College of Engineering

CS Capstone Requirements Document

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BLAMO Requirements Document

Prepared for

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Abstract

The Borehole Logging Application Made for Oregon (BLAMO) project, developed for use by Dr. Matthew Evans and associated parties, serves to modernize the data collection process of borehole logging operations. The application aims to provide mobile front-end interfaces for data collection and automated back-end functionality for data storage and conversion for use in the field by researchers in outdoor environments.

The project will be considered complete once a product has been delivered that meets all milestones and fills the clients needs of remote borehole data collection and storage. This will be ensured by constant communication between all parties, vigorous peer-review practices and preemptive milestone and timeline planning.

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1 INTRODUCTION

1.1 Purpose

The purpose of this software is to modernize the current borehole logging process. Instead of writing down the data in the field and returning to an office to manually enter the data into a software application that then produces a drill log document, a mobile application could be developed with all necessary functionality. This application should take user input and output a professional drill log document that can be shared and transposed onto an aggregated map of borehole data.

1.2 Scope

The app, titled Borehole Logging Application Made for Oregon (BLAMO), will be utilized in the field to log boreholes and then create drill logs. These drill logs will be stored using a cloud service provider, which will be linked to geographic borehole locations using GIS software. This application will be developed with the intent of replacing handwritten forms, so its user interface for logging boreholes will mirror the process that users are already familiar with. This log will have entries for project, purpose, location, hole ID, workers, equipment, depth and a test description for every depth at which one was performed.

Once all the information for one borehole has been entered into the application, it will create a drill log document in the selected format. This document will be shared using exporting service provider(s) for the purpose of creating remote backup to improve accessibility to potential third parties. Due to the current logging process, there is a delay between the logging of the borehole and the creation of a drill log document due to the nature of manual recording. This application will reduce the delay as a drill log can be shared almost instantly after the necessary borehole information has been recorded.

Finally, these drill logs should be exported in such a format that they are compatible with third party ArcGIS projects, which will provide a visual and interactive representation of drill sites. This would allow users to discover sites using a map interface and view associated information, which will be useful for projects with a large number of logged boreholes. Additionally, it can also be used to view previous work done in an area the user is interested in.

1.3 Product Overview

1.3.1 Product Functions

The major functions of this software are:

- Get user input for general borehole information.
- Get user input for each test that was performed.
- Generate drill log document.
- Share drill log document.
- Link drill log to drill site.

1.3.2 User Characteristics

The users of this software should generally be well-educated and well-versed in soil and rock analysis. As such, field specific terminology and abbreviations can and should be used throughout the user interface. The users will be accustomed to a different process for logging boreholes and creating drill logs, but they should have experience with mobile interfaces and thus learnability should not be a problem.

1.3.3 Limitations

One limiting factor is the availability of a stable internet connection when the user is in the field. In many cases this should not be a problem and as coverage continues to increase this should be less and less of a problem. Another possible limitation is a potential lack of local and/or remote storage space. While these documents are small (on the order of hundreds of KB), there will be an ever-increasing number of them, which means that storage space must be considered a limitation despite its abundance. A final limitation is mobile device interface real estate. A lot of information must be recorded by the user, therefore an efficient method of logging must be designed to prevent user frustration and promote accessibility. If technology such as speech-to-text is used to address this concern, then there may be limitations with that as well.

1.4 Definitions

- ArcGIS : A geographic information system (GIS).
- gINT : Geotechnical and geoenvironmental software, distributed by Bentley
- Dart : A general-purpose programming language, supported by Google, primarily used for developing mobile applications for Android.

2 Specific Requirements

2.1 External Interfaces

Interfaces in the context of software development as a whole can be partitioned into two categories: internal and external. Internal interfaces are those that we as developers have full access to and control over. We control all portions of the application that are internal, and can diagnose problems accordingly. External interfaces are those that we don't have direct control over, or are managed by a third party.

In the context of the BLAMO project, potential external interfaces include the commissioned cloud service(s) and email services, as well as potentially some language plugins. Cloud services will likely be required to export data collected in the field through the application. We likely do not have the capabilities to provide this service ourselves, so we will likely need to outsource.

Part of the BLAMO project requirement is to create a visual printout summarizing select data sets. Currently, gINT's output is the standard for borehole logging. To match this output, we will be using a third-party plugin that provides in-app PDF design and creation tools which allow us to retrieve data saved to disk by the user and compile it in a readable, exportable format. Similarly, the project has a stretch goal of automatically updating a GIS database and display with collected data. We would face similar compatibility hurdles with ArcGIS as we will with gINT, and as such a workaround may be required.

2.2 Functions

The BLAMO application serves to fill the borehole logging needs of Dr. Evans and associates. Currently, the client is recording data manually by hand in the field which provides a number of issues for data collection, such as data loss due to illegibility of handwriting, inclement weather, debris-stained paper, etc. Creating an application for remote data collection resolves these issues while increasing the speed of collection by uploading data directly to a database from the field. This data should then be formatted into a visual summary similar to the output of gINT.

Additionally if development allows, the collected data should be imported into another existing database with GIS compatibility, creating a visual aggregate of all collected data on a geographic representation. The BLAMO app will serve to expedite the process from data collection to GIS importing.

2.3 Usability Requirements

The BLAMO application will primarily be used in the field by those collecting data. There are a number of needs that the application will need to meet in this situation relating to accessibility and ease of use.

Primarily, the app should be equally usable in both phone and tablet aspect ratios, as these are the two devices that the data collection will take place on the majority of the time. As an extension of this, the application should be easily usable and designed for use with both one hand, two hands and a stylus as users will potentially be recording in inclement weather conditions with gloves on.

Due to the large amount of data fields required and limited screen real estate, data should be grouped into categories and displayed in groups over a number of pages. Pages are easily accessible from one another, and can be returned to once data has been entered. Data categories should be based off of the visual output provided by the gINT summary (like a formatted CSV), as that is what most users will be familiar with.

Data should be uploaded to the cloud automatically, and ideally the user should have minimal interaction with the process, save a confirmation toast or notification upon transmission completion. If connection cannot be made, the application will, at the user's discretion, either upload when a connection can be made or postpone upload until manual prompt.

Beyond this, the back-end processes, data conversion, summary creation, etc, should be hidden from the user by default to further emphasize the data collection aspect of the product.

2.4 Performance Requirements

The performance requirements for this product are heavily weighted towards the user interface. The mobile application must be responsive, intuitive, and reliable without data loss even if the device crashes. Specifically, the pages that the user will be filling out must support all fields outlined by the data sheet provided by the client and the capacity to add as much detailed comments as possible. This allows for a complete recording of the user's work and flexibility to add extra detail when necessary.

There will only be a need for one user per mobile application. This application is required to work without any internet connection. Once an internet connection is available it needs to interface with exporting and email services to allow a user to upload their completed data sheet. From connection to storage, the process should handle all received data in less than a minute.

2.5 Internal Data Storage

Prior to being exported from the application, the data will need to be stored in a manner that is conducive for easy access by the application and user. Early iterations of the project design sought to offload these to a SQL server that would handle these processes. As the project progressed, this became increasingly less necessary and more counter-productive to our requirements that the application be primarily usable remotely in the field with no connection. Additionally, we would not necessarily be executing joins or creating views on log values - just reading and writing. As such, an internal file system implementation became the preferred method of storage.

File storage on disk is to be handled by a file handler in the application architecture, which will execute all disk i/o reads. This handler will interact with an object handler, which will convert this data into data types and objects that can be easily interacted with by the user. This process will improve data integrity and prevent the user from performing unauthorized file access while minimizing the number of required i/o calls.

2.6 Design Constraints

The scope of this project is rooted from an educational and public standpoint. Therefore, the greatest constraint is the overall cost of the project to develop and maintain. This leads to not being able to use any of the expensive proprietary software that would aid us in this implementation. Alongside the implementation, there is the constraint on what platform we use to store the recorded data. A solution will have to be middle ware that the requests go through one authentication that has access to the given endpoint, such as Box or email. Since this is a mobile application, we are restricted to the processing constraints of a tablet running android or iOS.

Additionally, our languages of choice - Flutter and Dart - are both relatively new. As such, there is less documentation and less compatibility with third-party programs and plugins. As such, any interfaces that we choose to implement during this process will have to be compatible with Flutter and Dart.

2.7 Software System Attributes

2.7.1 Reliability

System reliability is imperative to our project. We plan to implement reliability by establishing a saving feature. This saving feature will allow the data to backup after text entry, ensuring that the data is always present. Having a solid foundation for data dependency, guarantees minimum to zero loss in data. This “data contract” will persist through power cycles, app failures, and device damage (assuming memory is still intact). Additionally, auto-saves will help support our goal of ensuring paperless systems benefit over physical data entries.

Data integrity is important to our application due to the user reliance on accurate data. Therefore, the application and its file system functionality will need to function as smoothly as possible. Application faults (i.e. bugs and crashes) will be minimized. To reduce the number of crash scenarios and bug encounters, we will perform vigorous manual tests to best simulate the user experience. Testing will be conducted in a manner that will handle all possible usability cases. Lastly, the tests will primarily be black-box, white-box as needed, to guarantee objects are maintaining their functionality, and that implementation follows a logical execution. Testing will be a safety net to ensure product viability and minimize negative user experiences.

2.7.2 Maintainability

Program maintainability will be a strong point of focus for this project, as it may be passed on to other developers and scientists to use and change as their needs develop beyond our outlined scope. Focusing strongly on documentation and modular functionality will be crucial to keeping this project accessible for future Senior groups, and Geologists alike. Limiting concepts might include recursive operations, pointers, and data formatting. To produce a maintainable system, it will be of the utmost importance that we document how future users can modify and update this system in a way that won’t compromise its functionality or design.

Modularity will take form in the use of interfaces and logically segmented files. Interfaces will help enforce rules about objects that the application depends on, and logically segmenting files will allow future users and developers to easily understand what i/o goes where, and what to change if they have any future needs.

2.7.3 Portability

As our application develops, a stretch goal would be to port this android app to iOS. To facilitate this, we will develop using the Dart and Flutter language for its multi-platform support. This will help the contract holder to allow students and scholars to use their own preferred platform outside of school provided devices. Allowing users to choose the platform of their choice will broaden the potential user-base of the application.

2.8 Supporting Information

The BLAMO: Borehole Logging Application project is setting out to build a paperless system for geologists and students to use for recording data. The paper form our application will be replacing is the ODOT (Oregon Department of Transportation) form 739-3976, and looks like:

This form will be replaced by a digital form with a series of text fields, check lists, and other informational fields for users to fill out and log.

3 Verification

The project will be considered complete once we as developers have delivered a product that meets all milestones and fills the clients needs of remote borehole data collection and storage.

In order to keep the project moving fluidly and ensure project milestones are met on time, we will maintain an open line of contact directly to the client and provide regular updates to all parties involved as to the status of the project. Time estimates will be created ahead of time, prioritizing critical features, and adjusted with prior notice if necessary.

4 Appendices

Included are examples of a handwritten form, and a final drill log document. As well as a tentative timeline for development.

Oregon Department of Transportation

EXPLORATION LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. TB-1
Project IOWA ST. VIADUCT REP'L	Purpose MONITORING	E.A. No. N/A
Highway 001 MP 28F	County MULTNOMAH	Key No. 14949
Hole Location 11'E, 4'S of staked location		Start Card No.
Equipment CME 75 TRACKED	Driller JOEL / CASCADE	Bridge No. N/A
Project Geologist S. HAY	Recorder J. LAUER	Ground Elev. ~253'
Start Date 1-7-08	End Date 1-9-08	Total Depth 90'	Tube Height

Test Type	Rock Abbreviations: Discontinuity	Shape	Surface Roughness	Typical Drilling Abbreviations: Drilling Methods	Drilling Remarks
"A"–Auger Core	J – Joint	Pl – Planar	P – Polished	WL – Wire Line	LW – Lost Water
"X"–Auger	F – Fault	C – Curved	Sl – Slickensided	HS – Hollow Stem Auger	WR – Water Return
"C"–Core, Barrel Type ____	B – Bedding	U – Undulating	Sm – Smooth	DF – Drill Fluid	WC – Water Color
"N"–Standard Penetration	Fo – Foliation	St – Stepped	R – Rough	SA – Solid Flight Auger	D – Down Pressure
"U"–Undisturbed Sample	S – Shear	Ir – Irregular	VR – Very Rough	CA – Casing Advancer	DR – Drill Rate
				HA – Hand Auger	DA – Drill Action

Depth (~~meters~~) ft	Test Type, No.	Measured Recovery (inches)	Driving Resistance / Discontinuity Data	Graphic Log	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling Core Recovery, RQD, Formation Name.)	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
				ML		0- 10" HSA		
	N-1	16	3-4-5 (9)		N-1 2.5-4.0 SILT, ML, brown w/ gray-brown mottling, low plasticity, moist, stiff homogeneous w/ tr. f. sand [Fine-grained Flood Dep]			
5	N-2	12	3-4-5 (9)		N-2 5.0-6.5 gray and red-brown mottling			
	N-3	14	2-3-5 (8)	ML	N-3 7.5-9.0 intergrading SILT, as above but med. stiff to stiff, and SANDY SILT, f. sand, weak horiz layers			
10	N-4	12	3-4-6 (10)	ML/SM	N-4 10.0-11.5 intergraded SILT to SANDY SILT, as above but stiff and SILTY fine SAND, SM, NP to low plasticity, moist, loose to med. dense, horiz. layers			
	N-5	12	3-3-4 (7)	SM	N-5 12.5-14.0 SILTY SAND, SM pale yellow, NP, moist, loose, ~~massive~~ homogeneous, micaceous			
15	N-6	24	PUSH (ST)		N-6 (Shelby) 15.0-17.0			
	N-7	18	2-3-3 (6)		N-7 17.5-19.0 as above with fine orange oxydization banding as horizontal layers, occasional wood fragments			
20	N-8	NR	3-4-6 (10)		N-8 20.0-21.5 as above	no recovery @ 20'		
				ML				
25	N-9	18	2-2-5 (7)		N-9 25.0-26.5 SILT, ML, dark gray, med. plasticity, moist, med. stiff, homogeneous, micaceous			

734-3976(6-95)

Project Name IOWA ST. VIADUCT (TB-14949-2) Hole No. TB-1 Page 2 of 3

Depth (~~meters~~) ft	Test Type, No.	Measured Recovery (inches)	Driving Resistance / Discontinuity Data	Graphic Log	Material Description	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
30	N-10	18	5-10-11 (21)	ML	N-10 30.0-31.5 CLAYEY SILT, ML, dk gray, med. plasticity, moist, very stiff, weak subblocky structure			
				ML				
35	N-11	18	9-8-11 (19)		N-11 35.0-36.5 SANDY SILT, ML, light tan, low plasticity to NP, moist, v. stiff, homogeneous			
40	N-12	12	5-9-13 (22)	ML/SM	N-12 40.0-41.5 intergraded SANDY SILT, as above, w/ SILTY SAND, SM, lt. tan, NP, moist, med. dense, f. sand.	COB 1-7-08		
				SM				
45	N-13	4	50/1"		N-13 45.0-45' SILTY fine SAND, SM, light tan, NP, moist, very dense, homogeneous			
50	N-14	18	21-17-18 (35)		N-14 50.0-51.5 as above but dense			
55	N-15	18	14-34-27 (61)		N-15 55.0-56.5 intergraded SILTY SAND, as above but very dense, with SANDY SILT, ML, tan w/ dk brown staining, low to v. low plasticity, moist, hard, f. sand, tr. oxidization banding			
				ML		drill action indicates gravels 57-60'		
60	N-16	4	50/3"		N-16 60.0-60.3 SILT w/ SAND & GRAVEL, ML, dk brown to gray-brown, v. low plasticity to NP, moist, very hard, angular, decomp. basalt and quartzite gravels w/ silt + sand matrix-supported conglomerate, weakly cemented			
				CL/GC	[Troutdale Fm?]			
65	N-17	18	28-29-32 (61)		N-17 65.0-66.5 LEAN CLAY w/ SAND + GRAVEL to CLAYEY GRAVEL, CL/GC, lt. gray to red-brown, med. plasticity to NP, very hard + very dense, angular decomposed basalt gravels in clay & sand matrix occ. clast-supported, uncemented [decomp. CRB]			
70	N-18		45-50/6"		N-18 70.0-71.0			
	C-1	27	(9.5/12")		C-1 70.0-73.0			
					70.0-72.5 - as above			

Oregon Department of Transportation

EXPLORATION LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. TB-1
Project IOWA ST. VIADUCT REP'L	Purpose MONITORING	E.A. No.
Highway 001, MP 28F	County MULTNOMAH	Key No. 14949
Hole Location 11'E, 4'S of stake		Start Card No. N/A
Equipment CME 75 TRACK	Driller JOEL / CASCADE	Bridge No.
Project Geologist S. HAY	Recorder J. LAUER	Ground Elev. ~253'
Start Date 1-7-08	End Date 1-9-08	Total Depth 90'	Tube Height

Test Type	Rock Abbreviations: Discontinuity	Shape	Surface Roughness	Typical Drilling Abbreviations: Drilling Methods	Drilling Remarks
"A"–Auger Core	J – Joint	Pl – Planar	P – Polished	WL – Wire Line	LW – Lost Water
"X"–Auger	F – Fault	C – Curved	Sl – Slickensided	HS – Hollow Stem Auger	WR – Water Return
"C"–Core, Barrel Type ____	B – Bedding	U – Undulating	Sm – Smooth	DF – Drill Fluid	WC – Water Color
"N"–Standard Penetration	Fo – Foliation	St – Stepped	R – Rough	SA – Solid Flight Auger	D – Down Pressure
"U"–Undisturbed Sample	S – Shear	Ir – Irregular	VR – Very Rough	CA – Casing Advancer	DR – Drill Rate
				HA – Hand Auger	DA – Drill Action

Depth (~~meters~~) ft	Test Type, No.	Measured Recovery (inches)	Driving Resistance / Discontinuity Data	Graphic Log	Material Description	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
			scattered gravel-sized basalt frag	GC / BSLT	72.5-73.5 BASALT, dk gray, mod. weathered, med. hard (C-1), individual gravel- sized corestones in clay/ silt matrix, tr. secondary mineralization, 67% rec., 0% RQD	[decomp. CRB]		
	C-2	12			C-2 73.5-75.5 as above, 50% rec., 0% RQD			
75	C-3	24	occ. cobble-sized basalt frag.		C-3 75.5-80.5 as above, some vesicles, trace yellow clay infilling, 40% rec., 15% RQD			
					grades to v. close to close open fractures w/ trace clay infilling			
80	C-4	6	3 joint sets: vert, horiz and 45°		C-4 80.0-80.6 as above, 100% rec., 0% RQD			
	C-5	22			C-5 80.6-83.5 as above, 71% rec., 20% RQD			
	C-6	12			C-6 83.5-85.0, as above, 67% rec., 0% RQD	COB 1-8-08		
85	C-7	12	much small broken gravels		C-7 85.0-86.5, as above, 100% rec., 0% RQD			
	C-8	6			C-8 86.5-88.0 as above, 25% rec., 0% RQD			
	C-9	12			C-9 88.0-90.0, as above, 50% rec., 0% RQD			
90					Boring completed @ 90 ft. GW not observed during drilling.			
95								
100								

734-3976(6-95)

OREGON DEPARTMENT OF TRANSPORTATION

EXPLORATION LOG
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Page _______ of ________

			Hole No.
Project		Purpose	EA No.
Highway		County	Key No.
Hole Location			Start Card No.
Equipment		Driller	Bridge No.
Project Geologist		Recorder	Ground Elev.
Start Date	End Date	Total Depth	Tube Height

Test Type
"A"... Auger Core
"X"... Auger
"C"... Core, Barrel Type:___________
"N"... Standard Penetration
"U"... Undisturbed Sample

Rock Abbreviations

Discontinuity	*Shape*	*Surface Roughness*
J....... Joint	Pl......Planar	P........Polished
F ...... Fault	C.......Curved	Sl ....Slickensided
B ...... Bedding	U.......Undulating	Sm.....Smooth
Fo .... Foliation	St......Stepped	R........Rough
S...... Shear	Ir ....Irregular	VR .....Very Rough

Typical Drilling Abbreviations

Drilling Methods	*Drilling Remarks*
WL ... Wire Line	LW .....Lost Water
HS.... Hollow Stem Auger	WR ....Water Return
DF.... Drill Fluid	WC ....Water Color
SA.... Solid Flight Auger	D........Down Pressure
CA.... Casing Advancer	DR .....Drill Rate
HA.... Hand Auger	DA.....Drill Action

Depth (feet)	Test /Type No.	Measured Recovery (feet)	Soil: Driving Resistance	Rock: Discontinuity Data	Graphic Log	Material Description *Soil:* Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin *Rock:* Rock Name, Color, Weathering, Hardness, Discontinuity, Spacing, Joint Filling, Core Recovery, RQD, Formation Name	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation

734-3976 (11/06)

Fig. 1. ODOT Form 739-3976

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. 1-2000
Project Klamath Falls Port of Entry	Purpose Retaining Wall Foundation	E.A. No. C0181430/000
Highway The Dalles-California (US 97)	County Klamath	Key No. 08945
Hole Location Northing: 67,032.30 Easting: 1,392,252.99		Start Card No.
Equipment 93-991	Driller Dave Johnson	Bridge No.
Project Geologist Kris Iverson	Recorder Kris Iverson	Ground Elev. 1286.99m
Start Date April 19, 2000 / End Date April 19, 2000	Total Depth 7.32m	Tube Height

Test Type
"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DP - Drill Fluid	WC - Water Color
SA - Solid Fligh Auger	D - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (meters)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, RQD, Formation Name.)
0					
1	N1	80.0	2-3-21	102.5	N-1 (0.76 - 1.22) Elastic (Diatomaceous) SILT with Some Sand; MH; Light/Medium Brown (Variegated); High Plasticity; Wet; Medium Stiff/Medium Dense; Lensed; Pushed Gravel/Cobble In Final 0.15 m, LL=105/PI=34; (Fill)
	N2	7.0	9-9-8		N-2 (1.52 - 1.98) GRAVEL; GP; Black; Nonplastic; Wet; Medium Dense; Gravel Stuck In Shoe of Sampler; (Fill)
2	N3	69.0	5-10-25/0.10	26.1	N-3 (2.29 - 2.68) Sandy SILT with Some Gravel; MH-GM; Variegated: Medium Brown/Black; Medium Plasticity; Wet; Very Stiff/Very Dense; Homogeneous; Bounced on Rock, LL=58/PI=26; (Colluvium)
3	C1	100.0	RQD = 37		C-1 (3.02 - 4.27) BASALT (and Basalt Flow BRECCIA); Black; Slightly Weathered to Fresh; Hard (R4); RQD = 37; Very Close and Close Jointed; Breccia Zones: Sand/Gravel Size Basalt Fragments with Diatomaceous Silt Matrix; (Pliocene/Pleistocene Lavas)
4	C2	100.0	RQD = 35		C-2 (4.27 - 7.32) BASALT (and Basalt Flow BRECCIA); Black; Slightly Weathered; Hard (R4); RQD = 35; Very Close and Close Jointed with Some Healed Jointing; Some Diatomaceous Silt Infilling to 4.66 m, then Silty Sand Infilling and Thin (0.1 m), Silty Sand Interbeds; (Pliocene/Pleistocene Lavas)
5					
6					
7					
8					

Unit Description

0 - 0.3
Sandy GRAVEL (Shoulder Aggregate); GP; Variegated Gray; Nonplastic; Moist; (FILL);

0.3 - 2.13
Elastic (Diatomaceous) SILT with Some Sand and Gravel (Possible Cobble); MH; Variegated: Light Brown/Brown/Black; High Plasticity; Wet; Medium Stiff/Medium Dense; (FILL);

2.13 - 2.68
Sandy SILT with Some Gravel; MH-GM; Medium Brown/Black (Variegated); Medium Plasticity; Wet; Very Stiff/Very Dense; (COLLUVIUM);

2.68 - 7.32
BASALT and Basalt Flow BRECCIA; Black with Brown; Slightly Weathered to Fresh; Hard (R4); Very Close to Close Jointed; Diatomaceous Silt and Silty Sand Infilling and Few Thin Silty Sand Interbeds; (PLIOCENE/ PLEISTOCENE LAVAS);

Graphic Log

Drilling Methods, Size and Remarks / Water Level/ Date

Used Bentonite Mud Drill Fluid; Advanced with 0.1 m Tricone Bit and NW Rod (Open Hole).

Triconed to 3.02 m, then advanced with HQ Coring. Used 3.05 m (10 ft) Core Barrel.

Backfilled with 3/8 Bentonite Chips

Backfill/ Instrumentation

BLAMO: Gantt Chart

3/16/2020

* = an automatically calculated cell

TASK NAME	START DATE	DAY OF MONTH*	END DATE	DURATION* (WORK DAYS)	DAYS COMPLETE*	DAYS REMAINING*	TEAM MEMBER	PERCENT COMPLETE
Phase 1								
Design Android Application (UML, Tasks)	1/1	1	1/12	11	11	-75.57078396	Group	100%
Proto-type UX	1/1	1	1/12	11	8.8	-75.57078396	Group	80%
Implement I/O Systems	1/20	20	2/6	17	10.2	-56.57078396	TBA	60%
Implement UX	1/20	20	2/7	18	7.2	-56.57078396	TBA	40%
Implement Data Formatting	1/20	20	2/8	19	3.8	-56.57078396	TBA	20%
								0%
Phase 2								
Design Relational Systems (SQL)	2/1	1	2/8	7	7	-44.57078396	Group	100%
Design Network Systems for I/O	2/2	2	2/9	7	5.6	-43.57078396	Group	80%
Implement Network Availabilty	2/9	9	2/23	14	8.4	-36.57078396	TBA	60%
Implement local storage	2/9	9	2/23	14	5.6	-36.57078396	TBA	40%
Implement Auto Save features	2/22	22	3/1	8	1.6	-23.57078396	TBA	20%
Implement Android Email	2/22	22	3/1	8	0	-23.57078396	TBA	0%
Alpha Stage								
Plan Agenda for Meeting	2/14	14	2/19	5	5	-31.57078396	Group	100%
Prepare presentation	2/15	15	2/20	5	4	-30.57078396	Group	80%
Export to CSV	2/20	20	2/28	8	4.8	-25.57078396	Group	60%
Finalize Presentation	2/28	28	3/1	2	0.8	-17.57078396	Group	40%
Post	03/2020	1	3/1	0	0	-15.57078396	Group	20%
Beta Stage								
Finalize Phase 1	3/1	1	3/20	19	19	-15.57078396	Group	100%
Finalize Phase 2	3/2	2	3/20	18	14.4	-14.57078396	TBA	80%
Prepaire for Engineering Expo	5/1	1	5/14	13	7.8	45.42921604	TBA	60%
Present At Expo	5/15	15	5/15	0	0	59.42921604	TBA	0%
Phase 3 (Stretch)								
Design Server/App functionality for GIS	3/20	20	4/1	12	12	3.429216042	Group	100%
Implement GIS conversion	3/20	20	4/1	12	9.6	3.429216042	TBA	80%
Implement GIS File System	3/20	20	4/1	12	7.2	3.429216042	TBA	60%
Test	3/20	20	4/1	12	0	3.429216042	TBA	0%
Port to iOS	3/20	20	4/1	12	0	3.429216042	TBA