HYPER-RESOLUTION HYDRODYNAMIC AND SEDIMENT TRANSPORT MODELING AROUND STRUCTURES IN THE NORTHEAST SHARK RIVER SLOUGH (NESRS) CANALS

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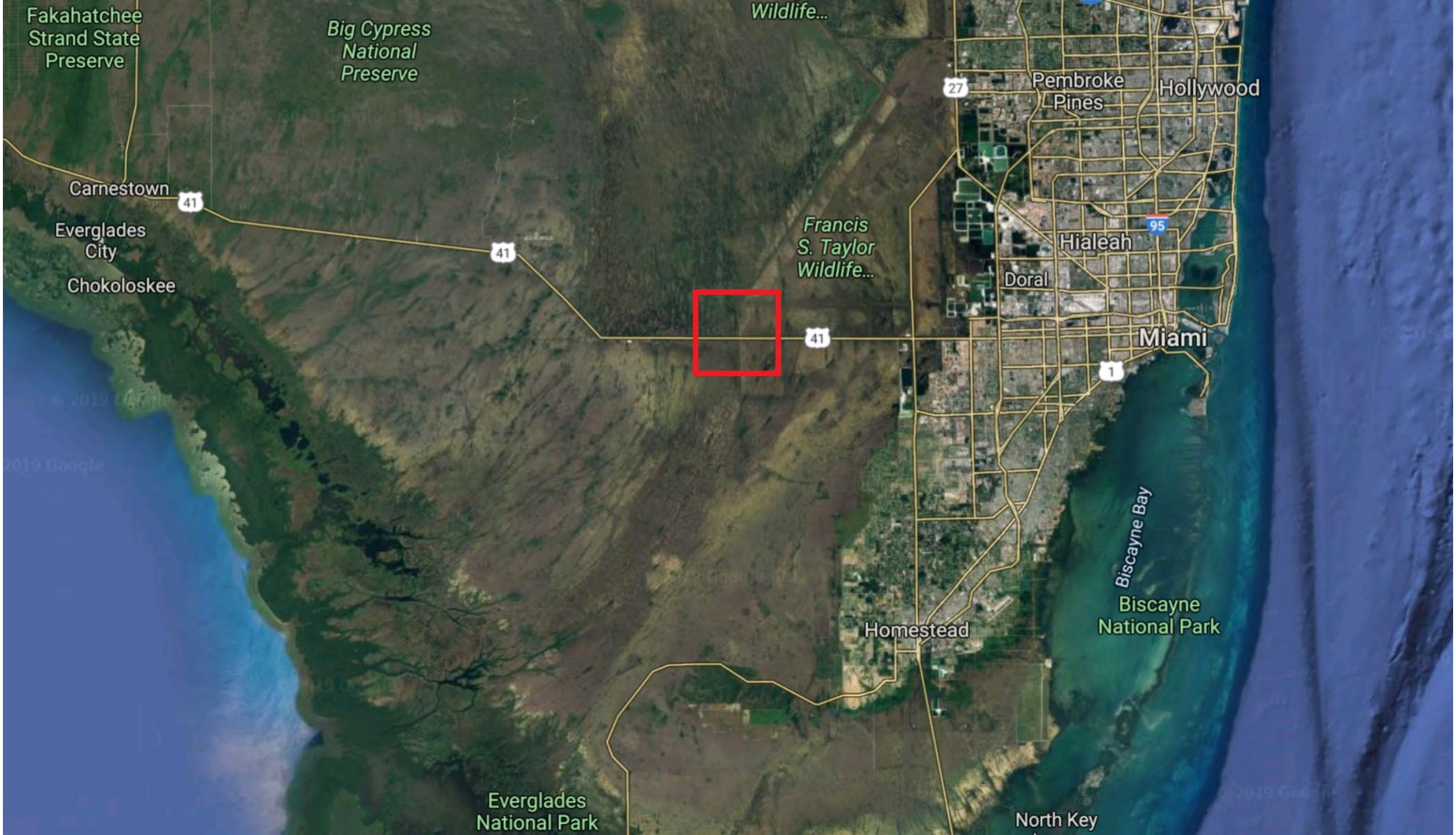
- Florida International University, Miami, FL, USA.

Project Objectives

- Study correlation between Total Phosphorous (TP) inflow into ENP as a function of canal water stages
- Use of water drones / autonomous surface vehicle (ASV) for bathymetric and velocity surveys to support modeling
- Apply a 2D Vertically Averaged hydrodynamic, pollutant and sediment transport model
- Ongoing project


Fakahatchee Strand State Preserve
Big Cypress National Preserve
Wildlife...
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Pembroke Pines
Hollywood
Carnestown
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Everglades City
Chokoloskee
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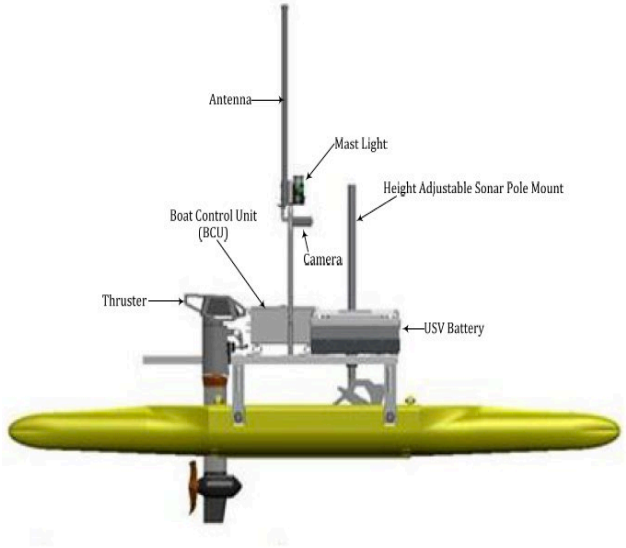
Francis S. Taylor Wildlife...
95
Hialeah
Doral
41
Miami
1
Biscayne Bay
Biscayne National Park
Homestead
Everglades National Park
North Key

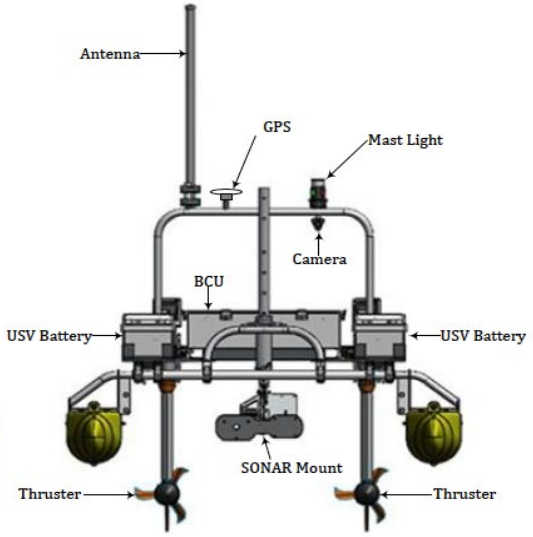
Everglades National Park, Florida, USA

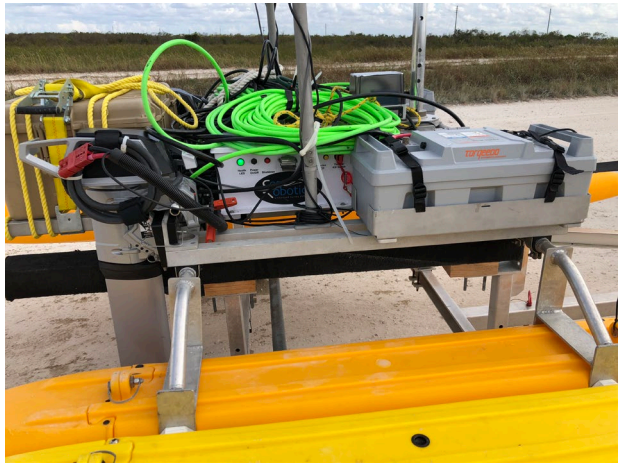
- How do sediment and pollutants flow into Everglades National Park?

LS67A Autonomous Surface Vehicle (ASV)

- Build at Florida International University
- SBG Ekinox-D INS/GNSS for autonomous navigation.
- Kongsberg M3 system Multi beam sonar
- Three broadband split beam Simrad EK80 scientific echo sounders
- Dual antenna GPS configuration
- The vessel follows a preprogramed path while recording data
- SBG transmits data in real time.



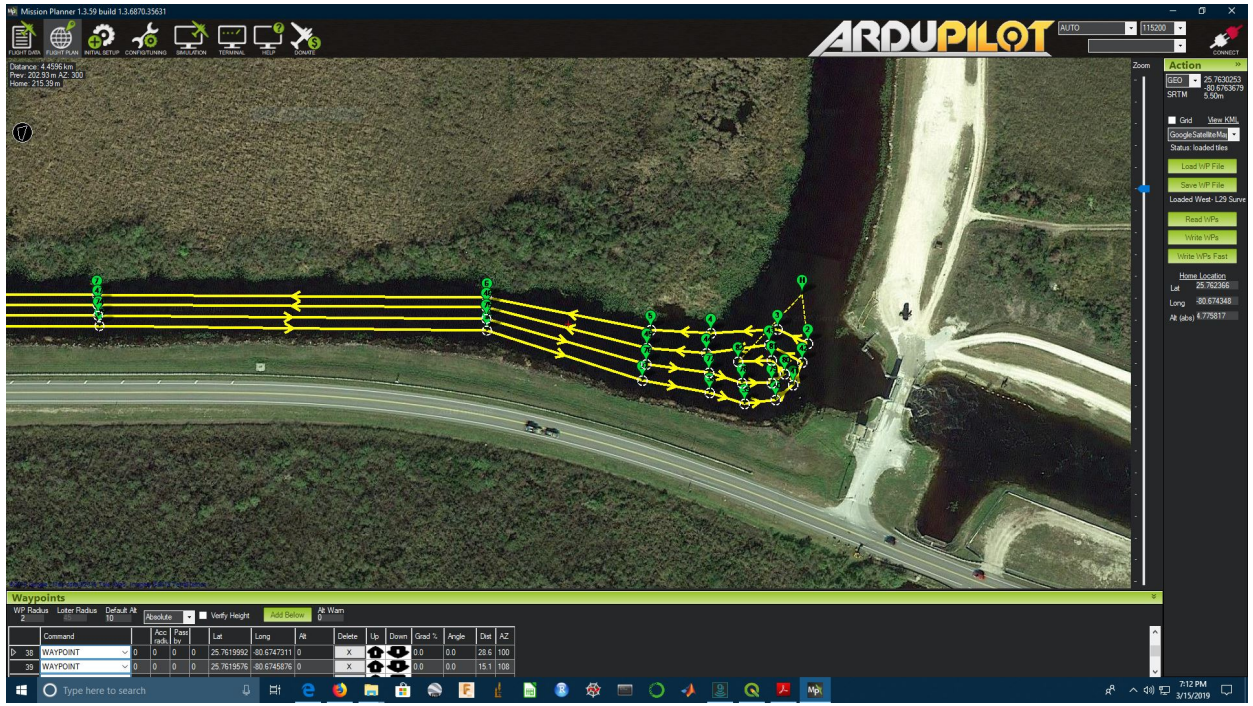


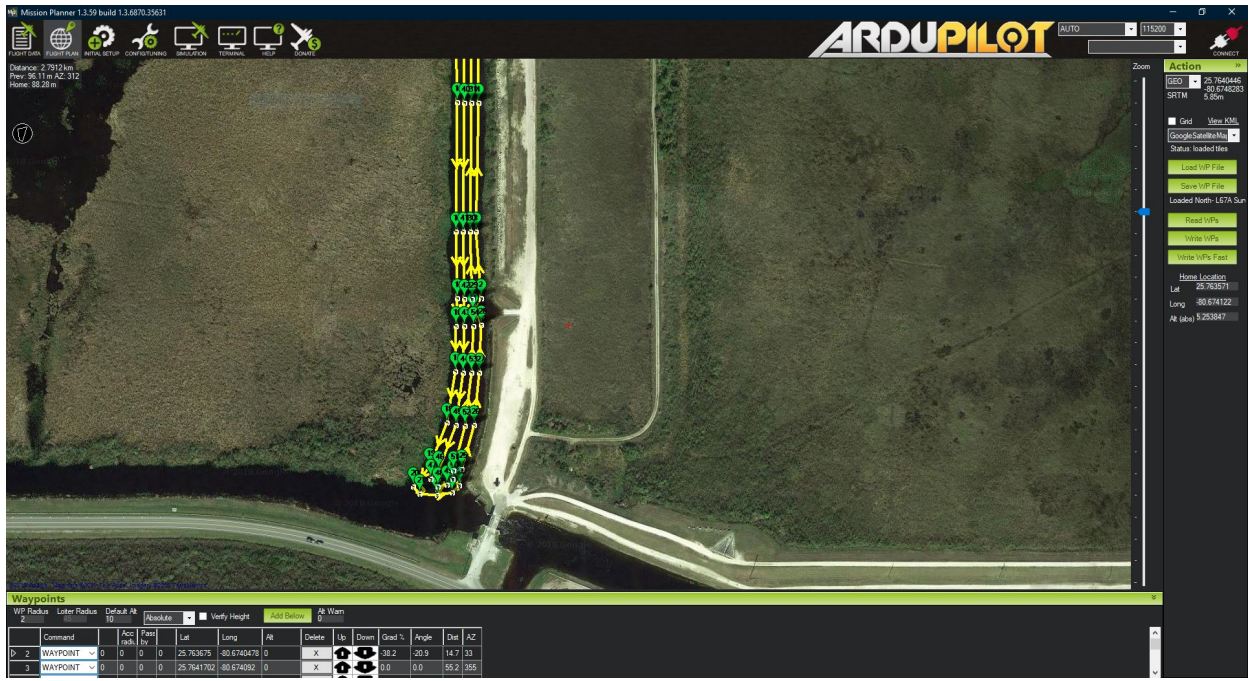


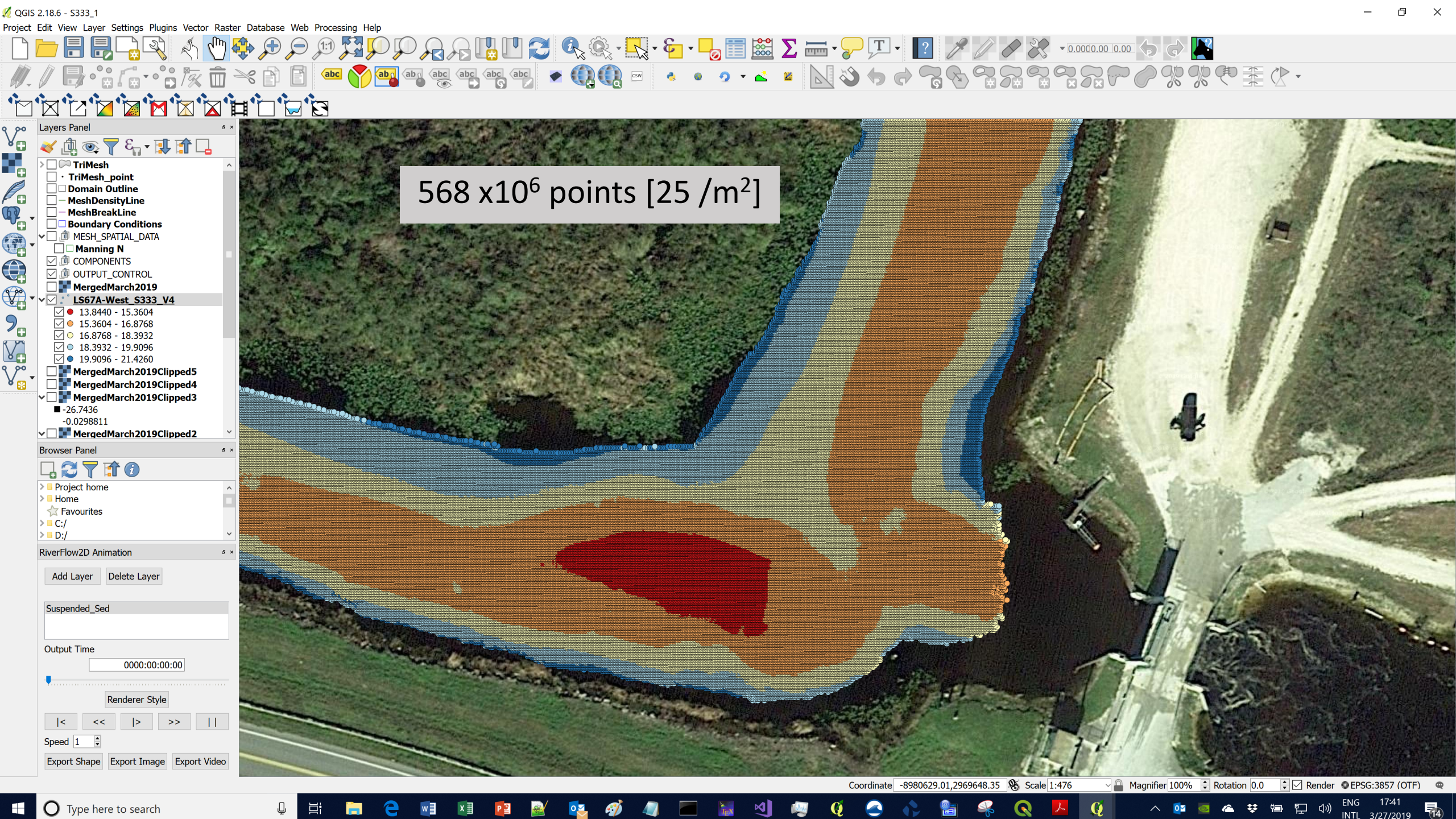
Track Plan

- To prepare the track plan we use ***Mission Planner***

- The way points generated from Mission Planner are loaded into the ***Sea Robotics*** software for translation and transmission to the ASV onboard computer.



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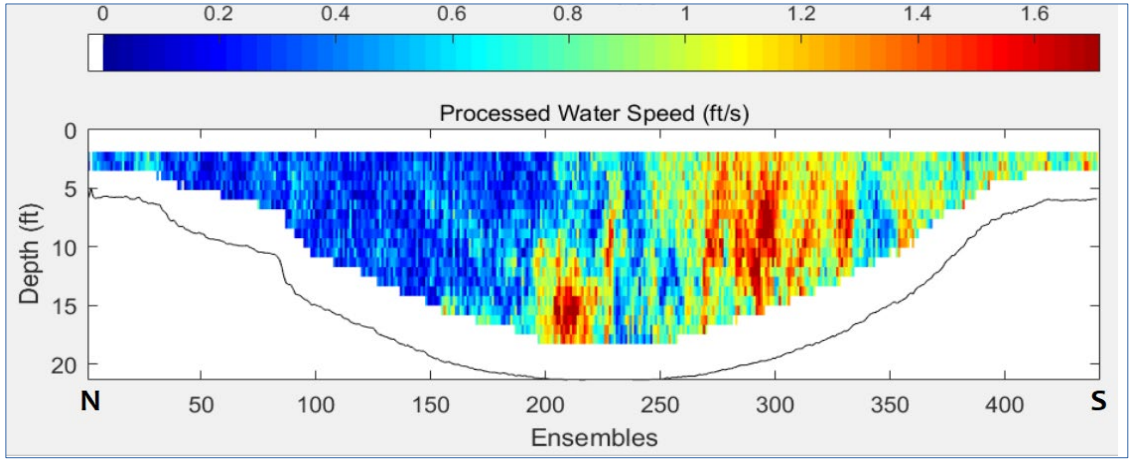
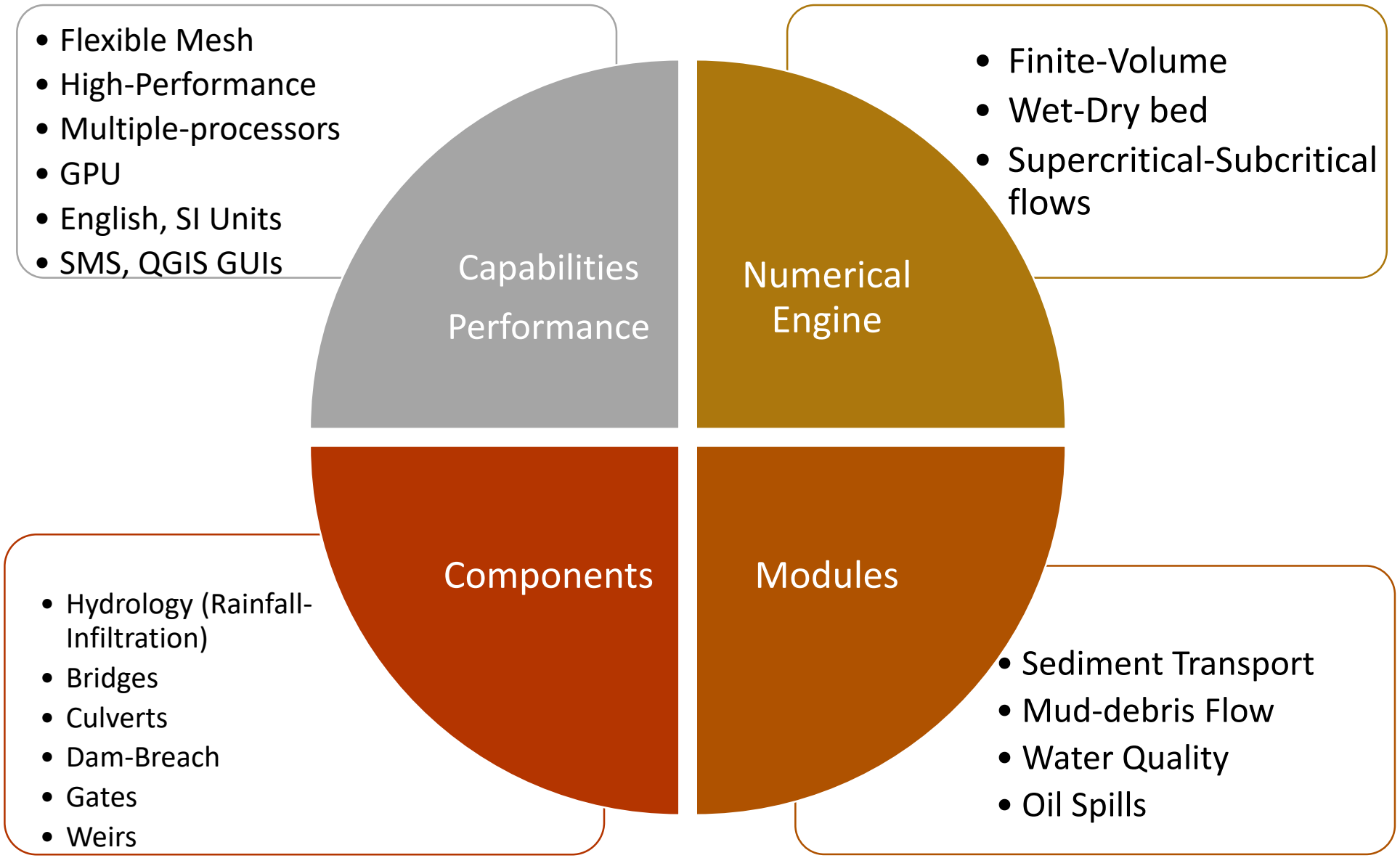
ADCP Measurements

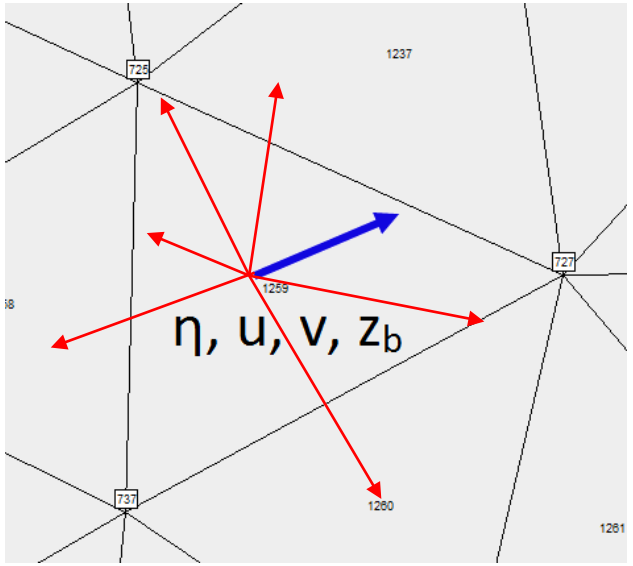
- Performed by the Everglades National Park Service
- Teledyne RD Instruments (TRDI) Riverboat with WorkHorse Rio Grande 1200kHz version 10.17
- Manually controlled tethered lines
- Realtime data monitoring via TRDI WinRiver II version 2.18 software
- Post measurement review with USGS QRev version 3.43 software



RiverFlow2D Hydrologic-Hydraulic Model



Flexible Mesh



Computational cell

GPU Speedups

GPU CARD	Number of Cores	Memory GB
GTX 1080 Ti	3,584	11
Tesla K80	2,496	12
Tesla P100	3,584	16
Tesla V100	5,120	16

Test 1: Run times for RiverFlow2D in different GPU hardware. Intel CPU corresponds to the non-parallelized model.

Mesh	No. Cells	Intel CPU	Tesla K40	Tesla K80	GTX 1080 Ti	Tesla P100	Tesla V100	Max Speedup
Mesh1	19,079	00:00:08:14	00:00:00:18	00:00:00:18	00:00:00:38	00:00:00:13	00:00:00:11	45x
Mesh2	154,880	00:03:23:47	00:00:02:42	00:00:02:38	00:00:02:44	00:00:01:24	00:00:00:51	238x
Mesh3	1,878,607	08:23:17:47	00:01:49:04	00:01:28:04	00:01:08:28	00:00:33:40	00:00:18:49	687x

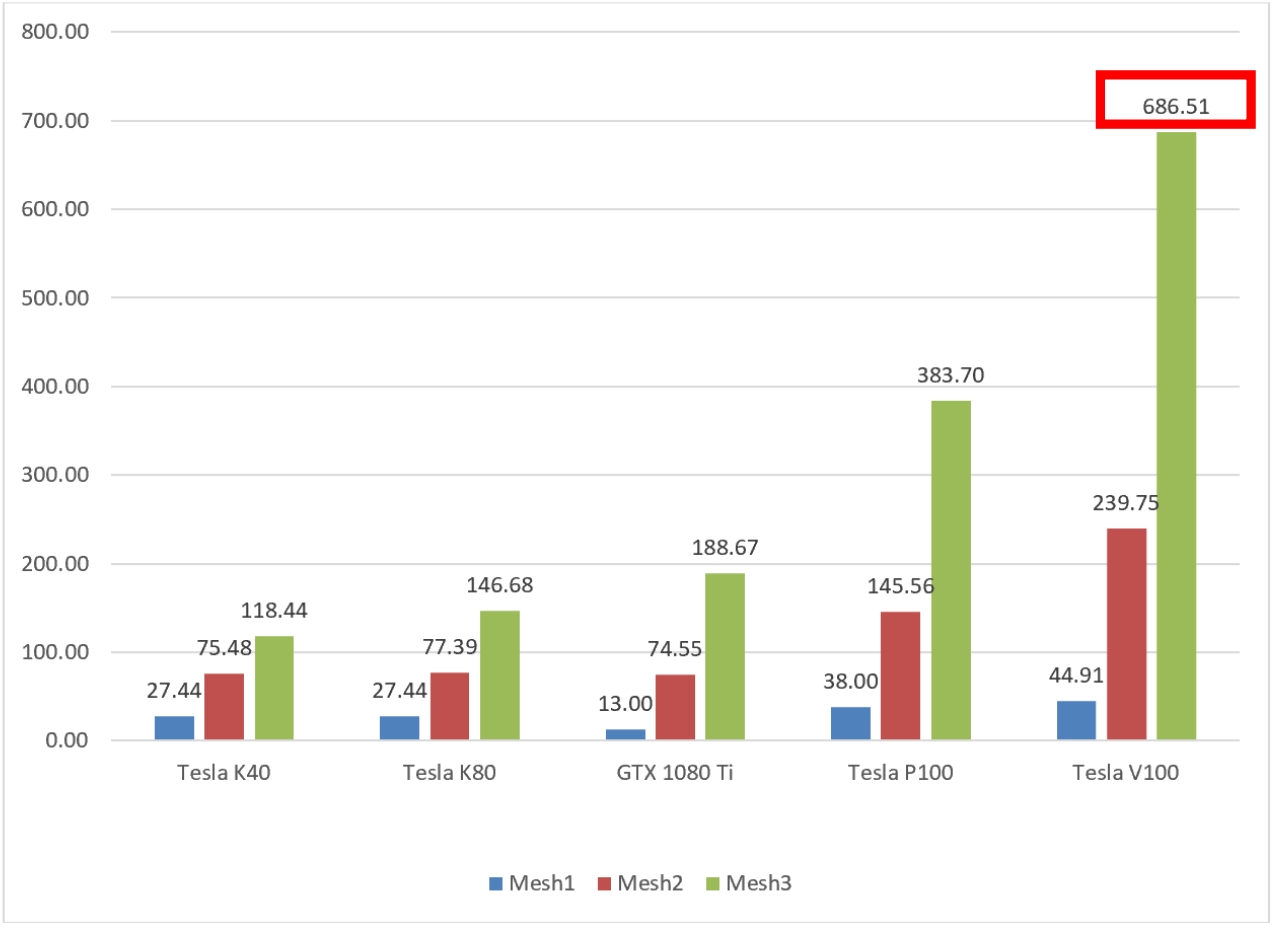
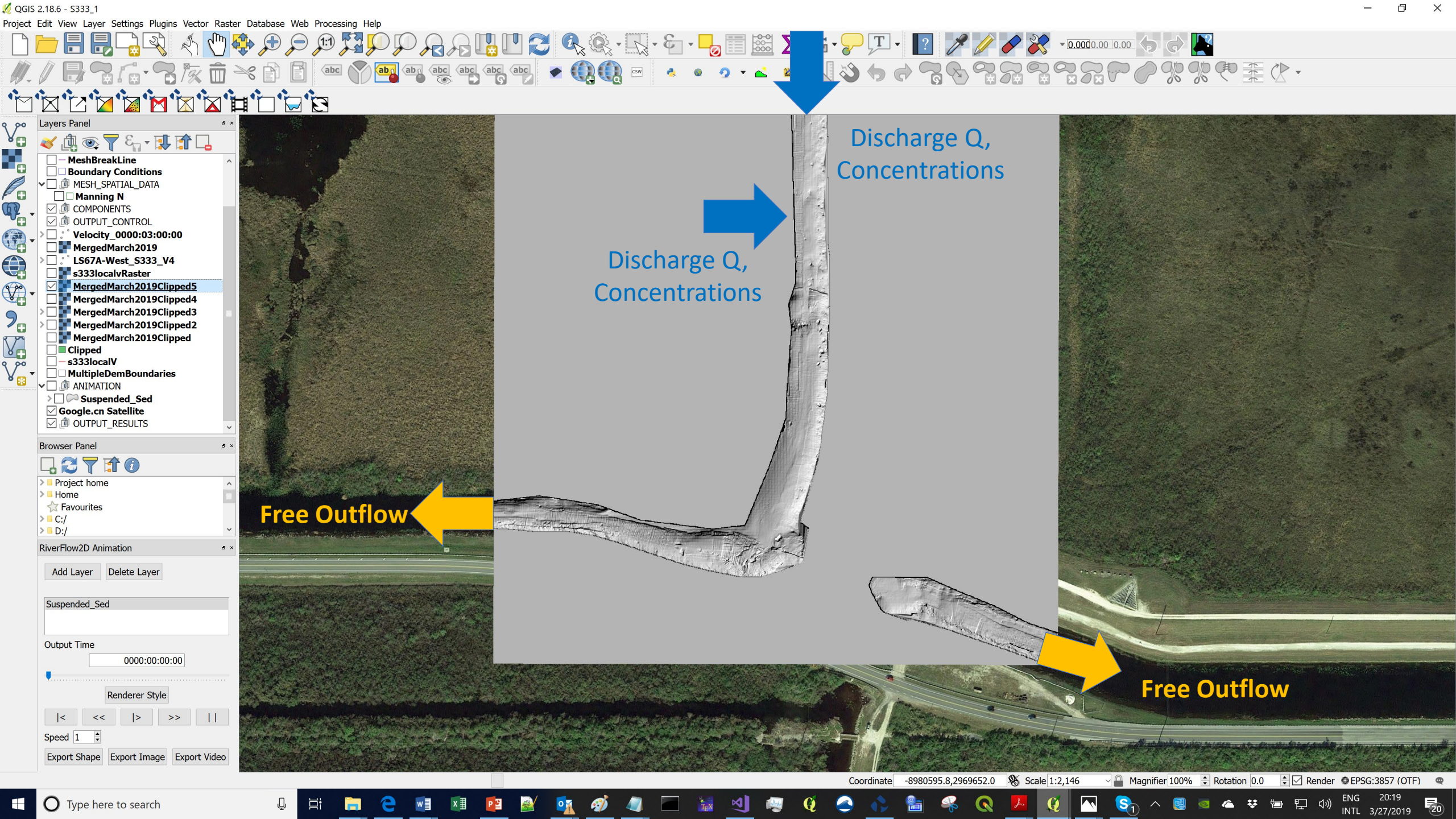


Figure 3 Test 1: Speed up of the GPU solution compared against the non-parallelized CPU version.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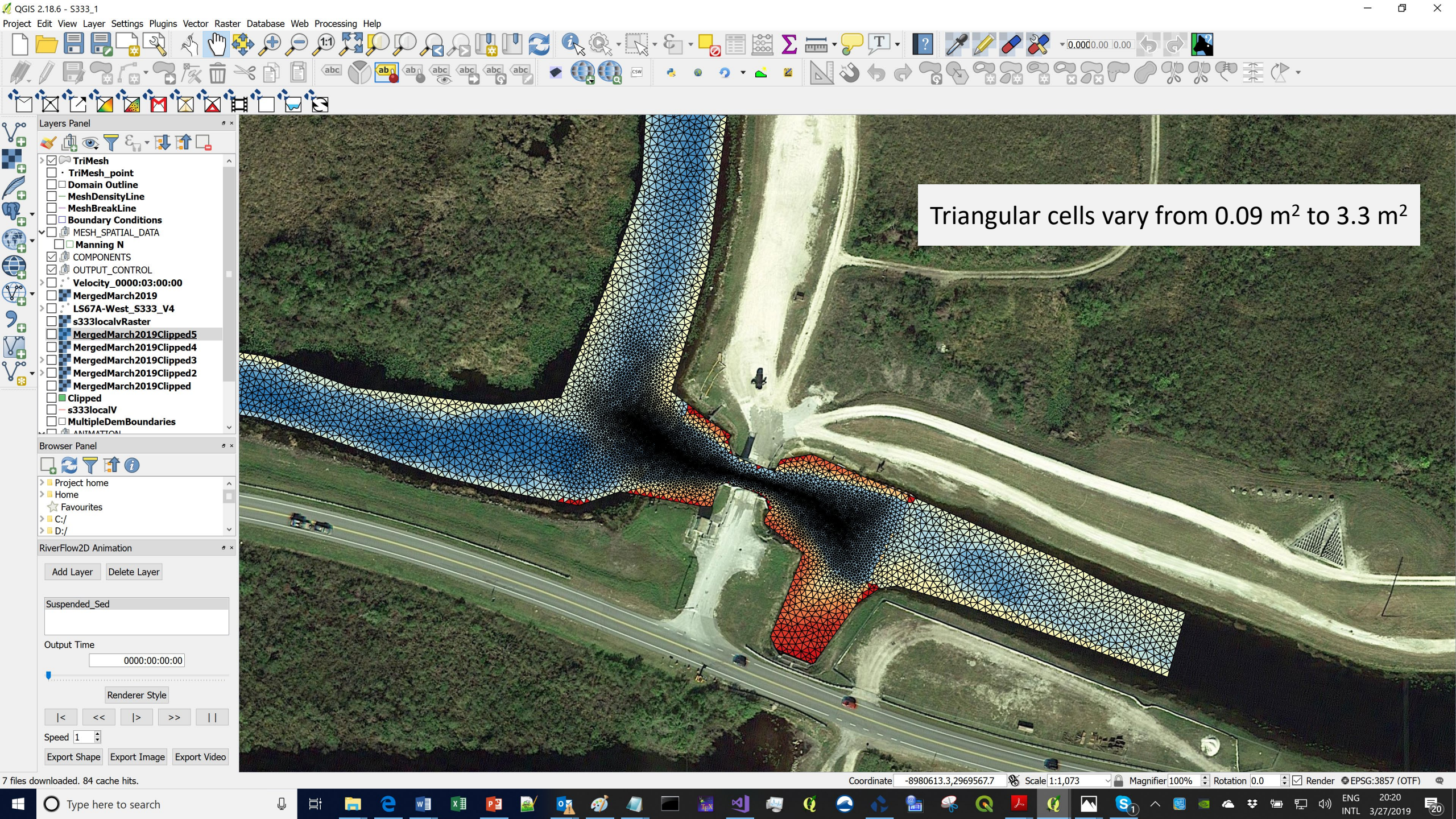
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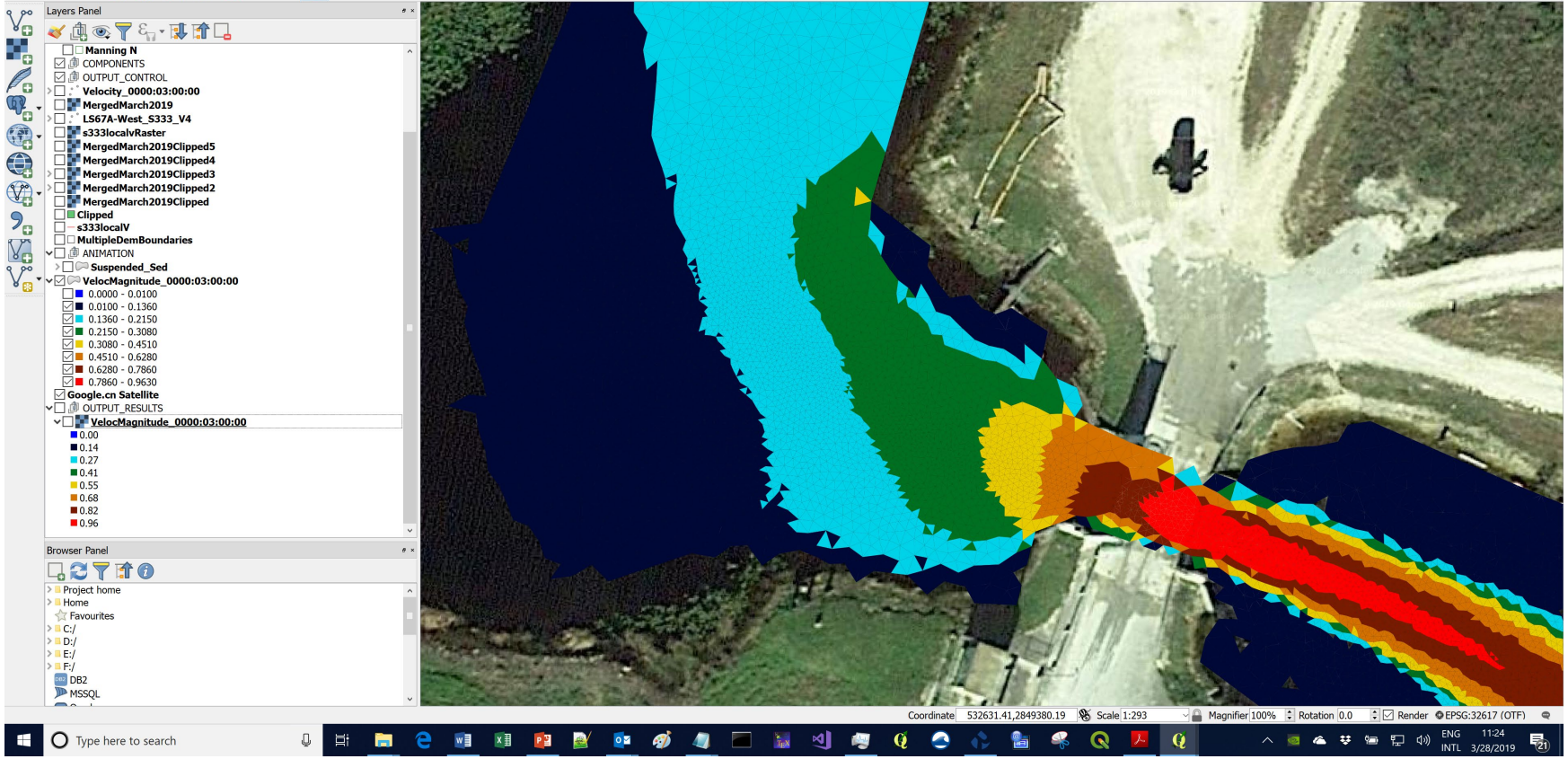
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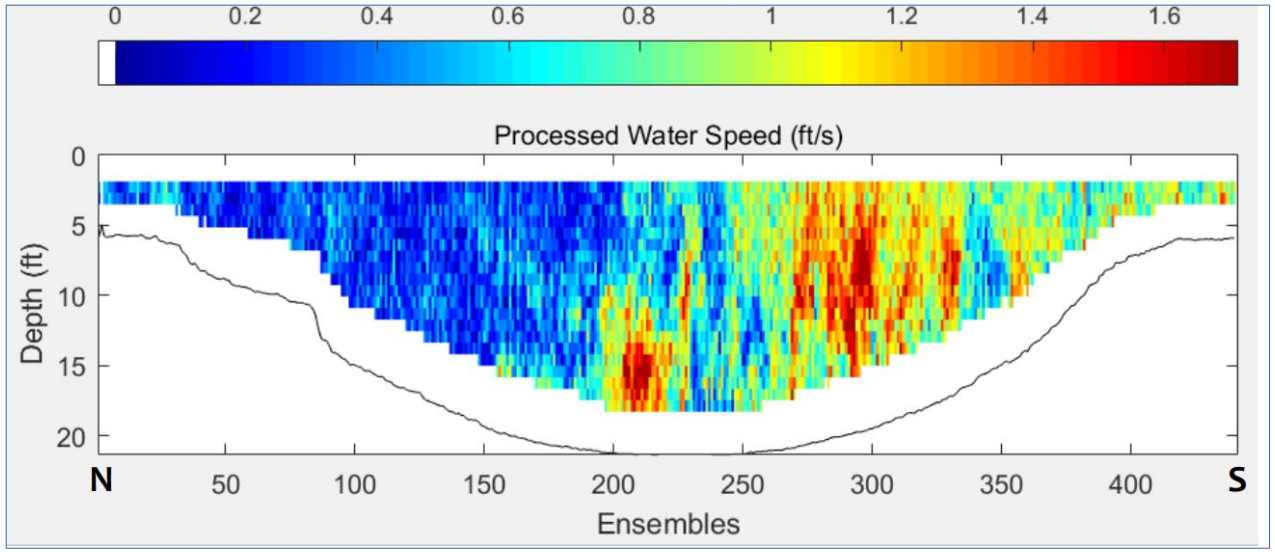
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0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Processed Water Speed (ft/s)
Depth (ft)
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QGIS 2.18.6 - S333_1

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Layers Panel

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Browser Panel

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RiverFlow2D Animation

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Speed 1

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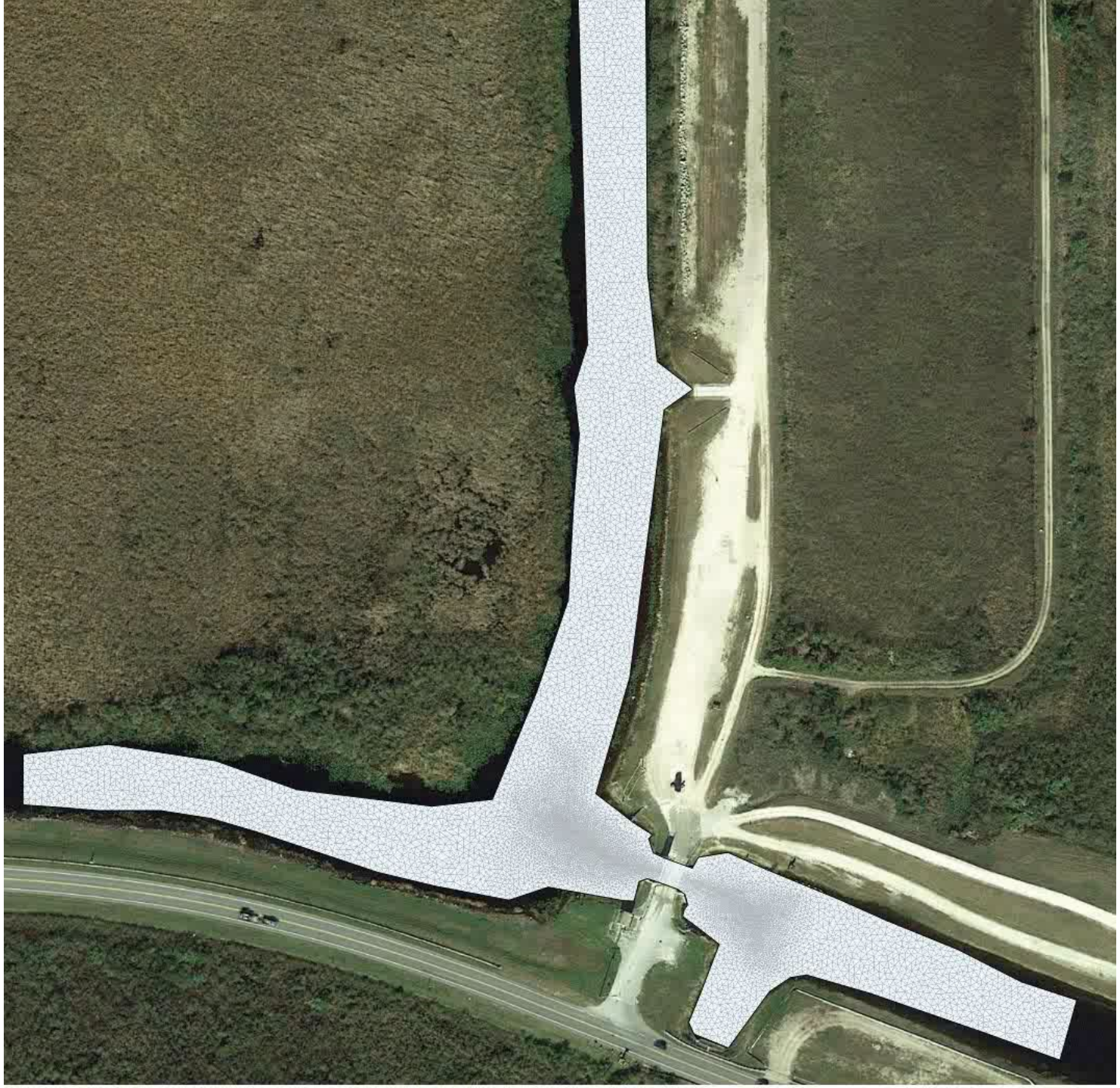
Suspended sediment concentrations



Thanks!

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