

Postmark
Fax Note H7573
To Jim McGuire
From Tom Hall
Phone 541-388-6146 X233

Expiration Date: 7/31/97
Permit Number: 100946
File Number: 33396
Page 1 of 5 Pages

WATER POLLUTION CONTROL FACILITIES PERMIT
Department of Environmental Quality
811 S.W. Sixth Avenue, Portland, OR 97204
Telephone: (503) 229-5696

Issued pursuant to ORS 468B.050

TRANSFERRED 05-05-97

~~ISSUED TO:~~
Gilchrist Sewer Company, LLC
~~Ernst Brothers Corporation~~
P.O. Box 637
Gilchrist, OR 97737

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Method of Disposal
Domestic sewage	Evaporation/Drainfield

PLANT TYPE AND LOCATION:

Three cell lagoon system
Northeast of Gilchrist
Gilchrist, OR 97737

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub Basin: Little Deschutes
Hydro Code: 25C-DELI 63.0 N
County: Klamath

Nearest surface stream which would receive waste if it were to discharge: Little Deschutes River

Issued in response to Application No. 998589 received October 18, 1989.

This permit is issued based on land use findings in the permit record.

Lydia R. Taylor
Lydia R. Taylor, Administrator

JUL 26 1992
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:

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Schedule A - Waste Disposal Limitations.....	2
Schedule B - Minimum Monitoring and Reporting Requirements...	3
Schedule C - Compliance Conditions and Schedules.....	4
Schedule D - Special Conditions.....	5
General Conditions.....	Attached

All direct discharges to public waters are prohibited.

This permit does not relieve the permittee from responsibility for compliance with any other applicable federal, state, or local law, rule, standard, ordinance, order, judgment, or decree.

SCHEDULE A

Waste Disposal Limitations

1. No discharge to state waters is permitted. Overflow from the lagoon shall be discharged into a soil absorption field for dissipation by evapotranspiration and controlled seepage so as to prevent:
 - a. Seepage of wastewater onto the ground surface;
 - b. Surface runoff or subsurface drainage through drainage tile;
 - c. The creation of odors, fly and mosquito breeding and other nuisance conditions; and
 - d. The overloading of land with nutrients or organics.
2. The monthly average flow to the facility shall not exceed 0.060 MGD.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements.
(unless otherwise approved in writing by the Department)

a. Influent

<u>Item or Parameter</u>	<u>Minimum Frequency</u>	<u>Type of Sample</u>
Total Flow (gallons/day)	Daily	Measurement
Flow Meter Calibration	Annual	Verification

b. Other Parameters

<u>Item or Parameter</u>	<u>Minimum Frequency</u>	<u>Type of Sample</u>
pH (effluent)	Weekly	Grab
Fecal Coliform	Annually (July)	Grab (See note 1/)
Perimeter inspection of lagoon and drainfield	Daily	Observation

Notes:

- 1/ One sample from each of the four groundwater monitoring wells around the drainfield shall be collected and analyzed.

2. Reporting Procedures

Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to the Department by the 15th day of the following month.

SCHEDULE C

Compliance Conditions and Schedules

1. By no later than thirty (30) days after issuance of this permit, a surety bond in the amount of \$25,000 executed in favor of the State of Oregon shall be filed with the Department of Environmental Quality as required by ORS 454.425.
2. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. Prior to constructing or modifying any wastewater control facilities, detailed plans and specifications shall be approved in writing by the Department. After approval of the plans, all construction shall be in strict conformance with the plans unless approved in writing by the Department.
2. The permittee shall, during all times of disposal, provide qualified personnel to ensure the continuous performance of the disposal system within the limitations of this permit.
3. In the event the permittee finds it necessary to remove accumulated sludge solids from the lagoon, the permittee shall submit and obtain Department approval of a sludge management plan developed in accordance with Administrative Rule, Chapter 340, Division 50, "Land Application and Disposal of Sewage Treatment Plant Sludge and Sludge Derived Products Including Septage", prior to removing sludge.
4. All sludge shall be managed in accordance with a sludge management plan approved by the Department of Environmental Quality. No substantial changes shall be made in sludge management activities which significantly differ from operations specified under the approved plan without the prior written approval of the Department.
5. The disposal field shall be kept vacant and free of vehicular or heavy equipment storage or traffic. The extreme corners of the disposal field unit shall be marked with an iron pipe or monument of durable material.

P33396W (6-15-92)



1. Introduction

2. Methodology

The first part of the study focuses on the theoretical framework and the research objectives. It discusses the importance of understanding the underlying mechanisms of the phenomenon being studied and the need for a systematic approach to data collection and analysis.

The methodology section describes the research design, including the selection of participants, the data collection instruments, and the statistical methods used to analyze the data.

The results section presents the findings of the study, organized into several sub-sections. Each sub-section discusses a specific aspect of the data and its implications for the research objectives.

The conclusion summarizes the main findings of the study and discusses their implications for future research. It also highlights the limitations of the study and suggests areas for further investigation.

PROJECT 5 - serves entire District and Gilchrist at existing site.

AERATION PONDS	
number of cells	2
Q (gpd)	208,113
d (ft)	10
Bottom Length (ft)	50 ft
Bottom Width	50 ft
Bottom Area	2,500 ft ²
WS length (ft)	110.00 ft
WS width	110.00 ft
WS Area (ft ²)	12,100 ft ²
Volume per Pond	73,000 ft ³
Detention Time (days)	5.2 days
Top of Bank Area	16,384 ft ²
Top Length	128.00 ft
Top Width	128.00 ft

Rainfall Area	
treatment ponds	sq. ft.
storage pond	ac
	0.75
	20.15
	0.56

Irrigation Area	5,502,875	126.33
Crop:	Pasture	eff.
		75%

IRR req. 218.69

Storage Required (ac-ft)	187.15
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Storage Dimensions	
Height (ft.)	13
Freeboard	3
Width (W ₆)	700
Length (L ₆)	1050
Bott. Area (A ₆)	735,000
Width (W ₇)	778
Length (L ₇)	1,128
Area (A ₇)	843,600
Top Area (A _T)	877,584
Volume (V ₆)	181.20

$$y = 1E-08x^3 - 2E-05x^2 + 0.0592x$$

Month	Influent (MGD)	Influent (ac-ft)	Precip (in.)	Precip (ac-ft)	Evap (in.)	Evap (ac-ft)	IRR* (in.)	IRR* (ac-ft)	Flow to Pond	Pond Depth	Evap. Area
Oct	0.208	19.48	1.51	2.63	2.46	3.70	0.78	10.95	7.46	41.70	785,675
Nov	0.208	19.48	3.99	6.95	0	0.00	0	0.00	26.43	68.13	3.94
Dec	0.208	19.48	4.59	7.99	0	0.00	0	0.00	27.47	95.60	5.49
Jan	0.208	19.48	4.25	7.40	0	0.00	0	0.00	26.88	122.48	6.97
Feb	0.208	19.48	2.84	4.95	0	0.00	0	0.00	24.43	146.91	8.30
Mar	0.208	19.48	2.49	4.34	0	0.00	0	0.00	23.82	170.73	9.57
Apr	0.208	19.48	1.11	1.93	2.99	5.00	0	0.00	16.42	187.15	10.44
May	0.208	19.48	0.82	1.43	5.15	8.61	0.78	10.95	1.36	188.50	10.52
Jun	0.208	19.48	0.8	1.39	6.49	10.77	1.56	21.90	-11.80	176.71	9.89
Jul	0.208	19.48	0.53	0.92	8.03	12.48	7.80	109.48	-101.56	75.14	4.34
Aug	0.208	19.48	0.76	1.32	6.85	10.30	3.10	43.51	-33.00	42.14	2.46
Sep	0.208	19.48	0.66	1.50	4.68	6.99	1.56	21.90	-7.90	34.23	2.00
		233.77		42.76	36.65	57.84	15.58	218.69	0.00		

Land Requirements	
Buffer Width (ft.)	50
Treatment Area	(ft ²) 1,333,256
	(acres) 30.6
Irrigation Area	(ft ²) 5,739,957
	(acres) 131.8
TOTAL	(acres) 162

PROJECT 4 - serves core area and Gilchrist at existing site

AERATION POND	
number of cells	1
Q (gpd)	116,079
d (ft)	10
Bottom Length (ft)	50 ft
Bottom Width	50 ft
Bottom Area	2,500 ft ²
WS length (ft)	110.00 ft
WS width	110.00 ft
WS Area (ft ²)	12,100 ft ²
Volume per Pond	73,000 ft ³
Detention Time (days)	4.7 days
Top of Bank Area	16,384 ft ²
Top Length	128.00 ft
Top Width	128.00 ft

Existing Lagoons	
Rainfall Area	165,591 ft ²
WS Area	150,200 ft ²

	Rainfall Area		Evap Area	
	sq. ft.	ac	sq. ft.	ac
treatment ponds	181,975	4.18	182,300	3.73
storage pond	504,347	11.58		

Irrigation Area	
Crop:	Pasture
IRR req.	129.97
	3,270,349
	75.08
	75%

Storage Required (ac-ft)	
	110.51

Storage Dimensions	
Height (ft.)	13
Freeboard	3
Width (W _h)	575
Length (L _h)	832.5
Area (A _h)	478,688
Volume (V _h)	100.61

$$y = 1E-07x^3 - 0.0001x^2 + 0.1093x$$

Month	Influent (MGD)	Influent (ac-ft)	Precip (in.)	Precip (ac-ft)	Evap (in.)	Evap (ac-ft)	IRR* (in.)	IRR* (ac-ft)	Flow to Pond	Total Volume In storage	Pond Depth	Evap. Area
Oct	0.116	10.87	1.51	1.98	2.48	2.08	0.78	6.51	4.26	22.99	2.45	441,575
Nov	0.116	10.87	3.99	5.24	0	0.00	0	0.00	16.10	38.99	4.12	
Dec	0.116	10.87	4.59	6.03	0	0.00	0	0.00	16.89	55.89	5.81	
Jan	0.116	10.87	4.25	5.58	0	0.00	0	0.00	16.45	72.33	7.42	
Feb	0.116	10.87	2.84	3.73	0	0.00	0	0.00	14.59	86.93	8.81	
Mar	0.116	10.87	2.49	3.27	0	0.00	0	0.00	14.14	101.05	10.13	
Apr	0.116	10.87	1.11	1.46	2.99	2.88	0	0.00	9.45	110.51	10.99	502,888
May	0.116	10.87	0.82	1.08	5.15	4.87	0.78	6.51	0.56	111.07	11.04	494,479
Jun	0.116	10.87	0.8	1.05	8.49	5.98	1.58	13.01	-7.08	103.99	10.40	482,000
Jul	0.116	10.87	0.53	0.70	8.03	7.09	7.80	65.07	-60.60	43.40	4.58	481,563
Aug	0.116	10.87	0.76	1.00	8.85	5.84	3.10	25.86	-19.83	23.56	2.52	445,537
Sep	0.116	10.87	0.86	1.13	4.68	3.92	1.56	13.01	-4.94	18.62	2.00	437,632
		130.39		32.23		32.86	15.58	129.97	0.00			

Land Requirements	
Buffer Width (ft.)	50
Treatment Area	798,243 (ft ²)
	18.3 (acres)
Irrigation Area	3,453,691 (ft ²)
	79.3 (acres)
TOTAL	98 (acres)

PROJECT 3 - STORAGE POND FOR GILCHRIST

Existing Lagoons	
Rainfall Area	165,591 ft ²
WS Area	150,200 ft ²

	Rainfall Area		Evap Area	
	sq. ft.	ac	sq. ft.	ac
treatment ponds	165,591	3.80	150,200	3.45
storage pond	317,184	7.28		

Irrigation Area	1,226,673	28.16
Crop: Pasture		eff. 75%

IRR req. 48.75

Storage Required (ac-ft)	56.12
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Storage Dimensions			
Depth (ft.)	12	Width (W_B)	400
Freeboard	3	Length (L_B)	600
		Bott. Area (A_B)	240,000
		Width (W_T)	472
		Length (L_T)	672
		Top Area (A_T)	317,184
		Volume (V_B)	55.47

$$y = 8E-07x^3 - 0.0004x^2 + 0.181x$$

Month	Influent (MGD)	Influent (ac-ft)	Precip (in.)	Precip (ac ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Total Volume in storage	Storage Pond Depth	Evap. Area
Oct	0.050	4.66	1.51	1.39	2.46	1.91	0.78	2.44	1.70	13.00	2.29	405,425
Nov	0.050	4.66	3.99	3.69	0	0.00	0	0.00	8.34	21.34	3.69	
Dec	0.050	4.66	4.59	4.24	0	0.00	0	0.00	8.90	30.24	5.13	
Jan	0.050	4.66	4.25	3.93	0	0.00	0	0.00	8.58	38.82	6.47	
Feb	0.050	4.66	2.84	2.62	0	0.00	0	0.00	7.28	46.10	7.57	
Mar	0.050	4.66	2.49	2.30	0	0.00	0	0.00	6.96	53.06	8.60	
Apr	0.050	4.66	1.11	1.03	2.99	2.62	0	0.00	3.07	56.12	9.04	457,169
May	0.050	4.66	0.82	0.76	5.15	4.47	0.78	2.44	-1.50	54.63	8.82	453,800
Jun	0.050	4.66	0.8	0.74	6.49	5.39	1.56	4.88	-4.87	49.75	8.11	433,964
Jul	0.050	4.66	0.53	0.49	8.03	6.47	7.80	24.41	-25.73	24.02	4.13	421,100
Aug	0.050	4.66	0.76	0.70	6.85	5.35	3.10	9.70	-9.69	14.33	2.51	408,524
Sep	0.050	4.66	0.86	0.79	4.68	3.60	1.56	4.88	-3.03	11.30	2.00	402,344
		55.88		22.67		29.81	15.58	48.75	0.00			

Project Option 2 - Phase I to serve core area only

Irrigation Area	1,910,818	43.87
Crop: LPB	off-farm eff.	75%

IRR req. 76.03 (ac-ft)

	Cell 1	Cell 2	Cell 3	Total
x	350	350	350	
h	11	11	11	
free brd	3	3	3	
d	8	8	8	
A _{BOIT}	81,667	81,667	189,933	353,267
A _{WS}	111,971	111,971	235,085	459,027
A _{TOP}	124,523	124,523	253,205	502,251
V (ft ³)	774,549	774,549	1,700,075	3,249,173
V (ac-ft)	17.78	17.78	39.03	74.59

Volume Required

75.54

$$y = 4E-07x^3 - 0.0002x^2 + 0.1243x$$

Month	Influent (MGD)	Influent (ac ft)	Precip (in.)	Precip (ac ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Volume in storage	Depth in Pond	Water Surface Area
Oct	0.072	6.73	1.51	1.45	2.46	1.79	0.78	3.80	2.59	19.19	2.31	8.73
Nov	0.072	6.73	3.99	3.83	0	0	0	0	10.56	29.75	3.53	8.88
Dec	0.072	6.73	4.59	4.41	0	0	0	0	11.14	40.88	4.77	9.18
Jan	0.072	6.73	4.25	4.08	0	0	0	0	10.81	51.69	5.95	9.49
Feb	0.072	6.73	2.84	2.73	0	0	0	0	9.46	61.15	6.94	9.79
Mar	0.072	6.73	2.49	2.39	0	0	0	0	9.12	70.27	7.89	10.11
Apr	0.072	6.73	1.11	1.07	2.99	2.52	0	0	5.27	75.54	8.42	10.11
May	0.072	6.73	0.82	0.79	5.15	4.27	0.78	3.80	-0.56	74.98	8.36	9.95
Jun	0.072	6.73	0.8	0.77	6.49	5.21	1.56	7.60	-5.32	69.66	7.82	9.64
Jul	0.072	6.73	0.53	0.51	8.03	6.14	7.80	38.02	-36.93	32.74	3.87	9.18
Aug	0.072	6.73	0.76	0.73	6.85	4.99	3.10	15.11	-12.64	20.10	2.42	8.73
Sep	0.072	6.73	0.86	0.83	4.68	3.35	1.56	7.60	-3.40	16.70	2.02	8.59
		80.72		23.59	36.65	28.27	15.60	75.94	0.10			

* Includes efficiency factor

Project Option 1 - serve entire CSD initially

Lagoon Dimensions

	Cell 1	Cell 2	Cell 3	Total
x	515	515	515	515
h	11	11	11	11
free brd	3	3	3	3
d	8	8	8	8
A _{bottom}	176,817	176,817	392,773	746,407
A _{aws}	220,321	220,321	456,405	897,047
A _{top}	237,823	237,823	481,455	957,101
V (ft ³)	1,588,549	1,588,549	3,396,715	6,573,813
V (ac-ft)	36.47	36.47	77.98	150.91

Volume Required
153.06

Irrigation Area	3,846,609	88.31
Crop: LPB	off-farm eff.	75%
IRR req.	153.06 (ac-ft)	

$$y = 3E-08x^3 - 4E-05x^2 + 0.0588x$$

Month	Influent (MGD)	Influent (ft)	Precip (in.)	Precip (ac ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Volume in storage	Depth in Each Pond	Water Surface Area
Oct	0.147	13.79	1.51	2.76	2.46	3.70	0.78	7.65	5.20	40.02	2.29	18.04
Nov	0.147	13.79	3.99	7.31	0	0	0	0	21.10	61.12	3.45	18.25
Dec	0.147	13.79	4.59	8.40	0	0	0	0	22.19	83.31	4.64	18.68
Jan	0.147	13.79	4.25	7.78	0	0	0	0	21.57	104.88	5.76	19.11
Feb	0.147	13.79	2.84	5.20	0	0	0	0	18.99	123.87	6.73	19.55
Mar	0.147	13.79	2.49	4.56	0	0	0	0	18.35	142.22	7.64	19.99
Apr	0.147	13.79	1.11	2.03	2.99	4.98	0	0	10.84	153.06	8.17	19.99
May	0.147	13.79	0.82	1.50	5.15	8.48	0.78	7.65	-0.85	152.21	8.13	19.77
Jun	0.147	13.79	0.8	1.46	6.49	10.45	1.56	15.31	-10.51	141.71	7.61	19.33
Jul	0.147	13.79	0.53	0.97	8.03	12.50	7.80	76.53	-74.27	67.44	3.79	18.68
Aug	0.147	13.79	0.76	1.39	6.85	10.30	3.10	30.42	-25.53	41.91	2.40	18.04
Sep	0.147	13.79	0.86	1.57	4.68	6.95	1.56	15.31	-6.89	35.01	2.01	17.82
		165.47		44.95	36.65	57.36	15.60	152.87	0.20			

* Includes efficiency factor

MODEL FOR AERATED POND DESIGN - completely mixed pond

Design Parameters

Q	208,113	gpd	Average Daily Flow
Q	788	m ³ /day	si units
C _o	200	mg/l	influent BOD
C _n	50	mg/l	BOD in last aerated cell
k _{c20}	2.5	days ⁻¹	reaction rate at 20° C
k _{cT}	0.35	days ⁻¹	reaction rate at winter ambient
k _{cT}	2.50	days ⁻¹	reaction rate at summer ambient
k _{cT}	2.26	days ⁻¹	reaction rate at design temp, summer
k _{cT}	0.79	days ⁻¹	reaction rate at design temp, winter
γ ³	1.085		

Temperature		
T _{ws}	18.77 °C	pond water temp, summer
T _{ww}	5.85 °C	pond water temp, winter
T _{ww}	5.85 °C	pond water temp, winter
T _{a1}	-4 °C	winter ambient air
T _{a2}	20 °C	summer ambient air
T _i	12 °C	influent winter temp
T _i	18 °C	influent summer temp
f	0.5 SI	proportionality constant
f	1.20E-05 english	

Pond Sizing

n	1	number of cells	
d	10 ft	depth of pond	
freeboard	3 ft		
DT_amb	8.50 days	detention time based on ambient temp	
DT	3.81 days	detention time for design	
V _T	2,999 m ³	total volume	Slope 3 :1
	792,158 gallons		
	105,903 ft ³		
V ₁	2.43 ac-ft		A _{AVG} 10,590 ft ²
	2,999 m ³	volume of one pond	d _{AVG} 5
	792,158 gallons		L _T 151 ft
	105,903 ft ³		L _{ws} 133 ft
	2.43 ac-ft		L _{avg} 103 ft
A _T	984 m ²	total area	L _B 73 ft
	0.24 ac		
A ₁	10,590 ft ²	area of one pond	
	984 m ²		
	0.24 ac		
	10,590 ft ²		

PROJECT 6 - serves core area and Gilchrist at existing site

AERATION POND	
number of cells	1
Q (gpd)	116,079
d (ft)	10
Bottom Length (ft)	50
Bottom Width	50
Bottom Area	2,500 ft ²
WS length (ft)	110.00
WS width	110.00
WS Area (ft ²)	12,100
Volume per Pond	73,000 ft ³
Detention Time (days)	4.7
Top of Bank Area	16,384 ft ²
Top Length	128.00
Top Width	128.00

Existing Lagoons	
Rainfall Area	165,591 ft ²
WS Area	150,200 ft ²

Rainfall Area	
treatment ponds	sq. ft.
storage pond	ac
	sq. ft.
	ac
	sq. ft.
	ac

Irrigation Area	
Crop:	Pasture
IRR req.	129.97
	75.08
	75%

Storage Required (ac-ft)	
	110.51

Storage Dimensions	
Height (ft.)	13
Freeboard	3
Width (W _{ws})	575
Length (L _{ws})	832.5
Area (A _{ws})	478,688
Volume (V _{ws})	100.61
Width (W _B)	515
Length (L _B)	773
Bott. Area (A _B)	397,838
Width (W _T)	593
Length (L _T)	851
Top Area (A _T)	504,347

$$y = 1E-07x^3 - 0.0001x^2 + 0.1093x$$

Month	Influent (MGD)	Influent (ac-ft)	Precip (in.)	Precip (ac-ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Total Volume in storage	Storage Pond Depth	Evap. Area
Oct	0.116	10.87	1.51	1.98	2.46	2.08	0.78	6.51	4.26	22.89	2.45	441,575
Nov	0.116	10.87	3.99	5.24	0	0.00	0	0.00	16.10	38.99	4.12	
Dec	0.116	10.87	4.59	6.03	0	0.00	0	0.00	16.89	55.89	5.81	
Jan	0.116	10.87	4.25	5.58	0	0.00	0	0.00	16.45	72.33	7.42	
Feb	0.116	10.87	2.84	3.73	0	0.00	0	0.00	14.59	86.93	8.81	
Mar	0.116	10.87	2.49	3.27	0	0.00	0	0.00	14.14	101.06	10.13	
Apr	0.116	10.87	1.11	1.46	2.99	2.88	0	0.00	9.45	110.51	10.99	502,888
May	0.116	10.87	0.82	1.08	5.15	4.87	0.78	6.51	0.56	111.07	11.04	494,479
Jun	0.116	10.87	0.8	1.05	6.49	5.98	1.56	13.01	-7.08	103.99	10.40	482,000
Jul	0.116	10.87	0.53	0.70	8.03	7.09	7.80	65.07	-60.60	43.40	4.56	461,563
Aug	0.116	10.87	0.76	1.00	6.85	5.84	3.10	25.86	-19.83	23.56	2.52	445,537
Sep	0.116	10.87	0.86	1.13	4.68	3.92	1.56	13.01	-4.94	18.62	2.00	437,632
		130.39		32.23		32.66	15.58	129.97	0.00			

Project Option 5- serve Crescent's core area and Gilchrist initially

Irrigation Area	3,079,217	70.69
Crop: Pasture	off-farm eff.	75%
IRR req.	122.37 (ac-ft)	

Lagoon Dimensions

	Cell 1	Cell 2	Total
x	400	400	400
h	11	11	11
free brd	3	3	3
d	8	8	8
A _{bottom}	240,000	240,000	480,000
A _{WS}	290,304.00	290,304	580,608
A _{TOP}	310,356	310,356	620,712
V (ft ³)	2,121,216	2,121,216	4,242,432
V (ac-ft)	48.70	48.70	97.39

Volume Required

111.56

$$y = 1E-07x^3 - 1E-04x^2 + 0.0906$$

Month	Influent (MGD)	Influent (ac ft)	Precip (in.)	Precip (ac ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Volume in storage	Depth in Pond	Surface Area
Oct	0.116	10.87	1.51	1.79	2.46	2.40	0.78	6.13	4.13	26.73	2.35	11.72
Nov	0.116	10.87	3.99	4.74	0	0.00	0	0	15.60	42.33	3.66	11.86
Dec	0.116	10.87	4.59	5.45	0	0.00	0	0	16.32	58.65	4.99	12.15
Jan	0.116	10.87	4.25	5.05	0	0.00	0	0	15.91	74.56	6.24	12.29
Feb	0.116	10.87	2.84	3.37	0	0.00	0	0	14.24	88.80	7.33	12.73
Mar	0.116	10.87	2.49	2.96	0	0.00	0	0	13.82	102.62	8.35	12.88
Apr	0.116	10.87	1.11	1.32	2.99	3.25	0	0.00	8.94	111.56	9.00	13.03
May	0.116	10.87	0.82	0.97	5.15	5.46	0.78	6.13	0.25	111.81	9.02	12.73
Jun	0.116	10.87	0.8	0.95	6.49	6.73	1.56	12.25	-7.16	104.64	8.50	12.44
Jul	0.116	10.87	0.53	0.63	8.03	8.13	7.80	61.26	-57.90	46.75	4.03	12.15
Aug	0.116	10.87	0.76	0.90	6.85	6.69	3.10	24.35	-19.27	27.48	2.42	11.72
Sep	0.116	10.87	0.86	1.02	4.68	4.51	1.56	12.25	-4.88	22.60	2.00	11.58
		130.39	24.55	29.15		37.17	15.58	122.37	0.00			

* Includes efficiency factor

Project Option 4: 3-cell lagoon serving CSD and Gilchrist

Irrigation Area	5,427,980	124.61
Crop: Pasture	off-farm eff.	75%
IRR req.	215.71 (ac-ft)	

	Cell 1	Cell 2	Cell 3	Total
x	600	600	600	
h	11	11	11	
free brd	3	3	3	
d	8	8	8	
A _{BOTT}	240,000	240,000	525,600	1,005,600
A _{WS}	290,304	290,304	598,752	1,179,360
A _{TOP}	310,356	310,356	627,372	1,248,084
V (ft ³)	2,121,216	2,121,216	4,497,408	8,739,840
V (ac-ft)	48.70	48.70	103.25	200.64

Volume Required
210.72

$$y = 9E-09x^3 - 2E-05x^2 + 0.0433$$

Month	Influent (MGD)	Influent (ac ft)	Precip (in.)	Precip (ac ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Volume in storage	Depth in Each Pond	Water Surface Area
Oct	0.208	19.48	1.51	3.61	2.46	4.98	0.78	10.80	7.31	54.44	2.30	24.30
Nov	0.208	19.48	3.99	9.53	0	0.00	0	0	29.01	83.45	3.48	24.54
Dec	0.208	19.48	4.59	10.96	0	0.00	0	0	30.44	113.89	4.69	25.29
Jan	0.208	19.48	4.25	10.15	0	0.00	0	0	29.63	143.52	5.83	25.79
Feb	0.208	19.48	2.84	6.78	0	0.00	0	0	26.26	169.78	6.82	26.30
Mar	0.208	19.48	2.49	5.95	0	0.00	0	0	25.43	195.21	7.76	26.56
Apr	0.208	19.48	1.11	2.65	2.99	6.62	0	0.00	15.51	210.72	8.32	26.56
May	0.208	19.48	0.82	1.96	5.15	11.29	0.78	10.80	-0.65	210.07	8.30	26.30
Jun	0.208	19.48	0.8	1.91	6.49	13.95	1.56	21.60	-14.16	195.92	7.78	25.79
Jul	0.208	19.48	0.53	1.27	8.03	16.59	7.80	107.99	-103.84	92.08	3.82	24.79
Aug	0.208	19.48	0.76	1.81	6.85	13.87	3.10	42.92	-35.50	56.58	2.39	24.30
Sep	0.208	19.48	0.86	2.05	4.68	9.38	1.56	21.60	-9.45	47.14	2.00	24.05
		233.77		58.62		76.68	15.58	215.71	0.00			

* Includes efficiency factor

PROJECT 3 - STORAGE POND FOR GILCHRIST

Existing Lagoons	
Rainfall Area	165,591 ft ²
WS Area	150,200 ft ²

Rainfall Area		Evap Area	
	sq. ft.	ac	sq. ft.
treatment ponds	165,591	3.80	150,200
storage pond	317,184	7.28	3.45

Irrigation Area	1,226,673	28.16
Crop: Pasture	eff.	75%

IRR req. 48.75

Storage Required (ac-ft)	56.12
--------------------------	-------

Storage Dimensions

Depth (ft.)	12	Width (W _B)	400
Freeboard	3	Length (L _B)	600
Width (W _S)	454	Bott. Area (A _B)	240,000
Length (L _S)	654	Width (W _T)	472
Area (A _S)	296,916	Length (L _T)	672
Volume (V _S)	55.47	Top Area (A _T)	317,184

$$y = 8E-07x^3 - 0.0004x^2 + 0.181x$$

Month	Influent (MGD)	Influent (ac-ft)	Precip (in.)	Precip (ac-ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Volume in storage	Storage Pond Depth	Evap. Area
Oct	0.050	4.66	1.51	1.39	2.46	1.91	0.78	2.44	1.70	13.00	2.29	405,425
Nov	0.050	4.66	3.99	3.69	0	0.00	0	0.00	8.34	21.34	3.69	
Dec	0.050	4.66	4.59	4.24	0	0.00	0	0.00	8.90	30.24	5.13	
Jan	0.050	4.66	4.25	3.93	0	0.00	0	0.00	8.58	38.82	6.47	
Feb	0.050	4.66	2.84	2.62	0	0.00	0	0.00	7.28	46.10	7.57	
Mar	0.050	4.66	2.49	2.30	0	0.00	0	0.00	6.96	53.06	8.60	
Apr	0.050	4.66	1.11	1.03	2.99	2.62	0	0.00	3.07	56.12	9.04	457,169
May	0.050	4.66	0.82	0.76	5.15	4.47	0.78	2.44	-1.50	54.63	8.82	453,800
Jun	0.050	4.66	0.8	0.74	6.49	5.39	1.56	4.88	-4.87	49.75	8.11	433,964
Jul	0.050	4.66	0.53	0.49	8.03	6.47	7.80	24.41	-25.73	24.02	4.13	421,100
Aug	0.050	4.66	0.76	0.70	6.85	5.35	3.10	9.70	-9.69	14.33	2.51	408,524
Sep	0.050	4.66	0.86	0.79	4.68	3.60	1.56	4.88	-3.03	11.30	2.00	402,344
		55.88		22.67		29.81	15.58	48.75	0.00			

Project Option 2 - serve Crescent's core area initially

Lagoon Dimensions

	Cell 1	Cell 2	Total
x	345	345	345
h	11	11	11
free brd	3	3	3
d	8	8	8
A _{BOIT}	178,538	178,538	357,075
A _{WS}	222,241.50	222,242	444,483
A _{TOP}	239,819	239,819	479,637
V (ft ³)	1,603,116	1,603,116	3,206,232
V (ac-ft)	36.80	36.80	73.60

Volume Required

74.82

Irrigation Area	1,883,478	43.24
Crop: Pasture	off-farm eff.	75%
IRR req.	74.85 (ac-ft)	

$$y = 3E-07x^3 - 0.0002x^2 + 0.121$$

Month	Influent (MGD)	Influent (ac ft)	Precip (in.)	Precip (ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond	Volume in storage	Depth in Each Pond	Water Surface Area
Oct	0.072	6.70	1.51	1.39	2.46	1.80	0.78	3.75	2.53	19.41	2.36	8.80
Nov	0.072	6.70	3.99	3.66	0	0.00	0	0	10.36	29.77	3.61	8.93
Dec	0.072	6.70	4.59	4.21	0	0.00	0	0	10.91	40.69	4.94	9.17
Jan	0.072	6.70	4.25	3.90	0	0.00	0	0	10.60	51.29	6.23	9.30
Feb	0.072	6.70	2.84	2.61	0	0.00	0	0	9.31	60.59	7.37	9.68
Mar	0.072	6.70	2.49	2.28	0	0.00	0	0	8.99	69.58	8.47	9.81
Apr	0.072	6.70	1.11	1.02	2.99	2.48	0	0.00	5.24	74.82	9.12	9.94
May	0.072	6.70	0.82	0.75	5.15	4.16	0.78	3.75	-0.45	74.37	9.06	9.68
Jun	0.072	6.70	0.8	0.73	6.49	5.10	1.56	7.49	-5.16	69.21	8.43	9.43
Jul	0.072	6.70	0.53	0.49	8.03	6.14	7.80	37.47	-36.43	32.79	3.98	9.17
Aug	0.072	6.70	0.76	0.70	6.85	5.02	3.10	14.89	-12.52	20.27	2.46	8.80
Sep	0.072	6.70	0.86	0.79	4.68	3.38	1.56	7.49	-3.39	16.88	2.05	8.68
		80.41	24.55	22.53		28.08	15.58	74.85	0.00			

Project Option 1 - serve entire CSD initially

Irrigation Area	3,846,609	88.31
Crop: LPB	off-farm eff.	75%
IRR req.	153.06 (ac-ft)	

Lagoon Dimensions

	Cell 1	Cell 2	Cell 3	Total
x	515	515	515	515
h	11	11	11	11
free brd	3	3	3	3
d	8	8	8	8
A _{Bottom}	176,817	176,817	392,773	746,407
A _{WWS}	220,321	220,321	456,405	897,047
A _{Top}	237,823	237,823	481,455	957,101
V (ft ³)	1,588,549	1,588,549	3,396,715	6,573,813
V (ac-ft)	36.47	36.47	77.98	150.91

Volume Required
153.06

$$y = 3E-08x^3 - 4E-05x^2 + 0.0588x$$

Month	Influent (MGD)	Influent (ac ft)	Precip (in.)	Precip (ac ft)	Evap (in.)	Evap (ac-ft)	IRR (in.)	IRR* (ac-ft)	Flow to Pond storage	Volume In Pond	Depth in Pond	Water Surface Area
Oct	0.147	13.79	1.51	2.76	2.46	3.70	0.78	7.65	5.20	40.02	2.29	18.04
Nov	0.147	13.79	3.99	7.31	0	0	0	0	21.10	61.12	3.45	18.25
Dec	0.147	13.79	4.59	8.40	0	0	0	0	22.19	83.31	4.64	18.68
Jan	0.147	13.79	4.25	7.78	0	0	0	0	21.57	104.88	5.76	19.11
Feb	0.147	13.79	2.84	5.20	0	0	0	0	18.99	123.87	6.73	19.55
Mar	0.147	13.79	2.49	4.56	0	0	0	0	18.35	142.22	7.64	19.99
Apr	0.147	13.79	1.11	2.03	2.99	4.98	0	0	10.84	153.06	8.17	19.99
May	0.147	13.79	0.82	1.50	5.15	8.48	0.78	7.65	-0.85	152.21	8.13	19.77
Jun	0.147	13.79	0.8	1.46	6.49	10.45	1.56	15.31	-10.51	141.71	7.61	19.33
Jul	0.147	13.79	0.53	0.97	8.03	12.50	7.80	76.53	-74.27	67.44	3.79	18.68
Aug	0.147	13.79	0.76	1.39	6.85	10.30	3.10	30.42	-25.53	41.91	2.40	18.04
Sep	0.147	13.79	0.86	1.57	4.68	6.95	1.56	15.31	-6.89	35.01	2.01	17.82
		165.47		44.95	36.65	57.36	15.60	152.87	0.20			

* Includes efficiency factor

[illegible]



L8939

Client: Geotechnical Resources, Inc.
Contact: George Freitag

Project: 2853
Crescent

Inorganics

Sample ID	Matrix	Result	Reporting Limit	Units (ppm)	Date Analyzed	Method	Lab Number	Comment	Analyst
Analyte									
P-9	Water						Sampled: 11/18/98		L8939-10
Nitrate + Nitrite as N		ND	0.01	mg/L	11/20/98	EPA 353.2		K1	NM
P-16	Water						Sampled: 11/18/98		L8939-11
Nitrate + Nitrite as N		1.1	0.10	mg/L	11/20/98	EPA 353.2		D,K1	NM
P-10	Water						Sampled: 11/18/98		L8939-12
Nitrate + Nitrite as N		0.02	0.01	mg/L	11/20/98	EPA 353.2		K1	NM
P-13	Water						Sampled: 11/18/98		L8939-13
Nitrate + Nitrite as N		0.03	0.01	mg/L	11/20/98	EPA 353.2		K1	NM

Sample Summary

Sample ID	Lab #	Description	Sampled	Received
P-2	L8939-1	water	11/18/98 14:00	11/19/98
P-3	L8939-2	water	11/18/98 14:20	11/19/98
P-5	L8939-3	water	11/18/98 14:50	11/19/98
P-4	L8939-4	water	11/18/98 15:00	11/19/98
P-6	L8939-5	water	11/18/98 16:00	11/19/98
P-7	L8939-6	water	11/18/98 16:20	11/19/98
P-15	L8939-7	water	11/18/98 16:45	11/19/98
P-8	L8939-8	water	11/18/98 17:00	11/19/98
P-11	L8939-9	water	11/18/98 17:45	11/19/98
P-9	L8939-10	water	11/18/98 17:50	11/19/98
P-16	L8939-11	water	11/18/98 18:10	11/19/98
P-10	L8939-12	water	11/18/98 18:25	11/19/98
P-13	L8939-13	water	11/18/98 18:45	11/19/98

Definition of Terms

- D** Reported value is based on a dilution.
- K1** Batch matrix spike recovery outside laboratory QC limits due to suspected matrix interference.
- ND** Analytical result was below the reporting limit.

Analysts

Initials	Analyst	Title
NM	Nick Miller	Technician

Method Summary

Analysis	Method
Nitrate + Nitrite as N	EPA 353.2



L8939

November 23, 1998

George Freitag
Geotechnical Resources, Inc.
9725 SW Beaverton-Hillsdale Hwy.
Suite 140
Beaverton, OR 97005

Phone: (503) 641-3478

FAX: (503) 644-8034

Re: Laboratory Sample Analysis

Project: 2853

Crescent

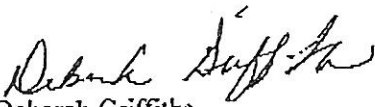
Project Manager: George Freitag

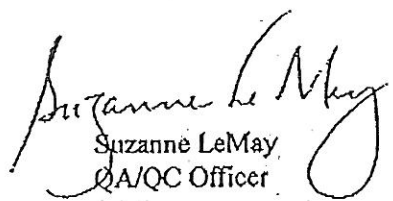
Dear George Freitag:

On Thursday, November 19, 1998, OAL received thirteen (13) water samples for analysis. The samples were analyzed utilizing EPA, ASTM, or equivalent methodology.

Should you have any questions concerning the results in this report, please contact us at (503) 590-5300. Refer to OAL login number L8939.

Sincerely,


Deborah Griffiths
Project Manager


Suzanne LeMay
QA/QC Officer

OREGON ANALYTICAL LABORATORY

A Division of Portland General Electric
14855 S.W. Scholls Ferry Road, Beaverton, OR 97007

APPENDIX A

CHEMICAL ANALYTICAL PROGRAM

Methods

Chain-of-custody procedures were followed during transport of the groundwater samples to the analytical laboratory. The samples were held in cold storage pending extraction and/or analysis. The analytical results are also summarized in the text and tables of this report.

Data Review

The laboratory maintains an internal quality assurance program. The laboratory uses a combination of method blanks and surrogate percent recovery to evaluate the validity of analytical results. No significant data quality exceptions were documented in the laboratory reports or noted during our review. Based on the data quality review, it is our opinion that the analytical data are acceptable for their intended use.

Test Results

The chemical test results are provided on the attached laboratory report.

APPENDIX A

Chemical Analytical Program