THE CITY OF OKLAHOMA CITY

WATER UTILITIES TRUST

WASTEWATER TREATMENT PLANTS BIOSOLIDS AND ODOR MANAGEMENT

CONTRACT NO.: ST-0154

CP&Y PROJECT NO.: OKCY1900800.00

ALTERNATIVE DEVELOPMENT AND EVALUATION

TECHNICAL MEMORANDUM

SHORT-TERM IMPROVEMENTS

June 2022

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THE OKLAHOMA CITY WATER UTILITIES TRUST

APPROVAL SHEET

Project No. ST-0154

Wastewater Treatment Plants Biosolids and Odor Management
North Canadian, Deer Creek, Chisholm Creek, and South Canadian Wastewater Treatment Plant and Witcher Lift Station

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APPROVED by the Trustees and signed by the Chairman of the Oklahoma City Water Utilities Trust this 8th day of November, 20 22.

ATTEST:

OKLAHOMA CITY WATER UTILITIES TRUST OFFICIAL SEAL OKLAHOMA

Secretary CHAIRMAN

CONCURRED by the Council and signed by the Mayor of the City of Oklahoma City this 22nd day of November, 20 22.

SEAL OF THE CITY OF OKLAHOMA CITY

City Clerk Mayor

THE CITY OF OKLAHOMA CITY

WATER UTILITIES TRUST

WASTEWATER TREATMENT PLANTS

BIOSOLIDS AND ODOR MANAGEMENT

June 2022

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ONE PAGE SUMMARY

The Oklahoma City Water Utilities Trust (OCWUT) operates wastewater collection and treatment facilities that that include four wastewater treatment plants (WWTPs) and the Witcher Lift Station (LS). Odors are a concern at each of these facilities and, for WWTPs, odors associated with solids management are a specific concern. To address these issues, OCWUT commissioned a comprehensive Biosolids and Odor Management Plan to define both short-term and long-term solutions for the identified concerns. As part of comprehensive planning, this report identifies short-term solutions at each of these existing WWTPs and the Witcher Lift Station.

Recommendations and probable costs associated with managing biosolids and odors at the facilities are summarized in the following table.

FACILITY	IMPROVEMENTS	TERM	CAPITAL
Deer Creek WWTP	BFP Hood Modifications and Hard Piping of Filtrate, Cake Storage Cover, Cake Storage Cover Vaporization System, Hydrogen Peroxide Feed System, BTF's for Sludge Holding Tank and Dewatering Building, Aerated Mixing for Sludge Holding Tank, Vaporization Improvements for FEB, Odor Monitoring Improvements, Bioset	Short (2 Phases)	$14,443,000 Capital Cost Range: $10,110,000 to $21,665,000
Chisholm Creek WWTP	Vaporization system for FEB, Odor Monitoring Improvements	Short	$295,000 Capital Cost Range: $207,000 to $443,000
North Canadian WWTP	Chlorite Injection, Cake Storage Area Covers, Cake Storage Cover Vaporization Systems, Odor Monitoring Systems, Belt Filter Press Hood Modifications and Hard Piping of Filtrate, Aerated Mixing of Sludge Holding Tanks, BTF's for Sludge Holding Tanks	Short	$21,170,000 Capital Cost Range: $14,819,000 to $31,756,000
Witcher Lift Station	BTF for Manholes, Vaporization System	Short	$1,124,000 Capital Cost Range: $787,000 to $1,686,000

1.0. EXECUTIVE SUMMARY

The Oklahoma City Water Utilities Trust (OCWUT) operates wastewater collection and treatment facilities that that include four wastewater treatment plants (WWTPs) and the Witcher Lift Station (LS). Odors are a concern at each of these facilities and, for WWTPs, odors associated with solids management are a specific concern. To address these issues, OCWUT commissioned a comprehensive Biosolids and Odor Management Plan to define both short-term and long-term solutions for the identified concerns. As part of comprehensive planning, this report identifies short-term solutions at each of these existing WWTPs and the Witcher Lift Station.

Specific objectives for the project include:

- Define odor control and solids management needs
- Determine short-term solutions to meet identified needs
- Identify odor control solutions that can meet a hydrogen sulfide (H_2S) concentration to 8 parts per billion (ppb)
- Develop hydrogen sulfide (H_2S) monitoring systems for all facilities

The overall workflow for the project is presented in Figure 1-1. This Technical Memorandum (TM) covers Steps 3, 4 and 5 in the figure and builds upon the findings and recommendations from Steps 1 and 2 to identify, develop, and evaluate alternative process trains at each of the facilities including: Deer Creek WWTP, Chisholm Creek WWTP, North Canadian WWTP, and Witcher LS. Prior assessments provided key insight into prioritization of facility improvements and determined that solids and odor improvements for South Canadian WWTP were not needed at this time.

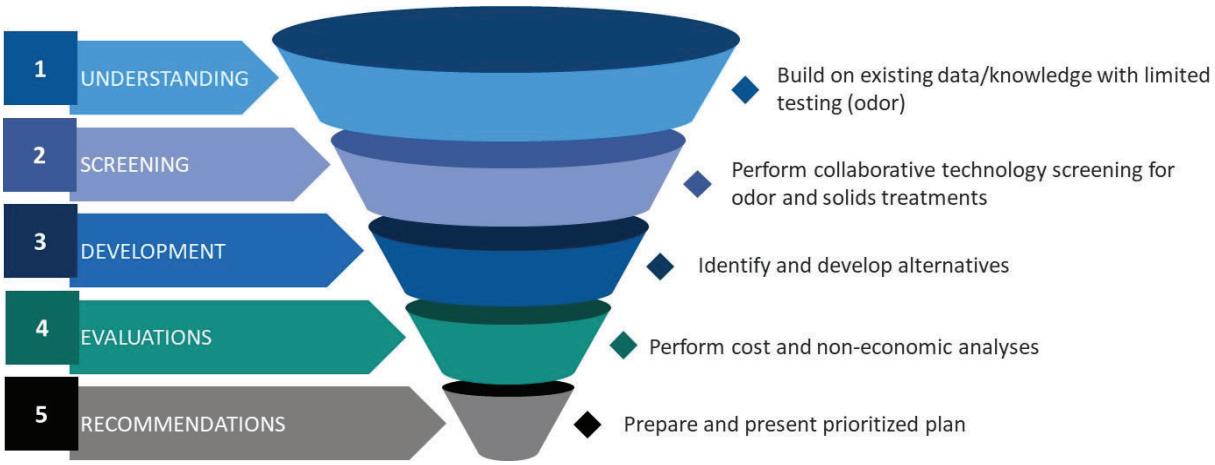

Figure 1-1 Project Workflow

This work presented in this TM relied upon the findings from the screening process to further assess solids and odor alternatives for analysis, considering each on a facility basis. Solids treatment, solids storage, and odor treatment alternatives were identified, developed, and evaluated independently before combining into comprehensive process trains for each facility.

Based upon the process train evaluations, the process alternatives shown in Table 1-1 are recommended to be carried forward for implementation planning. Together, the recommended improvements are intended to significantly reduce the odor profile of all OCWUT facilities. The short-term improvements for Deer Creek WWTP were broken into two phases with prioritization given to design projects that would reduce odors at the plant at lower capital costs. The Deer Creek short term phase 1 improvements will be implemented through a design project in the near term. The other improvements will be designed and constructed as funding allows.

Table 1-1 Preliminary Process Train Recommendations

PRELIMINARY ALTERNATIVE	ALT. NO.	KEY FEATURES
Deer Creek WWTP		
Short-term Phase 1	DC S1	• Storage tank aerated mixing • Hydrogen Peroxide dosing to reduce solids odors in dewatering building • Belt Filter Press (BFP) hood modifications and hard piping of filtrate • New Biological Trickling Filter (BTF) for storage tank/dewatering exhausts • Storage pad cover and vaporization system • Modify Flow Equalization Basin vaporization system.
Short-term Phase 2	DC S2	• Bioset solids stabilization
Chisholm Creek WWTP		
Short-term	CC S1	• New vaporization system at equalization (EQ) basin
North Canadian WWTP		
Short-term	NC S1	• Storage tank aerated mixing • Sodium Chlorite ($NaClO_2$) injection • BFP modified hoods and hard piping of filtrate • New BTF for storage tank/dewatering exhausts • Storage pad covers with vaporization systems
Witcher LS		
Short-term	W S1	• BTF to serve 3 manholes • EQ basin vaporization system

It is important to note that the recommendation of the Bioset technology to treat Deer Creek WWTP solids is predicated on the operation of a successful pilot.

This task also included an assessment of H_2S monitoring systems for all facilities. Based on the assessment, Envirosuite systems are preliminarily recommended for all WWTPs, while the Acrulog-based DiCom system is recommended for the Witcher LS EQ basin. Costs for the Envirosuite system are high, however, and the preliminary recommendation will be reviewed with OCWUT in the context of preferred functionalities.

2.0. INTRODUCTION

2.1. Overview

The Oklahoma City Water Utilities Trust (OCWUT) operates wastewater collection and treatment facilities that that include four wastewater treatment plants (WWTPs) and the Witcher Lift Station (LS). Odors are a concern at each of these facilities and, for WWTPs, odors associated with solids management are a specific concern. To address these issues, OCWUT commissioned a comprehensive Biosolids and Odor Management Plan to define both short-term and long-term solutions for the identified concerns. As part of comprehensive planning, this report identifies short-term solutions at Deer Creek WWTP, Chisholm Creek WWTP, North Canadian WWTP, and the Witcher Lift Station. Prior assessments provided key insight into prioritization of facility improvements and determined that solids and odor improvements for South Canadian WWTP were not needed at this time.

2.2. Objectives and Evaluation Framework

The purpose of this TM is to summarize the technology and process train evaluations for the OCWUT facilities. Solids treatment, solids storage, and odor treatment alternatives were identified, developed, and evaluated independently before combining into comprehensive process trains for each facility. The objectives of these assessments include:

- Evaluate solids and odor alternatives on a qualitative and economic basis for each facility
- Develop short-term alternative process trains for facility wide treatment at each of the WWTPs and Witcher LS
- Identify preliminary recommendations for integrated solids and odor reduction measures at each facility
- Summarize the results of implementation planning

3.0. TECHNOLOGY EVALUATIONS

The first step in developing process train alternatives is the selection of preferred technologies. The preferred technologies are further described below. Where two or more technologies were identified for a given process (for example, centrifuges and belt filter presses (BFPs) for dewatering), they are compared in this section.

3.1. Preferred Technology Summary

Preferred technologies for short-term alternatives selected during the technology screening effort and subsequent discussions with OCWUT staff are highlighted in this section.

Table 3-1, Table 3-2, and Table 3-3 focus on solids technologies, while Table 3-4 shows preferred odor control technologies.

Table 3-1 Dewatering Technologies

PLANT	SHORT-TERM DEWATERING TECHNOLOGIES	COMMENTS
Deer Creek WWTP	Belt Filter Presses	• Continue use of existing BFPs in short-term • Hard piping of filtrate
North Canadian WWTP	Belt Filter Presses	• Continue use of existing BFPs in short-term • Hard piping of filtrate

Table 3-2 Solids Stabilization Technologies

PLANT	SHORT-TERM STABILIZATION TECHNOLOGIES	COMMENTS
Deer Creek WWTP	Class B Lime Stabilization (DC-S1)	• Continuation of existing practice, can be used as baseline for comparison
	Bioset (DC-S2)	• Pilot recommended • Selected for odor reduction, capital cost and ease of implementation
North Canadian WWTP	Class B Lime Stabilization	• Continuation of existing practice, can be used as baseline for comparison

Table 3-3 Solids Storage Options

PLANT	SHORT-TERM SOLIDS STORAGE OPTIONS	COMMENTS
Deer Creek WWTP	Aerate Sludge Holding Tanks	• Provide aeration to mix and achieve aerobic conditions.
	Cover for dewatered sludge storage pad	• Combined with vaporization
North Canadian WWTP	Aerate Sludge Holding Tanks	• Provide aeration to mix and achieve aerobic conditions.
	Covers for dewatered sludge storage pads	• Combined with vaporization

Table 3-4 Odor Control Technologies

PLANT	SHORT-TERM ODOR CONTROL TECHNOLOGIES
Deer Creek WWTP	• Hydrogen peroxide chemical injection • Vaporization at pad • Covers or modified hoods for BFPs • BTF for storage tank and BFPs
Chisholm Creek WWTP	• Vaporization at EQ basin
North Canadian WWTP	• Sodium chlorite chemical injection • Covers or modified hoods for BFPs • BTF for storage tanks and BFPs • Vaporization at pads
Witcher LS	• BTF for manholes • Vaporization at EQ basin

3.2. Technology Assessment Approach and Assumptions

Probable capital costs and O&M costs were developed for each technology considered. Capital costs for equipment were primarily based upon vendor quotes with an allocation assigned for other miscellaneous improvement costs, while O&M unit costs were provided by OCWUT.

For this planning level study, capital costs presented are assumed to fall within the American Association of Cost Engineers "Class 4 Study or Feasibility" with respect to accuracy (see Table 3-5) and will need to be refined through preliminary and final engineering.

Table 3-5 Cost Estimate Anticipated Accuracy (American Association of Cost Engineers)

TYPE OF ESTIMATE	END USAGE	ANTICIPATED ACCURACY
Class 5	Concept Screening	-50% to +100%
Class 4	Study or Feasibility	-30% to +50%
Class 3	Budget Authorization	-20% to +30%
Class 2	Bid or Tender	-15% to +20%
Class 1	Check estimate	-10% to +15%

Additional assumptions, applied cost factors, and detailed cost summaries are included in Appendix A. Vendor data and proposals are included in Appendix B.

3.3. Solids Management Technology Assessments

Technology assessments were performed for solids management technologies that have been selected for improvements at Deer Creek WWTP and North Canadian WWTP in the previous technology screening process. A brief process description with important features, proposed locations, capacities, and associated cost information for each technology are presented in the following sections. No solids improvements are assessed for the Chisholm Creek WWTP as the plant's sludge storage tanks were recently fitted with new mixers and sludge from the plant will continue to be hauled to the North Canadian WWTP for dewatering.

3.3.1 Sludge Storage Tank Aeration

To address the H_2S-related odor problems and raise the ORP at the sludge holding tanks at both Deer Creek WWTP and North Canadian WWTP, the addition of blowers and diffusers are proposed to mix the sludge and create an aerobic environment in the tanks. Since the water surface fluctuates in the tanks, positive displacement blowers are needed. Packaged screw-type blowers are recommended for this application since they are more efficient and produce less noise as compared to piston-type blowers. An example packaged screw blower system is shown in Figure 3-1.

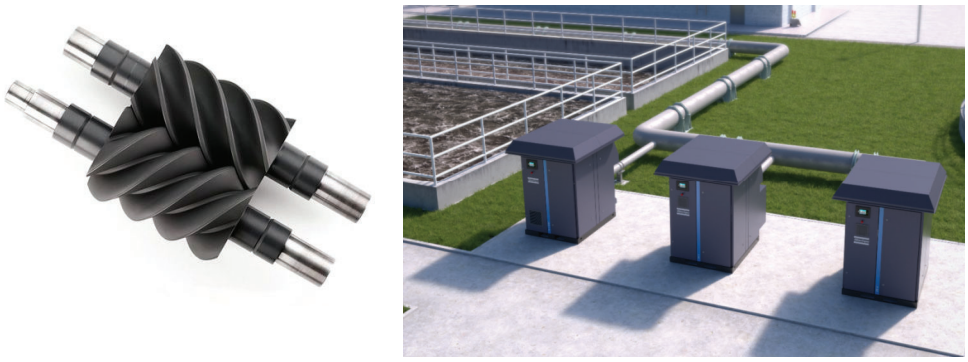

Figure 3-1 Screw Blowers (courtesy of Atlas Copco)

Table 3-6 Aerated Mixing of Sludge Storage Tanks

FACILITY	COMPONENT	SIZING	CAPITAL COST ($)	O&M COST ($/YR)
Deer Creek WWTP	Screw Blowers with Coarse Bubble Diffusers (Install in short-term and size for long-term)	5,000 scfm firm (3 blowers)	$3,185,000	$152,000
North Canadian WWTP	Screw Blowers with Coarse Bubble Diffusers (Install in short-term and size for long-term)	20,000 scfm firm (5 blowers)	$5,368,000	$545,000

3.3.2 Biosolids Dewatering

Dewatering is a biosolids handing process used for removing free water and reducing the volume of sludge cake for further treatment, hauling, beneficial applications, and/or final disposal. Continued use of the existing BFPs are planned with short-term improvements limited to the addition of new covers and hard piping of filtrate.

Table 3-7 BFP Requirements in Short-Term Alternatives

FACILITY	PARAMETER	SIZE	CAPITAL COST ($)
Deer Creek WWTP	Short-term use existing presses	• 2 x 2m presses • Odor Control Covers or Modified Hoods on Existing Presses • Hard piping of filtrate	$472,000
North Canadian WWTP	Short-term use existing presses	• 4 x 2m • Odor Control Covers or Modified Hoods on Existing Presses • Hard piping of filtrate	$943,000

3.3.3 Solids Stabilization

Stabilization is used for reducing offensive odors and pathogens, reducing biodegradable organic matter, improving sludge dewatering property, and/or meeting biosolids classification required specifically for a designated use such as land application. Stabilization is achieved by treating either raw sludges (liquid) prior to dewatering or dewatered sludge (cake) after dewatering. Bioset is the only alternative suitable process for consideration for short-term improvements.

3.3.3.1 Bioset Process

Bioset is a stabilization process developed by Schwing Bioset Inc. The system is provided as a package system (see Figure 3-2) with all major equipment and controls. The Bioset process stabilizes the solids via the time vs. temperature equation and pH adjustment per EPA 503 regulations. Temperature is achieved through the addition of Quicklime and Sulfamic acid and the high pH is achieved through the addition of the Quicklime. Biosolids and chemicals are homogenously mixed in a Schwing Bioset twin screw feeder and pumped with a Schwing Bioset piston pump through an insulated reactor. It is a continuous process with a reactor sized for a specific capacity. The lime dosage can be adjusted manually or controlled automatically by the SCADA system.

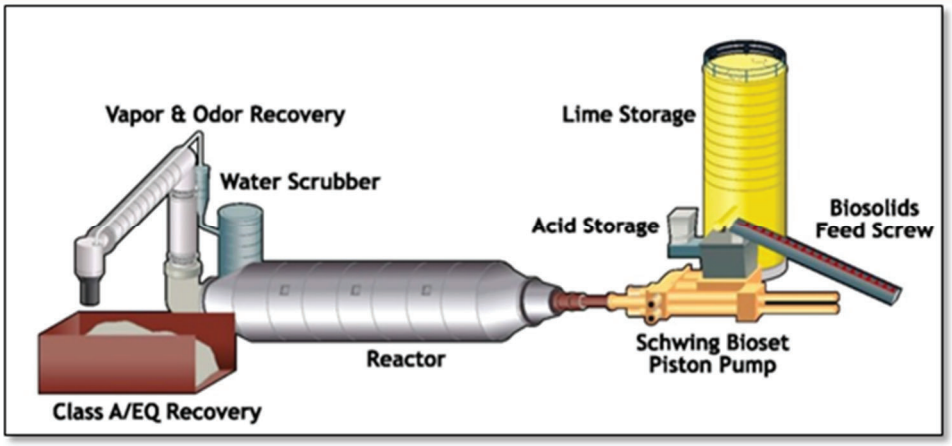

Figure 3-2 Example of Bioset Process Major Components (courtesy of Schwing Bioset, Inc.)

As treatment in the Bioset process is contained within the reactor, the process releases low concentrations of odors to the environment. Gases are emitted at the reactor discharge where they are captured and treated with a scrubber. The final material has an odor, due to the high lime content, that is similar to wet concrete.

Appendix C includes process and mass balance calculation results for the solids handling processes. Important process assessment results for the Bioset process alternatives at the Deer Creek WWTP are summarized in Table 3-8.

Table 3-8 Bioset Requirements

FACILITY	PARAMETER	CAPITAL COST ($)	O&M Cost ($/YR)
Deer Creek WWTP	Short-term 2 Bioset process system improvements	$5,305,000	$1,035,000 (Considers solids disposal values using BFPs.)

3.3.4 Storage Pad Covers

OCWUT currently has three storage pads for lime stabilized biosolids (one at Deer Creek WWTP and two at North Canadian WWTP). This storage is especially critical when wet weather or other factors prevent the biosolids from being land applied; however, extended storage on the existing uncovered pads can lead to odors. During wet weather events the biosolids on the existing uncovered pads may go through multiple wet/dry cycles before being land applied which destabilizes the biosolids and quickly becomes a significant source of odors and vector attraction.

To address these concerns, it is recommended to install a three-sided enclosure to cover the biosolids stacking pads. A similar enclosure is shown in Figure 3-3.

Figure 3-3 Example Storage Pad Cover

The addition of a vaporization system to the unenclosed side of the pad cover is also recommended to neutralize odors that occur naturally from stored biosolids. Keeping the biosolids dry will also decrease hauling costs in the future. Probable costs for each the stacking pad covers is shown in Table 3-9.

Table 3-9 Storage Pad Cover Sizes and Costs

FACILITY	CANOPY SIZES	CAPITAL COST ($)
Deer Creek WWTP	100'x100' canopy	$727,000
North Canadian WWTP	1 x 200'x200' canopy 1 x 300'x300' canopy	$7,091,000

3.4. Odor Control Technology Assessments

Odor control technology assessments focused on the following categories: vapor phase treatment, vaporization systems, liquid phase treatment, and H_2S monitoring. For vapor phase treatment, the technology screening initially yielded two potential technologies for treatment of contained foul air: biotrickling filters (BTFs) and catalyst scrubbers (i.e. the Source Technologies Evergreen Scrubber). However, it was ultimately decided that only BTFs would be further evaluated due to their long-standing history as an established, non-proprietary technology. The following sections summarize assessment of these approaches.

3.4.1 Biotrickling Filters

BTFs and bioscrubbers are predominantly used to remove H_2S and can treat very high H_2S concentrations, and they have been used both at the Deer Creek WWTP and North Canadian WWTP to treat strong exhaust streams. These systems are proposed for sources where the foul air can be contained and where H_2S is a concern, including storage tanks and dewatering processes.

The terms BTF and bioscrubber loosely refer to the irrigation approach for these systems: BTFs are irrigated in "once through" mode to maintain a neutral pH in the media, while bioscrubbers are irrigated with liquid recirculated from the vessel sump to maintain a low pH (~2) and target H_2S removal. This analysis is based upon BTFs, as they do not require recirculation pumps (and associated maintenance) on a routine basis and also offer better removal of reduced sulfur compounds (RSCs).

BTFs typically use an inert plastic media, which lasts between 10 and 20 years, contained in a fiberglass vessel. Foul air is introduced at the bottom of the media, and fresh water or recycled sump liquid is sprayed over the top of the media. The liquid flows downward through the media and provides a moist environment that supports microbial growth. Figure 3-4 presents a schematic of a BTF.

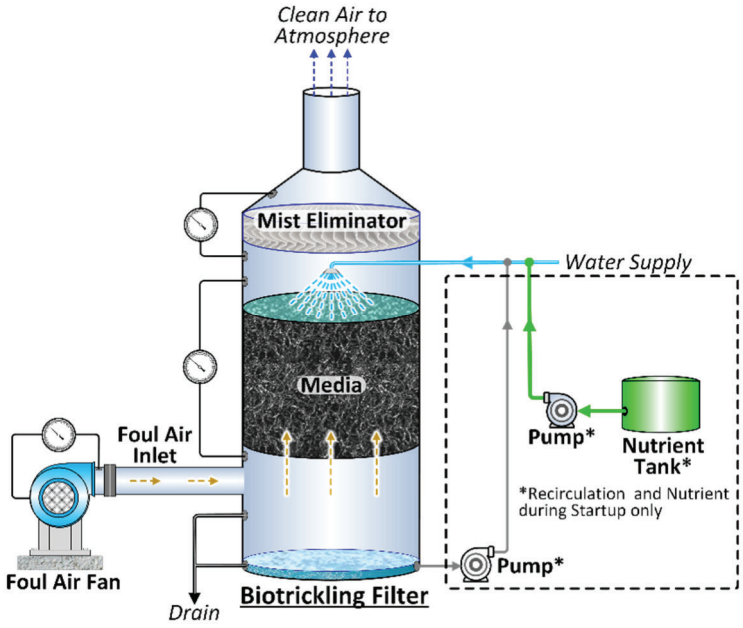

Figure 3-4 BTF Schematic

While BTFs can be provided in either vertical, circular vessels or horizontal, rectangular vessels, circular vessels are assumed for OCWUT applications. This assumption reflects their smaller footprint and generally lower cost.

These systems typically provide an empty bed residence time (EBRT) of 8 to 15 seconds (EBRT is the time required for air to pass through the depth of the media if there were no resistance). Typically, lower EBRTs are required to remove H_2S alone, while higher EBRTs are needed to remove other odorants. For this application, EBRTs will be higher under normal operations, as two vessels are being provided to meet OCWUT redundancy requirements of 50 percent capacity redundancy. Specifically, the exhaust from each source will be split equally (50%/50%) between two units. Each unit will be sized to handle 75 percent of the total flow, however, should one unit be offline. This higher unit capacity will allow each unit to accommodate the full flow, albeit at a reduced EBRT compared to normal operations; the lower EBRT will still provide effective treatment when only one unit is operational (expected to be a rare occurrence). This logic applies to all BTF systems with the exception of the North Canadian thickened waste activated sludge

(TWAS) tanks and dewatering system which will require a total of three units handling a third of the flow each under normal operation and the full flow with one unit offline. Preliminary layouts for each of these systems are included in Appendix D.

Table 3-10 summarizes the BTF systems proposed for OCWUT locations, including capacity, H_2S concentrations, capital cost and O&M costs. Note that costs for each system include two vertical towers (duty) and two fans (duty/standby) (with the exception of the North Canadian TWAS tanks and dewatering system which includes three towers and two fans). Where practical, combined treatment for multiple odor sources is proposed to minimize the number of systems required. Detailed costs for each system can be found in Appendix A.

Table 3-10 Proposed BTF System Summary and Costs

FACILITY	ODOR SOURCE(S)	TOTAL AIRFLOW (CFM)	AVG / PEAK H_2S (PPM)	CAPITAL COST ($)	O&M COST ($/YR)
Deer Creek WWTP	Sludge Tank/Dewatering	20,000	33/166	$4,922,000	$76,000
North Canadian WWTP	TWAS Tanks & Dewatering	31,300	10/98	$7,320,000	$114,000
Witcher LS	Manholes	250	10/69	$730,000	$8,000

3.4.2 Vaporization Systems

Vaporization systems are proposed for odor sources where full containment is not feasible, such as cake storage pads and equalization (EQ) basins. While not as robust as containment with vapor phase treatment, vaporization systems can reduce odor impacts and are routinely applied for non-contained large odor sources. With these systems, an odor neutralizing solution (not a masking agent) is sprayed around the perimeter of the odor source via a compressed air system and perforated piping. There are no nozzles or other ancillary hardware on the vapor system piping, unlike conventional misting systems which use pressurized water-based systems to create particles that are then sprayed through nozzles. Vapor distribution ports/holes are typically drilled by the installer at the size, location, and orientation defined by the vapor system supplier. Figure 3-5 shows a typical perimeter vaporization system.

Figure 3-5 Vaporization System

The odor neutralizer chemistry varies by suppliers, but most products can be classified as an emulsion of food grade essential oils, plant extracts, emulsifier, and water. Several suppliers have been providing these systems for several years (one offers 25 years of experience) and report no adverse effect with respect to human health, vegetation, etc.

The Deer Creek WWTP currently uses perimeter vaporization systems at the cake storage pad and lagoons; it is recommended that the storage pad be enclosed on three sides and appears feasible that the existing vaporization system can be re-used for the open side with some modifications. Similarly, modifications will be provided to the lagoon system at Deer Creek WWTP to improve the dosing control associated with the system. A similar cover and vaporization system arrangement is proposed for the North Canadian WWTP sludge dewatering and compost pads; however new vaporization systems would be provided for these applications. In addition to the storage pads, new vaporization systems are recommended for the EQ basin at Chisholm Creek WWTP and northern EQ basin at Witcher LS.

Table 3-11 provides a summary of the proposed vaporization systems and associated costs. Detailed costs for each system can be found in Appendix A.

Table 3-11 Proposed Vaporization System Summary and Costs

FACILITY	ODOR SOURCE(S)	SYSTEM CAPACITY (CFM)	CAPITAL COST ($)	O&M COST ($/YR)
Deer Creek WWTP	Cake Storage Pad	450 (re-use existing system)	$46,000	$28,000
Chisholm Creek WWTP	EQ Basin	1,200	$256,000	$96,000
North Canadian WWTP	Sludge Dewatering Pad	1,200	$218,000	$73,000
	Compost Pad	450	$155,000	$28,000
Witcher LS	North EQ Basin	1,200	$280,000	$96,000

3.4.3 Liquid Treatment

Liquid phase treatment via chemical injection was considered for plant sludge streams to reduce the odor potential for these sources. Figure 3-6 provides a summary of typical municipal liquid treatment approaches, including iron salts, oxidants, nitrates, and pH adjustment.

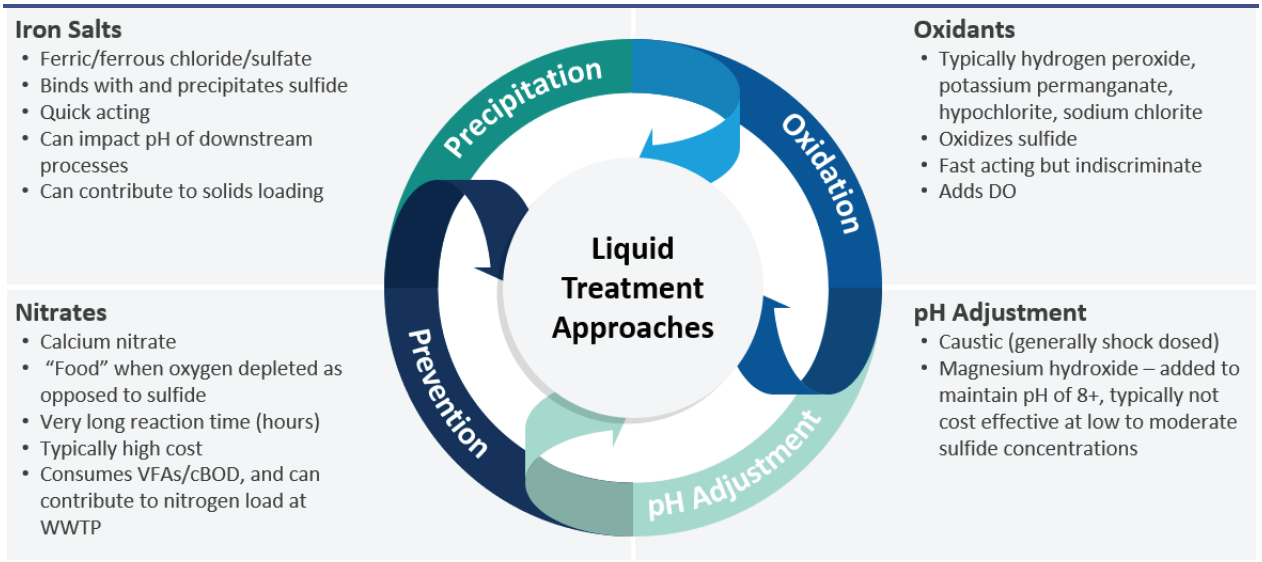

Figure 3-6 Summary of Liquid Phase Treatment Approaches

Bench scale testing performed by USP Technologies provided insight into the dosage, efficacy, and costs for various treatment strategies. Liquid grab samples and the bench scale analysis on sludge were conducted between April 27 and April 29, 2021 at Deer Creek WWTP, Chisholm Creek WWTP, and North Canadian WWTP. Testing suggested that chemical injection would not be a cost-effective treatment approach to reduce sludge odor at Chisholm Creek WWTP, due to the very high doses required for control. The complete testing report is included in Appendix B with preliminary recommendations for Deer Creek WWTP and North Canadian WWTP summarized in Table 3-12.

Table 3-12 Preliminary Chemical Dosing Recommendations and Unit Costs

PLANT	CHEMICAL	DOSAGE (MG/L)	ESTIMATED H_2S REMOVAL (%)	ESTIMATED COST ($/DT SLUDGE)
Deer Creek WWTP	Hydrogen peroxide (H_2O_2)	300	85	18
North Canadian WWTP	Sodium chlorite ($NaClO_2$)	100	90	20

Based on the findings of the bench scale testing, Table 3-13 provides a summary of the anticipated liquid phase treatment costs for Deer Creek WWTP and North Canadian WWTP. While the bench scale testing yielded preliminary recommendations, full scale pilot testing is recommended to confirm chemical dosage rates and efficacy prior to implementation.

Table 3-13 Proposed Liquid Phase Treatment Summary and Annual Costs

PROCESS	CHEMICAL	INJECTION LOCATION	ESTIMATED SOLIDS QUANTITY (DT/YR) [1]	CAPITAL COST ($)	ANNUAL O&M COST ($/YR)
Deer Creek WWTP	H_2O_2	Sludge transfer line	2,850	$36,000	$53,000
North Canadian WWTP	$NaClO_2$	Sludge transfer line	24,280	$36,000	$596,000

(1) Solids quantities based on 2025 projections

3.4.4 H_2S Monitoring

The Technology Screening Summary TM identified two ambient H_2S monitoring systems for further investigation: the Envirosuite System and the DiCom fence line monitoring system. These two systems were evaluated to determine which best meets OCWUT's needs at the Deer Creek WWTP, Chisolm Creek WWTP, North Canadian WWTP and Witcher LS EQ basins. The evaluation focused on functionality, features, and costs (capital, operation and maintenance, and life cycle) of the two alternative systems. The evaluation took into consideration the existing Envirosuite system at Deer Creek WWTP. A TM summarizing the H_2S Monitoring Assessment can be found in Appendix E.

Monitoring alternatives were developed for each plant and the Witcher LS. In order to provide a complete evaluation of the Envirosuite system, multiple alternatives were developed. For each facility, a DiCom alternative has been provided for comparison purposes. Up to a total of five alternatives were provided per facility. Shared features for each alternative (regardless of facility) are shown in Table 3-14.

Table 3-14 H_2S Monitoring Alternatives Overview

ALTERNATIVE	DESCRIPTION
Envirosuite 1 (EN1)	• Equipment and software platform by Envirosuite • Full software functionality • Provided under rental agreement • Envirosuite installation, with power through solar photovoltaic cells and batteries
Envirosuite 2 (EN2)	• Weather station and software platform by Envirosuite • Sensors by Acrulog, connected to software via Envirosuite's IoT gateway devices • Full software functionality • Envirosuite provided under rental agreement, Acrulogs purchase separately • Contractor installation, with power from plant site
Envirosuite 3 (EN3)	• Equipment and software platform by Envirosuite • Reduced software functionality (monitoring and incident intelligence functions only) • Provided under rental agreement • Envirosuite installation, with power through solar photovoltaic cells and batteries
Envirosuite 4 (EN4)	• Weather station and software platform by Envirosuite • Sensors by Acrulog, connected to software via Envirosuite's IoT gateway devices • Reduced software functionality (monitoring and incident intelligence functions only • Envirosuite provided under rental agreement, Acrulogs purchase separately • Contractor installation, with power from plant site
DiCom 5 (DI5)	• DiCom analyzers that will be connected to the SCADA System as is described in Section 4.1.2.

The evaluation found that the Envirosuite System provides superior functionality allowing operations staff and OCWUT staff to remotely monitor H_2S on site via a cloud interface. The cloud-based software functions allow staff to respond to odor complaints with factual data based on odor and weather conditions, anticipate when odors are leaving the plant site, and predict when in the future H_2S emissions are likely to leave the plant site. The DiCom system provides location specific measurements that are reported to the plant control system for monitoring. This system also records H_2S levels detected for future manual assessment.

The Envirosuite system has a higher operations and life cycle cost when compared to the DiCom system. This cost can be reduced by limiting the functions of the system to those that are more needed and by providing sensors sourced by others. At the wastewater treatment facilities where the information can be used to proactively adapt operations to reduce odors, the Envirosuite system provides value. In case of the Witcher LS where operations are more driven by weather, the fixed DiCom system is the recommended solution. Both systems provide a means of assessing H_2S concentrations.

Recommended alternatives are presented in Table 3-15, along with their respected costs.

Table 3-15 Recommended H_2S Monitoring Alternatives and Estimated Costs

FACILITY	RECOMMENDED ALTERNATIVE	NUMBER OF NEW SENSORS	OPCC	ANNUAL MAINTENANCE / RENTAL COST	LIFE CYCLE COST
Deer Creek WWTP	DCEN1	2	$0	$8,300	118,000
Chisholm Creek WWTP	CCEN1	3	$39,000	$62,200	$924,000
North Canadian WWTP	NCEN1	4	$39,000	$67,000	$992,000
Witcher LS	WLDI5	3	$114,000	$1,200	$132,000

3.5. Recommended Technologies for Process Trains

The independent technology assessments identified the preferred technologies for short-term process train alternatives and include the technologies summarized in Table 3-16.

Table 3-16 Preferred Technologies for Short-Term Process Train Alternatives

FACILITY	SOLIDS DEWATERING	SOLIDS STABILIZATION	ODOR CONTROL
Deer Creek WWTP	• BFP and hard piping of filtrate	• Lime stabilization (existing practice) • Bioset	• Vaporization systems • Chemical injection (H_2O_2, existing $FeCl_2$) • BTFs
Chisholm Creek WWTP	NA	NA	• Vaporization system
North Canadian WWTP	• BFP and hard piping of filtrate	• Lime stabilization (existing practice)	• BTFs • Vaporization systems • Chemical injection ($NaClO_2$)
Witcher LS	NA	NA	• BTFs • Vaporization system

- **All Deer Creek and North Canadian WWTP alternatives include new three-sided covers for storage pads, with a vaporization system on the 4th side**
- **Most Deer Creek and all North Canadian WWTP alternatives include new aeration/mixing for sludge storage tanks**

4.0. PLANT SPECIFIC PROCESS TRAIN EVALUATIONS

4.1. Overview

Short-term process train alternatives were developed for each facility by combining the technologies identified in the technology evaluations with other recommended improvements. Short-term improvements generally refer to lower capital projects that can be implemented within a year and may or may not be part of a longer-term solution.

A summary of key alternative technologies is provided in Table 4-1, while the following sections provide additional information on the alternatives for each WWTP and Witcher LS.

Table 4-1 Summary of Process Train Alternatives

ALT.	ALT. #	SOLIDS IMPROVEMENTS		ODOR CONTROL IMPROVEMENTS		
		DEWATERING	STABILIZATION	ODOR CAPTURE/TREATMENT	VAPORIZATION	CHEM INJECT.
DEER CREEK WWTP[Note 1]						
Short-term Alternative 1	DC S1	BFP (existing)	Lime (existing)	• BFP hoods, filtrate hard piping • BTF for sludge storage tank and dewatering exhausts	Cake storage pad	$FeCl_2$ (existing), H_2O_2
Short-term Alternative 2	DC S2	BFP (existing)	Bioset	• BFP hoods, filtrate hard piping • BTF for sludge storage tank and dewatering exhausts	Cake storage pad	$FeCl_2$ (existing), H_2O_2,
CHISHOLM CREEK WWTP						
Short-term Alternative 1	CC S1	NA	NA	NA	EQ basin	NA
NORTH CANADIAN WWTP[Note 1]						
Short-term Alternative 1	NC S1	BFP (existing)	Lime (existing)	• BFP hoods, filtrate hard piping • BTF for TWAS storage tanks and dewatering exhausts	• Sludge dewatering pad • Compost pad	$NaClO_2$
WITCHER LS						
Short-term Alternative 1	W S1	NA	NA	BTF for exhaust from manholes (three total)	EQ basin (northern)	NA

Note 1. All Deer Creek WWTP and North Canadian WWTP alternatives included covering storage pads on three sides with a vaporization system provided on the fourth side.

Other assumptions guiding the analysis are as follows:

- No Chisholm Creek solids improvements are included, as it is assumed that sludge will continue to be hauled to the North Canadian WWTP and new solids storage and mixing improvements were recently completed at Chisolm Creek.
- Potential benefits and costs for the installation of a Bioset system are considered to be preliminary and must be confirmed by pilot testing.
- Liquid treatment costs for both the Deer Creek and North Canadian WWTPs must also be confirmed via piloting.

A summary of alternative costs is presented for each facility following the alternative descriptions. For improvements that are noted in short-term costs are included for relevant alternatives due to uncertainty regarding the timing of implementation. Detailed cost estimates supporting the cost tables in this section can be found in Appendix A.

4.2. Deer Creek WWTP

Two short-term alternatives were identified for Deer Creek WWTP. Locations of the short-term improvement at the site are shown in Figure 4-1.

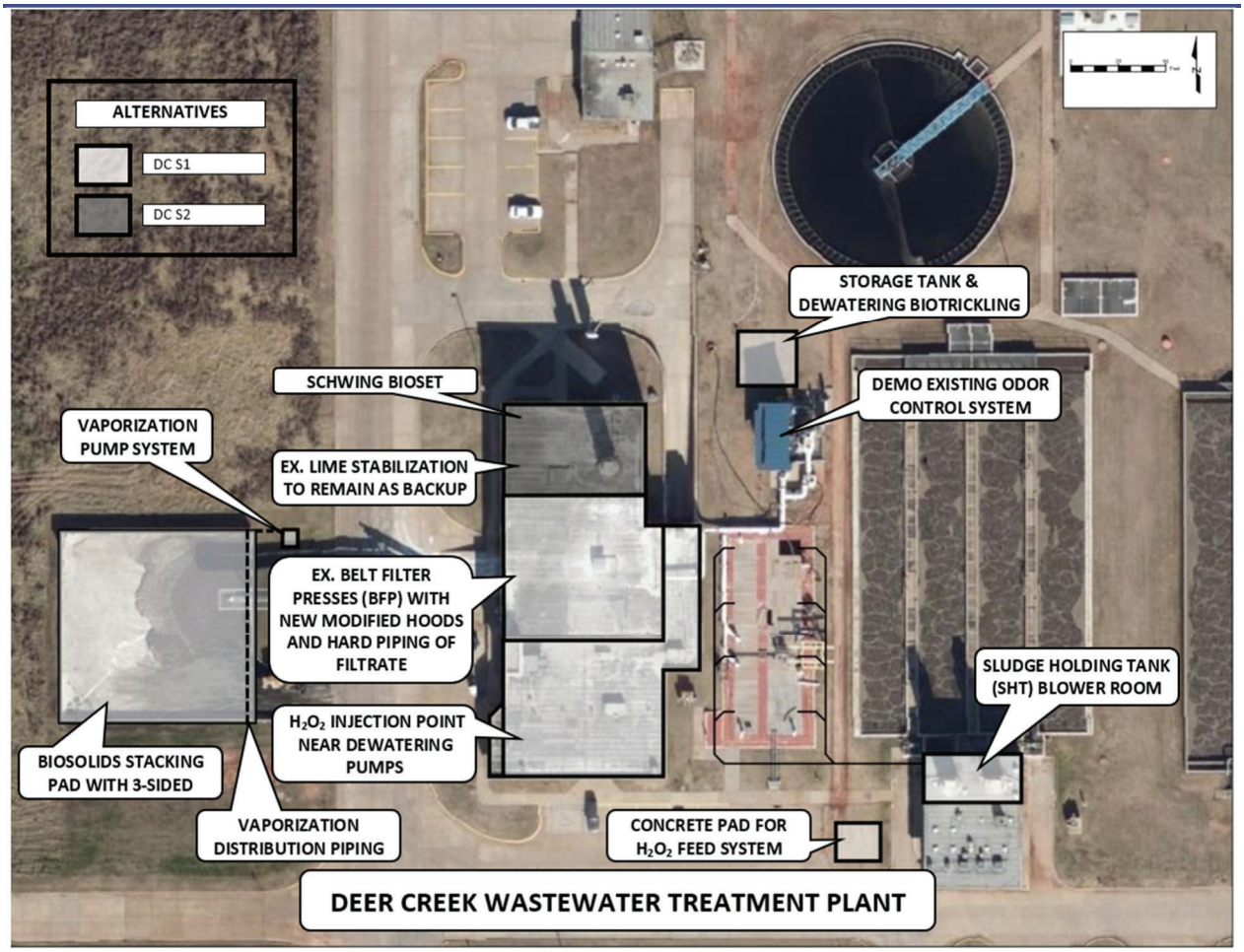

Figure 4-1 Location of Solids and Odor Improvements at Deer Creek WWTP

4.2.1 Short-term Alternatives

Alternative DC S1 includes solids storage and odor control improvements. This alternative represents a near-immediate solution that could be implemented within 1 to 2-years and assumes that aeration of the sludge storage tank would not yet be installed. It is assumed that current ferrous chloride dosing upstream of the storage tank would continue and additional liquid phase treatment via H_2O_2 injection into the sludge transfer line would be provided to reduce sludge odors. By providing covers or modifying the hoods for the existing BFPs, containment of the dewatering process air would be improved.

Solids improvements include aerating the sludge storage tanks to mix the tanks and reduce the odor causing septicity that exists in the tank. A new 20,000 cfm BTF odor control system would be provided to treat foul air from the aerated storage tank and the covered BFPs. Additional odor control would be provided through a perimeter vaporization system at the newly enclosed cake storage pad. It is envisioned that the existing vaporization system can be re-used for this application.

Figure 4-2 shows the Alternative DC S1 improvements.

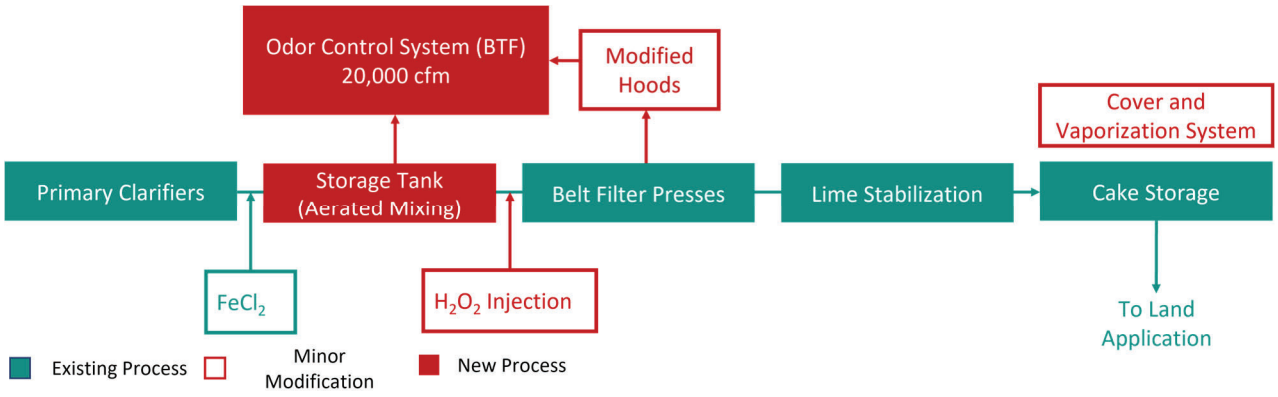

Figure 4-2 Alternative DC S1 Process Train Schematic

Alternative DC S2 includes solids stabilization improvements that require more time to implement than Alternative DC-S1. For this alternative, no additional chemical injection is proposed beyond the existing ferrous chloride injection and proposed hydrogen peroxide system. Similar to the previous Alternative DC-S1, a vaporization system would be provided at the cake storage pad.

A Bioset solids stabilization process is proposed to replace the existing lime stabilization process. The system includes additional odor control devices that scrub the air generated by the lime reaction with the solids.

Figure 4-3 shows the Alternative DC S2 improvements.

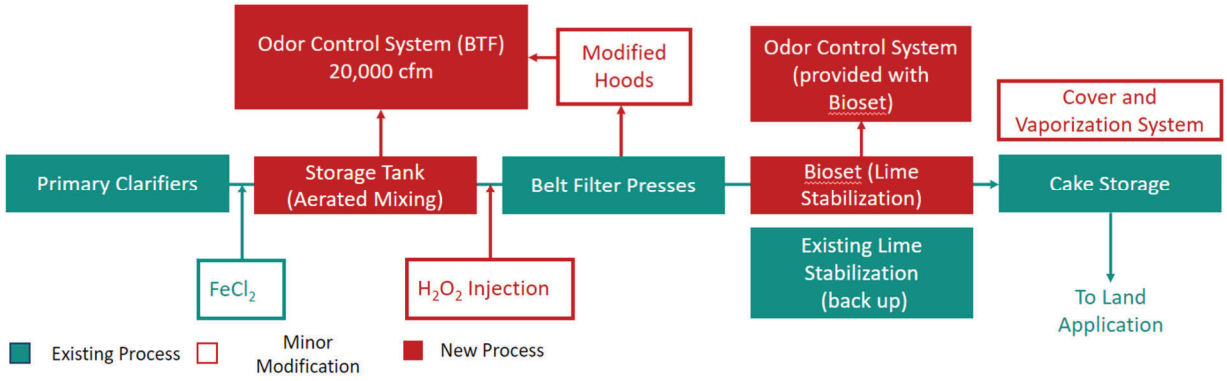

Figure 4-3 Alternative DC S2 Process Train Schematic

4.2.2 Summary

Table 4-2 summarizes the estimated capital and O&M costs for each of the Deer Creek WWTP alternatives described above. These costs do not include H_2S monitoring costs presented in 3.4.4.

Table 4-2 Deer Creek WWTP Odor and Solids Process Alternatives Estimated Costs

ALTERNATIVE	ALT. #	ESTIMATED CAPITAL COST ($)	ESTIMATED ANNUAL O&M COST ($/YR)
Short-term Alternative 1	DC S1	$9,138,000	$1,582,000
Short-term Alternative 2 (includes some capital costs included in DC S1)	DC S2	$5,305,000	$1,409,000

4.3. Chisholm Creek WWTP

Chisolm Creek options considered are limited, as the plant does not dewater or stabilize solids, sludge storage mixing and odor control system were recently improved, and other odor control systems were in reasonable condition. Bench scale testing did not identify a cost-effective liquid treatment approach, and so liquid treatment is not included (additional field studies would be needed to further assess liquid treatment for Chisholm Creek). Odor control improvements at the plant focused on the plant's equalization basin and extending the media life for the plant's existing odor control systems, as described below. Locations for the odor improvements at the Chisholm Creek WWTP are shown in Figure 4-4 and Figure 4-5.

Figure 4-4 Location of Odor Improvements at Chisholm Creek WWTP EQ Basin

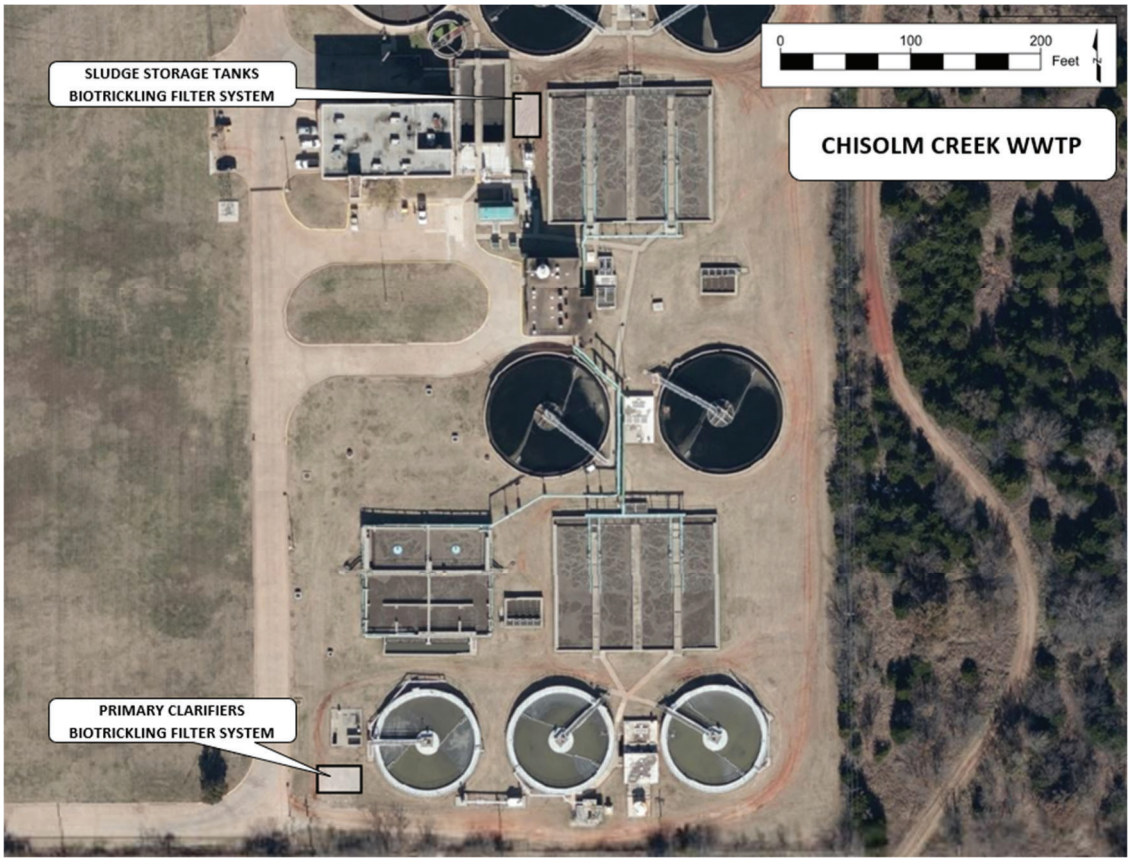

Figure 4-5 Location of Odor Improvements near Primary Clarifiers & Sludge Storage at Chisholm Creek WWTP

4.3.1 Short-term Alternative

Alternative CC S1 involves only odor control improvements through a 1,675 LF perimeter vaporization system at the EQ basin. The vaporization system would nearly encircle the basin and would require electrical improvements as there is not currently power near the basin.

Figure 4-6 shows the Alternative CC S1 improvements.

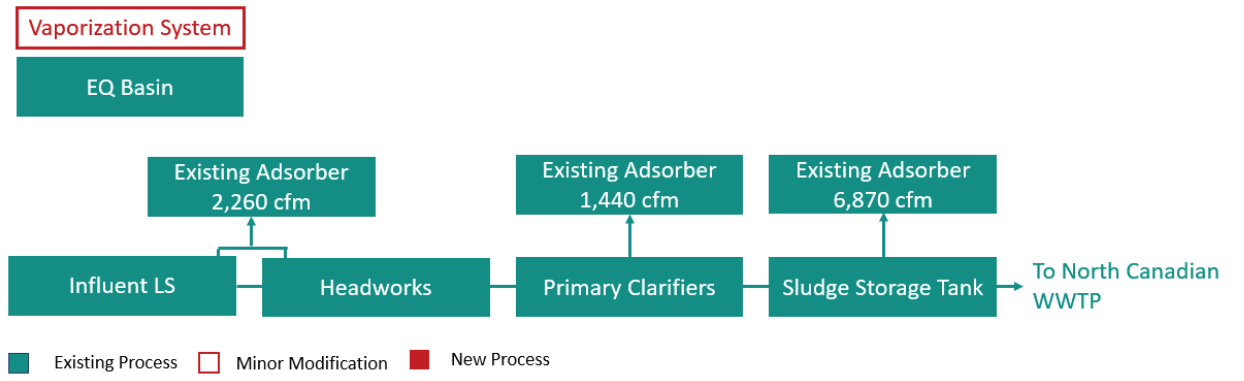

Figure 4-6 Alternative CC S1 Process Train Schematic

4.3.2 Summary

Providing a vaporization system around the perimeter of the EQ basin would provide near-term odor removal for this large area source. While these alternatives do not account for chemical injection, additional field testing could be performed to assess efficacy and cost implications for liquid treatment. Table 4-3 summarizes the estimated capital and O&M costs for the Chisholm Creek WWTP alternatives described above.

Table 4-3 Chisholm Creek WWTP Odor and Solids Process Alternatives Estimated Costs

ALTERNATIVE	ALT. #	ESTIMATED CAPITAL COST ($)	ESTIMATED ANNUAL O&M COST ($/YR)
Short-term Alternative 1	CC S1	$256,000	$96,000

4.4. North Canadian WWTP

North Canadian WWTP improvements focused on odor control at the sludge storage tanks, dewatering and biosolids storage pads, while solids improvements include sludge mixing/aeration and storage pad improvements. Specific alternatives developed for the site are described below.

4.4.1 Short-term Alternative

The short-term alternative for Alternative NC S1 focuses on odor control for solids processing. This alternative includes sodium chlorite injection to reduce sludge odors, which could be implemented in a short-time frame, although piloting is recommended to confirm full-scale dosages. As with Deer Creek, improvements at North Canadian also call for the addition of mixing and aeration of the plant's sludge storage tanks to improve the odor of sludge sent to dewatering. The high volume of air associated with tank aeration will necessitate the installation of a 31,000 cfm BTF. The BTF would treat foul air from modified hoods over the BFPs in addition to tank exhausts.

With the addition of aeration, it is expected that sodium chlorite dosages (which target dewatering odors) could be reduced, but they are included here at bench-scale dosages on the presumption that maximum odor mitigation is preferred.

Other improvements include the addition of vaporization systems on the open side of new three-sided containment buildings for the biosolids storage pads. A 210 LF system is proposed for the dewatering storage pad, while a 325 LF system is proposed for the compost pad.

Figure 4-7 shows the Alternative NC S1 improvements. Locations of the short-term improvements are shown in Figure 4-8 and Figure 4-9.

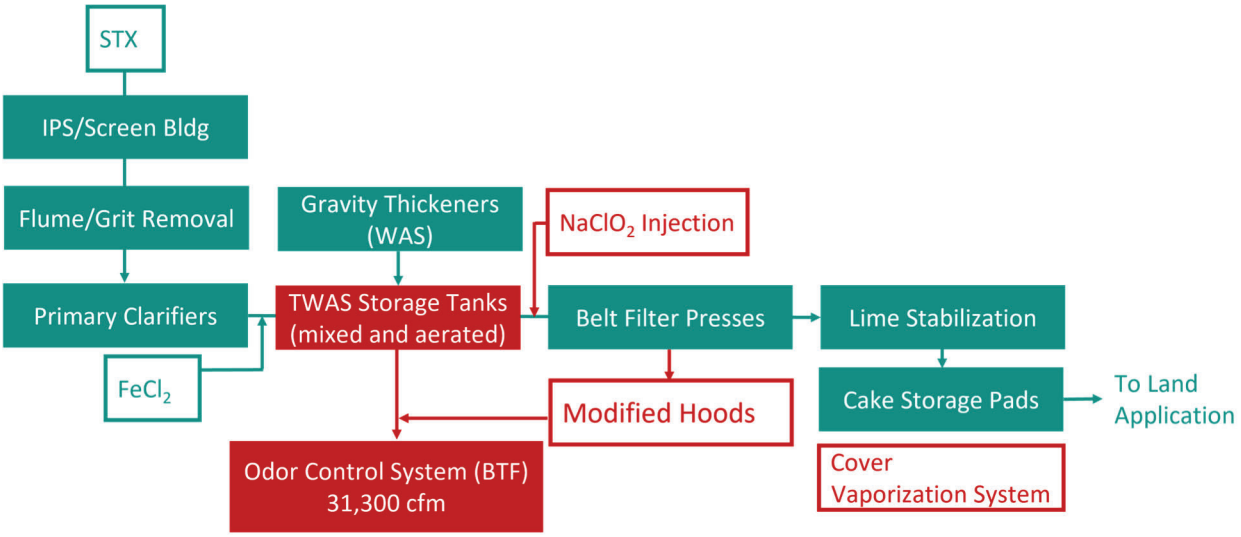

Figure 4-7 Alternative NC S1 Schematic

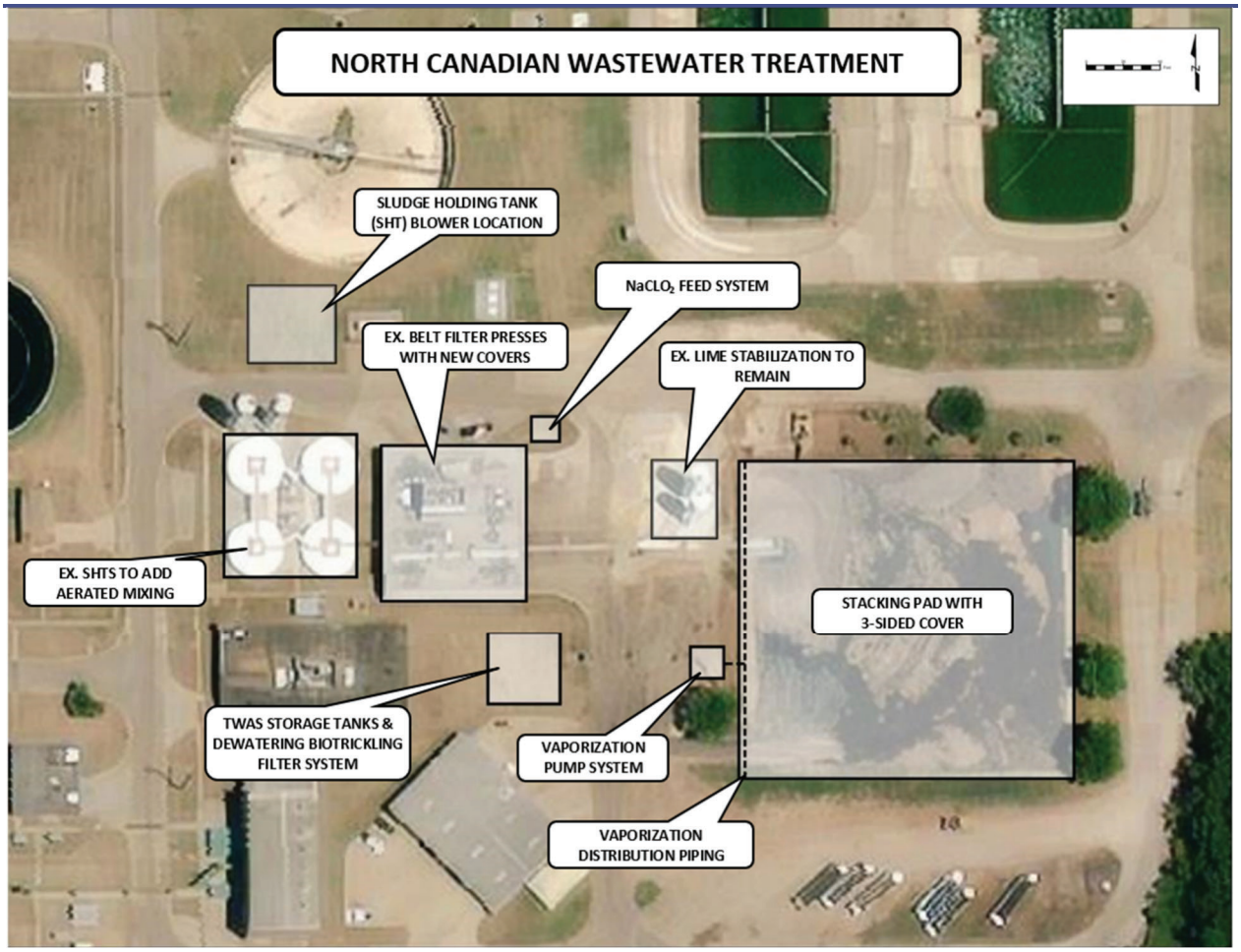

Figure 4-8 Location of Short-Term Solids and Odor Improvements at North Canadian WWTP

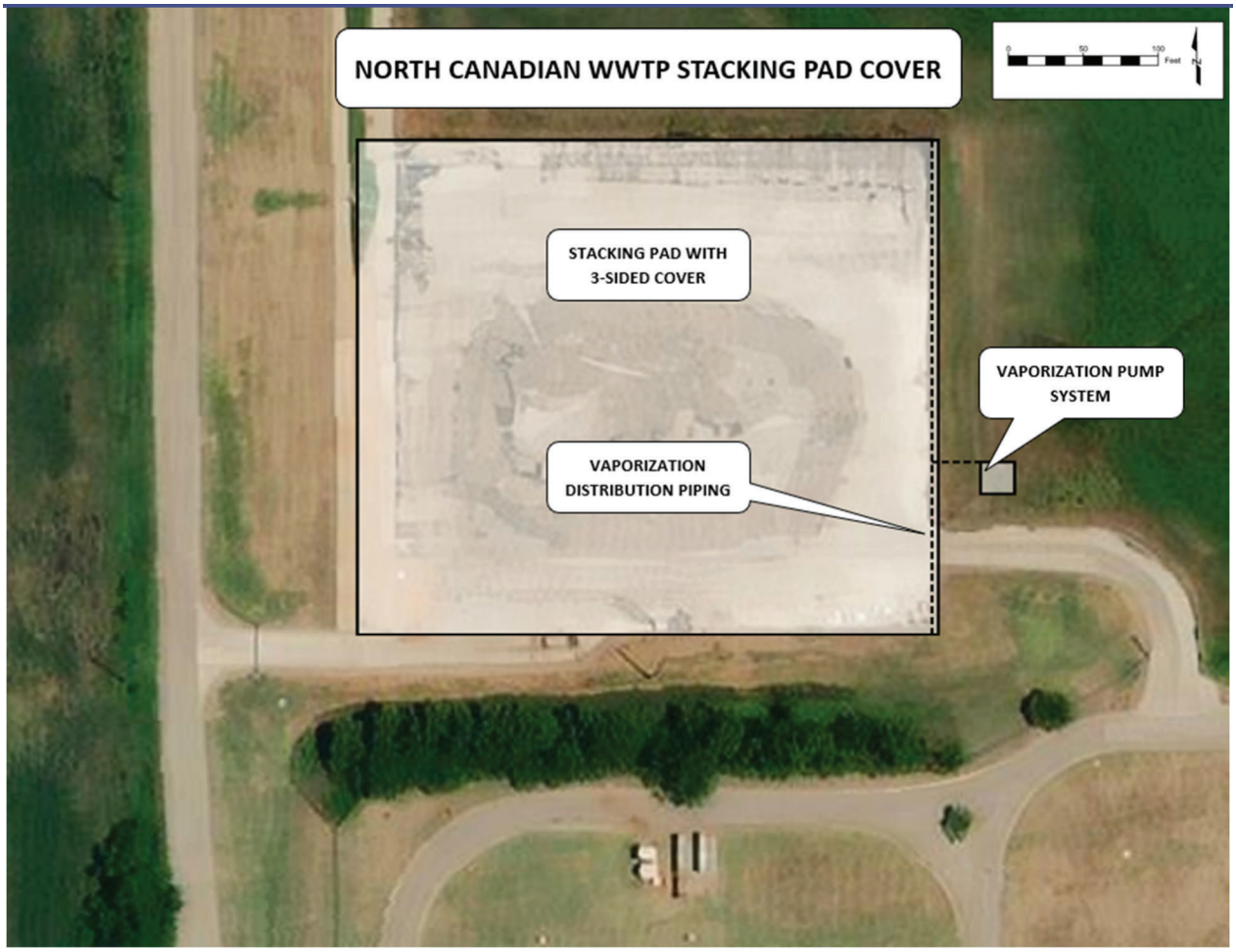

Figure 4-9 Location of Short-Term Odor Improvements at northwest Stacking Pad at North Canadian WWTP

4.4.2 Summary

Table 4-4 summarizes the estimated capital and O&M costs for each of the North Canadian WWTP alternatives described above. These costs do not include H_2S monitoring costs presented in 3.4.4.

Table 4-4 North Canadian WWTP Odor and Solids Process Alternatives Estimated Costs

ALTERNATIVE	ALT. #	ESTIMATED CAPITAL COST ($)	ESTIMATED ANNUAL O&M COST ($/YR)
Short-term Alternative 1	NC S1	$20,632,000	$11,290,000

4.5. Witcher Lift Station Alternative Evaluation

The three manholes near the Witcher LS and the equalization basins associated with the LS have been identified as odor sources. Short-term alternatives to address these odors are described below.

4.5.1 Short-term Alternative

Under this alternative, a small BTF would be provided to exhaust and treat foul air from three manholes near the LS. A single BTF system located south of the road would be provided to treat all three manholes, relying upon the headspace in the buried pipe to convey the foul air from the northern manhole to avoid the need for foul air duct road crossing. Because of its small size, this unit could be quickly designed and installed so the BTF could offer near-immediate odor reduction. Additionally, a 2,120 LF vaporization system would be installed surrounding the first (and most often used) basin in the three-basin equalization system.

Figure 4-10 shows the Alternative W S1 improvements. Locations of the improvements are shown in Figure 4-11.

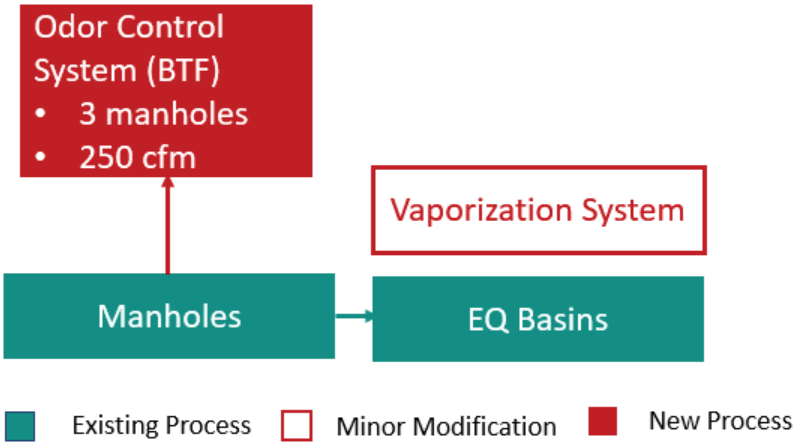

Figure 4-10 Alternative W S1 Schematic

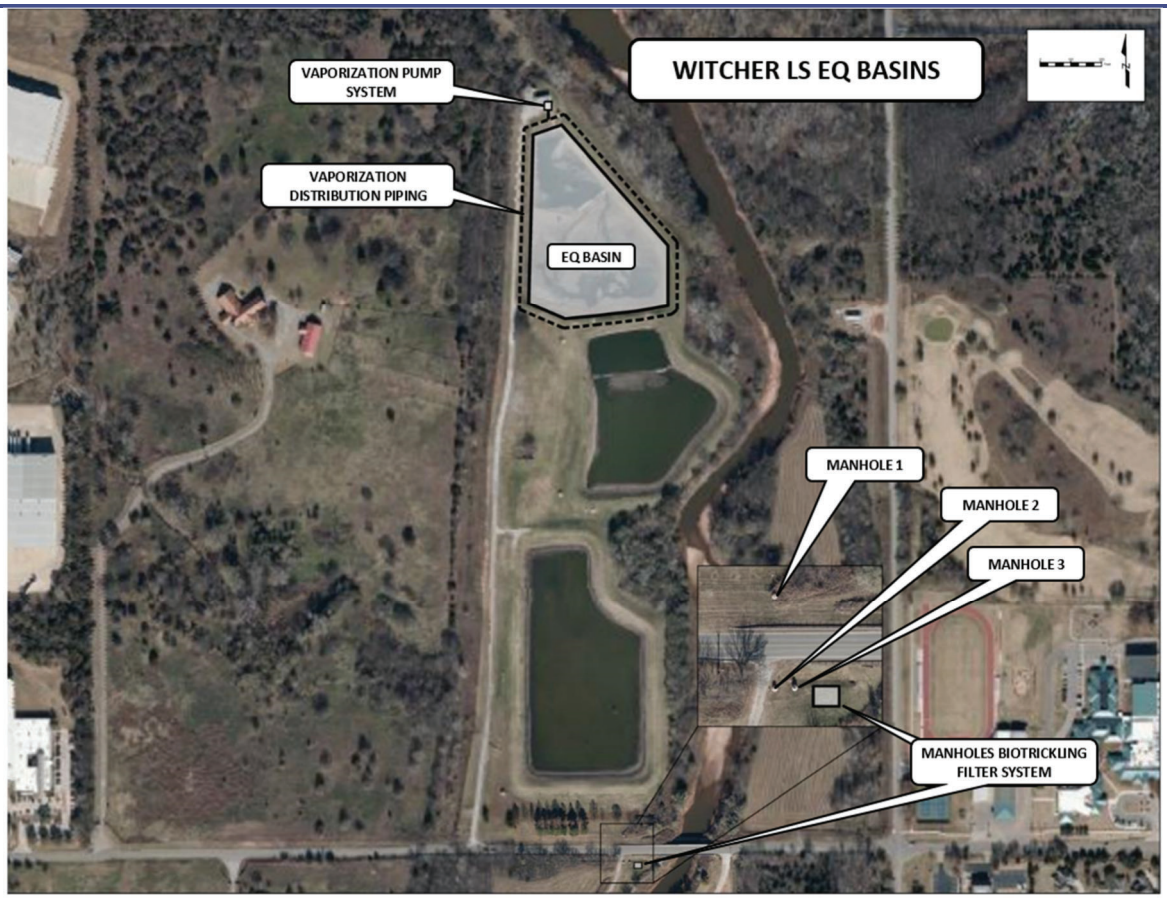

Figure 4-11 Location of Odor Improvements at the Witcher Lift Station

4.5.2 Summary

The short-term alternative allows for near term treatment of odors from the three manholes and most problematic EQ basin. Table 4-5 summarizes the estimated capital and O&M costs for the Witcher LS alternatives described above.

Table 4-5 Witcher LS Odor Process Alternatives Estimated Costs

ALTERNATIVE	ALT. #	ESTIMATED CAPITAL COST ($)	ESTIMATED ANNUAL O&M COST ($/YR)
Short-term Alternative 1	W S1	$1,010,000	$104,000

5.0. PRELIMINARY RECOMMENDATION SUMMARY

Based upon the evaluations above, the process alternatives shown in Table 5-1 were recommended to be carried forward for implementation planning. Together, the recommended improvements are intended to significantly reduce the odor profile of all OCWUT facilities. These recommendations are preliminary, however, and will be refined pending input from OCWUT.

Table 5-1 Preliminary Process Train Recommendations

PRELIMINARY PREFERRED ALTERNATIVE	ALT.	KEY FEATURES
Deer Creek WWTP		
Short-term	DC S1	• Storage tank aerated mixing • Hydrogen peroxide chemical feed system • BFP hood modifications and hard piping for filtrate • New BTF for storage tank/dewatering exhausts • Storage pad cover and vaporization system • Modify FEB vaporization system
Short-term	DC S2	• All DC S1 improvements • Bioset solids stabilization
Chisholm Creek WWTP		
Short-term	CC S1	• New vaporization system at EQ basin
North Canadian WWTP		
Short-term	NC S1	• Storage tank aerated mixing • $NaClO_2$ injection • BFP hood modifications and hard piping for filtrate • New BTF for storage tank/dewatering exhausts • Storage pad covers with vaporization systems
Witcher LS		
Short-term	W S1	• BTF to serve 3 manholes • EQ basin vaporization system

It is important to note that the recommendation of the Bioset technology to treat Deer Creek WWTP solids is predicated on the operation of a successful pilot.

Additionally, H_2S monitoring improvements are recommended. Preliminarily, these include the addition of new sensors and continued operation of the Envirosuite system at the Deer Creek WWTP, new Envirosuite systems for the Chisholm and North Canadian WWTPs, and an Acrulog-based DiCom system for the Witcher LS EQ basins.

6.0. IMPLEMENTATION PLAN

On November 5, 2021, an implementation planning meeting was held with OCWUT staff to discuss the recommended alternatives. As a result of the meeting the following implementation summary table was developed. In the case of DCWWTP and NCWWTP, the short-term improvements were broken into two phases with prioritization given to design projects that would reduce odors at the plant at lower capital

costs. The Deer Creek WWTP short term phase 1 improvements will be implemented through a design project in the near term. The other short-term improvements will be designed and constructed as funding allows. However, to achieve the study goals of odor reduction at the plant boundary to 8 ppb, short-term improvements must be implemented.

Table 6-1 Implementation Plan

FACILITY	IMPROVEMENTS	TERM	PHASE	CAPITAL	O&M
Deer Creek WWTP	• BFP Hood Modifications • Cake Storage Cover • Cake Storage Cover Vaporization System • Hydrogen Peroxide Feed System • BTF's for Sludge Holding Tank and Dewatering Building • Aerated Mixing for Sludge Holding Tank • Vaporization Improvements for FEB • Odor Monitoring Improvements	Short	Phase 1	$9,138,000 Capital Cost Range: $6,393,000 to $13,707,00	$1,582,000
Deer Creek WWTP	• Bioset	Short	Phase 2	$5,305,000 Capital Cost Range: $3,714,000 to $7,958,000	$1,744,000
Chisholm Creek WWTP	• Vaporization system for FEB • Odor Monitoring Improvements	Short	Phase 1	$295,000 Capital Cost Range: $207,000 to $443,000	$163,000
North Canadian WWTP	• Sodium Chlorite Injection • Cake Storage Area Covers • Cake Storage Cover Vaporization Systems • Odor Control Monitoring Systems • Belt Filter Press Hood Modifications • Aerated Mixing of Sludge Holding Tanks • BTF's for Sludge Holding Tanks	Short	Phase 1	$21,170,000 Capital Cost Range: $14,819,000 to $31,756,000	$22,014,000
Witcher Lift Station	• BTF for manholes • Vaporization System	Short	Phase 1	$1,124,000 Capital Cost Range: $787,000 to $1,686,000	$105,200

Appendix A – Probable Costs

ODOR CONTROL COST FACTORS		
General Assumptions		
Installation Factor	30%	
Mobilization/ Demobilization (% of sub total with contingencies)	5%	
Bonds and Insurance (% of subtotal with contingencies)	3%	
Contractors OH & P (% of subtotal with contingencies)	15%	
Contingencies (% of subtotal)	50%	
Eng., Legal, and Admin. (% of construction cost)	15%	
I & C (% of equipment cost)	15%	
Electrical (% of equipment cost)	15%	
Unit Costs		
Electricty	0.07	/kwh
Maintenance	3%	of equipment cost
Miscellaneous		
Foul air piping	10%	of equipment cost

Deer Creek WWTP
Odor Control System 1A (with Hood. Short curtain)

Source: Storage Tank (w/ Aerated Mixing) + Dewatering

Required Exhaust Rate: 20,000 cfm

Treatment: Biotrickling Filter

BTF Capacity (w/ Redundancy): 15,000 cfm per BTF

# of BTFs: 2

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
	CAPITAL COST					
1.0	**Mechanical**					
	Biotrickling Filter System	1	LS	$1,199,467	$360,000	$1,560,000
	Foul Air Piping	1	LS			$156,000
					Subtotal	**$1,716,000**
2.0	**Structural**					
	Concrete slab	87	CY	$1,000		$87,000
					Subtotal	**$87,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$258,000		$258,000
	Electrical Improvements	1	EA	$258,000		$258,000
					Subtotal	**$516,000**
					Overall Subtotal	**$2,319,000**
					Contingencies (50% of subtotal)	$1,160,000
					Overall Subtotal with Contingencies	**$3,479,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$174,000
					Bonds and Insurance (3% of subtotal with contingencies)	$105,000
					Contractors OH & P (15% of subtotal with contingencies)	$522,000
					Total Construction Cost	**$4,280,000**
					Eng., Legal, and Admin. (15% of construction cost)	$642,000
	Total Probable Capital Cost (Rounded)	**$4,922,000**				
	OPERATION AND MAINTENANCE					
1.0						
	Annual Electricity Cost	405,150	KWHR	$0.070		$29,000
	Maintenance	1	LS	$46,800		$46,800
Total Probable Operations and Maintenance (Rounded)		**$76,000**				

Deer Creek WWTP
Vaporization System

Source: Cake Storage Pad

Treatment: Vaporization System (450 cfm)

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	Vaporization system (re-use existing)	0	EA	$0	$0	$0
	Vaporization distribution piping	100	LF	$10		$1,000
					Subtotal	**$1,000**
2.0	**Structural**					
	Concrete slab	4	CY	$1,000		$4,000
					Subtotal	**$4,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$8,000		$8,000
	Electrical Improvements	1	EA	$8,000		$8,000
					Subtotal	**$16,000**
					Overall Subtotal	**$21,000**
					Contingencies (50% of subtotal)	$11,000
					Overall Subtotal with Contingencies	**$32,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$5,000
					Total Construction Cost	**$40,000**
					Eng., Legal, and Admin. (15% of construction cost)	$6,000
Total Probable Capital Cost (Rounded)		**$46,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	19,600	KWHR	$0.070		$2,000
	Chemical costs	12	EA	$2,158		$26,000
Total Probable Operations and Maintenance (Rounded)		**$28,000**				

Deer Creek WWTP
Chemical Injection

Treatment: Hydrogen peroxide addition to sludge transfer line

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
					$0	$0
					Subtotal	**$0**
2.0	**Structural**					
	Concrete slab	6	CY	$1,000		$6,000
					Subtotal	**$6,000**
3.0	**I&C and Electrical**					
	I&C Improvements	1	LS	$5,000		$5,000
	Electrical Improvements	1	LS	$5,000		$5,000
					Subtotal	**$10,000**
4.0	**Civil/Site**					
	Sitework	1	LS	**$0**		$0
					Subtotal	**$0**
					Overall Subtotal	**$16,000**
					Contingencies (50% of subtotal)	$8,000
					Overall Subtotal with Contingencies	**$24,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$31,000**
					Eng., Legal, and Admin. (15% of construction cost)	$5,000
Total Probable Capital Cost (Rounded)		**$36,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	3,300	KWHR	$0.070		$1,000
	Chemical costs	2,847	Dry Ton	$18		$52,000
Total Probable Operations and Maintenance (Rounded)		**$53,000**				

Deer Creek WWTP
BFP Shell Covers

Source: NA

Required Exhaust Rate: NA

Treatment: NA

BTF Capacity (w/ Redundancy): NA

# of BTFs: 2

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	BFP Shell Cover	2	EACH	$85,000	$26,000	$222,000
					Subtotal	**$222,000**
2.0	**Structural**					
					Subtotal	**$0**
3.0	**I&C and Electrical**					
					Subtotal	**$0**
					Overall Subtotal	**$222,000**
					Contingencies (50% of subtotal)	$111,000
					Overall Subtotal with Contingencies	**$333,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$17,000
					Bonds and Insurance (3% of subtotal with contingencies)	$10,000
					Contractors OH & P (15% of subtotal with contingencies)	$50,000
					Total Construction Cost	**$410,000**
					Eng., Legal, and Admin. (15% of construction cost)	$62,000
Total Probable Capital Cost (Rounded)		**$472,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	0	-	$0.000		$0
	Maintenance	0	-	$0		$0
Total Probable Operations and Maintenance (Rounded)		**$0**				

Chisholm Creek WWTP
Vaporization System

Source: EQ Basin

Treatment: Vaporization System (1,200 cfm)

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	Vaporization system	1	EA	$53,995	$17,000	$71,000
	Vaporization distribution piping	1675	LF	$10		$17,000
					Subtotal	**$88,000**
2.0	**Structural**					
	Concrete slab	4	CY	$1,000		$4,000
					Subtotal	**$4,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$14,000		$14,000
	Electrical Improvements	1	EA	$14,000		$14,000
					Subtotal	**$28,000**
					Overall Subtotal	**$120,000**
					Contingencies (50% of subtotal)	$60,000
					Overall Subtotal with Contingencies	**$180,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$9,000
					Bonds and Insurance (3% of subtotal with contingencies)	$6,000
					Contractors OH & P (15% of subtotal with contingencies)	$27,000
					Total Construction Cost	**$222,000**
					Eng., Legal, and Admin. (15% of construction cost)	$34,000
Total Probable Capital Cost (Rounded)		**$256,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	48,900	KWHR	$0.070		$4,000
	Chemical costs (based on 275 gal tote)	10	EA	$9,505		$92,000
Total Probable Operations and Maintenance (Rounded)		**$96,000**				

North Canadian WWTP
Odor Control System 3B

Source: TWAS Tanks + Dewatering

Required Exhaust Rate: 31,300 cfm

Treatment: Biotrickling Filter

BTF Capacity (w/ Redundancy): 15,650 cfm per BTF

# of BTFs: 3

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	Biotrickling Filter System	1	LS	$1,799,200	$540,000	$2,340,000
	Foul Air Piping	1	LS			$234,000
					Subtotal	**$2,574,000**
2.0	**Structural**					
	Concrete slab	97	CY	$1,000		$97,000
					Subtotal	**$97,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$387,000		$387,000
	Electrical Improvements	1	EA	$387,000		$387,000
					Subtotal	**$774,000**
					Overall Subtotal	**$3,445,000**
					Contingencies (50% of subtotal)	$1,723,000
					Overall Subtotal with Contingencies	**$5,168,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$259,000
					Bonds and Insurance (3% of subtotal with contingencies)	$156,000
					Contractors OH & P (15% of subtotal with contingencies)	$776,000
					Total Construction Cost	**$6,359,000**
					Eng., Legal, and Admin. (15% of construction cost)	$954,000
Total Probable Capital Cost (Rounded)		**$7,313,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	607,725	KWHR	$0.070		$43,000
	Maintenance	1	LS	$70,200		$70,200
Total Probable Operations and Maintenance (Rounded)		**$114,000**				

North Canadian WWTP
Vaporization System 1

Source: Sludge Dewatering Pad

Treatment: Vaporization System (1,200 cfm)

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	Vaporization system	1	EA	$53,995	$17,000	$71,000
	Vaporization distribution piping	210	LF	$10		$3,000
					Subtotal	**$74,000**
2.0	**Structural**					
	Concrete slab	4	CY	$1,000		$4,000
					Subtotal	**$4,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$12,000		$12,000
	Electrical Improvements	1	EA	$12,000		$12,000
					Subtotal	**$24,000**
					Overall Subtotal	**$102,000**
					Contingencies (50% of subtotal)	$51,000
					Overall Subtotal with Contingencies	**$153,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$8,000
					Bonds and Insurance (3% of subtotal with contingencies)	$5,000
					Contractors OH & P (15% of subtotal with contingencies)	$23,000
					Total Construction Cost	**$189,000**
					Eng., Legal, and Admin. (15% of construction cost)	$29,000
Total Probable Capital Cost (Rounded)		**$218,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	48,900	KWHR	$0.070		$4,000
	Chemical costs (based on 275 gal tote)	7	EA	$9,505		$69,000
Total Probable Operations and Maintenance (Rounded)		**$73,000**				

North Canadian WWTP
Chemical Injection

Treatment: Sodium Chlorite addition to sludge transfer line

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
					$0	$0
					Subtotal	**$0**
2.0	**Structural**					
	Concrete slab	6	CY	$1,000		$6,000
					Subtotal	**$6,000**
3.0	**I&C and Electrical**					
	I&C Improvements	1	EA	$5,000		$5,000
	Electrical Improvements	1	EA	$5,000		$5,000
					Subtotal	**$10,000**
4.0	**Civil/Site**					
	Sitework	1	LS	**$0**		$0
					Subtotal	**$0**
					Overall Subtotal	**$16,000**
					Contingencies (50% of subtotal)	$8,000
					Overall Subtotal with Contingencies	**$24,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$31,000**
					Eng., Legal, and Admin. (15% of construction cost)	$5,000
Total Probable Capital Cost (Rounded)		**$36,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	3,300	KWHR	$0.070		$1,000
	Chemical costs	24,273	Dry Ton	$25		$595,000
Total Probable Operations and Maintenance (Rounded)		**$596,000**				

North Canadian WWTP
BFP Shell Covers

Source: NA

Required Exhaust Rate: NA

Treatment: NA

BTF Capacity (w/ Redundancy): NA

# of BTFs: 2

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	BFP Shell Cover	4	EACH	$85,000	$26,000	$444,000
					Subtotal	**$444,000**
2.0	**Structural**					
					Subtotal	**$0**
3.0	**I&C and Electrical**					
					Subtotal	**$0**
					Overall Subtotal	**$444,000**
					Contingencies (50% of subtotal)	$222,000
					Overall Subtotal with Contingencies	**$666,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$34,000
					Bonds and Insurance (3% of subtotal with contingencies)	$20,000
					Contractors OH & P (15% of subtotal with contingencies)	$100,000
					Total Construction Cost	**$820,000**
					Eng., Legal, and Admin. (15% of construction cost)	$123,000
Total Probable Capital Cost (Rounded)		**$943,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	0	-	$0.000		$0
	Maintenance	0	-	$0		$0
Total Probable Operations and Maintenance (Rounded)		**$0**				

Witcher LS
Odor Control System 4

Source: Manholes

Required Exhaust Rate: 250 cfm

Treatment: Biotrickling Filter

BTF Capacity (w/ Redundancy): 188 cfm per BTF

# of BTFs: 2

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	Biotrickling Filter System	1	LS	$172,300	$52,000	$225,000
	Foul Air Piping	1	LS			$22,500
					Subtotal	**$247,500**
2.0	**Structural**					
	Concrete slab	18	CY	$1,000		$18,000
					Subtotal	**$18,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$38,000		$38,000
	Electrical Improvements	1	EA	$38,000		$38,000
					Subtotal	**$76,000**
					Overall Subtotal	**$341,500**
					Contingencies (50% of subtotal)	$171,000
					Overall Subtotal with Contingencies	**$512,500**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$26,000
					Bonds and Insurance (3% of subtotal with contingencies)	$16,000
					Contractors OH & P (15% of subtotal with contingencies)	$77,000
					Total Construction Cost	**$632,000**
					Eng., Legal, and Admin. (15% of construction cost)	$95,000
Total Probable Capital Cost (Rounded)		**$727,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	6,935	KWHR	$0.070		$1,000
	Maintenance	1	LS	$6,750		$6,750
Total Probable Operations and Maintenance (Rounded)		**$8,000**				

Witcher LS
Vaporization System

Source: North EQ Basin

Treatment: Vaporization System (1,200 cfm)

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	Vaporization system	1	EA	$56,990	$18,000	$75,000
	Vaporization distribution piping	2120	LF	$10		$22,000
					Subtotal	**$97,000**
2.0	**Structural**					
	Concrete slab	4	CY	$1,000		$4,000
					Subtotal	**$4,000**
3.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$15,000		$15,000
	Electrical Improvements	1	EA	$15,000		$15,000
					Subtotal	**$30,000**
					Overall Subtotal	**$131,000**
					Contingencies (50% of subtotal)	$66,000
					Overall Subtotal with Contingencies	**$197,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$10,000
					Bonds and Insurance (3% of subtotal with contingencies)	$6,000
					Contractors OH & P (15% of subtotal with contingencies)	$30,000
					Total Construction Cost	**$243,000**
					Eng., Legal, and Admin. (15% of construction cost)	$37,000
Total Probable Capital Cost (Rounded)		**$280,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	48,900	KWHR	$0.070		$4,000
	Chemical costs	10	EA	$9,505		$92,000
Total Probable Operations and Maintenance (Rounded)		**$96,000**				

Deer Creek WWTP Probable Costs

General Assumptions These cells are linked to general assumption spreadsheet.

Installation Factor	30%
Mobilization/ Demobilization (% of sub total wit	5%
Bonds and Insurance (% of subtotal with contin	3%
Contractors OH & P (% of subtotal with continge	15%
Contengencies (% of subtotal)	50%
Eng., Legal, and Admin. (% of construction cost)	15%
I & C (% of equipment cost)	15%
Electrical (% of equipment cost)	15%
Financing Rates =	4%
General Inflation Rate =	3%
Power Inflation Rate =	3%
Population Growth Rate =	2%
HP to KWHR Conversion	0.75
Stacking pad lighting intensity (lumens/SF)	30

Unit Costs

Electricity	0.07	/kwh
Maintenance	3%	of mechanical construction cost
Labor Rate	$40.00	
Water Cost	$0.003	gal
Polymer	$2.00	$/lb
Disposal Rate	$40.00	Dry Ton
BFP Polymer Usage	8.00	lb/Dry Ton
Centrifuge Polymer Usage	10.00	lb/Dry Ton
Quicklime Cost	120.00	$/ton

Lifecycle

Effective Interest	3.5%
Period (years)	20

Site Specific Assumptions

Deer Creek

AADF, MGD	17.1	MGD
Total solids, lb/day	18,570	Lb/day
Total Volume	148,100	gallons/day
BFP Unit Capacity lb/hr	1,110	Wet lb/hr
BFP Unit Capacity gpm	188	gpm
BFP Run time lb/hr	27,756	Hr/year
BFP Run time gpm	4,792	Hr/year
BFP Run Time for Calculations	27,756	Hr/year
BFP Dewatered %Solids	22%	

Belt Filter Press Power Usage	**21.33**	**HP**
Hydraulic Unit	2	HP
Feedbox	0.33	HP
Gravity	3	HP
Press Section	6	HP
Booster Pump	10	HP

Table 2.2.1 – Deer Creek WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**14.3**	**15.7**	**17.1**	**18.5**	**19.9**
Primary Solids, lb/day	7,950	8,731	9,511	10,292	11,072
Waste Activated Solids, lb/day	7,572	8,315	9,058	9,802	10,545
Total, lb/day	15,522	17,046	18,570	20,094	21,618

ST-0154 Odor and Biosolids Management Plan

Existing Solids Handling Process

Deer Creek WWTP

Belt Filter Presses	
No. of Units	2
Belt Width, m	2.00
Unit Capacity, lb/h	2,400
Unit Capacity, gpm	140
Firm Capacity, lb/h	2,400
Firm Capacity, gpm	280
Total Capacity, lb/h	4,800
Total Capacity, gpm	280

North Canadian

AADF, MGD	64.5	MGD
Total solids, lb/day	148,000	lb/day
BFP Unit Capacity	2,400	Wet lb/hr
BFP Wet Sludge	245,545,455	Wet lb/year
BFP Run time		Hr/year
Belt Filter Press Power Usage		HP
Conveyor Power Usage		HP
Sludge Feed Pump Power Usage		HP
Wash Pump Power Usage		HP
Polymer System Power Usage		HP
BFP Dewatering Rate	22%	
SHT Blower Power Usage		Kw/100CFM
SHT Blower Flow Rate		SCFM
BFP Water Usage		Gal

Table 2.3 – North Canadian WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**54.7**	**59.6**	**64.5**	**69.4**	**74.4**
Primary Solids, lb/day	73,855	81,330	88,805	96,280	103,755
Waste Activated Solids, lb/day	49,145	54,170	59,195	64,220	69,245
Total, lb/day	123,000	135,500	148,000	160,500	173,000

Chisholm Creek - doesn't have BFP

AADF, MGD	11.9	MGD
Total solids, lb/day	7,647	lb/day

Table 2.1.1 – Chisholm Creek WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**10.06**	**10.96**	**11.86**	**12.76**	**13.66**
Primary Solids, lb/day	6,486	7,066	7,647	8,227	8,807
Waste Activated Solids, lb/day	4,501	4,903	5,306	5,708	6,111
Total, lb/day	10,987	11,969	12,952	13,935	14,918

DC WWTP - Sludge Holding Tank Blowers

Air Flow: 5,000 cfm

Treatment: Sludge Holding Tank Blowers

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	SHT Blowers	3	EA	$130,465	$40,000	$512,000
	Diffusers	100	EA	$200	$100	$30,000
	Air Piping and Valves	600	LF	$50	$50	$60,000
	Pipe Supports	32	EA	$4,000	$4,000	$256,000
					Subtotal	**$858,000**
2.0	**Structural**					
	Equipment Pads	5	CY	$1,000	$1,000	$10,000
	Tank Penetrations	8	EA	$300	$4,000	$35,000
	Building Renovation	1	EA	$50,000	$50,000	$100,000
	Piers	8	EA	$4,000	$3,000	$56,000
					Subtotal	**$201,000**
3.0	**I&C and Electrical**					
	Electrical Improvements	1	EA	$129,000		$129,000
	Motor Control Panel	3	EA	$80,000	$24,000	$312,000
					Subtotal	**$441,000**
					Overall Subtotal	**$1,500,000**
					Contingencies (50% of subtotal)	$750,000
					Overall Subtotal with Contingencies	**$2,250,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$113,000
					Bonds and Insurance (3% of subtotal with contingencies)	$68,000
					Contractors OH & P (15% of subtotal with contingencies)	$338,000
					Total Construction Cost	**$2,769,000**
					Eng., Legal, and Admin. (15% of construction cost)	$416,000
Total Probable Capital Cost (Rounded)		**$3,185,000**				
OPERATION AND MAINTENANCE						
1.0						
	Blower Electricity Cost	1,795,800	KWHR	$0.070		$126,000
	Maintenance	1	LS	$25,740		$25,740

Total Probable Operations and Maintenance (Rounded)	**$152,000**
NET PRESENT WORTH	
Effective Interest	3.5%
Period (years)	20
Total Net Present Worth (Rounded)	**$5,346,000**

Deer Creek WWTP Probable Costs

DC WWTP - Schwing Bioset						
Dry Sludge: 18,600 Lb/Day **Treatment:** Treat Waste Activated Sludge with Schwing Bioset						
Item		**Quantity**	**Unit**	**Unit Cost**	**Installation**	**Rounded Subtotal**
CAPITAL COST						
1.0	**Mechanical**					
	Schwing Bioset System	2	EA	$600,000	$180,000	$1,560,000
	Conveyor Modifications	1	EA	$150,000	$45,000	$195,000
					Subtotal	**$1,755,000**
2.0	**Structural**					
	Pipe supports	40	EA	$4,000	$4,000	$160,000
	Equipment Pads	60	CY	$4,000	$3,000	$240,000
					Subtotal	**$400,000**
3.0	**I&C and Electrical**					
	Electrical Improvements	1	EA	$264,000	$80,000	$344,000
					Subtotal	**$344,000**
					Overall Subtotal	**$2,499,000**
					Contingencies (50% of subtotal)	$1,250,000
					Overall Subtotal with Contingencies	**$3,749,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$188,000
					Bonds and Insurance (3% of subtotal with contingencies)	$113,000
					Contractors OH & P (15% of subtotal with contingencies)	$563,000
					Total Construction Cost	**$4,613,000**
					Eng., Legal, and Admin. (15% of construction cost)	$692,000
Total Probable Capital Cost (Rounded)		**$5,305,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost - BFP	442,000	KWHR	$0.070	-	$31,000
	Annual Electricity Cost - Conveyor	139,000	KWHR	$0.070	-	$10,000
	Annual Electricity Cost - Sludge Feed Pumps	414,000	KWHR	$0.070	-	$29,000
	Annual Electricity Cost - Wash Pumps	104,000	KWHR	$0.070	-	$8,000
	Annual Electricity Cost - Polymer System	63,000	KWHR	$0.070	-	$5,000
	Annual Electricity Cost - Bioset	352,343	KWHR	$0.070	-	$25,000
	Quicklime Cost	310	Ton	$120.00	-	$38,000
	Solids Disposal	16,000	Wet Ton	$40.00	-	$640,000
	Polymer Cost	28,000	LB	$2.00	-	$56,000
	BFP Operations and Maintenance	1	LS	$193,000	-	$193,000
Total Probable Operations and Maintenance (Rounded)		**$1,035,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$20,015,000**				

DC WWTP - Stacking Pad Cover

Building Dimensions: 100'x100'

Treatment: Covers for biosolids stacking pad

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	100' x 100' Cover	1	EA	$200,000	$60,000	$260,000
					Subtotal	**$260,000**
2.0	**Structural**					
	30" Column Piers	14	EA	$3,000	$1,000	$56,000
					Subtotal	**$56,000**
3.0	**I&C and Electrical**					
	Electrical	1	EA	$20,000	$6,000	$26,000
					Subtotal	**$26,000**
					Overall Subtotal	**$342,000**
					Contingencies (50% of subtotal)	$171,000
					Overall Subtotal with Contingencies	**$513,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$26,000
					Bonds and Insurance (3% of subtotal with contingencies)	$16,000
					Contractors OH & P (15% of subtotal with contingencies)	$77,000
					Total Construction Cost	**$632,000**
					Eng., Legal, and Admin. (15% of construction cost)	$95,000
Total Probable Capital Cost (Rounded)		**$727,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Electricity Cost	6,000	KWHR	$0.070	-	$1,000
Total Probable Operations and Maintenance (Rounded)		**$1,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$742,000**				

General Assumptions These cells are linked to general assumption spreadsheet.

Installation Factor	30%
Mobilization/ Demobilization (% of sub total wit	5%
Bonds and Insurance (% of subtotal with conting	3%
Contractors OH & P (% of subtotal with continge	15%
Contengencies (% of subtotal)	50%
Eng., Legal, and Admin. (% of construction cost)	15%
I & C (% of equipment cost)	15%
Electrical (% of equipment cost)	15%
Financing Rates =	4%
General Inflation Rate =	3%
Power Inflation Rate =	3%
Population Growth Rate =	2%
HP to KWHR Conversion	0.75
Stacking pad lighting intensity (lumens/SF)	30

Unit Costs

Electricity	0.07	/kwh
Maintenance	3%	of mechanical construction cost
Labor Rate	$40.00	
Water Cost	$0.003	gal
Polymer	$2.00	$/lb
Disposal Rate	$40.00	Dry Ton
BFP Polymer Usage	8.00	lb/Wet Ton
Centrifuge Polymer Usage	10.00	lb/Wet Ton
Quicklime Cost	120	$/ton

Lifecycle

Effective Interest	3.5%
Period (years)	20

Site Specific Assumptions

Deer Creek

AADF, MGD	17.1	MGD
Total solids, lb/day	18,570	Lb/day
Total Volume	148,100	gallons/day
BFP Unit Capacity lb/hr	1,110	Wet lb/hr
BFP Unit Capacity gpm	188	gpm
BFP Run time lb/hr	27,756	Hr/year
BFP Run time gpm	4,792	Hr/year
BFP Run Time for Calculations	27,756	Hr/year
BFP Dewatered %Solids	22%	
Belt Filter Press Power Usage	**21.33**	**HP**
Hydraulic Unit	2	HP
Feedbox	0.33	HP
Gravity	3	HP
Press Section	6	HP
Booster Pump	10	HP

North Canadian

AADF, MGD	64.5	MGD
Total solids, lb/day	148,000	lb/day
Total volume	579,600	gal/day
BFP Unit Capacity	2,400	Wet lb/hr
BFP Unit Capacity gpm	188	gpm
BFP Run time lb/hr	102,311	Hr/year
BFP Run time gpm	18,755	Hr/year
BFP Run Time for Calculations	102,311	Hr/year
BFP Dewatering Rate	22%	
Biosolids Cover Lights	115	Total number of lights
Lumens delivered per light	34000	Lumens
Power usage per light	240	watts
Biosolids Cover Light Run time	50	Hours/week
Biosolids Cover Light Power Usage	71760	KWH/year
Lime Use for Stabilization	20%	of wet solids
SHT Blower Flow Rate	20000	SCFM

South Canadian

AADF, MGD	7.0	MGD
Total solids, lb/day	10,440	lb/day
BFP Unit Capacity	2,400	Wet lb/hr
BFP Wet Sludge	27,219,614	Wet lb/year
BFP Run time		Hr/year
Belt Filter Press Power Usage		HP
Conveyor Power Usage		HP
Sludge Feed Pump Power Usage		HP
Wash Pump Power Usage		HP
Polymer System Power Usage		HP
BFP Dewatering Rate	14%	
SHT Blower Power Usage		Kw/100CFM
SHT Blower Flow Rate		SCFM
BFP Water Usage		Gal

Chisholm Creek - doesn't have BFP

AADF, MGD	11.9	MGD
Total solids, lb/day	7,647	lb/day

Table 2.2.1 – Deer Creek WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**14.3**	**15.7**	**17.1**	**18.5**	**19.9**
Primary Solids, lb/day	7,950	8,731	9,511	10,292	11,072
Waste Activated Solids, lb/day	7,572	8,315	9,058	9,802	10,545
Total, lb/day	15,522	17,046	18,570	20,094	21,618

ST-0154 Odor and Biosolids Management Plan

Existing Solids Handling Process

Deer Creek WWTP

Belt Filter Presses	
No. of Units	2
Belt Width, m	2.00
Unit Capacity, lb/h	2,400
Unit Capacity, gpm	140
Firm Capacity, lb/h	2,400
Firm Capacity, gpm	280
Total Capacity, lb/h	4,800
Total Capacity, gpm	280

Table 2.3 – North Canadian WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**54.7**	**59.6**	**64.5**	**69.4**	**74.4**
Primary Solids, lb/day	73,855	81,330	88,805	96,280	103,755
Waste Activated Solids, lb/day	49,145	54,170	59,195	64,220	69,245
Total, lb/day	123,000	135,500	148,000	160,500	173,000

Table 2.4.1 – South Canadian WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**5.8**	**6.5**	**7.1**	**7.6**	**8.2**
Waste Activated Solids, lb/day	8,626	9,667	10,485	11,303	12,121
Total, lb/day	8,626	9,667	10,485	11,303	12,121

Table 2.1.1 – Chisholm Creek WWTP Projected Loadings

Parameter	2020	2025	2030	2035	2040
AADF, MGD	**10.06**	**10.96**	**11.86**	**12.76**	**13.66**
Primary Solids, lb/day	6,486	7,066	7,647	8,227	8,807

NC WWTP - Sludge Holding Tank Blowers

Air Flow: 20,000 cfm

Treatment: Sludge Holding Tank Blowers

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	SHT Blowers	5	EA	$130,465	$40,000	$853,000
	Diffusers	200	EA	$200	$1,000	$240,000
	Air Piping and Valves	1000	LF	$50	$50	$100,000
	Pipe Supports	25	EA	$4,000	$4,000	$200,000
					Subtotal	**$1,393,000**
2.0	**Structural**					
	Equipment Pads	10	CY	$1,000	$1,000	$20,000
	Tank Penetrations	16	EA	$300	$4,000	$69,000
	Blower Building	900	SF	$150	$150	$270,000
	Piers	25	EA	$4,000	$3,000	$175,000
					Subtotal	**$534,000**
3.0	**I&C and Electrical**					
	Electrical Improvements	1	EA	$209,000		$209,000
	Motor Control Panel	5	EA	$80,000	$24,000	$520,000
					Subtotal	**$729,000**
					Overall Subtotal	**$2,656,000**
					Contingencies (50% of subtotal)	$1,328,000
					Overall Subtotal with Contingencies	**$3,984,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$200,000
					Bonds and Insurance (3% of subtotal with contingencies)	$120,000
					Contractors OH & P (15% of subtotal with contingencies)	$598,000
					Total Construction Cost	**$4,902,000**
					Eng., Legal, and Admin. (15% of construction cost)	$736,000
Total Probable Capital Cost (Rounded)		**$5,638,000**				
OPERATION AND MAINTENANCE						
1.0						
	Blower Electricity Cost	7,183,200	KWHR	$0.070		$503,000
	Maintenance	1	LS	$41,790		$41,790

Total Probable Operations and Maintenance (Rounded)	**$545,000**
NET PRESENT WORTH	
Effective Interest	3.5%
Period (years)	20
Total Net Present Worth (Rounded)	**$13,384,000**

NC WWTP - Stacking Pad Cover

Building Dimensions: 200'x200' and 300'x300'

Treatment: Covers for biosolids stacking pad with vaporization units

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Mechanical**					
	200' x 200' Cover	1	EA	$700,000	$210,000	$910,000
	300' x 300' Cover	1	EA	$1,650,000	$495,000	$2,145,000
					Subtotal	**$3,055,000**
2.0	**Structural**					
	30" Column Piers	52	EA	$3,000	$1,000	$208,000
					Subtotal	**$208,000**
3.0	**I&C and Electrical**					
	Electrical	1	EA	$60,000	$18,000	$78,000
					Subtotal	**$78,000**
					Overall Subtotal	**$3,341,000**
					Contingencies (50% of subtotal)	$1,671,000
					Overall Subtotal with Contingencies	**$5,012,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$251,000
					Bonds and Insurance (3% of subtotal with contingencies)	$151,000
					Contractors OH & P (15% of subtotal with contingencies)	$752,000
					Total Construction Cost	**$6,166,000**
					Eng., Legal, and Admin. (15% of construction cost)	$925,000
Total Probable Capital Cost (Rounded)		**$7,091,000**				
OPERATION AND MAINTENANCE						
1.0						
	Electricity Cost - Lights	72,000	KWHR	$0.070	-	$5,100
Total Probable Operations and Maintenance (Rounded)		**$6,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$7,177,000**				

Appendix B – Vendor Information

BIOTRICKLING FILTER
VENDOR DATA

Proposed Treatment System
System 1 - Deer Creek Sludge Tank (1A)

BioAir Proposal No: Q211A037 R2.2 OK City Water Utilities
Reactor Vessel: (2 x EcoFilter EF124.5)
Technology Type: Biotrickling Filter
Total Price: **$ 712,000** (FOB Project Site)

Design Conditions

Parameter	Units	*Average*	*Transient Maximum*	*Remarks*
Airflow	(cfm)	20250	20250	
Hydrogen Sulfide (H_2S)	(ppmv)	33	166	
Volatile Organic Compounds (VOCs)	(ppmv)	< 0.5	< 1.0	Assumed
Reduced Sulfur Compounds (RSCs)	(ppmv)	< 0.5	< 1.0	Assumed
Volatile Fatty Acids (VFAs)	(ppmv)	< 0.5	< 1.0	Assumed
Odourous Air Temperature	(°F)	59-100	105	
Ambient Air Temperature	(°F)	33-110	120	

EcoFilter EF124.5 Reactor Details

Quantity:	*2*
Height:	*29.1 ft (excluding stack)*
Diameter:	*11.8 ft*
Operating Weight:	*49100 lb each*
Pressure Drop:	*2.5 in. w.c. (est. w/ all online)*

Performance Guarantee*

All Online: H_2S (avg): *99.5% or < 0.1 ppmv*
One Offline: H_2S (avg): *N/A*

* Based on 'Design Conditions' above and 'BioAir Standard Performance Test Protocol'

Major Equipment Included

2 Blowers (1 duty/1 standby)
Electrical Control Panel
Water Control Panel w/ Nutrient Dosing System

Field Services Included

Equipment Startup
Performance Testing

Required Utilities

Electrical Power Supply:	*480 V / 3-phase / 60 Hz*
Energy Use:	*433.9 (kw*hr)/day (estimated)*
Instantaneous Water Supply:	*34 gpm @ 75 psi (intermittent)*
Water Use**:	*12700 gal/day (total)*
Nutrient Powder***:	*1550 lb/year*
Mixed Nutrient Solution***:	*155 gal/month*

** Water use is directly proportional to the avg H_2S concentration and assumes drain water pH = 1.7.
If the actual H_2S concentration is lower, the water use will be lower.
*** Nutrients are not required, provided that the water supply contains 1-5 mg/L total P and 3-20 mg/L total N.

Proposed Treatment System
System 7 - N. Canadian TWAS Tanks (3B)

BioAir Proposal No: Q211A037 R2.2 OK City Water Utilities
Reactor Vessel: (3 x EcoFilter EF136)
Technology Type: Biotrickling Filter
Total Price: **$ 1,799,200** (FOB Project Site)

Design Conditions

Parameter	Units	*Average*	*Transient Maximum*	*Remarks*
Airflow	(cfm)	46950	46950	
Hydrogen Sulfide (H_2S)	(ppmv)	10	98	
Volatile Organic Compounds (VOCs)	(ppmv)	< 0.5	< 1.0	Assumed
Reduced Sulfur Compounds (RSCs)	(ppmv)	< 0.5	< 1.0	Assumed
Volatile Fatty Acids (VFAs)	(ppmv)	< 0.5	< 1.0	Assumed
Odourous Air Temperature	(°F)	59-100	105	
Ambient Air Temperature	(°F)	33-110	120	

EcoFilter EF136 Reactor Details

Quantity:	*3*
Height:	*35.7 ft (excluding stack)*
Diameter:	*13.0 ft*
Operating Weight:	*92200 lb each*
Pressure Drop:	*4.6 in. w.c. (est. w/ all online)*

Performance Guarantee*

All Online: H_2S (avg): *99.5% or < 0.1 ppmv*
One Offline: H_2S (avg): *N/A*

* Based on 'Design Conditions' above and 'BioAir Standard Performance Test Protocol'

Major Equipment Included

2 Blowers (1 duty/1 standby)
Electrical Control Panel
Water Control Panel w/ Nutrient Dosing System

Field Services Included

Equipment Startup
Performance Testing

Required Utilities

Electrical Power Supply:	*480 V / 3-phase / 60 Hz*
Energy Use:	*1664.5 (kw*hr)/day (estimated)*
Instantaneous Water Supply:	*53 gpm @ 80 psi (intermittent)*
Water Use**:	*9000 gal/day (total)*
Nutrient Powder***:	*1090 lb/year*
Mixed Nutrient Solution***:	*109 gal/month*

** Water use is directly proportional to the avg H_2S concentration and assumes drain water pH = 1.7.
If the actual H_2S concentration is lower, the water use will be lower.
*** Nutrients are not required, provided that the water supply contains 1-5 mg/L total P and 3-20 mg/L total N.

Proposed Treatment System
System 9 - Witcher LS (4)

BioAir Proposal No: Q211A037 R2.2 OK City Water Utilities
Reactor Vessel: (2 x EcoFilter EF41)
Technology Type: Biotrickling Filter
Total Price: **$ 172,300** (FOB Project Site)

Design Conditions

Parameter	Units	*Average*	*Transient Maximum*	*Remarks*
Airflow	(cfm)	376	376	
Hydrogen Sulfide (H_2S)	(ppmv)	10	69	
Volatile Organic Compounds (VOCs)	(ppmv)	< 0.5	< 1.0	Assumed
Reduced Sulfur Compounds (RSCs)	(ppmv)	< 0.5	< 1.0	Assumed
Volatile Fatty Acids (VFAs)	(ppmv)	< 0.5	< 1.0	Assumed
Odourous Air Temperature	(°F)	59-100	105	
Ambient Air Temperature	(°F)	33-110	120	

EcoFilter EF41 Reactor Details

Quantity:	*2*
Height:	*9.0 ft (excluding stack)*
Diameter:	*4.0 ft*
Operating Weight:	*1900 lb each*
Pressure Drop:	*0.1 in. w.c. (est. w/ all online)*

Performance Guarantee*

All Online: H_2S (avg): *99.5% or < 0.1 ppmv*
One Offline: H_2S (avg): *N/A*

* Based on 'Design Conditions' above and 'BioAir Standard Performance Test Protocol'

Major Equipment Included

2 Blowers (1 duty/1 standby)
Electrical Control Panel
Water Control Panel w/ Nutrient Dosing System

Field Services Included

Equipment Startup
Performance Testing

Required Utilities

Electrical Power Supply:	*480 V / 3-phase / 60 Hz*
Energy Use:	*19.1 (kw*hr)/day (estimated)*
Instantaneous Water Supply:	*6 gpm @ 65 psi (intermittent)*
Water Use**:	*580 gal/day (total)*
Nutrient Powder***:	*51 lb/year*
Mixed Nutrient Solution***:	*5 gal/month*

** Water use is directly proportional to the avg H_2S concentration and assumes drain water pH = 1.7.
If the actual H_2S concentration is lower, the water use will be lower.
*** Nutrients are not required, provided that the water supply contains 1-5 mg/L total P and 3-20 mg/L total N.

VAPORIZATION S YSTEM
VENDOR DATA

ECOSORB
Natural Industrial Odor Solutions

BLACK AND VEATCH

May 17, 2021 | Proposal #20210517BAV-2

Project: Inframark- Chisolm Creek EQ Basin

PROPOSAL BY

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Ecosorb OMI Industries
220 N. Smith St., Suite 315
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PRESENTED TO

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Black and Veatch
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CONTENTS

INTRODUCTION

ABOUT ECOSORB AND OMI INDUSTRIES

OMI Industries specializes in developing natural solutions to control industrial odors, based on our **powerful chemistry, innovative technology,** and **proven expertise**.

The line of Ecosorb® products and delivery equipment eliminate industrial odors without the use of harsh or hazardous ingredients, expensive emission control systems, or masking fragrances. For virtually every odor, every industry, every plant, factory, or facility, there is an Ecosorb odor removing solution.

CHEMISTRY

Ecosorb uses simple science — adsorption, absorption, gas solubility, reaction, and biodegradation — to harness the power of plant oils as natural odor removers. Our proprietary blends are developed in lab settings to tackle specific or broad-spectrum odors.

Ecosorb is strong enough to battle the toughest smells (from landfills to refineries to wastewater treatment facilities), yet safe for people and the environment. Its plant-based formula is non-toxic and does not rely on harmful chemicals to be effective.

TECHNOLOGY

Based on the environment and odor type, Ecosorb is available as water-based, gel, or additive formulas. The experienced engineers at OMI have designed and built a range of delivery systems, tested and proven to remove odors in many industries.

Odor & Gas Testing

On-site odor quantification and composition testing available with Nasal Ranger and Scentroid unit. In-house gas testing is also available using our expertly calibrated gas chromatography-mass spectrometer (GCMS).

Equipment

We manufacture and customize equipment to deliver Ecosorb, based on each application and its environment — weather, delivery method, output volume, and more. Ecosorb delivery systems fully integrate with your existing equipment and processes. Our engineers work with your team to install and maintain a complete odor solution. We also develop and build made-to-order solutions, tailored to your unique odor issues. All technologies allow for optional PLC controls, web-based/phone-based monitoring controls, and on-site warranty and service programs.

EXPERTISE

Over 30 years of field research and successful applications, OMI Industries has emerged as the **world's authority in natural odor elimination.**

Detailed testing data proves Ecosorb works across a variety of industrial markets. The odor-destroying powers of Ecosorb are supported by research by independent labs, universities, and olfactometry researchers. Each has proven its safety and effectiveness – something that sets Ecosorb apart from other odor control products.

Independent firms, both in the U.S. and internationally, were used to ensure accurate, unbiased results. We also continually test Ecosorb products and develop new custom blends in our state-of-the-art Research & Development center to ensure consistency, effectiveness, and quality.

The experienced engineers at OMI work with each facility to create a total odor solution, tailored to your needs. Using our years of expertise in odor control, we match your odor problem to an existing Ecosorb blend. In some cases, a custom formula is needed to battle unique odor combinations. Chemists at OMI can determine the best mix of ingredients for each odor issue.

TECHNOLOGY PROPOSAL

Quantity	Equipment Name & Description	Price
1 ea.	A1101: 1200 CFM Vapor Phase System with PLC Controls 480 VAC, 3 Phase, 60 Hz; 11 Amps Includes: 7.5 Hp Blower, 12 GPD Micropump output range 2.0-12.0 GPD, Oil-less air compressor, built-in Timer, Autoprime, Analog Low liquid level monitoring, Remote [Cellular] Monitoring (with Control) via PC or Smart device. Rear discharge (8in pipe flange). Tote Connection. (Tote) Heat & Insulation Package for 1200 CFM VP Units (Includes Tote Heater & Cover Set). Option: Wind Sensor/Control; PLC Systems VAPOR PHASE EXTENDED ON-SITE SERVICE WARRANTY: Onsite parts and labor. Also includes 3-year service and maintenance with four onsite visits per year from date of shipment. This system is capable of an ECOSORB output of 2.0 to 12.0 gallons per 24-hour period.	$53,995.00 $2, 995.00
1 ea.	275 Gallon Tote of Ecosorb 606	$9,505.00
	GRAND TOTAL OF EQUIPMENT WITH WIND SENSOR, WARRANTY, AND ECOSORB:	$66,495.00
	GRAND TOTAL OF EQUIPMENT WITHOUT WIND SENSOR, WARRANTY, AND ECOSORB:	$63,500.00

UTILITY REQUIREMENTS

UTILITY REQUIREMENTS OF 1200 CFM VAPOR PHASE WITH PLC CONTROLS:

- System requires 480 VAC, 3 Phase, 60 Hz; 20Amp Electrical Power Supply
- Customer will be responsible to provide utility power source to the system.
- Customer responsible for system installation.
- Customer will be responsible for installation of purchased PVC/Vapor Line.

SYSTEM LOCATION REQUIREMENTS FOR 1200 CFM WITH PLC CONTROLS:

- Unit should be located indoors or outside under shelter and protected from the elements.
- ECOSORB is water-based and will freeze @ <32F. System & Product must be freeze protected.
- System dimensions: 56" L x 48" W x 79" H. Weight: 910 lbs.
    - Shipping Crate Size: 75" L x 69" W x 79" H. Weight: 1260 lbs.

NOTES

- Please allow for approximately *8-12 weeks lead time.
    - * Lead-time is subject to change due to uncertainties in the ever-changing workplace climate due to COVID-19.
- Purchasing Terms: 25% down payment before equipment ships.
- Balance due within 30 days with approved Net 30 terms.
- All prices are FOB Rising Sun, Indiana.
- Prices shown do not include freight and taxes.
- All prices are USD.
- Pricing is valid for 90 days from the date of proposal.
- Vapor System ducting is not included in this proposal.

EQUIPMENT PHOTOS

Optional Wind Sensor/ Control

1200 CFM Vapor Phase System with PLC Controls

EQUIPMENT DRAWING

PRODUCT WARRANTY

Products manufactured by OMI Industries, Inc. bear the following limited warranty:
The seller warrants that the goods to be delivered will be of the kind and quality described in the proposal, purchase order, or contract and will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within one (1) year after the initial date of delivery, the seller shall, upon notification thereof and substantiation that the goods have been stored, installed, maintained, and operated in accordance with the seller's operational manual and standard industry practice, correct such defect by suitable repair or replacement at the seller's expense. This warranty is limited to repairing or replacing products which the manufacturer's investigation shows were defective at the time of shipment by the manufacturer.

All products subject to this warranty shall be returned for examination, repair, or replacement freight prepaid to:

OMI Industries, Inc. (Equipment Division)
1300 Barbour Way
Rising Sun, IN 47040

This warranty is exclusive and is in lieu of any warranty or merchant ability, fitness for a particular purpose or other warranty of quality, whether expressed or implied, except of title and against patent infringement. Correction of non-conformities, in the manner and for the period of the time provided above, shall constitute fulfillment of all liabilities of the seller to the purchaser with respect to, or arising out of the good, whether based on contract negligence, strict tort or otherwise.

LIMITATION OF LIABILITIES

Repair or replacement of defective products as provided above is the sole and exclusive remedy provided hereunder and the seller shall not under any circumstances be liable for special or consequential damages such as, but not limited to, damage or loss of other property or equipment, loss of profits, or revenue, cost of capital, cost of purchased or replacement goods, or claims customers of the purchaser for service interruptions. The remedies of the purchaser set forth are exclusive and the liability of seller with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale delivery, resale, installation, or use of any goods covered by or furnished under this contract whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liabilities based. This is the only warranty on any OMI Industries product. No other writing, or description, in the literature shall be construed as a warranty.

Products manufactured by another entity (other than OMI Industries), bear the following limited warranty: Seller warrants that the goods manufactured by others will conform to the description herein stated. No other warranty expressed or implied is made, and warranty of the manufacturer is hereby assigned and transferred to the buyer. Furthermore, except for the manufacturer's warranty, if any, the products sold hereunder are sold as is. OMI Industries is not liable for any incidental or consequential damages in connection with these products.

ECOSORB 606

Safety Data Sheet
according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations
Date of issue: 04/07/2017 Revision date: 11/07/2017 Supersedes: 04/07/2017 Version: 1.1

SECTION 1: Identification

1.1. Identification

Product form : Mixture

Product name : ECOSORB 606

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Odor Neutralizer

Recommended use : Odor Neutralizer

Restrictions on use : None known

1.3. Details of the supplier of the safety data sheet

Manufacturer
OMI Industries
1300 Barbour Way
Rising Sun, IN 47040 - U.S.A
T 1-847-304-9111

1.4. Emergency telephone number

Emergency number : 1-800-662-6367, Monday - Friday 8 am to 5 pm CST

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

2.3. Other hazards

Other hazards not contributing to the classification : None under normal conditions. Keep out of reach of children.

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/Information on ingredients

3.1. Substances

3.2. Mixtures

This mixture does not contain any substances to be mentioned according to the criteria of section 3.2 of HazCom 2012

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Call a poison center/doctor/physician if you feel unwell.

First-aid measures after inhalation : Move to fresh air if necessary.

First-aid measures after skin contact : Wash skin with plenty of water.

First-aid measures after eye contact : Rinse eyes with water as a precaution.

First-aid measures after ingestion : Call a poison center/doctor/physician if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects : None under normal use.

Symptoms/effects after inhalation : No effects known.

Symptoms/effects after skin contact : No effects known.

Symptoms/effects after eye contact : No effects known.

Symptoms/effects after ingestion : No effects known.

Symptoms/effects upon intravenous administration : No other effects known.

Chronic symptoms : No effects known.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Dry powder. Foam. Carbon dioxide.

Unsuitable extinguishing media : No unsuitable extinguishing media known.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Not flammable.

Reactivity : The product is non-reactive under normal conditions of use, storage and transport.

5.3. Advice for firefighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety.

Protection during firefighting : Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Absorb spillage to prevent material-damage.

6.1.1. For non-emergency personnel

Protective equipment : Gloves and safety glasses recommended. Gloves and safety glasses recommended.

Emergency procedures : Ventilate spillage area.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Avoid release to the environment. Prevent liquid from entering sewers, watercourses, underground or low areas.

6.3. Methods and material for containment and cleaning up

For containment : Collect spillage.

Methods for cleaning up : Take up liquid spill into absorbent material.

Other information : Dispose of materials or solid residues at an authorized site.

6.4. Reference to other sections

For further information refer to section 13. For further information refer to section 8: "Exposure controls/personal protection".

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Not expected to present a significant hazard under anticipated conditions of normal use.

Precautions for safe handling : Ensure good ventilation of the work station. Wear personal protective equipment.

Hygiene measures : Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Does not require any specific or particular technical measures.

Storage conditions : Store in a well-ventilated place. Keep cool.

Incompatible products : Oxidizing agent. Strong acids.

Incompatible materials : Keep away from strong acids and strong oxidizers.

Storage temperature : 4 - 29 °C 40°F and 85°F Allowing product to freeze may cause layering.

Information on mixed storage : KEEP SUBSTANCE AWAY FROM: (strong) acids. oxidizing agents.

Storage area : Keep container in a well-ventilated place. Store in a cool area. Keep out of direct sunlight. Store in a well-ventilated place.

Special rules on packaging : Keep only in original container.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.2. Exposure controls

Appropriate engineering controls : Ensure good ventilation of the work station.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment : Gloves and safety glasses recommended.

Hand protection : Protective gloves. Recommended.

Eye protection : Safety glasses. Recommended.

Skin and body protection : None under normal use.

Respiratory protection : Respiratory protection not required in normal conditions.

Thermal hazard protection : Not applicable.

Environmental exposure controls : Avoid release to the environment.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Appearance	: White liquid.
Color	: White
Odor	: Characteristic odour
Odor threshold	: No data available
pH	: 5.5 - 8
Melting point	: Not applicable
Freezing point	: < 0 °C
Boiling point	: ≈ 97 °C
Flash point	: No data available
Relative evaporation rate (butyl acetate=1)	: No data available
Flammability (solid, gas)	: Not applicable.
Vapor pressure	: No data available
Relative vapor density at 20 °C	: No data available
Relative density	: ≈ 0.99
Solubility	: Soluble in water.
Partition coefficient n-octanol/water	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Viscosity, kinematic	: ≈ 1 cSt
Viscosity, dynamic	: No data available
Explosion limits	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is non-reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.5. Incompatible materials

Oxidizing agent. Strong acids.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure : Skin and eye contact

Acute toxicity : Not classified

ECOSORB 606	
LD50 oral rat	> 50 g/kg
LD50 dermal rat	> 50 g/kg

Skin corrosion/irritation : Not classified
pH: 5.5 - 8

Serious eye damage/irritation : Not classified
pH: 5.5 - 8

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity – single exposure : Not classified

Specific target organ toxicity – repeated exposure : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : No other effects known.

Symptoms/effects after inhalation : No effects known.

Symptoms/effects after skin contact : No effects known.

Symptoms/effects after eye contact : No effects known.

Symptoms/effects after ingestion : No effects known.

Symptoms/effects upon intravenous administration : No other effects known.

Chronic symptoms : No effects known.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : The product is not considered harmful to aquatic organisms or to cause long-term adverse effects in the environment.

ECOSORB 606	
LC50 fish 1	> 1000 mg/l
EC50 Daphnia 1	> 1000 mg/l

12.2. Persistence and degradability

ECOSORB 606	
Persistence and degradability	Readily biodegradable in water.

12.3. Bioaccumulative potential

ECOSORB 606	
Bioaccumulative potential	No bioaccumulation data available.

12.4. Mobility in soil

ECOSORB 606	
Ecology - soil	The product is predicted to have high mobility in soil. Soluble in water.

12.5. Other adverse effects

Effect on the global warming : No known effects from this product.

GWPmix comment : No known effects from this product.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Regional legislation (waste) : Disposal must be done according to official regulations.

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Sewage disposal recommendations : Disposal must be done according to official regulations.

Product/Packaging disposal recommendations : Avoid release to the environment.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Not regulated

Transportation of Dangerous Goods

Not regulated

Transport by sea

Not regulated

Air transport

Not regulated

SECTION 15: Regulatory information

15.1. US Federal regulations

ECOSORB 606
Not subject to reporing requirements of the United States SARA Section 313 Listed on the United States TSCA (Toxic Substances Control Act) inventory

ALL COMPONENTS OF THIS PRODUCT ARE LISTED, OR EXCLUDED FROM LISTING, ON THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY

15.2. International regulations

CANADA

ECOSORB 606	
Listed on the Canadian DSL (Domestic Substances List)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

ECOSORB 606
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)- Directive 79/831/EEC, sixth Amendment of Directive 67/548/EEC (dangerous substances) Listed on ELINCS (European List of Notified Chemical Substances)

National regulations

ECOSORB 606
Listed on the Korean ECL (Existing Chemicals List) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the AICS (Australian Inventory of Chemical Substances) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on KECI (Korean Existing Chemicals Inventory)

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer, developmental and/or reproductive harm

SECTION 16: Other information

Revision date	:	11/07/2017
Data sources	:	This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200.
Training advice	:	Normal use of this product shall imply use in accordance with the instructions on the packaging.
Other information	:	None.

ABBREVIATIONS AND ACRONYMS:	
SDS	Safety Data Sheet
IMDG	International Maritime Dangerous Goods
IATA	International Air Transport Association

Hazard Rating

Health	:	0 Minimal Hazard - No significant risk to health
Flammability	:	0 Minimal Hazard - Materials that will not burn
Physical	:	0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.
Personal protection	:	B B - Safety glasses, Gloves

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product

ECOSORB®
Natural Industrial Odor Solutions

Vapor Phase 600 & 1200

A Simple, Efficient, and Economical Delivery System for Ecosorb Odor Neutralizer

Model 600

APPLICATIONS

- Petrochemical Plants
- Foundries
- Food Processors
- Wastewater Treatment
- Agriculture
- Landfills
- Pulp & Paper
- Soil Remediation
- And More

For large indoor or outdoor areas, the 600 and 1200 Vapor Phase units were designed to control the toughest industrial odors. Each unit is customizable with optional features to meet any application, including the ability to pair with an Ecosorb® 55 gallon drum or 275 gallon tote. Both models are capable of integrating with a color touch screen Programmable Logic Controller (PLC) for increased output control and monitoring.

BENEFITS

- No added water required
- Simple to install, operate & maintain
- Smaller droplets, more absorption
- Flexible & efficient
- Reduced capital expense
- Requires no mixing or dilution
- Zero nozzle maintenance in the distribution system

	Model 600	Model 1200	600 PLC	1200 PLC
		Technical		
Framing	Open	Open	Open with corner protectors	
Power	480V, 3 Phase, 60Hz, 8 Amps	480V, 3 Phase, 60Hz, 10 Amps	Same as Non-PLC	
Dimensions	71" x 36" x 48"; 930lbs	71" x 36" x 48"; 930lbs	71" x 36" x 48"; 930lbs	
Blower	5 HP	7.5 HP	Same as Non-PLC	
Blower Specs	600 CFM @ 19 IWG Static Pressure	1200 CFM @ 21 IWG Static Pressure	Same as Non-PLC	
Blower Outlet Size	6"	8"	Same as Non-PLC	
		Features		
Controls	Conventional	Conventional	Allen Bradley PLC w/ color touch screen	
Product Capacity	55 gal (Drum) or 275 gal (Tote)	55 gal (Drum) or 275 gal (Tote)	Same as Non-PLC	
Liquid Delivery	0.1 - 6 GPD	0.1 - 12 GPD	1.5 - 6 GPD	2.5 - 12 GPD
Low Liquid Level	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert	
Priming	Push to prime	Push to prime	Auto prime	
Intake	Filtered	Filtered	Filtered + Clean Indicator	
Monitoring	-	-	• Air & Liquid Pressure • Motor Current & Overload • Liquid Flow • Running Time	
		Options		
Timer	Multi-Event	Multi-Event	Included	
Extendable Intake	Side, Back, or Front	Side, Back, or Front	Side, Back, or Front	
Discharge Outlet Orientation	Rear Horizontal or Vertical	Rear Horizontal or Vertical	Rear Horizontal or Vertical	
Remote Monitoring	With or W/O Auto Control	With or W/O Auto Control	With or W/O Auto Control	
Alternate Voltage	✓	✓	✓	
Wind Direction Optimization	✓	✓	✓	
Plant Air Setup	✓	✓	✓	
High Pressure Static Version	✓	✓	✓	
Blower Motor Soft Start	✓	✓	✓	
Freeze Protection Package	✓	✓	✓	
Explosion Proof Package	✓	✓		
Alternate Blower/Motor Size	✓	✓	✓	
Valve Control			✓	
Air Flow Indicator			✓	

			Static Pressure (IWG)				Single Branch		2 Equal Branches	
Unit Model	**Product Uptake (Max)**	**Actual Airflow Max (CFM) @FLA**	**@Rated CFM**	**@FLA**	**Unit Blower Outlet Pipe Size(in.)**	**Duct Pipe Dia. (in.)**	**Pressure Loss/ 100ft (IWG)***	**Max. Duct Length (ft.)**	**Pressure Loss/ 100ft (IWG)***	**Max Duct Length (Ft) [TOTAL LENGTH]**
1200	12 GPD	1650	20.6	18.9	8	6	13.0	150	5.0	750
						8	4.0	500	1.2	3200
						10	1.3	1500	0.35	10000
600	6 GPD	1080	17.6	15.6	6	6	7.0	250	1.8	1725
						8	1.5	1000	0.45	6900
						10	0.5	4000	0.14	15000

LIQUID TREATMENT
VENDOR DATA

ECOSORB
Natural Industrial Odor Solutions

BLACK AND VEATCH

May 17, 2021 | Proposal #20210517BAV-1

Project: Inframark- North Canadian Sludge Dewatering Pad (Covered)

PROPOSAL BY

Greg Gandy
Ecosorb OMI Industries
220 N. Smith St., Suite 315
Palatine, IL 60067
(888) 201-3182
ggandy@omi-industries.com | (281) 705-2130

PRESENTED TO

Ulrich Bazemo
Black and Veatch
bazemouyy@bv.com| (301) 556-5376

CONTENTS

INTRODUCTION

ABOUT ECOSORB AND OMI INDUSTRIES

OMI Industries specializes in developing natural solutions to control industrial odors, based on our **powerful chemistry, innovative technology,** and **proven expertise**.

The line of Ecosorb® products and delivery equipment eliminate industrial odors without the use of harsh or hazardous ingredients, expensive emission control systems, or masking fragrances. For virtually every odor, every industry, every plant, factory, or facility, there is an Ecosorb odor removing solution.

CHEMISTRY

Ecosorb uses simple science — adsorption, absorption, gas solubility, reaction, and biodegradation — to harness the power of plant oils as natural odor removers. Our proprietary blends are developed in lab settings to tackle specific or broad-spectrum odors.

Ecosorb is strong enough to battle the toughest smells (from landfills to refineries to wastewater treatment facilities), yet safe for people and the environment. Its plant-based formula is non-toxic and does not rely on harmful chemicals to be effective.

TECHNOLOGY

Based on the environment and odor type, Ecosorb is available as water-based, gel, or additive formulas. The experienced engineers at OMI have designed and built a range of delivery systems, tested and proven to remove odors in many industries.

Odor & Gas Testing

On-site odor quantification and composition testing available with Nasal Ranger and Scentroid unit. In-house gas testing is also available using our expertly calibrated gas chromatography-mass spectrometer (GCMS).

Equipment

We manufacture and customize equipment to deliver Ecosorb, based on each application and its environment — weather, delivery method, output volume, and more. Ecosorb delivery systems fully integrate with your existing equipment and processes. Our engineers work with your team to install and maintain a complete odor solution. We also develop and build made-to-order solutions, tailored to your unique odor issues. All technologies allow for optional PLC controls, web-based/phone-based monitoring controls, and on-site warranty and service programs.

EXPERTISE

Over 30 years of field research and successful applications, OMI Industries has emerged as the **world's authority in natural odor elimination.**

Detailed testing data proves Ecosorb works across a variety of industrial markets. The odor-destroying powers of Ecosorb are supported by research by independent labs, universities, and olfactometry researchers. Each has proven its safety and effectiveness – something that sets Ecosorb apart from other odor control products.

Independent firms, both in the U.S. and internationally, were used to ensure accurate, unbiased results. We also continually test Ecosorb products and develop new custom blends in our state-of-the-art Research & Development center to ensure consistency, effectiveness, and quality.

The experienced engineers at OMI work with each facility to create a total odor solution, tailored to your needs. Using our years of expertise in odor control, we match your odor problem to an existing Ecosorb blend. In some cases, a custom formula is needed to battle unique odor combinations. Chemists at OMI can determine the best mix of ingredients for each odor issue.

TECHNOLOGY PROPOSAL

Quantity	Equipment Name & Description	Price
1 ea.	**A1005: 450 CFM Vapor Phase System** 480 VAC, 3 Phase, 60Hz; 6 Amps; [or 240VAC, 1 Phase, 60Hz, 15Amps] Includes: 3 Hp Blower, 4.5 GPD FMI Pump, Oil-less air compressor, 45 gallon Product storage tank, Low-Liquid Level Monitoring (Alert & Shutdown), Auto priming system, 6" Discharge outlet. Rear/Horizontal, or Vertical discharge [specify when ordering]. Heat & Insulation Package for 450 CFM Unit. Integrated Panel Timer for 450 CFM Unit, (Specify 24Hr Mech. Pin or 7D/24Hr Digital). VAPOR PHASE EXTENDED ON-SITE SERVICE WARRANTY: Onsite parts and labor. Also includes 3-year service and maintenance with four onsite visits per year from date of shipment. This System is capable of an Ecosorb output of 0.1 - 4.5 gallons per 24-hour period.	$35,765.00
1 ea.	**A1101: 1200 CFM Vapor Phase System with PLC Controls** 480 VAC, 3 Phase, 60 Hz; 11 Amps Includes: 7.5 Hp Blower, 12 GPD Micropump output range 2.0-12.0 GPD, Oil-less air compressor, built-in Timer, Autoprime, Analog Low liquid level monitoring, Remote [Cellular] Monitoring (with Control) via PC or Smart device. Rear discharge (8in pipe flange). Tote Connection. (Tote) Heat & Insulation Package for 1200 CFM VP Units (Includes Tote Heater & Cover Set). **Option**: Wind Sensor/Control; PLC Systems VAPOR PHASE EXTENDED ON-SITE SERVICE WARRANTY: Onsite parts and labor. Also includes 3-year service and maintenance with four onsite visits per year from date of shipment. This system is capable of an ECOSORB output of 2.0 to 12.0 gallons per 24-hour period.	$53,995.00 $2,995.00
1 ea.	55 Gallon Drum of Ecosorb 606 for A1005 450 CFM	$2,158.00
1 ea.	275 Gallon Tote of Ecosorb 606 for A1101 1200 CFM	$9,505.00
	GRAND TOTAL OF EQUIPMENT WITH WIND SENSOR, WARRANTY, AND ECOSORB:	$104,418.00
	GRAND TOTAL OF EQUIPMENT WITHOUT WIND SENSOR, WARRANTY, AND ECOSORB:	$101,423.00

UTILITY REQUIREMENTS

UTILITY REQUIREMENTS OF 450 CFM VAPOR PHASE:

- System required 480 VAC, 3 Phase, 60 Hz, 10 Amp Power Supply or 240VAC, 1 Phase, 60 Hz, 25 Amp Power Supply.
- Customer will be responsible to provide utility power source to the system.
- Customer will be responsible for installation of purchased PVC/Vapor Line.

UTILITY REQUIREMENTS OF 1200 CFM VAPOR PHASE WITH PLC CONTROLS:

- System requires 480 VAC, 3 Phase, 60 Hz; 20Amp Electrical Power Supply
- Customer will be responsible to provide utility power source to the system.
- Customer responsible for system installation.
- Customer will be responsible for installation of purchased PVC/Vapor Line.

SYSTEM LOCATION REQUIREMENTS FOR 450 CFM VAPOR PHASE:

- System requires an area of 62”x 48”x 43.5” height. Weight is 600lbs.

SYSTEM LOCATION REQUIREMENTS FOR 1200 CFM WITH PLC CONTROLS:

- Unit should be located indoors or outside under shelter and protected from the elements.
- ECOSORB is water-based and will freeze @ <32F. System & Product must be freeze protected.
- System dimensions: 56” L x 48” W x 79” H. Weight: 910 lbs.
    - Shipping Crate Size: 75” L x 69” W x 79” H. Weight: 1260 lbs.

NOTES

- Please allow for approximately *****8-12 weeks lead time.
    - ***** Lead-time is subject to change due to uncertainties in the ever-changing workplace climate due to COVID-19.
- Purchasing Terms: 25% down payment before equipment ships.
- Balance due within 30 days with approved Net 30 terms.
- All prices are FOB Rising Sun, Indiana.
- Prices shown do not include freight and taxes.
- All prices are USD.
- Pricing is valid for 90 days from the date of proposal.
- Vapor System ducting is not included in this proposal.
- All Vapor System ducting will be purchased by customer locally.

EQUIPMENT PHOTOS

Exterior Photo of 450 CFM Vapor Phase

Optional Wind Sensor/ Control

1200 CFM Vapor Phase System with PLC Controls

EQUIPMENT DRAWING

PRODUCT WARRANTY

Products manufactured by OMI Industries, Inc. bear the following limited warranty:
The seller warrants that the goods to be delivered will be of the kind and quality described in the proposal, purchase order, or contract and will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within one (1) year after the initial date of delivery, the seller shall, upon notification thereof and substantiation that the goods have been stored, installed, maintained, and operated in accordance with the seller's operational manual and standard industry practice, correct such defect by suitable repair or replacement at the seller's expense. This warranty is limited to repairing or replacing products which the manufacturer's investigation shows were defective at the time of shipment by the manufacturer.

All products subject to this warranty shall be returned for examination, repair, or replacement freight prepaid to:

OMI Industries, Inc. (Equipment Division)
1300 Barbour Way
Rising Sun, IN 47040

This warranty is exclusive and is in lieu of any warranty or merchant ability, fitness for a particular purpose or other warranty of quality, whether expressed or implied, except of title and against patent infringement. Correction of non-conformities, in the manner and for the period of the time provided above, shall constitute fulfillment of all liabilities of the seller to the purchaser with respect to, or arising out of the good, whether based on contract negligence, strict tort or otherwise.

LIMITATION OF LIABILITIES

Repair or replacement of defective products as provided above is the sole and exclusive remedy provided hereunder and the seller shall not under any circumstances be liable for special or consequential damages such as, but not limited to, damage or loss of other property or equipment, loss of profits, or revenue, cost of capital, cost of purchased or replacement goods, or claims customers of the purchaser for service interruptions. The remedies of the purchaser set forth are exclusive and the liability of seller with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale delivery, resale, installation, or use of any goods covered by or furnished under this contract whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liabilities based. This is the only warranty on any OMI Industries product. No other writing, or description, in the literature shall be construed as a warranty.

Products manufactured by another entity (other than OMI Industries), bear the following limited warranty: Seller warrants that the goods manufactured by others will conform to the description herein stated. No other warranty expressed or implied is made, and warranty of the manufacturer is hereby assigned and transferred to the buyer. Furthermore, except for the manufacturer's warranty, if any, the products sold hereunder are sold as is. OMI Industries is not liable for any incidental or consequential damages in connection with these products.

ECOSORB 606

Safety Data Sheet
according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations
Date of issue: 04/07/2017 Revision date: 11/07/2017 Supersedes: 04/07/2017 Version: 1.1

SECTION 1: Identification

1.1. Identification

Product form : Mixture

Product name : ECOSORB 606

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Odor Neutralizer

Recommended use : Odor Neutralizer

Restrictions on use : None known

1.3. Details of the supplier of the safety data sheet

Manufacturer
OMI Industries
1300 Barbour Way
Rising Sun, IN 47040 - U.S.A
T 1-847-304-9111

1.4. Emergency telephone number

Emergency number : 1-800-662-6367, Monday - Friday 8 am to 5 pm CST

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

2.3. Other hazards

Other hazards not contributing to the classification : None under normal conditions. Keep out of reach of children.

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/Information on ingredients

3.1. Substances

3.2. Mixtures

This mixture does not contain any substances to be mentioned according to the criteria of section 3.2 of HazCom 2012

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Call a poison center/doctor/physician if you feel unwell.

First-aid measures after inhalation : Move to fresh air if necessary.

First-aid measures after skin contact : Wash skin with plenty of water.

First-aid measures after eye contact : Rinse eyes with water as a precaution.

First-aid measures after ingestion : Call a poison center/doctor/physician if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects : None under normal use.

Symptoms/effects after inhalation : No effects known.

Symptoms/effects after skin contact : No effects known.

Symptoms/effects after eye contact : No effects known.

Symptoms/effects after ingestion : No effects known.

Symptoms/effects upon intravenous administration : No other effects known.

Chronic symptoms : No effects known.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Dry powder. Foam. Carbon dioxide.

Unsuitable extinguishing media : No unsuitable extinguishing media known.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Not flammable.

Reactivity : The product is non-reactive under normal conditions of use, storage and transport.

5.3. Advice for firefighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety.

Protection during firefighting : Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Absorb spillage to prevent material-damage.

6.1.1. For non-emergency personnel

Protective equipment : Gloves and safety glasses recommended. Gloves and safety glasses recommended.

Emergency procedures : Ventilate spillage area.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Avoid release to the environment. Prevent liquid from entering sewers, watercourses, underground or low areas.

6.3. Methods and material for containment and cleaning up

For containment : Collect spillage.

Methods for cleaning up : Take up liquid spill into absorbent material.

Other information : Dispose of materials or solid residues at an authorized site.

6.4. Reference to other sections

For further information refer to section 13. For further information refer to section 8: "Exposure controls/personal protection".

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Not expected to present a significant hazard under anticipated conditions of normal use.

Precautions for safe handling : Ensure good ventilation of the work station. Wear personal protective equipment.

Hygiene measures : Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Does not require any specific or particular technical measures.

Storage conditions : Store in a well-ventilated place. Keep cool.

Incompatible products : Oxidizing agent. Strong acids.

Incompatible materials : Keep away from strong acids and strong oxidizers.

Storage temperature : 4 - 29 °C 40°F and 85°F Allowing product to freeze may cause layering.

Information on mixed storage : KEEP SUBSTANCE AWAY FROM: (strong) acids. oxidizing agents.

Storage area : Keep container in a well-ventilated place. Store in a cool area. Keep out of direct sunlight. Store in a well-ventilated place.

Special rules on packaging : Keep only in original container.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.2. Exposure controls

Appropriate engineering controls : Ensure good ventilation of the work station.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment : Gloves and safety glasses recommended.

Hand protection : Protective gloves. Recommended.

Eye protection : Safety glasses. Recommended.

Skin and body protection : None under normal use.

Respiratory protection : Respiratory protection not required in normal conditions.

Thermal hazard protection : Not applicable.

Environmental exposure controls : Avoid release to the environment.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Appearance	: White liquid.
Color	: White
Odor	: Characteristic odour
Odor threshold	: No data available
pH	: 5.5 - 8
Melting point	: Not applicable
Freezing point	: < 0 °C
Boiling point	: ≈ 97 °C
Flash point	: No data available
Relative evaporation rate (butyl acetate=1)	: No data available
Flammability (solid, gas)	: Not applicable.
Vapor pressure	: No data available
Relative vapor density at 20 °C	: No data available
Relative density	: ≈ 0.99
Solubility	: Soluble in water.
Partition coefficient n-octanol/water	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Viscosity, kinematic	: ≈ 1 cSt
Viscosity, dynamic	: No data available
Explosion limits	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is non-reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.5. Incompatible materials

Oxidizing agent. Strong acids.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure : Skin and eye contact

Acute toxicity : Not classified

ECOSORB 606	
LD50 oral rat	> 50 g/kg
LD50 dermal rat	> 50 g/kg

Skin corrosion/irritation : Not classified
pH: 5.5 - 8

Serious eye damage/irritation : Not classified
pH: 5.5 - 8

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity – single exposure : Not classified

Specific target organ toxicity – repeated exposure : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : No other effects known.

Symptoms/effects after inhalation : No effects known.

Symptoms/effects after skin contact : No effects known.

Symptoms/effects after eye contact : No effects known.

Symptoms/effects after ingestion : No effects known.

Symptoms/effects upon intravenous administration : No other effects known.

Chronic symptoms : No effects known.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : The product is not considered harmful to aquatic organisms or to cause long-term adverse effects in the environment.

ECOSORB 606	
LC50 fish 1	> 1000 mg/l
EC50 Daphnia 1	> 1000 mg/l

12.2. Persistence and degradability

ECOSORB 606	
Persistence and degradability	Readily biodegradable in water.

12.3. Bioaccumulative potential

ECOSORB 606	
Bioaccumulative potential	No bioaccumulation data available.

12.4. Mobility in soil

ECOSORB 606	
Ecology - soil	The product is predicted to have high mobility in soil. Soluble in water.

12.5. Other adverse effects

Effect on the global warming : No known effects from this product.

GWPmix comment : No known effects from this product.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Regional legislation (waste) : Disposal must be done according to official regulations.

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Sewage disposal recommendations : Disposal must be done according to official regulations.

Product/Packaging disposal recommendations : Avoid release to the environment.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Not regulated

Transportation of Dangerous Goods

Not regulated

Transport by sea

Not regulated

Air transport

Not regulated

SECTION 15: Regulatory information

15.1. US Federal regulations

ECOSORB 606
Not subject to reporing requirements of the United States SARA Section 313 Listed on the United States TSCA (Toxic Substances Control Act) inventory

ALL COMPONENTS OF THIS PRODUCT ARE LISTED, OR EXCLUDED FROM LISTING, ON THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY

15.2. International regulations

CANADA

ECOSORB 606	
Listed on the Canadian DSL (Domestic Substances List)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

ECOSORB 606
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)- Directive 79/831/EEC, sixth Amendment of Directive 67/548/EEC (dangerous substances) Listed on ELINCS (European List of Notified Chemical Substances)

National regulations

ECOSORB 606
Listed on the Korean ECL (Existing Chemicals List) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the AICS (Australian Inventory of Chemical Substances) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on KECI (Korean Existing Chemicals Inventory)

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer, developmental and/or reproductive harm

SECTION 16: Other information

Revision date	:	11/07/2017
Data sources	:	This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200.
Training advice	:	Normal use of this product shall imply use in accordance with the instructions on the packaging.
Other information	:	None.

ABBREVIATIONS AND ACRONYMS:	
SDS	Safety Data Sheet
IMDG	International Maritime Dangerous Goods
IATA	International Air Transport Association

Hazard Rating

Health	:	0 Minimal Hazard - No significant risk to health
Flammability	:	0 Minimal Hazard - Materials that will not burn
Physical	:	0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.
Personal protection	:	B B - Safety glasses, Gloves

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product

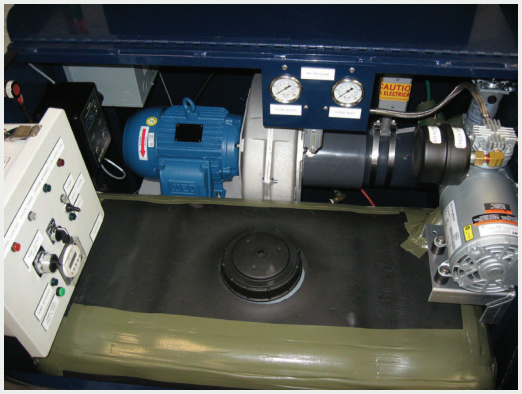
ECOSORB
Natural Industrial Odor Solutions

Vapor Phase 450

A Simple, Efficient, and Economical Delivery System for Ecosorb Odor Neutralizer

Model 450

Model 450 (PLC)



APPLICATIONS

- Petrochemical Plants
- Foundries
- Food Processors
- Wastewater Treatment
- Agriculture
- Landfills
- Pulp & Paper
- Soil Remediation
- And More

To combat strong odors outdoors, the standard 450 Vapor Phase unit is fully encased in durable steel. The optional PLC model is open, for easy pairing with an Ecosorb® 55 gallon drum or 275 gallon tote, and includes color touch screen controls. Each unit delivers continuous dry vapor to eliminate airborne odors from any industrial source.

BENEFITS

- No added water required
- Simple to install, operate & maintain
- Smaller droplets, more absorption
- Flexible & efficient
- Reduced capital expense
- Requires no mixing or dilution
- Zero nozzle maintenance in the distribution system

	Model 450	Model 450 (PLC)
Technical		
Framing	Enclosed	Open with corner protectors
Power	480V, 3 Phase, 60Hz, 4.5 Amps	480V, 3 Phase, 60Hz, 6 Amps
Dimensions	42” x 42” x 36”; 600lbs	44” x 36” x 68”; 600lbs
Blower	3 HP standard blower	3 HP standard blower
Blower Specs	450 CFM @ 15 IWG Static Pressure	450 CFM @ 15 IWG Static Pressure
Blower Outlet Size	6”	6”
Features		
Controls	Conventional	Allen Bradley PLC w/ color touch screen
Product Capacity	45 Gallon (on board tank)	55 Gallon (Drum) or 275 Gallon (Tote)
Liquid Delivery	0.1 - 4.5 GPD	1.0 - 4.5 GPD
Low Liquid Level	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert
Priming	Push to prime	Auto prime
Intake	Filtered	Filtered + Clean Indicator
Monitoring	-	• Air & Liquid Pressure • Motor Current & Overload • Liquid Flow • Running Time
Options		
Timer	Digital, Mechanical, Flip-flop	Included
Discharge Outlet Orientation	Rear Horizontal or Vertical	Rear Horizontal or Vertical
Extendable Intake	Side, Back, or Front	Side, Back, or Front
Remote Monitoring	With or W/O Auto Control	With or W/O Auto Control
Alternate Voltage	✓	✓
Wind Direction Optimization	✓	✓
Plant Air Setup	✓	✓
High Pressure Static Version	✓	✓
Blower Motor Soft Start	✓	✓
Freeze Protection Package	✓	✓
Explosion Proof Package	✓	
Sound Insulation Package	✓	
Alternate Blower/Motor Size	✓	✓
Valve Control		✓
Air Flow Indicator		✓

			Static Pressure (IWG)				Single Branch		2 Equal Branches	
Unit Model	Product Uptake (Max)	Actual Airflow Max (CFM) @FLA	@Rated CFM	@FLA	Unit Blower Outlet Pipe Size(in.)	Duct Pipe Dia. (in.)	Pressure Loss/ 100ft (IWG)*	Max. Duct Length (ft.)	Pressure Loss/ 100ft (IWG)*	Max Duct Length (Ft) [TOTAL LENGTH]
450	4.5 GPD	800	14.8	11.6	6	4	20.0	-	10.0	300
						6	4.0	450	1.5	1800
						8	1.0	1200	0.35	7500

ECOSORB®
Natural Industrial Odor Solutions

Vapor Phase 600 & 1200

A Simple, Efficient, and Economical Delivery System for Ecosorb Odor Neutralizer

Model 600

APPLICATIONS

- Petrochemical Plants
- Foundries
- Food Processors
- Wastewater Treatment
- Agriculture
- Landfills
- Pulp & Paper
- Soil Remediation
- And More

For large indoor or outdoor areas, the 600 and 1200 Vapor Phase units were designed to control the toughest industrial odors. Each unit is customizable with optional features to meet any application, including the ability to pair with an Ecosorb® 55 gallon drum or 275 gallon tote. Both models are capable of integrating with a color touch screen Programmable Logic Controller (PLC) for increased output control and monitoring.

BENEFITS

- No added water required
- Simple to install, operate & maintain
- Smaller droplets, more absorption
- Flexible & efficient
- Reduced capital expense
- Requires no mixing or dilution
- Zero nozzle maintenance in the distribution system

	Model 600	Model 1200	600 PLC	1200 PLC
		Technical		
Framing	Open	Open	Open with corner protectors	
Power	480V, 3 Phase, 60Hz, 8 Amps	480V, 3 Phase, 60Hz, 10 Amps	Same as Non-PLC	
Dimensions	71" x 36" x 48"; 930lbs	71" x 36" x 48"; 930lbs	71" x 36" x 48"; 930lbs	
Blower	5 HP	7.5 HP	Same as Non-PLC	
Blower Specs	600 CFM @ 19 IWG Static Pressure	1200 CFM @ 21 IWG Static Pressure	Same as Non-PLC	
Blower Outlet Size	6"	8"	Same as Non-PLC	
		Features		
Controls	Conventional	Conventional	Allen Bradley PLC w/ color touch screen	
Product Capacity	55 gal (Drum) or 275 gal (Tote)	55 gal (Drum) or 275 gal (Tote)	Same as Non-PLC	
Liquid Delivery	0.1 - 6 GPD	0.1 - 12 GPD	1.5 - 6 GPD	2.5 - 12 GPD
Low Liquid Level	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert	
Priming	Push to prime	Push to prime	Auto prime	
Intake	Filtered	Filtered	Filtered + Clean Indicator	
Monitoring	-	-	• Air & Liquid Pressure • Motor Current & Overload • Liquid Flow • Running Time	
		Options		
Timer	Multi-Event	Multi-Event	Included	
Extendable Intake	Side, Back, or Front	Side, Back, or Front	Side, Back, or Front	
Discharge Outlet Orientation	Rear Horizontal or Vertical	Rear Horizontal or Vertical	Rear Horizontal or Vertical	
Remote Monitoring	With or W/O Auto Control	With or W/O Auto Control	With or W/O Auto Control	
Alternate Voltage	✓	✓	✓	
Wind Direction Optimization	✓	✓	✓	
Plant Air Setup	✓	✓	✓	
High Pressure Static Version	✓	✓	✓	
Blower Motor Soft Start	✓	✓	✓	
Freeze Protection Package	✓	✓	✓	
Explosion Proof Package	✓	✓		
Alternate Blower/Motor Size	✓	✓	✓	
Valve Control			✓	
Air Flow Indicator			✓	

			Static Pressure (IWG)				Single Branch		2 Equal Branches	
Unit Model	**Product Uptake (Max)**	**Actual Airflow Max (CFM) @FLA**	**@Rated CFM**	**@FLA**	**Unit Blower Outlet Pipe Size(in.)**	**Duct Pipe Dia. (in.)**	**Pressure Loss/ 100ft (IWG)***	**Max. Duct Length (ft.)**	**Pressure Loss/ 100ft (IWG)***	**Max Duct Length (Ft) [TOTAL LENGTH]**
1200	12 GPD	1650	20.6	18.9	8	6	13.0	150	5.0	750
						8	4.0	500	1.2	3200
						10	1.3	1500	0.35	10000
600	6 GPD	1080	17.6	15.6	6	6	7.0	250	1.8	1725
						8	1.5	1000	0.45	6900
						10	0.5	4000	0.14	15000

ECOSORB
Natural Industrial Odor Solutions

BLACK AND VEATCH

May 14, 2021 | Proposal #20210514BAV

Project: Inframark- Witcher North EQ Basin

PROPOSAL BY

Greg Gandy
Ecosorb OMI Industries
220 N. Smith St., Suite 315
Palatine, IL 60067
(888) 201-3182
ggandy@omi-industries.com | (281) 705-2130

PRESENTED TO

Ulrich Bazemo
Black and Veatch
bazemouyy@bv.com| (301) 556-5376

CONTENTS

INTRODUCTION

ABOUT ECOSORB AND OMI INDUSTRIES

OMI Industries specializes in developing natural solutions to control industrial odors, based on our powerful chemistry, innovative technology, and proven expertise.

The line of Ecosorb® products and delivery equipment eliminate industrial odors without the use of harsh or hazardous ingredients, expensive emission control systems, or masking fragrances. For virtually every odor, every industry, every plant, factory, or facility, there is an Ecosorb odor removing solution.

CHEMISTRY

Ecosorb uses simple science — adsorption, absorption, gas solubility, reaction, and biodegradation — to harness the power of plant oils as natural odor removers. Our proprietary blends are developed in lab settings to tackle specific or broad-spectrum odors.

Ecosorb is strong enough to battle the toughest smells (from landfills to refineries to wastewater treatment facilities), yet safe for people and the environment. Its plant-based formula is non-toxic and does not rely on harmful chemicals to be effective.

TECHNOLOGY

Based on the environment and odor type, Ecosorb is available as water-based, gel, or additive formulas. The experienced engineers at OMI have designed and built a range of delivery systems, tested and proven to remove odors in many industries.

Odor & Gas Testing

On-site odor quantification and composition testing available with Nasal Ranger and Scentroid unit. In-house gas testing is also available using our expertly calibrated gas chromatography-mass spectrometer (GCMS).

Equipment

We manufacture and customize equipment to deliver Ecosorb, based on each application and its environment — weather, delivery method, output volume, and more. Ecosorb delivery systems fully integrate with your existing equipment and processes. Our engineers work with your team to install and maintain a complete odor solution. We also develop and build made-to-order solutions, tailored to your unique odor issues. All technologies allow for optional PLC controls, web-based/phone-based monitoring controls, and on-site warranty and service programs.

EXPERTISE

Over 30 years of field research and successful applications, OMI Industries has emerged as the world's authority in natural odor elimination.

Detailed testing data proves Ecosorb works across a variety of industrial markets. The odor-destroying powers of Ecosorb are supported by research by independent labs, universities, and olfactometry researchers. Each has proven its safety and effectiveness – something that sets Ecosorb apart from other odor control products.

Independent firms, both in the U.S. and internationally, were used to ensure accurate, unbiased results. We also continually test Ecosorb products and develop new custom blends in our state-of-the-art Research & Development center to ensure consistency, effectiveness, and quality.

The experienced engineers at OMI work with each facility to create a total odor solution, tailored to your needs. Using our years of expertise in odor control, we match your odor problem to an existing Ecosorb blend. In some cases, a custom formula is needed to battle unique odor combinations. Chemists at OMI can determine the best mix of ingredients for each odor issue.

TECHNOLOGY PROPOSAL

Quantity	Equipment Name & Description	Price
1 ea.	A1101: 1200 CFM Vapor Phase System with PLC Controls 480 VAC, 3 Phase, 60 Hz; 11 Amps Includes: 7.5 Hp Blower, 12 GPD Micropump output range 2.0-12.0 GPD, Oil-less air compressor, built-in Timer, Autoprime, Analog Low liquid level monitoring, Remote [Cellular] Monitoring (with Control) via PC or Smart device. Wind Sensor/Control; PLC Systems. Rear discharge (8in pipe flange). Tote Connection. (Tote) Heat & Insulation Package for 1200 CFM VP Units (Includes Tote Heater & Cover Set). VAPOR PHASE EXTENDED ON-SITE SERVICE WARRANTY: Onsite parts and labor. Also includes 3-year service and maintenance with four onsite visits per year from date of shipment. This system is capable of an ECOSORB output of 2.0 to 12.0 gallons per 24-hour period.	$56,990.00
1 ea.	275 Gallon Tote of Ecosorb 606	$9,505.00
	GRAND TOTAL OF EQUIPMENT, WARRANTY, AND ECOSORB:	$66,495.00

UTILITY REQUIREMENTS

UTILITY REQUIREMENTS OF 1200 CFM VAPOR PHASE WITH PLC CONTROLS:

- System requires 480 VAC, 3 Phase, 60 Hz; 20Amp Electrical Power Supply
- Customer will be responsible to provide utility power source to the system.
- Customer responsible for system installation.
- Customer will be responsible for installation of purchased PVC/Vapor Line.

SYSTEM LOCATION REQUIREMENTS FOR 1200 CFM WITH PLC CONTROLS:

- Unit should be located indoors or outside under shelter and protected from the elements.
- ECOSORB is water-based and will freeze @ <32F. System & Product must be freeze protected.
- System dimensions: 56" L x 48" W x 79" H. Weight: 910 lbs.
    - Shipping Crate Size: 75" L x 69" W x 79" H. Weight: 1260 lbs.

NOTES

- Please allow for approximately *8-12 weeks lead time.
    - * Lead-time is subject to change due to uncertainties in the ever-changing workplace climate due to COVID-19.
- Purchasing Terms: 25% down payment ($14,247.50) before equipment ships.
- Balance due within 30 days with approved Net 30 terms.
- All prices are FOB Rising Sun, Indiana.
- Prices shown do not include freight and taxes.
- All prices are USD.
- Pricing is valid for 90 days from the date of proposal.
- Vapor System ducting is not included in this proposal.
- All Vapor System ducting will be purchased by customer locally.

EQUIPMENT PHOTOS

1200 CFM Vapor Phase System
with PLC Controls

ECOSORB®
Natural Industrial Odor Solutions

Vapor Phase 600 & 1200

A Simple, Efficient, and Economical Delivery System for Ecosorb Odor Neutralizer

Model 600

APPLICATIONS

- Petrochemical Plants
- Foundries
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- Landfills
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- And More

For large indoor or outdoor areas, the 600 and 1200 Vapor Phase units were designed to control the toughest industrial odors. Each unit is customizable with optional features to meet any application, including the ability to pair with an Ecosorb® 55 gallon drum or 275 gallon tote. Both models are capable of integrating with a color touch screen Programmable Logic Controller (PLC) for increased output control and monitoring.

BENEFITS

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	Model 600	Model 1200	600 PLC	1200 PLC
		Technical		
Framing	Open	Open	Open with corner protectors	
Power	480V, 3 Phase, 60Hz, 8 Amps	480V, 3 Phase, 60Hz, 10 Amps	Same as Non-PLC	
Dimensions	71" x 36" x 48"; 930lbs	71" x 36" x 48"; 930lbs	71" x 36" x 48"; 930lbs	
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Product Capacity	55 gal (Drum) or 275 gal (Tote)	55 gal (Drum) or 275 gal (Tote)	Same as Non-PLC	
Liquid Delivery	0.1 - 6 GPD	0.1 - 12 GPD	1.5 - 6 GPD	2.5 - 12 GPD
Low Liquid Level	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert	Monitoring + Shut off + Alert	
Priming	Push to prime	Push to prime	Auto prime	
Intake	Filtered	Filtered	Filtered + Clean Indicator	
Monitoring	-	-	• Air & Liquid Pressure • Motor Current & Overload • Liquid Flow • Running Time	
		Options		
Timer	Multi-Event	Multi-Event	Included	
Extendable Intake	Side, Back, or Front	Side, Back, or Front	Side, Back, or Front	
Discharge Outlet Orientation	Rear Horizontal or Vertical	Rear Horizontal or Vertical	Rear Horizontal or Vertical	
Remote Monitoring	With or W/O Auto Control	With or W/O Auto Control	With or W/O Auto Control	
Alternate Voltage	✓	✓	✓	
Wind Direction Optimization	✓	✓	✓	
Plant Air Setup	✓	✓	✓	
High Pressure Static Version	✓	✓	✓	
Blower Motor Soft Start	✓	✓	✓	
Freeze Protection Package	✓	✓	✓	
Explosion Proof Package	✓	✓		
Alternate Blower/Motor Size	✓	✓	✓	
Valve Control			✓	
Air Flow Indicator			✓	

			Static Pressure (IWG)				Single Branch		2 Equal Branches	
Unit Model	**Product Uptake (Max)**	**Actual Airflow Max (CFM) @FLA**	**@Rated CFM**	**@FLA**	**Unit Blower Outlet Pipe Size(in.)**	**Duct Pipe Dia. (in.)**	**Pressure Loss/ 100ft (IWG)***	**Max. Duct Length (ft.)**	**Pressure Loss/ 100ft (IWG)***	**Max Duct Length (Ft) [TOTAL LENGTH]**
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						8	1.5	1000	0.45	6900
						10	0.5	4000	0.14	15000

ECOSORB
Natural Industrial Odor Solutions

ECOSORB® 606

A Simple, Efficient, and Economical Delivery System for Ecosorb Odor Neutralizer

Ecosorb® 606 is a broad spectrum odor neutralizer that can be diluted with water or used neat depending on application and delivery equipment. The product is commonly atomized into odorous process air, but can also be added to water tolerant resins, sludge, and the like to suppress the release of malodor. Given its effective strength, dilution with water ranges from roughly 1 part in 20 of water to 1 part in 400 of water and even higher. The product is a blend of plant oils, food grade surfactants, and purified water. It can be diluted with water and/or less polar solvents such as 2-propanol without expected reactions. When diluted with water, it forms a stable but weak emulsion. Whether used neat or if diluted with water, the product is safe to handle and can be disposed of down the drain.

FEATURES

- True odor neutralizer
- Biodegradable and non-toxic
- Environmentally friendly
- No measurable flash point
- Scientifically proven

ADVANTAGES

- Absorbs, reacts, and removes odors without masking
- Usually no permits required
- Safe for employees and neighbors
- Safe for all environments
- It performs as advertised

PHYSICAL PROPERTIES

pH:	~6 (see note below)
Specific gravity:	~0.99
Boiling point:	~208°F
Appearance:	milky white
Odor:	slight citrus and floral

pH note: Ecosorb 606 is made with purified water therefore having little ionic activity. Common pH instruments that measure ionic activity can give false low readings in the pH 4 range.

HMIS CLASSIFICATION

Health: 0

Flammability: 0

Reactivity: 0

Protective equipment: B

ALL INGREDIENTS CAN BE FOUND LISTED ON THE FOLLOWING CHEMICAL SUBSTANCE INVENTORIES:

United States: TSCA

Canadian: DSL

European: EINECS

Australian: AICS

HANDLING AND PACKAGING

Ecosorb® 606 is shipped in HDPE containers. It is recommended that the product be stored, even if diluted, in HDPE, polypropylene or stainless steel containers. Storage containers should be kept tightly sealed, long term exposure to ambient air can affect the product and it will attract airborne particulates. During storage it should not be subjected to temperatures below 35°F or above 85°F. Allowing the product to freeze is especially damaging and will disrupt the emulsion. Extended exposure to higher temperatures may cause separation, but the emulsion can be restored through agitation or mixing. The product does not burn.

DISPOSAL AND CLEANUP

Wash with water or soap and water. The product is not hazardous to humans, animals, or the environment and can be disposed of by flushing to the drain.

CONTAINERS

Ecosorb 606 is available in the following sizes:

- 5 Gallon Pails
- 55 Gallon Drums
- 275 Gallon Containers

PRODUCT WARRANTY

Products manufactured by OMI Industries, Inc. bear the following limited warranty:
The seller warrants that the goods to be delivered will be of the kind and quality described in the proposal, purchase order, or contract and will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within one (1) year after the initial date of delivery, the seller shall, upon notification thereof and substantiation that the goods have been stored, installed, maintained, and operated in accordance with the seller's operational manual and standard industry practice, correct such defect by suitable repair or replacement at the seller's expense. This warranty is limited to repairing or replacing products which the manufacturer's investigation shows were defective at the time of shipment by the manufacturer.

All products subject to this warranty shall be returned for examination, repair, or replacement freight prepaid to:

OMI Industries, Inc. (Equipment Division)
1300 Barbour Way
Rising Sun, IN 47040

This warranty is exclusive and is in lieu of any warranty or merchant ability, fitness for a particular purpose or other warranty of quality, whether expressed or implied, except of title and against patent infringement. Correction of non-conformities, in the manner and for the period of the time provided above, shall constitute fulfillment of all liabilities of the seller to the purchaser with respect to, or arising out of the good, whether based on contract negligence, strict tort or otherwise.

LIMITATION OF LIABILITIES

Repair or replacement of defective products as provided above is the sole and exclusive remedy provided hereunder and the seller shall not under any circumstances be liable for special or consequential damages such as, but not limited to, damage or loss of other property or equipment, loss of profits, or revenue, cost of capital, cost of purchased or replacement goods, or claims customers of the purchaser for service interruptions. The remedies of the purchaser set forth are exclusive and the liability of seller with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale delivery, resale, installation, or use of any goods covered by or furnished under this contract whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liabilities based. This is the only warranty on any OMI Industries product. No other writing, or description, in the literature shall be construed as a warranty.

Products manufactured by another entity (other than OMI Industries), bear the following limited warranty: Seller warrants that the goods manufactured by others will conform to the description herein stated. No other warranty expressed or implied is made, and warranty of the manufacturer is hereby assigned and transferred to the buyer. Furthermore, except for the manufacturer's warranty, if any, the products sold hereunder are sold as is. OMI Industries is not liable for any incidental or consequential damages in connection with these products.

June 10, 2021

Lynne H. Moss, P.E, BCEE
Black & Veatch Corporation
18310 Montgomery Village Ave #750
Gaithersburg, MD 20879

RE: Oklahoma City Water Utilities Trust Chemical Odor Control Testing Report

Dear Lynne,

USP Technologies (USP) appreciates the opportunity to evaluate various odor control chemicals at the Oklahoma City Water Utilities Trusts' Deer Creek, North Canadian, and Chisholm Creek wastewater treatment plants. This report summarizes the data collected from liquid grab samples and the bench scale analysis on the sludge conducted onsite April 27 to April 29, 2021.

These biosolids bench scale tests were conducted by collecting a 5 gallon plastic bucket of sludge that was gently mixed before samples were taken. Shake tests, in which samples of feed sludge were vigorously shaken within sealed one liter containers, were used to measure the gaseous hydrogen sulfide and mercaptans from the feed sludge before and after treatment with strong oxidants. Gasses were measured using a recently calibrated H2S OdaLog from App-Tek for gaseous hydrogen sulfide and colorimetric gas detector tubes manufactured by Gastec for ethyl mercaptans and total mercaptans.

We also measured the liquid total and dissolved hydrogen sulfides, temperature, pH, and iron at the headworks and primaries at each of these wastewater treatment plants. Because of a recent rain event, many of the values measured were low and may need to be remeasured under drier conditions.

Deer Creek WWTP

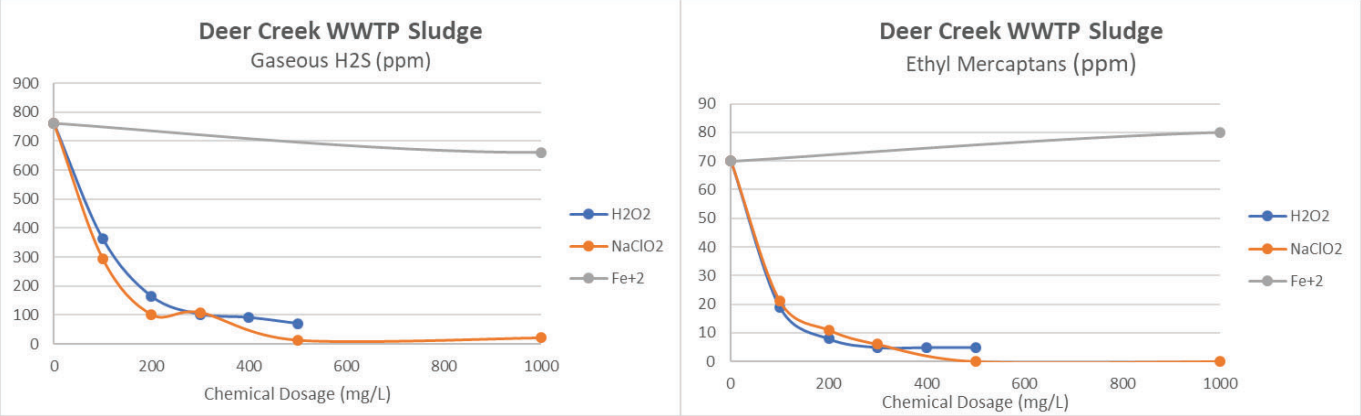
The shake tests at Deer Creek WWTP were conducted on April 29. We tested hydrogen peroxide, OC31E (sodium chlorite), and ferrous chloride. The sample we tested contained the ferrous chloride that was being added before pumping the sludge into the dewatering building. Inframark staff were unable to obtain a sludge sample without ferrous chloride. When we conducted the shake test using 500 ml on the baseline sample or sample with no additional chemicals besides the ferrous chloride, it exceeded the maximum limits on our OdaLog unit. We reduced our sample size to 100 ml. The baseline gaseous hydrogen sulfide measured 760 ppm and the ethyl mercaptans measured 70 ppm on this 100 ml sample shaken within the sealed 1 L container.

This testing showed good dose responses with both hydrogen peroxide and sodium chlorite (OC31E). Both oxidants provide effective treatment by reducing the purgeable gaseous hydrogen sulfides by > 85% and the ethyl mercaptans by > 90%. The ferrous chloride appeared to be rather ineffective. We believe the reason is the sludge pH is already very low, perhaps due to fermentative conditions developing in the process. The sludge sample we used for this testing started at pH 4.9. The results of our ferrous chloride testing are to some extent in line with what the Inframark operating staff reported to us during our walk-through. They reported that the ferrous chloride does reduce noticeable odors to an extent, but that they also have episodes of higher odor release that lead to odor complaints. They are then pressured to increase ferrous chloride dosing and find that the odors increase even further then. The results of our testing are in Table 1 and do show an increase in purgeable mercaptans with higher ferrous chloride concentrations and a very small reduction in purgeable hydrogen sulfide.

Table 1: Summary of biosolids odor survey initial oxidant dose response testing

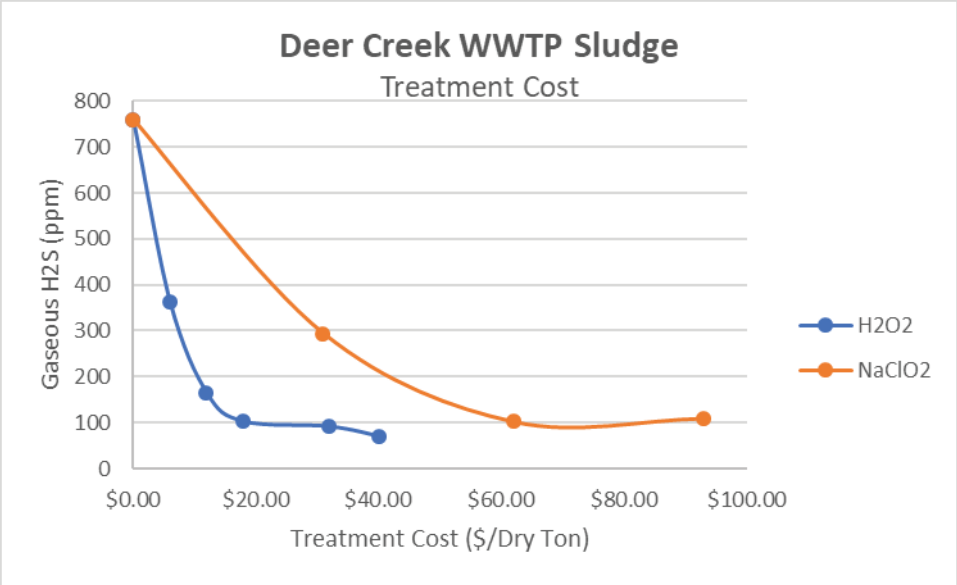
Deer Creek WWTP Sludge - Shake Test Results (ppm)						
Chemical Dosage (mg/L)	Hydrogen Peroxide (as 100% H2O2)		OC31E (as 100% NaClO2)		Ferrous Chloride (as 100% Fe+2)	
	H2S	Mercaptans	H2S	Mercaptans	H2S	Mercaptans
0	760	70	760	70	760	70
100	363	19	294	21		
200	165	7	102	11		
300	103	5	109	6		
400	92	5				
500	71	5	13	0		
1000	90	5	21	0	660	80
2000	98	5			776	80
3000	71	3			560	80

Figure 1: Graphical Summary of biosolids odor survey initial oxidant dose response testing



The results were very similar for both the hydrogen peroxide and the OC31E based on dosage of active chemical. However, the hydrogen peroxide is a more cost-effective treatment based on treatment cost. We calculated the treatment cost per dry ton of sludge using a sludge concentration of 3% and an estimate of delivered chemical cost on full service bulk deliveries. Figure 2 shows the treatment cost comparison of hydrogen peroxide and OC31E.

Figure 2: Graphical Summary of biosolids odor survey treatment costs



The estimated cost to effectively treat the Deer Creek WWTP sludge with hydrogen peroxide is between $12 and $18 per dry ton. At $18, the reduction of hydrogen sulfide is about 85%. The same treatment with OC31E is $62 per dry ton.

Figure 3: Biosolids pH and ORP with additional ferrous chloride treatment

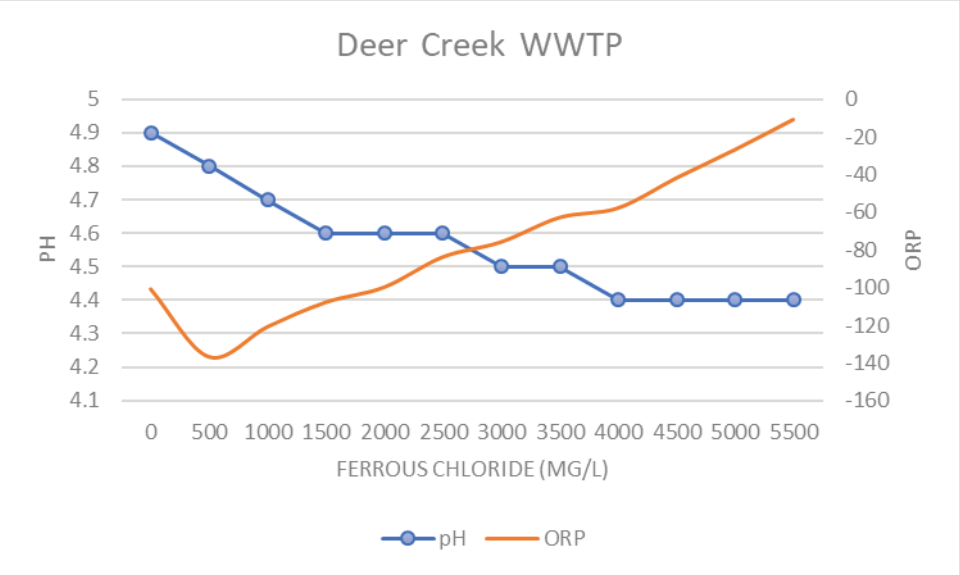


Figure 3 shows the impact of additional ferrous chloride dosing into the sludge. The starting pH is already at 4.9 which is not ideal for iron-sulfide binding. As we add additional ferrous chloride, the pH continues to drop. With lower pH the efficiency of iron-sulfide binding is also going to decline. It is possible that the current ferrous chloride dosage already exceeds the optimized dosage for odor control.

Table 2: Summary of the Deer Creek WWTP influent sewage liquid data collected

Site	Time	Temp	pH	Sulfides		T. Iron	Comments
				Total	Dissolved		
Influent Vault	10:15	65.7	8.0	0	0	0	Clear
Influent Vault	13:10	66.7	7.5	0	0	0	Clear
Primary	10:30	65.7	7.9	0	0		Clear
Primary	13:25	66.7	7.5	0	0	0	Clear
Bar Screen	10:45	66.0	6.9	0.7	0	10	Black
Bar Screen	13:40	66.5	7.2	0.1	0	4	Gray

The Deer Creek WWTP influent sewage hydrogen sulfide values were all very low and may need to be remeasured under drier conditions. Inframark staff confirmed that we were testing during a wetter period with lower influent odor levels.

North Canadian WWTP

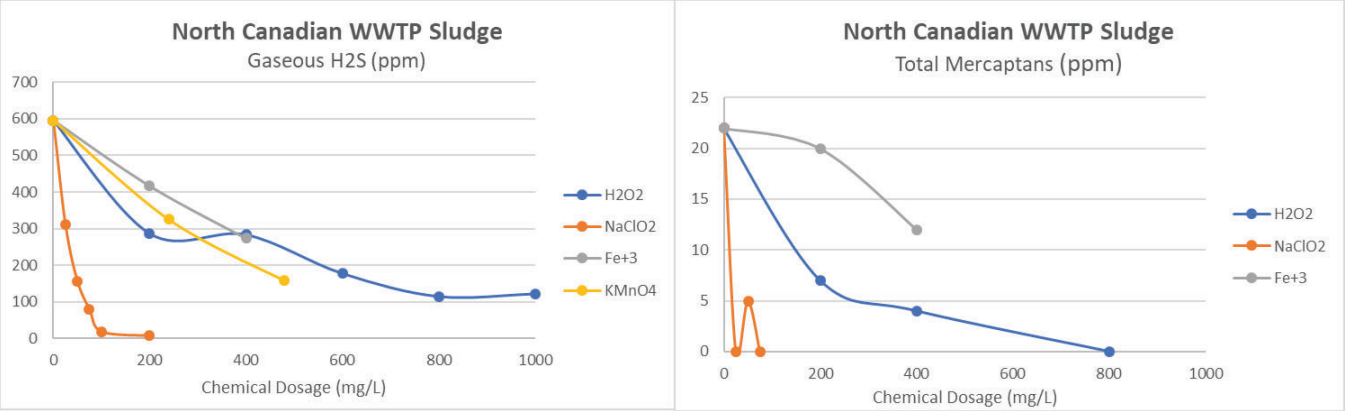
The shake tests at North Canadian WWTP were conducted on April 28. We tested hydrogen peroxide, OC31E (sodium chlorite), ferric chloride, and potassium permanganate. The sludge sample we tested was obtained before the addition of ferric chloride. We conducted the shake tests using 500 ml samples in the 1 L sealed containers. The baseline gaseous hydrogen sulfide measured 596 ppm and the total mercaptans measured 22 ppm. This sludge sample was pH 5.5

This testing showed that all chemicals reduced both the gaseous hydrogen sulfide and total mercaptans. However, the OC31E reduced the hydrogen sulfide by >98% to 8 ppm at much lower dosages. Hydrogen peroxide almost achieved 80% hydrogen sulfide treatment. The results of our testing are in Table 3.

Table 3: Summary of biosolids odor survey initial oxidant dose response testing

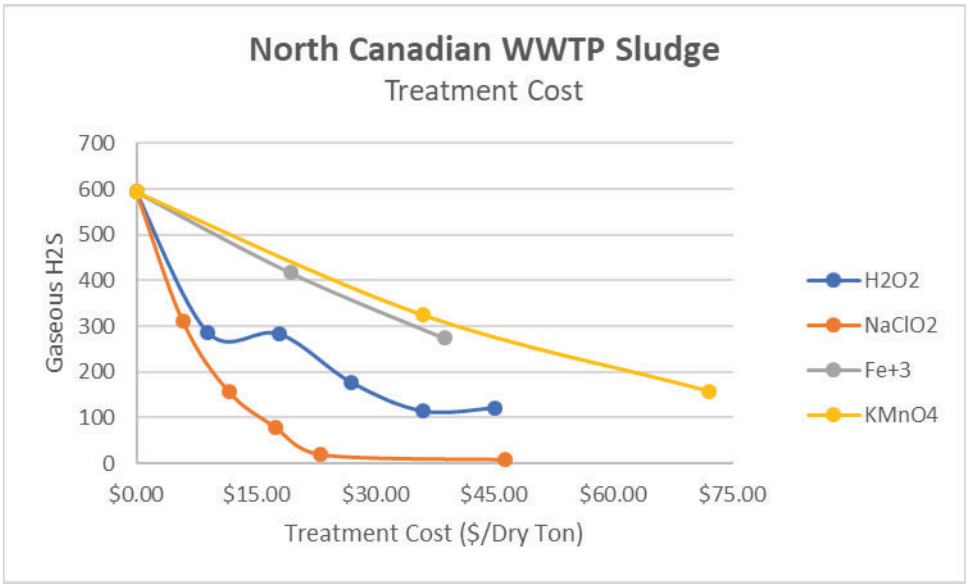
N. Canadian WWTP Sludge - Shake Test Results (ppm)								
Chemical Dosage (mg/L)	Hydrogen Peroxide (as 100% H2O2)		OC31E (as 100% NaClO2)		Ferric Chloride (as 100% Fe+3		P. Permangenate (as 100% KMnO4)	
	H2S	Mercaptans	H2S	Mercaptans	H2S	Mercaptans	H2S	Mercaptans
0	596	22	596	22	596	22	596	22
25			312	0				
50			157	5				
75			80	0				
100			19					
200	286	7	8		417	20		
240							325	
300								
400	283	4			274	12		
480							158	
500								
600	177							
700								
800	114	0						
900								
1000	121							

Figure 4: Graphical Summary of biosolids odor survey initial oxidant dose response testing



We calculated the treatment cost per dry ton of sludge using a sludge concentration of 4% and an estimate of delivered chemical cost. Figure 4 shows the treatment cost comparison of hydrogen peroxide, OC31E (sodium chlorite), and ferric chloride.

Figure 5: Graphical Summary of biosolids odor survey treatment costs



The most cost-effective treatment for the N Canadian WWTP sludge is OC31E or sodium chlorite. The cost to effectively treat the N Canadian sludge with OC31E or sodium chlorite is about $20 per dry ton which reduced hydrogen sulfide about 90%.

Figure 6: Biosolids pH and ORP with ferric chloride treatment

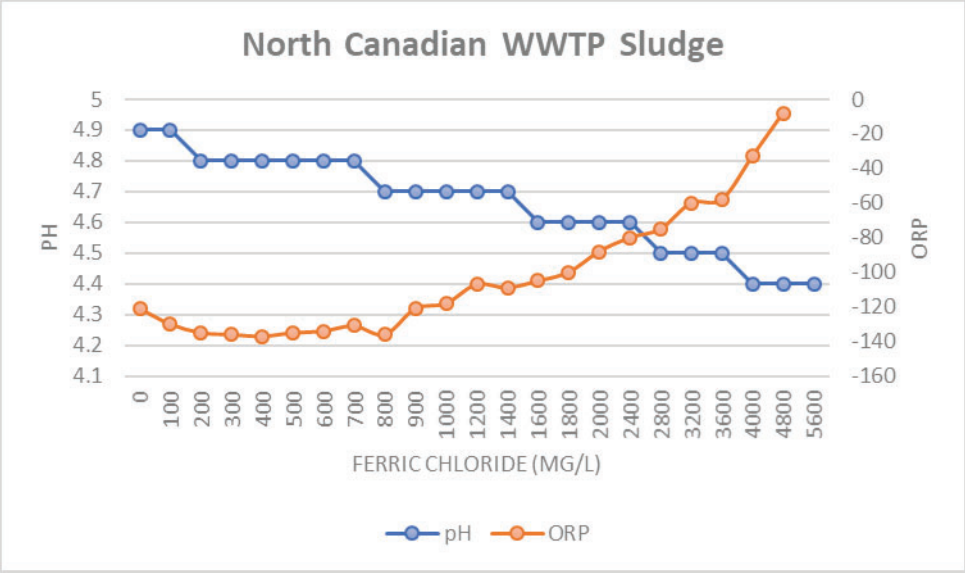


Figure 6 shows the impact on pH and ORP (Redox potential) of additional ferric chloride dosing. As we demonstrated in the sludge at Deer Creek with additional ferrous chloride in Figure 3, the pH can easily be dropped even further with increasing dosages of iron salts. Ferric chloride can oxidize sulfide and bind sulfide efficiently when pH is in the neutral to basic range, while ferrous chloride can only bind sulfide efficiently in the neutral to basic range. Under acidic conditions ferric chloride can still oxidize sulfide, but iron-sulfide binding efficiency is greatly reduced.

- Ferrous chloride reaction with hydrogen sulfide: $H_2S + FeCl_2 \rightarrow FeS + 2HCl$
- Ferric chloride reaction with hydrogen sulfide: $3\ H_2S + 2\ FeCl_3 \rightarrow S + 2\ FeS + 6\ HCl$

Table 4: Summary of the N. Canadian WWTP influent sewage liquid data collected

Site	Time	Temp	pH	Sulfides		T. Iron
				Total	Dissolved	
Influent	9:00	66.1	7.4	6.8	5.5	0.25
Influent	10:00	66.7	7.2	4.5	4	0
Influent	12:00	67.2	7.2	8	7	0
Primary Canal	9:20	66.3	7.4	0.2	0.1	1
Primary Canal	10:30	66.8	7.3	0.1	0	0
Primary Canal	12:15	67.0	7.2	2.4	0.6	0.5

These hydrogen sulfide values were taken at the wastewater treatment plant influent on April 28. Even though there was a recent rain event that may have reduced sulfide levels at the other two treatment plants, we measured at N. Canadian WWTP total sulfide levels from 4.5 to 8.0 mg/L, with an average of 6.4 mg/L. The influent samples were taken before treatment with hydrogen peroxide and the iron catalyst. After treatment, in the Primary Canal the total sulfides measured from 0.1 to 2.4 mg/L, averaging 0.9. During high hydrogen sulfide conditions, more odor control chemical may be needed.

Chisholm Creek WWTP

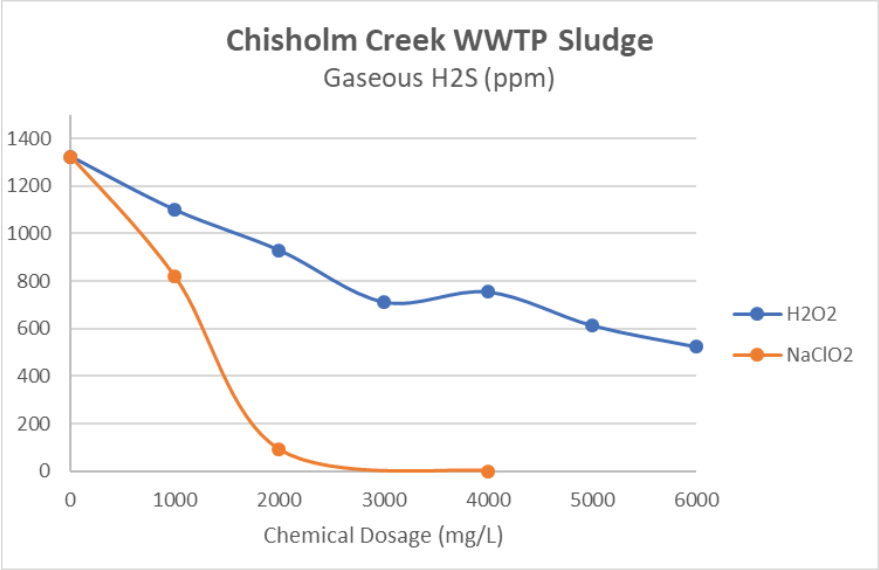
The shake tests of Chisholm Creek WWTP sludge were conducted on April 27. We tested hydrogen peroxide, OC31E (sodium chlorite), and bleach (sodium hypochlorite). Samples were obtained as the sludge was transferred out of the blend tank. When we conducted the shake test using 250 ml for the baseline sample, it exceeded the maximum limits on our OdaLog unit. Even a 100-ml sample exceeded our detection limits but we decided to use 100-ml sample because we did not believe we would get good mixing using a smaller sample size. The baseline gaseous hydrogen sulfide measured 1324 ppm with the maximum range on the instrument of 1000 ppm. This sludge sample was pH 5.5

This testing showed the sodium hypochlorite worked the best to reduce the gaseous hydrogen sulfides. The hydrogen peroxide and OC31E reduced the hydrogen sulfide but at higher dosage rates. The results of our testing are in Table 5.

Table 5: Summary of biosolids odor survey initial oxidant dose response testing

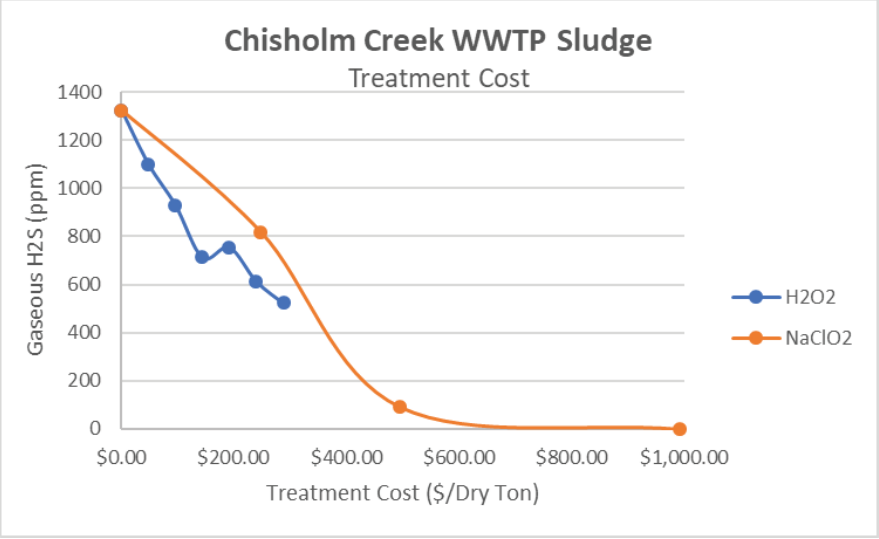
Chisholm Creek WWTP Sludge - Shake Test Results (ppm)						
Chemical Dosage (mg/L)	Hydrogen Peroxide (as 100% H2O2)		OC31E (as 100% NaClO2)		Bleach (as 100% NaClO)	
	H2S	Mercaptans	H2S	Mercaptans	H2S	Mercaptans
0	1324		1324		1324	
100					1321	
200					1316	
300					794	
400					420	
500					21	0
1000	1100		818		7	
2000	930		91		4	
3000	713					
4000	755		0			
5000	614					
6000	524					

Figure 7: Graphical Summary of biosolids odor survey initial oxidant dose response testing



We calculated the treatment cost per dry ton of sludge using a sludge concentration of 3.75% and an estimate of delivered chemical cost. Figure 8 shows the treatment cost comparison of hydrogen peroxide and OC31E.

Figure 8: Graphical Summary of biosolids odor survey treatment costs



The cost to treat this sludge is much higher than either Deer Creek or N. Canadian. Bleach, or sodium hypochlorite, was excluded from consideration because of concerns around its health and safety risks along with the potential for residuals to negatively impact the process biology when the sludge is transferred to the North Canadian plant. Hydrogen peroxide appears to have a lower treatment costs than OC31E but we stopped testing hydrogen peroxide at a concentration of 6000 mg/L. We needed to test it at higher dosage rate to compare it properly with OC31E. Hydrogen peroxide had the lowest treatment cost for the range we tested.

Table 6: Summary of the Chisholm Creek WWTP influent sewage liquid data collected

Site	Time	Temp	pH	Sulfides		T. Iron	Comments
				Total	Dissolved		
Splitter Box	11:45	67.1	7.9	0	0	0	Clear

The Chisholm Creek WWTP influent sewage hydrogen sulfide values were very low and may need to be remeasured under drier conditions.

Conclusions

Reduced sulfur compounds were found to be purgeable at relatively high concentrations at each plant, with Deer Creek and Chisholm Creek requiring us to slightly alter our standard test procedures to obtain H_2S measurements within the limits of our high range meter. Each plant's sludge was in the acidic pH range.

The results of our bench scale testing show that hydrogen peroxide is the best fit and most economic option to control sludge odors in the at Deer Creek wastewater treatment plant. We measured large reductions in both gaseous hydrogen sulfides and mercaptans. Also, the pH of the sludge was so low at pH 4.9 that we suspect the ferrous chloride may be at least at times overfed. It may be worth considering a trial in which ferrous chloride is reduced, eliminated, or injected in a different location while hydrogen peroxide is dosed immediately before the belt filter presses. It may also be worth considering switching from ferrous chloride to ferric chloride since ferric chloride can at least oxidize sulfide in the acidic pH range while both ferric chloride and ferrous chloride would struggle to efficiently bind sulfide in the acidic pH conditions found.

For the North Canadian WWTP, our sludge testing found that OC31E is the most effective treatment for controlling both gaseous hydrogen sulfides and mercaptans. OC31E is a USP chemical with an active ingredient of 31% sodium chlorite. Just like at Deer Creek, there are indications that increasing dosages of ferric chloride may drop the pH even further and potentially negatively impact odor control unintentionally.

Chisholm Creek WWTP sludge odors were treated most cost-effectively with sodium hypochlorite (bleach), but high concentrations are required. The health hazards and potential biocidal impacts to North Canadian's process when this sludge is transferred likely exclude it from consideration. Hydrogen peroxide was the next most economic option, but the dosages required for substantial odorant reductions may be so high as to be uneconomic when compared to those required for Deer Creek and North Canadian. Further jar testing may be needed to identify other potential control strategies, such as pH adjustment.

The recent rain event reduced the influent sewage hydrogen sulfide, at least at Deer Creek and Chisholm Creek. We would like to return when the weather is drier to better determine the most effective treatment program when sulfide levels are elevated and treatment needs would be expected to be higher. Typically, two weeks without rain in the area is required.

Finally, despite the rain events there was still elevated sulfide entering the North Canadian plant. The hydrogen peroxide and iron-based catalyst were confirmed to be substantially lowering total and dissolved sulfide as measured in the Primary Canal, but there were indications that higher dosing could be required to maintain acceptable H_2S concentrations at key control points.

We at USP Technologies thank you for the opportunity to examine potential chemical odor control options at these three facilities and hope that the data collected is helpful for all parties.

Sincerely,

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Territory Manager

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Ben Horne

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979-270-1070

Oklahoma City, OK
Quotation No.: 2021141
April 23, 2021

Proposal

Prepared for:

Michael Graves, PE

CP&Y

Project:

Class-B Biosolids Stabilization System

North Canadian WWTP, Oklahoma City

Engineered to Excel

350 SMC DRIVE
SOMERSET, WI 54025
PH: (715) 247-3433
FAX: (715) 247-3438
www.schwingbioset.com

A message from our President/CEO:

Thank you for your inquiry. We are honored you have chosen to discuss how a Schwing Bioset solution can solve your specific challenges. We feel you will soon discover our contributions will provide recognizable value, and our solution will provide the long-term peace of mind only felt when quality products have been selected. Along each step of the way, we are sure your confidence will build that you have made the right choice in selecting Schwing Bioset to assist with the development, design, and execution of your project.

Schwing Bioset has been solving the challenges faced by Wastewater Treatment Plants and Biosolids Management professionals for over thirty years from our simple beginnings as a piston pump supplier. Now in our fourth decade, we offer a wide range of products with best-in-class performance and reliability that we feel is unmatched by anyone in our industry.

Additionally, Schwing Bioset offers best-in-class aftermarket service and spare parts to support our ever expanding customer base. After all, without the support of quality trained service technicians and rapid spare parts delivery, the best technology in the world can't do its job if you can't turn it on.

But we aren't stopping here. Schwing Bioset continues to invest in Research & Development to continually improve our current products and to develop and identify new technology that will help sustain our Cities for the next generations to come. Reducing power demands, recovering nutrients, increased efficiency, and creating value-added products from biosolids are just a few of the many ways we are evolving from our beginnings in this business as a pump supplier.

And speaking of our business, it is guided by the Core Values shared on the following page. These values act as a beacon to guide us into the future as we grow, keeping us in line with our original goals. Also included is your list of primary contacts into our company. As you communicate your challenges and work towards a solution with us, know that each of these individuals, along with everyone else in our Company, was hired with these Core Values as a benchmark. This team of experts, collectively known as Schwing Bioset, will be working diligently to make your project a success.

Continually looking to the future, we believe the solution offered in this proposal will prove to be your most cost effective and sustainable option to implement within your project. We look forward to your favorable review and to welcoming you to the hundreds of other Wastewater Plants whom already enjoy the benefits of a Schwing Bioset solution. We are *Engineered to Excel.*

Sincerely,
Thomas Anderson
President/CEO

Core Values:

- Caring: Every employee has pride of ownership in their work with a genuine interest in our Client's success. We offer a workplace that allows a healthy balance between work and home life to inspire exceptional performance.
- Decent People: We are true professionals who respect the people we work with, both inside and outside of the company, and earn the respect of others.
- Dedicated Experts: We are comprised of the top talent in our respective fields, recruited and trained for the singular goal of contributing to the success of our Clients and our Company.
- Solutions Above and Beyond: We develop, provide, and support customer solutions that surpass our Client's expectations.
- Absolute Customer Satisfaction: We sleep well knowing our customers are happy.

Your Schwing Bioset, Inc. Contacts:

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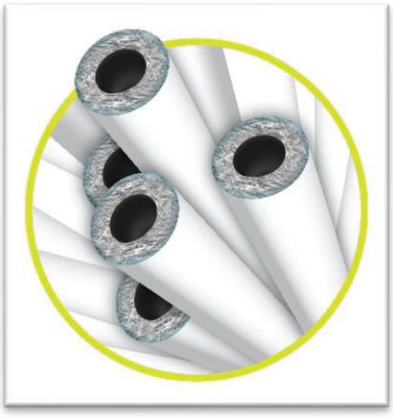
***** Introducing Schwing Bioset's Newest Product Offering *****

Membrane Bioreactor (MBR) Technology

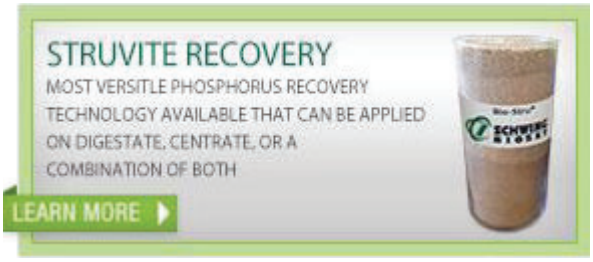
Schwing Bioset is proud to announce our newest product, an end-free hollow fiber PVDF MBR offered under license from Econity. Econity has over 2,000 installations worldwide and offers a unique cartridge design that assembles into larger cassettes. Because of this flexibility the dimensions can be easily adjusted to enable easy retrofits into existing installations of other technologies. The end-free hollow fiber design boasts:

- Higher operation flux
- Higher fiber packing density
- Compact footprint
- Drawer style design for easy installation and removal
- Efficient air scouring with bubble confinement
- End-free design eliminates likelihood of fiber breakage
- Shorter fiber length reduces internal losses and increases flux
- NSF/ANSI 61, California Title 22, and LT2 certifications



Capabilities:

(Click the images below to link to web page)



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April 23, 2021

CP&Y
20 E. 5th Street, Suite 630
Tulsa, Oklahoma 74103

Attention: Michael F. Graves, PE

Reference: Class-B Biosolids Lime Stabilization and Storage
North Canadian WWTP, Oklahoma City

Subject: Schwing Bioset, Inc. Quotation No. 2021141

Schwing Bioset, Inc. is pleased to propose the following as our scope of supply for the above referenced project:

BIOSOLIDS PROCESSING SUMMARY

Process Material Description:	Belt Press Dewatered Sludge
Process Material Solids Content:	Approximately 20-25% Total Dry Solids
Process Material Density:	63 lb/ft^3
Stabilization System Operation Schedule:	24 hours/day, 7 days/week
2040: Design Biosolids Processing Rate:	371,727 dry lbs/day at 20% solids (77,444 wet-lb/hr)
Estimated Lime Feed Rate:	1,548 lb/hr (2% of wet sludge cake mass)
Pump Flowrate (includes added chemicals):	78,992 wet-lb/hour (156 GPM) 39,496 wet-lb/hour/pump (78 GPM each pump)

SYSTEM EQUIPMENT SUMMARY

A. Lime Silo & Feeder – Provides storage and metering of quicklime (calcium oxide) into the Twin-Screw Mixer inlet hopper.
B. Twin-Screw Mixer – The Twin-Screw Mixer allows for the blending of the sludge and lime into a homogenous mixture. It also helps feed this mixture into the Biosolids Pump.
C. Biosolids Pump – The Biosolids Pump moves the sludge/lime mixture to Discharge Location.
D. Hydraulic Power Unit - Biosolids Pump – The Hydraulic Power Unit drives the Biosolids Pump, Twin-Screw Mixer, and Collection Conveyor.
E. Control Panel - Stabilization Process – Used to operate and monitor all Stabilization System equipment and instrumentation.

A. LIME SILO & FEEDER

Quantity:	**Two (2)**
Material of Construction:	A36 carbon steel
Material Storage:	Quicklime (Calcium Oxide)
Design Storage Capacity:	110 tons (4,000 ft^3 @ 55 lbs/ft^3) (alternate sizes available)
Diameter:	12 feet [3.6 m]
Height (Vertical Sidewall):	36 feet [11 m]
Height (Overall):	48 feet [14.6 m]

Scope includes:

1. Silo sidewalls, roof, and discharge cone shall be fabricated from A36 carbon steel plate. Silo shall be self supported with columns complete with base plates drilled for anchors. Anchors by others.
2. Silo shall be furnished with a 60º discharge cone and Vibrating Bin Activator. Electric motor for Bin Activator shall be 1.5 HP [1.1 kW].
3. A variable speed Lime Screw Feeder shall be furnished to meter and discharge lime into the Twin-Screw Mixer hopper. Electric motor for screw is 2 HP [1.5 kW].
4. Roof railings, toe board, and access ladder with safety cage shall be furnished.
5. A pulse-jet type dust collector shall be mounted at the roof of the lime silo. Air Compressor for pulse jet is 5 HP [3.7 kW].
6. PVR valve and 20-inch [500 mm] diameter manway shall be furnished at silo roof.
7. Fill pipe is 4-inches [100 mm] in diameter with long radius elbow and target box.
8. Three (3) RF type level switches are included.
9. Lime truck unloading controls in NEMA 4X, 304 stainless steel enclosure is included. This control enclosure is used to activate the silo dust filter when the silo is being filled with lime.
10. Lime silo exterior is painted with standard enamel finish. Interior shall be unpainted mill finish.
11. Silo will require on-site assembly by installing contractor. On-site assembly includes installation, erection, and field welding.

B. TWIN-SCREW MIXER

Quantity:	**Two (2)**
Model:	SD 350HD
Material of Construction:	A36 Carbon Steel
Auger Diameter:	13 inches
Inlet Opening Size:	Approx. 84 inches x 24 inches

Scope includes:

1. The Twin-Screw Mixer shall mix biosolids and lime into a homogenous mixture and feed that mixture into the Biosolids Pump. The augers shall be intermeshing and counter-rotating, with a combination of paddle flights and full flights.
2. The Twin-Screw Mixer is powered by the Hydraulic Power Unit.
3. The Twin-Screw Mixer shall be furnished with inboard bearings to support the end of the screw auger shafts.
4. Stainless steel Feed Hopper shall be supplied with the Twin-Screw Mixer. Inlet for sludge and lime feed are included.

5. A radar type level sensor shall be included with the Feed Hopper, mounted over the Twin-Screw Mixer inlet opening. Field wiring to the Stabilization Process Control Panel shall be completed by installing contractor.
6. The Twin-Screw Mixer transition shall be furnished with a pressure transducer to monitor inlet of the Biosolids Pump. A local LED pressure display shall be included at the screw feeder.

C. BIOSOLIDS PUMP

Quantity:	**Two (2)**
Model:	KSP 65 V(HD)L
Design Flowrate:	80 GPM [303 LPM] per pump
Pumping Stroke Length:	63 inches [1600 mm]
Diameter - Material Cylinders:	9 inches [230 mm]
Diameter – Hydraulic Cylinders:	5.9 inches [150 mm]
Cylinder Ratio:	2.35
Diameter - Suction Poppets:	8 inches [210 mm]
Diameter – Discharge Poppets:	6 inches [150 mm]

Scope includes:

1. The Biosolids Pump shall be a hydraulically driven, twin-cylinder, reciprocating piston pump equipped with poppet valves.
2. The Biosolids Pump shall be equipped with a single discharge outlet. An adapter to the pipeline shall be furnished at the discharge outlet, and shall consist of a quick-connect coupling, 6” spool piece, 2” pressure bleed valve, an 8” ANSI 600# flange.
3. One (1) ball valve to isolate the Biosolids Pump for maintenance by others. Pipeline to discharge location(s) by others
4. The Biosolids Pump water box shall have 1” connections for water supply and 1½” for overflow/drain line. Water lines and valves shall be supplied by installing contractor.
5. Maintenance Mode Controls shall be factory mounted at the Biosolids Pump. Maintenance Mode Controls include a MAINTENANCE MODE ON / OFF switch, FORWARD / OFF / REVERSE switch, PUMP JOG pushbutton, and EMERGENCY STOP pushbutton. Field wiring to the Stabilization Process Control Panel shall be completed by installing contractor.

D. BIOSOLIDS PUMP HYDRAULIC POWER UNIT

Quantity:	**Two (2)**
Model:	800L-200HP
Reservoir Size:	210 Gal.
Motor size/ power draw:	200 HP [150 kW], 480V / 3∅ / 60Hz

Scope includes:

1. The structural frame and oil reservoir shall be fabricated from A36 carbon steel.
2. Separate Rexroth variable displacement axial piston pumps shall be supplied to drive the hydraulic circuits for the Biosolids Pump, Twin-Screw Mixer, and Collection Twin-Screw Conveyor.
3. The Power Unit shall include an initial fill of oil, pressure gauge, pressure switch, relief valve, clean-out cover, 10-micron return line oil filter, and combination temperature and sight gauge.
4. A premium efficient, TEFC motor shall be supplied.

5. A junction box shall be factory mounted on the Power Unit.
    - The junction box enclosure shall be NEMA 4X, 304 stainless steel.
    - An EMERGENCY STOP pushbutton and circuit breaker disconnect switch shall be mounted on the front of the enclosure.
    - Field wiring to the Stabilization Process Control Panel shall be completed by the Installing Contractor.
6. Recirculating hydraulic oil conditioning loop shall include the following.
    - A constant volume hydraulic pump.
    - An air-cooled heat exchanger (water-cooled available upon request).
    - Temperature switch to regulate cooler fan.
    - 6-micron oil filter.
7. Rigid hydraulic tubing provided to connect equipment to the power unit. Four-foot-long hose connections provided at equipment to isolate vibration.
    - Piping shall be supplied in stock lengths. Contractor will field cut to fit.
    - Schwing Bioset shall supply all hydraulic valves and fittings required for installation.
    - Piping, valves, and fittings shall be installed and painted by the installation Contractor.
    - Hydraulic pipe and fittings shall be carbon steel rated for 310 bar (4500 psi).

E. CONTROL PANEL – STABILIZATION PROCESS

Quantity:	**Two (2)**

Scope includes:

1. Stabilization Process Control Panel enclosure shall be NEMA 4X, 304 stainless steel, free standing. A junction box shall be mounted on Biosolids Pump Hydraulic Power unit.
2. External power supply shall be 480V / 3∅ / 60Hz. A circuit breaker disconnect switch shall be provided at the front of the panel.
3. SBI PLC shall be used to control all panel functions.
4. Touch-screen interface shall be used for all operator input, status monitoring, local controls, and alarm notification.
5. The following shall be monitored using the touchscreen interface:
    - HOPPER LEVEL SENSOR. Measures material level in Twin-Screw Mixer Hopper.
6. The following shall be controlled/adjusted/monitored using the touchscreen interface:
    - LIME FEED RATE INTO THE MIXER HOPPER. The lime feed rate shall be manually adjusted as a fixed percentage of the sludge cake feed rate.
    - PUMPING RATE FOR THE BIOSOLIDS PUMP.
7. A POWER ON/OFF indicator light, EMERGENCY STOP pushbutton, ALARM indicator light, and ALARM RESET pushbutton shall be provided at the front of the panel.
8. Full-voltage motor starters for the following equipment shall be included:
    - Hydraulic Power Unit.
    - Lime Silo Bin discharger
9. Variable speed drives for the following equipment shall be furnished by Schwing Bioset and factory-mounted in the Stabilization Process Control Panel:
    - Lime Feed Screw.

SPECIAL TOOLS

One (1) set of Schwing Bioset standard tools is included.

SPARE PARTS

During commissioning, Schwing Bioset recommends changing out the hydraulic oil filter after the first 50 hours of Hydraulic Power Unit operation. The following spare part shall be furnished for this purpose.

Item:	**Quantity:**
Hydraulic Oil Filter	One (1) set per hyd Unit

No other spare parts are included with this quotation.

FIELD SERVICE

Schwing Bioset shall provide a trained service technician to supervise system installation, assist start-up, and / or to train the owner's personnel in the operation and maintenance of the Schwing Bioset supplied equipment.

The service technician shall be made available for Sixteen (16) days over Four (4) trips.

If required, additional service may be purchased at the prevailing rates at the time service is performed. Current service rates are as follows:

- US $145.00 per hour – standard eight (8) hour day.
- US $218.00 per hour – overtime (over and above the standard eight (8) hour day.)
- US $290.00 per hour – double time (Sundays and holidays).
- Travel and per diem (i.e., hotel, food, car) expenses at cost + 15%.

BIOSOLIDS STABILIZATION SCOPE OF SUPPLY SUMMARY

A. Lime Silo & Feed Screw:	Two (2)
B. Twin-Screw Mixer [SD 350HD]:	Two (2)
C. Biosolids Pump [KSP 65 V(HD)L]:	Two (2)
D. Hydraulic Power Unit- Biosolids Pump [Model 800-200 HP]:	Two (2)
E. Control Panel - Stabilization Process:	Two (2)
Spare Parts:	One (1) lot
Special Tools:	One (1) set
Field Service:	Sixteen (16) days, four (4) trips

Total price for the above listed scope of supply..... **$ 1,286,600**

F. SLUDGE STORAGE SILO

Quantity:	One (1)
Material of Construction:	A36, A500, A992 Carbon Steel
Silo Exterior Dimensions:	19'-8" Diameter x 45 ft H
Overall Height to Silo Roof:	63 ft
Capacity (nominal):	430 yd^3 (500 yd^3 total less AOR)
Stored Material:	Sludge Cake 20-25% dry solids

Scope includes:

1. The Silo shall be designed per IBC12 and local building code, current year. Silo welds are designed for visual inspection only per AWS D1.1. No additional testing is required.
2. Includes design approved by State of Oklahoma licensed P.E.
3. The circular Silo shall be of welded A36 Carbon Steel construction. The Silo floor shall be minimum 1" thick A36 Carbon Steel supported above base plates for 14ft clearance for truck loading.
4. The Silo roof and sidewalls shall be fabricated from minimum ¼ inch thick A36 Carbon Steel plate.
5. Structural support members extending to grade shall be fabricated from A36 carbon steel.
6. Silo sections will be shop welded per AWS D1.1, match-marked, and broke down for shipping in major pieces to reduce field welding. Support Steel and smaller pieces will be field welded or bolted as required.
7. A Sliding Frame Discharger shall be provided to direct material into the discharge outlets in the Silo floor. One (1) discharge outlet is included to connect to the Extraction Screw Conveyor.
8. Two (2) solids inlet flanges per silo to suit are included.
9. One (1) Radar level sensor included to be located on the roof of Silo.
10. Roof nozzles include One (1) 20-inch inspection hatch, One (1) level sensor port, and two (2) 8-inch vent ports. Ducting to vent ports **by others**.
11. Mezzanine platform included to provide access to Sliding Frame Cylinder.
12. Stairway is included to provide access to mezzanine level. Ladder from mezzanine to access to Silo roof is included.
13. Handrail constructed of aluminum is included for stairs, platform, and roof perimeter.
14. The Silo, support structure, stairs, railings etc. will require on-site assembly **by others**. On-site assembly includes installation, erection, field welding, and field painting.
15. Field weld seams shall be masked 2". Weld seams prepped and painted by others. All field touch-up painting of equipment shall be performed by others. Silos shall be painted as follows:
    Silo Exterior:
    - Surface Preparation – Sandblast SSPC-SP6
    - 1st Coat: S-W Phenicon HS FF Epoxy, 5-6 mils DFT (Factory applied)
    - 2nd Coat: S-W Acrolon 218 HS Polyurethane, 2-4 mils DFT (field applied by others)

    Silo Interior:
    - Surface Preparation – Sandblast SSPC-SP6
    - 1st Coat: S-W Phenicon HS FF Epoxy, 5-6 mils DFT (Factory applied)
    - 2nd Coat: S-W Phenicon HS Epoxy, 5-6 mils DFT (field applied by others)

G. SLIDING FRAME DISCHARGER

Quantity:	One (1)
Size:	6-meter nominal
Material of Construction:	A 36 Carbon Steel

Scope includes:

1. The Sliding Frame Discharger assembly consists of an ellipse-shaped frame driven by one (1) double-acting hydraulic cylinder.
2. During operation, the ellipse-shaped frame moves back and forth along the Silo floor, feeding material into the Silo discharge outlet.
3. The frame weldment shall be fabricated from Carbon Steel. Bolts, washers and nuts for affixing hold downs and attaching extension shaft to elliptical frame shall be A-325 structural grade Carbon Steel bolts as necessary for proper operation. Non-structural bolts shall be 304 stainless steel.
4. Each Sliding Frame Discharger assembly shall include one (1) each of the following items – hydraulic cylinder, extension shaft, clevis and pin, stuffing box seal with auto-greasing from extraction screw conveyor greaser.
5. Hydraulic cylinder shall include two (2) proximity switches to direct flow of oil. Field wiring to the Storage Silo Control Panel shall be completed **by others**.
6. The hydraulic cylinder includes a safety cover and drip pan.
7. The Sliding Frame Discharger components will require on-site assembly **by others**.
8. Sliding frame moving scraper is prime painted only. No additional paint required.

H. EXTRACTION SCREW CONVEYOR

Quantity:	One (1)
Design discharge rate:	3,000 ft^3/hr
Diameter of Flights (Nominal):	18 inches
Type of Flights:	Shafted Type
Length:	Approx. 16 feet
Quantity of Discharge Points:	One (1)
Motor:	30 HP
Electrical Service:	480 Volt / 3-Phase / 60 Hertz

Scope includes:

1. Trough, and end plates are constructed of 304L stainless steel minimum ¼" thick.
2. Screw center tube is constructed of 304 stainless steel. Shafted screw flights are constructed of ¼" thick 304L stainless steel. End shafts are constructed of 4140 carbon steel.
3. Hydraulically actuated Slide Gate is included to bolt to conveyor discharge flange. Gate hydraulic circuit is equipped with end of travel proximity switches and auto-close feature to close gate upon e-stop activation or loss of power.
4. Screw includes motion sensor alarm.
5. Carbon Steel motor and gear reducer shall be **standard painted only** as manufactured by OEM. Shafts shall be coated with rust preventive oil.

I. HYDRAULIC POWER UNIT - SILO

Quantity:	One (1)
Model:	220-30HP
Reservoir Size:	60 gallon
Motor Size:	30HP, 480V / 3∅ / 60Hz
Hydraulic Pump (Sliding Frame):	Constant volume gear pump

Scope includes:

1. The structural frame and oil reservoir for the Hydraulic Power Unit shall be fabricated from A36 carbon steel.
2. Constant volume gear pump shall be supplied to drive each hydraulic circuit for the Sliding Frame.
3. Auxiliary hydraulic circuit provided for slide gate actuation. Accumulator included to close upon E-stop activation or loss of power.
4. The Hydraulic Power Unit shall include an initial fill of oil, pressure gauges, pressure switches, relief valves, clean-out cover, 10-micron return line oil filter, and combination temperature and sight gauge.
5. A premium efficient, TEFC motor shall be supplied.
6. Rigid hydraulic tubing shall be provided to connect the Hydraulic Power Unit to the Sliding Frame Discharger.
    - Carbon steel seamless hydraulic tubing shall be supplied in nominal 20ft lengths. Others shall field cut to fit.
    - Schwing Bioset shall supply all fittings required for installation.
    - Flexible hose connections 4 ft long shall be provided at equipment to isolate vibration.
    - Hydraulic tubing and fittings shall be installed and painted **by others**.
    - All supports for the hydraulic tubing shall be supplied by others.
7. Motor Starter included in below control panel.

J. CONTROL PANEL – SILO

Quantity:	One (1)

Scope includes:

1. The Silo Control Panel enclosure shall be NEMA 4X, 304 stainless steel, mounted on the Hydraulic Power Unit frame. Control Panel is UL listed.
2. The external power supply shall be 480V / 3∅ / 60Hz. A circuit breaker disconnect switch shall be provided at the front of the panel.
3. Allen-Bradley CompactLogix PLC with Ethernet communications shall be used to control all panel functions.
4. A POWER ON/OFF indicator light, EMERGENCY STOP pushbutton, ALARM indicator light, and ALARM RESET pushbutton shall be provided at the front of the panel.
5. The Sliding Frame Silo Control Panel enclosure provides local control and is used to control and/or monitor the following equipment:
    - One (1) Hydraulic power unit.
    - One (1) Level sensor, located at the Silo roof.
    - One (1) Sliding Frame Discharger.
    - One (1) Extraction Screw Conveyor.
    - One (1) Slide Gate.

    Motor starter for Sliding Frame Hydraulic Power Unit and Extraction Screw Conveyors are included. Schwing Bioset standard input and output devices shall be provided.

PAINTING

Schwing Bioset standard primer and finish coatings shall be factory applied as follows, **unless otherwise noted above**. Stainless steel surfaces shall not be painted.

- Surface Preparation – Sandblast SSPC-SP6.
- 1st Coat – S-W Macropoxy 646 F.C. Epoxy, 3-5 mils DFT
- 2nd Coat – S-W Macropoxy 646 F.C. Epoxy, 3-5 mils DFT

All field touch-up painting of equipment shall be performed by others.

BIOSOLIDS STORAGE SILOS SCOPE OF SUPPLY SUMMARY

F. Biosolids Storage Silo:	One (1)
G. Sliding Frame Discharger:	One (1)
H. Extraction Screw Conveyor:	One (1)
I. Hydraulic Power Unit- Silo [Model 220-30 HP]:	One (1)
J. Control Panel - Silo:	One (1)
Spare Parts:	One (1) lot
Field Service:	Six (6) days, Two (2) trips

Total price for the above listed scope of supply..... **$ 864,000**

All prices are quoted:
DDP jobsite Incoterms® 2020
Price is valid for 60 days
Price is in US dollars

TERMS:

20% due at time of order
20% due at time of submittal approval
55% due at time goods are shipped
5% due upon acceptance of goods, not to exceed 90 days from shipment

Payment terms offered are subject to final credit approval.

SUBMITTALS:

Ten (10) to fourteen (14) weeks after receipt of approved order. One (1) electronic copy shall be provided.

DELIVERY:

Equipment shall be delivered Eighteen (18) to Twenty-four (24) weeks after submittals are approved.

OPERATION & MAINTENANCE MANUALS:

Two (2) final hard copies and one (1) electronic copy shall be furnished with the equipment. O&M Manuals will be delivered four (4) weeks after equipment delivery.

EQUIPMENT AND SERVICES TO BE PROVIDED BY OTHERS

1. Installation, offloading, field assembly, and erection of the Schwing Bioset, Inc. (SBI) supplied equipment.
2. Storage of equipment and/or costs for long term storage (longer than 3 months).
3. Racks, trays or supports for hydraulic lines, sludge lines, or control wiring.
4. Miscellaneous metal.
5. Field painting of any of the SBI supplied equipment. All touch up painting required due to normal wear and tear during shipping shall the responsibility of others.
6. Field-routed grease tubing
7. Supports for grease tubing, conduit or control wiring.
8. Field wiring of any kind.
9. Labor and material (e.g., polymer flocculant) for preliminary, final field, system performance and system integrity tests.
10. **Anchor bolts**, nuts, and washers for the SBI supplied equipment unless otherwise stated. Anchor design and embedment by others.
11. Cost for Engineer, Owner, or Contractor to witness any shop test.
12. Additional costs to supply alternate products other than specifically mentioned in this scope.
13. Networking, hardware, communication modules, or power supplies not specifically mentioned in this scope.
14. PLC programming software or software licenses not specifically mentioned in this scope.
15. It is the contractor's responsibility to field verify building dimensions, equipment access and that equipment layout /dimensions are suitable to accommodate the Schwing Bioset supplied equipment.
16. Field service technicians or special tools not specifically mentioned in this scope.
17. Water and drain piping of any kind.
18. Motor starters or variable frequency drives not specifically mentioned in this scope.
19. Spare parts not specifically mentioned in this scope.
20. **Supports, discharge cake conveyors, cake discharge chutes, and local disconnects** not specifically mentioned in this scope.

If you have any questions, please don't hesitate to contact me by phone (715-243-4597) or E-mail (KBauer@schwingbioset.com).

Yours very truly,
Schwing Bioset, Inc.

Kevin Bauer
Central Regional Sales Manager

cc: Chuck Wanstrom – SBI

Schwing Bioset, Inc. New Equipment Sales Terms and Conditions

1. Acceptance and Prices. These terms and conditions are an integral part of Schwing Bioset,Inc ("Schwing Bioset")'s firm offer and form the basis of any agreement resulting from Schwing Bioset's proposal. The proposal is subject to acceptance within thirty days from its date, and the prices are subject to change without notice prior to acceptance by the party to whom this offer is made, or its authorized agent ("Buyer"). Following acceptance without addition of any other terms and conditions of sale or any other modification by Buyer, the prices stated are firm provided that notification of release for immediate production and shipment is received at Schwing Bioset's factory not later than five months from Schwing Bioset's submittals. If through no fault of Schwing Bioset, the order is not released for manufacture within 5 months from Schwing Bioset's submittals, Schwing Bioset reserves the right to increase the price of the order. Any delay in shipment caused by Buyer's actions will subject prices to increase equal to the percentage increase in list prices during that period of delay. In no event will prices be decreased.

Acceptance will have occurred if Buyer: signs Schwing Bioset's proposal; issues written order pursuant to submission of proposal; or permits or accepts performance; or other commercially reasonable manner. If Buyer's order is an acceptance of Schwing Bioset's proposal, Schwing Bioset's return of such order with these terms and conditions attached serves as an acknowledgement and confirmation of receipt of order. If order is expressly conditioned upon Schwing Bioset's acceptance or assent to terms other than those expressed herein, return of order by Schwing Bioset with these terms and conditions attached serves as notice of objection to such terms and a counter-offer to provide equipment in accordance with scope and terms of the original proposal. If Buyer does not reject or object within ten days, counter-offer will be deemed accepted. If Buyer permits or accepts performance, such terms will be deemed accepted. In order for Schwing Bioset's acknowledgement of order to be valid it must be made at the corporate level.

2. Performance. Schwing Bioset shall be obligated to furnish only the goods described in Schwing Bioset's proposal, and submittal data (if such data is issued in connection with this order), and Schwing Bioset may rely on the acceptance of proposal and submittal data as acceptance of the suitability of the equipment for the particular project. Schwing Bioset's duty to perform under any order and the price thereof is dependent upon Schwing Bioset's corporate approval of the order and Schwing Bioset shall not be responsible for delays in contract formation caused by inclusion of new or different terms by Buyer, or delays in credit approval due to delayed or incomplete credit information by Buyer. Schwing Bioset's duty to perform is contingent upon the non-occurrence of an Event of Force Majeure. If the order is not approved at the corporate level, Schwing Bioset may elect to delay performance or to renegotiate with Buyer. If Schwing Bioset and Buyer are unable to agree on revised prices or terms, the order may be canceled without any liability. If Schwing Bioset shall be unable to carry out any material obligation under this Agreement due to an Event of Force Majeure, this Agreement shall at Schwing Bioset's election (i) remain in effect but Schwing Bioset's obligations shall be suspended until the uncontrollable event terminates or (ii) be terminated upon ten (10) days' notice to Buyer, in which event Buyer shall pay Schwing Bioset for all parts of the Work furnished to the date of termination. An "Event of Force Majeure" shall mean any cause or event beyond the control of Schwing Bioset. Without limiting the foregoing, "Event of Force Majeure" includes: acts of God; acts of terrorism, war or the public enemy; flood; earthquake; tornado; storm; fire; civil disobedience; pandemic insurrections; riots; labor disputes; labor or material shortages; sabotage; restraint by court order or public authority (whether valid or invalid); and action or non-action by or inability to obtain or keep in force the necessary governmental authorizations, permits, licenses, certificates or approvals if not caused by Schwing Bioset; and the requirements of the United States Government in any manner that diverts either the material or the finished product to the direct or indirect benefit of the Government.

3. Taxes. No taxes are included in this quote/order. The amount of any applicable present or future state/local sales/use tax or other government charge upon the production, sale, shipment, and/or use of the goods covered by this quotation shall be paid directly to the taxing authorities by purchaser, and paid tax receipts will be furnished to Schwing Bioset upon request, unless purchaser provides us with an exemption certificate acceptable to the taxing authorities.

4. Warranty and Liability. Schwing Bioset warrants its new parts and service work against defects in material and workmanship under normal use and service, and which shall not have been subject to misuse, negligence, or accident, for a period of one (1) year that shall commence upon startup or ninety (90) days from delivery, whichever occurs first. Schwing Bioset will replace or repair free of charge, F.O.B. SBI factory, such part or parts thereof as in its sole judgment shall be deemed defective. Due to the specialized nature of Schwing Bioset material handling equipment, Schwing Bioset field service technicians shall not be restricted in adjusting or repairing Schwing Bioset furnished equipment, regardless of collective bargaining agreements entered into by other parties. This warranty shall not apply to any equipment manufactured by us which shall have been loaded or operated beyond its rated capacity as specified by Schwing Bioset. Damage resulting from improper installations or alterations outside our plant will be considered as misuse and not as a defect. Certain parts of the equipment provided by Schwing Bioset such as the pumping cylinders, valves, pumping rams, screw flights, sliding frame components, trough liners for screws etc. that are in contact with material, are subject to normal wear. This normal wear is not covered under this warranty. Schwing Bioset shall not be liable for consequential damages or injuries of any kind, or for expenses, losses, or delays incidental to any failure. Schwing Bioset reserves the right to make changes and improvements in its product without incurring any obligation to install any such changes or improvements in its products previously manufactured. All warranty is void if equipment is not serviced by a Schwing Bioset certified technician and if replacement parts utilized are anything other than Schwing Bioset supplied and authorized parts, from delivery through termination of warranty period. In the event of a defect or issue with Schwing Bioset supplied equipment, buyer shall notify Schwing Bioset in writing of said defect and offer Schwing Bioset reasonable opportunity to cure. This warranty is in lieu of any other warranty expressed or implied or any other obligation or liability on the part of Schwing Bioset, and no other person is authorized to make any representations or warranties beyond those herein expressed. Without limiting the generalities of the foregoing, **THERE IS NO IMPLIED WARRANTY OF MARKETABILITY AND NO IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

5. Indemnity. Schwing Bioset agrees to indemnify and hold Buyer harmless from the amount of any final judgment entered against Buyer for injury or death to any person (including employees of Buyer and Schwing Bioset) or damage to tangible property of Buyer and based solely upon: (a) Schwing Bioset's defective manufacture of equipment sold to Buyer; (b) Schwing Bioset's violation of any applicable laws, rules or regulations in connection with the manufacture of said equipment, or (c) Schwing Bioset's gross negligence or intentional misconduct. The duty to indemnify will continue in full force and effect, notwithstanding the expiration or early termination hereof, with respect to any claims based on facts or conditions that occurred prior to expiration or termination.

6. Insurance. Schwing Bioset agrees to maintain the following insurance during the term of the contract with limits not less than shown below and will, upon request from Buyer, provide a Certificate of Insurance evidencing this coverage:

Commercial General Liability	$2,000,000 per occurrence
Automobile Liability	$2,000,000 CSL
Workers Compensation	Statutory Limits

In the event Schwing Bioset agrees to name Buyer or others as an additional insured, Schwing Bioset will do so but only under its primary Commercial General Liability policies to the extent of the indemnity obligation assumed herein. In no event does Schwing Bioset waive its right of subrogation.

7. Liability Disclaimer. NOTWITHSTANDING ANY PROVISION TO THE CONTRARY, IN NO EVENT SHALL SCHWING BIOSET BE LIABLE FOR ANY SPECIAL, INCIDENTAL, LIQUIDATED, CONSEQUENTIAL (INCLUDING WITHOUT LIMITATION LOST REVENUE OR PROFITS), OR PUNITIVE DAMAGES. This exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory. Should Schwing Bioset nevertheless be found liable for any damages they shall be limited to the purchase price of the equipment under the order. **SCHWING BIOSET DISCLAIMS ANY LIABILITY FOR DAMAGES OF ANY KIND (WHETHER DIRECT OR INDIRECT) ARISING FROM MOLD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES OR AIRBORNE BIOLOGICAL AGENTS.**

8. Patent Indemnity. The Schwing Bioset shall protect and indemnify the Buyer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the articles or material delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, Schwing Bioset shall promptly be notified and given full opportunity to negotiate a settlement. Schwing Bioset does not warrant against infringement by reason of Buyer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation Buyer agrees to reasonably cooperate with Schwing Bioset. In connection with any proceeding under the provisions of this Article all parties concerned shall be entitled to be represented by counsel at their own expense.

9. Shipment Dates. Shipment dates are estimates only. No valid contract may be made to ship within or at a specified time unless in writing, signed by an authorized signatory of Schwing Bioset. Shipments shall be f.o.b. factory or warehouse at named shipping point with title and risk of loss passing to Buyer upon delivery to the carrier unless quoted otherwise and stated as such in our formal written offer. Schwing Bioset shall not be liable for damages of any kind including Liquidated, Consequential, and/or Incidental.

10. Cancellation. If, following acceptance of proposal by Buyer, all or any portion of the resulting order is canceled by Buyer without default on the part of Schwing Bioset or without Schwing Bioset's written consent, Buyer shall be liable to Schwing Bioset for cancellation charges including but not limited to Schwing Bioset's incurred costs and such profit as would have been realized by Schwing Bioset from the transaction had the agreement not been breached by Buyer.

11. Payment. Pending Credit approval, Payment terms are 20% due at time of order, 20% due at time of submittal approval, 55% due at time goods are shipped, and 5% due upon acceptance of goods, not to exceed 90 days from shipment, unless otherwise expressly agreed to in writing by Schwing Bioset. Schwing Bioset reserves the right to add to any account outstanding for more than 30 days a service charge the lesser of 1-1/2% of the principal amount due at the end of each month, or the maximum allowable legal interest rate. Buyer shall be liable to Schwing Bioset for all collection expenses, including reasonable attorney's fees and court costs, incurred by Schwing Bioset in attempting to collect any amounts due from Buyer. If requested, Schwing Bioset will provide appropriate lien waivers upon receipt of payment. Schwing Bioset reserves the right to suspend or terminate performance in the event of Buyer's non-payment.

12. Returns. Products may be returned only with permission of Schwing Bioset and shall be subject to a 25% restocking fee.

13. Applicable Law. Any agreement resulting from Schwing Bioset's proposal will be governed and construed according to Minnesota law.

14. U.S. Government Work. This provision applies only to indirect sales by Schwing Bioset to the US Government. If the Work is in connection with a U.S. Government contract, Buyer certifies that it has provided and will provide current, accurate, and complete information, representations and certifications to all government officials, including but not limited to the contracting officer and officials of the Small Business Administration, on all matters related to the prime contract, including but not limited to all aspects of its ownership, eligibility, and performance. Anything herein notwithstanding, Schwing Bioset will have no obligations to Buyer unless and until Buyer provides Schwing Bioset with a true, correct and complete executed copy of the prime contract. Upon request, Buyer will provide copies to Schwing Bioset of all requested written communications with any government official related to the prime contract prior to or concurrent with the execution thereof, including but not limited to any communications related to Buyer's ownership, eligibility or performance of the prime contract. Buyer will obtain written authorization and approval from Schwing Bioset prior to providing any government official any information about Schwing Bioset's performance of the work that is the subject of this offer or agreement, other than this written offer or agreement.

15. Storage at Schwing Bioset. Should the customer desire to store the equipment purchased at Schwing Bioset's facilities, these services can be completed at a rate of $250.00 per week, or $1,000 per calendar month. Customer shall issue the original equipment purchase order with a contingency of 12 months storage that can be drawn from if required. These funds will not be utilized unless written approval from customer is offered. Terms for Storage Fees are 100% N30 from invoice date. Retainages and/or offsets do not apply.

Appendix C – Process Calculations

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. DC S1 (Existing BFP/Lime Stabilization)

Deer Creek WWTP

Biosolids Loading Projections

Parameter	2020	2025	2030	2035	2040
Plant AADF, MGD	**14.3**	**15.7**	**17.1**	**18.5**	**19.9**
Primary Solids, lb/day	8,000	8,700	9,500	10,300	11,100
Waste Activated Solids, lb/day	7,600	8,300	9,100	9,800	10,500
Total, lb/day	15,600	17,000	18,600	20,100	21,600
Plant MMF, MGD	**18.5**	**20.3**	**22.1**	**23.9**	**25.7**
Primary Solids, lb/day	10,200	11,200	12,200	13,200	14,200
Waste Activated Solids, lb/day	9,500	10,500	11,400	12,300	13,300
Total, lb/day	19,700	21,700	23,600	25,500	27,500

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. DC S1 (Existing BFP/Lime Stabilization)

Deer Creek WWTP

Sludge Holding/Blending Tanks

Parameter	2020	2025	2030	2035	2040
Biosolids Characteristics					
Solids Content, %	1.5%	1.5%	1.5%	1.5%	1.5%
DS Density, g/cm3	1.30	1.30	1.30	1.30	1.30
Specific Gravity	1.003	1.003	1.003	1.003	1.003
Plant AADF, MGD	**14.3**	**15.7**	**17.1**	**18.5**	**19.9**
Total Biosolids, lb/day	15,600	17,000	18,600	20,100	21,600
Total Sludge Volume, gpd	124,300	135,400	148,100	160,100	172,000
Plant MMF, MGD	**18.5**	**20.3**	**22.1**	**23.9**	**25.7**
Total Biosolids, lb/day	19,700	21,700	23,600	25,500	27,500
Total Sludge Volume, gpd	156,900	172,800	188,000	203,100	219,000

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. DC S1 (Existing BFP/Lime Stabilization)

Deer Creek WWTP

Belt Filter Presses	
Solids Capture Rate	95%

Parameter	2020	2025	2030	2035	2040
Dewatered Cake Characteristics					
Solids Content, %	25.0%	25.0%	25.0%	25.0%	25.0%
DS Density, g/cm3	1.30	1.30	1.30	1.30	1.30
Specific Gravity	1.06	1.06	1.06	1.06	1.06
Plant AADF, MGD	**14.3**	**15.7**	**17.1**	**18.5**	**19.9**
Total Biosolids, lb/day	15,600	17,000	18,600	20,100	21,600
Total Sludge Volume, gpd	124,300	135,400	148,100	160,100	172,000
Dewatered Cake, lb/day	14,800	16,200	17,700	19,100	20,500
Total Cake Volume					
gpd	6,690	7,330	8,000	8,640	9,270
cy/d	33	36	40	43	46
Operation Schedule					
Operation Hours per Day, hr/d	12	12	12	12	12
Operation Days per Week, d/wk	5	5	5	5	5
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	1,820	1,980	2,170	2,350	2,520
Feed Flow at Operation Schedule, gpm	240	260	290	310	330
Plant MMF, MGD	**18.5**	**20.3**	**22.1**	**23.9**	**25.7**
Total Biosolids, lb/day	19,700	21,700	23,600	25,500	27,500
Total Sludge Volume, gpd	156,900	172,800	188,000	203,100	219,000
Dewatered Cake, lb/day	18,700	20,600	22,400	24,200	26,100
Total Cake Volume					
gpd	8,460	9,320	10,130	10,940	11,800
cy/d	42	46	50	54	58
Operation Schedule					
Operation Hours per Day, hr/d	12	12	12	12	12
Operation Days per Week, d/wk	7	7	7	7	7
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	1,640	1,810	1,970	2,130	2,290
Feed Flow at Operation Schedule, gpm	220	240	260	280	300

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. DC S1 (Existing BFP/Lime Stabilization)

Deer Creek WWTP

Biosolids Stabilization (Existing Lime Process)		
Lime Addition	0.20	lb Lime/lb DS
Lime Remaining in Biosolids	1.00	lb DS/lb Lime Feed
Solids Destruction by Lime Addition	0%	TS by weight
Lime Bulk Density	55	lb/ft3

Parameter	2020	2025	2030	2035	2040
Stabilized Biosolids Characteristics					
Solids Content, %	28.0%	28.0%	28.0%	28.0%	28.0%
DS Density, g/cm3	1.23	1.23	1.23	1.23	1.23
Specific Gravity	1.06	1.06	1.06	1.06	1.06
Plant AADF, MGD	**14.3**	**15.7**	**17.1**	**18.5**	**19.9**
Dewatered Cake, lb/day	14,800	16,200	17,700	19,100	20,500
Dewatered Cake Volume					
gpd	6,690	7,330	8,000	8,640	9,270
cy/d	33	36	40	43	46
Lime Feed Rate, lb/day	2,960	3,240	3,540	3,820	4,100
Lime Volume					
ft3/d	54	59	64	69	75
cy/d	2.0	2.2	2.4	2.6	2.8
Lime Remaining in Biosolids, lb/day	2,960	3,240	3,540	3,820	4,100
Stabilized Biosolids, lb/day	17,760	19,440	21,240	22,920	24,600
Stabilized Biosolids Volume, cy/d	35	38	42	46	49
Operation Schedule					
Operation Hours per Day, hr/d	12	12	12	12	12
Operation Days per Week, d/wk	5	5	5	5	5
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	1,730	1,890	2,070	2,230	2,390
Feed Flow at Operation Schedule, gpm	13	14	16	17	18
Lime Feed Equipment Capacity					
Lime Mass at Operation Schedule, lb/hr	350	380	410	450	480
Lime Flow at Operation Schedule, ft3/hr	6.3	6.9	7.5	8.1	8.8
Plant MMF, MGD	**18.5**	**20.3**	**22.1**	**23.9**	**25.7**
Dewatered Cake, lb/day	18,700	20,600	22,400	24,200	26,100
Dewatered Cake Volume					
gpd	8,460	9,320	10,130	10,940	11,800
cy/d	42	46	50	54	58
Lime Feed Rate, lb/day	3,740	4,120	4,480	4,840	5,220
Lime Volume					
ft3/d	68	75	81	88	95
cy/d	2.5	2.8	3.0	3.3	3.5
Lime Remaining in Biosolids, lb/day	3,740	4,120	4,480	4,840	5,220
Stabilized Biosolids, lb/day	22,440	24,720	26,880	29,040	31,320
Stabilized Biosolids Volume, cy/d	45	49	53	57	62
Operation Schedule					
Operation Hours per Day, hr/d	12	12	12	12	12
Operation Days per Week, d/wk	7	7	7	7	7
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	1,560	1,720	1,870	2,020	2,180
Feed Flow at Operation Schedule, gpm	12	13	14	15	16
Lime Feed Equipment Capacity					
Lime Mass at Operation Schedule, lb/hr	310	340	370	400	440
Lime Flow at Operation Schedule, ft3/hr	5.7	6.3	6.8	7.3	7.9

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. NC S1 (Existing BFP/Lime Stabilization)

North Canadian WWTP

Biosolids Loading Projections

Parameter	2020	2025	2030	2035	2040
Plant AADF, MGD	**54.7**	**59.6**	**64.5**	**69.4**	**74.4**
Primary Solids, lb/day	80,400	88,400	96,400	104,500	112,600
Waste Activated Solids, lb/day	53,600	59,100	64,500	69,900	75,300
Total, lb/day	134,000	147,500	160,900	174,400	187,900
Plant MMF, MGD	**96.2**	**105**	**114**	**123**	**132**
Primary Solids, lb/day	135,800	156,000	176,200	196,400	216,600
Waste Activated Solids, lb/day	91,600	104,500	117,500	130,500	143,500
Total, lb/day	227,400	260,500	293,700	326,900	360,100

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. NC S1 (Existing BFP/Lime Stabilization)

North Canadian WWTP

Sludge Holding/Blending Tanks

Parameter	2020	2025	2030	2035	2040
Biosolids Characteristics					
Solids Content, %	3.5%	3.5%	3.5%	3.5%	3.5%
DS Density, g/cm3	1.30	1.30	1.30	1.30	1.30
Specific Gravity	1.008	1.008	1.008	1.008	1.008
Plant AADF, MGD	**54.7**	**59.6**	**64.5**	**69.4**	**74.4**
Total Biosolids, lb/day	134,000	147,500	160,900	174,400	187,900
Total Sludge Volume, gpd	455,100	501,000	546,500	592,400	638,200
Plant MMF, MGD	**96.2**	**105**	**114**	**123**	**132**
Total Biosolids, lb/day	227,400	260,500	293,700	326,900	360,100
Total Sludge Volume, gpd	772,400	884,800	997,600	1,110,400	1,223,100

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. NC S1 (Existing BFP/Lime Stabilization)

North Canadian WWTP

Belt Filter Presses	
Solids Capture Rate	95%

Parameter	2020	2025	2030	2035	2040
Dewatered Cake Characteristics					
Solids Content, %	20.0%	20.0%	20.0%	20.0%	20.0%
DS Density, g/cm3	1.30	1.30	1.30	1.30	1.30
Specific Gravity	1.05	1.05	1.05	1.05	1.05
Plant AADF, MGD	**54.7**	**59.6**	**64.5**	**69.4**	**74.4**
Total Biosolids, lb/day	134,000	147,500	160,900	174,400	187,900
Total Sludge Volume, gpd	455,100	501,000	546,500	592,400	638,200
Dewatered Cake, lb/day	127,300	140,100	152,900	165,700	178,500
Total Cake Volume					
gpd	72,640	79,950	87,250	94,550	101,860
cy/d	360	400	430	470	500
Operation Schedule					
Operation Hours per Day, hr/d	16	16	16	16	16
Operation Days per Week, d/wk	7	7	7	7	7
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	8,380	9,220	10,060	10,900	11,740
Feed Flow at Operation Schedule, gpm	470	520	570	620	660
Plant MMF, MGD	**96.2**	**105**	**114**	**123**	**132**
Total Biosolids, lb/day	227,400	260,500	293,700	326,900	360,100
Total Sludge Volume, gpd	772,400	884,800	997,600	1,110,400	1,223,100
Dewatered Cake, lb/day	216,000	247,500	279,000	310,600	342,100
Total Cake Volume					
gpd	123,260	141,230	159,210	177,240	195,210
cy/d	610	700	790	880	970
Operation Schedule					
Operation Hours per Day, hr/d	24	24	24	24	24
Operation Days per Week, d/wk	7	7	7	7	7
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	9,480	10,850	12,240	13,620	15,000
Feed Flow at Operation Schedule, gpm	540	610	690	770	850

ST-0154 Odor and Biosolids Management Plan

Design Solids Handling Process - Alt. NC S1 (Existing BFP/Lime Stabilization)

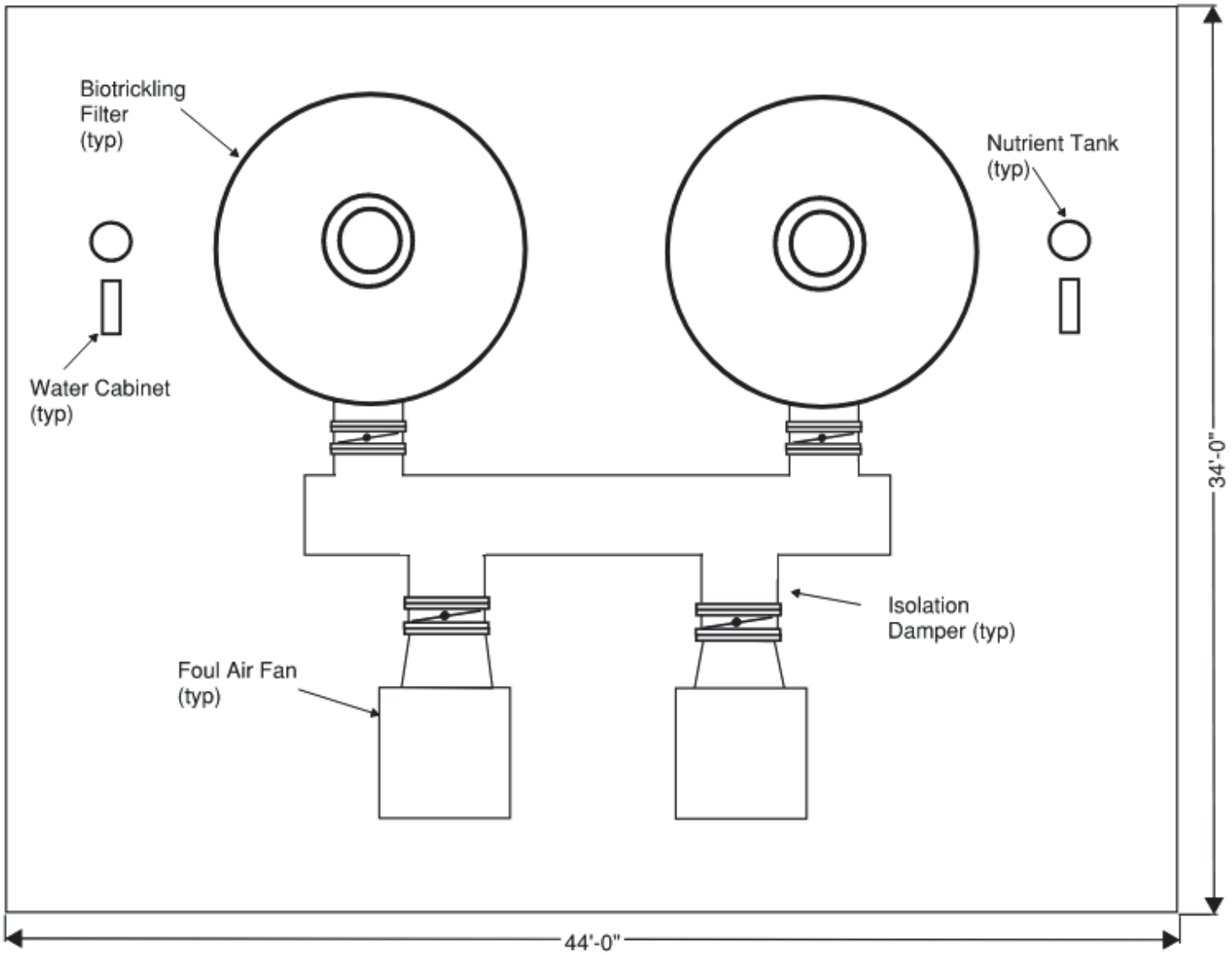
North Canadian WWTP

Biosolids Stabilization (Existing Lime Process)		
Lime Addition	0.20	lb Lime/lb DS
Lime Remaining in Biosolids	1.00	lb DS/lb Lime Feed
Solids Destruction by Lime Addition	0%	TS by weight
Lime Bulk Density	55	lb/ft3

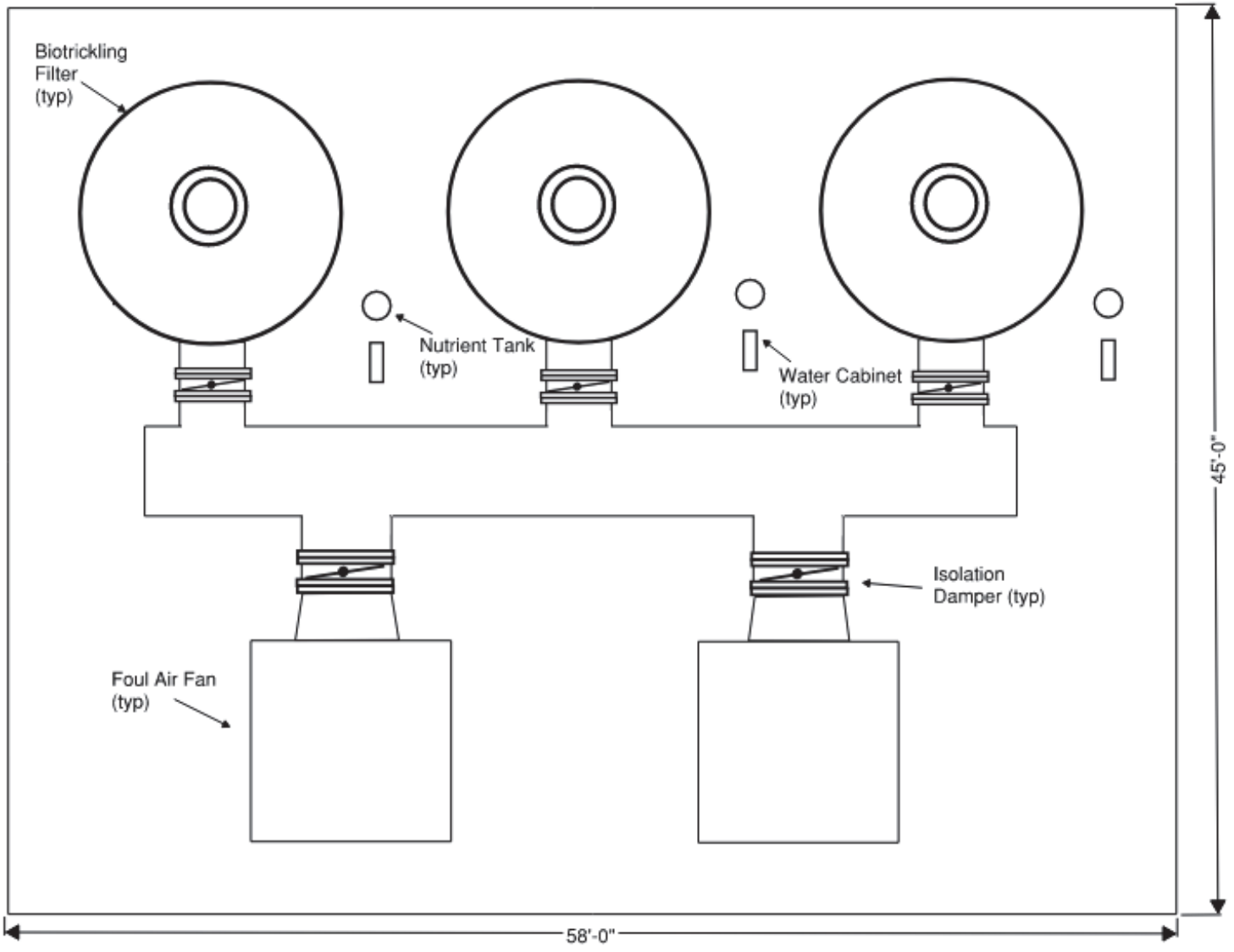
Parameter	2020	2025	2030	2035	2040
Stabilized Biosolids Characteristics					
Solids Content, %	23.5%	23.5%	23.5%	23.5%	23.5%
DS Density, g/cm3	1.09	1.09	1.09	1.09	1.09
Specific Gravity	1.02	1.02	1.02	1.02	1.02
Plant AADF, MGD	**54.7**	**59.6**	**64.5**	**69.4**	**74.4**
Dewatered Cake, lb/day	127,300	140,100	152,900	165,700	178,500
Dewatered Cake Volume					
gpd	72,640	79,950	87,250	94,550	101,860
cy/d	360	400	430	470	500
Lime Feed Rate, lb/day	25,460	28,020	30,580	33,140	35,700
Lime Volume					
ft3/d	463	509	556	603	649
cy/d	17	19	21	22	24
Lime Remaining in Biosolids, lb/day	25,460	28,020	30,580	33,140	35,700
Stabilized Biosolids, lb/day	152,760	168,120	183,480	198,840	214,200
Stabilized Biosolids Volume, cy/d	380	420	450	490	520
Operation Schedule					
Operation Hours per Day, hr/d	16	16	16	16	16
Operation Days per Week, d/wk	7	7	7	7	7
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	7,960	8,760	9,560	10,360	11,160
Feed Flow at Operation Schedule, gpm	76	83	91	98	106
Lime Feed Equipment Capacity					
Lime Mass at Operation Schedule, lb/hr	1,590	1,750	1,910	2,070	2,230
Lime Flow at Operation Schedule, ft3/hr	29	32	35	38	41
Plant MMF, MGD	**96.2**	**105**	**114**	**123**	**132**
Dewatered Cake, lb/day	216,000	247,500	279,000	310,600	342,100
Dewatered Cake Volume					
gpd	123,260	141,230	159,210	177,240	195,210
cy/d	610	700	790	880	970
Lime Feed Rate, lb/day	43,200	49,500	55,800	62,120	68,420
Lime Volume					
ft3/d	785	900	1,015	1,129	1,244
cy/d	29	33	38	42	46
Lime Remaining in Biosolids, lb/day	43,200	49,500	55,800	62,120	68,420
Stabilized Biosolids, lb/day	259,200	297,000	334,800	372,720	410,520
Stabilized Biosolids Volume, cy/d	640	730	830	920	1,020
Operation Schedule					
Operation Hours per Day, hr/d	24	24	24	24	24
Operation Days per Week, d/wk	7	7	7	7	7
Sludge Feed Equipment Capacity					
Feed Mass at Operation Schedule, lb/hr	9,000	10,310	11,630	12,940	14,250
Feed Flow at Operation Schedule, gpm	86	98	111	123	136
Lime Feed Equipment Capacity					
Lime Mass at Operation Schedule, lb/hr	1,800	2,060	2,330	2,590	2,850
Lime Flow at Operation Schedule, ft3/hr	33	38	42	47	52

Appendix D – Preliminary BTF System Layouts

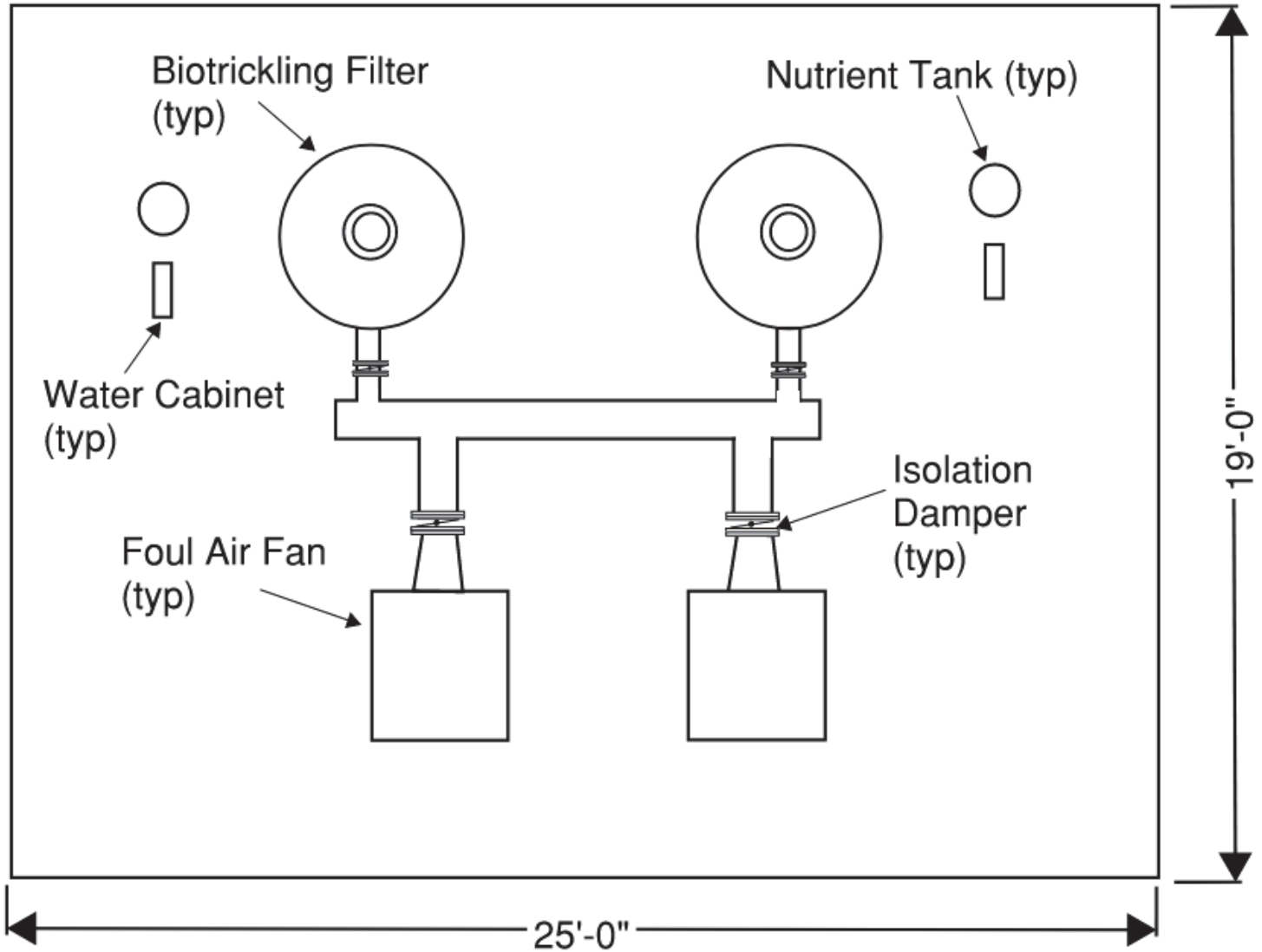
Odor Control System 1A - Deer Creek WWTP Storage Tank + Dewatering
Total Exhaust Rate: 13,500 cfm
Exhaust Rate per BTF: 10,125 cfm
Vessel Dia: 12 ft



Odor Control System 3B - North Canadian WWTP TWAS Tanks + Dewatering
Total Exhaust Rate: 31,300 cfm
Exhaust Rate per BTF: 15,650 cfm
Vessel Dia: 13 ft



Odor Control System 4 - Witcher LS Manholes
Total Exhaust Rate: 250 cfm
Exhaust Rate per BTF: 188 cfm
Vessel Dia: 4 ft



Appendix E – Odor Monitoring Systems Memo

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WASTEWATER TREATMENT PLANTS BIOSOLIDS AND ODOR MANAGEMENT

H2S Monitoring Assessment

OCWUT PROJECT NO. ST-0154

B&V PROJECT NO. NO. 404757

PREPARED FOR

Oklahoma City Water Utilities Trust

15 SEPTEMBER 2021

BLACK & VEATCH

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Executive Summary

This memorandum evaluates two hydrogen sulfide (H2S) monitoring systems: the Envirosuite System and the DiCom fence line monitoring system. This evaluation found that the Envirosuite System provides superior functionality allowing operations staff and OCWUT staff to remotely monitor odors on site via a cloud interface. The cloud-based software functions allow staff to respond to odor complaints with factual data based on odor and weather conditions, anticipate when odors are leaving the plant site, and predict when in the future odor emissions are likely to leave the plant site. The DiCom system provides location specific measurements that are reported to the plant control system for monitoring. This system also records odor levels detected for future manual assessment.

The Envirosuite system has a higher operations and life cycle cost when compared to the DiCom system. This cost can be reduced by reducing the functions of the system to those are move needed and by provided odor analyzers sourced by others. At the wastewater treatment facilities where the information can be used to proactively adapt operations to reduce odors, the Envirosuite system provides value. In case of the Witcher lift station where operations are more driven by weather, the fixed DiCom system is the recommended solution. Both systems provide a means of assessing odor generated on site.

1.0 Introduction

1.1 Overview

The Technology Screening Summary Technical Memorandum identified two hydrogen sulfide (H2S) monitoring systems for further investigation: the Envirosuite System and the DiCom fence line monitoring system. This memorandum summarizes the evaluation of these two alternatives that could be deployed at OCWUT's wastewater treatment facilities and Witcher Lift Station (LS) equalization (EQ) basins to monitor odor concentrations and help determine when odors from plant operations might be detectible offsite. This evaluation includes estimated capital, operations and maintenance costs for each H2S monitoring system alternative.

1.2 Objectives

The objective of this evaluation is to determine which H2S monitoring system best meets OCWUT's needs at the Deer Creek WWTP, Chisolm Creek WWTP, North Canadian WWTP and Witcher LS EQ basins. This evaluation will present the functionality, features, capital cost and operation and maintenance cost, and life cycle cost of the two alternative systems identified in the Technology Screening Summary Technical Memorandum.

2.0 Existing H2S Monitoring Systems

H2S monitoring systems are provided at the Deer Creek, Chisholm Creek and North Canadian WWTPs. Some of these systems focus on ambient monitoring for community impacts, while others are intended to monitor H2S for operator safety. Although this TM focuses on ambient monitoring, both systems are described below.

2.1 Deer Creek WWTP

Deer Creek WWTP has three existing H2S monitoring systems, two for ambient measurements focused on community impacts, and a third for operator safety.

The plant's Envirosuite system, monitors ambient H_2S concentrations and movement. The system consists of two mobile sensors, a fixed weather station and H_2S sensor, and a software system that can be used to model the collected information (see Figure 3-1 for sensor locations). The two mobile stations are trailer mounted and are generally located near the flow equalization basins (FEBs) and the stacking pad. The fixed weather station is located near the dewatering building. Figure 3-1 provides an aerial photograph of the WWTP plant site with the typical locations of the monitors and weather station shown. The mobile stations utilize Otis Detection Instrument Monitors with the ability to measure 0-10 ppm of H_2S. These components use cellular modems to communicate weather and odor concentrations to the Envirosuite software system which interrupts the results. More information about the functionality of the software system is provided below under the description of the Envirosuite system.

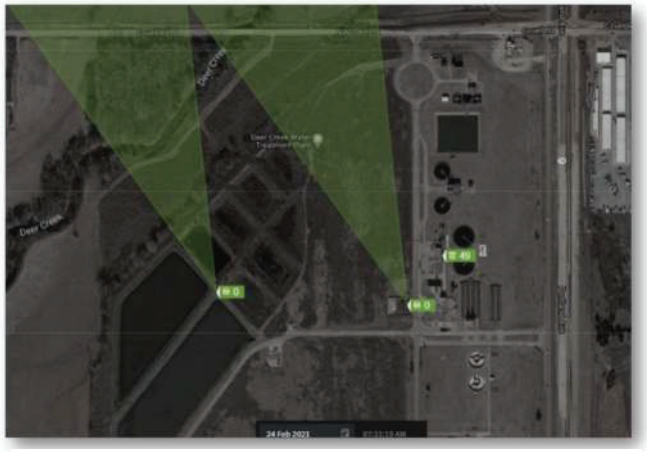


Figure 2-1 Existing Deer Creek Envirosuite System

The second ambient monitoring system installed at Deer Creek is an Odalog sensor located on the north fence. This is a manual sensor that is used to log H2S concentrations, but the sensor is not connected to the SCADA system.

For safety monitoring, the plant has H2S monitors by Mil Ram or Otis detection instruments with the ability to measure concentrations from 0 to 100 ppm. These monitors are installed in the Dewatering Building, report the H2S concentrations to the SCADA system, and are used to ensure operator safety. The sensor alarm when the concentrations exceed 10 ppm within the space. If the concentration within the space exceeds 90 ppm, the space must remain unoccupied.

2.2 Chisolm Creek WWTP

One H2S monitoring system is provided at the Chisolm Creek WWTP. This system consists of Odalog sensors installed at the grade elevation near the sludge holding tanks. This system is used to ensure operator safety.

2.3 North Canadian WWTP

North Canadian WWTP has two existing H2S monitoring systems, both focused on operator safety.

The first system consists of H2S monitors by Mil Ram or Otis detection instruments with the ability to measure concentrations from 0 to 100 ppm. These monitors are installed in the Bar Screen and Dewatering Buildings and report H2S concentrations to the SCADA system (see Figure 3-2). These sensors alarm when the concentrations exceed 10 ppm within the space. If the concentration within the space exceeds 90 ppm, the space must remain unoccupied. The H2S concentration within the Bar Screen Building is also used to control the Source Technologies STX system which doses chemicals to reduce H2S.

In addition to the fixed monitoring systems, Odalog monitors are installed within the Bar Screen and Dewatering area to log H2S concentrations over time. The Odalog monitors are not connected to the SCADA system.

Figure 2-2 NCWWTP Bar Screen H_2S Local Monitor

3.0 Alternative Evaluations

3.1 Technology Overview

Below is a summary of each monitoring systems components and features.

3.1.1 EnviroSuite

Envirosuite is a web-based software platform and measurement system that collects odor and weather data on the plant site to model, visualize and predict the impact odors will have offsite. The software platform has four key functions which are illustrated in the Figure 4-1 and further described in the paragraphs below. The primary functions that Inframark utilizes from the Envirosuite tools are the measurement and incident intelligence modules. Two pricing packages will be provided for each facility installation. One package includes all the functions of the Envirosuite platform. The other quotation will limit the software to the measurement and incident intelligence functions that are used the most.

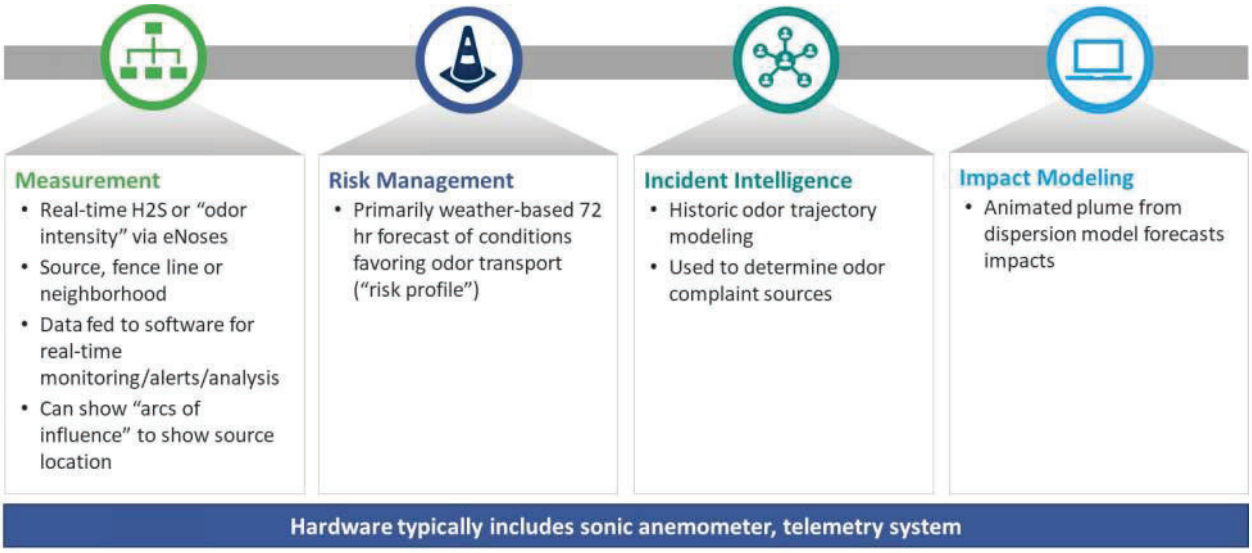


Figure 3-1 Envirosuite Functions

3.1.1.1 Measurement

The Envirosuite system can be provided with sensors which provide continuous measurements of H2S on site (the sensors can also measure up to three additional pollutants, although those capabilities are not included for this application). This data is then integrated with live weather data to provide real time modeling of the WWTP's offsite odor emissions. The Envirosuite system also has the capability of receiving inputs from sensors manufactured by others, such as Detection Instruments' Acrulog.

3.1.1.2 Risk Management

The Envirosuite system utilizes weather forecast data and user defined off-site areas with sensitive receptors to predict the risk that odors will be detected beyond the plant boundary due to wind and weather conditions. This system allows plant operations to be proactive in scheduling activities that could result in odors. Figure 4-2 shows an example odor risk report generated for Deer Creek WWTP using the Risk Management function.

Figure 3-2 Envirosuite Risk Management

3.1.1.3 Incident Intelligence

This software function allows odor source tracing to occur when offsite odor complaints are provided from the community. The system uses historical weather data with measured onsite odor readings to backtrack and determine if the WWTP is responsible for the odor complaint. The system also has a data management system to manage and investigate odor complaints. Figure 4-3 provides an example of the Incident Intelligence output from Deer Creek's Envirosuite system.

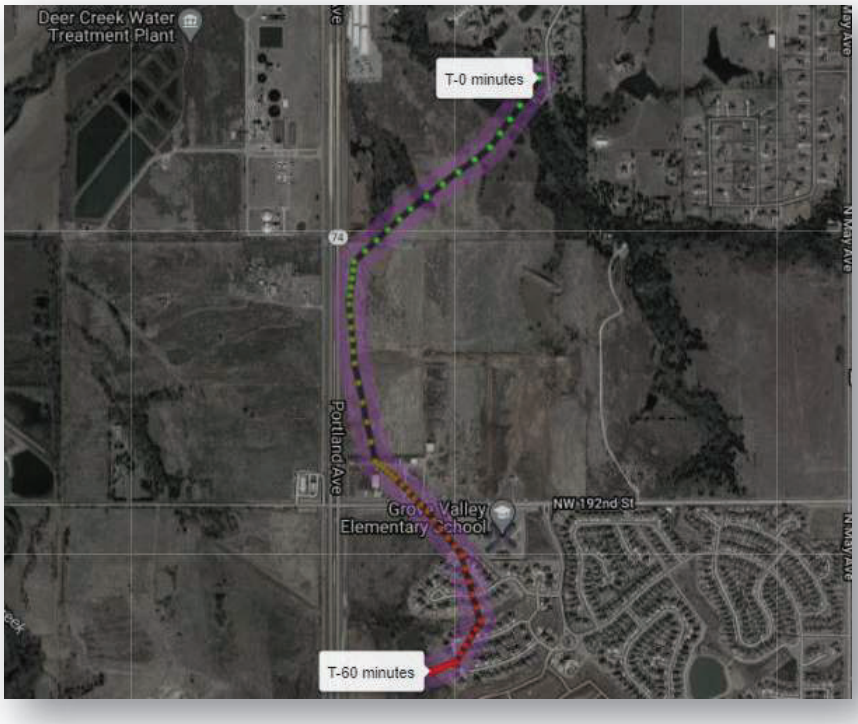


Figure 3-3 Envirosuite Incident Intelligence Example

3.1.1.4 Impact Modeling

This system function incorporates weather and sensor data into a dispersion model (CalPuff) to create an animated plume visually depicting the areas that will be impacted by odor emissions. This can be used to see if the odors are leaving the site. Figure 4-4 shows the Impact modeling output from the Envirosuite system.

Figure 3-4 Envirosuite Impact Modeling

3.1.2 DiCom

DiCom Perimeter System is a system that utilizes H2S emission monitors designed to continuously measure and record low level (0-2000 ppb) H2S emissions at the fence line. A typical installation includes multiple monitors. The monitors are housed in weatherproof enclosures and use Acrulog technology to provide continuous real-time data. The system displays the data at each monitor for local viewing, provides a 4-20 mA signal output for remote monitoring from a SCADA system, and stores H2S data for later downloading and viewing. Figure 4-5 shows the DiCom Analyzer.

Figure 3-5 DiCom Analyzer

3.2 Alternatives

In each of the following sections alternatives are described on a per facility basis for each H2S monitoring system. In order to provide a complete evaluation of the Envirosuite system, multiple alternatives have been developed. For each facility, a DiCom alternative has been provided for comparison purposes. Up to a total of five alternatives are provided per facility. Each alternative will be named utilizing the following acronym: FFSS#, where FF is the facility abbreviation, SS is the system abbreviation (either for Envirosuite or DiCom) and the # is the number of the alternative. For example, NCEN1 is the Envirosuite alternative 1 for the North Canadian WWTP.

Table 3-1 H_2S Monitoring Alternatives Overview

ALTERNATIVE	DESCRIPTION
Envirosuite 1 (EN1)	▪ Equipment and software platform by Envirosuite ▪ Full software functionality ▪ Provided under rental agreement ▪ Envirosuite installation, with power through solar photovoltaic cells and batteries
Envirosuite 2 (EN2)	▪ Weather station and software platform by Envirosuite ▪ Sensors by Acrulog, connected to software via Envirosuite's IoT gateway devices to ▪ Full software functionality ▪ Envirosuite provided under rental agreement, Acrulogs purchase separately ▪ Contractor installation, with power from plant site
Envirosuite 3 (EN3)	▪ Equipment and software platform by Envirosuite ▪ Reduced software functionality (monitoring and incident intelligence functions only) ▪ Provided under rental agreement ▪ Envirosuite installation, with power through solar photovoltaic cells and batteries
Envirosuite 4 (EN4)	▪ Weather station and software platform by Envirosuite ▪ Sensors by Acrulog, connected to software via Envirosuite's IoT gateway devices to ▪ Reduced software functionality (monitoring and incident intelligence functions only ▪ Envirosuite provided under rental agreement, Acrulogs purchase separately ▪ Contractor installation, with power from plant site
DiCom 5 (DI5)	▪ DiCom analyzers that will be connected to the SCADA System as is described in Section 4.1.2.

3.3 Deer Creek WWTP

As indicated in Section 3.1, Deer Creek WWTP has an existing Envirosuite that includes the complete software platform with all software functions, a weather station and two odor sensors. Because the current system has the complete software platform with all the software functions only the Envirosuite alternatives with the complete functionality are included. A new DiCom system is provided as an alternative for comparison purposes.

3.3.1 EnviroSuite System Modifications

The improvements included in the Envirosuite system alternatives include the addition of two new odor analyzers to improve H2S detection and analysis capabilities at the plant site. Figure 4-6 shows the location of the new and existing analyzers and weather station. The costs included in this alternative include both the current rental fee and additional cost associated with incorporating the new equipment into the existing Envirosuite System.

Figure 3-6 Deer Creek WWTP Envirosuite System Layout

3.3.2 New DiCom System

The DiCom system includes four (4) fixed location monitors with the ability to monitor, locally display, transmit to SCADA and record H2S concentrations from 0-2000 ppb. Preliminarily, it is assumed that 3 sensors would be located along the north and eastern fenceline, with a 4th located by the EQ basins. The system includes a cellular modem and data plan for uploading H2S data data twice per day. Table 5-1 summarizes the costs associated with this system. A layout for the DiCom system is found in Appendix B.

3.4 Chisolm Creek WWTP

Currently Chisolm Creek WWTP has local H2S monitors for safety purposes on site. This evaluation considered the addition of a new EnviroSuite System and a DiCom System to the existing plant site to monitor H2S emissions.

3.4.1 EnviroSuite

A new Envirosuite system would include three sensors, a weather station and the software platform. Four different Envirosuite alternatives were developed and are presented in Table 5-1. A layout for the Envirosuite system is found in Appendix A.

3.4.2 DiCom

As an alternative to the Envirosuite systems, a DiCom system was evaluated. This system includes three (3) fixed location monitors with the ability to monitor, locally display, transmit to SCADA and record H2S concentrations from 0-2000 ppb. The unit includes a cellular modem and data plan for uploading odor data twice per day. Cost assume the analyzers will be mounted on an existing fence or post and each unit will require power and a 4-20 mA signal to the SCADA system. Appendix D summarizes the costs associated with this system. A layout for the DiCom system is found in Appendix B.

3.5 North Canadian WWTP

Currently North Canadian WWTP has local H2S monitors for safety and chemical feed control purposes on site. This evaluation considered the addition of a new EnviroSuite System and a DiCom System to the existing plant site to monitor odor emissions.

3.5.1 EnviroSuite

A new Envirosuite system includes four (4) odor analyzers, a weather station and the software platform. Four different Envirosuite alternatives were developed and are presented in Table 5-1. A layout for the Envirosuite system is found in Appendix A.

Figure 3-7 North Canadian DiCom System Layout

3.5.2 DiCom

As an alternative to the Envirosuite system alternatives, a DiCom system was evaluated. This system includes four (4) fixed location monitors with the ability to monitor, locally display, transmit to SCADA and record H2S concentrations from 0-2000 ppb. The unit includes a cellular modem and data plan for uploading odor data twice per day. Cost assume the analyzers will be mounted on an existing fence or post and each unit will require power and a 4-20 mA signal to the SCADA system. Table 5-1 summarizes the costs associated with this system. A layout for the system is found in Appendix B.

3.6 Witcher Lift Station

This evaluation considered the addition of a new EnviroSuite System and a DiCom System to the existing lift station and FEB site to monitor odor emissions.

3.6.1 EnviroSuite

A new Envirosuite system includes three odor analyzers, a weather station and the software platform. Four different Envirosuite alternatives were developed and are presented Table 5-1. Layouts for this system are found in Appendix A.

3.6.2 DiCom

As an alternative to the improvements to the Envirosuite system, a DiCom system was evaluated. This system includes three (3) fixed location monitors with the ability to monitor, locally display, transmit to SCADA and record H2S concentrations from 0-2000 ppb. The unit includes a cellular modem and data plan for uploading odor data twice per day. Table 5-1 summarized the costs associated with this system. Appendix B provides a layout showing the location of the new analyzers.

4.0 Cost Comparison

Table 5-1 compares costs for each of the alternatives presented above. As shown in the table, costs for the DiCom system is generally lower than the cost for the Envirosuite, which is intuitive given the different capabilities of the system. The exception is Deer Creek, where the cost shown reflects new equipment only, rather than current investments in the existing system.

Note that costs for new Envirosuite systems may seem high compared to existing costs at Deer Creek. This reflects a somewhat discounted pricing structure for the existing system which is no longer available.

Table 4-1 H_2S Monitoring Alternatives Comparison

PLANT	ALTERNATIVE	SOFTWARE FUNCTIONS	PROCURE-MENT	OPCC	ANNUAL MAINTENANCE/ RENTAL COST	LIFE CYCLE COST
Deer Creek WWTP	DCEN1	All	Rent	$0	$28,400	$404,000
	DCEN2	All	Own	$54,000	$20,800	$350,000
	DCDI5	None	Own	$222,000	$3,000	$265,000
Chisholm Creek WWTP	CCEN1	All	Rent	$39,000	$62,200	$924,000
	CCEN2	All	Own	$105,000	$44,800	$742,000
	CCEN3	Reduced	Rent	$39,000	$54,900	$820,000
	CCEN4	Reduced	Own	$105,000	$36,900	$630,000
	CCDI5	None	Own	$167,000	$2,000	$196,000
North Canadian WWTP	NCEN1	All	Rent	$39,000	$67,000	$992,000
	NCEN2	All	Own	$139,000	$56,500	$943,000
	NCEN3	Reduced	Rent	$27,000	$59,900	$879,000
	NCEN4	Reduced	Own	$95,000	$50,000	$806,000
	NCDI5	None	Own	$222,000	$3,000	$265,000
Witcher Lift Station	WLEN1	All	Rent	$39,000	$58,100	$865,000
	WLEN2	All	Own	$82,000	$40,400	$657,000
	WLEN3	Reduced	Rent	$39,000	$53,500	$879,000
	WLEN4	Reduced	Own	$79,000	$35,500	$584,000
	WLDI5	None	Own	$114,000	$1,200	$132,000

5.0 Recommendations

Both the Envirosuite and DiCom monitoring system measure, record, and report H_2S concentrations on site at specific locations. The key difference between the two systems is what is done with this information. The DiCom system reports this information to SCADA system and provides logs that can be downloaded for manual manipulation. The Envirosuite reports this data to the cloud and combines this data with weather data collected on site within the Envirosuite software platform to show the impact H2S has on the surrounding community automatically. This key differentiator comes with a much higher life cycle cost, but the functionality and the ability to quickly, confidently and even retroactively respond to odor complaints and understand the underlying causes of those complaints is a key benefit of the Envirosuite system. This system allows operations to be adapted to eliminate complaints in the future when possible.

In the unique case of Deer Creek WWTP, the small cost associated with the additional analyzers makes enhancing the existing Envirosuite system result in similar life cycle cost to a new DiCom System. In the other cases, using the DiCom system is much less costly and has a lower life cycle cost, but provides a lower level of functionality.

Utilizing Acrulog analyzers with the new Envirosuite analyzers provides costs savings but results in additional operations and maintenance. Reducing the functions used in the Envirosuite provides a lower cost without sacrificing the key functions that are routinely used at the wastewater treatment plants.

Generally, the Envirosuite system is recommended at each wastewater treatment plant evaluated because of the ability of plant staff to adjust operations to respond to odor complaints. The DiCom system is a more economic fit and is recommended for the Witcher Lift Station application.

Appendix A. Envirosuite System Layouts

North Canadian WWTP

Chisholm Creek WWTP

Witcher Lift Station and EQ Basins

Appendix B. DiCom System Layouts

Proposed locations for DICOM H2S monitors at Deer Creek WWTP

North Canadian WWTP

Chisholm Creek WWTP

Proposed locations for DICOM H2S monitors at Witcher Lift Station

Appendix C. Opinion of Probable Costs

An Opinion of Probable Construction Cost (OPCC) was developed for each H2S monitoring system alternative. As a recommended practice of AACEI, the cost estimate completed for this evaluation was allocated to a specific class recommended by AACEI Cost Estimate Classification System, which is based on the project stage. A Class 5 Estimate with a 30% contingency was utilized as a basis for the OPCC. The accuracy range for a Class 5 Estimate is -30% to 50%. The values presented include direct costs, specified contingency, and all indirect costs such as general conditions, contractor overhead and profit, contractor bonds and insurance, construction escalation assuming construction occurs by 2022, and engineering services during design and construction.

The OPCC information has been prepared for guidance in project evaluation and implementation from the information available at the time the OPCCs were developed. Appendix C provides the OPPC breakdown information. The final costs of the project will be dependent on the design the final routing of conduit, on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable conditions such as market events including COVID related material and labor shortages beyond the control of Black & Veatch and the City, and political events. The OPCC assumes the projects are completed using a competitive bid basis. The annual operations costs are based on rental fees and maintenance activities identified in each systems O&M manual. In the case of the Envirosuite system, all maintenance and installation is assumed to be provided by Envirosuite. The table below summarizes assumptions used in the cost analysis of the alternatives.

PARAMETER	ASSUMPTION
Installation factor (contractor installed equipment)	30%
Mobilization/ Demobilization (% of sub total with contingencies)	5%
Bonds and Insurance (% of subtotal with contingencies)	3%
Contractors OH & P (% of subtotal with contingencies)	15%
Contingencies (% of subtotal)	50%
Eng., Legal, and Admin. (% of construction cost)	17%
I & C (allowance per odor analyzer connected to SCADA)	$3000
Electrical (allowance per odor analyzer connected to Plant Power)	$3000
Effective Interest Rate	3.5%
Period (Life Cycle Evaluation)	20 years

COST SUMMARIES

Plant	Alternative	Capital Cost	Annual O&M Cost	NPW Cost
Deer Creek WWTP	DCEN1	$ -	$ 28,400	$ 404,000
	DCEN2	$ 54,000	$ 20,800	$ 350,000
	DCDI5	$ 222,000	$ 3,000	$ 265,000
Chisholm Creek WWTP	CCEN1	$ 39,000	$ 62,200	$ 924,000
	CCEN2	$ 105,000	$ 44,800	$ 742,000
	CCEN3	$ 39,000	$ 54,900	$ 820,000
	CCEN4	$ 105,000	$ 36,900	$ 630,000
	CCDI5	$ 167,000	$ 2,000	$ 196,000
N. Canadian WWTP	NCEN1	$ 39,000	$ 67,000	$ 992,000
	NCEN2	$ 139,000	$ 56,500	$ 943,000
	NCEN3	$ 27,000	$ 59,900	$ 879,000
	NCEN4	$ 95,000	$ 50,000	$ 806,000
	NCDI5	$ 222,000	$ 3,000	$ 265,000
Witcher LS	WLEN1	$ 39,000	$ 58,100	$ 865,000
	WLEN2	$ 82,000	$ 40,400	$ 657,000
	WLEN3	$ 39,000	$ 53,500	$ 879,000
	WLEN4	$ 79,000	$ 35,500	$ 584,000
	WLDI5	$ 114,000	$ 1,200	$ 132,000

Deer Creek WWTP
Envirosuite Alternative 1 (DCEN1)

Number of Additional Sensors:2

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$0	$0
					Subtotal	**$0**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$0**
					Contingencies (50% of subtotal)	$0
					Overall Subtotal with Contingencies	**$0**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$0
					Bonds and Insurance (3% of subtotal with contingencies)	$0
					Contractors OH & P (15% of subtotal with contingencies)	$0
					Total Construction Cost	**$0**
					Eng., Legal, and Admin. (15% of construction cost)	$0
Total Probable Capital Cost (Rounded)		**$0**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$8,263.000		$8,300
	Existing Rental Fee	1	year	$20,004.000		$20,100
Total Probable Operations and Maintenance (Rounded)		**$28,400**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$404,000**				

Deer Creek WWTP
Envirosuite Alternative 2 (DCEN2)

Number of Sensors: 2

Supplied by: Detection Instruments

Communication by: Envirosuite

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Sensor Costs**					
	Acrulog by Detection Instruments	2	EA	$5,715	$2,000	$16,000
	Acrulog calibration kit	3	EA	$645		$1,935
					Subtotal	**$17,935**
2.0	**I&C and Electrical**					
	Electrical Improvements	2	EA	$3,000		$6,000
					Subtotal	**$6,000**
					Overall Subtotal	**$23,935**
					Contingencies (50% of subtotal)	$12,000
					Overall Subtotal with Contingencies	**$35,935**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$2,000
					Contractors OH & P (15% of subtotal with contingencies)	$6,000
					Total Construction Cost	**$46,000**
					Eng., Legal, and Admin. (15% of construction cost)	$8,000
Total Probable Capital Cost (Rounded)		**$54,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Calibration costs	2	per unit	$350.000		$700
	Existing Rental Fee	1	year	$20,004.000		$20,100
Total Probable Operations and Maintenance (Rounded)		**$20,800**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$350,000**				

Deer Creek WWTP
DiCom Alternative 5 (DCDI5)

Number of Sensors: 2
Supplied by: Detection Instruments
Communication by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
1.0	**Sensors Cost**					
	DiCom Sensors	4	EA	$13,650	$5,000	$75,000
	Acrulog calibration kit	4	EA	$645		$2,580
					Subtotal	**$77,580**
2.0	**I&C and Electrical**					
	I&C Improvements	4	EA	$3,000		$12,000
	Electrical Improvements	4	EA	$3,000		$12,000
					Subtotal	**$24,000**
					Overall Subtotal	**$101,580**
					Contingencies (50% of subtotal)	$51,000
					Overall Subtotal with Contingencies	**$152,580**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$8,000
					Bonds and Insurance (3% of subtotal with contingencies)	$5,000
					Contractors OH & P (15% of subtotal with contingencies)	$23,000
					Total Construction Cost	**$189,000**
					Eng., Legal, and Admin. (15% of construction cost)	$33,000
Total Probable Capital Cost (Rounded)		**$222,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Calibration Costs	4	EA	$560.000		$3,000
Total Probable Operations and Maintenance (Rounded)		**$3,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$265,000**				

Chisolm Creek WWTP
Envirosuite Alternative 1 (CCEN1)

Number of Weather Stations:1

Number of Sensors:3

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$16,900	$17,000
					Subtotal	**$17,000**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$17,000**
					Contingencies (50% of subtotal)	$9,000
					Overall Subtotal with Contingencies	**$26,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$33,000**
					Eng., Legal, and Admin. (15% of construction cost)	$6,000
Total Probable Capital Cost (Rounded)		**$39,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$62,200.000		$62,200
Total Probable Operations and Maintenance (Rounded)		**$62,200**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$924,000**				

Chisolm Creek WWTP
Envirosuite Alternative 2 (CCEN2)

Number of Weather Stations:1

Number of Sensors:3

Sensors provided supplied by: Detection Instruments

Installed by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Envirosuite Equipment)	1	LS		$16,900	$11,800
	Acrulog calibration kit	3	EA	$645		$1,935
	Acrulog by Detection Instruments	3	EA	$5,715	$2,000	$24,000
					Subtotal	**$37,735**
2.0	**I&C and Electrical**					
	Electrical Improvements	3	EA	$3,000		$9,000
					Subtotal	**$9,000**
					Overall Subtotal	**$46,735**
					Contingencies (50% of subtotal)	$24,000
					Overall Subtotal with Contingencies	**$70,735**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$4,000
					Bonds and Insurance (3% of subtotal with contingencies)	$3,000
					Contractors OH & P (15% of subtotal with contingencies)	$11,000
					Total Construction Cost	**$89,000**
					Eng., Legal, and Admin. (15% of construction cost)	$16,000
Total Probable Capital Cost (Rounded)		**$105,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$44,800.000		$44,800
Total Probable Operations and Maintenance (Rounded)		**$44,800**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$742,000**				

Chisolm Creek WWTP
Envirosuite Alternative 3 (CCEN3)

Number of Weather Stations:1

Number of Sensors:3

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$16,900	$17,000
					Subtotal	**$17,000**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$17,000**
					Contingencies (50% of subtotal)	$9,000
					Overall Subtotal with Contingencies	**$26,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$33,000**
					Eng., Legal, and Admin. (15% of construction cost)	$6,000
Total Probable Capital Cost (Rounded)		**$39,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$54,900.000		$54,900
Total Probable Operations and Maintenance (Rounded)		**$54,900**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$820,000**				

Chisolm Creek WWTP
Envirosuite Alternative 4 (CCEN4)

Number of Weather Stations:1

Number of Sensors:3

Sensors provided supplied by: Detection Instruments

Installed by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$11,800	$12,000
	Acrulog calibration kit	3	EA	$645		$1,935
	Acrulog by Detection Instruments	3	EA	$5,715	$2,000	$24,000
					Subtotal	**$37,935**
2.0	**I&C and Electrical**					
	Electrical Improvements	3	EA	$3,000		$9,000
					Subtotal	**$9,000**
					Overall Subtotal	**$46,935**
					Contingencies (50% of subtotal)	$24,000
					Overall Subtotal with Contingencies	**$70,935**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$4,000
					Bonds and Insurance (3% of subtotal with contingencies)	$3,000
					Contractors OH & P (15% of subtotal with contingencies)	$11,000
					Total Construction Cost	**$89,000**
					Eng., Legal, and Admin. (15% of construction cost)	$16,000
Total Probable Capital Cost (Rounded)		**$105,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$36,900.000		$36,900
Total Probable Operations and Maintenance (Rounded)		**$36,900**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$630,000**				

Chisolm Creek WWTP
DiCom Alternative 5 (CCDI5)

Number of Sensors: 3

Supplied by: Detection Instruments

Communication by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
1.0	**Sensors Cost**					
	DiCom Sensors	3	EA	$13,650	$5,000	$56,000
	Acrulog calibration kit	3	EA	$645		$1,935
					Subtotal	**$57,935**
2.0	**I&C and Electrical**					
	I&C Improvements	3	EA	$3,000		$9,000
	Electrical Improvements	3	EA	$3,000		$9,000
					Subtotal	**$18,000**
					Overall Subtotal	**$75,935**
					Contingencies (50% of subtotal)	$38,000
					Overall Subtotal with Contingencies	**$113,935**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$6,000
					Bonds and Insurance (3% of subtotal with contingencies)	$4,000
					Contractors OH & P (15% of subtotal with contingencies)	$18,000
					Total Construction Cost	**$142,000**
					Eng., Legal, and Admin. (15% of construction cost)	$25,000
Total Probable Capital Cost (Rounded)		**$167,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Calibration Costs	3	EA	$560.000		$1,700
Total Probable Operations and Maintenance (Rounded)		**$2,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$196,000**				

North Canadian WWTP
Envirosuite Alternative 1 (NCEN1)

Number of Weather Stations:1

Number of Sensors:3

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$16,828	$17,000
					Subtotal	**$17,000**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$17,000**
					Contingencies (50% of subtotal)	$9,000
					Overall Subtotal with Contingencies	**$26,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$33,000**
					Eng., Legal, and Admin. (15% of construction cost)	$6,000
Total Probable Capital Cost (Rounded)		**$39,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$67,000.000		$67,000
Total Probable Operations and Maintenance (Rounded)		**$67,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$992,000**				

North Canadian WWTP
Envirosuite Alternative 2 (NCEN2)

Number of Weather Stations:1

Number of Sensors:3

Sensors provided supplied by: Detection Instruments

Installed by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Envirosuite Equipment)	1	LS		$16,828	$16,828
	Acrulog by Detection Instruments	4	EA	$5,715	$2,000	$31,000
	Acrulog calibration kit	4	EA	$645		$2,580
					Subtotal	**$50,408**
2.0	**I&C and Electrical**					
	Electrical Improvements	4	EA	$3,000		$12,000
					Subtotal	**$12,000**
					Overall Subtotal	**$62,408**
					Contingencies (50% of subtotal)	$32,000
					Overall Subtotal with Contingencies	**$94,408**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$5,000
					Bonds and Insurance (3% of subtotal with contingencies)	$3,000
					Contractors OH & P (15% of subtotal with contingencies)	$15,000
					Total Construction Cost	**$118,000**
					Eng., Legal, and Admin. (15% of construction cost)	$21,000
Total Probable Capital Cost (Rounded)		**$139,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$56,500.000		$56,500
Total Probable Operations and Maintenance (Rounded)		**$56,500**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$943,000**				

North Canadian WWTP
Envirosuite Alternative 3 (NCEN3)

Number of Weather Stations:1

Number of Sensors:3

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$11,558	$12,000
					Subtotal	**$12,000**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$12,000**
					Contingencies (50% of subtotal)	$6,000
					Overall Subtotal with Contingencies	**$18,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$1,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$3,000
					Total Construction Cost	**$23,000**
					Eng., Legal, and Admin. (15% of construction cost)	$4,000
Total Probable Capital Cost (Rounded)		**$27,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$59,855.000		$59,900
Total Probable Operations and Maintenance (Rounded)		**$59,900**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$879,000**				

North Canadian WWTP
Envirosuite Alternative 4 (NCEN4)

Number of Weather Stations:1

Number of Sensors:3

Sensors provided supplied by: Detection Instruments

Installed by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$11,558	$12,000
	Acrulog calibration kit	4	EA	$645		$2,580
	Acrulog by Detection Instruments	4	EA	$5,715	$2,000	$31,000
					Subtotal	**$31,000**
2.0	**I&C and Electrical**					
	Electrical Improvements	4	EA	$3,000		$12,000
					Subtotal	**$12,000**
					Overall Subtotal	**$43,000**
					Contingencies (50% of subtotal)	$22,000
					Overall Subtotal with Contingencies	**$65,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$4,000
					Bonds and Insurance (3% of subtotal with contingencies)	$2,000
					Contractors OH & P (15% of subtotal with contingencies)	$10,000
					Total Construction Cost	**$81,000**
					Eng., Legal, and Admin. (15% of construction cost)	$14,000
Total Probable Capital Cost (Rounded)		**$95,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$49,990.000		$50,000
Total Probable Operations and Maintenance (Rounded)		**$50,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$806,000**				

North Canadian WWTP
DiCom Alternative 5 (NCDI5)

Number of Sensors: 3

Supplied by: Detection Instruments

Communication by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
1.0	**Sensors Cost**					
	DiCom Sensors	4	EA	$13,650	$5,000	$75,000
	Acrulog calibration kit	4	EA	$645		$2,580
					Subtotal	**$77,580**
2.0	**I&C and Electrical**					
	I&C Improvements	4	EA	$3,000		$12,000
	Electrical Improvements	4	EA	$3,000		$12,000
					Subtotal	**$24,000**
					Overall Subtotal	**$101,580**
					Contingencies (50% of subtotal)	$51,000
					Overall Subtotal with Contingencies	**$152,580**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$8,000
					Bonds and Insurance (3% of subtotal with contingencies)	$5,000
					Contractors OH & P (15% of subtotal with contingencies)	$23,000
					Total Construction Cost	**$189,000**
					Eng., Legal, and Admin. (15% of construction cost)	$33,000
Total Probable Capital Cost (Rounded)		**$222,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Calibration Costs	4	EA	$560.000		$2,300
Total Probable Operations and Maintenance (Rounded)		**$3,000**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$265,000**				

Witcher Lift Station
Envirosuite Alternative 1 (WLEN1)

Number of Weather Stations:1

Number of Sensors:3

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$16,900	$17,000
					Subtotal	**$17,000**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$17,000**
					Contingencies (50% of subtotal)	$9,000
					Overall Subtotal with Contingencies	**$26,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$33,000**
					Eng., Legal, and Admin. (15% of construction cost)	$6,000
Total Probable Capital Cost (Rounded)		**$39,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$58,100.000		$58,100
Total Probable Operations and Maintenance (Rounded)		**$58,100**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$865,000**				

Witcher Lift Station
Envirosuite Alternative 2 (WLEN2)

Number of Weather Stations:1

Number of Sensors:3

Sensors provided supplied by: Detection Instruments

Installed by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Envirosuite Equipment)	1	LS		$11,800	$11,800
	Acrulog by Detection Instruments	2	EA	$5,715	$2,000	$16,000
	Acrulog calibration kit	4	EA	$645		$2,580
					Subtotal	**$30,380**
2.0	**I&C and Electrical**					
	Electrical Improvements	2	EA	$3,000		$6,000
					Subtotal	**$6,000**
					Overall Subtotal	**$36,380**
					Contingencies (50% of subtotal)	$19,000
					Overall Subtotal with Contingencies	**$55,380**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$3,000
					Bonds and Insurance (3% of subtotal with contingencies)	$2,000
					Contractors OH & P (15% of subtotal with contingencies)	$9,000
					Total Construction Cost	**$70,000**
					Eng., Legal, and Admin. (15% of construction cost)	$12,000
Total Probable Capital Cost (Rounded)		**$82,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$40,400.000		$40,400
Total Probable Operations and Maintenance (Rounded)		**$40,400**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$657,000**				

Witcher Lift Station
Envirosuite Alternative 3 (WLEN3)

Number of Weather Stations:1

Number of Sensors:3

Supplied by: Envirotech via rental contract

Installed by: Envirotech

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$16,900	$17,000
					Subtotal	**$17,000**
2.0	**I&C and Electrical**					
	I & C Improvements	1	EA	$0		$0
	Electrical Improvements	1	EA	$0		$0
					Subtotal	**$0**
					Overall Subtotal	**$17,000**
					Contingencies (50% of subtotal)	$9,000
					Overall Subtotal with Contingencies	**$26,000**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$2,000
					Bonds and Insurance (3% of subtotal with contingencies)	$1,000
					Contractors OH & P (15% of subtotal with contingencies)	$4,000
					Total Construction Cost	**$33,000**
					Eng., Legal, and Admin. (15% of construction cost)	$6,000
Total Probable Capital Cost (Rounded)		**$39,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$53,450.000		$53,500
Total Probable Operations and Maintenance (Rounded)		**$53,500**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$800,000**				

Witcher Lift Station
Envirosuite Alternative 4 (WLEN4)

Number of Weather Stations:1

Number of Sensors:3

Sensors provided supplied by: Detection Instruments

Installed by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
CAPITAL COST						
1.0	**Installation Cost**					
	Installation Cost (Installation by Envirotech)	1	LS	$0	$11,800	$12,000
	Acrulog by Detection Instruments	2	EA	$5,715	$2,000	$16,000
	Acrulog calibration kit	2	EA	$645		$1,290
					Subtotal	**$29,290**
2.0	**I&C and Electrical**					
	Electrical Improvements	2	EA	$3,000		$6,000
					Subtotal	**$6,000**
					Overall Subtotal	**$35,290**
					Contingencies (50% of subtotal)	$18,000
					Overall Subtotal with Contingencies	**$53,290**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$3,000
					Bonds and Insurance (3% of subtotal with contingencies)	$2,000
					Contractors OH & P (15% of subtotal with contingencies)	$8,000
					Total Construction Cost	**$67,000**
					Eng., Legal, and Admin. (15% of construction cost)	$12,000
Total Probable Capital Cost (Rounded)		**$79,000**				
OPERATION AND MAINTENANCE						
1.0						
	Rental Fee	1	year	$35,450.000		$35,500
Total Probable Operations and Maintenance (Rounded)		**$35,500**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$584,000**				

Witcher Lift Station
DiCom Alternative 5 (WLDI5)

Number of Sensors: 3
Supplied by: Detection Instruments
Communication by: Contractor

Item		Quantity	Unit	Unit Cost	Installation	Rounded Subtotal
1.0	**Sensors Cost**					
	DiCom Sensors	2	EA	$13,650	$5,000	$38,000
	Acrulog calibration kit	2	EA	$645		$1,290
					Subtotal	**$39,290**
2.0	**I&C and Electrical**					
	I&C Improvements	2	EA	$3,000		$6,000
	Electrical Improvements	2	EA	$3,000		$6,000
					Subtotal	**$12,000**
					Overall Subtotal	**$51,290**
					Contingencies (50% of subtotal)	$26,000
					Overall Subtotal with Contingencies	**$77,290**
					Mobilization/Demobilization (5% of subtotal with contingencies)	$4,000
					Bonds and Insurance (3% of subtotal with contingencies)	$3,000
					Contractors OH & P (15% of subtotal with contingencies)	$12,000
					Total Construction Cost	**$97,000**
					Eng., Legal, and Admin. (15% of construction cost)	$17,000
Total Probable Capital Cost (Rounded)		**$114,000**				
OPERATION AND MAINTENANCE						
1.0						
	Annual Calibration Costs	2	EA	$560.000		$1,200
Total Probable Operations and Maintenance (Rounded)		**$1,200**				
NET PRESENT WORTH						
					Effective Interest	3.5%
					Period (years)	20
Total Net Present Worth (Rounded)		**$132,000**				

Appendix D. Cost Quotation

Bill To:
Lynne Moss
Black & Veatch
18310 Montgomery Village Ave., # 7
Gaithersburg MD 20879

Quotation #: **50198**
Quotation Date: Aug 25, 2021
Customer ID: **8388**

Detection Instruments Corp.

18441 N. 25th Avenue, Suite 101
Phoenix, AZ 85023
Ph: (602) 797-0630, Fax (602) 797-0631

Ship To:
Lynne Moss 512-271-6244
Black & Veatch
18310 Montgomery Village Ave., # 750
Gaithersburg MD 20879

Display Decimal?

P.O. # QUOTATION	Rep Lindy Eppinger	Authorized by	Terms Net 30 Days
Ship Via FedX GRD	Ship Date 8/25/2021	Notes **bolded items extras**	

Qty	Project	Description	Unit Price	Disc%	Extended Price
1	DiCom2	Single Point Continuous H2S monitor, Stainless Steel NEMA4x enclosure -	$11250.00		$11250.00
1	DiCom-ALS	Durable Aluminum sunshade to shield sunlight and excess heat on DI-Com monitor. -	$540.00		$540.00
1	Acrustat software	Acrustat Software with Bluetooth Adapter -	$150.00		$150.00
1	**4GXT**	4GXT wireless upgrade for JJ Pressure, CEM, DiCom or APPB2000 -	$1500.00		$1500.00
1	**4GXT-DP12**	Acrulog 4GXT 12 month data plan, allows for 2 transmissions per day -	$210.00		$210.00
1	FRT-TBD	Freight charge to be determined - TBD			$0.00
		-			

Date Shipped_____

Invoice Total **$13650.00**

Order Form

Bill To:
Accounts Payable
Black & Veatch
18310 Montgomery Village Ave., # 7
Gaithersburg MD 20879

Quotation #: **50255**
Quotation Date: Aug 31, 2021
Customer ID: **8388**

Detection Instruments Corp.

18441 N. 25th Avenue, Suite 101
Phoenix, AZ 85023
Ph: (602) 797-0630, Fax (602) 797-0631

Ship To:
Ulrich Bazemo 512-271-6244
Black & Veatch
18310 Montgomery Village Ave., # 750
Gaithersburg MD 20879

Display Decimal?

P.O. # QUOTATION	Rep Lindy Eppinger	Authorized by	Terms PROFORMA
Ship Via FedX GRD	Ship Date 8/31/2021	Notes	

Qty	Project	Description	Unit Price	Disc%	Extended Price
1	APPB2000mA	Acrulog H2S 0-2000 ppb gas monitor with 3M sample draw, external power, 4/20 mA output, with accessory kit -	$5545.00		$5545.00
1	3M S-Tube	3 meter sample tube -	$170.00		$170.00
1	FRT-PPA	Prepay and add freight charges -			$0.00
		-			
		Date Shipped_____	*Invoice Total*		**$5715.00**
		Order Form			

Environmental Intelligence Solution for North Canadian WWTP

31 August, 2021

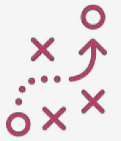
BLACK & VEATCH

envirosuite

Our Proposed Solution

- We propose equipping the staff at the **North Canadian WWTP** with an **Environmental Intelligence** platform, which will allow them to quickly become aware of any future risk to the community, and validate any incoming reports with ease and confidence.
- The features in the platform will allow staff to:
  - Access the platform from any internet-able device with a modern web browser (e.g. a tablet with a SIM card or Wi-Fi available)
  - Quickly trigger advanced analysis in the application at the touch of a button, and view the results within minutes to use in the course of their work
  - Easily configure their own personal dashboards, and run a variety of useful reports
  - Receive automated alerts based on rules/conditions – even when not logged in

Key Software Platform Features



Predict and understand your risk

- Get a clear view of future risk that is tailored to your situation
- Plan your operations around favourable conditions to reduce risk of impact

Get to the root of issues, fast

- Trajectory analysis that you can trust, and is not time-dependent
- Quickly identify if your site is involved, or if other area facilities might be the cause
- Respond to community members confidently and quickly

Always be aware

- Intelligent rules allow for automated alerts to be sent to staff based on forecasted risk and other conditions
- Anyone can use their mobile device to log into the system from anywhere, empowering quick action

REQUIRED EQUIPMENT

Advanced Weather Station

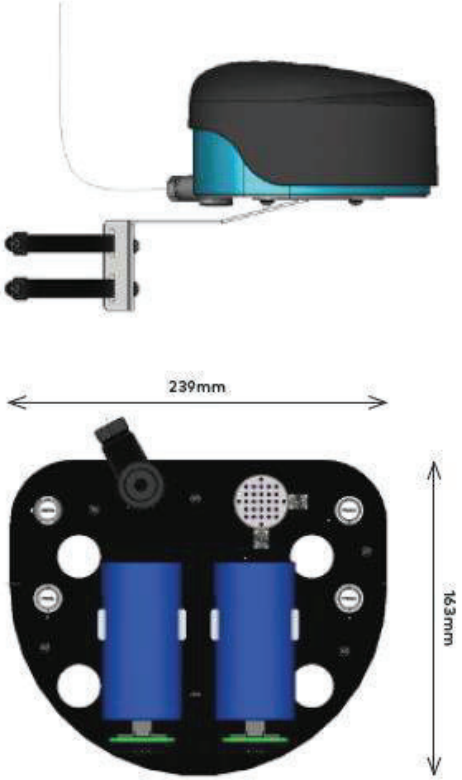
- Supplies all required weather parameter readings to the Envirosuite software platform (i.e temperature, RH, wind speed/direction, barometric pressure, solar irradiance, precipitation, etc.)
- Includes all required solar power and communications accessories for a turn-key solution
- Envirosuite to work with North Canadian WWTP to find appropriate location for installation
- Ideally, it should be installed on a 30-ft (10m) tower

OPTIONAL EQUIPMENT

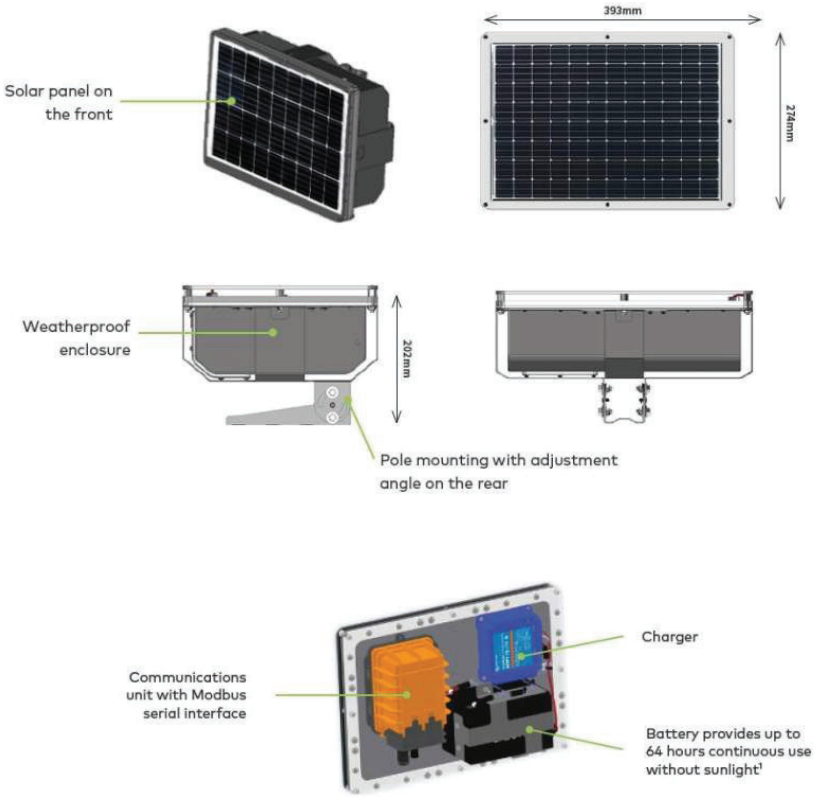
Ambient Monitoring Station

- Able to track up to 3 different compounds in a single enclosure
- Provides pollutant concentration in units (e.g. ppb, $\mu g/m^3$, etc.)
- Includes all required solar power and communications accessories for a turn-key solution
- Envirosuite to work with North Canadian WWTP to find appropriate locations for installation
- Can be mounted on poles, fences, tripods, etc.

Sensing Unit



Power, Comms & Data Logger Unit



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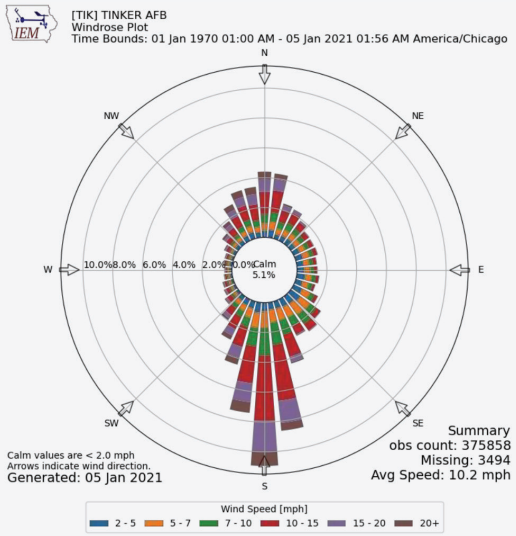
Proposed Sensor Specifications

Sensor	Minimum Detection Limit	Lower Limit[4]	Upper Limit[4]	Uncertainty	Operating Range
Air Quality Sensors					
Hydrogen sulfide (H_2S) and methylmercaptan (CH_4S)	10 ppb	20 ppb	1 ppm	± 30%, Linearity < 10%	-20C to + 40 C; 10 to 90 %RH non condensing

Proposed Equipment Locations



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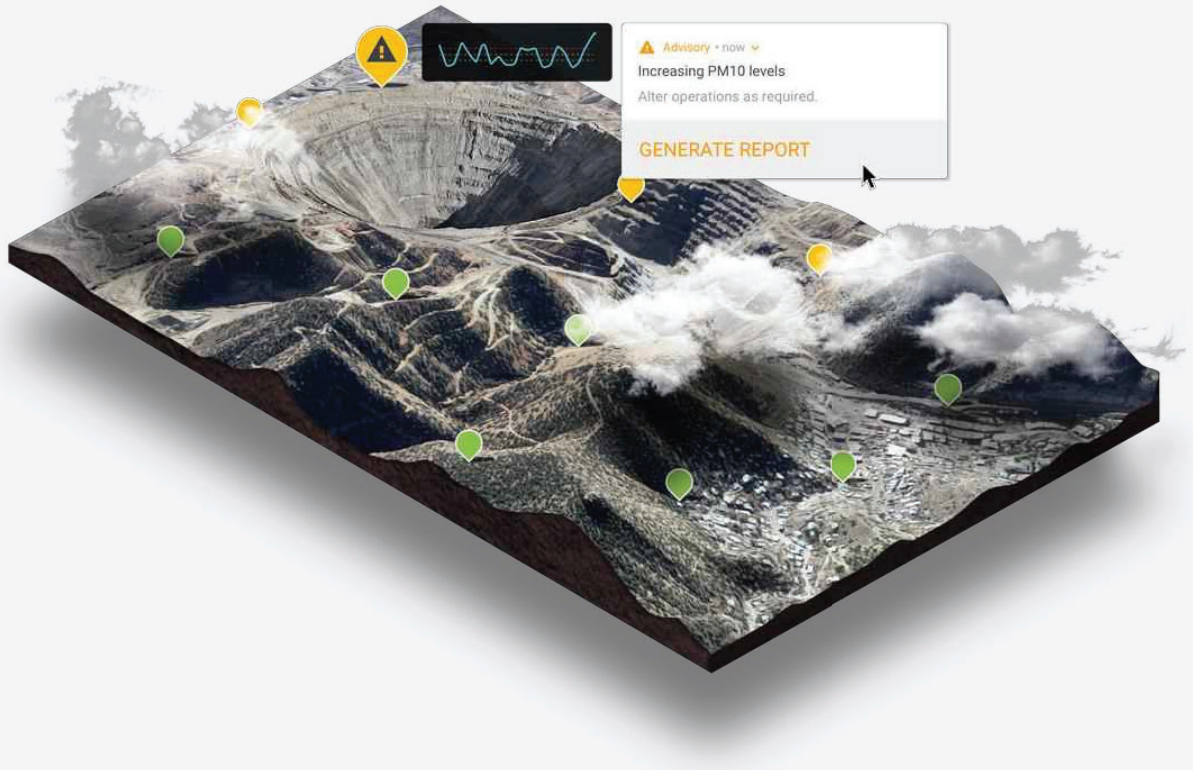
Environmental
Compliance

Environmental compliance without the headaches

- See issues simply
- Take instant action
- Use the past to predict the future
- Reduce reporting and admin time



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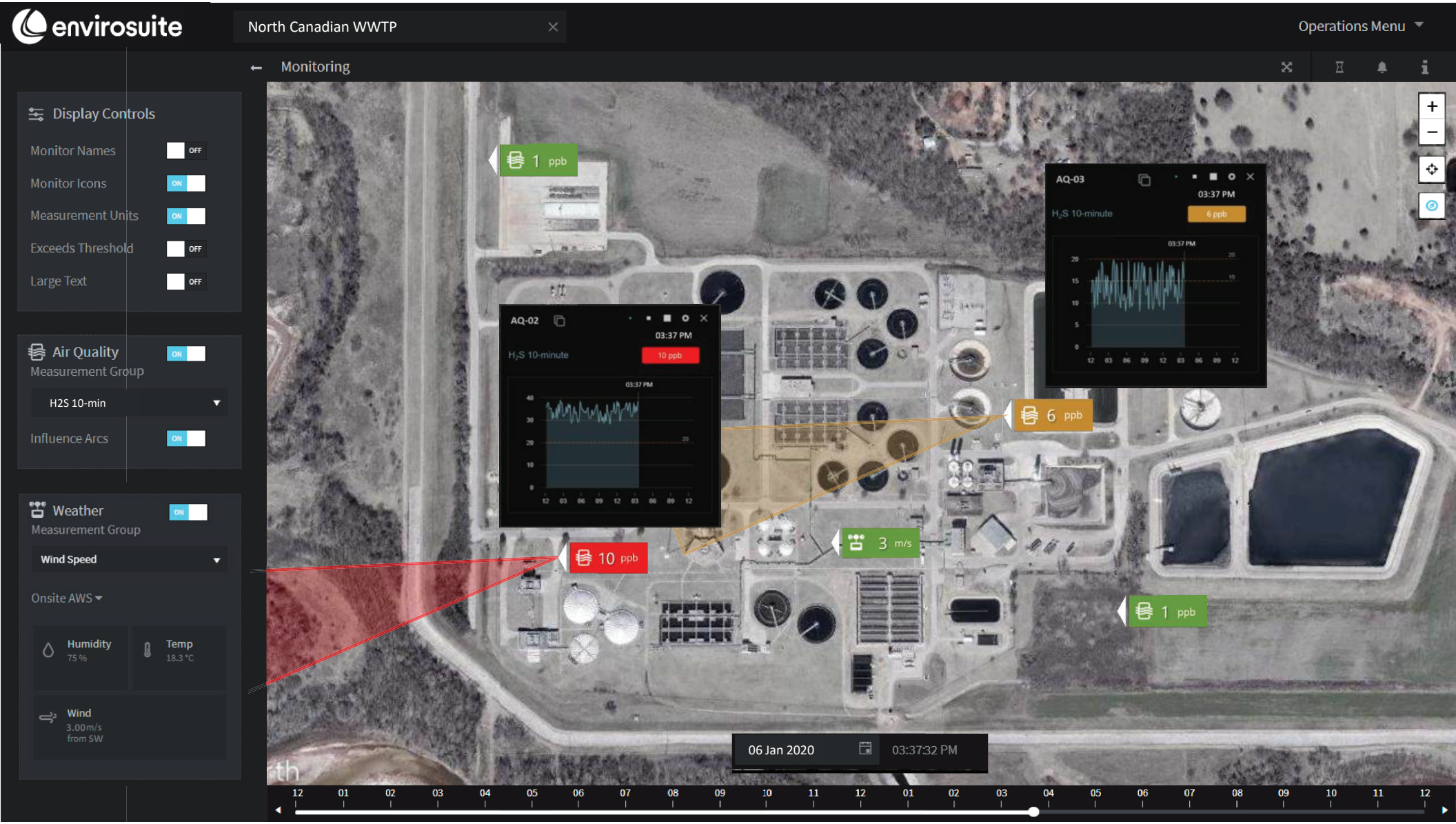
envirosuite
North Canadian WWTP
Operations Menu
Monitoring
Display Controls
Monitor Names
Monitor Icons
Measurement Units
Exceeds Threshold
Large Text
Air Quality
Measurement Group
H2S 10-min
Influence Arcs
Weather
Measurement Group
Wind Speed
Onsite AWS
Humidity
75 %
Temp
18.3 °C
Wind
3.00m/s
from SW
1 ppb
AQ-02
03:37 PM
H2S 10-minute
10 ppb
AQ-03
03:37 PM
H2S 10-minute
6 ppb
6 ppb
3 m/s
10 ppb
1 ppb
06 Jan 2020
03:37:32 PM


envirosuite
North Canadian WWTP
Operations Menu
Monitoring
Display Controls
Monitor Names
Monitor Icons
Measurement Units
Exceeds Threshold
Large Text
Air Quality
Measurement Group
H2S 10-min
Influence Arcs
Weather
Measurement Group
Wind Speed
Onsite AWS
Humidity
75 %
Temp
18.3 °C
Wind
3.00m/s
from SW
Display controls allow for quick focus on relevant information.
Monitor pop-up charts are available for each sensor location, and for all the various parameters being monitored. Historical information is available on demand.
Arcs of influence show the likely source of the current value. The arc is based on real-time statistical analysis of weather data recorded at the site or monitoring location.
1 ppb
AQ-02
03:37 PM
H2S 10-minute
10 ppb
AQ-03
03:37 PM
H2S 10-minute
6 ppb
6 ppb
3 m/s
10 ppb
1 ppb
06 Jan 2020
03:37:32 PM

Incident
Intelligence

Stop incidents from slowing down your operation.

- Identify the likely origin of observed/reported nuisance
- Reduce time inspecting and handling complaints
- Communicate quickly whenever is needed

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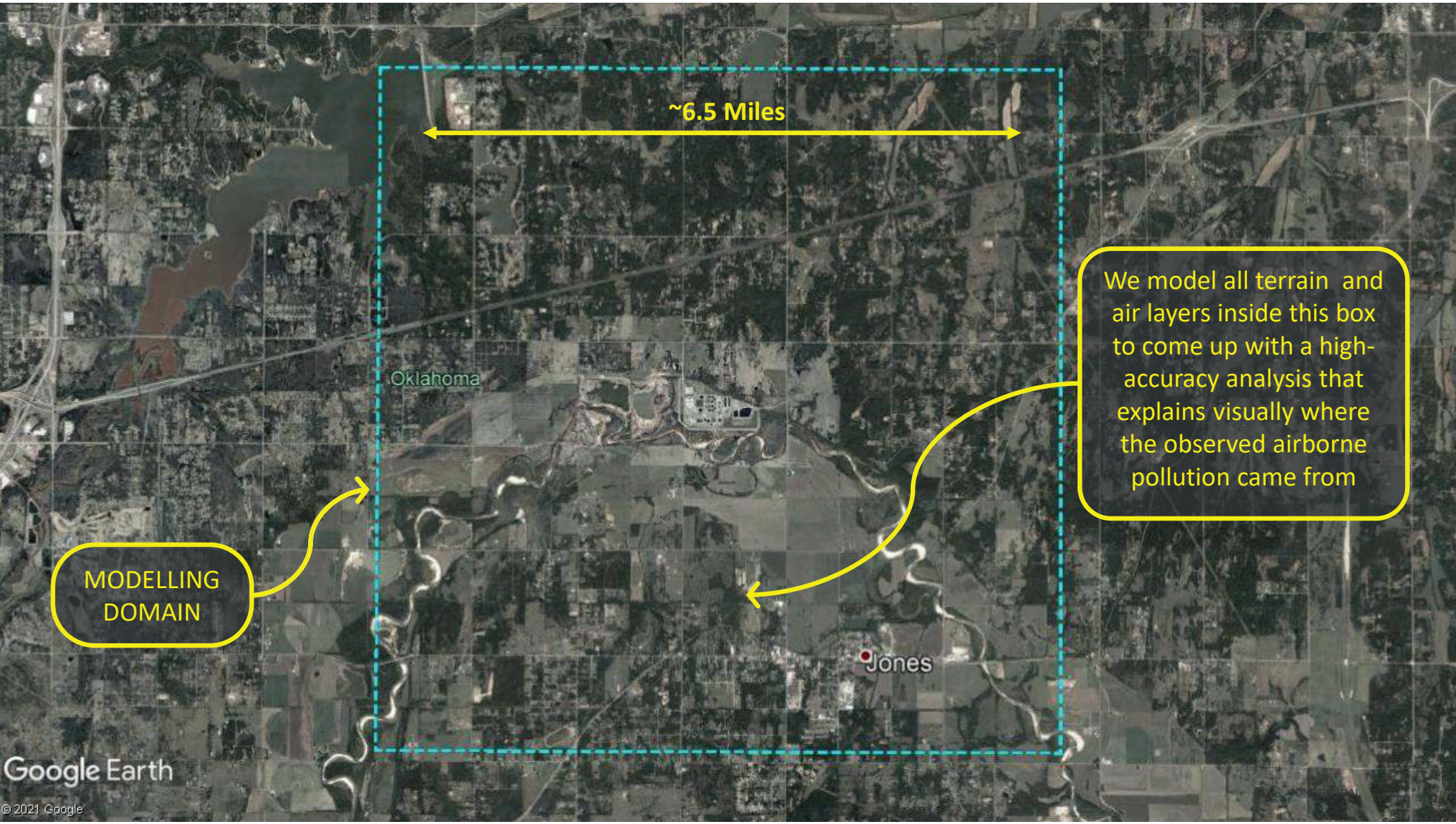
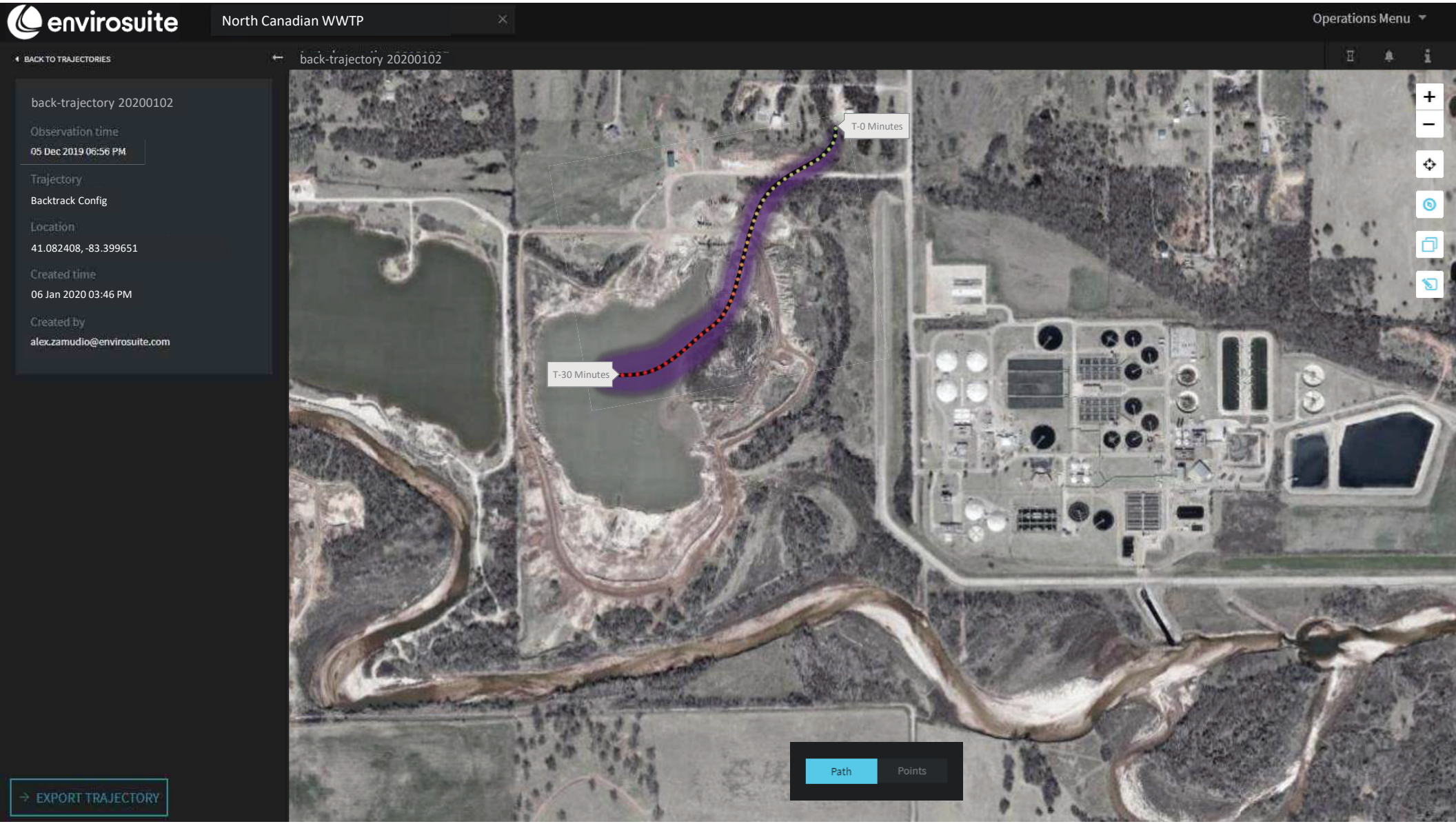
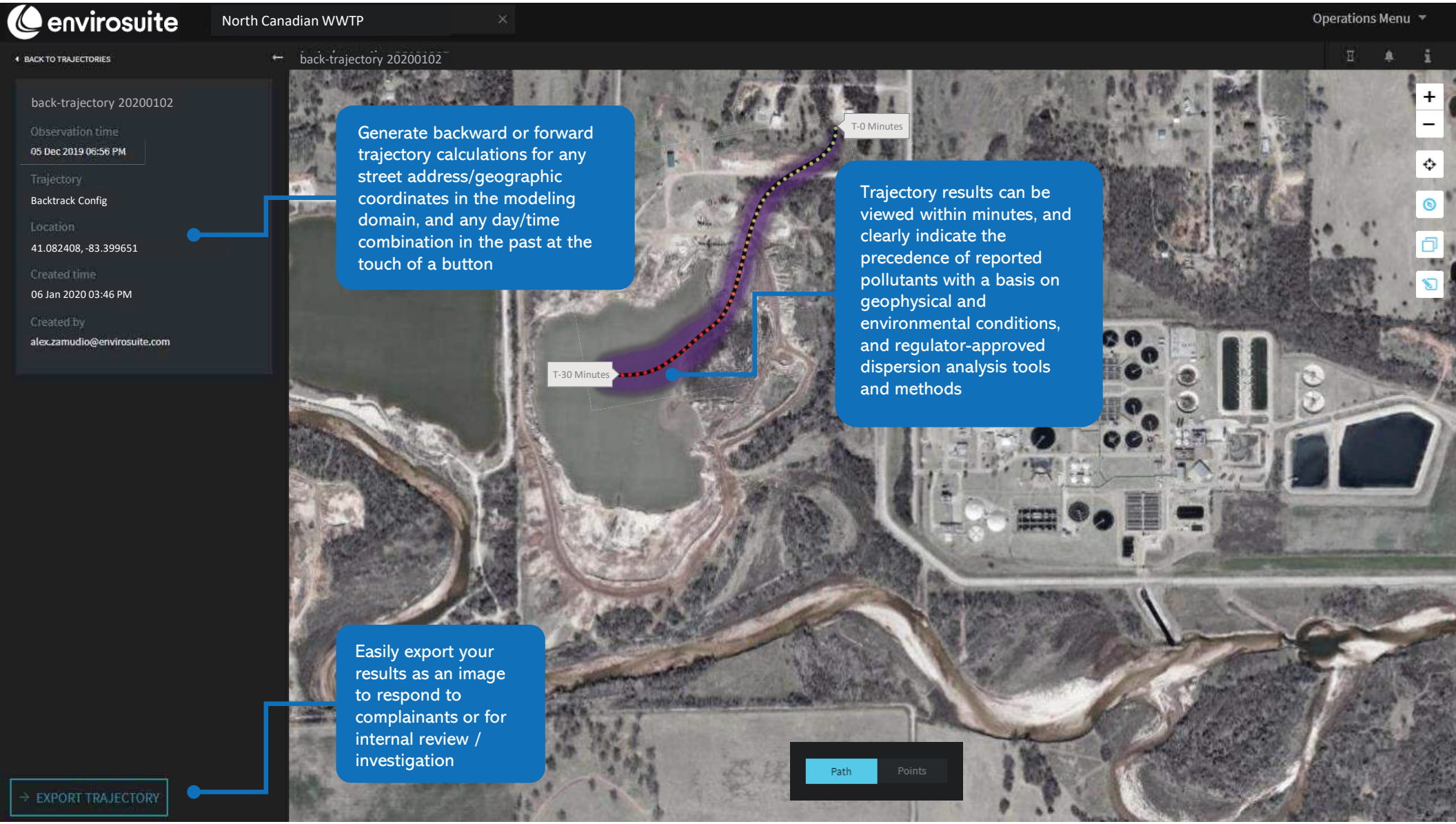

~6.5 Miles
Oklahoma
Jones
We model all terrain and air layers inside this box to come up with a high-accuracy analysis that explains visually where the observed airborne pollution came from
MODELLING DOMAIN
Google Earth
© 2021 Google

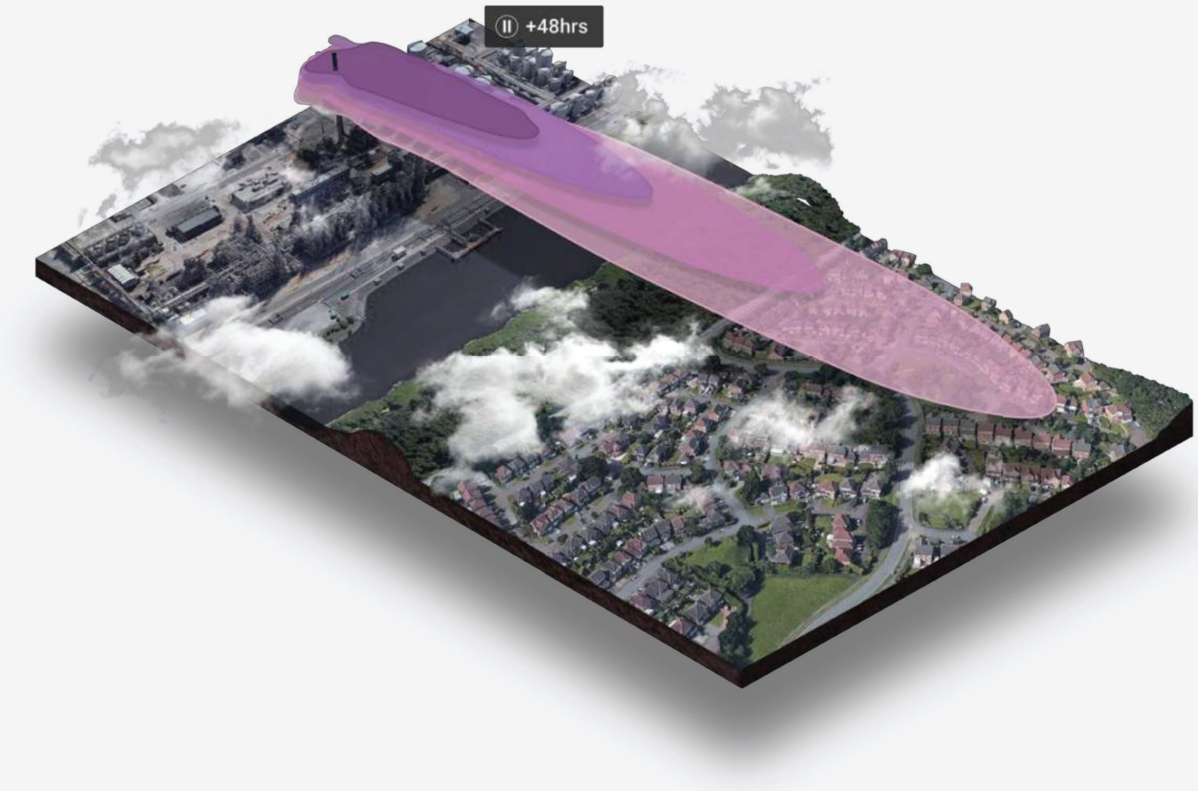

envirosuite
North Canadian WWTP
Operations Menu
BACK TO TRAJECTORIES
back-trajectory 20200102
back-trajectory 20200102
Observation time
05 Dec 2019 06:56 PM
Trajectory
Backtrack Config
Location
41.082408, -83.399651
Created time
06 Jan 2020 03:46 PM
Created by
alex.zamudio@envirosuite.com
T-0 Minutes
T-30 Minutes
Path
Points
EXPORT TRAJECTORY


envirosuite
North Canadian WWTP
Operations Menu
BACK TO TRAJECTORIES
back-trajectory 20200102
back-trajectory 20200102
Observation time
05 Dec 2019 06:56 PM
Trajectory
Backtrack Config
Location
41.082408, -83.399651
Created time
06 Jan 2020 03:46 PM
Created by
alex.zamudio@envirosuite.com
Generate backward or forward trajectory calculations for any street address/geographic coordinates in the modeling domain, and any day/time combination in the past at the touch of a button
T-0 Minutes
T-30 Minutes
Trajectory results can be viewed within minutes, and clearly indicate the precedence of reported pollutants with a basis on geophysical and environmental conditions, and regulator-approved dispersion analysis tools and methods
Easily export your results as an image to respond to complainants or for internal review / investigation
EXPORT TRAJECTORY
Path
Points

Impact
Modelling

Real-time 360° clarity on your impact

- Know your impact before you act
- Track your impact in real-time
- Clearly visualize your risk due to present/future weather conditions



envirosuite

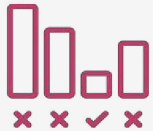

envirosuite
North Canadian WWTP
Operations Menu
Modelling
Model Setup
Date/Time
21 Apr 2019 11:00 PM
Model From
-0 min
Model To
+12 hr
Auto Update
OFF
Models
Hourly H2S Forecast (controlled)
OFF
Hourly H2S Forecast (uncontrolled)
ON
Pollutant Values
H2S
1 ppm
5 ppm
10 ppm
20 ppm
Hourly wind forecast
OFF
Emission Sources
Display Emission Sources
ON
22 Apr 2019 — 02:00 AM - 03:00 AM


envirosuite
North Canadian WWTP
Operations Menu
Modelling
Model Setup
Date/Time
21 Apr 2019 11:00 PM
Model From
-0 min
Model To
+12 hr
Auto Update
OFF
Models
Hourly H2S Forecast (controlled)
OFF
Hourly H2S Forecast (uncontrolled)
ON
Pollutant Values
H2S
1 ppm
5 ppm
10 ppm
20 ppm
Hourly wind forecast
OFF
Emission Sources
Display Emission Sources
ON
Virtual Alert Points can be set up at sensor coordinates or other points of interest in the surrounding areas to automatically issue alerts if an exceedance is predicted to occur in the future
A dispersion plume can be generated based on different environmental conditions, rates of emission, etc. This may inform the timely and efficient application of odor control measures, etc.
The solution can be set to model historical values, or predict future risk. Different models can be set up, and visualized as overlays on the map by simply activating the slider switches.
22 Apr 2019 — 02:00 AM - 03:00 AM

Key benefits to North Canadian WWTP

Fix only the issues that you caused and save resources

- Significantly reduce investigation time and improve their accuracy
- Visual analysis output that anyone can understand at a glance
- Combine multiple views for increased understanding of any event



Capitalize on favorable conditions, avoid high-risk periods

- Schedule tasks that can cause nuisance for the right time and minimize risk
- Multiple scenarios allow you to understand effect with/without the use of control measures
- Unattended analysis + automated warnings keeps your team ahead

Maintain great community relationships

- Maintain a proactive stance in everything you do
- Confidently and quickly respond to any stakeholder concerns

Preliminary Budget

- **Base Assumptions:**
  - Envirosuite to configure software platform, test and install equipment on site
  - a 30-ft tower or other suitable structure will be provided by the client to install the proposed weather station according to EPA guidelines
  - Client is able to provide appropriate emissions reference values for the sources to be modelled in the application; if those are not available, a sampling campaign and olfactometry analysis may be conducted by Envirosuite for an additional fee

Proposed Budget

PACKAGE: MONITORING + TRAJECTORIES + RISK FORECASTING

Scenario 1 – Envirosuite provides all equipment on a rental

- DEPLOYMENT SERVICES (ONE-TIME): $16,828 (invoiced upon contract signature)
- ANNUAL SOFTWARE SUBSCRIPTION AND EQUIPMENT RENTAL: $67,000 (invoiced quarterly)
- Equipment rental includes all spares and an annual service visit, wireless data service
- annual OEM sensor calibration certificate provided by Envirosuite
- **North Canadian WWTP's TCO in year-1: $83,125 (approx. $ 6,927 /month)**

Scenario 2 – Envirosuite provides data connectivity to four (4) H2S sensors supplied by the client

- DEPLOYMENT SERVICES (ONE-TIME): $16,828 (invoiced upon contract signature)
- ANNUAL SOFTWARE SUBSCRIPTION AND EQUIPMENT RENTAL: $56,500 (invoiced quarterly)
- **North Canadian WWTP's TCO in year-1: $73,328 (approx. $ 6,110 /month)**

Proposed Budget

ALTERNATIVE PACKAGE: MONITORING + TRAJECTORIES

Scenario 1 – Envirosuite provides all equipment on a rental

- DEPLOYMENT SERVICES (ONE-TIME): $11,558 (invoiced upon contract signature)
- ANNUAL SOFTWARE SUBSCRIPTION AND EQUIPMENT RENTAL: $48,297 (invoiced quarterly)
- Equipment rental includes all spares and an annual service visit, wireless data service
- annual OEM sensor calibration certificate provided by Envirosuite
- **North Canadian WWTP's TCO in year-1: $59,855 (approx. $ 4,988 /month)**

Scenario 2 – Envirosuite provides data connectivity to four (4) H2S sensors supplied by the client

- DEPLOYMENT SERVICES (ONE-TIME): $11,558 (invoiced upon contract signature)
- ANNUAL SOFTWARE SUBSCRIPTION AND EQUIPMENT RENTAL: $38,432 (invoiced quarterly)
- **North Canadian WWTP's TCO in year-1: $49,990 (approx. $ 4,166 /month)**

Thank you!

We'd love to hear from you:

Alex Zamudio
Regional Lead | Northeast USA
+1-514-916-9358
alex.zamudio@envirosuite.com

envirosuite

Travelletti, Ryan

From: Alex Zamudio <Alex.Zamudio@envirosuite.com>
Sent: Wednesday, September 8, 2021 4:14 PM
To: Doerflinger, Andrew O. (Water)
Cc: Bazemo, Ulrich Yoan Yanick; Moss, Lynne H; Edmondson, Shirley; Andres Quijano
Subject: RE: OKC Deer Creek Discussion | Black & Veatch + Envirosuite

Hi Andrew,
Thanks for your call this morning. Assuming that the software scope for those 2 additional locations remains the same as for North Canadian WWTP, you'd be looking at the following numbers in each case for Scenarios 1 (i.e. EVS provides all equipment on a rental) and Scenario 2 (i.e. EVS provides only the IoT gateways to connect 3rd-party sensors):

CHISHOLM CREEK WWTP ← Quotation based on 3 sensor system

	SCENARIO 1		SCENARIO 2	
	Monitoring + Trajectories	Monitoring + Trajectories + Modelling	Monitoring + Trajectories	Monitoring + Trajectories + Modelling
INSTALLATION (ONCE-OFF)	$ 11,800.00	$ 16,900.00	$ 11,800.00	$ 16,900.00
SOFTWARE SUBSCRIPTION AND EQUIPMENT RENTAL (RECURRING)	$ 44,800.00	$ 62,200.00	$ 36,900.00	$ 54,900.00
TOTAL FEES	**$ 56,600.00**	**$ 79,100.00**	**$ 48,700.00**	**$ 71,800.00**

WITCHER PS ← Quotation based on 1 sensor

	SCENARIO 1		SCENARIO 2	
	Monitoring + Trajectories	Monitoring + Trajectories + Modelling	Monitoring + Trajectories	Monitoring + Trajectories + Modelling
INSTALLATION (ONCE-OFF)	$ 11,800.00	$ 16,900.00	$ 11,800.00	$ 16,900.00
SOFTWARE SUBSCRIPTION AND EQUIPMENT RENTAL (RECURRING)	$ 36,000.00	$ 54,000.00	$ 34,000.00	$ 52,000.00
TOTAL FEES	**$ 47,800.00**	**$ 70,900.00**	**$ 45,800.00**	**$ 68,900.00**

Please keep in mind these numbers are just a projection based on the budgetary figures for North Canadian, and as such are subject to change following proper discovery with the client's team. Our recommendation would be to do proper discovery, and then provide a package price for the City that takes into account the number of facilities in scope for added savings.

Please feel free to include our scope presentation as an attachment to your report, and let me know how else we can assist.

Note: Adjusted OPCC to include two sensors so costs are $40,400; $58,100; $35,450; and $53,450

Best,
Alex Z.

From: Doerflinger, Andrew O. (Water) <DoerflingerAO@bv.com>
Sent: September 8, 2021 9:21 AM
To: Alex Zamudio <Alex.Zamudio@envirosuite.com>
Subject: RE: OKC Deer Creek Discussion | Black & Veatch + Envirosuite

Travelletti, Ryan

From: Alex Zamudio <Alex.Zamudio@envirosuite.com>
Sent: Wednesday, September 8, 2021 8:05 AM
To: Bazemo, Ulrich Yoan Yanick; Edmondson, Shirley; Moss, Lynne H
Cc: Andres Quijano; Doerflinger, Andrew O. (Water)
Subject: RE: OKC Deer Creek Discussion | Black & Veatch + Envirosuite
Attachments: Environmental Intelligence Solution for North Canadian WWTP 20210826.pdf

Hi everyone,
I have enclosed here the scope presentation for North Canadian with the details and budgetary numbers for each of the scenarios we discussed.

Per our last chat, we will leave the software modules for Deer Creek as they are, and the additional fees for integrating the 2x additional sensors would be:

- Scenario 1 – Envirosuite provides the equipment on a rental: additional annual fee of $8,263. This includes spares, annual service visit, and data allowance to connect to the existing system
- Scenario 2 – Envirosuite provides cloud connectivity for two (20) Acrulogs to be supplied by the client: additional annual fee of $3,330. Envirosuite would be responsible for servicing the IoT gateway devices, but not the sensors themselves.

Please let us know any other questions/comments, and thanks for your patience while we put this info together.

Best,
Alex Z.

From: Alex Zamudio
Sent: September 7, 2021 3:38 PM
To: Bazemo, Ulrich Yoan Yanick <BazemoUYY@bv.com>; Edmondson, Shirley <EdmondsonS@bv.com>; Moss, Lynne H <MossLH@bv.com>
Cc: Andres Quijano <Andres.Quijano@envirosuite.com>; Doerflinger, Andrew O. (Water) <DoerflingerAO@bv.com>
Subject: RE: OKC Deer Creek Discussion | Black & Veatch + Envirosuite

Hi Ulrich,
I hope everyone had a good LD weekend. I am aiming to send this over by EOD today. Thanks for your patience!

Best,
Alex Z.

From: Bazemo, Ulrich Yoan Yanick <BazemoUYY@bv.com>
Sent: September 7, 2021 1:59 PM
To: Alex Zamudio <Alex.Zamudio@envirosuite.com>; Edmondson, Shirley <EdmondsonS@bv.com>; Moss, Lynne H <MossLH@bv.com>
Cc: Andres Quijano <Andres.Quijano@envirosuite.com>; Doerflinger, Andrew O. (Water) <DoerflingerAO@bv.com>
Subject: RE: OKC Deer Creek Discussion | Black & Veatch + Envirosuite

BLACK & VEATCH

TELEPHONE MEMORANDUM

OCWUT
ST-0154 Wastewater Treatment Plants Biosolids and Odor Management
Acrulog and DiCom Annual Calibration Costs

B&V Project 404757
B&V File 40.3002
9/9/2021
10:00 am

From: Lindy Eppinger
Company: Detection Instruments Corp
Phone No.: 602-797-0630

Recorded by: A. Doerflinger

Purpose of the call was to determine the annual maintenance costs for the Acrulog DI COM and Acrulog PPB detector.
Lindy indicated that the units should be periodically checked and calibrated on site. The cost of the calibration kit is $645 and $145 for the calibration gas. Calibrations shouldn't be required but quarterly. Annual the Arculog should be removed from the unit and shipped back to Detection Units for calibration and repairs. The cost of this service is $165 plus shipping. The units should be shipped via ground. The cost of the shipping is approximately $20 one way.

So the total annual cost for calibration per unit is $350 per year depending on the cost of shipping.