LIDAR Data for Furrow Irrigation System Design in the Phaucet Program

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What is Phaucet…

- Uses Field and Technical Data to help design and evaluate irrigation systems
- Requires in input of several variables including well flow rate, crown elevations, row lengths, and poly pipe dimensions
- Leads to more efficient irrigation by suggesting to irrigators what size holes to punch in their poly pipe

The Need for New Tools

Data collection is the main hurdle to overcome with the program

Flow Rates and Side Slope Determinations are the most difficult to obtain

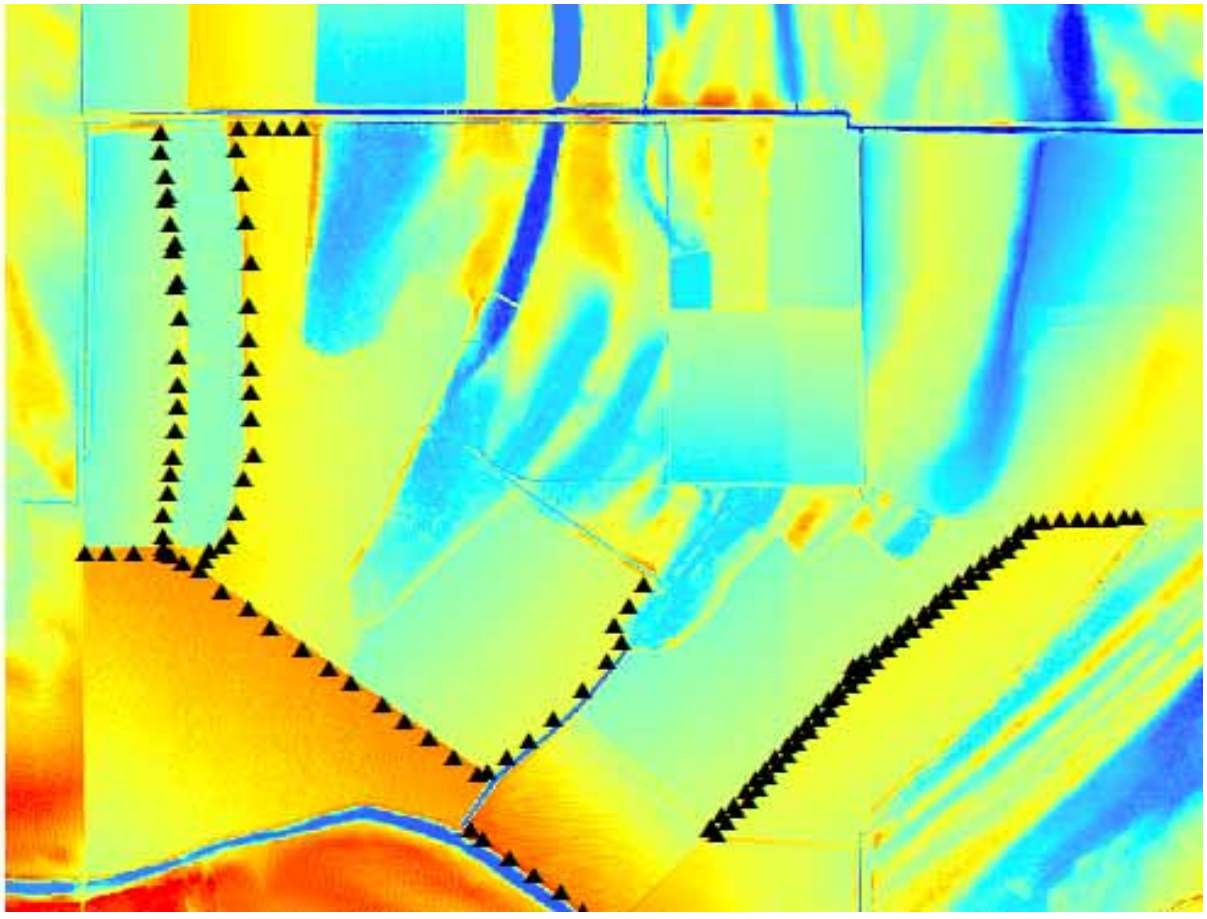
LIDAR used in place of data gathered with survey equipment

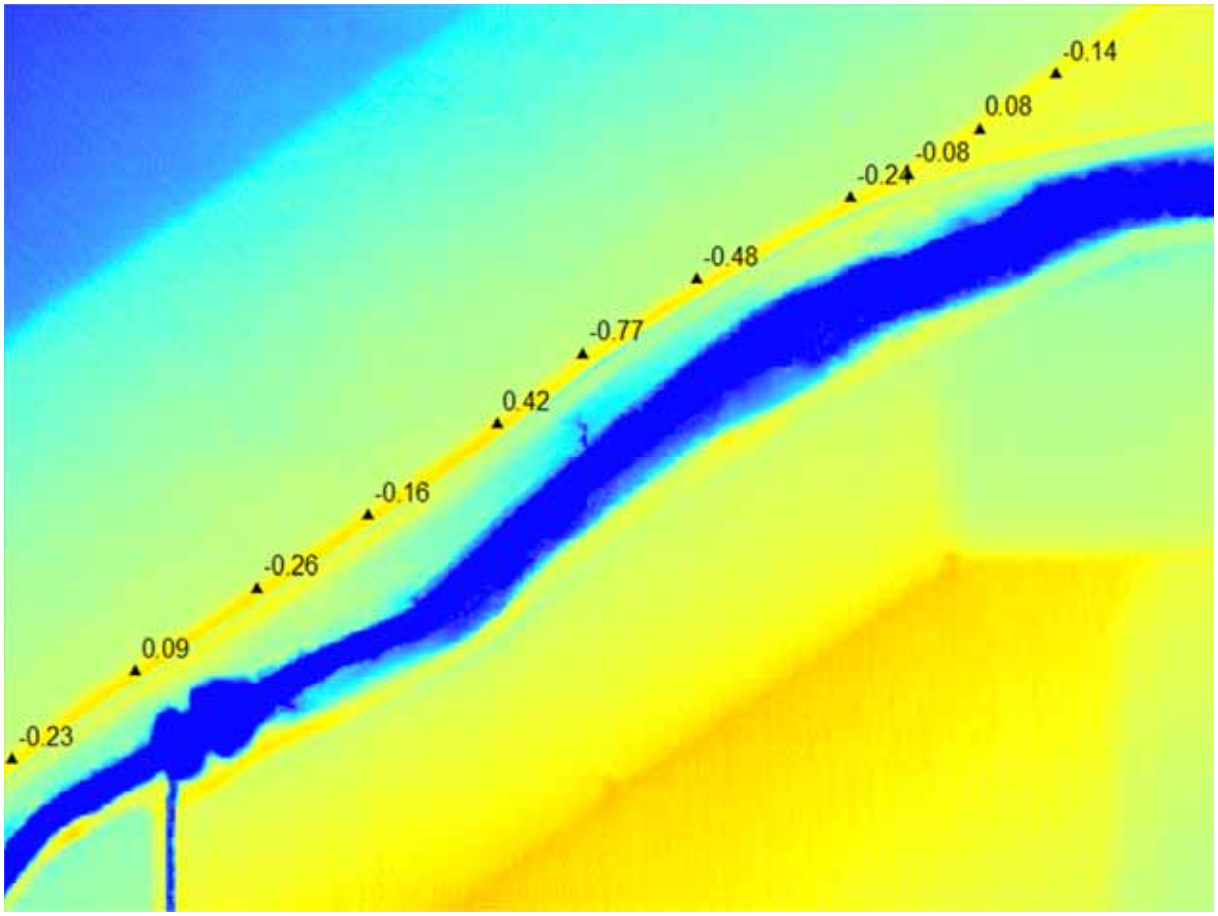
Data

5 Sites previously designed and implemented using on the ground survey data

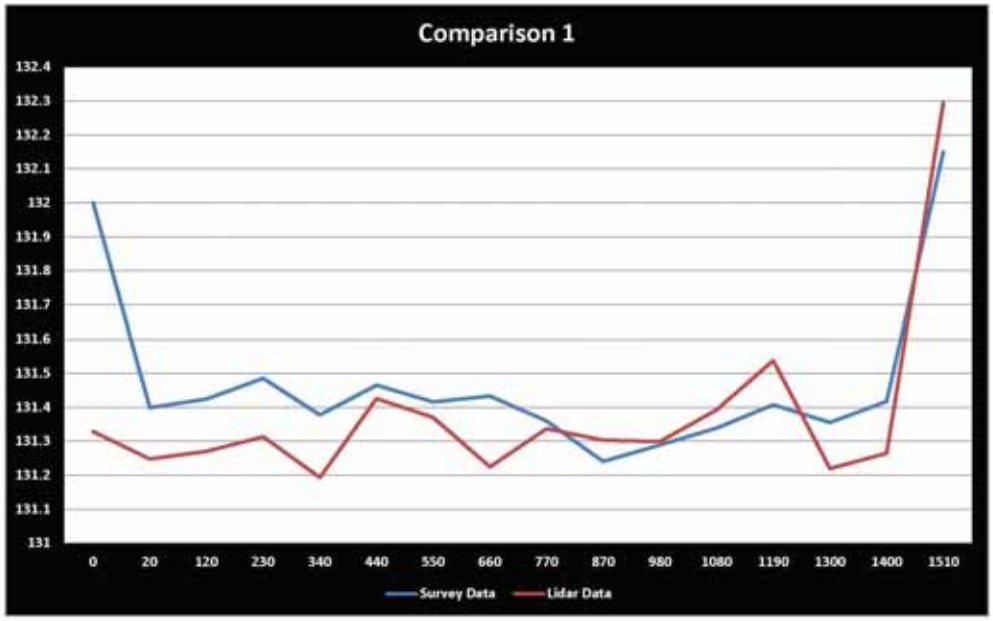
Original equipment was TOPCON survey grade GPS system accurate to +/- .1'

Elevation data for each point was obtained from LIDAR and entered into Phaucet in place of the survey data





DESIGN COMPARISONS



Comparison 1: Design Breakdown

Survey Data Design	
No. of holes	Size
2	7/8
27	13/16
76	3/4
1	11/16
1	5/8
1	9/16
78	1/2
17	7/16
15	3/8
14	5/16
7	1/4

Survey Based Design

Distribution Uniformity = 94.2

Maximum Head =1.74

Minimum Head = .6

Maximum Head Station = 25

Average Furrow Flow = 5.8 gpm

LIDAR Data Design	
No. of Holes	Size
29	13/16
40	11/16
5	3/4
31	11/16
1	5/8
1	9/16
79	1/2
14	7/16
15	3/8
16	5/16
8	1/4

LIDAR Based Design

Distribution Uniformity = 91.9

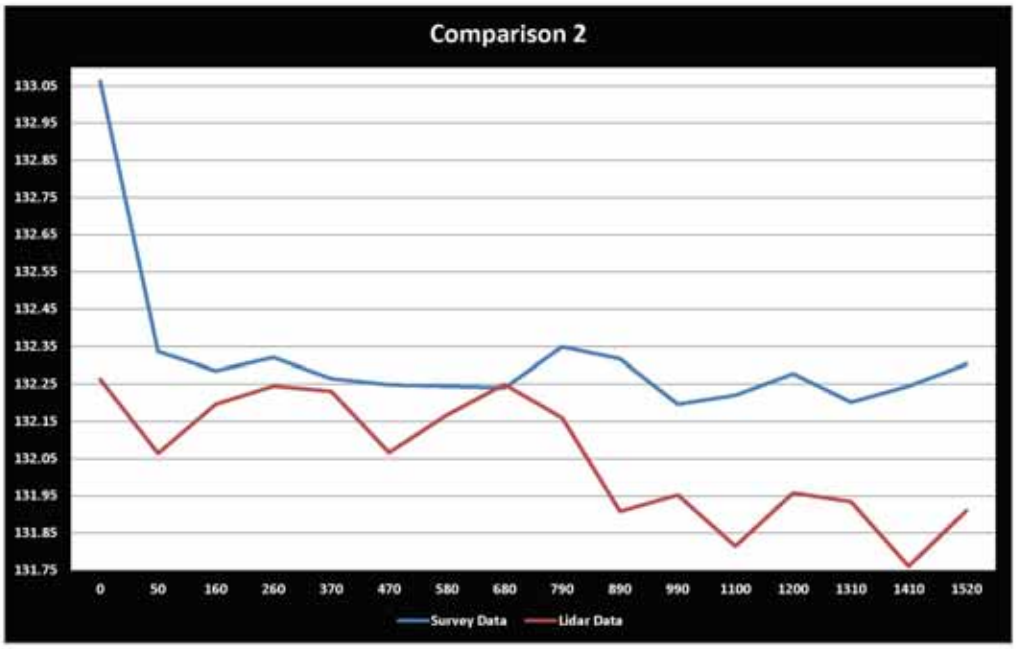
Maximum Head = 2.05

Minimum Head = .62

Maximum Head Station = 19

Average Furrow Flow = 5.8 gpm

Design evaluation: Both designs call for similar hole sizes down the length of the pipe. Both keep head pressures within acceptable levels. Distribution uniformity for both designs is acceptable. Both are valid designs.



Comparison 2: Design Breakdown

Survey Data Design	
No. of Holes	**Size**
5	5/8
51	9/16
106	5/8
9	9/16
15	1/2
13	7/16
12	3/8
9	5/16
8	1/4
3	3/16

Survey Based Design

Distribution Uniformity = 90.6

Maximum Head =2.43

Minimum Head = 1.77

Maximum Head Station = 51

Average Furrow Flow = 5.7 gpm

5/8 Total = 111
9/16 Total = 70

LIDAR Data Design	
No. of Holes	**Size**
19	9/16
145	5/8
17	9/16
16	1/2
13	7/16
11	3/8
9	5/16
8	1/4
3	3/16

LIDAR Based Design

Distribution Uniformity = 92.9

Maximum Head = 2.35

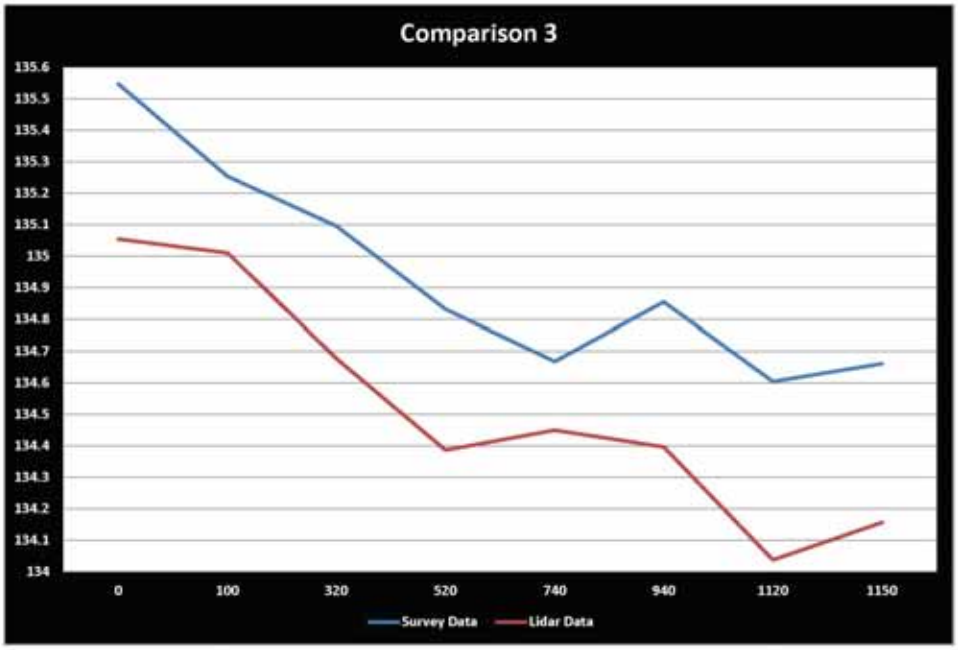
Minimum Head = 1.68

Maximum Head Station = 51

Average Furrow Flow = 5.7 gpm

5/8 Total = 145
9/16 Total = 36

Design evaluation: Designs are similar and valid. Slight variations in elevations led to a slightly different arrangement of hole sizes. Note both designs recognize station 51 as the Maximum Head Station.



Comparison 3: Design Breakdown

Survey Data Design	
No. Of Holes	Size
64	11/16
118	5/8

Survey Based Design

Distribution Uniformity = 93.7

Maximum Head = 2.19

Minimum Head = 1.76

Maximum Head Station = 1120

Average Furrow Flow = 7.6 gpm

11/16 Total = 64
5/8 Total = 118

LIDAR Data Design	
No. of Holes	Size
77	11/16
23	5/8
35	11/16
47	5/8

LIDAR Based Design

Distribution Uniformity = 90.6

Maximum Head = 2.17

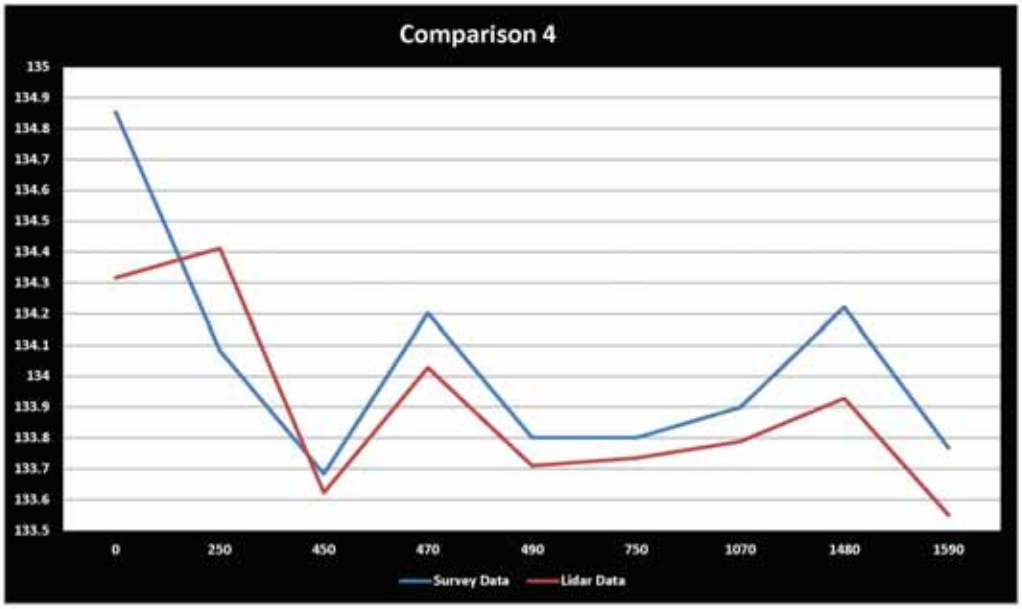
Minimum Head = 1.61

Maximum Head Station = 1120

Average Furrow Flow = 7.6 gpm

Total 11/16 = 112
Total 5/8 = 70

Design evaluation: Designs are similar and valid. Slight variations in elevations led to a slightly different arrangement of hole sizes. Note both designs recognize station 1120 as the Maximum Head Station.



Comparison 4: Design Breakdown

Survey Data Design	
No. of Holes	Size
115	1/2
137	9/16

Survey Based Design

Distribution Uniformity = 92.1

Maximum Head = 1.90

Minimum Head = 1.07

Maximum Head Station = 449

Average Furrow Flow = 4.4 gpm

1/2 Total = 115
9/16 Total = 137

LIDAR Data Design	
No. of Holes	Size
104	1/2
148	9/16

LIDAR Based Design

Distribution Uniformity = 94.1

Maximum Head = 1.82

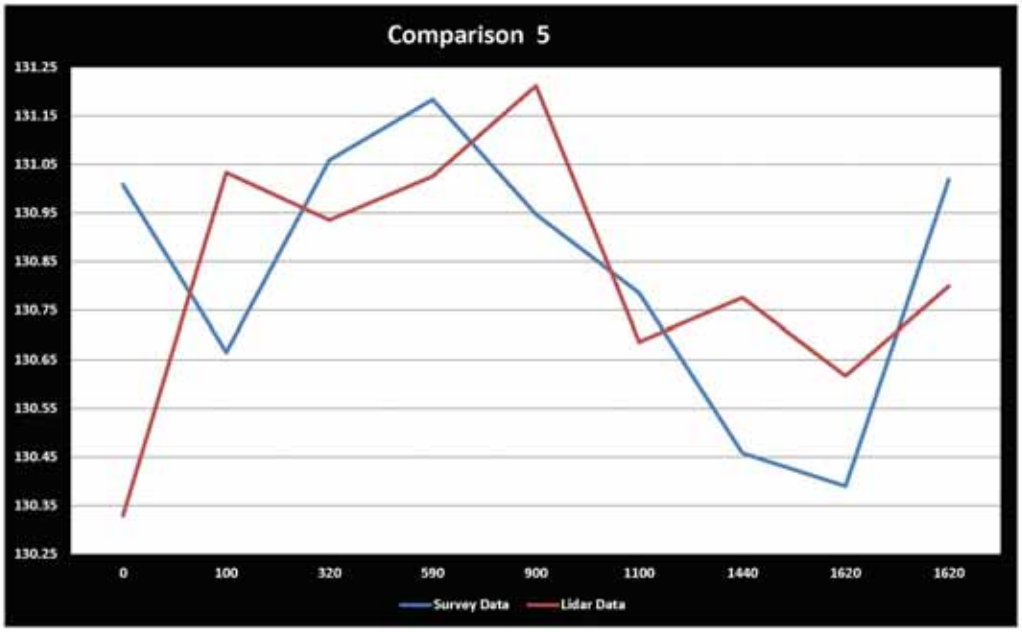
Minimum Head = 1.17

Maximum Head Station = 449

Average Furrow Flow = 4.4 gpm

½ Total = 104
9/16 Total = 148

Design evaluation: Nearly identical designs.



Comparison 5: Design Breakdown

Survey Data Design	
No. of Holes	Size
32	5/8
41	11/16
155	3/4
29	11/16
6	3/4
1	13/16

Survey Based Design

Distribution Uniformity = 94.5

Maximum Head = 2.57

Minimum Head = .90

Maximum Head Station = 95

Average Furrow Flow = 7.8 gpm

Total 5/8 = 32
Total 11/16= 70
Total 3/4= 161

LIDAR Data Design	
No. of Holes	Size
14	5/8
56	11/16
44	3/4
49	13/16
61	3/4
6	13/16
33	3/4
1	13/16

LIDAR Based Design

Distribution Uniformity = 93.9

Maximum Head = 3.06

Minimum Head = .73

Maximum Head Station = 0

Average Furrow Flow = 7.8 gpm

Total 5/8 = 14
Total 11/16 = 56
Total 3/4 = 138
total 13/16= 56

Design Evaluations: Similar designs. LIDAR based design shows as higher risk of pipe rupture; its highest head pressure is just over the highest acceptable level of 3.0.

Conclusions

- LIDAR derived data is adequate for Phaucet design
- Potential time savings by using elevations generated from LIDAR Data are great
- There is a need to create a user friendly web based elevation tool for irrigators to access

Questions?