![Michigan Tech logo] **Images Courtesy of Seiler Instrument and Michigan Tech University Capstone Project by Jacob Fabian and Matthew Kunkel titled: Hydrographic Survey for Irrigation Pond Evaluation.** The Trimble R10 GNSS rovers were used to establish control and to measure topo around the site. The Hydrone-RCV boat and a Sonarmite (depth finder) were combined with the R10 rover to map the bottom of the pond. See project images below.
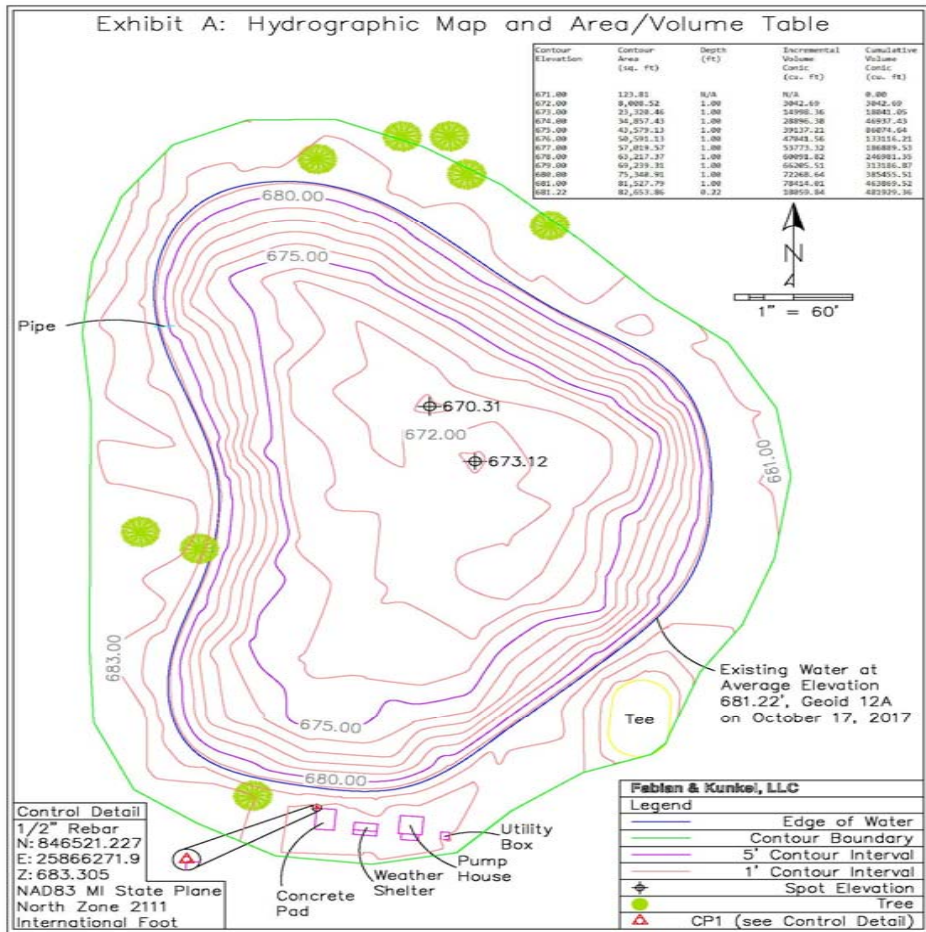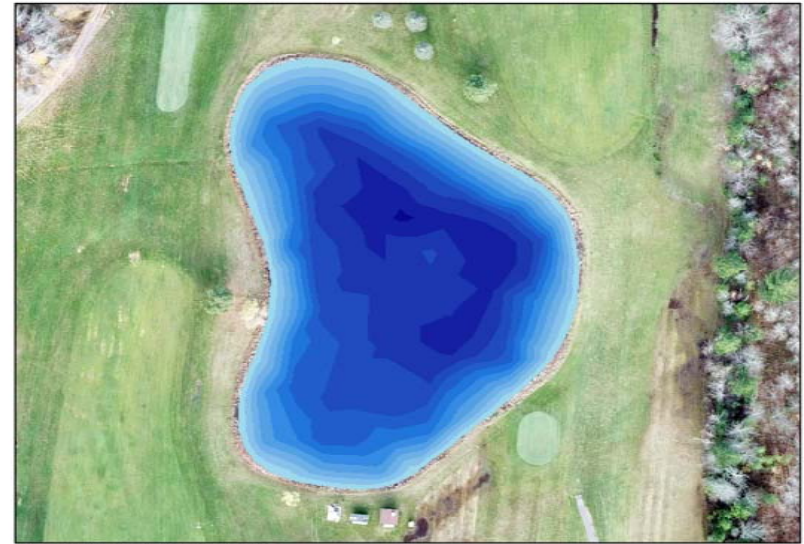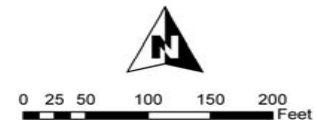
Exhibit A: Hydrographic Map and Area/Volume Table

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Cubic (cu. ft)	Cumulative Volume Cubic (cu. ft)
671.00	123.81	N/A	N/A	0.00
672.00	8,008.52	1.00	3042.69	3042.69
673.00	21,320.46	1.00	14998.36	18041.05
674.00	34,857.43	1.00	28896.38	46937.43
675.00	42,579.13	1.00	39137.21	86074.64
676.00	50,591.13	1.00	47843.56	133916.21
677.00	57,019.57	1.00	53773.32	186889.53
678.00	63,217.37	1.00	60091.82	246981.35
679.00	69,239.31	1.00	66205.51	313186.87
680.00	75,348.91	1.00	72268.64	385455.51
681.00	81,527.79	1.00	78414.01	463869.52
681.22	82,653.86	0.22	18059.84	481929.36

N

1" = 60'

Pipe

670.31

673.12

680.00

675.00

672.00

681.00

683.00

675.00

680.00

Existing Water at
Average Elevation
681.22', Geoid 12A
on October 17, 2017

Tee

Control Detail
1/2" Rebar
N: 846521.227
E: 25866271.9
Z: 683.305
NAD83 MI State Plane
North Zone 2111
International Foot

CP1

Concrete
Pad

Weather
Shelter

Pump
House

Utility
Box

Fabian & Kunkel, LLC
Legend

	Edge of Water
	Contour Boundary
	5' Contour Interval
	1' Contour Interval
	Spot Elevation
	Tree
CP1	CP1 (see Control Detail)

Portage Lake Golf Course - 3D Map
Houghton, Michigan

Aerial photography collected 10/25/2017

Pond Information:
Area: 1.90 Acres
Max Depth: 10.91 Feet
Mean Depth: 5.62 Feet
Volume: 3.61 Million Gallons

Mapping Information:
Data Collection Performed: October 2017
GPS: Survey Grade
Points Collected: 450
Pond Level: Full Pool

N

0 25 50   100   150   200
Feet

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