

SECTION 44 42 23.07

INCLINED PLATE CLARIFIERS - PRE-PURCHASE SPECIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the covered flash mix tanks, flocculation tanks and inclined plate clarifier (IPC) system, including mixers and associated control panels as shown on the Contract Drawings. Refer to the attached Process and Instrumentation Drawing (P&ID) for an example schematic of the system. The space allocated for the system is as shown on the enclosed General Arrangement Plan. The general scope of the work is to furnish, deliver, and provide start-up assistance for the IPC system, so that a complete system successfully performs as designed
- B. The information provided is based upon sixteen frac tank clarifier units. The type, size and quantity of these IPC units are what were used to develop the design basis for this project. However, the intent is to specify performance-based equipment. Quantities, sizes and types are all subject to change based upon the equipment manufacturer's compliance to the performance criteria described herein. Manufacturers shall consider alternate equipment, as needed, to optimize the design to propose more cost effective alternatives. As such, traditional IPC units, or other differences will be acceptable and will be considered. The IPC units shall be kept to Manufacturer's standard offerings, as much as possible. Any requests in this RFP which, in the Vendor's opinion, impart unnecessary costs or unnecessarily differ from Manufacturer's standard offerings shall be clearly identified in Bidder's proposal
- C. The IPC system shall be designed to precipitate dissolved metals and remove total suspended solids (TSS). A 20 percent solution of aluminum sulfate (alum) will be added to the flash mix tank to attain the desired solution concentration with the IPC feed water. Chemical storage and feed equipment are provided by others.
- D. The system is planned to be installed (by others) inside a structure at the Owner's facility and operated approximately seven months out of each year (April 15<sup>th</sup> through November 15<sup>th</sup>) for four years beginning in the year 2012. In addition to the short-term (4-year) treatment trains, a long-term treatment train (which includes an IPC component) will also be operated at the same Owner's facility. This long-term treatment train will be designed to treat a much lower flow rate. The long-term IPC unit will treat the same water (contains the same constituents at the same concentrations as shown on Table 2) but at a maximum flow rate of 500 gpm, and for an expected operational lifespan of 20 years. The long-term unit(s) shall be within a heated building. The Manufacturer shall select equipment such that an appropriately-sized IPC unit(s) is shared between the "short-term" and the "long-term" treatment trains (i.e. serving as a part of the short-term IPC system during the seven months of "summer" operation and then used as part of the lower-flow, long-term system during the winter months for the first four years and year-round after year 4).

Even though the short-term equipment will be located inside a structure, the structure is not heated and therefore the units are subject to freezing during the non-operational

winter months (but after they have been drained). Manufacturer shall identify required means, methods and procedures, if any, needed to prepare units for storage over the winter months.

- E. Start-up services shall be provided. Provide a factory representative for up to 40 hours of field start-up assistance at the Owner's facility.
- F. The equipment shall fit within the footprint allocated as shown on the General Arrangement Drawing GA-01 provided herein. The clarifier system shall be serviceable, including removal of plates and mixers, within the building's clear height. There is no lifting mechanism proposed above the IPC. Manufacturer shall identify any operational or maintenance clearances required with the Bid. The equipment will need to fit through the building's overhead door which has dimensions of 14 feet x 18 feet. The building will be new construction. Manufacturer shall advise if a larger overhead door opening is required. Manufacturer is to confirm that the equipment can enter the building via the overhead door and be moved to the positions shown on drawing GA-01. The clear height at the building eave is estimated at 18'-0". At the planned location of the north end of the IPC's, the clear height is approximately 20'-6". Additional clear height is available between roof support members.

## 1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
  - 1. American Society of Mechanical Engineers (ASME)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. American National Standards Institute (ANSI)
  - 4. NACE International
  - 5. National Electric Code (NEC)

## 1.3 COORDINATION REQUIREMENTS

- A. Coordinate delivery with project schedule as maintained by Construction Supervisor.
- B. Coordinate with Engineer and Control System Integrator for controls integration.
- C. Bid Review Meeting: Following the Engineer's review of the proposal, a bid review meeting will be held in Syracuse, NY.
- D. Scheduling: The IPC system must be operational before April 2012. Refer to RFP Section IV "Information" Schedule Milestones for schedule dates.

## 1.4 SUBMITTALS

- A. Prepare and provide drawings and submittals specific to this system in accordance with the requirements shown on Table 1 (provided as Appendix A to this specification).

- B. Product Data Submittals: “Catalog cuts” and spec sheets included as submittals shall be marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Submittal data for motors shall be in accordance with the attached Specification 26 05 13 “Electric Motors.”
- D. Operation and Maintenance Data
  - 1. Presentation of Submittals
    - a. Operational and Maintenance Manuals (3 hard copies each in a 3-ring binder and 1 electronic copy). Owner’s name, address, equipment serial numbers, and model numbers shall be clearly identified on the cover. Include Manufacturer and local service representative contact information, including phone numbers and e-mail addresses, on the cover.
    - b. Each manual shall include a table of contents, an index, and sequential section dividers separating equipment information into subsections. Each manual shall incorporate, at a minimum, the following: field installation instructions, written operation description of the equipment and corresponding components, starting and stopping procedures, routine maintenance procedures, procedures for protecting the equipment during short-term and long-term downtime, schedules, parts lists, troubleshooting topics, illustrations and diagrams and safety instructions for operating personnel.
    - c. Each manual shall include any other information that is required by maintenance personnel for proper operation and maintenance.
    - d. Electronic files of the complete operation and maintenance manual are to be provided on CD.

## 1.5 QUALITY ASSURANCE

- A. Qualifications
  - 1. Manufacturer to provide description of relevant past experience providing IPC systems. Especially of interest is past experience with projects where IPC units were used to clarify water from dredging operations or surface water clean-up projects. Manufacturer shall provide a list of references and contact information.
  - 2. Seismic Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing structural and seismic engineering services, including the design of seismic restraints.
  - 3. Owner or Owner’s Representative will be conducting scheduled visits to Manufacturer’s facilities during fabrication and/or Manufacturer’s shop testing procedures.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. As required, disassemble and deliver IPC system in the minimum number of pieces.
- B. Site access is via a one-way access road, parts of which are steeply graded. Equipment Manufacturer to ensure adequate means of delivery is provided to enable delivery to the site. A site visit prior to delivery is recommended.
- C. Materials and equipment shall be boxed, crated or otherwise completely protected during shipment, delivery, storage and handling. Such boxes, crates or protection shall be clearly labeled with the Manufacturer's and Owner's name, site address, project equipment tag numbers, brand or model.
- D. Ship, deliver, store and handle to prevent damage and in accordance with Manufacturer's written instructions. Provide factory-installed lifting provisions.
- E. The IPC system shall be delivered freight on board (FOB) to the project site.
- F. Manufacturer's storage requirements shall be provided. Units will be stored outside and unprotected from weather events for a prolonged period of time prior to installation. Manufacturer shall provide adequate packaging and protection so as to prevent damage under these conditions.
- G. Off-loading of equipment delivered to the site is by Others.

## 1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Purchase Order General Terms and Conditions, and the Supplemental Terms and Conditions.
- B. The standard warranty duration shall be from delivery date of units to one year after start-up. Start-up is defined as the initiation of operational commissioning (assume start-up to begin on April 30, 2012). Provide with the Bid the cost adder to extend the warranty to 42 months after start-up, as described in the Bid Tab document. The standard warranty shall include parts and labor for all supplied items, including but not limited to, equipment, controls, and coating system.

## 1.8 PERFORMANCE GUARANTEE

- A. Performance shall be warrantied and proven. Performance shall be demonstrated continuously for four weeks after start-up under full operating conditions. Performance testing is by others. IPC Manufacturer's Representative shall be present at the site to witness a portion of the performance testing, per Section 3.5.B.2, and provide input as requested. The IPC system shall be designed to achieve effluent concentrations, given the maximum influent concentrations provided on Table 2. Performance shall be warrantied over the entire range of flow rates. Anticipated maximum influent and required effluent concentrations, and minimum and maximum flow rates for the system are provided in Table 2. If the equipment fails to continuously meet this effluent quality, the Manufacturer shall, at no additional cost to the Owner or Buyer, provide and install replacement equipment, parts, and labor (including cost of return trips to the site as

needed), to correct demonstrated performance deficiencies as needed to achieve the required performance.

- B. Process: the provided system shall achieve an effluent TSS concentration of 10 mg/L or less. The design value for TSS concentration of the influent water is as shown on Table 2. If the influent TSS concentration exceeds the design value, than 95% removal is required. If the equipment fails to continuously meet this effluent quality, the Manufacturer shall, at no additional cost to the Owner or Buyer, provide and install additional or replacement equipment, parts and labor to correct demonstrated performance deficiencies as needed to achieve the required performance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The following Manufacturers are named to establish a standard of quality necessary for the Project:
1. Unipure
  2. Graver
  3. Parkson
  4. Siemens
  5. WesTech
  6. Or approved equal

### 2.2 PERFORMANCE REQUIREMENTS

- A. The influent water characteristics shall be as shown in Table 2 (see Appendix B to this specification).
- B. The flash mix tank criteria shall be as follows:

Application	Chemical addition
Number of Flash Mix Tanks	Manufacturer to identify
Alum Dosage (Note 1)	20 mg/L
Flash Mix Tank Residence Time, Minimum	1 – 5 minutes, Manufacturer to confirm
Flash Mix Tank Mixer, Motor (Note 1)	Manufacturer to provide HP
Flash Mix Tank Mixer, Type	Flange mounted, constant speed (Note 1).

Note 1: Motors shall be in accordance with requirements provided in Appendices.

- C. The flocculation tank criteria shall be as follows:

Application	Chemical precipitation and solids coagulation
Number of Flocculation Tanks	Manufacturer to identify
Flocculation Tank Residence Time, Minimum	5 - 15 minutes, Manufacturer to confirm
Flocculation Tank Mixer, Motor (Note 1)	Manufacturer to provide HP

Flocculation Tank Mixer, Type	Flange mounted, variable speed (Note 1). VFD by Others.
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Note 1: Motors shall be in accordance with requirements provided in Appendices. Mixer VFD's to be provided by Others.

D. The IPC criteria shall be as follows:

Application	Gravity settling of suspended solids
Number of IPC units	Manufacturer to identify
Material of Construction, Tank	Coated carbon steel, FRP or approved alternate MOC, as recommended by the Manufacturer.
Material of Construction, Plates	Manufacturer to provide
Projected Sludge Generation Rate (at Maximum Influent Flow of 5,668 gpm)	708 gpm
Projected Sludge Solids Concentration (as determined during jar testing)	0.85%
Sludge Withdrawal	Intermittent
Hopper Volume, Minimum	Manufacturer to provide
Effective Settling Area per IPC unit, Minimum	Manufacturer to provide
Surface Overflow Rate Range (based on treatability testing)	0.22 to 0.72 gpm/sf
Plate, Angle	Manufacturer to provide
Plate, Size	Manufacturer to provide
Plate Thickness, Minimum	Manufacturer to provide
Plate Perpendicular Spacing, Minimum	Manufacturer to provide
Number of Plates, Minimum	Manufacturer to provide
Weir Type	Flat plate, with gasket
Influent Nozzle Diameter	Manufacturer to provide
Effluent Nozzle Diameter	Manufacturer to provide
Drain/Sludge Hopper Nozzle Diameter	Manufacturer to provide
Hopper Sample Port Nozzle Diameter	¾" diameter
Hopper Sample Port Nozzles, Quantity	Manufacturer to provide

E. The inclined plate clarifier system shall be designed for an effluent TSS concentration of 10 mg/L or less. The design value for TSS concentration of the influent water is as shown on Table 2. If the influent TSS concentration exceeds the design value, than 95% removal is required.

F. The IPC system will receive water from dredged locations with different water makeup and varying settling properties. As such, treatability testing performed showed a range in the acceptable surface overflow rate of 0.22 to 0.72 gpm/sf (refer to attached Treatability Testing Report). However, Manufacturer shall select equipment and revise surface overflow rate as needed. Manufacturer shall size and propose equipment based on achieving the desired effluent TSS concentration, while optimizing equipment sizing to fit in allotted space, and minimizing operational and equipment cost. An important factor in the consideration of the award of the purchase contract for the IPC system will be Manufacturer's design and/or operational strategies, equipment sizing, and other ideas and concepts which place a high importance on maximizing treatment while minimizing

capital and operation/maintenance costs. Vendor shall present any original design alternatives with the Bid.

- G. Although maximum concentrations and flow rates have been identified, actual flow rates and concentrations may be less than what is expected. The first year of operation will establish typical flow rates and concentrations and will be used to fine-tune equipment requirements and operational plans for future years of operation. As such, Vendor shall propose ways to optimize the design of the IPC system. Strategies such as the purchase of a core number of units during year one supplemented by lease of additional units as needed will be entertained. If actual conditions warrant the eventual purchase of these leased units, the accrued lease costs would then be applied towards the purchase of these units. Other strategies, as proposed by the Vendor with the Bid, are encouraged and will be evaluated.
- H. The influent chamber of the inclined plate clarifier shall be designed to ensure even distribution of the influent.
- I. The flash mix compartment shall be separated from the flocculation compartment by a baffle, separate structure, or other acceptable means.
- J. The inclined plate clarifier system shall be designed to operate with the flow in an upward direction. The horizontal spacing of the plates shall be such that the maximum vertical velocity of the flow is at the maximum loading.
- K. The inclined plates shall be removed as a unit or individually for cleaning and/or replacement. Manufacturer to identify weights, clearances required, recommended means of removal, and what additional lifting equipment is required.
- L. The effluent shall be collected by an overflow box or trough with an adjustable weir. The weir shall be leveled to provide an even overflow across each weir plate and shall be positively assured by visual inspection. Design of weir adjustment must be adequate to compensate for differential settlement of the equipment as described herein.
- M. The sludge collection area shall be sufficiently sized to collect sludge generated within the system. A nozzle(s) shall be provided at the bottom of the sludge collection area. A sludge auger is to be provided, if required. The nozzle shall be a connection point to remove sludge under tank hydraulic head from the sludge collection area and designed such that the sludge flows freely to the discharge point without buildup or short-circuiting. Vendor to recommend means and methods of sludge removal and sludge removal rate.
- N. Each of the vessels (flash mix, flocculation, and clarifier) shall be provided with separate, removable, gasketed covers for containment of headspace vapors. Each cover will be provided with pick points for lifting, and will be designed to support live loads of 60 lbs per square foot and super-imposed equipment dead loads of 10 lbs per square foot, plus all mixer loads (i.e. vertical downward load, bending moment, static moment, torque, etc.). OSHA-approved 5,000 lb. tie-off points for personnel shall be included. Each of the covers shall be provided with load-rated viewports as follows:
  - 1. One viewport for Flash Mix
  - 2. One viewport for Flocculation chamber
  - 3. Two viewports for clarifier section; one at each end

Inspection ports shall be equipped with manual quick release latches.

- O. The covered headspaces above the flash mix tank, flocculation tank, and the clarifier shall be vented to atmosphere via adequately sized vent nozzles. The tanks shall be designed for atmospheric service (no pressure) under maximum inflow and outflow conditions.
- P. Electrical classification in the headspace of the tanks and outside of the tanks is designated as ordinary.
- Q. An elevated access platform (constructed with OSHA-compliant materials of construction) shall be provided, as necessary, to enable routine maintenance and cleaning at the top of the covers. Handrails and guardrails shall comply with the attached Specification 05 52 13 – Pipe and Tube Railings. Manufacturer shall provide in the base bid pricing, the cost for a platform and access to that platform at the top of each IPC unit. If possible, (and as shown on the General Arrangement Drawing,) it would be preferred to share platforms between pairs of IPC units such that the quantity of access ladders and platforming is kept to a minimum. For example, in the General Arrangement Drawing equipment shown, eight access ladders would be required in the base bid. Each pair of IPC units could have one (combined) ladder for access to the top of the units and one handrail/guardrail system around the perimeter of both units together.

In addition, provide pricing for staircases in lieu of ladders in the Base Bid. Manufacturer is to indicate (and include pricing for) the recommended platform arrangement being proposed.

Manufacturer shall also provide optional separate pricing to provide gangplank type platforms between the IPC units such that personnel would be able to access all the IPC covers via one platform without the need to climb up and down ladders/stairs for each unit. Gangplanks shall be used in lieu of fixed platforms to be able to absorb lateral and vertical movement between the units. Manufacturer shall consider the most cost efficient way to allow access to the units while allowing for lateral and vertical movement and taking into account ease of operator access. For the optional gangplank type platform, Manufacturer shall adjust the number of access ladders/stairs to three (one on each end of platform and one in central location).

Locations of top nozzles, manways, and equipment or instrumentation located on the tops of tanks shall be grouped together as much as possible, and located outside of main access paths to avoid trip hazards for personnel walking on the access platforms.

- R. The interiors of the clarifier vessels, equipment, piping, coating system, and all wetted ancillaries shall be selected by the Manufacturer to be compatible with constituents found in the water up to the combined maximum concentrations identified in Table 2 (see Appendix B). Note the water exhibits chlorides and organic compound solvent concentrations. When selecting materials of construction, the Manufacturer shall also consider the expected project lifespan of 4 years, and potential buy-back option after completion of the anticipated 4-year term, and select materials of construction accordingly, except for the single “shared” system that is expected to remain operational for the long-term project life and as addressed by the alternative materials of construction described in the Bid Tab Items.

- S. All tanks, equipment items, valves, and instruments shall be provided with stainless steel tags. Tags shall be permanently affixed or chained to the item, and will indicate the tag number and description of the item as shown on the P&ID (e.g., IPC-0601 Inclined Plate Clarifier). Lettering on the tag shall be etched or struck, with a minimum letter height of 0.5 inches.
- T. All units and equipment shall be designed to resist the design loads per the Building Code of New York State (BCNYS) 2007 edition, including sloshing effects resulting from a hydrodynamic and/or seismic analysis. Vessel/equipment support layout details, including locations of anchor bolt holes, anchor bolt size and type, and embedment length shall be provided. Maximum Reaction Forces and moments at each anchor point shall be provided. The structural design criteria provided below for this site are preliminary, based on initial information available for the site, and are subject to change upon completion of a site geotechnical evaluation. Finalized structural design criteria will be provided prior to award of purchase order. Once finalized design criteria is provided, Manufacturer to certify that equipment design and anchoring is in compliance with the finalized structural design criteria. Draft structural design criteria are as follows:

SEISMIC DESIGN CRITERIA:

Seismic Importance Factor, $I_E$	1.25
Seismic Use Group	II
Mapped Spectral Response Acceleration, $S_S$	0.192 g
Mapped Spectral Response Acceleration, $S_1$	0.078 g
5% Damped Spectral Response Acceleration at Short Periods, $S_{DS}$	0.32 g
5% Damped Spectral Response Acceleration at 1 sec Periods, $S_{D1}$	0.182 g
Seismic Design Category, SDC	C

- U. The IPC units will be placed on a former wastebed. As such, the soils are limited in the amount of weight they can support. Units must be designed to limit loading to less than 1,500 pounds per square foot at floor contact points when full of water. Skid mounting of equipment may be necessary to achieve this acceptable loading. Manufacturer shall advise in Bid. IPC units are to be installed on either timber mats or concrete pads. Manufacturer to identify any concerns with planned support arrangement (i.e. embedment into timber mats, etc.). Because of the properties of the soil, it is expected that potentially uneven settlement will occur. Assume the maximum acceptable settlement is as follows: less than 3/4" differential settlement across each unit and less than 1.5" of total overall settlement. Equipment Manufacturer shall identify the maximum acceptable differential settlement their unit can encounter without affecting the equipment or its operation. Means to relevel shall be provided.
- V. Manufacturer shall identify minimum flow rate into the individual IPC's that will still allow for proper treatment and operational performance. Manufacturer shall identify minimum and maximum acceptable hydraulic flow for each unit (flash tank, flocculation tank, and clarifier) and provide this information with the Bid.
- W. Each unit shall be equipped with a minimum of four lifting lugs to facilitate lifting/rigging.
- X. The attached P&ID's show IPC system arrangement utilizing frac tank vessels. The P&ID's are to be used only as examples of the functionality of an IPC system. Alternate

types of systems, such as traditional IPC clarifiers with integral Flash Mix (adder) and Flocculation tanks will be considered.

- Y. Controls, alarms, and sludge pumps or sludge discharge valves (if hydraulic head discharge of sludge is used) are by others. Manufacturer shall recommend alarm conditions and setpoints (for example "Mixer Off" setpoint, etc.), as appropriate.
- Z. Instruments to be provided by the Manufacturer, as indicated herein, shall comply with the attached Specification 16900, Instrumentation and Controls Requirements. Controls and alarms associated with the IPC system are to be integrated into a Distributed Control System (DCS). Programming and hardware associated with the DCS is by others. The Manufacturer shall provide supporting documents as specified in Specification 16900, "Instrumentation and Controls Requirements," as required.
- AA. Manufacturer shall provide one spare for each different instrument provided. In addition, one spare mixer of each different type provided by Manufacturer shall be provided.
- BB. The Manufacturer shall conduct shop testing to satisfy hydraulic conditions of each component. The IPC systems shall be hydrostatically leak tested by filling units at the Manufacturer's shop prior to delivery to the site. Certified test reports for each unit shall be provided prior to delivery.
- CC. All tank nozzles shall be provided with flanges designed in accordance with ASME B16.5, 150# flanges. Nozzle projections shall be of sufficient lengths to allow access to flange bolts and nuts.
- DD. Any stainless steel bolts shall be applied with anti-seize thread lubricant.

## 2.3 COMPONENTS

- A. Flash Mix Tank and Mixer(s) (submitted as adders)
  - 1. The flash mix tank shall provide the necessary mixing energy and detention time to completely mix and provide contact between the coagulant and the influent solids.
  - 2. The flash mix tank mixers shall be constant speed. Motors shall be TENV or TEFC, 480 volt, three phase, 60 Hertz, with anticondensation heaters in accordance with Specification 26 05 13, "Electric Motors."
  - 3. The tank shall be equipped with a removable cover. A cover gasket, or some other acceptable means to reduce potential emissions from the removable cover, shall be provided. The cover shall also contain a viewport to allow visual inspection of floc formation.
  - 4. A 30-inch diameter manway with a loose-bolted blind flange shall be provided on the top of the vessel to be used as a tank overflow. Materials of construction of the overflow manway flange shall be selected, and the overflow shall be designed, such that the flange would lift off to allow water to overflow. .

5. High and low level switches shall be provided. Level switches shall comply with attached Specification 16900, "Instrumentation and Controls Requirements."
6. The flash mix tank shall be provided with the following nozzles:
  - a. 30-inch diameter influent nozzle.
  - b. 4-inch diameter drain.
  - c. 1-inch diameter alum inlet.
  - d. Mixer flanges, as necessary.
  - e. 4-inch diameter high level switch nozzle.
  - f. 4-inch diameter low level switch nozzle.
  - g. 30-inch diameter outlet.
  - h. 30-inch diameter manway with loose-bolted blind flange (overflow).
  - i. 4-inch diameter spare nozzle.
  - j. 6-inch diameter spare nozzle.
  - k. 30-inch diameter vent.

Note: sizes of nozzles are based on equipment selected during preliminary design (one 18,000 gallon [nominal] flash mix tank) and may change based upon Manufacturer's equipment selection. Nozzle sizes/locations will be finalized after selecting equipment Manufacturer.

B. Flocculation Tank and Mixer(s)

1. The flocculation tank shall provide the necessary blending energy and detention time to facilitate the formation of large flocs.
2. The flocculation tank mixer(s) shall be variable speed and sufficient horsepower to provide adequate mixing. Motors shall be TENV or TEFC, 480 volt, three phase, 60 Hertz, inverter duty type (60 NEMA MG1, Part 31 compliant) with anticondensation heaters in accordance with attached Specification 26 05 13, "Electric Motors." The mixers shall be equipped with locally mounted variable speed controllers provided by Others. The controllers may be mounted to the inclined plate clarifier system in a position that will be accessible to operating personnel. Manufacturer to identify mixer speed ranges
3. The tank shall be equipped with a removal cover. A cover gasket, or some other acceptable means to reduce potential emissions from the removable cover, shall be provided. The cover shall also contain a viewport to allow visual inspection of floc formation and depth.
4. An 8-inch diameter nozzle with a loose-bolted blind flange shall be provided on the top of the vessel to be used as a tank overflow. Materials of construction of the overflow blind flange shall be selected, and the overflow shall be designed, such that the flange would lift off to allow water to overflow.
5. High and low level switches shall be provided. Level switches shall comply with attached Specification 16900, Instrumentation and Controls Requirements.
6. The flocculation tank shall be provided with the following nozzles:
  - a. 8-inch diameter influent nozzle.

- b. 4-inch diameter drain.
- c. 8-inch diameter nozzle with loose-bolted blind flange (overflow).
- d. Mixer flange(s), as necessary.
- e. 4-inch diameter high level switch nozzle.
- f. 4-inch diameter low level switch nozzle.
- g. Overflow baffle (or other outlet, if not combined with IPC unit).
- h. 4-inch diameter spare nozzle.
- i. 6-inch diameter spare nozzle.

If Flocculation Tank and clarifier are not housed within the same tank with a shared headspace, then Flocculation Tank shall also be provided with an independent, appropriately sized outlet nozzle and vent.

Note: sizes of nozzles are based on equipment selected during preliminary design (representing one of sixteen flocculation tanks) and may change based upon Manufacturer's equipment selection. Nozzle sizes/locations will be finalized after selecting equipment Manufacturer.

C. Mixers General

1. The motors shall be designed in accordance with the requirements provided in the appendices herein.
2. The mixer Manufacturer shall be Lightnin, Chemineer, or approved equal.
3. The mixers shall be equipped with 316 stainless steel shafts and impellers, or approved alternate, as recommended by the Manufacturer (refer to Table 2).
4. Mixer blades shall be attached to shaft by keyways. Blades attached by set screws only are not acceptable.

D. Inclined Plate Clarifier System

1. The IPC shall be equipped with a removable cover. A cover gasket, or some other acceptable means to reduce potential emissions from the removable cover, shall be provided. Cover shall be removable to allow access and/or removal of the inclined plates for periodic cleaning. The cover shall contain two viewports, one of which will be an access/view hatch to allow visual inspection of a LNAPL (floating oil) removal device (e.g., floating boom, by others). Additionally, the Vendor shall provide a means of LNAPL collection by use of an underflow baffle or some other design feature in place to allow capture of floating LNAPL. Vendor shall identify means of LNAPL capture with the Bid.
2. The IPC tank shall be provided with the following nozzles:
  - a. 4-inch diameter drain.
  - b. 6-inch diameter treated water outlet
  - c. 4-inch diameter sludge outlet.
  - d. Sludge sampling ports, as necessary.
  - e. 8-inch vent.
  - f. 4-inch diameter spare nozzle.

- g. 6-inch diameter spare nozzle.

If Flocculation Tank and clarifier are not housed within the same tank with a shared headspace, then clarifier shall also be provided with an independent, appropriately sized overflow with loose-bolted flange.

Note: sizes of nozzles are based on equipment selected during preliminary design (representing one of sixteen clarifier tanks) and may change based upon Manufacturer's equipment selection. Nozzle sizes/locations will be finalized after selecting equipment Manufacturer.

3. Inclined Plates

- a. The plates shall be constructed of materials of construction, as recommended by the Manufacturer, to be suitable for the water chemistry (refer to Table 2).

4. Weir Plate

- a. The weir plates shall be adjustable and unaffected by the chemicals identified in Table 2.
- b. A gasket shall be installed between the weir plates and effluent trough. The gasket materials of construction shall be compatible with the water chemistry data (see attached Table 2).

5. Sludge Hopper

- a. Sample ports shall be provided at varying elevations (in 6-inch increments) on the sludge hopper for sludge sampling.

2.4 SOURCE QUALITY CONTROL

A. Factory Assembly

- 1. Owner or Owner's Representative reserves the right to visit Manufacturer's factory during fabrication to witness progress and fabrication.

B. Factory Test

- 1. Each IPC system shall be factory tested as follows:
  - a. Manufacturer's standard inspections and tests
  - b. Hydrostatically tested by the Manufacturer at the shop prior to delivery to the site. Notice shall be given to the Engineer at least two weeks prior to hydrostatically testing the equipment, so that arrangements can be made for Engineer and/or other Owner's Representative to witness the testing at the Manufacturer's facility.
- 2. Submit factory test reports for approval prior to shipment.

## 2.5 SHOP FINISHES

- A. All surfaces to be coated shall be prepared in accordance with PIP VESV1003HA and Honeywell's associated overlay document associated with the PIP specification. Surface preparation prior to coating application shall be in accordance with the NACE standard SP0178 and NACE SP0178 Appendix C NACE Weld Preparation Designation C, and coating Manufacturer's instructions, whichever is more stringent.
- B. The Manufacturer shall provide a shop applied protective coating system for all interior metal surfaces of the IPC package in accordance with coating system manufacturer recommendations. The interior linings of the units shall be compatible with the influent parameters and concentrations presented in this specification (refer to Table 2) and shall be abrasion resistant for this intended use. Coal tar epoxy is not an acceptable interior lining. Proposed coating and lining systems and dry film thickness (DFT) of each coat and of the overall coating system proposed shall be provided with the Bid. Stainless steel does not require coating. Cathodic protection may be used for supplemental corrosion resistance, as recommended by the Manufacturer and at no additional cost.
- C. The Manufacturer shall provide a shop-applied protective coating system (primer and suitable top coat(s)) for all exterior metal surfaces of the IPC system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. As part of on-site start-up services, Manufacturer's representative shall examine areas and conditions for compliance with Manufacturer's installation recommendations and requirements.
- B. Proceed with start-up only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Installation is by others. Installation shall be per Manufacturer's instructions.

### 3.3 FIELD QUALITY CONTROL

- A. The Manufacturer shall furnish the services of a Manufacturer's representative to inspect the installation (by others) and to provide start-up services for the units.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. The on-site services of the Manufacturer's field representative shall be provided during the start-up and adjustment in accordance with this specification and as identified in the Bid Documents.
- B. The services of the Manufacturer's field representative shall be provided during installation. The Manufacturer's field representative is not required to be on-site during installation efforts, but will be conferred if problems or questions occur during installation.

- C. A factory-authorized service representative will perform the following inspections, checks, start-up, and supervision of testing per Section 3.5.B.1:
1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the Manufacturer's installation recommendations and requirements.
  2. Set field-adjustable settings to the values recommended by the equipment Manufacturer.
  3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
  4. Witness and provide input as requested during on-site performance tests (testing to be performed by others)
  5. Perform or supervise start-up services
  6. Prepare written report to record the following:
    - a. Inspections and checks carried out on-site.
    - b. Optimization of chemical dosages.

### 3.5 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.
1. Review data in Operation and Maintenance manuals.
  2. Schedule training with Owner or Engineer, with at least two weeks advance notice.
- B. The services of the Manufacturer's representative shall be provided as separate visits, if required, for the minimum hours as listed below for each IPC system:
1. Twenty-eight hours for installation assistance, inspection, certification of installation and start-up.
  2. Eight hours for performance testing.
  3. Four hours for the owner's personnel training.

Manufacturer shall advise if the amount of hours specified are reasonable or provide the number of hours recommended if different than what is allotted above.

PART 4 - APPENDICES

- A. Table 1 – IPC Submittal Schedule
- B. Table 2 – Constituent Concentrations
- C. Process Flow Diagram – PFD-1
- D. P&ID's
  - 1. Lead Sheets
  - 2. I-03 Flash Mix Tank
  - 3. I-06 Inclined Plate Clarifier
- E. General Arrangement Plan – GA-01
- F. Treatability Test Results
- G. Specification 16900 - Instrumentation and Controls Requirements
- H. Specification 26 05 13 – Electric Motors
- I. Honeywell overlay document
  - 1. Process Industry Practices (PIP) Standard VESV1003
  - 2. Honeywell Specification MSL-2002 HW (*not applicable for this contract*)
- J. NACE SPO178-2007 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service
- K. NACE SPO188-2006 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
- L. Specification 05 52 13 – Pipe and Tube Railings

END OF SECTION

SECTION 44 43 13.26

MULTIMEDIA FILTRATION PRE-PURCHASE SPECIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the equipment and associated controls associated with the skid-mounted Multimedia Filter (MMF) system as shown on the Contract Drawings. Refer to the attached Process and Instrumentation Drawing (P&ID) for an example schematic of the system. The space allocated for the system is as shown on the General Arrangement Plan (attached as Appendix E to this specification). The general scope of the work is to furnish, deliver, and provide start-up assistance for the MMF system, so that a complete system successfully performs as designed.
1. The equipment shall include filter vessels, filter media support, filter media, underdrain, inlet distributor, backwash system, electrical and instrumentation termination panels, air scour system, valve manifold with control and manual valves, and all required accessories for a completely assembled, ready to install system.
  2. The filtration system will be one component of a water treatment train, designed to remove solids, metals, and organic compounds. The filtration component will be designed to remove residual suspended solids from a clarifier effluent stream.
  3. The filtration system shall be delivered FOB project site to 522 Gere Lock Road, Syracuse, NY 13209.
- B. The information provided is based upon four horizontal type Multimedia Filters. The type, size and quantity of these MMF units are what were used to develop the design basis for this project. However, the intent is to specify performance-based equipment. Quantities, sizes and types are all subject to change based upon the equipment manufacturer's compliance to the performance criteria described herein. Manufacturers shall consider alternate equipment, as needed, to optimize the design to propose more cost effective alternatives. As such, vertical MMF units, or other differences will be acceptable and will be considered. Any requests in this RFP which, in the Vendor's opinion, impart unnecessary costs or unnecessarily differ from Manufacturer's standard offerings should be clearly identified in Bidder's proposal.
- C. The system is planned to be installed (by others) inside a structure at the Owner's facility and operated approximately seven months out of each year (April 15<sup>th</sup> through November 15<sup>th</sup>) for four years beginning in the year 2012. In addition to the short-term (4-year) treatment trains, a long-term treatment train (which includes a MMF component) will also be operated at the same Owner's facility. This long-term treatment train will be designed to treat a much lower flow rate. The long-term MMF unit will treat the same water (contains the same constituents at the same concentrations as shown on Table 2 provided in Appendix B to this specification) but at a maximum flow rate of 500 gpm,

and for an expected operational lifespan of 20 years. The Manufacturer shall select equipment such that appropriately-sized MMF unit(s) is shared between the “short-term” and the “long-term” treatment trains (i.e. serving as a part of the short-term MMF system during the seven months of “summer” operation and then used as part of the lower-flow, long-term system during the winter months for the first four years and year-round after year 4). The long-term system will be in a heated space.

Even though the short-term equipment will be located inside a structure, the structure is not heated and therefore the units are subject to freezing during the non-operational winter months. Manufacturer shall identify required means, methods and procedures needed to prepare units for storage over the winter months.

- D. Start-up services shall be provided. Provide a factory representative for up to 40 hours of field start-up assistance at the Owner’s facility.
- E. The equipment shall fit within the footprint allocated as shown on the General Arrangement Drawing GA-01 provided herein. Manufacturer shall identify any operational or maintenance clearances required with the Bid. The equipment will need to fit through the building’s overhead door which has dimensions of 14 feet x 18 feet. The building will be new construction. Manufacturer shall advise if a larger overhead door opening is required. Manufacturer is to confirm that the equipment can enter the building via the overhead door and be moved to the positions shown on drawing GA-01. The clear height at the building eave is estimated at 18’-0”. Additional clear height is available between roof support members.

## 1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
  - 1. American Society for Testing and Materials (ASTM)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society of Mechanical Engineers (ASME)
  - 4. NACE International
  - 5. National Electric Code (NEC)

## 1.3 COORDINATION REQUIREMENTS

- A. Coordinate delivery with project schedule as maintained by Construction Supervisor.
- B. Coordinate with Engineer and Control System Integrator for controls integration.
- C. Bid Review Meeting: Following the Engineer’s review of the proposal, a bid review meeting will be held in Syracuse, NY.

- D. Scheduling: The MMF system must be operational before April 2012. Refer to RFP Section IV “Information” Schedule Milestones Table for schedule dates.

#### 1.4 SUBMITTALS

- A. Prepare and provide drawings and submittals specific to this system in accordance with the requirements shown on Table 1 (provided as Appendix A to this specification).
- B. Product Data Submittals: “Catalog cuts” and spec sheets included as submittals shall be marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Operation and Maintenance Data
  - 1. Presentation of Submittals
    - a. Operational and Maintenance Manuals (3 hard copies each in a 3-ring binder and 1 electronic copy). Owner’s name, address, equipment serial numbers, and model numbers shall be clearly identified on the cover. Include Manufacturer and local service representative contact information, including phone numbers and e-mail addresses, on the cover.
    - b. Each manual shall include a table of contents, an index, and sequential section dividers separating equipment information into subsections. Each manual shall incorporate, at a minimum, the following: field installation instructions, operation description including each mode of operation (i.e. normal flow-through, backwash and air scour modes), written description of the equipment and corresponding components, starting and stopping procedures, routine maintenance procedures, procedures for protecting the equipment during short-term and long-term downtime, schedules, parts lists, troubleshooting topics, illustrations and diagrams and safety instructions for operating personnel.
    - c. Each manual shall include any other information that is required by maintenance personnel for proper operation and maintenance.
    - d. Electronic files of the complete operation and maintenance manual are to be provided on CD.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications
  - 1. Manufacturer to provide description of relevant past experience providing MMF systems. Especially of interest is past experience with projects where MMF units were used to clarify water from dredging operations or surface water clean-up projects. Manufacturer shall provide a list of references and contact information.
  - 2. Seismic Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is

experienced in providing structural and seismic engineering services, including the design of seismic restraints.

3. Owner or Owner's Representative will be conducting scheduled visits to Manufacturer's facilities during fabrication and/or Manufacturer's shop testing procedures.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. As required, disassemble and deliver MMF system in the minimum number of pieces.
- B. Site access is via a one-way access road, parts of which are steeply graded. Equipment vendor to ensure adequate means of delivery are provided to enable delivery to the site. A site visit prior to delivery is recommended.
- C. Materials and equipment shall be boxed, crated or otherwise completely protected during shipment, delivery, storage and handling. Such boxes, crates or protection shall be clearly labeled with the Manufacturer's and Owner's name, site address, project equipment tag numbers, brand or model.
- D. Ship, deliver, store and handle to prevent damage and in accordance with Manufacturer's written instructions. Provide factory-installed lifting provisions.
- E. The MMF system shall be delivered freight on board (FOB) to the project site.
- F. Media shall not be delivered or installed until approximately three weeks prior to the initiation of operational commissioning at the site (assume operational commission begins April 30, 2012).
- G. Manufacturer's storage requirements shall be provided. Units will be stored outside and unprotected from weather events for a prolonged period of time prior to installation. Manufacturer shall provide adequate packaging and protection so as to prevent damage under these conditions.
- H. Off-loading of equipment delivered to the site is by Others.

#### 1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Purchase Order General Terms and Conditions, and the Supplemental Terms and Conditions.
- B. The standard warranty duration shall be from delivery date of units to one year after start-up. Start-up is defined as the initiation of operational commissioning (assume start-up to begin on April 30, 2012). Provide with the Bid the cost adder to extend the warranty for 42 months after start-up, as described in the Bid Tab document. The standard warranty shall include parts and labor for all supplied items, including but not limited to, equipment, controls, and coating system.

## 1.8 PERFORMANCE GUARANTEE

- A. Performance shall be warranted and proven. Performance shall be demonstrated continuously for four weeks after start-up under full operating conditions. Performance testing is by others. MMF Manufacturer's Representative shall be present at the site to witness a portion of the performance testing, per Section 3.5.B.2, and provide input as requested. The MMF system shall be designed to achieve effluent concentrations, given the maximum influent concentrations provided on Table 2. Performance shall be warranted over the entire range of flow rates. Anticipated maximum influent and required effluent concentrations, and minimum and maximum flow rates for the system are provided in Table 2. If the equipment fails to continuously meet this effluent quality, the Manufacturer shall, at no additional cost to the Owner or Buyer, provide and install additional or replacement equipment, parts, and labor (including cost of return trips to the site as needed) to correct demonstrated performance deficiencies as needed to achieve the required performance.
- B. Process: the provided system shall achieve an effluent TSS concentration of 5 mg/L or less. The design value for TSS concentration of the influent water is as shown on Table 2. If the influent TSS concentration exceeds the design value, than 90% removal is required. If the equipment fails to continuously meet this effluent quality, the Manufacturer shall, at no additional cost to the Owner or Buyer, provide and install additional or replacement equipment, parts and labor to correct demonstrated performance deficiencies as needed to achieve the required performance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard quality necessary for the Project:
1. General Electric
  2. Siemens
  3. Graver
  4. Yardney
  5. WesTech
  6. TIGG
  7. Or approved equal

### 2.2 PERFORMANCE REQUIREMENTS

- A. The MMF system shall be suitable for filtration of suspended solids from the water under the design influent specified herein to the effluent concentrations specified herein. The MMF vessels shall be backwashable, capable of automatic or hand operation.

B. The MMF system criteria shall be as follows:

Application	Filtration of suspended solids
Materials of construction, tanks	Manufacturer to provide
Filter Media	Sand, anthracite and gamet (or alternate, as recommended by the Manufacturer)
Acceptable surface loading rate	4-6 gpm/sf @ maximum gpm is what was used for design basis. However, Manufacturer shall make recommendation.

C. Water influent and acceptable effluent constituents and their respective concentrations are provided in the attached Table 2. Manufacturer shall size filters to handle the peak flow rate as provided in Table 2 and to reach effluent TSS limits. Manufacturer shall identify proposed surface loading rate at maximum flow rate. Sizing and design of filters shall be based on normal operation with Vendor to select number of MMF units based on maximum full flow with a redundant on-line spare MMF unit also being provided. The design intent is that the on-line spare will be in “standby” mode until one of the operating units initiates a backwash. At that point, the vessel to be backwashed will be taken off-line to be backwashed while the forward flow is redirected to the redundant unit. Once the backwash is complete, that unit would be kept in “standby” mode until another unit requires backwashing. At that time, the “standby” vessel will again be put back into service accepting forward flow.

D. The MMF’s shall be designed to remove total suspended solids (TSS) from the influent. Removal of TSS shall be as follows:

1. Influent TSS of >5 mg/L to 50 mg/L requires TSS removal to 5 mg/L or less in MMF effluent.
2. Influent TSS >50 mg/L requires 90% TSS removal in MMF effluent.

E. Materials of construction for the interiors of the MMF vessels, equipment, piping, and all wetted ancillaries shall be selected by the Vendor to be compatible with constituents found in the water at the combined maximum concentrations identified herein (see Table 2). Note the water exhibits chlorides and organic compound solvent concentrations. When selecting materials of construction, the Vendor shall also consider the expected project lifespan of 4 years and potential buy-back option after completion of the anticipated 4-year term, and select materials of construction accordingly, except for the “shared” unit(s) that is expected to remain operational for the long-term project life and as addressed by the alternative materials of construction described in the Bid Tab Items.

F. All units and equipment shall be designed to resist the design loads per the Building Code of New York State (BCNYS) 2007 edition, including sloshing effects resulting from a hydrodynamic and/or seismic analysis. Vessel/equipment support layout details, including locations of anchor bolt holes, anchor bolt size and type, and embedment length shall be provided. Maximum Reaction Forces and moments at each anchor point shall be provided. The structural design criteria provided below for this site are preliminary, based on initial information available for the site, and are subject to change upon completion of a site geotechnical evaluation. Finalized structural design criteria will be provided prior to award of purchase order. Once finalized design criteria is provided,

Vendor to certify that equipment design and anchoring is in compliance with the finalized structural design criteria. Draft structural design criteria are as follows:

SEISMIC DESIGN CRITERIA:

Seismic Importance Factor, $I_E$	1.25
Seismic Use Group	II
Mapped Spectral Response Acceleration, $S_S$	0.192 g
Mapped Spectral Response Acceleration, $S_1$	0.078 g
5% Damped Spectral Response Acceleration at Short Periods, $S_{DS}$	0.32 g
5% Damped Spectral Response Acceleration at 1 sec Periods, $S_{D1}$	0.182 g
Seismic Design Category, SDC	C

- G. The MMF units will be placed on a former wastebed. As such, the soils are limited in the amount of weight they can support. Units must be designed to limit loading to less than 1,500 pounds per square foot at floor contact points when full of media and water, or just water, whichever is heaviest. Skid mounting of the equipment may be necessary to achieve this acceptable loading. Manufacturer shall advise in Bid. MMF skids are to be installed on either timber mats or concrete pads. Vendor to identify any concerns with planned support arrangement (i.e. embedment into timber mats, etc.). Because of the properties of the soil, it is expected that potentially uneven settlement will occur. Assume the maximum acceptable settlement is as follows: less than 3/4" differential settlement across each unit and less than 1.5" of total overall settlement. Equipment Manufacturer shall identify the maximum acceptable differential settlement their unit can encounter without affecting the equipment or its operation. Means to relevel shall be provided.
- H. The vessels shall be designed for a pressure of 100 psig or 1.3 times the peak pressure during the backwash cycle, whichever is greater. The vessels shall be designed and fabricated in accordance with the ASME boiler and unfired pressure vessel code. ASME code stamp is required.
- I. Manufacturer shall identify minimum flow rate into the individual MMF's that will still allow for proper treatment and operational performance. Manufacturer shall identify minimum and maximum acceptable hydraulic flow for each unit and provide this information with the Bid.
- J. Instrumentation and components shall be sized per Manufacturer's recommendations and shall comply with Specification 16900 – Instrumentation and Controls Requirements. Each filter tank shall be equipped with the following features:
1. Automatic air release/vacuum valve – valve shall be sized to automatically relieve air as vessel is filling with water and introduce air as vessel is draining.
  2. Inlet and outlet pressure gauges with diaphragm seals.
  3. Differential pressure indicating transmitter – Differential pressure will be continuously monitored across each MMF. Transmitter shall have diaphragm seals on each leg. An operator-adjustable set point will indicate when initiation of a backwash is warranted. High differential pressure across an MMF vessel

shall automatically close an electrically-operated flow valve on the influent of the MMF and open a valve on the idle MMF unit to redirect flow to the stand-by MMF. Control of this function is via Owner-provided Distributed Control System (DCS).

4. Inlet and outlet sample taps.
5. Top and side manways – a minimum 14” x 18”, easy-open type manway suitable for maintenance access on the top of each vessel and a second manway on the sidewall with a minimum opening dimension of not less than 20” diameter shall be provided. Manways must be suitably sized to allow entry for inspection and repair of coatings and interior components. Manways shall comply with ASME boiler and unfired pressure vessel code. Manways shall be flanged. Side manways shall be equipped with a davit hinge.
6. Rupture disk (or other Engineer-approved device) – over pressurization protection shall consist of a standard rupture disk designed for bursting pressure of 95% (+/- 5%) of the design pressure rating of the vessel. The rupture disk shall be equipped with a tell-tale device which alerts the Operator (via an alarm to the DCS) that the disk has ruptured. The rupture disk will be interlocked to shut the feed valve (valve by MMF vendor) to the MMF system upon rupturing. The rupture disk shall be in compliance with ASME code requirements. Three spare rupture disks shall be provided for the complete MMF system.
7. Sight flow indicator tube – A sight flow indicator shall be provided on the backwash waste line of each MMF. The sight tube shall consist of a 2 foot long (minimum) section of transparent rigid pipe or other Engineer-approved design. Manufacturer shall confirm feasibility of using transparent rigid pipe with air scouring.
8. Vent – An adequately-sized vent with an automatic electrically-actuated flow valve shall be provided to permit exhaust of air when unit is in air scour mode.
9. Air scour feature – MMF vessels shall be required to undergo automatic air scour step with each backwash. Compressed air is available and will be provided by others. MMF Manufacturer shall identify compressed air requirements including required quality of air, flow rate, pressure, pressure drop (through Vendor-provided system), connection(s) sizes and types, duration of air scour step, and volume of air required. A description of operation of the MMF, including the air scour step, shall be provided. MMF Vendor to advise of benefits to air scour.
10. Drain with isolation valve – As part of the air scour feature, it is anticipated that a gravity drain down will be required prior to initiation of air scouring. An adequately-sized drain with an automatic electrically-actuated flow valve shall be provided by the Vendor to permit the vessel to automatically gravity drain. Drain down valve shall include an open and closed limit switch to shut drain down valve upon high level in the receiving sump or tank. In addition, MMF’s shall be equipped with a manual drain with isolation valve to enable manual draining of each MMF for maintenance purposes.

- K. The vessel internal filter inlet and outlet distribution configurations shall be designed to provide uniform distribution of flow at any flow range between the minimum and maximum flow rates specified herein.
- L. The underdrain system shall be capable of supporting the media when the vessel is filled with water and media and pressured to the system design pressure.
- M. Each unit shall be equipped with lifting lugs to facilitate lifting/rigging.
- N. Each filter shall be equipped with media loading and clean-out ports.
- O. The filter tanks shall be fitted with electrically actuated control valves to accomplish backwash and to isolate the operating filters during backwash of the redundant unit. Valves shall be Manufacturer's standard if they are suitable for expected concentrations of constituents found in the water. Valves 8 inches and larger shall be equipped with a gear operator. Each valve shall be provided with two limit switches (open and closed). Any manually operated valves located higher than 6 feet shall be equipped with a chain operator.
- P. MMF vessels shall have provisions for a fully automatic water backwash of each individual MMF vessel. The source of backwash water shall be from an external treated water source (by others) unless it is possible to use forward flow from other MMF's (or other chambers of same MMF, if feasible) as the source of backwash water. It is preferred to use the treated water from MMF's as the backwash water source. Manufacturer shall identify requirements (i.e. acceptable water source and water properties, volume, required pressure, duration, flow rate, pressure drop, connection sizes/locations/types, etc.) Manufacturer shall minimize the amount of backwash water required. A complete and detailed description of the backwash/air scour process shall be provided with the Bid that provides a step-by-step, sequential description of the process. Instrumentation and actuated valves provided shall comply with Specification 16900 Instrument and Controls Requirements. Control valves shall be electrically actuated. Backwash may be automatically initiated upon:
  - 1. High differential pressure, or
  - 2. Timer, or
  - 3. High discharge turbidity, or
  - 4. Manually, at the Operator Interface Terminal (OIT)

A pressure differential transmitter shall be provided to allow initiation of backwash of a MMF upon exceedance of a pre-set, operator-adjustable pressure differential. A turbidimeter on the effluent piping from the filters will be provided by Others, with filter backwash possibly initiated at a pre-set turbidity value (operator-adjustable set point). A time clock controller shall be provided at DCS (by others) which is capable of being set to backwash each filter at a pre-set time each day, or any selection of days in a 14 day

cycle, or to skip a day or several days. A manual override to permit manual initiation of backwashing shall also be provided.

- Q. The Manufacturer shall provide MMF media that meets the design requirements. The type, properties and depth of media shall be identified by the Manufacturer with the Bid. Information provided shall include media material identification, gradation and sizing.
- R. The attached P&ID I-08 is for a typical horizontal, pressure-type MMF system. The P&ID is to be used only as an example of filtration functionality. Alternate filtration systems may be considered.
- S. The automatic controls and alarms associated with the MMF system are to be integrated into a DCS. Programming and hardware associated with the DCS is by others. The Manufacturer is required to provide a detailed control description along with other supporting documents as specified in Section 16900 "Instrumentation and Controls Requirements." All instruments shall be installed and wired back to electrical and instrumentation terminal strip boxes (NEMA 4) by the Manufacturer. One terminal box strip shall be provided for each MMF. All instrumentation and controls shall be as specified in Section 16900 "Instrumentation and Controls Requirements" (no exceptions).
- T. Manufacturer shall recommend alarm and shutdown conditions, as appropriate. Alarms shall have a sufficient programmable time delay to minimize nuisance alarms and system shutdowns. Interlocks will be incorporated in the DCS to prevent:
1. Initiation of backwash while any other MMF vessel is backwashing
  2. Initiation of backwash on high water level in the collection vessel accepting spent backwash water
  3. Initiation of backwash on a low water level in the backwash water source tank (if applicable)
- U. Electrical area hazard classification (interior and exterior of the MMF's) is designated as ordinary.
- V. All tanks, equipment items, valves, and instruments shall be provided with stainless steel tags. Tags shall be permanently affixed or chained to the item, and will indicate the tag number and description of the item as shown on the P&ID (e.g., MMF-0801 – Multimedia Filter # 1). Lettering on the tag shall be etched or struck, with a minimum letter height of 0.5 inches.
- W. Vendor shall identify any issues that may result from a prolonged shutdown and what time interval it would be expected that the issues may occur at.
- X. All interconnecting piping between the individual MMF vessels of the MMF system shall be provided by others. The piping from each vessel to its associated valve manifold is by MMF Vendor, as shown on P&ID's (see Appendix D to this specification).

- Y. All MMF system nozzles shall be provided with flanges designed in accordance with ASME B16.5, 150# flanges. Nozzle projections shall be of sufficient lengths to allow access to flange bolts and nuts.
- Z. Although polymer is not envisioned to be added, the potential exists that it may be used in the future. If polymer builds up on the filtration media, a mechanism must be provided to remove polymer (e.g., chemical cleaning). Manufacturer is to advise suitability of acid cleaning and/or identify other acceptable or recommended means for polymer removal.
- AA. Calcium scale is experienced at the site. Manufacturer is to advise suitability of acid cleaning and/or identify other acceptable or recommended means for scale removal.
- BB. Any stainless steel bolts shall be applied with anti-seize thread lubricant.

### 2.3 SHOP FINISHES

- A. All surfaces to be coated shall be prepared in accordance with PIP VESV1003HA and Honeywell's associated overlay document associated with the PIP specification. Surface preparation prior to coating application shall be in accordance with the NACE standard SP0178 and NACE SP0178 Appendix C NACE Weld Preparation Designation C, and coating Manufacturer's instructions, whichever is more stringent.
- B. The Manufacturer shall provide a shop applied protective coating system for all wetted metal surfaces of the MMF vessel package. The interior linings of the vessels shall be compatible with the influent parameters and concentrations presented in this specification as well as potential cleaning chemicals (to remove polymer and scale build-up) and shall be abrasion resistant for this intended use. Coal tar epoxy is not an acceptable interior lining. Proposed coating and lining systems and dry film thickness (DFT) of each coat and of the overall coating system proposed shall be provided. Stainless steel does not require coating. Cathodic protection may be used for supplemental corrosion resistance, as recommended by the Manufacturer and at no additional cost.
- C. The Manufacturer shall provide a shop-applied protective coating system (primer and suitable top coat(s)) for all non-wetted metal surfaces of the MMF system.

### 2.4 SOURCE QUALITY CONTROL

- A. Factory Assembly
  - 1. Owner or Owner's Representative reserves the right to visit Manufacturer's factory during fabrication to witness progress and fabrication.
- B. Factory Test
  - 1. Each MMF unit shall be factory tested as follows:
    - a. Manufacturer's standard inspections and tests

- b. Hydrostatically tested by the Manufacturer at the shop prior to delivery to the site. Notice shall be given to the Engineer at least two weeks prior to hydrostatically testing of fully assembled equipment, so that arrangements can be made for Engineer or other Owner's Representative to witness the testing at the Manufacturer's facility.
- c. Testing of interior coating systems per NACE standards SP0188 and SP0178.

- 2. Submit factory test report for approval prior to shipment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. As part of on-site start-up services, Manufacturer's representative shall examine areas and conditions for compliance with Manufacturer's installation recommendations and requirements.
- B. Proceed with start-up only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Installation is by others. Installation shall be per Manufacturer's instructions.
- B. The MMF system shall fit and be serviceable in the allocated space as shown on the General Arrangement Plan (Drawing GA-01). If an alternate system can be proposed that would require less space, it will be considered an advantage. Dimensions of building access doors and overhead clearances were provided previously herein.

### 3.3 FIELD QUALITY CONTROL

- A. The Manufacturer shall furnish the services of a Manufacturer's representative to inspect the installation (by others) and to provide start-up services for the units.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. The on-site services of the Manufacturer's field representative shall be provided during the start-up and adjustment in accordance with this specification and as identified in the Bid Documents.
- B. The services of the Manufacturer's field representative shall be provided during installation. The Manufacturer's field representative is not required to be on-site during installation efforts, but will be conferred if problems or questions occur during installation.
- C. A factory-authorized service representative shall perform the following inspections and checks:

1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the Manufacturer's installation recommendations and requirements.
2. Set field-adjustable settings to the values provided by the equipment Manufacturer.
3. Test and adjust Vendor-provided controls and safety devices. Replace damaged and malfunctioning instrumentation and components.
4. Witness and provide input as requested during on-site performance tests (testing to be performed by others).
5. Perform or supervise start-up services.
6. Prepare written report to record the following:
  - a. Inspections and checks carried out on site
  - b. Test procedures used to test controls and instrumentation
  - c. Test results that comply with requirements for controls and instrumentation
  - d. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements for controls and instrumentation.

### 3.5 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.
  1. Review data in Operation and Maintenance manuals.
  2. Schedule training with Owner or Engineer, with at least two weeks advance notice.
- B. The services of the Manufacturer's representative shall be provided as separate visits, if required, for the minimum hours as listed below for the MMF system:
  1. Twenty-Eight hours for inspection, certification of installation and start-up.
  2. Eight hours of site presence during performance testing.
  3. Four hours on-site for the owner's personnel training.

Vendor shall advise if the amount of hours specified are reasonable or provide the number of hours recommended if different than what is allotted above.

PART 4 - APPENDICES

- A. Table 1 – MMF Submittal Schedule
- B. Table 2 – Constituent Concentrations
- C. Process Flow Diagram – PFD-1
- D. P&ID Lead Sheets and I-08 Multimedia Filter
- E. General Arrangement Plan – GA-01
- F. Treatability Test Results
- G. Specification 16900 - Instrumentation and Controls Requirements
- H. Honeywell overlay document
  - 1. Process Industry Practices (PIP) Standard VESV1003
  - 2. Honeywell Specification MSL-2002 HW (*not applicable for this contract*)
- I. NACE SPO178-2007 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service
- J. NACE SPO188-2006 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

END OF SECTION

SECTION 44 43 13.29

GRANULAR ACTIVATED CARBON SYSTEM PRE-PURCHASE SPECIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes work consisting of furnishing, delivering and providing start-up and operational change-out services for a liquid-phase granular activated carbon (GAC) system as shown on the Site Plan and Process and Instrumentation (P&ID) drawings.
1. The equipment shall include skid-mounted, backwashable GAC vessels, carbon, interconnecting piping, manual valves, distribution and collection laterals, and accessories and controls for a completely assembled, ready to install and operate system.
  2. The GAC system will be one component of a water treatment system designed to remove metals, and organic compounds. The GAC system will be designed to remove volatile and semi-volatile organic compounds from an effluent stream of a polishing filter system.
  3. The GAC system shall be delivered FOB project site to 522 Gere Lock Road, Syracuse, NY 13209.
- B. The system is planned to be installed (by others) inside a structure at the Owner's facility and operated approximately seven months out of each year (April 15<sup>th</sup> through November 15<sup>th</sup>) for four years beginning in the year 2012. In addition to the short-term (4-year) treatment trains, a long-term treatment train (which includes a GAC component) will also be operated at the same Owner's facility. This long-term treatment train will be designed to treat a much lower flow rate. The long-term GAC unit will treat the same water (contains the same constituents at the same concentrations as shown on Table 2) but at a maximum flow rate of 500 gpm, and for an expected operational lifespan of 20 years. The Manufacturer shall select equipment such that one appropriately-sized GAC lead/lag unit is shared between the "short-term" and the "long-term" treatment trains (i.e. serving as a part of the short-term GAC system during the seven months of "summer" operation and then used as part of the lower-flow, long-term system during the winter months for the first four years and year-round after year 4). The long-term system will be in a heated space.

Even though the short-term equipment will be located inside a structure, the structure is not heated and therefore the short-term units are subject to freezing during winter months. Vendor shall identify required means, methods and procedures needed to prepare units for storage over the winter months. As part of the Service Contract described in the Bid Tab Items, Vendor will be responsible for filling units, and bringing system on-line and fully operational each year prior to April 15<sup>th</sup>, and emptying/removal of carbon (if required) and rendering system safe for winter downtime/storage immediately after the November 15<sup>th</sup> yearly shutdown.

- C. Start-up services shall be provided. Provide a factory representative for up to 40 hours of field start-up assistance at the Owner's facility.
- D. Provide a maintenance/service contract for operational change-out services on an annual basis. Treatability testing conducted on the water estimates that lead GAC units will need to be changed out approximately once every month. Due to the quantity of GAC units required to treat the volume of water, and in order to maintain design flow rate requirements, GAC change-outs will need to be staggered such that only one pair can be off-line at a given time. However, it is up to the Manufacturer to appropriately size the equipment hydraulically and estimate change-out frequency based upon criteria (maximum influent and effluent concentrations) presented herein. It is assumed that spent carbon would need to be classified as Hazardous.
- E. The equipment shall fit within the footprint allocated as shown on the General Arrangement Drawing GA-01 provided herein. The equipment will need to fit through the building's overhead door which has minimum dimensions of 16 feet x 16 feet. The building will be new construction. Vendor shall advise if a larger overhead door opening is required. The clear height at the building eave is estimated at 18'-0". At the planned location of the GAC's, the clear height is approximately 20'-6". Additional clear height is available between roof support members.

## 1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
  - 1. American Society of Mechanical Engineers (ASME)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. American National Standards Institute (ANSI)
  - 4. NACE International
  - 5. National Electric Code

## 1.3 COORDINATION REQUIREMENTS

- A. Coordinate delivery with project schedule as maintained by Construction Supervisor.
- B. Coordinate with Engineer and Control System Integrator for controls integration.
- C. Bid Review Meeting: Following the Engineer's review of the proposal, a bid review meeting will be held in Syracuse, NY.
- D. Scheduling: The GAC system must be operational before April 2012. To allow adequate time for installation (by others), the equipment must arrive on-site no later than April 20, 2011.

## 1.4 SUBMITTALS

- A. Prepare and provide drawings and submittals specific to this system in accordance with the requirements shown on Table 1 herein.
- B. Product Data Submittals: “Catalog cuts” and spec sheets included as submittals shall be marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Presentation of Submittals
  - 1. Operation and Maintenance Data
    - a. Operational and Maintenance Manuals (3 hard copies each in a 3-ring binder and 1 electronic copy). Owner’s name, address, equipment serial numbers, and model numbers shall be clearly identified on the cover. Include Manufacturer and local service representative contact information, including phone numbers and e-mail addresses, on the cover.
    - b. Each manual shall include a table of contents, an index, and sequential section dividers separating equipment information into subsections. Each manual shall incorporate, at a minimum, the following: field installation instructions, brief written description of the equipment and corresponding components, change-out procedures, starting and stopping procedures, routine maintenance procedures, procedures for protecting the equipment during short-term and long-term downtime, schedules, parts lists, troubleshooting topics, illustrations and diagrams and safety instructions for operating personnel.
    - c. Each manual shall include any other information that is required by maintenance personnel for proper operation and maintenance.
    - d. Electronic files of the complete operation and maintenance manual are to be provided on CD.

## 1.5 QUALITY ASSURANCE

- A. Qualifications
  - 1. Manufacturer’s Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.
  - 2. Seismic Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing structural and seismic engineering services, including the design of seismic restraints.
  - 3. Owner or Owner’s Representative will be conducting scheduled visits to Manufacturer’s manufacturing facilities during fabrication and/or Manufacturer’s shop testing procedures.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. As required, disassemble and deliver GAC system in the minimum number of pieces.
- B. Site access is via a one-way access road, parts of which are steeply graded. Equipment vendor to ensure adequate means of delivery are provided to enable delivery to the site. A site visit prior to delivery is recommended.
- C. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during delivery, storage and handling. Such boxes, crates or protection shall be clearly labeled with the Manufacturer's and Owner's name, site address, project equipment tag numbers, brand or model.
- D. Deliver, store and handle to prevent damage and in accordance with Manufacturer's written instructions. Provide factory-installed lifting provisions.
- E. The GAC system shall be delivered freight on board (FOB) to the project site.
- F. Carbon shall not be delivered or installed until approximately two weeks prior to the initiation of operational commissioning at the site (assume date of April 30, 2012).
- G. Manufacturer's storage requirements shall be provided. Units will be stored outside and unprotected from weather events for a prolonged period of time. Manufacturer shall provide adequate storage so as to prevent damage under these conditions.

## 1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Subcontractor Agreement For Services.
- B. The standard warranty duration shall be from delivery date of units to one year after start-up. Start-up is defined as the initiation of operational commissioning (assume start-up to begin on April 30, 2012). Provide with the Bid the cost adder to extend the warranty for 42 months, as described in the Bid Tab document. The standard warranty shall include parts and labor for all supplied items, including but not limited to, equipment, controls, and coating system.

## 1.8 PERFORMANCE GUARANTEE

- A. Performance shall be warrantied and proven. Performance shall be demonstrated continuously for four weeks after start-up under full operating conditions. Performance testing is by others. GAC Vendor shall be present at the site (assume 8 hours) to witness performance testing and provide input as requested. The provided GAC system shall be designed to achieve effluent concentrations, given the maximum influent concentrations provided on Table 2. Performance shall be warrantied over the entire range of flow rates. Anticipated maximum influent concentrations, required effluent concentrations, and minimum and maximum flow rates for the system are provided in Table 2. If the equipment fails to continuously meet this effluent quality during the warranty period, the

Manufacturer shall, at no additional cost to the Owner or Buyer, provide and install replacement equipment, parts, and labor to correct demonstrated performance deficiencies as needed to achieve the required performance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The following Manufacturers are named to establish a standard of quality necessary for the Project:
  - 1. Calgon Carbon
  - 2. Siemens Water Technology
  - 3. Carbonair Environmental
  - 4. Carbtrol Corporation
  - 5. TIGG Corporation
  - 6. Envirogen
  - 7. Or approved equal

### 2.2 PERFORMANCE REQUIREMENTS

- A. The GAC vessels shall be suitable for contact removal of VOCs and SVOCs from the water stream with the design influent characteristics to the effluent concentrations as specified in Table 2 herein. The GAC vessels shall also be backwashable.
- B. Water constituents and concentrations are provided in Table 2 herein.
- C. Emphasis will be placed on the following criteria and objectives to evaluate Bids for the GAC system. The GAC system criteria shall be as follows:
  - 1. Application – Adsorption of VOCs/SVOCs
  - 2. Minimum Empty Bed Contact Time (EBCT) – The GAC system shall be sized to achieve a minimum EBCT of 15 minutes (lead and lag vessels combined). During times when a GAC unit is taken offline for backwashing or change-out, the system shall be sized such that the remaining GAC vessels shall be capable of accepting and treating the full flow with a reduced EBCT of 14 minutes, minimum.
  - 3. Vendor to optimize design such that operational downtime is minimized. System shall be designed so that no vessels are off-line for more than four hours for normal maintenance, backwashing or carbon change-out events. An important factor in the consideration of the award of the purchase contract for the GAC system will be Vendor's design and/or operational strategies, equipment sizing, and other ideas and concepts which place a high importance on maximizing system uptime. Vendor shall present any original alternatives which maximize uptime with the Bid.

4. Vendor design and operational strategy shall minimize, to the extent possible, the amount of spent backwash water generated and also minimize the amount of solids in the spent backwash water. Any means of lessening the volume and/or amount of solids in the spent backwash water shall be specifically identified by the Vendor with the Bid as this is an important factor in the consideration of the award of the contract.
  5. Since maximizing system uptime is a main concern, it is important to minimize the time required to perform routine change-out events. Good operational start-up practice for bringing new carbon on-line should include sufficient time to wet the carbon and allow for degassing, stratification, and removal of fines and alkalinity. However, this wetting period should not take away from system uptime. Therefore, Vendor should provide with the Bid their plan for managing change-out events to minimize downtime, operating and capital costs. Vendor shall provide with the Bid the estimated time required to perform a carbon change-out event.
  6. Upon notification from site Operators that a vessel change-out is required, Vendor shall be capable of arriving at the site within a reasonable amount of time with the appropriate materials required to perform a vessel change-out so that system is not required to be shut down on contaminant breakthrough through the lag vessel. Vendor to provide with the Bid the number of hours required from when the call for a change-out is received, until arrival on-site to begin the change-out, including if notification occurs on a weekend or holiday, if different than at other times.
  7. Although maximum concentrations and flow rates have been identified, actual flow rates and concentrations may be less than what is expected. The first year of operation will establish typical flow rates and concentrations and will be used to fine-tune equipment requirements and operational plans for future years of operation. As such, Vendor shall propose ways to optimize the design of the GAC system. Strategies such as the purchase of a core number of vessels during year one supplemented by lease of additional units as needed will be entertained. If actual conditions warrant the eventual purchase of these leased units, the accrued lease costs would then be applied towards the purchase of these units. Other strategies, as proposed by the Vendor with the Bid, are encouraged and will be evaluated.
  8. Materials of Construction, Vessels – Vessel materials of construction should be selected by the Vendor to be compatible with constituents found in the water at the concentrations identified herein (see Table 2). When selecting materials of construction, the Vendor shall also consider the expected project lifespan of 4 years and select materials of construction accordingly, except for the single lead/lag system that is expected to remain operational for the long-term project life and as addressed by the alternative materials of construction described in Bid Item No. 2.
- D. All vessels and equipment shall be designed to resist the design loads per the Building Code of New York State (BCNYS) 2007 edition, including sloshing effects resulting from a hydrodynamic and/or seismic analysis. Vessel/equipment support layout details, including locations of anchor bolt holes, anchor bolt size and type, and embedment length

shall be provided. Maximum Reaction Forces and moments at each anchor point shall be provided. The structural design criteria provided below for this site are preliminary, based on initial information available for the site, and are subject to change upon completion of a site geotechnical evaluation. Finalized structural design criteria will be provided prior to award of the Contract. Once finalized design criteria is provided, Vendor to certify that equipment design and anchoring is in compliance with the finalized structural design criteria. Draft structural design criteria are as follows:

LIVE LOAD:

Roof Live Load	20 psf
Floor Live Load	250 psf or 3 kips

SEISMIC DESIGN CRITERIA:

Seismic Importance Factor, $I_E$	1.25
Seismic Use Group	II
Mapped Spectral Response Acceleration, $S_s$	0.192 g
Mapped Spectral Response Acceleration, $S_1$	0.078 g
5% Damped Spectral Response Acceleration at Short Periods, $S_{DS}$	0.32 g
5% Damped Spectral Response Acceleration at 1 sec Periods, $S_{D1}$	0.182 g
Seismic Design Category, SDC	C

- E. GAC system shall be designed for lead/lag operation. Manually operated valves and manifold piping shall be provided such that either unit may operate in the lead position. Operator should be able to select (by manual manipulation of valve operators) which of the vessels is to serve as the lead vessel. Also, design of the entire system shall allow the isolation of any unit (1 pair of vessels) for backwash or carbon change-out while maintaining full flow through the other units. A valve sequencing chart and valve labels shall be provided by the Vendor for this purpose and to minimize potential Operator mistakes.
- F. The design of the valve manifold skid shall be sized to include extra space to allow a change to automated (electrically-actuated) valves in the future. Shop drawings shall show (in dashed lines) the outline of potential future valve actuators, drawn to scale. Proposed actuator make and model shall be identified by the Vendor with shop drawings provided to indicate how, if required in the future, they may be fitted up to the valves. Vendor shall verify that the proposed valve is able to be mated with the proposed actuator.
- G. The GAC units will be placed on a former wastebed. As such, the soils are limited in the amount of weight they can support. Units must be designed to limit loading to less than 1,500 pounds per square foot when full of carbon and water, or just water. Therefore, GAC units are required to be skid-mounted with skids to comply with the 1,500 psf loading criteria. Skids are to be installed on either timber mats or concrete pads. Vendor to identify any concerns with planned support arrangement. Because of the properties of the soil, it is expected that potentially uneven settlement will occur. Assume the maximum acceptable settlement is as follows: less than 3/4" differential settlement across each unit and less than 1.5" of total overall settlement. Equipment Manufacturer shall identify the maximum acceptable differential settlement their unit can encounter without affecting the equipment or its operation.

- H. The vessels shall be designed for a pressure of 125 psig or 1.3 times the peak pressure during the backwash cycle, whichever is greater. The vessels shall be designed and fabricated in accordance with ASME boiler and unfired pressure vessel code. ASME code stamp is required.
- I. Manufacturer shall identify minimum flow rate into the GACs that will still allow for proper operational performance.
- J. Each GAC vessel shall be equipped with a vent connection with a manual valve for air/vacuum relief. Additionally, over-pressurization protection, differential pressure indicating transmitter, and inlet and outlet pressure gauges shall be provided as shown on the P&ID. The pressure differential transmitter shall be provided to alarm to the Distributed Control System (DCS) upon exceedance of a pre-set, operator-adjustable pressure differential. Each vessel shall be provided with influent and effluent sample cocks. Instrumentation and control components shall be sized per Manufacturer's recommendations and shall comply with the "Instrumentation and Controls Requirements" document attached herein. Over-pressurization protection shall consist of a standard rupture disk designed for bursting pressure of 95% (+/-5%) of the working design pressure or other Engineer-approved device. The rupture disk shall be equipped with a tell-tale device which alerts the Operator (via an alarm to the DCS) that the disk has ruptured. The rupture disk will be interlocked to shut a feed valve to the GAC system upon rupturing. The rupture disk shall be in compliance with ASME code requirements.
- K. A sight flow indicator tube shall be provided on the backwash waste line of each adsorber. The sight tube shall consist of a 2 foot long (minimum) section of transparent rigid pipe or other Engineer-approved design.
- L. The GAC vessels shall contain a minimum 14" x 18", easy-open type manway suitable for maintenance access on the top dish of each unit and a second manway on the straight sidewall with a minimum opening dimension of not less than 20" diameter. Alternative dimensions will be considered. Manways must be suitably sized to allow entry for inspection and repair of coatings and interior components. Manways shall comply with ASME boiler and unfired pressure vessel code. Manways shall be flanged. Side manways shall be equipped with a davit hinge.
- M. The inlet and outlet distribution laterals shall be designed to provide uniform distribution of flow at any flow rate range between the minimum and maximum flow rates specified herein. Inlet and outlet distribution laterals shall be separated from the carbon.
- N. The underdrain system shall be capable of supporting the carbon when the vessel is filled with water and pressured to the system design pressure.
- O. Each unit shall be equipped with a minimum of three lifting lugs to facilitate lifting/rigging.
- P. Each GAC vessel shall be equipped with carbon loading and clean-out ports. The setup shall allow the removal and addition of carbon in a fluidized form. Manufacturer shall provide manual air/vacuum relief, as required, to promote GAC filling and clean-out activities. Adsorber design shall incorporate the feature to remove carbon without

requiring the adsorber to be opened and cleaned or hosed. Carbon loading and drain line shall be fitted with quick disconnect adapters. A mating tank truck adapter shall be provided for each type and size of quick disconnect fitting provided.

- Q. The Manufacturer shall provide face (manifold) piping between the lead and lag carbon vessels. Manifold piping shall be pre-assembled and skid-mounted by the Manufacturer and shall require only the connection of the influent, effluent and backwash influent and effluent piping in the field. Valves shall be Manufacturer's standard if they are suitable for expected concentrations of constituents found in the water. Valves located higher than 6 feet shall be equipped with a chain operator. Valves 8 inches and larger shall be equipped with a gear operator.
- R. Treatability testing indicates the build-up of gas bubbles which form within the carbon vessel occupying the voids between the carbon media. The treatability testing results are provided as an Appendix herein. It is not apparent if the bubbles are a result of bioactivity, a by-product of a chemical reaction taking place, or as a result of another phenomenon. The presence of these gas bubbles may act to reduce the surface area of available carbon media, thereby reducing treatability. Therefore, GAC vessels shall be capable of being backwashed with water. The source of backwash water shall be from an external treated water source (by others). Manufacturer to identify size and location of connection(s) provided for the backwash piping. Manufacturer to design and size system such that only a single vessel can be backwashed at any one time. Manufacturer to identify backwash pumping flow and head (at the vessel) requirements and durations with the Bid.
- S. The Subcontractor shall provide GAC media that meets the design requirements. The depth of media shall be provided by the Manufacturer. Coal-based carbon shall be used. A cost comparison will be performed to evaluate the use of virgin carbon vs. reactivated carbon (as shown in the Bid Items). If reactivated carbon is used, the initial carbon fill would be with virgin carbon. Thereafter, the same carbon would be reactivated and returned to the site. This reactivated carbon would be dedicated solely to this Honeywell project. Additional carbon used to supplement the reactivated carbon, as needed, would be virgin type carbon. All virgin carbon (including carbon used to supplement after reactivation) shall meet the following criteria:

Iodine Number, mg/g (min)	1000
Moisture, weight % (max)	2
Abrasion Number (min)	75
Effective Size (mm)	0.55-0.75
Uniformity Coefficient (max)	1.9
Ash, weight % (max)	9
Apparent Density, g/cc (min)	0.44
Screen Size, US Sieve Series, weight %	
Larger than No. 12 (max)	5
Smaller than No. 40 (max)	4

All reactivated carbon shall meet the following criteria:

Iodine Number, mg/g (min)	900
Moisture, weight % (max)	2
Abrasion Number (min)	75
Effective Size (mm)	0.55-0.75

Uniformity Coefficient (max)	1.9
Ash, weight % (max)	9
Apparent Density, g/cc (min)	0.44
Screen Size, US Sieve Series, weight %	
Larger than No. 12 (max)	5
Smaller than No. 40 (max)	4

- T. The attached P&ID I-09 shows a typical downflow, pressure-type GAC vessel system. The P&ID is to be used only as an example of the functionality of a GAC system. Alternate types of systems may be considered.
- U. Controls and alarms associated with the GAC system are to be integrated into a DCS. Programming and hardware associated with the DCS is by others. The Manufacturer shall provide supporting documents as specified in the "Instrumentation and Controls Requirements" appendix for Vendor provided instruments. All instruments will be installed and wired back to common electrical and instrumentation terminal boxes by the Manufacturer. One terminal box shall be provided for each lead/lag unit. Terminal boxes shall be NEMA 4X enclosures for operation in an indoor, unheated temporary structure.
- V. Manufacturer shall recommend alarm conditions and setpoints, as appropriate. Manufacturer shall identify recommended time delay to minimize nuisance alarms.
- W. Electrical classification is ordinary.
- X. The Manufacturer shall conduct shop testing to satisfy hydraulic conditions and pressure ratings of each tank. The GAC vessels shall be hydrostatically pressure tested by the Manufacturer at the shop prior to delivery to the site. Certified test reports for each unit shall be provided prior to delivery.
- Y. The interiors of the GAC vessels, equipment, piping, and all wetted ancillaries are to be constructed of materials that are compatible with the water characteristics provided in Table 2. Note the water exhibits chlorides and organic compound solvent concentrations.
- Z. All tanks, equipment items, valves, and instruments shall be provided with stainless steel tags. Tags shall be permanently affixed or chained to the item, and will indicate the tag number and description of the item as shown on the P&IDs. Lettering on the tag shall be etched or struck, with a minimum letter height of 0.5 inches.
- AA. Vendor shall identify any issues that may result from a prolonged shutdown and what time interval it would be expected that the issues may occur at.

### 2.3 SHOP FINISHES

- A. All surfaces to be coated shall be prepared in accordance with PIP VESV1003HA and Honeywell's associated overlay document associated with the PIP specification. Surface preparation prior to coating application shall be in accordance with the NACE standard

SP0178 and NACE SP0178 Appendix C NACE Weld Preparation Designation C, and coating Manufacturer's instructions, whichever is more stringent.

- B. The Manufacturer shall provide a shop applied protective coating system for all wetted metal surfaces of the GAC vessel package. The interior linings of the vessels shall be compatible with the influent parameters and concentrations presented in this specification and shall be abrasion resistant for this intended use. Coal tar epoxy is not an acceptable interior lining. Proposed coating and lining systems and DFT proposed shall be provided. Stainless steel does not require coating. Cathodic protection may be used for supplemental corrosion resistance, as recommended by the Manufacturer.
- C. The Manufacturer shall provide a shop-applied protective coating system for all non-wetted metal surfaces of the GAC system.

## 2.4 SOURCE QUALITY CONTROL

- A. Factory Quality Certification
  - 1. Provide written documentation of Manufacturer's Factory Quality Management system to satisfy Quality Assurance requirements as specified in Section 1.5.
- B. Factory Assembly
  - 1. GAC systems shall be manufactured in accordance with the Factory Quality Management system's certification document.
- C. Factory Test
  - 1. Each GAC system shall be factory tested as follows:
    - a. Manufacturer's standard inspections and tests
    - b. Hydrostatically tested by the Manufacturer at the shop prior to delivery to the site. Notice shall be given to the Engineer at least two weeks prior to hydrostatically testing the equipment, so that arrangements can be made for Engineer or other Owner's Representative to witness the testing at the Manufacturer's facility.
    - c. Testing of interior coating systems per NACE standards SP0188 and SP0178.
  - 2. Submit factory test reports for approval prior to shipment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. As part of on-site start-up services, Manufacturer's representative shall examine areas and conditions for compliance with Manufacturer's installation recommendations and requirements.

- B. Proceed with start-up only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Installation is by others. Installation shall be per Manufacturer's instructions.
- B. The GAC system shall fit and be serviceable in the allocated space as shown on the Site Plan (Drawing GA-01). Dimensions of building access doors and overhead clearances were provided previously herein.

### 3.3 FIELD QUALITY CONTROL

- A. The Manufacturer shall furnish the services of a Manufacturer's representative to inspect the installation (by others) and to provide start-up services for the units.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. The on-site services of the Manufacturer's field representative shall be provided during the start-up and adjustment in accordance with this specification and as identified in the Bid Documents.
- B. The services of the Manufacturer's field representative shall be provided during installation. The Manufacturer's field representative is not required to be on-site during installation efforts, but will be conferred if problems or questions occur during installation.
- C. A factory-authorized service representative shall perform the following inspections and checks:
  - 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the Manufacturer's installation recommendations and requirements.
  - 2. Set field-adjustable settings to the values recommended by the equipment Manufacturer.
  - 3. Witness and provide input as requested during on-site performance tests (testing to be performed by others).
  - 4. Perform or supervise start-up services.
  - 5. Prepare written report to record the following:
    - a. Inspections and checks carried out on site

### 3.5 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.

1. Review data in Operation and Maintenance manuals.
  2. Schedule training with Owner /Engineer, with at least two weeks advance notice.
- B. The on-site services of the Manufacturer's representative shall be provided as separate visits, if required, for the minimum hours as listed below for the GAC system:
1. Twenty-Eight hours for inspection, certification of installation and start-up.
  2. Eight hours of site presence during performance testing.
  3. Four hours on-site for the owner's personnel training.

Vendor shall advise if the amount of hours specified are reasonable or provide the number of hours recommended if different than what is allotted above.

### 3.6 MAINTENANCE/SERVICE CONTRACT

- A. Refer to Bid Tab Item 7.

### PART 4 - APPENDICES

- A. Table 1 – GAC Submittal Schedule
- B. Table 2 – Constituent Concentrations
- C. Process Flow Diagram – PFD-1
- D. P&ID I-09 Carbon Filters
- E. General Arrangement Plan – GA-01
- F. Treatability Testing Results
- G. Section 16900 - Instrumentation and Controls Requirements
- H. Honeywell overlay document
  1. Process Industry Practices (PIP) Standard VESV1003
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- I. NACE SPO178-2007 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service
- J. NACE SPO188-2006 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

END OF SECTION

SECTION 44 42 73

FRAC TANKS PRE-PURCHASE SPECIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes work consisting of furnishing and delivering Frac Tanks as shown on the Process and Instrumentation (P&ID) drawings and General Arrangement Plan (attached as Appendices D and E, respectively). Refer to the attached P&ID drawings for example schematics of the systems. The space allocated for the tanks are as shown on the General Arrangement Plan.
1. Twelve Frac Tanks are required. The equipment shall include tanks and accessories for a completely assembled, ready to install and operate system.
  2. The Frac Tanks shall be delivered FOB project site to 522 Gere Lock Road, Syracuse, NY 13209.
- B. The system is planned to be installed (by others) inside a structure at the Owner's facility and operated approximately seven months out of each year (April 15<sup>th</sup> through November 15<sup>th</sup>) for four years beginning in the year 2012. In addition to the short-term (4-year) treatment trains, a long-term treatment train (which includes a total of five Frac Tanks) will also be operated at the same Owner's facility. The long-term tanks will treat the same water (contains the same constituents at the same concentrations as shown on Table 2 provided in Appendix B to this specification) but for an expected operational lifespan of 20 years. The long-term system will be in a heated space.
- Even though the short-term tanks will be located inside a structure, the structure is not heated and therefore the short-term tanks are subject to freezing during non-operational winter months (but after they have been drained). Vendor shall identify required means, methods and procedures, if any, needed to prepare units for storage over the winter months.
- C. The equipment shall fit within the footprint allocated as shown on the General Arrangement Drawing GA-01 provided herein. Manufacturer shall identify any operational or maintenance clearances required with the Bid. The equipment will need to fit through the building's overhead door which has dimensions of 14 feet width x 18 feet height. The building will be new construction. Vendor shall advise if a larger overhead door opening is required. Manufacturer is to confirm that the equipment can enter the building via the overhead door and be moved to the positions shown on drawing GA-01. The clear height at the building eave is estimated at 18'-0". Additional clear height is available between roof support members.
- D. The Frac Tanks shall be kept to Manufacturer's standard offerings, as much as possible. New, used or refurbished tanks are acceptable if they meet the design intent and warranty requirements. Any requests in this RFP which, in the Vendor's opinion, impart

unnecessary costs or unnecessarily differ from Manufacturer's standard offerings shall be clearly identified in Bidder's proposal.

## 1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
  - 1. American Society of Mechanical Engineers (ASME)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. American National Standards Institute (ANSI)
  - 4. NACE International
  - 5. National Electric Code

## 1.3 COORDINATION REQUIREMENTS

- A. Coordinate delivery with project schedule as maintained by Construction Supervisor.
- B. Bid Review Meeting: Following the Engineer's review of the proposal, a bid review meeting will be held in Syracuse, NY.
- C. Scheduling: The Frac Tanks must be operational before April 2012. Refer to RFP Section IV "Information" Schedule Milestones Table for schedule dates.

## 1.4 SUBMITTALS

- A. Prepare and provide drawings and submittals specific to this system in accordance with the requirements shown on Table 1 (provided as Appendix A to this specification).
- B. Product Data Submittals: "Catalog cuts" and spec sheets included as submittals shall be marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Submittal data for motors shall be in accordance with the attached Specification 26 05 13 "Electric Motors."
- D. Operation and Maintenance Data
  - 1. Presentation of Submittals
    - a. Operational and Maintenance Manuals (3 hard copies each in a 3-ring binder and 1 electronic copy). Owner's name, address, equipment serial numbers, and model numbers shall be clearly identified on the cover. Include

Manufacturer and local service representative contact information, including phone numbers and e-mail addresses, on the cover.

- b. Each manual shall include a table of contents, an index, and sequential section dividers separating equipment information into subsections. Each manual shall incorporate, at a minimum, the following: field installation instructions, brief written description of the equipment and corresponding components, routine maintenance procedures, procedures for protecting the equipment during short-term and long-term downtime, schedules, parts lists, troubleshooting topics, illustrations and diagrams and safety instructions for operating personnel.
- c. Each manual shall include any other information that is required by maintenance personnel for proper operation and maintenance.
- d. Electronic files of the complete operation and maintenance manual are to be provided on CD.

## 1.5 QUALITY ASSURANCE

### A. Qualifications

1. Manufacturer shall provide a list of references and contact information.
2. Seismic Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing structural and seismic engineering services, including the design of seismic restraints.
3. Owner or Owner's Representative reserves the right to conduct scheduled visits to Manufacturer's facilities during fabrication to witness progress and fabrication and/or during Manufacturer's shop testing procedures.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. As required, disassemble and deliver Frac Tanks and ancillary equipment in the minimum number of pieces.
- B. Site access is via a one-way access road, parts of which are steeply graded. Equipment Vendor to ensure adequate means of delivery is provided to enable delivery to the site. A site visit prior to delivery is recommended.
- C. Materials and equipment shall be boxed, crated or otherwise completely protected during shipment, delivery, storage and handling. Such boxes, crates or protection shall be clearly labeled with the Manufacturer's and Owner's name, site address, project equipment tag numbers, brand or model.
- D. Ship, deliver, store and handle to prevent damage and in accordance with Manufacturer's written instructions. Provide factory-installed lifting provisions.
- E. Manufacturer's storage requirements shall be provided. Units will be stored outside and unprotected from weather events for a prolonged period of time prior to installation.

Manufacturer shall provide adequate packaging and protection to prevent damage under these conditions.

- F. Off-loading of equipment delivered to the site is by Others.

## 1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Purchase Order General Terms and Conditions, and the Supplemental Terms and Conditions.
- B. The standard warranty duration shall be from delivery date of units to one year after start-up. Start-up is defined as the initiation of operational commissioning (assume start-up to begin on April 30, 2012). Provide with the Bid the cost adder to extend the warranty for 42 months after start-up, as described in the Bid Tab document. The standard warranty shall include parts and labor for all supplied items, including but not limited to, equipment, controls, and coating system. Any defects in equipment shall be corrected by Manufacturer, at no additional cost to the Owner or Buyer. Manufacturer shall provide and install additional or replacement equipment, parts, and labor (including cost of return trips to the site as needed), to correct deficiencies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The following Manufacturers are named to establish a standard of quality necessary for the Project:
  - 1. Baker Corp
  - 2. Adler Tank
  - 3. Rain For Rent
  - 4. Del Tanks
  - 5. Or approved equal

### 2.2 PERFORMANCE REQUIREMENTS

- A. The Frac Tank criteria shall be as follows:

<b><i>pH ADJUST TANKS</i></b>	
Number of pH Adjust Tanks	8
Capacity	18,000 gallons, nominal (or greater)
Mixers required/application?	Yes/chemical addition and neutralization
Covered?	Yes
<b><i>FLASH MIX TANK</i></b>	
Number of Flash Mix Tanks	1
Capacity	18,000 gallons, nominal (or greater)

Mixers required/application?	Yes/chemical addition
Covered?	Yes
<b><i>FILTER FEED TANK</i></b>	
Number of Flash Mix Tanks	1
Capacity	18,000 gallons, nominal (or greater)
Mixers required/application?	No
Covered?	Yes
<b><i>EFFLUENT MONITORING TANKS</i></b>	
Number of Flash Mix Tanks	2
Capacity	18,000 gallons, nominal (or greater)
Mixers required/application?	Yes/chemical addition and neutralization
Covered?	No

Note 1: Motors shall be in accordance with requirements provided in Appendices.

- B. Emphasis will be placed on the following criteria and objectives to evaluate Bids for the Frac Tanks:
1. With the short-term and long-term components to this project, and with the seven-month operational up-time per year for the short-term tanks, this project lends itself to some unique opportunities for purchasing/rental options. Vendor shall propose cost effective ways to optimize the Frac Tank purchasing strategy. Strategies such as the purchase of the Frac Tanks coupled with Vendor buy-back after project completion (estimated to be 4 years), or rental of tanks with decreased rental pricing for off-line months, etc. will be entertained. If actual conditions warrant the eventual purchase of these rented units, the accrued rental costs would then be applied towards the purchase of these units. Other strategies, as proposed by the Vendor with the Bid, are encouraged and will be evaluated.
- C. Water constituents and concentrations are provided in Table 2 (provided as Appendix B to this specification).
- D. Materials of Construction, Vessels – The material of construction for the interior of the tanks or coating system and any potentially wetted parts shall be selected by the Vendor to be compatible with constituents found in the water up to the combined maximum concentrations identified in Table 2 (see Appendix B to this specification). Note the water exhibits chlorides and organic compound solvent concentrations. When selecting materials of construction, the Vendor shall also consider the expected project lifespan of 4 years and select materials of construction accordingly, except for the Frac Tanks to be used in the long-term, heated building which are expected to remain operational for the long-term project life and as addressed by the alternative materials of construction described in Bid Item No. 2.
- E. All vessels and equipment shall be designed to resist the design loads per the Building Code of New York State (BCNYS) 2007 edition, including sloshing effects resulting from a hydrodynamic and/or seismic analysis. Vessel/equipment support layout details,

including locations of anchor bolt holes, anchor bolt size and type, and embedment length shall be provided. Maximum Reaction Forces and moments at each anchor point shall be provided. The structural design criteria provided below for this site are preliminary, based on initial information available for the site, and are subject to change upon completion of a site geotechnical evaluation. Finalized structural design criteria will be provided prior to award of the Contract. Once finalized design criteria is provided, Vendor to certify that equipment design and anchoring is in compliance with the finalized structural design criteria. Draft structural design criteria are as follows:

**SEISMIC DESIGN CRITERIA:**

Seismic Importance Factor, $I_E$	1.25
Seismic Use Group	II
Mapped Spectral Response Acceleration, $S_S$	0.192 g
Mapped Spectral Response Acceleration, $S_1$	0.078 g
5% Damped Spectral Response Acceleration at Short Periods, $S_{DS}$	0.32 g
5% Damped Spectral Response Acceleration at 1 sec Periods, $S_{D1}$	0.182 g
Seismic Design Category, SDC	C

- F. The Frac Tanks will be placed on a former wastebed. As such, the soils are limited in the amount of weight they can support. The support structure (by Others) for the tanks will be designed to limit loading at floor contact points when full of water. Frac Tanks are to be installed on concrete pads or elevated cribbing. Vendor shall identify if continuous support is required beneath tanks, or if tanks can span between support locations (if timbers or concrete cribbing is used). Vendor to identify any concerns with planned support arrangement. Because of the properties of the soil, it is expected that potentially uneven settlement will occur. Assume the maximum acceptable settlement is as follows: less than 3/4" differential settlement across each tank and less than 1.5" of total overall settlement. Equipment Manufacturer shall identify the maximum acceptable differential settlement their unit can encounter without affecting the equipment or its operation.
- G. The vessels shall be designed for atmospheric service (no pressure).
- H. The Frac Tanks shall be equipped with nozzles, manways, downcomers, and all accessories as described herein and on the attached Nozzle Schedule drawings (see Appendix F to this specification). Manways shall be minimum 20" diameter, easy-open type, suitable for maintenance access on the top cover of each tank and a second manway on the sidewall with a minimum opening dimension of not less than 20" diameter. Alternative dimensions will be considered. Manways must be suitably sized to allow entry for inspection and repair of coatings and interior components. Manways shall be gasketed and flanged. Side manways shall be equipped with a davit hinge.
- I. Access to the tops of the tanks and walkable tank covers shall be provided, as necessary, to enable routine maintenance and cleaning at the top of the covers. Handrails and guardrails shall comply with the attached Specification 05 52 13 – Pipe and Tube Railings. Manufacturer shall provide in the base bid pricing, the cost for top of tank access for each Frac Tank. If possible, (and as shown on the General Arrangement Drawing,) it would be preferred to share access between pairs of Frac Tanks grouped together (such as the pH Adjustment Tanks) such that the quantity of access ladders and handrailing is kept to a minimum. For example, in the General Arrangement Drawing equipment shown, each pair of pH Adjustment Tanks could have one (combined) ladder

for access to the top of the units and one handrail/guardrail system around the perimeter of both units together.

In addition, provide pricing for staircases in lieu of ladders as identified in the Bid Tab Items. Manufacturer is to indicate (and include pricing for) the recommended arrangement being proposed and clearly identify the number, size and location of handrails, walkable (portions of) tank covers, ladders or stairways, etc. Manufacturer shall propose a cost-effective means of providing necessary access without imposing unnecessary custom design components, if possible.

Locations of top nozzles, manways, and equipment or instrumentation located on the tops of tanks shall be grouped together as much as possible, and located outside of main walkable paths to avoid trip hazards for personnel walking on the tank covers.

- J. Each Frac Tank shall be equipped with a minimum of four lifting lugs to facilitate lifting/rigging.
- K. Nozzle sizes, locations and information are presented on the Tank Nozzle Schedule drawings (included in Appendix F to this specification.) Tanks which are covered will be designed to support live loads of 60 lbs per square foot and super-imposed equipment dead loads of 10 lbs per square foot, plus all mixer loads (i.e. vertical downward load, bending moment, static moment, torque, etc.). OSHA-approved 5,000 lb. tie-off points for personnel shall be included. Each of the covers shall be provided with load-rated manways.
- L. For those tanks with mixers, tank manufacturer shall coordinate with engineer and/or mixer manufacturer to ensure that the tanks are designed to handle the loads imposed by the mixers. This coordination between the mixer manufacturer and the tank manufacturer is required regardless of whether the mixers are included in the scope of the tank manufacturer or not.
- M. Mixers shall be constant speed. Motors shall be TENV or TEFC, 480 volt, three phase, 60 Hertz, with anticondensation heaters in accordance with Specification 26 05 13, "Electric Motors" (attached as Appendix G to this specification.)
- N. Mixers General
  - 1. The motors shall be designed in accordance with the requirements provided in the appendices herein.
  - 2. The mixer Manufacturer shall be Lightnin, Chemineer, or approved equal.
  - 3. The mixers shall be equipped with 316 stainless steel shafts and impellers, or approved alternate, as recommended by the Manufacturer.

4. Mixer blades shall be attached to shaft by keyways. Blades attached by set screws only are not acceptable.
- O. The attached P&ID's show typical Frac Tank arrangements for each of the 4 types of tanks needed (pH Adjust Tanks, Flash Mix Tank, Filter Feed Tank, and Effluent Monitoring Tanks).
- P. Electrical area hazard classification (interior and exterior of the Frac Tanks) is designated as ordinary.
- Q. The Manufacturer shall conduct shop testing to satisfy hydraulic conditions of each tank. The Frac Tanks shall be hydrostatically leak tested by filling units at the Manufacturer's shop prior to delivery to the site. Certified test reports for each Frac Tank shall be provided prior to delivery.
- R. The interiors of the Frac Tanks, equipment, piping, and all wetted ancillaries are to be constructed of materials that are compatible with the water characteristics provided in Table 2. Note the water exhibits chlorides and organic compound solvent concentrations.
- S. All tanks, equipment items, valves, and instruments shall be provided with stainless steel tags. Tags shall be permanently affixed or chained to the item, and will indicate the tag number and description of the item as shown on the P&IDs. Lettering on the tag shall be etched or struck, with a minimum letter height of 0.5 inches.
- T. Vendor shall identify any issues that may result from a prolonged shutdown and what time interval it would be expected that the issues may occur at.
- U. All tank nozzles shall be provided with flanges designed in accordance with ASME B16.5, 150# flanges. Nozzle projections shall be of sufficient lengths to allow access to flange bolts and nuts
- V. Manufacturer shall provide pricing for one spare for each different type of mixer provided.
- W. Any stainless steel bolts shall be applied with anti-seize thread lubricant.

### 2.3 SHOP FINISHES

- A. All surfaces to be coated shall be prepared in accordance with PIP VESV1003HA and Honeywell's associated overlay document associated with the PIP specification. Surface preparation prior to coating application shall be in accordance with the NACE standard SP0178 and NACE SP0178 Appendix C NACE Weld Preparation Designation C, and coating Manufacturer's instructions, whichever is more stringent.
- B. The Manufacturer shall provide a shop applied protective coating system for all interior metal surfaces of the Frac Tanks system in accordance with coating system manufacturer recommendations. The interior linings of the Frac Tanks shall be compatible with the influent parameters and concentrations presented in this specification. Coal tar epoxy is not an acceptable interior lining. Proposed coating and lining systems and dry film

thickness (DFT) of each coat and of the overall coating system proposed shall be provided with the Bid. Stainless steel does not require coating. Cathodic protection may be used for supplemental corrosion resistance, if recommended by the Manufacturer.

- C. The Manufacturer shall provide a shop-applied protective coating system (primer and suitable top coat(s)) for all exterior metal surfaces.

## 2.4 SOURCE QUALITY CONTROL

### A. Factory Test

1. Each Frac Tank shall be factory tested as follows:
  - a. Manufacturer's standard inspections and tests
  - b. Hydrostatically tested by the Manufacturer at the shop prior to delivery to the site. Notice shall be given to the Engineer at least two weeks prior to hydrostatically testing the equipment, so that arrangements can be made for Engineer and/or other Owner's Representative(s) to witness the testing at the Manufacturer's facility.
  - c. Testing of interior coating systems per NACE standards SP0188 and SP0178.
2. Submit factory test reports for approval prior to shipment.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation is by others. Installation shall be per Manufacturer's instructions.

### 3.2 MANUFACTURER'S SERVICES

- A. If mixers are provided by the Frac Tank Successful Bidder, the on-site services of the Manufacturer's field representative shall be provided during the start-up and adjustment in accordance with this specification and as identified in the Bid Documents.
- B. The services of the Manufacturer's representative shall be provided during installation. The Manufacturer's representative is not required to be on-site during installation efforts, but will be conferred if problems or questions occur during installation. Assume 4 hours for mixer installation assistance and 2 hours for Frac Tanks installation assistance.
- C. A factory-authorized service representative will perform the following inspections, checks, and start-up assistance per Section 3.3.B:
  1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the Manufacturer's installation recommendations and requirements.

2. Set field-adjustable settings to the values recommended by the equipment Manufacturer.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
4. Perform or supervise start-up services.
5. Prepare written report to record the following:
  - a. Inspections and checks carried out on-site.

### 3.3 DEMONSTRATION AND TRAINING

- A. If mixers are provided by the Frac Tank Successful Bidder, engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.
  1. Review data in Operation and Maintenance manuals.
  2. Schedule training with Owner or Engineer, with at least two weeks advance notice.
- B. If mixers are provided by the Frac Tank Successful Bidder, the services of the Manufacturer's representative shall be provided within one site visit for the minimum hours as listed below:
  1. Thirty-Six hours for inspection, certification of installation and start-up assistance.
  2. Four hours for training Owner's personnel.

Manufacturer shall advise if the amount of hours specified are reasonable or provide the number of hours recommended if different than what is allotted above

### PART 4 - APPENDICES

- A. Table 1 – Frac Tank Submittal Schedule
- B. Table 2 – Constituent Concentrations
- C. Tank Data Sheets
- D. P&ID's
  1. Lead Sheets
  2. I-01 pH Adjustment Tank #1
  3. I-02 pH Adjustment Tank #2
  4. I-03 Flash Mix Tank #1
  5. I-07 Filter Feed Tank

6. I-10 Effluent Monitoring Tank #1

- E. General Arrangement Plan – GA-01
- F. Nozzle Schedule Drawings
  - 1. M-12 Flash Mix Tank #1 Nozzle Schedule
  - 2. M-14 pH Adjust Tank #1 Nozzle Schedule
  - 3. M-15 Filter Feed Tank Nozzle Schedule
  - 4. M-16 Effluent Monitoring Tank #1 Nozzle Schedule
  - 5. M-17 Effluent Monitoring Tank #2 Nozzle Schedule
- G. Specification 26 05 13, “Electric Motors”
- H. Specification 05 52 13 – “Pipe and Tube Railings”
- I. Honeywell overlay document
  - 1. Process Industry Practices (PIP) Standard VESV1003
  - 2. Honeywell Specification MSL-2002 HW (*not applicable for this contract*)
- J. NACE SPO178-2007 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service
- K. NACE SPO188-2006 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

END OF SECTION