



Section 4: Layout



**Please bring all
materials for this
section:**

**Laser, 100' tape,
rolling wheel, etc.**

What to expect:

For the layout portion of the exam, you will be assigned a lot with four property corner flags and two flags to represent the two soil pits. The soil pit flags will have loading rates on them. The house location and system design will be your choice.

What to expect:

Part 1: Flagging out the field

Part 2: Ground elevations and flowlines

Part 3: Drawing system

Make sure that you understand and demonstrate maximum storage in your design. If your system does not meet maximum storage (flat or sloping ground) then you will not be able to pass this section of the exam.

Part 1: Flagging the field

Using the loading rates provided, design a gravity flow, pipe & gravel wastewater system with a distribution box for a 1200 ft² one level house on a well. **Use 370 GPD. Absorption trenches on 10' centers.**

SECTION 1

20 POINTS

60 MINUTES

- a. Flag and label the bench mark. **(1 pt.)**
 - b. Flag and label the stub-out. **(1 pt.)**
 - c. Flag and label the inlet & outlet of the septic tank. **(1 pt.)**
 - d. Flag and label the distribution box. **(1 pt.)**
 - e. Layout primary absorption area on contour. **(8 pt.)**
 - f. Flag and label the beginning, middle and end of each line in the primary area. **(3 pt.)**
 - g. Layout the four corners of the alternate absorption area on contour. **(4 pt.)**
 - h. Flag and label the 4 house corners. **(1 pt.)**
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Wastewater Flows for Residences

1 bedroom → 150 GPD

2 bedroom → 270 GPD

3 bedroom → 370 GPD

4 bedroom → 450 GPD

Each bedroom over 4 → 50 GPD

How many gallons per day would a 7 bedroom house be sized for?

600 GPD

Practice Problems:

1. The septic system for a 2-bedroom home has a loading rate of 0.56. How many linear feet of field line are required?

2-bedroom home is 270 gpd

$$270 \text{ gpd} \div 0.56 = 482 \text{ sq. ft.}$$

$$482 \text{ sq. ft.} \div 2 = 241'$$

This 2-bedroom home requires a minimum of 241 linear feet of field line. This could be accomplished in several ways:

3 lines @ 81' long

4 lines @ 61' long

Or other variations

Practice Problems:

2. The septic system for a 4-bedroom home has a loading rate of 0.71. How many linear feet of field line are required?

4-bedroom home is 450 gpd

$$450 \text{ gpd} \div 0.71 = 634 \text{ sq. ft.}$$

$$634 \text{ sq. ft.} \div 2 = 317'$$

This 4-bedroom home requires a minimum of 317 linear feet of field line. This could be accomplished in several ways:

4 lines @ 80' long

5 lines @ 64' long

Or other variations

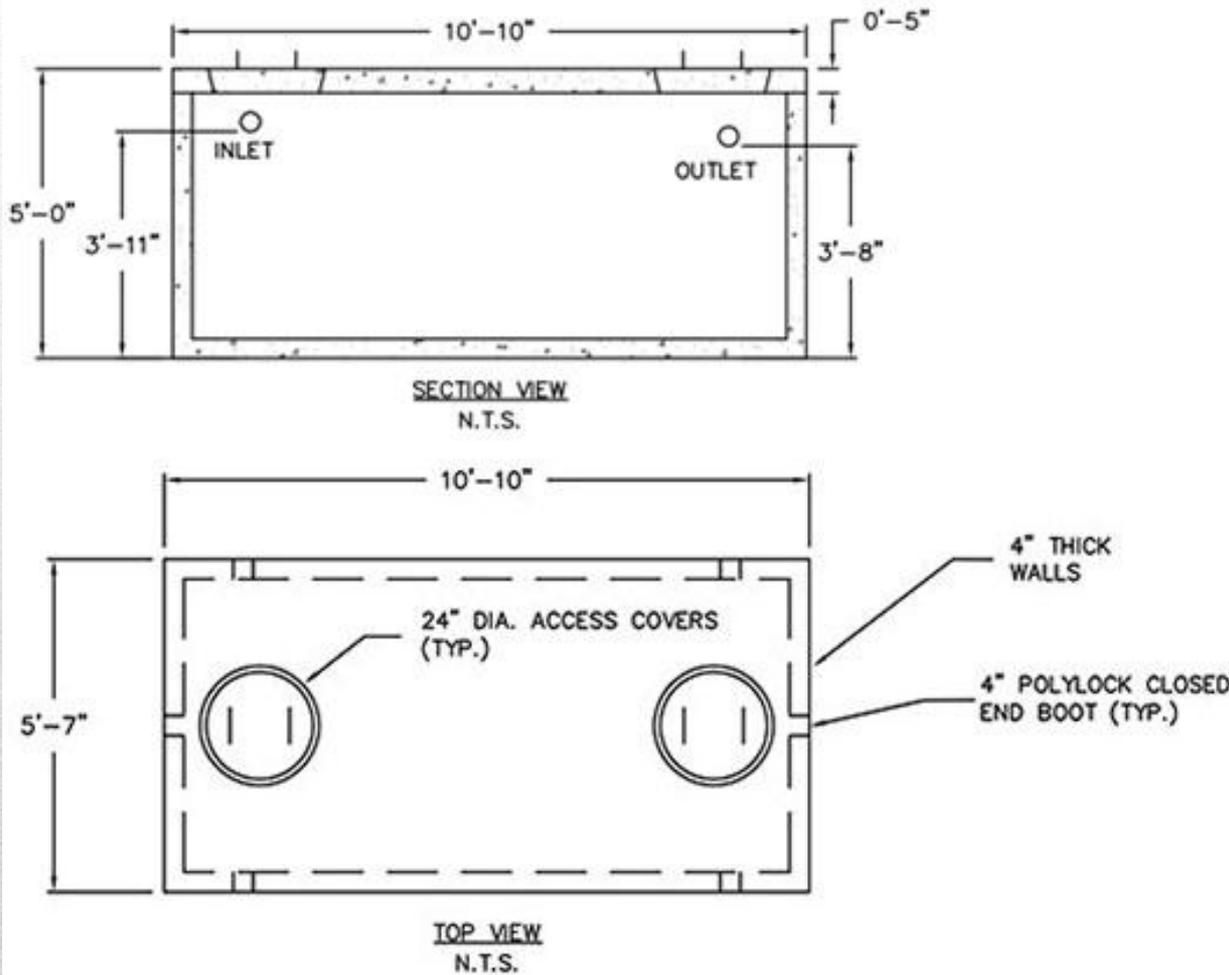
Tips for flagging out system

- Contour is critical!
 - Beginning, middle and end of each field line should be the same ground elevation
 - Start by flagging out field lines to make sure they will fit. House location can be anyway on your test “lot”.
 - Flag for test pit must be in the field line area
 - Suggestion: Layout out one or two lines up slope from “test pit” and one or two below.
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Part 2: Ground elevations & flowlines

PRIMARY SITE	Ground Elevation			Flowline Elevation		
	Begin	Mid	End	Begin	Mid	End
Stub Out						
Septic tank IN						
Septic tank OUT						
D-Box IN						
D-Box OUT						
	Begin	Mid	End	Begin	Mid	End
Ln 1						
Ln 2						
Ln 3						
Ln 4						
Second area		XXXXXXXX				
Second area		XXXXXXXX				
				Benchmark		
Cover over tank/ht. above grade (at outlet)						
Cover over D box/ht. above grade (at outlet)						

Reading tank diagrams



1. How much fall is across this septic tank?

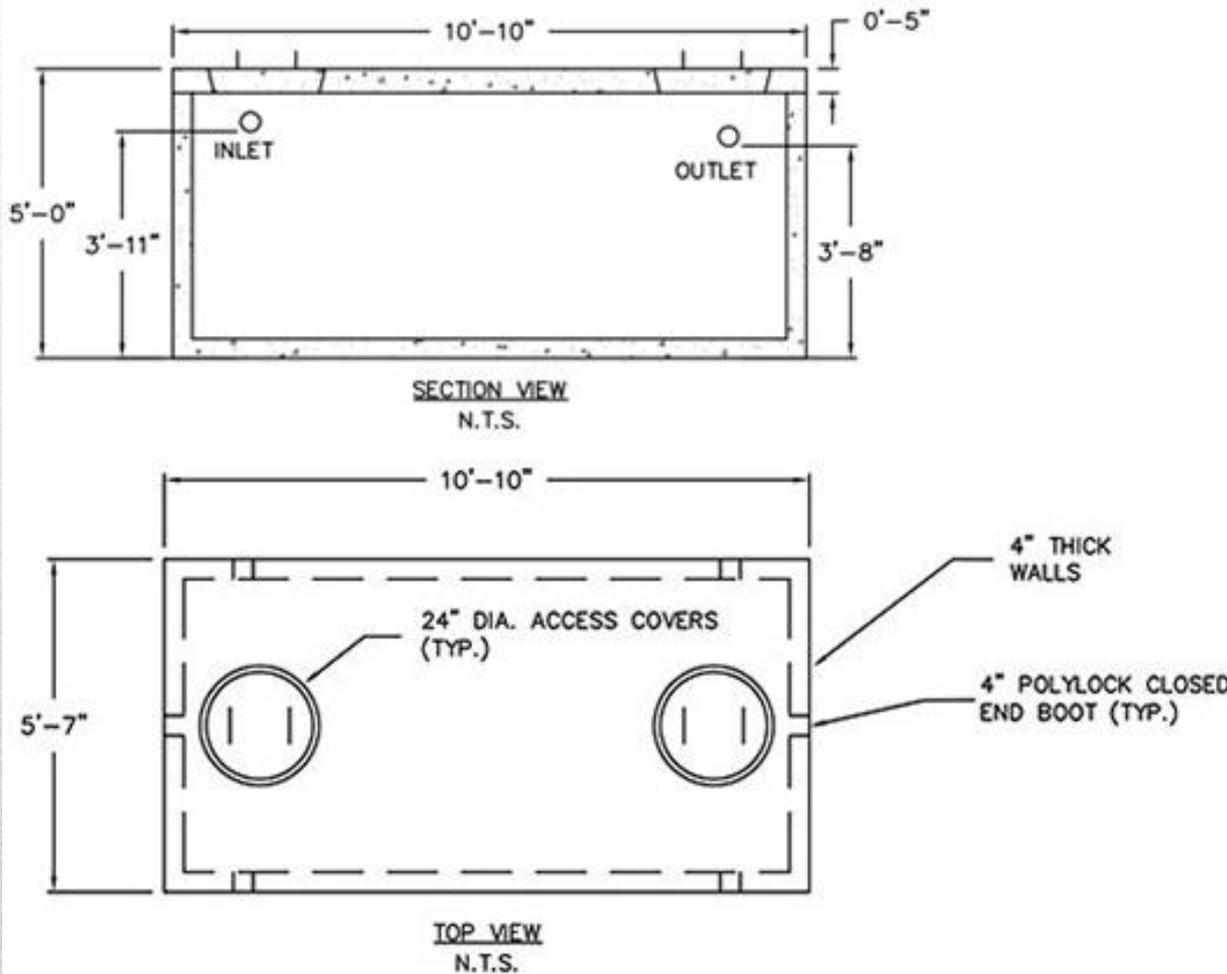
Looking for difference in inlet and outlet heights.

Inlet (to bottom): 3' 11"
Outlet (to bottom): 3' 8"

Difference of 3"

This tank has 3" of fall across the tank

Reading tank diagrams



2. How many inches is top of tank lid over the outlet.
NOTE: Flowline is bottom of pipe.

Entire tank: 5' 0" tall

To bottom of outlet: 3' 8"

$$5' 0'' - 3' 8'' =$$

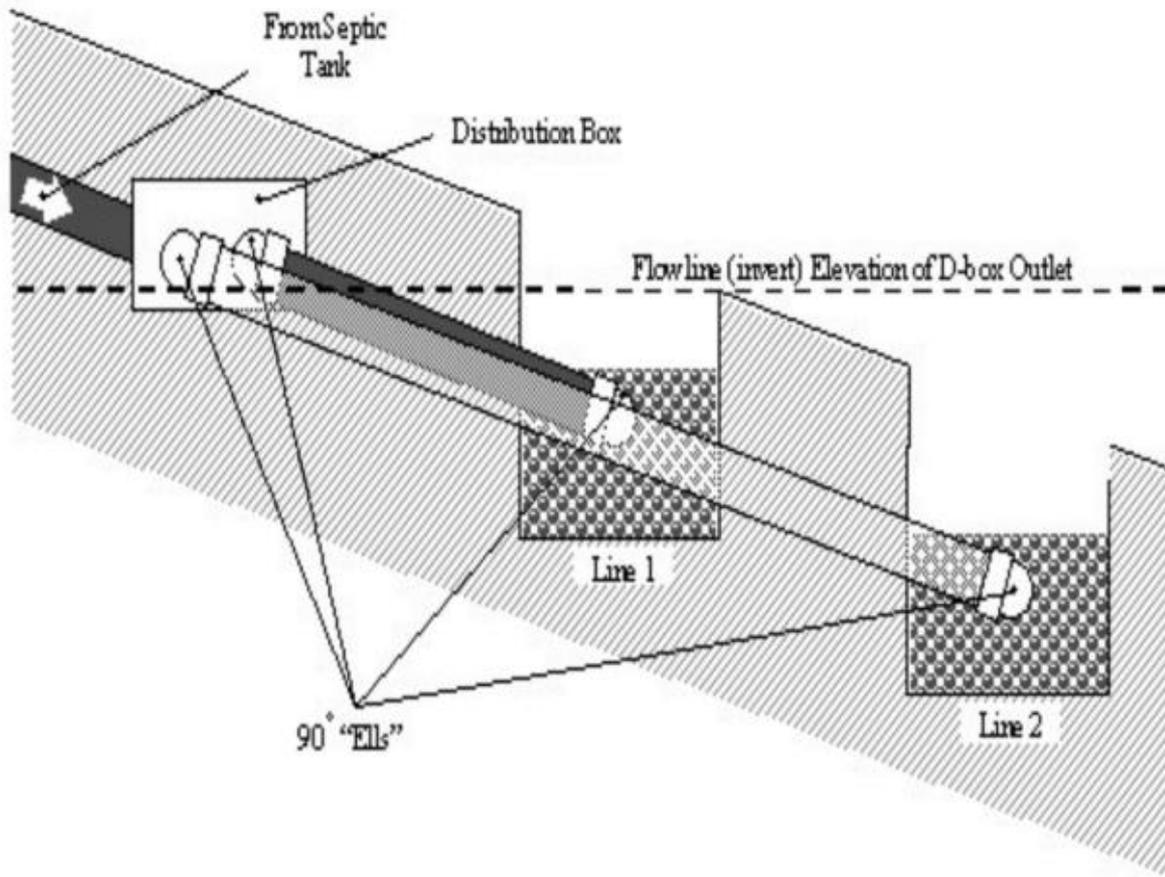
$$1' 4'' \text{ or } 16''$$

There is 16" from the outlet flowline (bottom of pipe) to top of tank lid

This helps to calculate burial depth of tank and cover depth (if tank lid is underground)

Sloping Ground:

Maximum Storage on Sloping Ground



6" or more of difference between ground elevation of first and last line

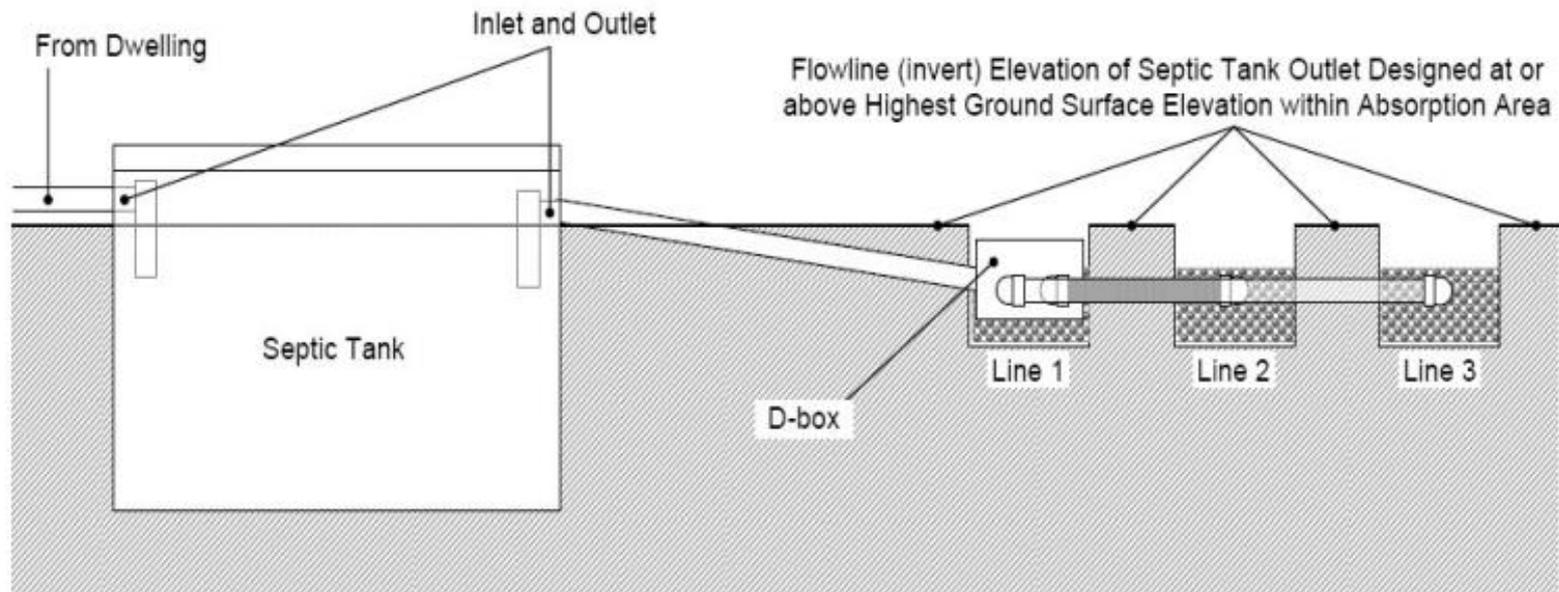
D-box outlet has to be at or above the ground elevation of highest line

Flat Ground:

< 6" of difference between ground elevation of first and last line

Septic tank outlet has to be higher than ground elevation at highest line

Maximum Storage on Level Ground



Example #1 (answers on next slide)

System specs:

18" trench depth

2" fall across d-box

Trench bottom = flow-line

4" fall across tank

	Ground Elevation	Flow Line Elevation
Benchmark	2' 3"	
Stub-Out	3' 1"	
Tank Inlet	3' 3"	
Tank Outlet	3' 3"	
D-Box	3' 4"	
Line 1	3' 4"	
Line 2	3' 4"	

Question: Is this flat or sloping ground?

FLAT

Example #1

System specs:

18" trench depth

2" fall across d-box

Trench bottom = flow-line

4" fall across tank

	Ground Elevation	Flow Line Elevation
Benchmark	2' 3"	XXXXXXXXXXXX
Stub-Out	3' 1"	2' 10" (assuming fall)
Tank Inlet	3' 3"	3' 0"
Tank Outlet	3' 3"	3' 4" (or higher)
D-Box	3' 4"	3' 10 (can vary)
Line 1	3' 4"	4' 10
Line 2	3' 4"	4' 10"

Example #2 (answers on next slide)

System specs:

18" trench depth

2" fall across d-box

Trench bottom = flow-line

4" fall across tank

	Ground Elevation	Flow Line Elevation
Stub-Out	2' 4"	
Tank Inlet	2' 9"	
Tank Outlet	2' 10"	
D- Box Inlet	3' 3"	
D-Box Outlet	3' 3"	
Line 1	3' 9"	
Line 2	4' 4"	

Question: Is this flat or sloping ground?

SLOPING

Example #2

System specs:

18" trench depth

2" fall across d-box

Trench bottom = flow-line

4" fall across tank

	Ground Elevation	Flow Line Elevation
Stub-Out	2' 4"	2' 11" (assuming fall)
Tank Inlet	2' 9"	3' 2"
Tank Outlet	2' 10"	3' 6" (can vary)
D- Box Inlet	3' 3"	3' 7"
D-Box Outlet	3' 3"	3' 9" (or higher)
Line 1	3' 9"	5' 5"
Line 2	4' 4"	6' 0"

Part 3: Drawing

SECTION 3

30 POINTS

60 MINUTES

Indicate the following items on a scale drawing using the following criteria:

1. Use a 1 inch = 20 feet or 1 inch = 30 feet scale. Indicate scale. **(2 pt.)**
2. House with dimensions. **(1 pt.)**
3. Location of all septic system components. **(2 pt.)**
4. Indicate North. **(1 pt.)**
5. Property lines with dimensions. **(1 pt.)**
6. Location of utility/service lines. **(1 pt.)**
7. Driveway and dimensions. **(1 pt.)**
8. Location and elevation of water well. **(2 pt.)**
9. All septic system setbacks. **(6 pt.)**
10. Contour lines or arrows indicating the direction and percent of slope in the primary and secondary absorption locations. **(2 pt.)**
11. Bench mark location. **(1 pt.)**
12. Volume of septic tank. **(1 pt.)**
13. Pipe specifications for all parts of the system. **(2 pt.)**
14. Correct size for primary and secondary areas in ft² of absorption lines. **(4 pt.)**
15. Absorption trench depth. **(1 pt.)**
16. Identify and locate each soil pit **(2 pt.)**

SYSTEM LAYOUT AND DRAWING

(100 points total)

NAME _____

LOT NO. _____

Using the loading rates provided, design a gravity flow, pipe & gravel wastewater system with a distribution box for a 1200 ft² one level house on a well. Use 370 GPD. Absorption trenches on 10' centers.

SECTION 1 20 POINTS 60 MINUTES

- a. Flag and label the bench mark. (1 pt.)
- b. Flag and label the stub-out. (1 pt.)
- c. Flag and label the inlet & outlet of the septic tank. (1 pt.)
- d. Flag and label the distribution box. (1 pt.)
- e. Layout primary absorption area on contour. (8 pt.)
- f. Flag and label the beginning, middle and end of each line in the primary area. (3 pt.)
- g. Layout the four corners of the alternate absorption area on contour. (4 pt.)
- h. Flag and label the 4 house corners. (1 pt.)

SECTION 2 50 POINTS 150 MINUTES

Use attached elevation/flowline form. Turn in this sheet before beginning Section 3.

SECTION 3 30 POINTS 60 MINUTES

Indicate the following items on a scale drawing using the following criteria:

1. Use a 1 inch = 20 feet or 1 inch = 30 feet scale. Indicate scale. (2 pt.)
2. House with dimensions. (1 pt.)
3. Location of all septic system components. (2 pt.)
4. Indicate North. (1 pt.)
5. Property lines with dimensions. (1 pt.)
6. Location of utility/service lines. (1 pt.)
7. Driveway and dimensions. (1 pt.)
8. Location and elevation of water well. (2 pt.)
9. All septic system setbacks. (6 pt.)
10. Contour lines or arrows indicating the direction and percent of slope in the primary and secondary absorption locations. (2 pt.)
11. Bench mark location. (1 pt.)
12. Volume of septic tank. (1 pt.)
13. Pipe specifications for all parts of the system. (2 pt.)
14. Correct size for primary and secondary areas in ft² of absorption lines. (4 pt.)
15. Absorption trench depth. (1 pt.)
16. Identify and locate each soil pit (2 pt.)