SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: JAMIE CLEMENT
TESTING DATE: SEPTEMBER, 2005

DTH 1 ELEV=334.0
DEPTH HORIZON TEXTURE
0"-75" F
75"-152" C
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 63"

DTH 2 ELEV=345.0
DEPTH HORIZON TEXTURE
0"-52" F
52"-60" A SL
60"-72" B SL
72"-144" C SL
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 72"

DTH 3 ELEV=345.5
DEPTH HORIZON TEXTURE
0"-40" F
40"-48" A SL
48"-68" B SL
68"-144" C SL
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 65"

DTH 4 ELEV=344.8
DEPTH HORIZON TEXTURE
0"-40" F
40"-50" A SL
50"-63" B SL
63"-144" C SL
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 63"

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: JANUARY 4, 2006

PERC A
90" DEEP
8 MIN/INCH

PERC B
96" DEEP
14 MIN/INCH

PERC C
92" DEEP
16 MIN/INCH

ELEVATIONS BLDG 1/2

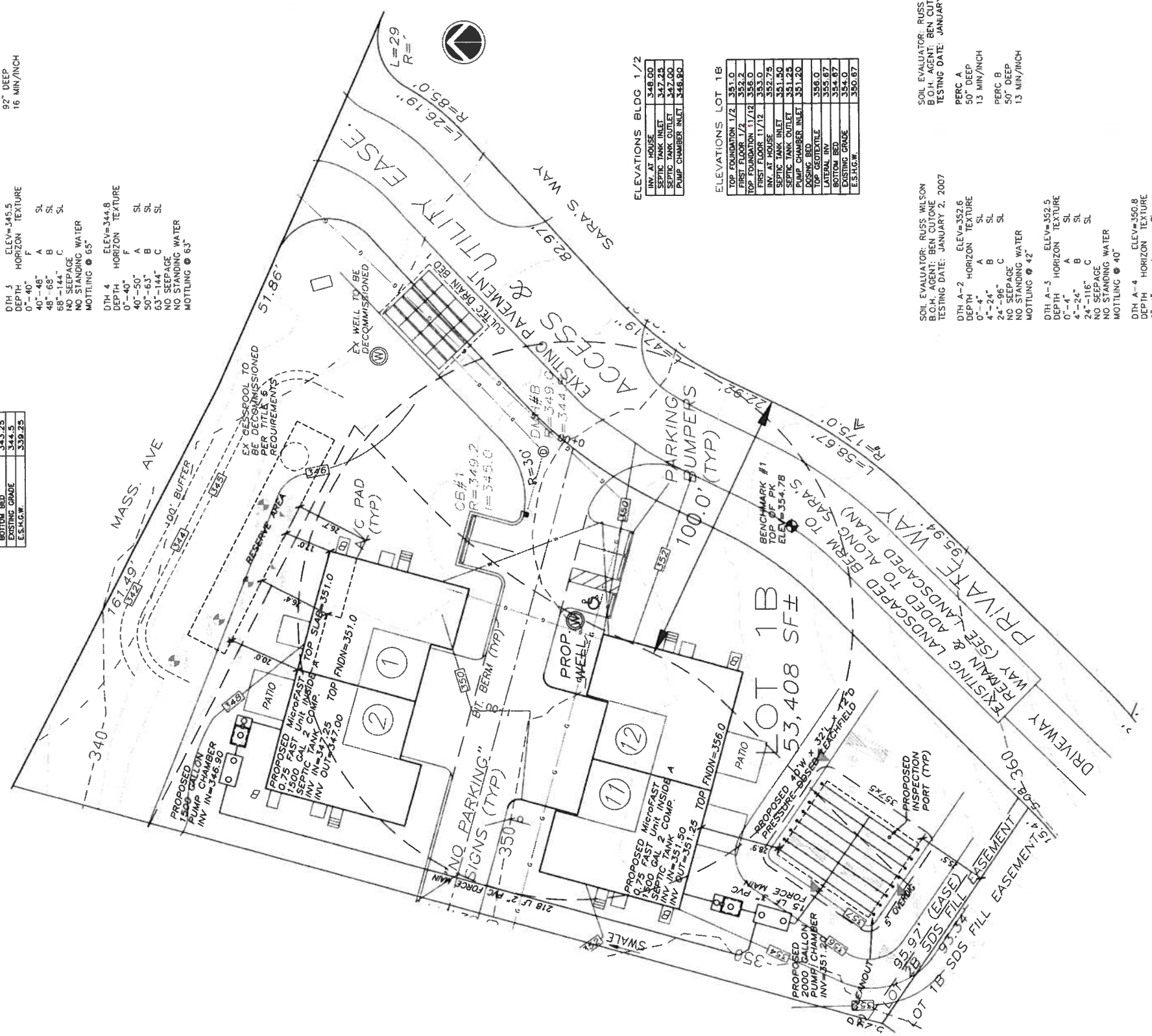
INV AT HOUSE	348.00
SEPTIC TANK INLET	347.25
SEPTIC TANK OUTLET	347.00
PUMP CHAMBER INLET	346.90

ELEVATIONS LOT 1B

TOP FOUNDATION 1/2	351.0
FIRST FLOOR 1/2	352.2
TOP FOUNDATION 11/12	356.0
FIRST FLOOR 11/12	353.0
INV AT HOUSE	352.75
SEPTIC TANK INLET	351.50
SEPTIC TANK OUTLET	351.25
PUMP CHAMBER INLET	351.20
DOSING BED	
TOP GEOTEXTILE	356.0
LATERAL INV	355.67
BOTTOM BED	354.67
EXISTING GRADE	354.0
E.S.H.G.W.	350.67

ELEVATIONS LOT 1B

RESERVED BED	
TOP GEOTEXTILE	344.6
LATERAL INV	344.25
BOTTOM BED	343.25
EXISTING GRADE	344.5
E.S.H.G.W.	339.25



GENERAL NOTES:
1. THIS PLAN IS TO BE USED FOR THE INSTALLATION OF THE SUBSURFACE SEWAGE DISPOSAL SYSTEM ONLY.

2. ALL TOPSOIL, FILL OR OTHER UNSUITABLE IMPERVIOUS DEBRIS SHALL BE REMOVED FROM THE SEWAGE DISPOSAL AREA AS SHOWN AND REPLACED WITH FILL MATERIAL PURSUANT TO TITLE 5 (310 CMR 15.255).

3. ANY DEVIATION FROM THE DESIGN OF THIS PLAN MUST FIRST BE APPROVED BY THE LOCAL BOARD OF HEALTH AGENT.

4. THE CONTRACTOR SHALL NOTIFY THE BOARD OF HEALTH AGENT 48 HOURS PRIOR TO BACKFILLING FOR A PRE-COVER INSPECTION.

5. ALL CONCRETE SHALL BE PRECAST CONCRETE (MINIMUM STRENGTH 4,000 PSI AFTER 28 DAYS).

6. ALL PIPES AND JOINTS SHALL BE WATER TIGHT AND SHALL BE ASTM-STANDARD SCHEDULE 40 PVC PIPE, UNLESS OTHERWISE INDICATED. ALL GASKETED JOINTS TO CONFORM TO ASTM D-3212.
A STANDARD LOW PRESSURE AIR TEST SHALL BE PERFORMED ON ALL SEPTIC TANKS. PLUMBERS MUST BE PRESENT FOR THE COMMON SEWER PIPE SYSTEM.

7. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDED IN ORDER TO PREVENT EROSION.

8. THIS SYSTEM IS NOT DESIGNED FOR GARBAGE DISPOSAL.

9. ALL OWNERS OF SYSTEM SHALL TAKE STEPS TO ENSURE THAT UNIT OWNERS OF SYSTEM SHALL FOLLOW RULES AND REGULATIONS.

10. THE APPLICANT AND CONTRACTOR SHALL BE AWARE OF THEIR OBLIGATION TO COMPLY WITH THE REQUIREMENTS OF THE WETLANDS PROTECTION ACT AND THE TOWN BYLAW.

11. THE LOCATION OF ALL KNOWN WATER COURSES AND BORDERING VEGETATED WETLANDS WITHIN 100 FT. OF THE PROPOSED SYSTEM HAVE BEEN SHOWN.
THE LOCATION OF ALL KNOWN SOURCES OF WATER SUPPLY (PUBLIC WELLS, PRIVATE WELLS, AND SURFACE WATER SUPPLIES) HAVE BEEN SHOWN. IN CASE OF SURFACE WATER SUPPLIES AND GRAVEL PACKED PUBLIC SUPPLY WELLS, WITHIN 250 FT. OF THE PROPOSED SYSTEM LOCATION IN WHICH CASE DOWNGRADIENT OBSERVATION WELLS MUST BE INSTALLED OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF PRIVATE WATER SUPPLY WELLS OR JUNCTIONS MUST BE AT LEAST 10 FT. FROM THE PROPOSED SEPTIC SYSTEM.

12. ALL WATER LINE JUNCTIONS MUST BE AT LEAST 10 FT FROM THE PROPOSED SEPTIC SYSTEM.

13. THERE IS NO FOUNDATION DRAIN PROPOSED FOR THE DWELLING SHOWN.

14. CONTRACTOR MUST VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION. CALL DIGSAFE 1-888-DIG-SAFE.

15. ALL SYSTEM COMPONENTS SHALL BE MARKED WITH MAGNETIC MARKING TAPE OR ANY OTHER ACCEPTABLE MEANS IN ORDER TO LOCATE THEM ONCE BURIED. (310 CMR 15.222 (3)).

16. ALL RISERS INSTALLED FOR SEPTIC TANKS SHALL BE NO DEEPER THAN SIX (6) INCHES BELOW GROUND SURFACE. (310 CMR 15.221 (13)).

17. PUMP CHAMBER ACCESS MANHOLES SHALL BE BROUGHT TO FINISH GRADE.

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: JANUARY 2, 2007

DTH A-2 ELEV=352.6
DEPTH HORIZON TEXTURE
0"-4" A SL
4"-24" B SL
24"-96" C SL
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 42"

DTH A-3 ELEV=352.5
DEPTH HORIZON TEXTURE
0"-4" A SL
4"-24" B SL
24"-116" C SL
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 40"

DTH A-4 ELEV=350.8
DEPTH HORIZON TEXTURE
0"-4" A SL
4"-24" B SL
24"-120" C SL
NO SEEPAGE
NO STANDING WATER
MOTTLING @ 40"

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: JANUARY 4, 2006

PERC A
50" DEEP
13 MIN/INCH

PERC B
50" DEEP
13 MIN/INCH

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TOWN OF BOXBOROUGH

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TOWN OF BOXBOROUGH

PREPARED BY
NASHOBA ENGINEERING ASSOCIATES
6 BEAVER BROOK ROAD
LITTLETON, MA 01460
978-501-3007

CIVIL ENGINEERING CONSULTANTS

COMMONWEALTH OF MASSACHUSETTS
JOHN F. FELD
CIVIL
No. 18241
REGISTERED PROFESSIONAL ENGINEER
11-8-18

Revision	Description	Date	Initial
1	BOH Comments	8/20/18	DG/JF
2	BOH Comments	10/2/18	DG/JF

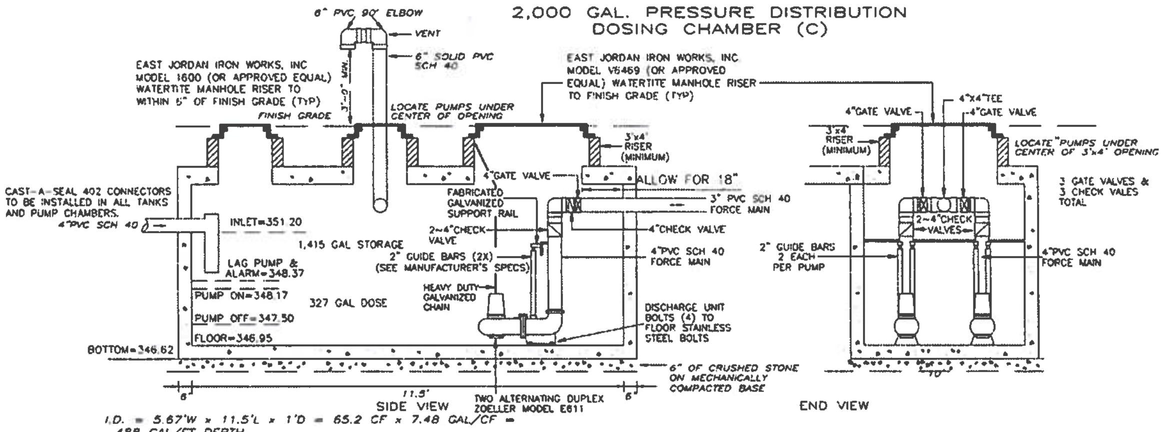
Site: 984 MASSACHUSETTS AVENUE
BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: LOT 1 SEPTIC SYSTEM DESIGN PLAN

Scale: 1" = 20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL

Project No.

Drawing No. S-1

2,000 GAL. PRESSURE DISTRIBUTION DOSING CHAMBER (C)



I.D. = 5.67'W x 11.5'L x 1'D = 65.2 CF x 7.48 GAL/CF = 488 GAL/FT DEPTH

DAILY FLOW:
5 DOSES PER DAY:
132 GPD + DRAINBACK (36 GPD) FOR BLDG 1/2 = 168 GAL/DOSE
132 GPD + DRAINBACK (26 GPD) FOR BLDG 11/12 = 158 GAL/DOSE
TOTAL DOSE = 326 GAL

USE A 2,000 GALLON PUMP CHAMBER (SHEA 2,000 GAL SEPTIC TANK TK-M20002CH, OR APPROVED EQUIVALENT)

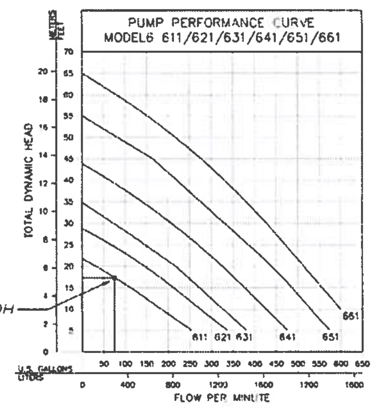
PUMPING TO BE ACCOMPLISHED BY TWO ALTERNATING ZOELLER MODEL E611 PUMPS (1 HP, SINGLE PHASE, 230 V) WITH 3" DISCHARGE CONNECTIONS, CONTROLLED WITH MERCURY SWITCH TILT BULBS AND A CSI CONTROL PANEL LOCATED NEAR THE SYSTEM.
(ALSO TO HAVE 115V RECEPTICLE INSTALLED)
NOTE: PUMPS MUST BE ABLE TO PRODUCE 75 GPM @ 17.3 TDH PLUS ADDITIONAL HEAD TO OFFSET VALVING.

THE CONTROLS ARE TO BE FIELD ADJUSTED TO DISCHARGE 0.67 FEET (327 GALLONS) PER CYCLE.

THE HIGH WATER ALARM IS TO BE ON A SEPARATE CIRCUIT. PROVIDE SLIDE RAIL SYSTEM FOR PUMP REMOVEL. PUMPS MUST PASS 1 1/4" SOLIDS PER TITLE 5.

THE STORAGE AVAILABLE BETWEEN THE PUMP CHAMBER INLET AND HIGH WATER ALARM (1,381 GAL) IS IN EXCESS OF THE 24 HOUR STORAGE REQUIRED (1,320 GAL).

CSI AUTOMATIC CONTROL PANEL TO HAVE OPTIONS AS FOLLOWS:
1. *TOP MOUNTED FLASHING LIGHT AND HORN WITH SILENCER*
2. *MAIN DISCONNECT SWITCHES AND CIRCUIT BREAKERS*
3. *230 VOLT POWER RECEPTACLE*
4. *RUN TIME METERS*
5. *CYCLE COUNTERS*
6. *ANTI-CONDENSATION HEATER*
7. *LIGHTNING ARRESTOR AND SURGE PROTECTOR*
8. *AUTO-DIALER SET TO MAINTENANCE PERSON*



TOTAL DYNAMIC HEAD:
PIPE DIAMETER, INCHES (Dd) = 3
PIPE LENGTH, FT (Ld) = 15
SCH 40 PVC PIPE (Ch) = 140
FLOW, GPM (Qm) = 75
DELIVERY LOSS = Ld(3.55 Qm / Ch Dd$^{2.63}$)$^{1.85}$
= 1.63 FT
NETWORK LOSSES = 5.00 FT
STATIC HEAD = INV LATERAL − PUMP OFF
= 355.67 − 347.50 = 8.17 FT
DISTAL HEAD = 2.5 FT

TOTAL DYNAMIC HEAD = 17.3 FT

DESIGN FLOW:
NO GARBAGE DISPOSAL
SINGLE FAMILY RESIDENCES
12 BEDROOMS x 110 GPD = 1,320 GPD

SINGLE FAMILY SEPTIC TANKS:
200% x 660 GPD = 1,320 GAL
USE MicroFAST 1.50 TANK APPROVED FOR UP TO 1,500 GPD

PRIMARY AREA:
PERCOLATION RATE: 20 MIN./INCH
SOIL CLASS: II
LTAR: 0.53 GPD/S.F.

LEACHFIELD DESIGN:
1,320 GPD / 0.53 GAL/FT = 2,491 SF LEACHING AREA REQUIRED
UP TO 50% REDUCTION ALLOWED WITH MicroFAST TANK
SECONDARY TREATMENT UNIT (STU) USED = 1,245.5 SF REQUIRED
USE 40'W x 32'L x 12"D LEACHFIELD = 1,280 SF PROVIDED
(15'W x 86'L x 12"D RESERVE = 1,290 SF)

PRESSURE DISTRIBUTION CALCULATIONS:

ASSUMPTIONS:
2.5 FT SYSTEM HEAD (MIN.)

1/4" PERFORATIONS @ 5.0 FT ON CENTER
PERFORATIONS @ 12 O'CLOCK POSITION
(6 O'CLOCK AT END OF LATERAL)

LATERAL LENGTH = 40.0'
USE 8 − 40.0' CENTER FED LATERALS
LATERAL DIAMETER = USE 1.5"
(MIN. 1.25" PER FIGURE 8a)
LATERAL DISCHARGE RATE = 1.17 GPM/HOLE (TABLE 1)
8 PERFORATIONS PER LATERAL x 1.17 GPM/HOLE
= 9.36 GPM/LATERAL

MANIFOLD LENGTH = 31.0'
LATERAL SPACING = 4'
MANIFOLD DIAMETER = 4" PVC (TABLE 2)

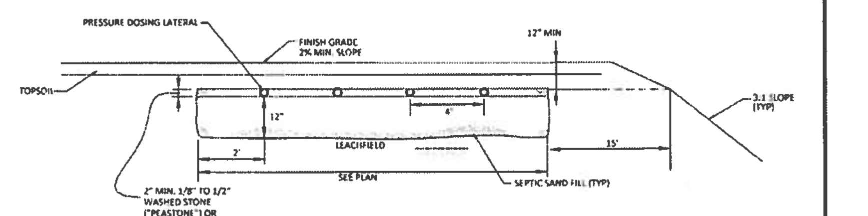
DOSE VOLUME:
TOTAL LENGTH OF LATERALS = 8 x 40.0' = 320.0 FT
AREA 1.5" LATERALS = PI(0.0625)^2 = 0.0123 SF
TOTAL PIPE VOLUME = 0.0123 SF x 320.0'
= 3.94 CF X 7.48 GAL/CF = 29.5 GAL

MIN. DOSE VOLUME: 5 x 29.5 = 147.5 GAL
MAX. DOSE VOLUME: 10 x 29.5 = 295.0 GAL
DOSE 5 TIMES DAILY WITH DOSE VOL 264 GAL

MINIMUM DISCHARGE RATE = 9.36 GPM x 8 LATERALS = 74.9 GPM

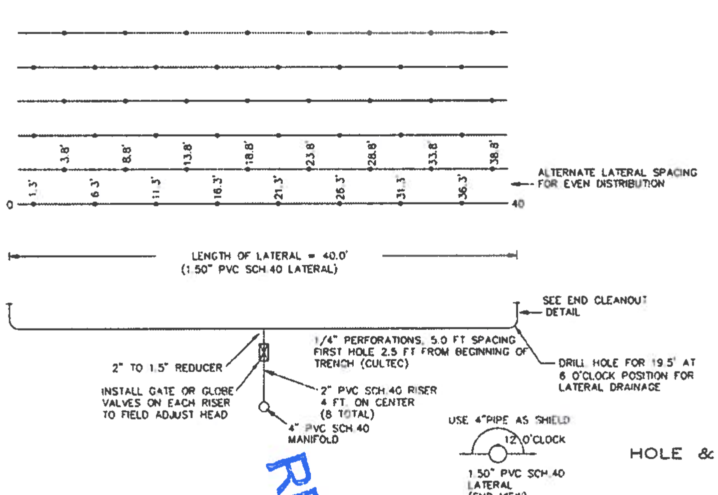
DRAINBACK VOLUME:
4" MANIFOLD =31.0' x PI(0.167)^2 = 2.72 CF
3" FORCE MAIN = 15' x PI(0.125)^2 = 0.74 CF
(2.72 + 0.74) x 7.48 GAL/CF = 25.9 GAL

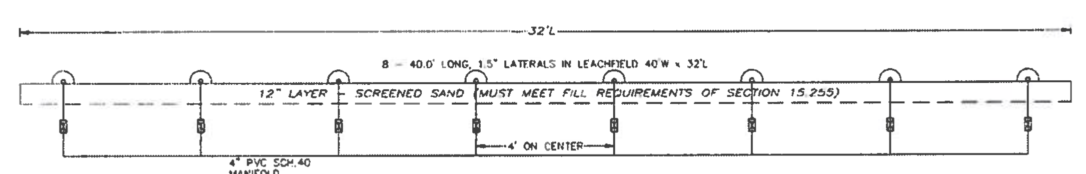
TOTAL DOSE VOLUME = 264 GAL DOSE + 26 GAL DRAINBACK = 290 GAL



NOTES:
- BED AND FILL SHALL CONFORM TO TITLE 5 REQUIREMENTS
- BED BOTTOM SHALL BE SET AT SAME ELEVATION THROUGHOUT.

LEACHFIELD DETAIL
(NOT TO SCALE)





HOLE & RISER LAYOUT DETAIL

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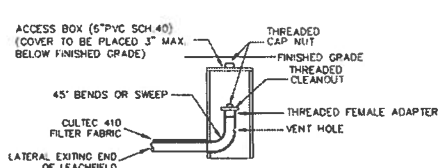
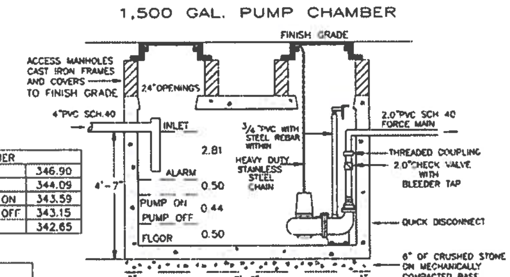
TOWN OF BOXBOROUGH



END CLEANOUT DETAIL

1,500 GAL. PUMP CHAMBER



PUMP CHAMBER	
INV. INLET	346.90
ELEV. ALARM	344.09
ELEV. PUMP ON	343.59
ELEV. PUMP OFF	343.15
FLOOR	342.65

INLET TO FLOOR=4.25', LIQUID DEPTH=4.00', INLET TO TOP OF TANK=1.08'

A 1,500 GAL. PUMP CHAMBER IS TO BE INSTALLED IN THE LOCATION SHOWN. USE A 1,500 GAL. H-10 (STANDARD) E.A. SHEA PRECAST SEPTIC TANK (OR APPROVED EQUIVALENT) AS A PUMP CHAMBER.

PUMPING IS TO BE ACCOMPLISHED BY ONE GOULDS 3886, WS05B, 1 HP, 230 VOLT PUMP OR EQUIVALENT WITH MERCURY SWITCH TILT BULB CONTROLS AND A NEMA 1 SIMPLEX CONTROL PANEL WHICH IS TO BE LOCATED WITHIN THE DWELLING.
PUMP MUST PASS 1-1/4 INCH SOLIDS ACCORDING TO TITLE 5. [310 CMR 15.231(7)]

INSIDE DIMENSION = 5.17' W x 10' L x 1.00' D = 51.7 C.F./FT. DEPTH
51.7 C.F./FT. DEPTH X 7.48 GAL./C.F. = 386 GAL./FT. DEPTH

660 GPD @ 5 DOSES/DAY = 132 GAL/DOSE
DRAINBACK VOLUME:
2" MANIFOLD =218' x PI(0.083)^2 = 4.72 CF x 7.48 = 36 GAL
TOTAL DOSE VOLUME = 132 GAL DOSE + 36 GAL DRAINBACK = 168 GAL

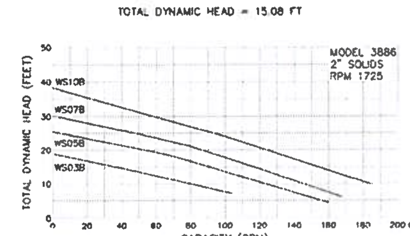
THE CONTROLS ARE TO BE FIELD ADJUSTED TO DISCHARGE 0.44 FT (170 GAL) PER CYCLE.

THE STORAGE (1084 GAL.) AVAILABLE IN THE PUMP CHAMBER BETWEEN THE ELEVATION OF PUMP CHAMBER INLET AND THE HIGH WATER ALARM IS IN EXCESS OF THE 24 HOUR STORAGE (660 GAL.) REQUIRED.
ALL PUMPS MUST BE EQUIPPED WITH A HIGH WATER ALARM LOCATED IN THE BUILDING SERVED WHICH IS POWERED BY A CIRCUIT SEPARATE FROM THE CIRCUIT TO THE PUMP(S). [310 CMR 15.231(9)]
Wiring shall be continuos to the building without the use of a junction box in the pump chamber. This includes wiring for the pump and the floats. Any conduit around electric lines shall be caulk sealed to prevent liquid or gas entry at both ends of the conduit.

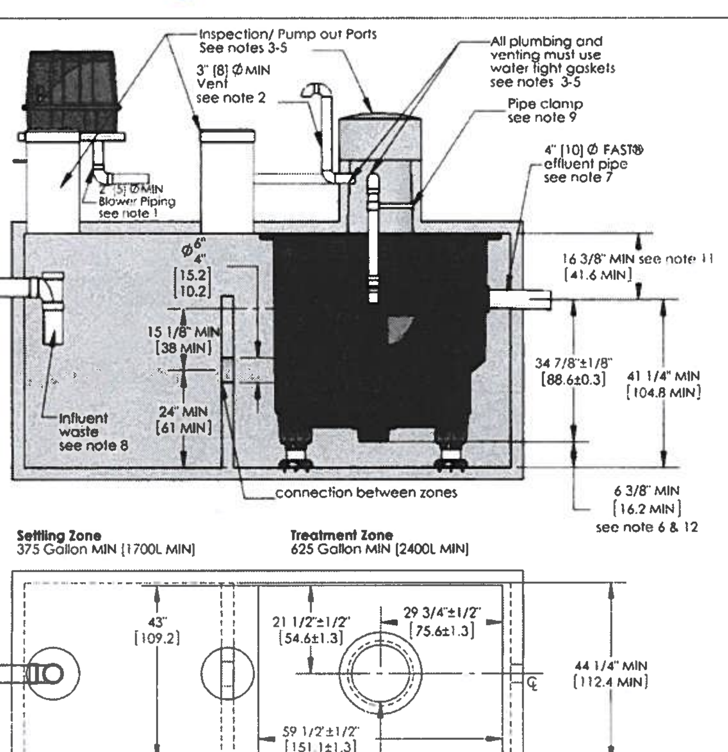
Rail system shall consist of 3/4" PVC pipe with steel rebar within for support. The ends of the pipe are to be sealed to prevent effluent infiltration.

TOTAL DYNAMIC HEAD:
PIPE DIAMETER, INCHES (Dd) = 2
PIPE LENGTH, FT (Ld) = 218
SCH 40 PVC PIPE (Ch) = 140
FLOW, GPM (Qm) = 50
DELIVERY LOSS = Ld(3.55 Qm / Ch Dd)
= 2.03 FT
NETWORK LOSSES = 5.00 FT
STATIC HEAD = PC 11/12 INV − PUMP OFF
= 351.20 − 343.15 = 8.05 FT

TOTAL DYNAMIC HEAD = 15.08 FT



MINIMUM DISCHARGE RATE = 21.1 GPM AT 34.5 TDH



NOTES
1. Airline piping to FAST® may not exceed 100 FT [30m] total length and have a maximum of 4 elbows in the piping system. For distances greater than 100 FT [30m] consult factory. Blower must be located above flood levels on a concrete base 26" X 20" X 2" [65 X 50 X 5cm] min.
2. Vent to desired location and cover opening with a vent grate with at least 7 sq in.[45 sq. cm] open surface area. Secure with stainless steel screws. Vent piping must not allow condensate build up or create back pressure. Vent must be above finished grade or higher (see sheet 4 of 4).
3. All appurtenances to FAST® (e.g. tanks, access ports, electrical, etc.) must conform to all applicable country, state, province, and local plumbing and electrical codes. Pump out access shall be adequate to thoroughly clean out both zones.
4. All inspection, viewing and pump out ports must be secured to prevent accidental or unauthorized access.
5. Tank, piping, conduit, etc. are provided by others. Blower control system by Bio-Microbics, Inc. See Installation Manual.
6. If less than the specified minimums are considered necessary, consult factory for guidance.
7. All piping and ancillary equipment installed after FAST must not impede or restrict free flow of effluent.
8. The tank(s) shall be designed to prevent air passage between the settling zone/tank and the treatment zone and preventing an air lock. Examples include a baffle wall sealed to the lid or treatment zone inlet line with a pipe cap. Consult factory for guidance.
9. The air supply line into the FAST® unit must be secured to prevent vibration induced damage. The air supply line should be secured with a non-corrosive clamp every 2' min [60 cm]. See alternate air supply option on sheet 4 of 4.
10. Specialized treatment levels may require specific features to be incorporated into the design. Consult factory for guidance.
11. Min. height may be reduced, consult factor and reference "Low Profile Module Procedure.pdf"
12. Refer to sheet 4 of 4 for leg extensions requirements.

DO NOT SCALE

UNLESS NOTED DIMENSIONS ARE IN INCHES [CENTIMETERS]
TOLERANCES ± 0.02 IN/IN [± 0.05 CM/CM]

BIO MICROBICS
BETTER WATER BETTER WORLD

MicroFAST 0.75 FAST Unit

WEIGHT	lb	SIZE	DRAWING NUMBER	SHEET
	NAME / DATE	A	MicroFAST® 0.75 with feet	2 OF 4
DRAWN	CTC 12/18/2006			
CHECKED	FF 7/15/2013		REVISED 7/15/2013 REV. INI-07-D	

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Drawing No. **S-2**
Project No.
Scale: 1"=20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL

Site
984 MASSACHUSETTS AVENUE
BOXBOROUGH, MA 01719
Project
GRANITE HILL DEVELOPMENT
Sheet
LOT 1 SEPTIC SYSTEM DETAIL SHEET

Revisions
Number − Description − Date − Initial
1 − BOH Comments − 8/20/18 − DG/JF
2 − BOH Comments − 10/2/18 − DG/JF

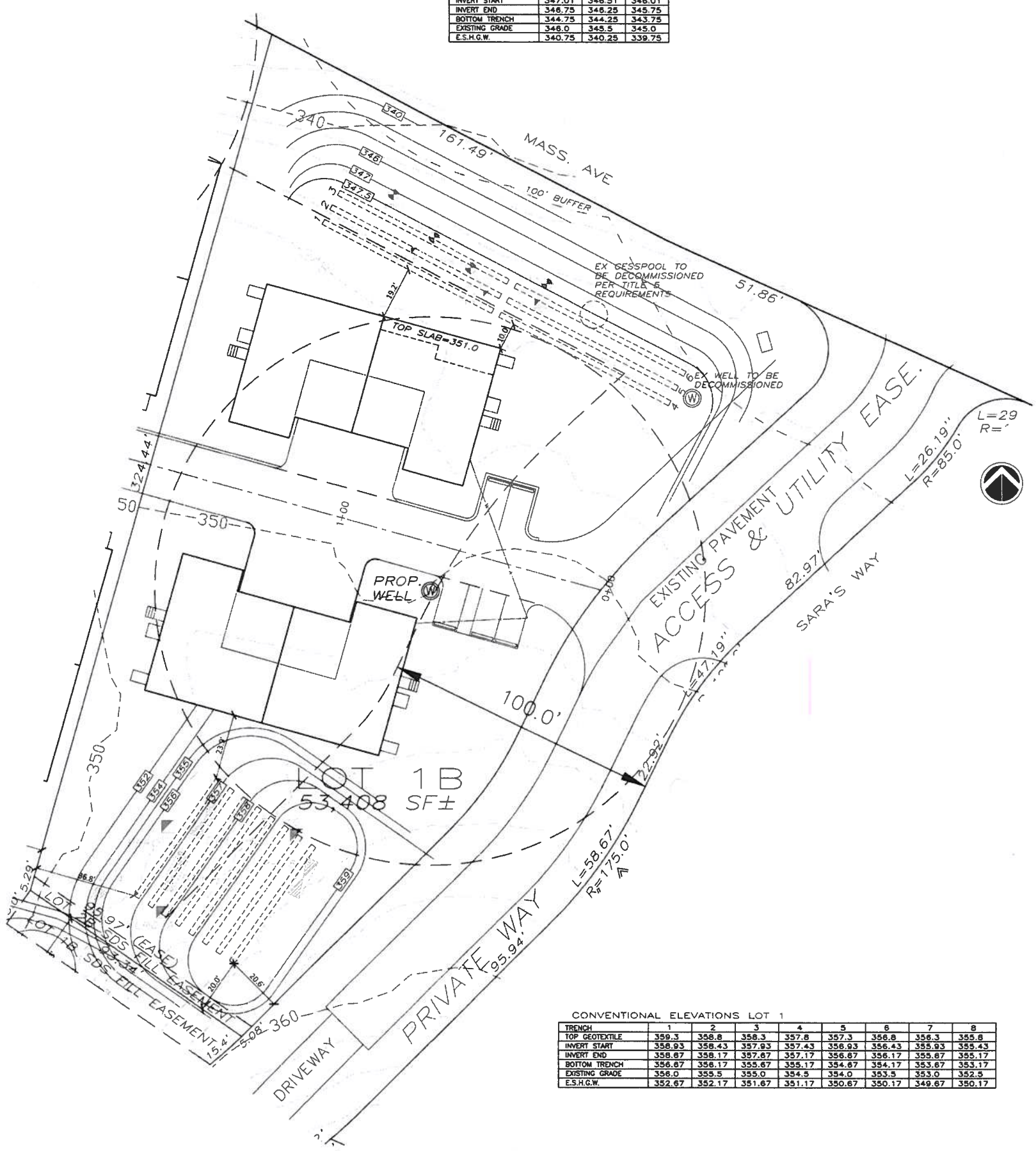
Seal
COMMONWEALTH OF MASSACHUSETTS
JOHN F. FIELD
CIVIL
No. 492..
REGISTERED PROFESSIONAL ENGINEER
John Field
11-8-18

PREPARED BY
NASHOBA ENGINEERING ASSOCIATES
6 BEAVER BROOK ROAD
LITTLETON, MA 01460
978-501-3007

CIVIL ENGINEERING CONSULTANTS

CONVENTIONAL RESERVE ELEVATIONS LOT 1

TRENCH	1 & 4	2 & 5	3 & 6
TOP GEOTEXTILE	347.4	346.9	346.4
INVERT START	347.01	346.51	346.01
INVERT END	346.75	346.25	345.75
BOTTOM TRENCH	344.75	344.25	343.75
EXISTING GRADE	346.0	345.5	345.0
E.S.H.G.W.	340.75	340.25	339.75



CONVENTIONAL ELEVATIONS LOT 1

TRENCH	1	2	3	4	5	6	7	8
TOP GEOTEXTILE	359.3	358.8	358.3	357.8	357.3	356.8	356.3	355.8
INVERT START	358.93	358.43	357.93	357.43	356.93	356.43	355.93	355.43
INVERT END	358.67	358.17	357.67	357.17	356.67	356.17	355.67	355.17
BOTTOM TRENCH	356.67	356.17	355.67	355.17	354.67	354.17	353.67	353.17
EXISTING GRADE	356.0	355.5	355.0	354.5	354.0	353.5	353.0	352.5
E.S.H.G.W.	352.67	352.17	351.67	351.17	350.67	350.17	349.67	350.17

DESIGN FLOW:
NO GARBAGE DISPOSAL
4-THREE BEDROOM SINGLE FAMILY UNITS
12 BEDROOMS x 110 GPD = 1,320 GPD

LEACHING TRENCHES DESIGN:
PERCOLATION RATE: 20 MIN./INCH
SOIL CLASS: II
LTAR: 0.53

CONVENTIONAL
1320 GPD / 0.53 GAL/FT = 2,491 SF LEACHING AREA REQUIRED
USE TRENCHES 2'W x 2'D = 6 SF/FT
2,491 SF / 6 SF/FT = 415.2 FT OF TRENCH REQUIRED
USE 8 TRENCHES 2'W x 2'D x 52' LONG = 416 LF TRENCH PROVIDED

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TOWN OF BOXBOROUGH

Drawing No. S-3
Project No.
Scale: 1"=20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL

Site: 984 MASSACHUSETTS AVENUE BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: **LOT 1 CONVENTIONAL SYSTEM**

Revisions
Number – Description – Date – Initial
1 – BOH Comments – 8/9/18 – DG/JF
2 – BOH Comments – 10/15/18 – DG/JF

Seal: JOHN F. FIELD CIVIL No. 49241 REGISTERED PROFESSIONAL ENGINEER MASSACHUSETTS

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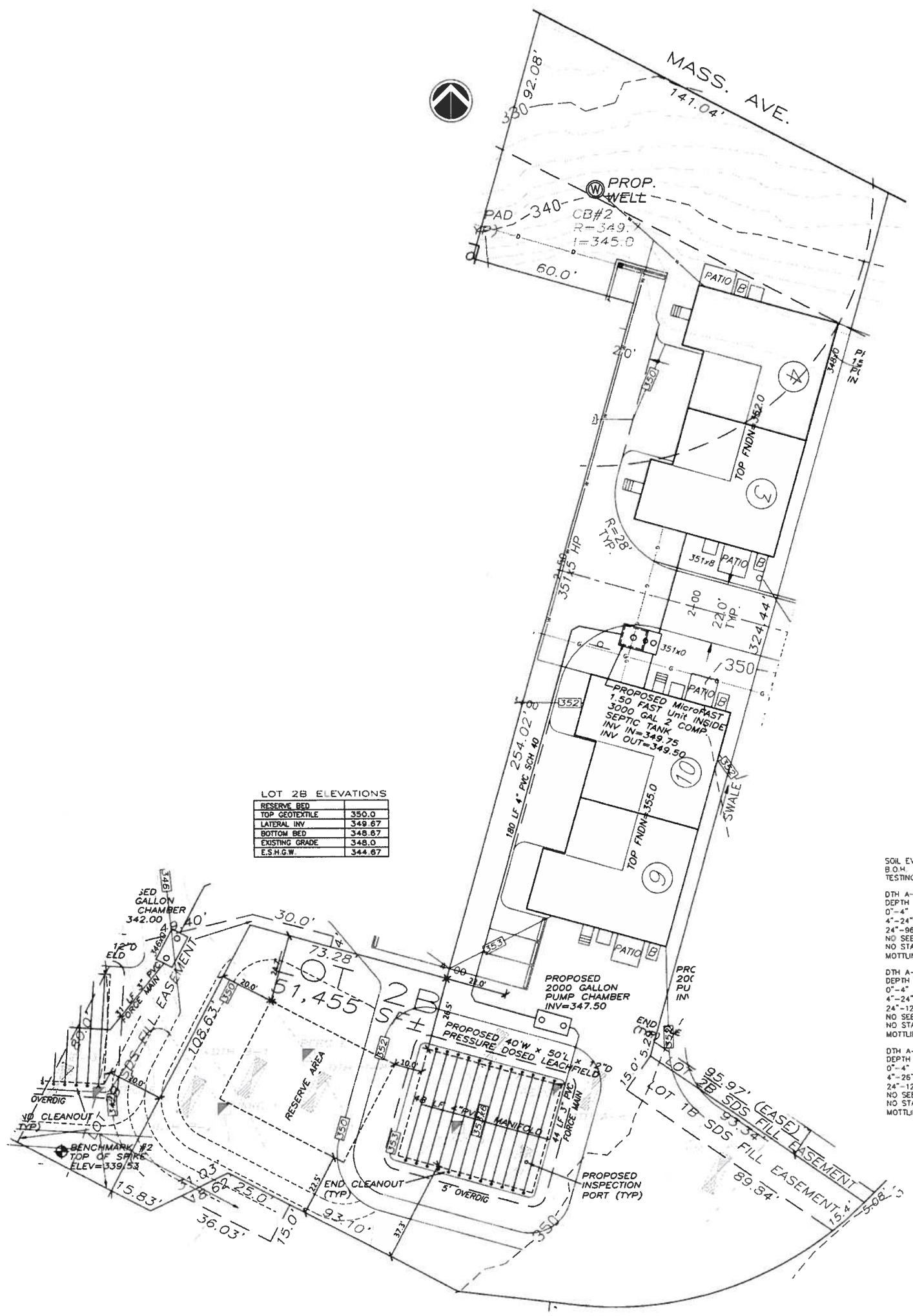
John Field
11-8-18



LOT 2B ELEVATIONS

RESERVE BED	
TOP GEOTEXTILE	350.0
LATERAL INV	349.67
BOTTOM BED	348.67
EXISTING GRADE	348.0
E.S.H.G.W.	344.67

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: JANUARY 2, 2007

DTH A-5

DEPTH	HORIZON	TEXTURE
0"-4"	A	SL
4"-24"	B	SL
24"-96"	C	SL

NO SEEPAGE
NO STANDING WATER
MOTTLING @ 44"

DTH A-6

DEPTH	HORIZON	TEXTURE
0"-4"	A	SL
4"-24"	B	SL
24"-120"	C	SL

NO SEEPAGE
NO STANDING WATER
MOTTLING @ 46"

DTH A-7

DEPTH	HORIZON	TEXTURE
0"-4"	A	SL
4"-26"	B	SL
24"-124"	C	SL

NO SEEPAGE
NO STANDING WATER
MOTTLING @ 46"

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: JANUARY 2, 2007

DTH B-1 ELEV=340.2

DEPTH	HORIZON	TEXTURE
0"-6"	A	SL
6"-28"	B	SL
28"-120"	C	SL

NO SEEPAGE
NO STANDING WATER
MOTTLING @ 40"

DTH B-2 ELEV=338.2

DEPTH	HORIZON	TEXTURE
0"-4"	A	SL
4"-24"	B	SL
24"-96"	C	SL

NO SEEPAGE
NO STANDING WATER
MOTTLING @ 40"

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: FEBRUARY 28, 2007

DTH B-8 ELEV=342.3

DEPTH	HORIZON	TEXTURE
0"-5"	A	SL
5"-24"	B	SL
24"-120"	C	SL

NO SEEPAGE
NO STANDING WATER
MOTTLING @ 40"

SOIL EVALUATOR: RUSS WILSON
B.O.H. AGENT: BEN CUTONE
TESTING DATE: JANUARY 4, 2006

PERC C
50" DEEP
13 MIN/INCH

PERC D
50" DEEP
21 MIN/INCH

PERC E
48" DEEP
18 MIN/INCH

PERC F
48" DEEP
19 MIN/INCH

LOT 2 ELEVATIONS

TOP FOUNDATION 3/4	352.0
FIRST FLOOR 3/4	353.2
OUTLET 9/10	350.50
TOP FOUNDATION 9/10	355.0
FIRST FLOOR 9/10	356.2
OUTLET 9/10	350.00
SEPTIC TANK INLET	348.33
SEPTIC TANK OUTLET	348.00
PUMP CHAMBER INLET	347.80
DOSING BED	
TOP GEOTEXTILE	352.0
LATERAL INV	351.67
BOTTOM BED	350.67
EXISTING GRADE	350.0
E.S.H.G.W.	346.67

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TOWN OF BOXBOROUGH

Drawing No. S-1

Project No.

Scale: 1"=20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL

Site: 984 MASSACHUSETTS AVENUE
BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: **LOT 2 SEPTIC SYSTEM DESIGN PLAN**

Revisions

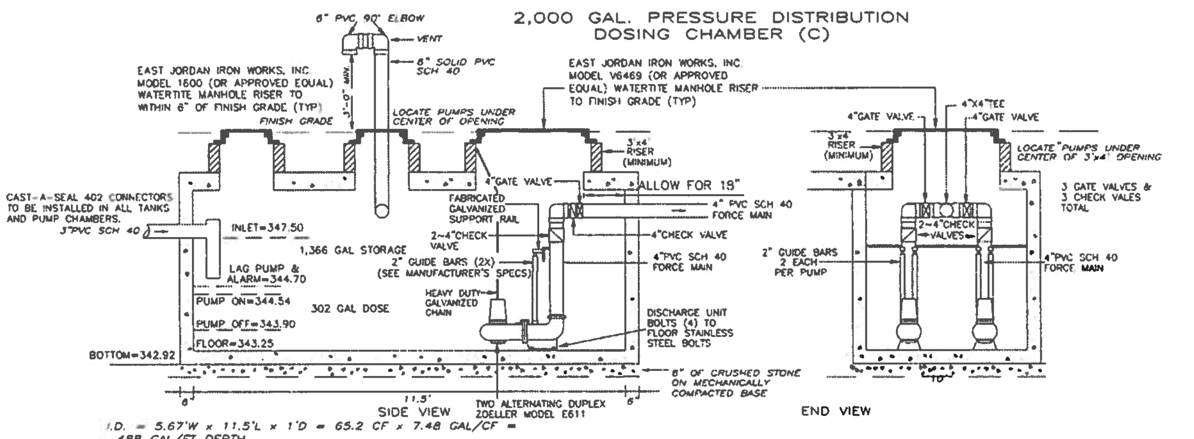
Number	Description	Date	Initial
1	BOH comments	8/20/18	DG/JF
2	BOH comments	10/15/18	DG/JF

Seal: COMMONWEALTH OF MASSACHUSETTS JOHN F FIELD No. 23... REGISTERED PROFESSIONAL ENGINEER
John Field
11-8-18

PREPARED BY
NASHOBA ENGINEERING ASSOCIATES
6 BEAVER BROOK ROAD
LITTLETON, MA 01460
978-501-3007

CIVIL ENGINEERING CONSULTANTS

2,000 GAL. PRESSURE DISTRIBUTION DOSING CHAMBER (C)



I.D. = 5.67'W x 11.5'L x 1'D = 65.2 CF x 7.48 GAL/CF = 488 GAL/FT DEPTH

DAILY FLOW:
12 BEDROOMS
12 x 110 GPD = 1,320 GPD

1,320 GPD / 5 DOSES = 264 GAL/DOSE
DRAINBACK VOLUME = 48 GAL
TOTAL DOSE = 312 GAL

USE A 2,000 GALLON PUMP CHAMBER (SHEA 2,000 GAL SEPTIC TANK TK-M20002CH, OR APPROVED EQUIVALENT)

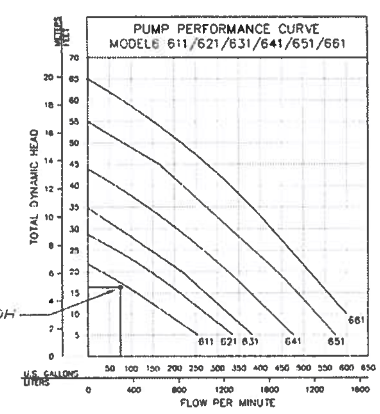
PUMPING TO BE ACCOMPLISHED BY TWO ALTERNATING ZOELLER MODEL E611 PUMPS (1 HP, SINGLE PHASE, 230 V) WITH 3" DISCHARGE CONNECTIONS, CONTROLLED WITH MERCURY SWITCH TILT BULBS AND A CSI CONTROL PANEL LOCATED NEAR THE SYSTEM.
(ALSO TO HAVE 115V RECEPTICLE INSTALLED)
NOTE: PUMPS MUST BE ABLE TO PRODUCE 75 GPM @ 16.3 TDH PLUS ADDITIONAL HEAD TO OFFSET VALVING.

THE CONTROLS ARE TO BE FIELD ADJUSTED TO DISCHARGE 0.64 FEET (312 GALLONS) PER CYCLE.

THE HIGH WATER ALARM IS TO BE ON A SEPARATE CIRCUIT. PROVIDE SLIDE RAIL SYSTEM FOR PUMP REMOVEL. PUMPS MUST PASS 1 1/4" SOLIDS PER TITLE 5.

THE STORAGE AVAILABLE BETWEEN THE PUMP CHAMBER INLET AND HIGH WATER ALARM (1,366 GAL) IS IN EXCESS OF THE 24 HOUR STORAGE REQUIRED (1,320 GAL).

CSI AUTOMATIC CONTROL PANEL TO HAVE OPTIONS AS FOLLOWS:
1. *TOP MOUNTED FLASHING LIGHT AND HORN WITH SILENCER*
2. *MAIN DISCONNECT SWITCHES AND CIRCUIT BREAKERS*
3. *230 VOLT POWER RECEPTACLE*
4. *RUN TIME METERS*
5. *CYCLE COUNTERS*
6. *ANTI-CONDENSATION HEATER*
7. *LIGHTNING ARRESTOR AND SURGE PROTECTOR*
8. *AUTO-DIALER SET TO MAINTENANCE PERSON*



TOTAL DYNAMIC HEAD:

PIPE DIAMETER, INCHES (Da) = 3
PIPE LENGTH, FT (Ld) = 40
SCH 40 PVC PIPE (Ch) = 140
FLOW, GPM (Qm) = 75
DELIVERY LOSS = $Ld(3.55\ Qm / Ch\ Dd^{2.63})^{1.85}$
= 1.1 FT
NETWORK LOSSES = 5.00 FT
STATIC HEAD = INV LATERAL – PUMP OFF
= 351.67 – 343.90 = 7.70 FT
DISTAL HEAD = 2.5 FT

TOTAL DYNAMIC HEAD = 16.3 FT

DESIGN FLOW:
NO GARBAGE DISPOSAL
SINGLE FAMILY RESIDENCES
12 BEDROOMS x 110 GPD = 1,320 GPD

SINGLE FAMILY SEPTIC TANKS:
200% x 660 GPD = 1,320 GAL.
USE MicroFAST 1.50 TANK APPROVED FOR UP TO 1,500 GPD

PRIMARY AREA:
PERCOLATION RATE: 25 MIN./INCH
SOIL CLASS: II
LTAR: 0.33 GPD/S.F. (PER BOXBOROUGH BOH REQUIREMENTS)

LEACHFIELD DESIGN:
1,320 GPD / 0.33 GAL/FT = 4,000 SF LEACHING AREA REQUIRED
UP TO 50% REDUCTION ALLOWED WITH MicroFAST TANK
SECONDARY TREATMENT UNIT (STU) USED = 2,000 SF REQUIRED
USE 40'W x 50'L x 12"D LEACHFIELD = 2,000 SF PROVIDED

PRESSURE DISTRIBUTION CALCULATIONS:

ASSUMPTIONS:
2.5 FT SYSTEM HEAD (MIN.)

1/4" PERFORATIONS @ 5.0 FT ON CENTER
PERFORATIONS @ 12 O'CLOCK POSITION
(6 O'CLOCK AT END OF LATERAL)

LATERAL LENGTH = 40.0'
USE 12 – 40.0' CENTER FED LATERALS
LATERAL DIAMETER = USE 1.5"
(MIN. 1.25" PER FIGURE 8a)
LATERAL DISCHARGE RATE = 1.17 GPM/HOLE (TABLE 1)
8 PERFORATIONS PER LATERAL x 1.17 GPM/HOLE
= 9.36 GPM/LATERAL

MANIFOLD LENGTH = 48.0'
LATERAL SPACING = 4'
MANIFOLD DIAMETER = 4" PVC (TABLE 2)

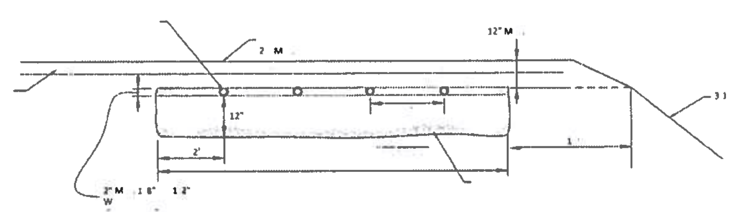
DOSE VOLUME:
TOTAL LENGTH OF LATERALS = 12 x 40.0' = 480.0 FT
AREA 1.5" LATERALS = $PI(0.0625)^2$ = 0.0123 SF
TOTAL PIPE VOLUME = 0.0123 SF x 480.0'
= 5.90 CF X 7.48 GAL/CF = 44 GAL

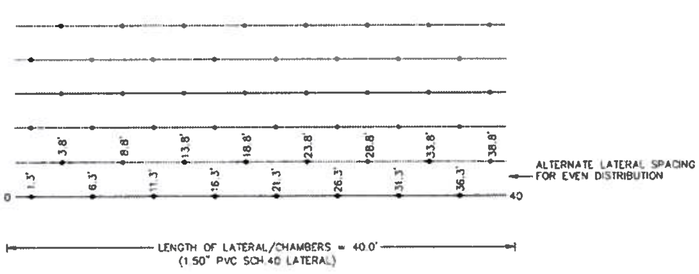
MIN. DOSE VOLUME: 5 x 44 = 220 GAL
MAX. DOSE VOLUME: 10 x 44 = 440 GAL
DOSE 5 TIMES DAILY WITH DOSE VOL 264 GAL

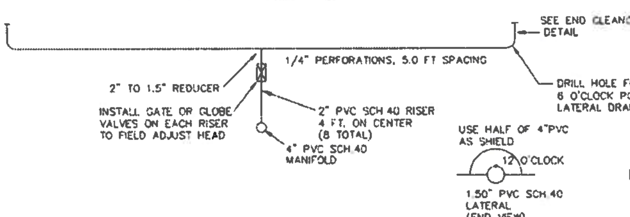
MINIMUM DISCHARGE RATE = 9.36 GPM x 12 LATERALS = 112 GPM

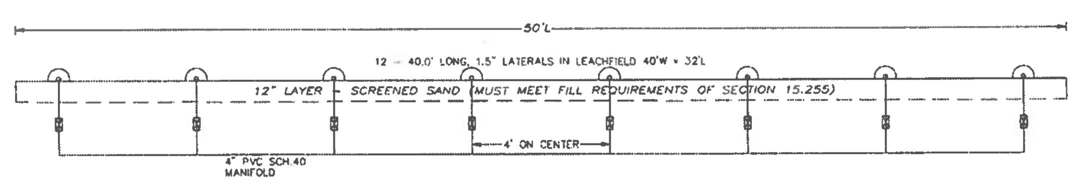
DRAINBACK VOLUME:
4" MANIFOLD =48.0' x $PI(0.167)^2$ = 4.20 CF
3" FORCE MAIN = 44' x $PI(0.125)^2$ = 2.16 CF
(4.2 + 2.16) x 7.48 GAL/CF = 48 GAL

TOTAL DOSE VOLUME = 264 GAL DOSE + 48 GAL DRAINBACK = 312 GAL

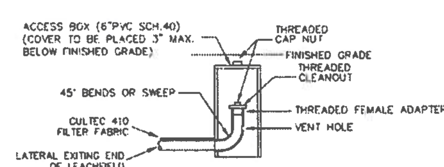




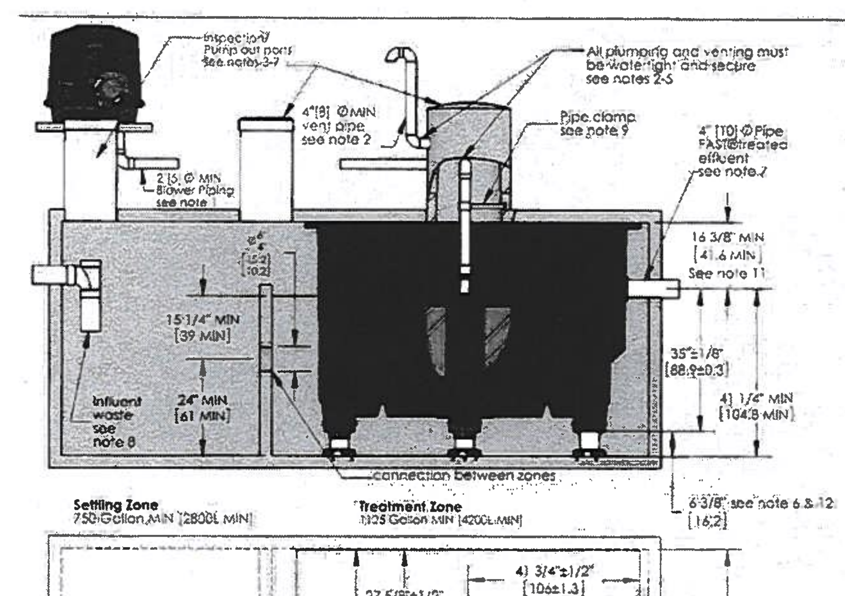




HOLE & RISER LAYOUT DETAIL



END CLEANOUT DETAIL



NOTES
1. Airline piping to FAST® may not exceed 100 FT [30m] total length and have a maximum of 4 elbows in the piping system. For distances greater than 100 FT [30m] consult factory. Blower must be located above flood levels on a concrete base 42" X 28" X 2" [105 X 70 X 5cm] min.
2. Vent to desired location and cover opening with a vent grate with at least 9 sq.in.[60 sq. cm] open surface area. Secure with stainless steel screws. Vent piping must not allow condensate build up or create back pressure. Vent must be above finished grade or higher (see sheet 4 of 4).
3. All appurtenances to FAST® (e.g. tanks, access ports, electrical, etc.) must conform to all applicable country, state, province, and local plumbing and electrical codes. Pump out access shall be adequate to thoroughly clean out both zones.
4. All inspection, viewing and pump out ports must be secured to prevent accidental or unauthorized access.
5. Tank, piping, conduit, etc. are provided by others. Blower control system by Bio-Microbics, Inc. See Installation Manual.
6. If less than the specified minimums are considered necessary, consult factory for guidance.
7. All piping and ancillary equipment installed after FAST must not impede or restrict free flow of effluent.
8. The tank(s) shall be designed to prevent air passage between the settling zone/tank and the treatment zone and preventing an air lock. Examples include a baffle wall sealed to the lid or treatment zone inlet line with a pipe cap. Consult factory for guidance.
9. The air supply line into the FAST® unit must be secured to prevent vibration induced damage. The air supply line should be secured with a non-corrosive clamp every 2' min [60 cm]. See alternate air supply option on sheet 4 of 4.
10. Specialized treatment levels may require specific features to be incorporated into the design. Consult factory for guidance.
11. Min. height may be reduced, consult factor and reference "Low Profile Module Procedure.pdf"
12. Refer to sheet 4 of 4 for leg extensions requirements.

DO NOT SCALE
UNLESS NOTED DIMENSIONS ARE IN INCHES [CENTIMETERS] TOLERANCES ± 0.02 IN/IN [± 0.05 CM/CM]

BIO MICROBICS
BETTER WATER. BETTER WORLD®
MicroFAST 1.50 FAST Unit
WEIGHT | SIZE A | MicroFAST® 1.50 with feet | SHEET 2 OF 4
DRAWN | CHECKED

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GENERAL NOTES:
1. THIS PLAN IS TO BE USED FOR THE INSTALLATION OF THE SUBSURFACE SEWAGE DISPOSAL SYSTEM ONLY.
2. ALL TOPSOIL, PEAT OR OTHER UNSUITABLE IMPERVIOUS SOIL LAYERS SHALL BE REMOVED FROM BELOW AND 5 FT. AROUND THE LEACHING AREA AS SHOWN AND REPLACED WITH FILL MATERIAL PURSUANT TO TITLE 5 (310 CMR 15.255).
3. ANY DEVIATION FROM THE DESIGN OF THIS PLAN MUST FIRST BE APPROVED BY THE LOCAL BOARD OF HEALTH AND ENGINEER.
4. THE CONTRACTOR SHALL NOTIFY THE BOARD OF HEALTH AGENT AND OR ENGINEER A MINIMUM OF 24 HOURS BEFORE EACH REQUIRED INSPECTION.
5. ALL STRUCTURES SHALL BE PRECAST CONCRETE (MINIMUM STRENGTH 4,000 PSI AFTER 28 DAYS)
6. ALL PIPES AND JOINTS SHALL BE WATER TIGHT AND SHALL BE 4" PVC SCH. 40 CONFORMING TO ASTM D1785 & D2665 UNLESS OTHERWISE INDICATED. ALL GASKETED JOINTS TO CONFORM TO ASTM D-3212. A STANDARD LOW PRESSURE AIR TEST SHALL BE PERFORMED ON ALL SEPTIC TANKS, PUMP CHAMBERS, MANHOLES AND THE COMMON SEWER PIPE SYSTEM.
7. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDED IN ORDER TO PREVENT EROSION.
8. THIS SEPTIC SYSTEM IS NOT DESIGNED FOR GARBAGE DISPOSAL UNIT. OWNERS OF SYSTEM SHALL TAKE STEPS TO ENSURE THAT GARBAGE DISPOSAL UNITS ARE NOT INSTALLED.
9. THE APPLICANT AND CONTRACTOR SHALL BE AWARE OF THEIR OBLIGATION TO COMPLY WITH THE REQUIREMENTS OF THE WETLANDS PROTECTION ACT (M.G.L. CH.131 SECT.40).
10. THE LOCATION OF ALL KNOWN WATER COURSES AND BORDERING VEGETATED WETLAND WITHIN 100 FT. OF THE PROPOSED SYSTEM LOCATION ARE SHOWN.
11. THE LOCATION OF ALL KNOWN SOURCES OF WATER SUPPLY (PUBLIC & PRIVATE) WITHIN 400 FT. OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF SURFACE WATER SUPPLIES AND GRAVEL PACKED PUBLIC SUPPLY WELLS; WITHIN 250 FT. OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF TUBULAR WATER SUPPLY WELLS, AND WITHIN 150 FT OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF PRIVATE WATER SUPPLY WELLS ARE SHOWN.
12. ANY WATER LINE CONNECTIONS MUST BE AT LEAST 10 FT. FROM THE PROPOSED SEPTIC SYSTEM.
13. THERE IS NO FOUNDATION DRAIN PROPOSED FOR THE DWELLING SHOWN.
14. CONTRACTOR MUST VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION. DIG-SAFE TELEPHONE NUMBER: 1-888-DIG-SAFE
15. ALL SYSTEM COMPONENTS SHALL BE MARKED WITH MAGNETIC MARKING TAPE OR A COMPARABLE MEANS IN ORDER TO LOCATE THEM ONCE BURIED. [310 CMR 15.22 (12)]
16. ALL RISERS INSTALLED FOR SEPTIC TANKS SHALL BE NO DEEPER THAN SIX (6) INCHES BELOW GROUND SURFACE. [310 CMR 15.22 (13)] PUMP CHAMBER ACCESS MANHOLES SHALL BE BROUGHT TO FINISH GRADE.

Drawing No.: S-2
Project No.:
Scale: 1"=20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL

Site: 984 MASSACHUSETTS AVENUE BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: **LOT 2 SEPTIC SYSTEM DETAIL SHEET**

Revisions
Number – Description – Date – Initial
1 – BOH comments – 8/20/18 – DG/JF
2 – BOH comments – 10/15/18 – DG/JF

Seal: COMMONWEALTH OF MASSACHUSETTS JOHN F. FIELD CIVIL No. 49241 REGISTERED PROFESSIONAL ENGINEER
John Field
11-8-18

PREPARED BY
NASHOBA ENGINEERING ASSOCIATES
6 BEAVER BROOK ROAD
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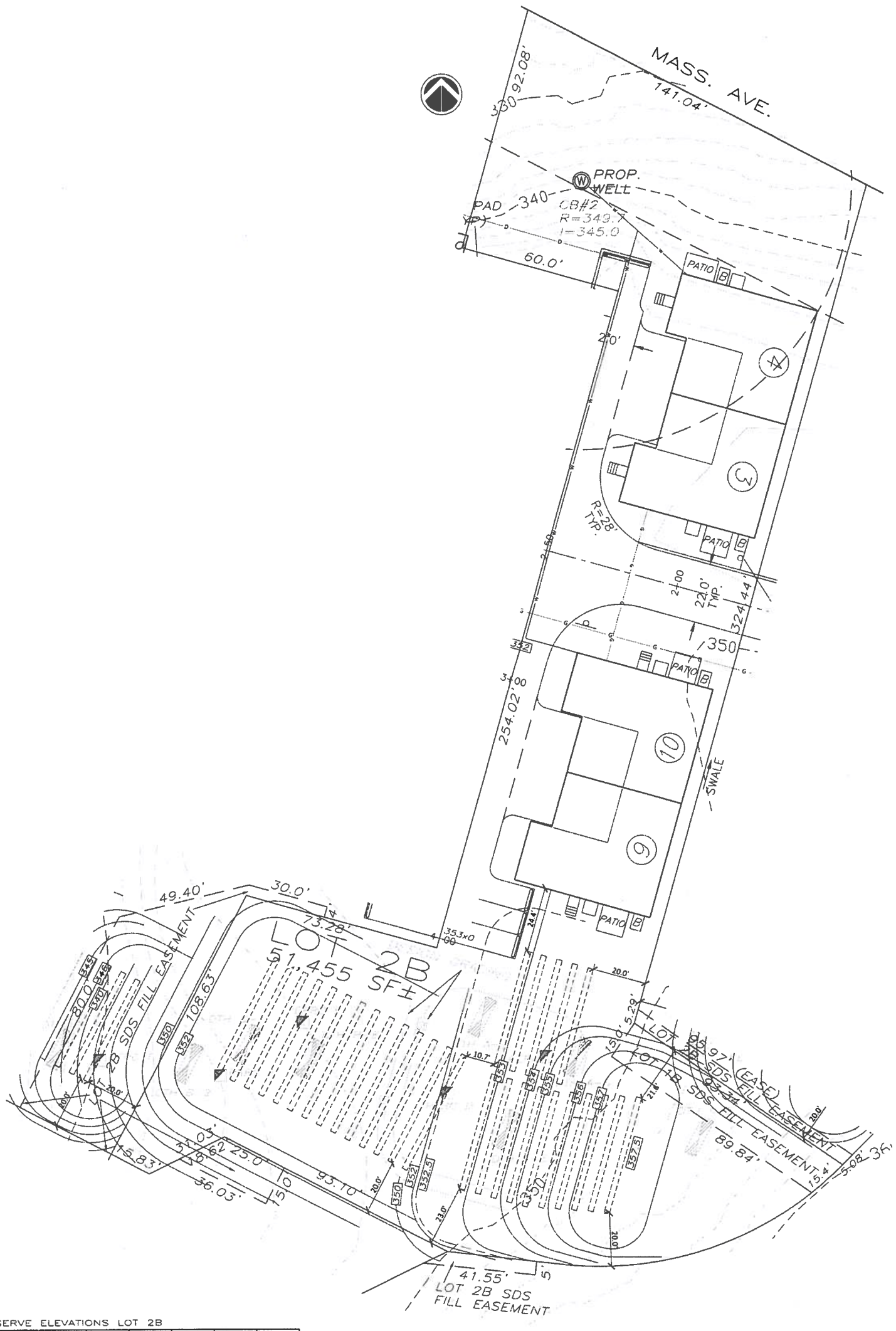
CIVIL ENGINEERING CONSULTANTS



CONVENTIONAL RESERVE ELEVATIONS LOT 2B

TRENCH	ALL	2	3	4	5	6–7	8–9	10–15
TOP GEOTEXTILE	351.8	355.8	355.3	354.8	353.8	353.3	352.8	352.3
INVERT START	351.41	355.41	354.91	354.41	353.41	352.91	352.41	351.91
INVERT END	351.17	355.17	354.67	354.17	353.17	352.67	352.17	351.67
BOTTOM TRENCH	349.17	353.17	352.67	352.17	351.17	350.67	350.17	349.67
EXISTING GRADE	348.5	352.5	352.0	351.5	350.5	350.0	349.5	349.0
E.S.H.G.W.	345.17	349.17	348.67	348.17	347.17	346.67	346.17	345.67

CONVENTIONAL PRIMARY ELEVATIONS LOT 2B

TRENCH	1	2	3	4	5	6–7	8–9	10–15
TOP GEOTEXTILE	356.3	355.8	355.3	354.8	353.8	353.3	352.8	352.3
INVERT START	355.91	355.41	354.91	354.41	353.41	352.91	352.41	351.91
INVERT END	355.67	355.17	354.67	354.17	353.17	352.67	352.17	351.67
BOTTOM TRENCH	353.67	353.17	352.67	352.17	351.17	350.67	350.17	349.67
EXISTING GRADE	353.0	352.5	352.0	351.5	350.5	350.0	349.5	349.0
E.S.H.G.W.	349.67	349.17	348.67	348.17	347.17	346.67	346.17	345.67

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DESIGN FLOW:
NO GARBAGE DISPOSAL
4–THREE BEDROOM SINGLE FAMILY UNITS
12 BEDROOMS x 110 GPD = 1,320 GPD

LEACHING TRENCHES DESIGN:
PERCOLATION RATE: 25 MIN./INCH
SOIL CLASS: II
LTAR: 0.33 (PER BOXBOROUGH BOH REGULATIONS)

CONVENTIONAL
1,320 GPD / 0.33 GAL/FT = 4,000 SF LEACHING AREA REQUIRED
USE TRENCHES 2'W x 2'D = 6 SF/FT
4,000 SF / 6 SF/FT = 666.7 FT OF TRENCH REQUIRED
USE 15 TRENCHES 2'W x 2'D x 44.5' LONG = 667.5 LF TRENCH PROVIDED
RESERVE – 14 TRENCHES 2'W x 2'D x 48' LONG = 672 LF TRENCH PROVIDED

Drawing No. S-3
Project No.
Scale: 1" = 20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL

Site: 984 MASSACHUSETTS AVENUE
BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: **LOT 2 CONVENTIONAL SYSTEM**

Revisions
Number – Description – Date – Initial
1 – BOH comments – 8/20/18 – DG/JF
2 – BOH comments – 10/15/18 – DG/JF

Seal: COMMONWEALTH OF MASSACHUSETTS JOHN F. FIELD CIVIL No. 49241 REGISTERED PROFESSIONAL ENGINEER

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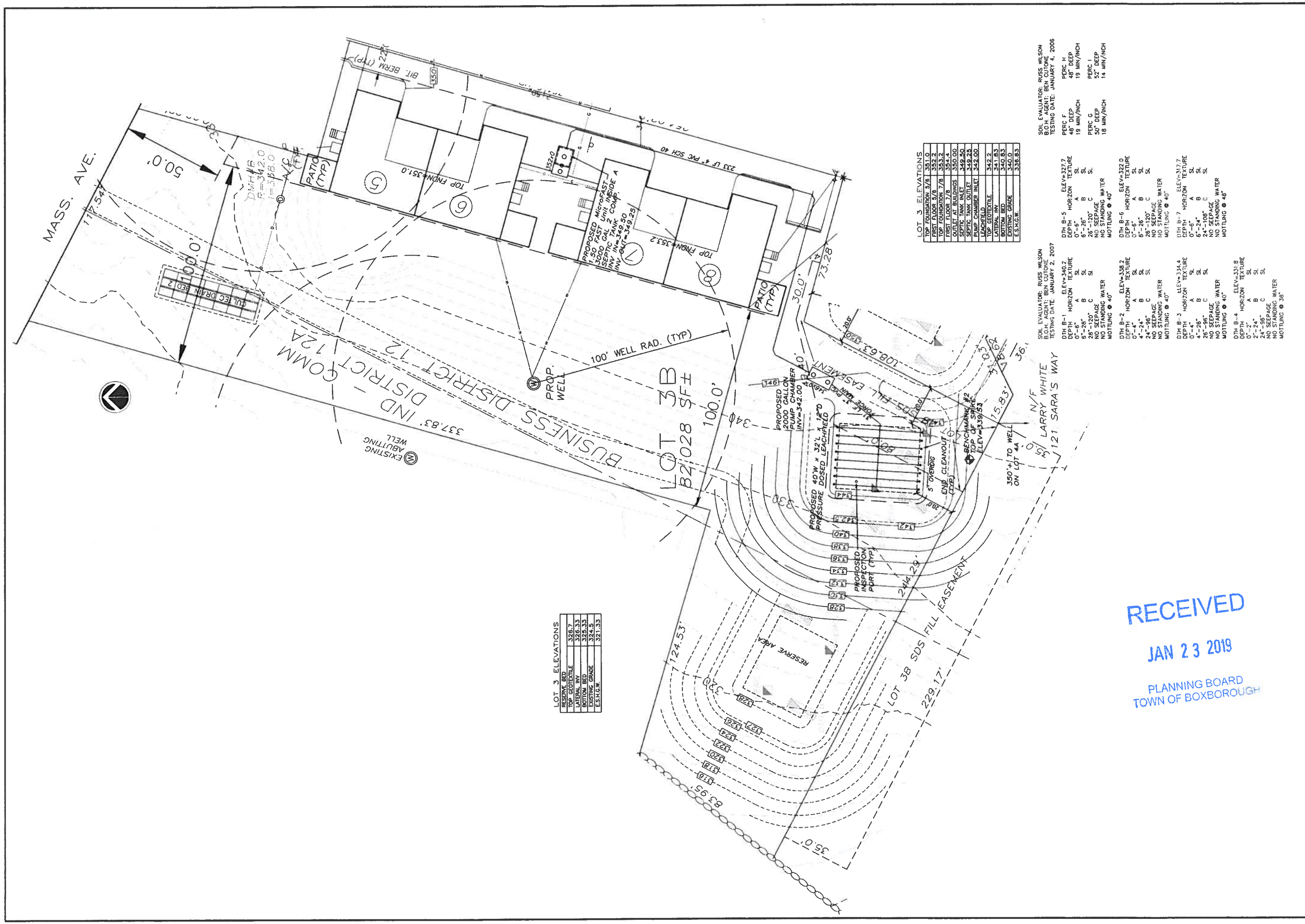

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978-501-3007

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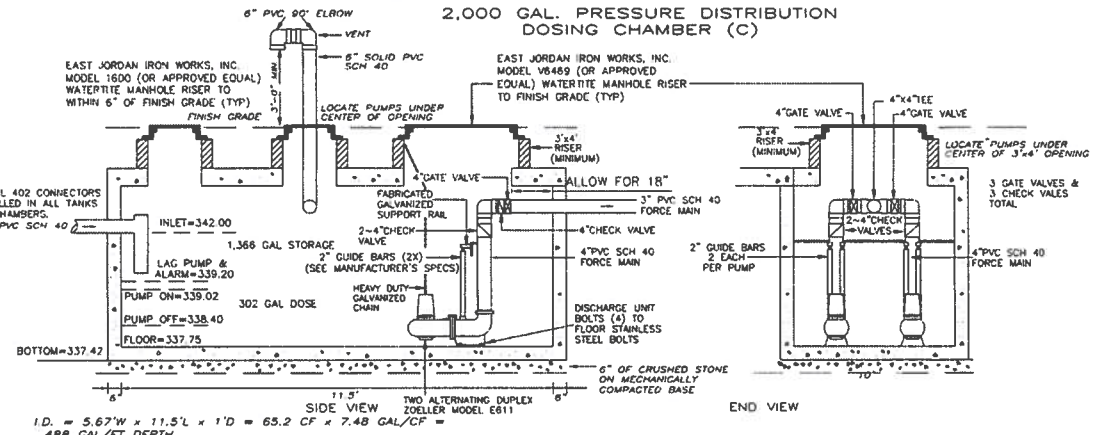
Revision Number	Description	Date	Initial
1	BOH Comments	9/20/18	DG/JF
2	PDR Comments	10/10/18	DG/JF

Site: 984 MASSACHUSETTS AVENUE BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: **LOT 3 SEPTIC SYSTEM DESIGN PLAN**

Scale: 1"=20'
Drawn By / Approved By: DG / JFF
File Name: GRANITE HILL_SDS
Date: JUNE 25, 2018
Issued For: BOH APPROVAL
Project No.
Drawing No. **S-1**

2,000 GAL. PRESSURE DISTRIBUTION DOSING CHAMBER (C)



I.D. = 5.67'W x 11.5'L x 1'D = 65.2 CF x 7.48 GAL/CF = 488 GAL/FT DEPTH

DAILY FLOW:
12 BEDROOMS
12 x 110 GPD = 1,320 GPD

1,320 GPD / 5 DOSES = 264 GAL/DOSE
DRAINBACK VOLUME = 32 GAL
TOTAL DOSE = 296 GAL

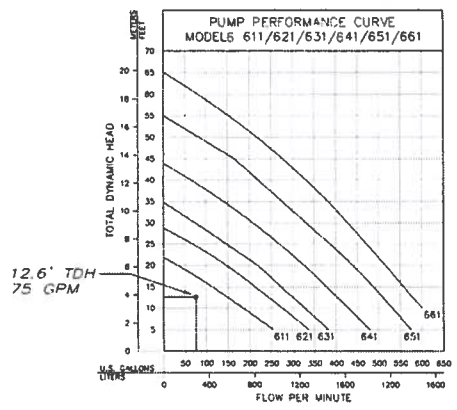
USE A 2,000 GALLON PUMP CHAMBER (SHEA 2,000 GAL SEPTIC TANK TK-M20002CH, OR APPROVED EQUIVALENT)

PUMPING TO BE ACCOMPLISHED BY TWO ALTERNATING ZOELLER MODEL E611 PUMPS (1 HP, SINGLE PHASE, 230 V) WITH 3" DISCHARGE CONNECTIONS, CONTROLLED WITH MERCURY SWITCH TILT BULBS AND A CSI CONTROL PANEL LOCATED NEAR THE SYSTEM.
(ALSO TO HAVE 115V RECEPTICLE INSTALLED)
NOTE: PUMPS MUST BE ABLE TO PRODUCE 75 GPM @ 12.6 TDH PLUS ADDITIONAL HEAD TO OFFSET VALVING.
THE CONTROLS ARE TO BE FIELD ADJUSTED TO DISCHARGE 0.62 FEET (302 GALLONS) PER CYCLE.

THE HIGH WATER ALARM IS TO BE ON A SEPARATE CIRCUIT
PROVIDE SLIDE RAIL SYSTEM FOR PUMP REMOVEL
PUMPS MUST PASS 1 1/4" SOLIDS PER TITLE 5.

THE STORAGE AVAILABLE BETWEEN THE PUMP CHAMBER INLET AND HIGH WATER ALARM (1,366 GAL) IS IN EXCESS OF THE 24 HOUR STORAGE REQUIRED (1,320 GAL).

CSI AUTOMATIC CONTROL PANEL TO HAVE OPTIONS AS FOLLOWS:
1. TOP MOUNTED FLASHING LIGHT AND HORN WITH SILENCER
2. MAIN DISCONNECT SWITCHES AND CIRCUIT BREAKERS
3. 230 VOLT POWER RECEPTACLE
4. RUN TIME METERS
5. CYCLE COUNTERS
6. ANTI-CONDENSATION HEATER
7. LIGHTNING ARRESTOR AND SURGE PROTECTOR
8. AUTO-DIALER SET TO MAINTENANCE PERSON



TOTAL DYNAMIC HEAD:
PIPE DIAMETER, INCHES (Dd) = 3
PIPE LENGTH, FT (Ld) = 40
SCH 40 PVC PIPE (Ch) = 140
FLOW, GPM (Qm) = 75
DELIVERY LOSS = Ld(3.55 Qm / Ch Dd$^{2.63}$)$^{1.85}$
= 1.1 FT
NETWORK LOSSES = 5.00 FT
STATIC HEAD = INV LATERAL - PUMP OFF
= 342.33 - 338.40 = 3.93 FT
DISTAL HEAD = 2.5 FT

TOTAL DYNAMIC HEAD = 12.53 FT

DESIGN FLOW:
NO GARBAGE DISPOSAL
SINGLE FAMILY RESIDENCES
12 BEDROOMS x 110 GPD = 1,320 GPD

SINGLE FAMILY SEPTIC TANKS:
200% x 660 GPD = 1,320 GAL
USE MicroFAST 1.50 TANK APPROVED FOR UP TO 1,500 GPD

PRIMARY AREA:
PERCOLATION RATE: 20 MIN./INCH
SOIL CLASS: II
LTAR: 0.53 GPD/S.F.

LEACHFIELD DESIGN:
1,320 GPD / 0.53 GAL/FT = 2,491 SF LEACHING AREA REQUIRED
UP TO 50% REDUCTION ALLOWED WITH MicroFAST TANK
SECONDARY TREATMENT UNIT (STU) USED = 1,245.5 SF REQUIRED
USE 40'W x 32'L x 12"D LEACHFIELD = 1,280 SF PROVIDED

PRESSURE DISTRIBUTION CALCULATIONS:

ASSUMPTIONS:
2.5 FT SYSTEM HEAD (MIN.)

1/4" PERFORATIONS @ 5.0 FT ON CENTER
PERFORATIONS @ 12 O'CLOCK POSITION
(6 O'CLOCK AT END OF LATERAL)

LATERAL LENGTH = 40.0'
USE 8 - 40.0' CENTER FED LATERALS
LATERAL DIAMETER = USE 1.5"
(MIN. 1.25" PER FIGURE 8a)
LATERAL DISCHARGE RATE = 1.17 GPM/HOLE (TABLE 1)
8 PERFORATIONS PER LATERAL x 1.17 GPM/HOLE
= 9.36 GPM/LATERAL

MANIFOLD LENGTH = 31.0'
LATERAL SPACING = 4'
MANIFOLD DIAMETER = 4" PVC (TABLE 2)

DOSE VOLUME:

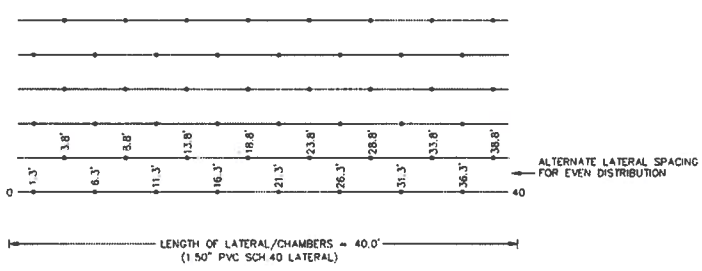
TOTAL LENGTH OF LATERALS = 8 x 40.0' = 320.0 FT
AREA 1.5" LATERALS = Pi(0.0625)^2 = 0.0123 SF
TOTAL PIPE VOLUME = 0.0123 SF x 320.0'
= 3.94 CF X 7.48 GAL/CF = 29.5 GAL

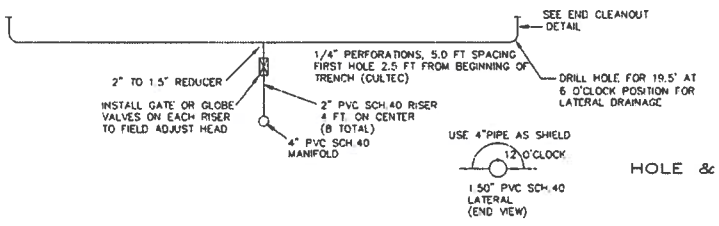
MIN. DOSE VOLUME: 5 x 29.5 = 147.5 GAL
MAX. DOSE VOLUME: 10 x 29.5 = 295.0 GAL
DOSE 5 TIMES DAILY WITH DOSE VOL 264 GAL

MINIMUM DISCHARGE RATE = 9.36 GPM x 8 LATERALS = 74.9 GPM

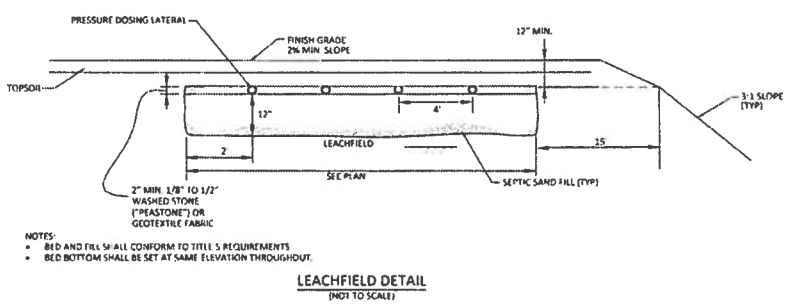
DRAINBACK VOLUME
4" MANIFOLD =31.0' x Pi(0.167)^2 = 2.72 CF
3" FORCE MAIN = 31' x Pi(0.125)^2 = 1.52 CF
(2.72 + 1.52) x 7.48 GAL/CF = 32 GAL

TOTAL DOSE VOLUME = 264 GAL DOSE + 32 GAL DRAINBACK = 296 GAL

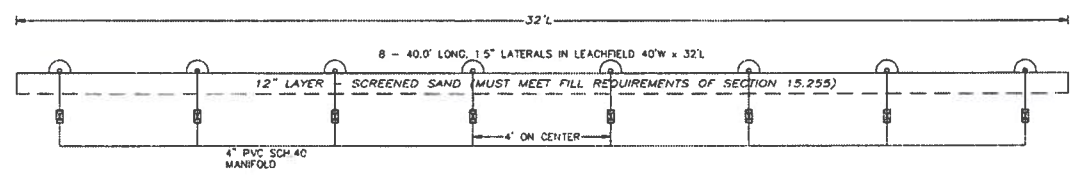


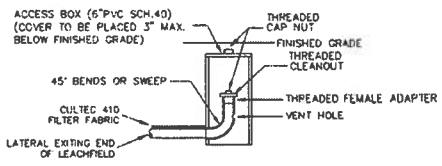


HOLE & RISER LAYOUT DETAIL

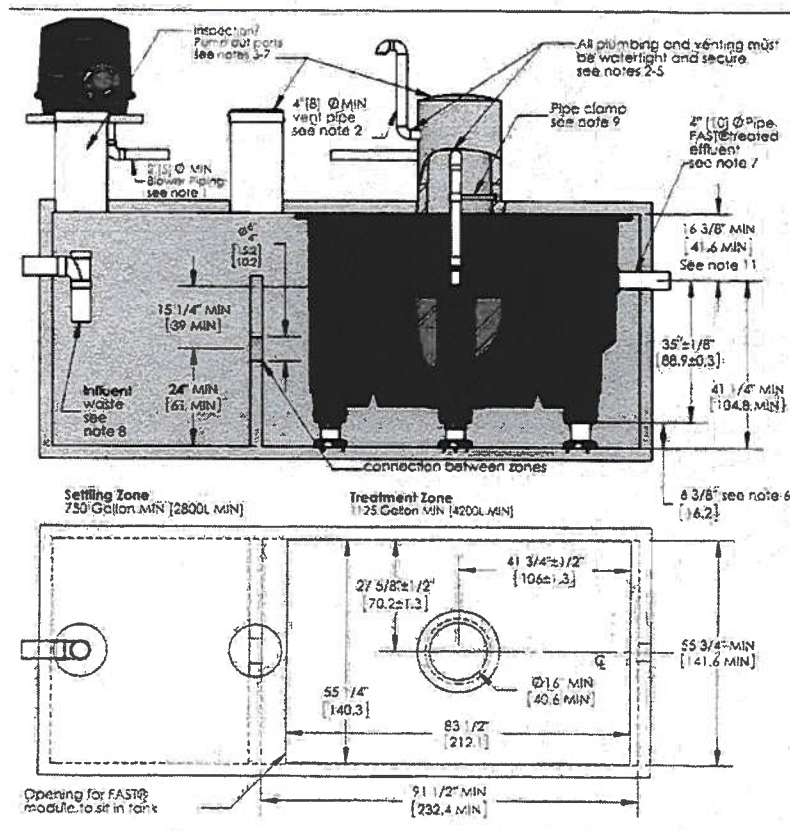


LEACHFIELD DETAIL
(NOT TO SCALE)





END CLEANOUT DETAIL



NOTES
1. Airline piping to FAST® may not exceed 100 FT [30m] total length and have a maximum of 4 elbows in the piping system. For distances greater than 100 FT [30m] consult factory. Blower must be located above flood levels on a concrete base 42"-X 28"-X 2" [105 X 70 X 5cm] min.
2. Vent to desired location and cover opening with a vent grate with at least 9 sq in [60 sq. cm] open surface area. Secure with stainless steel screws. Vent piping must not allow condensate build up or create back pressure. Vent must be above finished grade or higher (see sheet 4 of 4).
3. All appurtenances to FAST® (e.g. tanks, access ports, electrical, etc.) must conform to all applicable country, state, province, and local plumbing and electrical codes. Pump out access shall be adequate to thoroughly clean out both zones.
4. All inspection, viewing and pump out ports must be secured to prevent accidental or unauthorized access.
5. Tank, piping, conduit, etc. are provided by others. Blower control system by Bio-Microbics, Inc. See Installation Manual.
6. If less than the specified minimums are considered necessary, consult factory for guidance.
7. All piping and ancillary equipment installed after FAST must not impede or restrict free flow of effluent.
8. The tank(s) shall be designed to prevent air passage between the settling zone/tank and the treatment zone and preventing an air lock. Examples include a baffle wall sealed to the lid or treatment zone inlet line with a pipe cap. Consult factory for guidance.
9. The air supply line into the FAST® unit must be secured to prevent vibration induced damage. The air supply line should be secured with a non-corrosive clamp every 2' min [60 cm]. See alternate air supply option on sheet 4 of 4.
10. Specialized treatment levels may require specific features to be incorporated into the design. Consult factory for guidance.
11. Min. height may be reduced, consult factor and reference "Low Profile Module Procedure.pdf"
12. Refer to sheet 4 of 4 for leg extensions requirements.

DO NOT SCALE
UNLESS NOTED DIMENSIONS ARE IN INCHES [CENTIMETERS]
TOLERANCES
± 0.02 IN/IN
[± 0.05 CM/CM]

BIO MICROBICS
BETTER WATER. BETTER WORLD
MicroFAST 1.50 FAST Unit

WEIGHT | SIZE A | DRAWING NUMBER MicroFAST® 1.50 with feet | SHEET 2 OF 4

DRAWN | CHECKED

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RECEIVED
JAN 23 2019
PLANNING BOARD
TOWN OF BOXBOROUGH

GENERAL NOTES:

1. THIS PLAN IS TO BE USED FOR THE INSTALLATION OF THE SUBSURFACE SEWAGE DISPOSAL SYSTEM ONLY.
2. ALL TOPSOIL, PEAT OR OTHER UNSUITABLE IMPERVIOUS SOIL LAYERS SHALL BE REMOVED FROM BELOW AND 5 FT. AROUND THE LEACHING AREA AS SHOWN AND REPLACED WITH FILL MATERIAL PURSUANT TO TITLE 5 (310 CMR 15.255).
3. ANY DEVIATION FROM THE DESIGN OF THIS PLAN MUST FIRST BE APPROVED BY THE LOCAL BOARD OF HEALTH AND ENGINEER.
4. THE CONTRACTOR SHALL NOTIFY THE BOARD OF HEALTH AGENT AND OR ENGINEER A MINIMUM OF 24 HOURS BEFORE EACH REQUIRED INSPECTION.
5. ALL STRUCTURES SHALL BE PRECAST CONCRETE (MINIMUM STRENGTH 4,000 PSI AFTER 28 DAYS)
6. ALL PIPES AND JOINTS SHALL BE WATER TIGHT AND SHALL BE 4" PVC SCH. 40 CONFORMING TO ASTM D1785 & D2665 UNLESS OTHERWISE INDICATED. ALL GASKETED JOINTS TO CONFORM TO ASTM D-3212. A STANDARD LOW PRESSURE AIR TEST SHALL BE PERFORMED ON ALL SEPTIC TANKS, PUMP CHAMBERS, MANHOLES AND THE COMMON SEWER PIPE SYSTEM.
7. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDED IN ORDER TO PREVENT EROSION.
8. THIS SEPTIC SYSTEM IS NOT DESIGNED FOR GARBAGE DISPOSAL UNIT. OWNERS OF SYSTEM SHALL TAKE STEPS TO ENSURE THAT GARBAGE DISPOSAL UNITS ARE NOT INSTALLED.
9. THE APPLICANT AND CONTRACTOR SHALL BE AWARE OF THEIR OBLIGATION TO COMPLY WITH THE REQUIREMENTS OF THE WETLANDS PROTECTION ACT (M.G.L. CH 131 SECT.40).
10. THE LOCATION OF ALL KNOWN WATER COURSES AND BORDERING VEGETATED WETLAND WITHIN 100 FT. OF THE PROPOSED SYSTEM LOCATION ARE SHOWN.
11. THE LOCATION OF ALL KNOWN SOURCES OF WATER SUPPLY (PUBLIC & PRIVATE) WITHIN 400 FT. OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF SURFACE WATER SUPPLIES AND GRAVEL PACKED PUBLIC SUPPLY WELLS; WITHIN 250 FT. OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF TUBULAR WATER SUPPLY WELLS; AND WITHIN 150 FT. OF THE PROPOSED SYSTEM LOCATION IN THE CASE OF PRIVATE WATER SUPPLY WELLS ARE SHOWN.
12. ANY WATER LINE CONNECTIONS MUST BE AT LEAST 10 FT. FROM THE PROPOSED SEPTIC SYSTEM.
13. THERE IS NO FOUNDATION DRAIN PROPOSED FOR THE DWELLING SHOWN.
14. CONTRACTOR MUST VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION.
DIG-SAFE TELEPHONE NUMBER: 1-888-DIG-SAFE
15. ALL SYSTEM COMPONENTS SHALL BE MARKED WITH MAGNETIC MARKING TAPE OR A COMPARABLE MEANS IN ORDER TO LOCATE THEM ONCE BURIED [310 CMR 15.22 (12)]
16. ALL RISERS INSTALLED FOR SEPTIC TANKS SHALL BE NO DEEPER THAN SIX (6) INCHES BELOW GROUND SURFACE. [310 CMR 15.22 (13)]
PUMP CHAMBER ACCESS MANHOLES SHALL BE BROUGHT TO FINISH GRADE.

Drawing No. S-2

Project No.

Scale 1" = 20'
Drawn By / Approved By DG / JFF
File Name GRANITE HILL_SDS
Date JUNE 25, 2018
Issued For BOH APPROVAL

Site
984 MASSACHUSETTS AVENUE
BOXBOROUGH, MA 01719
Project
GRANITE HILL DEVELOPMENT
Sheet
LOT 3 SEPTIC SYSTEM DETAIL SHEET

Revisions
Number - Description - Date - Initial
1 - BOH Comments - 8/20/18 - DG/JF
2 - BOH Comments - 10/15/18 - DG/JF

Seal
COMMONWEALTH OF MASSACHUSETTS
JOHN F. FIELD
CIVIL
No. 49241
REGISTERED PROFESSIONAL ENGINEER
11-8-18

PREPARED BY
NASHOBA ENGINEERING ASSOCIATES
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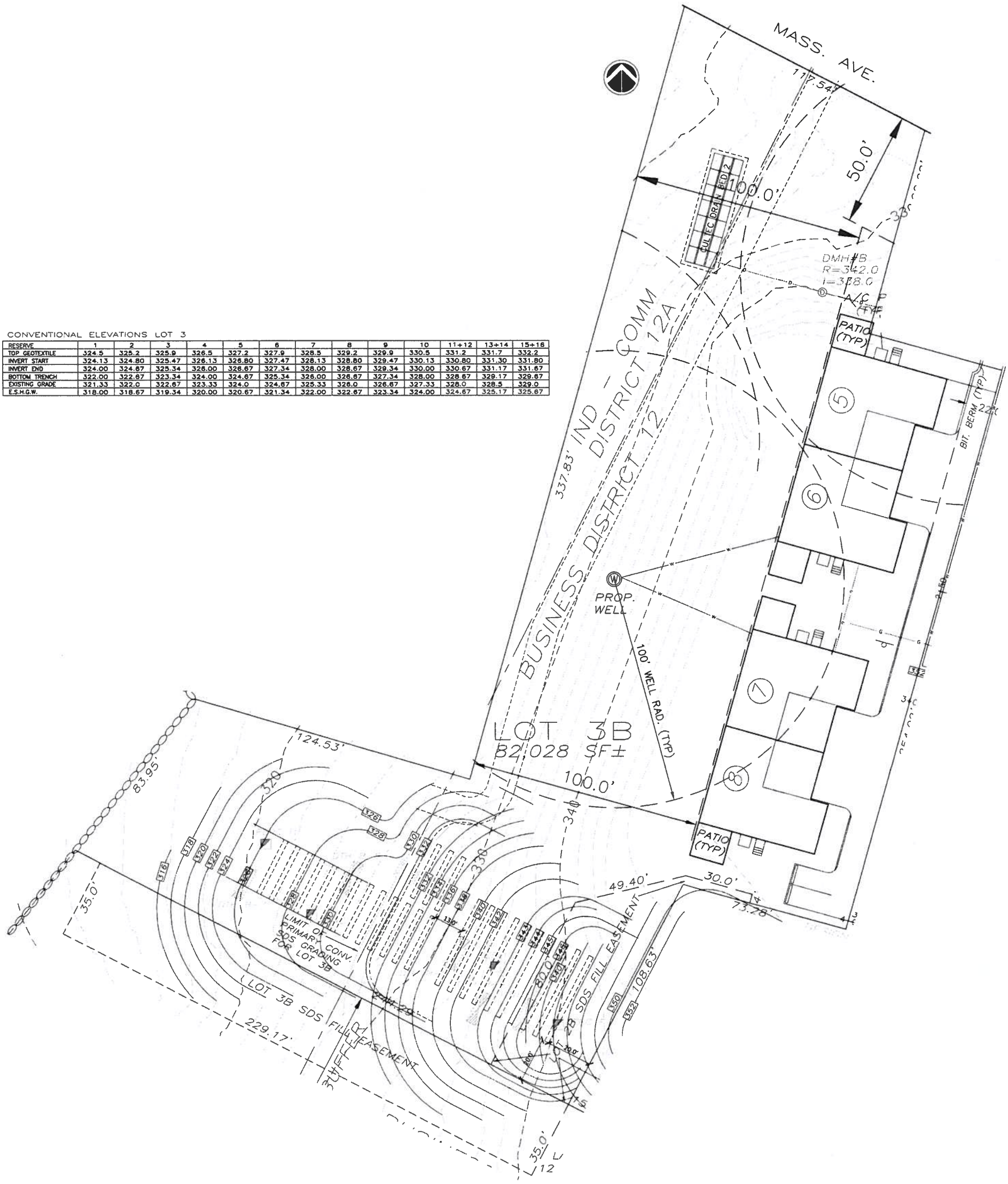
CIVIL ENGINEERING CONSULTANTS



CONVENTIONAL ELEVATIONS LOT 3

RESERVE	1	2	3	4	5	6	7	8	9	10	11+12	13+14	15+16
TOP GEOTEXTILE	324.5	325.2	325.9	326.5	327.2	327.9	328.5	329.2	329.9	330.5	331.2	331.7	332.2
INVERT START	324.13	324.80	325.47	326.13	326.80	327.47	328.13	328.80	329.47	330.13	330.80	331.30	331.80
INVERT END	324.00	324.67	325.34	326.00	326.67	327.34	328.00	328.67	329.34	330.00	330.67	331.17	331.67
BOTTOM TRENCH	322.00	322.67	323.34	324.00	324.67	325.34	326.00	326.67	327.34	328.00	328.67	329.17	329.67
EXISTING GRADE	321.33	322.0	322.67	323.33	324.0	324.67	325.33	326.0	326.67	327.33	328.0	328.5	329.0
E.S.H.G.W.	318.00	318.67	319.34	320.00	320.67	321.34	322.00	322.67	323.34	324.00	324.67	325.17	325.67

DESIGN FLOW:
NO GARBAGE DISPOSAL
4-THREE BEDROOM SINGLE FAMILY UNITS
12 BEDROOMS x 110 GPD = 1,320 GPD

LEACHING TRENCHES DESIGN:
PERCOLATION RATE: 20 MIN./INCH
SOIL CLASS: II
LTAR: 0.53

CONVENTIONAL
1,320 GPD / 0.53 GAL/FT = 2,491 SF LEACHING AREA REQUIRED
USE TRENCHES 2'W x 2'D = 6 SF/FT
2,491 SF / 6 SF/FT = 415.2 FT OF TRENCH REQUIRED
USE 10 TRENCHES 2'W x 2'D x 42' LONG = 420 LF TRENCH PROVIDED
RESERVE 16 TRENCHES 2'W x 2'D x 26' LONG = 416 LF TRENCH PROVIDED

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CONVENTIONAL ELEVATIONS LOT 3

TRENCH	1	2	3	4	5	6	7	8	9	10
TOP GEOTEXTILE	345.4	344.4	343.4	342.4	341.9	341.4	339.4	338.4	336.4	334.9
INVERT START	345.04	344.04	343.04	342.04	341.54	341.04	339.54	338.04	336.04	334.54
INVERT END	344.83	343.83	342.83	341.83	341.33	340.83	339.33	337.83	335.83	334.33
BOTTOM TRENCH	342.83	341.83	340.83	339.83	339.33	338.83	337.33	335.83	333.83	332.33
EXISTING GRADE	342.0	341.0	340.0	339.0	338.5	337.5	336.5	335.0	333.0	331.5
E.S.H.G.W.	338.83	337.83	336.83	335.83	335.33	334.83	333.33	331.83	329.83	328.33

Drawing No. S-3

Project No.:

Issued For: BOH APPROVAL
Date: JUNE 25, 2018
File Name: GRANITE HILL_SDS
Drawn By / Approved By: DG / JFF
Scale: 1" = 20'

Site: 984 MASSACHUSETTS AVENUE
BOXBOROUGH, MA 01719
Project: GRANITE HILL DEVELOPMENT
Sheet: **LOT 3 CONVENTIONAL SYSTEM**

Revisions
Number – Description – Date – Initial
1 – BOH Comments – 8/9/18 – DG/JF
2 – BOH Comments – 10/15/18 – DG/JF

Seal: COMMONWEALTH OF MASSACHUSETTS – JOHN F. FIELD – CIVIL – No 49241 – REGISTERED PROFESSIONAL ENGINEER
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