BlueOrchardBeesInArizonaProject

Interim Report

This is the BlueOrchardBeesInArizonaProject ('the Project') first interim report that documents our activities to date. The Project Research Proposal (Phase 0) is shown in Appendix A. The Project Objectives are shown in Appendix B.

INTRODUCTION

The Project is planned in three, overlapping phases: 1. Placing the bees/habitats, 2. Monitoring the status of the bees/habitats, and 3. Harvesting the cocoons. See the schedule/Gantt in Appendix C.

We have now completed the first phase of the Project. This document will detail the results of the first phase of the Project and some preliminary accounts of the second phase. This document will make extensive use and reference to the materials posted to the Project website, *BlueOrchardBeesInArizonaProject.com*.

RESULTS			15-May-2019
Metric	CurrentValue	MaxValue	% Complete
Bees Placed / Max Value	5060	5000	101.2%
Sites Populated / All Sites	7	7	100.0%
Habitats Deployed	50	49	102.0%
Tubes Filled / Tubes Placed	10	3202	0.3%
Cocoons Harvested / Cocoons Deployed	0	5000	0.0%

We have accomplished the tasks in Phase 1 to place the bees/cocoons and associated habitats in the four locations in Arizona. We surpassed 100% by purchasing some additional bees/habitat to complete our efforts.

We gratefully acknowledge the support and expertise of:

- Dr. Natalie Boyle of the USDA-ARS
- Dr. Steve Peterson of Foothill Bee Ranch
- Mr. Jim Watts of Watts Solitary Bees
- Mr. Dave Hunter of Crown Bees
- Mr. Glen Trostle of the Pollination Systems, LLC

PHASE 1: PLACING THE BEES/HABITATS

In Phase 1, we received the cocoons, ordered and received the habitats and placed them at the four Arizona sites:

1. March 10-11, 2019 Gilbert, AZ, 1,237 ft. Elevation, Residential Lakeside Lots
    - March 11, 2019: Set-up Site1a1 (220 cocoons, 3 habitats, 176 tubes)
    - March 10, 2019: Set-up Sites 1a2 (580 cocoons, 5 habitats, 338 tubes)
2. March 27, 2019 Cornville, AZ, 3225 ft. Elevation, Residential Family Farms
    - Set-up Site2a (1,000 cocoons, 14 habitats, 960 tubes)
    - Set-up Site2b (1,000 cocoons, 14 habitats, 960 tubes)
3. March 28, 2019 Payson, AZ, 4606 ft. Elevation
    - Set-up Site3a (1,900 cocoons, (60 cocoons, 9 habitats, 528 tubes)
    - Set-up Site3b (300 cocoons, 4 habitats, 192 tubes)
4. May 10, 2019 Flagstaff, AZ, 6,910 ft. Elevation, Master Garden
    - Set-up Site4 (60 cocoons, 1 habitat, 48 tubes)

Each setup/trip was extensively documented in computer files and via the above hyperlinks to our website BlueOrchardBeesInAriaonaProject.com.

Complete details of the characteristics (property type, local environment, geographic location, elevation, lot size, plant fauna,) can be seen in our 'Master Site Characteristics, Data and Summary Results.xlsx' spreadsheet, summary in Appendix D; and the complete spreadsheet is located on the website. The site maps (not to scale) are in Appendix E and also in the spreadsheet.

PHASE 2: MONITORING THE STATUS OF THE BEES/HABITATS

Once the cocoons have been placed and the habitats set up properly; we have been observing and monitoring bee activity. We have documented this with counts of tubes filled, temperature and humidity data sets, 35 blog posts, costs of the study, and an extensive set of observations documented with photos, videos and hand written logs. We have also observed phenomena such as evidence of parasitic wasps, native Leafcutter bee activity in Phoenix, and the preference of shaded habitats for desert locations.

PHASE3: HARVESTING THE COCOONS

The timing of harvesting at the desert Sites1a is under review. The remaining sites to follow.

INTERIM OBSERVATIONS and NEXT STEPS

While it is too early to draw definitive conclusions, our preliminary data suggests:

- Our observation so far is that Blue Orchard Bees located in desert conditions perform better in full shade. We have no tubes filled in the sunny, partially sunny habitats; tubes are filled in all three fully shaded habitats.
- Placing mud sources near the nest does not seem to matter. We have not observed any bees using the provided mud sources. Obviously, they are finding mud somewhere else as evidenced by the completed tubes.
- The parasitic wasps ("Those are Monodontomerus larvae. They are not uncommon unfortunately.") were observed. Their larvae have been observed
- Native population of leafcutter bees have been observed in the low desert conditions. Since leafcutter bees are active at higher temperatures than BOBs, they may be a better choice for Arizona locations.

We plan to further investigate the above observations during the remainder of the project.

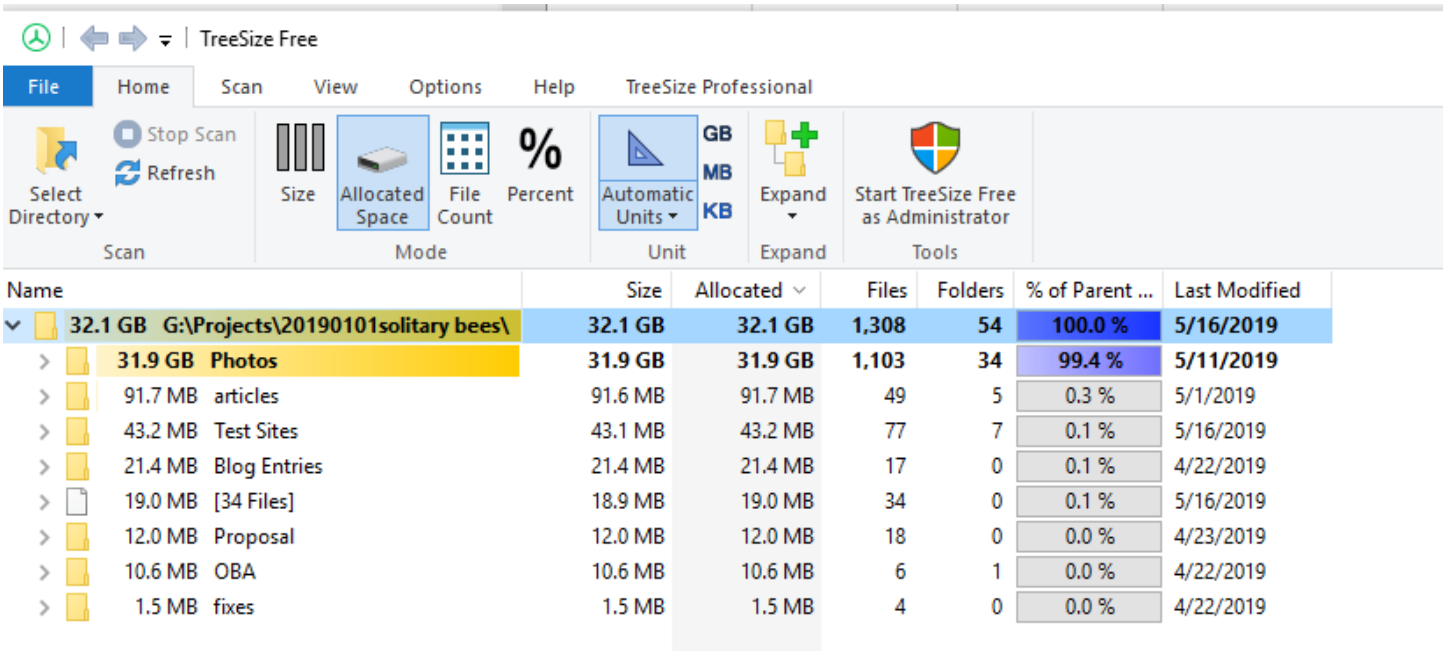
Submitted on 24 May 2019

Respectfully,

Michelle Sarina, Gene DeBons, Jim Sarina

REFERENCE MATERIALS

All activities are documented in 1,308 files in 54 folders as of 15 May 2019:



Name	Size	Allocated	Files	Folders	% of Parent ...	Last Modified
32.1 GB G:\Projects\20190101solitary bees	**32.1 GB**	**32.1 GB**	**1,308**	**54**	**100.0 %**	**5/16/2019**
31.9 GB Photos	**31.9 GB**	**31.9 GB**	**1,103**	**34**	**99.4 %**	**5/11/2019**
91.7 MB articles	91.6 MB	91.7 MB	49	5	0.3 %	5/1/2019
43.2 MB Test Sites	43.1 MB	43.2 MB	77	7	0.1 %	5/16/2019
21.4 MB Blog Entries	21.4 MB	21.4 MB	17	0	0.1 %	4/22/2019
19.0 MB [34 Files]	18.9 MB	19.0 MB	34	0	0.1 %	5/16/2019
12.0 MB Proposal	12.0 MB	12.0 MB	18	0	0.0 %	4/23/2019
10.6 MB OBA	10.6 MB	10.6 MB	6	1	0.0 %	4/22/2019
1.5 MB fixes	1.5 MB	1.5 MB	4	0	0.0 %	4/22/2019

Appendix A – Research Proposal

RESEARCH PROPOSAL

by Gene DeBons, Michelle Sarina, Jim Sarina

Rationale for conducting this research

- Study the propagation of Blue Orchard Bees (BOBs) in several different environments in Arizona.

Where will the study be conducted and why these sites were specifically chosen?

Four locations in the state of Arizona (chosen for):

1. Phoenix Metro Area, 1200 ft elevation; two sites: a lakeside residential site with a mixture of landscape and decorative plants; and a commercial orange orchard (different plant fauna).
2. Cottonwood, AZ, 3200 ft elevation; two sites: a 6-acre apple orchard and a 5-acre pear orchard (different bloom times).
3. Payson, AZ riparian region (on the East Verde River), 4600 ft elevation; two sites: a one acre, master garden located 1/8 mile from the river and two residential lots (totaling 1.5 acres) on the river with minimal plant coverage (plant density).
4. Sedona, AZ, 4350 ft elevation; master garden location(s); specific sites, approximately 1 acre each, to be determined upon visiting the sites (different plant fauna).

These sites provide a diversity of climate, elevation, bloom time, plant species, plant mixture and hydrology.

Methodology

- Several models of BOB housing nesting kits will be obtained from "Watts Solitary Bees" and placed as appropriate for each environment.
- The bees (roughly 1000 per acre/location) will be released on a timeline consistent with the flowering of plants in that area.
- The primary study methodology will be regular visual observation and data collection of bee activity and habitat and real-time environmental conditions.
- After the completion of season, the cocoons will be counted and evaluated for general quality (e.g., health, male/female ratio, size) by established BOB experts.

Who will conduct the study?

- The study will be organized and conducted by Gene DeBons, Michelle Sarina, and Jim Sarina. Gene has previously conducted a smaller scale, similar study in Gilbert, AZ in 2018.
- Expert advice will be provided by Jim Watts and Steve Peterson and other associates of the Orchard Bee Association on an as necessary basis.
- Regular, on-site inspection, review and documentation (photos, notes, videos) will be conducted by local personnel.

What outcomes are expected?

- Measurable and verifiable data collection methods and analytics within diverse Arizona environments to determine BOB behavior, ideal habitats and population sustainability.
- Understanding and development of best practices to insure BOB propagation in these diverse environments.

What deliverables will be provided?

Three deliverables:

- one: a thorough report in a publishable format encompassing all the activities of the study,
- two, a presentation that summarizes the results of the study to be delivered at the December meeting of the OBA,
- three, a website (https://www.blueorchardbeesinarizonaproject.com/) which captures the week-to-week activities and results of the study for educational and reporting purposes.

Appendix B – Objectives of the Project

The BlueOrchardBeesInArizonaProject has three objectives:

1. **BASIC RESEARCH** – Conduct basic research in the propagation of mason bees in multiple Arizona environments differentiating among geographic, altitude, urban, rural, plant fauna, water resources and more.

   Prime metric 1 (quantitative): the number of viable cocoons harvested divided by the number of cocoons placed. This metric, R equals 'Replication Rate', needs to be greater than one (> 1) to ensure successful propagation.

2. **EDUCATION** – Produce materials useful for educational purposes in K-12 schools.

   Prime metric 2 (qualitative): Production of a set of traceable materials including text, timelines, photos, videos (e.g.,in-the-field or animated), and numerical data sets to allow educators to create teaching materials explaining the scientific method at the K-12 school level. These materials can be used to demonstrate various aspects of the scientific method including correlation, interaction of variables in an experiment, methods of analysis, experiment setup concepts and limitations, and basic concepts in physics, biology, engineering (e.g., thermal), and environmental impact.

3. **MARKETING** - Produce materials useful for marketing and fund raising purposes for the OBA and education of the general public on the importance of solitary bees in our ecosystem.

   Prime metric 3 (qualitative): Production of a set of entertaining and informative materials including text, timelines, photos, videos (e.g.,in-the-field or animated), cost information to allow marketers to create materials explaining the role of the OBA and the critical role that solitary bees and other pollinators play in our ecosystem and food chain.

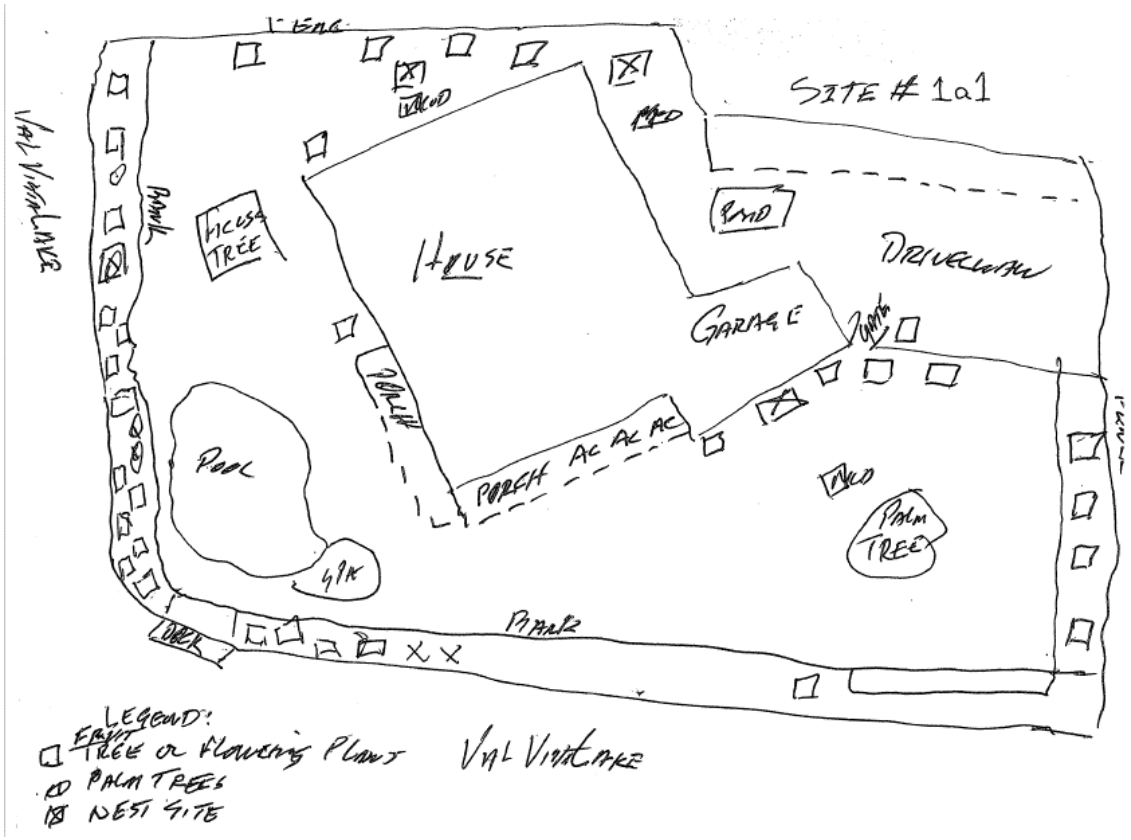
Appendix C – Schedule, Gantt Chart

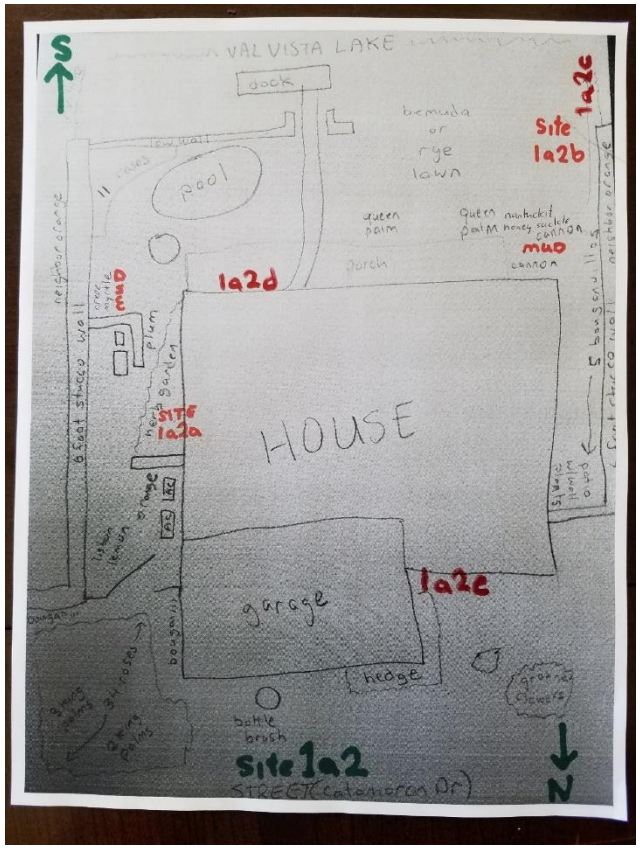
[Under Development]

Appendix D – Detailed Results as of 15 May 2019

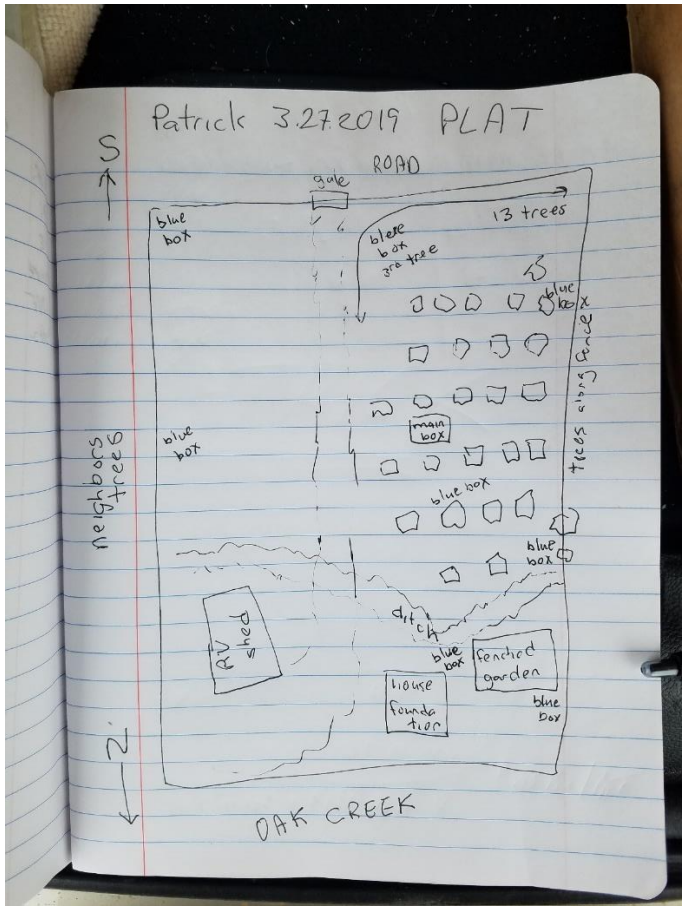
Site	City (AZ)	Location	Lat/Long	Elevation (ft)	Description	Size (acres)	# of Bees	# of Habitats	# of Tubes	# of Tubes Filled	# of Cocoons Harvested
1a1.	Gilbert	Val Vista Lakes	33.376125, -111.750427	1,237	Lake Side Residential Lot	0.41	220	3	176	7	
1a2.	Gilbert	Val Vista Lakes	33.376041, -111.749390	1,237	Lake Side Residential Lot	0.27	580	5	338	3	
2a.	Cottonwood	Cornville	34.753271, -111.889603	3,225	Family Farm	5	1000	14	960	0	
2b.	Cottonwood	Cornville	34.751925, -111.889659	3,225	Family Farm	5	1000	14	960	0	
3a.	Payson	Flowing Springs	34.316621, -111.333613	4,606	Master Garden	1	1900	9	528	0	
3b.	Payson	Flowing Springs	34.315490, -111.334790	4,606	Riverside Residential Lot	0.8	300	4	192	0	
4a.	Flagstaff		35.217587, -111.647934	6,910	Residential Lot	0.26	60	1	48	0	
Total							**5060**	**50**	**3202**	**10**	**0**
Date	**15-May-19**					**Max Value**	5000	49	3154	3154	

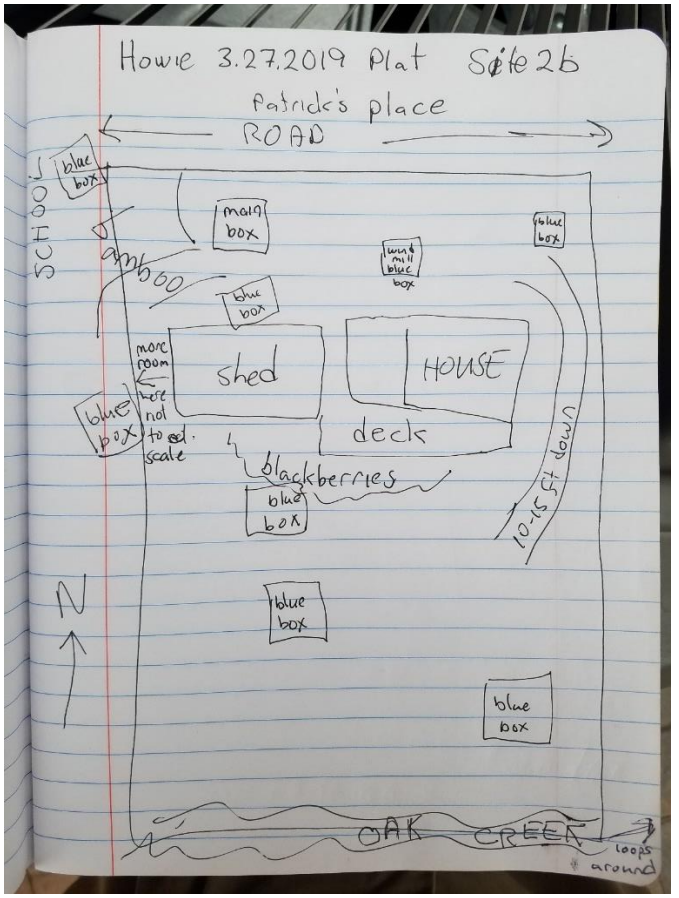
Appendix E – Site Maps



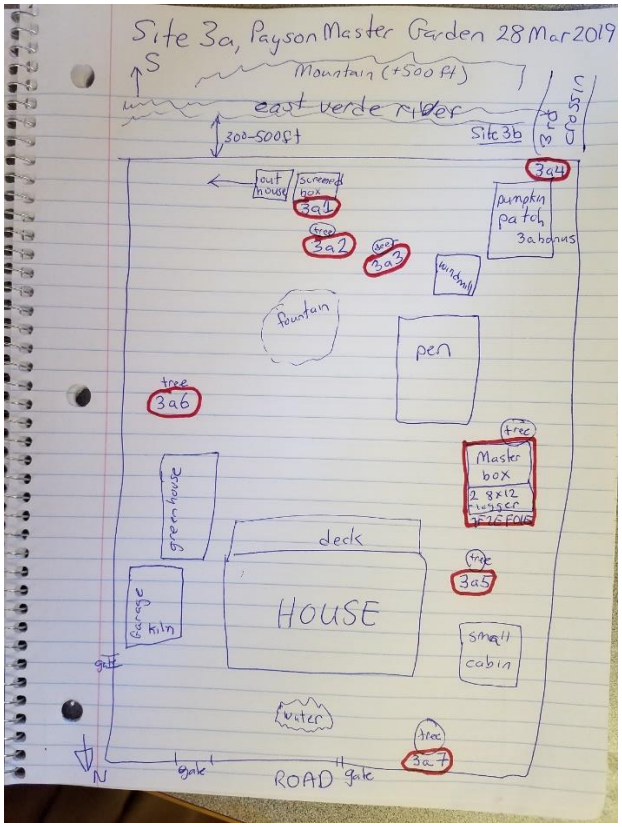


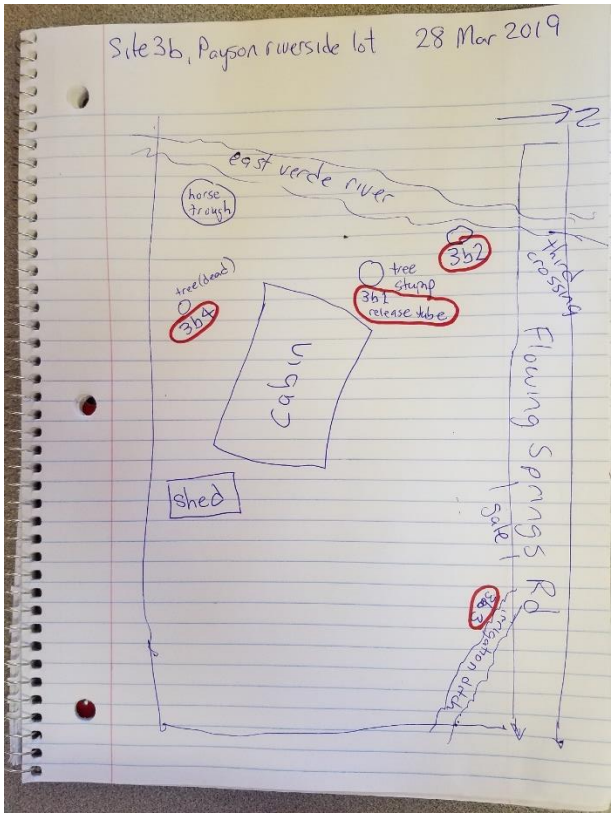
Site1a1 and Site1a2





Site2a and Site2b





Site3a and Site3b

TBS

Site4