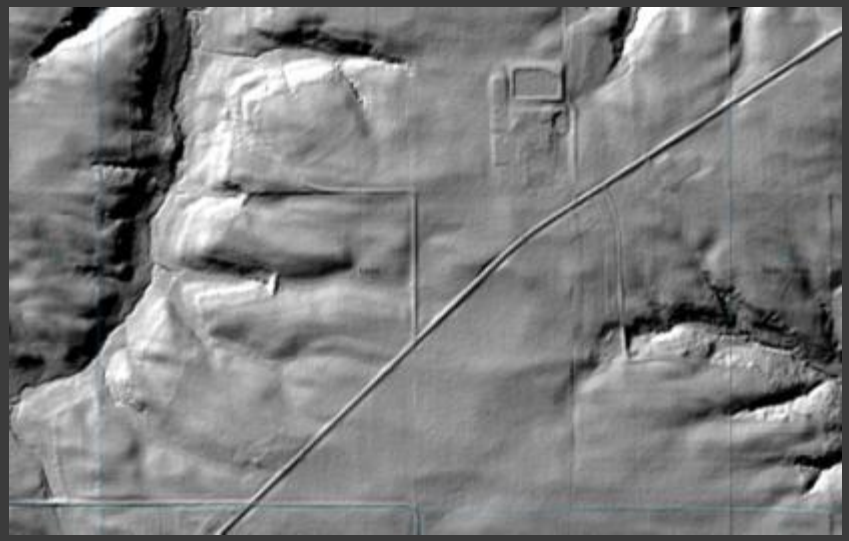
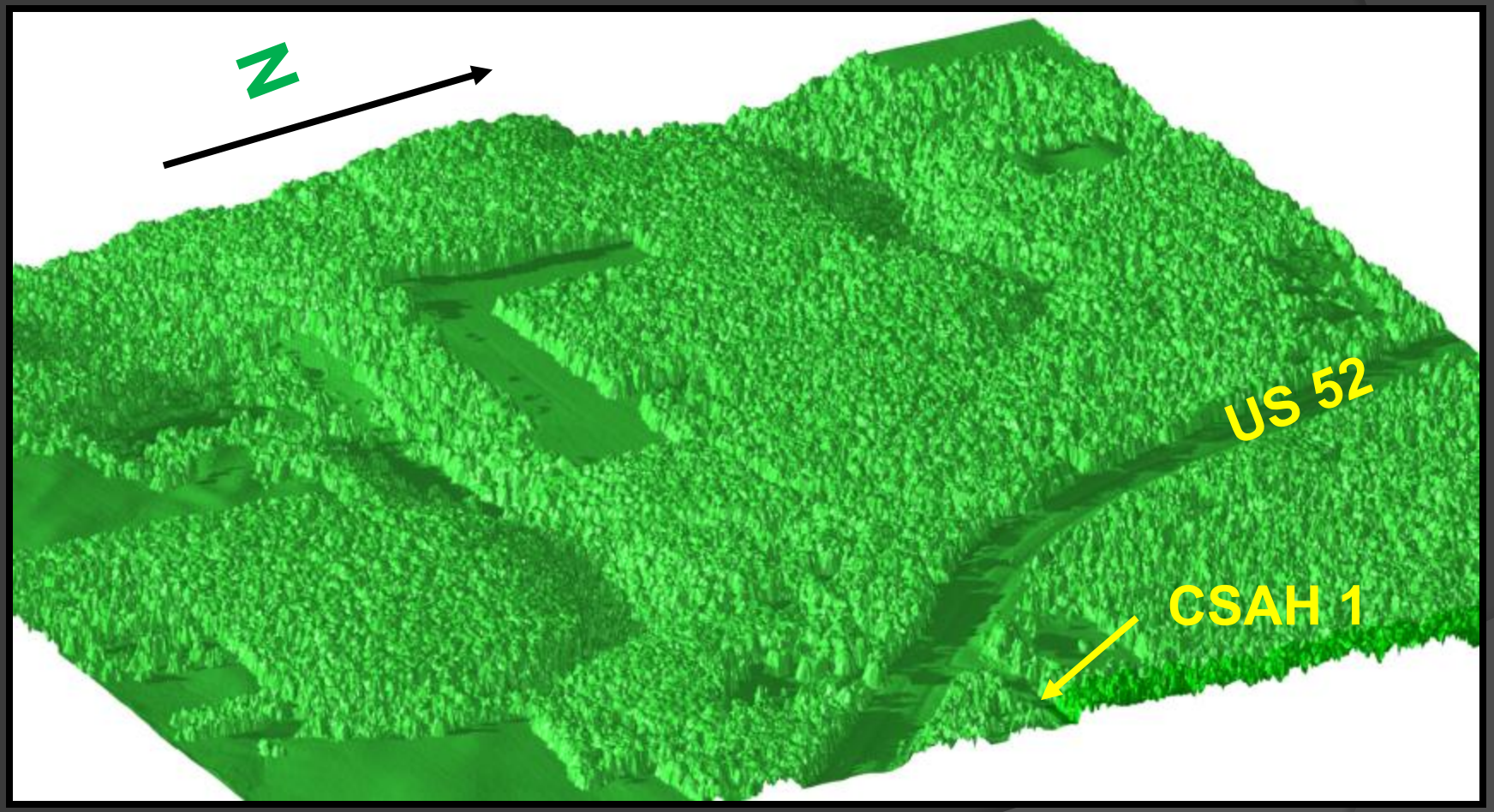
SE MN GIS User Group
August 23th 2012

How Goodhue SWCD is using GIS and LiDAR Data

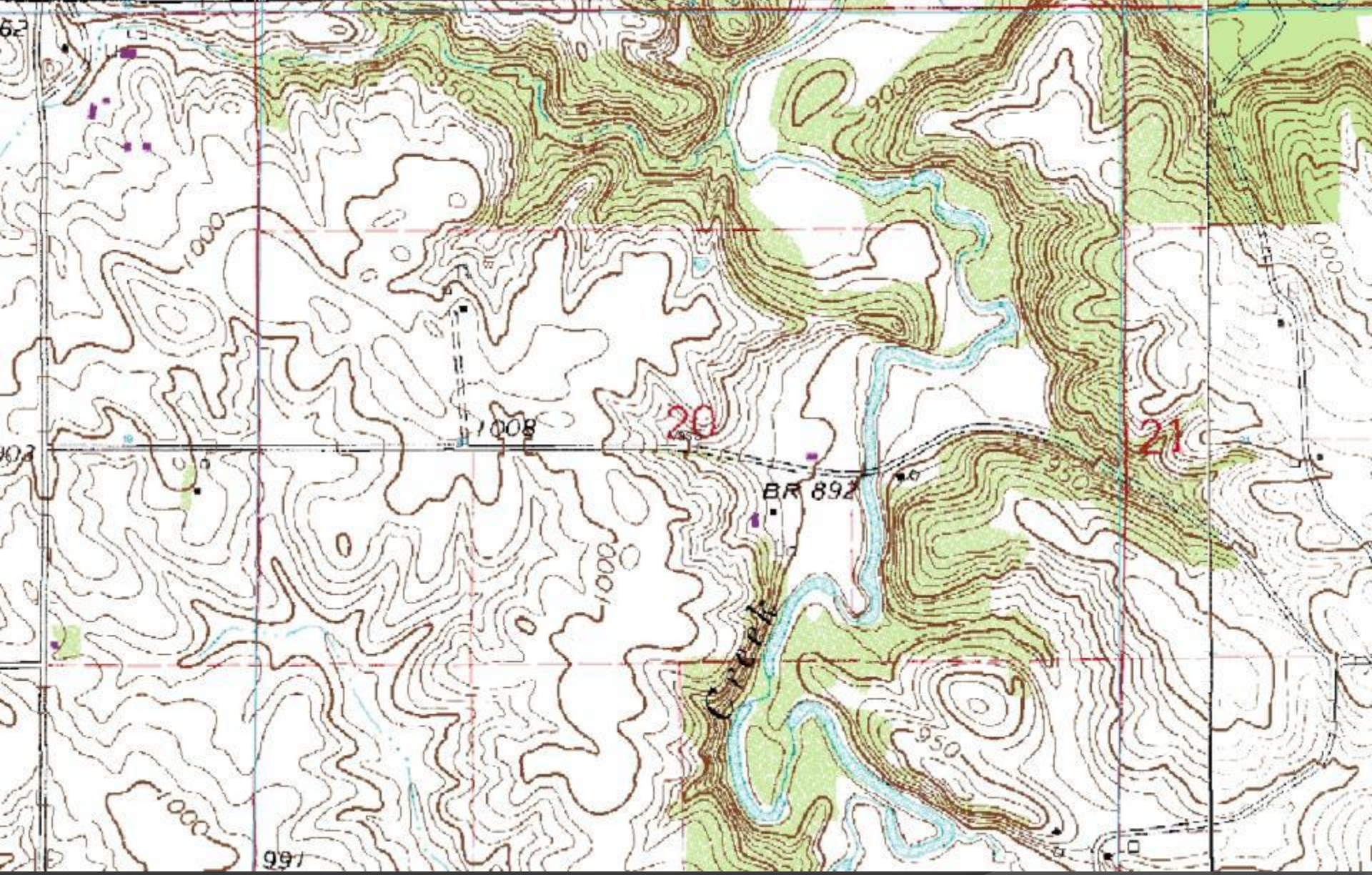


2001 Goodhue County Project

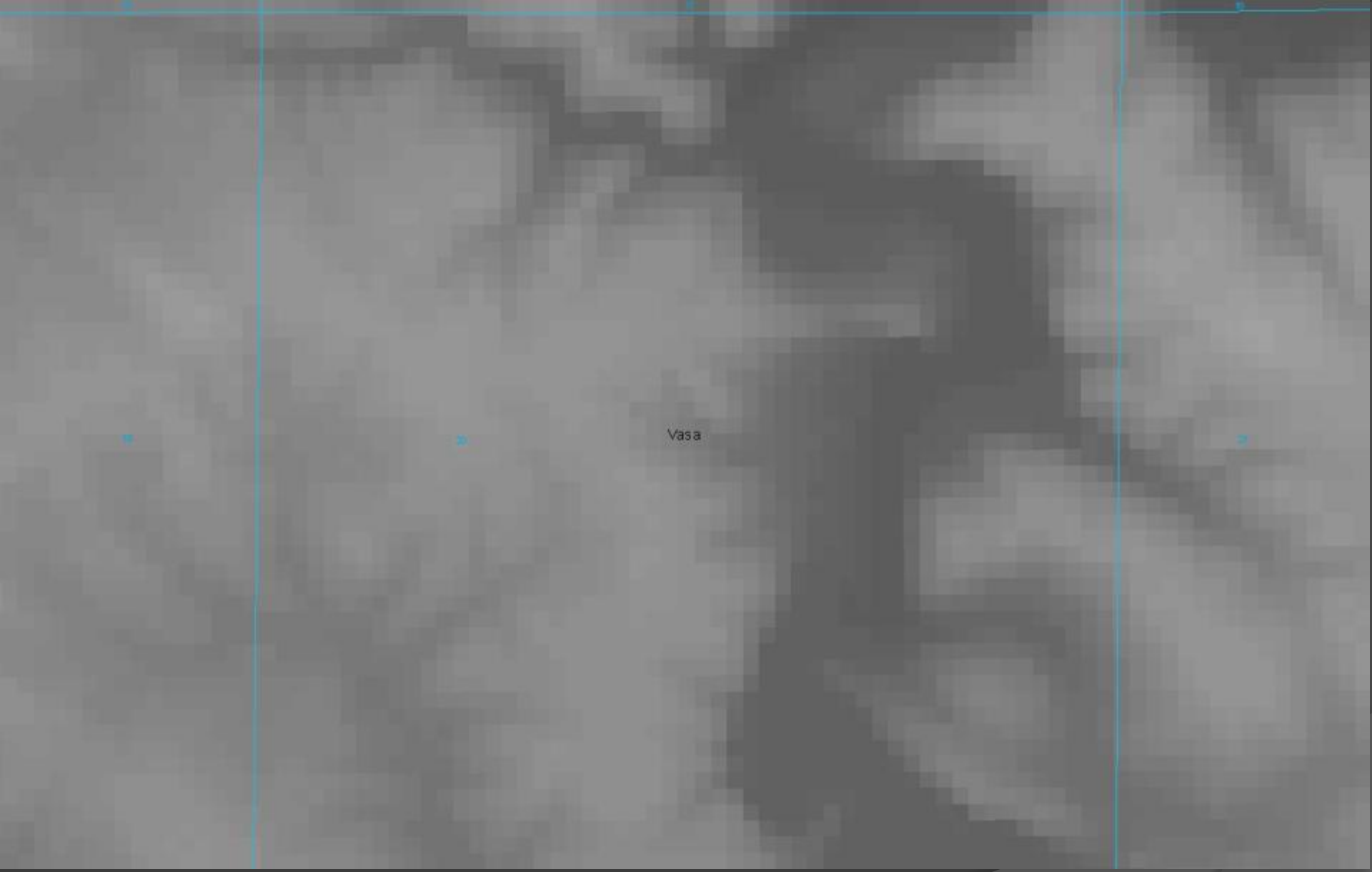
First Pulse data



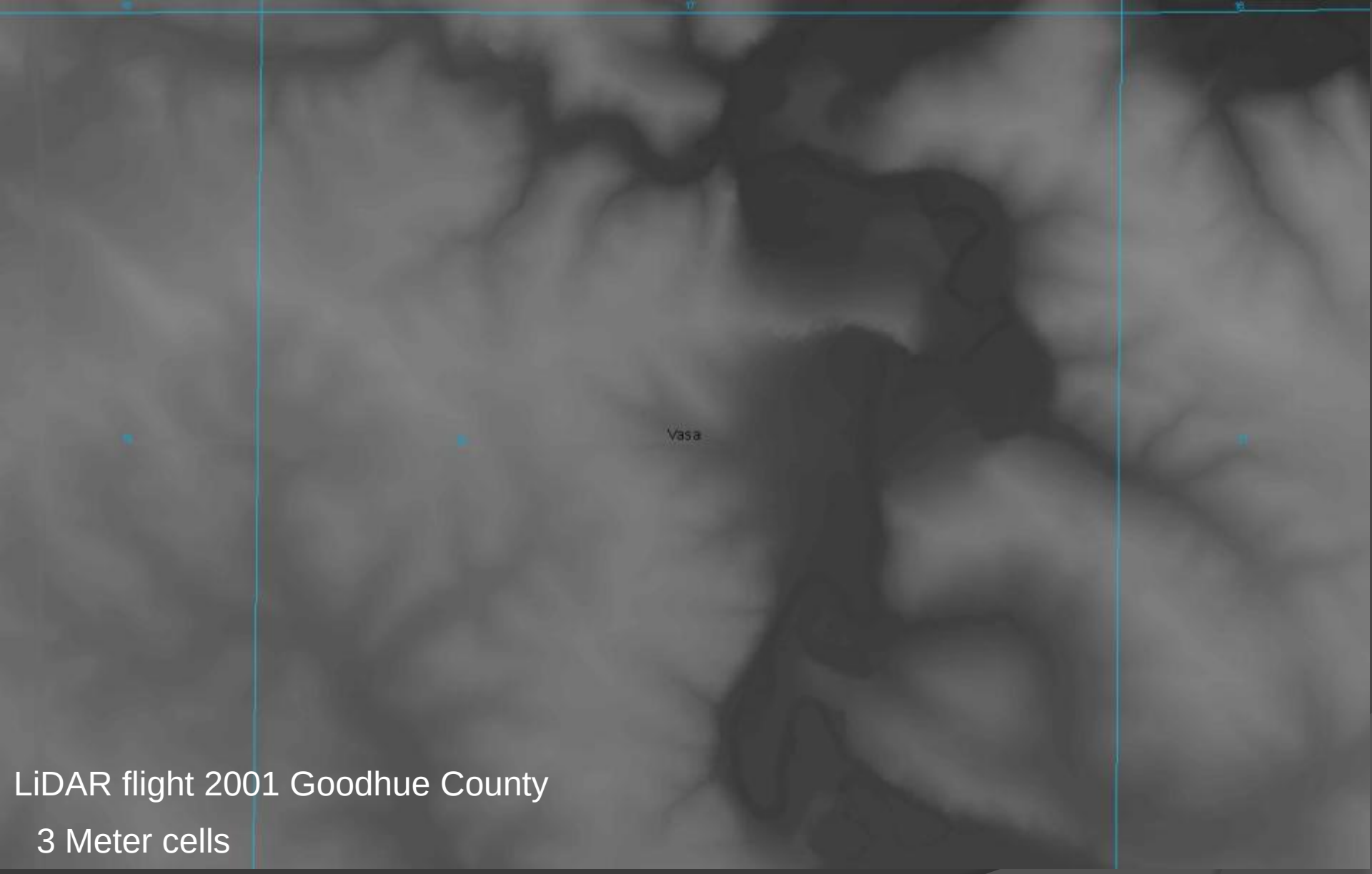
Slide courtesy of Goodhue County GIS/Survey Dept.



What we had.



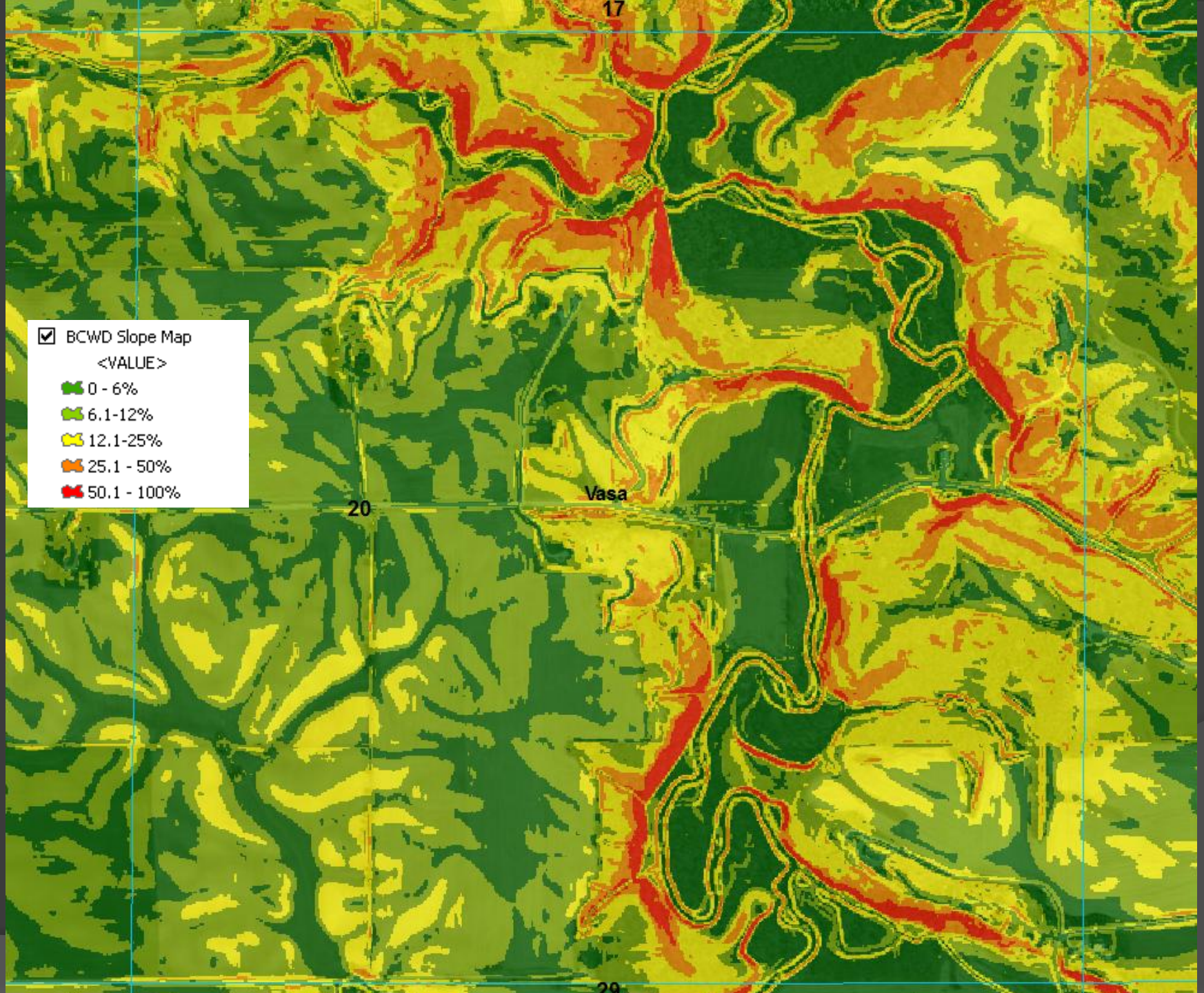
DNR 30 meter cells



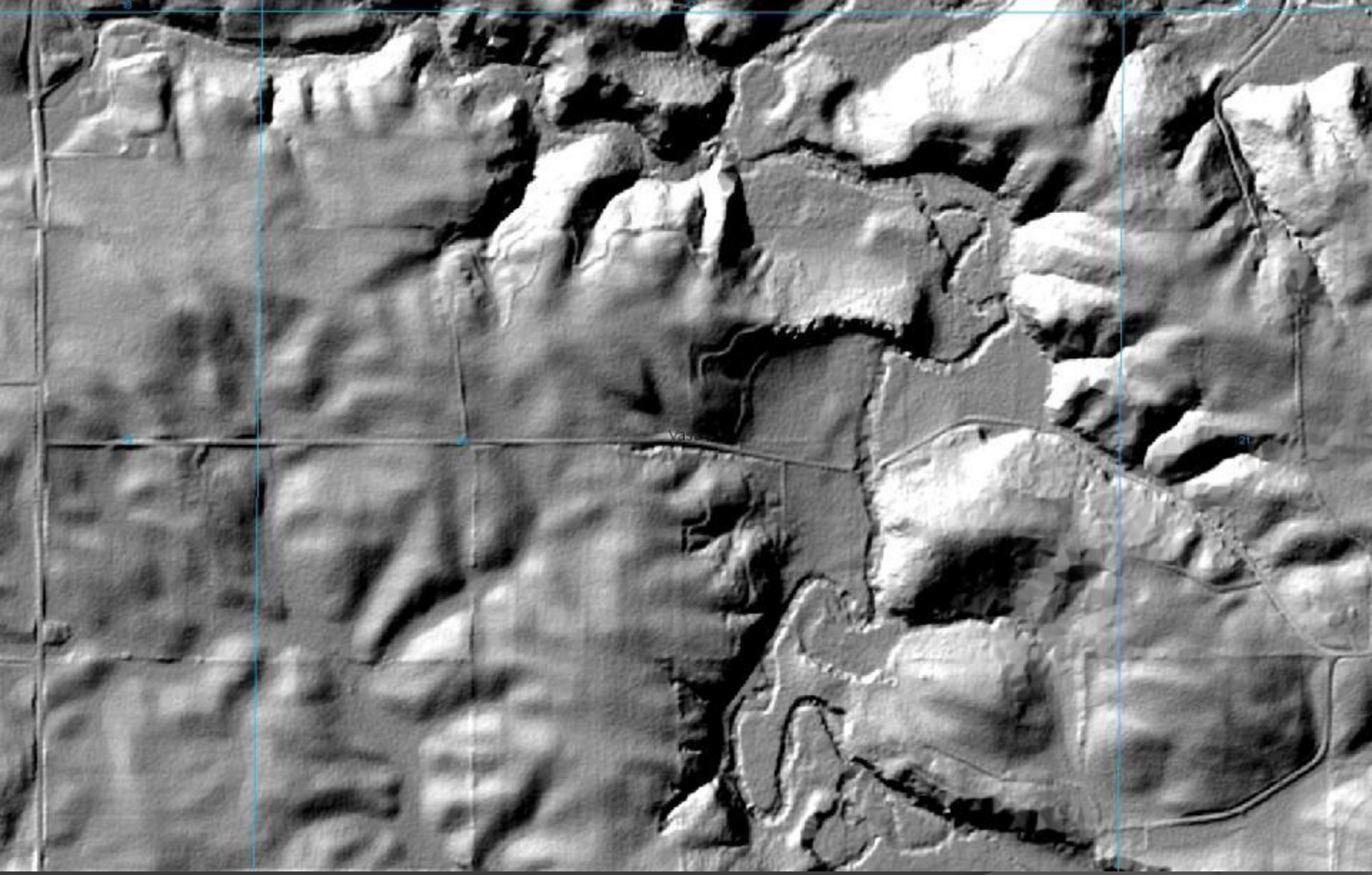
LiDAR flight 2001 Goodhue County

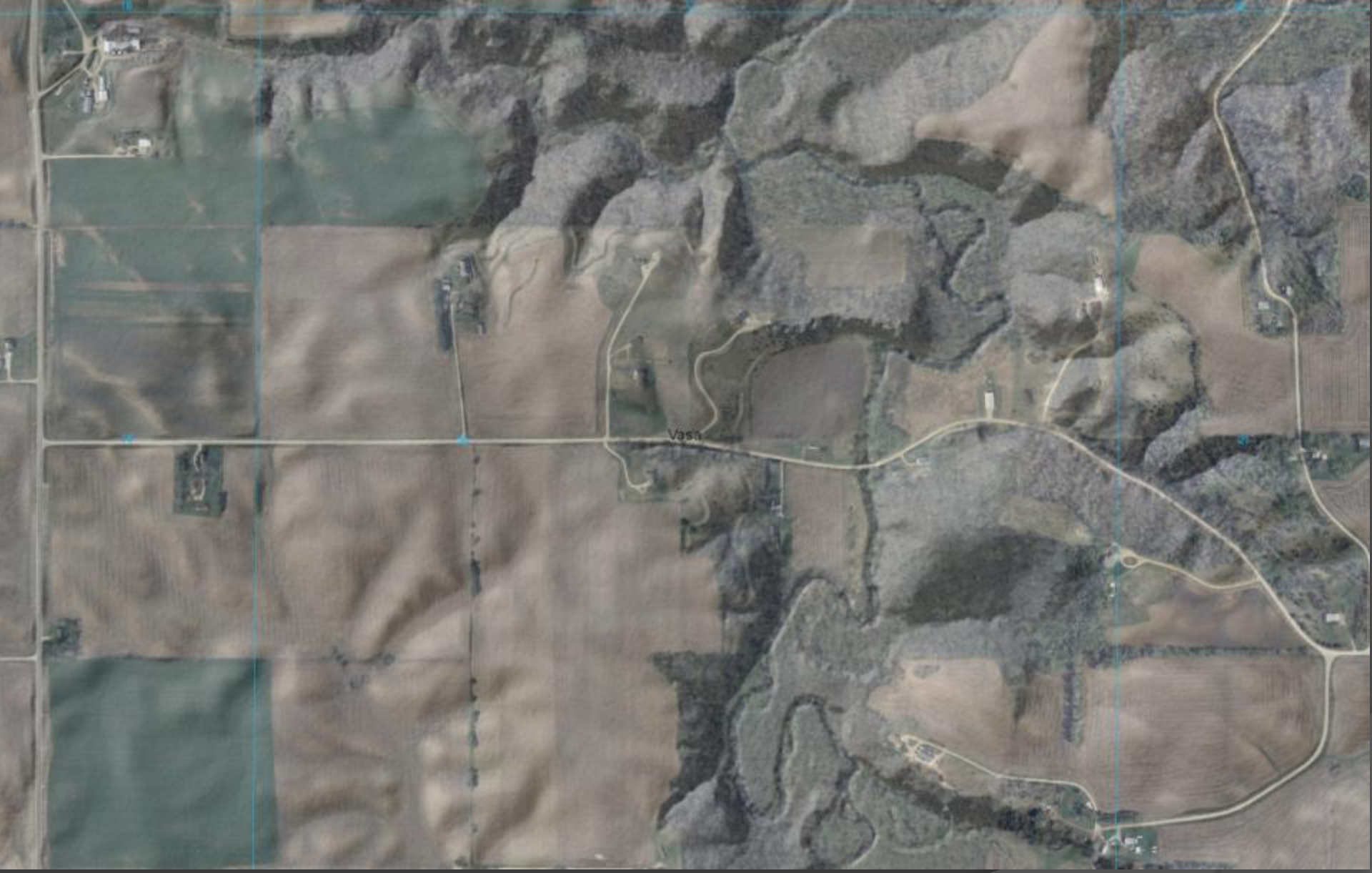
3 Meter cells

Now we have accurate elevation data to manipulate……
The above data is basically what generates what comes next.

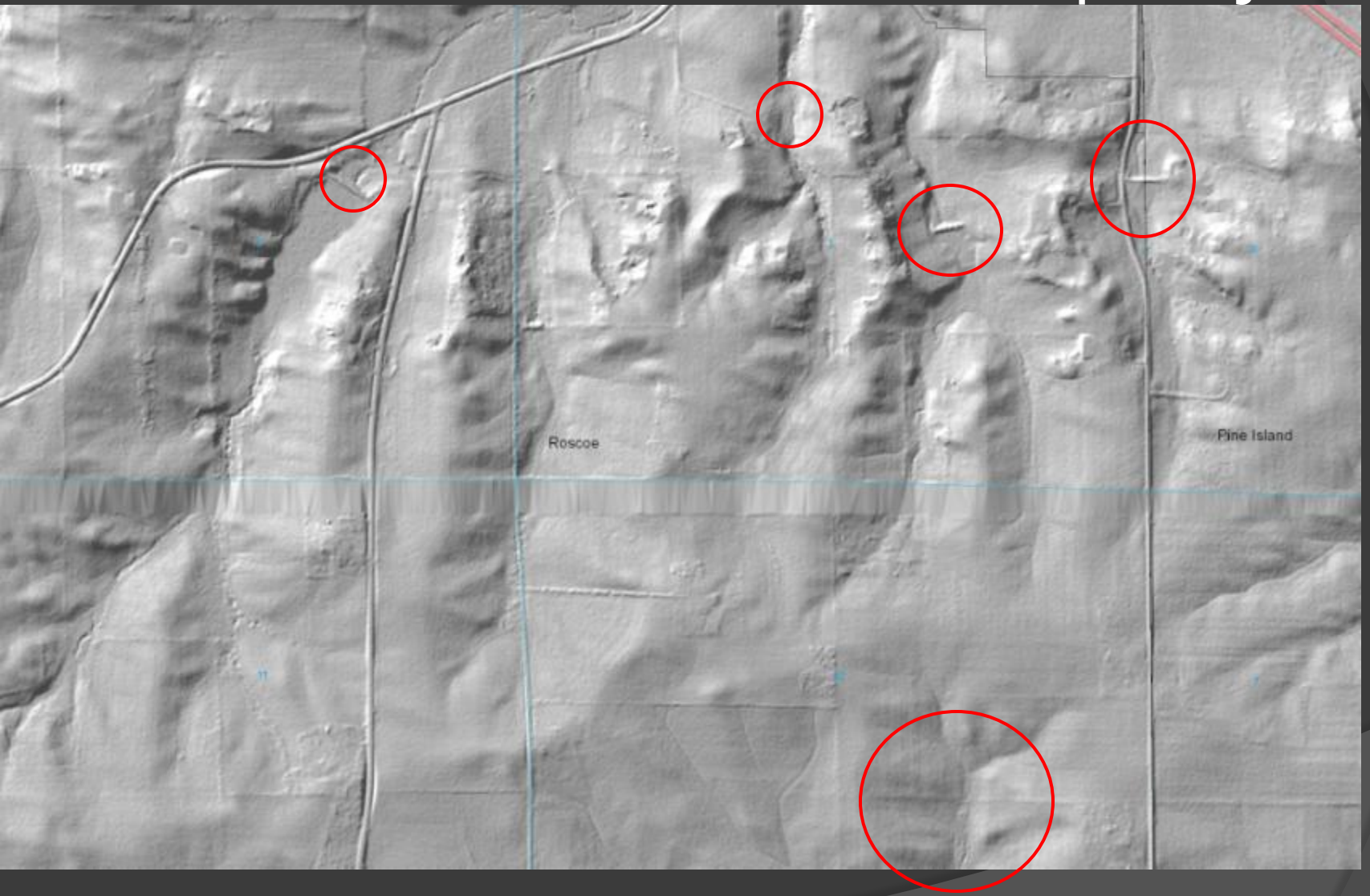

BCWD Slope Map
<VALUE>
0 - 6%
6.1-12%
12.1-25%
25.1 - 50%
50.1 - 100%
17
Vasa
20
29

Uses: County Building Permit Reviews
Planning opportunities when assessing watersheds/TWPs
Investigating highly erodible farm land

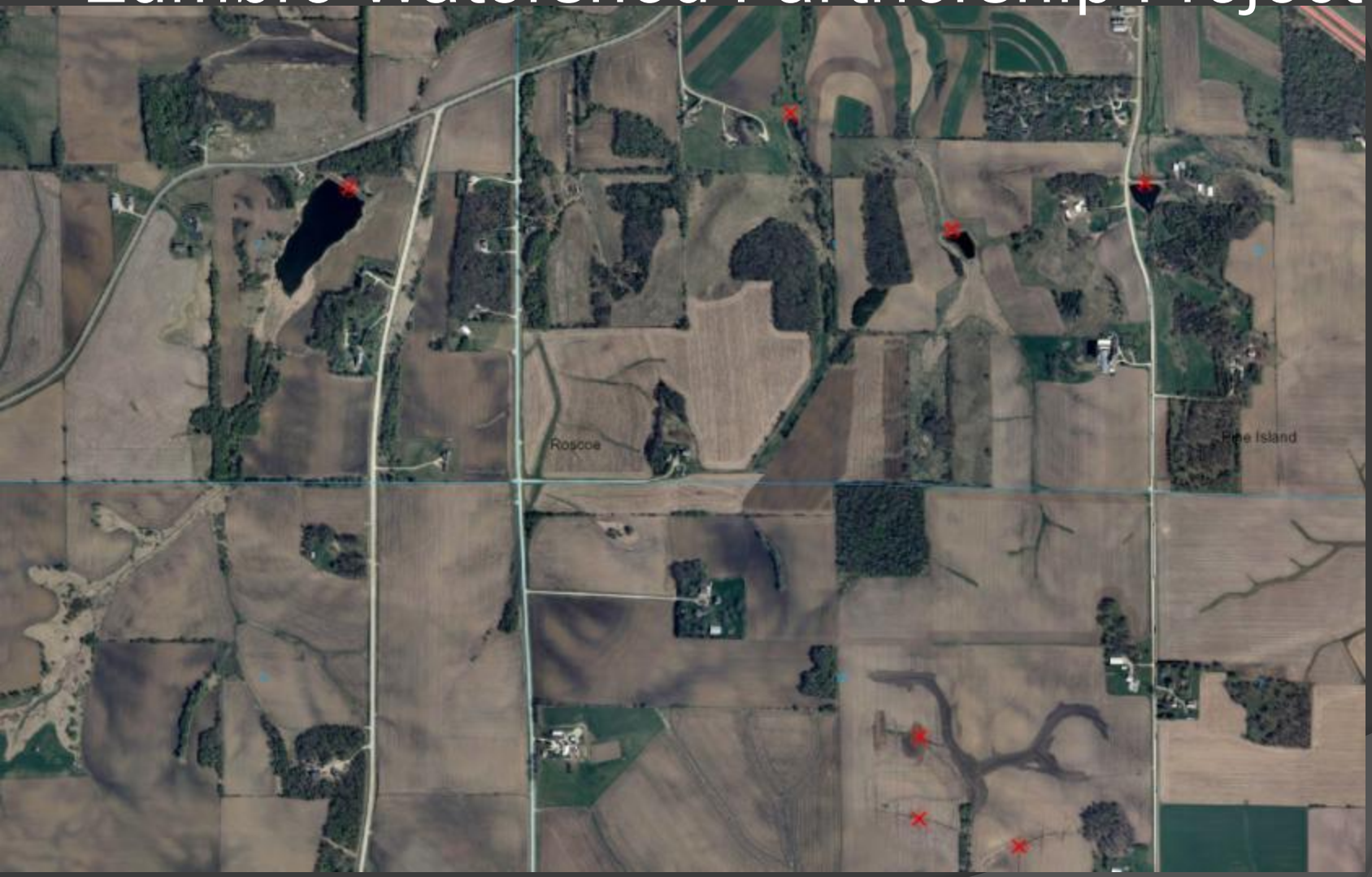


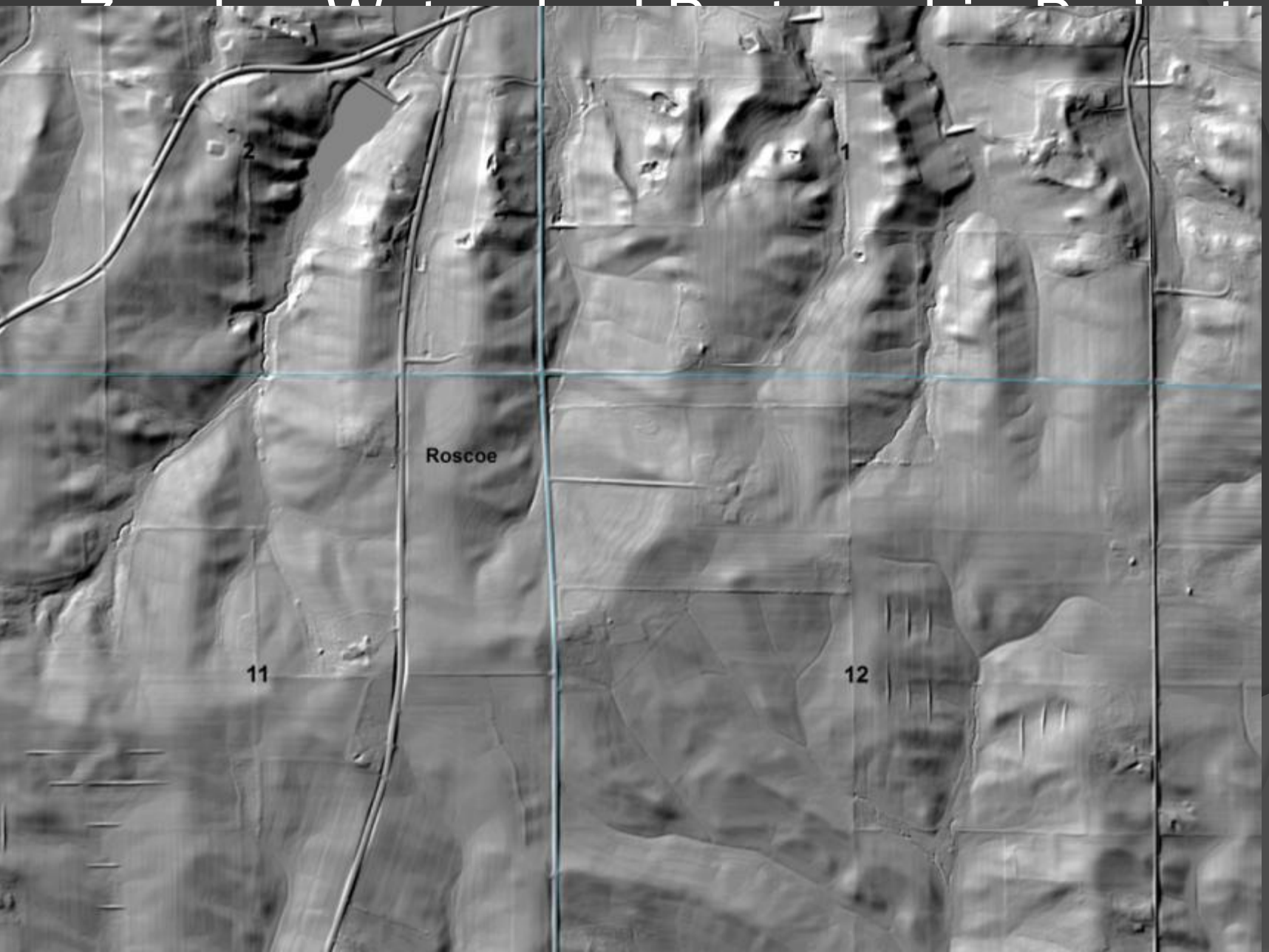

Vasa

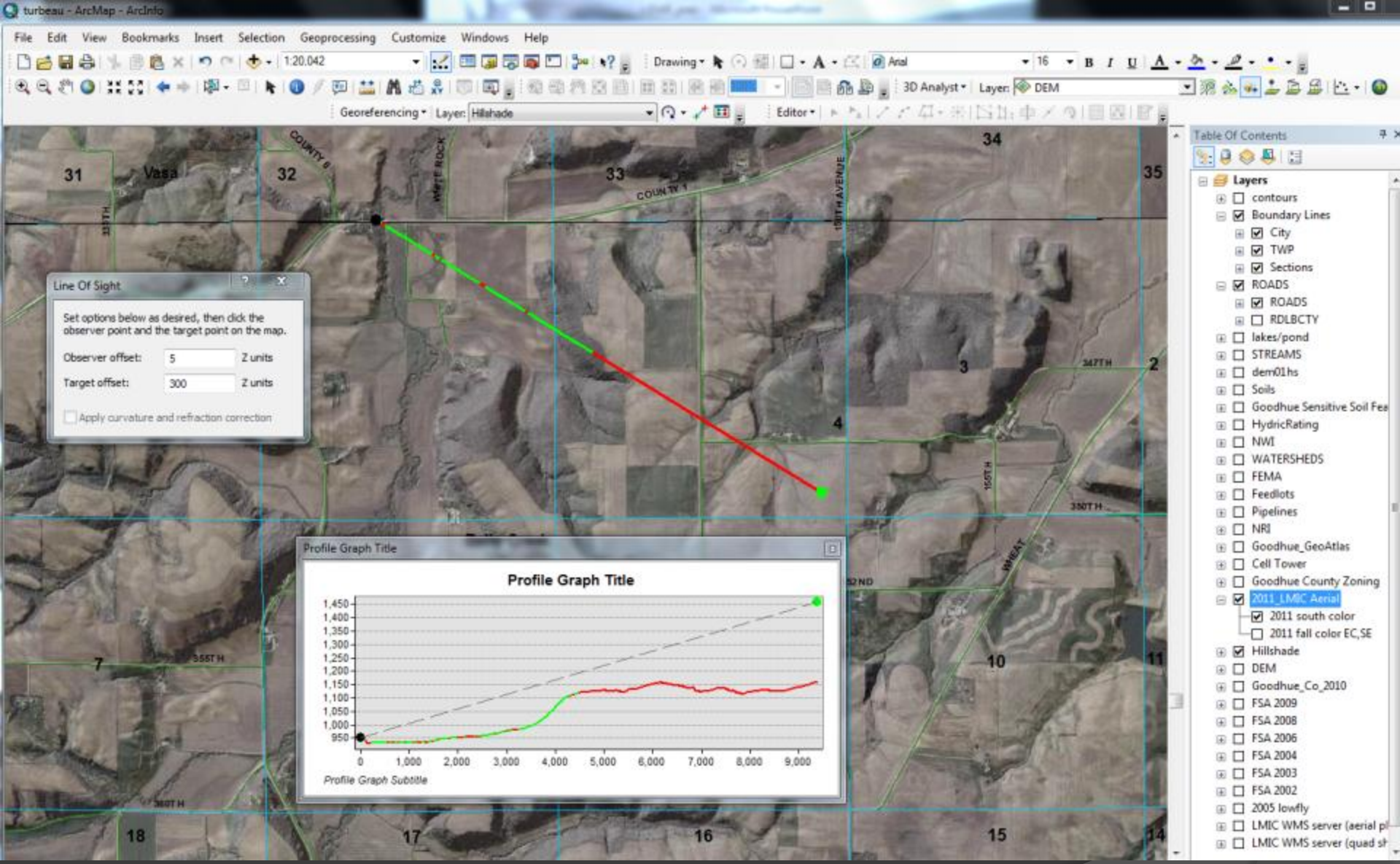
Zumbro Watershed Partnership Project



Zumbro Watershed Partnership Project




2
1
Roscoe
11
12


turbeau - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
Line Of Sight
Set options below as desired, then click the observer point and the target point on the map.
Observer offset: 5 Z units
Target offset: 300 Z units
Apply curvature and refraction correction
Profile Graph Title
Profile Graph Title
Profile Graph Subtitle
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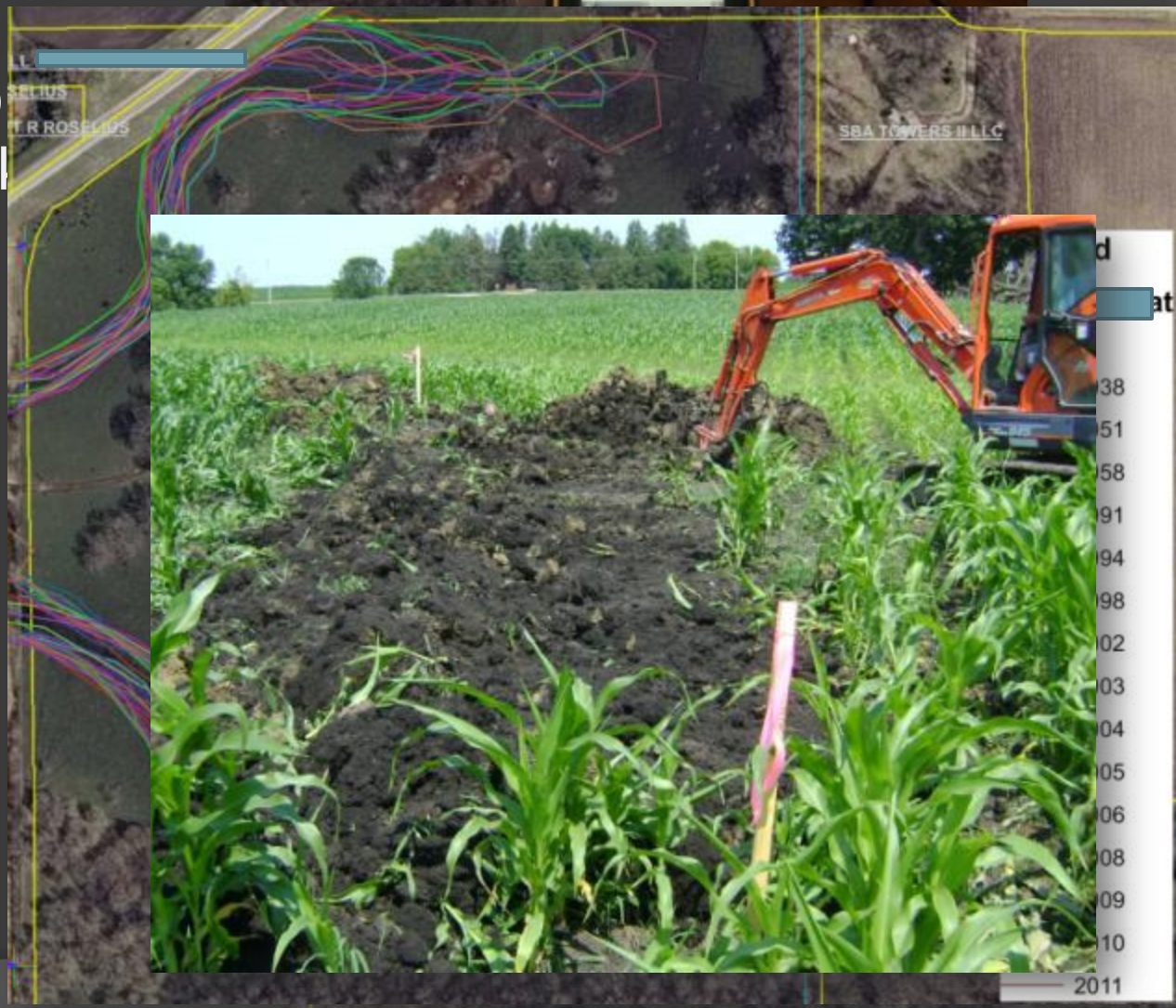
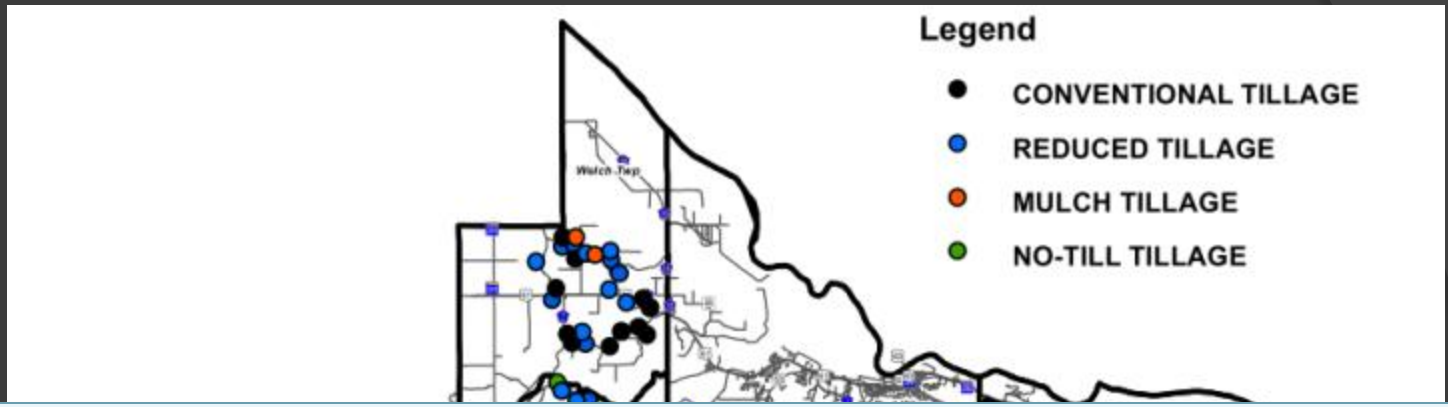
2005 lowfly
LMIC WMS server (aerial pl
LMIC WMS server (quad sh

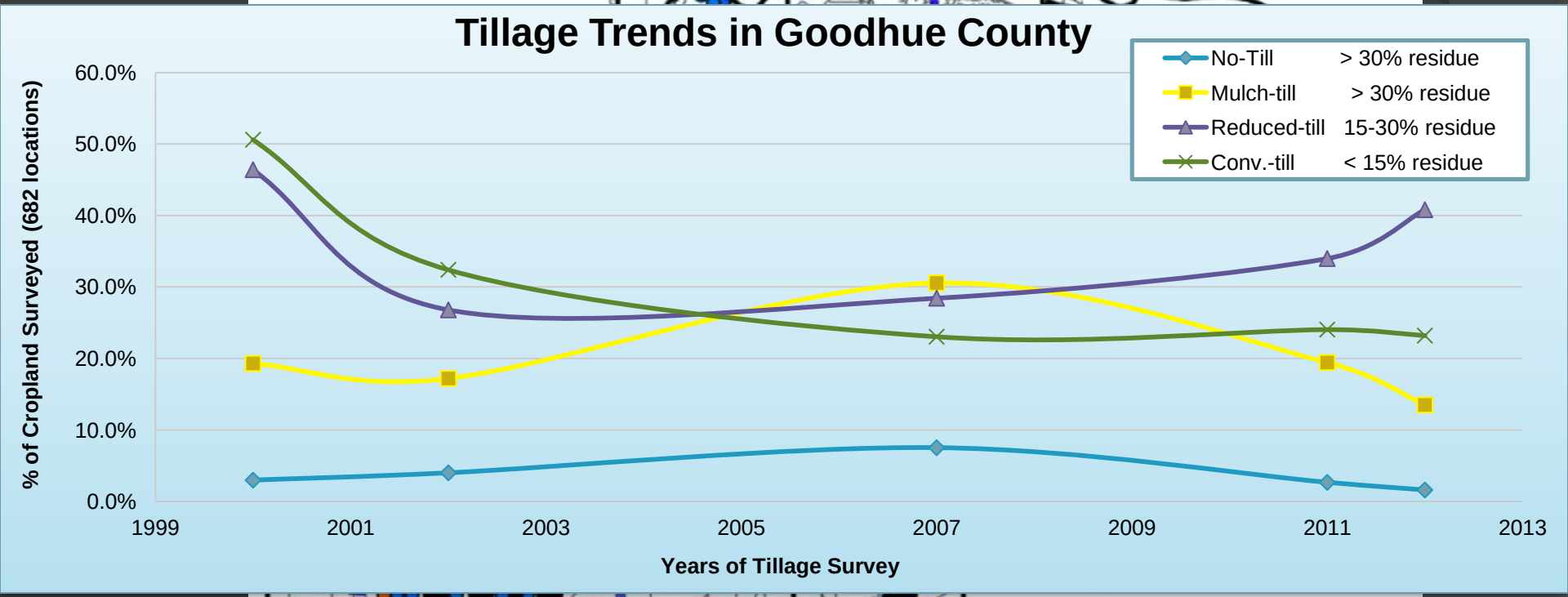
Trimble GeoXT

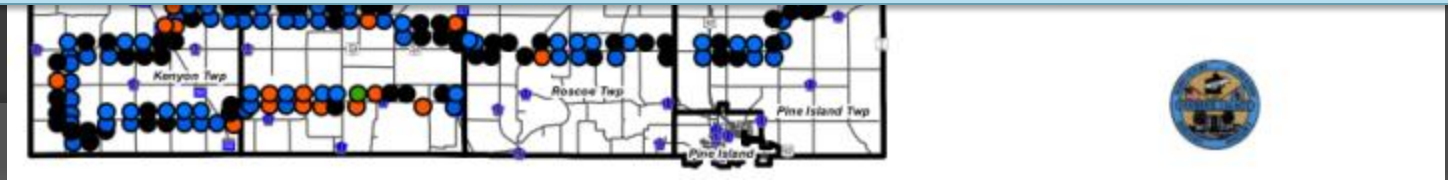
- Wetland Delineatio
- Contour Buffer Stal
- Tillage Transects
- Buffer Layouts
- endless…..



Trimble GeoXT





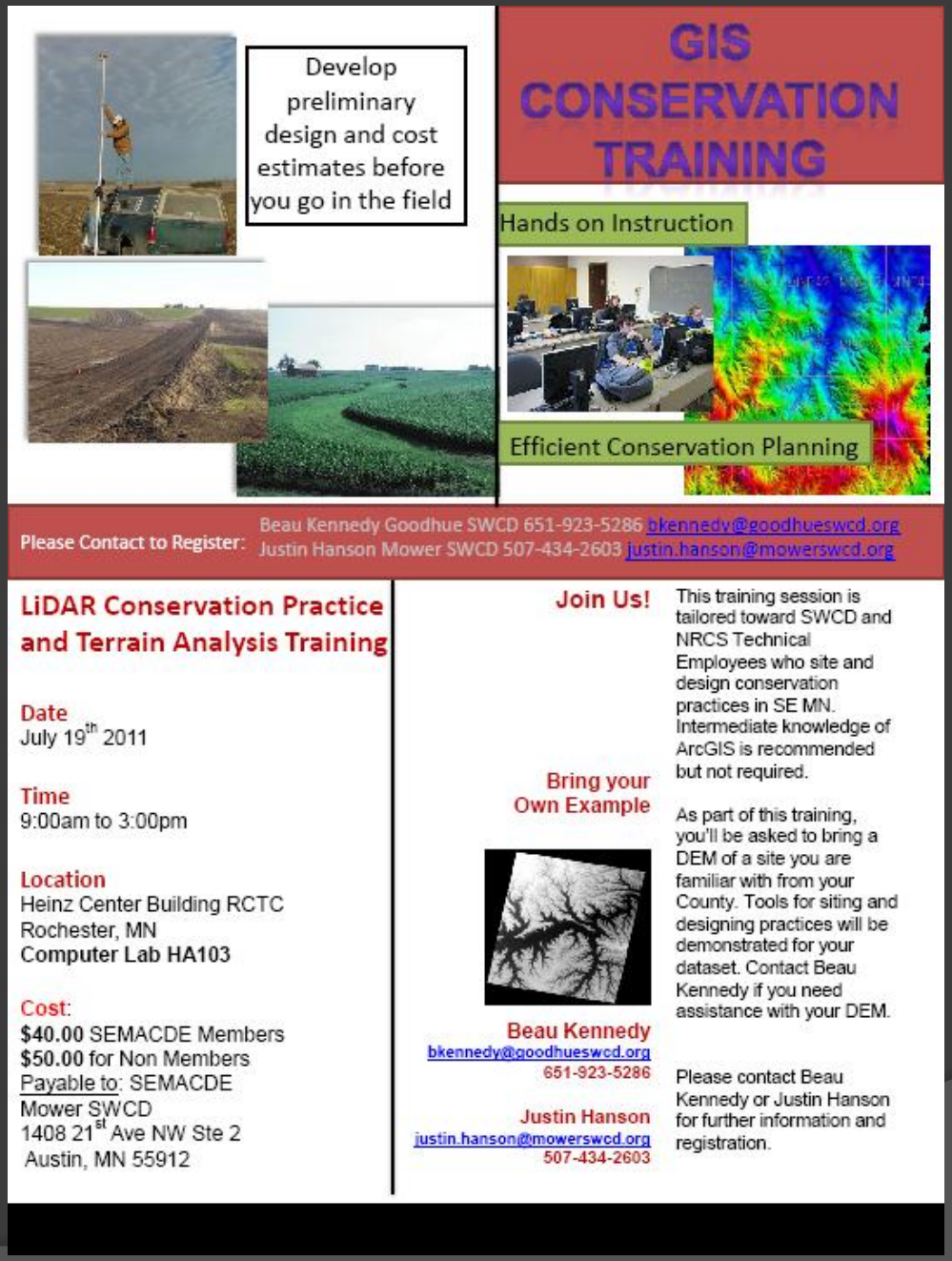


McMurtrie Streambank Project

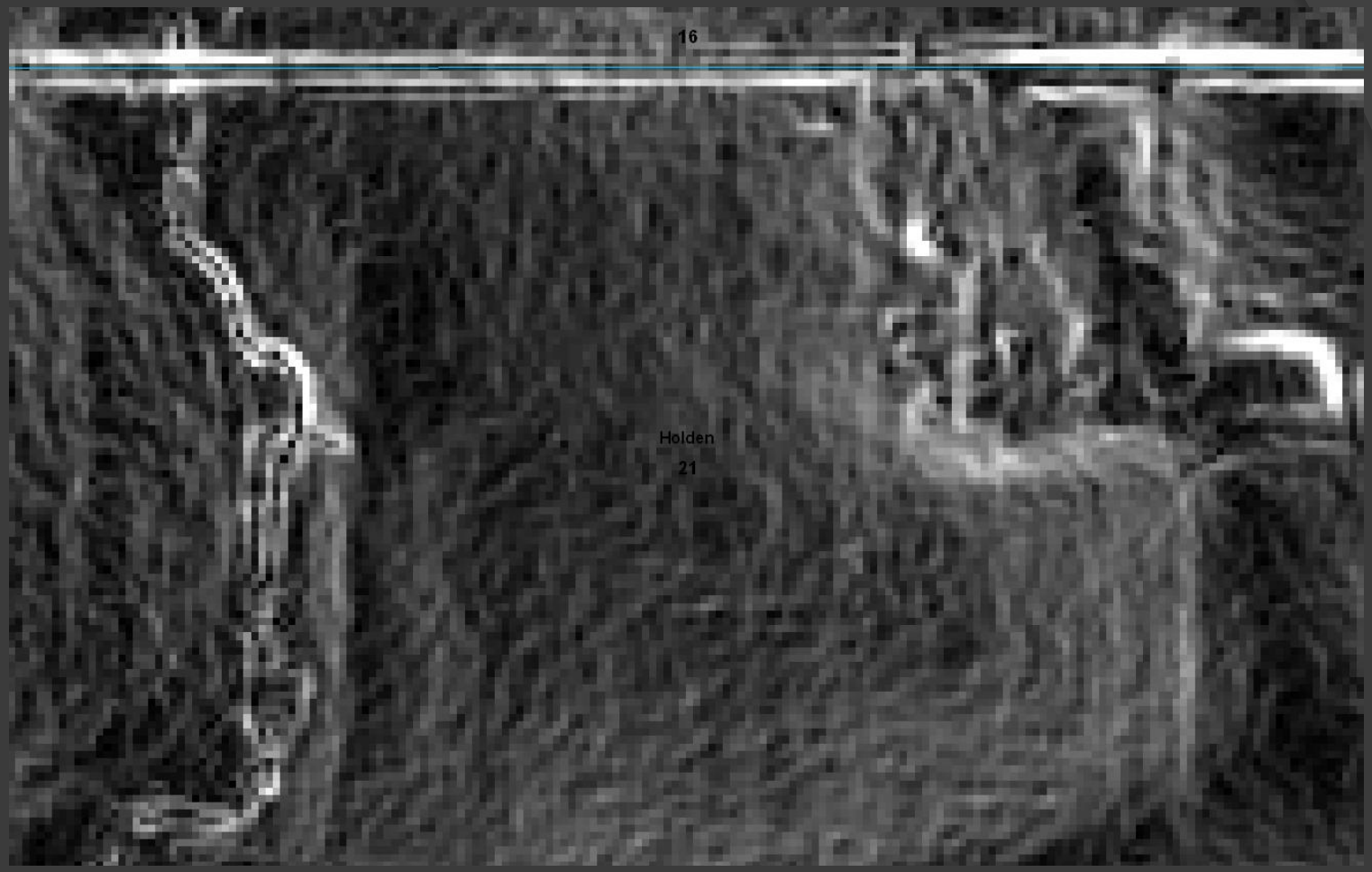
Preparer: Beau Kennedy

0 50 100 200 300 400 500

Held Training last Summer for SWCD/NRCS technicians.

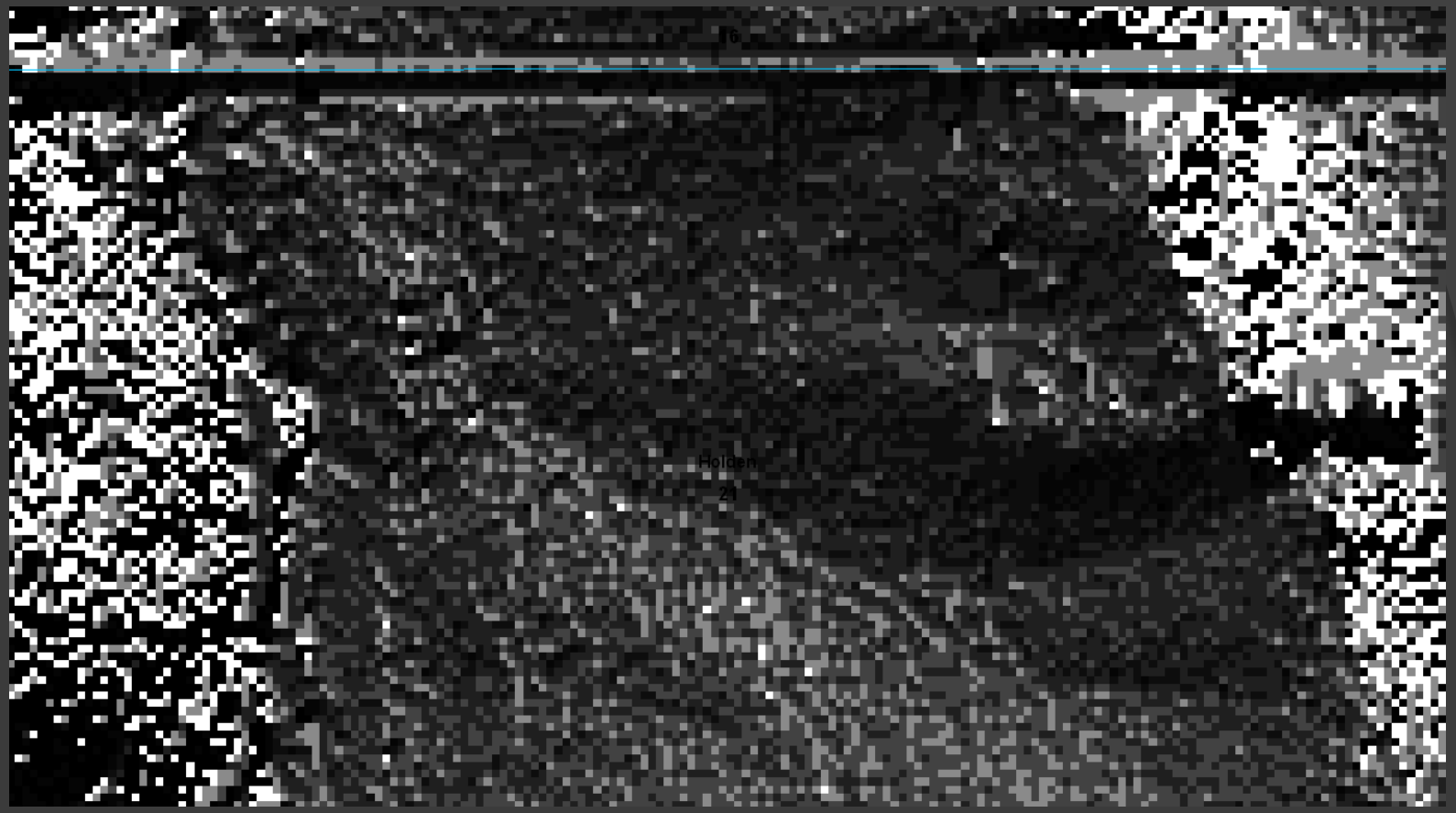


Terrain Analysis



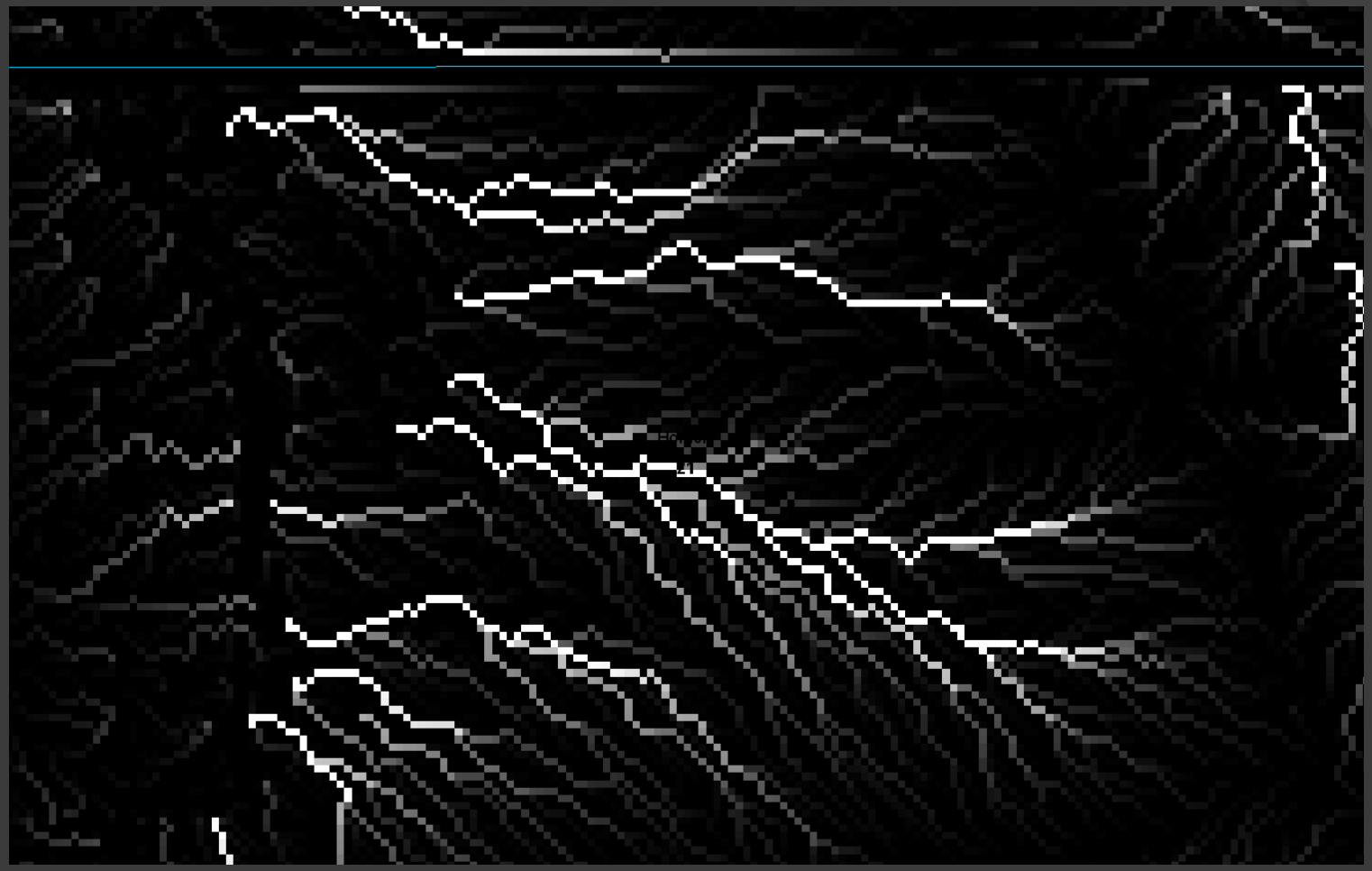
Terrain Analysis

Slope



Terrain Analysis

Flow Direction



Terrain Analysis

Flow Accumulation

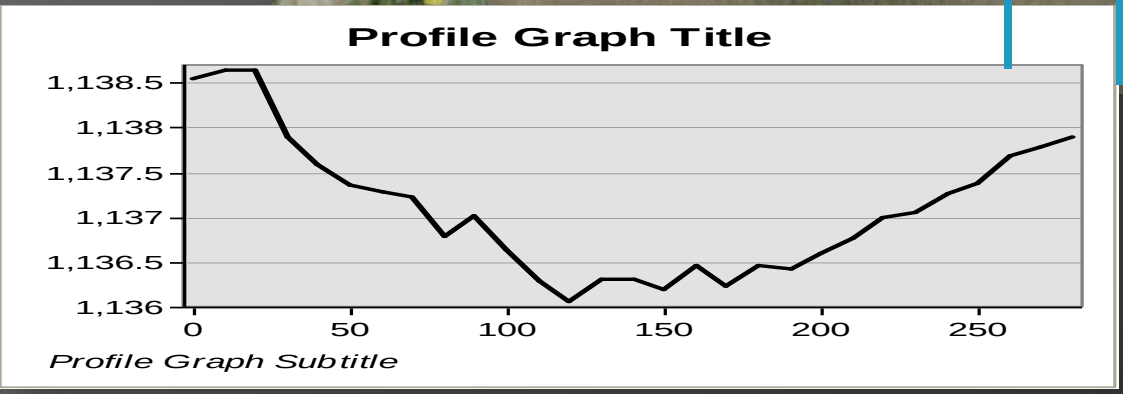
Terrain Analysis

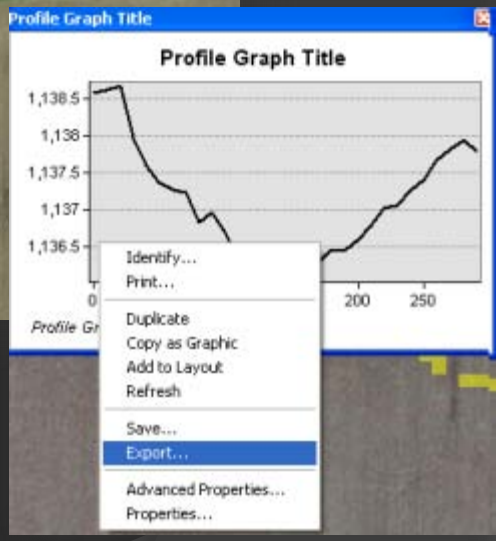
Top 10% of SPI values

(we use top 2 to 5% in the eastern portions of the County)

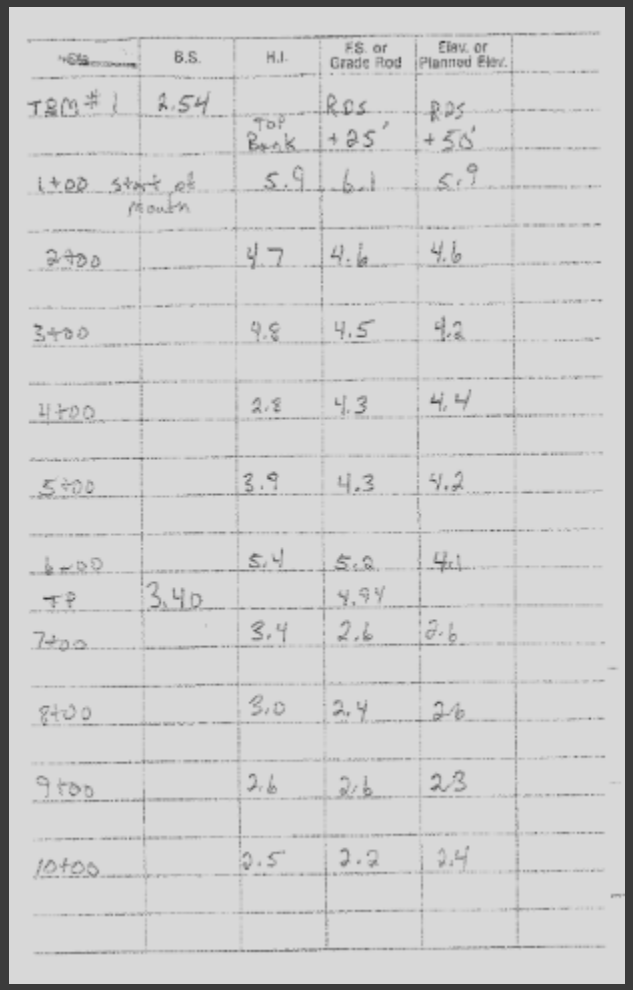
Ln(Flow Acc x Slope)

Using the 3D Analyst and Terrain Analysis Tools





Now a desktop survey is in a Excel format can be used in the NRCS Terrace and Waterway Design Programs, etc.



Sta.	B.S.	H.I.	F.S. or Grade Rod	Elev. or Planned Elev.
TBM #1	2.54		ROS	ROS
		Top Bank	+25'	+50'
1+00 start at mouth		5.9	6.1	5.9
2+00		4.7	4.6	4.6
3+00		4.8	4.5	4.2
4+00		2.8	4.3	4.4
5+00		3.9	4.3	4.2
6+00		5.4	5.2	4.1
TP	3.40		4.94	
7+00		3.4	2.6	2.6
8+00		3.0	2.4	2.6
9+00		2.6	2.6	2.3
10+00		2.5	2.2	2.4

X	Y	rod reading
0	1139.904	5.0965
49.48495	1138.491	6.5086
98.96991	1137.259	7.7408
148.4549	1136.5	8.4996
197.9398	1136.179	8.821
247.4248	1136.57	8.4297
296.9097	1137.38	7.6196
346.3947	1138.13	6.8703
395.8796	1139.588	5.412
425.5706	1139.565	5.4352
50' off		
X	Y	rod reading
0	1141.768	3.2321
49.86219	1140.482	4.5178
99.72437	1139.084	5.9162
149.5866	1138.129	6.8707
199.4487	1138.249	6.7513
249.3109	1139.124	5.8763
299.1731	1140.493	4.5069
349.0353	1141.95	3.05
398.8975	1143.05	1.9503
428.8148	1143.319	1.6814

NEW

ARCHIVE

DESIGN DATA

Runoff Curve Number = 75
10yr 24hr Rainfall = 4.25 inches
Sediment Capacity = S 0.28 inches
Drainage Area = 1.6 acres
Flood Duration = H 24 hours
Frontslope Width = 13 feet
Survey Offset Distance = 50 feet

E G Grade Rod HI Reference = 5.36 feet
End Block Side Slope = 10 : 1
Cut Slope = 8 : 1
Steepest Allowable Frontslope = 2 : 1
W R Backslope Ratio = 2 : 1
Channel Bottom Width = 2 feet
Ridge Top Width = 6 feet
Minimum Terrace Depth = 0 feet
D % Settlement Factor = 5 %
Compaction Factor = 1.4 X fill volume
Use Average Slope = %

Terrace End Block Design
End BlockTop Width = feet
Station 0+00 End Block Rod = feet
Station 2+00 End Block Rod = feet

SOLUTION

Average Slope = 9.72 %
10yr 24hr Runoff = 1.86 inches
Design Storage Depth = 4.42 feet
Design Storage Ridge Rod = 10.08 feet
Intake Rod = 14.5 feet
Minimum Storage Volume 1ac" = 7434 cubic feet
Required Storage Volume = 8430 cubic feet
Calculated Storage Volume = 8452 cubic feet
Excess Storage Volume = 22 cubic feet

EARTHWORK VOLUMES

Ridge Fill Volume = 457 cubic yards
Channel Fill Volume = 0 cubic yards
No End Block at Sta. 0+00
No End Block at Sta. 2+00

Designed By : CLH
Landowner : Mike Kennedy
Location : Cannon Falls 27
Terrace : Basin #1
Save as :
Date : 8/21/12 Update : 3/14/02

ADDSTA DELSTA SOLVE

station	grnd rod	offset rod	chan rod
0+00	6.7	4.2	6.7
0+50	12.0	8.0	12.4
1+00	14.5	9.9	14.5
1+50	10.6	4.4	11.2
2+00	7.1	0.1	7.1

PRINT DESIGN

PG UP CUTS
PG DN SHEET

PRINT CUTS

TERRACE CUT SHEET

TYPE 2

Landowner : Mike Kennedy
Location : Cannon Falls 27
Design Date : 8/21/12
Terrace : Basin #1
Ridge Top Width = 6 feet
Frontslope Width = 13 feet
Channel Bottom Width = 2 feet
Backslope Ratio = 2 : 1
Grade Rod HI Reference = 5.36

Channel and Ridge cuts are referenced to natural ground at channel.

CUTS

PG DN

Station	Ground	Channel	Ridge	Offset	Channel		Ridge	Station
0+00	6.7	6.7	6.6	6.7	Cut : 0.0		Fill : 0.1	0+00
0+50	12.0	12.4	9.9	12.0	Cut : 0.4		Fill : 2.1	0+50
1+00	14.5	14.5	9.7	14.5	Cut : 0.0		Fill : 4.8	1+00
1+50	10.6	11.2	9.9	10.6	Cut : 0.6		Fill : 0.7	1+50
2+00	7.1	7.1	6.9	7.1	Cut : 0.0		Fill : 0.2	2+00

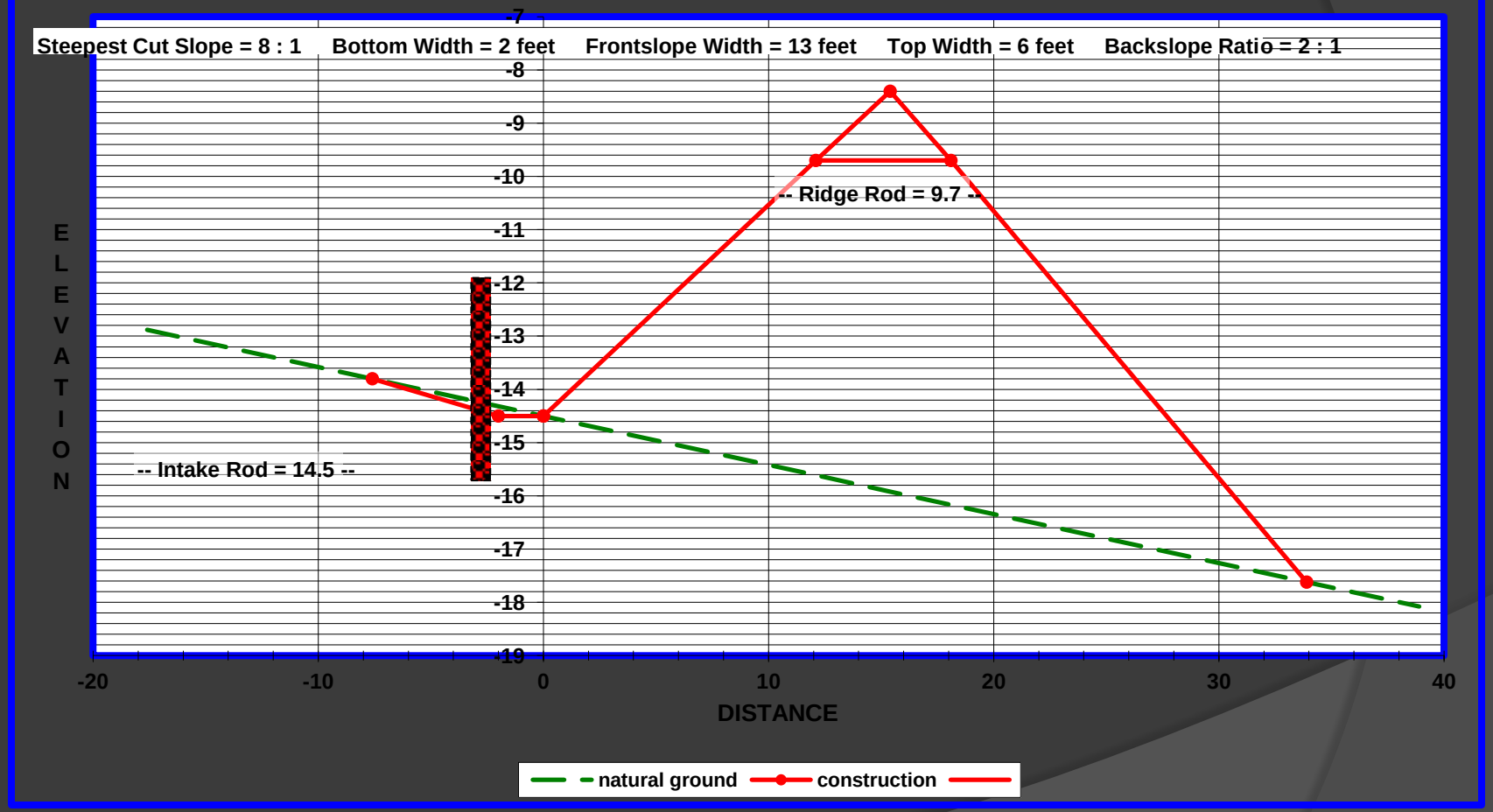
EARTHWORK QUANTITIES

	CHANNEL		RIDGE	
Station	Cut cy	Fill cy	Fill cy	Width ft
0+00			62	21
0+50	5		165	26
1+00	336		154	31
1+50	500		76	26
2+00				27

Channel Cut = 845 cubic yard
Compacted Fill = 457 cubic yard

Benchmark Description

NRCS Terrace Program



Our Example
Comparing Desktop Survey vs. Actual Survey

Ex: Goodhue SWCD Sediment Basin

Desktop Survey	Actual Survey
Total Compacted Fill – 664 cu/yd $3.50/yd x 644 cu/yds = $2,254.00	Total Compacted Fill – 615 cu/yd $3.50/yd x 615 cu/yds = $2,152.50

Difference of $102.50 on earthwork

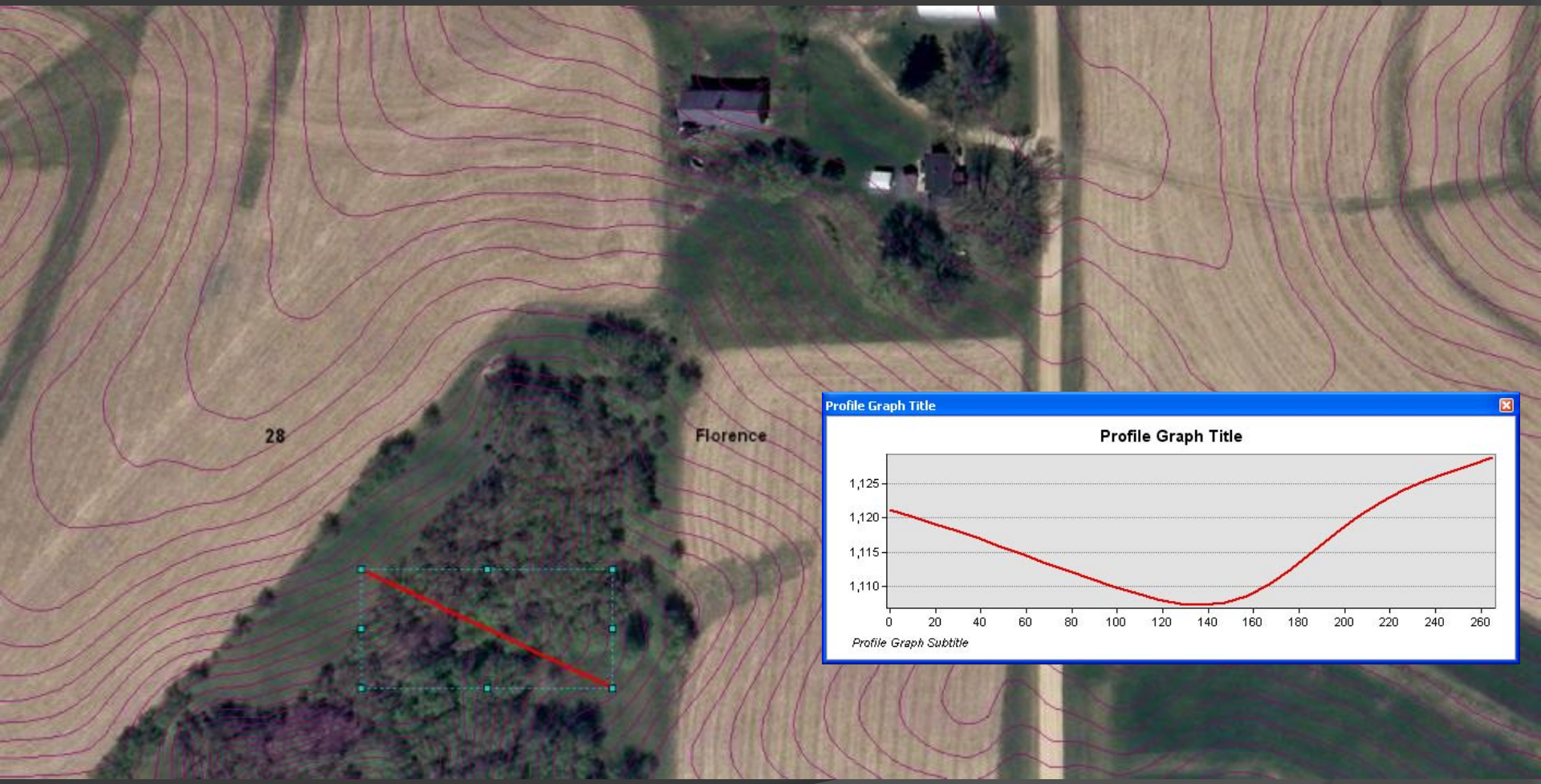
410 Grade Stabilization Example

Slope ,Size and land use of Watershed is needed to find the acre feet of storage needed behind the structure.

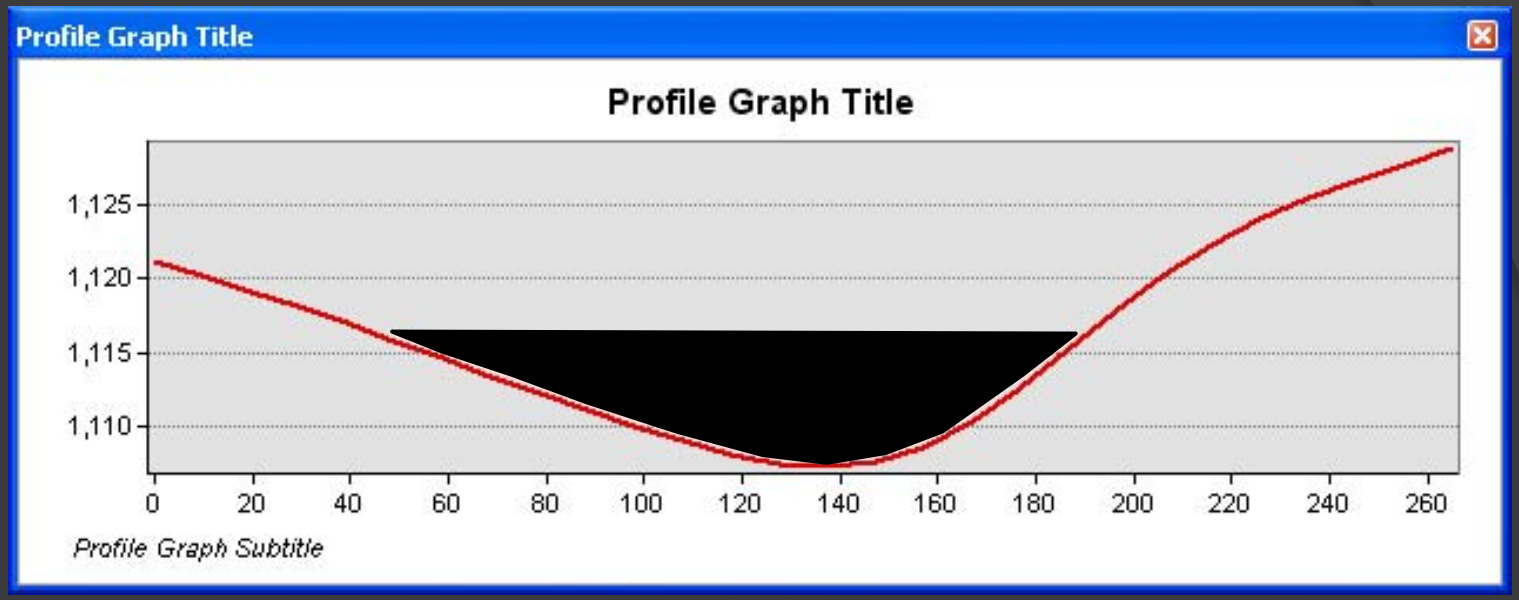
Once acre feet is known, then you know how high to build your dam

410 Example

Draw Interpolate line across draw where practice will be located. Pay attention to contour lines for estimated dam height.



For this example, this structure needed 0.56 acre feet of storage



QUANTITIES					
STATION	DISTANCE	DEPTH	AREA	AVE. AREA	VOLUME
	feet	feet	sq. ft.	sq. ft.	cu. ft.
0		0	0.00		
19.52916	19.529159	1.5629	21.74	10.87	212.24
39.05832	19.529159	3.4926	65.42	43.58	851.05
58.58748	19.529159	5.74	139.77	102.60	2,003.60
78.11664	19.529159	8.1665	248.39	194.08	3,790.25
97.6458	19.529159	10.7279	395.00	321.70	6,282.46
117.175	19.529159	13.3761	581.06	488.03	9,530.81
136.7041	19.529159	15.2719	735.80	658.43	12,858.56
156.2333	19.529159	15.4565	751.82	743.81	14,525.98
175.7624	19.529159	13.1016	560.15	655.98	12,810.83
195.2916	19.529159	8.653	273.72	416.93	8,142.31
214.8208	19.529159	3.7295	72.07	172.89	3,376.43
234.3499	19.529159	0	0.00	36.03	703.71
	-		-	-	-

Our Example
Comparing Desktop Survey vs. Actual Survey

Ex: Goodhue SWCD 410 Example

Desktop Survey	Actual Survey
Fill Required for Structure– 2,781 cu/yd	Fill Required for Structure– 2,251 cu/yd
$3.50/yd x 2,781 cu/yds = $9,733.00	$3.50/yd x 2,251 cu/yds = $7,878.50

Actual Cost of earthwork on project was $8,710.00


28
Florence


28
Florence


28
Florence

Ag

Stan

Pond Selection

between and

Pond Size (acres)	Pond Depth (feet)	Dam Height (feet)	Drainage:P Area Rati
15.01	14.0	18.7	9 : 1
15.01	14.0	18.3	9 : 1
15.01	14.0	20.5	9 : 1
15.01	14.0	19.6	9 : 1
15.01	14.0	17.8	9 : 1
13.78	13.5	18.5	10 : 1
13.78	13.5	18.2	10 : 1
13.78	13.5	19.1	10 : 1
13.78	13.5	18.8	10 : 1
15.01	14.0	17.5	9 : 1
16.16	14.5	18.3	8 : 1
15.01	14.0	19.6	9 : 1
16.16	14.5	19.2	8 : 1
16.16	14.5	18.8	8 : 1
15.01	14.0	19.3	9 : 1

« Prev 1 2 3 4 5

* Base Cost includes Dam Fill (with be
Core Trench Excavation, an

Grubbing, Seeding, and Fencing co

Costs: [Change] (These are the standard costs fo

Dam Fill (per cubic yard): $ 2.71 Seeding (

Trench Fill (per cubic yard): $ 2.65 Grubbing (

Pond Planning Details

Drainage Area: 132.4 acres
Drainage/Pond Area Ratio: 13 : 1
Effective Fill Height:
Constructed Fill Height:
Dam Height (settled):
Lowest pond elevation:
Top of settled fill elevat
Auxiliary spillway eleva
Elevation of crest:
Volume of permanent p
Volume of temporary p
Volume of total storage
Soil loss rate:
Runoff curve number:
Main fill including berm
and core trench
Core Trench Excavation
Pipe Type:
Pipe Size:
Pipe Length:

Emergency Sp

Water Level 11

1166.2'

Trench Bottom 1160'

Earthwork Dimensions

Square Yardage reflects earth quantity before settling.

Station	Elevation	Grade	Sq. Yds.
100.0	1,179.6	4.10	0.3
105.0	1,177.5	3.85	5.3
110.0	1,176.5	4.07	8.9
115.0	1,175.3	4.25	13.9
120.0	1,174.2	4.25	20.7
125.0	1,172.9	4.25	29.7
130.0	1,172.0	4.19	36.5
135.0	1,170.6	3.81	47.9
140.0	1,169.0	3.03	63.4
145.0	1,166.4	2.55	92.0
150.0	1,165.2	2.48	107.2
155.0	1,164.2	3.92	121.9
160.0	1,163.7	4.99	128.4
165.0	1,163.5	4.04	132.0
170.0	1,163.4	3.01	132.9
175.0	1,163.8	1.53	126.3
180.0	1,164.5	0.74	116.6
185.0	1,166.1	0.02	96.4
190.0	1,167.9	0.31	76.1
195.0	1,168.0	1.24	74.6
200.0	1,168.4	2.72	69.4
205.0	1,168.7	3.56	67.1
210.0	1,169.0	3.99	63.7
215.0	1,169.5	3.49	59.1
220.0	1,170.0	2.96	54.0
225.0	1,170.4	2.79	50.0
230.0	1,170.8	2.61	46.0
235.0	1,171.4	2.95	41.0
240.0	1,172.1	3.37	35.1
245.0	1,172.5	3.68	32.3
250.0	1,173.0	4.16	28.4
255.0	1,173.5	4.69	25.4
260.0	1,173.9	4.95	22.3
265.0	1,174.5	5.28	18.7
270.0	1,175.2	5.53	14.3
275.0	1,175.7	5.50	11.9
280.0	1,177.0	5.72	6.8
285.0	1,177.5	5.84	5.4
290.0	1,178.1	5.91	3.6
295.0	1,178.9	6.15	1.7
300.0	1,179.5	6.44	0.6

Cost/Benefit....

Hard to estimate

- 410 Example:
  - Desktop using LiDAR:
    - *2 hours @ desk to estimate cu/yd quantities for preliminary cost-estimate*
    - *$100.00*
  - Field Survey and Design:
    - *4 hour survey under proper conditions*
    - *~ 6 hour design*
    - *$500.00?*

Thank you for your time,

Beau Kennedy
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651-923-5286
bkennedy@goodhueswcd.org