determine the thickness of the saturated zone"*. Bedrock encountered in City Well 13 (at an elevation of -51 feet NGVD29) can be used to approximate the saturated thickness of the aquifer beneath the site, and aquifer properties associated with pumping tests in the PAA can be used to support mounding analysis.

3. The SMMWW requires site characterization to include an excavation *"to a depth below the base of the infiltration BMP of at least 5 times the maximum design depth of ponded water proposed for the infiltration BMP, but not less than 10 feet below the base of the BMP."* Assuming that the infiltration pond will hold 5 feet of water, an excavation (test pit or well) would be required to a depth of 25 feet below the Infiltration BMP or 31 feet below the current land surface. The deepest excavation in the Geotech Report was 12 feet below land surface.

4. The SMMWW requests three monitoring wells to estimate groundwater flow direction, but is willing to accept a single well if "gradient and flow direction are not critical". As discussed above, groundwater flow is expected to be controlled by river elevations and predominantly occur to the southwest. Based on this information, three monitoring wells are unlikely to be needed.

5. The SMMWW also requires water-level monitoring through at least one wet season to assess the seasonal high water table "unless substantially equivalent site historical data regarding groundwater levels is available". Based on discussion with DD&C, two adjacent sites have been approved for stormwater infiltration. Data submitted for these sites may be useful for meeting the SMMWW requirement.

It should be noted that PGG's analysis is based on the conclusion that the stormwater infiltration facility can accommodate expected stormwater loading (Soil and water Technologies Inc., 2018) and that the transmissivity of the aquifer is sufficiently high that mounding will not significantly reduce local depth to water. If a mounding analysis (or other requirements of the SMMWW noted above) require attention, PGG is available to provide assistance.

REFERENCES

Department of Ecology, 2019. Stormwater Management Manual for Western Washington. Publication Number 19-10-021. July 2019.

Department of Ecology, 2020a. Washington State Water Well Report Viewer. https://appswr.ecology.wa.gov/wellconstruction/map/WCLSWebMap/default.aspx. Accessed June 2020.

Department of Ecology, 2020b. Washington State Water Quality Assessment, 303(d)/305(b) List. https://apps.ecology.wa.gov/ApprovedWQA. Accessed June 2020.

Department of Ecology, 2020c. River and Stream Flow Monitoring Network. https://fortress.wa.gov/ecy/eap/flows/station.asp?sta=28B080#block3

Evarts, R.C. and J.E. O'Connor, 2008. Geologic Map of the Camas Quadrangle, Clark County, Washington, and Multnomah County, Oregon. Scientific Investigations Map 3017.

Pacific Groundwater Group (PGG), 2004. City of Camas Water Supply Alternatives Investigation. Consultant's report prepared for the City of Camas by Pacific Groundwater Group and Fishman Environmental Services dated 10/22/2004.

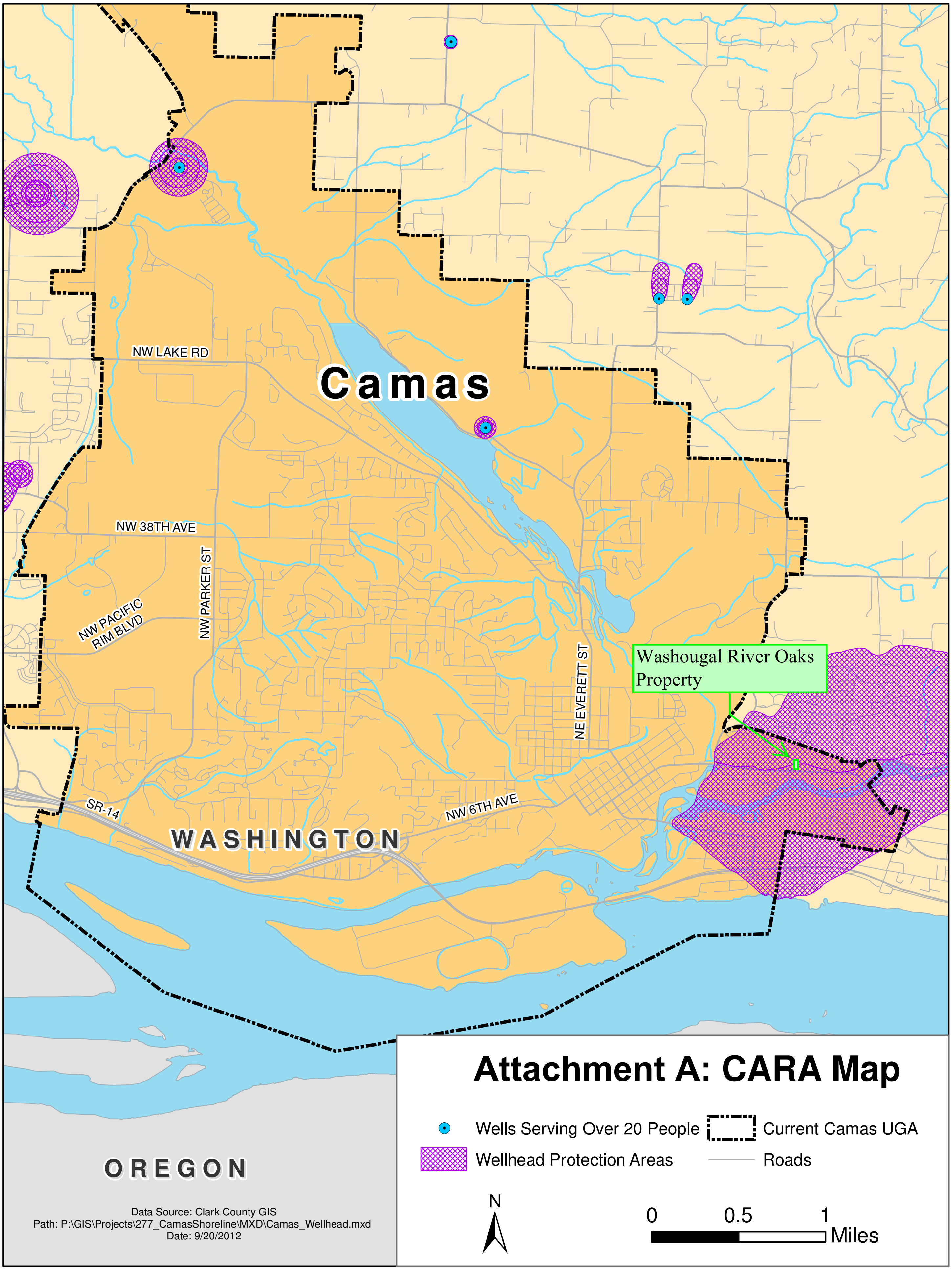
Soil and Water Technologies, Inc., 2018. Geotechnical Engineering Study, Proposed 2531 NE 3rd Avenue Subdivision, 2531 NE 3rd Avenue, Camas, Clark County, WA 98607.

US Department of Agriculture, 2020. SoilWeb Online soil Survey Browser. https://casoilresource.lawr.ucdavis.edu/gmap/. Accessed June 2020.

JZ2038

Attachment A

Critical Aquifer Recharge Area Map


Camas
NW LAKE RD
NW 38TH AVE
NW PARKER ST
NW PACIFIC RIM BLVD
NE EVERETT ST
Washougal River Oaks Property
SR-14
NW 6TH AVE
WASHINGTON
OREGON
Attachment A: CARA Map
Wells Serving Over 20 People
Current Camas UGA
Wellhead Protection Areas
Roads
N
0
0.5
1
Miles
Data Source: Clark County GIS
Path: P:\GIS\Projects\277_CamasShoreline\MXD\Camas_Wellhead.mxd
Date: 9/20/2012

Attachment B

Water Well Logs

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original with Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy
193883

WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent W220603
UNIQUE WELL I.D. # ALL-997
Water Right Permit No. 64072-A

(1) OWNER: Name City of Camas Address PO Box 1055 Camas, WA 98607

(2) LOCATION OF WELL: County Clark SW 1/4 NW 1/4 Sec 12 T 1 N.R. 3E WM

(2a) STREET ADDRESS OF WELL: (or nearest address) NE 1st Ave.

TAX PARCEL NO.: 090928-000

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) Well 13
☒ New Well ☐ Deepened ☐ Reconditioned ☐ Decommission
Method: ☐ Dug ☐ Bored ☒ Cable ☐ Driven ☐ Rotary ☐ Jetted

(5) DIMENSIONS: Diameter of well 20 inches
Drilled 111 feet. Depth of completed well 103 ft.

(6) CONSTRUCTION DETAILS
Casing Installed:
☒ Welded 20" Diam. from +2 ft. to 80 ft.
☐ Liner installed ___" Diam. from ___ ft. to ___ ft.
☐ Threaded ___" Diam. from ___ ft. to ___ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used ___
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.

Screens: ☒ Yes ☐ No ☐ K-Pac Location 77 ft
Manufacturer's Name Johnsons
Type 304 Stainless Model No. ___
Diam. 18 Slot Size 150 from 80 ft. to 98 ft.
Diam. ___ Slot Size ___ from ___ ft. to ___ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand ___
Material placed from ___ ft. to ___ ft.

Surface seal: ☒ Yes ☐ No To what depth? 34 ft.
Material used in seal Bentonite
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name ___
Type: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level 55 ft.
Static level 48.2 ft. below top of well Date 2/8/06
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? P66 / Holt
Yield: 1393 gal./min. with 1.9 ft. drawdown after 24 hrs.
Yield: ___ gal./min. with ___ ft. drawdown after ___ hrs.
Yield: ___ gal./min. with ___ ft. drawdown after ___ hrs.
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 2/8/06
Bailer test ___ gal./min. with ___ ft. drawdown after ___ hrs.
Airtest ___ gal./min. with ___ ft. drawdown after ___ hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water ___ Was a chemical analysis made? ☒ Yes ☐ No

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. Indicate all water encountered.

MATERIAL	FROM	TO
Brown Silt & Gravel	0	4
Brown Silt, Sand, Gravel & Boulders	4	13
Brown Silty Sand, Gravel & Cobbles	13	19
Brown Silt, Gravel, Cobbles & Boulders	19	25
Brown silty Gravel & Cobbles	25	29
Brown silty Sand, Gravel & cobbles	29	45
Brown slightly gravelly silty Sand	45	54
Brown silty Sand & Gravel	54	60
Brown siltbound Sand & Gravel	60	68
Brown Sand & Gravel with siltbound interbeds	68	86
Brown cobbly Sand and Gravel (loose)	86	92
Brown cobbly Sand & Gravel with siltbound interbeds	92	100
Tan-gray silt with weathered rock frags.	100	108
Bedrock	108	111

RECEIVED
APR 17 2006
Washington State Department of Ecology

Work Started 12/18/2005 Completed 2/10/2005

WELL CONSTRUCTION CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Type or Print Name Randy Holt License No. 1099 (Licensed Driller/Engineer)
Trainee Name ___ License No. ___
Drilling Company Holt Drilling / Boart Longyear
(Signed) Randy Holt License No. 1099 (Licensed Driller/Engineer)
Address Po Box 1890, Milton WA 98354
Contractor's Registration No. BOARTLC055PZ Date 4/04/06

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (360) 407-6600. The TDD number is (360) 407-6006.

ECY 050-1-20 (11/98)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W-48582
UNIQUE WELL I.D. #
Water Right Permit No.

(1) OWNER: Name Mark Thomas Address Camas Wa.

(2) LOCATION OF WELL: County Clark - NW 1/4 NW 1/4 Sec 12 T. 1 N., R. 3E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 3701 SE Crown Rd.

(3) PROPOSED USE: ☒ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one)
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 475 feet. Depth of completed well 475 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 6 " Diam. from +1 ft. to 37 ft.
Welded ☒ " Diam. from ft. to ft.
Liner installed ☐ " Diam. from ft. to ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 37 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 217 ft. below top of well Date 8-15-96
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest 150 gal./min. with stem set at 475 ft. for 5 hrs.
Artesian flow g.p.m. Date
Temperature of water 57 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Top Soil + Clay	0	6
Fractured Shale	6	22
Medium Grey Basalt w/Brown Basalt Ribs	22	318
Hard Grey Basalt	318	387
Vesecular Black Basalt w/Quartz	387	401
Medium Grey Basalt	401	435
Vesecular Black Basalt w/Quartz	435	471
Vesecular Brown Basalt w/Expanded Shales (w/B)	471	475

Work Started 8-14-96 19. Completed 8-15 19 96

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Bills Well Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address Goldendale - Wa.
(Signed) Donald D. K. Reed Jr. (WELL DRILLER) License No. 1052

Contractor's Registration No. BILLSWD088OC Date 8-15 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Attachment C

Excerpt from the Construction Stormwater General Permit cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Channels must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

b. Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches at the outlets of all conveyance systems.

9. Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The Permittee must:

a. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.

b. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.

c. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.

e. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, recycled concrete stockpiles, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. (Also refer to the definition for "concrete wastewater" in Appendix A--Definitions.)

g. Adjust the pH of stormwater or authorized non-stormwater if necessary to prevent an exceedance of groundwater and/or surface water quality standards.

h. Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete truck drums or concrete handling equipment onto the ground, or into storm drains, open ditches, streets, or streams. Washout of concrete handling equipment may be disposed of in a designated concrete washout area or in a formed area awating concrete where it will not contaminate surface or ground water. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge directly to groundwater or surface waters of the State is prohibited. Do not wash out to formed areas awaiting LID facilities.

i. Obtain written approval from Ecology before using any chemical treatment, with the exception of CO_2 or dry ice used to adjust pH.

j. Uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations may be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters. Prior to infiltration, water from water-only based shaft drilling that comes into contact with curing concrete must be neutralized until pH is in the range of 6.5 to 8.5 (su).

10. Control Dewatering

a. Permittees must discharge foundation, vault, and trench dewatering water, which have characteristics similar to stormwater runoff at the site, into a controlled conveyance system before discharge to a sediment trap or sediment pond.

b. Permittees may discharge clean, non-turbid dewatering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Special Condition S9.D.8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that “surface waters of the State” may exist on a construction site as well as off site; for example, a creek running through a site.

c. Other dewatering treatment or disposal options may include:

i. Infiltration.

ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.