TECHNICAL MEMORANDUM

BRIARWOOD STORMWATER TREATMENT FACILITY

SUMMARY OF OPERATIONS AND TREATMENT OPTIMIZATION

REPORTING LIMITATIONS: This technical memorandum (TM) provides information related to the results of performance optimization of the Briarwood Stormwater Treatment Facility (BSTF) during the period from August through December, 2013. The performance optimization considered three operational scenarios that varied flow rates and hydraulic detention periods through the BSTF treatment train. Results of the operations are briefly summarized with a focus on optimizing solids and nitrogen removal in the system. This report is not intended to be construed as monitoring documentation required in the FDEP 319h Grant original monitoring requirements; however, It provides practical recommendations for operation through the FDEP monitoring period, considering general observations of environmental conditions.

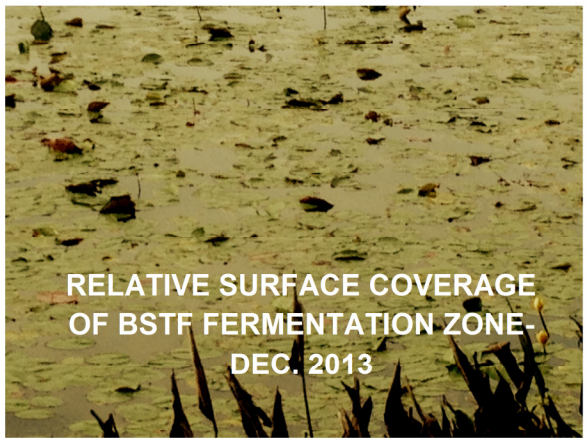
WATERMARK
ENGINEERING GROUP, INC

1.0- BSTF Background Information

BSTF REAERATION BASIN FLOW CONTROL STRUCTURE AND LOCAL WILDLIFE

1.1 General Description: The Briarwood Stormwater Treatment Facility (BSTF) incorporates physical solids separation and biological treatment processes coupled with stormwater harvesting to reduce pollutant loading to Alligator Creek. The general concept of treatment involves an un-interrupted diversion of stormwater flow (or programmed batch flow of stormwater) during rainfall events and intermittent periods between storms. The BSTF enables the facility to provide high volumes of treatment with high mass pollutant removals. The high mass pollutant removal does not necessarily depend on high efficiency treatment processes, but on maintaining consistent treatment parameters with predictable results.

Stormwater is introduced into the BSTF by a controlled and programmed pumped rate of water through a sequence of treatment areas (treatment train) with the goal of a high mass recovery of organic solids. The organic solids in this stormwater source (largely algal biomass) are responsible for nearly all of the nitrogen found in the water column. Organic solids may sorb or settle, eventually degrade, and release bio-available nitrogen and phosphorus. A fraction of the degraded nutrients are available for plant uptake and microbial nitrification and denitrification processes (biological nitrogen removal occurs with optimum environmental conditions that are controlled within the aerobic zone and B&G upflow filters).



RELATIVE SURFACE COVERAGE OF BSTF FERMENTATION ZONE- DEC. 2013

1.2 Objectives of Performance Optimization Evaluation: The effectiveness of treatment within the BSTF is affected by a number of environmental conditions and operator managed parameters that can be controlled within the treatment system.

The BSTF was operated for a minimum 6 month period to establish complete surface coverage in the fermentation zone (See photo), and equilibrated wetland environmental conditions. Once the wetland treatment system was established, each unit process was evaluated to better prescribe seasonal operational

parameters. This TM provides an overall summary of the evaluation and recommended operational protocols during dry and wet periods, and during summer and winter temperate conditions.

The BSTF has flexibility in operational protocols to vary the rate of flow, hydraulic residence time, and the daily period of backwash times (filter backwash is necessary to reverse flow and dislodge solids that may otherwise block the upflow filter treatment system).

The performance evaluation was structured to examine the treatment train effectiveness of the sedimentation area, fermentation zone, aerobic zone, anaerobic zone, and upflow filter units. A total of six sample locations were identified for process evaluation throughout the BSTF treatment train:

- Site 1-Influent Wet-well (PS-a);
- Site 2-Sedimentation pond overflow;
- Site 3-Fermentation zone outflow;
- Site 4-Aerobic Zone outflow (to submerged rock filter);
- Site 5-Filter effluent;
- Site 6-Final treated effluent at Wet-well (PS-B).

The design of the BSTF provides for flexibility in the operations based on either water level feedback, or timed pump operation. The BSTF operation is also intended to be semi-passive, requiring only occasional operator intervention.

It was initially determined that continuous flow treatment application would need to be maintained at a minimum 900 GPM to manage the system hydraulics and treatment goals. The overall efficiency of treatment removals at this pumping rate was estimated at about 25-50% removal of organic solids. Specific details of operation of the BSTF were not field documented (particularly with respect to nitrogen removal) to prescribe operational parameters that may achieve the optimum removals to meet overall project goals. Three basic modes of operation were established in the optimization study to determine what treatment schemes may produce optimum removal of pollutants.

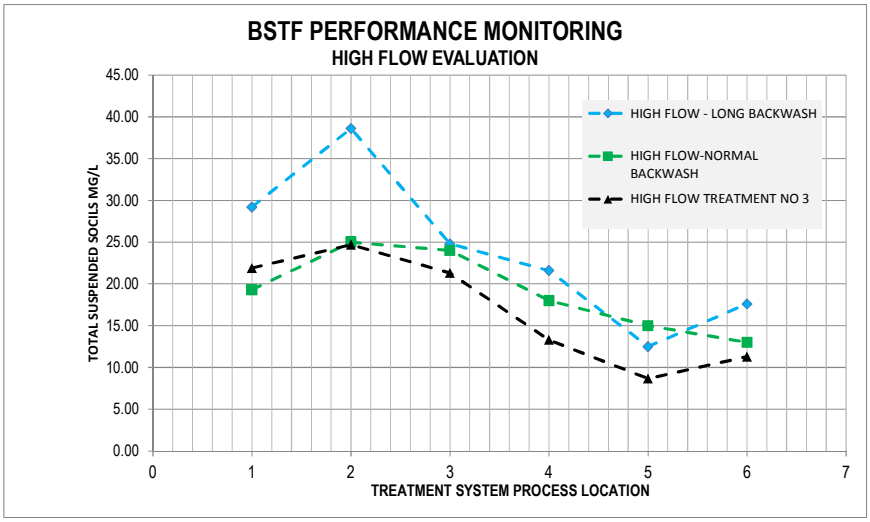
High Flow Operations: The High flow operations (HF) treatment scheme is intended to convey the maximum flow rate of stormwater through the BSTF to achieve high rates of mass pollutant removals. The HF treatment scheme provides for treatment of 2.0 to 2.5 MGD of stormwater with a minimal hydraulic residence in the BSTF. With this operational protocol, the upflow filters are automatically drained and flow is reversed through the filters on a daily basis. If the returned flow recycle is considered through the last segment of the Briarwood Lakes ponds, a minimum 3-5 day residence time may be possible.

Low Flow Operations: The low flow operations (LF) treatment scheme maintains inter-event stormwater flow between 0.8 and 1.3 MGD through continuous flow to the treatment system. This operational protocol also provides for upflow filters to be automatically drained with the filter flow reversed on a daily basis. The LF treatment scheme increases residence time in the fermentation zone to provide for more sorption, algal senescence and degradation, and settling. It has been postulated that higher hydraulic retention time will increase treatment efficiency.

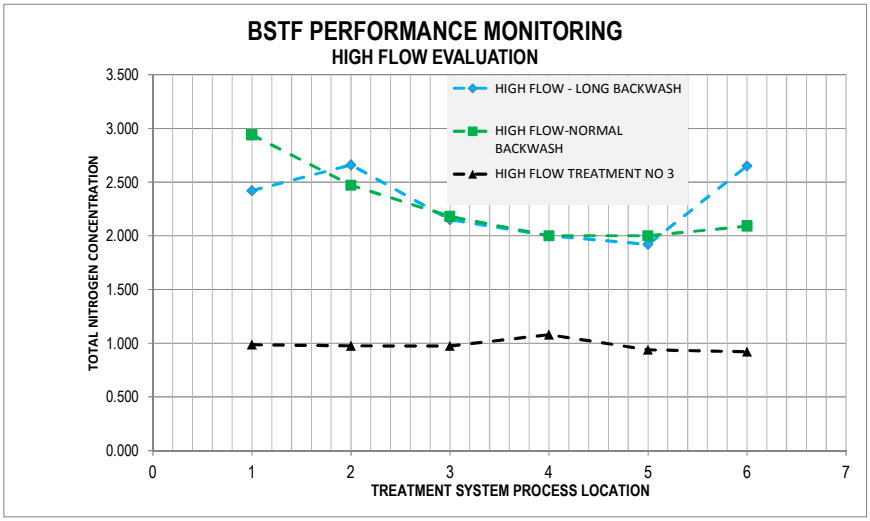
Batch Flow Operations: The batch flow operations (BF) treatment scheme involves a timed scheduled filling of the BSTF, a timed resting period (treatment), and a return of treated flow to the Briarwoods Lake system. The discharge may also be directed to Alligator Creek. With this operational protocol, upflow filters are drained and flow is reversed through the filters on a timed hourly interval basis (this may be extended beyond a daily backwash frequency period).

2.0-High Flow Treatment Observations

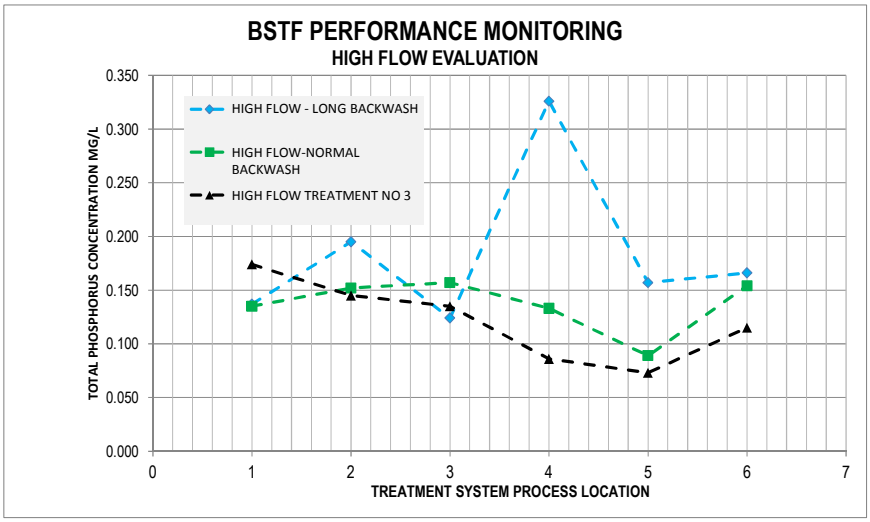
2.1 TSS Results: The HF operational protocol option demonstrated effective physical and filtration capacity for reproducible TSS results. With three different trials, the results demonstrated similar findings during constant wet weather conditions. Note that extended backwash cycles did not significantly impact aerobic or filter effectiveness.



2.2 TN Results: The TN reduction from an HF operational protocol demonstrated effective settling and filtration capacity of organic solids to consistently reduce TN with high influent background concentrations (above 2 mg/l). It should be noted that lower TN influent concentrations (less than 1.5 mg/l) was linked to lower treatment effectiveness. It is possible that dilution effects of rainfall changes the environmental dynamics of treatment.

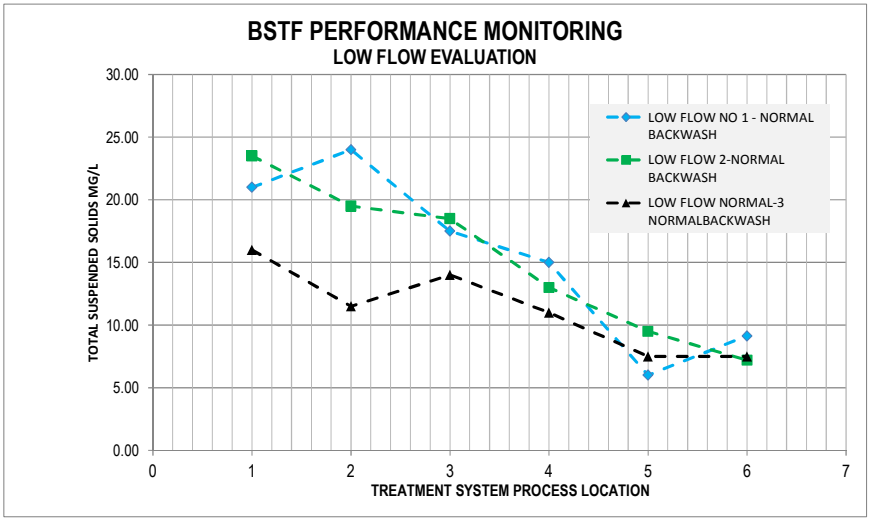


2.3 TP Results: The TP reduction potential from a HF operational protocol demonstrated less effective pollutant reductions through the aerobic zone but some removal was still noted through upflow filter processes. Note that the long backwash cycle appeared to negatively impact performance of the aerobic zone.

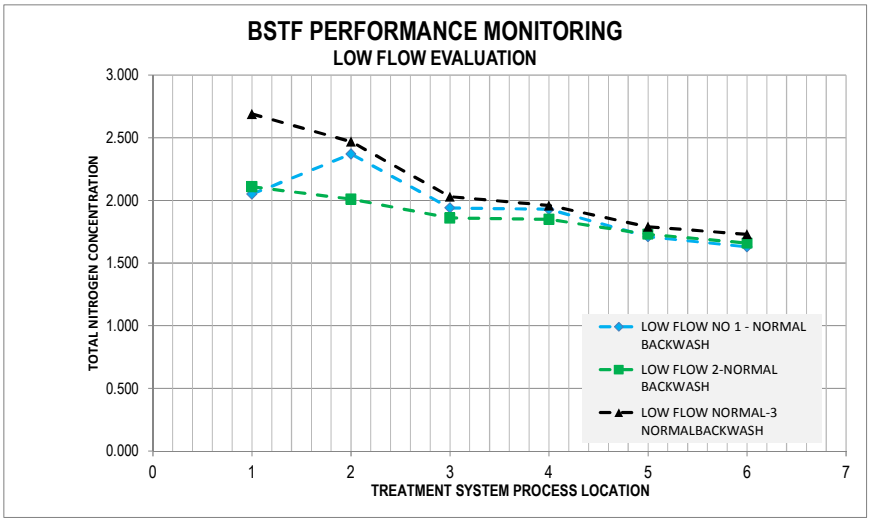


3.0-Low Flow Treatment Observations

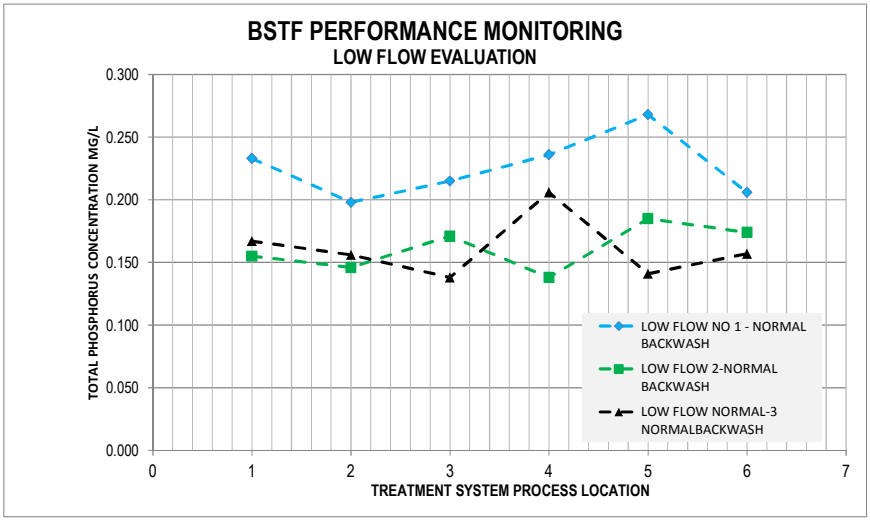
3.1 TSS Results: The TSS reduction from a LF operational protocol demonstrated similar trends for settling and filtration capacity when compared to the HF protocol, providing up to 50% reduction in concentration. With three different trials, the results demonstrated reproducible results during wet weather conditions.



3.2 TN Results: TN reduction from an LF operational protocol demonstrated reproducible consistent results than the HF evaluation. With three different trials, the results continue to demonstrate good results for high mass removals during wet weather conditions.

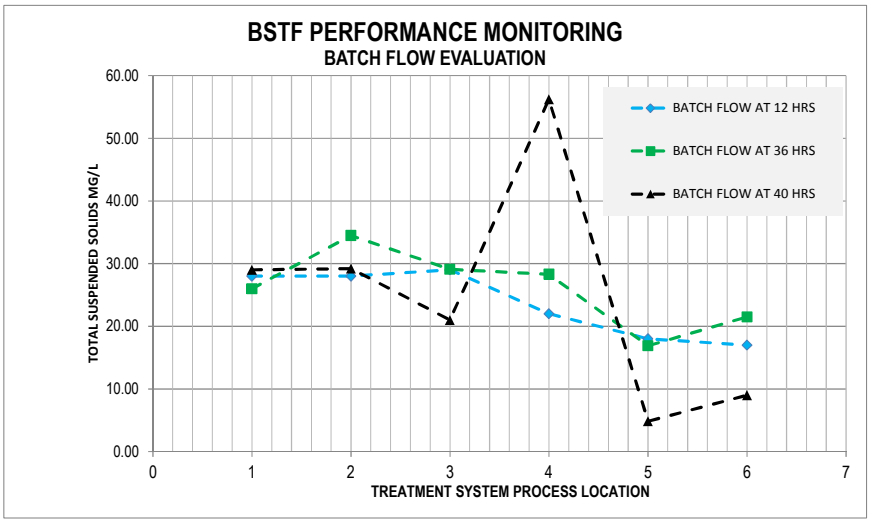


3.3 TP Results: TP reduction from an LF operational scheme showed no improvement over the HF operational scheme and in fact showed increase TP through the upflow filter in one instance. With three duplicate trials, the results do not show good correlation.



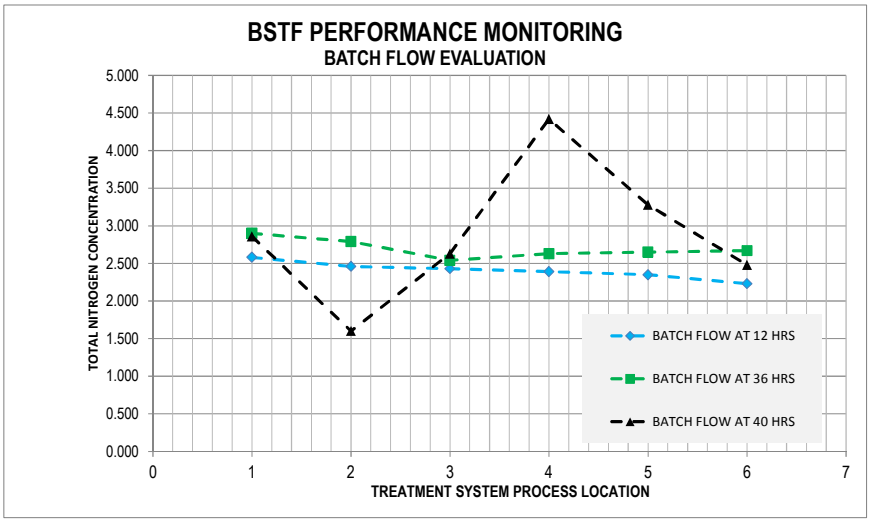
4.0-Batch Flow Treatment Observations

4.1 TSS Results: TSS reduction from a BF operational protocol demonstrated some interesting results for settling and filtration capacity. In this mode of operation, aeration (at two aerobic zone locations) was installed and fully operational. The operation of both aerators caused visible degradation in water clarity and spikes in solids and nutrients. Despite this observation, there were still significant reductions in TSS through the upflow filter.

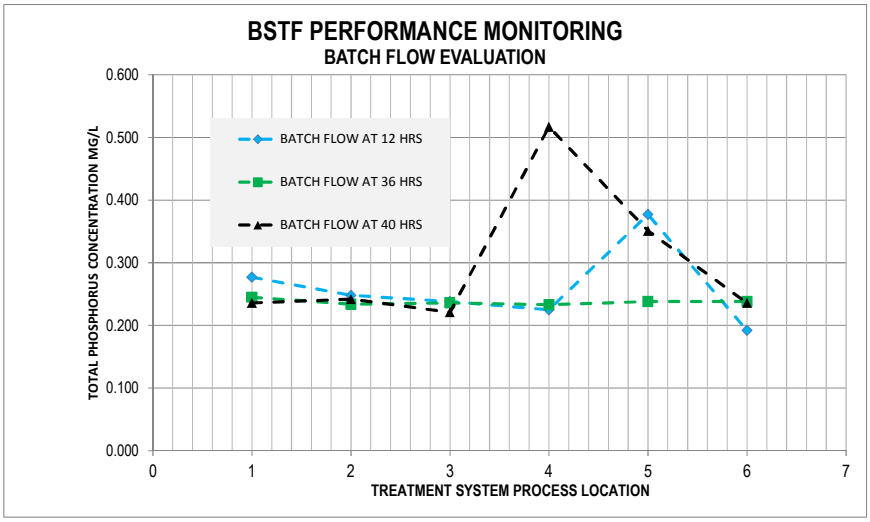


4.2 TN Results: TN reduction from a BF operational protocol demonstrated little or no improvements for settling over the HF and LF protocols. The higher retention time exhibited lowered TN in the fermentation area-showing promise for optimization of biological removals; however suspended organic flocculent in the aerobic area brought concentrations well above the influent flows in the extended BF operations (40 hrs). TN reduction in the first settling zone was more dramatic

in the BF long hydraulic retention operational protocol. It is envisioned that the enhanced reduction was a result of removals from periphyton that has established on the settling basin overflow weir.



4.3 TP Results: TP reduction from the BF operational protocols demonstrated little or no improvements over HL or LF operations scheme. With three different trials at varied hydraulic retention times, the results continue to demonstrate very little differences, except in the last trial where organics were re-suspended. The upflow filter effectively reduced TP in two of the trials.

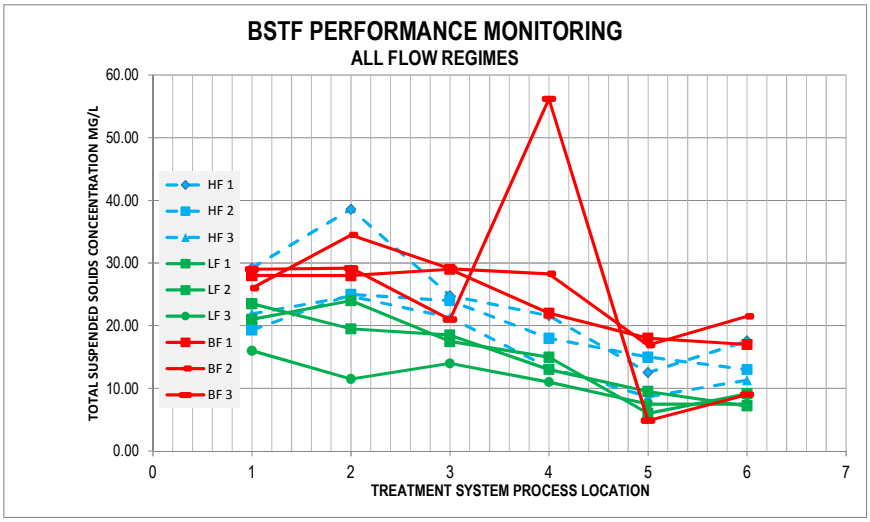


5.0-Performance Comparison of Operational Systems

Each of the BSTF unit treatment train processes is designed to provide optimal environmental conditions for treatment (settling, anaerobic environment or aerobic

conditions, and sorptive sites). Composited operational observations of physical and biological systems are compared under the nine monitoring events with three flow schemes within this section to better assess any performance benefits from low flow and longer hydraulic residence periods.

5.1 Performance Evaluation of Physical Treatment Systems: The BSTF has demonstrated consistent performance for physical settling, sorption, and filtration capabilities in all treatment modes. Interestingly, increased flow capacity through the filter system does not significantly hinder the capability of physical removal (entrapment or sorption) in the rock filter or the upflow filters (Note below graphical representation that demonstrates solids to be consistently reduced in every case).



There is little if any demonstrated benefit in solids settling in the first solids settling basin (Location 2). Some limited solids settling effectiveness is demonstrated in the aerobic zone.

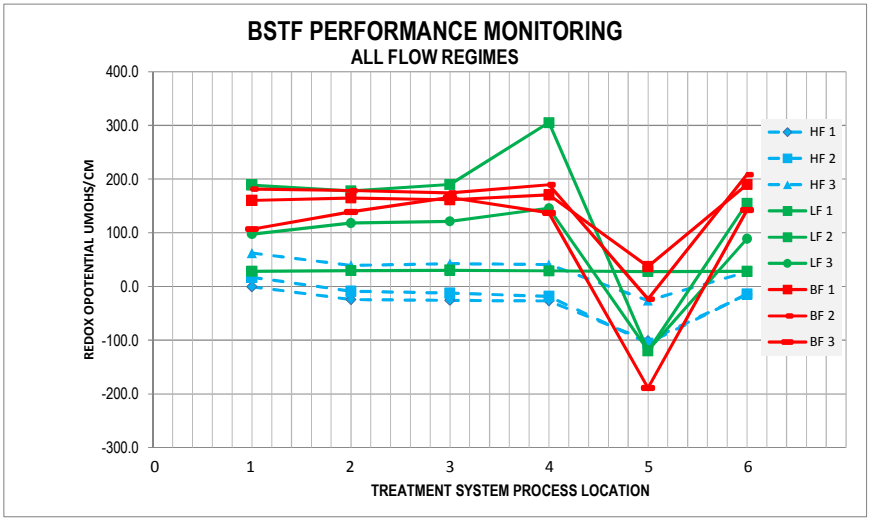
Interestingly, it is demonstrated that in high flow applications, solids may be released from the first settling basin (this is believed to be the result of dislodgement of periphyton growth on the overflow weir), and a significant increase in solids was observed in the aeration zone following the placement of two aerators (reportedly placed just above the basin bottom). It should be noted that organic algal biomass exhibits a low specific gravity and individual cells are very small in diameter. Algae may be also subjected to electrostatic forces and a high zeta potential that make algal solids very difficult to settle-but with senescence and quiescent flow, they aggregate as mats and either float or settle as detrital material.

Physical removal is the most effective form of solids and nutrient reduction that is documented in this evaluation. It should be noted that settling processes are linked to the prolonged long term promotion of biological removals (the trapped

organic solids will eventually degrade and release nitrogen compounds and ammonia that will become available for nitrification/denitrification).

The sorptive capacity of the BSTF is affected by the available surface area and electrostatic forces that exist in wetland vegetation emergent stems and leaves, bottom sediments, and other structural features where physical attachment may occur (i.e. floating wetland root structure). The establishment of vegetation in the fermentation area has demonstrated reasonable good capacity to capture solids through sorption. The lack of established vegetation in the aerobic zone does not provide significant surface areas for continued attachment sites.

5.2 Performance Evaluation of Biological Treatment Systems: The BSTF exhibited mixed results for biological transformation of organic solids over the course of this evaluation. The fundamental principal of BSTF treatment relies on the initial decomposition of organic solids to produce ammonia (this is a bio-available form of nitrogen) and other bioavailable nitrogen compounds. The effectiveness of biological degradation is dependent on environmental conditions that promote a change in metabolic pathways (i.e. a shift from aerobic to anaerobic respiration). With anaerobic conditions, organics may undergo degradation or even possibly direct conversion to nitrate.



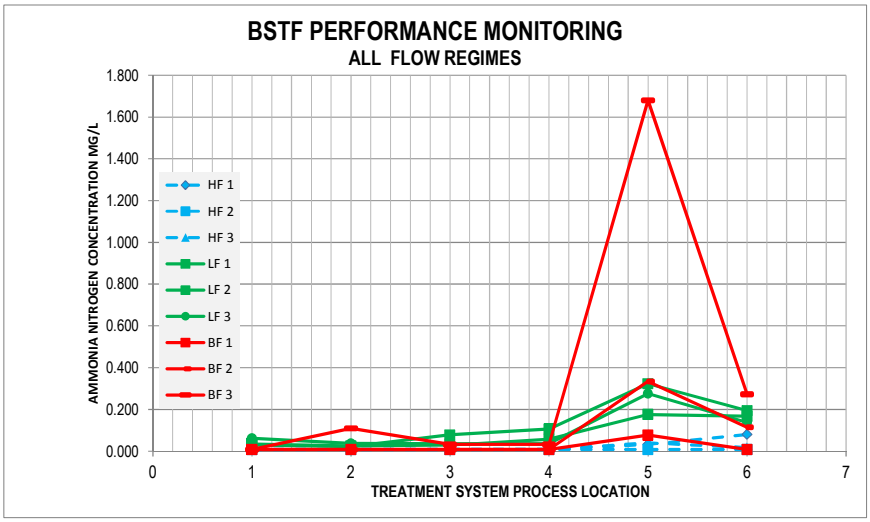
At HF operations, it was demonstrated that a reducing environment was maintained throughout the entire BSTF system. Furthermore, the general trends of redox potential suggest consistent reducing conditions in the upflow filtration system for any flow regime. This reducing environment condition is conducive to denitrification processes. When the BSTF system was converted to the LF operational scheme, redox potential in the aerobic zone remained consistent and increased in one instance (suggesting more optimum aerobic conditions for nitrification).

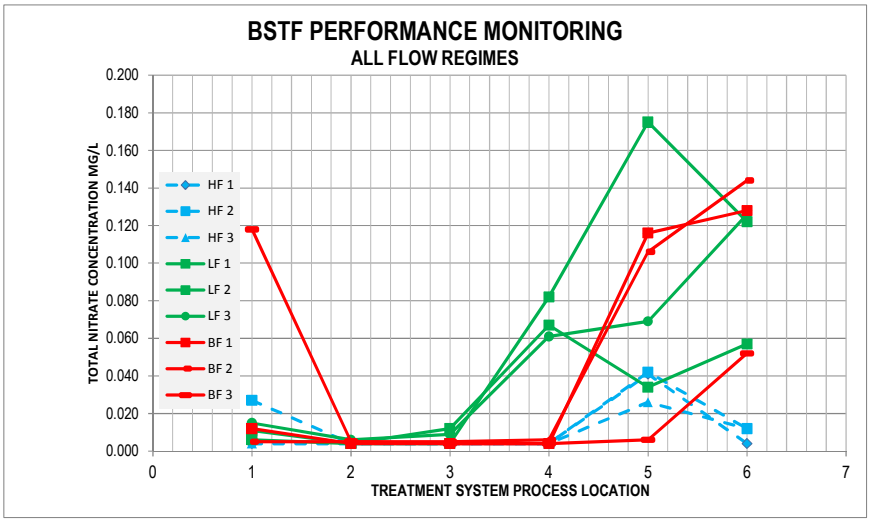
The success of biological treatment can be qualitatively measured by water quality results that give evidence of the conversion of nitrogen species from ammonia and organic nitrogen to nitrate. Biological treatment mechanisms rely on specific environmental conditions, including sufficient alkalinity, a carbon source or alternate electron donor, and adequate residence time. Biological treatment in the BSTF occurs primarily as attached microbial growth (on plant biomass, root systems, and structures)-effective treatment is not expected to occur in open water.

The flexible operation schemes of increased hydraulic residence periods (variation in flow application rates) is a potential key factor for the success of biological nitrogen removal that may be evaluated based on all nine (9) performance monitoring events.

As the hydraulic residence time was increased from HF to the LF operations mode (up to 40 HRS of inter-event treatment batch flow), the effectiveness of biological treatment increased, particularly in the fermentation and aerobic zones. This is demonstrated by the slight increase in nitrates and ammonia. It should be noted that nitrification and denitrification may occur in every unit process of the treatment system, and these processes are usually prominent in microbial attached growth.

It should be noted that any increased concentrations of ammonia and nitrate, albeit they are small, confirm biological conversion of nitrogen forms which are known to be comprised completely of organic solids (also note that most nitrogen speciation in this evaluation documents a based concentration of about 1 mg/l of dissolved organic nitrogen-(non-reactive portion of nitrogen)).





6.0-Operational Recommendations

6.1 Wet-weather Operations: The recommended operational protocol for wet weather periods is to maximize the flow through the BSTF with the HF operations scheme. With a consistent pumped maximum flow of 1,500 GPM (2.0 MGD), it is believed that the overall volumetric treatment capability of the BSTF can consistently meet treatment goals (with added nutrient management from stormwater harvesting). The primary source of removal in this operation will continue to be solids removal. It is interesting to note that continued maturity of the wetland system and seasonal changes in ambient temperatures may positively affect biological processes (this may be linked to the percent of effective plant cover in the fermentation zone and improved littoral shelf growth in the aerobic zone). Frequent visual observations and photographic record keeping of algal mat growth coupled with maintenance of excessive algal growth in the re-aeration zone and visual documentation of water turbidity (i.e. sechi depth) may be used as routine indicators for increased activity of biological treatment processes, noting there is the possibility for reducing the application flow rates in wet weather conditions.

6.2 Dry-weather Operations: The dry season coincides with seasonal changes in ambient temperatures that occur in the winter months. Based on information collected to date, the recommendation for dry-weather treatment is to maintain HF flow conditions as long as water levels in the main Briarwood Lakes system remain above 10.5 FT at the staff gauge. Frequent visual observations and photographic record keeping of algal mat growth coupled with maintenance of excessive algal growth in the re-aeration zone and documentation of improved water turbidity (i.e. sechi depth) may be used as routine indicators for potential improvements in biological treatment processes, noting there is the opportunity for

reducing the application flow rates (reducing slightly the flow rates) during dry weather.

6.3 Recycle Treatment Options: The operation of the BSTF has been entirely based on the return of treated effluent to the last portion of the Briarwood Lakes system. It is possible to provide once-through treatment, providing that water levels of the Briarwood Lakes system are not significantly impacted. Once through treatment may effectively result in higher pollutant loading to the BSTF and slightly improved capacity for overall nutrient removals; however, the legacy loads of nitrogen and phosphorus that exist in the Briarwoods System far exceed the treatment capacity of the BSTF. In extended or extreme wet periods, reduced concentrations of nutrients may warrant once through treatment to achieve higher mass removals.

If the normal water levels in the Briarwoods Lake system consistently exceed 10.99 FT for more than three weeks, the option for once through treatment should be considered.

ATTACHMENT NO 1-SUMMARY TABLE OF OPERATIONS OPTIMIZATION

SARASOTA COUNTY ADVANCED NUTRIENT TRAINING PROGRAM
REPORT ON OPERATIONAL OPTIMIZATION

DATE: 1.11.2014

TRAINING SESSION	BSTF TRAINING SESSION	OPERATIONAL RECOMMENDATIONS
PRE	**FIELD INTERVIEWS WITH SCGOV STAFF-TO LEARN ABOUT OPERATIONAL UNDERSTANDING OF STAFF**	**STE RECOMMENDATION:** EMERGENT VEGETATION AND WEED CONTROL-SPECIFIC DIRECTION IS PROVIDED WITHIN FERMENTATION AND AERBIC ZONE TO SELECTIVELY CONTROL NUSIENCE VEGATION WITH SYSTEMIC HERBICIDE-LIMIT APPLICATION TO HAND APPLICATION WITHIN LITTORAL AREA. APPLICATION OF ALL HERBICIDE SHALL BE RECORDED ON BSTF LOG. REMOVE ALL EXCESSIVE DEAD VEGETATION SEMI-ANNUALLY.
1	**SESSION 1-UNDERSTANDING NITROGEN IN THE STORMWATER ENVIRONMENT**	NO OPERATIONAL RECOMMENDATIONS WERE PROVIDED. STE PROVIDED INSTRUCTION ON VARIOUS NATURAL PROCESSES OF THE NITROGEN CYCLE
2	**SESSION 2-INTRODUCTION TO THE BSTF TREATMENT PROCESS**	NO OPERATIONAL RECOMMENDATIONS WERE PROVIDED. STE PROVIDED INSTRUCTION DESCRIBING VARIOUS PHYSICAL AND BIOLOGICAL PROCESSES TO ENHANCE SOLIDS AND NITROGEN REMOVAL
3	**SESSION 3-OPERATING THE BSTF LOOKING AT FIELD PUMPING SYSTEMS AND THEIR CONTROLS**	**RECOMMENDATION:** STE AND WATERMARK STRESSES AN O&M MANUAL REVIEW AND OVERVIEW OF THE BSTF HMI SCREEN SETTINGS. STE LED ONE-ON-ONE DISCUSSION AND PROVIDED AN OPERATIONAL RECOMMENDATION THAT EACH SC GOV STAFF LEARN BASIC SCREEN PROGRAM SHOTS; WATERMARK LED AND SPECIFICALLY INSTRUCTED SCGOV STAFF IN ADJUSTING SET POINTS FOR PUMP STATIONS. THIS INCLUDED FUNDAMENTAL SETTINGS AS FOLLOWS: **HI-A. HI FLOW-RUN PUMP STATION A AT 80% POWER; AND HI-B AND PUMP STATION B VFD SETTING AT 100%. THERE ARE BASIC HMI SCREENS THAT ARE CONTROLLED BY "MAIN MENU" SETTINGS AND TOUCH SCREEN TECHNOLOGY. LOW FLOW AND BATCH FLOWS WILL BE PROVIDED AS THE OPTIMIZATION PERFORMANCE MONITORING PROGRAM IS COMPLETED.**
4	**SESSION 4-OPTIMIZATION OF CONTROLS FOR ENHANCED SOLIDS SEPARATION (ALTERNATIVE FLOW SCHEMES)**	STE AND WATERMARK HAS PROVIDED AN OPERATIONAL RECOMMENDATION OF INSTALLATION OF A SEDIMENT BAFFLE SYSTEM AT THE BSTF UPFLOW FILTER (END OF AEROBIC ZONE) TO FOLLOW UCF STORMWATER ACADEMY PROCEDURES. THE FLOATING BAFFLE IS TO BE CONSTRUCTED OF 8 INCH DR35 PIPE, 1/2 INCH CHAIN, AND REMOVABLE NON-WOVEN FABRIC (MIRIFI 140N); **WATERMARK RECOMMENDS REVIEW OF CURRENT O&M OPERATIONAL FIGURES AND INSTUCTION ON VISUAL INSPECTION AND PROGRAMMED SCHEDULE FOR MAINTAINING UPFLOW FILTER EFFLUENT COLLECTION FILTERS (AS DESCRIBED IN THE O&M MANUAL). BASED ON OPERATIONAL INFORMATION COLLECTED TO DATE, THIS INSPECTION CAN BE ADJUSTED TO ONCE EVERY OTHER MONTH. THE FILTERS CAN BE REMOVED BY HAND AND PRESSURE WASHED, ON SITE. OBTAIN WATER SOURCE FROM SCGOV PUMP STATION WATER SUPPLY (LOCATED ON SW CORNER OF BSTF PROPERTY)**
5	**SESSION 5-PRINCIPALS OF ALGAL GROWTH, SENESCENCE AND RELEASE OF NITROGEN TO THE ENVIRONMENT**	**RECOMMENDATION:** STE GATHERED SAMPLES OF ALGAE FOR EXAMINATION BY THE UCF BIOLOGY DEPARTMENT IN ORDER TO CLASSIFY AND BETTER UNDERSTAND THE SPECIES-WITH RECOMMENDATIONS TO CORRELATE A VISUAL ID TO THE ALGAL SPECIES; WATERMARK RECOMMENDS MONTHLY REMOVAL OF ALGAL MATS FROM RE-AERATION AREA. WATERMARK ALSO RECOMMENDS CONSIDERATION OF CONTROL OF LYNGBIA BY ALGAL MAT VERIFICATION, AND POSSIBLE TREATMENTS IF THE ALGAL BECOMES DOMINANT.
6	**SESSION 6-PRINCIPALS OF AEROBIC NITROGEN TREATMENT-NITRIFICATION**	**RECOMMENDATIONS:** SARASOTA COUNTY HAS INSTALLED A SMALL AERATOR; HOWEVER, THE FUNCTION OF THE STORMWATER REUSE IRRIGATION SYSTEM HAS NOT BEEN REALIZED. WATERMARK RECOMMENDS IMMEDIATE REPAIRS TO THE IRRIGATION SYSTEM AND DOCUMENTATION OF DO LEVELS IN THE POND AT THE PEAK PERIOD OF PHOTORESPIRATION. THE STORMWATER SPRAY APPLICATION PERIOD SHOULD COINCIDE WITH LOW DO PERIODS (I.E. FROM MIDNIGHT TO DAWN).

SARASOTA COUNTY ADVANCED NUTRIENT TRAINING PROGRAM
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TRAINING SESSION	BSTF TRAINING SESSION	OPERATIONAL RECOMMENDATIONS
7	SESSION 7-FUNCTIONS OF THE BOLD AND GOLD FILTER	**RECOMMENDATION:** PRELIMINARY OPERATIONAL DATA SUGGEST THAT THE FILTER SHOULD BE OPERATED AT LOWER FLOWS. THIS EQUATES TO A VFD PUMP SETTING OF 32 HZ THAT PRODUCES ABOUT 750 GPM. WATERMARK WILL REPORT ON MINIMUM FLOW OPERATIONAL AND BATCH FLOW OPERATIONS REPORTS ONCE DATA ARE AVAILABLE.
POST TRAINING NO 1 REPORT-HIGH FLOW	POST TRAINING REPORTS OF HIGH FLOW TREATMENT PERFORMANCE	**OBSERVATIONS:** THE BSFT WAS OPERATED FOR A THREE (3) FIVE DAY DAY PERIODS AT HIGH FLOW. TWO OPTIONAL HIGH FLOW BACKWASH PERIODS WERE CONSIDERED-ONE AT 120 MINUTE DRAIN AND 120 MINUTES BACKWASH-DAILY AND ONE AT 120 MINUTES DRAIN AND 60 MINUTES BACKWASH-DAILY. THERE WAS NO APPARENT ADVANTAGE FOR DOUBLING THE FILTER BACKWASH AND NO FILTER BLINDING WAS NOTED. ALTHOUGH THE BSTF IS DESIGNED AROUND MASS BALANCE OF FLOW, EQUAL PUMP RATES CANNOT BE EXACTLY ACHIEVED FOR HIGH FLOW CONDITIONS. IN FACT THE INITIAL HF SAMPLING REQUIRED ADJUSTED LEVELS IN THE BASIN TO BALANCE THE INFLUENT FLOWS, BUT THIS ADJUSTMENT WAS DETERMINED TO BE SENSITIVE TO WITHIN VERY SMALL ELEVATION CHANGES. THE IMBALANCE IN FLOW IS BECAUSE OF ADDED PRECIPITATION, POSSIBLE ADDED INPUTS DURING IRRIGATION, AND INITIAL PUMP START-UPS FOLLOWING THE BACKWASH CYCLE (PUMP STATION A STARTS AHEAD OF PUMP STATION B, THUS STAGING UP THE BASINS). IT IS ADVISABLE TO ALWAYS SET PUMP STATION B TO THE MAXIMUM RATE WHEN APPLYING THE LEVEL BASED CONTROLS. LEVEL CONTROLS ARE THEN NOT SO CRITICAL. AN AERATION SYSTEM WAS INSTALLED IN THE AEROBIC NITRIFICATION ZONE, BUT NOT FULLY FUNCTIONAL. **RECOMMENDATIONS:** (1) PUMP SPEED:PUMP STATION A SHOULD REMAIN AT 80% OF THE MAXIMUM FLOW IN THE HIGH FLOW MODE. THIS EQUATES TO A SETTING OF 75% TO 85% OF THE VFD RHEOSTAT SETTING (SAY ABOUT 50HZ) TO PUMP NO MORE THAN 900 GPM. OPERATIONS AT HIGH FLOW WILL REQUIRE MAXIMUM PUMP SETTINGS **FOR PUMP STATION B** (SET AT ABOUT 63HZ). THIS MAXIMUM SETTING EQUATES TO ABOUT 1,500-1,700 GPM OF CONTINUOUS FLOW OPERATIONS. **TREATMENT EFFECTIVENESS:** THE INFLUENT CONCENTRATION OF NITROGEN VARIED IN THE TESTING PROGRAM-AS A RESULT OF RAINFALL. OPTIMUM OVERALL HIGH FLOW TREATMENT EFFICIENCY RESULTS IN ONCE THROUGH REMOVAL RATES OF ABOUT 20%. THE EXPECTED REMOVALS ARE POTENTIALLY BETTER IF SOLIDS SETTLING IS OPTIMIZED. HIGH FLOW PERFORMANCE SAMPLING WAS COMPLETED WITHOUT CONSIDERATION OF METERED IRRIGATION FLOWRATES. NOTE THAT THE IRRIGATION PROVIDES 85% REMOVAL OF TN AND IS A CRITICAL ELEMENT OF THE HIGH FLOW TREATMENT.

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DATE: 1.11.2014

TRAINING SESSION	BSTF TRAINING SESSION	OPERATIONAL RECOMMENDATIONS
POST TRAINING NO 2 REPORT- LOW FLOW	**POST TRAINING REPORTS OF LOW FLOW TREATMENT PERFORMANCE**	**OBSERVATIONS:** THE BSFT WAS OPERATED FOR A THREE (3) FIVE DAY DAY PERIODS AT LOW FLOW. BACKWASH PERIODS WERE SET AT 120 MINUTE DRAIN AND 60 MINUTES BACKWASH-DAILY. NO RECORDS OF FILTER MAINTENANCE WERE PROVIDED BY SARASOTA COUNTY, YET EFFLUENT CHIMNEY FABRIC FILTERS APPEARED CLEAN. REAERATION EFFLUENT BASIN EXHIBITED MORE GROWTH OF ALGAE AND MORE SOLIDS. NO IMBALANCE IN LOW FLOWS WAS OBSERVED OVER THE THREE EVENTS. AN AERATION SYSTEM WAS INSTALLED IN THE AEROBIC NITRIFICATION ZONE, AND WAS FUNCTIONAL. THE RATE OF FLOW GENERALLY APPEARS TO OFFER MORE OPPORTUNITY FOR COLLOIDAL SOLIDS SETTLING IN THE FERMENTATION AREA THAN IN HIGH FLOW MODE. TREATMENT EFFECTIVENESS WAS INITIALLY IMPROVED UNDER LOW FLOW CONDITIONS. **RECOMMENDATIONS:** (1) PUMP SPEED:PUMP STATION A SHOULD REMAIN AT 30% OF THE MAXIMUM FLOW IN THE LOW FLOW MODE . THIS EQUATES TO A SETTING OF ABOUT 36HZ) TO PUMP NO MORE 650 GPM. OPERATIONS AT LOW FLOW WILL STILL REQUIRE MAXIMUM PUMP SETTINGS **FOR PUMP STATION B** (SET AT ABOUT 63HZ). THIS MAXIMUM SETTING EQUATES TO ABOUT 1,500-1,700 GPM OF CONTINUOUS FLOW OPERATIONS AND WILL INSURE WATER BALANCE IN THE SYSTEM. LOW FLOW OPERATIONS MAY CONSIDER ADJUSTMENTS IN BACKWASH TO WEEKLY VERSUS DAILY (THIS IS ONLY A RECOMMENDATION BASED ON LOW FILTER BLINDING). SEASONAL OPERATION DURING DRY PERIODS IS RECOMMENDED FOR LOW FLOW TREATMENT. THE UPFLOW FILTER MAINTAINED MAINTAINED A REDUCING ENVIRONMENT AT LOW FLOWS-BUT THIS VARIED A BIT. IT IS NOTED THAT HF CONDITIONS ALSO MAINTAINED REDUCING ENVIRONMENT. **TREATMENT EFFECTIVENESS:** IRRIGATION SYSTEM WAS NOT REPORTED AS WORKING. PROBLEMS WITH THE MC AC UNIT PERSISTED BUT DID NOT APPARENTLY IMPACT MECHANICAL FUNCTION OF THE SYSTEM. NOTE THAT THE IRRIGATION PROVIDES 85% REMOVAL OF TN AND IS A CRITICAL ELEMENT OF THE LOW FLOW TREATMENT TRAIN. THIS IS MORE IMPORTANT DURING DRY PERIODS WHEN THE TURF CAN HANDLE HIGH RATES OF APPLICATION.
POST TRAINING NO 3 REPORT- BATCH FLOW	**POST TRAINING REPORTS OF BATCH FLOW TREATMENT PERFORMANCE**	**OBSERVATIONS:** THE BSTF WAS OPERATED UNDER BATCH FLOW (TIMED OPERATION OF PUMPS) FOLLOWING MINOR OPERATIONAL (PLC PROGRAMMING) CORRECTIONS. AS WITH OTHER MODES, IT IS RECOMMENDED TO ALWAYS SET PUMP STATION B TO THE MAXIMUM RATE WHEN APPLYING THE TIMER BASED CONTROLS. **RECOMMENDATIONS:** (1) PUMP SPEED:OPERATIONS AT BATCH FLOW WILL REQUIRE MINIMUM PUMP SETTINGS **FOR PUMP STATION B** (SET AT 60HZ) FOR 12 HOURS, FOLLOWED BY OFF PERIODS OF 12 HOURS, 24 HOURS, OR 36HR. WATERMARK COMPLETED AND RECEIVED DATA FOR ALL BATCH FLOW EVENTS. **TREATMENT EFFECTIVENESS:** OPTIMUM OVERALL HIGH FLOW TREATMENT EFFICIENCY RESULTS IN ONCE THROUGH REMOVAL RATES OF ABOUT 20%. PERFORMANCE SAMPLING WAS COMPLETED WITHOUT CONSIDERATION OF METERED IRRIGATION FLOWRATES. IRRIGATION PROVIDES 85% REMOVAL OF TN AND IS A CRITICAL ELEMENT OF THE HIGH FLOW TREATMENT. BATCH FLOW RESULTS SUGGEST THAT LONGER BATCH TIMES RESULT IN A RE-RELEASE OF NUTRIENTS IN THE AEROBIC ZONE, PRESUMABLY PARTIALLY DUE TO RESUSPENSION OF COLLOIDAL ORGANIC SOLIDS. SINCE THE FACLITY HAS BEEN IN OPERATION FOR OVER 1 YEAR, THE ACCUMULATION OF COLLOIDAL SOLIDS MAY AFFECT TREAMENT IN GENERAL. **IF BATCH FLOW IS SELECTED, IT IS RECOMMENDED TO BE SET FOR 12 HOURS.**