Performance Evaluation Report #30

Des Moines TCE Site (DICO)
200 SW 16th Street
Des Moines, Iowa

Project No: 16-361

May 26, 2016

FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL

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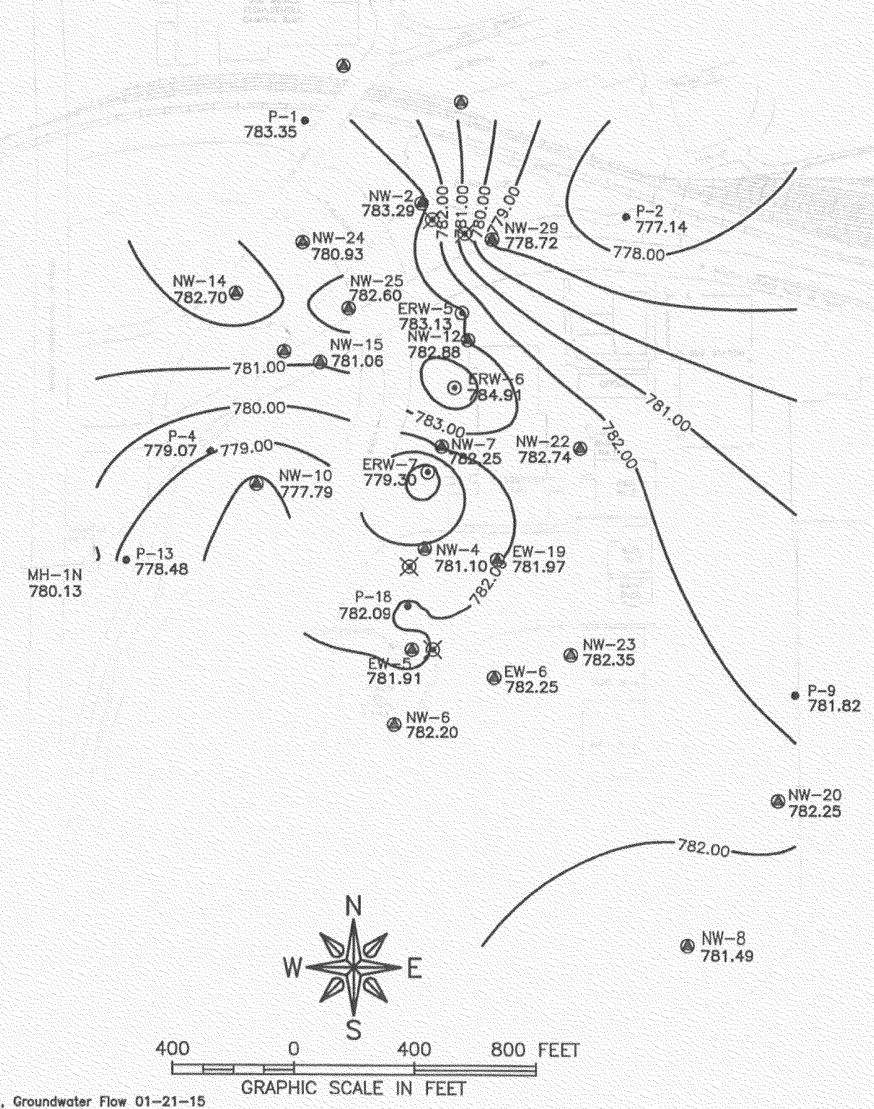
Groundwater Flow Maps



LEGEND

ERW-3	NON-OPERATING RECOVERY WELL
ERW-5	OPERATING RECOVERY WELL
EW-3, NW-18	MONITORING WELL
P-1	PIEZOMETER
— 780.00 —	EQUIPOTENTIAL LINE.

NOTES

RACCOON RIVER STAGE AT FLEUR DRIVE BRIDGE CROSSING IS 783.73 FT. ASL.

CONTOUR INTERVAL = 1.00 FEET.
DATA COLLECTED JANUARY 21, 2015.

FIGURE 11
GROUNDWATER FLOW MAP
DES MOINES TCE SITE
DES MOINES, IOWA

05/02/16

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ILLINOIS
IOWA
WISCONSIN

G:\C3D\16\16-361\Plans\16-361 BASE.dwg, Groundwater Flow 01-21-15

PLOT DATE: 5/3/16

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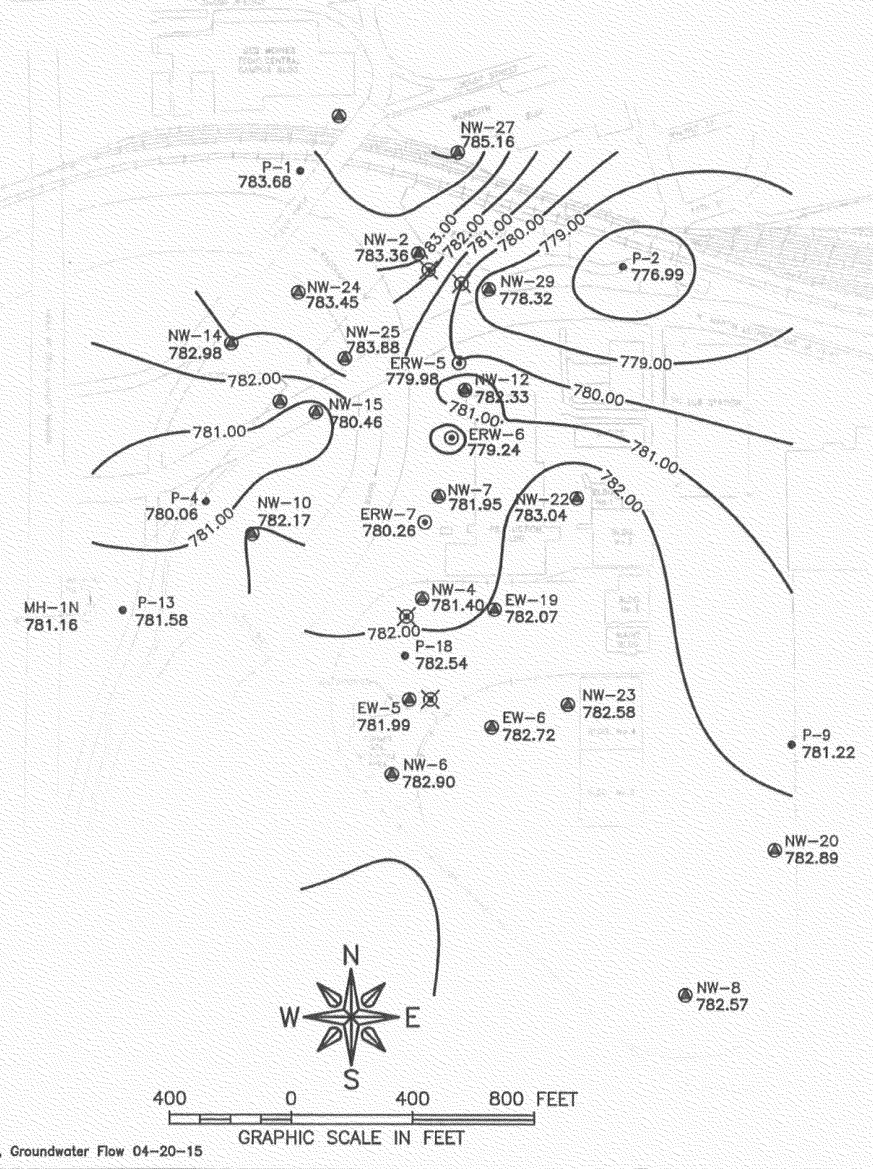

LEGEND

ERW-3	NON-OPERATING RECOVERY WELL
ERW-5	OPERATING RECOVERY WELL
EW-3, NW-18	MONITORING WELL
P-1	PIEZOMETER
— 780.00 —	EQUIPOTENTIAL LINE.

NOTES

RACCOON RIVER STAGE AT FLEUR DRIVE BRIDGE CROSSING IS 785.66 FT. ASL.

CONTOUR INTERVAL = 1.00 FEET.
DATA COLLECTED APRIL 20, 2015.

FIGURE 11
GROUNDWATER FLOW MAP
DES MOINES TCE SITE
DES MOINES, IOWA

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PLOT DATE: 5/2/16

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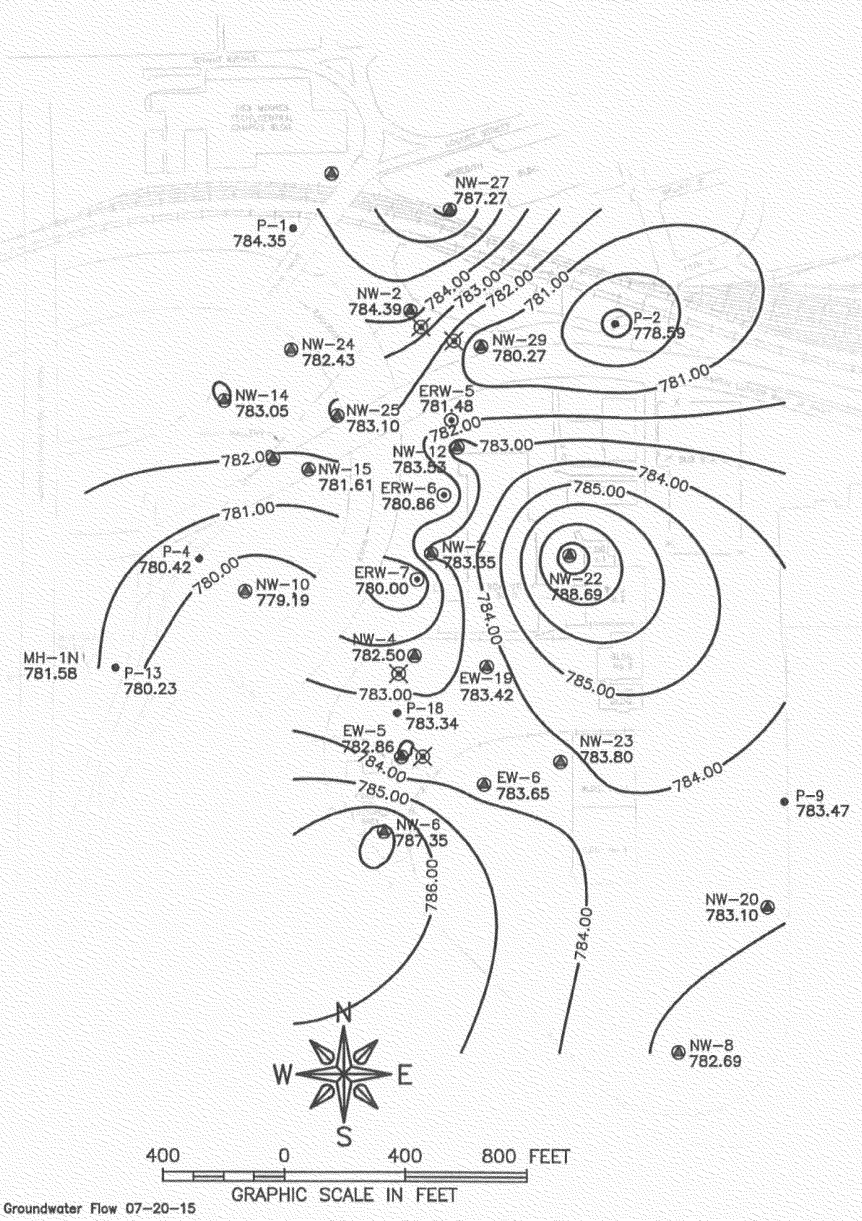

LEGEND

ERW-3	NON-OPERATING RECOVERY WELL
ERW-5	OPERATING RECOVERY WELL
EW-3, NW-18	MONITORING WELL
P-1	PIEZOMETER
— 780.00 —	EQUIPOTENTIAL LINE.

NOTES

RACCOON RIVER STAGE AT FLEUR DRIVE BRIDGE CROSSING IS 783.71 FT. ASL.

CONTOUR INTERVAL = 1.00 FEET.
DATA COLLECTED JULY 22, 2015.

FIGURE 11
GROUNDWATER FLOW MAP
DES MOINES TCE SITE
DES MOINES, IOWA

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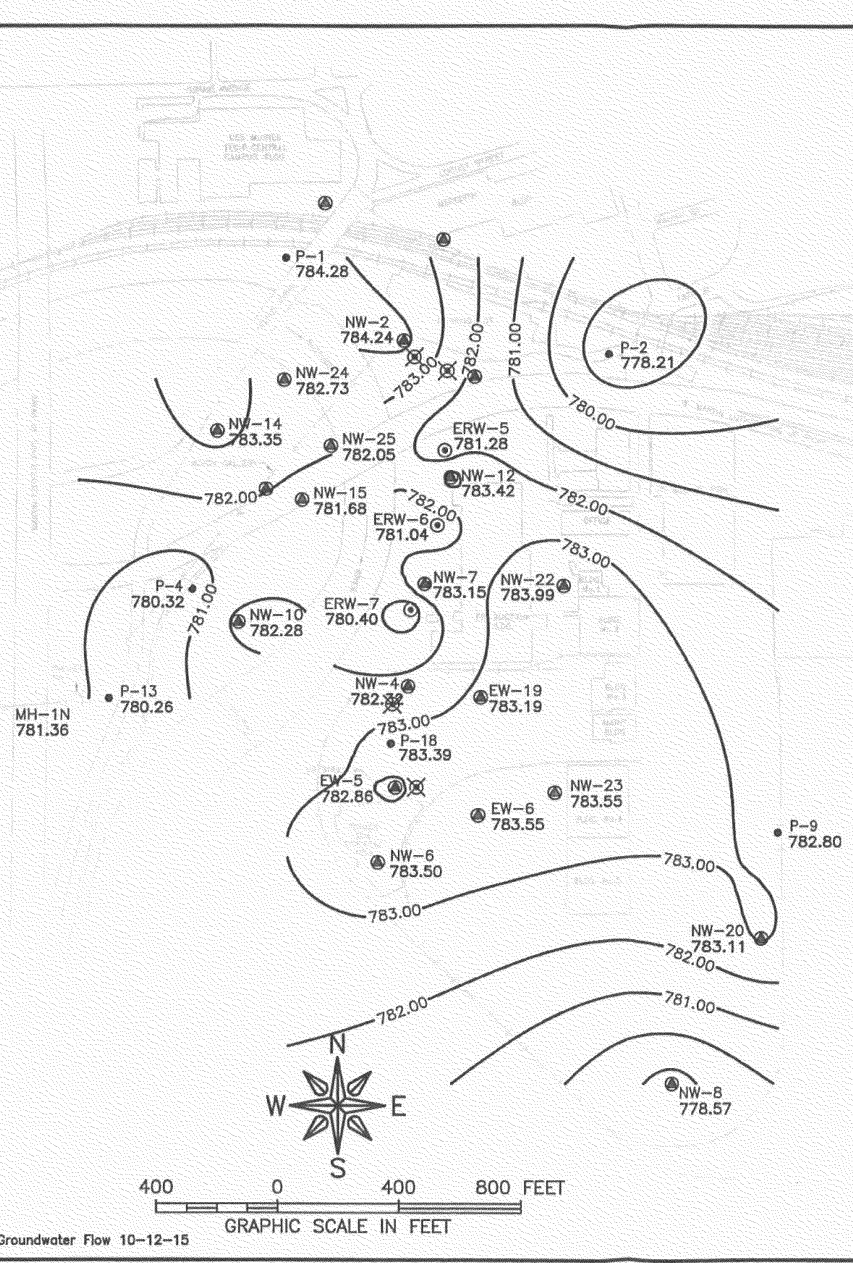
G:\C3D\16\16-361\Plans\16-361 BASE.dwg, Groundwater Flow 07-20-15

PLOT DATE: 8/3/16



LEGEND

ERW-3	NON-OPERATING RECOVERY WELL
ERW-5	OPERATING RECOVERY WELL
EW-3, NW-18	MONITORING WELL
P-1	PIEZOMETER
— 780.00 —	EQUIPOTENTIAL LINE.

NOTES

RACCOON RIVER STAGE AT FLEUR DRIVE BRIDGE CROSSING IS 783.79 FT. ASL.

CONTOUR INTERVAL = 1.00 FEET.
DATA COLLECTED OCTOBER 12, 2015.

FIGURE 11
GROUNDWATER FLOW MAP
DES MOINES TCE SITE
DES MOINES, IOWA

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G:\C3D\16\16-361\Plans\16-361 BASE.dwg, Groundwater Flow 10-12-15

PLOT DATE: 5/3/16

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Figure 12

TCE Concentrations in Groundwater
(April 2015)

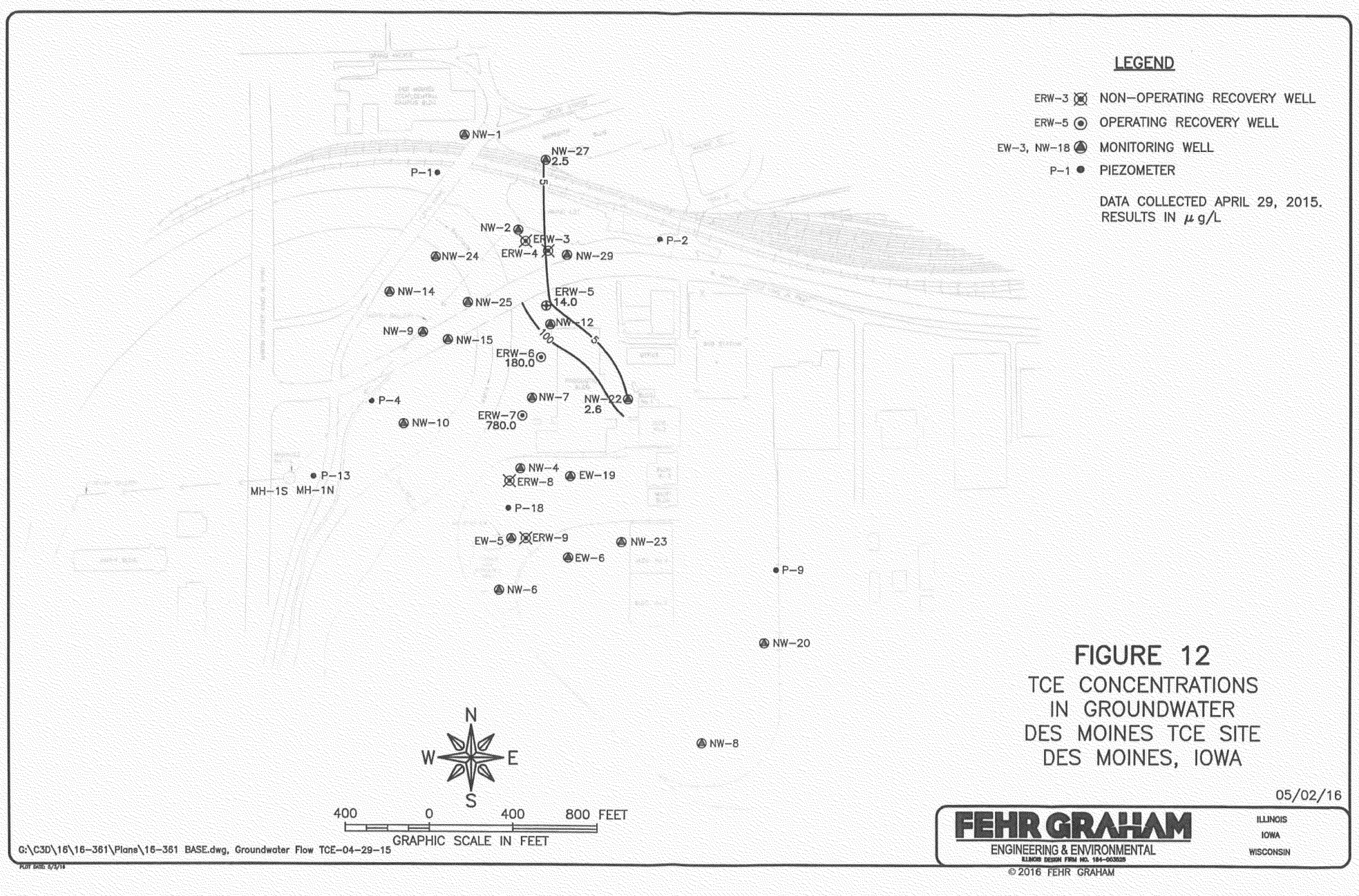
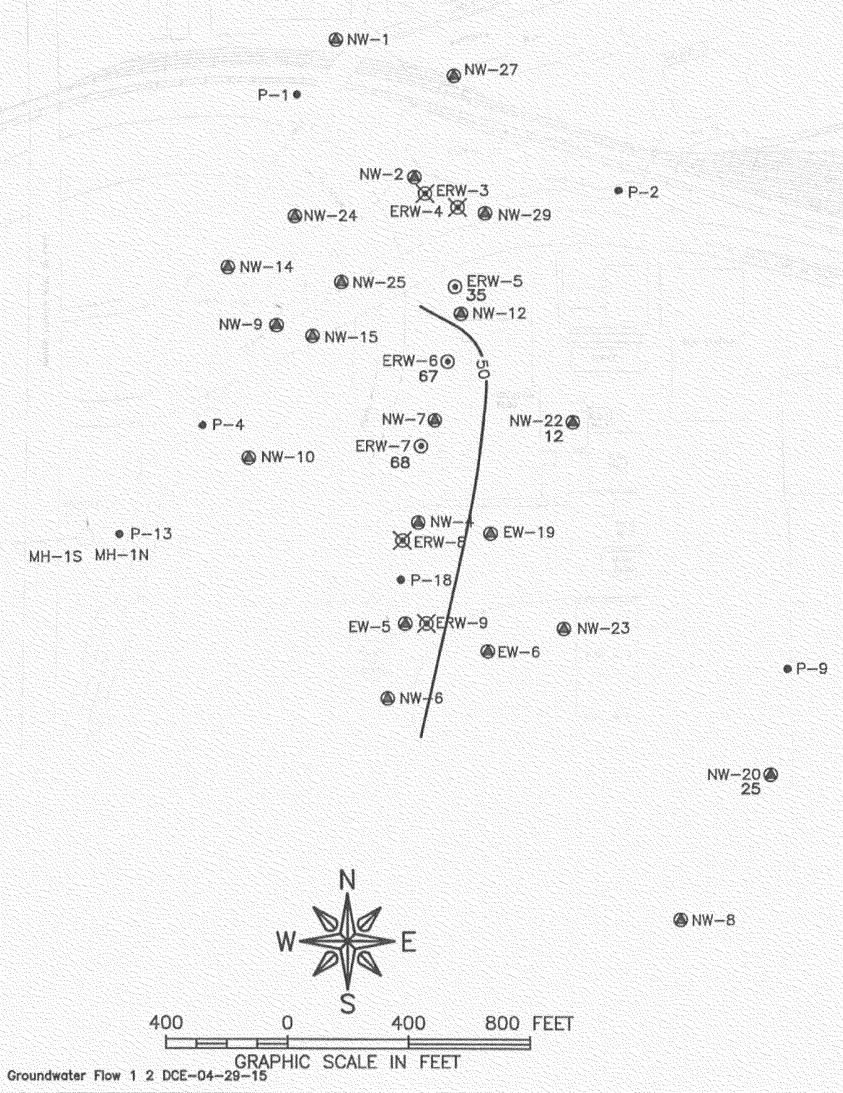


FIGURE 12
TCE CONCENTRATIONS
IN GROUNDWATER
DES MOINES TCE SITE
DES MOINES, IOWA

05/02/16

Figure 13

1,2-DCE Concentrations in Groundwater (April 2015)



LEGEND

ERW-3	NON-OPERATING RECOVERY WELL
ERW-5	OPERATING RECOVERY WELL
EW-3, NW-18	MONITORING WELL
P-1	PIEZOMETER

DATA COLLECTED APRIL 29, 2015.
RESULTS IN μg/L

FIGURE 13

1,2-DCE CONCENTRATIONS
IN GROUNDWATER
DES MOINES TCE SITE
DES MOINES, IOWA

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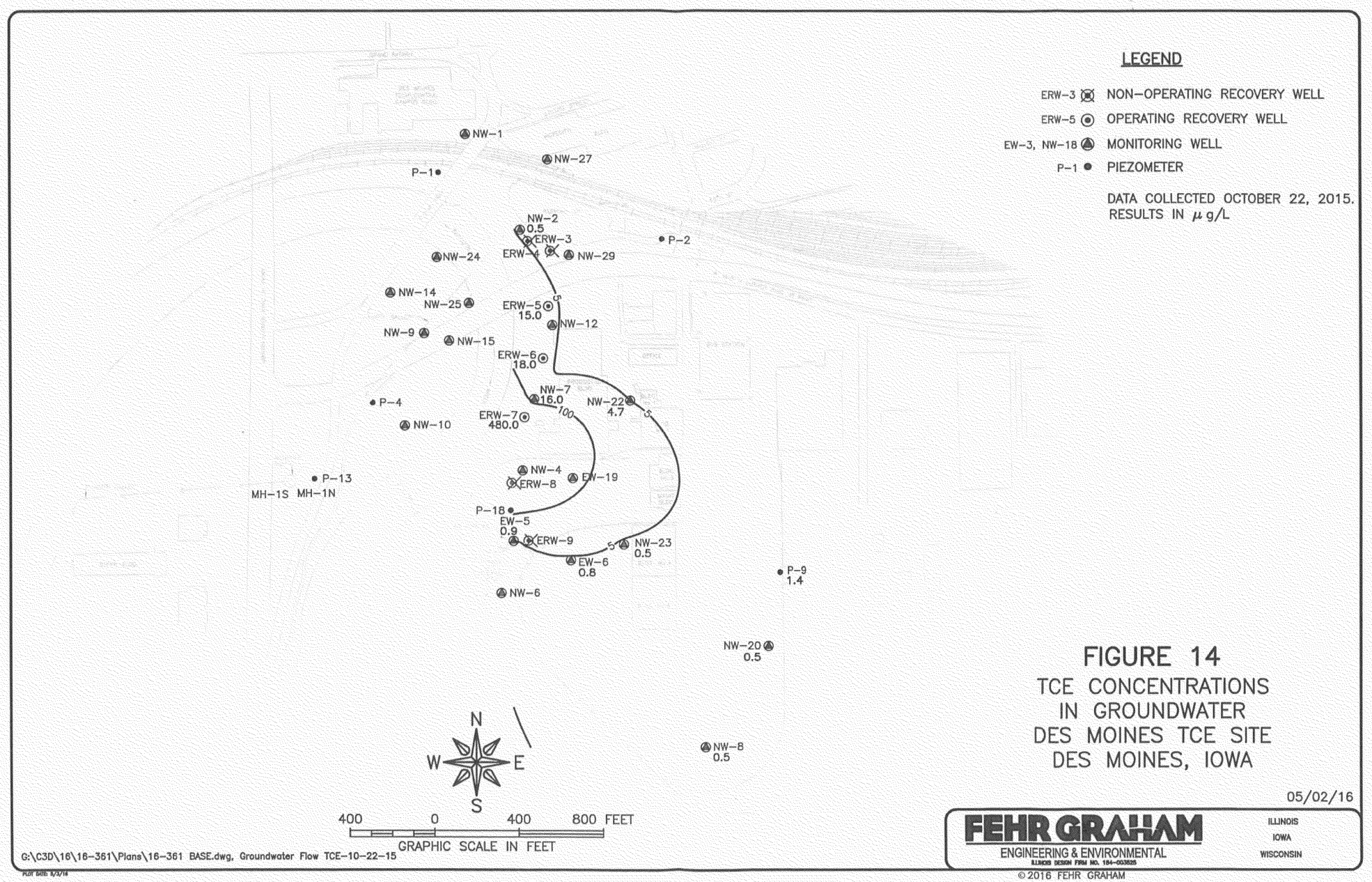
G:\C3D\16\16-361\Plans\16-361 BASE.dwg, Groundwater Flow 1 2 DCE-04-29-15

PLOT DATE: 5/2/16

Figure 14

TCE Concentrations in Groundwater
(October 2015)


LEGEND
ERW-3 NON-OPERATING RECOVERY WELL
ERW-5 OPERATING RECOVERY WELL
EW-3, NW-18 MONITORING WELL
P-1 PIEZOMETER
DATA COLLECTED OCTOBER 22, 2015.
RESULTS IN μg/L
NW-1
NW-27
P-1
NW-2
0.5
ERW-3
P-2
NW-24
ERW-4
NW-29
NW-14
NW-25
ERW-5
15.0
NW-12
NW-9
NW-15
ERW-6
18.0
NW-7
16.0
NW-22
4.7
P-4
ERW-7
480.0
NW-10
NW-4
EW-19
P-13
ERW-8
MH-1S
MH-1N
P-18
EW-5
0.9
ERW-9
NW-23
0.5
EW-6
0.8
P-9
1.4
NW-6
NW-20
0.5
NW-8
0.5
N
W
E
S
400
0
400
800 FEET
GRAPHIC SCALE IN FEET
FIGURE 14
TCE CONCENTRATIONS
IN GROUNDWATER
DES MOINES TCE SITE
DES MOINES, IOWA
05/02/16
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ILLINOIS DESIGN FIRM NO. 184-003825
ILLINOIS
IOWA
WISCONSIN
G:\C3D\16\16-361\Plans\16-361 BASE.dwg, Groundwater Flow TCE-10-22-15
PLOT DATE: 5/3/16
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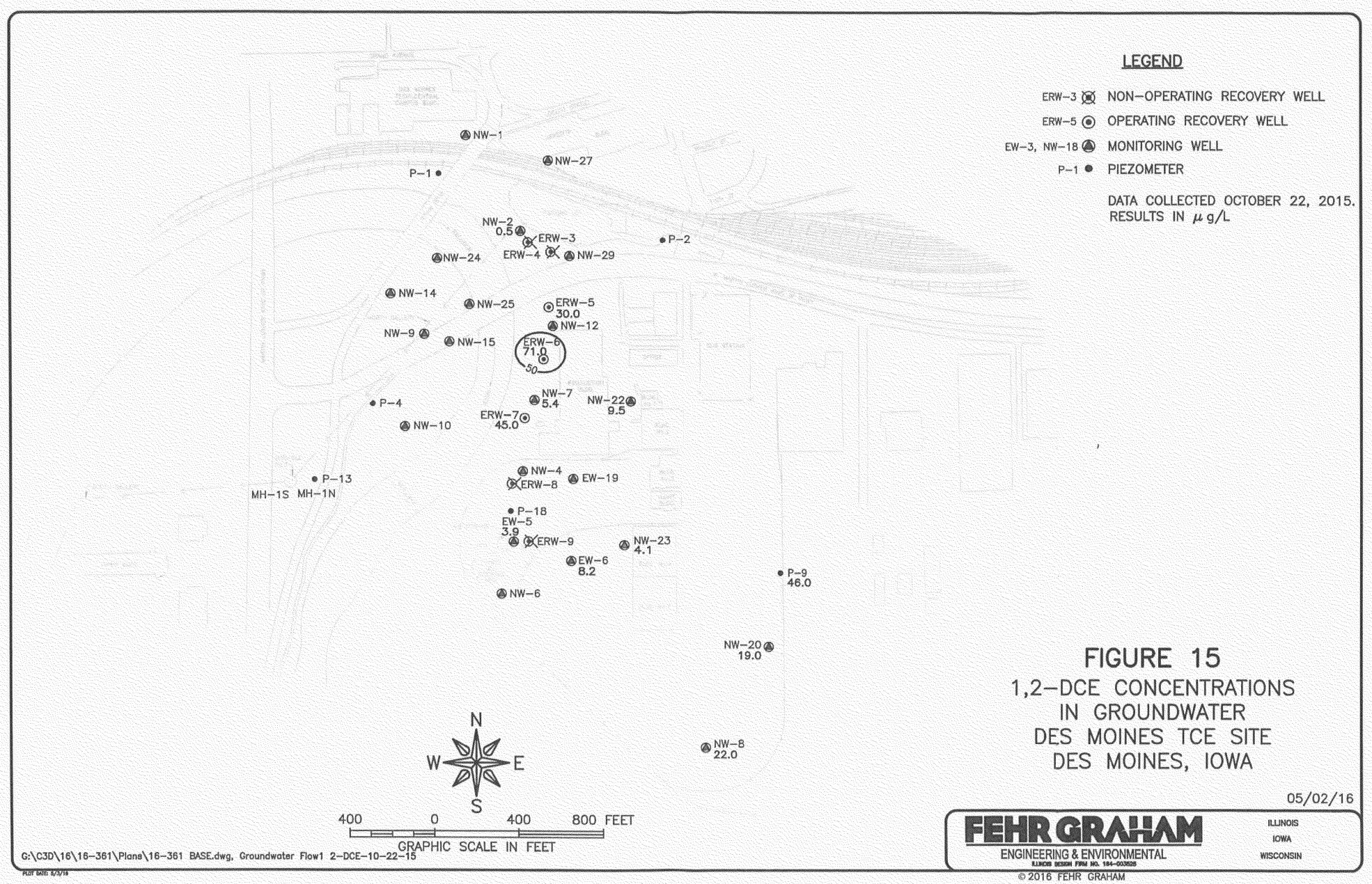
Figure 15

1,2-DCE Concentrations in Groundwater (October 2015)


LEGEND
ERW-3 NON-OPERATING RECOVERY WELL
ERW-5 OPERATING RECOVERY WELL
EW-3, NW-18 MONITORING WELL
P-1 PIEZOMETER
DATA COLLECTED OCTOBER 22, 2015.
RESULTS IN μg/L
NW-1
NW-27
P-1
NW-2
0.5
ERW-3
ERW-4
NW-29
P-2
NW-24
NW-14
NW-25
ERW-5
30.0
NW-12
NW-9
NW-15
ERW-6
71.0
50
NW-7
5.4
NW-22
9.5
P-4
ERW-7
45.0
NW-10
P-13
MH-1S
MH-1N
NW-4
ERW-8
EW-19
P-18
EW-5
3.9
ERW-9
NW-23
4.1
EW-6
8.2
P-9
46.0
NW-6
NW-20
19.0
NW-8
22.0
N
W
E
S
400
0
400
800 FEET
GRAPHIC SCALE IN FEET
FIGURE 15
1,2-DCE CONCENTRATIONS
IN GROUNDWATER
DES MOINES TCE SITE
DES MOINES, IOWA
05/02/16
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ILLINOIS DESIGN FIRM NO. 184-003528
ILLINOIS
IOWA
WISCONSIN
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G:\C3D\16\16-361\Plans\16-361 BASE.dwg, Groundwater Flow1 2-DCE-10-22-15
PLOT DATE: 5/3/16

Table 1

Groundwater Elevation Measurements (2015)

Table 1

Groundwater Elevation Measurements
(2015)
Des Moines TCE Site

Well ID	Easting	Northing	Top of Casing	January		February		March		April		May		June		July		August		September		October		November		December	
				Date Measured:	01/21/15	Date Measured:	02/16/15	Date Measured:	03/23/15	Date Measured:	04/20/15	Date Measured:	05/19/15	Date Measured:	06/01/15	Date Measured:	07/22/15	Date Measured:	08/26/15	Date Measured:	09/28/15	Date Measured:	10/12/15	Date Measured:	11/18/15	Date Measured:	12/29/15
	(ft)	(ft)	(ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)	Depth to Water (ft)	Groundwater Elevation (ft ASL)
ERW-5	2285.1951	3944.5887	806.18	23.05	783.13	26.92	779.26	27.30	778.88	26.20	779.98	23.75	782.43	Flooded	NR	24.70	781.48	24.80	781.38	24.55	781.63	24.90	781.28	25.00	781.18	21.30	784.88
ERW-6	2260.1291	3699.6094	804.56	19.65	784.91	23.92	780.64	23.00	781.56	25.32	779.24	22.92	781.64	Flooded	NR	23.70	780.86	20.60	783.96	22.15	782.41	23.52	781.04	23.50	781.06	19.40	785.16
ERW-7	2170.7126	3422.2393	801.40	22.10	779.30	21.93	779.47	22.35	779.05	21.14	780.26	22.91	778.49	Flooded	NR	21.40	780.00	21.40	780.00	20.71	780.69	21.00	780.40	20.95	780.45	16.90	784.50
EW-5	2119.3754	2840.2265	803.41	21.50	781.91	NR	NR	NR	NR	21.42	781.99	NR	NR	Flooded	NR	20.55	782.86	NR	NR	NR	NR	20.55	782.86	NR	NR	NR	NR
EW-6	2391.3831	2749.3644	799.55	17.30	782.25	NR	NR	NR	NR	16.83	782.72	NR	NR	Flooded	NR	15.90	783.65	NR	NR	NR	NR	16.00	783.55	NR	NR	NR	NR
EW-19	2400.1490	3136.0012	800.42	18.45	781.97	NR	NR	NR	NR	18.35	782.07	NR	NR	Flooded	NR	17.00	783.42	NR	NR	NR	NR	17.23	783.19	NR	NR	NR	NR
MH-1N	1078.9261	3142.8268	796.58	16.45	780.13	16.40	780.18	17.35	779.23	15.42	781.16	12.10	784.48	Flooded	NR	15.00	781.58	14.40	782.18	14.75	781.83	15.22	781.36	14.80	781.78	14.25	782.33
MH-15	1033.4391	3120.1139	796.56	No Water	NR	20.78	775.78	Mud	NR	20.80	775.76	18.35	778.21	Flooded	NR	Mud	NR	MUD	NR	19.80	776.76	20.70	775.86	MUD	NR	MUD	NR
NW-1	1893.0547	4753.4938	803.55	Blocked	NR	NR	NR	NR	NR	19.36	784.19	NR	NR	Flooded	NR	Blocked	NR	NR	NR	NR	NR	19.46	784.09	NR	NR	NR	NR
NW-2	2151.4212	4303.2535	806.69	23.4	783.29	NR	NR	NR	NR	23.33	783.36	NR	NR	Flooded	NR	22.3	784.39	NR	NR	NR	NR	22.45	784.24	NR	NR	NR	NR
NW-4	2161.9814	3172.1293	803.30	22.2	781.10	NR	NR	NR	NR	21.9	781.40	NR	NR	Flooded	NR	20.8	782.50	NR	NR	NR	NR	20.98	782.32	NR	NR	NR	NR
NW-6	2062.3194	2595.5391	803.20	21	782.20	NR	NR	NR	NR	20.3	782.90	NR	NR	Flooded	NR	15.85	787.35	NR	NR	NR	NR	19.7	783.50	NR	NR	NR	NR
NW-7	2217.3970	3507.2473	800.80	18.55	782.25	19.15	781.65	22.95	777.85	18.85	781.95	16.72	784.08	Flooded	NR	17.45	783.35	17.15	783.65	17.22	783.58	17.65	783.15	17.7	783.10	17.45	783.35
NW-8	3032.5520	1874.3329	793.89	12.4	781.49	NR	NR	NR	NR	11.32	782.57	NR	NR	Flooded	NR	11.2	782.69	NR	NR	NR	NR	15.32	778.57	NR	NR	NR	NR
NW-9	1695.8397	3818.2277	Not Surveyed	13.7	13.70	NR	NR	NR	NR	13	13.00	NR	NR	Flooded	NR	12.9	12.90	NR	NR	NR	NR	12.95	12.95	NR	NR	NR	NR
NW-10	1603.3353	3383.3057	793.09	15.3	777.79	12.47	780.62	16.15	776.94	10.92	782.17	7.80	785.29	Flooded	NR	13.9	779.19	13.05	780.04	27.31	765.78	10.81	782.28	14.1	778.99	5.8	787.29
NW-12	2304.7394	3856.1022	805.08	22.2	782.88	NR	NR	NR	NR	22.75	782.33	NR	NR	Flooded	NR	21.55	783.53	NR	NR	NR	NR	21.66	783.42	NR	NR	NR	NR
NW-14	1536.4443	4008.0375	794.50	11.8	782.70	NR	NR	NR	NR	11.52	782.98	NR	NR	Flooded	NR	11.45	783.05	NR	NR	NR	NR	11.15	783.35	NR	NR	NR	NR
NW-15	1814.4393	3783.1677	795.46	14.4	781.06	NR	NR	NR	NR	15	780.46	NR	NR	Flooded	NR	13.85	781.61	NR	NR	NR	NR	13.78	781.68	NR	NR	NR	NR
NW-20	3331.0239	2347.4729	797.00	14.75	782.25	NR	NR	NR	NR	14.11	782.89	NR	NR	Flooded	NR	13.9	783.10	NR	NR	NR	NR	13.89	783.11	NR	NR	NR	NR
NW-22	2671.2100	3501.0000	799.89	17.15	782.74	17.2	782.69	18	781.89	16.85	783.04	15.11	784.78	Flooded	NR	11.2	788.69	15.8	784.09	15.6	784.29	15.9	783.99	16.4	783.49	12.95	786.94
NW-23	2641.4500	2823.6321	802.20	19.85	782.35	NR	NR	NR	NR	19.62	782.58	NR	NR	Flooded	NR	18.4	783.80	NR	NR	NR	NR	18.65	783.55	NR	NR	NR	NR
NW-24	1757.2138	4174.8833	797.63	16.7	780.93	NR	NR	NR	NR	14.18	783.45	NR	NR	Flooded	NR	15.2	782.43	NR	NR	NR	NR	14.9	782.73	NR	NR	NR	NR
NW-25	1909.4739	3959.2554	796.40	13.8	782.60	NR	NR	NR	NR	12.52	783.88	NR	NR	Flooded	NR	13.3	783.10	NR	NR	NR	NR	14.35	782.05	NR	NR	NR	NR
NW-27	2282.5859	4635.0422	802.57	Damaged	NR	NR	NR	NR	NR	17.41	785.16	NR	NR	Flooded	NR	15.3	787.27	NR	NR	NR	NR	Damaged	NR	NR	NR	NR	NR
NW-29	2383.7624	4185.2871	800.52	21.8	778.72	NR	NR	NR	NR	22.2	778.32	NR	NR	Flooded	NR	20.25	780.27	NR	NR	NR	NR	Plugged	NR	NR	NR	NR	NR
P-1	1764.6057	4573.2060	804.10	20.75	783.35	NR	NR	NR	NR	20.42	783.68	NR	NR	Flooded	NR	19.75	784.35	NR	NR	NR	NR	19.82	784.28	NR	NR	NR	NR
P-2	2826.7079	4259.4786	798.79	21.65	777.14	NR	NR	NR	NR	21.8	776.99	NR	NR	Flooded	NR	20.2	778.59	NR	NR	NR	NR	20.58	778.21	NR	NR	NR	NR
P-4	1450.7788	3490.6407	795.17	16.1	779.07	16.52	778.65	17.05	778.12	15.11	780.06	11.67	783.50	Flooded	NR	14.75	780.42	14.2	780.97	14.4	780.77	14.85	780.32	14.45	780.72	13.8	781.37
P-9	3386.0436	2693.5567	792.17	10.35	781.82	NR	NR	NR	NR	10.95	781.22	NR	NR	Flooded	NR	8.7	783.47	NR	NR	NR	NR	9.37	782.80	NR	NR	NR	NR
P-13	1175.8079	3132.4654	793.08	14.6	778.48	NR	NR	NR	NR	11.5	781.58	NR	NR	Flooded	NR	12.85	780.23	NR	NR	NR	NR	12.82	780.26	NR	NR	NR	NR
P-18	2105.1343	2984.1400	802.64	20.55	782.09	NR	NR	NR	NR	20.1	782.54	NR	NR	Flooded	NR	19.3	783.34	NR	NR	NR	NR	19.25	783.39	NR	NR	NR	NR

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Table 2

Summary of Air Stripper Efficiency (2015)

Table 4

Summary of Groundwater and Surface Water Quality Data (April 2015)

Table 4

Summary of Groundwater and Surface Water Quality Data (April 2015)
Des Moines TCE Site

Well Number	Sample Date	Laboratory	TCE (µg/L)	1,2-DCE (µg/L)	VC (µg/L)	1,2-DCA (µg/L)	1,1,1-TCA (µg/L)	1,1-DCE (µg/L)	Chloroform (µg/L)
ERW-5	29-Apr-15	SHL	14	35	<0.5	<0.5	<0.5	<0.5	<0.5
ERW-6	29-Apr-15	SHL	180	67	<5	<5	<5	<5	<5
ERW-7	29-Apr-15	NS	780	68	<5	<5	<5	<5	<5
MH-1N	29-Apr-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MH-1S	29-Apr-15	NS	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NW-1	29-Apr-15	NS	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NW-10	29-Apr-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NW-14	29-Apr-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NW-20	29-Apr-15	SHL	<0.5	25	<0.5	<0.5	<0.5	<0.5	<0.5
NW-22	29-Apr-15	SHL	2.6	12	<0.5	<0.5	<0.5	<0.5	<0.5
NW-25	29-Apr-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NW-27	29-Apr-15	SHL	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Racoon River	29-Apr-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Des Moines River	29-Apr-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Notes: All concentrations are reported in micrograms per liter (µg/L) or parts per billion (ppb)

< = Not Detected
NS = Not Sampled
J = Estimated Concentration
B = Compund also detected in associated blank

TCE = Trichloroethene
1,2-DCE = 1,2-Dichloroethene (cis+trans)
VC = Vinyl Chloride
1,2-DCA = 1,2-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCE = 1,1-Dichloroethene

Table 5

Summary of Groundwater and Surface Water Quality Data (October 2015)

Table 5

Summary of Groundwater and Surface Water Quality Data (October 2015)
Des Moines TCE Site

Well Number	Sample Date	Laboratory	TCE (µg/L)	1,2-DCE (µg/L)	VC (µg/L)	1,2-DCA (µg/L)	1,1,1-TCA (µg/L)	1,1-DCE (µg/L)	Chloroform (µg/L)	PCE (µg/L)	Toluene (µg/L)	1,2 DCP (µg/L)	CT (µg/L)	MC (µg/L)	Benzene (µg/L)
ERW-5	22-Oct-15	SHL	15	30	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
ERW-6	22-Oct-15	SHL	18	71	<5	<5	<5	<5	NS	<5	<5	<5	<5	<10	<5
ERW-7	22-Oct-15	SHL	480	45	<5	<5	<5	<5	NS	<5	<5	<5	<5	<10	<5
EW-5	22-Oct-15	SHL	0.9	3.9	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
EW-6	22-Oct-15	SHL	0.8	8.2	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
MH-1N	22-Oct-15	SHL	<2	<2	<2	<2	<2	<2	NS	<2	<2	<2	<2	<4	<2
MH-1S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NW-1	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-2	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NW-7	22-Oct-15	SHL	16	5.4	<2	<2	<2	<2	NS	<2	<2	<2	<2	<4	<2
NW-8	22-Oct-15	SHL	<0.5	22	1.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-9	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-10	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	5.6	<0.5	<0.5	<1	<0.5
NW-14	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-15	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-20	22-Oct-15	SHL	<0.5	19	1.3	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-22	22-Oct-15	SHL	4.7	9.5	3.4	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	1.1
NW-23	22-Oct-15	SHL	<0.5	4.1	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-24	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	15	<0.5	<0.5	<1	<0.5
NW-25	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
NW-27	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P-1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P-9	22-Oct-15	SHL	1.4	46	<0.5	0.6	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
Racoon River	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5
Des Moines River	22-Oct-15	SHL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<1	<0.5

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1,2-DCE = Total 1,2-Dichloroethene
VC = Vinyl Chloride
1,2-DCA = 1,2-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCE = 1,1-Dichloroethene

PCE = Tetrachloroethene
1,2 DCP = 1,2 Dichloropropane
CT = Carbon Tetrachloride
MC = Methylene Chloride