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Salish Sea Ecosystem Conference

2018 Salish Sea Ecosystem Conference
(Seattle, Wash.)

Apr 4th, 3:45 PM - 4:00 PM

Structure from motion on Salish shores: remote mapping for restoration

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Structure from Motion on Salish Shores: Remote Mapping for Restoration

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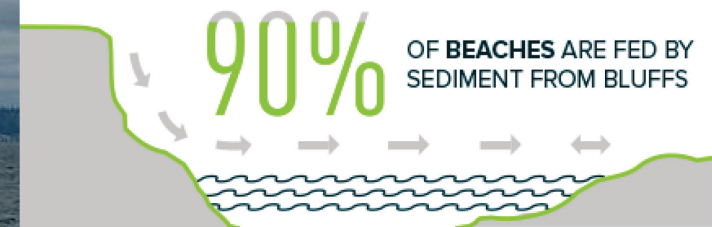




Beaches in the Region: Why Care?

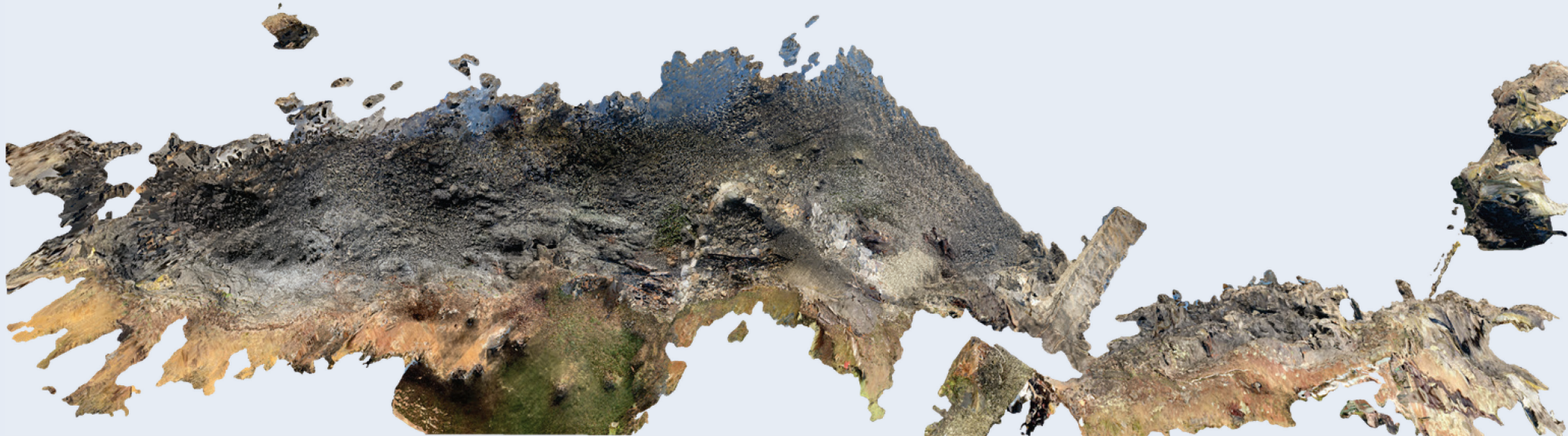
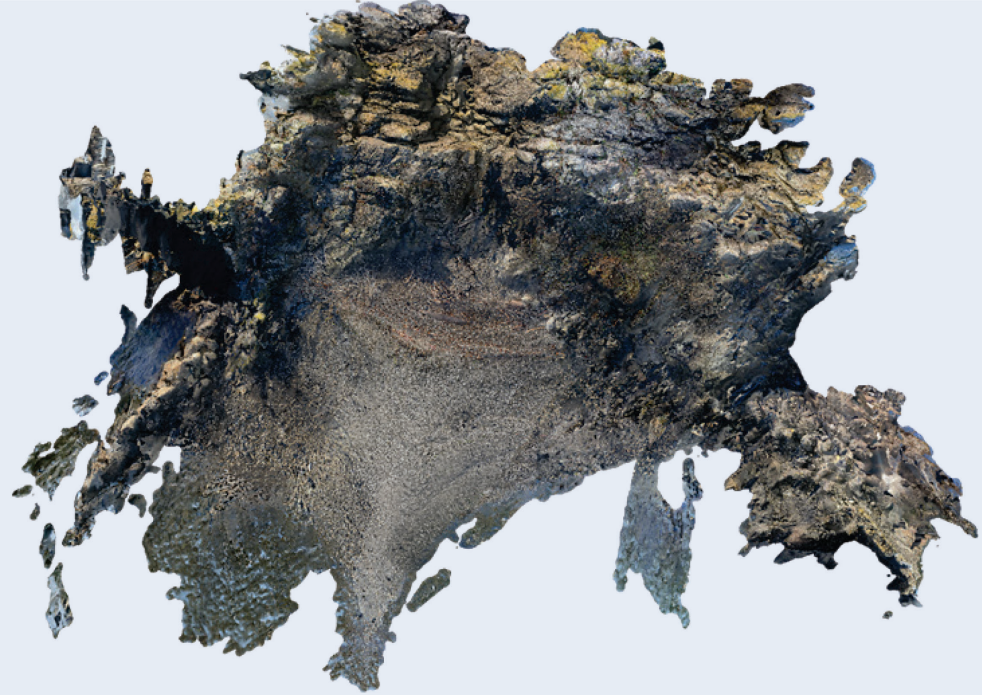
- No coral, not much sediment from rivers
- Feeder bluffs supply ~90% Salish Sea beach seds
- Natural gravel required for forage fish spawning
 - Surf smelt, sand lance, herring
 - Messed up by bulkheads, seawalls, etc.
- Forage fish a keystone species; food for salmon
 - Also food for seabirds and marine mammals

Natural beaches are critical to Puget Sound biodiversity.

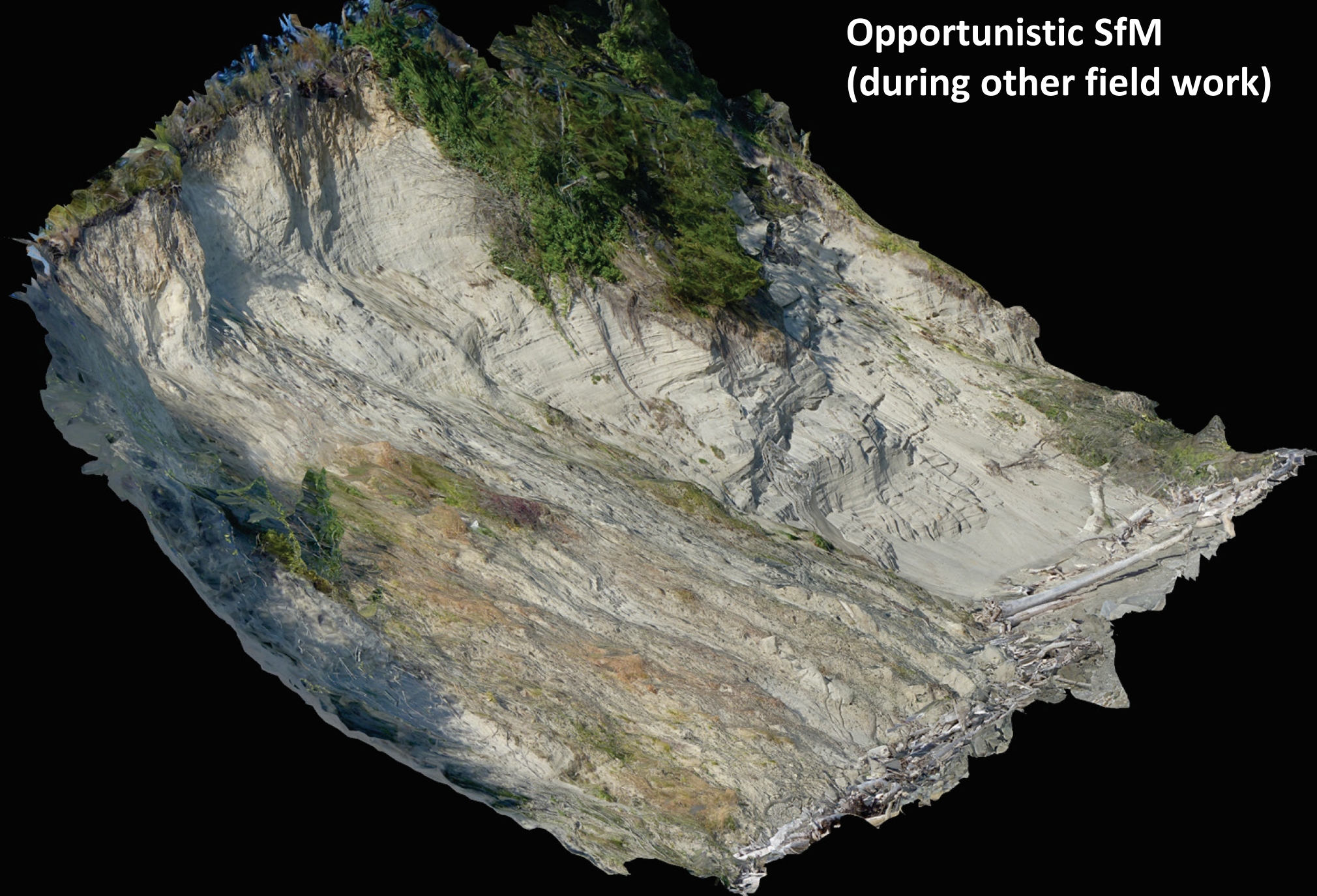


Path to Acceptance of SfM

- Limited R&D in a seven-person company
- Kites, camera-on-a-stick, ground photos
- Initial efforts quick and dirty
- Long path to billable UAV work



**Opportunistic SfM
(during other field work)**

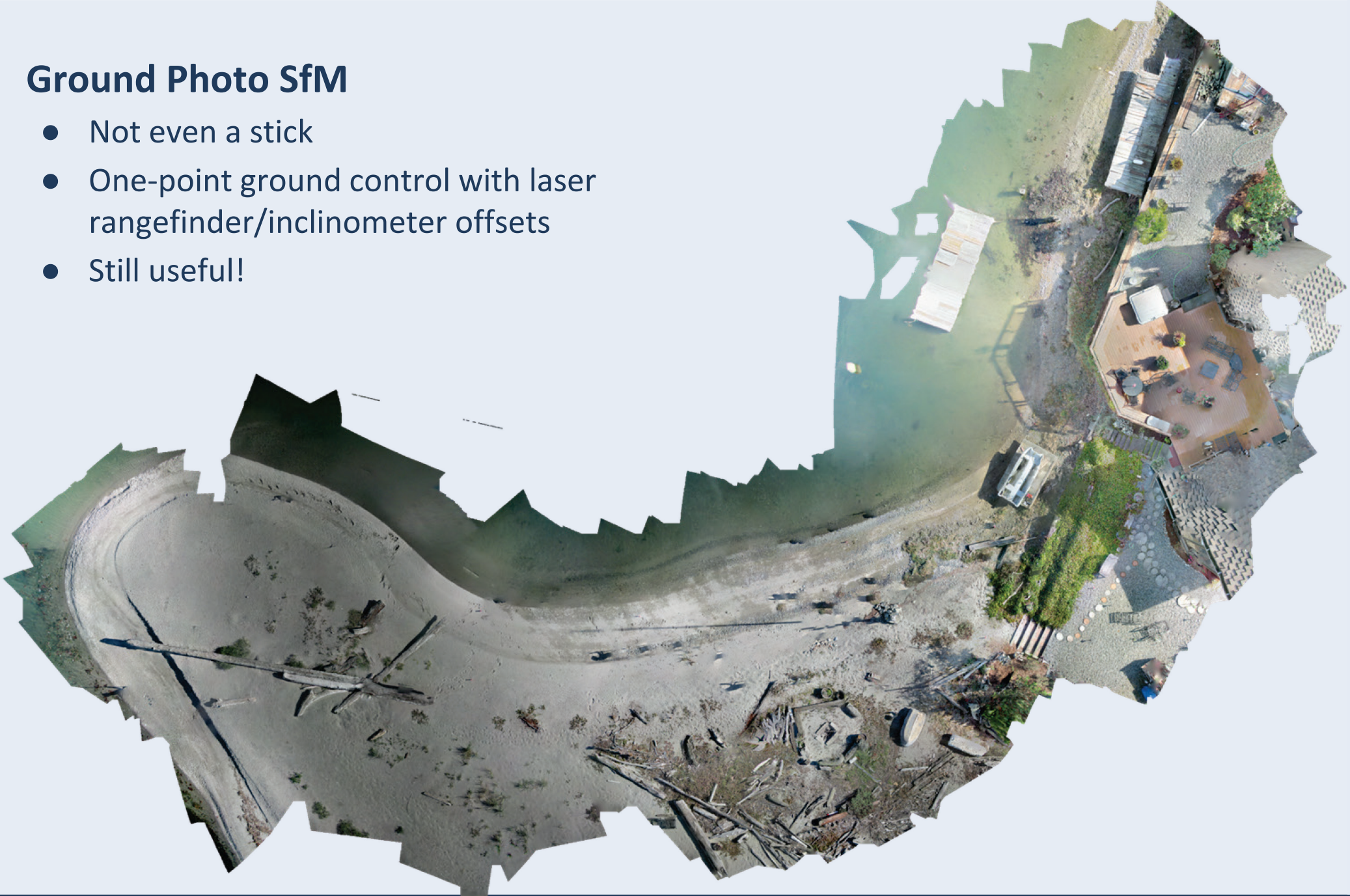


SfM with Others' Aerial Photos



Ground Photo SfM

- Not even a stick
- One-point ground control with laser rangefinder/inclinometer offsets
- Still useful!



Internal Research and Development Report

Why Structure from Motion? When?

Structure from motion is a cutting-edge 3D imaging tool that other folks are successfully using to study geomorphology. It's accessible, quick, and gives results that fill a gap between other techniques. It won't replace any other technique, just like a handheld Trimble GPS doesn't replace a total station.

	Total Station Survey	Structure from Motion	LiDAR
Resolution	Very low	Highest	High
Precision	Very high	Varies a lot	High
Color texture map	No	Yes	No
CGS can do	Yes	Yes	No
Staff time	High (2 simultaneous)	Moderate	N/A
Works underwater	Yes, to ~4 feet	No	Not really

Photos can be taken quickly, during currently scheduled site visits. A small site might take 20–30 minutes. A decision can be made later about whether to build a SfM model—the time-consuming part.

SfM Compared to Total Station

- Demonstrated better resolution
- Caught a missed inflection

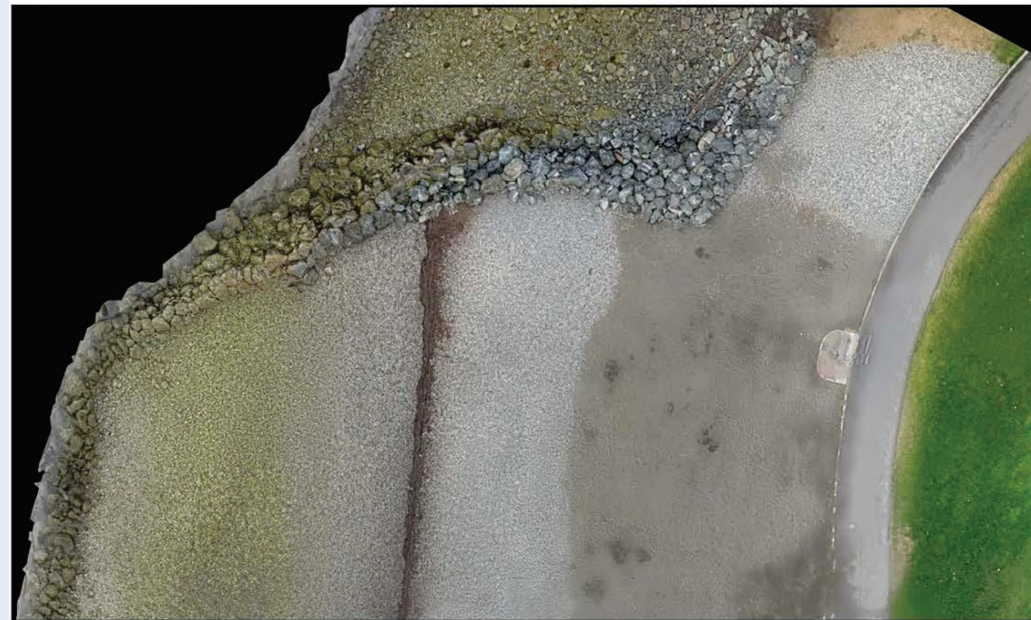
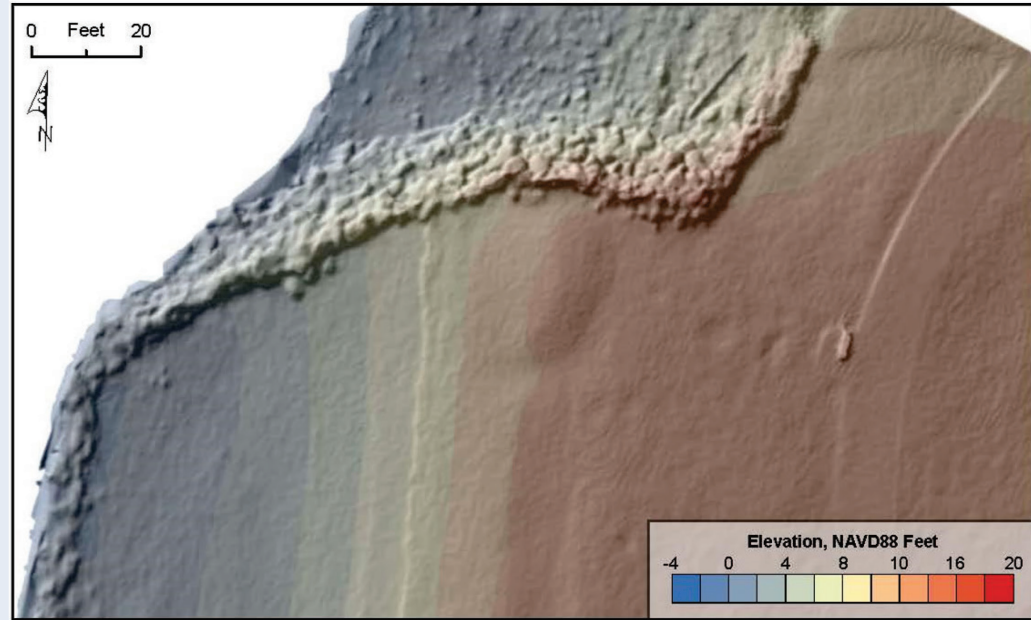
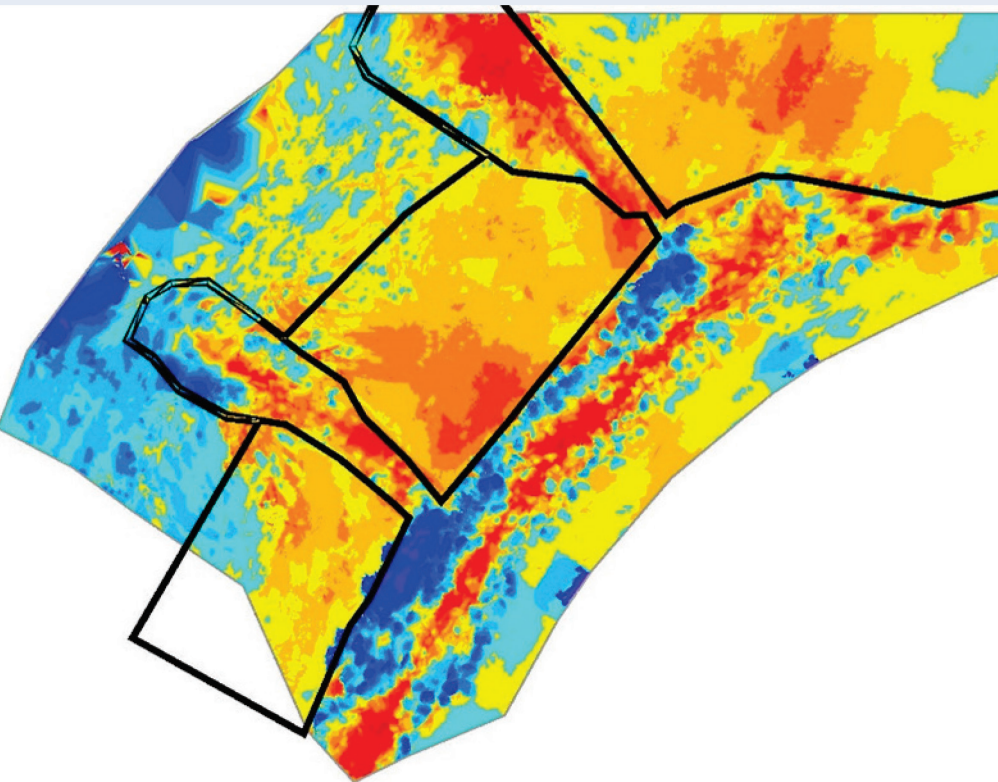
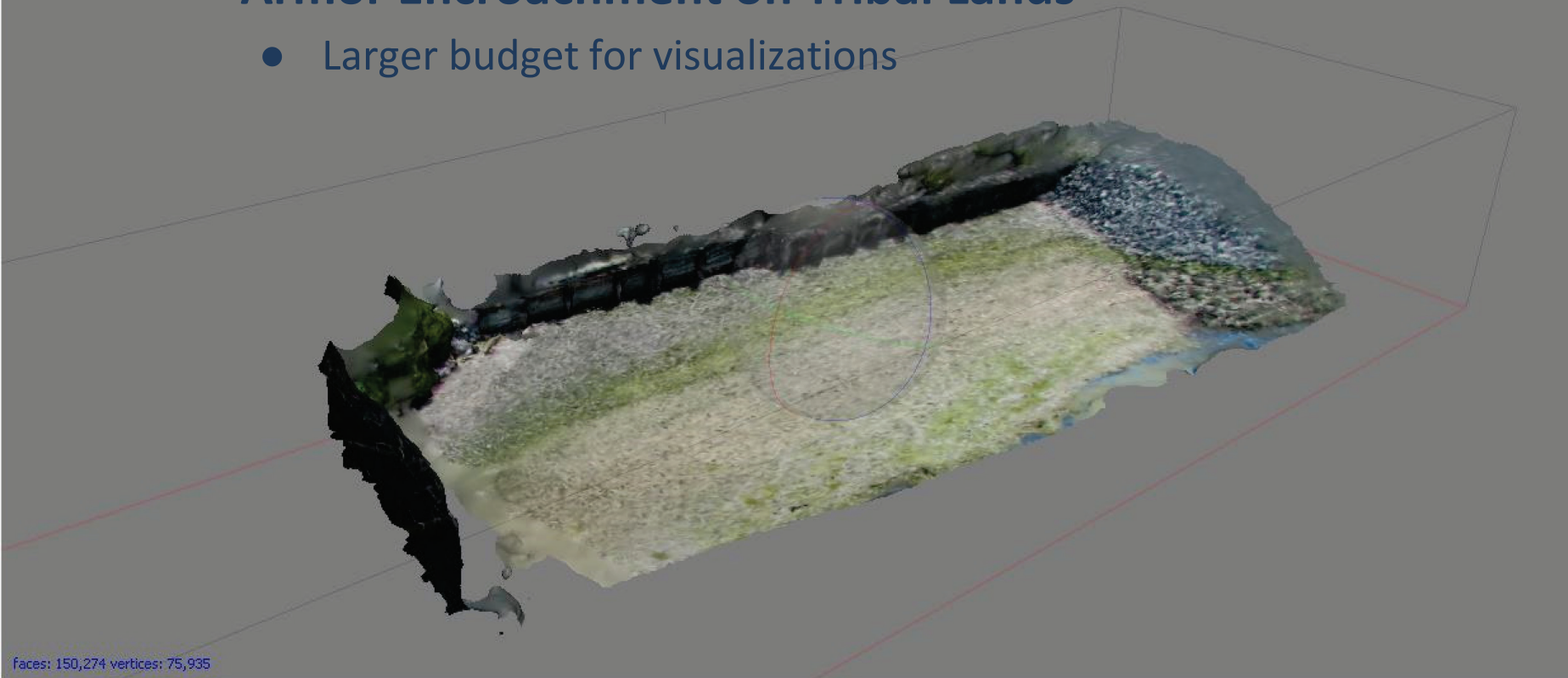


Figure 1. Topography (top) and orthomosaic (bottom) of Boulevard Park drift sill reconstructed from 386 aerial photos using *structure from motion*.
Boulevard Park, Bellingham



Armor Encroachment on Tribal Lands

- Larger budget for visualizations



Faces: 150,274 vertices: 75,935

Photos



SfM to CAD + 3Ds

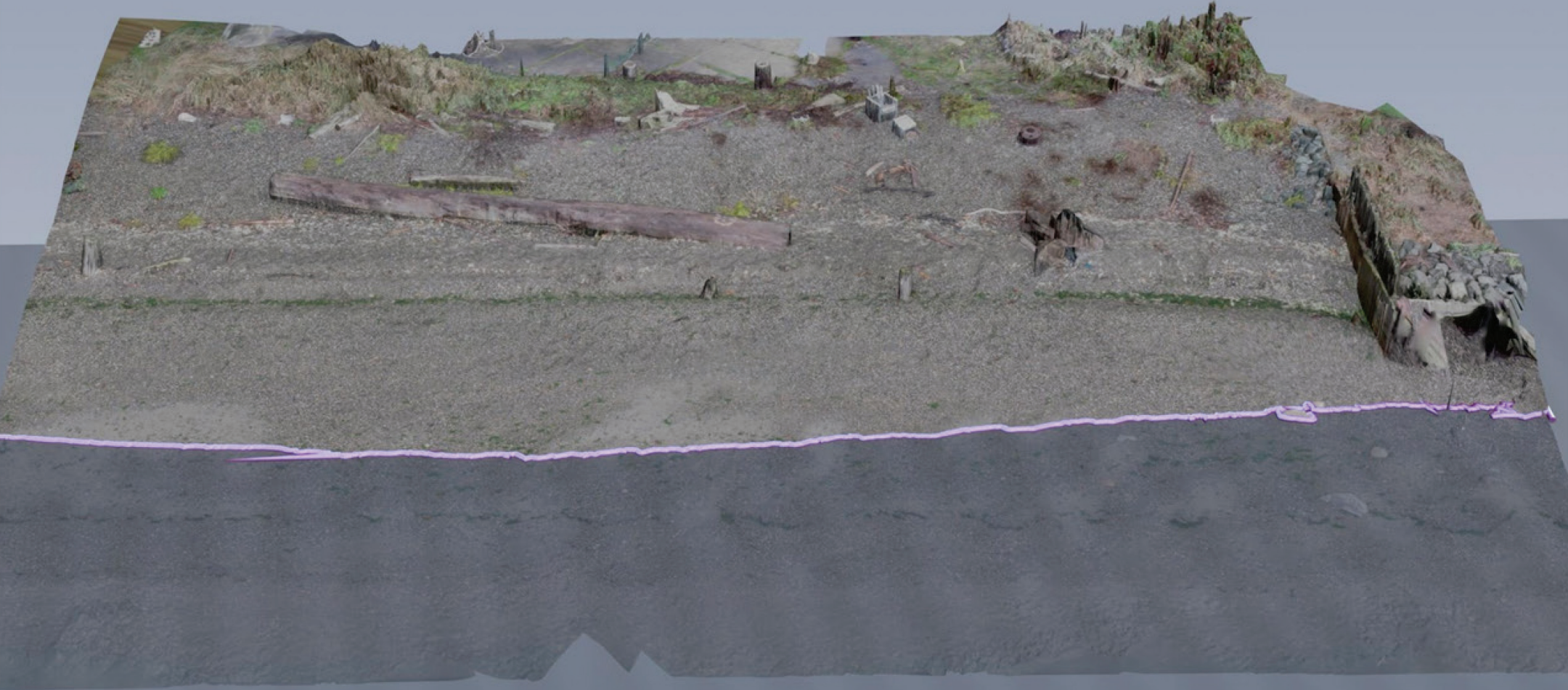
- Very good vertical essential
- GCP from licensed surveyors



Armor Encroachment on Tribal Tidelands

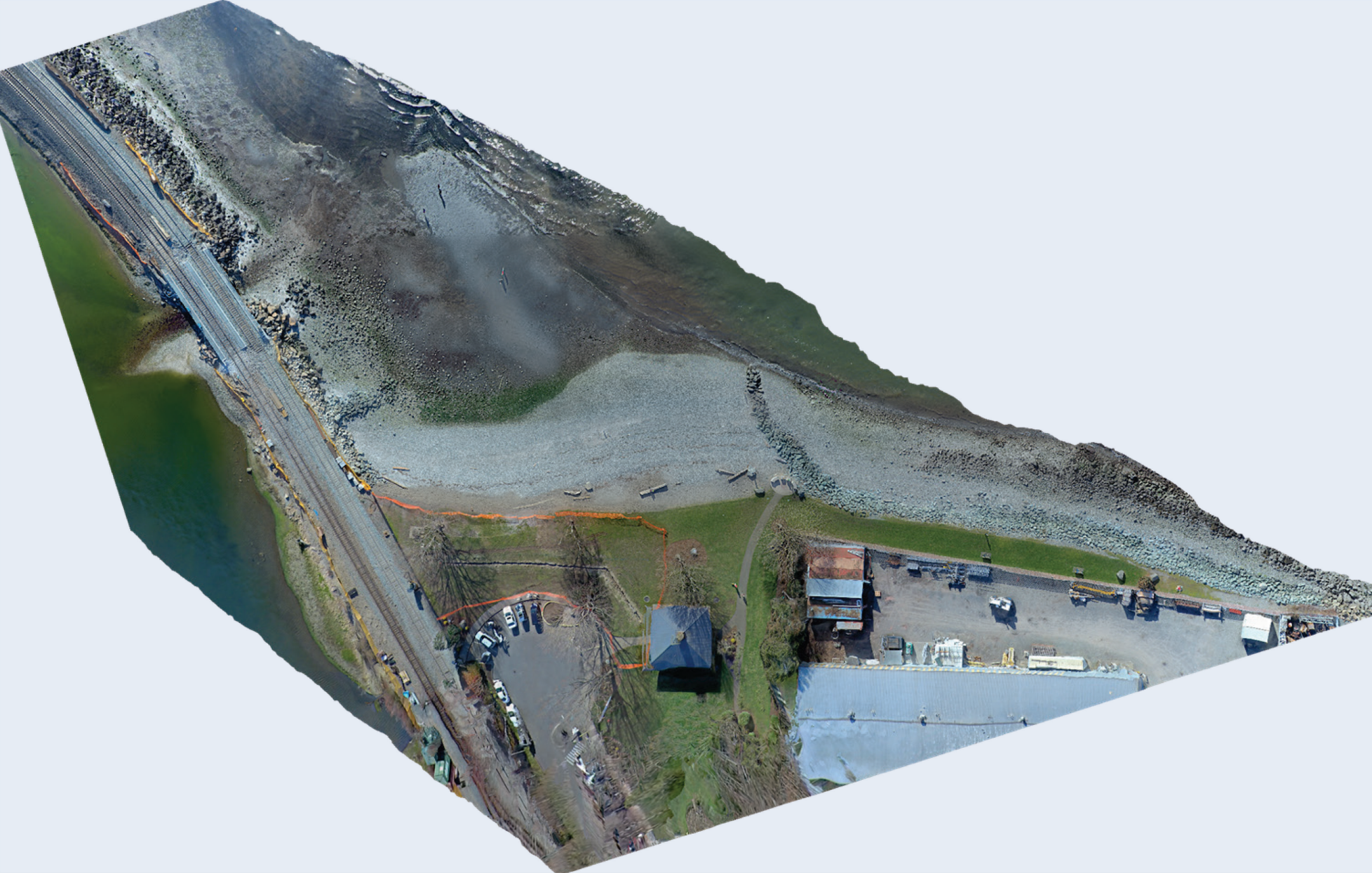


Reference Beach



Drone!





Fun mapping for future change

- Future park on fill
- Planned beach restoration
- Future sailing facility?



Eelgrass Mapping

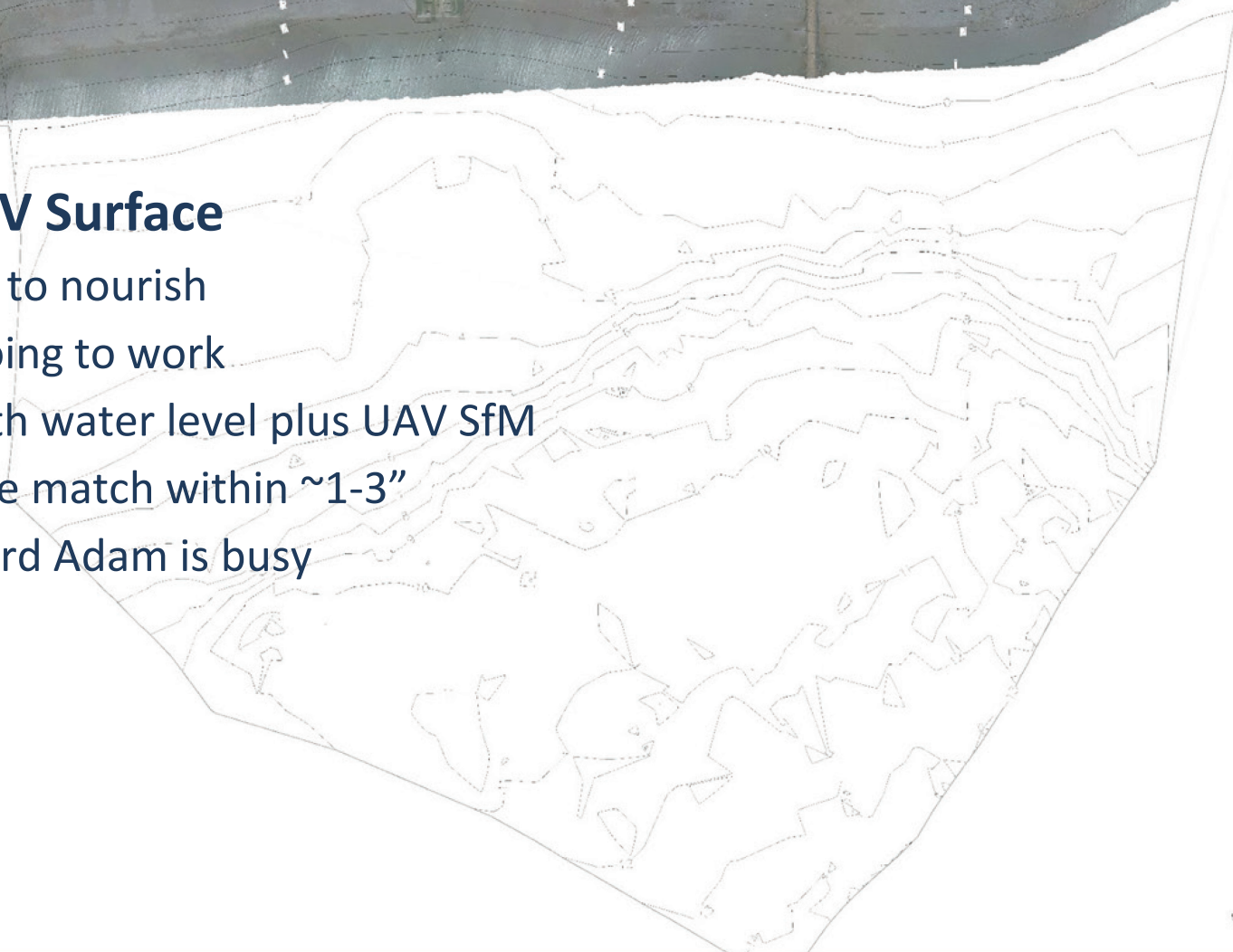
- Good enough for pre-design





Sonar + UAV Surface

- Dredging to nourish
 - Not going to work
- Sonar with water level plus UAV SfM
 - Surface match within ~1-3"
- CAD wizard Adam is busy



REVISIONS	
DRAWN BY:	
DESIGNED BY:	
CHECKED BY:	
DATE SURVEYED:	
SURVEYED BY:	

Port of Silverdale
Dredging Plan - 2017

MHW=0.0 FT MLLW=10.85 FT
SCALE: AS SHOWN
DATE: 5/25/2016
SHEET: 1
CR: 3





Orthomosaics Most Useful?



Lummi Shore Road

- 5.5 miles long, stitched
- 7 field days
- PPK GPS ground control
- Lower target resolution
- During BC fires!



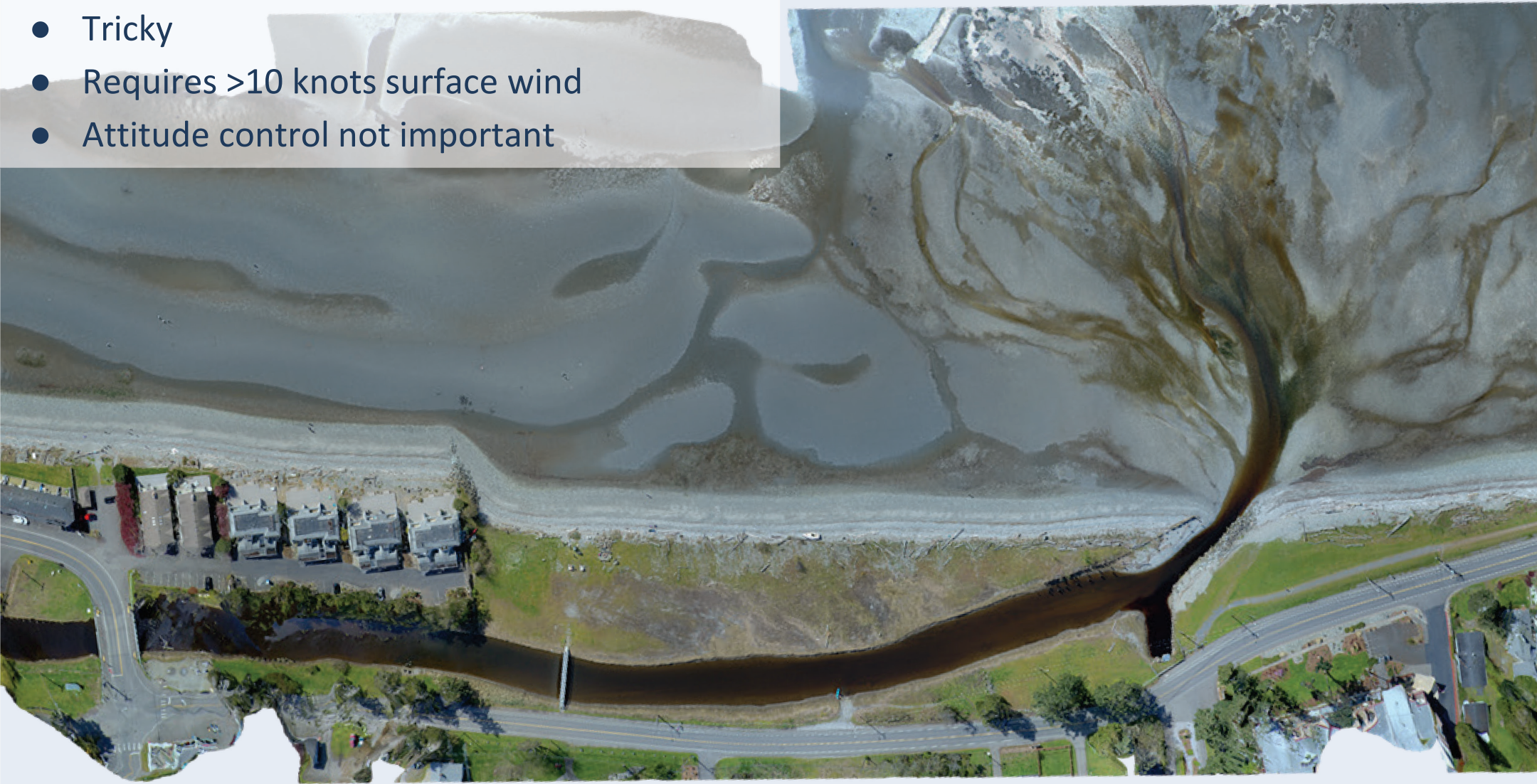


Homeowner Scale

- Precise quantities
- Nice views
- Techy!

Kite Photos where UAVs Not Permitted

- Cheap
- Tricky
- Requires >10 knots surface wind
- Attitude control not important



Upcoming Work

- Wavelet analysis of surface grain size
- Sediment budgets
- Possible bathymetry
- Immersive visualizations in Unity
- Alpine forest mapping (me but not CGS)
- Automated armor extraction?



Questions?