FIU D04 SITE CHARACTERIZATION: SUMMARY

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See configuration management system for approval history.

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
1.0	05/03/2010		Initial draft
A	06/22/2010	NEON.FIU.000242.CRE	CCB approved initial release
B	10/14/2010	NEON.FIU.000262.CRE	Updates see CRE
C	12/10/2010	NEON.FIU.000278.CRE	Updates see CRE
D	09/23/2011	ECO-00279	Update to new document numbers & template
E	12/03/2013	ECO-01014	Change Guanica DFIR location; Add Ponce Mameyes Relocatable site characterization information

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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 D04 Site Characterization: Supporting Data (AD[01]).

1.2 Scope

This document summarizes the FIU site characterization data for three D04 tower locations: Guanica (Core), Lajas (Relocatable) and Ponce Mameyes (Relocatable).

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.011032	FIU D04 Site Characterization Supporting Data
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

2.3 Acronyms

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

3 GUANICA FOREST

3.1 Desired ecosystem

The core site and representative of the ecosystem type and management practice for Domain 04.

Table 1. Guanica Forest

Ecosystem Type	Management activity
Subtropical dry seasonal forest	State Forest, some former plantation

The forest is a subtropical dry forest. Canopy height averages 10 m at the tower site and the mature forest is dense, with about 12,000 stems/ha (≥2.5 cm dbh). Tree species richness averages about 33 per 0.1 ha and there is a total of 169 tree species in Guanica Forest, with 50 species being relatively common (Murphy and Lugo 1986). The forest has closed canopy. LAI reaches ~4 in peak growing season (September), and decreases to ~2 in February (pers. comm. S. Van Bloem). Young seedlings and saplings are very dense and form a thick understory, but no obvious stratums (structural delineations).

The original tower location was placed at 17.97592830, -66.86355546, and was on the bottom of a large hill slope. Cold air drainage during nighttime along the hill slope is a large concern for accurate flux measurements and representative microclimate measurements. A new tower location at a relatively flat area at 17.96955, -66.86870 is recommended here, which is closer to the existing access road as well as electrical power, and is still under the same land owner and EA. The ecosystem in interest is the same type, which is subtropical dry forest. Local representatives also support this move.

Table 2. Ecosystem and site attributes for the Guanica Forest Advanced site

Ecosystem attributes	Measure and units
Mean canopy height	10 m
Surface roughness[a]	1 m
Zero place displacement height[a]	7 m
Structural elements	Closed forest canopy, dense, uniform
Altitude[b]	15 [m] a.s.l.
Slope	3-10%
Aspect	SE
Time zone	Atlantic
Magnetic declination	12° 22' W changing by 0° 2' W/year
Frost-free period	365 days

[a] From field survey.

[b] From field survey and best estimate.

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 (short-side of instrument hut is perpendicular to the **Instrument hut orientation vector)**. **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 5 being the upper most level at this tower site.

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

Table 3. Tower oriented design attributes for the Guanica Forest Advanced site

Attribute	lat	long	degree	meters	notes
Airshed			60° to 155°		Clockwise from 60°
Tower location	17.96955	-66.86870	--	--	new site
Instrument hut	17.96947	-66.86880			
Instrument hut orientation vector	--	--	270° to 90°		
Instrument hut distance z	--	--	--	13	
Anemometer/Temperature boom orientation	--	--	90°	--	From tower point to this direction
DFIR	17.97515	-66.87946			
Height of measurement levels					
Level 1				0.3	m.a.g.l.
Level 2				4.0	m.a.g.l.
Level 3				8.0	m.a.g.l.
Level 4				12.0	m.a.g.l.
Level 5				20.0	m.a.g.l.
Tower Height				20.0	m.a.g.l.

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

Keep in mind that all **radiation sensors** above canopy need to be mounted on the south side of the tower to avoid shadow from tower structure and mounting parts.

Boardwalks.

- 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 to soil array.
- No boardwalk from the soil array to the individual soil plots
- No boardwalk needed at DFIR site
- Option 2 pattern, Appendix A.

DFIR (Double Fenced International Reference) for bulk precipitation collection was originally located at a water catchment on the north direction of tower about 400 meters away at Lat. 17.97314, Lon. -

66.86831, and changed to 17.97515, -66.87946 in November 2011 per host request. This new location is about 1.3 km from tower location. **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.

3.3 Soil Attributes

Soils are typical to the region, San German, Southwestern Puerto Rico (PR787) - La Covana-Limestone outcrop-Seboruco complex, 12 to 40 percent slopes. The soils are fine-loamy, mixed, superactive, isohyperthermic Typic Calciargids. During construction a soil profile shall be dug at each core site and samples throughout the profile will be extracted. The soil array vector is ***from*** the soil plot closest to the tower ***toward*** the farthest soil plot.

0° represents true north and accounts for declination.

Table 4. Summary of soil array and soil pit information at Guanica

Soil plot dimensions	5 m x 5 m
Soil array pattern	B (Fig. 5)
Distance between soil plots: x	40 m
Distance from tower to closest soil plot: y	19 m
Approximate latitude and longitude of 1st soil plot OR direction from tower	17.96957°, -66.86852°
Direction of soil array	110°
Latitude and longitude of FIU soil pit	17.968963, -66.868795 (primary)
Latitude and longitude of FIU soil pit	17.970013, -66.866197 (alternate 1)
Latitude and longitude of FIU soil pit	17.968630, -66.865811 (alternate 2)
Dominant soil type	La Covana-Limestone outcrop-Seboruco complex, 12 to 40 percent slopes
Expected soil depth	>2 m
Depth to water table	>2 m

Expected depth of soil horizons	Expected measurement depths
0-0.13 m (gravelly clay)	0.07 m
0.13-0.48 m (extremely gravelly clay)	0.17 m
0.48-0.79 m (cemented)	0.31 m
0.79-2 m (silt loam)	1.40 m

3.4 Ecosystem Productivity Plots.

The tower at Guanica Advanced site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (subtropical dry forest). Wind vectors from the tower dictate the airshed is from 60 degrees to 155 degrees (clockwise from 60 degrees) in

Figure 1, and 90% signals for flux measurements are within a distance of 800 m from tower. The FSU Ecosystem Productivity plots should be within the airshed boundaries of the 60 degrees line, and the 155 degree line.

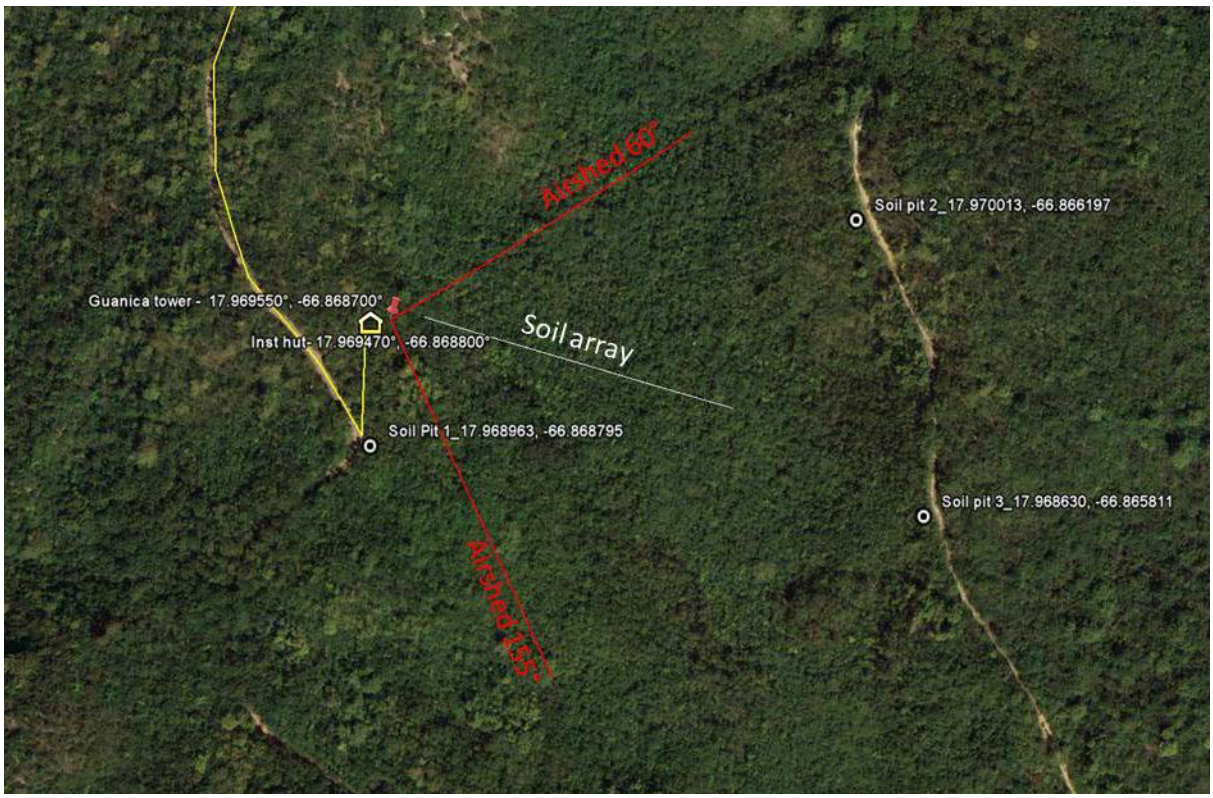


Figure 1. Two plan views of site layout at Guanica Advanced tower site

i) new tower location is presented, ii) red lines indicate the airshed boundaries. Vectors 60° and 155° are the North-eastern most and South-eastern most vectors (starting clockwise from 60°) that would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut. iv) Blue pin indicates DFIR location for bulk precipitation collection.

4 LAJAS EXPERIMENTAL STATION

4.1 Desired ecosystem

The Lajas relocatable site is designed to represent economic and agronomic decisions typically found in farming practices in southern Puerto Rico. The original tower location was placed at 18.03300000, -67.06600000. The airshed at this location will mainly fall in the paddy rice field, which is small, patchy and not representative for this region. A new tower location is at 18.02125°,-67.07690°, which is controlled grazing land. It is still under the same land owner. The land use type is a typical type in this region, and fetch area is large and adequate for flux measurements. Power is very close to the proposed site (<300 m). The owner and local representatives are in favor of this move.

This relocatable site is designed to represent economic and agronomic decisions typically found in farming practices in south eastern Puerto Rico.

Table 5. The Lajas relocatable site

Ecosystem Type	Management activity
Agronomic	Grazing (cattle)

The site is a controlled grazing grass field that is divided into grids by wire fences for experiments of different grazing frequency. Shrubs are scattered in the field (low density) and were controlled under 4 m. Wind break trees (~10 -15 m in height) were planted along the field edge. But they are either on the leeside of proposed tower or are far away enough from tower, thus are not a concern for FIU measurements.

The site is a confined grazed field.

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

Ecosystem attributes	Measure and units
Mean canopy height	0.4 m
Surface roughness[a]	0.02 m
Zero place displacement height[a]	0.29 m
Structural elements	Short, uniform, homogeneous
Altitude[b]	15 [m] a.s.l.
Slope	0%
Aspect	±0
Time zone	Atlantic
Magnetic declination	12° 16' W changing by 0° 2' W/year
Frost-free period	365 days

[a] From footprint analysis below.

[b] http://www.lajaspr.com/engDescripcionGeographica.htm

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 (short-side of instrument hut is perpendicular to the **Instrument hut orientation vector)**. **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 4 being the upper most level at this tower site.

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

Table 7. Tower oriented design attributes for the Lajas Relocatable site

Attribute	lat	long	degree	meters	notes
Airshed			60° to 155°		Clockwise from 60°
Tower location	18.02125°	-67.07690°	--	--	new site
Instrument hut	18.02133°	-67.07705°			
Instrument hut orientation vector	--	--	270° to 90°		
Instrument hut distance z	--	--	--	19	
Anemometer/Temperature boom orientation	--	--	90°	--	From tower point to this direction
Height of measurement levels					
Level 1				0.15	m.a.g.l.
Level 2				2.0	m.a.g.l.
Level 3				4.0	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.

Keep in mind that all **radiation sensors** above canopy need to be mounted on the south side of the tower to avoid shadow from tower structure and mounting parts.

Boardwalks.

- Gravel walkway is from the access dirt road to instrument hut, down the fence line (towards the instrument hut), pending landowner decision, and ease to bring supplies to instrument hut
- Boardwalk from fence line west to instrument hut
- boardwalk from the instrument hut to the tower to intersect on north face of the tower
- No boardwalk to the soil array and the individual soil plots
- Option 2, Appendix A.

Secondary **precipitation collector** for bulk precipitation collection will be located the top of tower at this site. No **Wet deposition collector** will deployed at this site. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

4.3 Soil Attributes

The dominant soil type is San German Area, Southwestern Puerto Rico (PR787) - Cartagena clay, 0 to 2 percent slopes. These soils are fine, mixed, superactive, isohyperthermic Sodic Haplusterts. The soil array vector is ***from*** soil plot closest to the tower ***toward*** the adjacent soil plot in towards the east (Fig.2).

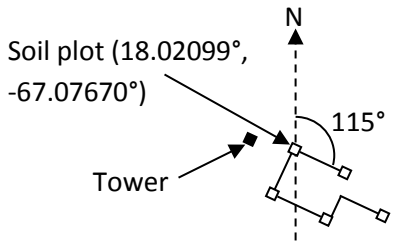


Figure 2. Schematic diagram of soil array layout in relation to tower

Soil plot positions are approximate.

0° represents true north and accounts for declination.

Table 8. Summary of soil array and soil pit information at Lajas

Soil plot dimensions	5 m x 5 m
Soil array pattern	C
Distance between soil plots: x	25 m
Distance from tower to closest soil plot: y	21 m
Approximate latitude and longitude of 1st soil plot OR direction from tower	18.02099°, -67.07670°
Direction of soil array	115°
Latitude and longitude of FIU soil pit 1	18.021845°, -67.076083° (primary)
Latitude and longitude of FIU soil pit 2	18.021133°, -67.076068° (alternate)
Latitude and longitude of FIU soil pit 3	18.020211°, -67.076043° (alternate)
Dominant soil type	Cartagena clay, 0 to 2 percent slopes
Expected soil depth	>2 m
Depth to water table	>2 m

Expected depth of soil horizons	Expected measurement depths
0-0.18 m (clay)	0.09 m
0.18-0.38 (clay)	0.28 m
0.38-1.17 (clay)	1.55 m
1.17-1.52 (clay)	1.35 m

4.4 Ecosystem Productivity Plots.

The tower at Lajas site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (grazing grassland). Wind vectors from the tower dictate the airshed is from 60 degrees to 155 degrees (clockwise from 60 degrees) in Figure 3, and 90% signals for flux measurements are within a distance of 500 m from tower, and 80% within 350 m. The road on the east most direction on the map is the boundary line. The FSU Ecosystem Productivity plots are recommended within the boundaries of the 60 degree line, the 155 degree line and the paved road on east direction.

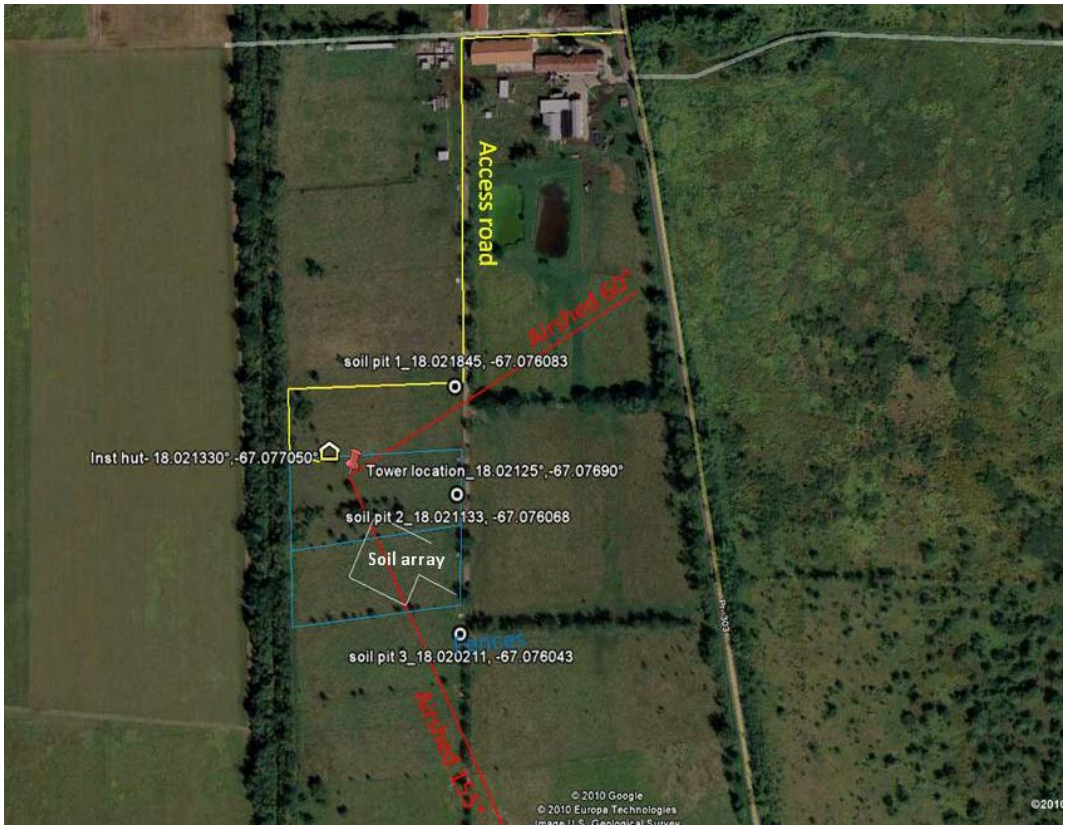


Figure 3. Site layout at Lajas Relocatable site

i) new tower location is presented, ii) red lines indicate the airshed boundaries. Vectors 60° and 155° are the North-eastern most and South-eastern most vectors (starting clockwise from 60°) that would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut. iv) Blue line is the fence.

5 PONCE MAMEYES (RELOCATABLE TOWER SITE)

5.1 Desired ecosystem

The NEON relocatable site at Ponce, PR is designed to monitor urban environment. After several rounds of site selection, this site location is determined to be at Ponce Mameyes, a former landslide area. After the landslide and evacuation, most housing in this community collapsed or was destroyed, leaving large amounts of foundation and residential material on the ground surface or buried. 80 – 90% of the ground surface in this area is covered by housing debris. Plants naturally seeded and grew between the concrete gaps in the soil and on any rubble cavity. Plants rapidly formed a complete closed forest canopy, interweaving the roots from the plant canopy and the concrete rubble. The structure of this highly disturbed, secondary urban forest pairs closely with the natural forest found at Guanica.

Table 9. The Ponce Mameyes relocatable site

Ecosystem Type	Management activity
Naturally regenerated secondary forest	No known management activities

Table 10. Ecosystem and site attributes for the Mameyes Relocatable site

Ecosystem attributes	Measure and units
Mean canopy height	21 m
Surface roughness[a]	0.9 m
Zero place displacement height[a]	17 m
Structural elements	Well-developed overstory and understory, no obvious canopy strata
Time zone	Atlantic
Magnetic declination	12° 16' W changing by 0° 2' W/year
Frost-free period	365 days

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 (short-side of instrument hut is perpendicular to the **Instrument hut orientation vector)**. **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.

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

Table 11. Tower oriented design attributes for the Mameyes Relocatable site

Attribute	lat	long	degree	meters	notes
Airshed			20° to 160°		Clockwise from first angle.
Tower location	18.02201,	-66.61371	--	--	new site
Instrument hut	18.022132°	-66.613816			
Instrument hut orientation vector	--	--	0°-90°		
Instrument hut distance z	--	--	--	17.5	
Anemometer/Temperature boom orientation	--	--	90°	--	
Height of measurement levels					
Level 1				0.3	m.a.g.l.
Level 2				3.0	m.a.g.l.
Level 3				17.0	m.a.g.l.
Level 4				21.0	m.a.g.l.
Level 5				25.0	m.a.g.l.
Level 6				30.0	m.ag.l.
Tower Height				30.0	m.a.g.l.

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

All **radiation sensors** need to be mounted on the south side of the tower to avoid shadow from tower structure and mounting parts.

Vegetation is dense at this site. To minimize the impacts on the tree roots, and to let field crew access site safely for route works, specific boardwalks at this site:

- Boardwalk from the access dirt road to instrument hut, pending landowner decision.
- Boardwalk from the instrument hut to the tower.
- Boardwalk to soil array Boardwalk from soil array boardwalk to individual soil plots.

Secondary **precipitation collector** for bulk precipitation collection will be located the top of tower at this site. No **Wet deposition collector** will deployed at this site. See AD[04] for further information and requirements for bulk precipitation collection and wet deposition collection.

5.3 Soil Attributes

Dominant soil series at the site is not available as it is currently mapped as "Not complete" on the USDA NRCS Web Soil Survey.

0° represents true north and accounts for declination.

Table 12. Summary of soil array and soil pit information at Memeyes

Soil plot dimensions	5 m x 5 m
Soil array pattern	C
Distance between soil plots: x	40 m
Distance from tower to closest soil plot: y	21 m
Latitude and longitude of 1st soil plot OR direction from tower	18.022167°, -66.613599°
Direction of soil array	175°
Latitude and longitude of FIU soil pit 1	18.022505°, -66.614144° (primary location)
Latitude and longitude of FIU soil pit 2	18.022281°, -66.613965° (alternate 1)
Latitude and longitude of FIU soil pit 3	18.022630°, -66.614281° (alternate 2)
Dominant soil type	Not available
Expected soil depth	Not available (expected to be >2m)
Depth to water table	Not available

Expected depth of soil horizons	Expected measurement depths*
Not available†	Not available†

*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.

†The soil array area has not been fully mapped on the NRCS Web Soil Survey yet.

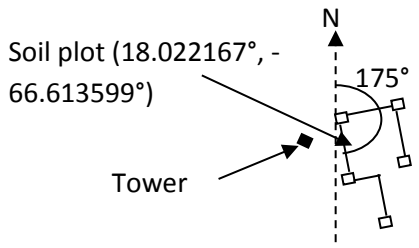


Figure 4. Schematic diagram of soil array layout in relation to tower. Soil plot positions are approximate

5.4 Information for Ecosystem Productivity Plots.

The tower at Ponce Mameyes site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (regenerated forest under the impacts of urban environment). Wind vectors from the tower dictate the airshed is from 20 degrees to 160 degrees (clockwise from 20 degrees), and 90% signals for flux measurements are within a distance of 800 m from tower, and 80% within 500 m.

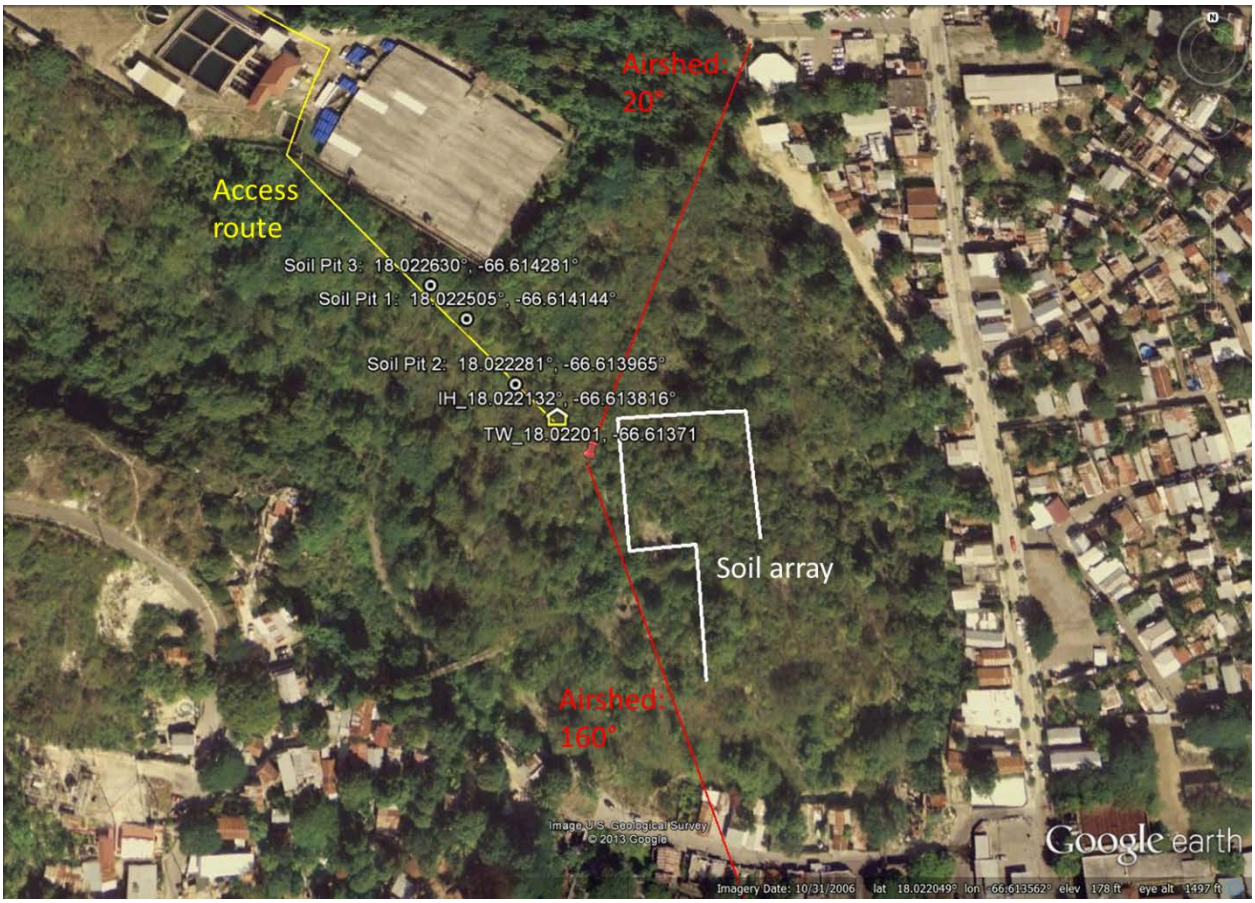


Figure 5. Site layout for Ponce Mameyes Relocatable site

i) tower location is presented (red pin), ii) red lines indicate the airshed boundaries. Vectors from 20^{o} to 160^{o} (clockwise from 20^{o}, major airshed) would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access way to instrument hut.

5.5 Issues and concerns

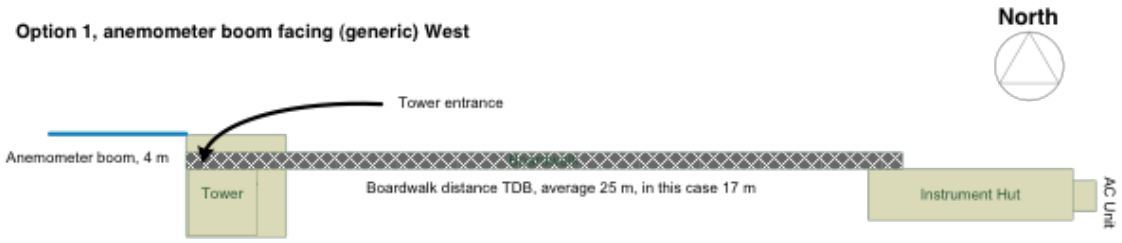
Based on our observations, we highlight the following issues and concerns at this site:

1. The regenerated forest area is small. The signals measured by some tower sensors are likely mixed with both forest ecosystem and surrounding urban environment.
2. 80-90% of the ground surface and soil were covered by the concrete and metal materials (See figure below). It will be a challenge for FCC to establish a tower foundation and an instrument hut foundation. Heavy machinery may be needed to excavate. But it is challenging to determine how to bring the heavy machinery to the site through the dense canopy without significantly impacting the site and vegetation.
3. 80-90% of the ground surface and soil were covered by concrete and metal material. After several hours of visual inspection, FIU can only identify two possible locations for soil plots. It will be a challenge to deploy the full FIU measurements here. A special design may be needed for this site.
4. A memorial park was built and dedicated to the victims of the landslide area. The proposed site is next to a memorial park but still in the landslide area. Hence, permitting may be challenging. The construction of a tower and disturbing the ground may become an issue to local the families of the victims.
5. This small piece of land is surrounded by lower-income neighborhoods.
6. Safety concerns:
    a. This site is close to Ponce drinking water treatment plant, which is a gated and fenced property. If the NEON tower and instrument hut are fenced within the existing property and personnel can gain access through the water plant's gate, the tower and instrument hut will be well secured. Fencing around the water treatment plant can be extended to accommodate tower and instrument hut. This site does not appear to be used by the local communities, as evidenced by little of no walking paths throughout the area.
    b. The concrete and metal debris (see figure below) on the ground create an uneven surface filled with hidden holes that are often covered by leaves and plants, generating potential safety concerns for field crews. Dense forest and vines make it difficult to walk around.
    c. Due to the close proximity of houses to the site, human safety may be an concern in this area, but not any more or less than that found elsewhere in Ponce (pers comm. Vice Mayor Arturo Valis). Field technicians should not have any concern at this site during daylight hours.
    d. Tower and instrument hut locations will be less than 200 m from the neighborhood housing. Theft, vandalism and destruction of property are a common occurrence in this area. Though this can be minimized through fencing, and access through the water treatment plant.

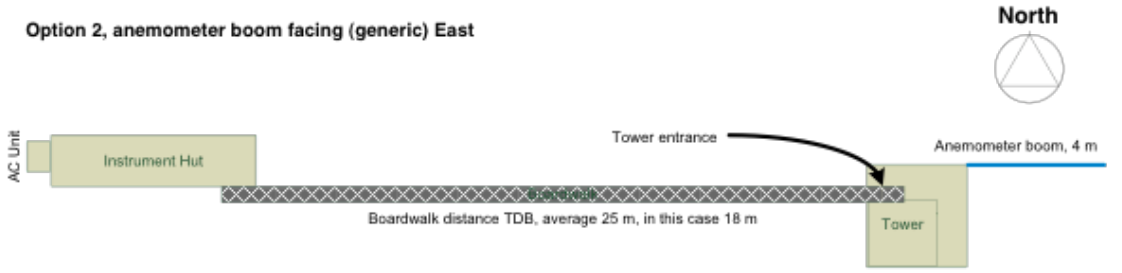
Figure 6. Typical view of the concrete and metal debris on the ground surface at Ponce Mameyes tower site

6 APPENDIX A. SITE DESIGNS AND SOIL ARRAY PATTERNS

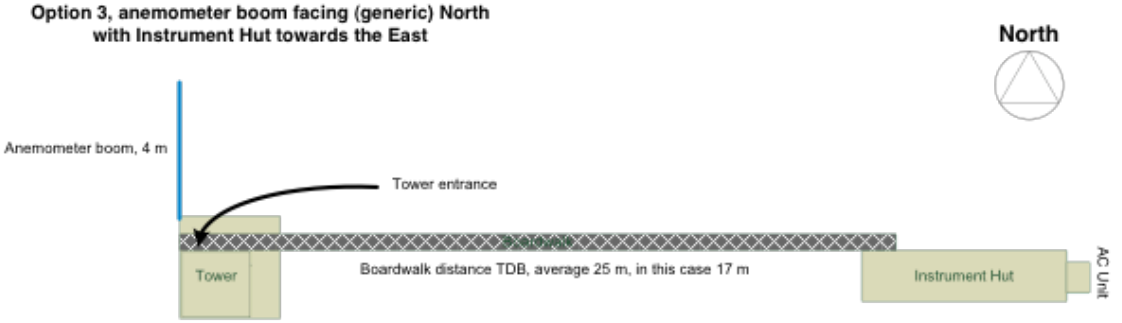
Option 1, anemometer boom facing (generic) West



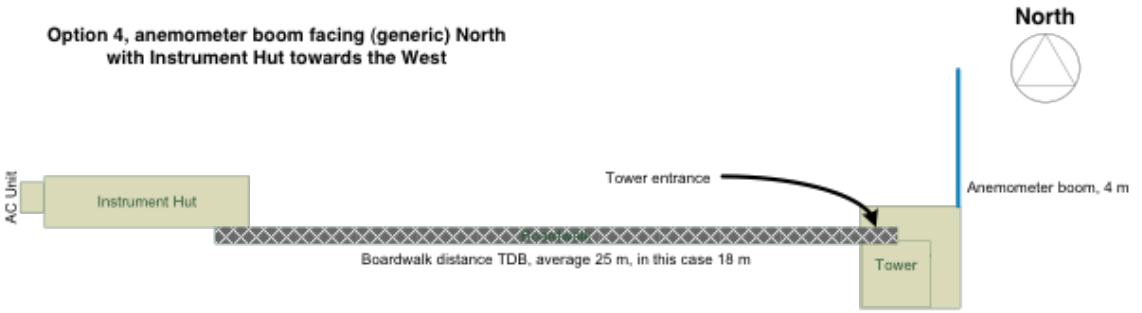
Option 2, anemometer boom facing (generic) East

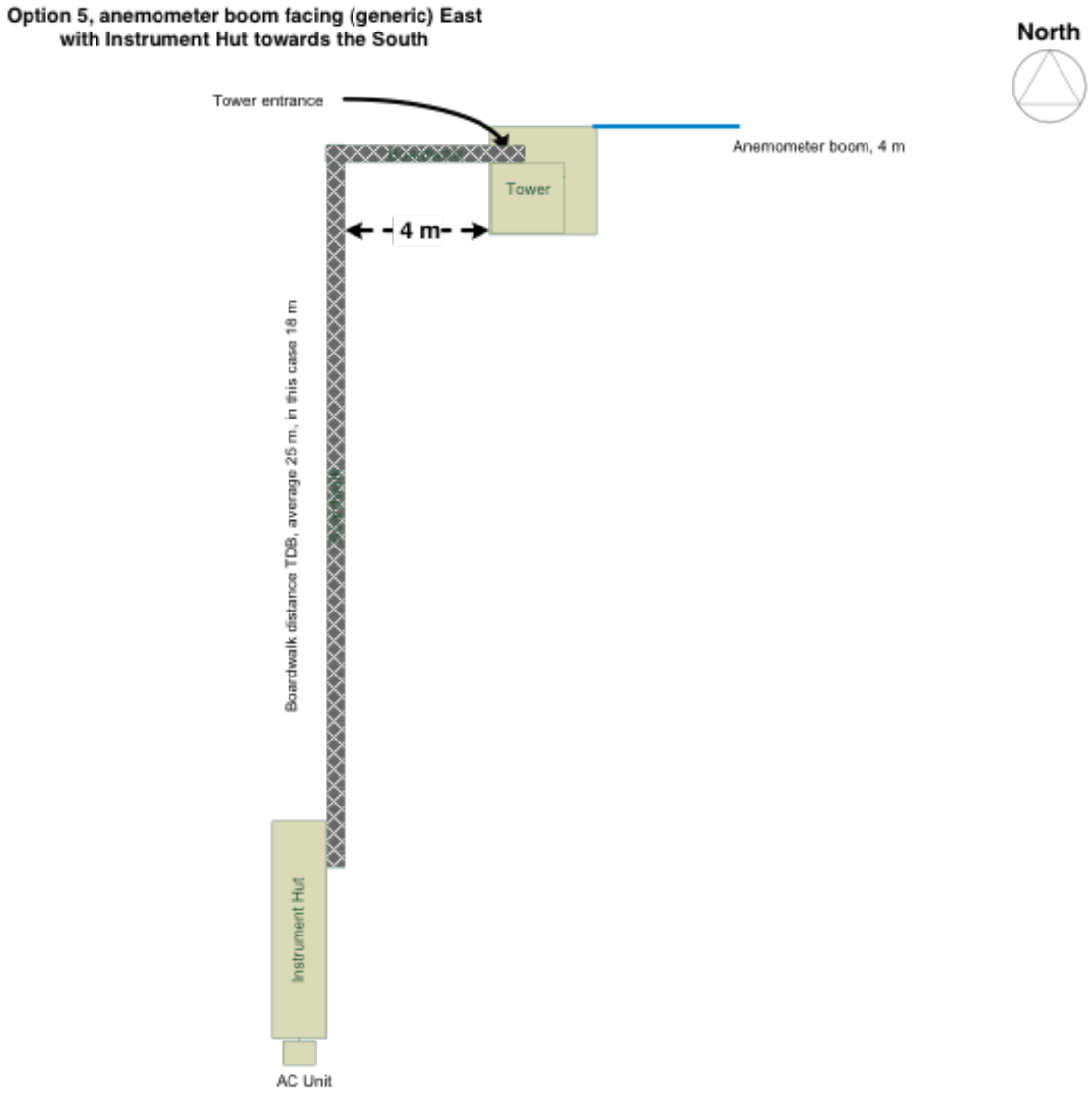


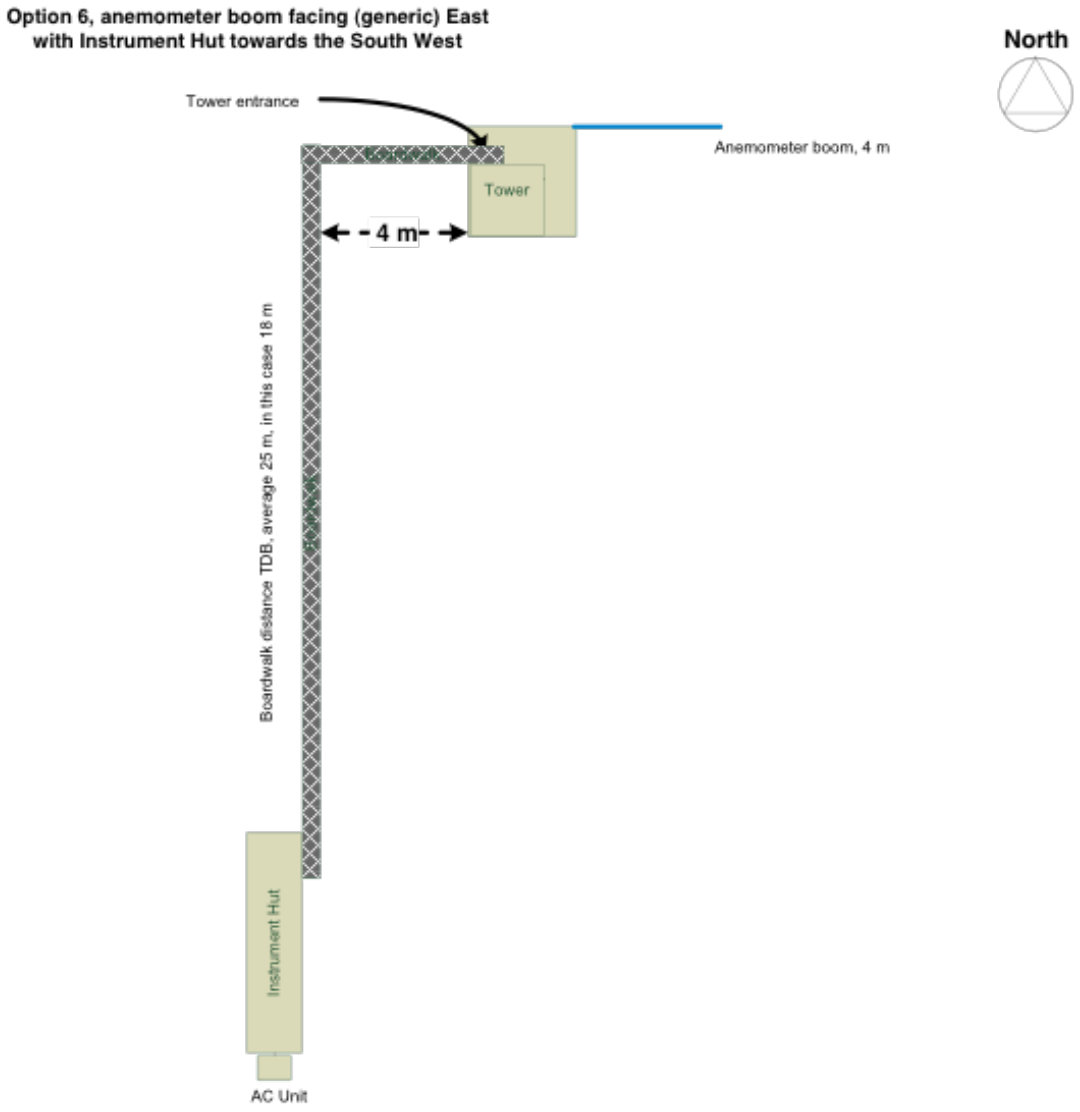
Option 3, anemometer boom facing (generic) North with Instrument Hut towards the East



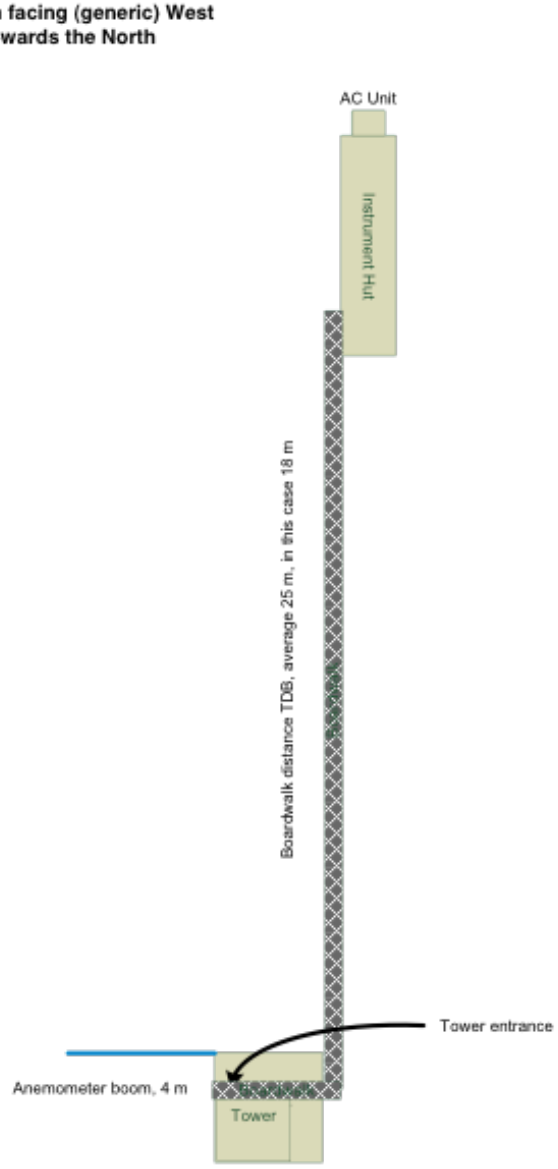
Option 4, anemometer boom facing (generic) North with Instrument Hut towards the West







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



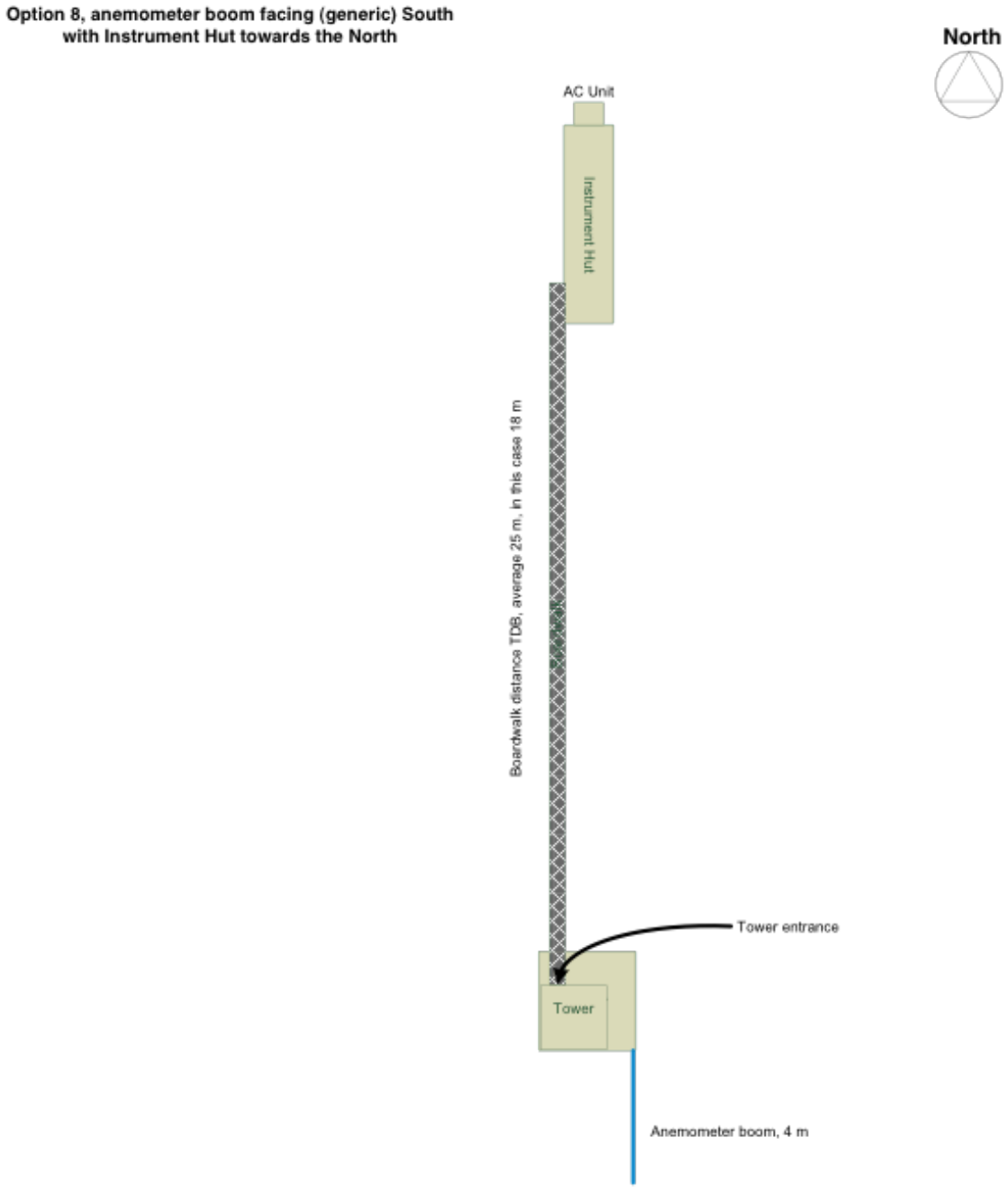
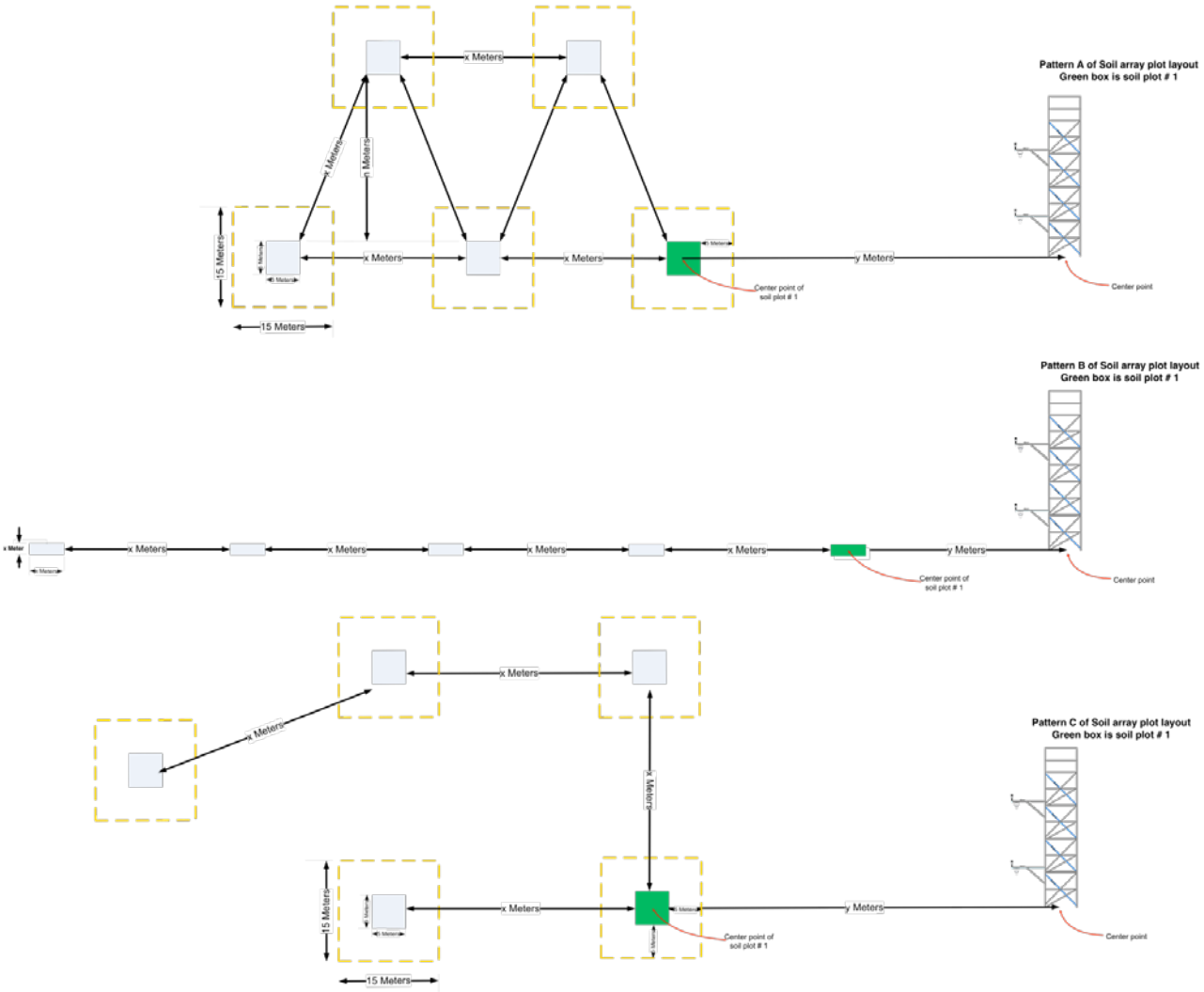


Figure 7. Generic patterns for the boardwalk configuration

These generic configurations are from the instrument hut to the tower based on 5 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.



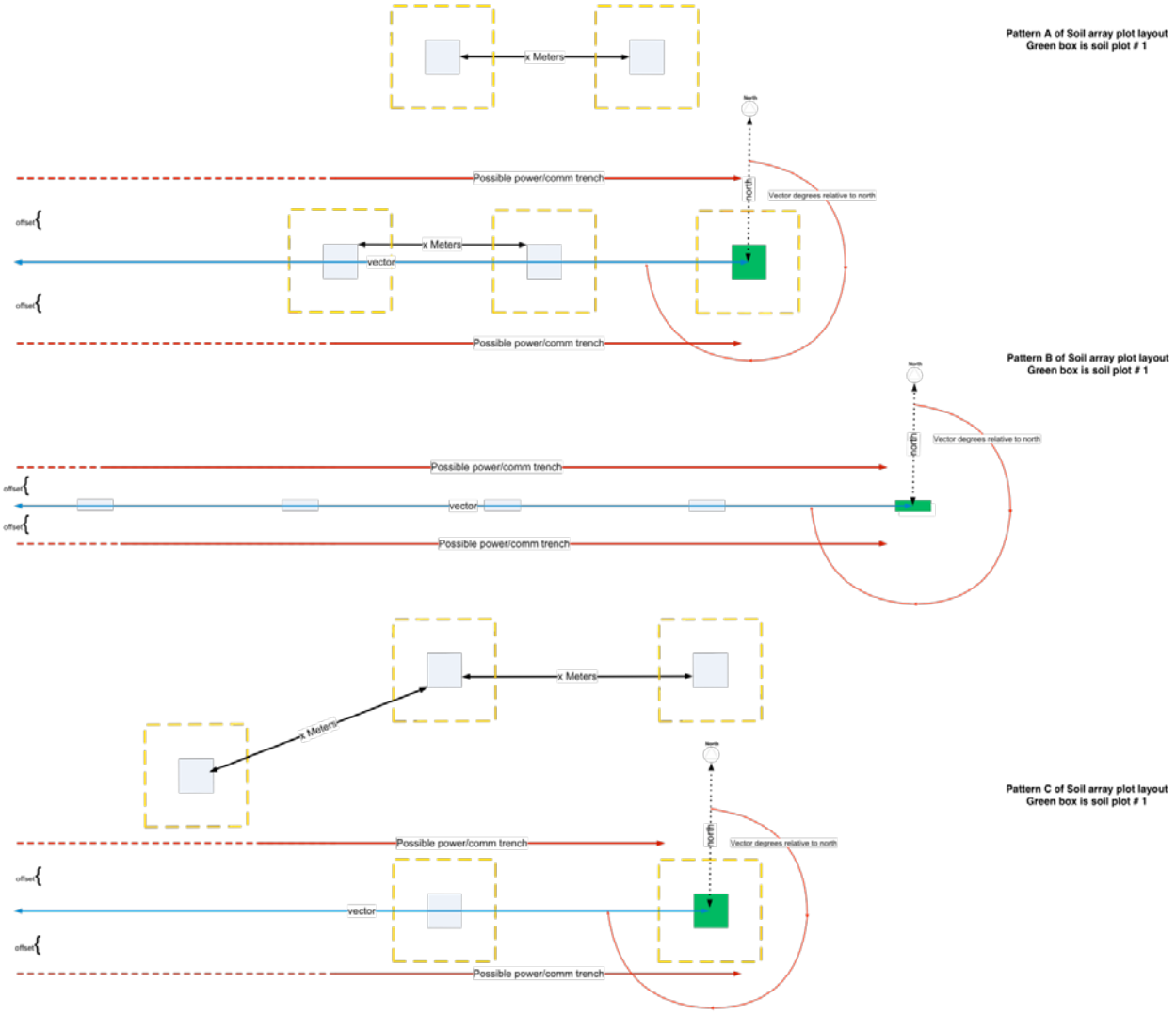


Figure 8. Conceptual diagram of Soil Array Patterns

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.

7 APPENDIX B. FCC SUMMARY TABLES

Table 13. FCC Summary Table for FIU site components at D04 Guanica Core Site

Site Component				**units**
Tower location	17.96955	-66.86870		Lat, Long, in degrees
Tower height[f]	20			meters
Tower guying	yes			yes/none, notes
Instrument Hut location	17.96947	-66.86880		Lat, Long, in degrees
IH orientation[a]	270° - 90°			vector
Boom orientation[b]	90°			degrees
Distance from center of tower to IH center		13	option 2	distance (m), option #
How the Bwalk intersects the tower access	Boardwalk intersects the north-side of the tower from the southwest.			description
How the Boardwalk intersects the tower access	Boardwalk from IH to the north side of tower, dogleg may be used pending design.			description
Air shed vector(s)[c]	60° to 155°			Vector, clock wise from first angle
Boardwalk from AP to IH	yes, from dirt road to IH	west from road to IH (see Figure 1)		yes/none, notes
Boardwalk from tower to soil array	yes			yes/none, notes
Boardwalk needed to DFIR	no			yes/none, notes
Power and Communication line	10 m from edge of plot to centerline of power/comms line	110° whichever side is easiest		offset, notes
DFIR location	17.97515	-66.87946	No BW	Lat, Long in degrees, notes
DFIR power supply	30 amp AC power from tower			description
Soil plot 1st location	17.96957°	-66.86852°		Lat, Long in degrees (center point)
Soil plot distance between plots (x)	40 m			meters
Soil array pattern and vector[d]	B	110°		A, B, or C, vector
Soil plot dimensions	5 m x 5 m			L x W (meters)
Soil profile pit primary	17.968963,	-66.868795	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 1	17.970013,	-66.866197	>2 m	Lat, Long, and expected depth

Soil profile pit alternative 2	17.968630,	-66.865811	>2 m	Lat, Long, and expected depth
Fencing needs	none	none	none	IH, Soil Arrays, Guy anchors
Presence of large grazing animals	No			description
Site management*	Preserve, State Forest, some former plantation			description
Any additional site specific information	Subtropical dry seasonal forest, canopy height ~ 10 m			description
Magnetic declination	12° 22' W changing by 0° 2' W/year			At time of site visit

Table 14. FCC Summary Table for FIU site components at D04 Lajas Relocatable site 1

Site Component				**units**
Tower location	18.02125°	-67.07690°		Lat, Long in degrees
Tower height[f]	6			meters
Tower guying	none			yes/none, notes
Instrument Hut location	18.02133°	-67.07705°		Lat, Long in degrees
IH orientation[a]	270º-90º			vector
Boom orientation[b]	90°			degrees
Distance from center of tower to IH center		19	Option 2	vector, distance (m), option #
How the boardwalk intersects the tower access	Boardwalk intersects the north-side of the tower from the North.			description
How the boardwalk intersects the tower access	IH on the northwest to tower. dogleg may be used pending site design.			description
Air shed vector(s)[c]	60° to 155°	Clockwise from first angle		vector, notes
Boardwalk from AP to IH	yes	Gravel path along fence line, boardwalk from fence to IH. Access west from the road (Figure 3)		yes/none, notes
Boardwalk from tower to soil array	no			yes/none, notes
Boardwalk needed to DFIR	no DFIR			yes/none
DFIR location	none			Lat, Long
Power and communication line	10 m from edge of plot to centerline of	115° whichever side is easiest[e], trench below ground.		offset, notes

	power/comms line			
DFIR power supply	na.			description
Soil plot 1st location	18.02099°,	-67.07670°		Lat, Long (center point)
Soil plot distance between plots (x)	25 m			meters
Soil array pattern and vector[d]	C	115°		A, B, or C, vector
Soil plot dimensions	5 m x 5 m			L x W (meters)
Soil profile pit primary	18.021845,	-67.076083	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 1	18.021133,	-67.076068	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 2	18.020211,	-67.076043	>2 m	Lat, Long, and expected depth
Fencing needs	no	no	no	IH, Soil Arrays, Guy anchors
Presence of large grazing animals	Yes, presence of cattle, grazing experiments. May need fencing in future around lowest boom.			description
Site management*	Grazing			description
Any additional site specific information	Pasture grassland, uniform, ~ 0.4 m tall.			description
Magnetic declination	12° 16' W changing by 0° 2' W/year			At time of site visit

Table 15.FCC Summary Table for FIU site components at D04 Ponce Mameyes Relocatable site 2

Site Component				**units**
Tower location	18.02201,	-66.61371		Lat, Long in degrees
Tower location	18° 1' 19.24"	-66° 36' 49.36"		
Tower height[f]	30			meters
Tower guying	yes			yes/none, notes
Instrument Hut location	18.022132°	-66.613816		Lat, Long in degrees
Instrument Hut location	18° 1' 19.68"	-66° 36' 49.74"		
IH orientation[a]	270º-90º			vector
Boom orientation[b]	90°			degrees
Distance from center of tower to IH center		17.5	Option 2	vector, distance (m), option #
Air shed vector(s)[c]	20° to 160°	Clockwise from first angle		vector, notes
Boardwalk from AP to IH	yes			yes/none, notes
Boardwalk from IH to tower	yes			yes/none, notes
Boardwalk to soil array	yes	Boardwalk to individual soil plots		yes/none, notes
Boardwalk to DFIR	NA			yes/none
DFIR location	NA			Lat, Long
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 power supply	na.			description
Soil plot 1st location	18.022167°	-66.613599°		Lat, Long (center point)
Soil plot 1st location	18° 1' 19.80"	-66° 36' 48.96"		
Soil plot distance between plots (x)	40 m			meters
Soil array pattern and vector[d]	C	175°		A, B, or C, vector
Soil plot dimensions	5 m x 5 m			L x W (meters)
Soil profile pit primary	18.022505°	-66.614144°	>2 m	Lat, Long, and expected depth
Soil profile pit primary	18° 1' 21.02"	-66° 36' 50.92"		
Soil profile pit alternative 1	18.022281°	-66.613965°	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 1	18° 1' 20.21"	-66° 36' 50.27"		

Soil profile pit alternative 2	18.022630°	-66.614281°	>2 m	Lat, Long, and expected depth
Soil profile pit alternative 2	18° 1' 21.4674"	-66° 36' 51.4116"		
Fencing needs	no	no	no	IH, Soil Arrays, Guy anchors
Presence of large grazing animals	no			description
Site management*	Not known			description
Any additional site specific information	Land slide area, 80-90% of the ground surface and soil were covered by the concrete and metal housing debris materials			description
Magnetic declination	12° 16' W changing by 0° 2' W/year			At time of site visit

[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 report

[d]From 1st plot toward other plots if pattern B, from 1st plot toward nearest neighbor (see diagram of the patterns)

[e]see Appendix A. Options for Soil Array, second figure.

[f]Tower Height is for FIU requirements; actual tower height will increase toward the next section height, indicates that the top measurement location is equal to level 4, and the tower top shall be taller based on the sections of tower.

IH = instrument hut

AP = auxillary portal

*burn information that may affect boardwalk, IH, or tower infrastructure, or other management activities

8 REFERENCES

Murphy, P.G. and A.E. Lugo, Structure and biomass of a subtropical dry forest in Puerto Rico. Biotropica, 1986. 18(2): p. 89-96