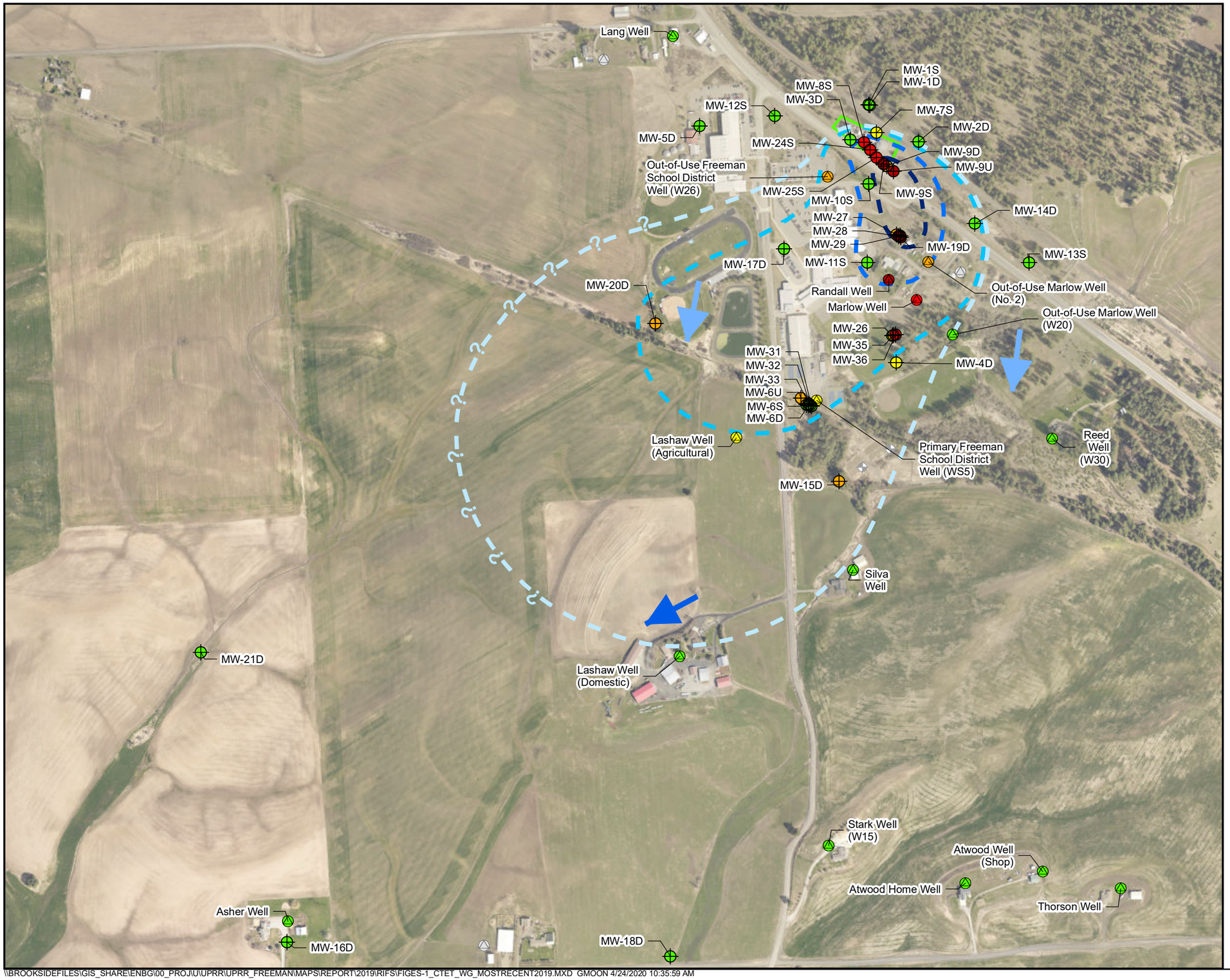
Figures



LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Groundwater flow direction (lower fractured basalt unit, see note 6)
- Groundwater flow direction (inferred transition zone)

Concentration Range

- <=0.625 ug/L
- >0.625 and <=5 ug/L
- >5 and <=100 ug/L
- >100 and <=200 ug/L
- >200 ug/L

Carbon Tetrachloride Concentration

(Contours shown for deeper fractured basalt)

- 0.625 ug/L ("?" indicates where inferred)
- 10 ug/L
- 100 ug/L
- 400 ug/L

Note

1. MW-22s and MW-23s were decommissioned due to artesian conditions.
2. Davey, Brandt and Freeman Store wells are not included in the GW monitoring program.
3. Groundwater concentration data shown on figure is from July to October 2019 with the following exceptions: MW-26 (May 2019), Atwood Home Well (June 2019) and Atwood Well (Shop) (June 2019).

N

0 335 670 1,340 Feet

Figure ES-1
Carbon Tetrachloride in Groundwater Samples from Wells
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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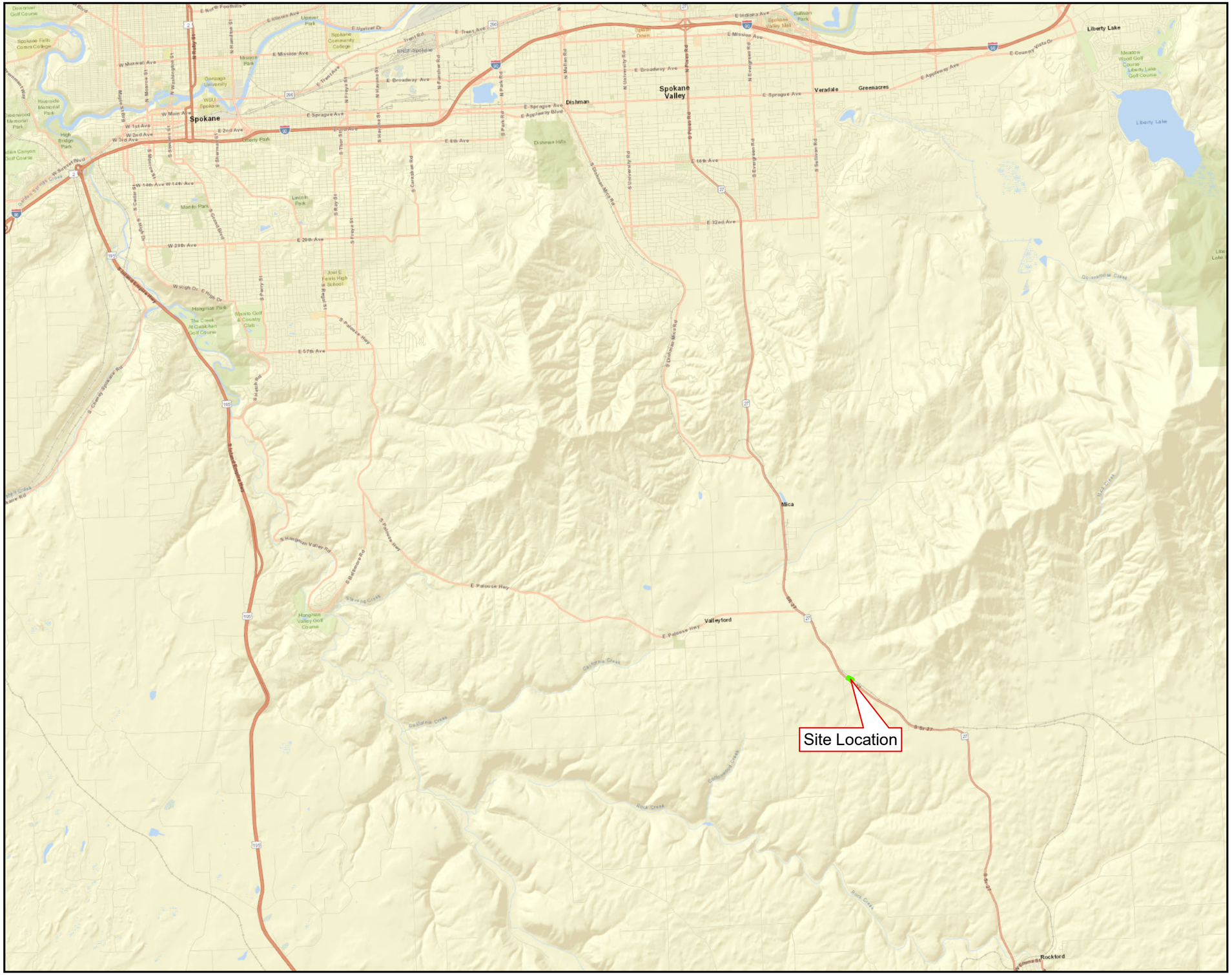
\\BROOKSIDEFILES\GIS_SHARE\ENBG\00_PROJ\U\UPRR\UPRR_FREEMAN\MAPS\REPORT\2019\RIFS\FIGES-1_CTET_WG_MOSTRECENT2019.MXD GMOON 4/24/2020 10:35:59 AM



LEGEND

Grain Handling Facility at Freeman

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

N

0 5,000 10,000 20,000 Feet

Figure 1-1
Site Location
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

\\BROOKSIDEFILES\GIS_SHARE\ENBG\00_PROJ\U\UPRR\UPRR_FREEMAN\MAPS\REPORT\2019\RIFS\FIG1-1_SITELOCATION.MXD GMOON 10/29/2019 12:17:53 PM

JACOBS

LEGEND

Grain Handling Facility at Freeman

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

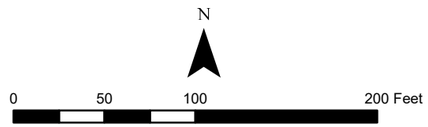


Figure 2-1
Grain Handling Facility at Freeman
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman, Freeman, Washington

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LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Freeman School District
- Stream

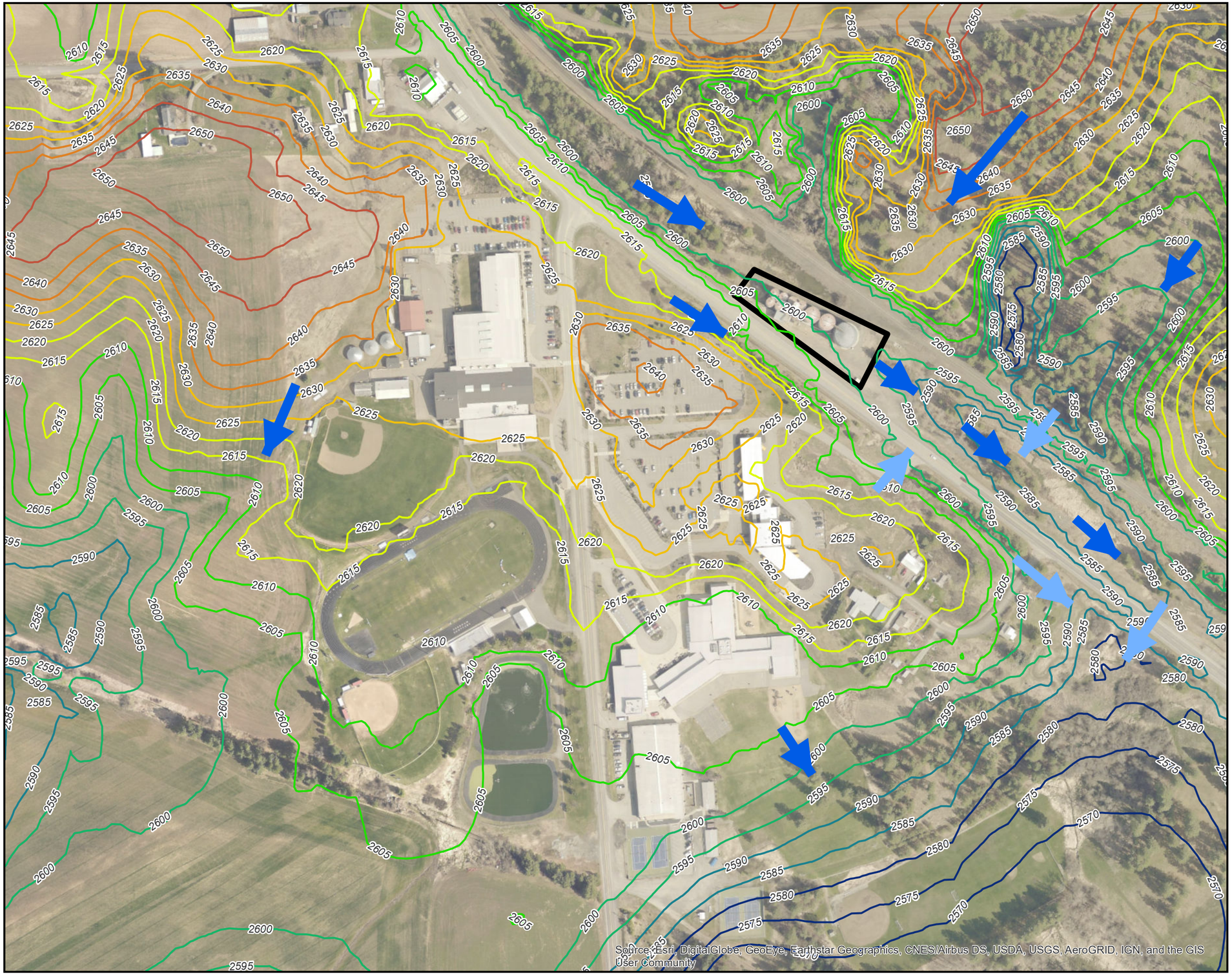
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 200 400 800 Feet

Figure 2-2
Site and Surrounding Features
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS



LEGEND

- Drainage Direction
- Flow Through Culvert

Elevation Contour (5 ft Contour Interval, NAVD88)

- 2575, 2580
- 2585, 2590
- 2595, 2600
- 2605, 2610
- 2615, 2620
- 2625, 2630
- 2635, 2640
- 2645, 2650
- Cenex Harvest States Facility

Sources:
Aerial photo: U.S. Geological Survey, 2012.

N

0 150 300 600 Feet

Figure 3-1
Site Topography and Surface Drainage
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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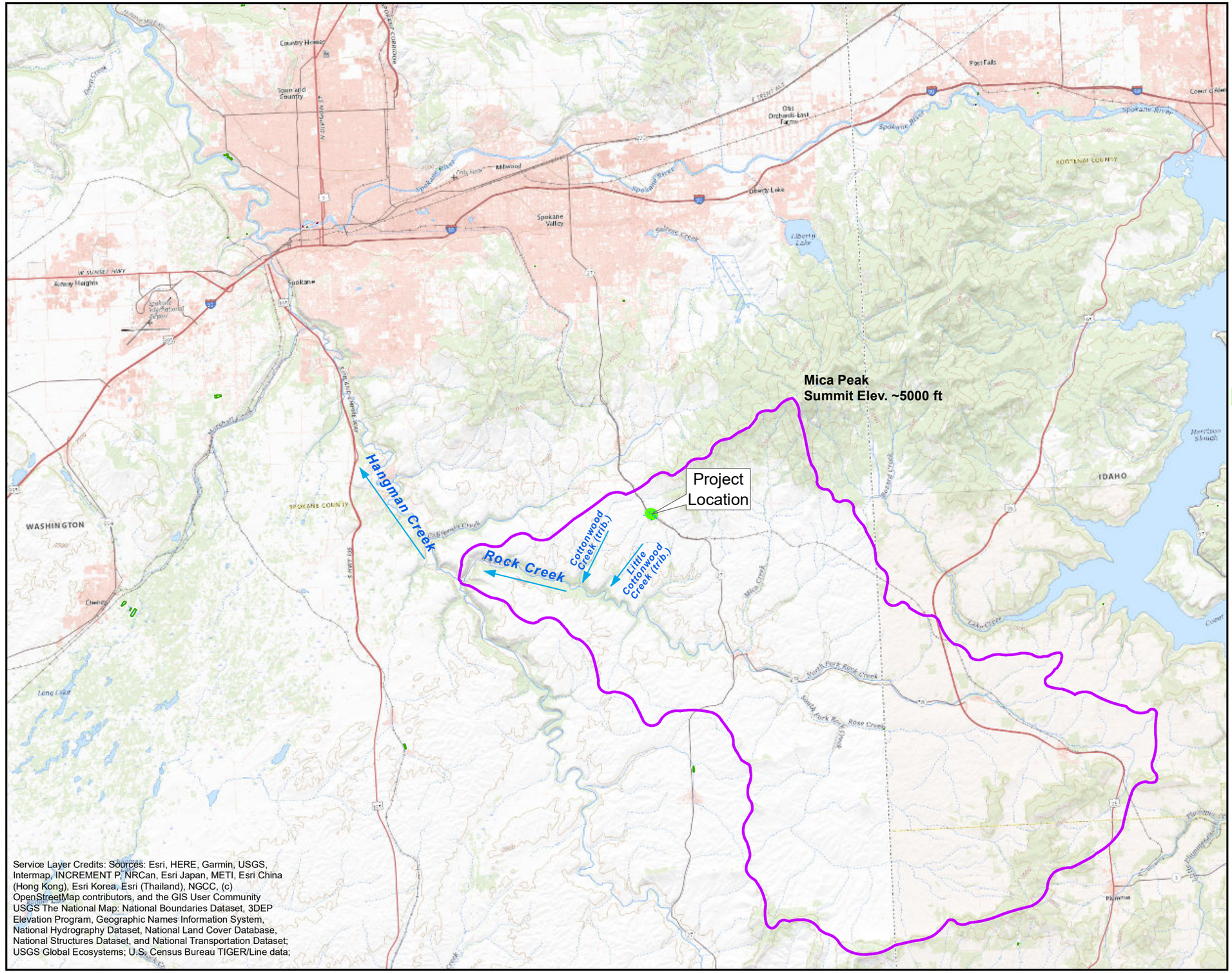

LEGEND

- Surface Water Flow Direction
- Rock Creek Subwatershed Boundary of Hangman Creek Watershed (approximated line taken from Buchanan Hydro Report)
- Cenex Harvest States Facility

N

0 10,000 20,000 40,000 Feet

Figure 3-2
Regional Topography, Physiographic Features, and Watershed Boundaries
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman, Freeman, Washington

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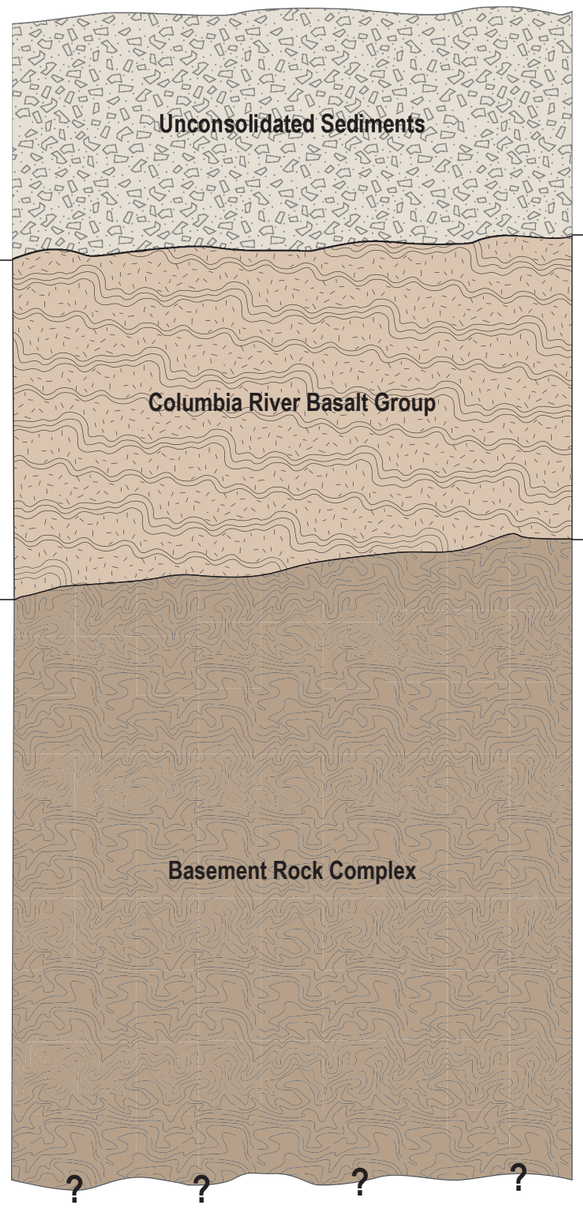
GEOLOGIC UNITS & AGE	GENERALIZED STRATIGRAPHY	TYPICAL THICKNESS OF GENERALIZED UNITS *(in vicinity of GHFF site)*	AQUIFER TYPE/GROUNDWATER FLOW CHARACTERISTICS/AND-OR TYPICAL YIELD *(for wells completed in each unit, etc)*
Quaternary Sediments: • Post Glacial Deposits (alluvium) • Glacial Flood Deposits (high energy sand & gravel; low energy silt & clay) • Eolian (wind blown loess) – Palouse Formation		• Range of 10-85 feet • Typical thickess of ~40-60 ft	• Permeability of fine-grained loess (silt-clay) is relatively low; theoretical/book values in range of 0.001 to 1 feet per day. • Generally considered an unproductive zone for water wells as the units beneath are targets for public and domestic wells; none of the well logs in Ecology's database are screened in this upper zone.

Tertiary Volcanic Rocks and Sedimentary Interbeds:
• Columbia River Basalt Group:
  • Wanapum Formation
  • Grande Ronde Formation
• Latah Formation – fine grained interbeds
		• Highly variable – thickens to southwest
		• Ranges from 0 (not present) to over 350 feet in areas south of GHFF site.
			• Higher K found in fractured zones typically between flows.
			• Aquifer type characterized as confined to semi-confined.
			• Moderate to high well yield reported at up to 1,500 gpm (HCI); and 10-1000 gpm (Buchanan 2003).

Pre-Tertiary Igneous and Metamorphic Rocks:
• Metamorphic:
  • Quartzite
  • Gneiss
• Igneous (intrusive):
  • Granite
		• Extensive – total depth unknown.
		• Inferred to be tens to hundreds of feet+ thick.
			• More permeable and saturated conditions occur in weathered zones.
			• Aquifer type characterized as confined to semi-confined.
			• Relatively low yield but suitable for domestic use; well yield reported at less than 10 gpm (Buchanan 2003).

Note: generalized stratigraphy and supporting information compiled from published sources as described in Section 4.1.1.

Figure 3-3
Generalized Stratigraphic Section
Remedial Investigation/Feasibilty Study Report
Grain Handling Facility at Freeman
Freeman, Washington

JACOBS

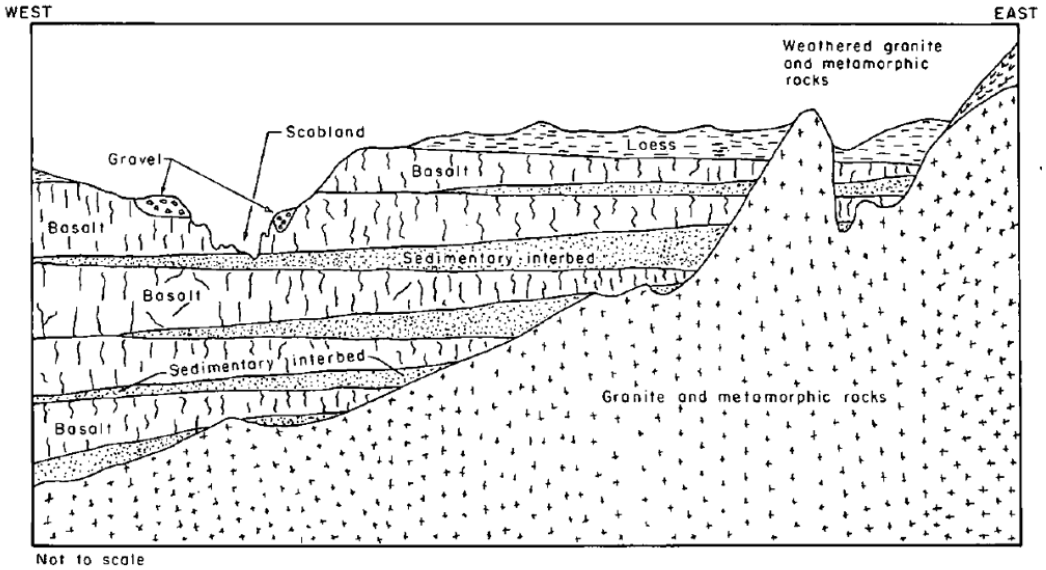


FIGURE A2.--Diagrammatic west-to-east geologic section through the Palouse River basin.

A.

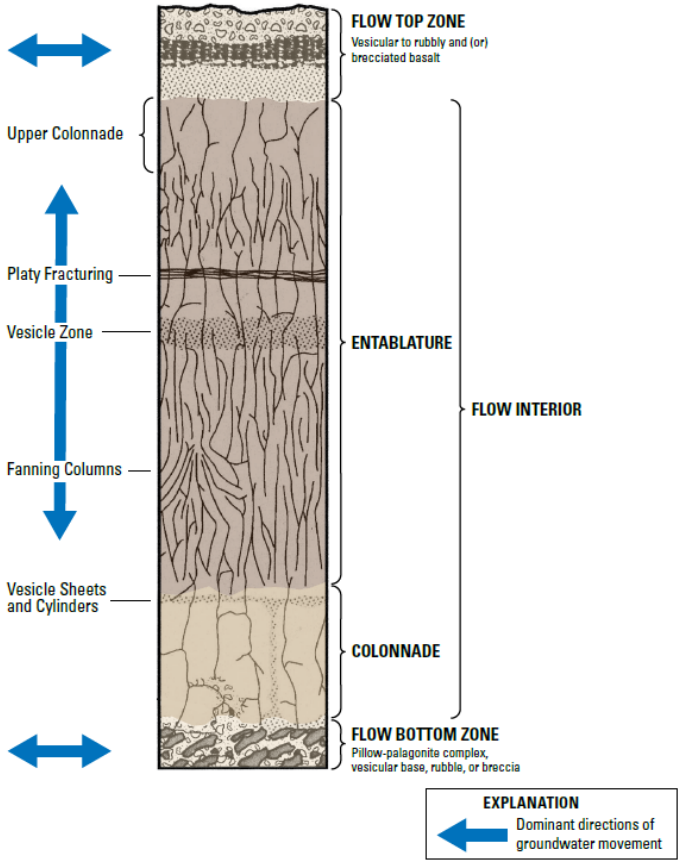


Figure 5. Features within a typical Columbia River Basalt Group flow. Modified from Vaccaro (1986) and Reidel and others (2002).

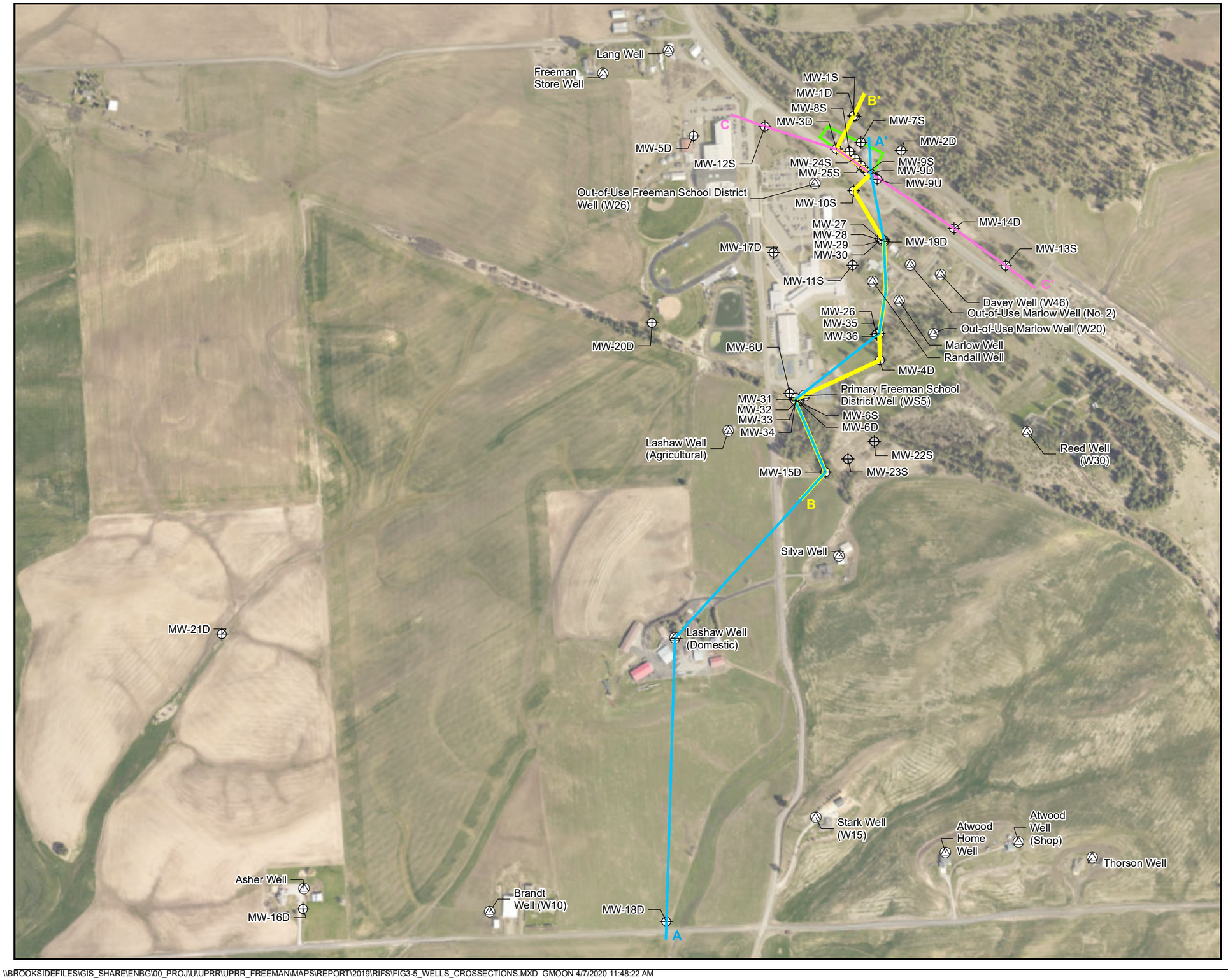
B.

Notes:

A. Figure A2 is taken from Water Supply Bulletin 39 (1975) and depicts a cross section through the Palouse River Basin that is remarkably similar to the geologic setting near Freeman.

B. Figure 5 depicts a typical basalt flow group illustrating the variations in basalt texture and dominant groundwater pathways in different zones.

Figure 3-4
Typical Basalt Flow Detail
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman Freeman, Washington



LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman

Cross Sections

- A-A'
- B-B'
- C-C'

Notes:
Greyed out wells have been decomissioned.

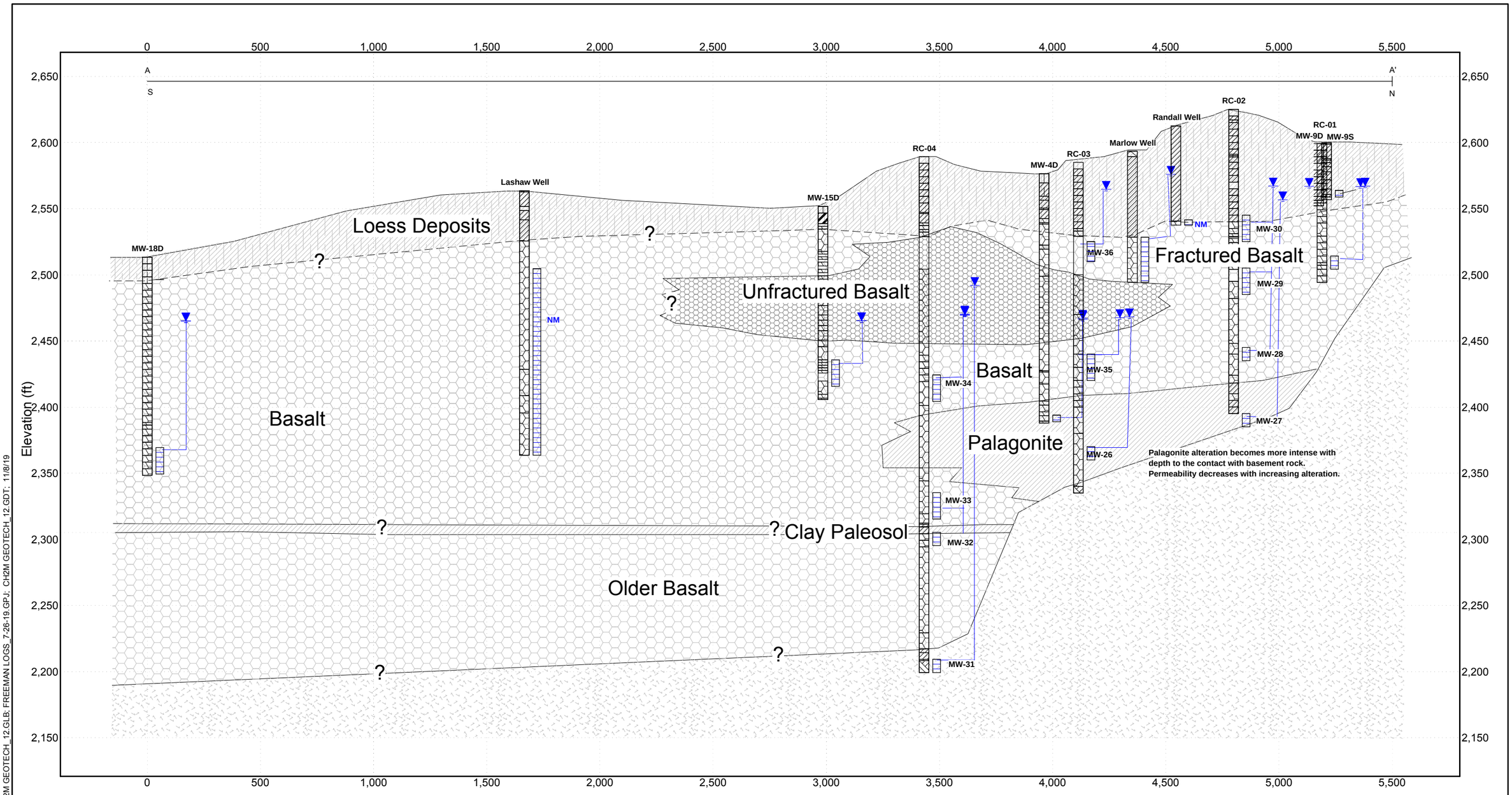
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

N

0 350 700 1,400 Feet

Figure 3-5
Well Location Map and Cross-Section Locations
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS



VERTICAL SCALE: 1" = 73.0'
HORIZONTAL SCALE: 1" = 426.4'

11X17 STICK LOG WITH LEGEND; DRAFT CH2M GEOTECH_12.GLB; FREEMAN LOGS_7-26-19.GPJ; CH2M GEOTECH_12.GDT; 11/8/19

JACOBS™

LITHOLOGY GRAPHICS

- Organic Clay or Silt
- BR-Lean Clay
- Well-Graded Sand
- Basalt
- Silt
- Fat Clay
- Well-Graded Sand with Silt
- Poorly Graded Sand with Silt
- BR-Lean Clay
- Clayey Sand
- Clayey Gravel
- Poorly Graded Sand
- Bedrock

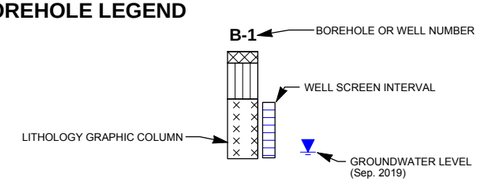
LEGEND

- – – – – Inferred Geologic Contact

Note:
Ground surface shown is connected between boring logs and does not represent actual surface topography on the section line; refer to Figures 3-1 and 3-2 for surface topography.

NM Not Measured

BOREHOLE LEGEND



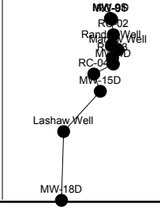
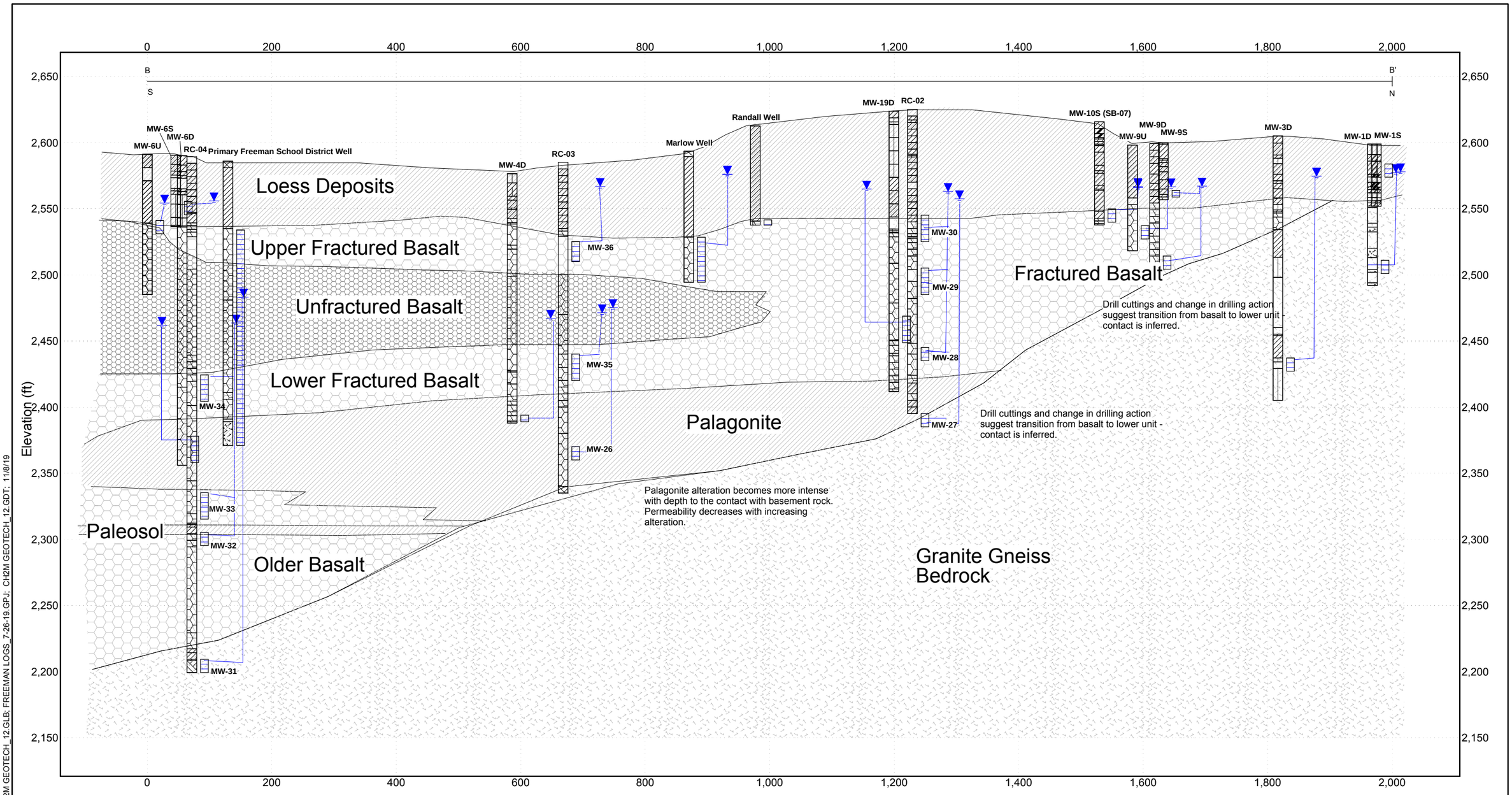


Figure 3-6
Generalized Hydrogeological Cross Section, A-A' (North to South)
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

Project Number: 661508



VERTICAL SCALE: 1" = 73.0'
HORIZONTAL SCALE: 1" = 155.0'

11X17 STICK LOG WITH LEGEND; DRAFT CH2M GEOTECH_12.GLB; FREEMAN LOGS_7-26-19.GPJ; CH2M GEOTECH_12.GDT; 11/8/19

JACOBS™

LITHOLOGY GRAPHICS

- Organic Clay or Silt
- BR-Lean Clay
- Well-Graded Sand
- Basalt
- Silt
- Fat Clay
- Well-Graded Sand with Silt
- Poorly Graded Sand with Silt
- BR-Lean Clay
- Clayey Sand
- Clayey Gravel
- Poorly Graded Sand
- Bedrock

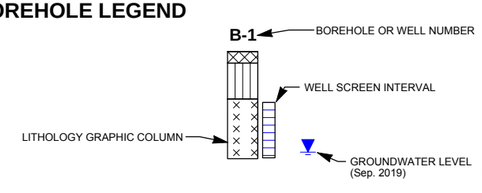
LEGEND

- – – – – Inferred Geologic Contact

Note:
Ground surface shown is connected between boring logs and does not represent actual surface topography on the section line; refer to Figures 3-1 and 3-2 for surface topography.

NM Not Measured

BOREHOLE LEGEND



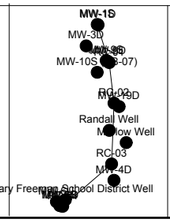
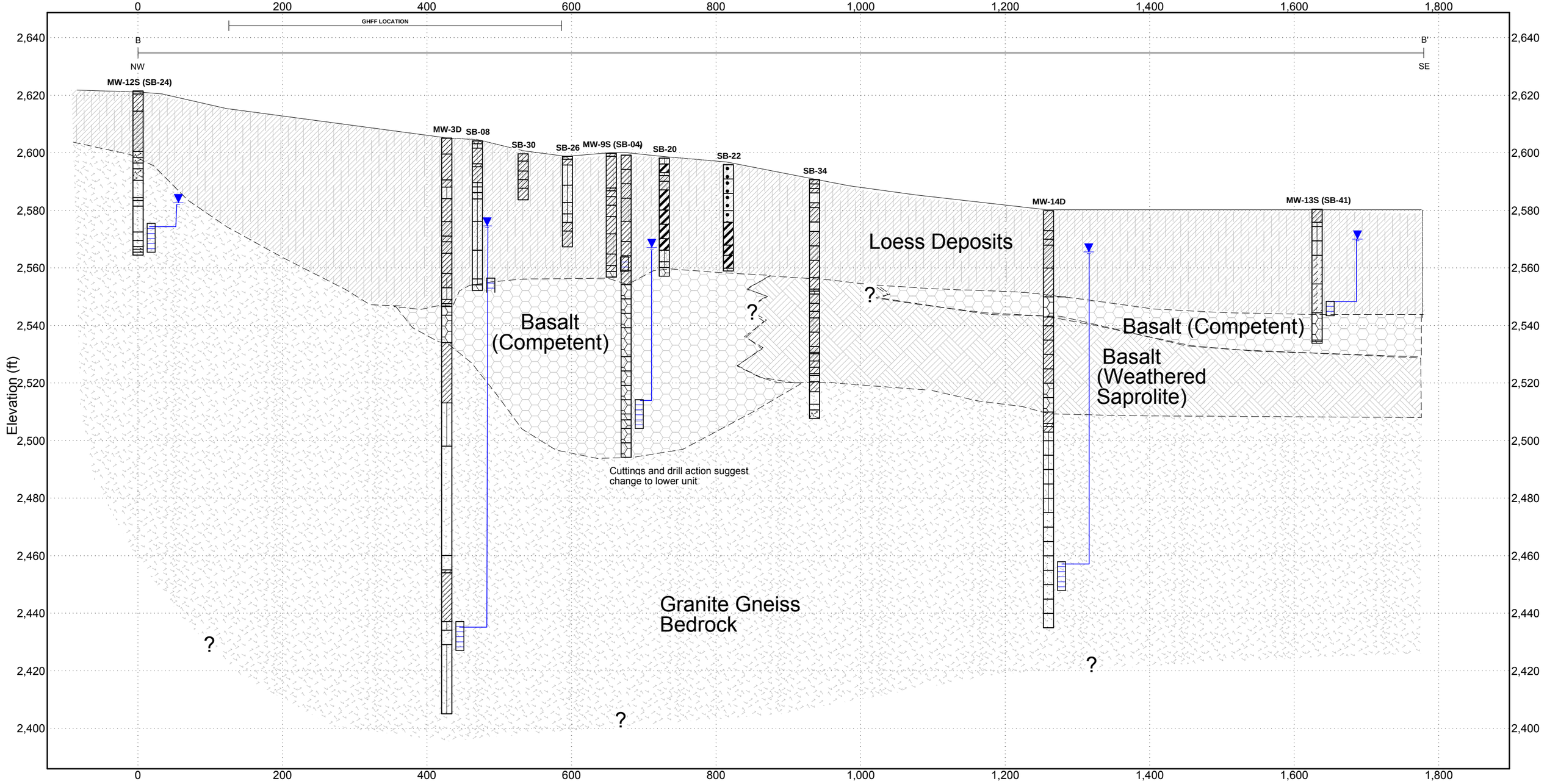


Figure 3-7
Generalized Hydrogeological Cross Section, B-B' (North to South)
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

Project Number: 661508



VERTICAL SCALE: 1" = 35.0'
HORIZONTAL SCALE: 1" = 139.5'

11X17 STICK LOG WITH LEGEND; DRAFT CH2M GEOTECH_12.GLB; FREEMAN LOGS_2-20-18.GPJ; CH2M GEOTECH_12.GDT; 3/15/18

JACOBS™

LITHOLOGY GRAPHICS

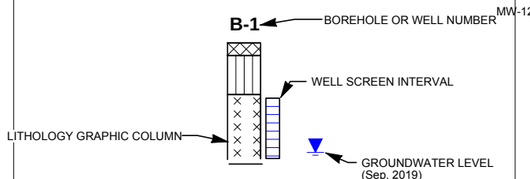
- Organic Clay or Silt
- BR-Lean Clay
- Well-Graded Sand
- Basalt
- Fat Clay
- Silt
- Well-Graded Sand with Silt
- Poorly Graded Sand with Silt
- Silty Sand
- BR-Lean Clay
- Lean Clay with Silt
- Granite
- Sandstone
- Poorly Graded Sand
- Clayey Sand
- Clayey Gravel
- Fill (made ground)
- Weathered Basalt (Saprolite)

LEGEND

– – – – – Inferred Geologic Contact

Note:
Ground surface shown is connected between boring logs and does not represent actual surface topography on the section line; refer to Figures 3-1 and 3-2 for surface topography.

BOREHOLE LEGEND



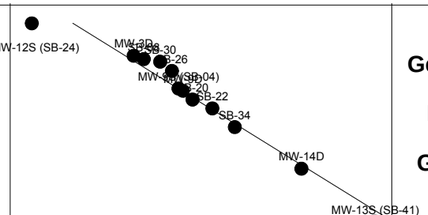


Figure 3-8
Generalized Hydrogeological Cross Section, C-C' (NW to SE)
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

Project Number: 661508

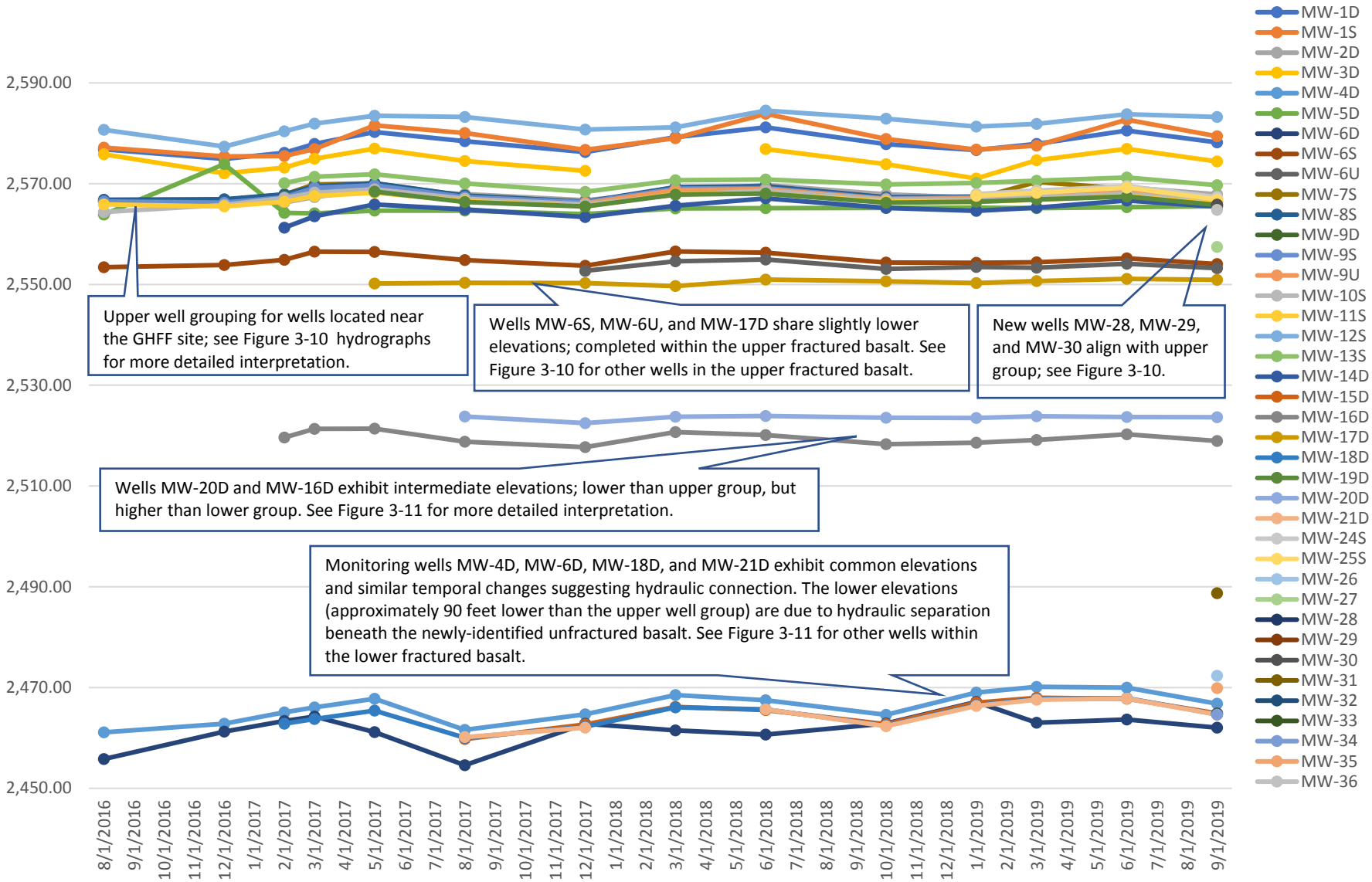


Figure 3-9
Groundwater Elevation Hydrographs, All Remedial Investigation Wells
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

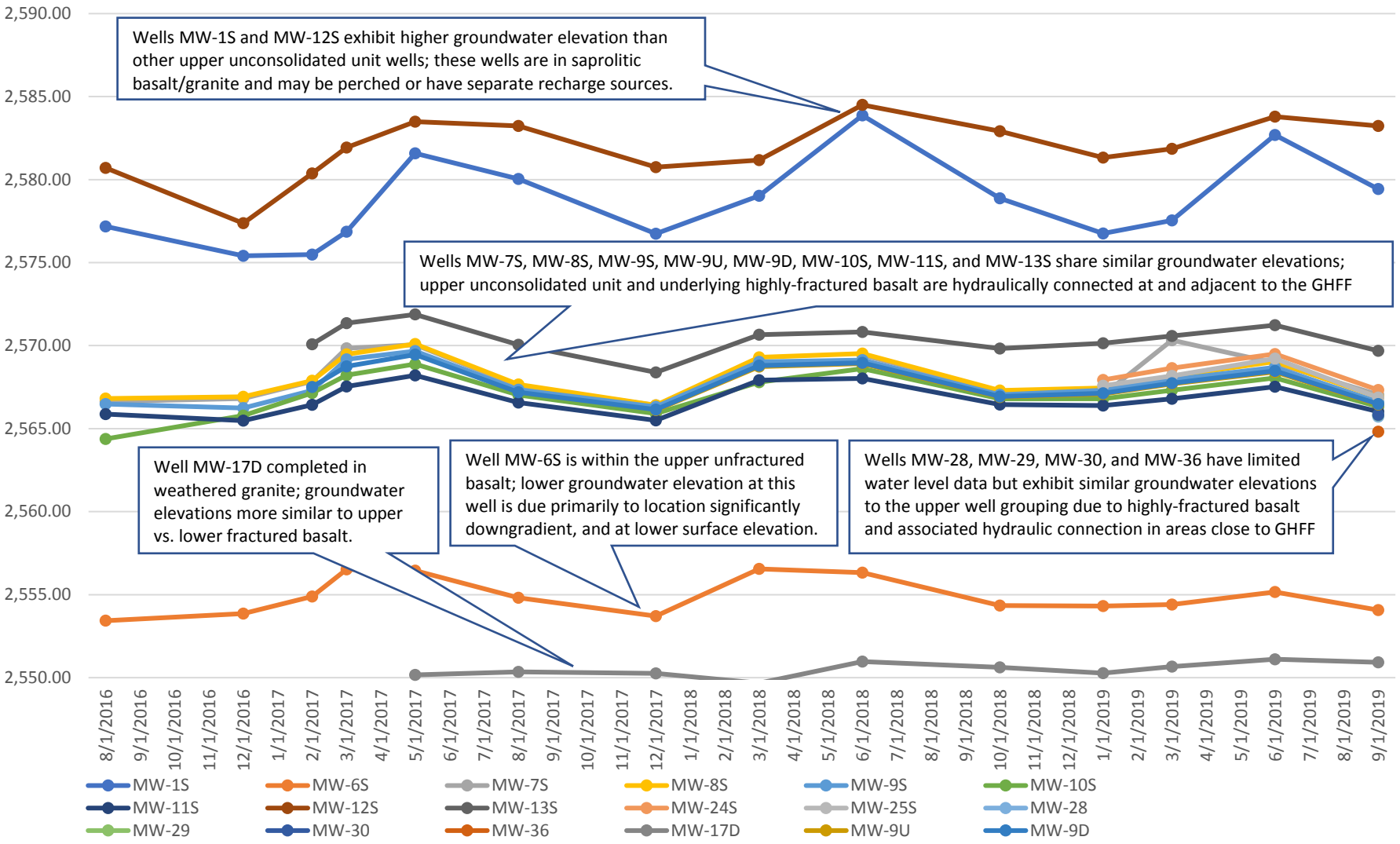


Figure 3-10
Groundwater Elevation Hydrographs, Upper Well Grouping
Remedial Investigation/Feasibility Study Report *Grain Handling Facility at Freeman*

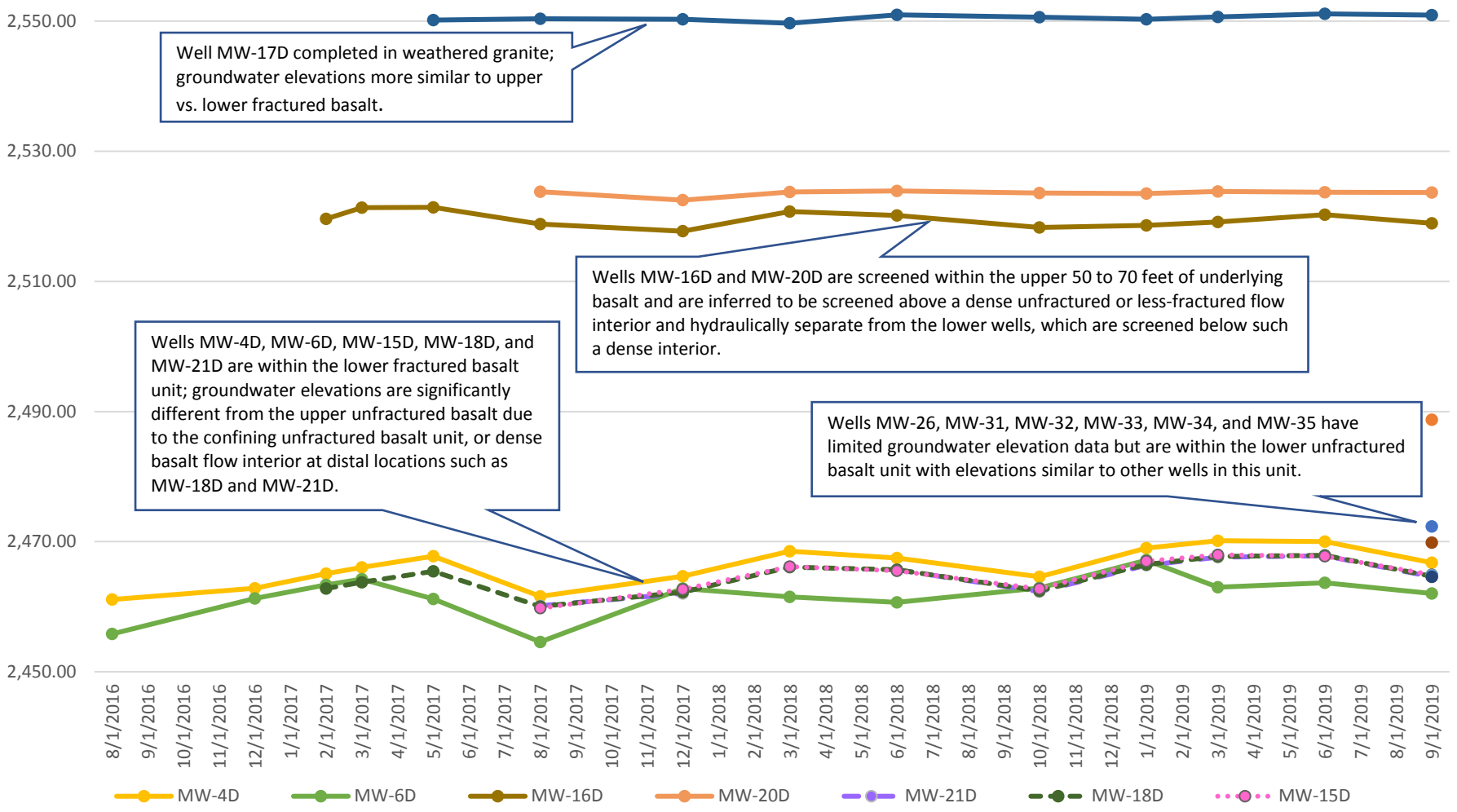


Figure 3-11
Groundwater Elevation Hydrographs, Lower Well Grouping
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

LEGEND

- Monitoring Well
- Abandoned Monitoring Well
- Groundwater Elevation (feet above MSL)
- Groundwater Flow Direction
- Grain Handling Facility at Freeman

MW-8S Well ID
2566.4 Groundwater Elevation

Notes:
1. Groundwater elevations near each well represent measurements from September 2019.
2. Wells grouped in this category include upper unconsolidated and basalt units inferred to be in hydraulic connection near GHFF.
3. See separate map for wells south of 6s/6dwell pair.
4. Wells in grey text not used for contouring.
5. MW-22s and MW-23s were decommissioned due to artesian conditions.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

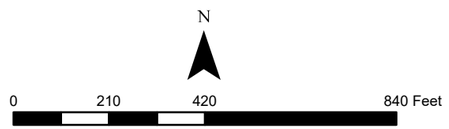


Figure 3-12
Inferred Groundwater Elevation Contours and Flow Map for Upper Unconsolidated Sediment and Basalt Unit
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS

LEGEND

- Inferred Lower Fractured Basalt Monitoring Well
- Inferred Upper Fractured Basalt Monitoring Well
- Monitoring Well
- Domestic Well
- Stream Gauge
- Groundwater flow direction (lower fractured basalt unit, see note 6)
- Groundwater flow direction (inferred transition zone)
- Grain Handling Facility at Freeman

MW-8S Well ID
2566.4 Groundwater Elevation

Note
1. MW-22s and MW-23s were decommissioned due to artesian conditions.
2. Davey, Brandt and Freeman Store wells are not included in the GW monitoring program.
3. Groundwater elevations near each well represent measurements from September 2019.
4. Wells shown in blue are within the lower fractured basalt unit south of transition zone where an unfractured basalt separates the upper and lower fractured basalt units. The lower fractured basalt unit becomes more confined.
5. Wells MW-20D and MW-16D exhibit uncharacteristically high elevations to be grouped or included in the “lower fractured basalt unit” –well screen depth below top of basalt is relatively shallow and suggests they should be categorized as “upper fractured basalt”.
6. Groundwater elevations from MW-4D, MW-6D, MW-15D, MW-18D, and MW-21D suggest general GW flow direction in lower fractured basalt unit shifting to more west-southwest direction in this area, which would be consistent with the regional setting/watershed characteristics. Need more data in southern locations to prove this hypothesis.

N

0 335 670 1,340 Feet

Figure 3-13
Groundwater Elevations and Conceptualized Flow for Area South/Southwest of Site
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS

LEGEND

- Monitoring Well
- Abandoned Monitoring Well
- Groundwater Elevation (feet above MSL)
- Groundwater Flow Direction
- Grain Handling Facility at Freeman

MW-8S Well ID
2566.4 Groundwater Elevation

Notes:
1. Groundwater elevations near each well represent measurements from September 2019
2. Wells grouped in this category include lower decomposed/weathered granite near GHFF assumed to be in hydraulic connection.
3. Wells in grey text not used for contouring.
4. MW-22S and MW-23S were decommissioned due to artesian conditions.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 245 490 980 Feet

Figure 3-14
Inferred Groundwater Elevation Contours and Flow Map for Lower Decomposed/Weathered Granite Unit
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman, Freeman, Washington

JACOBS

LEGEND

- Soil Boring
- Monitoring Well
- Domestic Well
- Horizontal Boring Location
- Pothole Location
- Sub Slab Locations
- Excavation Location
- Horizontal Boring (HB)
- Grain Handling Facility at Freeman

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 25 50 100 Feet

Figure 4-1
Soil Sample Locations
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS

LEGEND

- Sub-Slab Soil
- Monitoring Well
- Domestic Well
- Excavation Area
- Grain Handling Facility at Freeman
- Access Tunnel

SV-113 ← Location ID
SO: ND (0.55) (03/30/18, 0) FD ← Sample Type Field Duplicate
Depth (feet bgs)
Sample Date
Concentration
Matrix

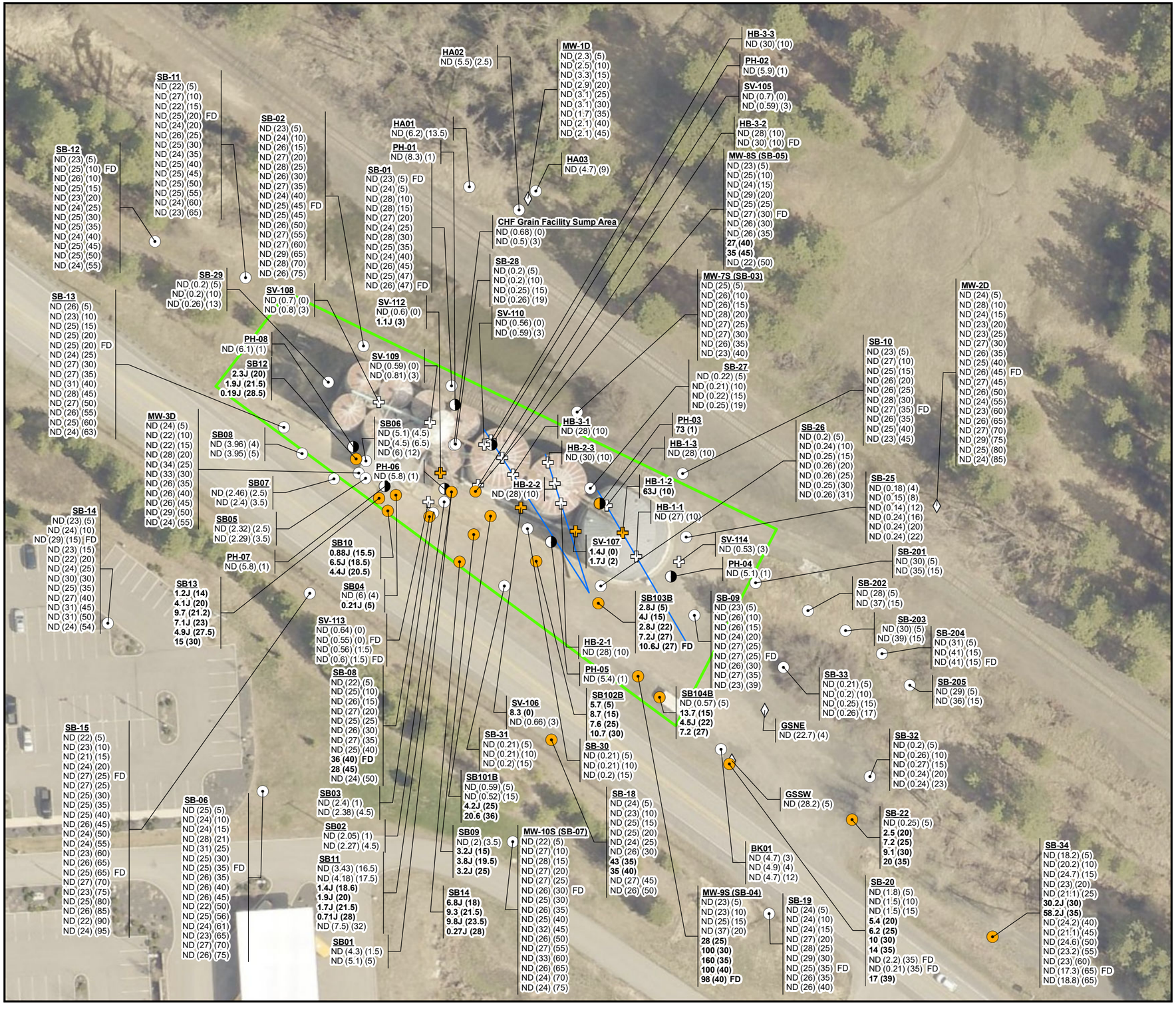
Notes:
Bold values indicate detected concentrations.
Soil concentrations are shown in micrograms per kilogram (µg/kg).
Soil vapor concentrations are shown in micrograms per cubic meter (µg/m^3).
ft bgs = feet below ground surface
ND (###) = Compound not detected at or above the adjusted method detection limit.
SO = Soil matrix
SV = Soil vapor matrix

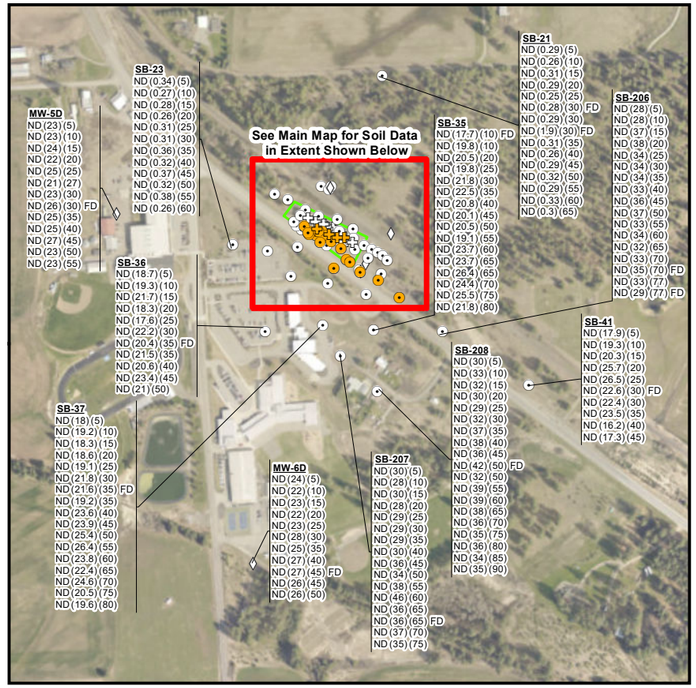
Sub-slab vapor sampling was attempted but unsuccessful from vapor probes installed at locations SV-106, SV-108, SV-109, and SV-110 due to either water entry to the Summa canister or to field conditions preventing vapor entry to the Summa canister (i.e., tight formation).

N
0 30 60 120 Feet

Figure 4-2
Carbon Tetrachloride in Sub-slab Soil and Soil Vapor Samples
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS





LEGEND

- Soil Boring Location
- Soil Excavation Location
- Sub-Slab Location
- Pothole Location
- Location With At Least One Detected Concentration
- Horizontal Boring (HB)
- Grain Handling Facility at Freeman

Notes:
Bold values indicate detected concentrations
µg/kg = micrograms per kilogram
ft bgs = feet below ground surface
J = Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
<### = Compound not detected at or above the adjusted method detection limit.
Screening level value = 14,300 µg/kg

Sample Location ID — **SB-22**
Carbon Tetrachloride Concentration (µg/kg) — ND (0.25) (5)
Soil Sample Depth (ft bgs)

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

N

0 37.5 75 150 Feet

Figure 4-3
Carbon Tetrachloride in Soil Samples
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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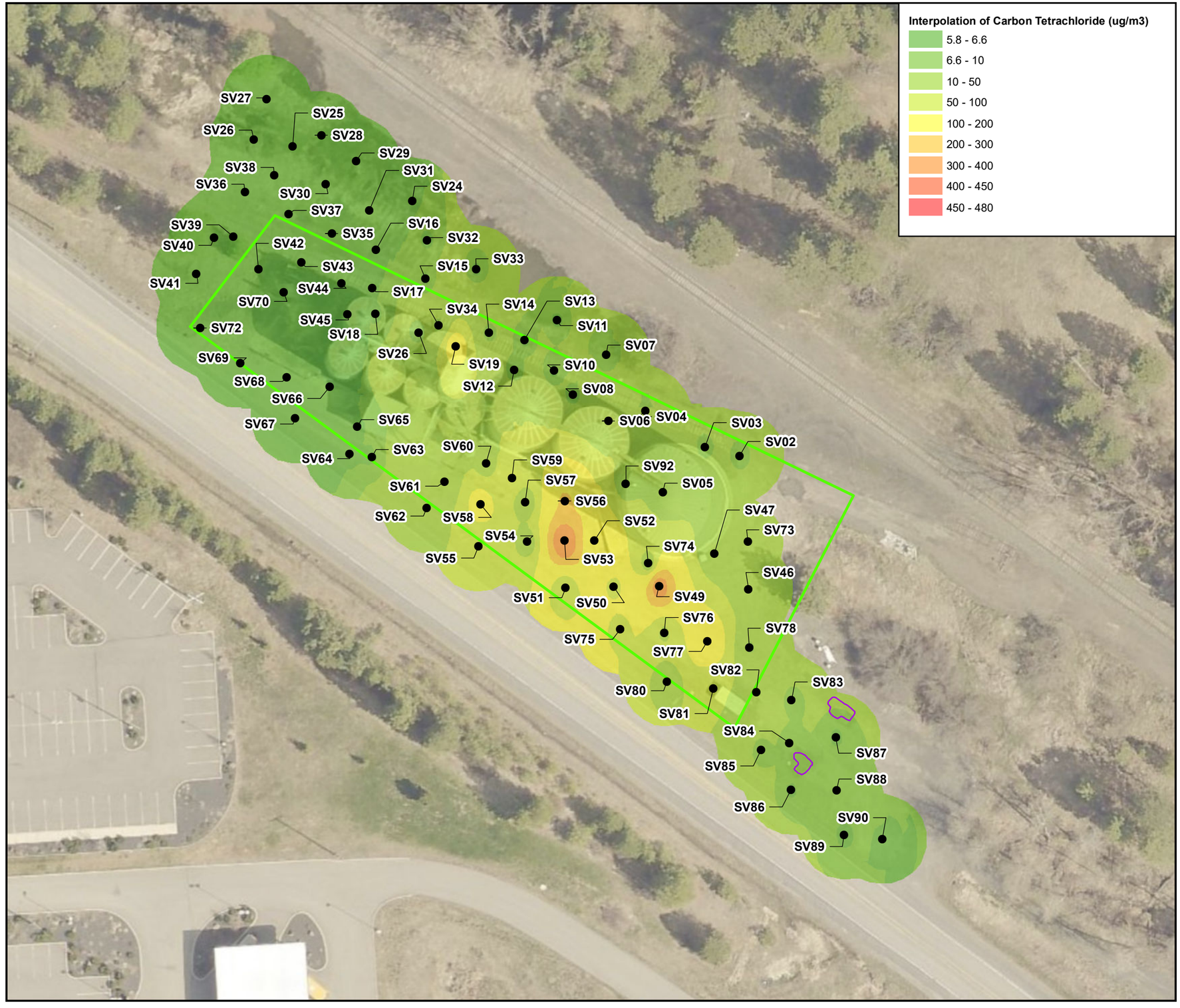

Interpolation of Carbon Tetrachloride (ug/m3)

- 5.8 - 6.6
- 6.6 - 10
- 10 - 50
- 50 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 450
- 450 - 480

LEGEND

- Passive Soil Gas Sampling Location (2017)
- Grain Handling Facility at Freeman
- Excavation Boundary

Notes:
ug/m3 = micrograms per cubic meter

The purpose of the excavation was to identify the subsurface anomaly detected during the geophysical survey.

N

0 30 60 120 Feet

Figure 4-4
Passive Soil Gas Survey Results
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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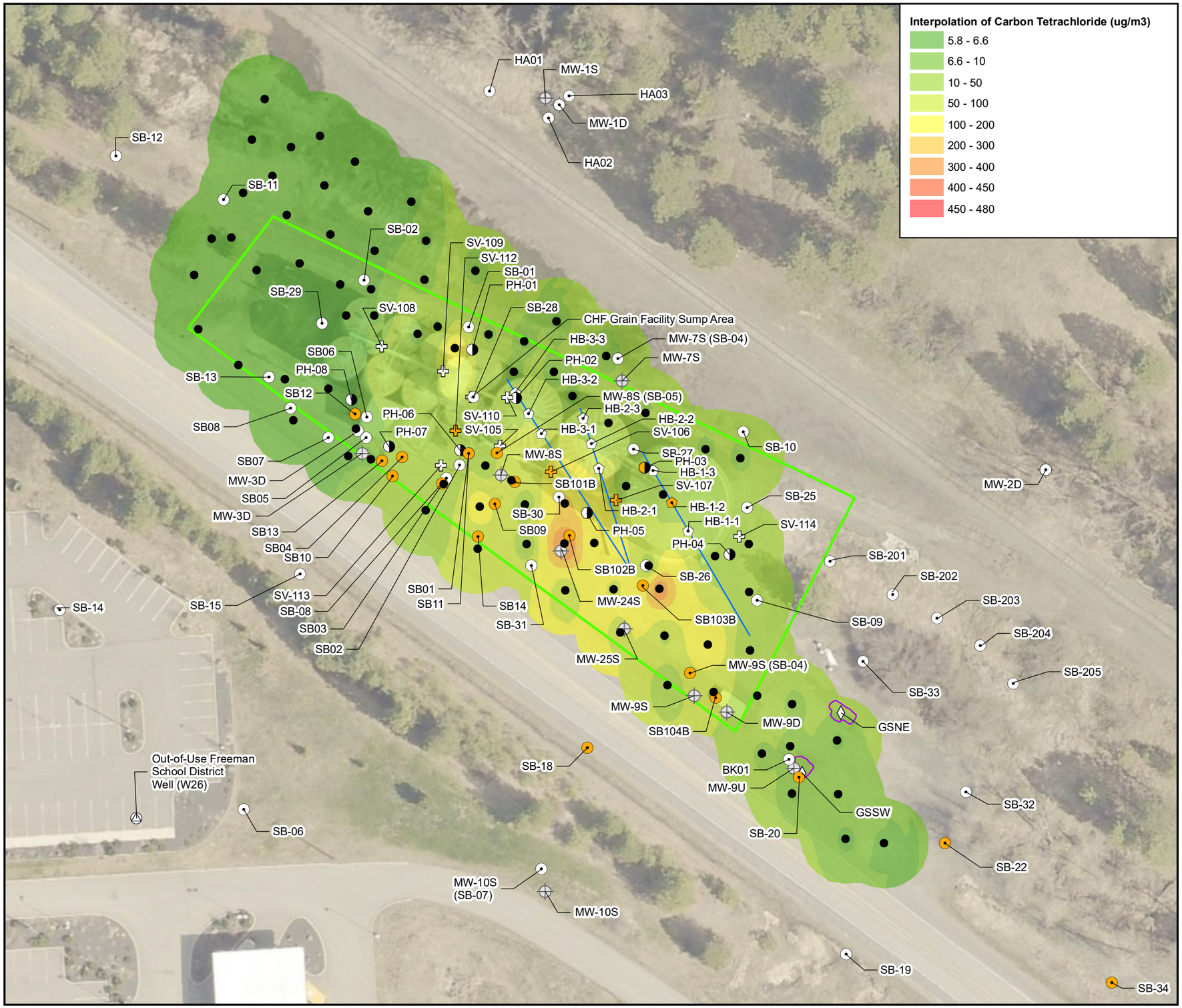

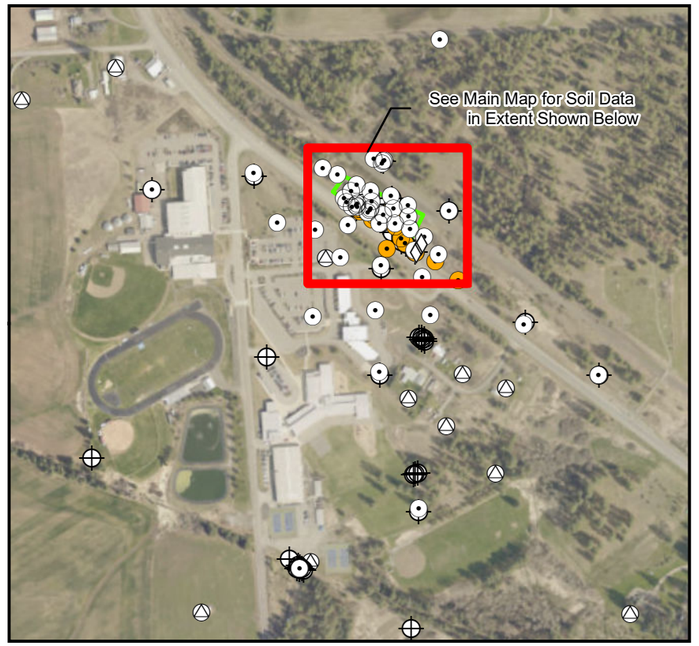

LEGEND

- Horizontal Soil Boring Location
- Pothole Location
- Sub-Slab Location
- Soil Excavation Location
- Soil Boring Location
- Monitoring Well
- Domestic Well
- Location With At Least One Detected Concentration
- Passive Soil Gas Sampling Location (2017)
- Horizontal Boring (HB)
- Grain Handling Facility at Freeman
- Excavation Boundary

Notes:
ug/m3 = micrograms per cubic meter

The purpose of the excavation was to identify the subsurface anomaly detected during the geophysical survey.

Some MWs (shown in light gray) are included for context only (no soil data collected).

N

0 30 60 120 Feet

Figure 4-5
Passive Soil Vapor Survey and Soil Sample Results
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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LEGEND

- Extraction Well
- Monitoring Well
- Domestic Well
- Stream Gauge
- Grain Handling Facility at Freeman

Note
1. EW-6U, EW-9U, MW-22s and MW-23s were decommissioned due to artesian conditions.
2. Davey, Brandt and Freeman Store wells are not included in the GW monitoring program.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 335 670 1,340 Feet

Figure 4-6
Well Locations/Groundwater Monitoring Network
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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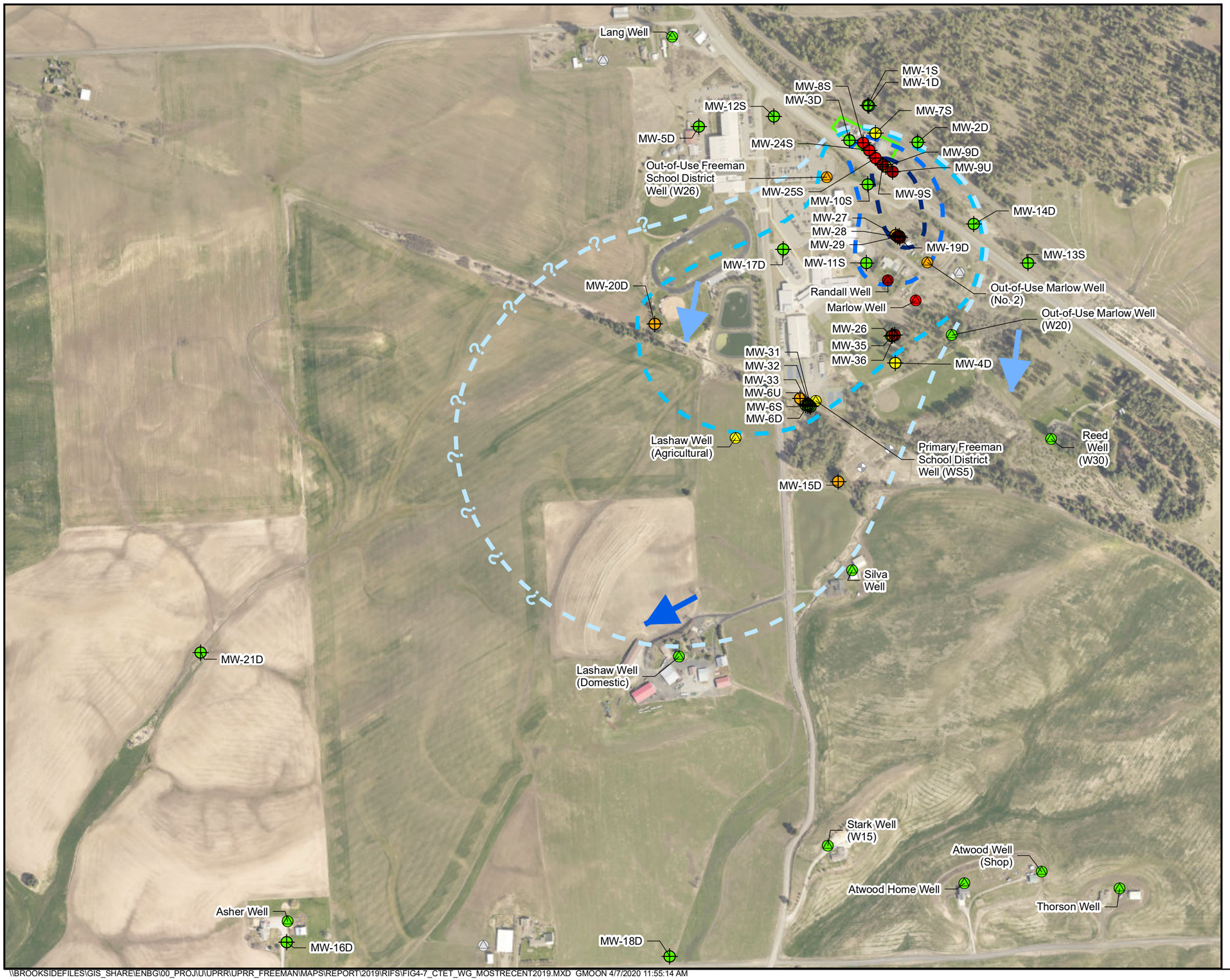

LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Groundwater flow direction (lower fractured basalt unit, see note 6)
- Groundwater flow direction (inferred transition zone)

Concentration Range

- <=0.625 ug/L
- >0.625 and <=5 ug/L
- >5 and <=100 ug/L
- >100 and <=200 ug/L
- >200 ug/L

Carbon Tetrachloride Concentration

(Contours shown for deeper fractured basalt)

- 0.625 ug/L ("?" indicates where inferred)
- 10 ug/L
- 100 ug/L
- 400 ug/L

Note

1. MW-22s and MW-23s were decommissioned due to artesian conditions.
2. Davey, Brandt and Freeman Store wells are not included in the GW monitoring program.
3. Groundwater concentration data shown on figure is from July to October 2019 with the following exceptions: MW-26 (May 2019), Atwood Home Well (June 2019) and Atwood Well (Shop) (June 2019).

N

0 335 670 1,340 Feet

Figure 4-7
Carbon Tetrachloride in Groundwater Samples from Wells
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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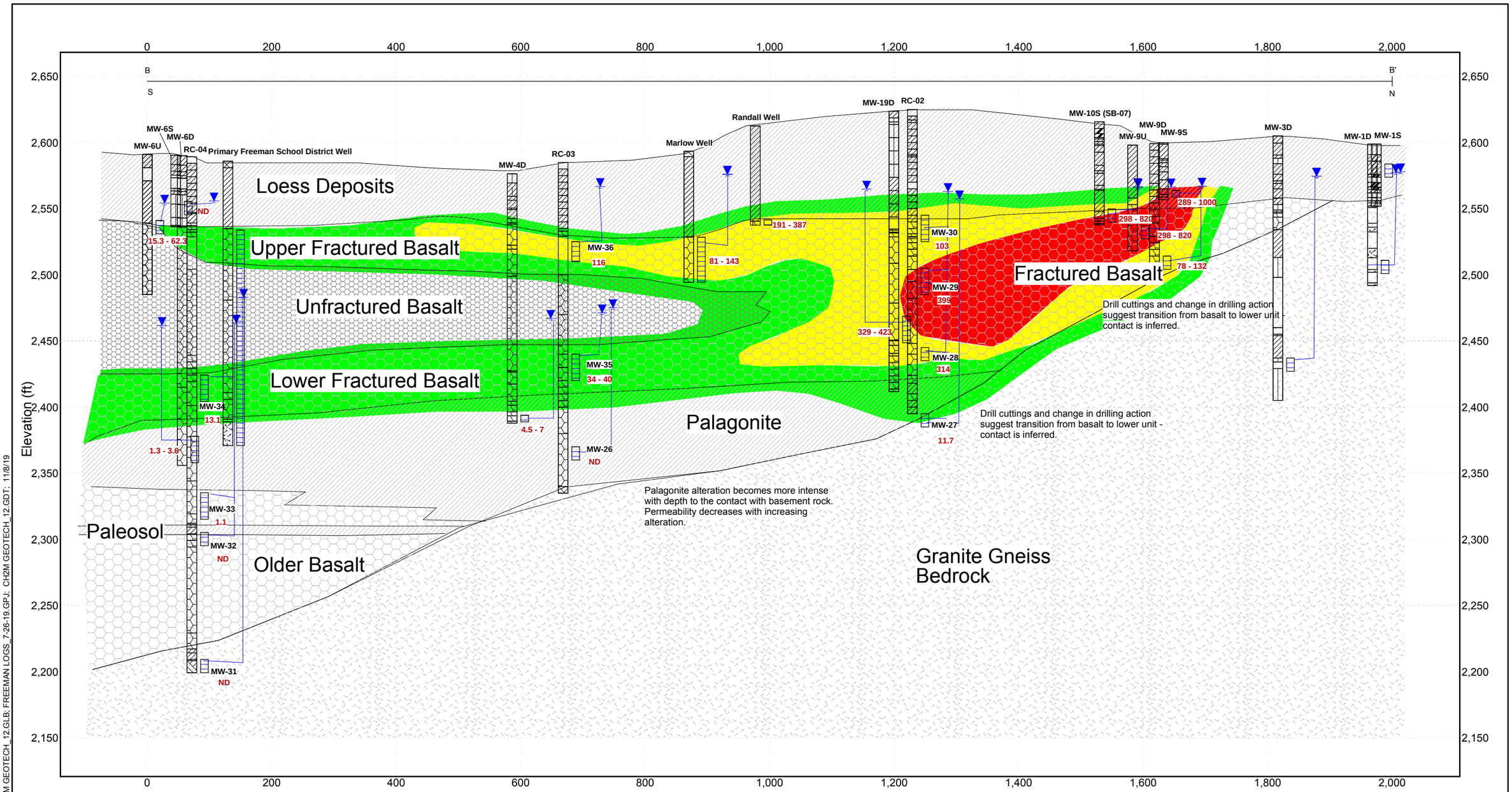

VERTICAL SCALE: 1" = 73.0'
HORIZONTAL SCALE: 1" = 155.0'

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LITHOLOGY GRAPHICS

- Organic Clay or Silt
- BR-Lean Clay
- Well-Graded Sand
- Basalt
- Silt
- Fat Clay
- Well-Graded Sand with Silt
- Poorly Graded Sand with Silt
- BR-Lean Clay
- Clayey Sand
- Clayey Gravel
- Poorly Graded Sand
- Bedrock

LEGEND

- Inferred Geologic Contact

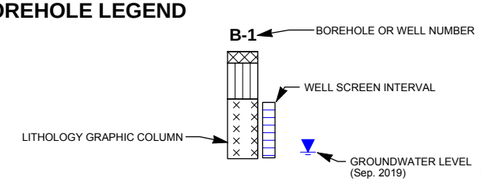
Note:
Ground surface shown is connected between boring logs and does not represent actual surface topography on the section line; refer to Figures 3-1 and 3-2 for surface topography.

NM Not Measured

1.1 Carbon Tetrachloride sampling results in ug/L

Carbon Tetrachloride Concentration
- >400 ug/L
- 100 - 400 ug/L
- 10 - 100 ug/L

BOREHOLE LEGEND



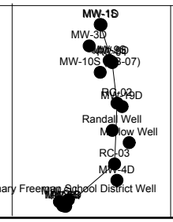


Figure 4-8
Generalized Hydrogeological Cross Section B-B' with Contaminant Plume (North to South)
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington
Project Number: 661508

11X17 STICK LOG WITH LEGEND; DRAFT CH2M GEOTECH_12.GLB; FREEMAN LOGS_7-26-19.GPJ; CH2M GEOTECH_12.GDT; 11/8/19

LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Groundwater flow direction (lower fractured basalt unit, see note 6)
- Groundwater flow direction (inferred transition zone)

MaxOfResult_0_val

- <=1.4 ug/L
- >1.4 and <=5 ug/L
- >5 and <=100 ug/L

Chloroform Concentration

(Contours shown for deeper fractured basalt)

- 1.4 ug/L
- 10 ug/L

Note

1. MW-22s and MW-23s were decommissioned due to artesian conditions.
2. Davey, Brandt and Freeman Store wells are not included in the GW monitoring program.
3. Groundwater concentration data shown on figure is from July to October 2019 with the following exceptions: MW-26 (May 2019), Atwood Home Well (June 2019) and Atwood Well (Shop) (June 2019).

N

0 335 670 1,340 Feet

Figure 4-9

Chloroform in Groundwater Samples from Wells

Remedial Investigation/Feasibility Study Report

Grain Handling Facility at Freeman,
Freeman, Washington

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LEGEND

- Surface Soil Sample
- Parcel Boundary
- Grain Handling Facility at Freeman

Sample Location ID — P0101-01
Carbon Tetrachloride Concentration (µg/kg) — ND (0.0028)

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

N

0 50 100 200 Feet

Figure 4-10
Residential Soil Sample Locations
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

\\BROOKSIDEFILES\GIS_SHARE\ENBG\00_PROJ\U\UPRR\UPRR_FREEMAN\MAPS\REPORT\2019\RIFS\FIG4-10_CTET_SS_RES.MXD GMOON 12/12/2019 8:00:38 PM

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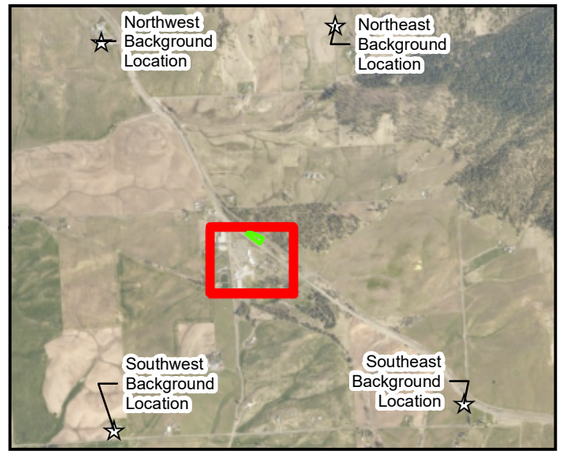

LEGEND

- Crawl Space
- Indoor Air
- Outdoor Air
- Soil Vapor
- Sub-slab Soil Vapor
- Background Air
- Grain Handling Facility at Freeman

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

N

0 95 190 380 Feet

Figure 4-11
Outdoor Air, Indoor Air, Indoor Crawl Space, Background Air, Sub-Slab Soil Vapor, and Soil Vapor Sampling Locations
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman, Freeman, Washington

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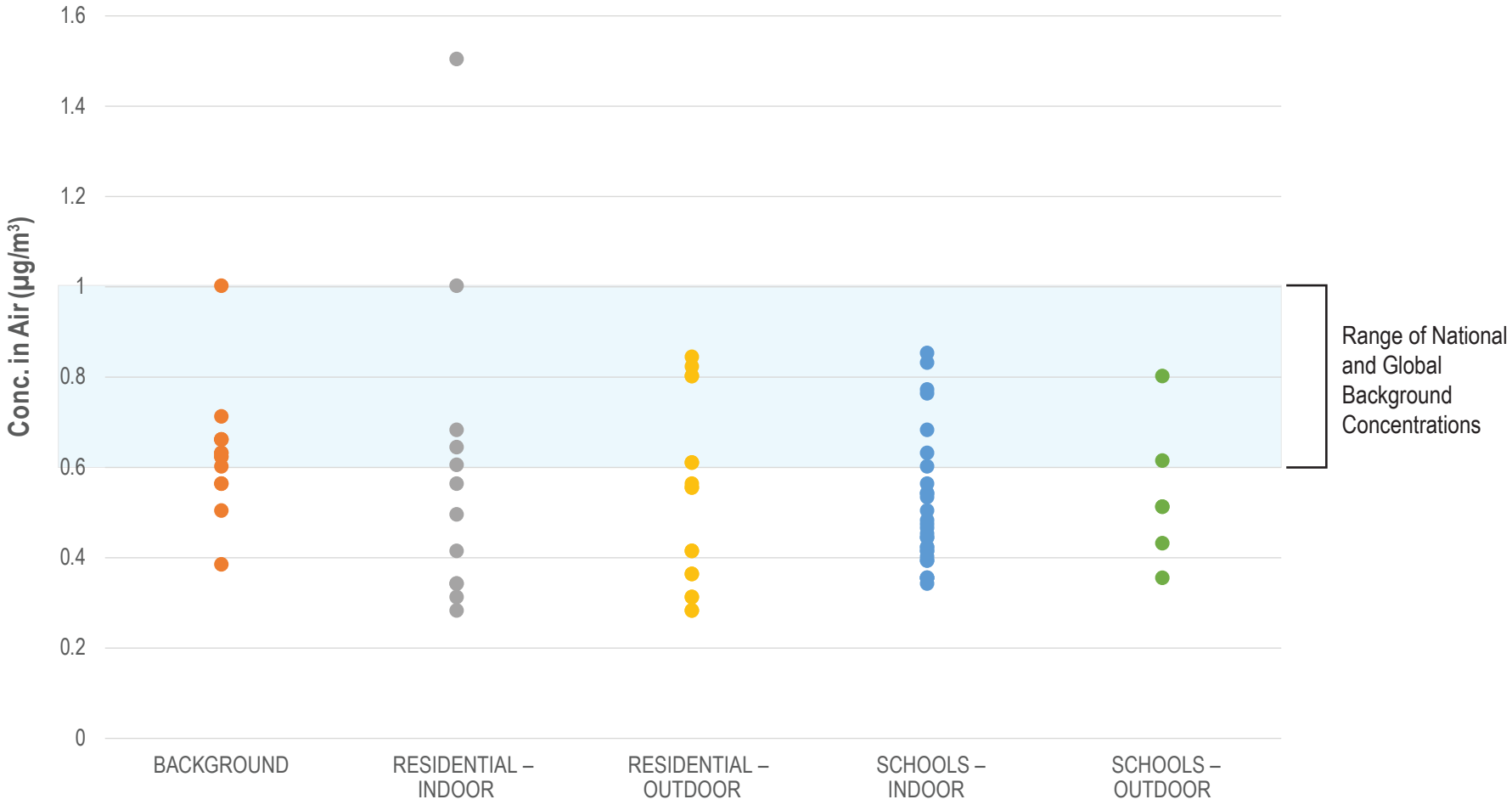

Figure 4-12
Comparison of Carbon Tetrachloride Concentrations in Air
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

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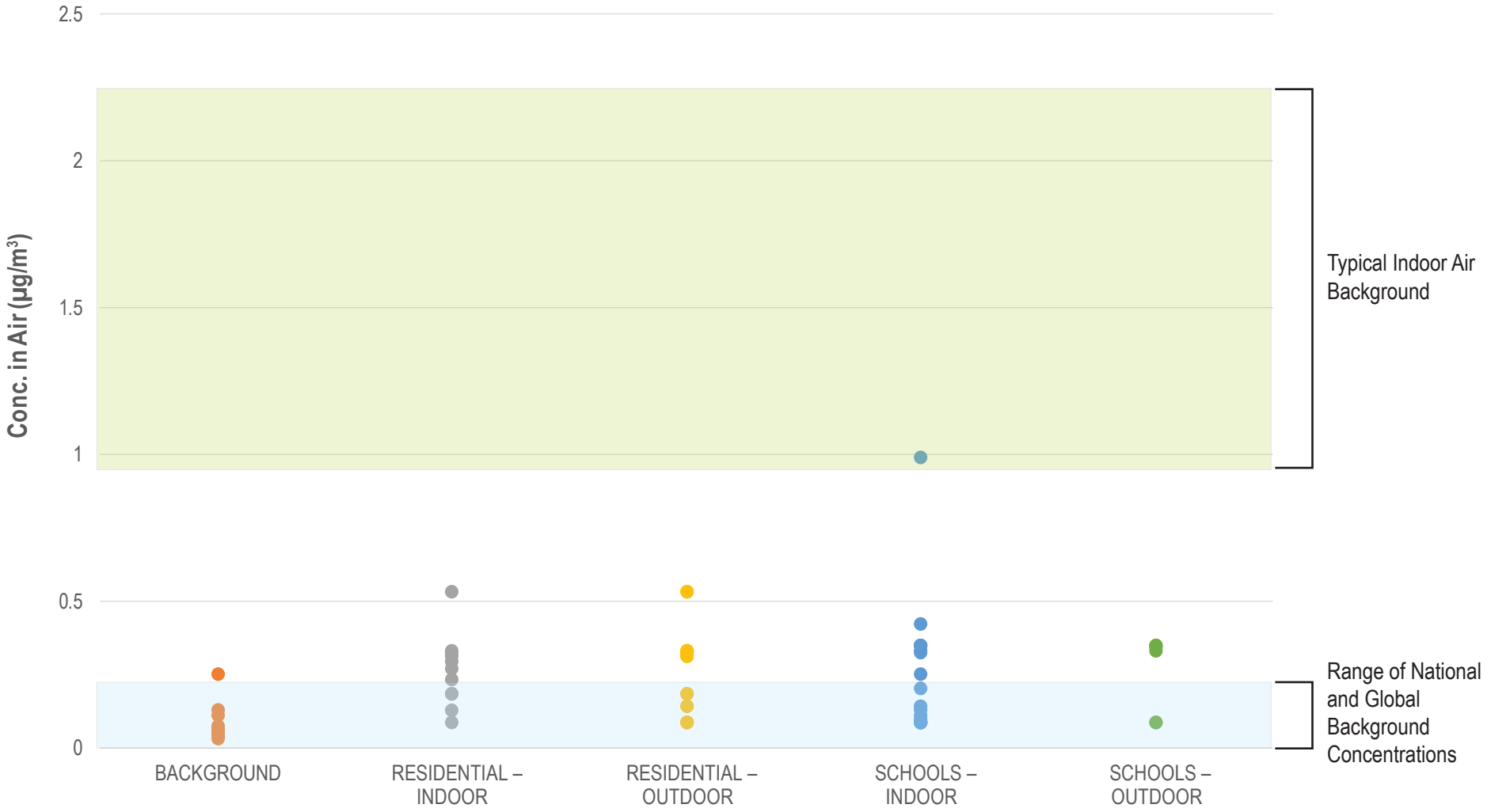
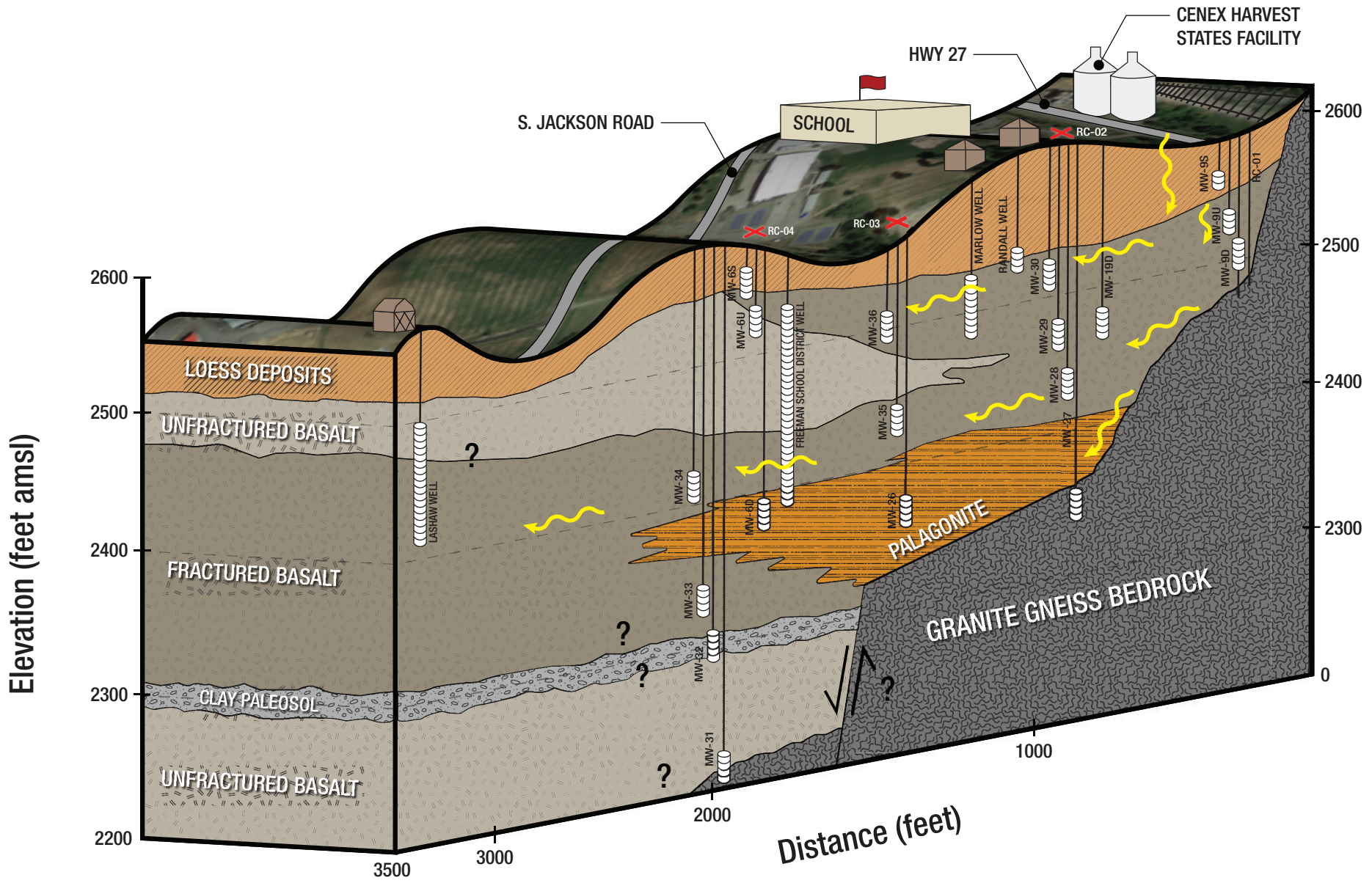


Figure 4-13
Comparison of Chloroform Concentrations in Air
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington



LEGEND

Inferred contaminant migration pathway

Figure 5-1
Conceptual Site Model
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

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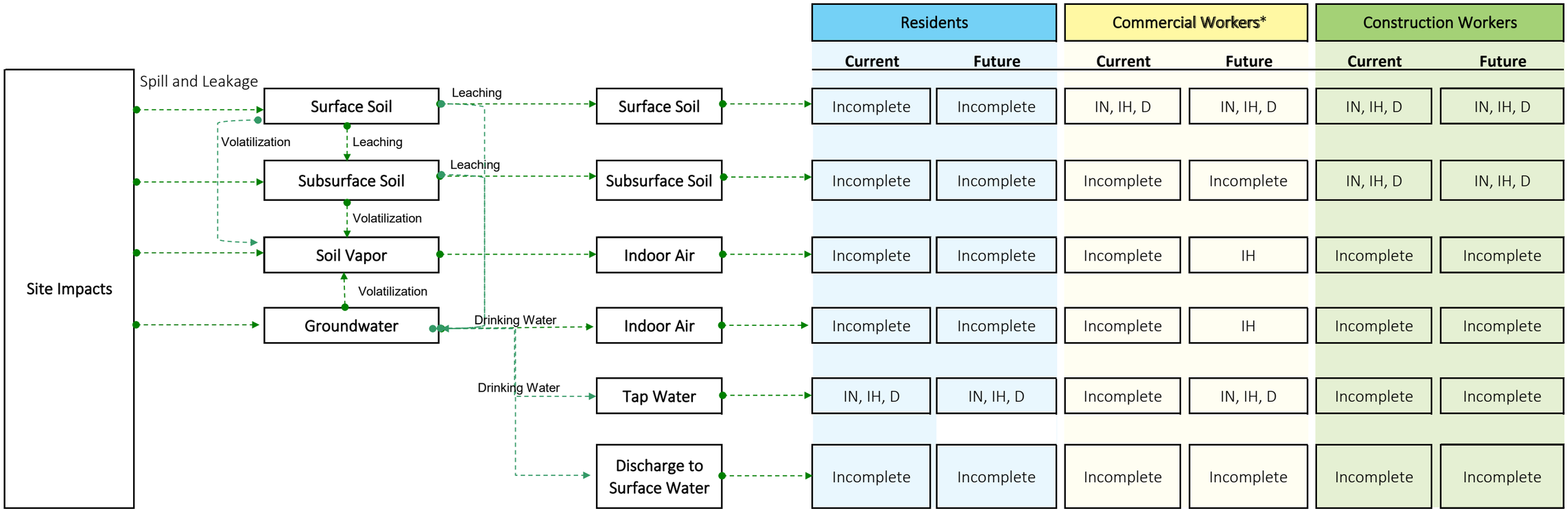
Primary Source	Primary Release Mechanism	Secondary Source / Secondary Release Mechanism	Exposure Media



	Residents		Commercial Workers*		Construction Workers	
	Current	Future	Current	Future	Current	Future
Surface Soil	Incomplete	Incomplete	IN, IH, D	IN, IH, D	IN, IH, D	IN, IH, D
Subsurface Soil	Incomplete	Incomplete	Incomplete	Incomplete	IN, IH, D	IN, IH, D
Indoor Air	Incomplete	Incomplete	Incomplete	IH	Incomplete	Incomplete
Indoor Air	Incomplete	Incomplete	Incomplete	IH	Incomplete	Incomplete
Tap Water	IN, IH, D	IN, IH, D	Incomplete	IN, IH, D	Incomplete	Incomplete
Discharge to Surface Water	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete

LEGEND

Complete or Potentially Complete Current or Future Transport Pathway Quantitatively

IN — Ingestion

IH — Inhalation

D — Dermal

* Commercial Workers includes Freeman School District students and employees and workers at the Site, where appropriate.

Figure 5-2
Conceptual Site Model for Screening Level Risk Evaluation – Potential Receptors and Exposure Pathways
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

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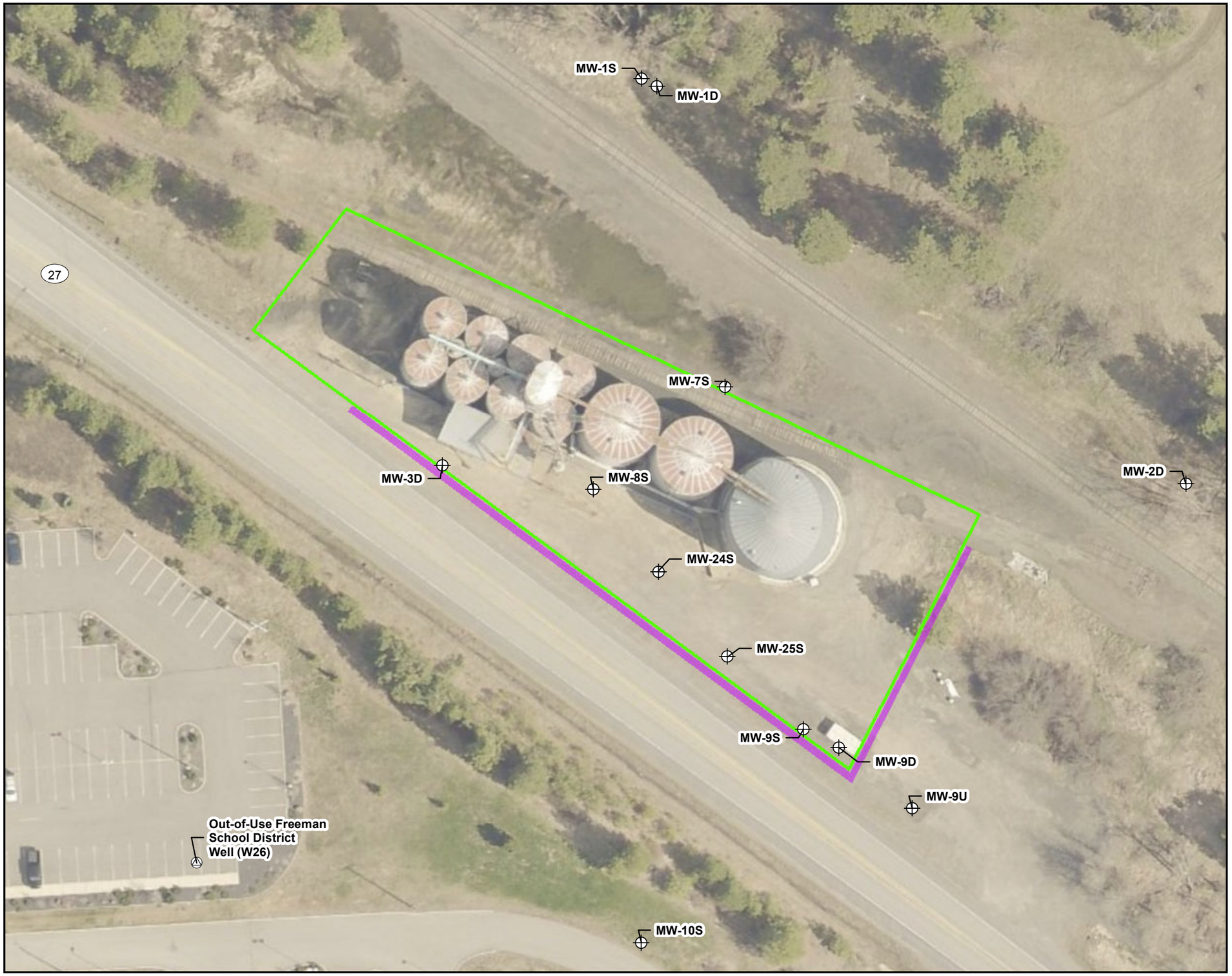

LEGEND

- Monitoring Well
- Domestic Well
- Proposed Permeable Adsorptive Barrier Alignment
- Grain Handling Facility at Freeman

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

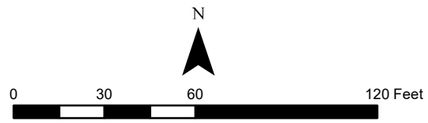

Figure 8-1
Alternative 1 Conceptual Layout – PAB Location
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman,
Freeman, Washington

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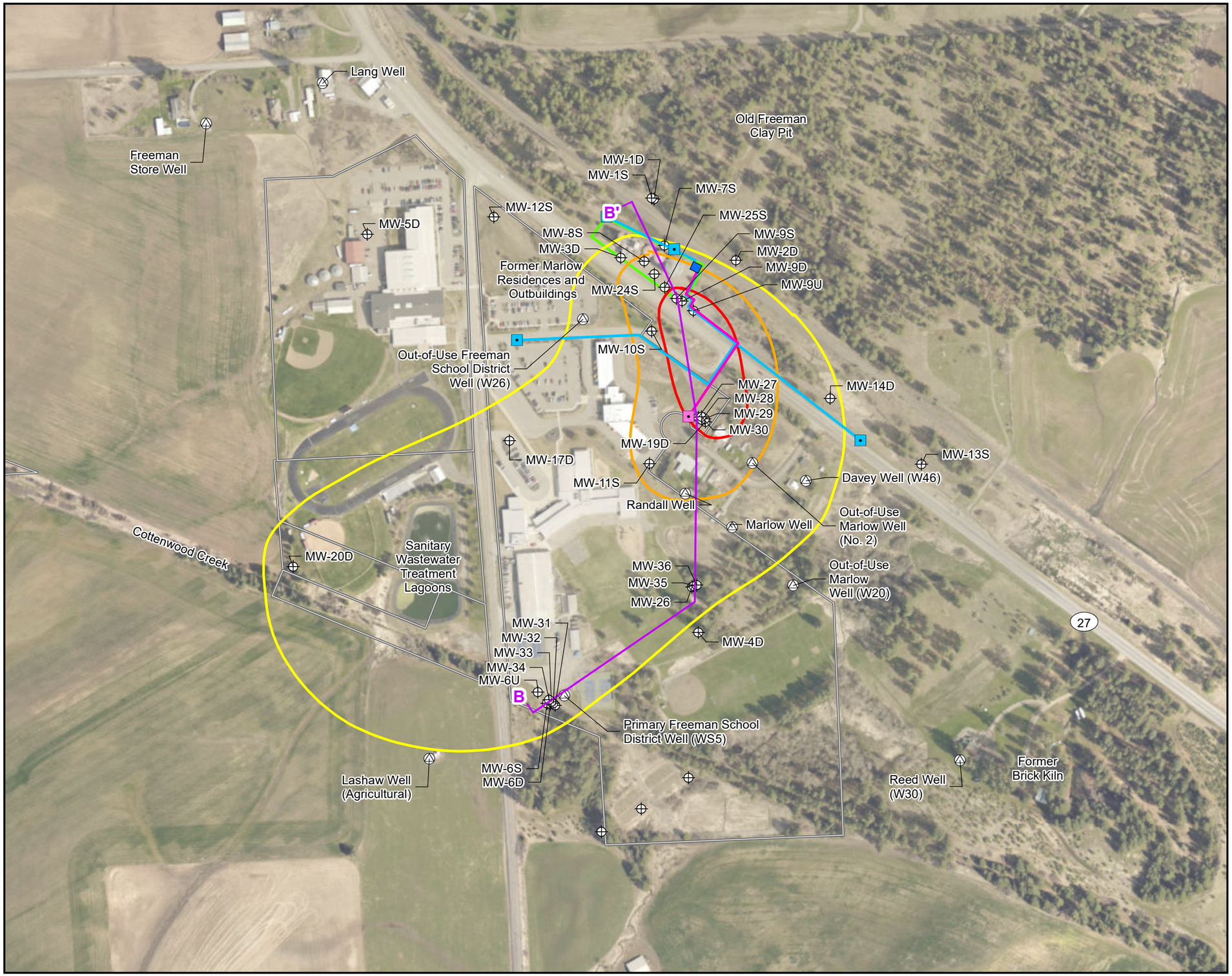

LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Freeman School District
- Proposed Treatment Plant
- Proposed Infiltration Well
- Proposed Extraction Well
- Proposed Infiltration Pipeline
- Proposed Extraction Pipeline
- Cross Section Alignment (See Figure 8-3)

Carbon Tetrachloride Concentration (Basalt Aquifer)

- 10 ug/L
- 100 ug/L
- 400 ug/L

N

0 205 410 820 Feet

Figure 8-2
Alternative 2 Conceptual Layout – Groundwater Recirculation Components
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman, Freeman, Washington

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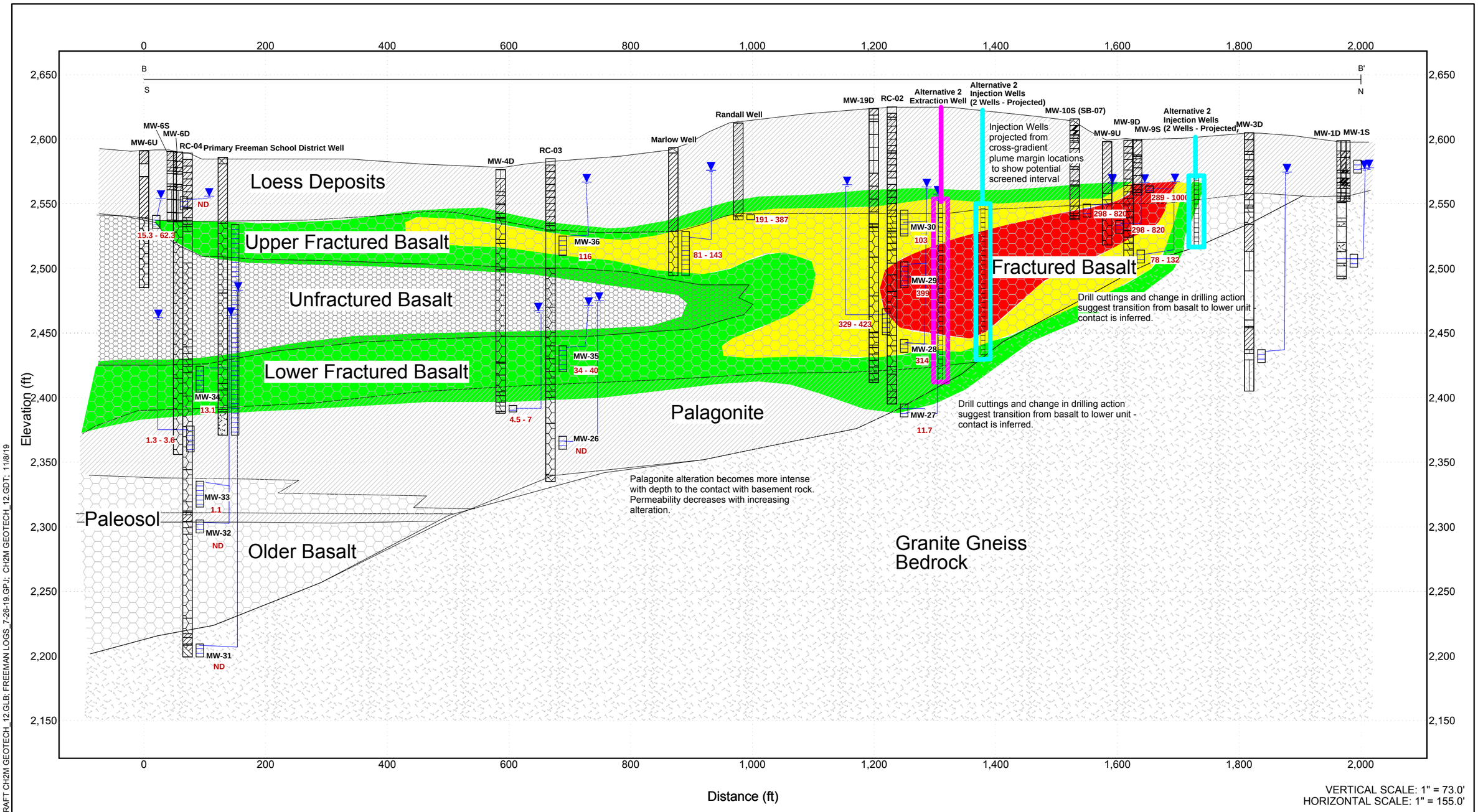

VERTICAL SCALE: 1" = 73.0'
HORIZONTAL SCALE: 1" = 155.0'

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LITHOLOGY GRAPHICS

- Organic Clay or Silt
- BR-Lean Clay
- Well-Graded Sand
- Basalt
- Silt
- Fat Clay
- Well-Graded Sand with Silt
- Poorly Graded Sand with Silt
- BR-Lean Clay
- Clayey Sand
- Clayey Gravel
- Poorly Graded Sand
- Bedrock

LEGEND

- Inferred Geologic Contact

Note:
Ground surface shown is connected between boring logs and does not represent actual surface topography on the section line; refer to Figures 3-1 and 3-2 for surface topography.

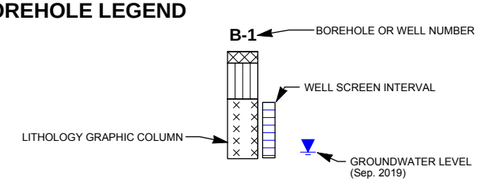
NM Not Measured

1.1 Carbon Tetrachloride sampling results in ug/L

Carbon Tetrachloride Concentration

- >400 ug/L
- 100 - 400 ug/L
- 10 - 100 ug/L

BOREHOLE LEGEND



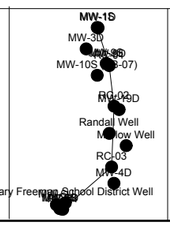
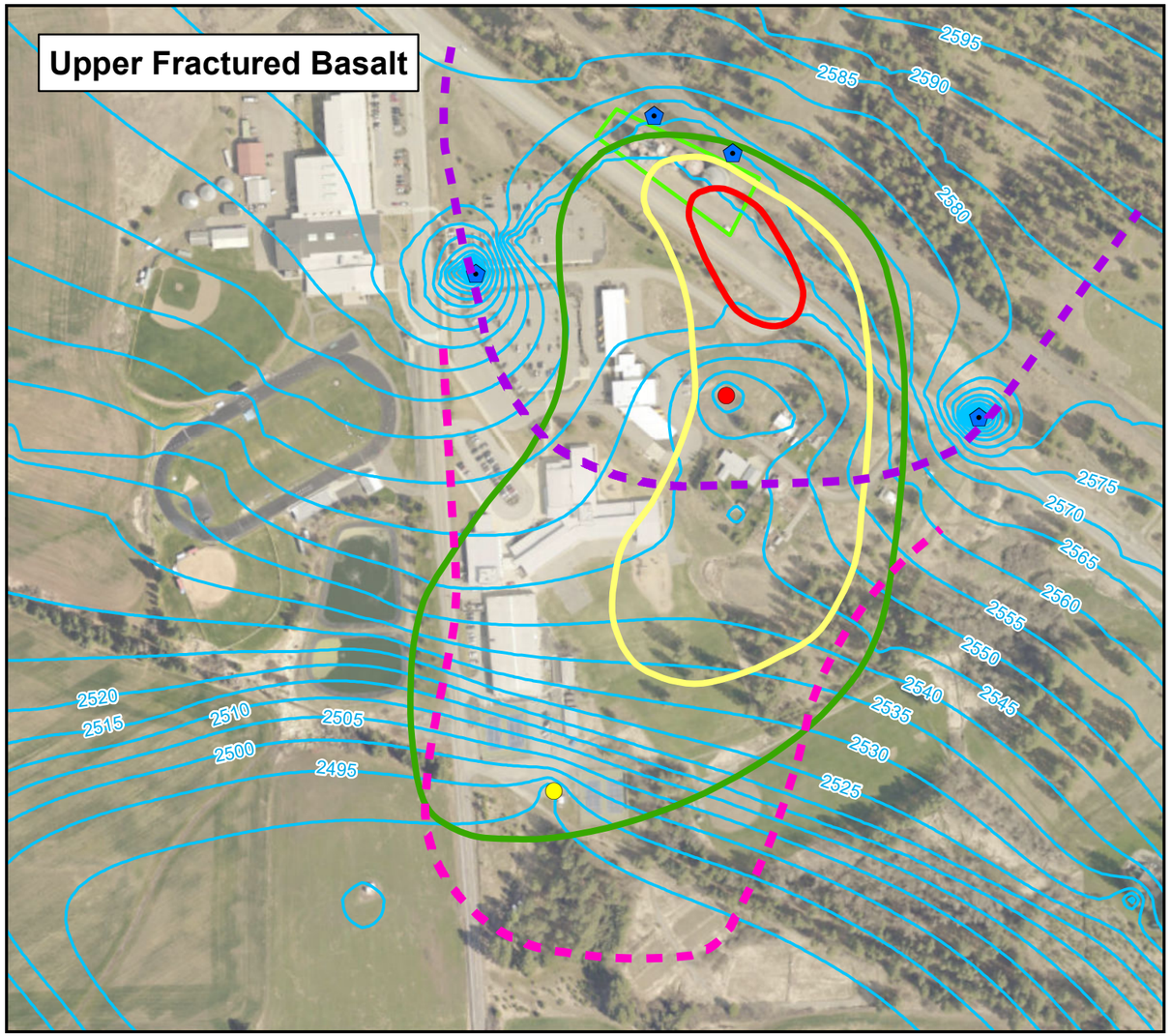
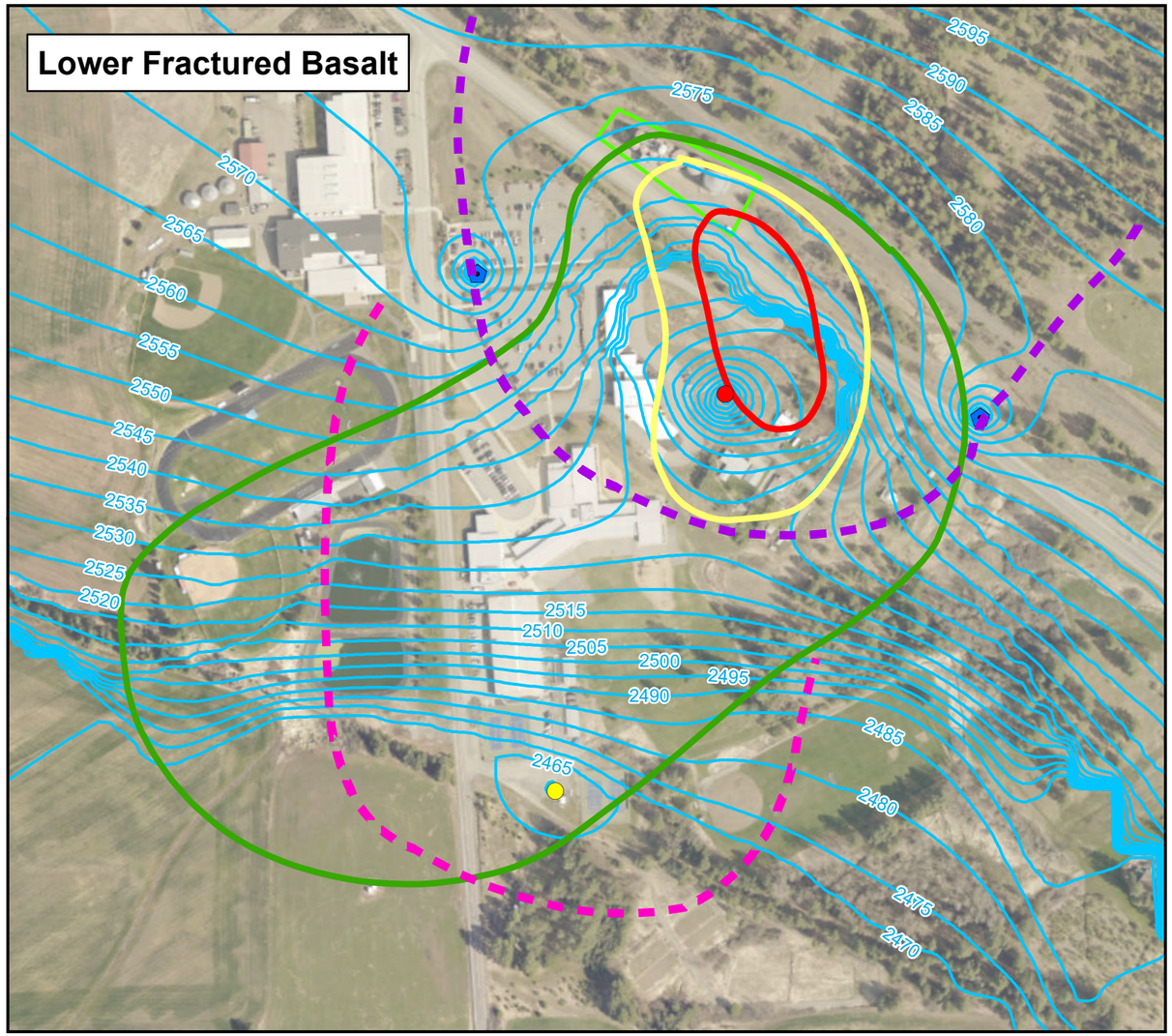


Figure 8-3
Alternative 2 Cross Section
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman
Freeman, Washington

Project Number: 661508

11X17 STICK LOG WITH LEGEND; DRAFT CH2M GEOTECH_12.GLB; FREEMAN LOGS_7-26-19.GPJ; CH2M GEOTECH_12.GDT; 11/8/19





LEGEND

Pumping Wells
- Injection Well
- Extraction Well
- Primary Freeman School District Well (WS5)

CTET Concentration ug/L
- 10 ug/L
- 100 ug/L
- 400 ug/L

Capture Zones
- New Extraction Well
- Primary Freeman School District Well (WSS)

- Groundwater Elevation (feet amsl)
- Grain Handling Facility at Freeman

Notes:
amsl = above mean sea level

Injection wells are shown only within the hydrostratigraphic unit within which they are screened. The lower fractured basalt does not exist at the GHFF, and thus two injection wells at the GHFF are not shown in this panel.

Service Layer Credits:
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

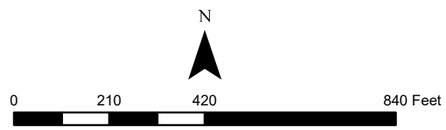


Figure 10-1
Simulated Groundwater Elevations and Capture Zones, Remedial Alternative 2
Remedial Investigation/Feasibility Study Report
Grain Handling Facility at Freeman, Freeman, Washington

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