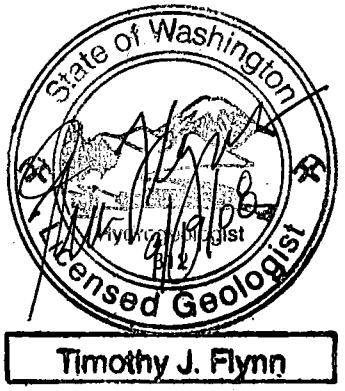
Department of Ecology
Publication No. 14-03-026

Aspect consulting
earth+water

MEMORANDUM

Project No.: 080088-001-01

September 22, 2008



To: Jan Brending, City of Bingen

From: **David H. McCormack, LHG, LEG**
Associate Engineering Geologist

Timothy J. Flynn, LHG, CGWP
Principal Hydrogeologist

Re: **Hydrogeologic Evaluation – Same Body of Groundwater Determination**
City of White Salmon Wells #1 and #2 and City of Bingen Wells

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Introduction

The City of Bingen (Bingen) filed a water right change application with the Klickitat County Water Conservancy Board (Board) requesting the addition of the City of White Salmon's (White Salmon) Wells #1 and #2 as additional points of withdrawal on Bingen's existing water rights. The Washington State Department of Ecology (Ecology) has indicated that a condition for addition of one or more of these points of diversion is demonstrating that the Bingen and White Salmon water supply sources are in hydraulic continuity and are tapping the same body of groundwater. The Board has requested that Bingen provide a hydrogeologic analysis to address Ecology's concern prior to further processing of the change application.

This technical memorandum summarizes the results of our hydrogeologic evaluation conducted to determine if the White Salmon's Well #1 and/or Well #2 are completed in the same body of groundwater as the existing Bingen water system wells (Bingen Park, Dry Creek, Reservoir and Maple Street wells). This evaluation was based on existing information, including well log data from Ecology data and published literature as noted in the References section. Work completed for this investigation was performed in accordance with our proposal to you, dated April 14, 2008.

Figure 1 shows the locations of the existing wells and the geologic elements of the project area. The evaluation includes analyses of the hydrostratigraphy of the area based on published geologic maps and interpretation of subsurface conditions based on lithologic descriptions and groundwater level information presented on well logs available from the Ecology well log database. The hydrogeologic evaluation also includes examination of historical water supply and observation well groundwater level data. Figure 2 presents an interpreted hydrostratigraphic cross-section of the area between the White Salmon and Bingen water system wells.

Hydrogeologic Setting

Hydrostratigraphy

Bedrock in the vicinity of the White Salmon and Bingen area (Newcomb, 1969; Bela, 1982; and Korosec, 1987) is locally mantled with thin surficial deposits of recent alluvium (Qa), landslide debris (Qls), and glacial flood deposits subdivided into silty and sandy deposits (Qfs), and gravelly deposits (Qfg). Figure 1 presents the mapped extent of these units. The uppermost bedrock unit consists of Quaternary age basalt flows and cinder deposits of the North of White Salmon basalt and the White Salmon basalt [Qvb(ws)] and [Qvb(wn)]. These Quaternary sediments and volcanic deposits are underlain by a thick sequence of Miocene age volcanic flows and inter-flow sediments of the Columbia River Basalt group (CRBG), which consists of flood basalt deposits present throughout much of south-central and southeastern Washington. The uppermost Miocene volcanic unit is the Frenchman Springs member [Mv(wfs)] of the Wanapum Basalt, and the lower consists of the Grande Ronde basalt [Mv(g)].

Each member of the CRBG is generally composed of numerous flows of variable lateral extent that range from several feet (ft) to hundreds of ft thick. The thicker flows generally include a sequence (from bottom upward) of basal colonnade, a thicker flow interior consisting of generally massive basalt, and a flow top. The flow top usually consists of vesicular basalt, which generally represents the primary water-bearing zone within the flow. Thinner flows generally consist of weathered, altered, rubbly or vesicular flow tops and bottoms with a fractured interior.

Between CRBG eruptive events, streams, rivers, and lakes covered portions of the basalt flow tops in structural low areas. Fluvial and lacustrine sediments interbedded within the various members of the CRBG collectively compose the Ellensburg Formation [Mc(e)]. These sedimentary interbeds range in thickness from inches to over 100 ft. The thicker interbeds may form prominent stratigraphic markers and are assigned formation names, including the Vantage interbed, which if present, lies between the Wanapum basalt and the Grand Ronde basalt.

Geologic Structures

Numerous faults and folds are present in the vicinity of the project area (Figures 1 and 2). The locations of geologic structures presented on Figures 1 and 2 are based on regional mapping, mapped bedding dip angles, and calculated dips based on the three-dimensional geometry of geologic contacts at the surface. Bedding dip angles are shown on Figures 1 and 2.

The Bingen wells are located in close proximity to the axis of the Bingen Anticline, a prominent northeast to southwest-trending structure. In the Bingen area, this anticline has about 1,000 ft of structural relief (Newcomb, 1969), which is defined as the amount of vertical offset of a stratum between the synclinal and anticlinal axes of the fold. More northeast-trending anticlines and synclines are mapped to the north and west of the Bingen Anticline.

A series of northwest-trending normal faults are also present in the area. Two of these faults, the Hood River fault and the Buck Creek fault form a structural block that extends between the White Salmon wells and the Bingen wells. Both of these faults are mapped as high-angle (nearly-vertical) faults with the southwestern side down-dropped.

Faults with significant displacement often develop a sheared and clayey gouge zone that acts as a barrier to groundwater flow, while faults with little displacement often have fractured zones that can act as conduits for groundwater movement and locally increase groundwater flow. Based on analysis of groundwater levels and description of brecciation and cementation in well logs, there is an unnamed and unmapped shear zone fault that lies between the White Salmon Wells #1 and #2. The presence of this structure was noted and shown schematically on cross-sections by Mark Yinger Associates (2001) and Bell Design Company (2002). This structure must dip south or southeast to account for its presence in Well #2 and absence in Well #1. The tectonics of the area suggests that it lies parallel to the syncline identified by Bela (1982) that extends parallel to Northwestern Lake, and surfaces near the topographic low area occupied by Northwestern Lake. Well logs for the each of the respective wells discussed above and below are provided in Attachment A.

Well Completion Hydrostratigraphy

White Salmon Well #1 (10A02) was completed in 1998 to a depth of 755 ft, and cased to 215 ft depth. The producing zone appears to be fractured and un-cemented basalt from 215 ft to the bottom of the hole. Groundwater flows during development increased from around 200 gallons per minute (gpm) to 1,100 gpm at the bottom of the hole.

Regional geologic maps indicate that Well #1 is completed within the Grande Ronde member of the CRBG. A thin sedimentary interbed consisting of brown sand and silt, and basalt fragments was noted at 360 ft below ground surface (bgs). This is interpreted to be a contact between Grand Ronde basalt flows. Groundwater inflows were noted to increase by 200 to 250 gpm when this interbed was encountered. No other significant stratigraphic markers were logged.

Production Well #2 (3Q01) was drilled to a depth of 1,242 ft bgs in 2000 and 2001, and cased to a depth of 804 ft. A prominently fractured to sheared and mineral-cemented zone is present from about 510 to 860 ft bgs. The producing zone appears to be from un-cemented, fractured to brecciated basalt below 860 ft. Shut-in groundwater pressures of around 100 pounds per square inch (psi) (static head at about elevation 702) were noted with flows increasing to about 500 gpm as drilling progressed to the bottom of the well. Geologic maps also indicate that this well is completed within the Grande Ronde basalt.

The Bingen water system (Mark Yinger Associates, 2005) consists of 4 wells (Bingen Park, Dry Creek, Reservoir and Maple Street wells), located about 5 miles southeast of the White Salmon wells. The Maple Street well has not been used since the late 1980s and no well logs were available for either the Maple Street or Reservoir wells. Based on the regional maps and logs of the Dry Creek well (30X03), drilled in 1980 to 423 ft depth, and the 2005 Bingen Park (30H03) well deepening log (deepened from 410 to 510 ft), the Bingen bedrock wells are completed within the Grande Ronde basalt. The Dry Creek (30X03) log notes basalt from a depth of 28 ft to the bottom of the hole at 423 ft, with the exception of "rhyolite" at a depth

of 219 to 238 ft. Since a rhyolite flow is geologically unlikely within a thick sequence of basalt flows, this is most likely a volcaniclastic sedimentary interbed that marks the contact between major Grande Ronde flows. Most of the water bearing zones in 30X03, and the producing zone for 30H03 would occur below this sedimentary interbed. No other significant basalt stratigraphic marker beds were noted in the other Bingen well logs.

Groundwater Level Evaluation

An evaluation of static groundwater head elevations (potentiometric surface) was performed in order to determine if the White Salmon wells appear to be producing from the same body of groundwater as the Bingen wells, and if significant hydraulic barriers are present. Static head levels obtained from well logs were contoured for all wells in the region, and separately for those completed in the Grande Ronde basalt. The analysis shows a regional groundwater mound in the topographic high area of Sections 12 and 13, located between the White Salmon and Bingen wells. This mound is interpreted to be due to recharge from the upland areas. Groundwater gradients slope from this recharge area to the north, west, and south – all toward regional surface water bodies in topographic low areas where discharge would be expected.

The regional groundwater elevations of the confined basalt aquifer zones within the structural block bounded by the Hood River and Buck Creek faults lie well above the tops of the anticline between the White Salmon wells and the Bingen wells (Figure 2). The producing zones for the wells occur in folded stratigraphic layers that remain below the potentiometric surface. The available information does not suggest the presence of low-permeability fault barriers, indicating hydraulic continuity through the anticlines and synclines between the White Salmon and Bingen wells within this structural block.

Groundwater level contours for wells completed in the Grande Ronde basalt are shown on Figure 1. White Salmon Well #2 is noted to be completed below the sheared and cemented fault zone present from 510 to 860 ft bgs (shown on Figure 2 and discussed in the hydrogeologic setting section above), and Well #1 is completed above this fault. A steep groundwater gradient (Figure 1) is present between Well #1 and Well #2 with a measured head difference of about 400 ft. The difference in heads between these nearby wells demonstrates the presence of a low-permeability barrier, interpreted to be the sheared and faulted zone identified in Well #2. Since this unnamed fault is located between Well #1 and Well #2, these wells do not appear to be in hydraulic continuity. No other groundwater barriers are apparent between White Salmon Well #1 and the Bingen wells.

Summary of Conclusions

Based on the completion of this hydrogeologic evaluation, we conclude the following:

- The Bingen basalt wells and the White Salmon Wells #1 and #2 are all completed within the Grande Ronde basalt hydrostratigraphic unit.
- White Salmon Well #2 is separated from Well #1 and from the Bingen wells by a hydraulic barrier created by a sheared and cemented fault zone. Wells #1 and #2 therefore do not meet the Ecology definition of being completed in the same body of groundwater.

- There is a syncline and an anticline located between the White Salmon and Bingen wells. The amplitude of these structures which is inferred from bedding dip angles would not prevent lateral flow of groundwater within individual water-bearing layers or flow contacts.
- Groundwater head levels do not indicate the presence of hydraulic barriers between White Salmon Well #1 and the Bingen wells.
- Therefore, White Salmon Well #1 is in hydraulic continuity with the City of Bingen basalt wells, and they are completed in the same body of groundwater.

References

Bela, J.L., compiler, 1982, Geologic and Neotectonic Evaluation of North-Central Oregon: The Dalles 1° x 2° quadrangle, Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-27.

Bell Design Company, 2002, City of White Salmon Wellhead Protection Plan. May 6, 2002.

Drost, B.W., Whiteman, K.J., and Gonthier, J.B., 1990, Geologic framework of the Columbia Plateau aquifer system, Washington, Oregon, and Idaho, U.S. Geological Survey Water-Resources Investigations Report 87-4238.

Korosec, M.A., compiler, 1987, Geologic map of the Hood River quadrangle, Washington and Oregon, Washington Division of Geology and Earth Resources Open File Reports 87-6.

Mark Yinger Associates, 2001, Aquifer Test Report for Production Well #2 – City of White Salmon. May 21, 2001.

Mark Yinger Associates, 2005, Letter Concerning City of Bingen Water Wells. November 9, 2005.

Newcomb, R.C., 1969, Effect of Tectonic Structure on the Occurrence of Ground Water in the Basalt of the Columbia River Group of The Dalles Area, Oregon and Washington, U.S. Geological Survey Professional Paper 383-C.

Washington State Department of Ecology online well database - http://apps.ecy.wa.gov/welllog/.

Attachments

Figure 1 – Well Location and Geologic Map
Figure 2 – Cross Section A-A'
Appendix A – Well Logs

W:\080088 City of Bingen - Water Rights Support Services\Deliverables\Hydrogeologic Evaluation\Memo 9-22-08

Geology Data Sources: WA DNR 1:100K; Bela, 1980; Newcomb, 1969

Surficial Geologic Units

- Qa - alluvium
- Qfg - outburst flood deposits (gravels)
- Qfs - outburst flood deposits (silts and sands)
- Qls - landslide
- Qva(mf) - McCoy Flat andesite
- Qva(rs) - Rattle Snake Creek andesite
- Qvb - basalt flows (unnamed)
- Qvb(ic) - Ice Cave basalt
- Qvb(uw) - Underwood basalt
- Qvb(wn) - North of White Salmon basalt
- Qvb(ws) - White Salmon basalt
- QPLvb - basalt flows
- Mc(e) - Ellensburg formation
- Mv(wfs) - Wanapum basalt, Frenchman Springs
- Mv(g) - Grande Ronde basalt

Faults

- Fault, unknown offset, concealed
- Normal fault, bar and ball on downthrown side
- Normal fault, concealed, bar and ball on downthrown side
- Normal fault, inferred, bar and ball on downthrown side
- Strike and Dip

Folds

- Anticline
- Anticline, concealed
- Syncline
- Syncline, concealed

N W E S

T04R10E T04R11E T03R10E T03R11E

Hood River Fault

Buck Creek Fault

Bingen Anticline

Columbia River

Hood River Bridge

Q01 (Production Wells #2)

A02 (Production Wells #1)

X03 (Dry Creek)

H03 (Bingen Park)

Portway

Riverside

May

Belmont

Mv(gR2) Mv(wfs) Mc(e) Qvb Qvb(ic) QPLvb Qfs Qls Qvb(uw) Qvb(wn) Qvb(ws) Qva(mf) Qfg Qa

A A'

17 2 4 5 7

0 3,000 6,000 Feet

Wells

Depth (ft)

- 4 - 100
- 101 - 250
- 251 - 500
- 501 - 750
- 751 - 1242

Location Source

- GPS
- Qtr-Qtr Section
- Grande Ronde Aquifer Groundwater Elevation Countours (ft)
- Cross Section
- Sections
- Township and range

Aspect consulting earth+water www.aspectconsulting.com

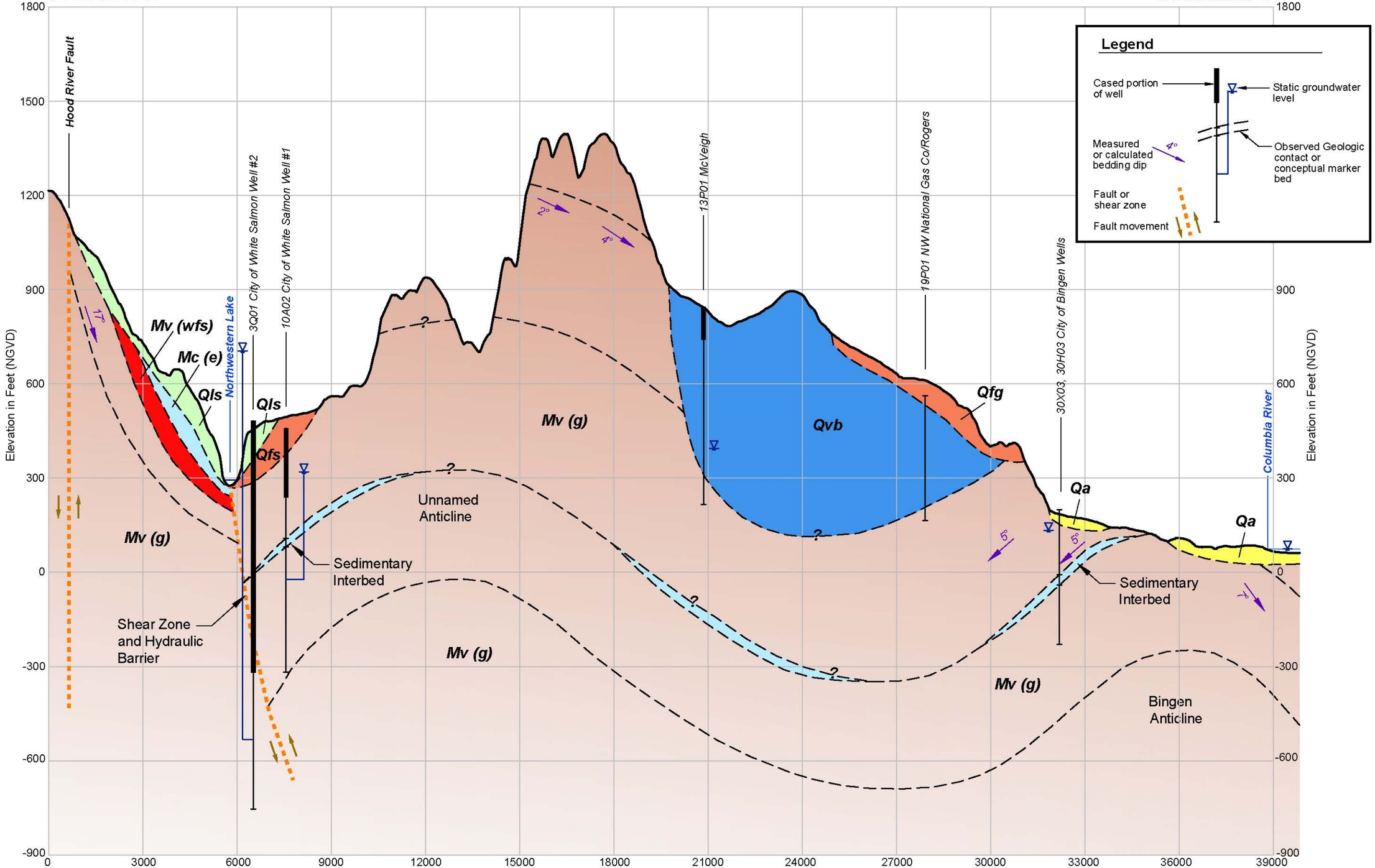
Well Location and Geologic Map

City of Bingen Water Rights Support
Bingen, WA

DATE:	PROJECT NO.
Aug 2008	080088
DESIGNED BY: ACM	
DRAWN BY: ACM	FIGURE NO. 1
REVISED BY: PPW	

T:\projects_8\white_salmon\2008\Working\well_locs_and_geo.mxd

A Northwest — Southeast A'



Refer to Figure 1 for explanation of Geologic Units

Vertical Exaggeration = 10X
Scale: 1" = 3000' Horiz.
1" = 300' Vert.

0 1000 2000
Feet

Aspect consulting earth+water
www.aspectconsulting.com
a limited liability company

Cross Section A-A'

City of Bingen Water Rights Support
Bingen, Washington

DATE: Aug 2008	PROJECT NO. 080088
DESIGNED BY: JMS	
DRAWN BY: PMB	FIGURE NO. 2
REVISED BY: -	

Q:\City of Bingen\2008-08\080088-AA.dwg

APPENDIX A

Well Logs

3Q01

Project: City of White Salmon
Boring method: Air Rotary - Rev. Circulation
Logged by: Mark Yinger, 10/16/00 - 3/14/01
Ground surface elev.:

Well No.: **Power House Rd. Prod. #2**
Borehole Diameter: 28, 24, 20 and 15 inch
Sheet: 1 of 4
Casing elev.:

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
0	0 - 85 ' Brown elastic silt with fine sand 5% to 10%. angular. SWL 23.3'.	MH				
50						
	85 - 91' Gray clay with basalt fragments and fine sand 5%, firm. SWL 31.7'.	CL				
100	91 - 136' Black basalt with 1 - 1.5 mm gray phenocrysts. Air rotary drilling hard. Produces fine chips, massive. Bottom 10 feet broken. SWL 42' at 134'.					
	136 - 142' Gray gravel and and basalt boulders, basalt and andesite gravel coarse well rounded 50%, boulders 25%, sand fine to coarse subangular to rounded 25%.	SW-SC				
150	142 - 180' Gray clayey-gravel with sand and boulders, basalt and andesite gravel fine to coarse well rounded 50%, sand fine to coarse subangular to rounded 25%. SWL 68'.					
	180 - 189' Gray weathered basalt, finely fractured with minor sand and clay, sand fine to coarse subangular.	SC				
200	189 - 305' Brownish-gray basalt, very fine grained aphanitic, finely fractured, easy drilling. Most chips have several surfaces colored with oxides, evidence intense fracturing.					
250						
300						

Groundwater & Environmental Consultants
Mark Yinger Associates
4865 Baseline Road, Parkdale OR, 97041 - 541-352-6015

Power House Road Prod. Well #2

3201

Project: City of White Salmon
Boring method: Air Rotary - Rev. Circulation
Logged by: Mark Yinger, 10/16/00 - 3/14/01
Ground surface elev.:

Well No.: **Power House Rd. Prod. #2**
Borehole Diameter: 28, 24, 20 and 15 inch
Sheet: 2 of 4
Casing elev.:

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
300	305 - 360 ' Grayish-black basalt more massive less fracture, finer cuttings 3 to 5 mm. 15 to 25 % facture surface colored with oxides, SWL 96'.					
350	360 - 450' Black basalt, coarser cuttings 1 to 2 cm, few surfaces with oxides.					
400						
450	450 - 510' Black basalt, coarser cuttings 1 to 4 cm, intensely fractured, almost all surfaces coated with oxides.					
500	510 - 760' Black basalt, fractured, fractures cemented with greenish-white hard cement that does not effervescent under dilute hydrochloric acid, cement oxidizes to a light-brown, cuttings 0.5 to 1cm.					
550						
600						

Ground water & Environmental Consultants
Mark Yinger Associates
4865 Baseline Road, Parkdale OR, 97041 - 541-352-6015

3 Q01

Project: City of White Salmon
Boring method: Air Rotary - Rev. Circulation
Logged by: Mark Yinger, 10/16/00 - 3/14/01
Ground surface elev.:

Well No.: **Power House Rd. Prod. #2**
Borehole Diameter: 28, 24, 20 and 15 inch
Sheet: 3 of 4
Casing elev.:

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
600						
650						
700	SWL 120.5', 300 gpm.					
750						
	760 - 845' As above, with traces of pyrite.					
800	SWL 109', harder drilling, 3 fpm					
	845 - 859' Grayish-black basalt breccia, very finely fractured, fractures cemented with greenish-white cement, fine cuttings 1 to 2.5 mm. Approximately 40% cement.					
850						
	859 - 870' Grayish-black basalt microbreccia, 0.25 to 2.5 mm angular basalt grains in a dark gray aphanitic matrix, some basalt frags to 1 cm, larger cuttings show faint flow banding, hard slow drilling.					
	870 - 955' Black basalt fractured, fracture surfaces coated with oxides, coarser cuttings, 1 to 3 cm, increasing water, flowing over casing at 75 gpm, shut-in 96 psi.					
900	Thin microbreccias at 896' and 913'.					

3Q01

Project: City of White Salmon
Boring method: Air Rotary - Rev. Circulation
Logged by: Mark Yinger, 10/16/00 - 3/14/01
Ground surface elev.:

Well No.: **Power House Rd. Prod. #2**
Borehole Diameter: 28, 24, 20 and 15 inch
Sheet: 4 of 4
Casing elev.:

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
900	173 feet of drawdown while blowing approx. 500 gpm.					
950	955 - 1050' Black basalt, aphanitic, much less fractured, fine cuttings 3 to 10 mm, fractures coated with a soft greenish-black mineral possibly chlorite, non-effervescent, trace pyrite, shut-in 100 psi.					
1000						
1050	1050 - 1100' Dark-gray basalt, fine grained, olivine?, very fractured and loose, caving from 1065 to 1080, almost all surfaces of cuttings are fracture surfaces coated with oxides, cuttings 1 to 8 cm, gained significant volume of water. Fragments of this zoned caved for the remainder of the drilling.					
1100	1100 -1160' Grayish-black basalt fine grained, olivine?, fractured, tight, fractures coated with a soft green to dark-green mineral possibly chorite and serpentinite.					
1150	1160 -1242' black basalt, aphanitic, less fractured, tight, fractures coated with a soft dark-green mineral possibly chorite, hard drilling 31.7 feet of drawdown while blowing approx. 500 - 550 gpm, free flow approx. 420 gpm,					
1200	Bottom of hole at 1242', Shut-in 98 psi.					

Ground water & Environmental Consultants
Mark Yinger Associates
4865 Baseline Road, Parkdale OR, 97041 - 541-352-6015

Power House Road Prod. Well #2

Project: City of White Salmon
Boring method: Air Rotary - Cable Tool
Logged by: Mark Yinger, Sept-Oct/98
Ground surface elev.: 432.88

Boring No.: Power House Road Test Well
Borehole Diameter: 16, 12 & 10 inch
Sheet: 1 of 3
Casing elev.: 434.63

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
0	0 - 75' Brown elastic silt with fine sand 5% to 10%.	MH				
50						
	75 - 92' Gray lean clay with fine sand 5%, firm.	CL				
100	92 - 100' Black broken basalt with fat clay 10% and fine to coarse angular sand 10%. Basalt vesicular.					
	100 - 135' Black basalt with distinctive 1 - 1.5 mm gray phenocrysts. Air rotary drilling hard. Produces blade like chips, massive. Bottom 10 feet broken. SWL 52' at 126', making 15 gpm.				▽	
150	135 - 158' Gray well graded sand with gravel clay and basalt boulders, basalt and andesite gravel fine to coarse well rounded 25%, sand fine to coarse subangular to rounded 60%. SWL 44', 50 gpm.	SW-SC				
	158 - 180' Gray clayey sand with gravel and boulders, basalt and andesite gravel fine to coarse well rounded 25%, sand fine to coarse subangular to rounded 50%. SWL 55', 30 gpm.	SC				
200	180 - 200' Gray clayey sand and gravel with basalt boulders, gravel fine to coarse well rounded 20%, sand fine to coarse subangular 20%, subangular boulders to 40%, partially cemented with oxides. Hard Drilling. SWL 80', 50 gpm.					
	200 - 280' Brownish-gray basalt, finely fractured, easy drilling. Most chips have at least one surface colored with oxides, evidence fine fracturing. SWL 130', 300 gpm					
250						
	280 - 360' Black basalt, finely fractured, easy drilling.					
300						

Environmental & Ground Water Consultants
Mark Yinger Associates
4865 Baseline Road, Parkdale OR, 97041 - 541-352-6015

10A02

Project: City of White Salmon
Boring method: Air Rotary - Cable Tool
Logged by: Mark Yinger, Sept-Oct/98
Ground surface elev.:

Boring No.: **Power House Road Test Well**
Borehole Diameter: 16, 12 & 10 inch
Sheet: 2 of 3
Casing elev.:

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
300						
	360' Brown silt and sand with basalt fragments. Based primarily on brief change in color of discharge water. Picked up 200 to 250 gpm. SWL 125'					
350						
	360 - 755' Gray to brownish-gray basalt, fractured easy drilling. SWL steady at 125' Steady increase in flow to 1,100 gpm at 755'					
400						
450						
500						
550						
600						

Environmental & Ground Water Consultants
Mark Yinger Associates
4865 Baseline Road, Parkdale OR, 97041 - 541-352-6015

10A02

Project: City of White Salmon
Boring method: Air Rotary - Cable Tool
Logged by: Mark Yinger, Sept-Oct/98
Ground surface elev.:

Boring No.: Power House Road Test Well
Borehole Diameter: 16, 12 & 10 inch
Sheet: 3 of 3
Casing elev.:

Depth Feet	Geologic Description	USC	Sample No.	Blow Count	Ground Water Level	Completion Design
600						
650						
700						
750	Bottom of 10" open hole at 755 feet.					
	Note: A sample of drill cuttings was collected at ten foot intervals.					
800						
850						
900						

Environmental & Ground Water Consultants
Mark Yinger Associates
4865 Baseline Road, Parkdale OR, 97041 - 541-352-6015

13P01

WATER WELL REPORT

Start Card No. W183117
Unique Well I.D. # AKL710
Water Right Permit No.

168639

STATE OF WASHINGTON

(1) OWNER: Name MCVEIGH MICHAEL (01932) Address 1228 SNOWDEN RD WHITE SALMON, WA 98672-

(2) LOCATION OF WELL: County KLICKITAT - SE 1/4 SW 1/4 Sec 13 T 3 N., R 10E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 1330 DILLON RIDGE RD, WHITE SALMON

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 170 ft. Depth of completed well 170 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 19 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
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 0 ft. below top of well Date 02/22/05
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

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

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min, ft. drawdown after hrs.
Air test 0 gal/min. w/ stem set at 160 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
TOP SOIL	0	2
BROWN CLAY & BROKEN	2	8
BASALT	2	8
GRAY BASALT ,HARD	8	40
GRAY & RED BASALT ,FRACTURED	40	52
FRACTURED BASALT & CINDERS	52	70
RED CLAY ,HARD	70	78
GRAY CINDERS W/BROWN CLAY	78	102
RED & GRAY CINDERS	102	170

DEPT. OF ECOLOGY Received FEB 28 2005 CENTRAL REGION OFFICE

Work started 02/21/05 Completed 02/22/05

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 M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] _____ License No. 833, (2740,) 2560

Contractor's
Registration No. MKDRIC134PE Date 02/23/05

13P01

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W189162
Unique Well I.D. # AKL710
Water Right Permit No.

176800

(1) OWNER: Name MCVEIGH MICHAEL (01967) Address 1228 SNOWDEN RD WHITE SALMON, WA 98672-

(2) LOCATION OF WELL: County KLICKITAT - SE 1/4 SW 1/4 Sec 13 T 3 N., R 10E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 1330 DILLON RIDGE RD, WHITE SALMON

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
DEEPENED Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 440 ft. Depth of completed well 610 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 99 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
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 455 ft. below top of well Date 07/05/05
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

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

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 15 gal/min. w/ stem set at 600 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
RED & GRAY CINDERS	170	190
GRAY BASALT ,MEDIUM HARD	190	201
GRAY CINDERS ,MEDIUM	201	212
RED CINDERS ,SOFT	212	240
GRAY BASALT ,MEDIUM HARD	240	259
RED & GRAY CINDERS ,MEDIUM	259	290
GRAY BASALT ,MEDIUM HARD	290	321
RED & GRAY CINDERS	321	362
RED CINDERS	362	482
GRAY & RED CINDERS	482	558
GRAY & BROWN BASALT ,CREVISED	558	595
,WATER BEARING	558	595
GRAY BASALT ,MEDIUM HARD	595	610

DEPT OF ECOLOGY Received JUL 29 2005 CENTRAL REGION OFFICE

Work started 06/30/05 Completed 07/05/05

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 M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Gabe Klein License No. 0833,2740 (2560)

Contractor's Registration No. MKDRIC134PE Date 07/5/05

19P01

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. _____

UNIQUE WELL I.D. # _____

Water Right Permit No. _____

(1) OWNER: Name Northwest Natural Gas Co./Rogers Address P.O. Box 4709 Portland, Ore. 97208-4708

(2) LOCATION OF WELL: County Klickitat SE 1/4 SW 1/4 Sec 19 T. 3N N., R 11E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) SE 6th Ave. & Jewett Blvd. White Salmon, Wa.

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

(4) TYPE OF WORK: Owner's number of well (If more than one) Rect. # 355

Abandoned ☐ New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches.
Drilled 384 feet. Depth of completed well 384 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" steel Diam. from 0 ft. to 19' ft.
Welded ☐ 1" PVC SCH80 Diam. from 0 ft. to 384' ft.
Liner installed ☐ Threaded ☐ 1" PVC SCH40 Diam. from 0 ft. to 384 ft.

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? 124' ft.
Material used in seal Bore Plug
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

NOT A WATER WELL

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

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 0 ft. below top of well Date 11-14-97
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

NOT A WATER WELL

Date of test _____
Bailer test 0 gal./min. with 0 ft. drawdown after 0 hrs.
Airtest 0 gal./min. with stem set at 0 ft. for 0 hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ 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
Crushed rock	0	1
Sand gravel and clay	1	6
Broken rock and clay	6	9
Lava Rock loose layers 180-210	9	335
300-315		
Gray rock hard	335	380
Broken gray rock water	380	384

NOT A WATER WELL

RECEIVED
DEC 22 1997
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

NOT A WATER WELL

Work Started 11-4-97 19. Completed 11-14-97 19

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 Hansen Drilling Co., Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 6711 NE 58th Ave. Vancouver, Wa. 98661

(Signed) Timothy James (WELL DRILLER) License No. 1342

Contractor's Registration No. HANSED*377NT Date 11-19-97 19

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

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

Application No. 30403
Permit No. ....

(1) OWNER: Name City of Bingen   Address Bingen, WA 98605

(2) LOCATION OF WELL: County Klickitat   SE ¼ NE ¼ Sec. 30 T. 3 N., R. 10E W.M.

Bearing and distance from section or subdivision corner Water Right no G4-25406C

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

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

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 423 ft. Depth of completed well 423 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from 0+ ft. to 58 ft.
Threaded ☐ ____" Diam. from ____ ft. to ____ ft.
Welded ☒ ____" Diam. from ____ ft. to ____ ft.

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? 58 ft.
Material used in seal Cement Grout
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 58' ft. below top of well Date 12-18-80
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
Air test		300 gal plus			

Date of test 12-18-80
Bailer test ____ gal./min. with ____ ft. drawdown after 2 hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG: Well #4 "Park"

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 formation.*

MATERIAL	FROM	TO
Top soil & river gravel	0'	5'
river gravel & boulders W.B.	5'	28'
gray basalt, med hard	28'	87'
black basalt, porous	87'	114'
gray basalt, med hard	114'	127'
black basalt, green & white mineral	127'	146'
black basalt, vesicular WB	146'	170'
black basalt, med hard	170'	189'
gray basalt, hard	189'	219'
gray & black ryolite	219'	238'
gray basalt, hard	238'	308'
gray basalt, crevised, hard, WB	308'	350'
black & brown basalt, vesicular WB	350'	354'
gray basalt hard	354'	410'
gray basalt, crevised WB	410'	414'
gray basalt hard	414'	423'

Work started 12-12- 1980. Completed 12-18- 1980

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME M-K Drilling Company (Person, firm, or corporation) (Type or print)

Address P.O.Box 206 Dallesport, WA 98617

[Signed] Karl F. Moore (Well Driller)

License No. 0344 Date 12-20-80, 19 80

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30H03

18118S

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W189135
Unique Well I.D. # ALC862
Water Right Permit No.

(1) OWNER: Name CITY OF BINGEN (02002) Address P O BOX 607 BINGEN, WA 98605-

(2) LOCATION OF WELL: County KLICKITAT - SE 1/4 NE 1/4 Sec 30 T 3 N., R 11E WM
(2a) STREET ADDRESS OF WELL (or nearest address) BINGEN PARK WELL, BINGEN

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
DEEPENED Method: ROTARY

(5) DIMENSIONS: Diameter of well 8 inches
Drilled 100 ft. Depth of completed well 510 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: " Dia. from ft. to ft.
" Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: NO To what depth? ft.
Material used in seal
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
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 50 ft. below top of well Date 08/29/05
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

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

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 150 gal/min. w/ stem set at 490 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG H

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 in formation.

MATERIAL	FROM	TO
GRAY BASALT ,MEDIUM	410	455
GRAY & BLACK BASALT ,CREVISED, W.B.	455	472
GRAY BASALT W/GREEN CLAYSTONE	472	480
GRAY BASALT W/WHITE SEAMS	480	492
BLACK, GRAY BASALT	492	504
POROUS ,WATER BEARING	492	504
GRAY BASALT ,HARD	504	510

DEPT OF ECOLOGY Received OCT 0 3 2005 CENTRAL REGION OFFICE

Work started 08/29/05 Completed 08/29/05

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 M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 , DALLESPORT, WA

[SIGNED] Gabe Haase License No. 0833,2740,2560

Contractor's
Registration No. MKDRIC134PE Date 09/07/05

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion

WATER WELL REPORT

STATE OF OREGON
(Please type or print)
(Do not write above this line)

Dry Creek Well 30x03

State Well No .....

State Permit No .....

copy

(1) OWNER:

Name Town of Bingen

Address Bingen, Washington

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:

Threaded ☐ Welded ☒

8 " Diam from 0 ft to 40 ft Gage ¼ wall

" Diam from ft to ft Gage

Diam from ft to ft Gage

(6) PERFORATIONS:

Perforated? ☐ 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.
perforations from ft to ft
perforations from ft to ft.

(7) SCREENS:

Well screen installed? ☐ Yes ☒ No

Manufacturer's Name When well was enlarged from 8" to 12" Type the last 30' was filled with material from Drilling Model No.

Diam. Slot size Set from ft to ft.

Diam Slot size Set from ft to ft.

(8) WATER LEVEL: Completed well.

Static level 100 ft. below land surface Date 9-2-69

Artesian pressure lbs. per square inch Date

(9) WELL TESTS

Drawdown is ... water level is lowered below ...

Was a pump test made? ☐ Yes ☒ No If yes, by whom?

Yield gal./min with ft. drawdown after hrs

" " " "

" " " "

~~Bail~~ test 275 plus gal./min. with 150 ft drawdown after 1 hrs

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:

Well seal—Material used cement

Depth of seal from 38 to 0 feet ft.

Diameter of well bore to bottom of seal 12 in.

Were any loose strata cemented off? ☐ Yes ☒ No Depth

Was a drive shoe used? ☐ Yes ☒ No

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

(11) LOCATION OF WELL:

County Driller's well number

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner

Walnut & Jefferson
NW Dry Creek

(12) WELL LOG:

Reamed To 12 inches
Diameter of well below casing 8 inch

Depth drilled 330 ft. Depth of completed well 330 ft.

Formation: Describe color, texture, grain size and structure of materials and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Sand and boulders	0	33	
Blue basalt with brown	33	38	
Blue basalt hard	38	50	
Blue basalt med.	50	85	
Brown lava rock	85	90	
Blue basalt	90	200	
Brown rock med.	200	235	
Blue rock with seams	235	275	
Brown and grey mixed	275	300	
Hard grey rock	300	330	

Proved Depth 300'

25 gal min. @ 135 ft.
75 gal min. @ 165 ft.
275 gal min. @ 310 ft.
finished at 330 with 275 gal min. or better.

Work started 8-25-69 19 Completed 9-2-69 19

Date well drilling machine moved off of well 9-2-69 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] (Drilling Machine Operator) Date ....., 19...

Drilling Machine Operator's License No. Oregon 566

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ralph Turner Drilling Co. (Marty Bright)
(Person, firm or corporation) (Type or print)

Address Rte 1 Box 141 Hillsboro, Oregon

[Signed] (Water Well Contractor)

Contractor's License No. 247 Date 9 - 2 19 69

USE ADDITIONAL SHEETS IF ...