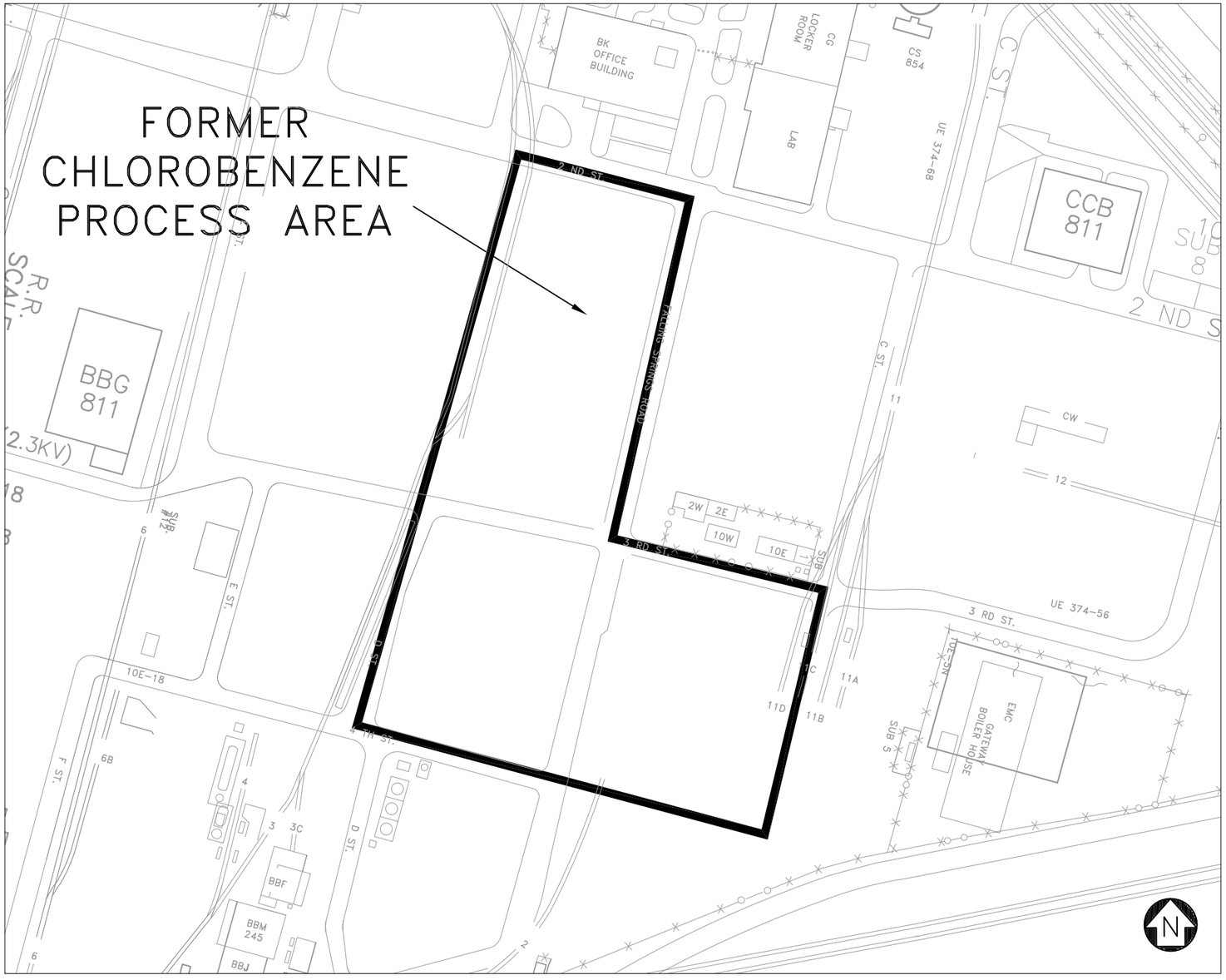
Figures

FULL – SCALE ENHANCED AEROBIC BIOREMEDIATION SYSTEM

W.G. KRUMMRICH FACILITY – SAUGET, IL



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75' 0' 75' 150'

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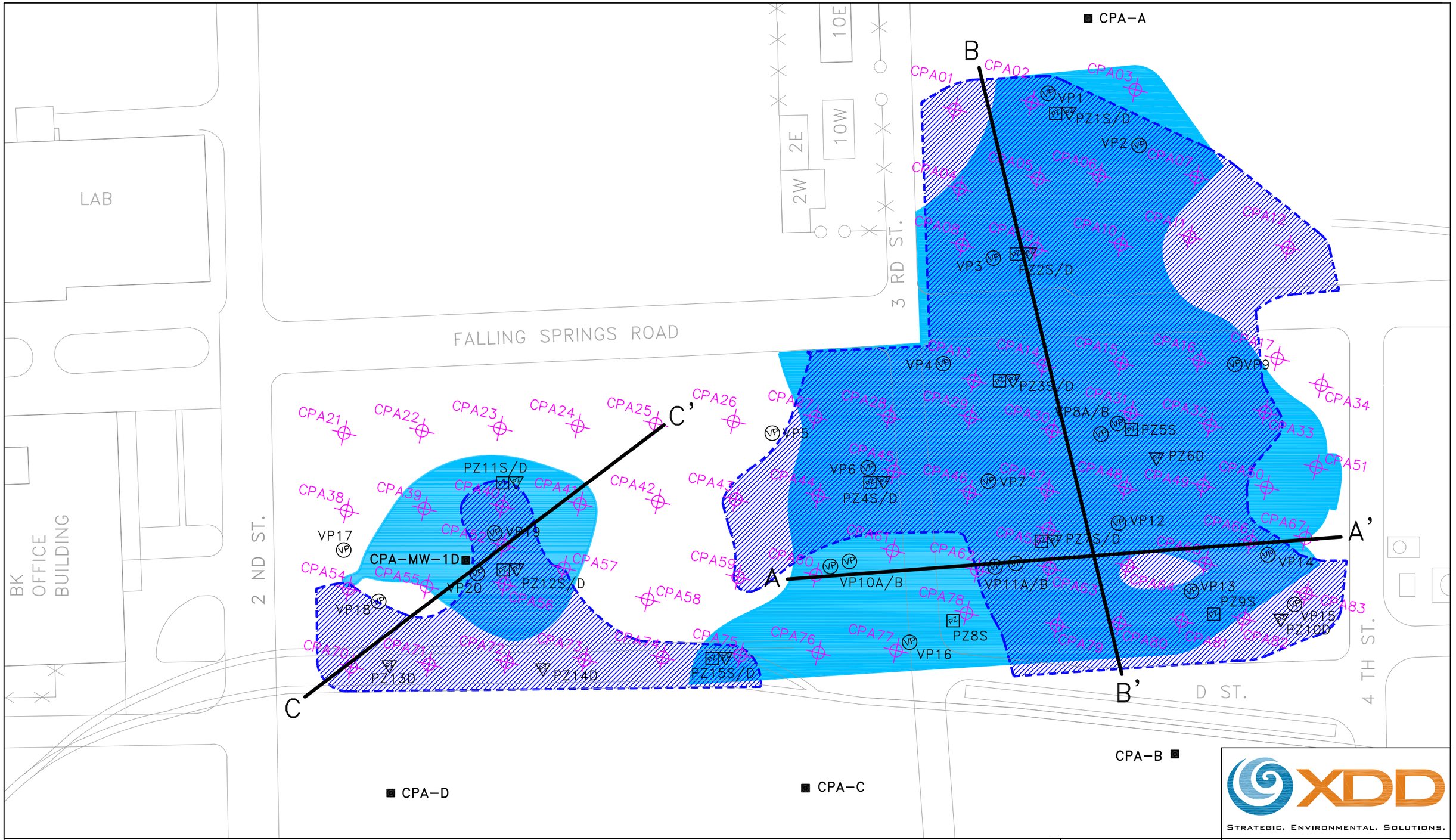
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: AS SHOWN	TITLE: SITE PLAN AND DRAWING INDEX W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 1
CHECKED BY: JMP	REV: 3
PROJ. MGMT. APPROVAL: JMP	



LEGEND:

- EXISTING MONITORING WELL/CLUSTER
- URS SOIL BORING (2009)
- 15–22 FOOT INTERVAL COC EXCEEDANCE AREA
- 22–30 FOOT INTERVAL COC EXCEEDANCE AREA
- SHALLOW PIEZOMETER LOCATION
- DEEP PIEZOMETER LOCATION
- SHALLOW AND DEEP NESTED VAPOR PROBE LOCATION
- CROSS–SECTION LOCATIONS (REFER TO FIGURES 3A THROUGH 3C)

30' 0' 30' 60'

NOTES:

- COC: CONTAMINANT OF CONCERN
- EABR: ENHANCED AEROBIC BIOREMEDIATION

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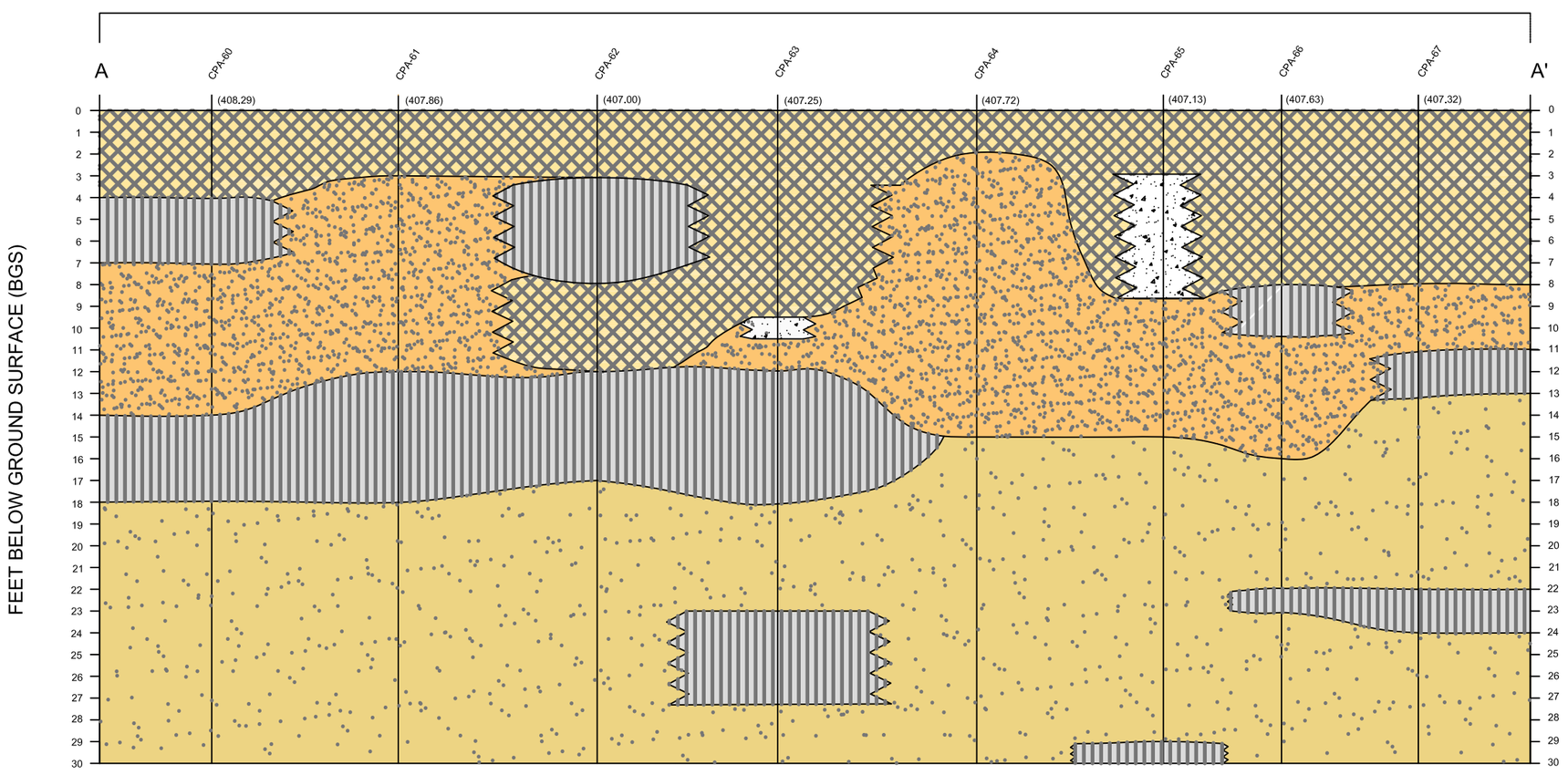
SCALE: AS SHOWN	TITLE: EABR TREATMENT AREA W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: LBC	
CHECKED BY: SCC	
PROJ. MGMT. APPROVAL: SCC	DRAWING NO.: FIGURE 2 — REV: 3

TREATMENT AREA



LEGEND:

- SANDY FILL/UPPER SILTY SAND LAYER
- SHALLOW HYDROGEOLOGIC UNIT
- INTERMEDIATE SILTY CLAY LAYER
- CONCRETE AND/OR CINDERS
- LOWER SILTY SAND LAYER

20' 0' 20' 40'
HORIZONTAL SCALE

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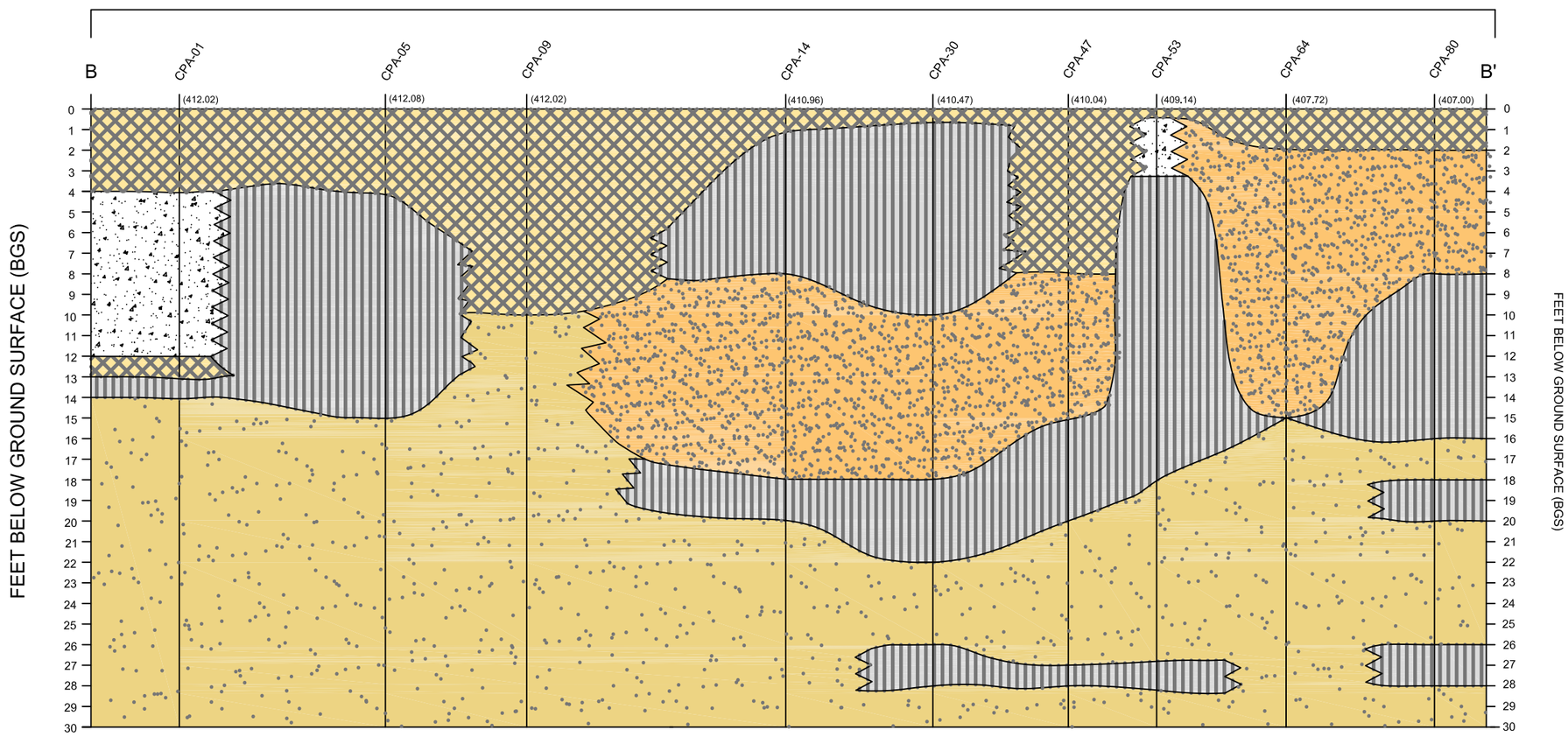
SCALE: AS SHOWN	TITLE: GEOLOGICAL CROSS SECTION A–A' W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: PC	DRAWING NO.: FIGURE 3A
CHECKED BY: ELS	REV: 1
PROJ. MGMT. APPROVAL: SC	

TREATMENT AREA



LEGEND:

- SANDY FILL/UPPER SILTY SAND LAYER
- SHALLOW HYDROGEOLOGIC UNIT
- INTERMEDIATE SILTY CLAY LAYER
- CONCRETE AND/OR CINDERS
- LOWER SILTY SAND LAYER

20' 0' 20' 40'
HORIZONTAL SCALE

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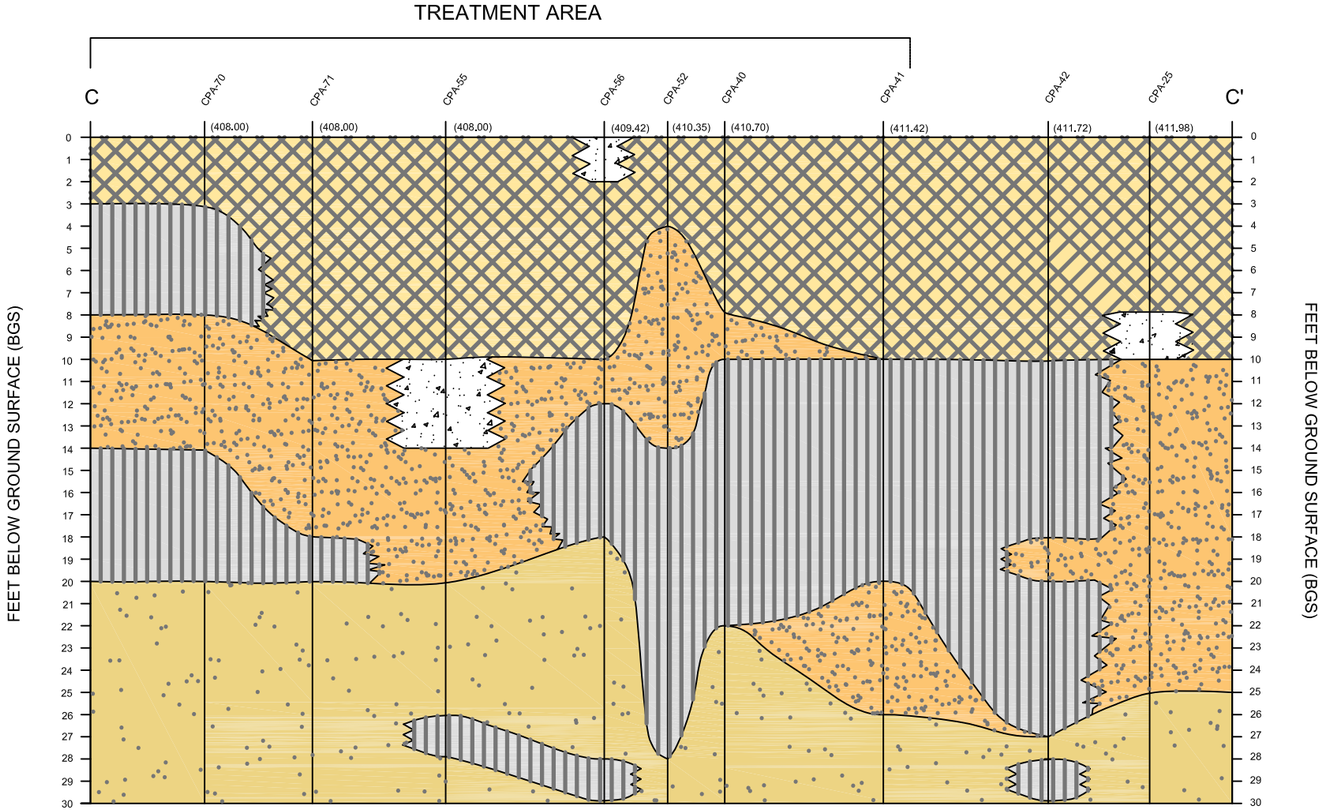
SCALE: AS SHOWN	TITLE: GEOLOGICAL CROSS-SECTION B-B' W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: PC	DRAWING NO.: FIGURE 3B
CHECKED BY: ELS	REV: 2
PROJ. MGMT. APPROVAL: SC	

TREATMENT AREA



LEGEND:

- SANDY FILL/UPPER SILTY SAND LAYER
- INTERMEDIATE SILTY CLAY LAYER
- LOWER SILTY SAND LAYER
- SHALLOW HYDROGEOLOGIC UNIT
- CONCRETE AND/OR CINDERS

20' 0' 20' 40'

HORIZONTAL SCALE

XDD

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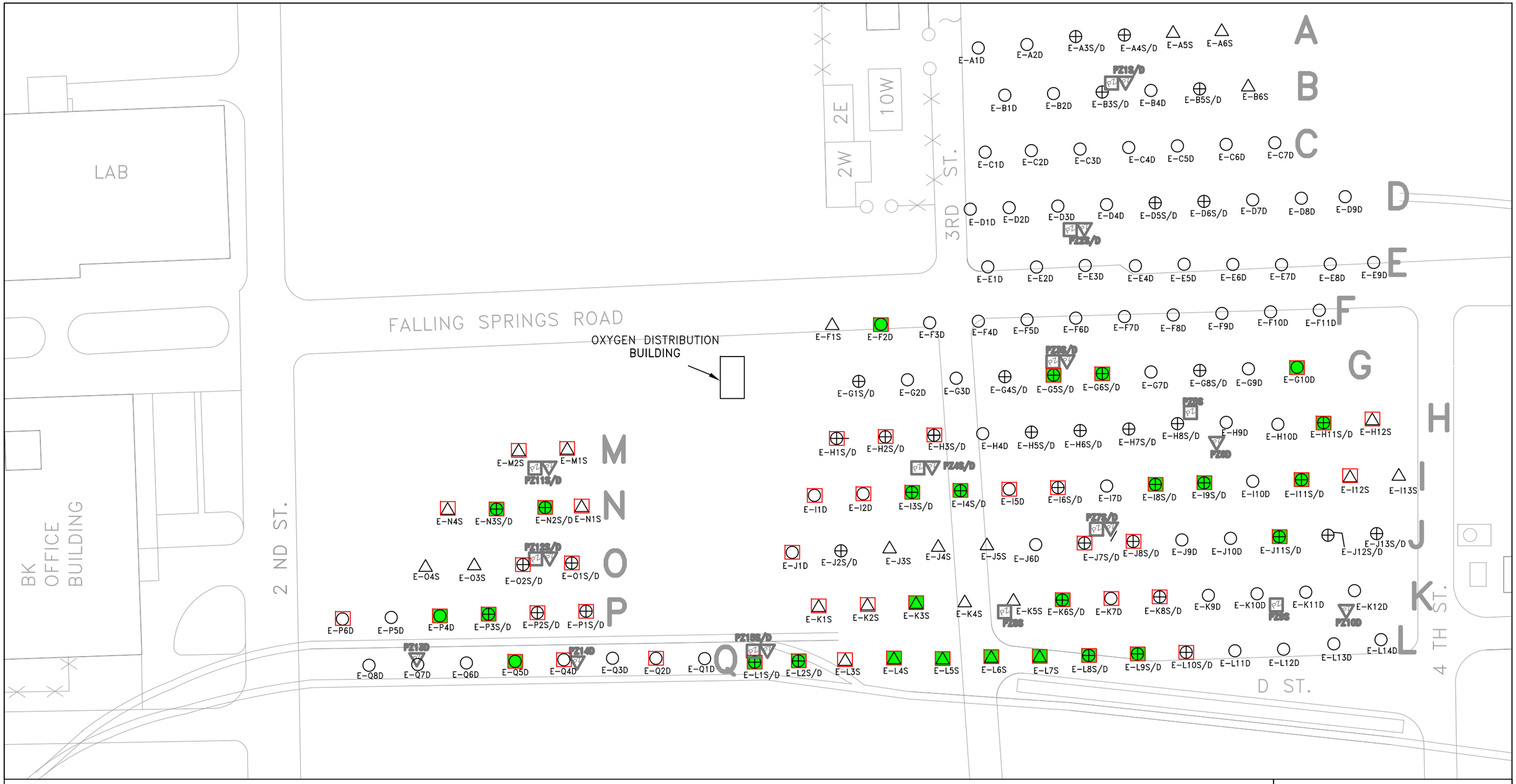
SCALE: AS SHOWN	TITLE: GEOLOGICAL CROSS-SECTION C-C' W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: PC	DRAWING NO.: FIGURE 3C
CHECKED BY: ELS	REV: 2
PROJ. MGMT. APPROVAL: SC	



LEGEND:

- △ EABR SHALLOW WELL LOCATION
- ○ EABR DEEP WELL LOCATION
- ⊕ EABR COMBINATION SHALLOW AND DEEP WELL LOCATION
- ⊕ PRE-BORING EABR LOCATION TO CONFIRM GEOLOGY PRIOR TO WELL INSTALLATION WITH SONIC
- ⊕ PRE-BORING EABR LOCATION TO CONFIRM GEOLOGY PRIOR TO WELL INSTALLATION WITH DPT
- PZ SHALLOW PIEZOMETER
- PZ DEEP PIEZOMETER

A ROW DESIGNATION

30' 0' 30' 60'

NOTES:

- EABR: ENHANCED AEROBIC BIOREMEDIATION
- T-SVE: THERMALLY ENHANCED SOIL VAPOR EXTRACTION

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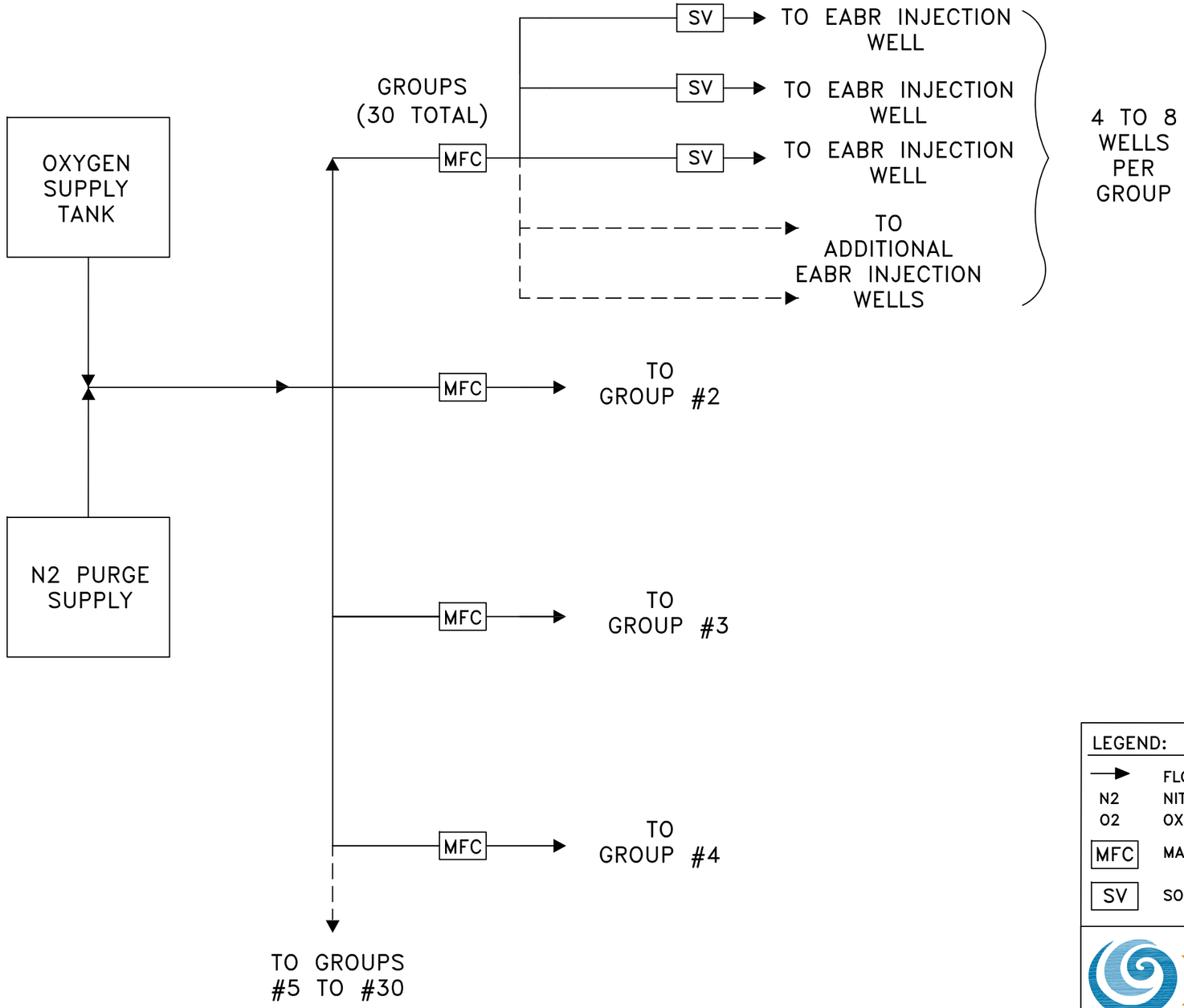
SCALE: AS SHOWN	TITLE: EABR WELL LOCATION MAP W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: FJS	DRAWING NO.: FIGURE 4
CHECKED BY: JMP	REV: 3
PROJ. MGMT. APPROVAL:	



LEGEND:

→	FLOW DIRECTION
N2	NITROGEN
O2	OXYGEN
MFC	MASS FLOW CONTROLLER
SV	SOLENOID VALVE

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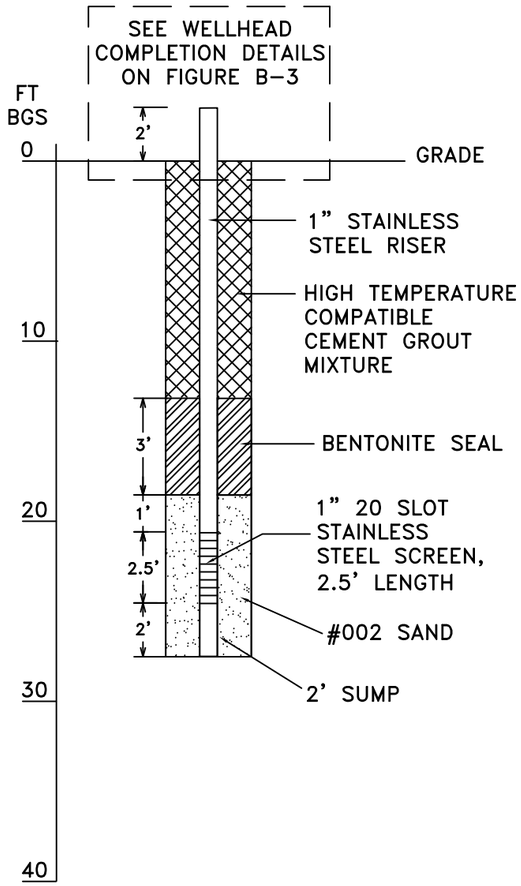
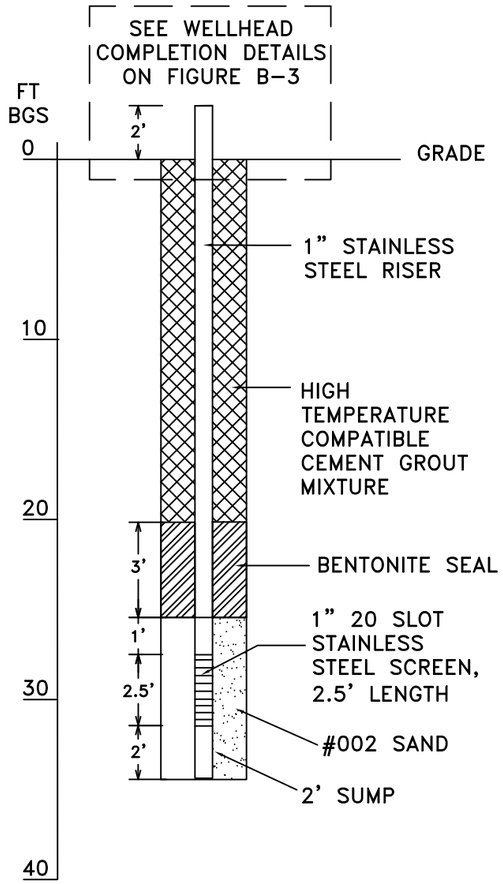
SCALE: NOT TO SCALE	TITLE: EABR SYSTEM PROCESS FLOW DIAGRAM W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: FJS	DRAWING NO.: FIGURE 5
CHECKED BY: JMP	REV: 1
PROJ. MGMT. APPROVAL: JMP	

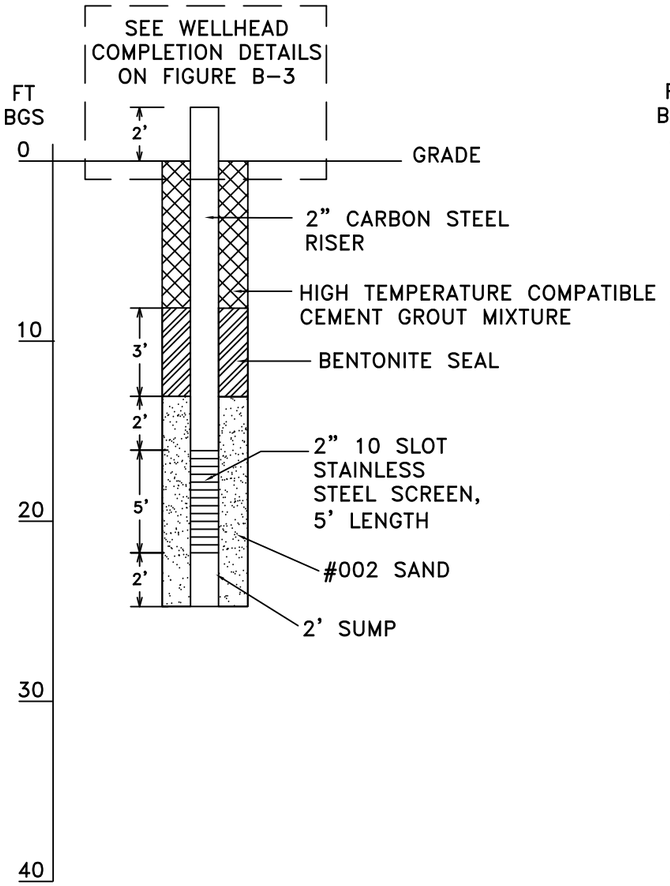
TYPICAL SHALLOW EABR WELL



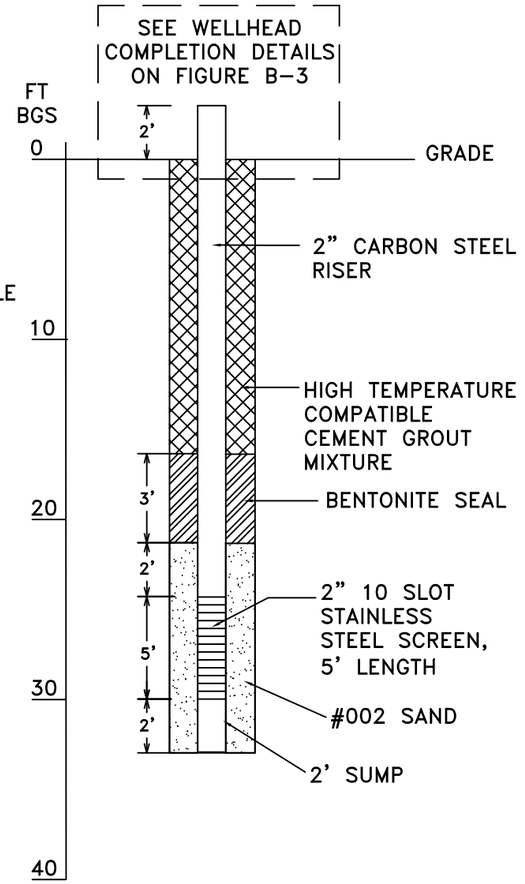
TYPICAL DEEP EABR WELL



TYPICAL SHALLOW PIEZOMETER



TYPICAL DEEP PIEZOMETER



NOTES:

- FT BGS = FEET BELOW GROUND SURFACE
- HORIZONTAL SCALE IS EXAGGERATED FOR DETAIL
- OXYGEN INJECTION WELL DEPTHS ARE SUBJECT TO CHANGE BASED ON SUBSURFACE CONDITIONS

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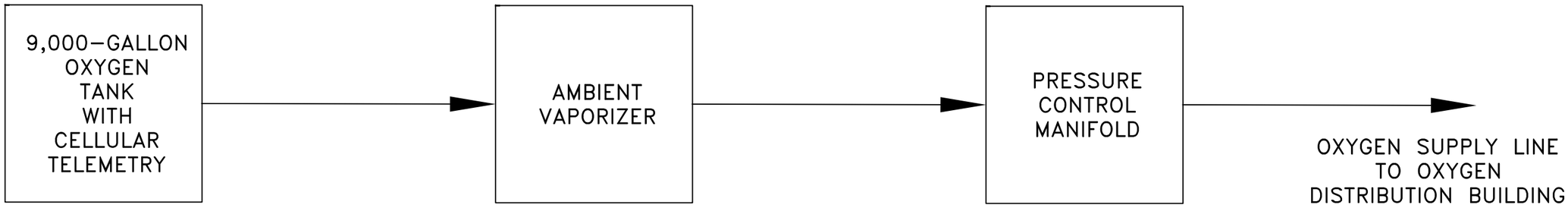
SCALE: NOT TO SCALE	TITLE: EABR WELL AND PIEZOMETER DESIGN CROSS-SECTION W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 6
CHECKED BY: JP	REV: 2
PROJ. MGMT. APPROVAL: SCC	



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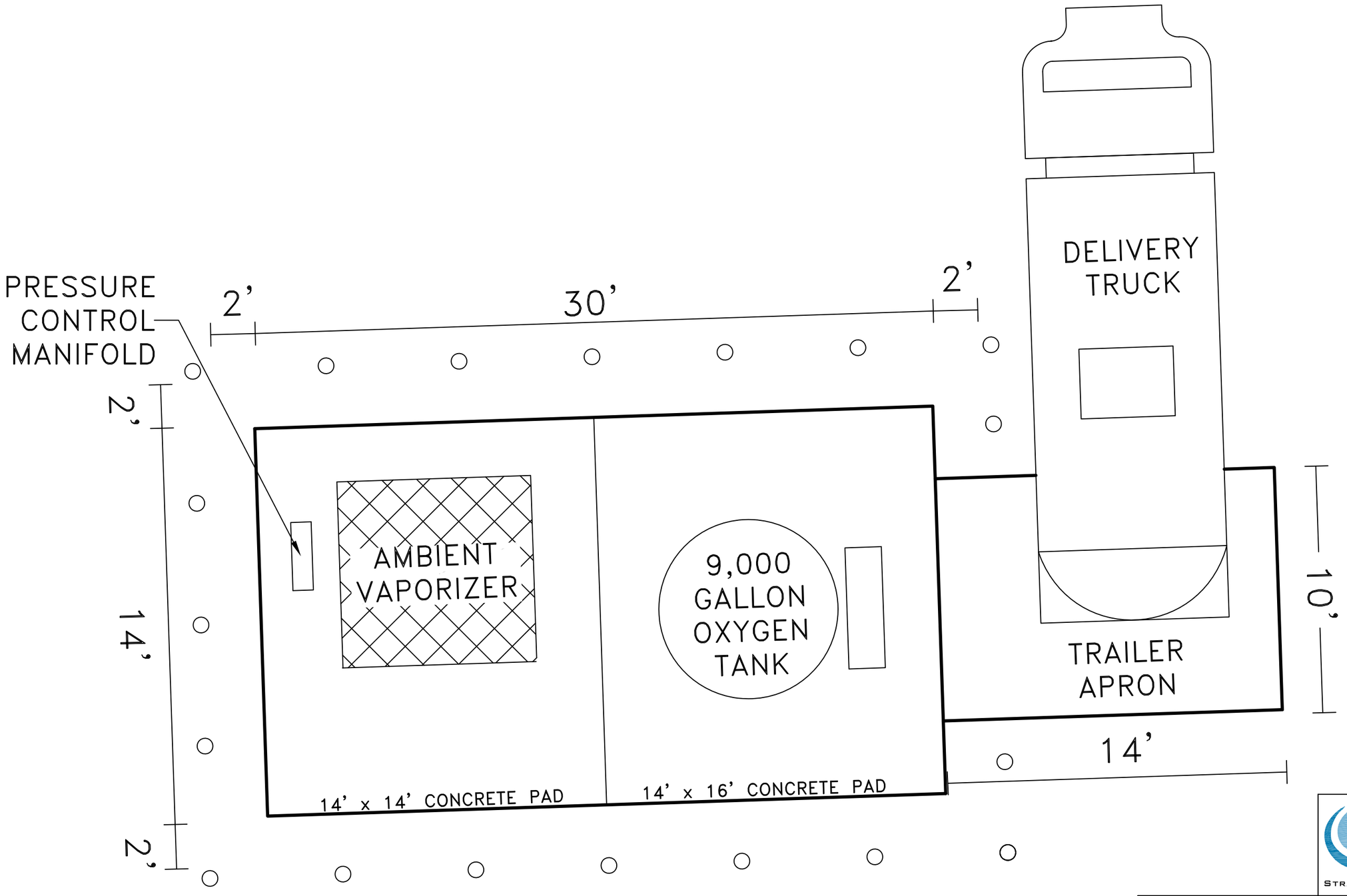
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

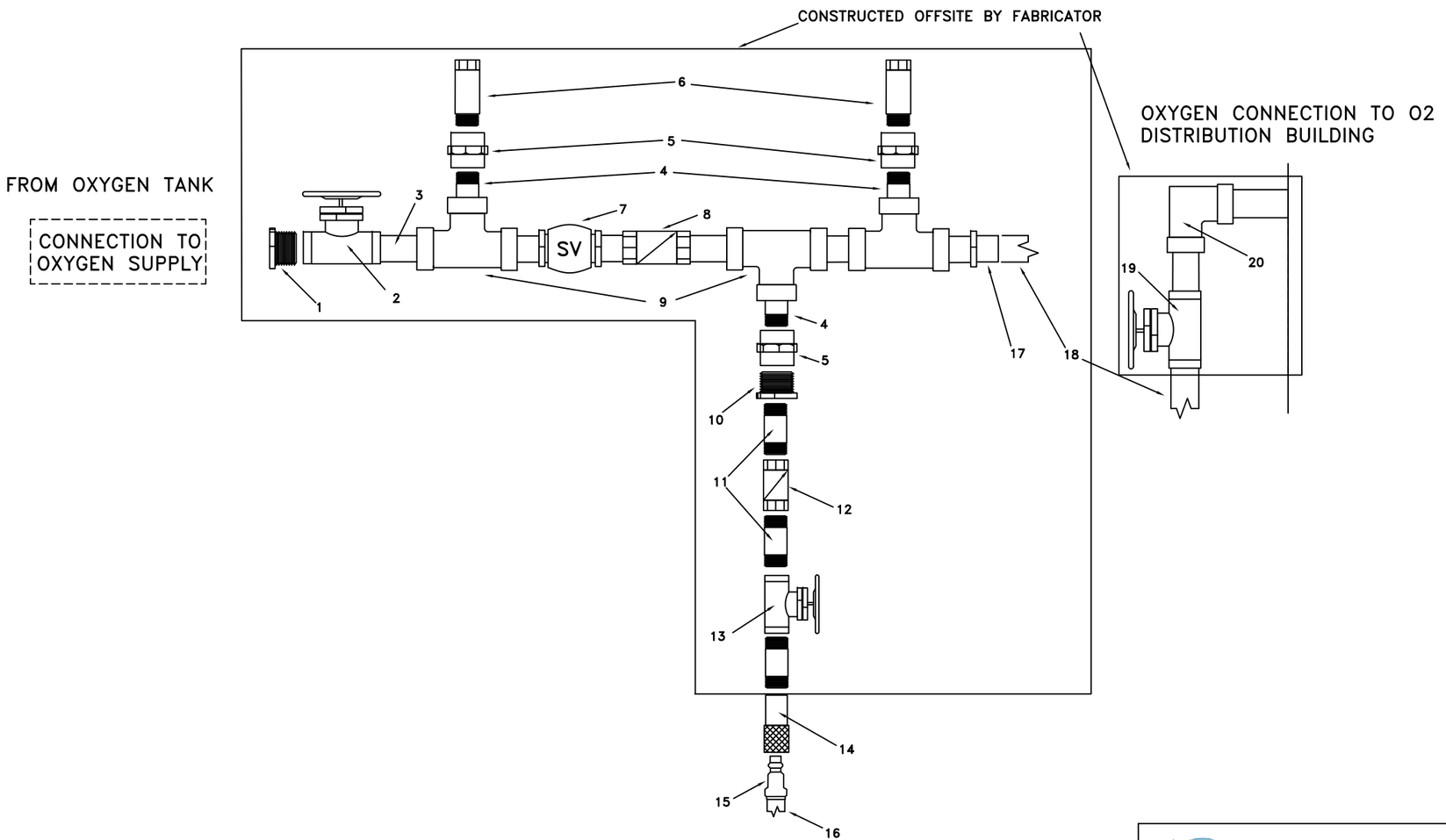
SCALE: NOT TO SCALE	TITLE: OXYGEN SUPPLY FLOW SCHEMATIC W,G. KRUMMRICH FACILITY, SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: JDA	DRAWING NO.: FIGURE 7
CHECKED BY: JMP	REV: 1
PROJ. MGMT. APPROVAL: JMP	



XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: NOT TO SCALE	TITLE: OXYGEN SUPPLY EQUIPMENT LAYOUT W,G. KRUMMRICH FACILITY, SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: JDA	DRAWING NO.: FIGURE 8 — REV: 1
CHECKED BY: JMP	
PROJ. MGMT. APPROVAL: JMP	

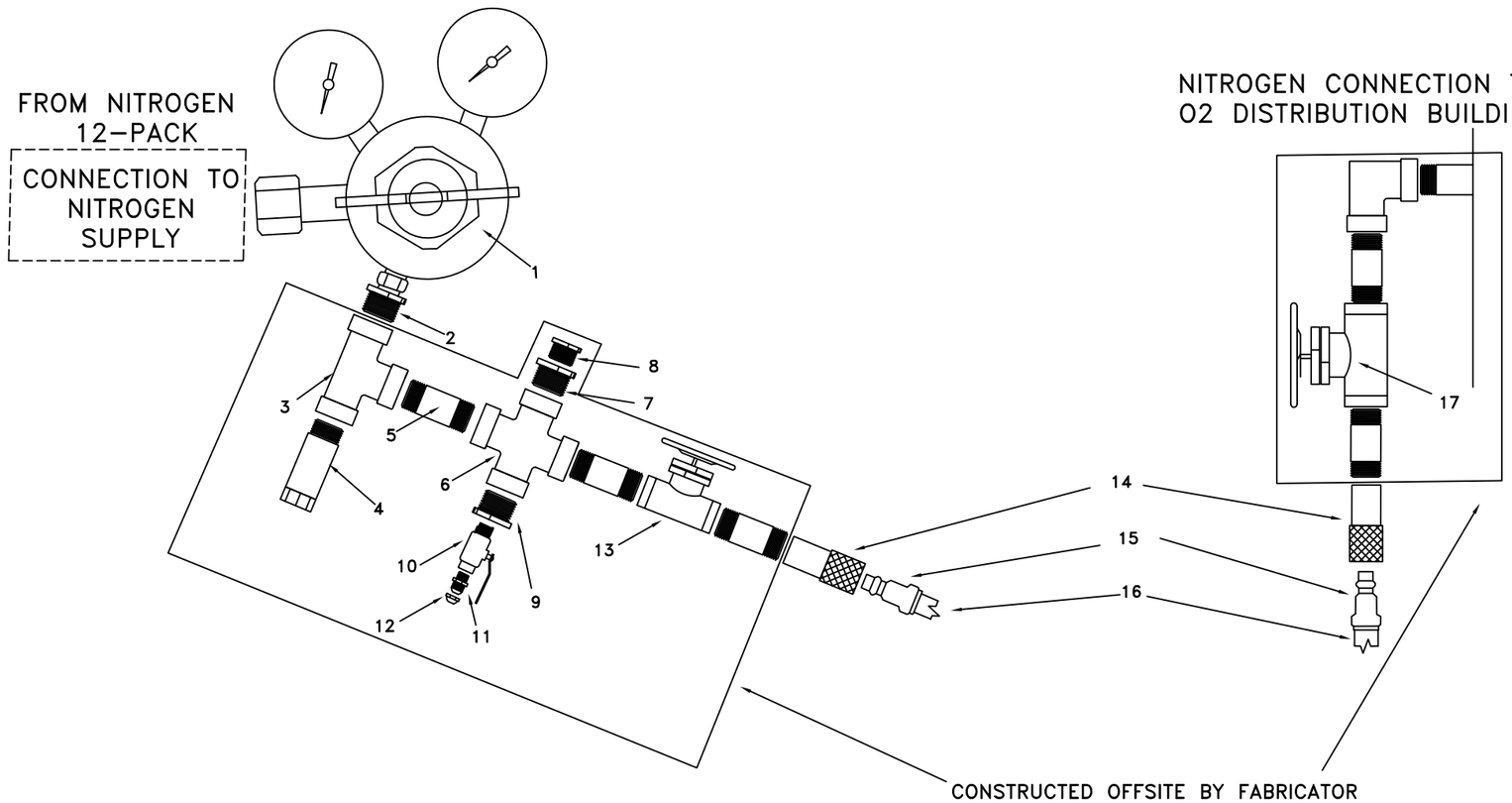
Main Oxygen Line Fittings	
Item	Description
1	1" to 1¼" Reducing Bushing
2	1¼" Female NPT X Female Socket Ball Valve with Oval Handle (Isolation Valve)
3	2" Female Socket X 1¼" Nipple (Soldered Connections)
4	2" Female Socket x 1¼" NPT Nipple (Soldered Connections)
5	1¼" Female NPT Brass Coupling
6	1¼" Male NPT Brass Pressure Relief Valve (Set at 100 psi)
7	1¼" Female NPT Brass Body Solenoid Valve (SIL Rated)
8	1¼" Female Check Valve (Soldered Connections)
9	1¼" Female Socket Pipe Tee (Soldered Connections)
10	1¼" to ¾" Hex Reducing Bushing
11	3" Male NPT x ¾" Male NPT Brass Nipple
12	¾" Female Check Valve
13	¾" Female NPT Ball Valve (Isolation Valve)
14	¾" Female NPT Industrial Socket Quick-Disconnect Hose Coupling
15	¾" Female NPT Industrial Plug Quick-Disconnect Hose Coupling
16	¾" Oxygen Cleaned Air Hose (onsite)
17	1½" x 1¼" Reducing Bushing (Soldered Connections)
18	1½" Flex Copper Tubing (Soldered Connections)
19	1½" Female Socket Ball Valve with Oval Handle (Isolation Valve)
20	1½" Female Socket Pipe Elbow (Soldered Connections)
	Notes: Whip-checks will be installed on all quick-connect fittings (onsite). Materials of construction shall be copper (Type K), brass or stainless steel that are compatible with and cleaned for oxygen service.



XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: NOT TO SCALE	TITLE: MAIN OXYGEN SUPPLY LINE DETAILS W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: FJS	DRAWING NO.: FIGURE 9
CHECKED BY: JMP	REV: 3
PROJ. MGMT. APPROVAL: JMP	

Main Nitrogen Line Fittings	
Item	Description
1	Smith Nitrogen Pressure Regulator (Set at 75 psi)
2	¾" to ½" Hex Reducing Bushing
3	¾" Female NPT Pipe Tee
4	¾" Male NPT Brass Pressure Relief Valve (Set at 100 psi)
5	2" Male NPT x ¾" Male NPT Nipple
6	¾" Female NPT Pipe Cross
7	¾" to ½" Hex Reducing Bushing
8	½" Fusible Plug (100 °C)
9	¾" Male NPT x ½" Female NPT Hex Reducing Bushing
10	½" Male NPT x Female NPT Ball Valve with Oval Handle
11	⅜" 45° Flare X ½" Male NPT Adapter
12	⅜" 45° Flare Cap
13	¾" Female NPT Ball Valve with Oval Handle (Isolation Valve)
14	¾" Female NPT Industrial Socket Quick–Disconnect Hose Coupling
15	¾" Female NPT Industrial Plug Quick–Disconnect Hose Coupling
16	¾" Oxygen Cleaned Air Hose (onsite)
17	¾" Female NPT Ball Valve with Oval Handle (Isolation Valve)
	Notes: Whip–checks will be installed on all quick–connect fittings (onsite). Materials of construction shall be copper (Type K), brass or stainless steel that are compatible with and cleaned for oxygen service.



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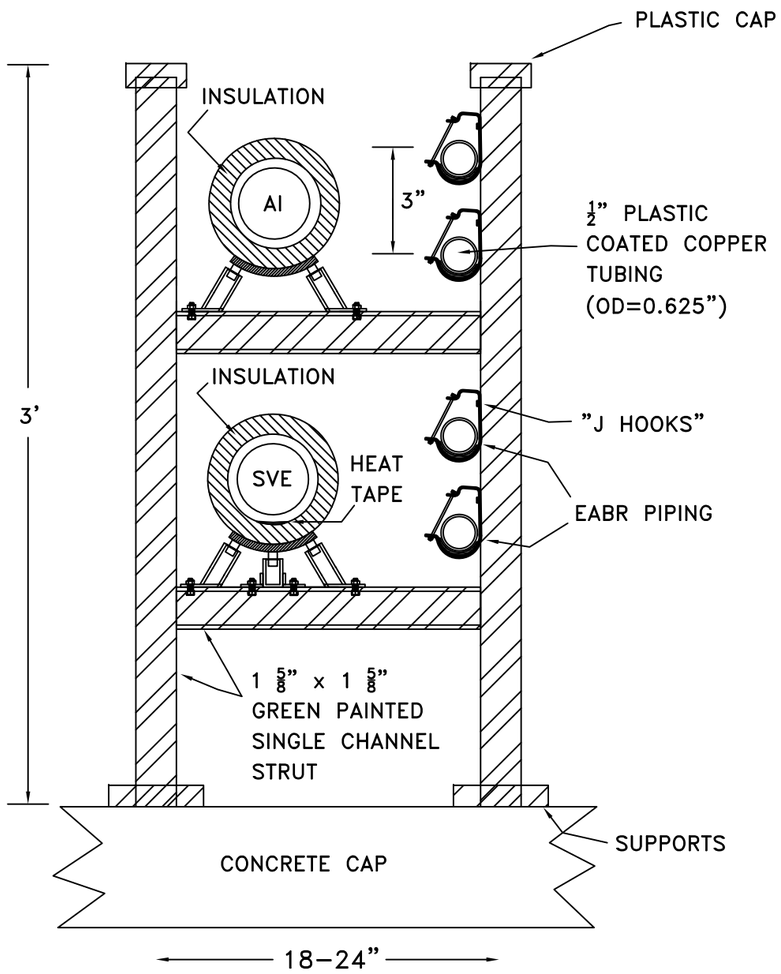
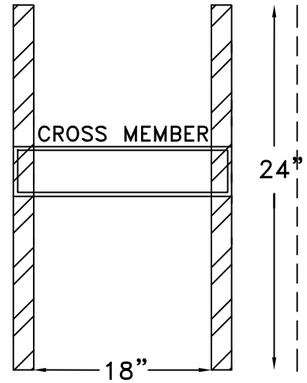
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

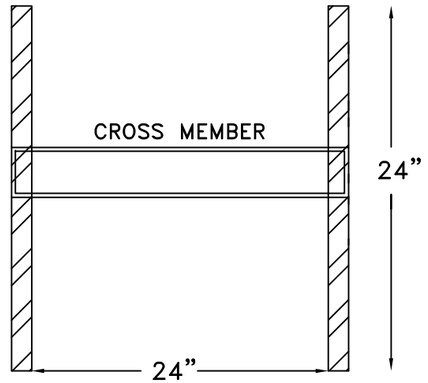
SCALE: NOT TO SCALE	TITLE: MAIN NITROGEN SUPPLY LINE DETAILS W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: FJS	DRAWING NO.: FIGURE 10
CHECKED BY: JMP	REV: 3
PROJ. MGMT. APPROVAL: JMP	

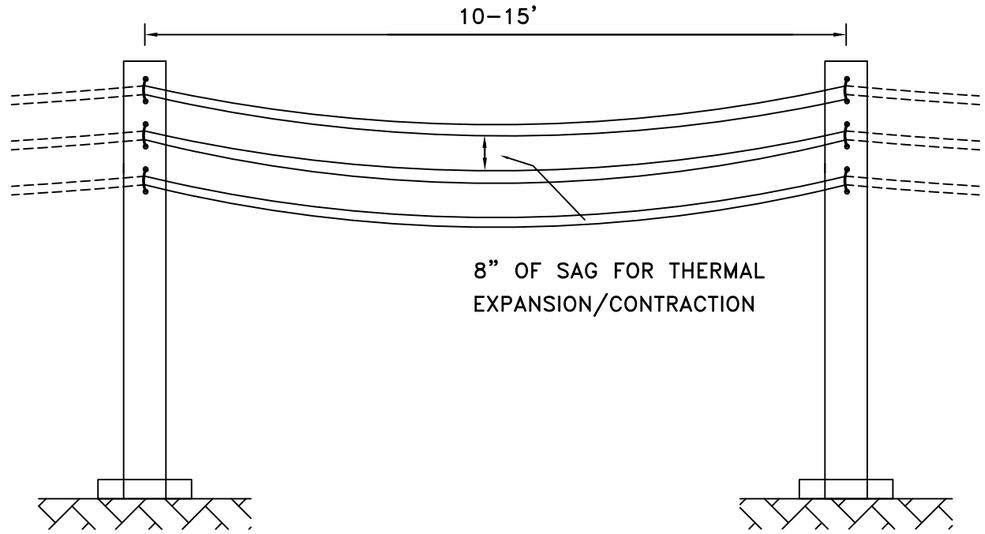


PLAN–VIEW LATERAL



PLAN–VIEW MAIN





NOTE:

- SUPPORT POSTS TO BE PLACED EVERY 10 TO 15 FEET
- ADDS A MINIMUM OF 6" EVERY 100 FEET FOR THERMAL EXPANSION/CONTRACTION

NOTES:

- AI = AIR INJECTION
- EABR = ENHANCED AEROBIC BIOREMEDIATION
- OD = OUTER DIAMETER
- SVE = SOIL VAPOR EXTRACTION
- ALL WELLHEADS (SVE AND SVE/AI) AND AI MANIFOLD PIPING WILL INSULATED.
- ALL SVE MANIFOLD PIPING WILL BE INSULATED AND HEAT TRACED FOR FREEZE PROTECTION.

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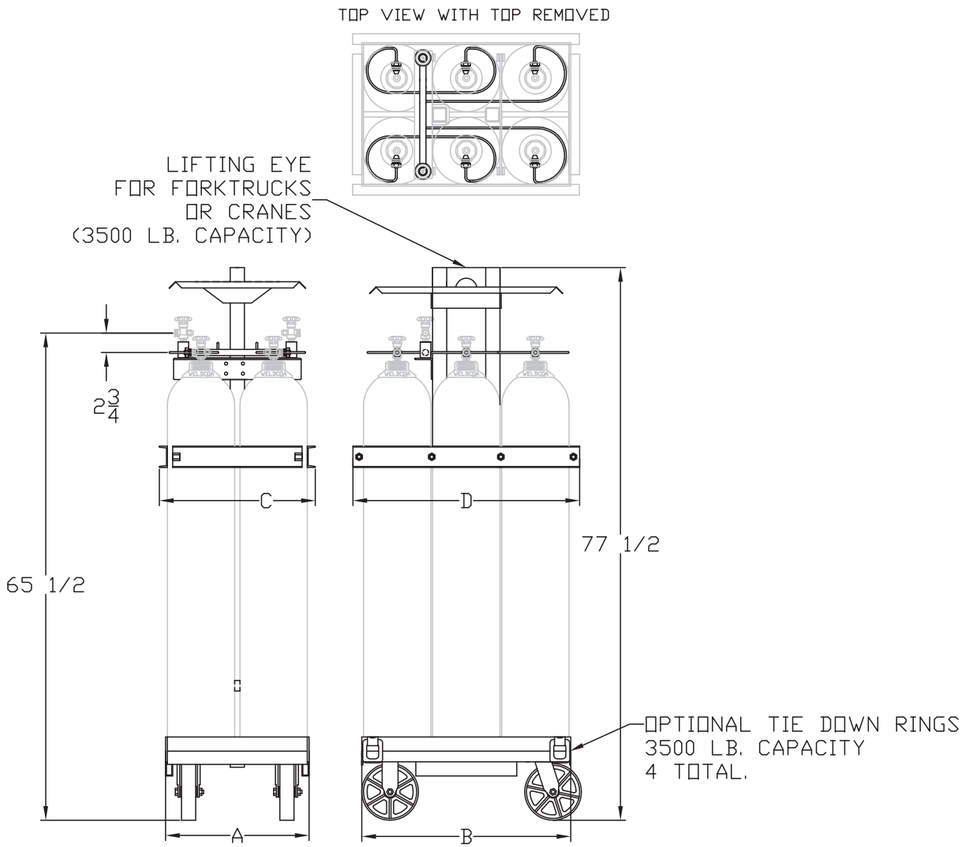
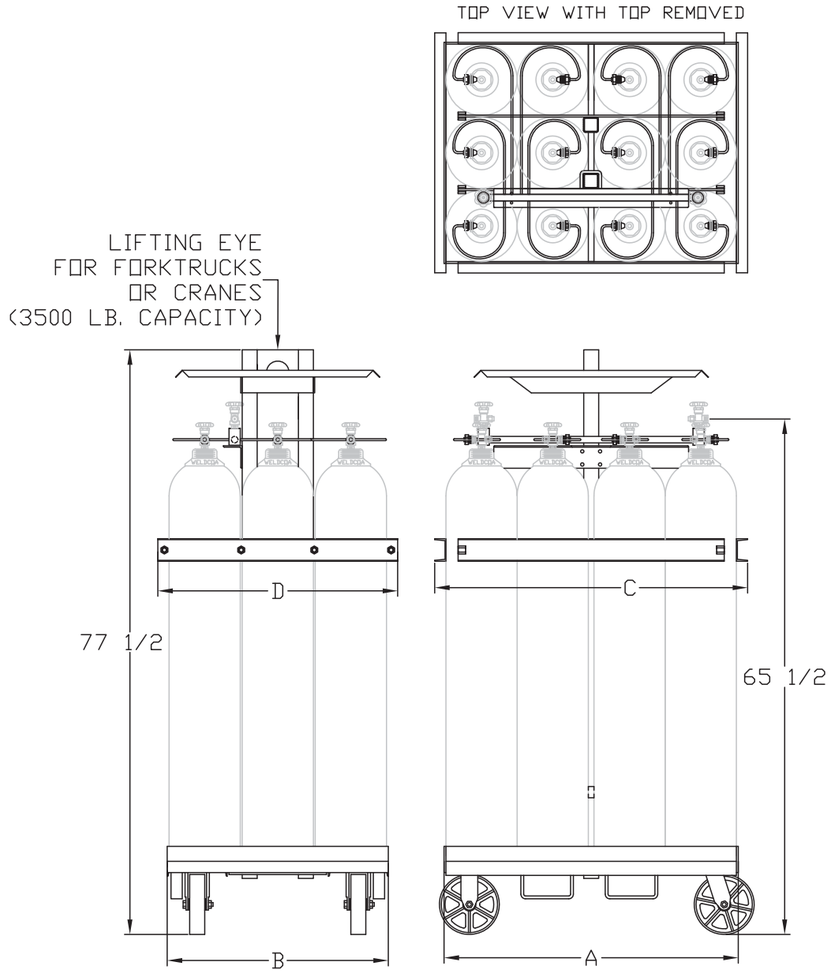
SCALE: NOT TO SCALE	TITLE: LATERAL PIPE SUPPORTS W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA, INC.	
DRAWN BY: LBC	DRAWING NO.: FIGURE 11
CHECKED BY: SCC	REV: 2
PROJ. MGMT. APPROVAL: SCC	



PART NUMBER	CYLINDER DIAMETER	A	B	C	D
LCS06-ASC	8.75"-9.5"	20.25"	29.5"	22"	32"
LCS06-BSC	9.5"-10"	21.25"	31"	23"	33.5"
LCS06-CSC	10"-10.5"	22.25"	32.5"	24"	35"

SHOWN WITH STAINLESS STEEL MANIFOLD
WITH STAINLESS STEEL LEADS
ALL DIMENSIONS ARE APPROXIMATE
(CYLINDERS NOT INCLUDED, ORDER MANIFOLD SEPARATELY)

WELDCOA 6 CYLINDER CART



PART NUMBER	CYLINDER DIAMETER	A	B	C	D	EMPTY WEIGHT*
LCS12-ASC	8.75"-9.5"	39.5"	29.5"	40.25"	32"	462 LB.
LCS12-BSC	9.5"-10"	41.5"	31"	42.25"	33.5"	468 LB.
LCS12-CSC	10"-10.5"	43.5"	32.5"	44.25"	35"	474 LB.

SHOWN WITH BRASS MANIFOLD
WITH STAINLESS STEEL LEADS
ALL DIMENSIONS ARE APPROXIMATE
(CYLINDERS NOT INCLUDED)

*WITHOUT MANIFOLD

WELDCOA 12 CYLINDER CART

FIGURE 12 NITROGEN SUPPLY EQUIPMENT LAYOUT

OXYGEN SUPPY TANK
OT101

NITROGEN PURGE SUPPLY
NS101

INSIDE OXYGEN DISTRIBUTION BUILDING

VENT OUTSIDE BUILDING

SV001 BV001 BV101 PR101 CV101 PRV101

BV002 BV102 PR102 CV102

BV105 BV106 BV107

TEE/VENTED TO OUTSIDE

SV101 SV102 R I

TT101 TI101 FS/FT101 PT101 PI101

1.5" COPPER PIPE

OS102 OS101 EF IL POW

ELECTRICAL PANEL

BV108 BV109 BV110

TEE/VENTED TO OUTSIDE

INSIDE OXYGEN DISTRIBUTION BUILDING

TYPICAL A TOTAL OF 30 MANIFOLD LEGS

0.5" COPPER PIPE

TO LATERAL D GROUP 2
BV205 MFC205 3WV205 RM205 3WV305 PT205 PI205 FS205

TO LATERAL D GROUP 1
BV204 MFC204 3WV204 RM204 3WV304 PT204 PI204 FS204

TO LATERAL C
BV203 MFC203 3WV203 RM203 3WV303 PT203 PI203 FS203

TO LATERAL B
BV202 MFC202 3WV202 RM202 3WV302 PT202 PI202 FS202

TO LATERAL A
BV201 MFC201 3WV201 RM201 3WV301 PT201 PI201 FS201

TO WELLFIELD

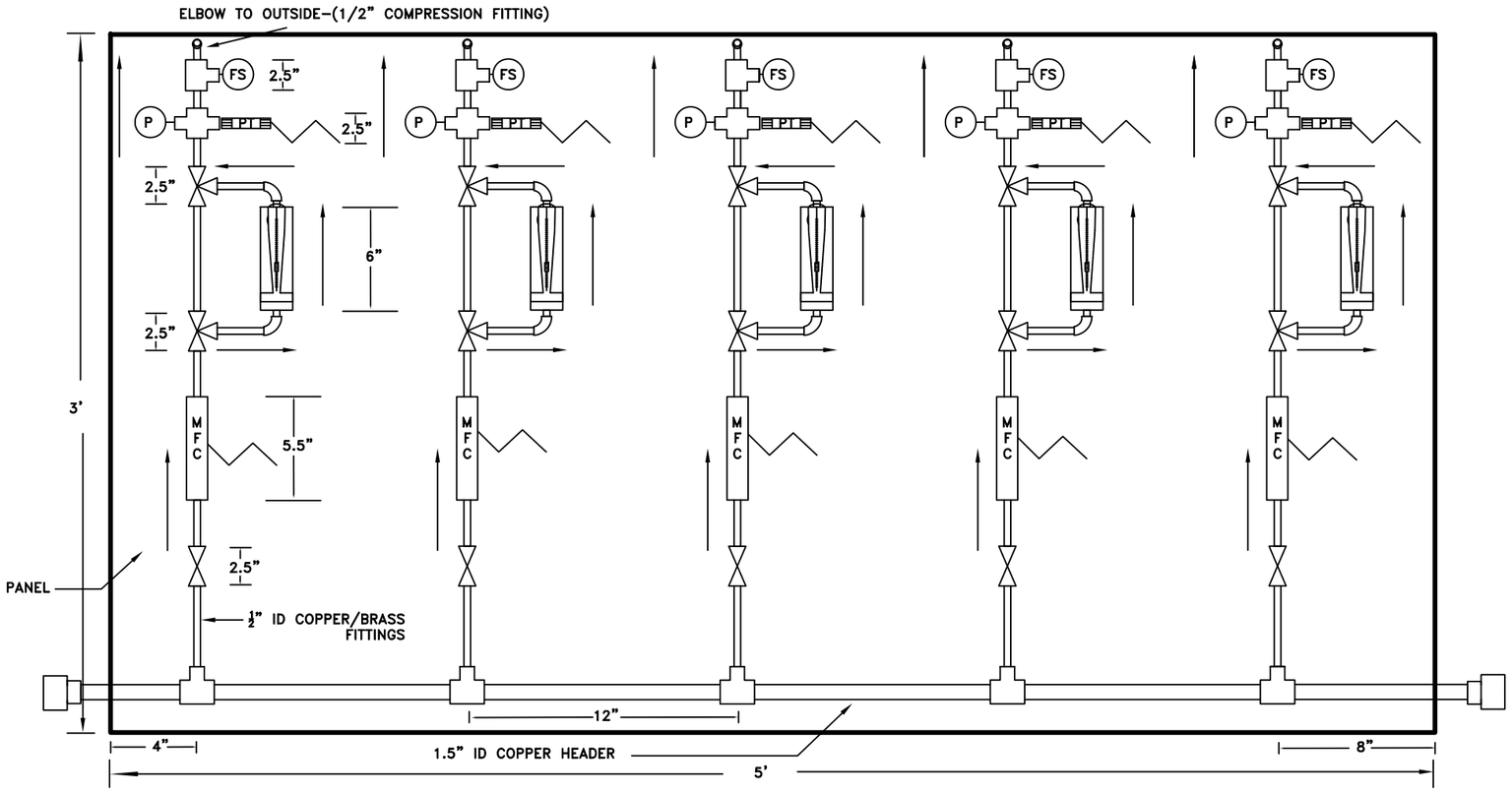
0.5" COPPER TUBING

LEGEND:

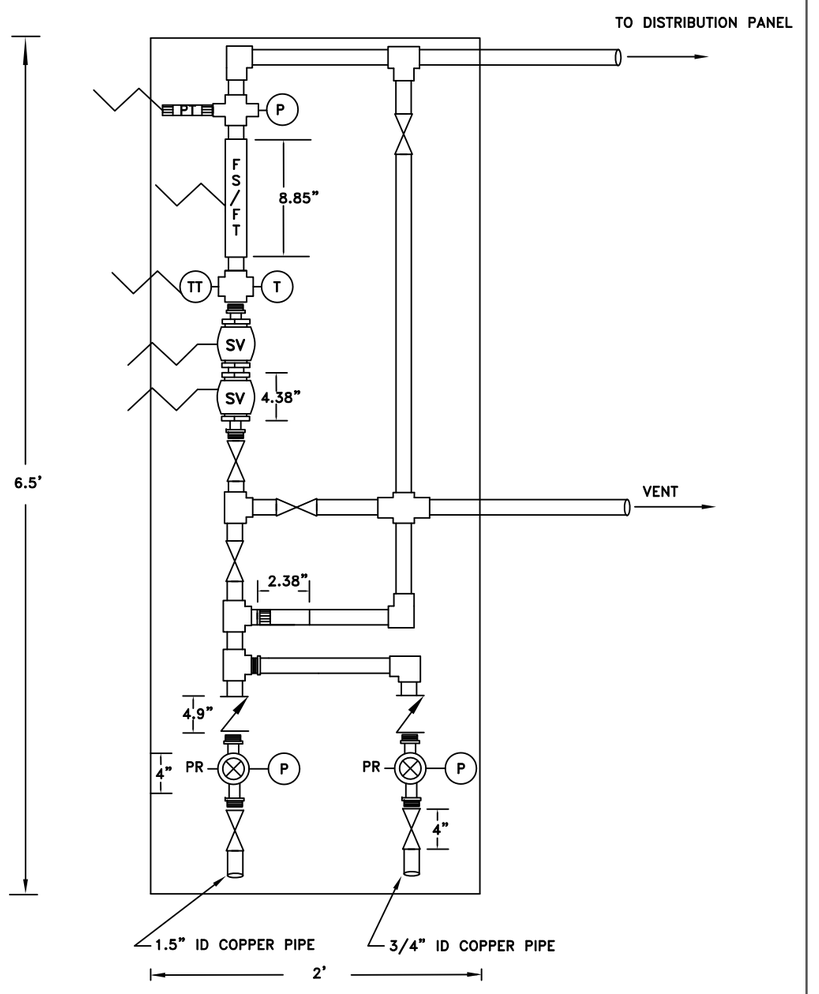
- PIPING
- BV – BALL VALVE
- CV – CHECK VALVE
- I – INDICATOR LIGHT
- MFC – MASS FLOW CONTROLLER
- PLC – PLC CONNECTION
- PRV – PRESSURE RELIEF VALVE
- R – REDUCER
- RELAY CONNECTION (REDUNDANT CONTROL SYSTEM FOR SHUTDOWN)
- ROTAMETER
- SV – SOLENOID VALVE
- 3WV – THREE WAY VALVE
- FS – FLOW SWITCH
- FT – FLOW TRANSDUCER
- PI – PRESSURE INDICATOR
- PT – PRESSURE TRANSDUCER
- TT – TEMPERATURE TRANSDUCER
- TI – TEMPERATURE INDICATOR
- OS – OXYGEN SENSOR
- EF – EXHAUST FAN
- IL – INTERIOR LIGHTING
- POW – GFCI POWER RECEPTACLES
- PR – PRESSURE REGULATING VALVE

XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: NOT TO SCALE	TITLE: OXYGEN DISTRIBUTION MANIFOLD PIPING AND INSTRUMENTATION DIAGRAM W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: FJS	DRAWING NO.: FIGURE 13
CHECKED BY: JMP	REV: 2
PROJ. MGMT. APPROVAL: JMP	



DISTRIBUTION PANEL



SUPPLY PANEL

LEGEND:

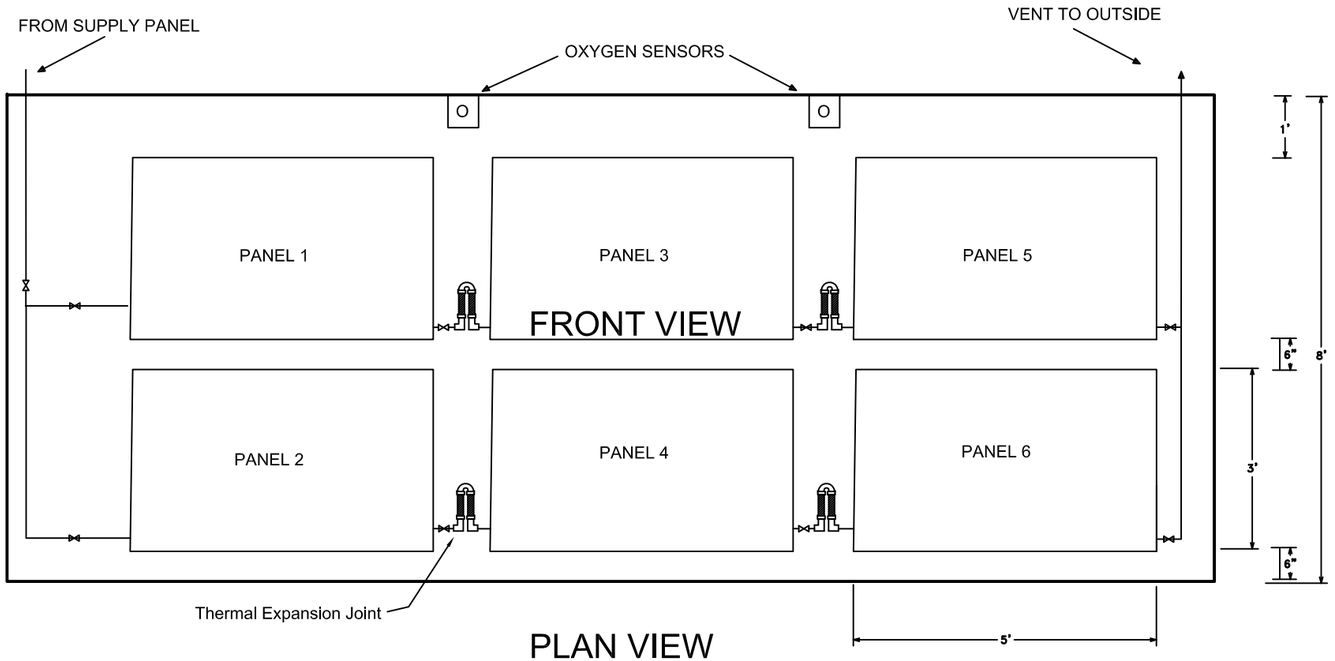
- BALL VALVE
- ELBOW
- FLOW DIRECTION
- FLANGE
- PIPING
- TEE
- THREE WAY VALVE
- MFC – MASS FLOW CONTROLLER
- FS – FLOW SWITCH
- P – PRESSURE GAUGE
- T – TEMPERATURE GUAGE
- TT – TEMPERATURE INDICATOR
- CROSS
- PR – PRESSURE REGULATOR
- PRESSURE RELIEF VALVE
- CHECK VALVE
- PT – PRESSURE TRANSDUCER
- WIRE FOR PLC CONNECTION
- ROTAMETER
- REDUCING BUSHING
- SV – SOLENOID VALVE
- FS/FT – MASS FLOW METER

NOTES:

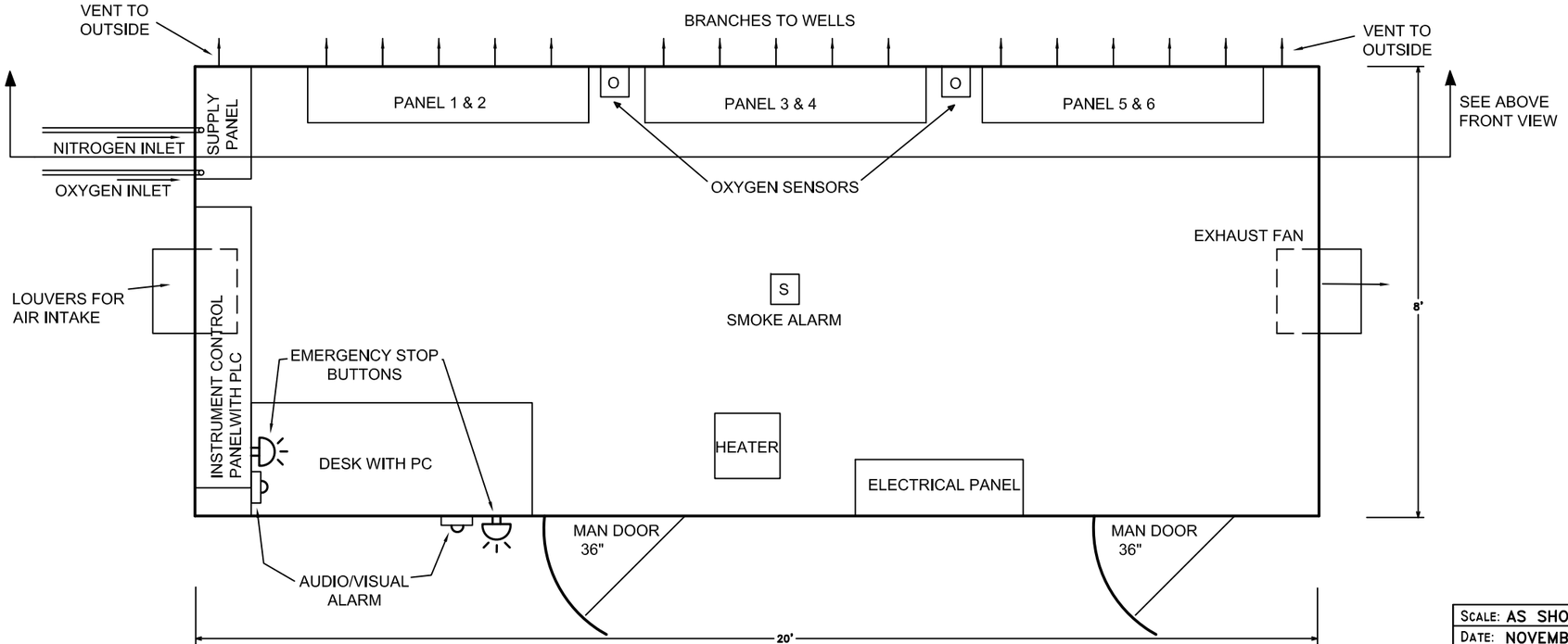
- TYPICAL ASSEMBLY: 5 BRANCHES PER PANEL, DIMENSIONS ARE APPROXIMATE.
- PANEL SHALL BE OF OPEN FRAME DESIGN WITH STEEL FRONT AND SIDE PANELS AS REQUIRED.
- COLOR TO BE APPROVED BY ENGINEER
- PANELS OF SAME CONSTRUCTION WITH ROOM FOR 5 MASS FLOW CONTROLLED BRANCHES PER PANEL. SIX PANELS WILL ACCOMMODATE 30 BRANCHES.
- ALL TUBING, FITTINGS, AND CONNECTED INSTRUMENTS MUST BE RATED AND CLEANED FOR OXYGEN SERVICE.

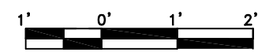
XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: NOT TO SCALE	TITLE: OXYGEN DISTRIBUTION BUILDING MANIFOLD PANEL LAYOUT W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT No.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 14
CHECKED BY: JMP	REV: 2
PROJ. MGMT. APPROVAL: JMP	



PLAN VIEW





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STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: AS SHOWN	TITLE: OXYGEN DISTRIBUTION BUILDING LAYOUT W.G KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC	
DRAWN BY: KB	DRAWING NO.: FIGURE 15
CHECKED BY: JMP	REV: 1
PROJ. MGMT. APPROVAL: JMP	

LEGEND:

- △ EABR SHALLOW WELL LOCATION
- ○ EABR DEEP WELL LOCATION
- ⊕ EABR COMBINATION SHALLOW AND DEEP WELL LOCATION
- D1 LATERAL DESIGNATION. THE 30 LATERALS ARE IDENTIFIED BY ROW (A–Q) AND LINE NUMBER (1–3). [E.G., D1 IS ROW D, LINE 1]
- SCHEMATIC OF INDIVIDUAL LINES SHOWN IN GROUPS EXITING OXYGEN DISTRIBUTION BUILDING
- SCHEMATIC OF PIPING TO INDIVIDUAL WELLS (SUPPORTS TO HAVE A SPACING INTERVAL OF 10 FEET)
- SHALLOW PIEZOMETER
- DEEP PIEZOMETER
- SOLENOID BANKS

30' 0' 30' 60'

NOTES:

- EABR: ENHANCED AEROBIC BIOREMEDIATION
- THE RED LINES SHOW THE SCHEMATIC OF EABR PIPING. THE PIPING LAYOUT IS SHOW IN THE INSET OF THIS FIGURE.
- 3RD STREET AND FALLING SPRINGS ROAD WILL BE CLOSED DURING THE OPERATION OF THE SYSTEM.

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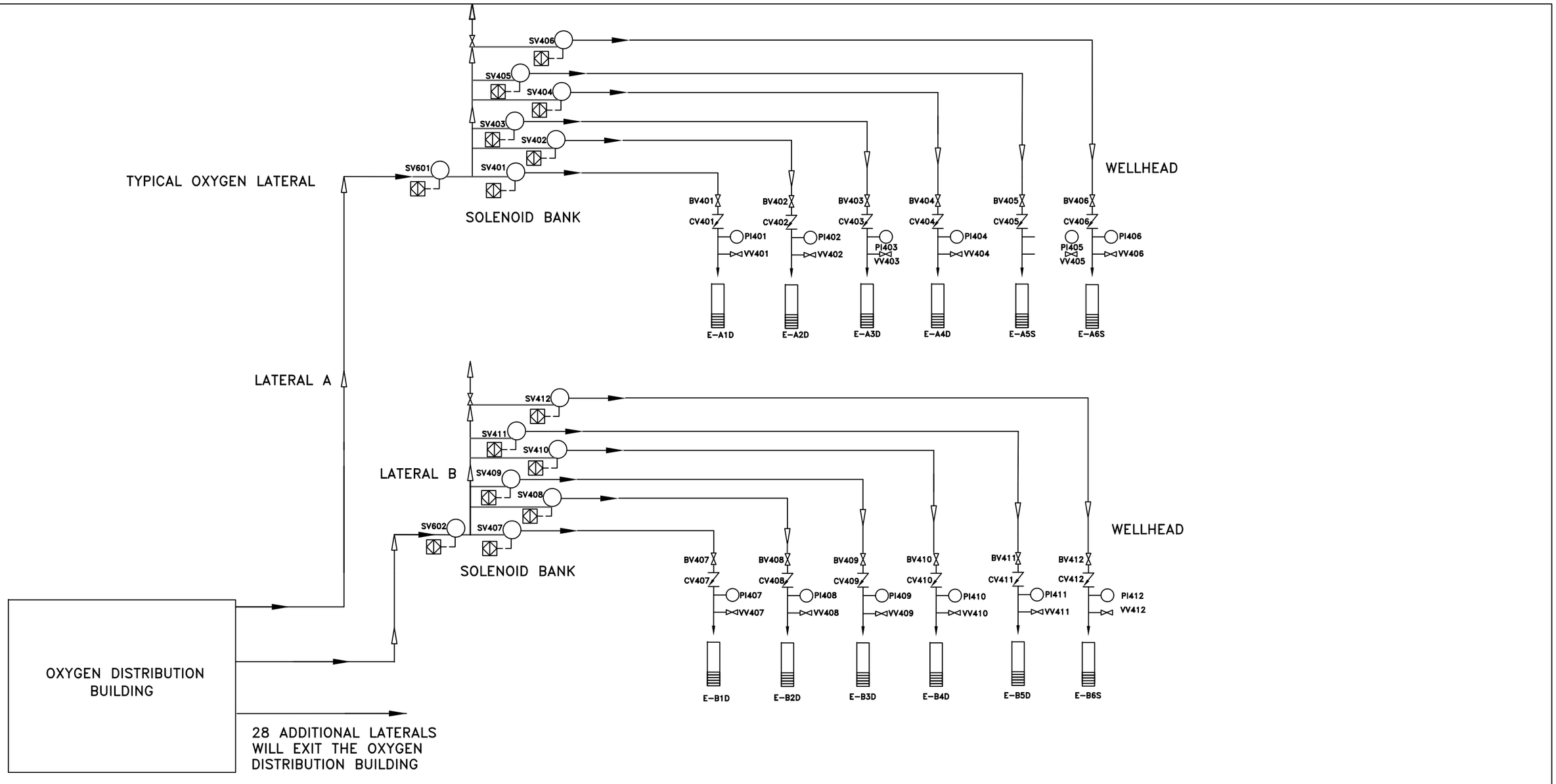
SCALE: AS SHOWN	TITLE: EABR PIPING LAYOUT W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 16
CHECKED BY: JMP	REV: 2
PROJ. MGMT. APPROVAL: JMP	



LEGEND:

- PIPING
- BV – BALL VALVE
- CV – CHECK VALVE
- PI – PRESSURE INDICATOR
- PLC – PLC CONNECTION
- SV – SOLENOID VALVE
- E-B1D — INJECTION WELL
- PURGE TEE ASSEMBLY WITH PLUG

NOTES:

- FOUR TO EIGHT WELLS PER SOLENOID BANK
- 30 MANIFOLD LATERALS TOTAL

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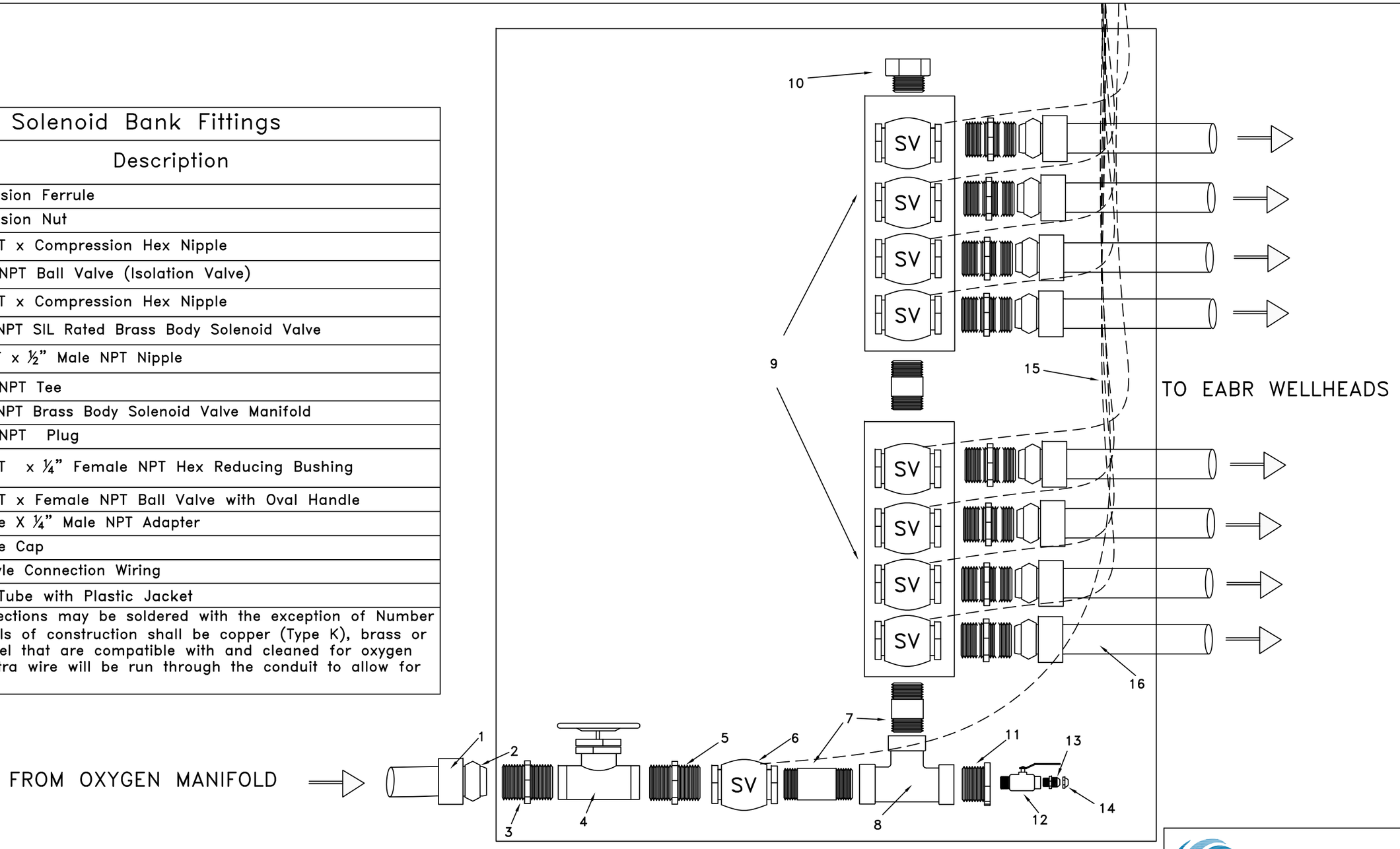
SCALE: NOT TO SCALE	TITLE: LATERAL/WELLHEAD PIPING AND INSTRUMENTATION DIAGRAM W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 17
CHECKED BY: JMP	REV: 2
PROJ. MGMT. APPROVAL: JMP	

Solenoid Bank Fittings

Item	Description
1	½" Compression Ferrule
2	½" Compression Nut
3	½" Male NPT x Compression Hex Nipple
4	½" Female NPT Ball Valve (Isolation Valve)
5	½" Male NPT x Compression Hex Nipple
6	½" Female NPT SIL Rated Brass Body Solenoid Valve
7	2" Male NPT x ½" Male NPT Nipple
8	½" Female NPT Tee
9	½" Female NPT Brass Body Solenoid Valve Manifold
10	½" Female NPT Plug
11	½" Male NPT x ¼" Female NPT Hex Reducing Bushing
12	¼" Male NPT x Female NPT Ball Valve with Oval Handle
13	⅜" 45° Flare X ¼" Male NPT Adapter
14	⅜" 45° Flare Cap
15	Solenoid Vavle Connection Wiring
16	½" Copper Tube with Plastic Jacket
	Notes: Connections may be soldered with the exception of Number 10. Materials of construction shall be copper (Type K), brass or stainless steel that are compatible with and cleaned for oxygen service. Extra wire will be run through the conduit to allow for expansion.



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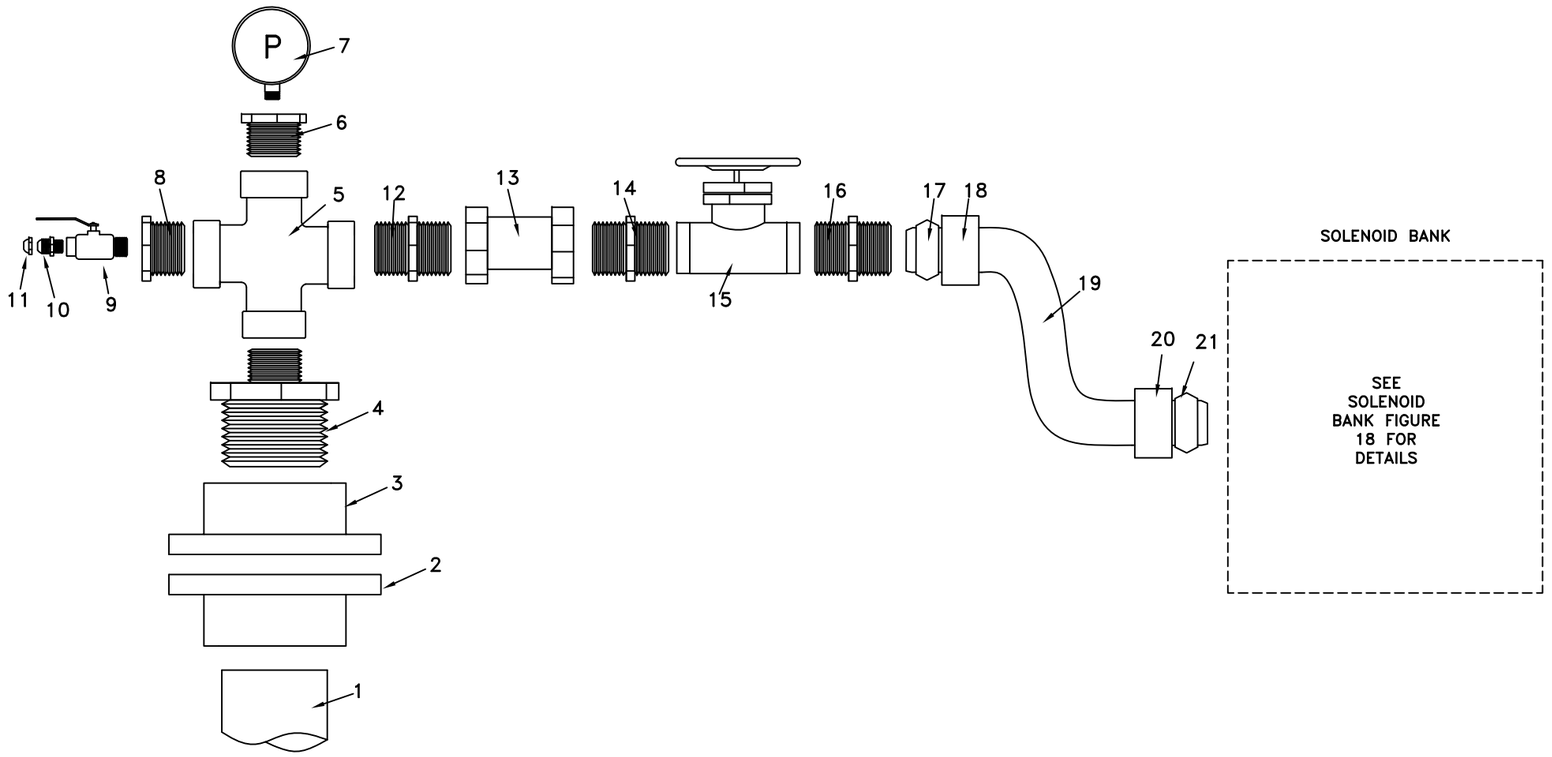
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: NOT TO SCALE	TITLE: SOLENOID BANK DETAILS W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 18
CHECKED BY: JMP	REV: 3
PROJ. MGMT. APPROVAL: JMP	

TYPICAL EABR WELLHEAD ASSEMBLY DETAILS

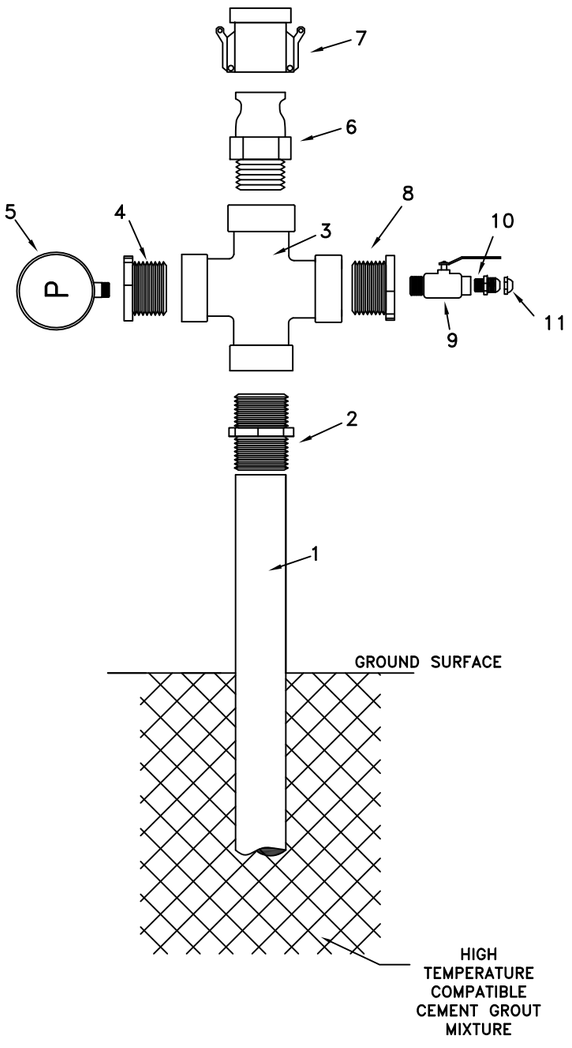


EABR Wellhead Fittings	
Item	Description
1	1" Stainless Steel Well Casing
2	1" Stainless Steel Slip Flange Brazed to Well Casing (may not be necessary depending on well construction)
3	1" Female NPT Stainless Steel Flange (may not be necessary depending on well construction)
4	1" Male NPT x ½" Male NPT Brass Hex Reducing Bushing
5	½" Female NPT Brass Cross
6	½" Male NPT x ¼" Female NPT Brass Hex Reducing Bushing
7	¼" Male NPT Oxygen Service Rated Pressure Gauge (0 – 30 PSI)
8	½" Male NPT x ¼" Female NPT Brass Hex Reducing Bushing
9	¼" Male NPT X ¼" Female NPT Brass Ball Valve
10	⅜" 45° Brass Flare X ¼" Male NPT Adapter
11	⅜" 45° Brass Flare Cap
12	½" Male NPT Brass Hex Nipple
13	½" Female NPT Brass Poppet Check Valve
14	½" Male NPT Brass Hex Nipple
15	½" Female NPT Brass Ball Valve
16	½" Brass Male NPT Hex Nipple
17	½" Brass Compression Ferrule
18	½" Brass Compression Nut
19	½" Copper Tube with Plastic Jacket
20	½" Brass Compression Nut
21	½" Brass Compression Ferrule

NOTE:
WELL STICKUPS WITH THREADED END WILL CONNECT DIRECTLY TO THE REDUCING PIPE ADAPTER (ITEM#4)

Piezometer Wellhead Fittings	
Item	Description
1	2" Stainless Steel Well Casing
2	2" Male NPT Brass Hex Nipple
3	2" Female NPT Brass Cross
4	2" Male NPT x ¼" Female NPT Brass Hex Reducing Bushing
5	¼" Male NPT Oxygen Service Rated Pressure Gauge (0 – 30 PSI)
6	2" Cam-Lock Male Adapter (MNPT)
7	2" Cam-Lock Female Plug
8	2" Male NPT x ¼" Female NPT Brass Hex Reducing Bushing
9	¼" Male NPT X ¼" Female NPT Brass Ball Valve
10	⅜" 45° Brass Flare X ¼" Male NPT Adapter
11	⅜" 45° Brass Flare Cap

TYPICAL PIEZOMETER WELLHEAD ASSEMBLY DETAILS



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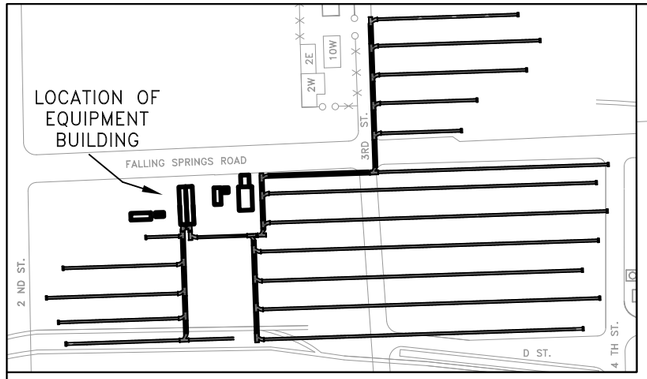
SCALE: NOT TO SCALE	TITLE: EABR AND PIEZOMETER WELLHEAD DETAILS W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 19
CHECKED BY: JMP	REV: 2
PROJ. MGMT. APPROVAL: JMP	



FALLING SPRINGS ROAD

T–SVE EQUIPMENT CONTAINERS

SEWER

NAPL DRUM

MUST HAVE 50' MINIMUM SEPARATION BETWEEN NAPL STORAGE AND O2 TANK

O2 DISTRIBUTION TRAILER

6' X 6' N2 CONCRETE PAD

N2 CYLINDER 12–PACK (43.5" X 35")

10'

14'

2'

30'

TRAILER APRON

FILL CONNECTION

VALVE SKID

O2 TANK

14' x 16' CONCRETE PAD

AMBIENT VAPORIZER

14' x 14' CONCRETE PAD

2'

2'

14'

2'

BOLLARDS

SCRUBBER

THERMOX

STACK

SEWER

WATER

WATER (ALONG T–SVE/EABR PIPE RACKS)

TO SEWER 1–FF (ALONG T–SVE/EABR PIPE RACKS)

LEGEND:

COPPER LATERAL MANIFOLD PIPING

NOTES:

- N2: NITROGEN
- NAPL: NON–AQUEOUS PHASE LIQUID
- O2: OXYGEN
- THERMOX: REGENERATIVE THERMAL OXIDIZER
- SVE: SOIL VAPOR EXTRACTION
- T–SVE: THERMALLY ENHANCED SVE
- THE THERMOX AND SCRUBBER CANNOT BE WITHIN 20' OF ANY PIPE RACKS

N

5' 0' 5' 10'

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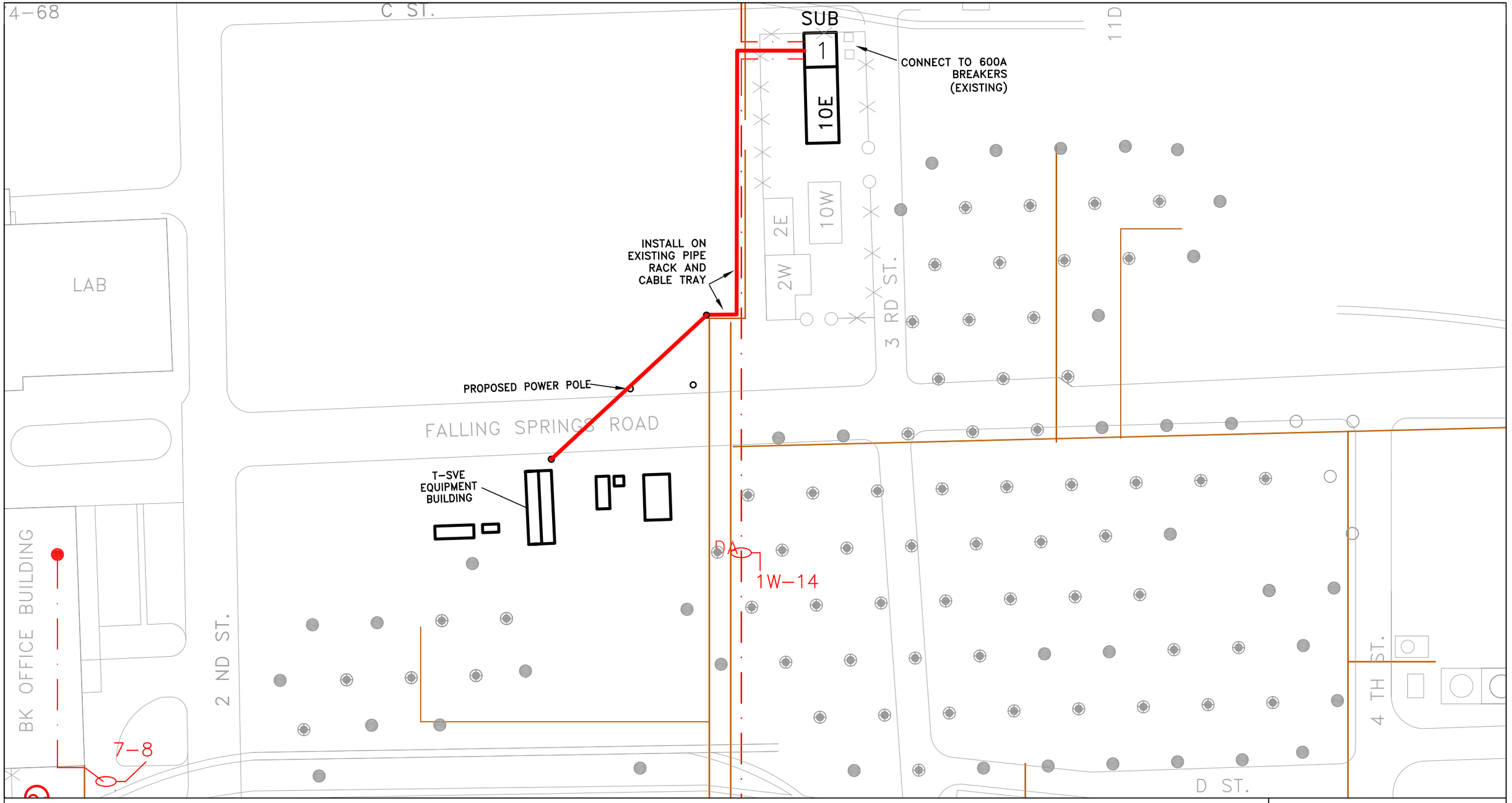
SCALE: AS SHOWN	TITLE: EQUIPMENT BUILDING LAYOUT W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: KB	DRAWING NO.: FIGURE 20
CHECKED BY: LBC	REV: 2
PROJ. MGMT. APPROVAL: SCC	



LEGEND:

- EXISTING 13.8 KILOVOLT OVERHEAD ELECTRICAL LINE
- PROPOSED 13.8 KILOVOLT OVERHEAD ELECTRICAL LINE
- PIPE BRIDGE
- T-SVE COMBINATION SHALLOW AND DEEP WELL LOCATION
- T-SVE DEEP WELL LOCATION
- AIR INJECTION WELL LOCATION

NOTES:

- BASE MAP PROVIDED BY W.G. KRUMMRICH FACILITY.
- ONLY 480 VOLT POWER FEEDERS ARE INDICATED, NOT ALL 480 VOLT CABLES.

30' 0' 30' 60'

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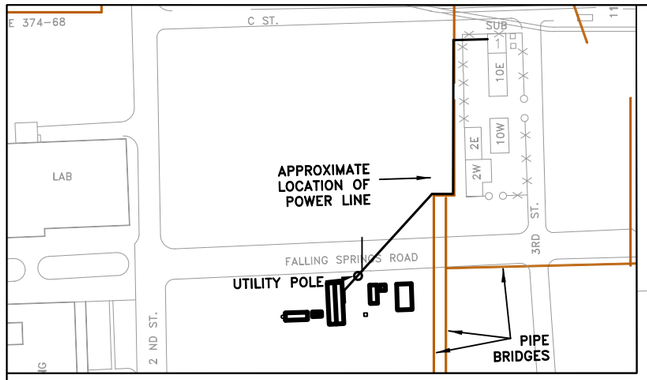
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: AS SHOWN	TITLE: ELECTRICAL UTILITIES LAYOUT W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: LBC	DRAWING NO.: FIGURE 21
CHECKED BY: SCC	REV: 2
PROJ. MGMT. APPROVAL: SCC	



FALLING SPRINGS ROAD

INCOMING MAIN POWER

UTILITY POLE

O2 DISTRIBUTION TRAILER

PLC

N2

PP-1 SP-2 SP-3

O2 TANK

AMBIENT VAPORIZER

GROUND ROD

LIGHTNING ROD/GROUND

SP-5 PLC

SCRUBBER

STACK

SP-4 PLC

THERMOX

PLC

T-SVE BUILDING

SP-6

GROUND ROD

NAPL DRUM

PP-1	MAIN PANEL	NEMA 3R, 480V/277V, 3PH, 4 WIRE
SP-1	T-SVE PANEL	NEMA 3R, 480V, 3PH, 4 WIRE
SP-2	T-SVE HVAC PANEL	NEMA 3R, 277V, 3PH, 4 WIRE
SP-3	HEAT TRACE PANEL	NEMA 3R, 277V, 3PH, 4 WIRE
SP-4	THERMOX PANEL	NEMA 3R, 480V, 3PH, 4 WIRE
SP-5	SCRUBBER PANEL	NEMA 3R, 480V, 3PH, 4 WIRE
SP-6	O2 BUILDING PANEL	NEMA 3R, 480V, 3PH, 4 WIRE

NOTES:

- HEAT TRACE – 10 W/FT SELF REGULATING (SR) 240 V COPPER BRAID THERMOPLASTIC HEAT TAPE, WITH POWER/END SEAL/THERMOSTAT KIT CLASS I/DIV II.
- UTILITY POLE – 40 FT CLASS II UTILITY POLE WITH CABLE TRAY OR ELECTRICAL NON-METALLIC TUBING (ENT) AND STRAIN RELIEF CORD GRIPS (CGB-TYPE).

- N2: NITROGEN
- NAPL: NON-AQUEOUS PHASE LIQUID
- O2: OXYGEN
- PLC: PROGRAMMABLE LOGIC CONTROLLER
- PP: POWER PANEL
- SP: SUB-PANEL
- SVE: SOIL VAPOR EXTRACTION
- V: VOLT

5' 0' 5' 10'

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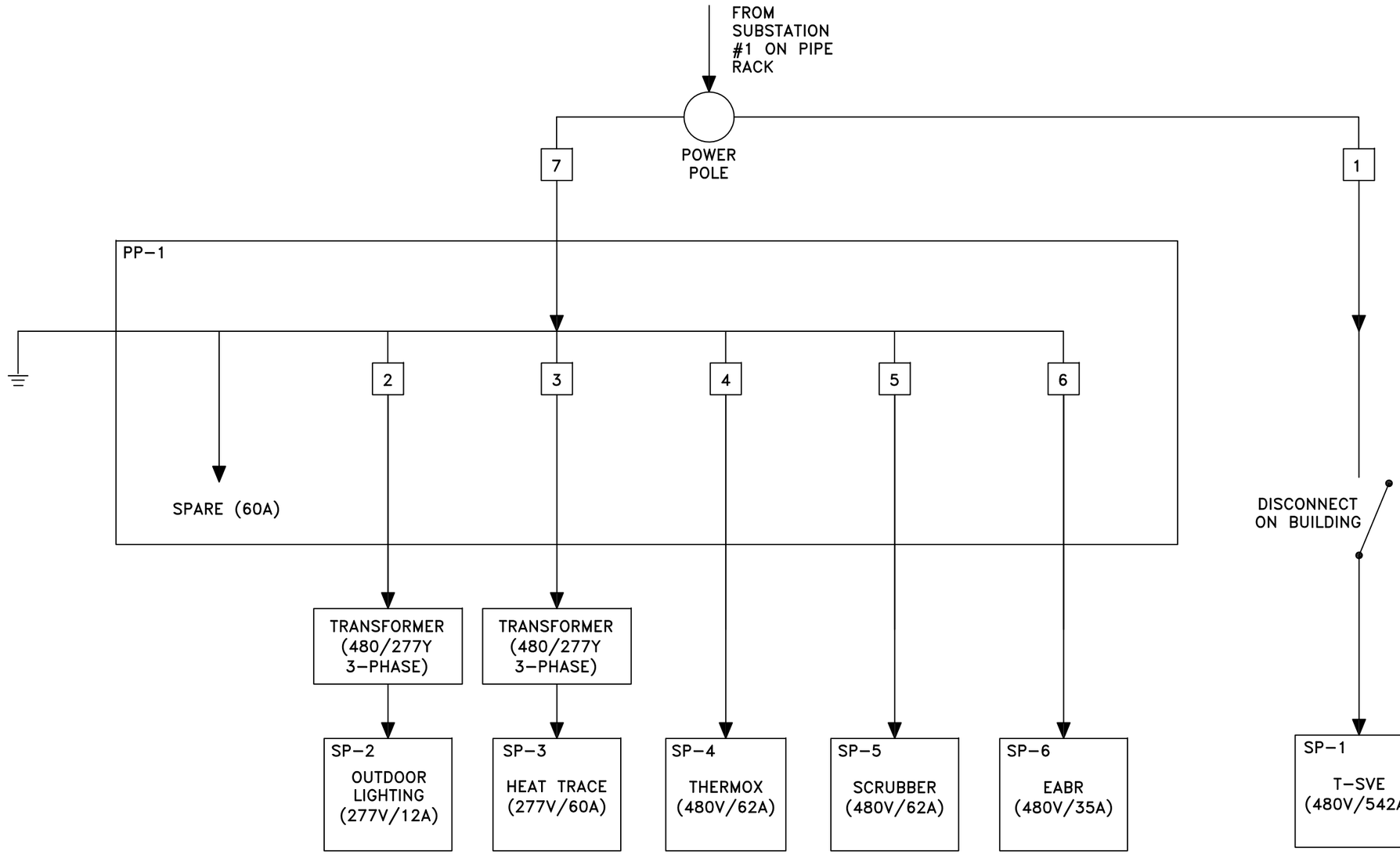
SCALE: AS SHOWN	TITLE: ELECTRICAL DETAILS – MAIN POWER AND SUB-PANEL LAYOUT W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: MAW	DRAWING NO.: FIGURE 22
CHECKED BY: LBC	REV: 2
PROJ. MGMT. APPROVAL: SCC	



ID	APPROXIMATE CABLE/CONDUIT DISTANCE (FT)	DESCRIPTION	WIRE TYPE/CAUGE
1	30	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR
2	20	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR
3	25	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR
4	70	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR
5	100	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR
6	60	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR
7	40	CABLE–3/CONDUCTOR COPPER WITH GROUND	SPECIFIED BY CONTRACTOR

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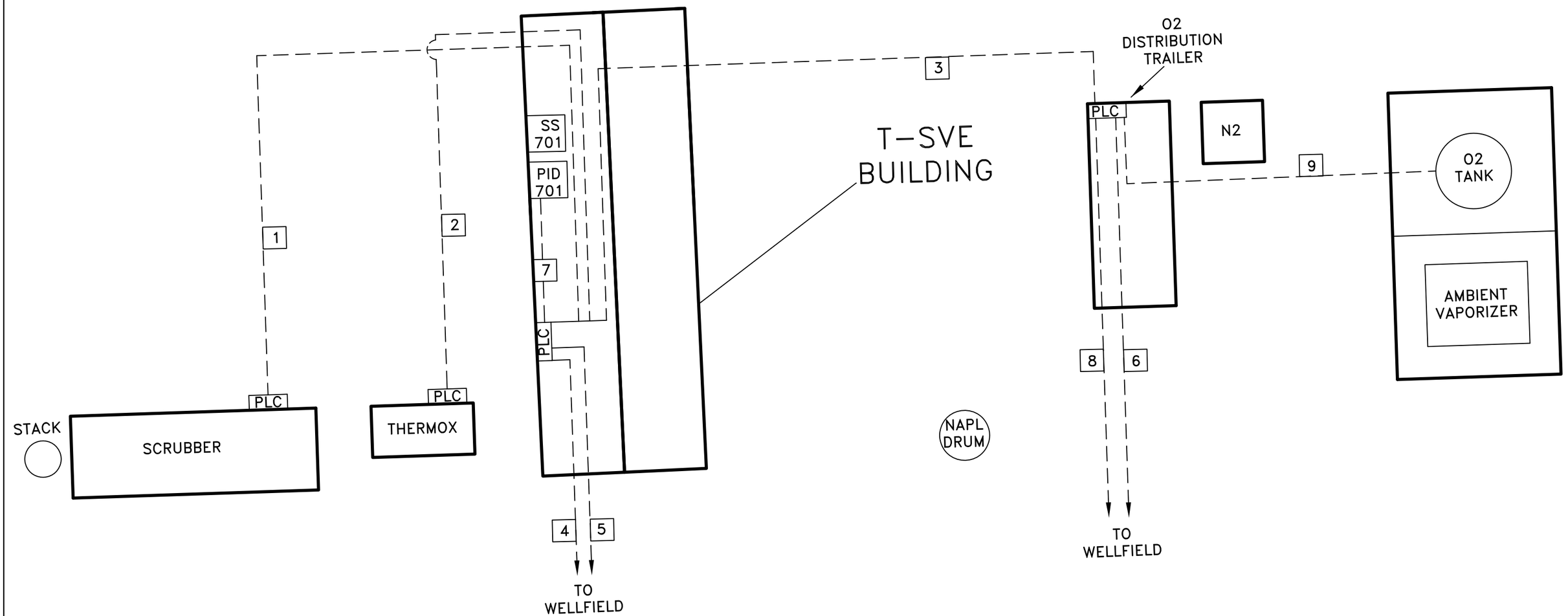
SCALE: NOT TO SCALE	TITLE: ELECTRICAL DETAILS – LINE DIAGRAM SUB–PANEL DESIGN W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA	
DRAWN BY: JWH	DRAWING NO.: FIGURE 23
CHECKED BY: SC	REV: 2
PROJ. MGMT. APPROVAL: SC	



CONDUIT INTERLOCK	# OF INTERLOCKS	CONTROL/INTERLOCK CONNECTIONS	WIRE TYPE/GAUGE	APPROXIMATE CONDUIT LENGTH (FT)	SETS OF WIRES
1	2	PAH403/PAL403 – HIGH/LOW PRESSURE SPRAY	18 AWG / 2 WIRE W/ GROUND	60	6 + 1 SPARE
	1	TAH403 – QUENCH TEMPERATURE			
	2	LAH402/LALL402 – SUMP HIGH/LOW			
	1	AAL401/AAH401 – pH HIGH/LOW AND READOUT			
2	1	THERMOX READY (SVE START) AND ALLOW OPENING OF INLET VALVE	18 AWG / 2 WIRE W/ GROUND	50	2 + 1 SPARE
	1	THERMOX ALARM (SHUT DOWN SVE AND SCRUBBER) – CLOSE INLET VALVE			
3	1	O2 TRAILER – O2 SENSORS TRIGGER FULL SHUTDOWN (REFER TO 100% EABR DESIGN)	18 AWG / 2 WIRE W/ GROUND	50	2 + 1 SPARE
	1	SVE/THERMOX PROCESS INLET – O2 SENSORS TRIGGER FULL SHUTDOWN			
4	11	TEMPERATURE PROBES/DATA LOGGER	18 AWG / 2 WIRE W/ GROUND	SEE FIGURE 21	SEE FIGURE 21
5	4	WATER LEVEL TRANSDUCERS/DATA LOGGER	SUPPLIED BY OTHERS		
6	10	DO PROBES/DATA LOGGER (4 WIRE, 24V DC, 4–20 MA – REFER TO 100% EABR DESIGN			
7	2	PID701 (SVE BUILDING VOCs)/SS701 SEISMIC SWITCH– TRIGGER FULL SHUTDOWN	18 AWG / 2 WIRE W/ GROUND	10	2
8	191	SOLENOID VALVES SV401–SV591 (REFER TO 100% EABR DESIGN)	18 AWG / 2 WIRE W/ GROUND	REFER TO 100% EABR DESIGN	191 + 30 SPARES (1 PER SOLENOID VALVE BANK)
9	1	20A, 120V CONNECTION (POWER SUPPLY FOR O2 TANK TELEMETRY SYSTEM)	CONTRACTOR SPECIFIED	40	1

5' 0' 5' 10'

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SCALE: AS SHOWN	TITLE: ELECTRICAL DETAILS – SENSORS AND INTERLOCKS WIRING W.G. KRUMMRICH FACILITY SAUGET, IL
DATE: NOVEMBER 2011	
PROJECT NO.: 11003	
CLIENT: SOLUTIA INC.	
DRAWN BY: LBC	DRAWING NO.: FIGURE 24
CHECKED BY: LBC	REV: 1
PROJ. MGMT. APPROVAL: SCC	

FIGURE 25A - PROJECT SCHEDULE

Design, Permitting, and Construction

Chlorobenzene Process Area (CPA) Thermally Enhanced Soil Vapor Extraction (T-SVE) and Enhanced Aerobic Bioremediation (EABR) Treatment
W.G. Krummrich Facility, Sauget, Illinois

ID	Task Name	Start	Finish
1	CPA Design and Permitting	Mon 10/3/11	Fri 12/30/11
2	Full-Scale Design	Fri 11/4/11	Fri 11/4/11
3	Full-Scale Design Submittal to EPA	Fri 11/4/11	Fri 11/4/11
4	Permitting	Mon 10/3/11	Fri 12/30/11
5	Illinois Environmental Protection Agency Air Permit (T-SVE)	Mon 10/3/11	Fri 12/30/11
6	American Bottoms Waste Water Permit (T-SVE)	Mon 10/3/11	Fri 11/4/11
7	Underground Injection Control Notification (T-SVE and EABR)	Fri 11/4/11	Fri 11/4/11
8	CPA Equipment Fabrication	Mon 10/24/11	Fri 2/17/12
9	T-SVE/EABR Equipment Fabrication	Mon 10/31/11	Fri 2/17/12
10	Fabricator Notice to Proceed	Mon 10/31/11	Mon 10/31/11
11	Fabricator Submittal of Drawings	Mon 10/31/11	Fri 11/18/11
12	Solutia Review/Approval of Drawings	Mon 11/21/11	Fri 12/2/11
13	Fabrication/Delivery	Mon 12/5/11	Fri 2/17/12
14	ThermOx/Scrubber Equipment Fabrication	Mon 10/24/11	Fri 2/17/12
15	Fabricator Notice to Proceed	Mon 10/24/11	Mon 10/24/11
16	Fabricator Submittal of Drawings	Mon 10/24/11	Fri 11/11/11
17	Solutia Review/Approval of Drawings	Mon 11/14/11	Fri 11/25/11
18	Fabrication/Delivery	Mon 11/28/11	Fri 2/17/12
19	CPA Construction	Mon 9/26/11	Fri 3/2/12
20	Drilling	Mon 9/26/11	Fri 11/4/11
21	Geotechnical Borings	Mon 9/26/11	Fri 9/30/11
22	T-SVE Well Installation	Mon 10/3/11	Fri 11/4/11
23	EABR Well Installation	Mon 10/3/11	Fri 11/4/11
24	Insulating Concrete Cap Install	Mon 10/17/11	Fri 11/11/11
25	Install Insulating Concrete Cap	Mon 10/17/11	Fri 11/11/11
26	Manifold Installation	Mon 10/24/11	Fri 2/24/12
27	T-SVE Manifold Installation	Mon 10/24/11	Fri 2/10/12
28	EABR Manifold Installation	Mon 10/24/11	Fri 2/10/12
29	Utilities Installation	Mon 10/24/11	Fri 2/24/12
30	Electrical Installation	Mon 10/17/11	Fri 3/2/12
31	Electrical Installation	Mon 10/17/11	Fri 3/2/12
32	Equipment Installation	Mon 2/20/12	Fri 3/2/12
33	T-SVE Equipment Installation	Mon 2/20/12	Fri 3/2/12
34	EABR Equipment Installation	Mon 2/20/12	Fri 3/2/12
35	ThermOx / Scrubber Installation	Mon 2/20/12	Fri 3/2/12

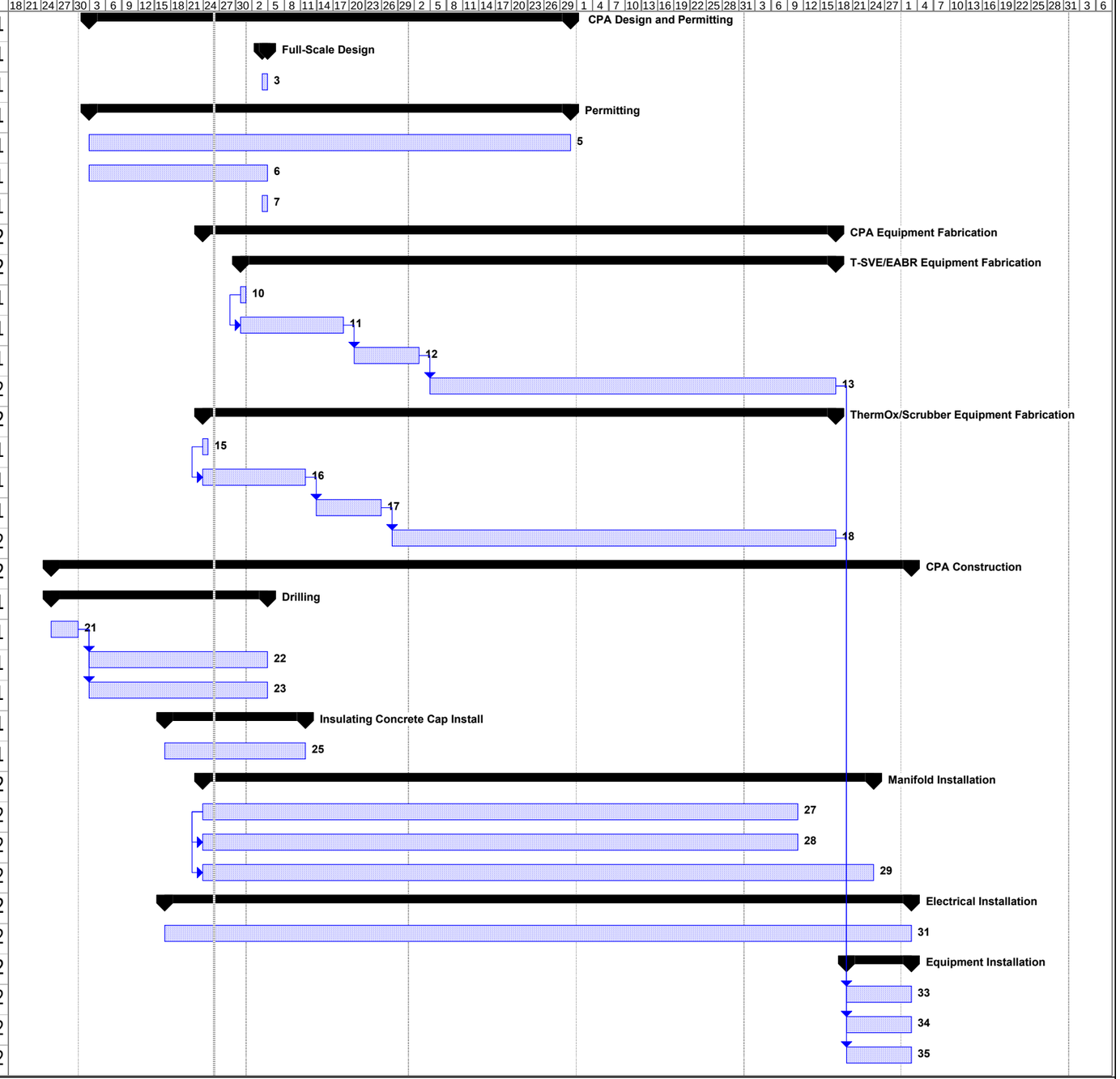
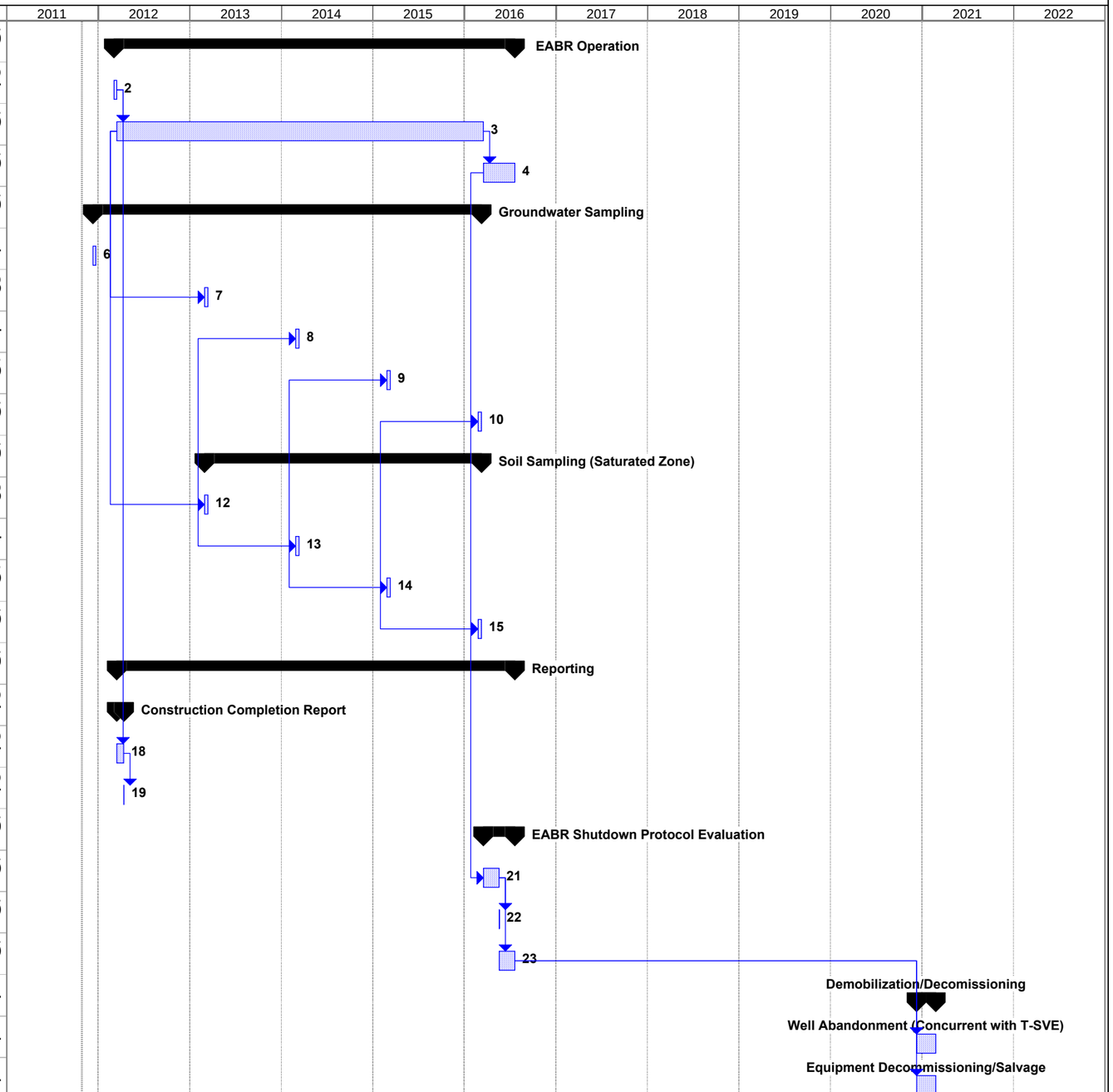


FIGURE 25B
EABR OPERATION SCHEDULE
Enhanced Aerobic Bioremediation (EABR) Treatment
Former Chlorobenzene Process Area (CPA), W.G. Krummrich Facility, Sauget, Illinois

ID	Task Name	Start	Finish
1	EABR Operation	Mon 3/5/12	Thu 7/21/16
2	Start-Up	Mon 3/5/12	Thu 3/15/12
3	EABR Operation (4 Years)	Fri 3/16/12	Thu 3/17/16
4	Ongoing Operation During Shutdown Evaluation	Fri 3/18/16	Thu 7/21/16
5	Groundwater Sampling	Mon 12/12/11	Thu 3/10/16
6	Baseline Groundwater Sampling	Mon 12/12/11	Fri 12/23/11
7	Groundwater Sampling (Year 1)	Fri 3/1/13	Thu 3/14/13
8	Groundwater Sampling (Year 2)	Fri 2/28/14	Thu 3/13/14
9	Groundwater Sampling (Year 3)	Fri 2/27/15	Thu 3/12/15
10	Groundwater Sampling (Year 4)	Fri 2/26/16	Thu 3/10/16
11	Soil Sampling (Saturated Zone)	Fri 3/1/13	Thu 3/10/16
12	Soil Sampling (Year 1)	Fri 3/1/13	Thu 3/14/13
13	Soil Sampling (Year 2)	Fri 2/28/14	Thu 3/13/14
14	Soil Sampling (Year 3)	Fri 2/27/15	Thu 3/12/15
15	Soil Sampling (Year 4)	Fri 2/26/16	Thu 3/10/16
16	Reporting	Fri 3/16/12	Thu 7/21/16
17	Construction Completion Report	Fri 3/16/12	Fri 4/13/12
18	Draft Completion Report	Fri 3/16/12	Thu 4/12/12
19	Submittal to USEPA	Fri 4/13/12	Fri 4/13/12
20	EABR Shutdown Protocol Evaluation	Fri 3/18/16	Thu 7/21/16
21	Shutdown EABR Protocol Report	Fri 3/18/16	Thu 5/19/16
22	Submittal to USEPA	Fri 5/20/16	Fri 5/20/16
23	USEPA Review/Approval	Fri 5/20/16	Thu 7/21/16
24	Demobilization/Decomissioning	Fri 12/11/20	Thu 2/25/21
25	Well Abandonment (Concurrent with T-SVE)	Fri 12/11/20	Thu 2/25/21
26	Equipment Decommissioning/Salvage	Fri 12/11/20	Thu 2/25/21