ASLA Technical Workshop: LARE Prep Section 4

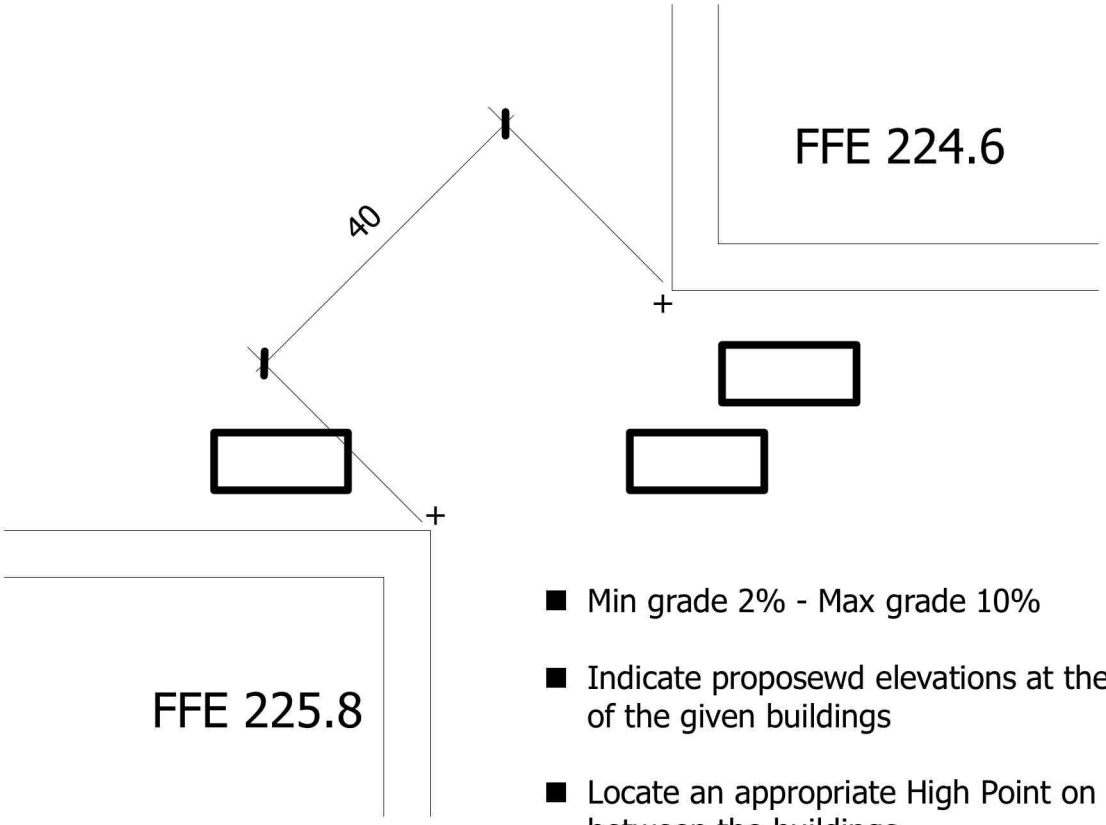
Post-Session Handouts

This packet includes:

- High Point on a Swale Problem and Solution
- Site Layout using Coordinates
- Pipe Underdrain Problem & Solution
- Roadway Grading Problem & Solution
- Roadway Site Distance
- Storm Sewer Calculations (2 examples)

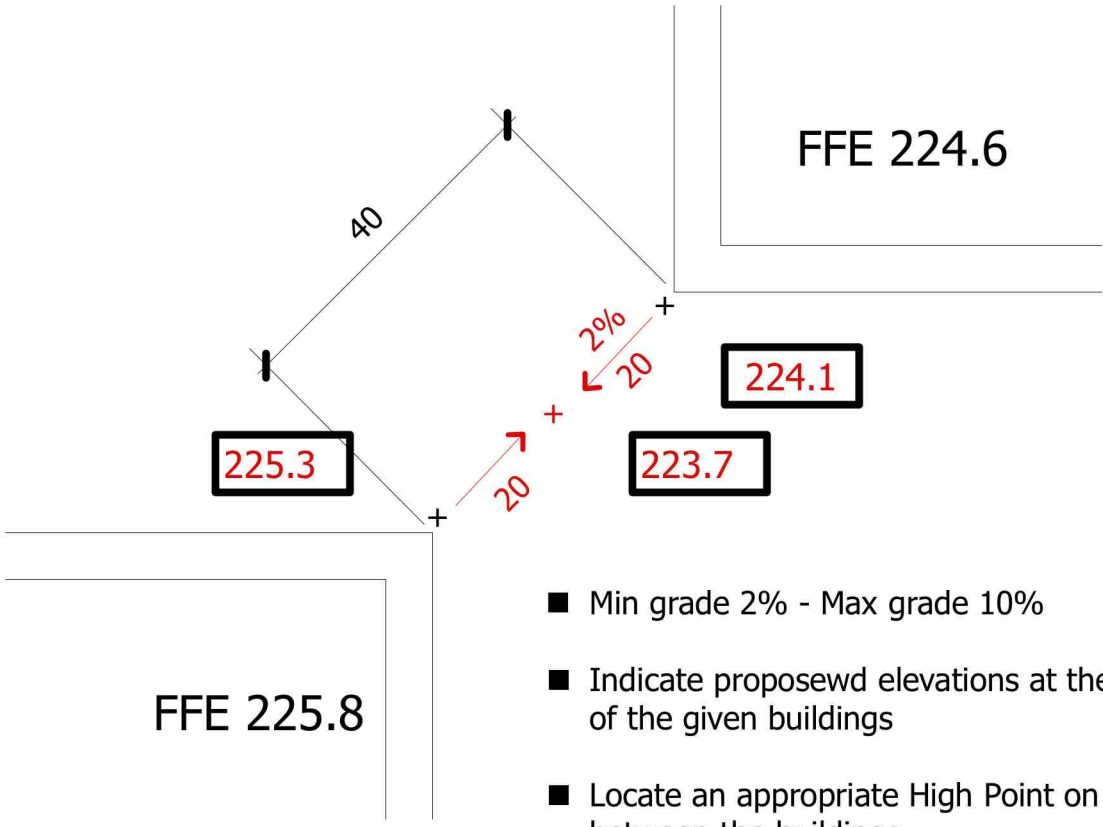
ASLA Annual Meeting
September 2012
Phoenix, Arizona

HPS - High Point on a Swale



- Min grade 2% - Max grade 10%
- Indicate proposewd elevations at the outside corner of the given buildings
- Locate an appropriate High Point on a Swale (HPS) between the buildings
- Provide an appropriate Spot Elevation for the HPS

HPS - High Point on a Swale

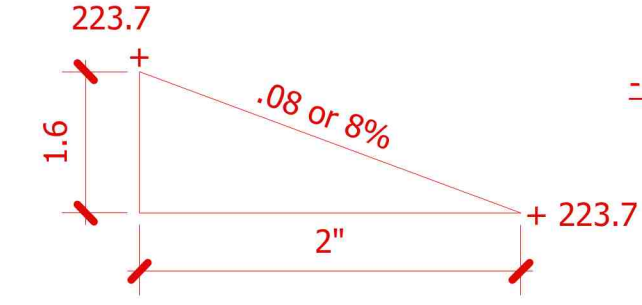


- Min grade 2% - Max grade 10%
- Indicate proposewd elevations at the outside corner of the given buildings
- Locate an appropriate High Point on a Swale (HPS) between the buildings
- Provide an appropriate Spot Elevation for the HPS

1. SEs on corners of buildings are generally placed .5 lower than the FFE

2. HPS is lower than the SEs so as to prevent water from flowing toward the building(s). - 2%@20 is a good response

3. By using 2% from the lower SE, the HPS is 223.7



225.3
- 223.7
1.6

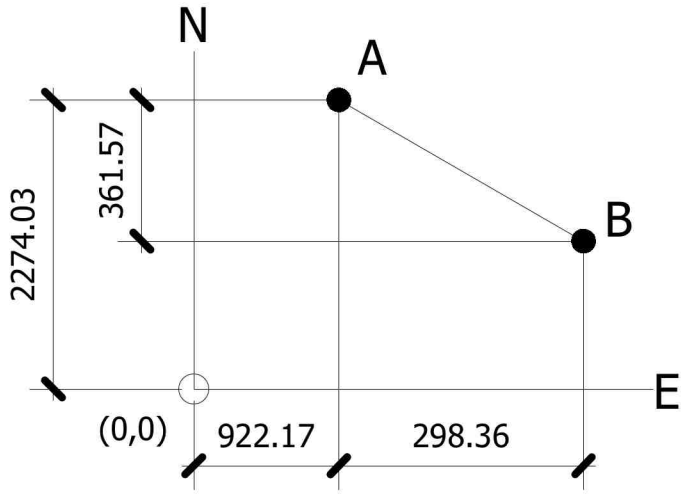
$G=D/L$ $G=1.6/20 = .08$ or 8%

Site layout using the coordinate system.

The Coordinates of point A are N2274.03 and E922.17

Point B is 361.57 S and 298.36 E of point B

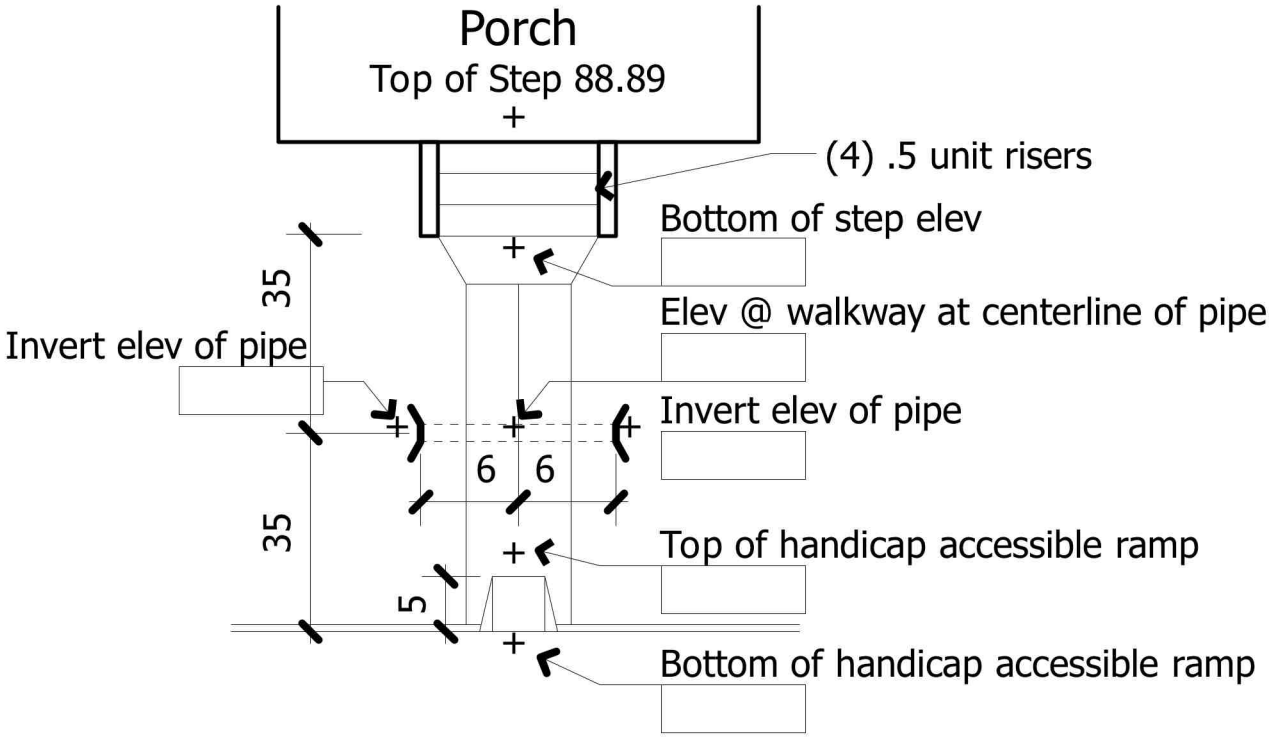
What are the coordinates of Point B



SOLUTION:

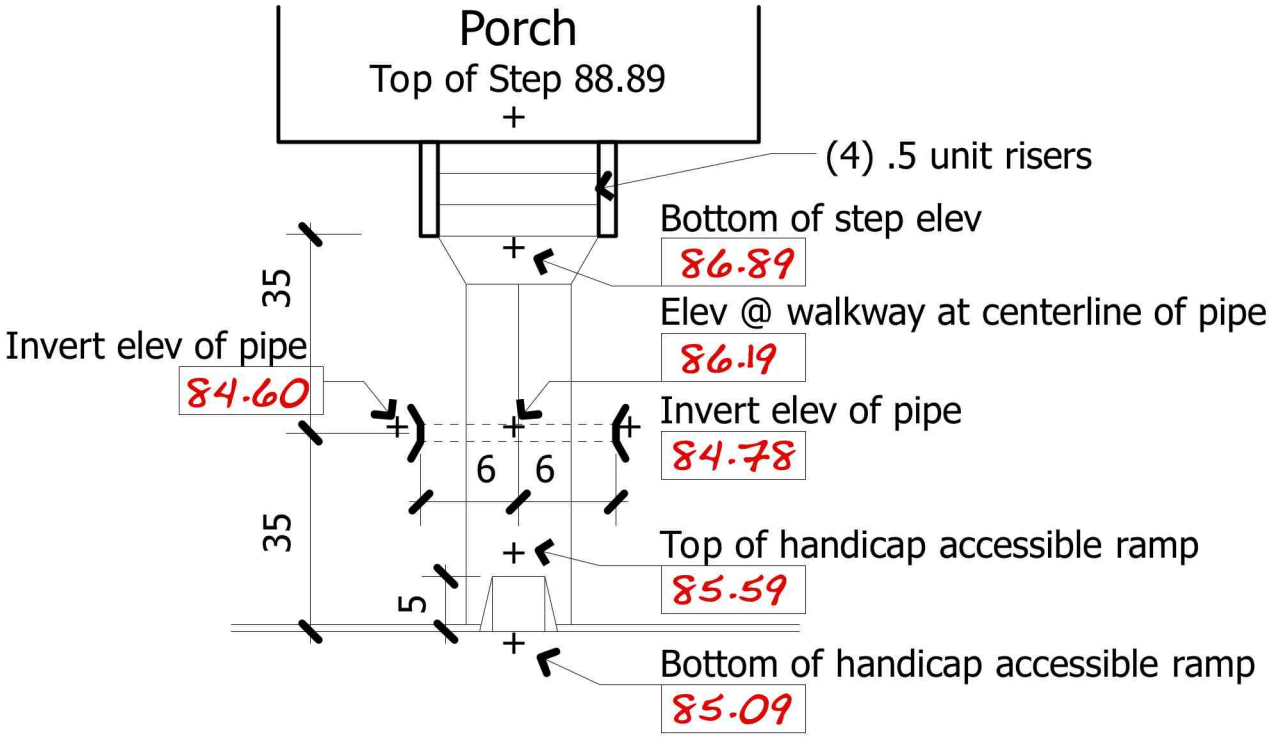
N 2274.03	E 922.17
- 361.57	+ 298.36
N 1912.46	E 1220.53

WALKWAY WITH PIPE UNDERDRAIN



Given: Concrete on walkway .5 units thick, slope 2%
.5 unit pipe to slope 1.5%
with a minimum of 12" cover over pipe, including walkway

WALKWAY WITH PIPE UNDERDRAIN



Given: Concrete on walkway .5 units thick, slope 2%
.5 unit pipe to slope 1.5%
with a minimum of 12" cover over pipe, including walkway

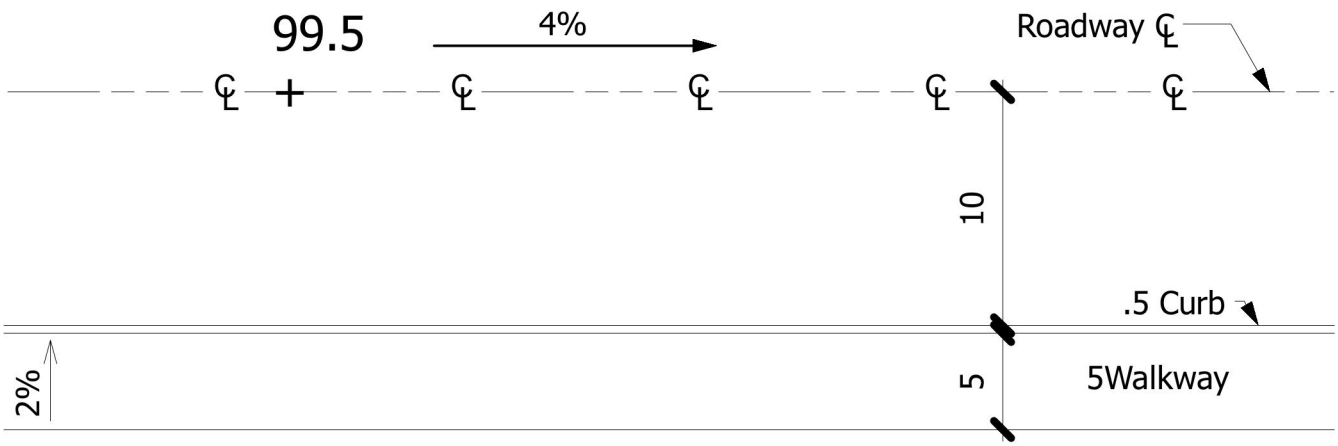
Solution

1. TOS 88.89 - 4 risers (2 units) = 86.89 BOS
2. 35 units to CL of pipe @ 2% = .70

   86.89 - .70 = 86.19
3. 86.19 - 1 unit cover - .5 dia pipe = 84.69

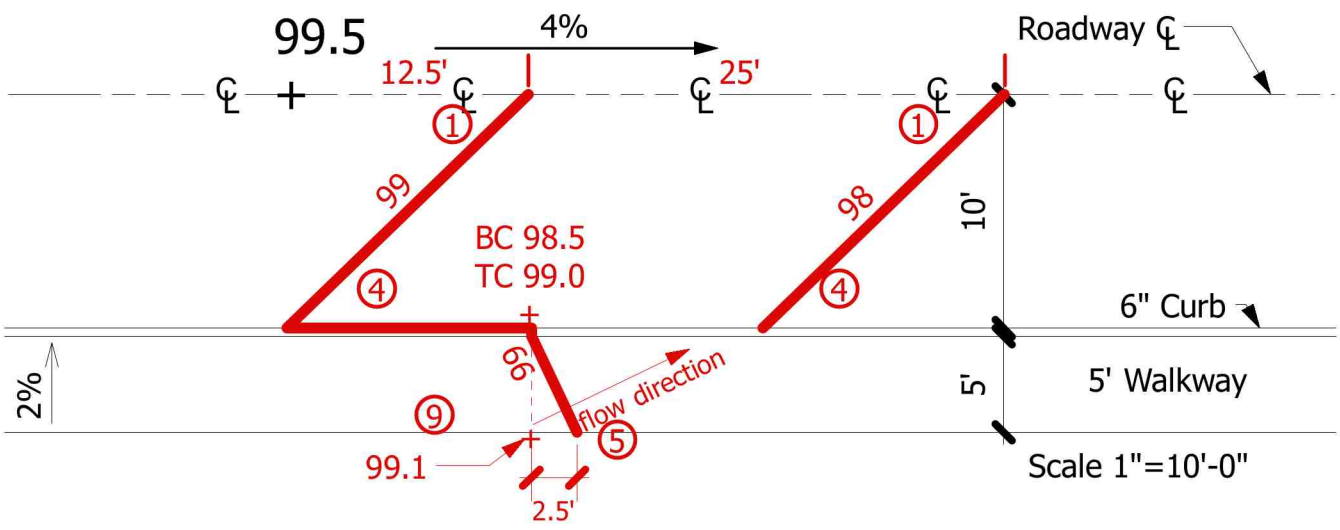
   1.5% for 6 units = .09 84.69 + .09 = 84.78
4. 1.5% for 12 units run of pipe = .18 84.78 - .18 = 84.60
5. 30units from elev at pipe @ 2% = .60 86.19 - .60 = 85.59
6. Bottom of HC ramp 85.59 - .50 = 85.09

ROADWAY DRAINAGE



1. From the given SE, locate the 99 and the 98 contour on the CL of the roadway._____
2. What is the distance from SE to the 99 contour _____
3. What is the distance between the 99 & 98 contour ____
4. Using the 99 & 98 contours, construct a 6" crown from the CL to the existing curb_____
5. Construct the 99 contour on the walkway_____
6. What is the BC elevation at the 99 walkway contour____
7. What is the SE on the offside of the walkway at the TC 99.0 SE _____
8. What is the distance from the offside SE to the proposed 99 contour _____
9. Draw in the flow direction (runoff) for the walkway_____

ROADWAY DRAINAGE

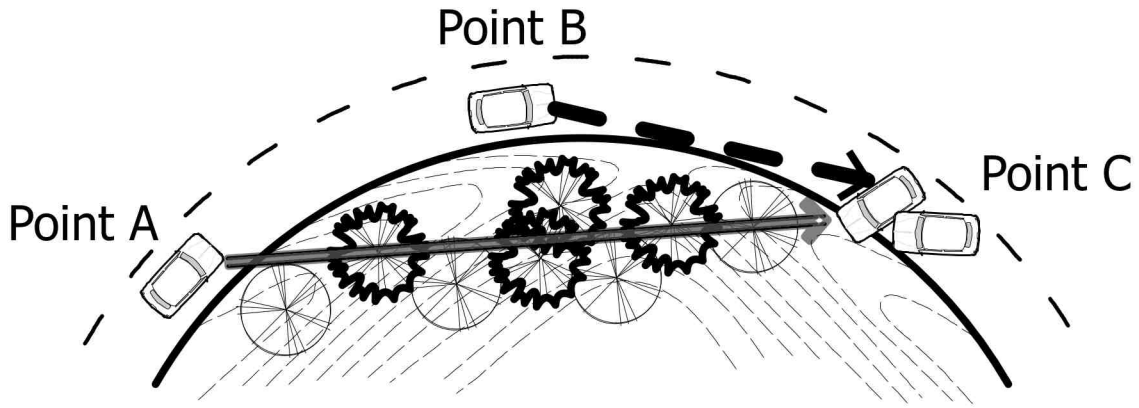


1. From the given SE, locate the 99 and the 98 contour on the CL of the roadway. Draw ①
2. What is the distance from SE to the 99 contour 12.5'
3. What is the distance between the 99 & 98 contour 25'
4. Using the 99 & 98 contours, construct a 6" crown from the CL to the existing curb Draw ④
5. Construct the 99 contour on the walkway Draw ⑤
6. What is the BC elevation at the 99 walkway contour 98.5
7. What is the SE on the offside of the walkway at the TC 99.0 SE 99.1
8. What is the distance from the offside SE to the proposed 99 contour 2.5'
9. Draw in the flow direction (runoff) for the walkway Draw ⑨

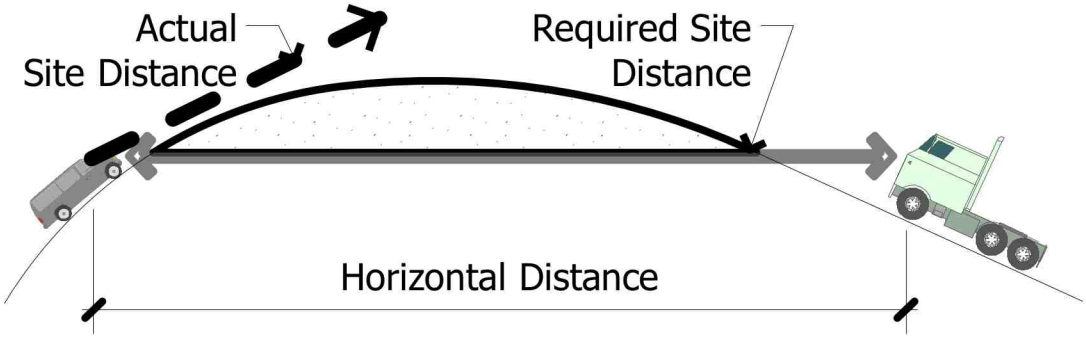
Formula to get walkway crosspitch

$$\frac{\text{slope of walk x width of walk}}{\text{roadway slope}} = \frac{.02 \times 5}{.04} = \frac{.1}{.04} = 2.5'$$

Roadway Site Distance in Curve
Daylighting a Curve

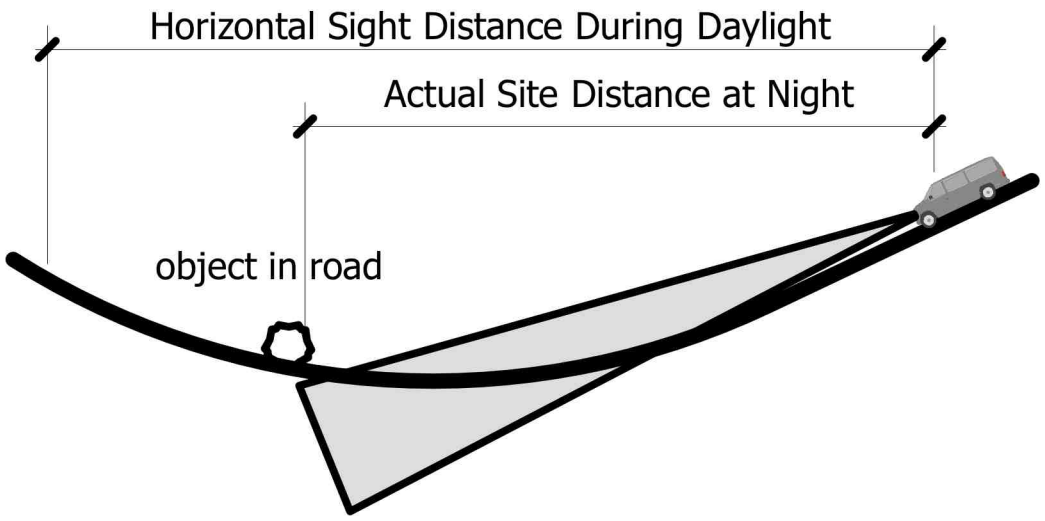


Car at Pt. A cannot see accident at Pt. C because of trees. At Pt. B there will not be enough time to stop. Indicate minimum site distance.

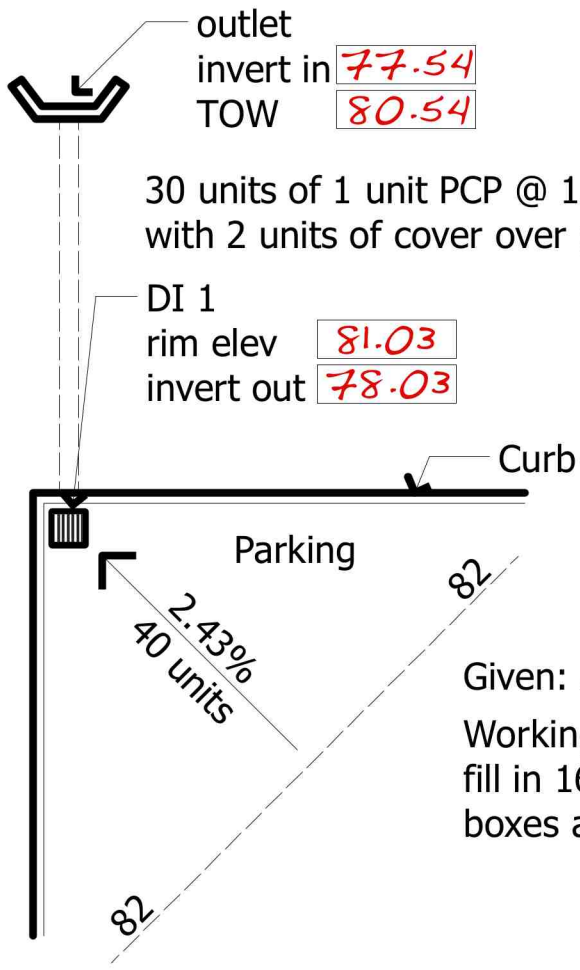


Design height of driver from ground must be able to see an object in the roadway at _____units.

Place appropriate SE at apex of horizontal curve to assure roadway safety.



STORM SEWER ELEVATION CALCULATIONS



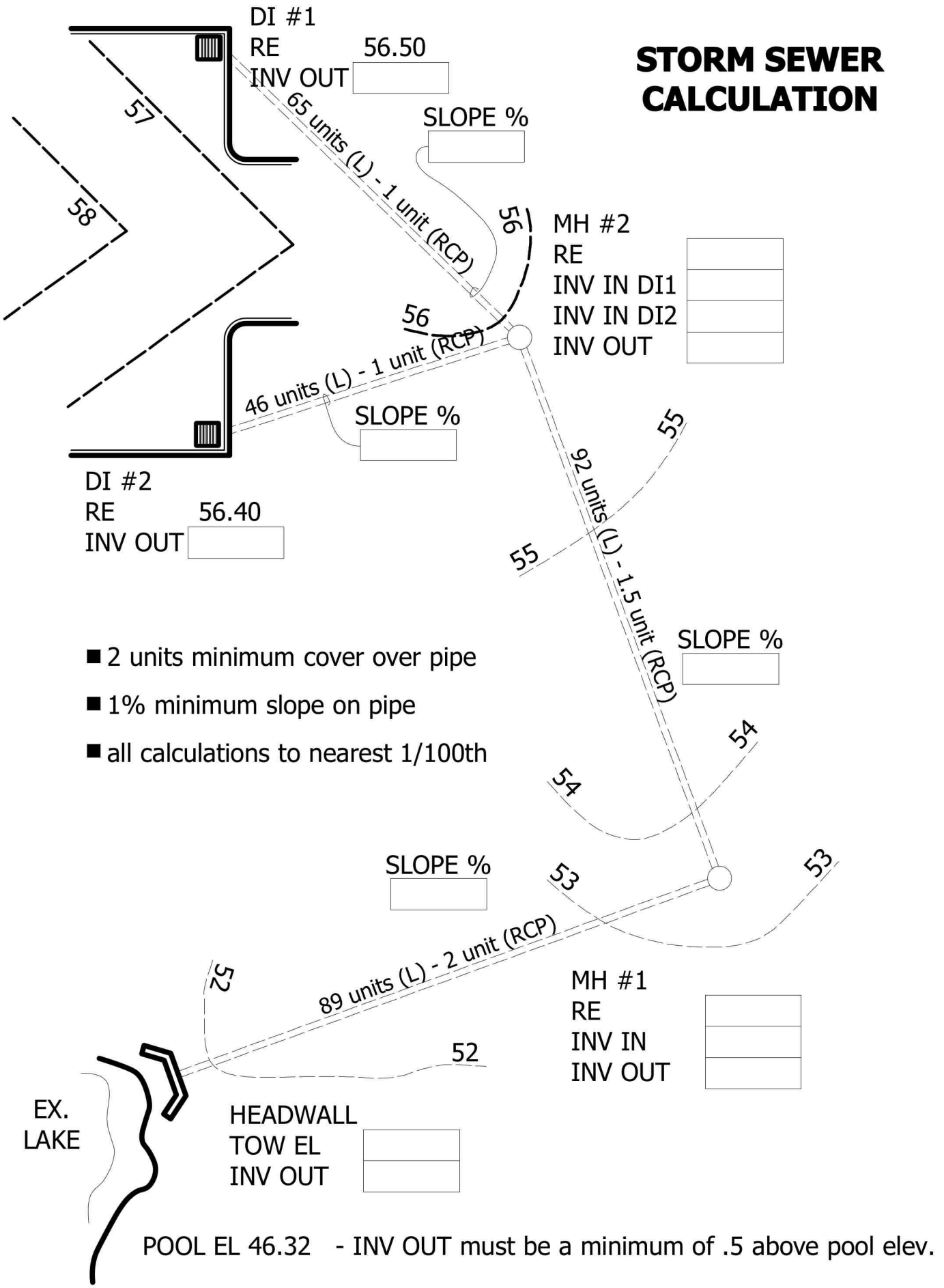
Given: A parking lot drainage situation.

Working from the existing 82 contour, fill in 16 appropriate elevations in the boxes above - to the nearest 1/100th.

Approach

1. 2.43% slope of 40 units from 82 contour = .97 DE
   82.00-.97= 81.03 RE @ DI
2. 81.03-1 unit pipe + 2 units cover = 78.03 inv. out @DI1
3. 1.63% slope with 30 unit pipe run = DE .49
4. 78.03 - .49 = 77.54 invert in @ oulte
5. TOW EL invert in 77.54 + 1 unit pipe + 2 units cover = 80.54 TOW @ outlet

STORM SEWER CALCULATION



- 2 units minimum cover over pipe
- 1% minimum slope on pipe
- all calculations to nearest 1/100th

POOL EL 46.32 - INV OUT must be a minimum of .5 above pool elev.

Storm Sewer Problem Resolution

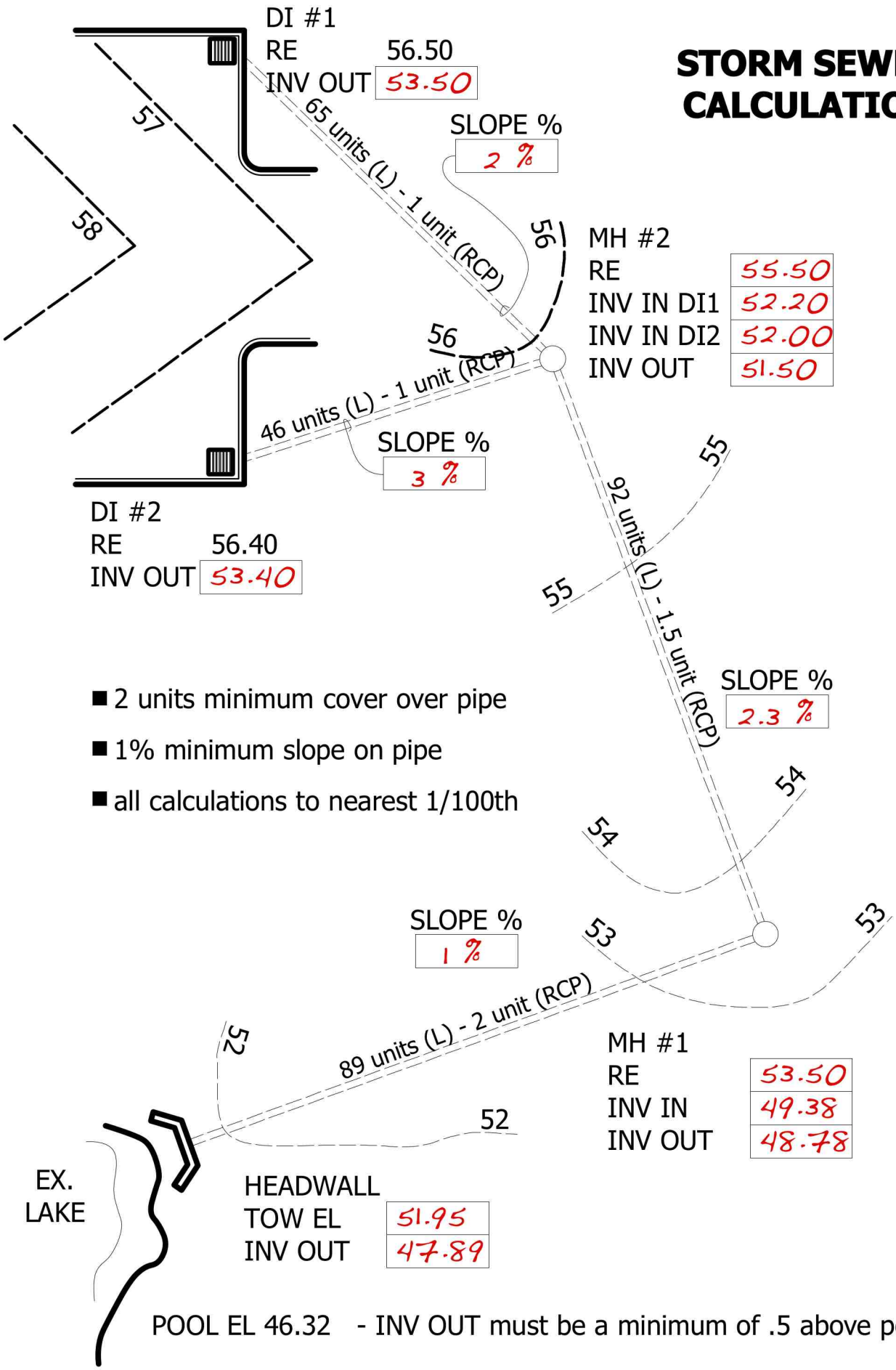
Terms

MH - Man Hole
DI - Drain Inlet
CB - Catch Basin
TOW - Top of Wall Elevation
RCP - Reinforced Concrete Pipe
DE - Difference in Elevation
RE - Rim Elevation
InvIn - Invert Elevation In - entering the drainage system
InvOut- Invert Elevation Out - exiting the drainage system

Resolution Steps

1. Begin @ DI1 - given RE = 56.50 which requires a minimum cover of 2' over 12" pipe
2. InvOut must be a least 53.50 (12" pipe plus 2' cover)
3. Slope over 65' of 12" RCP from DI 1 must be a minimum of 1%
    - Note: existing 56 contour near MH3 therefore RE @ MH 3 should be 55.50 +/-
    - 2% slope on 12" pipe gives a DE of1.30' and an InvIn from DI 1 of 52.20. This is 3.30" lower than the RE of 55.50 - so it is OK
4. InvOut @ DI 2 must be at least 53.40 - meets the 12" pipe plus required 2' cover
5. Slope on 46' of 12" RCP from DI 2 to MH 3 must be a minimum of 1%
    - Set the InvIn from DI 2 @ MH 3 .2 lower than the one from DI 1 - this gives an InvIn of 52.00 for DI 2
    - The DE from DI 2 and MH 3 (53.40 - 52.00) is 1.4' Then 1.4/46' = 3%
6. InvOut @ MH3
    - Take lowest InvIn - 52.00 .5 to get DE between the 2 pipes
    - Note: When there are like pipe sizes entering and exiting the same MH or DI the elevation of the InvOut will be .1 or .2 lower than the InvIn
    - Note: When there are unlike pipe sizes entering and exiting the same MH or DI the elevation of the InvOut will be the DE between the two pipes., e.g. 18" pipe entering with a 24" pipe exiting gives a DE of .5
    - Inv Out @ MH 3 = 51.50
7. Pipe from MH 3 to MH 2 92' of 18" RCP @ min 1%
    - Note: Existing contours 54 & 53 so RE @ MH 3 should be between them - e.g., 53.5
    - Considering the 18" pipe and 2" cover the InvIn must be at least 50.00 or lower
    - 92' - 18" RCP @ 2.3% = 2.12 51.50 - 2.12 = 49.30 - so this works
    - InvOut @ MH 2 is to be .5 lower than 49.38 (difference in pipe sizes) = 48.78
8. Pipe from MH 2 to Headwall @ Lake
    - Note: Existing contour is 52 so TOW should approximate the contour
    - Slope 24" RCP at 1% 1% of 89' = .89 48.78 - .89 = 47.89 InvOut
    - 51.95 - 47.89 = 4.06 This gives you 2' cover @ Headwall
    - Invert enters lake above the 46.32 pool

STORM SEWER CALCULATION



- 2 units minimum cover over pipe
- 1% minimum slope on pipe
- all calculations to nearest 1/100th

POOL EL 46.32 - INV OUT must be a minimum of .5 above pool elev.