North Shore Gas
South Plant MGP Site (SA)
Waukegan, IL

January, 2014

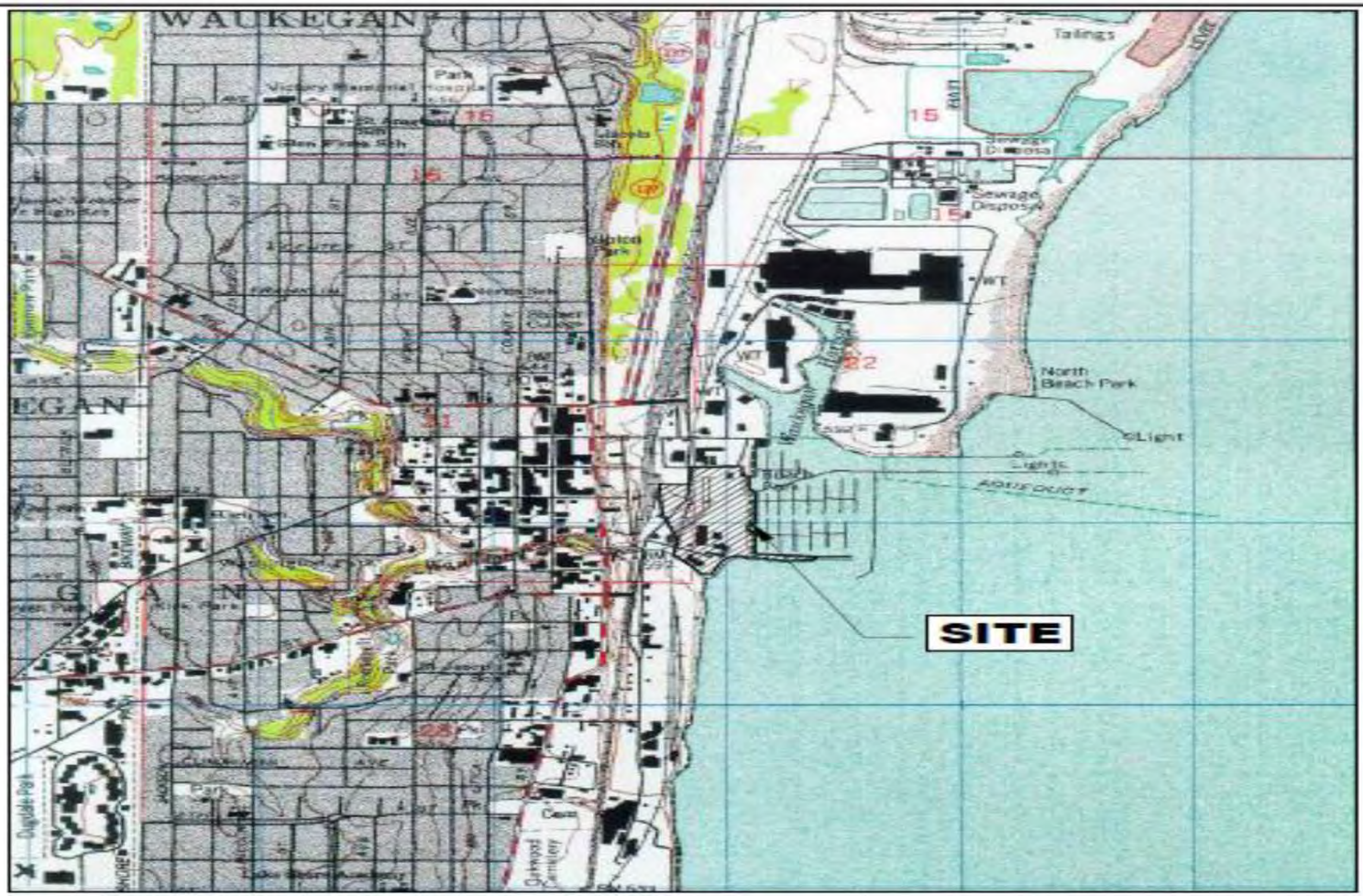
RI Findings

Agenda

1. Introduction
2. Site Description/History
3. Nature and Extent of Contamination
4. BLRA/RAOs/CSM/ARARs
5. Alternatives Array Screening Discussion
6. State/Community/PRP Perspectives
7. Q/A

Site Description

- Located near Waukegan Harbor
- Former MGP property (2 acres), plus nearby properties where MGP contaminants were discovered (approx. 20 acres):
  - ❑ WPD (marina/adm. bldg/parking lots)
  - ❑ Akzo Nobel Aerospace Coatings
  - ❑ Elgin, Joliet, and Eastern (EJ & E) tracks & ROW
  - ❑ City Of Waukegan ROW
- Zoned for commercial/industrial use



SOURCE:

THIS DRAWING WAS DEVELOPED FROM "Figure 1, SITE LOCATION MAP.dwg", BY BURNS McDONNELL ENGINEERING COMPANY, INC.

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SITE LOCATION MAP

NATURAL RESOURCE TECHNOLOGY

REMEDIAL INVESTIGATION REPORT
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

PROJECT NO. 1983

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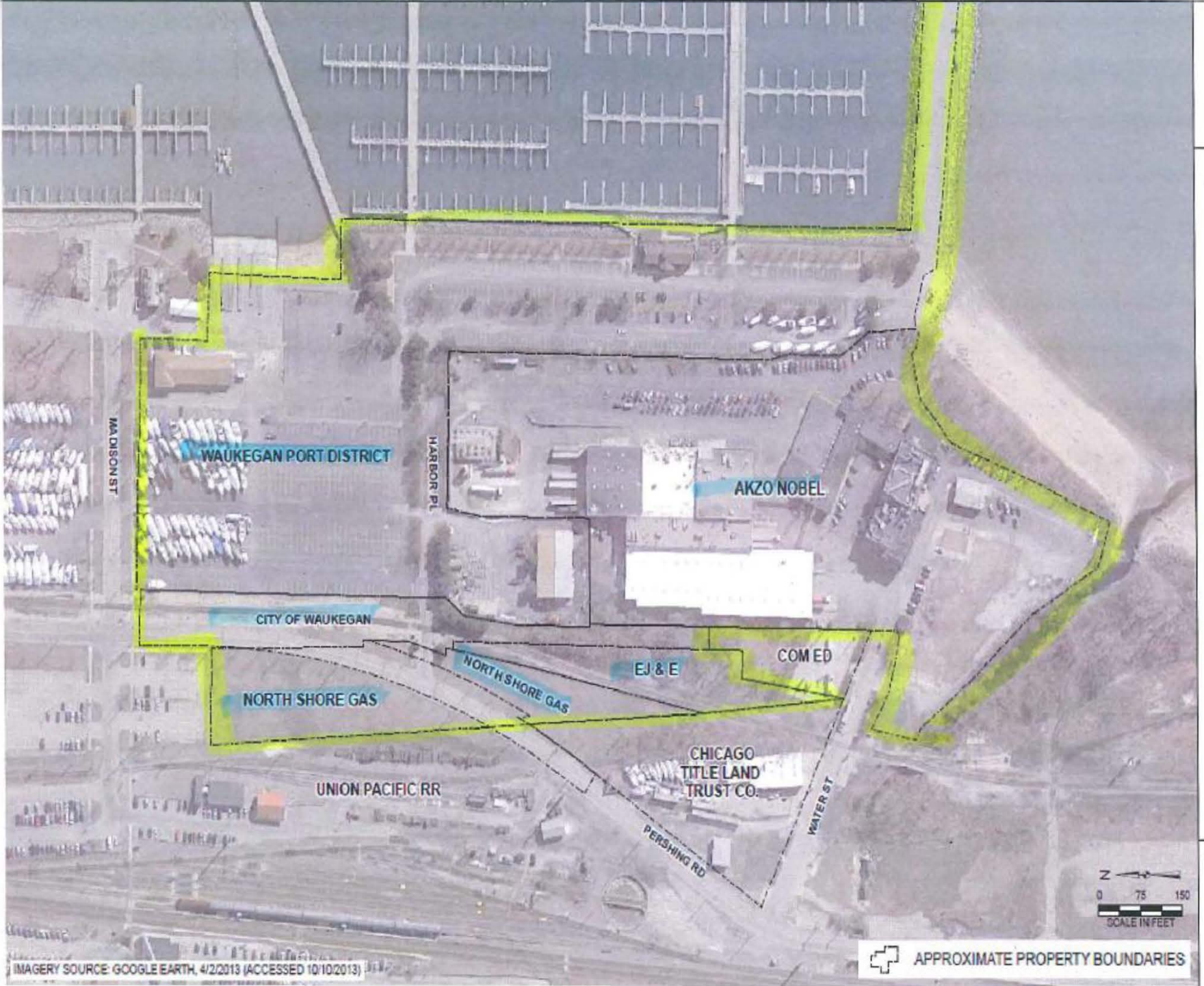
FIGURE NO. 1

DRAWN: RLH DATE: 12/04/12 CHK'D: EPK DATE: 12/04/12 APP'D: JMK DATE: 12/06/12



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OPERATIONS UNIT MAP

REMEDIAL INVESTIGATION REPORT, REVISION 1
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY

PROJECT NO: 19

FIGURE NO: 9

Natural Resource Technology


Former MGP property – looking north
12.03.2012

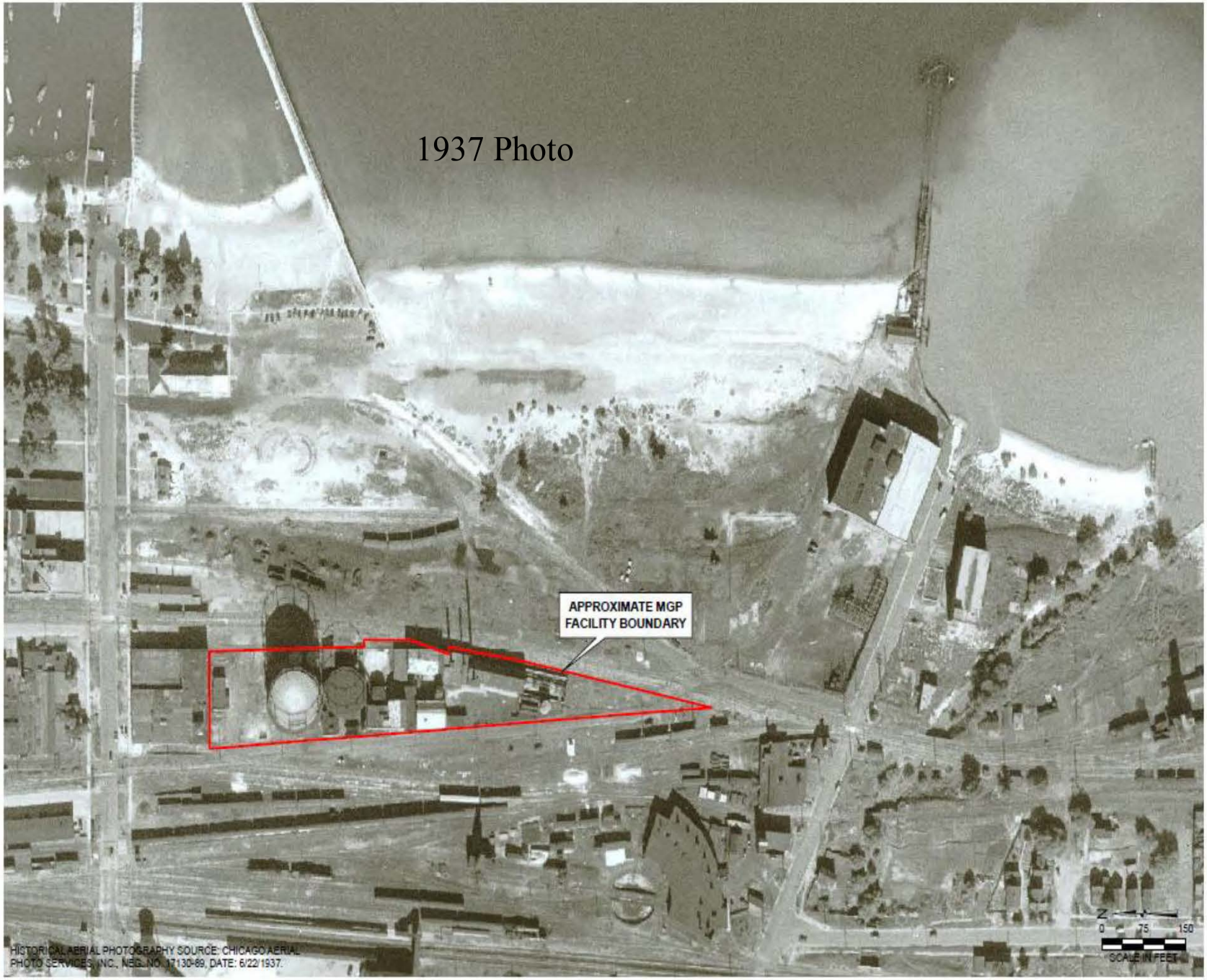

EJ & E railroad tracks
Former MGP property – looking southwest
12.03.2012


Waukegan Harbor Marina – looking east
12.03.2012


Akzo-Nobel property
12.03.2012

Site History

- MGP constructed in 1897
- Operated from 1898 to 1946
- Ownership
  - ❑ Waukegan Pipeline Service Company (1897)
  - ❑ North Shore Gas (1900)
  - ❑ Integrys (2006 - present)



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APPROXIMATE MGP FACILITY BOUNDARY (1937)

REMEDIAL INVESTIGATION REPORT, REVISION 1
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

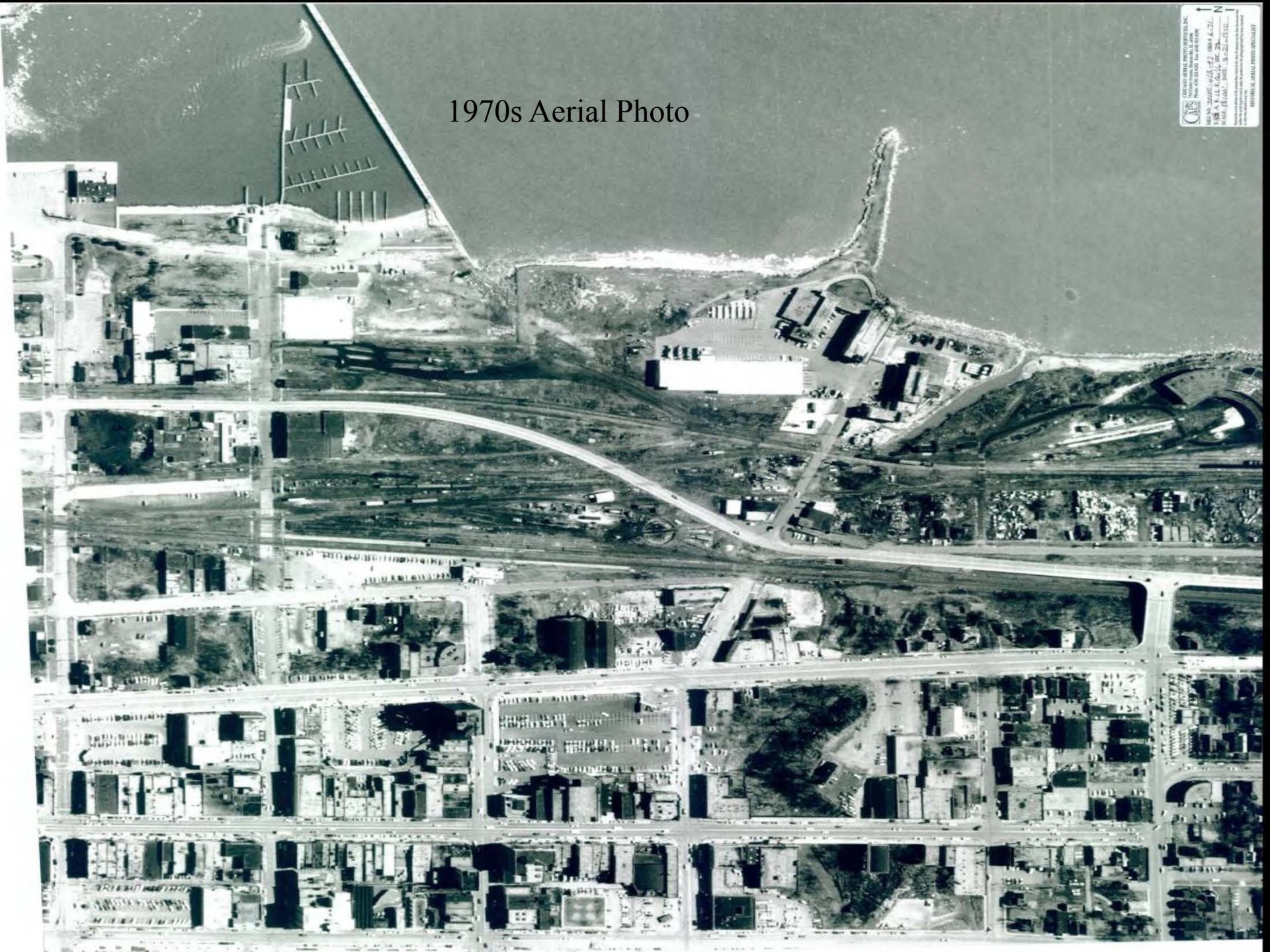
PROJECT NO: 1983

FIGURE NO: 5A

NATURAL RESOURCE TECHNOLOGY

Site History

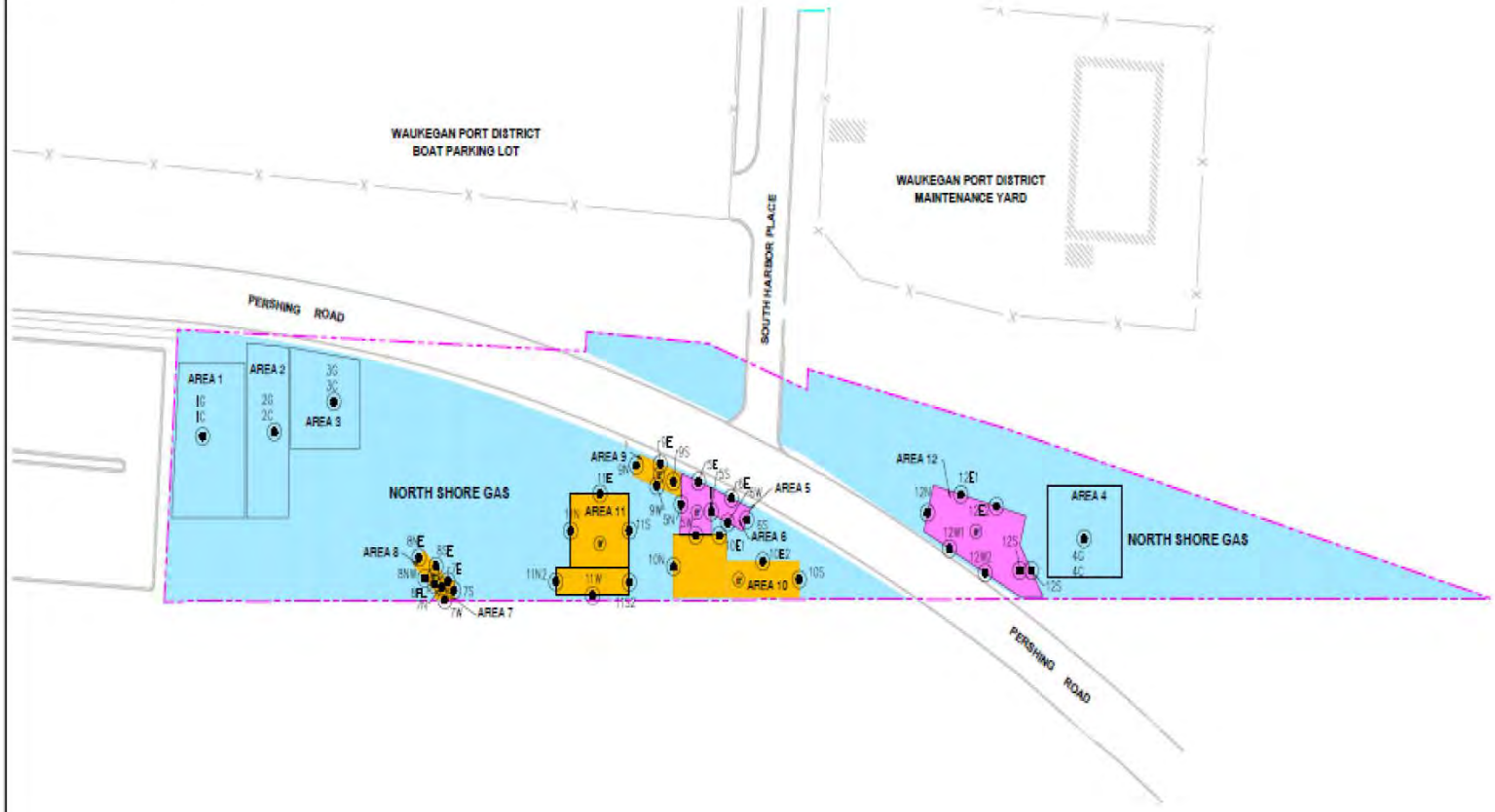
- MGP facility demolished in 1951 (above-ground structures removed)
  - ❑ Coke ovens
  - ❑ Tar/oil tanks
  - ❑ Gas holders
  - ❑ Coal shed
  - ❑ Office building


1970s Aerial Photo


1980s Aerial
Photo

Site History – Cont'd

- State inspections (2 in 1991)
  - 1991 CERCLA Preliminary Assessment Report
  - 1992 CERCLA SSI Report
  - Recommended placing site in CERCLIS and assigned medium priority status
- PRP investigations 1993–2007 (soil & gw)
- 2003 – 2004 response action
  - Excavated contaminated soil above water table
  - Plastic liner between clean fill and potentially impacted soil below water table



APPROXIMATE PROPERTY LINE OF FORMER SOUTH PLANT

SOIL EXCAVATED TO 3.5' BGS

IMPACTED MATERIAL EXCAVATED ABOVE WATER TABLE

ADDITIONAL DEEP EXCAVATION EXCAVATED ABOVE WATER TABLE

11W SOIL CONFIRMATION SAMPLING LOCATIONS

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SCALE IN FEET

SOURCE:

THIS DRAWING WAS DEVELOPED FROM "FIGURE 6 EXCAVATION PLAN FROM 2003 REMEDIATION.dwg", DATED 09-02-08 BY BURNS McDONNELL ENGINEERING COMPANY, INC.

DRAWN BY: RLH DATE: 12/04/12

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APPROVED BY: JMK DATE: 12/14/12

DRAWING NO: 1983-41-806C

REFERENCE: REV 0

2003 EXCAVATION AREAS AND CONFIRMATION SAMPLING LOCATIONS

REMEDIAL INVESTIGATION REPORT
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

NATURAL RESOURCE TECHNOLOGY

PROJECT NO.
1983/4.1

Site History

- PRP request for MGP sites placed under federal program – 2006
- Superfund Alternative Sites (SA)
- Multi-site RI/FS AOCs 2007 and 2008

Multi-Site Investigations

- 19 MGP Sites in IL (13) and WI (6)
- Similarities
  - ❑ Same PRP
  - ❑ Facilities dismantled/parcels redeveloped
  - ❑ Located near a water body in urban areas
  - ❑ Shallow gw impacted (not drinking water source)
  - ❑ Similar COPCs in gw, soil, and sediment
- Multi-site support documents developed

Multi-site Support Documents

- Health & Safety Plan
- QAPP
- Risk Assessment Framework (HH and Eco)
- CSM
- FS

Nature and Extent of Contamination

RI Report

- Draft 12/2012; Final 01/22/2014
- Media: GW, Soil, Sediment, Soil Vapor, and SW
- Constituents of Potential Concern (COPCs)
  - ❑PAHs
  - ❑PVOCs (BTEX + trimethylbenzenes)
  - ❑Cyanides/Phenols
  - ❑Metals

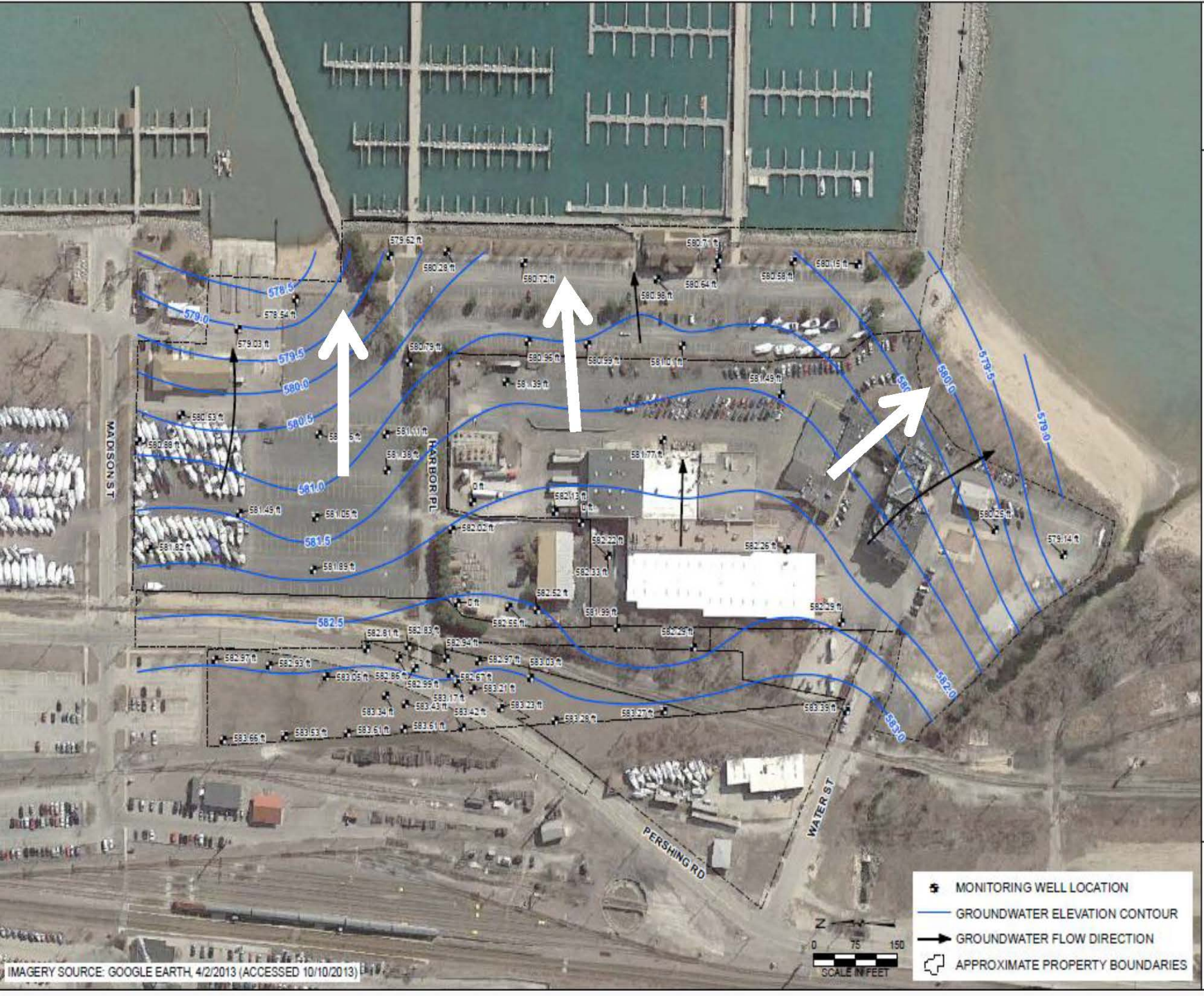
Groundwater

- GW sampling 2009 – 2012: 8 quarterly rounds + 2 semiannual rounds
- 85 monitoring wells
- Data compared with EPA RSLs, Illinois TACO values (residential and industrial), and MCLs

Groundwater

- Primary west to east flow (towards the lake)
  - ❑Depth to gw: 6-8 ft. bgs
- NAPL observed at MGP, WPD, and Akzo
- Site-wide PVOC and PAH plume
  - ❑Benzene
  - ❑Naphthalene
  - ❑Benzo(a)pyrene

Note: Marina sheetpile wall/bulkhead down to clay layer – may be impeding gw flow to sw along marina



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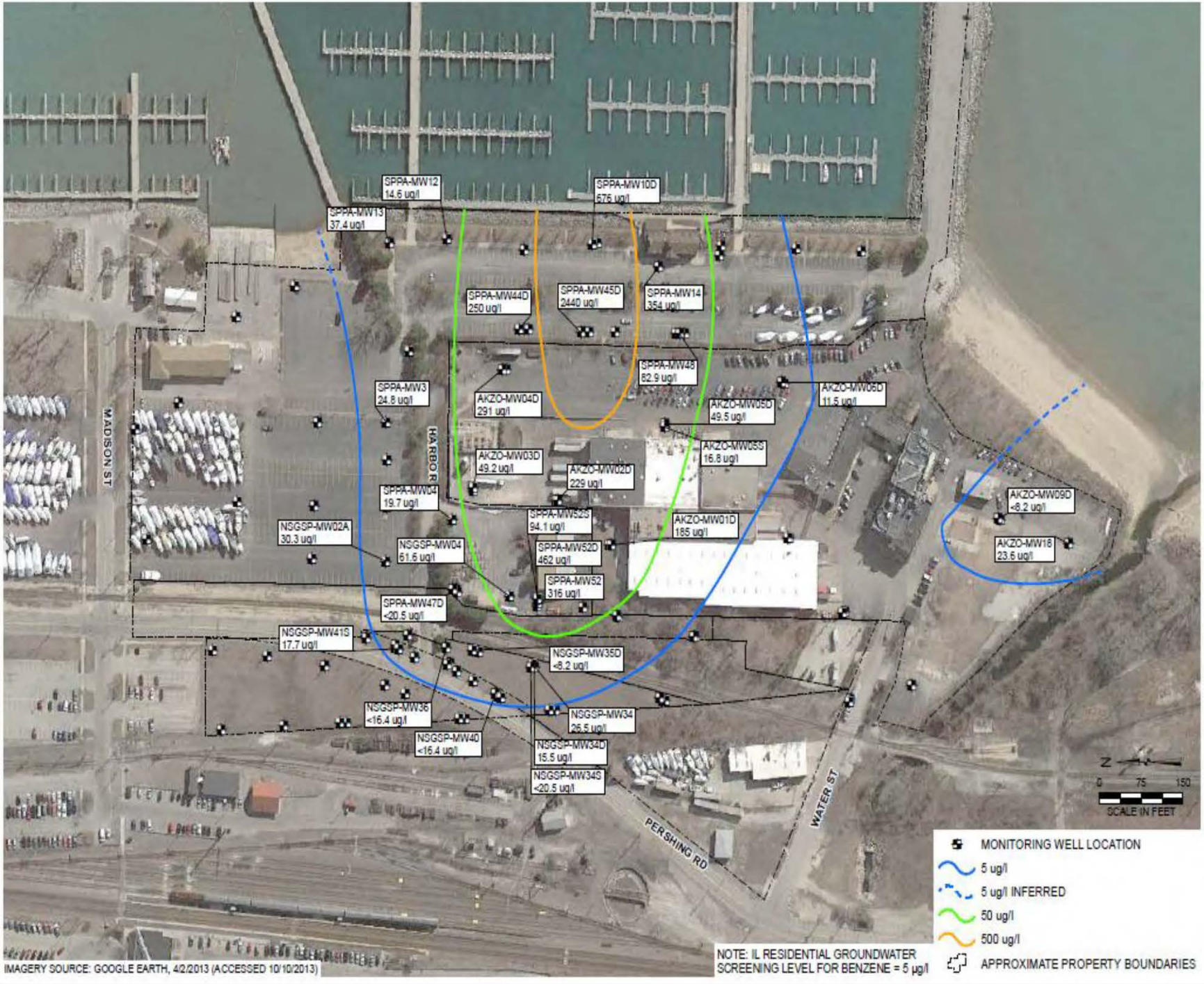
GROUNDWATER ELEVATION CONTOURS MARCH 2013

REMEDIAL INVESTIGATION REPORT, REVISION 1
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

PROJECT NO: 1983

FIGURE NO: 28A

Natural Resource Technology



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REVIEWED BY/DATE: EPK 10/11/13
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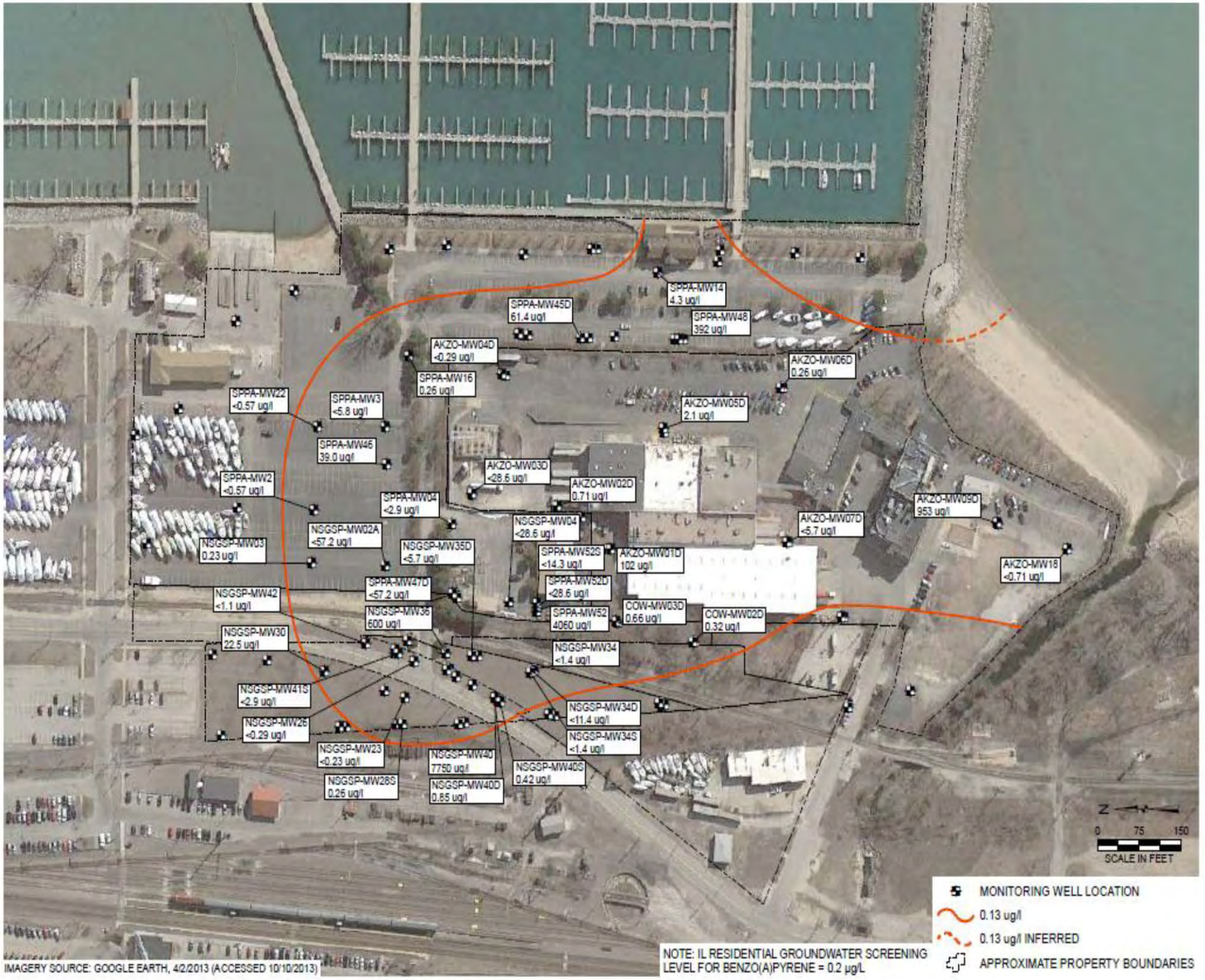
BENZENE EXCEEDANCES IN GROUNDWATER MARCH 2013

REMEDIAL INVESTIGATION REPORT, REVISION 1
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

PROJECT NO: 1983

FIGURE NO: 33A

NATURAL RESOURCE TECHNOLOGY



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APPROVED BY/DATE:
EPK 10/15/13

BENZO(A)PYRENE EXCEEDANCES IN GROUNDWATER MARCH 2013

REMEDIAL INVESTIGATION REPORT, REVISION 1
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

PROJECT NO: 1983

FIGURE NO: 56A

NATURAL RESOURCE TECHNOLOGY

IMAGERY SOURCE: GOOGLE EARTH, 4/2/2013 (ACCESSED 10/10/2013)

NOTE: IL RESIDENTIAL GROUNDWATER SCREENING LEVEL FOR NAPHTHALENE = 140 µg/L

DRAWN BY/DATE: TDC 10/10/13
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APPROVED BY/DATE: EPK 10/15/13

NAPHTHALENE EXCEEDANCES IN GROUNDWATER MARCH 2013

REMEDIAL INVESTIGATION REPORT, REVISION 1
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

PROJECT NO: 1983

FIGURE NO: 46A

NATURAL RESOURCE TECHNOLOGY

Soil

- Sand/silty sand underlain by clay layer
- DNAPL extending from MGP facility to parts of WPD and Akzo properties
- Exceedances of SLs (residential or industrial) for PVOCs, PAHs (incl. all cPAHs), and metals

- APPROXIMATE PROPERTY LINE
- EXISTING FENCE
- RAILROAD TRACKS
- EXISTING STORM SEWER (APPROXIMATE)
- EXISTING SANITARY SEWER (APPROXIMATE)
- EXISTING BUILDING
- SHEETPILE WALL
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- APPROXIMATE LOCATION OF WATER LINE

- NSGSP-SB107 — SOIL BORING LOCATION
- AKZO-SB02/MW02 — SOIL BORING/ DEEP MONITORING WELL LOCATION
- AKZO-SB02/MW02 — SOIL BORING/ SHALLOW MONITORING WELL LOCATION
- AKZO-SG01 — SOIL VAPOR PROBE
- SPPA-SD01 — SEDIMENT SAMPLE LOCATION
- SOIL VAPOR PROBE (2005 LOCATION)
- MONITORING WELL LOCATION
- D — DEEP MONITORING WELL LOCATION
- S — SHALLOW MONITORING WELL LOCATION

- PETROLEUM RESIDUALS OBSERVED IN SOIL
- MGP RESIDUALS OBSERVED IN SOIL
- DNAPL PRESENT IN MONITORING WELL
- RECOVERY WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- TW — SEDIMENT SAMPLE LOCATION
- SOIL — BEACH SAMPLE LOCATION
- EXTENT OF MGP RESIDUALS OBSERVED IN SOIL

SOURCE:

THIS DRAWING WAS DEVELOPED FROM "PRELIMINARY SUMMARY OF FINDINGS.dwg", DATED 01-21-10 BY BURNS & McDONNELL ENGINEERING COMPANY, INC.

MGP AND/OR PETROLEUM RESIDUALS OBSERVATIONS IN SOIL

REMEDIAL INVESTIGATION REPORT
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS

CHECKED BY:	EPK	DATE: 12/07/12
APPROVED BY:	JMK	DATE: 12/17/12
DRAWING NO: 1963-41-818C		
REFERENCE: REV 0		

NATURAL RESOURCE TECHNOLOGY

PROJECT NO.
1963/4.1

FIGURE NO.
18

Table 5. Soil Summary Statistics for Parameters Exceeding the Screening Levels

North Shore Gas - Former Waukegan South Plant Manufactured Gas Plant Site
2 North Pershing Road & 1 South Pershing Road, Waukegan, Illinois
USEPA ILD984809228 / Illinois EPA #0971900058

Parameter (µg/kg)	Samples Analyzed	Samples Exceeding the MDL	Minimum (µg/kg)	Maximum (µg/kg)	Residential Soil SL (µg/kg)	Samples Exceeding Residential SL	Industrial Soil SL (µg/kg)	Samples Exceeding Industrial SL
Volatile Organic Compounds (VOCs)								
Benzene	169	24	5.7	180,000	1,100	3	5,400	1
Ethylbenzene	165	48	8.9	1,900,000	5,400	21	27,000	13
Total Xylenes	165	44	13	7,800,000	630,000	5	2,700,000	1
1,2,4-Trimethylbenzene	6	2	6	62,300	62,000	1	260,000	0
Polynuclear Aromatic Hydrocarbons (PAHs)								
Benzo(a)anthracene	164	113	27	500,000	150	90	2,100	41
Benzo(a)pyrene	164	114	29	430,000	15	114	210	83
Benzo(b)fluoranthene	164	110	30	210,000	150	86	2,100	46
Benzo(k)fluoranthene	164	108	29	290,000	1,500	38	21,000	5
Carbazole	128	19	200	34,000	32,000	1	290,000	0
Chrysene	164	115	27	510,000	15,000	16	210,000	1
Dibenz(a,h)anthracene	164	88	26	40,000	15	88	210	53
Indeno(1,2,3-cd)pyrene	164	114	26	110,000	150	80	2,100	25
2-Methylnaphthalene	133	44	180	590,000	230,000	2	2,200,000	0
Naphthalene	168	106	30	4,500,000	3,600	37	18,000	23
Inorganic Compounds								
Antimony	132	6	1,500	130,000	31,000	1	410,000	0
Arsenic*	159	142	540	32,000	390 (13,000)	142 (7)	1,600 (13,000)	102 (7)
Cyanide	134	23	330	68,000	47,000	1	610,000	0
Iron	96	96	2,300,000	57,000,000	55,000,000	1	720,000,000	0
Lead	165	164	11	1,400,000	400,000	4	800,000	1
Thallium	30	1	1,000	1,100	780	1	10,000	0

Notes

* The arsenic screening criteria (residential and industrial) is 13,000 µg/kg, which is the background concentration for metropolitan counties of Illinois as presented in the Illinois Tiered Approach to Corrective Action Objectives (TACO-Table G). Concentrations and samples exceeding the TACO Table G are listed in parentheses.

Refer to Table E1, Appendix E for a listing of all parameters analyzed.

µg/kg = microgram per kilogram
MDL = Method Detection Limit
SL = Screening Level

Note: Cyanide (<SL of 78 mg/kg) & Thallium not used in HHRA. Arsenic SL s/b 610, instead of 390 – based on revised 10/13 HHRA

Sediment

- Sampled 2009 (marina) and 2011 (Lake Michigan)
  - ❑ Used soil SLs for human health/threshold and probable effect concentrations (TEC/PEC) for eco
  - ❑ Residential SLs exceeded for 5 cPAHs
  - ❑ Industrial SLs exceeded for 2 cPAHs
  - ❑ One exceedance of TEC in surface sample
  - ❑ Along beach, exceedances of residential and eco SLs
  - ❑ Exceedances of PECs limited and at depth

Table 20. Lake Michigan Sediment Summary Statistics for Parameters Exceeding Human Health and Ecological Screening Levels

North Shore Gas - Former Waukegan South Plant Manufactured Gas Plant Site
2 North Pershing Road & 1 South Pershing Road, Waukegan, Illinois
USEPA ILD984809228 / Illinois EPA #0971900058

Parameter (µg/kg)	Samples Analyzed	Samples Exceeding the MDL	Minimum (µg/kg)	Maximum (µg/kg)	Residential Soil SL (µg/kg)	Samples Exceeding Residential SL	Ecological SL - TEC (µg/kg)	Samples Exceeding the TEC	Ecological SL - PEC (µg/kg)	Samples Exceeding the PEC
Volatile Organic Compounds (VOCs)										
Benzene	72	6	49.2	898	1,100	0	308	1	NA	0
Ethylbenzene	72	13	11.6	13,900	5,400	2	459	5	NA	0
Xylenes, Total	72	16	30.7	6,940	630,000	0	465	5	NA	0
Polynuclear Aromatic Hydrocarbons (PAHs)										
Acenaphthene	73	57	2.9	38,400	3,400,000	0	*396*	*6*	*NA*	*0*
Acenaphthylene	73	32	3.3	6,320	3,400,000	0	*365*	*1*	*NA*	*0*
Anthracene	73	59	5.4	24,900	17,000,000	0	*57.2*	*22*	*845*	*2*
Benzo(a)anthracene	73	66	3.3	13,000	150	16 (1)*	*108*	*24*	*1,050*	*2*
Benzo(a)pyrene	73	65	3.6	8,790	15	57 (10)*	*150*	*15*	*1,450*	*1*
Benzo(b)fluoranthene	73	65	4.2	3,820	150	14 (1)*	*788*	*4*	*NA*	*0*
Benzo(k)fluoranthene	73	63	3.9	6,230	1,500	1	*791*	*3*	*NA*	*0*
Chrysene	73	69	4.1	12,500	15,000	0	*166*	*16*	*1,290*	*2*
Fluoranthene	73	65	10.5	24,800	2,300,000	0	*423*	*13*	*2,230*	*3*
Fluorene	73	52	5.2	17,400	2,300,000	0	*77.4*	*10*	*536*	*1*
Naphthalene	73	58	4.0	110,000	3,600	3 (1)*	*176*	*7*	*561*	*6*
Phenanthrene	73	69	7.2	71,400	17,000,000	0	*204*	*21*	*1,170*	*4*
Pyrene	73	68	3.6	32,600	1,700,000	0	*195*	*24*	*1,520*	*3*
Total PAHs (13)	73	71	7.7	370,160	*NA*	*0*	**1,610**	**21**	**22,800**	**1**
Benzo(ghi)perylene	73	67	2.3	2,940	1,700,000	0	*882*	*2*	*NA*	*0*
Dibenz(a,h)anthracene	73	48	5.8	1,150	15	30 (3)*	*33*	*16*	*NA*	*0*
Indeno(1,2,3-cd)pyrene	73	62	4.8	2,520	150	8 (1)*	*899*	*1*	*NA*	*0*
Inorganic Compounds										
Copper, Total	67	67	2000	436,000	3,100,000	0	31,600	10	149,000	2
Lead, Total	67	67	2300	428,000	400,000	1	35,800	11	128,000	3
Mercury, Total	66	65	3.4	670	23,000	0	180	1	1,060	0
Nickel, Total	67	67	3100	28,800	1,500,000	0	22,700	3	48,600	0
Silver, Total	67	33	11	1,600	390,000	0	1,600	1	NA	0
Zinc, Total	67	67	13300	4,020,000	23,000,000	0	121,000	14	459,000	2

Note:
1) Concentrations are micrograms per kilogram (µg/kg) for all parameters.
2) Values exceeding the human health (residential soil) screening levels are bold/underlined. Values in parentheses highlighted with the asterisk "(10)*" indicate total number of samples for a particular compound that exceed the industrial soil screening criteria. If no value is listed, then all results were below the applicable criteria.
3) For Ecological evaluation, PAHs are screened against the Total PAH criteria based on the sum of 13 PAHs (the three not included are italicized).
Individual PAHs are not screened against their respective TEC and PEC criteria. The screening values for individual PAHs are provided for informational purposes only. Refer to Table 17.
4) "TEC" is the Threshold Effects Concentration and "PEC" is the Probable Effects Concentration.
5) µg/kg = microgram per kilogram.
6) SL = Screening Level
7) MDL = Method Detection Limit

Note: HHRA used sediment data from 0-2 ft. interval only; # of exceedances shown in table may be correct, but doesn't reflect the HHRA

Soil Vapor

- 2009 (soil gas only) and 2012 (2 rd. w/sub-slab)
- 2012 data compared to EPA RSLs
  - ❑ Industrial SLs exceeded at Akzo, COW, and WPD maintenance bldg. areas
  - ❑ Detected primarily chlorinated VOCs (TCE and chloroform), naphthalene, and benzene

Table 25. Soil Vapor Summary Statistics

North Shore Gas - Former Waukegan South Plant Manufactured Gas Plant Site
2 North Pershing Road & 1 South Pershing Road, Waukegan, Illinois
USEPA ILD984809228 / Illinois EPA #0971900058

Parameter ($\mu g/m^3$)	Samples Analyzed	Samples Exceeding the MDL	Minimum ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	Industrial Shallow Vapor SL ($\mu g/m^3$)	Samples Exceeding Ind. Shallow Vapor SL
Benzene	76	9	1.1	2,400	16	5
Ethylbenzene	76	28	2.1	140,000	49	6
Xylenes, Total	76	36	5	450,000	4400	3
1,2,4-Trimethylbenzene	76	14	1.7	10,000	310	1
Naphthalene	76	39	0.47	5,100	3.6	9
Bromodichloromethane	76	3	5.5	19	3.3	3
Chloroform	76	14	2.4	600	5.3	12
Tetrachloroethene	76	45	2.8	1,800	470	1
Trichloroethene	76	13	2.3	45	30	3
Vinyl Chloride	76	1	140	140	28	1

Notes:

1) $\mu g/m^3$ = microgram per cubic meter
2) SL = Screening Level
3) MDL = Method Detection Limit

Surface Water

- Samples taken in 2011 (1A, 2A, T3C, 4A, and 5A)
- BaP and lead detected just above eco SL at 2 locations
- In general, very low conc. for detected compounds

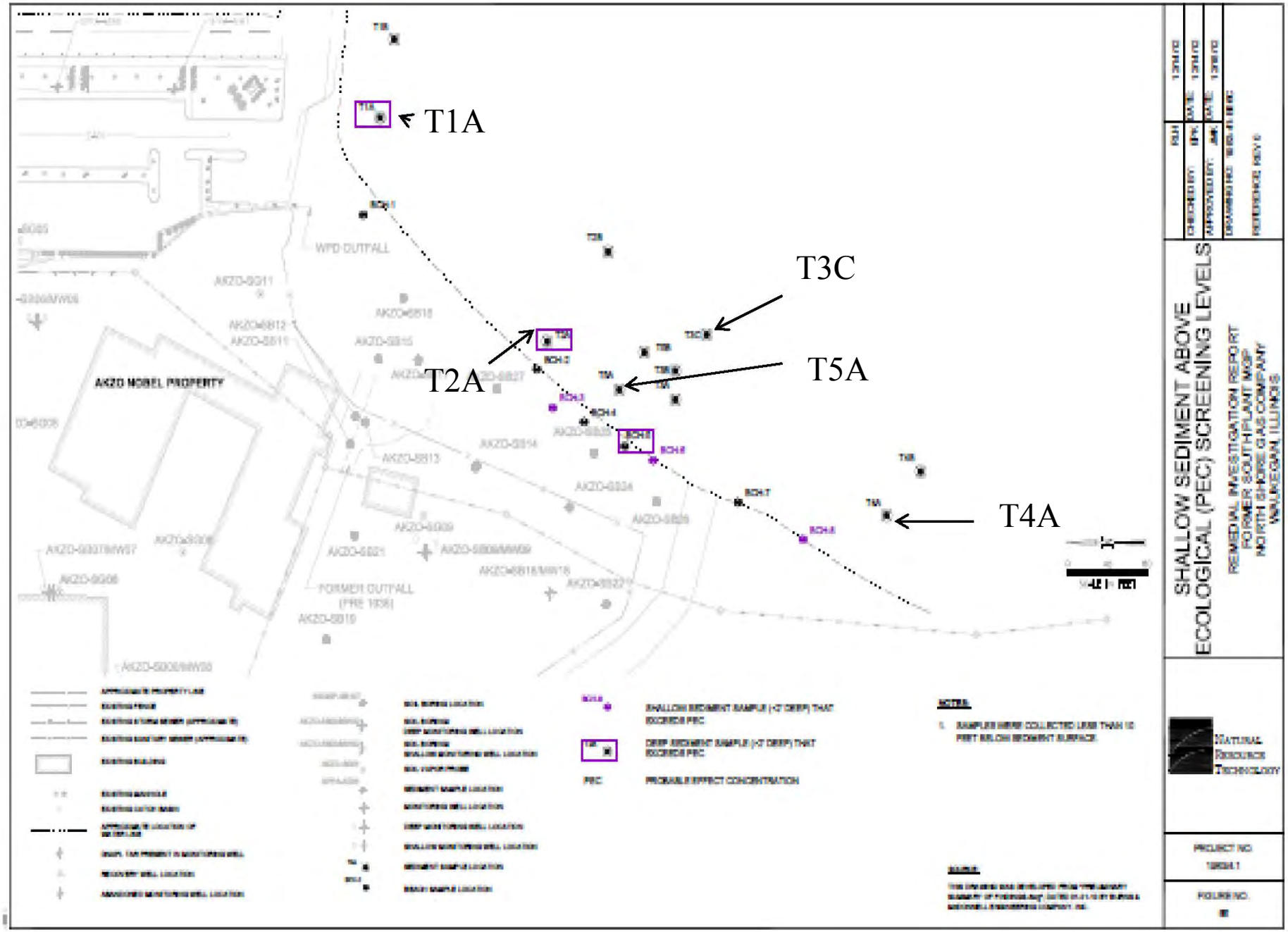

T1A
T2A
T3C
T5A
T4A
AKZO NOBEL PROPERTY
WPD OUTFALL
FORMER OUTFALL
SHALLOW SEDIMENT ABOVE ECOLOGICAL (PEC) SCREENING LEVELS
REMEDIAL INVESTIGATION REPORT
FORMER SOUTH PLANT MGP
NORTH SHORE GAS COMPANY
WAUKEGAN, ILLINOIS
NATURAL RESOURCE TECHNOLOGY
PROJECT NO.
FIGURE NO.

Table 23. Lake Michigan Surface Water Results
North Shore Gas - Former Waukegan South Plant Manufactured Gas Plant Site
2 North Pershing Road & 1 South Pershing Road, Waukegan, Illinois
USEPA ILD984809228 / Illinois EPA #0971900058

Sample Location	Sample Date	Volatile Organic Compounds (µg/l)					
		Benzene	Ethylbenzene	Toluene	Xylenes, Total	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene
IL Res. Water SL		5	700	1000	10000	15	87
IL Ecologic SL		NS	NS	NS	NS	NS	NS
T1A	07/25/11	<0.41	<0.54	<0.67	<2.6	<0.97	<0.83
T2A	07/26/11	<0.41	<0.54	<0.67	<2.6	<0.97	<0.83
T3C	07/28/11	<0.41	<0.54	<0.67	<2.6	<0.97	<0.83
T4A	07/25/11	<0.41	<0.54	<0.67	<2.6	<0.97	<0.83
T5A	07/28/11	<0.41	<0.54	<0.67	<2.6	<0.97	<0.83

Sample Location	Sample Date	Polynuclear Aromatic Hydrocarbons (µg/kg)															
		Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene (PAH)	Phenanthrene	Pyrene
IL Res. Water SL		420	420	2100	0.13	0.2	0.18	210	0.17	1.5	0.3	280	280	0.43	140	2100	210
IL Ecologic SL		38	4840	0.035	0.025	0.014	9.07	7.64	NS	NS	5	1.9	19	4.31	13	3.6	0.3
T1A	07/25/11	<0.0045	<0.0036	<0.0057	0.006	0.0074	0.012	0.0083	0.011	0.015	<0.0032	0.034	<0.0048	0.0068	<0.047	<0.0081	0.018
T2A	07/26/11	0.0046	<0.0036	<0.0057	<0.0036	<0.0029	0.0039	<0.0048	<0.0044	0.0075	<0.0032	0.019	<0.0048	<0.0047	<0.047	<0.0081	0.0075
T3C	07/28/11	0.015	<0.0072	<0.011	0.016	**0.021**	0.027	0.025	0.033	0.038	<0.0064	0.064	0.0096	0.018	<0.094	0.027	0.053
T4A	07/25/11	<0.0045	<0.0036	<0.0057	<0.0036	0.0041	0.0069	0.005	0.0079	0.0087	<0.0032	0.015	<0.0048	<0.0047	<0.047	<0.0081	0.0084
T5A	07/28/11	0.022	<0.0036	0.0079	0.015	**0.018**	0.023	0.019	0.025	0.029	0.005	0.07	0.011	0.015	<0.047	0.025	0.048

Sample Location	Sample Date	Inorganic Compounds (µg/kg)												
		Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Copper, Total	Cyanide, Available	Lead, Total	Mercury, Total	Nickel, Total	Selenium, Total	Silver, Total	Zinc, Total
IL Res. Water SL		10	2000	4	5	100	650	200	7.5	2	100	50	50	5000
IL Ecologic SL		150	220	NS	0.25	74	9	NS	2.5	0.77	52	5	0.12	120
T1A	07/25/11	1.1	21.7	<0.25	<0.13	0.44	1.6	<0.3	0.61	<0.1	0.57	<0.4	<0.059	5.7
T2A	07/26/11	1.2	23.1	<0.25	<0.13	0.67	2.5	<0.3	0.81	<0.1	0.76	<0.4	<0.059	5.5
T3C	07/28/11	1.7	25.6	<0.25	<0.13	2.5	5.3	1	**2.5**	<0.1	2.7	<0.4	<0.059	19.7
T4A	07/25/11	1.2	21.4	<0.25	<0.13	0.59	2.5	<0.3	1.1	<0.1	0.76	<0.4	<0.059	8.2
T5A	07/28/11	1.7	25.8	<0.25	<0.13	2.4	4.4	1	**3.5**	<0.1	2.3	<0.4	<0.059	14

Note: SW data screened against tapwater RSLs – exceedances of BaP , dibenzo(a,h) antharacene, and arsenic

Notes:
1) Samples exceeding the Ecological Screening Levels are bold.
2) "na" - sample not analyzed for this parameter.
3) "NS" - No standard has been established for this parameter.
4) µg/l = microgram per liter.
5) SL = Screening Level

Table 4. Human health screening results: Constituents exceeding criteria
Former South Plant MGP Site
Waukegan, Illinois
Baseline Risk Assessment (Revision 1)

	Residential	Industrial
Surface Soil (0–2 ft)		
NSGSP	No data	No data
WPD	No data	No data
AKZO	7 cPAHs, benzene,[a] ethylbenzene, xylene, antimony, arsenic, (lead[b])	4 cPAHs, benzene,[a] ethylbenzene, xylene, arsenic, (lead[b])
COW	5 cPAHs	Benzo[a]pyrene
Total Soil (0–10 ft)		
NSGSP	8 cPAHs, benzene, ethylbenzene, 1,2,4-trimethylbenzene, xylene, arsenic	8 cPAHs, benzene, ethylbenzene, xylene, arsenic
WPD	6 cPAHs	3 cPAHs
AKZO	8 cPAHs, 2-methylnaphthalene, benzene,[a] ethylbenzene, xylene, antimony, arsenic, iron, (lead[b])	6 cPAHs, benzene,[a] ethylbenzene, xylene, arsenic, (lead[b])
COW	6 cPAHs	3 cPAHs
Soil Vapor: All Samples, Both Outside and Underneath Building		
NSGSP	No exceedances	No exceedances
WPD	Naphthalene, benzene, ethylbenzene, bromodichloromethane, chloroform, trichloroethene, 1,2,4-trimethylbenzene	Naphthalene, benzene, bromodichloromethane, chloroform
AKZO	Naphthalene, benzene, ethylbenzene, toluene, xylene, bromodichloromethane, carbon tetrachloride, chloroform, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, 1,2,4-trimethylbenzene, vinyl chloride	Naphthalene, benzene, ethylbenzene, xylene, bromodichloromethane, chloroform, tetrachloroethene, trichloroethene, 1,2,4-trimethylbenzene, vinyl chloride
COW	Naphthalene, chloroform, ethylbenzene	Chloroform, ethylbenzene
Soil Vapor: Sub-slab Samples Under Building[c]		
NSGSP	No data	No data
WPD	Naphthalene, benzene, ethylbenzene, bromodichloromethane, chloroform, 1,2,4-trimethylbenzene	Naphthalene, benzene, bromodichloromethane, chloroform
AKZO	Naphthalene, ethylbenzene, bromodichloromethane, carbon tetrachloride, chloroform, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene	Naphthalene, ethylbenzene, bromodichloromethane, chloroform, trichloroethene
COW	No data	No data
Sediments		

Table 4. Human health screening results: Constituents exceeding criteria
Former South Plant MGP Site
Waukegan, Illinois
Baseline Risk Assessment (Revision 1)

	Residential	Industrial
Surface Soil (0–2 ft)		
Sediments		
NSGSP	No data	No data
Marina (<2 ft)	3 cPAHs	No exceedances
WPD	No data	No data
Beach (<4 ft)	5 cPAHs	Benzo[a]pyrene
AKZO	7 cPAHs, benzene,[a] ethylbenzene, xylene, antimony, arsenic, (lead[b])	4 cPAHs, benzene,[a] ethylbenzene, xylene, arsenic, (lead[b])
Lake (<2 ft)	5 cPAHs	Benzo[a]pyrene, dibenz[a,h]anthracene
COW	5 cPAHs	Benzo[a]pyrene
Surface Water	Benzo[a]pyrene, dibenz[a,h]anthracene, arsenic	--
Total Soil (0–10 ft)		
NSGSP	8 cPAHs, benzene, ethylbenzene, 1,2,4-trimethylbenzene, xylene, arsenic	8 cPAHs, benzene, ethylbenzene, xylene, arsenic
Groundwater		
NSGSP	6 cPAHs	3 cPAHs
WPD	17 PAHs, dibenzofuran, BTEX, styrene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, arsenic, chromium, cobalt, iron, manganese, nickel, thallium, vanadium	--
AKZO	8 cPAHs, 2-methylnaphthalene, benzene,[a] ethylbenzene, xylene, antimony, arsenic, iron, (lead[b])	6 cPAHs, benzene,[a] ethylbenzene, xylene, arsenic, (lead[b])
WPD	16 PAHs, BTEX, styrene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, arsenic	--
COW	6 cPAHs	3 cPAHs
AKZO	16 PAHs, 2,4-dimethylphenol, BTEX, methylene chloride, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, vinyl chloride, arsenic	--
Soil Vapor: All Samples, Both Outside and Underneath Building		
NSGSP	No exceedances	No exceedances
COW	8 cPAHs, benzene, ethylbenzene, 1,2,4-trimethylbenzene, arsenic, iron, manganese	--
WPD	Naphthalene, benzene, ethylbenzene, bromodichloromethane, chloroform, trichloroethene, 1,2,4-trimethylbenzene	Naphthalene, benzene, bromodichloromethane, chloroform
AKZO	Naphthalene, benzene, ethylbenzene, toluene, xylenes, bromodichloromethane, carbon tetrachloride, chloroform, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, 1,2,4-trimethylbenzene, vinyl chloride	Naphthalene, benzene, ethylbenzene, xylene, bromodichloromethane, chloroform, tetrachloroethene, trichloroethene, 1,2,4-trimethylbenzene, vinyl chloride
COW	Naphthalene, chloroform, ethylbenzene	Chloroform, ethylbenzene
Soil Vapor: Sub-slab Samples Under Building[c]		
NSGSP	No data	No data
WPD	Naphthalene, benzene, ethylbenzene, bromodichloromethane, chloroform, 1,2,4-trimethylbenzene	Naphthalene, benzene, bromodichloromethane, chloroform
AKZO	Naphthalene, ethylbenzene, bromodichloromethane, carbon tetrachloride, chloroform, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene	Naphthalene, ethylbenzene, bromodichloromethane, chloroform, trichloroethene
COW	No data	No data

Notes:

This table lists chemicals that exceeded screening criteria, developed using a target cancer risk level of 1×10^{-6} or a noncancer hazard quotient of 1, along with default residential and industrial scenario assumptions.

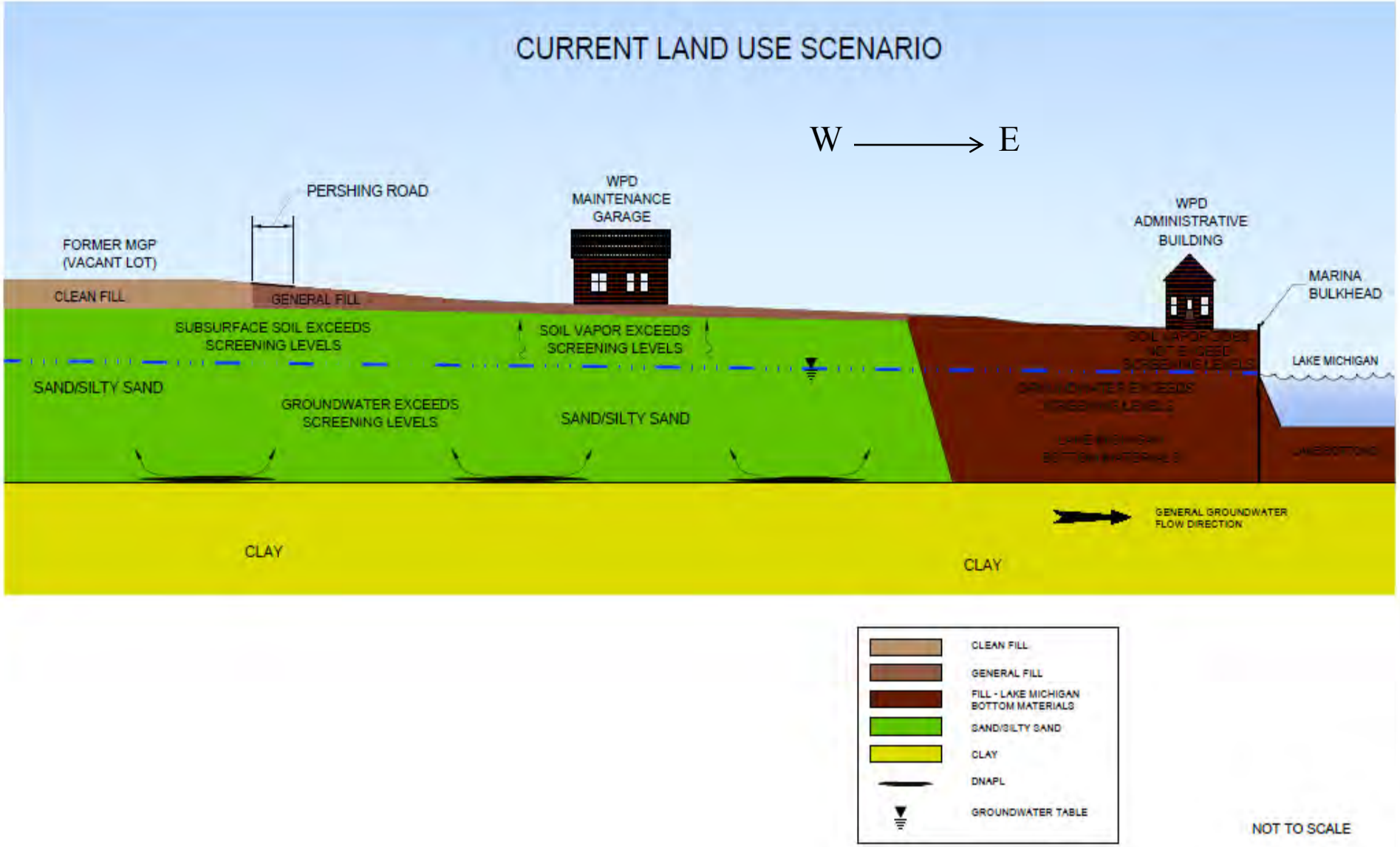
Some additional cPAHs were retained as COPCs because of the method used for deriving toxicity values. See text for details.

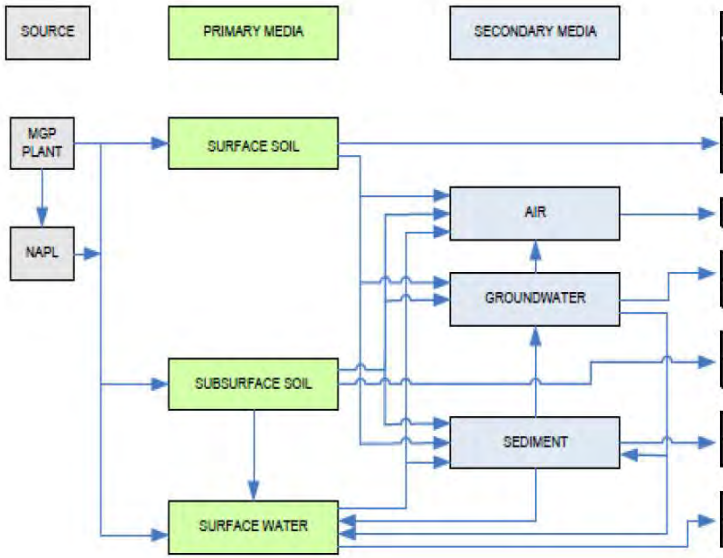
-- - not applicable
BTEX - benzene, toluene, ethylbenzene, and total xylenes
cPAH - carcinogenic polynuclear aromatic hydrocarbon
COPC - constituent of potential concern
PAH - polynuclear aromatic hydrocarbon

[a] Some non-detect results for benzene exceeded the criterion in areas impacted by other petroleum components.

[b] Although maximum value for lead exceeded criterion, the average value did not.

[c] Includes only the samples taken immediately below the building (i.e., sub-slab) and excludes any deeper samples.


CURRENT LAND USE SCENARIO
W
E
PERSHING ROAD
WPD MAINTENANCE GARAGE
WPD ADMINISTRATIVE BUILDING
FORMER MGP (VACANT LOT)
CLEAN FILL
GENERAL FILL
MARINA BULKHEAD
SUBSURFACE SOIL EXCEEDS SCREENING LEVELS
SOIL VAPOR EXCEEDS SCREENING LEVELS
LAKE MICHIGAN
SAND/SILTY SAND
GROUNDWATER EXCEEDS SCREENING LEVELS
SAND/SILTY SAND
GENERAL GROUNDWATER FLOW DIRECTION
CLAY
CLAY
CLEAN FILL
GENERAL FILL
FILL - LAKE MICHIGAN BOTTOM MATERIALS
SAND/SILTY SAND
CLAY
DNAPL
GROUNDWATER TABLE
NOT TO SCALE



EXPOSURE ROUTE	HUMAN RECEPTORS				ECOLOGICAL RECEPTORS				
	INDUSTRIAL/ COMMERCIAL WORKER	CONSTRUCTION WORKER	RECREATIONAL	RESIDENTIAL	BIRDS	MAMMALS	FISH	BENTHIC INVERTEBRATES	PLANTS
INGESTION	•	•	•	•	○	○	NA	NA	NA
DERMAL	•	•	•	•	○	○	NA	NA	NA
INHALATION	• [a]	• [b]	○	• [a]	○	○	NA	NA	NA
INGESTION	•	•	○	•	○	○	NA	NA	NA
DERMAL	•	•	○	•	○	○	NA	NA	NA
INGESTION	•	•	○	•	○	○	NA	NA	NA
DERMAL	•	•	○	•	○	○	NA	NA	NA
INGESTION	•	•	•	○	•	•	•	•	NA
DERMAL	•	•	•	○	•	•	•	•	• [c]
INGESTION	•	•	•	○	•	•	•	•	NA
DERMAL	•	•	•	○	•	•	•	•	○ [c]

LEGEND:

- • Pathway potentially complete and warrants further evaluation within the Baseline Risk Assessment. The level of evaluation will be dependent on site conditions.
- ○ Pathway not complete or considered insignificant; No further evaluation is recommended.

NA: Not Applicable

NAPL: Nonaqueous-phase liquid

[a] This pathway includes vapor intrusion into indoor air from subsurface sources.

[b] This pathway includes the potential migration of soil vapors into excavations created as part of construction activities.

[c] This pathway refers to root uptake.

Figure 1	SITE-SPECIFIC CONCEPTUAL SITE MODEL FORMER SOUTH PLANT MGP SITE WAUKEGAN, ILLINOIS BASELINE RISK ASSESSMENT	Drawn By:	RK
Revision 1		Checked By:	MWK
Date 12/31/2013	NORTH SHORE GAS COMPANY	Approved By:	BA

HH Risk Assessment

- Human Health Receptors/Exposure Pathways
  - ❑ Construction/Industrial/Commercial Workers
    - Incidental ingestion/Dermal contact/Inhalation (incl. VI) of soil and gw
  - ❑ Recreational Visitors
    - Incidental ingestion of surface water and sediment
    - Dermal contact with surface water and sediment
  - ❑ Residents (future use scenario)
    - Incidental soil ingestion/Dermal contact/Inhalation (incl. VI)

HH Risk Assessment – Cont'd

HHRA Conclusions & Comparison to Risk Management Range (10^{-6} to 10^{-4}):

- SW & sediment – below
- GW (Potable Use; all areas) – exceeds
- NAPL in subsurface soil, GW, soil vapor - exceeds for construction worker exposure
- Soil (Residential) – exceeds at Akzo & NSGSP
- Soil (Industrial) – exceeds at Akzo & NSGSP
- Vapor Intrusion (Industrial) - Akzo: may exceed at eastern ½ of building where subslab sampling not performed
- Vapor Intrusion (Residential) – Akzo & WPD maintenance bldg. exceeds

Eco Risk Assessment

- Screening level ERA performed
- Focused on adjacent beach and open water south of Akzo property and harbor area
- Media of concern – SW and sediment
- Potential receptors
  - ❑ Beach/open water: aquatic mammals, birds, fish, benthic invertebrates, and plants
  - ❑ Waukegan Harbor: fish & benthic invertebrates

Table 49. Sediment ecological benchmark hierarchy and selected screening values
Former South Plant MGP Site
Waukegan, Illinois
Baseline Risk Assessment (Revision 1)

		Screening Criteria			MacDonald et al. 2000		DiToro/McGrath 2000
Analyte	Units	Y/N	Source	Value	TEC Consensus-Based Threshold Effect Concentrations	Consensus-based Probable Effect Concentration	EQP-SQG Narcotic Chemicals and PAH Criteria
PVOCs							
Benzene	µg/kg	Yes	EQP-SQG	308			308
Ethylbenzene	µg/kg	Yes	EQP-SQG	459			459
Toluene	µg/kg	Yes	EQP-SQG	383			383
Xylene isomers (total)	µg/kg	Yes	EQP-SQG	465			465
1,3,5-Trimethylbenzene	µg/kg	No		NA			
1,2,4-Trimethylbenzene	µg/kg	No		NA			
Semivolatile Organic Compounds							
PAHs							
Total PAHs	µg/kg	Yes	TEC	1610	1610	22800	
Acenaphthene	µg/kg	Yes	EQP-SQG	396			396
Acenaphthylene	µg/kg	Yes	EQP-SQG	365			365
Anthracene	µg/kg	Yes	TEC	57.2	57.2	845	479
Benz[a]anthracene	µg/kg	Yes	TEC	108	108	1050	677
Benzo[b]fluoranthene	µg/kg	Yes	EQP-SQG	788			788
Benzo[k]fluoranthene	µg/kg	Yes	EQP-SQG	791			791
Benzo[a]pyrene	µg/kg	Yes	TEC	150	150	1450	777
Benzo[ghi]perylene	µg/kg	Yes	EQP-SQG	882			882
Chrysene	µg/kg	Yes	TEC	166	166	1290	679
Dibenz[a,h]anthracene	µg/kg	Yes	TEC	33	33		904
Fluoranthene	µg/kg	Yes	TEC	423	423	2230	570
Fluorene	µg/kg	Yes	TEC	77.4	77.4	536	434
Indeno[1,2,3-cd]pyrene	µg/kg	Yes	EQP-SQG	899			899
Naphthalene	µg/kg	Yes	TEC	176	176	561	311
Phenanthrene	µg/kg	Yes	TEC	204	204	1170	480
Pyrene	µg/kg	Yes	TEC	195	195	1520	562
2-Methylnaphthalene	µg/kg	Yes	EQP-SQG	360			360
Phenols							
2,4-Dimethylphenol	µg/kg	No		NA			
2-Methylphenol	µg/kg	No		NA			
4-Methylphenol	µg/kg	No		NA			
Phenol	µg/kg	No		NA			

Table 50. Summary of ecological screening evaluation
Former South Plant MGP Site
Waukegan, Illinois
Baseline Risk Assessment (Revision 1)

	COPC (Number of samples above screening criterion)	Comments Concerning Exceedances
Sediments		
Beach (<2 ft)	Copper (4), lead (3), nickel (1), zinc (6)	Nickel was above its TEC, but below its PEC. Copper (2), lead (1), and zinc (2) exceedances were above their PEC.
Beach (>2 ft)	Total 13-PAH (11), benzene (1), ethylbenzene (3), total xylenes (3), copper (5), lead (3), mercury (1), zinc (4)	Total 13-PAHs in only one sample was above the PEC (i.e., sample BCH-5_137-223), metals exceedances were all below their PEC. There is no TEC and PEC for benzene, ethylbenzene, or total xylenes (see text for explanation). The number of samples exceeding the screening criteria for benzene, ethylbenzene, and total xylenes represent exceedances of EQP-SQG values.
Lake (<2 ft)	Total 13-PAH (3), copper (1), lead (1), zinc (3)	Sample(s) were above the TEC, but below the PEC.
Lake (>2 ft)	Total 13-PAH (7), ethylbenzene (2), xylenes (2), lead (4), nickel (2), zinc (1)	Exceedances of total 13-PAHs, nickel, and zinc were above the TEC, but below the PEC. Lead was below its PEC in two samples and above its PEC in two samples. There is no TEC or PEC for ethylbenzene or total xylenes (see text for explanation). The number of samples exceeding the screening criteria for ethylbenzene and total xylenes represent exceedances of EQP-SQG values.
Marina (All depths)	Total 13-PAHs	One sample was slightly above the TEC, but below the PEC.
Surface Water		
All samples	Benzo[a]pyrene (2), lead (1)	The maximum concentration of each analyte was only slightly above its screening criteria (i.e., less than 2-fold factor). The average concentration of each analyte was below its screening level.

Notes: This table lists chemicals that exceeded ecological screening criteria in each medium. The number of samples exceeding the screening criterion is provided in parentheses.

The comments section is used to describe the magnitude of the exceedances to put them into a better perspective.

Refer to Tables 51 through 56 for detailed results of the ecological screening evaluation.

COPC - constituent of potential concern based on ecological screening evaluation
EQP-SQG - equilibrium partitioning model (EQP) - sediment quality guidelines (SQG) (DiToro and McGrath 2000)
PAH - polycyclic aromatic hydrocarbon
PEC - consensus-based, probable-effect concentration (MacDonald et al. 2000)
TEC - consensus-based, threshold-effect concentration (MacDonald et al. 2000)

Eco Risk Assessment

Conclusions

- Aquatic receptors feeding on benthic invertebrates not at risk to levels of COPCs found in SW and sediments
- Upland portion does not support habitat for eco receptors
- Harbor sediments don't pose eco concern/able to support healthy benthic community
- Beach sediments contain metals potentially posing risk to sensitive receptors (not MGP-related, however)

Media of Concern

- **Soil:** Areas of concern for industrial site users located on former MGP property beneath Pershing Rd. and Akzo property
- **Groundwater**: Groundwater impacts include both dissolved and phase separated (NAPL) impacts. DNAPL is located beneath all areas except COW, while LNAPL is present in all areas
- **Soil Vapor**: Unacceptable HH risks from COPCs in the WPD maintenance building and NE corner of main Akzo manufacturing building

Remedial Action Objectives (RAOs)

- Prevent construction worker exposure to soil containing MGP-related contaminants that present risks> 10^{-4} ELCR and HQ>1;
- Prevent residential & industrial worker exposure to surface soil and total soil, including dermal contact, ingestion, and inhalation (due to VI), to MGP-related contaminants that present risks > 10^{-4} ELCR and HQ>1;
- Restore GW to meet cleanup goals for MGP-related contaminants within reasonable time
- Reduce potential for contaminated GW to migrate to surface water at levels above surface water criteria for protection of human health and ecological receptors
- Reduce potential for migration of NAPL to surface water and sediment in the lake

State Perspective

- Long history/involvement with site (since 1990s)
- Overseen previous response action (2003-2004)
- Expected to play active role in future cleanup

Community Perspective

- Environmental Justice area
- Knowledgeable
- Updated periodically via CAG meetings
- Likely to comment on proposed cleanup plan

PRP Perspective

- Cooperative
- Likely to support proposed cleanup plan
- Good relations with adjacent property owners

Site Team

Ross del Rosario – RPM

Peter Felitti - ORC

David Klatt – CH2M Hill (EPA Contractor)

Doyle Wilson - IEPA