D02 FIU SITE CHARACTERIZATION: SUMMARY

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See Configuration Management System for approval history.

Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	10/25/2010	NEON.FIU.000260.CRE	Initial Release
B	12/10/2010	NEON.FIU.000278.CRE	UPDATE SEE CRE
C	09/23/2011	ECO-00279	Update to new document number's/template throughout document.

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1 DESCRIPTION

1.1 Purpose

The data summarized here is used to inform the site design activities for NEON project Teams, EHS (permitting), FCC, ENG and FSU. This document summarizes the FIU site characterization data collected, analyzed, and described in the FIU D02 Site Characterization: Supporting Data (AD[01]).

1.2 Scope

This document summarizes the FIU site characterization data for three D02 tower locations: Smithsonian Conservation Biology Institute (SCBI) (Advanced), Smithsonian Environmental Research Center Relocatable site (SERC) (Relocatable 1), and the Blandy Experimental Farm site (Relocatable 2). Issues and concerns for each site that need attentions are also addressed in this document according to our best knowledge.
Disclaimer, all latitude and longitude points are subject to the tolerances of our measurement system, i.e., GPS

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

AD[01]	NEON.DOC.011045 _ FIU D02 Site Characterization Supporting Data.docx
AD[02]	NEON.DOC.011018 _WID between FIU and FCC
AD[03]	NEON.DOC.011008 _ FIU Tower Science Requirements
AD[04]	NEON.DOC.011029 _ FIU Precipitation Collector Site Design Requirements

2.2 Reference Documents

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]		
RD[04]		

2.3 Acronyms

m.a.s.l.	Meters above sea level
m.a.g.l.	Meters above ground level

2.4 Verb Convention

"Shall" is used whenever a specification expresses a provision that is binding. The verbs "should" and "may" express non-mandatory provisions. "Will" is used to express a declaration of purpose on the part of the design activity.

3 SMITHSONIAN CONSERVATION BIOLOGY INSTITUTE (SCBI) ADVANCE TOWER SITE

3.1 Desired ecosystem

Table 1. Ecosystem at SCBI tower site.

Ecosystem Type	Management activity
Tulip popular and oak dominated closed forest	Managed Forest

The representative ecosystem that NEON design is focused around for this core site is tulip popular and oak dominated closed forest, mixed with black walnuts and ash. Canopy height is ~35 m around tower site with lowest branches at ~7 m. Oak, ash and other tree species form upper understory with height ~ 8 m. Berry vines (species unknown) form the middle understory with mean height ~ 1.2 m. New ash seedlings and grasses form the understory at ground level with height ~ 0.3 m.

Table 2. Ecosystem and site attributes for SCBI Advanced tower site.

Ecosystem attributes	Measure and units
Mean canopy height	35 m
Surface roughness[a]	1.4 m
Zero place displacement height[a]	30 m
Structural elements	Closed canopy, understory present
Time zone	Eastern time
Magnetic declination	10° 3' W changing by 0° 1' W/year

Note, [a] From field observation.

3.2 Site Design and Tower Attributes

The site layout is summarized in the table below. Assume the projected area of the tower is square. **Anemometer/temperature boom arm direction** is ***from*** the tower ***toward*** the prevailing wind direction or designated orientation. **Instrument hut orientation vector** is parallel to the long side of the instrument hut. **Instrument hut distance z** is the distance from the center of tower projection to the center of the instrument hut projection on the ground. The numbering of the **measurement levels** is that the lowest is level one, and each subsequent increase in height is numbered sequentially, in this case, level 6 being the upper most level at this tower site.

Table 3. Site design and tower attributes for SCBI Advanced site.

0° is true north with declination accounted for. Color of Instrument hut exterior shall be tan to best match the surrounding environment.

Attribute	lat	long	degree	meters	notes
Airshed area			0^o to 70^o and 155^o to 230^o		Clockwise from first angle
Tower location	38.89292	-78.13950	--	--	Same location, new coordinates
Instrument hut	38.89283	78.13934			

Instrument hut orientation vector	--	--	30° - 210°	
Instrument hut distance z	--	--	--	15
Anemometer/Temperature boom orientation	--	--	300°	--
DFIR	38.89755	-78.15170		

Height of the measurement levels		
Level 1	0.2	m.a.g.l.
Level 2	7.0	m.a.g.l.
Level 3	17.0	m.a.g.l.
Level 4	29.0	m.a.g.l.
Level 5	38.0	m.a.g.l.
Level 6	50.0	m.a.g.l.
Tower Height	50.0	m.a.g.l.

See AD 03 for technical requirement to determine the boom height for the bottom most measurement level.

Eddy covariance, sonic wind and air temperature **boom arms** orientation toward the NW will be best to capture signals from all major wind directions, including the downhill flows. **Radiation boom arms** should always be facing south to avoid any shadowing effects from the tower structure.

DFIR (Double Fenced International Reference) will be used for bulk precipitation collection. We had difficulty to find adequate open area to meet USCRN class 1 and class 2 criteria for DFIR within 500 m radius from tower. The best and closest open area we can find is on the northwest side of tower and ~1.2 km away from tower and on a small hill top, which is next to access road and power line (< 100 m). It is in the same watershed with tower site. Coordinates are 38.89755, -78.15170. There are 3 – 4 small trees at the DFIR location. Dr Norman Bourg said it is no problem to remove these trees. After this tree removal, the open area will meet USCRN class 1 criteria for DFIR. **Wet deposition collector** will collocate at the top of the tower. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

Boardwalks. Ultimately, the decision to use a boardwalk will be, in part, based on owner's preferences. There are strong science requirements that minimize site disturbance to the surrounding area, which will be difficult to manage over a 30-y period. Traffic control is key to minimizing the site disturbance. Confining foot traffic to boardwalks minimizes site impact; this is particularly true in places where wear caused by foot traffic becomes noticeable and grows. For example, in places with snow part of the year, worn footpaths tend to have low places that collect water, or places where the snow pack becomes uneven causing personnel to walk farther and farther around the sides of the original path, causing the path to grow in width. This is a very common phenomenon. Here, FIU assumes that all conduits will be either buried, or placed inside the boardwalk such that it does not extend beyond the 36" (0.914 m). wide footprint. The boardwalk to access the tower is not on any side that has a boom.
Specific Boardwalks at SCBI site

- Boardwalk is from the access dirt road to instrument hut. SCBI does not have regulation on boardwalk usage.

- Boardwalk from the instrument hut to the tower to intersect on north face of the tower
- Boardwalk required from tower or instrument hut to soil array.
- No boardwalk from the soil array boardwalk to the individual soil plots
- No boardwalk needed at DFIR site

The relative locations between tower, instrument hut and boardwalk can be found in the Figure below:

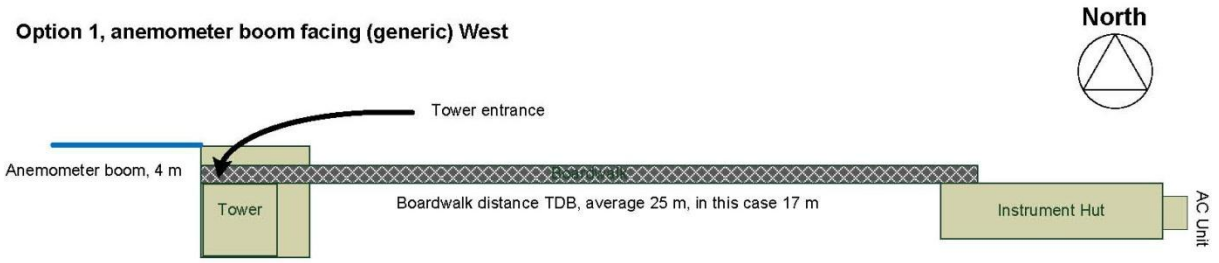


Figure 1. Generic diagram to demonstration the relationship between tower and instrument hut when boom facing west and instrument hut on the east towards the tower.

This is just a generic diagram. The actual layout of boardwalk (or path if no boardwalk required) and instrument hut position will be the joint responsibility of FCC and FIU. At SCBI Advanced site, the boom angle will be 300 degrees, instrument hut will be on the SE towards the tower, the distance between instrument hut and tower is ~15 m. The instrument hut vector will be NE-SW (30^{o}-210^{o}, longwise).

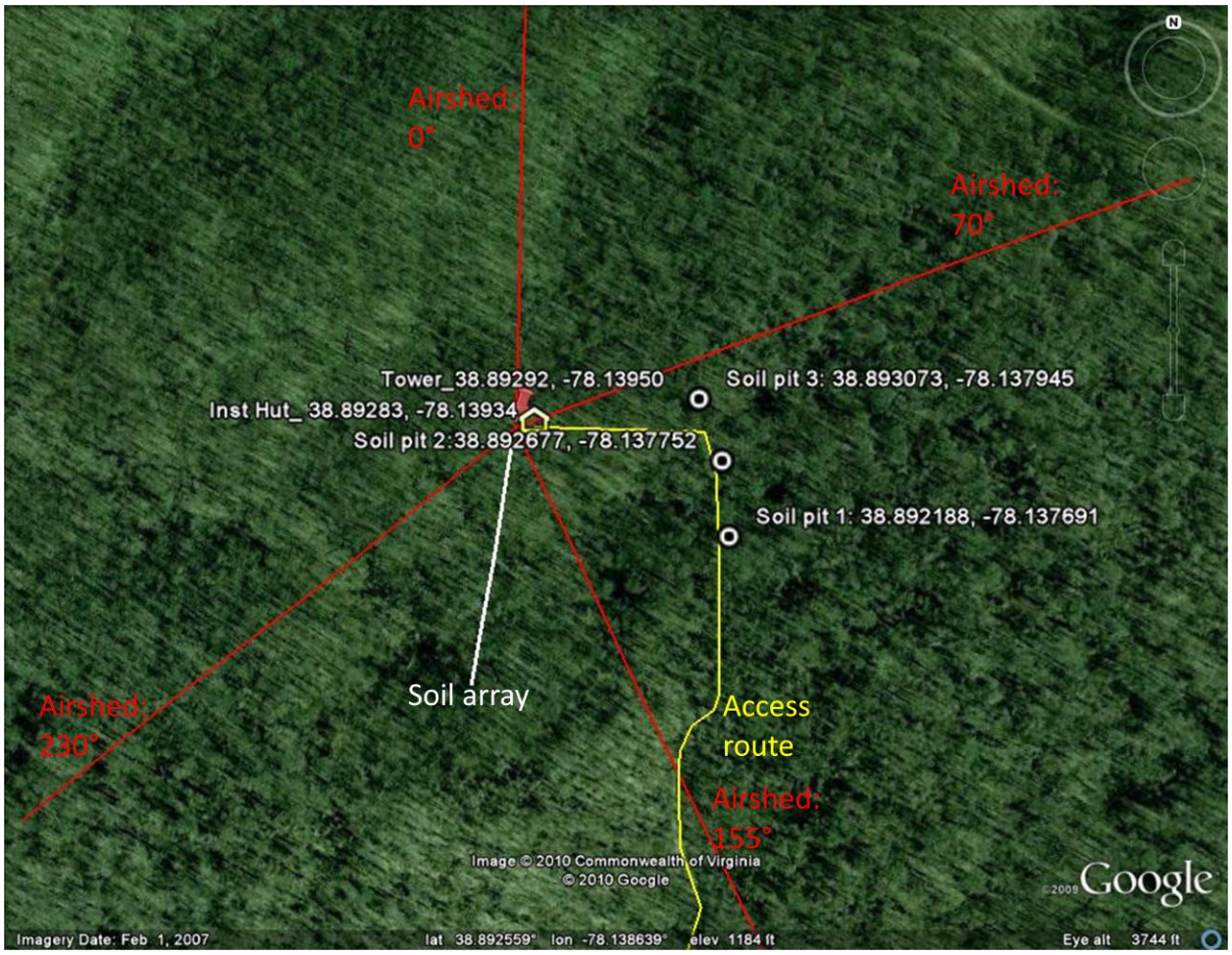


Figure 2. Site layout for SCBI Advanced tower site.

i) Tower location is presented (red pin), ii) red lines indicate the airshed boundaries. Vectors 0^o to 70^o (clockwise from 0^o) and 155^o to 230^o (clock wise from 155^o) are the airshed area that would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut.

Figure 3. DFIR location at SCBI tower site.
Purple pin indicates the DFIR location, which is close to access road and power line. It is~ 1.2 km away from tower location, but in the same watershed.

3.3 Soil Attributes

The soil array vector is ***from*** the soil plot closest to the tower ***toward*** the farthest soil plot. The exact location of each soil plot will be chosen by an FIU team member during site construction to avoid placing a soil plot at an unrepresentative location (e.g., rock outcrop, drainage channel, large tree, etc).

Dominant soil series at the site: Lew loam, 25 to 65 percent slopes, very stony. The taxonomy of this soil is shown below:
Order: Alfisols
Suborder: Udalfs
Great group: Hapludalfs
Subgroup: Ultic Hapludalfs
Family: Loamy-skeletal, mixed, active, mesic Ultic Hapludalfs
Series: Lew loam, 25 to 65 percent slopes, very stony

Table 4. Summary of soil array and soil pit information at SCBI.
0° represents true north and accounts for declination.

Soil plot dimensions	5 m x 5 m
Soil array pattern	B
Distance between soil plots: x	40 m
Distance from tower to closest soil plot: y	14 m
Latitude and longitude of 1st soil plot OR	38.89280°, -78.13953°

direction from tower	
Direction of soil array	190°
Latitude and longitude of FIU soil pit 1	38.892188, -78.137691 (primary location)
Latitude and longitude of FIU soil pit 2	38.892677, -78.137752 (alternate 1)
Latitude and longitude of FIU soil pit 3	38.893073, -78.137945 (alternate 2)
Dominant soil type	Lew loam, 25 to 65 percent slopes, very stony
Expected soil depth	>2 m
Depth to water table	>2 m

Expected depth of soil horizons	**Expected measurement depths***
0-0.30 m (Channery loam)	0.15 m
0.30-1.52 m (Very channery clay loam)	0.91 m

*Actual soil measurement depths will be determined based on measured soil horizon depths at the NEON FIU soil pit and may differ substantially from those shown here.

3.4 Information for ecosystem productivity plots.

The tower at SCBI Advanced site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (tulip popular-oak-black walnut hardwood forest). Major airshed area at this site are from 0^o to 70^o (clockwise from 0^o) and 155^o to 230^o (clock wise from 155^o), and 90% signals for flux measurements are in a distance of 800 m from tower, and 80% within 600 m. We suggest FSU Ecosystem Productivity plots be placed within the boundaries of 0^o to 70^o (clockwise from 0^o) and 155^o to 230^o (clock wise from 155^o) from tower.

3.5 Issues and attentions

SCBI is very willing to collaborate with NEON. We are not aware of any major logistics or political issues. Tower site is on a hill slope. Cold air drainage is likely to happen, like any other non-flat site. Caution is needed when interpreting such flux data. DFIR location is about 1.2 km away from tower location, but in the same watershed.

4 SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER (SERC), RELOCATEABLE TOWER 1

4.1 Desired ecosystem

Table 5. Ecosystem at the SERC Relocatable site.

Ecosystem Type	Management activity
hardwood deciduous forest dominant by tulip popular, oak and ash	Managed Forest

The Smithsonian Environmental Research Center (SERC) is a 2,800-acre (11 km2) environmental research and educational facility operated by the Smithsonian Institution located in Edgewater, MD. The representative ecosystem at SERC is hardwood deciduous forest dominant by tulip popular, oak and ash. Selective logging occurs at the north end of the property. Majority forest in the property is well preserved for research use. Our interest is in the well preserved forest.

Canopy height is 38 m around tower site with lowest branches at 10 m above ground level. Oak recruitments form upper understory, which vary from 3 to 15 m in height without obvious strata. Seedlings and sapling of ash and oak forms the lower understory with height 0.5-1.5 m. Ferns and new recruitment of ash and oak form the understory at ground level with height ~ 0.3 m (Figure 26). Grass and other annuals are not common at this site.

Table 6. Ecosystem and site attributes for the SERC Relocatable site.

Ecosystem attributes	Measure and units
Mean canopy height	38 m
Surface roughness[a]	6 m
Zero place displacement height[a]	32 m
Structural elements	Closed-canopy, uniform, homogeneous
Time zone	Eastern time
Magnetic declination	11° 5' W changing by 0° 0' W/year

Note, [a] From field survey.

4.2 Site Design and Tower Attributes

The site layout is summarized in the table below. Assume the projected area of the tower is square. **Anemometer/temperature boom arm direction** is ***from*** the tower ***toward*** the prevailing wind direction or designated orientation. **Instrument hut orientation vector** is parallel to the long side of the instrument hut. **Instrument hut distance z** is the distance from the center of tower projection to the center of the instrument hut projection on the ground. The numbering of the **measurement levels** is that the lowest is level one, and each subsequent increase in height is numbered sequentially, in this case, level 6 being the upper most level at this tower site.

Table 7. Site design and tower attributes for SERC Relocatable site

0° is true north with declination accounted for. Color of Instrument hut exterior shall be tan to best match the surrounding environment.

Attribute	lat	long	degree	meters	notes
Airshed			280° to 320 and 170° to 220° (major), 80° to 110° (secondary)		Clockwise from first angle
Tower location	38.89008,	-76.56001	--	--	Same site, new GPS
Instrument hut	38.88999,	-76.55985			
Instrument hut orientation vector	--	--	120°-300°		
Instrument hut distance z	--	--	--	15	
Anemometer/Temperature boom orientation	--	--	230°	--	
Height of the measurement levels					
Level 1				0.2	m.a.g.l.
Level 2				5.0	m.a.g.l.
Level 3				15.0	m.a.g.l.
Level 4				28.0	m.a.g.l.
Level 5				42.0	m.a.g.l.
Level 6				60.0	m.a.g.l.
Tower Height				60.0	m.a.g.l.

See AD 03 for technical requirement to determine the boom height for the bottom most measurement level.

Eddy covariance, sonic wind and air temperature **boom arms** orientation toward the southwest will be best to capture signals from all major wind directions. **Radiation boom arms** should always be facing south to avoid any shadowing effects from the tower structure.

Secondary **precipitation collector** for bulk precipitation collection will be located the top of tower at this site. **Wet deposition collector** will collocate at the top of the tower. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

Boardwalks. Ultimately, the decision to use a boardwalk will be, in part, based on owner's preferences. There are strong science requirements that minimize site disturbance to the surrounding area, which will be difficult to manage over a 30-y period. Traffic control is key to minimizing the site disturbance. Confining foot traffic to boardwalks minimizes site impact; this is particularly true in places where wear caused by foot traffic becomes noticeable and grows. For example, in places with snow part of the year, worn footpaths tend to have low places that collect water, or places where the snow pack becomes uneven causing personnel to walk farther and farther around the sides of the original path, causing the path to grow in width. This is a very common phenomenon. Here FIU assumes that all conduits will be either buried, or placed inside the boardwalk such that it does not extend beyond the 36' wide footprint. While the final design is not yet known, there are some general criteria that can be outlined. We assume that the boardwalk width is 36" (0.914 m). Material is not known, but must be fire proof, and in some locations the site is seasonally flooded and inundated with water. Boardwalks may also

provide a scratching structure for grazing animals that in turn, would wear and unduly impact the site. Site by site evaluations must be done.

Specific boardwalks at the SERC site

- Boardwalk is from the access paved road to instrument hut. SERC does not have any specific requirement about boardwalk.
- Boardwalk from the instrument hut to the tower to intersect on north face of the tower
- Boardwalk required from the instrument hut to the soil array
- No boardwalk from the soil array boardwalk to the individual soil plots

The relative locations between tower, instrument hut and boardwalk can be found in the diagram below:

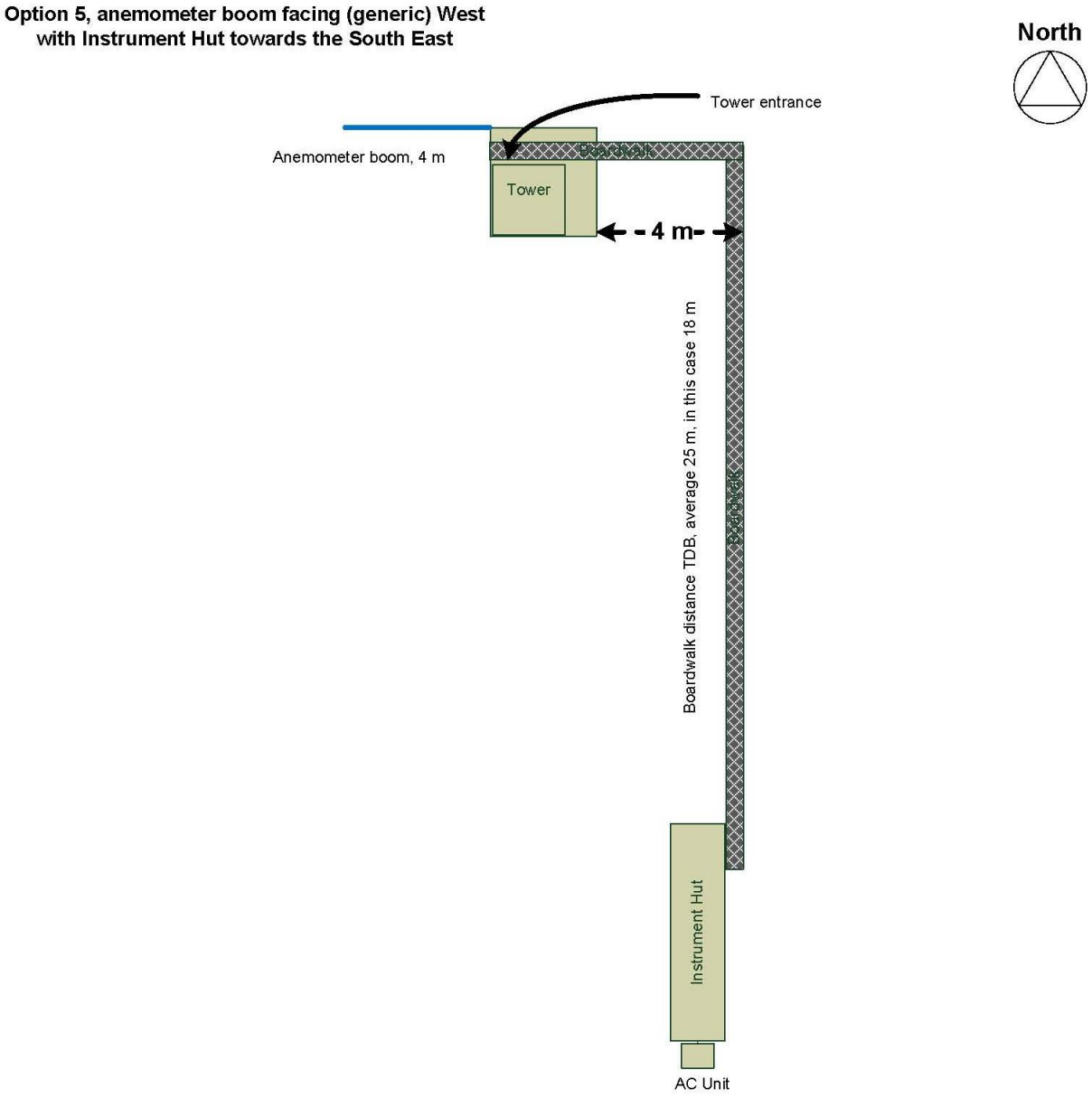


Figure 4. Generic diagram to demonstration the relationship between tower and instrument hut when boom facing west and instrument hut on the south towards the tower.
This is just a generic diagram. The actual design of boardwalk (or path if no boardwalk required) and instrument hut position will be the responsibility of FCC and LAD following FIU's guidelines. At SERC relocatable site, the boom angle will be 230 degrees, instrument hut will be on the southeast towards the tower, the distance between instrument hut and tower is ~15 m. The instrument hut vector will be SE-NW (120°-300°).

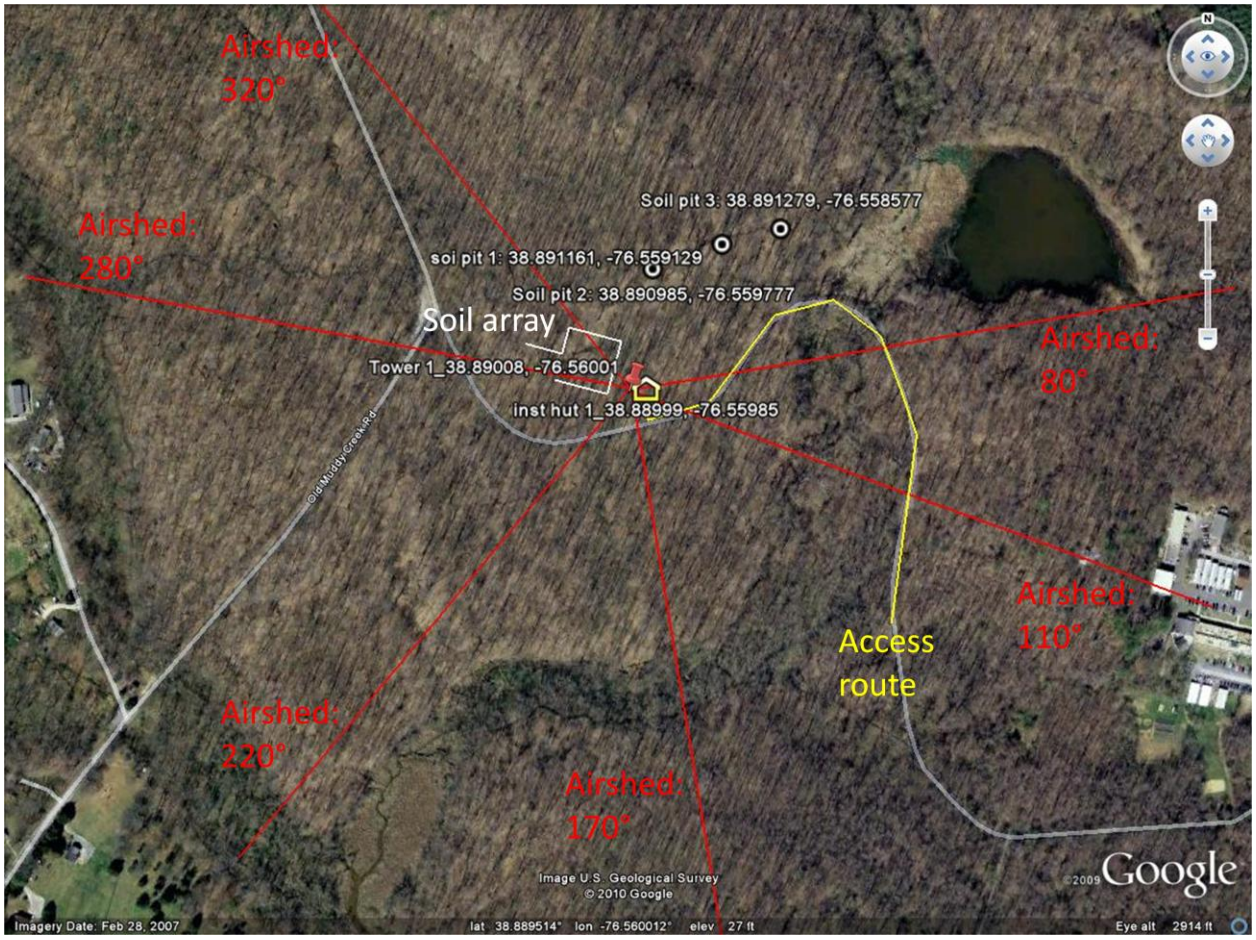


Figure 5. Site layout for SERC Relocatable site.

i) new tower location is presented (red pin), ii) red lines indicate the airshed boundaries. Vectors of 280° to 320° (major airshed, clockwise from 280°) and 170° to 220° (clockwise from 170°), and 80° to 110° (secondary airshed, clockwise from 80°) would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut.

4.3 Soil Attributes

The soil array vector is ***from*** soil plot closest to the tower ***toward*** to the nearest soil plot to the west (Fig. 6). The exact location of each soil plot will be chosen by an FIU team member during site

construction to avoid placing a soil plot at an unrepresentative location (e.g., rock outcrop, drainage channel, large tree, etc).

Dominant soil series at the site: Collington-Wist complex, 5 to 10 percent slopes. The taxonomy of this soil is shown below:
Order: Ultisols
Suborder: Udults
Great group: Hapludults
Subgroup: Typic Hapudults
Family: Fine-loamy, mixed, active, mesic Typic Hapludults
Series: Collington-Wist complex, 5 to 10 percent slopes

Table 8. Summary of soil array and soil pit information at SERC.
0° represents true north and accounts for declination.

Soil plot dimensions	5 m x 5 m
Soil array pattern	C
Distance between soil plots: x	34 m
Distance from tower to closest soil plot: y	18 m
Latitude and longitude of 1st soil plot OR direction from tower	38.890065°, -76.560215°
Direction of soil array	285°
Latitude and longitude of FIU soil pit 1	38.891161, -76.559129 (primary location)
Latitude and longitude of FIU soil pit 2	38.890985, -76.559777 (alternate 1)
Latitude and longitude of FIU soil pit 3	38.891279, -76.558577 (alternate 2)
Dominant soil type	Collington-Wist complex, 5 to 10 percent slopes
Expected soil depth	>2 m
Depth to water table	>1.02-2 m

Expected depth of soil horizons	**Expected measurement depths***
0-0.33 m (Fine sandy loam)	0.17 m
0.33-0.43 m (Fine sandy loam)	0.38 m
0.43-1.04 m (Sandy clay loam)	0.74 m
1.04-2 m (Fine sandy loam)	1.52 m

*Actual soil measurement depths will be determined based on measured soil horizon depths at the NEON FIU soil pit and may differ substantially from those shown here.

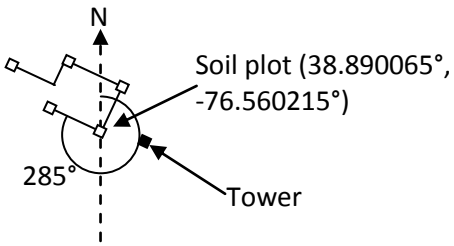


Figure 6. Schematic diagram of soil array layout in relation to tower. Soil plot positions are approximate.

4.4 Information for ecosystem productivity plots.

The tower at SERC Relocatable site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (hardwood forest). Major airshed at this site from northwest (280^o to 320^o, clockwise from 280^o) and from South (170^o to 220^o, clockwise from 170^o), and secondary airshed from 80^o to 110^o (clockwise from 80^o). Most of the time, 90% signals for flux measurements are within a distance of 800 m from tower, and 80% within 500 m. We suggest FSU Ecosystem Productivity plots to be placed within the major airshed boundaries of 280^o to 320^o (clockwise from 280^o) from tower.

4.5 Issues and attentions

Research activities are active at this site. Tower location at the existing tower location is our first recommendation for NEON tower location, which can minimize disturbance and impacts during construction, minimize the conflicts with other research projects, and is also the preference option of SERC. Power is available at site. Paved road lead to tower location within 100 m, which make the accessibility very convenient. Paved road is ~ 6 m wide and currently open 2 hours daily for public traffic. After the major road is paved (it is ongoing and expect to be finished soon), this paved road will be closed for public use, thus has very limit impacts of car gas emission and security concerns. The director of SERC, Tuck Hines, also thought that having the NEON tower to occupy the very site of the current SERC tower is worth considering. However, if for any reason the above location doesn't work, the second option of our tower location and instrument hut location are inside SERC plots (Tower 2_38.89057, -76.56079, Inst hut 2_38.89055, -76.56070), where every single tree with diameter > 1cm will be monitored and measured periodically. Dr Geoffrey (Jess) Parker also has long term experiment set up here for over 15 years. This tower location is very close to selective logging area (~70 m), edge effects between these two different density ecosystems could be a concern. Dr Geoffrey (Jess) Parker picked this second set of tower and instrument hut locations with FIU team at field.

Dr Geoffrey (Jess) Parker required us to do site layout design and send to him for comments, so that he can check our design layout with existing research projects at SERC. Dr Geoffrey (Jess) Parker also wants all NEON facilities stays on the west side of red stake line between SERC plot 4 and 8. We may have to adjust our soil plots location accordingly to minimize the conflicts. We assume this will be EHS's

responsibility to present our site layout and communicate with SERC, then get back to FIU team for further discussion.

5 BLANDY EXPERIMENTAL FARM, RELOCATEABLE TOWER 2

5.1 Desired ecosystem

Table 9. Ecosystem at Blandy Experimental Farm Relocatable site.

Ecosystem Type	Management activity
Old field	Currently unmanaged

NEON tower site (39.06026°, -78.07164°) is in an old field, which is under succession. Goldenrod (*Solidago altissima,* in more recent abandon farm field) and shrub common buckthorn (*Rhamnus cathartica,* in older abandoned farm field) are the dominant vegetation in the major airshed northwest of the tower location. Invasive species are common in this area. Common buckthorn (*Rhamnus cathartica*) is the dominant invasive plants in this field. The major ecosystem in the secondary airshed on the south to the tower location is hay or corn, depending on farmers' decision.

Canopy height is ~1.2 m (varies from 0.5 m to 2.5 m) around tower site with lowest branches at ground level at old field area. Canopy height is ~0.5 m for the hay farm land. No understory layers are presented. Windbreak trees are ~ 400 m on the west of tower location, which is >> 5x of the mean canopy height (~25 m), thus wake effect and edge effect are not major concerns.

Table 10. Ecosystem and site attributes for the Blandy Experimental Farm Relocatable site.

Ecosystem attributes	Measure and units
Mean canopy height[a]	1.2 m in major airshed /0.5 m in secondary airshed
Surface roughness[a]	0.2 m/0.05
Zero place displacement height[a]	0.8 m/0.35
Structural elements	Abandoned old farm field / hay farmland
Time zone	Eastern time
Magnetic declination	11° 5' W changing by 0° 0' W/year

Note, [a] From field survey.

5.2 Site Design and Tower Attributes

The site layout is summarized in the table below. Assume the projected area of the tower is square. **Anemometer/temperature boom arm direction** is ***from*** the tower ***toward*** the prevailing wind direction or designated orientation. **Instrument hut orientation vector** is parallel to the long side of the instrument hut. **Instrument hut distance z** is the distance from the center of tower projection to the center of the instrument hut projection on the ground. The numbering of the **measurement levels** is that the lowest is level one, and each subsequent increase in height is numbered sequentially.

Table 11. Site design and tower attributes for Blandy Experimental Farm Relocatable site

0° is true north with declination accounted for. Color of Instrument hut exterior shall be tan to best match the surrounding environment.

Attribute	lat	long	degree	meters	notes

Airshed			280° to 320° (major) 130° to 220° (secondary)		Clockwise from first angle
Tower location	39.06026°,	-78.07164°	--	--	new site
Instrument hut	39.06025°,	-78.07141°			
Instrument hut orientation vector	--	--	120°-300°		
Instrument hut distance z	--	--	--	19	
Anemometer/Temperature boom orientation	--	--	240°	--	
Height of the measurement levels					
Level 1				0.2	m.a.g.l.
Level 2				1.2	m.a.g.l.
Level 3				3.0	m.a.g.l.
Level 4				6.0	m.a.g.l.
Tower Height				6.0	m.a.g.l.

See AD 03 for technical requirement to determine the boom height for the bottom most measurement level.

Eddy covariance, sonic wind and air temperature **boom arms** orientation toward the southwest will be best to capture signals from all major wind directions. **Radiation boom arms** should always be facing south to avoid any shadowing effects from the tower structure.

Secondary **precipitation collector** for bulk precipitation collection will be located at the top of tower at this site. **Wet deposition collector** will collocated at the top of the tower at this site. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

Boardwalks. Ultimately, the decision to use a boardwalk will be, in part, based on owner's preferences. There are strong science requirements that minimize site disturbance to the surrounding area, which will be difficult to manage over a 30-y period. Traffic control is key to minimizing the site disturbance. Confining foot traffic to boardwalks minimizes site impact; this is particularly true in places where wear caused by foot traffic becomes noticeable and grows. For example, in places with snow part of the year, worn footpaths tend to have low places that collect water, or places where the snow pack becomes uneven causing personnel to walk farther and farther around the sides of the original path, causing the path to grow in width. This is a very common phenomenon. Here FIU assumes that all conduits will be either buried, or placed inside the boardwalk such that it does not extend beyond the 36' wide footprint. While the final design is not yet known, there are some general criteria that can be outlined. We assume that the boardwalk width is 36" (0.914 m). Material is not known, but must be fire proof, and in some locations the site is seasonally flooded and inundated with water. Boardwalks may also provide a scratching structure for grazing animals that in turn, would wear and unduly impact the site. Site by site evaluations must be done.

Specific boardwalks at the Blandy Experimental Farm Relocatable site

- Boardwalk is from the access dirt road to instrument hut, pending landowner decision

- Boardwalk from the instrument hut to the tower to intersect on north face of the tower
- Boardwalk required to the soil array
- No boardwalk from the soil array boardwalk to the individual soil plots

The relative locations between tower, instrument hut and boardwalk can be found in the diagram below:

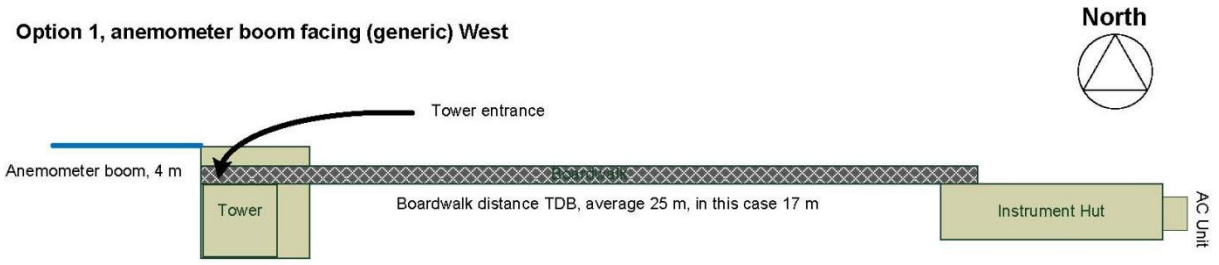


Figure 7. Generic diagram to demonstration the relationship between tower and instrument hut when boom facing west and instrument hut on the east towards the tower.

This is just a generic diagram when boom facing west and instrument hut on the general east towards the tower. The actual design of boardwalk (or path if no boardwalk required) and instrument hut position will be the co-responsibility of FCC and FIU team. At this site, the boom angle will be 240 degrees, instrument hut will be on the east towards the tower, the distance between instrument hut and tower is ~19 m. The instrument hut vector will be SE-NW (120^{o}-300^{o}).

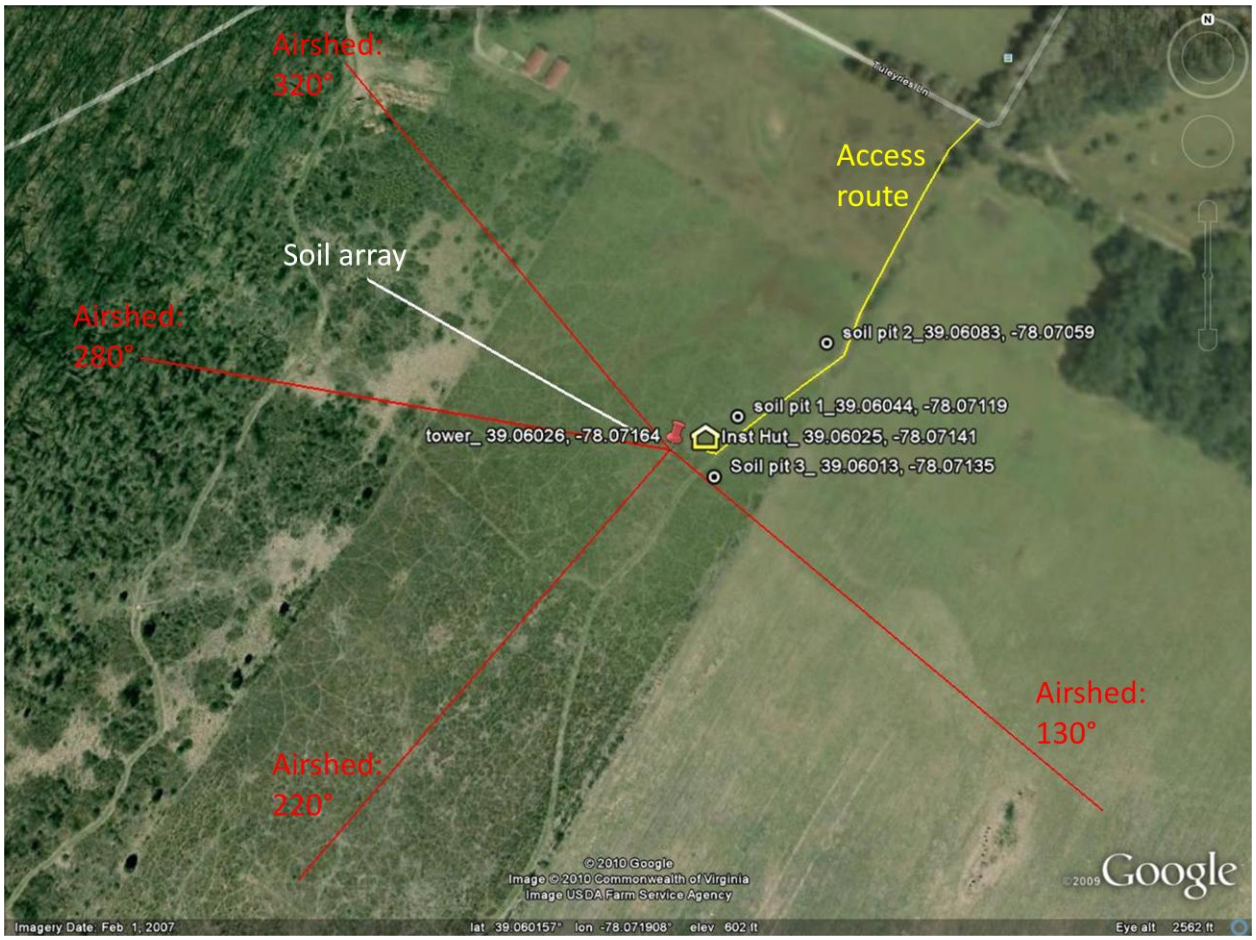


Figure 8. Site layout for Blandy Experimental Farm Relocatable site.

i) new tower location is presented (red pin), ii) red lines indicate the airshed boundaries. Vectors 280° to 320° (clockwise from 280°, major airshed), and from 130° to 220° (clockwise from 220°, secondary airshed) would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut.

5.3 Soil Attributes

The soil array vector is ***from*** the soil plot closest to the tower ***toward*** the farthest soil plot. The exact location of each soil plot will be chosen by an FIU team member during site construction to avoid placing a soil plot at an unrepresentative location (e.g., rock outcrop, drainage channel, large tree, etc).

Dominant soil series at the site: Timberville silt loam, 0 to 7 percent slopes-Poplimento silt loam, 3 to 8 percent slopes-Nicholson-Duffield silt loams, 3 to 8 percent slopes. The taxonomy of this soil is shown below:
Order: Ultisols-Alfisols
Suborder: Udults-Udalfs
Great group: Hapludults-Hapludalfs-Fragiudalfs
Subgroup: Typic Hapludults-Ultic Hapludalfs-Oxyaquic Fragiudalfs

Family: Fine, mixed, active, mesic Typic Hapludults- Fine, mixed, subactive, mesic Ultic Hapludalfs -Fine-silty, mixed, active, mesic Oxyaquic Fragiudalfs-Fine-loamy, mixed, active, mesic Ultic Hapludalfs
Series: Timberville silt loam, 0 to 7 percent slopes-Poplimento silt loam, 3 to 8 percent slopes-Nicholson-Duffield silt loams, 3 to 8 percent slopes

Table 12. Summary of soil array and soil pit information at Blandy.
0° represents true north and accounts for declination.

Soil plot dimensions	5 m x 5 m
Soil array pattern	B
Distance between soil plots: x	40 m
Distance from tower to closest soil plot: y	15 m
Latitude and longitude of 1st soil plot OR direction from tower	39.060323°, -78.071794°
Direction of soil array	300°
Latitude and longitude of FIU soil pit 1	39.06044, -78.07119 (primary location)
Latitude and longitude of FIU soil pit 2	39.06083, -78.07059 (alternate 1)
Latitude and longitude of FIU soil pit 3	39.06013, -78.07135 (alternate 2)
Dominant soil type	Timberville silt loam, 0 to 7 percent slopes-Poplimento silt loam, 3 to 8 percent slopes-Nicholson-Duffield silt loams, 3 to 8 percent slopes
Expected soil depth	1.22 - >2 m
Depth to water table	0.46 - >2 m

Expected depth of soil horizons	**Expected measurement depths****
0-0.23 m (Silt loam)*	0.12 m
0.23-0.58 m (Silt loam-Silty clay loam-Clay)*	0.41 m
0.58-0.91 m (Silt loam-Silty clay loam-Clay)*	0.75 m
0.91-2 m (Silty clay-Silt loam-Very channery silty clay-Clay)*	1.46 m

*Since there are many different soil types at this site, the number of soil horizons, and their depth, may differ substantially among the 5 soil plots
**Actual soil measurement depths will be determined based on measured soil horizon depths at the NEON FIU soil pit and may differ substantially from those shown here.

5.4 Information for ecosystem productivity plots.

The tower at this site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (common buckthorn (*Rhamnus cathartica*) and goldenrod (*Solidago altissima*) in the abandoned old fields and hays/corns in the farm field). Airshed at this site is from 280° to 320° (clockwise from 280°, major airshed) and from 130° to 220° (clockwise from 130°, secondary airshed) throughout the whole year. 90% daytime signals for flux measurements are within a distance of 700 m from tower, and 80% within 400 m. Therefore, we suggest FSU Ecosystem Productivity plots are placed within the major tower airshed boundaries of 280° to 320° (clockwise from

280°) for invasive species study, or within the secondary tower airshed boundaries of 130° to 220° (clockwise from 130°) for hay/corn study.

5.5 Issues and attentions

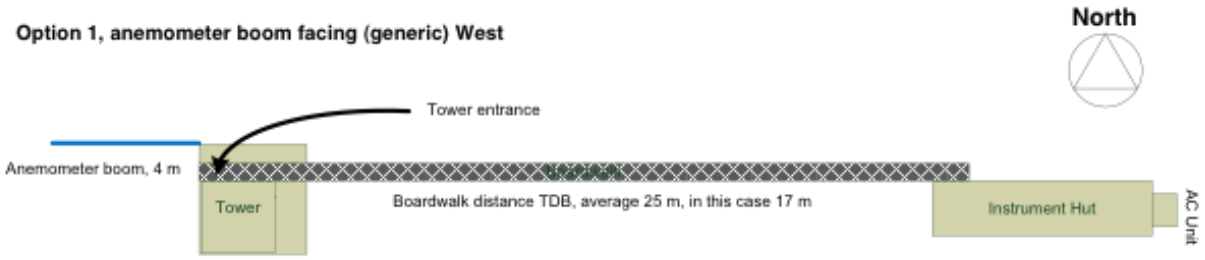
The tower site on EHS' list is 39.0621°, -78.05446667°. According to the wind roses and footprint analysis, the major fetch area for this tower site is from the experimental area, which contents 20 plots at different ecosystem succession stages as results of soil plow in different frequencies. This will make it difficult to interpret the flux signals from this area due to the fragment surface. After FIU site characterization, tower location is miscrosited to 39.06026°, 78.07164° in abandoned old fields. Goldenrod (*Solidago altissima,* in more recent abandon farm field) and shrub common buckthorn (*Rhamnus cathartica,* in older abandoned farm field) are dominant vegetation in the major airshed on northwest to tower location (280° to 320°, clockwise from 280°). Invasive species is common in this area. Common buckthorn (*Rhamnus cathartica*) is the dominant invasive plants in this field, although there is some disagreement about the species identification (per personal communication with Dr David Carr). FIU measurements can be tied to the FSU study about invasive species here. The dominant ecosystem type in the secondary airshed on the south to the tower location is hays or corns, depending on farmers' decision. Although ideally we wish to have a homogenous surface in the tower airshed for flux measurements, two ecosystems in our airshed will has less uncertainty than 20 different plots when interpreting flux signals. However, how to separate signals from different ecosystems, how to interpret the measurement results, and how to quantify the uncertainties remains a challenge.

Tower location in the abandon field has gotten the ok from the Blandy Farm director Dr David Carr. According to Kyle Jonathan Haynes (Associate Director), the farmland is currently leased to farmer, and can be taken back if NEON or other research projects need it. If possible, we would suggest Blandy Farm take the farmland back so that NEON's science will be less impacted by the unforeseen consequences during the measurement period.

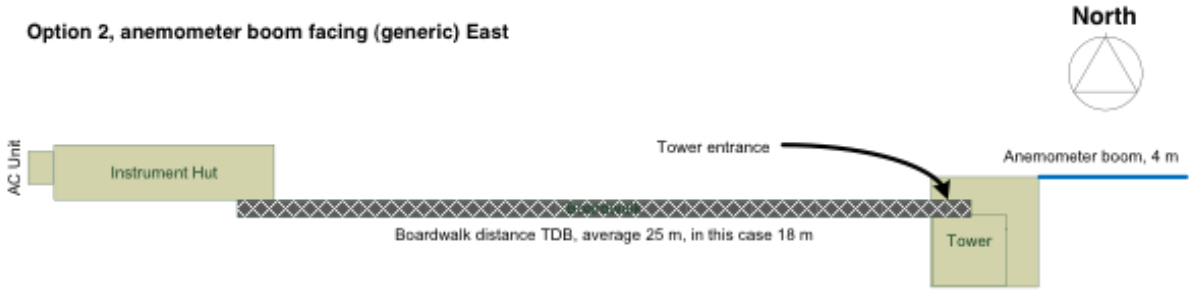
There is an existing 10-m antenna tower southwest ~80 m to NEON tower location. It is on the edge of our secondary airshed. No large impact is foreseen on NEON measurements. No active measurements were observed on the tower during FIU site visit. Dr David Carr will check with the tower operator and get back us if he/she has any concerns.

We do not see any major logistic issues at this site. Power line is <100 m from tower location. Access road is next to tower location and instrument hut location.

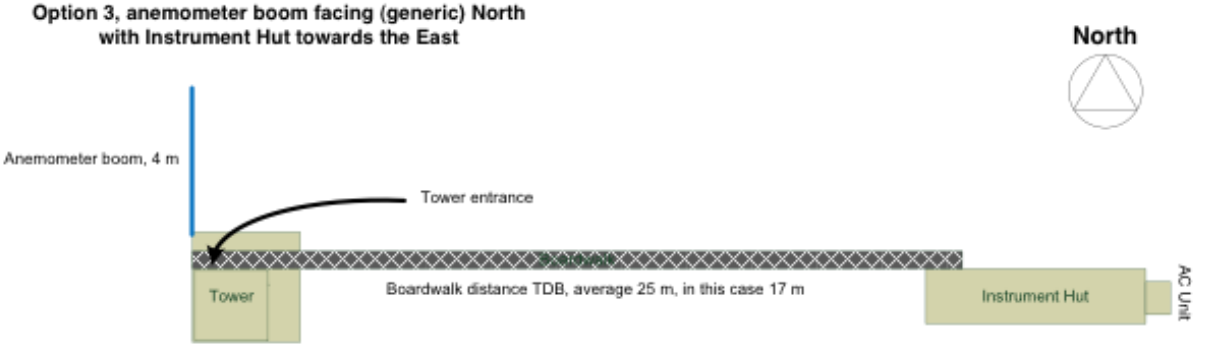
Option 1, anemometer boom facing (generic) West



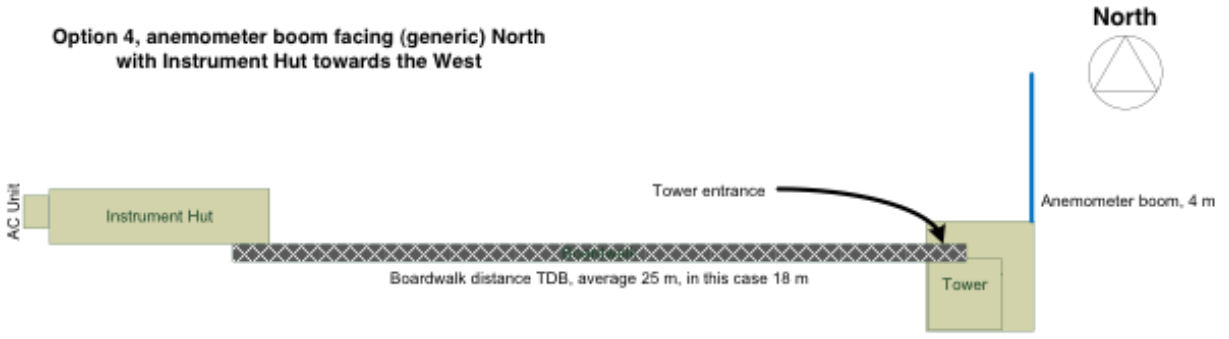
Option 2, anemometer boom facing (generic) East



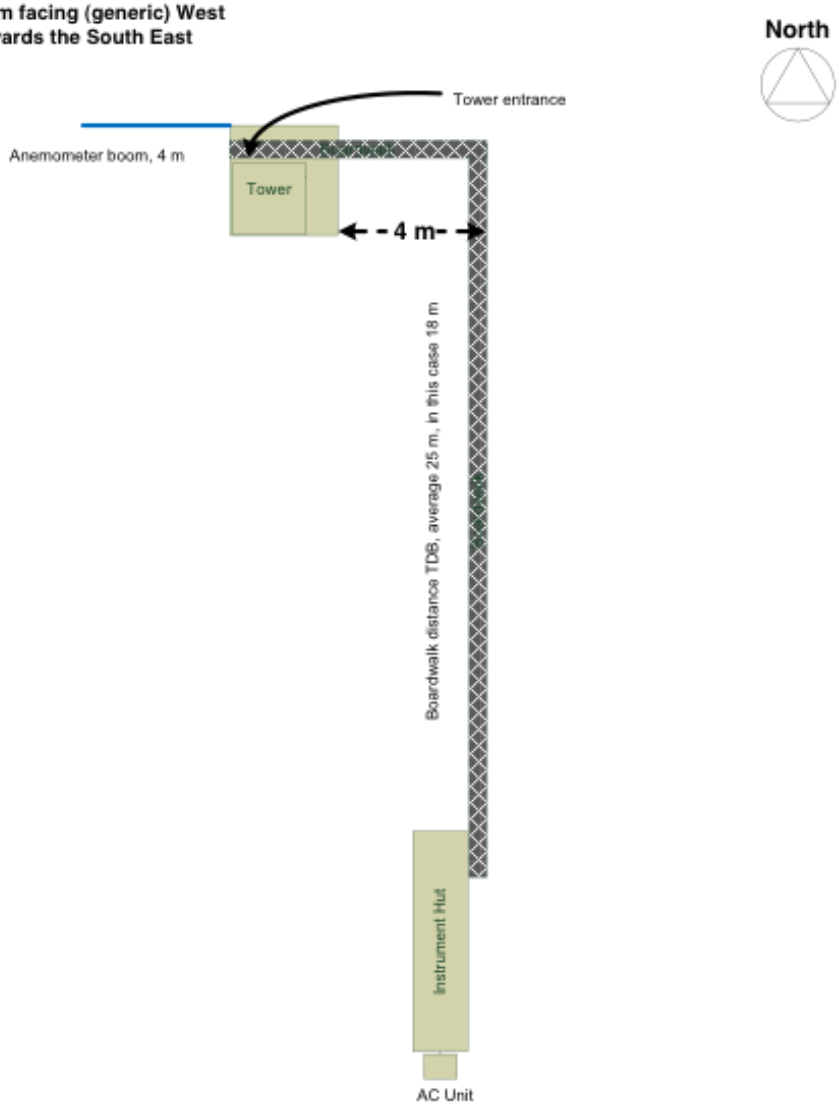
Option 3, anemometer boom facing (generic) North with Instrument Hut towards the East

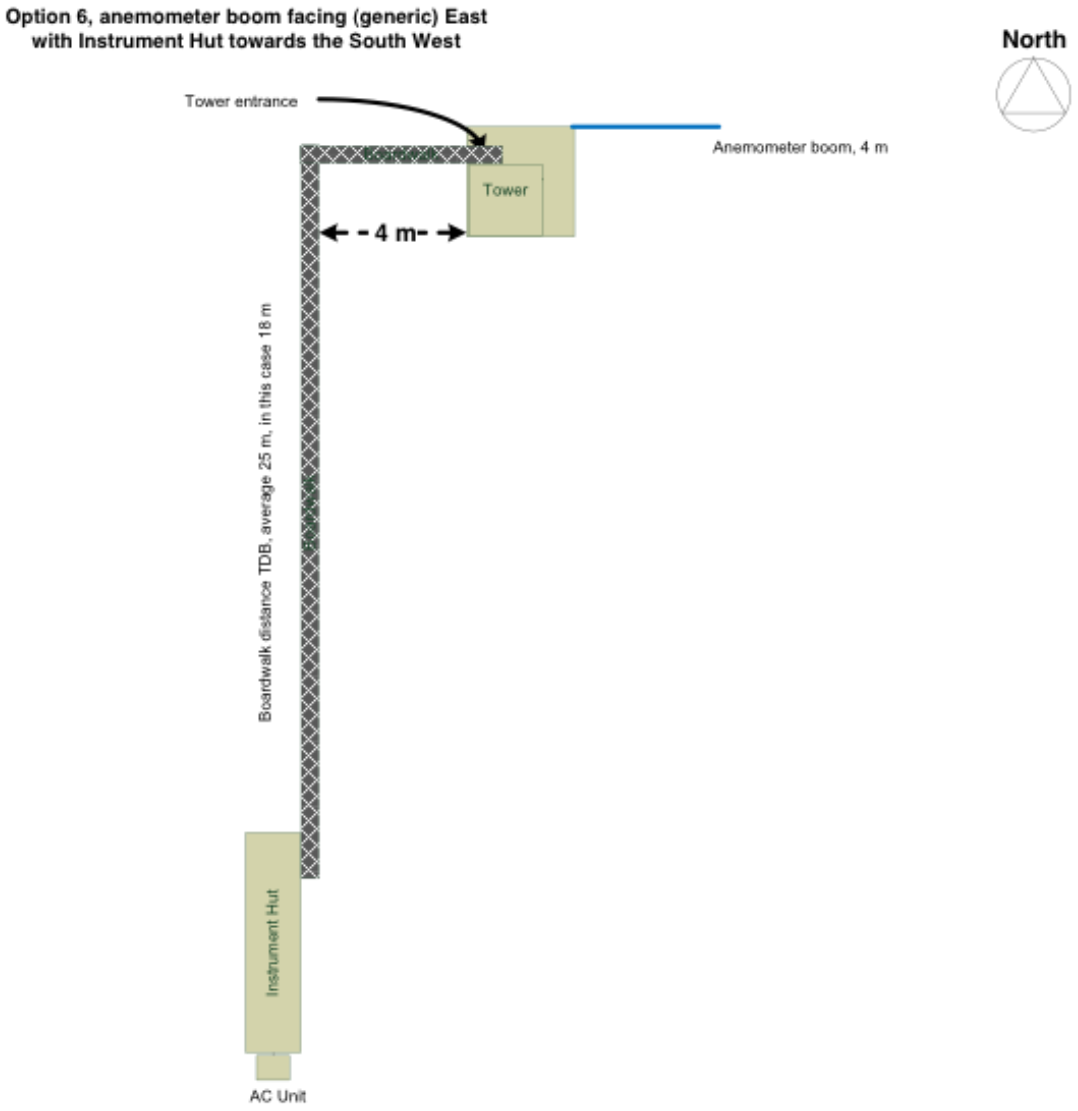


Option 4, anemometer boom facing (generic) North with Instrument Hut towards the West

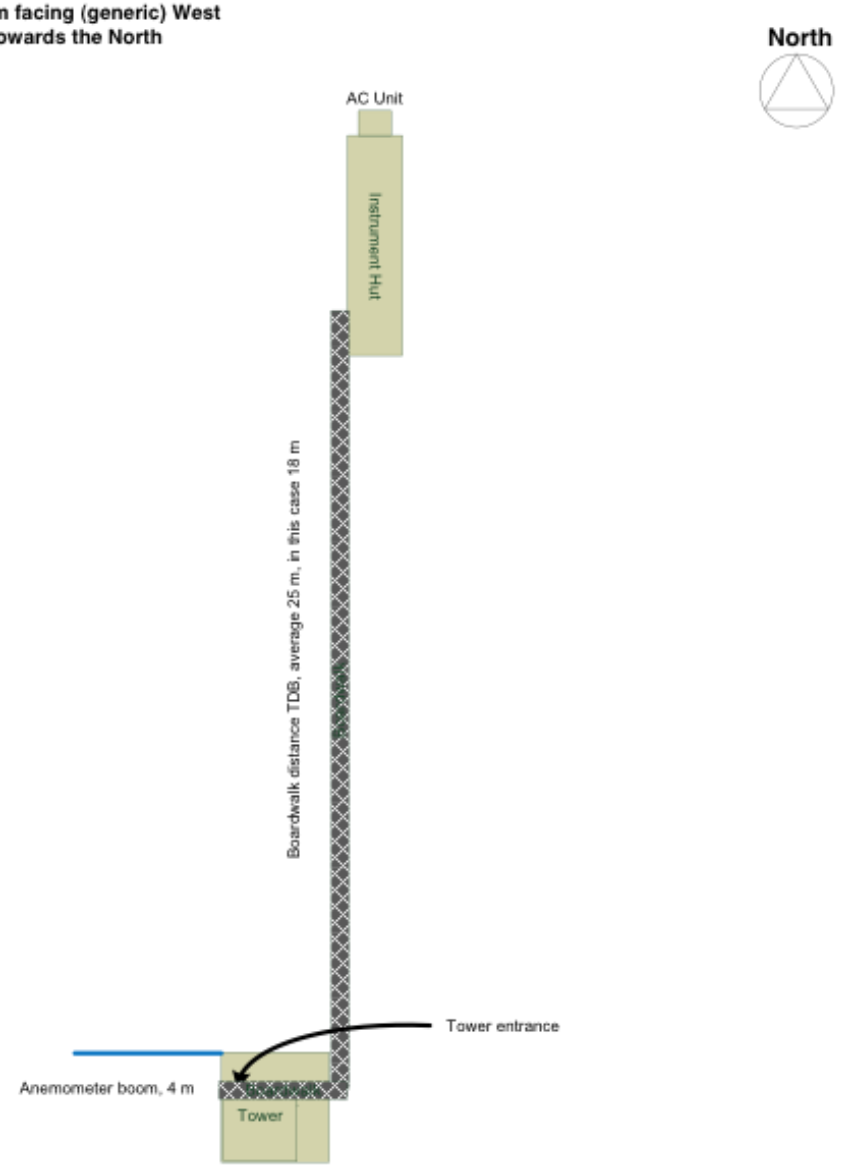


Option 5, anemometer boom facing (generic) West with Instrument Hut towards the South East




Option 6, anemometer boom facing (generic) East
with Instrument Hut towards the South West
North
Tower entrance
Anemometer boom, 4 m
Tower
4 m
Boardwalk distance TDB, average 25 m, in this case 18 m
Instrument Hut
AC Unit

Option 7, anemometer boom facing (generic) West with Instrument Hut towards the North



Option 8, anemometer boom facing (generic) South with Instrument Hut towards the North

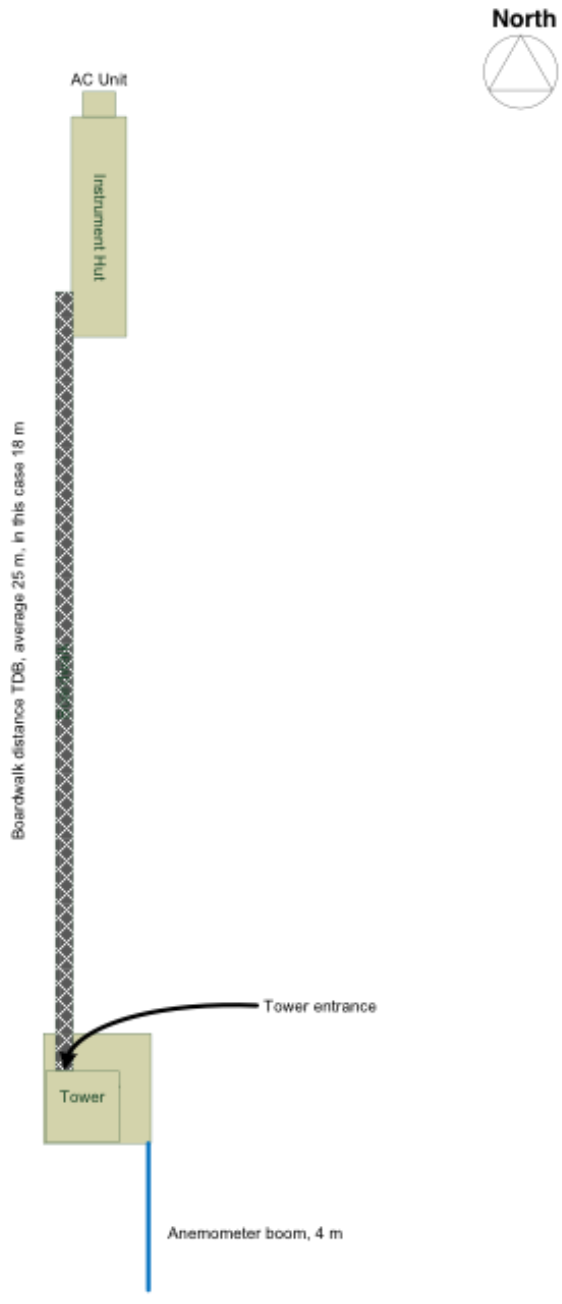
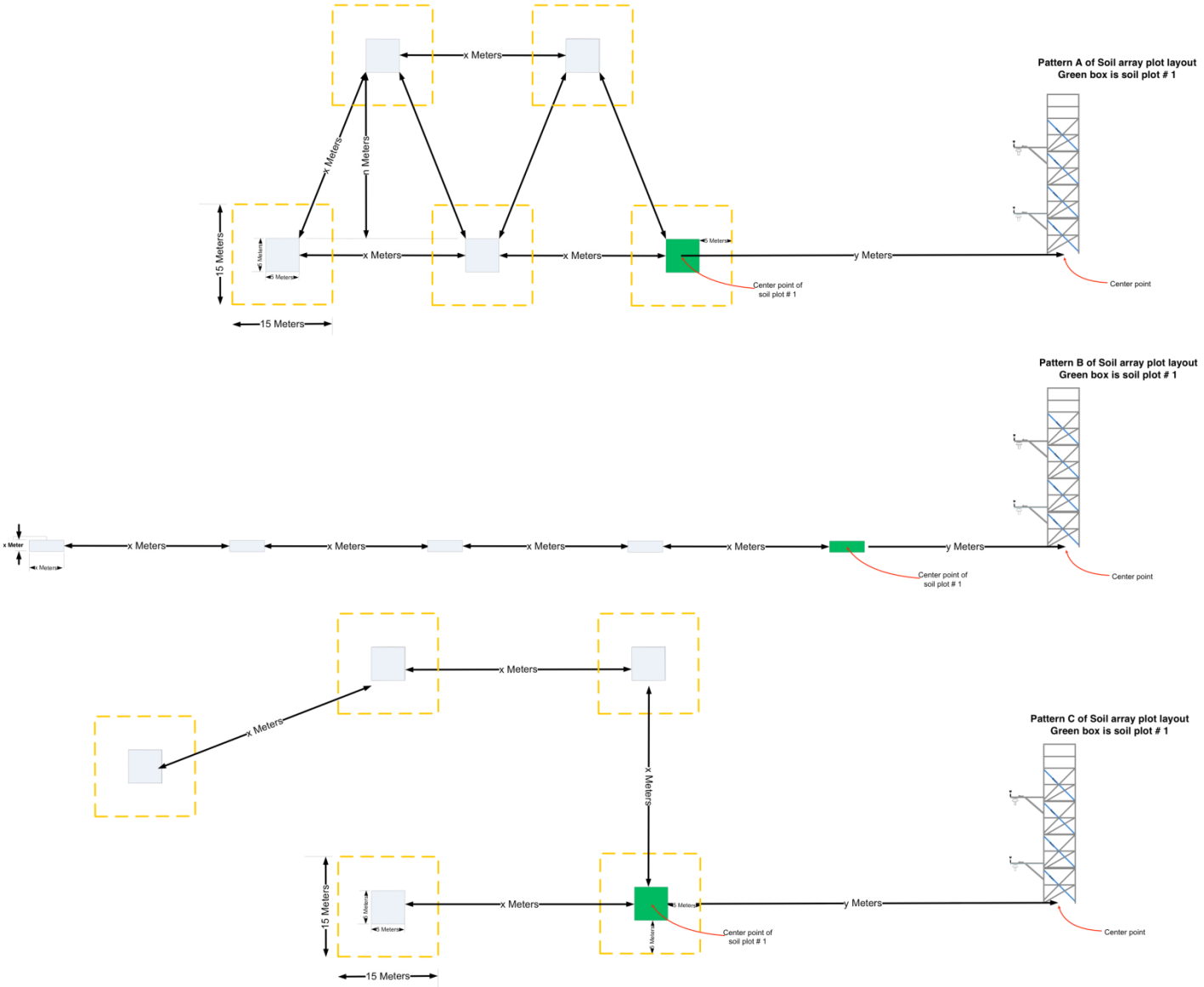


Figure 9. Generic patterns for the boardwalk configuration

These generic configurations are from the instrument hut to the tower based on 8 generic scenarios. The five options are based on anemometer boom orientation and the leeward side of the tower where the instrument hut is located. The tower entrance is always on the North side of the tower. Exact tower and instrument hut location and orientation will be specified at each location and presented in the site characterization document.


Pattern A of Soil array plot layout
Green box is soil plot # 1
x Meters
x Meters
n Meters
15 Meters
x Meters
x Meters
y Meters
15 Meters
Center point of soil plot # 1
Center point
Pattern B of Soil array plot layout
Green box is soil plot # 1
x Meter
x Meters
x Meters
x Meters
x Meters
y Meters
Center point of soil plot # 1
Center point
Pattern C of Soil array plot layout
Green box is soil plot # 1
x Meters
x Meters
x Meters
15 Meters
x Meters
y Meters
15 Meters
Center point of soil plot # 1
Center point

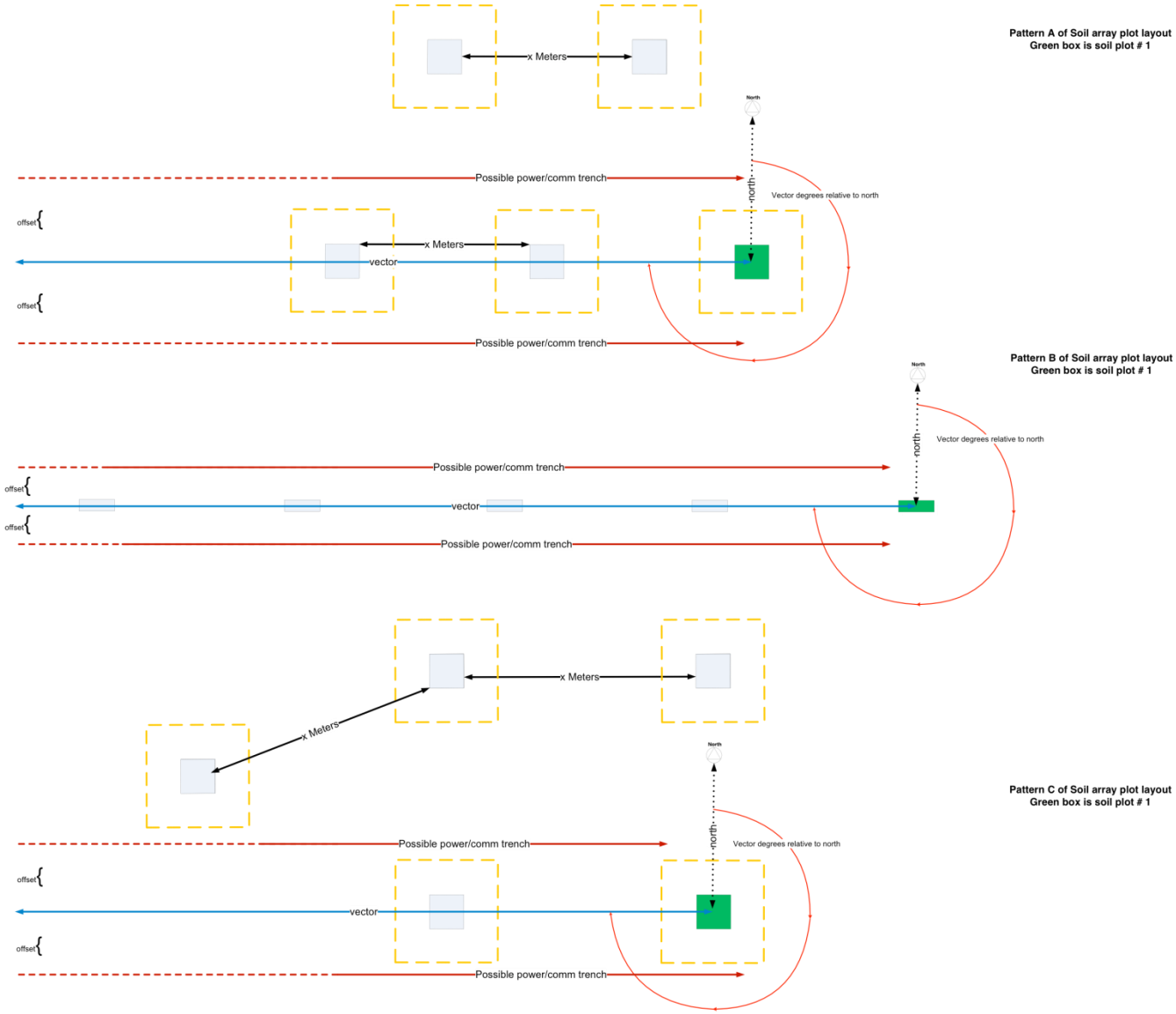

Pattern A of Soil array plot layout
Green box is soil plot # 1
x Meters
North
Possible power/comm trench
north
Vector degrees relative to north
offset
x Meters
vector
offset
Possible power/comm trench
Pattern B of Soil array plot layout
Green box is soil plot # 1
North
north
Vector degrees relative to north
Possible power/comm trench
offset
vector
offset
Possible power/comm trench
x Meters
x Meters
Pattern C of Soil array plot layout
Green box is soil plot # 1
North
Possible power/comm trench
north
Vector degrees relative to north
offset
vector
offset
Possible power/comm trench

Figure 10. Conceptual diagram of Soil Array Patterns

Outlines the orientation for the soil array and instrument hut from the center point of the tower. The x, y, z distances are i) the distance between soil plots, ii) distance between the tower centerpoint and the closest edge of soil plot, and iii) the distance between the tower centerpoint and the closest edge of the instrument hut, respectively. The yellow outline around each soil plot is the 5 m perimeter keep out zone.

6 APPENDIX A. FCC SUMMARY TABLES

Table A1. FCC Summary Table for FIU site components at D02 SCBI Core Site

Site Component				**units**
Tower location	38.89292	-78.13950		Lat, Long
Tower height	50			meters
Tower guying	yes	prefer not removing any branches		yes/none, notes
Instrument Hut location	38.89283	-78.13934		Lat, Long
IH orientation[a]	30° - 210°			vector
boom orientation[b]	300°			degrees
distance from center of tower to IH center		15	Option 1	distance (m), option #
how the Bwalk intersects the tower access	Boardwalk intersects the north-side of the tower from the east.			description
how the Boardwalk intersects the tower access	Boardwalk to skirt around the east side of tower with 4 m (min) distance away from the tower base			description
Air shed vector(s)[c]	0° to 70° and 155° to 230°	Clockwise from first angle		vector, notes
Boardwalk from AP to IH	yes	access west from the road to IH (Fig. 2)		yes/none, notes
Boardwalk from tower to soil array	yes			yes/none, notes
Boardwalk needed to DFIR	none			yes/none
Power and Communication line	10 m from edge of plot to centerline of power/comms line	whichever side is easiest[e], line above ground		offset, notes
DFIR location	38.89755	-78.15170		Lat, Long
DFIR power supply	Line power needed and available			description
Soil plot 1st location	38.89280°	-78.13953°		Lat, Long (center point)
Soil plot distance between plots (x)	40 m			meters
Soil array pattern and vector[d]	B	190°		A, B, or C, vector
Soil plot dimensions	5 m x 5 m			L x W (meters)
Soil profile pit primary	38.892188	-78.137691	2 m	Lat, Long, and expected depth
Soil profile pit alternative 1	38.892677	-78.137752	2 m	Lat, Long, and expected depth
Soil profile pit alternative 2	38.893073	-78.137945	2 m	Lat, Long, and expected depth

Fencing needs	none	none	none	IH, Soil Arrays, Guy anchors
Presence of large grazing animals	none			description
Site management*	Managed Forest			description
Any additional site specific information	Eastern Deciduous forest			description
Magnetic declination	10° 3' W changing by 0° 1' W/year			At time of site visit

Table A2. FCC Summary Table for FIU site components at D02 SERC Relocatable 1

Site Component				**units**
Tower location	38.89008,	-76.56001		Lat, Long
Tower height	60			meters
Tower guying	yes	prefer not removing any branches		yes/none, notes
Instrument Hut location	38.88999,	-76.55985		Lat, Long
IH orientation[a]	120°-300°			vector
boom orientation[b]	230°			degrees
distance from center of tower to IH center		15	Option 5	distance (m), option #
how the Bwalk intersects the tower access	Boardwalk intersects the north-side of the tower from the east.			description
how the Boardwalk intersects the tower access	Boardwalk to skirt around the east side of tower with 4 m (min) distance away from the tower base			description
Air shed vector(s)[c]	280° to 320° (major), 170° to 220° (secondary)	Clockwise from first angle		vector, notes
Boardwalk from AP to IH	yes	access straight N from the road to IH (Fig. 5)		yes/none, notes
Boardwalk from tower to soil array	yes			
Boardwalk needed to DFIR	none			yes/none
Power and Communication line	10 m from edge of plot to centerline of power/comms line	line should be parallel to soil array vector (285°) and should be placed North of 1st soil plot[e], line above ground		offset, notes
DFIR location	none			Lat, Long
DFIR power supply	na.			description
Soil plot 1st location	38.890065°	-76.560215°		Lat, Long (center point)
Soil plot distance between plots (x)	34 m			meters
Soil array pattern and vector[d]	C	285°		A, B, or C, vector
Soil plot dimensions	5 m x 5 m			L x W (meters)
Soil profile pit primary	38.891161°	-76.559129°	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 1	38.890985°	-76.559777°	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 2	38.891279°	-76.558577°	>2 m	Lat, Long, and expected depth

Fencing needs	none	none	none	IH, Soil Arrays, Guy anchors
Presence of large grazing animals	none			description
Site management*	Managed Forest			description
Any additional site specific information	Eastern Deciduous forest			description
Magnetic declination	11° 5' W changing by 0° 0' W/year			At time of site visit

Table A3. FCC Summary Table for FIU site components at D02 Blandy Experimental Farm Relocatable 2

Site Component				**units**
Tower location	39.06026°,	-78.07164°		Lat, Long
Tower height	6.0			meters
Tower guying	none			yes/none, notes
Instrument Hut location	39.06025°,	-78.07141°		Lat, Long
IH orientation[a]	120°-300°			vector
boom orientation[b]	240°			degrees
distance from center of tower to IH center		19	Option 1	distance (m), option #
how the Bwalk intersects the tower access	Boardwalk intersects the north-side of the tower from the east.			description
Air shed vector(s)[c]	280° to 320° (major) 130° to 220° (secondary)	Clockwise from first angle		vector, notes
Boardwalk from AP to IH	yes	access east from the road to IH (Fig. 8)		yes/none, notes
Boardwalk from tower to soil array	yes			yes/none, notes
Boardwalk needed to DFIR	no DFIR			yes/none
Power and Communication line	10 m from edge of plot to centerline of power/comms line	Whichever side is easiest[e], line above ground		offset, notes
DFIR location	none			Lat, Long
DFIR power supply	na.			description
Soil plot 1st location	39.060323°,	-78.071794°		Lat, Long (center point)
Soil plot distance between plots (x)	40 m			meters
Soil array pattern and vector[d]	B	300°		A, B, or C, vector
Soil plot dimensions	5 m x 5 m			L x W (meters)
Soil profile pit primary	39.06044,	-78.07119	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 1	39.06083,	-78.07059	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 2	39.06013,	-78.07135	>2 m	Lat, Long, and expected depth
Fencing needs	none	none	none	IH, Soil Arrays, Guy anchors
Presence of large grazing animals	none			description
Site management*	Natural succession field and farmland			description
Any additional site specific information	Abandoned old farm field (successional field) and hay farmland,			description

	canopy heights are 1.2 m and 0.5 m respectively	
Magnetic declination	11° 5' W changing by 0° 0' W/year	At time of site visit

Notes;

[a]parallel to the long side of the IH
[b]From tower point to this direction
[c]Clockwise from first angle, recommend reviewing FIU site characterization summary
[d]From 1st plot toward other plots if pattern B, from 1st plot toward nearest neighbor (see diagram of the patterns)
[e]see FIGURE 10. Options for Soil Array, second figure.
Tower Height is for FIU requirements; actual tower height will increase toward the next section height
IH = instrument hut
AP = auxillary portal
*burn information that may affect boardwalk, IH, or tower infrastructure, or other management activities