MARCH 2017 QUARTERLY REPORT

Evaluation of Soil Biogeochemical Properties Influencing Phosphorus Flux in the Everglades Stormwater Treatment Areas (STAs)

Work Order #: 4600003031-WO01

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This quarterly progress report summarizes the activities performed during the period of January – March 2017, as per tasks described in the Science Plan project - Evaluation of Soil Biogeochemical Properties Influencing Phosphorus Flux in the Everglades Stormwater Treatment Areas (STAs). This period covered the third quarter of Year 2 of the project and included various activities that were initiated to meet the objectives laid out under multiple tasks.

Contents

Preliminary Data Disclaimer*: The water quality data from the transect study are provisional and as such, are subject to change. Given this, and the limited amount of available data, the discussion of results from the flow event is considered preliminary. A more comprehensive analysis will be performed on the final water quality data, and perhaps with a larger dataset including other STA cells selected for this project.*

1 Introduction

The primary objectives of this project are to: (1) determine relative storages of non-mobile and mobile phosphorus (P) in the EAV and SAV treatment trains; (2) quantify the interactions between mobile P and non-mobile P in the soil and surface water; (3) enhance the understanding of biotic and abiotic mechanisms and factors regulating P dynamics, especially in the lower reaches of the treatment trains, and (4) document current soil conditions in the STAs and provide process-level information on P uptake and release, and transport of mobile P across the soil/water interface, as well as movement of P within the soil profile. These broad objectives will be accomplished by conducting specific studies in STA-2 and STA-3/4. In addition, studies will be conducted at select sites along soil P and vegetation gradients in WCA-2A for comparison. Please refer to the Project Work Plan (UF-WBL, 2015) for details on specific objectives and tasks.

This quarterly report describes activities related to the following tasks:

- Tasks 3 and 4. Year two benchmark sampling –Benchmark sites in STA-2 and STA-3/4
- Task 5. Soil Phosphorus Fractionation – Preliminary results and summary data
- Task 6a. Initial work in connection to phosphorus sorption/desorption characteristics
- Task 7b. Transect study: Enzyme and microbial biomass
- Task 8. Biogeochemical processes: Laboratory and field studies
- Task 10. Data synthesis and integration

2 Benchmark Soil Sampling [Task 3 and Task 4]

The objective of this task is to revisit established benchmark locations and collect information pertaining to nutrient storages in floc and soils. A more comprehensive analysis of these samples will provide information that will help enhance our understanding of biogeochemical transformations occurring within the surface water, across the soil-surface water interface and within the soil column. Soil sampling locations included three benchmark sites (inflow, midflow, and outflow) along the transect parallel to the flow direction, from the inflow to outflow points of the cell. Sampling of benchmark locations at half yearly interval provides information on short term changes in floc and soil physico-chemical properties and can offer insights into short term temporal changes in soil characteristics and associated P removal mechanisms.

2.1 Work Completed During this Quarter

Second round of year two benchmark soil, plant litter and surface water samplings in STA-3/4 (Cells 3A and 3B) and STA-2 (Cells 1 and 3) were conducted in February 2017 and March 2017, respectively. This task was completed with coordination between UF and District project personnel. Collected samples were divided into two sets; one set was submitted to the District laboratory and the other to the UF Wetland Biogeochemistry laboratory for various analyses.

2.2 STA-3/4 – Cell 3A and Cell 3B

Benchmark soil, plant litter and surface water samplings were conducted in STA-3/4 Cell 3A and Cell 3B on Feb. 28, 2017. Three benchmark stations, A8 (inflow), A32 (midflow) and A56 (outflow) in Cell 3A and three pairs of benchmark stations (A7 and A7c, C7 and C7c, D7 and D7c), corresponding to inflow, midflow, and outflow regions of Cell 3B, respectively, were sampled (Figure 2-1; *See Appendix for GPS coordinates of sampling locations*).

STA-3/4 Cell 3A is categorized as an emergent aquatic vegetation (EAV) cell with primarily *Typha domingensis* with patches of *Pistia* and *Salvinia*. STA-3/4 Cell 3B is primarily characterized as a submerged aquatic vegetation (SAV) cell, but SAV regions are surrounded by emergent vegetation (*Typha domingensis*) strips. *Chara* spp. was the predominant vegetation in open areas within the cell, however emergent vegetation (*Typha domingensis*) was present as vegetation strips forming quadrats surrounding SAV zones. To capture differences in soil properties from these two different vegetated zones, additional sampling locations were identified near existing sampling grid points. These additional sites are depicted by a suffix 'c' indicating cattail dominant zone (for example- A7c, C7c, and D7c).

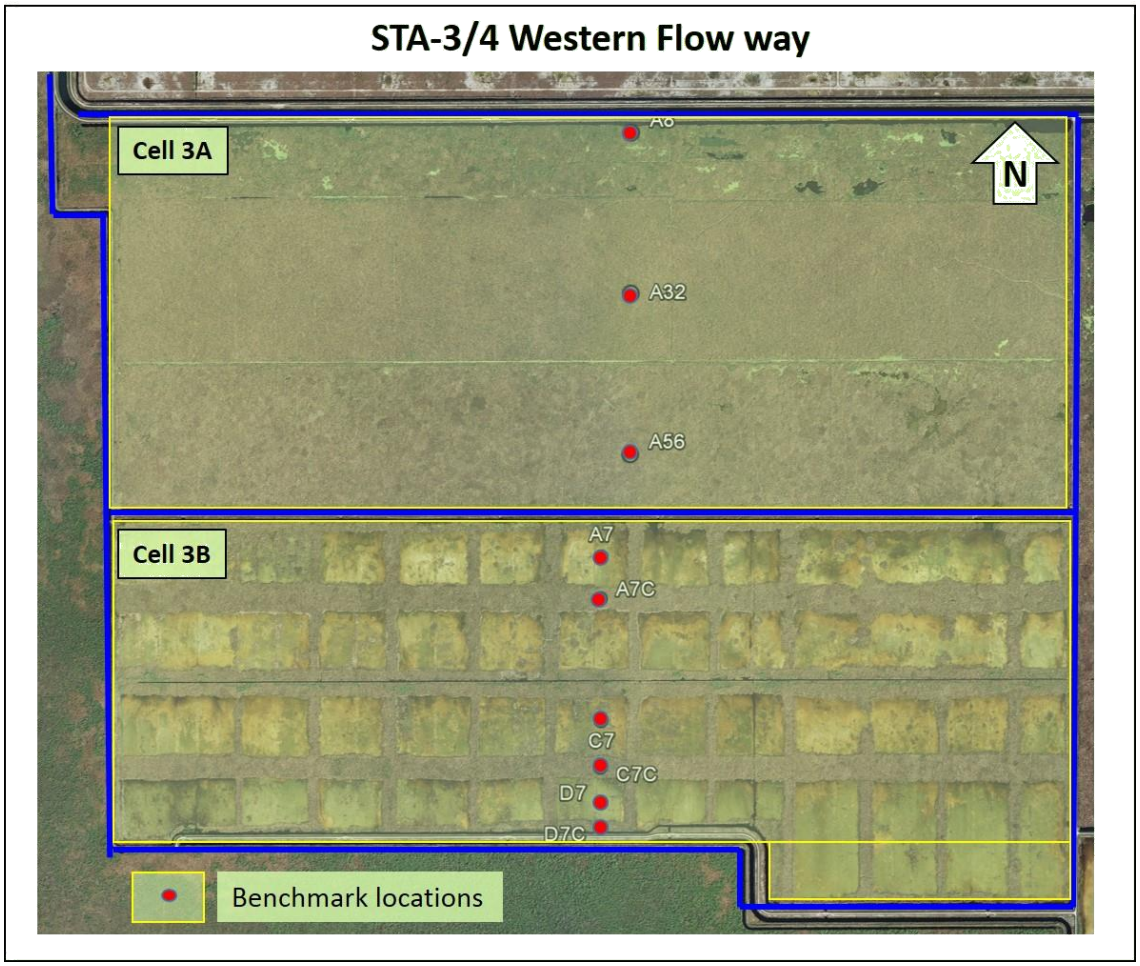

Figure 2-1. Benchmark locations in STA-3/4 Cells 3A and 3B where soil, plant litter and surface water were collected.

Two intact soil cores were taken from each location, to meet the amount of samples needed for the different studies. A total of 54 cores (27 x 2) were obtained from the two cells. Soil cores were stored in a cold room (~4^{o}C) until they were separated into plant litter (when present), floc, recently accreted soil (RAS) and pre-STA soil sections. Pre-STA soils were divided into two sections: 0-5 cm and 5 - 15 cm, or up to entire depth of soil core, whichever happened to be smaller (Table 2-1). Pre-STA soil was separated from the overlying RAS and its thickness (depth) varied from one location to another depending on the total depth of the soil core.

Floc was characterized as the suspended unconsolidated material on top of consolidated RAS. It was poured into a plastic bag and underlying RAS layer was collected in a separate bag after recording its thickness. Floc depth was measured by allowing settling of the suspended flocculent material before determination of floc depth. Floc was poured into empty plastic tubes (same dimension as the soil core tubes), and allowed to settle for 4 hours. The supernatant water was discarded and thickness of settled floc was measured (Figure 2-2; steps 1 through 3).

Floc and soil sections from two soil cores were thoroughly mixed and weighed before dividing into two sub-samples - one to be submitted to the District while the other sent to the UF-Wetland Biogeochemistry Laboratory (WBL) for analyses. Bulk plant litter samples were also sent to UF-WBL.

Grab surface water samples were processed and submitted to District laboratory for the analysis of total phosphorus (TP), total dissolved P (TDP), soluble reactive P (SRP), ammonium nitrogen (NH_4^+), nitrous oxides, NO_x (NO_3^- + NO_2^-), dissolved organic nitrogen (DON), total N (TN), dissolved organic carbon (DOC), alkalinity, calcium, magnesium, chloride, sodium, sulfate and chlorophyll-a.

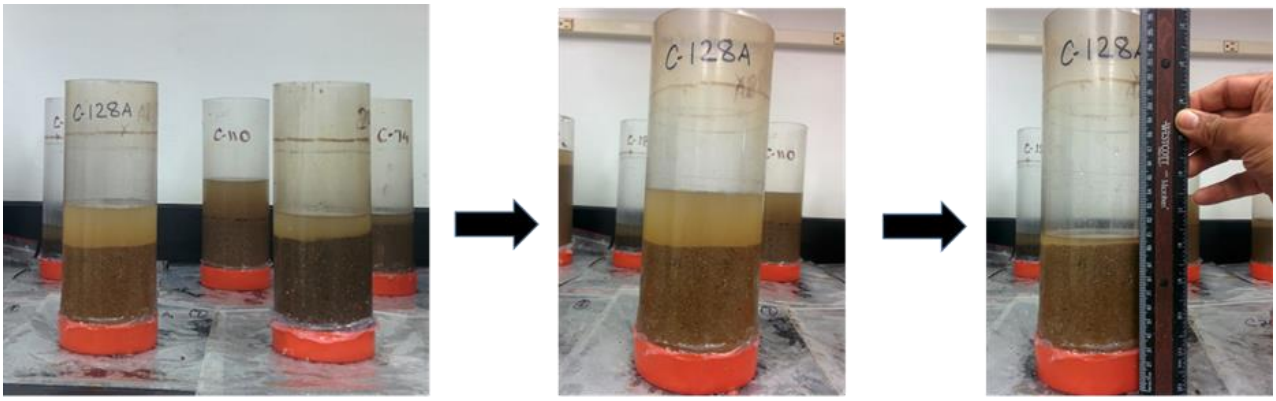

Figure 2-2: Three step process for determination of floc depth.

Field parameters such as surface water pH, specific conductance, temperature and dissolved oxygen were measured using a hand held YSI. Soil and water depths were also recorded at each station at the time of sampling (Table 2-2).

Table 2-1. STA-3/4 Cell 3A and 3B: Depths of various sections after sectioning intact soil cores.

STA-3/4	Station id	Thickness of section (cm)			
		Floc	RAS	Pre-STA-1 (0-5 cm)	Pre-STA-2 (5-15 cm)
Cell 3A	A8A	21.5	4.0	5.0	12.0
Cell 3A	A8B	19.9	7.0	5.0	12.0
Cell 3A	A8C	17.2	5.5	5.0	12.0
Cell 3A	A32A	7.5	3.0	5.0	12.0
Cell 3A	A32B	3.6	6.0	5.0	12.0
Cell 3A	A32C	3.5	3.8	5.0	9.5
Cell 3A	A56A	5.1	5.5	5.0	12.0
Cell 3A	A56B	3.4	3.5	5.0	12.0
Cell 3A	A56C	5.6	3.3	5.0	12.0
Cell 3B	A7A	11.3	3.0	5.0	9.0
Cell 3B	A7B	10.6	3.3	5.0	9.0
Cell 3B	A7C	10.1	3.5	5.0	10.5
Cell 3B	A7cA	3.5	5.5	5.0	12.0
Cell 3B	A7cB	5.7	6.0	5.0	12.0
Cell 3B	A7cC	4.5	5.3	5.0	13.5
Cell 3B	C7A	8.1	4.5	5.0	12.0
Cell 3B	C7B	7.3	2.8	5.0	10.0
Cell 3B	C7C	6.7	4.5	5.0	9.5
Cell 3B	C7cA	5.8	5.5	5.0	12.0
Cell 3B	C7cB	9.1	4.5	5.0	11.0
Cell 3B	C7cC	5.6	4.5	5.0	12.0
Cell 3B	D7A	8.0	3.5	5.0	10.0
Cell 3B	D7B	5.2	3.5	5.0	8.0
Cell 3B	D7C	6.8	5.0	5.0	8.0
Cell 3B	D7cA	0.9	1.5	5.0	11.0
Cell 3B	D7cB	2.2	3.3	5.0	11.0
Cell 3B	D7cC	1.0	1.8	5.0	11.0

Table 2-2. Field parameters recorded at the time of sampling.

STA-3/4	pH	Water Temp.	Conductivity	Dissolved Oxygen	Water depth	Substrate thickness *
Cell 3A	(SU)	(^{o}C)	($\mu s\ cm^{-1}$)	($mg\ L^{-1}$)	(cm)	(cm)
A8	7.3	23.4	408	4.4	94	43
A32	7.1	20.5	516	2.0	70	29
A56	7.2	22.0	562	2.4	35	55
Cell 3B						
A7	7.8	25.9	570	13.9	49	46
A7c	7.3	22.9	617	2.3	49	46
C7	7.8	25.1	581	10.6	30	47
C7c	7.3	23.2	559	2.6	35	56
D7	8.1	24.7	556	13.6	25	25
D7c	7.3	23.6	550	2.3	25	52

2.3 STA-2 – Cell 1 and Cell 3

Benchmark soil, plant litter and surface water samplings were conducted in STA-2 Cell 1 and Cell 3 on March 13-14, 2017. Three benchmark stations, C20 (inflow), C128 (midflow) and C200 (outflow) were sampled in Cell 3 and A34 (inflow), A121(midflow), and A208 (outflow) were sampled in Cell 1 (Figure 2-3; *See Appendix for GPS coordinates of sampling locations*).

STA-2 Cell 1 is categorized as an EAV cell with *Typha domingensis* as dominant vegetation with patches of *Cladium jamaicense* and *Nymphaea odorata,* whereas Cell 3 is predominantly a SAV cell, with *Chara spp., Potamogeton spp. and Hydrilla verticillata* as dominant vegetation. Approximately 20% of the treatment area of Cell 3 (south - eastern region) has EAV vegetation consisting of *Typha domingensis* and few patches of *Cladium jamaicense*.

Two intact soil cores were taken from each location, to meet the amount of sample needed for the different studies. A total of 36 cores (18 x 2) were obtained from the two cells. Soil cores were stored in a cold room (~4^{o}C) until they were separated into plant litter (when present), floc, recently accreted soil (RAS) and pre-STA soil sections. Pre-STA soils were divided into two sections: 0-5 cm and 5 - 15 cm, or up to entire depth of soil core, whichever happened to be smaller (Table 2-3). Pre-STA soil was separated from the overlying RAS and its thickness (depth) varied from one location to another depending on the total depth of the soil core.

Floc was characterized as the suspended unconsolidated material on top of consolidated RAS. It was poured into a plastic bag and underlying RAS layer was collected in a separate bag after recording its thickness. Floc depth was measured by allowing settling of the suspended flocculent material before determination of floc depth. Floc was poured into empty plastic tubes (same dimension as the soil core tubes), and allowed to settle for 4 hours. The supernatant water was discarded and thickness of settled floc was measured (Figure 2-2; steps 1 through 3).

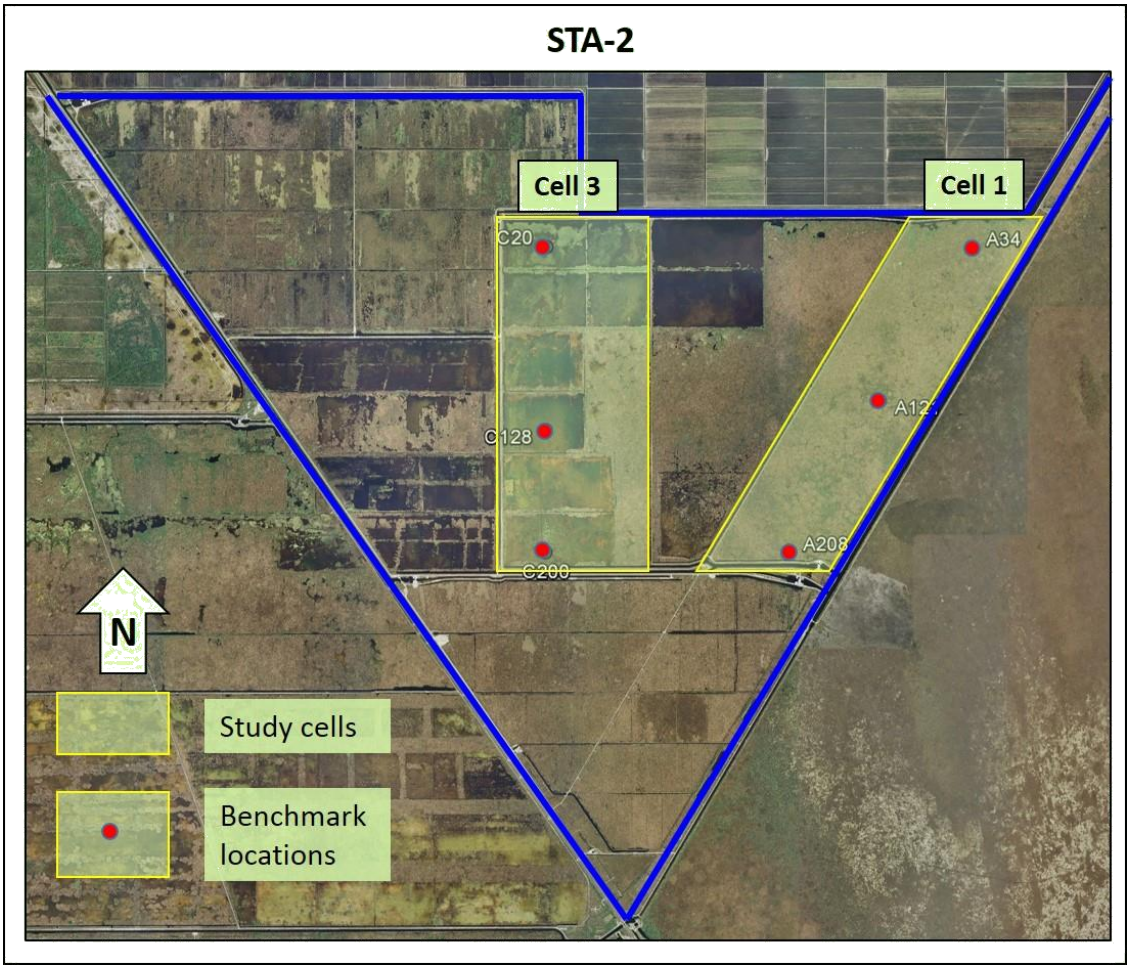

Figure 2-3. Benchmark locations in STA-2 Cells 1 and 3 where soil, plant litter and surface water were collected.

Floc and soil sections from two soil cores were thoroughly mixed and weighed before dividing into two sub-samples - one subsample was submitted to the District while the other sent to the UF-Wetland Biogeochemistry Laboratory (WBL) for analyses. Bulk plant litter samples were also sent to UF- WBL.

Grab surface water samples were processed and submitted to District laboratory for the analysis of total phosphorus (TP), total dissolved P (TDP), soluble reactive P (SRP), ammonium nitrogen (NH_4^+), nitrous oxides, NO_x (NO_3^- + NO_2^-), dissolved organic nitrogen (DON), total N (TN), dissolved organic carbon (DOC), alkalinity, calcium, magnesium, chloride, sodium, sulfate and chlorophyll-a.

Field parameters such as surface water pH, specific conductance, temperature and dissolved oxygen were measured using a hand held YSI. Soil and water depths were also recorded at each station at the time of sampling (Table 2-4).

Table 2-3. STA-2 Cell 1 and Cell 3: Depth of various sections after sectioning intact soil cores.

STA-2	Station id	Thickness of section (cm)			
		Floc	RAS	Pre-STA-1 (0-5 cm)	Pre-STA-2 (5-15 cm)
Cell 1	A-34A	4.6	7.3	5.0	12.0
Cell 1	A-34B	7.9	4.8	5.0	12.0
Cell 1	A-34C	3.2	5.3	5.0	12.0
Cell 1	A-121A	7.0	3.3	5.0	12.0
Cell 1	A-121B	6.5	2.5	5.0	12.0
Cell 1	A-121C	8.5	1.8	5.0	12.0
Cell 1	A-208A	1.3	4.0	5.0	12.0
Cell 1	A-208B	3.2	6.0	5.0	12.0
Cell 1	A-208C	2.1	6.5	5.0	12.0
Cell 3	C-20A	8.0	4.0	5.0	12.0
Cell 3	C-20B	7.9	4.8	5.0	12.0
Cell 3	C-20C	7.8	6.5	5.0	12.0
Cell 3	C-128A	9.1	8.0	5.0	12.0
Cell 3	C-128B	7.3	5.5	5.0	8.5
Cell 3	C-128C	9.4	7.0	5.0	12.0
Cell 3	C-200A	10.0	6.3	5.0	12.0
Cell 3	C-200B	5.7	3.3	5.0	12.0
Cell 3	C-200C	4.7	2.3	5.0	12.0

Table 2-4. Field parameters recorded at the time of sampling.

STA-2	pH	Water Temp.	Conductivity	Dissolved Oxygen	Water depth	Substrate thickness *
Cell 1	(SU)	(^{o}C)	($\mu s\ cm^{-1}$)	($mg\ L^{-1}$)	(cm)	(cm)
A-34	7.6	23.0	469	4.8	80	160
A-121	7.6	21.9	684	6.4	50	152
A-208	7.4	22.7	964	5.0	66	123
Cell 3						
C-20	8.3	24.8	897	5.2	61	24
C-128	9.3	24.5	913	8.1	57	109
C-200	8.2	24.1	483	4.2	55	59

3 Soil Phosphorus Fractionation (Task 5)

This task involves determination of the forms and distribution of P in the floc and soil layers (RAS and Pre-STA) at the sampling locations using an operationally defined P fractionation scheme (Figure 3-1). This information will be used to assess the relative proportion of reactive and stable P pools in the different soil layers and to explore correlative relationships between the various P pools, soil physical and chemical characteristics, flux rates, sorption and desorption characteristics, and surface water P species and concentration.

Chemical separation of the different P forms will be conducted on wet samples using the fractionation method developed by Ivanoff et al. (1998) and Richardson and Reddy (2013). All laboratory work related to P fractionation is being conducted at the Wetland Biogeochemistry Lab, University of Florida.

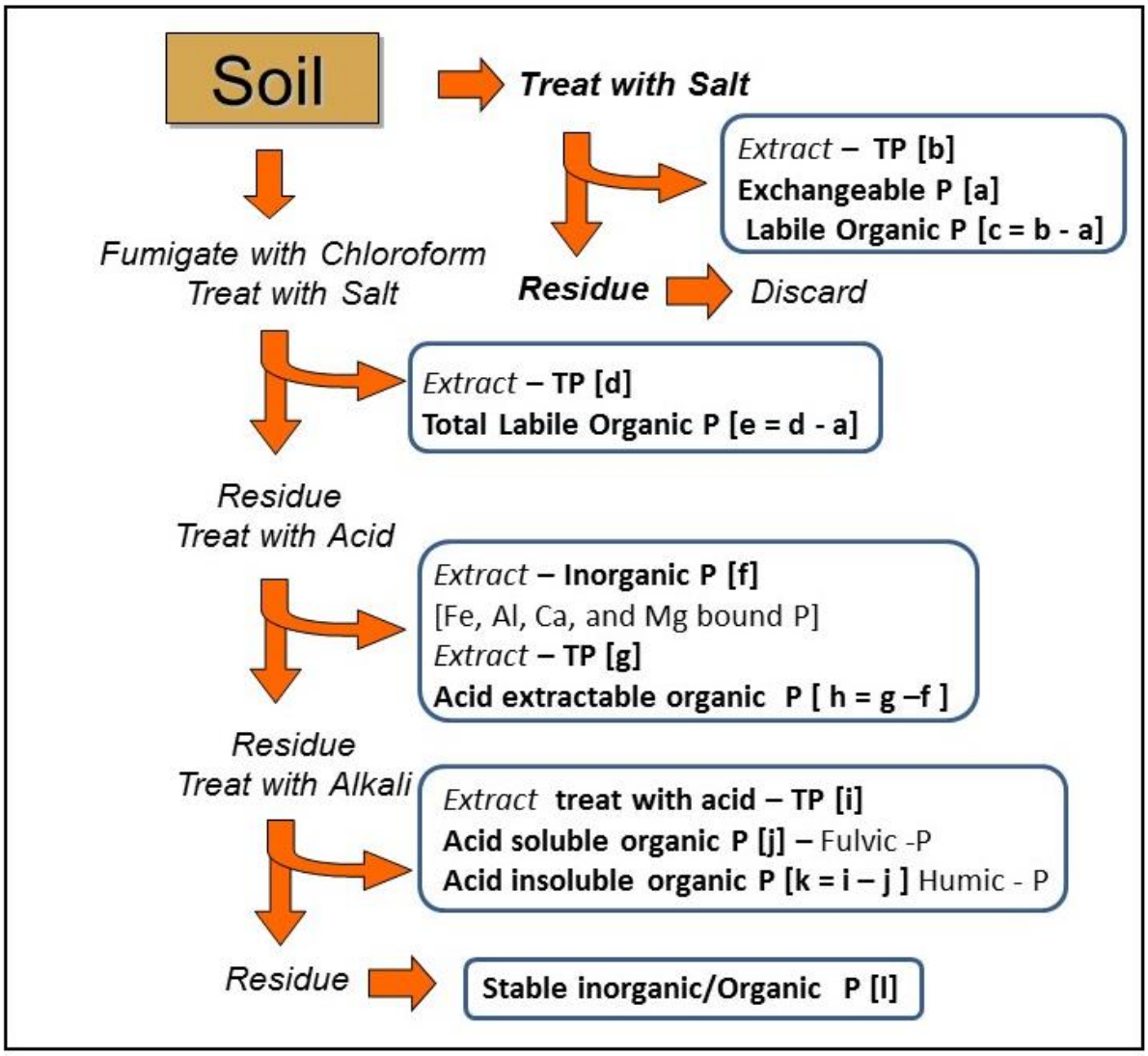

Figure 3-1: Schematic showing operationally defined P fractionation scheme used in wetland soils. Please refer Table 3-2 for details of various fractions.

Soil and floc samples from transect locations in STA-2 Cell 1 and Cell 3, STA-3/4 Cell 3A and 3B, and WCA-2A were obtained and subjected to detailed fractionation scheme as shown in Figure 3-1. Progress to-date and preliminary results are presented in this report.

Table 3-1. Station names within the established transects from where soil cores are obtained for P fractionation during Year 2**.** Bolded stations are sampled in triplicate and represent benchmark stations.

Location	**Stations**	**Status**
STA-2 Cell 1	**34,** 51, 69, 86, 104, **121**, 138, 156, 173, 191, and **208**	Phosphorus fractionation is complete. Summary data tables were presented in last quarterly report
STA-2 Cell 3	**20,** 38, 56, 74, 92, 110, **128**, 146, 164, 182, and **200**	Phosphorus fractionation is complete. Summary data tables were presented in last quarterly report
STA-3/4 Cell 3A	**A8,** A20**, A32,** A44**, A56**	Phosphorus fractionation is complete. Summary data tables are presented in this report
STA-3/4 Cell 3B	**A7, A7c,** B7, B7c, **C7, C7c, D7** and **D7c**	Phosphorus fractionation is complete. Summary data tables are presented in this report
WCA-2A	**F1, F2, F4, E5**, and **U3**	Phosphorus fractionation is on-going. Summary data tables will be presented in subsequent reports

Table 3-2. Brief description of phosphorus forms extracted based on their solubility in acid or alkali solutions. Figure 3-1 shows the sequential order in which these fractions were obtained.

P- fraction	**Description**
$NaHCO_3$-Pi [a]	0.5 *M* Bicarbonate extractable inorganic P. Also known as Olsen P. Considered as labile inorganic P. Readily available for use by macrophytes and periphyton.
$NaHCO_3$-TP [b]	0.5 *M* Bicarbonate extractable total P (includes both organic P and inorganic P). Considered as labile inorganic and organic P. Readily available for use by macrophytes and periphyton.
$NaHCO_3$-Po [c]	0.5 *M* Bicarbonate extractable organic P. Also known as labile organic P (LOP). LOP = [$NaHCO_3$-TP] – [$NaHCO_3$-Pi]. Rapidly mineralized to inorganic and made available for use by macrophytes and periphyton.
F- $NaHCO_3$-TP [d]	Floc and soil samples are fumigated with chloroform to lyse microbial cells. Fumigated samples are extracted with 0.5 *M* bicarbonate and analyzed for total P (includes both organic P and inorganic P). Organic P in fumigated sample extracts also includes P released from lysed microbial cells as total labile organic and labile inorganic P. Readily available for use by macrophytes and periphyton.
F- $NaHCO_3$-Po [e]	Fumigated + 0.5 *M* bicarbonate extractable organic P. Also known as total labile organic P (TLOP). TLOP = [F-$NaHCO_3$-TP] – [$NaHCO_3$-Pi]. Rapidly mineralized to inorganic and made available for use by macrophytes and periphyton.
MBP	Microbial biomass P. MBP = [F-$NaHCO_3$-TP] – [$NaHCO_3$-TP]. MBP values not adjusted to P extraction efficiency.
HCl-Pi [f]	Acid (1 *M* HCl) extractable inorganic P. This represents calcium, magnesium, iron, and aluminum associated P.
HCl-TP [g]	Acid (1 *M* HCl) extractable TP. This represents calcium, magnesium, iron, and aluminum associated P and acid hydrolysable organic P.
HCl – Po [h]	Acid (1 *M* HCl) hydrolysable organic P is estimated as the difference between HCl-TP and HCl-Pi.
NaOH-TP [i]	Alkali (0.5 *M* NaOH) extractable total P.
NaOH-FA-P [j]	Alkali extracts treated with acid (conc. H_2SO_4) to partition organic P into fulvic acid (FA) and humic acid (HA) bound P. FA- presents acid soluble and alkali insoluble P.
NaOH-HA-P [k]	Humic acid (HA) – P soluble in both acid and alkali. HA-P = [NaOH-TP] – [FA-P].
Residue- P [l]	Acid (1 *M* HCl) and alkali (0.5 *M* NaOH) insoluble P. Considered as non-reactive P and stable pool.
Total Inorganic P	TPi = [$NaHCO_3$-Pi] + [HCl-Pi]
Total Organic P	TPo = [$NaHCO_3$-Po] + [MBP] + [HCl-Po] + [NaOH-FA-P] + [NaOH-HA-P] + [Residue- P]
Total P	Sum of Inorganic and Organic TP

3.1 Preliminary Results and Summary Data Tables

- Soil and floc samples from STA-2 Cell 1 and STA-3/4 Cell 3A and 3B are completely processed and analyzed for various P forms. Summary data tables are presented in this report.
- Soil and floc samples from WCA-2A are in various stages of processing and analysis. At the time of this report writing, sample and analysis was completed. We are currently reviewing the results for QA/QC. Final results will be presented in the annual report.
- Additional analysis for various routine chemical parameters is currently being conducted by the District laboratory. Data are not available at the time of this quarterly report preparation. As soon as these data become available, correlative relationships between P forms and select soil chemical properties will be explored.
- Interpretation of results will be presented in the second annual report due in July 2017.

3.1.1 STA-2 Cell 1

Table 3-3. Concentration of bicarbonate-extractable inorganic phosphorus **($NaHCO_3$-Pi)**, also known as labile inorganic phosphorus (LIP) (mg/kg), in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**138±63**	**47±3**	**11±2**	**9±4**
51	800	330	42	7	13
69	1200	354	27	10	11
86	1700	236	31	13	13
104	2200	188	12	13	13
121*	2700	**88±21**	**27±8**	**13±3**	**17±1**
138	3200	36	24	11	16
156	3700	46	18	12	13
173	4200	15	34	13	8
191	4600	12	18	14	11
208*	5200	**7.7±4**	**18±19**	**13±2**	**16±2**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-4. Concentration of bicarbonate extractable total phosphorus (**$NaHCO_3$-TP**) (mg/kg), considered as labile inorganic and organic P, in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**222±57**	**71±14**	**14±2**	**13±1**
51	800	451	69	15	13
69	1200	388	62	21	22
86	1700	280	41	17	15
104	2200	202	59	14	14
121*	2700	**147±14**	**52±24**	**14±3**	**17±1**
138	3200	77	70	30	22
156	3700	106	27	15	13
173	4200	59	46	14	10
191	4600	41	36	18	13
208*	5200	**48±7**	**43±29**	**19±5**	**20±7**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-5. Concentration of bicarbonate extractable organic phosphorus **($NaHCO_3$-Po)**, also known as labile organic phosphorus (LOP) (mg/kg) in floc and soil samples from STA-2 Cell 1. LOP = ($NaHCO_3$-TP - $NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**84±12**	**25±15**	**3±1**	**3±2**
51	800	121	27	8	0
69	1200	34	35	11	11
86	1700	45	10	5	2
104	2200	15	47	2	1
121*	2700	**59±18**	**26±18**	**2±1**	**1±1**
138	3200	41	45	18	6
156	3700	60	9	3	0
173	4200	44	12	1	2
191	4600	28	18	3	2
208*	5200	**40±6**	**24±11**	**6±3**	**5±5**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-6. Concentration of bicarbonate extractable total phosphorus **(F-$NaHCO_3$-TP)** (mg/kg) in fumigated floc and soil samples from STA-2 Cell 1. Considered as labile inorganic and organic P.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**461±72**	**127±36**	**30±11**	**28±9**
51	800	591	208	29	27
69	1200	652	123	26	26
86	1700	766	132	32	38
104	2200	573	173	30	24
121*	2700	**601±50**	**190±132**	**28±8**	**26±2**
138	3200	390	174	48	35
156	3700	263	126	35	30
173	4200	459	159	33	26
191	4600	251	114	38	40
208*	5200	**332±15**	**197±26**	**49±16**	**40±10**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-7. Concentration of bicarbonate extractable organic phosphorus **(F-$NaHCO_3$-Po)**, also known as total labile organic phosphorus (TLOP) in fumigated floc and soil samples from STA-2 Cell 1. TLOP = (F-$NaHCO_3$-TP -$NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**323±51**	**80±35**	**19±10**	**19±8**
51	800	260	166	22	14
69	1200	299	96	16	15
86	1700	530	102	20	25
104	2200	385	161	17	11
121*	2700	**513±35**	**162±126**	**15±5**	**9±3**
138	3200	354	150	36	19
156	3700	217	108	23	16
173	4200	445	125	21	19
191	4600	238	96	23	29
208*	5200	**325±15**	**179±9**	**37±16**	**24±8**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-8. Concentration of microbial biomass phosphorus **(MBP)** (mg/kg), in floc and soil samples from STA-2 Cell1.MBP = (F-$NaHCO_3$ -TP and $NaHCO_3$ -TP).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**238±40**	**56±28**	**16±11**	**16±8**
51	800	139	139	14	14
69	1200	265	61	5	4
86	1700	486	91	15	13
104	2200	371	114	15	10
121*	2700	**454±38**	**139±108**	**14±5**	**9±3**
138	3200	313	105	18	13
156	3700	157	99	20	13
173	4200	400	113	20	16
191	4600	210	78	20	27
208*	5200	**285±8**	**155±15**	**31±15**	**20±6**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-9. Concentration of acid (1 *M* HCl) extractable inorganic phosphorus **(HCl-Pi)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P, in floc and soil samples from STA-2 Cell1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**376±69**	**266±13**	**44±2**	**15±2**
51	800	362	270	47	17
69	1200	505	201	29	19
86	1700	478	178	35	17
104	2200	446	185	35	18
121*	2700	**428±27**	**248±94**	**45±8**	**18±4**
138	3200	318	212	50	15
156	3700	190	172	26	13
173	4200	192	96	54	13
191	4600	146	154	49	18
208*	5200	**331±155**	**139±83**	**53±34**	**17±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-10. Concentration of acid (1 *M* HCl) extractable total phosphorus **(HCl-TP)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P and acid hydrolysable organic P, in floc and soil samples from STA-2 Cell1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**534±67**	**357±28**	**68±3**	**28±4**
51	800	489	394	70	30
69	1200	574	281	46	28
86	1700	503	254	69	31
104	2200	468	257	60	31
121*	2700	**478±17**	**321±89**	**71±5**	**33±10**
138	3200	363	287	78	32
156	3700	244	206	41	23
173	4200	207	132	82	32
191	4600	163	185	71	30
208*	5200	**366±177**	**178±74**	**79±34**	**33±5**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-11. Concentration of acid (1 *M* HCl) hydrolysable organic phosphorus **(HCl-Po)** (mg/kg) in floc and soil samples from STA-2 Cell1. HCl-Po = (HCl-TP and HCl-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**148±54**	**91±17**	**24±4**	**13±6**
51	800	58	27	21	37
69	1200	70	80	17	9
86	1700	26	75	33	14
104	2200	22	72	25	12
121*	2700	**50±15**	**73±6**	**27±5**	**14±7**
138	3200	46	75	28	17
156	3700	54	34	15	9
173	4200	15	36	28	19
191	4600	16	32	22	12
208*	5200	**35±25**	**39±15**	**26±6**	**17±4**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-12. Concentration of alkali (0.5 *M* NaOH) extractable total phosphorus **(NaOH-TP)** (mg/kg) in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**638±126**	**369±176**	**162±28**	**111±17**
51	800	701	506	172	88
69	1200	436	480	161	91
86	1700	462	296	161	78
104	2200	415	347	166	97
121*	2700	**540±30**	**363±142**	**144±29**	**79±3**
138	3200	446	505	198	107
156	3700	408	222	147	98
173	4200	173	249	184	133
191	4600	199	253	207	173
208*	5200	**353±35**	**321±12**	**261±39**	**172±18**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-13. Concentration of acid soluble and alkali insoluble phosphorus, also known as fulvic acid bound P **(NaOH-FA-P)** (mg/kg) in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**364±113**	**207±91**	**77±19**	**49±3**
51	800	347	243	73	36
69	1200	237	221	67	50
86	1700	218	143	84	40
104	2200	170	245	88	46
121*	2700	**298±26**	**170±65**	**61±21**	**33±4**
138	3200	310	177	64	32
156	3700	209	78	51	40
173	4200	109	148	100	69
191	4600	55	108	54	53
208*	5200	**164±11**	**94±10**	**89±9**	**66±20**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-14. Concentration of alkali soluble phosphorus, also known as humic acid bound phosphorus **(NaOH-HA-P)** (mg/kg) in floc and soil samples from STA-2 Cell 1. NaOH-HA-P = (NaOH-TP- NaOH-FA-P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**274±84**	**162±103**	**85±18**	**62±17**
51	800	353	263	99	52
69	1200	199	259	94	42
86	1700	244	152	77	38
104	2200	245	102	79	50
121*	2700	**242±52**	**193±106**	**83±31**	**45±6**
138	3200	137	328	134	74
156	3700	198	143	96	57
173	4200	64	101	84	64
191	4600	144	144	152	120
208*	5200	**189±42**	**227±22**	**172±31**	**106±19**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-15. Concentration of acid (1 *M* HCl) and alkali (0.5 *M* NaOH) insoluble phosphorus **(Residue-TP)** (mg/kg), considered as non-reactive and stable P pool, in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**515±126**	**260±43**	**56±4**	**22±2**
51	800	402	274	52	21
69	1200	460	266	45	22
86	1700	363	189	81	22
104	2200	254	264	80	38
121*	2700	**241±11**	**240±49**	**69±3**	**30±5**
138	3200	167	228	55	35
156	3700	133	126	44	21
173	4200	248	146	73	24
191	4600	179	122	64	26
208*	5200	**82±17**	**118±9**	**62±10**	**30±2**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-16. Concentration of total inorganic phosphorus **(TPi)** (mg/kg), taken as the sum of $NaHCO_3$-Pi and HCl-Pi, in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**514±90**	**313±12**	**55±4**	**24±6**
51	800	692	312	53	30
69	1200	858	228	39	30
86	1700	713	209	48	30
104	2200	634	197	48	31
121*	2700	**517±48**	**275±101**	**57±9**	**35±5**
138	3200	353	237	62	31
156	3700	237	189	38	27
173	4200	206	131	67	21
191	4600	159	172	63	29
208*	5200	**339±156**	**157±76**	**65±34**	**32±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-17. Concentration of total organic phosphorus **(TPo)** (mg/kg) in floc and soil samples from STA-2 Cell 1. TPo = ($NaHCO_3$-Po+ MBP + HCl-Po + NaOH-FA-P + NaOH-HA-P + Residue- P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**1623±83**	**800±252**	**261±34**	**166±16**
51	800	1490	1071	269	137
69	1200	1265	922	239	137
86	1700	1381	661	295	138
104	2200	1076	844	288	158
121*	2700	**1344±24**	**838±288**	**255±27**	**132±6**
138	3200	1013	958	317	178
156	3700	811	490	229	145
173	4200	881	556	307	195
191	4600	632	502	316	241
208*	5200	**794±33**	**657±2**	**386±68**	**243±31**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-18. Concentration of total phosphorus **(TP)** (mg/kg), taken as the sum of total inorganic and organic P, in floc and soil samples from STA-2 Cell 1.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
34*	400	**2137±159**	**1113±264**	**315±37**	**190±11**
51	800	2182	1383	322	166
69	1200	2123	1150	278	168
86	1700	2094	871	343	168
104	2200	1710	1041	336	189
121*	2700	**1861±25**	**1114±389**	**312±34**	**167±11**
138	3200	1366	1194	379	209
156	3700	1048	679	267	171
173	4200	1087	687	373	216
191	4600	791	674	379	270
208*	5200	**1133±189**	**814±76**	**452±83**	**275±33**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

3.1.2 STA-2 Cell 3

Table 3-19. Concentration of bicarbonate-extractable inorganic phosphorus **($NaHCO_3$-Pi)**, also known as labile inorganic phosphorus (LIP) (mg/kg), in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**276±41**	**194±40**	**14±2**	**11±4**
38	750	174	124	15	17
56	1150	198	116	14	13
74	1550	141	137	15	21
92	2000	35	217	19	29
110	2380	64	39	26	19
128*	2800	**36±14**	**34±9**	**15±3**	**24±2**
146	3200	18	22	14	10
164	3600	20	18	7.7	9.3
182	4000	66	23	10	8.8
200*	4450	**36±7**	**21±3**	**10±3**	**8±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-20. Concentration of bicarbonate extractable total phosphorus (**$NaHCO_3$-TP**) (mg/kg), considered as labile inorganic and organic P, in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**331±47**	**227±40**	**18±4**	**17±4**
38	750	189	131	17	21
56	1150	204	117	16.3	15
74	1550	152	144	22	24
92	2000	52	258	24	44
110	2380	77	42	36	25
128*	2800	**46±10**	**45±7**	**21±5**	**36±2**
146	3200	30	24	14	11
164	3600	31	22	10	12
182	4000	86.0	31	11	12
200*	4450	**46±15**	**22±4**	**14±1**	**10±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-21. Concentration of bicarbonate extractable organic phosphorus **($NaHCO_3$-Po)**, also known as labile organic phosphorus (LOP) (mg/kg), in floc and soil samples from STA-2 Cell 3. LOP = ($NaHCO_3$-TP- $NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**55.6±10**	**33.9±2**	**4.6±4**	**5.7±2**
38	750	15.3	6.5	2.9	3.9
56	1150	6.5	0.5	2.1	2.1
74	1550	11.8	6.5	6.4	3.2
92	2000	16.6	41.6	5.4	14.7
110	2380	13.5	2.9	10.0	6.2
128*	2800	**10.0±3**	**10.8±2**	**6.6±3**	**11.5±0.4**
146	3200	12.0	2.3	0.2	0.4
164	3600	11.5	3.9	2.2	3.1
182	4000	19.8	7.7	0.9	2.8
200*	4450	**10.5±9**	**1.3±1**	**3.4±1**	**2.2±0.3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-22. Concentration of bicarbonate extractable total phosphorus **(F-$NaHCO_3$-TP)** (mg/kg), considered as labile inorganic and organic P, in fumigated floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**395±55**	**272±41**	**28±5**	**28±2**
38	750	282	161	24	34
56	1150	370	168	20	21
74	1550	210	196	31	46
92	2000	92	304	44	73
110	2380	242	81	38	48
128*	2800	**98±17**	**77±28**	**33±3**	**49±3**
146	3200	130	57	15	15
164	3600	95	43	12	16
182	4000	201	32	16	18
200*	4450	**118±22**	**31±3**	**15±1**	**17±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-23. Concentration of bicarbonate extractable organic phosphorus **(F-$NaHCO_3$-Po)**, also known as total labile organic phosphorus (TLOP), in fumigated floc and soil samples from STA-2 Cell 3. TLOP = (F-$NaHCO_3$-TP -$NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**122±49**	**79±7**	**15±4**	**17±2**
38	750	108	36	10	18
56	1150	173	52	6.3	8.4
74	1550	69	59	16	25
92	2000	57	87	25	44
110	2380	178	42	12	29
128*	2800	**62±7**	**43±26**	**18±1**	**25±2**
146	3200	112	36	1.3	4.6
164	3600	76	25	4.0	7.0
182	4000	135	9.0	6.0	9.5
200*	4450	**82±15**	**10±5**	**4.7±2**	**8.7±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-24. Concentration of microbial biomass phosphorus **(MBP)** (mg/kg), in floc and soil samples from STA-2 Cell 1. MBP = (F-$NaHCO_3$ -TP and $NaHCO_3$ -TP).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**66±58**	**45±10**	**10±2**	**11±2**
38	750	93	30	6.9	14
56	1150	166	51	4.1	6.3
74	1550	57	52	9.2	22
92	2000	40	45	20	30
110	2380	165	40	2.0	23
128*	2800	**52±9**	**33±27**	**11±4**	**13±2**
146	3200	100	33	1.1	4.2
164	3600	64	21	1.8	3.9
182	4000	115	1.3	5.1	6.7
200*	4450	**72±10**	**9±5**	**1±1**	**7±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-25. Concentration of acid (1 *M* HCl) extractable inorganic phosphorus **(HCl-Pi)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P, in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**410±25**	**351±62**	**105±18**	**111±18**
38	750	458	386	205	286
56	1150	721	304	219	189
74	1550	346	328	62	38
92	2000	117	221	34	247
110	2380	170	150	97	164
128*	2800	**104±14**	**118±14**	**47±2**	**57±5**
146	3200	113	90	45	54
164	3600	91	123	84	75
182	4000	217	148	125	106
200*	4450	**204±26**	**168±20**	**143±5**	**156±60**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-26. Concentration of acid (1 *M* HCl) extractable total phosphorus **(HCl-TP)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P and acid hydrolysable organic P, in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**477±26**	**385±68**	**130±20**	**130±20**
38	750	516	413	226	323
56	1150	768	313	244	201
74	1550	375	348	66	39
92	2000	121	242	51	257
110	2380	187	155	117	178
128*	2800	**115±11**	**138±26**	**99±11**	**84±6**
146	3200	118	111	111	95
164	3600	108	144	123	107
182	4000	239	165	171	143
200*	4450	**207±22**	**192±23**	**196±3**	**198±66**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-27. Concentration of acid (1 *M* HCl) hydrolysable organic phosphorus **(HCl-Po)** (mg/kg), in floc and soil samples from STA-2 Cell 3. HCl-Po = (HCl-TP and HCl-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**67±2**	**34±6**	**25±2**	**19±2**
38	750	58	27	21	37
56	1150	47	9.0	25	11
74	1550	29	19	4.2	1.2
92	2000	4.5	21	17	10
110	2380	17	5.0	21	14
128*	2800	**11±9**	**20±12**	**52±10**	**26±10**
146	3200	5.2	21	67	40
164	3600	17	20	39	32
182	4000	21	16	46	37
200*	4450	**4±4**	**24±4**	**53±2**	**42±12**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-28. Concentration of alkali (0.5 *M* NaOH) extractable total phosphorus **(NaOH-TP)** (mg/kg) in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**102±9**	**64±2**	**101±3**	**94±6**
38	750	126	29	81	120
56	1150	92	61	102	85
74	1550	137	87	116	91
92	2000	51	58	138	89
110	2380	69	36	133	92
128*	2800	**81±41**	**82±29**	**227±12**	**167±24**
146	3200	65	70	156	123
164	3600	131	141	117	157
182	4000	150	101	146	181
200*	4450	**128±21**	**104±8**	**165±18**	**173±36**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-29. Concentration of acid soluble and alkali insoluble phosphorus, also known as fulvic acid bound P **(NaOH-FA-P)** (mg/kg), in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**75±15**	**44±14**	**45±3**	**38±7**
38	750	84	28	38	115
56	1150	10	32	76	83
74	1550	79	57	96	45
92	2000	38	45	52	39
110	2380	67	30	60	48
128*	2800	**49±13**	**68±22**	**139±16**	**93±7**
146	3200	65	67	65	109
164	3600	89	90	76	86
182	4000	119	72	85	110
200*	4450	**84±12**	**81±25**	**104±38**	**101±12**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-30. Concentration of alkali soluble phosphorus, also known as humic acid bound phosphorus **(NaOH-HA-P)** (mg/kg), in floc and soil samples from STA-2 Cell 3. NaOH-HA-P = (NaOH-TP- NaOH-FA-P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**28±20**	**20±12**	**56±4**	**56±1**
38	750	42	0.8	43	4.6
56	1150	82	29	26	1.6
74	1550	58	30	20	46
92	2000	13	14	87	51
110	2380	2.3	6.5	74	44
128*	2800	**32±29**	**14±10**	**88±27**	**74±25**
146	3200	0.5	3.1	92	15
164	3600	41	51	42	72
182	4000	31	29	61	72
200*	4450	**44±30**	**23±17**	**61±53**	**72±45**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-31. Concentration of acid (1 *M* HCl) and alkali (0.5 *M* NaOH) insoluble phosphorus **(Residue-TP)** (mg/kg), considered as non-reactive and stable P pool, in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**141±23**	**104±21**	**25±4**	**24±4**
38	750	169	126	41	44
56	1150	75	99	43	29
74	1550	117	117	27	28
92	2000	47	86	21	41
110	2380	90	100	28	30
128*	2800	**38±8**	**71±6**	**22±4**	**18±2**
146	3200	51	54	40	28
164	3600	62	61	42	37
182	4000	99	60	48	33
200*	4450	**82±13**	**49±13**	**37±10**	**27±5**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-32. Concentration of total inorganic phosphorus **(TPi)** (mg/kg), taken as the sum of $NaHCO_3$-Pi and HCl-Pi, in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**685±57**	**544±97**	**119±17**	**122±23**
38	750	633	510	219	303
56	1150	919	420	233	202
74	1550	487	466	77	59
92	2000	153	438	53	276
110	2380	234	189	123	183
128*	2800	**140±17**	**152±24**	**62±4**	**81±6**
146	3200	130	112	59	65
164	3600	111	141	92	84
182	4000	284	172	135	115
200*	4450	**239±30**	**189±19**	**153±7**	**164±60**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-33. Concentration of total organic phosphorus **(TPo)** (mg/kg) in floc and soil samples from STA-2 Cell 3. TPo = ($NaHCO_3$-Po+ MBP + HCl-Po + NaOH-FA-P + NaOH-HA-P + Residue- P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**432±66**	**280±32**	**165±5**	**152±7**
38	750	462	218	153	218
56	1150	386	220	176	133
74	1550	352	281	162	146
92	2000	159	252	201	184
110	2380	354	184	193	165
128*	2800	**192±45**	**216±53**	**318±17**	**236±26**
146	3200	233	180	264	196
164	3600	285	247	202	233
182	4000	404	187	246	260
200*	4450	**296±42**	**187±20**	**259±14**	**251±43**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-34. Concentration of total phosphorus **(TP)** (mg/kg), taken as the sum of total inorganic and organic P, in floc and soil samples from STA-2 Cell 3.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-I	Pre-STA-2
20*	350	**1117±96**	**825±123**	**284±21**	**274±27**
38	750	1094	728	372	521
56	1150	1305	640	408	335
74	1550	838	747	239	204
92	2000	310	690	254	460
110	2380	588	373	317	348
128*	2800	**332±62**	**368±72**	**381±16**	**317±23**
146	3200	364	292	323	260
164	3600	396	388	294	317
182	4000	687	358	381	375
200*	4450	**535±64**	**375±39**	**412±20**	**415±83**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

3.1.3 STA-3/4 Cell 3A

Table 3-35. Concentration of bicarbonate-extractable inorganic phosphorus **($NaHCO_3$-Pi)**, also known as labile inorganic phosphorus (LIP) (mg/kg), in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**67±9**	**83±9**	**64±7**	**28±5**
3A_20	450	60	23	23	28
3A_32*	850	**73±30**	**35±9**	**24±3**	**37±8**
3A_44	1260	77	32	13	14
3A_56 *	1700	**72±8**	**80±66**	**21±4**	**16±2**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-36. Concentration of bicarbonate extractable total phosphorus (**$NaHCO_3$-TP**) (mg/kg), considered as labile inorganic and organic P, in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**97±12**	**103±9**	**86±3**	**48±7**
3A_20	450	166	72	46	51
3A_32*	850	**133±24**	**79±11**	**53±6**	**62±12**
3A_44	1260	227	99	26	31
3A_56 *	1700	**133±16**	**122±72**	**46±5**	**35±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-37. Concentration of bicarbonate extractable organic phosphorus **($NaHCO_3$-Po)**, also known as labile organic phosphorus (LOP) (mg/kg), in floc and soil samples from STA-3/4 Cell 3A. LOP = ($NaHCO_3$-TP- $NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**29±5**	**20±5**	**22±4**	**20±2**
3A_20	450	106	49	23	24
3A_32*	850	**60±19**	**44±8**	**29±5**	**25±4**
3A_44	1260	149	67	13	17
3A_56 *	1700	**61±22**	**42±7**	**25±6**	**19±2**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-38. Concentration of bicarbonate extractable total phosphorus **(F-$NaHCO_3$-TP)** (mg/kg), considered as labile inorganic and organic P, in fumigated floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**194±24**	**124±25**	**102±3**	**60±6**
3A_20	450	557	254	64	65
3A_32*	850	**503±87**	**211±70**	**77±5**	**73±7**
3A_44	1260	600	277	58	47
3A_56 *	1700	**409±51**	**280±42**	**121±20**	**76±4**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-39. Concentration of bicarbonate extractable organic phosphorus **(F-$NaHCO_3$-Po)**, also known as total labile organic phosphorus (TLOP) (mg/kg), in fumigated floc and soil samples from STA-3/4 Cell 3A. TLOP = (F-$NaHCO_3$-TP -$NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**127±25**	**41±16**	**38±5**	**32±4**
3A_20	450	497	230	41	38
3A_32*	850	**431±117**	**176±63**	**53±7**	**36±2**
3A_44	1260	523	245	46	34
3A_56 *	1700	**336±48**	**200±66**	**101±20**	**59±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-40. Concentration of microbial biomass phosphorus **(MBP)** (mg/kg), in floc and soil samples from STA-3/4 Cell 3A. MBP = (F-$NaHCO_3$ -TP and $NaHCO_3$ -TP).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**97±22**	**21±17**	**16±2**	**12±3**
3A_20	450	391	181	18	14
3A_32*	850	**370±107**	**133±60**	**24±11**	**11±5**
3A_44	1260	373	178	33	16
3A_56 *	1700	**275±48**	**158±69**	**75±25**	**41±5**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-41. Concentration of acid (1 *M* HCl) extractable inorganic phosphorus **(HCl-Pi)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P, in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**581±29**	**497±118**	**422±14**	**250±14**
3A_20	450	228	246	318	321
3A_32*	850	**288±59**	**310±58**	**423±43**	**491±62**
3A_44	1260	285	212	132	128
3A_56 *	1700	**260±52**	**220±25**	**145±25**	**129±22**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-42. Concentration of acid (1 *M* HCl) extractable total phosphorus **(HCl-TP)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P and acid hydrolysable organic P, in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**630±35**	**531±107**	**432±23**	**303±12**
3A_20	450	379	337	404	388
3A_32*	850	**351±56**	**380±64**	**505±44**	**541±53**
3A_44	1260	335	252	160	145
3A_56 *	1700	**310±4**	**278±42**	**210±25**	**149±21**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-43. Concentration of acid (1 *M* HCl) hydrolysable organic phosphorus **(HCl-Po)** (mg/kg) in floc and soil samples from STA-3/4 Cell 3A. HCl-Po = (HCl-TP and HCl-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**49±23**	**34±11**	**9±9**	**53±5**
3A_20	450	151	91	86	67
3A_32*	850	**63±6**	**71±6**	**82±11**	**50±8**
3A_44	1260	50	41	28	18
3A_56 *	1700	**50±51**	**57±26**	**65±16**	**19±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-44. Concentration of alkali (0.5 *M* NaOH) extractable total phosphorus **(NaOH-TP)** (mg/kg) in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**236±59**	**144±72**	**131±13**	**322±18**
3A_20	450	620	552	336	322
3A_32*	850	**714±249**	**432±20**	**333±6**	**294±32**
3A_44	1260	513	404	192	129
3A_56 *	1700	**419±49**	**375±21**	**322±66**	**206±32**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-45. Concentration of acid soluble and alkali insoluble phosphorus, also known as fulvic acid bound P **(NaOH-FA-P)** (mg/kg), in floc and soil samples from STA-3/4 Cell 3A. .

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**139±60**	**73±36**	**68±7**	**160±33**
3A_20	450	298	234	164	174
3A_32*	850	**407±226**	**222±22**	**170±28**	**157±12**
3A_44	1260	270	231	92	51
3A_56 *	1700	**235±53**	**213±50**	**151±25**	**85±19**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-46. Concentration of alkali soluble phosphorus, also known as humic acid bound phosphorus **(NaOH-HA-P)** (mg/kg), in floc and soil samples from STA-3/4 Cell 3A. NaOH-HA-P = (NaOH-TP- NaOH-FA-P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**96±1**	**71±36**	**63±14**	**162±21**
3A_20	450	323	318	172	148
3A_32*	850	**307±28**	**211±18**	**163±22**	**137±26**
3A_44	1260	242	173	100	78
3A_56 *	1700	**184±19**	**162±29**	**171±43**	**121±13**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-47. Concentration of acid (1 *M* HCl) and alkali (0.5 *M* NaOH) insoluble phosphorus **(Residue-TP)** (mg/kg), considered as non-reactive and stable P pool, in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**250±27**	**235±27**	**190±11**	**74±16**
3A_20	450	252	209	93	81
3A_32*	850	**221±40**	**227±28**	**137±11**	**110±21**
3A_44	1260	256	245	89	80
3A_56 *	1700	**220±15**	**180±29**	**93±11**	**61±12**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-48. Concentration of total inorganic phosphorus **(TPi)** (mg/kg), taken as the sum of $NaHCO_3$-Pi and HCl-Pi, in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**648±21**	**580±127**	**487±20**	**278±19**
3A_20	450	288	269	341	349
3A_32*	850	**360±39**	**345±67**	**448±41**	**528±66**
3A_44	1260	362	243	144	141
3A_56 *	1700	**332±44**	**301±47**	**165±24**	**146±20**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-49. Concentration of total organic phosphorus **(TPo)** (mg/kg) in floc and soil samples from STA-3/4 Cell 3A. TPo = ($NaHCO_3$-Po+ MBP + HCl-Po + NaOH-FA-P + NaOH-HA-P + Residue- P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**661±72**	**455±67**	**368±13**	**481±13**
3A_20	450	1520	1082	556	508
3A_32*	850	**1429±330**	**906±82**	**605±30**	**491±45**
3A_44	1260	1341	935	355	261
3A_56 *	1700	**1025±138**	**812±111**	**581±73**	**346±31**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-50. Concentration of total phosphorus **(TP)** (mg/kg), taken as the sum of total inorganic and organic P, in floc and soil samples from STA-3/4 Cell 3A.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
3A_8*	40	**1310±62**	**1034±147**	**855±33**	**759±18**
3A_20	450	1808	1351	897	857
3A_32*	850	**1789±369**	**1251±121**	**1053±55**	**1019±22**
3A_44	1260	1703	1178	499	402
3A_56 *	1700	**1358±110**	**1113±124**	**746±77**	**492±43**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

3.1.4 STA-3/4 Cell 3B

Table 3-51. Concentration of bicarbonate-extractable inorganic phosphorus **($NaHCO_3$ -Pi)**, also known as labile inorganic phosphorus (LIP) (mg/kg), in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**34±8**	**22±3**	**14±4**	**14±5**
A7c*	385	**69±14**	**35±10**	**18±2**	**22±2**
B7	600	15	10	13	11
B7c	770	63	24	21	15
C7*	1000	**8.0±4**	**10±3**	**9.7±1**	**11±1**
C7c*	1230	**60±22**	**38±8**	**23±0.3**	**18±3**
D7*	1430	**2.5±1**	**7.5±3**	**8.9±3**	**6.6±2**
D7c*	1550	**59±6**	**15±4**	**8.6±4**	**7.8±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-52. Concentration of bicarbonate extractable total phosphorus (**$NaHCO_3$-TP**) (mg/kg), considered as labile inorganic and organic P, in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**38±7**	**32±10**	**32±4**	**26±3**
A7c*	385	**104±08**	**72±6**	**35±4**	**33±2**
B7	600	20	17	21	18
B7c	770	67	48	37	21
C7*	1000	**14±5**	**21±3**	**20±4**	**14±1**
C7c*	1230	**66±22**	**49±11**	**26±3**	**21±3**
D7*	1430	**8.6±4**	**18±7**	**15±3**	**11±1**
D7c*	1550	**75±5**	**26±13**	**15±7**	**17±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-53. Concentration of bicarbonate extractable organic phosphorus **($NaHCO_3$-Po)**, also known as labile organic phosphorus (LOP) (mg/kg), in floc and soil samples from STA-3/4 Cell 3B. LOP = ($NaHCO_3$-TP - $NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**3.9±2**	**9.5±7**	**18±7**	**13±9**
A7c*	385	**35±15**	**37±12**	**17±6**	**11±4**
B7	600	4.4	7.0	7.2	6.6
B7c	770	3.9	24	16	6.3
C7*	1000	**6.1±3**	**10±6**	**10±3**	**2.6±1**
C7c*	1230	**5.8±5**	**11±9**	**3.8±3**	**3.3±2**
D7*	1430	**6.2±4**	**11±4**	**6.4±5**	**4.2±3**
D7c*	1550	**16±10**	**11±11**	**6.6±4**	**8.9±1**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-54. Concentration of bicarbonate extractable total phosphorus **(F-$NaHCO_3$-TP)** (mg/kg), considered as labile inorganic and organic P, in fumigated floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**171±10**	**62±6**	**58±11**	**47±5**
A7c*	385	**317±61**	**197±19**	**83±26**	**68±4**
B7	600	90	57	52	38
B7c	770	146	105	84	48
C7*	1000	**102±19**	**46±8**	**32±4**	**18±2**
C7c*	1230	**183±52**	**127±29**	**48±10**	**32±2**
D7*	1430	**98±30**	**52±8**	**35±4**	**19±2**
D7c*	1550	**273±36**	**56±21**	**27±15**	**30±3**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-55. Concentration of bicarbonate extractable organic phosphorus **(F-$NaHCO_3$-Po)**, also known as total labile organic phosphorus (TLOP), in fumigated floc and soil samples from STA-3/4 Cell 3B. TLOP = (F-$NaHCO_3$-TP -$NaHCO_3$-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**137±15**	**40±3**	**44±13**	**33±5**
A7c*	385	**248±71**	**162±9**	**64±28**	**46±3**
B7	600	74	47	39	27
B7c	770	83	81	63	33
C7*	1000	**94±19**	**35±11**	**23±3**	**6.3±2**
C7c*	1230	**123±40**	**89±23**	**26±10**	**14±3**
D7*	1430	**96±29**	**45±6**	**26±6**	**13±3**
D7c*	1550	**214±33**	**41±17**	**19±11**	**23±4**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-56. Concentration of microbial biomass phosphorus **(MBP)** (mg/kg), in floc and soil samples from STA-3/4 Cell 3B. MBP = (F-$NaHCO_3$ -TP and $NaHCO_3$ -TP).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**133±15**	**31±7**	**26±7**	**21±7**
A7c*	385	**212±60**	**125±21**	**47±22**	**35±6**
B7	600	70	40	31	20
B7c	770	79	56	47	27
C7*	1000	**88±16**	**25±7**	**12±3**	**3.7±1**
C7c*	1230	**117±44**	**78±20**	**22±12**	**11±5**
D7*	1430	**90±30**	**34±7**	**19±3**	**8.4±3**
D7c*	1550	**198±39**	**31±11**	**12±9**	**14±4**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-57. Concentration of acid (1 *M* HCl) extractable inorganic phosphorus **(HCl-Pi)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P, in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**80±15**	**145±27**	**198±36**	**67±5**
A7c*	385	**235±40**	**251±19**	**245±21**	**113±18**
B7	600	87	121	184	120
B7c	770	240	261	294	161
C7*	1000	**73±5**	**115±37**	**174±6**	**163±3**
C7c*	1230	**203±47**	**187±14**	**199±7**	**177±57**
D7*	1430	**87±32**	**124±96**	**187±8**	**117±10**
D7c*	1550	**209±15**	**222±10**	**169±20**	**167±8**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-58. Concentration of acid (1 *M* HCl) extractable total phosphorus **(HCl-TP)** (mg/kg), taken as the sum of calcium, magnesium, iron and aluminum associated P and acid hydrolysable organic P, in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**93±14**	**167±31**	**242±29**	**71±6**
A7c*	385	**317±43**	**309±46**	**309±15**	**137±19**
B7	600	94	144	251	146
B7c	770	323	359	419	214
C7*	1000	**84±1**	**135±39**	**203±15**	**170±3**
C7c*	1230	**249±44**	**224±20**	**219±25**	**194±62**
D7*	1430	**93±27**	**149±92**	**228±8**	**128±10**
D7c*	1550	**240±18**	**230±17**	**179±35**	**184±6**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-59. Concentration of acid (1 *M* HCl) hydrolysable organic phosphorus **(HCl-Po)** (mg/kg) in floc and soil samples from STA-3/4 Cell 3B. HCl-Po = (HCl-TP and HCl-Pi).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**12±3**	**22±4**	**44±31**	**4.8±1**
A7c*	385	**82±54**	**57±33**	**64±14**	**24±6**
B7	600	7.0	24	67	26
B7c	770	83	98	124	52
C7*	1000	**12±4**	**20±2**	**29±11**	**7.8±2**
C7c*	1230	**46±17**	**40±11**	**20±18**	**17±5**
D7*	1430	**5.6±5**	**25±7**	**41±6**	**11±2**
D7c*	1550	**31±7**	**7.7±8**	**10±15**	**17±11**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-60. Concentration of alkali (0.5 *M* NaOH) extractable total phosphorus **(NaOH-TP)** (mg/kg) in samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**18±1**	**47±12**	**274±10**	**104±21**
A7c*	385	**415±34**	**354±37**	**283±57**	**170±16**
B7	600	11	29	258	172
B7c	770	352	329	419	243
C7*	1000	**16±4**	**34±7**	**217±30**	**113±11**
C7c*	1230	**437±166**	**341±79**	**255±31**	**137±46**
D7*	1430	**34±21**	**58±43**	**208±13**	**79±7**
D7c*	1550	**290±20**	**141±50**	**111±73**	**178±58**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-61. Concentration of acid soluble and alkali insoluble phosphorus, also known as fulvic acid bound P **(NaOH-FA-P)** (mg/kg), in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**13±3**	**30±11**	**137±28**	**31±8**
A7c*	385	**206±13**	**210±33**	**135±36**	**68±5**
B7	600	11	20	133	58
B7c	770	159	157	235	128
C7*	1000	**12±4**	**25±5**	**120±26**	**56±9**
C7c*	1230	**224±44**	**248±56**	**188±39**	**80±32**
D7*	1430	**15±11**	**51±44**	**148±8**	**45±7**
D7c*	1550	**185±21**	**93±49**	**71±56**	**106±44**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-62. Concentration of alkali soluble phosphorus, also known as humic acid bound phosphorus **(NaOH-HA-P)** (mg/kg), in floc and soil samples from STA-3/4 Cell 3B. NaOH-HA-P = (NaOH-TP- NaOH-FA-P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**4.7±2**	**17±1**	**137±19**	**72±14**
A7c*	385	**209±39**	**145±15**	**148±21**	**101±20**
B7	600	0.2	9.1	125	113
B7c	770	193	172	183	115
C7*	1000	**4.0±1**	**10±4**	**97±7**	**58±5**
C7c*	1230	**213±144**	**93±31**	**68±12**	**57±14**
D7*	1430	**20±29**	**7.5±4**	**59±10**	**34±6**
D7c*	1550	**105±33**	**48±8**	**40±17**	**72±17**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-63. Concentration of acid (1 *M* HCl) and alkali (0.5 *M* NaOH) insoluble phosphorus **(Residue-TP)** (mg/kg), considered as non-reactive and stable P pool, in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**46±7**	**110±8**	**84±5**	**33±4**
A7c*	385	**170±8**	**183±36**	**118±16**	**45±4**
B7	600	70	130	113	46
B7c	770	159	151	115	49
C7*	1000	**74±14**	**125±13**	**160±8**	**71±6**
C7c*	1230	**144±37**	**183±9**	**162±23**	**72±5**
D7*	1430	**67±30**	**158±84**	**189±18**	**89±12**
D7c*	1550	**171±27**	**139±52**	**98±36**	**117±26**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-64. Concentration of total inorganic phosphorus **(TPi)** (mg/kg), taken as the sum of $NaHCO_3$-Pi and HCl-Pi, in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**114±19**	**167±30**	**212±38**	**80±10**
A7c*	385	**304±53**	**287±10**	**263±24**	**135±17**
B7	600	102	131	198	131
B7c	770	303	285	315	176
C7*	1000	**81±7**	**125±36**	**184±5**	**174±2**
C7c*	1230	**263±44**	**222±21**	**222±6**	**195±55**
D7*	1430	**90±32**	**132±99**	**196±7**	**123±12**
D7c*	1550	**267±21**	**237±10**	**178±24**	**175±8**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-65. Concentration of total organic phosphorus **(TPo)** (mg/kg) in floc and soil samples from STA-3/4 Cell 3B. TPo = ($NaHCO_3$-Po+ MBP + HCl-Po + NaOH-FA-P + NaOH-HA-P + Residue- P).

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**213±8**	**219±21**	**447±44**	**175±19**
A7c*	385	**915±84**	**756±89**	**530±98**	**286±18**
B7	600	162	230	476	271
B7c	770	676	658	721	378
C7*	1000	**196±27**	**214±2**	**429±45**	**198±18**
C7c*	1230	**749±169**	**654±113**	**464±55**	**240±56**
D7*	1430	**203±23**	**286±125**	**464±14**	**191±14**
D7c*	1550	**706±35**	**329±126**	**237±134**	**334±80**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

Table 3-66. Concentration of total phosphorus **(TP)** (mg/kg), taken as the sum of total inorganic and organic P, in floc and soil samples from STA-3/4 Cell 3B.

Transect Station	Distance from inflow (m)	Floc	RAS	Pre-STA-1	Pre-STA-2
A7 *	180	**327±25**	**386±38**	**658±52**	**255±9**
A7c*	385	**1218±59**	**1043±84**	**793±80**	**420±35**
B7	600	264	361	674	402
B7c	770	979	943	1036	554
C7*	1000	**276±29**	**339±34**	**613±49**	**372±19**
C7c*	1230	**1012±168**	**875±118**	**685±60**	**435±110**
D7*	1430	**293±53**	**418±224**	**659±17**	**315±5**
D7c*	1550	**974±55**	**566±134**	**415±158**	**509±80**

* Benchmark sites. Bolded values represent mean concentration and standard deviation of triplicate samples.

4 Phosphorus Sorption/Desorption Characteristics of STA Soils [Task 6a]

Preliminary tests of P sorption/desorption indicated the necessary P concentration ranges required to encompass all sorption parameters for floc and soil samples from different sampling locations and depth profiles. The concentration range selected for the test range from background (STA site water outflow SRP concentrations), ~ 2 µg/L, to 25, 50, 100, 250, 500, 1000, and 5000 µg/L. This wide range should be sufficient to ensure that the equilibrium P concentration was within the test range. Sample P retention occurred for several standard P concentrations below the 5000 µg/L tested, while P release was often observed for several of the lowest P concentrations tested. The resulting regression was suitable for predicting the EPC, so completion of the sorption/desorption should be performed using this concentration range. Field P loading rates would not exceed the concentration range that is being tested. There is some debate as to whether the entire retention/release curve should be used for EPC calculation and other parameters. Selections can be made in consultation with UF and SFWMD to best calculate EPC using the retention/release curves.

Table 4-1. Equilibrium P concentration of soil depth samples extracted with various site water sources.

Sample Type	Extractant	EPC
		(mg/L)
Floc	0.01 M KCl	0.026
Floc	STA-2 Cell 3 outflow	0.027
Floc	STA-2 Cell 1 outflow	0.029
RAS	0.01 M KCl	0.127
RAS	STA-2 Cell 3 outflow	0.145
RAS	STA-2 Cell 1 outflow	0.132
Pre STA	0.01 M KCl	0.078
Pre STA	STA-2 Cell 3 outflow	0.069
Pre STA	STA-2 Cell 1 outflow	0.071

Floc and soil samples are analyzed for moisture content, then approximate dry-weight equivalents used for the sorption/desorption experiment. Sample site waters are adjusted to the desired P concentration range using dilutions of a P concentration standard (LabChem 1000 mg P/L standard) to create the desired P concentration range using STA outflow site water. Twenty-five mL of adjusted STA outflow site water is subsequently added to samples, then total solution volume calculated including the soil moisture content. After shaking the soils for an equilibration period of 24 hours, samples are centrifuged and filtered through 0.45 µm membrane filters into scintillation vials. Centrifuge tubes are weighed empty, then after floc and soil sample addition, then again after filtration (pre-desorption). Desorption occurs by addition of unamended site water (control), followed by the same procedure of 24-hr equilibration by shaking, centrifugation, and filtration. Analysis of P concentrations occurs immediately after filtration to minimize storage time.

Table 4-2. Phosphorus release/retain values for different extractants as a function of added P concentration.

	Added P conc.	S' Negative Value P release P release/retain		
	mg/L	0.01 M KCl	STA-2 Cell 3 Outflow	STA-2 Cell 1 Outflow
Floc	0	0.43	-0.05	0.04
	0.01	-0.09	-0.04	0.61
	0.025	-0.35	0.66	1.17
	0.05	0.37	1.88	1.83
	0.1	1.12	4	4.04
	0.5	29.59	19.93	19.31
	1	35.13	29.13	32.28
	5	234.23	191.3	223.59
Pre STA	0	-0.56	-0.35	0.11
	0.01	-0.72	-0.3	-0.01
	0.025	-1.17	-0.29	-0.27
	0.05	-0.21	0.16	0.15
	0.1	0.72	0.35	1.29
	0.5	10.32	8.23	8.09
	1	11.11	13.89	17.5
	5	98.3	98.2	154.96
RAS	0	-1.23	-0.89	-1.47
	0.01	-1.46	-1.29	-1.75
	0.025	-1.44	-2	-1.56
	0.05	-3.25	-3.62	-4.12
	0.1	-3.46	-3.22	-3.97
	0.5	9.8	8.12	9.32
	1	15.96	14.92	20.72
	5	108.7	114.55	119.46

Sample site water is to be collected from near the outflow of each of the STA cells, and floc and soil samples from that cell will be incubated with that site water from the same cell. All outflow site waters tested so far showed similar SRP concentrations of 2 µg P/L. Site waters are pre-filtered through 0.45 µm membrane filters before use in the sorption/desorption experiments. As the rainy season begins, after May, 2017, there should be adequate site water and at typical P concentrations to collect for use in this part of the study.

5 Transect Study - Water Quality Monitoring [Task 7a]

There was no flow event during this reporting period. Next report will include information on water quality monitoring from the next flow event planned for May 2017.

6 Transect Study- Laboratory Enzymes and Data Analysis [Task 7b]

The objective of this task is to determine the effect of water flow within the STAs on enzyme activities related to carbon (β Glucosidase), nitrogen (Aminopeptidase and N-acetyl glucosaminidase), and P (alkaline phosphatase (monoesterase), Bis-phosphatase (di-esterase) in floc and litter samples collected from the three benchmark sites (C20, C128, and C200) in STA-2 Cell 3.

6.1 Work Completed During this Quarter

No sampling event occurred during this quarter due to low water levels.

Data collected/ measured from samples collected (on November 1, and November 15, 2016) during the fifth experimental flow event that occurred from October 12 to November 22, 2016 was sent in the previous report (#6). However, microbial biomass data for some samples were reanalyzed. The updated data are presented in Table 6-1 and Table 6-2.

Currently, UF-WBL is investigating the relationships of causal factors of system flow (e.g., potential effect of flow on microbial nutrient use efficiency or water column nutrient levels) on observed enzyme activities. These findings were presented as a poster "Effect of Flow on Phosphorus Enzymes" at the GEER meeting in April 2017.

During this period, UF-WBL responded to several queries from the District regarding the methodology and the data calculation for the enzyme assays, and had two telephone conferences during this time for up to 1.5 hours.

Table 6-1. Microbial biomass carbon (MBC), nitrogen (MBN) and phosphorus (MBP) based on dry weight for floc and soil samples collected from benchmark sites in STA-2 Cell 3. There were no litter samples collected. Some of the values were rerun and this table contains the **updated values. (ND= no data)** (sampling date: November 1, 2016).

Site	Flow	Flow Event	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
C20	Low flow	5	Floc	83.81	3402	418	ND
C20	Low flow	5	Floc	86.63	3915	452	24
C20	Low flow	5	Floc	83.89	3037	316	ND
C128	Low flow	5	Floc	91.45	5836	576	127
C128	Low flow	5	Floc	92.35	6089	492	184
C128	Low flow	5	Floc	91.50	5419	621	113
C200	Low flow	5	Floc	90.51	4438	384	76
C200	Low flow	5	Floc	94.10	7324	857	136
C200	Low flow	5	Floc	93.57	6361	765	191

Table 6-2. Microbial biomass carbon (MBC), nitrogen (MBN) and phosphorus (MBP) based on dry weight for floc and soil samples collected from benchmark sites in STA-2 Cell 3. There were no litter samples collected. Some of the values were rerun and this table contains the **updated values.** (sampling date: November 15, 2016).

Site	Flow	Flow Event	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
C20	Stagnant	5	Floc	85.15	3947	414	57
C20	Stagnant	5	Floc	82.89	2390	225	43
C20	Stagnant	5	Floc	84.12	3344	300	73
C128	Stagnant	5	Floc	87.21	3842	364	64
C128	Stagnant	5	Floc	90.84	4755	432	91
C128	Stagnant	5	Floc	89.99	5750	582	124
C200	Stagnant	5	Floc	88.86	5609	555	130
C200	Stagnant	5	Floc	92.50	7434	841	190
C200	Stagnant	5	Floc	93.77	11021	1203	255

7 Biogeochemical Processes: Laboratory and Field Studies (Task 8)

The objectives of this study are to: (1) determine patterns of biogeochemical parameters, microbial activity and organic P mineralization as they relate to spatial gradients of nutrients and vegetation type in STA soils; and (2) document the patterns of decomposition processes and nutrient release in vertical profiles (aerobic/anaerobic transitions) of key STA regions.

7.1 Work Completed During this Quarter

Transect soil sampling was conducted in STA-2 Cell 1 and STA-2 Cell 3 on March 13-14, 2017. Soil cores were collected from three (3) benchmark sites (34, 121, 208) in STA-2 Cell 1 (Table 7-1) and from three (3) benchmark sites (20, 128, 200) in STA-2 Cell 3 (Table 7-2). Samples were received by UF-WBL on March 17, 2017. Litter samples from the above-mentioned sites in all 4 cells were collected on March 13-14, 2017.

Transect soil sampling was conducted in STA-3/4 Cells 3A and 3B over a period of 3 days (Feb 28-March 1, 2017). Three (3) benchmark sites (A8, A32, A56) were sampled in STA-3/4 Cell 3A (Table 7-3). Six (6) benchmark sites (A7, A7c, C7, C7c, D7, D7c) were sampled in STA-3/4 Cell 3B (Table 7-4). Samples were received by UF-WBL on March 7, 2017. Samples were stored at 4°C until analysis.

At each benchmark site, 3 replicate cores were collected. All cores were sectioned into floc, recently accreted soil (RAS) and 2 pre-STA soil fractions for STA-2 Cell 1 (n=36), STA-2 Cell 3 (n=36), STA-3/4 Cell 3A (n=36) and STA-3/4 Cell 3B (n=72). Floc depth was determined after allowing flocculent material to settle in a plastic core tube for 3-4 hours. Plant litter samples were collected from STA-2 Cell 1(n=9), STA-3/4 Cell 3B (n=18) and STA-3/4 Cell 3A (n=9), STA-2 Cell 3 (n=9). Samples were stored in plastic sample bags at ~4^{o}C until they were shipped to the UF-WBL.

Analyses of microbial biomass carbon, nitrogen and phosphorus are currently underway for all samples. Other biogeochemical parameters including rates of enzyme activities (phosphatase, bis-phosphatase, aminopeptidase, glucosidase) respiration (aerobic and anaerobic) and potential mineralizable phosphorus (PMP) and nitrogen (PMN) are analyzed in select samples (see tables below). Data analyses for some microbial parameters (respiration, and enzymes) are completed and some are still underway (to be analyzed=TBA).

Data analyses of the potential mineralizable phosphorus (PMP) and nitrogen (PMN) and respiration (aerobic and anaerobic) from sampling conducted in October 2016 were completed during this quarter (Table 7-5 to

Table 7-11). The results are presented below. Data from respiration values (ReDo) are currently being reviewed. Microbial biomass carbon (MBC), nitrogen (MBN) and phosphorus (MBP) in the samples collected in October 2016 are presented in Table 7-12 to Table 7-18. Some of the samples were reanalyzed and the MBP data has been included. Additional analyses was performed on Pre-STA-I samples only.

Table 7-1. Samples collected from benchmark sites in STA-2 Cell 1 were received by (UF-WBL) in March, 2017. Number of samples collected from the respective sites are indicated by letter 'x' (red or black). All samples were analyzed for microbial biomass C/N/P (n=45). Samples analyzed for additional parameters (enzymes, respiration and mineralizable nutrients) are indicated by the red 'x' (n=36).

STA-2 Cell 1						
Location	**Replicates**	**Litter**	**Floc**	**RAS**	**Pre STA-1**	**Pre STA-2**
C34	3	xxx	xxx	xxx	xxx	xxx
C121	3	xxx	xxx	xxx	xxx	xxx
C208	3	xxx	xxx	xxx	xxx	xxx

Table 7-2. Samples collected from benchmark sites in STA-2 Cell 3 were received by (UF-WBL) in March, 2017. All samples were analyzed for microbial biomass C/N/P (n=45). Samples analyzed for additional parameters (enzymes, respiration and mineralizable nutrients) are indicated by the red 'x'(n=36).

STA-2 Cell 3						
Location	Replicates	Litter	Floc	RAS	Pre STA-1	Pre STA-2
C20	3	xxx	xxx	xxx	xxx	xxx
C128	3	xxx	xxx	xxx	xxx	xxx
C200	3	xxx	xxx	xxx	xxx	xxx

Table 7-3. Samples collected from benchmark sites in STA-3/4 Cell 3A were received by (UF-WBL) in March, 2017. All samples were analyzed for microbial biomass C/N/P (n=45). Samples analyzed for additional parameters (enzymes, respiration and mineralizable nutrients) are indicated by the red 'x'(n=36).

STA-3/4 Cell 3A						
Location	Replicates	Litter	Floc	RAS	Pre STA-1	Pre STA-2
A8	3	xxx	xxx	xxx	xxx	xxx
A32	3	xxx	xxx	xxx	xxx	xxx
A56	3	xxx	xxx	xxx	xxx	xxx

Table 7-4. Samples collected from benchmark sites in STA-3/4 Cell 3B were received by (UF-WBL) in March, 2017. All samples were analyzed for microbial biomass C/N/P (n=90). Samples analyzed for additional parameters (enzymes, respiration and mineralizable nutrients) are indicated by the red 'x'(n=72).

STA-3/4 Cell 3B						
Location	Replicates	Litter	Floc	RAS	Pre STA-1	Pre STA-2
A7	3	xxx	xxx	xxx	xxx	xxx
A7c	3	xxx	xxx	xxx	xxx	xxx
C7	3	xxx	xxx	xxx	xxx	xxx
C7c	3	xxx	xxx	xxx	xxx	xxx
D7	3	xxx	xxx	xxx	xxx	xxx
D7c	3	xxx	xxx	xxx	xxx	xxx

Table 7-5. Potentially mineralizable nitrogen (PMN) and phosphorus (PMP) based on dry weight for litter samples from transect and benchmark sites at STA-3/4 Cell 3B. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient.

STA-3/4	**WBLID**	**Station**	**PMN**	**PMP**	**Aerobic Respiration**	**Anaerobic Respiration**
Cell			ug NH_4-N/g dw/day	ug PO_4^- P/g dw/day	umolsCO_2^-C/g dw/day	umolsCO_2^-C/g dw/day
			Litter			
Cell-3B	16-743-745	A7	41.023	5.038	355.00	110.77
Cell-3B	16-746	A7c-A	-25.503	-3.218	184.63	42.93
Cell-3B	16-747	A7c-B	7.984	-0.744	83.19	29.67
Cell-3B	16-748	A7c-C	2.275	-0.422	66.86	32.02
Cell-3B	16-749	B7	52.09	7.481	506.82	24.14
Cell-3B	16-750	B7c	-1.645	0.174	120.81	31.46
Cell-3B	16-751	C7-A	-10.937	0.522	137.85	31.52
Cell-3B	16-752	C7-B	-41.963	0.124	412.01	75.38
Cell-3B	16-753	C7-C	-24.929	-0.382	713.55	37.43
Cell-3B	16-754	C7c-A	-1.157	-0.574	107.19	32.99
Cell-3B	16-755	C7c-B	-9.394	-0.384	163.94	38.93
Cell-3B	16-756	C7c-C	-1.41	0.536	164.45	46.25
Cell-3B	16-757	D7-A	29.617	1.065	286.91	77.52
Cell-3B	16-758	D7-B	12.426	0.615	521.19	56.36
Cell-3B	16-759	D7-C	70.792	-0.238	577.95	91.13
Cell-3B	16-760	D7c-A	26.92	-0.461	284.40	27.98
Cell-3B	16-761	D7c-B	12.381	4.285	517.11	25.04
Cell-3B	16-762	D7c-C	15.161	-2.152	77.23	35.00

Table 7-6. Potentially mineralizable nitrogen (PMN) and –phosphorus (PMP) based on dry weight for floc, and soil samples from transect and benchmark sites at STA-3/4 Cell 3B. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Values with ReDo indicate that some replicate samples are currently being reanalyzed. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient.

SAT-3/4	WBLID	Sample type	Station	PMN	PMP	Aerobic Respiration	Anaerobic Respiration
Cell				ug NH_4-N/g dw/day	ug PO_4^- P/g dw/day	umolsCO_2^- C/g dw/day	umolsCO_2^- C/g dw/day
Cell-3B	16-776	Floc	A7-A	-15.041	-0.449	3.01	1.18
Cell-3B	16-777	RAS	A7-A	-16.05	-0.12	0.58	0.77
Cell-3B	16-778	Pre-STA I	A7-A	-39.55	-0.651	3.53	2.08
Cell-3B	16-780	Floc	A7-B	-23.727	-0.309	3.19	0.83
Cell-3B	16-781	RAS	A7-B	-17.357	-0.126	1.72	0.75
Cell-3B	16-782	Pre-STA I	A7-B	-38.359	-0.886	6.40	1.37
Cell-3B	16-784	Floc	A7-C	-23.927	-0.253	2.31	0.44
Cell-3B	16-785	RAS	A7-C	-25.711	-0.13	5.84	1.02
Cell-3B	16-786	Pre-STA I	A7-C	-49.202	3.712	ReDo	2.22
Cell-3B	16-788	Floc	A7c-A	-44.792	-1.918	4.03	1.84
Cell-3B	16-789	RAS	A7c-A	-40.05	-1.751	5.28	2.68
Cell-3B	16-790	Pre-STA I	A7c-A	-28.456	-2.099	8.16	1.20
Cell-3B	16-792	Floc	A7c-B	-50.747	-1.681	ReDo	1.71
Cell-3B	16-793	RAS	A7c-B	-39.254	-1.582	8.58	2.70
Cell-3B	16-794	Pre-STA I	A7c-B	-26.952	-1.498	12.24	1.86
Cell-3B	16-796	Floc	A7c-C	-48.416	-2.62	1.78	3.20
Cell-3B	16-797	RAS	A7c-C	-58.035	-1.461	8.88	7.94
Cell-3B	16-798	Pre-STA I	A7c-C	-13.159	-1.093	8.16	1.02
Cell-3B	16-800	Floc	B7	-8.598	-0.067	ReDo	ReDo
Cell-3B	16-801	RAS	B7	-14.138	-0.134	ReDo	1.18
Cell-3B	16-808	Floc	C7-A	-10.705	-0.202	1.34	2.50
Cell-3B	16-809	RAS	C7-A	-10.402	-0.17	ReDo	0.93
Cell-3B	16-810	Pre-STA I	C7-A	-6.688	-0.092	ReDo	1.15
Cell-3B	16-812	Floc	C7-B	-9.656	-0.11	0.48	0.99
Cell-3B	16-813	RAS	C7-B	-6.155	-0.119	5.22	0.94
Cell-3B	16-814	Pre-STA I	C7-B	-8.221	-0.159	6.96	1.53
Cell-3B	16-816	Floc	C7-C	-13.306	-0.106	4.32	1.35
Cell-3B	16-817	RAS	C7-C	-9.128	-0.217	4.80	1.04
Cell-3B	16-818	Pre-STA I	C7-C	-6.013	-0.08	0.77	1.32
Cell-3B	16-832	Floc	D7-A	-7.138	-0.187	7.68	3.56
Cell-3B	16-833	RAS	D7-A	-24.449	-0.236	56.71	2.86
Cell-3B	16-834	Pre-STA I	D7-A	-4.975	-0.144	12.16	1.68
Cell-3B	16-836	Floc	D7-B	-7.448	-0.085	9.60	2.55
Cell-3B	16-837	RAS	D7-B	-9.468	-0.196	21.62	0.96
Cell-3B	16-838	Pre-STA I	D7-B	-4.947	-0.097	4.90	1.41
Cell-3B	16-840	Floc	D7-C	-17.627	-0.382	24.71	1.48
Cell-3B	16-841	RAS	D7-C	-13.271	-0.266	16.16	1.11
Cell-3B	16-842	Pre-STA I	D7-C	-6.688	-0.152	12.78	1.22
Cell-3B	16-844	Floc	D7c-A	-39.457	-1.882	27.14	5.49
Cell-3B	16-845	RAS	D7c-A	-31.723	-0.758	91.52	2.06
Cell-3B	16-846	Pre-STA I	D7c-A	-17.389	-0.257	9.05	1.56
Cell-3B	16-848	Floc	D7c-B	-44.97	-3.242	116.60	9.84

Cell-3B	16-849	RAS	D7c-B	-10.814	-0.129	23.81	2.22
Cell-3B	16-850	Pre-STA I	D7c-B	-4.239	-0.028	7.64	1.07
Cell-3B	16-852	Floc	D7c-C	-5.762	-1.159	70.47	7.70
Cell-3B	16-853	RAS	D7c-C	-12.371	-0.077	13.61	4.08
Cell-3B	16-854	Pre-STA I	D7c-C	-7.814	-0.042	2.40	0.98

Table 7-7. Potentially mineralizable-nitrogen (PMN) and -phosphorus (PMP) based on dry weight for litter samples from transect and benchmark sites at STA-3/4 Cell 3A. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient.

STA-3/4 Cell	**WBLID**	**Station**	**PMN**	**PMP**	**Aerobic Respiration**	**Anaerobic Respiration**
			ug NH_4-N/g dw/day	ug PO_4^- P/g dw/day	umolsCO_2-C/g dw/day	umolsCO_2-C/g dw/day
			Litter			
Cell 3A	16-913	A8-A	145.423	21.649	810.83	71.85
Cell 3A	16-914	A8-B	99.7	29.17	489.04	33.29
Cell 3A	16-915	A8-C	97.105	35.554	1199.46	41.02
Cell 3A	16-916	A20	55.077	15.352	304.20	23.08
Cell 3A	16-917	A32-A	64.743	2.753	297.91	32.84
Cell 3A	16-918	A32-B	53.385	25.17	324.93	24.05
Cell 3A	16-919	A32-C	26.253	7.06	332.84	9.55
Cell 3A	16-920	A44	7.409	2.518	116.96	34.10
Cell 3A	16-921	A56-A	69.663	2.721	187.71	42.49
Cell 3A	16-922	A56-B	60.103	1.177	322.80	47.30
Cell 3A	16-923	A56-C	64.166	-1.785	240.38	40.03

Table 7-8. Potentially mineralizable nitrogen (PMN) and -phosphorus (PMP) based on dry weight for floc, and soil samples from transect and benchmark sites at STA3/4 Cell 3A. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient.

STA-3/4 Cell	WBLID	Sample type	Station	PMN	PMP	Aerobic Respiration	Anaerobic Respiration
				ug NH_4-N/g dw/day	ug PO_4^- P/g dw/day	umolsCO_2-C/g dw/day	umolsCO_2-C/g dw/day
Cell 3A	16-924	Floc	A20	19.196	2.773	127.71	5.83
Cell 3A	16-925	RAS	A20	5.023	1.31	52.54	4.12
Cell 3A	16-928	Floc	A32-A	103.686	5.784	143.93	11.10
Cell 3A	16-929	RAS	A32-A	2.051	0.38	26.80	2.42
Cell 3A	16-930	Pre-STA I	A32-A	-0.984	0.083	19.71	0.78
Cell 3A	16-932	Floc	A32-B	16.075	2.004	28.96	6.48
Cell 3A	16-933	RAS	A32-B	8.993	1.085	46.22	4.04
Cell 3A	16-934	Pre-STA I	A32-B	1.126	0.093	18.47	1.17
Cell 3A	16-936	Floc	A32-C	8.791	2.379	65.05	6.26
Cell 3A	16-937	RAS	A32-C	6.756	0.762	29.65	2.78
Cell 3A	16-938	Pre-STA I	A32-C	0.716	0.08	32.72	1.31
Cell 3A	16-940	Floc	A44	57.04	6.07	135.94	18.43
Cell 3A	16-941	RAS	A44	15.851	2.762	34.33	6.29
Cell 3A	16-944	Floc	A56-A	50.638	3.691	23.66	8.92
Cell 3A	16-945	RAS	A56-A	29.814	2.635	37.43	6.28
Cell 3A	16-946	Pre-STA I	A56-A	3.858	0.551	36.70	2.05
Cell 3A	16-948	Floc	A56-B	51.638	1.795	73.01	13.97
Cell 3A	16-949	RAS	A56-B	21.479	1.371	49.09	5.86
Cell 3A	16-950	Pre-STA I	A56-B	3.27	0.328	48.70	1.89
Cell 3A	16-952	Floc	A56-C	58.326	3.907	96.99	11.46
Cell 3A	16-953	RAS	A56-C	19.59	1.332	56.41	6.09
Cell 3A	16-954	Pre-STA I	A56-C	1.269	0.352	5.30	2.13
Cell 3A	16-956	Floc	A8-A	3.477	1.258	31.28	2.08
Cell 3A	16-957	RAS	A8-A	2.939	1.464	13.34	2.08
Cell 3A	16-958	Pre-STA I	A8-A	2.171	0.702	29.19	1.45
Cell 3A	16-960	Floc	A8-B	9.023	1.95	24.10	2.42
Cell 3A	16-961	RAS	A8-B	2.05	0.989	19.92	1.27
Cell 3A	16-962	Pre-STA I	A8-B	-0.345	0.157	31.79	0.59
Cell 3A	16-964	Floc	A8-C	4.567	1.985	61.78	2.61
Cell 3A	16-965	RAS	A8-C	2.937	0.747	122.66	0.99
Cell 3A	16-966	Pre-STA I	A8-C	2.04	0.302	102.66	0.77

Table 7-9. Potentially mineralizable nitrogen (PMN) and -phosphorus (PMP) based on dry weight for litter samples from transect and benchmark sites at STA-2 Cell 1. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient.

STA-2 Cell	WBLID	Sample type	Station	PMN	PMP	Aerobic Respiration	Anaerobic Respiration
				ug NH_4-N/g dw/day	ug PO_4^- P/g dw/day	umolsCO_2^- C/g dw/day	umolsCO_2^- C/g dw/day
Cell-1	16-602	Litter	34-A	35.45	7.07	62.6	14.7
Cell-1	16-603	Litter	34-B	21.16	5.42	20.8	8.3
Cell-1	16-604	Litter	34-C	15.75	4.23	220.1	12.3
Cell-1	16-605	Litter	51	16.41	2.49	240.3	12.5
Cell-1	16-606	Litter	69	18.66	1.71	146.2	16.8
Cell-1	16-607	Litter	86	16.92	4.32	35.4	12.4
Cell-1	16-608	Litter	104	5.15	3.61	37.0	36.0
Cell-1	16-609	Litter	121-A	11.63	1.95	69.5	5.8
Cell-1	16-610	Litter	121-B	17.70	2.22	129.4	14.6
Cell-1	16-611	Litter	121-C	42.06	6.62	60.1	14.2
Cell-1	16-612	Litter	138	-5.88	0.22	41.4	48.9
Cell-1	16-613	Litter	156	32.54	4.38	58.2	39.7
Cell-1	16-614	Litter	173	15.71	-0.35	102.4	34.5
Cell-1	16-615	Litter	191	4.94	-0.44	87.0	24.9
Cell-1	16-616	Litter	208-A	18.12	2.16	69.4	24.1
Cell-1	16-617	Litter	208-B	17.64	3.18	45.1	16.3
Cell-1	16-618	Litter	208-C	24.83	-0.27	58.0	15.1

Table 7-10. Potentially mineralizable nitrogen (PMN) and phosphorus (PMP) based on dry weight for floc, and soil samples from transect and benchmark sites at STA-2 Cell 1. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient. (Pre-STA-II samples were excluded from additional analysis. see text of page 48).

STA-2 Cell	WBLID	Sample type	Station	PMN	PMP	Aerobic Respiration	Anaerobic Respiration
				ug NH_4-N/g dw/day	ug PO_4^- P/g dw/day	umolsCO_2^- C/g dw/day	umolsCO_2^- C/g dw/day
Cell-1	16-675	Floc	34-A	59.102	3.635	92.36	17.22
Cell-1	16-676	RAS	34-A	4.299	0.123	30.17	2.89
Cell-1	16-677	Pre-STA I	34-A	1.178	0.095	41.78	2.18
Cell-1	16-679	Floc	34-B	23.015	5.356	88.47	15.46
Cell-1	16-680	RAS	34-B	3.569	0.11	48.80	3.24
Cell-1	16-681	Pre-STA I	34-B	-1.675	-0.099	34.97	4.12
Cell-1	16-683	Floc	34-C	43.58	8.087	142.74	18.41
Cell-1	16-684	RAS	34-C	3.292	0.124	36.90	2.90
Cell-1	16-685	Pre-STA I	34-C	0.457	0.013	29.83	2.10
Cell-1	16-687	Floc	51	50.07	11.616	250.17	29.51
Cell-1	16-688	RAS	51	12.271	-0.078	43.82	6.66
Cell-1	16-691	Floc	69	137.159	4.593	682.83	39.75
Cell-1	16-692	RAS	69	4.475	-0.024	46.92	4.35
Cell-1	16-695	Floc	86	86.679	0.863	178.73	30.51
Cell-1	16-696	RAS	86	11.933	0.46	87.06	8.45
Cell-1	16-699	Floc	104	57.485	1.518	177.50	23.80
Cell-1	16-700	RAS	104	8.573	0.571	65.78	4.07
Cell-1	16-703	Floc	121-A	12.163	-0.777	356.29	11.10
Cell-1	16-704	RAS	121-A	2.649	0.12	24.42	4.94
Cell-1	16-705	Pre-STA I	121-A	-0.159	0.005	25.56	2.97
Cell-1	16-707	Floc	121-B	25.321	-0.312	113.17	13.58
Cell-1	16-708	RAS	121-B	4.241	0.314	17.71	4.95
Cell-1	16-709	Pre-STA I	121-B	-1.056	-0.028	22.49	2.69
Cell-1	16-711	Floc	121-C	43.386	-0.212	83.93	17.41
Cell-1	16-712	RAS	121-C	8.912	0.622	57.18	3.40
Cell-1	16-713	Pre-STA I	121-C	2.924	0.076	37.44	3.34
Cell-1	16-715	Floc	138	9.065	-0.625	54.45	10.42
Cell-1	16-716	RAS	138	1.808	-0.258	44.68	4.01
Cell-1	16-719	Floc	156	16.61	1.007	150.94	8.75
Cell-1	16-720	RAS	156	6.325	0.319	42.47	6.94
Cell-1	16-723	Floc	173	19.363	-0.296	65.93	17.69
Cell-1	16-724	RAS	173	5.098	2.435	41.20	21.71
Cell-1	16-727	Floc	191	15.823	0.347	31.35	15.12
Cell-1	16-728	RAS	191	1.068	0.043	24.89	4.04
Cell-1	16-731	Floc	208-A	31.716	1.943	87.15	19.91
Cell-1	16-732	RAS	208-A	7.638	0.209	45.86	7.13
Cell-1	16-733	Pre-STA I	208-A	1.602	0.009	16.24	2.28
Cell-1	16-735	Floc	208-B	21.178	0.604	84.00	15.43
Cell-1	16-736	RAS	208-B	3.93	0.311	26.88	6.83
Cell-1	16-737	Pre-STA I	208-B	3.41	0.06	16.77	2.23
Cell-1	16-739	Floc	208-C	25.066	-0.089	96.18	21.89

Cell-1	16-740	RAS	208-C	6.603	0.796	33.17	7.98
Cell-1	16-741	Pre-STA I	208-C	0.873	0.036	18.04	1.73

Table 7-11. Potentially mineralizable nitrogen (PMN) and –phosphorus (PMP) based on dry weight for floc, and soil samples (no litter was collected) from transect and benchmark sites at STA-2 Cell 3. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Values with ReDo indicate that some replicate samples are currently being reanalyzed. The negative values for the PMN and PMP indicate microbial immobilization of the nutrient.

STA-2 Cell	WBLID	Sample type	Station	PMN	PMP	Aerobic Respiration	Anaerobic Respiration
				ug NH4-N/g dw/day	ug PO4-P/g dw/day	umolsCO2-C/g dw/d	umolsCO2-C/g dw/day
Cell-3	16-534	Floc	C-20-A	2.622	0.223	ReDo	0.88
Cell-3	16-535	RAS	C-20-A	2.71	0.125	76.10	0.49
Cell-3	16-536	Pre-STA I	C-20-A	1.615	0.068	4.54	ReDo
Cell-3	16-538	Floc	C-20-B	2.126	0.308	5.87	ReDo
Cell-3	16-539	RAS	C-20-B	0.338	0.025	2.68	ReDo
Cell-3	16-540	Pre-STA I	C-20-B	-1.474	-0.02	9.50	ReDo
Cell-3	16-542	Floc	C-20-C	2.135	0.292	19.93	ReDo
Cell-3	16-543	RAS	C-20-C	4.487	0.022	11.03	ReDo
Cell-3	16-544	Pre-STA I	C-20-C	-0.183	0.006	6.55	ReDo
Cell-3	16-590	Floc	38	2.929	0.153	5.37	ReDo
Cell-3	16-591	RAS	38	0.067	-0.115	30.12	ReDo
Cell-3	16-594	Floc	56	1.49	-0.075	11.11	ReDo
Cell-3	16-595	RAS	56	0.06	-0.088	24.88	ReDo
Cell-3	16-598	Floc	74	3.744	0.024	12.19	ReDo
Cell-3	16-599	RAS	74	0.732	-0.082	16.75	ReDo
Cell-3	16-582	Floc	92	3.014	0.011	6.96	ReDo
Cell-3	16-546	RAS	92	-0.718	-0.112	30.02	0.52
Cell-3	16-549	Floc	110	2.118	0.002	17.39	ReDo
Cell-3	16-550	RAS	110	-0.348	-0.001	39.76	ReDo
Cell-3	16-583	Floc	128-A	4.932	0.09	49.91	ReDo
Cell-3	16-553	RAS	128-A	0.698	0.014	84.41	ReDo
Cell-3	16-554	Pre-STA I	128-A	2.949	0.067	ReDo	ReDo
Cell-3	16-584	Floc	128-B	16.241	0.001	5.12	0.75
Cell-3	16-556	RAS	128-B	1.947	0.028	29.65	ReDo
Cell-3	16-557	Pre-STA I	128-B	-2.984	0.099	9.61	ReDo
Cell-3	16-585	Floc	128-C	8.09	0.218	11.53	ReDo
Cell-3	16-559	RAS	128-C	2.389	0.024	5.34	ReDo
Cell-3	16-560	Pre-STA I	128-C	1.72	0.099	20.25	ReDo
Cell-3	16-586	Floc	146	7.306	-0.017	5.83	ReDo

Cell-3	16-562	RAS	146	3.486	0.038	9.90	ReDo
Cell-3	16-565	Floc	164	9.661	0.047	41.33	ReDo
Cell-3	16-566	RAS	164	2.128	0.012	28.32	ReDo
Cell-3	16-569	Floc	C-182	6.42	0.185	91.09	ReDo
Cell-3	16-570	RAS	C-182	0.589	0.008	0.00	ReDo
Cell-3	16-587	Floc	C-200-A	2.46	-0.003	26.26	ReDo
Cell-3	16-573	RAS	C-200-A	0.521	0.011	63.98	ReDo
Cell-3	16-574	Pre-STA I	C-200-A	0.235	0.004	36.93	0.19
Cell-3	16-588	Floc	C-200-B	2.804	0.015	19.76	ReDo
Cell-3	16-576	RAS	C-200-B	0.833	-0.002	7.69	ReDo
Cell-3	16-577	Pre-STA I	C-200-B	-0.453	-0.026	0.05	ReDo
Cell-3	16-589	Floc	200-C	6.377	0.138	ReDo	ReDo
Cell-3	16-579	RAS	200-C	1.03	0.006	87.26	ReDo
Cell-3	16-580	Pre-STA I	200-C	-1.74	-0.002	6.67	ReDo

Table 7-12. Microbial biomass -carbon (MBC), -nitrogen (MBN) and –phosphorus (MBP) based on dry weight for floc and soil samples collected from transect and benchmark sites in STA-2 Cell 3. There were no litter samples collected. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated table**.

STA-2 Cell	WBL#	Site	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
Cell-3	16-535	C-20-A	RAS	74.25	1185	159.69	40.22
Cell-3	16-536	C-20-A	Pre-STA I	66.58	539	55.51	8.15
Cell-3	16-537	C-20-A	Pre-STA II	68.82	404	30.67	11.82
Cell-3	16-538	C-20-B	Floc	84.25	2158	313.22	9.49
Cell-3	16-539	C-20-B	RAS	72.89	1410	142.94	55.50
Cell-3	16-540	C-20-B	Pre-STA I	66.22	765	113.69	12.77
Cell-3	16-541	C-20-B	Pre-STA II	68.05	804	77.32	8.80
Cell-3	16-542	C-20-C	Floc	85.12	3033	395.98	125.91
Cell-3	16-543	C-20-C	RAS	76.58	1348	102.80	38.40
Cell-3	16-544	C-20-C	Pre-STA I	64.30	407	23.29	9.15
Cell-3	16-545	C-20-C	Pre-STA II	65.77	558	39.83	12.71
Cell-3	16-546	92	RAS	82.67	715	13.14	45.31
Cell-3	16-547	92	Pre-STA I	69.65	651	20.68	19.59
Cell-3	16-548	92	Pre-STA II	73.34	654	49.22	29.57
Cell-3	16-549	110	Floc	88.86	3477	439.81	164.46
Cell-3	16-550	110	RAS	75.67	1158	71.44	39.60
Cell-3	16-551	110	Pre-STA I	70.97	780	50.37	2.04
Cell-3	16-552	110	Pre-STA II	69.92	588	17.79	23.00
Cell-3	16-553	128-A	RAS	83.26	1534	84.06	42.39
Cell-3	16-554	128-A	Pre-STA I	75.10	632	12.07	14.82
Cell-3	16-555	128-A	Pre-STA II	73.35	1582	117.82	12.82
Cell-3	16-556	128-B	RAS	82.57	3001	281.99	53.31

Cell-3	16-557	128-B	Pre-STA I	71.82	665	37.11	11.11
Cell-3	16-558	128-B	Pre-STA II	76.50	1278	43.35	15.54
Cell-3	16-559	128-C	RAS	82.69	2240	170.23	2.13
Cell-3	16-560	128-C	Pre-STA I	72.99	1448	83.96	7.71
Cell-3	16-561	128-C	Pre-STA II	77.01	1468	66.01	11.38
Cell-3	16-562	146	RAS	84.11	2423	192.22	33.20
Cell-3	16-563	146	Pre-STA I	74.26	916	31.53	1.11
Cell-3	16-564	146	Pre-STA II	71.19	931	130.98	4.15
Cell-3	16-565	164	Floc	89.81	5589	640.55	64.29
Cell-3	16-566	164	RAS	82.15	1822	179.19	20.86
Cell-3	16-567	164	Pre-STA I	71.41	608	21.96	1.81
Cell-3	16-568	164	Pre-STA II	69.72	393	54.56	3.92
Cell-3	16-569	C-182	Floc	92.62	6156	696.10	114.78
Cell-3	16-570	C-182	RAS	78.66	1237	61.91	1.30
Cell-3	16-571	C-182	Pre-STA I	74.68	892	19.06	5.13
Cell-3	16-572	C-182	Pre-STA II	72.41	418	8.15	6.72
Cell-3	16-573	C-200-A	RAS	80.20	1237	85.11	14.90
Cell-3	16-574	C-200-A	Pre-STA I	73.42	1017	39.54	0.00
Cell-3	16-575	C-200-A	Pre-STA II	69.55	396	7.80	8.13
Cell-3	16-576	C-200-B	RAS	83.12	1317	29.00	5.37
Cell-3	16-577	C-200-B	Pre-STA I	75.13	633	11.71	1.40
Cell-3	16-578	C-200-B	Pre-STA II	65.11	843	35.30	2.99
Cell-3	16-579	200-C	RAS	79.62	1106	13.93	6.55
Cell-3	16-580	200-C	Pre-STA I	73.65	953	32.79	2.47
Cell-3	16-581	200-C	Pre-STA II	65.16	652	22.35	8.34
Cell-3	16-582	92	Floc	88.26	2174	247.15	40.10
Cell-3	16-583	128-A	Floc	90.55	3299	358.39	55.11
Cell-3	16-584	128-B	Floc	92.88	6242	957.77	59.02
Cell-3	16-585	128-C	Floc	90.20	4293	477.93	41.18
Cell-3	16-586	146	Floc	90.94	6070	768.93	99.65
Cell-3	16-587	C-200-A	Floc	86.85	2456	295.65	70.31
Cell-3	16-588	C-200-B	Floc	90.53	3614	317.57	62.67
Cell-3	16-589	200-C	Floc	90.33	3913	466.82	82.19
Cell-3	16-590	38	Floc	86.06	2335	174.84	93.09
Cell-3	16-591	38	RAS	77.69	919	73.43	29.97
Cell-3	16-592	38	Pre-STA I	68.69	443	15.27	6.85
Cell-3	16-593	38	Pre-STA II	67.64	1058	27.29	13.74
Cell-3	16-594	56	Floc	83.40	2132	227.09	166.17
Cell-3	16-595	56	RAS	77.03	771	24.34	51.25
Cell-3	16-596	56	Pre-STA I	70.23	946	34.57	4.15
Cell-3	16-597	56	Pre-STA II	71.83	613	29.01	6.34
Cell-3	16-598	74	Floc	85.84	2953	359.08	57.35
Cell-3	16-599	74	RAS	80.24	939	66.23	52.22
Cell-3	16-600	74	Pre-STA I	75.76	416	24.83	9.21
Cell-3	16-601	74	Pre-STA II	77.85	1236	39.93	22.12

Table 7-13. Microbial biomass -carbon (MBC), -nitrogen (MBN) and –phosphorus (MBP) based on dry weight for floc and soil samples collected from transect and benchmark sites in STA-2 Cell 1. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated* table**.

STA-2 Cell	WBL#	Site	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
Cell-1	16-675	34-A	Floc	95.79	13064	1530.05	230.93
Cell-1	16-676	34-A	RAS	85.72	2570	288.41	49.28
Cell-1	16-677	34-A	Pre-STA I	80.51	2306	186.57	25.38
Cell-1	16-678	34-A	Pre-STA II	79.81	1022	100.31	22.82
Cell-1	16-679	34-B	Floc	97.65	13508	1422.39	202.61
Cell-1	16-680	34-B	RAS	90.06	3526	398.03	86.10
Cell-1	16-681	34-B	Pre-STA I	80.64	1588	99.90	17.97
Cell-1	16-682	34-B	Pre-STA II	81.46	1877	74.45	16.51
Cell-1	16-683	34-C	Floc	98.17	12947	1188.93	281.70
Cell-1	16-684	34-C	RAS	88.30	3806	427.91	32.04
Cell-1	16-685	34-C	Pre-STA I	79.74	1145	62.02	4.03
Cell-1	16-686	34-C	Pre-STA II	80.27	2551	113.57	7.62
Cell-1	16-687	51	Floc	98.64	23508	2078.32	139.30
Cell-1	16-688	51	RAS	93.24	7006	808.30	138.90
Cell-1	16-689	51	Pre-STA I	84.51	1534	142.47	14.33
Cell-1	16-690	51	Pre-STA II	84.92	3562	188.57	14.18
Cell-1	16-691	69	Floc	97.74	19983	1804.13	264.96
Cell-1	16-692	69	RAS	91.41	5126	540.23	61.23
Cell-1	16-693	69	Pre-STA I	82.15	1852	130.86	5.11
Cell-1	16-694	69	Pre-STA II	82.28	2203	136.21	4.30
Cell-1	16-695	86	Floc	97.22	23626	2525.97	485.59
Cell-1	16-696	86	RAS	91.46	6183	698.94	91.27
Cell-1	16-697	86	Pre-STA I	84.44	1384	33.49	14.99
Cell-1	16-698	86	Pre-STA II	83.58	1238	81.50	22.91
Cell-1	16-699	104	Floc	98.18	25507	3197.79	370.55
Cell-1	16-700	104	RAS	92.50	5337	642.50	113.84
Cell-1	16-701	104	Pre-STA I	84.99	1322	57.10	15.29
Cell-1	16-702	104	Pre-STA II	84.19	1240	77.54	9.54
Cell-1	16-703	121-A	Floc	97.21	28639	4012.96	429.64
Cell-1	16-704	121-A	RAS	92.51	5682	482.84	63.95
Cell-1	16-705	121-A	Pre-STA I	84.24	1641	44.26	8.68
Cell-1	16-706	121-A	Pre-STA II	87.33	1530	97.40	5.81
Cell-1	16-707	121-B	Floc	97.42	29344	3946.06	434.86
Cell-1	16-708	121-B	RAS	91.65	5352	620.83	85.19
Cell-1	16-709	121-B	Pre-STA I	85.70	1216	51.80	15.78
Cell-1	16-710	121-B	Pre-STA II	85.63	728	8.91	11.46

Cell-1	16-711	121-C	Floc	97.55	29686	3565.36	497.45
Cell-1	16-712	121-C	RAS	92.82	7831	840.98	261.13
Cell-1	16-713	121-C	Pre-STA I	86.05	1594	129.95	17.07
Cell-1	16-714	121-C	Pre-STA II	85.27	1152	60.59	9.15
Cell-1	16-715	138	Floc	95.09	12391	1435.55	312.66
Cell-1	16-716	138	RAS	92.19	4380	386.10	104.71
Cell-1	16-717	138	Pre-STA I	84.71	1022	4.61	18.07
Cell-1	16-718	138	Pre-STA II	85.55	358	44.23	12.83
Cell-1	16-719	156	Floc	96.13	9253	871.27	157.29
Cell-1	16-720	156	RAS	90.35	4737	500.32	99.09
Cell-1	16-721	156	Pre-STA I	85.29	933	51.55	19.84
Cell-1	16-722	156	Pre-STA II	85.90	894	18.32	16.43
Cell-1	16-723	173	Floc	94.66	16170	1947.99	400.44
Cell-1	16-724	173	RAS	93.86	8447	728.85	113.17
Cell-1	16-725	173	Pre-STA I	84.95	1334	20.89	19.54
Cell-1	16-726	173	Pre-STA II	82.07	1127	43.86	16.33
Cell-1	16-727	191	Floc	92.91	9560	1018.29	210.16
Cell-1	16-728	191	RAS	90.69	4007	538.03	77.79
Cell-1	16-729	191	Pre-STA I	82.56	1617	86.14	20.13
Cell-1	16-730	191	Pre-STA II	82.87	1084	69.94	27.29
Cell-1	16-731	208-A	Floc	95.55	14549	1883.48	290.61
Cell-1	16-732	208-A	RAS	94.28	7038	705.96	151.85
Cell-1	16-733	208-A	Pre-STA I	83.95	1043	57.88	26.46
Cell-1	16-734	208-A	Pre-STA II	83.83	2011	52.50	25.39
Cell-1	16-735	208-B	Floc	95.92	12050	1235.84	275.48
Cell-1	16-736	208-B	RAS	95.10	7884	649.68	170.97
Cell-1	16-737	208-B	Pre-STA I	86.53	1700	108.62	46.73
Cell-1	16-738	208-B	Pre-STA II	83.81	1583	65.64	19.38
Cell-1	16-739	208-C	Floc	95.20	15149	2068.93	287.55
Cell-1	16-740	208-C	RAS	94.31	5703	557.50	141.52
Cell-1	16-741	208-C	Pre-STA I	82.44	800	55.25	18.62
Cell-1	16-742	208-C	Pre-STA II	82.37	1052	79.23	14.47

Table 7-14. Microbial biomass -carbon (MBC), -nitrogen (MBN) and –phosphorus (MBP) based on dry weight for litter samples collected from transect and benchmark sites in STA-2 Cell 1. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated* table**.

STA-2 Cell	WBL#	Site	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
Cell-1	16-602	34-A	Litter	95.40	16620	1734.51	196.21
Cell-1	16-603	34-B	Litter	94.51	16494	1955.41	247.29
Cell-1	16-604	34-C	Litter	95.65	11671	1436.59	164.39
Cell-1	16-605	51	Litter	94.93	12774	1492.20	186.90
Cell-1	16-606	69	Litter	94.37	9752	1089.18	372.02
Cell-1	16-607	86	Litter	94.89	16154	2027.22	316.74
Cell-1	16-608	104	Litter	94.15	12910	1416.91	207.91
Cell-1	16-609	121-A	Litter	93.04	6405	466.41	107.37
Cell-1	16-610	121-B	Litter	94.25	19383	2877.97	122.07
Cell-1	16-611	121-C	Litter	92.65	7070	489.64	350.34
Cell-1	16-612	138	Litter	94.64	15381	1617.66	413.46
Cell-1	16-613	156	Litter	93.56	14581	1672.11	207.64
Cell-1	16-614	173	Litter	90.98	9539	932.82	131.53
Cell-1	16-615	191	Litter	93.70	12370	702.19	164.75
Cell-1	16-616	208-A	Litter	94.46	9364	758.76	128.89
Cell-1	16-617	208-B	Litter	94.08	11219	1024.61	191.81
Cell-1	16-618	208-C	Litter	90.49	14619	1693.09	17.87

Table 7-15. Microbial biomass -carbon (MBC), -nitrogen (MBN) and –phosphorus (MBP) based on dry weight for floc and soil samples collected from transect and benchmark sites in STA-3/4 Cell 3A. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated* table.**

STA-3/4 Cell	WBL#	Site	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
Cell 3A	16-924	A20	Floc	96.09	8935	808.26	391.05
Cell 3A	16-925	A20	RAS	94.12	2000	85.77	181.45
Cell 3A	16-926	A20	Pre-STA I	74.12	1221	16.26	17.54
Cell 3A	16-927	A20	Pre-STA II	64.67	213	5.83	14.12
Cell 3A	16-928	A32-A	Floc	95.08	7591	630.97	254.08
Cell 3A	16-929	A32-A	RAS	89.85	1806	93.30	70.64
Cell 3A	16-930	A32-A	Pre-STA I	67.58	496	26.92	12.05
Cell 3A	16-931	A32-A	Pre-STA II	62.14	587	32.63	7.96
Cell 3A	16-932	A32-B	Floc	93.48	6370	535.44	392.75
Cell 3A	16-933	A32-B	RAS	93.54	6069	384.16	190.21
Cell 3A	16-934	A32-B	Pre-STA I	76.73	2740	78.07	31.68
Cell 3A	16-935	A32-B	Pre-STA II	62.89	1065	0.82	16.77
Cell 3A	16-936	A32-C	Floc	95.62	10477	648.88	463.92
Cell 3A	16-937	A32-C	RAS	92.11	4938	360.92	136.98
Cell 3A	16-938	A32-C	Pre-STA I	70.79	1069	37.99	28.62

Cell 3A	16-939	A32-C	Pre-STA II	62.20	1076	16.79	9.66
Cell 3A	16-940	A44	Floc	95.27	12124	383.59	373.47
Cell 3A	16-941	A44	RAS	93.37	7972	298.43	177.99
Cell 3A	16-942	A44	Pre-STA I	71.65	1668	87.07	32.69
Cell 3A	16-943	A44	Pre-STA II	62.10	1192	50.18	16.26
Cell 3A	16-944	A56-A	Floc	94.12	12511	1020.71	292.14
Cell 3A	16-945	A56-A	RAS	92.61	7540	735.60	218.54
Cell 3A	16-946	A56-A	Pre-STA I	83.01	2807	156.60	51.14
Cell 3A	16-947	A56-A	Pre-STA II	75.57	1533	157.83	36.95
Cell 3A	16-948	A56-B	Floc	94.24	9998	870.04	221.26
Cell 3A	16-949	A56-B	RAS	92.03	7103	479.79	172.62
Cell 3A	16-950	A56-B	Pre-STA I	86.82	2784	111.49	100.64
Cell 3A	16-951	A56-B	Pre-STA II	80.69	2532	163.50	46.05
Cell 3A	16-952	A56-C	Floc	94.58	10195	936.96	312.80
Cell 3A	16-953	A56-C	RAS	92.55	5976	523.57	82.61
Cell 3A	16-954	A56-C	Pre-STA I	83.04	3515	109.54	74.34
Cell 3A	16-955	A56-C	Pre-STA II	76.24	2067	141.44	38.86
Cell 3A	16-956	A8-A	Floc	89.02	2601	262.85	73.07
Cell 3A	16-957	A8-A	RAS	86.16	1572	99.90	31.47
Cell 3A	16-958	A8-A	Pre-STA I	77.35	1347	94.18	14.33
Cell 3A	16-959	A8-A	Pre-STA II	71.24	1042	68.90	11.08
Cell 3A	16-960	A8-B	Floc	89.09	2164	294.72	103.63
Cell 3A	16-961	A8-B	RAS	79.91	1214	121.19	29.52
Cell 3A	16-962	A8-B	Pre-STA I	75.36	930	84.13	15.95
Cell 3A	16-963	A8-B	Pre-STA II	66.26	612	33.63	15.45
Cell 3A	16-964	A8-C	Floc	92.20	2558	108.34	115.13
Cell 3A	16-965	A8-C	RAS	78.48	580	13.91	1.93
Cell 3A	16-966	A8-C	Pre-STA I	76.61	722	38.09	17.87
Cell 3A	16-967	A8-C	Pre-STA II	68.26	364	5.12	9.49

Table 7-16. Microbial biomass -carbon (MBC), nitrogen (MBN) and phosphorus (MBP) based on dry weight for litter samples collected from transect and benchmark sites in STA-3/4 Cell 3A. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated* table**.

STA-3/4 Cell	WBL#	Site	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
Cell 3A	16-913	A8-A	Litter	94.90	24442	2324.67	162.25
Cell 3A	16-914	A8-B	Litter	91.14	22142	1451.56	187.77
Cell 3A	16-915	A8-C	Litter	90.79	24615	3468.46	360.36
Cell 3A	16-916	A20	Litter	93.16	19061	2589.77	332.83
Cell 3A	16-917	A32-A	Litter	92.34	20122	2720.57	291.82
Cell 3A	16-918	A32-B	Litter	87.07	14820	1402.41	128.35
Cell 3A	16-919	A32-C	Litter	74.83	6823	949.58	160.68
Cell 3A	16-920	A44	Litter	94.55	20559	2661.41	143.90
Cell 3A	16-921	A56-A	Litter	93.76	16764	1823.17	355.71
Cell 3A	16-922	A56-B	Litter	93.39	20568	2181.71	393.51
Cell 3A	16-923	A56-C	Litter	94.56	24053	2952.59	336.58

Table 7-17. Microbial biomass carbon (MBC), nitrogen (MBN) and phosphorus (MBP) based on dry weight for floc and soil samples collected from transect and benchmark sites in STA-3/4 Cell 3B. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated* table**.

STA-3/4 Cell	WBL#	Site	Substrate	Moisture content	MBC	MBN	MBP
				%	mg/kg	mg/kg	mg/kg
Cell-3B	16-776	A7-A	Floc	87.96	3132	402.75	125.78
Cell-3B	16-777	A7-A	RAS	78.60	1367	69.68	38.58
Cell-3B	16-778	A7-A	Pre-STA I	80.30	2219	127.09	17.95
Cell-3B	16-779	A7-A	Pre-STA II	79.35	1996	87.73	13.29
Cell-3B	16-780	A7-B	Floc	86.76	3003	286.05	122.69
Cell-3B	16-781	A7-B	RAS	78.73	1506	88.54	27.05
Cell-3B	16-782	A7-B	Pre-STA I	80.54	1055	62.96	29.07
Cell-3B	16-783	A7-B	Pre-STA II	79.17	1132	102.71	22.73
Cell-3B	16-784	A7-C	Floc	85.21	3525	350.69	149.85
Cell-3B	16-785	A7-C	RAS	78.43	1239	45.73	25.95
Cell-3B	16-786	A7-C	Pre-STA I	81.17	700	56.80	30.02
Cell-3B	16-787	A7-C	Pre-STA II	78.76	891	69.10	25.88
Cell-3B	16-788	A7c-A	Floc	94.98	6210	483.19	205.37
Cell-3B	16-789	A7c-A	RAS	93.14	4099	457.86	119.22
Cell-3B	16-790	A7c-A	Pre-STA I	86.44	2226	55.66	67.16
Cell-3B	16-791	A7c-A	Pre-STA II	81.44	1040	62.77	38.62
Cell-3B	16-792	A7c-B	Floc	96.65	8554	622.48	156.10
Cell-3B	16-793	A7c-B	RAS	92.52	3649	397.39	147.71
Cell-3B	16-794	A7c-B	Pre-STA I	85.89	2244	100.43	50.84
Cell-3B	16-795	A7c-B	Pre-STA II	81.20	2118	96.99	38.84
Cell-3B	16-796	A7c-C	Floc	95.50	8620	651.75	275.38

Cell-3B	16-797	A7c-C	RAS	94.78	6506	126.49	106.68
Cell-3B	16-798	A7c-C	Pre-STA I	85.42	2466	29.39	24.09
Cell-3B	16-799	A7c-C	Pre-STA II	81.05	851	39.21	28.18
Cell-3B	16-800	B7	Floc	86.85	2753	211.30	69.86
Cell-3B	16-801	B7	RAS	80.95	2128	110.54	40.11
Cell-3B	16-802	B7	Pre-STA I	80.84	2519	127.22	31.40
Cell-3B	16-803	B7	Pre-STA II	77.56	1506	84.03	20.15
Cell-3B	16-804	B7c	Floc	92.72	5822	362.00	78.84
Cell-3B	16-805	B7c	RAS	91.83	4594	261.68	56.28
Cell-3B	16-806	B7c	Pre-STA II	77.39	263	23.07	47.24
Cell-3B	16-807	B7c	Pre-STA I	83.26	1617	23.34	26.84
Cell-3B	16-808	C7-A	Floc	87.45	3477	276.84	105.30
Cell-3B	16-809	C7-A	RAS	81.19	1797	80.82	33.71
Cell-3B	16-810	C7-A	Pre-STA I	73.84	838	36.62	13.94
Cell-3B	16-811	C7-A	Pre-STA II	60.33	622	40.44	3.56
Cell-3B	16-812	C7-B	Floc	84.84	2810	217.00	84.87
Cell-3B	16-813	C7-B	RAS	74.94	1505	6.63	20.16
Cell-3B	16-814	C7-B	Pre-STA I	75.63	1782	64.28	9.52
Cell-3B	16-815	C7-B	Pre-STA II	63.66	840	47.75	4.79
Cell-3B	16-816	C7-C	Floc	87.05	3435	250.37	74.82
Cell-3B	16-817	C7-C	RAS	82.99	2676	154.06	22.04
Cell-3B	16-818	C7-C	Pre-STA I	74.62	1449	79.24	14.02
Cell-3B	16-819	C7-C	Pre-STA II	61.92	839	26.03	2.80
Cell-3B	16-820	C7c-A	Floc	93.58	7658	781.87	81.98
Cell-3B	16-821	C7c-A	RAS	92.37	4444	399.31	75.87
Cell-3B	16-822	C7c-A	Pre-STA I	83.55	1756	121.06	10.48
Cell-3B	16-823	C7c-A	Pre-STA II	76.07	705	45.24	5.61
Cell-3B	16-824	C7c-B	Floc	92.39	4668	441.10	101.60
Cell-3B	16-825	C7c-B	RAS	91.24	2904	169.48	59.61
Cell-3B	16-826	C7c-B	Pre-STA I	83.72	2179	112.20	35.00
Cell-3B	16-827	C7c-B	Pre-STA II	77.78	1352	58.98	12.16
Cell-3B	16-828	C7c-C	Floc	93.47	6304	787.93	166.78
Cell-3B	16-829	C7c-C	RAS	93.55	5839	628.15	99.02
Cell-3B	16-830	C7c-C	Pre-STA I	85.79	1715	111.11	20.48
Cell-3B	16-831	C7c-C	Pre-STA II	75.90	769	62.87	15.32
Cell-3B	16-832	D7-A	Floc	85.86	5391	545.74	78.60
Cell-3B	16-833	D7-A	RAS	89.03	5127	171.88	32.07
Cell-3B	16-834	D7-A	Pre-STA I	76.07	1399	114.76	16.45
Cell-3B	16-835	D7-A	Pre-STA II	67.86	938	56.10	7.39
Cell-3B	16-836	D7-B	Floc	85.22	3595	394.33	66.96
Cell-3B	16-837	D7-B	RAS	82.14	2827	232.03	29.03
Cell-3B	16-838	D7-B	Pre-STA I	75.26	1788	110.94	19.65
Cell-3B	16-839	D7-B	Pre-STA II	67.42	947	31.10	11.58
Cell-3B	16-840	D7-C	Floc	90.40	5798	637.57	124.01
Cell-3B	16-841	D7-C	RAS	81.19	2725	158.97	41.67
Cell-3B	16-842	D7-C	Pre-STA I	74.66	1436	66.50	21.44
Cell-3B	16-843	D7-C	Pre-STA II	65.25	764	46.14	6.32
Cell-3B	16-844	D7c-A	Floc	94.33	6634	620.46	153.18
Cell-3B	16-845	D7c-A	RAS	90.13	4810	258.72	38.24
Cell-3B	16-846	D7c-A	Pre-STA I	83.44	3028	132.40	21.96
Cell-3B	16-847	D7c-A	Pre-STA II	77.60	607	53.12	11.44
Cell-3B	16-848	D7c-B	Floc	96.85	10264	1149.84	227.48
Cell-3B	16-849	D7c-B	RAS	78.72	1735	106.26	18.52
Cell-3B	16-850	D7c-B	Pre-STA I	66.84	847	45.43	6.47

Cell-3B	16-851	D7c-B	Pre-STA II	73.91	962	65.32	18.04
Cell-3B	16-852	D7c-C	Floc	93.79	9466	852.35	213.54
Cell-3B	16-853	D7c-C	RAS	81.99	2572	171.04	34.75
Cell-3B	16-854	D7c-C	Pre-STA I	63.96	220	1.53	7.69
Cell-3B	16-855	D7c-C	Pre-STA II	72.80	1581	78.80	11.61

Table 7-18. Microbial biomass -carbon (MBC), nitrogen (MBN) and phosphorus (MBP) based on dry weight for litter samples collected from transect and benchmark sites in STA-3/4 Cell 3B. Three replicate cores for all three benchmark sites and only one core for all other transect points were collected. Some of the values were rerun and this is the **updated table** (nes = Not enough sample).

STA-3/4 Cell	**WBL#**	**Site**	**Substrate**	**Moisture content**	**MBC**	**MBN**	**MBP**
				%	mg/kg	mg/kg	mg/kg
Cell-3B	16-743-745	A7	Litter	92.38	nes	nes	nes
Cell-3B	16-746	A7c-A	Litter	95.14	11351	1052.50	265.21
Cell-3B	16-747	A7c-B	Litter	94.41	12025	1163.24	66.36
Cell-3B	16-748	A7c-C	Litter	95.03	9621	1092.78	122.24
Cell-3B	16-749	B7	Litter	90.93	9069	351.00	126.06
Cell-3B	16-750	B7c	Litter	92.96	9561	1216.94	96.06
Cell-3B	16-751	C7-A	Litter	89.97	7466	592.40	52.46
Cell-3B	16-752	C7-B	Litter	94.53	17522	1191.55	164.04
Cell-3B	16-753	C7-C	Litter	92.08	8928	149.84	33.10
Cell-3B	16-754	C7c-A	Litter	94.30	10223	908.75	133.80
Cell-3B	16-755	C7c-B	Litter	94.66	13870	1422.67	156.28
Cell-3B	16-756	C7c-C	Litter	93.02	26458	1211.15	157.94
Cell-3B	16-757	D7-A	Litter	92.63	18393	1541.74	145.92
Cell-3B	16-758	D7-B	Litter	93.56	20087	2102.89	151.09
Cell-3B	16-759	D7-C	Litter	95.75	21391	2667.85	147.61
Cell-3B	16-760	D7c-A	Litter	94.73	13726	1623.18	115.73
Cell-3B	16-761	D7c-B	Litter	92.92	9915	1218.20	142.14
Cell-3B	16-762	D7c-C	Litter	95.53	16679	2275.76	24.32

8 Data Integration and Synthesis (Task 10)

The objective of this task is to integrate data obtained from this project and legacy data into a cohesive framework to identify crucial soil and floc processes for P retention. Further key indicator variables are to be identified, which can be relatively easily measured but help monitor these key processes. The specific task is to link measurements via a conceptual/numerical framework here referred to as "analysis tool".

8.1 Work Completed During this Quarter

8.1.1 Conceptual Model Data Synthesis

A key component of Data Integration and Synthesis will be the integration of the measured data with the conceptual model. In the last quarterly report, we provided preliminary shell how the conceptual model can be formulated mathematically and coded up in a numerical framework (for example in the open source software R). In this quarter, we focused on literature analysis on how such integration is best carried out. UF proposes using *Bayesian Inversion* (Gilks et al., 1995), which has been used in other biogeochemical models (for example - Tang and Zhuang (2009)). The central question to ask for model inversion is: "*What is the best model given the data?*". Subsequent questions are: How well do model and data agree? Can all the processes considered in the conceptual model be sufficiently constrained with the available data? What measurements would allow to constrain the model further (i.e. advance our understanding of the model)? Finally, while somewhat flawed, the introduction of structural error terms in the model could help to detect knowledge gaps.

To answer these questions there is not just a need to choose the best possible model, but also to assess its uncertainty of the associated processes given the data. Much of these lines of inquiries do fit into a Bayesian framework.

First we consider a model that has an output (i.e. the numerical representation of the conceptual model), given parameters, and boundary and initial conditions of the model. Initial conditions are the values of the predicted variable at a start of the simulation (e.g. at the inception of a Stormwater Treatment Area). Boundary conditions are external drivers of the model that are changing through time (e.g. inflow rates, inflow concentrations, atmospheric deposition, climate data, etc.). And finally parameters are fixed numbers that relate processes with each other (e.g. Q10 for biological activities, first order rates for decomposition or plant uptake, etc.). Finally, variables are model predictions, that is, P cycling variables we seek to understand (e.g. labile P concentration in the water column, P in floc, litter and soil, etc.). Variables are thus model predictions. A model links parameter and boundary conditions and initial conditions:

$$y_{i,j} = f\left(\theta_k, x_l, y_{i,0}\right) + \varepsilon_{i,j}$$

Where yi,j is the measured variable j (i=1… n variables) at time i (j=1…i times), $f\left(\theta_k, x_{l,i}, y_{j,0}\right)$ is the model, θ_k are the parameters (k = 1 … p) parameters, xl the boundary condition (l= 1 … o, number of forcing factors), $y_{i,0}$ are the initial conditions of the variables and ε is the model error.

Each of the parameters, initial conditions and boundary conditions can have errors, thus they can have a priori probabilities. Further, the error can be separated into structural errors (The model has inherent errors due to simplifications and insufficient system knowledge), and a random error. Thus

$$\varepsilon_{i,j} := \delta_{i,j} + \varepsilon_{i,j}$$

As pointed out earlier, the primary goal is not to make predictions, but to understand the system. In other words, we ask the question to what degree the conceptual model agrees with the data. Bayesian inversion is such a tool. In the past quarter, we have researched methods for Bayesian analysis/inversion.

In Bayesian inversion, it is asked, what is the likelihood of the prediction y, given parameters, initial conditions and boundary conditions (how well does our conceptual model agree with the data), which is

$$l[\theta, x, y_0, \delta | \, y] \propto p(y|f(\theta, x, y_0, \delta) * p(\theta) * p(y_0) * p(\delta)$$

Where l is a single likelihood to predict a measured variable based on parameters (q), boundary conditions (x), initial conditions y_0, and model error d. l is calculated as the product of the probability of a variable given the model, the probabilities of parameters, the probabilities of the initial conditions and structural errors. $\propto$ denotes "proportional". Since the predictions will be the number of variables measured (which is > 1, several measurements and several variables), the final likelihood number is the product of the individual probabilities

$$L[\theta, x, y_0, \delta | \, y] := \prod_i^n \prod_j^m p(y_{i,j}|f_{i,j}(\theta, x, y_0, \delta) * \prod_k^p p(\theta) * \prod_i^n p(y_{0,i}) * \prod_l^o p(x_l) * \prod_i^n \prod_j^m p(\delta_{i,j})$$

Where we define *L* as the overall likelihood number.

In order to obtain the likelihood number, certain assumptions about the error structure needs to be made. Here we assume that all the probability functions are normally distributed, except for the structural error. For the structural error, the dimension can be reduced, by assuming a constant error for each variable. Further, to allow a wide structural error, different distributions are sought. Here we follow Arhonditsis (2012), who assumed the variance of the structural error follows a conjugate inverse gamma distribution. The variance of random errors and errors of the initial conditions are assumed to be proportional to the mean, and the "best guess" of the initial condition (proportionality factors *a* and *b*). Further, the parameters are log-transformed for the analysis (rendering the error distribution of the parameters to be log-normal). With these assumption, the likelihood function becomes:

$$L[\theta, x, y_0, \sigma^2 | \, y]$$

$$= \prod_j^m (2\pi)^{\frac{n}{2}} \left(a^2 * \bar{y}_j + \sigma^2\right) exp\left[-\frac{1}{2 * \left(a^2 * \bar{y}_j + \sigma^2\right)} * \sum_i^n \left(f(\theta, x, y_0, \sigma^2) - y_{i,j}\right)^2\right] *$$

$$(2\pi)^{\frac{p}{2}} * \prod_k^p \Sigma_{\theta,k}^{-1/2} \frac{1}{\theta_k} * exp\left[\frac{1}{2}(\log(\theta_k) - \log(\theta_0))^2 \Sigma_\theta^{-1}\right] *$$

$$(2\pi)^{-\frac{m}{2}} \prod_j^m \Sigma_{y_{0,m}}^{-\frac{1}{2}} \exp\left[\frac{1}{2}(y_0 - \widehat{y_0})^2 \Sigma_{y_0,m}^{-1}\right] *$$

$$(2\pi)^{-o/2} \prod_l^o \Sigma_{x,l}^{-1/2} \exp\left[-\frac{1}{2}(x_l - \bar{x_l})^2 \Sigma_{x,l}^{-1}\right] * \prod_j^m \frac{\beta_j^{\alpha_j}}{\Gamma(\alpha_j)} \sigma_j^{-2(\alpha_j+1)} \exp\left(\frac{\beta_j}{\sigma_j^2}\right)$$

Where $\bar{y}_j$ is the mean of the observations, Σ_θ is the (estimated) variance for each parameter, $\Sigma_{y_{0,m}}$ is the (estimated) variance of each of the initial conditions, $\Sigma_{x,l}^{-1}$ is the variance of each of the forcing factors. This specific set up is that the structural error does not change through time. The conceptual/numerical model will likely not have a prior error distribution of the parameters. Hence for the Bayesian analysis prior error will likely be uniformly distributed within a certain range (e.g. factor of 3 from a best guess. This would render the factor that addresses the probability of the parameters (4th line) to a value of 1. For practical reasons, the products (Π) will be log transformed. The log likelihood is the sum of the log-transformed factors.

The best model data fit is achieved when *L* is maximized (Maximum Likelihood). However, it is also desirable to understand the posterior error structure (i.e. what are the likelihoods for a range of parameter values?). Thus, the analysis is not just simply an optimization, but requires a more methodical analysis of the parameter space. This gives useful information: A narrow peak for the resulting probability density distribution of specific parameter suggests that this parameter (and the associated process) is fairly constrained by the data. In contrast a broad range of possible parameter values implies that the process is unconstrained by the data. This information can then be combined with a sensitivity analysis that allows to estimate whether the parameter (and the process) is critical for a model's prediction. Further, the sensitivity analysis can then be augmented by allowing the parameter ranges to sample from the posterior distribution, instead of using broad ranges.

A method to efficiently cover the range of parameters (θ) and structural errors (σ), is a Markov Chain Monte Carlo Method (MCMC, Hastings (1970)). Here, we tentatively settled on a modified Metropolis-Hasting algorithm. This requires the model to be run several 1000 times. The Markov Chain (a random walk type of parameter update) is achieved by updating the parameter based on a normal distribution with mean of the old parameter value and a fixed standard deviation (a factor of the default). Only values that are within a reasonable expectation

to improve the model (i.e. the likelihood is within the ranges of the previous calculation) are being used. Such a particle filter is set up by comparing $\min(L(\theta_i+1)/L(\theta_i),1)$ to a random number draw. The simulation (and thus the parameter set) is accepted if that ratio is bigger than the random number. The first few 1000 steps should be thrown out because their results (the inferred parameters), are not considered draws from the actual distribution (Brooks et al., 2011). Overall this algorithm allows for a relatively efficient search of the potential parameter space around the model optimum [model results with high likelihood, Gilks et al. (1995)]. Overall algorithm:

1. Draw randomly from initial conditions, boundary conditions, parameters and structural error distribution
2. Run the conceptual mathematical model
3. Calculate L (or log L)
4. While $n < samples$
    a. Draw randomly from initial conditions, boundary conditions, parameters and structural error
    b. Calculate L (or log L)
    c. Calculate $ratio = Current\ L/Previous\ L$
    d. Draw a random number g from uniform distribution (0,1)
    e. if $ratio > g$
        i. keep the sample
        ii. increase n

    else

        iii. throw the sample away
5. End

8.1.2 Future Steps

UF is currently implementing the MCMC algorithm to be run with the conceptual model – where a first test will be the Paudel and Jawitz (2012) model with outflow concentration as the single predicted variable. We are testing parallel application (using the University of Florida High Performance Computing System), which allows us to test different assumptions for updating the Markov chain (allow for larger or smaller variances when updating, testing updates of series of parameters vs. one parameter at a time).

UF is further expanding the model to include other direct measurements (Floc, Soil, macrophyte) as obtained from this project, as the data becomes available.

UF is also waiting on input from the District to calculate velocities or piecewise (both temporal and spatial) hydrologic residence time to feed the spiraling model.

9 Planned Activities

The following activities are planned for the next quarter (April 1 to June 30, 2017).

- Overall task – Preparation of Annual Report Year 2 (July 2016 to June, 2017).
- **Tasks 3 and 4**, Analysis of soils data that were collected in last quarter.
- **For Task 5**, soil and floc samples are currently being processed to determine P forms samples collected from WCA-2A.
- As data on various chemical parameters become available, correlative relationships between P forms and select soil chemical properties will be explored.
- **For Task 6**, experiments to determine P sorption capacities of soils are underway for samples collected from STA-2 and STA-3/4.
- **For Task 7a**, continue data analysis for samples (floc) collected for *P-Flow* study during previous events. Explorations of relationships between EXO-Sonde data and TP and TN trends using advanced analytical tools.
- **For Task 7b**, data and statistical analysis for parameters measured on samples collected during all past events for *P-Flow* study. Preparation for next flow event (tentatively scheduled for May, 2017).
- **For Task 8a**, continue data analysis for biogeochemical parameters in litter, floc and soil samples collected for *transect and benchmark* study from 4 sites (STA-2 Cell 1 and 3, STA-3/4 Cell 3A and 3B). Analysis completed to date (reruns of some samples, PMN/PMP and respiration, NAG and mineralizable P and N) will be made available in the subsequent reports as data becomes available.
- Begin with data (calculations and statistics) analysis of the biogeochemical measurements.
- **For Task 10**, implement better (prescribed) water dynamics into the analysis tool, using stage heights.
- Model improvement: partition dissolved P in water and soil column.

10 References

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11 Appendices

11.1 Benchmark sampling locations in STA-3/4 Cell 3A and Cell 3B.

STA-3/4	Station ID	Latitude	Longitude	Transect station	Benchmark station (Triplicate cores)
Cell 3A	A8	26.39534	-80.6586	✓	✓✓✓
Cell 3A	A32	26.38802	-80.6586	✓	✓✓✓
Cell 3A	A56	26.3807	-80.6587	✓	✓✓✓
Cell 3B	A7	26.37603	-80.6602	✓	✓✓✓
Cell 3B	A7C	26.37412	-80.6602	✓	✓✓✓
Cell 3B	C7	26.36857	-80.6602	✓	✓✓✓
Cell 3B	C7C	26.36857	-80.6602	✓	✓✓✓
Cell 3B	D7	26.36484	-80.6602	✓	✓✓✓
Cell 3B	D7C	26.3637	-80.6602	✓	✓✓✓

11.2 Benchmark sampling locations in STA-2 Cell 1 and Cell 3.

STA-2	Station ID	Latitude	Longitude	Transect station	Benchmark station (Triplicate cores)
Cell 1	A34	26.41706	-80.4919	✓	✓✓✓
Cell 1	A121	26.39877	-80.5042	✓	✓✓✓
Cell 1	A208	26.38046	-80.5165	✓	✓✓✓
Cell 3	C20	26.41725	-80.5489	✓	✓✓✓
Cell 3	C128	26.39525	-80.549	✓	✓✓✓
Cell 3	C200	26.38058	-80.5491	✓	✓✓✓

11.3 Equations for Initial Simple Conceptual Model.

a) P in the water column

$$\frac{\partial P}{\partial t} = -u\frac{\partial P}{\partial x} + \frac{S_p}{H} - U_P + S$$

Where P is phosphorus concentration in the water column (g m^{-3}), t is time, u the average flow velocity, x the flow direction, S is the total local source (g m^{-2} day^{-1}), H the height of the water column (m) and U_p the uptake of P from the water column into macrophytes, periphyton and soils.

b) P in macrophytes

Macrophytes take up P from the water column, but are also able to access P stored in the litter through possibly through symbiosis with heterotrophs (fungi and bacteria). Macrophyte decay (death) is assumed to be proportional to the stored P.

$$\frac{dM}{dt} = U_{M,P} + U_{M,L} - \lambda_M M$$

Where M is the amount of P stored in macrophytes (g m^{-2}), U the uptake from the water column and litter, respectively, and λ_M a first order decay term.

The original model had macrophyte uptake as an exclusively P limited function, which under ample supply can lead to unrestricted growth. Thus uptake is constrained here to an upper limit that would indicate limitation by other sources than P, such as nitrogen or light. Thus

$$U_{M,P} = min\left(\frac{k_{M,W} * P}{H}, U_{M,max}\right)$$

Where *min* is the minimum function taking the lesser value of the 2 arguments, $k_{M,W}$ is the P limited uptake rate (day^{-1}), and $U_{M,max}$ is the maximum uptake rate occurring when P supply is sufficient. The division by water column height H is necessary, because of the conversion from concentration into a mass per area.

Similarly, uptake from litter is parameterized as

$$U_{M,L} = min\left(k_{M,L}, U_{M,max} - U_{M,P}\right)$$

Where $k_{M,L}$ is the uptake rate from litter (day^{-1}). It is assumed that macrophytes fulfill their P needs by the easier accessible P in the water column.

c) P in periphyton

Periphyton uptake and death is following the formulation of macrophyte uptake and decay, with the exception that Periphyton does not mine P in litter.

$$\frac{dA}{dt} = min\left(\frac{k_{A,W}P}{H}, U_{A,max}\right) - \lambda_A A$$

Where A is P in periphyton (g m^{-2}), $k_{A,W}$ is the uptake rate coefficient, $U_{A,max}$ a maximum periphyton growth, and λ_A the inverse of the turnover time of periphyton. Again, we assume that there is an upper limit to periphyton uptake, keeping periphyton growth in check if P is abundant.

d) P in litter

The litter pool is considered as dead plant material, receiving input from macrophyte death, periphyton death, and some material from settling. Litter is turning over at a constant rate.

$$\frac{dL}{dt} = \lambda_M f_{M,L} M + \lambda_A f_{A,L} A + \frac{k_S f_{S,L} P}{H} - \lambda_L L$$

Where L is the amount of P in litter, $f_{M,L}$ the fraction of plant decay added to the litter pool (as opposed to the water column), $f_{A,L}$ the fraction of periphyton turnover added to the litter, k_s the settling rate, $f_{S,L}$ the fraction of settling added to the litter, and λ_l the decay rate of litter.

e) P in recently accreted soil

Currently, soil only gets P directly from the water column, and turns over at a constant rate.

$$\frac{dS}{dt} = \frac{k_S(1 - f_{s,L})P}{H} - \lambda_s S$$

Where λ_s is the inverse turnover of soil organic matter.

f) Closing the phosphorus budget

The losses from macrophytes, periphyton, litter and soil feed into the source term S for the dynamics of P in the water column. In addition, there can be external sources S_0 (release from pre-STA soils, atmospheric deposition, birds).

$$S_p = \frac{1}{H}\left[\lambda_M M\left(1 - f_{M,L}\right) + \lambda_A A\left(1 - f_{A,L}\right) + \lambda_s S + \lambda_s S + S_0\right]$$

Sinks of P in the water column are as follows:

$$U = U_{M,P} + U_{A,P} + k_S P$$