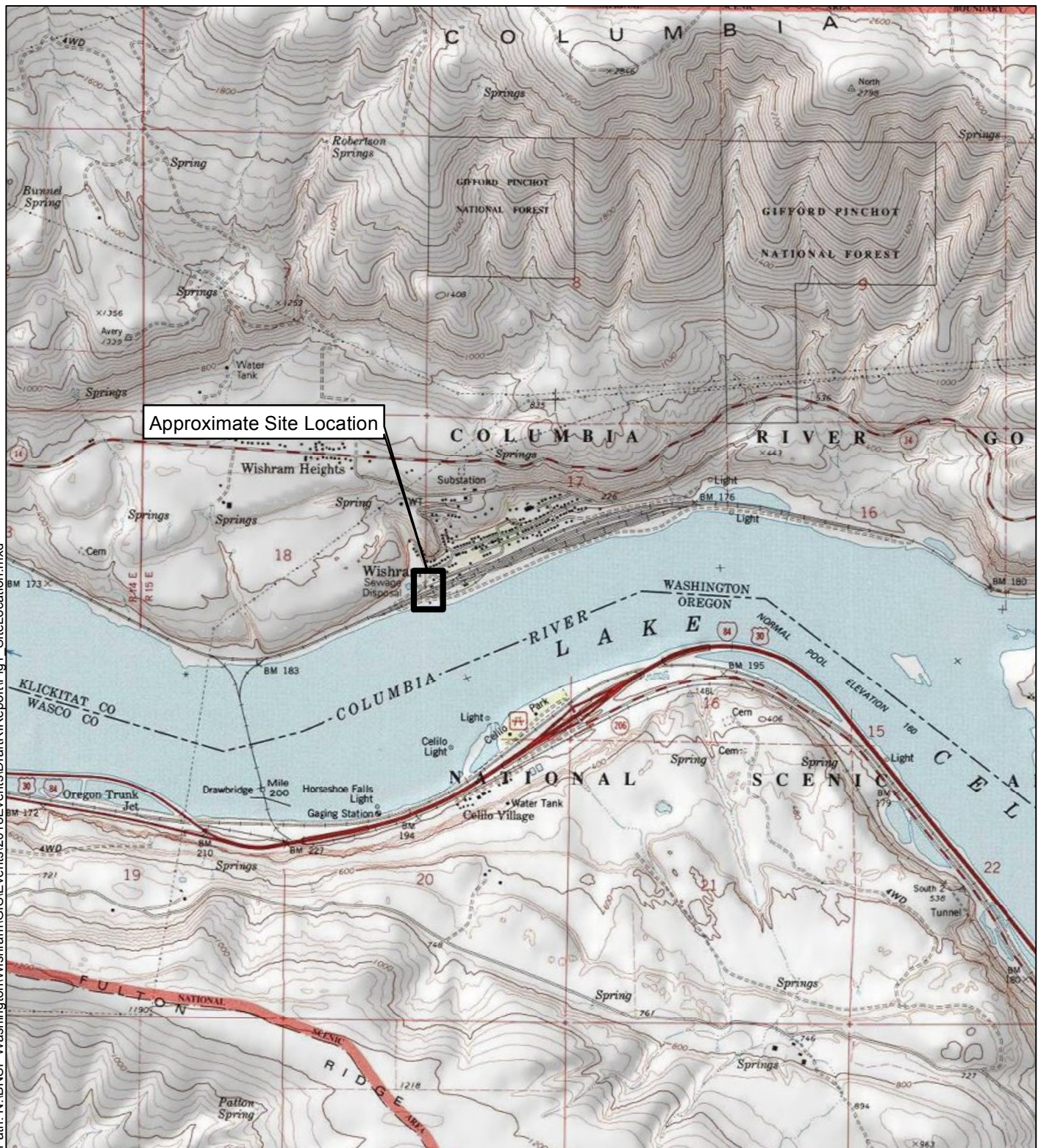
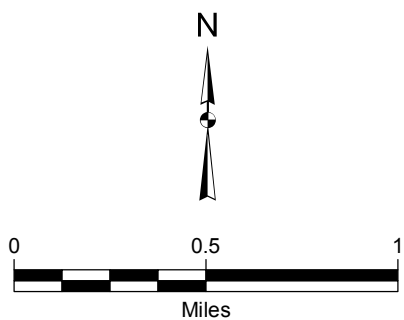


Figures

Path: N:\BNSF Washington\Wishram\GIS\Events\2018\Events\DraftRpt\Fig1_Sitelocation.mxd



Copyright:© 2013 National Geographic Society, i-cubed



Note:
1. Locations are approximate.

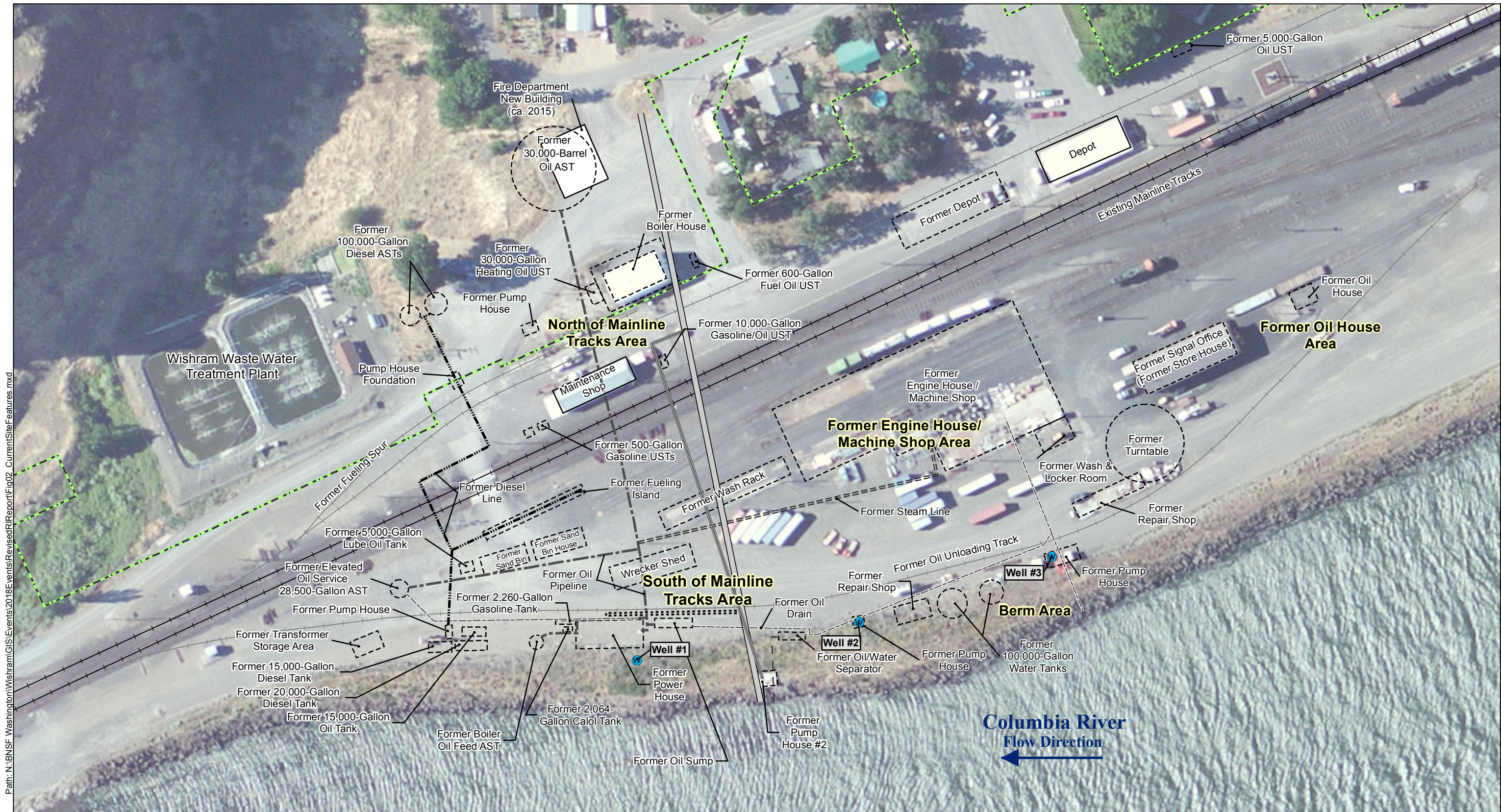
Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Site Location Map

1896120*04
November 2018

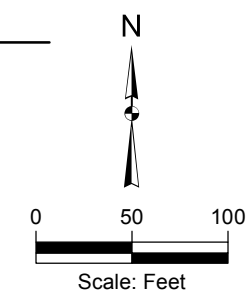
Figure 1



Legend

- | | |
|--|---|
| Former Water Supply Well (Approximate) | Former Sewer Line (Potential) |
| Approximate BNSF Property Line | Stormwater Underdrain (A portion removed from service circa 1960) |
| Existing Site Feature | Stormwater Underdrain (Rerouted portion circa 1960) |
| Former Site Feature | Former Diesel Line |
| Former Bunker Fuel / Oil Pipeline | Former Steam Line |
| Former Oil Drain | |
| Former Oil Trough | |

Note:
1. Locations are approximate.



Kennedy/Jenks Consultants

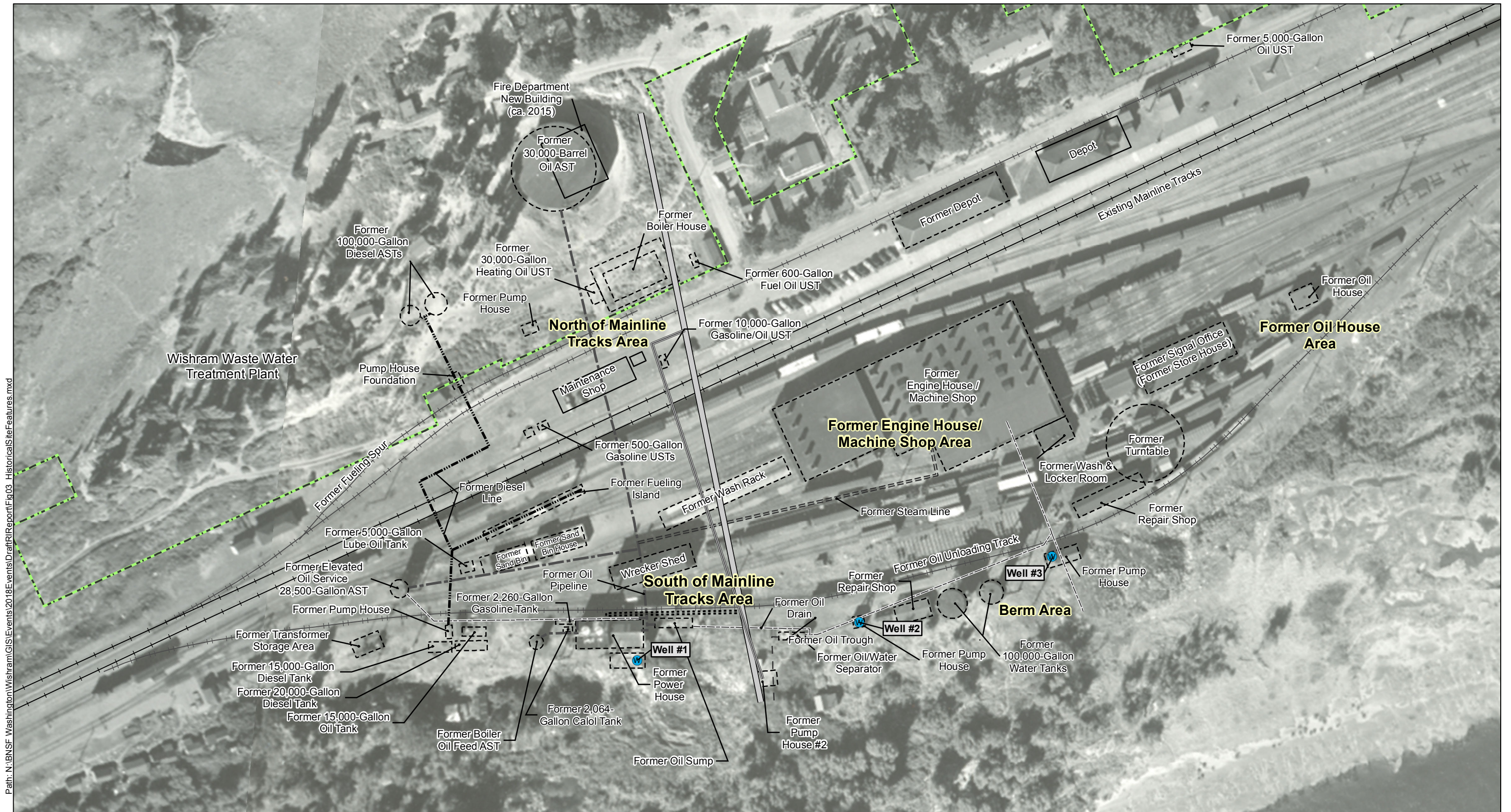
BNSF Wishram Railway
Wishram, Washington

Current and Historical Site Features

1896120.04
March 2020

Figure 2

Path: N:\BNSF Washington\GIS\Events\2018\Events\DraftRIR\Report\Fig03_HistoricalSiteFeatures.mxd

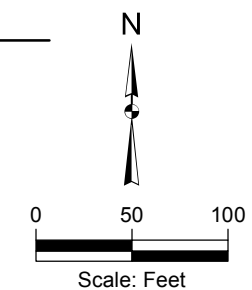


Legend

- | | | |
|--|---|-----------------------|
| Former Water Supply Well (Approximate) | Former Sewer Line (Potential) | Existing Site Feature |
| Approximate BNSF Property Line | Stormwater Underdrain (A portion removed from service circa 1960) | Former Site Feature |
| Former Railroad Tracks | Stormwater Underdrain (Rerouted portion circa 1960) | |
| Former Bunker Fuel / Oil Pipeline | Former Diesel Line | |
| Former Oil Drain | Former Steam Line | |
| Former Oil Trough | | |

Notes:

1. Locations are approximate.
2. Background image from U.S. Army Corps of Engineers, 1951.



Kennedy/Jenks Consultants

BNSF Wishram Rail yard
Wishram, Washington

Historical Site Features

1896120.04
March 2020

Figure 3



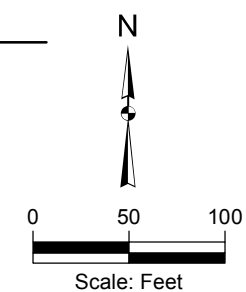
Path: N:\BNSF Washington\Wishram\GIS\Events\2018\Events\DraftRIRReport\Fig05_sever_1961_east.mxd

Legend

- Approximate BNSF Property Line
- Existing Site Feature
- Former Site Feature

Notes:

- Locations are approximate.
- Background image from U.S. Army Corps of Engineers, 1962.



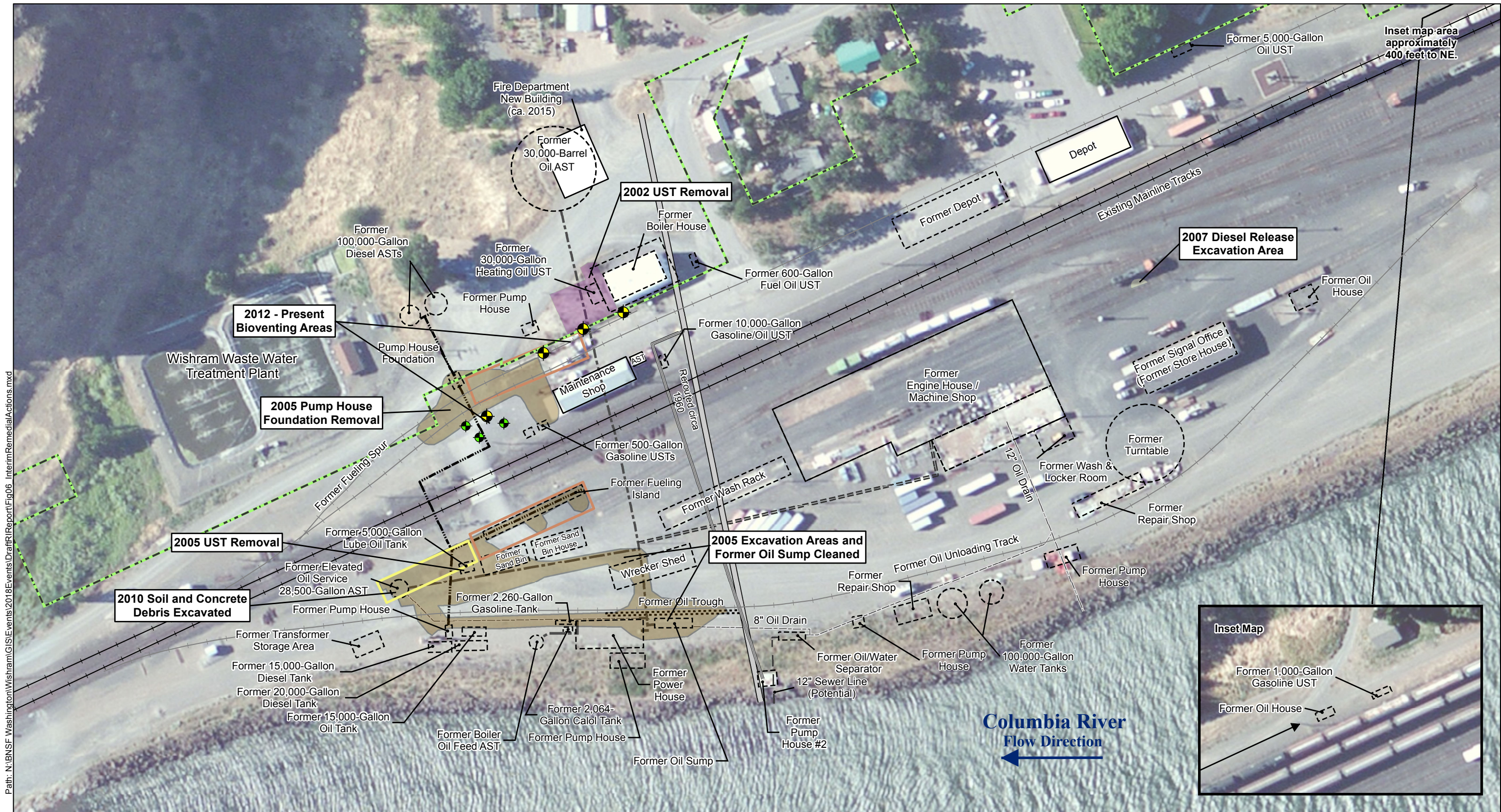
Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Historical Site Features - East Area

1896120°00
July 2020

Figure 5



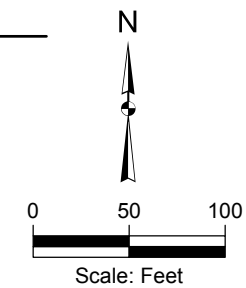
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- | | | |
|--|--|--|
| | | |
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| | | |
| | | |
| | | |
| | | |

Note:
1. Locations are approximate.



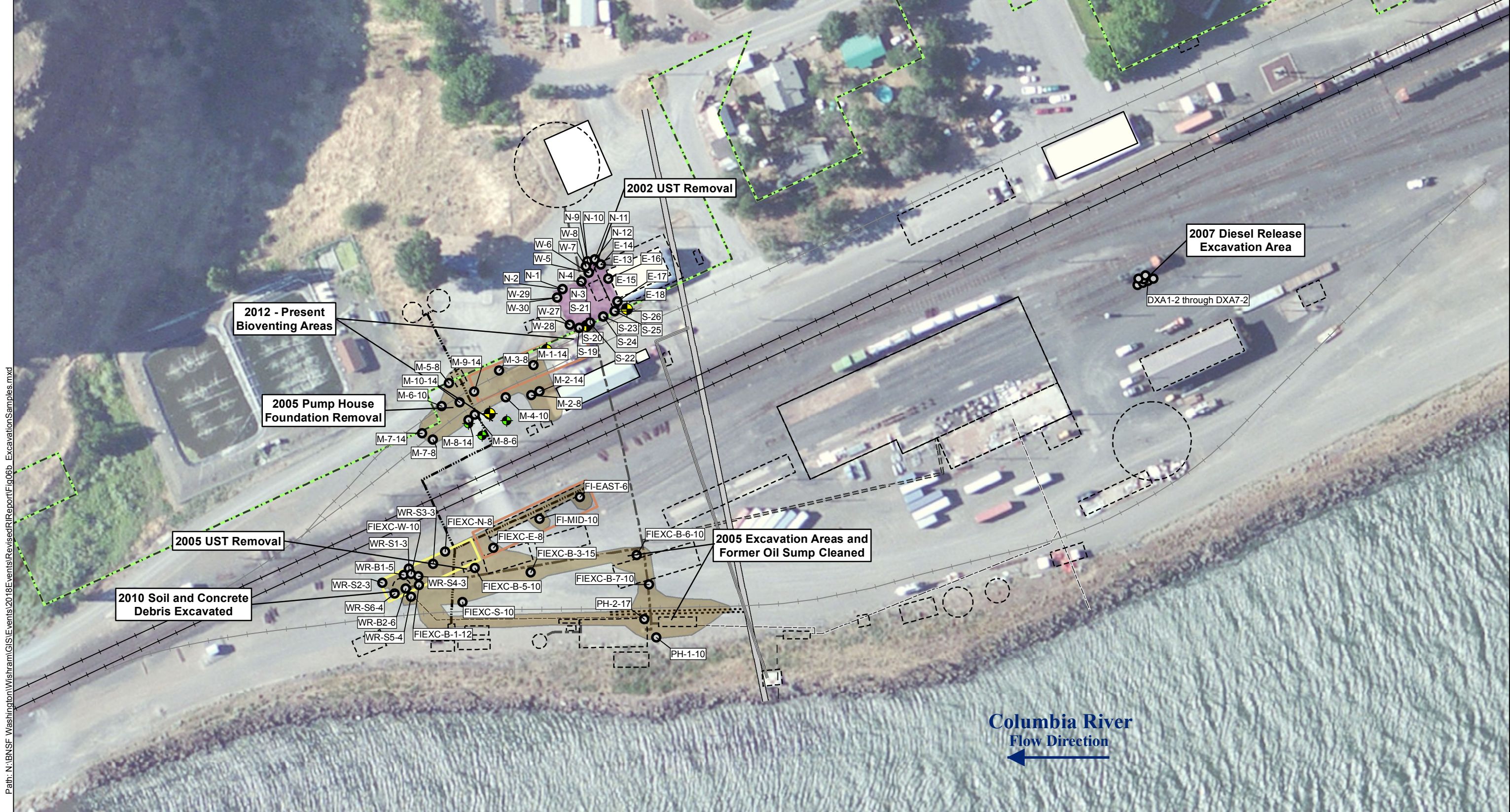
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BNSF Wishram Railway
Wishram, Washington

Previous Interim Remedial Actions

1896120.04
January 2019

Figure 6A



Path: N:\BNSF Wishram\GIS\Events\2018Events\RevisedR\Report\Fig06b ExcavationSamples.mxd

Legend

Bioventing Injection Well	Former Sewer Line (Potential)	Suspected Diesel Fueling Area
Air Sparge (AS) Well	Stormwater Underdrain (A portion removed from service circa 1960)	Suspected Oil Fueling Area
Excavation Soil Sample	Stormwater Underdrain (Rerouted portion circa 1960)	Approximate Previous Excavation Area (2002)
Approximate BNSF Property Line	Former Diesel Line	Approximate Previous Excavation Area (2005/2010)
Former Bunker Fuel / Oil Pipeline	Former Steam Line	Approximate Previous Excavation Area (2007)
Former Oil Drain		Existing Site Feature
Former Oil Trough		Former Site Feature

Note:
1. Locations are approximate.

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BNSF Wishram Railway
Wishram, Washington

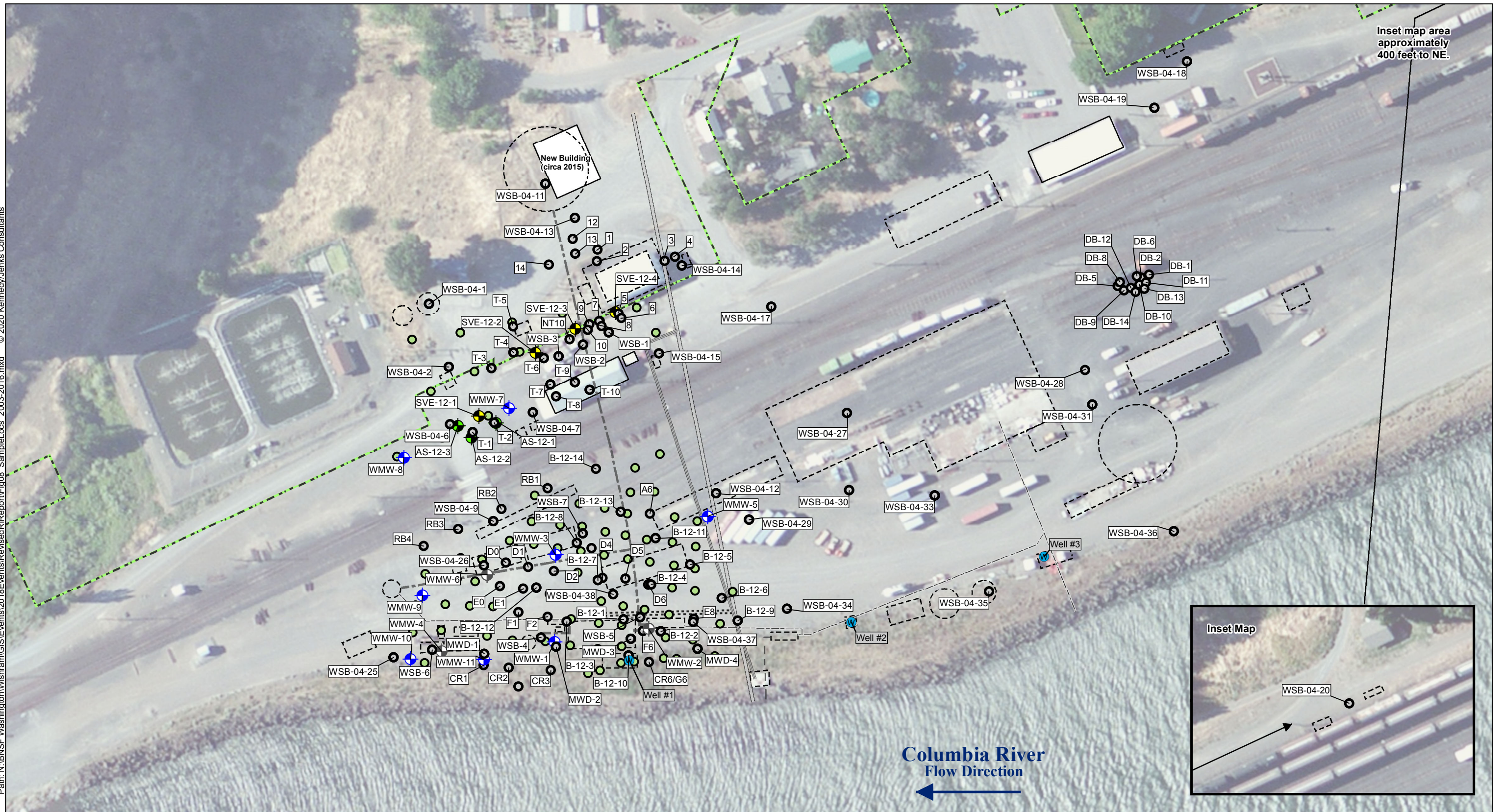
Excavation Confirmation Soil Samples

1896120.04
July 2020

Figure 6B

Columbia River
Flow Direction

Path: N:\BNSF Washington\Wishram\GIS\Events\2018\Events\RevisedRIR\Report\Fig08_Sample_locs_2003-2016.mxd © 2020 Kennedy/Jenks Consultants

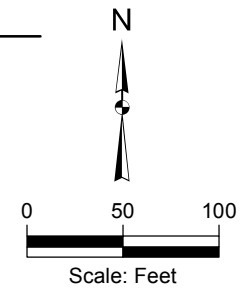


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- | | |
|--|-------------------------|
| LIF Location | Air Sparge Well |
| Former Water Supply Well (Approximate) | Bioventing Well |
| Shallow Monitoring Well | Soil Boring (2002-2014) |
| Abandoned Monitoring Well | |



Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Sample Locations (2002-2014) - Main Area

1896120°00
July 2020

Figure 7

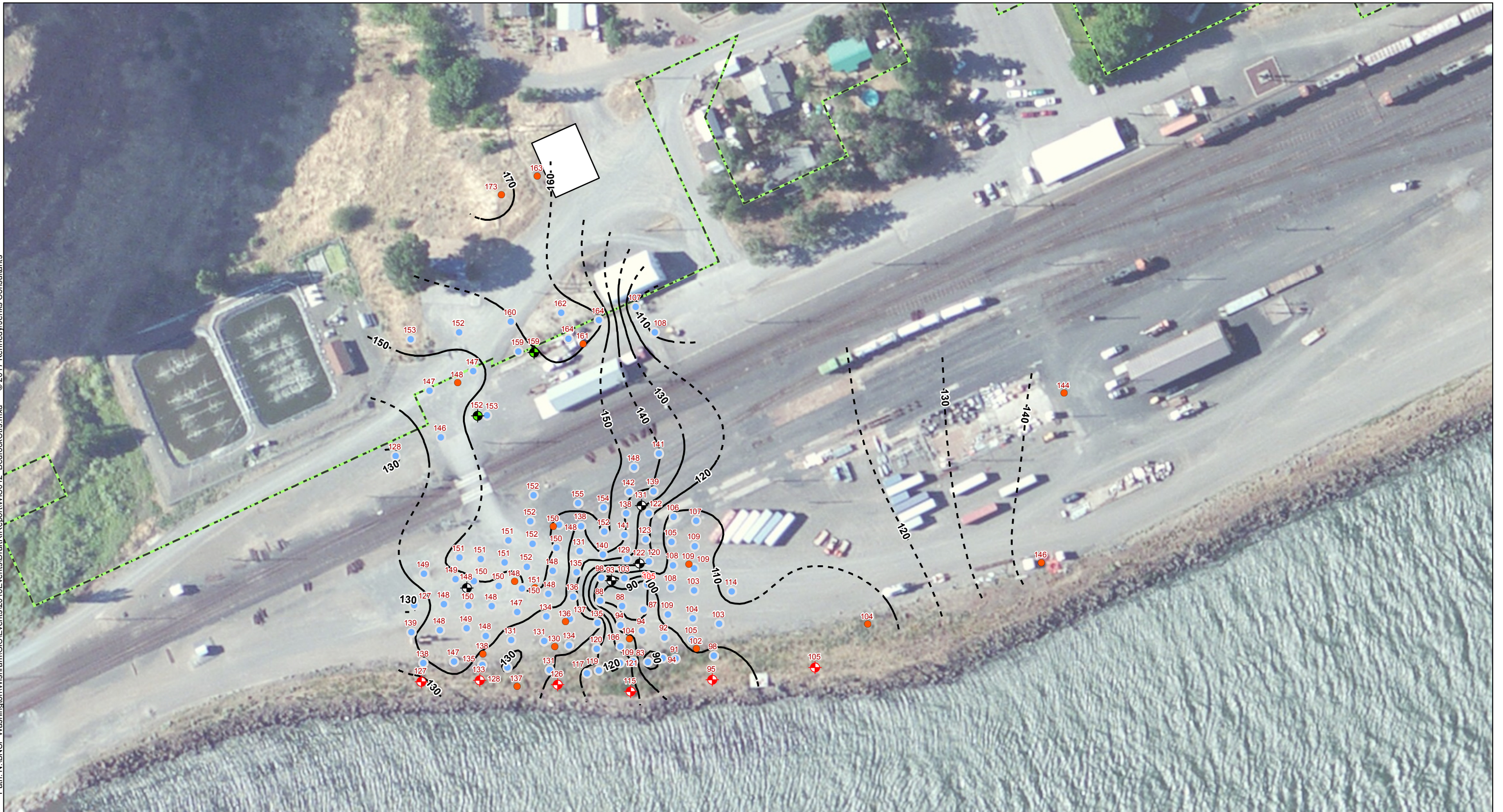


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Kennedy/Jenks Consultants

Path: N:\BNSF Washington\Wishram\GIS\Events\2018\Events\DraftRIR\Report\WIS012_BedrockCtrs.mxd © 2017 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

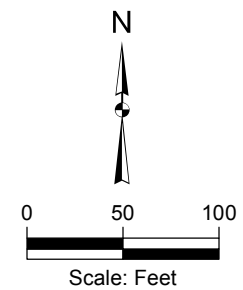
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- LIF Boring
- Soil Boring
- ◆ Oil Head Monitoring Well
- ◆ Deep Monitoring Well
- ◆ SVE Well
- Estimated Bedrock Elevation Contour (10 ft interval)
- - - Inferred Bedrock Elevation Contour

Notes:

1. Locations are approximate and have been determined using past reports and historical maps and images.
2. Values displayed on map indicate bedrock elevation in feet above mean sea level (ft amsl).



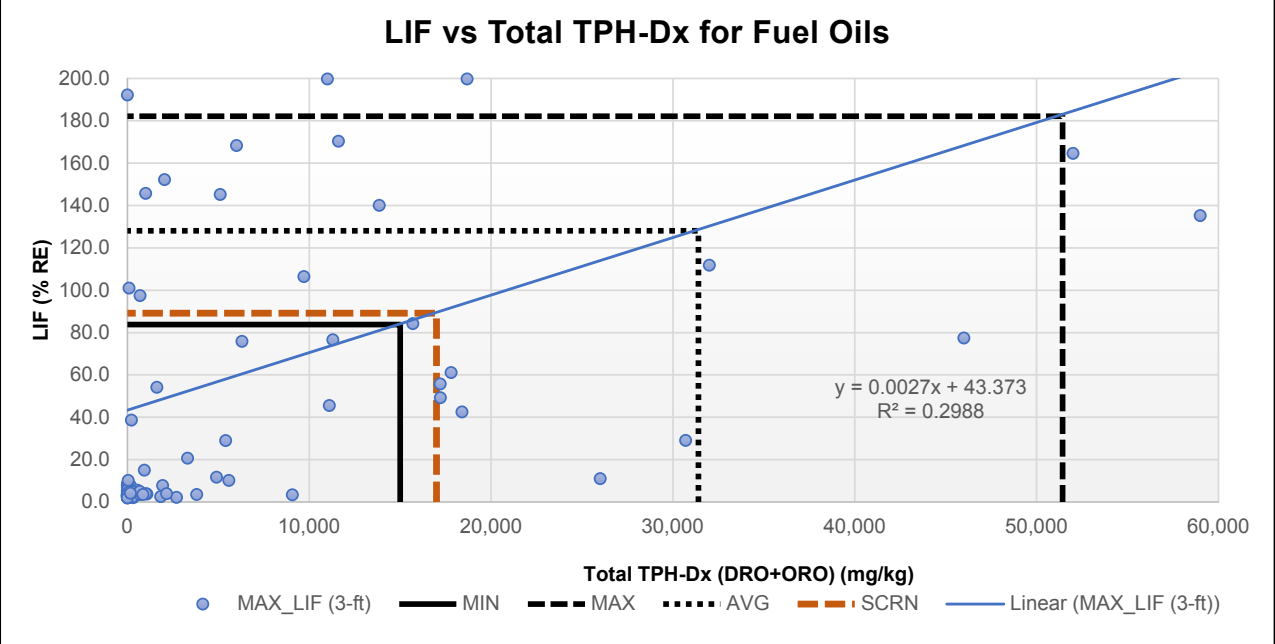
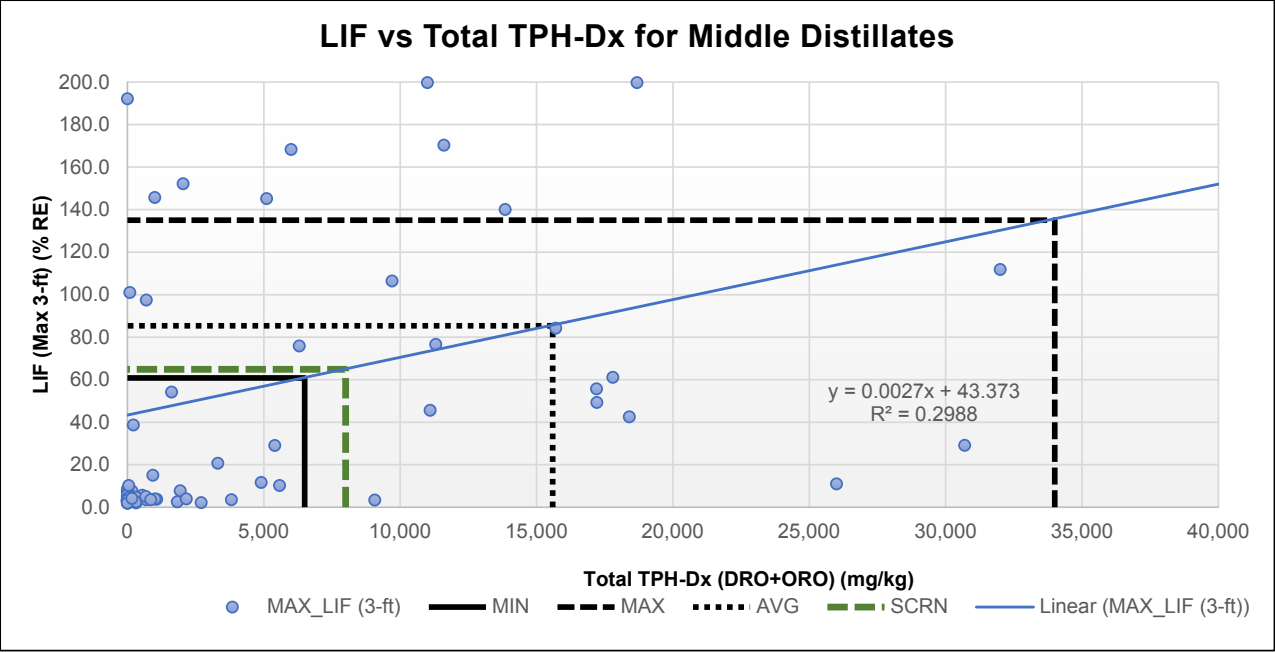
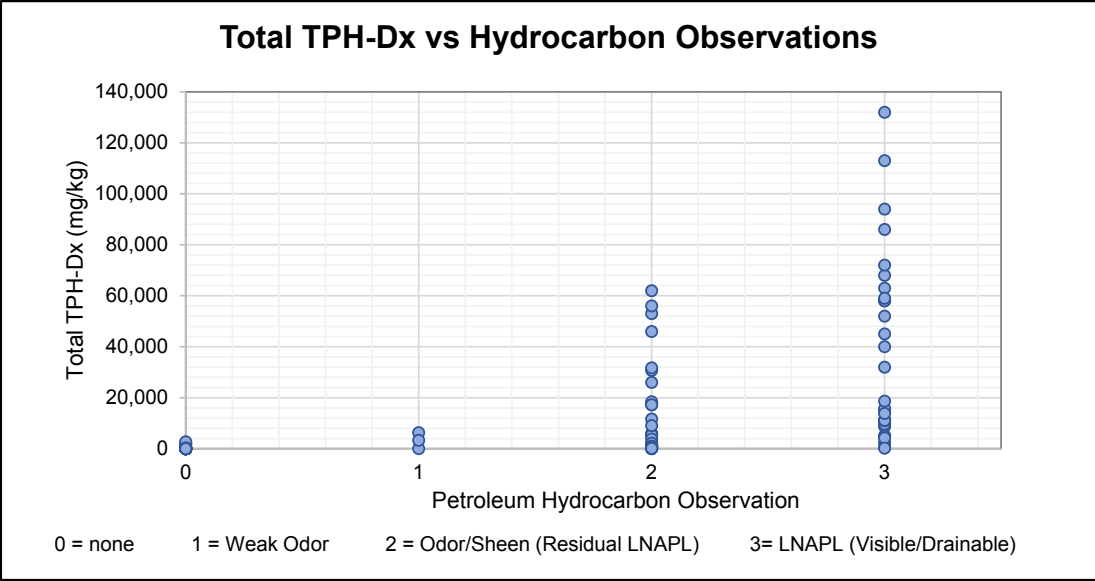
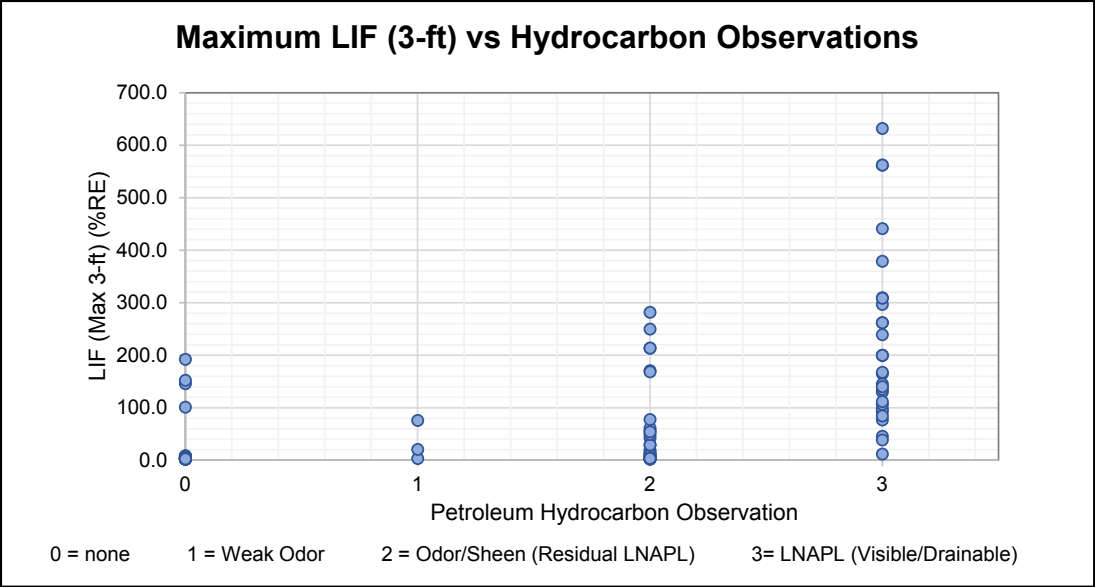
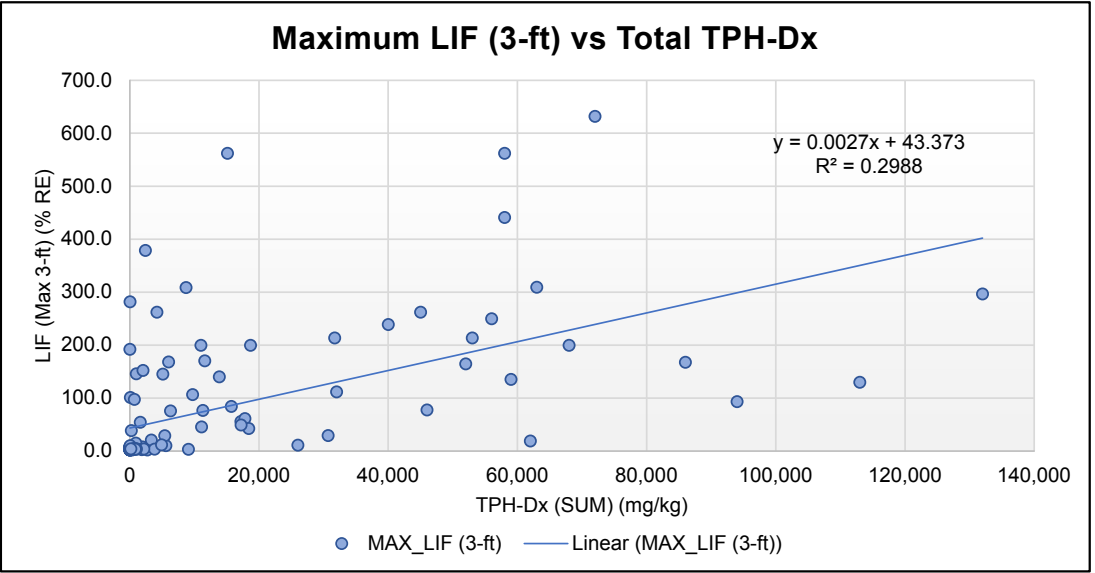
Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Approximate Bedrock Elevation Contour Map

1896120°00
December 2018

Figure 9



Notes:

Plots present data for laser induced fluorescence (LIF) percent reference emitter (%RE) compared to sum of NWTPH-Dx results (e.g. Total TPH-Dx) for diesel- and oil-range organics (DRO and ORO), hits only.

Minimum (MIN), maximum (MAX), and average (AVG) residual saturation concentration in milligrams per kilogram (mg/kg) from literature values listed below for Middle Distillates (e.g. diesel) and Fuel Oils (e.g. Bunker C, oil).

Screening values (SCRN) presented in Brost et al. (2000).

Middle Distillates	% RE	Fuel Oil	% RE	Source	Soil Type
6,500 MIN	60.9	15,000 MIN	83.9	API 1628	Coarse sand
17,000	89.3	39,000	148.7	API 1628	Fine sand/silt
7,742	64.3	17,419	90.4	Brost and DeVaul, 2000	medium to coarse
13,333	79.4	30,000	124.4	Brost and DeVaul, 2000	Fine to medium sand
22,857	105.1	51,429 MAX	182.2	Brost and DeVaul, 2000	silt to fine sand
7,700	64.2	17,000	89.3	Brost and DeVaul, 2000	Fine to medium sand
34,000 MAX	135.2	50,000	178.4	Brost and DeVaul, 2000	Fine to medium sand
15,590 AVG	85.5	31,400 AVG	128.2		
8,000 Screening	65.0	17,000 Screening	89.3	Brost and DeVaul, 2000	

American Petroleum Institute. 1996. A Guide to the Assessment and Remediation of Underground Petroleum Releases. API Publication 1628, Third Edition, July 1996.

Brost, E.D. and G.E. DeVaul. 2000. Non-Aqueous Phase Liquid (NAPL) Mobility Limits in Soil. Soil & Groundwater Research Bulletin. No.9. June 2000.

BNSF Wishram Railyard
Wishram, Washington

**LIF Response Data
Correlations**

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig09_LIF_Diesel_SMZ.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

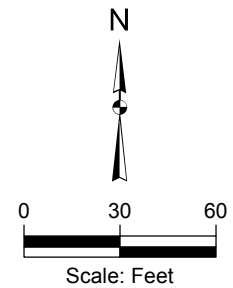
Legend

LIF Response (Diesel and/or Mixed)

- Inferred Diesel-Like LNAPL (> 60 %RE)
- Residual LNAPL (20 to 60 % RE)
- No LNAPL or Residual LNAPL (< 20 %RE)
- Inferred Lateral Extent of Shallow (at water table) Diesel-Like LNAPL Impacts
- Approximate BNSF Property Line

Notes:

- Locations are approximate.
- LNAPL = light non-aqueous phase liquid
- Inferred lateral extent of potentially mobile Diesel-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs.



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BNSF Wishram Railway
Wishram, Washington

Inferred Shallow Diesel-Like LNAPL Extent Map

2096120.00
July 2020

Figure 11

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig10_LIF_Diesel_SUB.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

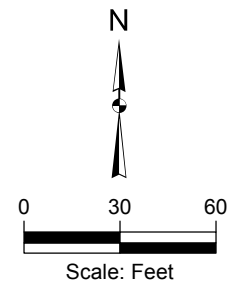
Legend

LIF Response (Diesel and/or Mixed)

- Inferred Diesel-Like LNAPL (> 60 %RE)
- Residual LNAPL (20 to 60 % RE)
- No LNAPL or Residual LNAPL (< 20 %RE)
- Inferred Lateral Extent of Submerged (below water table) Diesel-Like LNAPL Impacts
- Approximate BNSF Property Line

Notes:

- Locations are approximate.
- LNAPL = light non-aqueous phase liquid
- Inferred lateral extent of potentially mobile Diesel-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs.



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BNSF Wishram Rail yard
Wishram, Washington

Inferred Submerged Diesel-Like LNAPL Extent Map

2096120.00
July 2020

Figure 12

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig11_LIF_Oil_SMZ.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

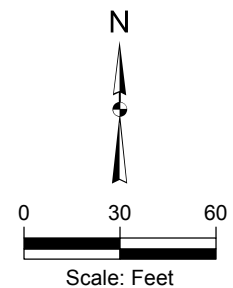
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- LNAPL Observed in Boring
- Approximate BNSF Property Line
- Inferred Oil-Like LNAPL (> 60 %RE)
- Residual LNAPL (20 to 60 % RE)
- No LNAPL or Residual LNAPL (< 20 %RE)
- Inferred Lateral Extent of Shallow (at water table) Oil-Like LNAPL Impacts

Notes:

- Locations are approximate.
- LNAPL = light non-aqueous phase liquid
- Inferred lateral extent of potentially mobile Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs.



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BNSF Wishram Railway
Wishram, Washington

Inferred Shallow Oil-Like LNAPL Extent Map

1896120.00
July 2020

Figure 13

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig12_LIF_Oil_SUB.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

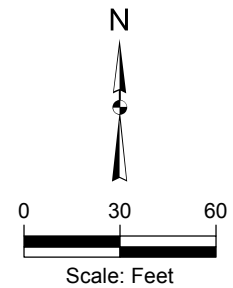
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- LNAPL Observed in Boring
- Approximate BNSF Property Line
- Inferred Oil-Like LNAPL (> 60 %RE)
- Residual LNAPL (20 to 60 % RE)
- No LNAPL or Residual LNAPL (< 20 %RE)
- Inferred Lateral Extent of Submerged (below water table) Oil-Like LNAPL Impacts

Notes:

1. Locations are approximate.
2. LNAPL = light non-aqueous phase liquid
3. Inferred lateral extent of potentially mobile Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs.



Kennedy/Jenks Consultants

BNSF Railway Company
Wishram, Washington

Inferred Submerged Oil-Like LNAPL Extent Map

1896120.00
July 2020

Figure 14

Path: N:\BNSF Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig13_LIF_Dx_SMZ.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

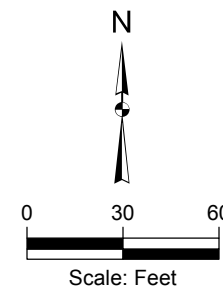
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- LNAPL Observed in Boring
- LIF Response (Diesel, Oil and/or Mixed)**
- Inferred Diesel/Oil-Like LNAPL (> 60 % RE)
- Residual LNAPL (20 to 60 % RE)
- No LNAPL or Residual LNAPL (< 20 % RE)
- Inferred Lateral Extent of Shallow (at water table) Diesel-Like LNAPL Impacts
- Inferred Lateral Extent of Shallow (at water table) Oil-Like LNAPL Impacts
- Approximate BNSF Property Line

Notes:

1. Locations are approximate.
2. LNAPL = light non-aqueous phase liquid
3. Inferred lateral extent of potentially mobile Diesel- or Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs.



Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Combined Inferred Shallow LNAPL Extent Map

1896120.00
August 2020

Figure 15

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig14_LIF_Dx_SUB.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

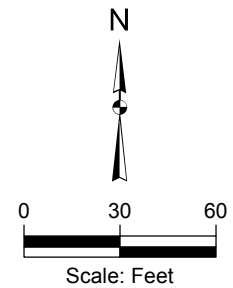
Legend

- LNAPL Observed in Boring
- LIF Response (Diesel, Oil and/or Mixed)**
- Inferred Diesel/Oil-Like LNAPL (> 60 %RE)
- Residual LNAPL (20 to 60 % RE)
- No LNAPL or Residual LNAPL (< 20 %RE)

- Inferred Lateral Extent of Submerged (below water table) Diesel-Like LNAPL Impacts
- Inferred Lateral Extent of Submerged (below water table) Oil-Like LNAPL Impacts
- Approximate BNSF Property Line

Notes:

1. Locations are approximate.
2. LNAPL = light non-aqueous phase liquid
3. Inferred lateral extent of potentially mobile Diesel- or Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs.



Kennedy/Jenks Consultants

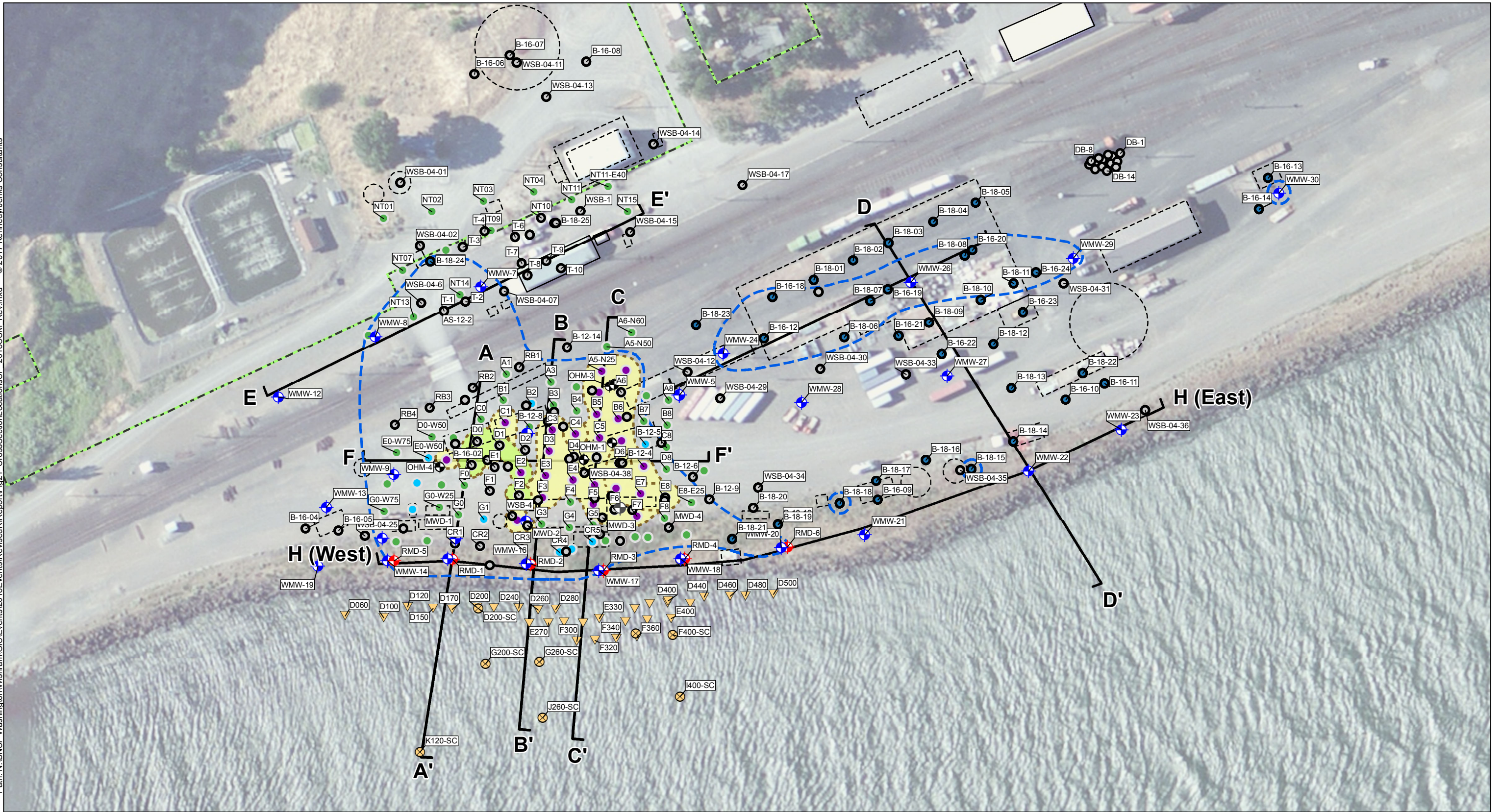
BNSF Wishram Rail Yard
Wishram, Washington

Combined Inferred Submerged LNAPL Extent Map

1896120.00
July 2020

Figure 16

Path: N:\BNSF_Wishram\GIS\Events\2018Events\RevisedRIR\Report\Fig21_CrossSectionLocationsSP_2018CSM_Rev.mxd © 2017 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

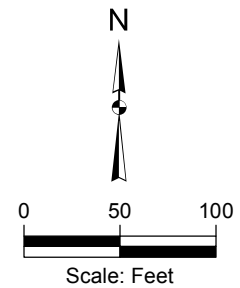
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- | | | |
|--------------------------------------|---|---|
| Monitoring Well | Inferred Diesel/Oil-Like LNAPL (> 60 %RE) | Sediment Core Location |
| Oil-Head Monitoring (OHM) Well | Residual TPH (20 to 60 % RE) | Approximate Lateral Extent of Dissolved Phase Diesel and/or Oil |
| Riverside Monitoring Deep (RMD) Well | No LNAPL or Residual TPH (< 20 %RE) | Shallow and Submerged LNAPL Extents |
| Abandoned Monitoring Well | Cross Section Line | Inferred Lateral Extent of Diesel Impacts |
| Soil Boring (2002-2014) | Approximate BNSF Property Line | Inferred Lateral Extent of Oil Impacts |
| Soil Boring (2016-2018) | DART Location | |

Notes:

1. All locations are approximate and have been determined using past reports and historical maps and images.
2. Distribution of saturated zone NAPL and light hydrocarbon is based on LIF survey and other results
3. Approximate BNSF property lines are based on Klickitat County parcel maps and other available information and may not represent actual property lines.



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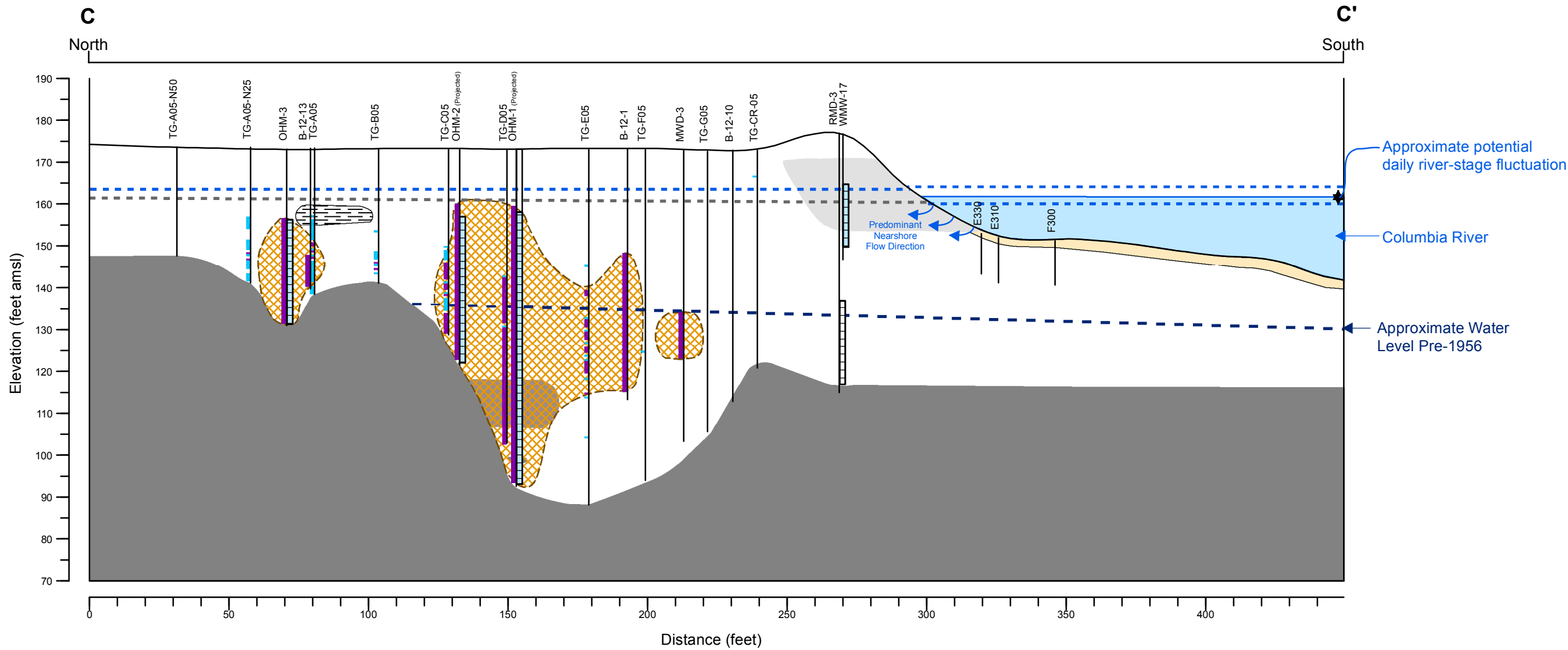
BNSF Wishram Railway
Wishram, Washington

Cross Section Location Map

1896120°00
August 2020

Figure 17

N:\BNSF Washington\Wishram\GIS\Events\2018\Events\RevisedRIR\Report\Fig24 Transect CC.mxd Date: 8/3/2020 Printed by: Katie Haskins



Legend

- Inferred Maximum Measured Groundwater Elevation
- Inferred Minimum Measured Groundwater Elevation
- River Sediment (Interpreted)
- Columbia River

Lithology

- Gravelly Sand Fill Material
- Sand and Sand with Silt
- Gravel and Gravel with Sand
- Clay and Silty Clay
- Basalt Bedrock



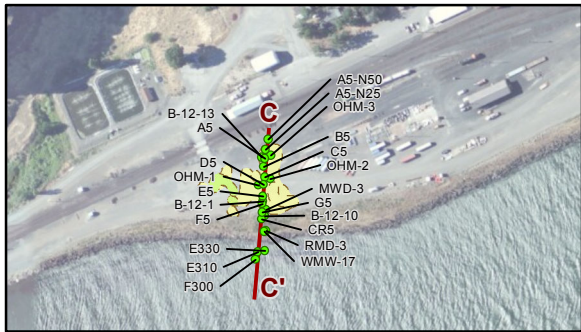
Well screen interval



Well screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L).

Inferred LNAPL/Residual TPH Extent

- Inferred Zone of Oil-like LNAPL
- Inferred Zone of Diesel-like LNAPL
- Inferred LNAPL in Boring
- Inferred Residual LNAPL in Boring



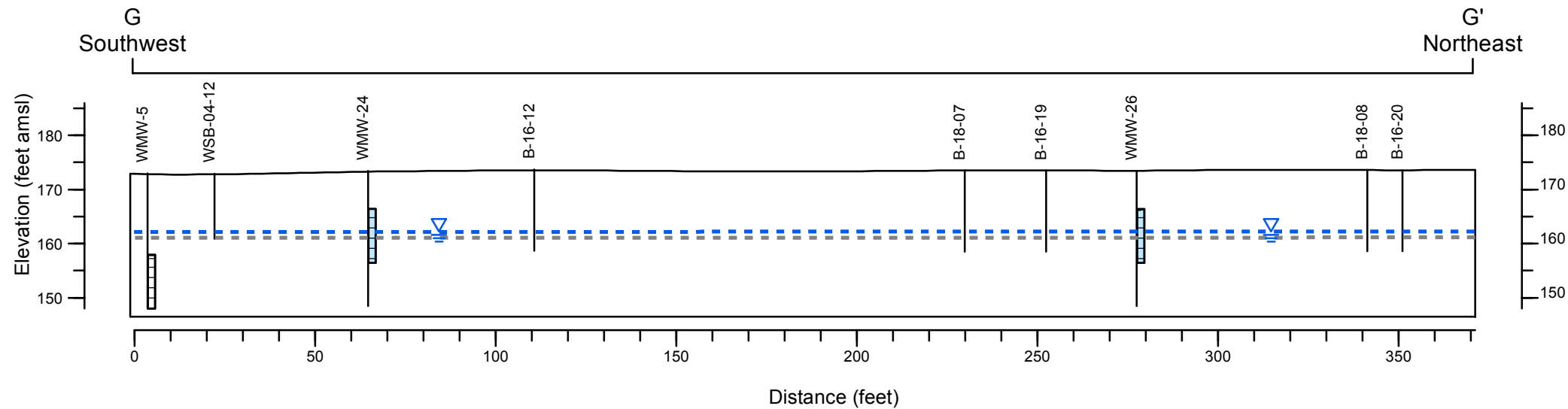
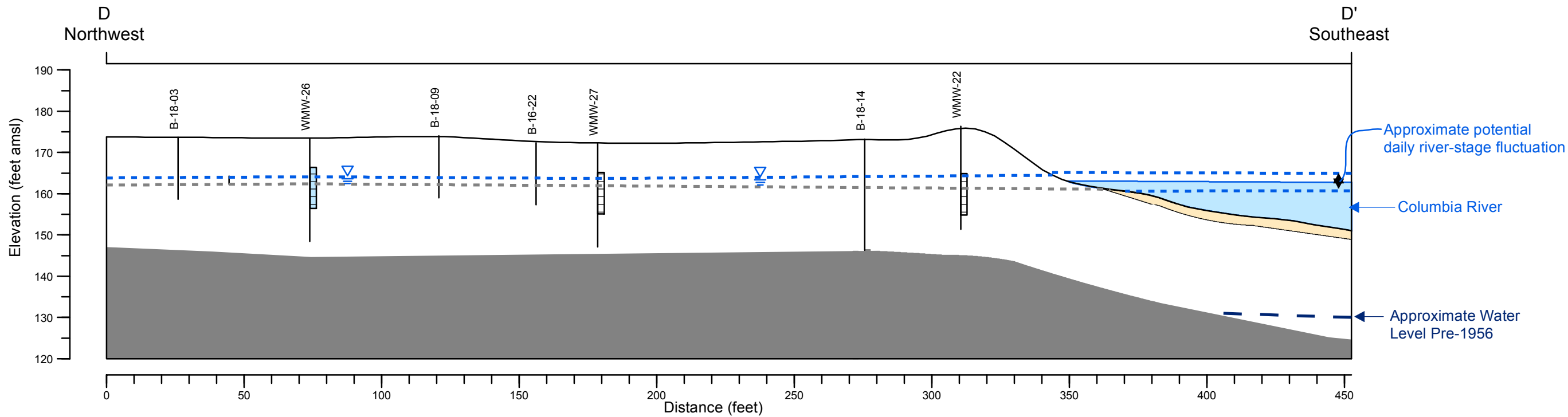
Kennedy/Jenks Consultants

BNSF Wishram Rail Yard
Wishram, Washington

**Hydrogeologic Cross Section
Transect C to C'**

Figure 19

N:\BNSF Washington\Wishram\GIS\Events\2018Events\RevisedRIR\Report\Fig25 Transect_DD_GG.mxd Date: 8/6/2020 Printed by: KatieHaskins



- Notes:**
1. All locations and depths are approximate. Lithologic interpretation inferred from boring logs, historical documents, maps, and/or field observations.
 2. AMSL = above mean sea level.
 3. MTCA = Washington Model Toxics Control Act.
 4. LNAPL = light non-aqueous phase liquid
 5. TPH = total petroleum hydrocarbon
 6. LIF = laser-induced fluorescence
 7. Inferred LNAPL/residual TPH extent from interpretation of LIF waveforms and LNAPL field observations in soil borings.

Legend

- Inferred Maximum Measured Groundwater Elevation
- Inferred Minimum Measured Groundwater Elevation
- River Sediment (Interpreted)
- Columbia River

Lithology

- Gravelly Sand Fill Material
- Sand and Sand with Silt
- Gravel and Gravel with Sand
- Clay and Silty Clay
- Basalt Bedrock



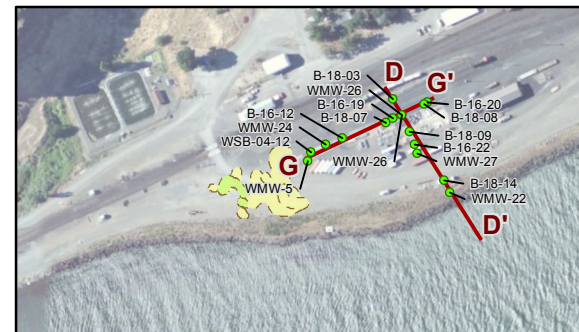
Well screen interval



Well screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L).

Inferred LNAPL/Residual TPH Extent

- Inferred Zone of Oil-like LNAPL
- Inferred Zone of Diesel-like LNAPL
- Inferred LNAPL in Boring
- Inferred Residual LNAPL in Boring



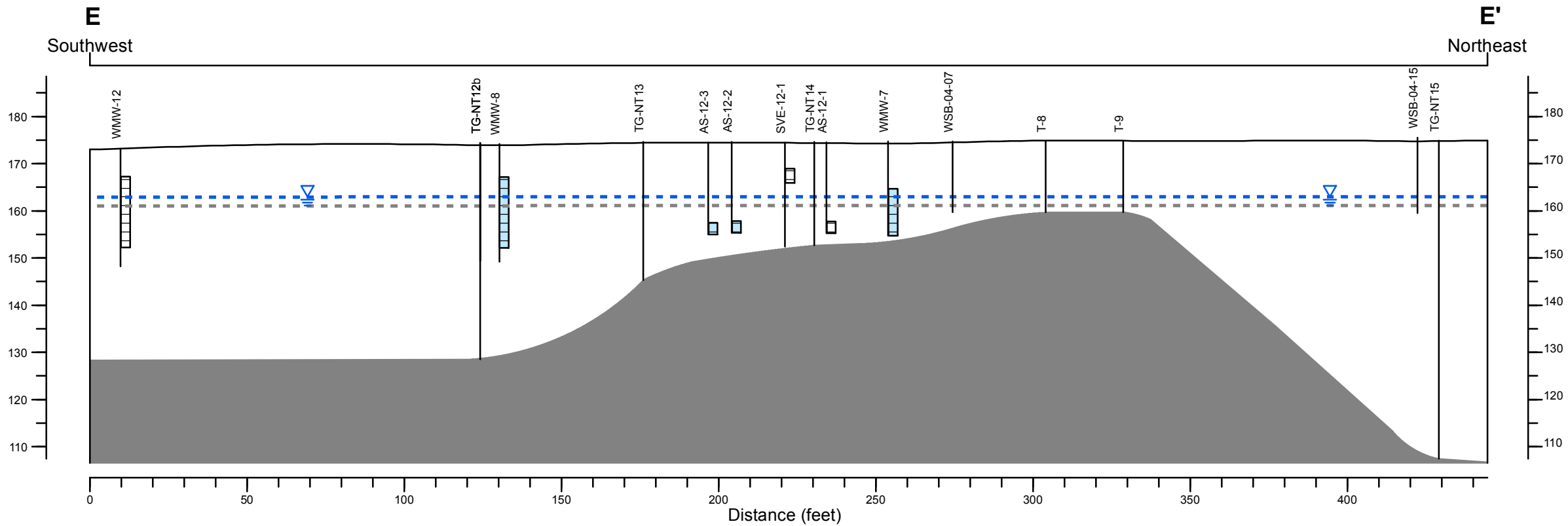
Kennedy/Jenks Consultants

BNSF Wishram Rail Yard
Wishram, Washington

Hydrogeologic Cross Section Transect D to D' and Transect G to G'

Figure 20

N:\BNSF Washington\Wishram\GIS\Events\2018Events\RevisedRIR\Report\Fig26 Transect EE.mxd Date: 08/03/2020



Notes:
1. All locations and depths are approximate. Lithologic interpretation inferred from boring logs, historical documents, maps, and/or field observations.
2. AMSL = above mean sea level.
3. MTCA = Washington Model Toxics Control Act
4. LNAPL = light non-aqueous phase liquid
5. TPH = total petroleum hydrocarbon
6. LIF = laser-induced fluorescence
7. Inferred LNAPL/residual TPH extent from interpretation of LIF waveforms and LNAPL field observations in soil borings.

Legend

- | | | | |
|---|--|--|--|
| <ul style="list-style-type: none">Inferred Maximum Measured Groundwater ElevationInferred Minimum Measured Groundwater ElevationRiver Sediment (Interpreted)Columbia River | <p>Lithology</p> <ul style="list-style-type: none">Gravelly Sand Fill MaterialSand and Sand with SiltGravel and Gravel with SandClay and Silty ClayBasalt Bedrock | <ul style="list-style-type: none">Well screen intervalWell screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L). | <p>Inferred LNAPL/Residual TPH Extent</p> <ul style="list-style-type: none">Inferred Zone of Oil-like LNAPLInferred Zone of Diesel-like LNAPLInferred LNAPL in BoringInferred Residual LNAPL in Boring |
|---|--|--|--|



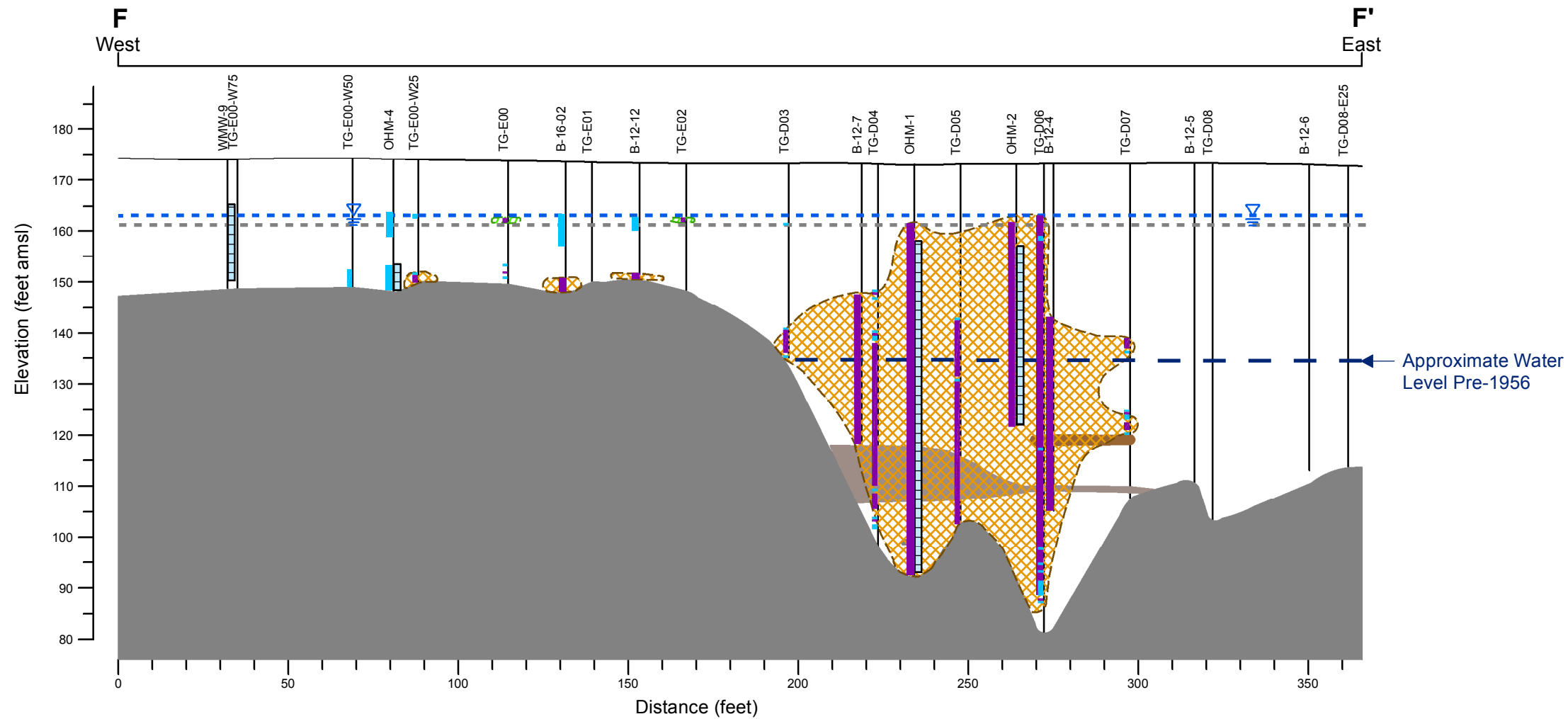
Kennedy/Jenks Consultants

BNSF Wishram Rail yard
Wishram, Washington

**Hydrogeologic Cross Section
Transect E to E'**

Figure 21

N:\BNSF Washington\Wishram\GIS\Events\2018Events\RevisedRIR\Report\Fig27 Transect FF.mxd Date: 8/3/2020 Printed by: Katie Haskins

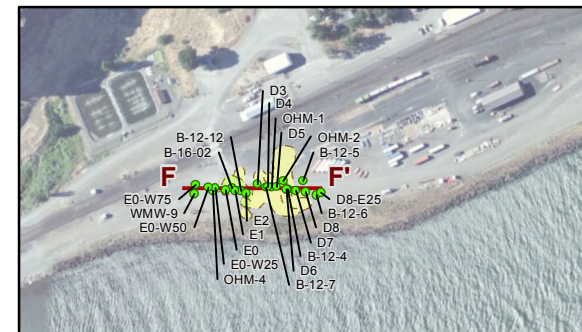


- Notes:**
1. All locations and depths are approximate. Lithologic interpretation inferred from boring logs, historical documents, maps, and/or field observations.
 2. AMSL = above mean sea level.
 3. MTCA = Washington Model Toxics Control Act
 4. LNAPL = light non-aqueous phase liquid
 5. TPH = total petroleum hydrocarbon
 6. LIF = laser-induced fluorescence
 7. Inferred LNAPL/residual TPH extent from interpretation of LIF waveforms and LNAPL field observations in soil borings.

Legend

- | | | | |
|--|---|--|---|
| | Inferred Maximum Measured Groundwater Elevation | | Well screen interval |
| | Inferred Minimum Measured Groundwater Elevation | | Well screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L). |
| | River Sediment (Interpreted) | | |
| | Columbia River | | |
| | Lithology | | |
| | | | Gravelly Sand Fill Material |
| | | | Sand and Sand with Silt |
| | | | Gravel and Gravel with Sand |
| | | | Clay and Silty Clay |
| | | | Basalt Bedrock |

- Inferred LNAPL/Residual TPH Extent**
- Inferred Zone of Oil-like LNAPL
 - Inferred Zone of Diesel-like LNAPL
 - Inferred LNAPL in Boring
 - Inferred Residual LNAPL in Boring



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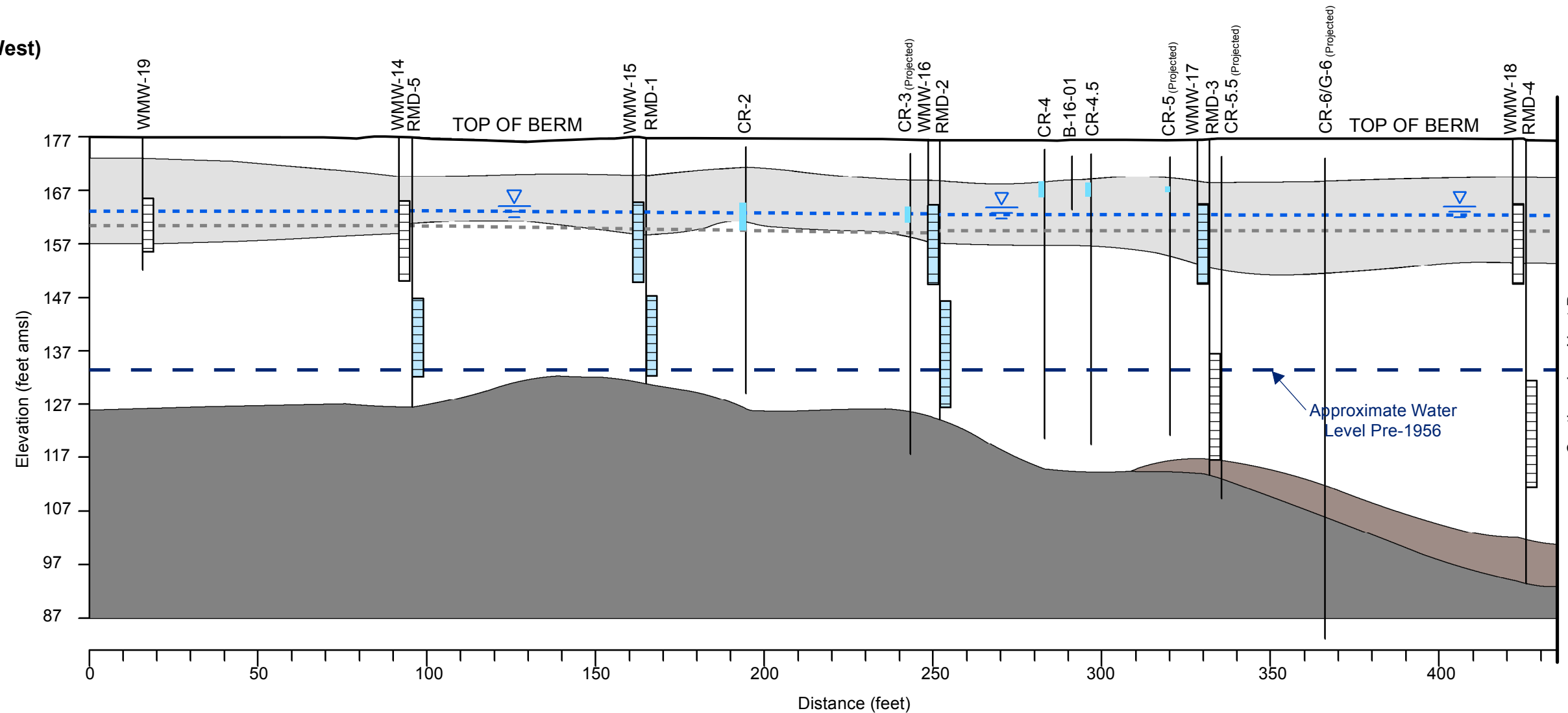
BNSF Wishram Rail yard
Wishram, Washington

**Hydrogeologic Cross Section
Transect F to F'**

Figure 22

N:\BNSF Washington\Wishram\GIS\Events\2018Events\RevisedRIR\Report\Fig27 Transect H West.mxd Date: 7/23/2020 Printed by: Katie Haskins

H (West)



- Notes:**
1. All locations and depths are approximate. Lithologic interpretation inferred from boring logs, historical documents, maps, and/or field observations.
 2. AMSL = above mean sea level.
 3. MTCA = Washington Model Toxics Control Act
 4. LNAPL = light non-aqueous phase liquid
 5. TPH = total petroleum hydrocarbon
 6. LIF = laser-induced fluorescence
 7. Inferred LNAPL/residual TPH extent from interpretation of LIF waveforms and LNAPL field observations in soil borings.

Legend

- Inferred Maximum Measured Groundwater Elevation

--- Inferred Minimum Measured Groundwater Elevation

River Sediment (Interpreted)

Columbia River
- Lithology**

Gravelly Sand Fill Material

Sand and Sand with Silt

Gravel and Gravel with Sand

Clay and Silty Clay

Basalt Bedrock
- Well screen interval

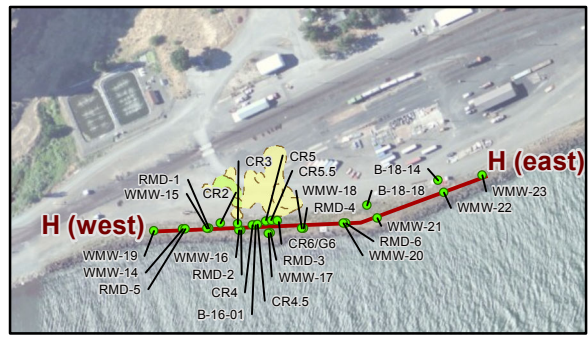
Well screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L).
- Inferred LNAPL/Residual TPH Extent**

Inferred Zone of Oil-like LNAPL

Inferred Zone of Diesel-like LNAPL

Inferred LNAPL in Boring

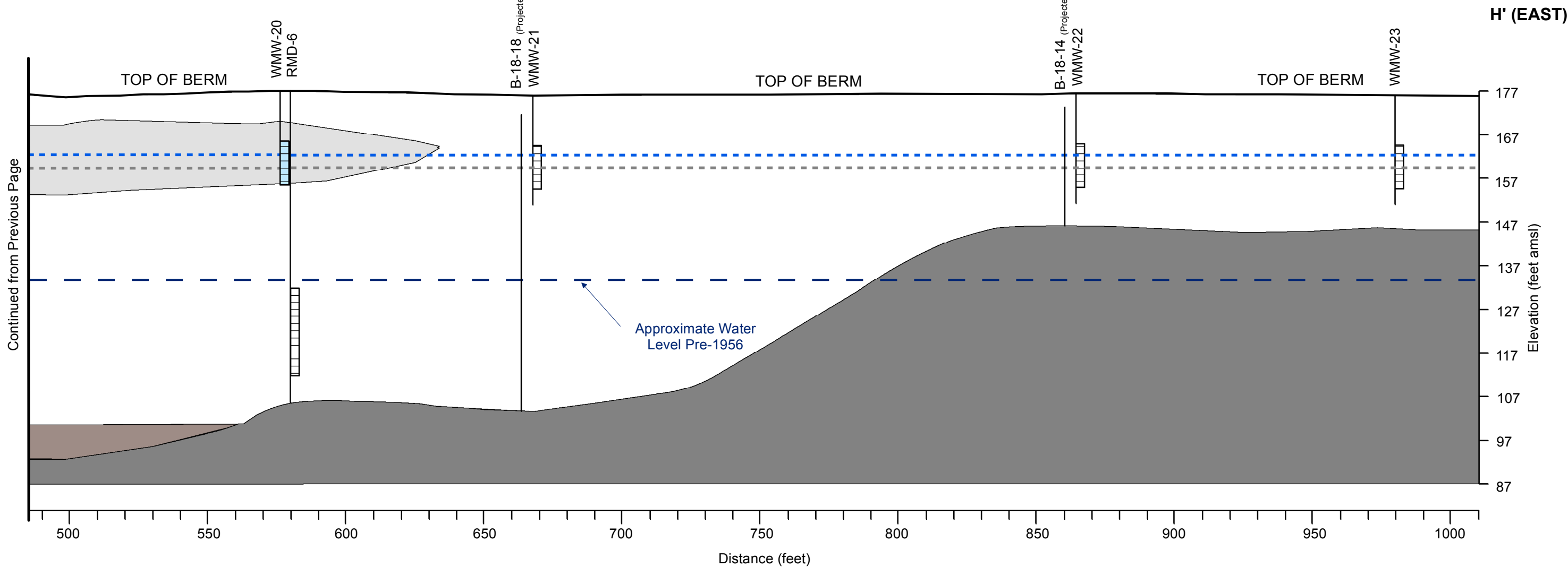
Inferred Residual LNAPL in Boring



Kennedy/Jenks Consultants
BNSF Wishram Rail yard
Wishram, Washington

**Hydrogeologic Cross Section
Transect H to H' (West)**

Figure 23

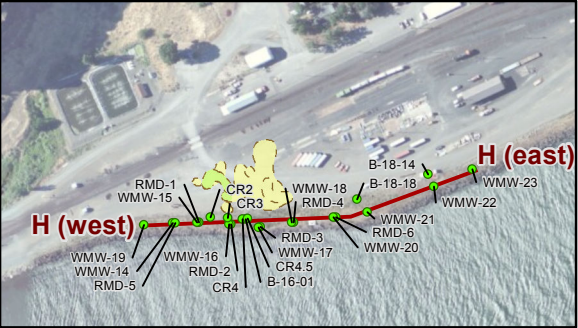


Notes:

1. All locations and depths are approximate. Lithologic interpretation inferred from boring logs, historical documents, maps, and/or field observations.
2. AMSL = above mean sea level.
3. MTCA = Washington Model Toxics Control Act
4. LNAPL = light non-aqueous phase liquid
5. TPH = total petroleum hydrocarbon
6. LIF = laser-induced fluorescence
7. Inferred LNAPL/residual TPH extent from interpretation of LIF waveforms and LNAPL field observations in soil borings.

Legend

- | | | | |
|---|--|--|--|
| <ul style="list-style-type: none">--- Inferred Maximum Measured Groundwater Elevation--- Inferred Minimum Measured Groundwater Elevation■ River Sediment (Interpreted)■ Columbia River | <p>Lithology</p> <ul style="list-style-type: none">■ Gravelly Sand Fill Material■ Sand and Sand with Silt■ Gravel and Gravel with Sand■ Clay and Silty Clay■ Basalt Bedrock | <ul style="list-style-type: none">■ Well screen intervalWell screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L). | <p>Inferred LNAPL/Residual TPH Extent</p> <ul style="list-style-type: none">■ Inferred Zone of Oil-like LNAPL■ Inferred Zone of Diesel-like LNAPL■ Inferred LNAPL in Boring■ Inferred Residual LNAPL in Boring |
|---|--|--|--|

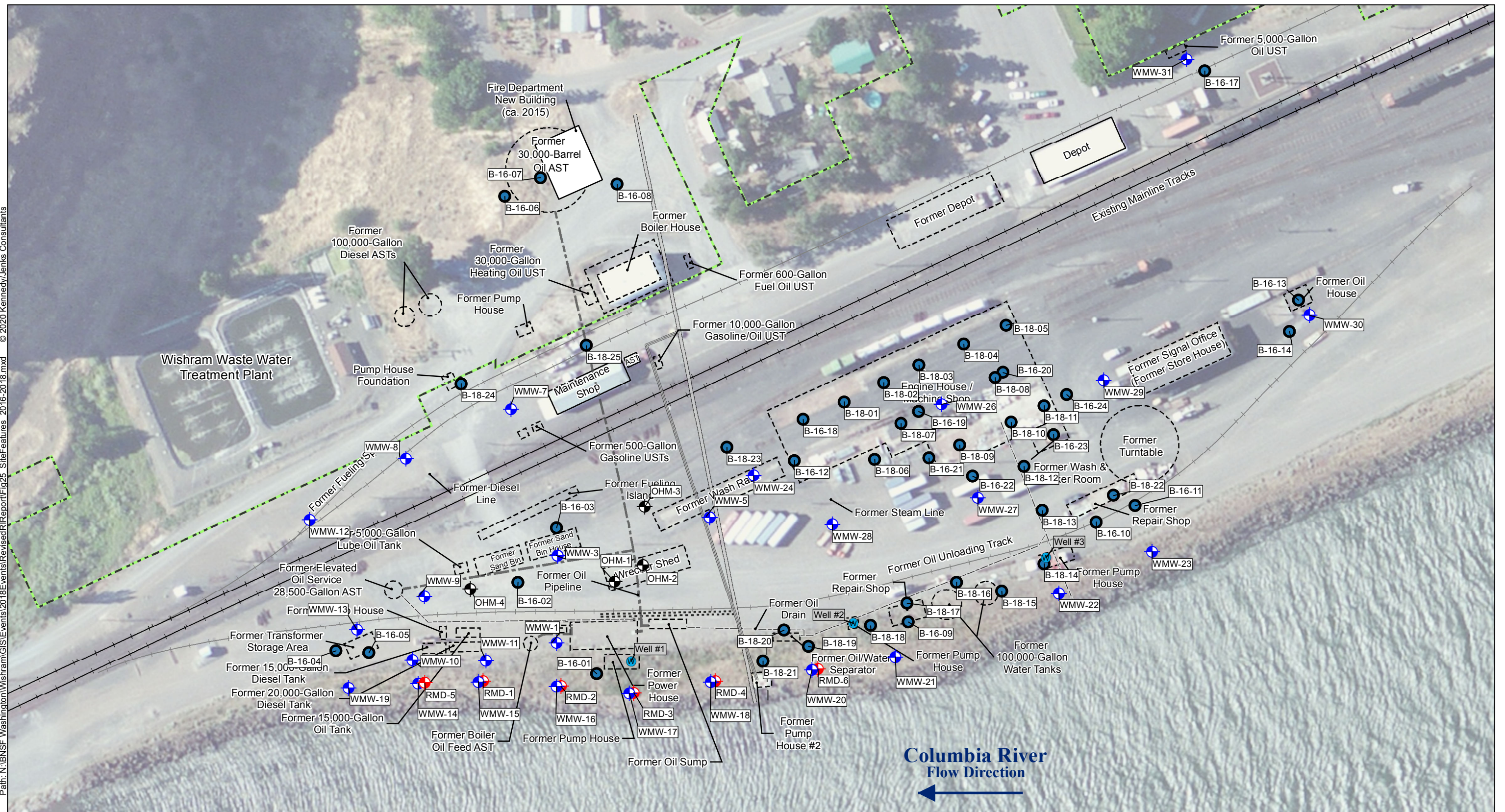


Kennedy/Jenks Consultants

BNSF Wishram Rail yard
Wishram, Washington

**Hydrogeologic Cross Section
Transect H to H' (East)**

Figure 24



Path: N:\BNSF-Washington\Wishram\GIS\Events\2018\Events\DraftRIRReport\Fig16_SiteFeatures_2016-2018_east.mxd © 2019 Kennedy/Jenks Consultants

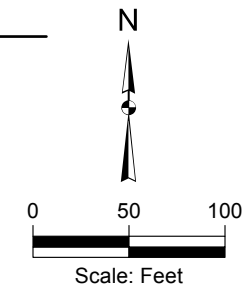


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Oil Head Monitoring Well
- Soil Boring (2016-2018)



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BNSF Wishram Rail yard
Wishram, Washington

Sample Locations (2016-2018) and Former Site Features - East Area

1696120.02
January 2019

Figure 26

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\Events\DraftRIRReport\Fig17_GWSampleLocs.mxd © 2019 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Shallow Monitoring Well

RMD Monitoring Well

Oil-Head Monitoring Well

Reconnaissance Groundwater Location (2004)

Reconnaissance Groundwater Location (2012-2014)

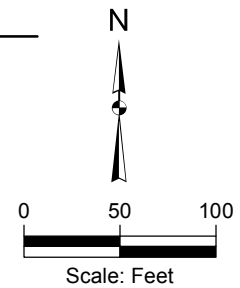
Reconnaissance Groundwater Location (2016-2018)

Existing Site Feature

Former Site Feature

Note:

1. Locations are approximate.



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BNSF Wishram Railway
Wishram, Washington

Monitoring Wells and Reconnaissance Groundwater Sample Locations - Main Area

1896120°04
January 2019

Figure 27

Path: N:\BNSF Washington\Wishram\GIS\Events\2018Events\DraftRIRReport\Fig18_GWSampleLocs east.mxd © 2019 Kennedy/Jenks Consultants



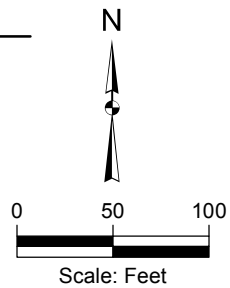
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Shallow Monitoring Well
- RMD Monitoring Well
- Oil-Head Monitoring Well
- Reconnaissance Groundwater Location (2004)
- Reconnaissance Groundwater Location (2012-2014)
- Reconnaissance Groundwater Location (2016-2018)
- Existing Site Feature
- Former Site Feature

Note:
1. Locations are approximate.



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BNSF Wishram Railway
Wishram, Washington
**Monitoring Wells and
Reconnaissance Groundwater
Sample Locations - East Area**

1896120°04
January 2019
Figure 28

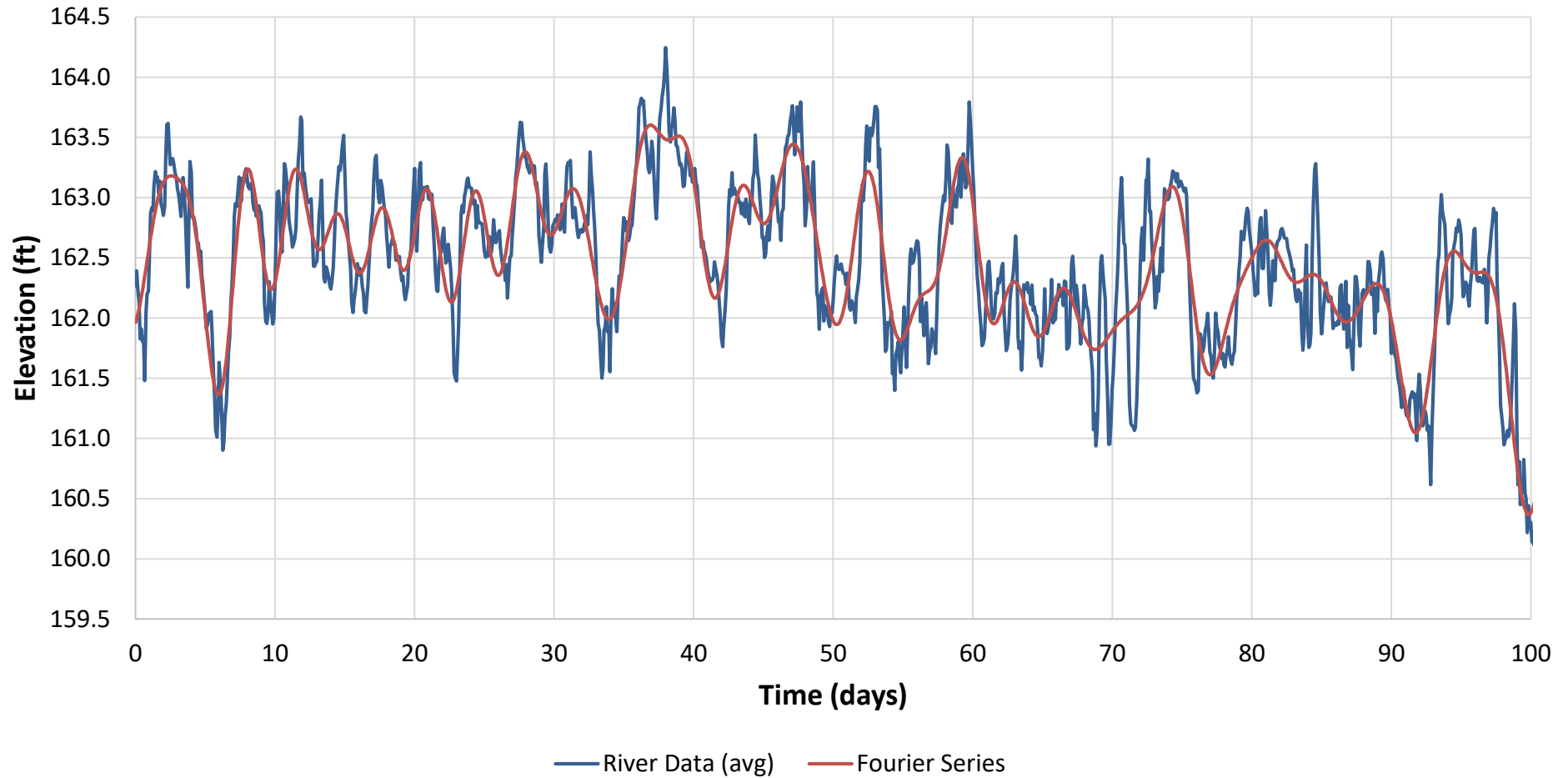
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Inferred Oil-Like LNAPL (> 60 %RE)
- Residual TPH (20 to 60 % RE)
- No LNAPL or Residual TPH (< 20 %RE)
- Approximate Lateral Extent of Submerged Diesel Impacts
- Approximate Lateral Extent of Submerged Oil Impacts

 < 4% (Not Mobile LNAPL)
 4 to 40% (Potentially Mobile LNAPL)
 > 40% (Mobile LNAPL)
 Approximate BNSF Property Line

A north arrow pointing upwards, labeled 'N' at the top. Below it is a scale bar with markings at 0, 30, and 60. The text 'Scale: Feet' is written below the scale bar.

1896120.00
July 2020
Figure 29



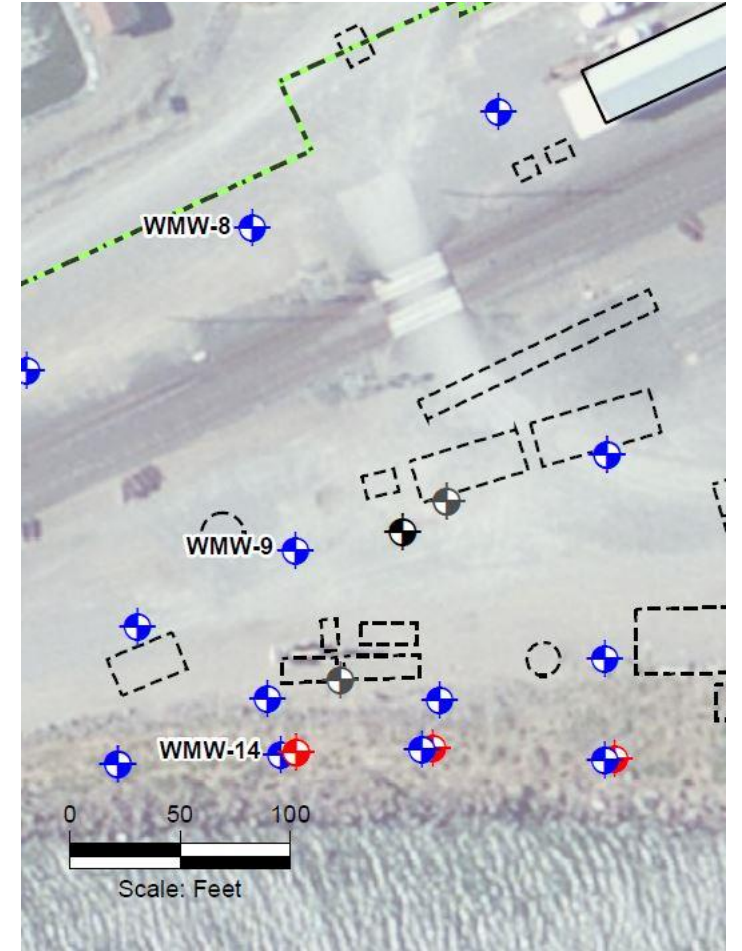
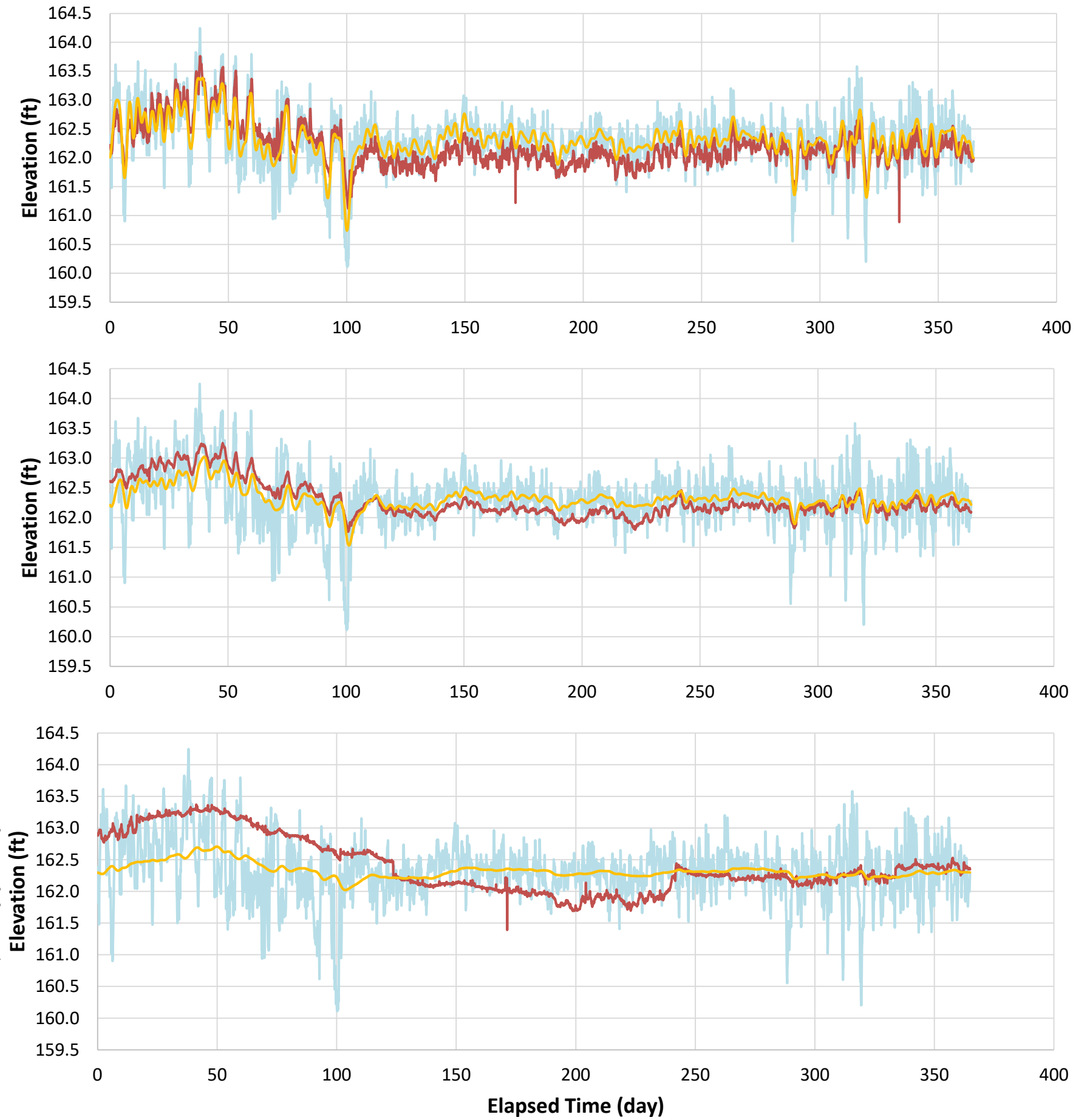
Kennedy/Jenks Consultants

BNSF Wishram Railyard
Wishram, Washington

**Fourier Series Approximation of Columbia
River Elevation**

1896120*00
May 2019
Figure 30

N:\Projects\2018\1896120.00 WishramRI Report\Working Figures\Draft Figures



Kennedy/Jenks Consultants

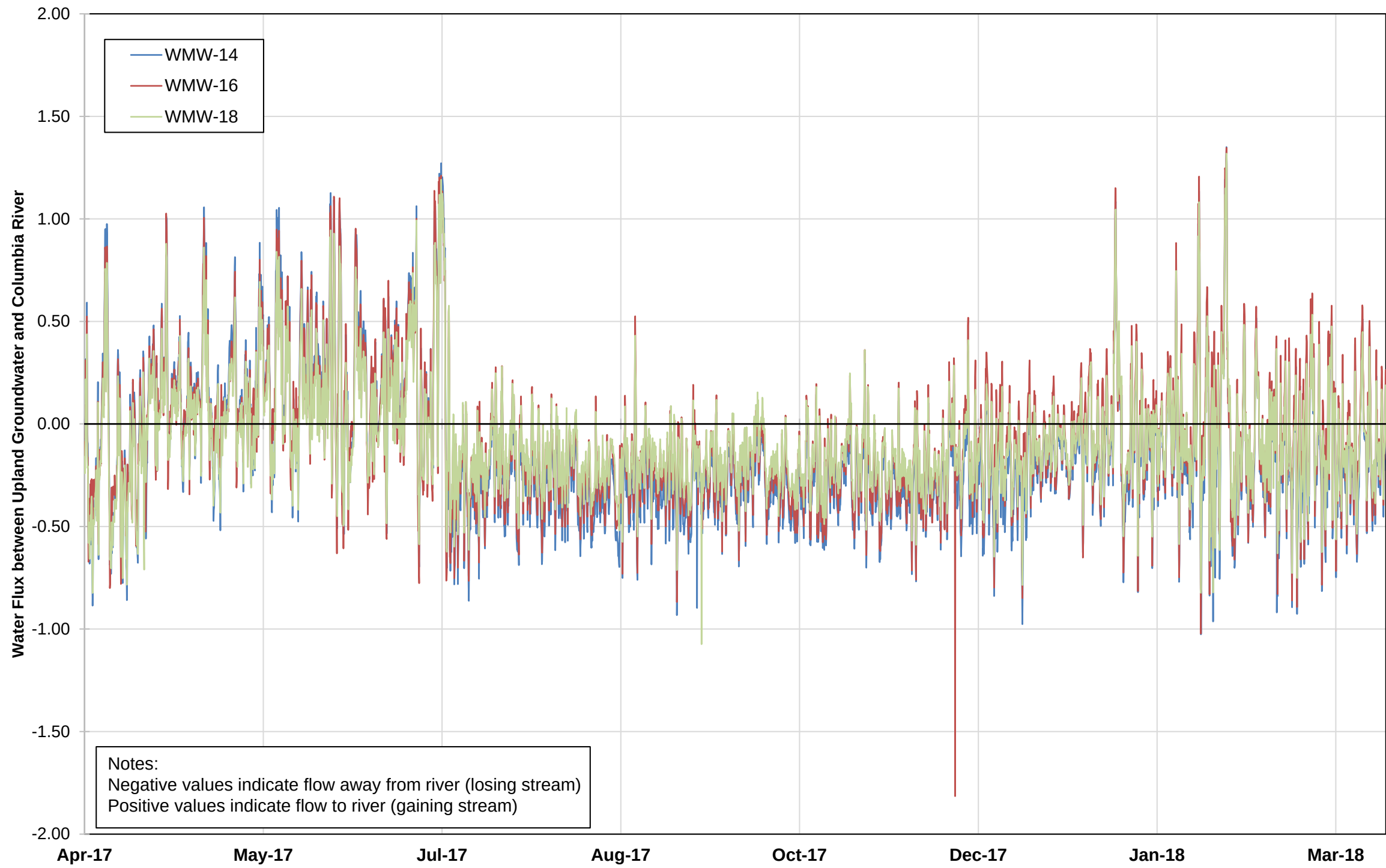
BNSF Wishram Railyard
Wishram, Washington

**Comparison of Modelled to Measured
Groundwater Elevation in Selected
Monitoring Wells**

1896120*00
May 2019

Figure 31A

N:\Projects\2018\1896120.00 WishramRI Report\Working Figures\Draft Figures



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BNSF Wishram Railyard
Wishram, Washington

**Flux Between Upland Groundwater and
Columbia River**

1896120*00
May 2019

Figure 31B

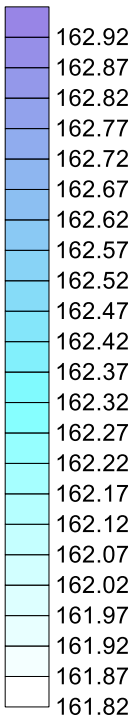
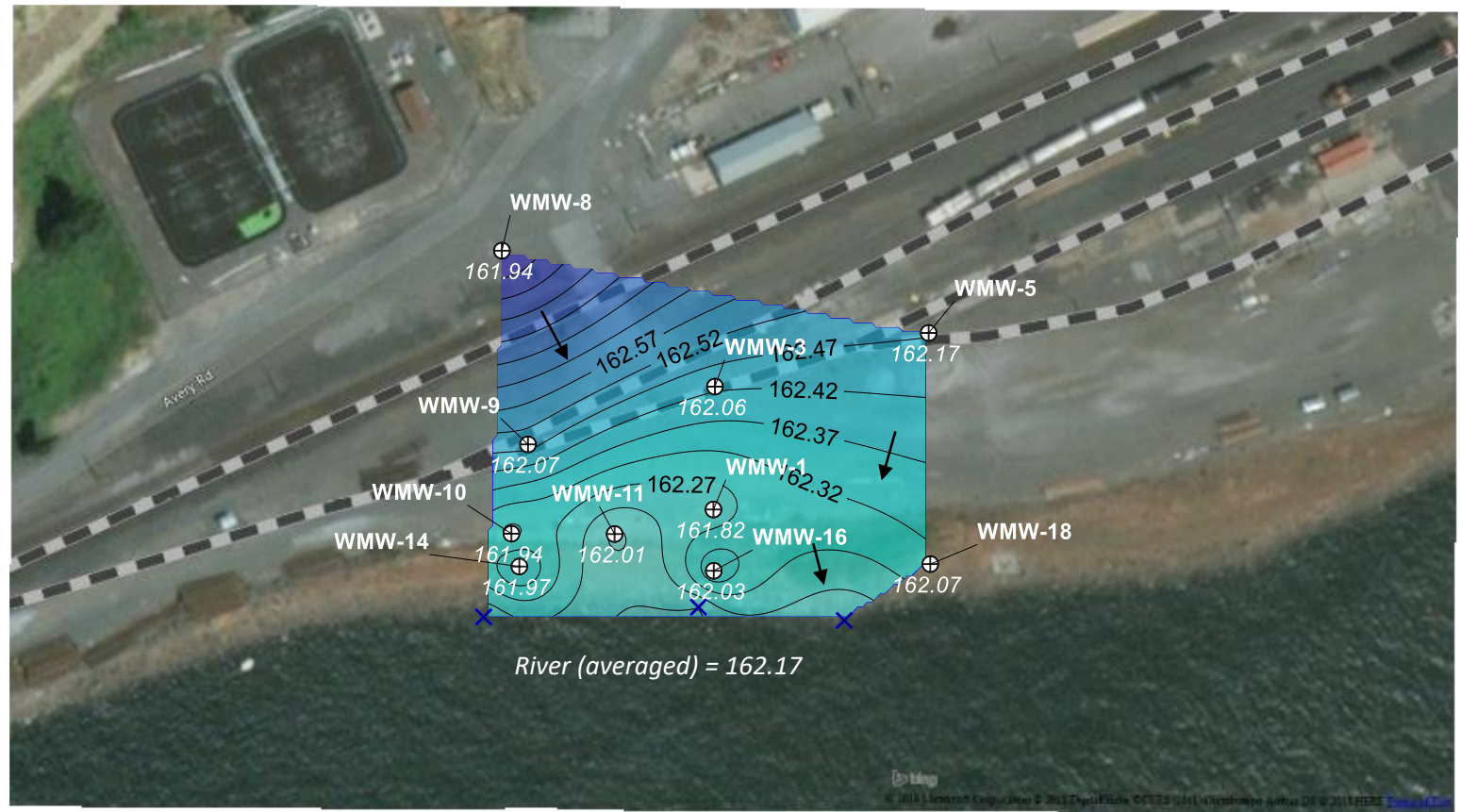


Figure 32a: Interpolated Averaged Groundwater Elevations (feet amsl) in June 2017: Apparent Gaining Stream Condition

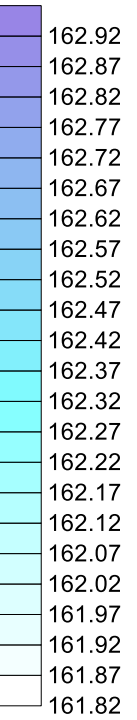


Figure 32b: Interpolated Averaged Groundwater Elevations (feet amsl) in November 2017: Apparent Losing Stream Condition

Kennedy/Jenks Consultants

BNSF Wishram Railyard
Wishram, Washington

Representative Interpolated Averaged Groundwater Elevations for Losing and Gaining Stream Conditions

2096120*02
August 2020

Figure 32



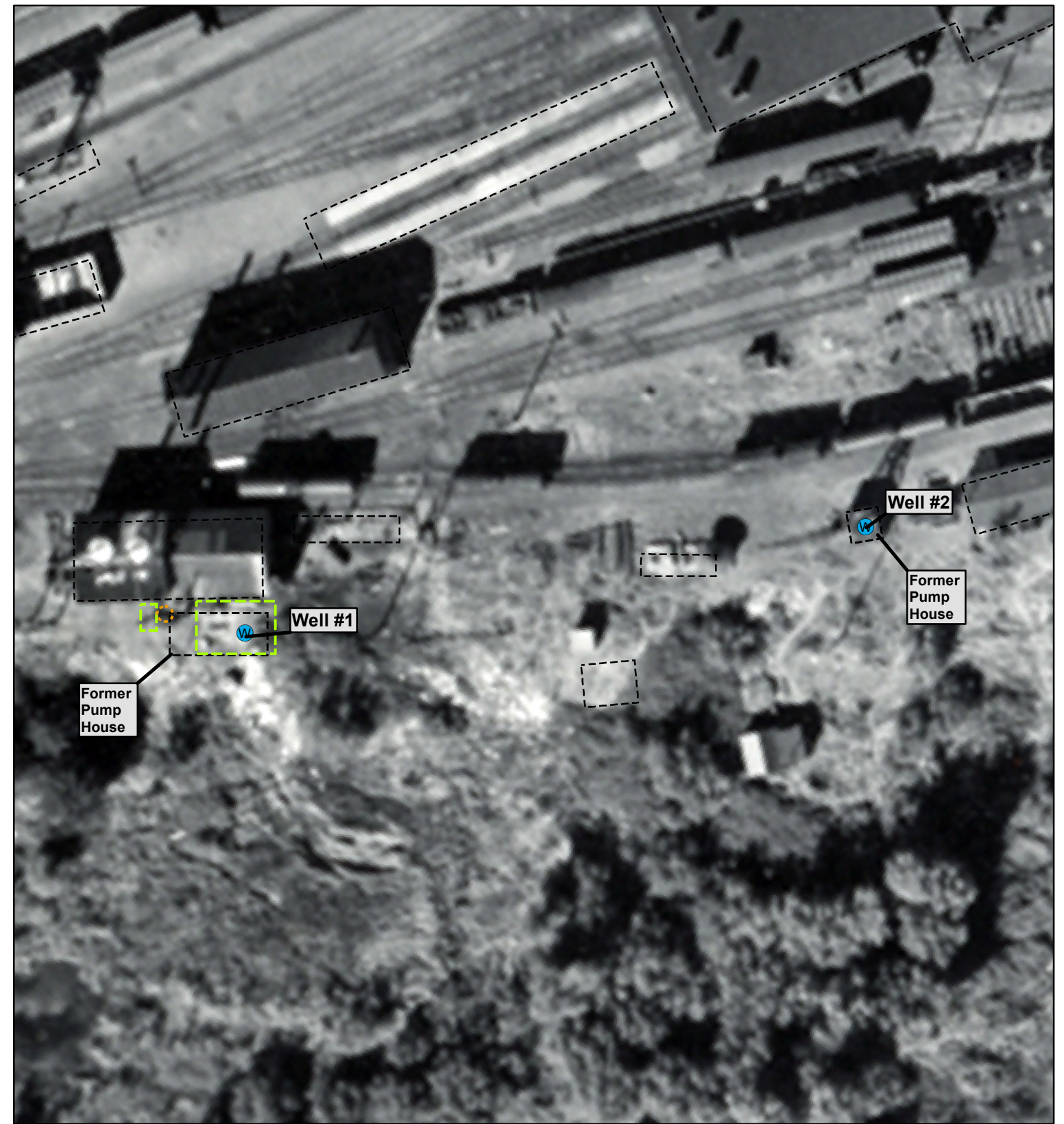
Path: N:\BNSF Washington\Wishram\GIS\Events\2018\Events\Draft\RIReport\WISRI_020_FormerWaterWells_tableid.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

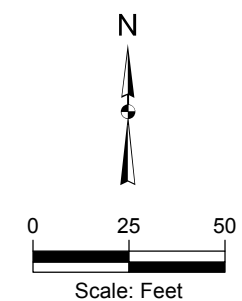
Legend

- Former Water Supply Well (Approximate)
- Suspected Utility Pole
- Approximate Excavation Area



Note:

1. Locations are approximate.
2. Aerial photograph on right dated 4 October 1951 obtained from USACE.



Kennedy/Jenks Consultants

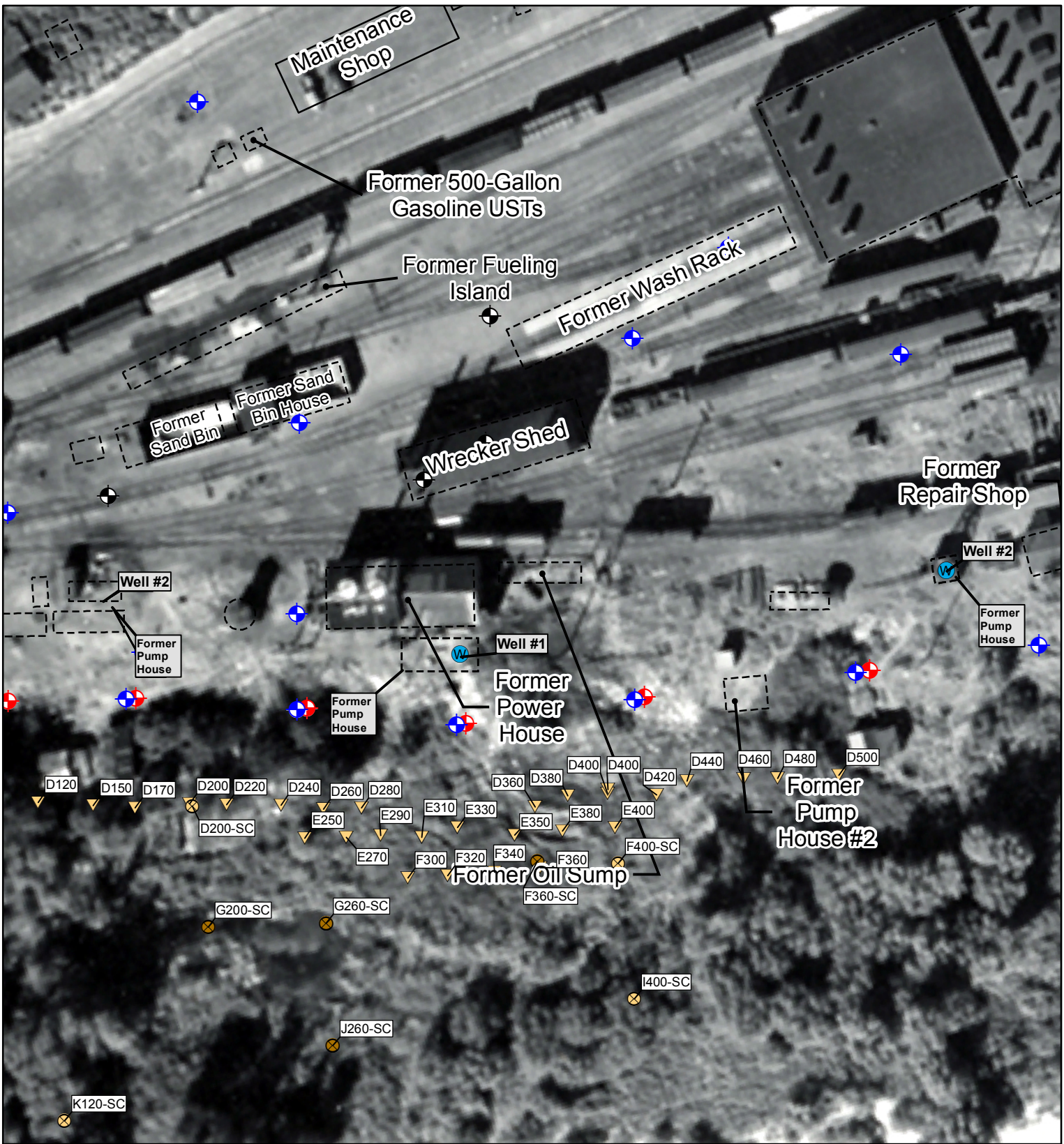
BNSF Wishram Railway
Wishram, Washington

**Approximate Excavation Areas
Completed 20 September 2018**

1896120.04
December 2018

Figure 33





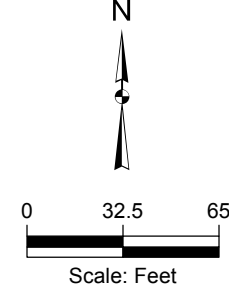
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Former Water Supply Well (Approximate)	Shallow Monitoring Well
DART Location	Deep Monitoring Well
Sediment Core Location - No LNAPL Observed	Oil Head Monitoring Well
Sediment Core Location - LNAPL Observed	

Note:
 1. Locations are approximate.
 2. Aerial photograph on right dated 4 October 1951 obtained from USACE.



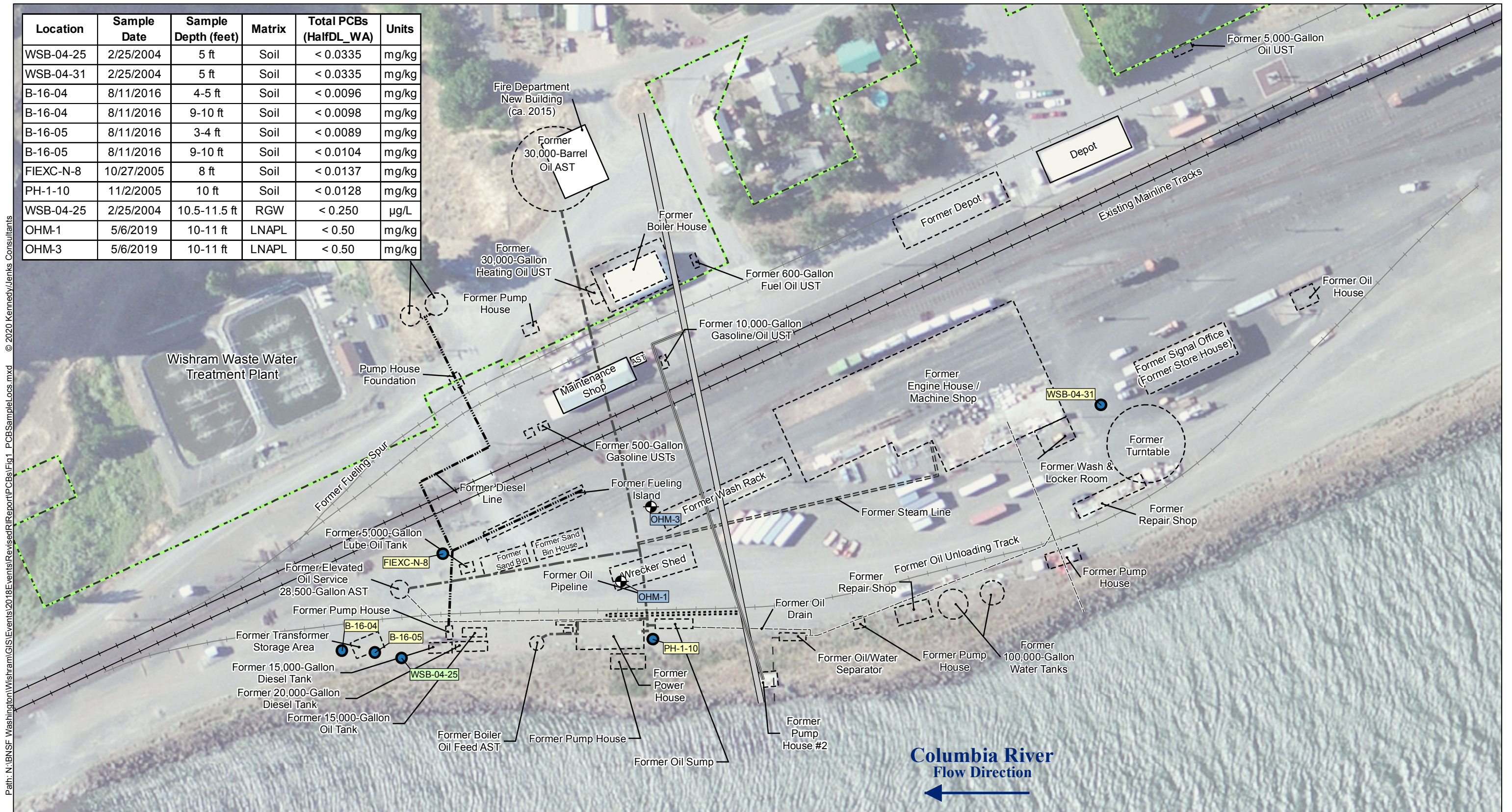
Kennedy/Jenks Consultants
 BNSF Wishram Railway
 Wishram, Washington

**Inundated Lands Sample Locations
 June and August 2018**

1896120.04
 January 2019

Figure 35

Location	Sample Date	Sample Depth (feet)	Matrix	Total PCBs (HalfDL_WA)	Units
WSB-04-25	2/25/2004	5 ft	Soil	< 0.0335	mg/kg
WSB-04-31	2/25/2004	5 ft	Soil	< 0.0335	mg/kg
B-16-04	8/11/2016	4-5 ft	Soil	< 0.0096	mg/kg
B-16-04	8/11/2016	9-10 ft	Soil	< 0.0098	mg/kg
B-16-05	8/11/2016	3-4 ft	Soil	< 0.0089	mg/kg
B-16-05	8/11/2016	9-10 ft	Soil	< 0.0104	mg/kg
FIEXC-N-8	10/27/2005	8 ft	Soil	< 0.0137	mg/kg
PH-1-10	11/2/2005	10 ft	Soil	< 0.0128	mg/kg
WSB-04-25	2/25/2004	10.5-11.5 ft	RGW	< 0.250	µg/L
OHM-1	5/6/2019	10-11 ft	LNAPL	< 0.50	mg/kg
OHM-3	5/6/2019	10-11 ft	LNAPL	< 0.50	mg/kg



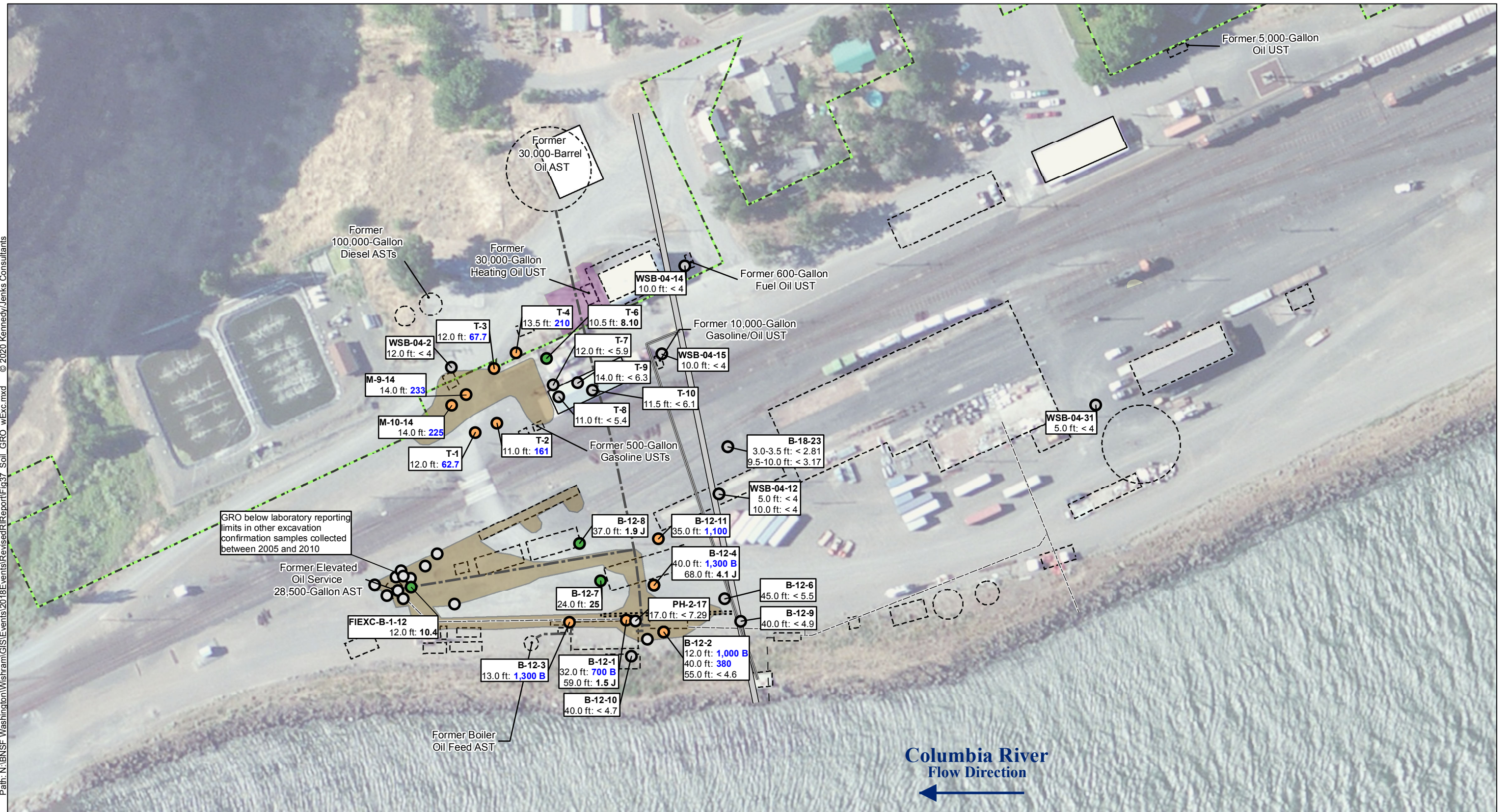
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

-  OHM Well
  B-16-04 Soil Sampled for PCBs
 Soil Boring Location
  WSB-04-25 Soil and RGW Sampled for PCBs
 OHM-1 LNAPL Sampled for PCBs

1. RGW = reconnaissance groundwater sample.
2. LNAPL = light non-aqueous phase liquid
3. µg/L = micrograms per liter
mg/kg = milligrams per liter
4. Total PCBs = Total Polychlorinated biphenyls (PCBs) concentrations were calculated by summing individual PCB concentrations. All individual PCBs were not detected, therefore one half the lowest method reporting limit was used as the total PCBs concentration.

Kennedy/Jenks Consultants

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig37_Soil_GRO_wExc.mxd © 2020 Kennedy/Jenks Consultants



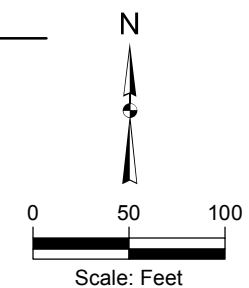
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- GRO Concentration Above MTCA Method A CUL
- GRO Concentration Below MTCA Method A CUL
- GRO Concentration Below Laboratory Reporting Limit
- Approximate Previous Excavation Area (2002)
- Approximate Previous Excavation Area (2005/2010)

Note:
1. Locations are approximate.
2. GRO = Gasoline-Range Organics.
3. Soil sample results from 2004 - 2018 are shown.
4. Only locations analyzed for GRO are shown.
5. Samples from areas later excavated are not shown.



Kennedy/Jenks Consultants

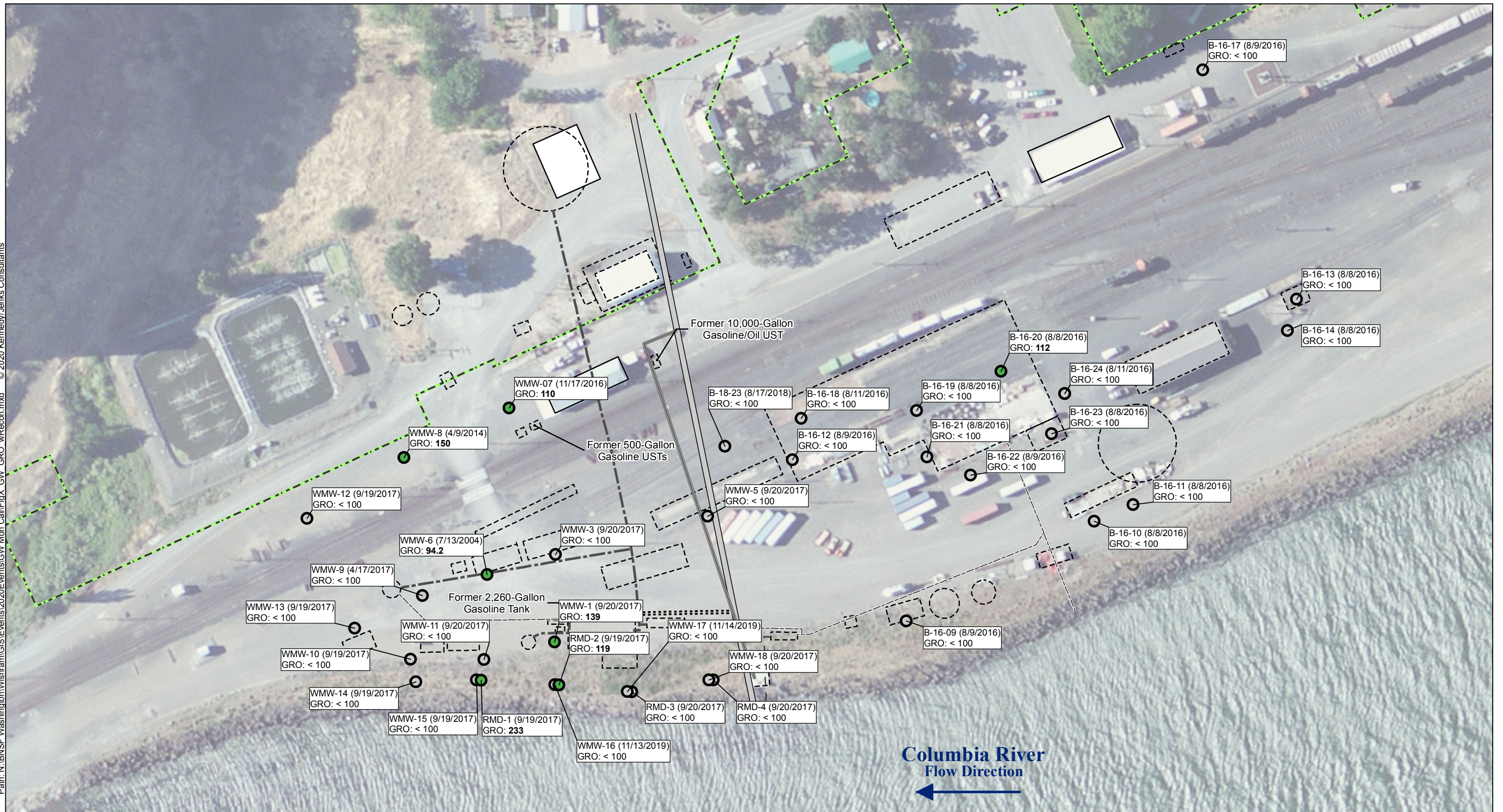
BNSF Wishram Railway
Wishram, Washington

Soil Sampling Results GRO (2004 - 2018) - Main Area

1696120.02
July 2020

Figure 37

Path: N:\BNSF Washington\Wishram\GIS\Events\2020Events\GW Mon Call\FigX GW GRO wRecon.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

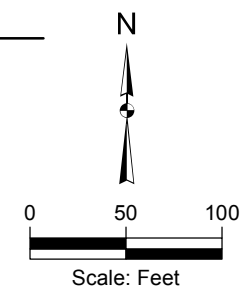
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- GRO Concentration Above MTCA Method A CUL
- GRO Concentration Below MTCA Method A CUL
- GRO Concentration Below Laboratory Reporting Limit

Note:

- Locations are approximate.
- GRO = Gasoline-Range Organics.
- Most recent monitoring well and reconnaissance groundwater sample results from 2004 through 2019 are shown.
- Only locations analyzed for GRO are shown.
- Results from up to eight previous sampling events are shown.



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BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results GRO (2004 - 2019) - Main Area

1696120.02
July 2020

Figure 38

Path: N:\BNSF_Washington\Wishram\GIS\Events\2020Events\GW Mon Call\FigX_Soil GRO E.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

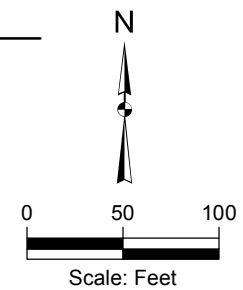
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- GRO Concentration Above MTCA Method A CUL
- GRO Concentration Below MTCA Method A CUL
- GRO Concentration Below Laboratory Reporting Limit

Note:

1. Locations are approximate.
2. GRO = Gasoline-Range Organics.
3. Soil sample results from 2004 - 2018 are shown.
4. Only locations analyzed for GRO are shown.



Kennedy/Jenks Consultants

BNSF Wishram Rail Yard
Wishram, Washington

Soil Sampling Results GRO (2004 - 2018) - East Area

1696120.02
April 2020

Figure 39

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\Revised\Report\Fig35_Soil_TPHDx_AWT_wExc.mxd © 2020 Kennedy/Jenks Consultants

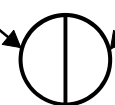


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

DRO Result

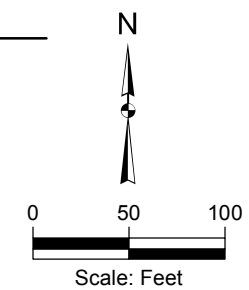


ORO Result

- Result is above MTCA Method A CUL
- Result is below MTCA Method A CUL
- Result is below laboratory reporting limit

Notes:

- Locations are approximate.
- DRO = Diesel-Range Organics.
ORO = Oil-Range Organics.
- Results present for soil samples collected between 2002 and 2018.
- MTCA Method A Cleanup level for diesel- and oil-range organics (DRO and ORO) in soil is 2,000 milligrams per kilogram (mg/kg).
- Unsaturated depths are from approximately 0 to 10 feet below ground surface (bgs).



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BNSF Wishram Railway
Wishram, Washington

DRO/ORO in Subsurface Soil (Unsaturated) - Main Area

1696120.02
August 2020

Figure 41

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig35_Soil_totalTPH_AWT_wExc.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

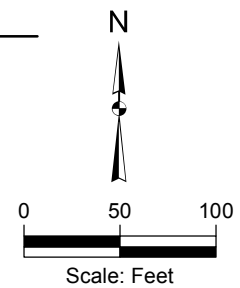
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit

Notes:

1. Locations are approximate.
2. Total TPH-Dx = Sum of diesel-range and oil-range organics results.
3. Results presented for soil samples collected between 2002 and 2018.
4. MTCA Method A Cleanup level for TPH in soil is 2,000 milligrams per kilogram (mg/kg).
5. Unsaturated depths are from approximately 0 to 10 feet below ground surface (bgs).



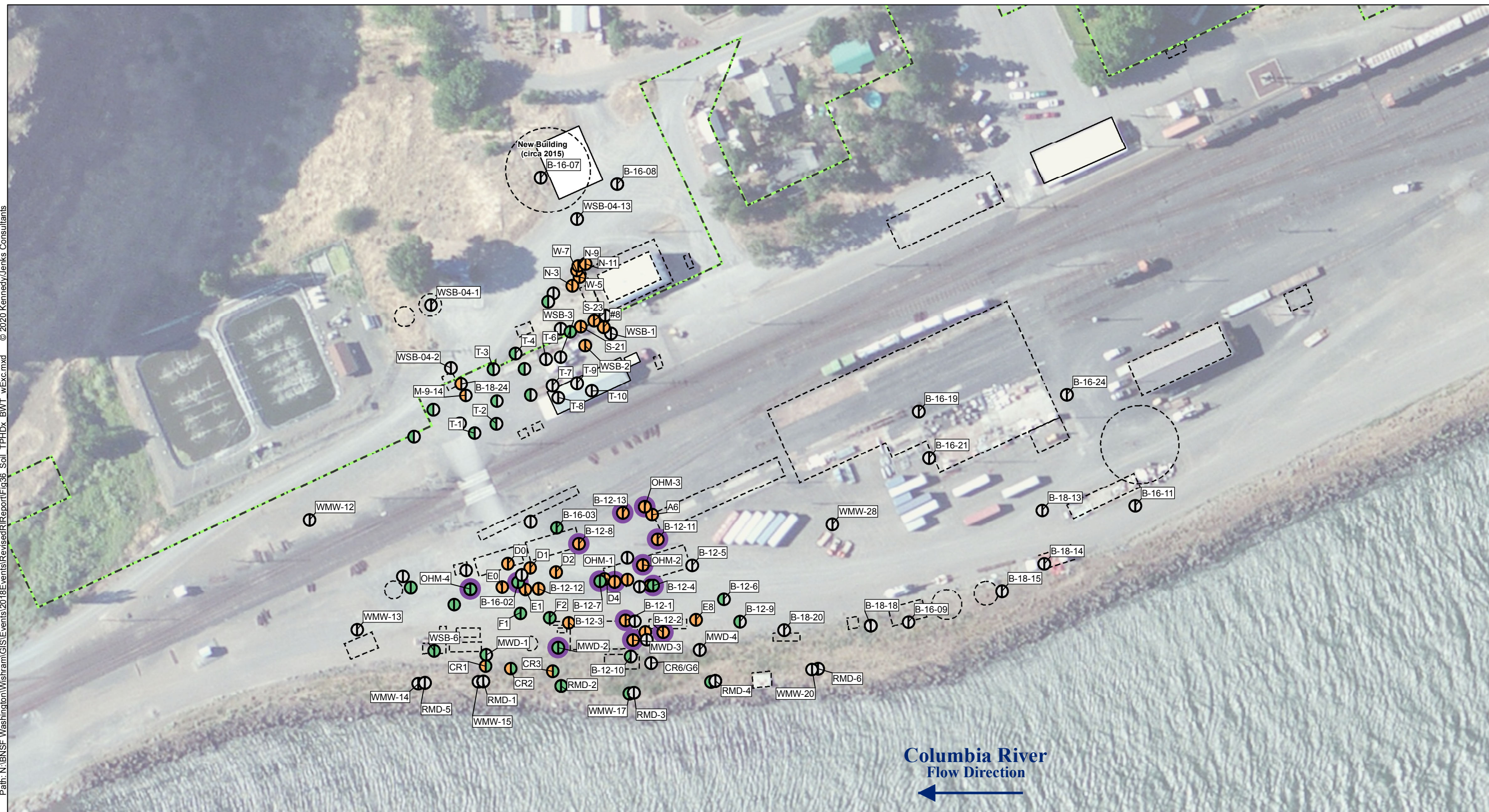
Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Total TPH-Dx in Subsurface Soil (Unsaturated) - Main Area

1696120.02
August 2020

Figure 42

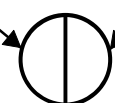


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

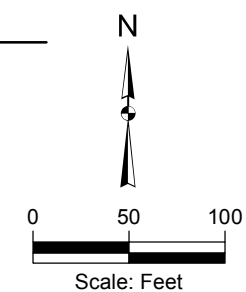
DRO Result ORO Result



- Result is above MTCA Method A CUL
- Result is below MTCA Method A CUL
- Result is below laboratory reporting limit
- LNAPL Observed in Boring

Notes:

1. Locations are approximate.
2. DRO = Diesel-Range Organics.
ORO = Oil-Range Organics.
3. Results present for soil samples collected between 2002 and 2018.
4. MTCA Method A Cleanup level for diesel- and oil-range organics (DRO and ORO) in soil is 2,000 milligrams per kilogram (mg/kg).
5. Saturated depths are from approximately 10 feet below ground surface (bgs) to bedrock.
6. Not all points are labeled. See Figures 7, 8, and 15 for complete labels.



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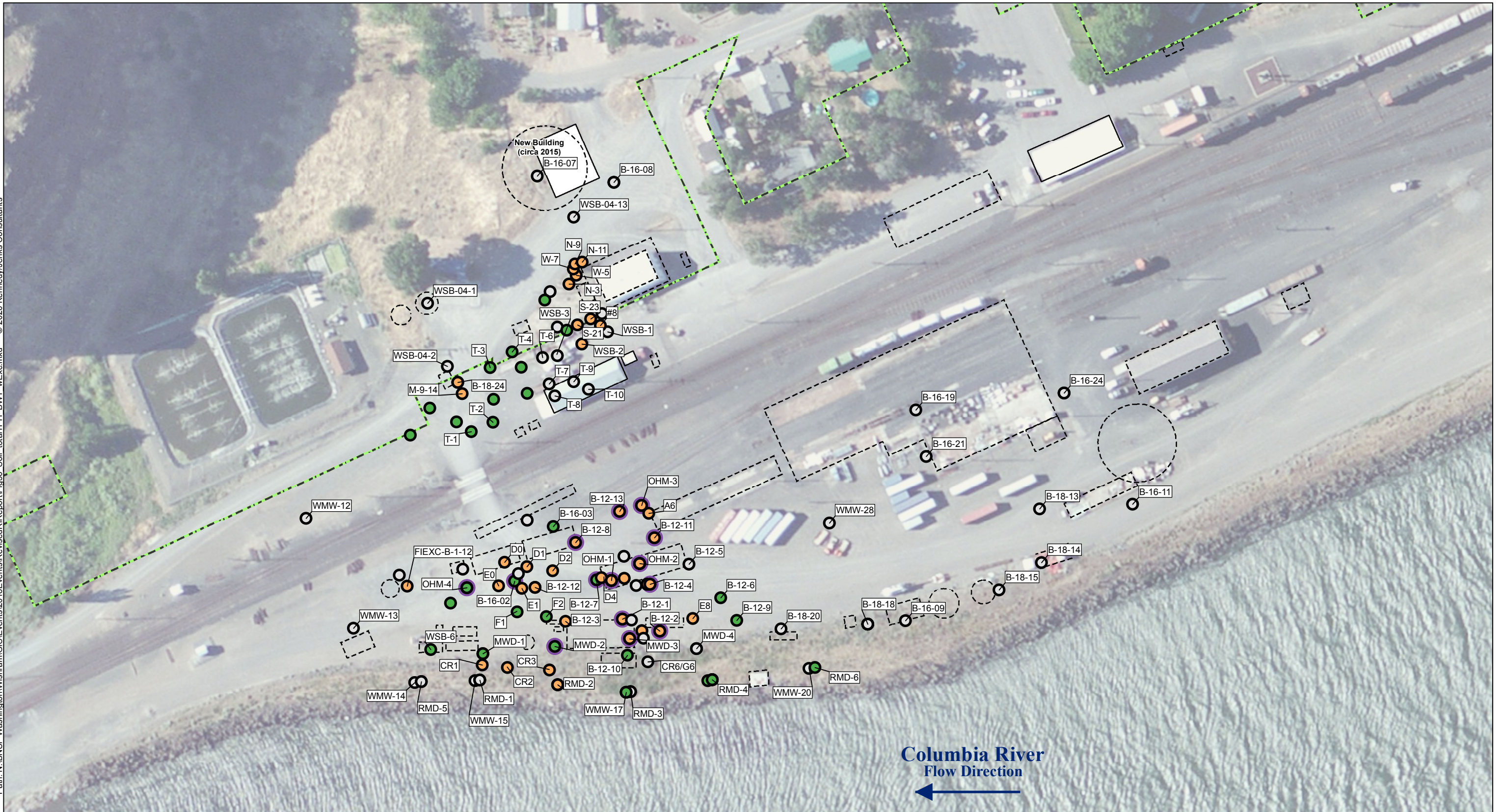
BNSF Wishram Railyard
Wishram, Washington

DRO/ORO in Subsurface Soil (Saturated) - Main Area

1696120.02
August 2020

Figure 43

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig36_Soil_totalTPH_BWT_wExc.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

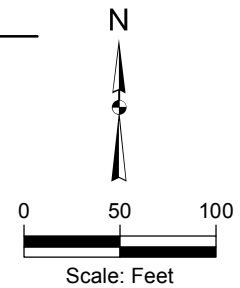
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit
- LNAPL Observed in Boring

Notes:

1. Locations are approximate.
2. Total TPH-Dx = Sum of diesel-range and oil-range organics results.
3. Results presented for soil samples collected between 2002 and 2018.
4. MTCA Method A Cleanup level for TPH in soil is 2,000 milligrams per kilogram (mg/kg).
5. Saturated depths are from approximately 10 feet below ground surface (bgs) to bedrock.
6. Not all points are labeled. See Figures 7, 8, and 15 for complete labels.



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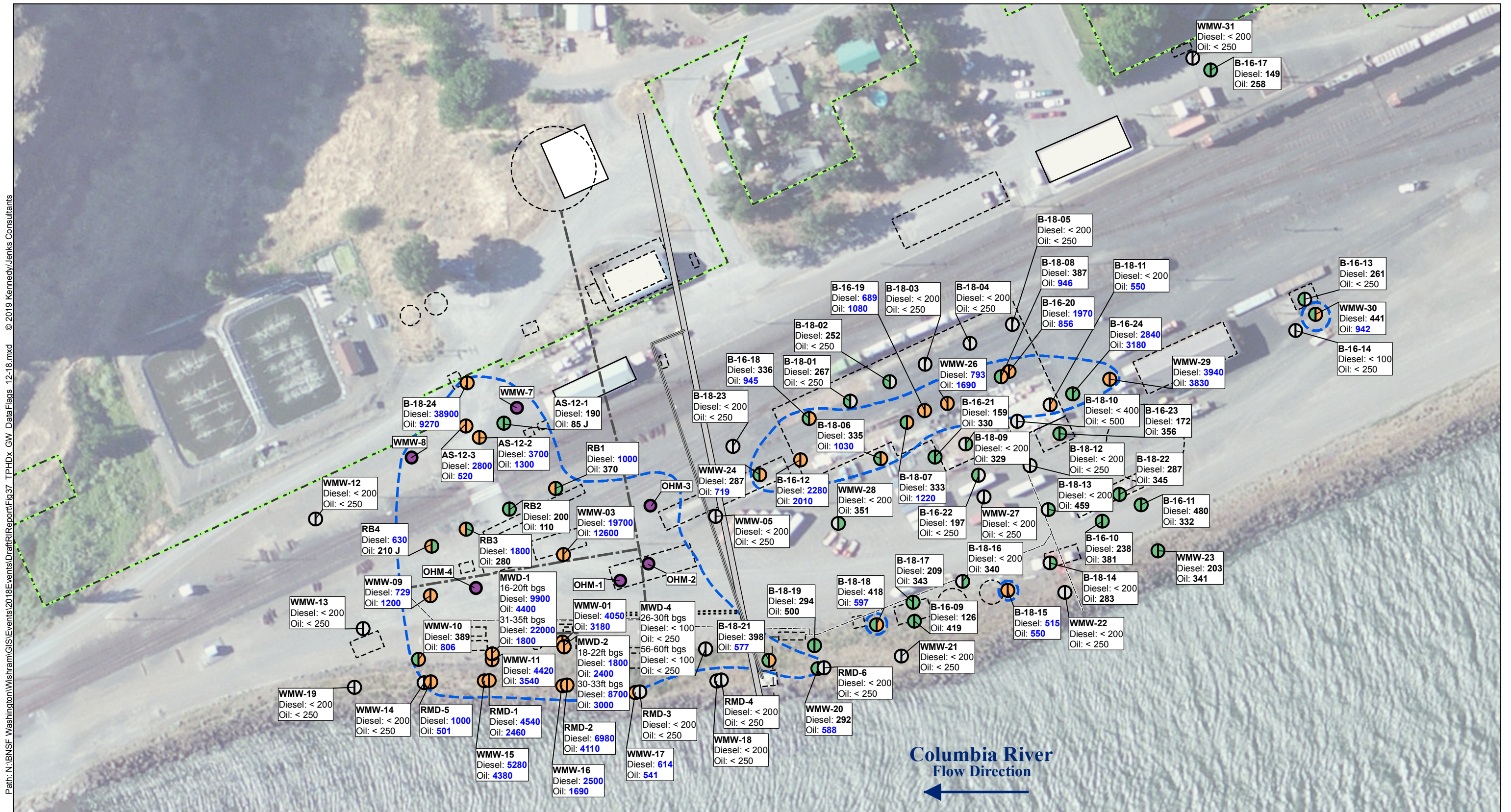
BNSF Wishram Railway
Wishram, Washington

**Total TPH-Dx in Subsurface Soil
(Saturated) - Main Area**

1696120.02
August 2020

Figure 44

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\Events\DraftRIR\Report\Fig37_TPHDx_GW_DataFlags_12-18.mxd © 2019 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

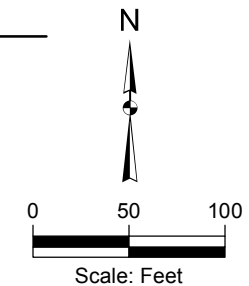
DRO Result ORO Result

- Result is above MTCA Method A CUL
- Result is below MTCA Method A CUL
- Result is below laboratory reporting limit
- LNAPL observed, well not sampled

Approximate Lateral Extent of Dissolved Phase Diesel and/or Oil

Note:

- Locations are approximate.
- "Diesel" = Diesel-Range Organics.
"Oil" = Oil-Range Organics.
- MTCA Method A Cleanup levels (CULs) for diesel- and oil-range organics (DRO and ORO) in groundwater is 500 micrograms per liter (µg/l).
- Reconnaissance groundwater samples from 2012, 2014, 2016, and 2018 are shown. Samples from 2012 and 2014, and some samples from 2016, were analyzed with silica gel cleanup. Monitoring well sample results from August 2018 are shown.
- Bold font indicates result reported above the laboratory reporting limit, blue font indicates result reported above the MTCA Method A CUL.



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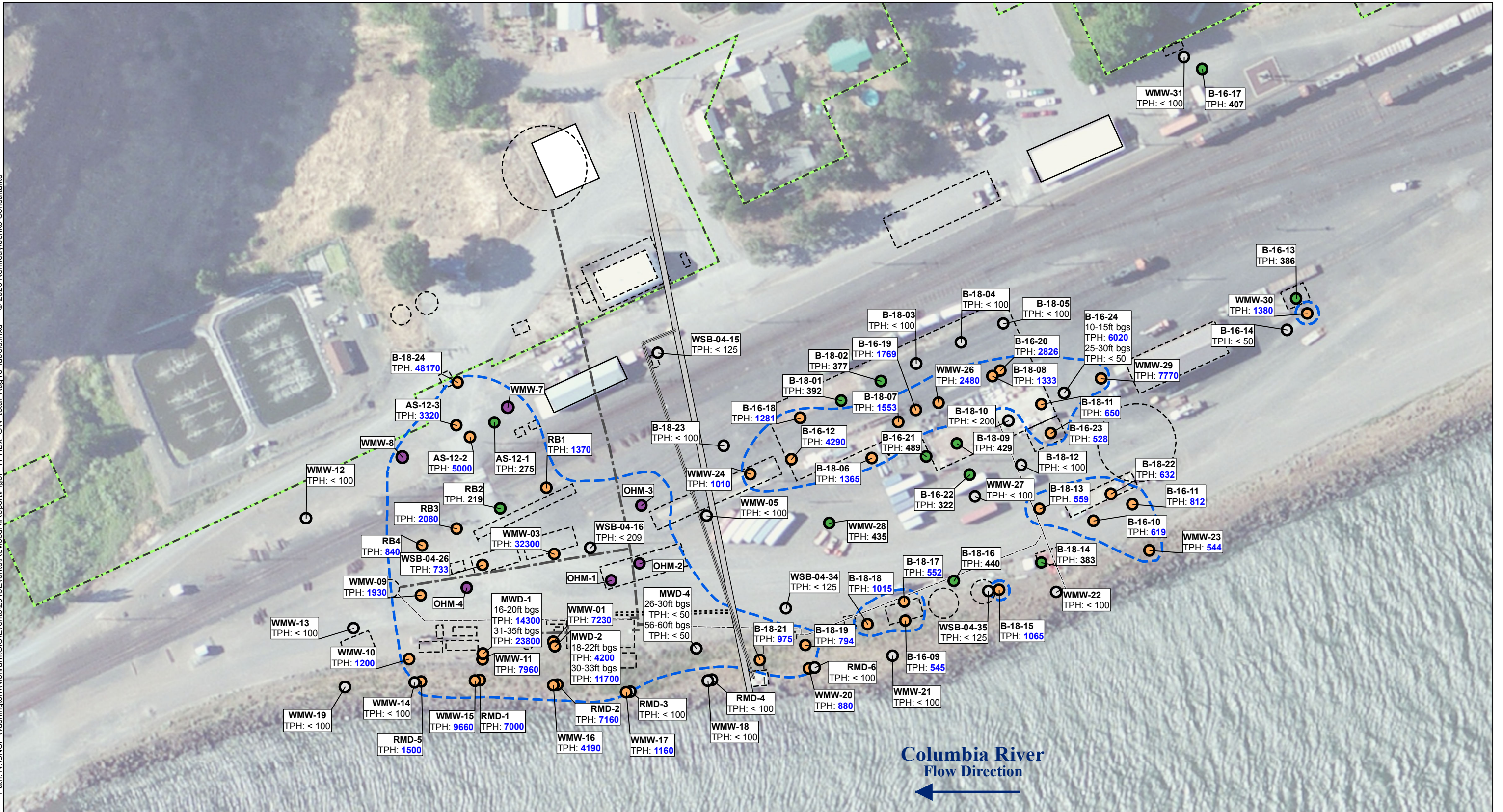
BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results DRO and ORO (2012 - 2018) - Main Area

1696120.02
June 2019

Figure 45

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig37_TPHDx_GW_total_Aug18_labels.mxd © 2020 Kennedy/Jenks Consultants



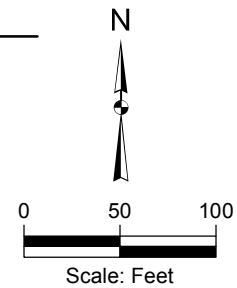
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit
- LNAPL Observed, Well Not Sampled
- Approximate Lateral Extent of Dissolved Phase Diesel and/or Oil

- Note:**
- Locations are approximate.
 - MTCA Method A Cleanup level (CUL) for total petroleum hydrocarbons (TPH) in groundwater is 500 micrograms per liter (µg/l).
 - Total TPH-Dx = Sum of diesel-range and oil-range organics results.
 - Reconnaissance groundwater samples from 2012, 2014, 2016, and 2018 are shown. Samples from 2012 and 2014, and some samples from 2016, were analyzed with silica gel cleanup. Monitoring well sample results from August 2018 are shown.
 - Bold font indicates result reported above the laboratory reporting limit, blue font indicates result reported above the MTCA Method A CUL.



Kennedy/Jenks Consultants

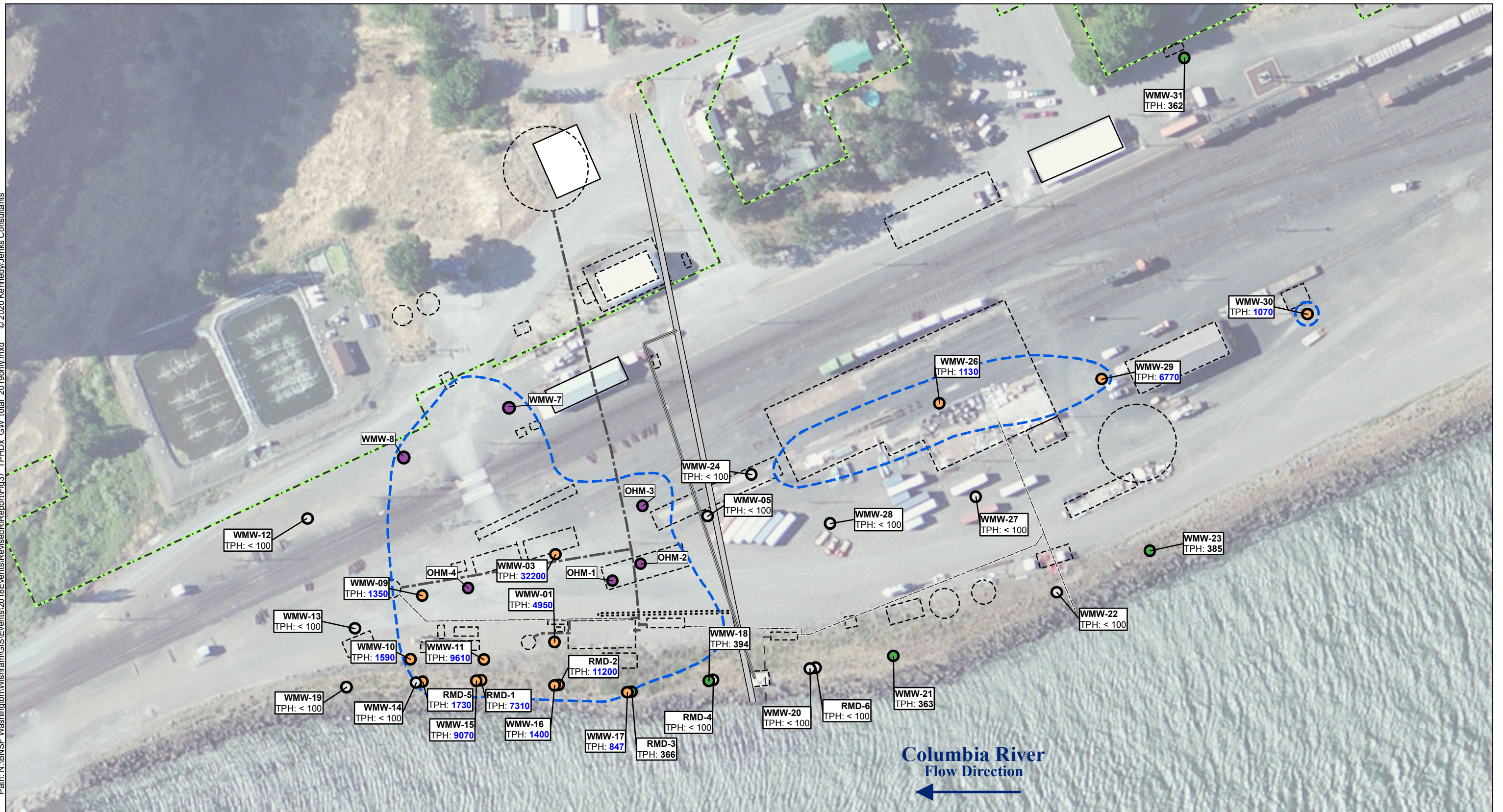
BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results Total TPH-Dx (2012 - 2018) - Main Area

1696120.02
July 2020

Figure 46

Path: N:\BNSF_Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig37_TPHDx_GW_total_2019only.mxd © 2020 Kennedy/Jenks Consultants



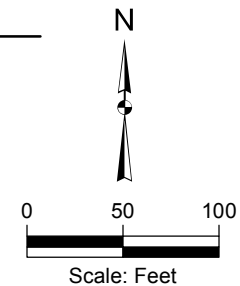
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit
- LNAPL Observed, Well Not Sampled

Note:
1. Locations are approximate.
2. MTCA Method A Cleanup level (CUL) for total petroleum hydrocarbons (TPH) in groundwater is 500 micrograms per liter (µg/l).
3. Total TPH-Dx = Sum of diesel-range and oil-range organics results.
4. Monitoring well sample results from August 2019 are shown.
5. Bold font indicates result reported above the laboratory reporting limit, blue font indicates result reported above the MTCA Method A CUL.



Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results Total TPH-Dx (2019) - Main Area

1696120.02
July 2020

Figure 47



Path: N:\BNSF Wishram\GIS\Events\2018Events\DraftRIRReport\Fig08b_Soil_TPHDx_AWT_east.mxd © 2019 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

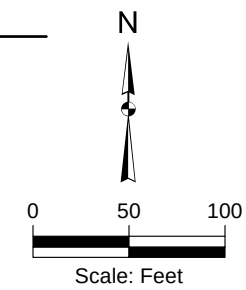
DRO Result **ORO Result**

Result is above MTCA Method A CUL

Result is below MTCA Method A CUL

Result is below laboratory reporting limit

- Notes:**
1. Locations are approximate.
 2. DRO = Diesel-Range Organics.
ORO = Oil-Range Organics.
 3. Results present for soil samples collected between 2002 and 2018.
 4. MTCA Method A Cleanup level for diesel- and oil-range organics (DRO and ORO) in soil is 2,000 milligrams per kilogram (mg/kg).
 5. Unsaturated depths are from approximately 0 to 10 feet below ground surface (bgs).



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BNSF Wishram Railyard
Wishram, Washington

DRO/ORO in Subsurface Soil (Unsaturated) - East Area

1896120°00
May 2019

Figure 48

Path: N:\BNSF Washington\Wishram\GIS\Events\2018Events\RevisedRIRReport\Fig38_Soil_totalTPH_AVT_east.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

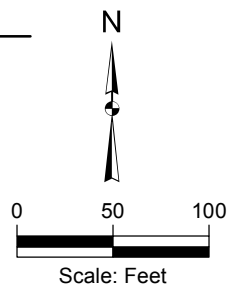
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit

Notes:

1. Locations are approximate.
2. Total TPH-Dx = Sum of diesel-range and oil-range organics results.
3. Results presented for soil samples collected between 2002 and 2018.
4. MTCA Method A Cleanup level for TPH in soil is 2,000 milligrams per kilogram (mg/kg).
5. Unsaturated depths are from approximately 0 to 10 feet below ground surface (bgs).



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BNSF Wishram Rail yard
Wishram, Washington

Total TPH-Dx in Subsurface Soil
(Unsaturated) - East Area

1696120.02
June 2020

Figure 49



Path: N:\BNSF Wishram\GIS\Events\2018Events\DraftRIRReport\Fig08b_Soil_TPHDx_BWT_east.mxd © 2018 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

DRO Result

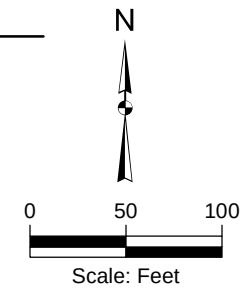
ORO Result

Result is above MTCA Method A CUL

Result is below MTCA Method A CUL

Result is below laboratory reporting limit

- Notes:
1. Locations are approximate.
 2. DRO = Diesel-Range Organics.
ORO = Oil-Range Organics.
 3. Results present for soil samples collected between 2002 and 2018.
 4. MTCA Method A Cleanup level for diesel- and oil-range organics (DRO and ORO) in soil is 2,000 milligrams per kilogram (mg/kg).
 5. Saturated depths are from approximately 10 feet below ground surface (bgs) to bedrock.



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BNSF Wishram Railyard
Wishram, Washington

**DRO/ORO in Subsurface Soil
(Saturated) - East Area**

1896120*00
May 2019

Figure 50

Path: N:\BNSF Washington\Wishram\GIS\Events\2018Events\RevisedRIRReport\Fig39_Soil_totalTPH_BWT_east.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

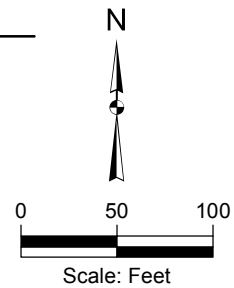
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

-  Total TPH-Dx Concentration Above MTCA Method A CUL
-  Total TPH-Dx Concentration Below MTCA Method A CUL
-  Total TPH-Dx Concentration Below Laboratory Reporting Limit

Notes:

1. Locations are approximate.
2. Total TPH-Dx = Sum of diesel-range and oil-range organics results.
3. Results presented for soil samples collected between 2002 and 2018.
4. MTCA Method A Cleanup level for TPH in soil is 2,000 milligrams per kilogram (mg/kg).
5. Saturated depths are from approximately 10 feet below ground surface (bgs) to bedrock.



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BNSF Wishram Railway
Wishram, Washington

Total TPH-Dx in Subsurface Soil (Saturated) - East Area

1696120.02
June 2020

Figure 51

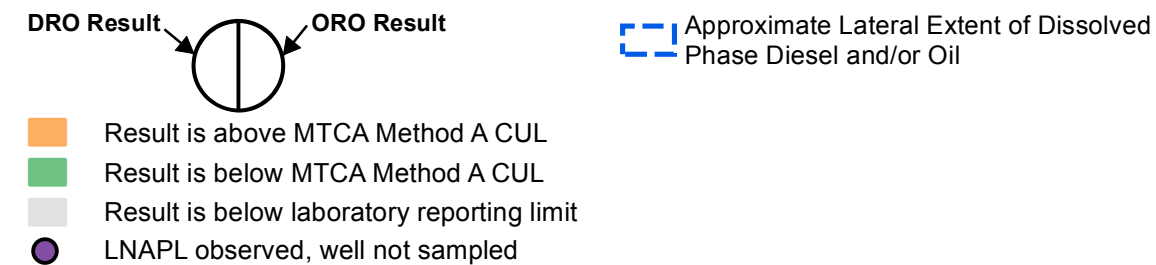
Path: N:\BNSF Washington\GIS\Events\2018Events\DraftRIRReport\Fig40_TPHDx_GW_DataFlags_12-18E.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

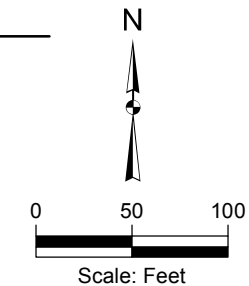
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend



Note:

- Locations are approximate.
- "Diesel" = Diesel-Range Organics.
"Oil" = Oil-Range Organics.
- MTCA Method A Cleanup levels for diesel- and oil-range organics (DRO and ORO) in groundwater is 500 micrograms per liter (µg/l).
- Reconnaissance groundwater samples from 2012, 2014, 2016, and 2018 are shown. Samples from 2012 and 2014, and some samples from 2016, were analyzed with silica gel cleanup. Monitoring well sample results from August 2018 are shown.
- Bold font indicates result reported above the laboratory reporting limit, blue font indicates result reported above the MTCA Method A CUL.



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BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results DRO and ORO (2012 - 2018) - East Area

1696120.02
July 2020

Figure 52

Path: N:\BNSF Washington\GIS\Events\2018Events\RevisedRIRReport\Fig40_TPHDx_GW_total_Aug18_E_labels.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

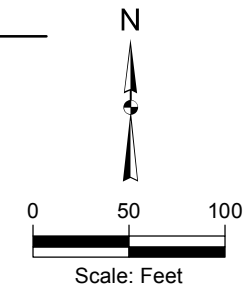
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit
- LNAPL Observed, Well Not Sampled
- Approximate Lateral Extent of Dissolved Phase Diesel and/or Oil

Note:

- Locations are approximate.
- MTCA Method A Cleanup level (CUL) for total petroleum hydrocarbons (TPH) in groundwater is 500 micrograms per liter (µg/l).
- Total TPH-Dx = Sum of diesel-range and oil-range organics results.
- Reconnaissance groundwater samples from 2012, 2014, 2016, and 2018 are shown. Samples from 2012 and 2014, and some samples from 2016, were analyzed with silica gel cleanup. Monitoring well sample results from August 2018 are shown.
- Bold font indicates result reported above the laboratory reporting limit, blue font indicates result reported above the MTCA Method A CUL.



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BNSF Wishram Rail Yard
Wishram, Washington

Groundwater Sampling Results Total TPH-Dx (2012 - 2018) - East Area

1696120.02
June 2020

Figure 53

Path: N:\BNSF Washington\GIS\Events\2018Events\RevisedRIRReport\Fig40_TPHDx_GW_total_2019only_E.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

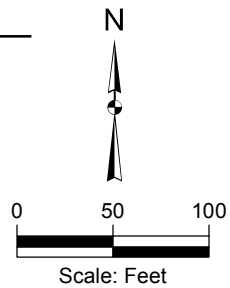
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Total TPH-Dx Concentration Above MTCA Method A CUL
- Total TPH-Dx Concentration Below MTCA Method A CUL
- Total TPH-Dx Concentration Below Laboratory Reporting Limit
- LNAPL Observed, Well Not Sampled

Note:

1. Locations are approximate.
2. MTCA Method A Cleanup level (CUL) for total petroleum hydrocarbons (TPH) in groundwater is 500 micrograms per liter (µg/l).
3. Total TPH-Dx = Sum of diesel-range and oil-range organics results.
4. Monitoring well sample results from August 2019 are shown.
5. Bold font indicates result reported above the laboratory reporting limit, blue font indicates result reported above the MTCA Method A CUL.



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BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results Total TPH-Dx (2019) - East Area

1696120.02
August 2020

Figure 54

Path: N:\BNSF_Wishram\GIS\Events\2018\Events\DraftRIR\Report\Fig41_Soil_Arsenic.mxd © 2019 Kennedy/Jenks Consultants



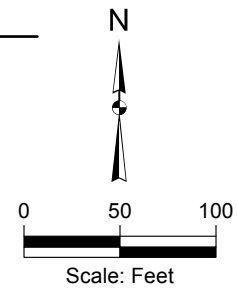
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Arsenic Concentration Below Cleanup Levels
- Arsenic Concentration Below Reporting Limit
- Existing Site Feature
- Former Site Feature

Note:
1. Locations are approximate.



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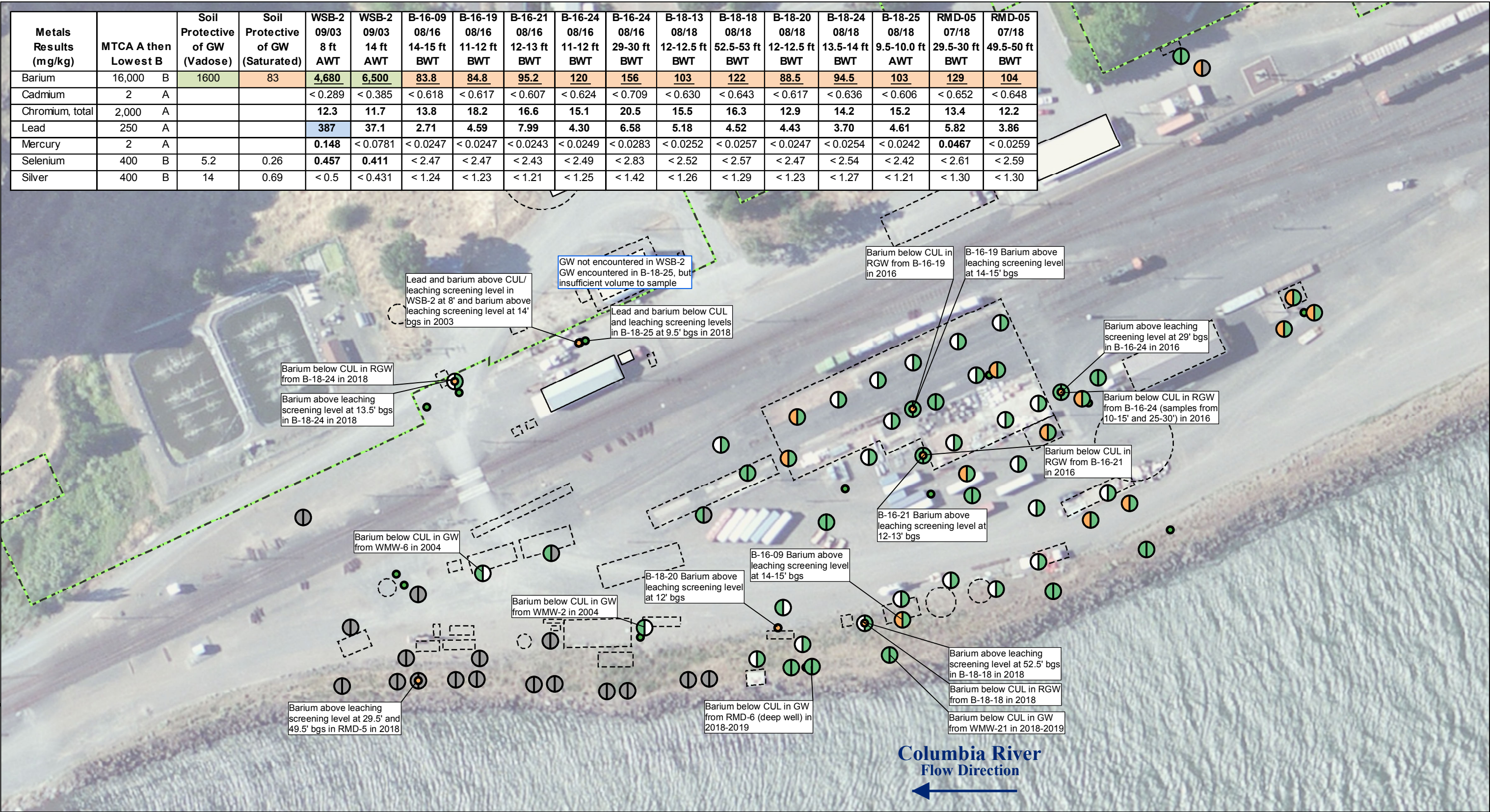
BNSF Wishram Railway
Wishram, Washington

Arsenic Distribution in Subsurface Soil - Main Area

1896120°04
January 2019

Figure 55

Path: N:\BNSF Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig55 SoilandGW Metals.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Soil Sample with Metals Result Above MTCA Method A or B CUL or Above Leaching Screening Level

Soil Sample with Metals Result Below MTCA Method A or B CUL

Total Metals Result

Dissolved Metals Result

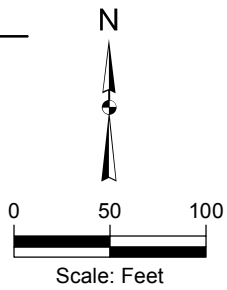
Result is above MTCA Method A or B CUL

Result is below MTCA Method A or B CUL

Result is below laboratory reporting limit

Not Analyzed

- Notes:
- Locations are approximate.
 - "Metals" includes one or more of Barium, Cadmium, Chromium, Lead, Mercury, Selenium, or Silver.
 - Results presented for soil samples collected between 2003 and 2018.
 - Symbols for adjacent locations have been spaced apart to prevent overlap.
 - Metals results in milligrams per kilogram (mg/kg).
 - Value in cell shaded blue indicates result above MTCA Method A or B cleanup level (CUL). Underlined value indicates result above an applicable soil protective of groundwater (GW) screening level in the vadose zone (green shaded) or saturated zone (orange shaded). Bold font indicates result reported above the laboratory reporting limit.

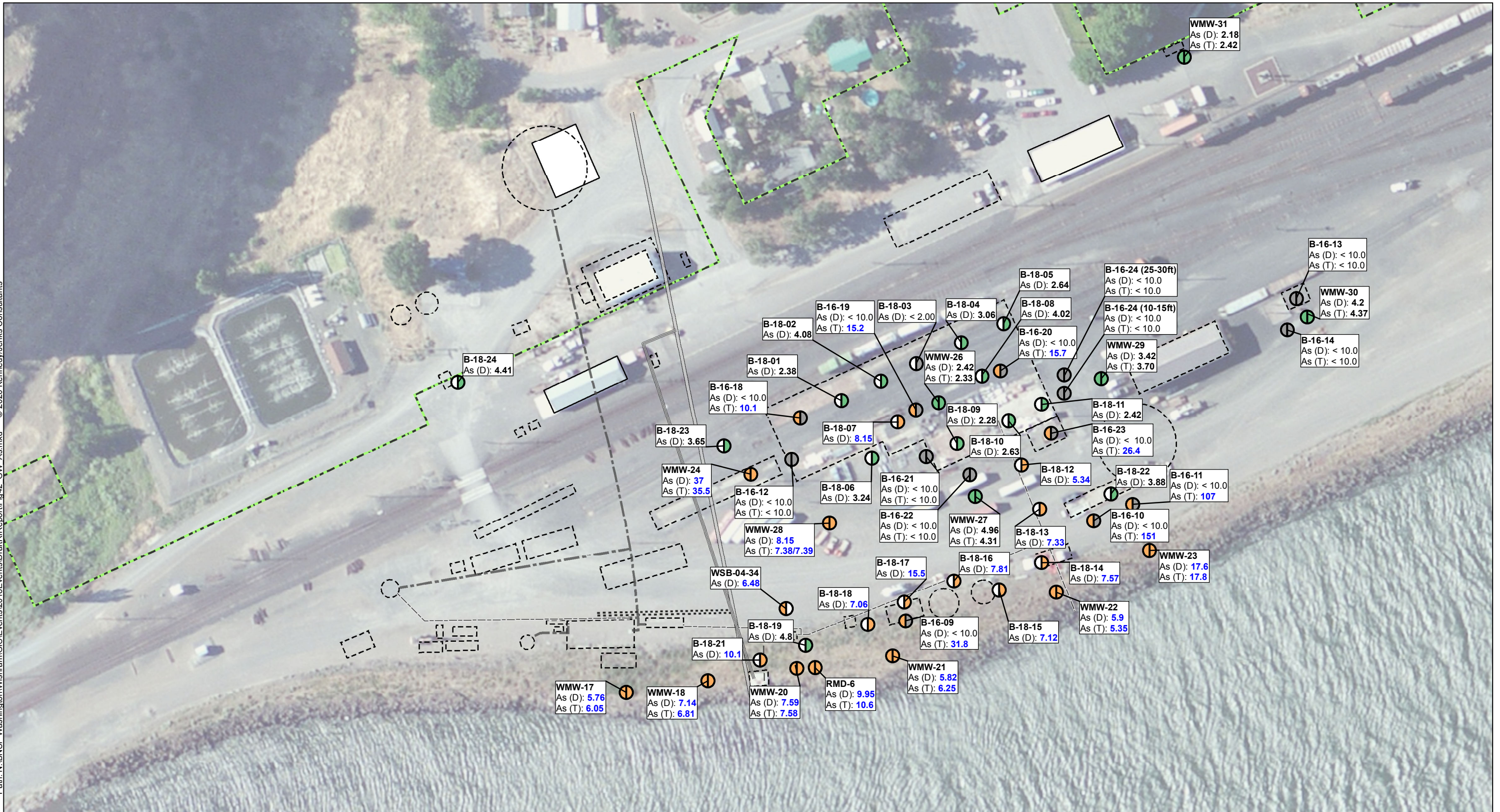


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BNSF Wishram Rail Yard
Wishram, Washington

Metals in Subsurface Soil and Groundwater - Main Area

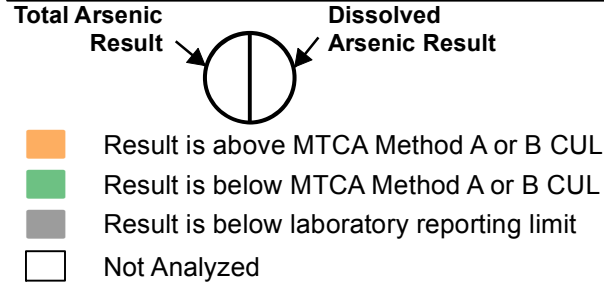
Path: N:\BNSF_Washington\Wishram\GIS\IEvents\2018Events\DraftRIR\Report\Fig42_GW_Ar.mxd © 2020 Kennedy/Jenks Consultants



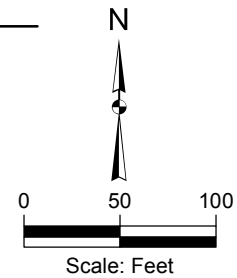
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend



- Note:**
- Locations are approximate.
 - Symbol type based on monitoring well sample results for dissolved (D) and total (T) arsenic during the August 2018 event, and reconnaissance groundwater sample results for dissolved arsenic only from the 2016 and 2018 investigations.
 - MTCA Method A Cleanup levels for arsenic in groundwater is 5 micrograms per liter (µg/l).



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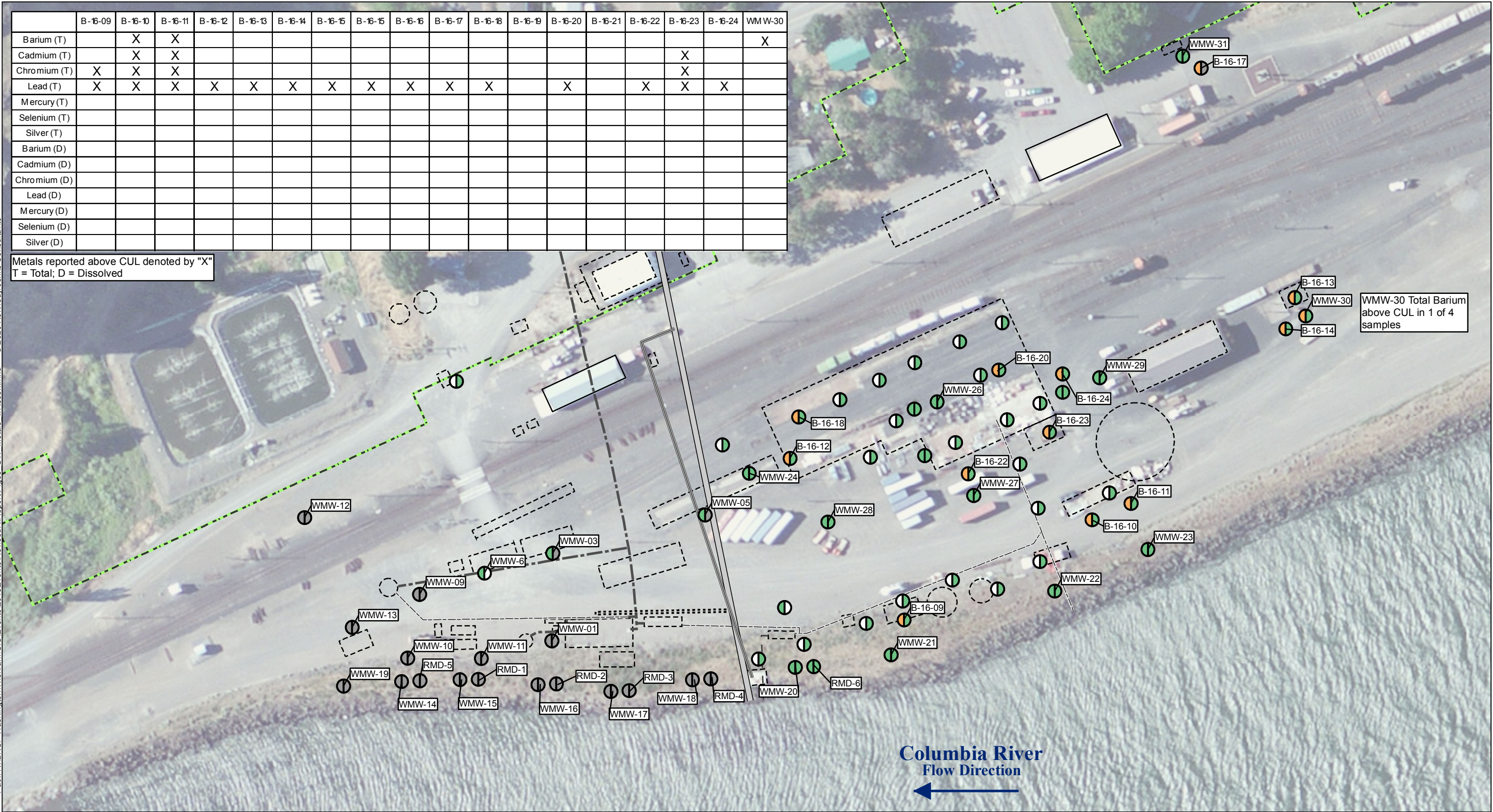
BNSF Wishram Rail Yard
Wishram, Washington

Groundwater Sampling Results Arsenic, August 2016 to August 2018 - Main Area

1896120.00
June 2020

Figure 57

Path: N:\BNSF Washington\Wishram\GIS\Events\2018\RevisedRIR\Report\Fig58 GW Metals wRecon.mxd © 2020 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Total Metals Result

Dissolved Metals Result

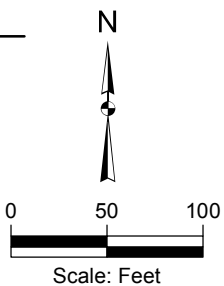
Result is above MTCA Method A or B CUL

Result is below MTCA Method A or B CUL

Result is below laboratory reporting limit

Not Analyzed

- Note:
- Locations are approximate.
 - "Metals" includes one or more of barium, cadmium, chromium (total), lead, mercury, selenium, and silver. Arsenic results are shown on a separate figure.
 - Monitoring well sample results from September 2003 through November 2019 are shown. Reconnaissance groundwater samples from February 2004 through August 2018 are shown.
 - Only locations with one or more metals above the CUL are shown on table.
 - Symbols for adjacent wells (i.e. shallow and deep well pairs) have been spaced apart to prevent overlap.



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BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results
Metals (2003 - 2019) - Main Area

1696120.02
July 2020
Figure 58



Path: N:\BNSF Washington\Wishram\GIS\Events\2018\Events\Draft\Report\Fig43_Soil_Arsenic.mxd © 2019 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

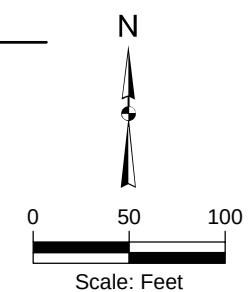
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Arsenic Concentration Below Cleanup Levels
- Arsenic Concentration Below Reporting Limit
- Existing Site Feature
- Former Site Feature

Note:

- Locations are approximate.
- Soil boring locations labeled if one or more soil samples contained an arsenic concentration above laboratory reporting limits (shown in **boldface** type). Results shown in milligrams per kilogram (mg/kg). Sample depths in feet below ground surface (bgs).



Kennedy/Jenks Consultants

BNSF Wishram Rail Yard
Wishram, Washington

Arsenic Distribution in Subsurface Soil - East Area

1996120°00
May 2019

Figure 59



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

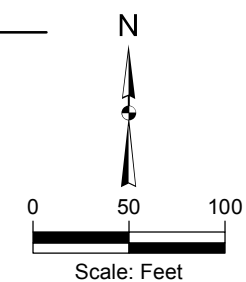
Total Arsenic Result

Dissolved Arsenic Result

- Result is above MTCA Method A or B CUL
- Result is below MTCA Method A or B CUL
- Result is below laboratory reporting limit
- Not Analyzed

Note:

- Locations are approximate.
- Symbol type based on monitoring well sample results for dissolved (D) and total (T) arsenic during the August 2018 event, and reconnaissance groundwater sample results for dissolved arsenic only from the 2016 and 2018 investigations.
- MTCA Method A Cleanup levels for arsenic in groundwater is 5 micrograms per liter ($\mu\text{g/l}$).



Kennedy/Jenks Consultants

BNSF Wishram Railway
Wishram, Washington

Groundwater Sampling Results Arsenic, August 2016 to August 2018 - East Area

1896120.00
June 2020

Figure 60



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Total Metals Result

Dissolved Metals Result

Result is above MTCA Method A or B CUL

Result is below MTCA Method A or B CUL

Result is below laboratory reporting limit

Not Analyzed

Note:

- Locations are approximate.
- "Metals" includes one or more of barium, cadmium, chromium (total), lead, mercury, selenium, and silver. Arsenic results are shown on a separate figure.
- Monitoring well sample results from September 2003 through November 2019 are shown. Reconnaissance groundwater samples from February 2004 through August 2018 are shown.
- Only locations with one or more metals above the CUL are shown on table.
- Symbols for adjacent wells have been spaced apart to prevent overlap.

N

0

50

100

Scale: Feet

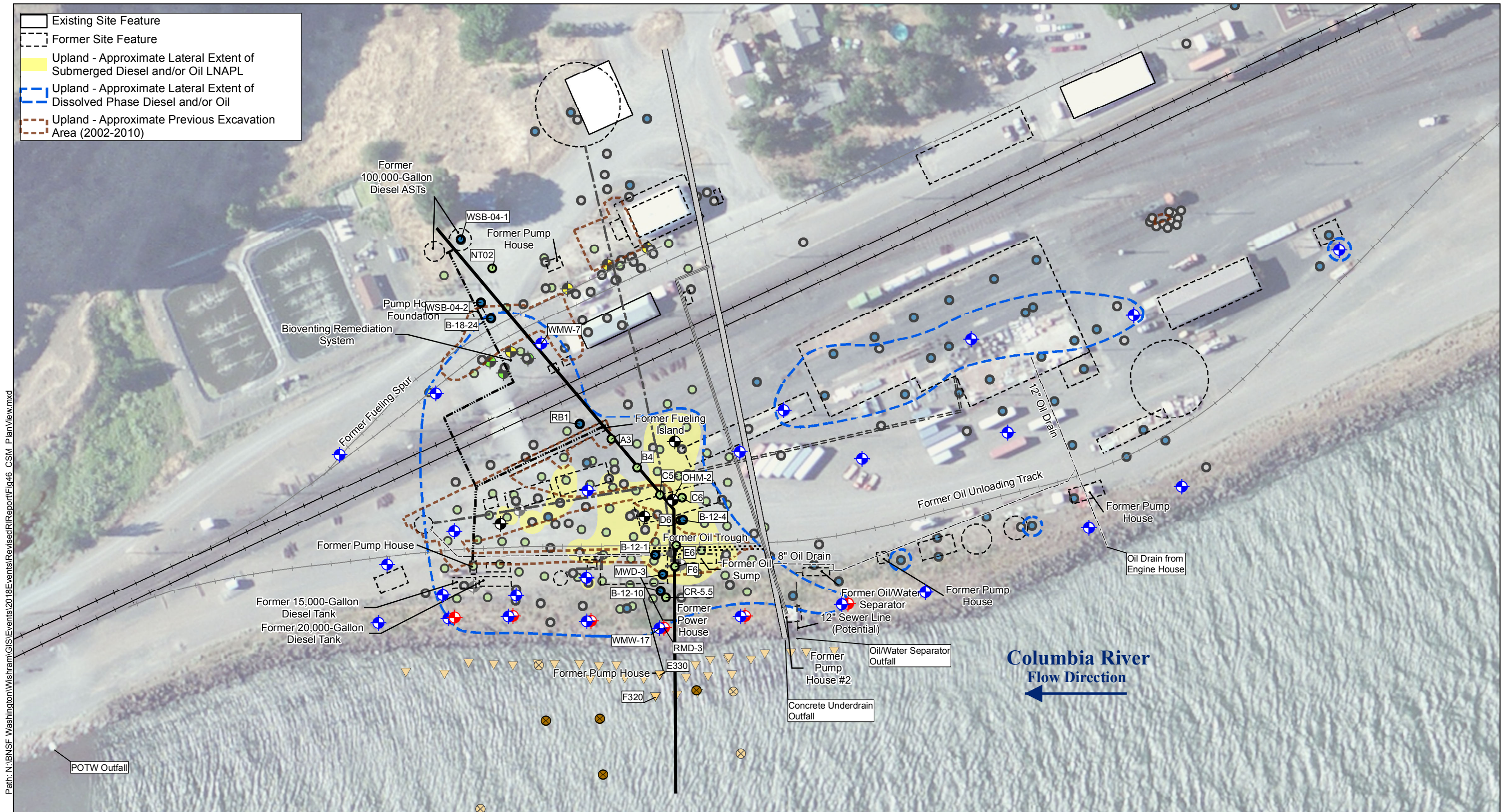
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BNSF Wishram Railway
Wishram, Washington

**Groundwater Sampling Results
Metals (2003 - 2019) - East**

1696120.02
July 2020

Figure 61



Path: N:\BNSF Wishram\GIS\Events\2018\Events\Revised\Report\Fig46 CSM PlanView.mxd

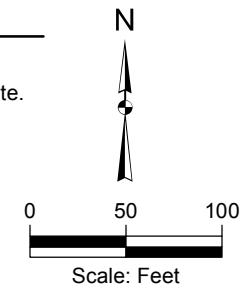
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- | | | | |
|---------------------------------------|---------------------------|-----------------------------|---|
| --- Former Bunker Fuel / Oil Pipeline | --- Stormwater Underdrain | ● Bioventing Injection Well | ● Soil Boring (2002-2014) |
| --- Former Oil Drain | --- Stormwater Underdrain | ● Air Sparge (AS) Well | ● Soil Boring (2016-2018) |
| --- Former Oil Trough | --- Former Diesel Line | ● Shallow Monitoring Well | ● LIF Location |
| --- Former Sewer Line (Potential) | --- Former Steam Line | ● Deep Monitoring Well | ● DART Location |
| --- CSM Cross Section Line | | ● Oil Head Monitoring Well | ● Sediment Core Location - No NAPL Observed |
| | | | ● Sediment Core Location - NAPL Observed |

Note:
1. Locations are approximate.



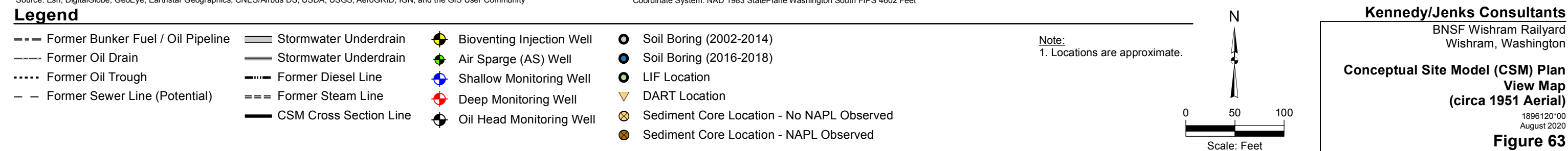
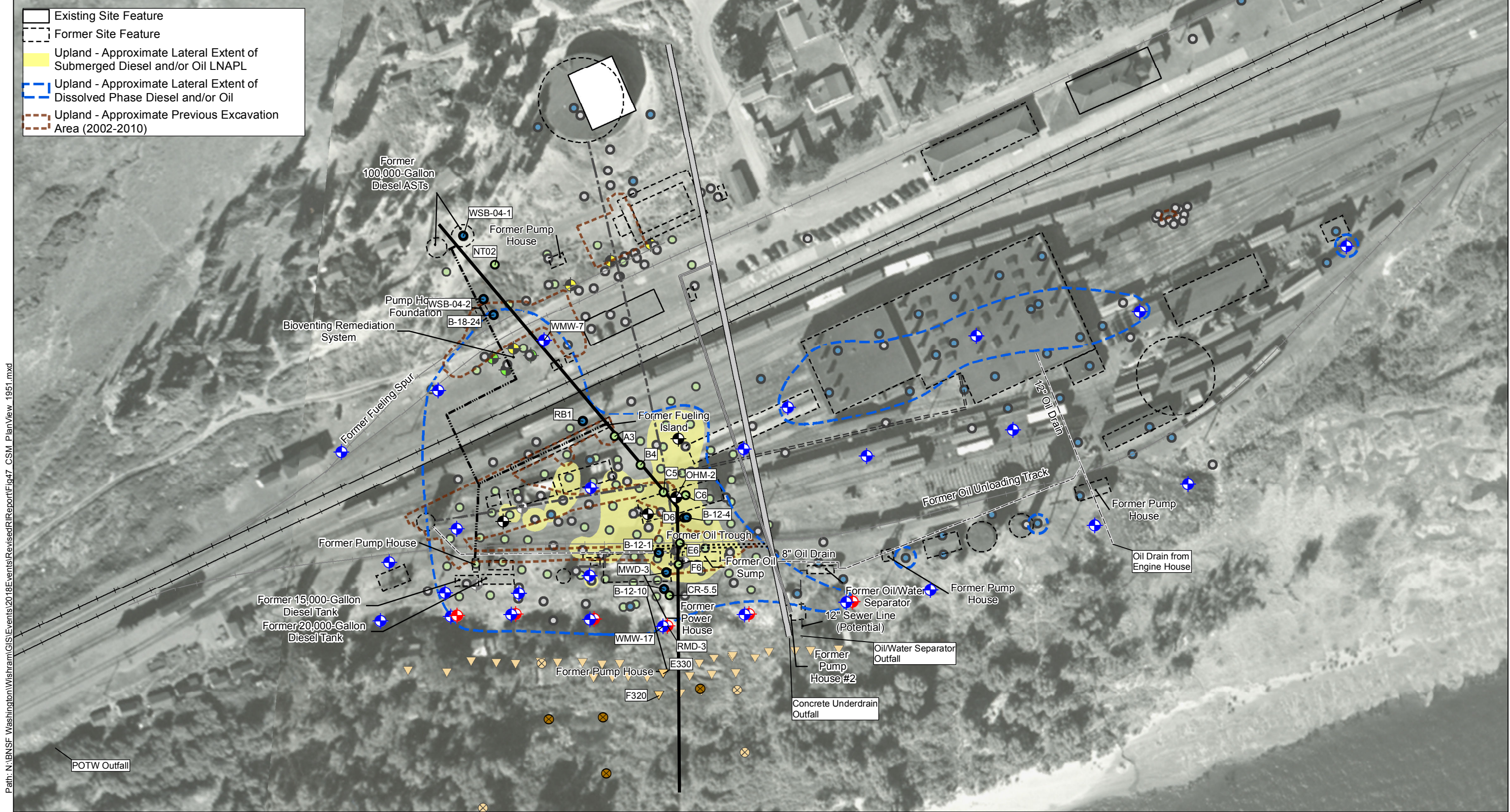
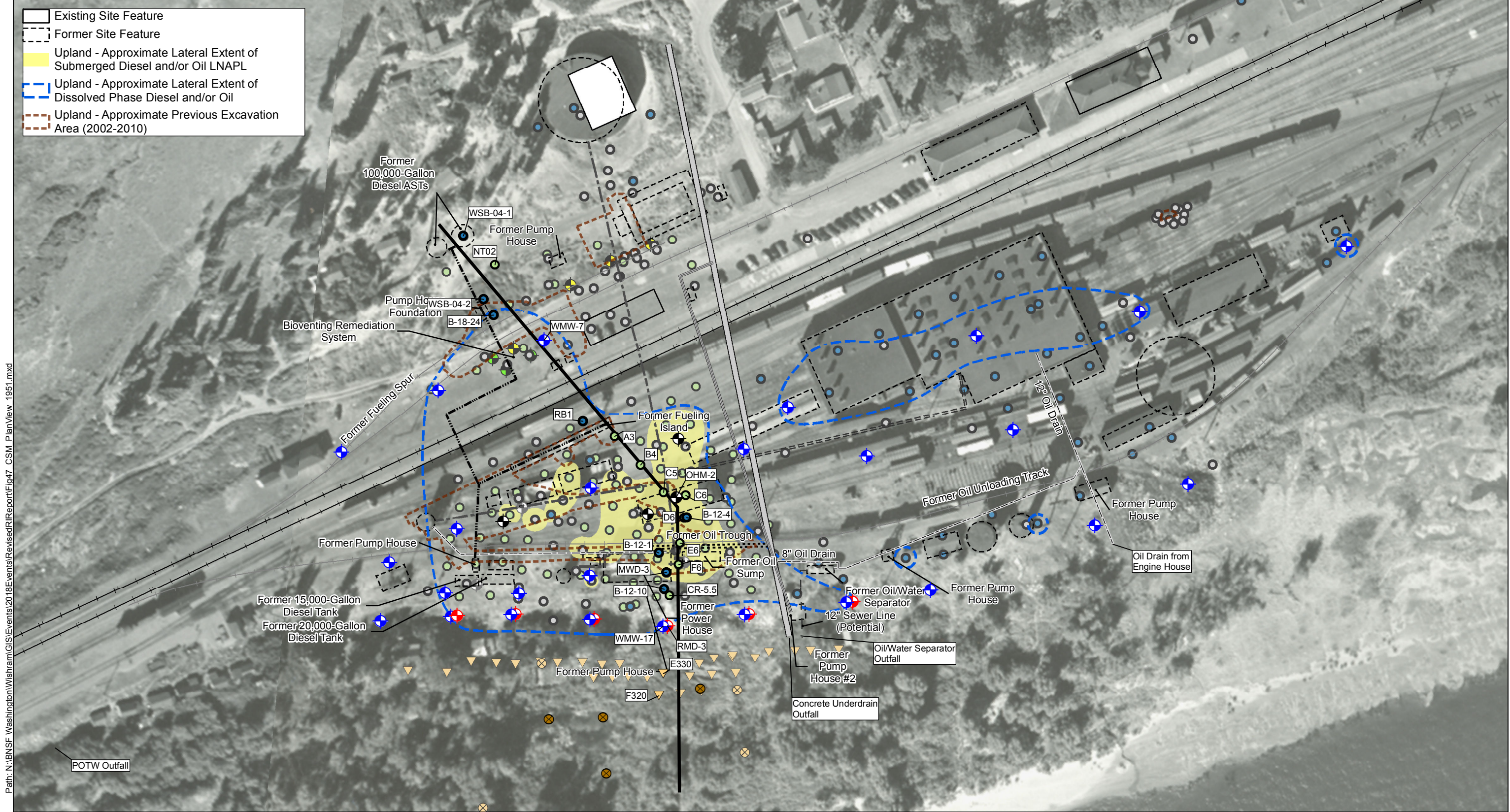
Kennedy/Jenks Consultants

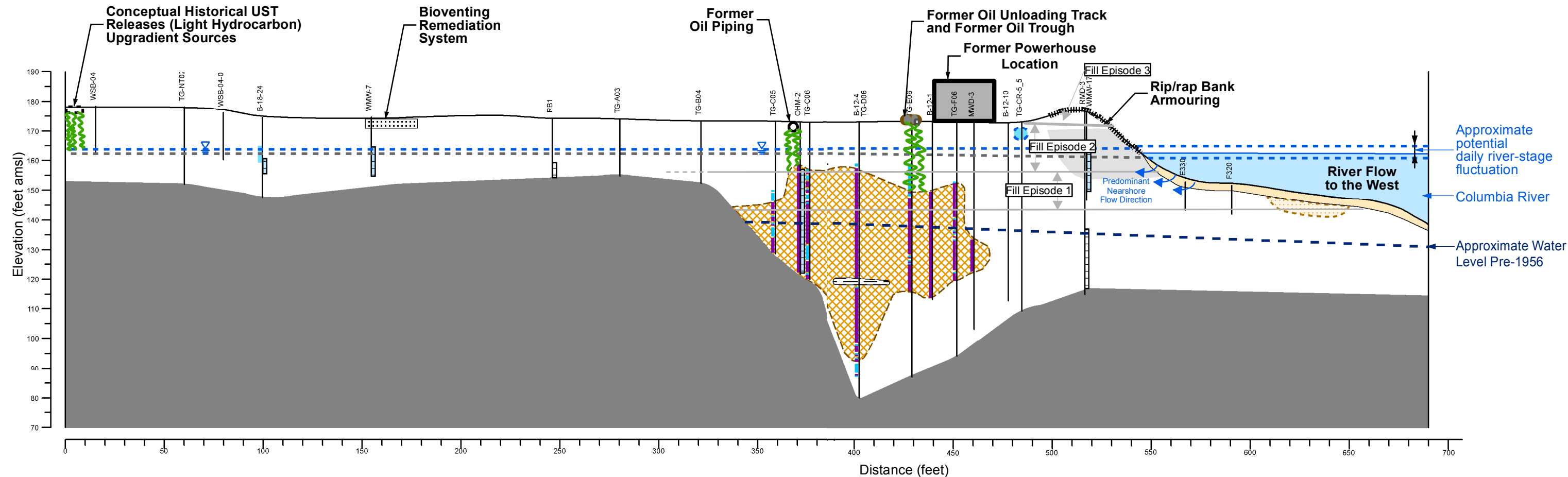
BNSF Wishram Rail Yard
Wishram, Washington

Conceptual Site Model (CSM) Plan View Map (circa 2011 Aerial)

1896120°00
August 2020

Figure 62

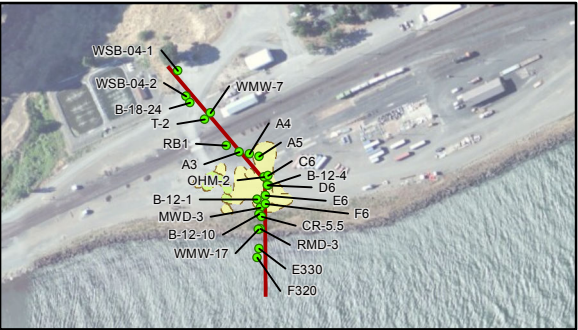




- Notes:**
1. All locations and depths are approximate. Lithologic interpretation inferred from boring logs, historical documents, maps, and/or field observations.
 2. AMSL = above mean sea level.
 3. MTCA = Washington Model Toxics Control Act
 4. LNAPL = light non-aqueous phase liquid
 5. TPH = total petroleum hydrocarbon
 6. LIF = laser-induced fluorescence
 7. Inferred LNAPL/residual TPH extent from interpretation of LIF waveforms and LNAPL field observations in soil borings.

Legend

- - - Inferred Maximum Measured Groundwater Elevation
- - - Inferred Minimum Measured Groundwater Elevation
- Orange Box River Sediment (Interpreted)
- Blue Box Columbia River
- Lithology**
 - Gray Box Gravelly Sand Fill Material
 - White Box Sand and Sand with Silt
 - Brown Box Gravel and Gravel with Sand
 - Horizontal Lines Box Clay and Silty Clay
 - Dark Gray Box Basalt Bedrock
- Well screen interval
- Well screen interval, blue shading indicates dissolved concentrations of diesel-range and/or oil-range organics in groundwater are above MTCA Method A cleanup levels (500 µg/L).
- Inferred LNAPL/Residual TPH Extent**
 - Blue Dashed Box Shallow Soil Diesel/Oil Impacts
 - Orange Box Inferred Zone of Oil-like LNAPL
 - Orange Box Inferred Zone of Oil-like LNAPL (Inundated Lands)
 - Purple Box Inferred LNAPL in Boring
 - Blue Box Inferred Residual TPH in Boring



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Wishram, Washington

Conceptual Site Model

Figure 64