

**CITY OF MARATHON, FLORIDA  
RESOLUTION 2010-103**

**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, APPROVING A CONTRACT BETWEEN THE CITY AND CENTRISYS CORPORATION FOR THE PURCHASE OF A CENTRIFUGE WITH TRAILER MOUNT SYSTEM IN AN AMOUNT NOT TO EXCEED \$622,000.00; AUTHORIZING THE CITY MANAGER TO EXECUTE THE CONTRACT ON BEHALF OF THE CITY AND EXPEND BUDGETED FUNDS; AND PROVIDING FOR AN EFFECTIVE DATE.**

**WHEREAS**, the City of Marathon (“City”) solicited bids for Centrifuge equipment with trailer mount system (“Centrifuge”); and

**WHEREAS**, the City Clerk opened sealed bids for the Centrifuge on August 13, 2010, and staff subsequently reviewed the bid for completeness, and to determine whether bidders were responsive and responsible; and

**WHEREAS**, it was determined that the bid received from Centrisys Corporation in the amount of \$622,000.00 was the lowest responsive and responsible bid for the Centrifuge; and

**WHEREAS**, the City Council finds that approving of the award of bid for the Centrifuge to Centrisys Corporation is in the best interest of the City.

**NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, THAT:**

**Section 1.** The above recitals are true and correct and incorporated herein.

**Section 2.** The contract between the City and Centrisys Corporation in an amount not to exceed \$622,000.00 for the purchase of a Centrifuge attached as Exhibit “A,” together with such non-material changes as may be acceptable to the City Manager and approved as to form and legality by the City Attorney is approved. The City Manager is authorized to execute the contract and expend budgeted funds.

**Section 3.** This resolution shall take effect immediately upon its adoption.

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, THIS 14<sup>th</sup> DAY OF SEPTEMBER, 2010.

THE CITY OF MARATHON, FLORIDA

  
\_\_\_\_\_  
Ginger Snead, Mayor

AYES: Keating, Worthington, Cinque, Ramsay, Snead  
NOES: None  
ABSENT: None  
ABSTAIN: None

ATTEST:

  
\_\_\_\_\_  
Diane Clavier, City Clerk

(City Seal)

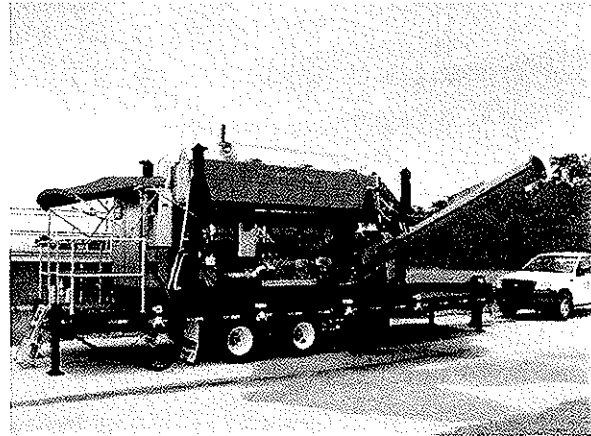
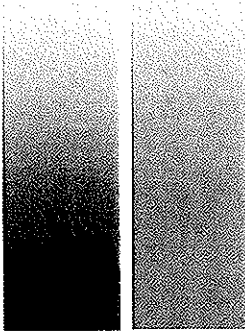
APPROVED AS TO FORM AND LEGAL SUFFICIENCY FOR THE USE AND RELIANCE OF THE CITY OF MARATHON, FLORIDA ONLY:

  
\_\_\_\_\_  
City Attorney

# **EXHIBIT A**

# Tom Evans Environmental, Inc.

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Ms Zully Hemeyer, Utilities Manager  
City of Marathon  
9805 Overseas Highway  
Marathon, Florida 33050

RE: Centrisys Trailer Mounted Sludge Dewatering Centrifuge System  
Process Data Questionnaire for Test Site

Dear Ms. Hemeyer:

Thank you for the opportunity to provide the City of Marathon a physical presentation of the Centrisys product for your evaluation and consideration for purchase. I am writing to address the questions you posed to me in your mail of September 13, 2010 concerning service and parts. I will restate your questions and provide my comments thereafter, below:

1. **How long would it take to have a repair technician on site and the costs involved?**

Your first line of response will come from your phone call to us in Lakeland, Florida. We are Centrisys's local trained Representatives and can provide you, in-state, local response when you need it.

Centrisys has dedicated factory service technicians available to the City on a 24 hour basis and are also available via their mobile phone contact information.

Depending upon what your needs are for expeditious or emergency response to restore your equipment operation, we will mobilize either our local Florida Service technician from Lakeland or the manufacturer's factory service personnel. Factory service personnel can respond to the installation site within 24 hours from Wisconsin or Delaware.

Service required for equipment failures determined to be warranty related will be provided at no charge to the City.

Training and process set-up for each site is included in the project bid price. Service requested for normal repairs, additional training, preventative maintenance, and other needs in the years to come, will be provided at the factory's standard service rates and will include travel and expenses applicable.

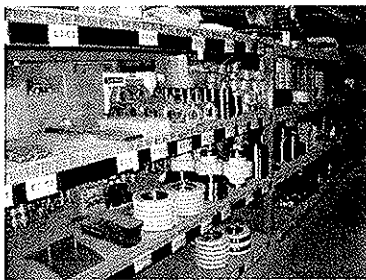
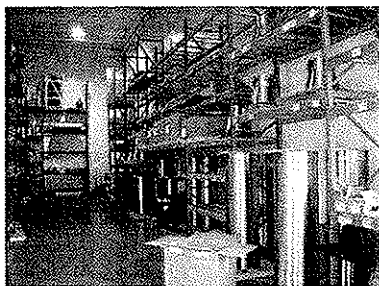
Service oftentimes involves electronic or automatic controls related questions that can be requested of the manufacturer via phone and solved via electronic methods. The centrifuge system is provided with the equipment and the ability for the equipment to be accessed via a network connection to the internet, where the factory can view everything concerning the centrifuge operation. This requires the IP address locally, but is a simple matter these days.

## 2. **Repair Guidance and replacement equipment if necessary.**

Centrisys has the ability to provide a temporary replacement machine in the event that is needed during a major equipment repair.

Centrisys also maintains a stock of every part and item used to build the machine you are considering purchasing. Every part is on the shelf in Kenosha, WI., and can be air-freighted if necessary within 24 to 48 hours.

Centrisys actually began its business as a centrifuge service company 25 years ago that grew into a full manufacturing operation to provide the highest level of customer service available in this industry today.



## 3. **Costs involved in Temporary use of Equipment:**

Centrisys has provided equipment to customers on occasion for rental. Pricing for this equipment provision is generally offered on an application by application basis, based upon the size of the equipment needed, personnel required to operate it, and the hours / gallons of process required.

Generally the equipment is skid mounted and shipped to the customer's site on a flat bed, commercial trailer and operated from that trailer, hooked up as required for the site conditions. Every site is different and requires careful evaluation to price rental service fairly for the customer.

**4. Maintenance Requirements (type of oils)**

The centrifuge you are considering requires high temperature grease which is administered to two main bearings in an electronically controlled automatic lubrication system.

Two Scroll Conveyor bearings are accessible when the machine is off, from the top platform and require a single shot of grease once each week of continuous operation.

The system bearings have an L-10 bearing life rating of 60,000 hours.

The centrifuge back-drive is an oil / hydraulic operated unit that will require 20 weight hydraulic oil change approximately every 6 months.

The Centrifuge system is a collection of several process subsystems all operating in concert with each other and controlled and monitored from a single control system screen. Each system has its own set of observation and maintenance considerations.

I am appending a 15 page Maintenance & Inspection Information document from Centrisys which has a detailed description of what to look at, when to lubricate, and what lubricants are recommended, for your review.

**5. Down-Time For Maintenance:**

There are daily inspections that should take about 5 minutes when the operator begins his daily process.

On a weekly basis, or when the trailer unit is moved between sites, there are a couple of additional items that require attention in the set-up and making the transported unit ready for operation. These considerations would involve 10 to 15 minutes of actual machine condition review, in addition to connecting hoses, power, and water. These procedures are well documented in the attached information.

**6. Information on operating time, procedures, length of times, etc.:**

The proposed dewatering centrifuge will perform dewatering for your sludge digesters at a rate of 250 GPM or 50 GPM, depending upon the desires of the operator using the machine. Polymer / coagulant requirements depend upon the feed rate of the sludge to be de-watered.

The machine can be operated manually or automatically as the operator desires. We recommend automatic operation as the machine, once set up with adjustments required for each site, will start with the push of a start button, operate all day, and stop with the press of the stop button. In between these start and stop commands, the machine will automatically control the flow of sludge, polymer, flush water, conveyors, and clean its self up at the end of the day when told to stop.

7. Polymers:

Polymers are a key ingredient to the operation of the sludge feed (not the centrifuge machine itself) with regard to the preparation of the sludge to let-go of the water it is contained within. There are hundreds of these chemicals available for use in this process. Some are excellent and some are not. Usually the excellent products are more expensive, but work so well that very little of the chemical is required to perform its task.

As a part of the centrifuge system's commissioning for the City, Centrisys will provide many days of site training and performance optimization at the City's process sites. The project bid outlined a specific, minimum quantity of operational days that will be required from the manufacturer's service technician. During that time, Centrisys will provide operator training, recommendations for the City's selection of a polymer product, and provide site application adjustments of its dosing to achieve the best possible performance from the coagulant used.

All of these training services were included in the project bid price offered to the City.

Thank you for your consideration of the Centrisys product for your sludge dewatering needs. We are dedicated to your complete satisfaction and successful process.

If you have any questions or comments, please call me directly on my office or cell phone at 863-619-3789, office; 305-588-6761 mobile phone.

Sincerely,

*Tom Evans*

Thomas R. Evans, President  
Tom Evans Environmental, Inc., for Centrisys Corp.  
3605 Ventura Drive East  
Lakeland, Florida, 33811  
863-619-3789 office  
863-619-8098 fax  
305-588-6761 mobile  
[te@tomevans.com](mailto:te@tomevans.com)

Michael Kopper, President  
Centrisys Corp.  
Kenosha, WI  
262-654-6006



*"Excellence in Engineering"*

August 16, 2010

Zully Hemeyer  
City of Marathon  
9805 Overseas Highway  
Marathon, Florida 33050

Re: Recommendation of Award  
Centrifuge with Trailer Mount System  
ITB: 10-010W

Dear Ms. Hemeyer:

Bids for the above referenced projects were received at the Marathon City Office until 3:00 p.m., August 13, 2010, at which time they were opened publicly, and read aloud at the Marathon City Hall in Marathon, Florida.

A single response was received, and therefore was ranked as the lowest bidder. The submitting company, Centrisys, has demonstrated responsiveness with respect to the scope of work advertised.

Based on this review of the Centrisys Corporation bid documents, we have determined that they qualify as responsible and are capable of supplying the equipment that will provide sludge dewatering at the six City of Marathon wastewater treatment facilities. Weiler Engineering recommends that the City award the bid to Centrisys Corporation in the amount of \$622,000.00 as the lowest responsive, responsible bidder.

Weiler Engineering recommends that the City of Marathon consult with their financial advisor and legal counsel for their respective input and recommendations regarding this bid re-evaluation, as well as any other criteria that they may feel are appropriate in making a final determination of award.

Please contact us if you need further information or have questions regarding our evaluation.

Sincerely,

Edward R. Castle, P.E.  
Vice President, Director of Wastewater



Ms. Susie Thomas

Recommendation of Award Letter – Mobile Centrifuge Equipment

Page 2 of 2

<b>Marathon Mobile Centrifuge Project</b>							
<b>Bid Summary &amp; Documents Checklist</b>							
Bidder	Rank	Bid	Bid Form	Signatory Authority	Certificates of Insurance	American Made Product Certification	Addenda
Centrisys Corporation	1	\$622,000	Y	Y	Y	Y	Y

20020 Veterans Boulevard, Suite 7-9 \* Port Charlotte, Florida 33954 \* (941) 764-6447 phone \* (941) 764-8915  
6805 Overseas Highway \* Marathon, Florida 33050 \* (305) 289-4161 phone \* (305) 289-4162 fax  
6630 Front Street \* Key West, Florida 33040 \* (305) 295-3301 phone \* (305) 295-0143 fax

**CITY OF MARATHON  
INVITATION TO BID**

**ITB NO. 10-010W: CENTRIFUGE WITH TRAILER MOUNT SYSTEM**

All interested parties are hereby notified that the City of Marathon, Florida ("City") Utilities Department is accepting sealed bids to furnish and deliver centrifuge equipment for mobile use including trailer mount system to the Marathon Wastewater Treatment Plant located at 140 Sombrero Beach Road, Marathon, Florida 33050 (the "Work"). The Work consists of all labor, materials, supplies, supervision, equipment and incidentals required for the furnishing and delivery of the centrifuge in accordance with the requirements contained herein. This Work also includes submittal of shop drawings, start up, on site testing and training.

Bidders shall submit one (1) original and three (3) copies of a written bid attached to this form, signed in ink, in a sealed opaque package, clearly marked on the front of the package: **BID: CENTRIFUGE**. All bids must include required forms signed by the bidder and attached to the bid package. All bids shall be received in the City Clerk's office no later than 3:00 PM eastern time, *August 13, 2010* at the offices of the City Clerk, City of Marathon located at 9805 Overseas Highway, Marathon, Florida, 33050, and commencing at 3:00 PM will be opened and read aloud at City Hall.

Prospective respondents shall not contact or otherwise communicate with City staff or City officials except as set forth herein.

The City reserves the right to reject any or all bids and to waive informalities, except timely submission of bids, to re-advertise for bids or to take any other such actions that may be deemed in the best interest of the City. As a matter of information to respondents, the City does not bind itself to accept the minimum specifications stated herein, but reserves the right to accept any bid, which in the judgment of the City Council will best serve the needs and interests of the City.

**SECTION 1  
INSTRUCTIONS TO BIDDERS**

- 1.01. **DELIVERY** - Sealed bids for furnishing all goods and services necessary to complete the Work specified in these documents will be received as follows:

**Date:** August 13, 2010

**Time:** 3:00 p.m.

**Place:** City Hall, 9805 Overseas Highway, Marathon FL 33050

- 1.02. **DEFINITION OF TERMS-** Certain terms used in these documents are defined as follows:

Bid/Bid	The bid documents submitted by the Respondent.
Respondent	Any Person, firm or corporation submitting a bid for the Work covered by these specifications or his duly authorized representative.
City	The City Council of the City of Marathon or the City Manager, if applicable.
Contractor	The person, firm or corporation with whom the City has executed a contract for the Work.
Days	Days shall mean calendar days.
Responsible Bidder	Any person, firm, or corporation submitting a Bid for the Work who maintains a permanent place of business, has adequate equipment and personnel to do the Work within the time limits that are established, has adequate financial status to meet the obligations to perform the Work and has not defaulted on a prior contract with the City.
Responsive Bid	Any person, firm or corporation submitting a Bid for the Work whose Bid form is complete and includes all required attachments and enclosures, free from exclusions or special conditions and has no alternative Bids for any work items, unless alternatives are requested in the specifications. To be a Responsive Bid, the Bid must be submitted to the City within the required times.
Work	The products and/or services required by the bid documents, including labor and materials.

1. **Bid shall include:**
  - a. Signed bid forms;
  - b. Evidence of signature authority;
  - c. Certificates of Insurance;
  - d. American Made Product Certification

**Do not send bids by facsimile. Bids sent by facsimile or email will not be accepted.**

2. **Non-Responsive Bids.** Bidders shall sign and return the entire Invitation for Bid. Unsigned or non-responsive bids shall not be accepted.
3. **Contract Award.** The contract will be awarded to the lowest responsible bidder whose bid is responsive, conforms to the Invitation for Bid, is most advantageous to the City, price and other factors considered. All aspects of the City purchasing policy will be considered, including any applicable advantage for local bidders.
4. **Interpretation and Clarification.** All questions about the meaning and intent of the Bid Documents and specifications shall be directed in writing to the Utilities Manager at 9805 Overseas Highway, Marathon, FL 33050. Interpretation or Clarifications considered necessary by the City in response to such questions will be issued by means of addenda mailed or delivered to all parties recorded by City as having received the Proposal Documents. Only questions answered by written addenda shall be binding. Oral and other interpretation or clarifications shall be without legal effect.
5. **Rejected Bids.** City reserves the right to reject any and all bids.
6. **The Work.** Bidder shall begin the Work no later than five days after Notice to Proceed is issued by City unless specified otherwise in the purchase order. The City's minimum specifications (the "Work") are provided as Exhibit "D", attached hereto and incorporated herein. The City's wastewater treatment plant at 140 Sombrero Beach Road is available for inspection, if requested. The bidder shall supply all of the labor, materials, equipment, tools, apparatus, means of transportation, services and incidentals necessary for completion of the Work, shall be accountable for the safe, proper and reasonable installation, maintenance and use of the same during performance of the Work, and shall remove all set up equipment, tools and apparatus upon completion. Proposer shall perform all Work in the best and most workmanlike manner. Special care shall be taken in placing and removing material or equipment to avoid unnecessary injury to either public or private property or areas involving and adjacent to the Work.
7. **Eligibility.** To be eligible to bid, bidders must not have been convicted of or served any form of probation or deferred adjudication for any crimes of moral turpitude, felony offense by any federal, state or local governmental entity. Bids received from ineligible bidders shall be rejected. This prohibition applies to individuals, individual members of partnerships, corporate bidders, and the officers and directors of corporate bidders, or any other party or entity submitting a bid.
8. **Bid Bond.** A bid bond is not required.

9. **Failure to Perform.** If the successful bidder fails to complete the Work or perform as required herein, the City reserves the right to award the bid to the next lowest responsible and responsive bidder. All bids shall remain firm offers for 90 days following submission.
10. **Purchase Order.** Notice of award in the form of a purchase order, mailed or otherwise furnished to the successful bidder, will be provided.
11. **Required Documentation.** The successful bidder shall provide all items described in the specifications (all Exhibits) as well as proof of applicable licensure and insurance.
12. **Permits and Registration.** The City may charge for building permits for the Work. The successful bidder must pay a registration fee to the City Building Department, as appropriate. **NOT APPLICABLE FOR THIS BID**
13. **Commencement of Work.** Unless specified otherwise in a purchase order, the successful bidder shall not commence work until a notice to proceed has been issued to bidder by City.
14. **Clean-Up.** The successful bidder shall remove any debris related to the Work from City premises, using bidder's own labor, material and tools, immediately following completion of Work. City personnel will not be available to perform these functions. City premises must be left in the same or better condition as provided. Prior to commencement of the Work, bidder shall provide City the name and location of the facility that will be used for debris placement, if applicable. The Bidder shall provide the City with copies of receipts for debris placement from the disposal facility, if applicable. The Work shall be performed in such a manner as to provide a minimum of inconvenience to the residents of the area. Any debris or other material spilled shall be removed by the bidder and the area and surrounding area shall be cleaned daily to the satisfaction of the City.
15. **Hours.** All Work must be performed between the hours of 7:30 A.M. and 6:00 P.M., Monday through Friday. Any Work to be performed outside of these days and hours must be approved in advance, in writing, by the City Manager.
16. **Status of Bidder.** The City shall accept bids from manufacturers and/or authorized distributors of products as specified herein.
17. **Indemnification.** Bidder hereby agrees to indemnify, defend and hold harmless City, and City's officers and employees from liabilities, damages, losses and costs (including, but not limited to, reasonable attorney's fees at any level) on account of or relating to the Work, the bid, any resulting contract or acts related thereto, and whether caused in whole or part by the negligence or fault of City, or otherwise.

The provisions of this INDEMNIFICATION are solely for the benefit of the City and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

18. **Warranty.** All labor and materials provided by Bidder shall be warranted for a period of two (2) years from date of acceptance by the City.

19. **Termination.** City may reject this bid or terminate the resulting agreement at any time after award for cause or convenience upon written notice to bidder. City shall have no liability for services provided or goods ordered or any other expenses incurred by bidder pursuant to the agreement subsequent to notice of termination.
20. **No Assignment.** Bidder shall not sell, assign, transfer or convey this bid or resulting contract, in whole or in part, without the prior written consent of the City Manager. Any such assignment without prior approval shall be void ab initio.
21. **Applicable Law.** Bidder shall be solely responsible for and shall comply with all Federal, state and local laws regarding the bid and the Work required hereunder.
22. **Entire Agreement.** This bid and attached forms and any purchase order and notice to proceed to bidder from City, together with exhibits, constitutes the final and entire agreement between the bidder and City and contains all of the terms and conditions agreed upon. No other agreements, oral or otherwise, regarding this bid or any resulting contract shall be deemed to exist or to bind either party, unless same is in writing, dated subsequent to the date hereto, and duly executed by the party to be charged.
23. **Location of Claims.** This bid and all actions thereunder shall in all respects be governed by and interpreted and enforced pursuant to the laws of the State of Florida. Any suit arising out of this bid or the resulting contract shall be brought in Monroe County, Middle Keys Division, Florida or U.S. Southern District Court.
24. **Expenses and Delay.** The City shall have no liability to the bidder for any expenses incurred in response to this bid or for any damages to the bidder for delay or interruption of the Work. The bidder's sole and exclusive remedy for any such delay, if any, shall be an extension of the time required or allowed to complete the Work. In order to obtain an extension of time, the bidder shall request same of the City in writing within 24 hours of any delay or interruption of the Work.
25. **Severability.** Should any provision, paragraph, sentence, word, or phrase contained in this document be determined by a court of competent jurisdiction to be invalid, illegal, or otherwise unenforceable under the laws of the State of Florida, such provision, paragraph, sentence, word, or phrase shall be deemed modified to the extent necessary in order to conform with such laws, and the remainder shall remain unmodified and in full force and effect.
26. **Waiver of Jury Trial and Venue.** The City and bidder knowingly, irrevocably, voluntarily and intentionally waive any right either may have to a trial by jury in State and or Federal court proceedings in respect to any action, proceeding, lawsuit or counterclaim based upon this bid, resulting contract and/ arising out of, under, or in connection with the Work, or any course of conduct, course of dealing, statements or actions or inactions of any party.

27. **Attorneys' Fees.** If either the City or bidder is required to enforce the terms of this bid or resulting contract by court proceedings or otherwise, whether or not formal legal action is required, the prevailing party shall be entitled to recover from the other party all such costs and expenses, including, but not limited to, court costs, and reasonable attorneys' fees.
28. **Signature on Bid.** Anyone signing the bid shall include in the bid legal evidence of his/her authority to do so. The Bidder's signature below indicates Bidder has read, understands and accepts all provisions contained herein, including the attached exhibits and that the Bidder has the requisite authority to sign this Bid.

CENTRISYS CORP.  
Name of Bidder/Business

State of Wisconsin  
Sworn to and subscribed before me this  
6th day of August 2010.

By: William Fairbairn  
Signature

Notary Public  
Jane L. Leskover  
My Commission Expires: 4-3-2011

WILLIAM FAIRBAIRN VP  
Print Name and Title

9586 58th PLACE  
Mailing Address

KENOSHA, WI 53144

EXHIBIT "A"

BID FORM

INVITATION TO BID NO. 10-010W: CENTRIFUGE WITH TRAILER MOUNT SYSTEM

This form must be signed and submitted with Bid to be deemed responsive. The undersigned guarantees the truth and accuracy of all statements and the answers contained herein.

Name of Proposer: CENTRISYS CORPORATION  
Address: 9586 58th PLACE  
City/St/Zip: KENOSHA, WI 53144  
Phone/Fax: 262-654-6006 FAX 262-764-8702

Name of authorized representative of proposer: WILLIAM FAIRBAIN

This Bid proposal is hereby submitted for work performed on a lump sum basis and shall be inclusive of all work described herein. The Basis of Design/Basis of Bid is Centrysis Corporation. You must bid this product or an "equal" product. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function and quality required. Material or equipment from other Suppliers may be accepted by the CITY'S REPRESENTATIVE, with the recommendation of the ENGINEER if sufficient information is submitted by CONTRACTOR to allow a determination that the material or equipment proposed is equivalent or equal to that named. Requests for review of substitute or alternate items of material and equipment will not be accepted.

Bidder will complete the Work in accordance with the requirements herein for the following Lump Sum Bid (in numerals):

\$ 622,000<sup>00</sup>

Written Bid Amount (in Words):

SIX HUNDRED AND TWENTY TWO THOUSAND (Dollars) NO/100 (cents)

WILLIAM FAIRBAIN  
Name of Bidder  
William Fairbain  
Signature of Bidder

Witness or Notary Public: Jane T. Leskovec



EXHIBIT "A"

BID FORM

INVITATION TO BID NO. 10-010W: CENTRIFUGE WITH TRAILER MOUNT SYSTEM

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Address: 9586 58th PLACE  
City/St/Zip: KENOSHA, WI 53144  
Phone/Fax: 262-654-6006 FAX 262-764-8702

Name of authorized representative of proposer: WILLIAM FAIRBAIN

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Bidder will complete the Work in accordance with the requirements herein for the following Lump Sum Bid (in numerals):

\$ 622,000<sup>00</sup>

Written Bid Amount (in Words):

.../

State of Wisconsin

County of Kenosha

This instrument was acknowledged before me on the 6 th of August 2010

Signature Jane E. Leskover  
Notary Public

My commission expires: 4-3-2011

CONSENT ACTION OF  
BOARD OF DIRECTORS AND SHAREHOLDERS OF  
CENTRISYS CORPORATION

AUGUST 21, 2007

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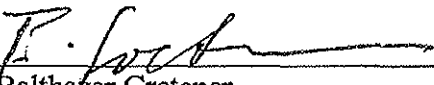
The following action is hereby taken by the unanimous written consent of the Board of Directors/Shareholders pursuant to statutory law. The undersigned, being all of the Shareholders and Directors of Centrisys Corporation, an Illinois Corporation ("Corporation") do hereby unanimously adopt the following resolution which gives specific authority to certain employees of Centrisys to execute and deliver documents and contracts on behalf of the Corporation.

"RESOLVED, that the undersigned as Directors and Shareholders, do hereby authorize and direct Michael Kopper ("President and CEO"), William Fairbairn ("Vice-President-General Manager") and Virginia Welter ("Director of Financial Services") to execute and deliver on behalf of the Corporation the following documents and/or contracts relating to its business: bid proposals, bonding documents, contracts with customers for the sale and lease of centrifuges, waivers, contracts with vendors and lessors for goods and services and contracts to procure or grant credit."

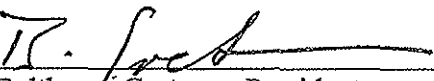
"FURTHER RESOLVED that this Resolution shall be considered binding upon the Corporation and effective from this date forward until the undersigned Directors and Shareholders either revoke or amend the same with a new Resolution."

Dated this 21<sup>ST</sup> day of AUGUST, 2007.

  
\_\_\_\_\_  
Michael Kopper  
Director/Shareholder

  
\_\_\_\_\_  
Balthazar Gretener  
Director

ABG Holdings, Ltd.

  
\_\_\_\_\_  
Balthazar Gretener, President  
Shareholder

**City of Marathon**

**ADDENDUM NO. 1 TO ITB-10-010W**

**Issue Date: July 27, 2010**

**Project Name: CITY OF MARATHON: CENTRIFUGE WITH TRAILER MOUNT SYSTEM**

Notice to All Proposers

**ADDENDA TO BE PLACED HERE**

Addendum #1 contains one item: 1. Corrections to bid documents  
2. Updated bid form

**Issued By:** Susie Thomas  
Name

**PROOF OF RECEIPT**

**Recipient  
Signature:  
Print Name:  
Firm:  
Date:**

William Fairbairn  
WILLIAM FAIRBAIRN  
CENTRISYS CORP  
8-5-10

## Correction to Bid Documents

### Exhibit "D" Specifications/Scope of Work

Item #2: Delete: " Additive alternate Bid may also be provided for power supply"

### Part 1 General

Item 1.1 A. 2. k. add: "including all flexible connecting hoses and fittings"

Item 1.2 A. 7. Replace existing paragraph with the following:

"Centrysis Corporation is the Basis of Design / Basis of Bid manufacturer in full compliance with the specifications, flow, and feed conditions. The City will not consider substitute or alternate products but will consider "equal" products provided that sufficient documentation is provided to establish equivalence. See revised bid form for "equal" definition.

Item 1.2 A. 8. Delete entire item.

Item 1.4 A. Delete "deliver anchor bolts and anchorage devices which are to be imbedded in cast-in-place concrete in ample time to prevent delay of that work"

Item 2.2 A. 2. Insert definition of "or equal" as follows: "Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function and quality required. Materials or equipment of other Suppliers may be accepted by the CITY'S REPRESENTATIVE, with the recommendation of the ENGINEER if sufficient information is submitted by CONTRACTOR to allow a determination that the material or equipment proposed is equivalent or equal to that named. Requests for review of substitute or alternate items of material and equipment will not be accepted."

Item 2.2 B. Delete this paragraph in its entirety

Item 2.3 N. 1. d. Replace solids percent range with "0.5 – 2.0"

**City of Marathon  
CENTRIFUGE WITH TRAILER MOUNT SYSTEM  
Addendum #1**

**Item #1**

**Corrections to Bid Document**



# CITY OF MARATHON, FLORIDA

9805 Overseas Highway, Marathon, Florida 33050  
Phone: (305) 743-0033 Fax: (305) 743-3667  
www.ci.marathon.fl.us

## City of Marathon

### ADDENDUM NO. 2 TO ITB10010W Issue Date: August 4, 2010

Project Name: **CITY OF MARATHON: CENTRIFUGE WITH TRAILER MOUNT SYSTEM**

Notice to All Proposers:

#### ADDENDA TO BE PLACED HERE

Addendum #2 contains one section: **1. ONLY DEMANDSTAR BY ONVIA PLANHOLDERS WILL BE ACCEPTABLE BIDDERS ON THE INVITATION TO BID, CITY OF MARATHON: CENTRIFUGE WITH TRAILER MOUNT SYSTEM**

Issued By: Susie Thomas  
Name

#### PROOF OF RECEIPT

Recipient Signature: *W Fairbairn*  
Print Name: WILLIAM FAIRBAIRN  
Firm: CENTRISYS CORP.  
Date: 8-5-10

**City of Marathon  
CENTRIFUGE WITH TRAILER MOUNT SYSTEM  
Addendum #1**

**Item #2**

**Updated Bid Form**



# CITY OF MARATHON, FLORIDA

9805 Overseas Highway, Marathon, Florida 33050  
Phone: (305) 743-0033 Fax: (305) 743-3667  
www.ci.marathon.fl.us

## City of Marathon

### ADDENDUM NO. 3 TO ITB10010W

Issue Date: August 11, 2010

Project Name: **CITY OF MARATHON: CENTRIFUGE WITH TRAILER MOUNT SYSTEM**

#### Notice to All Proposers:

#### Addendum #3 contains one section:

1. No later than three business days after the notice of award, the winning Bidder shall obtain and deliver to the City a clean, unconditional and irrevocable standby letter of credit ("Letter of Credit") in the amount of the Bid issued by a banking corporation (the "Issuing Bank").

The Letter of Credit shall be in a form acceptable to City in its sole discretion. The Letter of Credit shall have an expiration date no earlier than one year following date of execution and shall automatically extend for additional period of one (1) year until the obligations of Invitation to Bid, secured by the Letter of Credit, have been fully satisfied at the City's sole discretion.

The Issuing Bank shall not be permitted to terminate the Letter of Credit and shall be required to automatically extend the Letter of Credit for additional periods of one (1) year each, unless at least sixty (60) days prior to the then applicable expiration date, the Issuing Bank notifies City in writing that it has elected not to consider the Letter of Credit extended for any such additional period of one (1) year (a "Non-Extension Notice"). If Issuing Bank provides a Non-Extension Notice to City, then, unless a replacement irrevocable letter of credit in conformity with the requirements of this Invitation to Bid is obtained and delivered to City, then City shall have the right to draw down on the Letter of Credit and apply such draws for the purposes that draws are permitted hereunder.

In the Event that the winning Bidder and the City cannot agree as to the form of the Letter of Credit, the winning bidder will be required to obtain a bond in the amount of the bid. The City shall reimburse the cost to obtain the bond in an amount not to exceed \$15,000.

In the event of any dispute arising in connection with the Letter of Credit or the bond, the prevailing party (as finally adjudicated by a court having jurisdiction over the dispute) shall be entitled to recover its fees and costs, including reasonable attorney's fees.

Issued By: Susie Thomas  
Name

### PROOF OF RECEIPT

Recipient Signature: *William Fairbairn*  
Print Name: WILLIAM FAIRBAIRN  
Firm: CENTRISYS CORPORATION  
Date: 8-11-2010



## EXHIBIT "B" INVITATION TO BID

### *INSURANCE AND LICENSES*

1. There will not be a specific licensing requirement.
2. Equipment Supplier shall provide copies of certificates of insurance for Comprehensive General Liability and Business Automobile Liability insurance with limits as follows:
  - a. Comprehensive general liability insurance with limits of liability of not less than \$1,000,000 per occurrence, combined single limit for Bodily Injury Liability and Property Damage Liability.
  - b. Business Automobile Liability with minimum limits of \$1,000,000.00 per person, per occurrence, combined single limit for Bodily Injury Liability and Property Damage Liability each. Coverage must be afforded on a form no more restrictive than the latest edition of the Business Automobile Liability policy, without restrictive endorsements, as filed by the Insurance Services Office, and must include Owned Vehicles, Hired and Non-Owned Vehicles and Employers' Non-Ownership.
  - c. Worker's Compensation Insurance for statutory obligations imposed by Worker's Compensation or Occupational Disease Laws.
3. Equipment Supplier shall secure and maintain throughout the duration of this Purchase Order/Contract insurance of such types and in such amounts as specified above.
4. A Certificate(s) of Insurance shall be provided to show the City of Marathon as a certificate holder and the certificate shall be provided to the City at the time of execution of the Purchase Order/Contract. Insurance shall be underwritten by a firm qualified to do business in the State of Florida.


EXHIBIT "C"

BUY AMERICA CERTIFICATE

The Bidder hereby certifies that it will comply with the requirements of 49 U.S.C. Section 5323 (j) (l). Section 165 (a) of the Surface Transportation Assistance Act of 1982, as amended, but it may qualify for an exception to the requirements pursuant to Section 165 (b)(2) or (b)(4) of the Surface Transportation Assistance Act of 1982 and regulation in 49 CFR 661.7.

Firm Name: CENTRISYS CORPORATION

Date: 8/6/10

Signature of Authorized Representative: 

Printed Name: WILLIAM FAIRBAIRN

Title: VP

## EXHIBIT "D" INVITATION TO BID

### *SPECIFICATIONS / SCOPE OF WORK*

#### INVITATION TO BID NO. 10-010W: CENTRIFUGE WITH TRAILER MOUNT SYSTEM

The City of Marathon, Florida is requesting bids to furnish and deliver centrifuge equipment for mobile use including trailer mount system to the Marathon Wastewater Treatment Plant located at 140 Sombrero Beach Road, Marathon, Florida 33050 (the "Work"). The Work consists of all labor, materials, supplies, supervision, equipment and incidentals required for the furnishing and delivery of the centrifuge in accordance with the requirements contained herein. This Work also includes submittal of shop drawings, start up, on site testing and training.

The City of Marathon requires centrifuge equipment to provide sludge de-watering for six remote (6) wastewater treatment facilities located within city limits.

The following scope of work includes but is not necessarily limited to the items noted herein. This listing is intended to provide clarification and is not intended to be a complete listing of the responsibilities of the Work.

#### **GENERAL SPECIFICATIONS:**

1. As a municipal corporation, the City is tax exempt. Sales tax shall not be included in bid.
2. A Lump Sum Bid shall be provided on the form in Exhibit "A." Bid provided shall include amount to furnish and deliver one (1) packaged centrifuge equipment for mobile use including one (1) trailer mount system as outlined herein. Additive alternate Bid may also be provided for power supply.
3. City intends to provide complete deposit for product and Bid shall include providing "**Bond**" to City for delivery of trailer mounted centrifuge equipment.
4. Bid shall include a "Certification" that product procured by the City of Marathon complies with 49 USC 5323(j) and 49 CFR Part 661, which provide that Federal funds may not be obligated unless steel, iron, and manufactured products used are produced in the United States. The Buy America Certificate provided in Exhibit "D."
5. Delivery shall be made "FOB jobsite." Delivery, assembly and offload, if required, shall be provided in Bid. The City will not provide for off load or assembly.
6. The Bid shall confirm warranty period.
7. The Bid shall include providing shop drawings and technical data for all equipment including installation instructions and operating manual.
8. The Bid shall include all start up requirements and training for City staff.
9. The City will not provide off-load of the equipment.
10. The City will provide power for start up, testing and training.
11. All Work shall be done in coordination with the City's Utilities Manager and Engineering Consultant, Weiler Engineering Company (City's Engineer).

*SPECIFICATIONS / SCOPE OF WORK*  
CONTINUED

TECHNICAL SPECIFICATIONS

## TRAILER MOUNTED CENTRIFUGE DEWATERING SYSTEM

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

##### A. Scope:

1. Vendor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, test, and start-up one complete factory assembled Trailer-mounted centrifuge sludge dewatering system complete and operational.
2. The equipment to be provided for each pretested trailer mounted centrifuge dewatering system shall include, but not be limited to:
  - a. One high-solids, solid bowl horizontal continuous feed scroll type centrifuge with a cylindrical section and a conical beach section.
  - b. Equipment package skid of epoxy coated fabricated steel forms and shapes allowing access to all sides of the centrifuge for both maintenance and operation with centrifuge base of epoxy coated cast iron.
  - c. One progressive cavity solids feed pump
  - d. One centrifuge drive motor, minimum 6-Pulse Width Modulated drive with 5% input line reactor.
  - e. One centrifuge hydraulic back drive
  - f. One inline sludge grinder
  - g. One emulsion polymer blender and feed system
  - h. Piping connectors for feed, centrate and water supply
  - i. One magnetic sludge flow meter
  - j. One cake discharge shaftless screw conveyor
  - k. All interconnecting piping *+ all connecting hoses & fittings (add 1)*
  - l. Free-standing control panel with PLC based controls
  - m. One Dual Axle, over-the-road trailer with air operated wheel brakes and hydraulic leveling jacks for connection to the county's appropriate haul vehicle.
  - n. A vibration monitor located at each local control panel and device of the machine.
  - o. All required vibration isolators. All necessary bolts, anchor bolts, and hardware.
  - p. All necessary conduits, wiring, disconnects and motor protection.
  - q. All motor controllers, panel instrumentation and pilot devices for a complete integrated system.
  - r. Provide waterproof receptacle with disconnect mounted to trailer for main power connection. Power receptacle shall not be located under air conditioning unit for main control panel. Include 50 feet of extension power cord to connect to site located remote receptacle. Coordinate with the City for plug type.
  - s. Provide complete stainless steel underdrain and centrate capture-pump back system. Pump-back system shall provide for disposal pumping of all water and sludge drainage generated from the dewatering process through panel connected discharge hose to areas of treatment plant sites for liquid and sludge capture for retreatment.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the trailer mounted centrifuge dewatering system equipment Work.
2. Notify other contractors in advance of the installation of the trailer mounted centrifuge equipment to provide them with sufficient time for the installation of items included in their contracts that must be installed with, or before, the trailer mounted centrifuge equipment Work.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer shall have a minimum of 10 years of experience of producing substantially similar equipment, and shall be able to show evidence of at least 5 mobile installations in satisfactory operation at the time of the bid.
2. The centrifuge(s) shall be the product of a manufacturer regularly engaged in the design, fabrication, service and repair of high-speed centrifuges. The centrifuge(s) shall be manufactured utilizing the latest manufacturing machine tool technology. The bowl, scroll and frame of each centrifuge shall be manufactured to precise tolerances and shall be readily interchangeable with those components of other identical models.
3. The manufacturer shall be certified for ISO 9001 in the United States for Quality Assurance in the design, development, production, installation and servicing of machines and installations for mechanical separation. The centrifuge manufacture shall maintain their own manufacturing facility and service facility in the United States. The units for this project must be directly manufactured in the manufacturing facility located in the United States.
4. The centrifuge manufacturer shall supply qualified installation engineers to supervise the unloading, erection, placement, adjustment, testing, start-up, commissioning, and guaranteed performance testing of the equipment specified in this Section.
5. Provide qualifications of the technicians that the centrifuge manufacturer will be providing for installation, testing and start-up, and commissioning of the centrifuge assemblies. The qualifications shall be submitted to the ENGINEER for approval before the installation is initiated. Welders shall have passed AWS qualification tests or equivalent tests within the last 12 months. Evidence of compliance shall be submitted to the ENGINEER.

7. Centrisys Corporation is the Basis of Design / BASIS OF BID manufacturer in full compliance with the specifications and flow conditions. The contractor shall submit his bid based upon the use of this equipment or equivalent. The City will consider alternate equipment manufacturers with equivalent products at their convenience.

8. Alternate equipment shall provide a complete submittal with their bid to determine compliance with the specifications in their entirety. Alternate suppliers shall also conduct a full scale pilot test at the plant to prove compliance with the performance requirements. The pilot test must be witnessed by the owner and the engineer and must show complete conformance with all process requirements listed herein. During pilot test the manufacturer shall conduct an 8 hour performance run meeting the field testing requirements of the specification in full to be considered as an alternate manufacturer.

See add 1

delete  
see add 1

B. Component Supply and Compatibility:

1. Obtain all equipment included in this Section regardless of the component manufacturer from a single trailer mounted centrifuge dewatering system equipment manufacturer who shall be fully responsible for the engineering, design, selection, and operation of all systems and components specified and furnished. The systems and components are integrated into a complete and functional system conforming to all specified design and performance requirements.
2. Centrifuge equipment manufacturer shall prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically designed for centrifuge service and shall be integrated into the overall equipment design by the centrifuge equipment manufacturer.
- 4.

C. Shop Tests:

1. Visual Inspection: Verify that equipment complies with Specifications and approved Shop Drawings.
2. Running Test: Test each trailer mounted centrifuge assembly for minimum 4 hours run-time, in the manufacturer's plant with the job motor.
3. Vibration Tests: Take vibration measurements to determine mechanical integrity. Operational full load vibration shall not exceed 2.50 mils at the top or bottom motor bearing. Chassis vibration shall not exceed 3.0 mils. The vibration velocity shall not exceed 0.50/in./sec. at any position on the volute, chassis or motor bearings. The test results shall be submitted to the Contractor.
4. Develop a plot of starting current and KW vs. time. Readings of current drawn by the motor shall be taken at 15 second intervals during the starting period. This data, in the form of a chart or plot, shall be submitted to the Contractor.
5. Develop a plot of brake horsepower vs. hydraulic feed rate. Develop plot from five evenly spaced test points including the design point. This data, in the form of a chart or plot, shall be submitted to the Contractor.
6. Each test shall be witnessed by the engineer's representative and/or the owner's representative and equipment tests must be approved by both prior to shipment. The engineer shall certify that the required tests were performed. Engineer's certification shall show the state of his/her registration, registration number and his/her name on the seal shall be clearly legible. Certification shall show the serial numbers of all equipment tested. This certification shall be submitted to the Contractor.
7. Control Panel Tests:
  - a. The control panel shall be tested in the factory in accordance with the requirements of applicable sections of Division 13.
8. Packing:
  - a. Inspect prior to packing to assure that assemblies and components are complete and undamaged.
  - b. Protect machined surfaces and mating connections.
  - c. Protect bearings and gearing with a shop applied corrosion prevention coating.
  - d. Cover all openings into gear boxes with vapor inhibiting and water repellent material.
  - e. Adequately crate to prevent damage during shipment, delivery and storage.

- f. Identify crate contents on a packing slip fastened to the outside of crate.
- D. Reference Standards: Comply with the latest edition of the applicable codes and regulations, including the following:
- 1. American Bearing Manufacturers Association, (ABMA).
    - a. ABMA STD 9, Load Ratings and Fatigue Life for Ball Bearings.
    - b. ABMA STD 11, Load Ratings and Fatigue Life for Roller Bearings.
  - 2. American Gear Manufacturers Association, (AGMA).
  - 3. American Institute of Steel Construction, (AISC).
  - 4. American Iron and Steel Institute, (AISI).
  - 5. American National Standards Institute, (ANSI).
  - 6. American Society for Testing Materials, (ASTM).
    - a. ASTM A 36/A 36M, Specification for Carbon Structural Steel.
    - b. ASTM A 48/A 48M, Specification for Grey Iron Castings.
    - c. ASTM G 65, Test Method for Measuring Abrasion using the Dry Sand/Rubber Wheel Apparatus.
  - 7. American Welding Society, (AWS).
    - a. AWS D1.1/D1.1M, Structural Welding Code-Steel.
  - 8. Institute of Electrical and Electronics Engineers, (IEEE).
    - a. IEEE 112, Test Method for Polyphase Induction Motors and Generators.
  - 9. National Electrical Code, (NEC).
  - 10. National Electrical Manufacturers Association, (NEMA).
    - a. NEMA MG1, Motors and Generators.
  - 11. National Fire Protection Association, (NFPA).
    - a. NFPA 79, Electrical Standard for Industrial Machinery.
  - 12. Underwriters' Laboratories, Inc., (UL).
    - a. UL 674, Electric Motors and Generators for use in Division 1 Hazardous (Classified) Locations.
    - b. UL 1004, Electric Motors.
  - 13. Standards of Hydraulic Institute.
  - 14. American Society of Mechanical Engineers, (ASME).

### 1.3 SUBMITTALS

- A. Shop Drawings and Product Data: Submit the following:
- 1. All documents shall be in English or with all captions in foreign languages translated into English. Documents with any un-translated captions will be automatically rejected. S.I. (metric) units will be acceptable.
  - 2. Manufacturer's literature, data sheets, fabrication, foundation, assembly, mounting and installation drawings of the following components showing materials and dimensions in sufficient detail to demonstrate compliance with specified requirements.
    - a. Centrifuge Bowl:
      - 1) Materials of construction.
    - b. Conveyor:



- 1) Details of construction.
  - 2) Surfacing materials.
  - c. Gear Reducer:
    - 1) Model number.
    - 2) AGMA horsepower rating.
    - 3) Insulation and enclosure details.
    - 4) Efficiency at full, 3/4 and 1/2 load.
  - d. Lubrication System:
    - 1) Reservoir.
    - 2) Pumps.
    - 3) Controls and accessories.
  - e. Motors:
    - 1) Horsepower.
    - 2) Rpm.
    - 3) Insulation and enclosure details.
    - 4) Efficiency at full, 3/4 and 1/2 load.
    - 5) Motor rating including all nameplate data, guaranteed minimum rated efficiently, and speed torque curves.
  - f. Electrical Information:
    - 1) Wiring diagrams showing all electrical connections to motors and controls.
    - 2) Drawings of control panels furnished in accordance with applicable sections of Division 13.
  - g. Calculated ABMA L-10 bearing life.
  - h. For skid, indicate profiles, sizes, spacing, and locations of structural members, connection, attachments, fasteners, cambers, loads, and any special details.
  - i. For skid, indicate welded connections using standard AWS welding symbols.
  - j. For the trailer, submit complete drawings, gross vehicle weight, and operational logistics of the hydraulic leveling jacks and system.
  - k. For all components of equipment as appropriate, including setting drawings and instructions for installation of anchor bolts, including tolerances.
  3. Setting drawings, templates and directions for the installation of anchor bolts and other anchorages.
- B. Support Design Information: Submit for record purposes only:
1. Weight of complete assembly.
  2. Materials of Construction / Abrasion Protection Features.
  3. Anchor Bolts / Vibration Isolator Detail
  4. Lubrication and Maintenance Schedule
  5. Spare Parts and Tools List
  6. Surface Preparation and Painting Details
  7. Discharge Connection Details
  8. Installation Plan
- C. Shop Test Procedure: CONTRACTOR shall submit for approval six copies of the procedure at least 60 days before conducting the shop tests.
- D. Shop Test Results:

1. Submit results of vibration tests.
  2. Submit curve(s) of starting current and KW vs. time.
  3. Submit plot(s) of brake horsepower vs. hydraulic feed rate.
  4. Submit results of control panel shop tests required.
  5. Submit results of balance tests.
- E. Field Acceptance Test Results: CONTRACTOR shall submit for approval six copies of the results of all field tests conducted on the installed centrifuges within 30 days of completion of each field test as required by these Specifications. Field Test Acceptance shall be performed under the following service conditions:
1. Sludge feed concentrations of a minimum 0.5% to a maximum of 2.0%.
  2. Volatile Suspended Solids (VSS) between 76% to 82%.
  3. Design sludge flow rate of 250 gpm excluding polymer solution feed rate.
  4. Minimum cake dry solids of 21%.
  5. Minimum solids capture of 98%.
  6. Maximum polymer use of 25 lbs per dry ton of solids.
- F. Submit written report of the results of each visit by a manufacturer's serviceman, including purpose and time of visit, tasks performed and results obtained.
- G. Resume of proposed manufacturer's field representative for approval.
- H. Certifications: Submit all certificates of conformance and compliance for items required in these Specifications.
- I. Operation and Maintenance Data: Submit complete manuals including:
1. Copies of all Shop Drawings, test reports, maintenance data and schedules, description of operation, and spare parts information.
  2. Acceptable lubricants.
  3. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operations and Maintenance Data.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site to insure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work. *delete per add 1.*
- B. Inspect all boxes, crates and packages upon delivery to the Site. Notify ENGINEER of any loss or damage to equipment or components. Replace losses and repair damage to new condition, in accordance with manufacturer's instructions.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

## 1.5 WARRANTY

- A. The manufacturer shall warrant the equipment for a two-year period. The warranty shall commence from the date of start-up.
- B. During installation, testing and warranty period of two years, the centrifuge manufacturer shall replace and reinstall any tiles, which come off the scroll with no charge to the OWNER. If more than 5 tiles in total or partial come off during this period, the centrifuge manufacturer shall remove the scroll, replace missing or broken tiles and rebalance it with no charge to the OWNER. During rebalancing the centrifuge manufacture shall provide the OWNER with a temporary scroll replacement free of charge.
- C. Abrasion protection on the scroll conveyor shall be designed for a minimum of 16,000 hours of operation at the given sludge feed rate before refurbishment or replacement is required. This shall be warranted for the 16,000 hours of operation or 4 years whichever comes first. If it wears more than ½ the tungsten carbide portion of the tile prior to this time the manufacturer will reline the entire scroll conveyor, at no cost to the OWNER.
- D. Operational and testing requirements are described in Section 3.4.

## 1.6 MATERIALS AND WORKMANSHIP

- A. All parts shall be of high quality workmanship, shall be in production at the time of response, and no part or attachment shall be substituted or applied contrary to the manufacturer's recommendations and standard practices. The complete machine and all non-stainless components including tanks, compressor, structural support etc., shall have a minimum of one prime coat and one finish coat of epoxy paint. The prime coat material shall be specifically compounded for the respective metals to which it is applied. Exceptions to the coating requirements are limited to: plastics, cadmium & chromium plated, galvanized or stainless steel materials. Glvanized piping threads must be coated with a cold galvanized spray after assembly on skid in final position to prevent pipe threads from corrosion.
- B. All componenets utilizing oild lubricated gear cases, bearing chanbers, and/or oil reservoirs shall be equipped with a threaded NPT connection pipe nipple, minimum 2 inch spool piece, 90 degree bend, ball valve and pipe plug installed for ease of maintenance in performing standard O&M oil change procedures.
- C. All workmanship shall be of quality and performed in a professional manner to insure a safe and functional apparatus with an aesthetic appearance.
- D. Defective components shall not be furnished. Parts, equipment, and assemblies, which have been repaired or modified to overcome deficiencies, shall not be furnished without the written approval of Hernando County. Welded, bolted, and riveted construction utilized shall be in accordance with the accepted dimensions with proper fits, clearances, and

- uniformity. The general appearance of the equipment shall not show any evidence of poor workmanship.
- E. The City shall be the final judge of the quality of workmanship. The following evidence of poor workmanship will not be accepted by the City.
1. Rough, sharp, or unfinished edges, burrs, seams, sharp corners, joint, cracks, and dents.
  2. Non-uniform panels. Edges that are not radiused, beveled, etc.
  3. Paint runs, sags, orange peel, "fish eyes", etc., and any other imperfection or lack of complete coverage.
  4. Body panels that are uneven, unsealed, or contain voids.
  5. Misalignment of body fasteners, glass, viewing panels, light housings, other items with large or uneven gaps, spacing, etc., such as door, body panels, and hinged panels.
  6. Improper body-design or interface with the chassis that could cause injury during normal use or maintenance.
  7. Improperly fabricated and routed wiring or harness.
  8. Improperly supported or secured hoses, wires, wiring harness, mechanical controls, etc.
  9. Loose, vibrating, abrading body parts, components, subassemblies, hoses, wiring harness or trim.
  10. Interference of chassis components, body parts, doors, etc.
  11. Leaks of any fuel, vacuum, or fluid lines, (coolant, oil, air, etc.)
  12. Noises, panel vibrations, etc.
  13. Incomplete or incorrect application of undercoating or rust proofing.
  14. Inappropriate or incorrect use of hardware, fasteners, components, or methods of construction.
  15. Incomplete or improper welding.
  16. Visual deformities.
  17. Lack of uniformity and symmetry where applicable.
  18. Unsealed appurtenances or other body components, gaskets, etc.
  19. If trailer provided is not proven legal to travel on roadways without the use of any additional permitting and/or expense to the county.
- F. In addition, any deviation from the requirements of this specification, unless previously approved by City of Marathon, that affects form, fit, function, durability, reliability, safety, performance or appearance shall be cause for rejection.

## PART 2 - PRODUCTS

### 2.1 SERVICE CONDITIONS

- A. General: Design equipment to be suitable for the process and service conditions described below and in the Schedule of Service Conditions.
1. The fully factory assembled, trailer mounted centrifuge skid dewatering system shall be designed for continuous 24 hour per day, 7 day per week operation.
- B. Schedule of Service Conditions:
1. Sludge Characteristics:

- a. Type of Sludge: Waste activated sludge from extended aeration and secondary clarification system.
  - b. Sludge Concentration:
    - 1) Minimum Sludge Feed Concentration: 0.5 percent.
    - 2) Maximum Sludge Feed Concentration: 2.0 percent.
  - c. Percent Volatile Solids: 76 – 82 percent.
2. Centrifuge Parameters:
- a. Design Sludge Flow Rate (excluding polymer solution) to Centrifuge(s): 250 gpm per centrifuge.
  - b. Minimum Required Cake Dry Solids at Design Feed Rate Percent Feed Sludge Dry Solids: 21 percent.
  - c. Minimum Solids Capture: 98 percent.
  - d. Maximum Noise Level: 85 dBA at 1 meter from the equipment.
  - e. Maximum Installed Horsepower of Centrifuge System: 128
  - f. Maximum Polymer Use: 25 lbs/dry ton.
  - g. Number of Trailer Mounted Centrifuge Assemblies Required: 1

2.2 PRODUCT AND MANUFACTURER

A. Manufacturer: Provide one of the following:

- 1. Centrisys, Model CS21-4HC.
- 2. Or equal.

*NOTE See add 1 for definition of "or equal"*

B. ~~These centrifuge model selections have been provided by the listed centrifuge manufactures as suitable for the intended for this project and meet the performance requirements for dewatering as described in these specifications. If the equipment provided fails to meet specified performance requirements, the CONTRACTOR shall, at the CONTRACTOR's expense, repair or replace the equipment until the specified performance requirements are met. Rejection of the equipment is discussed in the General Conditions.~~

*delete per add 1*

2.3 DETAILS OF CONSTRUCTION

A. General:

- 1. Centrifuge shall be of the horizontal, solid bowl, counter-current scroll type. Furnish unit with motors, back drive system, reducers, guards, baseplates, vibration isolators, lubrication systems, operating controls and all appurtenant equipment required for centrifuge operation. Dynamically balance unit to minimize vibration.
- 2. The trailer mounted centrifuge dewatering systems shall be identical in design and construction.
- 3. Individual parts shall be identical in design and workmanship and shall be interchangeable between the centrifuge assemblies.
- 4. Design centrifuge for continuous or intermittent operation.
- 5. For each centrifuge, the entire operating process shall be monitored and controlled from a dedicated Centrifuge Control Panel, which shall be furnished by the system supplier.

6. All appurtenant equipment and piping normally furnished as an integral component of the machine and which is required for proper operation of the unit shall be furnished whether or not specific reference is made thereto in these Specifications.
7. Each centrifuge shall be provided with an accessible Type 316 stainless steel nameplate, securely fastened to the base or other conspicuous place, and clearly inscribed with the manufacturer's name, year of manufacture, model number, serial number, and principal rating numbers. This nameplate shall also carry the Project identification number of the unit. The minimum size of the inscribed and stenciled characters shall be 1/2-inch. The minimum size of the nameplate shall be 6-inches by 12-inches. During the witness shop tests, the same equipment identification number shall also be stenciled on the following parts, where indicated by the witnessing Engineer.
  - a. Centrifuge cover.
  - b. Centrifuge lower casing.
  - c. Centrifuge base.
  - d. Centrifuge main bearing pillow blocks.
  - e. Lube oil units.
8. Design requirements of the unit specified shall be understood to establish minimum requirements only. The equipment, when installed and operating, shall meet or exceed the specified minimum performance requirements.
9. Centrifuges shall be completely factory assembled and tested unless otherwise specified herein. The assembly shall require only connection of external piping and electrical wiring. Equipment which might be damaged during shipping if mounted on the unit shall be installed following shipment by a representative of the manufacturer. All electrical components located on the machine shall be pre-wired at the factory.
10. Design and construct centrifuges in such a manner so as to be suitable for continuous heavy duty use in a humid and corrosive atmospheric environment.
11. There shall be no rigid connections at the feed tube, solids discharge or liquid discharge on the centrifuge and any other connections in order to prevent transmission of vibration to structures, piping, conduits, etc.
12. The centrifuges shall be furnished with motors that shall not be overloaded throughout the full range of the centrifuge operation.
13. Welding shall conform to AWS D1.1/D1.1M, and for special welding, ASME code for Boiler and Pressure Vessels.
14. Routine maintenance shall be possible without taking the machine out of service.
15. All parts requiring routine maintenance shall be readily accessible from the outside of the machine.
16. All carbon steel surfaces shall be protected by a paint system specifically designed to resist chipping, cracking, and lye or acid corrosion. The paint shall consist of a two-part epoxy metal primer and a polyurethane finish coat.
17. Equipment Skid: Epoxy Coated carbon steel shapes and components.
18. Centrifuge and equipment shall be mounted aboard a single skid with all connections between components pre-wired and pre-piped. The stand which supports the centrifuge shall not be used for support of any other component other than the centrifuge itself. The ancillary components are to be mounted aboard the skid structure independent of the centrifuge stand. The complete centrifuge dewatering system will be skid mounted and installed on a trailer for mobile sludge dewatering at various locations.

19. The centrifuge and its components shall have the following nominal dimensions:
  - a. Bowl shall be a minimum of 101 inches long by a minimum of 21.6 inches (550 mm.) in diameter with a minimum length to diameter ratio of the internal dimension of the bowl of 4.3:1.
  - b. Frame assembly 20' long by 8'-4" wide (the largest dimension in either direction).
  - c. Motor assembly 2'-7" long by 3'-8" wide (the largest dimension in either direction).
  - d. Overall centrifuge height with cover open of 6'-6"
  - e. Overall centrifuge length of 15'-9"
  - f. Overall centrifuge width of 3'-8"

B. Equipment to include:

1. High solids horizontal bowl centrifuge.
2. Sludge feed pump.
3. Inline Sludge Grinder.
4. Centrifuge drive motor.
5. Hydraulic back drive.
6. Dewatered cake duplex screw conveyor system.
7. Magnetic sludge flow meter.
8. Polymer feed system.
9. Centralized manifold for liquid connection.
10. Allen Bradley PLC Control panel.
11. DOT approved Trailer as specified.

C. Materials:

1. Unless otherwise specified, all parts of the centrifuge contacted by process material shall be of Type 316 stainless steel except O-rings, seals and abrasion resistant materials.
2. O-rings: Buna-N rubber; lip type seals shall be Buna-N.
3. Feed Tube Seals: Teflon
4. All cake and liquid casings shall be of 316 stainless steel.
5. Miscellaneous hardware, including bolts, nuts, washers, and fastener clips, shall be ASTM A320, of 316L stainless steel when in direct continuous contact with process water, otherwise all hardware shall be 304 SS.
6. Except steel to steel contact, no dissimilar metals or connectors shall be in direct contact unless properly electrically insulated with a 2mm thick continuous neoprene gasket.
7. Bowl Wall: Centrifugally Cast Duplex stainless steel bowl with welded wear strips along entire length.
8. Feed Port: Sintered tungsten carbide.
9. Gear Box Adapter, Pillow Blocks and Pins: High strength alloy steel.
10. Base-Frame Assembly: Cast-iron ASTM A 48/A 48M, fabricated steel ASTM A 36/A 36M, or a combination of both and epoxy coated.
11. Feed Compartment Walls: Field replaceable stainless steel plates with Flame-Sprayed Tungsten Carbide hard surfacing.
12. Feed Port: Field replaceable tungsten carbide bushings (Chemical joints, bonds, glue, etc. are not allowed) All joints are to be mechanical (Flanged, etc.)

13. Solids Discharge Port: Field replaceable Tungsten Carbide bushings (Chemical joints, bonds, etc. are not allowed) All joints are to be mechanical (Flanged, etc.)
14. Discharge Casting: Centrifugally Cast Duplex Stainless.
15. Centrifuge Cover: 316 Stainless Steel.
16. Scroll conveyor: Centrifugally Cast Duplex Stainless hub with 316 SS flights.
17. Structural steel shall conform to ASTM A 36/A 36M.
18. All other equipment and guards shall be constructed of stainless steel.

D. Bowl:

1. Bowls shall be solid horizontal cylinder type with a conical beach extension in which a scroll conveyor fits concentrically. The bowl shall be a minimum of 21.6 inches in diameter and 100 inches in length. Cylindrical and conical sections of the bowl shall have a minimum thickness of 0.7 inches. End hubs shall have a minimum thickness of 3 inches. Bowl cylinder section shall be a minimum length of 78 inches from the inside of the liquid hub to the start of the conical section.
2. Bowls shall be manufactured from centrifugal castings of 316 or duplex stainless steel with a minimum tensile strength of 100,000 psi and be designed to withstand all centrifugal forces encountered at the maximum design speed, with an adequate factor of safety. Fabricated or statically cast bowls will not be accepted.
3. Examine all surfaces for cracks, shrinkage, porosity or other defects by means of a liquid penetrant test. Bowl inspection reports shall be supplied on request.
4. The bowl shall be independently balanced.
5. The maximum bowl speed shall 3150 RPM, producing a minimum gravitational force of 3000 G's.
6. Minimum G-volume shall be 287,167 g-gallons calculated by the following formula at a 3000 G value assumed for G-force:

$$G\text{-vol} = KW^2DL (D^2 - (D - 2d)^2), \text{ where:}$$

G-vol = volume where process material is contained and solid/liquid separation occurs [g\* gallons]

K = constant [ $4.82 * 10^{-8}$  g\* gallons \* min<sup>2</sup> \* in<sup>-4</sup>]

W = bowl rotational speed [min<sup>-1</sup>]

L = length of the cylindrical portion of the bowl [in]

D = inside diameter of bowl [in]

d = minimum pond depth [in]

7. The pool depth in the centrifuge bowl shall be adjustable by use of weirs constructed of 304 stainless steel. The weirs shall be at the large diameter of the bowl.
8. Solids shall be discharged from the small diameter end of the bowl opposite from the liquid discharge.
9. The bowl shall be protected by replaceable longitudinal 316 SS wear strips to prevent circumferential slippage of the sedimented solids and the formation of a protective feed solids layer. Grooves are not accepted.

E. Scroll Conveyor:



1. The centrifuge shall include a 316 stainless steel horizontal scroll conveyor equipped with helical flights and independently mounted concentrically with the centrifuge bowl. The scroll shall convey solids from the bowl to the solids discharge ports located at the small diameter end of the conical section. The scroll shall contain a feed compartment designed for the gradual acceleration and low velocity introduction of feed to the centrifuge bowl. Provisions shall be made for introduction of polymer inside this feed compartment to minimize shear forces and polymer consumption. The feed tube shall be 2-inch 316L stainless steel. Scroll conveyor shall incorporate all new technology which shall include open flighting from the feed zone back to the concentrate discharge point.
2. Bearings shall be anti-friction type and shall be grease lubricated from external fittings, easily accessible for proper maintenance. The edge and the face of the conveyor flights shall be protected as described in section M of this specification. Each tile assembly shall be affixed to the conveyor flight by an electric-welding attachment procedure. Wear tile hardness shall exceed 2500 Vickers hardness.
3. Tungsten Carbide surfacing shall be guaranteed for 16,000 hours of operation.
4. Conveyor hub shall be centrifugally cast duplex stainless steel. Fabricated or statically cast scroll conveyor hubs will not be accepted.
5. Coating of the outer tile edge of the flight tip shall indicate wear patterns and service schedules. The replacement shall be easily made by removal of the old assembly and welding a new assembly in place.
6. Scroll shall be independently balanced at full operational speeds prior to shipment. Certification of this procedure to be provided prior to shipment.
7. The feed nozzles or ports shall be protected by tungsten carbide. The feed nozzles shall be field replaceable.
8. In order to minimize downtime, the manufacturer shall offer a scroll exchange program. The scroll exchange program shall be established where an exchange scroll shall be shipped to the plant site for installation into the centrifuge. The original scroll shall be subsequently shipped back to the repair facility for rework and be placed into the exchange program. Scroll shall be shipped within 24 hours of exchange request.
9. Provide rubber boot to connect to solids conveyor.

F. Sludge Feed/Discharge:

1. Solids shall be introduced to the bowl by an internal scroll conveyor rotating at a positive differential or slight differential speed from the bowl and be supported by bearings. The feed chamber assembly shall be protected from abrasion wear by flame sprayed sintered tungsten carbide hard surfacing.
2. The solids shall be discharged from the bowl via a series of discharge ports. The solids discharge ports shall utilize field replaceable mechanically attached sintered tungsten carbide wear nozzles. Nozzles that utilize chemical bonding for attachment are not acceptable.
3. Feed compartment shall be designed with a polyurethane liner which shall act as an abrasion barrier for the inner hub, or be protected with a flame sprayed and fused nickel-chrome-boron alloy containing tungsten carbide particles. Feed shall be

uniformly distributed through mechanically attached feed ports of ceramic or sintered tungsten carbide construction which shall be field replaceable.

4. Conveyor feed compartment shall be centrifugally cast duplex stainless steel.

G. Bowl Cover:

1. The outer cover shall be fabricated 316 stainless steel. The outer cover shall be protected at the centrate and solids discharge ports by a stainless steel inner casing designed to resist abrasion and prevent direct contact of material with the outer cover.

H. Casing and Frame:

1. Provide protective casings fabricated from 316 stainless steel in two sections (upper and lower) with hub seals to prevent leakage.
2. Top casing shall be one piece design, hinged and open able to expose bowl for maintenance.
3. Provide unit with lifting hooks.
4. The inner casing at the solids and centrate discharge points shall be a minimum of 0.5" thick stainless steel.
5. Tungsten carbide scrapers will be utilized to eliminate sludge build-up in the cake discharge section of the casing, if required by the process conditions.
6. The rotating assembly and bearings of the centrifuge shall rest on a one piece fabricated steel frame, specifically designed for rigidity and noise reduction. Frames containing concrete shall not be allowed. The casing/frame shall be designed to act as a protective guard and to provide a complete enclosure for odor containment. The product collection chambers shall be stainless steel with flanges for the sludge cake and centrate discharge. The frame shall be painted with a lye, acid, and impact resistant two-part epoxy resin paint powder coating. The casing shall be of Type 316L stainless steel, in the case of the casing being incorporated into the centrifuge cover the entire cover shall be of Type 316L stainless steel. Manufactures utilizing separate casings and covers shall not be permitted.
7. All wetted parts shall be 316 stainless steel suitably isolated from carbon steel components.
8. The solids and centrate discharge from the casing shall be flanged to allow from a simplified and sealed installation.
9. Provide flexible connectors to solids discharge screw conveyor.
10. To limit splashing and air leakage, the casing shall be provided with seals where the bowl hubs intersect the casing and a gasket on the machine flanges where the upper and lower casings join.

I. Noise and Vibration:

1. Provide pedestal supports with vibration isolators placed on machined surfaces of all support locations. Isolators shall be specifically sized depending on bowl speed and service conditions so that they have a minimum dampening effect of 98 percent of all vibration loads in all directions. Machined surfaces shall be provided at all points where support loads are transferred to the base.
2. There shall be no rigid connections at the feed tube, vents, solids discharge, liquid discharge, electrical connections, or other components whatsoever to the machine, thus preventing transmission of vibration to structure, piping and appurtenant equipment.

3. Vibration limitations are described in 1.2.C.3 of this Section.
  4. For vibration monitoring, the centrifuge shall be equipped with a vibration monitoring system consisting of an accelerometer, digital display, 4-20 mA output, alert alarm and danger alarm. Vibration of a predetermined displacement shall automatically shut down the machine.
  5. Each centrifuge shall be dynamically balanced prior to shipment and shall be designed such that operating noise levels will not exceed 85dBA at a 1 meter distance from the centrifuge, as measured at the factory with all inlet and outlet openings closed, and running.
- J. Pillow Block Bearings:
1. Bearings shall be spherical or cylindrical roller type. Bearings shall have a B-10 life of 100,000 hours minimum at 24 hours per day service.
  2. Resistance temperature detectors (RTDs) shall be provided for each bearing for continuous temperature monitoring, alarm and shutdown functions through the centrifuge control system.
  3. Scroll bearings shall be externally greased. "Spray or mist" oil lubricators are not allowed.
  4. Lubricated by automatic PLC controlled grease lubrication system.
- K. Connectors, Chutes, Flexible Connectors and Sampling Ports:
1. Provide pedestals with mechanical connection for solids feed, water supply and centrate discharge piping.
  2. Flexible connectors shall include liquid discharge connector, solids discharge connector, flexible feed hose, frame drain hose, and polymer hose.
  3. Flexible pipe connections shall be supplied by the manufacturer for the sludge feed line, polymer connection and frame drain. All flexible connections shall be flanged for simple connection to associated piping, and shall comply with applicable requirements of Division 15.
  4. Flexible liquids and solids discharge connectors shall be of black molded neoprene, two ply fabric reinforced with polyester cord, and complete with stainless steel back-up flanges and hardware. Neoprene flanges shall match the dimensions of the centrifuge casing flanges. Face-to-face flange dimension shall be not less than 12 inches.
  5. Provide a liquids (concentrate) discharge chute. It shall be rectangular with a top flange matching the flange of the liquids discharge connection. Chute shall include a 10 inch A.S.A. (vent) flange mounted as close to the top of the chute as possible. Chute shall maintain the shape of the centrifuge casing discharge connection. Chute shall be independently supported so as to impose no weight on the centrifuge casing flange. Chute material shall be of Type 304 stainless steel.
  6. Provide solids discharge chutes as required to connect centrifuge casing discharge, and screw conveyor inlet connection. Chutes shall be flanged and sized to provide transition between components listed, and shall have sides as straight as possible in order to prevent solids from bridging or hanging up. Chutes shall be independently supported and shall impose no weight on the centrifuge casing or screw conveyor mating flanges. Chute material shall be of Type 304 stainless steel.
  7. Provide 2-inch diameter sampling taps to sample feed sludge, centrate, and dewatered sludge from each centrifuge. Sampling taps shall be easily accessible from the

centrifuge operating floor level. Thickened sludge sampling tap shall be a 2-inch PVC pipe with a cut-out and pipe cap and shall be mounted at the inlet to the solids discharge chute. Centrate sampling tap shall be mounted at the inlet to the centrate discharge chute. Feed sludge sampling tap shall be located as shown on the Drawings.

8. Flexible electrical connections shall be provided in accordance with local codes and applicable requirements of Division 16.
  
- L. Flocculant Distribution: Make provisions for introducing flocculant internally into the centrifuge as well as through 3 additional ports on the dewatering skid including at the: sludge pump discharge, sludge pump suction and in the piping between the sludge pump discharge and the centrifuge.
  
- M. Abrasion Protection: To minimize wear from abrasive materials in the feed, the centrifuge shall be equipped with the following features:
  1. Bowl Wall: The full length of the bowl wall shall be protected by replaceable longitudinal wear strips to prevent circumferential slippage of the sedimented solids and the formation of a protective feed solids layer.
  2. Scroll Conveyor: The face and outer edge of the scroll conveyor flights shall be protected against abrasion over the full length of the scroll conveyor. The feed compartment and discharge ports shall be protected from wear by field replaceable flame-sprayed tungsten carbide components. The flights shall be protected from abrasion by the following method:
    - a. The edge and the face of the conveyor shall be protected against abrasion over half the length of the conveyor by a series of sintered tungsten carbide tiles from the feed chamber to the solids discharge and the remaining area from the feed chamber to the liquid discharge shall be protected with flame sprayed tungsten carbide.
    - b. Tungsten carbide tiles shall have a volume loss of no more than 3.0 cubic millimeters at the end of the test. The test shall be conducted in accordance with ASTM G 65, Procedure A. The centrifuge manufacturer shall submit test results from a qualified laboratory as part of the equipment submittal specified in Article 1.4, above.
    - c. Abrasion protection for the conveyor flights shall be designed for a minimum of 16,000 hours of operation before refurbishment or replacement is required.
    - d. Tiles shall be welded to the conveyor. No glued or bolted tile connections to the conveyor will be allowed.
    - e. Tiles shall be weight corrected, field replaceable and not directly brazed to the scroll.
  3. Solids Discharge Ports: The solids discharge ports shall be protected by field replaceable tungsten carbide inserts. The inserts shall be designed and attached in such a fashion that when localized wear is sufficient to require replacement, they can be rotated to double their useful life.
  4. Casing Discharge: The casing solids discharge shall be protected by field replaceable inserts designed to protect the discharge casing from discharged solids abrasion.
  
- N. Progressive Cavity Sludge Feed Pump (See Instrumentation Section for Motor Controller)
  1. Design Criteria

- a. Provide sludge feed pump with skid-mounted mobile dewatering system.
  - b. Type: progressive cavity.
  - c. Number of pumps: 1
  - d. Solids Percent: 0.5 – 1.5 *0.5 - 2.0 per add 1*
  - e. Variable speed operation, VFD controlled from centrifuge enclosure.
  - f. Suction Size: 6"
  - g. Discharge Size: 6"
  - h. Maximum Speed: 500 RPM
  - i. Design Point at Maximum Speed: 305 gpm @44psi
  - j. Minimum Speed: 50 RPM
  - k. Approximate Design Point at Minimum Speed: 15 gpm @ 44 psi
  - l. Capacity Range: Up to 300 gpm.
  - m. Body: Cast Iron
  - n. Rotor: Chrome Plated Tool Steel.
  - o. Stator: Buna-N.
  - p. Base: Fabricated steel.
  - q. Seal: Mechanical, Burgmann type MG1
  - r. Speed reducing units: Gear driven, belt drives not permitted.
  - s. Motor: TEFC 460V, 60 Hz, 3Ø, 10 hp or manufacturers standard as required to deliver the flow rates specified.
  - t. Control: Feed pump control from PLC & VFD integrated into centrifuge control panel.
  - u. Feed pump shall be manufactured by Netzsch.
2. Pump Suction and Discharge Casing
- a. The pump casing shall be designed for the type of service specified and shall be of sufficient strength, weight and metal thickness to ensure long life, accurate alignment and reliable operation. The suction casing shall be constructed of close-grained cast iron and have two clean out ports. The casing shall have connection for vents, drains, and gauges.
  - b. The suction and discharge connections shall be ANSI/B16.1 flanges sized for the pump specified. The discharge flange shall have a vent/gauge connection that can be rotated in 90° increments. The discharge support feet shall be separate from the discharge flange.
  - c. The pump shall be supplied with adequate NPT connections for stuffing box drainage, pump drainage, flushing and gauge connections.
3. Stator
- a. The pump's stator shall be formed from Buna-N rubber. The stator shall be affixed to the suction casing by the use of four (4) thru-bolts for easy removal and replacement. Stators shall not be affixed to the suction casing by threaded connections or by snap rings. The suction edge of the stator shall be chamfered to allow for unrestricted flow into the pumping elements. The rubber shall be molded around the ends of the stator tube sealing at the suction and discharge to prevent leakage. The use of separate o-rings or flat rings for stator sealing shall not be required.
4. Rotor
- a. The rotor shall be precision machined from tool steel with a chromium content of 11-13.5% hardened to a Rockwell C hardness of C57-60 and then covered with

heavy layers of hard chrome plating. The rotor shall be driven by means of a heavy duty sealed drive train.

5. Drive Train
  - a. The rotor shall be driven by means of a heavy duty drive train. The rotor shall be joined to the drive shaft by means of a mild steel connecting rod with sealed pin type universal joints at each end. The sealed pin type universal joints shall be factory lubricated with oil and completely sealed from the abrasive fluid being pumped. To optimize seal and pin joint life, the connecting rod shall be of sufficient length to maintain its operating angle within 1 degree. Flexshafts are not acceptable.
6. Gland Housing and Stuffing Box
  - a. The pumps shall be constructed with adequately sized stuffing boxes capable of sealing the pumpage within the pump casing. The gland housing shall be field replaceable as a separate casting. The stuffing box shall be drilled and tapped for water flush.
7. Pump Drive Shaft
  - a. The drive shaft shall be of the solid drive shaft design in order to avoid clogging and/or trapping of solids, which could either interrupt the movement of the connecting rod or disturb the seal of the rear pin joint. Maximum shaft deflection under normal operating conditions shall not exceed .002".
  - b. The solid drive shaft shall be mounted in a single row ball bearing on the coupling side of the drive shaft and a double row ball bearing on the stuffing box side of the drive shaft. The ball bearings shall be adequately sized to handle the radial and thrust forces, with a minimum B-10 bearing life of 100,000 hours. Upon written request, the Manufacturer shall supply to the owner all bearing life calculations. Hollow or telescoping designed drive shafts are not acceptable.
8. Bearing Frame
  - a. The pump bearing frame housing shall be a one piece rigid cast iron casting, providing a self-centering and self-indexing fit with the casing of the pump, to insure proper alignment of the bearings and stuffing box. The bearing housing shall be equipped with lip type grease seals and deflectors to prevent the entrance of contaminants. The bearings shall be grease lubricated.
9. Pump Performance
  - a. The suction body of the pump shall be oversized at the entrance of the rotor and stator pumping elements to allow the free flow of high solids materials. The rotor joint head shall be set back from the stator and the leading edge of the stator shall be chamfered so not to restrict the flow into the pumping elements. If the pump does not incorporate the aforementioned features the use of a rag deflector shall be required.

O. Sludge Grinder:

1. General: Furnish equipment suitable for the process and service conditions described below and in the Schedule of Service Conditions.
  - a. Provide sludge grinder with skid-mounted mobile dewatering system. Each grinder shall include but is not limited to, cutters, spacers, shafts, bearings and seals, in-line housing with pipe flanges, inspection ports, cutter stack adjustment port, reducer, and motor.

- b. All grinders will normally operate with a flooded suction. When operated manually, all grinders could be subject to less than a full pipeline.
  - c. The cutter cartridge and drive assembly shall be removable from the main housing as a complete assembly without further disassembly. The components of that assembly include cutters, spacers, shafts, reducer, motor, bearings, and seals.
  - d. Grinders designed with cutter and spacer cartridges rather than individual cutters and spacers, shall not be acceptable.
  - e. Cantilevered two-shaft design and capable of continuous operation processing wet or dry sludge.
  - f. Body: ASTM A-48 cast iron.
  - g. Top cover: ASTM A-48 cast iron.
  - h. Drive and driven shafts: AISI 4150 heat treated hexagon steel.
  - i. Gear Reducer: Grease-filled planetary-type.
  - j. Cutters and Spacers: AISI 4140 heat treated alloy steel through-hardened to a minimum of HRC 45-50, minimum diameter of 5.9 inches, minimum force of 435 lbs per HP continuously and 1430 lbs per HP at momentary load peaks at the tooth tip.
  - k. Bearings and Seals: Sealed oversized Conrad type ball bearings protected by a combination of tortuous path device and end face mechanical seals rated at 90 PSI continuous duty, face materials to be tungsten carbide.
  - l. Motor: TEFC 4-pole 460V, 60 Hz, 3Ø, 15 hp, minimum 1000 in-lbs continuous running torque per hp, minimum 3300 in-lbs momentary peak running torque per hp.
  - m. Control: Grinder control integrated into centrifuge control panel.
  - n. Grinder shall be manufactured by Borger or equal.
2. Schedule of Service Conditions:
- a. Total Number of Units: 1
  - b. Minimum Flow Capacity per Unit (gpm): 250
  - c. Liquid Pumped: WAS (0.5 – 1.5 percent Solids)
  - d. Suction Conditions: Flooded
  - e. Minimum Motor Size: 15 hp
3. Details of construction:
- a. Housings and Covers:
    - 1) Grinder housing shall be a solid cast structure made of A-536-84 ductile iron. Provide gasketed clean-out covers for access to the cutting chamber. Housing shall have standard ANSI B16.1 inlet and outlet connections. The one-piece flanged body shall be capable of remaining in-line if removal of the cutter cartridge and drive assembly is required for service.
    - 2) The main housing shall be provided with a covered access port for equipment inspection. Inspection port covers shall be A-536-84 ductile iron.
  - b. Cutting Elements:
    - 1) Provide cutting elements of hardened AISI 4140 heat treated alloy steel. Individual cutters should be surface ground for uniformity and through-hardened to a minimum of 45-50 Rockwell C.
    - 2) The inside configuration of both the individual cutters and individual spacers shall be hexagonal so as to fit the shafts with a total clearance not to exceed

- 0.015 inch (0.38 mm) across the flats to assure positive drive, minimize wear on the cutters, and increase the comprehensive strength of the spacers.
- 3) Cutter configuration shall consist of one shaft having 5 tooth double-edged cutters and one shaft having 11 tooth cam cutters. To maintain particle size, the height of the tooth shall not exceed ½ inch (13 mm) above the root diameter. Cutter to cutter root diameter overlap shall be not less than 1/16 (1.6 mm) or greater than ¼ inch (6 mm) to maintain the best possible cutting efficiency while incurring the least amount of frictional losses.
  - 4) The cutter shall exert a minimum force at the tooth tip of 1,641 lbs/hp (9,787 N/kW) during momentary load peaks.
- c. Shafts and Intermediate Shaft Support:
- 1) Shafts shall be 4150 heat treated hexagon steel with a tensile rating of not less than 149,000 psi (1.027 kPa), minimum diameter 2-1/2 inches, set back at a minimum angle of 25° from vertical towards the flow with trash trap mounted below.
  - 2) Each hexagonal shaft shall measure a nominal 2 inches (51 mm) across parallel surfaces.
- d. Shaft Bearings and Seals:
- 1) The radial and axial loads of the cutter shafts shall be borne by sealed oversized, deep-groove ball bearings at each end.
  - 2) The bearings shall be protected by a combination of a replaceable and independent tortuous path device and mechanical seals.
  - 3) Face materials shall be of tungsten carbide.
  - 4) O-rings shall be made of Buna-N elastomers.
  - 5) Products requiring continuous or occasional lubrication or flushing shall not be accepted.
  - 6) The mechanical seal shall be rated at 90 psi (620 kPa) continuous duty by the seal supplier.
  - 7) The bearings shall be housed in a replaceable cartridge that supports and aligns the bearings and seals, as well as protects the shafts and end housings. The seal elements shall maintain their factory preload independent of the cutter stack tightness.
  - 8) Seals shall meet required pressure rating regardless of cutter stack fit. The seal cartridge shall provide seal protection against axial loading on shafts and bearings during shaft deflection.
  - 9) Each seal element shall be positively locked to its corresponding rotating or static cartridge element. This positive lock on the seal elements is critical to long seal life in applications where grit or other abrasive materials are present.
- e. Reducer and Drive Unit Assembly:
- 1) The speed reducer shall be a grease-filled planetary-type of reducer with a 500% shock load capacity. The reduction ratio shall be 29:1.
  - 2) The input shaft of the reducer shall be directly coupled to the motor using a three-piece coupling, and the output shaft of the reducer shall be directly coupled with the grinder using a two-piece coupling.
  - 3) Drive unit shall conform to AGMA rating and specification for heavy shock, 24 hour, full load operation with a service factor of 1.50.



- 4) Speed reducer shall be planetary type enclosed in a cast iron or welded steel weatherproof casing.
  - 5) Speed reducer moving parts shall be immersed in oil, and bearings shall be anti-friction throughout. Casing shall be provided with inspection covers, oil fill, and drain connections and means for inspection of oil flow. Inspection, oil fill and drain covers shall be chained to the casing.
- f. Motor:
- 1) TEFC motor with a maximum speed of 1750 rpm.
  - 2) Motor shall be suitable for operation on a 230/460 volt, 3 phase, 60 Hz supply.
  - 3) Provide Motor Space Heaters connected to motor controllers
  - 4) Provide motor of proper size to drive the grinder continuously at any point on the operating curve without exceeding the nameplate horsepower but not less than the horsepower shown in the Schedule of Service Conditions.
  - 5) Motor shall be NEMA Premium Efficiency and shall have a 1.15 service factor, the efficiency factor shall be not less than 94% at full load and the power factor not less than 80% at full load and shall comply with the latest ANSI, NEMA, and IEEE Standards as a minimum.
  - 6) Locked rotor current shall be as specified in NEMA standards.
  - 7) Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of service, and shall have a minimum B-10 life of 30,000 hours.
  - 8) Motor shall have a stainless steel nameplate which shall provide the following: type, frame, insulation, class, hp, full load current RPM, centigrade degree rise, manufacturer's name and serial number model, voltage, locked rotor KVA code, bearing numbers and a connection diagram.

P. Dewatered Solids Conveyor (See Instrumentation Section for Motor Controller):

1. General

- a. Furnish shaftless screw conveyors system with skid-mounted mobile dewatering system consisting of two conveyors, one to receive centrifuge discharge and convey to the second movable swivel mounted unloading conveyor.
- b. Provide conveyors without intermediate bearings to convey the material specified in a totally enclosed and lined trough. Screw conveyors shall conform to CEMA 300 and CEMA 350, if applicable.
- c. The conveyor shall be fixed below centrifuge to collect solids from centrifuge and discharge into desired receptacle. The conveyor shall be installed with a reversing starter that is controlled by centrifuge torque to allow direction change during startup for handling of wet material during startup and flushing.
- d. Screw conveyor drive unit shall be designed for 100 percent of rated capacity and be capable of starting screw conveyor with a completely full trough.
- e. Screw conveyor shall be designed and constructed for conveying material with minimal maintenance. Design spiral flights to be self guiding and aligning in the trough. Guide bearings are not allowed.
- f. Conveyor shall be a minimum 16 feet in length, 12" in diameter and self supporting without the use of a stand at a maximum discharge angle of 32 degrees.
- g. Conveyor shall have a minimum capacity of 3,300 pounds per hour.
- h. Trough and chute: Stainless steel, 1/8 inch thick minimum.
- i. Trough cover: Stainless steel, 12 gauge minimum.

- j. Spiral flights: Cold-formed, carbon-based micro alloy steel, spring steel, Brinell hardness: 250 minimum with the ability to transmit a minimum of 32,000 inch-pounds of input torque. Thickness: 3/8 inch minimum.
  - k. Wear liner: Ultra high-molecular weight polyethylene per ASTM D4020. Attached to the trough with 316 stainless steel clips, 3/8 inch minimum thickness. Liner shall be sintered with an antiwear filler to reduce wear and a synthetic lubricant to reduce friction. The liner shall be provided with a visual, two-color indicator of excessive wear. Wear liner bars are not acceptable.
  - l. Fasteners for Conveyor Supports: ASTM A193/A193M, type 316 stainless steel.
  - m. Fasteners in Contact with Conveyed Material: ASTM A193/A193M, type 316 stainless steel.
  - n. Drive shaft: AIS11045.
  - o. Gaskets: Neoprene, 50 durometer.
  - p. Finish paint: Provide fusion bonded epoxy, minimum thickness of 10 mils.
  - q. One conveyor shall be 3Hp and the other conveyor shall be 7.5 Hp TEFC, 460V, 3 phase, 60 Hz, 1800 RPM constant speed motors with gear box running at 0 rpm with the 3 Hp conveyor receiving centrifuge discharge being direction reversible. Motors shall be NEMA Premium Efficiency TEFC Type II enclosure. Provide with 1.15 service factor and comply with latest ANSI, NEMA, and IEEE Standards.
  - r. Motor thrust bearings shall be adequate to carry continuous thrust loads under all service conditions and have a minimum B-10 life of 30,000
  - s. Provide Motor Space Heaters connected to motor controllers.
  - t. Shaft: Minimum 2 inch diameter welded to spiral with sealed housing at tail bearing.
  - u. Trough to be equipped with filling chute at loading end.
  - v. Provide discharge chute.
  - w. Solids conveyor controls: Provide hand/off/automatic switch within NEMA 4X centrifuge control panel and integrated with centrifuge PLC.
  - x. Provide conveyor winch with weather resistant handheld remote and 5 foot cable with storage for the remote in a weather proof enclosure mounted on the steel frame with a unistrut support
  - y. Furnish conveyor with motion failure alarm connected to PLC with run confirmation signal displayed on centrifuge control panel.
  - y. Conveyor manufacturer shall be Martin Sprocket and Gear.
2. Details of Construction:
- a. Screw flights:
    - 1) Screw flights shall be helicoids, ribbon-type. Sectional flighting formed from flat discs or plates are not acceptable.
    - 2) Design screw flights with the stability to prevent distortion and jumping in trough.
    - 3) Splice connections between spirals shall be full penetration welds. Field welds of spiral sections, when required, shall be done in strict accordance with manufacturer's recommendations.
    - 4) Pitch flights shall be constant over the entire length of screw conveyor.
    - 5) As its torsional rating, the stress in the screw flighting shall not exceed 30 percent of F<sub>y</sub> value in extreme fiber of flight material.
    - 6) Brake horsepower: Produce less torque than rating of screw flighting.

- 7) At 250 percent torque of motor nameplate horsepower rating, drive train shall not produce more torque than screw flighting's torsional rating.
  - 8) Spiral edges shall be smooth in as-rolled condition and not show grinding marks.
  - 9) "Spring effect" of screw shall not exceed 0.8 percent of total spiral length.
  - 10) Connection of screw to drive system shall be via a flanged connection plate welded to screw forming a smooth and continuous transformation from flange plate to screw. Drive shaft shall have a mating flange and be bolted to screw connection plate.
- b. Conveyor Drive Shaft Seals: Compression packing gland between the drive shafts and sleeves.
  - c. Conveyor Troughs:
    - 1) Screw conveyor troughs shall be tubular-shaped, double flanged style.
    - 2) Fabricate troughs from 3/16-inch minimum, ASTM A167, type 316 stainless steel.
    - 3) Roll troughs to shape with flanges formed with or welded to trough. Troughs shall be similar to dimensional standards of CEMA 300 and enclosure Classification IIE.
    - 4) Discharge conveyor trough inlet hopper shall be designed with the largest size possible with regard to machine clearance when affixed in the transport position to prevent spillage under normal operation.
  - d. Trough End Plates:
    - 1) Fabricate end plates from a single 3/8-inch thick, type 316 stainless steel plate, shaped to support bearings and drives in true alignment. Support bearings and end drive housings shall be welded to screw conveyor trough end plates or bolted to trough end plate using a matching 3/8-inch thick mounting plate. Provide trough stiffener channels as required per ASTM A276.
  - e. Conveyor Trough Covers and Clips:
    - 1) Provide flanged covers that provide an airtight seal for portions of trough that are not covered by inlet ports.
    - 2) Covers shall be fabricated from a minimum 12-gage, ASTM A167, type 316 stainless steel.
    - 3) Individual covers shall be no greater than six feet in length each.
    - 4) Provide a 1/16-inch thick gasket between cover and full width of trough top flange.
  - f. Inlet and Discharge Ports:
    - 1) Provide a flanged, flexible connector at each port where the screw conveyor is connected to other equipment, including other screw conveyors, or a hopper.
    - 2) Flexible connector shall be 1/4-inch thick neoprene with integrally molded flange at each end, and include stainless steel back-up bars. Flexible connector shall be at least six inches high.
    - 3) Flanged connections shall include a minimum 1/8-inch thick gasket and stainless steel connecting hardware for both flanges.
    - 4) CONTRACTOR and screw conveyor manufacturer shall coordinate design of inlet and discharge ports with equipment to which they will connect. Provide flexible connectors to mate with connecting equipment.

- 5) Provide external, stainless steel stiffeners to prevent port deformation.
- g. Flushing and Drain Connections: Provide flushing inlets and drain outlet, welded to the screw conveyor. Flushing inlets shall be type 316 stainless steel, NPT connection. Drain outlet shall be type 316 stainless steel, flanged connection.
- h. Motors:
  - 1) Electric drive motors shall operate on electrical service specified in this Section under Service Conditions.
  - 2) Motors shall be premium efficiency with TEFC Type II enclosure.
  - 3) Provide with 1.15 service factor and comply with latest ANSI, NEMA, and IEEE Standards.
  - 4) Motors shall be air cooled. Auxiliary cooling is not acceptable.
  - 5) Motor thrust bearings shall be adequate to carry continuous thrust loads under all service conditions and have a minimum B-10 life of 30,000 hours.

Q. Sludge Flow Meter:

1. Furnish flow meter with skid-mounted mobile trailer dewatering system.
2. Meter shall be of the magnetic style.
3. Centrifuge control panel shall display readout and totalizer.
4. Accuracy requirements: Flow within + or - 0.5 percent of actual flow rate for 1 - 100 percent full scale where velocity is between 1.0 and 30 feet per second.
5. Materials compatible with waste activated sludge with a solids content of 0.5 - 1.5 percent.
6. Housed in NEMA 4X SS enclosure.
7. Calibrated to standards traceable to NIST.
8. Manufacturer shall be Endress & Hauser.

R. Polymer Feed System:

1. General Requirements
  - a. Furnish emulsion polymer blending system with skid-mounted mobile trailer dewatering system.
  - b. Non-mechanical, polymer dilution/feed unit shall be capable of automatically metering, diluting, activating and feeding a liquid polymer with water.
  - c. Provide a progressive cavity pump for metering neat polymer to the mixing chamber.
  - d. Pump shall be rated for up to 10 gph.
  - e. Dilution water shall be controlled by a rotameter with an electric solenoid valve for on/off control.
  - f. Dilution water system capacity shall be up to 40 gpm minimum.
  - g. Provide type 304 stainless steel polymer injection and mixing system.
  - h. Polymer blending system shall be manufactured by Fluid Dynamics Corporation.
2. Polymer Mixing Chamber
  - a. A high energy, multi-zoned, hydro-mechanical (motor operated) mixing device shall be provided designed to effectively activate, dilute and mix polymer and dilution water without damage to the polymer's molecular structure. The mixing chamber shall have a translucent front cover for viewing mixing action.
  - b. Mixer Motor: ½ HP, 90 VDC, 1750 RPM, Wash-Down Duty with keyless shaft and left hand impeller mounting screw

- c. Hydro-Mechanical impeller designed to produce variable intensity, back-flow mixing action to optimize polymer performance without damaging polymer molecular structure
- d. Mixer Shaft Seal: Mechanical
- e. Mixer Shaft Seal Flushing Assembly with ON/OFF Valve
- f. Neat polymer poppet style check valve specifically designed to isolate neat polymer and dilution water. The check valve shall be held in place by a quick release pin for easy assembly and disassembly
- g. Materials of construction
  - Impeller: Stainless Steel
  - Body: PVC
  - Cover: Clear Lexan
  - Fasteners: 304 SS
  - Seals (non-mechanical): Viton
  - Seals (mechanical): Viton, stainless steel, ceramic
  - Check Valve: Teflon, stainless steel
- h. Pressure Rating: 100 psi
- 3. Neat Polymer Metering Pump
  - a. A stainless steel & Viton progressive cavity metering pump shall be provided to deliver: 0.75 to 15 GPH of neat polymer. The metering pump shall be controlled by an SCR motor controller as part of the control system provided herein.
  - b. ½ HP, 2500 RPM, 90 VDC, TEFC Motor
  - c. 10:1 Gear Reducer
  - d. Thermal type loss of polymer flow sensor
  - e. Metering pump calibration assembly with isolation valves: 1000 ml
- 4. Dilution Water Inlet Assembly shall be provided, including the following:
  - a. 1-1/2" FNPT water inlet connection
  - b. Dilution Water ON/OFF Solenoid Valve
  - c. Manual Rate Control Valve
  - d. Primary dilution water flow meter (Rotameter): 8 to 50 GPM
  - e. Low differential pressure alarm switch
  - f. 0-160 psi inlet water pressure gauge (stainless steel, liquid filled)
  - g. Plumbing – SCH. 80 PVC
- 5. Solution Discharge Assembly
  - a. 1-1/2" FNPT solution discharge connection
  - b. 0-160 psi solution discharge pressure gauge (stainless steel, liquid filled)
  - c. Plumbing – SCH. 80 PVC
- 6. Control Panel
  - a. NEMA 4X FRP enclosure
  - b. 120 VAC, 60 Hz, 1 Ph Service
  - c. Solid state SCR drive with motor circuit protection
  - d. Terminal block wiring, numbered with legend on diagram
  - e. All wiring to be numbered and run in raceways
  - f. NEMA 4X Conduit and fittings (Series D) between enclosure instrumentation and controls
  - g. Operator Interface – NEMA 4X Pilot Devices Mounted on Outside of Enclosure
    - 1) System ON / OFF(reset) / REMOTE

- 2) Metering Pump HAND / AUTO (AUTO = 4-20mA pacing)
- 3) Ten-Turn Potentiometer – Metering Pump Control
- 4) One-Turn Potentiometer – Mixer Speed Control
- h. Status / Alarm Indicators: NEMA 4X Pilot Devices Mounted on Outside of Enclosure
  - 1) System Running Indication
  - 2) LED Display Metering Pump Rate
  - 3) Low Water Differential Pressure Alarm
  - 4) Low Polymer Flow Alarm
- i. Inputs (signals by others)
  - 1) Remote Start / Stop (discrete dry contact)
  - 2) Pacing Signal Based on Process Flow (4-20mA)
- j. Outputs:
  - 1) System Running (discrete dry contact)
  - 2) Remote Mode (discrete dry contact)
  - 3) Common Alarm (discrete dry contact)
- 7. System Skid:
  - a. Frame: 304 stainless steel, open frame design for access to all components
  - b. Fasteners: 304 SS
  - c. Designed for bolt-down

S. Main Drive Motor (See Instrumentation Section for Motor Controller):

- 1. The centrifuge shall be V-belt driven. The belt drive system shall consist of multiple V-belts to provide full load capacity and to withstand the full starting torque of the system. The centrifuges shall be provided with variable frequency drives to optimize and control bowl speed. Speed adjustment will be at the control panel.
- 2. Motor:
  - a. Motor shall be sized according to manufacturer's requirements and shall be NEMA Premium Efficiency.
  - b. Provide motor space heater connected to motor controller.
  - c. The main drive motor shall be designed, manufactured and tested in accordance with the latest NEMA, IEEE and ANSI standards.
  - d. The main motor shall be a squirrel cage induction motor and shall be provided with thermistors for thermal protection. The motor shall have copper windings and be designed for operation with 480 volt / 3 phase / 60 Hz nominal power. The motor shall have Class F insulation with a B Rise, 3600 RPM, TEFC, inverter duty, NEMA design B oversized cast iron terminal box, and continuous duty. The motor temperature shall not exceed 130°C at 90% nameplate voltage. The noise level shall not exceed 85 dbA sound pressure measured at 3 feet from the motor in all directions.
  - e. Motor shall have sufficient torque and thermal capacity to successfully start and accelerate the centrifuge from the plant power system without subjecting the motor to excessive heating. Provide space heaters, 120 volt, single phase.
  - f. Motor shall have a minimum 1.15 service factor (sine wave).
  - g. Locked rotor current shall be as specified in NEMA standards.

- h. Motor frames and end shields shall be heavy fabricated steel or cast iron of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.
- i. Shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating.
- j. Stator cores shall be made of low loss, non-aging electrical sheet steel with insulated laminations. Stator coils shall be form wound and of identical size, shape, insulation and number of turns.
- k. Stators shall be form wound and insulated with glass and mica applied directly to the coils. Motors shall have a Class F non-hygroscopic epoxy vacuum/pressure impregnated insulation system, limited to the temperature rise specified herein. All connections shall be brazed, with no crimp connections used except for terminals. A coil bracing for stator end turns shall be utilized to eliminate coil movement and vibration during starting and running conditions. Stator design and construction shall be such as to secure mechanical rigidity to withstand repeated full voltage starts and eliminate overheating.
- l. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel cage windings may be cast or extruded copper alloy bar-type construction with brazed end rings.
- m. Bearings shall be anti-friction type, oil lubricated. Bearings shall be designed to prevent leakage of oil and entrance of dust, shall contain a large oil sump with settling chamber, and shall be equipped with a guarded sight gauge, plugged drain cock, and filler connection. Bearings shall have a average L-10 life of 100,000 hours.
- n. Motors shall have a chemical resistant, corrosion and fungus protective coating on all interior surfaces. Exterior prime coating shall be compatible with the field applied finish coating.
- o. Enclosures shall have stainless steel screen and shall be protected against corrosion, fungus and insects.
- p. All fittings, bolts, nuts and screws shall be plated to resist corrosion. Bolts and nuts shall have hex heads.
- q. Motor shall have a stainless steel nameplate which shall provide the following: type, frame, insulation, class, Hp, full load current, RPM, centigrade degree rise, manufacturer's name and serial number model, voltage, locked rotor KVA code, bearing numbers and a connection diagram.
- r. Motors shall have a minimum full load efficiency of 94.5 percent when operating at rated voltage and frequency.
- s. Motors shall be rated for continuous operation in an ambient temperature not exceeding 130 C. The temperature rise as measured by the resistance method shall not be more than 80 C, or 85 C by embedded detector at design horsepower nor more than 90 C by embedded detector at 1.15 service factor.
- t. Six dual type resistance temperature detectors (RTDs) shall be distributed about the stator, each being embedded between upper and lower coil in the coil slot. Leads shall be brought out to a separate terminal box, through a flexible sleeve which will protect the leads and assure their flexibility after dipping and baking of stator.

- u. One dual type resistance temperature detector of the same rating and material as defined above shall be provided for each motor bearing and wired to a separate terminal box.
  - v. Maximum motor horsepower: 75
  - w. Ambient temperature rating: 40 degrees C
  - x. Maximum temperature rating: 120 degrees C
  - y. Protective Devices: Provide the following:
    - 1) Three current transformers for differential relay protection.
    - 2) Surge protection capacitors and lightning arresters installed in the motor terminal box as described above.
  - z. Manufacturer: Provide equipment of one of the following:
    - 1) Baldor
    - 2) US Motors
    - 3) Reliance Electric.
    - 4) Or equal.
3. Bracket and plate assembly for maindrive motor shall be mounted on not less than two spring type or rubber buffer isolators. Spring isolator shall consist of not less than one or more steel springs provided with built-in leveling bolts and dampers to control oscillation. Isolators shall be designed for external level adjustment. After installation, isolators shall be inspected and adjusted by a qualified representative of the centrifuge manufacturer. Rubber type vibration isolators shall be of the self leveling type.
  4. Main Drive motor shall be mounted on a hinged end plate of fabricated steel in such a manner that it can be easily disengaged and swung away from the connection to the centrifuge for easy motor removal for replacement and/or maintenance.

T. Hydraulic Back Drive System (See Instrumentation Section for Motor Controller):

1. Provide an automatic, torque controlled hydraulic scroll drive system to control and adjust the differential speed between the scroll conveyor and the centrifuge bowl. The backdrive shall operate in a manner such that, as the reactive torque of the scroll shaft increases due to solids in the bowl, the system shall gradually decrease the scroll differential speed. The resultant effect shall be to optimize the amount of time that the cake solids are subjected to centrifugal force.
2. Hydraulic scroll drive shall maintain a continuous torque of 12,000 Nm.
3. The hydraulic backdrive shall independently drive the scroll conveyor.
4. The system shall use a hydraulic pump drive unit and a rotating hydraulic motor driven unit. The hydraulic backdrive system shall be installed and operated without a gear reducer. Torque shall be measured as a function of the hydraulic pressure. The maximum torque and rate of change of scroll differential speed shall be adjustable. The backdrive shall also provide for operation at a fixed specific, adjustable, scroll differential speed, with torque allowed to vary up to the maximum allowable scroll shaft torque.
5. The hydraulic pump drive unit shall include an oil reservoir of heavy-gauge steel construction. The reservoir shall be equipped with an oil temperature and an oil level indicator, easily accessible drain plug, filler and breather cap, suction strainer, and pressure filter. Easy access to the interior shall be provided for cleaning. The pump drive unit shall also include the hydraulic pump, electric motor, motor-pump coupling, control panel and heat exchanger.



6. Hydraulic scroll drive shall be water-cooled and have a minimum continuous torque capacity of 12,000 Nm. The scroll drive shall be capable of supplying clean-in-place capability through the bowl to conveyor differential speed, at the full torque rating system, without requiring any external motor or mechanical device to maintain a constant or zero bowl speed. Provide solenoid on cooling water to be initiated on equipment startup and prevent startup in absence of cooling water supply.
7. Unit shall be capable of automatic or manual operation.
8. Manual mode shall permit operation of specific adjustable scroll differential speed with internal torque allowed to vary up to maximum shaft torque.
9. Hydraulic unit shall automatically vary scroll speed to react to changes in feed solids concentrations.
10. Maximum torque input and rate of change differential of scroll shall be adjustable.
11. In the event of excessive torque, the system shall first provide a signal to stop the feed flow to the centrifuge and commence flushing, and restart automatically when conditions return to normal.
12. Provide automatic shutdown of feed pump and centrifuge when torque value approaches limit of drive. Restarting equipment is to be manually initiated by operator.
13. Cyclo gears or Planetary gears or Simp drive backdrive systems to achieve a differential speed between the bowl and scroll will not be accepted.
14. Hydraulic back-drive motor shall be 15 hp, 1800 rpm, maximum power.
15. The backdrive motor shall include the following features:
  - a. NEMA MG-1 rated
  - b. TEFC
  - c. Horizontal squirrel-cage type
  - d. NEMA Premium Efficiency motor
  - e. Provide motor space heater connected to motor controller
  - f. Class F insulation
  - g. 1.15 service factor
  - h. Corrosion resistant rotor and starter
  - i. Condensate drain
  - j. Gasketed conduit box
  - k. Low noise design
  - l. Stainless steel nameplate
  - m. Thermal switch

U. Highway Approved Trailer:

1. Furnish a suitable heavy duty, dual axel trailer to carry the complete weight of the skid mounted packaged centrifuge system with an approximate gross vehicle weight of 29,000 lbs.
2. Maximum trailer dimensions: 30' x 102"
2. Provide the trailer such that the framework" of the centrifuge system is completely bolted down to the trailer frame structure.
3. Provide the equipment system such that all process connections are terminated with quick disconnect connections on a common fabricated panel on one side of the centrifuge system and the solids discharge conveyor configured on the opposite side.
4. Provide the trailer system with the control panel located on the end of the trailer with 48 inches of remaining trailer decking space for the operator to stand safely on the end

of the trailer for operation and maintenance of the trailer mounted unit. The space provided for the operations personnel shall have as a minimum requirement, the area required by the NEC between the open control panel enclosure door and the end of the trailer. Also provide a collapsible sun shade awning or bimini style top easily deployed at the operation site and stowed for transportation. The manufacturer shall submit the design to the owner for their review acceptance of its configuration. The awning shall provide reasonable coverage and shade from direct sun and glare for the easy view of the control station screens and protection from moderate rain. The color of the awning shall match the manufacturer's standard blue equipment coatings. Framework shall be a marine grade, 316 series stainless steel.

5. Provide the trailer with an area to carry and use a commercial tote size container of Polymer for the centrifuge process. The centrifuge system shall be configured such that the system can use a supply of polymer fixed at a given plant site, or the supply provided and hauled on the trailer with the centrifuge equipment.
6. Provide a pintail hook connection system for the trailer unit connection to the haul vehicle.
7. All areas of the trailer mounted system shall be open and provide access to fasteners and service of mounted equipment on the centrifuge system. No critical fasteners shall be blocked by the trailer mounting configuration and special consideration shall be made to provide access to them by tools.
8. Provide four leveling jacks for the trailer system, powered by the centrifuge hydraulic drive assembly system for use by the operator in leveling the system quickly and easily at any plant site on uneven ground. The systems hydraulic system shall have provision for independent operation of these leveling jacks when the power is connected at a given site. Design the system in such a way that the leveling hydraulics will operate when the centrifuge is not in operation during set up and break-down, and will not operate or move when the centrifuge system is powered on. Hydraulic levers shall be physically protected from operation in an area provided for them, lockable during centrifuge operation, preventing retraction during operation of the centrifuge.
9. A certified weight slip shall be supplied with the trailer upon delivery. Trailer must meet all of the following specifications without exception:
  - a. There shall be no scotch locks in the wiring.
  - b. The trailer shall have air brakes installed with automatic adjusters. The air brakes shall include maxi brake chambers.
  - c. Supplied air tanks shall have easily accessible drains, if applicable.
  - d. All DOT approved lights and reflectors shall be installed on the trailer. All lights shall be recessed and protected.
  - e. All manual support jacks shall be rated for 10,000 lbs, must match and be interchangeable and should come with a pad for each jack.
  - f. The trailer shall hook to a pintail hitch for pulling by county trailer.
  - g. All tires shall be DOT approved. Two spare tires and wheels shall be provided and mounted under trailer unit.
  - h. The trailer mounted centrifuge dewatering system, as installed with all the equipment for the dewatering process, shall be street legal without permits.

- U. Maintenance Water Connection: Provide an operator wash water hose connection an facet for operator hand wash at a convenient location near the connection panel for the process fluids.

## 2.4 INSTRUMENTATION

- A. Scope: Furnish complete instrumentation and control system to operate all trailer mounted equipment listed in section 2.02 B of these Specifications.
  - 1. Main circuit breaker.
  - 2. Provide Allen Bradley (AB) Control Logix PLC for control logic, suitable for direct connection to an AB micrologic PLC system via Ethernet IP. Provide AB Panel View Plus 1000 Series color operator interface for display, recording, and downloading of all necessary information. Control of all equipment shall be accessible through the operator interface and remote SCADA via Ethernet connection through a WLAN network using the 802.11N router provided.
  - 3. One spare PCU module shall be included and pre-programmed with control logic for simple exchange.
  - 4. PLC shall be protected by uninterrupted power source.
  - 5. Viscotherm CVC model 600 scroll drive controller.
  - 6. Variable frequency drive for the main drive motor.
  - 7. Variable frequency drive for the sludge feed pump.
  - 8. Controls for emulsion polymer blending system.
  - 9. Pushbuttons and red running lights included in the operator interface for:

- Main Drive Motor
- Backdrive Motor
- Polymer System
- Sludge Feed Pump
- Conveyors
- Relays for Water Valves

- 10. Ammeter and non-resetable hours-run meter for main drive motor to be mounted on the enclosure door.
- 11. Indication on the operator interface of the following malfunctions:

- All Alarms
- Alarm History
- Flow for feed pump
- Polymer system feed rate
- Bearing temperature
- Vibration
- Hour Meter
- High main drive motor temperature.
- High backdrive motor temperature.
- High vibration in main bearings.
- High backdrive torque (hydraulic pressure)
- Backdrive low level

Backdrive high temperature

12. Audible alarm with re-set.
- B. Free Standing Centrifuge Control Panel: Provide one free standing, skid-mounted control panel in NEMA 4X stainless steel enclosure with following features:
1. Enclosure: NEMA 4X SS.
  2. Through-the-door main disconnect, lockable to off position
  3. Variable frequency drive for bowl and scroll motors
  4. Power supply: 480V, 3Ø, 60 Hz, 200 amps, with transformer to operate auxiliary components.
  5. Programmable logic controller, Allan-Bradley Control Logix
  6. Control relays
  7. Interconnection terminal points
  8. Provide door-mounted equipment as follows:
    - a. Illuminated selector switch
    - b. Mushroom head emergency stop switch
    - c. NEMA 4X rated color touch screen Operator Interface Terminal (OIT), Panelview 1000
  9. Interior light, with separate on/off switch
  10. Interior wattage strip heater, thermostat controlled
  11. Interior 120V/20A duplex receptacle (on a dedicated 20A c
  12. Exterior 120V/20A duplex receptacle for connecting UPS power backup when stationary
  13. Exterior WLAN antenna to transmit router signal from Ethernet modem connection for remote monitoring of system control panel.
  14. Any and all uni-strut or "B" strut mounts shall be fabricated out of 316SS material.
- C. System Software:
1. General:
    - a. CONTRACTOR shall provide all operating and vf. Software required shall consist of all programs and systems necessary to efficiently perform the functions specified and shown and to enable convenient and efficient preparation of new programs.
    - b. Specifics for the system are given as a guide; however, manufacturer's standard packages that can accomplish all of the specified functions will be considered.
    - c. All system software shall be supplied on CD's and shall provide fast system start-up, simple system installation, and ease of building tasks, control schemes, and displays. For added security, the system furnished shall include provisions for copying the contents of the system to a backup "Flash" drive or CD Read/Write through the use of supplied backup software.
    - d. System software shall provide for convenient addition, modification and deletion of application programs without interruption of the processes.
    - e. System parameters (e.g., set points, alarm limits, and loop tuning constants) shall be enterable or modifiable using the operator's workstation or console.
    - f. The capability for displaying all system inputs and outputs on the operator's consoles and workstation shall be provided.
- D. Operating Software

1. The operating software shall include the operating system and other software that supports the complete process control system.
  2. Real Time Application System:
    - a. The Real Time Application System shall run on Microsoft Windows XP. - Application programs that adhere to Microsoft Windows platform shall run under this system.
- E. Operator Interface Panel Functions.
1. System control power (shall be hardwired pushbutton)
  2. Auto sequence
  3. Clean in place sequence
  4. Centrifuge drives
  5. Washwater solenoid valve
  6. Polymer system
  7. Solids feed pump
  8. Inline Sludge Grinder
  9. Sleep mode
  10. Pause mode
  11. Cake conveyors
  12. Alarm control
- F. Operator Interface Terminal Status Indication of the Following:

<u>Item</u>	<u>Indication</u>
1. System Control Power	"On"
2. Auto Start	"Starting in Auto"
3. Auto Stop	"Stopping in Auto"
4. CIP (Clean in Place)	"Running in CIP"
5. Centrifuge	"Running"
6. Washwater Solenoid	"Open"
7. Polymer System	"Running"
8. Sludge Feed Pump	"Running"
9. Inline Sludge Grinder	"Running"
10. Cake Conveyor System	"Running"

G. Alarms

1. Emergency Stop	"Fault"
2. Bowl Drive VFD	"Fault"
3. Bowl Drive Motor Temperature	"Fault"
4. Back Drive	"Fault"
5. Back Drive Motor Temperature	"Fault"
6. Back Drive High Torque	"Fault"
7. Back Drive High-High Torque	"Fault"
8. Bearing Temperature High	"Fault"
9. Bearing Temperature High-High	"Fault"
10. High Vibration	"Fault"
11. High-High Vibration	"Fault"
12. Low Relative Speed	"Fault"

- |     |                       |         |
|-----|-----------------------|---------|
| 13. | Polymer System        | "Fault" |
| 14. | Sludge Feed Pump      | "Fault" |
| 15. | Inline Sludge Grinder | "Fault" |
| 16. | Cake Conveying System | "Fault" |

H. Operator Interface Terminal indication of the following analog process variables

	<u>Item</u>	<u>Indication</u>
1.	Bowl Speed	"RPM"
2.	Scroll Speed	"RPM"
3.	Back drive Torque	"Percent"
4.	Relative Speed	"RPM"
5.	Vibration	"In/Sec"
6.	Polymer Feed	"GPM"
7.	Solids Feed	"GPM"
8.	Bearing Temperature	"DEG"

I. Operator Interface Terminal Speed Control for the following:

1. Bowl Speed
2. Scroll Relative Speed (PI Manual)
3. Scroll Torque (PI Auto)
4. Polymer System
5. Sludge Feed Pump

J. Variable Frequency Drives

1. General:

- a. The adjustable frequency controller shall be microprocessor-based, pulse width modulated design, suitable for operation on a 480 volt, 3 phase supply. The controller shall produce an adjustable AC voltage/frequency output so to vary the speed of the driven equipment. The controller shall consist of the following sections:
  - b. Six pulse diode bridge converter input section.
  - c. Fixed DC bus section.
  - d. Six pulse power transistor inverter output section.
2. The controller switching frequency shall be adjustable and permit operation at 5,000 Hertz or less. The switching technology shall also include a scheme specifically design to reduce the dv/dt of the output supply.
3. The controller shall be equipped with a five percent DC bus reactor or input line reactor.
4. The controllers' solid state converter input section switching devices shall have a 1600 volt PIV rating.
5. The controller shall have an overload rating of 110 percent variable torque, 150 percent constant torque for one minute.
6. Controller shall be able to withstand output terminal line-to-line short circuits without component failure.

2. Operating Criteria:

- a. The controller's operating criteria shall be in accordance with the following.
  - 1) Ambient temperature range, 0 to 40 Degrees C.

- 2) Operational humidity, up to 90 percent non-condensing.
  - 3) Altitude, below 3,300 feet above sea level.
  - 4) Nominal voltage, 480 volts plus or minus ten percent, 3-phase, 3 wire. The controller shall include an undervoltage feature to permit trip-free operation down to 35 percent undervoltage.
  - 5) Nominal frequency, 60 Hertz plus or minus 3 Hz.
  - 6) Input power factor, 95 percent displacement power factor at all operating speeds.
  - 7) Efficiency, 96 percent at full speed and full load.
3. Features:
- a. The controller shall have features in accordance with the following:
    - 1). Digital keypad and display module shall provide parameter setting, adjustments and monitoring of control functions and faults. Display messages shall be in English.
    - 2) Serial communication port shall allow connecting to a programmable controller interface using manufacturer standard protocol..
    - 3) Independent acceleration/deceleration rates shall provide 2 to 600 seconds minimum. When called to stop, the motor shall decelerate to minimum speed before stopping.
    - 4) Power loss feature shall allow 5 cycle ride through capability for input supply interruptions..
    - 5) Time delay automatic restart shall allow restart after controller fault conditions with programmable attempts.
    - 6) Coasting motor restart shall permit the controller to restart into a coasting motor without damage or tripping. The coasting motor restart feature shall allow switching from bypass mode to VFD mode while operating without shutdown.
    - 7) Control inputs and outputs shall be isolated.
4. Protection:
- a. The controller shall have protective functions in accordance with the following:
    - 1) Input line metal oxide varistor transient protection.
    - 2) Electronic over-current trip instantaneous and inverse time overload protection with thermal memory retention.
    - 3) Over-temperature trip temperature protection.
    - 4) Current limit trip protection.
    - 5) Input line over and under voltage trip protection.
    - 6) Ground fault trip protection.

K. Hydraulic Back-drive Control Panel

This electronic display and control system is used for continuous regulation of hydraulic VISCOTHERM ROTODIFF Systems for decanting centrifuges. The CVC system operates by means of an efficient microprocessor ensuring absolutely precise measuring and control (digital signal processing). All key operating parameters can directly be set at the equipment. All regulating targets, measuring values, operating status and disturbance messages are transmitted via the integrated Modbus DP interface to the control station. By means of the universal, software-supported end-stages of valves many different pump types (including also position adjustment) can directly be controlled without any hardware

modification. Strict use of pluggable connecting terminals. Control panel shall include the following at a minimum:

Visualizing of: Bowl speed in rpm  
Differential and scroll speed in rpm  
Hydraulic pressure (torque) in bar  
Additional measurement values (e.g. oil temperature, vibration, ...)  
Operating hours of Rotodiff, maintenance interval indicator

Plaintext display of: Cut-off pressure p2 in bar feeding pump off  
Cut-off pressure p3 in bar bowl drive off  
Standstill of centrifuge  
Disturbance messages

Selectable languages: German, English, French, Portuguese, Spanish,  
Dutch, Norwegian, Italian

Process control: Change-over to 9 different curves ensuring process control  
For every regulating curve, the following values may be set:

Base speed	$\Delta n$
Control pressure	p1
Regulating stiffness	$\alpha$ (linear regulating curves)
Cut-off pressure	p2 (feeding pump off)
Cut-off pressure	p3 (bowl drive off)
Pressure limitation	(only by visualizing)
Speed limitation	(only by visualizing)
Curve characteristics and form	(only by visualizing)

Speed regulation: Adjustment to the set nominal value, thus correcting automatically.  
Any deviations from rpm values due to ageing.

Remote adjustment: All regulating parameters can be remote-adjusted via Modbus DP.  
Change-over commutation of all regulating curves by means of relay points. Optional visualizing for modifying adjustment of regulating Parameters.

#### L. Remote monitoring of Centrifuge:

The centrifuge shall be equipped with remote monitoring capability that will allow the owner to observe/review the mechanical condition and process performance of the installed machine while away from the facility/equipment. The system will support the operation, training, optimization and if required troubleshooting of the equipment during the initial operating period of the equipment and later through the life of the equipment. The system will also have automated alarm notification that will notify the owner if the machines parameters exceed any preset level for safety, mechanical health and/or optimum process operation.



Communication- The system must be able to communicate independently of the plant IT network through the use of wireless cellular technology. All transmitters shall not interfere with installed plant devices and be FCC compliant.

System shall also be capable of communicating with the plant IT network through a WLAN network by transmitting from a model 802.11N router connected to the ethernet modem provided in the control panel. Hernando County Utilities shall be responsible for providing and installing any repeaters necessary to boost the router transmission signal a greater length than the router is rated for as standard.

Monitoring & Reporting- The system will independently monitor the operating data from the machine 24 hours/day and record it offsite on an independent webserver. The data will be maintained as current for a minimum period of six months and be accessible through any internet connection. The data shall be displayed graphically for daily review of operations, trend analysis and preventative maintenance.

The system will have adjustable alarm settings for each parameter monitored. When an alarm is triggered the system will be able to notify the operator and the maintenance team by email and/or telephone that an alarm condition exists. This alarm sequence will operate separately and independently from the machine controller so as not to interfere with local control of the equipment.

The system shall have the minimum capabilities:

1. Monitor up to six (6) six digital and six (6) analog signals of the owners choice including but not limited to:

#### Analog

- Flowrate
- Machine Speed
- Differential speed
- Bearing temperatures
- Vibration level
- Machine torque
- Motor amps

#### Digital

- On/off for any equipment
- Run enabled for any equipment
- Full/empty tank levels
- Hi/Lo pressure
- Auto/manual setting
- Elapsed time on/off for any digital signal.

- Alarm condition for any device with contactor.
2. Be accessible from any internet connection with secure password protection.
  3. Provide automated alarm notification.
  4. Have web based operator interface with graphical capabilities for data reporting.
  5. Have battery back-up to protect data and settings for 100 hours in the event of a power outage.

Licenses and Fees:

The system will be installed and be free of all fees for the initial warrantee period. Continuation of this service, if desired will require fees for annual enrollment of service and/or maintenance agreements through the centrifuge supplier.

## 2.5 CENTRIFUGE EQUIPMENT INTERFACE REQUIREMENTS

- A. Electrical Instrumentation and Control Systems to Satisfy the Following Interface Requirements: ALL I/O POINTS ARE TO BE MADE AVAILABLE TO SCADA.
  1. Centrifuge Control Panel. Power input 460 VAC, 3 Phase, 60 Hz, 100 amps
  2. Power output to centrifuge drive motors:
    - a. Bowl drive motor
    - b. Scroll drive motor
  3. PLC dry contact Inputs/Outputs:
    - a. Bowl drive run command (includes E-Stop)
    - b. Bowl drive run confirm
    - c. Bowl drive VFD fault
    - d. Back drive run confirm
    - e. Back drive fault
    - f. Bowl drive motor thermostat
    - g. Scroll drive motor thermostat
    - h. Emergency Stop
  4. PLC Analog Inputs/Outputs: (4-20 mADC Signal)
    - a. Bowl drive speed reference
    - b. Back drive speed reference
    - c. Bowl drive speed feedback
    - d. Bowl drive load feedback
    - e. Back drive speed feedback
    - f. Back drive torque feedback
  5. Control Power Transformer:
    - a. 120 VAC, 1 phase, 60 Hz, 10 amps
  6. Inputs from centrifuge motors: (dry contact)
    - a. Bowl drive motor thermostat
    - b. Scroll drive motor thermostat
  7. Inputs from machine junction box: (dry contact)
    - a. Scroll drive high-high torque limit switch

8. Inputs from ancillary equipment: (dry contact)
  - a. Polymer pump run confirm
  - b. Polymer pump fault
  - c. Sludge pump run confirm
  - d. Sludge pump fault
  - e. Inline sludge grinder confirm
  - f. Inline sludge grinder fault
  - g. Cake conveyor system run confirm
  - h. Cake conveyor system fault
9. Inputs from machine junction box: (4-20 MADC Signal)
  - a. Centrifuge vibration
  - b. Drive end bearing temperature
  - c. Feed end bearing temperature
10. Inputs from ancillary equipment: (4-20 MADC Signal)
  - a. Polymer pump flow (or speed)
  - b. Solids pump flow (or speed)
11. Outputs to field mounted devices:
  - a. 120 VAC wash water solenoid power (open command)
12. Outputs to ancillary equipment: (dry contact)
  - a. Polymer pump run command (includes E-Stop)
  - b. Solids pump run command (includes E-Stop)
  - c. Grinder run command (includes E-Stop)
  - d. Cake conveyor run command (includes E-Stop)
13. Outputs to ancillary equipment (4-20 MADC Signal)
  - a. Polymer pump speed reference
  - a. Solids pump speed reference
  - b. Grinder speed reference

## 2.6 DESCRIPTION OF OPERATIONAL SYSTEM

### A. General Requirements:

1. The dewatering system shall be capable of the following operational characteristics as described below:
  - a. Emergency stops to de-energize the master control relay to interrupt all run commands for immediate shutdown
  - b. To restart system, the emergency stop must be manually reset
2. Starting/Stopping Modes:
  - a. On the "Main" screen the system operating mode shall be selected by touching one of the mode select touch zones. All equipment must be stopped to change modes which will be indicated by the mode select enabled indicator.
  - b. Manual mode - In this mode system components shall be started with their respective start pushbuttons, which shall be accessed by touching the manual control touch zone that displays the "Manual Control" screen. Emergency stop shall always stop all equipment. This mode of operation shall be provided for maintenance purposes only.
  - c. Auto mode - (Sleep Mode) - In this mode, shutdown shall be controlled from the /auto stop pushbuttons. At any time while in the Auto mode the operator shall be able to begin a shutdown. After a start-up has been completed the operator shall be

capable of entering a shutdown time on the "Sleep Mode" screen to end a process run. At the end of the run time the control system shall automatically begin a shutdown and cleaning cycle. The OIT shall display all automatic conditions and allow control of all time settings.

- d. The Auto Start cycle shall initiate the following sequence of start-up events:
    - 1) Centrifuge feed tank agitator energized for preset time delay (1-60 seconds) prior to start of centrifuge bowl drive
    - 2) Solids inlet control valve opens and closes to maintain feed tank in preset deadband level
    - 3) Centrifuge bowl drive starts (instantly)
    - 4) Centrifuge back drive starts (3 second delay from bowl starting; sequence may be reversed depending upon manufacturer)
    - 5) Polymer system starts (once bowl and back drive come to speed)
    - 6) Solids feed pump and grinder starts operator adjustable time delay from polymer starting; time delay between starting of polymer pump and sludge pump shall be set on "Setup 2" screen)
    - 7) Conveyor starts (when back drive torque reaches operator adjustable percentage set point; Torque setting for conveyor shall be set on "Setup 2" screen)
  - e. While Auto start is in progress the Auto start indicator light shall flash "STARTING IN AUTO". After start-up is complete the indicator light shall stay on steady "RUNNING IN AUTO"
  - f. The Auto Stop cycle shall initiate the following sequence of shut-down events:
    - 1) Solids feed pump stops (instantly)
    - 2) Grinder stops (instantly)
    - 3) Polymer system stops (instantly)
    - 4) Centrifuge goes to relative speed control
    - 5) Centrifuge goes to auto stop preset speed #1 (at normal deceleration ramp)
    - 6) Washwater valve opens (once centrifuge is at preset speed #1)
    - 7) Centrifuge remains at this preset speed #1 (duration as set on "Setup 2" screen)
    - 8) Centrifuge goes to auto stop preset speed #2 (at normal deceleration ramp)
    - 9) Centrifuge remains at this preset speed #2 (duration as set on "Setup 2" screen)
    - 10) Centrifuge stops (at normal deceleration ramp)
    - 11) Washwater valve closes (at bowl speed set on "Setup 2" screen)
    - 12) The conveyor will stop once the purge cycle times out
    - 13) CIP will be initiated
  - g. Auto stop indicator light shall flash "STOPPING IN AUTO" while in progress and go instead "STOPPED IN AUTO" when complete.
3. CIP mode: Clean in place (CIP). In this mode, startup and shutdown shall be controlled from the CIP start/stop pushbuttons. Operating the CIP start pushbutton or an auto stop shall initiate a CIP cycle as described below.
- a. Centrifuge bowl drive starts (instantly)
  - b. Centrifuge back drive starts (3 second delay from bowl run confirm; sequence may vary depending upon manufacturer)
  - c. Washwater valve opens (once bowl and scroll come to speed)

- d. The duration and speeds for the CIP cycle are set on "Setup 2" screen. Operating the CIP Stop pushbutton will initiate the following sequence of events:
  - 1) Washwater valve closes (instantly)
  - 2) Stop centrifuge (at normal deceleration ramp)
4. Purge/Resume Mode: The pause function adjustable up to 60 minutes shall deactivate the feed solids and polymer flow while keeping the centrifuge up to speed. Once an empty storage container is in place, the resume function shall reactivate the feed solids, polymer flow and conveyors.
5. Operating Mode:
  - a. Torque/relative speed control: Centrifuge to be operable in two different control modes, torque control (PI Auto) or relative speed control (PI manual). The active control mode to be indicated below the centrifuge graphic on the main screen. To access control mode selection and setpoint entry, the centrifuge graphic shall be touched displaying the Torque control screen. The control mode shall be selected by touching either the Auto or Manual touch zones. Touching the numeric display of the current setpoint, shall bring up a numeric entry keypad from which the setpoint shall be entered. The setpoint range shall be from 0 to 100 percent for Torque setpoint and 0 to XX for relative speed setpoint. Torque setpoint may be limited on the Torque Control Setup screen. Relative speed maximum shall be limited on "Setup 1" screen.
  - b. Feed control: Touching either pump graphic shall access the speed/flow setpoints for the polymer and solids pumps. The "Polymer and Solids Setup" screen shall be displayed. Touching the numeric display below the word setpoint shall bring up a numeric entry keypad. The setpoint range shall be 0 to 100 percent.
  - c. Centrifuge Feed Tank Level Control: Provide outputs for opening and closing the solids inlet control valve (CV901) to maintain the centrifuge feed tank within desired deadband level.
6. The control system shall provide a minimum of six preset operational settings. Each of these settings shall have established process parameter setpoints for bowl speed, scroll torque, polymer and solids flow. Setpoints shall be adjustable and maintained on a secured setup screen on the OIT.

## 2.7 ALARMS

- A. General Description:
  1. Alarm conditions to be indicated with red background on the alarm screen and initiate alarm horn to sound and beacon to flash. Alarm indicator illuminated as long as condition is still in fault condition. Operating acknowledge pushbutton to silence horn and cause indicator to flash only if condition has been cleared. Reset button to clear the alarm indicator and allow system startup. Normal alarm condition to be indicated in green.
  2. System Shutdown:
    - a. The following conditions will shutdown the complete system in auto, manual or CIP:
      - 1) Emergency stop.
      - 2) Bowl drive VFD fault.
      - 3) Bowl motor high temperature.

- 4) Back drive fault.
  - 5) Back drive high temperature.
  - 6) Bearing temperature high-high.
  - 7) Back drive high-high torque.
  - 8) High-High vibration.
3. Polymer and Solids Feed Pump Shutdown:
    - a. The following conditions will shutdown the polymer and solids feed in auto mode:
      - 1) High vibration.
      - 2) Back drive high torque.
      - 3) Polymer system fail.
      - 4) Solids pump system fail.
      - 5) Grinder fail.
      - 6) Low relative speed.
      - 7) Conveyor system fail.
  4. Vibration and Torque Shutdown:
    - a. High vibration or high torque to initiate a pause and flush sequence
    - b. Duration of the flush time to be operator adjustable
    - c. Feed to the centrifuge shall automatically resume when vibration or high torque conditions are cleared
    - d. Auto stop sequence to be initiated if three high vibration or high torque alarms occur within a ten-minute time limit.
    - e. Alarm setpoints to be set on "Setup 3" screen.

## 2.8 ANCHOR BOLTS

- A. Furnish anchor bolts and nuts of ample size and strength for the purpose intended, sized by the equipment manufacturer. Provide hooked anchor bolts for direct embedment during placement of concrete. Anchor bolt materials shall be of Type 316 stainless steel conforming to Section 05051.

## 2.9 SPARE PARTS AND SPECIAL TOOLS

- A. The following spare parts shall be furnished with each of the trailer mounted centrifuges systems:
  1. One set of pillow block bearings and seals.
  2. One set of conveyor bearings.
  3. Two sets of replaceable feed ports.
  4. One set of o-rings and seals.
  5. Two sets of cake discharge ports.
  6. One set of gaskets (frame).
  7. One set of gaskets (rotating assembly).
  8. One set of ring dams.
  9. One set of solids discharge housing wear plates.
  10. One backplane, 16 slot.
  11. One set of matched drive belts.
  12. One year supply of lubricants for each piece of equipment.
  13. One year supply of filters.

14. One PLC power supply.
15. One PLC CPU module.
16. One Input Card, 16 point, 120 VAC.
17. One Input Card, 32 point, 24 VDC.
18. One Output Card, 16 point, 120 VAC.
19. One Relay Card, 8 point.
20. One set of contactors/relays.
21. One set of light bulbs.
22. One set of fuses.
23. One set of bearing temperature sensors.
24. One set of speed pickups.
25. One set of VFD spare parts.
26. One vibration monitor standard spare parts kit.
27. One set of liquid end replacement kit for polymer feed pump.
28. One set of grinder spares.
29. One spare rotor for polymer pump
30. One spare rotor for sludge feed pump
31. One set of spare motion sensors for drum and internal back drive
32. One motor for each screw conveyer
33. One centrate discharge cap
34. One centrate hose
35. Once centrifuge feed tube

- B. Manufacturer shall furnish a list of additional recommended spare parts for an operating period of one year. The list shall describe each part, the quantity recommended, and the unit price of the part.
- C. Furnish two sets of any special tools required for normal operation and maintenance accompanied by a list of these tools.
- D. Spare parts and tools shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project.

#### 2.10 SHOP PAINTING

- A. Clean and prime coat ferrous metal surfaces of equipment in the shop in accordance with the requirements of Section 09900.

#### 2.11 LUBRICANTS

- A. Furnish and install oil and grease required for initial operation. Products shall be as recommended by the manufacturer.

#### 1:12 ACCESSORIES

A. The trailer system shall be provided with a blue Sunbrella awning, Bimini style cover with stainless steel tube frame and hook straps that shall provide shade and personel protection for the centrifuge top platform around the decanter unit. This awning shall be removable and stowable for highway travel and easy deployment at sites.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Inspection:
1. Inspect and verify that structures or surfaces on which equipment will be installed have no defects which will adversely affect installation.
  2. Inspect all equipment prior to installation.
  3. Promptly report defects which may affect the Work to ENGINEER.

#### 3.2 INSTALLATION

- A. General: Install in a manner and to the tolerances recommended by the equipment manufacturer.
- B. Installation shall include furnishing the required lubricants and solids conditioning polymer for initial operation. Furnish minimum 20 gallons of recommended polymer
- C. All equipment, components, piping and appurtenances shall be installed true to alignment and rigidly supported. Any damage caused by the negligence of the Contractor to the above items shall be repaired or replaced by the Contractor to its original condition.
- D. Interconnecting piping supplied by the Contractor to be hydrostatically tested by the Contractor.
- E. The centrifuge system Manufacturer's representative to be present during placement and connection of the unit to power and liquid connections to instruct and observe installation.
- F. The centrifuge Manufacturer's representative to inspect the installation prior to startup in order to verify that the equipment has been properly installed.
- G. The centrifuge system Manufacturer's representative to calibrate the equipment with the Owner's operator present after installation prior to startup.
- H. Provide installation instruction manuals for Contractor's assistance at least 30 days prior to shipment of factory assembled treatment units
- I. Provide general assistance regarding handling, assembly and installation requirements for complete installation by Contractor
- J. Verify all equipment installed per manufacturer's recommendations and literature and the Drawings.



- K. Confirm all wiring connections and PLCs are tight to prevent leakage.

### 3.3 FIELD PAINTING

- A. Field painting shall conform to the requirements of Section 09900.
- B. Do not paint the stainless steel skid members.

### 3.4 START-UP AND TEST

- A. Perform operating tests to demonstrate that the equipment operates without excessive vibration.
- B. Make adjustments required to place equipment in proper operating condition.
- C. Process Performance Test:
  - 1. The trailer mounted centrifuge assembly will be required to dewater the sludge produced from operation of the wastewater treatment facility. The sludge to be provided to the units will not vary significantly from sludge having the characteristics described in this Specification.
  - 2. The acceptance test will be scheduled by OWNER and will be conducted 8 continuous hours per day for a minimum of two consecutive days. All testing will be supervised by either OWNER'S personnel or ENGINEER.
  - 3. Contractor is responsible for proper offsite disposal of dewatered sludge during testing.
  - 4. The test period will be conducted on weekdays and will consist of 1 to 2 days for polymer dosage and operational optimization and 2 to 3 days of intensive testing. At least 3 test runs shall be conducted during the intensive test period, the results of which will be used by ENGINEER for performance evaluation. A continuous 8-hour test run will be conducted each day during the intensive test period. Working hours for the test program will correspond to the normal plant day shift of 7:30 a.m. to 3:30 p.m.
  - 5. The following protocol shall be used to perform process performance acceptance testing.
    - a. The Manufacturer shall submit to the OWNER and ENGINEER all alarm conditions and all protocols required to clear the alarms before a process performance acceptance test shall be scheduled.
    - b. The Manufacturer shall submit to the OWNER and ENGINEER detailed sequences of start-up, Clean in Place (CIP), and shutdown procedures including time required to "ramp up" and "ramp down" to complete each process before a process performance test shall be scheduled.
    - c. Before a test can be scheduled, the Manufacturer shall certify that all systems and equipment are functioning properly and the system and equipment are functioning properly and the system and equipment are capable of completing the required 8 hours of continuous operation for a minimum of two consecutive days.
    - d. Manufacturer shall ensure that the volume of the polymer at the Site is sufficient to complete the 8 hours of continuous operation for a minimum of 2 consecutive

- days, before requesting the OWNER to schedule a process performance acceptance testing date and time.
- e. Once the Manufacturer has submitted the required data and certification, the OWNER shall schedule a process performance acceptance testing time and date. Each test run shall begin promptly at the OWNER scheduled time. Failure to begin at the scheduled time can prohibit the Manufacturer from completing the 8 hours of continuous operation. The Manufacturer shall notify the OWNER and ENGINEER a minimum of 24 hours in advance if the scheduled date and start time cannot be met.
  - f. The start time of each test run shall be considered when the first sludge cake is observed on the conveyor. The stop time shall be considered at the moment the stop sequence is initiated.
  - g. The process performance acceptance test shall be considered a failure if at any time the following conditions occur or are observed after the first visual of sludge cake:
    - i. Liquid sludge is observed on the conveyor.
    - ii. Sludge feed pump failure.
    - iii. Polymer feed pump failure.
    - iv. Polymer mixing equipment failure.
    - v. Conveyor failure or inability to convey the sludge cake to the designated receptacle at the design flow rate.
    - vi. Centrifuge does not meet the required RPMs within the specified time provided by the Manufacturer, sludge feed rate exceeds the time to "ramp up" to 250 gpm provided by the Manufacturer, or exceeds the time specified to "ramp down" provided by the Manufacturer.
    - vii. Any alarm condition that initiates sludge feed stop or centrifuge shutdown.
  - h. After completion of 2 consecutive days of 8 hours of continuous operation, the ENGINEER shall validate the performance of the centrifuge based on the samples analyzed by the OWNER.
  - i. If any of the performance criteria are not met or the testing run is considered a failure by the aforementioned criteria, the Manufacturer shall be required to perform additional process performance acceptance testing until the criteria are met and no failures occur.
5. Samples of the sludge feed, sludge cake, and filtrate/liquid waste shall be taken at the end of each hour of the 8-hour test runs. Manufacturer may request that two additional sets of samples be taken at any time during the last two hours of a test run. Average results of the samples taken during each test run will be used to represent the performance during the run.
6. Test information required for each test run is as follows:
- a. Test run number
  - b. Sludge feed rate in gpm
  - c. Percent dry solids of feed sludge
  - d. Percent dry solids of sludge cake
  - e. Percent water removed
  - f. Percent solids capture
  - g. Liquid waste dry solids in mg/l

- h. Liquid waste discharge rate in gpm
  - i. Polymer feed rate in gpm
  - j. Polymer type and feed concentration
  - k. Polymer consumption in pounds/ton of feed sludge dry solids
  - l. The flow rate of the filtrate leaving the machine as wastewater shall be measured by determining the time required to fill a predetermined volume, by actual measurement of flow in the drain line, or by any other method approved by OWNER'S personnel or ENGINEER.
7. CONTRACTOR will be responsible for collecting, marking and delivering samples to the OWNER's laboratory for testing. The percent solids in the sludge feed and cake samples will be determined as Total Residue Dried at 103-105 C in accordance with Standard Methods for Examination of Water and Wastewater, latest edition. Plant personnel will assist CONTRACTOR during the optimization period by performing tests for sludge, washwater, and filtrate/ liquid waste solids on hourly samples. CONTRACTOR will have continuous access to results of laboratory tests conducted on their test samples during the testing period as necessary to determine the need for adjustments to the polymer or sludge feed or to the equipment. Results on samples taken during the last three hours of a test run may not be available until the following day. CONTRACTOR may at his option, obtain split samples during the test run and utilize the services of commercial laboratory acceptable to OWNER at his own expense for obtaining additional test results for his own use. ENGINEER and CONTRACTOR will have access to the tabulated test results prepared by OWNER'S personnel within three days of the end of CONTRACTOR'S scheduled testing period.
  8. CONTRACTOR shall use the average feed sludge consistency during a run for reporting purposes. CONTRACTOR shall construct curves representing the feed sludge percent dry solids versus cake percent dry solids and the feed sludge percent dry solids versus polymer dosage for each throughput rate. The average values of percent dry solids and polymer dosage for each of the test runs shall be used to plot points to construct the curves.
  9. The rates of unconditioned sludge feed to the centrifuge, polymer solution added to the feed sludge, and liquid waste discharged from the centrifuge shall be measured and recorded during the test runs whenever samples are taken.
  10. Upon completion of the testing, ENGINEER will tabulate the test results in terms of machine throughput rate, polymer usage, solids capture, and sludge cake dry solids and make a determination as to the conformance of each machine with the specified process performance. ENGINEER'S determination will be based on the average performance of each machine over the test period. The average process performance for each machine will be calculated on the basis of the total quantities of water and solids processed by each machine during the test period. If ENGINEER determines that the dewatering equipment meets the specified process performance, the equipment will be acceptable and CONTRACTOR and OWNER will be notified accordingly.
  11. ENGINEER will notify CONTRACTOR and OWNER if any dewatering machine fails to meet the specified performance. A second test will be allowed for those machines which did not meet the specified performance during the initial test. The second test shall be conducted within 30 calendar days of the initial acceptance test and in accordance with the procedure described above for the initial test.

12. Upon completion of the second test, ENGINEER will tabulate the test results and will notify CONTRACTOR and OWNER as to equipment conformance with specified performance. If the equipment does not meet the specified performance during the second test, the situation shall be remedied by either repair, modification, or replacement of the defective equipment. Additional testing of any equipment that has been repaired, modified, or replaced shall be conducted in accordance with the procedure for the initial acceptance test described above. Conformance with the specified performance must be achieved before the equipment will be acceptable.

### 3.5 MANUFACTURER'S FIELD SERVICES

- A. A manufacturer's factory-trained representative shall be present on-site for 5 consecutive 8-hour work days to check and approve the installation before operation. The representative shall operate and test system in the presence of ENGINEER and verify that the equipment conforms to requirements, and instruct plant personnel on care and maintenance. The representative shall revisit the Site as often as necessary until all deficiencies are corrected.
- B. Perform testing, checkout and start-up of the equipment under the technical direction of the manufacturer's factory-trained representative. Do not energize the drive shaft without authorization from manufacturer's representative.

### 3.6 MANUFACTURER'S REPAIR SERVICES

- A. Provide services of factory-trained representatives of the manufacturer to correct defective Work during the specified warranty period.
- B. Replacement parts or equipment installed during the specified warranty period shall be equal to or better than the original.

### 3.7 TRAINING

- A. In addition to the above requirements, furnish services of a qualified factory trained operations and maintenance serviceman to instruct and train operators in the proper care, operation and maintenance of the equipment. Provide one (1) trip; minimum two (2) , 8-hour days to provide classroom training of operating personnel in the operation of centrifuge system and to provide "hands-on" training for operation of equipment. OWNER shall be comfortable operating the unit without supervision from the manufacturer or vendor once training has been completed.

++ END OF SECTION ++