Environmental
Resources
Management

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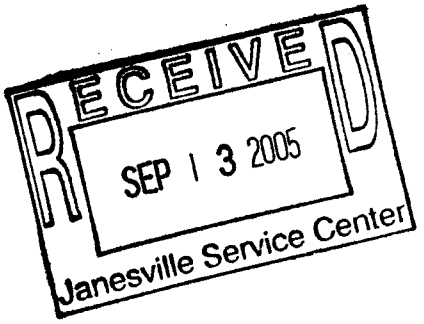
September 12, 2005



Mr. Jim Kralick
Wisconsin Department of Natural Resources
2514 Morse Street
Janesville, WI 53545-0249

RE: Design Modifications for the SVE System
Johnson Controls Watertown Facility
Jefferson County, Wisconsin
BRRTS No. 03-28-000156

Dear Mr. Kralick:

As specified in our April 20, 2005 letter to the Wisconsin Department of Natural Resources (WDNR), ERM developed an engineering design to modify the existing soil vapor extraction (SVE) system at the Johnson Controls, Inc. (JCI) site in Watertown, Wisconsin for the purpose of treating residual chlorinated volatile organic compounds (CVOCs) in the soil beneath the north-central portion of the facility. This letter report presents the design basis and the proposed engineering design. The general layout of the site is shown on Drawing Y1.

Design Basis

The design of the modified SVE system is based on the lithology of the vadose zone soils, depth to groundwater, location and depth of the vadose zone contamination, current building configuration, existing SVE system equipment, previous SVE pilot test and operating system data, locations of utilities, access restrictions, and experience at similar project sites. The design basis for the modified SVE system is summarized below.

- The vadose zone soils consist of silt with traces of clay, sand and gravel;
- The water table is approximately 8 feet below ground surface (bgs);
- The location and area of residual vadose zone soil contamination exceeding the site-specific residual contaminant levels (RCLs) and requiring remediation is illustrated on Drawing Y2;
- The vadose zone soil contamination requiring remediation extends from ground surface to approximately 8 feet bgs;

- The contaminants detected in the soil at concentrations exceeding their RCLs are trichloroethene (TCE), tetrachloroethene (PCE), and cis-1,2-dichloroethene (cis-1,2-DCE);
- The current configuration of the facility building includes space for multiple tenants;
- Building columns within the area to be remediated are approximately 50 foot on center;
- Building footings on the east-west foundation walls extend to a depth of approximately 4.5 feet bgs;
- The existing SVE equipment includes:
  - A Gardner Denver DuroFlow Sutorbilt blower model 6LVL, 25 HP, 1750 rpm. Equipment specification- 615 scfm at 136 inches of water (vacuum);
  - A silencer and knockout tank;
  - A sparge system to treat the wastewater prior to discharge to the sanitary sewer;
  - Piping and header materials; and
  - A building to house the SVE equipment;
- The system will utilize horizontal venting wells to maximize coverage and minimize tenant disturbance during installation;
- The estimated radius of influence for the horizontal wells is 27 feet; therefore, the wells will be spaced 50 foot on center;
- An SVE screen open area of approximately 718 square inches will be utilized for the 250 feet of screen at a flow of 200 scfm, approximately 2% of the available area as open screen;
- SVE rate of 200 scfm per 250 foot of screened section (0.80 scfm per foot of screen); and
- Flow loss through the existing system will allow 12 inches of water loss to the separator tank, silencer, and piping.

SVE System Modification Engineering Design

The engineering design for the modified SVE system is presented on the following drawings:

- Y1- SVE System Base Map
- Y2- SVE System Conceptual Treatment Area Map
- Y3- SVE System Conceptual System Layout Plan;
- Y4- SVE System Mechanical Details;
- P1- SVE System Piping and Instrumentation Diagram;
- P2- SVE System Symbol List; and
- P3- SVE System Process Flow Diagram.

This limited design package was prepared to an appropriate level of completion to allow permit acquisition and provide functional design information for construction purposes.

As shown on Drawing Y3, the system will include an estimated 5 horizontal SVE wells that extend through the area of vadose zone contamination requiring remediation. The wells will be drilled starting from the grass-covered areas north of the JCI building and traveling south to a receiving pit located interior to the JCI building. Each well will have a receiving pit that will be constructed by removing a three foot by three foot section of the existing concrete floor. The receiving pits will be located approximately 15 feet north of the interior division wall that separates JCI buildings five and eight. Drilling associated with the installation of the horizontal SVE wells can provide 1 to 1.5 feet of fall maximum per 10 feet of run (10 to 15% fall). Typical horizontal well, well head and header detail are shown on Drawing Y4. The wells will be connected to piping and a header within the facility. The header will be connected via existing piping to the existing SVE equipment located in the shed to the east of the facility (Drawing Y3).

The critical component of the proposed system modification is the use of the horizontal extraction wells, which have been designed based on calculations and existing data from the previous vertical well system. To maximize the efficiency and cost effectiveness of the system modification, ERM recommends installing one of the horizontal wells and operating it for a short period of time before installing the remaining wells. The well would be operated for approximately two weeks and the air flow, pressure drop, contaminant concentrations, and radius of influence would be monitored during that time to evaluate and optimize the well spacing and design. Once the design optimization is completed, the rest of the horizontal wells would be installed and brought on line as quickly as possible.

We anticipate initiating construction of the modified system within approximately 8 weeks (lead time for well materials) of receiving WDNR's approval to proceed. The construction activities (including operation of the first horizontal well) can be completed within approximately 5 weeks of initiating the construction. Prior to starting up the modified system, ERM will provide WDNR with an updated Operation, Maintenance and Monitoring (OM&M) Plan for the SVE system. The OM&M plan will include a description of the proposed shutdown criteria for the system, estimated period of operation, and the proposed confirmatory soil sampling program.

If you have any questions or comments regarding the proposed SVE system modifications, please do not hesitate to contact us.

Sincerely,

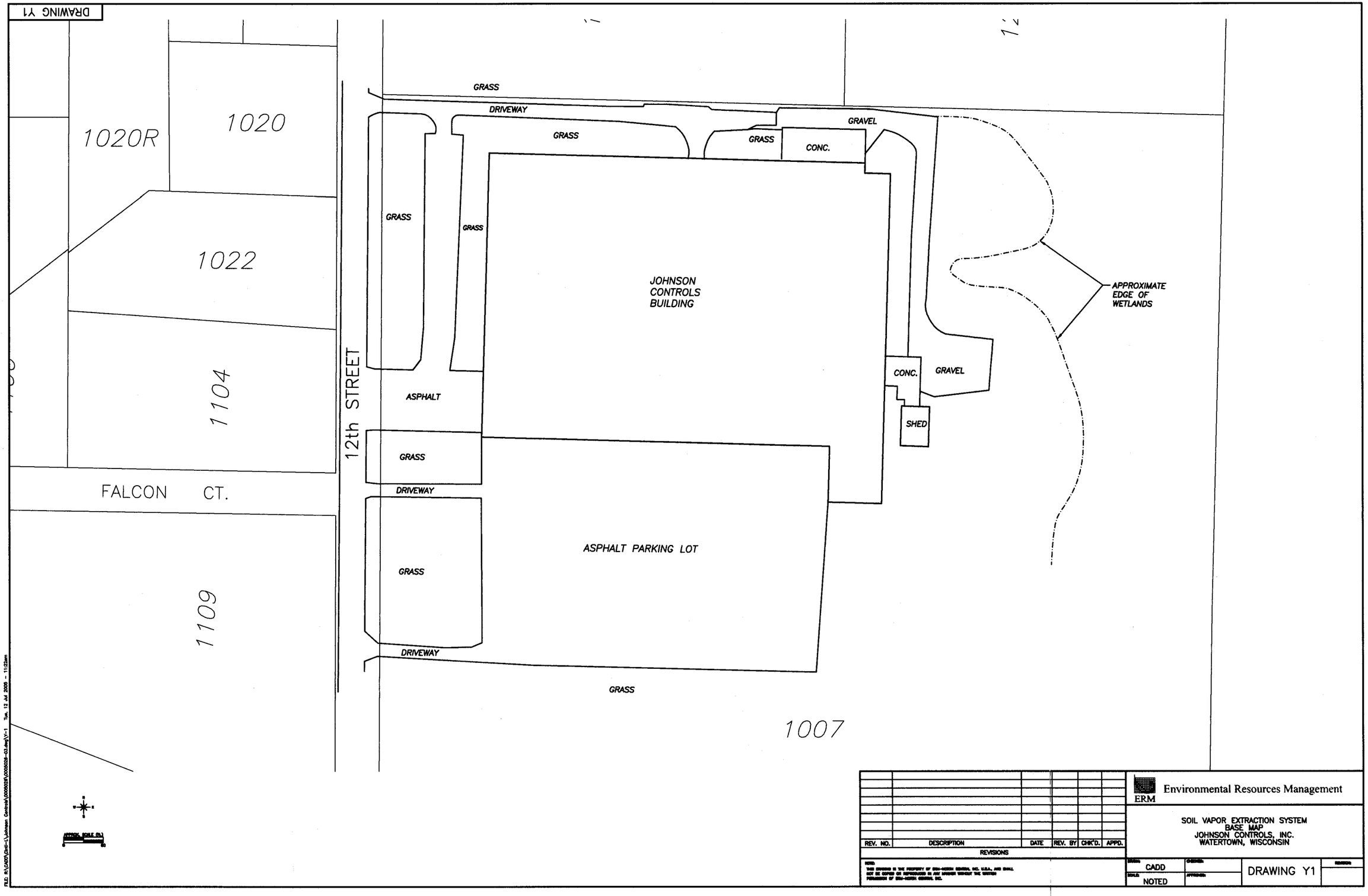
Environmental Resources Management, Inc.

Mark Seaman, P.E.
Senior Project Engineer

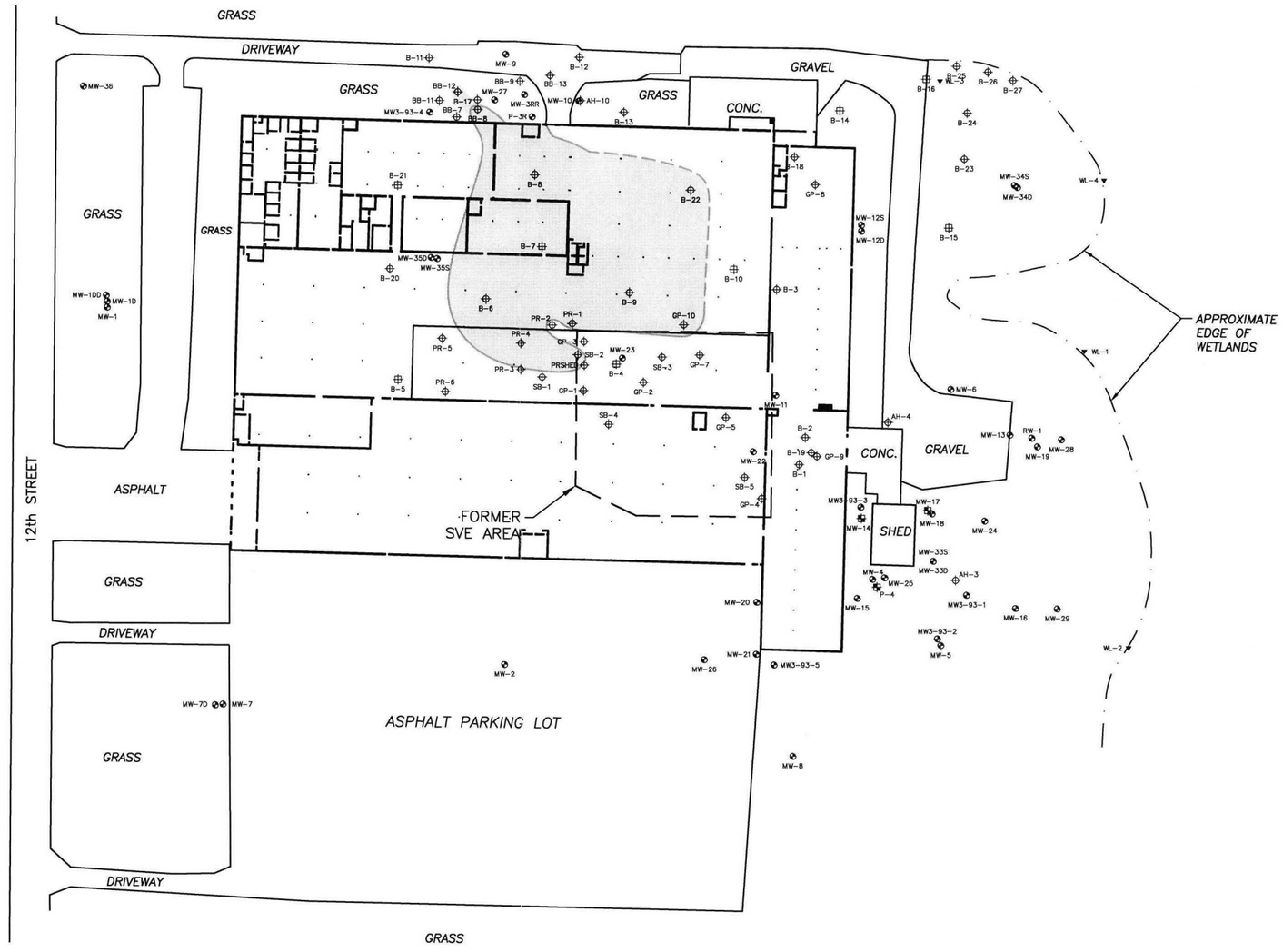
John Roberts, P.G.
Senior Project Manager

David Edwards, P.G.
Principal

cc: Jeff Werwie, Johnson Controls, Inc.
Brian Heysek, Johnson Controls, Inc.
Dennis Reis, Dennis Reis, LLC


DRAWING Y1
1020R
1020
1022
1104
1109
1007
FALCON CT.
12th STREET
GRASS
DRIVEWAY
GRASS
GRASS
CONC.
GRAVEL
GRASS
GRASS
JOHNSON CONTROLS BUILDING
APPROXIMATE EDGE OF WETLANDS
CONC.
GRAVEL
SHED
ASPHALT
GRASS
DRIVEWAY
GRASS
ASPHALT PARKING LOT
DRIVEWAY
GRASS
APPROX. SCALE (ft.)
REV. NO.
DESCRIPTION
DATE
REV. BY
CHK'D.
APPD.
REVISIONS
ERM
Environmental Resources Management
SOIL VAPOR EXTRACTION SYSTEM
BASE MAP
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN
CADD
NOTED
DRAWING Y1

DRAWING Y2



N
W E
S

KEY:

AST = ABOVE GROUND STORAGE TANK
TCE = TRICHLOROETHYLENE

APPROX. SCALE (ft.)
0 60

SYMBOL LEGEND

- MONITORING WELL LOCATION
- EXTRACTION WELL LOCATION
- SOIL BORING LOCATION
- TEMPORARY WELL LOCATION
- STAFF GAUGE LOCATION
- AREA OF SOIL VOC CONTAMINATION

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ERM Environmental Resources Management

SOIL VAPOR EXTRACTION SYSTEM
CONCEPTUAL TREATMENT AREA MAP
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

DRAWN:	CHECKED:		
CADD		DRAWING Y2	REVISION:
SCALE: NOTED	APPROVED:		

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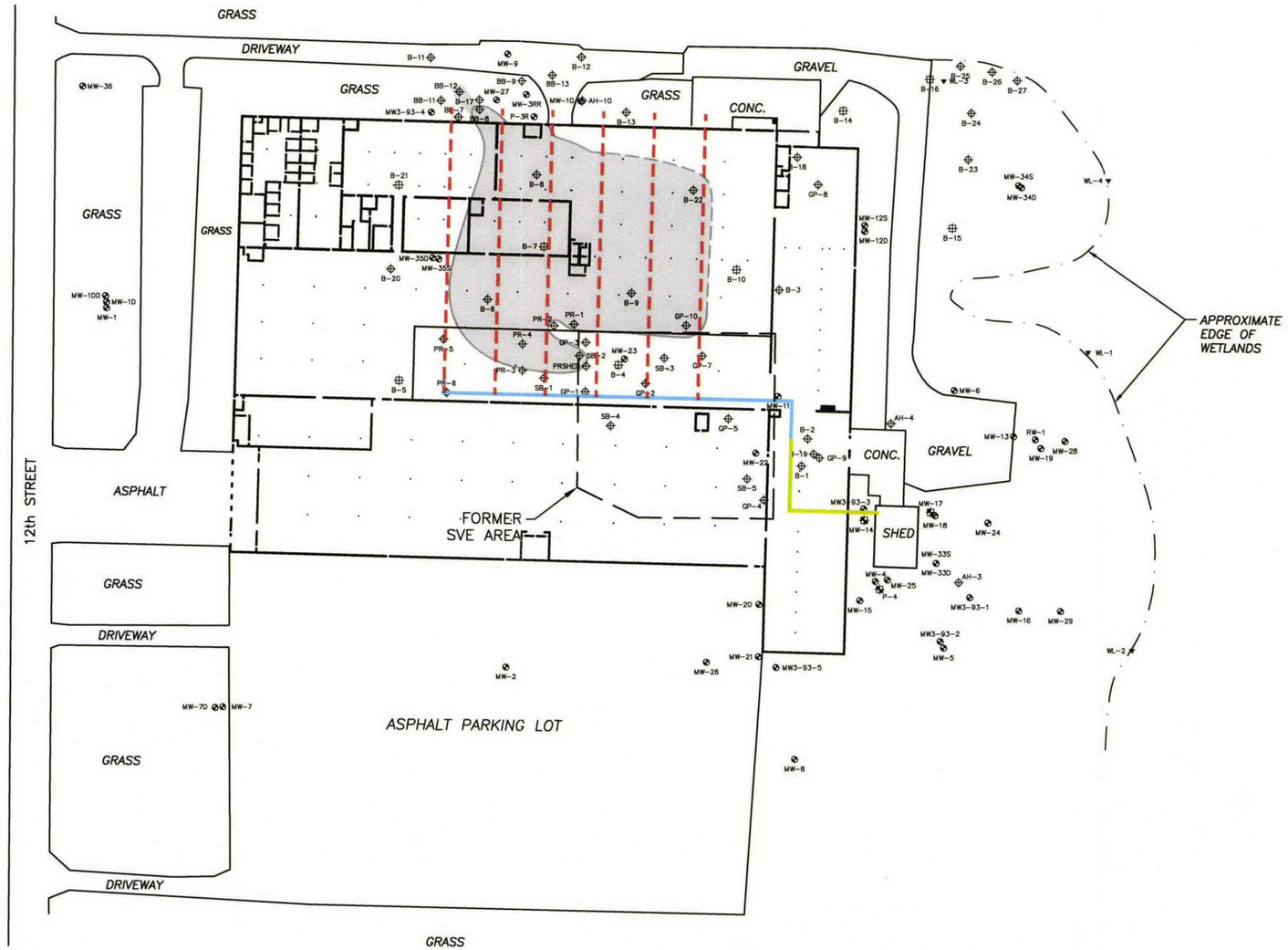
DRAWING Y3



N
W E
S

APPROX. SCALE (ft.)
0 120

SYMBOL LEGEND

- MONITORING WELL LOCATION
- EXTRACTION WELL LOCATION
- SOIL BORING LOCATION
- TEMPORARY WELL LOCATION
- STAFF GAUGE LOCATION
- EXISTING ABOVE GRADE TRANSMISSION PIPE
- PROPOSED ABOVE GRADE HEADER & TRANSMISSION PIPE
- PROPOSED SUB GRADE EXTRACTION PIPE

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SOIL VAPOR EXTRACTION SYSTEM
CONCEPTUAL SYSTEM LAYOUT PLAN
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

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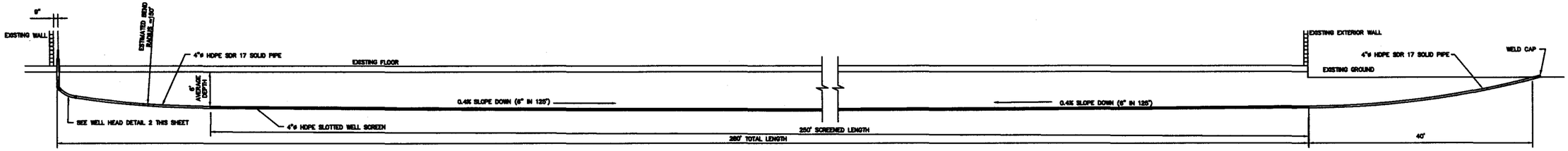
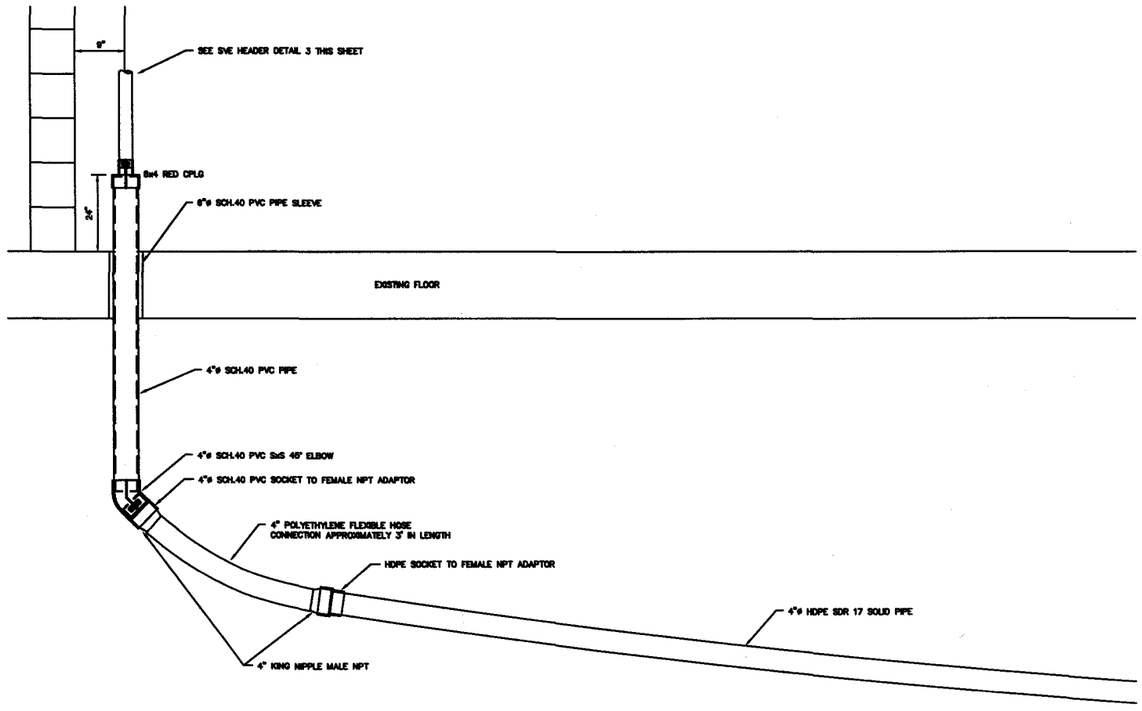
SCALE: NOTED	APPROVED:		

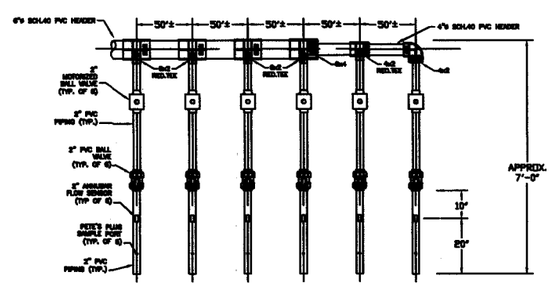
DRAWING Y4



1/Y4 TYPICAL HORIZONTAL WELL DETAIL
NOT TO SCALE



2/Y4 TYPICAL WELL HEAD DETAIL
NOT TO SCALE



3/Y4 SVE HEADER DETAIL
NOT TO SCALE

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ERM Environmental Resources Management

SOIL VAPOR EXTRACTION SYSTEM
MECHANICAL DETAILS
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

LEVEL	CHECKED		
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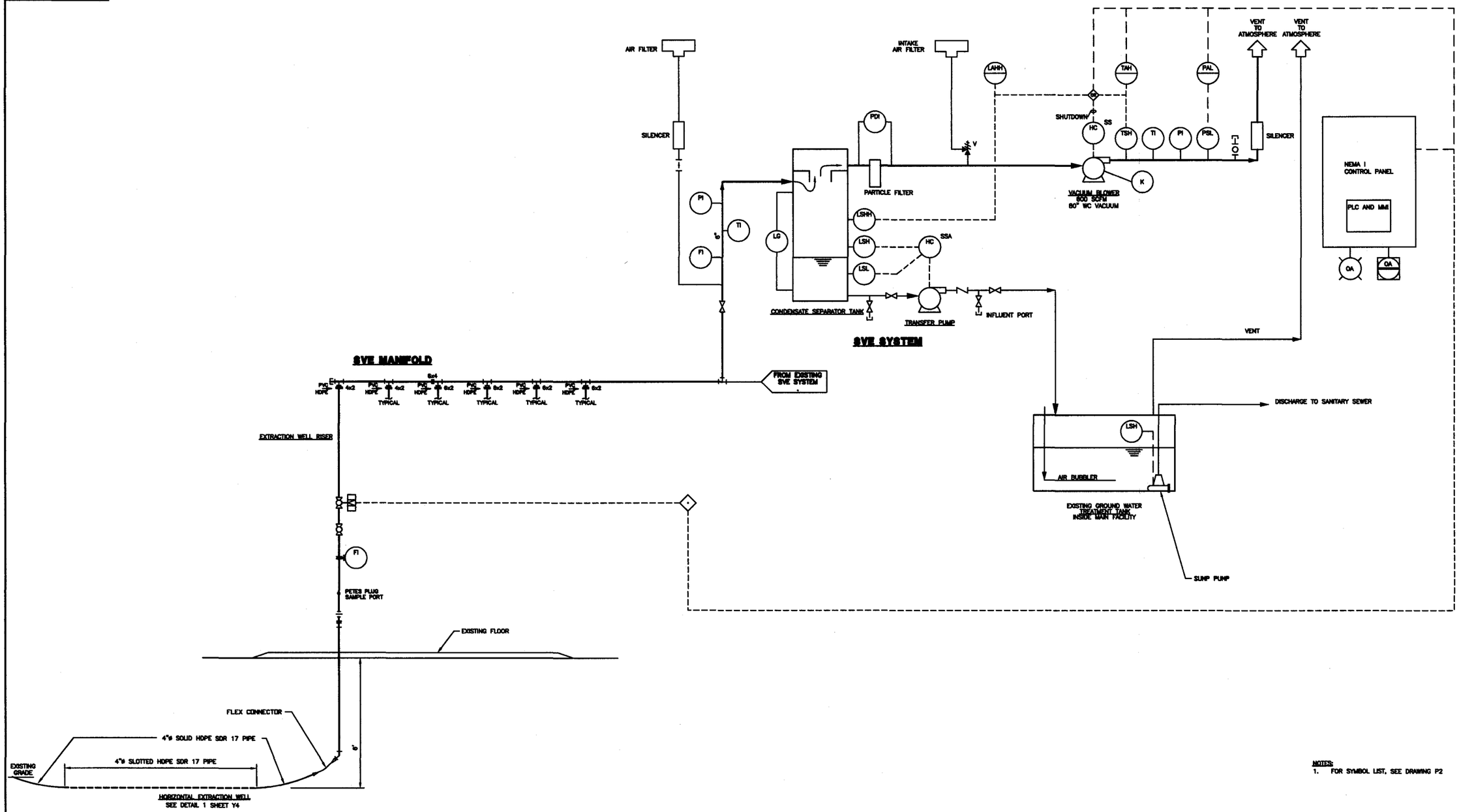
DRAWING P1



NOTES:
1. FOR SYMBOL LIST, SEE DRAWING P2

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Environmental Resources Management

SOIL VAPOR EXTRACTION SYSTEM
PIPING AND INSTRUMENTATION DIAGRAM
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

DRAWN	CHECKED	DRAWING P1	REVISION
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SCALE: NOT TO SCALE	APPROVED		

DRAWING P2

VALVES

NORMALLY OPEN	NORMALLY CLOSED	
		GLOBE VALVE
		BALL VALVE
		PLUG VALVE
		DIAPHRAGM VALVE
		NEEDLE VALVE
		METERING VALVE
		CHECK VALVE
		CHECK VALVE (PISTON OPERATED)
		CHECK VALVE (BALL TYPE)
		BUTTERFLY VALVE
		ANGLE VALVE
		3-WAY VALVE
		VACUUM RELIEF
		PRESSURE RELIEF
		LIQUID INJECTOR (LI)
		DEFROST RELIEF VALVE (DRV)
		HAND EXPANSION VALVE (HEV)

VALVE OPERATORS

NORMALLY OPEN	NORMALLY CLOSED	
		HANDWHEEL
		HANDLE OR WRENCH
		PRESSURE REDUCING
		BACK PRESSURE
		DIFFERENTIAL PRESSURE REGULATOR
		DIAPHRAGM
		SOLENOID
		ELECTRIC MOTOR
		GEAR
		HYDRAULIC
		PISTON
		THERMAL EXPANSION VALVE (TXV)
		FUSIBLE LINK VALVE

SYMBOLS

- PRIMARY FLOW
- SECONDARY FLOW
- AIR FILTER
- AIR LUBRICATOR
- FILTER-REGULATOR-LUBRICATOR UNIT
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- STRAINER 'Y' TYPE
- STRAINER
- STEAM TRAP
- AIR RELEASE
- STRAINER SINGLE BASKET
- STRAINER DUAL BASKET
- FLANGED ORIFICE ASSEMBLY
- METERED TUBE ORIFICE ASSEMBLY
- QUICK DISCONNECT (FEMALE)
- QUICK DISCONNECT (MALE)
- EJECTOR
- INSULATED
- INSULATED & ELECTRIC HEAT TRACED
- INSULATED & STEAM HEAT TRACED
- PROTECTIVE DIAPHRAGM
- RUPTURE DISK
- OPEN DRAIN OR OPEN SIGHT FUNNEL
- EXPANSION JOINT
- SIGHT GLASS
- PULSATION DAMPENER

EQUIPMENT

- POSITIVE DISPLACEMENT AIR COMPRESSOR
- POSITIVE DISPLACEMENT PUMP
- CENTRIFUGAL PUMP
- AIR OPERATED DOUBLE DIAPHRAGM PUMP
- VERTICAL SLURRY PUMP
- VERTICAL TURBINE PUMP
- SUBMERSIBLE PUMP
- TURBINE PUMP

INSTRUMENTATION

- MOUNTED LOCALLY AT EQUIPMENT OR LINE
- MOUNTED ON PRIMARY CONTROL PANEL FRONT
- MOUNTED ON AUXILIARY CONTROL PANEL FRONT
- MOUNTED INSIDE PRIMARY CONTROL PANEL
- MOUNTED INSIDE AUXILIARY CONTROL PANEL
- INDICATING LIGHT R-RED G-GREEN B-BLUE A-AMBER W-WHITE
- INSTRUMENT INCLUDED IN COMPUTER, MICRO PROCESSOR, OR PROGRAMMABLE CONTROLLER SYSTEM
- ALARM INDICATION AT REMOTE SUPERVISORY STATION
- INSTRUMENT CONNECTION OR UNSPECIFIED LINE
- INSTRUMENT AIR LINE
- CAPILLARY LINE
- ELECTRIC LINE
- HYDRAULIC TUBING

INTERLOCK

- AND — EFFECTIVE IF ALL INPUTS EXIST
- 1 — INTERLOCK LOGIC AS DEFINED
- OR — EFFECTIVE IF ONE OR MORE INPUTS EXIST

CONTROL

XX	CONTROL STATION
S	START
SS	START - STOP
LL	LEAD - LAG
OHA	OFF - HAND - AUTO
RL	RAISE - LOWER
TOR	TEST - OFF - REMOTE
MA	MANUAL - AUTO
OCA	OPEN - CLOSE - AUTO
RLA	REMOTE - LOCAL - AUTO
FSR	FORWARD - STOP - REVERSE
TOA	TEST - OFF - AUTO
SSL	START - STOP - LOCAL
TTOA	TELEMETER - TEST - OFF - AUTO
T	TEST
SSJ	START - STOP - JOG (REVERSE)
HLOA	HIGH - LOW - OFF - AUTO
OLP	OF - LOCAL - PLC

MEANINGS OF INSTRUMENT IDENTIFICATION LETTER

	FIRST LETTER: INITIATING VARIABLE MEASURED OR	FIRST LETTER: MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING LETTERS: OUTPUT FUNCTION	SUCCEEDING LETTERS: MODIFIER
A	ANALYSIS (pH, ETC.)		ALARM		
B	BURNER FLAME				
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	
D	DENSITY OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EFM)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAGING (DIMENSIONAL)		GLASS		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY				
N	NOISE				
O	MALFUNCTION		ORIFICE (RESTRICTION)		MIDDLE OR INTERMEDIATE
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VISCOSITY			VALVE, DAMPER OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	TORQUE				
Y	USER'S CHOICE			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

ABBREVIATIONS

EXTERNAL TO IDENTIFICATION SYMBOL

ALT	ALTERNATE	LSH	LEVEL SWITCH HIGH
AS	AIR SUPPLY	LSHH	LEVEL SWITCH HIGH HIGH
C	CLOSED	LSL	LEVEL SWITCH LOW
ES	ELECTRICAL	LSLL	LEVEL SWITCH LOW LOW
FC	FAIL CLOSED	NC	NORMALLY CLOSED
IA	INSTRUMENT AIR	NO	NORMALLY OPEN
KY	TIMER	O	OPEN
LC	LEVEL CONTROL	PI	PRESSURE INDICATOR
LG	LEVEL GAUGE	SP	SET POINT
LI	LEVEL INDICATOR	TE	TEMPERATURE ELEMENT
LL	LIQUID LEVEL	TI	TEMPERATURE INDICATOR

PROCESS ABBREVIATIONS

ATM	ATMOSPHERE
EQ	EQUALIZATION LINE
FG	FOUL GAS
HG	HOT GAS
LPL	LOW PRESSURE LIQUID
LPLS	LOW PRESSURE LIQUID SUCTION
O/S	OIL SEPARATOR
PO	PUMP OUT
SP	SET POINT
TR	TONS OF REFRIGERATION

NOTE:
1. THIS IS A GENERAL SYMBOL LIST; NOT ALL SYMBOLS MAY BE USED ON THESE DRAWINGS.

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ERM Environmental Resources Management

PIPING AND INSTRUMENTATION DIAGRAM
SYMBOL LIST
JONSON CONTROLS, INC.
WATERTOWN, WISCONSIN

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FKSR--			
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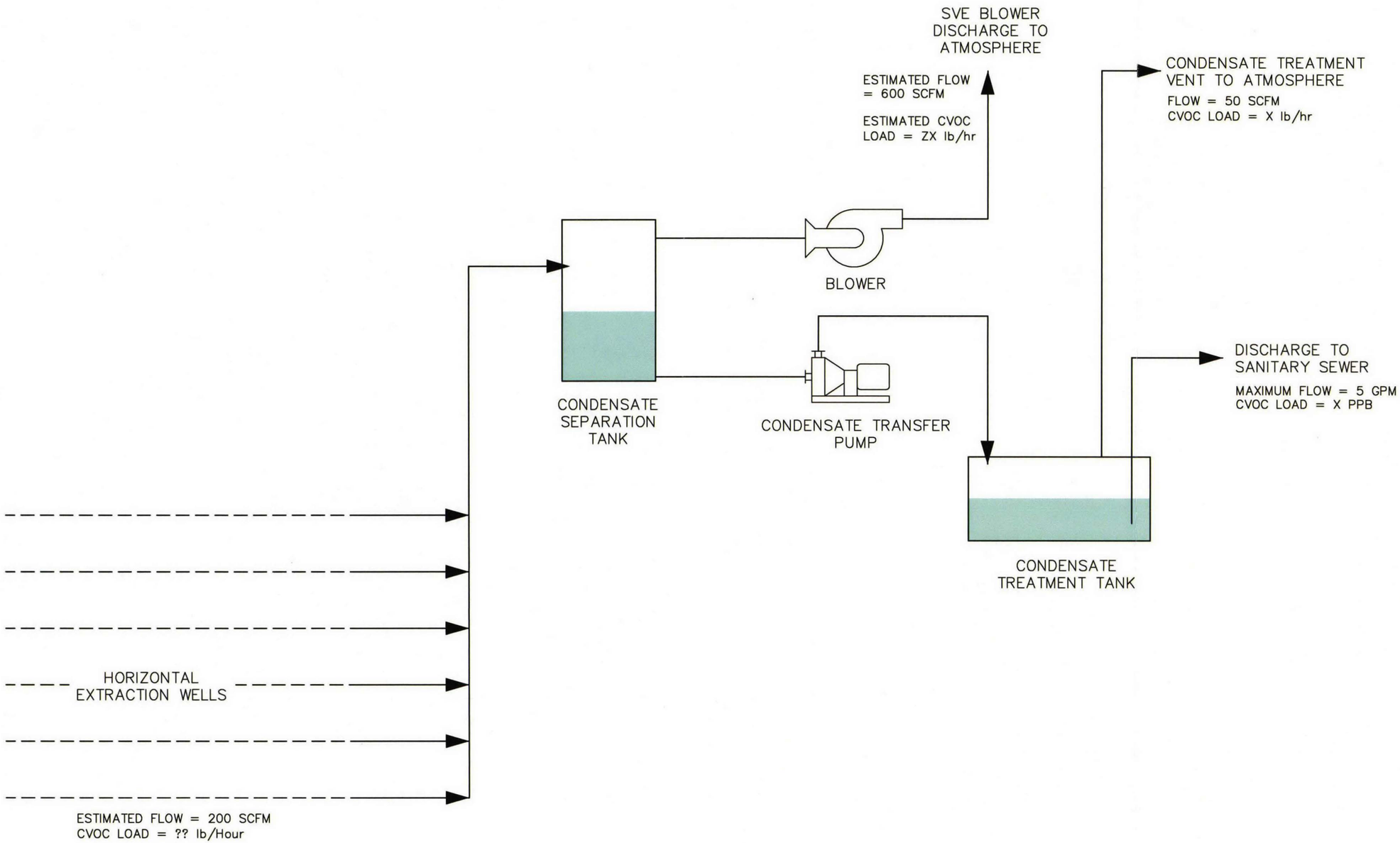

DRAWING P3

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ERM Environmental Resources Management

SOIL VAPOR EXTRACTION SYSTEM
SVE PROCESS FLOW DIAGRAM
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

DRAWN: FK SR
CHECKED:
SCALE: NOT TO SCALE
APPROVED:
DRAWING P3
REVISION:

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