Hickory Hills Water & Sewer — update June 2, 2014 — merciel and harrison
SR-2014-0166 & WR-2014-0167
Estimation of Rates with Alternative 1 with Pollution Control System and 5 year institution financing

Sewer	Monthly Rates			Annual Cost	18-month Period	
Current Rates	$42.50	12	47	$23,970		
Misc. Revenues	$0.31			$173		
New Revenue Requirement	$7.72			$4,353		
Interim treatment facility, 5 year financin	$56.49			$31,858		
2 interim lift stations, 5 year financing	$5.36			$3,020		exclude lagoon dewatering pump facility $1,900 to $3,200 capital cost 86c to $1.46 per customer 5 yr
Electric usage/electric connection charge	$5.32			$3,000		$2,729.70 actual electric usage estimate, but connection cost must be included here
Rock & Grading, 5 yr financing	$0.95			$537		
	$118.64			$66,911		exclude sludge hauling, use the lagoon initially for interim sludge storage $3,900 annual expens $6.91 per customer

Water					Monthly Charge	Usage
Current Rates Including Water Usage	$38.72	12	47	$21,838	$11,545	$10,293
Misc. Revenues	$0.31			$173		
New Revenue Requirement	$25.47			$14,365		
	$64.50			$36,376		
Total Water & Sewer Rates	$183.13			$103,287		

Hickory Hills Water & Sewer
SR-2014-0166 & WR-2014-0167
Estimation of Rates with Alternative 1 with Frontier and 18 mo amortizations

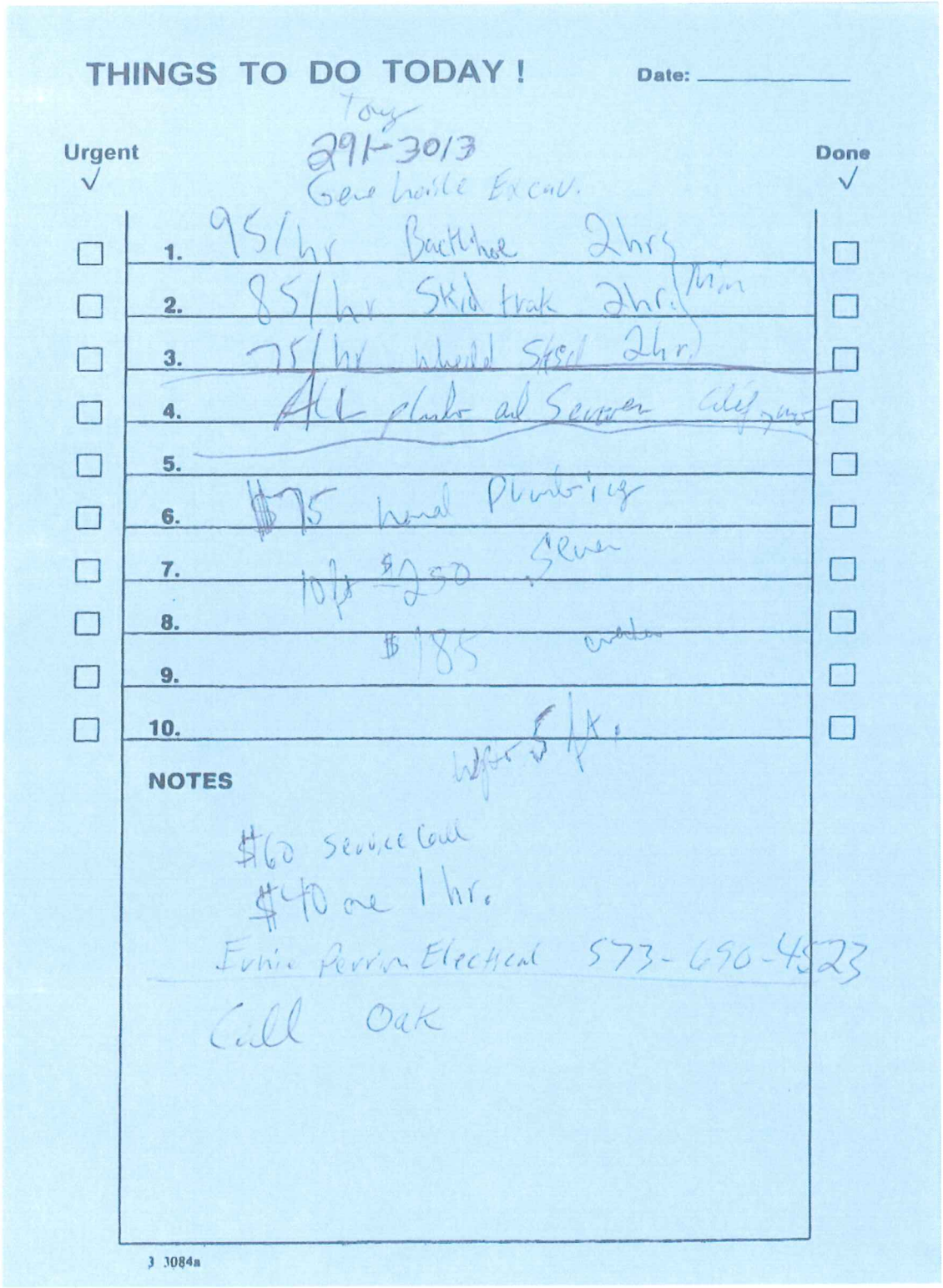
update June 2, 2014 merciel and harrison

Sewer	Monthly Rates			Annual Cost	18-month Period	
Current Rates	$42.50	12	47	$23,970		
Misc. Revenues	$0.31			$173		
New Revenue Requirement	$7.72			$4,353		
Interim treatment facility, 18 mo lease	$38.30			$21,600		
2 Interim lift stations, 18 mo amort	$8.69			$4,899	$7,348	exclude lagoon dewatering pump facility $1,900 to $3,200 capital cost $2.50 to $4.21per customer 18 mo
Electric usage/electric connection charge	$5.32			$3,000		$ 2,729.70 actual electric usage estimate, but connection cost must be included here
Rock & Grading 18 mo amort	$2.47			$1,393	$2,090.00	
	$105.30			$59,388	$9,438	exclude sludge hauling, use the lagoon initially for interim sludge storage $3,900 annual expens $6.91 per customer

Water					Monthly Charge	Usage
Current Rates Including Water Usage	$38.72	12	47	$21,838	$11,545	$10,293
Misc. Revenues	$0.31			$173		
New Revenue Requirement	$25.47			$14,365		
	$64.50			$36,376		
Total Water & Sewer Rates	$169.79			$95,764		

Vendor list

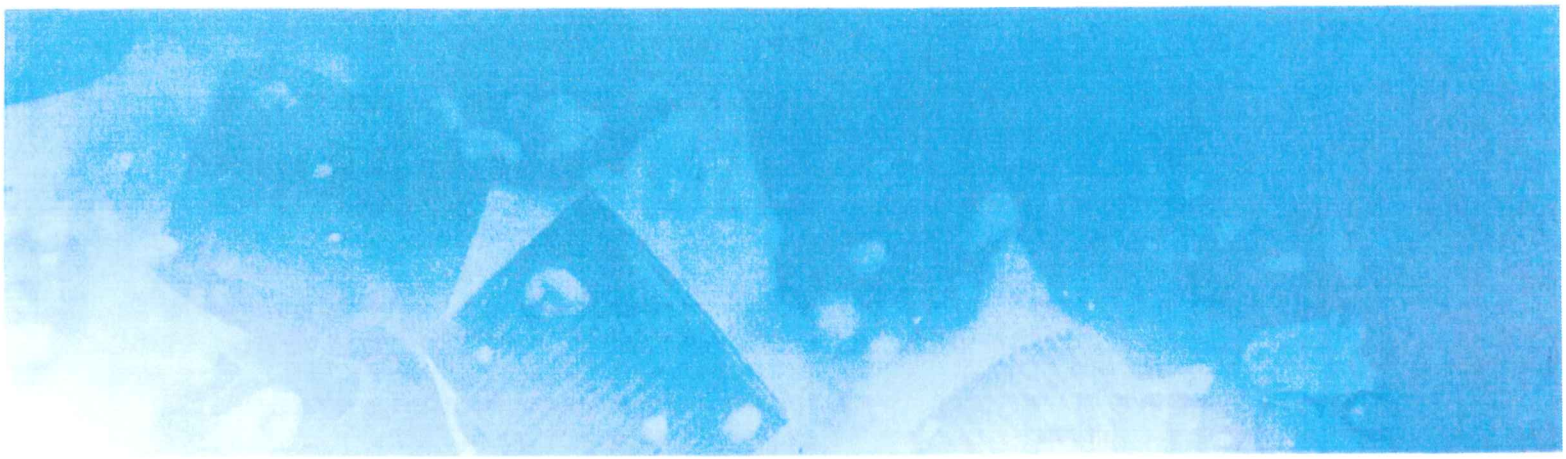
Menards
Ameren UE
Gene Haile Excavation California, MO
Ernie Perrin Electrcial California, MO
All Plumbing and Sewer California, MO



Proposal for Supply Of:

HIT-CS

Headworks Integrated Treatment – Compact System



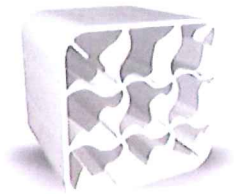
Prepared For:

Hickory Hill
Budgetary Proposal A-02767, REV 1

Submitted By:

Headworks BIO™ Inc.

Submission Date: May 6, 2014



CONTENTS

1.5 CHANGES

Seller shall not implement any changes in the scope of work described in Seller's documentation unless Buyer and Seller agree in writing to the details of the changes and any resulting price, schedule, or contractual modifications. This includes any changes necessitated by a change in applicable law occurring after the effective date of any contract including these terms.

1.6 STAINLESS STEEL AND NATURAL GAS PRICE INCREASES

All Orders accepted, are subject to the following terms:

Headworks BIO reserves the right to adjust the price of the equipment based on increases in the price of stainless steel or natural gas. This increase would be based on stainless steel and/or natural gas price increases (including surcharges) as published monthly in the U.S. with the base price being that price (including surcharges, if any) published on the date of this offer. Such price increase only affects the cost of the stainless steel material portion of the affected equipment.

1.7 FORCE MAJEURE

"Force Majeure" shall mean any act or event which is outside the reasonable control of a party including, without prejudice to the foregoing generality, Acts of God, epidemics, tidal waves, explosions, lightning, earthquakes, hurricanes, wars (whether declared or not), riots, strikes and industrial actions (other than among the employees of party seeking to rely on such event, or its subcontractor), civil and military disturbances and unrest, acts of the public enemy, action or inaction of the government or governmental authorities or of representatives thereof. If Headworks BIO is prevented from or delayed in performing its obligations as a result of Force Majeure, such prevention or delay shall not be considered a breach of the Agreement, but shall for the duration of such event relieve Headworks BIO of its respective obligations thereunder. Should the Force Majeure suspension period last for more than one (1) month, Headworks BIO may terminate this quote or agreement.

1.8 FREIGHT TERMS

Equipment is sold EX Works, Houston TX.

1.9 SUBMITTAL PREPARATION

Technical submittal drawings for review, authority examination and approval shall be furnished to the buyer within 2 - 4 weeks of order acceptance. The buyer shall approve the submittals within 4 weeks from receipt; otherwise the Stainless Steel and Natural Gas Price Increases clause described above will become applicable.

HEADWORKS BIOINC. SHALL NOT BE LIABLE FOR NORMAL WEAR AND TEAR, NOR FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE DUE TO INOPERABILITY OF ITS EQUIPMENT FOR ANY REASON NOR ANY CLAIM THAT ITS EQUIPMENT WAS NEGLIGENTLY DESIGNED OR MANUFACTURED.

1.15 TERMINATION

Buyer may at any time terminate this order or any part hereof for its sole convenience. In the event of such termination, Seller shall immediately stop all work hereunder, and shall immediately cause any of its suppliers or subcontractors to cease such work. Seller shall be paid a reasonable termination charge consisting of a percentage of the order price reflecting the percentage of the work performed prior to the notice of termination, including without limitations any and all engineering work completed in submittal preparation, plus actual direct costs resulting from termination. Seller shall not be paid for any work done after receipt of the notice of termination, nor for any costs incurred by the Seller's suppliers or subcontractors which Seller could reasonably have avoided. Buyer will make no payments for finished work, work in process, or raw material fabricated or procured by the Seller in excess of any order or release.

1.16 LIMITATION OF LIABILITY

In no event shall Seller be liable for anticipated profits or for incidental or consequential damages. Seller's liability on any claim of any kind for any loss or damage arising out of or in connection with or resulting from this contract or from the performance or breach thereof shall in no case exceed the price allocable to the goods or services which gives rise to the claim. Seller shall not be liable for penalties of any description. Any action resulting from any breach on the part of Seller as to the goods or services delivered hereunder must be commenced within one (1) year after the cause of action has accrued.

Technical Specification for Supply Of:

HIT-CS

Advanced Wastewater Purification System

A-02767 Hickory Hill
Generic HIT-CS Specification, rev 1

Submitted By:

Headworks Bio Inc.

Date: May 6, 2014

CONTENTS

1.0 APPLICATION AND DESIGN BASIS

The Headworks Bio (HWBio) HIT-CS® has been specifically developed as a complete, highly reliable and compact package system, incorporating the ActiveCell® biological treatment process. In addition to the ActiveCell® process, the HIT-CS® incorporates various other processes such as mixing/equalization, secondary DAF, and optional polishing filter, and UV disinfection.

The biological process proposed is the ActiveCell™ biofilm MBBR process. MBBR is a self-sustaining biological process, eliminating both the need to periodically waste sludge and the requirement to supply a dilute return activated sludge. For the proposed concept, there is no requirement to supply a return sludge line.

The process employs Headworks' proprietary mobile biofilm carriers (ActiveCell 920) to support a very high concentration of attached biomass; and maintain excellent mass transfer conditions. The neutrally buoyant HDPE ActiveCell biofilm carriers within the bioreactor tanks provide a stable base for growth of a diverse community of microorganisms. Every biofilm carrier has a very high surface-to-volume ratio, allowing for a high concentration of biological growth to thrive within the internally protected areas.

Based on wastewater influent parameters and the effluent requirement, the proposed treatment is a two stage MBBR system to remove BOD and Nitrify the plant's wastewater. The tanks will be operated under aerobic conditions so that bacteria will consume the BOD and Ammonia in the wastewater while utilizing the oxygen for metabolism and for growing the bacterial colonies. In addition to providing oxygen for the bacteria, the proposed aeration grids also supply mixing energy to maintain complete-mix conditions in the reactors.

1.1 PROCESS ADVANTAGES:

- Field Proven - Suspended carrier elements are ideal for high rate BOD removal in a small footprint. ActiveCell systems are typically a fraction of the size of activated sludge systems.
- Responds to Load Fluctuations without Operator intervention – Self-regulating nature of biofilm adjusts to variations in process load. As the contaminant load increases, the microbial population in the biofilm increases enabling additional treatment capacity. Likewise, during low loading conditions, the population self-adjusts and decreases. This eliminates the need to return a dilute activated sludge stream and alleviates the requirements for continual adjustments associated with a suspended growth system.
- Resilient to Toxic Shocking - Fixed film processes are resistant to toxic contaminants as the inner layer of biofilm is protected. In the case of toxic shock, the outer layer of dead bacteria will be removed by normal detachment mechanisms present in the bioreactor, while the inner layer will provide a seed for microbial growth and enabling the system to continue meeting the contaminant load.
- ActiveCell Eliminates Traditional Operator Tasks - The need to periodically waste sludge and the requirement to supply a dilute return activated sludge to maintain a food-to-microorganism (F/M) ratio is not required in a MBBR. The sloughed biomass from the attached growth media will remain suspended within ActiveCell system, and will be continuously removed from the process by the exiting flow stream, resulting in an operator free biological treatment system.

1.2 DESIGN FLOW

The design wastewater flow rate for the proposed HIT-CS is calculated as summarized below. The number of persons used in the table is for reference purposes only.

Model	Head Count	Allowance per person per day	Design Hydraulic Capacity
HIT-CS - 100	***333***	***300 Litres***	***100 m³/day***

Table 1 – Wastewater Flows

1.3 DESIGN LOAD

The design of the HIT-CS is based on basic parameters associated with wastewater composition, namely Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS). Associated loadings assumed for this project are presented below, and represent 100% loading conditions:

SOURCE	Daily Vol. (m^3/day)	BOD (mg/l)	TSS (mg/l)	Daily BOD (Kg/day)	Daily TSS (Kg/day)
Influent from lift station	100	300	300	30	30

Table 2 – Wastewater Composition and Loads

Additionally, the following parameters are part of the design and limitations of the system:

Parameter	Limit
Influent temperature to Bioreactor	***20 – 38 deg C***
Chlorides	***0-400 ppm***
Hardness	***0-15 dH***
$CaCO_3$	***0-300 ppm***
pH	***6-9***
Residual Chlorine	***0-2 ppm***

Table 3 – Additional Influent Characteristics

It is important to note that the figures in table 4 assume steady state operation. Sudden changes in the flow rate to the HIT-CS could result in temporary non-compliant effluent.

Table 1, 2, and 3 above, together, form the design basis for the proposed HIT-CS, with a capacity of 100% of the nominal design flow. Upon commissioning of the vessel, if any of the ***composite or total values in bold italics*** listed in the tables are exceeded, the proposed treatment system's design may need to be revised for the new design basis at additional costs.

1.4 PERFORMANCE CRITERIA

Provided all the influent characteristics are as described in **tables 1, 2, and 3**, fit within the normal operating conditions, and the system is installed and operated in accordance with HWBio's installation and operating instructions, the effluent quality after the HIT-CS will meet or exceed the discharge criteria indicated below. In the event that the total influent load exceeds the design criteria, or the system is not operated in accordance with the O&M Manual, effluent results are NOT guaranteed.

Parameter	HIT-CS Effluent (Base Unit)	HIT-CS Effluent (W/ PF+UV)
BOD_5 (mg/l)*	< 10	< 10
COD (mg/l)*	< 100	< 100
TSS (mg/l)*	< 30	< 10
Ammonia (mg/l)*	< 1	< 1
Phosphorus (mg/l)*	< 10	< 10
Fecal Coliform (CFU/100 ml)*	< 100	< 14
Free Chlorine (mg/l)	< 2	< 0.01

* 30 day geometric average, minimum 5 samples.

Table 4 – Performance Criteria

1.5 PROJECT COMPLETION

HWBio is committed to delivering a system that will meet the required performance criteria. The project will be considered completed following the successful completion of compliance testing and a written test report by a mutually selected third party which shows in writing that the HIT-CS meets the performance criteria as stated within **Section 1.3** for effluent quality, the final completion of the project has been satisfied.

1.6 DESIGN ASSUMPTIONS

Many assumptions regarding the project scope, and requirements have been made, and are summarized below. Any changes to the listed assumptions will require a design review and may result in design changes. These changes may result in increased prices and change order notifications.

- The design of the system is based on the 100% flow and influent characteristics of typical municipal wastewater. Other applications may be appropriate – consult HWBio for more details.
- Minimal redundancy is supplied unless requested otherwise.
- Electrical supply per supplier standard unless specific electrical requirements provided.

1.7 INSTALLATION OPTIONS

The following general guidelines are given for several common HIT-CS installation options, all subject to local code and regulations:

Above Ground:

- Must be installed onto a concrete pad.
- Access to the plant via at least 1 level entry. This is because regular operation requires periodic entry with chemicals pails (~20 L) or drums (~200L), and removal of primary solids.
- Covering structure can be open-walled, with louvered walls, or fully enclosed. For fully enclosed structures, adequate ventilation must be provided.
- In floor sump(s) recommended.
- Influent typically from below-grade, gravity fed lift station (by others).

Below Ground:

- Must be installed onto a concrete floor.
- Ramp, elevator or other lift mechanism provided for access. This is because regular operation requires periodic entry with chemicals pails (~20 L) or drums (~200L), and removal of primary solids.
- Must be adequately ventilated with sufficient egress options to avoid being deemed a confined space, per applicable regulations.
- H_2S sensors in the area highly recommended for all below-grade installations
- In floor sump(s) required.
- Influent typically from below-grade, gravity fed lift station (by others).

For other installation arrangements, please contact HWBio.

1.8 DEVIATIONS FROM RFQ

- TBD

2.0 DESIGN SPECIFICATIONS AND SUPPLY

HWBio HIT-CS® employs proven components and processes employed by HWBio in marine, industrial, and municipal wastewater treatment applications.

The treatment system consists of a compact treatment skid designed for easy installation, operation and maintenance with the following features:

- Reliable Performance: The HIT-CS achieves high quality effluent for compliant discharge regardless of changes to temperature or flow volume within design parameters Mixing Tanks
- Minimal Chemical Usage: The HIT-CS uses only minimal amounts of polymer and defoamer. No other chemical additives or cleaners are required as there are no membranes.
- Low Maintenance: Process control is simple and overall process efficiency can be easily monitored with standard monitoring equipment. The process uses no membranes, eliminating the need for replacement and cleaning of these maintenance items.
- Odor Free: The highly oxygenated environment does not allow for septic conditions; offensive odors are eliminated. Additionally, the entire system is fully enclosed and self-contained.
- Reduced Solids Handling Requirements: The HIT-CS utilizes a combination of "self-digesting" sludge management process, and a sludge concentration system limiting the production of secondary solids. The solids produced in the HIT-CS have high solids concentration (~8% dwt); this also reduces sludge handling costs.
- Optional: Chlorine-Free Process: The HIT-CS equipped with an optional UV system uses no chlorine additives, eliminating the need to store or handle chlorinated compounds; effluent is safely discharged without any chlorine contamination.

2.1 GENERAL SPECIFICATION SUMMARY

HIT-CS	Specification	
Treatment Technology Basis	MBBR	
Maximum Daily Hydraulic Load	100 m3/day	
Influent Load Capacity	BOD TSS	300-500 mg/L 300-500 mg/L
Discharge Effluent Quality	BOD COD TSS Fecal	< 10 mg/L < 100 mg/L < 10 mg/L < 14 CFU/100 mL
Bioresidue Production	125 ~ 175 Litres/day @ ~8% dwt.	
Overall Noise	< 85 dB (A)	
Weight	DRY WET	7,000 kg 30,500 kg
Dimensions	5.8m L x 2.9m W x 2.7m T	
Mixing/Surge Tank Requirement	Included, integrated	
Temperature Range (operating)	45°C Max, 5°C Min, 30~35°C Recommended	
Construction Materials	Tanks Transfer Pumps DAF Pump Piping	Epoxy Coated CS Cast Iron, Bronze SS 316 Impeller PVC
Power	440V/60Hz/3P	

2.2 CONSUMABLES SUMMARY

The following utilities and chemicals are required to operate the HIT-CS at 50 m3/day. The system is typically expected to operate at 60~80% of maximum capacity.

Utility	Consumption @ 100%	Expected Consumption	Unit Cost (US only)	Annual Cost (est.)
Power (requested)	4 kW	**~3.6 kW**	$0.010/kW	$3,154
Power (installed)	9.3 kW		-	
Technical Water for Polymer System	100 L/day	**~75 L/day**	-	
Neat (38%) Polymer (AWP)	1.3 L/day	**~0.85 L/day**	$5.00/L	$1,551
Chlorine*	2.1 L/day	**~1.65 L/day**	$4.50/L	$2,710
Defoamer**	<0.25 Kg/day*		$3.75/L	$341
Consumables***	~$2,250 per year		-	$2,250
			Annual Total	**$10,006**

Table 3 – Operating Costs

* Not used if polishing filter and UV option is added.
**If required. Defoamer consumption may be much higher depending on the amount of detergents and cleaning chemicals that are entering the system.
*** Such as pump seals/bearings, stators, blower oil and filters, etc.

The following additional utilities are required to operate the HIT-CS if the optional polishing filter and UV option is selected:

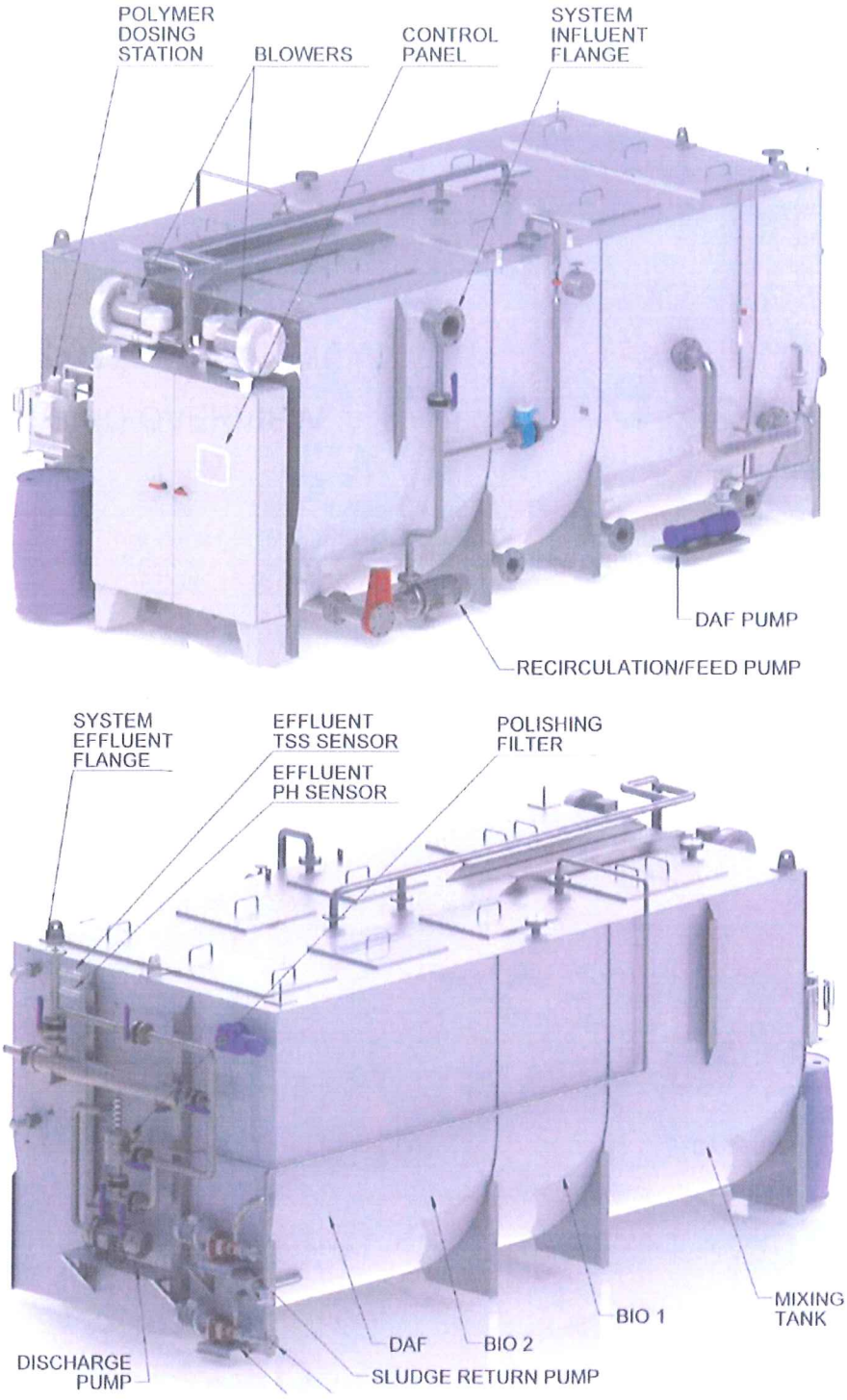
Utility	Consumption @ 100%	Expected Consumption	Unit Cost	Annual Cost
Power (requested)	3.6 kW	**~1.7 kW**	$0.010/kW	$1,489
			Annual Total	**$1,489**

2.3 OPERATIONS AND MAINTENANCE

HIT-CS SYSTEM	Specification
Cleaning and Maintenance Requirement	12 hours/month plus an additional 4 hours/quarter *Typical Tasks:* *- Spray-down of DAF internals (1 hour, 1/week).*
Exposure to Sewage Contaminated Material	No exposure under typical operation.
Operation and Labour Requirement	Average of 8 hours/month. Minimal effort. *Typical Tasks:* *- Replacement of seals in the polishing filter (4 hours, 1/year)* *- Replacement of seals and bearings in pumps (8 hours, 1/two years per unit)* *- Replacement of blower filters (1 hour, 1/year)* *- Replacement of UV lamp and sleeve (4 hours, 1/two years) – IF EQUIPPED*

2.4 HIT-CS SKID OVERVIEW

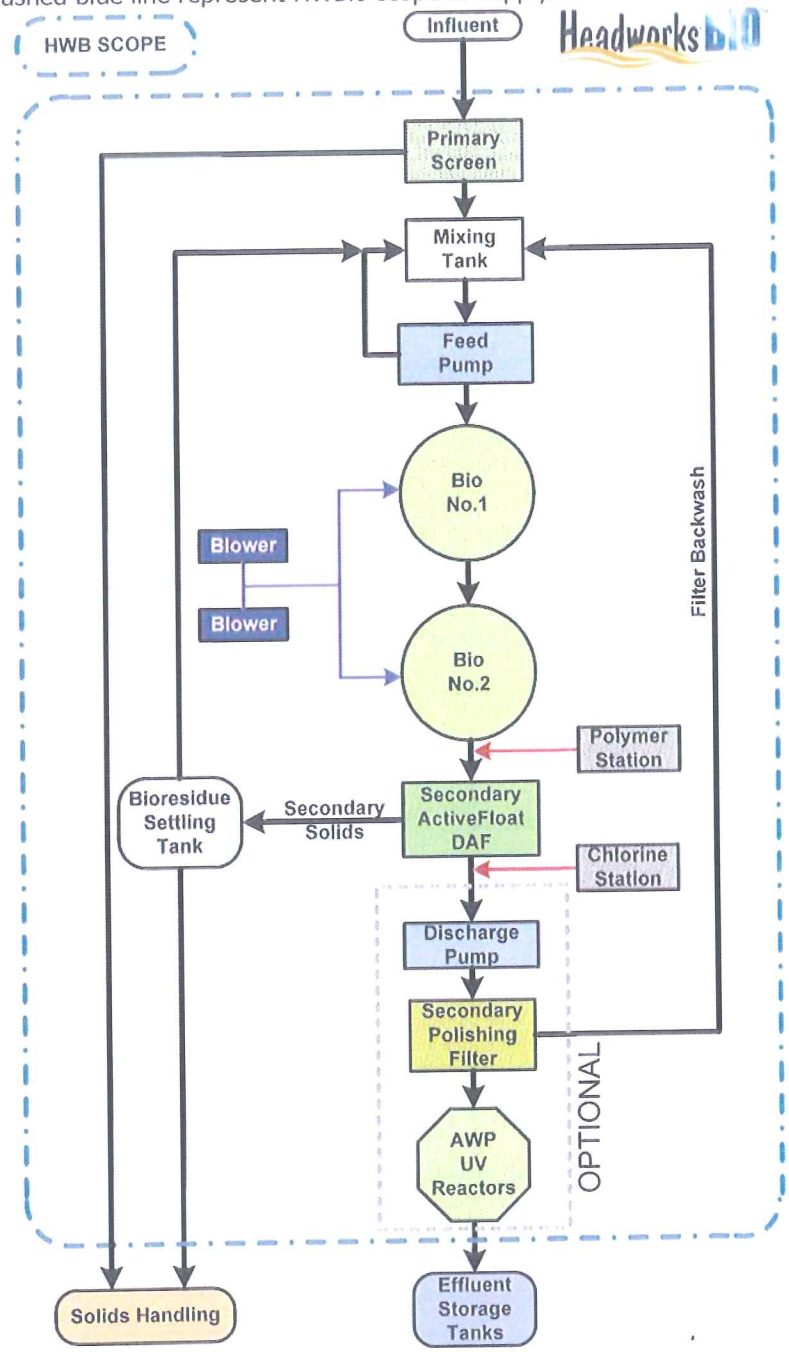
The general arrangement of the system skid is shown below.



2.5 PROCESS DIAGRAM (SIMPLIFIED)

A simplified general process arrangement of these components and the waste streams processed is shown in Figure 1.

Items within the dashed blue line represent HWBio scope of supply.



The following sections describe each stage of the system and general scope of supply.

2.6 PRIMARY SCREENING

Collection and blending of the influent waste streams in a mixing tank or equalizing the flow and load to the HWBio HIT-CS is recommended. The HWBio HIT-CS is provided with a cutoff contact to the lift station discharge pumps (by others).

A inclined bar screen is provided to remove coarse solids from the influent and is supplied as follows:

Description	Quantity	Supply	Notes
Bar Screen	1	HWBio	Sidehill type, manual cleaning
Flow meter	1	HWBio	On inlet to Bioreactor #1

Items not included but available at additional cost:
- Primary drum screen (for separation of plastics from bioresidue)

2.7 MIXING/EQUALIZATION

Collection and blending of the influent waste streams in a mixing tank or equalizing the flow and load to the bioreactors is an important unit process in the HWBio HIT-CS. The HWBio HIT-CS is provided with a cutoff contact to the lift station discharge pumps (by others).

A recirculation/feed macerating pump continuously recirculates the mixing tank and feeds the bioreactor.

The integrated mixing tank design is supplied as follows:

Description	Quantity	Supply	Notes
Mixing Tank	1	HWBio	7.73 m^3 (usable) tank. 2m water height (2.3m overall)
Bar Screen	1	HWBio	Sidehill type, manual cleaning
Recirculation/Feed Pump	1	HWBio	
Flow meter and control valve	1	HWBio	On inlet to Bioreactor #1
Level Sensors / Switches	Lot	HWBio	Single dosing pump

Items not included but available at additional cost:
- Primary drum screen (for separation of plastics from bioresidue)
- Foam sensors
- Redundant Recirculation/Feed pump

2.8 ACTIVECELL® BIOREACTORS

The biological process is the ActiveCell® biofilm process which employs Headwork's proprietary mobile biofilm carriers (ActiveCell920™) to support a very high concentration of attached biomass. ActiveCell® is a self-sustaining biological process, and operation is simplified due to the self-regulating nature of a fixed film system.

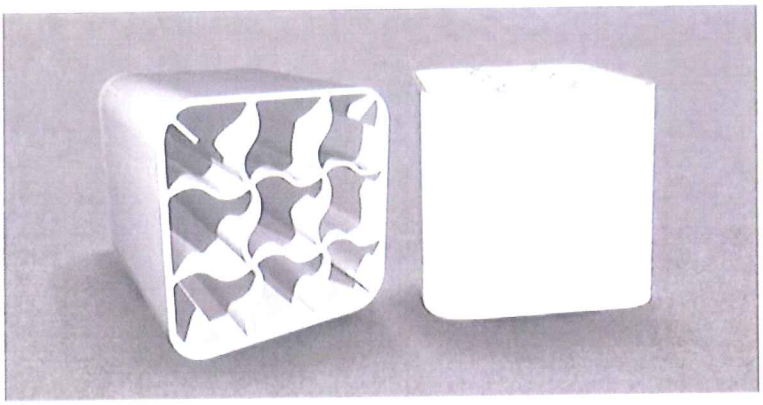


Figure 1: Media Carrier ActiveCell920

The integrated bioreactor design is supplied as follows:

Description	Quantity	Supply	Notes
Bioreactor Tanks	2	HWBio	4.4 m^3 (usable) tanks, 2m water height (2.3m overall)
Air Blower	2	HWBio	1 duty, 1 standby, each with 100% capacity.
Aeration Grid	2	HWBio	SS grid coarse bubble grid.
Retention Screens	5	HWBio	2 effluent, 2 drain screens, 1 overflow
ActiveCell 920	6 m^3	HWBio	50% Fill Fraction
Defoaming Station	1	HWBio	Single dosing pump
Level Sensors / Switches	Lot	HWBio	
Handheld DO sensor	1	HWBio	For periodic verification of DO levels

Items not included but available at additional cost:

- Foam sensors

2.9 SECONDARY DAF

Secondary solids separation is necessary to remove the sloughed biomass following the ActiveCell® process. Secondary solids separation is accomplished via the ActiveFloat™ DAF, specifically designed for use with the ActiveCell biological process.

The secondary DAF design is supplied as follows:

Description	Quantity	Supply	Notes
ActiveFloat DAF	1	HWBio	Integrated design
Recirculation Pump	1	HWBio	SS316 Impeller
Bio-residue Pumps	2	HWBio	
Polymer Preparation Station	1	HWBio	100% capacity, uses commercially available liquid polymer (38% solution).

Items not included but available at additional cost:

- Redundant Recirculation pump
- Redundant Polymer preparation station

2.10 POLISHING FILTER - OPTIONAL

The tertiary polishing system provides a "positive barrier" to ensure that the total suspended solids discharge requirement is met in higher than normal loading events. The polishing filter is a compact filter system with an automated backwash cycle. Filter material is 316SS. The filters are hydraulically fed by the discharge pumps after the post-DAF, with sufficient residual pressure to pass through the UV system and to discharge.

The polishing filter design can be supplied as follows:

Description	Quantity	Supply	Notes
Discharge Pump	1	HWBio	VFD Controlled
Polishing Filter Unit	1	HWBio	SS304, automatic backwash.

Items not included but available at additional cost:

- Redundant Discharge pump
- Redundant Polishing Filter Unit

2.11 CHLORINE DISINFECTION

Chlorine is used to disinfect the treated wastewater with standard 12% chlorine solution in the base option.

The Chlorine disinfection design is supplied as follows:

Description	Quantity	Supply	Notes
Chlorine Dosing Pump	1	HWBio	100% Capacity

Items not included but available at additional cost:
- Redundant Chlorine pump
- TSS Sensor / Transmitter
- pH Sensor / Transmitter

2.12 UV DISINFECTION - OPTIONAL

Ultra Violet (UV) light is used to disinfect the treated wastewater with high intensity low pressure multi-lamp UV reactors. There are no cleaning chemicals required for the UV Disinfection units since they equipped with automated wiper mechanisms that clean the quartz sleeves automatically. The multiple-lamp configuration provides a suitable level of redundancy within the unit.

The UV design can be supplied as follows:

Description	Quantity	Supply	Notes
UV Reactor and Panel	1	HWBio	Low pressure, continuous duty UV.
TSS Sensor / Transmitter	1	HWBio	
pH Sensor / Transmitter	1	HWBio	

Items not included but available at additional cost:
- Redundant UV Reactor

2.13 BIO-RESIDUE STORAGE TANK

Bio-residue is generated by the secondary DAF, and is transferred to the bio-residue settling tank. The settling tank allows the suprenant to be returned to the mixing tank along with some solids, and the sludge is settled to increase the solids content to ~8% dwt.

The bioresidue tank design is supplied as follows:

Description	Quantity	Supply	Notes
Bio-residue Settling Tank	1	HWBio	1 m^3 (usable) tank.
Level Sensors / Switches	Lot	HWBio	

2.14 CONTROL SYSTEMS DESCRIPTION

The control system design is supplied as follows:

Description	Quantity	Supply	Notes
MCC / Control Panel	1	HWBio	▪ Includes 1 local HMI ▪ NEMA 12/4 Panel Construction (NEMA 4X SS304 Panel Construction is optional) ▪ HOA (Hand/Off/Auto) switches for all equipment on skid located in the panels.
PLC	1	HWBio	
PLC and HMI Software	1	HWBio	
Integration with other systems, equipment and monitoring	1	By Others	
Interface Features	LOT	HWBio	▪ Plant/process related graphics ▪ Alarm handling (system and process alarms) ▪ Trend displays (flow rates, sludge production, etc) ▪ Hour counters ▪ Parameter settings ▪ Manual and automatic operation of automated motors and valves ▪ Storage of logged data for download via HWBio remote monitoring system (optional)

2.15 MISCELLANEOUS

Description	Quantity	Supply	Notes
Warranty	1 year	HWBio	
2 Year Spares	LOT	Not Included	Consumable (2 years) spares can be provided per HWB supplied list.
Startup Chemicals	Optional	Not Included	Defoamer, polymer, chlorine.
HIT-CS Unit Ventilation Fan(s)	Optional	Not Included	Corrosion resistant, SS316 construction, supplied loose for installation.
Wastewater Treatment Room Ventilation	Lot	By Others	
Gas Monitoring System	Lot	By Others	System to continuously measure H_2S with alarm.

2.17 COMMISSIONING

HWBio can supply technical personal and equipment to achieve project completion (as defined in **Section 1.4**), provided:

- Installation is approved by HWBio representative.
- All pre-requirements for commissioning have been met. HWBio to provide list of requirements.
- In the case of delays or interruptions not caused by HWBio, Purchaser shall pay living and traveling expenses of HWBio personnel visiting the site and in addition shall pay the then current per diem rate per man day or fraction thereof of such personnel. Nevertheless, such personnel will, on request, work with Purchaser, at Purchasers expense, in making necessary corrections to accommodate the changed conditions.

HWBio can conduct the commissioning of the system as follows:

Description	Estimated Time	Supply	Notes
Equipment Commissioning	Included in Delivery	HWBio	All interconnections and equipment are tested and started
System Startup	1 - 3 weeks	HWBio	Startup and tuning with wastewater
Compliance Testing	TBD, per local regulations	Others	3rd Party evaluation of the HIT-CS system performance. Samples taken as required by local regulations.
Signoff	1 day	ALL Parties	

Onsite time rates, not including daily travel expenses:

Technician:	$ 850/day
Engineer:	$ 1250/day
Programmer:	$ 1250/day
Travel to/from site:	At cost+10%

2.18 STAFF TRAINING

Staff training is available during the commissioning and start-up period if commissioning services are purchased. Typical training takes place over one week with each day scheduled to suit the staff schedule and include a couple hours with the appropriate people.

Training sessions are typically split up into ~2 hour classes as follows:

1) Biology 101: Using PowerPoint presentation, the objective is to present why we treat wastewater, how the bioreactors work (and the biomass carriers, or "macaronis"), and what conditions are favourable for the bioreactors (pH levels, DO, soluble BOD, etc.)
2) System overview – Health and safety: Wastewater precautions, UV lamp disposal and UV light, clean-up of spilled polymer, defoamer handling, H_2S dangers and precautions.
3) Component description and walk through system: While in the WWTP room, each component is explained in detail and what happens at each stage from a process point of view. It is also explained how each piece of equipment performs this task.
4) HMI and system operation; Navigating the HMI screens, review of the critical information and settings on each page. There is an emphasis on daily operation and checks, system logs, re-starting from a power failure, etc.
5) Maintenance schedule
6) Review, questions, and completion certificates given out.

2.19 DESIGN AND DELIVERY DOCUMENTATION

HWBio will provide relevant design material including project schedule to clients plans, detailed process & instrumentation drawings (P&ID), and electrical single-line and loop drawings. An electronic copy of the operating and maintenance documentation, customer drawings, and training material will be provided. Any updates to the O&M after delivery will be provided in electronic form only.

In addition two (2) complete hard copy sets of English operating and maintenance documentation for all equipment are included with the system.

2.20 AFTER SALES SERVICE

With offices in Houston (USA), Victoria (Canada), London (England), Dubai (UAE) and Bangalore (India), after sales service by HWBio trained technicians is available from HWBio anywhere in the world by contacting the service department in Houston:

1.877.647.6667 or +1.713.647.6667

Response time to the vessel will be within 24 hrs.

2.21 SPARE PARTS

HWBio fully supports all products sold and stands ready at all times to coordinate with suppliers and manufacturers for spare parts support.

After sales spare parts are available from HWBio anywhere in the world by contacting the service department in Houston:

1.877.647.6667 or +1.713.647.6667

3.0 SCOPE OF SUPPLY BY CUSTOMER/OTHERS

- Scope of supply by others as identified in Section 2.
- Equipment storage and duties.
- All civil works; including: tanks, pads, foundations, demolition and structural modification to any existing structures
- Equipment unloading and installing in place.
- Field assembly or installation of all HWBio-supplied loose equipment.
- All piping, valves, structural support, etc. to and from equipment skid(s).
- All power and wiring to and from equipment skid(s).
- Integration of the HIT-CS unit with other automation systems.
- All influent stream collection and delivery to the HIT-CS (lift stations, etc).
- Service (cold) water to indicated locations.
- Safety related equipment like fire extinguishers, safety shower, breathing apparatus, eye wash stations, etc.
- Secondary containment (if required) for various chemical reagents or equipment.
- Sludge storage, handling and disposal.
- Power supply and emergency power supply.
- Venting from HIT-CS unit.
- Additional ventilation to WWTP room or area, if required for heat balance and/or air supply.
- Internet connection (wireless, if available) at no charge to HWBio personnel while onsite.
- Electronic copies of all applicable specifications outlined in the RFP at no charge to HWBio.
- Sampling and analysis of effluent samples for compliance testing
- Any item not listed in Sections 1 and 2.

Pollution Control Systems, Inc

5827 Happy Hollow Rd. Suite 1-B
Milford, OH 45150-1830
Tel: (513) 831-1165 Fax: (513) 965-4812
E-mail: Polconsys@aol.com
www.PollutionControlSystem.com

April 23, 2014

Hickory Hills Water and Sewer

Quote Number: PCS-14047

I. Pollution Control Systems, Inc. (PCS) is pleased to provide the following equipment for your consideration.

One (1) Model PCS-15-ESC prefabricated carbon steel packaged wastewater treatment plant. The package plant will use the extended aeration version of the activated sludge process and will be capable of treating 15,000 GPD with 30 pounds of BOD wastewater down to 30 mg/l.

A. General Specifications

Equalization Chamber Volume:	4950 gallons
Sludge Holding Chamber Volume:	3500 gallons
Aeration Chamber Volume:	15,050 gallons
Clarifier Chamber Volume:	2680 gallons
Chlorine Contact Chamber Volume:	411 gallons

Overall Length/Width/Height: 46' 3"/ 10'- 0" / 11'-0"
Shipping Weight: 33,100 lbs. (approximate)

B. Materials of Construction

All tank vessels will be fabricated of 1/4" structural grade ASTM designationA-36 steel plates joined by arc welding with fillets of adequate section for the joint involved. All walls will be continuous and watertight and will be supported by structural reinforcing members where required. Fabrication and erection would conform to the appropriate requirements of "AISC Specification for Buildings". Connections will conform to the requirements of the American Welding Society's Code and will develop the full strength of the member.

All piping within the plant will be Schedule 40 steel pipe except as may be noted on other sections of the specifications. All vessel surfaces to be painted will be properly prepared in a workmanlike manner so as to obtain a smooth, clean and

dry surface. All rust, dust and mill scale, as well as other extraneous matter, will be removed by means of cleaning by a SP-6 and SP-10 sandblast . All interior and exterior vessel surfaces will be painted with epoxy coal tar.

C. Equalization Chamber

A duplex set of equalization pumps will be furnished and installed within the chamber. The pumps will be rated 1/2 HP, 230 volt, 3 phase, and 60 cycle. An emergency overflow will be provided between the equalization and aeration chamber.

Flow control will be accomplished by pumping plant influent to a flow control box containing an adjustable overflow broad weir and two 11 degree V-notch discharge weir. The overflow broad weir will be adjustable so that a measured amount of pumped influent will discharge through the V-notch weir to the aeration chamber, while overflowing the remaining pumped influent back into the equalization chamber.

The pumps and blower/motor unit will be regulated by liquid level sensors. Controls will be provided in the plant control panel.

D. Sludge Holding Chamber

The chamber will be of the aerated type. Diffused air will be supplied by the plant blower system supplying 30 CFM of air per 1000 cubic feet of volume. The diffusers will be located parallel to and near the bottom of the tank. All piping and valves within the chamber will be factory installed.

E. Aeration Chamber

The aeration chamber will be of sufficient capacity to provide a minimum of 24 hours retention of the average daily flow, and/or maximum loading of 15 pounds of BOD5 per 1,000 cubic feet of aeration tank volume. The vessels will be shaped on each side to prevent scum and froth accumulation. To insure maximum retention and eliminate short circuiting of raw sewage, the aeration chamber will be constructed with air diffusers placed longitudinally along one side of the chamber so as to, in conjunction with the flow control baffles, enhance the spiral rotation of the chamber contents. To insure adequate circulation velocity, the proportion of chamber width to depth, in the direction of rotation, will not exceed 1.33 to 1. The velocity of rotation will be sufficient to scour the chamber bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

F. Clarifier Chamber

The clarifier chamber will be of such size as to provide a minimum of 4 hours retention, based upon the same design flow rates governing the aeration chamber, but including adjustment of such rates to compensate for runoff periods, and will have proper baffling to prevent short circuiting and to provide maximum uniform retention.

The total settling volume will include the volume of the upper 1/3 of the sludge hopper or hoppers. Flat bottom area of hopper will in no case be greater than one square foot. The slope of the hopper walls will not be less than 1.7 vertical to 1.0 horizontal.

Settled sludge will be returned from the clarifier sludge hopper to the aeration chamber by the positive sludge return system, consisting of one or more airlift pumps. The clarifier effluent will pass over the edge of the baffled effluent weir into the effluent trough and then out of the chamber. The effluent weir trough will be equipped with adjustment to permit precise leveling of the serrated weir after plant installation.

G. Sludge Recirculation System

There will be installed within the clarifier chamber a positive sludge recirculation system consisting of one (1) 2 inch diameter airlift sludge return assemblies per hopper meeting the following specifications: The airlift pump will have the recirculation capacity ranging from 0% to 150% of the design flow. The air line supplying air to the pump will be equipped with a cock valve to vary the amount of air supplied to each pump, thus varying the capacity of the pump. The airlift pump will be firmly supported and will be equipped with a clean-out plug to allow for easy cleaning and maintenance.

H Scum Recirculation System

There will be installed within each clarifier chamber a positive scum and skimming recirculation system consisting of one (1) 2" diameter airlift skimming device meeting the following specifications: The skimming device will be of the positive airlift pump type, located in a position to skim and return floating material to the aeration chamber. The air line supplying air to the skimming device will be equipped with a valve to regulate the rate of return. The scum intake will be equipped with an adjustment assembly which will enable exact positioning of the skimmer at water level.

I Air Diffusion System

An air distribution manifold consisting of a rectangular hollow steel tube is installed along the entire length of the plant. The manifold feed a series of assemblies.

Each diffuser drop assembly will be equipped with an air regulation and/or shut-off cock valve, union and an air diffuser header. The diffusers will be parallel to and near the base of the vessels side wall, at an elevation which will provide the optimum diffusion and mixing.

Each Hydro-Chek Model DP-75 air diffuser will be constructed of Celcon plastic with a removable and replaceable neoprene air check diaphragm. It will be designed to handle a wide range of air flow. The oxygen transfer capacity of each diffuser will be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements.

J Blower/Motor Units

Two (2) positive displacement blower/motor units will be supplied. The blower/motors shall be mounted at a remote location. The blower/motor unit (s) shall be capable of providing a minimum of 2100 cubic feet of air per pound of BOD5 plant loading.

The blowers will be capable of delivering 68 CFM when operating at 5 PSI. The motor will be 2 HP, ODP type, for operation on 230 volt, 3 phase, 60 cycle service.

The blower/motor will be mounted to a reinforced molded fiberglass base, with a molded fiberglass weatherproof hood.

The lockable fiberglass hood is designed for easy access to service the unit. It will be equipped with locking facilities.

The blower motor base and enclosures will be mounted on vibration dampeners. The motor will be mounted on an adjustable mounting base. The blower will be fitted with a dry type filter/silencer at the air intake. Each blower discharge will be fitted with a check valve, and a flexible rubber discharge coupling.

For purposes of determining the blower performance and/or diffuser condition, a pressure relief valve and pressure gauge will be mounted in the air manifold.

K. Central Control Panel

A central control system installed within a weatherproof enclosure will be provided.

The enclosures will be NEMA 4X. The electrical controls will consist of magnetic starters, program timers and switches necessary to automatically control all electro-mechanical components on the treatment system.

The blower motors will be controlled by M-O-A selector switches and magnetic starters in conjunction with the programmable timer. The programmable timers will have the capability to operate the aeration system as required by the variation in the daily flowrate. All electrical equipment and circuitry will be protected by properly sized circuit breakers and fuses. All duplex or standby equipment will be designed so that it may be operated by devices by the control system. The enclosure will be wired for 230 volt, 3 phase, 3 wire incoming power.

L Service Walkways

A service walkway will be provided to service the plant equipment. Grating panels will each consist of one piece skid resistant steel plank. All grating panels will be constructed of 18 gauge, galvanized sheet steel. Each grating panel has a standard 9" surface width and a 2 ½ " rib depth. Each panel will be so supported as to have a safe uniform load carrying capacity of 80 pounds per square foot. The service walkways will can also be provided with handrails for and additional cost.

M Delivery Schedule

Equipment drawings will be submitted 1-2 weeks after the receipt and approval of the purchase order. The equipment would be delivered 8-12 weeks after the receipt of approved submittals.

N. **Sell Price:** $106,888.00 plus taxes and freight F.O.B. Factory
If a 16,400 GPD system is needed the cost would be $112,650.00

Add for field service: $500.00 per day plus all travel expenses

- Payment Terms: 30% with order, balance due net before delivery. Subject to continuing credit approval by PCS.
- All taxes are the responsibility of the purchaser.
- Installation of all tankage, media, field piping and wiring are the responsibility of the purchaser.
- A Purchase Order would be subject to the included Payment Terms and Conditions and the approval of an Officer of PCS.
- Cost increases, if any, will be based on cost increases incurred by PCS.
- PCS takes exception and excludes any equipment and services not stated on this document.
- This document is valid for 30 days.
- This document includes attached terms and conditions

PROPOSED BY:

_____
Tim Poynter
Pollution Control Systems, Inc.

ACCEPTED BY:

_____ date:_____
An Authorized Officer
of the Purchasing Entity

FRONTIER™
ENVIRONMENTAL TECHNOLOGY

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Rolla, MO 65401
(573) 612-1123 www.FrontierET.com

Initial Proposal

Hickory Hills Subdivision, California, MO

Deployable Baffled Bioreactor (dBBR) for Sewage Treatment

April 2, 2014

Site Visit:

On March 31, 2014 Dr. Jianmin Wang with Frontier Environmental Technology met with Missouri Public Service Commission (PSC) staff at the lagoon site that is currently used to treat wastewater from Hickory Hills/Temple Terrace subdivisions. The lagoon serves approximately 50 houses. Based on the initial discussion with officials from the PSC, the lagoon has been used since the 1970s, and has never been cleaned. The initial observation indicated that the facultative style lagoon was filled with sludge, and the water depth at the lagoon edge is only a few inches. The effluent from the lagoon (Outfall #1) and the water within the creek where the lagoon is discharged have significant turbidity and green algae growth. According to the existing information, this lagoon has been out of compliance for a long time. No permit has been issued since the expiration date of the last one on March 18, 2009, Permit No. MO-0082121.

Recommendation:

Continued allowance of unpermitted discharge from this lagoon by the Missouri Department of Natural Resources (MDNR) is unlikely. Even if the lagoon is dried either naturally or artificially, the small capacity of the lagoon makes future usability unlikely. In addition, re-permitting the lagoon as a treatment facility by MDNR is questionable due to the poor performance of this type of facility, especially during the winter time.

Frontier's deployable baffled bioreactor (dBBR) is recommended as a solution. This system has electronic controls that make the unit significantly automated and has low maintenance costs compared to other treatment options. The estimated maintenance time per week is less than one hour. The dBBR effluent quality significantly exceeds the federal standard applicable to many large facilities (BOD_5 < 30 mg/L, and SS < 30 mg/L, without any total nitrogen requirement). The dBBR also features UV disinfection, which further exceeds the disinfection practices at many small system treatment facilities. For this application, the power usage is approximately 2 kW, with the total power cost per month estimated to be $150, making the electrical operation cost very low.

The inflow alternatives of how the dBBR is fed influent water from the lagoon, will influence the ability of the lagoon to dry. By treating the raw sewage from the collecting sewer and considering MDNR allows dBBR liquid effluent to discharge into the receiving stream, the lagoon could be dried through natural evaporation and cleaned. The dried sludge from the lagoon could be land-applied if MDNR permits. In the future the lagoon can be used as the sludge drying bed if the current sludge is removed by some means, to store and dry the sludge from the dBBR. It is estimated that the dBBR will generate approximately 100 gallons of stabilized sludge each day based on current population sewage generation data.

Cost:

The rental cost for the dBBR is $1800 per month with a minimal lease period of 18 months. This price will include delivery, installation, initial start up and training, technical support through the phone, and up to 2 site visits from Frontier per year. After delivery, Frontier personnel will come to the site to hook up power, the intake and discharge lines, and initially start the dBBR as part of the installation. The site preparation and power outlet installation will be the responsibility of the customer.

If the customer rents the dBBR for more than 6 years, only the first 6-year rental fee will be collected by Frontier ($129,600). After that the dBBR will automatically be the property of the customer (rent-to-own option).

The dBBR effluent will be regularly monitored per MDNR requirement at the cost of the customer. If the long term data convince MDNR that the dBBR can be permitted as a permanent installation, and the customer decides to purchase the dBBR within the initial leasing period, a discount price of $100,000 will be requested as the purchase price of the dBBR, and the rental fee previously paid to Frontier will be considered as part of the purchase price (purchase option).

The $100,000 purchase price reflects a sharp discount to the market price of related systems since Frontier is interested in deploying this unit to more users at this stage of the business, as an advertisement and research tool to further disseminate research data. In comparison, the popular recirculating sand filter technology would cost this community approximately $200,000 and a large field (which is not particularly feasible at this site), based on Frontier's estimation. For example, Dr. Wang lives in a small community that has 16 homes. The cost to re-build the sand filter (mostly media replacement after 10 years) cost this community about $40,000. The effluent from the sand filter may not meet the federal discharge limits, therefore is worse than the effluent from dBBR.

Site Requirements (customer expense):

The user will be responsible for site preparation. The following items should be included:

1. Power - a standard single phase power meter at 220 vac, with the peak power capacity of 5 kW.

2. A 1000 gallon pump tank below grade, and all sewage should be directed to this pump tank (may involve another pump tank and pump so that all sewage is pumped to this 1000 gallon tank)..

3. If the users do not have septic tanks, or do not have a screen within their septic tanks, a fine screen will be needed before the sewage is collected by the 1000-gallon pump tank. The customer will be responsible for regularly clean this fine screen.

4. The dBBR should be set on a leveled gravel base, and the effluent and sludge discharge lines should naturally slope towards the outlet below the freezing line. This is to prevent water deposition and freezing within the pipe in winter.