Implementation of a Field Mobile Data Collection Program: A Case Study

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LANGAN

esri Partner Network Silver

earthsoft Business Partner Program

Agenda

- Background
- Project Specifics
- Workflow Development
- Considerations
- Results

Background

- Multi-disciplinary firm founded in 1970
  - 31Offices (International)
  - 1000 Employees
- Corporate initiative included a focus on data management and mobile data collection solutions
- Needed a project with ongoing field work and with multiple staff to test new tools
  - Goal was to perform a before and after comparison

Project Specifics

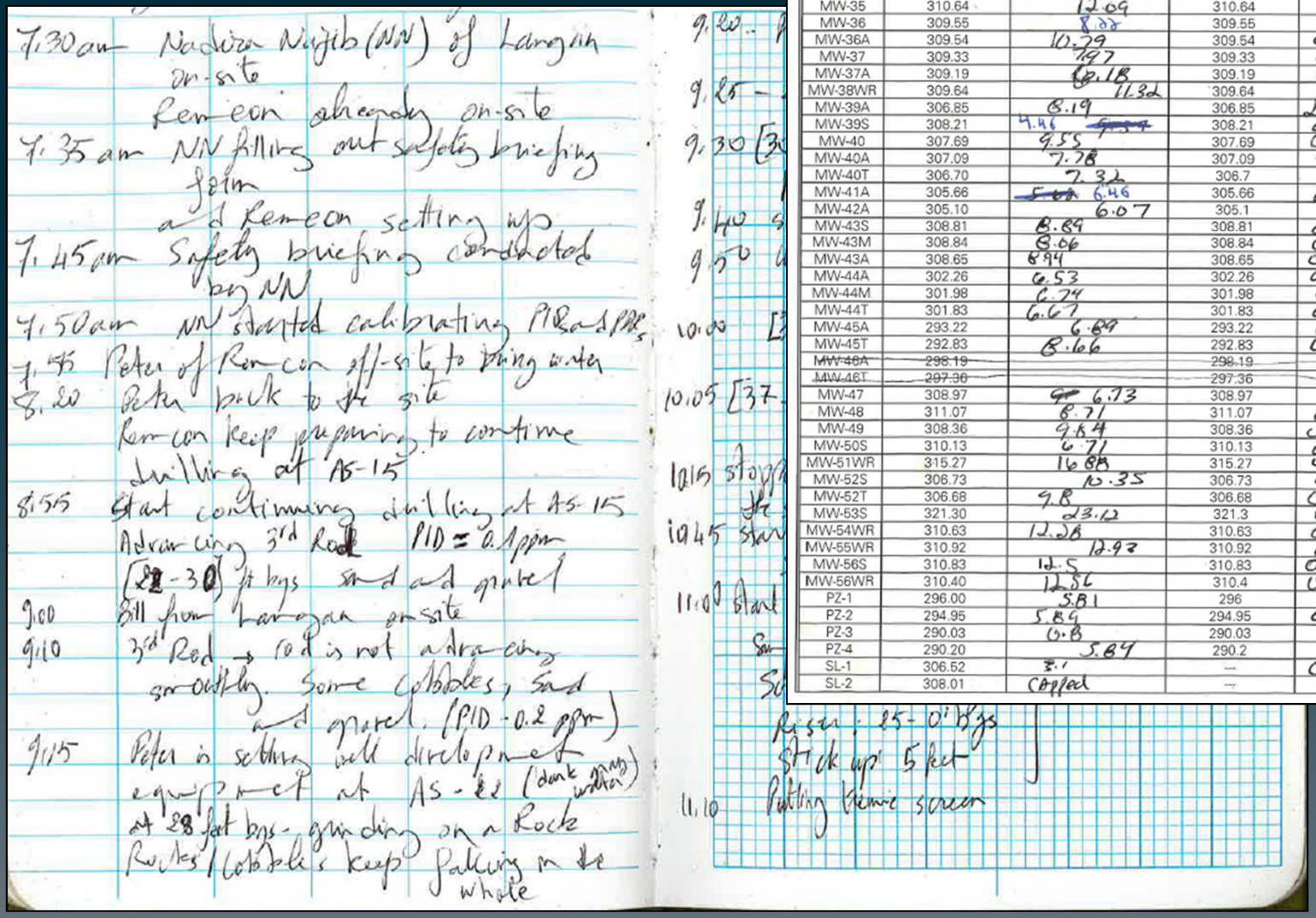
- Former chemical manufacturing facility
  - 30+ acres (12 AOCs)
    - 101 monitoring wells
    - Groundwater sampling event
    - 3 SVE system installations
  - Field team of 5 staff and 1 field team lead
    - Field experience range 1 – 46 years
    - Variable comfort level with mobile tech
  - Client requires daily updates of progress

Old Workflow

- Hand written documentation
  - Field books and paper forms
  - Calculations performed manually
  - Photos taken with camera
- Manual review
  - Field lead reviews all forms for completeness and correctness
- Staff transcription into Excel
  - Photos added to Word and comments transcribed
- Final QC by staff

- Highly inefficient and lots of room for errors

Old Workflow

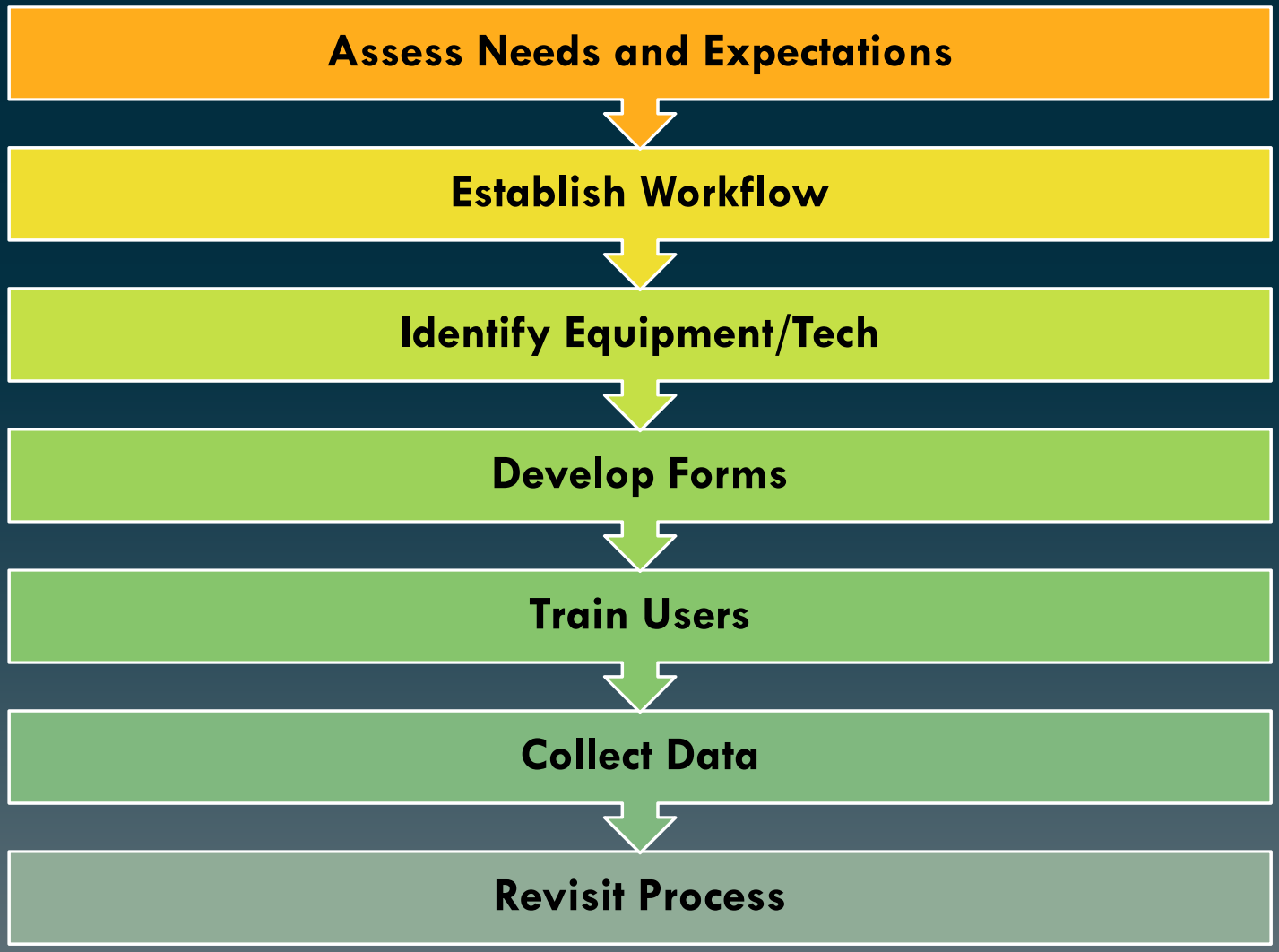


7:30 am Nadira Najib (NN) of Langan on-site
Rem-con already on-site
7:35 am NN filling out safety briefing form
and Rem-con setting up
7:45 am Safety briefing conducted by NN
7:50 am NN started calibrating PIDs and PRs
7:55 Peter of Rem-con off-site to bring water
8:20 Peter back to the site
Rem-con keep preparing to continue drilling at AS-15
8:55 Start continuing drilling at AS-15
Advancing 3rd Rock PID = 0.1 ppm
[28-30] ft bgs sand and gravel
9:00 Bill from Langan on-site
9:10 3rd Rod → rod is not advancing smoothly. Some cobbles, sand and gravel. (PID - 0.2 ppm)
9:15 Peter is setting well development equipment at AS-22 (dark water) at 28 feet bgs - grinding on a Rock
Rocks/cobbles keep falling in the whole

9:20 ...
9:25 -
9:30 [3
9:40 s
9:50
10:00 [3
10:05 [37
10:15 stopp
10:45 star
11:00 Start
Sa
Sc
Risen: 25-0" bgs
Stick up: 5 feet
11:10 Putting sieve screen

Well	Top of Casing Elevation (ft.)	Depth to Ground Water (ft)	Ground Water Elevation (ft)	PID Reading (ppm)	Aquifer Material
MW-26S	297.74	9.9	297.74	0	Alluvial
MW-27S	298.81	5.18	298.81	0	Alluvial
MW-27M	299.51	4.68	299.51	0	Upper Glacial
MW-27T	299.67	4.54	299.67	0	Deep Glacial
MW-28A	309.83	9.28	309.83	0	Deep Glacial
MW-29A	309.75	7.33	309.75	0	Deep Glacial
MW-30	309.86	9.40	309.86	0	Alluvial
MW-31	307.80	7.42	307.80	0	Fill/Alluvial
MW-32A	302.26	5.63	302.26	0	Upper Glacial
MW-33A	309.95	13.21	309.95	0	Upper Glacial
MW-33WR	309.57	13.88	309.57	0	Weathered Bedrock
MW-35	310.64	12.09	310.64	0	Fill/Alluvial
MW-36	309.55	8.88	309.55		Alluvial
MW-36A	309.54	10.29	309.54	0	Deep Glacial
MW-37	309.33	7.97	309.33	0	Alluvial
MW-37A	309.19	8.18	309.19	0	Deep Glacial
MW-38WR	309.64	11.32	309.64	0	Weathered Bedrock
MW-39A	306.85	8.19	306.85	21.1	Upper Glacial
MW-39S	308.21	4.46 ~~[illegible]~~	308.21	0	Alluvial
MW-40	307.69	9.55	307.69	0	Alluvial
MW-40A	307.09	7.28	307.09	40.8	Upper Glacial
MW-40T	306.70	7.32	306.7	0	Deep Glacial
MW-41A	305.66	~~5.84~~ 6.46	305.66	0	Upper Glacial
MW-42A	305.10	6.07	305.1	0	Upper Glacial
MW-43S	308.81	8.89	308.81	0	Alluvial
MW-43M	308.84	8.06	308.84	0	Upper Glacial
MW-43A	308.65	8.94	308.65	0	Upper Glacial
MW-44A	302.26	6.53	302.26	0	Upper Glacial
MW-44M	301.98	6.74	301.98	0	Upper Glacial
MW-44T	301.83	6.67	301.83	0	Deep Glacial
MW-45A	293.22	6.89	293.22	0	Upper Glacial
MW-45T	292.83	8.66	292.83	0	Deep Glacial
~~MW-46A~~	~~298.19~~		~~298.19~~		~~Upper Glacial~~
~~MW-46T~~	~~297.36~~		~~297.36~~		~~Deep Glacial~~
MW-47	308.97	6.73	308.97	0	Alluvial
MW-48	311.07	8.71	311.07	0	Alluvial
MW-49	308.36	9.84	308.36	0	Alluvial
MW-50S	310.13	6.71	310.13	0	Fill/Alluvial
MW-51WR	315.27	16.88	315.27	0	Weathered Bedrock
MW-52S	306.73	10.35	306.73	0	Alluvial
MW-52T	306.68	9.8	306.68	0	Deep Glacial
MW-53S	321.30	23.12	321.3	0	Alluvial
MW-54WR	310.63	12.28	310.63	0	Weathered Bedrock
MW-55WR	310.92	12.93	310.92	0	Weathered Bedrock
MW-56S	310.83	12.5	310.83	0	Alluvial
MW-56WR	310.40	12.56	310.4	0	Weathered Bedrock
PZ-1	296.00	5.81	296		Alluvial
PZ-2	294.95	5.89	294.95	0	Alluvial
PZ-3	290.03	6.8	290.03		Alluvial
PZ-4	290.20	5.89	290.2		Alluvial
SL-1	306.52	3.1	—	0	Perched
SL-2	308.01	Capped	—		Perched

Defining a New Process



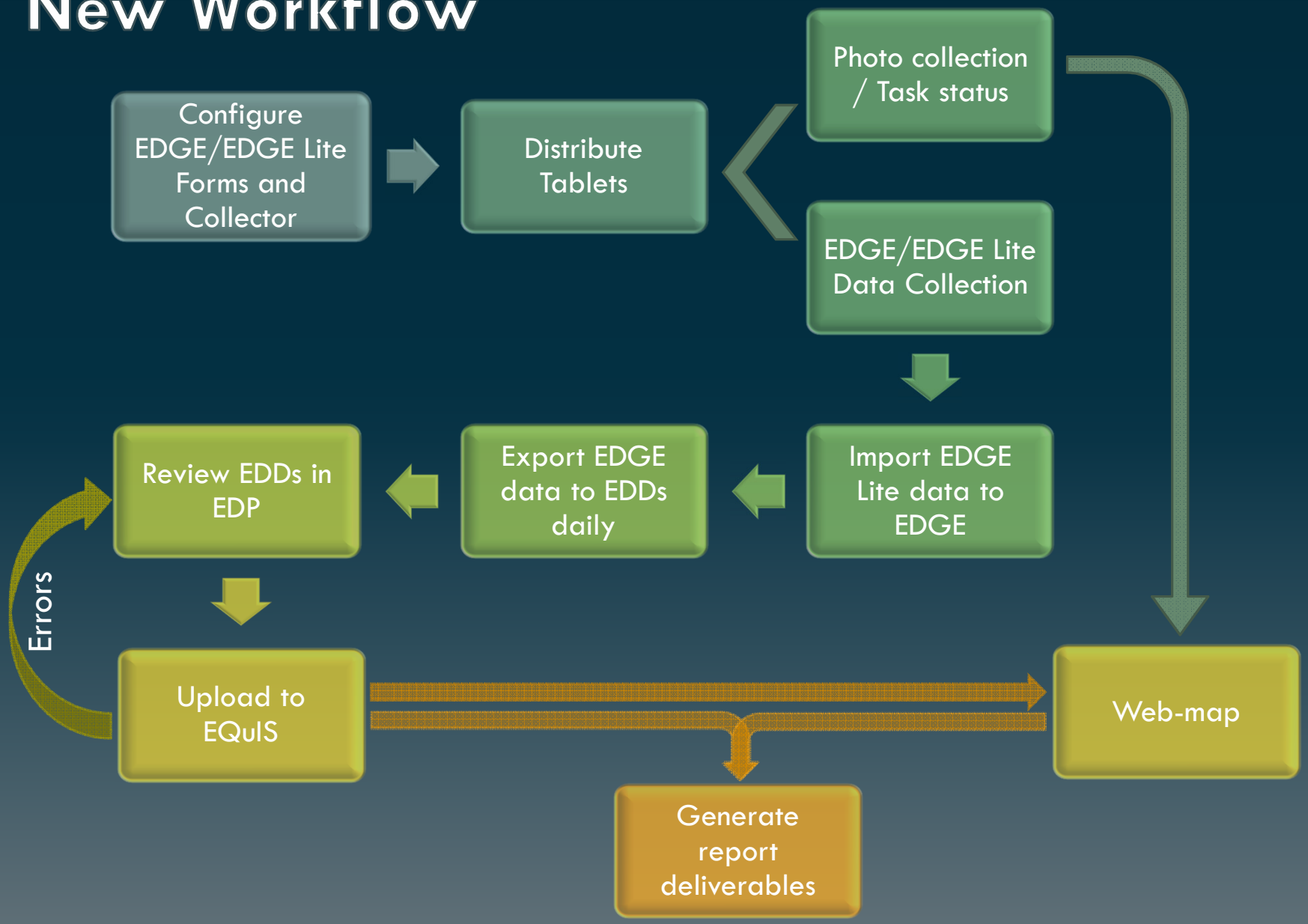
Needs Assessment

- Reduce errors in field data collection
- Eliminate time spent transcribing data
- Reduce the time field lead spends on basic QC
- Maintain regulatory requirements for field deliverables
- Provide field manager with real-time updates to redistribute staff assignments to minimize time in the field
- Real-time updates showing sampling progress to client

Needs Assessment

- EDGE
  - Groundwater sampling
- EDGE Lite
  - Static water level gauging
- Esri Collector/Webmap
  - Real-time site photo updates
  - Tracking progress of gauging/sampling activities
  - Client access

New Workflow



Mobile Device Considerations

- Battery life
- Temperature sensitivity
- Ruggedness
- Spatial accuracy
- Size/weight
- Screen glare
- Performance
- Operating system
- Connectivity

Caution!!

Not all devices are equal.

Field conditions and data quality objectives should be defined prior to data collection to ensure proper devices and technology are being used.

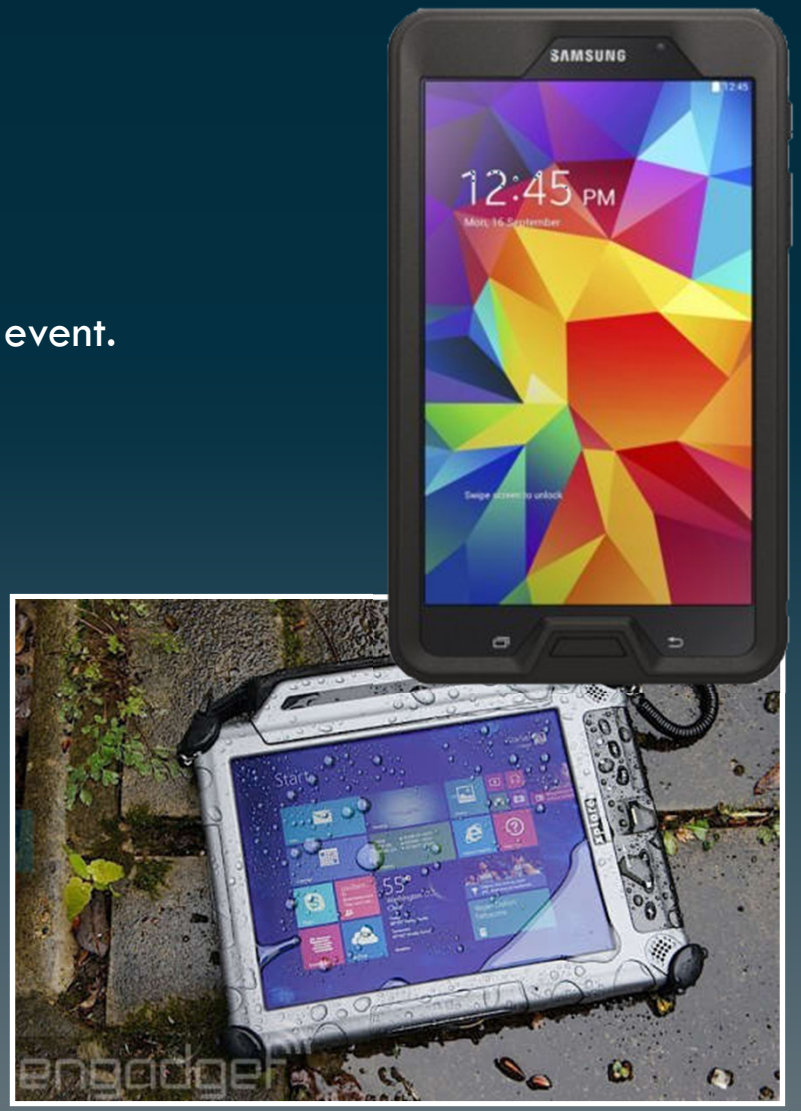
Mobile Device Considerations – Spatial Data

- Accuracy requirements may change depending on the phase of the project

Device	Real-Time Accuracy	Post-Process Accuracy	Training Requirements
Cell Phone/Tablet	3-10,000 m Horizontal No Vertical	NA	None
Consumer Grade GPS	3-5 m Horizontal Questionable Vertical	NA	Little
Mapping Grade GPS	<3 m Horizontal <9 m Vertical	0.5 – 3 m Horizontal 1.5 – 9 m Vertical	Moderate
Total Station / Mobile Scanner	0.02-0.25 m Horizontal / Vertical		Significant (Licensed Surveyors)

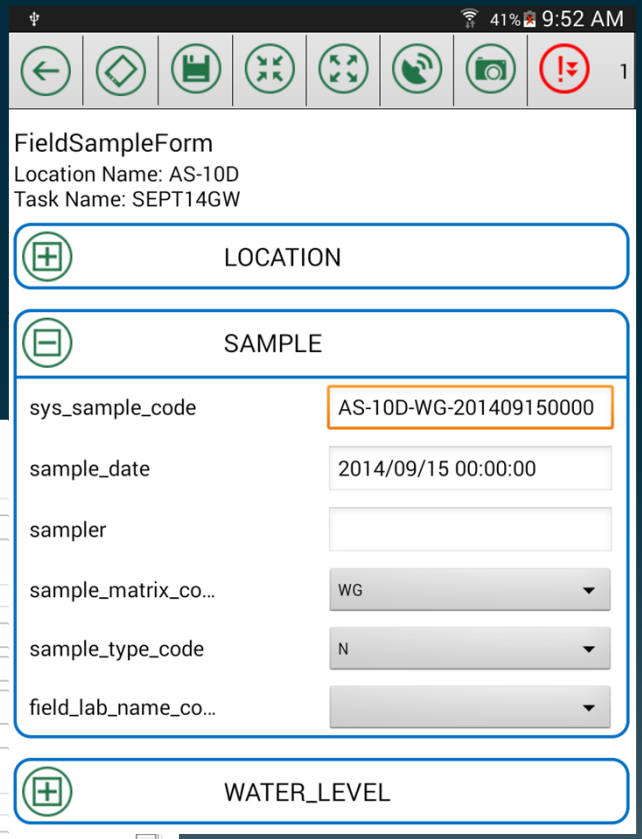
Mobile Device Selection

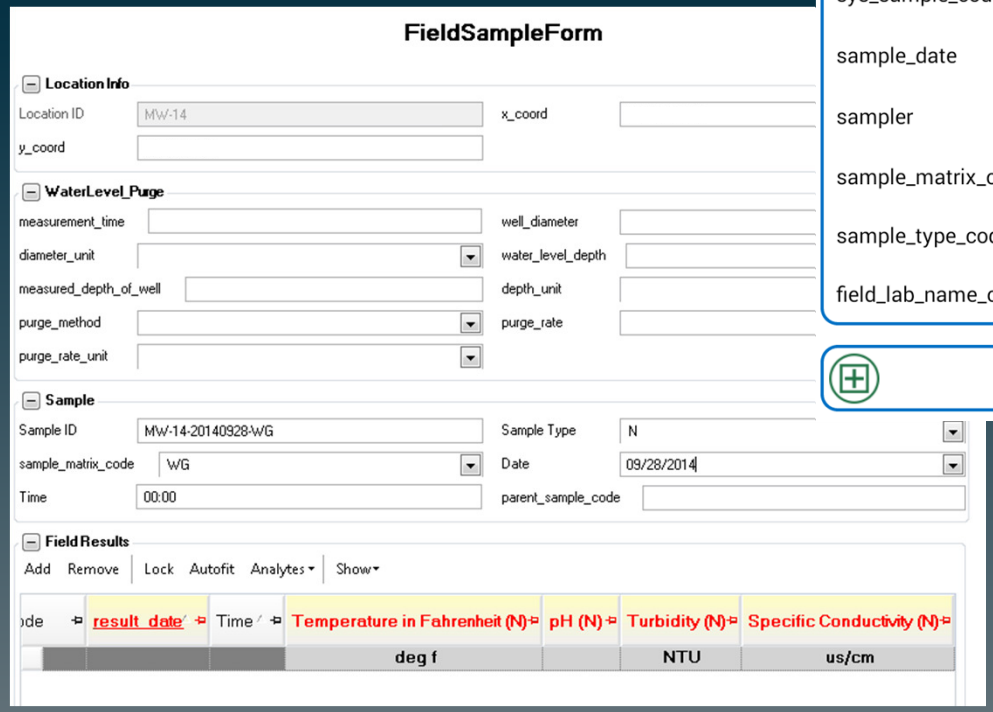
- 2 Tablets for 2 purposes
  - Samsung Galaxy tablets
    - Collector application and EDGE Lite
      - Site photos and water level gauging event.
  - Xplore Windows tablets
    - EDGE
      - Groundwater sampling event
  - Collector application available for Android and web mapping was available for the Windows OS.



EDGE Forms

- Water levels – EDGE Lite
- Groundwater sampling – EDGE
  - EDGE form includes action levels for the stabilization parameters and range constraints for select field measurements





Training Users

- Dual learning curves
  - Technology
    - New devices / operating system
  - Workflow
    - Changing a habit

Data Collection Complete

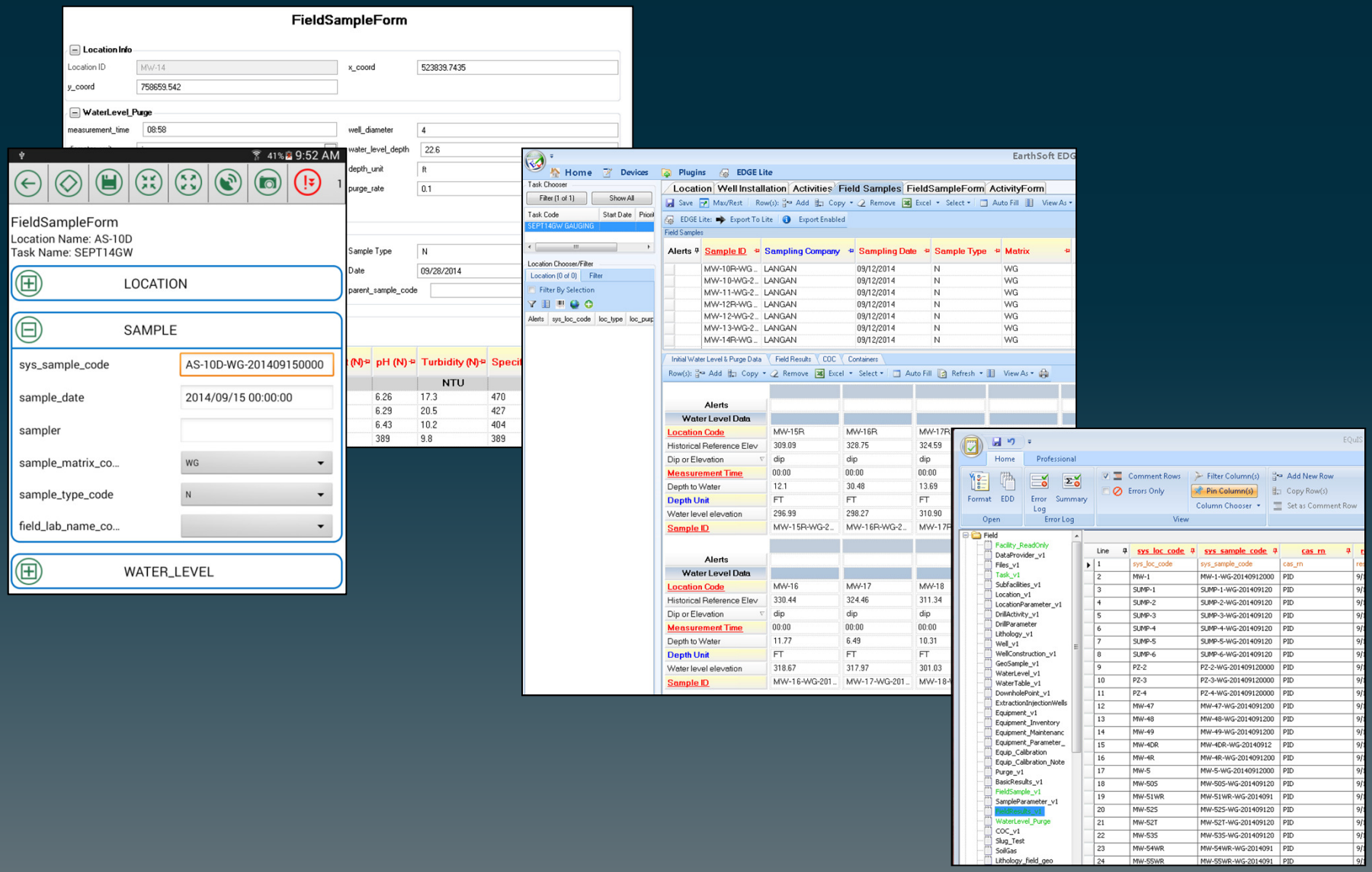
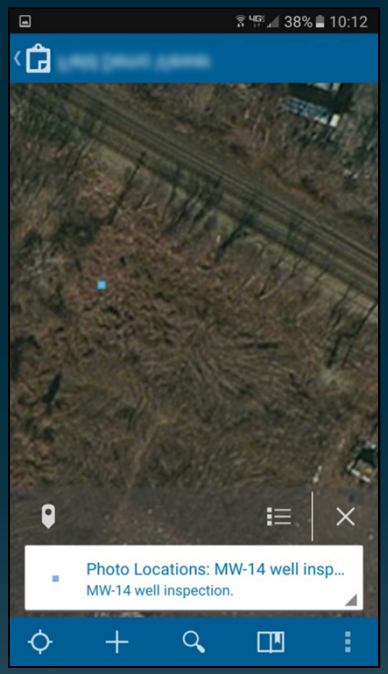
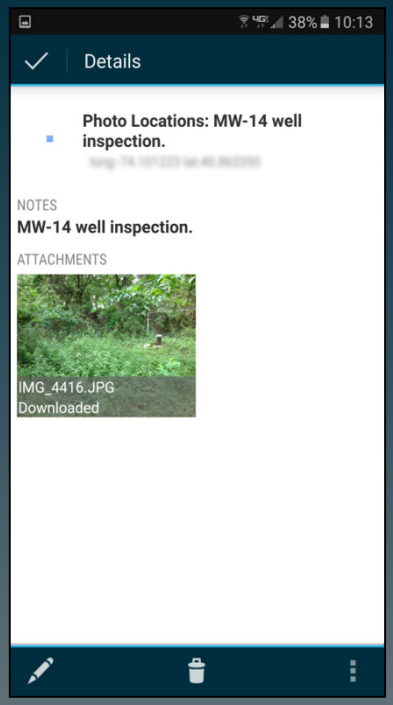
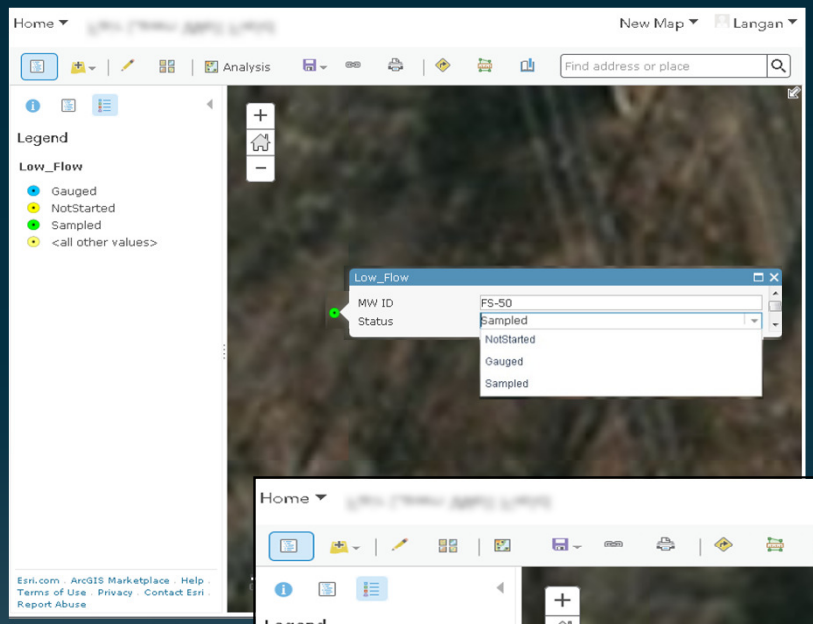
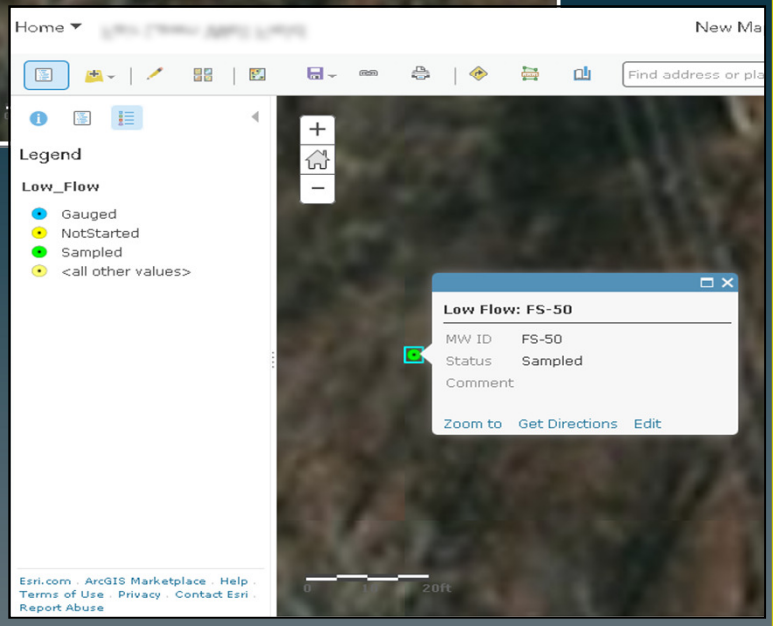


Photo Collection and Status









Auto-generated Deliverables

TABLE 4A
Groundwater and Stream Elevations - September 2015

Well	Top of Casing Elevation (ft)	Depth to Ground Water (ft btoc)	Ground Water Elevation (ft)	PID Reading (ppm)	Aquifer Material
MW-1	315.6	6.41	309.19	0.0	Alluvial
MW-2	311.63	10.9	300.73	0.0	Alluvial
MW-2R	311.47	9.87			
MW-3	311.59	11.19			
MW-3WR	314.83	16.29			
MW-4	311.14	10.43			
MW-4DR	309.9	11.44			
MW-4R	309	10.18			
MW-5	310.72	5.45			
MW-6	302.83	8.31			
MW-6A	303.31	7.09			
MW-6S	303.41	—			
MW-7	304.52	8.14			
MW-7A	305.22	9.95			
MW-7S	305.32	7.4			
MW-7R	304.92	10.33			
MW-8	304.55	7.92			
MW-9	307.8	8.77			
MW-9R	307.33	10.54			
MW-10	297.91	10.74			
MW-10R	297.75	9.02			
MW-11	294.02	2.7			
MW-12	298.46	3.51			
MW-12R	297.68	4.78			
MW-13	305.24	7.29			
MW-14	309.43	6.38			
MW-14R	310	11.28			
MW-15	309.88	9.42			
MW-15R	309.96	11.76			
MW-16	330.44	13.26			
MW-16R	328.75	30.26			
MW-17	325.33	8.8			
MW-17R	325.46	14.87			
MW-18	312.21	9.81			
MW-18R	310.84	13.23			
MW-19	314.18	12.71			
MW-19R	313.99	14.5			
MW-20A	311.1	11.84			
MW-20R	311.59	12.93			
MW-20S	311.1	9.6			
MW-21S	303.5	9.04			
MW-22	308.01	8.79			
MW-23A	302.83	4.71			
MW-23S	302.61	5.82			
MW-25S	298.68	4.94			
MW-26S	297.77	4.43			
MW-27S	299.03	4.68			
MW-27M	299.34	4.91			
MW-27T	299.67	4.17	295.5	0.0	Deep Glacial
MW-28A	309.89	9.26	300.63	0.0	Deep Glacial
MW-29A	309.8	7.58	302.22	1.4	Deep Glacial
MW-30	309.89	9.11	300.78	2.5	Alluvial
MW-31-2	310.79	11.17	299.62	0.0	Fill/Alluvial
MW-32A	302.26	5.06	297.2	0.0	Upper Glacial

Project:		Site Location:		Well No:	MW-3	Well Depth (btoc):	17'
Project Number:	2032709	Sampling Event:	September 2015	Well Permit #:		Well Diameter:	4"
Personnel:	LS	Weather:	50, Overcast	Pump Intake Depth (ft btoc):	13.95	Sample Time:	8:58
Meter Model/Number:	*ysi 650 mds*	Background PID Reading:	0.0	Depth to Water Before Pump	N/A	Sample No.:	6119
Meter Serial Number:	*30419*	PID Beneath Inner Cap:	0.0	Pressure (psi)	*20.00*	Sample Date:	10/1/2015

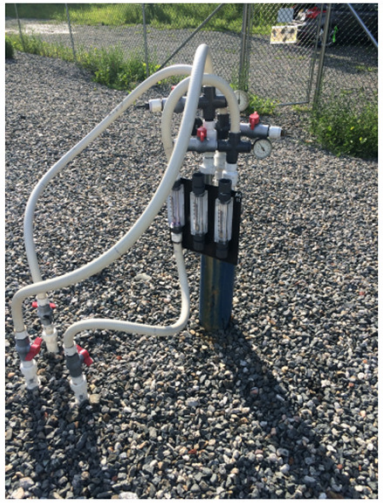
STABILIZATION = 3 successive readings within limits

TIME	PH [su] (+/- 0.1)	CONDUCTIVITY [uS/cm] (+/- 3%)	DO [mg/l] (+/- 10%)	ORP [mv] (+/- 10mV)	TURBIDITY [ntu] (+/- 10%)	TEMP	DTW	O	NOTES
8:25	—	—	—	—	—				
8:30	6.41	0.23	5.28	197.30	196.30				
8:35	6.53	0.19	5.11	193.60	9.80				
8:40	6.63	0.18	5.16	188.80	7.50				
8:45	6.68	0.17	5.31	185.50	7.10				
8:50	6.74	0.17	5.41	181.10	6.20				
8:55	6.77	0.17	5.42	178.20	6.00				

LANGAN

Langan PN: 100577900
Date: 9/29/2014

SITE OBSERVATION REPORT



Facing: N
Pin Number: (No Location)
Description: Complete installation of AS-4.

Cc:	Joseph Romano (Langan)	By:	Kristen Ward
			LANGAN

Sheet 3 of 3

How did it go?

- Overall very positive feedback from field staff
- Enhanced field to office communication
  - Real-time updates to project team
  - Ability to share site photos
  - Enhanced communication between consultant and client
- Improved quality and efficiency
  - Pre-populated fields
  - Drop down selections
  - Required fields
  - Built in constraints and checks

How did it go?

- Feedback
  - Some experienced screen glare issues
  - Stylus vs. finger
  - Accessory requests
  - Minor tweaks to EDGE form
  - Add a form for equipment calibration
- Lessons learned
  - Proper training on devices and software critical
  - Unexpected field staff changes
  - SOP's nice to have
  - Not everyone treats devices kindly
  - Project team engagement during setup ensured project was properly scoped

Summary Statistics

Task	Old Workflow	New Workflow	Savings
Transcription time	20 hours	Eliminated	20 hours / $1700
QC of field forms	8 hours	Eliminated	8 hours / $680
Errors due to miscalculations, transcription or missing information	20-30%	Eliminated	Risk/liability reduction
Photo log	9 hours	~30 minutes	~8.5 hours / $720
Field time	10 days	~9.5 days	~0.5 days / $2125
TOTAL			~7 days / $5225

Questions?
esri
Partner Network
Silver
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Business Partner Program