CITY OF LEAVENWORTH, KANSAS

LEAVENWORTH WWTP

UV DISINFECTION IMPROVEMENTS

DESIGN MEMORANDUM – FINAL

JUNE 22, 2011

PN 172827

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Table of Contents

Tables

Figures

Appendices

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City of Leavenworth, Kansas
Leavenworth WWTP
UV Disinfection Improvements
Comparison of Opinion of Probable Project Cost
May 18, 2011

	Master Plan Update	Design Memorandum		Notes:
Treatment Plant Facilities	November-10	May-11	*Variance from MP Update*	
General Requiremnts	$ 400,000	$ 389,000	*$ (11,000)*	Reduced construction multiplier to 10%
Sitework	$ 300,000	$ 174,000	*$ (126,000)*	Quantity takeoff based on DM figures and expected work. Yard structures listed separately
Special Manhole No. 6	$ -	$ 90,000	*$ 90,000*	Previously in sitework multiplier
UV Disinfection Building	$ 3,248,000	$ 2,930,000	*$ (318,000)*	Reduced for Engine-Generator removal and UV system cost
Flow Division Structure No. 2	$ -	$ 24,000	*$ 24,000*	Previously in sitework multiplier
Electrical and I&C	$ 800,000	$ 670,000	*$ (130,000)*	Construction multiplier applied to reduced line item costs
Subtotal	$ 4,748,000	$ 4,277,000	*$ (471,000)*	
Contingency (25%)	$ 800,000	$ 1,069,000	*$ 269,000*	Construction multiplier applied differently
Total Probable Construction Cost	**$ 5,548,000**	**$ 5,346,000**	***$ (202,000)***	
Engineering	$ 1,100,000	-	$ 265,000	
Preliminary Design		$ 160,000		
Detailed Design (Est.)		$ 350,000		
Bidding and Award Services (Est.)		$ 25,000		
Construction Phase Services (Est.)		$ 300,000		
Total Probable Project Cost	**$ 6,648,000**	**$ 6,181,000**	***$ (467,000)***	

1.0 General

1.1 Project Descriptions

This project involves preparation of drawings, specifications, and contract documents for the ultraviolet (UV) disinfection system improvements at the Leavenworth Wastewater Treatment Plant (WWTP).

The detailed drawings and specifications for the WWTP improvements will be prepared for selection of a general contractor based on competitive bids under a single contract for performance of all construction work. The facilities to be constructed and work to be performed are described in the Scope of Services, approved January 25, 2011 prepared by Black & Veatch and supplemented herein. A general description of the improvements to the WWTP is as follows:

- Selection of a UV disinfection system based on a competitive pre-selection process.
- Construction of the UV Disinfection Building, including heating, ventilation, electrical improvements, and installation of the UV disinfection system.
- Construction of a new Special Manhole No. 6 to re-direct final clarifier effluent to the UV disinfection system.
- Construction of a new Effluent Meter Vault to house a new 30-inch magnetic flow meter.
- Modifications to Special Manhole No. 2 to provide an isolation slide gate on the existing final clarifier effluent line.
- Miscellaneous piping modifications.

1.2 Background

The WWTP's current National Pollutant Discharge Elimination System (NPDES) permit issued by the Kansas Department of Health and Environment (KDHE) under the Schedule of Compliance mandates the City disinfect treated effluent year-round with facilities on line and able to disinfect by December 31, 2012.

Black & Veatch evaluated the use of sodium hypochlorite disinfection and UV disinfection based on regulatory requirements, capital costs, operational costs, and the results of bench-scale testing. The recommendation of UV disinfection was provided in the November 2010 Master Plan and Collection System Update.

Leavenworth WWTP discharges treated wastewater effluent to the Missouri River and consists of the following facilities: influent screening and pumping, aerated grit removal, primary clarification, intermediate pumping (settled sewage), trickling filters, final clarification, and sludge dewatering (belt filter press). Refer to **Figure 1** for a partial liquids process schematic of plant facilities applicable to this project.

1.3 Project Schedule

The project design schedule covers the period from March 2011 through completion of bid and award services in the fourth quarter of 2011. Biddable plans and specifications are anticipated to be ready in October 2011. Construction is anticipated to start in January 2012 and the UV system is expected to be operational by the end of 2012. The following is a summary of key project dates:

Project Milestone or Task	Date
Start of Detailed Design	June 2011
Submit Level 1 (50%) Documents	August 12, 2011
Submit Level 2 (90%) Documents	October 14, 2011
Submit Bid-Set (100%) Documents/Advertise to Bid	November 3, 2011
Bid Opening	December 1, 2011
Award Construction Contract	December 2011
Start Construction	January 2012
Achieve Compliance with Permit	December 31, 2012

1.4 Site Description

Location. The WWTP is located at 1800 South 2nd Street in Leavenworth, Kansas. Refer to **Figure 3** for partial site plan of plant facilities applicable to this project.

Datum. Elevations use on the project drawings and in the calculations will be based on USGS NAVD88 datum. One benchmark will be established for vertical control. Horizontal control will be based on the Kansas State Plane coordinate system.

Flood Level. The WWTP site lies adjacent to Five Mile Creek and near the Missouri River. The following Missouri River levels were interpolated from a recent Flood Insurance Survey profile and are at the mouth of Five Mile Creek.

Frequency	Elevation
25-year	770.22
50-year	771.00
100-year	772.00

1.5 Utility Contacts and Code Officials

Information on codes, design criteria, and existing utilities serving the plan will be obtained from the following:

- KDHE – Rod Geisler (785) 296-5527
- City of Leavenworth – Community Development, Berrin Nejad (913) 684-2626
- City of Leavenworth – Building Permits, Harold Burdette (913) 684-0378
- Water – Leavenworth Water Department, (913) 682-1513
- Power – Westar Energy (913) 758-2721
- Gas – Kansas Gas (913) 758-2718

1.6 Work by Subconsultants

Site Survey. Black & Veatch will retain the services of a surveying firm as a subcontractor to provide a limited survey of the site to determine key hydraulic

elevations and existing grade elevations. The surveying will be performed by Atlas Surveying, (913) 682-8600. The contact person is Roger Dill.

1.7 Standards and Documents

Drawings. The contract drawings will be prepared on standard 22-inch by 34-inch Bond sheets. Black & Veatch Americas standards, as modified by the Drafting Coordinator, will be used on this project. All sheets will be generated using AutoCAD 2008. Each sheet will bear the following general title:

Leavenworth, Kansas

Leavenworth WWTP

UV Disinfection Improvements

Specifications. Black & Veatch standard "front-end" contract documents, supplementary conditions, and technical specifications will be used and modified as required to suit the project.

1.8 Document Management

Project documents will be posted on the ProjectWise, Bentley's project execution and document management system. ProjectWise will be used by the Project Team for sharing and editing of project correspondence, specifications, drawings, and other project documents.

1.9 Other Available Resources

The following drawings, reports, and studies are available as reference material during design of this project:

Drawings

- Drawings dated 1960, prepared by the Office of Truman Schlup, Consulting Engineer, titled "Sewage Treatment Plant, Contract 1."
- Drawings dated 1972, prepared by Black & Veatch, titled "Sewerage Works Improvements, Contract No. 2, Wastewater Plant Improvements."

- Drawings dated 2004, prepared by Black & Veatch, titled "Wastewater Treatment Plant Improvements, Phase – 1."
- Drawings dated 2006, prepared by Black & Veatch, titled "Wastewater Treatment Plant Improvements, Phase – 2."

Reports and Studies

- Master Plan dated 2010, prepared by Black & Veatch, titled "Wastewater Master Plan Update and Collection System I&I Assessment."
- Geotechnical Report dated 2006, prepared by Alpha Omega Geotech, Inc., titled "Geotechnical Engineering Report".
- Geotechnical Report dated 2003, prepared by Burns & McDonnell, titled "Subsurface Information for the Food Control project at the Wastewater treatment Plant for the City of Leavenworth, Kansas".

1.10 Applicable Codes and Design Guidelines

The following codes and standards will apply to this project:

- International Building Code, 2006 Edition
- International Code Council Electrical Code, 2006 Edition
- International Plumbing Code, 2006 Edition
- International Mechanical Code, 2006 Edition
- International Fuel Gas Code, 2006 Edition
- International Fire Code, 2006 Edition
- Local Amendments to the Codes
- City of Leavenworth Code Footprint Requirements
- NFPA 101 Life Safety Code, 2009
- NFPA 820 – Fire Protection in Wastewater Treatment and Collection Facilities, 2008.
- Kansas Department of Health and Environment Minimum Standards of Design for Water Pollution Control Facilities, 1978.

- Black & Veatch Corporation Design Standards.
- Hydraulic Institute Standards
- City of Leavenworth Civil Engineering Standards

1.11 Permit Requirements and Agencies

Permit requirements and agencies affecting the design are as follows:

- Leavenworth Building Permit
- Leavenworth Code Footprint Requirements
- A general storm water permit for construction activities is required by the National Pollutant Discharge Elimination System (NPDES) and must be submitted by the Contractor and the Owner.

1.12 Project Approval

Approval from KDHE will be required before construction is started. KDHE will review the project documents including the Design Memorandum for compliance with their design requirements. The City of Leavenworth will complete a building code review.

2.0 Process Design Criteria

2.1 Design Wastewater Flows

Design wastewater flows to be used in for the Ultraviolet (UV) Disinfection Improvements at Leavenworth Wastewater Treatment Plant (WWTP) are summarized in **Table 2-1**. The Wastewater Master Plan Update and Collection System I&I Assessment completed November 2010 is used as the basis for the following UV disinfection system design flows.

Table 2-1
Design Wastewater Flows

Parameter	Flow, mgd
Average Daily	4.5
Peak Day	13
Peak Hour	30

2.2 Applicable NPDES Effluent Limits and Monitoring Requirements

The current effluent limits for Leavenworth WWTP as defined in the National Pollutant Discharge Elimination System (NPDES) permit became effective on July 1, 2008, and will expire on December 31, 2012. The applicable final effluent limitations per schedule of compliance stated in the permit are presented in **Table 2-2**. A copy of the plant's complete NPDES permit is included in **Appendix A**. The plant's permit starting January 1, 2013 is anticipated to have the same limits for criteria applicable to disinfection.

Table 2-2 Leavenworth WWTP Applicable Final Permit Limits	
Design Flow, mgd	6.88
Total Suspended Solids (TSS)	
Weekly Average, mg/L	45
Monthly Average, mg/L	30
E. coli, Colonies/100 mL, Monthly Geometric Mean	
April through October	160
November through March	2,358
pH	6.0-9.0
Flow, mgd	Monitor

2.3 Plant Hydraulics

The new UV disinfection system will be installed in the existing chlorine contact basins. Weirs at the final clarifiers and Flow Division Structure No. 2 will be slightly submerged at peak hour flows. However, this is primarily caused by the depth of flow in the clarifier effluent launders. Therefore the UV disinfection improvements will not adversely affect the existing hydraulic profile through the plant. For additional information, refer to **Figure 2** for a partial hydraulic profile.

A new Special Manhole No. 6 will be constructed to combine and re-direct final clarifier effluent flow to the south side of the existing contact basins. The new manhole will reduce hydraulic constraints in the existing plant hydraulics. A new magnetic flow meter will be provided on the new UV influent line for effluent flow measurement. This effluent flow meter will also be used by the UV disinfection system for automatic flow pacing control. At the UV channel effluent box, a flap gate will be added to the existing 54-inch effluent line from Special Manhole No. 2. The new flap gate will prevent any backflow of UV effluent into the primary clarifier effluent lines. Refer to **Figure 1** for a partial liquids process schematic of plant facilities applicable to this project.

3.0 Treatment Facilities

3.1 UV Disinfection Building

3.1.1 UV Disinfection Building Structure

Leavenworth Wastewater Treatment Plant's (WWTP's) previous National Pollutant Discharge Elimination System (NPDES) permits have not required disinfection of effluent flows. A plant expansion in 1975 added chlorine disinfection facilities in anticipation of the requirement. However, the facilities were never placed in operation.

Black & Veatch evaluated the use of sodium hypochlorite and ultraviolet (UV) disinfection based on regulatory requirements, capital costs, operational costs, and results of bench-scale testing. The recommendation of UV disinfection was provided in the November 2010 Master Plan and Collection System Update.

The UV Disinfection Building will house UV channels and disinfection equipment, a composite effluent sampler, a storage room and an electrical room. The building will be constructed over the existing chlorine contact basins and will adjoin the existing Chorine Building. The building addition will house the UV room, storage room, and electrical room. The UV room will house the UV channels and UV lamp ballast enclosures. The UV room will be heated and intermittently ventilated to remove equipment heat. Continuous ventilation is not required and will not be provided. The storage room will house UV disinfection system spare parts and will be provided with ventilation similar to the UV room. The electrical room will contain all electrical power distribution and instrumentation and control equipment for the UV disinfection system. The electrical and storage rooms will be heated and intermittently ventilated similar to the UV room and will not be mechanically cooled. The UV Disinfection Building will be masonry construction with masonry block bearing walls and face brick veneer. The building will have a precast concrete roof system. Refer to **Figure 4 and 5** for plan and section figures of the proposed UV Disinfection Building. Also, refer to **Appendix B** for a summary of code requirements for the proposed building.

3.1.2 UV Disinfection System

A competitive pre-selection of UV disinfection system suppliers was completed as part of the Design Memorandum preparation. The Trojan UV3000Plus system was selected at the conclusion of the competitive pre-selection process. The system utilizes low pressure, high output lamps arranged horizontally. Automatic cleaning of the lamps is provided integral to the system and is completed with no disruption to operation.

The UV disinfection system will be installed in three individually-operated channels with two banks of lamps per channel. Each bank of lamps will have its own power distribution center and will be located directly above the banks on the UV room operating floor. Each channel will be designed for a peak flow of 10.0 mgd for a total capacity of 30.0 mgd. Water surface elevation in the UV channels will be maintained by motor controlled downward opening weir gates located at the end of each channel. The flow over the weir gates will be measured and used for effluent flow reporting and by the UV disinfection system for flow pacing. Motor operated slide gates will be located at the entrance to each channel to provide channel isolation for maintenance and when a channel is not in operation. An overhead monorail and motorized trolley and hoist will be provided in the UV room to lift the UV lamp modules from the UV channels for maintenance. The control system will use its standard programming to avoid excessive cycling of the lamps during average or low flow conditions to minimize lamp wear and replacement.

An online UV transmittance monitor will be located in the common influent channel. Online transmittance data will be used with effluent flow measurements to control lamp intensity required to deliver the minimum UV dosage required for adequate disinfection. The design UV transmittance values will be provided by operation of the upstream treatment processes. In particular, the trickling filter recycling rate will be increased over historical operation and maintenance of the existing trickling filter media will be increased. The increased recycle rate will be provided by operating a minimum of 2 or 3 recycle pumps based on effluent UV transmittance data. The UV disinfection design requirements are listed in **Table 3-1**.

design requirements are listed in **Table 3-1**. Refer to **Figure 12** for a UV disinfection system process and instrumentation drawing (P&ID).

Table 3-1
UV Disinfection System Design Requirements

Manufacturer	Trojan Technologies
Model	UV3000Plus
UV Lamp Type	Low-Pressure, High-Output
Design UV Transmittance, %	50
Estimated Influent E. coli count	500,000 per 100 mL
UV Influent Total Suspended Solids, mg/L	
Monthly Average	30
Weekly Average	45
Maximum Particle Size, microns	45
Minimum Design UV Dosage, mJ/cm2	45 mJ/cm^2 based on MS2 phage
Effluent E. coli count	
Monthly Geometric Mean	160 per 100 mL
Weekly Geometric Mean	1030 per 100 mL
Total Peak Flow, mgd	30.0
Total Average Daily Flow (ADF), mgd	4.5
Number of Channels	3
Number of Horizontal UV Banks	6 (2 per channel)
Number of Modules Per UV Bank	28
Number of UV Lamps per Module	8
Total Number of UV Lamps	1344
Water Depth, inches	24
Channel Width, inches	84

3.2 Existing Water Systems

3.2.1 Potable and Clear Water

The potable water system provides water via a 4-inch line to the Filter Control Building for use in the laboratory, washrooms, and restrooms. A single backflow preventer is provided at the Filter Control Building to provide clear water for other plant uses. A clear water system is defined as potable water downstream of the backflow preventer. An existing 1-1/2 inch clear water line is available at the UV Disinfection Building.

3.2.2 Non-Potable Water

Currently non-potable water supply can be drawn from the chlorine contact basins, Special Manhole No. 2, or Final Clarifier No. 1 via an 8-inch line. After the completion of this project, only the existing non-potable water supply from the UV Disinfection Building (former chlorine contact basins) will be available for use. No piping modifications are required to the existing non-potable water supply. However, the supply line isolation valve at the UV Disinfection Building will be replaced.

The supply line transfers water to the non-potable water system pumps located in the basement of the Settled Sewage Pump Station. From the Settle Sewage Pump Station, non-potable water is distributed to the plant. Non-potable water is utilized at the following locations for services as listed.

- Settled Sewage Pumping Station – interior hose bibbs
- Raw Sewage Pumping Station – pump gland seals and interior hose bibbs
- Sludge Pumping Station – pump gland seals and interior hose bibbs
- Preparation Structure/Grit Facility – pump gland seals, interior hose bibbs, and water supply to the bucket elevator, screw conveyor, and grit washer
- UV Disinfection Building – interior hose bibbs
- Holding Tank Sludge Pump House – pump gland seals and interior hose bibbs
- Filter Control Building – lime feed equipment, pump gland seals, sludge filtration equipment, and interior hose bibbs and valves
- Yard – hose bibbs and hose valves.

3.3 Natural Gas

A 2-inch line supplies natural gas to the plant site. Natural gas is distributed to each building for heat. A 1-inch gas line is provided at the UV Disinfection Building.

3.4 Yard Piping

A 54-inch pipe will be constructed from the UV Disinfection Building to Special Manhole No. 6. The pipe may be pre-stressed concrete cylinder or ductile iron pipe.

3.5 Yard Structures

New Special Manhole No. 6 will be cast-in-place around the existing 36-inch reinforced concrete pipe. After the manhole has been constructed, the existing pipe will be removed, allowing flow from Final Clarifiers No. 1 and 2 to convey through the new Effluent Meter Vault to the new UV Disinfection Building. An isolation slide gate will be provided on the new UV influent line for isolation of the new magnetic flow meter.

New Effluent Meter Vault will be a cast-in-place, below grade concrete structure. The vault will house a new 30-inch magnetic flow meter. The new flow meter will measure total plant effluent flow. This flow measurement will be used by the City for permit flow reporting. In addition, the UV disinfection system and composite effluent sampler will use the effluent flow measurement for flow pacing.

3.6 Sitework

No additional site drainage is anticipated. After the construction of the yard piping, Special Manhole No. 6, and Effluent Meter Vault the site will be restored to the existing grade.

3.7 Modifications to Existing Plant

An isolation slide gate will be provided at Special Manhole No. 2 on the existing 42-inch final clarifier effluent. Final clarifier effluent will normally flow through the Effluent Meter Vault to the UV Disinfection Building. However, final clarifier effluent may flow around the two structures through Special Manhole No. 2 during temporary maintenance or emergency situations.

4.0 Architectural Design Criteria

4.1 General

This chapter describes the architectural issues involved in housing the ultraviolet (UV) disinfection system. The City would like to reuse and modify as needed the existing chlorine building and contact basins for the new UV disinfection system. The existing contact basins will be converted to UV channels and enclosed with a building addition. The existing chlorine building will be modified to support the UV disinfection system. Refer to **Figure 4** for a building floor plan.

4.2 Function

The existing contact basins will be covered with a concrete slab with grating over the UV channels. There will be enough slab area to create an electrical room and a large storage room. The space below the electrical and storage rooms will be a dry pit.

In the existing building, the wall between the existing storage room and the feed room will be removed to enlarge the space. The existing electrical room will remain.

Access between the addition and the existing building will be created by removing one of the existing windows in the east wall and enlarging the opening for a pair of doors.

4.3 Code Requirements

According to the 2006 International Building Code, the UV Disinfection Building will have a mixed occupancy. The new UV area will have a Factory Industrial F-2 Low-hazard occupancy and the existing storage space will have an occupancy of Low-hazard Storage S-2. Although the Existing Storage Room was not designed for storage, it will need to be separated from the rest of the building by 1-hour rated construction. The existing walls qualify as 1-hour rated construction. The 2 new doors in the east wall will be rated.

The new and existing construction will be classified as Type II-B construction. Type II-B construction is non-combustible construction that does not require fire-resistant materials. However, since the new storage room will be over 100 square feet, we will separate it from the rest of the building to avoid the need for a fire sprinkler system. The UV Disinfection Building will have an area of 4,750 square feet and the building code allows 23,000 square feet.

The Americans with Disabilities Act (ADA) will have very little impact on the UV Disinfection Building. The building is not used by the public and operators must be able bodied to perform their other duties. All new doors and door hardware will be required to meet ADA.

4.4 Building Materials

The exterior materials of the addition will match the appearance of existing building. The exterior walls will be brick veneer over concrete block back-up. The City has identified a potential source to match the existing brick. Also, the brick used on the Phase 2 Expansion project was an acceptable match to the existing brick. The masonry wall will be capped with a cast-in-place concrete beam. Windows will be incorporated into the design of the UV room.

Although the appearance of the new exterior walls will match, they need to be constructed a differently. The walls of the existing building do not have insulation. The new walls will have a cavity behind the brick veneer with insulation. The structural roof of the addition will be precast concrete double T's and require a perimeter support beam deeper than the 26 inch beam of the existing building. The new beam will be 26 inches on the exterior face to match the existing building. However, the new beam may be significantly deeper on the interior

Because double T's move vertically over time, we propose a flexible roof system such as EPDM rubber. This is available in black or energy efficient white.

If the existing building still has the original 1 ½ inches of insulation, the City may want to consider reroofing the building when the addition is constructed. Due to ever

rising energy costs, Black & Veatch recommends new roofs have an average of 5 inches of insulation, giving an R-value of 25.

All interior walls will be concrete block and will be painted. The precast concrete ceiling will also be painted. The walls and ceiling of the existing building will be repainted.

All new doors will be painted galvanized steel and exterior windows will be aluminum. Galvanizing and aluminum will be durable in the humid environment of the building. The existing doors have deteriorated and will be replaced.

5.0 Structural Design Criteria

This chapter describes the basis of structural design associated with the Leavenworth Wastewater Treatment Plant (WWTP) Ultraviolet (UV) Disinfection Improvements project. The new UV Disinfection Building addition will be constructed on top of existing chlorine contact basins. Existing pile capacities and foundation design will be finalized in detailed design. Precast concrete roof elements will be designed by the supplier unless noted otherwise.

5.1 Design Codes and References

Design of structural elements will comply with the design codes and standards listed below. The applicable edition of the codes and standards should be confirmed at the start of detailed design:

- International Building Code (IBC), 2006 Edition
- ACI 318-05: Building Code Requirements for Reinforced Concrete and Commentary
- ACI 350-06: Code Requirements for Environmental Engineering Concrete Structures and Commentary
- ACI 530-05: Building Code Requirements for Masonry Structures
- ACI 530.1-05: Specification for Masonry Structures
- AISC – Steel Construction Manual, 13th Edition
- AISC 360-05: Specification for Structural Steel Buildings
- ASCE 7-05: Minimum Design Loads for Buildings and Structures
- Aluminum Design Manual, Specifications for Aluminum Structures, 2005

5.2 Design Stresses and Loading Criteria

5.2.1 Design Stresses

Structural Concrete

Structural Concrete, min f'_c	4,000 psi
(specified f'_c may be higher for liquid containing structures and for precast concrete)	
Reinforcing steel, f_y	60,000 psi

Structural Steel

Rolled W shapes, ASTM A992	50,000 psi
Rolled shapes and plates, ASTM A36 (min), f_y	36,000 psi
Pipe Sections, ASTM A53, Type E, f_y	35,000 psi
Tube sections, ASTM A500, Type B or C, f_y	46,000 psi

Masonry

CMU units, Compressive strength	1,900 psi
Compressive strength of mortar, Type S	1,800 psi
Compressive strength of grout	2,000 psi
Masonry unit assembly, f'_m	1,500 psi
(f'_m may be higher, if required by design)	

5.2.2 Loading Criteria

Dead Loads

Equipment:	Actual
Monorails or cranes:	Actual
Roof, superimposed:	Actual, 15 psf min.

Live Loads

Roof (non reducible):	20 psf
Walkways and platforms:	100 psf
Monorails or cranes:	Full rated capacity with 25% impact

Floor:	150 psf (or HS20-44, if applies)

Lateral Loads

Active earth pressure	40 psf (drained)
	80 psf (undrained)
At-rest earth pressure	60 psf (drained)
	90 psf (undrained)
Lateral surcharge load from compaction	400 psf
(Decreases linearly at same rate as earth pressure)	
Hydrostatic	63 pcf
HS20 vertical surcharge	Equivalent to 2 feet additional soil

The active pressure values will only be used for site retaining walls free to rotate.

Snow Loads

Ground Snow Load	20 psf
Roof Snow Load	(As calculated + 5psf rain-on-snow surcharge)
Exposure Category	C
Importance Factor	1.1
Exposure Factor, C_e	1.0
Thermal Factor, Ct	1.0 (for regular structures) 1.1 (for structures kept above freezing)

Seismic Loads

Short Period Spectral Acceleration (S_s)	0.130g
One Second Period Spectral Acceleration (S_1)	0.055g
Seismic Design Category	B
Occupancy Category	III
Importance Factor	1.25
Soil Site Class	E

Wind Loads

Basic wind speed, 3 second gust; for use with ASCE-7	90 mph
Exposure	C
Importance factor:	1.15

Wind loads will be determined in accordance with the International Building Code and ASCE 7.

5.3 Liquid Containment Structures and Vaults

5.3.1 Materials of Construction

Liquid containing structures will be constructed of reinforced concrete. Any platforms associated with these structures will be constructed of aluminum shapes, aluminum grating, and aluminum guardrail, unless a more corrosion resistant material is deemed appropriate. Connection bolts will be of stainless steel, aluminum, or titanium. Reinforced concrete platforming will be used in locations where the use of grating is not appropriate.

5.3.2 Design Procedures and Assumptions

Liquid containment structures will be designed based upon the loads, load combinations, and allowable stresses contained in the International Building Code, ACI 318, or ACI 350, whichever is applicable.

Listed below is a summary of the primary loading assumptions and load factors for design. Other load combinations will be considered when applicable:

Where:

D = Dead Load

L = Live Load

F = Lateral hydrostatic pressure

Hw = Flood/Overflow lateral hydrostatic pressure

Hs = Lateral Static Soil Load (including at-rest soil plus groundwater hydrostatic pressure, surcharge, compaction pressures)

Sd = ACI 350, Environmental durability factor

Service Water Condition

Maximum service water level while any adjacent basin is empty, ignore soil backfill loads, consider internal tensile forces in wall, and load combinations as follows:

Flexure: phi*Mn/Sd > 1.4*(D+ F) * M

Shear: phi*Vc + phi*Vs/Sd > = 1.4*(D+F) * V

Tension: phi*Tn/Sd > 1.4*(D+F) * T

Flood/Overflow Water Condition

Maximum water level at flood/overflow elevation (highest water elevation that could occur hydraulically, i.e., not necessarily the top of basin wall) while any adjacent basin is empty, ignore soil backfill loads, consider internal tensile forces in wall but ACI 350 Sd factor ignored, and load combinations as follows:

Flexure: phi * Mn > 1.4 * (D+ Hw) * M

Shear: phi * Vc + phi * Vs > 1.4 * (D+ Hw) * V

Tension: phi * Tn > 1.4 *(D+ Hw) * T

Service Soil Condition

Maximum soil backfill height with at rest pressure, without internal liquid loads, groundwater table at its normal elevation, a minimum soil pressure of 400 psf for compaction decreasing linearly at the same rate as the soil pressure. For an HS20-44 truck load, analyze for a 2 foot additional soil surcharge, not to be combined with the compaction surcharge. Use the worst case of the compaction and HS20-44 surcharge for design. Load combinations as follows:

Flexure: phi * Mn/Sd > (1.2D +1.6H) * M

Shear: phi * Vc + phi * Vs/Sd > (1.2D+1.6H) * V

Flood Soil Condition

Maximum soil backfill height with at rest pressure plus hydrostatic pressure of groundwater at 100 year flood level, without internal liquid loads, a minimum soil pressure of 400 psf for compaction decreasing linearly at the same rate as the soil pressure. Load combinations as follows:

Flexure: phi * Mn > (1.2D+1.6H) * M

Shear: phi * Vc + phi*Vs > (1.2D+1.6H) * V

If the normal groundwater elevation is near the 100 year flood level, groundwater at the 100 year flood level can be used for the soil service condition and, the load combinations listed in the flood soil condition can be ignored.

Factor of safety of 1.1 with soil shear stress equal to zero shall be considered to resist buoyancy or flotation.

Rectangular walls will be analyzed as two-way rectangular plates when the aspect ratio of length to height is 2:1 or less. The boundary conditions will be chosen to provide reasonably conservative results. If the aspect ratio exceeds 2:1, the wall will be designed as a one-way rectangular plate and the corners will be investigated assuming a 2:1 ratio.

The design of water containment walls will consider both flexure and tension in walls due to internal water pressure. The tension in the walls may be resisted by both faces of reinforcement in walls.

Direct tension in the foundation and top slabs due to internal water pressure will be accounted for in the design of the slab horizontal reinforcing. The foundation top reinforcement will be assumed to resist 100 percent of the tension at the foundation. The tension in the top slab may be resisted by both faces for reasonably thin slabs.

A minimum reinforcement for shrinkage and temperature will be provided in accordance with ACI 350. A minimum reinforcement ratio of 0.5 percent will be provided in basin walls and base slab, with a basin dimension of 40 feet or more in any direction. Reinforcement ratios in the direction where the structure dimension are less

than 40 feet will be in accordance with ACI 350. Minimum size of shrinkage and temperature reinforcement will be #4, and will be divided equally between the two surfaces of the concrete section. Concrete sections greater than 24 inches thick may have minimum reinforcing based on a 24 inch thickness.

5.4 Building Structures

Building structures, excluding structural concrete, will be designed based upon the loads, load combinations, and allowable stresses (or minimum strength requirements) contained in the International Building Code. Structural concrete design will be based on strength design in accordance with the International Building Code and ACI 318. The additional concrete design requirements of ACI 350 will not be considered applicable for building structures, unless exposed to water, wastewater, or aggressive chemicals. In addition, building structures and their components subject to equipment impact and vibration will be designed in accordance with the applicable recommendations of ACI 350.4R, subject to engineering judgment.

Wind loads will be transferred to the foundation from their origin in a rational manner. The horizontal distribution of wind loads will be based on the assumption that the roof/floor diaphragms are flexible for steel deck diaphragms, and rigid for cast-in-place or precast concrete diaphragms. Where the diaphragm is assumed to perform in a flexible manner, the wind lateral load distribution will be based upon the tributary area to the resisting elements. Where the diaphragm is assumed to perform as a rigid panel, the seismic or wind lateral load distribution is based on the relative rigidities of the resisting elements.

5.5 Inspection

Structural inspection for construction will be required in accordance with the International Building Code, Section 109, and Chapter 1. Special inspection for reinforced masonry will be required. The "Unit Strength Method" shall verify the strength of the CMU units, mortar, and grout.

6.0 Mechanical Systems

6.1 General

The following describes the basis of mechanical design and criteria associated with the plumbing; heating, ventilating, and air conditioning (HVAC) systems. The selection of the systems will be based on system performance, operating efficiency, safety, long-term durability, redundancy, local representation/service, ease of operation as well as site and specific requirements identified by the project team.

6.2 Applicable Codes and Standards

In addition to the applicable codes and standards previously identified, the system designs will also be based on, but not limited to, the following publications and standards:

- American Society of Plumbing Engineers (ASPE) Handbooks.
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbooks and Standards.
- Sheet Metal and Air Conditioning Contractor National Association (SMACNA) Handbooks.
- National Fire Protection Association Recommended Practices (NFPA) and Manuals.
- Recommended Standards for Sewage Works - Great Lakes - Upper Mississippi River Board of Sanitary Engineers (10 States Standards).
- Occupational Safety and Health Act (OSHA) Standards Manual.

6.3 Design Criteria

Site Elevation	
Above sea level, ft	775
Site Location	
North Latitude, degrees	39.31
West Longitude, degrees	94.92
Ambient Design Temperatures [1]	
Winter, design dry bulb, °F	-0.10
Summer, design dry bulb/mean coincident wet bulb, °F	92.7/78.8
Rainfall Intensity [2]	
Actual, inches/hour	3.6
Design, inches/hour	
Primary Roof Drains	4.0
Secondary (emergency) Roof Drains	4.0

[1] The winter and summer design temperatures are based on the ASHRAE frequency levels 99.6 percent and 1.0 percent, respectively based on Kansas City, MO International Airport.

[2] The actual rainfall intensity rate is based on a 60 minute duration and 100 year return period.

6.4 Building Design Requirements

The following is a description of the plumbing and HVAC systems serving the areas of the plant.

6.4.1 Plumbing Design

Storm Drainage Systems

Primary and secondary roof drainage systems will be provided for all flat roofed areas of the new UV Disinfection Building addition. The primary systems will consist of roof drains and interior piping which will discharge above grade to splash blocks. The secondary system will consist of overflow roof drains set at an elevation two inches above the primary roof drains. There will be one overflow roof drain for each primary roof drain. The overflow roof drains will be piped on the interior of the building independently from the primary system, and will discharge above grade to splash blocks.

All horizontal storm drainage piping within structures will be sized based on a slope of 1/8 inch per foot. To facilitate maintenance, cleanouts will be installed throughout the primary and secondary storm drain systems. The location will be in accordance with the applicable code requirements. Cleanouts will be the same size of pipe up to 4 inches and for larger pipe sizes, the cleanouts will be 4 inches in size. Piping materials will be cast iron soil pipe with hubless or bell and spigot joints for above grade locations and bell and spigot joints for below grade locations.

Sanitary Drainage Systems

It is anticipated the floor of the new UV Disinfection Building addition will slope to the open channels. The funnel receptor for the emergency eyewash station will drain directly to the UV channels. The funnel receptor drain will be provided with a trap and vent where required.

The drainage system in the existing building will be modified to discharge into the UV influent channel.

Water Piping Systems

Potable water from the existing water distribution system will be supplied to the emergency eyewash fixture. Where the water pressure exceeds 80 psig, a pressure reducing station will be provided to reduce the water pressure.

Protection of the potable water system will be in accordance with local codes or standards. Reduced pressure principle backflow preventers will be provided on the water supply to nonpotable water systems. Vacuum breakers will be provided on hose faucets and wall hydrants served by the potable water system when a nonpotable water system is not available.

Domestic hot and cold water will be provided to plumbing fixtures as required. A water heater and blending valve will be provided in the cold water supply to the emergency eyewash fixture to permit tepid water temperatures (60°F to 90°F) to be supplied to the fixture. Hose faucets and 1-1/2 inch hose valves will be provided in

unfinished areas that may require periodic washdown. Frostproof wall hydrants will be provided at intervals around the exterior of the structure.

Natural Gas Piping System

Natural gas piping and pressure regulation will be provided at the building for building heat and domestic water heaters as necessary.

Plumbing Fixtures

Plumbing fixtures will be selected for durability and ease of maintenance and housekeeping.

An emergency eyewash station will be provided in the new UV Disinfection Building addition.

Water heaters located downstream from a backflow prevention device will be protected by use of an expansion tank.

6.4.2 Heating, Ventilating, and Air Conditioning

The following is a description of the HVAC systems.

Indoor Design Conditions

Indoor design conditions are as shown in Table 6-1.

Table 6-1
Indoor Design Conditions

Area	Design Temperatures (°F) [1]			Ventilation Requirements[2]	Ventilation Notes
	Summer	Winter			
	Design	Design	Setpoint		
UV Room	103	60	60	12 AC/HR (I)	1
Electrical & Storage Rooms	103	60	60	6 AC/HR (I)	1

Notes:

[1] Indoor conditions reflect operating temperatures for personnel comfort, code/standard recommendations, or equipment protection.

[2] AC/HR - designates air changes per hour.
(C) - designates the ventilation system operates continuously.
(I) - designates the ventilation system operates intermittently.

Ventilation Note:

1. The ventilation system will be sized on the more restrictive of the AC/HR listed or the airflow required to maintain the indoor design temperature based on the summer outside design temperature.

General Requirements

Intakes. Outdoor air intakes will be designed to manage rain entrainment in accordance with the latest ASHRAE standards. Louvers will be selected to limit water penetration to a maximum of 0.01 oz/ft^2 of louver free area at the maximum intake velocity. Corrosion resistant screens will cover the openings with 1/2 inch openings.

Building Loads. Lighting will be sized at 2 watts/sq ft, unless otherwise indicated.

Ductwork. Ductwork will be sized for a friction loss of 0.075 inches water column per 100 feet.

Heating Systems

Space heating will be provided by individual natural gas unit heaters in the UV Disinfection Building. The heaters will be located to provide uniform space heating of the area served. Each unit heater will be controlled by an adjustable wall mounted thermostat.

Ventilation Systems

An intermittent ventilation system will serve the UV Disinfection Building. The system will consist of fans, louvers, dampers, and aluminum ductwork as required. The ventilation system will be designed to promote removal of exhaust air from all portions of the ventilated space. The ventilation systems will be arranged to avoid short-circuiting of intake and exhaust air from the space. Control dampers in the intake and exhaust systems will be used to isolate the spaces from ambient conditions upon system shutdown. The system will be controlled by a local "ON-OFF-AUTO" selector switch. When the switch is in the "AUTO" position, control will be from a thermostat.

The existing ventilation systems of the existing building will remain as is and will be modified as necessary due to the building addition and additional electrical equipment loads. The ventilation system in the existing storage room (former chlorine and chlorine feed rooms) will be modified due to removal of a separating wall.

7.0 Electrical Systems

7.1. General Electrical Design Criteria

This chapter describes the existing electrical power distribution system and presents the criteria for modifications to the electrical power distribution system and in addition describes how new facilities constructed under this expansion project will receive electrical service. This chapter also describes general items that will be specified and/or shown on design drawings.

7.2 Codes and Standards

Electrical design shall conform to the latest editions of the following applicable standards and codes:

- International Code Council Electrical Code Administrative Provisions (ICC-ECAP)
- National Electrical Code (NEC-NFPA 70)
- National Electrical Safety Code (NESC)
- National Fire Protection Association Life Safety Code (NFPA-101-AB)
- National Fire Protection Association Standard for Fire Protection in Wastewater Treatment and Collection Facilities (NFPA-820)

Standards and codes of the following organizations shall also govern where applicable:

- American National Standards Institute (ANSI)
- Illuminating Engineers Society (IES)
- Instrument Society of America (ISA)
- National Electrical Manufacturers Association (NEMA)
- Institute of Electrical and Electronic Engineers (IEEE)
- Insulated Cable Engineers Association (ICEA)

- Occupational Safety and Health Act (OSHA)
- American Society for Testing and Materials (ASTM)
- Underwriters Laboratory (UL)

Applicable federal and local codes and UL listing requirements shall be followed. Exit signs, emergency egress lighting and emergency lighting power supply will conform to the requirements of the local code authority.

7.3 Power Distribution Design

The design of the power distribution system for the project will follow the current design guidelines as recognized by IEEE and current industry standards. Refer to **Figure 6** for the power distribution functional diagram which includes all major electrical distribution equipment such as switchgear, motor control centers (MCCs) and transformers. Refer to **Figure 7** for the electrical site plan which includes all the locations of major electrical gear.

7.3.1 Existing Plant Electrical Distribution System

Electrical service to Leavenworth Wastewater Treatment Plant (WWTP) is provided by Westar Energy. The plant can be powered from either one of two separate utility feeds from the same substation. The City staff has the ability to switch between the two utility feeds with a manual switch located at the switchgear. The plant receives power from the utility at 12.47 KV. One utility feed enters from the north side of the site. The second utility feed enters from the south side of the site. Based on engineering reference drawings from Leavenworth, Kansas 1972 Wastewater Plant Improvements, the service entrance conductors are 15 KV rated conductors. The ampacity of the service entrance conductors, for the purpose of evaluating and engineering this project, is 295 amps. Service entrance conductors are routed down the final utility pole and go underground to the main switchgear located on the site.

7.3.2 New Plant Electrical Distribution System

The proposed modifications to the existing power distribution system include a new pad mounted transformer, replacing the existing transformer #3, to step the voltage down to a utilization voltage of 480VAC. The existing transformer is not large enough to handle the additional ultraviolet (UV) disinfection system load. It is anticipated that the new transformer will need to be 750 KVA. Existing drawings indicate that the existing conductors feeding existing manhole #1, from where existing transformer #3 is fed, are appropriately sized to handle the increase in transformer size. The UV Disinfection Building will be constructed to have a new electrical room that will house the new electrical gear. The new transformer will feed a new MCC that will be used to power the new UV disinfection system and other associated miscellaneous loads. The existing MCC #3 will be sub-fed from the new MCC. The new MCC will be provided with adequate spare sections allowing the City to transfer all loads, currently fed from the existing MCC #3, to the new MCC in the future.

7.3.3 Distribution and Utilization Voltages

The following distribution and equipment utilization voltages and ratings will generally be used. Depending on the specific equipment requirements determined in design, there may be some exceptions to the following numbers:

Plant service	12.47 KV, three-phase
Plant distribution	12.47 KV, three-phase
Motors, 1/2 hp and larger	480 volts, three-phase
Motors, less than 1/2 hp	120 volts, single-phase
Motor Control	120 volts, single-phase
Lighting	120 volts, single-phase
Convenience Outlets	120 volts, single-phase

7.3.4 Standby Power

Kansas Department of Health and Environment (KDHE) "Minimum Standards of Design for Water Pollution Control Facilities" is the governing state design requirements document for Leavenworth WWTP. The KDHE document does not require standby power for disinfection facilities. United States Environmental Protection Agency (US EPA) provides guidelines for wastewater treatment plant design and recommends that several treatment processes, including disinfection, be provided with standby power. Since no direct standby power is provided for upstream processes at the plant, which are required to deliver water to the new UV disinfection system, no standby power will be provided with this project.

7.4 Electrical Equipment Design Criteria

The following criteria identify the general requirements and guidelines to be used for the electrical power equipment and support systems in the electrical design.

7.4.1 480 Volt Motor Control Centers and Starters

Indoor, class II, type B wiring MCCs will be used in areas that will contain multiple motors. Supply circuit to MCCs will be 480 volts, three-phase, three-wire. MCCs will have copper phase buses and a copper ground bus. MCCs will be specified to be as manufactured by Allen-Bradley, Cutler-Hammer, General Electric, or Square D without exception. Surge Protective Devices will be provided integral to each MCC assembly.

Except for packaged and HVAC equipment, motor starters will generally be located within an MCC. Starters will include a green indicating lamp for OFF, a red indicating lamp for RUNNING, and an amber indicating lamp for trouble or failure (where applicable).

Areas that contain no, or very few, motors may be powered using 480V power centers.

7.4.2 Motors and Adjustable Frequency Drives

Motors will be specified with high efficiency ratings. Motor enclosures will be suitable for the environment in which they are installed. All motors driven from adjustable frequency drives (AFDs) will be inverter duty rated and will be rated for such applications.

All motors 1 hp and larger will be provided with integral space heaters. The heaters will be designed to operate on 120VAC power from the associated motor starter.

AFDs will be pulse width modulated type. AFDs will be fed from a dedicated 480V, three-phase feeder. A harmonic analysis will be provided on the connected bus for those serving AFDs. Drives for motors smaller than 100 hp will use 6-pulse type. Drives for motors 100 hp and larger will use 18-pulse type drives to minimize harmonics.

7.4.3 Power Transformers

12.47KV to 480V transformers will be furnished and installed by the Contractor. Existing transformer #3 shall be salvaged to the City during construction.

7.4.4 Panelboards

Power distribution panelboards or power centers, if required in design, will be 480Y/277 volt, three-phase, four-wire type with a main circuit breaker.

Lighting panelboards will be 208Y/120V, three-phase, four-wire type with the main circuit breaker sized to match the lighting transformer capacity.

Each panelboard will have a minimum of 20 percent spare breakers with spaces, bus work, and terminations to complete the standard size panelboard. Transient voltage surge suppressors will be provided integral to each panel assembly.

7.4.5 Convenience Receptacles

Convenience receptacles for general service will be located on the surface of walls or columns. Provisions for receptacles at all air conditioning units and air handling units will be made as required by NEC.

Convenience receptacles will generally be mounted 18 inches above floors, except convenience receptacles outdoors or in garages, shops, storerooms, or rooms where equipment may be hosed down will be mounted 48 inches above the floor or grade.

Weatherproof receptacles will be utilized outdoors, in chemical feed and storage areas, and in wet and damp locations. Receptacles installed outdoors will be provided with ground fault circuit interrupting capability.

7.4.6 Raceways

Specific types of raceway will be chosen for use in various locations in the facility based on moisture, temperature, and exposure to damage, corrosion, voltage, and cost. An underground duct bank consisting of concrete encased PVC conduits will be provided for most circuits that are routed outside of buildings on the site. Duct banks will include spare conduits. The following systems will be separately grouped in duct banks:

- Power and discrete control wiring below 600 volts.
- Variable frequency drive power circuits will be in steel conduit.
- Process instrumentation analog and communication wiring, including 24 volt discrete signals, intrinsically safe circuits, and LAN/Data Highway computer circuits.

The following general guidelines will be used for raceway sizing, selection, and installation:

- Conduit will be sized based on cross-linked high heat water resistant insulated wire (XHHW) insulation for all conductors 600 volts and below.
- The minimum diameter of exposed conduit in all areas will be 3/4 inch.

- Raceways in duct banks will generally not be smaller than 2 inches.
- Raceways in walls and ceilings of control rooms, offices, and all areas with finished interiors will be concealed.
- The number of conduit bends will be limited to an equivalent of 270 degrees on long runs.
- Exterior, exposed conduit will be PVC coated rigid galvanized steel (RGS). The use of this type of conduit will be limited to required areas only.
- Exterior underground direct buried and concrete-encased conduit will be rigid Schedule 40 PVC.
- Interior, exposed conduit will be RGS.
- PVC Schedule 40 conduit will be used for corrosive chemical areas.
- Interior, concealed conduit will be RGS or electrical metallic tubing (EMT) in frame construction and finished ceiling spaces.
- Conduit installed in floor slabs and walls in non-hazardous locations shall be rigid Schedule 40 PVC.

7.4.7 Cable

All power, and control wiring rated 600 volts and below will use stranded copper conductors with XHHW insulation. All lighting wiring rated 600 volts and below will use stranded copper conductors with thermoplastic high heat resistant nylon coated (THHN) or XHHW insulation. Individual No. 14 American wire gauge (AWG) conductors will be used for discrete control circuits, unless it is practical to use multi conductor cables to group control circuits. Cables will have 600V insulation.

Twisted shielded pair control cable with 16 AWG individual stranded copper conductors, PVC insulation, and an aluminum Mylar tape shield around the pair will be used for analog signals. Multi pair cables will be used where grouping of circuits is practical. Cables will have 600V insulation.

7.4.8 Grounding and Lightning Protection

The electrical system and equipment will be grounded in compliance with the NFPA NEC. Conductors will be No. 4/0 AWG copper, minimum, for interconnecting ground rods and for connections to transformers, MCCs, and switchgear. A grounding ring will be provided around all new buildings and major structures. Electrical equipment, devices, panelboards, and metallic raceways that do not carry current will be connected to the ground conductors. Transformer neutrals of wye connected transformers will be solidly grounded through a grounding conductor connected to the grounding system.

A ground wire will be installed in all raceways that contain power conductors at any voltage.

A lightning risk factor calculation will be completed for the project. If the calculated risk of lightning strike is substantial, lightning protection systems meeting the requirements of NFPA 780, Standard for Lightning Protection Systems, will be provided for the appropriate buildings or structures.

7.5 Lighting Design Criteria

Lighting levels in the facilities will be provided following the recommended levels as suggested in the IES handbook. In general, the following suggested foot candle levels will be the target levels for design. Actual levels provided will be further evaluated in detailed design. Suggested levels are as follows.

Area	Foot Candle
Conference rooms	40
Control rooms	30
Electrical rooms	35
General site	1
Lunchrooms	35
Laboratories	75
Maintenance areas	50
Office	70

Process, inside	30
Process, outside	5
Storage, inside	15
Walkway	5

The following general types of light source will be used to provide the proposed foot candle levels.

Area	Light Source
Office	Fluorescent
Process, above 14 feet mounting height	High Intensity Discharge (HID)
Storage, inside	Fluorescent
Walkway, inside	Fluorescent
Walkway, outside	High Intensity Discharge (HID)
General site	High Pressure Sodium

Where fluorescent lights are indicated, fixtures with energy-saver ballasts and lamps will be used. Outdoor lighting will use luminaries with individual photocells. High bay lighting fixtures will use HID lights with metal halide, instant-on, lamps.

7.6 Fire Alarm System

A fire alarm system will not be included with the project.

7.7 Telephone and Communication Design Criteria

A telephone line will be provided to the UV Disinfection Building for remote troubleshooting assistance of the UV disinfection system. City staff indicated that a phone line is available at Special Manhole No. 2 and it is anticipated that telephone service will be provided from this location.

7.8 Security System

A security system will not be included with this project.

7.9 Calculation and Analysis Requirements

7.9.1 Load Analysis

The final loads will be analyzed during detailed design. Final computations will be based on the actual loads shown on the drawings, HVAC load on actual motor horsepower, process load on actual motor horsepower, general building load on number of receptacles, the connected lighting load and the actual connected load of special appliances.

7.9.2 Short Circuit Analysis

For purposes of design, estimated short-circuit levels and steady state voltage drops will be calculated using a computer-based program. Short-circuit values obtained will be used to specify the appropriate short-circuit ratings for electrical equipment. Design will generally be such that voltage drops will not exceed 3 percent for branch voltages and 5 percent for bus voltages under steady-state conditions.

7.9.3 Arc Flash

Lighting panels, power panels, power centers, and meter socket enclosures shall be provided with permanent labels warning the risk of arc flash and shock hazard.

8.0 Instrumentation and Control System

8.1. General

All instrumentation and control (I&C) work will be in accordance with the criteria outlined in this chapter and other requirements applicable to the I&C design. The I&C system design will stress efficient monitoring and control of equipment and process conditions. All I&C work will be in accordance with local codes, the criteria outlined in this memorandum, Black & Veatch standards, and other requirements applicable to the I&C design for wastewater processing facilities. The P&IDs indicating process and instrumentation features for the major facilities are shown on **Figures 9 through 12**.

8.2 Plant Control System

The Plant Control System (PCS) for the Leavenworth Wastewater Treatment Plant (WWTP) currently utilizes stand alone programmable logic controllers (PLCs). New PLCs will have Ethernet/IP communication capabilities for a future telemetry or fiber optic cable based plant wide network. There will be one new PLC incorporated under this project to provide control and monitoring for the UV Disinfection equipment added under this project. The new PLC enclosure will be sized to accommodate the specified equipment.

The PLC enclosure will be provided with local Human Machine Interface (HMI) touch screens, also commonly referred to as Operator Interface Terminals (OITs). The OIT software will be configured to provide graphical displays of the related new control equipment. The UV system OIT will be configured by the UV System Supplier.

Refer to **Figure 8** for the proposed control system architecture.

8.3 Control Modes

Up to three modes of control will be provided for equipment:

- Local Manual: The equipment is manually controlled locally at the equipment, manually controlled from a nearby Motor Control Center (MCC), or manually controlled from a local control panel.
- Remote Manual: The equipment is manually controlled using commands issued from an OIT local to a PLC and in the future through an Operator HMI Workstation computer located in the control room or electrical rooms around the plant site.
- Automatic: The equipment is controlled automatically by the local PLC based upon operator entered setpoints and commands issued from the local OIT and in the future from the Operator HMI Workstation computers or commands and process variables received from other plant PLCs or from process interlocks. The PLC converts the commands and setpoint values into physical outputs to the field devices.

The control mode will be selectable, where applicable, based on Local-Off-Remote switches located at the equipment and Manual-Auto selection of control mode at the OIT or in the future from Operator HMI Workstation computers. This will allow the operator to manually override the automatic controls. In Remote, feedback will be wired back to the PLC so that an operator using the OIT will know whether a device is available for control through the PCS or is selected for local control.

The I&C system design will provide control descriptions that define the PLC and OIT programming requirements. These descriptions will be included in specification Section 13550, Software Control Block Descriptions, and will be based on the control described in this memorandum.

8.4 Plant Instrumentation

UV instrumentation will be provided to support monitoring of the process and control of the equipment. Additional instrumentation will be provided to alarm abnormal system operation, pending problems, or safety hazard conditions. Where possible, instruments will be microprocessor based instruments, which can be calibrated and maintained through a digital interface.

8.5 Equipment Controls

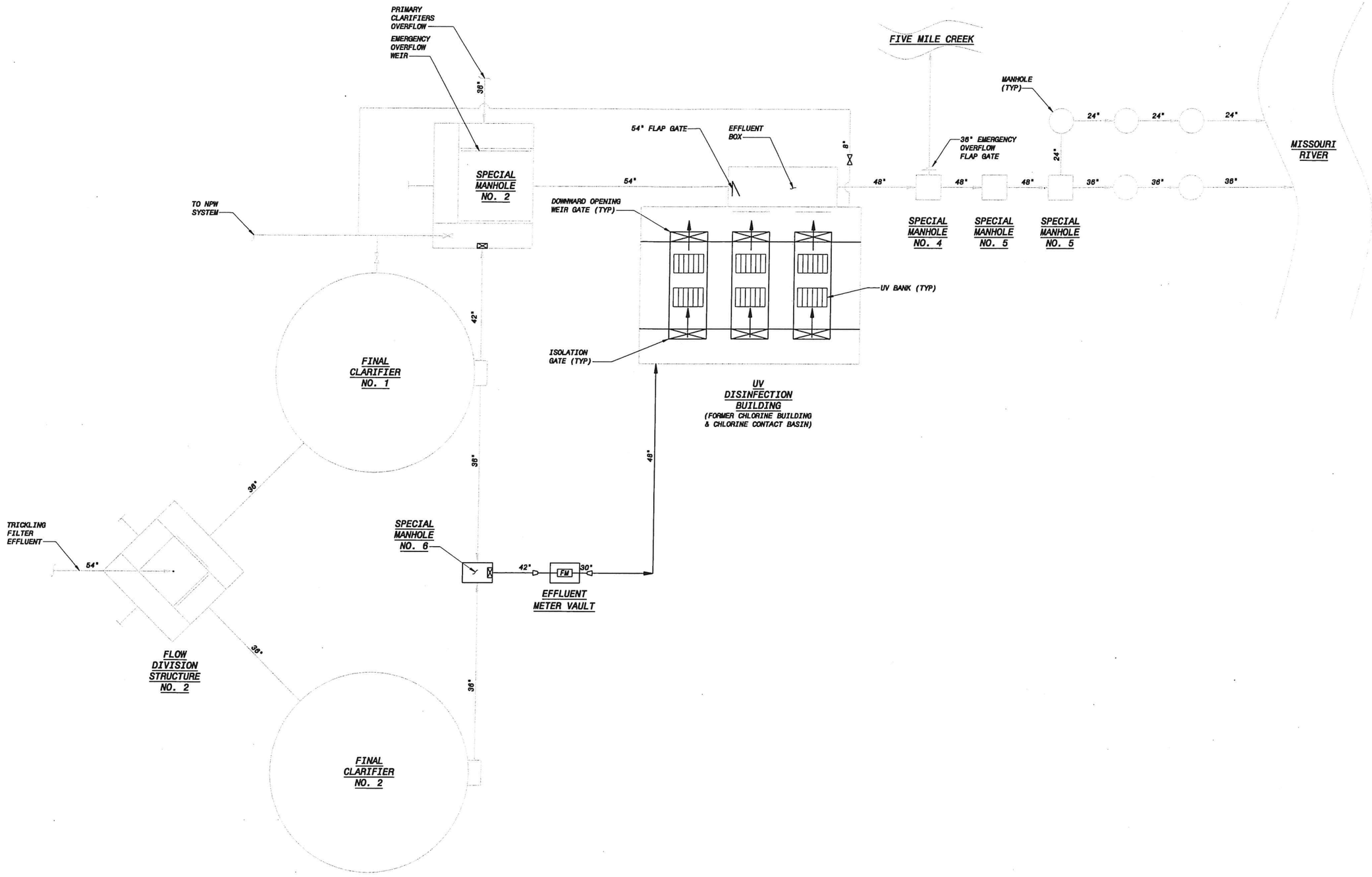
Equipment will be controlled as described in **Table 8-1**.

Table 8-1
Equipment Controls

Equipment/ Process	PCS Monitoring Functions	PCS System Control Functions	Local Control Functions	Hardwired Protective Interlocks
UV Channel Inlet Gates **Figure 12**	Open, Closed, In-Remote	**Manual Control:** Operator shall have commands for Open and Close available locally and at the OIT/HMI. **Automatic Control:** The UV PLC shall open the channel inlet gate when the corresponding channel is brought online and close when taken off line.	Local-Off-Remote, Open, Stop, Close	
UV Disinfection System **Figure 12**	Running, Fail, UV Transmittance, UV Intensity, Total Flow, Channel Level	**Manual Control:** Operator shall have commands for UV Channel Start and Stop available at the UV PLC OIT **Automatic Control:** The UV PLC shall adjust the number of channels operating, the number of banks operating, and the UV Intensity based on the flow and UV transmittance level. There is also an automatic cleaning cycle initiated by the UV PLC to remove build-up on the lamp sleeves.	On-Off-Auto	Alarm on High Channel Level, Alarm and Shutdown on Low Channel Level,

Table 8-1
Equipment Controls

Equipment/ Process	PCS Monitoring Functions	PCS System Control Functions	Local Control Functions	Hardwired Protective Interlocks
UV Channel Outlet Gates **Figure 12**	Open, Closed, In-Remote, Position	**Manual Control:** Operator shall have commands for Open, Stop, and Close available locally and at the UV PLC OIT/HMI. **Automatic Control:** The UV PLC shall modulate the channel outlet gate to maintain channel level.	Local-Off-Remote, Open, Stop, Close	



PARTIAL LIQUIDS PROCESS SCHEMATIC
NO SCALE

PRELIMINARY - NOT FOR CONSTRUCTION

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BLACK & VEATCH
Building a world of difference.
Black & Veatch Corporation
Kansas City, Missouri

LEAVENWORTH, KANSAS
LEAVENWORTH WWTP
UV DISINFECTION IMPROVEMENTS

CIVIL
PARTIAL LIQUIDS PROCESS SCHEMATIC

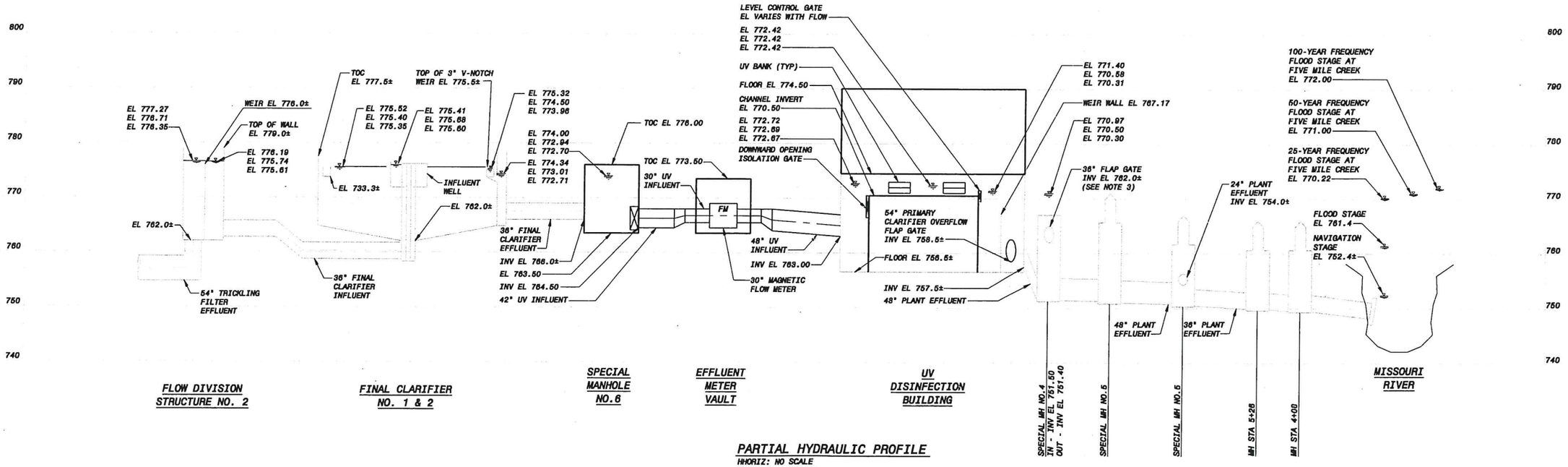
DESIGNED: MWW
DETAILED: MDA
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 1

FM0000
D172827



PARTIAL HYDRAULIC PROFILE

HHORIZ: NO SCALE
VERT: 1" = 10'-0"

DESIGN FLOW RATES

TOTAL PLANT FLOW, MGD

AVERAGE DAY	4.5
PEAK DAY WET WEATHER	13.0
PEAK HOUR WET WEATHER	30.0

NOTES:

1. EL XXX.XX (WATER SURFACE @ PEAK HOUR WET WEATHER)
   EL XXX.XX (WATER SURFACE @ PEAK DAY WET WEATHER)
   EL XXX.XX (WATER SURFACE @ AVERAGE DAY)
2. WATER SURFACE ELEVATIONS SHOWN ARE BASED ON 25-YEAR FLOOD STAGE AT FIVE MILE CREEK ELEVATION 770.22.
3. HYDRAULIC MODELING ASSUMES ALL FLOW PASSES THROUGH THE SUBMERGED 36" FLAP GATE AT SPECIAL MANHOLE NO. 4 FOR 25-YEAR FLOOD STAGE CONDITION.

PRELIMINARY - NOT FOR CONSTRUCTION

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Black & Veatch Corporation
Kansas City, Missouri

LEAVENWORTH, KANSAS
LEAVENWORTH WWTP
UV DISINFECTION IMPROVEMENTS

CIVIL
PARTIAL HYDRAULIC PROFILE

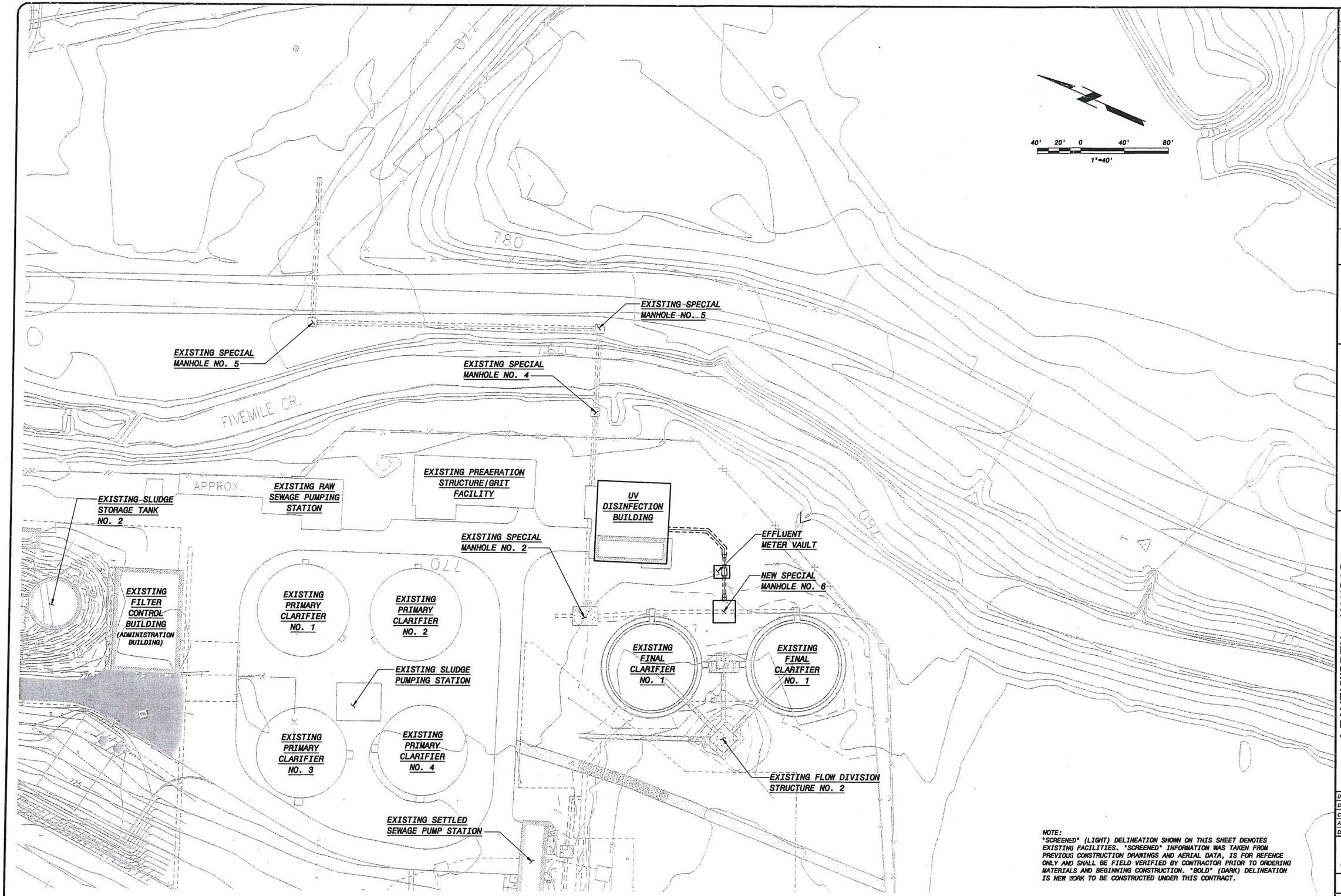
DESIGNED:	NWW
DETAILED:	NDA
CHECKED:	
APPROVED:	
DATE:	

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 2

FD8000
D172827



SITE PLAN
1" = 40'-0"

NOTE:
"SCREENED" (LIGHT) DELINEATION SHOWN ON THIS SHEET DENOTES EXISTING FACILITIES. "SCREENED" INFORMATION WAS TAKEN FROM PREVIOUS CONSTRUCTION DRAWINGS AND AERIAL DATA, IS FOR REFENCE ONLY AND SHALL BE FIELD VERIFIED BY CONTRACTOR PRIOR TO ORDERING MATERIALS AND BEGINNING CONSTRUCTION. "BOLD" (DARK) DELINEATION IS NEW WORK TO BE CONSTRUCTED UNDER THIS CONTRACT.

PRELIMINARY - NOT FOR CONSTRUCTION

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XREF4: M0000A982.DWG
DWG VER: 1000

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LEAVENWORTH WWTP
UV DISINFECTION IMPROVEMENTS

CIVIL
SITE PLAN

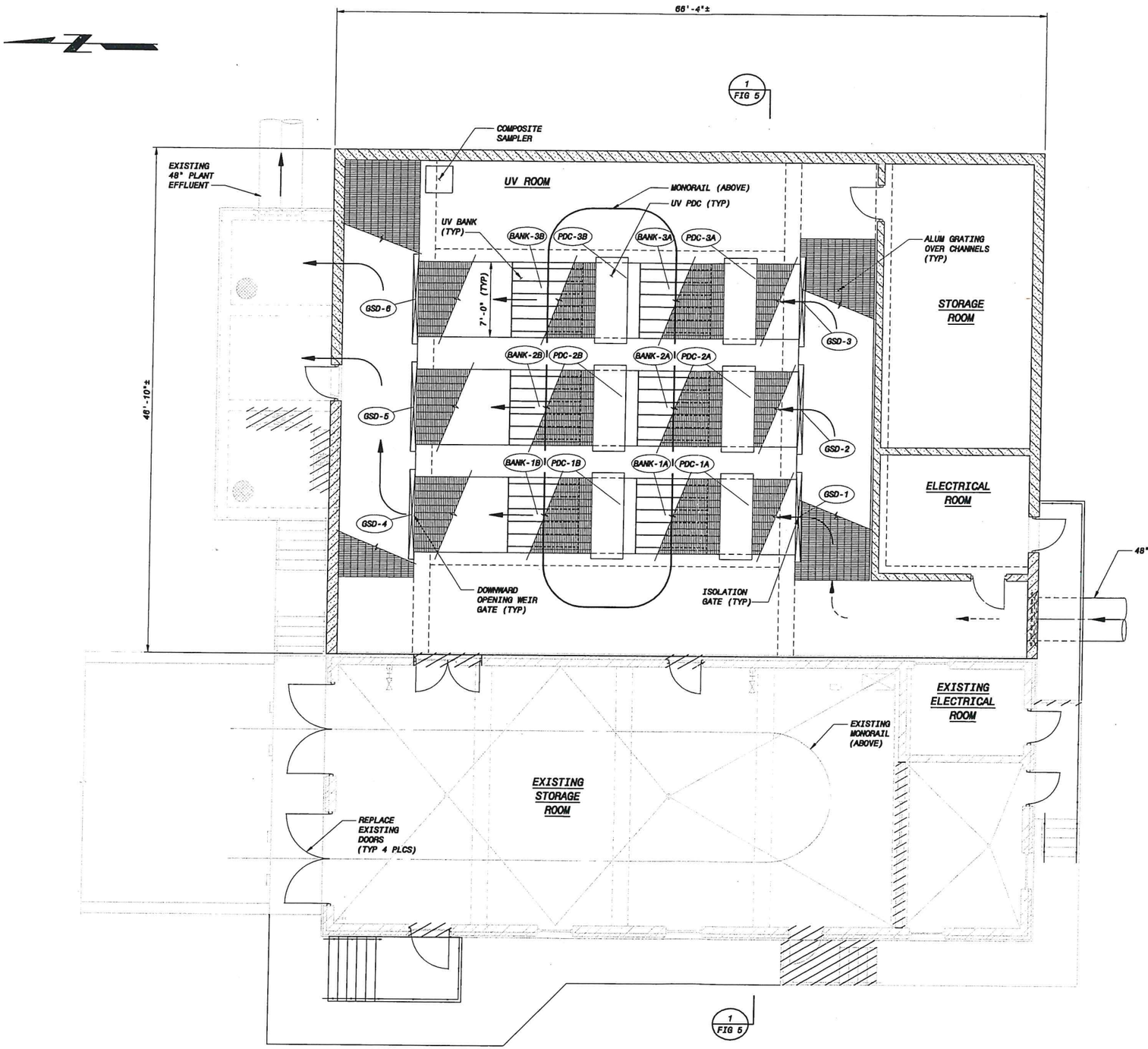
DESIGNED:	JW
DETAILED:	MDA
CHECKED:	
APPROVED:	
DATE:	

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 3

FD8000
D172827



UV DISINFECTION BUILDING - PLAN
3/16" = 1'-0"

PRELIMINARY - NOT FOR CONSTRUCTION

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DATE: REVISIONS AND RECORD OF ISSUE
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PW PRFILE: Design Memo Figure 4.dwg XREF1:UV_BLDG_Existing.dwg
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CIVIL
UV DISINFECTION BUILDING
PLAN

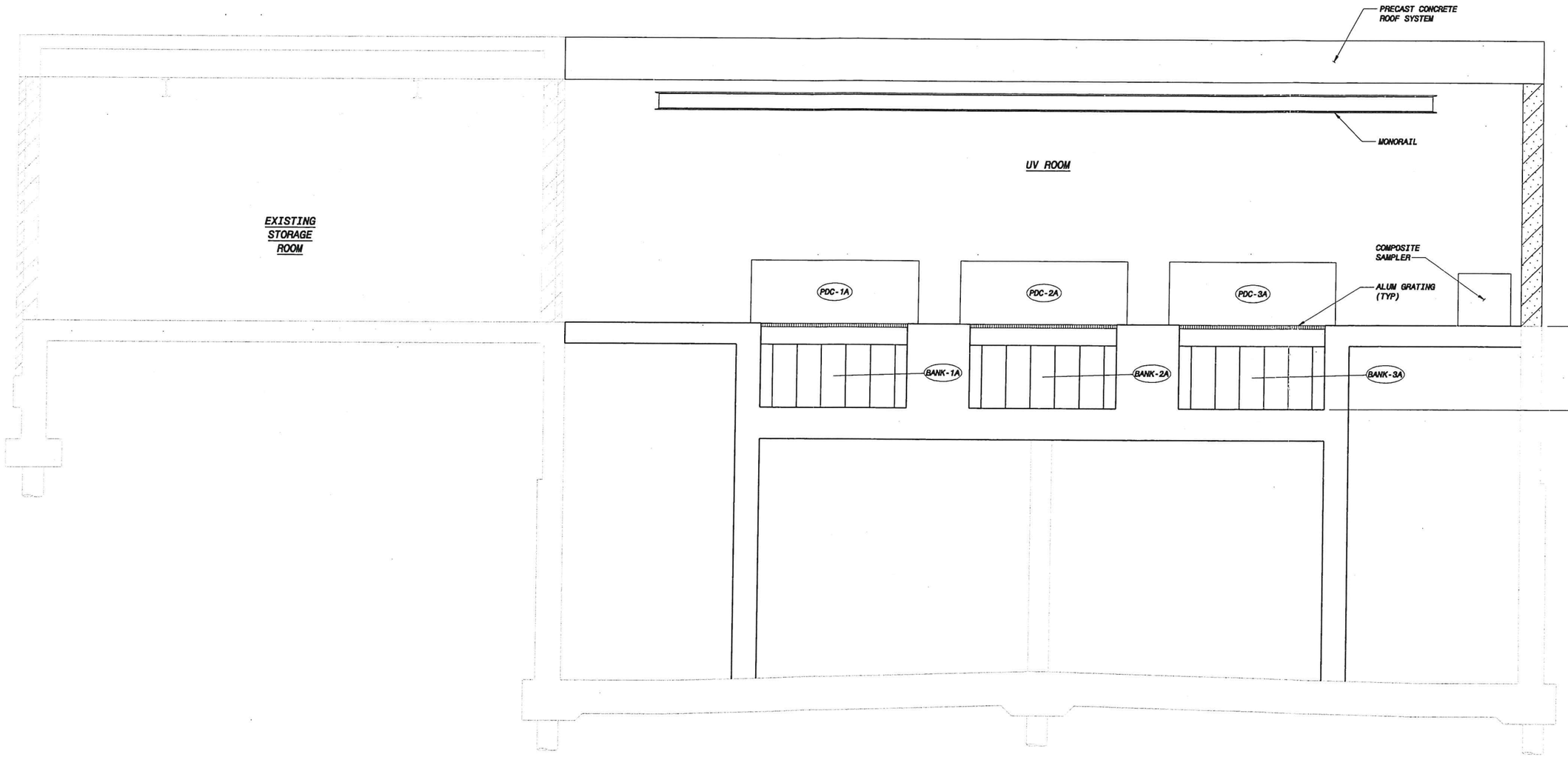
DESIGNED:	MWW
DETAILED:	MDA, TSH
CHECKED:	
APPROVED:	
DATE:	

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 4

FD8000
D172827



SECTION 1 / FIG 4
3/8" = 1'-0"

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NO.	BY	CK	APP
REVISIONS AND RECORD OF ISSUE			

DATE
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CIVIL
UV DISINFECTION BUILDING
SECTION

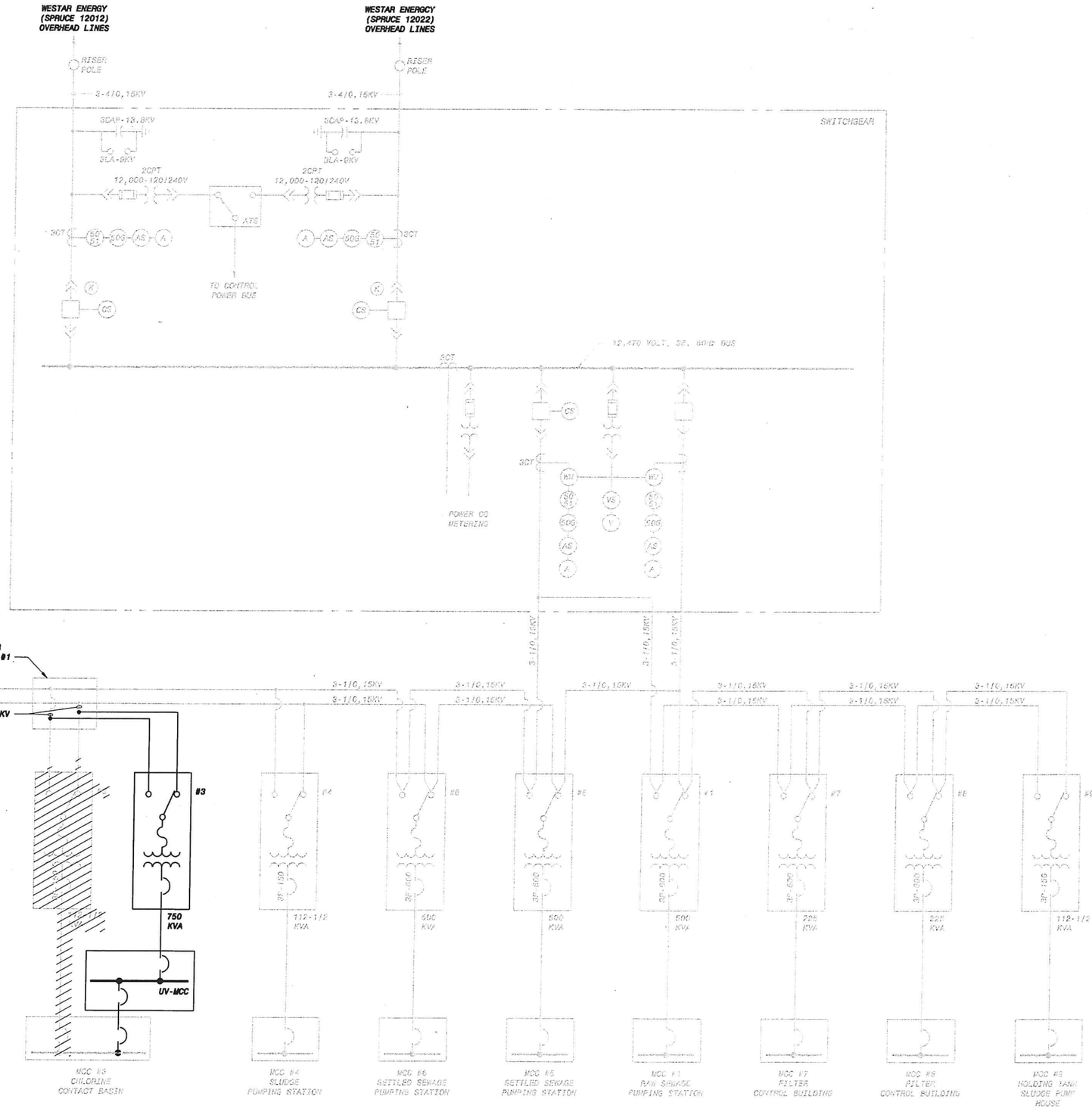
DESIGNED: NWW
DETAILED: WDA
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 5

FD6000
172827



PRELIMINARY - NOT FOR CONSTRUCTION

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USER: WHT40210 DWG VER: 1004 XREF4:

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ELECTRICAL
POWER DISTRIBUTION FUNCTIONAL DIAGRAM

DESIGNED: BLB
DETAILED: DAH
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

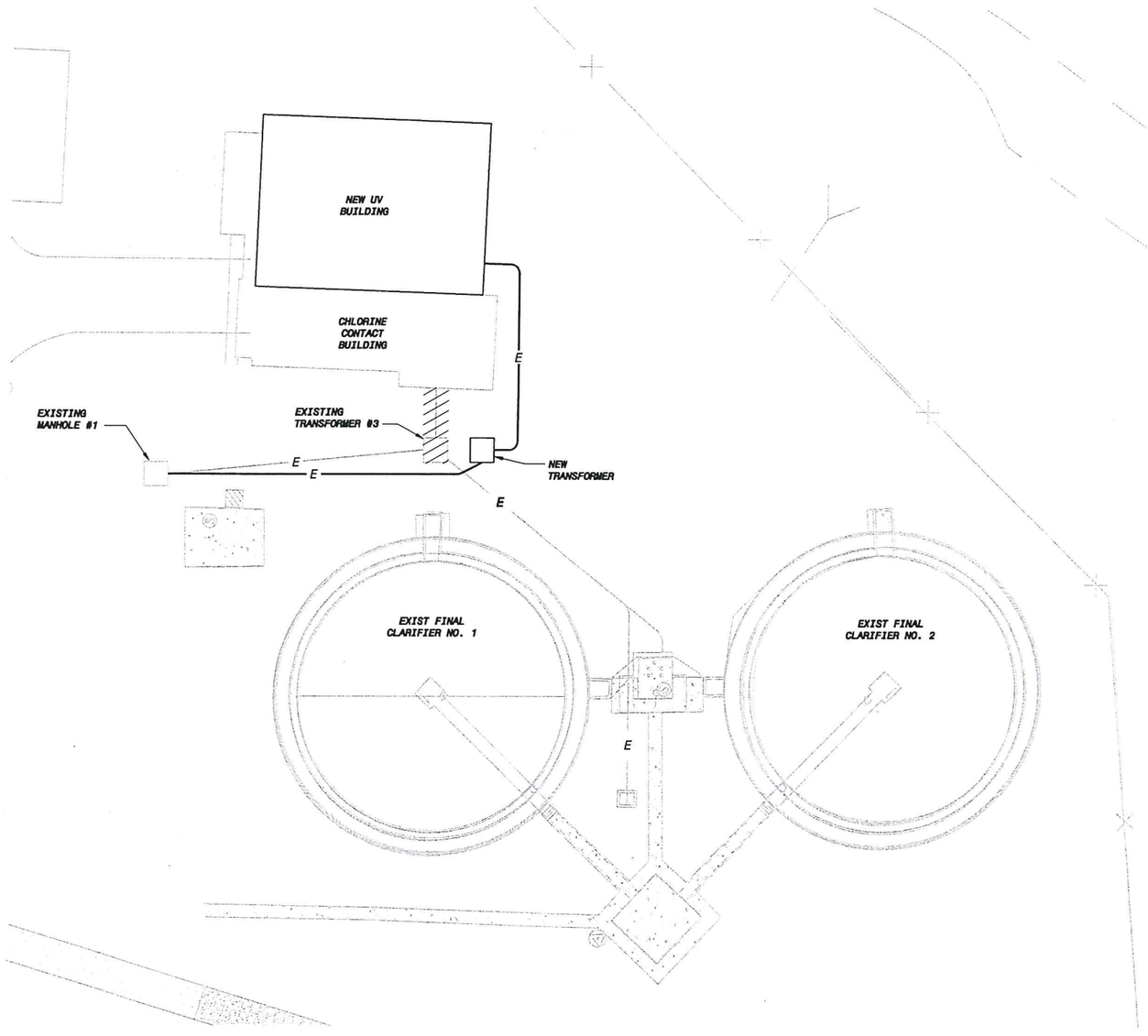
PROJECT NO. 172827

FIG 6
SHEET
OF

FD6000
D172827

20' 10' 0 20' 40'

1"=20'



SITE PLAN
1" = 20'-0"

PRELIMINARY - NOT FOR CONSTRUCTION

NO.	BY	CK	APP	DATE	REVISIONS AND RECORD OF ISSUE

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USER: WH140210 DWG VER: 1002 XREF4:

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ELECTRICAL
SITE PLAN

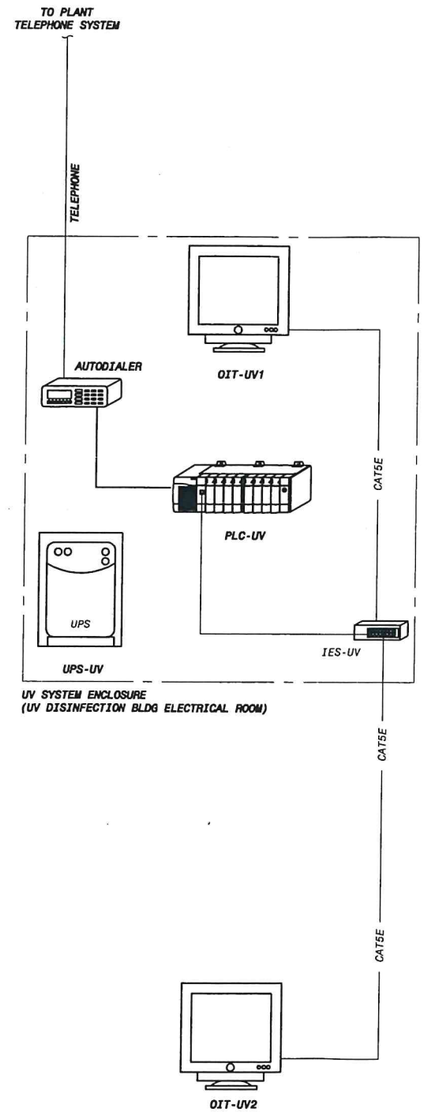
DESIGNED: BLB
DETAILED: DAH
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 7
SHEET
OF

FD6000
D172827



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REVISIONS AND RECORD OF ISSUE

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XREF3:
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INSTRUMENTATION
CONTROL BLOCK DIAGRAM

DESIGNED: BLB
DETAILED: BLB
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

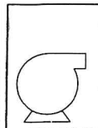
PROJECT NO.
172827

FIG 8

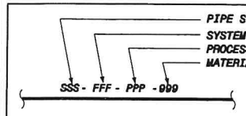
PRELIMINARY - NOT FOR CONSTRUCTION

FR0000
D172827

EQUIPMENT IDENTIFICATION DESCRIPTION



PIPELINE IDENTIFICATION DESCRIPTION



LINE SYMBOLS

- MAJOR PROCESS PIPING OR FLOW CHANNEL
- SECONDARY PROCESS PIPING
- MISCELLANEOUS PIPING
- SCREENED LINE DENOTES EXISTING PIPE OR EQUIPMENT
- DASHED LINE DENOTES FUTURE PIPE AND EQUIPMENT
- ELECTRIC SIGNAL
- HYDRAULIC SIGNAL
- PNEUMATIC SIGNAL
- SIGNAL CONNECTION POINT
- INTERNAL SYSTEM SIGNAL LINK (SOFTWARE OR DATA LINK)
- SIGNAL LINE GOING TO ANOTHER SHEET (B PI-4)
- SIGNAL LINE FROM ANOTHER SHEET (MATCH LETTERS) (B PI-4)
- FLOW ARROW FOR PROCESS PIPING
- PROCESS LINE GOING TO ANOTHER SHEET (B PI-45)
- MATCH SHEET NO. IDENTIFIER
- MATCH LINE NO.
- PROCESS LINE COMING FROM ANOTHER SHEET (B PI-45)
- PROCESS LINES CROSSING (NOT CONNECTED)

MECHANICAL EQUIPMENT SYMBOLS

- VAPORIZER: WATER BATH
- VAPORIZER: AMBIENT
- PARTICULATE FILTER
- AIR STRIPPER OR PACKED TOWER
- MIXER (M)
- AIR FILTER
- WATER FILTER: CARTRIDGE TYPE
- WATER FILTER: MEMBRANE TYPE
- FLOCCULATION MIXER
- COMPRESSOR
- VALVE: MATERIAL HANDLING ROTARY (M)
- HEAT EXCHANGER: FINNED TUBE
- HEAT EXCHANGER: SHELL & TUBE
- HEAT EXCHANGER: PLATE & FRAME
- HEAT EXCHANGER: SPIRAL
- HEAT EXCHANGER: TUBE-IN-TUBE
- BOILER
- PACKAGED AIR COMPRESSOR SYSTEM
- COOLING TOWER
- AFTERCOOLER
- STATIC MIXER
- WATER HEATER
- FILTER SEPARATOR
- SILENCER

PUMP & BLOWER SYMBOLS

- CENTRIFUGAL PUMP OR OTHER TYPE NOT SPECIFIED
- SCREW (LIFT) PUMP
- ROTARY PUMP
- PROGRESSING CAVITY PUMP
- POSITIVE DISPLACEMENT PUMP
- PLUNGER PUMP
- VERTICAL PUMP
- SUMP PUMP (M)
- CENTRIFUGAL FAN
- METERING PUMP
- CENTRIFUGAL BLOWER
- POSITIVE DISPLACEMENT BLOWER
- COMPRESSOR: RECIPROCATING
- COMPRESSOR: ROTARY SCREW
- COMPRESSOR: LIQUID RING
- DIAPHRAGM METERING PUMP "S" INDICATES SOLENOID TYPE (S)
- PERISTALTIC PUMP
- DRUM PUMP
- DOUBLE DIAPHRAGM

WASTEWATER PROCESS SYMBOLS

- CLARIFIER: RECTANGULAR
- CLARIFIER: CIRCULAR
- UV CHANNEL
- BASIN: ANOXIC/OXIC
- BASIN: OXIC
- AERATION BASIN
- BAR SCREEN: MANUAL
- BAR SCREEN: MECHANICAL
- DAF TANK
- GRAVITY THICKENER
- SLUDGE GRINDER: INLINE
- SLUDGE GRINDER: CHANNEL MTD
- SLUDGE SCREEN: INLINE
- GRIT COLLECTOR: VORTEX TYPE
- GRIT CONCENTRATOR & DEWATERING SCREW
- GRIT COLLECTOR: AERATED TYPE
- GRAVITY BELT THICKENER
- BELT FILTER PRESS
- CENTRIFUGE
- TRICKLING FILTER
- DIGESTER: GAS HOLDER COVER
- DIGESTER: FIXED COVER
- DIGESTER: MEMBRANE COVER
- DIGESTER: FLOATING COVER
- GAS FLARE
- SEPARATOR
- FOAM SEPARATOR

PRIMARY ELEMENT & FITTING SYMBOLS

- DIAPHRAGM SEAL
- PRIMARY FLOW ELEMENT: ORIFICE PLATE
- PRIMARY FLOW ELEMENT: FLUME
- PRIMARY FLOW ELEMENT: TURBINE OR PROPELLER-TYPE
- PRIMARY FLOW ELEMENT: ELECTROMAGNETIC
- THERMAL DISPERSION TYPE FLOW ELEMENT
- PRIMARY FLOW ELEMENT: TRANSIT-TIME ULTRASONIC
- TEMPERATURE ELEMENT WITH THERMOWELL (TE 101)
- ELECTRODE TYPE LEVEL SWITCH (LE)
- ANNULAR TYPE DIAPHRAGM SEAL
- PRIMARY FLOW ELEMENT: POSITIVE DISPLACEMENT
- PRIMARY FLOW ELEMENT: VENTURI TUBE
- PRIMARY FLOW ELEMENT: WEIR
- PRIMARY FLOW ELEMENT: PITOT TUBE
- PRIMARY FLOW ELEMENT: CORIOLIS
- PRIMARY FLOW ELEMENT: DOPPLER TYPE ULTRASONIC
- PRIMARY ELEMENT: ROTAMETER (FE 100)
- ULTRASONIC LEVEL ELEMENT (LE 100)
- REDUCER - CONCENTRIC
- REDUCER - ECCENTRIC
- FLANGE
- DRAIN - BELL-UP
- DRAIN - FUNNEL
- FLEXIBLE CONNECTION
- CAP
- PLUG
- TRAP
- FLAME CHECK
- SURGE CHAMBER
- FLAME ARRESTER
- SEDIMENT TRAP
- UNION
- HOSE CONNECTION
- STRAINER - Y TYPE
- STRAINER - BASKET
- QUICK CONNECT
- VENT
- VENT - SCREENED
- COUPLING
- SIGHTGLASS
- MOISTURE SEPARATOR

CHEMICAL FEED EQUIPMENT SYMBOLS

- DIFFUSER: TANK
- DIFFUSER: CHANNEL
- INJECTOR
- RUPTURE DISK
- PULSATION DAMPNER
- CHEMICAL INDUCTION UNIT
- CHLORINE CYLINDER
- VAPOR SUPERHEATER
- PRESSURE BUILDING COIL
- CALIBRATION COLUMN
- EXPANSION TANK OR FUNNEL
- WEIGH SCALE
- DRIP LEG HEATER
- SCALE (CT)
- TOTE (TOTE)
- AUTOMATIC SWITCHOVER (AS)
- GAS FEEDER
- EVAPORATOR
- DRY CHEMICAL FEEDER
- TON CONTAINER
- POLYMER BLENDER FEEDER
- POLYMER BLENDER FEEDER
- PASTE TYPE LIME SLAKER
- POLYMER ACTIVATION CHAMBER (POLYMER ACTIVATION CHAMBER)
- DIFFUSER
- POLYMER INJECTION RING
- ACTIVATION CHAMBER

VALVE & GATE SYMBOLS

- GATE: SLUICE, SLIDE, OR WEIR
- VALVE: GATE OR OTHER IN-LINE TYPE NOT OTHERWISE IDENTIFIED
- VALVE: BALL
- VALVE: GLOBE
- VALVE: BUTTERFLY, DAMPER OR LOUVER
- VALVE: PLUG
- VALVE: THREE WAY
- VALVE: FOUR WAY
- VALVE: CHECK
- VALVE: ANGLE
- VALVE: SET STOP
- VALVE: PINCH
- VALVE: CHLORINE
- VALVE: CHLORINE WITH YOKE
- VALVE: DIAPHRAGM
- VALVE: PRESSURE REDUCING
- VALVE: PRESSURE SUSTAINING
- VALVE: PRESSURE REDUCING (SELF ACTUATING TYPE)
- VALVE: PRESSURE SUSTAINING (SELF ACTUATING TYPE)
- VALVE: PILOT
- VALVE: VACUUM RELIEF
- VALVE: PRESSURE RELIEF
- VALVE: PRESSURE/VACUUM RELIEF
- VALVE: FOUR FUNCTION
- VALVE: AIR-VACUUM
- VALVE: AIR RELEASE
- VALVE: THERMAL SHUTOFF
- VALVE: MUD
- VALVE: SLEEVE
- VALVE: KNIFE GATE
- CHLORINE VACUUM REGULATOR (M)
- BACKFLOW PREVENTER
- GATE: FLAP
- VACUUM BREAKER
- EXPLOSION RELIEF

VALVE AND GATE ACTUATOR SYMBOLS

- AIR CYLINDER (P)
- AIR-OIL CYLINDER (P/O)
- HYDRAULIC CYLINDER (H)
- ELECTRO HYDRAULIC (E/H)
- SOLENOID (S)
- STANDARD ELECTRIC (M)
- PROGRAMMABLE ELECTRIC (M/P)
- NETWORKED ELECTRIC (M/N)
- SMALL MOTOR ACTUATOR (M/SM)
- CHAINWHEEL (CW)
- WRENCHNUT (WN)
- HANDWHEEL
- LEVER

THE FOLLOWING ADDITIONAL DESIGNATIONS MAY BE UTILIZED ADJACENT TO SOME VALVE OR GATE SYMBOLS.

NC NORMALLY CLOSED
NO NORMALLY OPEN
FC FAILS CLOSED
FO FAILS OPEN
FIP FAILS IN LAST POSITION

MATERIAL HANDLING EQUIPMENT SYMBOLS

- CYCLONE SEPARATER
- BIN: LIVE BOTTOM
- BIN: SLIDING FRAME
- SCREEN: SINGLE VIBRATORY
- SCREEN: DOUBLE VIBRATORY
- GRINDER
- PELLETIZER
- BIN - OPEN TOP
- BIN - CLOSED TOP
- CONVEYOR: SCREW
- CONVEYOR: BUCKET
- CONVEYOR: BELT
- CONVEYOR: VIBRATORY
- PISTON CAKE PUMP: SINGLE
- PISTON CAKE PUMP: DOUBLE

GENERAL NOTES

1. IN GENERAL, THE P &ID SYMBOLS AND DEVICE IDENTIFICATIONS ARE BASED ON INSTRUMENT SOCIETY OF AMERICA, STANDARD PRACTICE ISA-S5.1 (1988). SOME MODIFICATIONS, ADDITIONS, AND ALTERATIONS HAVE BEEN MADE AS NEEDED TO ACCOMMODATE THE PROJECT REQUIREMENTS.
2. SOME CONTROL AND INTERLOCK REQUIREMENTS WHICH CAN BE MORE CLEARLY ILLUSTRATED ON SCHEMATIC DRAWINGS HAVE BEEN OMITTED FROM THE P & ID DRAWINGS.
3. THIS IS A GENERAL LEGEND SHEET. SOME SYMBOLS AND ABBREVIATIONS MAY NOT BE UTILIZED ON THIS SPECIFIC PROJECT.
4. PIPING AND EQUIPMENT LEGEND APPLIES TO P & ID SHEETS ONLY AND MAY DIFFER FROM LEGENDS FOR OTHER SHEETS.

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P&ID
LEGEND & ABBREVIATIONS
SHEET 1 OF 3

DESIGNED: BLB
DETAILED: BLB
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 9
SHEET
OF

FD6000
D172827

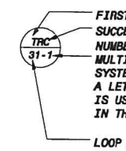
INSTRUMENT TAG NUMBERS
MEANINGS OF IDENTIFICATION LETTERS

LETTER	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE		GLASS		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME-SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTER-MEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE	INTEGRATE OR TOTALIZE		
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, OR PRESENCE			RELAY OR COMPUTE	
Z	POSITION, DIMENSION			DRIVE, ACTUATOR OR UNCLASSIFIED FINAL CONTROL ELEMENT	

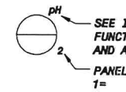
GENERAL INSTRUMENT SYMBOLS

- FIELD MOUNTED INSTRUMENT
- INSTRUMENT MOUNTED ON FACE OF PANEL
- INSTRUMENT MOUNTED BEHIND OR INSIDE OF PANEL
- INSTRUMENT MOUNTED ON FACE OF LOCAL PANEL
- INSTRUMENT MOUNTED BEHIND OR INSIDE OF LOCAL PANEL
- SINGLE INSTRUMENT HOUSING CONTAINING TWO (OR MORE) INSTRUMENTATION FUNCTIONS
- I — CONTROL INTERLOCK FUNCTION, SEE SCHEMATICS AND SYSTEM SPECIFICATIONS FOR SPECIFIC FUNCTION

TAG NUMBERS AND ADDITIONAL DESIGNATIONS



- FIRST LETTER
- SUCCEEDING LETTERS
- NUMBER AFTER DASH (-1, -2, ETC) DENOTES MULTIPLE DEVICES USED IN IDENTICAL DUPLICATE SYSTEMS.
- A LETTER AFTER THE LOOP NUMBER (31A, 31B, ETC) IS USED TO DISTINQUISH MULTIPLE SIMILAR DEVICES IN THE SAME INSTRUMENT LOOP.
- LOOP DESIGNATION NUMBER



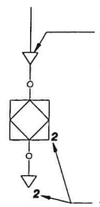
- SEE INSTRUMENT FUNCTIONAL DESIGNATIONS AND ABBREVIATIONS.
- PANEL REFERENCE NUMBER AS FOLLOWS:
  - 1=
  - 2=
  - 3=
  - 4=

DIGITAL SYSTEMS INTERFACE SYMBOLS

NOTE: REFER TO DETAILED SYSTEM SPECIFICATIONS FOR FUNCTIONAL DESCRIPTION. ALSO SEE I/O SCHEDULES FOR COMPLETE INPUT AND OUTPUT LISTINGS.

- COMPUTER, DISTRIBUTED CONTROL SYSTEM, OR DISPLAY FUNCTION BLOCK
- LETTERS, TAG NUMBERS, ABBREVIATIONS AND OTHER ANNOTATIONS ARE SIMILAR TO THE GENERAL INSTRUMENT LEGEND

- PROGRAMMABLE LOGIC CONTROLLER SYSTEM FUNCTION BLOCK
- "CB" NUMBER REFERS TO SOFTWARE CONTROL BLOCK DESCRIPTION IN THE SPECIFICATIONS.



- DIGITAL SYSTEM I/O INTERFACE DIRECTION OF ARROW DENOTES WHETHER INPUT OR OUTPUT
- ∇_2 DISCRETE I/O
- $\blacktriangle_2$ ANALOG I/O
- SYSTEM REFERENCE NUMBER, AS FOLLOWS:
  - 1=
  - 2=
  - 3=
  - 3A=
  - 3B=

GENERAL NOTES

1. IN GENERAL, THE P&ID SYMBOLS AND DEVICE IDENTIFICATIONS ARE BASED ON INTERNATIONAL SOCIETY OF AUTOMATION, STANDARD PRACTICE ISA-S5.1 (1988). SOME MODIFICATIONS, ADDITIONS, AND ALTERATIONS HAVE BEEN MADE AS NEEDED TO ACCOMMODATE THE PROJECT REQUIREMENTS.
2. SOME CONTROL AND INTERLOCK REQUIREMENTS WHICH CAN BE MORE CLEARLY ILLUSTRATED ON SCHEMATIC DRAWINGS HAVE BEEN OMITTED FROM P&ID DRAWINGS.
3. THIS IS A GENERAL LEGEND SHEET. SOME SYMBOLS AND ABBREVIATIONS MAY NOT BE UTILIZED ON THIS SPECIFIC PROJECT. PIPING AND EQUIPMENT LEGEND APPLIES TO P&ID SHEETS.
4. PIPING AND EQUIPMENT LEGEND APPLIES TO P&ID SHEETS ONLY AND MAY DIFFER FROM LEGENDS FOR OTHER SHEETS.

PIPELINE MATERIAL CODE ABBREVIATIONS

PCCP	SECTION 02612, PRESTRESSED CONCRETE CYLINDER PIPE
CBWS	SECTION 02614, CONCRETE BAR-WRAPPED, STEEL CYLINDER PIPE
LHCPP	SECTION 02616, LOW HEAD CONCRETE PRESSURE PIPE
RCP	SECTION 02618, CONCRETE PIPE
PVC	SECTION 15061, POLYVINYL CHLORIDE PIPE
DIP	SECTION 15061, DUCTILE IRON PIPE
SP	SECTION 15062, STEEL PIPE
LWS-XX	SECTION 15063, LIGHT WALL STEEL PIPE
SS-XX1	SECTION 15064, STAINLESS STEEL PIPE, TUBING, AND ACCESSORIES
CSB-XX	SECTION 15065, MISCELLANEOUS STEEL PIPE, TUBING, AND ACCESSORIES
CS-XX	SECTION 15065, MISCELLANEOUS STEEL PIPE, TUBING, AND ACCESSORIES
FRPE-XX	SECTION 15066, FIBERGLASS REINFORCED PLASTIC PIPE (EXHAUST AIR SERVICE)
FRP-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
PVC-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
CPVC-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
PE-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
PP-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
PVDF-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
RPT-XX	SECTION 15067, MISCELLANEOUS PLASTIC PIPE, TUBING, AND ACCESSORIES
SS	SECTION 15068, AWWA STAINLESS STEEL PIPE
CI-XX	SECTION 15069, CAST IRON SOIL PIPE AND ACCESSORIES
CU-XX	SECTION 15070, COPPER TUBING AND ACCESSORIES
BR-XX	SECTION 15080, MISCELLANEOUS PIPING AND PIPE ASSEMBLY
HS-XX	SECTION 15080, MISCELLANEOUS PIPING AND PIPE ASSEMBLY
TG-XX	SECTION 15080, MISCELLANEOUS PIPING AND PIPE ASSEMBLY
CRP-XX	SECTION 15080, MISCELLANEOUS PIPING AND PIPE ASSEMBLY

1. XX= numbers 01-20

FUNCTION DESIGNATIONS AND ABBREVIATIONS

INSTRUMENT DESIGNATIONS

K	GAIN OR ATTENUATE (INPUT:OUTPUT)
-K	GAIN AND REVERSE
Σ	ADD OR SUM (ADD AND SUBTRACT)
Δ	SUBTRACT (DIFFERENCE)
√‾	EXTRACT SQUARE ROOT
÷	DIVIDE
F(X)	CHARACTERIZE SIGNAL
>	HIGH-SELECT
<	LOW-SELECT
×	MULTIPLY
∫	INTEGRATE (TIME INTEGRAL)
CH_4	METHANE
CL_2	CHLORINE RESIDUAL
CO_2	CARBON DIOXIDE
DO	DISSOLVED OXYGEN
LEL	LOWER EXPLOSIVE LIMIT
MCC	MOTOR CONTROL CENTER
MLSS	MIXED LIQUOR SUSPENDED SOLIDS
O_2	OXYGEN (PURITY)
pH	pH CELL
TURB	TURBIDITY

HAND SWITCH DESIGNATIONS

HOA	HAND-OFF-AUTO
LR	LOCAL REMOTE
OC	OPEN-CLOSE
OO	ON-OFF
LOR	LOCAL-OFF-REMOTE
OOA	ON-OFF-AUTO
OCR	OPEN-CLOSE-REMOTE
OOR	ON-OFF-REMOTE
FR	FORWARD-REVERSE

TRANSDUCER & CONVERTER DESIGNATION

E	VOLTAGE
FSK	FREQUENCY SHIFT KEYING
H	HYDRAULIC
I	CURRENT
P	PNEUMATIC PULSE
PD	PULSE DURATION
PF	PULSE FREQUENCY
R	RESISTANCE (ELECTRICAL)

EXAMPLE: I/P = CURRENT TO PNEUMATIC TRANSDUCER

POWER SUPPLY ABBREVIATIONS

AS	AIR SUPPLY
ES	ELECTRIC SUPPLY
GS	GAS SUPPLY
HS	HYDRAULIC SUPPLY
NS	NITROGEN SUPPLY
SS	STEAM SUPPLY
WS	WATER SUPPLY

AS — POWER SUPPLY SOURCE LABEL. USED ONLY WHERE NECESSARY TO HELP CLARIFY AN INSTRUMENT OR SYSTEM FUNCTION.

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UV DISINFECTION IMPROVEMENTS

P&ID
LEGEND & ABBREVIATIONS
SHEET 2 OF 3

DESIGNED:	BLB
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0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO. 172827

FIG 10
SHEET OF

FD4000
D172827

SYSTEM CODE ABBREVIATIONS

ACETIC ACID	ACE	FLOCCULATION	FLC	RESIDUALS	RES
ACETYLENE	ACT	GASEOUS OXYGEN	GOX	RETURN ACTIVATED SLUDGE	RAS
ACTIVATED CARBON - GRANULAR	GAC	GASOLINE	GSL	REVERSE OSMOSIS	ROS
AERATION AIR/PROCESS AIR	AIR	GREASE	GRS	SCREENINGS	SCR
AERATION SYSTEM	AER	GRIT	GRT	SECONDARY CLARIFICATION	SCL
AIR WASH	ARW	HELIUM	HEL	SECONDARY SCUM	SSC
ALUMINUM SULFATE	ALS	HYDRAULIC FLUID	HFL	SEPTAGE	SEP
AMMONIUM SULFATE	NSO4	HYDROCHLORIC ACID	HCL	SETTLED WATER	SET
ANHYDROUS AMMONIA	NH3	HYDROFLUOSILIC ACID (FLUORIDE)	HFS	SEWAGE	SEW
ANTI-SEALANT	AS	HYDROGEN	HYD	SODA ASH	NAC
AQUA AMMONIA	NHOH	HYDROGEN PEROXIDE	PER	SODIUM ALUMINATE	NAL
ARGON	ARG	INCINERATION	INC	SODIUM ALUMINATE	NAM
ASH	ASH	INFLUENT PUMPING	INFP	SODIUM BICARBONATE	NBC
BACKWASH - MEMBRANE/FILTER	BWH	INTAKE	INT	SODIUM BISULFITE	NHS
BALLASTED FLOCCULATION	BAL	LAGOON STORAGE	LAG	SODIUM CHLORIDE	NCL
BIOSOLIDS	BIO	LAND APPLICATION	LAP	SODIUM CHLORITE	NCL2
BIOTOWER	BIT	LIME - HYDRATED	CAH	SODIUM FLUORIDE	NAF
BLENDED SLUDGE	BLS	LIME - QUICKLIME	CAO	SODIUM HEXAMETAPHOSPHATE	NAX
BNR	BNR	LIME STABILIZATION	LIM	SODIUM HYDROXIDE	NAOH
BRINE	BRN	LIQUID OXYGEN	LOX	SODIUM HYPOCHLORITE	NOCL
CALCIUM HYPOCHLORITE	CACL	LP GAS OR PROPANE GAS	LPG	SODIUM SILICOFLUORIDE	NASF
CALCIUM THIOSULFATE	CATS	MAGNESIUM HYDROXIDE	MGOH	STEAM	STM
CARBON DIOXIDE	CO2	MEMBRANE	MEM	STORM SEWER	STS
CARBON SLURRY	CAS	METHANE GAS	MEG	STORM WATER	STW
CARBONIC ACID	HCO3	METHANOL	MTH	SULFUR DIOXIDE	SO2
CENTRATE	CEN	MIXED LIQUOR	MXL	SULFURIC ACID	HSO4
CHEMICAL ENHANCED BACKWASH - MEMBRANE	CEB	NATURAL GAS	NG	SURFACE WASH	SW
CHLORINE	CL2	NITROGEN	NIT	TERTIARY TREATMENT	TERT
CHLORINE DIOXIDE	CLO2	NITROUS OXIDE	NIO	THICKENED PRIMARY SLUDGE	TPRS
CITRIC ACID	CA	ODOR CONTROL	ODC	THICKENED WASTE ACTIVATED SLUDGE	TWAS
CLEAN IN PLACE	CIP	OIL	OIL	THICKENING	THCK
COAGULATION	COA	OIL - FUEL	FO	TREATED WATER	TW
COMPRESSED AIR - INSTRUMENT	CAI	OZONE	OZN	TRICKLING FILTER	TF
COMPRESSED AIR - SERVICE	CMS	OZONE DESTRUCT	OZD	ULTRAVIOLET	UV
COPPER SULFATE	CUS	PHOSPHATE	PPP	VACUUM	VAC
CORROSION INHIBITOR	CI	PHOSPHORIC ACID	PO4	WASH WATER	WW
DECHLORINATION	DCL	POLYALUMINUM CHLORIDE	PCL	WASTE ACTIVATED SLUDGE	WAS
DETERGENT	DET	POLYMER	POLF	WASTE WASH WATER	WWW
DEWATERING	DWT	POTASSIUM PERMANGANATE	KMN	WATER - CONDENSATE	CDW
DIESEL FUEL	FUE	POWDERED ACTIVATE CARBON	PAC	WATER - COOLING	COLW
DIGESTER GAS	DGG	PRE-AERATION	PAR	WATER - DISTILLED WATER	DW
DIGESTER GAS MIXING	DGM	PRESEDIMENTATION	PSD	WATER - FIRE	FW
DIGESTER SLUDGE	DGS	PRIMARY CLARIFICATION	PRC	WATER - IRRIGATION	IRW
DIGESTION - AEROBIC	DGA	PRIMARY SCUM	PSC	WATER - OZONATED	OZW
DIGESTION - ANAEROBIC	DIG	PRIMARY SLUDGE	PRS	WATER - SEAL	SWT
DISINFECTION CONTACT BASIN	DCB	RAW WASTEWATER PUMPING	WWP	WATER - WATER HEATING	HW
DISSOLVED AIR FLOTATION	DAF	RAW WATER PUMPING	RWP	WATER DEIONIZED	DEIW
DRAINAGE	DRN	RAW WATER STORAGE	RWS	WATER NON-POTABLE	NPW
EFFLUENT PUMPING	EFP	RECIRCULATED SLUDGE	RCS	WATER PLANT EFFLUENT	PEW
ENGINE EXHAUST	EXH	RECLAIMED WATER	RCW	WATER POTABLE	PW
EQUALIZATION BASIN	EQB	REFRIGERANT	REF	WATER RAW	RW
FERRIC CHLORIDE	FEC			WET WEATHER TREATMENT	WWT
FERRIC SULFATE	FES			ZINC ORTHOPHOSPHATE	ZOP
FERROUS CHLORIDE	FRC				
FERROUS SULFATE	FRS				
FILTRATION	FLT				

PROCESS CODE ABBREVIATIONS

ACETIC ACID	ACE_X	FLOCCULATION	FLC_X	RESIDUALS	RES_X
ACETYLENE	ACT_X	GASEOUS OXYGEN	GOX_X	RETURN ACTIVATED SLUDGE	RAS_X
ACTIVATED CARBON - GRANULAR	GAC_X	GASOLINE	GSL_X	REVERSE OSMOSIS	ROS_X
AERATION AIR/PROCESS AIR	AIR_X	GREASE	GRS_X	SCREENINGS	SCR_X
AERATION SYSTEM	AER_X	GRIT	GRT_X	SECONDARY CLARIFICATION	SCL_X
AIR WASH	ARW_X	HELIUM	HEL_X	SECONDARY SCUM	SSC_X
ALUMINUM SULFATE	ALS_X	HYDRAULIC FLUID	HFL_X	SEPTAGE	SEP_X
AMMONIUM SULFATE	NSO4_X	HYDROCHLORIC ACID	HCL_X	SETTLED WATER	SET_X
ANHYDROUS AMMONIA	NH3_X	HYDROFLUOSILIC ACID (FLUORIDE)	HFS_X	SEWAGE	SEW_X
ANTI-SEALANT	AS_X	HYDROGEN	HYD_X	SODA ASH	NAC_X
AQUA AMMONIA	NHOH_X	HYDROGEN PEROXIDE	PER_X	SODIUM ALUMINATE	NAL_X
ARGON	ARG_X	INCINERATION	INC_X	SODIUM ALUMINATE	NAM_X
ASH	ASH_X	INFLUENT PUMPING	INFP_X	SODIUM BICARBONATE	NBC_X
BACKWASH - MEMBRANE/FILTER	BWH_X	INTAKE	INT_X	SODIUM BISULFITE	NHS_X
BALLASTED FLOCCULATION	BAL_X	LAGOON STORAGE	LAG_X	SODIUM CHLORIDE	NCL_X
BIOSOLIDS	BNR_X	LAND APPLICATION	LAP_X	SODIUM CHLORITE	NCL2_X
BIOTOWER	BIO_X	LIME - HYDRATED	CAH_X	SODIUM FLUORIDE	NAF_X
BLENDED SLUDGE	BIT_X	LIME - QUICKLIME	CAO_X	SODIUM HEXAMETAPHOSPHATE	NAX_X
BNR	BLS_X	LIME STABILIZATION	LIM_X	SODIUM HYDROXIDE	NAOH_X
BRINE	BRN_X	LIQUID OXYGEN	LOX_X	SODIUM HYPOCHLORITE	NOCL_X
CALCIUM HYPOCHLORITE	CACL_X	LP GAS OR PROPANE GAS	LPG_X	SODIUM SILICOFLUORIDE	NASF_X
CALCIUM THIOSULFATE	CATS_X	MAGNESIUM HYDROXIDE	MGOH_X	STEAM	STM_X
CARBON DIOXIDE	CO2_X	MEMBRANE	MEM_X	STORM SEWER	STS_X
CARBON SLURRY	CAS_X	METHANE GAS	MEG_X	STORM WATER	STW_X
CARBONIC ACID	HCO3_X	METHANOL	MTH_X	SULFUR DIOXIDE	SO2_X
CENTRATE	CEN_X	MIXED LIQUOR	MXL_X	SULFURIC ACID	HSO4_X
CHEMICAL ENHANCED BACKWASH - MEMBRANE	CEB_X	NATURAL GAS	NG_X	SURFACE WASH	SW_X
CHLORINE	CL2_X	NITROGEN	NIT_X	TERTIARY TREATMENT	TERT_X
CHLORINE DIOXIDE	CLO2_X	NITROUS OXIDE	NIO_X	THICKENED PRIMARY SLUDGE	TPRS_X
CITRIC ACID	CA_X	ODOR CONTROL	ODC_X	THICKENED WASTE ACTIVATED SLUDGE	TWAS_X
CLEAN IN PLACE	CIP_X	OIL	OIL_X	THICKENING	THCK_X
COAGULATION	COA_X	OIL - FUEL	FO_X	TREATED WATER	TW_X
COMPRESSED AIR - INSTRUMENT	CAI_X	OZONE	OZN_X	TRICKLING FILTER	TF_X
COMPRESSED AIR - SERVICE	CMS_X	OZONE DESTRUCT	OZD_X	ULTRAVIOLET	UV_X
COPPER SULFATE	CUS_X	PHOSPHATE	PPP_X	VACUUM	VAC_X
CORROSION INHIBITOR	CI_X	PHOSPHORIC ACID	PO4_X	WASH WATER	WW_X
DECHLORINATION	DCL_X	POLYALUMINUM CHLORIDE	PCL_X	WASTE ACTIVATED SLUDGE	WAS_X
DETERGENT	DET_X	POLYMER	POLF_X	WASTE WASH WATER	WWW_X
DEWATERING	DWT_X	POTASSIUM PERMANGANATE	KMN_X	WATER - CONDENSATE	CDW_X
DIESEL FUEL	FUE_X	POWDERED ACTIVATE CARBON	PAC_X	WATER - COOLING	COLW_X
DIGESTER GAS	DGG_X	PRE-AERATION	PAR_X	WATER - DISTILLED WATER	DW_X
DIGESTER GAS MIXING	DGM_X	PRESEDIMENTATION	PSD_X	WATER - FIRE	FW_X
DIGESTER SLUDGE	DGS_X	PRIMARY CLARIFICATION	PRC_X	WATER - IRRIGATION	IRW_X
DIGESTION - AEROBIC	DGA_X	PRIMARY SCUM	PSC_X	WATER - OZONATED	OZW_X
DIGESTION - ANAEROBIC	DIG_X	PRIMARY SLUDGE	PRS_X	WATER - SEAL	SWT_X
DISINFECTION CONTACT BASIN	DCB_X	RAW WASTEWATER PUMPING	WWP_X	WATER - WATER HEATING	HW_X
DISSOLVED AIR FLOTATION	DAF_X	RAW WATER PUMPING	RWP_X	WATER DEIONIZED	DEIW_X
DRAINAGE	DRN_X	RAW WATER STORAGE	RWS_X	WATER NON-POTABLE	NPW_X
EFFLUENT PUMPING	EFP_X	RECIRCULATED SLUDGE	RCS_X	WATER PLANT EFFLUENT	PEW_X
ENGINE EXHAUST	EXH_X	RECLAIMED WATER	RCW_X	WATER POTABLE	PW_X
EQUALIZATION BASIN	EQB_X	REFRIGERANT	REF_X	WATER RAW	RW_X
FERRIC CHLORIDE	FEC_X			WET WEATHER TREATMENT	WWT_X
FERRIC SULFATE	FES_X			ZINC ORTHOPHOSPHATE	ZOP_X
FERROUS CHLORIDE	FRC_X				
FERROUS SULFATE	FRS_X				
FILTRATION	FLT_X				

X = PROCESS CODE SUFFIX USED TO FURTHER SPECIFY A PROCESS STREAM (I.E. CL2_G FOR CHLORINE GAS OR CL2_S FOR CHLORINE SOLUTION)

FUNCTION CODE ABBREVIATIONS

ACTIVATION CHAMBER	AC	DIGESTER COVER, GAS HOLDER	DCG	MEMBRANE	MFM	SCUM COLLECTOR	SMC	VALVE, MATERIAL HANDLING ROTARY	VMR
ADJUSTABLE FREQUENCY DRIVE	AFD	DIGESTER COVER, MEMBRANE	DCM	MEMBRANE, MICROFILTRATION	MBMF	SCUM WEIR - ROTATING	SCW	VALVE, MUD	VMD
AERATOR, COARSE BUBBLE DIFFUSED	ACD	DIGESTER, AEROBIC	DGE	MEMBRANE, NANOFILTRATION	MBNF	SEPARATOR	SEP	VALVE, PILOT	PTV
AERATOR, FINE PORE DIFFUSED	AEFD	DIGESTER, ANAEROBIC PRIMARY	DGAP	MEMBRANE, REVERSE OSMOSIS	MBRO	SIGHT GLASS - TALL	SGT	VALVE, PINCH	VPN
AERATOR, FLOATING SURFACE	AFS	DIGESTER, ANAEROBIC SECONDARY	DGAS	MEMBRANE, ULTRAFILTRATION	MBUF	SIGHTGLASS	SG	VALVE, PISTON OPERATED	VPO
AERATOR, SURFACE	AES	DISINFECTION UNIT, UV	DSUV	MIXER, CARBON	MXC	SILENCER	SIL	VALVE, PLUG	VPG
AFTERCOOLER	AFC	DISSOLVED AIR FLOTATION THICKENER	DAF	MIXER, FLLOCCULATION	FLM	SLUDGE COLLECTOR, CIRCULAR	SLC	VALVE, PRESSURE REDUCING	VPR
AIR DRYER	AD	DUST COLLECTOR	DUC	MIXER, IN-LINE	MXI	SLUDGE COLLECTOR, FLOCCULATING-CLARIFYING	SFC	VALVE, PRESSURE REGULATING	VPC
AIR FILTER	AF	ELECTRICAL EQUIPMENT, GENERAL	EQPE	MIXER, PUGMILL	MXPG	SLUDGE COLLECTOR, SECONDARY CLARIFIERS	SCS	VALVE, PRESSURE RELIEF	VSP
AIR RECEIVER	AR	EMERGENCY EYE WASH	EEW	MIXER, RAPID	MXR	SLUDGE COLLECTOR, SOLIDS CONTACT	SSC	VALVE, PRESSURE/VACUUM RELIEF	VSPV
AIR SEPARATOR	AS	EMERGENCY SHOWER	ES	MIXER, STATIC	MXS	SLUDGE COLLECTOR, STRAIGHT LINE	SLCS	VALVE, PROCESS	VP
AIR STRIPPER	AST	EMERGENCY SHOWER & EYEWASH	ESE	MIXER, SUBMERSIBLE PROPELLER	MXP	SLUDGE GRINDER	SLG	VALVE, RESILIENT SEATED GATE	VGR
BACKFLOW PREVENTER	BFP	EQUIPMENT, GENERAL OR UNSPECIFIED	EQPT	OVERFLOW ROOF DRAIN	ORD	SLUDGE SCREEN-INLINE	SCRI	VALVE, SAFETY	VS
BASIN, AERATION	BSNA	EVAPORATOR	EV	OZONE DESTRUCT UNIT	ODU	SOLIDS BLENDER-INLINE	SBL	VALVE, SLEEVE	VSLV
BASIN, ANOXIC	BSNX	EXPANSION CHAMBER	EXC	OZONE GENERATOR	OGEN	STRAINER	STR	VALVE, SOLENOID	VSL
BASIN, BNR	BNR	FAN SUPPLY OR EXHAUST	FAN	PARTICLE COUNTER	PCN	STRAINER ? BASKET TYPE	STRB	VALVE, THERMAL SHUTOFF	VTS
BASIN, CHLORINE CONTACT	BSNC	FILTER SEPARATOR	FTSP	PELLETIZER	PLT	STRAINER ?Y TYPE	STRY	VALVE, THREE WAY	VTW
BASIN, OZONE CONTACT	BSNO	FILTER, CARTRIDGE TYPE	FLC	PIPE	PIPE	SURGE CHAMBER	SRCH	VALVE, VACUUM BREAKER	VVB
BELT FILTER PRESS	BFPS	FILTER, UNDERDRAINS AND MEDIA	FLT	PLATE SETTLER	PSE	TANK, ABOVE GROUND STORAGE	TSA	VALVE, VACUUM RELIEF	VSV
BIN (STORAGE - ALL TYPES)	B	FILTER. SURFACE WASH EQUIPMENT	FSW	POLYMER RING	PIR	TANK, AMMONIA STORAGE	TCN	VALVE, V-PORT BALL	VBP
BIN AGTIVATOR	BA	FITTING, MISCELLANEOUS	FTTNG	POWER SUPPLY UNIT	PSU	TANK, CRYOGENIC STORAGE	TCR	VAPORIZER	VAP
BLOWER, CENTRIFUGAL	BLC	FLAME ARRESTER	FAR	PULSATION DAMPNER	PD	TANK, DOUBLE WALL	DWT	WEIR, CIPOLETTI	WC
BLOWER, POSITIVE DISPLACEMENT	BL	FLAME CHECK	FC	PUMP, AIR DIAPHRAGM	PAD	TANK, ELEVATED STORAGE	TSE	WEIR, RECTANGULAR	WR
BOILER	BLR	FLOCCULATOR, HORIZONTAL	FLCH	PUMP, CENTRIFUGAL	PCL	TANK, EXPANSION	TX	WEIR, V-NOTCH	WV
BUILDING SERVICES EQUIPMENT	EQPB	FLOCCULATOR, VERTICAL	FLCV	PUMP, DIAPHRAGM METERING	PDM	TANK, FRP CHEMICAL STORAGE	TCF	WELL, HORIZONTAL COLLECTOR	WLHC
CALIBRATION COLUMN	CCLM	FLOOR DRAIN	FD	PUMP, HEATING WATER	PHW	TANK, GENERAL OR UNSPECIFIED	TNK	WELL, VERTICAL	WLV
CENTRIFUGE	CFG	FLOW SPLITTER	FS	PUMP, HORIZONTAL END SUCTION	PHE	TANK, PE CHEMICAL STORAGE	TCP		
CHEMICAL FEEDER	CHF	FLUME, PARSHALL	FE	PUMP, HORIZONTAL SPLIT CASE	PSC	TANK, STEEL CHEMICAL STORAGE	TCS		
CHLORINE GAS SCRUBBER	CGS	FOAM SEPARATOR	FMSP	PUMP, PERISTALTIC	PPS	TANK, STEEL WATER STORAGE	TSW		
CLARIFIER, PRIMARY	PCLR	GAS CYLINDER	CYG	PUMP, PLUNGER	PPL	TRAP, DRIP	TRP		
CLARIFIER, SECONDARY	SCLR	GAS FEEDER	GFD	PUMP, PROGRESSING CAVITY	PPC	TRAP, SEDIMENT	TRPS		
CLASSIFIER, GRIT	CGR	GAS FLARE	GF	PUMP, SCREW ENCLOSED	PSEN	TURBIDIMETER	TB		
CLEARWELL	CW	GAS WATER HEATER	GWH	PUMP, SCREW OPEN	PSO	UNINTERRUPTABLE POWER SUPPLY	UPS		
COMPRESSOR	CMP	GATE, FLAP	GFL	PUMP, SUBMERSIBLE	PSM	VACUUM REGULATOR	VRG		
COMPRESSOR, BASE MOUNTED	CMB	GATE, SLIDE	GSD	PUMP, SUBMERSIBLE CHOPPER	PCH	VALVE, AIR RELEASE	VR		
COMPRESSOR, ROTARY SCREW	CMR	GATE, SLUICE	GSC	PUMP, SUBMERSIBLE SUMP	PSS	VALVE, AIR-VACUUM	VRAV		
CONTAINER, PROCESS	CTR	GATE, WEIR	G	PUMP, SUMP	PSP	VALVE, ANGLE	VAG		
CONVEYOR, BELT	COB	GENERATOR, ENGINE (BACKUP POWER)	GEN	PUMP, UNSPECIFIED TYPE	P	VALVE, AWWA BALL	VBL		
CONVEYOR, SCREW	COS	GRAVITY BELT THICKENER	GBT	PUMP, VERTICAL DIFFUSION VANE	PVD	VALVE, AWWA BUTTERFLY	VBF		
COVER, ALUMINUM DOME BASIN	CFA	GRAVITY THICKENER	GVT	PUMP, VERTICAL END SUCTION	PVE	VALVE, BALL MISCELLANEOUS	VBM		
COVER, FIXED DIGESTER	CFD	GRINDER	GRD	PUMP, VERTICAL WET PIT	PVW	VALVE, CHECK	VCK		
COVER, FLOATING DIGESTER	CFL	GRIT BASIN, AERATED OR VORTEX TYPE	GRB	RESERVOIR	RSV	VALVE, CONE	VCN		
CRANE	CR	GRIT EQUIPMENT, FORCED VORTEX	GRV	RESIDUAL COLLECTOR	RCO	VALVE, DIAPHRAGM OPERATED OPEN OR CLOSE	VDG		
CRANE, GANTRY	CRG	HEAT EXCHANGER	HEX	ROTAMETER	RM	VALVE, DOUBLE DISC GATE	VGD		
CRANE, JIB	CRJ	HOIST, CHAIN	HSC	RUPTURE DISK	RD	VALVE, ECCENTRIC PLUG	VPL		
CRANE, PORTABLE GANTRY	CRP	HOIST, WIRE ROPE	HSE	SAMPLER	SAMP	VALVE, EXPLOSION RELIEF	VER		
CRANE, TRAVELLING BRIDGE	CRT	HYDRANT, FIRE	HYDF	SCALE	SC	VALVE, GATE	VG		
CYLINDER, CHLORINE	CYL	HYDRANT, WALL	HYDW	SCREEN, MECHANICALLY CLEANED BAR	SCRA	VALVE, GENERAL OR UNSPECIFIED	V		
DEWATERING SCREW	DWS	HYDROCYCLONE	HYC	SCREEN, STEP	SCRS	VALVE, GLOBE	VGL		
DIAPHRAGM SEAL	DPS	INJECTOR, CHEMICAL	INJ	SCREEN, TRAVELLING WATER	SCT	VALVE, INDUSTRIAL BUTTERFLY	VBI		
DIFFUSER	DIF	LIME SLAKER	LS	SCRUBBER	SCU	VALVE, KNIFE GATE	VKG		
DIFFUSER BANK	DFB								

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USER: WH149210 DWG VER: 1000 XREF4:

BLACK & VEATCH
Building a world of difference.
Black & Veatch Corporation
Kansas City, Missouri

LEAVENWORTH, KANSAS
LEAVENWORTH WWTP
UV DISINFECTION IMPROVEMENTS

P&ID
LEGEND & ABBREVIATIONS
SHEET 3 OF 3

DESIGNED: BLB
DETAILED: BLB
CHECKED:
APPROVED:
DATE:

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 11
SHEET
OF

FD0000
D172827

PLC-UV
UV SYSTEM SUPPLIERS PLC

I/O AND INSTRUMENTATION TYPICAL FOR THREE UV CHANNELS

I/O TYPICAL FOR THREE INLET GATES

I/O TYPICAL FOR THREE OUTLET GATES

PLANT EFFLUENT UV FLOW
PLANT EFFLUENT UV TRANSMITTANCE
UV SYSTEM CHANNEL 1 INLET GATE OPEN CMD
UV SYSTEM CHANNEL 1 INLET GATE CLOSE CMD
UV SYSTEM CHANNEL 1 INLET GATE IN-REMOTE
UV SYSTEM CHANNEL 1 INLET GATE OPENED
UV SYSTEM CHANNEL 1 INLET GATE CLOSED
UV SYSTEM CHANNEL 1 BANK A UV INTENSITY
UV SYSTEM CHANNEL 1 BANK A MODULE LIFTED
UV SYSTEM CHANNEL 1 BANK A MODULE DISCONNECTED
UV SYSTEM CHANNEL 1 BANK A MODULES 1-3 WIPER END
UV SYSTEM CHANNEL 1 BANK A MODULES 1-3 WIPER REST
UV SYSTEM CHANNEL 1 BANK A WIPER SOLENOID VALVE OPEN CMD
UV SYSTEM CHANNEL 1 BANK B UV INTENSITY
UV SYSTEM CHANNEL 1 BANK B MODULE LIFTED
UV SYSTEM CHANNEL 1 BANK B MODULE DISCONNECTED
UV SYSTEM CHANNEL 1 BANK B MODULES 1-3 WIPER END
UV SYSTEM CHANNEL1 BANK B MODULES 1-3 WIPER REST
UV SYSTEM CHANNEL 1 BANK B WIPER SOLENOID VALVE OPEN CMD
UV SYSTEM CHANNEL 1 LEVEL
UV SYSTEM CHANNEL 1 LEVEL LOW
UV SYSTEM CHANNEL 1 LEVEL HIGH
UV SYSTEM CHANNEL 1 OUTLET GATE OPEN CMD
UV SYSTEM CHANNEL 1 OUTLET GATE CLOSE CMD
UV SYSTEM CHANNEL 1 OUTLET GATE IN-REMOTE
UV SYSTEM CHANNEL 1 OUTLET GATE OPENED
UV SYSTEM CHANNEL 1 OUTLET GATE CLOSED
UV SYSTEM CHANNEL 1 OUTLET GATE POSITION
PLANT EFFLUENT UV FLOW
TREATED WATER SAMPLER FAIL
UV SYSTEM WARNING
UV SYSTEM ALARM

UV SYSTEM ENCLOSURE
HS MANUAL / AUTO
AUTODIALER NOTE 8

AIT 10A
AIT 10B
UV-PDC-1A
UV-PDC-1B
LIT 10
LE 10
LSH 10
LSL 10
LE 10A
OSC LOR HS HS ZSC ZSO ZT

FROM SPECIAL MANHOLE NO. 2
64"
AE 1
120VAC
REFRIDGERATED COMPOSITE SAMPLER

FINAL CLARIFIER NO.1 EFFLUENT
96"
FIT 1
AIT 1
AE 1
H MN
SCL-GSD-1
42"
FE 1
48"
30"
EFFLUENT METER VAULT
SPECIAL MANHOLE NO.6
96"
FINAL CLARIFIER NO.2 EFFLUENT

GSD-1
GSD-2
GSD-3
GSD-4
GSD-5
GSD-6
M
SLD

AE 10A
AE 10B
UV BANK 1A
UV BANK 1B

UV SYSTEM POWER DISTRIBUTION CENTER (TYP)
UV-PDC-2A
UV-PDC-2B
LIT 20
LE 20
LSH 20
LSL 20
LE 20A
AE 20A
AE 20B
UV BANK 2A
UV BANK 2B

UV-PDC-3A
UV-PDC-3B
LIT 30
LE 30
LSH 30
LSL 30
LE 30A
AE 30A
AE 30B
UV BANK 3A
UV BANK 3B

UV-GFL-1
48"
PLANT EFFLUENT TO MISSOURI RIVER
UV-VG-1
8"
NON-POTABLE WATER SUPPLY

NOTES:
1. SEE LEGEND ON DRAWINGS FIG 9, FIG 10 AND FIG 11.
2. SYSTEM CODE IS UV UNLESS OTHERWISE NOTED.
3. NOT ALL CONTROL AND INDICATING DEVICES ARE INDICATED. FOR ADDITIONAL REQUIREMENTS, REFER TO UV SPECIFICATION.
4. I/O INDICATED IS TYPICAL FOR REMAINING MODULE TRIPLETS IN EACH BANK.
6. ONLY I/O REMOTE FROM THE UV SYSTEM ENCLOSURE IS INDICATING.
6. SIGNALS TO NEW AUTODIALER. LOCATE AUTODIALER IN UV SYSTEM ENCLOSURE.

PRELIMINARY - NOT FOR CONSTRUCTION

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

PW: PW FILE: ....\Figure 12.dwg BORDER.dwg XREF1:
PW #PROFILE: Design Mode Figure 12.dwg XREF2:
SAVED: KEPA30224, 6/17/2011 7:46:20 AM XREF3:
PLOTTED: APL16082, 6/17/2011 2:00:30 PM XREF4:
USER: WHT40210 DWG VER: 1000

BLACK & VEATCH
Building a world of difference:
Black & Veatch Corporation
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LEAVENWORTH, KANSAS
LEAVENWORTH WWTP
UV DISINFECTION IMPROVEMENTS

P&ID
UV DISINFECTION SYSTEM

DESIGNED:	BLB
DETAILED:	BLB
CHECKED:	
APPROVED:	
DATE:	

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
172827

FIG 12
SHEET
OF

FD8000
D172827

APPENDIX A – NPDES PERMIT

KANSAS

DEPARTMENT OF HEALTH
AND ENVIRONMENT

Division of Environment

Kathleen Sebelius, Governor
Roderick L. Bremby, Secretary

www.kdheks.gov

June 19, 2008

City Clerk
100 N. 5th Street
Leavenworth, KS 66048

RE: Kansas Water Pollution Control
Permit No. M-MO12-IO01
City of Leavenworth

Dear Permittee:

You have fulfilled all the filing requirements for a Kansas Water Pollution Control Permit and Authorization to Discharge under the National Pollutant Discharge Elimination System (NPDES). We are pleased to forward your new permit. While it is permissible to make as many copies as needed for monitoring and reporting purposes, you need to retain the original permit for your files.

We suggest you carefully read the terms and conditions of your permit and understand these terms and conditions are enforceable under both State and Federal law.

Please notice the reporting paragraph on page 2 of your permit, where all reports are due by the 28th day of the schedule noted. Please submit reports to the Kansas Department of Health and Environment, Bureau of Water-TSS, 1000 SW Jackson St., Suite 420, Topeka, Kansas 66612-1367.

If you have any questions concerning this permit, contact Ed Dillingham at (785)296-5513.

Sincerely,

Karl Mueldener

Karl Mueldener, P.E.
Director, Bureau of Water

pc: NE - District
RG- Permit File

Kansas Permit No.: M-MO12-I001

Federal Permit No.: KS0036366

KANSAS WATER POLLUTION CONTROL PERMIT AND
AUTHORIZATION TO DISCHARGE UNDER
THE NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM

Pursuant to the Provisions of Kansas Statutes Annotated 65-164 and 65-165, the Federal Water Pollution Control Act as amended, (33 U.S.C. 1251 et seq; the "Act"),

Owner:	Leavenworth, City of
Owner's Address:	100 N. 5th Street Leavenworth, Kansas 66048
Facility Name:	Leavenworth Wastewater Treatment Plant
Facility Location:	1800 S. 2nd Street Leavenworth, Kansas 66048 SE¼, NW¼, NE¼, Section 1, Township 9S, Range 22E Leavenworth County, Kansas
Receiving Stream & Basin:	Missouri River Missouri River Basin

is authorized to discharge from the wastewater treatment facility described herein, in accordance with effluent limitations and monitoring requirements as set forth herein.

This permit is effective July 1, 2008, supersedes the previously issued water pollution control permit M-MO12-IO01, and expires December 31, 2012.

FACILITY DESCRIPTION:

1. Bar Screening
2. Aerated grit basin
3. Primary settling basin
4. Trickling filters - plastic media
5. Final settling basin
6. Chlorine contact basin (Currently Not Used)
7. Belt Filter Press for Sludge Dewatering
8. Pug Mill for Lime Addition
9. Design P.E. = 55,000
10. Design Flow = 6.88 MGD

Secretary, Kansas Department of Health and Environment

June 19, 2008
Date

4. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in this permit. The effluent limitations shall become effective on the dates specified herein. Such discharges shall be controlled, limited, and monitored by the permittee as specified. There shall be no discharge of floating solids or visible foam in other than trace amounts.

Monitoring reports shall be submitted on or before the 28th day of the following month. In the event no discharge occurs, written notification is still required.

	EFFLUENT LIMITATIONS		MONITORING REQUIREMENTS	
	Interim Limitations Upon Issuance	Final Limitations Per Schedule of Compliance		
Effective Date				
Outfall Number and Effluent Parameters			Measurement Frequency	Sample Type
001AG - Influent to Treatment Plant				
Biochemical Oxygen Demand (5-Day)-mg/l	Monitor	Monitor	Twice Weekly	24-Hour Composite
Total Suspended Solids-mg/l	Monitor	Monitor	Twice Weekly	24-Hour Composite
Total Phosphorus (as P)-mg/l	Monitor	Monitor	Once Monthly	Grab
Total Kjeldahl Nitrogen (as N)-mg/l	Monitor	Monitor	Once Monthly	Grab
001 - Effluent after disinfection				
Biochemical Oxygen Demand (5-Day)*			Twice Weekly	24-Hour Composite
Weekly Average-mg/l	45	45		
Monthly Average-mg/l	30	30		
Total Suspended Solids*			Twice Weekly	24-Hour Composite
Weekly Average-mg/l	45	45		
Monthly Average-mg/l	30	30		
Ammonia (as N)-mg/l	Monitor	Monitor	Twice Weekly	Grab
E. coli (Colonies/100 ml)			Twice Weekly	Grab
April through October				
Monthly Geometric Average	Monitor	160		
November through March				
Monthly Geometric Average	Monitor	2358		
Total Residual Chlorine**			Daily	Grab
Daily Maximum - ug/l	N/A	71		
pH - Standard Units	6.0-9.0	6.0-9.0	Twice Weekly	Grab
Total Phosphorus-mg/l (as P) (lbs/day)	Monitor (Calc.)	Monitor (Calc.)	Once Monthly	Grab
Nitrate (NO_3) + Nitrite (NO_2) as N-mg/l***	Monitor	Monitor	Once Monthly	Grab
Total Kjeldahl Nitrogen (as N)-mg/l ***	Monitor	Monitor	Once Monthly	Grab
Total Nitrogen (as N)-mg/l (lbs/day)*** (TKN + NO_3 + NO_2)	Calculate	Calculate	Once Monthly	Calculate

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (continued)

Effective Date	EFFLUENT LIMITATIONS Interim Limitations Upon Issuance	EFFLUENT LIMITATIONS Final Limitations Per Schedule of Compliance	MONITORING REQUIREMENTS	
Outfall Number and Effluent Parameters			Measurement Frequency	Sample Type
Whole Effluent Toxicity - See Supplemental Conditions E.1.				
Priority Pollutant Scan - See Supplemental Conditions E.2.				
Flow - MGD	Monitor	Monitor	Daily	Meter

* Minimum removal of 85% required for Total Suspended Solids and Biochemical Oxygen Demand (5-Day). If inhibited Biochemical Oxygen Demand (5-Day) test is used, limits are 5 mg/l less than shown.

** (If disinfection is by chlorination) Permittee shall conduct testing for total residual chlorine according to the methods prescribed in 40 CFR Part 136. The current acceptable quantification level for total residual chlorine in wastewater is 100 micrograms/L. Test results in excess of the quantification level are violations of the permit limits.

*** Permittee shall sample for these tests on the same day and calculate the total nitrogen only when both test values are available. The Minimum Reportable Limit (MRL) for TKN is 1 mg/l and for nitrate + nitrite is 0.1 mg/l. Values less than the MRL shall be reported using the less than sign (<) with the MRL value but for purposes of calculating and reporting the total nitrogen result, less than values shall be defaulted to zero.

B. STANDARD CONDITIONS

In addition to the specified conditions stated herein, the permittee shall comply with the attached Standard Conditions dated August 1, 1996.

C. SUPPLEMENTAL CONDITIONS

Sludge disposal shall be in accordance with the 40 CFR Part 503 Sludge Regulations.

D. SCHEDULE OF COMPLIANCE

1. Permittee shall submit to KDHE for review an updated Wastewater Master Plan for the City by December 1, 2010.

   a. The Master Plan shall include plans and a schedule to upgrade the wastewater treatment facility (or facilities) to meet the final limits for E. coli stated herein. The schedule shall require the final limits for E. coli for the current wastewater treatment facility to be met by December 31, 2012 and any new wastewater treatment facility to be met within 3 months of startup. For the current wastewater treatment plant, the permittee shall provide completion dates for the following activities for the disinfection upgrade.

      1) Submit Plans and Specifications to KDHE for approval
      2) Advertise for Construction Bids
      3) Begin Construction
      4) Complete Construction
      5) Achieve Compliance with Permit by no later than December 31, 2012.

   b. The Master Plan shall include the study of options to meet the nutrient reduction goals as stated herein in the plant effluent for the current wastewater treatment facility and any new wastewater treatment facilities planned by the permittee.

D. SCHEDULE OF COMPLIANCE (continued)

1) The permittee shall conduct studies to assess the cost and feasibility for this facility to meet each of the following effluent nutrient goals as annual averages:

Goal	1	2	3
Total Nitrogen (as N) - mg/l	8.0	5.0	3.0
Total Phosphorus (as P)- mg/l	1.5	0.5	0.3

The studies shall include operational and capital costs for 1) operational changes only, if feasible, 2) biological treatment additions and 3) physical and chemical treatment additions to meet the stated goals.

2) The permittee shall provide the study results to KDHE with the updated Master Plan.

c. The Master Plan may also include plans and schedules for implementing any alternative equivalent methods for nutrient (mass) reduction in lieu of meeting the nutrient reduction goals at the current wastewater treatment facility and any new facilities proposed by the permittee.

2. Plans and schedules provided in the submittals are subject to approval by KDHE and may be incorporated into this permit or other enforceable documents.

E. BIOMONITORING AND PRIORITY POLLUTANTS

1. Whole Effluent Toxicity:

a. Acute Whole Effluent Toxicity (WET) testing on a 24-hr composite sample shall be conducted once in calendar year 2008 and annually thereafter. The median lethal concentration, LC50, shall be equal to or greater than 89% effluent. Test results less than 89% are violations of this permit. The test procedures shall use the 48 hour static non-renewal test method in accordance with the EPA document, Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, fifth edition, October 2002 using test organisms *Pimephales promelas* (fathead minnow) and any of the following daphnid (water flea) species: *Daphnia pulex, Daphnia magna,* or *Ceriodaphnia dubia* within a dilution series containing 0%, 25%, 50%, 75%, 89%, and 100% effluent. KDHE reserves the right to increase or decrease testing frequency based upon compliance history and toxicity testing results.

b. If the WET test results indicate the LC50 is equal to or greater than 89% effluent, the effluent has passed the toxicity test and the test report shall be due with the next scheduled Discharge Monitoring Report.

c. If the WET test results indicate the LC50 is less than 89% effluent, the effluent has failed the toxicity test and the permittee shall immediately notify KDHE by telephone (785) 296-5517 and submit to KDHE a copy of the test report within five days of receipt of the information. KDHE reserves the right to require the permittee to take such actions as are reasonable to identify and remedy any identified or predicted toxic conditions in the receiving stream outside of the zone of initial dilution which is caused by the permittee's effluent.

E. BIOMONITORING AND PRIORITY POLLUTANTS (continued)

d. Permittee shall also test a portion of one of same effluent samples used for the WET test for the following parameters (required minimum reportable detection levels are in parenthesis):

Antimony (10 µg/L)*	Nickel (10 µg/L)*
Arsenic (10 µg/L)*	Selenium (5 µg/L)*
Beryllium (5 µg/L)*	Silver (2 µg/L)*
Cadmium (2 µg/L)*	Thallium (10 µg/L)*
Chromium (10 µg/L)*	Zinc (20 µg/L)*
Copper (10 µg/L)*	Total Hardness as CaCO3 mg/l
Lead (5 µg/L)*	Ammonia (mg/l)
Mercury (0.2 µg/L-Cold Vapor Method)	

* Parameter shall be tested and reported as "total recoverable" metals.

e. The permittee shall coordinate sampling for this test with other requirements of this permit. The permittee shall use a laboratory approved by KDHE for Whole Effluent Toxicity testing.

2. Permittee shall conduct a Priority Pollutant Scan on the effluent from Outfall 001A1 for the parameters listed in Table I, Priority Pollutant Scan, as noted below. The Priority Pollutant Scan shall be conducted during the last calendar year of this permit and the results reported to KDHE with the next Discharge Monitoring Report following receipt of the results but not later than August 31, 2012. Sample type shall be 24-hour composite except for Volatiles which shall be a grab sample. See Supplemental Condition E.1.d. for minimum detection limits for certain metals in the Priority Pollutant Scan.

Table I
Priority Pollutant Scan

Metals
- Total Recoverable Arsenic (ug/l)
- Total Recoverable Beryllium (ug/l)
- Total Recoverable Cadmium (ug/l)
- Total Recoverable Chromium (ug/l)
- Total Recoverable Copper (ug/l)
- Total Recoverable Lead (ug/l)
- Total Mercury (ug/l)
- Total Recoverable Molybdenum (ug/l)
- Total Recoverable Potassium (ug/l)
- Total Recoverable Nickel (ug/l)
- Total Recoverable Selenium (ug/l)
- Total Recoverable Silver (ug/l)
- Total Recoverable Thallium (ug/l)
- Total Recoverable Zinc (ug/l)

Pesticides
- Aldrin (mg/l)
- Alpha-BHC (mg/l)
- Beta-BHC (mg/l)
- Gamma-BHC (mg/l)
- Delta-BHC (mg/l)
- Chlordane (mg/l)
- 4,4-DDT (mg/l)
- 4,4-DDD (mg/l)
- 4,4-DDE (mg/l)
- Dieldrin (mg/l)
- Alpha-endosulfan (mg/l)
- Beta-endosulfan (mg/l)
- Endosulfan sulfate (mg/l)
- Endrin (mg/l)
- Endrin aldehyde (mg/l)
- Heptachlor (mg/l)
- Heptachlor epoxide (mg/l)
- Toxaphene (mg/l)
- Malathion (mg/l)
- Diazinon (mg/l)

Polychlorinated Biphenyls (mg/l)
- PCB-1242
- PCB-1254
- PCB-1221
- PCB-1232
- PCB-1248
- PCB-1260
- PCB-1016

Priority Pollutant Scan (continued)

3 ;/Neutral
.cenaphthene (mg/l)
Acenaphtylene (mg/l)
Anthracene (mg/l)
Benzidine (mg/l)
Benzo(a) anthracene (mg/l)
Benzo(a)pyrene (mg/l)
3,4-benzofluoranthene (mg/l)
Benzo (ghi) perylene (mg/l)
Benzo (b) fluoranthene (mg/l)
Bis(2-chloroethoxy)methane (mg/l)
Bis(2-chloroethyl)ether (mg/l)
Bis(2-ethylhexyl)phthalate (mg/l)
Bis(2-chloroisopropyl) ether (mg/l)
1,2-diphenylhydrazine (mg/l)
Fluoranthene (mg/l)
Fluorene (mg/l)
Nitrobenzene (mg/l)
N-nitrosodimethylamine (mg/l)
N-nitrosodi-n-propylamine (mg/l)
N-nitrosodiphenylamine (mg/l)
Phenanthrene (mg/l)
Pyrene (mg/l)
1,2,4-trichlorobenzene (mg/l)
4-bromophenyl phenyl ether (mg/l)
Butyl benzyl phthalate (mg/l)
2-chloronaphthalene (mg/l)
hlorophenyl phenyl ether (mg/l)
ysene (mg/l)
benzo(a,h) anthracene (mg/l)
-,2-dichlorobenzene (mg/l)
1,3-dichlorobenzene (mg/l)
1,4-dichlorobenzene (mg/l)
3,3-dichlorobenzidine (mg/l)
Dimethyl phthalate (mg/l)
Diethyl phthalate (mg/l)
Di-n-butyl phthalate (mg/l)
2,4-dinitrotoluene (mg/l)
2,6-dinitrotoluene (mg/l)
Di-n-octyl phthalate (mg/l)
Hexachlorobenzene (mg/l)
Hexachlorobutadiene (mg/l)
Hexachlorocyclopentadiene (mg/l)
Hexachloroethane (mg/l)
Indeno (1,2,3-cd) pyrene (mg/l)
Naphthalene (mg/l)
Isophorone (mg/l)

Priority Pollutant Scan (continued)

Acid Compounds
- Chlorophenol (mg/l)
- 2,4-dichlorophenol (mg/l)
- 2,4-dimethylphenol (mg/l)
- 2,4-dinitrophenol (mg/l)
- 2-nitrophenol (mg/l)
- 4-nitrophenol (mg/l)
- Parachlorometa cresol (mg/l)
- Pentachlorophenol (mg/l)
- Phenol (mg/l)
- 4,6-dinitro-o-cresol (mg/l)
- 2,4,6-trichlorophenol (mg/l)

Volatiles
- Acrolein (mg/l)
- Acrylonitrile (mg/l)
- Benzene (mg/l)
- Bromoform (mg/l)
- Carbon Tetrachloride (mg/l)
- Chlorobenzene (mg/l)
- Chlorodibromomethane (mg/l)
- Chloroethane (mg/l)
- 2-chloroethylvinyl ether (mg/l)
- Chloroform (mg/l) (mg/l)
- Dichlorobromomethane (mg/l)
- 1,1-dichloroethane (mg/l)
- 1,2-dichloroethane (mg/l)
- 1,1-dichloroethylene (mg/l)
- 1,2-dichloropropane (mg/l)
- `-dichloropropylene (mg/l)
- ylbenzene (mg/l)
- thyl bromide (mg/l)
- ethyl chloride (mg/l)
- Methylene chloride (mg/l)
- 1,1,2,2-tetrachloroethane (mg/l)
- Tetrachloroethylene (mg/l)
- Toluene (mg/l)
- 1,2 trans-dichloroethylene (mg/l)
- 1,1,1-trichloroethane (mg/l)
- 1,1,2-trichloroethane (mg/l)
- Trichloroethylene (mg/l)
- Vinyl chloride (mg/l)

Miscellaneous
- Total Cyanide (mg/l)*
- Total Phenols (mg/l)

The total cyanide analysis must include preliminary treatment of the sample to avoid NO_2^- interference. Addition of sulfamic acid to the sample before distillation can prevent such interference, see Standard Methods for the Examination of Water and Wastewater, 18th Edition, 4500-CN^- B. Preliminary Treatment of Samples.

STANDARD CONDITIONS FOR
KANSAS WATER POLLUTION CONTROL AND
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

1. Representative Sampling:

   A. Samples and measurements taken as required herein shall be representative of the nature and volume of the monitored discharge. All samples shall be taken at the location designated in this permit, and unless specified, at the outfall(s) before the effluent joins or is diluted by any other water or substance.

   B. Monitoring results shall be recorded and reported on forms acceptable to the Division and postmarked no later than the 28th day of the month following the completed reporting period. Signed and certified copies of these, prepared in accordance with KAR 28-16-59 and all other reports required herein, shall be submitted to:

      Kansas Department of Health & Environment
      Bureau of Water-Technical Services Section
      1000 SW Jackson Street, Suite 420
      Topeka, KS 66612-1367

2. Schedule of Compliance: No later than 14 calendar days following each date identified in the "Schedule of Compliance," the permittee shall submit to the above address, either a report of progress or, in the case of specific action being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements, or, if there are no more scheduled requirements, when such noncompliance will be corrected.

3. Definitions:

   A. The "daily average" discharge means either the total discharge by weight during a calendar month divided by the number of days in the month that the facility was operating or the average concentration for the month. The daily average discharge shall be determined by the summation of all measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made, or by the summation of all concentrations determined during the calendar month divided by the number of samples collected and analyzed.

   B. The "daily maximum" discharge means the total discharge by weight or average concentration during a 24 hour period.

   C. The "monthly average", other than for fecal coliform bacteria, is the arithmetic mean of the value of effluent samples collected in a period of 30 consecutive days. The monthly average for fecal coliform bacteria is the geometric mean of the value of the effluent samples collected in a period of 30 consecutive days.

   D. The "weekly average", other than for fecal coliform bacteria, is the arithmetic mean of the value of effluent samples collected in a period of 7 consecutive days. The weekly average for fecal coliform bacteria is the geometric mean of the value of effluent samples collected in a period of 7 consecutive days.

   E. A "grab sample" is an individual sample collected in less than 15 minutes.

F. A "composite sample" is a combination of individual samples in which the volume of each individual sample is proportional to the discharge flow, the sample frequency is proportioned to the flow rate over the sample period, or the sample frequency is proportional to time.

G. The "act" means the Clean Water Act, 30 USC Section 1251 et seq.

H. The terms "Director", "Division", and "Department" refer to the Director, Division of Environment, Kansas Department of Health and Environment, respectively.

I. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

J. "Bypass" means any diversion of waste streams from any portion of a treatment facility or collection syste

4. Test Procedures: All analysis required by this permit shall conform to the requirements of 33 USC Section 1314(h), and shall be conducted in a laboratory certified by this Department. For each measurement or sample, the permittee shall record the exact place, date, and time of sampling; the date of the analyses, the analytical techniques or methods used, and the individual(s) who performed the sampling and analysis and, the results. If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved procedures, the results shall be included in the Discharge Monitoring Report form required in 1.B. above. Such increased frequencies shall also be indicated.

5. Records Retention: All records and information resulting from the monitoring activities required by this permit, including all records of analyses and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of 3 years, or longer if requested by the Division.

6. Change in Discharge: All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant not authorized by this permit or of any pollutant identified in this permit more frequen' than or at a level in excess of that authorized shall constitute a violation of this permit. Any anticipated facili, expansions, productions or flow increases, or process modifications which result in a new, different, or increased discharge of pollutants shall be reported to the Division at least one hundred eighty (180) days before such chang

7. Noncompliance Notifications: If for any reason, the permittee does not comply with, or will be unable to comply with any daily maximum or weekly average effluent limitations specified in this permit, the permittee shall provide the Department with the following information in writing within five days of becoming aware of such condition:

A. A description of the discharge and cause of noncompliance, and

B. the period of noncompliance including exact dates and times or if not corrected, the anticipated time the noncompliance is expected to continue and steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

The above information shall be provided with the submittal of the regular Discharge Monitoring Report form for violations of daily average or monthly average effluent limitations.

F. A "composite sample" is a combination of individual samples in which the volume of each individual sample is proportional to the discharge flow, the sample frequency is proportioned to the flow rate over the sample period, or the sample frequency is proportional to time.

G. The "act" means the Clean Water Act, 30 USC Section 1251 et seq.

H. The terms "Director", "Division", and "Department" refer to the Director, Division of Environment, Kansas Department of Health and Environment, respectively.

I. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

J. "Bypass" means any diversion of waste streams from any portion of a treatment facility or collection syst

4. Test Procedures: All analysis required by this permit shall conform to the requirements of 33 USC Section 1314(h), and shall be conducted in a laboratory certified by this Department. For each measurement or sample, the permittee shall record the exact place, date, and time of sampling; the date of the analyses, the analytical techniques or methods used, and the individual(s) who performed the sampling and analysis and, the results. If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved procedures, the results shall be included in the Discharge Monitoring Report form required in 1.B. above. Such increased frequencies shall also be indicated.

5. Records Retention: All records and information resulting from the monitoring activities required by this permit, including all records of analyses and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of 3 years, or longer if requested by the Division.

6. Change in Discharge: All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant not authorized by this permit or of any pollutant identified in this permit more frequen than or at a level in excess of that authorized shall constitute a violation of this permit. Any anticipated facili expansions, productions or flow increases, or process modifications which result in a new, different, or increased discharge of pollutants shall be reported to the Division at least one hundred eighty (180) days before such chan

7. Noncompliance Notifications: If for any reason, the permittee does not comply with, or will be unable to comply with any daily maximum or weekly average effluent limitations specified in this permit, the permittee shall provide the Department with the following information in writing within five days of becoming aware of such condition:

A. A description of the discharge and cause of noncompliance, and

B. the period of noncompliance including exact dates and times or if not corrected, the anticipated time the noncompliance is expected to continue and steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

The above information shall be provided with the submittal of the regular Discharge Monitoring Report form for violations of daily average or monthly average effluent limitations.

8. Facilities Operation: The permittee shall at all times maintain in good working order and efficiently and effectively operate all treatment, collection, control systems or facilities, to achieve compliance with the terms of this permit. Such proper operation and maintenance procedures shall also include adequate laboratory controls and appropriate quality assurance procedures. Maintenance of treatment facilities which results in degradation of effluent quality, even though not causing violations of effluent limitations shall be scheduled during noncritical water quality periods and shall be carried out in a manner approved in advance by the Division. The permittee shall take all necessary steps to minimize or prevent any adverse impact to waters of the State resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge. When necessary to maintain compliance with the permit conditions, the permittee shall halt or reduce those activities under its control which generate wastewater routed to this facility.

9. Immediate Reporting Required: Any diversion from, or bypass of facilities necessary to maintain compliance with the permit is prohibited, except: where no feasible alternatives to the bypass exist and 1) where necessary to prevent loss of human life, personal injury or severe property damage; or 2) where excessive stormwater inflow or infiltration would damage any facilities necessary to comply with this permit or 3) where the permittee notifies the Director seven days in advance of an anticipated bypass. The Director or Director's designee may approve a bypass, after considering its adverse effects, if any of the three conditions listed above are met. The permittee shall immediately notify the Division by telephone [(913) 296-5517 or the appropriate KDHE District Office] of each bypass and shall confirm the telephone notification with a letter explaining what caused this spill or bypass and what actions have been taken to prevent recurrence. Written notification shall be provided to the Director within five days of the permittee becoming aware of the bypass. The Director or Director's designee may waive the written report on a case-by-case basis.

10. Removed Substances: Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner acceptable to the Division.

11. Power Failures: The permittee shall provide an alternative power source sufficient to operate the wastewater control facilities or otherwise control pollution and all discharges upon the loss of the primary source of power to the wastewater control facilities.

12. Right of Entry: The permittee shall allow authorized representatives of the Division of Environment or the Environmental Protection Agency upon the presentation of credentials, to enter upon the permittee's premises where an effluent source is located, or in which are located any records required by this permit, and at reasonable times, to have access to and copy any records required by this permit, to inspect any monitoring equipment or monitoring method required in this permit, and to sample any influents to, discharges from or materials in the wastewater facilities.

13. Transfer of Ownership: The permittee shall notify the succeeding owner or controlling person of the existence of this permit by certified letter, a copy of which shall be forwarded to the Division. The succeeding owner shall secure a new permit. The permit is not transferable to any person except after notice and approval by the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary.

14. Availability of Records: Except for data determined to be confidential under 33 USC Section 1318, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department. Effluent data shall not be considered confidential. Knowingly making any false statement on any such report or tampering with equipment to falsify data may result in the imposition of criminal penalties as provided for in 33 USC Section 1319 and KSA 65-170c.

Permit Modifications and Terminations: As provided by KAR 28-16-62, after notice and opportunity for a hearing, this permit may be modified, suspended or revoked or terminated in whole or in part during its term for cause as provided but not limited to those set forth in KAR 28-16-62 and KAR 28-16-28b through f. The permittee shall furnish to the Director, within a reasonable amount of time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish upon request, copies of all records required to be kept by this permit.

16. Toxic Pollutants: Notwithstanding paragraph 15 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified at such effluent standards) is established under 33 USC Section 1317(a) for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition. Nothing in this permit relieves the permittee from complying with federal toxic effluent standards as promulgated pursuant to 33 USC Section 1317.

17. Civil and Criminal Liability: Except as authorized in paragraph 9 above, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance as provided for in KSA 65-170d, KSA 65-167, and 33 USC Section 1319.

18. Oil and Hazardous Substance Liability: Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject to under 33 USC Section 1321 or KSA 65-164 et seq. The municipal permittee shall promptly notify the Division by telephone upon discovering crude oil or any petroleum derivative in its sewer system or wastewater treatment facilities.

19. Industrial Users: The municipal permittee shall require any industrial user of the treatment works to comply with 33 USC Section 1317, 1318 and any industrial user of storm sewers to comply with 33 USC Section 1308.

20. Property Rights: The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights nor a infringements of or violation of federal, state or local laws or regulations.

21. Operator Certification: The permittee shall ensure the wastewater facilities are under the supervision of an operator certified by the Department. If the permittee does not have a certified operator or loses its certified operator, appropriate steps shall be taken to obtain a certified operator as required by KAR 28-16-30 et seq.

22. Severability: The provisions of this permit are severable. If any provision of this permit or any circumstance is held invalid, the application of such provision to other circumstances and the remainder of the permit shall not be affected thereby.

23. Removal from Service: The permittee shall inform the Division at least three months before a pumping station, treatment unit, or any other part of the treatment facility permitted by this permit is to be removed from service and shall make arrangements acceptable to the Division to decommission the facility or part of the facility being removed from service such that the public health and waters of the state are protected.

24. Duty to Reapply: A permit holder wishing to continue any activity regulated by this permit after the expiration date, must apply for a new permit at least 180 days prior to expiration of the permit.

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APPENDIX B – CODE CLASSIFICATION TABLE

CODE CLASSIFICATION TABLE

PROJECT INFORMATION	
Owner:	City of Leavenworth, KS
Plant:	Leavenworth WWTP
Location:	Leavenworth, KS
Project Number:	172827

CODE REFERENCES	
Building Code:	International Building Code, 2006 ed.
Mechanical Code:	International Mechanical Code, 2006 ed.
Plumbing Code:	International Plumbing Code, 2006 ed.
Fire Code:	International Fire Code, 2006 ed.
Electrical Code:	International Code Council Electrical Code, 2005 ed.
Energy Code:	International Energy Conservation Code, 2006 ed.
Other:	2008 National Fire Protection Association NFPA 820 Fire Protection in Wastewater Treatment and Collection Facilities

DESIGN TEAM	
Engineering Manager:	ADK
Civil:	NWW
Architect:	DJT
Mechanical (Building Systems):	GWP
Electrical:	LP

STRUCTURE, ROOM OR AREA		NFPA 820		HAZARDOUS MATERIALS				BUILDING CODE												FIRE PROTECTION				VENTILATION				FIRE CODE REQUIREMENTS																										ELECTRICAL CODE			REMARKS
Name	Room No.	Table, Row, & Line	Fire Protect Measures	Description	Quantity	Hazard Classification Type	Hazard Classification Description	Occup Class	Type of Cons't	Area Allowed	Area sq ft	Occup Load	ADA Access	Exits Reqd	Exits Actual	Building Height Allowed	Building Height Actual	Stories	Grade Location	Hazard Class	Sprinkler Type	Density/Area	Smoke Detection	Cont/Int	Odor Control	Rate (Note 1)	Airflow Switch	exempt amount (chem feed/civil input)	secondary containment (chem feed/civil input)	cont. ventilation (mech input)	vent shutoff switches (mech input)	fire sprinkler system (mech input)	explosion control (civil/arch/chem feed input)	standby power (elec input)	emergency power (elec input)	limit controls (chem feed/civil input)	emergency alarm (chem feed/elec input)	alarm supervision (elec input)	treatment system (mech input)	excess flow control (chem feed input)	gas detection (chem feed input)	breathing apparatus (chem feed input)	smoke detection (elec input)	liquid tight floor (chem feed/civil input)	non-comb. const (arch/civil input)	fire extinguishers (arch input)	smoke and heat vents (arch input)	fire hydrant (arch input)	Class	Group	Division	
SPECIAL MANHOLE NO. 6		Table 5.2, Row 24,25	H	N/A	N/A	N/A	N/A	NR	NR	NR	N/A	NR	No	NR	N/A	NR	N/A	N/A	Below	N/A	NR	N/A	None	N/A	No	N/A	No																								N/A	N/A	N/A	
EFFLUENT METER VAULT		Table 5.2, Row 24,25	H	N/A	N/A	N/A	N/A	NR	NR	NR	N/A	NR	No	NR	N/A	NR	N/A	N/A	Below	N/A	NR	N/A	None	N/A	No	N/A	No																								N/A	N/A	N/A	
UV DISINFECTION BUILDING								F2	II-B	23,000	4,752	47	No	1	2	55'	16'	3 allowed	Above																												X					N/A	N/A	N/A	
UV ROOM		Table 5.2, Row 24,25 (Note 1)	H	N/A	N/A	N/A	N/A	F2			2,355	23		1	2				Above	N/A	NR	N/A	None	Int	No	12 AC/HR	No																							2		N/A	N/A	N/A	
ELECTRICAL ROOM (New)		Unclassified	NR	N/A	N/A	N/A	N/A	F2			135	1		1	1				Above	N/A	NR	N/A	None	Int	No	6 AC/HR	No																							1		N/A	N/A	N/A	
STORAGE ROOM		Unclassified	NR	N/A	N/A	N/A	N/A	S2			365	3		1	1				Above	N/A	NR	N/A	None	Int	No	6 AC/HR	No																							1		N/A	N/A	N/A	
ELECTRICAL ROOM (Existing)		Unclassified	NR	N/A	N/A	N/A	N/A	F2			88	1		1	1				Above	N/A	NR	N/A	None	Int	No	6 AC/HR	No																							1		N/A	N/A	N/A	
STORAGE ROOM (Existing)		Unclassified	NR	N/A	N/A	N/A	N/A	S2			1,155	11		1	2				Above	N/A	NR	N/A	None	Int	No	6 AC/HR	No																							1		N/A	N/A	N/A	

ABBREVIATIONS

AC/HR	Air Changes per Hour
AC	Air Conditioning
Cont	Continuous
Gal	Gallons
GPM	Gallons per Minute
HE	Health Hazard
Int	Intermittent
Lbs	Pounds
N/A	Not Applicable
NL	Not Limited
OH	Ordinary Hazard Group
PH	Physical Hazard
Sqft	Square Feet

NOTES

NFPA 820

CGD = Combustible Gas Detectors
FDS = Fire Detection System
FAS = Fire Alarm System
FE = Portable Fire Extinguishers
FSS = Fire Suppression System
H = Hydrant Protection

Note 1: Table 5.2, Row 9 or 10 may also be applicable in this room in a Primary Clarifiers overflow event. However, the space remains Unclassified with only hydrant fire protection required.

Hazardous Materials

Building Code

Fire Protection

Ventilation

Note 1: The ventilation system will be sized on the more restrictive of the AC/HR listed or the airflow required to maintain the indoor design temperature based on the summer outside design temperature.

Fire Code Requirements

Electrical Code Requirements

APPENDIX C – TROJAN UV3000PLUS PROPOSAL

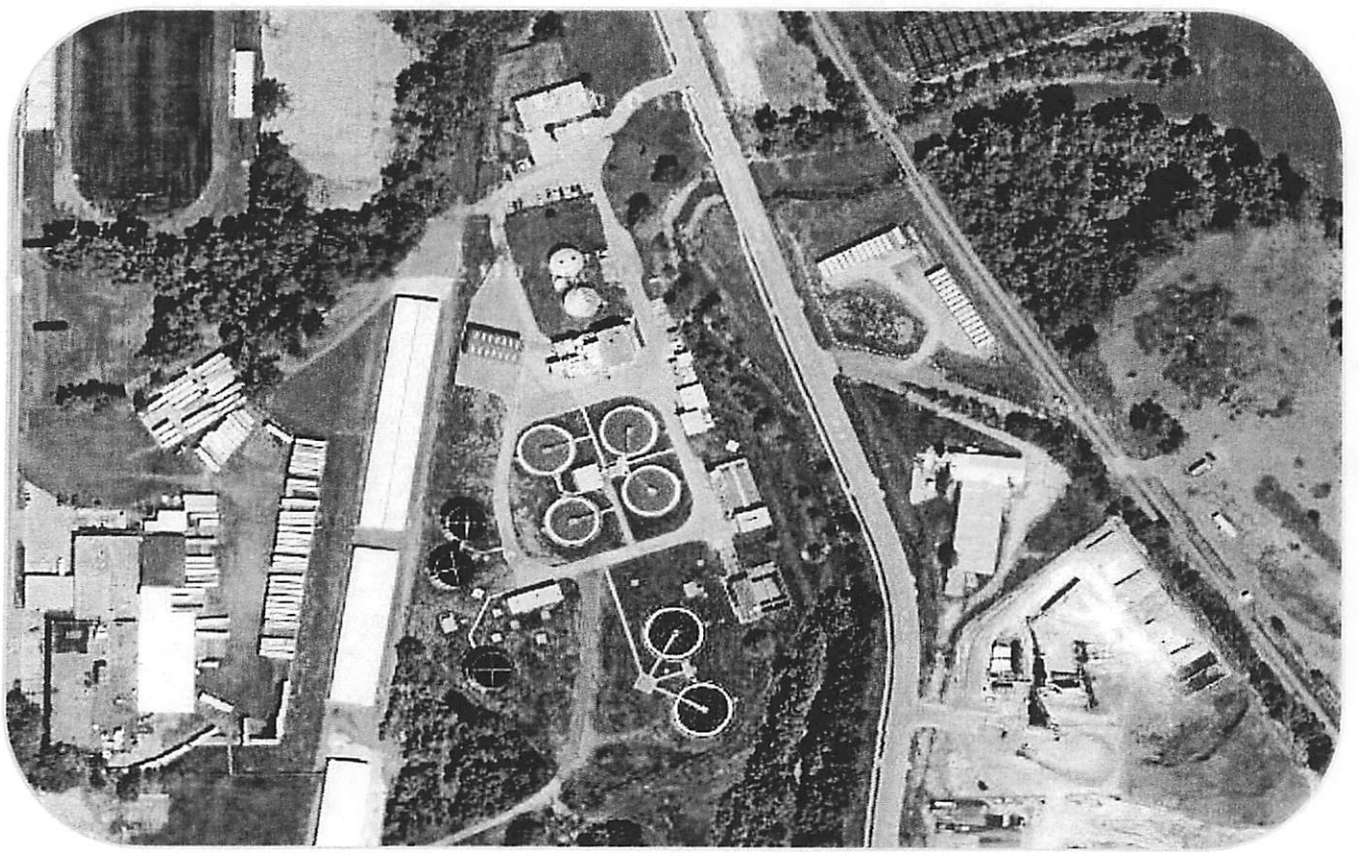
TROJAN UV

Response to the Request for UV Disinfection System Pre-Selection for:

THE CITY OF LEAVENWORTH, KANSAS

Leavenworth Wastewater Treatment Plant
Ultraviolet (UV) Disinfection System

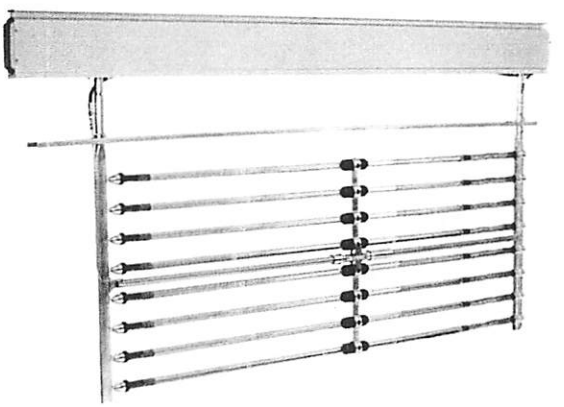
B&V Project File No. 172827



SUBMITTED BY TROJAN TECHNOLOGIES

MICHAEL SHORTT mshortt@trojanuv.com 519.457.3400

APRIL 2011



TROJANUV
WATER CONFIDENCE

April 13, 2011

John Keller, Project Manager
Black & Veatch Corporation
8400 Ward Parkway
Kansas City, Missouri, 64114

Re: City of Leavenworth – Leavenworth, Kansas – UV Disinfection Project
UV Disinfection System Pre-Selection
B & V Project Number: 172827
B & V File: 14.6001

Dear Mr. Keller,

We are pleased to submit the enclosed TrojanUV3000Plus™ proposal for consideration by the City of Leavenworth, KS for the supply of an Ultraviolet Disinfection System. To facilitate your navigation through the enclosed information we have summarized the design and key differentiating benefits with the TrojanUV3000Plus™ in this letter.

TrojanUV3000Plus™ Design Summary:
Trojan's design for this facility utilizes three (3) channels with two (2) banks of lamps in each channel and is further described in the attached "UV Disinfection Design Requirement Table" and Scope of Supply.

We would like to bring to your attention a number of benefits uniquely offered by Trojan.

Experience – It comes with Trojan
- Trojan has set the standard for proven UV technology and innovation for over 30 years – and has the largest UV installation base, over 6,000 municipal installations operating worldwide, including over sixty (60) municipal systems operating in Kansas alone.
- Almost one in five WWTPs in North America use Trojan equipment.
- Over 1,300 UV3000Plus™ systems are operating around the world,
- Through thousands of installations worldwide, Trojan has proven its ability to design and supply UV systems that exceed Owner expectations. If selected, Trojan is fully committed to support The City of Leavenworth and their engineer through the detailed design, purchase agreement, submittal, equipment delivery and startup phases by carrying out all provisions required.

UV Lamps – The key component
- Trojan's UV3000Plus™ lamps undergo a special manufacturing process that ensures lamp life longevity. This feature has also been NWRI validated to allow the use of a higher lamp aging factor in the overall system sizing – further increasing the system efficiency.
- Trojan offers the most comprehensive lamp warranty with the UV3000Plus™. Lamps are warranted at 100% (non-prorated) for 9,000 operating hours and we offer a further prorated warranty up to 12,000 operating hours. This means that if a lamp fails prior to 9,000 hours a replacement lamp is provided at no cost. Failed or spent lamps will be recycled by Trojan at an approved facility, again at no cost to the Owner.

TROJAN UV
WATER CONFIDENCE

Cleaning System – The best in the industry

- Trojan is the only UV manufacturer to offer a fully automatic chemical/mechanical sleeve cleaning system essentially eliminating operator involvement for sleeve cleaning. The NWRI validated quartz sleeve fouling factor (0.95) confirms the efficiency of the cleaning system – saving the Owner in power costs.
- With other manufacturers a chemical dip tank along with a larger overhead crane is required to facilitate module removal from the channel for sleeve cleaning. The Trojan UV3000Plus™ module weighs only 110 lbs and can be removed from the channel by the operators or using a small davit crane.

Modularity – For safety and redundancy

- The UV3000Plus™ system is uniquely modular. Each single-leg UV module is an independent electrical sub-system and one power distribution center is provided for each group (bank) of UV modules.
- This configuration increases the electrical redundancy of the system and allows operators to work safely while the highest percentage of UV equipment stays in operation.

Ballast Location – Compact with convection-cooling

- Electronic ballasts are housed in an aluminum enclosure mounted directly above the UV module. The enclosure design and material of construction does not require any forced-air or A/C cooling. This design feature saves the Owner both capital and operating costs and is proven reliable and effective in thousands of installations worldwide.
- The UV system can be installed completely outdoors, again saving in construction costs. Minimal ancillary facilities or equipment is required with the Trojan system.

Service – Local and long term

- Trojan stands behind every TrojanUV3000Plus™ system that we design and manufacture. Trojan will provide the City of Leavenworth with a Lifetime UV Performance Guarantee - valid for the life of the UV system.
- Trojan offers a 1-800 number with qualified Technicians available 24-hours / 7 days a week for emergency support.
- Trojan UV installations are supported by a network of over 70 factory-trained certified technicians in North America, and include a local Trojan certified service technician located in Belton, Missouri at the Ray Lindsey Company.

We would like to thank the City of Leavenworth and Black & Veatch for the invitation to submit our proposal for this project. If you have any questions or require any additional information please do not hesitate to contact our local representative Joe Maris of the Ray Lindsey Company or myself at (519) 457-3400.

With best regards,
Trojan Technologies

Michael Shortt
Regional Manager
Trojan Technologies
mshortt@trojanuv.com

UV EQUIPMENT PROCUREMENT PRE-SELECTION INFORMATION

REQUIREMENT #1 - PROPOSED SYSTEM DESCRIPTION

The TrojanUV3000Plus™ is a highly flexible and reliable UV disinfection system with demonstrated performance in over 1,300 installations around the world. The TrojanUV3000Plus™ consists of several main components or building blocks. Complete system description including quantities can be found in the attached Scope of Supply:

- UV Modules - Contains germicidal lamps and electronic ballasts
- System Control Center (SCC) - Controls the functions of the UV Modules
- Power Distribution Center(s) (PDC) - Provides the power for each UV Module.
- ActiClean™ Cleaning System (ACS) and Hydraulic System Center (HSC) -Automatically cleans the quartz sleeves of the UV Modules to ensure proper disinfection. This cleaning system is hydraulically driven by the HSC
- UV Sensor(s) - Measures the UV intensity.
- On-line UV Transmittance Controller and Sensor - Measures the UV Transmittance of the water. The SCC uses this information and adjusts the lamp parameters to maintain UV dose and disinfection.
- Water Level Sensor - Ensures all lamps are submerged
- Water Level Controller (Optional) - Maintains effluent level within UV channel
- Module Support Rack - Supports UV module bank within the channel.

SYSTEM COMPONENTS
UV MODULES

The module is the support structure for the UV lamps, enclosed in quartz sleeves, and for the ActiClean™ Cleaning System. The module enclosure contains the ballasts, module control boards and wiring from each ballast to lamp. All ballast and lamp wiring runs inside the module frame to shield them from the harsh effluent environment and exposure to UV. The module is 6P rated – air and water tight – to ensure all components are protected from the harsh effluent, dust and moisture.

SYSTEM CONTROL CENTER (SCC)

The SCC encompasses all of the hardware required to control the UV system. It includes a PLC, Operator Interface, input/output connections and communication hardware. The SCC is also equipped with an extensive alarm reporting system to ensure fast and accurate diagnosing of system processes and maintenance alarms.

POWER DISTRIBUTION CENTER (PDC)

The PDC powers each bank of modules and typically spans the width of the channel. The PDC distributes power from the main electrical service out to the modules in the bank. It contains the communication and control equipment for the bank of modules.

SENSOR

The patented UV Sensor measures the UV intensity within each bank of modules and is located in the center module of the bank's lamps.

ACTICLEAN™ CLEANING SYSTEM (ACS) AND HYDRAULIC SYSTEMS CENTER (HSC)

A magnetically coupled submersible wiper drive is supplied on each UV module. This patented design drives a wiper carriage assembly with attached wiper canisters along the UV modules. The wiper canisters surround each quartz lamp sleeve and are filled with a Trojan approved cleaning agent. The cleaning fluid in the wiper canisters contacts

the lamp sleeves between two wiper seals and maintains the sleeve transmittance to ensure disinfection. Cleaning is achieved mechanically with the scraping action of the wiper seals and chemically by the chemical reaction between the cleaning agent and the build-up on the sleeves. The cleaning takes place while the lamps are submersed and operating.

Fouling rates are dependent on many site variables and can vary from site to site. The default cleaning frequency in the PLC controller is set to wipe once every 24 hours and is operator adjustable to as frequent as one (1) cleaning cycle per hour. The recommended cleaning schedule for typical conditions is once every 12 hours. ActiClean™ usage will depend upon the nature of fouling, rate of fouling, and the wiping frequency. Each wiper canister houses 50 mL of gel. Typically, the cleaning solution is re-charged (topped up) every six (6) months during a routine preventative maintenance inspection.

ON-LINE UV TRANSMITTANCE CONTROLLER AND SENSOR

The Hach UV Transmittance instrument samples and measures the percent of UV transmittance (%T) in the effluent. The results are communicated to the SCC and are used to adjust the UV dose in conjunction with flow signals and lamp age to maintain disinfection and minimize power consumption.

WATER LEVEL SENSOR

Another feature is the standard Low Water Level Sensor and an optional High Water Level Sensor. These sensors are positioned in each channel downstream of the UV system banks. A high or low water level will trigger an alarm at the SCC and shutdown the UV system.

WATER LEVEL CONTROLLER

A motorized weir gate is used to maintain the optimal water level over the lamps at all flows. Maintaining control of the water level ensures uniform UV exposure for proper disinfection and protects the system by keeping the lamps submerged.

REQUIREMENT #2 - SCHEDULE FOR SUPPLY FROM ISSUANCE OF PURCHASE ORDER -

This information is detailed in the Scope of Supply

REQUIREMENT #3 - SYSTEM REPLACEMENT ITEMS

LAMPS

- Lamps are regularly replaced when they reach their end of lamp life (12,000 hours of operation).

ACTICLEAN GEL and WIPER RINGS

- ActiClean Gel is typically replaced (or topped up) every six (6) months.
- Wiper ring replacement is generally completed every two (2) or three (3) years.

BALLAST REPLACEMENT

- Ballasts are warrantied for five (5) years and are replaced only when they fail (not at the end of their warranty period.

REQUIREMENT #4 - SPARE PARTS PROVIDED – refer to the Scope of Supply

REQUIREMENT #5 - TESTING FOR THE SYSTEM - refer to the Scope of Supply

TROJANUV

UV EQUIPMENT PRE-SELECTION INFORMATION

REQUIREMENT #6 - INSTALLATION LIST #1 FOR TROJAN SYSTEM IN IOWA, KANSAS, MISSOURI AND NEBRASKA

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
Anamosa	IA	2.00	80	UV2000	
Ankeny	IA	11.00	544	UV2000	
Madrid	IA	1.53	40	UV2000	
Edgewood	IA	1.73	48	UV3000	6/2/2010
Emmetsburg	IA	2.25	80	UV3000	10/1/2009
Madrid Replacement	IA	1.53	40	UV3000	10/22/2004
Nora Springs	IA	1.10	72	UV3000	2/16/1992
Algona	IA	4.22	84	UV3Plus	3/22/2011
Clear Lake	IA	3.90	48	UV3Plus	8/29/2003
Cresco	IA	4.68	48	UV3Plus	9/6/2006
Decorah	IA	8.00	96	UV3Plus	7/22/2004
Forest City	IA	3.15	48	UV3Plus	11/3/2009
Fort Dodge WWTP	IA	16.00	128	UV3Plus	8/30/2010
Humboldt WWTP	IA	3.00	36	UV3Plus	10/15/2009
Mason City	IA	21.60	192	UV3Plus	3/29/2009
Monticello	IA	2.70	64	UV3Plus	11/26/2010
Red Oak	IA	4.00	112	UV3Plus	2/20/2011
Walcott	IA	2.40	24	UV3Plus	4/20/2007
Waverly	IA	6.43	80	UV3Plus	7/18/2008
Asbury	IA	1.00	32	UV3PTP	6/27/2006
Corning	IA	1.50	40	UV3PTP	11/15/2006
Dows	IA	1.48	64	UV3PTP	3/15/2011
Elgin	IA	1.12	64	UV3PTP	8/6/2010
Elma WWTP	IA	0.84	24	UV3PTP	7/15/2008
FLOYD	IA	0.20	8	UV3PTP	5/16/1997
Hedrick	IA	1.12	32	UV3PTP	6/1/2010
Interstate Power & Light	IA	0.04	2	UV3PTP	6/6/2005
Leon	IA	1.40	80	UV3PTP	8/3/2010
Lyon Co Casino & Golf Resort	IA	0.56	32	UV3PTP	3/15/2011
Maple River JCT	IA	0.04	4	UV3PTP	9/15/2010
Mapleton	IA	0.56	16	UV3PTP	6/13/2008
Remsen WWTP	IA	2.80	80	UV3PTP	11/15/2010
Rock Valley	IA	1.08	64	UV3PTP	3/9/2010
Sac & Fox Indian Tribe Casino	IA	1.00	32	UV3PTP	1/15/2003
Sapp Brothers Truck Stop (Percival)	IA	0.06	4	UV3PTP	4/1/2003
Springbrook State Park	IA	0.05	4	UV3PTP	7/6/1998
STEAMBOAT ROCK	IA	0.05	4	UV3PTP	2/22/1997
Stuart	IA	1.28	32	UV3PTP	5/14/2010
North Liberty	IA	6.50	24	UV4000	9/1/1998
Stillwell, KS	KS	0.12	8	UV2000PTP	-
ANDOVER	KS	3.00	160	UV3000	12/15/1996
Blue River Upgrade	KS	6.00	288	UV3000	12/1/1998

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
Blue River/Plant 1	KS	2.88	128	UV3000	12/5/1993
Camp Forsyth	KS	1.10	64	UV3000	8/29/1997
Cedar Creek (Olathe)	KS	7.50	320	UV3000	11/30/1998
Conagra	KS	2.50	144	UV3000	4/1/1998
Eudora	KS	3.00	128	UV3000	12/29/1998
Great Bend	KS	7.28	320	UV3000	6/22/1998
Junction City	KS	5.50	208	UV3000	8/15/1996
Junction City - 2	KS	7.00	192	UV3000	7/14/2000
Main Post	KS	1.50	144	UV3000	8/29/1997
Prairie Creek	KS	0.63	18	UV3000	11/22/2001
Pratt	KS	2.30	96	UV3000	12/1/1998
St. Mary's	KS	1.75	60	UV3000	12/10/2001
Valley Center	KS	1.50	80	UV3000	3/27/1993
Wamego	KS	2.25	96	UV3000	11/15/1995
Yates Center	KS	1.02	42	UV3000	4/22/2002
Blue River Main WWTP	KS	24.00	224	UV3Plus	4/27/2006
Chanute	KS	4.50	48	UV3Plus	6/8/2001
Fredonia	KS	2.20	24	UV3Plus	11/1/2005
Fredonia System Replacement	KS	2.20	24	UV3Plus	9/19/2007
Harold Street WWTP - Olathe	KS	6.40	120	UV3Plus	10/26/2007
Hiawatha	KS	4.50	48	UV3Plus	4/1/2005
Manhattan	KS	24.00	224	UV3Plus	8/1/2011
Mill Creek WWTP Johnson Co.	KS	24.00	224	UV3Plus	1/22/2005
New Century	KS	4.00	40	UV3Plus	11/10/2003
Olathe - Cedar Creek WWTP	KS	25.00	192	UV3Plus	8/1/2011
Baldwin City	KS	0.90	36	UV3PTP	2/26/1999
Caney	KS	0.30	16	UV3PTP	5/31/2000
Claflin	KS	0.28	12	UV3PTP	12/13/2004
Edgerton	KS	0.40	16	UV3PTP	11/1/2001
ELLIS	KS	0.75	64	UV3PTP	2/23/1998
Farmland Industries	KS	0.14	6	UV3PTP	9/5/2000
Garden Plain	KS	0.50	16	UV3PTP	7/20/2010
Gardner	KS	0.30	12	UV3PTP	3/7/2001
Hanston	KS	0.08	4	UV3PTP	8/28/2006
Hill City	KS	0.35	14	UV3PTP	9/17/2001
Holton	KS	1.58	40	UV3PTP	4/21/2005
Jackson County / K-Road	KS	0.18	6	UV3PTP	4/15/2002
Lakewood Hills	KS	0.15	6	UV3PTP	12/1/2000
Lyons	KS	0.55	40	UV3PTP	11/14/2003
Medicine Lodge WWTP	KS	1.00	32	UV3PTP	11/11/2004
Mulvane	KS	1.44	40	UV3PTP	1/31/2006
Mulvane	KS	1.00	80	UV3PTP	11/3/1995
POTTAWATOMIE COUNTY	KS	0.25	10	UV3PTP	2/18/1998
Prairie Band, Mayetta	KS	0.80	24	UV3PTP	1/29/2004

TROJANUV

UV EQUIPMENT PRE-SELECTION INFORMATION

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
Sedgwick	KS	0.40	16	UV3PTP	10/26/1998
St. George	KS	0.20	8	UV3PTP	1/9/2004
Stockton	KS	0.30	12	UV3PTP	12/8/2000
Strahm Development	KS	0.20	8	UV3PTP	5/14/2002
Strother Field	KS	0.84	24	UV3PTP	11/23/2007
SUPPESVILLE GOLF COUR.	KS	0.15	6	UV3PTP	1/31/1995
Toronto	KS	0.22	10	UV3PTP	5/9/2002
Towanda	KS	0.60	24	UV3PTP	12/18/2000
Wellsville	KS	1.20	36	UV3PTP	10/27/2004
Wolcott WWTP	KS	0.42	12	UV3PTP	10/15/2008
Arkansas City	KS	6.50	20	UV4000	7/31/2000
Indian Creek Middle Basin	KS	30.00	96	UV4000	11/30/2000
Nelson Complex	KS	52.00	400	UV4000	10/10/2000
Topeka (Oakland WWTP)	KS	37.50	112	UV4000	8/1/2000
Wichita (Northwest Plant #3)	KS	4.00	24	UV4000	5/21/2002
Wichita(Plant #2)	KS	80.00	288	UV4000	8/16/2001
Aurora	MO	3.00	120	UV2000	-
Crane	MO	0.40	24	UV2000	-
Farmington	MO	2.60	108	UV2000	-
Galena	MO	0.30	16	UV2000	-
Kimberling	MO	1.00	44	UV2000	-
Leadwood	MO	0.56	32	UV2000	-
Mansfield	MO	1.60	72	UV2000	-
Nixa	MO	3.30	144	UV2000	-
Rogersville	MO	0.43	24	UV2000	-
Walnut Grove	MO	0.30	20	UV2000	-
Carthage, MO	MO	0.12	8	UV2000PTP	-
Edgar Springs, MO	MO	0.06	4	UV2000PTP	-
Fenton, MO	MO	0.09	6	UV2000PTP	-
Fenton, MO	MO	0.20	8	UV2000PTP	-
Jackson, MO	MO	0.12	8	UV2000PTP	-
Leadwood, MO	MO	0.56	24	UV2000PTP	-
Monroe City, MO	MO	0.09	6	UV2000PTP	-
Neely's Landing	MO	0.15	6	UV2000PTP	-
Norwood, MO	MO	0.09	6	UV2000PTP	-
Ridgedale, MO	MO	0.06	4	UV2000PTP	-
Summersville, MO	MO	0.30	12	UV2000PTP	-
Anderson	MO	1.00	40	UV3000	12/23/1991
Ash Grove	MO	1.57	48	UV3000	7/31/2007
Aurora	MO	4.00	128	UV3000	11/20/2002
Ava	MO	3.75	112	UV3000	8/2/2004
Big Cedar Lodge	MO	0.70	32	UV3000	4/6/1996
Bonne Terre	MO	3.20	144	UV3000	3/1/2001
Branson West	MO	2.34	96	UV3000	11/29/1997
Byrnes Mill	MO	1.67	60	UV3000	10/30/2002
California	MO	2.25	144	UV3000	12/20/1998
Cassville	MO	2.17	60	UV3000	12/10/2003
Fair Grove	MO	0.63	24	UV3000	10/29/1991
Fair Grove	MO	1.50	48	UV3000	6/4/2009
Farmington	MO	5.40	224	UV3000	2/14/2001
Forsyth	MO	1.90	72	UV3000	4/13/1993
Hayti	MO	1.80	48	UV3000	11/30/2010
Kimberling 2	MO	1.01	36	UV3000	10/10/2000
Kimberling Expansion	MO	1.01	36	UV3000	10/25/1995
Marionville	MO	2.50	80	UV3000	8/9/2010
Montgomery City	MO	2.50	80	UV3000	3/30/2007
Moscow Mills	MO	0.35	32	UV3000	2/1/1998
Moscow Mills 2	MO	0.35	32	UV3000	3/1/2000
Moscow Mills 3	MO	2.40	72	UV3000	10/14/2005
Mountain View	MO	1.60	48	UV3000	2/17/2004
Piedmont	MO	1.05	32	UV3000	2/15/2011
Premium Standard Foods	MO	1.73	126	UV3000	12/8/1997
Reeds Springs	MO	2.16	64	UV3000	8/10/2010
Rogersville	MO	1.62	48	UV3000	6/3/2002
Simmons Industries	MO	1.95	112	UV3000	7/11/1997
St. Robert	MO	3.00	128	UV3000	9/4/2001
West Plains	MO	3.50	96	UV3000	4/27/2006
Boonville	MO	4.00	32	UV3Plus	7/29/2009
Forsyth	MO	1.90	32	UV3Plus	11/22/2010
Herculaneum	MO	3.45	32	UV3Plus	9/27/2007
Houston	MO	3.00	24	UV3Plus	7/1/2010
Joplin - Turkey Creek WWTP	MO	24.00	224	UV3Plus	9/24/2010
Missouri WWTP, St. Charles	MO	24.42	360	UV3Plus	3/15/2011
Nevada	MO	10.00	96	UV3Plus	6/1/2009
New Haven	MO	0.50	48	UV3Plus	3/7/2011
Nixa	MO	11.50	128	UV3Plus	9/20/2002
Northeast Public Sewer District	MO	10.00	96	UV3Plus	3/8/2009
O'Fallon	MO	15.00	144	UV3Plus	11/24/2008
Platte County	MO	7.50	96	UV3Plus	5/17/2007
Rock Creek WWTP	MO	16.70	216	UV3Plus	9/1/2010
Smithville WWTP	MO	5.95	64	UV3Plus	10/28/2009
Springfield	MO	17.00	160	UV3Plus	12/16/2005
St. Peters WWTP	MO	19.00	192	UV3Plus	6/2/2009
TAIPA	MO	9.51	80	UV3Plus	11/19/2010
Thayer	MO	3.00	24	UV3Plus	6/24/2010
Troy	MO	2.25	24	UV3Plus	3/2/2006
Union	MO	3.20	24	UV3Plus	11/16/2006
Union - Denmark Road STP	MO	1.90	18	UV3Plus	12/30/2009
Washington	MO	12.00	96	UV3Plus	11/15/2008
Wentzville	MO	23.40	256	UV3Plus	11/21/2006
Willow Springs	MO	2.50	24	UV3Plus	4/15/2011
Ameren Rush Island WWTP	MO	0.01	4	UV3PTP	7/2/2010

TROJANUV

UV EQUIPMENT PRE-SELECTION INFORMATION

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
Arcadia East Lagoon	MO	0.02	4	UV3PTP	9/10/2008
Arcadia West Lagoon	MO	0.06	4	UV3PTP	9/10/2008
Birch Tree	MO	0.42	12	UV3PTP	3/9/2010
Bloomsdale	MO	0.14	4	UV3PTP	8/12/2010
Bolivar	MO	0.21	6	UV3PTP	5/31/2005
BRANSON	MO	0.15	8	UV3PTP	11/15/1994
Branson Glades	MO	0.15	6	UV3PTP	1/4/2000
CAMDENTON	MO	0.30	12	UV3PTP	11/6/1997
Camelot Estates WWTP	MO	0.84	24	UV3PTP	5/8/2008
Cape Girardeau / Proctor & Gamble	MO	0.10	6	UV3PTP	1/6/2000
Carl Junction	MO	1.01	40	UV3PTP	2/26/1996
Carl Junction	MO	1.01	40	UV3PTP	1/28/2003
Cedar Hill	MO	0.17	20	UV3PTP	2/24/2005
Clever	MO	0.72	32	UV3PTP	8/13/1999
Crane	MO	0.86	40	UV3PTP	1/8/1996
Dogwood Canyon	MO	0.02	2	UV3PTP	5/7/2009
Dogwood Canyon Expansion	MO	0.10	2	UV3PTP	10/9/2009
Eagle Knoll WWTP	MO	0.14	4	UV3PTP	7/7/2008
Eastland Oaks	MO	0.08	6	UV3PTP	6/3/2002
Edgar Springs	MO	0.03	2	UV3PTP	7/21/2004
Edina	MO	0.57	16	UV3PTP	6/15/2007
Everton	MO	0.28	8	UV3PTP	6/2/2009
Fayette	MO	1.40	40	UV3PTP	5/21/2009
Fisk	MO	0.12	4	UV3PTP	9/2/2010
Galena	MO	0.21	6	UV3PTP	3/31/2005
Gallatin WWTP	MO	0.98	28	UV3PTP	8/19/2005
Hickory Trails	MO	0.28	8	UV3PTP	6/17/2008
Hillsboro	MO	0.84	24	UV3PTP	11/8/2007
Hinton Road	MO	0.21	8	UV3PTP	7/11/2007
House Springs	MO	0.50	20	UV3PTP	2/5/2002
Hurley	MO	0.21	8	UV3PTP	7/3/2001
Laurie	MO	0.88	32	UV3PTP	9/22/2003
Leadwood WWTF	MO	0.35	10	UV3PTP	4/20/2006
Lohman	MO	0.04	4	UV3PTP	2/6/2001
Majestic Lakes	MO	0.95	28	UV3PTP	9/15/2005
Midway Crossings WWTP	MO	0.56	16	UV3PTP	2/15/2007
Missouri-Americal Water Co. Plant 1	MO	0.35	10	UV3PTP	9/12/2006
Missouri-Americal Water Co. Plant 2	MO	0.35	10	UV3PTP	9/12/2006
Monett	MO	0.01	2	UV3PTP	4/4/2006
Morrisville	MO	0.52	16	UV3PTP	2/16/2004
NEW MELLE	MO	0.08	4	UV3PTP	1/22/2008
Newburg	MO	0.35	16	UV3PTP	11/30/1994
Northwest WWTP	MO	2.80	80	UV3PTP	12/10/2008
Ozark Meadows/Aqua America	MO	0.03	2	UV3PTP	6/2/2009
Pevely	MO	0.15	6	UV3PTP	11/8/1999
Pevely Farm	MO	0.38	16	UV3PTP	6/4/2001

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
PINEVILLE	MO	0.31	16	UV3PTP	10/15/1999
Potosi WWTP #3 (Industrial Park)	MO	0.50	40	UV3PTP	8/21/2002
Preston	MO	0.14	4	UV3PTP	4/1/2010
Purcell	MO	0.11	6	UV3PTP	10/27/2004
Raintree Plantation	MO	0.42	12	UV3PTP	12/18/2008
RIDGEDALE	MO	0.15	6	UV3PTP	11/3/1993
Rolla	MO	0.10	40	UV3PTP	12/13/2007
Rolla	MO	1.00	40	UV3PTP	12/8/1997
Sand Creek	MO	0.98	28	UV3PTP	3/3/2005
SE Wastewater Treatment Facility, Odessa, MO	MO	1.00	40	UV3PTP	5/26/2006
Silver Dollar City	MO	0.15	6	UV3PTP	5/31/2002
FOX FIRE UTILITY	MO	0.20	8	UV3PTP	9/6/1993
South Greenfield WWTP	MO	0.08	4	UV3PTP	11/11/2004
South Troy	MO	0.04	4	UV3PTP	9/26/2005
Sparta	MO	0.84	24	UV3PTP	4/4/2008
TANEY CO, OREMUS OZARK VENTURES WWTP	MO	0.15	6	UV3PTP	9/30/1997
TANEY CO./TOP OF THE ROCK	MO	0.05	4	UV3PTP	4/15/1996
Taneyville	MO	0.33	16	UV3PTP	10/2/2000
Theodosia	MO	0.24	10	UV3PTP	10/15/2002
Top of the Rock, Hollister, MO	MO	0.08	4	UV3PTP	7/20/2007
Vanburen	MO	0.56	16	UV3PTP	3/3/2008
VERSAILLES	MO	0.03	2	UV3PTP	12/29/1995
WARSAW	MO	0.40	16	UV3PTP	10/7/1998
Wentworth	MO	0.16	8	UV3PTP	6/7/2002
Westphalia	MO	0.30	14	UV3PTP	8/9/2004
Wildwood Lake	MO	0.50	20	UV3PTP	7/15/2002
Winona	MO	1.00	32	UV3PTP	10/22/2004
Wright City	MO	2.00	60	UV3PTP	2/1/2008
Wright County-Grovespring WWTP	MO	0.14	4	UV3PTP	9/21/2010
Yorktown Villages	MO	1.12	32	UV3PTP	5/1/2007
Republic	MO	3.70	12	UV4000	3/9/2001
Omaha	NE	1.04	40	UV2000	
Valentine	NE	1.09	42	UV2000	
ASHLAND	NE	2.00	80	UV3000	3/29/2007
Battle Creek	NE	1.60	96	UV3000	8/25/2006
Beatrice Expansion WWTP	NE	5.00	304	UV3000	4/10/1999
Beatrice WWTP	NE	5.00	304	UV3000	7/15/1997
Beaver Lake	NE	1.44	60	UV3000	4/1/1999
Broken Bow WWTP	NE	9.75	288	UV3000	8/14/2009
Central City	NE	3.60	224	UV3000	9/30/1999
Cozad WWTP	NE	2.75	128	UV3000	10/30/1997
Crete	NE	2.00	84	UV3000	3/21/1996
ELKHORN	NE	2.50	96	UV3000	2/28/1997
Fairbury	NE	1.50	112	UV3000	2/22/1999
Falls City	NE	3.46	96	UV3000	11/30/2004
Gothenburg	NE	1.80	84	UV3000	7/15/1999

TROJANUV

UV EQUIPMENT PRE-SELECTION INFORMATION

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
Holdredge	NE	3.45	96	UV3000	8/1/2010
McCook	NE	1.80	128	UV3000	11/7/1996
Stanton	NE	1.30	60	UV3000	7/3/2000
Superior	NE	1.50	96	UV3000	7/20/1996
Valentine	NE	1.09	42	UV3000	8/28/2003
Wahoo	NE	2.25	128	UV3000	5/15/2010
Columbus - Two Channels	NE	12.00	144	UV3Plus	2/15/2011
Grand Island	NE	28.20	416	UV3Plus	3/20/2006
Lexington	NE	3.40	96	UV3Plus	6/26/2006
Norfolk	NE	12.00	112	UV3Plus	4/1/2003
Seward WWTP	NE	2.86	80	UV3Plus	1/24/2011
Tecumseh	NE	2.30	36	UV3Plus	7/1/2009
West Point	NE	5.00	80	UV3Plus	2/14/2005
Ainsworth	NE	1.68	48	UV3PTP	7/27/2009
Arnold	NE	0.20	8	UV3PTP	1/3/2001
ASHLAND	NE	0.60	24	UV3PTP	7/31/1995
Bancroft	NE	0.19	16	UV3PTP	9/8/2008
Brule WWTP	NE	0.28	8	UV3PTP	3/15/2011
Buccanger Bay	NE	0.21	6	UV3PTP	10/20/2004
Burwell	NE	0.43	32	UV3PTP	4/14/2000
Butler County SID#1	NE	0.07	4	UV3PTP	4/15/2011
Cambridge	NE	0.72	28	UV3PTP	11/6/2002
Cass County	NE	0.12	6	UV3PTP	10/9/2009
Cedar Rapids	NE	0.15	6	UV3PTP	10/12/2000
Ceresco WWTP	NE	0.56	32	UV3PTP	7/9/2008
Coleridge	NE	0.28	8	UV3PTP	7/24/2009
Creighton	NE	0.56	32	UV3PTP	10/13/2009
Crofton	NE	0.56	16	UV3PTP	6/10/2010
Decatur	NE	0.20	8	UV3PTP	9/17/2008
Eagle	NE	1.00	32	UV3PTP	12/17/2008
Edison	NE	0.05	4	UV3PTP	9/11/2000
Elgin	NE	0.56	16	UV3PTP	5/1/2009
ELKHORN	NE	0.10	4	UV3PTP	2/4/1998
Elmwood	NE	1.12	32	UV3PTP	6/1/2010
Emerson	NE	0.14	8	UV3PTP	5/8/2007
Flying J - Gretna	NE	0.08	4	UV3PTP	5/23/2005
Friend	NE	0.28	8	UV3PTP	11/4/2009
Grand Island	NE	0.08	4	UV3PTP	10/29/2004
Grand Island	NE	0.10	4	UV3PTP	8/26/1993
GRAND ISLAND (NIGERIA)	NE	0.15	6	UV3PTP	11/1/1996
GRAND ISLAND -2	NE	0.10	4	UV3PTP	7/1/1994
Gretna - NE Crossing Mall	NE	0.28	4	UV3PTP	3/16/2009
Hartington	NE	0.65	32	UV3PTP	9/7/2010
HEBRON	NE	0.50	20	UV3PTP	10/17/1995
Hooper	NE	0.30	24	UV3PTP	7/22/1998
Humboldt WWTP	NE	0.65	24	UV3PTP	3/18/2009

PROJECT NAME	STATE	PEAK DESIGN FLOW (MGD)	NUMBER OF LAMPS	PRODUCT TYPE	DELIVERY DATE
Laurel	NE	0.56	32	UV3PTP	12/1/2009
Madison	NE	1.40	80	UV3PTP	10/27/2006
Malcolm 2	NE	0.28	8	UV3PTP	10/23/2009
Malcolm WWTP	NE	0.12	6	UV3PTP	10/15/2008
Mead	NE	0.28	8	UV3PTP	5/9/2008
MFS/York/Stormer/Global Wastewater	NE	0.08	6	UV3PTP	10/25/2001
MFS/York/Stormer/Global Wastewater	NE	0.20	8	UV3PTP	10/25/2001
Miller County (Grand Island-3)	NE	0.07	6	UV3PTP	6/24/1998
MONROE	NE	0.14	12	UV3PTP	10/29/1999
Nehwaka	NE	0.12	6	UV3PTP	2/24/2009
Neligh	NE	0.80	32	UV3PTP	2/19/2001
Oakland	NE	0.91	24	UV3PTP	8/18/2010
O'neil	NE	0.10	48	UV3PTP	1/28/2008
Pender	NE	0.96	32	UV3PTP	10/1/2008
Ponca	NE	0.60	24	UV3PTP	7/11/2005
Raymond WWTP	NE	0.16	8	UV3PTP	8/11/2008
Riverside Lakes	NE	0.15	6	UV3PTP	5/18/1998
Scribner WWTP	NE	0.85	32	UV3PTP	1/21/2009
Shubert	NE	0.28	8	UV3PTP	7/1/2009
Snyder	NE	0.28	8	UV3PTP	7/1/2008
Springfield	NE	1.00	32	UV3PTP	5/16/2009
St Paul	NE	0.98	56	UV3PTP	8/11/2006
Staplehurst	NE	0.11	6	UV3PTP	3/10/2010
Stuart	NE	0.28	8	UV3PTP	11/19/2010
Table Rock	NE	0.12	6	UV3PTP	2/27/2009
Valley View	NE	0.08	4	UV3PTP	8/8/2007
Waterloo	NE	0.50	20	UV3PTP	3/4/2002
Waterloo '/Carot M.H.P.	NE	0.10	4	UV3PTP	8/27/1997
Weeping Water	NE	0.84	48	UV3PTP	3/9/2009
Wisner	NE	0.60	32	UV3PTP	8/13/2001
Wood River	NE	0.03	2	UV3PTP	9/30/1997

TROJAN UV

UV EQUIPMENT PRE-SELECTION INFORMATION

INSTALLATION LIST #2 - TRICKLING FILTER PLANT INSTALLS IN THE USA AND CANADA

PROJECT NAME	STATE	COUNTRY	PEAK DESIGN FLOW (MGD)	PRODUCT TYPE	DELIVERY DATE
Medicine Hat	AB	CA	17.96	UV3Plus	6/19/2009
Chilliwack	BC	CA	15.85	UV3Plus	6/10/2005
CFB Winnipeg, 17 Wing	MB	CA	1.15	UV3000	2/23/2006
Cullman	AL	US	40.00	UV4000	2/21/2001
Mt. View	CA	US	11.10	UV3000	3/1/1994
Holtville	CA	US	1.60	UV3Plus	6/30/2003
Watsonville	CA	US	7.70	UV3Plus	9/30/2007
Vallejo - Deep Water	CA	US	30.00	UV4000	6/19/1996
Security Sanitation District	CO	US	4.00	UV3Plus	11/14/2003
Algona	IA	US	4.22	UV3Plus	12/1/2010
Monticello	IA	US	2.70	UV3Plus	4/1/2003
Waverly	IA	US	6.43	UV3Plus	7/18/2008
Bloomington West #1	IL	US	35.00	UV4000	10/15/2007
Petersburg	IN	US	1.30	UV3000	4/1/2002
Hebron	IN	US	3.50	UV3Plus	2/25/2010
Tell City	IN	US	7.50	UV3Plus	1/10/2011
Shelbyville	IN	US	16.00	UV4000	2/4/2000
Toronto	KS	US	0.22	UV3000 PTP	5/9/2002
Harold Street WWTP - Olathe	KS	US	6.40	UV3Plus	10/26/2007
Arkansas City	KS	US	6.50	UV4000	7/31/2000
Nelson Complex	KS	US	52.00	UV4000	10/10/2000
Fort Campbell	KY	US	16.00	UV3000	9/22/1992
Carrollton	KY	US	1.70	UV3Plus	4/11/2006
Richmond	KY	US	3.00	UV3Plus	8/15/2000
Jonesville	MI	US	2.00	UV3000	10/31/2003
Bay City	MI	US	18.00	UV3Plus	8/31/2002
Elk River	MN	US	2.00	UV3000	1/1/1994
Elk River	MN	US	7.00	UV3Plus	5/27/2008
Falls City	NE	US	3.46	UV3000	11/30/2004
Superior	NE	US	1.50	UV3000	7/20/1996
Burwell	NE	US	0.43	UV3000 PTP	4/14/2000
Hooper	NE	US	0.30	UV3000 PTP	7/22/1998
Lexington	NE	US	3.40	UV3Plus	6/26/2006
Seward WWTP	NE	US	2.86	UV3Plus	2/1/2011
Hackettstown	NJ	US	7.20	UV3000	10/31/2002
North Hudson SA - Adams Street	NJ	US	45.00	UV3Plus	12/10/2010
Western Monmouth - 2 channels	NJ	US	24.00	UV3Plus	9/28/2010
Shiprock	NM	US	1.90	UV3000	6/4/2004
Sanford	NY	US	0.70	UV3000	1/18/2005
Chittenango Service Area	NY	US	0.29	UV3000 PTP	12/13/2002
Germantown	NY	US	0.10	UV3000 PTP	6/12/2003
Irving	NY	US	0.06	UV3000 PTP	7/26/2004
Belgrave WPCD	NY	US	6.00	UV3Plus	9/7/2006
Cooperstown	NY	US	2.30	UV3Plus	6/15/2004
Port Washington	NY	US	7.00	UV3Plus	10/16/2009
Portville	NY	US	1.20	UV3Plus	5/8/2006
Yorktown Heights	NY	US	4.50	UV3Plus	11/15/2007
Alfred	NY	US	2.94	UV4000	2/16/2000
Auburn	NY	US	25.00	UV4000	4/12/1996
Carrollton	OH	US	0.90	UV3000	10/1/1998
Elida	OH	US	1.20	UV3000	8/4/2003
McComb	OH	US	0.75	UV3000	12/11/2000
Ashland	OH	US	10.00	UV3Plus	10/15/2002
Oxford	OH	US	8.00	UV3Plus	3/2/2000
Amherst	OH	US	5.00	UV4000	3/15/1997
Oak Harbor	OH	US	4.00	UV4000	12/7/1998
Mount Gretna	PA	US	0.20	UV3000 PTP	8/2/2002
West Goshen	PA	US	8.00	UV3Plus	3/20/2000
Ambler	PA	US	25.00	UV4000	11/15/1998
Lafayette	TN	US	4.50	UV3Plus	6/1/2004
Marshall	TX	US	18.00	UV3Plus	6/11/2003
Dayton	WA	US	2.60	UV3000	5/13/1999
Midway Sewer District	WA	US	18.00	UV4000	5/10/1999
Sparta	WI	US	4.00	UV3Plus	3/1/2005

REQUIREMENT #7 - NUMBER OF CHANNELS, LAMPS, BALLAST AND SPACE REQUIREMENTS – as summarized in the attached "UV Disinfection System Design Requirements Table" and are detailed in the Scope of Supply and on the layout drawing

Leavenworth, Kansas Leavenworth WWTP UV Disinfection System Design Requirements (Include Completed Form with Proposal)	
SUPPLIER INFORMATION	
UV System Supplier	TROJAN TECHNOLOGIES
UV System Model	TROJAN UV3000 PLUS
DESIGN REQUIREMENTS	
UV Lamp Type	Low-Pressure, High-Output
Design UV Transmittance, %	50
Estimated Influent E. coli count	500,000 per 100 mL
UV Influent Total Suspended Solids, mg/L	
Monthly Average	30
Weekly Average	45
Maximum Particle Size, microns	45
Minimum Design UV Dosage, mJ/cm2	45 mJ/cm² based on MS2 phage
End of Lamp Life (EOLL) Factor at 12,000 hours	0.95
Fouling Factor at 12,000 hours	0.90
Effluent E. coli count	
Monthly Geometric Mean	160 per 100 mL
Weekly Geometric Mean	1030 per 100 mL
Total Peak Flow, mgd	30.0
Total Average Daily Flow (ADF), mgd	4.5
Number of Channels, (2 or 3 only)	3
Number of Horizontal UV Banks	2 per channel
Number of Modules Per UV Bank	28
Number of UV Lamps per Module	8
Total Number of UV Lamps	1,344
Water Depth, inches	24
Channel Width, inches	84
Maximum Headloss Across Channel, inches (Measured at Total Peak Flow from upstream of level control gate to just downstream of inlet gate including all appurtenances installed in the UV channels)	1.55
Maximum Distance from Ballasts to UV Lamps	12.819" *
Required Area for Ballasts and Ballast Control Enclosures	Ø - BALLASTS LOCATED ON TOP OF MODULE

* THIS DIMENSION IS FROM THE TOP OF THE LAMP TO THE BOTTOM OF THE BALLAST ENCLOSURE. THE MODULE CAN BE STRETCHED FROM 6-36 INCHES SO THE MAXIMUM THIS DISTANCE COULD BE IS 48.819".

SCOPE OF SUPPLY FOR LEAVENWORTH, KANSAS WASTEWATER TREATMENT PLANT ULTRAVIOLET DISINFECTION EQUIPMENT – TROJAN SYSTEM UV3000Plus™

Consulting Engineer: Black & Veatch

Specification Section: UV System Pre-Selection Letter (March 23, 2011)

Trojan Quote: LBZ1167C

Design Criteria:

Current Peak Design Flow:	30 MGD
UV Transmission:	50 %, minimum
Total Suspended Solids:	30 mg/l, monthly average
	45 mg/l, weekly average
Discharge Limit:	160 e-coli/100 ml, monthly geometric mean
	1030 e-ecoli/100 ml, weekly geometric mean

We are pleased to submit the following scope of equipment based on the above criteria. The Trojan System UV3000Plus™ described herein is named as the basis for design.

The purchaser is responsible for reading all information contained in this Supply Contract. Trojan will not be held accountable for the supply of equipment not specifically detailed in this document. Supplemental Terms and Conditions are attached to this document. Detailed installation instructions are provided with the shop drawings and are available earlier upon request. Changes to this Scope of Supply that affect selling price will be handled through a change order.

Please refer all inquiries to Trojan Manufacturer's Representative:

Joe Maris
RAY LINDSEY COMPANY
Phone: 816-388-7440
Fax: 816-388-7434

This proposal has been respectfully submitted by,
Trojan Technologies

Michael Shortt
Regional Manager
Trojan Technologies

Unless otherwise indicated in this proposal all conduit, conductors, local disconnects and transformers (if required) are the responsibility of the CONTRACTOR and are not included in this Scope of Supply.

ULTRAVIOLET MODULES

Trojan's Responsibility: Each module supplied shall be completely assembled containing lamps, quartz sleeves and be electrically wired to each electronic ballast. Modules are shipped in a support rack and crated.

Model and Make:	Standard System UV3000Plus™
Quantity:	168 UV modules will be supplied each containing 8 lamps
Material of Construction:	316 stainless steel frame
Approximate Weight:	100 pounds per module

SYSTEM CONTROL CENTER

Trojan's Responsibility: One (1) System Control Center (SCC) shall be supplied to monitor and control the UV System. Trojan will provide a PLC I/O and soft address map to aid the Contractor with integration of the UV PLC and WWTP SCADA system. The UV SCC shall consist of the following:

Quantity Supplied	One (1) SCC will be supplied
Location:	Wall mounted
Controller Type:	Allen Bradley Control Logix L61
Operator Interface:	Allen Bradley Panelview 1000+ with color, touch screen display
Panel UPS:	Phoenix 24VDC DIN rail UPS with Phoenix 24VDC battery"
Material of Construction:	304 SST
Enclosure Rating:	Type 4X
Approximate Weight:	200 pounds

Installation Contractor's Responsibility: The Installation Contractor to be responsible for mounting the SCC as indicated on the drawings. The Installation Contractor to be responsible for the supply, installation and connection of the following at the SCC:

1. One (1) 120 Volt, 60 Hz, 1 phase, 2 wire (plus ground), 15 Amps power supply.
2. One (1) 4 – 20 mA DC analog signal from plant flow meter
3. One (1) 4 – 20 mA DC analog signal from plant the Hach On Line UVT.
4. Six (6) 4 – 20 mA DC analog signals from each of the Ultrasonic Level Sensors. (2 per channel – see notes & clarifications)
5. One (1) Ground Link, 14 gauge minimum type TWH stranded, daisy chained to the HSC and PDC's.
6. One (1) serial communication link consisting of one (1) shielded twisted pair, 18 gauge maximum from the HSC and other PDC's (daisy chained).
7. Discrete inlet gates signals.
8. Discrete weir gate signals.
9. An available telephone line for remote monitoring modem must be in the vicinity of the SCC.
10. Discrete signals from Plant SCADA for remote monitoring (or serial communication link to SCADA – describe protocol, Modbus, Ethernet, DH+ etc.)

SYSTEM CONTROL CENTER (Remote HMI Panel)

Trojan's Responsibility: One (1) System Control Center (SCC) shall be supplied to act as a remote HMI panel

Quantity Supplied	One (1) SCC will be supplied
Location:	Wall mounted
Operator Interface:	Allen Bradley Panelview 1000+ with color, touch screen display
Material of Construction:	304 SST
Enclosure Rating:	Type 4X
Approximate Weight:	200 pounds

Installation Contractor's Responsibility: The Installation Contractor to be responsible for mounting the SCC as indicated on the drawings. The Installation Contractor to be responsible for the supply, installation and connection of the following at the SCC:

1. One (1) 120 Volt, 60 Hz, 1 phase, 2 wire (plus ground), 15 Amps power supply.
2. One Ethernet cable connection from remote HMI panel to SCC panel.

POWER DISTRIBUTION CENTERS

Trojan's Responsibility: The Power Distribution Center (PDC) distributes power to the UV Modules and shall consist of the following:

Quantity Supplied:	Total of 6 PDC(s) will be supplied
Material of Construction:	304 stainless steel
Enclosure Rating:	Type 4X
Approximate Weight:	450 Pounds

Installation Contractor's Responsibility: The Installation Contractor to be responsible for setting in place and bolting the Power Distribution Centers to the top of channel. The Installation Contractor to be responsible for the supply, installation and connection of the following at the Power Distribution Center(s):

1. One (1) 480Y/277 Volt, 3 phase, 4 wire (plus ground), 57.1 kVA power feed with local disconnect to each of 6 PDC(s)
2. One (1) Ground Link, 14 gauge minimum, TWH stranded single wire from the HSC.
3. One (1) communication link consisting of one (1) shielded twisted pair from the SCC and daisy chained to other PDC's.
4. One (1) pair of 12Volt DC, 18 gauge minimum discrete signal to the Water Level Sensor from PDC closest to the sensor.

HYDRAULIC SYSTEM CENTER

Trojan's Responsibility: The Hydraulic System Center (HSC) houses the ancillary equipment required to operate the quartz sleeve cleaning system.

Quantity Supplied:	1 HSC will be supplied
Materials of Construction:	304 stainless steel
Enclosure Rating:	Type 4X
Approximate Weight:	500 pounds

Installation Contractor's Responsibility: The Installation Contractor to be responsible for setting in place and bolting the HSC and manifold as shown on the contract drawings. The HSC should be located within 50 feet (15 meters) from the farthest PDC. The Installation Contractor shall be responsible for the supply, connection and installation of the following at the HSC:

1. One (1) 480 Volt, 3 phase, 3 wire (plus ground), 60Hz, 5 Amp power feed with local disconnect.
2. One (1) ground link of, 14 gauge minimum, TWH stranded from the PDC(s).
3. Connection of the hydraulic hoses from PDC(s). Hoses and connections will be supplied by Trojan.
4. One (1) serial communication link of one (1) twisted, shielded pairs, 18 gauge maximum cable from the SCC and daisy chained to the PDC's.

SUPPORT RACKS

Trojan's Responsibility: Support racks are provided to support UV modules in the effluent channel.

Quantity Supplied:	6 racks will be supplied
Material of Construction:	304 stainless steel
Approximate Weight:	100 pounds each

Installation Contractor's Responsibility: The Installation Contractor to be responsible for setting in place and bolting the support racks to the channel walls. The Contractor will be required to supply eight (8) 1/2" Diameter x 5 1/2"Long expansion anchor bolts per rack.

WEIR GATE LEVEL CONTROLLER

Trojan's Responsibility: Level control devices are required to maintain and control the effluent level in the channel, regardless of flow rate.

Quantity Supplied:	Three (3) level controllers to be supplied
Description:	Level Control Weir Gate
Material of Construction:	304 stainless steel frame and yoke
Size:	84" wide x 25" High
Approximate Weight:	1000 pounds each

Installation Contractor's Responsibility: The Installation Contractor to be responsible for setting in place, grouting and sealing the level control weir gate and the installation of the following connections:

1. One 480 Volt, 3 phase, 3 wire, 5 AMP (plus ground) feed to each of the weir gates.
2. Open command discrete output, two (2) conductors, 20 gauge minimum, from SCC to each weir gate.
3. Close command discrete output, two (2) conductors, 20 gauge minimum, from SCC to each weir gate.
4. Remote mode discrete input, two (2) conductors, 20 gauge minimum, to SCC from each weir gate.
5. Gate position analog input, one (1) twisted shielded pair, 24 gauge minimum, to SCC from each weir gate.

ULTRASONIC CHANNEL LEVEL SENSOR (Weir Gate Control)

Trojan's Responsibility: An ultrasonic level sensor will be supplied to monitor the effluent levels within each UV Channel specifically for weir gate control. The transducer will be supplied with a sufficient length of cable to distribute to the monitor panel along with a mounting bracket.

Installation Contractor's Responsibility: The Contractor shall be responsible for mounting the transducer and bracket in the UV Channel, the monitor panel adjacent to the channel, and distributing the following cable/wiring between these two components and to SCC in appropriate conduit:

1. One (1) 120 Volt, 1 phase, 2 wire, 15 VA (plus ground) from a Distribution Panel (by others) to each Level Sensor Monitor.
2. One (1) 4-20mA analog signal from each Level Sensor Monitor to the System Control Center (SCC).
3. One (1) communication link using 30 feet of cable (supplied by Trojan) from the Level Sensing Transducer to the Level Sensor Monitor.

ULTRASONIC CHANNEL LEVEL SENSOR (Head Over Weir Calculations)

Trojan's Responsibility: An additional ultrasonic level sensor will be supplied to monitor the effluent levels within each UV Channel specifically for determine the flow in the UV channel via head over weir calculations. The transducer will be supplied with a sufficient length of cable to distribute to the monitor panel along with a mounting bracket.

Installation Contractor's Responsibility: The Contractor shall be responsible for mounting the transducer and bracket in the UV Channel, the monitor panel adjacent to the channel, and distributing the following cable/wiring between these two components and to SCC in appropriate conduit:

1. One (1) 120 Volt, 1 phase, 2 wire, 15 VA (plus ground) from a Distribution Panel (by others) to each Level Sensor Monitor.
2. One (1) 4-20mA analog signal from each Level Sensor Monitor to the System Control Center (SCC).

3. One (1) communication link using 30 feet of cable (supplied by Trojan) from the Level Sensing Transducer to the Level Sensor Monitor.

ON-LINE UV TRANSMISSION MONITOR

Trojan's Responsibility:

Description:	One (1) Hach UVT meter containing: One (1) submersible probe with multi-beam flash photometer, one (1) 25' cable between the probe and the controller, One (1) OptiQuant SAC UV-254 Analyzer Controller.
Enclosure Rating:	Type 4X
Controller Dimensions:	12 x 12 x 4 inches
Operating Temperature:	32 to 140°F (Probe), 14 to 122°F (Controller)
Approximate Weight:	30 pounds (includes Probe and Controller)
Probe Immersion Depth:	up to 6 feet

Installation Contractor's Responsibility: The Installation Contractor to be responsible for setting in place and bolting the controller panel and the probe. The Installation Contractor shall also be responsible for the supply, installation and connection of the following:

1. One (1) 120 Volt, 1 phase, 2 wire (plus ground), 14 VA power supply
2. One (1) 4-20mA DC Analog communications link between the Controller and the SCC
3. Installation of sensor communication cable between Probe and Controller (Cable supplied by Trojan)
4. Supply of the required bolts for mounting Controller and Probe to the channel edge

WATER LEVEL SENSOR KIT

Trojan's Responsibility: The water level sensor is located downstream of the UV System and provides a digital signal to shut down & protest the UV System if the water level is too low.

Quantity Supplied:	3 water level sensor to be supplied
Enclosure Rating:	Type 4X
Approximate Weight:	5 pounds

Installation Contractor's Responsibility: The Installation Contractor to be responsible for setting in place and bolting the water level sensor panel to the effluent channel wall. The Installation Contractor shall also be responsible for the supply of mounting hardware, watertight conduit and supply and connection of one discrete signal (pair of 12V DC, 14 gauge) from the water level sensor probe to each PDC.

INDIVIDUAL UV MODULE LIFTING SLING WITH FRAME

Trojan's Responsibility: In order to remove individual modules, by mechanical means, a 2 rope sling with frame shall be supplied to interface with the existing overhead crane.

Quantity:	1 Sling Kit
Materials of Construction:	304 SST
Approximate Weight:	10 pounds

SPARE PARTS AND SAFETY EQUIPMENT

Trojan's Responsibility: The following spare parts and safety equipment will be supplied with the UV system:

2	Spare Modules
68	UV lamps
68	Quartz sleeves
34	Ballasts
68	Lamp holder seals
102	Spare Wiper Seals

2	Spare UV Intensity Sensors
6	Hydraulic Hose Kits
2	Operators Kit (including face shield, gloves and cleaning solution)

DOCUMENTATION (SHOP DRAWINGS AND O & M MANUALS)

Trojan's Responsibility: The following documentation will be supplied to the contractor by Trojan per the following schedule:

Required copies of submittal shop drawings 4 - 6 weeks after receipt of written purchase order.
Required copies of Trojan Standard O&M manuals at time of equipment delivery.

DELIVERY, START-UP AND TRAINING

Trojan manufactured equipment shipped 7 – 8 weeks after approval of Shop Drawings.
Weir gates required by this project shipped 12 – 16 weeks after approval of Shop Drawings.
Installation and training services will minimally be provided as specified.
Trojan will provide 3 - 4 days on site to assist with performance testing of UV equipment.

WARRANTY

Trojan's Responsibility: Trojan Technologies will warrant the equipment and parts for 12 months after start-up or 18 months after shipment, whichever comes first. Refer to attached Terms and Conditions for additional details.

- Lamps shall be warranted for 12,000 hours prorated after 9,000 hours. Lamps should be limited to 4 On/Off cycles per day on average
- Ballast shall be warranted for 5 years, prorated after 1 year.

MICROBIOLOGICAL PERFORMANCE TESTING

Trojan's Responsibility: Trojan will supply a performance testing protocol to the Contractor to be forwarded to the Engineer for approval. Trojan will produce the final test report (based on data supplied by the independent lab) and will forward the final report to the Contractor.

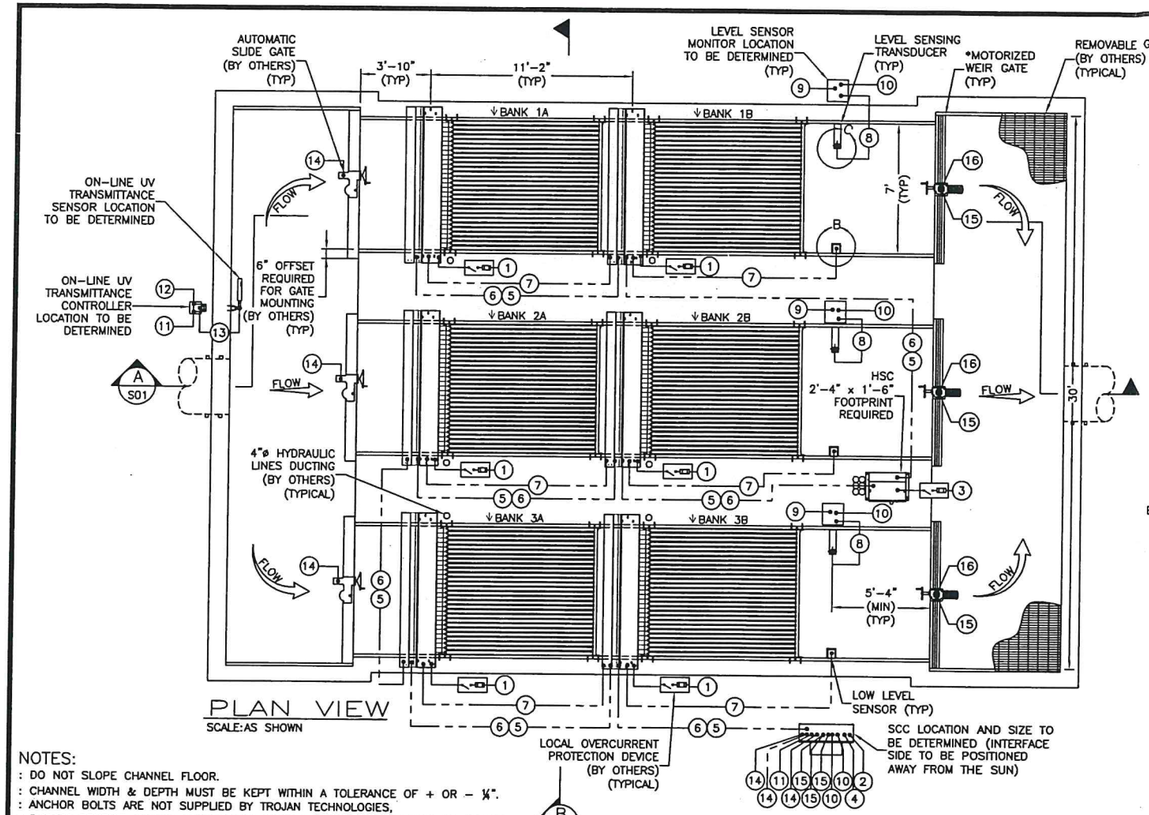
Installation Contractor's or Others Responsibility: Either the contractor or Owner will cover on site costs for performance testing (independent lab services, bottles, shipment, etc.). The Contractor, with the assistance of Trojan, will be responsible for completing the performance testing as per the testing protocol supplied by Trojan and approved by the Engineer.

SELLING PRICE

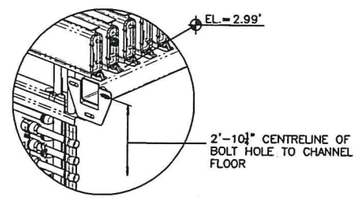
$_____Pricing valid for until April 13th, 2012.

PAYMENT TERMS

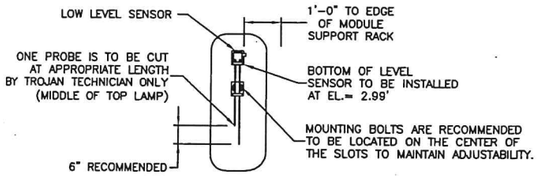
10% after approved submittal
85% upon delivery of equipment to site
5% upon equipment acceptance or 60 days after delivery (whichever occurs first)
Net 30 Days
If UV System Start-up is required within 30 days of shipment, Trojan requires 95% payment unless agreed upon in writing before authorizing system Start-up.
Freight included for all North American projects
Selling price does not include any applicable duties or taxes.



PLAN VIEW
SCALE:AS SHOWN



DETAIL A
SCALE:NOT TO SCALE



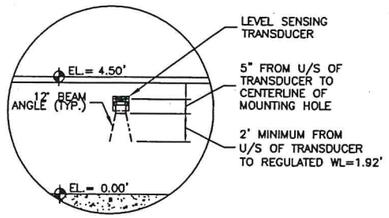
DETAIL B
SCALE:NOT TO SCALE

TROJAN UV3000™ PLUS
EQUIPMENT INTERCONNECTIONS

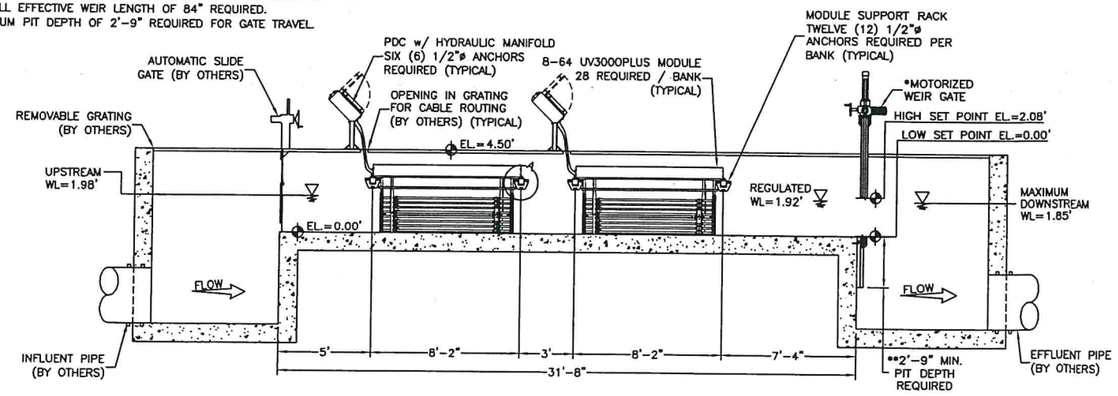
No.	DESCRIPTION	FROM	TO
1	POWER DISTRIBUTION CENTER (PDC) POWER SUPPLY 480Y/277V, 3 PHASE, 4 WIRE + GROUND 57.1 kVA/PDC POWER DRAW 73.6 MAXIMUM CURRENT/PHASE	DISTRIBUTION PANEL (DP) (BY OTHERS) (NOT SHOWN)	PDC
2	SYSTEM CONTROL CENTER (SCC) POWER SUPPLY 120 V, 1 PHASE, 2 WIRE + GROUND 15 AMPS	DISTRIBUTION PANEL (DP) (BY OTHERS) (NOT SHOWN)	SCC
3	HYDRAULIC SYSTEM CENTER (HSC) POWER SUPPLY 480 V, 3 PHASE, 3 WIRE + GROUND, 3 AMPS	DISTRIBUTION PANEL (DP) (BY OTHERS) (NOT SHOWN)	HSC
4	FLOW METER 4–20 mA, DC ANALOG INPUT (BY OTHERS)	FLOW METER PANEL (NOT SHOWN) (BY OTHERS)	SCC
5	GROUND LINK 14 AWG TYPE TWH STRANDED	SCC	PDC & HSC (DAISY CHAINED)
6	MODBUS 1 SHIELDED TWISTED PAIR	SCC	PDC & HSC (DAISY CHAINED)
7	DISCRETE LOW LEVEL SIGNAL 12 VDC – 2 CONDUCTORS	LOW LEVEL SENSOR	PDC(S) DAISY CHAINED
8	COMMUNICATION LINK 30ft CABLE PROVIDED BY TROJAN	LEVEL SENSING TRANSDUCER	LEVEL SENSOR MONITOR
9	LEVEL SENSOR POWER SUPPLY 120 V, 1 PHASE, 2 WIRE + GROUND 15 VA	DP (BY OTHERS) (NOT SHOWN)	LEVEL SENSOR MONITOR
10	WATER LEVEL SENSING 4–20 mA ANALOG INPUT SIGNAL	LEVEL SENSOR MONITOR	SCC
11	ON–LINE UV TRANSMITTANCE CONTROLLER SIGNAL 4–20 mA ANALOG INPUT	ON–LINE UV TRANSMITTANCE CONTROLLER	SCC
12	ON–LINE UV TRANSMITTANCE CONTROLLER POWER SUPPLY 120 V, 1 PHASE, 2 WIRE + GROUND 1 AMPS	DISTRIBUTION PANEL (DP) (BY OTHERS) (NOT SHOWN)	ON–LINE UV TRANSMITTANCE CONTROLLER
13	ON–LINE UV TRANSMITTANCE SENSOR COMMUNICATION (SENSOR CABLE PROVIDED BY HACH)	ON–LINE UV TRANSMITTANCE SENSOR	ON–LINE UV TRANSMITTANCE CONTROLLER
14	DISCRETE GATE OPEN CONTROL INPUT 2 CONDUCTORS DISCRETE GATE CLOSED CONTROL INPUT 2 CONDUCTORS DISCRETE OPEN COMMAND OUTPUT 2 CONDUCTORS DISCRETE CLOSE COMMAND OUTPUT 2 CONDUCTORS DISCRETE GATE IN REMOTE MODE INPUT 2 CONDUCTORS	SLIDE GATE (BY OTHERS) SLIDE GATE (BY OTHERS) SCC SCC SLIDE GATE (BY OTHERS)	SCC SCC SLIDE GATE (BY OTHERS) SLIDE GATE (BY OTHERS) SCC
15	OPEN COMMAND DISCRETE OUTPUT (MIN 20 AWG) – 2 CONDUCTORS CLOSE COMMAND DISCRETE OUTPUT (MIN 20 AWG) – 2 CONDUCTORS GATE IN REMOTE MODE DISCRETE INPUT (MIN 20 AWG) – 2 CONDUCTORS GATE FAULT DISCRETE INPUT (MIN 20 AWG) – 2 CONDUCTORS GATE POSITION ANALOG INPUT 4–20mA 1 TWISTED SHIELED PAIR (24 AWG)	SCC SCC WEIR GATE WEIR GATE WEIR GATE	WEIR GATE WEIR GATE SCC SCC SCC
16	WEIR GATE POWER SUPPLY 480V, 3 PHASE, 2 WIRE + GROUND	DISTRIBUTION PANEL (DP) (BY OTHERS) (NOT SHOWN)	WEIR GATE

PRELIMINARY, NOT FOR CONSTRUCTION.
SUBJECT TO CHANGE.

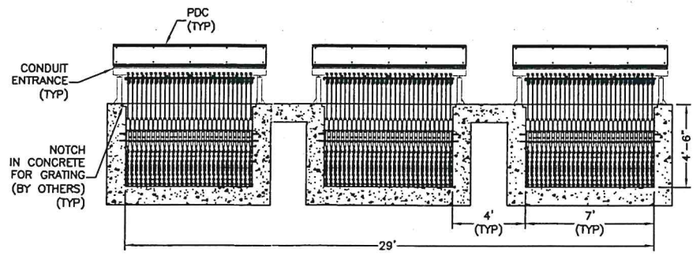
NOTES:
: DO NOT SLOPE CHANNEL FLOOR.
: CHANNEL WIDTH & DEPTH MUST BE KEPT WITHIN A TOLERANCE OF + OR – ¼".
: ANCHOR BOLTS ARE NOT SUPPLIED BY TROJAN TECHNOLOGIES,
: SYSTEM CONDUIT, WIRING, DISTRIBUTION PANELS & INTERCONNECTIONS BY OTHERS.
: ELECTRICAL REQUIREMENTS SHOWN ARE TO SUPPLY TROJAN UV EQUIPMENT ONLY. ELECTRICAL INRUSH FACTOR TO BE ADDED AS PER LOCAL CODE.
: REMOVABLE GRATING SECTIONS SHALL BE EASILY REMOVED BY ONE PERSON. MAXIMUM WEIGHT OF THE SECTIONS SHALL BE IN ACCORDANCE WITH REQUIREMENTS OF THE APPLICABLE JURISDICTION.
: CONTRACTOR TO REVIEW ALL TROJAN TECHNOLOGIES INSTALLATION INSTRUCTIONS PRIOR TO EQUIPMENT INSTALLATION.
: EFFLUENT LEVELS SHOWN REFLECT HYDRAULICS ASSOCIATED WITH TROJAN EQUIPMENT ONLY. EFFLUENT LEVELS MAY BE ALTERED DUE TO CHANNEL DEBRIS OR GEOMETRY.
: GRATING IMMEDIATELY ABOVE UV MODULES TO BE OPEN TYPE (EG. PERFORATED) TO ALLOW ADEQUATE COOLING OF THE UV MODULES.
: HSC STANDALONE IS TO BE LOCATED WITHIN 45' OF FURTHEST PDC.
* OVERALL EFFECTIVE WEIR LENGTH OF 84" REQUIRED.
** MINIMUM PIT DEPTH OF 2'-9" REQUIRED FOR GATE TRAVEL.



DETAIL C
SCALE:NOT TO SCALE



A S01 SECTION
SCALE:AS SHOWN
NOTE: ON–LINE UV TRANSMITTANCE SENSOR AND ON–LINE UV TRANSMITTANCE CONTROLLER, LEVEL SENSING TRANSDUCER AND LEVEL SENSOR MONITOR NOT SHOWN FOR CLARITY.



B S01 SECTION
SCALE:AS SHOWN
NOTE: REMOVABLE GRATING (BY OTHERS), AUTOMATIC SLIDE GATE(S) (BY OTHERS) AND ON–LINE UV TRANSMITTANCE SENSOR AND ON–LINE UV TRANSMITTANCE CONTROLLER NOT SHOWN FOR CLARITY.

DESIGN CRITERIA		
	PEAK FLOW	30.0 MGD
	U.V TRANSMITTANCE AT 253.7 nm	50 %
	SUSPENDED SOLIDS	30 mg / L
	DISINFECTION STANDARD	160 E.COLI / 100ml

TROJAN UV

DESCRIPTION: LAYOUT, UV3000PLUS LEAVENWORTH KS

DRAWN BY : SPM	DATE : 11AP06	QUOTE NO.	LBZ1167C
CHECKED BY : AMP	DATE : 11AP07	PROJECT NO.	N/A
APPROVED BY : SDI	DATE : 11AP07	DWG NO.	S01
SCALE (11x17) : 3/16" = 1'0"	LOG NUMBER : N/A	REV.	A

APPENDIX D – OPINION OF PROBABLE PROJECT COSTS

BLACK & VEATCH
Building a world of difference.

8400 Ward Parkway, P.O. Box 8405, Kansas City, Missouri 64114, (913) 458-2000

B&V Project 172827

Design Memorandum

Leavenworth, Kansas
Leavenworth WWTP
UV Disinfection Improvements

OPINION OF
PROBABLE PROJECT COST
May 18, 2011

SUMMARY

General Requiremnts	10%	$389,000
Sitework		$174,000
Special Manhole No. 6		$90,000
UV Disinfection Building		$2,930,000
Flow Division Structure No. 2		$24,000
Electrical and I&C	22%	$670,000
Contingencies	25%	$1,069,000
TOTAL PROBABLE CONSTRUCTION COST		**$5,346,000**
Engineering		
Preliminary Design		$160,000
Detailed Design (Est.)		$350,000
Bidding and Award Services (Est.)		$25,000
Construction Phase Services (Est.)		$300,000
TOTAL PROBABLE PROJECT COST		**$6,181,000**