AMENDMENT NO. 3

TO

CONTRACT FOR PROFESSIONAL ENGINEERING SERVICES

W.O. 14-11

WASTEWATER TREATMENT PLANT NUTRIENT UPGRADE, EXPANSION AND IMPROVEMENTS

THIS AGREEMENT, made and entered into on _____, 2016, by and between the following:

CITY OF BILLINGS, a Municipal Corporation,
Billings, Montana 59103,
Hereinafter designated the City

and

HDR Engineering, Inc.
2913 Millennium Circle
Billings, Montana 59102
Hereinafter designated the Contractor

WITNESSETH:

WHEREAS, the City and Contractor have entered into a contract dated June 9, 2014, for Contractor to provide engineering services to the City for Work Order 14-11 Wastewater Treatment Plant Nutrient Upgrade, Expansion and Improvements, and;

WHEREAS, the City has need for additional engineering services, and;

WHEREAS, the City has authority to contract for consulting engineering services, and;

WHEREAS, the Contractor represents that he is qualified to perform such services, is in compliance with Montana Statutes relating to the registration of professional engineers and is willing to furnish such services to the City;

NOW, THEREFORE, in consideration of the terms, conditions, covenants and performance contained herein, or attached and incorporated herein, the Parties hereto agree as follows:

Part I, Section 4. is amended as follows:

Increase the amount of compensation by Six Million Nine Hundred Seven Thousand Four Hundred and no/100 DOLLLARS ($6,907,400.00) to Eleven Million Nine Hundred Twenty Six Thousand and no/100 DOLLARS ($11,926,00.00).

Appendix A, Section 3. Add the following to the Scope of Work:

TASK SERIES 100 – PROJECT INITIATION, COORDINATION AND MANAGEMENT

104 – Project Management
Project Manager, Programming Managers and Accountant will continue to monitor project status, maintain project schedule and prepare financial documents throughout construction.

TASK SERIES 600 – CONSTRUCTION PHASE
Construction Phase scope of work is based on a 27 month construction period to substantial completion and a 3 month period to final completion.

601 – Construction Initiation Services
The Consultant shall prepare construction contracts, conduct a preconstruction conference and prepare minutes summarizing the conference. The Consultant will provide the owner with three sets and the contractor one pdf of "Issue for Construction" plans and specifications.

602 – Office Assistance and Administration
During the construction phase of the project, the Consultant will provide office assistance to the City on the administration of the project. This effort will include review and preparation of change orders, shop drawing review, interpretation of drawings and specifications including answering requests for information (RFI), monitoring of compliance with procedure requirements on the project, coordinating with the contractor, evaluation of pay estimates, review for compliance of certified pay-rolls, and conducting weekly (or as needed) construction meetings.

603 – Field Services
The Consultant will provide full-time on-site construction observation services. One full-time resident project representative will be supported by the full-time on-site engineers for construction observation. The on-site engineers construction observation time is included in Subtask 602. The full-time resident project representative will provide up to 5000 hours of construction observation and related tasks. The resident project representative and on-site engineers will monitor the project for compliance with contract documents.

604 – Electrical Field Services
The Consultant will provide part-time on-site electrical construction observation services. An electrical engineer will provide up to 1000 hours (approximately 8 hours per week) of construction observations and related tasks. The electrical resident project representative will

monitor the project for compliance with contract documents, NEC code and for City preferences for electrical installation.

605 – Construction Wrap-Up and Acceptance

Upon completion of the construction of the improvements, the Consultant will schedule and hold a final project walk-through and assist the City in the final wrap-up of the project, including preparing record drawings, preparation of a punch list, preparation of Certificate of Substantial Completion, information review and recommendation of final acceptance.

606 – Post-Construction Warranty Services

After final acceptance, the Consultant will provide warranty item consultation, assist in the eleven-month warranty inspection, and provide warranty follow-up.

TASK SERIES 700 – TRAINING, STARTUP AND ELECTRONIC OPERATIONS MANUAL PHASE (eOM)

701 – Training

Coordinate training of new equipment with manufacturers and the City. Work with staff to develop protocol for operation of equipment including normal operation and backup or alternative operations.

702 – Startup

Work with manufacturers and contractor to verify proper installation of new equipment. Coordinate startup of equipment with Contractor, manufacturer representative and the City. Verify new systems are functioning properly.

703 – eO&M

HDR will develop an Electronic Operations Manual (eOM) similar to the UV Disinfection System for the entire plant. The eOM will provide the Owner's staff a graphical user interface to the information necessary to operate and maintain the plant facilities in an efficient and reliable manner. The eOM content will include facility and equipment descriptions, design criteria, process control narratives, design drawings, and vendor supplied equipment O&M manuals. The eOM will provide a permanent archive of the information. HDR will provide an eOM website structure for the entire plant.

As with the UV project, the eOM will be developed as a web application in the Microsoft ASP.net web environment and will function on the City's Windows-based server. The eOM will be internally accessible via Internet Explorer but will not be accessible by the general public. An HTML text editor will be embedded in the eOM web pages to enable easy text editing by City staff without having to know HTML. HDR owns the HTML editor enterprise license which allows FREE distribution provided the editor software is only used in HDR's eOM application. The recommended minimum hardware and software that the City will need to provide to host the eOM on the City server includes:

eOM Web Server Minimum Requirements

1. Microsoft Windows Server 2008 R2 Standard Edition or greater
2. 2 GHz dual/quad processor or better

3. 4 GB of RAM
4. 40 GB of hard drive space

eOM Client (End User) Machine - Software Minimum Requirements

1. Internet Explorer
2. Adobe Acrobat Reader
3. IIS (Internet Information Services 6.0 or higher)
4. Microsoft.NET Framework 3.5
5. SCL server 2008 R2 Express Version

Recommended Tools for Content Authors

1. Microsoft Office
2. Internet explorer
3. Adobe Acrobat Standard - to modify new or scanned equipment O&M manuals in PDF format

The following items will be provided by the City:

1. Network server, network and personal computers, including standard Microsoft network software as described above.
2. Path to and necessary server space on the City's network server to host the eOM application.
3. Ancillary software on the City's computers necessary to run the eOM, including Microsoft Internet Explorer, Windows, and SQL Server.

A kickoff workshop will be held to discuss general eOM content and the schedule for developing and implementing the eOM. The purpose of the workshop is to review a website map to illustrate the eOM layout and structure. HDR will prepare a draft website map of the entire plant for review and comment prior to the workshop. The final website map developed at the workshop will be emailed to City staff after the workshop for final approval.

The draft website map will illustrate how and where the following will be organized:

1. The information structure, organization and level of detail.
2. How the navigation between each section will function.
3. What plant general reference information to include.
4. The unit process content detail to be provided.
5. How the equipment O&M manual hyperlinks will function.
6. An eOM content management guide.

The website map will be developed in coordination with City staff, and will be specifically tailored to meet the requirements and needs of the plant staff.

- **Deliverables** – Meeting agenda and minutes from the workshop.
- **Deliverables** – Draft eOM web site map prior to workshop.

- **Deliverables** – Final eOM web site map after the workshop for approval.

HDR will prepare the eOM manual structure and content for each unit process and facility. Example content definitions are shown in the following table. Note that content definitions for this project will be specific and customized to those sub-sections agreed upon and defined by the website map developed with the plant staff.

Example Unit Process Content Pages	
Section	**Text**
Overview	This section will include the following narratives and photos: Purpose Theory Equipment List Equipment Photos with a Detailed Description
Process Flow Diagrams	Process flow diagrams to communicate the design intent to the plant staff. The diagrams will be created in Microsoft Visio and saved as PDF files. Both the Visio and PDF files will be included in the eOM. A total of 5 process flow diagrams are anticipated. In addition, HDR will incorporate the plant as-built drawings into the eOM Plant Reference section in PDF file format and provide hyperlinks to the drawings.
Design Criteria	Tabular listing of unit process sizes, loadings, and other design criteria.
Equipment	Hyperlinks to vendor supplied equipment manuals in PDF file format. Existing equipment O&M manuals that are only available in hard copy will be scanned into PDF files and hyperlinked within the eOM application
Controls	A description of manual and automatic equipment controls.
System Procedures	A list of general procedures for starting up and shutting down the process.
Troubleshooting	A compilation of both process and specific equipment troubleshooting guides.
Safety	General and process specific safety considerations.

Meetings with the City will be conducted approximately monthly to review development of the eOM for each process and facility. The meetings will include input from the City on the eOM content and as a means for HDR to obtain additional information from the City for development of the eOM. Additionally, HDR will provide the City with access to the draft eOM as they are developed. Procurement of and hyperlinking to as-built equipment photographs will occur after startup and removal of all contractor equipment and materials. The draft eOM will be accessible by City staff as the unit process is started up. The final eOM will be delivered approximately 60 days following receipt of as-built drawings in PDF file format.

- **Deliverables** – Draft eOM accessible by plant staff via the Internet as the eOM is developed.
- **Deliverables** – Final eOM downloadable to City network server.

HDR will develop the draft and final eOM on an HDR server. Upon completion HDR will coordinate installation of the final eOM on the City's server. The final eOM will be downloaded to the City's network server.

HDR will schedule a meeting with the plant staff, and facilitate training sessions for the plant staff on how to use and maintain the eOM.

- **Deliverables** – Coordinate with the City's IT staff to download and install final eOM.
- **Deliverables** – Provide two one-hour training sessions at plant to City O&M staff.

TASK SERIES 800 – OPERATIONS ASSISTANCE

801 – Operations Assistance

Assist the City with operation of the plant for one year after substantial completion of the bioreactors. Begin assistance 8 weeks prior to bioreactor substantial completion to work with the plant staff on operating a nutrient removal plant. Provide on-site Operations Specialist for five day weeks every other week on the average for a total of 30 weeks. In addition, provide support and coordination from local staff and project manager and as needed from HDR nutrient process experts. Operations assistance will be on a time and expense basis with a cost not to exceed.

TASK SERIES 900 – APPLICATION SOFTWARE PROGRAMMING

Objectives: Implement the programming for the plant SCADA system including PLC (Programmable Logic Controller) using ladder logic and their associated HMI (Human-Machine Interface) configurations. The new PLC ladder logic will be installed on the plant PLC's (new and existing as required). The new HMI interface will be configured using the system selected during the design phase of the project. The PLC ladder logic and HMI process displays will be developed in collaboration with WRF personnel to provide the controls as described in the Project Contract Documents.

901 – System Integration Support

HDR will provide systems integration support for the project for the following work activities:

- Prepare and maintain a work plan and project instructions to include organization, roles, responsibilities, schedule, budget, and staff plan for execution of the PLC and HMI application software (Software) Programming effort. The workplan and project instructions will include a QA/QC plan.
- Hold meetings with City personnel, Contractor and design staff to discuss the mechanics of implementing the project programming scope and to define standards to be followed. The project schedule will be discussed and coordinated with the construction schedule to define milestones and resource allocations.
- Document meeting decisions and action items; assign the activities to team members, and follow-up to ensure timely resolution.
- Assist in reviewing Contractor provided equipment and electrical submittals, and provide coordination input for electrical and instrumentation systems.
- Monitor project progress including work completed, work remaining, budget expended, schedule, estimated cost of work remaining, and estimated cost at completion.

- The project schedule will be developed to show the required programming to be completed one month before the associated construction task start-up date.

Deliverables:

- Agendas for meetings.
- Preliminary project schedule with milestones.
- Meeting notes for meetings.

902 – Software Pre-Design Report

HDR will provide software development preliminary design and develop a software design summary for the project. The following work activities are planned:

- Prepare a *Software Pre-Design Report* for the project which will include the following information:
  1. Understanding of the City's HMI and PLC Software standards.
  2. Updated Control Loop Descriptions (using Contract Document Specification Section 40 90 05).
  3. Existing SCADA System Process Display Printouts marked up to show planned modifications.
  4. Interface Definition Specifications (IDS), i.e. PLC/HMI tag database, based on information in the Contract Document.
  5. Alarm generation and alarm management will be as shown in the Contract Documents. As a minimum, alarms will be stored in an alarm database to enable access and/or report generation and printing from the SCADA report printer.
  6. Real time and historical data management will be consistent with current Software standards. Reports will be printed from the historical database files, in spreadsheet format as desired by the City. This will include the capability for automated state review forms.
  7. Define eOM interface requirements and coordinate with eOM development team.

- Conduct Software Pre-Design Report review meetings with City staff to discuss the following:
  1. The new process displays and their functionality for the major process areas.
  2. Identify which process screens (and tags) are to be removed or updated.
     a. Report content, format and printing.
     b. Alarm management.
     c. Data management.
- Document meeting decisions and action items; assign the activities to team members, and follow-up to ensure timely resolution.
- Final Software Pre-design Report – Digital Copy to all necessary parties.

Deliverables:

- Agendas for review meetings.
- Meeting notes of review meetings.
- Final Software Pre-design Report – Five (5) hard copies and an electronic copy.

903 – Software Programming & Testing

The PLC logic program and HMI process screen configuration will be designed from the information provided by the *Final Software Pre-Design Report*. This subtask includes the following work activities:

- Obtain the most current existing PLC programs, HMI process screens, configuration files, tag database(s), data files, and other required files from City's SCADA system just prior to beginning the programming effort.
- Develop the programming for the new equipment to meet the requirements identified in the updated Final Software Pre-Design Report.
- The PLC program will be based on the final approved control strategies agreed between the City, Designer and the programmer. PLC program will be based on the approved final control strategies. A draft PLC program will be delivered to the City for review and comment. HDR shall develop the final PLC program after incorporating mutually agreed comments into the draft PLC program and load into the PLC's that is currently installed at the site. The PLC shall be Allen Bradley Controllogix Series and the software used to program shall be RS Logix / Studio 5000. Based on the current design documents a total of 1,600 physical IO, 600 networked IO and 2000 virtual (calculated points) are estimated for PLC programming for this project. Internal QA/QC of the PLC programs is also included in this scope of work.
- Obtain the latest process screen and configuration files and databases (i.e., process database, alarm area database, picture files) for the WRF from the City.
- The Operator Interface Terminals (OIT) screens will be based on the final approved control strategies agreed between the City, Designer and the programmer. Based on the current design a total of 200 IO +/- 5% are estimated for OIT programming of this project. Internal QA/QC of the OIT programs is also included in this scope of work. HDR shall develop the HMI database and screens for the Billings HMI system. Through a collaborative process the points that need to be incorporated will be agreed between the City, HDR, and the vendors. The alarming strategy for the WWTP shall be agreed to ensure minimal nuisance alarms within the system. Historizing strategy shall also be agreed to, to ensure that only relevant data is historized. HDR shall also develop the HMI screens for monitoring the WWTP. These screens will be developed through a workshop with Owner staff and will adhere strictly with agreed to standards in the pre design report. The screens will include processes to be monitored and controlled by the PLC's programmed under this scope of work. Based on the design documents a total of 4,200 SCADA points (1,600 physical, 2,000 virtual and 600 networked IO) and 35 HMI screens are estimated for this project.
- Process screens will be designed to meet the requirements identified in the Final Software Pre-design Report. The types of process graphics or pictures to be generated include process screens, overview screens, controller pop-ups, real time and historical trending screens, and report screens.
- The new process tag database, tag-groups, process screens and picture files for the new equipment being added will be merged or replaced with existing screens and files on the SCADA Server.
- HDR shall develop and use the available HMI trending functionality. 10 pre-defined trends are estimated for this project. In addition HDR shall also develop process operational reports with flow totals and runtime hours. 10 pre configured reports are estimated for this project.

- The Software will be tested and debugged. HDR reserves the right to use a software simulation package (where possible and practical) to thoroughly test the Software and process interface. The I/O simulator software program will be used to simulate the real I/O to be connected for this project. Only the pertinent process databases and the new process screens will be active in the simulator for testing.

Deliverables:

- Draft and Final PLC ladder logic disk and hardcopy (print-outs).
- Latest process electronic files for screens, pictures, pop-ups, alarms, and data handling.
- 90% complete process displays for City of Billings staff review (color print-out hardcopy, and where applicable marked up color print-outs of existing graphic displays).
- Final Control Strategies as programmed into the PLC's that are new or modified
- Final Control System Architecture
- As-built documentation of non-modified PLCs or HMI components is not included.

904 –Factory Acceptance Tests (FAT)

HDR shall participate in the Factory Acceptance Testing (FAT) that will be performed at the Contractors' panel shop floor prior to shipment of SCADA equipment to the project site for installation. FAT shall include testing to verify that system hardware and software components are functioning properly and that they meet the functional and performance requirements of the Design Documents. The FAT will demonstrate that the hardware supplied and built by the Contractor and software developed by HDR have been assembled, programmed and configured in conformance with the Design Documents.

The FAT will demonstrate proper operation of all system software (e.g. process monitoring and control, OIT, historical data, alarming, trends, etc.) incorporated into the system to implement the various functions and capabilities as per the Design Documents.

System performance shall be tested using a fully integrated system, including all system software and hardware as applicable. The entire control system, including all the peripheral devices and all interconnecting cables, shall be assembled by the Contractor at the panel shop floor and simulated inputs applied. CONTRACTOR shall carry out a full system test, during which the entire system shall operate continuously without failure. Demonstration of communication between processors or to remote I/O's shall be included in the FAT. Test shall include demonstration that communication performance (speed, error rates, failure and recovery) conforms to specified requirements.

Prior to the staging and testing of the system, HDR shall load all the programs into the PLC's and the displays (Operator Interface Terminals and Human Machine Interfaces) into the SCADA system. During this phase of the factory acceptance test, the overall display structure and touch screen points including pop-ups shall be demonstrated, including environment configurations, passwords, security, etc. Each process graphic, system graphic, and diagnostic/troubleshooting graphic display (process, system, communication, diagnostic/troubleshooting, etc.) shall be reviewed for correctness in terms of the text, layout, symbols, color scheme, dynamic actions (color changes, toggle, visual effects), etc. The operation of standard alarm management displays (Current Alarm Display, Alarm History, etc.) shall also be checked during the FAT.

Deliverables:

- FAT Test Plan.

- Results and punch list from the FAT .

905 – Training

HDR shall coordinate with the City to arrange for the training for appropriate City staff. HDR shall prepare a training manual and curriculum based on staff interactions with the control system. Training shall be completed before the commissioning and start up of the plant. Training shall be imparted in a class room environment. The training will be hands on as much as possible. The scope includes 05 training sessions, each of four hour duration - four for operators and one for maintenance staff. Additional training may be mutually agreed between HDR and the City. Control system hardware training and vendor supplied control system training will be covered under separate scope by Vendors.

Deliverables:

- Training Manual
- Training Curriculum

906 – Field Commissioning and Software Startup

This subtask includes the following work activities:

- Prior to commissioning and startup of the programmed control system HDR shall develop a commissioning and start up plan for the control system and review the plan with the City. HDR will incorporate any comments to the plan. HDR shall follow this plan to test and deliver the update control system to the City. Some key features of the testing are listed below.
- HDR will verify that the interconnections for the new PLC I/O are terminated correctly by witnessing the Contractor perform loop testing (specified in Section 40 90 05). These tests are referred to as the Operational Readiness Tests (or Loop Checkouts).
- HDR will upload the new PLC ladder logic to its respective PLC's. HDR will also upload the new and revised HMI screens and associated databases to the plant SCADA system and HMI workstations.. The new remote I/O will then be attached to the associated PLCs, and the Functional Testing period will begin.
- Functional Testing is the process of putting the new equipment into full automatic operation. Loop tuning of the controls will be performed. Minor corrections will be made to the new PLC logic and SCADA process interface if found necessary.

907 – Post Startup Support

Upon substantial completion of the new programming, the automated system will be turned over to the City. HDR and City staff will periodically monitor the SCADA system to verify that Operations can satisfactorily control the processes as designed. HDR has allocated 80 hours of project engineer time in the budget for this subtask. These hours shall be available to be utilized within 6 months after the project is turned over to the City.

Deliverables:

- System health report
- Repair report.
- Updates of any changes from startup.

908 – Instrument Oversight

Throughout the project, the integrator will coordinate with instrumentation providers and the project general contractor to verify correct installation, set-up, and scaling of process instruments. Integrator will work to verify proper system instrumentation point to point communications are provided.

All other terms and conditions of the contract to which this amendment applies shall remain in full effect.

CONSULTANT

NAME: _____

BY: _____

TITLE: _____

DATE: _____

CITY OF BILLINGS, MONTANA

BY: _____
Mayor

DATE: _____