Exhibit A

STATE OF MISSOURI

Matt Blunt
Secretary of State

CORPORATION DIVISION

CERTIFICATE OF GOOD STANDING

I, MATT BLUNT, Secretary of the State of Missouri, do hereby certify that the records in my office and in my care and custody reveal that

CALVEY BROOK SEWER INC.
00520625

was created under the laws of this State on the 29th day of April, 2003, and is in good standing, having fully complied with all requirements of this office.

IN TESTIMONY WHEREOF, I have set my hand an imprinted the GREAT SEAL of the State of Missouri, on this, the 22nd day of August, 2003

Matt Blunt
Secretary of State

Certification Number: 6037889-1 Page 1 of 1 Reference:
Verify this certificate online at http://www.sos.state.mo.us/businessentity/verification

SOS #30 (1-01)

No. 00520625

STATE OF MISSOURI

Matt Blunt
Secretary of State

CORPORATION DIVISION

CERTIFICATE OF INCORPORATION

WHEREAS, duplicate originals of Articles of Incorporation of

CALVEY BROOK SEWER INC.

have been received and filed in the office of the Secretary of State, which Articles, in all respects, comply with the requirements of General and Business Corporation Law;

NOW, THEREFORE, I, MATT BLUNT, Secretary of State of the State of Missouri, by virtue of the authority vested in me by law, do hereby certify and declare this entity a body corporate, duly organized this date and that it is entitled to all rights and privileges granted corporations organized under the General and Business Corporation Law.

IN TESTIMONY WHEREOF, I have set my hand and imprinted the GREAT SEAL of the State of Missouri, on this, the 29th day of APRIL, 2003.

Matt Blunt
Secretary of State

$58.00

SOS #30 (1-01)

State of Missouri

Matt Blunt, Secretary of State

Corporations Division
P.O. Box 778, Jefferson City, MO 65102

James C. Kirkpatrick State Information Center
600 W. Main Street, Rm 322, Jefferson City, MO 65101

Articles of Incorporation

(To be submitted in duplicate by an attorney or an incorporator)

The undersigned natural person(s) of the age of eighteen years or more for the purpose of forming a corporation under the General and Business Corporation Law of Missouri adopts the following Articles of Incorporation:

Article One

The name of the corporation is CALVEY BROOK SEWER INC.

Article Two

The address, including street and number, if any, of the corporation's initial registered office in this state is

2801 W. OSAGE (Street Address (P.O. Box may only be used in conjunction with a physical street address)) PACIFIC (City) MO 63069 (State/Zip)

and the name of its initial agent at such address is Jeff Snider

Article Three

The aggregate number, class and par value, if any, of shares which the corporation shall have authority to issue shall be:

1,000 Shares @ 1.00 Per share

The preferences, qualifications, limitations, restrictions, and the special or relative rights, including convertible rights, if any, in respect to the shares of each class are as follows:

FILED

APR 29 2003

Matt Blunt
SECRETARY OF STATE

Article Four

The extent, if any, to which the preemptive right of a shareholder to acquire additional shares is limited or denied.

Article Five

The name and place of residence of each incorporator is as follows:

Name	Street	City/State/Zip
JEFF SNIDER	11616 Kennedy RD ~~Po Box 104~~	ROBERTSVILLE MO 63072
ROGER GULLET	2135 young Rd	PACIFIC MO 63069

Article Six
(Designate which and complete the applicable paragraph.)

? The number of directors to constitute the first board of directors is 2.
Thereafter the number of directors shall be fixed by, or in the manner provided by the bylaws. Any changes in the number will be reported to the Secretary of State within thirty calendar days of such change. **(NOTE: If the number of directors is to be one or two, do not check this box.)**

OR

? The number of directors to constitute the board of directors is ________. (The number of directors to constitute the board of directors must be stated herein if there are to be less than three directors. The person to constitute the first board of directors may, but not need, be named.)

Article Seven

The duration of the corporation is PERPETUAL
(indicate either perpetual or the date the corporation expires)

Article Eight

The corporation is formed for the following purposes:
UTILITY CO.

IN WITNESS WHEREOF, these Articles of Incorporation have been signed on APRIL 29 2003
month/day/year

[signature] Signature — Jeff Snider Printed Name

[signature] Signature — ROGER GULLET Printed Name

Signature — Printed Name

Signature — Printed Name

State of Missouri
County of St Louis City } ss

I, Jacqueline A. Green, A Notary Public, do hereby certify that on 4-29-03 (month/day/year)

personally appeared before me Jeff Snider Roger Gullet, and being duly sworn by me, acknowledged that they ~~he/she~~ signed as his/her own free act and deed the foregoing document in the capacity therein set forth and declared that the statements therein contained are true.

IN WITNESS WHEREOF, I have hereunto set my hand and seal the day and year before written.

(Notarial Seal or Stamp)

Jacqueline A Green
Notary Public

My commission expires _____

My County of Commission _____

JACQUELINE A GREEN
Notary Public - Notary Seal
STATE OF MISSOURI
ST. LOUIS COUNTY
My Commission Exp. Mar. 22, 2004

Corp. #41 (03/01)

Exhibit B

AFFIDAVIT

State of Missouri)
) ss
County of Franklin)

I, Jeff Snider, of lawful age, being first duly sworn upon my oath, state that I am the Vice-President of Calvey Brook Sewer Inc. and that the facts set forth in the foregoing Application are true to the best of my knowledge and belief.

Jeff Snider

Subscribed and sworn before me this 2nd day of January, 2004.

Notary Public

My commission expires:

STEVEN L. KAMIENSKI
Notary Public - Notary Seal
State of Missouri
St. Charles County
My Commission Expires June 20, 2006

Exhibit C

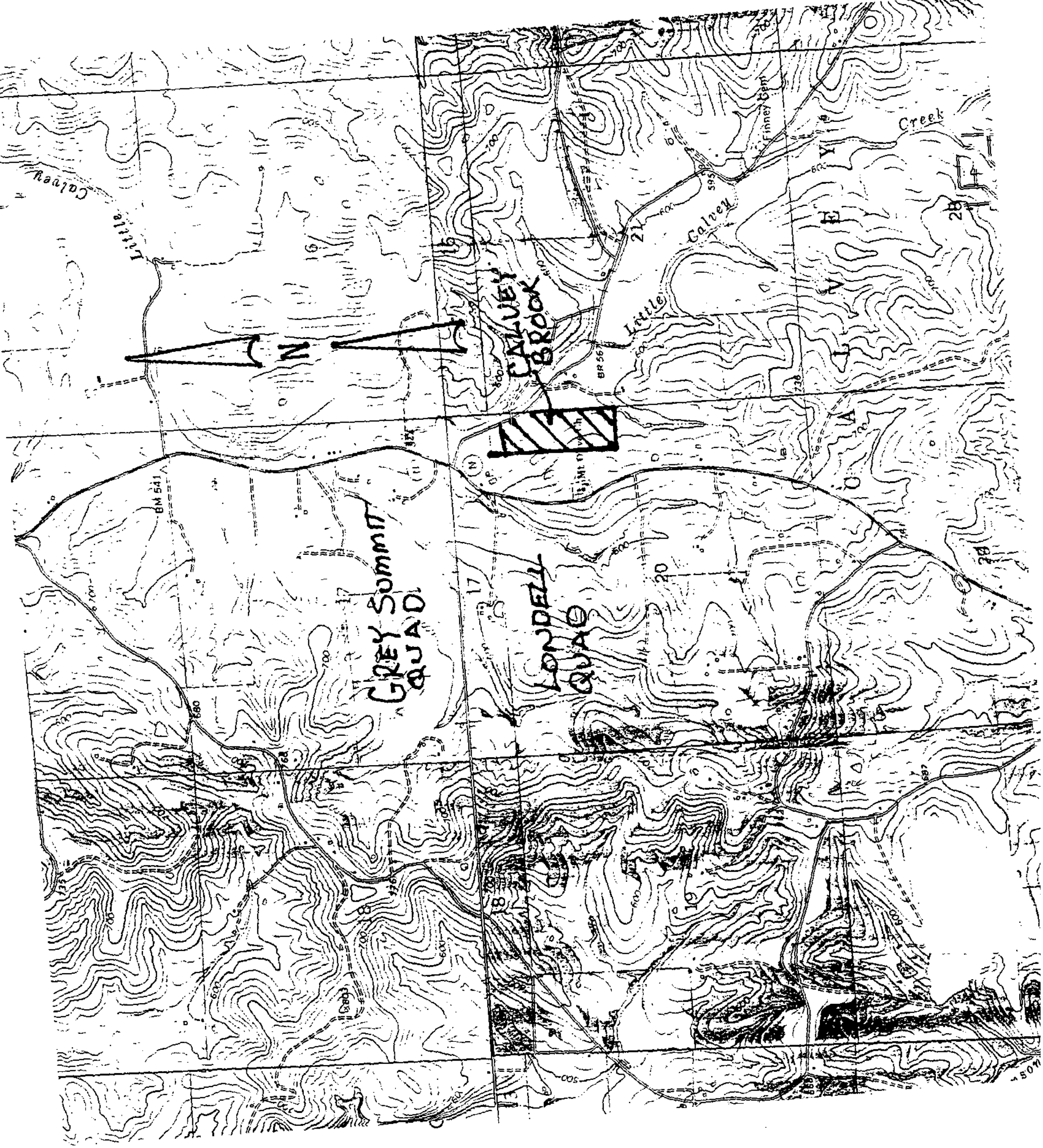

N
CALVEY BROOK
GREY SUMMIT QUAD
LONDELL QUAD
Little Calvey
Creek

EXHIBIT D

LEGAL DESCRIPTION

A tract of land being part of the Northeast quarter of Section 20, Township 42 North, Range 2 East of the 5th P.M., Franklin County, Missouri, being more fully described as follows: Beginning at the intersection of the Southwest right-of-way of Finney Road with the section line located South 02 degrees 07 minutes 43 seconds West 663.52 feet from a stone at the Northeast corner of said Section 20; thence South 02 degrees 07 minutes 44 seconds West on the section line 1356.97 feet to the centerline of a creek; thence on the centerline of said creek as follows: North 49 degrees ' 51 minutes 29 seconds West 59.03 feet; South 69 degrees 07 minutes 51 seconds West 157.81 feet; North 57 degrees 12 minutes 25 seconds West 65.14 feet; South 68 degrees 42 minutes 54 seconds West 126.36 feet; South 84 degrees 15 minutes 33 seconds West 102.41 feet; North 86 degrees 45 minutes 35 seconds West 121.86 feet; and North 60 degrees 44 minutes 05 seconds West 68.30 feet; thence leaving said creek North 0 degrees 36 minutes 35 seconds East on the property line 699.29 feet to an iron rod; thence North 01 degree 54 minutes 47 seconds East on the East line of Finney Lake Estates for 939.81 feet; thence North 73 degrees 19 minutes 45 seconds East 517.78 feet to the West right-of-way of Finney Road; thence on the West right-of-way of Finney Road as follows: South 17 degrees 16 minutes 41 seconds East 173.84 feet; South 18 degrees 45 minutes 34 seconds East 118.50 feet; South 23 degrees 00 minutes 47 seconds East 127.03 feet; and South 33 degrees 15 minutes 56 seconds East 44.47 feet to the point of beginning,

ITEM 1

Wastewater Treatment Facility

Packed Media Bed Filter System

For

Calvey Brook Estates

April 21, 2003

Owner G&S Development
2801 West Osage Suite 5
Pacific Missouri 63077

by
Wunderlich Surveying & Engineering, Inc.
20 South Church Street
P.O. Box 536
Union Missouri 63084

4-22-03

Table of Contents

INTRODUCTION:

G&S Development currently owns a 25 acre tract of land that is part of the northeast quarter of section 20 township 42 north range 2 east of the 5th prime meridian. They intend to create a 36 lot residential subdivision on this ground. Franklin County Planning and Zoning allows for this type of subdivision under the condition that central water and central sewage service is provided. An application for a construction permit to build the central water system has been submitted to the public drinking water program for review.

The area where the proposed subdivision will be constructed is in Franklin County Public Water District Number 2(PWSD). However, According to the Franklin County Planning and Zoning Department, this PWSD exists on paper only and it has no active members or persons to contact.

DESIGN ASSUMPTIONS

It was assumed that the 36 lot subdivision would be residential in nature. The design population per home was assumed as 3.7 persons per home. This created a design population of 133 persons. The following treatment options were considered to treat the residential waste.

Options

The first option was the construction of a three-cell lagoon. The construction cost of the lagoon is low and the operation cost of the lagoon is low as well. However the require size of the lagoon would make the subdivision unprofitable due to the number of lots lost to the construction of the lagoon.

A second option was a mechanical treatment facility. The mechanical plant will provided better effluent quality than the lagoon. The plant will cost considerably more than a lagoon system. These system usually require three phase electric. This site has only single phase electric available. The mechanical plant does require more maintenance and a higher skilled operator.

The third option was a sand filter system. These systems cost approximately the same as the mechanical plant. They require single phase electric, and are relatively simple to operate. The sand filter system can provide very high quality effluent. However, the availability of the appropriate size media can be problem.

The forth option was a packed media bed system. This system operates similar to the sand filter, requires single phase electric, and easy to operate. The packed media bed is manufactured and assembled in a factory., and it can then be shipped to the site ready for installation and use. The filter media is a fiberglass blanket that can be washed clean and reused when it becomes necessry. The cost of this system is relatively expensive.

Given all of the above mentioned options the owners have chosen to use the packed media bed.

Site Consideration

The site chosen for the location of the sewage facility is at the lowest point of the subdivision. This site will be graded to prevent flooding of the treatment facility at the 100-yr flood plane as shown on the FEMA flood boundary maps.

A few small ponds are located within 2,500 feet of the treatment facility. All of these ponds are located up grade of the facility. A proposed water storage pond will be placed approximately 220 feet from the media bed. This water impoundment will be used by the fire department for water storage to help fight fire.

All private wells are located further than 200 feet from the treatment facility, and all existing homes are located greater than 200 feet from the facility. A water line from the subdivision water supply system will be constructed to the treatment facility. The water line will pass through a RPZ backflow preventer prior to discharging at the site.

Geohydrologic Evaluation

A geohydrologic evaluation was performed by the Division of Geology and Land Survey on this site. The original evaluation was for a mechanical plant. This evaluation showed that the stream was gaining and the site had slight geological limitations. Our office contacted the Division of Geology and Land Survey about changing the prior letter to a recirculating bed. DGLS stated that if your office required evaluation form to be changed that they would do so. A copy of the geohydrologic report has been included.

Collection System Design

The sewage collection system will consist of individual septic tanks placed on each lot, which will discharge effluent into a common small diameter gravity sewer that terminated at the treatment facility recirculation tank. Instead of providing a single septic tank for primary treatment of the wastewater, each home will have a septic tank equipped with a biological filter. The minimum size septic tank shall be 1,000 gallons. The tanks shall be sized in according to the Franklin County Building Codes. All of the septic tanks shall be water tight and be made of either single pour fiberglass or single pour concrete. All septic tanks shall be tested for leakage prior to use. Water tight tanks will help prevent infiltration of water into the system. The continuing authority will have to have access to the septic tanks and have easements to access the septic tanks for periodic maintenance of the tanks and the pumping of solids. The septic tanks will provide about three days of detention time, settlement of the solids, and primary treatment of the wastewater.

The screened effluent from the septic tanks will discharge into a 4-inch SDR 35 gravity collection main A normal gravity collection system consists of either 6-inch or 8-inch SDR 35 pipe laid at grade between manholes. Manholes are a point of possible infiltration. The proposed system will utilize clean outs instead of manholes. Infiltration should be minimized. by solvent welding all non gasketed joints and using a threading pvc plug in the top of the cleanouts. Cleanouts will be place no greater than 300-feet apart. The cleanouts will have a square concrete pad with a metal lid over them to help protect the plastic from accidental damage to the pipe. A tracer wire will be extended into the open area under the lid.

The 4-inch gravity sewer line will be laid with the slope of the ground ranging in depth from 4 to 6-feet. Because the collection lines will be transporting screened effluent, there will be no need to maintain scour velocity. The 4-inch collection line will have a locator wire run along the collection main to aid in locating the sewer main in the future.

Design Hydraulic Loading

Using Table I from 10 CSR 20.08, the design hydraulic loading rate of the system was assumed to be 75 gallons per day per person. When the design population of 133 persons is multiplied by the hydraulic loading rate it yields a hydraulic loading of 9,975 gallons per day. The lower loading rate was chosen because or the reduction in infiltration into the sewer collection system. The peak loading rate for the system will be approximately 28 gallons per minute or 39,960 gallons per day. A 4-inch diameter pipe flowing full and laid at ½ percent slope can carry 78 gallons per minute. The velocity in the pipe will be 2 feet per second. The 4-inch diameter collection system should be more than capable of handling the flow from the system.

Recirculation Tank Design

The total volume of the recirculation tank for the system was calculated to be around 12,000 gallons. The owners may be able to purchase a tract of land adjacent to the proposed subdivision and wanted to allow for a possible future connection to this system. The possible addition could yield a total of 40 to 45 homes on the proposed system. Assuming the addition of the additional homes and allowing for the future surge volume the tank size increased to 15,000 gallons. To allow for any unknowns or possible higher loading rates the final recirculation tank size was increased to 20,000 gallons. The additional cost to change from a 15,000 gallon tank to a 20,000 gallon tank was determined to be minimal.

The fiberglass recirculation tank will be 10-foot in diameter and 37-feet 8-inchs long. The tank will be equipped with a collection line inlet, three openings for duplex pump vaults, and a return line discharge inlet. Two of the three duplex pump vaults will have screened effluent pumps. The pumps will be used to lift the incoming waste to the Advantex pods for treatment. The third pump port will be sealed with a bolt down lid. This will allow for a future addition to the system if it becomes necessary.

The normal liquid depth of the recirculation tank for the proposed 36 lot subdivision will be 5-feet. this point is approximately equal to the average daily flow for the system. The low water pump off float will be set at 2 ½ feet from the bottom of the tank. The high water pump on float will be set at the 6-foot depth of the tank. This will provide approximately 2,700 gallons of surge storage. The emergency high water alarm will be placed at the 7-foot level which will provide 2,500 gallons of emergency storage prior to the alarm. At average daily flow It will take 6 hours to trigger this alarm. The total volume in the recirculation tank at the high emergency water alarm will be approximately 15,000 gallons. At this point 5,000 gallons of storage will remain in the tank and will allow for approximately 12 hours of emergency response.

Advantex Pods

The Advantex Pod is a manufactured media bed that operates similar to a sand filter. Some of the advantages of the Advantex Pods are listed as follows. The pods are pre assembled and arrive on the jobsite ready for final installation. They have a fiberglass cloth media that has more surface area than common granular material and the media is more uniform than naturally occurring granular material. Because of the larger surface area, the manufacturer recommends a loading rate of 25 gallons per day per square foot. Each pod has an effective treatment area of 100 square feet, and are capable of treating 2500 gallons per day of flow. By dividing the loading rate into the average daily flow it is shown that 4 Advantex pods will be required. The biological loading rate provided by the manufacture is 8 pound per day. The biological loading form the proposed system using Table I at a rate of 0.17 pounds per person per day yield a system loading of 23 pounds per day. When the system biological loading is divided by the suggested loading rate, three Advantex pods are required. The governing factor will be the hydraulic loading of the system and 4 Advanted pods are proposed. Using the manufactures loading rates, each Advantex pod will be capable of treating 9 residential homes.

The pods will be dosed similar to a recirculating sand filter. The duplex pumps in the recirculation tank will pass effluent through a distribution valve and discharge via manifold system located over the fiberglass media. Two of the four pods will be energized during pumping. When the pumps rest the distribution valve will rotate to the next port in the distribution valve and energize the other two pods during the next pump cycle. The effluent will then pass over and through the fiberglass media for treatment.

The Advantex pods require an adequate supply of air for the system to function properly. A vent system will be installed on the system to draw air through the system. The air that is drawn through the system will be discharged through a carbon filter to eliminate any odors. .

Discharge

The flow from the Advantex pods will pass through a splitter weir. The splitter weir will allow 1/5 of the returning flow to be discharged and the remaining 4/5 of the returning flow will return to the recirculation tank. The return line from the recirculation tank will have a tee. If the recirculation tank would become full, the discharge would be combined with the discharge flow from the slitter weir.

Due to the relative flat topography in the location of the treatment facility, the discharge will be collected in a 1000-gallon pump tank containing duplex effluent pumps. The pumps will discharge through a force main to the nearest accessible discharge point. The owner were unable to obtain access easements from the neighbor to the north which is the shortest distance to the receiving tributary, They do have access to easements to the northeast which will discharge into the same receiving stream. Because the discharge effluent will be pumped, a flow meter will be installed on the discharge line to measure the quantity discharged by the system.

Ownership & Operation

G&S Development are currently creating a continuing authority in accordance with 10 CSR 20-06.010(3) (B). They intend to operate a utility service that will provide water and sewer service to the residents of this subdivision. Copies will be provided as soon as they are received from legal council.

Reference:

1.) EPA Manual, Alternative Wastewater Collection Systems. EPA 625/1-91/024

2.) Small and Decentralized Wastewater Management Systems, Crites & Tchobanoglous, McGraw-hill Published

3.) Missouri Code State Regulations 10CSR 20-8

4.) Arcom, Masterspec, AIA specification writing program.

5.) Orenco Systems Inc, manufacturers products and detailed drawings.

Downstream Owner

Wattler William R.
34 Lakeside Dr
Robertsville Mo 63072
Parcel No. 20 4 200 0 000 001000
20 5 210 0 000 014000
20 5 210 0 007 0131400

Adjoining Owners

Thomas Thomas & Kathleen
2866 Meramec Terrace Rd.
Robertsville Mo. 63072
Parcel No. 20 4 200 0 008 007200

Guidorzi Deborah
501 old hwy 100
Villa Ridge, Mo 63089
Parcel No. 20 4 200 0 009 007400

Miller Thomas
176 Finney Lake Dr
Robertsville Mo 63072
Parcel No. 20 4 200 0 009 007500

Ruegg Donald & Patricia
P.O. Box 233
Robertsville Mo 63072
Parcel No. 20 4 200 0 000 008000

Stockton Trust
6304 Vermont Ave
St Louis Mo 63111
Parcel No. 20 4 200 000 007100

McCord Pamell
5028 Hwy N
Robertsville Mo 63072
Parcel No. 20 4 200 0 000 012000

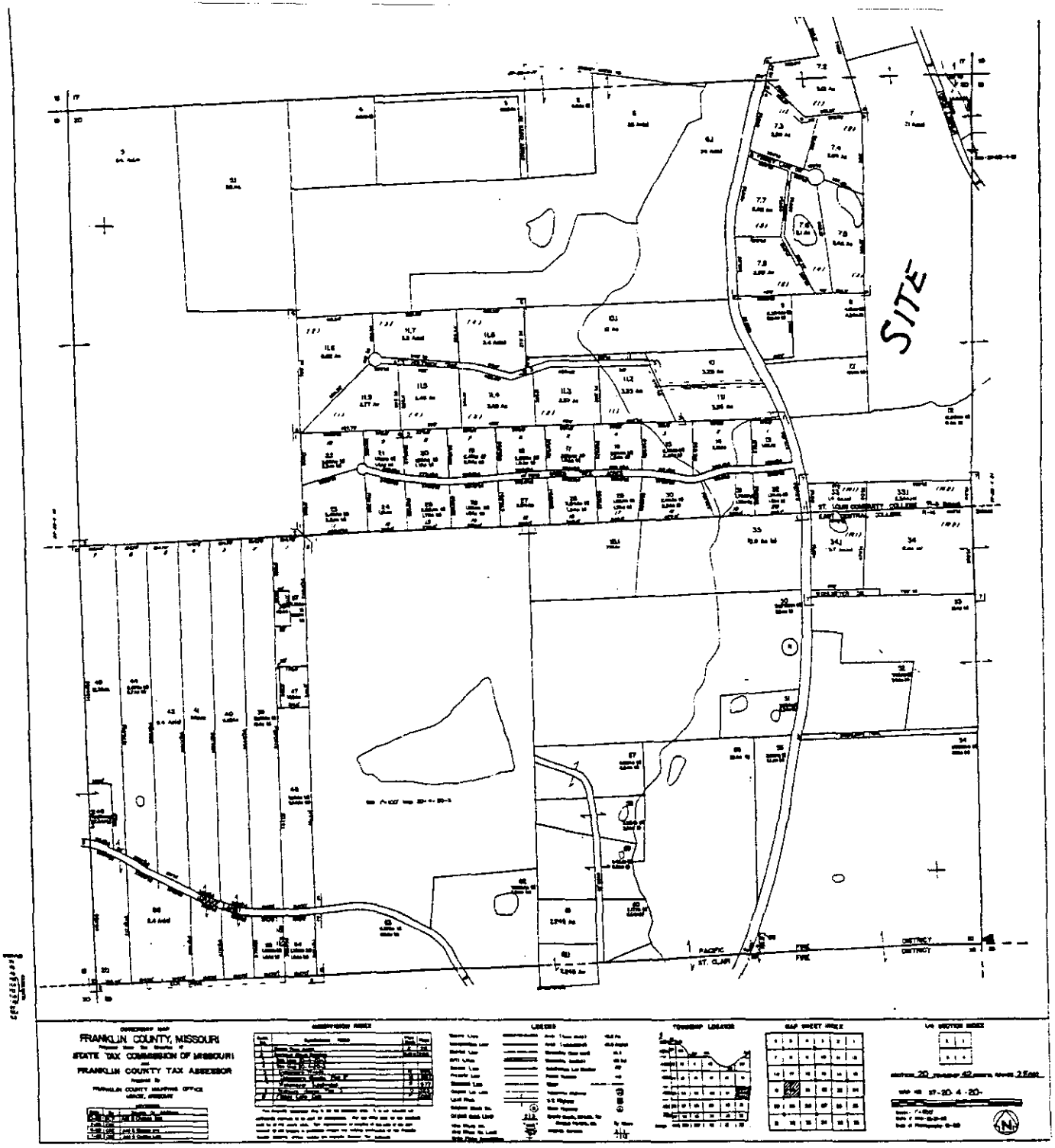
Hart Chas & Mary
1301 Bergman Rd
Robertsville Mo. 63072
Parcel No. 20 5 210 0 000 004000

Helzer Sherry
4740 elder Rd.
Villa Ridge Mo. 63089
Parcel No. 20 5 210 0 013 040600

Hoffmann John
P.O Box 6826
Brentwood Mo. 63144
Parcel No. 20 5 210 0 013 040500

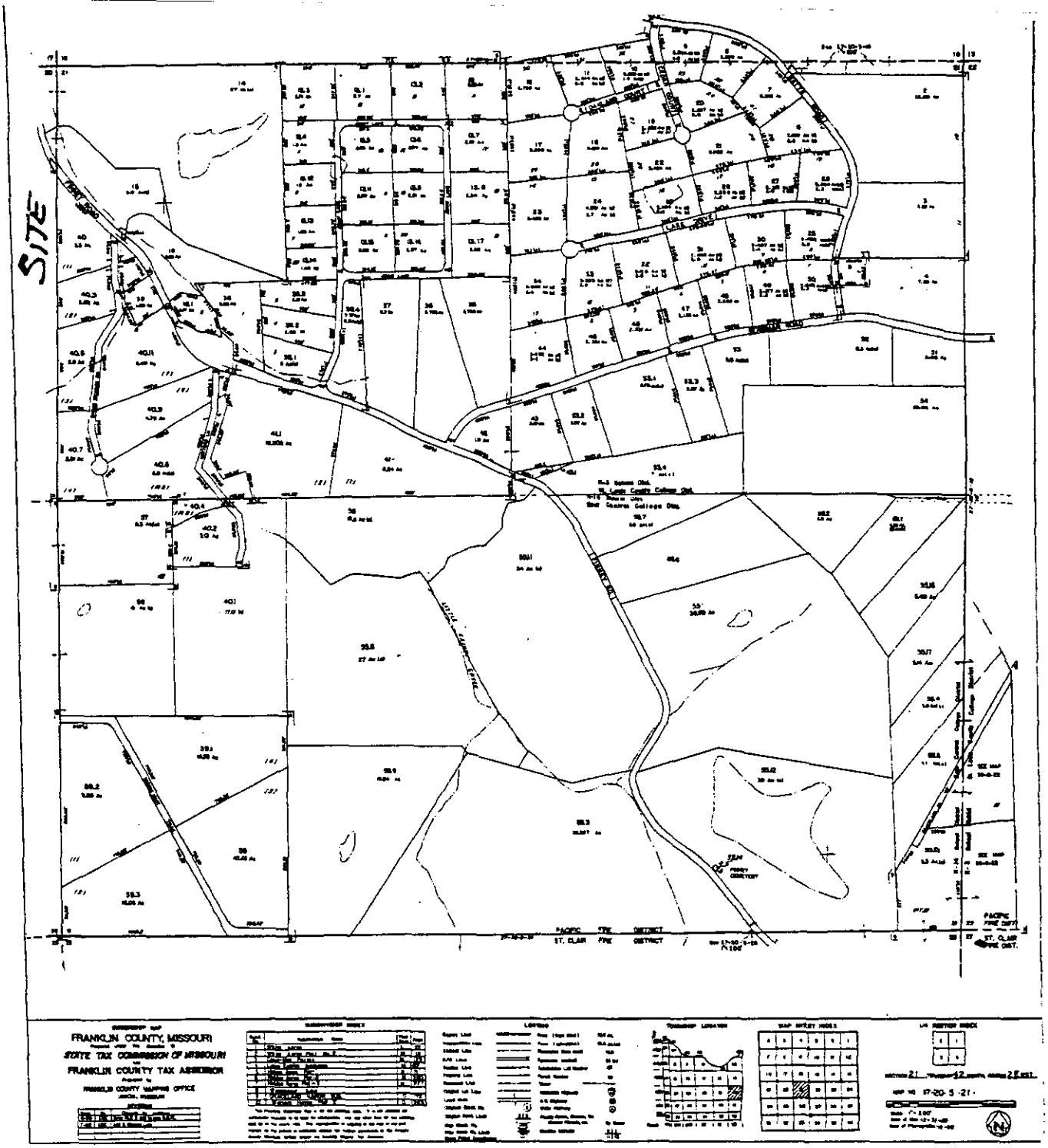
Smith Carolyn
P.O. box 304
Robertsville Mo 63072

See attached parcel maps Sections 20 & 21



SECTION 20

20-T-20



20-5-21

SECTION 21

Missouri Department Of Natural Resources
Geological Survey and Resource Assessment Division
P.O. Box 250
Rolla, Missouri 65402-0250
Phone - 573.368.2161 Fax - 573.368.2111
E-mail - gspeg@mail.dnr.state.mo.us

Project ID Number
14803
County
FRANKLIN

Geohydrologic Evaluation of Liquid-Waste Treatment Site

Project **Capitol Hill Farms** Quadrangle **LONEDELL**

Location **SE1/4,NE1/4,NE1/4** Section **20** Township **42 N** Range **02 E**

Additional Location Information

Latitude **38** Deg **22** Min **15** Sec North Longitude **90** Deg **48** Min **59** Sec West

Owner

Jeff Snider
2801 W. Osage Street Pacific MO 63069

Requestor

Norbert Wunderlich
20 South Church Street Union MO 63084

Previous Reports ☐ **Not Applicable**

Date

Identification Number

Fiscal Year

Facility Type

- (•) Mechanical treatment plant
- ( ) Recirculating filter bed
- ( ) Earthen lagoon with discharge
- ( ) Earthen holding basin
- ( ) Land application
- ( ) Other type of facility

Type of Waste

- ( ) Animal
- (•) Human
- ( ) Process or industrial
- ( ) Leachate
- ( ) Other waste type

Other Information

- ( ) Plans were submitted
- ( ) Site was investigated by NRCS
- ( ) Soil or geotechnical data were submitted

Funding Source

- (•) PPG
- ( ) WWLF-SRF

Date of Field Visit 11/2/2002 **Stream Classification** (•) Gaining ( ) Losing ( ) No discharge

Overall Geologic Limitations

- (•) Slight
- ( ) Moderate
- ( ) Severe

Collapse Potential

- (•) Not applicable
- ( ) Slight
- ( ) Moderate
- ( ) Severe

Topography

- ( ) < 4%
- (•) 4% to 8%
- ( ) 8% to 15%
- ( ) > 15%

Landscape Position

- ( ) Broad uplands
- ( ) Ridgetop
- (•) Hillslope
- ( ) Narrow ravine
- ( ) Floodplain
- ( ) Alluvial plain
- ( ) Terrace
- ( ) Sinkhole

Bedrock Ordovician-age Jefferson City Dolomite. Thin-bedded, gray to buff shaley dolomite.

Surficial Materials *Surficial materials consist of 10-15 feet of silty clay colluvium with moderate to low permeability.*

Recommended Construction Procedures

- ○ Installation of clay pad
- ○ Diversion of subsurface flow
- ○ Rock excavation
- ○ Compaction
- ○ Artificial sealing
- ○ Limit excavation depth

Required Geologic Exploration

(Missouri Clean Water Commission - 10 CSR 20 - 8.200 Wastewater Treatment Ponds)

Determine Overburden Properties

- ○ Partical size analysis
- ○ Standard Proctor density
- ○ Permeability coefficient for undisturbed sample
- ○ Atterburg limits
- ○ Overburden thickness
- ○ Permeability coefficient for remolded sample

Determine Hydrologic Conditions

- ○ Groundwater elevation
- ○ Direction of groundwater flow
- ○ 25-year flood level
- ○ 100-year flood level

Notify Geologist

- ○ Before exploration
- ○ During construction
- ○ After construction
- ◉ Not necessary

Remarks

Discharge from the proposed mechanical treatment plant is to the north in Little Calvey Creek. The stream was determined to be gaining.

The uppermost bedrock is the Ordovician-age Jefferson City Dolomite. The unit is a thinly bedded, light gray to buff shaley dolomite. The bedrock is highly weathered and has high permeability near the surface, but low permeability and less weathering with depth. The surficial materials consist of 10-15 feet of silty clay colluvium deposits. These materials exhibit moderate to low permeability.

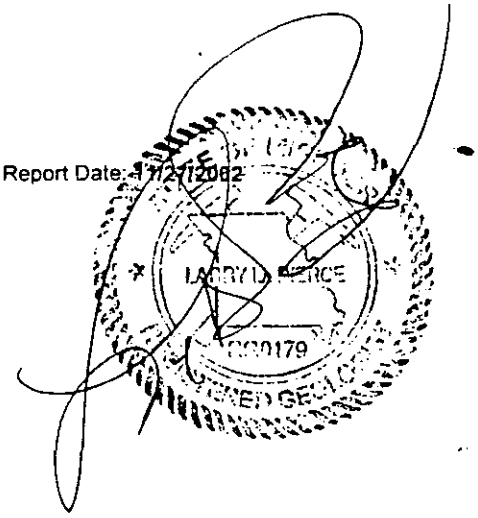
This site receives a slight overall geologic limitation rating.

This document is a preliminary report. It is not a permit. Additional data may be required by the Department of Natural Resources prior to the issuance of a permit. This report is valid only at the above location and becomes invalid one year after the report date below

Report By: Larry Pierce

Report Date: 11/27/2002

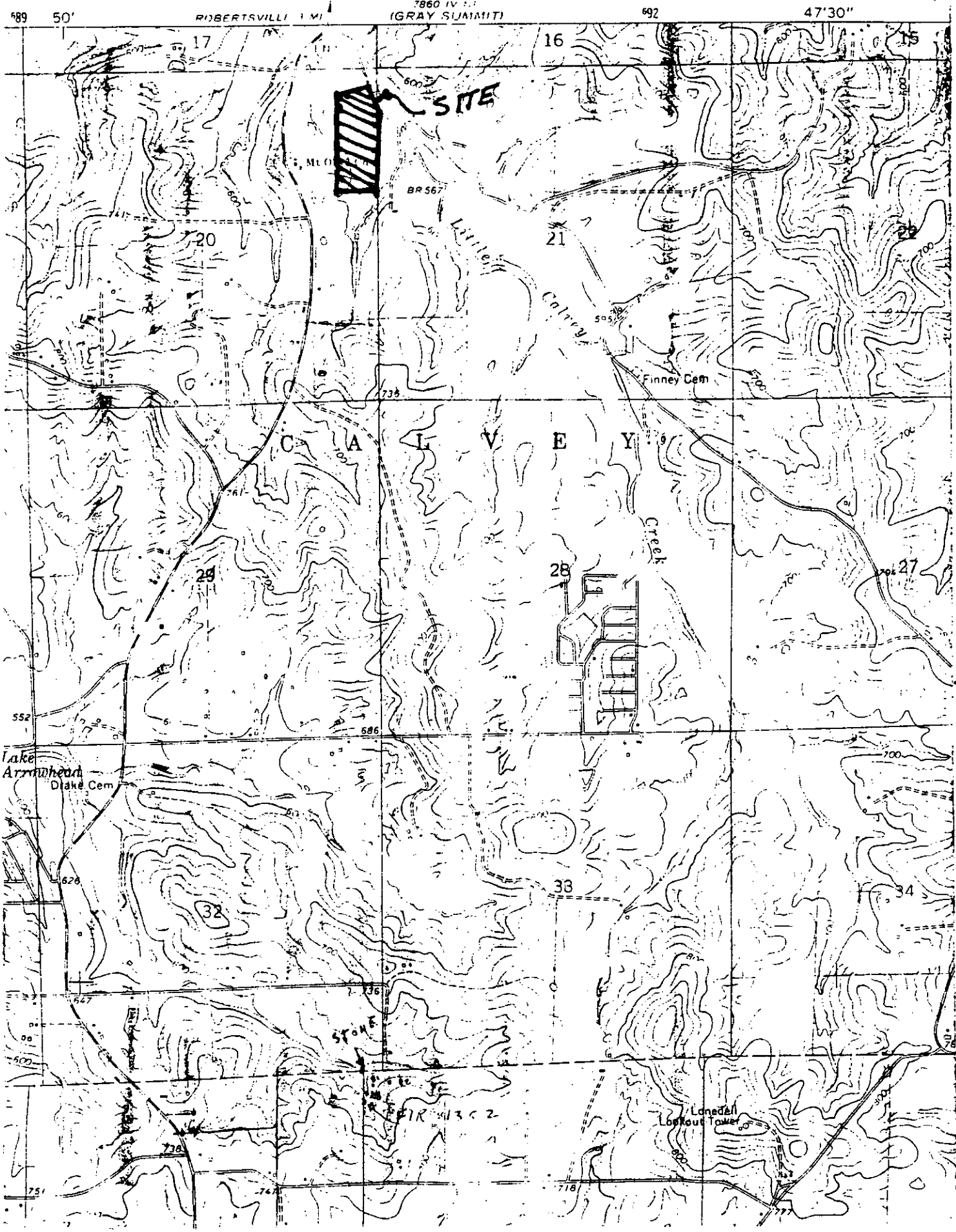
CC Norbert Wunderlich; SLRO; WPCP



STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
WALLACE B. HOWE, STATE GEOLOGIST

LONDELL QUAD

N



DESIGN SUMMARY

Total Population to be Served	$PE = 133 \cdot person$
Average Daily Design Flow	$Df = 9990 \cdot \frac{gal}{day}$
Peak Flow	$PF = 27.75 \cdot \frac{gal}{min}$ $PF = 39960 \cdot \frac{gal}{day}$
Average Daily BOD Loading	$BL = 22.64 \cdot \frac{lb}{day}$
Average Daily TSS Loading	$SS = 26.64 \cdot \frac{lb}{day}$
Septic tank storage volume	Each home will have a min. 1000 gallon septic tank
Detention time	3.5 days average per home
Recirculating tank volume	1 tank at 20,000 gal
Recirculating tank surge volume	2,729 gal
Recirculating Sand Filter size	length of 37'-8" diameter of 10'

The Advantex A-100 pods are assembled in the factory. They use spray nozzles for distribution over a fiberglass blanket filter media. The media has approximately 5 times the surface area of normal granular material and can be loaded at a rate of 25 gallons per square foot. This system will require 4 Advantex pods.

Design for "Calvey Brook Estates", Franklin County, Missouri
NE 1/4, NE 1/4, Section20 Township 42 N, Range 2E

Job No. 3797

Calvey Brook Estaes is a proposed 36 lot residential subdivision located in Franklin County, Missouri. The owners are currently looking at purchasing a tract of ground which could be sewered by the proposed system. An additional 8 lot are anticipated. The total number of residential lots to the system will be 44

Persons per Unit

Design Housing person = 1 Population Served

No. Res. Houseing RES = 36 Pu = 3.7·person PS = RES·Pu PS = 133.2

Desing Population Equivalent PE = PS PE = 133.2·person

Design flow per person $df = 75 \cdot \frac{gal}{(day \cdot person)}$ 10 CSR 20.8 Table 1 Residential

Design flow is the product of the design population and the flow per person

Desgin Average Daily Flow Df = PE·df $Df = 1335.47 \cdot \frac{ft^3}{day}$ $Df = 9990 \cdot \frac{gal}{day}$ $Df = 6.94 \cdot \frac{gal}{min}$

Design Peaking Factor of 4 PF = 4·Df

Peak Flow $PF = 27.75 \cdot \frac{gal}{min}$

Peak Hour Volume PH = PF·60·min $PH = 222.58 \cdot ft^3$ PH = 1665·gal

Biological loading and Solids loading

Bod loading $Bod = 0.17 \cdot \frac{lb}{(day \cdot person)}$ 10 CSR 20.8 Table 1 Residential

BL = Bod·PE $BL = 22.64 \cdot \frac{lb}{day}$

Total Suspended Solids $TSS = 0.20 \cdot \frac{lb}{(day \cdot person)}$

SS = TSS·PE $SS = 26.64 \cdot \frac{lb}{day}$

Proposed Media Bed, Advantex Treatment Ax 100, Fiberglass media.

Application Area of the Advantex Treatment Pod $Aa = 100 \cdot ft^2$

Advantex Media Loading Rate from the manufacturer

Hydraulic Loading Rate per Pod $AML = 25 \cdot \frac{gal}{(ft)^2 \cdot day}$

Biological Loading Rate per Pod $ABL = 8 \cdot \frac{lb}{day}$

Required Number of Pods Based on Design Hydraulic Loading

$Rhyd = \frac{Df}{AML}$ $Rhyd = 399.6 \cdot ft^2$ Required Treatment Area

Number of Pods $Npod = \frac{Rhyd}{Aa}$ $Npod = 4$ Pods **Use This Value**

Required Number of Pods Based on Organic Loading

$Rorg = \frac{BL}{ABL}$ $Rorg = 2.83$ Pods

Total number of pods based on the larger of the hydraulic or organic loading. Hydraulic loading is the governing factor.

Project: *Capital Hill Farms*
Project No.: 3797

Design of the Recirculating Tank

Average daily flow $ADF := 9990 \cdot \frac{gal}{day}$

Peaking Factor $PF := 4$

Peak Flow Rate $PFR := PF \cdot ADF$ $PFR = 39960 \cdot \frac{gal}{day}$

Provide an addition % of the average daily flow for equilazation volume $Ev := ADF \cdot 20 \cdot \%$

$Ev = 1998 \cdot \frac{gal}{day}$

Total Volume provided in the recirculation tank $TV := ADF - Ev$ $TV = 11988 \cdot \frac{gal}{day}$

The for possible future expansion of the proposed subdivision developer intends to use a 20.000 gallon manufactured fiberglass tank

Required Volume of the tank to be used $Rv := 20000 \cdot gal$

Volume of horizontal Cylinder at any depth

Radius of cylinder $r := 5 \cdot ft$

Lenght of cylinder $L := 27.67 \cdot ft$

Height of liquid in cylinder $h := 10 \cdot ft$

Volume in cylinder $Vc := L \cdot \left[r^2 \cdot \operatorname{acos}\left(\frac{r-h}{r}\right) - \left[\sqrt{2 \cdot r \cdot h - h^2}\right] \cdot (r-h) \right]$

$Vc = 16256.64 \cdot gal$

Volume of Sphere at any depth

Radius of Sphere $rs := 5 \cdot ft$

Height of liquid in sphere $hs := 10 \cdot ft$

Volume in Sphere $Vs := (\pi \cdot hs^2 \cdot rs) - \frac{\pi}{3} \cdot hs^3$ $Vs = 3916.79 \cdot gal$

Total Volume in the tank $TV := Vc - Vs$ $TV = 20173 \cdot gal$

Liquid depth in tank at Average Daily Flow $ADF = 9990 \cdot \frac{gal}{day}$

Height of Liquid $Hl = 4.965 \cdot ft$

Volume of horizontal Cylinder at any depth

Radius of cylinder $r = 5 \cdot ft$

Lenght of cylinder $L = 27.67 \cdot ft$

Height of liquid in cylinder $h = Hl$

Volume in cylinder $Vc = L \cdot \left[r^2 \cdot \operatorname{acos}\left(\frac{r-h}{r}\right) - (r-h) \cdot \sqrt{2 \cdot r \cdot h - h^2} \right]$

$Vc = 8055.88 \cdot gal$

Volume of Sphere at any depth

Radius of Sphere $rs = 5 \cdot ft$

Height of liquid in sphere $hs = Hl$

Volume in Sphere $Vs = \left(\pi \cdot hs^2 \cdot rs\right) - \frac{\pi}{3} \cdot hs^3$ $Vs = 1937.83 \cdot gal$

Total Volume in the tank at average daily flow $TVa = Vc - Vs$ $TVa = 9994 \cdot gal$

Storage Depth of Average Daily Flow $SD = hs$ $SD = 4.96 \cdot ft$

Minimum liquid depth in tank shall be 2 feet or 20% of the average daily flow

Min liquid depth $MLD = 20\%\cdot ADF\cdot 1\cdot day$ $MLD = 1998\cdot gal$ Use 2 feet

Depth of Liquid $Dl = 2.5\cdot ft$

Volume of horizontal Cylinder at any depth

Radius of cylinder $r = 5\cdot ft$

Lenght of cylinder $L = 27.67\cdot ft$

Height of liquid in cylinder $h = Dl$

Volume in cylinder $Vc = L\cdot\left(r^2\cdot acos\left(\frac{r-h}{r}\right) - \sqrt{2\cdot r\cdot h - h^2}\cdot(r-h)\right)$

$Vc = 3178.19\cdot gal$

Volume of Sphere at any depth

Radius of Sphere $rs = 5\cdot ft$

Height of liquid in sphere $hs = Dl$

Volume in Sphere $Vs = \left(\pi\cdot hs^2\cdot rs\right) - \frac{\pi}{3}\cdot hs^3$ $Vs = 612\cdot gal$

Total Volume in the tank at low water $TVl = Vc - Vs$ $TVl = 3790\cdot gal$

Liquid Depth in the tank at low water $Ld = hs$ $Ld = 2.5\cdot ft$

Emergency Pump On Elevation $Hwe := 6 \cdot ft$

Volume of horizontal Cylinder at any depth

Radius of cylinder $r = 5 \cdot ft$

Lenght of cylinder $L = 27.67 \cdot ft$

Height of liquid in cylinder $h := Hwe$

Volume in cylinder $Vc := L \cdot \left(r^2 \cdot \operatorname{acos}\left(\frac{r - h}{r}\right) - (2 \cdot r \cdot h - h^2) \cdot (r - h) \right)$

$Vc = 10184.3 \cdot gal$

Volume of Sphere at any depth

Radius of Sphere $rs = 5 \cdot ft$

Height of liquid in sphere $hs := Hwe$

Volume in Sphere $Vs := (\pi \cdot hs^2 \cdot rs) - \frac{\pi}{3} \cdot hs^3$ $Vs = 2538.08 \cdot gal$

Total Volume in the tank at high water level $TVe := Vc - Vs$ $TVe = 12722 \cdot gal$

All influent lines shall be turned down and discharge below the normal operating water level to prevent hydrogen sulfided oder problems.

Provide an addition % of the average daily flow for equilazation volume or surge volume $Ev \cdot day = 1998 \cdot gal$

Surge Voulme Provided $SVP := TVe - TVa$ $SVP = 2729 \cdot gal$

High Water Alarm Elevation $Hwa := 7 \cdot ft$

Volume of horizontal Cylinder at any depth

Radius of cylinder $r := 5 \cdot ft$

Lenght of cylinder $L := 27.67 \cdot ft$

Height of liquid in cylinder $h := Hwa$

Volume in cylinder $Vc := L \cdot \left(r^2 \cdot \operatorname{acos}\left(\frac{r - h}{r}\right) - (r - h) \cdot \sqrt{2 \cdot r \cdot h - h^2} \right)$

$Vc = 12154.83 \cdot gal$

Volume of Sphere at any depth

Radius of Sphere $rs := 5 \cdot ft$

Height of liquid in sphere $hs := Hwa$

Volume in Sphere $Vs := \left(\pi \cdot hs^2 \cdot rs\right) - \frac{\pi}{3} \cdot hs^3$ $Vs = 3070.76 \cdot gal$

Total Volume in the tank at high water level $TVh := Vc + Vs$ $TVh = 15226 \cdot gal$

Volume between emergency on and high water alarm $VEHW := TVh - TVe$

$VEHW = 2503.22 \cdot gal$

Average Daily Flow Rate $ADF := 6.94 \cdot \frac{gal}{min}$

Time Between Emergency Pump on and High Water Alarm $T := \frac{VEHW}{ADF}$

$T = 6.01 \cdot hr$

04/16/03

Flow in 4" pipe at peak flow

Manning's Equation for Uniform Flow
in a Circular Pipe

Input Quantities

	Diameter:	4.0000	in
	Manning's n:	0.0100	
	Slope:	0.5000	%
	Flow Rate:	36.0000	gpm
Calculated	Velocity:	1.9612	ft/s
Calculated	Depth:	1.9016	in

Calculated Quantities

Area Of Flow:	0.0409	sf
Wetted Perimeter:	6.0863	in
Hydraulic Radius:	0.9677	in
d/D Ratio:	0.4754	parts
Velocity Head:	0.0597	ft
Critical Depth:	1.8880	in
Full Capacity:	0.1748	cfs
Max Capacity:	0.1880	cfs

HHCalc, Version 7.0s
Eagle Point, 4131 WestMark Drive, Dubuque, IA, 52002, 1-800-678-6565

4" pipe full diameter flow
Manning's Equation for Uniform Flow in a Circular Pipe

Input Quantities

	Diameter:	4.0000	in
	Manning's n:	0.0100	
	Slope:	0.5000	%
Calculated	Flow Rate:	78.4495	gpm
Calculated	Velocity:	2.0030	ft/s
Calculated	Depth:	4.0000	in

Calculated Quantities

Area Of Flow:	0.0873	sf
Wetted Perimeter:	12.5664	in
Hydraulic Radius:	1.0000	in
d/D Ratio:	1.0000	parts
Velocity Head:	0.0623	ft
Critical Depth:	2.8320	in
Full Capacity:	0.1748	cfs
Max Capacity:	0.1880	cfs

HHCalc, Version 7.0s
Eagle Point, 4131 WestMark Drive, Dubuque, IA, 52002, 1-800-678-6565

Pump Selection for a AX100 System

Prepared for you by: Cody Vigil

Input Parameters

Number of Nozzles per Pod	32	
Pod Inlet Pressure	4.2	psi
Pods per Zone	1	
Distributing Valve Model	6402	
Lift to Manifold	21	feet
Transport Length	50	feet
Transport Pipe Class/Schedule	40	
Transport Line Size	2	inches
Discharge Assembly Size	2	inches
Flow Meter	None	inches
Add-On Friction Losses	0	feet

Calculation

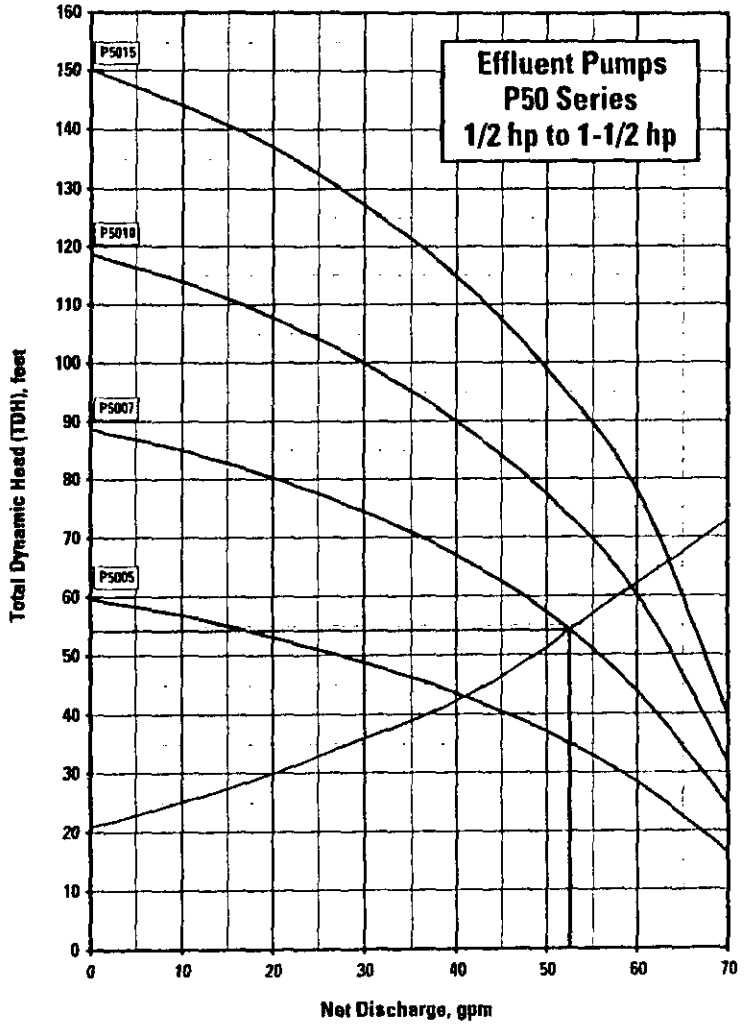
Flow Rate per Nozzle	1.64	gpm
Number of Nozzles per Cell	64	
Total Flow Rate per Zone	52.5	gpm

Frictional Head Losses

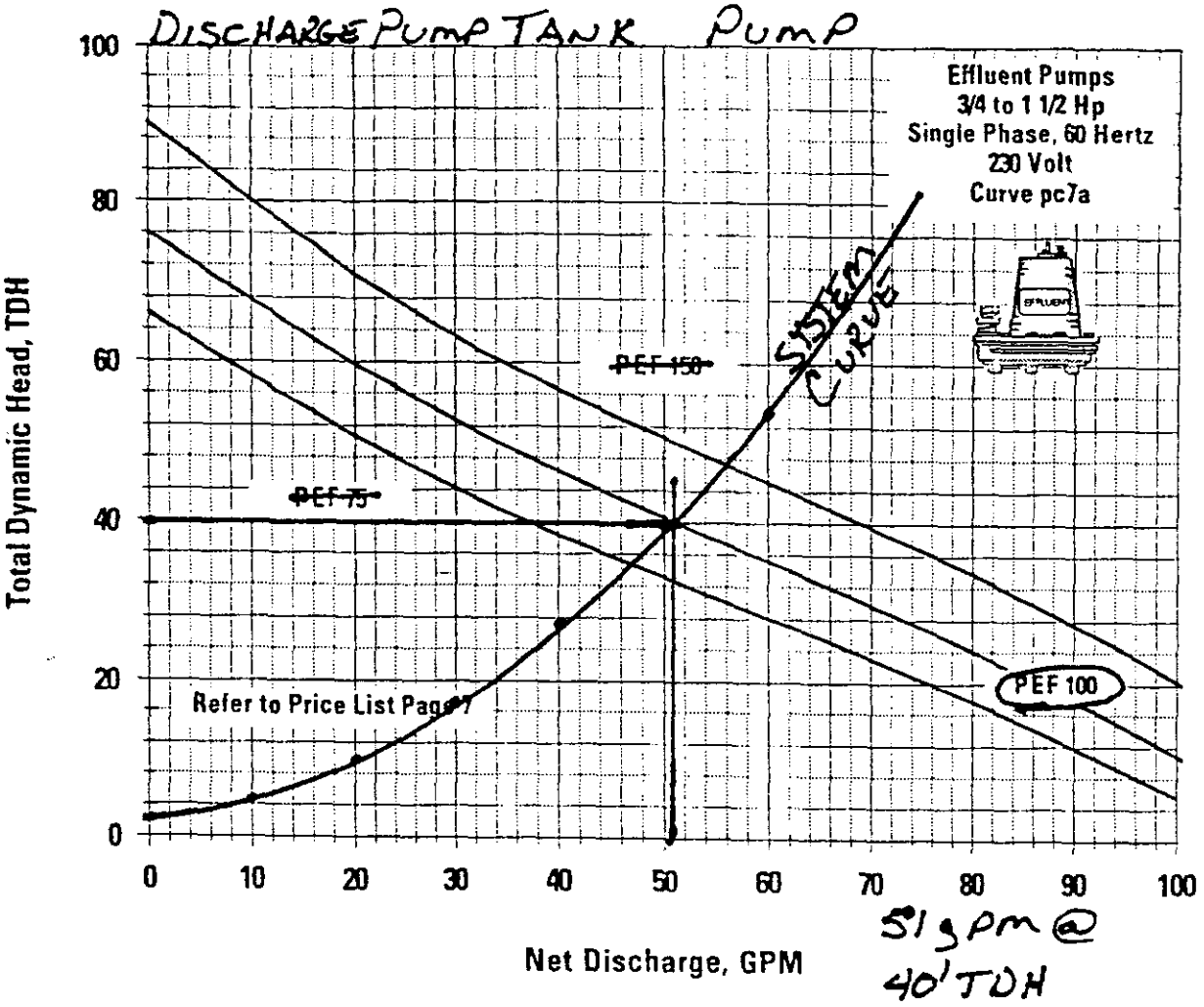
Head Loss through Distributing Valve	15.8	feet
Head Loss in Transport Pipe	2.2	feet
Head Loss through Discharge	5.5	feet
Head Loss through Flow Meter	0.0	feet
Add-On Friction Losses	0.0	feet

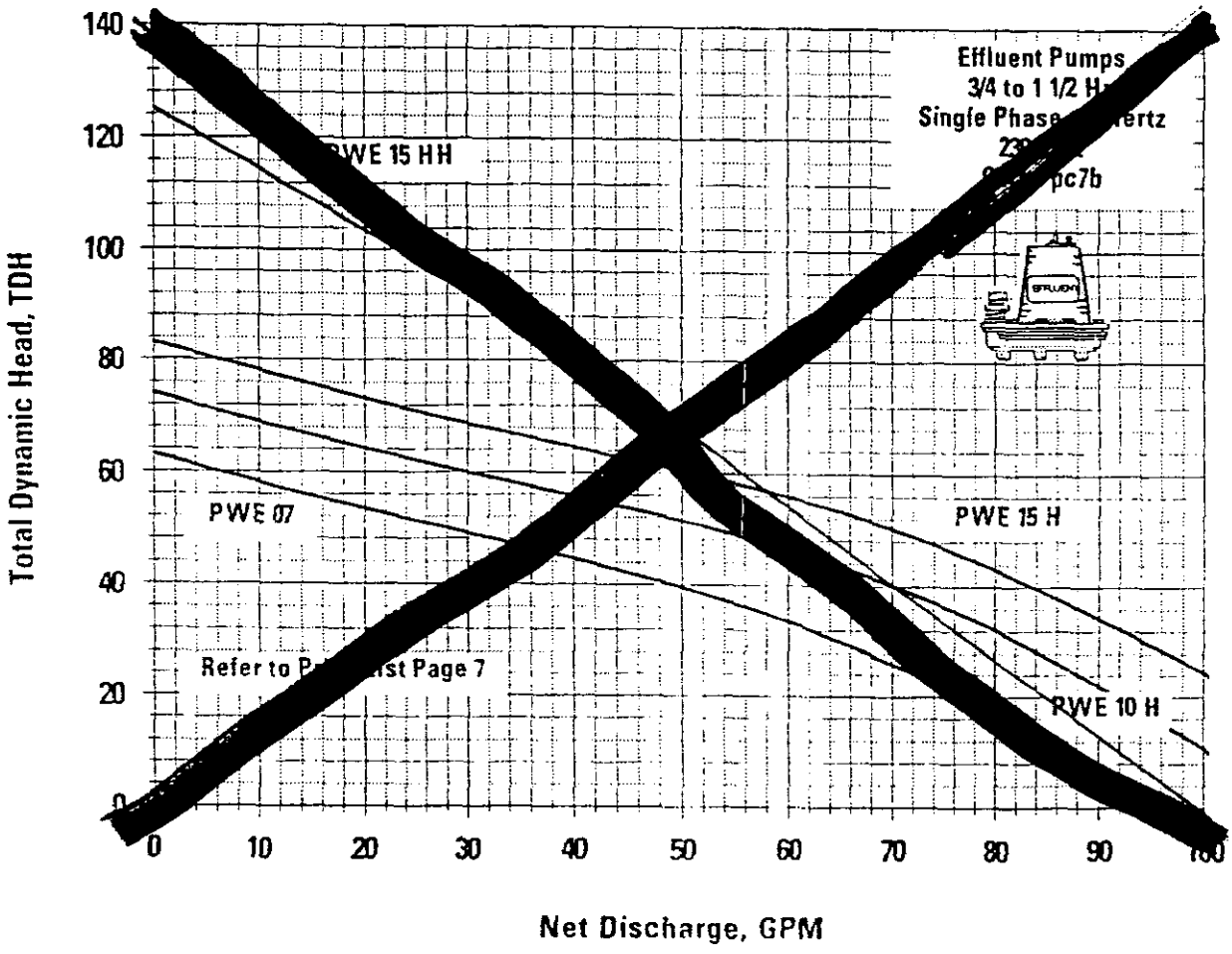
Size Pump

Design Flow Rate	52.5	gpm
Total Dynamic Head	54.2	feet



Orenco Systems® Incorporated





Orenco Systems®
Incorporated

814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479-9012

TELEPHONE:
(541) 459-4449

FACSIMILE:
(541) 459-2884

DISCHARGE PUMP HEAD LOSS

highest elevation	553.5	
lowest elevation	549.5	
length	630	in feet
c	135	constant
Dia of pipe	2	in inches

Is 1 only

Q gpm	headloss per /100	frictional headloss	static headloss	total headloss
10	0.29	1.829	4	5.83
15	0.61	3.873	4	7.87
20	1.05	6.594	4	10.59
25	1.58	9.964	4	13.96
30	2.22	13.961	4	17.96
35	2.95	18.568	4	22.57
40	3.77	23.771	4	27.77
45	4.69	29.558	4	33.56
50	5.70	35.919	4	39.92
55	6.80	42.846	4	46.85
60	7.99	50.329	4	54.33
65	9.26	58.361	4	62.36
70	10.62	66.937	4	70.94
75	12.07	76.050	4	80.05
80	13.60	85.694	4	89.69
85	15.22	95.865	4	99.86
90	16.91	106.557	4	110.56
95	18.69	117.767	4	121.77
100	20.55	129.489	4	133.49
105	22.50	141.721	4	145.72
110	24.52	154.458	4	158.46
115	26.62	167.697	4	171.70
120	28.80	181.434	4	185.43
125	31.06	195.667	4	199.67
130	33.40	210.392	4	214.39
135	35.81	225.607	4	229.61
140	38.30	241.308	4	245.31
145	40.87	257.493	4	261.49
150	43.52	274.159	4	278.16
155	46.24	291.305	4	295.31
160	49.04	308.927	4	312.93
165	51.91	327.024	4	331.02
170	54.86	345.593	4	349.59
175	57.88	364.632	4	368.63
180	60.97	384.139	4	388.14
185	64.14	404.112	4	408.11

System Material

Specifications

Throughout this document you will find the term "or approved equal". For this project this term "approved equal" shall mean equal in the judgement of the engineer.

Should the bidder seek approval of a product other than the brand or brands named in the specifications, it shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. Where the specified requirements involve conformance to recognized codes or standards the bidder shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and bearing an authorized signature.

Manufacturer's standard data and catalog cut sheets will not be considered sufficient in themselves, and the engineer will not be responsible for seeking further data from the manufacturer, or for otherwise researching the product. Failure to provide complete data will be cause for rejection of the product. The submission shall include any impacts that could be expected from the alternative product and shall also indicate any product that would require a license or royalty, the actual fees, and a note that these fees would be handled by the bidder.

A. PRIMARY AND SECONDARY TANKS

1. **General:**
   The manufacturer shall provide the structural design and certification to the engineer for review. The design shall be in accordance with accepted engineering practice. Precast concrete or fiberglass tanks shall have been designed by a registered engineer and approved by state or local regulatory agencies, or authorities.

   a. Loading Criteria:
      - There shall be 140 pcf for minimum weight of saturated backfill, or 127 pcf for unsaturated backfill (500 psf minimum).
      - Minimum lateral loading shall be 62.4 pcf. Lateral loading shall be determined from ground surface.
      - The tank shall also support a concentrated wheel load of 2500 lbs.

There are four (4) Typical loading conditions that should be analyzed:

1. 4 ft. Bury + Full Exterior Hydrostatic Load
2. 4 ft. Bury + Full Exterior Hydrostatic Load + 2500 lb. Wheel Load.
3. 1 ft. Bury + 2500 lb. Wheel Load.
4. Tank Full, Interior Hydrostatic Load and Unsupported by Soil.

Load Case 4 represents the tank full of liquid at 62.4 lbs/cu.ft. This condition addresses seam and haunch stress-strain relationships that occur during watertightness testing, as well as poor soil bedding conditions that provide inadequate support.

b. Tanks requiring deep burial (>48") or subject to truck or heavy traffic loading require special consideration. (A minimum soil cover of 12 inches shall be used, unless specified otherwise by manufacturer.)

c. *All tanks shall be structurally sound and watertight and* shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of final acceptance. Manufacturer's signed guarantee shall accompany bids. The tank guarantee/warranty shall be furnished at the time of submittal. Tank warranty shall not have a limited liability in regards to replacement cost of the tanks. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.

d. Tanks shall be manufactured and furnished with a minimum access opening of 20 inches in diameter and of the configuration shown on the manufacturer's drawings. Modification of completed tanks will not be permitted.

e. Inlet plumbing shall include an inlet tee which penetrates 18 inches into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth.) The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

f. Tanks shall be capable of successfully withstanding an aboveground static hydraulic test and shall be individually tested.

g. Tanks shall be installed in strict accordance with the manufacturer's recommended installation instructions.

1. Concrete Tanks:

a. Walls, bottom and top of reinforced concrete tanks shall be designed across the shortest dimension using one-way slab analysis. Stresses in each face of monolithically constructed tanks may be determined by analyzing the tank cross-section as a continuous fixed frame.

b. The walls and bottom slab shall be poured monolithically

c. Reinforcing steel shall be ASTM A-615 Grade 60, FY = 60,000 psi. Details and placement shall be in accordance with ACI 315 and ACI 318.

d. Concrete shall be ready-mix with cement conforming to ASTM CI50, Type II. It shall have a cement content of not less than six (6) sacks per cubic yard and maximum aggregate size of 3/4-inch. Water/cement ratio shall be kept low (0.35±), and concrete shall achieve a minimum compressive strength of 4000 psi in 28 days. The Contractor shall submit a concrete mix design to the Engineer for review and approval. Three (3) concrete sample cylinders shall be taken and tested until the manufacturer and Engineer are satisfied that the minimum compression strength is being obtained. To ensure compliance, the manufacturer shall then make and set three (3) sample cylinders for a minimum of 20% of the remaining tanks at the discretion of the Engineer. If the minimum compressive strength is not being obtained, the manufacturer shall be required to make the test sample cylinders for each tank manufactured. Calcium chloride will not be allowed in the mix design. The cost of testing cylinders shall be the tank manufacturer's responsibility.

e. Tanks may be protected by applying a heavy cement-base waterproof coating (Thoroseal® or equal), on both inside and outside surfaces, in compliance with Council of American Building Officials (CABO) report #NRB-168; 6181, however, the tank should be watertight without the addition of seal coatings.

f. Tanks shall not be moved from the manufacturing site to the job site until the tank has cured for seven (7) days or has reached two-thirds of the design strength.

g. Tanks shall be manufactured and furnished with access openings of the size and configuration necessary to accommodate individual packaged pump systems. For 24-inch diameter access risers, the tank manufacturer shall cast in place a flanged tank adapter to facilitate the bonding of a 24-inch diameter access riser. The flanged tank adapter shall be made of 1/4" thick ABS and shall have an outside diameter of 27 inches and an inside diameter of 22-3/4 inches. The flanged adapter shall be Orenco Systems®, Inc. Model PRTA24 or engineered approved equal. The adapter must have an overall height of no less than 3 inches to allow 1-1/2" exposed for sufficient bonding area once the adapter is installed in the tank. For 21 and 30-inch diameter access risers, either a grooved tank adapter plate (Model RRFTA or RRFTA30) or a flanged tank adapter (Model FRTA30) may be installed in the tank. The adapter shall be manufactured of fiberglass or ABS and shall accommodate a 21 or 30-inch diameter access riser.

h. The septic tank and the top slab shall be sealed with a preformed flexible plastic gasket. The flexible plastic gasket shall be equal to the

flexible butyl resin sealant congeal CS-102 or CS-202 as manufactured by Concrete Sealants, Inc. of New Carlisle, Ohio, and shall conform to federal specification SS-S-00210(2iOA) and AASHTO M-198. A mechanical fastening method shall be used if the seasonal groundwater level may reach the top slab seam of the tank.

i. In order to demonstrate watertightness, tanks shall be tested twice prior to acceptance. Inlets to the septic tank will be watertight pipe seal Cast-A-Seal™ (Manufactured by Press-Seal Gasket Corporation) or equal or engineer approved equal. Each tank shall be tested at the factory, prior to shipping, by filling with water to the soffit and letting stand. After 24 hours, the tank shall be refilled to the soffit and the exfiltration rate shall be determined by measuring the water loss during the next two (2) hours. Any leakage shall be cause for rejection. After installation is completed, each tank shall be filled with water to a point two (2) inches into the access riser and retested as previously described (the field test period may be reduced to not less than two (2) hours). Backfill of a depth equal to the water height in the riser must be in place over the tank to prevent damage due to hydrostatic uplift. No tank will be accepted if there is any leakage over the two (2) hour period.

2. Fiberglass Tanks:

a. Method of Calculations:

1. Fiberglass tanks shall be analyzed using finite element analysis for buried structures.
2. Calculations shall address the following:
   - strength with a minimum safety factor of 2.5
   - buckling with a minimum safety factor of 2.5
   - deflection of 5% of the tank diameter, based on service load (including long-term deflection lag)
   - buoyancy
3. Performance testing

Material Properties and Laminates

The laminates considered in this analysis shall be of general-purpose ortho-polyester resin with E-type fiberglass reinforcement or higher grade. The thicknesses for different regions of the tanks shall be described and shown in shop drawings for each individual tank.

Typical primary strength properties are listed below:

Tensile Modulus (psi)	1,000,000
Ultimate Tensile strength (psi)	10,000
Ultimate Compressive strength (psi)	21,000

Ultimate Flexural strength (psi)	18,000
Ultimate Shear In-Plane (psi)	7,800

b. In lieu of calculations for fiberglass tanks, the supplier may elect in-situ performance testing.
c. In-situ testing of each tank model shall include use of strain gauge and deflection gauge. The tank will be subjected to external forces equal to twice the actual load.
d. Maximum initial deflection based on test loading shall not exceed 3% of the tank diameter.
e. Performance testing will be evaluated by a Registered Professional Engineer (P.E.). The Engineer will have the sole responsibility to determine the maximum external loading on any of the tank models.
f. The tank shall be constructed with a glass fiber and resin content specified by the manufacturer and with no exposed glass fibers. Any metal part shall be 300 series stainless steel.
g. Inspections may be made by the engineer in the supplier's yard, within the plant, upon delivery and again after installation. The minimum wall thickness shall be 3/16-inch. If the wall thickness is suspected to be less than 3/16-inch or if delamination is suspected within any portion of the tank, the engineer may drill a 1/4-inch diameter hole through the tank wall for inspection purposes. If the required minimum 3/16-inch thickness is not found, repair if feasible shall be the responsibility of the contractor. If repair is judged not feasible, the tank shall be rejected. If twenty percent (20%) or more of the tanks are rejected for any of the aforementioned reasons, each tank under this bid will become suspect of substandard quality and subject to rejection by the engineer. If the required minimum 3/16-inch thickness is found and no delamination is present, the repair of the inspection holes shall be the responsibility of the engineer.
h. The minimum tank weight shall be specified by the manufacturer's engineer (i.e., 350 lbs for 1000 gallon tanks ...400 lbs for 1500 gallon tanks ±).
i. Holes specified for the tank shall be provided by the manufacturer. Resin shall be properly applied to all cut or ground edges so that no glass fibers are exposed and all voids are filled.
j. Orenco Systems®, inc. EPDM gaskets, or approved equal, shall be used at the inlet to join the tank wall and the inlet piping. ABS or Schedule 40 PVC pipe and fittings shall be used at the inlets.
k. Inlet plumbing shall include an inlet tee that penetrates 18-inches into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth). The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.
l. Water testing shall be performed on each tank and shall be witnessed by the engineer. Every tank shall be assembled by the manufacturer

and filled with water to the brim of the access opening for a minimum of two (2) hours. The tank shall show no leakage from section seams, pin-holes or other imperfections. Any leakage is cause for rejection.

m. When leakage occurs, if the tank is not rejected by the engineer, an additional water test shall be made on the tank after repairs have been completed, upon request by the engineer. The manufacturer shall be responsible for making all corrective measures in production or assembly necessary to ensure a completely watertight tank.

n. After installation of tank with riser is completed, each tank shall be filled with water to a point two (2) inches into the access riser and the water loss measured after a two-hour period. Every tank test shall be witnessed by the engineer. Any leakage shall be cause for rejection. Backfill of a depth equal to the water height in the riser must be in place over the tank to prevent damage due to hydrostatic uplift.

o. Each tank shall be marked in the upper most surface above or near the outlet and include a permit number or identification number, weight of tank, type of tank, and date of manufacture.

p. Installation shall be in accordance with the manufacturer's recommendations, or as shown on the Contract Plans, whichever is more stringent; no variations.

B. SEPTIC TANK EFFLUENT FILTER ASSEMBLY:

All filter systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. Effluent filters shall prevent particles larger than 1/8-inch in diameter from leaving the tank. Effluent filters shall have a solid bottom or deflecting device that prevents vertically rising solids from reaching the filtering surface area during ebullition (sludge bulking).

1. Risers:

Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 24 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100

or approved equal. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

2. **Inlet and Cleanout Risers:**

Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall extend to 3 inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 24 inches. See section 3 below for adhesive requirements.

3. **Outlet Risers:**

Outlet risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall be at least 12 inches high, and shall be factory-equipped with the following:

- Adhesive: When bonding to concrete or fiberglass grooves, a two-part epoxy, one pint required per 18-inch or 24-inch diameter riser and one quart required per 30-inch diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal shall be used.

4. **Riser-To-Tank Attachment:**

Risers shall be attached to tanks with one of the following attachment systems, or® approved equal: (1) Orenco Systems®, Inc. Model RUBDKIT attachment kit; (2) Orenco Systems, Inc. Model PRTA24 tank adapter used with Model PRTA24BDKIT bolt down kit, and Model MA320 or ADH100 adhesives; (3) Orenco Systems, Inc. Model RRFTA tank adapter used with Model RRFTABDKIT bolt down kit and Model ADHP10 adhesive; (4) Orenco Systems, Inc. Model FRTA30 tank adapter used with Model FRTA30BDKIT bolt down kit and Model ADH100 adhesive. All attachment components shall be constructed of waterproof, non-corrosive materials, such as PVC, ABS, fiberglass, or stainless steel. Adhesives and sealants shall be waterproof, corrosion resistant and approved for the intended application. The

riser-to-tank connection shall be watertight and structurally sound. The riser-to-tank connection shall be capable of withstanding a vertical uplift of 5000 pounds to prevent riser separation due to tank settlement, frost heave, or accidental vehicle traffic over the tank.

5. **Lids:**

One lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model FL24-4B, FL30G or engineer-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8-inch is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2-inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

Optional Components

a. Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

b. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

6. **Riser Installation:**

Riser installation shall be accomplished according to the manufacturer's instructions.

7. **Biotube® Effluent Filter**

Orenco Systems®, Inc. Model FT0854-36, FT1254-36 or FT1554-36, Biotube Effluent Filter or approved equal, installed in conformance with the engineer's

plans. The filter shall have a minimum effective screen area of no less than 15.8 square feet. The Biotube Effluent Vault shall consist of either an 8, 12, or 15-inch diameter, 54-inch deep PVC vault with eight (8) 1-3/8 inch diameter holes evenly spaced around the perimeter, located 22 inches from the base of the filter vault. The Biotube cartridge shall be made with 1/8-inch mesh polypropylene and with a solid base (to prevent solids from entering through the bottom during ebullition). The Biotube cartridge shall be housed inside the PVC vault.

C. PRIMARY SEPTIC TANK EFFLUENT PUMPING ASSEMBLY:

All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems, Inc. High-Head Pumping Assemblies or approved equal, composed of:

1. Risers:

Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 24 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

2. Inlet and Cleanout Risers:

Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall extend to two inches above the ground surface to allow for settlement

and shall have a minimum nominal diameter of 18-inches. See section 3b below for adhesive requirements.

3. **Outlet Risers:**

Outlet risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall be at least 12 inches high, and shall be factory-equipped with the following:

a. Electrical and Discharge Grommets: EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part epoxy, one pint required per 18-inch or 24-inch diameter riser and one quart required per 30-inch diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part epoxy, Model MA320 or equal, or a single component adhesive Model ADH100 or approved equal shall be used.

4. **Lids:**

One lid shall be furnished with each access riser. Lids shall be Orenco Systems®, Inc. Model FL24-4B, FL30G or engineer-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8-inch is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2-inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex,

Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

Optional Components

a. Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

b. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

5. Riser Installation:

Riser installation shall be accomplished according to the manufacturer's instructions.

6. Pump Vaults:

Orenco Systems, Inc. Model PVU Series, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 20.6 square feet The Biotube Pump Vault shall consist of a 12-inch diameter HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube® assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

7. Discharge Hose and Valve Assembly:

Orenco Systems®, Inc. Model HV125BC, HV150BC or HV200BC, 1.25-inch, 1.50-inch or 2-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with minimum working pressure rating of 64 psi, and Schedule 40 PVC pipe. When pumping downhill, include anti-siphon assembly.

8. Float Switch Assembly:

Orenco Systems, Inc. Model MF4A with four switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms, on and off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice

box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

9. High Head Effluent Pumps:

Must be approved for use in pump vault as described in C6. For most applications, an Orenco Systems, Inc. Model P Series, 1/2 to 1.5 hp, 115/230 VAC, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty.

10. Electrical Splice Box:

Orenco Systems, Inc. Model SB6, UL approved for wet locations, equipped with six electrical cord grips and a 1-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit shall be required to prevent the passage of gases, vapors, or flames through the conduit. Substitute Model SB4, equipped with four electrical cord grips and a 3/4-inch outlet fitting and Model SBX-D for Class 1, Division 1 applications.

11. Controls and Alarms (see Alternate):

Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. Model MVP-DAX1RO or MVP-DAX2RO control panel meeting the following:

Standard Components:

a. Motor-Start Contactor: 115 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

b. Toggle Switch: Single-pole, double-throw MOA switch. 20 amps, 1 hp.

c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

d. Audio Alarm: 80 dB at 24", warble-tone sound.

e. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

f. Panel Enclosure: Measures13.51" high x 11.29" wide x 5.58" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
g. MVP-DAX1RO Panel Ratings: 115 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.
h. MVP-DAX2RO Panel Ratings: 230 VAC, 2 hp, 14 amps, single phase, 60 Hz.
i. Event Counter: 115 VAC, 6-digit, non-resettable.
j. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.
k. Heater: Anti-condensation heater. Self-adjusting; radiates additional wattage as temperature drops.
l. Intrinsically Safe Controls Relays: 115 VAC. Listed per UL 913, for Class I, Div. I, Groups A, B, C, D hazardous locations. Larger enclosure required.
m. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

12. Location:

The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select a garage or outbuilding where the sound of the motor contactor engaging will not be noticed. If a garage or outbuilding wall isn't available, installation should include use of sound-deadening insulation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

13. Installation:

All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

D. RECIRCULATION / DILUTION TANK PUMPING ASSEMBLY:

All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems®, Inc. High-Head Pumping Assemblies or engineer-approved equal, composed of:

1. Risers:

Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 24 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

2. Inlet and RSV Riser:

Risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall extend to three inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 30 inches. See section 4b below for adhesive requirements.

a. Inlet & Outlet Grommets: EPDM grommets shall be installed by the manufacturer for discharge piping, to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

4. Outlet Riser:

Outlet risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall be at least 12 inches high, and shall be factory-equipped with the following:

a. Electrical and Discharge Grommets: EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part epoxy, one pint required per 18-inch or 24-inch diameter riser and one quart required per 30-inch diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part epoxy, Model MA320 or equal, or a single component adhesive Model ADH100 or approved equal shall be used.

5. Lids:

One lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model FL24-4B, FL30G or engineer-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8-inch is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2-inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

Optional Components

a. Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

b. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

6. Riser Installation:

Riser installation shall be accomplished according to the manufacturer's instructions.

7. **Pump Vault:**
Orenco Systems, Inc. Model PVU Series, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 20.6 square feet. (Note: Commercial and multiple-user tanks may require a larger or duplex Biotube® Pump Vault, the sizes of which must be individually determined and spelled out in the specifications.) The Biotube Pump Vault shall consist of a 12-inch diameter HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

8. **Discharge Hose and Valve Assembly:**
Orenco Systems®, Inc. Model HV125BC, HV150BC or HV200BC, 1.25-inch, 1.50-inch or 2-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with minimum working pressure rating of 64 psi, and Schedule 40 PVC pipe. When pumping downhill, include anti-siphon assembly.

9. **Float Switch Assembly:**
Orenco Systems, Inc. Model MF3A with three switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms, and override on/off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

10. **High-Head Effluent Pumps:**
Must be approved for use in pump vault as described in D7. For most applications, an Orenco Systems, Inc. Model P500512, 3/4 hp, 230 VAC, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be capable of providing a flow rate of 50 gpm against a head of 37 feet. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty. Larger horsepower units are available (1 to 1-1/2 hp, 230 VAC).

11. Electrical Splice Box:

Orenco Systems, Inc. Model SB5, UL approved for wet locations, equipped with five electrical cord grips and a 1-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit shall be required to prevent the passage of gases, vapors, or flames through the conduit. Substitute Model SB3, equipped with three electrical cord grips and a 3/4-inch outlet fitting and Model SBX-S for Class 1, Division 1 applications.

12. Controls and Alarms (see Alternate):

Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. Model MVP-DAX1PTRO or MVP-DAX2PTRO control panel meeting the following:

Standard Components:

a. Motor-Start Contactor: 115 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

a. Toggle Switch: Single-pole, double-throw MOA switch. 20 amps, 1 hp.

b. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

c. Audio Alarm: 80 dB at 24", warble-tone sound.

d. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

e. Panel Enclosure: Measures13.51" high x 11.29" wide x 5.58" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

f. MVP-DAX1PTRO Panel Ratings: 115 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.

g. MVP-DAX2PTRO Panel Ratings: 230 VAC, 2 hp, 14 amps, single phase, 60 Hz.

h. Event Counter: 115 VAC, 6-digit, non-resettable.

i. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

j. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.

k. Heater: Anti-condensation heater. Self-adjusting; radiates additional wattage as temperature drops.

l. Intrinsically Safe Controls Relays: 115 VAC. Listed per UL 913, for Class I, Div. I, Groups A, B, C, D hazardous locations. Larger enclosure required.

m. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

13. Location:

The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select a garage or outbuilding where the sound of the motor contactor engaging will not be noticed. If a garage or outbuilding wall isn't available, installation should include use of sound-deadening insulation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

14. Installation:

All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

E. ADVANTEX TREATMENT SYSTEM:

All components shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for onsite treatment systems. References must be available on request from the engineer.

1. Distributing Valve Assembly:

Provided as a complete assembly including inlet ball valve, distributing valve with 2 outlet ports, Schedule 80 unions for removal and cleaning, and clear PVC ports for inspection. Valve manufactured of corrosion resistant ABS polymer, stainless steel, and die cast metal. Assembly shall be Orenco Systems®, Inc. Model V6000 Series or approved equal. Each distributing valve shall include the following:

a. Distributing valve assembly shall be enclosed in ribbed PVC access riser as manufactured by Orenco Systems, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. Risers shall extend to two inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 30.

b. One lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model FL30GI2 or approved equal, fiberglass with green non-skid finish, and provided with stainless steel bolts, and

wrench. The riser and lid combination shall be sealed for watertightness and able to support a 2500 lb. wheel load. (Note: This is not to imply that PVC risers are intended for traffic areas.)

c. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

2. AdvanTex Treatment System:

Orenco Systems, Inc. AX100 AdvanTex Treatment System installed in conformance with the engineer's plans. The AX100 is a packed bed filter, consists of a proprietary textile media. The media has been specifically engineered for wastewater applications. The item is patent pending and the engineer knows of no equivalent.

3. Transport Piping / Fittings:

a. All transport piping and fittings from the recirculation / dilution tank shall meet a minimum pressure rating of Schedule 40.

b. The AdvanTex pod return lines shall be 4-inch diameter, Class 125 or higher pressure. All fittings shall be Schedule 40.

4. Installation

All AdvanTex components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

F. ADVANTEX VENTILATION SYSTEM:

1. Vent Fan:

The vent fan shall meet the following requirements:

a. The fan shall be UL Listed for use in wet locations and in conditioned air streams of up to 140°F

b. The fan shall be rated between 19 and 419 cfm at 0.8-inches of H_2O static pressure.

c. The fan shall be 100% speed controllable.

d. The fan shall have an external wiring box with a waterproof gasket.

2. Vent Fan Basin:

All risers shall be constructed watertight. Risers shall extend two inches above original grade to allow for settlement and to ensure a positive drainage away from the access. Risers containing vent fan shall be 24 inches in diameter. Risers shall be ribbed PVC as manufactured by Orenco Systems®,

Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. Risers shall be at least 12 inches high, shall have a minimum nominal diameter of 24 inches, and shall be factory-equipped with the following:

a. Electrical and Vent Grommets: when applicable, EPDM grommets shall be installed by the manufacturer for vent piping and the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

3. **Electrical Splice Box:**
Orenco Systems, Inc. Model SB1, UL approved for wet locations, equipped with 1 electrical cord grip and a 3/4-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors.

4. **Exhaust Basin:**
All risers shall be constructed watertight. Risers shall extend two inches above original grade to allow for settlement and to ensure a positive drainage away from the access. Risers containing carbon filtering media shall be 24-inches in diameter. Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. Risers shall be factory-equipped with the following:

a. Grommets: when applicable, EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

b. 6-inch layer of activated carbon, for odor suppression.

5. **Lids:**
One lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model, FL24-4B, or approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. The riser and lid combination shall be sealed for watertightness and able to support a 2500 lb. wheel load. (Note: This is not to imply that PVC risers are intended for traffic areas.)

6. **Transport Piping / Fittings:**

a. All transport piping and fittings from the recirculation / dilution tank shall meet a minimum pressure rating of Schedule 40.

b. The air return lines shall be 4-inch diameter, Class 125 or higher pressure. All fittings shall be Schedule 40.

End of Section

SECTION 2086 - FIBERGALSS RECIRCULATION TANK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Manufacture and installation of the fiberglass recirculation tank.

1.3 DEFINITIONS

A. Missouri Department of Natural Resources Mo~DNR

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Data: For the following:

1. Fiberglass Storage tank 20,000 gallons 10 foot diameter

C. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fiberglass recirculation tank.

D. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

E. Shop Drawings: Show fabrication and installation details for fiberglass recirculation tank.

F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be able to provide documentation that the tank shell has been built to the applicable requirements of Underwriters Laboratories Standard UL 1316

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer shall be responsible for the shipping of the fiberglass recirculation tank.

B. Contractor is responsible for off loading the tank and storage of the tank until installation is completed.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit tank installation to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Contractor to coordinate installation of the tank with the owner. No construction shall begin prior to a construction permit from Mo~DNR being issued.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of the fiberglass tank that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including.
b. Faulty operation of the tank .
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: 1 year from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fiberglass Tank:

   a. Xerxes Corporation, Minneapolis, Minnesota

2.2 Single-Wall Fiberglass Underground Tanks

A. Product-Storage Requirements:
   1. Tank shall be vented to atmospheric pressure as the tank is not designed as a pressure vessel.
   2. Tank shall be designed for maximum product-storage temperature of 150° F.

B. Loading Conditions: Tank shall meet the following design criteria:
   1. Internal Load: Tank shall withstand a 5-psig air-pressure test with 5:1 safety factor. Installer shall test each tank for leakage prior to installation. Maximum test pressure is 5 psig (3 psig for a 12-foot tank).
   2. Vacuum Test: To verify structural integrity, each tank up through 10-foot diameter shall be vacuum tested by the manufacturer at the factory to 11.5 inches of mercury.
   3. Surface Loads: Tank shall withstand surface H-20 axle loads when properly installed according to manufacturer's current installation instructions.
   4. External Hydrostatic Pressure and Burial Depth: Tank shall be capable of being buried in ground with 7 feet of overburden, the hole fully flooded and a safety factor of 5:1 against general buckling.
   5. Tank shall support accessory equipment—such as internal pump platform, drop tubes, submersible pumps and ladders—as shown on tank drawings and when installed according to tank manufacturer's recommendations.

2.3 Accessories

A. Optional Anchor Straps:
   1. Straps shall be FRP anchor straps as supplied by tank manufacturer.
   2. Number and location of straps shall be shown on tank drawings.

B. Optional Pump Ports & Return Ports:
   1. All ports shall be flanged and 30-inch-i.d., complete with UL-listed gaskets, bolts and covers.
   2. Location(s) shall be shown on tank drawings.

C. Optional Internal Pump Platform:
   1. Contact pump manufacturer for pump details.

PART 3 - EXECUTION

3.1 Testing and Installation

A. The tank shall be tested and installed according to the manufacturer's most current underground storage tank installation instructions.

B. The tank shall be anchored according to the approved manufacture's guidelines.

END OF SECTION 2086

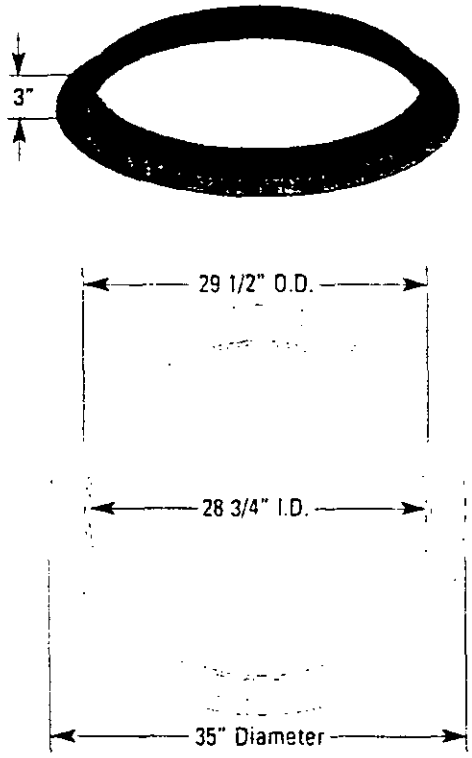
FRTA30 Tank Adapters

Submittal Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

The FRTA30 Tank Adapter is used to provide a structural watertight method of installing a 30" access riser over a tank opening.



General

Orenco FRTA30 Tank Adapters can either be cast into a tank or fastened to the top of the tank with an FRTA30BDKIT bolt down kit. The bolt down kit consists of 12 concrete anchors and a roll of butyl sealant.

The O.D. (29.5") of the vertical flange matches the I.D. of Orenco's 30" diameter ribbed riser, which provides a suitable joint to seal with IPS810 adhesive.

Standard Models

FRTA30

Nomenclature

FRTA □□

- □□ — Indicates riser diameter being used: 30 = 30" riser
- FRTA — Fiberglass riser tank adapter

Specifications

Dimensions are noted on the illustration above. The Tank Adapter has a nominal 1/4" thickness.

Materials of Construction:

Fiberglass Reinforced Polyester

Fiberglass Access Lids

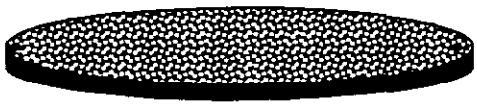
Submittal Data Sheet

Orenco Systems® Incorporated
1-800-348-9843

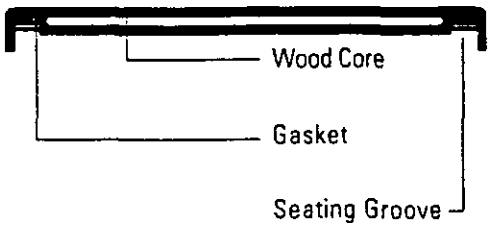
Applications

Orenco Fiberglass Access Lids are used as riser covers, pump basin covers, and access port covers. Lids fit "Perma-Loc" and "Ultra-Rib" type pipe.

Actual View



Cutaway View



General

Orenco Fiberglass Access Lids are molded using fiberglass reinforced polyester resin encapsulating a wood core. The finish is green and the top surface is textured to provide a non-skid surface. (Gasketed lids include a polyurethane gasket, which is cast-in). Lid comes with either two or four 1/4" or 5/16" stainless steel flathead socket cap screws and a hex key wrench. The 1/4" screws are used with Orenco inserts and the 5/16" screws are used with bolt catches and with Orenco's Riser-to-Lid Adapter.

Standard Models

~~FL18G-4BU, FL21G, FL24G, FL24-4B, FL24G-4BU~~, FL30G, ~~FL48G~~

Nomenclature

FL □□ □

- Indicates options:
  G = gasket
  V = vent
  CF = carbon filter
  I2 = 2" insulation
  I4 = 4" insulation
  4B = 4 bolt hole lid with four 5/16" bolts
  4BU = 4 bolt hole lid with four 1/4" bolts
- Lid diameter: 18", 21", 24", 30", 48"
- Fiberglass lid

Specifications

Dimensions

	~~Model FL18~~	~~Model FL21~~	~~Model FL24~~	Model FL30	~~Model FL48~~
O.D. (in.)	20	22.5	25.5	32	53.875
Groove I.D. (in.)	17.5	20.75	23.5	29.5	47.5
Avg. Thickness (in.)	.625	1	1	1.25	1.5

Orenco Fiberglass Access Lids are capable of supporting a 2500 lb. wheel load; however, they are not designed or recommended for vehicular traffic.

Options Available

Feature	Model Code Adder	Optional/Standard
Air Vent	V	Optional
Carbon Filter*	CF	Optional
Lid Insulation	I2 or I4	Optional

*For more information on this option, refer to the Carbon Filters submittal data sheet, ESU-RLA-CF-1.

Materials of Construction:

Fiberglass Reinforced Polyester
Wood Core
Polyurethane Gasket

Mechanical Float Switches

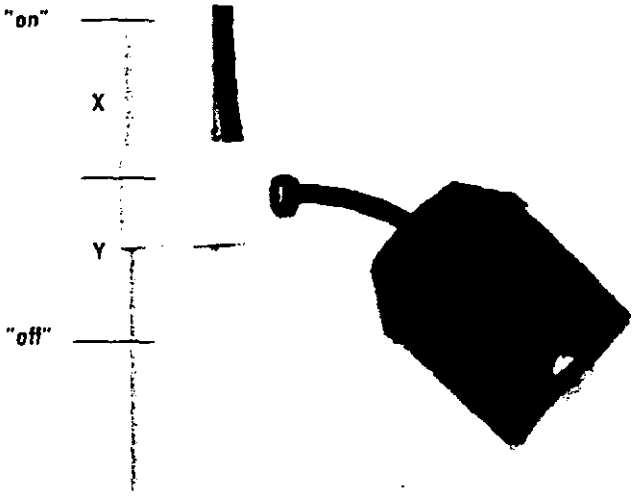
Pump Switches

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco float switches are used to activate control panel functions or directly control pumps in some pumping applications.



Note: The "ON" and "OFF" positions are descriptive of normally open floats For normally closed floats, the functions are reversed.

General

Orenco Mechanical Float Switches are mechanically activated with on-off differentials of not more than 25 degrees. All models listed are UL listed and CSA certified for use in water or sewage, utilize heavy duty contacts that allow for adjustable pumping ranges, and are horsepower rated. All listed models are normally open. Floats are typically ordered in assemblies which include a float stem (ordering explained below).

Standard Models

B, C, D.

Nomenclature

MF XXXX

- Indicates the float models in order from the top of the tank and number of floats.
- Mechanical/Mercury Float Assembly

Ex: MFAB - indicates one mercury "A" float (see *Mercury Float Switches* submittal) and one "B" float; the "B" is the lower on the float stem.

Specifications

	Model B		Model C		Model D	
Voltage 60 Hz, Single Phase	120 VAC	230 VAC	120 VAC	230 VAC	120 VAC	230 VAC
Maximum Current (amps)	13	13	13	13	13	13
Locked Rotor Amps*	85	85	85	85	85	85
Recommended Pump HP	1/2 or less	1 or less	1/2 or less	1 or less	3/4 or less	2 or less
X (in.) 2" Tether	2.5		3.5		3	
Y (in.) 2" Tether	1.5		3		2.5	
Drawdown (in.) 2" Tether	4		6.5		5.5	

*Locked Rotor test per UL 508/industrial equipment.
Floats carrying full pump current must be used only with pumps equipped with integral thermal overload protection.

Materials of Construction:

Float Housing:	Impact resistant non-corrosive PVC plastic for use in liquids up to 140° F (60° C)
Float Cord:	Flexible 16 gauge, 2 conductor per SJOW-A (UL), SJOW (CSA). Neoprene coating
Float Collar:	ABS

Universal Biotube® Pump Vaults

Submittal Data Sheet

Orenco Systems® Incorporated
1-800-348-9843

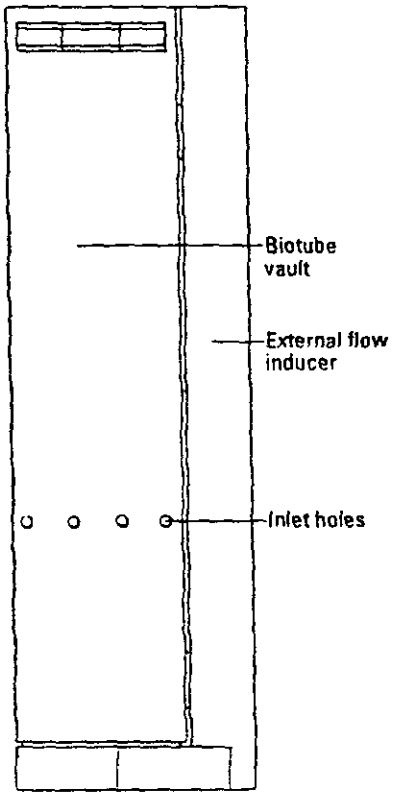
For use with Orenco 4" Submersible Effluent Pumps

Applications

Orenco Biotube Pump Vaults are used to filter effluent being pumped from septic tanks or separate dosing tanks in STEP systems and onsite wastewater disposal systems. Removes two-thirds of suspended solids, on average. When pumping from a single compartment tank or two compartment septic tank where both compartments are simultaneously drawn down during pumping, the discharge rate should not exceed approximately 40 gpm. Higher flow rates require a water-tight baffle or multiple tank arrangement, typically with an effluent filter in the primary tank.

General

The Orenco Biotube Pump Vault includes a molded polyethylene housing with an internal filter cartridge constructed of polypropylene and PVC. Schedule 80 PVC support pipes are included to suspend the vault in tank openings. The filter cartridge can be removed without pulling the pump or vault. Effluent enters through inlet holes around the perimeter of the Biotube vault and flows through the Biotubes to the external flow inducer. The external flow inducer accommodates one or two pumps. Orenco Biotube Pump Vaults are covered by US patents #4439323 and 5492635.



Side view

Standard Models

~~PVU57-1819, PVU57-2419~~

Nomenclature

126" 36" 19

PVU □□-□□ □□

- PVU: Universal Pump Vault
- □□: Vault height: ~~57", 66", 96" in 6" increments*~~
- □□: Cartridge height = ~~18", 24" standard, 36"*~~
- □□: Indicates inlet hole height: (inches) ~~13", 19" standard~~

*36" cartridge height and vault height of 66"-96" in 6" inch increments available mid-2001

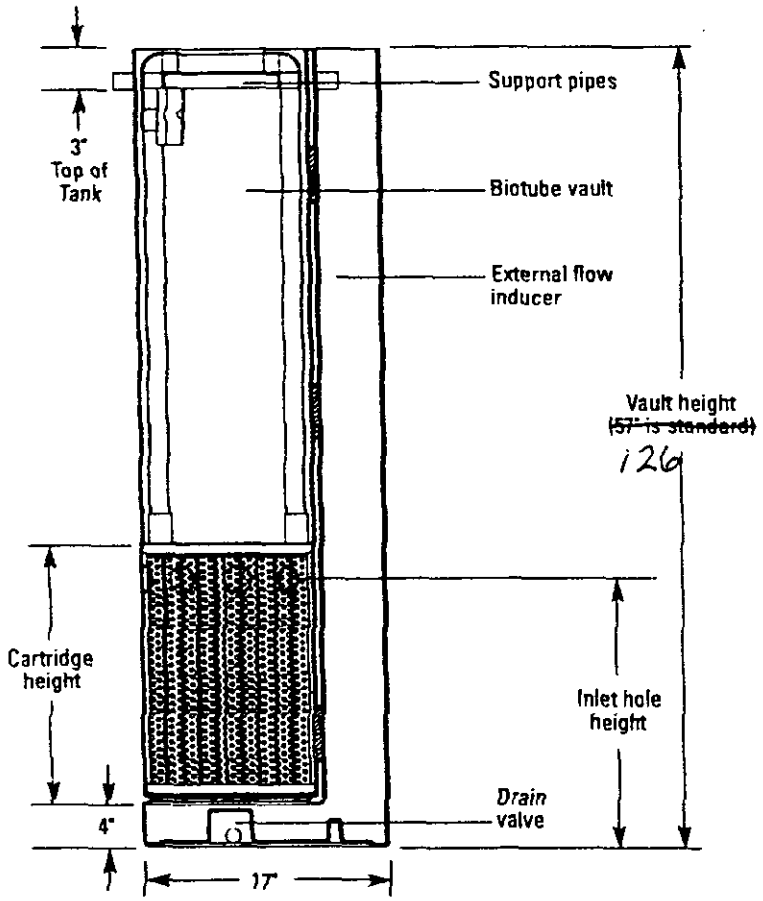
DETAILED SHOP DRAWING REQUIRED PRIOR TO FABRICATION

PVU-126-36-19

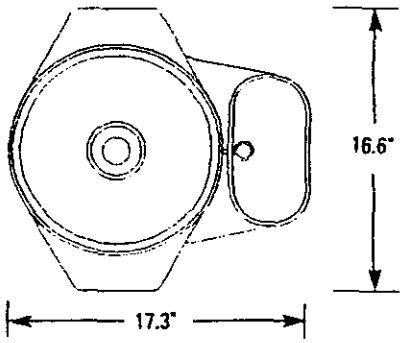
Tank Access and Riser Diameter

Biotube Series	Tank Access Dia. (Minimum)	Tank Access Dia. (Recommended)	Riser Dia. (Minimum)
~~PVU w/Simplex Pump~~	~~19"~~	~~20"~~	~~24"~~
PVU w/Duplex Pumps	~~19"~~	~~20"~~	~~30"~~

Universal Biotube® Pump Vaults (continued)



Side view



Top view

DETAILED SHOP DRAWINGS REQUIRED PRIOR TO FABRICATI.

PVU-126-36-19

Specifications

Model	~~PVU57-1819~~	~~PVU57-2419~~
Vault Height (in.)	~~57~~	~~57~~
Cartridge Diameter (in.)	~~12~~	~~12~~
Biotube Cartridge Height (in.)	~~18~~	~~24~~
Biotube Mesh Opening (in.)	~~0.125~~	~~0.125~~
Biotube Nominal Open Area (%)	~~30~~	~~30~~
Filter Surface Area (sq.ft.)	~~15.5~~	~~20.6~~
Inlet Hole Height* (in.)	~~19~~	~~19~~
Float Setting Range (from top of tank, in.)	~~29~~	~~23~~

**May vary depdending upon the configuration of the tank.*

Materials of Construction:

Vaults:	Polyethylene
Biotube Cartridge:	Polypropylene/PVC
Float Stem:	Sch. 40 PVC
Support Pipe:	Sch. 80 PVC
Drain Valve:	Polypropylene

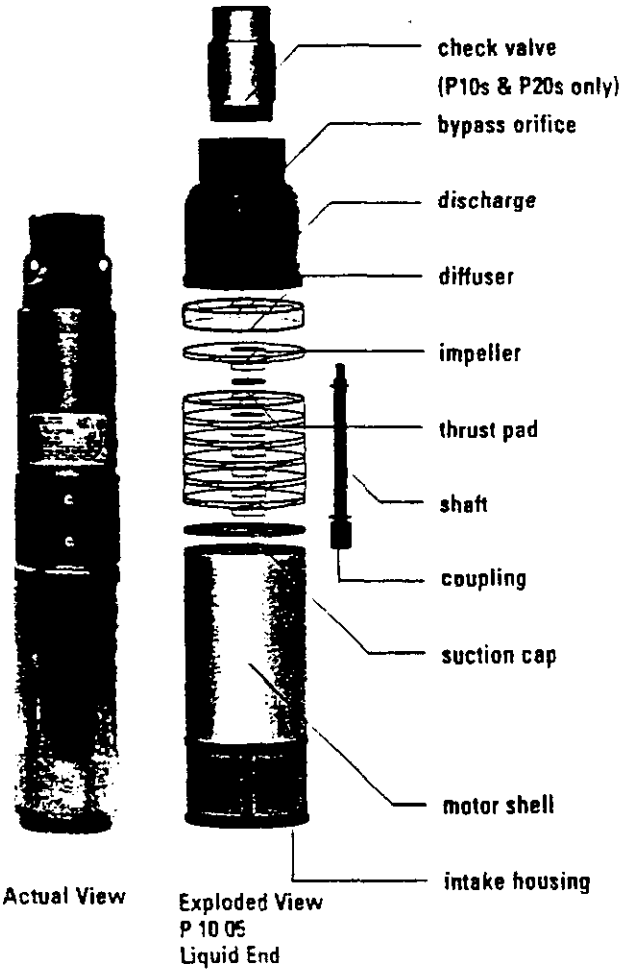
High-head Effluent Pumps
100SI - 500SI series

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco High-head Effluent Pumps are designed to transport screened effluent (with low TSS counts) from septic tanks to transport systems.



Actual View

Exploded View
P 10 05
Liquid End

General

Orenco High-head Effluent Pumps are single phase effluent pumps that utilize a floating stack design to minimize sand and particle interference. The diffusers and impellers are composed of dissimilar materials for frictional resistance. All models are UL listed and CSA certified for use in screened effluent pumping applications. Purchase for any other application nullifies the warranty. Consultation with Orenco personnel prior to alternative use is recommended.

Standard Models

See specifications for complete list.

Nomenclature

P XX XX X X

- Indicates voltage. (1 = 120 VAC, 2 = 240 VAC)
- Indicates phase (1 = single phase, 3 = three phase
- Indicates horsepower
- Indicates nominal flow (gpm)

High-head Effluent Pumps, 10 - 50 gpm (continued)

	Horsepower	Stages	Flow (gpm)	Diameter (in.)	Disch. Size (in.)	Length (in.)	MLL (in.)
~~P 10 03~~	1/3	3	10	4	1	19	18
~~P 10 05~~	1/2	6	10	4	1	22 1/4	20
~~P 10 07~~	3/4	8	10	4	1	25 1/4	22
~~P 10 10~~	1	10	10	4	1	30 3/4	24
~~P 20 05~~	1/2	5	20	4	1 1/4	22 3/4	20
~~P 20 07~~	3/4	5	20	4	1 1/4	23 3/4	22
~~P 20 10~~	1	7	20	4	1 1/4	27	25
~~P 20 15~~	1 1/2	9	20	4	1 1/4	32 3/4	28
~~P 30 05~~	1/2	3	30	4	1 1/4	21 1/4	22
~~P 30 07~~	3/4	4	30	4	1 1/4	24	24
~~P 30 10~~	1	5	30	4	1 1/4	26 1/2	27
~~P 30 15~~	1 1/2	6	30	4	1 1/4	31	29
~~P 50 05~~	1/2	2	50	4	2	21 1/4	22
P 50 07	3/4	3	50	4	2	24	24
~~P 50 10~~	1	4	50	4	2	26 1/2	27
~~P 50 15~~	1 1/2	5	50	4	2	32 3/4	29

Materials of Construction:

Check Valve:	Lexan® with bronze body and Celcon valve seat
Discharge:	High fiberglass thermoplastic (10 - 30 OSIs) or stainless steel (50 OSIs)
Discharge Bearing:	Nylatron®
Diffusers:	Lexan®
Impellers:	Delrin®
Thrust Pads:	(Proprietary)
Drive Shaft:	Hexagonal stainless steel
Intake Screen:	Corrosion-proof polypropylene
Intake Housing:	High fiberglass thermoplastic
Suction Cap:	Lexan®
Coupling:	Stainless steel
Shell:	Stainless steel

Franklin motor constructed of 100% corrosion-resistant stainless steel. Constant lubrication through water-filled design. Hermetically sealed motor assures moisture-free windings. All thrust absorbed by Kingsbury type thrust bearing. Rated for continuous duty. Protected against thermal overload and equipped with surge arrestors for added security. NEMA standard 2-wire motor with ground. Equipped with 16/3 SO type cable.

® Nylatron is a registered trademark of Sta-Rite Industries, Inc.
® Lexan is a registered trademark of General Electric Co.
® Delrin is a registered trademark of E.I. DuPont de Nemours & Co.
® Celcon is a registered trademark of Celanese Plastics Co.

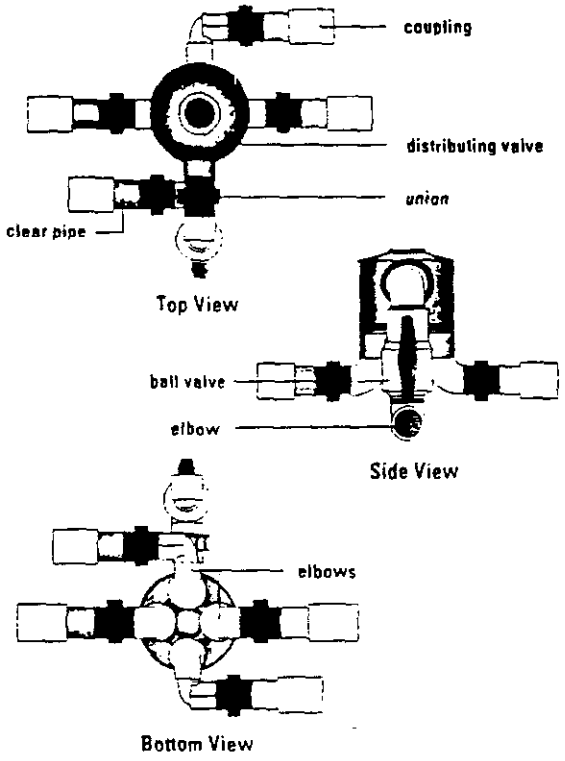
Distributing Valves

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Automatic Distributing Valve Assemblies are used to pressurize multiple zone distribution systems including sand filters and drainfields.



General

Orenco Automatic Distributing Valve Assemblies are pre-assembled for customer convenience. Each kit includes a Hydrotek® Distributing Valve, a section of clear pipe for each lateral, a ball valve, and the necessary elbows, unions, and couplings required for complete assembly.

Standard Models

~~V4402A, V4403A, V4404A, V4605A, V4606A, V5807A, V5808A,~~ V6402A, ~~V6403A, V6404A, V6605A, V6606A~~.

Nomenclature

V X X 0 X A

- A — Number of active outlet zones
- X — Number of available outlet zones
- X — Model series

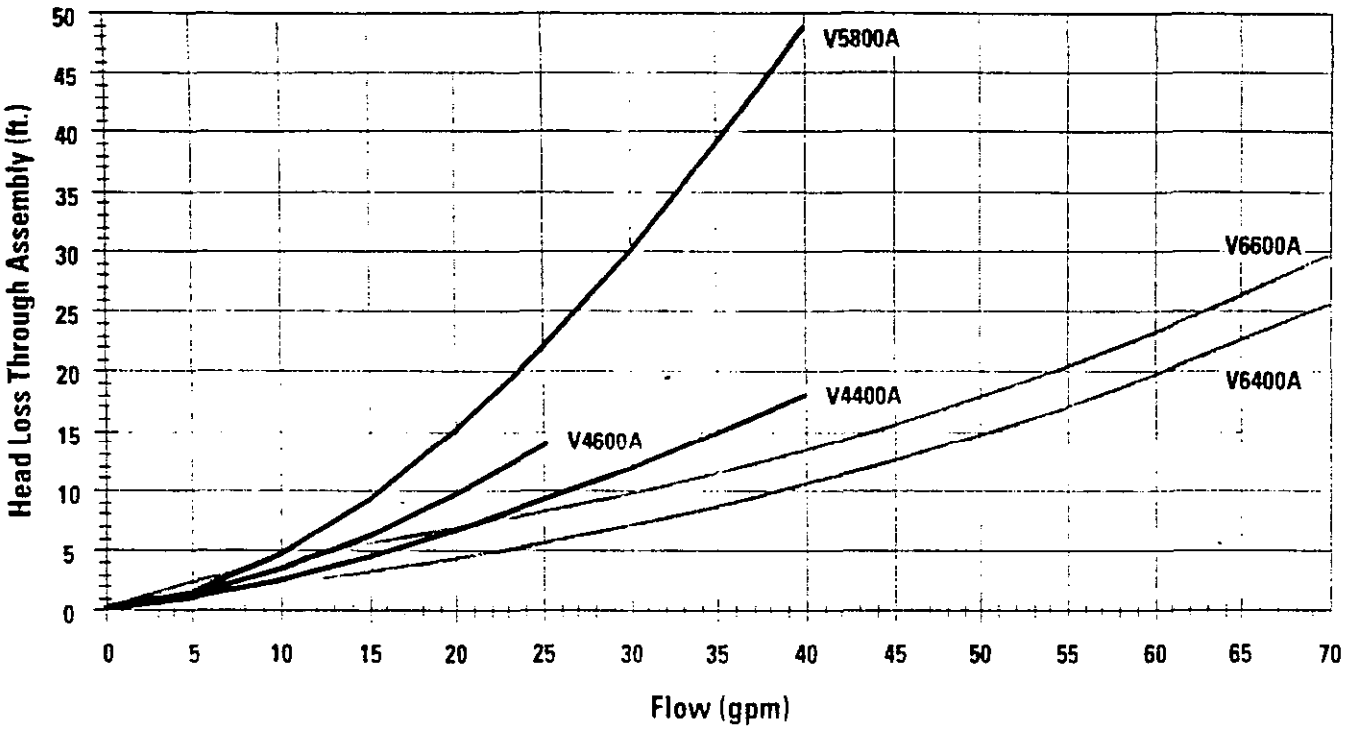
Specifications

Materials of Construction

All Fittings:	Sch. 40 PVC per ASTM specification
Unions:	Sch. 80 PVC per ASTM specification
Ball Valve:	Sch. 40 PVC per ASTM specification
Clear Pipe:	Sch. 40 PVC per ASTM specification
V4XXX Distributing Valves:	High-strength non-corrosive ABS polymer and stainless steel
V5XXX Distributing Valves:	High-strength non-corrosive ABS polymer, stainless steel, and die cast metal
V6XXX Distributing Valves:	High-strength non-corrosive ABS polymer, stainless steel, and die cast metal

Assemblies used to pressurize drainfields at a higher elevation require check valves in the transport lines (check valves sold separately). Other configurations may vary depending upon system. Contact Orenco for more information.

Distributing Valves (continued)



Model	Inlet Size (in.)	Outlets Size (in.)	Flow range (gpm)	Max Head (ft.)	Min. Enclosure
V4402A	1.25	1.25	10 - 40	170	VB1217
V4403A	1.25	1.25	10 - 40	170	VB1217
V4404A	1.25	1.25	10 - 40	170	VB1217
V4605A	1.25	1.25	10 - 25	170	RR2418
V4606A	1.25	1.25	10 - 25	170	RR2418
V5807A	1.5	1	10 - 40	170	RR2418
V5808A	1.5	1	10 - 40	170	RR2418
V6402A	1.5	1.5	15 - 100	345	RR2418
V6403A	1.5	1.5	15 - 100	345	RR2418
V6404A	1.5	1.5	15 - 100	345	RR2418
V6605A	1.5	1.5	15 - 100	345	RR2418
V6606A	1.5	1.5	15 - 100	345	RR2418

DISCHARGE

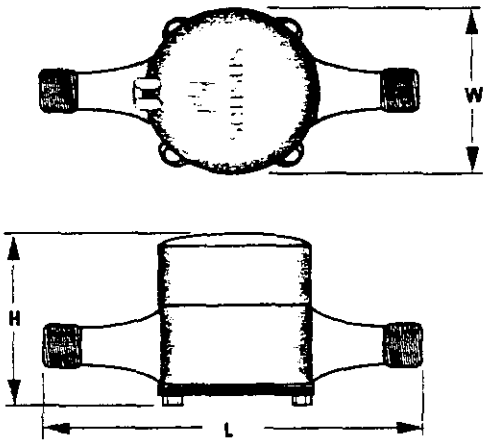
Flow Meters

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco Flow Meters are used to measure cumulative flow through a transport line.



General

Orenco Flow Meters utilize an oscillating piston and magnetic drive register to precisely measure variable flows. Display is an analog dial with an odometer-type totalizer and center sweep hand. Maximum error is only 1.5%. Available for 5/8", 3/4", 1", 1 1/2", and 2" discharge lines.

Standard Models

FM062, FM075, FM100, FM150, FM200.

Nomenclature

FM XXX
└ Indicates line size (in.)

Specifications

Model	FM062	FM075	FM100	FM150	FM200
L (in.)	7 1/2	9	10 3/4	13	17
W (in.)	4 5/8	5 1/4	6 3/4	8 3/4	9 3/4
H (in.)	4 9/16	5 1/8	5 3/4	6 7/8	7 1/2
Normal Flow Range (gpm)	1 - 10	2 - 15	3 - 25	5 - 50	8 - 80
Maximum Intermittent Flow (gpm)	20	30	50	100	160
Low Flow Registration (95% level, gpm)	1/4	1/2	3/4	1 1/2	2
Maximum Pressure (psi)	150	150	150	150	150
Nominal Line Size (in.) male thread	1	1	1 1/4	2	2

Materials of Construction:

Main Case:	Bronze
Register Box:	Bronze
Bottom Plate:	*Bronze or synthetic polymer (model dependent)*
Magnets:	Plasticized material
Casing Bolts:	Stainless steel
Strainer:	Synthetic polymer

For Health Hazard Applications

Series 909

Reduced Pressure Zone Backflow Preventer

Sizes: ¾", 1" (20, 25mm) - 909

Sizes: 1¼", 1½", 2" (32, 40, 50mm) - 909-M1

No. 909QT-S
1½" (40mm)

The Watts 909 Series Reduced Pressure Zone Backflow Preventers are designed to provide superior cross-connection control protection of the potable water supply in accordance with national plumbing codes and containment control for water authority requirements. This series can be utilized in a variety of installations, including health hazard cross-connections in plumbing systems or for containment at the service line entrance. With its exclusive, design incorporating the patented "air-in/water-out" principle it provides maximum relief valve discharge during the emergency conditions of combined back-siphonage and back-pressure with both checks fouled. No. 909-QT, standardly furnished with full port, resilient seated and bronze ball valve shutoffs. Sizes ¾" and 1" (20, 25mm) shutoffs have tee handles.

FEATURES

- *Modular design*
- *Replaceable bronze seats*
- *Compact for installation ease*
- *Horizontal or vertical (up or down) installation*
- ***No special tools required for servicing***

AVAILABLE MODELS

Suffix

QT -	with quarter-turn, full port, resilient seated ball valve shutoff (Standard)
S -	with bronze strainer
HW -	with stainless steel check modules for hot water and harsh water conditions
LF -	without shutoff valves
LH -	with lockable ball valve handles (open position)
HC -	with inlet/outlet fire hydrant fitting (2" only)

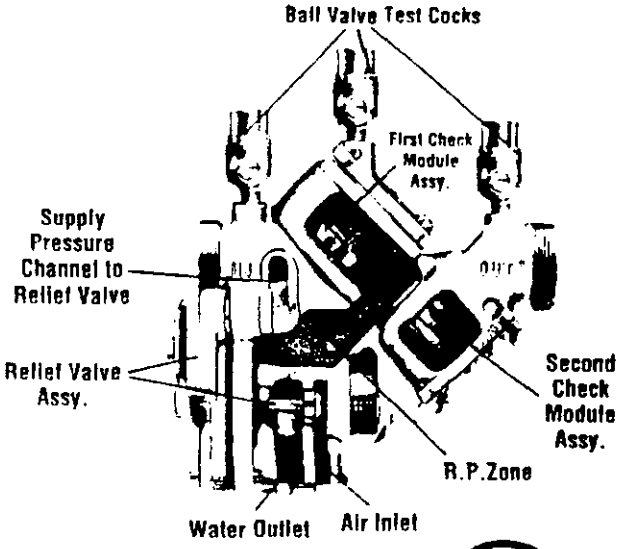
Prefix

C -	clean and check strainer - ¾" and 1" only (20 and 25mm)
U -	with integral body unions - ¾" and 1" only (20 and 25mm)
FAE -	with flanged adapter ends - 1¼", 1½", 2" only (32, 40, 50mm)

NOTE: The installation of a drain line is recommended. When installing a drain line, an air gap is necessary.

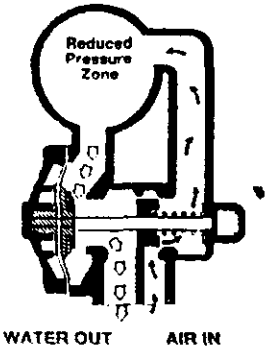
SPECIFICATIONS

A reduced pressure zone backflow preventer shall be installed at each cross connection to prevent backsiphonage and back-pressure backflow of hazardous materials into the potable water supply. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves. Backsiphonage protection shall include provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel, or directly into the supply pipe via a separate vent. The assembly shall include two tightly closing shutoff valves before and after the assembly, test cocks and a protective strainer upstream of the No. 1 shutoff valve. The assembly (specify Model 909 for temperatures up to 140°F (60°C) or Model 909HW for temperatures up to 210°F (99°C)) shall meet the requirements of ASSE Std. 1013; AWWA Std. C-511-92 CSA B64.4; FCCCHR of USC Manual Section 10. Listed by IAPMO (UPC). SBCCI (Standard Plumbing code). Watts Regulator Co. Model 909QT or 909QTHW.



HOW IT OPERATES

The unique relief valve construction incorporates two channels: one for air, one for water. When the relief valve opens, as in the accompanying air-in/water-out diagram, the right-hand channel admits air to the top of the reduced pressure zone, relieving the zone vacuum. The channel on the left then drains the zone to atmosphere. Therefore, if both check valves foul, and simultaneous negative supply and positive back-pressure develop, the relief valve uses the air-in/water-out principle to stop potential backflow.



Patent# 4,241,752

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Canada: 5435 North Service Rd., Burlington, ONT L7L 5H7; www.wattscda.com

ISO 9001 CERTIFIED

ATERIALS

e body construction - Model 909 Celcon® check seats, l 909HW stainless steel check seats - stainless steel valve seats, shafts and flange bolts - durable tight ng, rubber check valve and relief valve assemblies. ze body test cocks.

Celcon is a registered trademark of Hoescht Celanese.

CONNECTIONS

1" (19, 25mm) 909-NPT Female threaded body connection.
-2" (32-50mm) 909-M1-NPT Male threaded body connection.

STANDARDS

SE No. 1013, AWWA C-511-92
A B64.4, FCCCHR of USC Manual Section 10
MO (UPC), SBCCI (Standard Plumbing code)

APPROVALS

SE, AWWA, CSA.
ted by IAPMO
ted by SBCCI
pproved by the Foundation for Cross-Connection Control dHydraulic Research at the University of Southern California. orizontal and vertical "flow-up" approval on ¾" and 1" sizes lodels 909QT, 909PCQT, and U909QT).

***IMPORTANT:** Inquire with governing authorities for local installation requirements.*

PRESSURE - TEMPERATURE

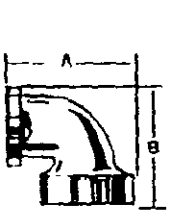
Model 909 suitable for supply pressures up to 175 psi (12.1 bars) and water temperatures to 140°F (60°C) continuous and 180°F (82°C) intermittent.

Model 909HW suitable for supply pressures up to 175 psi (12.1 bars) and water temperatures up to 210°F (99°C).

DIMENSIONS - WEIGHT

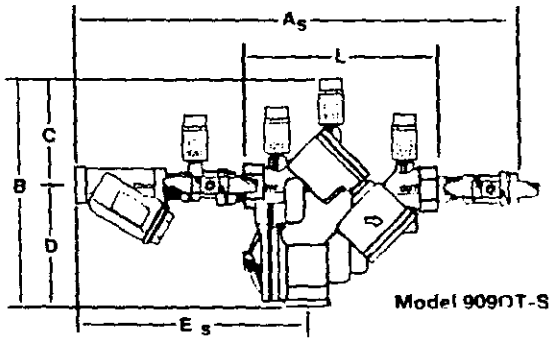
Series 909AG Air Gaps

When installing a drain line use 909AG series Air Gaps on No. 909 backflow preventers. *909EL series elbows are for air gaps on backflow preventers in vertical installations.



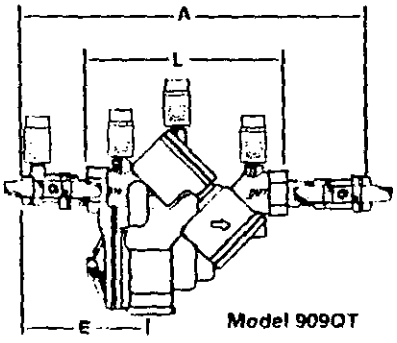
Iron Body No.	Desc.	No.909 Drain Sizes in.	mm	Outlet Sizes in.	mm	Dimensions A in.	mm	B in.	mm	Weight lbs.	kg.
909 AG-C	Air Gap	¾,1	19,25	1	25	3¼	83	4⅞	124	1½	.7
909 EL-C	Elbow*	¾,1	19,25	-	-	2⅜	60	2⅜	60	⅜	.2
909 AG-F	Air Gap	1¼-2	32-50	2	50	4⅜	111	6¾	171	3¼	1.5
909-EL-F	Elbow*	1¼-2	32-50	-	-	3⅝	92	3⅝	92	2	.9

DIMENSIONS and WEIGHTS

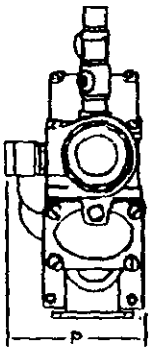


Model 909QT-S

Subscript 'S' = strainer model



Model 909QT



***909QT / 909QT-S Dimensions** — **Suffix HC - Fire Hydrant Fittings dimension "A" = 23¾" (603mm)**

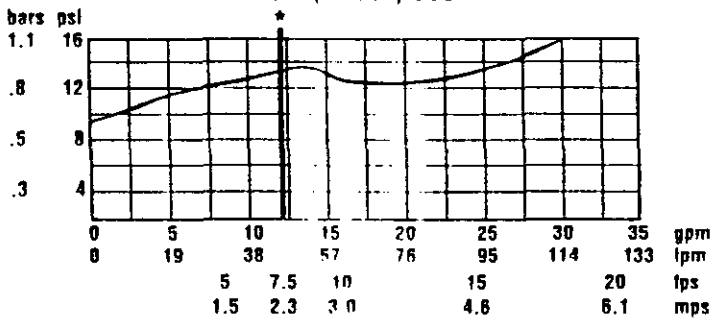
Size	Dimensions (approximate) A in.	mm	As in.	mm	B in.	mm	C in.	mm	D in.	mm	E in.	mm	Es in.	mm	L in.	mm	P in.	mm	Weight QT lbs.	kg.	QT-S lbs.	kg.
¾"	14⅜	365	18 1/16	459	8¾	222	4	102	4¾	121	6¾	171	10 5/16	259	7 5/16	186	3⅞	98	14	6.4	15.6	7.1
1"	15⅜	391	19⅜	498	8¾	222	4	102	4¾	121	7	178	11	279	7 5/16	186	3⅞	98	15	6.8	17.5	7.9
1¼"M1	18½	470	23 1/16	595	11⅝	295	5½	140	6½	165	7½	191	12 3/16	310	10⅜	264	5¼	133	40	18.1	42.8	19.4
1½"M1	19	483	24⅜	619	11⅝	295	5½	140	6½	165	7½	191	12⅜	321	10⅜	264	5¼	133	40	18.1	44.0	20.0
2"M1	19½	495	25 5/16	659	11⅝	295	5½	140	6½	165	7¾	197	13 5/16	354	10⅜	264	5¼	133	40	18.1	47.4	21.5
***U909QT Dimensions - with integral body unions (Prefix "U")**																						
¾"	14⅝	371	19 1/16	484	8¾	222	4	102	4¾	121	6¾	171	10 5/16	259	7 5/16	186	3⅞	98	14	6.4	15.6	7.1
1"	15⅝	397	20 5/16	532	8¾	222	4	102	4¾	121	7	178	11	279	7 5/16	186	3⅞	98	15	6.8	17.5	7.9
***FAE909QT Dimensions - with flanged adapter ends (Prefix "FAE")**																						
1¼"	19	483	24½	622	11⅝	295	5½	140	6½	165	7½	191	12 3/16	310	10⅜	264	5¼	133	40	18.1	42.8	19.4
1½	19¾	502	26⅛	664	11⅝	295	5½	140	6½	165	7½	191	12⅝	321	10⅜	264	5¼	133	40	18.1	44.0	20.0
2"	21	533	28⅜	721	11⅝	295	5½	140	6½	165	7¾	197	13 5/16	354	10⅜	264	5¼	133	40	18.1	47.4	21.5

CAPACITY

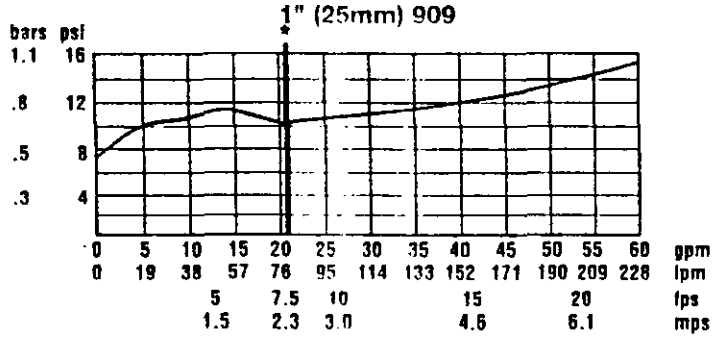
As compiled from documented Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California lab tests.

*Typical maximum system flow rate (7.5 feet/sec.)

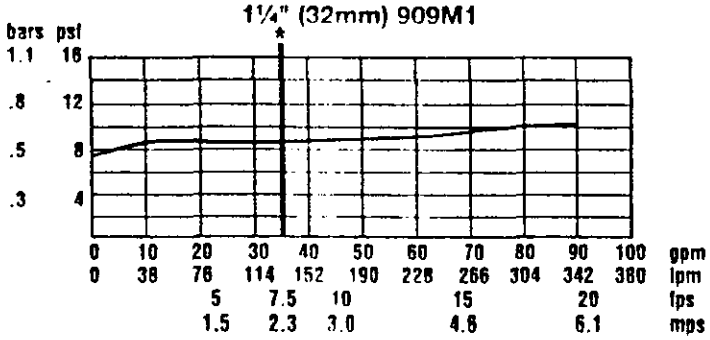
¾" (20mm) 909



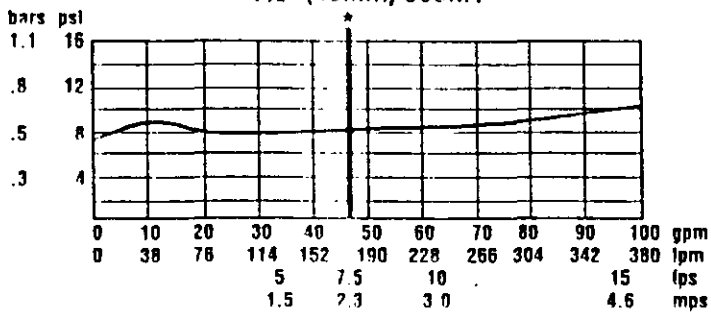
1" (25mm) 909



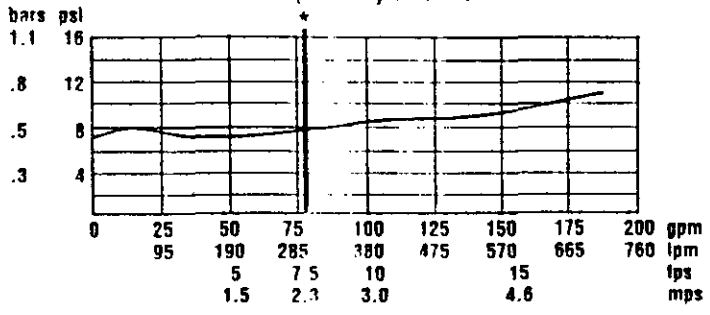
1¼" (32mm) 909M1



1½" (40mm) 909M1



2" (50mm) 909M1

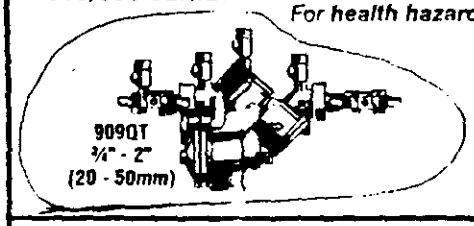


BACKFLOW PREVENTION ASSEMBLIES

Sizes in metric are DN equivalents. *For additional information, send for Catalog C-BPB.*

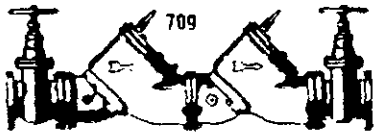
909/009 SERIES — REDUCED PRESSURE ZONE BACKFLOW PREVENTERS

*For **health hazard** cross-connections and continuous pressure applications.*



709/007 SERIES — DOUBLE CHECK VALVE ASSEMBLIES

*For **non-health hazard** cross-connections and continuous pressure applications.*



007/709 - 909 SERIES

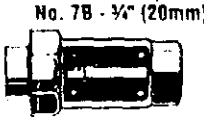
007QCDA - 2", 2½", 3" (50, 65, 80mm)
*For **non-health hazard** applications.*

*For **health hazard** applications.*

DETECTOR ASSEMBLIES - *For fire protection system supply mains.*

7 SERIES/L7/Cu7

7 Series - ½"-1¼" (15-32mm)
No. 7B - ¾" (20mm)



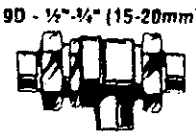
Series L7
¾" and 1"
(20-25mm)

Series Cu7
½" - 1"
(15-25mm)

DUAL CHECK VALVE BACKFLOW PREVENTERS
*For **non-health hazard** applications. Residential system containment.*

9D/9BD/N9/NLF9

9D - ½"-¾" (15-20mm)



9BD - ¾" (10mm) FCT
¼", ¾" (8, 10mm) NPTM

N9 - ¼", ⅜"
(8, 10mm)

SPECIALTY BACKFLOW PREVENTERS WITH INTERMEDIATE ATMOSPHERIC VENT
*For **non-health hazard** applications in small pipe sizes. Continuous pressure applications*

288A/N388/188A SERIES

188A
¾" - 2"
(20-50mm)

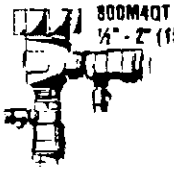
288A
¼" - 3"
(8-80mm)

N388
¼" - ⅜"
(8-10mm)

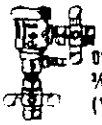
ATMOSPHERIC VACUUM BREAKERS
*For **health hazard** cross-connections not subject to continuous pressure - 6" above all downstream water.*

800QT/008QT SERIES

800M4QT
½" - 2" (15-50mm)



800M0QT
½" - ¾"
(15-20mm)



008QT
⅜"-1"
(10-25mm)

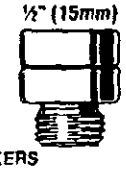
PRESSURE VACUUM BREAKERS / ANTI-SIPHON VACUUM BREAKERS
*For **health hazard** cross-connections.*
Continuous pressure applications - 12" above all downstream water.

8/8A/8B/NF8/8C/S8/8P

8A/8B
¾" (20mm) HT

NF8
¾" (20mm) HT

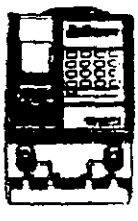
S8C
½" (15mm)



HOSE CONNECTION VACUUM BREAKERS
For residential and industrial hose supply outlets not subject to continuous pressure.

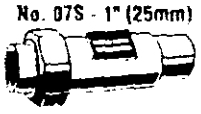
TEST KITS

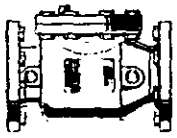
TK-DP Digital print out for all RPZ and DCVA backflow preventer models
TK-DL Same as TK-DP with computer download.
TK-99D Hand held digital LCD test kit
TK-99E Anti-parallax dial for all RPZ, DCV, PVB and SVB.
TK-9A Analog differential gauge for all RPZ, DCV, PVB and SVB
TK-7 Water column sight tube for **Dual check** and **Double check** valves



07S/07F SERIES

No. 07S - 1" (25mm)





07F
4" - 10"
(100-250mm)

DUAL CHECKS / SINGLE CHECKS FOR FIRE SPRINKLER SYSTEMS
Series 07F detector check for automatic fire sprinkler systems
No. 07S dual check backflow preventer for residential fire sprinkler system.

9943

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ISO 9001 CERTIFIED

ES-909S 0005

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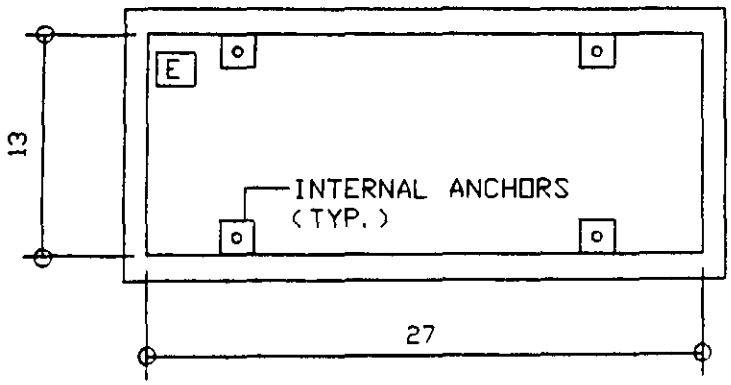
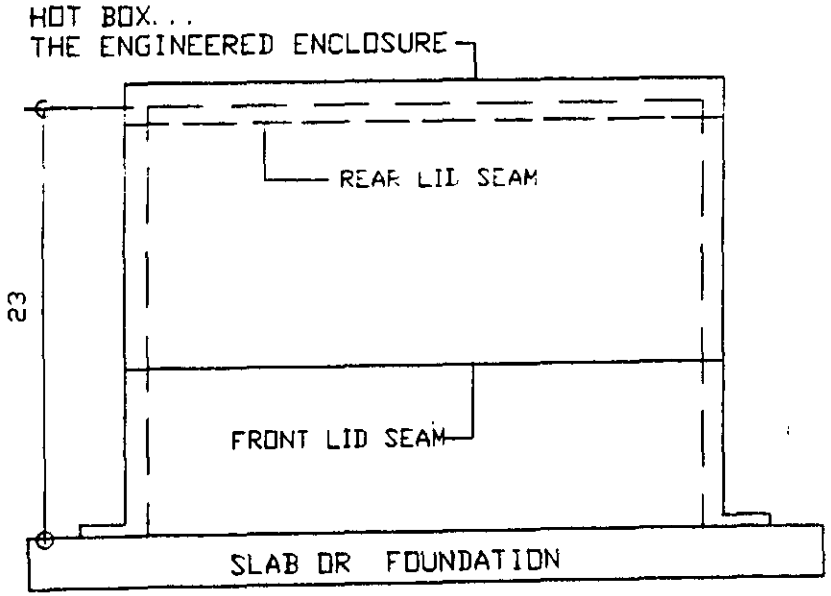
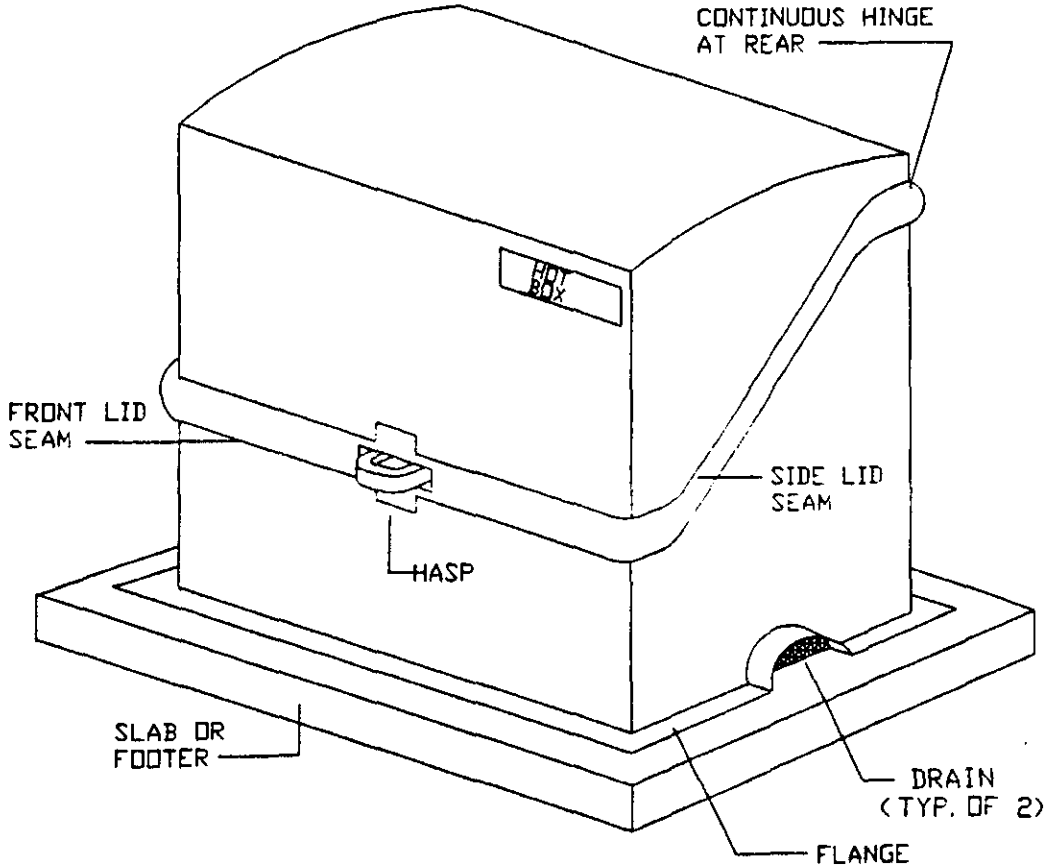


NOTE :

1. RECOMMENDED SLAB SIZE : 36"L x 22"W x 4" MINIMUM THICKNESS.
2. HEAT IS PROVIDED BY A 60W, 120V, SINGLE PHASE HEAT TRACE CABLE.
3. THE ENCLOSURE BECOMES A LB1 WHEN INSTALLED WITHOUT THE HEAT.





RESTRICTED DRAWING.
PATENT # 4,726,394.

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FAX (904) 783-6965
http://www.hot-box.com

TITLE : STANDARD # HB-1 FIBERGLASS ENCLOSURE

BY/DATE/DWG: SBT / 7-19-99 HB1

ENGINEER / CONTRACTOR :

LOCATION :

APPROVED/DATE :

. 1 :

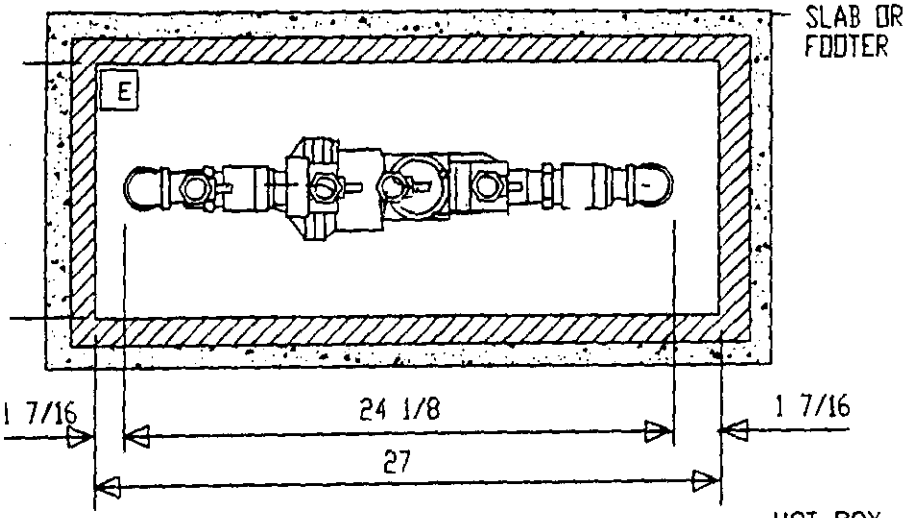
REV. 2 :

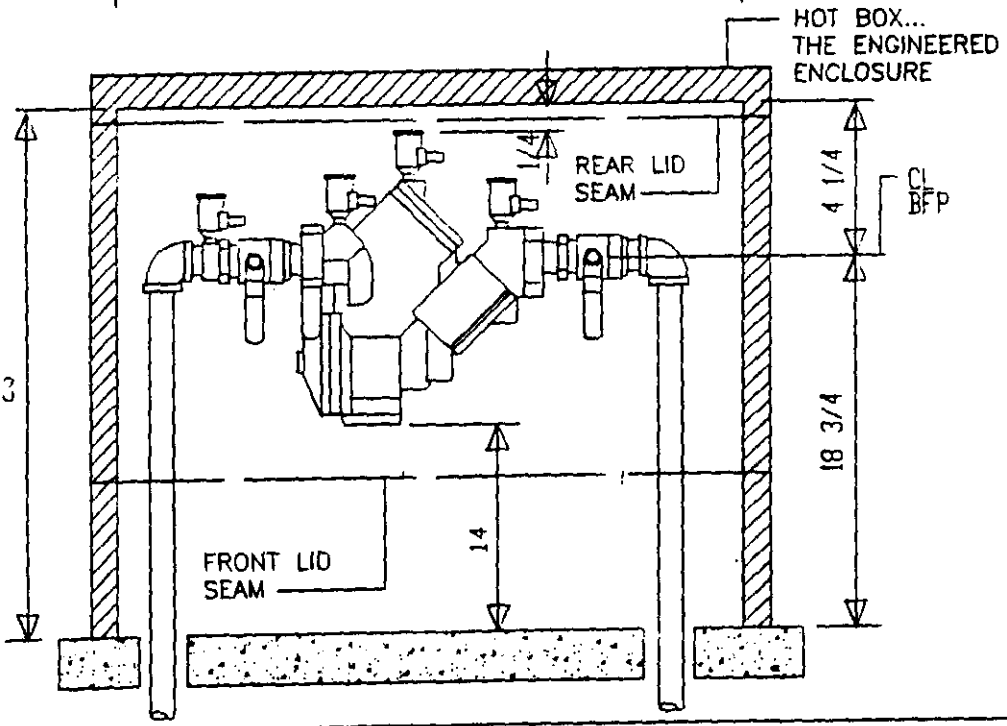
REV. 3 :

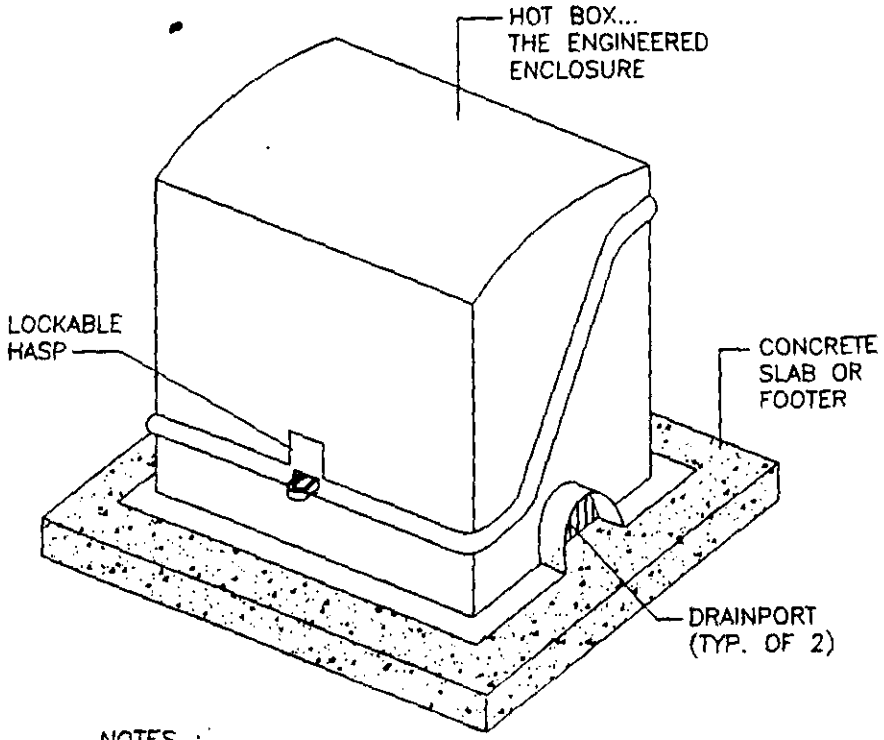
SCALE: N. T. S.

REP. / DISTRIBUTOR :

QUOTE NO.:







NOTES :

1. ALL DIMENSIONS ARE APPROXIMATED IN INCHES.
2. RECOMMENDED SLAB SIZE SHALL BE 36"L x 22"W x 4" MINIMUM THICKNESS.
3. "E" INDICATES THE ELECTRICAL RECEPTICLE. IT SHALL BE MOUNTED A MINIMUM OF 16" ABOVE THE SLAB.
4. HEAT IS PROVIDED BY A 60W, 120V, SINGLE PHASE HEAT TRACE CABLE (12'-0" LENGTH).
5. THE ENCLOSURE IS CONSTRUCTED OF FIBERGLASS AND DESIGNED AS A FLIP-TOP TO ASSURE EASIER ACCESS AND MAINTENANCE.
6. UNIT IS A LB1 WHEN INSTALLED WITHOUT HEAT.

RESTRICTED DRAWING
PATENT # 4,726,394.

HOT BOX ®

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FAX (904) 783-6965
HTTP://WWW.HOT-BOX.COM

TITLE : 3/4"WATTS 909-QT
(STANDARD #HB1 FIBERGLASS ENCLOSURE)

BY/DATE/DWG:
SBT / 6/28/01
AWAQ--11

ENGINEER / CONTRACTOR :

LOCATION :

APPROVED/DATE :

SCALE:

REP. / DISTRIBUTOR :

QUOTE NO.:

GRAVITY SEWERS

1. Materials

   A. PVC Solid Wall Sewer Pipe: Pipe and fittings under these Specifications shall be PVC solid wall pipe with bell and spigot gasketed joints, manufactured of materials and methods meeting the tests set forth in the latest revision of ASTM D-3034 and ASTM D-3212. PVC sewer pipe shall have a maximum standard dimension ratio of 35.

2. Underground Pipe Construction

   Underground pipe construction shall be in accordance with the recommended practice as outlined by the pipe manufacturer.

   All excavations shall be made to such depths and widths as will give ample room for building all structures, sewers, and appurtenances as detailed on the approved plans.

   Clearing and grubbing the site of work, excavation of earth or other materials, sheeting and bracing, pumping and drainage, backfilling, rough grading, and cleaning up shall all be done as specified. In addition, all work maintaining or replacing existing fences, roadways, drives, lawn, or structures disturbed by the work, safety precautions and other miscellaneous general work not specified under specific items is to be included in the work done under this section.

3. Sewer Pipes

   The trench excavation shall be of sufficient width to properly construct the joints and to allow for inspection of proper bedding of the pipe. In all cases, the bottom quadrant of the pipe trench should be carefully shaped at proper intervals so that no part of the load is supported by the pipe bells. The full load should rest on the barrel of the pipe.

   To assure stable pipe bedding, mechanical excavation should be made four (4) inches below the bottom of the pipe grade. A layer of compacted granular material at least four (4) inches thick shall be provided to stabilize the trench bottom.

   A laser beam may be used to attain property alignment of sewer pipe during construction. However, if such a device is used, a blower of sufficient capacity to prevent defraction of the beam by fumes from joint lubricant must be used.

   No pipe shall be installed in the trench until the bottom of the trench has been properly shaped and its conditions, line, and grade has been approved by the Engineer.

   Pipe shall be laid with the spigot end downstream entering the bell to full depth, and in such manner as not to drag earth into the joints. Pipe sections shall be fitted together and matched so that, when laid, they will form a sewer with a smooth and uniform invert. Installation shall be in accordance with manufacturer's recommendations.

   Wherever obstructions are encountered during the progress of the work and interfere to such an extent that an alteration in the Plan is required, the Engineer shall have the authority to change the approved plans and order a deviation from the line and grade or arrange with the Engineers of the structures for the removal, relocation, or reconstruction of the obstructions.

4. Cutting and Trenching Excavation

If local conditions permit their reuse, all surface materials suitable for reuse in restoring the surface shall be kept separate from the general excavation material.

All excavated material unsuitable for backfill shall be removed and disposed of off the site, by and at the expense of the Contractor.

All excavated material shall be piled in a manner that will not endanger the work and that will not avoid obstructing walks and driveways. Ditches shall be kept clear or other satisfactory provisions made for drainage.

All excavations shall be made to such depths and widths as detailed on the approved plans or an embodied in the Specifications or as will give ample room for carrying on the required construction operations.

No excavated trench shall be wider than one and four-tenths (1 4/10) times the pipe diameter in inches plus twelve (12) inches (width = 1.4d" + 12") or two (2) feet wide or as designated by the engineer.

Granular backfill material shall be tamped into the trench uniformly on both sides of the pipeline for the full width of the trench, up to the horizontal diameter of the pipeline.

No large rocks shall be allowed in contact with the pipe either in the bed or the backfill. Large rocks occurring in the bed shall be removed and the resulting hole filled with gravel.

Bell holes shall be of ample depth to permit the barrel of the pipe totally flat on the trench bottoms, but they shall not be larger than necessary for properly making the joint.

5. Trench Excavation Classifications

All excavation shall consist of two (2) classifications: Class "A" and Class "B"

A. Class "A" Excavation: Class "A" Excavation shall consist of all other materials not to be mentioned in Class "B". The decisions of the Consultants shall be final in the determination of the proper classification.

B. Class "B" Excavation: Any materials shall be considered Class "B" excavation, which, in the opinion of the Consultant cannot be excavated by any process other than drilling and blasting or drilling and wedging. The classification shall not be extended to include the materials, which can be removed by other means, but which, for reasons of economy in drilling and wedging. Such excavation shall include detached pieces of rock or boulders one (1) cubic yard or more in contents and masses of solid, well-defined ledge of stone or masses or rock, slate, shale, or soapstone and other similar substances. Class "B" Excavation shall be stripped for measurement if sections of such length as the Consultant may direct, and no rock excavated or blasted before such measurements will be allowed. Stripping shall mean the removal of all other materials so as to expose the surface of the rock.

   i. Explosives: Explosives shall only be used of such character and strength and in such manner as may be permitted by the Engineer. All necessary precautions shall be taken

to prevent accidents and injury or damage to adjacent buildings. Blasts shall be completely and carefully covered with heavy timbers or other adequate protection and shall be made only between such hours as may be designated by the Engineer. The Contractor shall be liable for all injuries or deaths of persons or damages to property caused by blasting or explosives.

ii. Measurement: All Class "B" Excavations shall be measured in place by the cubic yard. No loose, shaken or previously blasted rock will be allowed as Class "B" Excavation, nor shall any excavation exterior to the maximum of measurements be allowed.

6. Sheeting and Bracing

Furnish, put in place, and maintain such sheeting, braces, rangers, and other timbering as may be required to support the sides of the excavation and to prevent any movement which could in any way injure the sewers, diminish the necessary width of the excavation or otherwise injure or delay the work or endanger adjacent pavements, buildings, sewers, pipes, drains, conduits or other structures, or the lives of workmen employed thereon.

The engineer may direct that sheeting in the trench be cut off at any specified elevation and in no case without permission shall timber be left in the ground above and elevation eighteen (18) inches below the surface of the ground.

All timber, which may not be left in place under the foregoing provisions of this Specification, shall be removed in such manner as not to endanger adjacent pavements, structures or property, or to cause movement of the pipe or endanger the structure built in the excavation from which the timber of sheeting is being removed or adjacent thereto. All voids left by withdrawal of sheeting shall be immediately refilled with sand or fine earth by ramming with tools especially adapted to that purpose, by watering, or otherwise as may be directed by the engineer.

7. Laying Pipe

Pipe material shall meet the requirements of the Material Specifications. Branches, fittings, and specials shall be provided, and when not to be immediately used shall be closed with earthenware or pre-cast concrete stoppers sealed in place with bituminous mastic. When immediate use is to be made of them, they may be closed with a plywood stopper. The sewer at the end of the days' laying shall be closed with dirt-tight temporary stopper.

The interior of the sewers shall, as the work progresses, be cleared of all dirt, cement and superfluous materials of every description. On all diameter sewer, an approved swab or drag shall be kept in the pipeline and pulled forward past each joint immediately after its completion.

Unless otherwise permitted, at least four (4) finished joints shall be left exposed for inspection throughout the working day, and any and all sections of pipe laid shall be made accessible for inspection at any time while the work is progressing.

Pipe shall not be laid in water. No walking on or walking over the pipe will be permitted after they are laid except as may be necessary for backfilling and tamping.

Pipe shall be firmly supported for its entire length when laid in trench.

8. Backfilling for Trenches

A. General: When the pipe is laid, the Contractor shall backfill under and around the pipe as specified in "Pipe Bedding". The remainder of the trench shall then be carefully backfilled simultaneously on both sides of the pipe. Broken concrete or pavement, blasted rock and large boulders shall not be used as backfill materials. Any trenches improperly backfilled, or where settlement occurs, shall be repaired as directed by the engineer.

B. Backfill in Paved Areas: In areas of existing or proposed pavement or rock surfaces, the entire backfill shall consist of well-graded one (1) inch minus crushed limestone. The backfill material shall be compacted to ninety (90) percent of the Modified Proctor density by an acceptable method to ensure that no pavement settlement of the completed backfill will occur. All areas of existing pavement damaged during construction shall be repaved with three (3) inches of Type C asphaltic pavement and installed in accordance with the latest edition of the Missouri Standard Specifications for Highway Construction. Edges of the existing pavement shall be neatly cut in a straight line, removing all damaged pavement prior to repaving.

C. Backfill in Areas that are not Paved: The entire backfill for trenches in these areas shall be compacted to eighty-five (85) percent of the Modified Proctor density as directed by the engineer. It is the intent of these Specifications to secure a condition where no further settlement of trenches will occur after backfilling is completed.

D. Compaction: Care shall be exercised not to disturb pipe when placing backfill. All backfill or trenches shall be placed in uncompacted lifts not to exceed eight (8) inches in thickness, and each lift shall be compacted in a manner approved by the engineer.

E. Responsibility of Contractor for Backfill Settlement: The Contractor shall be responsible for the satisfactory compaction of backfill material described. If any trenches or other excavation are found to have settled, they shall be immediately reworked by the Contractor and restored to the specified grades. In addition, the Contractor shall be responsible for all damage or damages which might result from settlement or backfill made by him on the fulfillment of his Contract within and during the period of one (1) year from and after the date of final acceptance thereof by the Engineer.

F. Finish Grading: The finishing of side slopes, cuts, and fills shall be reasonably smooth uniform surfaces that will merge with the adjacent terrain without noticeable break. Finishing shall be done in accordance with grades shown on the approved plans and without variations that are readily discernible.

9. Testing of Sewers

A. General: After construction and backfilling are completed and before any services are connected to the sewers, the completed lines shall be tested for leaks and visually checked for straightness of line and cracked pipe. If any deficiencies in line are found which will be determined to the proper functioning of the sewer, the deficiencies shall be corrected. Any damaged or cracked pipe shall be excavated and relayed in a manner satisfactory to the engineer. Any section of sewer which is found to be leaking in excess of the allowable quantity shall be repaired.

B. Acceptance Tests: Each reach of sewer shall meet the requirements of the following acceptance tests. All defects shall be repaired to the satisfaction of the engineer.

i. Installation Acceptance of Plastic Gravity Sewer Lines shall be tested by using Low-Pressure Air

10. Sewers Near Water Mains

A. Horizontal Separation: Whenever possible, sanitary sewers and manholes shall be located at least ten (10) feet, horizontally, from any water main. When local conditions prevent a lateral separation of ten (10) feet, a sewer may be laid closer than ten (10) feet to a water main, provided that the water main is at least eighteen (18) inches above the top of the sewer. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical slip-on joint pipe and should be pressure-tested to assure water-tightness before backfilling.

B. Vertical Separation: Whenever sanitary sewers or house sewers must cross water mains, the sewer shall be laid at such an elevation that the bottom of the water main is eighteen (18) inches above the top of the drain or sewer. A full length of water main pipe shall be centered over the sewer line to be crossed as that the joints will be equally distant from the sewer and as remote therefrom as possible. This vertical separation shall be maintained for the portion of the water main located within ten (10) feet, horizontally, of any sewer or drain it crosses.

C. *Unusual Conditions:* Where conditions prevent the minimum vertical separation set forth above from being maintained, or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with mechanical joint cast-iron pipe, and the cast-iron pipe shall extend on each side of the crossing to a distance from the sewer of at least ten (10) feet. In making such a crossing, a full length of water main pipe must be centered over or under the sewer to be crossed, so that the joints will be equi-distant from the sewer and as remote therefrom as possible. The sewer line must also be constructed of cast-iron pipe with slip-on joints until the normal distance from the sewer line to the water main is at least ten (10) feet.

END OF SECTION

FORCE MAIN, SDR-21 (CLASS 200)

1. Material Specifications, PVC Pressure Rated Pipe and Fittings

   A. PVC Force Main:

      i. Pipe: Water mains shall be PVC Class 200. Pipe shall conform to ASTM D2241 and shall be pressure rated at 200 psi at 73°F with a standard dimension ratio of SDR 21. PVC pipe must bear the seal of approval of the National Sanitation Foundation. Net laying lengths must be twenty (20) feet. Joints shall be integral bell push-on joints with single rubber gasket, making a pressure tight seal. Said pipe shall be in accordance with ANSI/ASTM D2241-78 or the latest revision thereof.

      ii. Fittings for PVC Pipe: Fittings for pipe sizes two (2) inches through three (3) inches shall be made of the same quality as pipe meeting the requirements of PS22-70, ASTM D-2241 and ASTM D-1784 and shall have elastomeric seal joints. For pipe sizes greater than six (6) inches, flanged and/or mechanical joints cast iron fittings; for PVC pipe shall be used and shall meet the requirements of ANSI A21.11 (AWWA-C111). Fittings shall include appropriate transition gaskets.

      For pipe sizes greater than four (4) inches, mechanical joint cast iron fittings for PVC pipe shall be used and shall meet the requirements of ANSI Specification A21.11 (AWWA-C111). Fittings shall include appropriate transition gaskets.

   B. Pipe and Fitting Compound: PVC compounds shall be white in color for improved exposure resistance and shall comply with ASTM D-1784. Rigid Poly (Vinyl Chloride) Compounds with physical properties and chemical resistance of cell classifications for pipe of 12454-B, 12454-C, or 14333-D and cell classifications for fittings of 12454-B, 12454-C, or 13343-C. Different cell classifications having one or more superior properties and clean rework material generated by the manufacturer's own production shall be acceptable.

   C. Joints: Joints of both pipe and fittings shall comply with ASTM D-3139, Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals. Qualification test of the joint design shall result it no leakage under various laboratory test conditions of joint alignment at two (2) times rated pressure and at twenty-two (22) inches mercury vacuum.

   D. Gaskets: Gaskets shall be molded from a high grade, properly vulcanized, elastomeric compound consisting of either a basic natural or synthetic rubber. Gaskets shall be marked to show pipe size and type.

      Note: Specifications for Elastomeric Seals for Thermoplastic Pipes are being developed by ASTM. Until they are published, the compound for elastomeric seal rubber gaskets shall generally comply with modified physical requirements of ASTM Standard Specifications: D-1869, Rubber Rings for Asbestos Cement Pipe; C361, Reinforced Concrete Low-Head Pressure Pipe; and AWWA Standard C111 for Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.

   E. Valves: Valves for force mains shall be Mueller mechanical joint, non-rising stem, resilient wedge Model A-2360-20 seat, gate valves or approved equal. Each valve shall include the required Mueller Mechanical Joint Accessories. Said valves shall be of the size required in

the approved plans. All valves shall be manufactured in accordance with AWWA Standards C-509.

F. Valve Boxes: Valve boxes shall be Mueller Model H-10360 buffalo-type with lid as manufactured by the Mueller Company or approved equal.

G. Air Release Valves: Air release valves shall be Valmatic Model 48 or approved equal with steel floats, resilient seating and cast-iron housing.

H. Air/Vacuum Release Valves: Air/Vacuum Release Valves shall be Valmatic Model 301 or approved equal with steel floats, Buna-N seating and cast-iron housing.

2. Responsibility for Materials

A. Responsibility for Material Furnished by Contractor: The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found damaged or defective. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him and intended for the work until it has been incorporated in the completed project. The interior, as well as all sealing surfaces of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing. Pipe stored outside for a period longer than one (1) month shall be covered with canvas or other opaque material. Clear plastic sheets shall not be used. Air circulation shall be provided under covering.

3. Handling of Pipe and Accessories

A. Handling and Care: Pipe and accessories shall, unless contrary instructions are received, be unloaded at the point of delivery, and hauled to and distributed at the site of the Project by the Contractor. They shall at all times be handled with care to avoid damage.

4. Work to be Performed

A. Alignment and Grade: All pipe shall be laid to and maintained at the required lines and grades. Fittings shall be installed at the required locations.

B. Deviations Occasioned by Other Structures: Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other structures encountered in the progress of the work shall be furnished by the Contractor at his own expense. Where the grade or alignment of the pipe is obstructed by the existing utility structures such as conduits, ducts, pipes, branch connections to main sewers or main drains, the obstruction shall be permanently supported, relocated, removed or reconstructed by the Contractor. Whenever necessary to determine the location of existing underground utility structures, the Contractor. All pipe shall be laid to depth shown on the approved plans. The depth shall be measured from the established street grade or the surface of the permanent improvement to the top of the pipe barrel.

5. Excavation and Preparation of Trench

A. General: The trench shall be dug to the required alignment and depth shown on the approved plans. Unless specified otherwise, the minimum depth of pipe cover shall be forty-two (42) inches.

B. Trench Stability: Where necessary to prevent caving, trench excavations in unstable soil shall be adequately supported. Where sheeting and bracing are used the trench width shall not be less than that specified hereafter. As backfill is placed and sheeting is withdrawn, the void left by the withdrawn sheeting shall be filled and compacted before withdrawing the next increment.

C. Preparation of Trench Bottom: The trench bottom shall be so constructed so as to provide a firm, stable, and uniform support for the full length of the pipe. Bell holes at each joint shall be provided to permit the joint to be made properly.

D. Trench Excavation Classifications: All excavation shall consist of two classifications: Class "A" and Class "B".

i. Class "A" Excavation: Class "A" Excavation shall consist of all other materials not mentioned in Class "B". The decision of the ENGINEER shall be final on the determination of the proper classification.

ii. Class "B" Excavation: Any material shall be considered Class "B" Excavation, which, in the opinion of the ENGINER, cannot be excavated by any process other than drilling and blasting or drilling and wedging. This classification shall not be extended to include the materials, which can be removed by other means, but which, for reasons of economy in excavation, it is preferred to remove by drilling and blasting or drilling and wedging. Such excavation shall include detached pieces of rock or boulders one (1) cubic yard or more in content and masses of solid well-defined ledges of stone or masses of rock, slate, shale, or soapstone and other similar substances. Class "B" Excavation shall be stripped for measurement in sections of such length as the ENGINEER may direct, and no rock excavated or blasted before such measurements will be allowed. Stripping shall mean the removal of all other materials so as to expose the surface of the rock.

a. Explosives: All necessary precautions shall be taken to prevent accidents and injury or damage to adjacent buildings. Blasts shall be completely and carefully covered with heavy timbers, or other adequate protections. The Contractor shall be liable for all injuries or deaths or persons or damages to property caused by blasting or explosives.

b. Measurement: All Class "B" Excavation shall be measured in place by the cubic yard. No loose, shaken or previously blasted rock will be allowed as Class "B" Excavation, nor shall any excavation exterior to the maximum limits of measurement be allowed.

iii. Stockpiling of Excavated Material: All excavated material shall be stockpiled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and

accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage and natural watercourses shall not be obstructed.

6. Laying of Pipe

A. Lowering Pipe and Accessories into Trench:

i. General: Proper implements, tools and facilities shall be utilized by the Contractor for the safe and efficient execution of the work. All pipe, fittings, valves and accessories shall be carefully lowered into the trench using suitable equipment in such manner as to prevent damage to pipe and fittings. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench.

ii. Inspection of Pipe and Accessories: The pipe and accessories shall be inspected for defects prior to lowering into trench. Any defective, damages, or unsound material shall be repaired or replaced as directed by the ENGINEER.

iii. Pipe Kept Clean: All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench.

B. Joining Pipe Sections: The sealing surface of the pipe, the bell to be joined, and the rubber ring shall be cleaned immediately before assembly, and assembly shall be made as recommended by the manufacturer. When pipe laying is not in progress, the open ends of installed pipe shall be closed to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, enough backfill shall be placed on the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and the bedding restored. No pipe shall be laid when the trench conditions or the weather are unsuitable for proper installation.

C. Cutting Pipe: The pipe shall be cut in a neat and workmanlike manner without damage to the pipe so as to have a smooth end at right angles to the axis of the pipe.

D. End Preparation: Pipe ends shall be cut square and beveled in accordance with the pipe manufacturer's recommendations.

E. Joining PVC Pipe to Fittings and Accessories:

i. General: PVC pipe shall be manufactured with "iron pipe size" outside diameters. Each valve or fittings connected to PVC plastic pipe shall be equipped with a bell having a profile that permits a seal to be made directly between the pipe end and the bell of the fitting with a rubber gasket. The rubber gaskets shall be supplied by the fittings or accessory manufacturer.

ii. Push-On Joints: The push-on joint shall be a rubber gasket joint. It shall be assembled by the positioning of a rubber ring gasket in an annular recess in the fitting socket and then forcing the end of the pipe into the socket. The pipe end compresses the gasket radially to form a positive seal. The gasket and annular recess shall be designed, sized and shaped so that the gasket is locked in place against displacement. Care should be taken to use the correct gasket to match the fitting gasket groove profile. Assembly of

the gasket within the groove should be in accordance with the manufacturer's recommendations.

F. Setting of Valves and Fittings:

i. General: Valves and fittings shall be provided and installed as shown on the approved plans or as specified. They shall be inspected and cleaned prior to installation.

ii. Thrust Blocking: Thrust blocking shall be provided at each valve, bend, tee, and at reducers or fittings where changes in pipe direction occurs.

7. Pressure and Leakage Tests

A. General: Sufficient backfill shall be placed prior to fillings with water and field testing to prevent lifting of the pipe. When local conditions require that the trenches be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed.

At least seven (7) days shall elapse after the last concrete thrust blocking has been cast with normal (Type I) Portland cement. This elapsed time may be reduced to three (3) days with the use of high-early strength (Type III) Portland cement.

B. Procedure: The following procedure is based on the assumption that the pressure and leakage test will be performed at the same time. Each section of the pipeline shall be slowly filled with water and all air expelled by means of taps at high points. The specified test pressure shall be applied by means of a pump connected to the pipe. The test pressure shall be maintained by additional pumpage if necessary for the specified time during which all exposed pipe, fittings, valves, and hydrants shall be carefully examined. All defective elements shall be repaired or removed and replaced and the test repeated until all visible leakage has been stopped and the allowable leakage requirements have been met.

C. Allowable Leakage: The Contractor shall furnish the gauges and measuring device for the leakage test, pump, pipe, connections and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of each leakage test shall be two (2) hours and during the test the main shall be subjected to the pressure required above or as specified in the purchaser's addendum to this standard. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain the specified leakage test pressure after the pipe has been filled with water and the air in the pipe line has been expelled. No installation will be accepted if the leakage is greater than that determined by the formula:

$L=ND/7.400 \quad P=50$ psi

L is the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

8. Backfilling

A. Pipe Bedding: Pipe shall be laid in a flat bottom trench with backfill material approved by the ENGINEER deposited in the trench uniformly at both sides of the pipe line for the full

width of the trench, up to the horizontal diameter of the pipe line. This backfill material shall be tamped into layers and shall be sufficiently damp to permit thorough compaction under and on each side of the pipe to provide support free from voids. When pipe is to be laid in a trench excavated from rock, and overdig of four (4) inches shall be maintained and a four (4) inch thick sand layer provided to cushion the pipe.

B. Backfilling Procedure Before Tests: The pipe and joints shall be embedded as specified above and a cushion of material placed over the pipe and joints to an average depth of twelve (12) inches. If the joints are to be exposed during the test, additional backfill material shall be placed between the joints in order to hold the line securely during the test. The average depth of material in this instance shall be twelve (12) inches over the top of an eight (8) inch diameter and smaller pipe and twenty-four (24) inches over larger pipe.

C. Backfill Procedure after Tests: On completion of pressure and leakage tests, exposed joints shall be embedded as specified above and backfill placed to a depth of twelve (12) inches above the top of the pipe. The balance of backfill shall contain no stones more than six (6) inches in their largest dimension. Trenches shall be backfilled to a compaction density of ninety (90) percent as determined by the American Association of State Highway and Transportation Officials Method T99 for Compaction and Density of Soils. Additional backfill material shall be supplied if needed to completely backfill the trenches or to fill depressions caused by subsequent settlement.

9. Restoration of Surfaces and/or Structures

The Contractor shall restore and/or replace paving, curbing, sidewalks, gutters, shrubbery, fences, sod, or other disturbed surface or structure to a condition equal to that existing before the work began and to the satisfaction of the ENGINEER. Public street repairs shall be in accordance with the requirements of the Approved plans and Specifications.

10. Cleaning Up

All dirt, rubbish, and excess earth from excavations shall be disposed of by the Contractor in compliance with applicable laws and ordinances and these Specifications. The construction site shall be left clean to the satisfaction of the ENGINEER.

July 1, 2003

Project: Calvey Brook Estates
Sewer System Technical, Management, and Financial Capacity Statement

The following comments are designed to show the technical managerial and financial capacity of the Calvey Brook Sewer Company.

Item 1 Two copies of the engineering report have been submitted to Mo- DNR for review.
Item 2 Two copies of the detailed plans and specifications have been submitted to Mo~DNR for review.
Item 3 An Application for Construction Authorization has been submitted to Mo~DNR.

Required Items for Technical Capacity Demonstration

Item 1 Calvey Brook Sewer Company will higher a state certified operator. The Sewer Company will provide the operator with all required equipment for the operator to perform the job. Mr. Tim Flagg will be the certified operator.
Item 2 The continuing authority will maintain as built plans for collection system. The plans will be required to be updated after any new construction has occurred prior to final acceptance of the line by the continuing authority.

Additional space has been provided for in the tanks and filter bed for the addition of 2 treatment pods if required in the future of the system.

Design Guide Standards

Item 1 This system is intended to serve Calvey Brook Estates which is a tract of land located in the northeast corner of section 20 township 42 north range 2 east of the 5th P.M. in Franklin county Missouri. Calvey Brook Estates is a 36 lot residential subdivision on approximately 25 acres. This area has no centralized septic service available. The only method of sewage treatment is On-Site systems.

Item 2 This area is part of Public Water District No. 2. However, according to the Franklin County Planning & Zoning Department the above-mentioned water district exists on paper only and it has no active members. A letter waving the preferential status cannot be obtained.

Item 3 Calvey Brook Estates will be the only area served by this Sewer system. The boundaries will be the limits of the subdivision as it is recorded in the Franklin County Recorders Office. If additional connections are made Mo- DNR approval of the plans will be required prior to acceptance of the proposed addition.

Item 4 Franklin County Zoning Regulations require a dense subdivision to provide central water and central sanitary sewer. The chosen central sewer system will provided the best treatment system for the area being served.

Item 5 The treatment facility is located at the lowest point of the subdivision.

Project: Calvey Brook Estates
Sewer System Technical, Management, and Financial Capacity Statement

Item 6 The estimated flow to the treatment facility was assumed at 277 gallons per home.
Item 7 A future extension of 8 residential lots to the system was anticipated.
Item 8 Design hydraulic and biological loadings were supplied in the engineering report.
Item 9 Wunderlich Surveying & Engineering will provide inspection of the sewer system and will supply a certification to Mo~DNR.

Required Items for Managerial Capacity Demonstration

Item 1 The owners intend to develop companies that will be responsible for the operation and maintenance of the water and sewer systems. They are currently in the process of forming these companiess.
Item 2 A Written Rate Structure and Service Fee will be publicly displayed.
Item 3 The proposed company will hold public meetings for rate structure changes. All customers will be notified of such meeting prior to the meeting and before the rate changes take affect.
Item 4 Managerial Capacity for future regulation impacts have been considered.
Item 5 An organizational chart for Calvey Brook Sewer Co. is as follows:

President	Vice President	Treasurer	Secretary
Jeff Snider	Roger Gullet	Jeff Snider	Roger Gullet

Jeff Snider
2801 West Osage Suite
Pacific, Missouri 63069.
Phone 636 271-5792

Roger Gullet
2488 hwy N
Pacific, Missouri 63069
Phone 636 271 2327

Item 6 The designated customer complaint person will be Jeff Snider president of Calvey Brook Sewer Company. See above for address and phone number. Office hours will be from 8 am to 5 pm Monday through Friday.

Project: Calvey Brook Estates
Sewer System Technical, Management, and Financial Capacity Statement

Item 7 The written customer complaint procedure will be as follows
- a.) The received complaints will be recorded in a record book upon arrival
- b.) The system operator will respond to the complaint.
- c.) The system operator will try to solve the problem.
- d.) Disputes that cannot be resolved will be forwarded to the continuing authority for further review.
- e.) Complaint procedures will be publicly published with the rate structure.

Item 8 Mr.Tim Flagg shall be contacted as the compliance contact person.
Environmental Services
Phone 636 390 2517

Item 9 An Operation Management Plan will be included when received from the manufacture.

Item 10 An Emergency Operation Plan has been included.

Item 11 The water will be tested according to Mo~DNR Guidelines and shall meet the required discharge limits as determined by The State of Missouri.

Required Items for Financial Capacity Demonstration

Item 1 Standard Accounting Principles and Practices will be used.

Item 2 Legal action, disconnection, and late fees will be used in the event of non payment to the governing authority. The actions by the governing authority for non-payment will be publicly published with the rate structure.

Item 3 The governing authority will perform an annual budget of revenue and expenditures with an annual comparison to the planned budget.

Item 4 Written rate structure and service fee will be published publicly

Item 5 A financial capacity sheet shall be maintained by the governing authority, See attached.

Item 6 An operating reserve of the annual operations and maintenance will be established.

Item 7 Emergency equipment replacement reserve equal to the most expensive mechanical equipment over 20 years has been established.

Calvey Brook Sewer Company
Repair & Replacement Schedule

Missouri Department of Natural Resources

4.00% Inflation Rate per Year (Assumed)

Annual Payment to Repair and Replacement Account: $1,103
(This is the Minimum Annuity plus the Supplemental Annuity)

5.50% Expected Interest Rate on Balances Invested

0.00% Expected Interest Rate on Amounts Borrowed

Year Ending In	Replacement Item Description	Cost per Item in Current Dollars	# Items	Inflation Factor	Future Cost per Item	Yearly Total R & R Cost	Interest Earned (or Paid)	End of Year R & R Account Balance
2003				1.00	$0	$0	$0	$1,103
2004				1.04	$0	$0	$61	$2,267
2005				1.08	$0	$0	$125	$3,495
2006	distrubiting Valve	$400	1	1.12	$450	$450	$192	$4,340
2007				1.17	$0	$0	$239	$5,682
2008	Vent Fan	$1,000	1	1.22	$1,217	$1,217	$313	$5,881
2009				1.27	$0	$0	$323	$7,308
2010				1.32	$0	$0	$402	$8,813
2011	Pumps	$1,000	1	1.37	$1,369	$1,369	$485	$9,032
2012				1.42	$0	$0	$497	$10,632
2013				1.48	$0	$0	$585	$12,320
2014				1.54	$0	$0	$678	$14,100
2015	Filter Media	$5,000	1	1.60	$8,005	$8,005	$776	$7,974
2016				1.67	$0	$0	$439	$9,516
2017	Vent Fan	$1,000	1	1.73	$1,732	$1,732	$523	$9,410
2018				1.80	$0	$0	$518	$11,031
2019				1.87	$0	$0	$607	$12,741
2020				1.95	$0	$0	$701	$14,545
2021	Pumps	$1,000	1	2.03	$2,026	$2,026	$800	$14,422
2022				2.11	$0	$0	$793	$16,318

Notes:

Starting Account Balance	$0
Present Worth less Starting Account Balance	$7,590
Minimum Annual Annuity	$635
Supplemental Annual Annuity	$468

Calvey Brook Sewer Company

Fixed and Variable Operating Costs

Fixed Operating Costs Chart

Missouri Department of Natural Resources

Average Number of Customers During "Last Full Year": 36

Costs for the one Year Period Ending: 12/31/03

Item	Total Annual Cost for Each Item	Fixed Cost Percentage for Each Item		Cost After Adjustment for High-Strength & I/I		Adjusted Fixed Cost
Salaries & Benefits for Administration Staff	$0	100%	X	$0	=	$0
Billing, Office Operation & Utilities, Rent & Other Overhead	$1,200	100%	X	$1,200	=	$1,200
Insurance & Bonding	$2,000	100%	X	$2,000	=	$2,000
Accounting, Legal, Engineering & Other Professional Services	$1,200	100%	X	$1,200	=	$1,200
Debt Repayment & Related Expenses	$0	50%	X	$0	=	$0
Debt Reserve Payments	$0	50%	X	$0	=	$0
Other Reserve Payments	$0	0%	X	$0	=	$0
Salaries & Benefits for Operations Staff	$0	0%	X	$0	=	$0
Electricity & Utilities for Operations	$400	100%	X	$400	=	$400
Operating Supplies & Equipment	$300	100%	X	$300	=	$300
Chemicals		0%	X	$0	=	$0
Equipment Leases	$0	0%	X	$0	=	$0
Regular Maintenance & Repairs	$0	100%	X	$0	=	$0
Auto & Other Rolling Stock	$0	100%	X	$0	=	$0
Permits, Training	$0	100%	X	$0	=	$0
Taxes and Franchise Fees	$0	0%	X	$0	=	$0
Payment to R & R Account	$1,103	0%	X	$1,103	=	$0
Surchargeable Services (Adjustment)	N.A.	N.A.	X	$0	=	N.A.
Infiltration/Inflow (Adjustment)	N.A.	100%	X	$0	=	$0
System Maintenance & Operations	$3,000	100%	X	$3,000	=	$3,000
		100%	X	$0	=	$0
	$0	0%	X	$0	=	$0
Total Costs:	$9,203			$9,203		$8,100
	(Fixed Costs	$18.75		per month, per user)		

Calvey Brook Sewer Company

Variable Operating Costs Chart

Missouri Department of Natural Resources

Average Number of Customers During "Last Full Year": 36

Costs for the one Year Period Ending: 12/31/03

Item	Total Annual Cost for Each Item	Variable Cost Percentage for Each Item		Cost After Adjustment for High-Strength & I/I		Adjusted Variable Cost
Salaries & Benefits for Administration Staff	$0	0%	X	$0	=	$0
Billing, Office Operation & Utilities, Rent & Other Overhead	$1,200	0%	X	$1,200	=	$0
Insurance & Bonding	$2,000	0%	X	$2,000	=	$0
Accounting, Legal, Engineering & Other Professional Services	$1,200	0%	X	$1,200	=	$0
Debt Repayment & Related Expenses	$0	50%	X	$0	=	$0
Debt Reserve Payments	$0	50%	X	$0	=	$0
Other Reserve Payments	$0	100%	X	$0	=	$0
Salaries & Benefits for Operations Staff	$0	100%	X	$0	=	$0
Electricity & Utilities for Operations	$400	0%	X	$400	=	$0
Operating Supplies & Equipment	$300	0%	X	$300	=	$0
Chemicals	$0	100%	X	$0	=	$0
Equipment Leases	$0	100%	X	$0	=	$0
Regular Maintenance & Repairs	$0	0%	X	$0	=	$0
Auto & Other Rolling Stock	$0	0%	X	$0	=	$0
Permits, Training	$0	0%	X	$0	=	$0
Taxes and Franchise Fees	$0	100%	X	$0	=	$0
Payment to R & R Account	$1,103	100%	X	$1,103	=	$1,103
Surchargeable Services (Adjustment)	N.A.	N.A.	X	$0	=	N.A.
Infiltration/Inflow (Adjustment)	N.A.	0%	X	$0	=	$0
System Maintenance & Operations	$3,000	0%	X	$3,000	=	$0
0.0	$0	0%	X	$0	=	$0
	$0	100%	X	$0	=	$0
Total Costs:	$9,203			$9,203		$1,103
(Average User Uses	5,500	gallons/month)				
(Variable Costs	$0.46	per 1,000 gallons)				

Loading and Cost Allocation Calculations

Missouri Department of Natural Resources

The estimated cost to transport and treat surchargeable high-strength wastewater is **		$0
The percentage of Infiltration/Inflow is estimated to be		25%
The relative cost (percentage) to transport and treat I/I is		40%
The estimated cost to transport and treat Infiltration/Inflow is **		$0
The percentage of Infiltration/Inflow cost to allocate to fixed costs is		100%
Estimated Annual Flow (does not include Infiltration/Inflow)	2,376,000	gallons/year
+ Infiltration/Inflow	792,000	gallons/year
= Total Annual Flow	3,168,000	gallons/year

(The figure immediately above should be close to your master metered flow volume)

Directions for estimating Infiltration/Inflow (I/I) and surchargeable costs:

1. Surchargeable high-strength wastewater is wastewater that is stronger than normal for your system. "Normal" is usually considered to be domestic wastewater. If you have high-strength wastewater customers that you charge surcharges to, enter your estimate of the costs to treat this wastewater in cell G67. If you have no surchargeable customers, enter a zero.

2. I/I is water that gets into your system that shouldn't be there. This includes water that enters through line breaks, manhole covers that leak, roof downspouts connected to the sewers and the like. Old systems can have 30 to 50 percent or more of I/I. Even new systems have some I/I. In cell G68 above, enter your best estimate of the rate of I/I into your system. Hint: You should have master meter flow figures for your system for last year. If so, enter higher or lower percentage estimates of your I/I until the volume shown on the "Total Annual Flow" line is close to your known master metered flow volume.

3. Since it is fairly clear water, I/I is usually less costly to treat than full strength wastewater. Most systems can transport and treat I/I for about 40 percent of the cost of full strength wastewater. In the highlighted cell G69 above, enter the percent between 0 and 100 for your system.

4. Enter zero (0) in cell G70 above. The software will then make a calculation and show the correct estimate for your I/I costs below this instruction line. Now, enter this number in cell G70 above. Or, if you want to use your own estimate of the cost to transport and treat I/I, enter that amount in cell G70.

$147 This is the I/I cost estimated for your system based on the percentages you entered immediately above and the costs and percentages you entered in the Fixed Costs Chart above.

5. Frequently, 100 percent of I/I costs are allocated to fixed costs. If that is your choice, enter 100 in cell G71. Otherwise, enter your desired percentage between 0 and 100. If you have only unmetered, flat rate users, enter 100 percent here. With this final entry, your I/I costs will be calculated and allocated to fixed and variable costs as you desired.

Notes:

** These costs are entered by the software in the fixed costs chart above. High-strength wastewater treatment costs are normally paid for by each high-strength wastewater contributor through surcharges. Infiltration/Inflow costs are frequently allocated equally to all users' minimum charges.

When there are no or few users that produce Biochemical Oxygen Demand, Settleable Solids or other pollutants that are significantly higher strength than residential users, most sewer authorities assign all the treatment costs to flow only, to keep rates simple. If a cost was entered above for high-strength wastewater, that cost was not allocated as fixed or variable costs. However, these are treatment costs, therefore, they remain in the cost calculation charts above.

In the interest of making rates as equitable and collectible as possible, it is generally best to assign all appropriate high-strength treatment costs to surcharges, and as many of the remaining fixed and variable costs as possible to unit charges.

Calvey Brook Sewer Company
Rate Setting

Missouri Department of Natural Resources

Projected Costs for Year Ending In: 2004		Projected Revenues for Year Ending In: 2004	
		$0	Hookup Fees Devoted to Operating Costs
Fixed Costs	$8,456	$7,776	Minimum Charge Revenue
Variable Costs	$1,152	$5,724	Unit Charge Revenue
Surchargeable Service Costs	$0	$0	Surcharge Revenue
		$3,194	All Other Revenues
Total Costs	$9,608	$16,694	Total Revenue

Proposed Minimum Charge $18.00 per month

Proposed Minimum Charge Usage Allowance 1.0 thousand gallons

Proposed Unit Charge $3.00 per 1000 gallons

Proposed Average Hookup fee $3,000 Current Average Hookup fee is: $3,000

Proposed Surcharge Revenues $0 (for an entire year at the new rates)

How much of the proposed average hookup fee at left will be devoted to future capital improvements? $500

When the minimum charge is: $121.16 and the unit charge is: $3.00
and the usage allowance is zero, the rates are proportional to use.

Month within "Next Full Year" when new rates will be set: 1

At end of Year 5, Capital Improvement Reserves balance will be: $20,979

Revenue reduction needed to reach working capital goal by end of Year 5 (lower rates to approach $0): ($3,808)

Customer Class (use per Month in Gallons)	Projected Revenues at Old Rates During "Next Full Year": Revenue at old Minimum Charge Rate	Projected Revenues at Old Rates During "Next Full Year": Revenue at old Unit Charge Rates	Projected Revenues at Proposed (New) Rates During "Next Full Year": New Minimum Charge Rate for This Class	Projected Revenues at Proposed (New) Rates During "Next Full Year": Revenue at new Minimum Charge Rate	Projected Revenues at Proposed (New) Rates During "Next Full Year": New Unit Charge per 1000 Gallons for Gallons Within This Class	Projected Revenues at Proposed (New) Rates During "Next Full Year": Revenue at new Unit Charge Rates
Residential and General Customers						
Under 1,000	$0	$0	$18.00	$0	$3.00	$0
1,000-1,999	$0	$0	$18.00	$0	$3.00	$0
2,000-2,999	$0	$0	$18.00	$0	$3.00	$0
3,000-3,999	$0	$0	$18.00	$0	$3.00	$0
4,000-4,999	$0	$0	$18.00	$0	$3.00	$0
5,000-5,999	$648	$378	$18.00	$7,128	$3.00	$5,346
6,000-6,999	$0	$0	$18.00	$0	$3.00	$0
7,000-7,999	$0	$0	$18.00	$0	$3.00	$0
8,000-8,999	$0	$0	$18.00	$0	$3.00	$0
9,000-9,999	$0	$0	$18.00	$0	$3.00	$0
10,000-14,999	$0	$0	$18.00	$0	$3.00	$0
15,000-19,999	$0	$0	$18.00	$0	$3.00	$0
20,000-29,999	$0	$0	$18.00	$0	$3.00	$0
30,000-39,999	$0	$0	$18.00	$0	$3.00	$0
40,000-49,999	$0	$0	$18.00	$0	$3.00	$0
50,000 or more	$0	$0	$18.00	$0	$3.00	$0
Wholesale and Special Customers						
Commercial 1	$0	$0	$18.00	$0	$3.00	$0
Commercial 2	$0	$0	$18.00	$0	$3.00	$0
Wholesale 1	$0	$0	$18.00	$0	$3.00	$0
Wholesale 2	$0	$0	$18.00	$0	$3.00	$0
Unmetered, Flat Rate Customers	$0	$0	$18.00	$0	$3.00	$0
Totals for the Relevant Period of Time	$648	$378		$7,128		$5,346

Note: Revenues above for the year ending in 2004, which is the "next full year," assume the following:
1 months revenues at the existing "Old" user charge rates and; 11 months at the "New" user charge rates.

Calvey Brook Sewer Company

Rate Block Statistics

The chart below demonstrates the equitability of your rates as set in the Rate Setting Chart. This is how to use it.

If your rates are absolutely proportional to use on a volumetric basis, your % of usage and % of revenues figures will be the same within all the classes. If you have any minimum charge, that will not happen.

Normally, the % of usage figure will be lower than the % of revenue for the lower volume classes. That will switch for the higher volume classes. Even if you are proposing a declining rate structure in the Rate Setting Chart, this switch should occur near the volume of your average residential user. In your case, that volume is probably between 5,000 gallons per month and

5,500 gallons per month.

For example, for the 5,000-5,999 gallons per month class, your percentages are:

100.0% for % of usage, and
100.0% for % of revenue.

Compare your percentages all the way up the range of user classes. For equitable rates, make reasonable adjustments to your minimum charge and unit charges to get the percentages fairly close together.

"Next Full Year" Rate Block Statistics			
Customer Class (use per Month in Gallons)	% of Users	% of Usage	% of Revenue
Residential and General Customers			
Under 1,000	0%	0%	0%
1,000-1,999	0%	0%	0%
2,000-2,999	0%	0%	0%
3,000-3,999	0%	0%	0%
4,000-4,999	0%	0%	0%
5,000-5,999	100%	100%	100%
6,000-6,999	0%	0%	0%
7,000-7,999	0%	0%	0%
8,000-8,999	0%	0%	0%
9,000-9,999	0%	0%	0%
10,000-14,999	0%	0%	0%
15,000-19,999	0%	0%	0%
20,000-29,999	0%	0%	0%
30,000-39,999	0%	0%	0%
40,000-49,999	0%	0%	0%
50,000 or more	0%	0%	0%
Wholesale and Special Customers			
Commercial 1	0%	0%	0%
Commercial 2	0%	0%	0%
Wholesale 1	0%	0%	0%
Wholesale 2	0%	0%	0%
Unmetered, Flat Rate Customers	0%	0%	0%
Totals	100%	100%	100%

Calvey Brook Sewer Company
Costs and Revenues, 5 - Year Projection

Missouri Department of Natural Resources

ne #	Operating Cost and Income Items	Inflation Factor %	Year Ending In 2003	Year Ending In 2004	Year Ending In 2005	Year Ending In 2006	Year Ending In 2007	Year Ending In 2008
1	Total Number of Customers		36	36	36	36	36	36
2	Annual Increase in Customers (%)	0.0%	0.0% was last year's actual rate for adding new customers					
3	Total User Charges (Billable)	3.0%	$12,312	$13,500	$14,016	$14,437	$14,870	$15,316
4	Operating Incomes							
5	User Charges (Actual or Projected Receipts)		$12,312	$13,500	$14,016	$14,437	$14,870	$15,316
6	Surcharges		$0	$0	$0	$0	$0	$0
7	Working Capital Carried Over From Previous Year (for Operating Expenses)		$0	$3,109	$3,363	$3,512	$3,668	$3,832
8	Working Capital Interest Earned (or Paid)		$0	$85	$92	$97	$101	$105
9	Hookup Fees Devoted to Operating Costs		$0	$0	$0	$0	$0	$0
10	Other Charges (late payments, forfeited deposits, etc.)		$0	$0	$0	$0	$0	$0
11	Transfers From Capital Improvements Reserve		$0	$0	$0	$0	$0	$0
12	Withdrawals From Debt Reserve		$0	$0	$0	$0	$0	$0
13	Debt Reserve Interest Earned (or Paid)		$0	$0	$0	$0	$0	$0
14	Withdrawals From Other Reserves		$0	$0	$0	$0	$0	$0
15	Other Reserve Interest Earned (or Paid)		$0	$0	$0	$0	$0	$0
16	Other Income		$0	$0	$0	$0	$0	$0
17	Other Income		$0	$0	$0	$0	$0	$0
18	Other Adjust. (+ or -) Describe		$0	$0	$0	$0	$0	$0
19	Total Actual or Projected Operating Revenues		$12,312	$16,694	$17,472	$18,045	$18,639	$19,253
20	Operating Costs							
21	Salaries & Benefits for Administration Staff	5.0%	$0	$0	$0	$0	$0	$0
22	Billing, Office Operation & Utilities, Rent & Other Overhead	5.0%	$1,200	$1,260	$1,323	$1,389	$1,459	$1,532
23	Insurance & Bonding	5.0%	$2,000	$2,100	$2,205	$2,315	$2,431	$2,553
24	Accounting, Legal, Engineering & Other Professional Services	5.0%	$1,200	$1,260	$1,323	$1,389	$1,459	$1,532
25	Debt Repayment & Related Expenses	N.A.	$0	$0	$0	$0	$0	$0
26	Debt Reserve Payments	N.A.	$0	$0	$0	$0	$0	$0
27	Other Reserve Payments	N.A.	$0	$0	$0	$0	$0	$0
28	** Salaries & Benefits for Operations Staff	5.0%	$0	$0	$0	$0	$0	$0
29	** Electricity & Utilities for Operations	5.0%	$400	$420	$441	$463	$486	$511
30	** Operating Supplies & Equipment	5.0%	$300	$315	$331	$347	$365	$383
31	Chemicals	5.0%	$0	$0	$0	$0	$0	$0
32	Equipment Leases	5.0%	$0	$0	$0	$0	$0	$0
33	Regular Maintenance & Repairs	5.0%	$0	$0	$0	$0	$0	$0
34	Auto & Other Rolling Stock	5.0%	$0	$0	$0	$0	$0	$0
35	Permits, Training	5.0%	$0	$0	$0	$0	$0	$0
36	Taxes and Franchise Fees	0.0%	$0	$0	$0	$0	$0	$0
37	Payment to R & R Account	N.A.	$1,103	$1,103	$1,103	$1,103	$1,103	$1,103
38	Surchargeable Services (Adjustment)	5.0%	$0	$0	$0	$0	$0	$0
39	Infiltration/Inflow (Adjustment)	5.0%	$0	$0	$0	$0	$0	$0
40	System Maintenance & Operations	5.0%	$3,000	$3,150	$3,308	$3,473	$3,647	$3,829
41	0	5.0%	$0	$0	$0	$0	$0	$0
42		5.0%	$0	$0	$0	$0	$0	$0
43	Cost Adjustments (+ or -) describe	5.0%	$0	$0	$0	$0	$0	$0
44	Cost Adjustments (+ or -) describe	5.0%	$0	$0	$0	$0	$0	$0
45	Total Operating Costs		$9,203	$9,608	$10,033	$10,480	$10,949	$11,441
	** These cost items are forecast using both the inflation factor and increase in number of customers.							
46	Net Operating Income (Total Operating Income - Total Operating Costs)		$3,109	$7,086	$7,438	$7,565	$7,690	$7,812
47	Working Capital Goal is: 35% (Total Operating Costs times Working Capital Goal percentage)		$3,221	$3,363	$3,512	$3,668	$3,832	$4,004
48	Transfer to Capital Improvements Reserve		$0	$3,723	$3,926	$3,897	$3,858	$3,808
	(Net Operating Income in excess of the Working Capital Goal above are transferred into the Capital Improvements Reserve.)							
49	Additional Operating Income Needed to "Break Even" With Operating Costs		NA	NA	NA	NA	NA	NA
50	Additional Income/ Reduced Costs Needed to Attain Working Capital Goal (See note below)		$112	($3,723)	($3,926)	($3,897)	($3,858)	($3,808)

Note: If a figure on line 50 is in parentheses ( ), that means you will exceed your working capital goal by that amount for that year. Within reason, that is a desirable situation. If a figure is not in parentheses, you were short of reaching your goal by that amount.

Calvey Brook Sewer Company
Capital Investments and Reserves, 5 - Year Projection

Missouri Department of Natural Resources

Line #	Investment and Reserve Items	Year Ending In 2003	Year Ending In 2004	Year Ending In 2005	Year Ending In 2006	Year Ending In 2007	Year Ending In 2008
51	Sources of Funds						
52	Capital Improvements Carryovers Plus Transfers	$0	$3,723	$7,650	$11,649	$15,826	$20,185
53	Capital Improvements Interest Earned (or Paid)	$0	$0	$102	$318	$551	$795
54	Repair and Replacement Account Withdrawals	$0	$0	$0	$450	$0	$1,217
55	Hook up Fees Devoted to Capital Improvements	$0	$0	$0	$0	$0	$0
56	Cash Contributions From Customers and Others	$0	$0	$0	$0	$0	$0
57	Grants **(25% from CDBG)**	$0	$0	$0	$0	$0	$0
58	Loans **(63% from SRF loan)**	$0	$0	$0	$0	$0	$0
59	Other Reserve Withdrawals	$0	$0	$0	$0	$0	$0
60	Other Fund Sources **(10% from General Rev)**	$0	$0	$0	$0	$0	$0
61	Other Fund Sources **(2% from Self-help)**	$0	$0	$0	$0	$0	$0
62	Total Sources of Funds	$0	$3,723	$7,752	$12,418	$16,377	$22,196
63	Use of Capital Improvement and New Debt Funds						
64	Transfers to Operating Account for Operating Costs	$0	$0	$0	$0	$0	$0
65	Capital Improvement Plan (CIP) Expenditures						
66	Items from Repair and Replacement Account	$0	$0	$0	$450	$0	$1,217
67	**Treatment Plant, Line and Pump Upgrades**	$0	$0	$0	$0	$0	$0
68	**Capital Improvements Project - Describe**	$0	$0	$0	$0	$0	$0
69	**Non-facility Costs to Develop Conservation, Education, and Similar Programs**	$0	$0	$0	$0	$0	$0
70	**Other Uses of Funds**	$0	$0	$0	$0	$0	$0
71	Total Transfers & CIP Expenditures	$0	$0	$0	$450	$0	$1,217
72	New Debt Obligations (These exclude debt from Costs and Revenues worksheet.)						
73	Repayments to Customers and Others	$0	$0	$0	$0	$0	$0
74	Debt Service **($288,996, 2% int, 20 yrs)**	$0	$0	$0	$0	$0	$0
75	Debt Reserve payments **NA**	$0	$0	$0	$0	$0	$0
76	Fees for New Loans **(1.5% included in loan)**	$0	$0	$0	$0	$0	$0
77	Other Obligations **(Describe)**	$0	$0	$0	$0	$0	$0
78	Total New Debt Obligations	$0	$0	$0	$0	$0	$0
79	Total Use of Capital Improvement and New Debt Funds	$0	$0	$0	$450	$0	$1,217

Calvey Brook Sewer Company
Financial Capacity Indicators, 5 - Year Projection

Missouri Department of Natural Resources

Line #	Description	Inflation Factor %	Year Ending In 2003	Year Ending In 2004	Year Ending In 2005	Year Ending In 2006	Year Ending In 2007	Year Ending In 2008
80	Monthly Average Bill for all Customers System-wide	3.0%	$28.50	$31.25	$32.45	$33.42	$34.42	$35.45
81	Final Monthly Bill for a 5,000 gal per Month Residential User	3.0%	$27.00	$30.00	$30.90	$31.83	$32.78	$33.77
82	Annual Median Household Income (AMHI)	0.0%	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
83	Affordability Index		1.08%	1.20%	1.24%	1.27%	1.31%	1.35%
	(Percent of AMHI needed by a 5,000 gallon per month residential user to pay their bill. Average residential rates should not exceed 1.5 to 2.0% of AMHI if they are to be considered affordable.)							
84	Operating Ratio		1.34	1.74	1.74	1.72	1.70	1.68
	systems and 1.30 or more for smaller systems.)							
85	Coverage Ratio		NA	NA	NA	NA	NA	NA
	(Applies only if you have debt service. 1.0 is break even. Generally, the coverage ratio should be at least 1.25.							

Year Ending Reserve Balances

86	Reserves Available at end of Each Year	Balance for Year Ending In 2003	Balance for Year Ending In 2004	Balance for Year Ending In 2005	Balance for Year Ending In 2006	Balance for Year Ending In 2007	Balance for Year Ending In 2008
87	Net Operating Income (Working Capital Reserve)	$3,109	$3,363	$3,512	$3,668	$3,832	$4,004
88	Capital Improvements Reserve	$0	$3,723	$7,752	$11,968	$16,377	$20,979
89	Debt Reserve	$0	$0	$0	$0	$0	$0
90	Other Reserves	$0	$0	$0	$0	$0	$0
91	Repair and Replacement Reserve	$1,103	$2,267	$3,495	$4,340	$5,682	$5,881

Calvey Brook Sewer Company
Chart Summary Tables

Missouri Department of Natural Resources

Ratios Chart

For Year Ending In:	2003	2004	2005	2006	2007	2008
Operating Ratio	1.34	1.74	1.74	1.72	1.70	1.68
Coverage Ratio	NA	NA	NA	NA	NA	NA

Affordability Chart

For Year Ending In:	2003	2004	2005	2006	2007	2008
Average User Rate	$27.00	$30.00	$30.90	$31.83	$32.78	$33.77
Affordability Index	1.08%	1.20%	1.24%	1.27%	1.31%	1.35%
Average Change in Rates	$0.00	11.11%	3.00%	3.00%	3.00%	3.00%

Goal Chart

For Year Ending In:	2003	2004	2005	2006	2007	2008
Net Operating Income	$3,109	$3,363	$3,512	$3,668	$3,832	$4,004
Working Capital Goal	$3,221	$3,363	$3,512	$3,668	$3,832	$4,004

Net Income and Capital Improvement Reserves Chart

For Year Ending In:	2003	2004	2005	2006	2007	2008
Net Operating Income	$3,109	$3,363	$3,512	$3,668	$3,832	$4,004
Cap Improve Reserve	$0	$3,723	$7,752	$11,968	$16,377	$20,979

Franklin County (WPC)
Calvey Brook Estates

Exhibit F

RECEIVED AUG 0 5 2003

Bob Holden, Governor • Stephen M. Mahfood, Director
STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
www.dnr.state.mo.us

July 31, 2003

CERTIFIED MAIL #7001 1140 0001 4752 3365
RETURN RECEIPT REQUESTED

Mr. Jeff Snider, Vice President
G & S Development
2801 West Osage, Suite 5
Pacific, MO 63069

Dear Mr. Snider:

We are reviewing the engineering plans and specifications submitted by Wunderlich Surveying & Engineering for the proposed wastewater collection and treatment system to serve Calvey Brook Estates in Franklin County, Missouri. In order for us to complete our review of the project, please consult with your engineer and respond to the following comments by **September 5, 2003**:

1. We will need to review the documents establishing the homeowners association before we can proceed to review this project. Our Continuing Authority regulation requires that a valid continuing authority exist before the department can consider the application package to be complete. Please see the enclosed regulation and provide us with the documents establishing the homeowner's association including a copy of the document from the Missouri Secretary of State's office establishing the homeowners association corporation and also documents to verify that the homeowner's association will either own or have proper easements for the sewers and the land where the treatment plant will be located.

2. The proposed discharge is to a tributary of Little Calvey Creek. This creek is a "Class C" stream meaning that is has aquatic life even during critical dry periods that must be protected. It is also currently not impacted by any other point source discharge and may therefore be considered to be a "Tier II" stream as per the department's anti-degradation regulation (see enclosed). You will need to contact the department's Planning Section in Jefferson City (573-526-1599) to determine whether or not the receiving stream qualifies as a Tier II stream. If the stream is considered to be a Tier II stream, you will need to provide appropriate justification that this development is needed for social and economic development purposes and also the discharge will have to satisfy very strict effluent limitations so as to not degrade the in-stream water quality.

3. If the stream is not considered to be a Tier II stream, there is still the potential for adverse impacts on the receiving stream and existing in-stream uses will have to be protected. It is the responsibility of the department to make sure that proposed new wastewater discharges do not unduly impact water quality and consequently all discharge permits for new point sources must contain effluent limitations that are protective of water quality. In order to properly establish effluent limits in receiving streams where, in the opinion of the staff, there exists a significant potential for water quality impacts, some sort of a water quality impact study must be conducted. In the past, the department has performed such water quality investigations on an as-needed basis. However, we have limited staff resources to perform such studies and frequently such studies take a year or longer to complete.

4. Consequently, we are now suggesting that applicants consider conducting their own water quality impact study as a part of the preliminary design process. We will be willing to provide whatever data we have available to your consultant to assist them in conducting the assessment. However, the consultant will have to perform their own field investigations and use currently accepted modeling procedures in performing the assessment. The study will also have to be submitted to the department for review and be approved by the department prior to issuance of a construction permit.

5. If you do not wish to conduct a study, we will conduct a stream survey and other water quality studies as needed to set effluent limitations that we consider sufficient to protect in-stream water quality. However, please keep in mind that this process could take a year or longer to complete.

If it is not possible for you to respond within the time limit, you may request an extension by letter to this office. The request for extension must identify the reasons why the applicant cannot respond within the established time frame and must include a proposed timetable or deadline for response. The time extension will only be granted if the request is received by the September 5, 2003 deadline.

Further action on your submittal awaits your satisfactory response to the above comments. In the meantime, you are advised that construction of wastewater facilities without a construction permit as issued by this Department is prohibited. If you have any questions, please feel free to contact me at (314) 416-2960. Our address is 7545 S. Lindbergh Blvd., Suite 210, St. Louis, MO 63125.

Sincerely,

ST. LOUIS REGIONAL OFFICE

James A. Rhodes, P.E.
Environmental Engineer

JAR/jh

Enclosures: Continuing Authority Regulation
Anti-degradation Regulation

c: Wunderlich Surveying & Engineering ✓
WPCP

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Missouri Department Of Natural Resources
Geological Survey and Resource Assessment Division
P.O. Box 250
Rolla, Missouri 65402-0250
Phone - 573.368.2161 Fax - 573.368.2111
E-mail - gspeg@mail.dnr.state.mo.us

Project ID Number
15303
County
FRANKLIN

Geohydrologic Evaluation of Liquid-Waste Treatment Site

Project **Capitol Hill Farms** Quadrangle **LONEDELL**

Location **SE1/4,NE1/4,NE1/4** Section **20** Township **42 N** Range **02 E**

Additional Location Information

Latitude **38** Deg **22** Min **15** Sec North Longitude **90** Deg **48** Min **59** Sec West

Owner
Jeff Snider
2801 W. Osage Street Pacific MO 63069

Requestor
Norbert Wunderlich
20 South Church Street Union MO 63084

Previous Reports ☑ **Not Applicable**
Date
Identification Number
Fiscal Year

Facility Type
- ○ Mechanical treatment plant
- ◉ Recirculating filter bed
- ○ Earthen lagoon with discharge
- ○ Earthen holding basin
- ○ Land application
- ○ Other type of facility

Type of Waste
- ○ Animal
- ◉ Human
- ○ Process or Industrial
- ○ Leachate
- ○ Other waste type

Other Information
- ○ Plans were submitted
- ○ Site was investigated by NRCS
- ○ Soil or geotechnical data were submitted

Funding Source
- ◉ PPG
- ○ WWLF-SRF

Date of Field Visit 11/2/2002 **Stream Classification** ◉ Gaining ○ Losing ○ No discharge

Overall Geologic Limitations
- ◉ Slight
- ○ Moderate
- ○ Severe

Collapse Potential
- ◉ Not applicable
- ○ Slight
- ○ Moderate
- ○ Severe

Topography
- ○ < 4%
- ◉ 4% to 8%
- ○ 8% to 15%
- ○ > 15%

Landscape Position
- ○ Broad uplands
- ○ Ridgetop
- ◉ Hillslope
- ○ Narrow ravine
- ○ Floodplain
- ○ Alluvial plain
- ○ Terrace
- ○ Sinkhole

Bedrock Ordovician-age Jefferson City Dolomite. Thin-bedded, gray to buff shaley dolomite.

Surficial Materials Surficial materials consist of 10-15 feet of silty clay colluvium with moderate to low permeability.

Recommended Construction Procedures

- ○ Installation of clay pad
- ○ Diversion of subsurface flo
- ○ Rock excavation
- ○ Compaction
- ○ Artificial sealing
- ○ Limit excavation depth

Required Geologic E> ration

Missouri Clean Water Commission - 10 CSR 20 - 00 Wastewater Treatment Ponds)

Determine Overburden Properties

- ○ Partical size analysis
- ○ Standard Proctor density
- ?ermeability coefficient for undisturbed sample
- ○ Atterburg limits
- ○ Overburden thickness
- Permeability coefficient for remolded sample

Determine Hydrologic Conditions

- ○ Groundwater elevation
- ○ Direction of groundwater flow
- ○ 25-year flood level
- ○ 100-year flood level

Notify Geologist

- ○ Before exploration
- ○ During construction
- ○ After construction
- ◉ Not necessary

Remarks

Discharge from the proposed recirculating sand filter bed is to the north in Little Calvey Creek. The stream was determined to be gaining.

The uppermost bedrock is the Ordovician-age Jefferson City Dolomite. The unit is a thinly bedded, light gray to buff shaley dolomite. The bedrock is highly weathered and has high permeability near the surface, but low permeability and less weathering with depth. The surficial materials consist of 10-15 feet of silty clay colluvium deposits. These materials exhibit moderate to low permeability.

This site receives a slight overall geologic limitation rating.

This document is a preliminary report. It is not a permit. Additional data may be required by the Department of Natural Resources prior to the issuance of a permit. This report is valid only at the above location and becomes invalid one year after the report date below

Report By: Larry Pierce

Report Date: 12/13/2002

CC Norbert Wunderlich, SLRO; WPCP