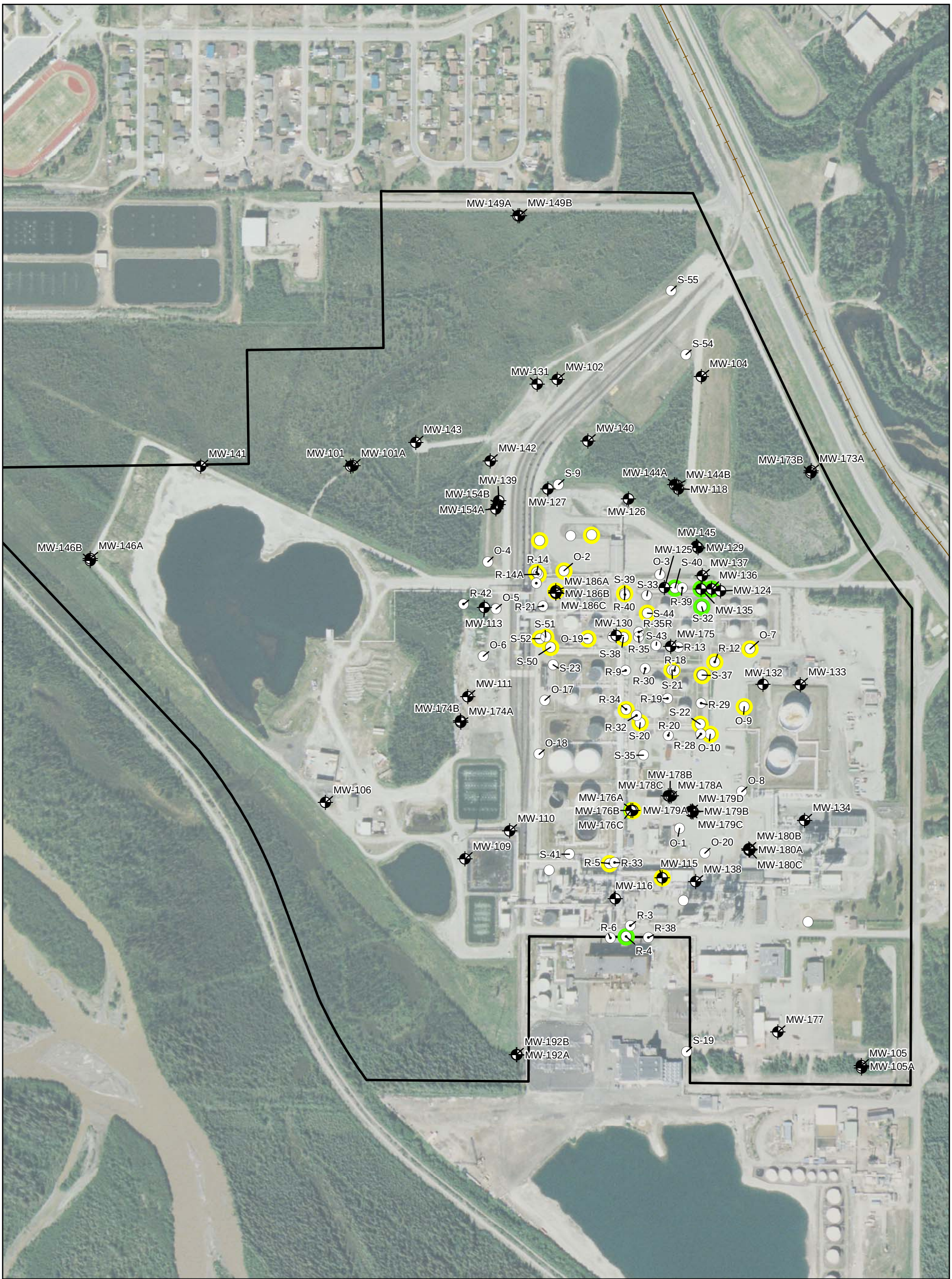


Monitoring Well

Observation Well

Recovery Well

Historical LNAPL Results

Measureable product

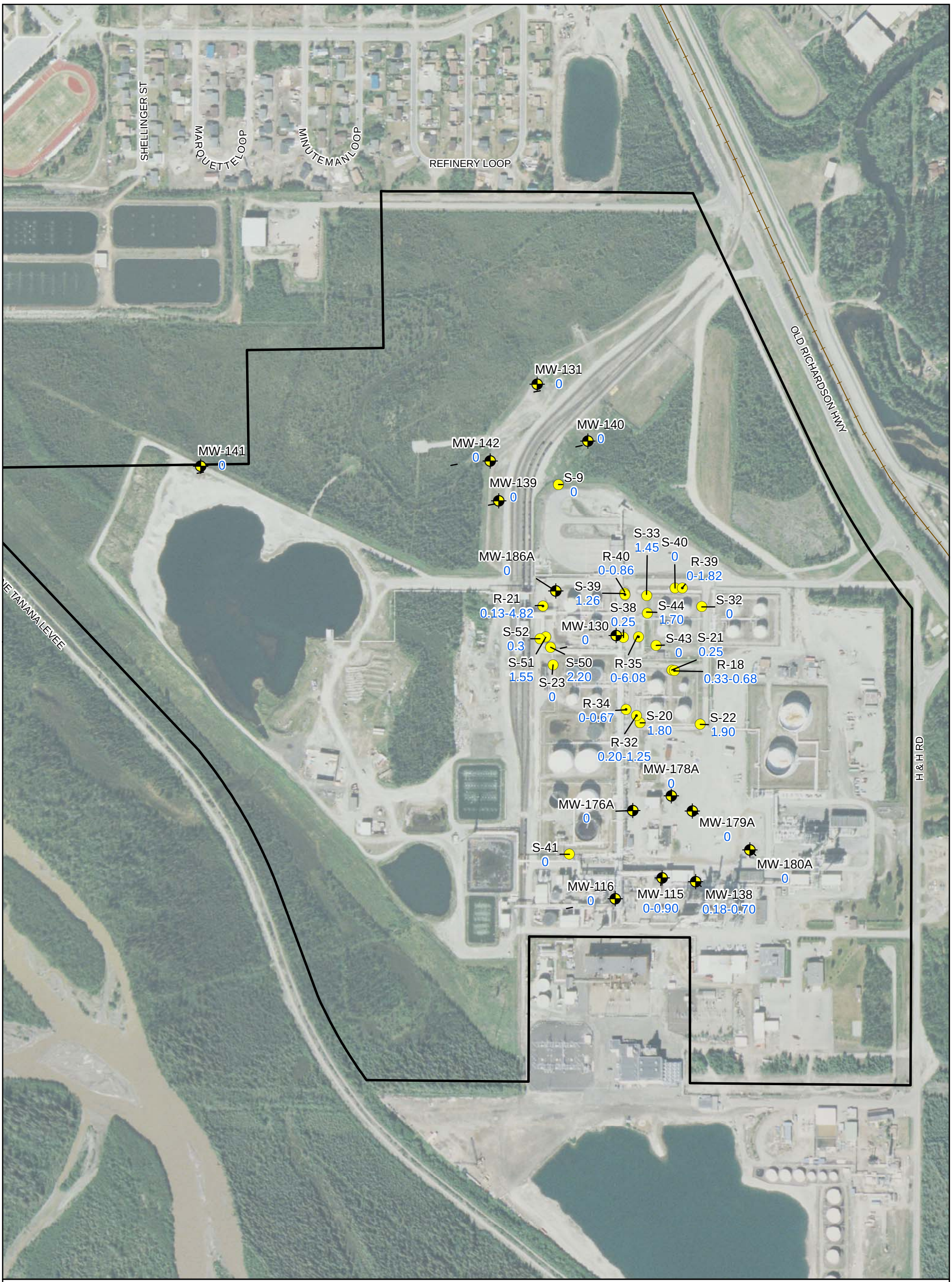
Sheen

FHRA Property Boundary

0 200 400 800

Feet

Figure 76
WELLS WITH HISTORICAL
LNAPL OCCURRENCE
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Observation Well

Recovery Well

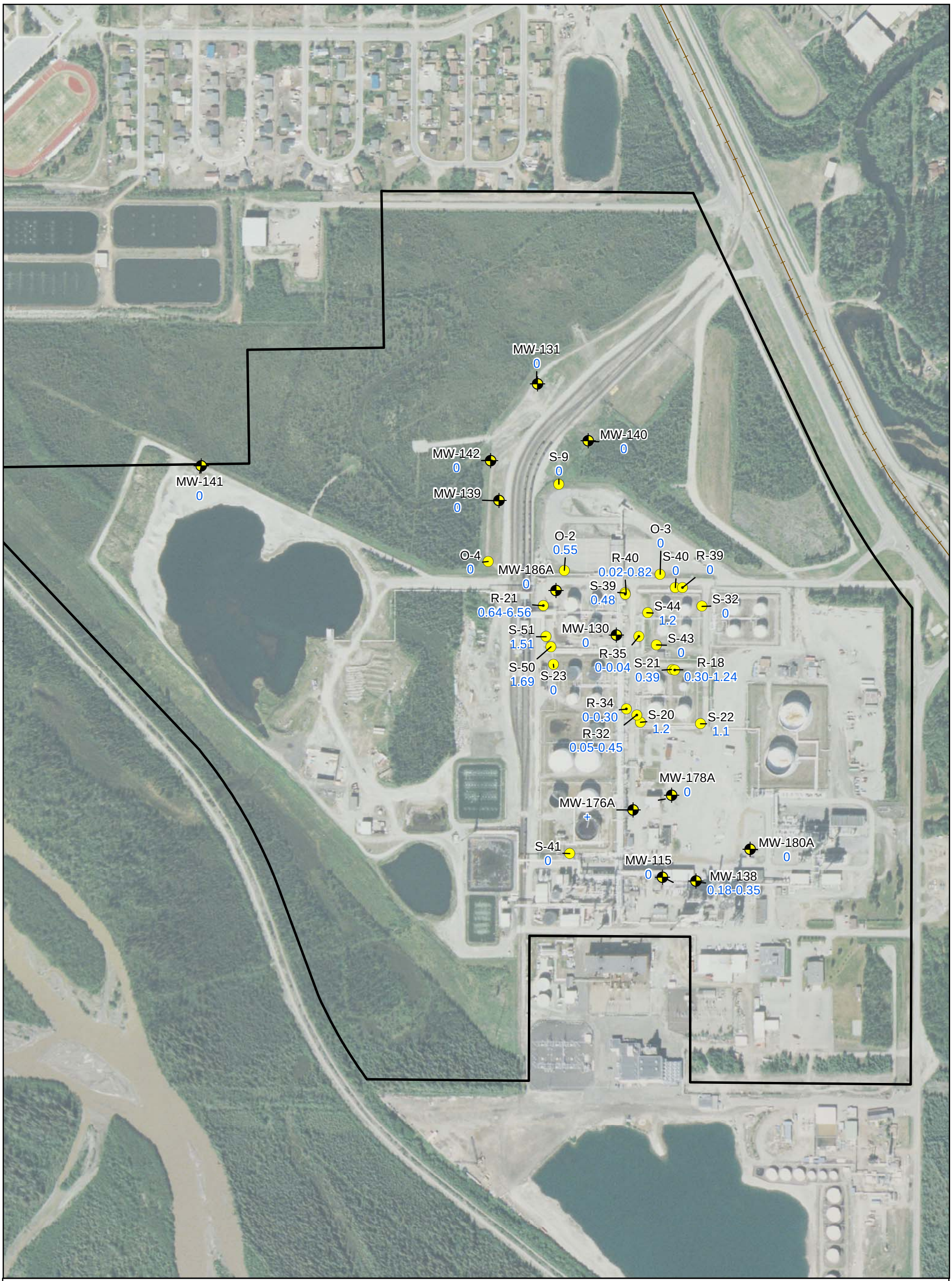
FHRA Property Boundary

1.0 LNAPL Thickness (ft)

0 200 400 800

Feet

Figure 77
LNAPL OCCURRENCE
FOURTH QUARTER 2010
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Observation Well

Recovery Well

FHRA Property Boundary

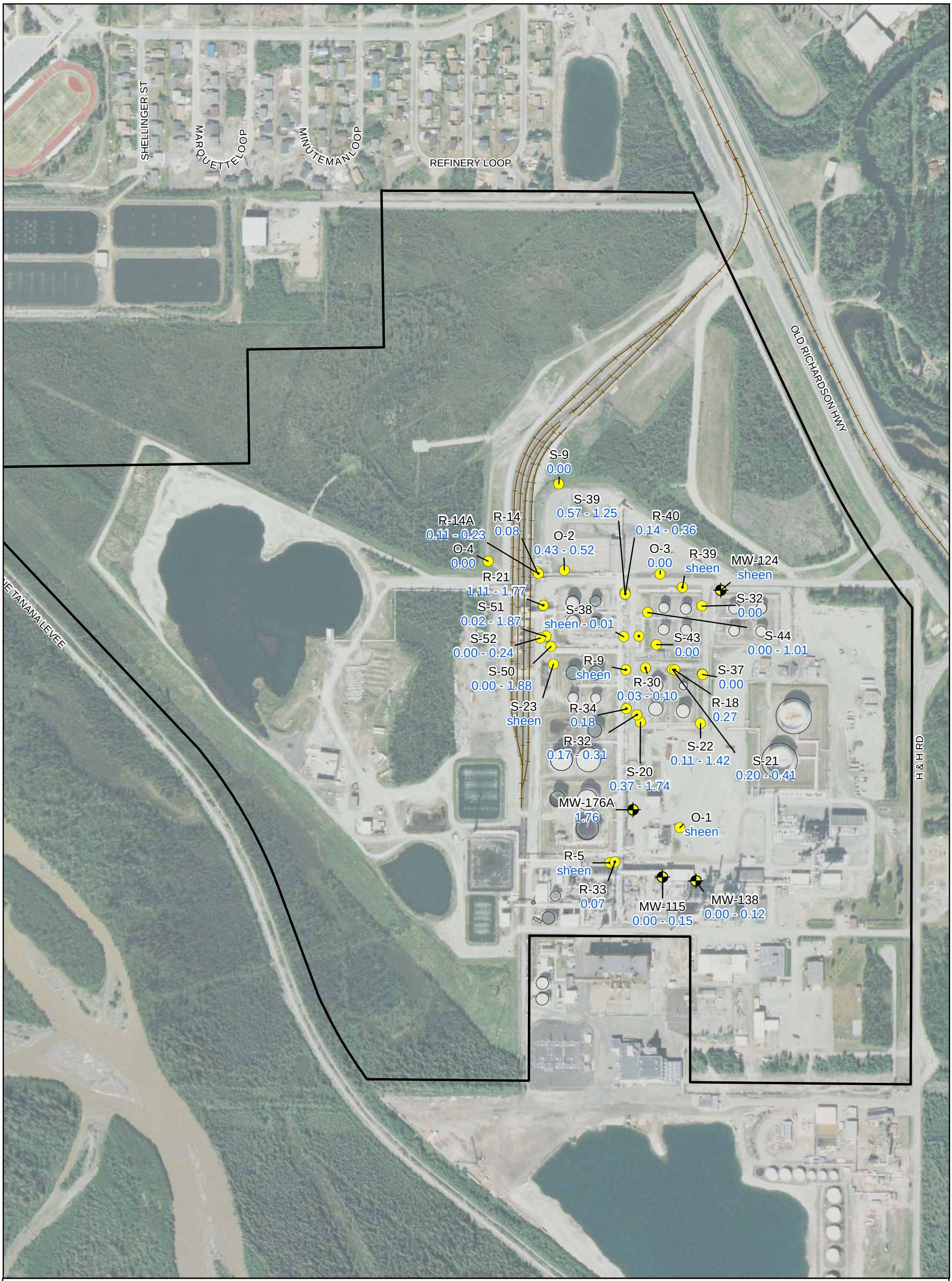
1.0 LNAPL Thickness (ft)

+ Product present, thickness not measured

0 200 400 800

Feet

Figure 78
LNAPL OCCURRENCE
FIRST QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Observation Well

Recovery Well

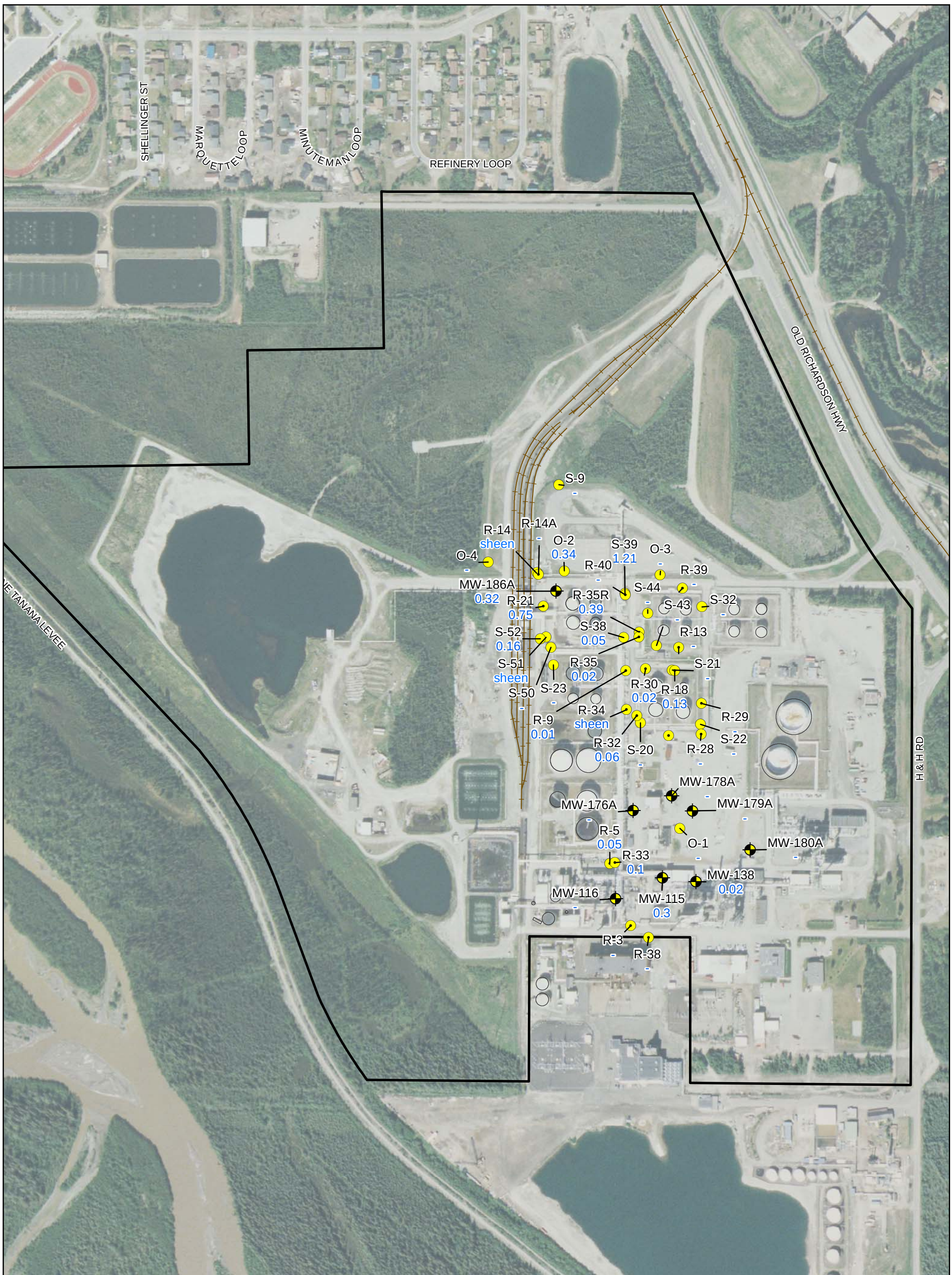
FHRA Property Boundary

1.0 LNAPL Thickness (ft)

0 200 400 800

Feet

Figure 79
LNAPL OCCURRENCE
SECOND QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Observation Well

Recovery Well

FHRA Property Boundary

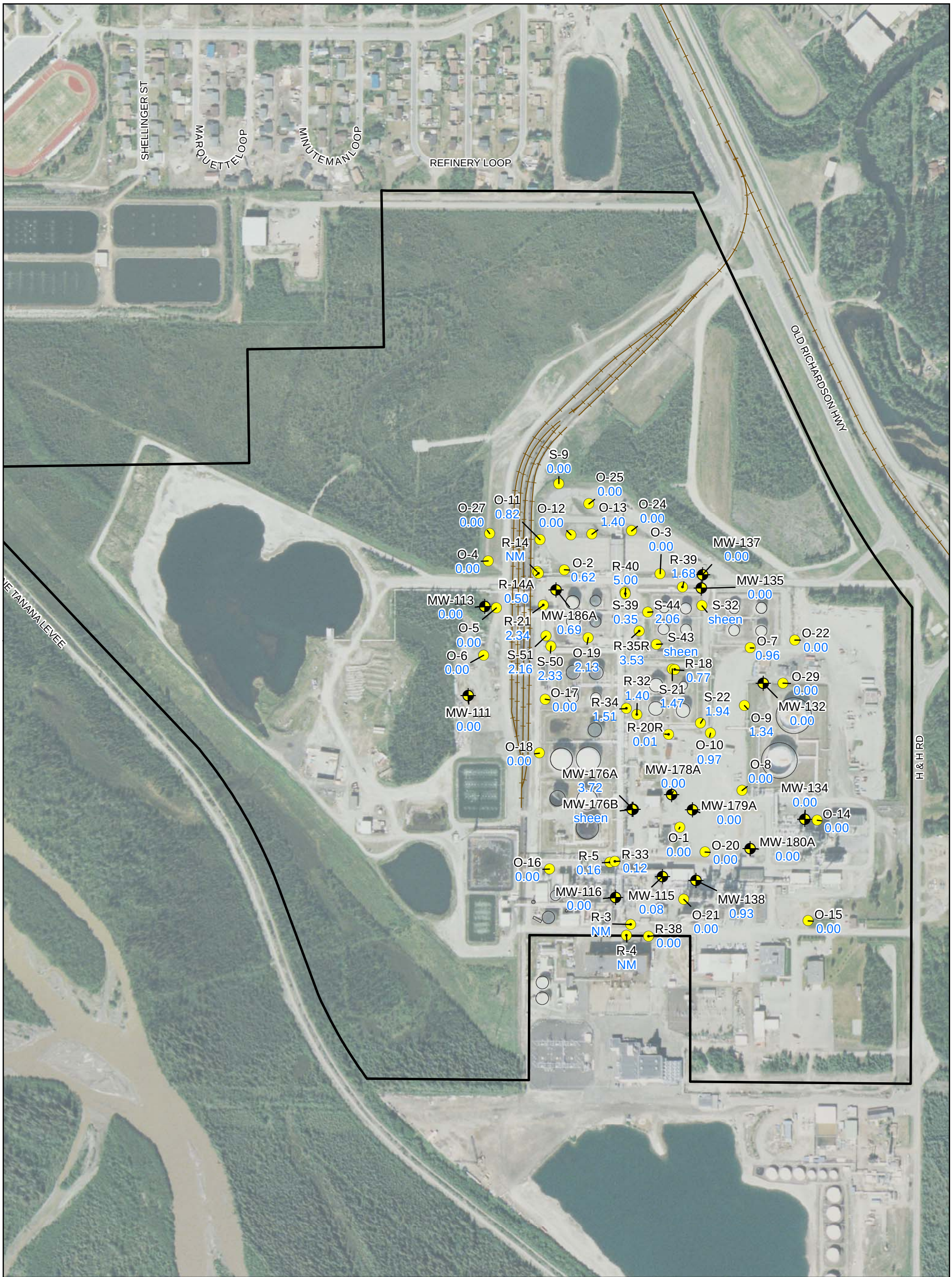
1.0 LNAPL Thickness (ft)

0 200 400 800

Feet

Figure 80
LNAPL OCCURRENCE
THIRD QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC

Note: Wells where interface probe results did not indicate presence of LNAPL are denoted with '-'
Wells were guaged for LNAPL July 14 and 15, 2011.



Monitoring Well

Observation Well

Recovery Well

FHRA Property Boundary

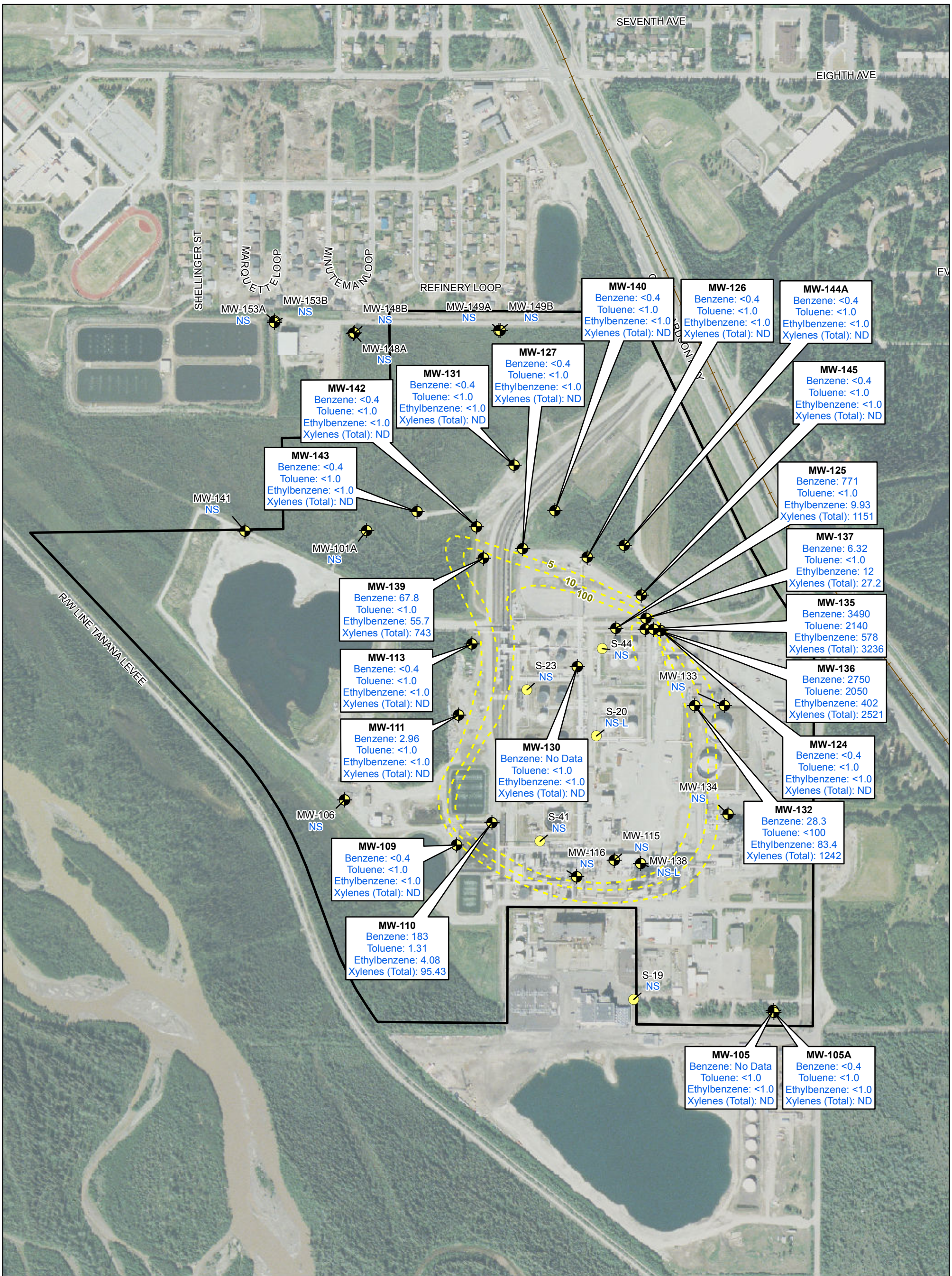
1.0 LNAPL Thickness (ft)

0 200 400 800

Feet

Figure 81
LNAPL OCCURRENCE
FOURTH QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC

Note: Wells where interface probe results did not indicate presence of LNAPL are denoted with '-'
Wells were guaged for LNAPL October 21 and 22, 2011.

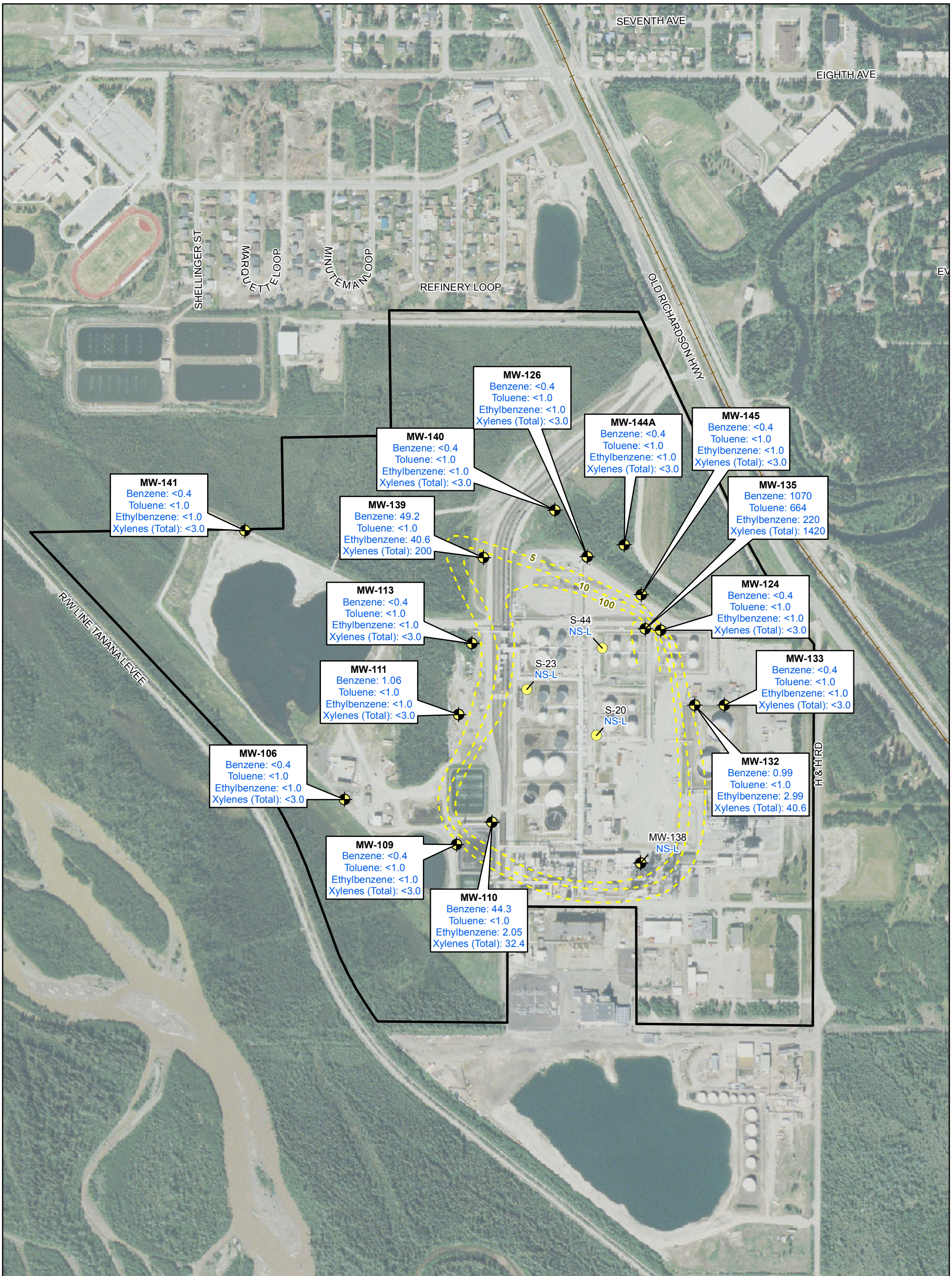


Monitoring Well
Observation Well
Approximate Benzene Isopleth in µg/L
FHRA Property Boundary
118 Concentration (µg/L)
NS-L Not sampled, LNAPL present
NS Not sampled
ND Non-Detect

N

0 250 500 1,000
Feet

Figure 82
BTEX CONCENTRATIONS
IN GROUNDWATER
FOURTH QUARTER 2010
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Observation Well

Approximate Benzene Isopleth in µg/L

FHRA Property Boundary

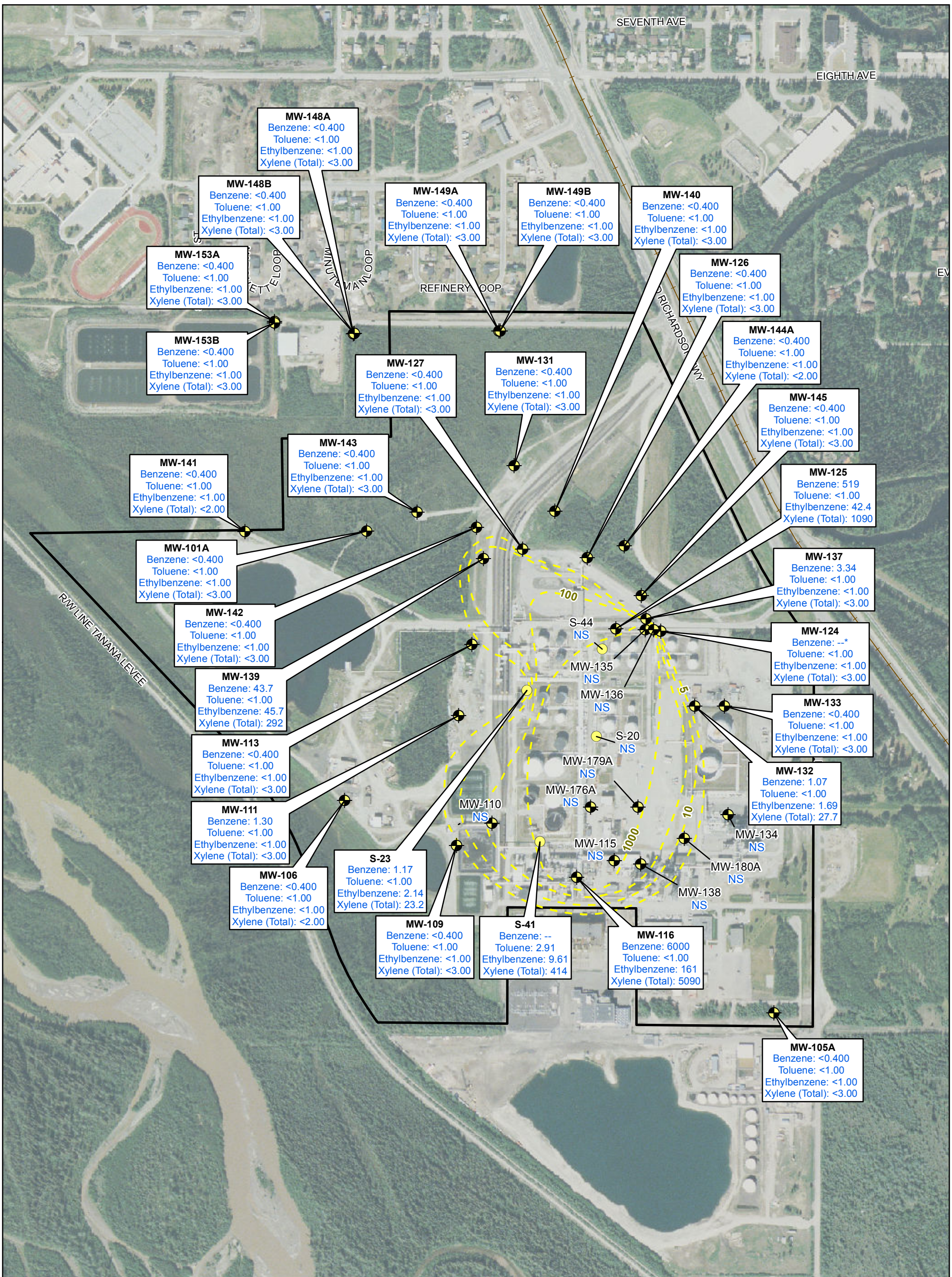
118 Concentration (µg/L)

NS-L Not sampled, LNAPL present

0 250 500 1,000

Feet

Figure 83
BTEX CONCENTRATIONS
IN GROUNDWATER
FIRST QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Observation Well

Approximate Benzene Isopleth in µg/L

FHRA Property Boundary

118 Concentration (µg/L)

J Estimated Value

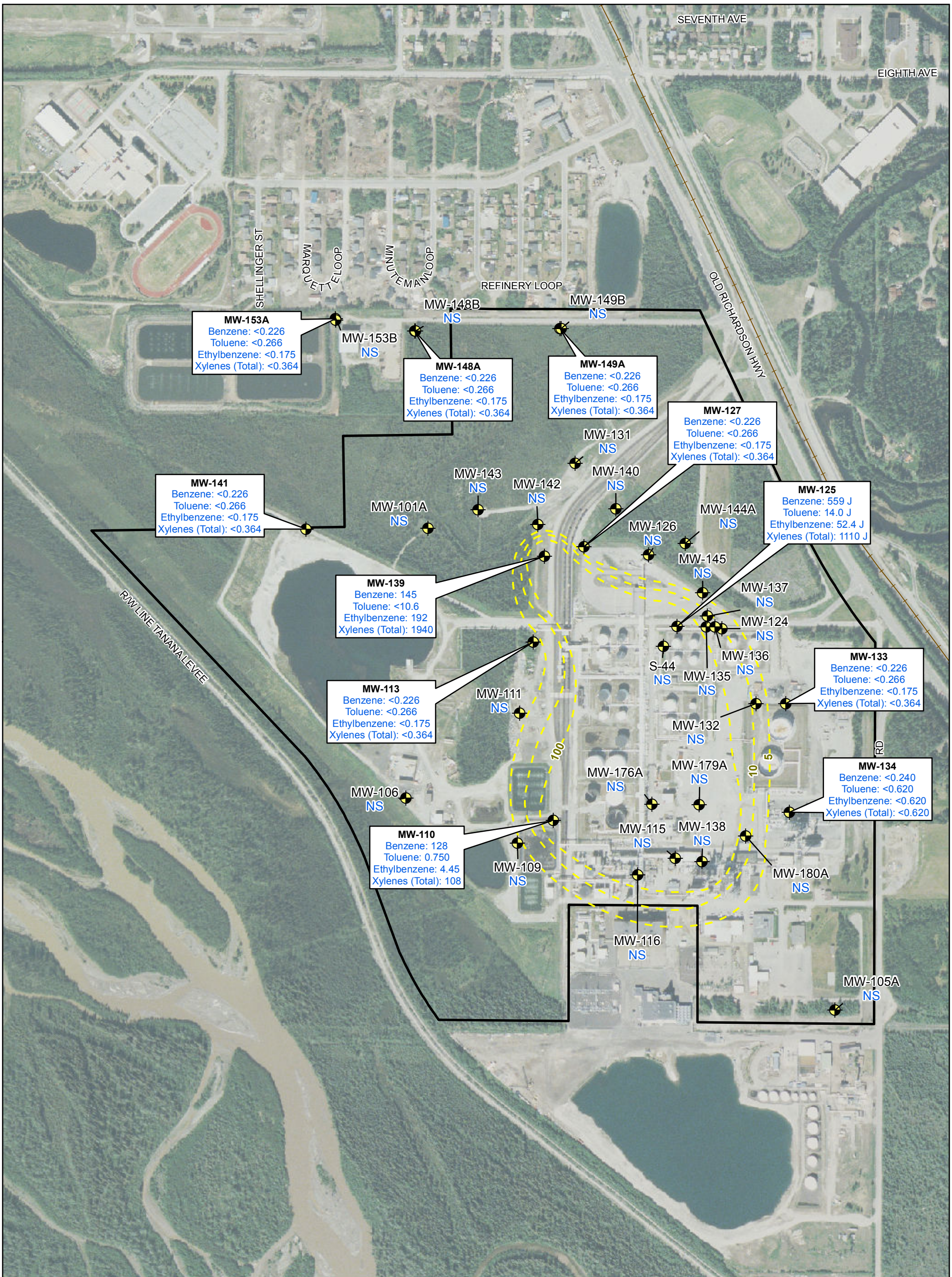
NS Not sampled

0 250 500 1,000

Feet

Figure 84
BTEX CONCENTRATIONS
IN GROUNDWATER
SECOND QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC

* Benzene result has been received but is still being validated



Monitoring Well

Approximate Benzene Isopleth in µg/L

FHRA Property Boundary

118 Concentration (µg/L)

J Estimated Value

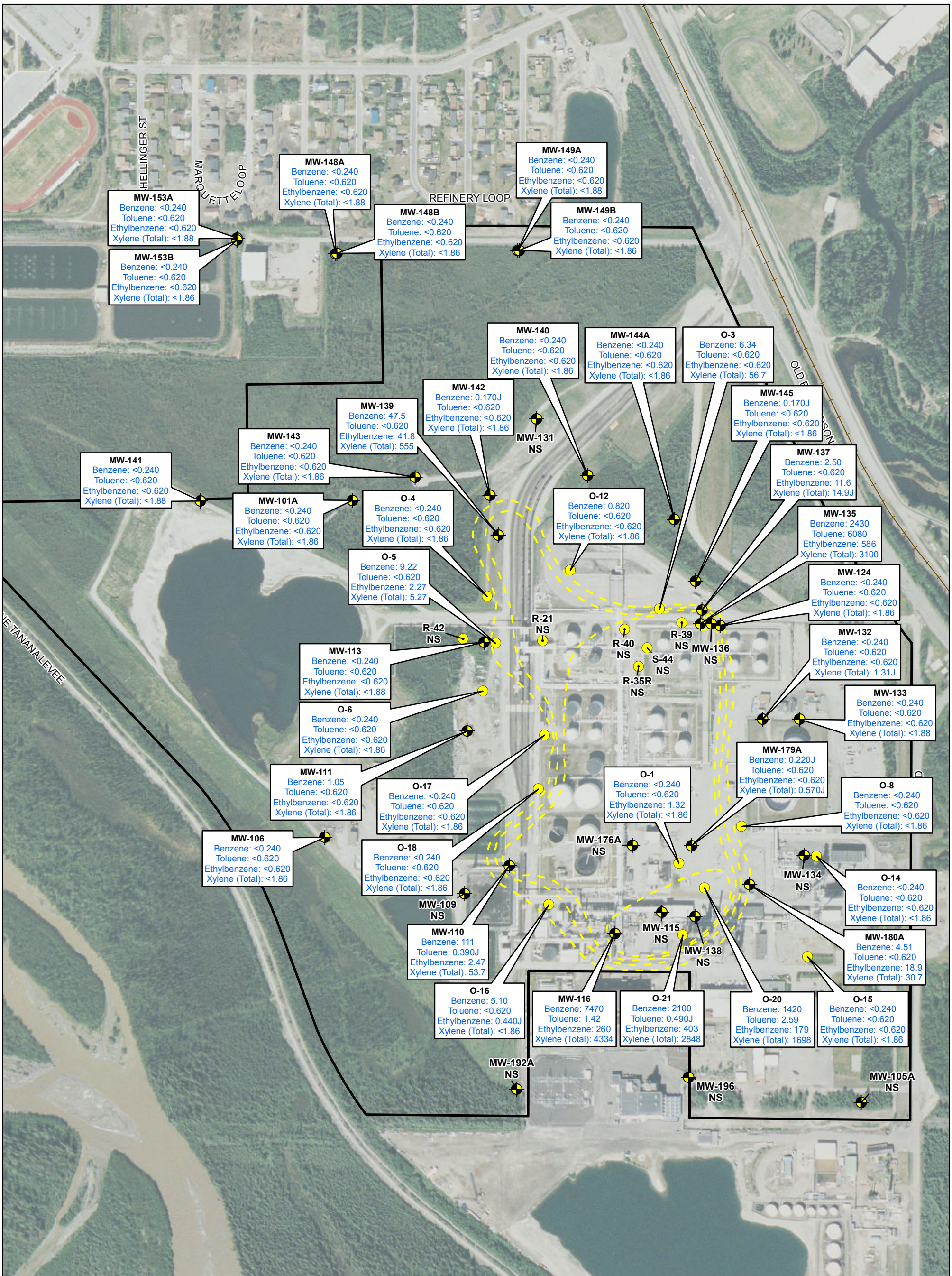
NS Not sampled

N

0 250 500 1,000

Feet

Figure 85
BTEX CONCENTRATIONS
IN GROUNDWATER
THIRD QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well
Observation Well
Recovery Well
FHRA Property Boundary
118 Concentration (µg/L)
J Estimated Value
NS Not sampled

0 200 400 800
Feet

Figure 86
BTEX CONCENTRATIONS
IN GROUNDWATER
FOURTH QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC

Monitoring Well

Approximate Sulfolane Isopleths in µg/L

FHRA Property Boundary

118 Sulfolane Concentration (µg/L)

NS Not Sampled

0 750 1,500 3,000
Feet

Figure 87
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
AT THE WATER TABLE
FOURTH QUARTER 2010
North Pole Refinery
Flint Hills Resources Alaska, LLC

Monitoring Well

Approximate Sulfolane Isopleth in µg/L

FHRA Property Boundary

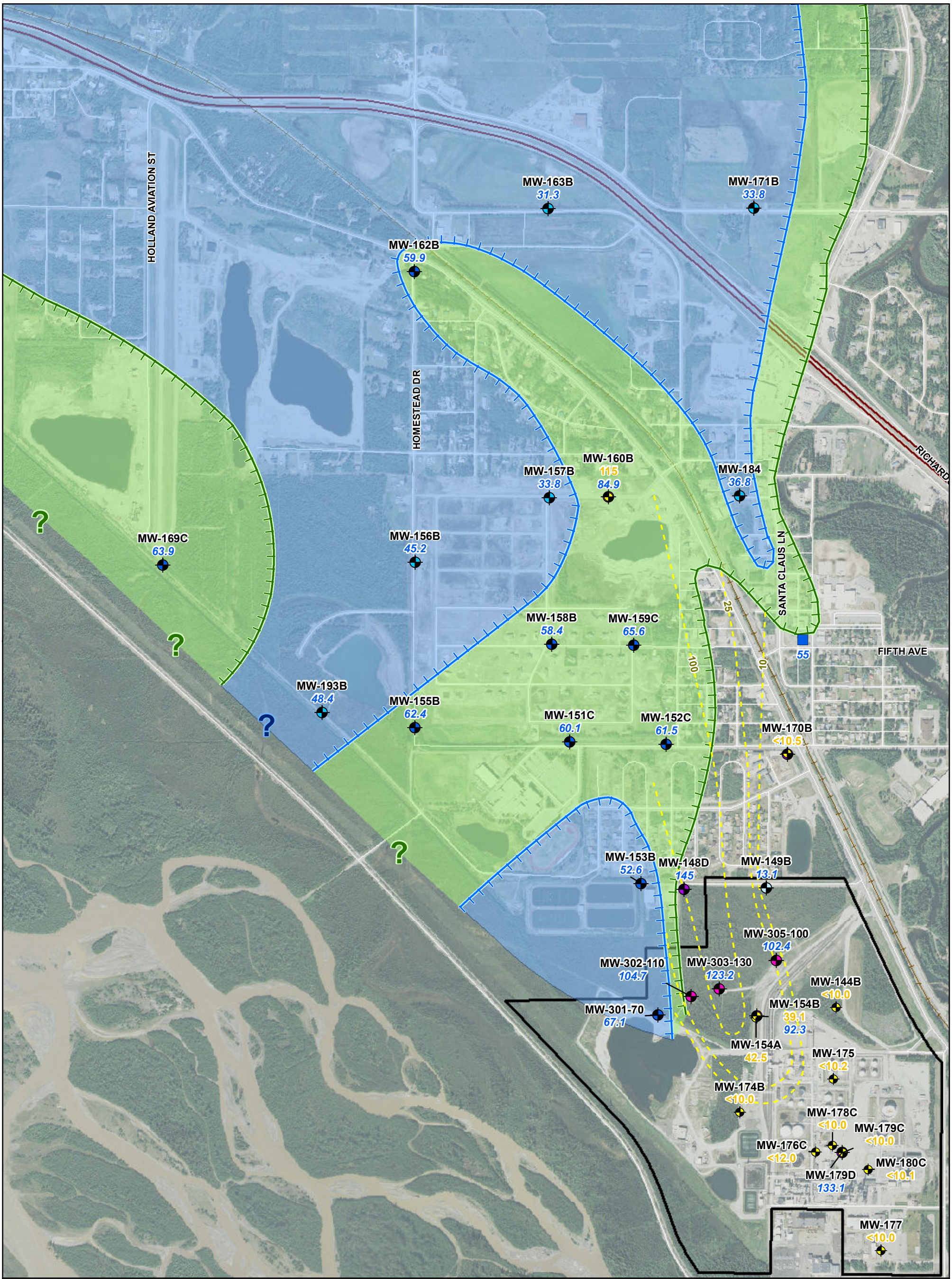
118 Sulfolane Concentration (µg/L)

NS Not Sampled

0 750 1,500 3,000

Feet

Figure 88
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
10-55' BELOW THE WATER TABLE
FOURTH QUARTER 2010
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well with Sulfolane Concentration (µg/L)

Depth To Permafrost

- 0 - 24.9 Ft
- 25 - 49.9 Ft
- 50 - 74.9 Ft
- 75 - 99.9 Ft
- 100 - 124.9 Ft
- 125 - 150 Ft

City Well

Approximate Sulfolane Isopleth in µg/L

Aquifer Frozen at 55' Below the Water Table

Aquifer Frozen at 90' Below the Water Table

FHRA Property Boundary

118 Sulfolane Concentration (µg/L)

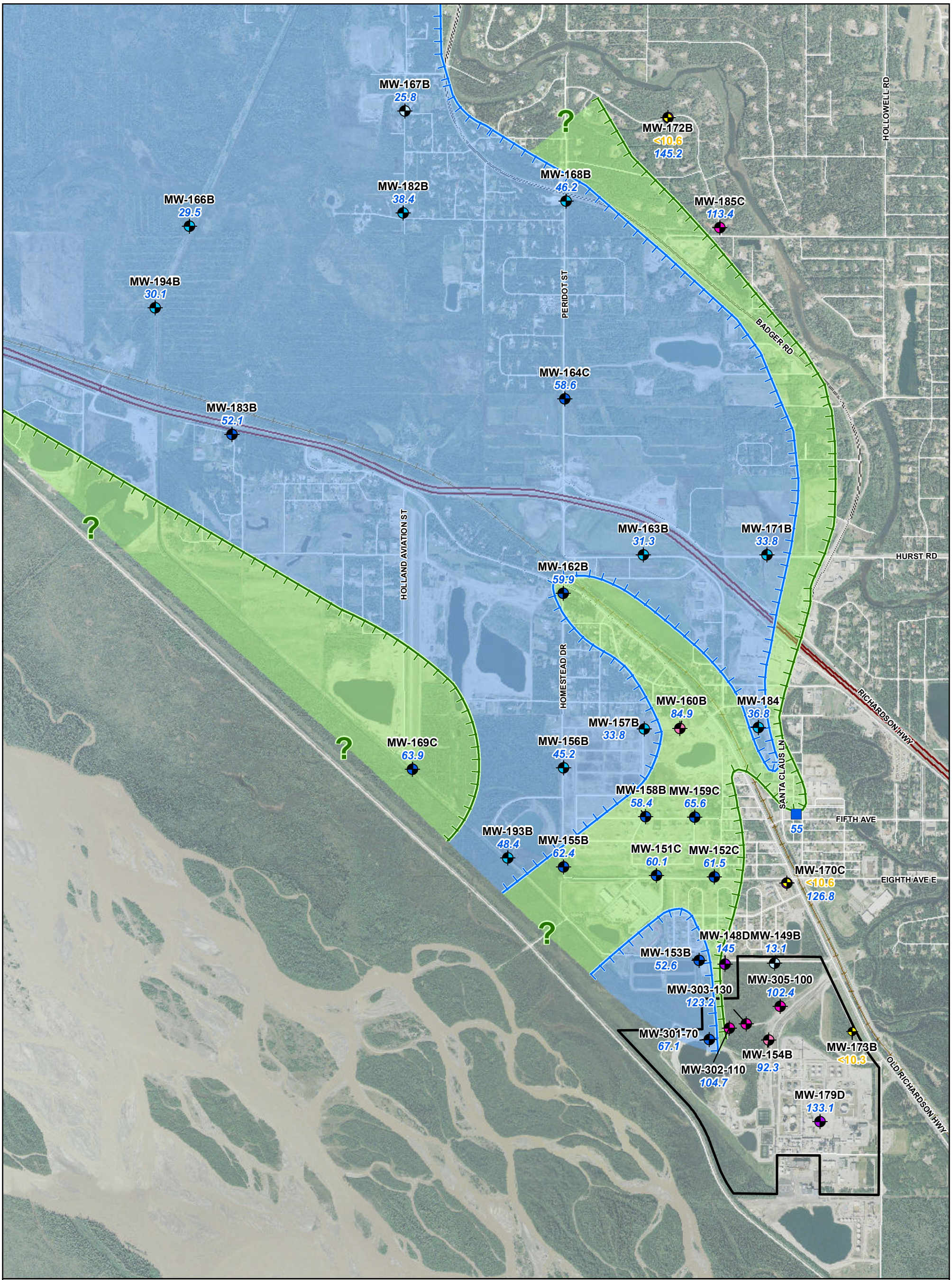
59.0 Depth to Permafrost (feet BGS)

N

0 450 900 1,800

Feet

Figure 89
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
55-90' BELOW THE WATER TABLE
FOURTH QUARTER 2010
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Depth To Permafrost (BWT)

- 0 - 24.9 Ft
- 25 - 49.9 Ft
- 50 - 74.9 Ft
- 75 - 99.9 Ft
- 100 - 124.9 Ft
- 125 - 150 Ft

City Well

FHRA Property Boundary

Aquifer Frozen at 55' Below the Water Table

Aquifer Frozen at 90' Below the Water Table

118 Sulfolane Concentration (µg/L)

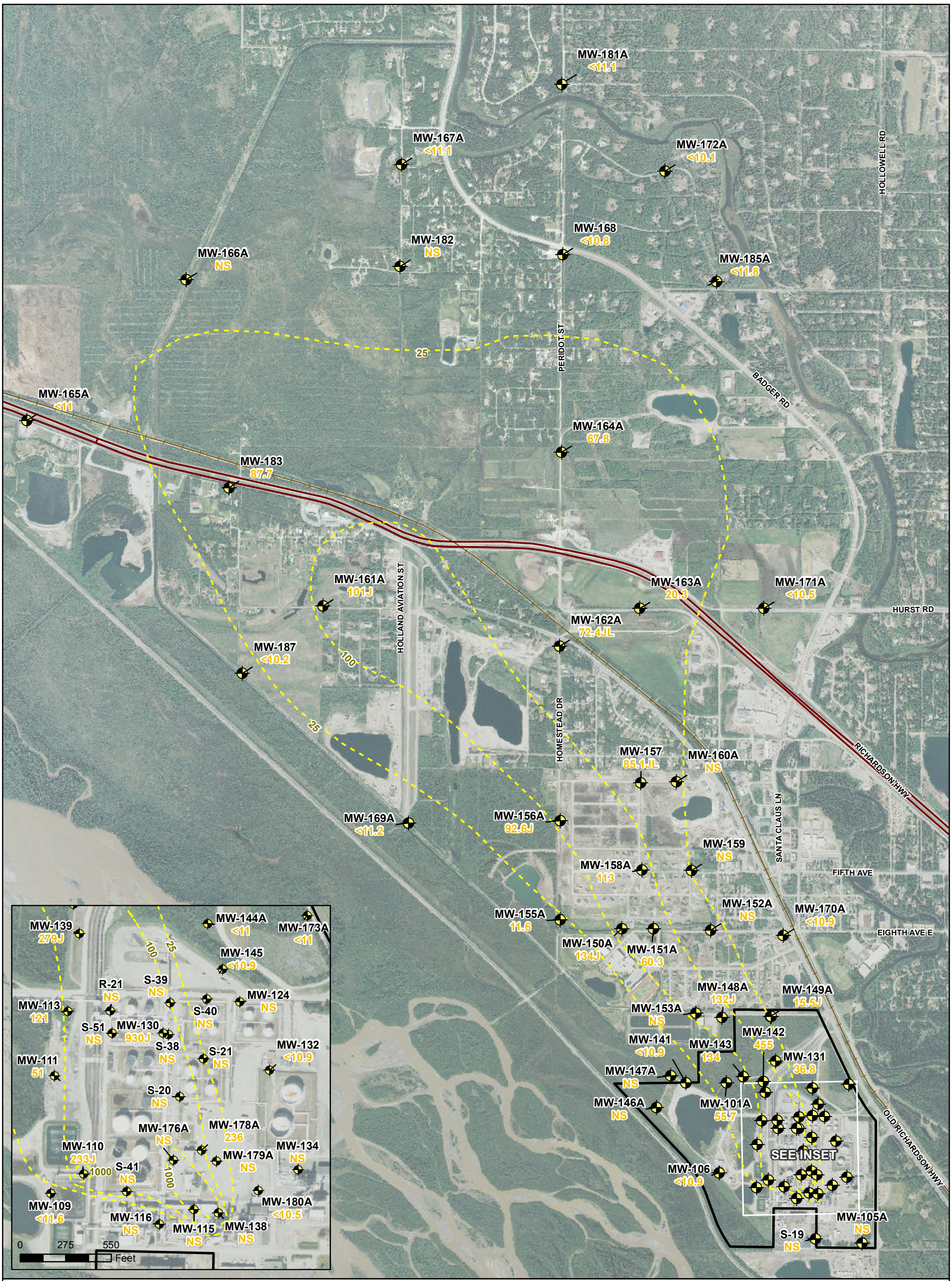
59.0 Depth to Permafrost (feet BGS)

*Extent of aquifer frozen at 160' below the water table is unknown.

0 750 1,500 3,000

Feet

Figure 90
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
90-160' BELOW THE WATER TABLE
FOURTH QUARTER 2010
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Approximate Sulfolane Isopleth in µg/L

FHRA Property Boundary

118 Sulfolane Concentration (µg/L)

J Estimated value

JL Estimated value, biased low

NS Not Sampled

0 750 1,500 3,000

Feet

Figure 91
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
AT THE WATER TABLE
FIRST QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC

Monitoring Well

Approximate Sulfolane Isopleth in µg/L

FHRA Property Boundary

118 Sulfolane Concentration (µg/L)

J Estimated value

JL Estimated value, biased low

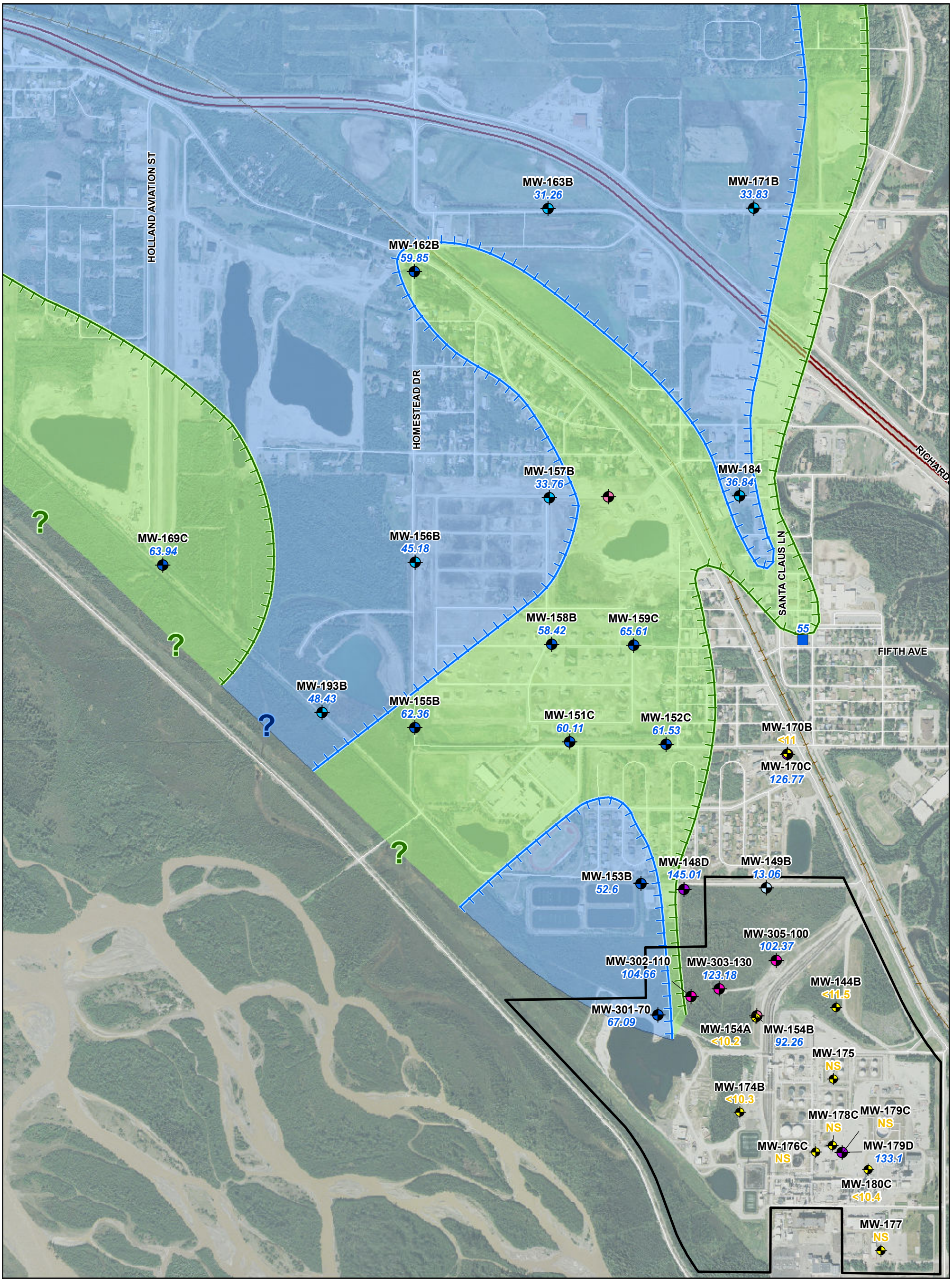
UJ The analyte was not reported above the limit of quantitation; however, the limit of quantitation is estimated because ice was observed in the sample.

NS Not Sampled

0 750 1,500 3,000

Feet

Figure 92
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
10-55' BELOW THE WATER TABLE
FIRST QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Wells

Depth to Permafrost (BWT)

- 0 - 24.9 Ft
- 25 - 49.9 Ft
- 50 - 74.9 Ft
- 75 - 99.9 Ft
- 100 - 124.9 Ft
- 125 - 149.9 Ft

City Well

FHRA Property Boundary

Aquifer Frozen at 55' Below the Water Table

Aquifer Frozen at 90' Below the Water Table

118 Sulfolane Concentration (µg/L)

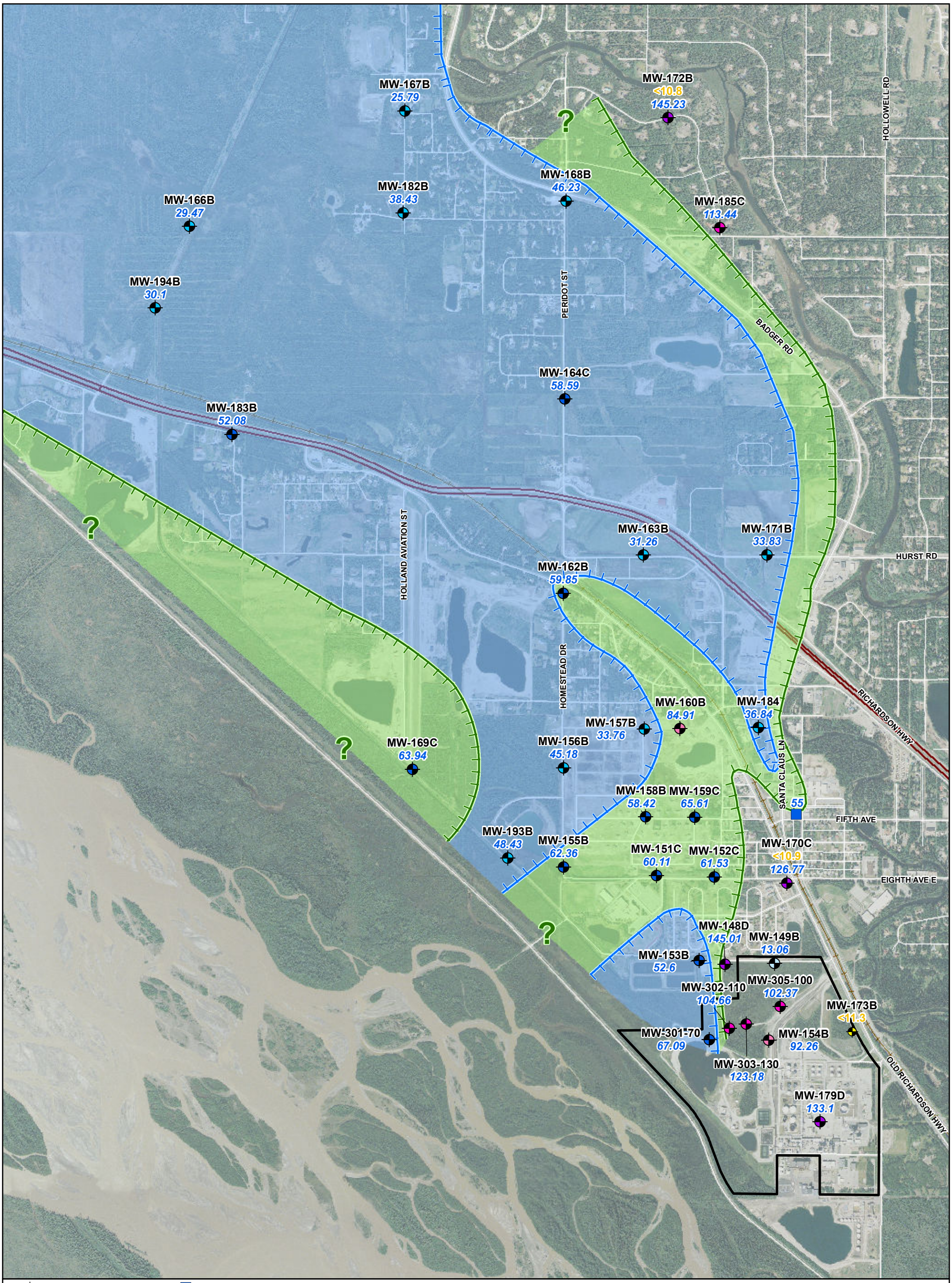
NS Not Sampled

59.0 Depth to Permafrost (feet BGS)

0 450 900 1,800

Feet

Figure 93
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
55-90' BELOW THE WATER TABLE
FIRST QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC



Monitoring Well

Depth to Permafrost (BWT)

- 0 - 24.9 Ft
- 25 - 49.9 Ft
- 50 - 74.9 Ft
- 75 - 99.9 Ft
- 100 - 124.9 Ft
- 125 - 149.9 Ft

City Well

FHRA Property Boundary

Aquifer Frozen at 55' Below the Water Table

Aquifer Frozen at 90' Below the Water Table

118 Sulfolane Concentration (µg/L)

59.0 Depth to Permafrost (feet BGS)

*Extent of aquifer frozen at 160' below the water table is unknown.

0 750 1,500 3,000

Feet

Figure 94
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
90-160' BELOW THE WATER TABLE
FIRST QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC

Monitoring Well

Approximate Sulfolane Isopleth in µg/L

FHRA Property Boundary

118 Sulfolane Concentration (µg/L)

NS Not Sampled

**Sulfolane was analyzed by EPA Method 1625B with Iso-dilution

0 750 1,500 3,000

Feet

Figure 95
SULFOLANE CONCENTRATIONS
IN GROUNDWATER
AT THE WATER TABLE
SECOND QUARTER 2011
North Pole Refinery
Flint Hills Resources Alaska, LLC