All Lines Approximated and Should be Verified

11711 NE Highway 240, Yamhill

Property Information

THE KELLY GROUP REAL ESTATE

Kelly Hagglund, Principal Broker
Licensed in Oregon

REALTOR® MULTIPLE LISTING SERVICE MLS® EQUAL HOUSING OPPORTUNITY

Table of Contents

General Vineyard & Land Information

Cantwell Vineyard

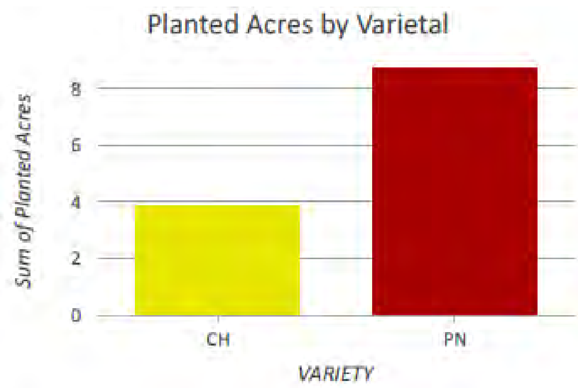
Appellation	Vineyard Manager (V.M.)	Vineyard	Block	Sub Block	Planted	Grafted	Variety	Clone	Start	Rows	Rootstock	Planted Acres	GPS Acres
Yamhill-Carlton/WillametteV	L. Catoria	Cantwell	20801	1	2016		PN	1A	SE	1-21 / 1-15	101-14	1.79	1.72
Yamhill-Carlton/WillametteV	L. Catoria	Cantwell	20802	2	2016		PN	667	S	1-59	101-14	2.86	2.86
Yamhill-Carlton/WillametteV	L. Catoria	Cantwell	20803	3	2016		PN	Pommard	S	1-77	101-14	4.14	4.18
Yamhill-Carlton/WillametteV	L. Catoria	Cantwell	20804	4	2016		CH	72 (Wente)	NW	1-34	3309C	0.90	1.01
Yamhill-Carlton/WillametteV	L. Catoria	Cantwell	20805	5	2016		CH	548	NW	35-54	3309C	0.98	0.98
Yamhill-Carlton/WillametteV	L. Catoria	Cantwell	20806	6	2016		CH	76	NW	55-99	3309C	2.04	2.07
												12.71	

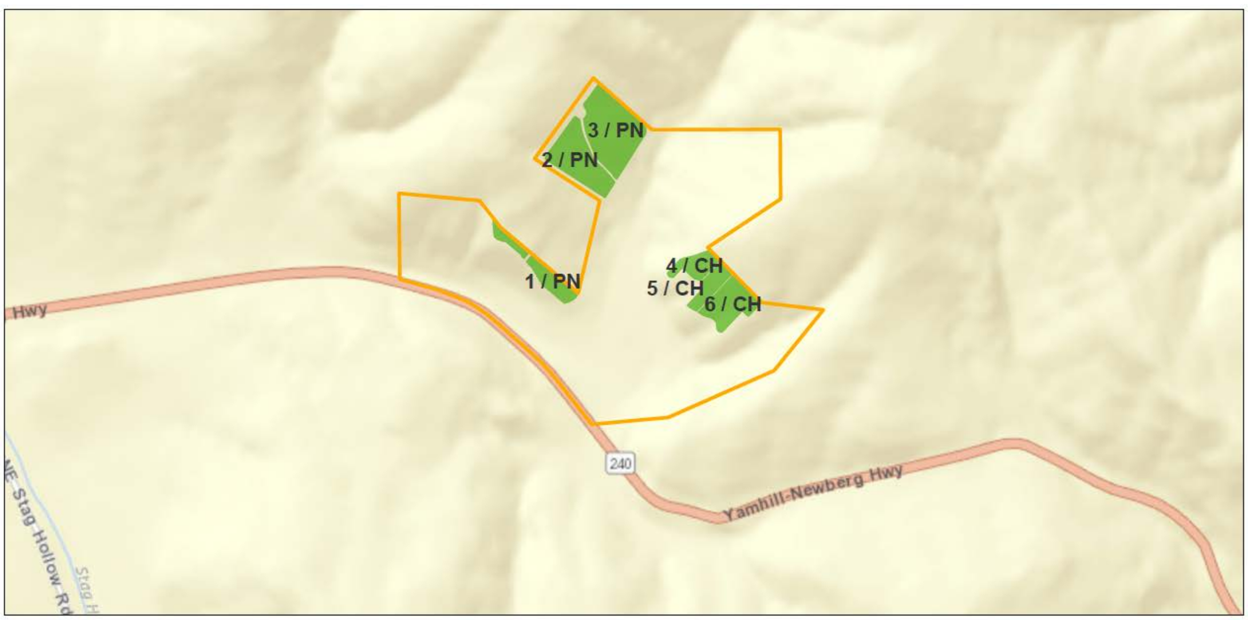
Cantwell Vineyard

Row Direction	Spacing	Trellis	Updated
132°	6.56 X 3.28	VSP-Train	12.13.2016
124°	6.56 X 3.28	VSP-Train	12.13.2016
124°	6.56 X 3.28	VSP-Train	12.13.2016
45°	6.56 X 3.28	VSP-Train	12.13.2016
45°	6.56 X 3.28	VSP-Train	12.13.2016
45°	6.56 X 3.28	VSP-Train	12.13.2016

Grape Varieties and Vineyard Information

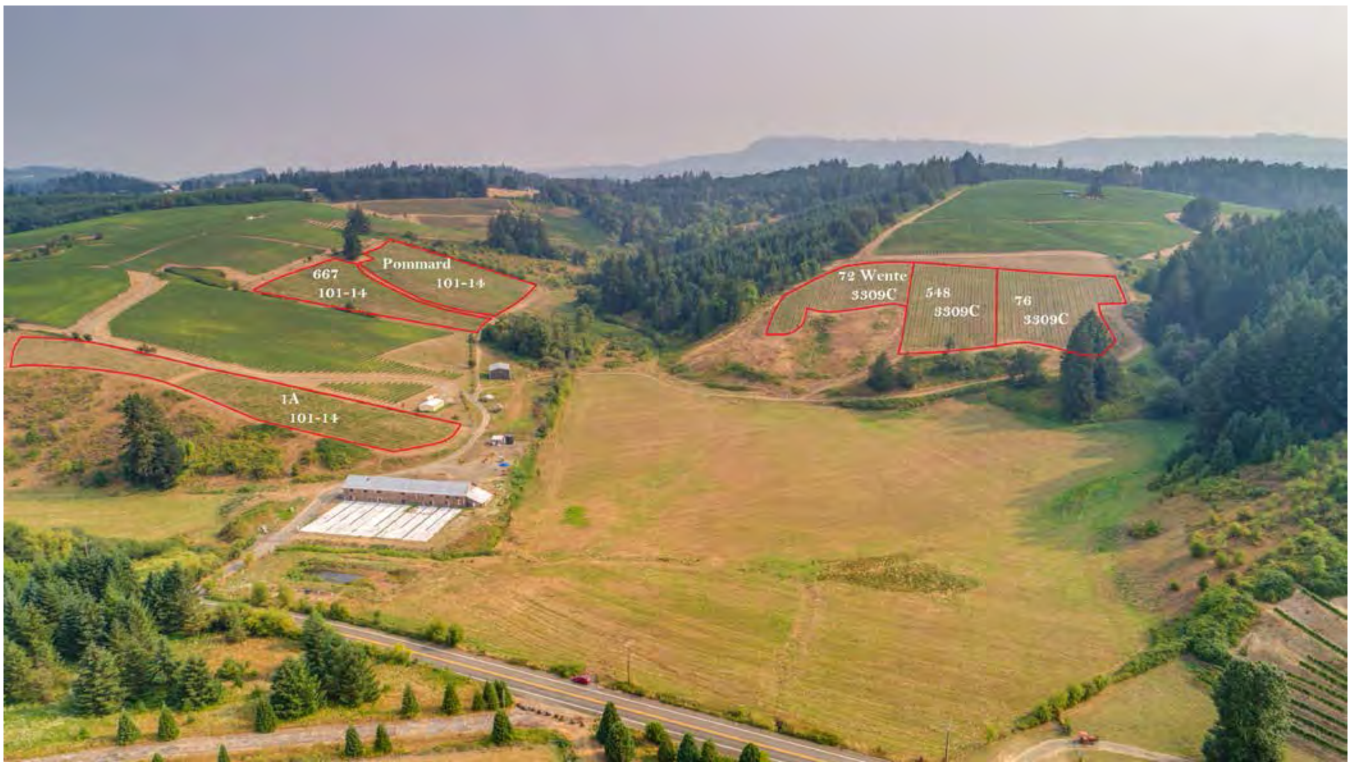
SUBBLK_FIL	ACRES	VARIETY	CLONE	PLANTED
1	1.168	PN	1A	2016
1	0.549	PN	1A	2016
2	2.857	PN	667	2016
3	4.182	PN	Pommard	2016
4	1.012	CH	72 (Wente)	2016
5	0.982	CH	548	2016
6	2.069	CH	76	2016

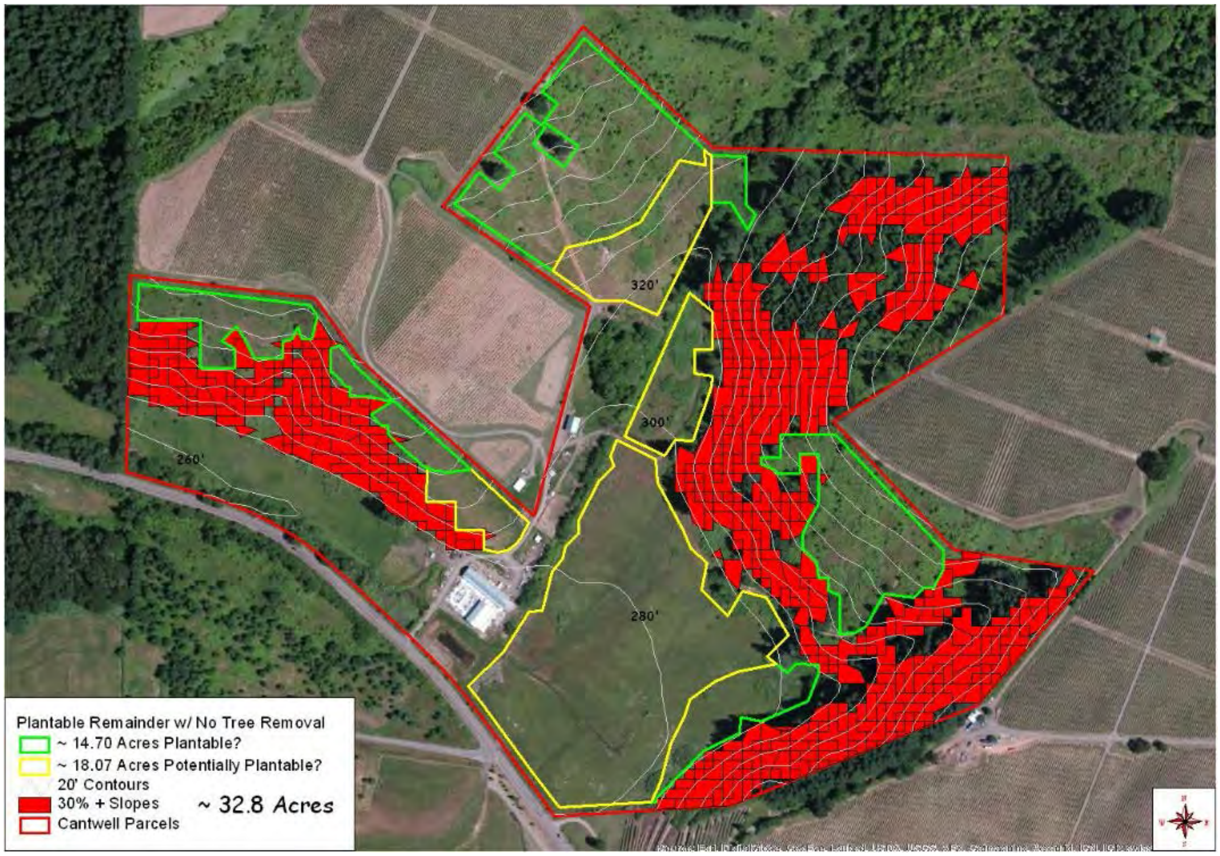


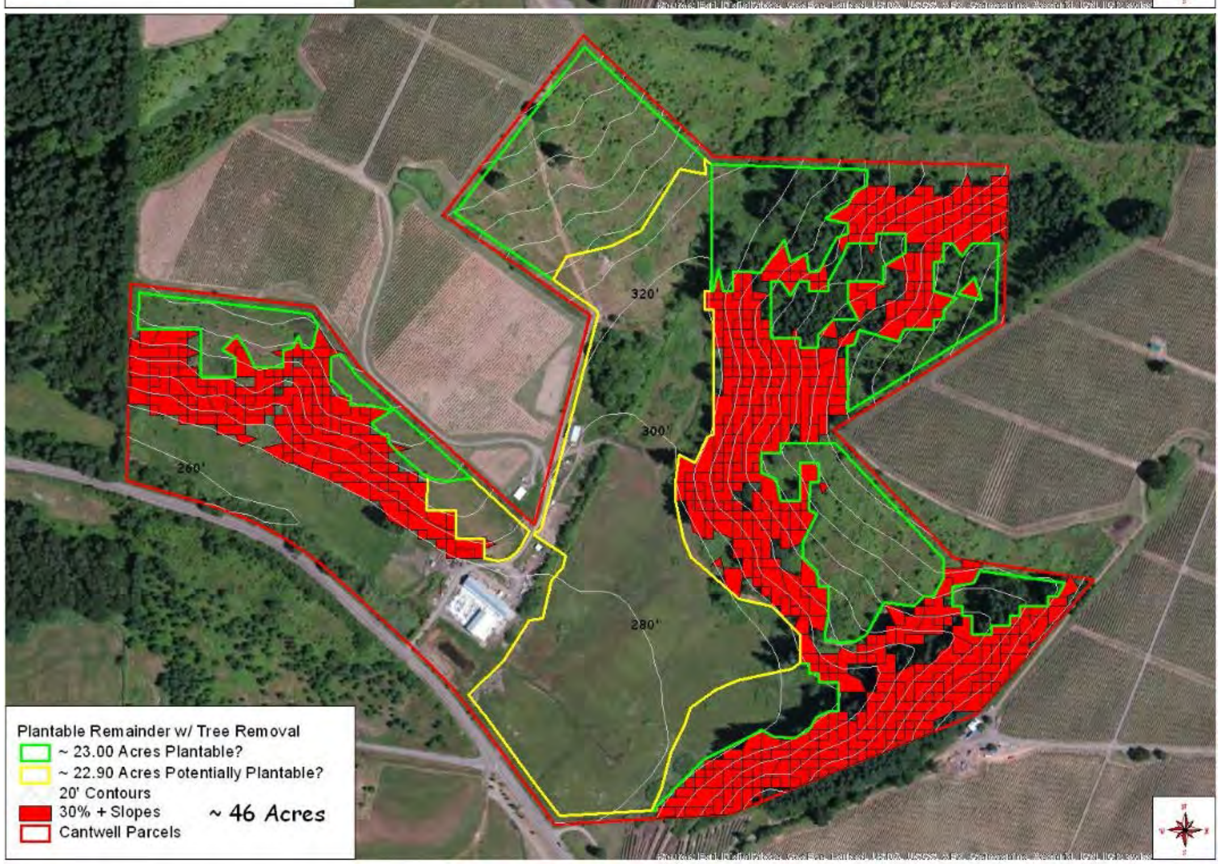


Vineyard Map

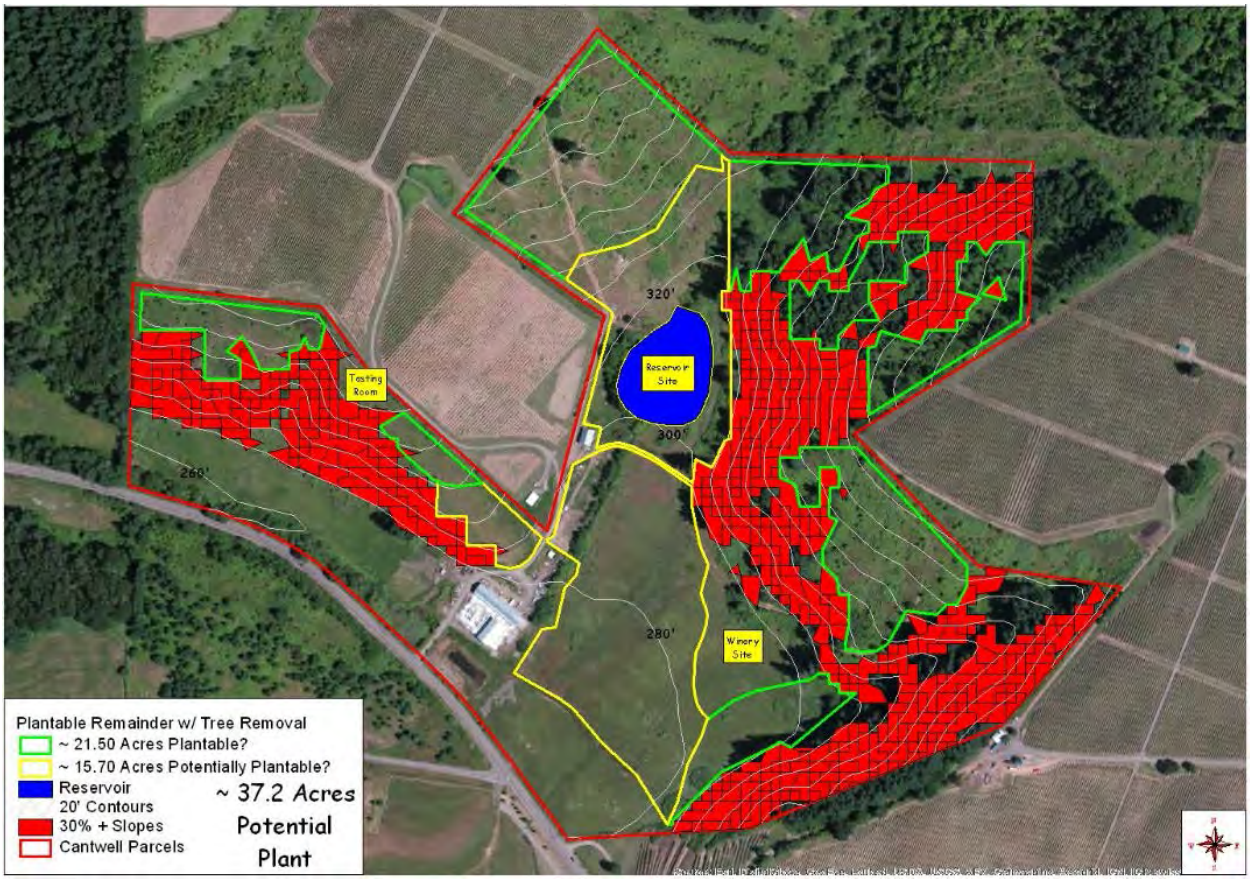
All Lines Approximated




320'
300'
260'
280'
Plantable Remainder w/ No Tree Removal
~ 14.70 Acres Plantable?
~ 18.07 Acres Potentially Plantable?
20' Contours
30% + Slopes
~ 32.8 Acres
Cantwell Parcels

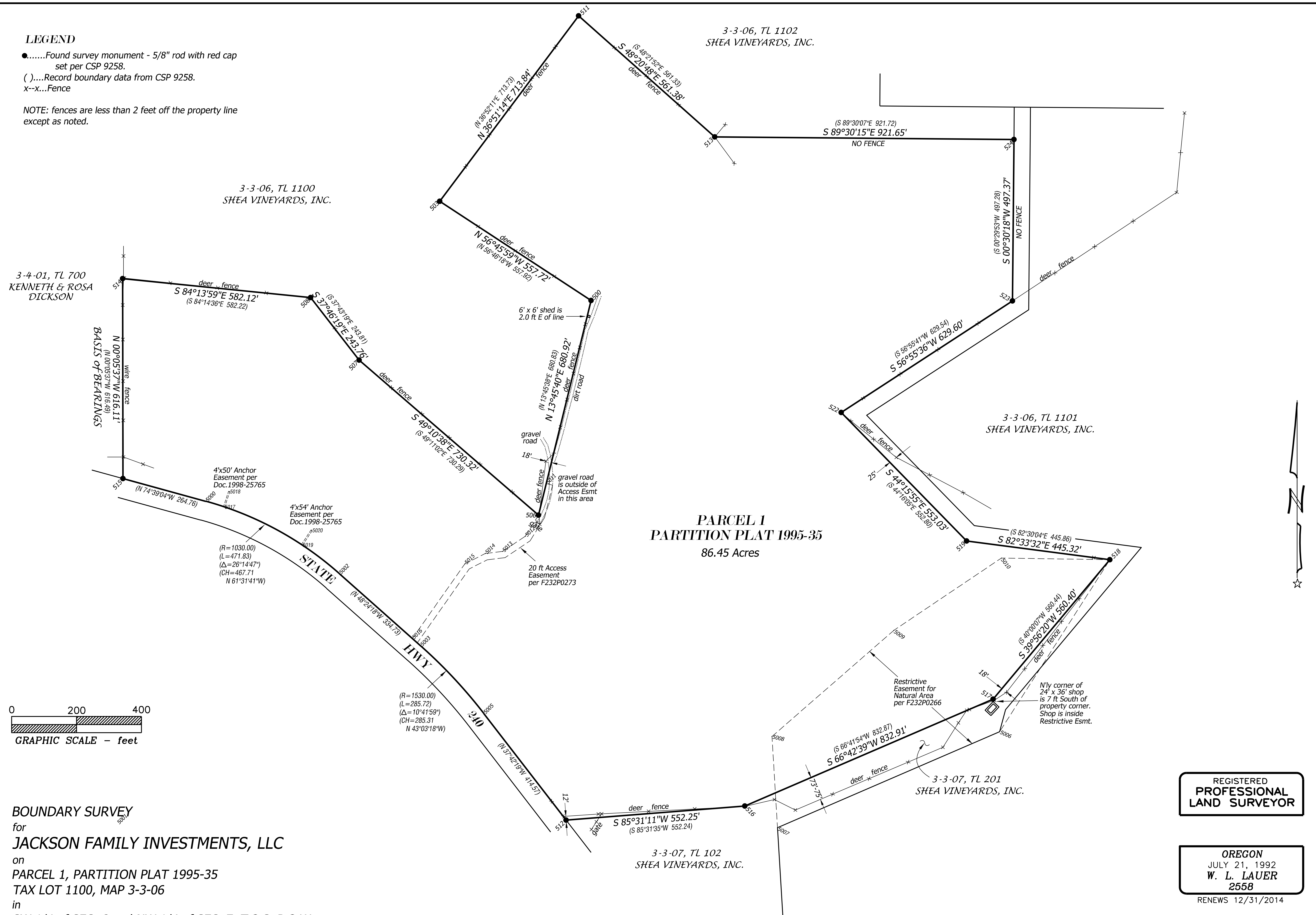

320'
300'
260'
280'
Plantable Remainder w/ Tree Removal
~ 23.00 Acres Plantable?
~ 22.90 Acres Potentially Plantable?
20' Contours
30% + Slopes
~ 46 Acres
Cantwell Parcels

Proposed Reservoir Location



Wetland Location on 11711 NE Highway 240, Yamhill

Drain Tile Map of 11711 NE Highway 240, Yamhill



BOUNDARY SURVEY
for
JACKSON FAMILY INVESTMENTS, LLC
on
PARCEL 1, PARTITION PLAT 1995-35
TAX LOT 1100, MAP 3-3-06
in
SW 1/4 of SEC. 6 and NW 1/4 of SEC. 7, T 3 S, R 3 W
and
SE 1/4 of SEC. 1 and NE 1/4 of SEC. 12, T 3 S, R 4 W
WILLAMETTE MERIDIAN
YAMHILL COUNTY, OREGON

SURVEYED April 1, 2, 3 & 7, 2014

REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
JULY 21, 1992
W. L. LAUER
2558
RENEWS 12/31/2014

NORTHSTAR SURVEYING, INC.
720 N.W. 4th Street
Corvallis, Oregon 97330
Phone: 541-757-9050

S:\2014JOBS\14070\wll\041614

[Click here and type address]

facsimile transmittal

To:	Don Miller	**Fax:**	503-378-2496
From:	Dan Eischen	**Date:**	12-Dec-00
Re:	Water Rights – DEQ permit	**Pages:**	2 pages
CC:	Ph 1-800-624-3199		

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Notes:

Don,

Attached is a copy of our stream flow readings. The ditch from the east maintains green grasses throughout the summer but is essentially dry when walked across. The flow we are getting from the east ditch must be surfacing near the buildings where the two ditches come together. The north to south ditch flows steady during the summer months and is measured a few hundred feet to the north of the buildings. Hope this covers what you need.

Thanks,

Dan Eischen

503-662-5410

Stream Flows Year 2000

DATE	North Stream coming down the valley GPM	Field Ditch Flowing Westwrd towards the Plant GPM	Combined Flows Driveway Bridge-Culvert GPM
8/27/00	2.6	-	4.8
8/28/00	3.2	2.1	6.8
8/29/00	2.5	1.3	6.6
8/30/00	3.2	1.6	7.9
8/31/00	4.4	1.8	11.6
9/1/00	5.1	1.6	8.1
9/5/00	4.9	5.3	17.7
9/6/00	5.2	7.9	15.8
9/7/00	5.2	7.9	27.2
9/8/00	7.4	7.9	28.3
9/11/00	5.6	6.7	15.5
9/13/00	3.5	5.2	11.3
9/14/00	4.6	5.2	12.6
9/15/00	4.4	4.6	10.7
9/17/00	4.3	4.5	10.4
9/18/00	3.9	4.4	11.4
9/19/00	4.0	4.3	10.4
9/20/00	4.3	4.2	10.6
9/21/00	5.1	-	14.9
9/22/00	4.7	-	10.1
9/25/00	3.6	7.3	12.3
9/26/00	3.3	4.9	10.5
9/27/00	2.6	4.3	10.7
9/28/00	4.3	3.0	9.2
9/29/00	5.4	3.2	10.3
10/2/00	5.3	7.0	12.5
10/4/00	5.1	5.3	10.8
10/5/00	3.6	4.8	7.7
10/16/00	8.4	11.1	21.1
10/1700	8.7	10.1	21.0
10/19/00	9.9	9.8	23.6

Well & Water Usage Information

Master

Pacific Hydro-Geology Inc.
18477 S. Valley Vista Rd.
Mulino, OR 97042
(503) 632-5016

July 8, 2004

Mr. Donn Miller
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-4172

Re: Pumping Test for Permit G-15014 (Application G-15078)

Dear Mr. Miller:

From August 15 to 17, 2005, Pacific Hydro-Geology Inc. (PHG) conducted a pumping test on property in Yamhill County formerly owned by Puriponics Inc., hereafter referred to as the McIntyre property (Figure 1). The pumping test was performed to meet a condition of ground water permit G-15014 (Application G-15078). PHG completed the pumping test with the assistance of the current property owners, Anne McIntyre and Vincent Cantwell, following the methods described in the work plan dated March 29, 2002 and subsequently amended on January 3, 2003 (Work Plan). Both of the documents comprising the Work Plan were submitted to the Oregon Water Resources Department (OWRD) and are a part of the record for the file (Application G-15078). This report summarizes the procedures followed to conduct the pumping test and documents the findings.

Summary of Pumping Test Procedures

The pumping test was conducted in three phases, including a 24-hour background monitoring phase, 24-hour pumping phase, and recovery phase. On-site wells monitored during the pumping test included all three wells on the McIntyre property (McIntyre Wells 1, 2, and 3). Off-site wells monitored during the pumping test included Shea Well 2 and Montgomery Wells 1 and 2. The locations of the on- and off-site wells monitored during the pumping test are shown on Figure 1. During the various phases of the test, water levels were monitored in McIntyre Wells 1 and 2 using pressure transducers and data loggers. Water levels were monitored in all other wells manually using electronic e-tape probes. Manual water level measurements in Montgomery Well 1 were sometimes difficult to make precisely because of cascading water in the well.

During the background, pumping, and recovery phases of the test, water levels were monitored continuously in McIntyre Wells 1 and 2 by the dataloggers. Water levels in McIntyre Well 3 and the off-site wells were measured manually at the beginning and end of the background phase, and then periodically throughout the pumping phase. The frequency of the manual measurements was about every hour at the beginning of the pumping phase, with a reduction in frequency as the pumping phase progressed. Because no response was noted in any of the wells being monitored manually (McIntyre Well 3, Shea Well 2, and Montgomery Wells 1 and 2) during the pumping phase of the test, these wells were not monitored during the recovery phase.

The plumbing for the pumping well (McIntyre Well 1) was disconnected from the pressure tank at the pump house to allow the well to pump continuously at its maximum rate. The pumped water was discharged to the ground near the pump house, which also houses McIntyre Well 2

The results from each of the three phases of the test are discussed in the following sections.

Background Phase

The background water level monitoring phase began at about 10:00 AM on August 15, 2005. All of the monitored wells had been idle for at least 8 hours prior to beginning the background monitoring.

The results of the continuous background water level monitoring for McIntyre Wells 1 and 2 are tabulated in Appendix A (Tables A-1 and A-2, respectively) and shown graphically on Figures 2 and 3, respectively. The results of the manual background measurements in McIntyre Well 3, Shea Well 2, and Montgomery Wells 1 and 2 are summarized in Appendix A (Tables A-3 through A-6, respectively), and shown graphically on Figures 4 through 7.

Based on the results of the background data as shown graphically on Figures 1 through 6, it appears that water levels remained relatively stable during the 24-hour background monitoring phase, with minor fluctuations ranging up to about 0.7 feet (Shea Well 2) most likely attributable to changes in barometric pressure.

Pumping Phase

The pumping phase of the test began with start-up of the pump in McIntyre Well 1 at about 10:43 AM on August 16, 2005. Manual water level measurements were made in McIntyre Well 1 (pumping well), and McIntyre Well 2 (other instrumented well) prior to starting the pump. The discharge of the pumping well was measured periodically by recording the time required to fill a 55-gallon drum. The discharge was measured four times (11:00 AM, 2:00 PM, and 7:00 PM on 8/16/05, and 9:00 AM on 8/17/05), yielding fill times of 3:30 (3 minutes, 30 seconds), 3:35, 3:33, and 3:44, respectively, with an average of 3:35.5, equivalent to 15.3 gallons per minute (gpm). This discharge represents the maximum sustainable rate from McIntyre Well 1.

The results of the continuous pumping phase water level monitoring for McIntyre Wells 1 and 2 are tabulated in Appendix A (Tables A-7 and A-8, respectively) and shown graphically on Figures 2 and 3, respectively. The results of the manual pumping phase water level measurements in McIntyre Well 3, Shea Well 2, and Montgomery Wells 1 and 2 are summarized in Appendix A (Tables A-3 through A-6, respectively), and shown graphically on Figures 4 through 7.

The graphical representation of the data for McIntyre Well 1 shows a typical response in a pumping well, with no obvious boundary effects during the 24-hour duration of the pumping phase. The graphs for McIntyre Well 2 (Figure 8), McIntyre Well 3 (Figure 3), Shea Well 2 (Figure 4), Montgomery Well 1 (Figure 5) and Montgomery Well 2 (Figure

6), show relatively flat-line, or even increasing trends, indicating no measurable response to the pumping in McIntyre Well 1.

The increase in water level elevations recorded in Shea Well 2 may represent the affects of barometric pressure changes occurring during the pumping phase. The relatively small water level rise in McIntyre Well 2 is likely the result of ground water mounding caused by infiltration of the discharged water near the pump house (where McIntyre Well 2 is located).

Recovery Phase

The pump in McIntyre Well 1 was shut off at 11:36 AM on August 17, 2005, to begin the recovery phase of the test. As there was no pumping response measured in any of the observation wells, recovery was not measured in the wells which had been monitored manually during the background and pumping phases. However, water levels in McIntyre Wells 1 and 2 continued to be monitored continuously using the data loggers through the end of the recovery phase. The recovery data from McIntyre Well 1 (pumped well) was used to estimate the aquifer transmissivity as discussed below.

After about 24 hours of recovery, the water level in McIntyre Well 1 (pumped well) had still not achieved 90% recovery. At around 12:00 PM on August 18, 2005, continuous, instrumented monitoring in McIntyre Wells 1 and 2 was discontinued. However, manual monitoring of recovery in McIntyre Well 1 was continued for four more days, with the final measurement taken at 12:10 PM on August 22, 2005. As of that final water level measurement, McIntyre Well 1 had recovered about 64%.

The results of the recovery phase water level monitoring for McIntyre Wells 1 and 2 are tabulated in Appendix A (Tables A-9 and A-10, respectively) and shown graphically on Figures 2 and 3, respectively. The recovery data from McIntyre Well 1 (pumped well) showed a response typical for a pumped well, with the exception that full recovery was not achieved, as discussed above. The recovery data from McIntyre Well 1 provided the basis for calculating the aquifer transmissivity. Using the time versus water level elevation data from the recovery in McIntyre Well 1, values for residual drawdown and the time ratio were tabulated as shown on Table 11, and plotted graphically on Figure 8 according to the methods described by Theis (1935). A straight line was fitted to the residual drawdown versus time ratio data to provide the basis for calculating aquifer transmissivity (T). The calculations for aquifer transmissivity and hydraulic conductivity (K) are presented in Appendix B. The transmissivity estimated by these calculations is 1.7×10^{-3} ft^2/sec, and the hydraulic conductivity is 8.5×10^{-5} ft/sec (2.6×10^{-5} m/s). The estimated value for hydraulic conductivity is at the upper end of the range expected for fractured rock (Freeze and Cherry, 1979).

Summary and Conclusions

The results of the pumping test indicated there was no measurable response in any of the observation wells after pumping McIntyre Well 1 at an average rate of 15.3 gpm for 24 hours. Analysis of the recovery data from McIntyre Well 1 yielded an estimate of transmissivity (T) of 1.7×10^{-3} ft^2/sec and hydraulic conductivity (K) of 8.5×10^{-5} ft/sec.

Completion of this work fulfills the pumping test conditions of ground water permit G-15014. Based on the results of the pumping test, it appears that normal operations at the McIntyre property under Permit G-15014 should not result in significant, adverse impacts to the surrounding ground water users.

Please call me at (503) 632-5016 if there are any questions, or additional information is required.

Sincerely,

Gregory E. Kupillas, R.G., C.W.R.E.

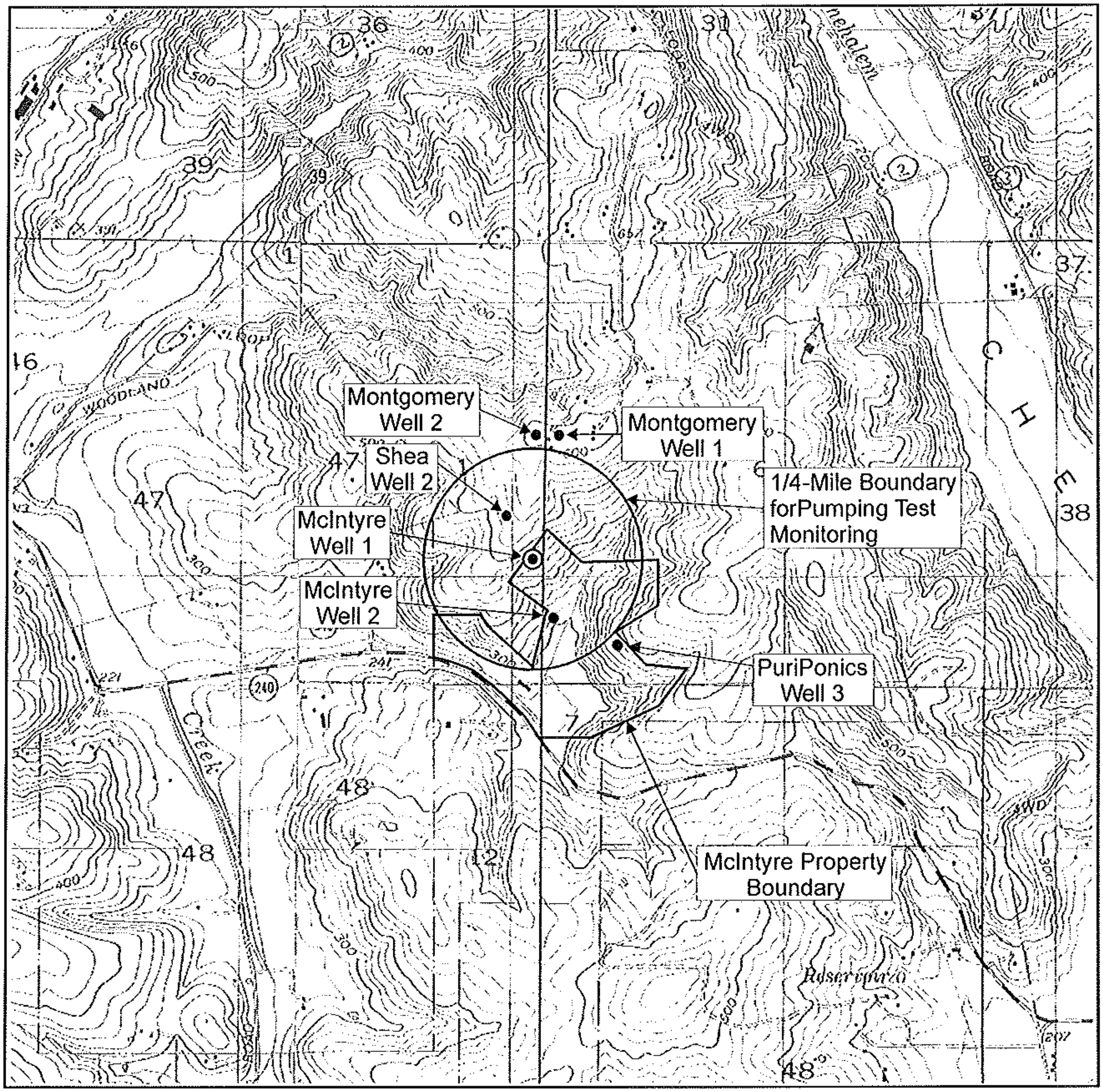
Attachments

References

References

Freeze, R.A. and J.A. Cherry. 1979. *Groundwater*. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 553 pp.

Theis, C.V. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage. *Transactions of the American Geophysical Union*. v. 16, pp. 519-524.



Key:

◉ Pumping Well

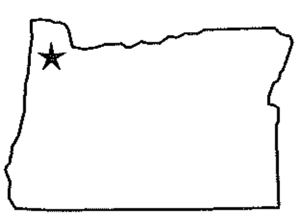
• Observation Well

Scale: 1:24000

0 — 1 Mile

Countour Interval 20 Feet

N



Source: USGS 7.5 Minute Topographic Survey Maps, Dundee and Carlton, Oregon Quadrangles, Photorevised 1993 and 1992, Respectively

Figure 1. Locations of Pumping and Observation Wells

McIntyre
Ground Water Permit
App. G-15087, Per. G-15014

Pacific Hydro-Geology Inc.

11/2005

McPmpTstF1.cdr

Figure 2. McIntyre Pumping Test
Background Monitoring, Pumping, and Recovery Phases - McIntyre Well 1

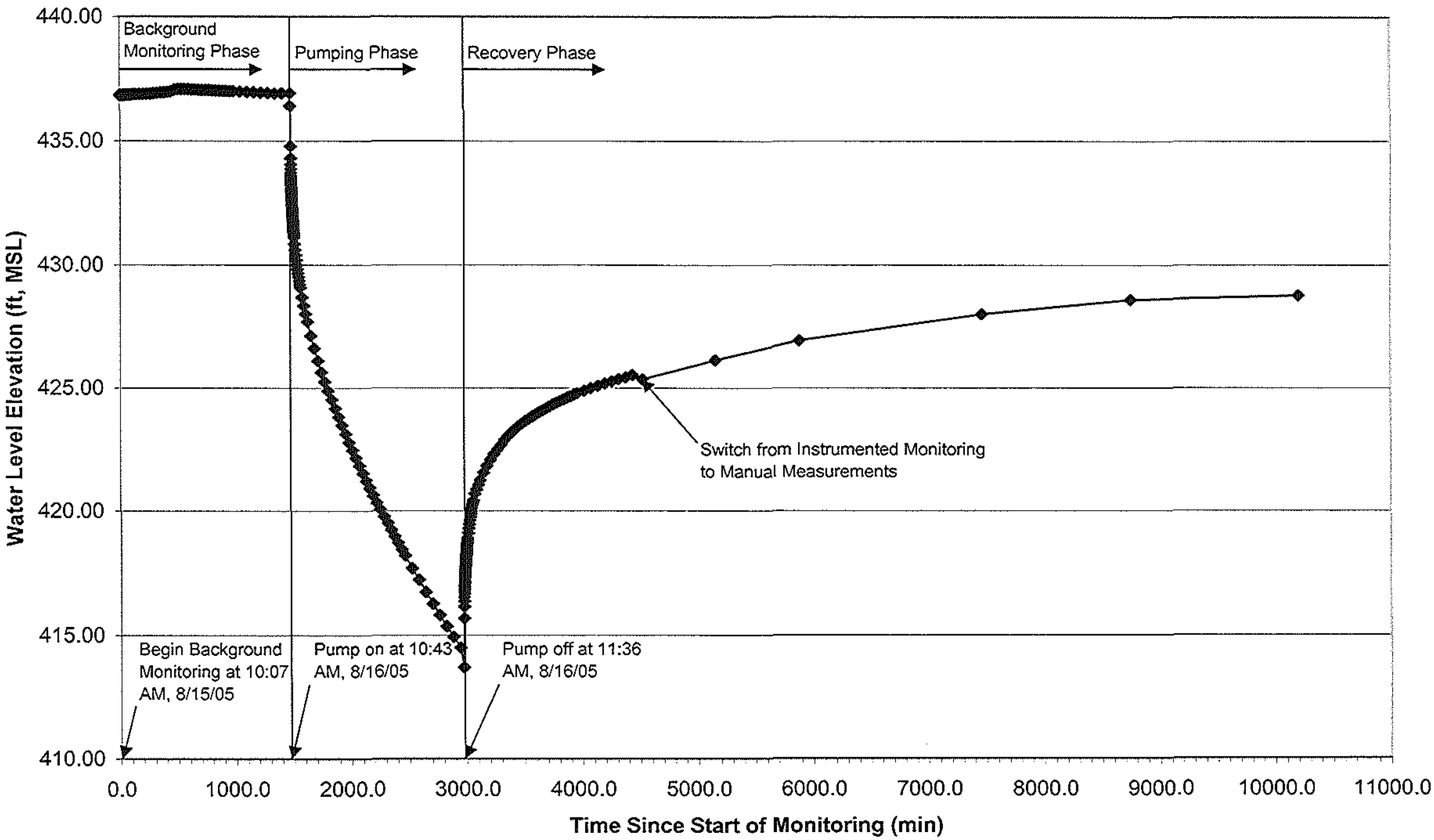


Figure 3. McIntyre Pumping Test
Background Monitoring, Pumping, and Recovery Phases - McIntyre Well 2

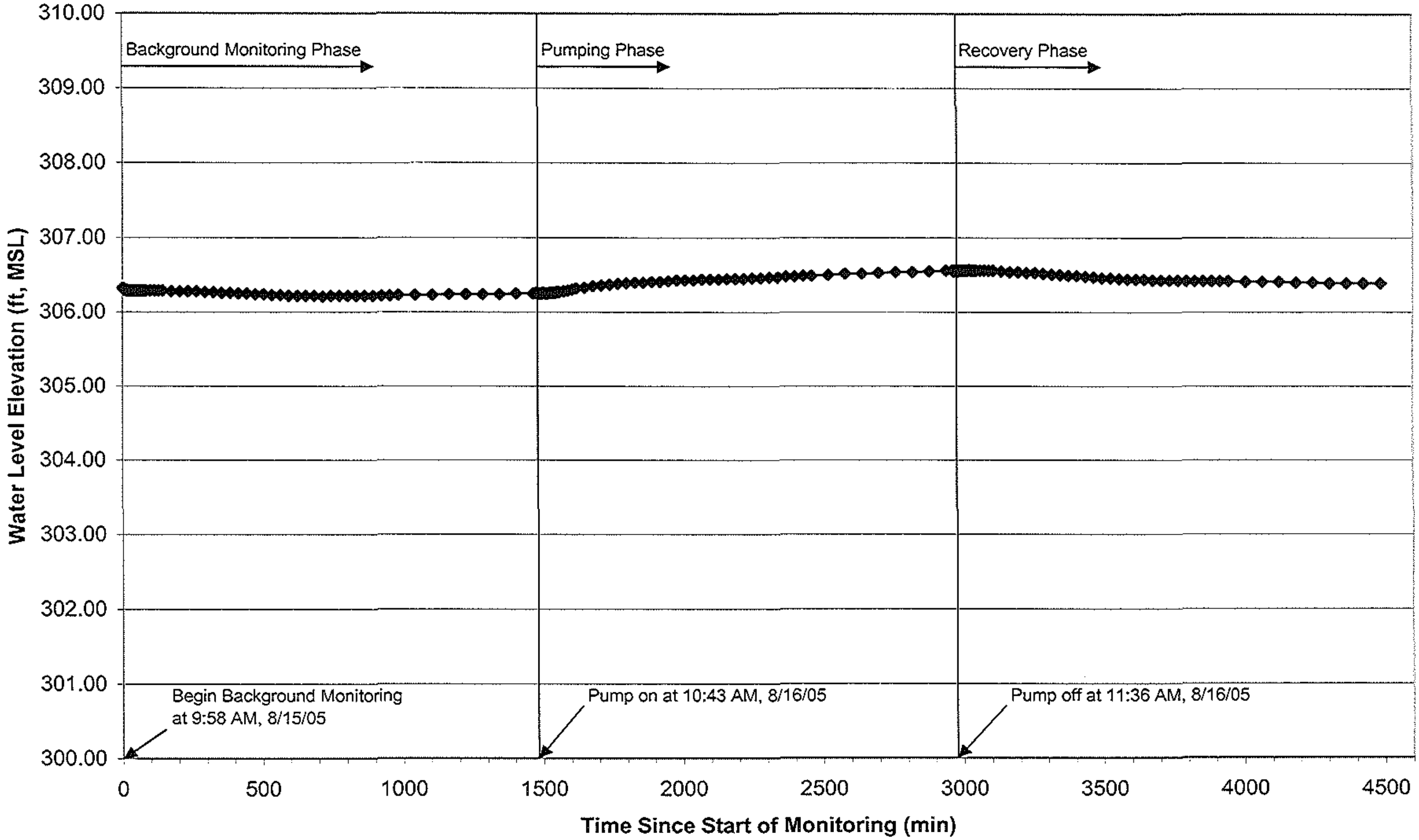


Figure 4. McIntyre Pumping Test
Background Monitoring and Pumping Phases - McIntyre Well 3

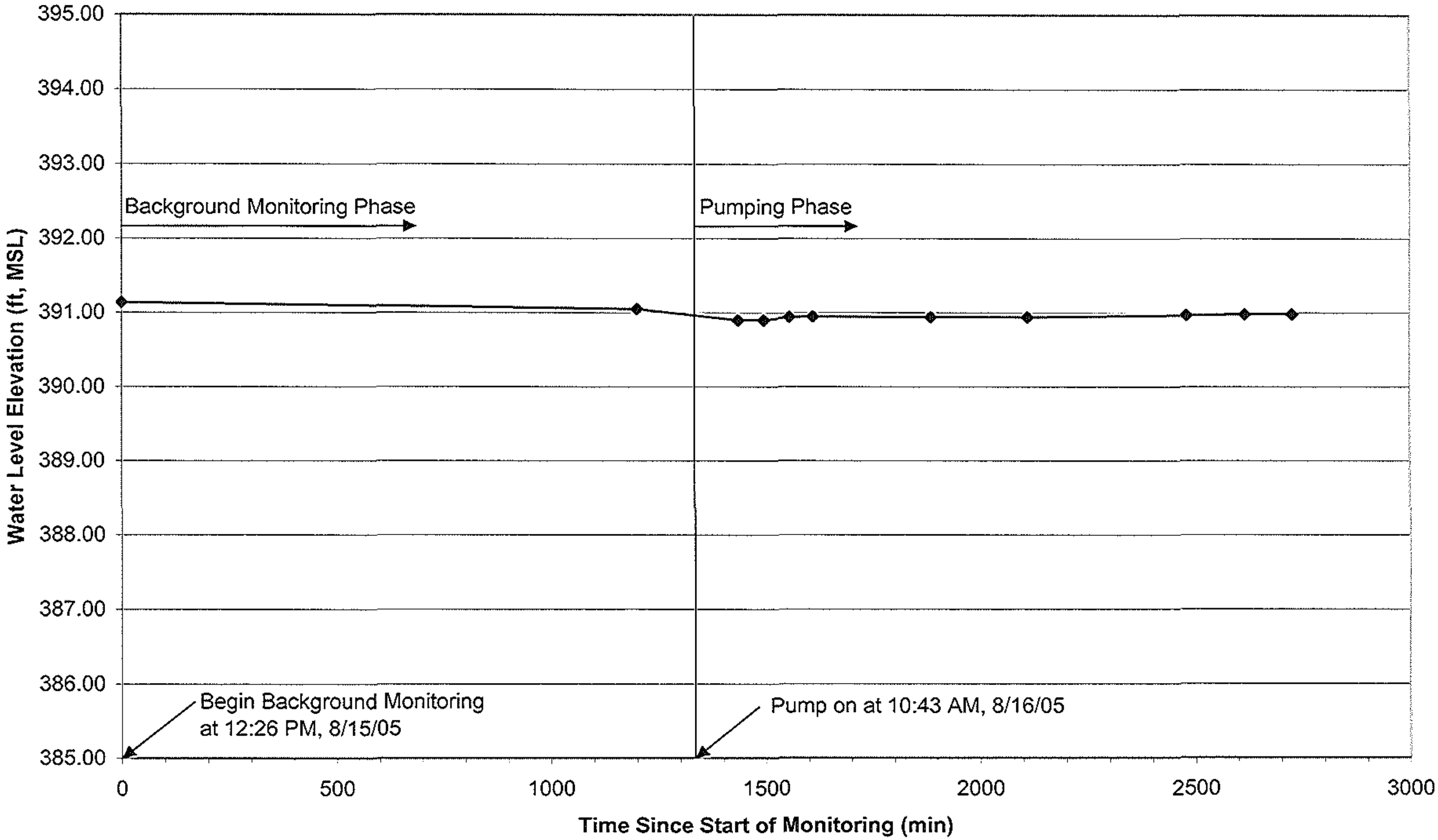


Figure 5. McIntyre Pumping Test
Background Monitoring and Pumping Phases - Shea Well 2

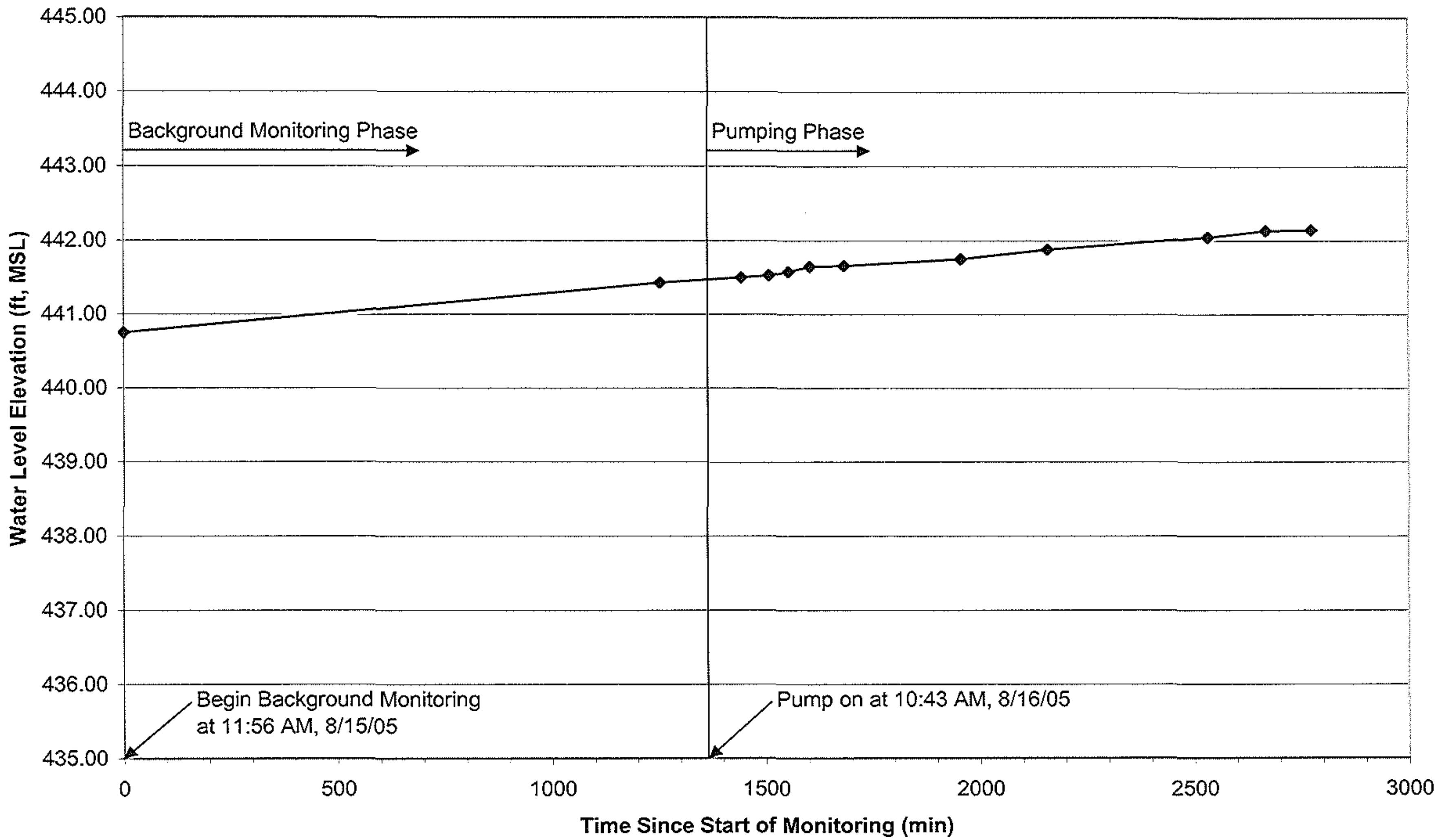


Figure 6. McIntyre Pumping Test
Background Monitoring and Pumping Phases - Montgomery Well 1

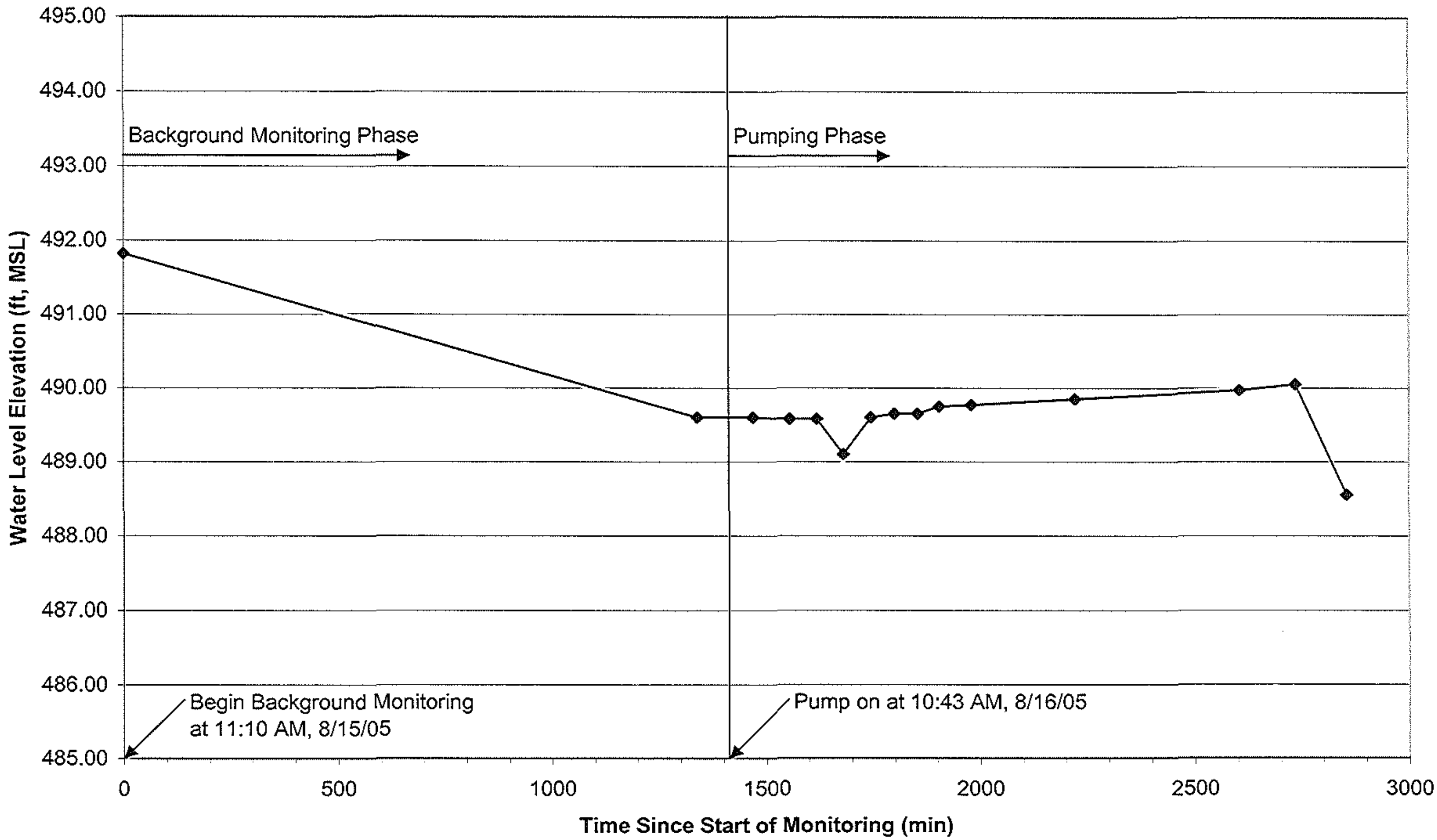


Figure 7. McIntyre Pumping Test
Background Monitoring and Pumping Phases - Montgomery Well 2

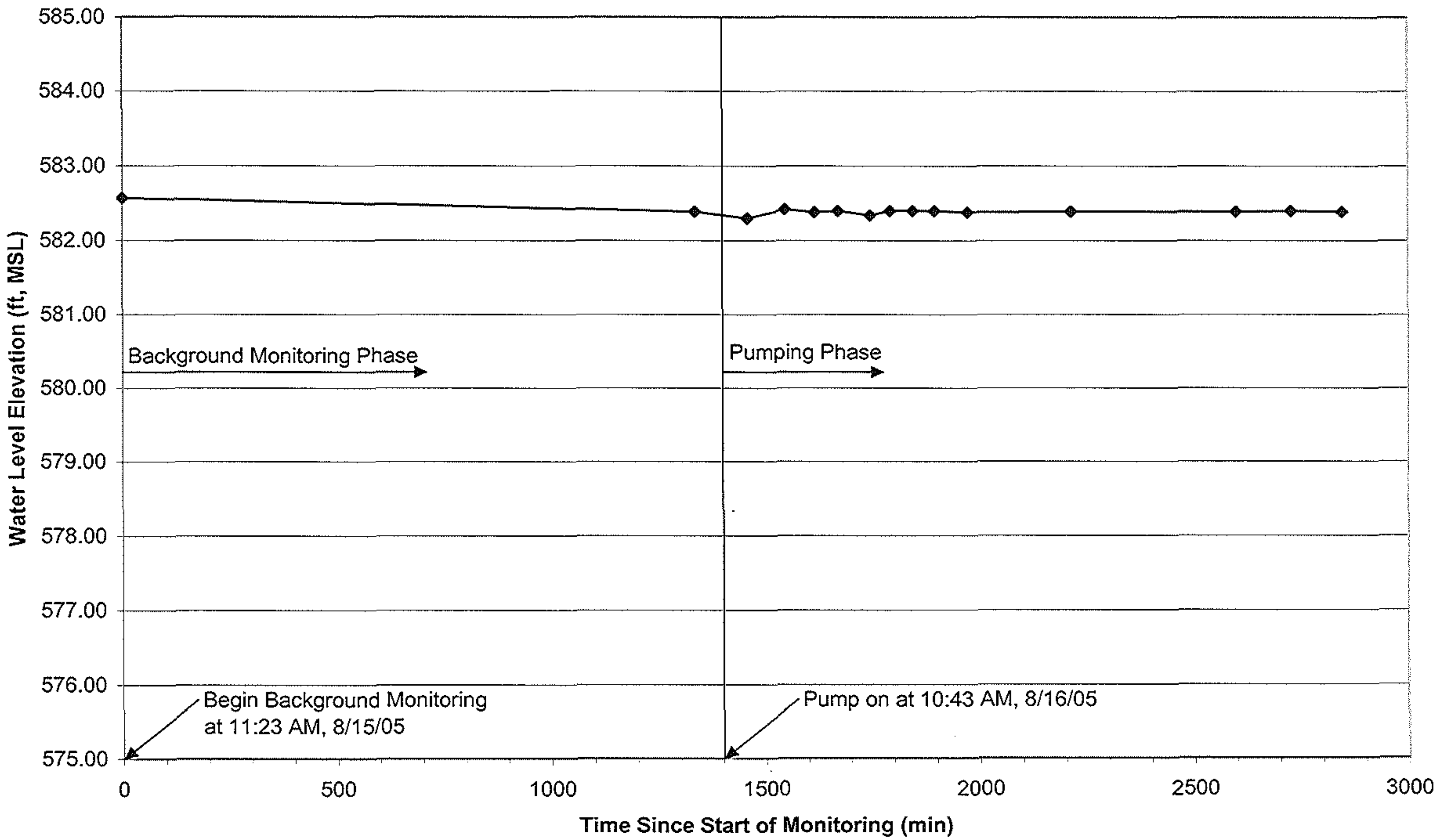
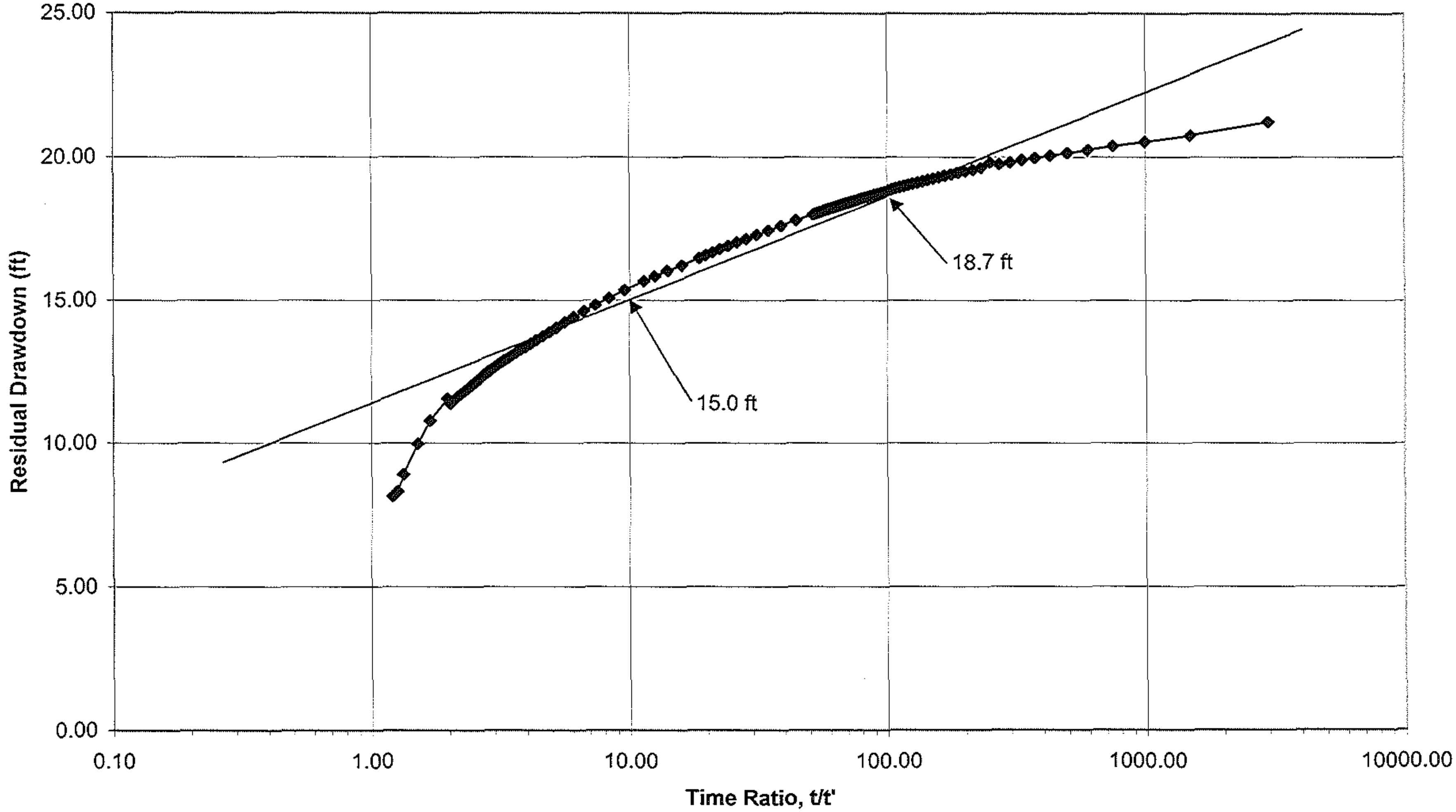


Figure 8. McIntyre Pumping Test
Recovery Phase - McIntyre Well 1
Time Ratio (t/t') vs Residual Drawdown



ANALYTICAL

Burlington, WA	Corporate Laboratory (a)	1620 S Walnut St	Burlington, WA 98233	800.755.9295 • 360.757.1400
Bellingham, WA	Microbiology (b)	805 Orchard Dr Ste 4	Bellingham, WA 98225	360.715.1212
Portland, OR	Microbiology/Chemistry (c)	9150 SW Pioneer Ct Ste W	Wilsonville, OR 97070	503.682.7802
Corvallis, OR	Microbiology (d)	540 SW Third Street	Corvallis, OR 97333	541.753.4946

NELAP ACCREDITED TNI LABORATORY

ORELAP - WA200008
ORELAP - OR100063

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Stettler Supply Company
4420 Ridge Dr NE
Salem, OR 97301

Reference Number: 14-18625
Project: Cantwell Lower Well

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: 11711 Hwy 240, Yamhill
County:

Sample Number: At Well
Lab Number: 14_42515
Collect Date: 9/22/14 12:20
Date Received: 9/22/14
Report Date: 10/15/14
Sampled By: Phil Chadsey
Sampler Phone:
Approved by: spm,sps
Authorized by:

Sarah P Miller
Lab Manager, Corvallis

EPA#	ANALYTES	RESULTS	UNITS	SRL	MCL	Analyst	Lab Code	METHOD	Analyzed	COMMENT
	ARSENIC	**0.002**	mg/L	0.001	0.010	mvp	WA200008	200.8	09/29/14	
	NITRATE-N	**2.6**	mg/L	1.0	10	rap	OR100009	SM4500-NO3	09/23/14 15:31	
2920	TOTAL COLIFORM	**ABSENT**	per 100mL	P/A		kdf	OR100009	SM9223 B	09/23/14 17:03	
3014	E. Coli	**ABSENT**	per 100mL	P/A		kdf	OR100009	SM9223 B	09/23/14 17:03	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).
An * in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples. Estimates of uncertainty are not included in this report. If this information is required please contact us at the phone number listed in the report header.

If you have any questions concerning this report contact us at the above phone number.

FORM: IOC_OR

Informational Water Quality Report

Watercheck w/PO

Client:
Cantwell- Lower Well 11711 Hwy 240

Ordered By:
Edge Analytical 540 SW 3rd Street Corvallis, OR 97333 ATTN: Gretchen Schrock

National Testing Laboratories, Ltd.
Quality Water Analysis
6571 Wilson Mills Rd
Cleveland, Ohio 44143
1-800-458-3330

Sample Number:	848516
Location:	42515-SSC
Type of Water:	Well Water
Collection Date and Time:	9/22/2014 12:20
Received Date and Time:	9/25/2014 10:10
Date Completed:	10/15/2014

Definition and Legend

This informational water quality report compares the actual test result to national standards as defined in the EPA's Primary and Secondary Drinking Water Regulations.

Primary Standards: Are expressed as the maximum contaminant level (MCL) which is the highest level of contaminant that is allowed in drinking water. MCLs are enforceable standards.

Secondary standards: Are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor,or color) in drinking water. Individual states may choose to adopt them as enforceable standards.

Action levels: Are defined in treatment techniques which are required processes intended to reduce the level of a contaminant in drinking water.

mg/L (ppm): Unless otherwise indicated, results and standards are expressed as an amount in milligrams per liter or parts per million.

Minimum Detection Level (MDL): The lowest level that the laboratory can detect a contaminant.

ND: The contaminant was not detected above the minimum detection level.

NA: The contaminant was not analyzed.

✓ The contaminant was not detected in the sample above the minimum detection level.

● The contaminant was detected at or above the minimum detection level, but not above the referenced standard.

▲ The contaminant was detected above the standard, which is not an EPA enforceable MCL.

✚ The contaminant was detected above the EPA enforceable MCL.

✖ These results may be invalid.

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
			Microbiologicals			
✓	Total Coliform by P/A	Total Coliform and E.coli were ABSENT in this sample.				
			Inorganic Analytes - Metals			
●	Aluminum	0.1	mg/L	0.2	EPA Secondary	0.1
✓	Arsenic	ND	mg/L	0.010	EPA Primary	0.005
✓	Barium	ND	mg/L	2	EPA Primary	0.30
✓	Cadmium	ND	mg/L	0.005	EPA Primary	0.002
●	Calcium	11.4	mg/L	--		2.0
✓	Chromium	ND	mg/L	0.1	EPA Primary	0.010
✓	Copper	ND	mg/L	1.3	EPA Action Level	0.004
▲	Iron	5.230	mg/L	0.3	EPA Secondary	0.020
✓	Lead	ND	mg/L	0.015	EPA Action Level	0.002
●	Magnesium	3.04	mg/L	--		0.10
▲	Manganese	0.324	mg/L	0.05	EPA Secondary	0.004
✓	Mercury	ND	mg/L	0.002	EPA Primary	0.001
✓	Nickel	ND	mg/L	--		0.020
✓	Potassium	ND	mg/L	--		1.0
✓	Selenium	ND	mg/L	0.05	EPA Primary	0.020
●	Silica	32.4	mg/L	--		0.1
✓	Silver	ND	mg/L	0.100	EPA Secondary	0.002
●	Sodium	7	mg/L	--		1
●	Zinc	0.126	mg/L	5	EPA Secondary	0.004
			Physical Factors			
●	Alkalinity (Total as CaCO3)	48	mg/L	--		20
●	Hardness	41	mg/L	100	NTL Internal	10
▲	pH	6.0	pH Units	6.5 to 8.5	EPA Secondary	
●	Total Dissolved Solids	91	mg/L	500	EPA Secondary	20
▲	Turbidity	21.0	NTU	1.0	EPA Action Level	0.1

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
	Inorganic Analytes - Other					
✓	Chloride	ND	mg/L	250	EPA Secondary	5.0
✓	Fluoride	ND	mg/L	4.0	EPA Primary	0.5
●	Nitrate as N	1.8	mg/L	10	EPA Primary	0.5
✓	Nitrite as N	ND	mg/L	1	EPA Primary	0.5
✓	Ortho Phosphate	ND	mg/L	--		2.0
✓	Sulfate	ND	mg/L	250	EPA Secondary	5.0
	Organic Analytes - Trihalomethanes					
✓	Bromodichloromethane	ND	mg/L	--		0.002
✓	Bromoform	ND	mg/L	--		0.004
✓	Chloroform	ND	mg/L	--		0.002
✓	Dibromochloromethane	ND	mg/L	--		0.004
✓	Total THMs	ND	mg/L	0.080	EPA Primary	0.002
	Organic Analytes - Volatiles					
✓	1,1,1,2-Tetrachloroethane	ND	mg/L	--		0.002
✓	1,1,1-Trichloroethane	ND	mg/L	0.2	EPA Primary	0.001
✓	1,1,2,2-Tetrachloroethane	ND	mg/L	--		0.002
✓	1,1,2-Trichloroethane	ND	mg/L	0.005	EPA Primary	0.002
✓	1,1-Dichloroethane	ND	mg/L	--		0.002
✓	1,1-Dichloroethene	ND	mg/L	0.007	EPA Primary	0.001
✓	1,1-Dichloropropene	ND	mg/L	--		0.002
✓	1,2,3-Trichlorobenzene	ND	mg/L	--		0.002
✓	1,2,3-Trichloropropane	ND	mg/L	--		0.002
✓	1,2,4-Trichlorobenzene	ND	mg/L	0.07	EPA Primary	0.002
✓	1,2-Dichlorobenzene	ND	mg/L	0.6	EPA Primary	0.001
✓	1,2-Dichloroethane	ND	mg/L	0.005	EPA Primary	0.001
✓	1,2-Dichloropropane	ND	mg/L	0.005	EPA Primary	0.002
✓	1,3-Dichlorobenzene	ND	mg/L	--		0.001

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
✓	1,3-Dichloropropane	ND	mg/L	--		0.002
✓	1,4-Dichlorobenzene	ND	mg/L	0.075	EPA Primary	0.001
✓	2,2-Dichloropropane	ND	mg/L	--		0.002
✓	2-Chlorotoluene	ND	mg/L	--		0.001
✓	4-Chlorotoluene	ND	mg/L	--		0.001
✓	Acetone	ND	mg/L	--		0.01
✓	Benzene	ND	mg/L	0.005	EPA Primary	0.001
✓	Bromobenzene	ND	mg/L	--		0.002
✓	Bromomethane	ND	mg/L	--		0.002
✓	Carbon Tetrachloride	ND	mg/L	0.005	EPA Primary	0.001
✓	Chlorobenzene	ND	mg/L	0.1	EPA Primary	0.001
✓	Chloroethane	ND	mg/L	--		0.002
✓	Chloromethane	ND	mg/L	--		0.002
✓	cis-1,2-Dichloroethene	ND	mg/L	0.07	EPA Primary	0.002
✓	cis-1,3-Dichloropropene	ND	mg/L	--		0.002
✓	DBCP	ND	mg/L	--		0.001
✓	Dibromomethane	ND	mg/L	--		0.002
✓	Dichlorodifluoromethane	ND	mg/L	--		0.002
✓	Dichloromethane	ND	mg/L	0.005	EPA Primary	0.002
✓	EDB	ND	mg/L	--		0.001
✓	Ethylbenzene	ND	mg/L	0.7	EPA Primary	0.001
✓	Methyl Tert Butyl Ether	ND	mg/L	--		0.004
✓	Methyl-Ethyl Ketone	ND	mg/L	--		0.01
✓	Styrene	ND	mg/L	0.1	EPA Primary	0.001
✓	Tetrachloroethene	ND	mg/L	0.005	EPA Primary	0.002
✓	Tetrahydrofuran	ND	mg/L	--		0.01
✓	Toluene	ND	mg/L	1	EPA Primary	0.001
✓	trans-1,2-Dichloroethene	ND	mg/L	0.1	EPA Primary	0.002

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
✓	trans-1,3-Dichloropropene	ND	mg/L	--		0.002
✓	Trichloroethene	ND	mg/L	0.005	EPA Primary	0.001
✓	Trichlorofluoromethane	ND	mg/L	--		0.002
✓	Vinyl Chloride	ND	mg/L	0.002	EPA Primary	0.001
✓	Xylenes (Total)	ND	mg/L	10	EPA Primary	0.001
	Organic Analytes - Others					
✓	2,4-D	ND	mg/L	0.07	EPA Primary	0.010
✓	Alachlor	ND	mg/L	0.002	EPA Primary	0.001
✓	Aldrin	ND	mg/L	--		0.002
✓	Atrazine	ND	mg/L	0.003	EPA Primary	0.002
✓	Chlordane	ND	mg/L	0.002	EPA Primary	0.001
✓	Dichloran	ND	mg/L	--		0.002
✓	Dieldrin	ND	mg/L	--		0.001
✓	Endrin	ND	mg/L	0.002	EPA Primary	0.0001
✓	Heptachlor	ND	mg/L	0.0004	EPA Primary	0.0004
✓	Heptachlor Epoxide	ND	mg/L	0.0002	EPA Primary	0.0001
✓	Hexachlorobenzene	ND	mg/L	0.001	EPA Primary	0.0005
✓	Hexachlorocyclopentadiene	ND	mg/L	0.05	EPA Primary	0.001
✓	Lindane	ND	mg/L	0.0002	EPA Primary	0.0002
✓	Methoxychlor	ND	mg/L	0.04	EPA Primary	0.002
✓	Pentachloronitrobenzene	ND	mg/L	--		0.002
✓	Silvex 2,4,5-TP	ND	mg/L	0.05	EPA Primary	0.005
✓	Simazine	ND	mg/L	0.004	EPA Primary	0.002
✓	Total PCBs	ND	mg/L	0.0005	EPA Primary	0.0005
✓	Toxaphene	ND	mg/L	0.003	EPA Primary	0.001
✓	Trifluralin	ND	mg/L	--		0.002

Status	Contaminant	Results	Units	National Standards	Min. Detection Level

We certify that the analyses performed for this report are accurate, and that the laboratory tests were conducted by methods approved by the U.S. Environmental Protection Agency or variations of these EPA methods.

These test results are intended to be used for informational purposes only and may not be used for regulatory compliance.

National Testing Laboratories, Ltd.

NATIONAL TESTING LABORATORIES, LTD

EDGE ANALYTICAL

Burlington, WA	Corporate Laboratory (a)	1620 S Walnut St	Burlington, WA 98233	**800.755.9295** • 360.757.1400
Bellingham, WA	Microbiology (b)	805 Orchard Dr Ste 4	Bellingham, WA 98225	360.715.1212
Portland, OR	Microbiology/Chemistry (c)	9150 SW Pioneer Ct Ste W	Wilsonville, OR 97070	503.682.7802
Corvallis, OR	Microbiology (d)	540 SW Third Street	Corvallis, OR 97333	541.753.4946

NELAP ACCREDITED TNI LABORATORY

ORELAP - WA200008
ORELAP - OR100063

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Stettler Supply Company
4420 Ridge Dr NE
Salem, OR 97301

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: 11711 Hwy 240, Yamhill
County:

Reference Number: 14-18654
Project: Cantwell Upper Well

Sample Number: At Well
Lab Number: 14_42559
Collect Date: 9/22/14 14:00
Date Received: 9/22/14
Report Date: 10/13/14
Sampled By: Phil Chadsey
Sampler Phone:
Approved by: spm,sps
Authorized by: Sarah P Miller

Sarah P Miller
Lab Manager, Corvallis

EPA#	ANALYTES	RESULTS	UNITS	SRL	MCL	Analyst	Lab Code	METHOD	Analyzed	COMMENT
	ARSENIC	**0.003**	mg/L	0.001	0.010	mvp	WA200008	200.8	09/29/14	
	NITRATE-N	**ND**	mg/L	1.0	10	rap	OR100009	SM4500-NO3	09/23/14 15:31	
2920	TOTAL COLIFORM	**ABSENT**	per 100mL	P/A		kdf	OR100009	SM9223 B	09/23/14 11:32	
3014	E. Coli	**ABSENT**	per 100mL	P/A		kdf	OR100009	SM9223 B	09/23/14 11:32	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).
An * in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples. Estimates of uncertainty are not included in this report. If this information is required please contact us at the phone number listed in the report header.

If you have any questions concerning this report contact us at the above phone number.

FORM: IOC_OR

Informational Water Quality Report

Watercheck w/PO

Client:
Cantwell- Upper Well 11711 Hwy 240

Ordered By:
Edge Analytical 540 SW 3rd Street Corvallis, OR 97333 ATTN: Gretchen Schrock

National Testing Laboratories, Ltd.
Quality Water Analysis
6571 Wilson Mills Rd
Cleveland, Ohio 44143
1-800-458-3330

Sample Number: 848512

Location:	42559-SSC
Type of Water:	Well Water
Collection Date and Time:	9/22/2014 14:00
Received Date and Time:	9/25/2014 10:10
Date Completed:	10/13/2014

Definition and Legend

This informational water quality report compares the actual test result to national standards as defined in the EPA's Primary and Secondary Drinking Water Regulations.

Primary Standards:	Are expressed as the maximum contaminant level (MCL) which is the highest level of contaminant that is allowed in drinking water. MCLs are enforceable standards.
Secondary standards:	Are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor,or color) in drinking water. Individual states may choose to adopt them as enforceable standards.
Action levels:	Are defined in treatment techniques which are required processes intended to reduce the level of a contaminant in drinking water.
mg/L (ppm):	Unless otherwise indicated, results and standards are expressed as an amount in milligrams per liter or parts per million.
Minimum Detection Level (MDL):	The lowest level that the laboratory can detect a contaminant.
ND:	The contaminant was not detected above the minimum detection level.
NA:	The contaminant was not analyzed.
✓	The contaminant was not detected in the sample above the minimum detection level.
●	The contaminant was detected at or above the minimum detection level, but not above the referenced standard.
▲	The contaminant was detected above the standard, which is not an EPA enforceable MCL.
✚	The contaminant was detected above the EPA enforceable MCL.
✖	These results may be invalid.

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
			Microbiologicals			
	Total Coliform by P/A	No bacteria sample was submitted.				
			Inorganic Analytes - Metals			
✓	Aluminum	ND	mg/L	0.2	EPA Secondary	0.1
✓	Arsenic	ND	mg/L	0.010	EPA Primary	0.005
✓	Barium	ND	mg/L	2	EPA Primary	0.30
✓	Cadmium	ND	mg/L	0.005	EPA Primary	0.002
●	Calcium	16.3	mg/L	--		2.0
✓	Chromium	ND	mg/L	0.1	EPA Primary	0.010
✓	Copper	ND	mg/L	1.3	EPA Action Level	0.004
▲	Iron	8.430	mg/L	0.3	EPA Secondary	0.020
✓	Lead	ND	mg/L	0.015	EPA Action Level	0.002
●	Magnesium	4.51	mg/L	--		0.10
▲	Manganese	0.259	mg/L	0.05	EPA Secondary	0.004
✓	Mercury	ND	mg/L	0.002	EPA Primary	0.001
✓	Nickel	ND	mg/L	--		0.020
●	Potassium	1.6	mg/L	--		1.0
✓	Selenium	ND	mg/L	0.05	EPA Primary	0.020
●	Silica	53.9	mg/L	--		0.1
✓	Silver	ND	mg/L	0.100	EPA Secondary	0.002
●	Sodium	11	mg/L	--		1
▲	Zinc	9.570	mg/L	5	EPA Secondary	0.004
			Physical Factors			
●	Alkalinity (Total as CaCO3)	76	mg/L	--		20
●	Hardness	59	mg/L	100	NTL Internal	10
▲	pH	6.3	pH Units	6.5 to 8.5	EPA Secondary	
●	Total Dissolved Solids	160	mg/L	500	EPA Secondary	20
▲	Turbidity	100.0	NTU	1.0	EPA Action Level	0.1

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
	Inorganic Analytes - Other					
✓	Chloride	ND	mg/L	250	EPA Secondary	5.0
✓	Fluoride	ND	mg/L	4.0	EPA Primary	0.5
✓	Nitrate as N	ND	mg/L	10	EPA Primary	0.5
✓	Nitrite as N	ND	mg/L	1	EPA Primary	0.5
✓	Ortho Phosphate	ND	mg/L	--		2.0
●	Sulfate	9.3	mg/L	250	EPA Secondary	5.0
	Organic Analytes - Trihalomethanes					
✓	Bromodichloromethane	ND	mg/L	--		0.002
✓	Bromoform	ND	mg/L	--		0.004
✓	Chloroform	ND	mg/L	--		0.002
✓	Dibromochloromethane	ND	mg/L	--		0.004
✓	Total THMs	ND	mg/L	0.080	EPA Primary	0.002
	Organic Analytes - Volatiles					
✓	1,1,1,2-Tetrachloroethane	ND	mg/L	--		0.002
✓	1,1,1-Trichloroethane	ND	mg/L	0.2	EPA Primary	0.001
✓	1,1,2,2-Tetrachloroethane	ND	mg/L	--		0.002
✓	1,1,2-Trichloroethane	ND	mg/L	0.005	EPA Primary	0.002
✓	1,1-Dichloroethane	ND	mg/L	--		0.002
✓	1,1-Dichloroethene	ND	mg/L	0.007	EPA Primary	0.001
✓	1,1-Dichloropropene	ND	mg/L	--		0.002
✓	1,2,3-Trichlorobenzene	ND	mg/L	--		0.002
✓	1,2,3-Trichloropropane	ND	mg/L	--		0.002
✓	1,2,4-Trichlorobenzene	ND	mg/L	0.07	EPA Primary	0.002
✓	1,2-Dichlorobenzene	ND	mg/L	0.6	EPA Primary	0.001
✓	1,2-Dichloroethane	ND	mg/L	0.005	EPA Primary	0.001
✓	1,2-Dichloropropane	ND	mg/L	0.005	EPA Primary	0.002
✓	1,3-Dichlorobenzene	ND	mg/L	--		0.001

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
✓	1,3-Dichloropropane	ND	mg/L	--		0.002
✓	1,4-Dichlorobenzene	ND	mg/L	0.075	EPA Primary	0.001
✓	2,2-Dichloropropane	ND	mg/L	--		0.002
✓	2-Chlorotoluene	ND	mg/L	--		0.001
✓	4-Chlorotoluene	ND	mg/L	--		0.001
✓	Acetone	ND	mg/L	--		0.01
✓	Benzene	ND	mg/L	0.005	EPA Primary	0.001
✓	Bromobenzene	ND	mg/L	--		0.002
✓	Bromomethane	ND	mg/L	--		0.002
✓	Carbon Tetrachloride	ND	mg/L	0.005	EPA Primary	0.001
✓	Chlorobenzene	ND	mg/L	0.1	EPA Primary	0.001
✓	Chloroethane	ND	mg/L	--		0.002
✓	Chloromethane	ND	mg/L	--		0.002
✓	cis-1,2-Dichloroethene	ND	mg/L	0.07	EPA Primary	0.002
✓	cis-1,3-Dichloropropene	ND	mg/L	--		0.002
✓	DBCP	ND	mg/L	--		0.001
✓	Dibromomethane	ND	mg/L	--		0.002
✓	Dichlorodifluoromethane	ND	mg/L	--		0.002
✓	Dichloromethane	ND	mg/L	0.005	EPA Primary	0.002
✓	EDB	ND	mg/L	--		0.001
✓	Ethylbenzene	ND	mg/L	0.7	EPA Primary	0.001
✓	Methyl Tert Butyl Ether	ND	mg/L	--		0.004
✓	Methyl-Ethyl Ketone	ND	mg/L	--		0.01
✓	Styrene	ND	mg/L	0.1	EPA Primary	0.001
✓	Tetrachloroethene	ND	mg/L	0.005	EPA Primary	0.002
✓	Tetrahydrofuran	ND	mg/L	--		0.01
✓	Toluene	ND	mg/L	1	EPA Primary	0.001
✓	trans-1,2-Dichloroethene	ND	mg/L	0.1	EPA Primary	0.002

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
✓	trans-1,3-Dichloropropene	ND	mg/L	--		0.002
✓	Trichloroethene	ND	mg/L	0.005	EPA Primary	0.001
✓	Trichlorofluoromethane	ND	mg/L	--		0.002
✓	Vinyl Chloride	ND	mg/L	0.002	EPA Primary	0.001
✓	Xylenes (Total)	ND	mg/L	10	EPA Primary	0.001
	Organic Analytes - Others					
✓	2,4-D	ND	mg/L	0.07	EPA Primary	0.010
✓	Alachlor	ND	mg/L	0.002	EPA Primary	0.001
✓	Aldrin	ND	mg/L	--		0.002
✓	Atrazine	ND	mg/L	0.003	EPA Primary	0.002
✓	Chlordane	ND	mg/L	0.002	EPA Primary	0.001
✓	Dichloran	ND	mg/L	--		0.002
✓	Dieldrin	ND	mg/L	--		0.001
✓	Endrin	ND	mg/L	0.002	EPA Primary	0.0001
✓	Heptachlor	ND	mg/L	0.0004	EPA Primary	0.0004
✓	Heptachlor Epoxide	ND	mg/L	0.0002	EPA Primary	0.0001
✓	Hexachlorobenzene	ND	mg/L	0.001	EPA Primary	0.0005
✓	Hexachlorocyclopentadiene	ND	mg/L	0.05	EPA Primary	0.001
✓	Lindane	ND	mg/L	0.0002	EPA Primary	0.0002
✓	Methoxychlor	ND	mg/L	0.04	EPA Primary	0.002
✓	Pentachloronitrobenzene	ND	mg/L	--		0.002
✓	Silvex 2,4,5-TP	ND	mg/L	0.05	EPA Primary	0.005
✓	Simazine	ND	mg/L	0.004	EPA Primary	0.002
✓	Total PCBs	ND	mg/L	0.0005	EPA Primary	0.0005
✓	Toxaphene	ND	mg/L	0.003	EPA Primary	0.001
✓	Trifluralin	ND	mg/L	--		0.002

Status	Contaminant	Results	Units	National Standards	Min. Detection Level

We certify that the analyses performed for this report are accurate, and that the laboratory tests were conducted by methods approved by the U.S. Environmental Protection Agency or variations of these EPA methods.

These test results are intended to be used for informational purposes only and may not be used for regulatory compliance.

National Testing Laboratories, Ltd.

NATIONAL TESTING LABORATORIES, LTD

Stettler Supply Company
"Committed to Service Excellence"
Since 1948
CCB# 0033228
4420 Ridge Drive NE • Salem, Oregon 97301
503.585.5550-office 503.581.6799-facsimile
866.985.5550-toll free

Jackson Family Wines
Cantwell Property: Upper and Lower Wells
Attn: Ken Kupperman

November 5, 2014

Stettler Supply performed flow tests and took water samples for two wells at the Cantwell property on 9/22/14. The property is located at 11711 Hwy 240 Yamhill, OR 97148. The scope of the work was to perform flow tests to determine what the flow capacity was for each well, with the existing pumps in each well. The water samples were submitted for comprehensive "Peace of Mind" water tests to be performed through Edge Analytical Laboratories. The results of the lab testing are attached. Also attached are the well logs for the two wells.

Lower Well – ID# L37133

The lower well is located in a small pump house at the base of the hill where the vineyard is to be developed. There is power to the pump house with several disconnects for the main power, the lower well and for the upper well. The power to the pump house is not currently turned on. There is neither a sanitary well seal nor discharge piping for the well. The pump within the well is a ½ horsepower, single phase, 230 volt submersible pump. The exact make and model of the pump and the gpm rating for the pump end is unknown at this time and can only be verified by pulling the pump. The pump was run by generator for approximately 30 minutes with the following results. The starting static water level was 8 feet below surface. The well pumped 15 gpm at open discharge with draw down. The well was throttled back to 7 gpm with 75 psi discharge pressure and stabilized at 30' below surface. The performance of the existing pump indicates that the pump end is a 5 to 10 gpm pump end.

Upper Well – ID# L37124

The upper well is located at the top of the hill on the west property boundary where the vineyard is to be developed. The well is mounted on a pitless adapter. There is no power or piping to the pump discharge. The pump within the well was tested for resistance and the results indicate a 3 horsepower, three phase, 230 volt submersible pump. The exact make and model of the pump and the gpm rating for the pump end is unknown at this time and can only be verified by pulling the pump. The pump was run by generator for approximately 30 minutes with the following results. The starting static water level was 34 feet below surface. The well pumped 50 gpm at open discharge with draw down and then stabilized at 48' below surface. The performance of the existing pump indicates that the pump end is a 35 gpm pump end.

Recommendations
I estimate that the lower well will produce 3-7 gpm and that the upper well can produce 25-35 gpm at 40+ psi with the existing pumps. The well logs indicate that the lower well was air tested at 5 gpm for 1 hour and that the upper well was air tested at 75 gpm for 2 hours. The upper well may be able to supply between 50 & 75 gpm at pressure with a larger pump. The future demand for the wells needs to be determined in deciding whether more production is required and/or desired than the current pump in the upper well will supply. To determine how much water the wells can reliably produce requires test pumping for a longer duration (minimum of 4 hours) and will require that a larger pump be put into the upper well.

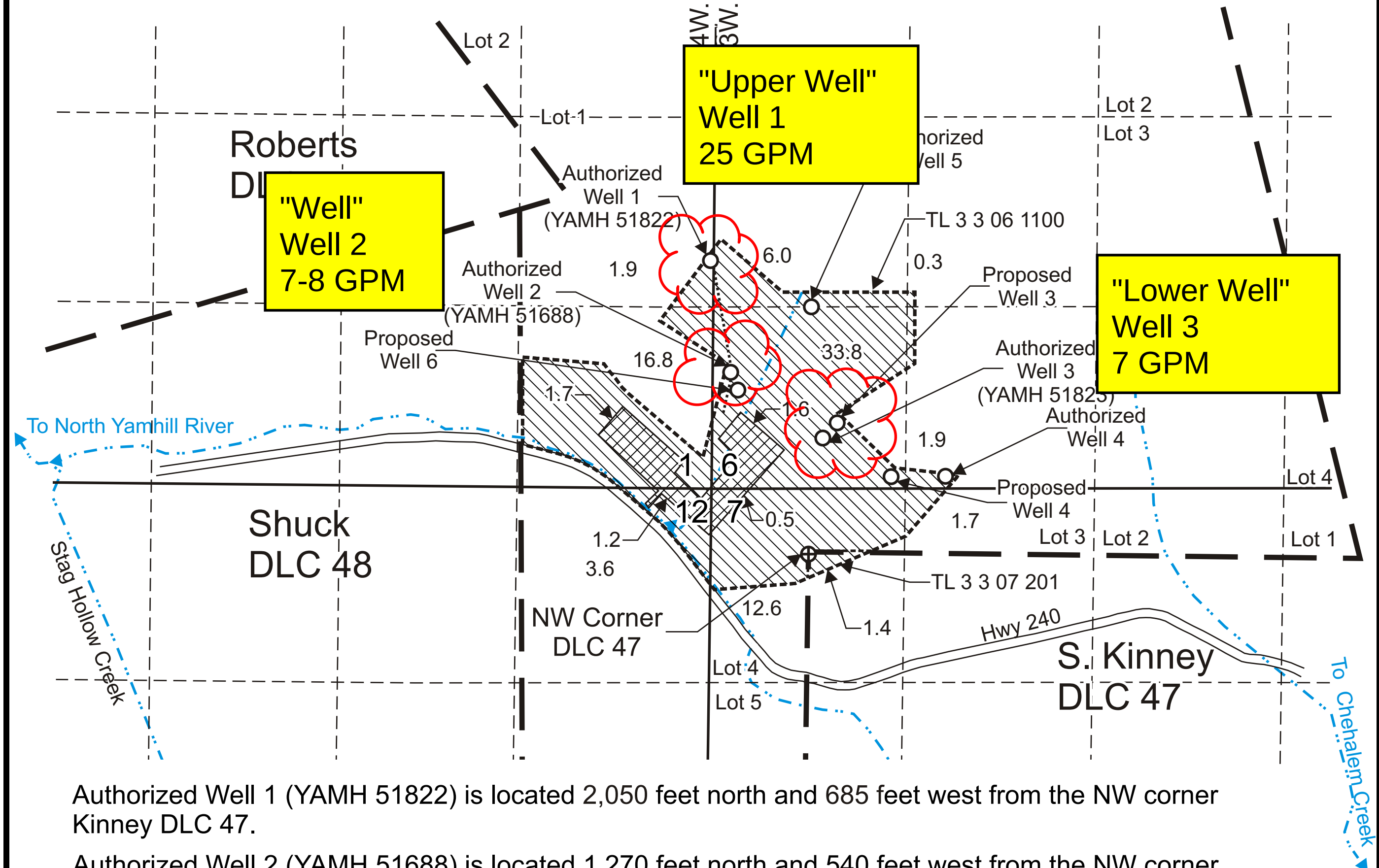
The water test results do not indicate any serious health hazards with the water however, the turbidity, iron, and manganese levels are extremely high in both wells along with zinc in the upper well. The reasons for the extremely high levels are probably twofold: first the wells have been sitting inactive for an unknown, but extended period of time; second, the wells probably have high levels of bacterial slimes that tend to "fix" these metals so that they read in extremely high levels in testing. I recommend chlorinating both wells, and recirculating them with the chlorine for 1-2 hours and then letting the well sit inactive for 24 hours. The wells should then be pumped until they visually clear of color and turbidity and until the chlorine is thoroughly flushed out. The water can then be resampled and these metals checked for the true elemental levels. Treatment options can then be determined based on what the end use of the water will be.

Please contact me if there are further questions or if additional information is needed.

Thank you,

Paul Walther
Irrigation Design and Sales

T.3S. R.3W. Sec. 6 & 7
T.3S. R.4W. Section 1 & 12, W.M.



Authorized Well 1 (YAMH 51822) is located 2,050 feet north and 685 feet west from the NW corner Kinney DLC 47.

Authorized Well 2 (YAMH 51688) is located 1,270 feet north and 540 feet west from the NW corner Kinney DLC 47.

Authorized Well 3 (YAMH 51823) is located 810 feet north and 100 feet east from the NW corner Kinney DLC 47.

Proposed Well 3 is located 915 feet north and 200 feet east from the NW corner, Kinney DLC 47.

Authorized Well 4 is located 545 feet north and 955 feet east from the NW corner Kinney DLC 47.

Proposed Well 4 is located 540 feet north and 575 feet east from the NW corner Kinney DLC 47.

Authorized Well 5 is located 1,710 feet north and 20 feet east from the NW corner Kinney DLC 47.

Proposed Well 6 is located 1,145 feet north and 490 feet west from the NW corner Kinney DLC 47.

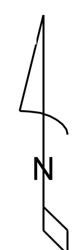
Area (80.0 acres) to be irrigated under Application G-15078, Permit G-15014, priority date December 28, 1999.

Area (5.0 acres) to be used for Hydroponics Algae Operation under Application G-15078, Permit G-15014, priority date December 28 1999.

Tax lot boundary

Donation Land Claim boundary

Irrigation mainline



Scale: 1" = 1,320'

0 1,320
Feet

This map was prepared for the purpose of identifying the location of a water right only and is not intended to provide legal dimensions or location of property ownership lines.

Permit Amendment Map
Application G-15078, Permit G-15014
Jackson Family Wines, Inc.
T.3S. R.3W. Sec. 6 & 7;
T.3S, R.4W. Sec. 1 & 12, W.M.

Pacific Hydro-Geology Inc.

03/2016

JacksonPAMap.cdr

#2

YAMH 51823

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D. # L 37133
START CARD # 125396

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number ______
Name Puriponics
Address 11741 N.E. Hwy 240
City Yamhill State Or Zip 97148

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☒ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 220 ft.
Explosives used ☐ Yes ☒ No Type ______ Amount ______

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10 5/8"	0	30	Bentonite	0	30	12
6"	30	220				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other Bentonite (Poured Slowly)
Backfill placed from ______ ft. to ______ ft. Material ______
Gravel placed from ______ ft. to ______ ft. Size of gravel ______

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+2	30	.25	☒	☐	☒	☐
Liner:	4"	0	220	160	☐	☒	☒	☐

Final location of shoe(s) ______

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Electric Drill
☐ Screens Type ______ Material ______

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
180	220		150	5/8" Circular		☐	☒

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
5	Air Lift	220	1 hr.

Temperature of water 51° Depth Artesian Flow Found ______
Was a water analysis done? ☐ Yes By whom ______
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other ______
Depth of strata: ______

(9) LOCATION OF WELL by legal description:
County Yamhill Latitude ______ Longitude ______
Township 3S N or S Range 3W E or W. WM.
Section 6 SE 1/4 SW 1/4
Tax Lot 3306 Lot 1100 Block ______ Subdivision ______
Street Address of Well (or nearest address) SAME

(10) STATIC WATER LEVEL:
72 ft. below land surface. Date 8/11/99
Artesian pressure ______ lb. per square inch. Date ______

(11) WATER BEARING ZONES:
Depth at which water was first found 84 3 G.P.M.

From	To	Estimated Flow Rate	SWL
84	86	3	72
147	149	2	

(12) WELL LOG:
Ground Elevation Appox 400'

Material	From	To	SWL
Topsoil	0	2	
Brown Clay	2	17	
Red Decomposed Clay	17	24	
Firm Gray Sandstone w/ unstable layers (possible caving).	24	220	

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SALEM, OREGON

Date started 10/8/99 Completed 10/11/99

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number ______
Signed Not Appl. Date ______

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 795
Signed Randall L. Wilson Date 10/12/99

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

YAMH 51822

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D. # L37124

(START CARD) # 125384

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name Puriponics
Address 11711 N.E. Hwy 240
City yamhill State Or. Zip 97148

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [X] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 180 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10 5/8"	0	49	Bentonite	0	49	22 Sacks
10 5/8"	49	67	Cement	49	67	8 Sacks
6"	67	180				

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[X] Other Bentonite placed top [illegible], Cement pumped
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+2	67	.250	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:	4"	4	180	160 PSI	[ ]	[X]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[X] Perforations Method Electric drill
[ ] Screens Type 5/8" circular drilled holes Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
140	180		140	5/8 circular drilled holes		[ ]	[X]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
75		180	2 hr.

Temperature of water 51° Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Yamhill Latitude Longitude
Township 3S N or S Range 3W E or W. WM.
Section 6 NE 1/4 SW 1/4
Tax Lot 3306 Lot 1100 Block Subdivision
Street Address of Well (or nearest address) SAME

(10) STATIC WATER LEVEL:
43 ft. below land surface. Date Oct. 8 99
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found 95 ft 2 GPM

From	To	Estimated Flow Rate	SWL
95	97	2 GPM	
99	100	5 GPM	
120	125	16 GPM.	
140	142	18 GPM.	
155	165	40 GPM.	

(12) WELL LOG:
Ground Elevation Appox 400'

Material	From	To	SWL
Topsoil	0	3	
Brown clay	3	18	
Brownish Yellow clay	18	52	
Brown Decomposed Clay	52	57	
Medium Hard Blue			
& Green Sandstone			
with Unstable Layers	57	180	

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SALEM, OREGON

Date started 10/6/99 Completed 10/8/99

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number
Signed Not App'. Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 268
Signed [signature] Date Oct 19 99

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

Department of Environmental Quality
LAND USE COMPATIBILITY STATEMENT (LUCS)

DEQ
State of Oregon
Department of Environmental Quality

WHAT IS A LUCS? The Land Use Compatibility Statement is the process used by the DEQ to determine whether DEQ permits and other approvals affecting land use are consistent with local government comprehensive plans.

WHY IS A LUCS REQUIRED? Oregon law requires state agency activities that impact land use be consistent with local comprehensive plans. DEQ Oregon Administrative Rules (OAR) Chapter 340, Division 18 identifies agency activities or programs that significantly affect land use and must have a process for determining local plan consistency.

WHEN IS A LUCS REQUIRED? A LUCS is required for nearly all DEQ permits and certain approvals of plans or related activities that affect land use. These permits and activities are listed on p. 2 of this form. A single LUCS can be used if more than one DEQ permit/approval is being applied for concurrently.

A permit modification requires a LUCS when any of the following applies:

1. Physical expansion on the property or proposed use of additional land;
2. A significant increase in discharges to water;
3. A relocation of an outfall outside of the source property; or
4. Any physical change or change of operation of an air pollutant source that results in a net significant emission rate increase as defined in OAR 340-200-0020.

A permit renewal requires a LUCS if one has not previously been submitted, or if any of the above modification factors apply.

HOW TO COMPLETE A LUCS:

Step	Who Does It	What Happens
1	Applicant	Completes Section 1 of the LUCS and submits it to the appropriate city or county planning office.
2	City or County Planning Office	Completes Section 2 of the LUCS by determining if the activity or use meets all local planning requirements, and returns to the applicant the signed and dated LUCS form **with findings of fact for any local reviews or necessary planning approvals**.
3	Applicant	Includes the completed LUCS with **findings of fact** with the DEQ permit or approval submittal application to the DEQ.

WHERE TO GET HELP: For questions about the LUCS process, contact the DEQ staff responsible for processing the permit/approval. Headquarters and regional staff may be reached using DEQ's toll-free telephone number 1-800-452-4011. For general questions, please contact DEQ land use staff listed at: www.deq.state.or.us/pubs/permithandbook/lucs.htm.

CULTURAL RESOURCES PROTECTION LAWS: *Applicants involved in ground-disturbing activities should be aware of federal and state cultural resources protection laws. ORS 358.920 prohibits the excavation, injury, destruction, or alteration of an archeological site or object, or removal of archeological objects from public and private lands without an archeological permit issued by the State Historic Preservation Office. 16 USC 470, Section 106, National Historic Preservation Act of 1966 requires a federal agency, prior to any undertaking, to take into account the effect of the undertaking that is included on or eligible for inclusion in the National Register. For further information, contact the State Historic Preservation Office at 503-378-4168, extension 232.*

SECTION 1 - TO BE COMPLETED BY APPLICANT

A. Applicant Name: 240 WINEWORKS LLC
Contact Name: Anne McIntyre
Mailing Address: P.O. Box 129
City, State, Zip: Dundee, Oregon, 97115
Telephone: 503 662-5021
Tax Account No.: 20-837115I

B. Project Name: 240 Wineworks
Physical Address: 11711 NE Highway 240
City, State, Zip: Yamhill, Oregon, 97148
Tax Lot No.: 1100
Township: 3 **Range:** 3 **Section:** 06
Latitude: 45°19'57.58" N
Longitude: 123°07'24.88" W

*For latitude/longitude, use the **DEQ Location** Finder at http://deq12.deq.state.or.us/website/findloc.*

C. Describe the type of business or facility and services or products provided:
New 10,000 case winery using constructed wetland for process wastewater treatment followed by irrigation disposal of treated PWW.

SECTION 1 - TO BE COMPLETED BY APPLICANT (Continued)

Applicant Name: 240 WINEWORKS LLC

Project Name: 240 Wine works

D. Check the type of DEQ permit(s) or approval(s) being applied for at this time.

☐ Air Notice of Construction	☐ Pollution Control Bond Request
☐ Air Discharge Permit *(excludes portable facility permits)*	☐ Hazardous Waste Treatment, Storage, or Disposal Permit
☐ Title V Air Permit	☐ Clean Water State Revolving Fund Loan Request
☐ Parking/Traffic Circulation Plan	☐ Wastewater/Sewer Construction Plan/Specifications *(includes review of plan changes that require use of new land)*
☐ Air Indirect Source Permit	☐ Water Quality NPDES Individual Permit
☐ Solid Waste Disposal Permit	☐ Water Quality WPCF Individual Permit *(for onsite construction-installation permits use DEQ's Onsite LUCS form)*
☐ Solid Waste Treatment Permit	☐ Water Quality NPDES Stormwater General Permit *(1200-A, 1200-C, 1200-CA, 1200-COLS, and 1200-Z)*
☐ Solid Waste Compost Registration or Permit	☒ Water Quality General Permit *(all general permits, except 600, 700-PM, 1700-A, and 1700-B when they are mobile.)*
☐ Solid Waste Letter Authorization Permit	☐ Water Quality 401 Certification for federal permit
☐ Solid Waste Material Recovery Facility Permit	
☐ Solid Waste Transfer Station Permit	
☐ Solid Waste Tire Storage Permit	

E. This application is for: ☐ permit renewal ☒ new permit ☐ permit modification ☐ other: ______

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL

Please Note: A LUCS approval cannot be accepted by DEQ until all local requirements have been met. Written findings of fact for all local decisions addressed under Item C below are required. Written findings for an activity or use addressed by the acknowledged comprehensive plan in accordance with OAR 660-031-0020 may simply reference the specific plan policies, criteria, or standards that were relied upon in rendering the decision and indicate why the decision is justified based on the plan policies, criteria, or standards.

A. The facility proposal is located: ☐ inside city limits ☐ inside UGB ☑ outside UGB

B. Name of the city or county that has land use jurisdiction *(the legal entity responsible for land use decisions for the subject property or land use)*: YAMHILL COUNTY

C. Does the activity or use comply with all applicable local land use requirements *(as required by OAR Chapter 660, Division 31)*?

☑ **YES,** you must complete below or attach findings to support the affirmative compliance decision

i) Relevant specific plan policies, criteria, or standards: C-03-05/SDR-03-05

ii) Provide the reasons for the decision: ATTACHED

☐ **NO,** you must complete below or attach findings for noncompliance, and identify requirements the applicant must comply with before LUCS compatibility can be determined.

i) Relevant specific plan policies, criteria, or standards: ______

ii) Provide the reasons for the decision: ______

D. Planning Official Signature: [signature] **Title:** ASSOCIATE PLANNER

Print Name: MARTIN CHROUST-MASIN **Telephone No.:** 503-434-7516 **Date:** 7-10-07

E. ***If necessary, depending upon city/county agreement on jurisdiction outside city limits but within UGB:***

Planning Official Signature: ______ **Title:** ______

Print Name: ______ **Telephone No.:** ______ **Date:** ______

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WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON

COUNTY OF YAMHILL

PERMIT TO APPROPRIATE THE PUBLIC WATERS

THIS PERMIT IS HEREBY ISSUED TO

PURI PONICS
DAN EISCHEN
806 SW BROADWAY, SUITE 900 (503)228-9205
PORTLAND, OREGON 97205

The specific limits and conditions of the use are listed below.

APPLICATION FILE NUMBER: G-15078

SOURCE OF WATER: FIVE WELLS AND WASTE WATER IN THE CHEHALEM CREEK BASIN

PURPOSE OR USE: WELLS 1,2,3, AND 4, AND WASTE WATER FROM HYDROPONICS OPERATION - IRRIGATION OF 80.0 ACRES; WELLS 1,2,3,4, AND 5 - HYDROPONICS ALGAE OPERATIONS ON 5.0 ACRES.

MAXIMUM RATE: NOT TO EXCEED A MAXIMUM CUMULATIVE TOTAL OF 0.167 CUBIC FOOT PER SECOND(CFS) FROM ANY COMBINATION OF THE WELLS FOR IRRIGATION OR HYDROPONICS OPERATIONS; AND UP TO 0.446 CFS MAY BE USED FROM WASTE WATER FROM HYDROPONICS OPERATION FOR IRRIGATION, OR AS MAY BE FURTHER RESTRICTED BY ANY REQUIRED DISCHARGE PERMIT.

PERIOD OF USE: WELLS 1,2,3, AND 4 - MARCH 1 THROUGH OCTOBER 31 FOR IRRIGATION AND YEAR ROUND FOR HYDROPONICS ALGAE OPERATIONS; WELL 5 - DECEMBER 1 THROUGH FEBRUARY 28 FOR HYDROPONICS ALGAE OPERATIONS; WASTE WATER - MARCH 1 THROUGH OCTOBER 31 FOR IRRIGATION

DATE OF PRIORITY: DECEMBER 28, 1999

WELL LOCATIONS:
WELL 2: SW 1/4 SW 1/4, SECTION 6, T3S, R3W, W.M. 1220 FEET NORTH AND 670 FEET WEST FROM NW CORNER DLC 47.

WELL 3: SW 1/4 SW 1/4, SECTION 6, T3S, R3W, W.M. 810 FEET NORTH AND 100 FEET EAST FROM NW CORNER DLC 47.

WELL 5: SW 1/4 SW 1/4, SECTION 6, T3S, R3W, W.M. 1710 FEET NORTH AND 20 FEET EAST FROM NW CORNER DLC 47.

WELL 4: SE 1/4 SW 1/4, SECTION 6, T3S, R3W, W.M. 450 FEET NORTH AND 750 FEET EAST FROM NW CORNER DLC 47.

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SALEM, OREGON

WELL 1: NE 1/4 SE 1/4, SECTION 1, T3S, R4W, W.M. 1860 FEET NORTH AND 600 FEET WEST FROM NW CORNER DLC 47.

The amount of water used for irrigation under this right, together with the amount secured under any other right existing for the same lands, is limited to a diversion of ONE-EIGHTIETH of one cubic foot per second (or its equivalent) and 2.5 acre-feet for each acre irrigated during the irrigation season of each year.

The amount of water used for HYDROPONICS OPERATIONS is limited to a diversion of 0.15 cubic foot per second per acre.

THE PLACE OF USE IS LOCATED AS FOLLOWS:

	IRRIGATION	HYDROPONICS
NW 1/4 SW 1/4	2.72 ACRES	
SW 1/4 SW 1/4	32.88 ACRES	1.6 ACRES
SE 1/4 SW 1/4	0.62 ACRE	
	SECTION 6	
NE 1/4 NW 1/4	2.38 ACRES	
NW 1/4 NW 1/4	18.20 ACRES	0.5 ACRES
	SECTION 7	
	TOWNSHIP 3 SOUTH, RANGE 3 WEST, W.M.	
NE 1/4 SE 1/4	0.62 ACRE	
SW 1/4 SE 1/4	0.27 ACRE	
SE 1/4 SE 1/4	17.95 ACRES	1.7 ACRES
	SECTION 1	
NE 1/4 NE 1/4	4.36 ACRES	1.2 ACRES
	SECTION 12	
	TOWNSHIP 3 SOUTH, RANGE 4 WEST, W.M.	

Measurement, recording and reporting conditions:

A. Before water use begins under this permit, the permittee **shall** install, for each well, a meter or other suitable measuring device as approved by the Director. The permittee **shall** maintain the meter or other measuring device in good working order. 1

B. The Director **requires** the permittee to keep and maintain a record of the amount (volume) of water used and requires the permittee to report use on a periodic schedule as established by the Director. In addition, the Director **requires** the permittee to report general water use information, the periods of water use and the place and 2 nature of use of water under the permit. The Director **may** provide an opportunity for the permittee to submit alternative reporting procedures for review and approval.

In the event of a request for a change in point of appropriation, an additional point of appropriation or alteration of the appropriation facility associated with this authorized diversion, the quantity of water allowed herein, together with any other right, shall not exceed the capacity of the facility at the time of perfection of this right.

If the number, location, or construction of any well deviates from that proposed in the permit application or permit conditions, the conclusions of the Initial Review or Proposed Final Order under which this permit was granted may be revised, conditions may be appropriately revised, or this permit may not be valid.

The permittee shall develop a plan to monitor and report the impact of water use under this permit on water levels with the aquifer that provides water to the permitted wells. **The plan shall be submitted to the Department within 60 days of the date that the permit is issued** and shall be subject to the approval of the Department. At a minimum, the plan shall include a program to periodically measure static water levels at the permitted wells and in wells within 1/4 mile of any well on the permittee's property (subject to offsite landowner access). The plan shall also stipulate a reference level(s) against which any water-level declines will be compared. 3

If a well listed on this permit (or replacement well) displays a total water level decline of 25 feet or more over any period of years, as compared to the reference level, then the permittee shall discontinue use of, or reduce the rate or volume of withdrawal from the well(s). Such action shall be taken until the water level recovers to above the 25-feet decline level or until the Department determines, based on the water user's and/or the Department's data and analysis, that no action is necessary because the aquifer in question can sustain the observed declines without adversely impacting the resource or senior water rights. The permittee shall in no instance allow excessive decline, as defined in Commission rules, to occur within the aquifer as a result of use under this permit.

If any other well with senior priority (or replacement well) displays a water level decline of 25 feet or more due to pumping of the permitted well(s), the permittee shall discontinue use of, or reduce the rate or volume of withdrawal from the well(s). Such action shall be taken until the water level recovers to above the 25-feet decline level.

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SALEM, OREGON

The water user shall conduct a constant-rate drawdown and recovery aquifer test to evaluate the hydraulic parameters of the aquifer system and develop information regarding the radius of influence of the withdrawal. The constant rate test shall be conducted under a plan submitted by the water user within sixty days of the date the permit is issued and shall be subject to the approval of the Department. Observation wells to be monitored during the test shall strive to include those within 1/4 mile of the pumping well. The raw data and results of the test shall be reported to the Department and made available to the public. 4

The use from well 5 may be restricted if the quality of the source stream or downstream waters decrease to the point that those waters no longer meet existing state or federal water quality standards due to reduced flows.

STANDARD CONDITIONS

The wells shall be constructed in accordance with the General Standards for the Construction and Maintenance of Water Wells in Oregon. The works shall be equipped with a usable access port, and may also include an air line and pressure gauge adequate to determine water level elevation in the well at all times.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

Prior to receiving a certificate of water right, the permit holder shall submit the results of a pump test meeting the department's standards, to the Water Resources Department. The Director may require water level or pump test results every ten years thereafter.

Failure to comply with any of the provisions of this permit may result in action including, but not limited to, restrictions on the use, civil penalties, or cancellation of the permit.

This permit is for the beneficial use of water without waste. The water user is advised that new regulations may require the use of best practical technologies or conservation practices to achieve this end.

By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan.

The use of water shall be limited when it interferes with any prior surface or ground water rights.

The Director finds that the proposed use(s) of water described by this permit, as conditioned, will not impair or be detrimental to the public interest.

Complete application of the water to the use shall be made on or before October 1, 2006. If the water is not completely applied before this date, and the permittee wishes to continue development under the permit, the permittee must submit an application for extension of time, which may be approved based upon the merit of the application.

Within one year after complete application of water to the proposed use, the permittee shall submit a claim of beneficial use, which includes a map and report, prepared by a Certified Water Rights Examiner (CWRE).

Issued January 30, 2002

Dwight French for

Paul R. Cleary, Director
Water Resources Department

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SALEM, OREGON

NOTE: Pursuant to ORS 537.330, in any transaction for the conveyance of real estate that includes any portion of the lands described in this permit, the seller of the real estate shall, upon accepting an offer to purchase that real estate, also inform the purchaser in writing whether any permit, transfer approval order, or certificate evidencing the water right is available and that the seller will deliver any permit, transfer approval order or certificate to the purchaser at closing, if the permit, transfer approval order or certificate is available.

Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301
(503) 986-0900
www.wrd.state.or.us

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WATER RESOURCES DEPT
SALEM, OREGON

Application for Extension of Time for a Water Right Permit

(Non-Municipal / Non-Quasi-municipal Water Use)

TO THE DIRECTOR OF THE OREGON WATER RESOURCES DEPARTMENT

I, Barbara Banke; for Jackson Family Wines Inc. GFK
NAME OF PERMIT HOLDER *[OAR 690-315-0020(1) and (3)(a)]*

the holder of: Application Number G-15078 Permit Number G-15014 *[OAR 690-315-0020(3)(b)]*

A separate application must be submitted for each permit as per OAR 690-315-0020(2).

425 Aviation Blvd.
MAILING ADDRESS

Santa Rosa, CA 95403
CITY, STATE, ZIP

(707) 738-6263
PHONE

E-MAIL ADDRESS

X **do hereby request that** the time to apply water to full beneficial use under the terms and conditions of the permit, which now expires on October 1, 2011, be extended to October 1, 2037.

Please Note. If the permit **does** specify a date when **construction** must be **completed**, you should request to extend both the time to apply water to full beneficial use **and** to complete construction. These dates are typically found on the permit above the signature of the Director.

and

☐ **do hereby request that** the time to complete construction of the water system, which now expires on Month ____ Day ____ Year ____, be extended to October 30, Year ____

Sign after completing the entire application, questions 1-11.

I am the permit holder, or have attached to this application written authorization from the permit holder, to apply for an extension of time under this permit. I understand that false or misleading statements in this extension application are grounds for OWRD to suspend processing of the request and/or reason to deny the extension. I have completed the entire application.

[signature] June 15 2015
Signature **Date**

Printed Name/Title Barbara Banke, Chairman, Jackson Family Wines

MAIL COMPLETED and SIGNED APPLICATION with the $575 STATUTORY FEE TO:

Water Resources Department
Attn: Water Right Permit Extensions
725 Summer Street NE, Suite A
Salem, Oregon 97301

RECEIVED
JUL 24 2015
WATER RESOURCES DEPT
SALEM, OREGON

Submit the following items with your Application for Extension of Time:

- **The signed and completed Application for Extension of Time.**
- **$575 check to OWRD or Oregon Water Resources Department**
- **All supporting documentation and/or evidence referenced in the application.**

Reference materials needed to complete this Application:

- **Water right permit.** A copy of the water right permit can be downloaded from the Department's Website at *http://www.wrd.state.or.us* (using the link to the Water Rights Information System (WRIS). A copy of the permit may be requested from the Water Rights Division at 503-986-0801 (copy fees will apply).
- **Documentation** which demonstrates compliance with permit conditions (for example, well construction logs; static water level measurement reports; annual water use reports; ODFW fish screen certification;, a plan to monitor the effect of water use on ground water aquifers utilized under the permit; etc.).

Helpful information for completing this Application:

- Permit holders of **municipal or quasi-municipal water use permits DO NOT use this form.** The form *Application for Extension of Time for Municipal and Quasi-Municipal Water Use Permits* is at the following link: http://www.wrd.state.or.us/OWRD/PUBS/forms.shtml#other
- Request the reasonable amount of time necessary to fully complete construction of the water project and/or to fully use the permitted quantity of water under the permit terms & conditions.
- The attached *Instructions for Completing an Application for Extension of Time for a Water Right Permit* will help you answer each question on the application. If, after reading the instructions, you need assistance, please call the Extensions Specialist at 503-986-0900.
- Permit extensions are evaluated under OAR Chapter 690, Division 315, which may be viewed at: http://www.wrd.state.or.us/OWRD/LAW/index.shtml. Please note that OWRD may require additional information, if necessary, to evaluate the application per OAR 315-0020(3)(n).
- OWRD will review applications received for completeness and will return incomplete or deficient applications per OAR 690-315-0040(1)(a) to the applicant.

Questions to Complete this Application for Extension of Time

Please see the instruction sheet to help you answers these questions.

[OAR 690-315-0020(3)(d)]

1. **Did the "actual construction" of the water system/well drilling begin within the time specified in the permit?** ☐ **Yes** ☐ **No** ☒ **N/A**, if not specified in this permit

Date "actual construction" began is: NA

Describe details of construction: NA

RECEIVED
JUL 24 2015
WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
WATER RESOURCES DEPARTMENT
725 Summer St. N.E. Ste. A
SALEM, OR 97301-4172
(503) 986-0900 / (503) 986-0904 (fax)

RECEIPT # 116720 INVOICE # ______

RECEIVED FROM: Jackson Family
BY: Wines, Inc.

APPLICATION	G-15078
PERMIT	
TRANSFER	

CASH: ☐ CHECK:# ☒ 683449 OTHER: (IDENTIFY) ☐ ______

TOTAL REC'D $575.00

1083 TREASURY 4170 WRD MISC CASH ACCT

0407	COPIES		$
______	OTHER:	(IDENTIFY) ______	$

0243 I/S Lease ______ 0244 Muni Water Mgmt. Plan ______ 0245 Cons. Water ______

4270 WRD OPERATING ACCT

MISCELLANEOUS 46111

0407	COPY & TAPE FEES		$
0410	RESEARCH FEES		$
0408	MISC REVENUE: (IDENTIFY)	______	$
TC162	DEPOSIT LIAB. (IDENTIFY)	______	$
0240	EXTENSION OF TIME		$ 575.00

WATER RIGHTS:

		EXAM FEE		RECORD FEE
0201	SURFACE WATER	$	0202	$
0203	GROUND WATER	$	0204	$
0205	TRANSFER	$		

WELL CONSTRUCTION

		EXAM FEE		LICENSE FEE
0218	WELL DRILL CONSTRUCTOR	$	0219	$
	LANDOWNER'S PERMIT		0220	$

______ OTHER (IDENTIFY) ______

0536 TREASURY 0437 WELL CONST. START FEE

0211	WELL CONST START FEE	$	CARD #	
0210	MONITORING WELLS	$	CARD #	

______ OTHER (IDENTIFY) ______

0607 TREASURY 0467 HYDRO ACTIVITY LIC NUMBER

0233	POWER LICENSE FEE (FW/WRD)		$
0231	HYDRO LICENSE FEE (FW/WRD)		$
______	HYDRO APPLICATION		$

______ TREASURY OTHER / RDX

FUND ______ TITLE ______
OBJ. CODE ______ VENDOR # ______ $
DESCRIPTION ______

RECEIVED OVER THE COUNTER

RECEIPT: 116720 DATED: 7/24/15 BY: [signature]

Distribution – White Copy - Customer, Yellow Copy - Fiscal, Blue Copy - File, Buff Copy - Fiscal

Winery Use Information

STAFF REPORT
YAMHILL COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT

DATE: March 11, 2005

DOCKET NO.: C-03-05/SDR-03-05

REQUEST: Conditional use and site design review approval for a commercial activity in conjunction with farm use to allow operation of a winery and wine tasting room with a limited number of special events and wine tasting within an existing building.

APPLICANT: Anne L. McIntyre

TAX LOT: 3306-1100

LOCATION: 11711 NE Highway 240, Yamhill, Oregon

ZONE: EF-80 Exclusive Farm Use

REVIEW CRITERIA: Sections 402.02(H), 402.04(G), 402.10(B) and (I), 1101.02 and 1202.02 of the *Yamhill County Zoning Ordinance*

COMMENTS: *SWCD* - We have reviewed the file and find no conflicts with our interests.
ODOT - Applicant must apply for and obtain a new or amended approach permit for access to the property from Highway 240. Contact Monte Richards, District 3 Permit Specialist at 503-986-2902 for information on the permit process.
DEQ - Will likely require a DEQ permit for handling of the process waste water. Contact Ben Maynard, 503-378-8240, ext. 282.

FINDINGS:

A. Background Facts

1. *Tract Size:* 87.5 acres.

2. *Access:* State Highway 240.

3. *On-Site Land Use:* The property is irregularly shaped and bordered by vineyards and State Highway. The property has uneven topography, contains a large building previously used for production of commercial hydroponic algae (nutritional supplement). The remainder of the parcel is devoted to agricultural uses, such as pasture, livestock and timber production. The winery is proposed for an existing 11,268 square foot building located on the parcel in addition to five large green houses. There is a small unnamed creek running at the front of the parcel, along the highway, from east to west.

(F) *The use is or can be made compatible with existing uses and other allowable uses in the area.*

3. The request is consistent with criterion (A) above in that a commercial activity in conjunction with farm use is listed as a conditional use in Section 402.04(G) and 402.10(B) of the EF Exclusive Farm use district.

4. Regarding criterion (B), the Yamhill County goals and policies do not provide standards or criteria for review of wineries. The subject parcel is not located in an area which is designated as a sensitive wildlife habitat, nor is it in the Willamette River Greenway, flood plain, or airport overlay district. No natural hazards have been identified.

5. Regarding criterion (C), the proposal is to have the winery located in the existing 11,268 square foot building located on the parcel. There is nothing to indicate that the size, shape and other physical features of the parcel are not suitable for the proposed use. There are no topographic restrictions or natural features that would adversely affect use of the parcel for the proposed business.

6. Regarding criteria (D), the permitted uses in the area are agricultural and forest related. The wine production will be conducted exclusively within the proposed winery building. The proposed tasting room will be open to the public. Well water serves the buildings on the parcel. However, the applicant should contact the Oregon Water Resources Department to inquire whether water rights are necessary in order to be able to use the well water for the winery. All wastewater from processing will be handled on-site by means approved by DEQ. This complies with criterion (D).

7. Regarding criteria (E), even though the tasting room will be open to the public, no additional infrastructure impacts are anticipated. A referral was sent to Oregon Department of Transportation (ODOT), they indicated that the applicant must apply for and obtain a new or amended approach permit for access to the property from Highway 240. The proposed use will be served by a private well and private septic system. The site is currently served by public power and phone service. The Newberg Rural Fire District will provide fire protection. Considering the adequacy of the public facilities and services existing in the area, the proposed use complies with criterion (E).

8. Regarding criteria (F), the area is already home to a variety of related agricultural oriented commercial activities. Wineries meeting certain criteria are permitted uses in EFU zones and limited tasting rooms are allowed at these wineries. The applicant's proposal is for a tasting room which could be a permitted use provided the minimum number of acres are planted. However, at this point the planted acreage does not meet the size requirements for a "permitted use". The use otherwise has the same characteristics as other wineries and tasting rooms in the county.. Notice was mailed to surrounding property owners but none of them voiced concern regarding the use. The proposal satisfies criterion (F).

9. Conditional uses in the EF district must also comply with the following criteria:

5. Regarding consideration (d), the traditional farming activities on-site, i.e. growing and harvesting of timber and raising livestock, will generate noise typical of farm uses. The grape processing will generate some noise, but is not expected to be greater than the noise of a typical farming operation. Such noise is expected in the farm zone and is compatible with surrounding uses. All of the equipment will be stored in the existing buildings and will be buffered from surrounding properties.

6. Regarding consideration (e) above, there are no significant natural features on-site that need to be preserved.

7. Regarding consideration (f) above, there is no additional hazard area that has been identified on the zoning map.

8. Regarding consideration (g), the notice of the proposed winery was sent to the surrounding property owners and published in the newspaper of general circulation. No objections were voiced to the proposed use.

CONCLUSIONS:

1. The proposed winery complies with the definition of a commercial activity in conjunction with farm use. The EF-80 zone allows commercial activity in conjunction with farm use subject to site design review approval.

2. With conditions, the request is consistent with the conditional use approval criteria of Section 1202.02 and 402.07 of the Yamhill County Zoning Ordinance.

3. With conditions, the request is consistent with the site design review standards in Section 1101.02 of the Yamhill County Zoning Ordinance.

DECISION:

Based upon the above findings and conclusions, the request by Anne L. McIntyre for a conditional use and site design review approval for a winery and a tasting room on a parcel identified as Tax Lot 3306-1100 be approved with the following conditions:

1. The applicant shall obtain all permits required by the Oregon Department of Transportation (ODOT), Department of Environmental Quality (DEQ) and the Oregon Liquor Control Commission (OLCC).

2. Tasting events shall be limited to three weekends per year, not to exceed three consecutive days of operation at any one time. In addition the tasting room may host private events, not to exceed one day in length.

3. All outside storage shall be screened from neighboring parcels.

4. All building permits necessary for construction of the winery building or conversion of an existing building for use as a winery shall be obtained from the Yamhill County Building Office.

Septic & Wastewater Treatment Information

DEQ USE ONLY – REGIONAL OFFICE
Received:
Application No.:
File No.:
EPA No.:
Mail ID #2/#9:
Hydrocode:
DOC Conf.:

APPLICATION FOR WATER POLLUTION CONTROL FACILITIES GENERAL PERMIT 1400 (WPCF-N)

STATE OF OREGON

DEQ USE ONLY – BUSINESS OFFICE
Date Received:
Amount Received:
Check No.:
Deposit No.:
NOTES:

A. REFERENCE INFORMATION

1. 240 WINEWORKS LLC
Legal Name of Applicant

Facility Identification

2. PO BOX 129
Mailing Address

DUNDEE — OR — 97115
City — State — Zip

3. VINCENT CANTWELL
Responsible Official

MEMBER
Title

PO BOX 129 DUNDEE, OR 97115 — 503-502-8040
Address or Location — Phone

4. ANNE McINTYRE
Alternate Responsible Official

MEMBER
Title

PO BOX 129 DUNDEE, OR 97115 — 503 226 4607
Address or Location — Phone

5. Facility Location if **different** from Mailing Address:
11711 NE HIGHWAY 240
YAMHILL, OR 97148

6. Enter Site Location by **Latitude** and **Longitude**:

LATITUDE			LONGITUDE		
1. Deg.	2. Min.	3. Sec.	1. Deg.	2. Min.	3. Sec.
45	19	57.6	123	07	24.9

B. GENERAL DESCRIPTION OF FACILITY

Briefly summarize the proposed facility and primary method of waste treatment and disposal.

WINERY.
TREATMENT BY CONSTRUCTED WETLAND. DISPOSAL BY IRRIGATION.

C. REQUIRED EXHIBIT

As EXHIBIT A, attach two (2) copies of a Preliminary Engineering Report or Facility Plan Report which fully describes the proposed project, using written discussion, maps, diagrams, and any other necessary materials. Specific items contained in the report should include:

1. A description of the proposal.
2. Schedule for development.
3. The location of the project and adjacent facilities and waterways.
4. A Wastewater Management Plan (submit as separate document).

D. LAND USE APPROVAL

LAND USE COMPATIBILITY STATEMENT: is attached ☒ is coming ☐ N/A ☐

E. OTHER PERMITS

Attach a list of other permits issued or applied for.

F. FEES — MUST ACCOMPANY THIS APPLICATION

Filing Fee $
Processing Fee ______
Compliance Determination Fee ______
TOTAL $ ______

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS APPLICATION IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Anne L McIntyre — MEMBER — 7/18/07
Signature of Legally Authorized Representative *(See Instructions)* — Title — Date

DEQ-WQ-IW\WH5794.DOC (9/96)

INSTRUCTIONS FOR FILING
FOR NEW WATER POLLUTION CONTROL FACILITIES GENERAL PERMIT 1400

BACKGROUND:

Pursuant to Oregon Revised Statutes (ORS) 468.740, a permit from the Department of Environmental Quality (DEQ) is required for all wastewater disposal systems. Wastewater disposal systems associated with wineries and other food processors are disposal systems under that statute and require a permit.

A winery or food processor which discharges all wastewater to a municipal sewerage system is not required to have a permit from DEQ. One may be required from the municipality.

A ***general permit*** has been issued in order to reduce the time and paperwork associated with the permit process. Those wineries and small food processors which may be eligible for the ***general permit*** are those whose majority of wastewater is seasonal, the maximum wastewater generated is less than 25,000 gallons per day, and all wastewater can be disposed on site without contamination of surface waters or groundwater.

Any proposed facility which does not qualify for the general permit because of its size or other factors, may be covered by an individual permit. Applications for individual permits are available from DEQ. These instructions are to assist in filling out the application to register for coverage by the general permit only.

A. REFERENCE INFORMATION:

1. Enter the applicant's official or legal name. Do not use a colloquial name. If a partnership, list each partner.
2. Enter the mailing address where the permit and related correspondence should go.
3. Give the name of the responsible official we should contact if we have questions about the application or the facility.
4. List an alternate to the official name in item '3'.
5. Enter the address of the proposed facility if different from the mailing address in item '2'.
6. Enter site location by latitude and longitude.

B. GENERAL DESCRIPTION OF FACILITY:

Please enter a general description of the proposed facility and the primary method of handling wastewaters.

Example: Wash and fresh pack strawberries and raspberries.

C. REQUIRED EXHIBIT:

NOTE:

Exhibit A is the must important part of the application. Failure to provide the required information will delay processing the application and final action on permit issuance.

1. Describe what type of wastewater treatment and disposal you are proposing.
2. Describe your proposed initial production capacity in relation to the ultimate planned capacity. If wastewater collection and disposal facilities will not be designed for the ultimate capacity, please indicate in No. 1 above the construction schedule for expanding the wastewater collection and disposal system.
3. Include a diagram, photo, or map that shows where the production facility, wastewater collection and treatment system, and the disposal site will be in relation to any streams, drainageways, property lines, roads, right-of-ways, or any other important landmarks which might create some limitations to the site.
4. A Wastewater Management Plan is required by the general permit and shall be submitted as a separate document. It will be attached to and made part of your permit. Your plan shall contain the following: ***(An example Plan is attached to these instructions for your reference.)***

   (a) A block flow diagram that should include all aspects of wastewater generation, collection, storage, treatment, and disposal. It should include the sanitary waste system as well as the process waste system.

   (b) Measurements of the wastewater volumes from like facilities. If you do not have measurements, provide your best estimate. If there are times of the year that volumes will be large compared with the remainder of the year, you should provide that information. Give the average and maximum flows anticipated in gallons per day.

(c) Give a range of wastewater pollutant concentrations for parameters listed. If no data from like facilities is available, you can make an estimate. The table below may be helpful in establishing these determinations for wineries:

TYPICAL WASTEWATER CHARACTERISTICS FROM WINERIES

PARAMETER	UNITS	CRUSHING SEASON		NON-CRUSHING SEASON	
		RANGE	MEAN	RANGE	MEAN
BOD-5	mg/L	2000 – 5000	2500	2000 – 5000	2400
COD	mg/L	4000 – 10000	5000	4000 – 10000	4000
Phosphorus	mg/L	5 – 10	10	10 – 25	25
Nitrogen	mg/L	5 – 40	20	10 – 50	40
Chloride	mg/L	100 – 250	150	100 – 250	150
Sodium	mg/L	100 – 200	150	100 – 200	140
TDS	mg/L	80 – 1600	800	400 – 800	700
pH	mg/L	3.5 – 5.5	4.1	3.5 – 5.5	4.8

(d) Indicate which months of the year wastewater will be disposed. For each of the months, indicate the source and relative quantity of the wastewater to be disposed. If different disposal systems are used for different times of the year, please explain.

(e) The information required by this section should be as complete as possible. Describe the crops grown on the irrigation site and the slope of the land as well as the general soil type. Include the acreage irrigated.

(f) How will solids be removed from the wastewater or other production processes? What will the solids consist of and how will they be disposed?

(g) If any chemical additives will be used, please list what they are, why they will be used, quantity used, and any characteristics of these additives that would be of concern to the disposal system.

(h) How will the irrigation be managed so that irrigation runoff does not occur or groundwater is not polluted? If the wastewater contains nitrogen, other chemicals or metals which would limit the amount which would safely be put on the soil for agronomic purposes, explain how the irrigation will be handled to assure that agronomic rates are not exceeded.

D. LAND USE APPROVAL:

The Department will not process a permit application without evidence provided that the proposal is approved by local land use planning agencies and meets statewide planning goals. The attached compatibility statement may be used for that evidence.

E. OTHER PERMITS:

In order for the Department to coordinate with other agencies and other Divisions within the agency, it is important to provide information regarding the status of other applications or permits.

F. FEES:

Appropriate fees must accompany every application. Please see attached fee schedule.

DEFINITION:
Signature Line — "Legally Authorized Representative"

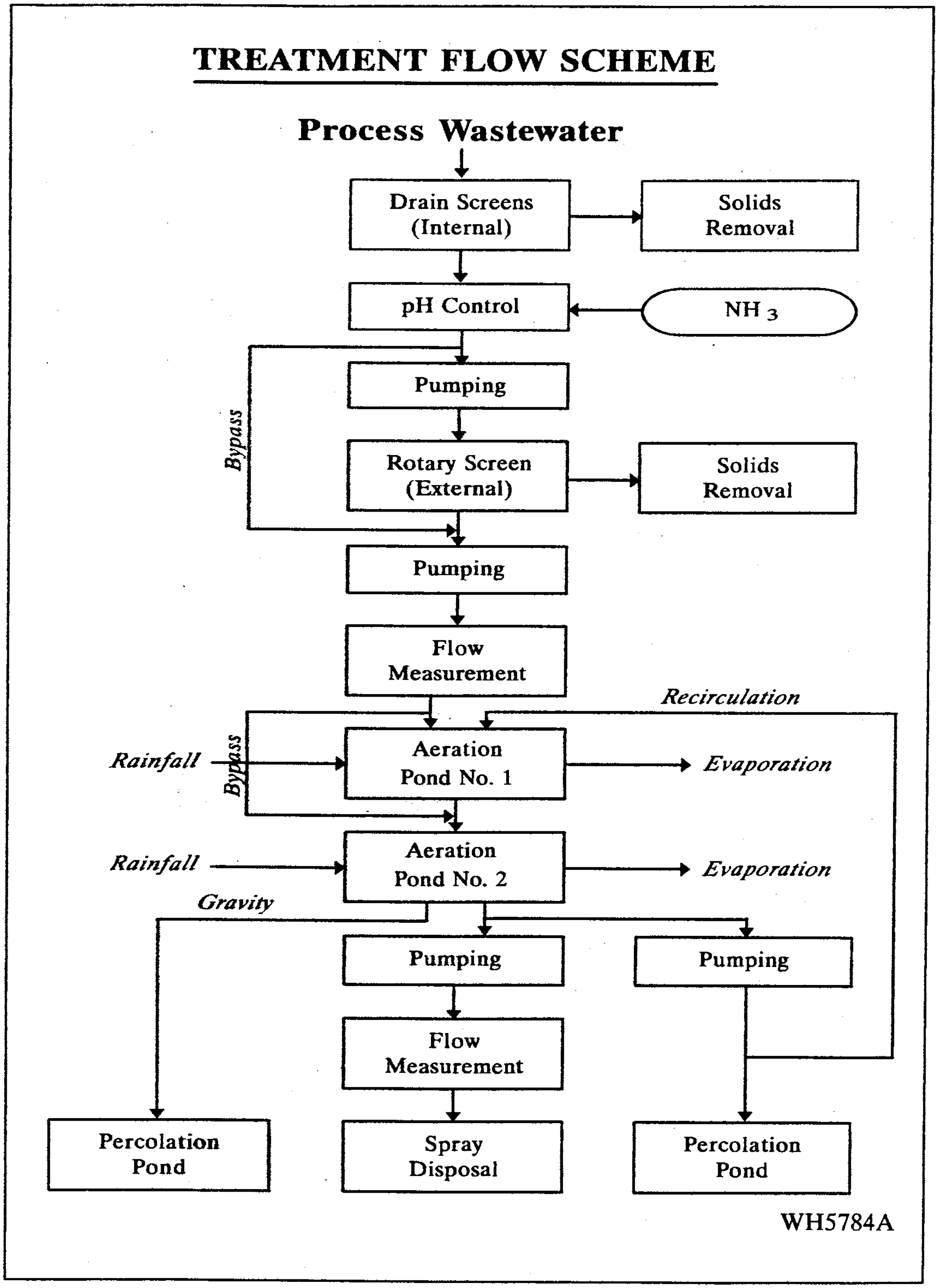
- **Corporation** — By a principal executive officer of at least the level of vice president;
- **Partnership or Sole Proprietorship** — By a general partner or the proprietor (owner), respectively; or
- **Municipality, State, Federal, or other Public Facility** — By either a principal executive officer or ranking elected official.

Please return Application Fee and Application to: Department of Environmental Quality, Business Office, 811 SW 6th Avenue, Portland, OR 97204

EXAMPLE

WASTEWATER MANAGEMENT PLAN

(a) Block flow diagram:



(b) Approximate wastewater volume:

- Harvest (September through November .... 1,000 g/d max. .... 500 g/d average.
- Winter (December through April) .... 500 g/d max. .... 100 g/d average.
- Spring-Summer (May–August) .... 200 g/d max. .... 25 g/d average.

(c) Wastewater Pollutant concentration:

- Crushing Season .... BOD-5 .... 2,500 mg/L Nitrogen .... 20 mg/L TDS .... 800 mg/L; COD .... 5,000 mg/L Choride .... 50 mg/LpH 4.1; Phosphorus .... 10 mg/L Sodium .... 150 mg/L.

- Non-Crushing Season ... BOD-5 .... 2,400 mg/L Nitrogen .... 40 mg/L TDS .... 700 mg/L; COD .... 4,000 mg/L Choride .... 150 mg/LpH .... 4.8; Phosphorus .... 25 mg/L Sodium .... 140 mg/L.

(d) Monthly wastewater distribution:

- January–April .... Tank/barrel/floor/equipment cleaning .... 25% of yearly total.
- May–August .... Floor cleaning .... 5% of yearly total.
- September–November .... Harvest equipment/tank/floor/barrel .... 60% of yearly total.
- December .... Tanks/floors/barrel cleaning .... 10% of yearly total.

100%

(e) Land/Crop description of wastewater drainage area:

- 150 acres of permanently grassed (native grasses) orchard (fruits & nuts, etc.).
- 12' deep sandy loam topsoil over river rock (river bottom) 0.5% slope.

(f) Solids removal from wastewater — solids consist of:

- Yeast following fermentation of wine. Disposed by on-site composting together with grape pomace, followed by broadcast application by manure spreader.

- Tartrates formed by reaction of tartaric acid and potassium, both naturally-occurring in juice; a.k.a. cream of tartar. The settled solids are removed prior to the discharge of wastewater to the effluent disposal system.

- Grape pomace — 100% organic residue. Composed and broadcast spread into orchard as top-dressing via manure spreader.

(g) Chemical additives:

Less than 25 lbs per year of caustic soda (NaOH) with less than 2 lbs per year of Tri-sodium Phosphate (TSP) used for tank cleaning. These additives serve to raise pH of wastewater. When applied via irrigation to orchard, they counterbalance soil acidification caused by low pH wastewater. At rates applied to orchard, these chemical additives will show no adverse effects on soil. Sulfur dioxide is added only to Wine-100.

(h) Irrigation Management:

The soil absorption potential is great enough that all winery effluent can be absorbed and decomposed by soil. All organic matter applied to the soil, including but not limited to pomace, tartrates, and composted yeast, enters the soil humus cycle and serves to maintain the fertility of the soil. The chemical additives present in effluent consist of sodium and phosphorus. Both are naturally occurring and in the amounts added fall within the standard range added during a well-balanced soil fertilization program. The addition of these cations and anions are considered when developing the mineral fertilization program.

COPY

GENERAL PERMIT

WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204
Telephone: (503) 229-5279
Issued pursuant to ORS 468B.050

ISSUED TO:

All Owners or Operators
Of Facilities Conducting
Activities Covered by
This Permit

COPY

SOURCES COVERED BY THIS PERMIT:

This permit covers wineries and seasonal fresh pack operations whose wastewater flow does not exceed 25,000 gallons per day and is only disposed of by land irrigation. To be considered a fresh pack produce operation, the facility shall not significantly alter its product from its original state by either cooking, pickling, slaughtering, or other mechanical or thermal processes.

Michael Llewelyn, Administrator
Water Quality Division

8/22/00
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge to waters of the state is prohibited, including discharge to an underground injection control system.

Oregon
Theodore R. Kulongoski, Governor

Department of Environmental Quality
Western Region - Salem Office
750 Front St. NE, Ste. 120
Salem, OR 97301-1039
(503) 378-8240
(503) 378-3684 TTY

August 22, 2007

Vincent Cantwell
240 Wineworks LLC
PO Box 129
Dundee, OR 97115-0129

RE: WPCF General Permit Number 1400A
File Number: 117202
Site Location: 240 Wineworks LLC, 11711 NE Hwy. 240, Yamhill
Yamhill County

Dear Mr. Cantwell:

We have received your application for assignment to the Water Pollution Control Facilities (WPCF) General 1400A Permit. The permit covers wineries and seasonal fresh pack operations whose wastewater flow does not exceed 25,000 gallons per day and is disposed of either by land irrigation or septic tank and drainfield. A permit for this activity is required by Oregon Revised Statute 468B.050; however, the general permit expired on June 30, 2005, and the Department cannot register your activity under an expired permit. Renewal of the general permit is expected in 2006 and we will review and act upon your application at that time.

In the interim, we request that you comply with the conditions in the expired general permit (enclosed) until it is renewed. As long as you follow these permit requirements, we believe the environment will be protected and we will not take enforcement action against you for operating without a current permit.

Please note that the Department uses "general" permits for categories of minor wastewater sources where site-specific "individual" permits are not necessary to adequately protect the environment. A "general" permit requires that all persons conducting the permitted activity comply with the same set of conditions and limitations regardless of the specific location. Developing a set of standard conditions allows the Department to keep general permit application fees lower than individual permit application fees ($402 for a general permit versus $10,000 for an individual permit). While the general permit process is desirable in many situations, resource constraints required that the Department postpone renewal of this permit. In addition, Oregon Administrative Rule prohibits using an expired general permit for new applicants.

If you have any further questions, please call me at (503) 378-5081. Thank you for your attention to this matter.

Sincerely,

John J. Ruscigno

John J. Ruscigno
Water Quality Manager
Western Region North

JJR:jjc

Enc. Expired WPCF General Permit 1400-A

cc: Source File, Salem Office
Annette Liebe, WQ

[OAR 690-315-0020(3)(e)(A)]

2-A. Please Describe how you have complied with each standard and special condition in the original permit [and, if applicable, conditions contained in any order approving a permit amendment and/or order approving a prior extension of time].

<u>TIP:</u> The instruction sheet explains which typical conditions must be addressed here.

Condition Number: Hand-number each condition on a copy of your permit (and, if applicable, any permit amendment and/or prior extension). Include a copy of your hand-numbered permit.

CHART-A

Condition Number	Date Satisfied	Describe How Permit Condition Has Been Satisfied
1	Late 2005	A meter was installed on the discharge line for Well 1. A meter had previously been installed on Well 2 on an unknown date.
2	2008	A water use report for 2008 was submitted by the previous owner. In addition, a water use report for 2014 has been submitted by Jackson Family Wines.
3	4/1/2002	A ground water monitoring plan, together with a plan for conducting a constant-rate drawdown and recovery test, was submitted to the Department on April 1, 2002, and approved by the Department on May 22, 2002. Water level monitoring was conducted in accordance with the ground water monitoring plan from March 2002 through March 2006. One additional round of water level measurements was made by the previous owners in March 2009. In addition, a round of water level measurements was completed this March (2015) by Jackson Family Wines.
4	12/14/2005	A constant-rate drawdown and recovery test was completed on August 18, 2005. The results of the pumping test were submitted to the Department on December 14, 2005

2-B. If you have NOT complied with all applicable conditions, explain the reasons why and indicate with a date certain (in the near future) when compliance will occur.

CHART-B

Condition Number	Date Will Comply	Explain Why Each Permit Condition Has NOT Been Satisfied
		RECEIVED
		JUL 24 2015
		WATER RESOURCES DEPT SALEM, OREGON

[OAR 690-315-0020(3)(e)]

3-A. Provide evidence of physical progress made toward completion of the water system and progress toward making beneficial use of water within the original permitted time period.

CHART-C (below) must be completed for all Application for Extension of Time requests. *Use chronological order.*

CHART-C

DATE	LIST & DESCRIBE WORK ACCOMPLISHED BEFORE PERMIT WAS ISSUED	COST*
October 1999	Wells 1, 2, and 3 were constructed.	$45,000
1999-2001	Pumps were installed in Wells 1 and 2, and the water delivery and treatment system for algae production facilities was installed.	$60,000
DATE	**LIST & DESCRIBE WORK ACCOMPLISHED AFTER PERMIT WAS ISSUED *and* PRIOR TO DATE FOR COMPLETE APPLICATION OF WATER**	**COST***
1/30/2002	Date the permit was signed - find date above signature on last page of permit.	
2005	Made repairs and modifications to existing water system in order to conduct pumping test.	$5,000
Late 2005	Purchased and installed a meter for Well 1.	$1,000
N/A	Date the permit specified "Actual Construction Work" shall begin ("A-Date") -not all permits contain this date.	
Late 2005 to Sept. 2006	Had a new water delivery and treatment system designed for a winery, and purchased much of the equipment to construct the treatment system. Installed a meter on the discharge line from Well 2.	$10,000
10/1/2006	Date the permit specified complete application of water to the use shall be made ("C-Date") - all permits contain this date.	
DATE	**LIST & DESCRIBE WORK ACCOMPLISHED AFTER DATE FOR COMPLETE APPLICATION OF WATER UP TO NOW** Complete if this is your first request for extension of time.	**COST***
	***Total Cost for Chart-C**	**$121,000**

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*** If exact cost is not known, please provide your best estimate.**

__IF this is__ your first Application for an Extension of Time, write NA in Chart D below and proceed to question 4 at the bottom of this page.

3-B) Provide evidence of physical progress made toward completion of the water system and progress toward making beneficial use of water within the most recent extension period.

If this __is not__ your 1st Application for Extension of Time request, fill out CHART-D below in addition to CHART-C above. *Use chronological order.*

CHART-D

DATE	LIST AND DESCRIBE WORK ACCOMPLISHED __DURING__ THE LAST EXTENSION PERIOD	COST*
10/1/2006	"Extended From" date for complete application of water used in the 1st (or the most recent) Application for Extension of Time.	
2009	Replaced the punp in Well 1 and made extensive repairs to the main water line and electrical line to Well 1.	$35,000
2011	Purchased and placed above-ground piping and used it to irrigate pasture areas.	$3,000
10/1/2011	"Extended To" date for complete application of water resulting from the 1st (or the most recent) Application for Extension of Time.	
DATE	**LIST AND DESCRIBE WORK ACCOMPLISHED __AFTER__ THE LAST EXPIRED EXTENSION PERIOD UP TO NOW**	**COST***
2014		
	Total Cost of Chart-D	**$38,000**

*** If exact cost is not known, please provide your best estimate.**

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[OAR 690-315-0020(3)(f)]

4. **Cost of project to date:** __$159,000__
(The total combined cost from CHART-C and CHART-D)

[OAR 690-315-0020(3)(e)(B)]

5. **Provide evidence of the maximum rate (or duty, if applicable) of water actually diverted for beneficial use under this permit and/or prior extensions of time (if any) made to date.**

TIP: Report the rate used to date in the same units of measurement as specified in the permit. Unless full beneficial use has been made, this rate will be less than the rate authorized on the permit.

5-A) For Surface Water Permit Extensions (e.g. S-XXXX or R-XXXX):

Maximum measured rate used to date = _____ cfs (cubic feet per second)
or
Maximum measured rate used to date = _____ gpm (gallons per minute)
or
Acre-feet stored to date = _____ AF

5-B) For Ground Water Permit Extensions (e.g. G-XXXX):

TIP: Include information from ALL wells that pertain to this permit including wells not currently being used.

CHART-E

			IF DRILLED					
Well # as identified on Permit	Water User's Well #	Has this well been drilled?	Well Log Number e.g. MORR 50473	Well Tag Number e.g. # 27566 or N/A	Is the actual drilled location authorized on this permit or on a permit amendment? (See 5-C below)	Maximum measured rate used from this well - - under this permit only (CFS or GPM)	Is this well authorized or utilized under any OTHER water rights?	If yes, provide the Permit, Certificate, or Transfer No.
1	1	Yes ☒ No ☐	YAMH 51822	L37124	Yes ☒ No ☐	~75gpm	Yes ☐ No ☒	- / -
2	2	Yes ☒ No ☐	YAMH 51688	L30239	Yes ☒ No ☐	~8 gpm	Yes ☐ No ☒	- / -
3	3	Yes ☒ No ☐	YAMH 51823	L37133	Yes ☒ No ☐	~5 gpm	Yes ☐ No ☒	- / -
4	4	Yes ☐ No ☒			Yes ☐ No ☐		Yes ☐ No ☐	- / -
5	5	Yes ☐ No ☒			Yes ☐ No ☐		Yes ☐ No ☐	-
Total measured rate from all wells utilized under this permit						~88 gpm		

5-C) If the drilled location of a well is not authorized on this permit, please specify its location below, or provide a map showing its location. Has or will a Permit Amendment Application been/be filed? Yes ☐ No ☐

If a Permit Amendment Application has been filed: Transfer No. T-_____

Well #_____: Actual location: _____

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[OAR 690-315-0020(3)(e)(C)]

6. **Provide the total number of acres actually irrigated to date under this permit (if any).**

Surface Water Permits: I have applied water to _____ acres for irrigation to date.

Ground Water Permits: I have applied water to ~15 acres for irrigation to date.

Please specify which wells are being utilized for this irrigation.

Well #1 Acres ~15 Well #2 Acres 0.0

Well #3 Acres 0.0 Well #4 Acres 0.0

Well #5 Acres 0.0

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[OAR 690-315-0020(3)(j)]

7. **Provide a summary of future plans and a schedule to complete construction of the water system, and/or apply water to full beneficial use under the permit terms and conditions.**

CHART-F

APPROXIMATE DATE RANGE (projected)	**LIST & DESCRIBE WORK TO BE ACCOMPLISHED TO COMPLETE WATER DEVELOPMENT** (projected)	**ESTIMATED COST** (projected)
2015	Submit permit amendment to add Well 5 to irrigation portion of the permit, and if necessary, to relocate Wells 3, 4, and 5.	$2,000
2015-2035	Replace Well 3, construct Wells 4 and 5, and complete irrigation system for vineyard and field crops.	$200,000
2035-2037	Irrigate vineyard and field crops using entire system to make full beneficial use of water under the terms and condition of the permit.	$2,000
Year: 2037	Date intend to apply water to full beneficial use under the terms and conditions of this permit.	
8.	**Estimated remaining total cost to complete the water development:** [OAR 690-315-0020(3)(g)]	**$204,000**

[OAR 690-315-0020(3)(h)]

9. **Describe the reasons why the water development was not constructed, and/or water was not beneficially used within permit time limits.** ***Provide supporting information for the reason(s) that best fits your circumstances (A, B, C or D).***

9-A) Is the project of a size and scope that was originally planned to be phased in over a time frame longer than the one allowed in the permit? If yes, describe.

NA

9-B) Did the financial resources needed to develop the project preclude completion of the project within authorized time frames? If yes, describe.

Yes, the previous owners, Vincent Cantwell and Anne McIntyre, made efforts to develop, repair, and modify the water system that was in place when they purchased the property from the original owner, Puri Ponics. However, the condition of the system was in serious disrepair, and they were unable to complete all of the necessary work and develop the vineyard within the prior extension period due to a combination of time and financial constraints. In addition, it appears that much of their work on the site was suspended while they took steps to settle their divorce, which involved the subject property, along with the water system improvements and the water right permit itself.

9-C) Did good faith attempts to comply with other agency permit conditions and/or acquire permits from other agencies, or otherwise comply with government regulations, delay completion of the project? If yes, describe.

NA

9-D) Have other unforeseen events delayed full development of the water system and use of water within the authorized time frames? If yes, describe.

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Yes, the previous owners, Vincent Cantwell and Anne McIntyre, made efforts to develop, repair, and modify the water system that was in place when they purchased the property from the original owner, Puri Ponics. However, the condition of the system was in serious disrepair, and they were unable to complete all of the necessary work and develop the vineyard within the prior extension period due to a combination of time and financial constraints. In addition, it appears that much of their work on the site was suspended while they took steps to settle their divorce, which involved the subject property, along with the water system improvements and the water right permit itself.

[OAR 690-315-0020(3)(k)]

10. Justify the time requested to complete the project and/or apply the water to full beneficial use. Your justification should combine information from your answers from Questions 2-B, 7, 8, and 9 of this Application for Extension of Time. Include any other information or evidence to establish that the requested amount of time is sufficient and that you will be able to complete the project within the amount of time requested.

The overall plan for the current owner, Jackson Family Wines, is to develop and irrigate vineyard and field crop on as much of the property as possible, consistent with the currently authorized POU included in the permit. In order to accomplish this, there is still much work to be done to complete the water system, including re-drilling Well 3, and constructing Wells 4 and 5. If Well 5 is made part of the irrigation water system, we are aware that it would need to be added as an additional POA for the irrigation use authorized under the permit, and that to accomplish this would require submittal and approval of a permit amendment application following approval of this application for extension of time. Full development of the water use under this permit will also require extensive upgrades and additions to the water delivery and irrigation systems. Given the overall plan for the property, which also includes plans for a winery, it is anticipated that 22 years will be needed to accomplish all of these tasks.

11. Provide any other information you wish OWRD to consider while evaluating your Application for Extension of Time.

Jackson Family Wines has considerable experience in developing vineyard properties and understands fully the importance of maintaining compliance with all permitting requirements. As such, Jackson Family Wines is committed to taking whatever actions are necessary to remain in compliance with all conditions of this ground water use permit. Jackson Family Wines completed the required monitoring as a new owner in March 2015 and will continue to actively monitor as it moves forward with any future development under the permit.

Thank you for submitting a complete and accurate application. Remember to sign the front page. If you have questions or need assistance, please ask to speak with the Department's Extension Specialist by calling 503-986-0900 during business hours.

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INSTRUCTIONS FOLLOW ON NEXT PAGE

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51098 12/5/97 Ready for PC Per Contractor

Control No.

$ 215.00

Fee

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

ON-SITE SEWAGE DISPOSAL SYSTEM

☑ New Construction ☐ Repair ☐ Other

Permit Issued To Pieviponies L.L.C. (Property Owner's Name) 3 (Township) 3 (Range) 06 (Section) 1100 (Tax Lot / Acct. No.)

Hwy 240 (Road Location) Newberg (City) (Issued by - Signature) 12-2-97 (Date Issued)

PERMITS ARE NOT TRANSFERABLE

ALL WORK TO CONFORM TO OREGON ADMINISTRATIVE RULES, CHAPTER 340. WORK SHALL BE DONE BY PROPERTY OWNER OR BY LICENSED SEWAGE DISPOSAL SERVICE. (MAKE NO CHANGES IN LOCATION OR SPECIFICATIONS WITHOUT WRITTEN APPROVAL)

SPECIFICATIONS

EXPIRATION DATE 12-2-98 TYPE OF SYSTEM Standard / Pump

Design Sewage Flow 350 Gallons/Day

Tank Volume 1500 Gallons Disposal Trenches ☑ Seepage Bed(s) ☐ 600 Square Feet

Maximum Depth 30 inches. Minimum Depth 24 inches. 300 Linear Feet

Equal ☐ Loop ☐ Serial ☒ Pressurized ☐ Minimum Distance Between Trenches 10 ft c/c.

Total Rock Depth 12 inches. Below Pipe 6 inches. Above Pipe 2 inches. ☒ Rake Sidewall

Special Conditions (Follow Attached Plot Plan) Maintain 50' setback from Intermittent Stream with all portions of leachfield

PRE-COVER INSPECTION REQUIRED — CONTACT

CERTIFICATE OF SATISFACTORY COMPLETION

As-Built Drawing with Reference Locations

Installer Oleson Exc. Co

Final Insp. Date

☐ Inspected By

☐ Issued by Operation of Law

☐ Pre-cover inspection waived pursuant to OAR 340, Division 71

12/5/97 D. field OK
needs tank & pump
12/10/97 OK pump needs [illegible]

In accordance with Oregon Revised Statute 454.665, this Certificate is issued as evidence of satisfactory completion of an on-site sewage disposal system at the location identified above.

Issuance of this Certificate does not constitute a warranty or guarantee that this on-site disposal system will function indefinitely without failure.

(Authorized Signature) Sanitarian (Title) 12/11/97 (Date) (Office)

DEQ/WQ—121—(R 1/94)

OFFICE COPY

3306 - 1100

OLESON
EXCAVATION CO.

Formerly Oleson & Oleson Construction, Inc.
Drainfields • Underground Utilities
General Drainage & Trenching
15405 SW PLEASANT VALLEY RD.
BEAVERTON, OR 97007
(503) 628-1880 FAX (503) 628-5632
CCB# 26266 DEQ 339-28

OWNER: PuriPonics LLC
806 SW Broadway
Suite 625
Portland, Ore.
97205
(503) 228-9205

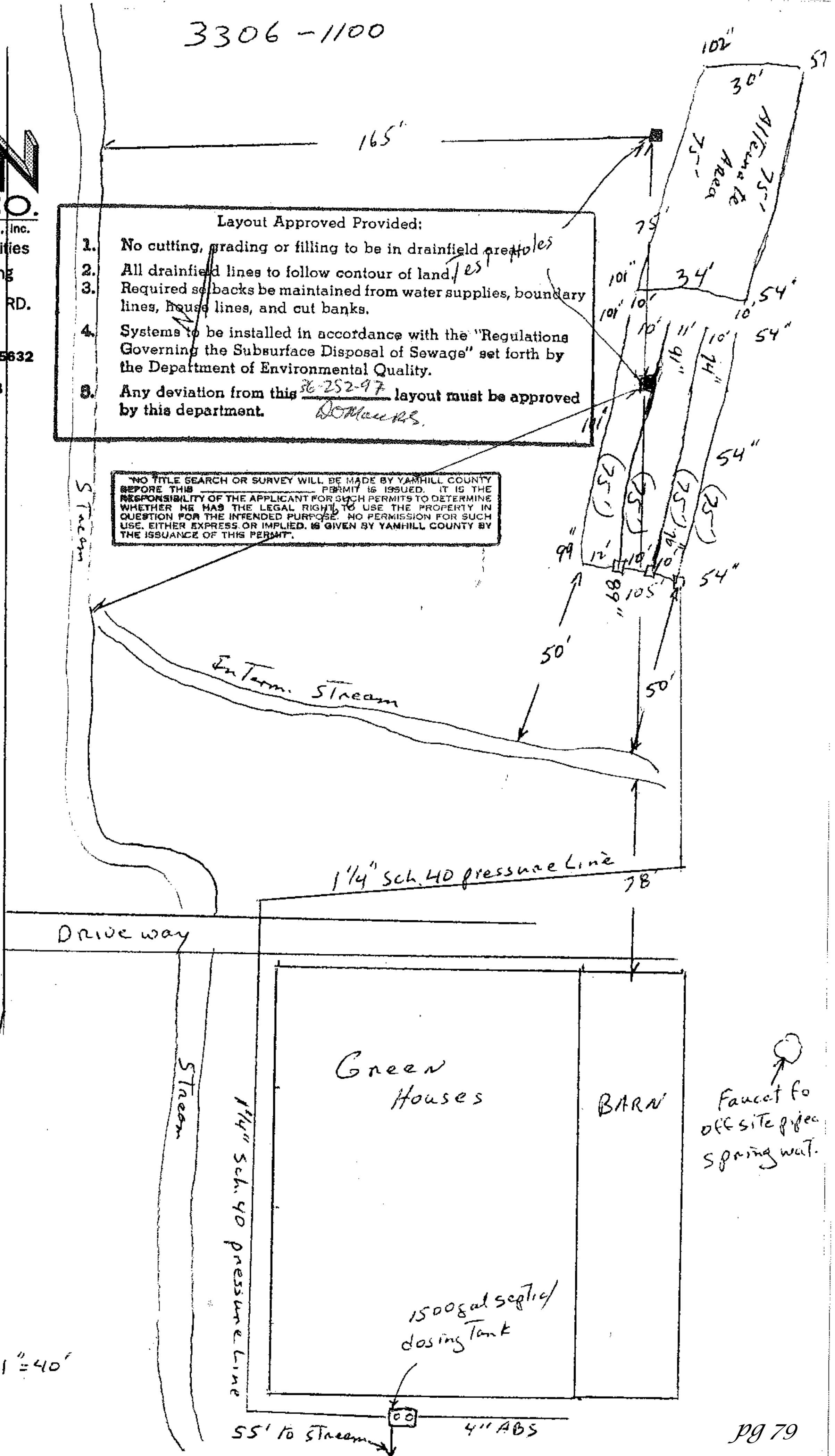
* 1000/500 septic/dosing Tank (Willamette Graystone)
* 400' 1¼ Sch. 40 pressure line
* 300' Infiltrator 24
* piped in spring water

INSTALL THIS SEWAGE DISPOSAL SYSTEM ONLY DURING THE MONTHS OF MAY, JUNE, JULY, AUGUST, SEPTEMBER OR OCTOBER, UNLESS OTHERWISE SPECIFICALLY AUTHORIZED

Layout Approved Provided:

1. No cutting, grading or filling to be in drainfield area.
2. All drainfield lines to follow contour of land.
3. Required setbacks be maintained from water supplies, boundary lines, house lines, and cut banks.
4. Systems to be installed in accordance with the "Regulations Governing the Subsurface Disposal of Sewage" set forth by the Department of Environmental Quality.
5. Any deviation from this 36-252-97 layout must be approved by this department. DOMeuers

"NO TITLE SEARCH OR SURVEY WILL BE MADE BY YAMHILL COUNTY BEFORE THIS ______ PERMIT IS ISSUED. IT IS THE RESPONSIBILITY OF THE APPLICANT FOR SUCH PERMITS TO DETERMINE WHETHER HE HAS THE LEGAL RIGHT TO USE THE PROPERTY IN QUESTION FOR THE INTENDED PURPOSE. NO PERMISSION FOR SUCH USE, EITHER EXPRESS OR IMPLIED, IS GIVEN BY YAMHILL COUNTY BY THE ISSUANCE OF THIS PERMIT".



Scale: 1" = 40'

[Y]AHILL COUNTY RECORD OF SEWAGE DISPOSAL SYSTEM

To Be Completed By Installer:

PERMIT ISSUED TO: Name Puri Ponics Installer's Name Oleson Excavation Co
Mailing Address: 806 SW. Broadway #625 Permit Number 36-232-97 Tax Lot No: 3306-1100
Portland, Ore. 97205 Property Address 10911 SW Hwy 240

TOTAL NUMBER: Living Units ____ Bedrooms ____ Basement: [ ] Yes [✓] No

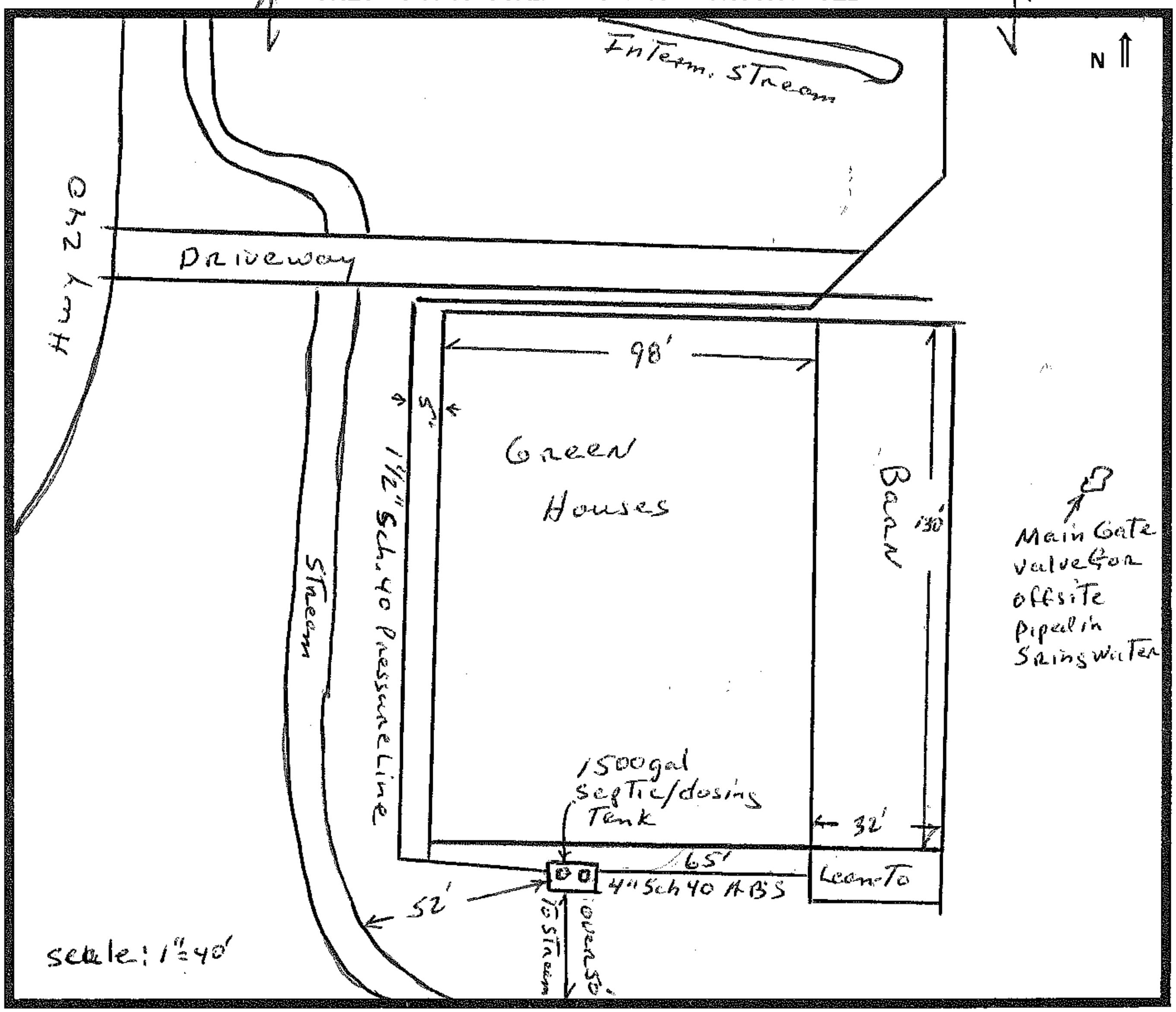
WATER SUPPLY: Public System ____ Individual ____ Type Off-site Spring Community [ ]

SEPTIC TANK: Distance from well ____ ft. Material ____ Tight Line 65' ft. ASTM# Sch 40 ABS 4"
Total Liquid Capacity 1000/500 gal. Manufacturer Willamette Graystone

DRAINFIELD: Total Linear Feet 300 ft. Number of Distribution Boxes 1 D-Box Leach Pipe (ASTM#) Equalizer 24
Total Square Footage ____ ft.² Header Pipe (ASTM#) ____
Depth Rock Beneath Drain Line N/A inches Depth Rock Over Drain Line N/A inches
Distance of Well From Closest Portion of Drainfield over 100' ft. (off site spring
Mfg./Type/Size of Rock Filter Material Equalizer 24

PUMP SYSTEM: Working Capacity of Chamber 500 gal. Gallons per cycle 180 gal.
"Working Capacity" Remaining After Alarm Has Activated ____ gal.

SKETCH OF ACTUAL SYSTEM AS CONSTRUCTED



Remarks: ____

The installer has tested septic tank and determined compliance with current DEQ water tightness requirements [OAR 340-73-025(3)] [✓] Yes [ ] No
I certify construction was in accordance with the permit and rules of the commission. [✓] Yes [ ] No

G. G. Oleson 12/10/97 [signature] 12/11/97 APPROVED [X]
SIGNATURE OF INSTALLER DATE SIGNATURE OF SANITARIAN DATE DISAPPROVED [ ]

F:\PLANNING\SHARE\FORMS\RECSEWDI.FM1 (Form #44) *WHITE COPY - County* *CANARY COPY - Homeowner* *PINK COPY - Installer*

[cut off]HILL COUNTY RECORD OF SEWAGE DISPOSAL SYSTEM

To Be Completed By Installer:

[cut off]RMIT ISSUED TO: Name *Puri-Ponics 625* Installer's Name *Oleson Excavation Co*
Mailing Address: *806 SW Broadway Suite* Permit Number 36 - ____ - ____ Tax Lot No: *3306 - 1100*
Portland, Ore. 97205 Property Address *10911 Hwy 240*

TOTAL NUMBER: Living Units ____ Bedrooms ____ Basement: [ ] Yes [ ] No

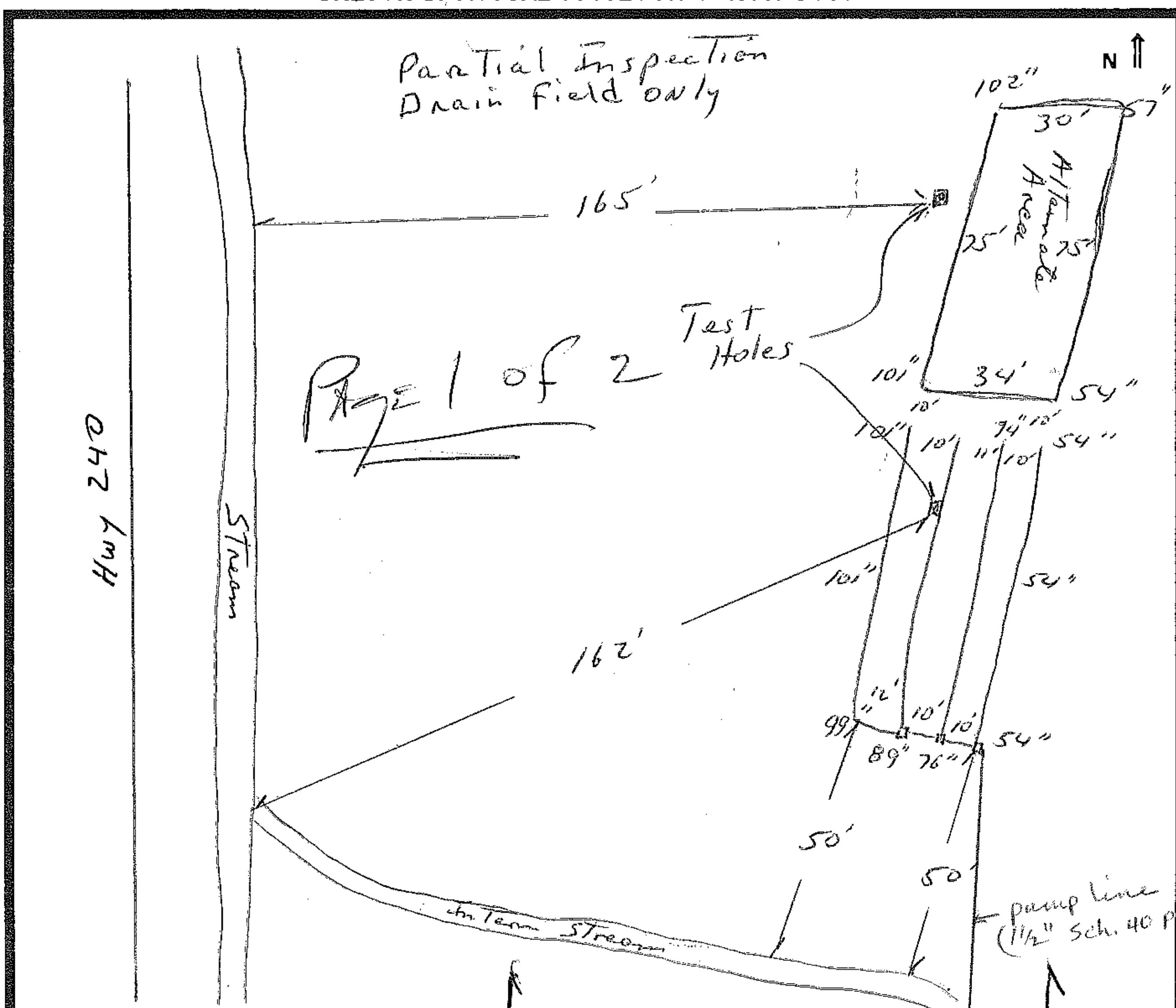
WATER SUPPLY: Public System ____ Individual ____ Type *Spring* Community [ ]

SEPTIC TANK: Distance from well ____ ft. Material ____ Tight Line ____ ft. ASTM# ____
Total Liquid Capacity ____ gal. Manufacturer ____

DRAINFIELD: Total Linear Feet ____ ft. Number of Distribution Boxes ____ Leach Pipe (ASTM#) ____
Total Square Footage ____ ft.^{2} Header Pipe (ASTM#) ____
Depth Rock Beneath Drain Line ____ inches Depth Rock Over Drain Line ____ inches
Distance of Well From Closest Portion of Drainfield ____ ft.
Mfg./Type/Size of Rock Filter Material ____

PUMP SYSTEM: Working Capacity of Chamber ____ gal. Gallons per cycle ____ gal.
"Working Capacity" Remaining After Alarm Has Activated ____ gal.

SKETCH OF ACTUAL SYSTEM AS CONSTRUCTED



Remarks: ____

The installer has tested septic tank and determined compliance with current DEQ water tightness requirements [OAR 340-73-025(3)] [X] Yes [ ] No

I certify construction was in accordance with the permit and rules of the commission. [X] Yes [ ] No

G. Oleson *12/4/97* [signature] *12/11/97* APPROVED [X]
SIGNATURE OF INSTALLER DATE SIGNATURE OF SANITARIAN DATE DISAPPROVED [ ]

F:\PLANNING\SHARE\FORMS\RECSEWDI.FM1 (Form #44) *WHITE COPY - County* *CANARY COPY - Homeowner* *PINK COPY - Installer*

Evaluation of Constructed Wetland Treatment Performance for Winery Wastewater

Mark E. Grismer, Melanie A. Carr, Heather L. Shepherd

ABSTRACT: Rapid expansion of wineries in rural California during the past three decades has created contamination problems related to winery wastewater treatment and disposal; however, little information is available about performance of on-site treatment systems. Here, the project objective was to determine full-scale, subsurface-flow constructed wetland retention times and treatment performance through assessment of water quality by daily sampling of total dissolved solids, pH, total suspended solids, chemical oxygen demand (COD), tannins, nitrate, ammonium, total Kjeldahl nitrogen, phosphate, sulfate, and sulfide across operating systems for winery wastewater treatment. Measurements were conducted during both the fall crush season of heavy loading and the spring following bottling and racking operations at the winery. Simple decay model coefficients for these constituents as well as COD and tannin removal efficiencies from winery wastewater in bench-scale reactors are also determined. The bench-scale study used upward-flow, inoculated attached-growth (pea-gravel substrate) reactors fed synthetic winery wastewater. Inlet and outlet tracer studies for determination of actual retention times were essential to analyses of treatment performance from an operational subsurface-flow constructed wetland that had been overloaded due to failure to install a pretreatment system for suspended solids removal. Less intensive sampling conducted at a smaller operational winery wastewater constructed wetland that had used pretreatment suspended solids removal and aeration indicated that the constructed wetlands were capable of complete organic load removal from the winery wastewater. *Water Environ. Res.*, **75**, 412 (2003).

KEYWORDS: constructed wetlands, winery wastewater, tracer studies, subsurface flow, degradation modeling.

Introduction

Winery- and brewery-process wastewater differ greatly from domestic wastewater because of high organic concentrations, variable flowrates, limited nutrients, and lack of pathogens (Cronin and Lo, 1998). If not disposed to municipal systems, winery wastewater is typically stored and treated in aerated ponds and may be disposed via postharvest vineyard irrigation. However, with increased production and costs, there has been a move for wineries to treat their wastewater on-site. Wastewater generated from wine or beer production is similar as it results from various processes, including fermentation followed by washing of tanks, barrels, bottles, and so on. However, breweries and wineries have different wastewater treatment concerns and seasonal variations such that the focus here is on winery wastewater treatment only. For example, winery wastewater flows and strength exhibit seasonal fluctuations due to fall harvesting and crush operations. Noting the ability of constructed wetlands to assimilate variable and large organic loadings as well as their low maintenance and operational costs (Etnier and Guterstam, 1997), Shepherd and Grismer (1997) and Larson (1999) asserted that constructed wetlands could be an attractive system for moderately sized wineries. Their application to these more highly concentrated wastewaters has also been explored (e.g., Ronquest and Britz, 1999; Shepherd, 1998; Shepherd et al., 2001a).

Current Research. Rapid expansion of the wine industry in rural California during the past three decades has created environmental contamination problems related to winery wastewater treatment and disposal. However, until recently (e.g., Shepherd et al., 2001a) little research has been conducted characterizing winery wastewater and use of on-site treatment.

Recent reviews (e.g., Carr, 2001; Grismer and Shepherd, 1998; Grismer et al., 1999, 2000; Grismer and co-workers, 2001a) of winery (and related brewery and distillery) wastewater treatment methods have underscored the need for additional research in the United States, particularly of full-scale systems and individual processes. In addition to the pilot-scale constructed wetlands described by Shepherd et al. (2001a), a variety of traditional treatment methods have been applied to winery wastewater treatment with varying success at the bench- or pilot-scale level. In many cases, performance of these systems in the field is uncertain or unknown because of limited testing of extremely variable wastewater flows and quality.

Recent research considering winery wastewater treatment includes evaluation of aerobic and upflow anaerobic sludge bed (UASB) reactors and constructed wetlands. A few of these investigations are briefly reviewed here to illustrate some of the complexities associated with winery wastewater treatment. Using air-bubble column bioreactors with self-adapted microbial populations (either free or immobilized on polyurethane particles or immobilized on Raschig rings in a packed bed), Petroccioli et al. (2000) measured chemical oxygen demand (COD) removal rates from winery wastewater. At loads ranging from 8×10^3 to 11×10^3 mg COD/L and a maximum loading rate of approximately 8800 mg COD/(L·d), the greatest COD removal rate achieved was greater than 90% (6600 mg COD/[L·d]) using free activated sludge in the bubble column bioreactor at a hydraulic retention time (HRT) of approximately 0.8 days. Kalyuzhnyi et al. (2000, 2001a, 2001b) evaluated the start-up and operational performance of two laboratory (2.6-L working volume) UASB reactors treating winery wastewater at strengths of 1×10^3 to 17×10^3 mg COD/L and a range of temperature and loading conditions. Following a 2- to 3-month start-up period, maximum loading rates were 15 900, 6.5×10^3, 12.5×10^3, and 7.2×10^3 mg COD/(L·d) for runs at 35, 19 to 21, 18 to 20, and 4 to 10 °C, respectively, with HRTs of approximately 1 day. Chemical oxygen demand removal rates

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Table 1—Constituent methods of analysis.

Constituent	Type of analysis	Accepted Hach method[a]
Ammonium	colormetric (Nessler)	8038
COD	digestion (colormetric)	8000
Nitrate	colormetric	8507
Phosphate	colormetric	8156
Sulfate	turbidimetric	8051
Sulfide	colormetric (methylene blue)	8131
Tannins	colormetric (Folin–Ciocalteau)	–
TKN	colormetric (Nessler)	8038
TSS	gravimetric	8164

[a] APHA et al. (1998).

exceeded 85% for the warmer systems and approximately 60% for the coldest, with substantial decoloration of effluents and reduction of polyphenols (between 45 and 67%) in all cases. When two UASB reactors were operated in series, the average total COD removal exceeded 70% for average loading rates of 2200, 1800, and 1300 mg COD/(L·d) and HRTs of 2 days at 10, 7, and 4 °C, respectively. In an evaluation of a full-scale UASB system at a winery in South Africa, Laubscher et al. (2001) found problems with accumulation of a floating scum layer that on occasion was so severe that it forced a shutdown of the treatment system to enable physical removal of the scum. Attempting to replicate the scum-layer formation in the laboratory, they found that the scum layer developed only with grain distillation wastewater and its severity seemed to depend on the wastewater total suspended solids (TSS) levels. Reducing TSS concentrations by drum filtration, settling, or dilution reduced but did not eliminate scum-layer accumulation, raising questions of the long-term viability of UASB systems for treating distillation wastewaters.

Finally, Shepherd et al. (2001a) evaluated the performance of a pilot-scale subsurface-flow constructed wetlands (6.1 m long × 2.4 m wide × 1.2 m deep) in treating winery wastewater flows ranging from 80 to 170 m^3/d at organic loads of 600 to 45 × 10^3 mg COD/L, and measured average removal rates of 98% for COD and 97% for TSS when combining the constructed wetlands with an upflow sand prefilter. The system also seemed to be effective at neutralizing the pH of the acidic winery wastewater and at removing the limited nitrogen (78.2%) in the wastewater in addition to sulfide (98.5%), orthophosphate (63.3%), volatile fatty acids (99.9%), tannins and lignins (77.9%), and all settleable solids. Grismer and co-workers (2001b) determined the hydraulic characteristics of the pilot-scale constructed wetlands used by Shepherd et al. (2001b) to determine a rate-dependent COD decay coefficient using a retardation-type model. What continues to be lacking is a complete evaluation of the performance of full-scale constructed wetlands or many other types of treatment systems for winery wastewater.

In addition to evaluation of full-scale systems, more information is needed about treatment of particular components of winery wastewater. For example, winery wastewater includes recalcitrant constituents (polyphenols and lignins) that are difficult to degrade because of their structure as well as high molecular weights. Of these, tannins are the most common and crucial to the wine-making process because of their effects on taste, puckering, bouquet, and finish of the wine; biological methods have been developed for their rapid measurement (Jewell and Ebeler, 2001). Tannins, which are most abundant in red wine, can precipitate proteins and act to inhibit microbial digestion (Sarni-Manchado et al., 1999), potentially limiting removal efficiencies. Of the three types of tannins (hydrolyzable, condensed, and catechins), hydrolyzable tannins are the simplest to degrade, while condensed tannins are rarely degraded (Bhat et al., 1998). Catechins exhibit both hydrolyzable and condensed properties. Tannins, however, are sensitive to light degradation, although they require months of exposure, but may adversely affect stream habitat when in high concentrations (Biosystems, 1993). An investigation of the performance of constructed wetlands for treating winery wastewater should include evaluation of the efficacy of recalcitrant compound degradation.

Evaluation of constructed wetland performance in the field requires not only analysis of constituent degradation or transformation, but also a hydraulic assessment of the flow properties of the constructed wetland bed under the variable operating conditions found during actual use so as to improve modeling and design efforts in the field. The overall project objective was to determine full-scale HRTs and treatment performance through assessment of water quality by daily sampling of total dissolved solids (TDS), pH, TSS, COD, tannins, nitrate, ammonium, total Kjeldahl nitrogen (TKN), phosphate, sulfate, and sulfide from two full-scale systems. A secondary goal was to quantify COD and tannin removal rates from winery wastewater in bench-scale reactors. Specifically, the research objectives were to

- Determine and model (i.e., estimate decay constants) tannin removal rates of full-scale constructed wetlands and simple bench-scale pea-gravel reactors;
- Determine and model full-scale treatment efficiencies for TSS, COD, sulfate, sulfide, TKN, nitrate, ammonium, and phosphate; and
- Quantify the difference in treatment of winery wastewater in constructed wetlands during crush and noncrush seasons.

Field Setting and Experimental Methods

Operational, full-scale subsurface-flow constructed wetlands servicing a moderate-production winery near Hopland, California, and a smaller production winery near Glen Ellen, California, were evaluated during the fall harvest–crush and spring seasons. In each case, potassium bromide tracer studies were conducted to determine HRTs during or prior to water quality sampling periods. Water quality sampling was much more intensive at the Hopland facility and included determination of COD and tannin removal rates in the effluent and at several locations along the constructed wetlands. The full-scale designs were scaled-up versions of the pilot-scale system described by Shepherd et al. (2001a), although TSS pretreatment systems differed. Both wastewater treatment systems included solids (e.g., stems, seeds, and skins) removal systems followed by facultative settling ponds prior to discharge to the constructed wetlands; however, the Glen Ellen facility also used a rotary screen TSS removal system before discharge to the facultative pond. At the Hopland facility, clarifiers were also added between the pond and constructed wetlands after this study was completed. The facultative pond at Glen Ellen served as a clarifier, while, at Hopland, the facultative pond was undersized, resulting in excess discharge of suspended solids and organics and subsequent overloading of the constructed wetlands during the study period. Both treatment systems had recirculation capabilities between the

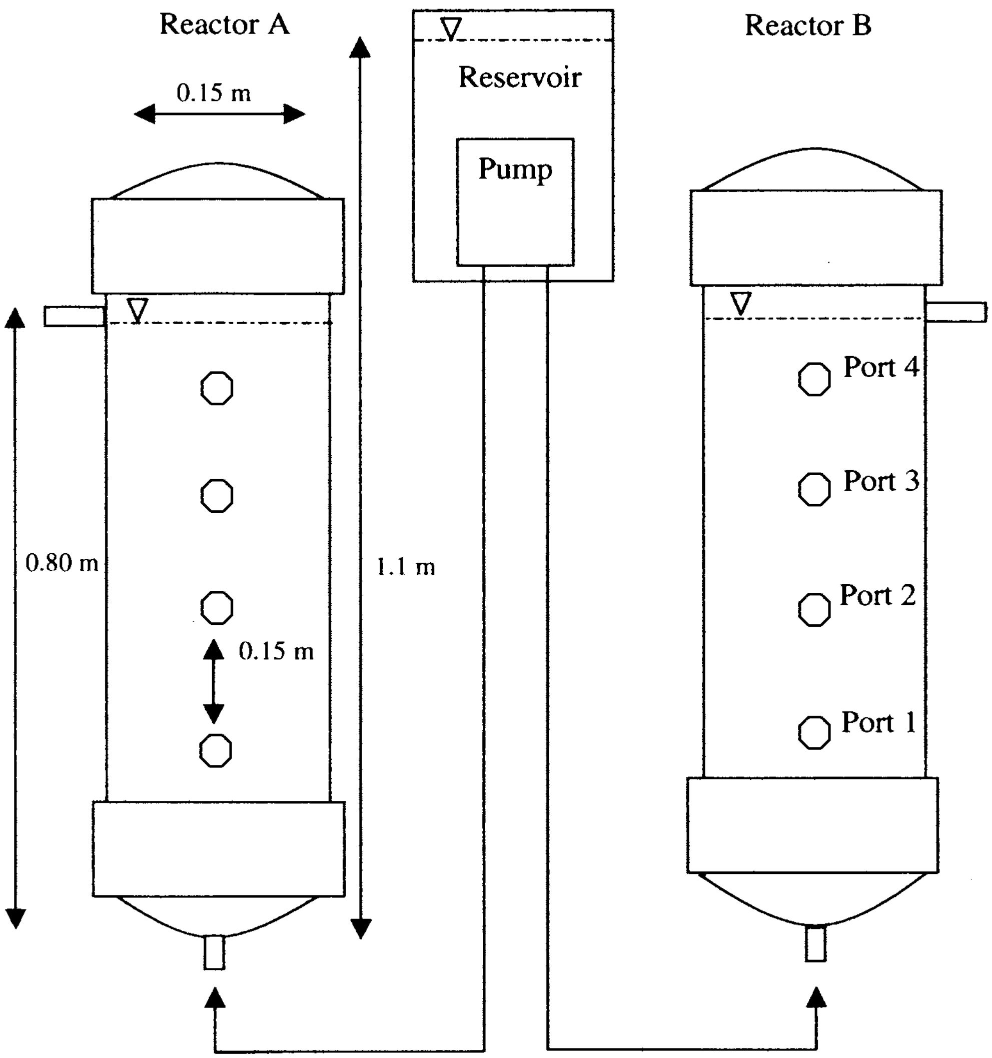

Figure 1—Schematic illustration of bench-scale reactors used for tannin removal studies.

constructed wetlands and facultative pond, although recirculation was only used at the Glen Ellen facility during the study period.

The field constructed wetlands included inlet and outlet manifolds that uniformly distributed flows across the full width at the wetland surface at the inlet as well as collected subsurface flows across the full width at the wetland bed base at the outlet. Both full-scale constructed wetlands used 1.1- to 1.2-m-thick "washed" pea (~4 mm) gravel (Glen Ellen) or rock (Hopland) substrates with established cattails and bulrush vegetation, and were designed to maintain water depths of 1.0 m. The crushed rock (10 to 30 mm) used at the Hopland constructed wetlands was not washed and was found to contain some soil and fines resulting in low, plugged-flow zones of the constructed wetlands. In addition, the Hopland constructed wetlands was not lined, but regular mass-balance measurements suggested that there was minimal, if any, seepage. The Glen Ellen constructed wetlands was lined with 1.5-mm (60-mil) polyethylene and also exhibited no seepage. The larger Hopland system (50 m wide × 88 m long) was designed for an HRT of approximately 10 days, while the Glen Ellen system (8 m wide × 38 m long) was designed for an HRT of approximately 5 days. Grids of sampling ports (16 ports at a depth of approximately 0.45 m in three evenly spaced parallel transects at the Hopland constructed wetlands and 10 dual-depth ports [approximately 0.4 and 0.95 m] in two transects at the Glen Ellen constructed wetlands) were installed to track potassium bromide tracer concentrations and water quality changes across the constructed wetlands.

Impulse-type potassium bromide tracer studies were conducted at the Hopland system in September 1999, April 2000, and October 2000 and at the Glen Ellen constructed wetlands in April 2000 to evaluate HRTs for the constructed wetlands. Because of winery expansion, the wastewater flowrate had increased by approximately 150% over design rates at the Hopland constructed wetlands, while the wastewater flowrate was less than the design rate at the Glen Ellen constructed wetlands. In the first two studies at the Hopland constructed wetlands, inflow and outflow rates were measured and samples were collected from all ports and the outlet at approximately 8- to 12-hour intervals for immediate potassium bromide analysis. In October 2000, observed fee-water conditions and apparent short-circuiting at the Hopland constructed wetlands resulted in a second test being conducted in which only outlet potassium bromide concentrations were measured at 10- to 15-minute intervals following potassium bromide injection. Tracer studies at the Glen Ellen constructed

Table 2—Average flowrates and HRTs for bench-scale experiments.

	Reactor A		Reactor B		Average	
Experiment no.	Flowrate (L/d)	HRT (d)	Flowrate (L/d)	HRT (d)	Flowrate (L/d)	HRT (d)
1	3.86	1.6	3.80	1.5	3.83	1.6
2	4.40	1.4	4.10	1.4	4.25	1.4
3	2.15	2.8	1.72	3.3	1.94	3.1

wetlands also used this more rapid sampling approach and included port sampling at two depths in repeated potassium bromide injections. The HRTs associated with the potassium bromide center of mass for each tracer study were calculated using the method-of-moments (Grismer and co-workers, 2001b) and compared with time to tracer peak (t_p) concentration and plug-flow retention times (T_d) to estimate the degree of short-circuiting, if any, in each constructed wetlands. Potassium bromide recovery during the tracer tests ranged from approximately 90 to 105% of the input mass.

Water quality samples were collected in the spring between April 18 and May 8, 2000, at both constructed wetlands and then in the fall from September 18 to October 13, 2000, at the Hopland constructed wetlands to evaluate system performance during both off-season and harvest–crush periods, respectively. The wastewater flowrate was maintained constant in both systems (e.g., approximately 137 m^3/d at the Hopland constructed wetlands) and inflow and outflow rates remained practically the same during the day, suggesting minimal evapotranspiration losses. Samples (200 mL) were analyzed daily for TDS, pH, TSS, COD, tannins, nitrate, phosphate, sulfate, sulfide, and settleable solids. Split samples (20 mL) were also acidified (2% sulfuric acid) and chilled for later TKN and ammonium analyses by the University of California, Davis, Division of Agriculture and Natural Resources Analytical Laboratory.

In the field and laboratory, chemical constituents were measured promptly using spectrophotometric methods (Hach Co., Loveland, Colorado) that are equivalent to accepted methods (APHA et al., 1998) (Table 1). Quantification of tannin concentrations is often difficult because no widely accepted test is available. While the Folin–Ciocalteau method is generally used to determine total phenolics (Ritta, 1985), tannic acid, a type of hydrolyzable tannin, is typical in winery wastewater and this spectrophotometric method was found to better measure tannic acid concentrations. Samples for TSS, tannin, phosphate, sulfate, and sulfide were diluted 1:4 for analysis purposes, while undiluted samples were analyzed for TDS, pH, COD, and nitrate. Approximately 10 to 15 samples were averaged for each port and constituent that was measured at the Hopland constructed wetlands.

In addition to the field evaluations, three bench-scale tannin (and COD) removal experiments were conducted from April to June 2001 using duplicate pea-gravel-filled cylindrical schedule 40 polyvinyl chloride reactors (150 mm diameter × 0.76 m tall) with working volumes of approximately 13.9 L (Figure 1). The reactors were shaken during filling with pea gravel to obtain packing-bulk densities similar to that found in the field, resulting in porosities of 44% for reactor A and 41% for reactor B, or pore volumes of 6.1 and 5.7 L, respectively. Upflow conditions were maintained in the reactors using a multistage peristaltic pump. Sampling ports were located at 150-mm intervals along each reactor as well as at the influent and effluent ends.

The reactors were filled with wastewater inoculum from the pilot-scale constructed wetlands (Shepherd et al., 2001a) that consisted of fermented grape juice and dextrose (1000 mg/L each) for 3 days then flushed with tap water and refilled with wastewater inoculum for another 3 days, after which synthetic wastewater was introduced at a steady rate. Synthetic wastewater containing 20 mL/L of white grape juice (tannin free) and 50 mg/L of reagent-grade tannic acid for organic loads of approximately 1000 mg COD/L was used to simulate wastewater in the full-scale constructed wetlands. The first two experiments used a steady flowrate of approximately 4 L/d (or HRTs of approximately 1.5 days) and samples were drawn twice daily (for 7 and 8 days, respectively) from all ports and analyzed for tannin and COD concentrations. The third experiment was conducted in the same manner, but used a smaller flowrate (approximately 2 L/d) to better simulate field conditions for constructed wetlands having retention times of approximately 5 days; this experiment continued for 13 days. Sample volumes of approximately 5 mL did not appreciably alter reactor volumes. Table 2 summarizes the flow conditions for the bench-scale experiments. Average reactor temperatures were 19 °C.

Tracer Study Results

Werner and Kadlec (2000) and Grismer and co-workers (2001b) underscore the need to determine the three-dimensional hydraulic performance of constructed wetlands prior to evaluation of their treatment potential so as to better determine appropriate removal models (e.g., Kadlec, 2000) as well as provide insight to remedial measures necessary to improve system performance. The tracer study results are briefly considered in this context, particularly because the treatment performance of the Hopland constructed wetlands had been compromised by excessive solids loading. Table 3 summarizes the results of the September 1999 and April 2000 tracer studies at the Hopland constructed wetlands.

Analysis of the outflow residence-time-distribution (RTD) curves from the first two tracer studies at the Hopland constructed wetlands yielded an HRT of only 133 hours (5.5 days), which was approximately one-half of that of the design HRT and less than the plug-flow retention time of 172 hours (7.2 days), suggesting some system short-circuiting as water passed through the constructed wetlands more rapidly than predicted by the system flowrate, constructed wetlands dimensions, and porosity of the wetland bed. Analysis of the RTD curves from ports within the constructed wetlands helped to identify where short-circuiting was located in the constructed wetlands for possible focused remediation as summarized in Table 3. Initially, flow was faster on the north side of the wetlands, indicating some form of short-circuiting specific to that side as verified by visual inspection of overland or preferential flows on this side. At the first set of ports, the center-line retention times matched plug-flow values, while those on the south side were actually slower than predicted, suggesting that some small flow

Table 3—Peak (t_p), observed (t_d), and plug-flow (T_d) HRTs of potassium bromide tracer at the Hopland constructed wetlands in October 1999 and 2000.

Distance from inlet	Transect	t_p (h)	t_d (h)	T_d (h)	Indications
	Outlet	85	133	172	Short-circuiting as t_p and $t_d < T_d$.
24.6 m	North	25	14	50	Greater flow on north side compared with center and south sides
	Center	25	50	50	
	South	25	51	50	
38.5 m	North	25	44	78	Flow exceeds plug-flow estimate on all three transects. Flow continues to be greater on the north side.
	Center	48	67	78	
	South	48	56	78	
53.8 m	North	108	114	109	Flow exceeds plug-flow estimate on center and south transects. Flow is less on north, indicating local area of restricted flow (fine particles).
	Center	61	96	109	
	South	61	65	109	
69.2 m	North	48	109	140	At this location, flows have increased on the south side, suggesting possible overland flow.
	Center	96	117	140	
	South	60	100	140	

restriction was present on the south side. By the second set of ports into the constructed wetlands, flow was faster than predicted by plug flow at all ports, especially on either side. Again, this could have been due to preferential flow through standing water on the sides of the constructed wetlands. However, by the third set of ports, flow was substantially slower on the north side. The third north-side port was intentionally placed in a sandy area as it was uncertain how influential the sandy areas were on flow. Water within the constructed wetlands seemed to flow around these areas, effectively reducing the size of the bed. By the final set of ports, all flow was faster than plug-flow predictions, especially on the south side. Overall, the tracer study indicated that the HRT of the constructed wetlands in the fall of 1999 and April 2000 was approximately 1.7 days less than the plug-flow HRT and that areas of limited flow existed in the constructed wetlands.

The October 2000 tracer study was initially conducted in the same manner as the previous two. However, little potassium bromide was detected in the first few 8- to 12-hour sampling periods. With the obvious surface flow conditions, a second rapid sampling impulse study was conducted. Sampling was conducted only at the outlet for the first 5 hours of the test, after which sampling occurred every hour and then less frequently as the tracer was observed to leave the system. Sampling continued at 12-hour intervals until a storm ended the study period after 4 days. The measured peak potassium bromide concentration of the outlet RTD curve from the second test occurred at 45 minutes following introduction of the tracer, and more than 75% of the tracer mass had come through the constructed wetlands within the first hour of sampling. Despite long "tailing" of the RTD, the method-of-moments suggested an HRT of approximately 1 hour. With an HRT of only 1 hour, bulk COD removal seen in the constructed wetlands (as will be discussed in a following section) was likely limited to physical processes (i.e., solids settling).

Two tracer studies in April 2000 at the Glen Ellen constructed wetlands were conducted at a flowrate greater than the wastewater design rate, allowing for a more rapid testing period. Table 4 summarizes the HRT results across the constructed wetlands at the two different sampling depths. In the first test at the shallow sampling depth, little tracer was detected in the ports along the south side, resulting in RTD curves that were virtually flat such that HRTs were not calculated for these ports. Because of the lack of detection in the south side of the constructed wetlands, it was anticipated that the system would show some short-circuiting and that the constructed wetlands bottom was slightly sloped to the north. While observed HRTs calculated for the north-side ports were more or less similar to the plug-flow HRTs, they were all somewhat less (with the exception of the first port). However, the fact that the observed HRT at the outlet was practically the same as the plug-flow HRT indicates little short-circuiting in this system as a whole. It is possible that at this mid-depth in the constructed wetlands there was some uneven gravel packing. Results from the second tracer test (at the 0.95-m depth) were similar to the first, except that practically equal tracer concentrations were found in both sides of the constructed wetlands, confirming that possible uneven packing near the surface, rather than bottom slope, was the cause of the observations in the first tracer test. Again, the observed outlet HRT was similar to the plug-flow HRT, indicating little, if any, short-circuiting across the Glen Ellen constructed wetlands.

Water Quality Results and Discussion

Monitoring of the range of water quality parameters across the Hopland constructed wetlands during the noncrush and crush periods demonstrated the variability in wastewater characteristics encountered as well as the problems associated with substantially increased short-circuiting between monitoring periods. Tables 5 and 6 summarize average variation and removal rates of the parameter concentrations across the inlet and outlet during the noncrush and crush periods, respectively. Relatively constant phosphate concentrations (approximately 1 mg/L) were not included in the tables because of their lack of variability and slight increase in concentration across the constructed wetlands. Calculated organic (COD) loading rates during the noncrush and crush periods (accounting for a small evapotranspiration concentration within the constructed wetlands [Carr, 2001]) were approximately 210 and approximately 720 kg/(ha·d), respectively. These loading rates exceeded design rates, but were comparable to those applied to the pilot-scale constructed wetlands system by Shepherd et al. (2001a).

Winery wastewater strength (COD concentration) and variability during the crush season are considerably greater than during the noncrush season. Overall COD removal rates (as well as those for most constituents listed in Tables 5 and 6) were far greater during the noncrush sampling period compared with the crush period

Table 4—Observed (t_d) and plug-flow (T_d) HRTs of potassium bromide tracer at the Glen Ellen constructed wetlands.

		0.30- to 0.45-m depth		0.95-m depth	
Distance from inlet	**Transect**	T_d **(h)**	t_d **(h)**	T_d **(h)**	t_d **(h)**
6.0 m	North	1.47	1.65	1.46	ND[a]
	South			1.46	ND
12.1 m	North	2.94	2.93	2.93	3.14
	South			2.93	3.15
18.3 m	North	4.4	4.24	4.39	4.28
	South			4.39	4.03
27.4 m	North	6.61	6.49	6.59	6.31
	South			6.59	5.84
35 m	North	8.45	7.57	8.42	8.41
	South			8.42	8.25
Outlet		8.89	8.65	8.85	8.66

[a] ND = not determined.

because of the inlet COD loading being approximately one-quarter of that during the crush period and the HRT being at least an order of magnitude greater. Figure 2 displays the COD concentration and standard deviation across the centerline length of the Hopland constructed wetlands during the noncrush and fall crush sampling periods and further illustrates the problems with short-circuiting during the crush sampling period.

Despite severe short-circuiting and solids overloading, the Hopland constructed wetlands achieved significant wastewater treatment. From a load perspective, it removed approximately 1200 kg COD/(ha·d), even with an HRT of just 1 hour. The constructed wetlands had been designed to remove a maximum of approximately 2700 kg COD/(ha·d) and 1200 kg/(ha·d) under regular operation. Clearly, more complete treatment would have occurred had the subsurface-flow conditions been restored and channeling across the constructed wetlands been reduced, as was later achieved through burning off of the vegetation and "ripping" of the rock substrate following this study.

Lack of short-circuiting and much smaller loading rates at the Glen Ellen constructed wetlands resulted in considerably different performance characteristics compared with those of the Hopland constructed wetlands. From limited grab sampling during crush and noncrush periods, the average COD and TSS concentrations to the aeration pond and from the pond to the constructed wetlands were 8000 mg COD/L and 630 mg/L and 300 mg COD/L and 175 mg/L, respectively. Average inlet and outlet COD and TSS concentrations to the constructed wetlands were only 290 mg COD/L and 145 mg/L and approximately 7 mg COD/L and 2 mg/L, respectively, yielding COD and TSS removal rates of approximately 98%. More importantly, perhaps, the outlet COD and TSS concentrations of less than 10 mg/L suggest that practically complete removal of organic loads from the winery wastewater is possible.

Removals of TSS, COD, sulfate, sulfide, tannins, and nitrate were modeled using either first-order or retarded first-order decay (i.e., Shepherd et al., 2001b) equations. Reaction rates were considered retarded when they changed along the length of the constructed wetlands. The retarded first-order decay equation developed from the simple first-order expression is given here.

$$C_t = C_o \exp[-k/R \ln(1 + Rt_d)] \qquad (1)$$

Where

C_t = constituent concentration at time t (mg/L),
C_o = initial constituent concentration (mg/L),
t_d = detention (HRT) time (d),
k = reaction rate constant (1/d), and
R = retardation coefficient (1/d).

Note that when $R = 0$, eq 1 reduces to the simple first-order decay model.

Table 5—Summary of inlet and outlet water quality statistics and removal rates across the Hopland constructed wetlands during noncrush period.

	Inlet			Outlet			
Constituent (mg/L)	***n***	**Mean**	**Standard deviation**	***n***	**Mean**	**Standard deviation**	**Removal rate (%)**
TSS	15	1042	251	19	110	103	85
COD	15	1721	439	19	362	676	79
Tannin	13	55.0	16.4	18	12.1	3.8	78
Nitrate	16	1.8	0.7	18	0.5	0.5	73
Ammonium	2	118	NA[a]	4	45	11	62
TKN	2	159	NA	4	54	15	66
Sulfate	4	35	19	9	2.0	2.5	95
Sulfide	14	0.56	0.20	16	0.12	0.10	78

[a] NA = not available.

Table 6—Summary of inlet/outlet water quality statistics and removal efficiencies across the Hopland constructed wetland during crush period.

	Inlet			Outlet			
Constituent (mg/L)	***n***	**Mean**	**Standard deviation**	***n***	**Mean**	**Standard deviation**	**Removal efficiency (%)**
TSS	11	1428	644	13	808	229	30
COD	11	7406	2090	13	3748	1826	49
Tannin	10	55.2	21.6	12	30.0	20.6	46
Nitrate	7	13.1	7.4	8	10.9	4.3	17
Ammonium	5	37	28	5	26	5	29
TKN	5	43	31	5	32	6	25
Sulfate	8	83	33.5	8	62	39	25
Sulfide	11	0.88	0.5	13	0.7	0.2	20

For example, the retarded first-order decay model was applied to TSS removal because of the differential removal of particles resulting from flocculation, straining, and settling along the constructed wetlands. As larger particles preferentially settle first, the TSS removal rate depends on the detention time, or distance through the constructed wetlands. Sulfide and nitrate removal also seemed to be better modeled by the first-order retarded degradation equation. Table 7 summarizes model coefficients determined from the best least-squares fitting of both equations to the measured concentrations as they varied with distance along the Hopland constructed wetlands, assuming a t_d of 5.5 days. Modeling of TKN and ammonia degradation was unsuccessful because of insufficient data at short detention times and, therefore, is not included. Sulfide and nitrate concentrations were at trace levels (concentrations ranging from 0 to 2 mg/L), resulting in relatively large standard deviations, poor model fitting, and ambiguous decay and retardation coefficients. Because the HRT of the Hopland constructed wetlands during the crush season was compromised by excessive short-circuiting, no attempts were made to model results from this period.

Tannin Removal: Results and Discussion

Average wastewater removal efficiency changed unexpectedly between periods when the three bench-scale reactor experiments were conducted, although the two reactors behaved nearly identically in each experiment. Despite doubling the HRT between the first two experiments and the third, both COD and tannin removal decreased (Table 8). It seems that either a steady-state condition was not reached or there was sloughing of organic material within the reactors between experiments.

Figure 3 illustrates average tannin removal within the reactors and the first-order decay (plug-flow) model coefficients for each experiment (Crites and Tchoblanoglous, 1998). Tannin decay coefficients and relative model fit (R^2 value) decreased with increasing HRT. However, overall tannin removal rates were approximately the same for the first and third experiments (Table 8), suggesting that these coefficients may have limited meaning such that an intermediate value may be appropriate. In each of the curves shown in Figure 3, tannic acid concentration initially decreases more rapidly than predicted by the first-order model and then levels off, suggesting that the reactors were of sufficient length to reach an approximate steady-state condition with respect to tannin degradation along the column length. This effect may also be attributed to differential ripening in the reactor or concentration of organic matter near the reactor inlet, a common "plugging" problem with sand and gravel filters.

Tannin concentrations and removal rates in the Hopland constructed wetlands were quite similar to those in the bench-scale reactors during both noncrush and crush periods at the winery (Tables 5 and 6). Average inlet tannin concentrations were approximately 55 mg/L during both periods, while average outlet concentrations ranged from 12 to 30 mg/L for removal efficiencies

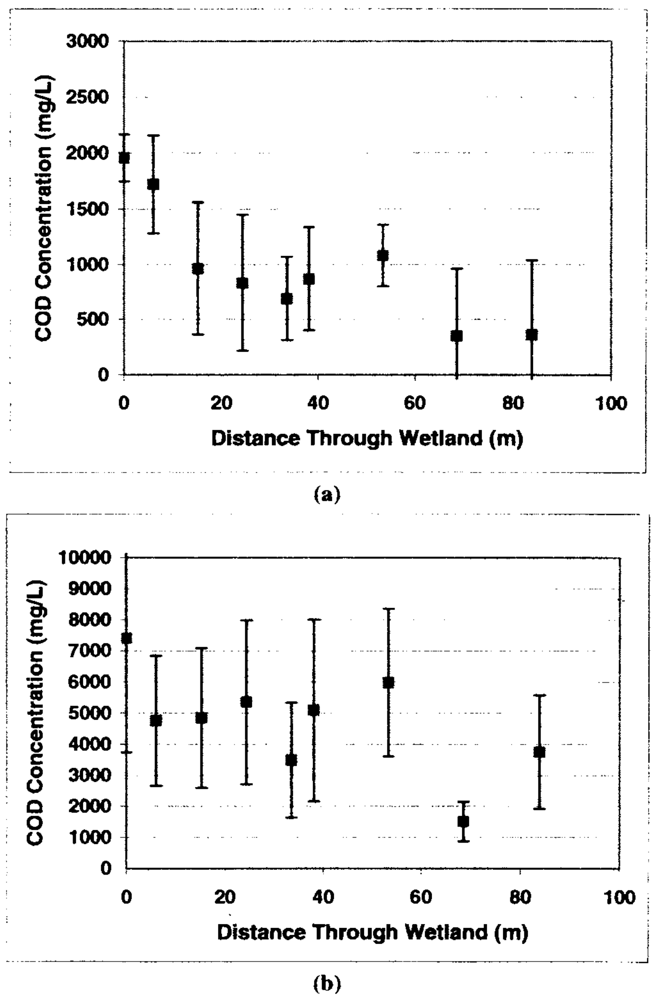

Figure 2—Concentration and variance of COD with distance along the Hopland constructed wetland centerline: (a) spring noncrush period and (b) fall crush period.

Table 7—First-order decay constants and retardation coefficients for constituent removal in the Hopland constructed wetlands during the noncrush season.

Constituent	k (d^{-1})	R (d^{-1})	R^{2a}
COD	0.31	0	0.78
Tannin	0.29	0	0.78
Sulfate	0.54	0	0.89
TSS	0.41	0.2	0.78
Sulfide	0.28	0.2	0.57
Nitrate	0.24	0.5	0.59

[a] Least-squares analysis.

of 78 to 48%, respectively, values similar to those found in the literature. Decreased tannin removal during the fall crush period was not surprising because of the extremely short effective HRT and high COD loads.

Figure 4 illustrates the variability of tannin degradation across the Hopland constructed wetlands during the noncrush and crush periods. Replacing distance along the constructed wetlands with the average HRT of 5.5 days for all three transects across the constructed wetland results in an average first-order decay coefficient of approximately 0.3 d^{-1} (R^2 = 0.77) that is similar to the value from the bench-scale data. During the crush period (Figure 4b), however, the tannin decay coefficient determined using an HRT of 1 hour is far greater (approximately 17 d^{-1} and R^2 = 0.49); an HRT of 1 day yields a more reasonable coefficient of approximately 0.7 d^{-1}. Tannin degradation in either system does not seem to be as recalcitrant as anticipated from the literature; rather, removal rates of 50 to 80% can be expected in these systems.

Summary and Conclusions

Use of constructed wetlands for winery wastewater treatment has the advantages associated with low operating costs and the ability to effectively assimilate the variably high organic loadings characteristic of winery wastewater production. Lignins, tannins, and other polyphenolics common in winery wastewater also pose particular treatment concerns because of potential downstream effects on aquatic life. However, little is known about the effectiveness of winery wastewater treatment by constructed wetlands in the field as the literature lacks evaluations of full-scale winery wastewater treatment systems.

Bench- and full-scale evaluations were conducted during 2000 and 2001 to quantify treatment efficiencies and model constituent degradation in constructed wetlands for winery wastewater treatment. Results were quite variable in the full-scale system, especially during the harvest–crush fall season. Chemical oxygen demand removal rates ranged from 59 to 72% for the simple bench-scale reactors, while tannin removal ranged from 54 to 58%. The Hopland constructed wetlands showed similar COD and tannin removal rates ranging from 49 to 79% and 46 to 78%, respectively, with greater removal occurring during the spring noncrush period. Although at smaller loading rates and greater HRTs than in the

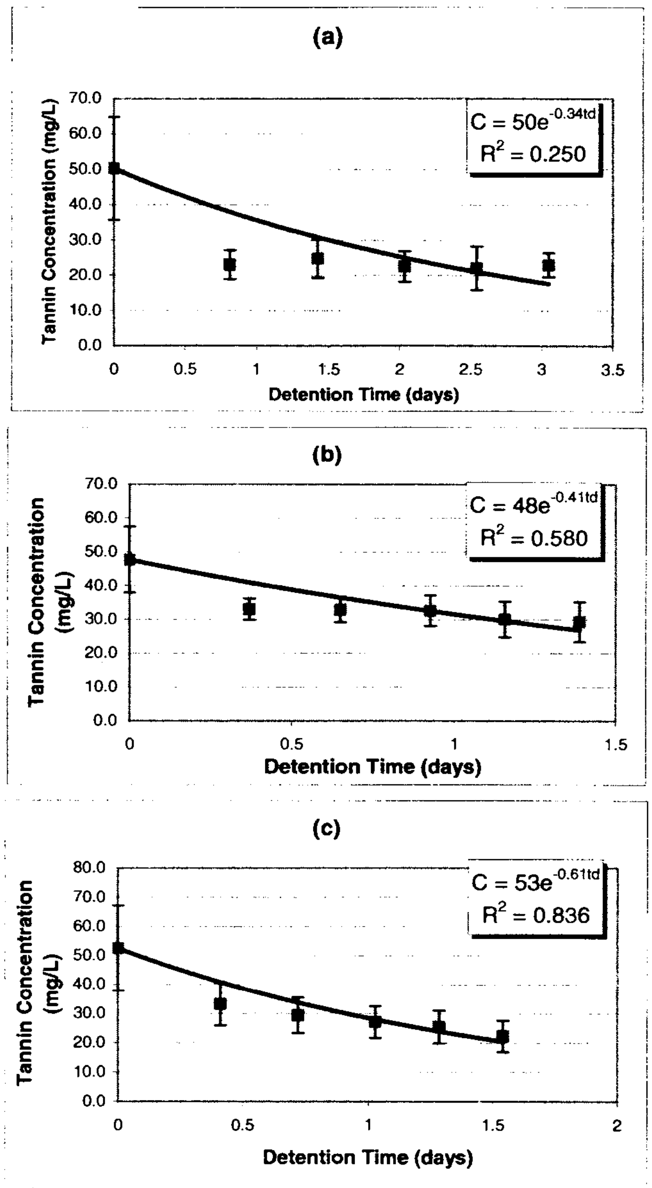

Figure 3—Averaged tannin removal from both reactors, its variability, and modeled decay: (a) experiment 3, (b) experiment 2, and (c) experiment 1.

Table 8—Chemical oxygen demand and tannin removal rates for bench-scale reactor experiments.

Experiment	Average inlet concentration (mg/L)	Average outlet concentration (mg/L) Reactor A	Reactor B	Average removal (%)
COD				
1	1247	347	348	72
2	1094	364	387	66
3	887	366	366	59
Tannin				
1	52.5	22.3	22.2	58
2	47.7	28.4	30.3	38
3	50.2	22.6	23.4	54

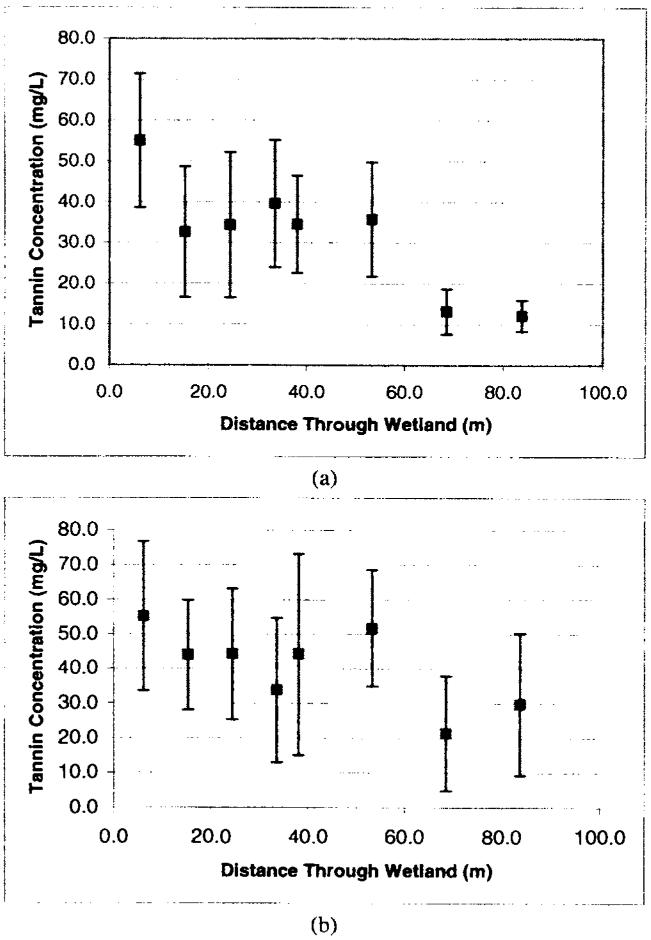

Figure 4—Tannin concentrations and variations along the centerline of the Hopland constructed wetlands: (a) spring noncrush period and (b) fall crush period.

Hopland system, the Glen Ellen constructed wetlands achieved nearly complete COD removal (from approximately 8000 mg/L to 5 mg/L) through use of the recirculation system, suggesting that, when properly loaded and operated, the system was quite capable of full treatment of winery wastewater.

First-order degradation models were applied for bench-scale tannin removal, and both first-order and retarded first-order decay equations were used to model full-scale constituent degradation. Although wastewater COD strength was much greater for the full-scale constructed wetlands, tannin loading and removal were similar in both the laboratory and field studies. Despite the shorter HRTs in the bench-scale reactors, tannin decay-rate constants for both systems were similar (approximately 0.3 d^{-1}). Determination of winery wastewater tannin composition during crush and noncrush periods as well as supplemental photodegradation of tannins in constructed wetlands may be a promising area for research.

Because of short-circuiting in the Hopland constructed wetlands prior to crush-season measurements, it was difficult to quantify actual treatment potential of this constructed wetlands. Although removal rates were substantially greater during the spring, it was not clear whether similar efficiencies could be obtained during the crush season had the constructed wetlands not been compromised. Nonetheless, despite HRTs on the order of 1 hour during the crush season compared with approximately 5 days during the noncrush season, the constructed wetlands reduced inlet COD by one-half while reducing other constituents by 20 to 30%. Understanding the HRTs of the constructed wetlands through tracer study analyses was crucial to interpretation of the water quality measurements across the constructed wetlands.

Acknowledgments

Authors. M. E. Grismer is a professor of Hydrology and Biological & Agricultural Engineering at the University of California, Davis; M. A. Carr is a former graduate student in Biological & Agricultural Engineering at the University of California, Davis; and H. L. Shepherd is an environmental engineer–scientist with Komex-H20 Science, Huntington Beach, California. Correspondence should be addressed to M. E. Grismer, 1 Shields Avenue, LAWR–Hydrology, UC Davis, Davis, California, 95616; e-mail: megrismer@ucdavis.edu.

Submitted for publication January 28, 2002; revised manuscript submitted October 21, 2002; accepted for publication October 29, 2002.

The deadline to submit Discussions of this paper is January 15, 2004.

References

American Public Health Association; American Water Works Association; Water Environment Federation (1998) *Standard Methods for the Examination of Water and Wastewater*, 20th ed.; Washington, D.C.

Bhat, T. K.; Singh, B.; Sharma, O. P. (1998) Microbial Degradation of Tannins—A Current Perspective. *Biodegradation*, **9** (5), 343.

Biosystems, Inc. (1993) *Lower Moukolemne River Management Plan*; Vol. 3, 1990–1992; San Francisco, California.

Carr, M. A. (2001) The Use of Constructed Wetlands to Treat Winery Wastewater. M.S. Thesis, *Biological and Agricultural Engineering*, University of California, Davis.

Crites, R.; Tchoblanoglous, G. (1998) *Small and Decentralized Wastewater Management Systems;* WCB/McGraw-Hill: Boston, Massachusetts.

Cronin, C.; Lo, K. V. (1998) Anaerobic Treatment of Brewery Wastewater Using UASB Reactors Seeded with Activated Sludge. *Bioresour. Technol.*, **64** (1), 33.

Etnier, C.; Guterstam, B., Eds. (1997) *Ecological Engineering for Wastewater Treatment*, 2nd ed.; Proceedings of the Conference at Stensund Folk College, Sweden, March 24–28; Lewis Publishers: Boca Raton, Florida.

Grismer, M. E.; Carr, M. A.; Shepherd, H. L. (1999) Fermentation Industry. *Water Environ. Research*, **71**, 805.

Grismer, M. E.; Carr, M. A.; Shepherd, H. L. (2000) Fermentation Industry. *Water Environ. Research*, **72** (5), Literature Review [CD-ROM].

Grismer, M. E.; Ross, C. C.; Valentine, G. E.; Smith, B. M.; Walsh, J. L. (2001a) Literature Review: Food Processing Wastes. *Water Environ. Res.*, 73 (5), Literature Review [CD-ROM].

Grismer, M. E.; Shepherd, H. L. (1998) Fermentation Industry. *Water Environ. Res.*, **70**, 637.

Grismer, M. E.; Tausendschoen, M.; Shepherd, H. L. (2001b) Subsurface Flow Hydraulic Characteristics of a Constructed Wetland for Treatment of Winery Effluent. *Water Environ. Res.*, **73**, 466.

Jewell, W. T.; Ebeler, S. E. (2001) Tyrosinase Biosensor for the Measurement of Wine Polyphenolics. *Am. J. Enol. Viticulture*, **52** (3), 219.

Kadlec, R. H. (2000) The Inadequacy of First-Order Treatment Wetland Models. *Ecol. Eng.*, **15**, 105.

Kalyuzhnyi, S. V.; Gladchenko, M. A.; Sklyar, V. I.; Kizimenko, Y. S.; Shcherbakov, S. S. (2001a) Psychrophilic One- and Two-Step Systems for Pre-Treatment of Winery Waste Water. *Water Sci. Technol.*, **44** (4), 23.

Kalyuzhnyi, S. V.; Gladchenko, M. A.; Sklyar, V. I.; Kizimenko, Y. S.; Shcherbakov, S. S. (2001b) One- and Two-Stage Upflow Anaerobic Sludge-Bed Reactor Pretreatment of Winery Wastewater at 4–10 C. *Appl. Biochem. Biotechnol.*, **90**, 107.

Kalyuzhnyi, S. V.; Gladchenko, M. A.; Sklyar, V. I.; Kurakova, O. V.; Shcherbakov, S. S. (2000) The UASB Treatment of Winery Wastewater under Submesophilic and Psychrophilic Conditions. *Environ. Technol.*, **21**, 919.

Larson, C. (1999) Constructed Wetlands Research Offers Treatment for Wastewater: Fetzer, Benziger Wineries Pioneer 'Green' Systems. *Wine Business Monthly*, **6** (12), 43.

Laubscher, A. C. J.; Wentzel, M. C.; Le Roux, J. M. W.; Ekama, G. A. (2001) Treatment of Grain Distillation Wastewaters in an Upflow Anaerobic Sludge Bed (UASB) System. *Water SA (Pretoria)*, **27**, 433.

Petroccioli, M.; Duarte, J. C.; Federici, F. (2000) High-Rate Aerobic Treatment of Winery Wastewater Using Bioreactors with Free and Immobilized Activated Sludge. *J. Biosci. Bioeng.*, **90**, 381.

Ritta, J.-T. (1985) Phenolic Constituents in the Leaves of Northern Willows: Methods for the Analysis of Certain Phenolics. *J. Agric. Food Chem.*, **33**, 213.

Ronquest, L. C.; Britz, T. J. (1999) Influence of Lower pH and Retention Time on the Efficiency of a UASB Bioreactor Treating Winery Wastewater. *South African J. Enol. Viticulture*, **20** (1), 35.

Sarni-Manchado, P.; Deleris, A.; Avallone, S.; Cheynier, V.; Moutounet, M. (1999) Analysis and Characterization of Wine Condensed Tannins Precipitated by Proteins Used as Fining Agent in Enology. *Am. J. Enol. Viticulture*, **50** (1), 81.

Shepherd, H. L. (1998) Performance Evaluation of a Pilot-Scale Constructed Wetland Used for Treatment of Winery Process Wastewater. *Second International Specialized Conference on Winery Wastewaters*, Bordeaux, France, May 5–7; INRA and Camagraf: France; pp 155–163.

Shepherd, H. L.; Grismer, M. E. (1997) Constructed Wetlands for Wastewater Disposal. *Vineyard Winery Manage.*, **23** (5), 65.

Shepherd, H. L.; Grismer, M. E.; Tchobanoglous, G. (2001a) Treatment of High-Strength Winery Wastewater Using a Subsurface Flow Constructed Wetland. *Water Environ. Res.*, **73**, 394.

Shepherd, H. L.; Tchobanoglous, G.; Grismer, M. E. (2001b) Time-Dependent Retardation Model for COD Removal in a Subsurface Flow Constructed Wetland for Winery Wastewater Treatment. *Water Environ. Res.*, **73**, 567.

Werner, T. M.; Kadlec, R. H. (2000) Wetland Residence Time Distribution Modeling. *Ecol. Eng.*, **15**, 77.