SUMMERSET CITY COMMISSION
ONLINE ZOOM MEETING
SUMMERSET MUNICIPAL BUILDING
7055 LEISURE LANE
THURSDAY MAY 7, 2020 6:00 P.M.

AGENDA

1) ROLL CALL

Kitzmiller, McCoy, Butler, Hirsch, Lutz

2) PLEDGE OF ALLEGIANCE

3) CALL FOR CHANGES

Approval of the Agenda of the Regular Meeting of the Summerset City Commission for May 7, 2020 as presented or amended.

4) CONSENT CALENDAR

APPROVAL OF THE MINUTES

4A) Approval of the minutes of the Regular Meeting from April 16, 2020 as presented or amended.

APPROVAL OF THE CLAIMS

4B) Approval of claims, hand checks and payroll checks in the amount of $151,207.16 from April 17, 2020 to May 7, 2020 as presented or amended.

5) UTILITY BILLING ADJUSTMENTS
Approval of utility billing adjustments of $857.02 for the period April 1-April 30, 2020.

6) DISCUSSION ON HAZARD PAY FOR THE POLICE DEPARTMENT

7) AUTHORIZE BANK DEPOSITORY
Approval of First Interstate Bank and the following authorized signers as the authorized bank depository: Mayor, Finance Commissioner, City Finance Officer.

8) DESIGNATION OF OFFICIAL PUBLICATION
Approval of designation Rapid City Journal as Official Publication.

9) MALT BERAGE LICENSE RENEWALS 2020-2021

9A) Package Off Sale Malt Beverage and SD Farm Wine License #R-25546 with Sunday Service, TFH Inc., dba Haggar's Grocery, 8031 Stagestop Road, Lot 2R

of Tract 1R of Siouxland Estates, NW ½ of Sec 25, T3N, R6E, BHM, Summerset, Meade County, South Dakota.

9B) Retail On-Off Sale Malt Beverage License #RB-2318 with Sunday Service and eight video lottery machines, MG Oil Company, dba Happy Jacks - Summerset, 8076 Stagestop Road, Lot SC4 and SC5 Siouxland Estates, Sec 23, T3N, R6E, BHM, Summerset, Meade County, South Dakota.

9C) Retail On-Off Sale Malt Beverage License #RB-18919 with Sunday Service and ten video lottery machines, MG Oil Company, dba Happy Jacks – Summerset 2, 8074 Stagestop Road, LotSC4 and SC5, Siouxland Estates, Sec 23, T3N, R6E, BHM, Summerset, Meade County, South Dakota.

10) DISCUSSION OF OPENING ADMINSTRATIVE OFFICE TO PUBLIC

11) DISCUSSION AND APPROVAL OF WATER WARRIORS PROJECT

12) APPROVAL OF PROPERTY ASSEMENT

13) UPCOMING EVENTS

14) CITIZENS INPUT

15) ITEMS FROM CITY ATTORNEY
Executive Session per SDCL 1-25-2 for discussing legal, economic development, and personnel issues.

16) ADJOURNMENT

Information regarding accessibility for the disabled may be obtained by calling the Summerset City Finance Officer at 605-718-9858. Individuals needing special accommodations are asked to call at least 48 hours prior to the meeting.

ALL MEETINGS OF THE SUMMERSET CITY COMMISSION ARE OPEN TO THE PUBLIC

In relation to the COVID-19 virus, and in following guidelines from the CDC in relation to minimizing exposure, the City will have a call-in number available (instructions below) for Thursday's City

Commission meeting. For those that wish to participate in the meeting remotely, we encourage you to follow the instructions below.

Call-in instructions:

Topic: Commission meeting

Time: May 7, 2020 06:00 PM Mountain Time (US and Canada)

Join Zoom Meeting
https://us02web.zoom.us/j/83875054902?pwd=SXV2SHhCc3hYSnJYbERQQlVvalZGdz09

Meeting ID: 838 7505 4902

Password: 530400

One tap mobile

*If you are participating telephonically, please ensure that you mute your phone during times where you are not speaking to keep the background noise to a minimum.

SUMMERSET CITY COMMISSION
ONLINE ZOOM MEETING
SUMMERSET MUNICIPAL BUILDING
7055 LEISURE LANE
THURSDAY APRIL 16, 2020 6:00 P.M.

Mayor Lutz called the Online Zoom Meeting (Regular Meeting) to order at 6:00 p.m. Commissioners Kitzmiller, Hirsch, McCoy and Butler were present. Also present was the, City Attorney, City Finance Officer and City Administrator.

Mayor Lutz led the Pledge of Allegiance.

Motion by Kitzmiller, second by Butler to approve the agenda for April 16, 2020. Motion carried

Motion by Butler, second by McCoy to approve the April 2, 2020 Minutes as presented. Motion carried.

APPROVAL OF CLAIMS

Motion by Hirsch, second by McCoy to approve the claims and hand checks in the amount of $58,331.86, from April 3, 2020 through April 16, 2020 as amended. Motion carried.

A&B BUSINESS SOLUTIONS	Professional Services	3033.8
AFLAC REMITTANCE	Accidental Insurance	124.67
BLACK HAWK WATER USERS	Govt Utilities	30.00
CBH CO-OP	Auto Expense	1,044.14
DAVID HIDALGO	WWTP Deposit Refund	50.00
FOOTHILLS AREA CHAMBER	Membership Expense	100.00
FOOTHILLS FENCE	WWTP Repairs	66.12
HYDRO-KLEAN, INC	WWTP Repairs	40,1868.20
JOAN PILLEN	WWTP Deposit Refund	50.00
KIEFFER SANITATION	Sanitation Expense	12,676.40
LIGHT AND SIREN	Street Auto Expense	272.00
MDU	Govt Utilities	390.34
MEADE COUNTY AUDITOR	Dispatch Expense	1,895.80
MIDCONTINENT COMMUNICATIONS	WWTP Utilities	191.73
MIDCONTINENT TESTING	WWTP Testing	112.00
MONICA SMITH	WWTP Deposit Refund	50.00
RAPID CITY JOURNAL	Publishing Expense	100.53
REKK PROPERTIES	Govt Rent Expense	450.00
SAMANTHA MILLEA	WWTP Deposit Refund	50.00
SD ONE CALL	Locating Expense	33.60
SERVALL UNIFROM & LINEN	Govt Repairs	130.51
TAYLOR, JUSTIN	LE Supplies	21.96

DISCUSSION AND APPROVAL OF TELEWORKING POLICY AND AGREEMENT

Motion by Kitzmiller, second by McCoy to approve teleworking policy agreement. Motion carried.

PAYROLL CHANGE

Motion by Butler, second by Hirsch to approve payroll change for part time Wastewater Operator, Dan Anderson, within budget, at $14.50/ hour effective April 26, 2020. Motion carried.

PRELIMINARY PLAT APPLICATION

Motion by McCoy, second by Butler to approve the Preliminary Plat of Lots 17A, 17 thru 19, Block 1; Lots 5 thru 8, Block 2; and Lots 1A, 1 thru 12, Block 5; Green Space 1; Green Space 2; and Dedicated Public Right-of-Way for Glenwood Drive and Arapahoe Street of Sun Valley Estates. Formerly a Portion of the Un-platted Portion of the SE ¼ of Section 14 Township 4 North, Range 6 East, Black Hills Meridian, City of Summerset, Meade County, South Dakota. Motion carried

WATERWARRIORS AND DENR UPDATE

The City Administrator provided an update on the most recent conference call with Waterwarriors and DENR. The City is currently waiting on a design plan from HDR before moving forward.

DEPARTMENT REPORTS

Streets-The groundwork for the Publics Works building is being done and garden boxes for Leisure Lane Park are being made. Currently yard waste containers are out and being provided.

WWTP-The upgrades to the plant are being looked into and the reed beds are being scheduled to be drained, and then cleaned.

LE-Officers are supplied and set up for COVID-19 safety and have been providing more night patrol.

Finance-March report was given, and city revenue is questionable at this time because of COVID-19. Projected revenue will be clearer by mid-May.

Economic Development-Nothing major is going on currently due to COVID-19.

UPCOMING EVENTS

Election-June 2, 2020

CITIZENS INPUT

None

ADJOURNMENT

Motion for adjournment at 6:54 pm by Hirsch, second Butler. Motion carried.

(SEAL)
ATTEST:

_____	_____
Debbie Muzio	Bryce Lutz
Finance Officer	Mayor

Direct Deposit - ACHA Preview

City of Summerset
Emp.Code Desc.:SDSUM

Date: 4/27/2020
Time: 12:03:46

Employee ID	Employee Name	Bank Routing Number	Account Number	Acct.Type	Amount
ALLEND	ALLEN, DONALD D	291479592	146868002	C	$3,349.40
AMBROSEJ	AMBROSE, JONATHAN D	091400486	500014070	C	$3,175.90
ANDERSONI	ANDERSON, DANIEL	091400046	1057990267	C	$1,212.55
BEWLEYD	BEWLEY, ORVILLE D	291479592	141529002	C	$69.26
BRAKKES	Brakke, Sheldon	091400538	1000064475	C	$137.14
BUTLERD	DAVID, BUTLER	291479291	52249	S	$511.20
CHRISTM	Christensen, Marcus R	291479356	81362098	C	$69.26
FENENGAT	FENENGA, TANNER	091409733	706754	C	$3,489.61
HARMONL	HARMON, LONNIE J	092901683	3301634	C	$3,267.71
HIRSCHC	HIRSCH, CLYDE A	291479592	030391084	C	$486.20
JOHNSONS	JOHNSON, SCOTT	091400525	900038450	C	$66.29
JUSOC	JUSO, COLTON	091400538	1000048135	C	$2,518.56
KITZMILLER	KITZMILLER, MICHAEL J	291479592	22139001	S	$538.70
LONGDENR	LONGDEN, ROBERT	291479592	130933002	C	$162.54
LUTZB	LUTZ, BRYCE J	291479592	52132002	C	$722.95
MCCOYS	MCCOY, STEPHANIE	091408501	175091113530	C	$538.70
MOOREJ	MOORE, JERRY N	291479592	29084088	C	$228.56
MUZIOD	MUZIO, DEBRA L	291479592	160396002	C	$3,323.16
OLDFIELDB	Oldfield, Brody R	314074269	236313746	C	$69.26
RYANB	PALMER, BRANDY N	291479592	150658002	C	$2,780.28
SEALEYC	SEALEY, CANDACE L	091408734	13530074	C	$2,381.32
TAYLOR	TAYLOR, JUSTIN P	091408763	31802814	C	$3,558.79
TWITEJ	TWITE, JEFFREY	091400046	0900153576	C	$731.42
WILSONG	WILSON, GREGORY L	091400046	2755231814	C	$69.26

Total Amount: $33,458.02

Check Register Report

Date: 05/06/2020
Time: 12:21 pm
Page: 1

City of Summerset

BANK: FIRST INTERSTATE BANK

Check Number	Check Date	Status	Void/Stop Date	Reconcile Date	Vendor Number	Vendor Name	Check Description	Amount
FIRST INTERSTATE BANK Checks								
22820	05/07/202(	Printed			1098	A&B BUSINESS SOLUTIONS		500.95
22821	05/07/202(	Printed			0962	ALLEN, DON	Cell Phone	50.00
22822	05/07/202(	Printed			1111	AMBROSE, JONATHAN	Cell Phone	50.00
22823	05/07/202(	Printed			1572	ANDERSON, DAN	Cell Phone	50.00
22824	05/07/202(	Printed			1191	AUTO OWNERS INSURANCE		100.00
22825	05/07/202(	Printed			0808	BLACK HILLS ENERGY		5,168.52
22826	05/07/202(	Printed			0095	Butler, Dave	Cell Phone	50.00
22827	05/07/202(	Printed			1504	CBH CO-OP		844.60
22828	05/07/202(	Printed			0468	DELTA DENTAL		498.60
22829	05/07/202(	Printed			1011	ELECTRICAL ENGINEERING & EQUIP		530.11
22830	05/07/202(	Printed			1251	FIRST INTERSTATE BANK		855.74
22831	05/07/202(	Printed			1251	FIRST INTERSTATE BANK		4,911.76
22832	05/07/202(	Printed			0814	FOOTHILLS FENCE		575.89
22833	05/07/202(	Printed			1120	FORD MOTOR CREDIT COMPANY, LLC		1,479.21
22834	05/07/202(	Printed			0246	GOLDEN WEST TECHNOLOGIES		62.50
22835	05/07/202(	Printed			0246	GOLDEN WEST TECHNOLOGIES		3,704.00
22836	05/07/202(	Printed			1369	GREENAPSIS		280.00
22837	05/07/202(	Printed			1599	GUTHRIE INC.	Erosion Control Deposit	1,000.00
22838	05/07/202(	Printed			0274	HARMON, LONNIE	Cell Phone	50.00
22839	05/07/202(	Printed			0698	HAWKINS INC.		2,412.00
22840	05/07/202(	Printed			1133	HDR ENGINEERING, INC		1,784.88
22841	05/07/202(	Printed			0041	HEALTH POOL OF SD		8,531.74
22842	05/07/202(	Printed			1506	HERMANSON EGGE ENGINEERING		2,090.00
22843	05/07/202(	Printed			1513	HIRSCH, CLYDE	Cell Phone Allowance	50.00
22844	05/07/202(	Printed			1601	JAKIE KOON	WWTP Deposit	50.00
22845	05/07/202(	Printed			1082	JIM'S PRIVATE UTILITY LOCATING		75.00
22846	05/07/202(	Printed			1566	JUSO, COLTON	Cell phone	50.00
22847	05/07/202(	Printed			1103	KITZMILLER, MICHAEL	Cell Phone	50.00
22848	05/07/202(	Printed			0052	LUTZ, BRYCE	Cell Phone	50.00
22850	05/07/202(	Printed			1172	MASTERCARD		3,702.38
22851	05/07/202(	Printed			1411	MBFS USA LLC		3,068.32
22852	05/07/202(	Printed			1157	MIDCONTINENT TESTING LABS		112.00
22853	05/07/202(	Printed			1602	MONIKA BOWEN	WWTP Deposit	100.00
22854	05/07/202(	Printed			0186	McLeod's Printing & Office Sup		190.76
22855	05/07/202(	Printed			0081	NBS CALIBRATIONS		193.00
22856	05/07/202(	Printed			1408	PALMER, BRANDY	Cell Phone	50.00
22857	05/07/202(	Printed			1603	RANDY CHAVEZ	WWTP Deposit	100.00
22858	05/07/202(	Printed			0008	RAPID CITY JOURNAL		216.48
22859	05/07/202(	Printed			1291	RCS CONSTRUCTION INC		2,500.00
22860	05/07/202(	Printed			1569	REKK PROPERTIES		500.00
22861	05/07/202(	Printed			1022	SDRS-SUPPLEMENTAL		420.00
22862	05/07/202(	Printed			1328	SERVALL UNIFORM & LINEN SUPPLY		130.51
22863	05/07/202(	Printed			1604	STACY BERG	WWTP Deposit	100.00
22864	05/07/202(	Printed			1346	STEPHANIE MCCOY	Cell Phone	50.00
22865	05/07/202(	Printed			0670	Semmler Mfg. Inc.	PW Building	67,260.00
22866	05/07/202(	Printed			0983	TANNER FENENGA	Cell Phone	50.00
22867	05/07/202(	Printed			1235	TAYLOR, JUSTIN	Cell Phone	50.00
22868	05/07/202(	Printed			1432	TNT CONSTRUCTION	Erosion Control Deposit	1,000.00
22869	05/07/202(	Printed			1189	VAST		742.44
22870	05/07/202(	Printed			0203	Verizon Wireless		228.45
22871	05/07/202(	Printed			1434	WELLS FARGO FINANCIAL SERVICES		1,079.30

Check Register Report

City of Summerset

BANK: FIRST INTERSTATE BANK

Check Number	Check Date	Status	Void/Stop Date	Reconcile Date	Vendor Number	Vendor Name	Check Description	Amount
					Total Checks: 51		**Checks Total (excluding void checks):**	**117,749.14**
					Total Payments: 51		**Bank Total (excluding void checks):**	**117,749.14**
					Total Payments: 51		**Grand Total (excluding void checks):**	**117,749.14**

April 2020

Name	Address	Account#		Amount	
Stagebarn Lodging	7900 Stagestop Rd	STGBA	$	55.96	Morton Adjustment
Diane Grimme	14787 Glenwood	GRIMM	$	84.33	PMT applied to wrong account
		GRIDI	$	79.33	PMT applied to wrong account
Slyvia Hanks	10162 Laramie Ln	HANKE	$	5.00	Late Fee Removal
Brian Holzer	7050 Townsend	HOLBR	$	73.68	PMT applied to wrong account
Kayleen Henderson	6625 Townsend	HENKA	$	68.68	PMT applied to wrong account
Dennis Shoup	10298 Ventura Ln	SHODE	$	68.68	PMT applied to wrong account
		SHOUP	$	68.68	PMT applied to wrong account
Pam Gutknecht	6900 Mulberry Dr	GUTPA	$	73.68	PMT applied to wrong account
Melissa Montgomery	14680 Telluride	MONME	$	5.00	Lae Fee Removal
Earl McKinstry	7410 Castlewood	MCKHA	$	73.68	PMT applied to wrong account
Earl McKinstry		MCKEA	$	68.68	PMT applied to wrong account
Carol Carleton	14057 Telluride	CARCH	$	5.00	Late Fee Removal
Joe Hockhausen	7120 Castlewood	HOCJO	$	4.52	Garbage Missed
Chris Brown			$	68.68	NSF
Stagebarn Lodging	7900 Stagestop Rd	STGBA	$	53.44	Morton Adjustment
		Total:	**$**	**857.02**	

Date Received 4/23/20

Date Issued _____

2020-2021

License No. RB-2318

Uniform Alcoholic Beverage License Application

A. Owner Name and Mailing Address

MG OIL COMPANY

PO BOX 1006
RAPID CITY, SD 57709

B. Business Name and Address

Lic # RB-2318
HAPPY JACKS - SUMMERSET

8076 STAGESTOP RD
SUMMERSET, SD 57718-9130

Owner's Telephone# : (605) 342-0527

Business Telephone #: 605-718-9639

C. Indicate the class of license being applied for (submit separate application for each class of license).

- [ ] Retail (on-sale) Liquor
- [ ] Retail (on-sale) Liquor - Restaurant
- [ ] Convention Center (on-sale) Liquor
- [ ] Package (off-sale) Liquor
- [ ] Retail (on-off sale) Wine and Cider
- [X] Retail (on-off sale) Malt Beverage & SD Farm Wine
- [ ] Package Delivery
- [ ] Hunting Preserve
- [ ] Other _____

Is this License in active use? [x] Yes [ ] No

Do you or any officers, directors, partners, or stockholders hold any other alcohol retail, manufacturing, or wholesaler licenses? [x] Yes [ ] No **If Yes, please list on the back page**

Place of business is located in a municipality? [x] Yes [ ] No

County: Meade

Do you own [ ] or lease [x] this property? (Check one)

Are real property taxes paid to date? [x] Yes [ ] No

D. Legal description of licensed premise:

23-3-6 Siouxland Estate Lot SC4-SC5, Sec 23, T2N, R6E, BHM, Summerset, Meade County, SD - only 8076 Stage Stop Road Area

Have you ever been convicted of a felony? [ ] Yes [x] No

E. State Sales Tax Number: 1028-0287-STC

F. New license? ____ Transfer? ($150) ____ Re-issuance? X

G. CERTIFICATE The undersigned applicant certifies under the penalties of perjury that all statements herein are true and correct; that the said applicant complies with all of the statutory requirements for the class of license being applied for and in addition agrees to permit agents of the Department of Revenue access to the licensed premises and records as provided in SDCL 35-2-2.1, and agrees this application shall constitute a contract between applicant and the State of South Dakota entitling the same or any peace officers to inspect the premises, books and records at any time for the purpose of enforcing the provisions of Title 35 SDCL, as amended.

Date April 17, 2020 Print Name Troy Erickson Signature Troy Erickson

H. APPROVAL OF LOCAL GOVERNING BODY- Notice of hearing was published _____. Public hearing on the application was held _____, not less than SEVEN (7) days after official publication. The governing body by majority vote recommends the approval and granting of this license and certifies that requirements as to location and suitability of premises and applicant have been reviewed and conform to the requirements of local and South Dakota law.

Renewal - no public hearing held ☐
Amount of fee collected with application $ _____
Amount of fee retained $ _____
Forwarded with application $ _____

For Local Government Use

(Seal) _____
Mayor or Chairman

If disapproved, endorse reason thereon and return to applicant

Transferred (State Use)

From _____

Sales tax approval _____ Date _____

STATE LIQUOR AUTHORITY: APPROVAL ____ **REVIEW** ____

Please complete reverse side

04/20/20	08935 - CITY OF SUMMERSET	1,500.00	0.00	1,500.00

THE FACE OF THIS DOCUMENT HAS A COLORED BACKGROUND/NOT A WHITE BACKGROUND

MG Oil Company 02
PO Box 1006
Rapid City, SD 57709
(800) 333-5173

Great Western Bank C-Stores
Rapid City, SD

04/20/20 — DATE
0135472 — CHECK NUMBER

PAY EXACTLY THIS AMOUNT

	AMOUNT
One Thousand Five Hundred Dollars	****1,500.00

TO THE ORDER OF
CITY OF SUMMERSET
7055 LEISURE LANE
SUMMERSET, SD 57718

Marilyn Erickson

⑈0135472⑈ ⑆091408734⑆ 140603505⑈

Company supplement information
(For corporate/partnership/LP/LLC applicants)

Name of corporation/partnership/LP LLC MG Oil Company

Address of office and principal place of business of corporation/partnership/LP/LLC 1180 Creek Dr., Rapid City, SD 57703

Are all managing officers of this corporation/partnership/LP/LLC of good moral character having never been convicted of a felony? ☑ Yes ☐ No

Name, title of office, occupation and address of each of the officers/owners of the corporation, partnership, LP or LLC:

Name	Office	Address	Occupation
Marlyn Erickson	Treasurer	PO Box 1006, Rapid City, SD 57709	Oil Jobber
Troy Erickson	President	PO Box 1006, Rapid City, SD 57709	Oil Jobber

Name of any officers, directors, partners or stockholders of applicant having a financial interest or capital stock in any other alcoholic beverage license:

Name	Type of License, License Number, Financial Interest Held, and Address of Business Location
See attached	

Where and with whom are all company records kept, such as charter, by-laws, minutes, accounts, notes payable, and notes and accounts receivable, etc?

Attorney - Jess Pekarski, 704 St Joseph Street, Rapid City, SD 57701

With signature the applicant agrees to the following:

That the applicant company will comply with all provisions of ARSD chapter No. 64:75:02 of the Department of Revenue, relating to the transfer of stock and prior approval of the transfer of such stock by the Secretary of Revenue and violation of any of the provisions of said regulation or failure to comply therewith, whether by the undersigned corporation, partnership/LP/LLC or by any stockholder thereof, or by anyone interested in said company, shall constitute cause for revocation or suspension of any license issued pursuant to and in reliance on this application, or for refusal to renew such license upon expiration thereof.

We the undersigned officers and directors of the applicant company acknowledge that the within supplement application form is true and correct in every respect and that there exists no financial arrangement concerning this or any other alcoholic beverage license than that expressly set forth above. If company stock is to be transferred we ask for approval of such voluntary stock transfer.

Signature of Authorized Officer/Director/Partner **Date**

Troy Erickson — April 17, 2020

ATTACHMENT TO:
UNIFORM ALCOHOLIC BEVERAGE LICENSE APPLICATION

Name of any officers, directors or stockholders of applicant Corporation having a financial interest or capital stock in any other retail, liquor outlet:

MG OIL COMPANY
Marlyn G. Erickson & Troy M. Erickson

Loc #	Location Name	Location Address	Type of License	License Nun	Owner
4	Corner Pantry #4	Rapid City, SD	Package off sales Malt Beverage	RB-25630	MG Oil
5	Corner Pantry #5	Rapid City, SD	Package off sales Malt Beverage	RB-25627	MG Oil
6	Corner Pantry #6	Sturgis, SD	Package (off-sale) Malt Beverage &	BW-19560	MG Oil
8	Corner Pantry #8	Rapid City, SD	Package off Sale Malt Beverage	RB-25629	MG Oil
9	Corner Pantry #9	Rapid City, SD	Package off Sale Malt Beverage	RB-25626	MG Oil
10	Corner Pantry #10	Rapid City, SD	Package off Sale Malt Beverage	RB-25625	MG Oil
11	Corner Pantry #11	Hot Springs, SD	Retail (on-off) Malt Beverage	RB-22547	MG Oil
11	Corner Pantry #11	Hot Springs, SD	Retail (on-off) Malt Beverage	RB-25225	MG Oil
12	Corner Pantry #12	Custer, SD	Retail (on-off) Malt Beverage	RB-3616	MG Oil
13	Corner Pantry #13	Rapid City, SD	Package off Sale Malt Beverage	RB-25624	MG Oil
14	Corner Pantry Deadwood Ave #14	Rapid City, SD	Package off Sale Malt Beverage	RB-25623	MG Oil
16	Corner Pantry Moon Meadows #16	Rapid City, SD	Package off Sale Malt Beverage	RB-25295	MG Oil
18	Corner Pantry Lacrosse #18	Rapid City, SD	Package off Sale Malt Beverage	RB-25628	MG Oil
20	Homestead Casino	Philip, SD	Retail (on-off) Malt Beverage	RB-24841	MG Oil
20	Corner Pantry #20	Philip, SD	Retail (on-off) Malt Beverage	RB-3661	MG Oil
21	Corner Pantry #21	Rapid City, SD	Retail (on-off) Malt Beverage	RB-24086	MG Oil
21	Corner Pantry #21 B	Rapid City, SD	Retail (on-off) Malt Beverage	RB-25294	MG Oil
22	Metro City Corner Pantry #22	Ft. Pierre, SD	Retail (on-off) Malt Beverage	RB-2555	MG Oil
25	Corner Pantry #25	Huron, SD	Retail (on-off) Malt Beverage	RB-2589	MG Oil
26	Corner Pantry #26	Huron, SD	Retail (on-off) Malt Beverage	RB-2730	MG Oil
27	Corner Pantry #27	Huron, SD	Retail (on-off) Malt Beverage	RB-2140	MG Oil
29	Corner Pantry #29	Huron, SD	Retail (on-off) Malt Beverage	RB-18935	MG Oil
29	Corner Pantry #29B	Huron, SD	Retail (on-off) Malt Beverage	RB-23334	MG Oil
30	Corner Pantry Casino #30	Huron, SD	Retail (on-off) Malt Beverage	RB-20010	MG Oil
30	Corner Pantry #30	Huron, SD	Retail (on-off) Malt Beverage	RB-2732	MG Oil
39	East North Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2946	MG Oil
46	Market Square II	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2604	MG Oil
46	Market Square	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3027	MG Oil
52	Flying J Travel Plaza	Box Elder, SD	Retail (on-off) Malt Beverage	RB-2977	MG Oil
53	Truck Stop Lounge	Box Elder, SD	Retail (on-off) Malt Beverage	RB-2743	MG Oil
54	Flying J Hermosa / Town of Hermosa	Hermosa, SD	Retail (on-off) Malt Beverage	RB-2776	MG Oil
58	Lucky Strike Casino	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-3473	MG Oil
60	Happy Jacks Sioux Falls II	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-21995	MG Oil
60	Happy Jacks Sioux Falls II - B	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-26718	MG Oil
61	LaCrosse Street Casino #1	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2797	MG Oil
61	LaCrosse Street Casino #2	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3011	MG Oil
61	Lacrosse Street Casino #3	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3114	MG Oil
63	Rushmore Casino III	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2342	MG Oil
63	Rushmore Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2952	MG Oil
63	Rushmore Casino II	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3015	MG Oil
64	BP Casino II	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2966	MG Oil
64	BP Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3012	MG Oil
65	Uncle Sam's West	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2275	MG Oil
65	Sam's #2	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3039	MG Oil
67	Uncle Sam's South Too	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2987	MG Oil
67	Uncle Sam's South	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3004	MG Oil
68	Chance's Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2967	MG Oil
68	Chances Casino 3	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3037	MG Oil
68	Chance's Casino Too	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3590	MG Oil
69	Jokerz 7	Tea, SD	Retail (on-off) Malt Beverage	RB-21591	MG Oil
69	Jokerz 7	Tea, SD	Retail (on-off) Malt Beverage	RB-2528	MG Oil
75	Jokerz Casino	Brandon, SD	Retail (on-off) Malt Beverage	RB-3167	MG Oil
76	Jokerz Too	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB 23116	MG Oil
77	Jokerz 3	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-2751	MG Oil
78	Jokerz 4	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-3119	MG Oil
78	Jokerz 5	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-24624	MG Oil
78	Jokerz 6	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-24623	MG Oil
79	Happy Jacks SF VI	Brandon, SD	Retail (on-off) Malt Beverage	RB-3612	MG Oil
80	Happy Jacks of Pierre #3	Pierre, SD	Retail (on-off) Malt Beverage	RB-22511	MG Oil
80	Happy Jacks of Pierre #2	Pierre, SD	Retail (on-off) Malt Beverage	RB-22518	MG Oil
80	Happy Jacks of Pierre #1	Pierre, SD	Retail (on-off) Malt Beverage	RB-3449	MG Oil
81	Happy Jacks East	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3006	MG Oil
81	Happy Jacks Too	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3657	MG Oil
84	Happy Jacks I-90	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2996	MG Oil
85	Happy Jacks Summerset 2	Summerset, SD	Retail (on-off) Malt Beverage	RB-18919	MG Oil

Date Received 4/23/20

Date Issued _____

2020-2021

License No. RB-18919

Uniform Alcoholic Beverage License Application

A. Owner Name and Mailing Address

M.G. OIL COMPANY
8074 STAGESTOP RD
SUMMERSET, SD 57718

B. Business Name and Address

Lic # RB-18919
HAPPY JACKS - SUMMERSET 2
8074 STAGESTOP RD
SUMMERSET, SD 57718

Owner's Telephone#: _____

Business Telephone #: 605-718-9639

C. Indicate the class of license being applied for (submit separate application for each class of license).

- [ ] Retail (on-sale) Liquor
- [ ] Retail (on-sale) Liquor - Restaurant
- [ ] Convention Center (on-sale) Liquor
- [ ] Package (off-sale) Liquor
- [ ] Retail (on-off sale) Wine and Cider
- [X] Retail (on-off sale) Malt Beverage & SD Farm Wine
- [ ] Package Delivery
- [ ] Hunting Preserve
- [ ] Other _____

Is this License in active use? [x] Yes [ ] No

Do you or any officers, directors, partners, or stockholders hold any other alcohol retail, manufacturing, or wholesaler licenses? [x] Yes [ ] No **If Yes, please list on the back page**

Place of business is located in a municipality? [x] Yes [ ] No

County: Meade

Do you own [ ] or lease [x] this property? (Check one)

Are real property taxes paid to date? [x] Yes [ ] No

D. Legal description of licensed premise:

23-3-6 Siouxland Estate Lot SC4-SC5, Sec 23, T2N, R6E, BHM, Summerset, Meade County, SD - only 8076 Stage Stop Road Area

Have you ever been convicted of a felony? [ ] Yes [x] No

E. State Sales Tax Number: 1032-4289-STC

F. New license? ____ Transfer? ($150) ____ Re-issuance? x

G. CERTIFICATE: The undersigned applicant certifies under the penalties of perjury that all statements herein are true and correct; that the said applicant complies with all of the statutory requirements for the class of license being applied for and in addition agrees to permit agents of the Department of Revenue access to the licensed premises and records as provided in SDCL 35-2-2.1, and agrees this application shall constitute a contract between applicant and the State of South Dakota entitling the same or any peace officers to inspect the premises, books and records at any time for the purpose of enforcing the provisions of Title 35 SDCL, as amended.

Date April 17, 2020 Print Name Troy Erickson Signature Troy Erickson

H. APPROVAL OF LOCAL GOVERNING BODY- Notice of hearing was published _____. Public hearing on the application was held _____, not less than SEVEN (7) days after official publication. The governing body by majority vote recommends the approval and granting of this license and certifies that requirements as to location and suitability of premises and applicant have been reviewed and conform to the requirements of local and South Dakota law.

Renewal - no public hearing held ☐
Amount of fee collected with application $ _____
Amount of fee retained $ _____
Forwarded with application $ _____

For Local Government Use

(Seal) _____
Mayor or Chairman

If disapproved, endorse reason thereon and return to applicant

Transferred (State Use)

From _____

Sales tax approval _____ Date _____

STATE LIQUOR AUTHORITY: APPROVAL ____ **REVIEW** ____

Please complete reverse side

04/20/20	08935 - CITY OF SUMMERSET	1,500.00	0.00	1,500.00

MG Oil Company 02
PO Box 1006
Rapid City, SD 57709
(800) 333-5173

Great Western Bank C-Stores
Rapid City, SD

04/20/20 — DATE
0135472 — CHECK NUMBER

PAY EXACTLY THIS AMOUNT	AMOUNT
One Thousand Five Hundred Dollars	****1,500.00

TO THE ORDER OF
CITY OF SUMMERSET
7055 LEISURE LANE
SUMMERSET, SD 57718

Marilyn Erickson

⑈0135472⑈ ⑆091408734⑆ 140603505⑈

Company supplement information
(For corporate/partnership/LP/LLC applicants)

Name of corporation/partnership/LP LLC MG Oil Company

Address of office and principal place of business of corporation/partnership/LP/LLC 1180 Creek Dr., Rapid City, SD 57703

Are all managing officers of this corporation/partnership/LP/LLC of good moral character having never been convicted of a felony? ☑ Yes ☐ No

Name, title of office, occupation and address of each of the officers/owners of the corporation, partnership, LP or LLC:

Name	Office	Address	Occupation
Marlyn Erickson	Treasurer	PO Box 1006, Rapid City, SD 57709	Oil Jobber
Troy Erickson	President	PO Box 1006, Rapid City, SD 57709	Oil Jobber

Name of any officers, directors, partners or stockholders of applicant having a financial interest or capital stock in any other alcoholic beverage license:

Name	Type of License, License Number, Financial Interest Held, and Address of Business Location
See attached	

Where and with whom are all company records kept, such as charter, by-laws, minutes, accounts, notes payable, and notes and accounts receivable, etc?

Attorney - Jess Pekarski, 704 St Joseph Street, Rapid City, SD 57701

With signature the applicant agrees to the following:

That the applicant company will comply with all provisions of ARSD chapter No. 64:75:02 of the Department of Revenue, relating to the transfer of stock and prior approval of the transfer of such stock by the Secretary of Revenue and violation of any of the provisions of said regulation or failure to comply therewith, whether by the undersigned corporation, partnership/LP/LLC or by any stockholder thereof, or by anyone interested in said company, shall constitute cause for revocation or suspension of any license issued pursuant to and in reliance on this application, or for refusal to renew such license upon expiration thereof.

We the undersigned officers and directors of the applicant company acknowledge that the within supplement application form is true and correct in every respect and that there exists no financial arrangement concerning this or any other alcoholic beverage license than that expressly set forth above. If company stock is to be transferred we ask for approval of such voluntary stock transfer.

Signature of Authorized Officer/Director/Partner **Date**

Troy Erickson — April 17, 2020

ATTACHMENT TO:
UNIFORM ALCOHOLIC BEVERAGE LICENSE APPLICATION

Name of any officers, directors or stockholders of applicant Corporation having a financial interest or capital stock in any other retail, liquor outlet:

MG OIL COMPANY
Marlyn G. Erickson & Troy M. Erickson

Loc #	Location Name	Location Address	Type of License	License Nun	Owner
4	Corner Pantry #4	Rapid City, SD	Package off sales Malt Beverage	RB-25630	MG Oil
5	Corner Pantry #5	Rapid City, SD	Package off sales Malt Beverage	RB-25627	MG Oil
6	Corner Pantry #6	Sturgis, SD	Package (off-sale) Malt Beverage &	BW-19560	MG Oil
8	Corner Pantry #8	Rapid City, SD	Package off Sale Malt Beverage	RB-25629	MG Oil
9	Corner Pantry #9	Rapid City, SD	Package off Sale Malt Beverage	RB-25626	MG Oil
10	Corner Pantry #10	Rapid City, SD	Package off Sale Malt Beverage	RB-25625	MG Oil
11	Corner Pantry #11	Hot Springs, SD	Retail (on-off) Malt Beverage	RB-22547	MG Oil
11	Corner Pantry #11	Hot Springs, SD	Retail (on-off) Malt Beverage	RB-25225	MG Oil
12	Corner Pantry #12	Custer, SD	Retail (on-off) Malt Beverage	RB-3616	MG Oil
13	Corner Pantry #13	Rapid City, SD	Package off Sale Malt Beverage	RB-25624	MG Oil
14	Corner Pantry Deadwood Ave #14	Rapid City, SD	Package off Sale Malt Beverage	RB-25623	MG Oil
16	Corner Pantry Moon Meadows #16	Rapid City, SD	Package off Sale Malt Beverage	RB-25295	MG Oil
18	Corner Pantry Lacrosse #18	Rapid City, SD	Package off Sale Malt Beverage	RB-25628	MG Oil
20	Homestead Casino	Philip, SD	Retail (on-off) Malt Beverage	RB-24841	MG Oil
20	Corner Pantry #20	Philip, SD	Retail (on-off) Malt Beverage	RB-3661	MG Oil
21	Corner Pantry #21	Rapid City, SD	Retail (on-off) Malt Beverage	RB-24086	MG Oil
21	Corner Pantry #21 B	Rapid City, SD	Retail (on-off) Malt Beverage	RB-25294	MG Oil
22	Metro City Corner Pantry #22	Ft. Pierre, SD	Retail (on-off) Malt Beverage	RB-2555	MG Oil
25	Corner Pantry #25	Huron, SD	Retail (on-off) Malt Beverage	RB-2589	MG Oil
26	Corner Pantry #26	Huron, SD	Retail (on-off) Malt Beverage	RB-2730	MG Oil
27	Corner Pantry #27	Huron, SD	Retail (on-off) Malt Beverage	RB-2140	MG Oil
29	Corner Pantry #29	Huron, SD	Retail (on-off) Malt Beverage	RB-18935	MG Oil
29	Corner Pantry #29B	Huron, SD	Retail (on-off) Malt Beverage	RB-23334	MG Oil
30	Corner Pantry Casino #30	Huron, SD	Retail (on-off) Malt Beverage	RB-20010	MG Oil
30	Corner Pantry #30	Huron, SD	Retail (on-off) Malt Beverage	RB-2732	MG Oil
39	East North Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2946	MG Oil
46	Market Square II	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2604	MG Oil
46	Market Square	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3027	MG Oil
52	Flying J Travel Plaza	Box Elder, SD	Retail (on-off) Malt Beverage	RB-2977	MG Oil
53	Truck Stop Lounge	Box Elder, SD	Retail (on-off) Malt Beverage	RB-2743	MG Oil
54	Flying J Hermosa / Town of Hermosa	Hermosa, SD	Retail (on-off) Malt Beverage	RB-2776	MG Oil
58	Lucky Strike Casino	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-3473	MG Oil
60	Happy Jacks Sioux Falls II	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-21995	MG Oil
60	Happy Jacks Sioux Falls II - B	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-26718	MG Oil
61	LaCrosse Street Casino #1	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2797	MG Oil
61	LaCrosse Street Casino #2	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3011	MG Oil
61	Lacrosse Street Casino #3	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3114	MG Oil
63	Rushmore Casino III	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2342	MG Oil
63	Rushmore Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2952	MG Oil
63	Rushmore Casino II	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3015	MG Oil
64	BP Casino II	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2966	MG Oil
64	BP Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3012	MG Oil
65	Uncle Sam's West	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2275	MG Oil
65	Sam's #2	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3039	MG Oil
67	Uncle Sam's South Too	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2987	MG Oil
67	Uncle Sam's South	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3004	MG Oil
68	Chance's Casino	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2967	MG Oil
68	Chances Casino 3	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3037	MG Oil
68	Chance's Casino Too	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3590	MG Oil
69	Jokerz 7	Tea, SD	Retail (on-off) Malt Beverage	RB-21591	MG Oil
69	Jokerz 7	Tea, SD	Retail (on-off) Malt Beverage	RB-2528	MG Oil
75	Jokerz Casino	Brandon, SD	Retail (on-off) Malt Beverage	RB-3167	MG Oil
76	Jokerz Too	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB 23116	MG Oil
77	Jokerz 3	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-2751	MG Oil
78	Jokerz 4	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-3119	MG Oil
78	Jokerz 5	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-24624	MG Oil
78	Jokerz 6	Sioux Falls, SD	Retail (on-off) Malt Beverage	RB-24623	MG Oil
79	Happy Jacks SF VI	Brandon, SD	Retail (on-off) Malt Beverage	RB-3612	MG Oil
80	Happy Jacks of Pierre #3	Pierre, SD	Retail (on-off) Malt Beverage	RB-22511	MG Oil
80	Happy Jacks of Pierre #2	Pierre, SD	Retail (on-off) Malt Beverage	RB-22518	MG Oil
80	Happy Jacks of Pierre #1	Pierre, SD	Retail (on-off) Malt Beverage	RB-3449	MG Oil
81	Happy Jacks East	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3006	MG Oil
81	Happy Jacks Too	Rapid City, SD	Retail (on-off) Malt Beverage	RB-3657	MG Oil
84	Happy Jacks I-90	Rapid City, SD	Retail (on-off) Malt Beverage	RB-2996	MG Oil
85	Happy Jacks Summerset 2	Summerset, SD	Retail (on-off) Malt Beverage	RB-18919	MG Oil

Date Received 4/24/20

Date Issued _____

2020-2021

License No. RB-25546

Uniform Alcoholic Beverage License Application

A. Owner Name and Mailing Address

TFH INC

8031 STAGESTOP ROAD
SUMMERSET, SD 57718-9141

Owner's Telephone#: 605-787-6545

B. Business Name and Address

Lic # RB-25546
HAGGAR'S GROCERY

8031 STAGESTOP ROAD
SUMMERSET, SD 57718-9141

Business Telephone #: 605-787-6545

C. Indicate the class of license being applied for (submit separate application for each class of license).

- [ ] Retail (on-sale) Liquor
- [ ] Retail (on-sale) Liquor - Restaurant
- [ ] Convention Center (on-sale) Liquor
- [ ] Package (off-sale) Liquor
- [ ] Retail (on-off sale) Wine and Cider
- [X] Retail (on-off sale) Malt Beverage & SD Farm Wine
- [ ] Package Delivery
- [ ] Hunting Preserve
- [ ] Other _____

Is this License in active use? [X] Yes [ ] No

Do you or any officers, directors, partners, or stockholders hold any other alcohol retail, manufacturing, or wholesaler licenses? [X] Yes [ ] No **If Yes, please list on the back page**

Place of business is located in a municipality? [X] Yes [ ] No

County: MEADE

Do you own [ ] or lease [ ] this property? (Check one)

Are real property taxes paid to date? [ ] Yes [ ] No

D. Legal description of licensed premise:

LOT 2R2 SIOUXLAND ESTATES
LOT 2R2 OF TRACT 1R
25·3·6

Have you ever been convicted of a felony? [ ] Yes [X] No

E. State Sales Tax Number: 7000-4395-MK

F. New license? ____ Transfer? ($150) ____ Re-issuance? X

G. CERTIFICATE: The undersigned applicant certifies under the penalties of perjury that all statements herein are true and correct; that the said applicant complies with all of the statutory requirements for the class of license being applied for and in addition agrees to permit agents of the Department of Revenue access to the licensed premises and records as provided in SDCL 35-2-2.1, and agrees this application shall constitute a contract between applicant and the State of South Dakota entitling the same or any peace officers to inspect the premises, books and records at any time for the purpose of enforcing the provisions of Title 35 SDCL, as amended.

Date 4·21·2020 Print Name LINDA K. HAGGAR Signature Linda K. Haggar

H. APPROVAL OF LOCAL GOVERNING BODY- Notice of hearing was published _____. Public hearing on the application was held _____, not less than SEVEN (7) days after official publication. The governing body by majority vote recommends the approval and granting of this license and certifies that requirements as to location and suitability of premises and applicant have been reviewed and conform to the requirements of local and South Dakota law.

Renewal - no public hearing held ☐
Amount of fee collected with application $ _____
Amount of fee retained $ _____
Forwarded with application $ _____

For Local Government Use

(Seal) _____
Mayor or Chairman

If disapproved, endorse reason thereon and return to applicant

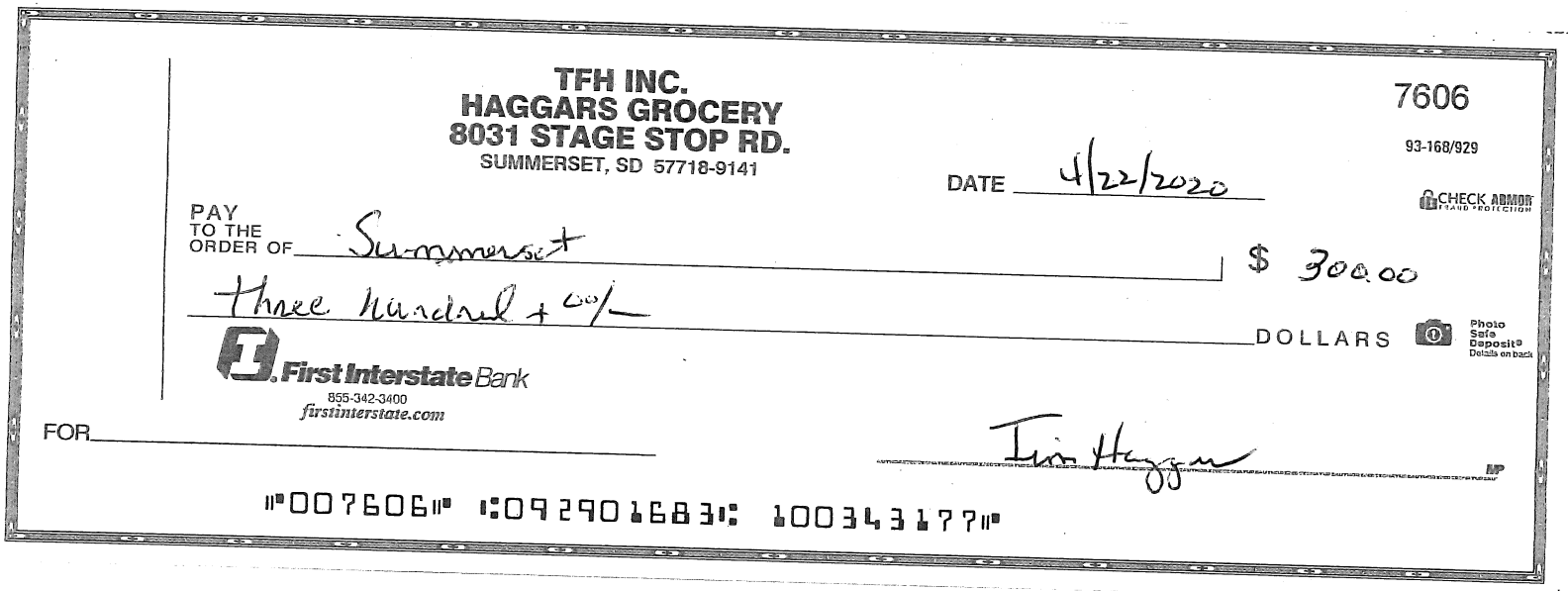
Transferred (State Use)

From _____

Sales tax approval _____ Date _____

STATE LIQUOR AUTHORITY: APPROVAL ____ **REVIEW** ____

Please complete reverse side



TFH INC.
HAGGARS GROCERY
8031 STAGE STOP RD.
SUMMERSET, SD 57718-9141

7606

93-168/929

CHECK ARMOR FRAUD PROTECTION

DATE 4/22/2020

PAY TO THE ORDER OF Summerset $ 300.00

Three Hundred + 00/

DOLLARS

Photo Safe Deposit® Details on back

First Interstate Bank
855-342-3400
firstinterstate.com

FOR

Tim Haggar

AP

⑈007606⑈ ⑆092901683⑆ 100343177⑈

UPGRADING SEQUENTIAL BATCH REACTOR TREATMENT PROCESS

Proposal Submitted to:

Mr. Jon Ambrose
City of Summerset
Wastewater Superintendent
7055 Leisure Lane
Summerset, SD 57718

Proposal Submitted by:

Water Warriors, Inc.
1776 Mentor Avenue; STE 400F
Cincinnati, OH 45212, USA
Attn: Steve Chamberland
Mobile: +1(859) 629-2236

February 2020v3

INTRODUCTION

The city of Summerset operates a Sequential Batch Reactor (SBR) wastewater treatment plant, which has the following characteristics:

WATER WARRIORS, INC.		
SEQUENTIAL BATCH REACTOR PARAMETERS		
Enter values in the green colored cells only		
Influent Flow Parameters		
Flowrate (MGD)	0.18	MGD
Suspended Solids (mg/L)	200	mg/L
Volatile Suspended Solids (VSS)		mg/L
Temperature (deg F)	65	deg F
Biological Oxygen Demand (BOD) (mg/L)	250	mg/L
Hydraulic Retention Time (hrs)	5.2	hrs
Ammonia concentration (mg/L)		mg/L
Total Nitrogen (mg/L)		mg/L
Total Phosphorus (mg/L)		mg/L
pH	7	
Reactor		
Number of Reactors	2	
Total volume of each reactor (Gallons)	170,000	gallons
% of Total volume filled with wastewater	11	%
Fill time of Reactor (hr)	2.67	hrs
Treament Time (hr)	5.2	hrs
Decant Time (hr)	0.8	hrs
Aeration Rate (acfm)		acfm
Power consumption by Blowers (HP)	25	HP
Effluent		
Suspended Solids (mg/L)	5	mg/L
Volatile Suspended Solids (VSS)		mg/L
Biological Oxygen Demand (BOD) (mg/L)	5	mg/L
Ammonia concentration (mg/L)	0.05	mg/L
Total Nitrogen (mg/L)	1	mg/L
Total Phosphorus (mg/L)	1	mg/L
pH	7.3	

The objective of this proposal is to provide a retrofittable, cost-effective solution for increasing plant capacity, improve effluent water quality, reduce energy consumption and decrease sludge production.

PROPOSED TECHNOLOGIES

There are three technologies which are proposed to achieve the objectives of this document. These three technologies are:

1. Waving Biomedia;
2. Microbubble Aeration; and
3. SETZYME, an enzyme which prevents the growth of filamentous organisms.

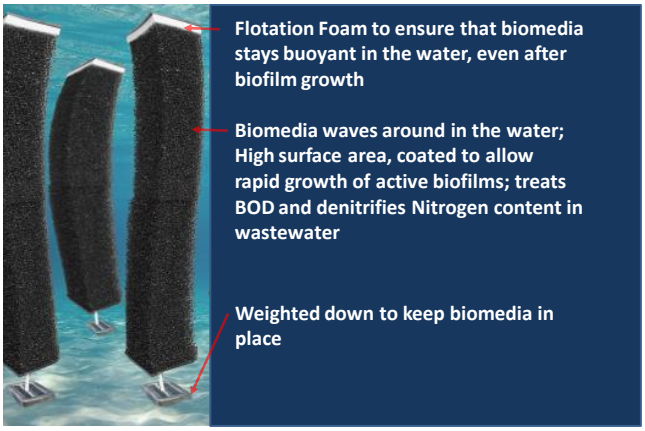
Validation case studies for these three proposed technologies are attached in Appendix 1.

Waving Biomedia: Waving Biomedia was developed as a hybrid between fixed and moving biomedias. Fixed biomedia is typically placed inside the lagoon or treatment system, and consists of plastic plates, bonded together to form a high surface area structure. The main issue with fixed biomedia is with respect to growth of biomass and deposition of suspended solids that eventually results in clogging of the biomedia, and the liquid flow begins to by-pass the fixed media, which decreases treatment efficiency. Moving biomedia, consists of small 1in. diameter plastic pieces, which are neutrally buoyant, and grow biofilms on their surface. Typically 50-60% of treatment volume is occupied by the moving media, which reduces treatment capacity substantially and these plastic pieces have to be retained using a screen at the exit of the treatment zone. In addition, due to the large number of plastic pieces, the biofilms abrade off the outside surfaces and their ability to retain effective biofilms is limited.

For both fixed and moving biomedias, the hydraulics of the liquid flow is very critical, in order to maintain treatment effectiveness.

Waving Biomedia stays in place, since it is weighted down, and it waves around in the water, instead of moving around. This gives the biomedia from accumulating suspended solids, like fixed biomedia, and its movement is independent of the hydraulics and mixing effectiveness, as is the case with moving biomedia. No screens are required to retain this biomedia, since the biomedia remains in place, and unlike fixed biomedia structure, it is simply placed within the lagoon or treatment system, since each biomedia piece is weighted down enough to keep it in one place. Schematic of the Waving Biomedia is shown on the next page. Each biomedia piece will be tied to the top to prevent it from falling when the reactor is decanted.

Waving Biomedia in water.



Nitrification/Denitrification

Waving biomedia is engineered to grow active biofilms, for treating organic contaminants and for nitrification and denitrification, as in the case of ammonia treatment. This biomedia, unlike other biomedias, is designed to create aerobic conditions on the outside area of the biomedia to nitrify the ammonia to nitrate/nitrite and anoxic conditions on the inside of the biomedia, in order to denitrify the nitrate/nitrite to nitrogen gas. The biomedia has a chemical coating on the surface of the foam material which enables rapid attachment of the active biofilms. In typical uncoated biomedias, biofilm attachment and growth can take considerable time, while in our coated biomedias, full biofilm growth is usually achieved in a few hours. In addition, 10% of the media can be supplied with **biomass pellets** that contain organisms (aerobic bacteria, nitrifiers/ denitrifiers), to seed the bed during start-up. This allows faster start-up of the biobeds, especially since nitrifiers and denitrifiers are slow growing organisms. Furthermore, biofilm attachment of these slow growing organisms prevents washout, which is a common problem with suspended culture bioreactors. In addition, the attached biofilms increase active biomass concentrations in the bio-beds five to seven-fold over suspended culture bioreactors, thereby increasing biotreatment rates substantially.

Waving Biomedia Specifications

Dimensions: 4 inches x 4 inches x Depth of water

Surface Area: 280 ft^2/ft^3

Max. BOD Treatment Rate: 0.005 lb BOD/ft^2.day

Max. TKN Treatment Rate: 0.004 lb TKN/ft^2.day

Nominal distance between pieces: 2 feet

Arrangement: Distributed within the reactor vessel

Location: Near or soon after aeration, to maximize dissolved oxygen in the flowing water

Microbubble Aeration: An aeration system is among the most energy-intensive operations in wastewater treatment systems and is responsible for between 50-90% of total energy consumption in typical municipal installations. The optimum bubble size for aeration with compressed air and no mechanical mixing typically is considered to be 1 to 2 mm in diameter. This range of bubble diameter provides a compromise between the conditions for good mass transfer and efficient mixing. Gas transfer technologies that are able to produce

bubbles in the range of 10 to 1000 μm require a high power input, such as fine bubble aeration, jet aeration, etc. For standard submerged aerators, the bubble formation on the surface of aerator undergoes three stages: expansion stage, detachment stage, and coalescence due to bubble-bubble combination, which results in larger bubbles.

The transfer of oxygen from the air bubble to the water depends on wastewater characteristics: (1) concentration of soluble salts (Total Dissolved Solids or TDS), water temperature, water depth, total suspended solids (TSS), presence of surface active agents, etc.; (2) tank geometry, bubble size, kinetic energy of the fluid, etc.; and (3) extent and type of liquid mixing with the bubbles, which determines the path length of the air bubble.

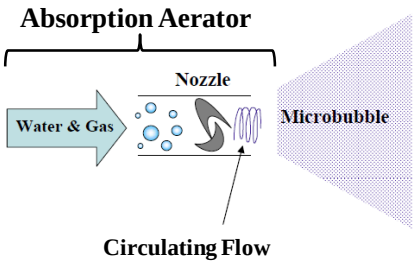
The Actual Oxygen Transfer Rate (AOTR) = Standard Oxygen Transfer Rate (SOTR) x α x β x φ
where SOTR is the oxygen transfer rate for pure water, α is the parameter that depends on the type of aeration device, intensity of mixing and tank geometry, β is the parameter that corrects for TDS, TSS, concentration of surface active agents, and φ is the parameter that adjusts for the oxygen solubility as a function of water temperature.

Table below lists the SOTR values for typical aerators, including the Absorption Aerator aeration system.

Type of Aeration System	**SOTR Value (lbs oxygen/hp/hr)**
Surface Aerator with draft tube	1.2 – 2.1
Surface high speed	1.2 – 2.0
Submerged turbine	1.0 – 2.0
Submerged turbine with sparger	1.2 – 1.8
Surface brush and blade	0.8 – 1.8
Fine bubble diffusers	0.5 – 1.5
Coarse bubble diffusers	0.3 – 0.8
Absorption Aerator	2.7 – 3.1

The Absorption Aerator's basic mechanism is to pump liquid water through a specially designed nozzle in which the high velocity of the liquid combined with swirl flow creates a negative pressure that draws in ambient air which is dispersed in the form of microbubbles (less than 50 μm in diameter). Figure 1 shows the basic schematic of the Absorption Aerator with its microbubble generation mechanism.

Basic mechanism of the Absorption Aerator.



The Absorption Aerator has a high oxygen transfer efficiency due to the following factors: (1) high gas/liquid ratio = 2.2:1.0; (2) high intensity of mixing in the nozzle system; (3) no external blower required, which has major maintenance requirements; (4) the microbubbles have a large residence time within the water, thereby allowing the dissolved gases in the water, such as carbon dioxide, hydrogen sulfide, etc. to be effectively stripped out; and (5) 50 μm or smaller bubbles ultimately dissolve completely, creating an implosion that creates hydroxyl radicals; these radicals effectively treat the contaminants in the water, such as hydrolysis of fats and oils, oxidation of ammonia, which promotes biological activity.

Table 2 compares the ordinary bubbles, created by sparging, surface aeration, etc with microbubbles created by the Absorption Aerator.

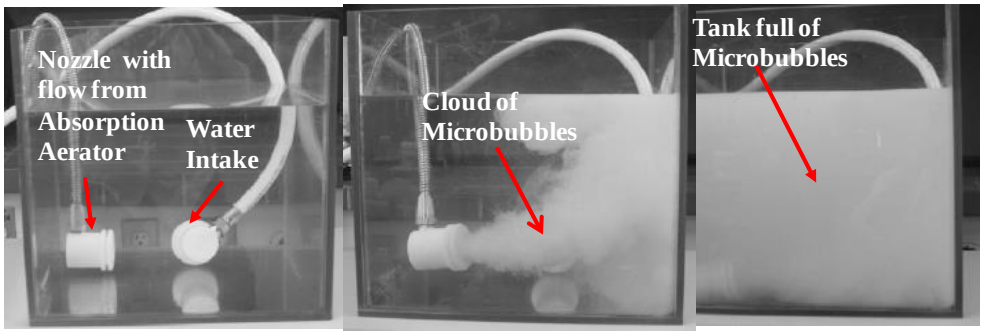
Table 2. Comparison of the Absorption Aerator's Microbubbles with Sparging Bubbles.

Bubble Size (μm)	**Production Method**	**Properties**
> 50	Submerged aeration, sparging, surface aeration, etc	Bubble coalesce into larger bubbles, rise quickly and break on the surface; oxygen transfer efficiency is less than 10% in clean water and less than 6% in wastewater
< 50	Absorption Aerator	Negatively charged surface of bubble prevents coalescence and bubble spends enough time within the water to achieve enhanced oxygen transfer; Once the bubble size becomes smaller than 10 μm due to air dissolution, the bubble does not rise to the surface, since its mass is balanced by its buoyancy; Microbubbles smaller than 10 μm effectively attach to submerged surfaces, thereby never rising to the water surface

Figure 2 shows a time lapse photograph of a glass tank, in which there is water intake going to the Absorption Aerator, outside the tank, and not shown in the pictures, and the outlet nozzle, within the tank

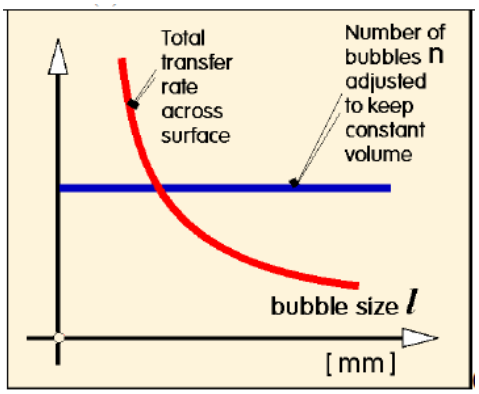
that discharges air/water mixture flow into the tank. The first picture shows the water intake and discharge nozzle, the second picture shows the onset of microbubbles leaving the discharge nozzle and the last photograph shows the tank filled with microbubbles of air.

Figure 2. Photographs showing the generation of microbubbles using the Absorption Aerator.



For a fixed volume of air, the surface area of the bubbles increases proportional to $1/\ell$, as the diameter of the bubble (ℓ) decreases, and this is shown in Figure 3.

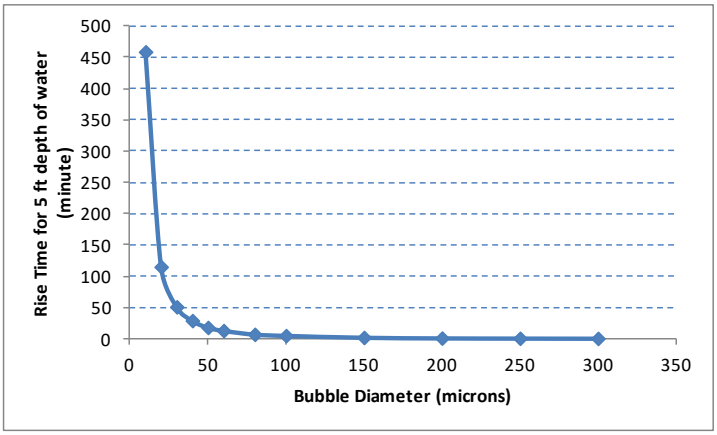
Figure 3. Increase in surface area as a function of bubble diameter (ℓ) for a fixed air flowrate.



Clearly, as the bubble diameter decreases, the total transfer rate of oxygen across the bubble interface increases, due to increases in bubble area.

The bubble rise (residence time) for a water depth of 5 ft has been calculated as a function of bubble diameter, and this is shown in Figure 4.

Figure 4. Bubble Rise Time through water depth of 5 ft. as a function of Bubble Diameter.

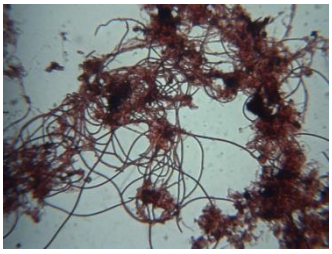


As the bubble size decreases below 50 microns (microbubbles), the rise time begins to increase rapidly for a tank with 5 ft depth of water. The above curve was constructed assuming that the water density is constant. However, as the bubble rise time increases, the density of the air-water mixture decreases, since at 70 deg F the density of air is 0.07 lb/ft3 while the density of water is 62.3 lbs/ft3. This decrease in air-water mixture density decreases the buoyancy of the bubble and slows down its rise rate through the water.

The mixing of the liquid in the bioreactor is very critical to maintain a nearly-uniform organic load throughout the reactor liquid. This is very essential to prevent uneven growth of biomass in the Waving Biomedia foam structure. This liquid mixing is achieved by recycling liquid back into the reactor during the aeration sequence.

This liquid mixing is achieved by using eductors to disperse the recycled liquid and air into the reactor liquid.

SETZYME Enzyme: Activated sludge, the essential component of a wastewater treatment process, includes a mixed and variable consortium of micro- and macro-organisms including viruses, bacteria, protozoa and metazoa who function in the transformation of organic materials into a liquid mixture that is relatively low in suspended solids and organic compounds. Among the key organic degraders, filamentous bacteria bond to other floc-forming organisms with biopolymers and provide important floc “backbones” to support the structure and shape of compact flocs for efficient sludge settling. The excessive growth of filamentous bacteria, however, trap and stabilize air bubbles when combined with biosurfactants, resulting in stable sludge foaming and biomass bulking on the surface of aerated reactors. Sludge bulking is a frequent operational problem and prevents adequate flocculation and impedes proper sludge mass settling.



Current control methods for sludge bulking depend on physio-chemical methods, including return sludge flow rate and aeration manipulation, surfactants and chlorine or hydrogen peroxide addition. Chlorine addition is especially an issue since it forms halocarbons, a highly carcinogenic, volatile chemical. Chlorine also increases the soluble BOD due to cell lysis and damages the active bacteria, needed for biological treatment of the wastewater.

One of the parameters used to define sludge bulking is Sludge Volume Index (SVI), which is defined as the volume of sludge (mL) which settles in 3o minutes using 1 liter of wastewater sample.

$$SVI = \frac{\text{volume (sludge) after 30 min. (ml/l)} \times 1000}{\text{MLSS (mg/l)}} = \frac{\text{ml}}{\text{g}}$$

Sludge with very few filamentous organisms will have SVI less than 70 mL/g, while bulking sludge will have a SVI greater than 150 mL/g. Bulking sludge will have a clear effluent but when the wastewater leaves the clarifier, it will contain large pieces of sludge, which increases the total suspended solids (TSS) in the effluent.

Causes of sludge bulking are summarized in Table 1. The most common causes are low dissolved oxygen and low Food to Microorganism (F/M) ratio, due to starvation conditions in the influent wastewater.

Water Warriors **SETZYME** is an enzyme formulation which is designed to reduce filamentous microbe populations, improve sludge settling and enhance overall system performance, while reducing operating costs. The formulation contains a combination of enzymes and other ingredients selected to destabilize many filamentous microbial forms and thus improve settling. The SDS sheets for SETZYME are attached in Appendix 1 of this document.

Table 1. Causes of Sludge Bulking.

Cause of Sludge Bulking	Filament Type
Septic conditions • Low Dissolved Oxygen • High sulfide concentration	Type 1701, *S. natans, H. hydrossls, Thiotrix sp., Begglatos and Type 021N*
Low Food/Microorganism Ratio	*M. parvicelle, H. hydrossis, Nocardia sp types 021 N, 0041, 0675, 0092, 0581, 0961, 0803*
Nutrient Deficiency	*Thiothrix sp., S. natana, type 021N, and possibly H. hydrossis and types 0041 and 0675*
Low pH	*fungi*

SETZYME Application:

Appearance:	Powder
Contents:	Enzymes and other proprietary ingredients
Shelf Life:	1 year
Application:	Applied directly to aeration basins or trickling filter influents
Optimum Dissolved Oxygen:	0.5 – 2.5 mg/L
pH:	6 – 9
Temperature:	10 – 40 deg C
BOD - NH_3-N	10:1 – 10:0.5; BOD – PO4-P:100:1 – 100:0.5
Application Rate:	High initial dose followed by lower dosing rate

Competitive Treatment Approaches: Competitive strategies includes the following: (1) adding biodegradable carbon to the influent to increase the feed to microorganism ratio; (2) using biocides such as chlorine or hydrogen peroxide to kill the filamentous organisms in the settlers; and (3) increase the amount of sludge being wasted in the activated sludge process. Biodegradable carbon, such as sugar, methanol, etc., provides more food to the microorganisms and increases the feed/microorganism ratio, which causes the growth of filamentous organisms. However, this also increases the treatment cost, since the added organic carbon has to be treated through the aeration, settling and sludge wasting process, which consumes operating cost.

Using biocides, such as chlorine or hydrogen peroxide to kill filamentous organisms is a common practice. While these biocides do kill the filamentous organisms, it also kills regular bacteria, which reduces the concentration of active bacteria in the process. Besides, these biocides are expensive to use, especially when the plant flowrates are large.

The third option is to reduce the amount of sludge recycle and waste more sludge. This reduces the bacteria concentration, which essentially increases the food to microorganism ratio. However, wasting more sludge also increases cost, since the wasted sludge has to be dewatered and landfilled.

Appendix 2 contains the SDS sheets for SETZYME product.

RETROFITTING PROPOSED TECHNOLOGIES

PHASE 1

The current SBR treatment process consists of two tanks, which are operated in the semi-batch mode. The following retrofits are proposed for one of these reactors in Phase 1 of the proposed project, with the second reactor being retrofitted in Phase 2.

1. Install 280 pieces of Waving Biomedia, with height equal to13.0 ft, in one of the two SBR vessels. Each piece of Waving Biomedia has a cross-section of 4 inches x 4 inches, and height equal to 13.0 ft, which is the average depth of water in the reactor.

   Calculations to determine the number of Waving Biomedia pieces per reactor are shown below:

Wastewater Flowrate			180,000	gpd	125	gpm	Two reactors
Influent BOD (mg/L)			250				
Effluent BOD (mg/L)			5				
Influent Ammonia-N (mg/L)			60				
Kinetic Parameters							
Yield Coefficient of VSS/BOD			0.5	lb VSS/lb BOD			
Decay Rate of Biomass			0.03	day-1			
Kinetic Rate for BOD			5	day-1			
Ks			60	mg BOD/L			
			40	mg/L COD			
Sludge Retention Time			10	days			
Observed Sludge Yield			0.38461538				
Increase in Biomass			141.459231	lbs/day			
Mass of BOD utilized			573.908135	lbs/day	per reactor		
Mass of Oxygen consumed per reactor			573.908135	lbs/day			23.91284 lbs/hr
Theoretical Air Requirement			32983.2261	ft3/day	22.90502	acfm	
Actual Air Requirement			164916.131	ft3/day	114.5251	acfm	Use 500 gpm aerator

The maximum biofilm thickness depends on the decay rate of biomass, which is in the range of 0.03 – 0.05/day, and depends on operating temperature. So the maximum amount of biomass in an aerobic bioreactor is given as follows:

Maximum Amount of Biomass = Growth Rate of Biomass (lbs/day)/(Biomass Decay Rate (day^{-1})

Growth Rate of Biomass in Bioreactor (lbs/day) =

= Wastewater Flowrate (MGD) x [Influent BOD (ppm) – Effluent BOD (ppm)] x Biomass Yield (lbs biomass/lb of BOD) x 8.34 lbs/gal

where MGD is million gallons per day, ppm is parts per million and BOD is Biological Oxygen Demand.

If the maximum amount of biomass is uniformly distributed within all the biomedia, then the maximum steady-state biofilm thickness = Maximum volume occupied by biomass divided by the total protected surface area of the biomedia.

If there is sufficient biomedia present in the bioreactor, then the total protected surface area of the biomedia = Surface Area of protected surface per biomedia piece x number of biomedia pieces. In order to have uniform distribution of biomass in all the biomedia present in the bioreactor, the concentration of BOD in the bioreactor has to be uniform, and this means that the bioreactor is completely mixed, as in an ideal stirred tank reactor.

The above calculations to determine the number of Waving Biomedia pieces needed in the bioreactor are shown below:

Biomass Growth Rate per reactor	286.954067	lbs/day				
Amount of Biomass in Reactor	9565.13558	lbs				
Volume of Biomass	153.042169	ft3				
Max thickness of biofilm	0.00416667	ft	50% pore occupied by biofilm			
Surface area of biofim needed	36730.1206	ft2				
Height of Waving Biomedia	13	ft				
Surface Area of Each Waving Biomedia Piece	133.333333	ft2				
Number of Waving Biomedia Pieces	275	per reactor		Use 280 pieces per reactor		
Volume occupied by Biomedia	2792.53333	gallons				
Volume of water in each reactor	124616.8	gallons				
% Reactor occupied by biomedia	2.24	%				

Liquid mixing is essential to achieve a uniform BOD concentration in the bioreactor, so that the biofilm thickness is within a narrow range. It improves movement of Waving Biomedia and transport of water through the open cell foam. It also Increases rate of mass transfer and sloughing of biomass from the unprotected surfaces of the biomedia, while improving oxygen transfer and rates of denitrification.

2. Microbubble aeration system for aeration of the wastewater. This involves using a liquid pump, with a design flowrate of 500 gpm, 30 psi (14 HP). During the aeration step, wastewater from the SBR is pumped through the Absorption Aerator, which draws in ambient air and creates microbubbles in the wastewater. This provides dissolved oxygen in the wastewater, needed for effective biotreatment of the wastewater.
   Calculations of air intake by the Absorption Aerator are given below:

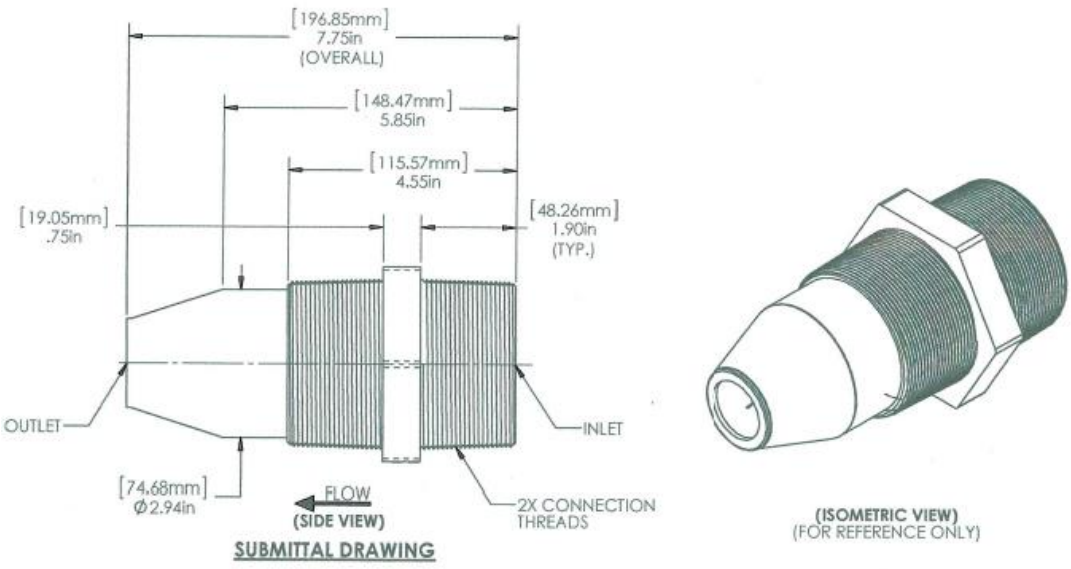
26 psig Inlet Pressure
Q = 495 gpm
Open Discharge
Vacuum = 1.9" H_2O
Nozzle Diameter = 1.944"
Air Inlet (orifice) = (2) 2.0" Diameter Holes
1.9" H_2O = 1.9 x .5781 = 1.10 oz/in^2
Velocity from plot @ 1.10 oz/in^2 = 95 fps. = 1140 in/sec.
Assume orifice C_D = 0.65
Area (2) 2.0" holes = 6.2832 in^2
Effective Area = 6.28 x 0.65 = 4.08 in^2

$$\text{SCFM} = \frac{4.08 \times 1140 \times 60}{1728} = 161.5 \text{ (162 SCFM)}$$

161.6 scfm x 60 min. x .0175** = 169.58# O2/hr. available
169.58 x 19.33% efficiency* = 32.78# O2 transferred/hr.

NOTE:
The above calculations were arrived at through the use of a pitot tube traverse across an air duct which communicates with a concentric jacket around the Absorption Aerator manifold.

The mixing of the wastewater in the reactor will be accomplished using eight (8) nozzles:



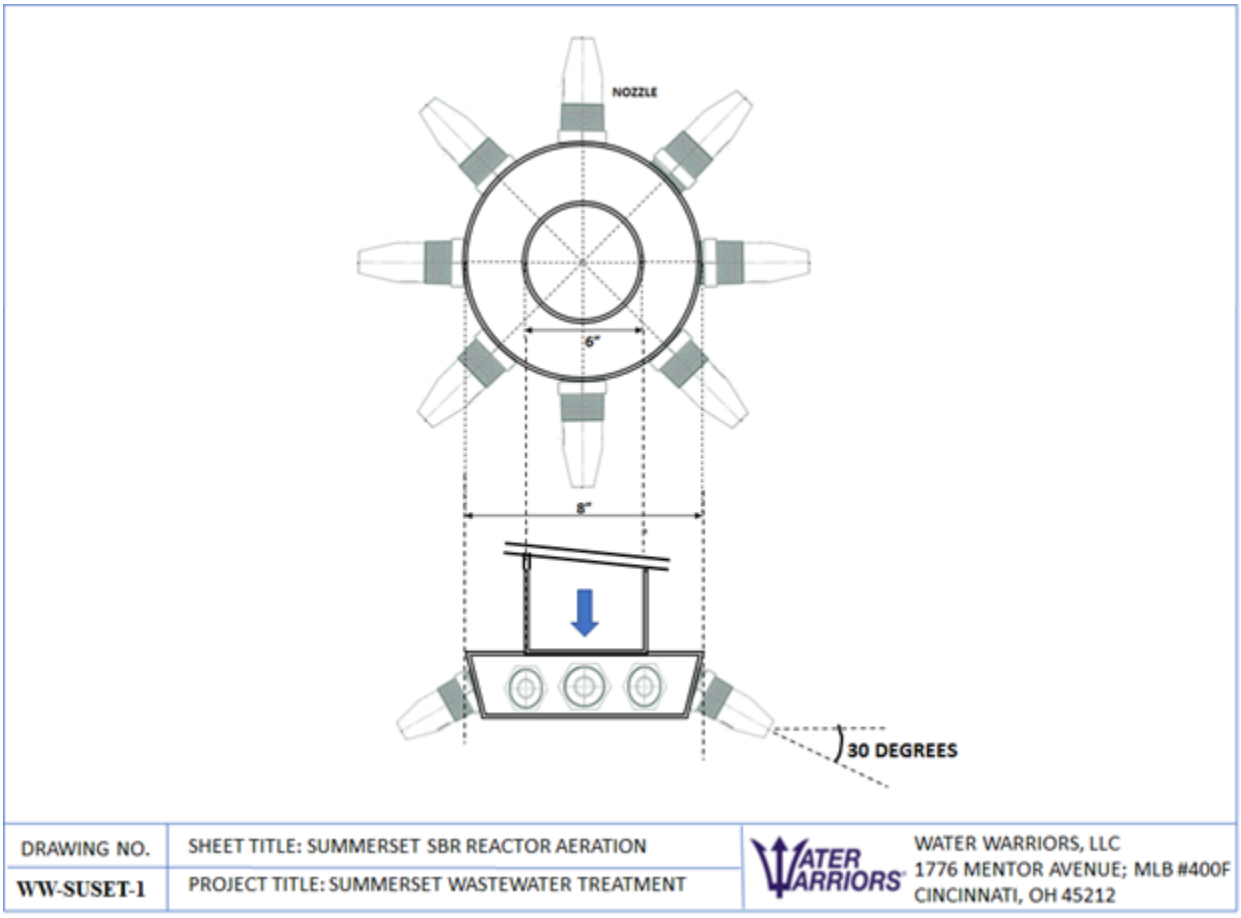
SUBMITTAL DRAWING

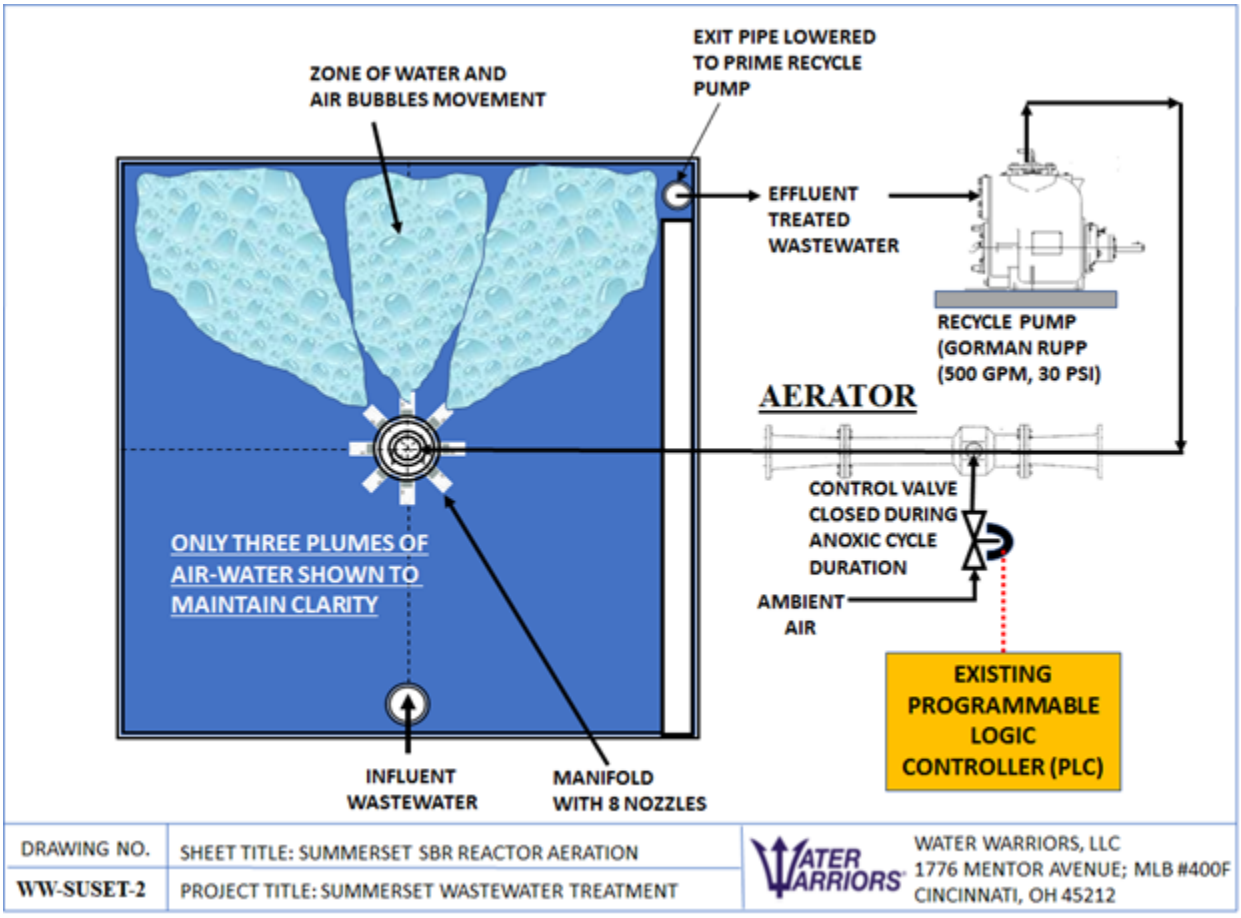
The eight nozzles will be pointing towards the four corners and four sides of the SBR tank, as shown in the drawings, presented later in this proposal. Each nozzle has openings of about 2 inches for the water to flow out at a high velocity, and this velocity is estimated to be 6.4 ft/sec.

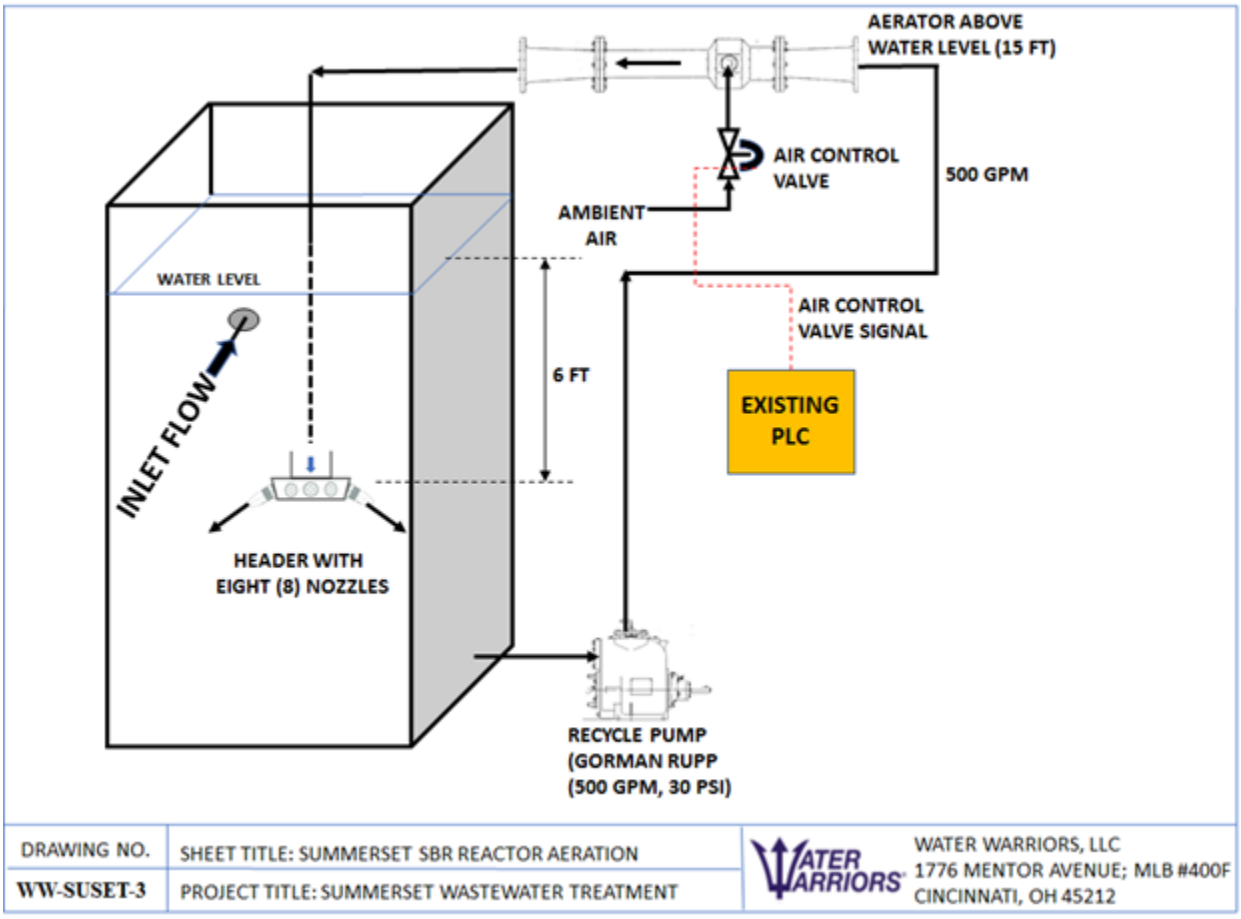
The total motive flow is 500 gpm. The optimum inlet pressure to the Absorption Aerator is 26 psi. The pipes connecting the exit of the pump to the inlet of the Absorption Aerator will be 6 inches nominal diameter, Sch 80 PVC pipes. The pressure drop in this pipe and fittings , assuming a length of 40 ft, will be about 0.6 psi. The outlet pressure after the Absorption Aerator will be 4 psi, since the pressure drop across the aerator is 20 psi. Pressure drop in the nozzle for 62.5 gpm flowrate through each nozzle (500 gpm/8 nozzles) is calculated to be about 2 psi.

Schematic drawings (not-to-scale) of the proposed aeration system are shown below.

It is important to note that during the anoxic cycle duration, the recycle pump can be kept running and the ambient air inlet control valve will be closed to allow anoxic conditions to develop during this cycle step duration. The recycle pump will be shut off during the settling and decant stage.




ZONE OF WATER AND AIR BUBBLES MOVEMENT
EXIT PIPE LOWERED TO PRIME RECYCLE PUMP
EFFLUENT TREATED WASTEWATER
RECYCLE PUMP (GORMAN RUPP (500 GPM, 30 PSI)
AERATOR
CONTROL VALVE CLOSED DURING ANOXIC CYCLE DURATION
AMBIENT AIR
EXISTING PROGRAMMABLE LOGIC CONTROLLER (PLC)
ONLY THREE PLUMES OF AIR-WATER SHOWN TO MAINTAIN CLARITY
INFLUENT WASTEWATER
MANIFOLD WITH 8 NOZZLES
DRAWING NO.
WW-SUSET-2
SHEET TITLE: SUMMERSET SBR REACTOR AERATION
PROJECT TITLE: SUMMERSET WASTEWATER TREATMENT
WATER WARRIORS, LLC
1776 MENTOR AVENUE; MLB #400F
CINCINNATI, OH 45212


AERATOR ABOVE
WATER LEVEL (15 FT)
AIR CONTROL
VALVE
500 GPM
AMBIENT
AIR
WATER LEVEL
AIR CONTROL
VALVE SIGNAL
6 FT
EXISTING
PLC
INLET FLOW
HEADER WITH
EIGHT (8) NOZZLES
RECYCLE PUMP
(GORMAN RUPP
(500 GPM, 30 PSI)
DRAWING NO.
WW-SUSET-3
SHEET TITLE: SUMMERSET SBR REACTOR AERATION
PROJECT TITLE: SUMMERSET WASTEWATER TREATMENT
WATER WARRIORS, LLC
1776 MENTOR AVENUE; MLB #400F
CINCINNATI, OH 45212

3. Addition of SETZYME to the influent flow of each SBR. SETZYME is supplied as a powder, packed in 1 lb water-soluble bags. A 330 gallon tote, equipped with a mixer, will be used to dissolve the SETZYME water soluble bags, and keep the SETZYME slurry well mixed, before it is dosed into the influent flow of the SBRs, using a metering pump. The following dose rate is recommended:

   Initial dosing rate: 10 GPD to provide a high dose of enzyme to the plant; this will empty the tote in 1 month; 23 lbs of Enzyme powder (25 bags) will be added to the tote.

   Dosing rate after initial dosing (after 1 month): 2.5 GPD, which will result in using up the 300 gallon mixture in 3 months time period; 10 lbs of Enzyme powder (9 bags) will be added to the tote, before filling it up with water.

   The Enzyme addition process consist of the following:

   1. Tank for mixing the SETZYME powder with water, which is needed to hydrate the enzyme before adding it to the system;

   2. Mixer for the tank, to ensure that the enzyme powder completely mixes with the water in the tank; and

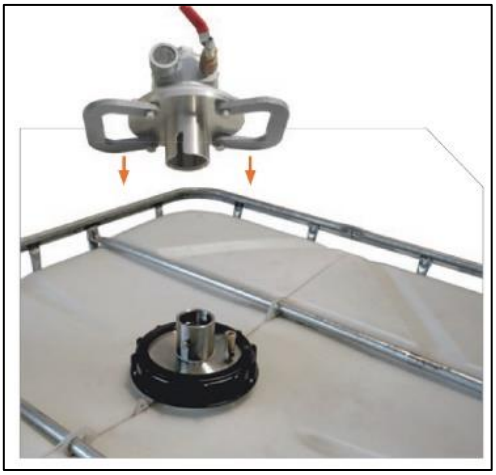
   3. Metering pump to feed the enzyme slurry to the process.

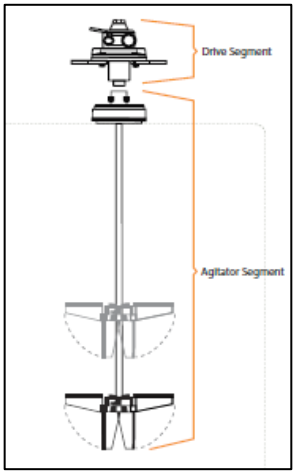
   Tank for Mixing the Enzyme Powder: 330 gallon heavy duty plastic Square Stackable tote with black base. Useful for both hazardous and non-hazardous commodity liquids. The tank includes a 2 inch drain valve at the bottom.

Capacity: 330 Gal
Length: 46 in
Width: 46 in
Height: 61 in
Weight: 245 lbs
Material: High Density Polyethylene (HDPE)
Color: Natural
Specific Gravity: 1.9

Mixer for the Tank: Gearmotor 0.5HP @ 175 rpm 1/60/110V TEFC with wiring, Reduced to 175 rpm– 6" Plastic Tote Mount– Shaft Assembly 0.75" dia. x 38" long (316SS) – 14" diameter, Collapsible mixer (316SS). This mixer will 717 gallons per minute, turning your tank 2.2 times per minute and bringing item to uniformity in 11.5 minutes.

Metering Pump for Enzyme Slurry: Piston type metering pump, which can handle slurries (9-29 mL/min flow capacity), 100 psi pressure. The pump has a valve-less design to prevent clogging of the pump by the slurry.





COST OF PROPOSED TECHNOLOGIES FOR PHASE 1

The total cost of the equipment for the proposed retrofit technologies will be **$247,515** and the breakdown of this total cost is given below. These costs do not include shipping, packaging, permitting and on-site installation costs.

Two pumps (500 gpm, 30 psi, 14 HP each pump) (This does not include pump housing, VFD)	$45,600
280 pieces of Waving Biomedia (13 ft height)	$61,000
Cost of Absorption Aerator, 8 nozzles and manifold	$28,100
Cost of SETZYME Addition System (tote, mixer and metering pump)	$14,000
Cost of SETZYME (1 year supply)	$12,000
Cost of Miscellaneous items and contingency	$10,000
Direct Cost of Phase 1	**$170,700**
Overhead costs (45%) of direct costs	$76,815
Total Cost	**$247,515**

This cost will include supplying 280 Waving Biomedia pieces (13.0 ft height) for one of the SBR vessels, two recycle pumps (14 HP each for one SBR vessel, and a second identical stand-by pump, which later can be used for the second reactor in Phase 2 or kept as a stand-by pump) for the microbubble aeration system, nozzles mounted on a header to disperse the air and water throughout the SBR vessels during the aeration step, Absorption Aerator for the aeration system, tote with mixer and metering pump for the SETZYME addition. It will also include the first year of SETZYME, supplied in 1 lb water soluble bags.

The recycle pump, Absorption Aerator and PLC will be supplied as a single skid. The recycle pump will operate on 230V, 3 phase electrical power. The metering pump, tote mixer, PLC and sensors will operate using 110V, single phase. The skid will have a footprint of 4 ft x 6 ft.

The above quote does not include the cost of shipping, installation at the site and permitting costs, if any.

This project total will be paid as follows:

Initial payment with Purchase Order	40%
Second payment after all equipment has been received by Water Warriors	40%
Third payment after equipment has been received at site	10%
Payment after commissioning of retrofit modifications	10%

The proposed retrofit system has major advantages over other possible solutions:

1. The aeration process is a simple process with minimal moving parts (recycle pump only), which can effectively treat the wastewater;

2. The proposed design aerates and moves the water simultaneously, and this water movement will increase the mixing level within each of the SBR vessels;

3. Simple installation, since the aeration nozzles and piping are installed below the water surface. The pump and Absorption Aerator are outside the reactors, and will be supplied on a skid, with a control box, which can be installed next to the SBR vessels;

4. High efficiency of oxygen transfer to the lagoon water and enhanced mixing of the water; Absorption Aerator's oxygen transfer efficiency is 2-3 times higher than bubble aeration;

5. Low energy consumption, since the Absorption Aerator delivers dissolved oxygen to the water at about ½ the horsepower consumed using bubble aeration; Currently, the aeration system uses 25 HP blowers, while the proposed aeration system will use 9 HP, which will save 64% of the current electrical power costs;

6. Because the Absorption Aerator effectively strips off carbon dioxide generated by aerobic microorganisms, it will raise the pH non-chemically thus contributing to reduced chemical usage. This becomes very evident when reviewing the following formula:

   $pH = 6.35 + \log(\text{alkalinity}/\text{carbon dioxide})$

   By raising the pH, non-chemical nitrification can begin almost instantly with the increase in pH above 6.8 levels; Obviously, the greater the increase in pH, the more rapidly nitrification occurs thus making nitrogen bioavailable for Colony Forming Units (CFUs);

7. The motive liquids continuously supply highly oxygenated liquids directly into the media keeping the biomass viable and removing carbon dioxide from the off-gassing of the microorganisms;

8. Less sludge production, since most of the biomass will be retained on the Waving Biomedia, which increases Sludge Retention Time (SRT) and hence reduces net sludge production;

9. Use of SETZYME will prevent growth of filamentous organisms, which will increase clarity of effluent water and decrease sludge settling time; and

10. Cost-effective, since the cost of the equipment will have a low payback time, when compared to the costs involved in using diffuse aerators.

In addition to saving some operating costs, there are other significant benefits that have not been monetized. These benefits are as follows:

1. Improved performance in terms of reducing 5-day BOD and TKN in the effluent and meeting the required pollutant discharge limits;

2. Reduction in sludge production, which has to be dewatered and disposed; and

3. Reduce the yearly electrical operating cost of the aeration system, while improving effluent water quality and increasing plant treatment capacity.

ABOUT WATER WARRIORS

WATER WARRIORS, Inc. (WATER WARRIORS) has the experience needed for designing advanced water treatment systems.. Our broad spectrum of applications includes chemical, petrochemical, industrial, mineral, wood products, carbon products, pharmaceutical, automotive, and many other applications.

WATER WARRIORS founders have executed several projects worldwide and is headquartered in Cincinnati, Ohio. We offer our worldwide customers the following benefits:

- Strong process design with 20+ years experience
- Custom design to suit project requirements
- Complete system integration experience
- Strong project management & engineering team
- Strong after market service team
- Respected industry reputation
- Guaranteed system performance

1776 Mentor Avenue; Suite 400F
Cincinnati. OH 45212

LAGOON AERATION CASE STUDY

A food processing facility in Wisconsin discharges the plant's effluent into a wastewater treatment lagoon system for the reduction of BOD, Phosphorus, Ammonia (NH3) and TSS prior to discharging to the local wastewater treatment plant.

The facility discharges ~75,000 gallons/day with BODs ~350 mg/L. The lagoon is very large 640' x 246' with an operating depth of 9' to 10' with sufficient retention time for biological processes. A hanging curtain baffle provides for an area of quiescence on the discharge side to reduce TSS and divides the lagoon. The lagoon originally was equipped with five (5) 15-hp high-speed floating impeller-type aerators [AireO2] and three (3) 20-hp [AireoMix] draft tube surface aerators for a total of 135 connected horsepower. While these aerators were able to mix and recirculate liquids in the lagoon they were not capable of adequately influencing the biological treatment for organic reductions to include nitrification.

Additionally, there was an increasing sludge accumulation of almost three feet (~32") or > of varying thickness [>3% solids] throughout the lagoon. This sludge was occupying 25% of the Lagoon volume. In this configuration the facility was not able to meet their discharge permit limits issued by the pretreatment coordinator at the local publicly owned treatment works (POTW) and was subject to surcharges for excess BOD, TSS and Phosphorus.

As a result of not being in compliance with their discharge permit the facility was being surcharged for BOD in excess of 200, and TSS >100. They began to look for alternative treatment solutions to bringing the facility into compliance, as surcharges were approaching $70,000/year.

With all four Absorption Aerator systems in operation the facility is in compliance with their discharge permit. BOD levels average 35, TSS 70, Ammonia <1.0 mg/L, Phosphorus <3 mg/ L, Nitrate <1.0 mg/L. Because the microbubbles are consistently stripping the carbon dioxide generated by the aerobic bacteria, the pH is buffered non-chemically. The facility's discharge pH averages 8.0 without the addition of alkalinity. The sludge blanket has been reduced to almost zero on the "aerobically treated" side of the baffle, while in the quiescent zone there is only an average of 4" of sludge <3% solids.

Design Objectives

1. BOD Reduction through high oxygen transfer,
2. Mixing and equalization
3. TSS resuspension for digestion
4. pH adjustment (non-chemically) by stripping CO_2
5. Ammonia (NH_3) reduction and Nitrification
6. Sludge reduction

Proposed Solution

Phase 1: Add two (2) WW-AA-500 aerators, using a 15 HP TEFC motor driven pump; Combined flowrate: 1100 gpm; Suction was located 18 inches above bottom

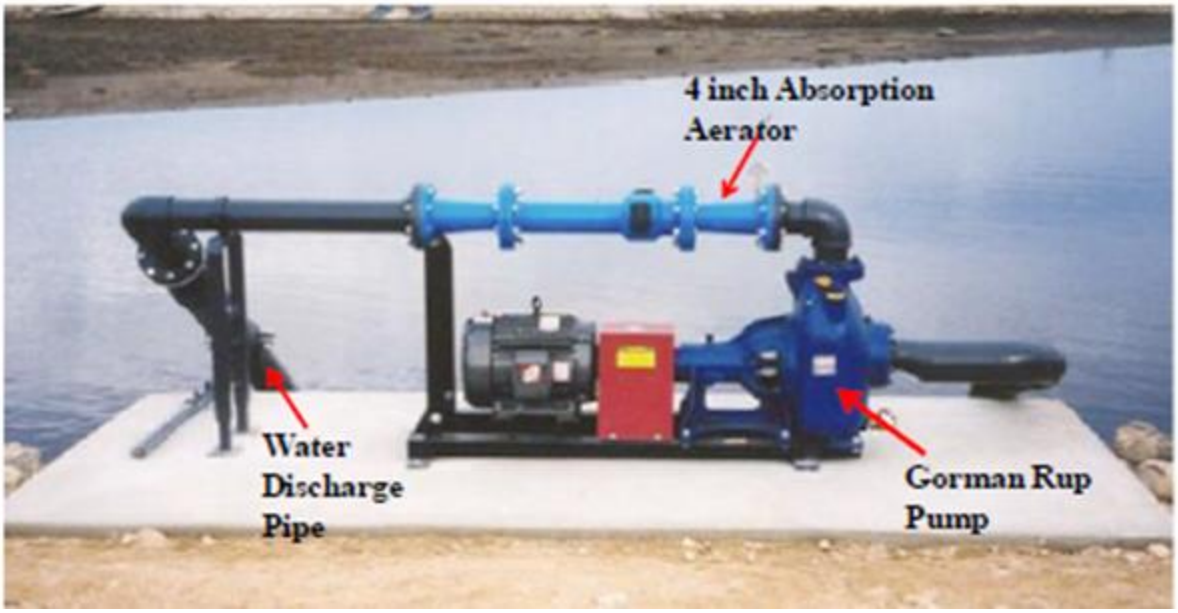
Phase 2: Add two (2) WW-AA-500 additional aerators, using two (2) 20 HP TEFC motors Gorman Rupp pumps were used in this case
Facility was brought into compliance after the commissioning of Phase 1.

Energy Savings
70 HP of the Absorption Aerator Systems compared to 135 HP originally

65 hp (reduction) x .746 = 48.5 kW/hour
48.5 kW/hr x 24 hours = 1164 kW/day
1164 x $0.060 = $ 69.84/day savings
69.84 x 31 days = $ **2165.00**/monthly energy savings

Cost Justification

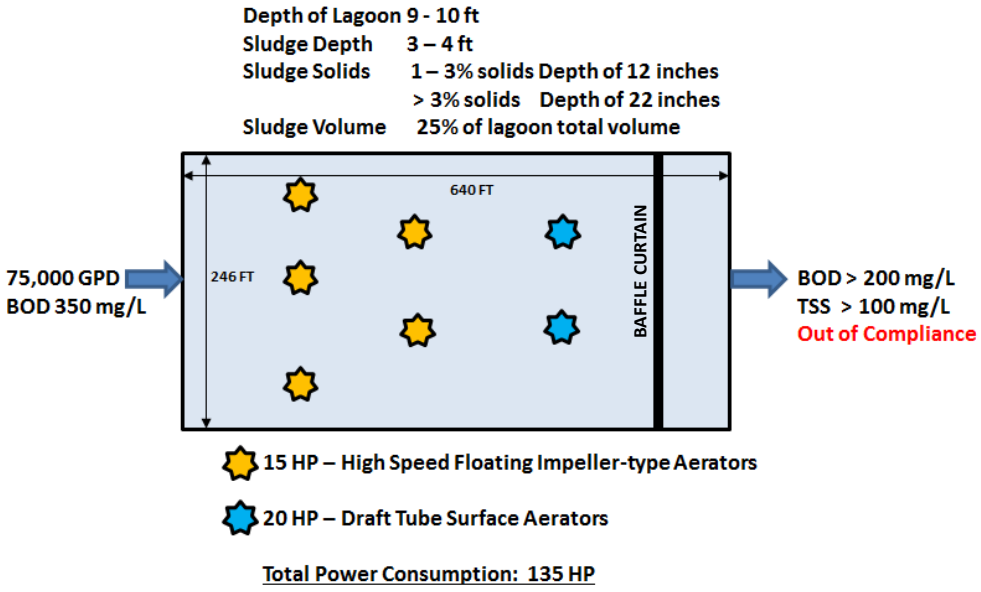
	Originally	With Absorption Aerators
Electrical Cost:	**$53,000/year (135 HP)**	**$27,500/year (70 HP)**
Fines:	**$70,000**	
Investment Cost:		**$400,000 ➔ $44,444/year (assuming 9 year life)**
Maintenance Cost:	**$22,000/year**	**$ 5,000/year**
Total Cost:	**$145,000/year**	**$77,000/year**
Savings:		**$68,000/year**


4 inch Absorption
Aerator
Water
Discharge
Pipe
Gorman Rup
Pump

1776 Mentor Avenue; Suite 400A
Cincinnati. OH 45212

LAGOON AERATION CASE STUDY SUMMARY

APPLICATION OF ABSORPTION AERATOR FOR LAGOON (FOOD PROCESSING FACILITY) USING EXISTING SURFACE AERATOR



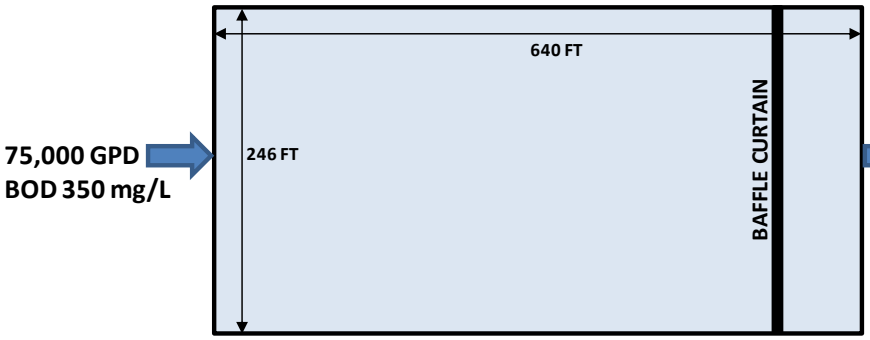
DRAWING NO.	SHEET TITLE: TYPICAL LAGOON AERATION DRAWING	WATER WARRIORS, LLC 1776 MENTOR AVENUE; MLB #400F CINCINNATI, OH 45212
	PROJECT TITLE: ABSORPTION AERATOR PROCESS	

1776 Mentor Avenue; Suite 400A
Cincinnati. OH 45212

LAGOON AERATION CASE STUDY SUMMARY

APPLICATION OF ABSORPTION AERATOR FOR LAGOON (FOOD PROCESSING FACILITY) USING ABSORPTION AERATORS IN PLACE OF THE SURFACE AERATORS

Depth of Lagoon 9 - 10 ft
Sludge Blanket Reduced to almost zero



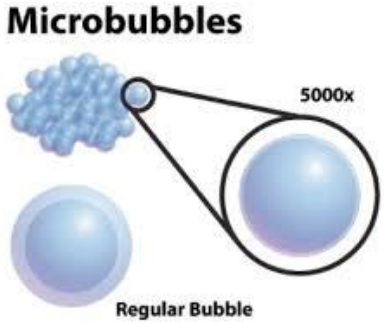
75,000 GPD
BOD 350 mg/L

BOD	**35 mg/L**
TSS	**70 mg/L**
Ammonia	**< 1 mg/L**
Phosphorus	**< 3 mg/L**
Nitrate	**< 1 mg/L**

In Compliance

Two (2) 500 GPM Absorption Aerators with Gorman Rupp Pump, 15 HP each
Two (2) 600 GPM Absorption Aerators with Gorman Rupp Pump, 20 HP each
Total Power Consumption = 70 HP
Monthly Energy Saving = $2,165 at $0.06/kWh

DRAWING NO.	SHEET TITLE: TYPICAL LAGOON AERATION DRAWING	WATER WARRIORS, LLC 1776 MENTOR AVENUE; MLB #400F CINCINNATI, OH 45212
	PROJECT TITLE: ABSORPTION AERATOR PROCESS	



Application of Microbubble Aeration for Wastewater Treatment

ANALYSIS OF EXISTING PERFORMANCE DATA

Submitted by:
Water Warriors, Inc.
1776 Mentor Avenue; SE 400F
Cincinnati, OH 45212, USA
Attn: Dr. Rakesh Govind
Tel: 513-673-3583

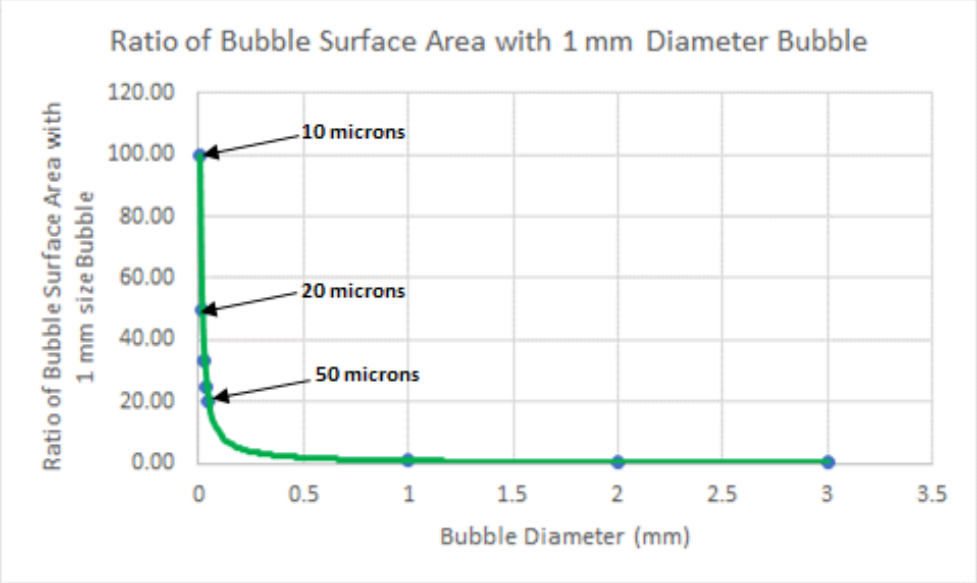
March 2018

INTRODUCTION

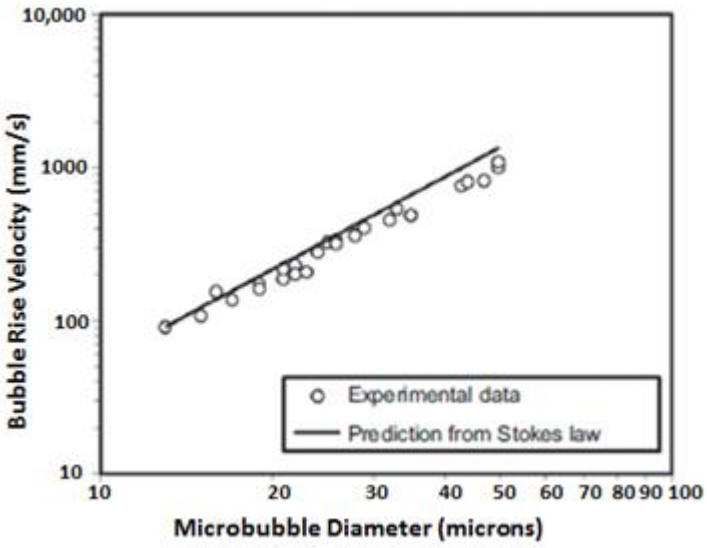
Water Warriors has introduced the Absorption Aerator technology, which uses a specially designed venturi system to entrain ambient air, without a blower, in most cases. In some applications, wherein the oxygen demand is high, a blower can be used in conjunction with the Absorption Aerator to maximize the oxygen absorption efficiency and minimize the energy consumption.

Absorption Aerator uses a specially designed venturi to achieve aeration using microbubbles. Microbubbles are air bubbles in the range of 10-50 micron diameter. Microbubbles are effective for effective aeration for the following reasons:

1. Their small size increases the surface area substantially; For example the following figure shows the surface area of the bubbles as a function of size, for the same volume of air (1 m^3).

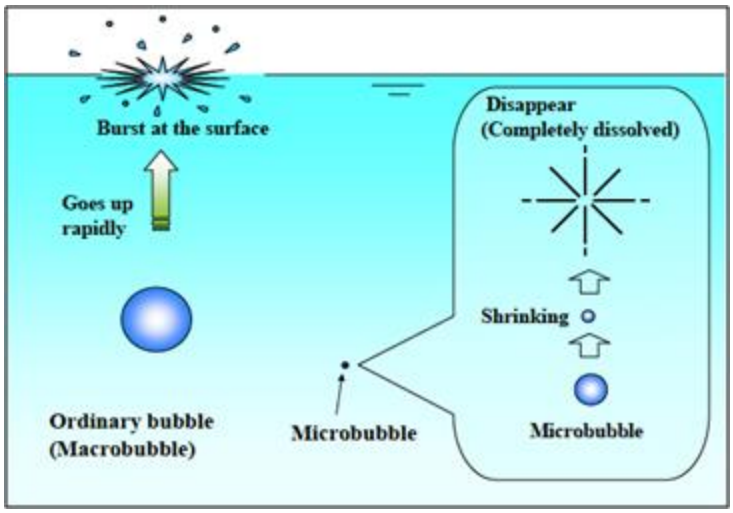


2. As the bubble size decreases, the buoyancy of the bubble becomes comparable to its weight, which allows the bubble to remain in the water for a long time; the following figure shows the rise velocity of the bubble as a function of its size;

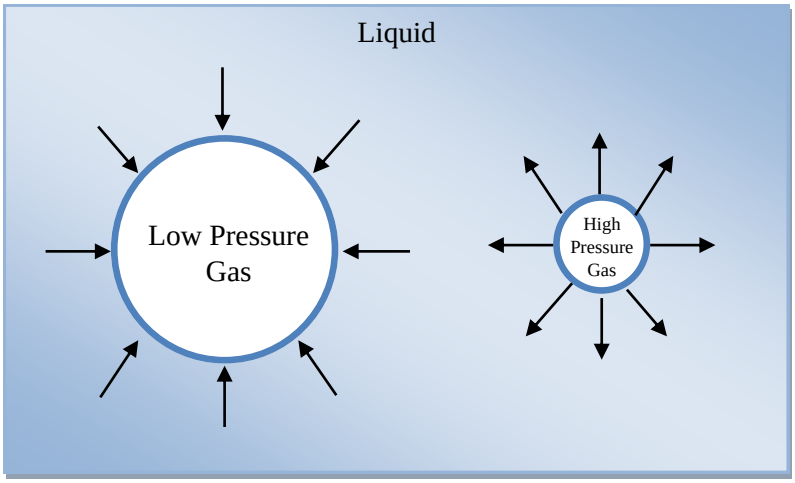


With increasing surface area and increasing amount of bubble residence time, the oxygen transfer efficiency of the air bubble is also going to increase. In addition, the number of bubbles is also increasing substantially, allowing the bubbles to disperse throughout the entire water volume, as compared to the millimeter size bubbles rising vertically through the water column.

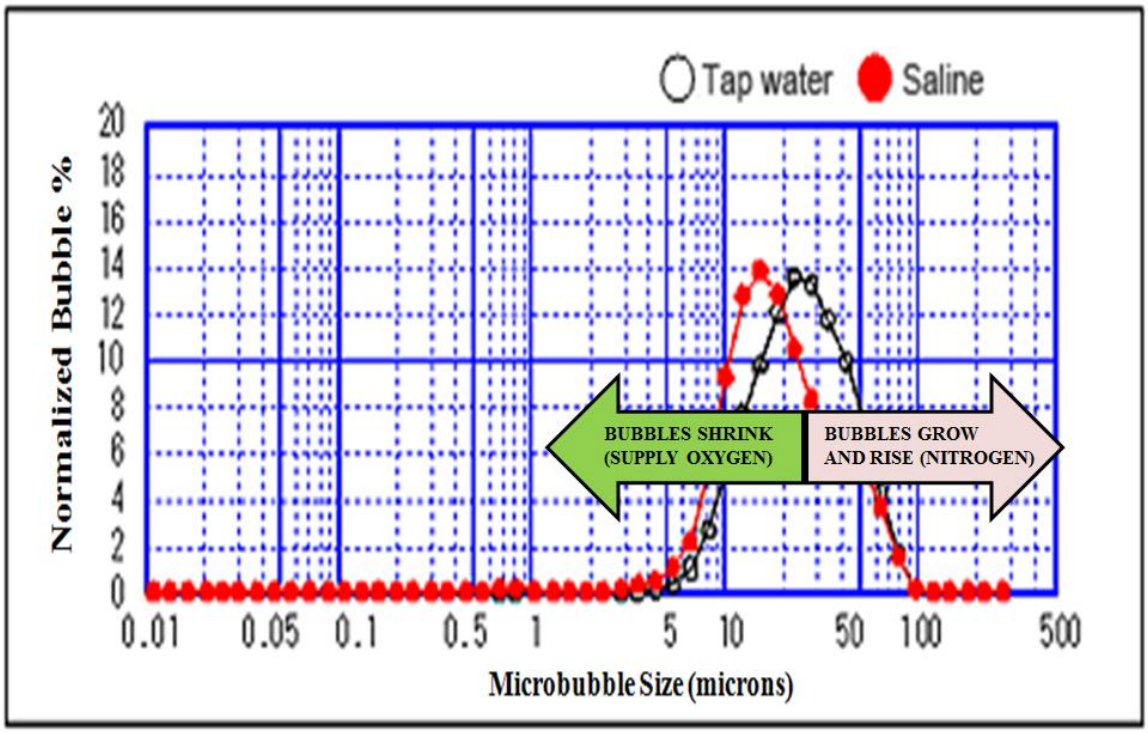
The following figure compares the behavior of the microbubbles with the regular millimeter size air bubbles, which quickly rise through the water column.



As the microbubbles rise through the water column, both oxygen and nitrogen gases dissolve in the water, and since the internal pressure inside the microbubble is much higher than in a millimeter size air bubble, the water surrounding the microbubble gets super saturated with oxygen and nitrogen gases, as shown below.



It is important to have a size distribution of bubble sizes, and the size distribution of the bubble sizes created by the Absorption Aerator is shown below:

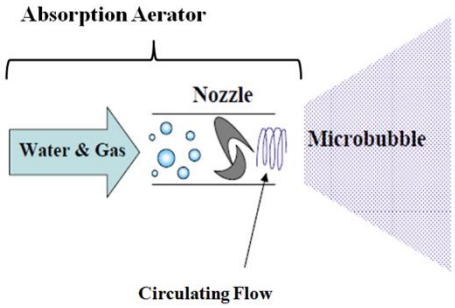


The larger bubbles (> 100 microns in diameter) increase in size, i.e., grow bigger due to transport of supersaturated nitrogen solubilized gas into the larger bubbles, thereby allowing the nitrogen gas to exit the water.

ABSORPTION AERATOR

The Absorption Aerator, which is a specially designed venturi was developed not just to entrain air with liquid flow, but rather to create microbubbles, using rotary motion of the air-water mixture using static vanes inside the venturi system. The following figures shows the basic flow through the Absorption Aerator, which shows that the centrifugal motion of the air-water mixture creates the microbubbles in the water flow.

ABSORPTION AERATOR MECHANISM



So in order to understand the oxygen transfer efficiency of the Absorption Aerator, it is important to see the oxygen transfer efficiency of just a basic venturi system. The Absorption Aerator is just a standard venturi system with the added capability of creating microbubbles, which we know will create improved oxygen transfer due to their small size (higher surface area) and longer residence time in the water, as discussed before in this document.

OXYGEN TRANSFER EFFICIENCY OF A STANDARD VENTURI SYSTEM

The Venturi Aeration System for wastewater aeration has been exhaustively tested following the **American Society of Civil Engineers, ASCE, Measurement of Oxygen Transfer in Clean Water, ANSI/ASCE 2-91 Second Edition**. The testing has been witnessed and certified by a Professional Engineer.

The Venturi Aeration System was composed of three basic units:

1. **Circulation Pump**
2. **Venturi system**
3. **Mixing Nozzles**

The circulation pump circulates water from the aeration basin through the Venturi system which aspirate large volumes of air, or concentrated oxygen, without the need for blowers or compressors. The Mixing Nozzles discharge the air/water mixture from the Venturi System into the bottom of the aeration basin at a designed velocity of about 15 ft/s, effectively mixing the aspirated air with several volumes of water in the aeration basin.

SOTR is the **Standard Oxygen Transfer Rate** of an aeration system determined by measurement of non-steady state oxygen uptake in clean water, which is measured following the test protocol detailed in the **American Society of Civil Engineers, ASCE, Measurement of Oxygen Transfer in Clean Water, ANSI/ASCE 2-91 Second Edition**.

SOTR is expressed in units of lbs/hour of oxygen transferred into clean water under **standard conditions**, which are defined as: **20**°C water temperature, standard atmosphere pressure, and 0 mg/l Dissolved Oxygen.

The **SOTR** is corrected to the **Operating Oxygen Transfer Rate**, **OTR**, under the actual operating conditions of a wastewater treatment facility following the procedures detailed in the **WEF Manual of Practice, MOP, FD-13**. Following is the formula used for correction of the **SOTR** to the **OTR**.

$$\mathbf{OTR} = ((\alpha\ (\mathbf{SOTR})\ \theta)/\ C^*_{\infty 20})\ x\ ((\ \tau\ \Omega\ \beta\ C^*_{\infty 20})\ -\ C_{op})$$

This formula accounts for the effects of water temperature, operating Dissolved Oxygen (DO), water chemistry etc. in the calculation of the **OTR**.

Following are pictures of the test facilities and components employed during the tests.

Test Tank 21' Diameter x 30' Deep & Circulation Pump

Venturi System used in the ASCE Test

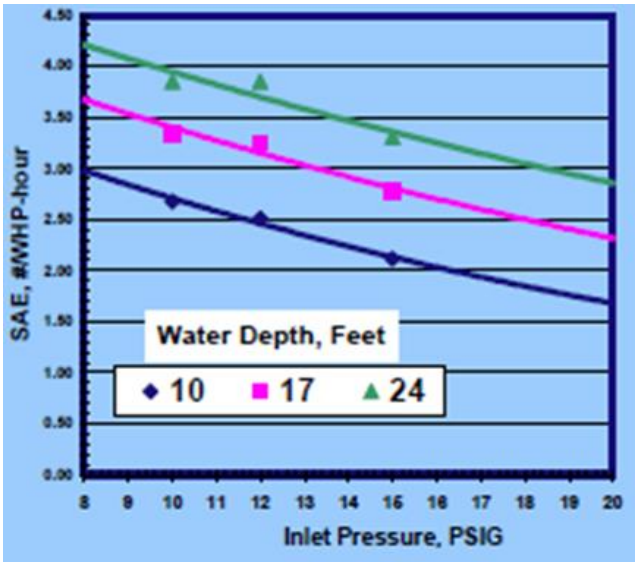
Mixing Nozzles inside the 21 ft diameter tank.

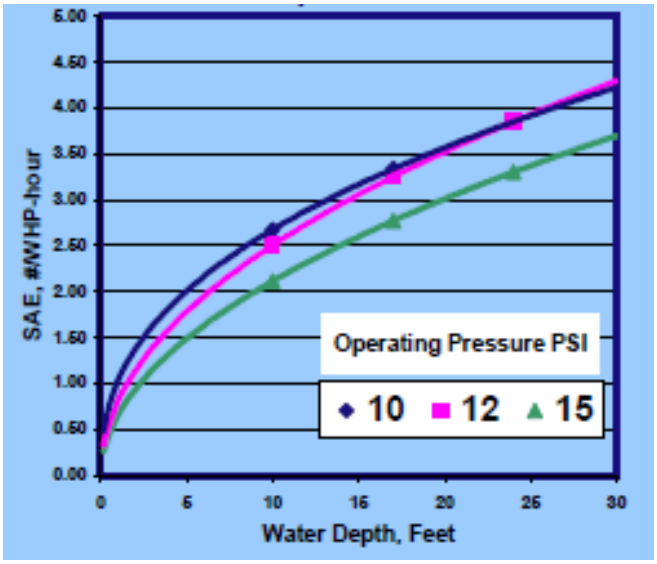
Forty-one Non-Steady State Oxygen Uptake tests were performed to determine the Standard Oxygen Transfer Rate (SOTR) for the Venturi System relative to the following variables:

1. Venturi System Inlet Pressure
2. Water Depth
3. Gas/Liquid Ratio, V_g/V_l

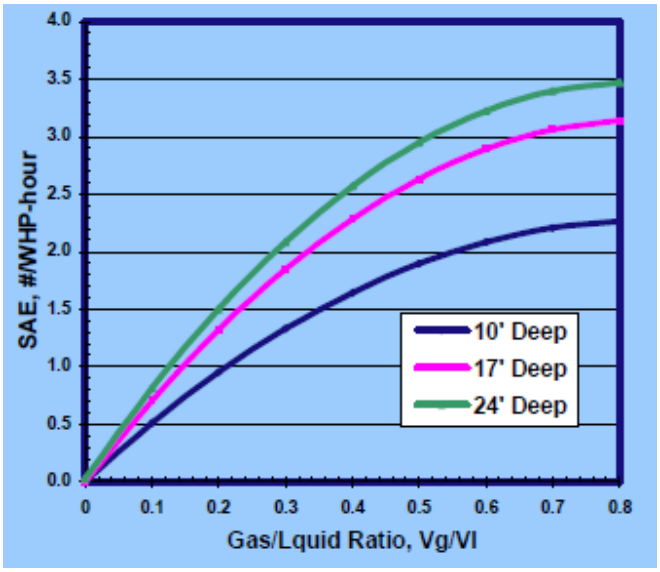
Oxygen transfer test results are expressed in units of Standard Oxygen Transfer Rate (SOTR), or Standard Aerator Efficiency (SAE). Standard Conditions are, by definition, 1.0 Standard Atmosphere absolute pressure (14.694 PSIA), 20.0 C water temperature and 0 mg/l Dissolved Oxygen concentration. SOTR is expressed in units of lbs/hour of Oxygen Transferred. SAE is in units of lbs/WHP-hour (lbs O2 transferred per Water-Horsepower hour applied). SAE relative to Brake Horsepower is dependent on the pumps; motors etc. employed in an Venturi System and is calculated during system design. The following charts are summaries of the test results, which were obtained using the ASCE testing procedure.

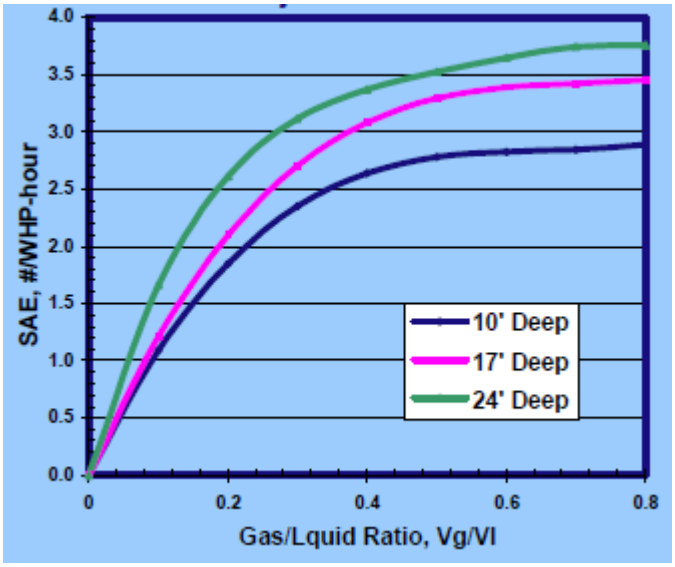
The SAE of the Venturi System increases with decreasing injector operating pressure. The SAE of the Venturi System increases with increasing water depth.





The SAE of the Venturi System increases with increasing Gas/Liquid Ratio, Vg/Vl. The Gas/Liquid Ratio is the volumetric ratio of the amount of air relative to the circulation rate through the Venturi System. Units are SCFM air or oxygen and CFM circulated water.





The SAE increases with the Gas/Liquid ratio for all inlet pressure into the Venturi System.

Since the Venturi system has been already tested using the ASCE Method for clean water, and the Absorption Aerator produces microbubbles compared to standard size bubbles produced by Venturi system, it can be concluded that the Absorption Aerator will give higher SAE values than the standard Venturi system.

CONCLUSION

Extensive testing of the venturi system using the ASCE testing procedure has already been conducted and the results are shown in this report. It is already established that the Absorption Aerator is a venturi system which creates microbubbles. It is well known that smaller air bubbles will result in significantly higher gas-liquid mass transfer area and since the smaller bubbles stay in the water longer, the Standard Aerator Efficiency (SAE) of the Absorption Aerator will be higher than the venturi system.

TREATMENT OF ORGANICS AND AMMONIA IN WASTEWATER USING BIOMEDIA

Submitted by:

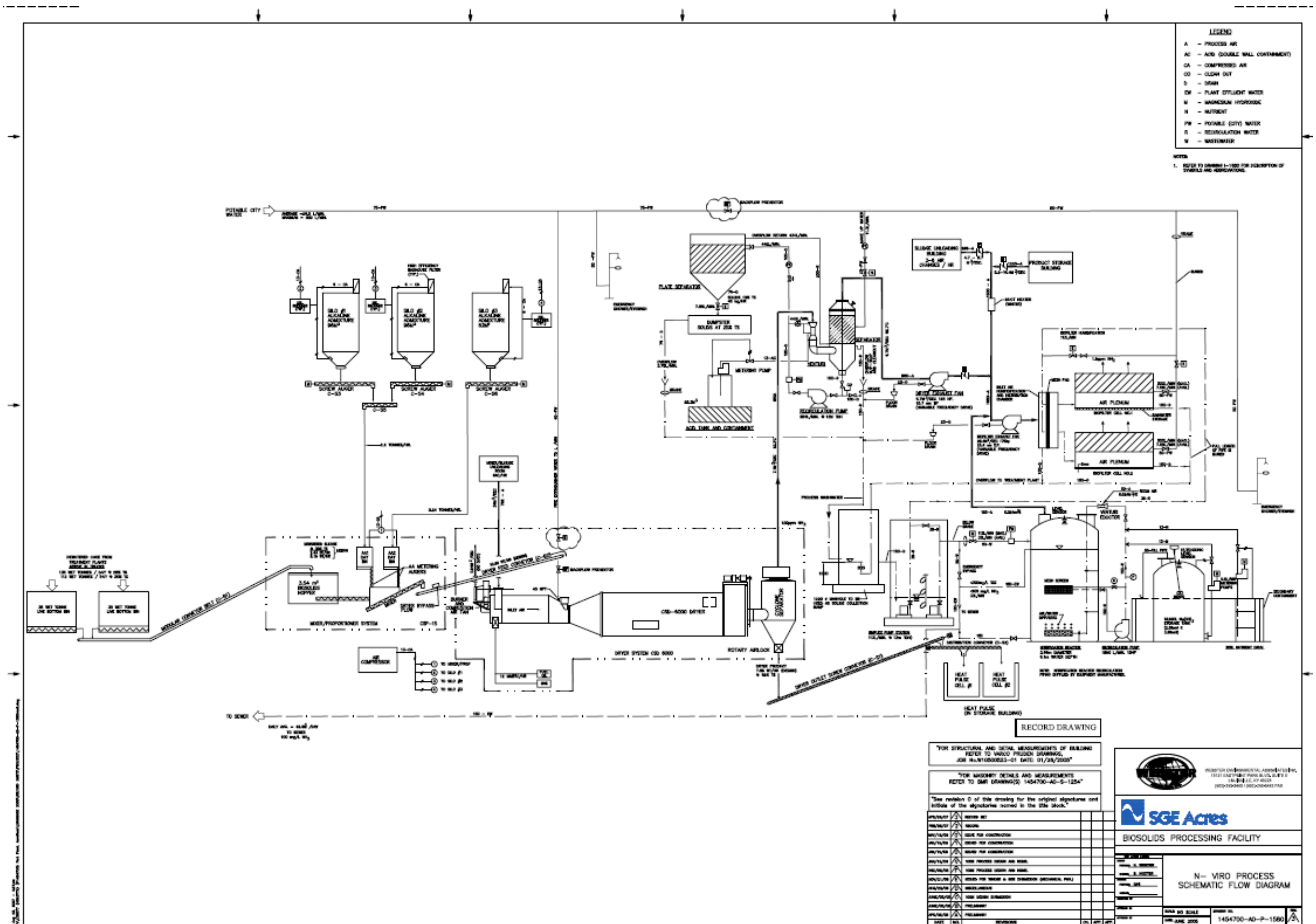
PRD Tech, Inc.
1776 Mentor Avenue; STE 400A
Cincinnati, OH 45212

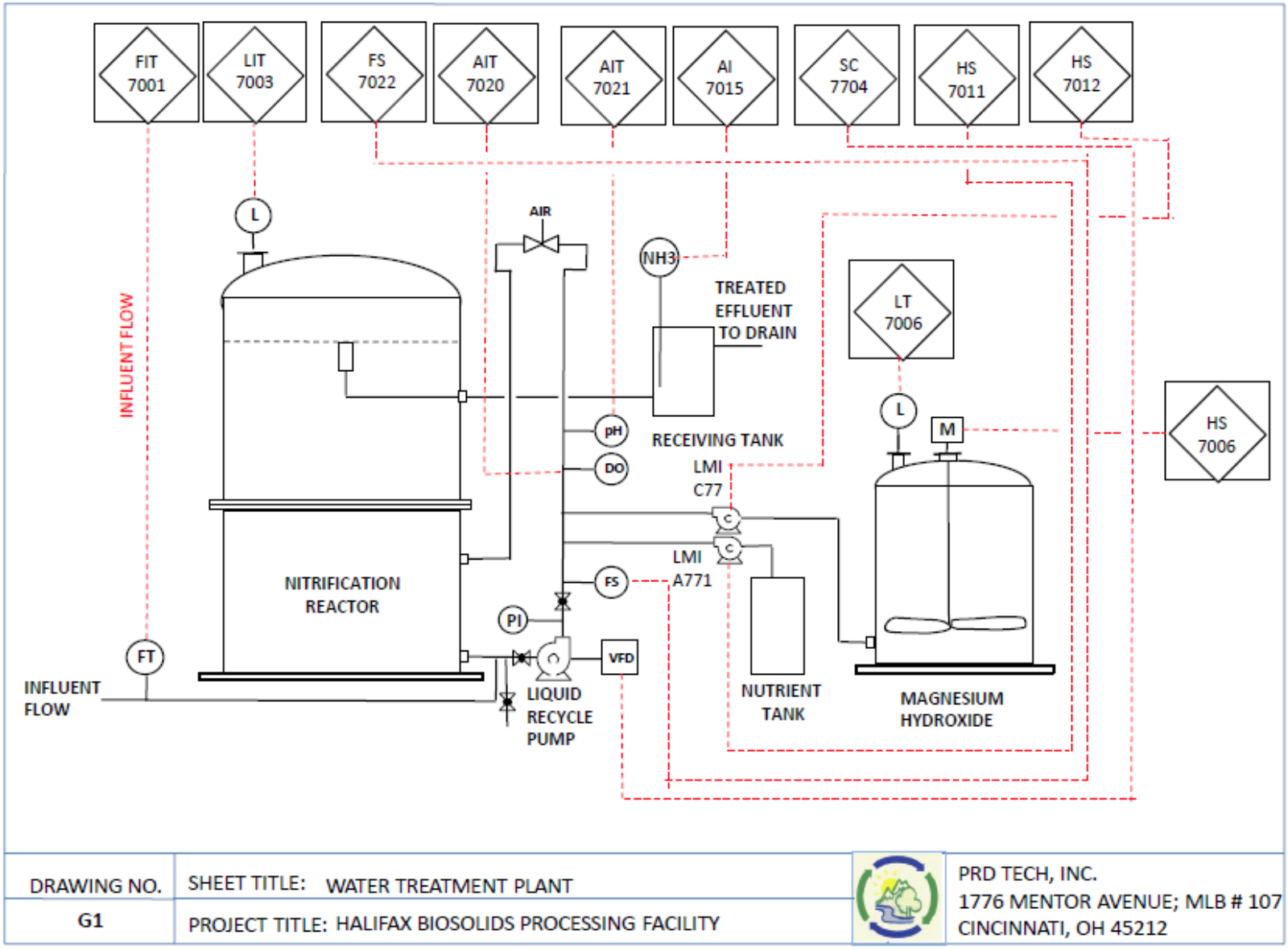
June 2007

Water Warriors has acquired its technologies from PRD Tech, Inc. In 2006, PRD Tech, Inc. constructed and installed a similar wastewater treatment plant in Halifax, Canada, which was designed to treat high levels of ammonia in the wastewater at the Halifax Biosolids Processing Facility, and the facility was designed by SGE Acres (Flow Diagram shown on the next page). The wastewater treatment process, treating 100,000 gallons per day of wastewater with levels of ammonia exceeding 300 mg/L is shown in the bottom right hand section of the flow drawing.

The flow diagram of the wastewater treatment process is shown in the subsequent figure. Wastewater flowed into an above-ground, cylindrical vessel, from which wastewater was recycled back using a recycle pump through an aerator, mounted at the top of the vessel, and then injected back into the vessel to create the air-water mixing. This provided dissolved oxygen in the water. The biomedia used was moving biomedia consisting of 1 inch size foam cubes (open cell foam), which moved around within the vessel. The average temperature of the influent wastewater was 10 deg C, and the objective of this design was to treat the influent BOD and ammonia and simultaneously digest any sludge produced in this process.

The treatment process was able to reduce the influent ammonia concentrations in the range of 310 – 400 mg/L to less than 10 mg/L in the effluent flow.


LEGEND
A – PROCESS AIR
AC – ACID (DOUBLE WALL CONTAINMENT)
CA – COMPRESSED AIR
CO – CLEAN OUT
D – DRAIN
EW – PLANT EFFLUENT WATER
M – MAGNESIUM HYDROXIDE
N – NUTRIENT
PW – POTABLE (CITY) WATER
R – RECIRCULATION WATER
W – WASTEWATER
NOTES:
1. REFER TO DRAWING I-1500 FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS.
POTABLE CITY WATER
PLATE SEPARATOR
ACID TANK AND CONTAINMENT
METERING PUMP
RECIRCULATION PUMP
SLUDGE UNLOADING BUILDING
PRODUCT STORAGE BUILDING
AIR PLENUM
SCREW AUGER
MIXER/PROPORTIONER SYSTEM
DRYER SYSTEM CSD 6000
CSD-6000 DRYER
ROTARY AIRLOCK
CYCLONE SEPARATOR
AIR COMPRESSOR
HEAT PULSE CELL #1
HEAT PULSE CELL #2
HEAT PULSE (IN STORAGE BUILDING)
TO SEWER
RECORD DRAWING
"FOR STRUCTURAL AND DETAIL MEASUREMENTS OF BUILDING REFER TO VARCO PRUDEN DRAWINGS, JOB No.N10500523-01 DATE: 01/28/2005"
"FOR MASONRY DETAILS AND MEASUREMENTS REFER TO SMR DRAWING(S) 1454700-A0-S-1254"
"See revision 0 of this drawing for the original signatures and initials of the signatories named in the title block."
SGE Acres
BIOSOLIDS PROCESSING FACILITY
N– VIRO PROCESS
SCHEMATIC FLOW DIAGRAM
NO SCALE
JUNE 2005
1454700-A0-P-1560



DRAWING NO.	SHEET TITLE: WATER TREATMENT PLANT	PRD TECH, INC. 1776 MENTOR AVENUE; MLB # 107 CINCINNATI, OH 45212
G1	PROJECT TITLE: HALIFAX BIOSOLIDS PROCESSING FACILITY	

Magnesium Hydroxide tank to supply alkalinity for nitrification in bioreactor.

OPTIMIZING OPERATION OF WASTEWATER TREATMENT PLANT USING GENE PROBE ANALYSIS

Prepared by:

Water Warriors, Inc.
1776 Mentor Avenue; STE 400F
Cincinnati, OH 45212

January 2019

INTRODUCTION

The gene probe technology is the only technology that allows highly specific visualization, identification and quantification of microorganisms. Dye-labeled and specifically programmed gene probes penetrate into the sample and bind highly specifically to the individual and living microorganisms. In the evaluation, the luminous and completely preserved microorganisms can then be quickly and reliably detected and quantified.

Gene probes are extremely small pieces of the genetic substance DNA. They can be designed to specifically bind to defined target structures in living bacteria cells. There are target structures or markers that are typical for an individual species of bacteria, but there are also markers that are typical for an entire group of bacteria. The advantages of this method are speed, reliability, extremely high specificity and the fact that the microorganisms are identified, quantified and visualized directly in the sample.

For more than 100 years, bacteria have been cultivated on artificial media in order to be able to detect them. And this has been the standard method in spite of the fact that up to 99% of all bacteria are non-cultivable. Gene probe analysis represents a different way of detecting bacteria which does not involve the conventional approach of incubating the sludge sample in order to detect the species of bacteria present in the sample. Gene probe technology uses dye labeled gene probes, which specifically bind to specific target sequences within living cells. When the labels are excited, they can be directly observed by a microscope. The number of labeled cell scan be quantified by a computer program which scans the image and provides a relative concentration of the targeted cells.

The main advantages of this gene probe technology are:

- **Direct:** Measurement of microorganisms directly in the sample
- **Fast: the** fastest possible detection of changes; after a change of process parameters short-term conclusions are obtained
- **Only live bacteria:** dead bacteria are not detected
- **Simple:** no calibration necessary; no indirect parameters
- **Specific:** accurate identification of bacteria regardless of their morphology
- **Comprehensive:** up to 100% of the bacteria can be detected, regardless of their cultivability
- **Robust:** no use of enzymes; trouble-free
- **Stable:** samples allow reproducible measurements over any period of time

GENE PROBE ANALYSIS

Samples of wastewater with sludge, as received, were immediately fixed in alcohol and refrigerated. The experimental protocol is given below:

Required materials

- Sterile sampling tube (plastic: PP or PS) e.g. 15 ml.
- Pure ethanol p.a. (> 96-99.9 %)

Protocol

1. Take sludge sample and mix well
2. Add 4 ml of sludge sample to sterile sampling tube
3. Add the identical volume (4 ml) of pure ethanol to the sampling tube (dilution 1:1)
4. Close tube tightly, eventually close it additionally with parafilm.
5. Mix solutions thoroughly.

For 1-2 days, these samples can be preserved in the refrigerator at 4-8 deg C, and for longer storage times, the samples can be kept in the freezer at -20 deg C.

Gene probes have been developed for a variety of organisms:

1. **Nitrification:** The nitrifying bacteria consist of the group of ammonium oxidizing bacteria (AOB) and the group of nitrite oxidizing bacteria (NOB). They belong to the group of chemolithotrophic bacteria and can oxidize both ammonium to nitrite and further oxidize the nitrite to nitrate. For example, anaerobic oxidation of ammonia is conducted by Annamox bacteria, which can be detected using these specific gene probes.

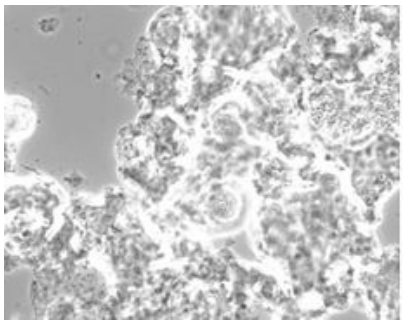
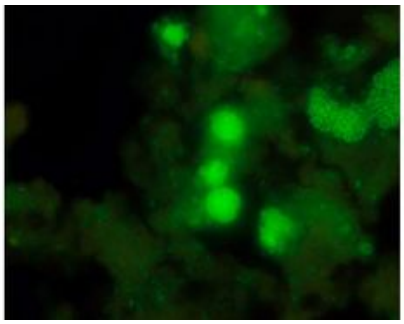
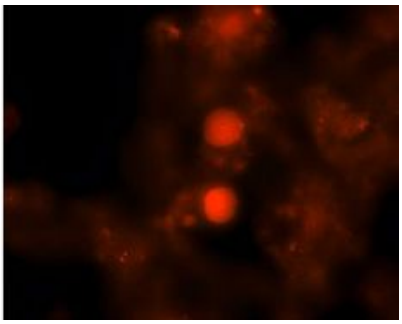


Image of sludge sample



Dye induced fluorescence of of all living bacteria



Dye induced florescence of Annamox bacteria only

2. **Denitrification:** Detection of denitrifiers is important in activated sludge to convert the nitrates and nitrites to nitrogen gas.

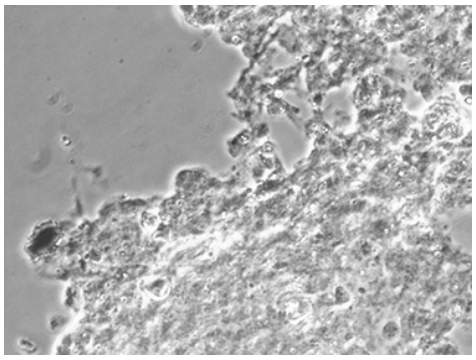
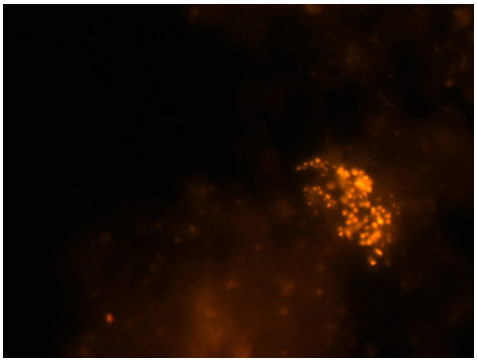
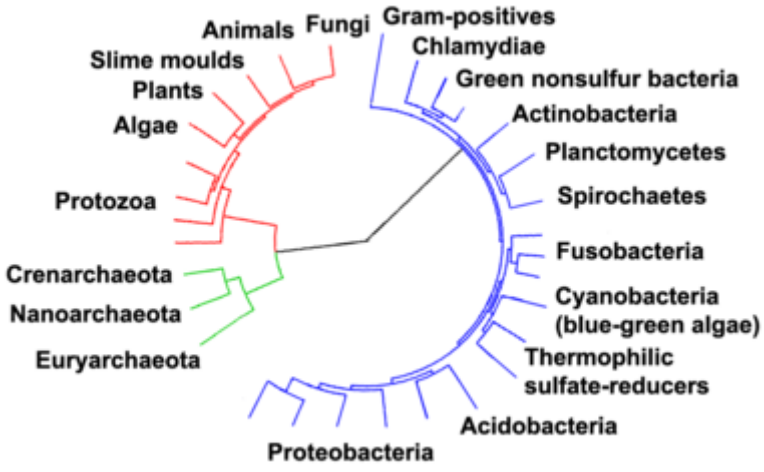


Image of Activated Sludge



Denitrifying bacteria are red in color

3. **Performance of Biodegradation Performance:** In a wastewater treatment plant, the ability of the bacteria to convert organic loading to carbon dioxide and water, results in the treatment of water. In contrast to a pure culture, in which only bacteria of one kind are present, the sludge consists of millions of different species, some of which work together or in competition with each other. The bacteria can be divided into individual groups using molecular biological methods. These groups are called Phyla. The subdivision is due to the natural relationship of the bacteria and not to artificial characteristics.



Profiles of wastewater samples are the subdivision of all bacteria into different groups and their subsequent quantification. The profiles are created using the gene probe technique, which records the bacterial groups directly without incubating the cultures.

The samples are examined with a selected gene probe set, which subdivides the bacteria expected in wastewater samples into large groups and records them to 95-98% completely. All populations are quantified in percentage relative to the total living biomass. The evaluation is qualitative and quantitative using the microscopic analysis.

The following 10 major bacterial groups are generally investigated: alpha, beta, gamma and delta proteobacteria, actinobacteria, firmicutes, cytophaga flexibacter subphylum, planctomycetes, chloroflexi, nitrospirae.

Furthermore, important functional groups are analyzed:

- the filamentous bacteria are quantified with individual gene probes (in addition to the quantification between problem-causing, (bulking, foam) and rather non-critical floc-forming filamentous bacteria; and
- the aerobic nitrifying bacteria are quantified as groups (AOB and NOB).

In addition, an absolute quantification of the total and living cell counts (cell count/ml can be performed.

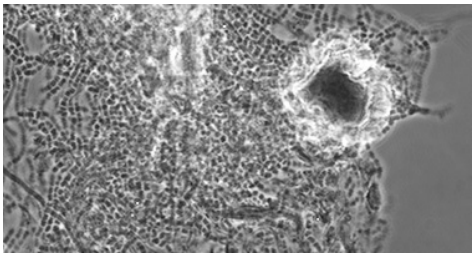
A reference profile can be created when the plant is functioning properly and then compared when there is an upset in the operation of the plant. This enables the plant personnel to identify the source of organisms responsible for the plant upset and take action before the effluent quality is affected adversely. This allows the plant to be controlled much better than reacting to large upsets in effluent quality, sometimes resulting in fines. Furthermore, when the effluent quality is out of bounds, it can take several weeks to bring the effluent back within the permit guidelines, while the deviation in sludge bacteria composition would have occurred several weeks before the violation of the permit requirements.

4. **Filamentous Bacteria:** Massive appearance of filamentous bacteria can cause bulking or floating sludge and consequently lead to contamination of the effluent. Bulking and floating sludge prevent sludge settling and result in high turbidity of the effluent.

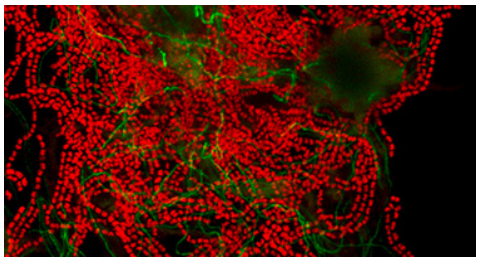
Floating Sludge

Slow Sludge Settling

Using gene probe technology, filamentous bacteria can be identified easily.



Difficult to identify Filamentous in regular microscopic image of sludge



Filamentous Organisms visible using gene probe analysis

The following filamentous bacteria are analyzed:

Haliscomenobacter hydrossis
Microthrix parvicella
Nostocoida limicola
Nocardioform actinomycetes/Mycolata
Thiothrix and Type 021N
1851

RESULTS OF GENE PROBE ANALYSIS

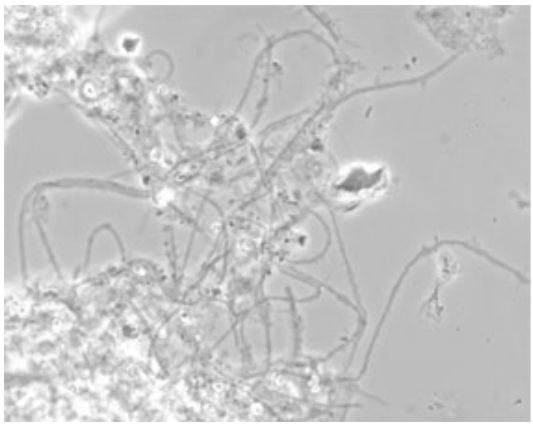
Two samples of wastewater (Samples 1 and 2) were received from Miller Coors. The first sample was analyzed qualitatively only to determine the dominant filamentous organisms present in the sample. The second sample was then analyzed using the gene probes for only the dominant filamentous organisms.

Analysis of Sample 1 shows that *Microthrix parvicella* was the dominant species present with branch growing, gram-positive filaments and single cells such as *Nocardia, Gordona, Rhodococcus, Skermania* and *Tsukamurella* (various genera of *Nocardioform Actinomycetes*), as the minor species. These bacteria are also considered primary cause of floating sludge and scum forming in many wastewater treatment plants.

The second sample of wastewater, Sample 2, as received, was divided into six (6) separate samples, after mixing, and labelled as 2.A, 2.B, 2.C,2.a, 2.b and 2.c. Samples 2.A, 2.B and 2.C were immediately fixed with alcohol, and analyzed using the gene probes for only the dominant filamentous, as identified using the first wastewater sample, i.e., Sample 1.

For samples 2.a, 2.b and 2.c, 1 ppm SETZYME solution in deionized, sterilized water was added to each of these samples, and after mixing and incubation at room temperature for 1 day, each of these samples were analyzed, after fixi9ng with alcohol, using gene probes for *Microthrix parvicella* and gram-positive Nocardia. Longer incubation times after addition of enzyme solution may have resulted in greater reductions in the relative amounts of filamentous bacteria, when compared with the raw sample.

The photograph below shows an image of the sludge sample using a microscope and the second image shows the image after addition of the specific gene probe for *Microthrix parvicella*.



Regular Microscope

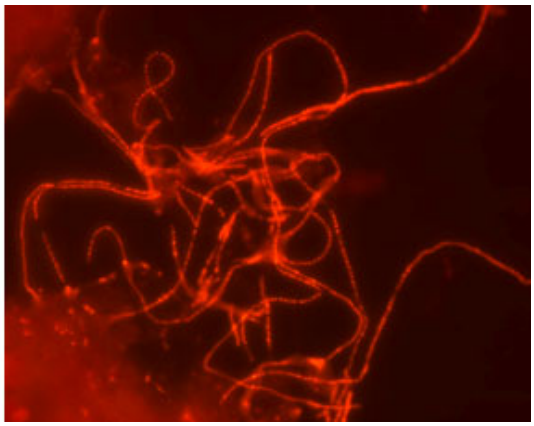
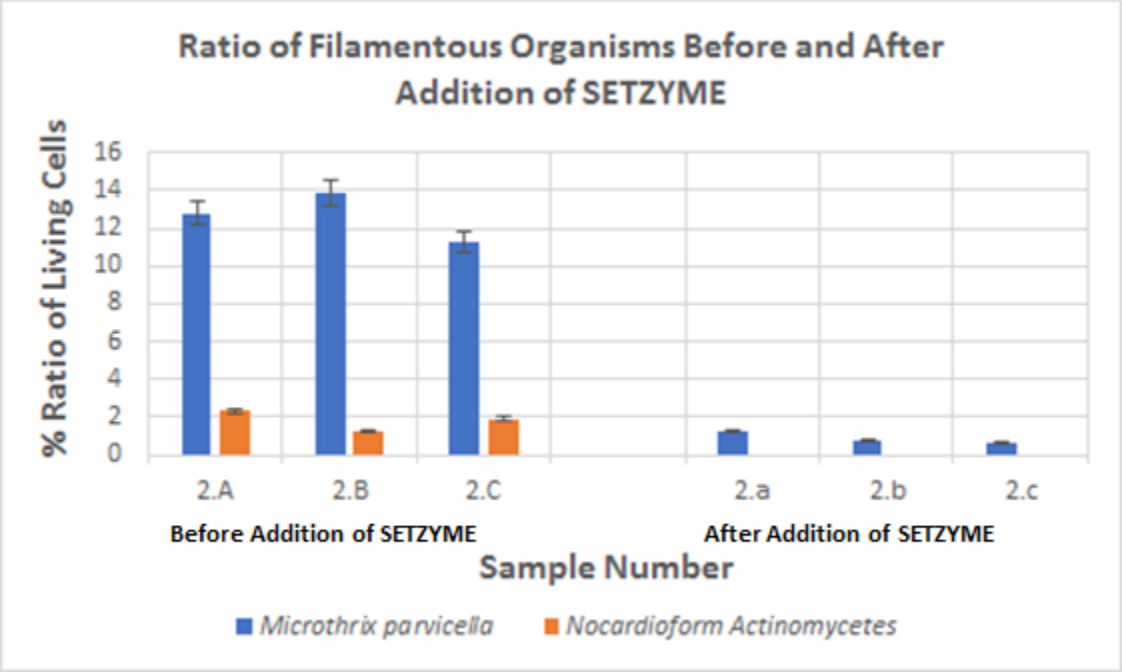


Image after use of gene probe for *Microthrix parvicella*

Results of the gene probe analysis for the samples gave the following results:

Before Addition of SETZYME		
Sample	**Ratio of Living Cell Count (%)**	
	Microthrix parvicella	***Nocardioform Actinomycetes***
2.A	12.8	2.3
2.B	13.9	1.2
2.C	11.3	1.9
After Addition of SETZYME and incubatioin for 1 day		
Sample	**Ratio of Living Cell Count (%)**	
	Microthrix parvicella	***Nocardioform Actinomycetes***
2.a	1.2	0
2.b	0.8	0
2.c	0.6	0

The graph below shows the results before and after the addition of SETZYME (1 ppm solution)



Clearly, there was a reduction of the dominant filamentous organisms after addition of SETZYME and incubation of the samples. Some reduction in % ratio can be attributed to growth of living bacteria added from the addition of SETZYME. However, it was calculated that using an acceptable growth rate of normal aerobic bacteria, the % reduction due to growth of bacteria, other than filamentous, was only about 1-2 % points and the rest of the % reduction in filamentous was mainly due to inhibition in the growth of filamentous organisms.

1776 Mentor Avenue; Suite 400F
Cincinnati. OH 45212

SAFETY DATA SHEET

According to OSHA Hazard Communication Standard 29 CFR 1910.1200; GHS 4th Revision

SECTION 1 IDENTIFICATION

Product Name: **SETZYME**

Identified Uses: Reduce the growth of filamentous organisms

Company: Water Warriors, Inc.
1776 Mentor Avenue; STE 400F
Cincinnati, OH 45212
Tel: (513) 673 3583

Website: www.waterwarriorssolutions.com

SECTION 2 HAZARD IDENTIFICATION

Classification	Category	H-statement
Skin irritant	2	H315
Eye irritant	2A	H319

Hazard pictograms

Signal words Warning

Hazard statements
Causes skin irritation (H315)
Causes serious eye irritation (H319)

Precautionary statements
P264 – Wash thoroughly with soap and water after handling.
P280 – Wear protective gloves, eye and/or face protection.
P302 + P352 – IF ON SKIN: Wash with soap and plenty of water.
P305 + P351 + P338 – IF IN EYES: Rinse cautiously with water for 15 minutes. Remove contact lenses, if present and easy to do so. Continue rinsing;
P332 + P313 – If skin irritation occurs: Get medical advice/attention.
P337 + P313 – If eye irritation persists: get medical advice/attention.
P362 + P364 – Take off contaminated clothing and wash before reuse.

Further information
Persons who have a compromised immune system or a history of severe allergic response should avoid contact and/or breathing dust or mist from product handling or manufacturing processes.
Crystalline silica is a known cause of silicosis (a non-cancerous lung disease). Prolonged and/or repeated inhalation must be avoided.

Other hazards

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Identity
Common Name
Synonyms Degradation Enzymes absorbed on wheat bran and corn gluten
Hazardous Components

Chemical Name (Concentration)	**CAS No.**
Dolomite (< 40%)	16389-88-1
Protease (< 1%)	9014-01-1
Amylase (< 1%)	9000-90-2

Chemical Name (Concentration)	**CAS No.**
Crystalline Silica (< 0.4%)	14808-60-7

Non-Hazardous Components

Name	**CAS No.**
Wheat bran	116469-86-4
Corn gluten	66071-96-3
Diatomaceous earth	91053-39-3
Sodium lauryl sulfate	151-21-3

SECTION 4 FIRST-AID MEASURES

Eye	Product may cause eye irritation. Direct contact with eyes should be avoided. In case of contact with eyes, flush eyes with water for at least 15 minutes. If irritation persists, seek medical attention.
Skin	Product may cause skin irritation. Direct contact with skin should be avoided. In case of contact with skin, wash skin with soap and water. Remove contaminated clothing and wash.
Inhalation	May cause sensitization by inhalation in hypersensitive individuals. Avoid product handling which results in dust generation. If inhaled, remove from contaminated area to fresh air. Report situation. Seek medical attention if allergic response exhibited.
Ingestion	Ingestion of material may cause mouth and throat irritation and/or gastric disturbance. If swallowed, rinse mouth and throat with tap water. Drink water.
Most important symptoms/effects, acute and delayed	Sensitization (shortness of breath, wheezing, and labored coughing) take individual to emergency room.
Further information	

SECTION 5 FIRE-FIGHTING MEASURES

Suitable extinguishing media	Dry chemical, carbon dioxide, chemical foam or water fog
Specific hazards arising from the chemical	
Special protective actions for fire-fighters	

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment, and emergency procedures	Provide sufficient ventilation. Advice for emergency responders: protective equipment see section 8.
Environmental precautions	
Methods and materials for containment and cleaning up	Spilled product should be removed immediately to avoid formation of dust. Contain spill, sweep up avoiding airborne dust. Provide sufficient ventilation.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling	Avoid creating dust. Adequately ventilate when handling this product. Provide eyewash capability.
Conditions for safe storage, including any incompatibilities	No special requirements. Organic dusts are a weak explosion hazard. Not hazardous under normal storage and use conditions.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control Parameters

Name	% by Weight	TLV (ACGIH)	PEL (OSHA)
Dolomite	<40	10 mg/m^3	5 mg/m^3
Crystalline silica	<0.4	0.1 mg/m^3	0.1 mg/m^3
Protease	<1	0.00006 mg/m^3 (as pure protease)	
Amylase	<1	None established	
Wheat bran	<40	10 mg/m^3 (nuisance dust)	
Corn gluten	<40	10 mg/m^3 (nuisance dust)	
Diatomaceous earth	<1	10 mg/m^3 (nuisance dust)	
Sodium lauryl sulfate	<3	10 mg/m^3 (nuisance dust)	

* Specific limits not set for these chemicals. Limits are shown for Particles Not Otherwise Regulated (PNOR) or Particles Not Otherwise Classified (PNOC). First number is for total dust second number { } is for respirable dust

Personal Safety Equipment

Eye Protection	Safety glasses with side shields or face shield.
Skin Protection	HANDS: 0.11 mm Nitrile rubber gloves (breakthrough time > 480 min) Wear long-sleeve shirt, trousers, safety shoes and gloves (rubber or vinyl).
Respiratory protection	Dust mask or respirator for particle removal (NIOSH).
Industrial Hygiene	Maintain good housekeeping. Avoid dusty conditions. Wash hands and exposed skin after contact. Avoid contact with food or food preparation surfaces. If exposure of food surfaces occurs, wash with germicidal detergent or chlorine bleach. Remove and wash contaminated clothing.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

BASIC PHYSICAL AND CHEMICAL PROPERTIES	
Appearance	Tan granular powder
Odour	Yeast odor
Odour threshold	Information Not Available
pH	6 – 9 (1% suspension)
Melting point /Freezing Point	Information Not Available
Initial Boiling point and boiling point range	Does Not Apply
Flash Point	Does Not Apply
Evaporation rate	Does Not Apply
Flammability (solid; gas)	Information Not Available
Upper/lower flammability or explosive limits	Does Not Apply
Vapour pressure	Does Not Apply
Vapour density	Does Not Apply
Relative density	Information Not Available
Solubility (ies)	< 5% in water
Partition coefficient: n-octanol/water	Does Not Apply
Auto-ignition temperature	Information Not Available
Decomposition temperature	Information Not Available
Viscosity	Does Not Apply
Other Physical/Chemical Properties	Information Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	Stable under normal conditions and use.
Possibility of hazardous reactions	Information Not Available
Conditions to avoid	Freezing or temperature greater than 100°F (40°C)
Incompatible materials	Strong acids, bases or oxidizers
Hazardous decomposition products	Information Not Available

SECTION 11 TOXICOLOGY INFORMATION

Acute toxicity	Information Not Available
Skin Corrosion/Irritation	Irritation
Serious Eye Damage/Irritation	Irritation
Respiratory or Skin Sensitization	May cause respiratory allergy in susceptible individuals: sensitization (shortness of breath, wheezing, and labored coughing) take individual to emergency room.
Ingestion	Mouth/throat irritation, gastric disturbance
Germ Cell Mutagenicity	Information Not Available
Carcinogenicity	Crystalline silica probably carcinogenic NTP: No IARC Monographs: No OSHA Regulated: No
Reproductive Toxicity	Information Not Available
Specific Target Organ Toxicity – Single Exposure	Information Not Available
Specific Organ Toxicity – Repeated Exposure	Information Not Available
Aspiration Hazard	Information Not Available
General Remarks	Product may contain <1% crystalline silica (CS). IARC has classified CS as probably carcinogenic for humans (2A). NTP lists CS as a substance which may reasonably be anticipated to be a carcinogen. CS is a known cause of silicosis (a non-cancerous lung disease). Enzymes in this product are non-toxic (LD 50 >2 g/kg in rats).

SECTION 12 ECOLOGICAL INFORMATION

Toxicity	Information Not Available
Persistence and degradability	Readily biodegradable
Bioaccumulative potential	Information Not Available
Mobility in Soil	Information Not Available
Other adverse effects	Information Not Available

SECTION 13 DISPOSAL CONSIDERATIONS

Methods	Dispose of all wastes in accordance with all Federal, state and local agencies.
Containers	n/a

SECTION 14 TRANSPORTATION INFORMATION

UN Number	Mixture not classified as Hazardous according to Regulation (EC) 1272/2008.
UN Proper Shipping Name	n/a
Transport Hazard Class	n/a
Packing Group (if applicable)	n/a
Environmental Hazards	n/a
Special Precautions for User	n/a
Transport in Bulk According to Annex II of	n/a
MARPOL 73/78 and the IBC Code	
DOT Proper Shipping Name	Chemicals not otherwise indexed (NOI) non-hazardous.

SECTION 15 REGULATORY INFORMATION

EU Directive 2000_54 regarding risks from biological agents: micro-organisms in Class 1 may be used without restriction.

WGK (Water Hazards Class): 0 non-hazardous to water.

WHMIS: Toxic Class D2B (eye irritant)

SECTION 16 OTHER INFORMATION

Key: N/A, n/a – Not available

Components not precisely identified are proprietary or non-hazardous. All chemical ingredients appear on the EPA TSCA inventory.

The information contained in this Safety Data Sheet, as of the issue date, is believed to be true and correct. However, the accuracy or completeness of this information and any recommendations or suggestions are made without warranty or guarantee. Since the conditions of use are beyond the control of our company, it is the responsibility of the user to determine the conditions of safe use of this product. The information in this sheet does not represent analytical specifications; for this information contact : **Water Warriors, Inc. Chief Technical Officer, Dr. Rakesh Govind**