WORKSHEET #10 – CONCEPTUAL SITE MODEL

The following CSM has been prepared using existing preliminary results of the RI activities and has been refined to a limited extent to support the scope of work presented in this QAPP. This CSM will be further refined and detailed as part of subsequent RI reporting.

SITE DESCRIPTION & EXISTING CONDITIONS

The current Site boundary encompasses approximately 24-acres and comprises five parcels: one currently owned by the City of Bangor and four privately owned commercial parcels. The Site work area is focused on the City of Bangor-owned 14 acres of undeveloped land behind the three commercially developed and one undeveloped parcel along Odlin Road. The four privately owned commercial parcels are not currently subject to investigation under the current RI as no known offsite migration has been documented to date.

The Site work area comprises a maintained field with a wooded area in the western portion of the Site and separate stands of trees and brush in the central and southern portions of the Site. These areas were cleared in November and December 2018 to support RI activities and again by the City of Bangor/Bangor International Airport (BIA) in 2020 as part of maintenance and due to safety concerns. Additional clearing was conducted by the City in late 2020 or early 2021 to remove brush/vegetation, railroad ties and rails. This area also contains a degraded wire fence and evidence of drums along the slope with a tar-like substances observed to be released from the drums.

A degraded paved driveway associated with former buildings is located east of former buildings T-133 and T-134 and connects to Telford Drive, which runs along the northern edge of the Site. A formerly utilized rail spur that served the Air Force Base (AFB) from the Maine Central line (Bangor Daily News [BDN], 2017) parallels the southeast boundary of the Site and an onsite spur ran to the west of former building T-134 where materials were on- and off-loaded; however, the onsite spur tracks have since been removed and the sleepers are stacked at the Site. The main formerly utilized rail line continues north, east of the former buildings and the degraded paved driveway.

The commercial properties, which are currently outside of the Site work area, and the surrounding area are primarily commercial to the south and east including a fun park, hotel, gas station, and restaurants. The City of Bangor fire training area adjoins the Site to the northwest and is occupied by a bunker and smoke training concrete block house. To the northwest, the Site is adjoined by BIA and is adjacent to the end of the extended runway and the former ready alert area/hangers (former building 600). One of the commercial properties also operated temporarily as a golf driving range, which extended from Odlin Road across the right-of-entry (ROE) boundary. It is unclear how long the facility operated before the parcel was commercially developed (based on 2011 via imagery). Commercial properties are currently owned by the following persons/entities (Bangor, 2018):

- Parcel R17-008-B, 252 Odlin Road - Stillwater Realty, PO Box 2400, Bangor, ME 04402
- Parcel R17-008-A, 267 Odlin Road – Maine Atlantic Properties, Inc., 24 Harriman Drive, Auburn, ME 04210

- Parcel R17-008-C, 285 Odlin Road – Tim Donut U.S. Limited, Inc., Attn: Account Payable 874, Oakville, ON L6K 2Y1
- Parcel R17-008, 301 Odlin Road – Cobalt Properties, LLC, C/O Irving Oil Limited, PO Box 868, Calais, ME 04619

PHYSICAL SETTING

Topography

According to the United States Geological Survey (USGS) Topographic Map of the Bangor Quadrangle, Maine (topoView, 2018), topography at the Site is generally flat. The northeast portion and eastern edge of the Site slopes gradually down to Odlin Road. The surrounding local area slopes gradually downward to the east toward Sucker Brook located approximately 700-feet east of the Site. Historical topographic maps (1902, 1942, 1946, 1955, 1978, and 2013) were reviewed and show only minor changes in topography of the Site from pre-airport construction through active Salvage Yard use in the 1950s. At the time, the elevation was mapped at approximately 180 feet above mean sea level (National Geodetic Vertical Datum (NGVD) 1929). More recent maps show similar contours; however, with a changed elevation of approximately 30 feet to 150 feet (North American Vertical Datum (NAVD) 1988). Based on similar mapped topography through the 1950s and lack of obvious changes from the aerial photographs that would result in a loss of 30 feet, this elevation change is suspected to be a change/update to the benchmark or local topographic system and not due to grading associated with airport construction activities. Topographical information (dated 2009) from the Maine GeoLibrary is included on **Figure 2**.

Aerial images from 1942 through current day indicate some grading on the Site during different phases of operation of the salvage yard. No dramatic changes in topography are noted in the aerial photographs (AGC, 2016) other than stockpiling. The 1960 aerial photograph indicates reconfiguration of portions of the airport that abutted the Site to the northwest, west and south, but regrading or filling of the Site during this reconfiguration is not apparent as Salvage Yard operations appear to continue unchanged through this period. This may indicate the fill used throughout much of the airport during the reconfiguration is not present at the Site.

The primary topographic concern is the presence of an apparent sharp slope in the western portion of the Site. The 1960 aerials photograph shows lobes of debris and coal consistent with this current topography. These lobes are also apparent in the 2010 American Recovery and Reinvestment Act (ARRA) light detection and ranging (LiDAR) data collected by the USGS, as well as mounds trending northeast to southwest that suggest bulldozing earthwork. These lobes may suggest stored debris was graded into this portion of the Site. These lobes are also consistent with the map view shape of the primary metallic anomalies. No observations in topographic changes or LiDAR would suggest the source of the conductive anomaly present in the center of the Site, and LiDAR observations in that vicinity are consistent with the linear berm observable at the Site at the surface.

Geology

Surficial Geology

According to the Maine Geological Survey (MGS) map, Surficial Geology of the Bangor Quadrangle, Maine (MGS, 2011b), Site overburden is the Presumpscot Formation, which typically consists of silt, clay, and sand deposited on the late-Pleistocene glacial seafloor.

Generally, soil borings from the previous Phase II ESA (Credere, 2017) and initial RI investigation activities in 2019 (Credere, 2021) indicated the Site was underlain by 1.5 to 5 feet of sand, silt, and gravel fill placed over native silt/clay. Fill was observed to be thickest in the southern corner of the Site along the edge of the debris lobe.

Clay and silt extend to 10 feet below ground surface (bgs) at the shallowest at SY-OBMW2 and up to 35 feet bgs at bedrock refusal at SY-OBMW5, both of these locations are located across Telford drive adjacent to the airport fence. In some locations, silt and clay transition to predominantly clay, and glacial till was not observed (SY-OBMW5, SY-OBMW8, SY-OBMW-14, and SY-SB20). In all other boring locations, silt/clay transitioned to glacial till before bedrock was encountered (BG-1 through BG-5 were not advanced to bedrock, and such observations could not be made in those borings). Silt/clay and till were mottled in most borings indicating variably saturated conditions. The till generally consisted of a dense, fine grained silt or clay matrix often containing a poorly sorted mixture of subrounded to subangular sands or gravels. Thicknesses of silt/clay and depth to till were reviewed for relative correlation; however, no obvious planes of these intervals were noted. This is consistent with the historical flat and seasonally saturated and flooded wetlands in the Site vicinity prior to development as an airport.

Electromagnetic geophysical work completed in 2017 and supplemented in 2019 indicates extensive areas of metallic fill. Test pit observations indicate the anomalous areas to be buried clinker with a metallic element (not significant metals detections from samples but audible clinking observation in the field), primarily in the central anomaly portion of the Site at SY-TP4, SY-TP5 and SY-TP6. Test pits indicate the metallic anomaly in the southernmost lobe of the Site to be primarily building rubble (concrete blocks, rebar; SY-TP9, SY-TP10, SY-TP11, SY-TP16, SY-TP20, SY-TP21, SY-TP22, SY-TP23), wood, and large metal scraps (SY-TP12).

Additionally, a soil conductivity anomaly with a peak of 300 millisiemens/meter (mS/m) at SY-TP18 was observed in the central portion of the Site. No evidence of the source of this anomaly has been identified in test pits (primarily SY-TP18 at the peak to a depth of 5 feet bgs), soil borings, monitoring wells, or associated sample results to date. The cause of this anomaly remains a data gap.

Coal was observed to range from a few inches to up to 1 foot near the surface in areas where coal was historically stored onsite (primarily the central open area of the Site and along the railroad tracks). The extent of this surficial coal layer is not currently known, but based on the limited thickness and lack of meaningful correlation to elevated concentrations of associated COPCs from the incremental sampling methodology (ISM) samples different from those of adjoining DUs, further delineation of coal is not warranted.

Total overburden thickness was observed based on soil boring refusal depths, overburden/bedrock rock coring, and through geophysical seismic methods of the broader Site to range from 11 to 31 feet bgs thickening toward the western portion of the Site (Hager-Richter Geosciences [HRGS], 2019). Localized areas of the northeast portion of the Site where the former buildings were located may also contain buried building debris, foundations, and utilities that may have loose material and may serve as preferential pathways to be considered during later RI activities. Overburden geologic cross sections considering observations in soil borings have been included as **Figures 11A through 11C**.

Bedrock Geology

According to the MGS map, Bedrock Geology of the Bangor Quadrangle, Maine (MGS, 2011a), the Site is underlain by Silurian Penobscot River Member fine-grained feldspathic metawacke of the Bangor Formation within the Vassalboro Group. Formation/Member contacts trend northeast to southwest and is characterized by isoclinal folding. The Bangor formation has been subdivided into three members including the Penobscot River Member, The Lovers Leap Member and the Kenduskeag Stream Member. The Site is located wholly within in the Penobscot River Member which is describes as a medium to dark gray medium to very fine-grained metamorphosed greywacke (Metawacke). Siltstone and claystone are minor lithologies within this member. Metawacke beds vary from 15 cm to in excess of 2 meters and may exhibit parallel or ripple cross-laminations and may be graded. The Lovers Leap member is a siltstone slate with thinly interbedded fine-grained metasandstone. The Kenduskeag Stream a member is a fine grained feldspathic metawacke with greenish gray slate.

The contact with the Lovers Leap Formation occurs east of Odlin Road, and quickly transitions into the Kenduskeag Stream member, back into Lovers Leap and then back into the Pensobscott River member. The Brewer Formation borders the Penobscot Member to the northwest and southeast and consists of dark black siltstone and claystone slate. There are no significant mapped faults in the area and the formational contacts are sedimentary in nature; however, lineaments are mapped to trend north to south.

Bedding and foliation (slatey cleavage) trend northeast parallel with the formational contacts based on available geologic maps. To the west of the Site and west of the Lover Leap formational contact, bedding in the Penobscot Member dips steeply to the northwest (72 - 88 degrees) and is commonly overturned. Bedding in the Penobscot formation east of the Kenduskeag Stream and Lovers Leap members also dips to the Northwest at moderate to steep angles (50 - 75 degrees) but is normal and not overturned. Foliation also dips northwest at similar steep to vertical angles and is generally subparallel to bedding. Collectively, these foliation and bedding features suggest the Penobscot Formation in vicinity of the Site locally contains a synclinal structure with younger beds (the Lovers Leap and Kenduskeag Members) within its core. Mapping to the northeast of the Site indicate presence of smaller scale overturned folds within the formation. Steep northwesterly trending joints are ubiquitous where outcrops are present dipping to the southwest and northeast from 60 to 88 degrees. Joints that strike southwest are also present and these tend to dip to the southeast from 34 to 85 degrees.

The Site is located approximately 3.3 miles northwest of the Norumbega Fault Zone (NFZ), which represents a major paleotectonic strike slip shear zone or suture zone with active deformation during the late Paleozoic (Hubbard et. al. 1995). The NFZ separates the Central Maine Synclinorium from the Avalonian terrain to the east that continues northeast into the Canadian Maritimes. The NFZ is narrow and well defined and does not extent into the Site study area.

Bedrock was encountered in soil borings between 20 and 36 feet bgs and was confirmed with a core at the bedrock surface in RI soil borings completed in 2019. These depths are consistent with the bedrock depths identified during the November and December 2018 seismic geophysical study (HRGS, 2019), which indicated depths between 11 and 31 feet bgs. The mapped bedrock surface using the seismic results indicates bedrock undulates but generally slopes to the east and southeast with the deepest bedrock in the northeast portion of the Site near the intersection of Telford Drive and Odlin Road (see Plate 1 of the HRGS report in **Appendix B**). Interpolated bedrock surface elevation contours and the interpreted bedrock surface topography are depicted on **Figure 9C**. An outcropping of bedrock is known to be present approximately 1,500 feet northwest of the Site within the airport.

Bedrock compressional wave velocities are lower in the western portion of the Site indicating possible increased weathering near the surface (HRGS, 2019); however, increased till thickness (10+ feet) above bedrock in this portion of the Site may also be the source of this decreased wave velocity.

In areas free from interference from utilities or other conductors, low-resistivity anomalies were not evident that would indicate conductive bedrock fracture zones. Based on resistivity survey data and seismic refraction results, no prominent bedrock fracture or weathered zones (e.g., with widths greater than 5 feet) were identified during the geophysical survey (HRGS, 2019). MGS surficial lineaments published at a scale of 1:250,000 indicate a northwesterly trending lineament near the Site to the northeast, but a lineament analysis specific to the Site has not been conducted (MGS, 1986). If lineaments were to be identified on or trending through the Site, they would potentially constitute bedrock drill targets.

<u>Hydrology</u>

The Site is located within the surficial drainage basin of the Penobscot River. Sucker Brook to the east of the Site flows southerly and discharges to the Penobscot River 2 miles southeast of the Site in the Town of Hampden. Area streams and surface waters are categorized as Urban Impaired due to water quality, which is monitored by the City of Bangor. Stormwater likely infiltrates the mostly permeable areas of the Site or flows overland off the paved developed portions of the Site. Relict stormwater management culverts and other subsurface utilities are present at the Site from prior development that may act as current preferential pathways for stormwater movement or subsurface flow. Impermeable surfaces at and immediately adjacent to the Site, as well as stormwater management or other subsurface utility structures, are depicted on **Figures 2 and 5**. The Site also likely receives some runoff from the adjoining airport and runways.

According to the U.S. Fish and Wildlife (USFW) National Wetlands Inventory (NWI) data mapper (USFW, 2018), there are no mapped wetlands, riparian lands, or managed lands at the Site. Given the limitations of NWI mapping tools lacking site-specific details, a wetland survey was completed in November 2018 in accordance with federal wetland delineation procedures. The extent of surveyed Site wetlands is shown on **Figure 2**; however, these extents are limited in that they did not include sufficient vegetative assessment due to the season (i.e., late fall). These areas have since been reviewed by a USACE Wetland specialist to confirm the vegetation is consistent with the mapped boundaries.

In the surrounding area there are riverine and freshwater forested/shrub wetlands along the tributary to the east and ponds and freshwater forested/shrub wetlands in small areas to the west. The nearest significant area of mapped wetlands is the Hermon Bog approximately 2 miles northwest of the Site (Credere, 2019a). Offsite wetlands are shown on **Figure 4**.

Additionally, as part of the wetlands survey, which was part of Credere's Field Summary and Data Submittal – Fall 2018, dated January 11, 2019 (Credere, 2019b), stream flow paths were traced for offsite contribution, onsite flow paths, and discharge points for the Site. Topographic data including 2-foot and 10-foot contours downloaded from the Maine GeoLibrary was evaluated during flow tracing, and was considered in conjunction with Credere's field observations during the wetland survey. Stormwater and drainage from the airport discharge directly to the adjoining Blackbeard's Fun Park pond (339 Odlin Road) and flows overland off the airport to an onsite swale along the northwest side of Telford Drive. The Blackbeard's Fun Park pond then drains and enters the southwest corner of the Site via an outfall. Drainage from this area continues southerly through the wetlands area toward Odlin Road and enters a 24-inch culvert along Odlin Road. The culvert then travels southwesterly along Odlin Road. A second drainage path at the Site begins on the westerly side of the railroad spur near the center of the Site (west of former Building T-134). Stormwater is dammed by a berm (historical significance not known) and drains to a small stream that meanders southwesterly and then easterly to a culverted pond/basin near the center of the Site. The culvert runs beneath the paved portion of the Site trending southeasterly and discharges to a swale that parallels the southeastern edge of the Site. These flow paths are shown in black arrows on **Figure 2**.

Hydrogeology

Site hydrogeology is locally influenced by stormwater engineering and drainage associated with the adjoining airport as well as relict stormwater systems, filled former building foundations and other subsurface utilities associated with historical salvage yard operations. Other assessments in the area have concluded the groundwater gradient is variable in the areas surrounding the airport based on the subsurface geology, which can likely be attributed to the original filling of former wetlands prior to construction of Godfrey airfield in the 1920s. Review of the MGS map, Significant Sand and Gravel Aquifer map for the Bangor Quadrangle, Maine (MGS, 2008), indicates the Site is not located within a significant sand and gravel aquifer.

Based on the relatively shallow transition from a granular soil to dense Presumpscot Formation, a perched water table is present for portions of the year during the growing season (as evidenced by the vegetated condition of the Site). This is evidenced by the wet nature of the Site during the spring months and observed mottling of soil.

Groundwater in bedrock appeared to be confined (i.e., under pressure) by the low permeability overburden, and the potentiometric surface in existing wells rises to within a few feet of the ground surface after weathered bedrock was penetrated. In some cases, the water level rises to above the ground surface (e.g., in SY-OBMW6). Most confined aquifers in nature are actually semi-confined because completely impervious confining layers are rare in nature. Because the confining layer must have substantially lower conductivity, the flux across the boundary is typically low. Under pumped conditions reduction of the piezometric head in the pumped aquifer would be expected to result in vertical movement or leakage of water from the confining layer into the pumped aquifer, hence semi-confined aquifers are also called leaky aquifers because water can move across that boundary. In these locations, weathered bedrock exhibited signs of water bearing fractures (smooth weathered fractures surfaces, oxidation/staining). Overlying silty clay and till was mottled in most borings indicating variably saturated conditions. Rock quality designation (RQD) was calculated using ASTM International D6032M-17 Standard Test Method for Determining RQD of Rock Core (ASTM, 2017) calculation methods. Observed RQDs primarily indicated very poor or poor rock quality, ranging from 0% to 46%; several observed RQDs indicated fair rock quality, ranging from 50% to 72%; and the observed RQD in one location (SY-SB10) was measured at 80% indicating good rock quality.

Test pits (SY-TP1 through SY-TP25) were completed in September 2019 through surficial fill and debris into the top of underlying native clay soil and in only one instance was perched overburden groundwater encountered (SY-TP12). The existence and extent of perched groundwater conditions was limited to one location. Groundwater was perched within a debris layer containing wood; however, was also confined vertically by an overlying blue clay (non-native) as evidence by the water "bubbling" up through the clay from below during test pitting.

Therefore, during monitoring well installation in 2018, in locations where more than 10 feet of dense unsaturated soil was encountered, this stratum was considered unlikely to produce water above bedrock and monitoring well screens were subsequently set as <u>hybrid</u> wells with the bottom 2 feet in weathered bedrock (SY-OBMW2, SY-OBMW3, and SY-OBMW9). Such hybrid screens were set at additional wells where boring observations indicated a substantial portion of the screened interval would have been set in unsaturated low permeability lithologies. The realistic concern was that the low permeability overburden was often not saturated and may not have produced water in sufficient quantity for a viable monitoring well had the bottom of the screen been set at the top of bedrock (e.g., dense till or mottled moist clay indicating a substantial portion of the screen would have been set in a horizon not permanently saturated; SY-OBMW5, SY-OBMW6, SY-OBMW8, SY-OBMW11, SY-OBMW12, SY-OBMW13, SY-OBMW14, and SY-OBMW15). These wells with screens that extend partially or mostly (e.g., SY-OBMW8 and SY-OBMW14) into bedrock are considered "hybrid" overburden/bedrock wells. Because the bentonite seal and at least a portion of the screens are within overburden and none of these hybrid wells have casing set into competent bedrock to confidently restrict flow of overburden groundwater (if present temporally) into the wells, none of these hybrid wells are strictly considered bedrock wells[1]. This is consistent with EPA standard operating procedures (SOPs) and USACE guidance that consistently require the installation of casing or, at a minimum, a seal into competent/firm bedrock as a preliminary step in bedrock installation (EPA, 2008; USACE, 1998). Remaining wells were set with the bottom of screen above bedrock (SY-OBMW1, SY-OBMW4, SY-OBMW7, and SY-OBMW10) and are considered true <u>overburden</u> wells. In <u>bedrock</u> wells where casings are set into competent bedrock, this potentially transmissive weathered bedrock zone is sometimes overlooked or excluded.

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[1] Maine Geological Survey, Anatomy of a drilled bedrock well:
https://www.maine.gov/dacf/mgs/explore/water/facts/well.htm

Formation hydraulic conductivity (K) was assessed at most wells by rising head slug tests during the week of December 16, 2019, and March 2020 (Credere, 2021). Average K values obtained between two tests for each well are summarized in the below table for reference:

Well ID	Well Type	Result K (ft/sec)
SY-OBMW1	Overburden	1.33E-05
SY-OBMW2	Hybrid	7.69E-06
SY-OBMW3	Hybrid	2.26E-05
SY-OBMW4	Overburden	2.21E-05
SY-OBMW5	Hybrid	1.58E-04
SY-OBMW6	Hybrid	3.30E-05
SY-OBMW7	Overburden	1.28E-05
SY-OBMW8	Hybrid	1.87E-06
SY-OBMW9	Hybrid	5.30E-06
SY-OBMW10	Overburden	2.72E-06
SY-OBMW11	Hybrid	2.03E-05
SY-OBMW12	Hybrid	2.05E-04
SY-OBMW13	Hybrid	1.24E-05
SY-OBMW14	Hybrid	1.60E-05
SY-OBMW15	Hybrid	3.95E-06

Stratigraphy over screened intervals included clay overlying silty till overlying weathered metamorphosed siltstone bedrock. SY-OBMW1 intercepted 44 inches of coarse sand beneath the till and directly above bedrock and SY-OBMY4 intercepted a 22-inch interval of fine sand and silt within the clay. These two wells with a granular interval ranged from 1.33 E-5 to 2.21E-5 feet/second (ft/sec) for computed K. Most of the overburden wells and the hybrid wells have similar computed ranges for K. This suggests the shallow weathered bedrock encountered in most wells and the immediately overlying overburden have similar hydraulic properties. The exceptions are hybrid well SY-OBMW5 and SY-OBMW12, which have Ks approximately an order of magnitude higher than most other wells. This may indicate proportionally higher contributions of water from weathered bedrock in these wells. Interpretations of groundwater flow directions from potentiometric water level data should consider the possibility that the weathered bedrock system may not be well connected laterally and that semi-confining conditions in bedrock may have different heads (higher) than overlying overburden.

Since the only wells where slug tests are performed are the existing wells (and replacements thereof) this condition is not met. Based on computed K values in wells screened predominately in till versus clay there is not a discernable difference in their respective hydraulic properties. Therefore, it cannot be unequivocally stated that the clay is more confining than the till. The hybrid wells screens cross the principal semi-confining layer, which is the low permeability soil overlying bedrock, therefore the top of the screen is not located some distance below the upper confining layer. Conditions of each well test will be stated in the RI report.

Based on gauging data collected from the Site during four rounds of sampling between December 2019 and December 2020, groundwater depth at the Site was measured to be between approximately 0.0 at SY-OBMW6 (i.e., above the ground surface) and 16.72 feet bgs in SY-

OBMW11. Depths to water show seasonal variability with a deeper water table in the summer compared to a shallower water table during the winter months. Groundwater is mapped to flow to the south and southeast as shown on **Figure 5** using the most recent groundwater elevations recorded during the December 2020 sampling event. The water elevation in overburden well SY-OBMW4 is not honored in this figure since it is not consistent with (lower than) elevations in upgradient (SY-OBMW-13) and downgradient (SY-OBMW15) hybrid wells. These differences indicate the potentiometric levels in at least these two hybrid wells are higher than overburden, which supports a conclusion that confined bedrock potentiometric heads are contributing to the observed water levels in these hybrid wells and are approximately a foot higher.

Based on mapped bedrock geology in the Bangor Quadrangle, conceptually bedrock groundwater at the Site is contained within an overturned limb of a synclinal fold structure and groundwater flow will migrate perpendicular to interpreted equipotential lines through a series of interconnected bedding parallel fractures and northwesterly trending joints that dip steeply to the southwest and northeast. Depending on the frequency of cross cutting joints, the ground system would be expected to have an anisotropic response to pumping along the direction of bedding and cleavage foliation. There are no known mapped faults or larger scale structures that would be expected to influence groundwater movement under ambient or pumping conditions. The mapped geology shows no dislocations of the geologic strata at the formational level.

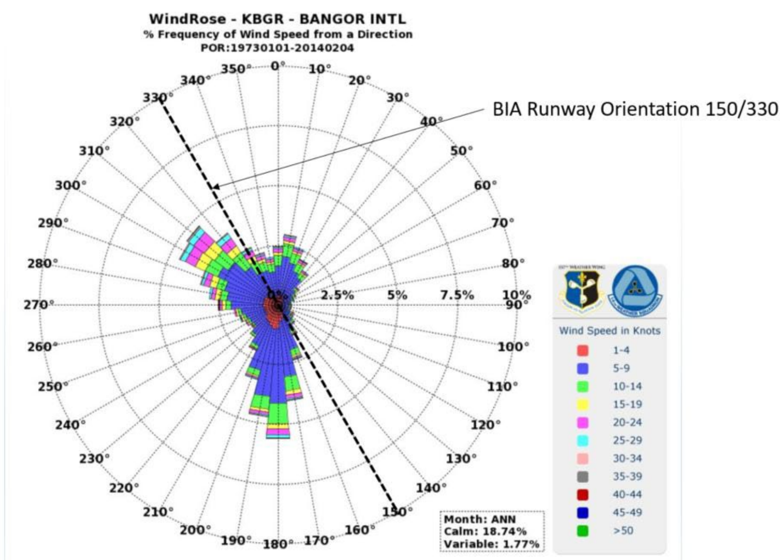
Well couplets have not been installed at the Site; therefore, vertical gradients cannot be computed. The shallowest depths to groundwater are associated with wells along the southeastern (topographically lower) portions of the Site that border wetland areas and surface water bodies (SY-OBMW7, SY-OBMW10) and along the slope bordering the topographically higher airfield (SY-OBMW3, SY-OBMW5, and SY-OBMW6); the latter of which are hybrid wells. As discussed above, Quarter 4 water level data indicates spatially lower elevations in SY-OBMW4 (an overburden well) compared to upgradient SY-OBMW13 and downgradient SY-OBMW15, which are hybrid wells. This suggests bedrock potentiometric surfaces may be higher than overburden and the presence of a semi-confined bedrock system with an upward vertical gradient when compared to overburden.

There are no free-flowing wells; however, water levels in SY-OBMW6 have been recorded twice above ground surface, but below the riser. These conditions suggest the bedrock system is, to some degree, confined and hydraulic gradients are vertically upward between bedrock and overburden at certain times of the year. The degree to which water is transmitted across the bedrock/overburden boundary is dependent on the contrast in hydraulic properties.

Site specific deeper bedrock aquifer information is not currently known as no bedrock wells have been installed at the Site to date. Two bedrock wells are located within one mile of the Site, to the northwest and south, with reported yields of 6 and 20 gallons per minute (GPM), respectively (MGS, 2010 and MGS Well Database https://www.maine.gov/dacf/mgs/pubs/digital/well.htm#mapsearch). MGS indicates wells with yields between 3 and 6 GPM are considered medium yield for water supply and that only approximately 35% of bedrock wells yield 10 GPM or more. The bedrock well yield data is limited near downtown Bangor by the availability of public water in the Bangor area and not suggestive of low aquifer yield. Nearby bedrock wells are shown on **Figure 4**. The hydrogeology and nature of fracturing of the bedrock aquifer remains a data gap in understanding the full nature of extent of contaminants (primarily TCE) identified in a hybrid well at the Site.

Climate

The average yearly temperature for the City of Bangor, Maine, is 55.2 degrees Fahrenheit (°F) (National Oceanic and Atmospheric Administration [NOAA], 2019) with a peak monthly average of 79°F for July and low monthly average of 27°F in January. Average rainfall is 41.91 inches per year (U.S. Climate Data, 2018). The average first frost is typically October 7th and the last spring frost is May 7th. Bangor has an average wind speed of 7.6 miles per hour (MPH) with variable direction. The following wind rose diagram was generated by the U.S. Air Force for the adjoining airport, which indicates a dominant wind direction from the south and northwest, both sub-parallel to the runway alignment with some variation. These wind directions place the Site slightly downwind of the airfield activities in the case of the northwesterly winds, which cause aircraft to take off and land into this wind direction. Winds from the south place the Site downwind of both Odlin Road and Interstate-95 traffic and vehicle exhaust. According to this diagram, north winds (i.e., directly toward the Site from the airport) are relatively rare for the vicinity and are most prominent in December and January.



Demographics and Land Use

The City of Bangor has a population of approximately 31,753 people (US Census, 2020), which translates to a population density of 925 persons per square mile (mi^2).

The undeveloped portion of the Site is currently zoned Airport Development and the commercial properties are currently zoned General Commercial & Services. The surrounding area is similarly commercial and industrial zoned with resource protection areas to the east. The nearest residentially zoned area is located 1,500 feet east of the Site (Bangor, 2018; **Figure 4**).

The Site is also subject to airport requirements due to the location within the 'runway protection zone'. A meeting was held January 7, 2021, with the City of Bangor to identify local site use restrictions and to identify reasonable future uses. The City indicated fixed based operations (FBO) or maintenance repair and overhaul (MRO) are possible airport related development facilities permitted within the zone but usually those are on the airfield, but more recently had expanded outside the airport to the surrounding industrial parks and adjoining land. Additionally, any future development is subject to dimensional controls set by the FAA; however, there are no ordinances restricting the types of development.

Priority Resources

Groundwater in the state of Maine is classified as GW-A, which shall be of such quality that it can be used for public water supplies. These waters shall be free of radioactive matter or any matter that imparts color, turbidity, taste or odor which would impair usage of these waters, other than that occurring from natural phenomena. At locations where contamination is identified or possible, in lieu of reclassification of groundwater as GW-B, a use restriction is typically recorded preventing the extraction of groundwater without Maine DEP's consent. Maine DEP's consent will typically require a Hydrologic Study to assess the nature and extent of contamination and proximity to groundwater extraction points.

The Site is within the Bangor Water public water and sewer systems service area, which receives its water from Floods Pond in Otis, Maine (BW, 2018). There are two public water supply wells within 1 mile of the Site and several additional wells beyond 1 mile along Odlin Road to the southwest (Credere, 2019). The two wells include the following:

- South, Bangor Christian School (current owner/occupant TBD) installed 165 feet bgs into bedrock beginning at 20 feet bgs (Credere, 2016)
- Northwest, Pine Grove Cemetery installed 420 feet bgs into bedrock beginning at 40 feet bgs (Credere, 2016)

Both wells are shown on **Figure 4**. Based on the inferred groundwater flow direction to the southeast, these wells are located cross gradient and upgradient of the Site, respectively.

Credere did a preliminary private well survey of the surrounding ½-mile of the Site using a list of Bangor Water accounts compared against the local tax maps during preparation of the prior 2019 QAPP. Based on this review, there was one suspected private residential water well within this ½-mile radius located at 81 Dayze Way east of the Site (Credere, 2019). This suspected well location is also shown on **Figure 4**. This well is in a crossgradient/semi-downgradient position and the well construction details are not known. This well survey is planned to be updated as part of the scope of work presented in this QAPP.

These well surveys can be expanded to a greater radius if contamination is found to have the potential to migrate offsite.

According to the Maine DEP GIS Environmental and Geographic Analysis Database (EGAD)[2] and the Maine Public Water Resource Information System[3], which were reviewed on October 30, 2018, via the Maine DEP Google Earth® application, the Site and surrounding 2-mile radius is not located in a source water protection area or within 1,000-feet of a direct surface water intake.

SITE HISTORY

In the early days of the Godfrey Airfield (1920s and 1930s) the Site was located in the undeveloped outskirts of the airfield and was likely used for farming. The Site was taken by the United States of America through a Declaration of Taking dated August 7, 1944. The Site was developed with two buildings as a satellite salvage yard associated with the Dow Army Airfield by 1942 (AGC, 2016), which later became the Dow AFB under control by the U.S. Air Force between 1947 and 1951. Site operations appeared freshly constructed with limited or no exterior storage of materials immediately after initial construction in 1942.

By 1944 (AGC, 2016), Salvage Yard operations had expanded and buildings consisted of three large buildings known as T-133, T-134, and T-161, one of which was likely a reclamation building (USACE, 2006); four smaller buildings known as T-162, T-163, and T-165 (possibly T-164); and at least one other unidentified building (AGC, 2016). The Salvage Yard buildings extended outside the current Site boundary to the north into the bounds of the airport. **Figure 2** shows the approximately layout of the historical buildings relative to current Site features. Significant exterior ground surface storage can be observed in the 1944 aerial photograph including two possible drum storage areas south of T-134 and south/southwest of T-161. By 1947 (AGC, 2016), a loop road is present in the vicinity of the former drum storage area to the southwest with an apparent trench or structure along the road, a second road extends from the storage area south of T-161 and extends to an apparent drainage area along the railroad spur.

Most of the buildings were used for general warehousing, but T-163, located offsite within the bounds of the airport, was identified specifically as a “Dope and Oil Warehouse” on a historical engineering drawing. A dope storage building was a location where paints, chemicals or bottled gas was stored (USACE, 2006). This building’s presence makes it less likely that oil and hazardous materials were stored in the larger warehouse buildings as they would have only been stored in the warehouse buildings when a dope and oil storage building was not constructed to save space (USACE, 2006).

During its operation, the salvage yard primarily accepted scrap metal, aircraft and auto parts, automobiles, paints, paint thinner, clothing, office furniture, and supplies from the AFB (USACE, 1994), after it was reopened around 1950. Salvage yards may also have generally accepted base-generated household waste, dead animals and manure, wastepaper/paperboard, critical reusable materials (metal, rubber, leather), unserviceable property, and abandoned private property but specifically did not accept explosives (USACE, 2005). Larger materials were stored on the open ground surface surrounding the former buildings as well as in an open storage area in the southwestern portion of the Site (AGC, 2016).

2 http://www.maine.gov/dep/gis/datamaps/index.htm#EGAD
3 http://www.maine.gov/dep/gis/datamaps/DWP_Wells/index.html

By 1960 (Credere, 2016), only one main building (T-134) remained and a large portion of the western half of the Site was used for open coal and debris storage. The majority of materials were stored in scrap bins along the rail lines surrounding T-134; however, a substantial area of debris storage and an apparent trench was present in the western corner of the Site. The area surrounding the salvage yard to the north, west, and southwest was highly reworked during reconfiguration of the airport, which appears to have been active at this time.

By 1964, debris piles were present throughout most of the western and southern portion of the Site with a particular lobe of material consistent with the current slope and southern field. These debris and coal storage areas are consistent with the field areas of the Site that abutted the tree line before clearing. The salvage yard operated at the Site through 1968 when the Dow AFB closed (BDN, 2018).

Based on historical aerials, the railroad spur was constructed to support transport of materials to and from the Salvage Yard and AFB (USACE, 2006) during the initial World War II (WWII) operation prior to 1945 and continued through the 1950s and 1960s. Fuel was primarily supplied by the Searsport pipeline; therefore, jet fuel, aviation gas, No. 2 fuel oil and diesel (GZA, 1998) did not likely pass through the Site on the rail. The railroad and spur extent are shown on **Figure 2**.

After declaration of excess in 1964 and closure of the AFB in 1968 (USACE, 1994), the Site was transferred to the City of Bangor, whom leased the Site to a plumbing and heating supply company and later a cabinet maker. By 2004, the final Salvage Yard era building was removed, and the Site has remained undeveloped and unused since that time (Credere, 2016). There are reports from current airport employees that the former building was partially salvaged for usable wood, and the remainder was demolished and buried onsite.

The immediate surrounding area was historically used for farming prior to construction of the Godfrey Airfield in 1927 (BIA, 2018; BDN, 2018). The civilian airport was converted to the Dow Army Airfield in 1942 (BDN, 2018); however, the runways and facilities were located approximately 0.5 miles north of the Site. The runways were reconfigured during the 1950s (BDN, 2018) for use by the U.S. Air Force as Dow AFB. The new runway extended to just north of the Site. Odlin Road and Routes 95 and 395 were also constructed or reconfigured east and south of the Site. The AFB was officially closed and ceased associated operations in 1968 (BDN, 2018). From 1973 through the early 1990s the adjoining properties were increasingly developed with commercial and light industrial development including gas stations, restaurants, a driving range, hotels, and a family fun park (Credere, 2016). Further discussion of the impact of these adjoining properties on the Site is provided in later sections.

ENVIRONMENTAL HISTORY

The following chronologically summarizes prior environmental reports prepared for the Site. Referenced sample locations are shown on **Figure 5**.

Site Inspection Report, Former Dow Air Force Base, USACE, September 1994 (USACE, 1994)

The USACE completed a Site Inspection report that included a summary of the history, physical setting, limited soil sampling, and summary of identified issues that would be the responsibility of the DoD as the responsible party (RP).

According to the report, the Site was used as a salvage yard by DoD as part of the Dow Military Airfield until 1968. The facility received scrap metal, aircraft and auto parts, automobiles, paints, paint thinner, clothing, and office furniture and supplies. Large coal piles were reported to be present at the Site, particularly in the vicinity of the railroad tracks. After 1968, the former Site building (T-134) was used by a plumbing and heating supply company and a cabinet maker.

To assess possible impacts associated with historical use of the property, 13 surface soil samples (samples A through M as shown on **Figure 5**) were collected and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), target analyte list (TAL) metals, and polychlorinated biphenyls (PCBs). Credere compared these results to the residential EPA RSLs at the time and Maine DEP Remedial Action Guidelines (RAGs) for Sites Contaminated with Hazardous Substances (Maine DEP, 2018) where RSLs were not established.

Arsenic exceeded the RSL in all locations but was below the undeveloped Maine background upper prediction limits (UPL) of 16 milligrams per kilogram (mg/kg) in all but two locations (F and H). Antimony, chromium (when compared to the hexavalent chromium RSL), cobalt, iron, and manganese also consistently exceeded the RSLs, and aluminum and cadmium exceeded the RSLs in two separate single locations. Polycyclic aromatic hydrocarbons (PAHs) were detected in samples B and C west of the former building along the railroad tracks exceeding the RSLs with benzo(a)pyrene also exceeding the RSLs in most of the remaining samples. PCBs and VOCs were below the laboratory reporting limit or were detected at only trace levels well below the current RSLs or Toxic Substances Control Action (TSCA) cleanup goals for PCBs.

The report recommended a risk assessment and possible further delineation of the identified PAH contamination.

Project Summary Sheet (Pages 33 and 34 only), USACE, July 28, 1995 (USACE, 1995)

A project summary sheet prepared by USACE included memoranda, determinations of eligibility, site surveys and other documents associated with the larger Dow AFB. Specific to the Site, recommendations included performance of a risk assessment to assess if additional sampling or remedial action was warranted based on the previously identified contamination. Based on the information provided in the project summary sheet, a Potentially Responsible Party/Hazardous, Toxic, and Radioactive Waste (PRP/HTRW) investigation was recommended.

Phase I ESA, Credere, July 8, 2016 (Credere, 2016)

Credere completed an ASTM E 1527-13 and All Appropriate Inquires (AAI) Phase I ESA at the Site in July 2016 for the City of Bangor U.S. EPA Brownfields Assessment Program as part of their environmental due diligence prior to the possible redevelopment of the property for commercial use. The intension of the work was to improve the marketability of the property with an envisioned use as a retail plaza. The Phase I ESA identified the following recognized environmental conditions (RECs):

- REC #1 – Documented PAHs and arsenic in surface soil at the Site likely associated with historical coal storage
- REC #2 – Likely release of oil or hazardous materials due to storage of salvaged materials on the open ground surface and possible dumping

The following were identified as environmental findings, which warranted the opinion of the Environmental Professional and may represent some degree of environmental business risk, but did not meet the definition of a REC, historical REC (HREC), controlled REC (CREC), or *de minimis* condition (DMC):

- Environmental Finding #1 – Possible historical use impacts to soil and groundwater across the Site unassociated with the identified RECs

Based on the RECs and environmental finding identified during the Phase I ESA, Credere recommended the following:

- Complete a Phase II ESA to assess the nature and extent of documented PAHs and arsenic in surface soil and generally assess the remainder of the formerly developed portion of the Site for soil and groundwater impacts particularly in the areas of storage on the open ground surface and possible dumping

Phase II Environmental Site Assessment, Credere, January 17, 2017 (Credere, 2017)

To assess the findings of the Phase I ESA, Credere prepared a Site-Specific Quality Assurance Project Plan (SSQAPP) dated July 27, 2016 (with a subsequent amendment dated August 30, 2016), that described Site conditions, established a preliminary CSM, outlined proposed samples and justification, provided field activity methodology, and established the regulatory criteria for the Site. This SSQAPP was reviewed and approved by the EPA and Maine DEP prior to initiation of field activities at the Site.

The objectives of the Phase II ESA were to assess the extent of PAHs, arsenic, and antimony in surface soil previously detected during the Site Inspection investigation at concentrations that exceeded the commercial, park user and construction worker Maine DEP RAGs (the applicable programmatic criteria for the Brownfields program assessment) and to assess for other possible releases associated with the historical storage of salvaged materials. To meet these objectives, Credere completed a limited geophysical survey, soil borings and soil sampling, groundwater temporary monitoring well installation and groundwater sampling, and test pitting.

The limited geophysical survey used electromagnetic (EM) methods to assess for buried debris. The survey was limited in horizontal extent by vegetation and the wooded area in the western portion of the Site. Several areas of metallic anomalies were identified by the survey, which are shown on **Figure 5**. These areas were assessed via test pitting and found to contain scrap metal, tires, cans, chains, concrete, culvert piping, asphalt, bricks, coal, coal dust, household waste, a pressure tank, and paint cans. Most notably, yellow paint was identified in test pit Anomaly #2 (sample CA-TP-A2), which was found to contain elevated VOCs, chromium (32,000 mg/kg), and lead (37,000 mg/kg). PCBs were not detected in the paint and the chromium was not speciated;

however, it is widely known that "chrome yellow" paint contained hexavalent chromium before being phased out of production. The extent of buried paint cans was not further investigated at the time. Elevated PAHs and/or metals were also identified in anomalies #1, #3 and #7.

Seven soil borings were advanced and five (5) were completed as temporary monitoring wells. Subsurface soil samples were collected from evidence of contamination (limited to a maximum photoionization detector [PID] reading of 12.5 parts per million [ppm]) or from the groundwater interface. Surface soil samples (0 to 2 feet bgs) were also collected from soil borings as well as from seven other locations to assess for residual coal and evidence of releases from open ground surface storage in the salvage yard. PAHs were detected in most of the soil samples but generally at relatively low concentrations near or just above the residential RSLs with the highest individual PAH concentration (benzo[k]fluoranthene) at 3.5 mg/kg. Elevated metals including antimony, arsenic, beryllium, chromium (when compared to the hexavalent chromium RSL), cobalt, manganese, lead, mercury, and vanadium were also identified above the RSLs. One sample in particular collected from yellow paint impacted soil, as discussed above during test pitting, contained highly elevated concentrations of VOCs, chromium, and lead. Additionally, PCBs exceeded the RSL in one location but were below the TSCA high occupancy cleanup goal of 1 mg/kg.

Monitoring wells were screened at the water table and low flow or no purge (when a stable groundwater flow rate could not be achieved) groundwater samples were collected from each of five wells. Groundwater contained dissolved arsenic well above the EPA Maximum Contaminant Level (MCL) in CA-MW-3 and dissolved manganese above the secondary criteria in all wells but CA-MW-4. Field parameters could not be collected from monitoring wells CA-MW-1, CA-MW-3, and CA-MW-5 due to rapid drawdown during low flow purging and insufficient recharge to achieve a stable flow rate. Therefore, field parameters could not be assessed to evaluate the geochemical conditions associated with the areas of elevated metals, particularly the elevated arsenic.

Based on these results, it was concluded that PAHs and metals were present in soil, particularly in the area of the former coal piles within certain test pit areas. Further investigation is needed to define the extent and type of buried debris that was encountered during preliminary test pitting activities. The primary limitation was the presence of vegetation that limited the assessment of the extent of debris into the wooded area of the Site. As the groundwater at the Site is not currently used for drinking water and the results did not exceed the commercial RAGs, metals in groundwater were not concluded to be a concern at the time. However, results do exceed the MCLs and will require further evaluation to assess exposure risk to the elevated arsenic and manganese in groundwater under the CERCLA. No other groundwater contamination that would suggest discharges from floor drains or dumping in the vicinity of the former Site buildings was encountered.

USACE Site Reconnaissance, March 6, 2018

The USACE Project Delivery Team (PDT) performed a cursory Site reconnaissance in the late winter of 2018 to support development of the PWS. During the reconnaissance, three partially buried drum carcasses were observed. These drums were partially covered in leaf litter and soils and were rusted. No markings or labels were observed.

Nearby to one of these drum carcasses, a dark-gray solid tar-like substance was observed near the eroding slope on the southwestern perimeter of the Site. There was no obvious odor and this material appeared to be an aged release. The surrounding slope has eroded somewhat indicating the drums may have been previously buried.

USACE staff did not have PID monitoring equipment and made location notes/photos of these items. The soil areas north and east of this location appeared re-graded with a man-made uniform surface only a short distance from this erosional embankment. The embankment had the appearance of the terminal extent of a bull-dozed re-graded surface at or near the drainage and property line. Evidence (sterno cans, food wrappers, garbage bags with clothing and sleeping items) of a local homeless encampment were observed beneath the canopy of a nearby apple tree near the southwest property line, not far from the drums and the adjacent Blackbeard's Fun Park.

Surface Geophysical Surveys and Addendum, Hager-Richter Geosciences, Inc., March 2019 (HRGS, 2019a) and December 2019 (HRGS, 2019b)

Credere contracted HRGS of Salem, New Hampshire, to perform surface geophysics including seismic refraction and electrical resistivity imaging (ERI) to assess bedrock contours and structure and EM and magnetic surveys to assess subsurface utilities, debris and evidence of potential contamination.

In November and December 2018, HRGS completed the initial investigation. Seismic and ERI were completed along nine transects that totaled 7,000 linear feet. Transects are depicted on Plates 1 and 4 of the report. EM and magnetic surveys were completed across the entirety of the Site; however, the EM methodology was limited by the presence of snow halfway through the geophysical program. Therefore, a portion of the Site was surveyed with the EM61 time domain electromagnetic induction prior to snowfall (see light blue area on Plate 2 of the HRGS report in north portion of the Site) and EM31 frequency domain in the remainder of the Site (see vivid colored remainder of the Site on Plate 2 of the HRGS report). While EM61 was the preferred method based on the target metallic anomalies, EM31 proved to be a beneficial alternative based on a significant electrically conductive anomaly in the central portion of the Site that would not have been identified by the EM61 methodology.

In September and October 2019, HRGS returned to the Site to perform supplemental EM31 survey to further delineate the conductive anomaly area. Results of the supplemental survey were reported in an addendum report (HRGS, 2019b). The conductive anomaly was defined and identified to have a max conductivity of 300 mS/m, which was well above the background of 15 mS/m throughout the Site. The peak anomaly area was marked in the field for further investigation. Anomaly contours are also provided in the Addendum report showing the peak location and gradient. The fully defined anomaly is also shown on **Figure 5**.

Based on the results of the two survey events, HRGS concluded the following:

- Competent bedrock ranges from 11 to 31 feet bgs with a total relief of approximately 37 feet. Review of Credere's borings logs, indicate the intrusive investigation results are consistent with this geophysical data.

- Upper material exhibited compressional wave velocities of 1,100 feet per second (fps) to 2,200 fps, and was interpreted as comprising unconsolidated sediment. A second distinct layer exhibited compressional wave velocities of 10,200 fps to 17,000 fps and was interpreted as comprising - bedrock. The seismic refraction model did not exhibit consistent low velocity zones that would be indicative of deeply weathered bedrock or fracture zones. Observed RQDs primarily indicated very poor or poor rock quality, ranging from 0% to 46%; several observed RQDs indicated fair rock quality, ranging from 50% to 72%; and the observed RQD in one location (SY-SB10) was measured at 80% indicating good rock quality. According to Barton (Keaton, 2009), the minimum seismic velocities of 10,200 fps is consistent with the mean and average RQDs at the Site. Both weathering and fracturing (which defines RQD) have similar effect on reducing seismic velocity from purely competent rock. Currently, the modeled bedrock compressional wave velocities range from 12,500 to 15,900 fps and the modeled accuracy (standard deviation) of seismically interpreted depth to bedrock is about +/- 10% or approximately two feet. These interpretations will continue to be updated with new boring information to verify the reasonableness of current bedrock depths and to refine the seismic interpretations of top of bedrock if needed.
- The compressional wave velocity was generally lower in the western portion of the Site, which may indicate a higher degree of weathering and fracturing or may be indicative of the presence of the glacial till layer observed during soil boring advancement.
- No prominent bedrock fracture zones/weathered zones with width greater than 5 feet were detected.
- Several prominent areas of buried metal debris are present throughout the Site based on the magnetic and EM methods. These areas are overlain on **Figures 5 through 9**.
- An anomalous electrically conductive area is present near the central portion of the Site that is inferred to represent an area of man-made materials or contamination. This area was further defined in October 2019 to allow for intrusive assessment.

Field Reports, Quarter 1 through Quarter 4, Credere Associates, LLC June 2020 through March 2021

The initial phase of RI activities was completed between September 2019 and December 2020. These activities were completed according to the QAPP (Credere, 2019a) with the exception of field limitation deviations reported specifically in the field reports (Credere, 2021). Methodologies and results were reported in four quarterly Field reports including the initial Quarter 1 Field Report in June 2020, which contained the majority of the initial assessment activities; Quarter 2 and Quarter 3 Letter Report Groundwater Sampling Data Transmittals dated July 2020 and December 2020, respectively; and Quarter 4 Cumulative Field Report dated March 2021, which reported the methodology and results of all the RI field activities cumulatively.

Completed activities included the following:

- Renewed a Digsafe utility clearance prior to RI activities.
- Performed supplemental Site clearing to facilitate access for RI activities.

- Sampled 13 ISM DUs (excluding test pit DUs), including four wetland DUs, one background wetland DU, five upland DUs, and three upland background DUs.
- Performed additional surface geophysics using EM31 methodology to fill data gaps remaining after the Fall 2018 geophysical survey.
- Completed test pitting at 25 locations. Sidewall and bottom of excavation ISM sampling was completed at 15 planned locations, and discrete samples were collected in seven test pits based on field observations. Ten supplemental test pits were completed based on field observation, geophysical survey results, or to fill gaps in the spatial distribution of planned test pits within the metallic/conductive anomaly areas.
- Sampled 12 surface water, pore water, and sediment sampling stations throughout the Site. Additionally, sampled three background sampling stations on the opposite side of Odlin Road from the Site.
- Advanced 36 soil borings at the Site including the following:
    - Advanced 20 soil borings to bedrock and collected associated soil samples. Installed co-located overburden monitoring wells at 15 locations, developed wells, collected groundwater samples, and conducted rising head testing at all new wells. A total of 4 overburden and 11 hybrid wells were constructed.
    - Advanced ten background borings by hand auger, or drill rig, to a depth of between 2 feet bgs and 10 feet bgs and collected background soil samples.
    - Advanced 6 soil borings to facilitate collection of surface soil samples within the paved parking area
- Conducted three additional rounds of groundwater sampling at the 15 monitoring wells in March 2020, August 2020, and November/December 2020.
- Collected discrete surface soils samples at eight additional locations. Collected five of the ten extra available soil samples based on visual evidence of contamination.
- Performed a general Site survey to establish the as-built elevations and lateral coordinates of monitoring wells, as well as numerous background borings, surface soil sample locations, and sampling stations. In November 2020, two permanent benchmarks were established and based on those elevations, all wells were resurveyed. These benchmarks have not been registered to date.
- The field record was documented in FUDSChem through upload of environmental measurements (EMI), groundwater levels (GWD), well completion info (WINT), well completion intervals (WCI), and lithology (LTD) files. Location data was updated after the field event with a location definition (LDI) Update.
- Analytical data was received from ARA and KAS with final analytical data received as of March 5, 2020. Analytical data SEDDs were loaded to FUDSChem and LDC performed validation of the results. Validation was complete as of March 18, 2020. Final approved data was available as of April 27, 2020.

DATA GAP ANALYSIS

Based on the above summary, Credere prepared this data gap analysis by reviewing prior RI investigation data, having PDT meetings, identifying areas of concern, and then assessing the need for additional investigations or data. It was found that the primary source of contamination is the buried or abandoned debris in the western portion of the Site and prior coal/clinker storage piles along the northwest edge of the Site. A source of the TCE identified SY-OBMW11 has not been identified.

The debris has been observed to consists of drums, buried paint cans, metal scraps, household debris, abundant concrete and rebar, hosing, clinker, coal, wood, and likely other previously unearthed and unobserved materials. The geophysical EM61 survey largely identified the extent of the debris as shown in red hatching on **Figure 5**. Based on the exposure pathways identified for the Site, ISM surface soil sampling and discrete subsurface soil sampling have adequately assessed the soil exposure pathway for contaminants related to this debris. At a high-level overview, metals, PAHs, and limited PCBs were identified in soil at concentrations greater than human health and ecological PALs that will be considered in the Human Health Risk Assessment (HHRA) and Screening Level Ecological Risk Assessment (SLERA). No concentrations of these analytes were significantly elevated; however, marginally elevated concentrations greater than the PAL generally correlate to the areas of buried coal and clinker. The data set for surface and subsurface soil is considered complete. As such, no data gaps were identified for assessment of the human health or ecological pathways identified in the CSM.

A high-level overview of the sediment sampling results indicates select metals, PAHs, and limited PCBs were identified at concentrations greater than human health and ecological PALs that will be considered in the HHRA and the SLERA, respectively. Surface water results indicate select metals were identified at concentrations greater than human health and ecological PALs that will be considered in the HHRA and the SLERA, respectively. Pore Water results indicate select metals were identified at concentrations greater than ecological PALs that will be considered in the SLERA. The data set collected for sediment, surface water and porewater were deemed to adequately assess the exposure pathways identified in the CSM. As such, no data gaps were identified for the assessment of these human health or ecological pathways.

One soil area with a conductive anomalous response was identified in the center of the Site (see purple hatching **Figure 5**). Test pitting (SY-TP18) to a depth of 5 feet bgs and soil sampling at the peak anomaly area did not indicate any evidence of conditions that would cause this anomaly; however, the anomaly could be present beneath this depth as deep as the geophysical penetration depth of approximately 18 feet bgs. Additionally, SY-TP3, SY-TP24, and SY-SB4/SY-OBMW4 and associated soil and groundwater samples also within the defined anomalous area further did not indicate any evidence of the source of the anomaly. As the peak of the anomaly (300 mS/m) was significantly above background conditions (15 mS/m), the source of this elevated response, which was reproducible during both the initial 2018 survey and supplemental survey in 2019, remains a data gap.

Four rounds of groundwater sampling were completed between December 2019 and December 2020. Occasional detections of PAHs benzo(a)pyrene and dibenz(a,h)anthracene, cobalt, iron, hexavalent chromium, aluminum, and thallium exceeded the EPA Tapwater RSLs. Additionally, arsenic and manganese consistently exceeded the Tapwater RSL in most samples collected during the four rounds. None of these detections appear to correlate with an onsite soil source and are generally considered to be Sitewide conditions. Direct contact of ground water with ecological receptors is considered an incomplete pathway. As such, no groundwater comparison for ecological screening was completed.

TCE was detected in groundwater above the Tapwater RSL and the MCL in SY-OBMW11 (a hybrid well) at concentrations ranging from 4.1 to 7.5 µg/L during the four rounds of groundwater sampling. TCE was also detected in SY-OBMW12 at an estimated concentration of 0.69 µg/L, which is just above the Tapwater RSL of 0.28 µg/L. Limits of detection (LOD) for the other three rounds for this well were 1.0 µg/L; therefore, the presence of TCE at these concentrations below 1.0 µg/L cannot be dismissed. Considering the relatively low concentrations in these two wells and lack of TCE detections in the other 13 monitoring wells at the Site, TCE in the shallow weathered bedrock/overburden aquifer is considered well delineated by the non-detect wells relative to concentrations that would exceed the MCL. None the less, the migration pathways in overburden versus weathered and fractured bedrock have not been defined and remain a gap. Assessment of TCE concentrations at low levels in the remaining wells (i.e., concentrations below 1 µg/L) remains a data gap for understanding concentrations that could contribute to vapor intrusion exposure. Additionally, considering the tendency of TCE free product to sink in the aquifer, concentrations of TCE and other CVOCs in the deeper bedrock aquifer remains a data gap.

Migration of TCE vapors to nearby commercial receptors along Odlin Road is considered unlikely based on the dense clay and till overburden geology that would limit migration of vapors, depth of overburden groundwater (appears confined to below till at the top of bedrock) flow greater than 15 feet bgs and as deep as approximately 30 feet bgs in most wells, and volatile contaminants currently confined to just two wells a significant distance from the receptors with limited mass for volatilization. However, due to the unknown specific source of TCE in the two monitoring wells and data gap related to the bedrock aquifer, vapor concentrations in proximity to the nearby Odlin Road commercial receptors remains a data gap.

In summary, the identified data gaps include the following:

- Source of the conductive anomaly in the central portion of the Site
- Assessment of the bedrock aquifer for TCE and other CVOCs based on the presence of TCE in two overburden/hybrid wells
- Assessment of vapor encroachment on the nearby commercial receptors along Odlin Road

CONSTITUENTS OF INTEREST

Based on the Site history, previous investigations, and data gap assessment, the following constituents of interest (COIs) are identified for the Site for the indicated media and will continued to be screened for during the investigation to identify the COPCs at the Site. These COI categories and lists will be refined as more data becomes available:

Soil	Groundwater	Surface Water/Pore Water/Sediment
VOCs SVOCs Metals Hexavalent chromium EPH/VPH PCBs	VOCs SVOCs Metals Hexavalent chromium EPH/VPH PCBs	VOCs SVOCs Metals Hexavalent chromium EPH/VPH PCBs

VPH – volatile petroleum hydrocarbons
EPH – extractable petroleum hydrocarbons

Considering RI analytical results from 2019-2020, the following table identifies the primary COPCs or COPC groups that exceed PALs:

Soil	Groundwater	Surface Water/Pore Water/Sediment
PAHs Metals Hexavalent chromium EPH/VPH PCBs	VOCs (mainly TCE) PAHs Metals Hexavalent chromium	PAHs Metals Hexavalent chromium PCBs

Although not considered COIs, additional analyses in groundwater for natural attenuation parameters will include the following:

Groundwater
anions (nitrate, nitrite and sulfate) dissolved gases (methane, ethane, and ethene) ferrous iron alkalinity total organic carbons (TOC) <u>Field Parameter</u>: dissolved oxygen (DO), pH, oxidation reduction potential (ORP), conductivity, turbidity, and temperature

These MNA parameters will be used only if a CVOC plume is identified at the Site and will be used to establish a baseline for future degradation trends (i.e., after the RI), as well as to evaluate the current status of degradation in the plume.

Additionally, microbiological census analysis may be warranted for bedrock monitoring wells if a more extensive CVOC plume is identified in bedrock but will be evaluated after the first round of bedrock groundwater sampling.

NATURE AND EXTENT OF CONTAMINATION

Buried Debris Area

The buried debris areas have been well defined using geophysical methods as shown on **Figure 5**. There are two general types of debris, however, that are not distinguishable from the geophysics: 1) benign building rubble including concrete, rebar, hosing, and scrap metals, and 2) clinker, coal, and ash. Generally, although concentrations are not highly elevated, concentrations of PAHs that exceed the PALs correlate to areas where clinker, coal, and ash were noted. Other than patches of visible solidified tar at the surface (see sample results for SY-SS9), the building rubble debris areas have no specific associated COPCs.

The horizontal extent of buried debris is inferred from the results of the geophysical magnetic and electromagnetic surveys. The concentrated location of the metallic debris, existing surface contours, the 1960 aerials photograph, and lobed Site features suggest prior debris was graded to the southwestern part of the Site. This area also contains wetlands and ponding water suggesting this area was the former low point and drainage receiving area for the Site and likely other areas to the southwest. Therefore, it is likely a former low point was filled, and the thickest debris is present in this western area of the Site.

Vertically, debris was confined to the surface and underlain by a confining clay layer. Concentrations in the clay were non detect for PAHs or, at a minimum, below the PALs suggest no vertical migration or leaching of contaminants from the surficial debris has occurred.

Arsenic concentrations were consistent with statewide background levels (Maine DEP, 2018) and the calculated Site-specific background concentrations in the debris areas. Groundwater in the vicinity of the coal area contained only low levels of arsenic (9 µg/L; Credere, 2017) during prior investigations. Additionally, the elevated concentration at CA-MW-3 (180 µg/L; Credere, 2017) could not be replicated in SY-OBMW-7, which was located nearest to the prior location of CA-MW-3. Therefore, arsenic does not appear to be leaching to groundwater from the buried debris.

Debris and conditions at SY-TP12 and prior test pit CA-TP-A2 (Credere, 2017) were substantially different than those observed elsewhere on the Site. Coal, large metal scraps, and wood debris were observed as deep as 9 feet bgs where saturated conditions were encountered. Coal and gravel were observed to be comingled with clay indicating past reworking of this depth. Additionally, a blue clay confining layer inconsistent with clay observed elsewhere on the Site was also observed at 5-6 feet bgs further suggesting reworking. Buried paint cans, including chrome yellow, were observed during excavation of CA-TP-A2. Although no evidence of drums was noted in these test pits, TCE has been detected consistently in groundwater in monitoring well SY-OBMW11 nearest this area at concentrations ranging from 4.1 to 7.5 µg/L. TCE was also detected in SY-OBMW12 at an estimated concentration of 0.69 µg/L, which is just above the Tapwater RSL of 0.28 µg/L. Considering the relatively low concentrations and lack of detections in the other 13 overburden monitoring wells at the Site, TCE in the shallow weathered bedrock/overburden aquifer is considered well delineated horizontally relative to concentrations that would exceed the RSL or MCL. TCE has not been evaluated in deeper bedrock.

The behavior of TCE in the subsurface is dependent on the nature of the release, the form of the contaminant, and the environmental matrix. TCE is sparingly soluble in water, but its solubility limit is environmentally important because it is well above regulatory criteria and environmental screening levels. The concentrations detected in groundwater to date are low and not suggestive of a neat source (e.g., a non-aqueous phase liquid [NAPL] material) that has migrated vertically by density to and through the water table. If a release of TCE from buried containers, either in a dissolved or neat form, or to soil has occurred above the water table, TCE would tend to sorb to soil and be bound by soil organic material and diffuse into finer grain soil material. This mass would be subject to volatilization as well as dissolution and leaching, resulting in vertical migration through the vadose zone into the aquifer. Once dissolved TCE enters the aquifer, its fate and transport is governed generally by advection, dispersion, sorption and transformations, whether biological or abiotic.

Based on the currently identified concentrations in groundwater, an associated soil source that is in equilibrium with groundwater would have a mass or concentration so low such that it would likely not be detectable using the typical analytical methods (i.e., 8260) and, therefore, would not be present at concentrations above the PALs. If the original release was able to migrate vertically unimpeded to bedrock it is possible higher dissolved concentrations might be expected in bedrock, which has not been assessed at the Site to date. Although the overburden and hybrid wells have similar hydraulic conductivities, solute transport in a fractured media is fundamentally different than in a porous or fractured porous media and transport rates in bedrock are typically higher. Therefore, concentrations of TCE and other CVOCs in the deeper bedrock aquifer remains a data gap.

Electrically Conductive Anomaly Area

One area of anomalous electrically conductive soil identified by both ERI and ground penetrating radar (GPR) is present near the center of the Site and overlaps with an area of metallic debris. The extent of the anomaly as identified by EM31 is shown on **Figure 5**. Test pitting (SY-TP18, to 5 feet bgs) and soil sampling at the peak anomaly area did not indicate any evidence of conditions that would cause this anomaly. The lack of evidence of conditions that would cause the anomaly was interpreted through observations of the test pit, which consisted of light brown sand and clay, in which no PID response was recorded, and in which no apparently foreign or other materials of interest were observed. Additionally, SY-TP3, SY-TP24, and SY-SB4/SY-OBMW4 and associated soil and groundwater samples also within the defined anomalous area further did not indicate any evidence of the source of the anomaly. As the peak of the anomaly (300 mS/m) was significantly above background conditions (15 mS/m) and no evidence of what caused the anomaly was observed during test pitting or soil sampling, the source of this elevated response, which was reproducible during both the initial 2018 survey and supplemental survey in 2019, remains a data gap.

Historical Operations Point Sources

Potential point sources were reviewed relative to prior sample locations collected during the 2017 Phase II ESA. If prior data indicated no contamination was identified, the point source was dismissed. The following additional historical point sources, which are identified on **Figure 5**, were assessed during preliminary RI sampling and were largely identified based on the AGC evaluation of the Site (AGC, 2016; see **Site History** section):

- The offsite Oil and Dope building (T-163) reportedly stored oil and hazardous materials in the Salvage Yard. The location of the building is upgradient/crossgradient of the northern corner of the Site based on the groundwater flow interpolated during the Phase II ESA.
- Two apparent drum storage areas were present on the 1944 aerial photograph: one west of the railroad tracks south of Building T-134 and a second larger area southwest of Building T-161.
- A suspected trench was present in 1947 and later in 1960 along the tree line in the western portion of the Site. The area surrounding the trench was also used for open ground storage or dumping. The purpose of the trench is not known; therefore, it is presumed to have been used for dumping.
- Metal scrap bins were positioned south of Building T-134 between the main rail line and the spur. These bins typically stored ferrous and non-ferrous materials, and possibly temporary materials pending previous metal recovery (USACE, 2005). Aerials suggest there were bin partitions for segregating materials, but the materials appear stored on the open ground surface. Metals impacts would be confined to surface soil.

No current evidence of releases from these point source areas is currently present at the Site and analytical results from preliminary RI activities did not suggest any evidence that these historical operations resulted in a point source release. Generally, potential surface releases from all these sources are anticipated to be comingled and disperse, particularly considering the reworking of the southwestern portion of the Site after salvage yard operations.

Potential Offsite Migration

Certain sorbed COIs (primarily PAHs, metals, and PCBs) may have been entrained on soil in surface flow and eroded into current and historical drainage features that would have allowed for possible offsite migration. Historical drainage features changed significantly after reconfiguration of the adjoining airport prior to the 1970s. The historical drainage features can vaguely be observed in historical aerial photographs; however, the true drainage is not known. Therefore, onsite wetlands and a nearby prominent surface water body to the east, (e.g., Sucker Brook) may have received more direct drainage from the airport and salvage yard operations than current conditions indicate. These migration pathways have been sampled and will be evaluated for nature and extent as part of the Screening Level Ecological Risk Assessment (SLERA) and RI.

EXPOSURE PATHWAYS & POTENTIAL RECEPTORS

The future land use of the Site is anticipated to be redeveloped into a commercial/industrial facility and the Site is located within the Airport Development District. According to the City of Bangor Codes of Ordinances (Bangor, 2017), this use suggests Site use would be, "*aviation uses as well* *as certain manufacturing, retail and service uses which generally would be considered compatible with an airport complex*." However, discussion on the anticipated land use with the City on January 7, 2021, indicated they would entertain any zoning change and would not restrict any use, including residential or childcare, as long as the proposed development and construction plans complied with airport and FAA runway proximity requirements.

As a baseline, the Site is to be screened for the need for remedial actions under an unlimited use and unrestricted exposure (UU/UE) scenario. Potential receptors are conservatively assumed to be future hypothetical residents and recreational users, potential future commercial and industrial workers, trespassers, outdoor maintenance workers, and construction workers during any potential redevelopment, as well as terrestrial and aquatic (stream or wetland) biota. Exposure pathways to these receptors, given the current CSM, would be through direct exposures including dermal absorption, or incidental ingestion of contaminated soil, inhalation of volatile compounds and particulates, active ingestion through drinking contaminated water or indirect exposures such as consuming contaminated biota.

A "complete" exposure pathway exists for a contaminated area only when all the following four elements are present:

1. A source and mechanism of chemical constituent release to the environment;
2. An environmental transport pathway or secondary media for the released chemical constituent or mechanism of transfer of the chemical from one environmental medium to another;
3. An exposure point (or area) for potential contact by human beings or ecological receptors with the environmental medium of interest; and
4. A route of exposure (i.e., ingestion, dermal absorption, inhalation, or uptake) for that receptor to come in contact with chemical constituent of interest.

Exposure pathways were evaluated as being either "potentially complete" or "incomplete". The potentially complete exposure pathways are shown with a black circle with a dot in the column beneath the receptor. Exposure pathways that are known to be incomplete (i.e., known to not have all four of the required elements) are shown with an open black circle. This is depicted in the flow chart CSM in the RAWP in the September 2019 QAPP. The following reflects the preliminary assumptions that will be verified or revised as the Site CSM evolves.

At this time, the potentially complete pathways for human receptors are considered to be the following:

- Each of the identified human receptors could be exposed to impacted particulates in ambient air from unvegetated or disturbed areas that could be entrained by the wind or resuspended by future construction activities or vehicle traffic, or from limited emitted volatiles.
- Each of the identified human receptors could be exposed to the accessible surface soil via incidental ingestion and/or dermal absorption.
- Possible future construction workers, utility workers, outdoor maintenance workers and hypothetical future residents could be exposed via incidental ingestion or dermal absorption

to subsurface soil during excavation or following site regrading via incidental ingestion or dermal absorption.

- A hypothetical future resident could ingest plants or wildlife that have lived or fed in the area of contamination.
- Possible future construction workers, utility workers, outdoor maintenance workers, recreational users, trespassers, and hypothetical residents could be exposed to onsite sediment via incidental ingestion or dermal absorption.
- Possible future construction workers, utility workers, outdoor maintenance workers, recreational users, trespassers, and hypothetical residents could be exposed to onsite surface water via ingestion (either incidentally or by intentional consumption) or dermal absorption. Surface water exposure could occur in seasonally wet areas, such as those in the southern portion of the Site, in the central portion of the Site, and along Odlin Road and the former railroad bed along the eastern to northeastern portion of the Site.
- Each of the identified human receptors could be exposed to the groundwater via ingestion (either incidentally or by intentional consumption), dermal absorption and/or inhalation of volatiles in the groundwater.
- A hypothetical future resident, possible future commercial/industrial worker and current nearby commercial/industrial workers could be exposed to volatiles in groundwater or soil vapor via indoor air through the vapor intrusion pathway. Possible future construction workers, and utility workers could be exposed to volatiles in groundwater or soil vapor via inhalation in an excavation/trench scenario.
- There is no documented munitions and explosives of concern (MEC) hazard associated with the Site.

At this time, the potentially complete pathways for ecological receptors are considered to be the following:

- The identified ecological receptors could be exposed to accessible terrestrial surface soils, wetland sediments or ponded surface water either via incidental ingestion (i.e., the birds, and mammals) or via direct contact/absorption/uptake (i.e., the plants and soil and benthic invertebrates).
- Higher trophic level ecological receptors (i.e., intermediate and higher trophic level receptors) are expected to come into contact with Site related constituents that can be accumulated through uptake in terrestrial and wetland plants and fauna (i.e., soil invertebrates and small mammals) through the dietary ingestion exposure route.
- Wildlife (i.e., birds and mammals) could be exposed to the surface soils, wetland soils/sediment and surface water (seasonally when present) in the upland and wetland habitats present. The degree to which chemical constituent levels in these media (especially the surface soils and sediment) are attributable to historical operations at the Site is not yet known.
- Birds and mammals could be exposed to the ambient air that could contain Site related constituents soil particulates from un-vegetated or disturbed areas of surface soil that may

be entrained by the wind or re-suspended by vehicle traffic. However, this exposure route is expected to be insignificant relative to other exposure routes being evaluated.

Some exposure pathways cannot currently be designated as complete or incomplete due to certain unknowns associated with the Site. The following exposure pathways are considered potentially complete and not quantitatively assessed for the Site:

- Dermal contact with surface soil and inhalation of particulates for ecological receptors are considered potentially complete exposure pathways. These exposure pathways have no standard methods for assessment in Ecological Risk Assessments. Dermal absorption may be a relatively minor exposure pathway for birds and mammals in certain circumstances because results of exposure studies indicate exposures to various chemicals such as metals due to dermal absorption are insignificant compared to ingestion (Peterle, 1991). Incidental soil ingestion also incorporates exposures from grooming of particulates on skin, feathers, and fur. Inhalation of airborne particulates is believed to be a relatively insignificant portion of the total risk in most circumstances (Carlsen, 1996). The discussion of these pathways will be qualitative.

WORKSHEET #11 – PROJECT/DATA QUALITY OBJECTIVES

The purpose of this QAPP is to provide guidance for generating data that are of the precision, accuracy, and completeness necessary for the intended end use of the data. QAPP approval will be obtained prior to initiating any field activities and documented by signatures on **Worksheets #1 & 2** Title and Approval Page.

DQOs for the systemic planning process for existing RI data are included in the original QAPP (Credere, 2019a).

STATEMENT OF PROBLEM

The problem to be addressed by the SOW proposed herein are the three data gaps identified in Worksheet #10. There remains insufficient data to support a comprehensive CSM and HHRA/SLERA to evaluate the need for remedial action at the Site.

Based on these basic concerns, the following specific problems/questions are to be addressed by the objectives in the subsequent sections:

- What is the source of the conductive anomaly in the central portion of the Site?
- Does TCE in groundwater identified in SY-OBMW11 and SY-OBMW12 extend vertically into the bedrock aquifer?
- If TCE extends into the bedrock aquifer, what are the offsite migration pathways?
- Are soil vapor concentrations that would represent a vapor encroachment concern to nearby commercial receptors present?
- Heaved monitoring wells previously installed during 2019 RI activities.

IDENTIFY THE GOALS OF THE STUDY

The primary goal of the scope work outlined in this QAPP is to assess the identified data gaps. The following specific objectives to address the above problem statements are established:

- Further assess the conductive anomaly areas to attempt to identify the source of the anomalous response
- Assess the bedrock aquifer by bedrock groundwater sampling for the presence and concentrations of TCE and other CVOCs.
- Assess local geology to identify potential migrations pathways if the bedrock aquifer is impacted with TCE
- Assess soil vapor concentrations in the vicinity of the nearby commercial buildings to evaluate vapor encroachment
- Repair heaved monitoring well SY-OBMW4

IDENTIFY INFORMATION INPUTS

The following data are required to support the above objectives:

- Field observations of physical conditions, particularly the conditions in the area of the conductive anomaly.
- Additional surface geophysics to include a 3-D ERI survey around the high EM anomaly in the central portion of the Site and an additional four seismic refraction lines to increase the density of data to improve the current bedrock model and further assess bedrock conditions beneath the conductive anomaly area.
- Field screening data (e.g., PID, oil-in-soil shake tests).
- Soil sample data to evaluate vertical extent in the conductive anomaly area to assess for contaminants that may be the source of the conductive anomaly. Analytical inputs include a wide list of analyses due to the unknown source of the anomaly. Analyses will include VOCs, SVOCs, metals, EPH, VPH, PCBs, and TOC to remain consistent with prior analytical suites.
- Observation of deeper bedrock geology through drilling observations, borehole geophysics, and hydraulic testing (HPFM and transmissivity testing), including rock type, quality, and the presence, orientation and water bearing potential of fractures and the bedrock aquifer onsite.
- Offsite fracture trace analysis and drinking water/supply well inventory to assess offsite migration pathways and potential drinking water receptors.
- Assessment of contaminant containing fractures/zones and construction of well liners to allow for groundwater sampling of discrete bedrock depths and determination of CVOC presence, absence, distribution and vertical extent. Although the primary objectives are presence or absence, the location of wells should give an initial assessment of both lateral and vertical distribution where CVOCs are present. Since the current CVOC distribution is unknown these wells may not provide full delineation; however, with aid of FACT data, multiport design should allow an adequate spatial understanding of CVOCs, if present. This input may also incidentally result in vertical delineation of CVOCs in bedrock based on the depth of the borings to 300 feet and three planned FLUTe intervals; however, this is not a primary objective of the FLUTe interval design. Groundwater sampling analyses will continue to include the full list of analyses completed previously including VOCs, SVOCs, metals, EPH, VPH, PCBs, TOC and MNA parameters (anions, dissolved gases, ferrous iron, and alkalinity).
- Establish a baseline for future CVOC degradation trends (i.e., after the RI), as well as evaluate the current status of degradation in the plume using MNA parameters.
- Overburden groundwater screening in the downgradient Site position, and soil vapor sampling data in the downgradient position of the Site nearest the commercial receptors along Odlin Road. Groundwater screening samples to assess the need for soil vapor sampling will include VOCs only. Soil vapor samples will also be analyzed for VOCs.
- Reinstallation of SY-OBMW4 followed by redevelopment, survey, and new hydraulic testing data.

- Collection of synoptic water levels to determine groundwater flow directions and gradients.
- USGS NWIS data to evaluate high, low, and baseflow conditions in Kenduskeag Stream as well as USGS monitoring well data that is publicly available to assess timing of groundwater sampling events.

DEFINE THE BOUNDARIES OF THE STUDY

Physical Boundaries

The physical boundaries of the area to be assessed are depicted on **Figure 2** and **Figures 5 through 9**. **Figure 2** shows the Site boundary and granted ROE boundary and depicts the local drainage features that may act as a pathway for offsite migration. Assessment beyond the ROE is currently limited by access at this time. Based on prior RI data, the extent of onsite contamination appears confined to the Site and generally limited to geophysically-bounded buried debris areas, TCE in SY-OBMW11 and SY-OBMW12, and limited impacted wetland areas. However, confirmation and refinement of these extents is the subject of the scope of work herein. Figures will be updated as data becomes available that indicates an extent of contamination. The current understanding of the extent of metallic debris and the electrically conductive anomaly area are shown on **Figure 5** based on the findings of the surface geophysics. The scope of work designed to meet these objectives is summarized in **Worksheet #17**.

Limitations on the study boundaries include the presence of wetlands throughout the Site as depicted on **Figure 2**. These wetlands overlap in the western portion of the Site with the extent of buried debris as defined by geophysical survey. Subsurface assessment of debris in these areas will be limited so as not to impact the wetlands through disturbance of the debris.

Additionally, the study boundary is currently limited by ROE agreements. Offsite conditions cannot be assessed, including immediate proximity to the Odlin Road commercial receptors, without legal ROE.

Bedrock investigations will be completed to depths of 300 feet bgs. Based on the Maine Geologic Survey Well Database within approximately 2 miles of the Site, private (domestic) bedrock drinking water wells vary from 75 to 533 feet bgs with yields ranging from 4 to 100 gallons per minute (gpm). The deepest well, a commercial well located 1.8 miles northeast of the Site is 1,500 feet deep. In vicinity of the Site the three deepest wells (depths between 420 and 533 feet bgs) all have surface casing that extend well into bedrock (25-35 feet into rock) and likely exclude inflow from shallower weathered bedrock. The other nearby wells are shallower (100 to 200 feet bgs) and tend to have shallower surface casings (5 to 15 feet into rock) and may have shallow fracture zone contribution. Due to the significant variability of depths and flow rates (yield) of these wells, 300 feet is a reasonable target depth to assess the presence or absence objective for the bedrock aquifer. This depth places boring completion depths at approximately 150 feet below sea level. Groundwater impacts, if present, are likely constrained within the local hydrologic flow system and are less likely to migrate vertically downward into the deeper, more regional, groundwater flow system. Therefore, 300 feet is an adequate, if not conservative depth for nature and extent assessment and with multilevel monitoring will meet vertical delineation objectives.

The quarry located approximate 1 mile southwest of the Site has been developed to an elevation between 10 and 0 feet (NAVD 88) from a rim elevation of approximately 150 feet (depth of 140-150 feet bgs) based on the 2021 Bangor USGS 7 ½ minute topographic quadrangle map.

The interpretation of photolineaments, their extraction and digitized locations will be completed using a series of GIS based work processes using a LiDAR derived DEM. The underlying accuracy of the DEM is derived from the density of the LiDAR point cloud data. For this available data set, 92 percent for the point cloud data has spacing of 7 feet or less indicating location accuracy of derived surfaces should be within 2 meters (+/-). Objects smaller than 2.4 feet would not likely be characterized or detected by this data.

Geologic structures are typically curvilinear, rather than straight, so placement of a photolineament is an approximation dependent on the scale (length) and "straightness" of the feature. Since extraction and digitization of a photolineament requires professional judgement and is also scale dependent the width error bar might be on the order of tens of feet or meters down to 2 meters (±) for the underlying point cloud data. In summary, the width and location error of any individual feature is case dependent. A minimum width location of 2 meters is a reasonable lower end for well-defined narrow features. If a photolineament is identified that transects the Site, surface geophysical surveys (resistivity or seismic reflection) to confirm feature location and attitude would likely be warranted prior to any confirmatory drilling.

Temporal Boundaries

Temporally, this investigation will represent a single snapshot for soil vapor, however, will represent the seasonal variation over the course of another year for groundwater. As this assessment is planned to represent exposure to human and biological populations that could be present throughout the year, the sampling timeline will not be biased by Site or local factors and will be selected based exclusively on the calendar. Temporal variability through vertical gradients will be limited through use of Flexible Liner Underground Technologies (FLUTe)™ liner technology.

The groundwater sampling program includes four quarterly sampling rounds. The USGS National Water Information System (NWIS) will be accessed to collect data related to high, low and baseflow conditions with the nearby Kenduskeag Stream monitoring station [01037000] as well as USGS monitoring wells data. This temporal data will direct the timing of the collection of groundwater samples: therefore, the "quarterly" events will not be restricted to just the three month calendar quarters. If chlorinated solvents are present in bedrock groundwater and concentrations indicated sequential dechlorination, the monitored natural attenuation (MNA) data will not show attenuation over the course of the year. The data will provide a baseline of the geochemical conditions at the Site that can be compared to the prior four quarters of overburden groundwater sampling between 2019 and 2020 and future long-term monitoring, if required.

DEVELOP THE ANALYTICAL APPROACH

Analytical data will be collected with a degree of certainty such that results meet the DQOs of the RI and HHRA/SLERA. At this phase of the assessment and without known contamination and conclusions of the HHRA/SLERA, an "Action Level" is considered investigation specific.

Therefore, risk-based PALs and project quantitation limit goals (PQLGs) and Site-specific background concentrations will be considered during this RI. Sample justifications/rationale are summarized in **Worksheet #17** and are considered to represent conditions specific to the indicated objective.

Previous groundwater data indicates the primary COPCs that exceed screening criteria to be TCE, metals, and limited PAHs in groundwater. However, for consistency with the existing groundwater sampling rounds and further confirmation of the lack of bedrock aquifer impacts, the analytical approach continues to include a wide list of analytical methods and is considered a groundwater screening. The soil vapor assessment analyses are limited to just VOCs, which are the only vapor migration COIs. Because PAHs and CVOCs are considered likely COPCs at the Site, PAHs and VOCs by SIM have been added at this phase to obtain the most usable data.

Should the COIs exceed screening criteria and be considered COPCs and require evaluation of risk, results will also be evaluated relative to background. Statistical hypothesis testing is the preferred method for background comparison. The most appropriate hypothesis testing technique is expected to be a two-sample test of the means, such as the Welch's t-test or the Student's t-test. The selection of the technique to be applied will ultimately be based on the characteristics of the data collected. If the collected data is such that statistical testing methods would not be sufficiently powerful to support the required Site management decision-making, graphical evaluation techniques for comparing the subarea data to background will be employed, as recommended by Interstate Technology & Regulatory Council (ITRC) and DoD guidance.

The hypothesis testing will be set up to match the current CSM. Site history and limited prior Phase II ESA data suggest that little or no contamination will be found in DUs 5. As such, the most appropriate hypothesis to be tested is that the concentrations of COIs are not statistically different from (greater than) background (i.e., Test Form 1). The use of Test Form 1 is consistent with Section A.2 of USEPA's Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, which suggests that in the characterization stage, Background Test Form 1 is useful for determining if the difference between the site mean and background mean is significantly greater than zero (USEPA, 2002). If the comparisons (including statistical testing, graphical evaluation, and consideration of other lines of evidence) indicate COPC concentrations are not greater than background, NFA relative to these constituents would be warranted as Maine DEP will not require a cleanup of Site soil to be more stringent than the local background concentrations (Maine DEP, 2021). If the comparisons indicate the concentrations of one or more of the selected COPCs in a DU are greater than background, a further line of assessment would be required.

Without considering the current unknowns or uncertainties, the decision rule will be that remedial action may be required if human health excess lifetime cancer risk (ELCR) exceeds $1x10^{-4}$ and/or hazard index (HI) exceed one (1) based on a Reasonable Maximum Exposure (RME) scenario for a complete or plausibly complete potential exposure pathway, or if the Baseline Ecological Risk Assessment (BERA) indicates excess risk to ecological receptors results in a hazard quotient (HQ) or equivalent comparison to an ecological screening value for a known cause and effect relationship exceeds one (1) for a complete exposure route. The results of the human health and ecological risk assessments and the uncertainties associated with those results must be considered when making risk management decisions that rely on those results. Uncertainty interpretation is especially relevant when the risks exceed the point of departure for defining "acceptable" risk.

Generally, the decision for action will be dictated by the HHRA/SLERA and CSM presented in the RI, which will be conducted in accordance with the following regulations/guidance:

- USACE Standards Scopes of Work for Environmental Risk Assessments (USACE, 2016)
- USACE Risk Assessment Handbook EM 200-1-4 Volume I and II (USACE, 1999; USACE, 2010)
- Tri-Service Position Paper on Background Levels in Risk Assessment (USACE, 2011)
- USACE Technical Project Planning, EM 200-1-2, (USACE, 2016)
- Remedial Investigation (OSWER Directive 9355.3-01; EPA, 1988)
- EPA Risk Assessment Guidance for Superfund Parts A-D (EPA, 1989; EPA, 1997)
- EPA Exposure Factors Handbook and 2014 update (EPA, 2011; EPA, 2014)
- Presumptive Remedy for CERCLA Municipal Landfill Sites (EPA 540-P-91-001 -- OSWER Directive 9355.3-11 and EPA 540/R-94/081, OSWER 9356.0-03; EPA, 1993)

SPECIFY PERFORMANCE AND ACCEPTANCE CRITERIA

Performance and acceptance quality assurance are summarized throughout this QAPP for both field and laboratory activities. Field personnel and subcontractors will review this QAPP to ensure these procedures are implemented.

The primary data quality objectives (DQOs) for all projects is to ensure: a) measurements are representative of actual Site conditions and data resulting from field, sampling, and analytical activities be comparable, reproducible, and generated in a scientifically valid and legally defensible manner; and b) judgments can be made against the applicable comparison criteria with minimized uncertainty for making project decisions.

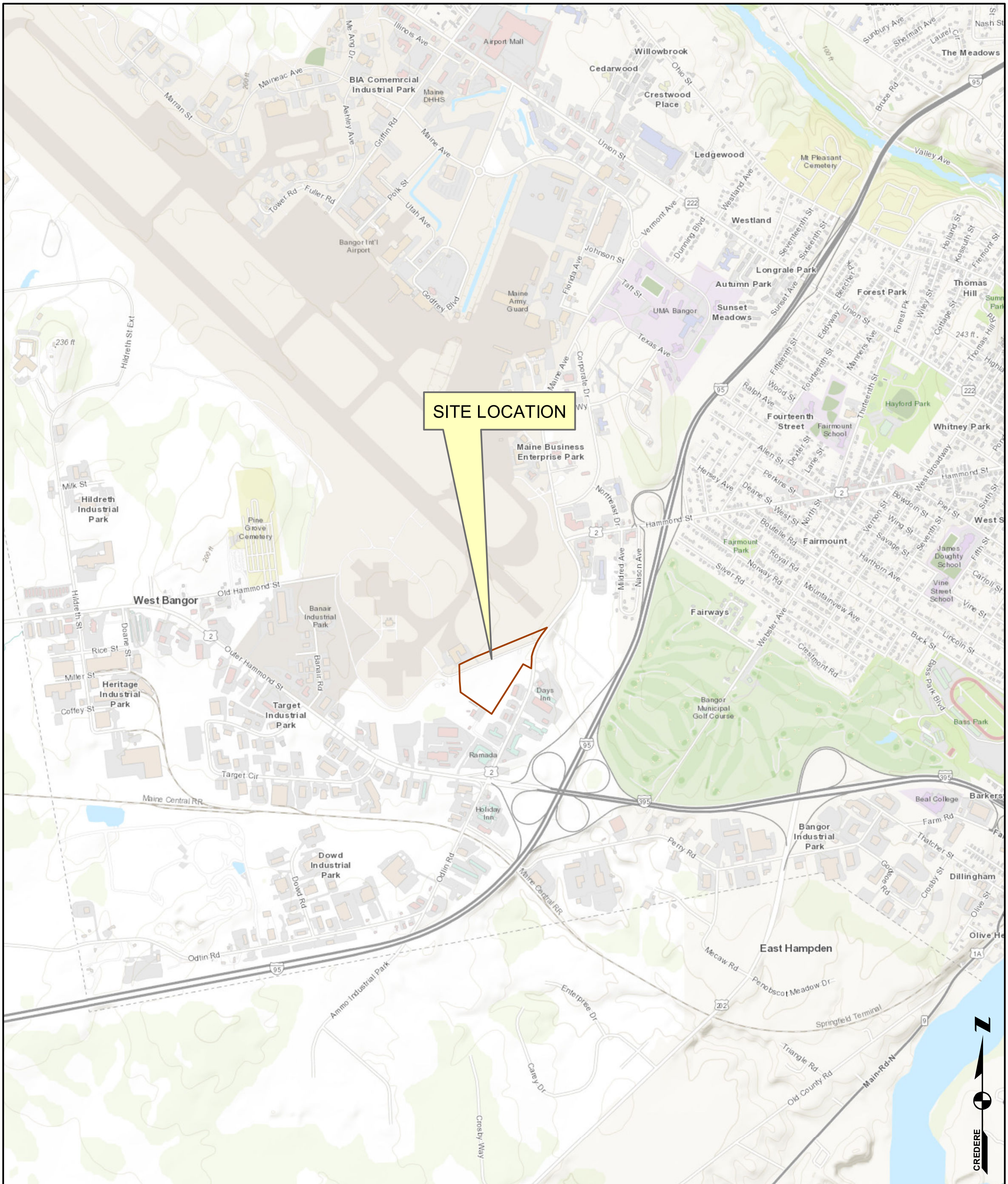
The primary analytical DQO will be for the limit of quantitation (LOQ) to be sufficiently lower than the PQLGs (half the PAL). When the LOQ is greater than the PQLG, the LOQ will be considered the PQLG. The analytical sensitivities noted in **Worksheet #15** are those achievable by the respective analytical methods by the analytical laboratories (ARA, KAS, and Alpha). Certain compounds continue to have PQLGs and PALs below the LOQ; however, have been evaluated on a compound by compound basis to assess if they are: 1) likely to be Site COIs, 2) whether an elevated reporting limit may falsely indicate risk, and 3) if there are feasibly other methods that could achieve lower limits. In these cases, the PQLG will be the LOQ. Based on this evaluation, the proposed methods are considered reasonable for this first phase of assessment. These criteria will be reevaluated as the COIs become more refined.

Acceptable limits of an alpha of 0.05 (i.e., requiring 95% confidence) and a beta of 0.20 on the Type I and Type II errors have been selected for the statistical hypothesis testing. If other analytical techniques become required, their application will be reviewed by the Project Team.

DEVELOP THE PLAN FOR OBTAINING DATA

The sample design includes overburden groundwater monitoring of existing wells, sampling of newly installed bedrock monitoring wells, sampling soil vapor, and assessment of local geologic fractures. A detailed plan for data collection is provided in **Worksheet #17,** and detailed field methodology is included in **Worksheet #21**.

FIGURES



DRAWN BY: **SCG**	DATE: **3/2/2022**
CHECKED BY: **ASD**	PROJECT:**18001468**

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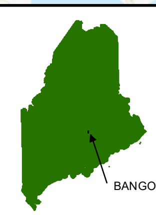
FIGURE 1
SITE LOCATION PLAN

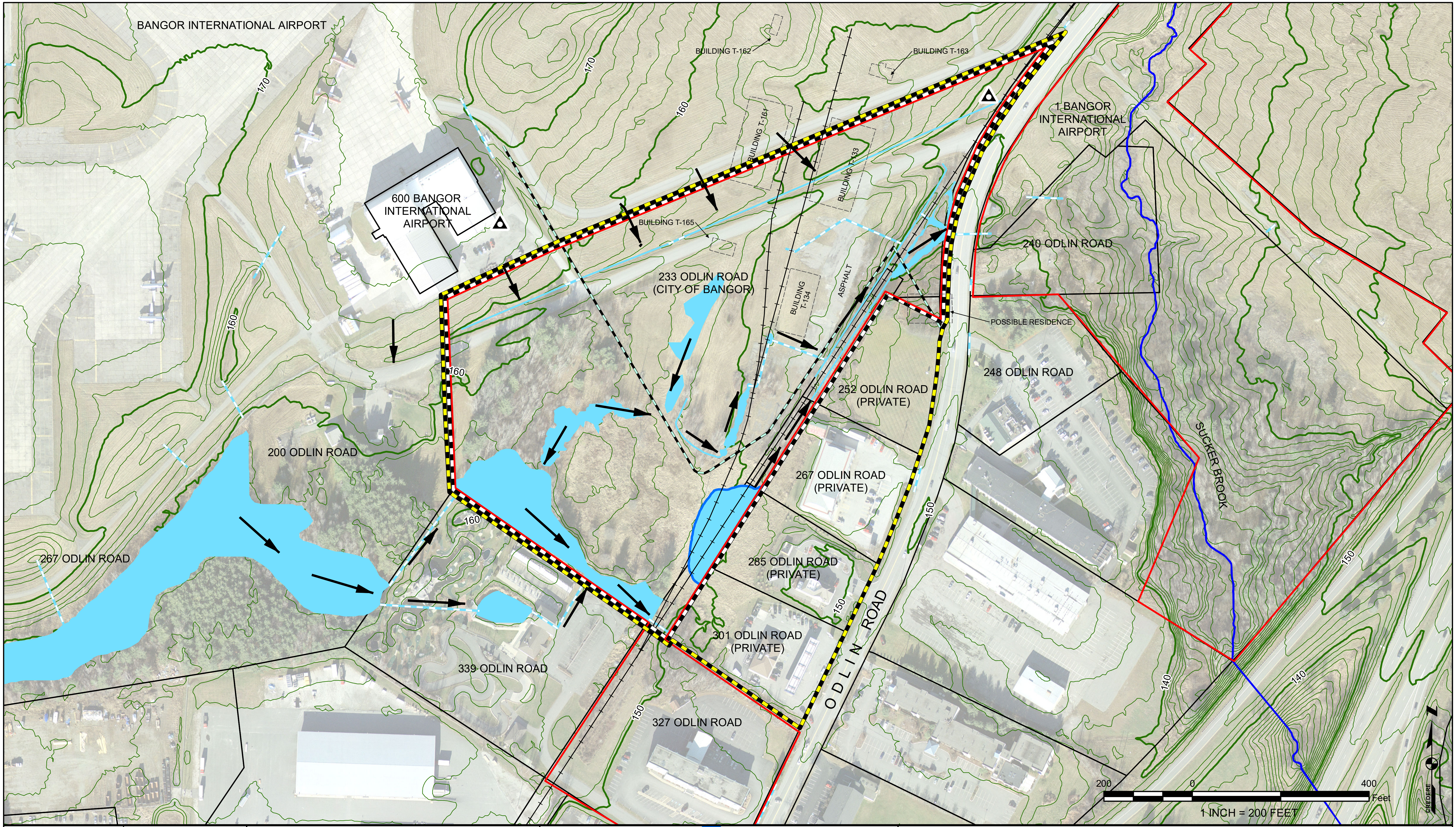
FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

1,000 0 2,000 Feet
1 INCH = 2,000 FEET



Topographic Map Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 1.mxd



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Community Economy Environment

FIGURE 2
SITE VICINITY LAYOUT, DRAINAGE PLAN, & MAP OF WETLANDS

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

Legend

- BENCHMARK
- RIGHT-OF-ENTRY PARCEL BOUNDARY
- FORMER SALVAGE YARD SITE AREA
- CURRENT RI INVESTIGATION AREA
- POWER LINES
- HISTORICAL RAILROAD TRACKS
- HISTORICAL SITE BUILDING
- DRAINAGE CULVERT
- DRAINAGE SWALE
- JULY 2019 USACE WETLAND DELINEATION
- APPROXIMATE PARCEL BOUNDARY
- PARCEL BOUNDARY
- SUCKER BROOK
- WETLAND
- DIRECTION OF SURFACE STORM WATER FLOW
- TWO FOOT ELEVATION CONTOUR
- TEN FOOT ELEVATION CONTOUR

NOTES:

1. EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM HISTORICAL PHOTOGRAPHS AND GIS DATA FROM US ARMY CORPS OF ENGINEERS (USACE), USACE 1994 SITE INSPECTION, MAINE GEOLIBRARY (2009 AERIAL IMAGERY AND TOPOGRAPHIC DATA), AND FIELD WORK PERFORMED BY CREDERE IN SPRING/SUMMER 2016, FALL 2018, AND FALL 2019.

2. POSITIONS INCLUDING BENCHMARKS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

https://gis.maine.gov/arcgis/services/imageryBaseMapsEarthCover/orthoMunicipalBangor2009/ImageServer

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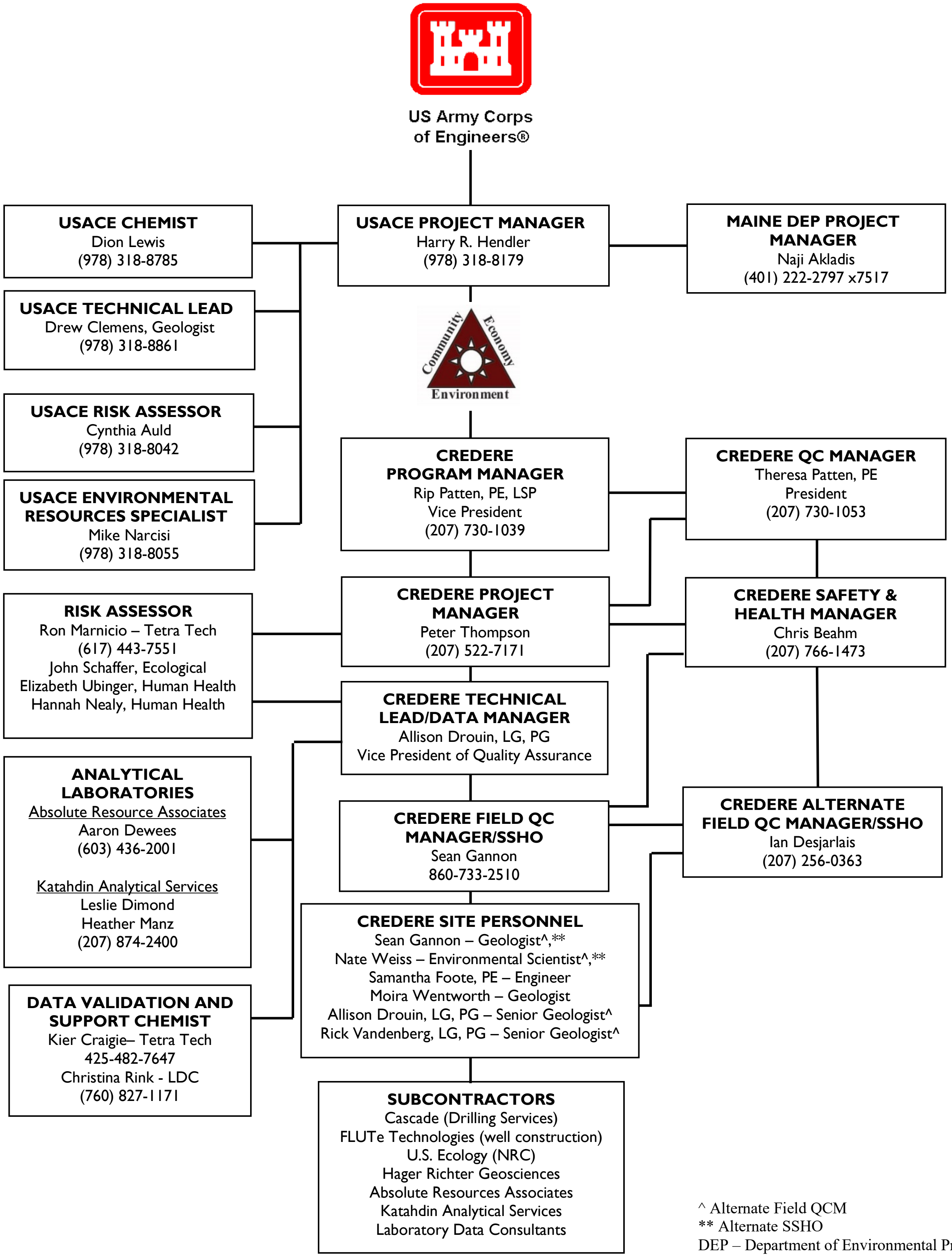
Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\Q4 Field Report\Figure 2 - Site and Vicinity Layout.mxd

Figure 3 – Project Organization Flow Chart



^ Alternate Field QCM
** Alternate SSHO
DEP – Department of Environmental Protection
LDC – Laboratory Data Consultants
LG – Licensed Geologist
LSP – Licensed Site Professional
PE – Professional Engineer
PG – Professional Geologist
QC – Quality Control
QCM – Quality Control Manager
SSHO – Site Safety and Health Officer
USACE – U.S. Army Corps of Engineers

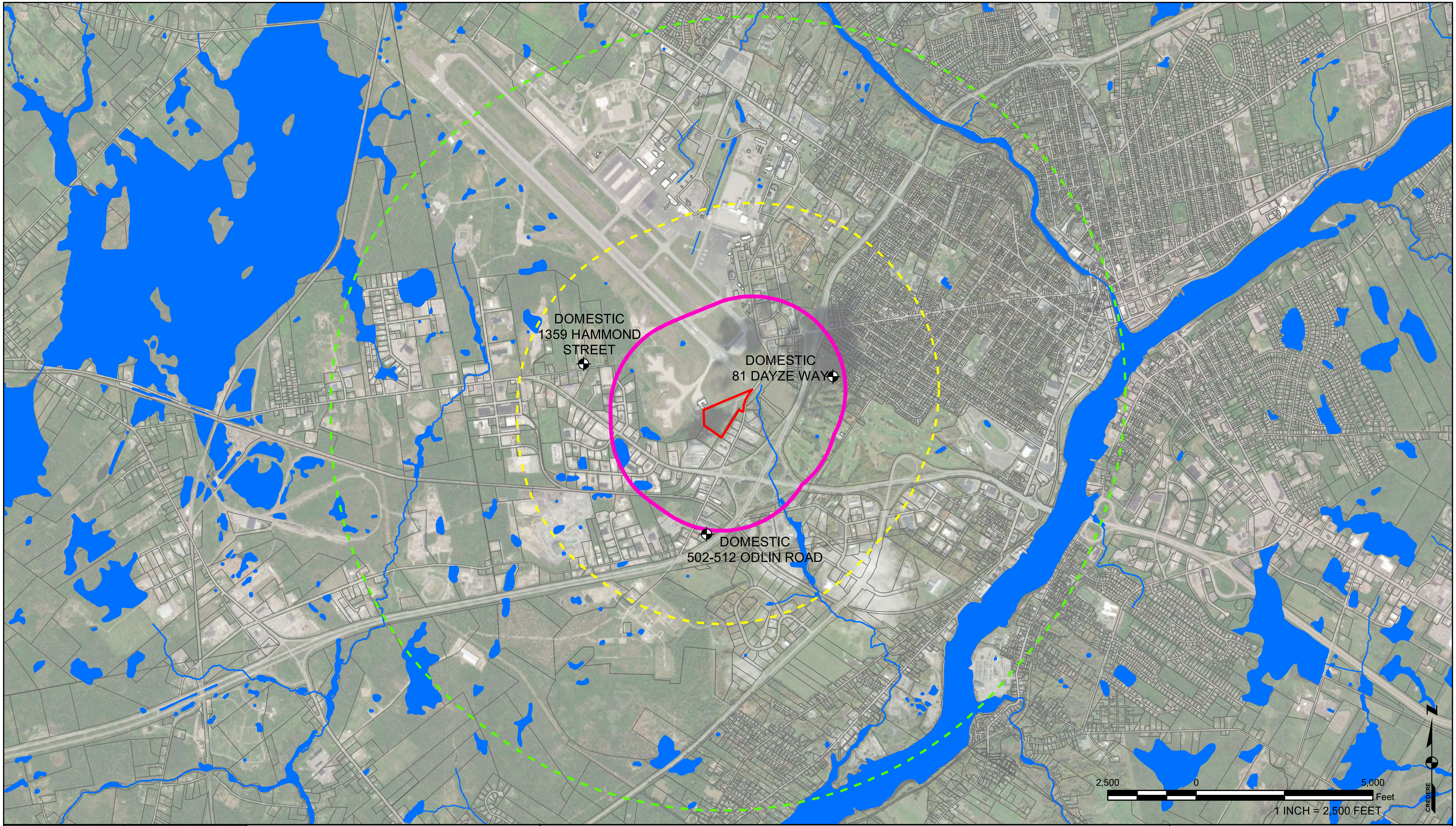


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FIGURE 4
PRIORITY RESOURCE MAP

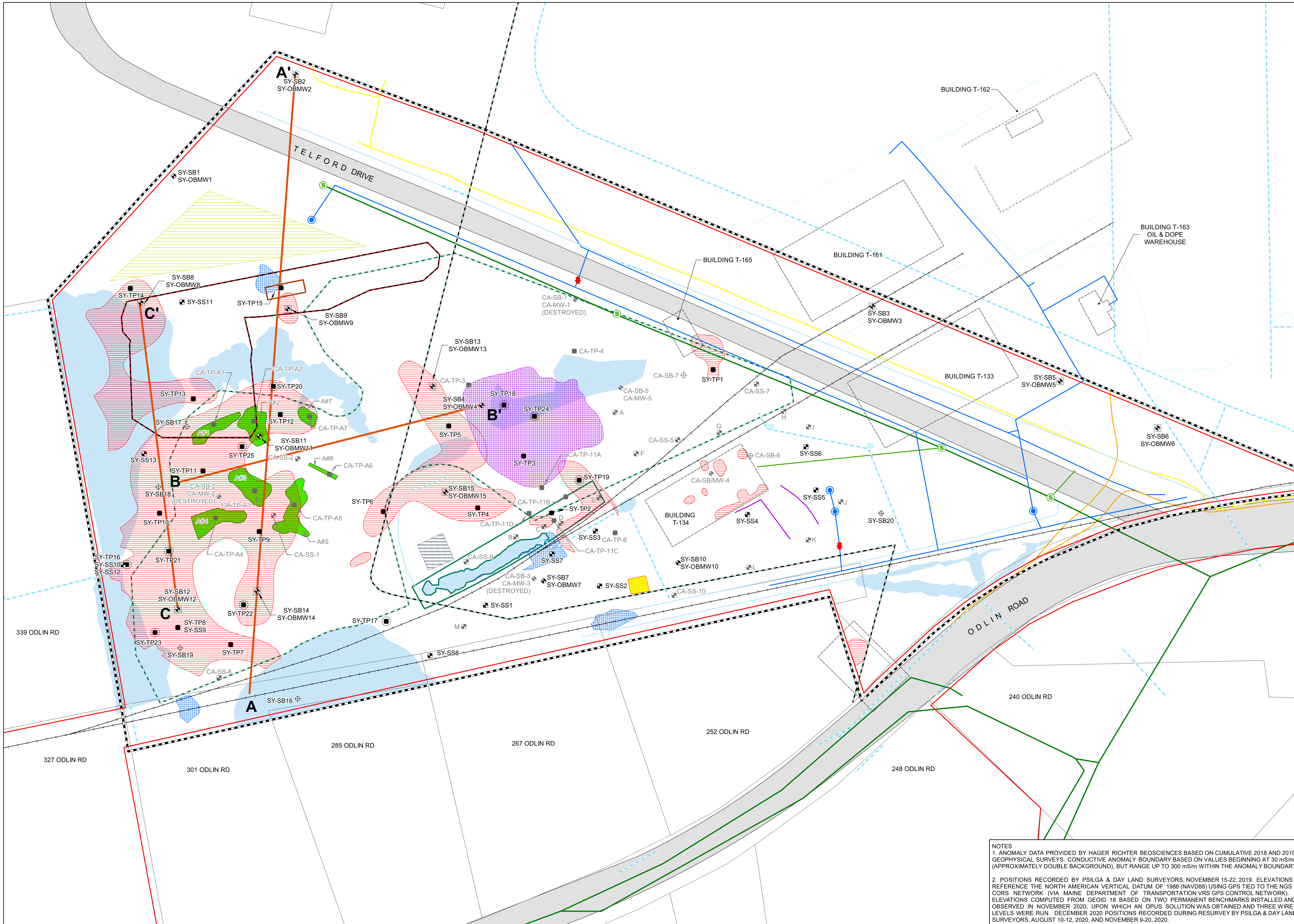
FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

DRINKING WATER WELL LOCATION
WORK PLAN INVESTIGATION AREA
HALF-MILE BUFFER
ONE-MILE BUFFER
TWO-MILE BUFFER
NWI WETLAND
APPROXIMATE PARCEL BOUNDARY

EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM BANGOR ONLINE GIS DATA AND MAINE GEOLOGICAL SURVEY WELL DATABASE VIEWED IN JANUARY 2022, AND ESRI ORTHO IMAGES.

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

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 4 - Priority Resource Map.mxd



Feet

0 15 30 60 90 120

1 inch = 60 feet

- SOIL BORING/ HYBRID MONITORING WELLS
- TEST PIT LOCATIONS (NOT SAMPLED)
- TEST PIT LOCATIONS
- SOIL BORING/ OVERBURDEN MONITORING WELL
- SURFACE SAMPLE
- SOIL BORING
- PREVIOUS SOIL BORING/ OVERBURDEN MONITORING WELL
- PREVIOUS SOIL BORING
- PREVIOUS SURFACE SOIL SAMPLE
- PREVIOUS TEST PIT
- HISTORICAL BUILDING
- RIGHT-OF-ENTRY PARCEL BOUNDARY
- CURRENT RI INVESTIGATION
- HISTORICAL RAILROAD TRACKS
- POWER LINES
- FENCED YARD
- CROSS SECTION TRANSECT
- CATCH BASIN
- HYDRANT
- MANHOLE
- VALVE TERMINUS
- HISTORICAL SWALE
- DRAINAGE SWALE
- WATER LINE
- COMMUNICATIONS CABLE
- STORMWATER SEWER/CULVERT
- ELECTRICAL LINE
- NATURAL GAS LINE
- SEWER LINE
- APPROXIMATE PARCEL BOUNDARY
- TRENCH AT DUMPING
- DUMPING AREA
- APPROXIMATE LAYDOWN/DECON
- EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
- AREA OF ANOMALOUS SOIL
- AREA OF POSSIBLE BURIED METAL
- EM SURVEY ANOMALY
- UNDISTURBED AREA
- PAVED/STORAGE AREA
- COAL AND DEBRIS
- DRAINAGE STRUCTURE
- WETLAND

NOTES

1. ANOMALY DATA PROVIDED BY HAGER RICHTER BEOSCIENCES BASED ON CUMULATIVE 2018 AND 2019 GEOPHYSICAL SURVEYS. CONDUCTIVE ANOMALY BOUNDARY BASED ON VALUES BEGINNING AT 30 mS/m (APPROXIMATELY DOUBLE BACKGROUND), BUT RANGE UP TO 300 mS/m WITHIN THE ANOMALY BOUNDARY.

2. POSITIONS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

FIGURE 5
SOIL AND GROUNDWATER SAMPLE LOCATION PLAN

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

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Coordinate System: NAD 1983 UTM Zone 19N
Projection: Transverse Mercator
Datum: North American 1983
Reference Scale: 1:720

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 5 - Sampling Plan-SizeD_Field Updates_10.5_QAPP.mxd

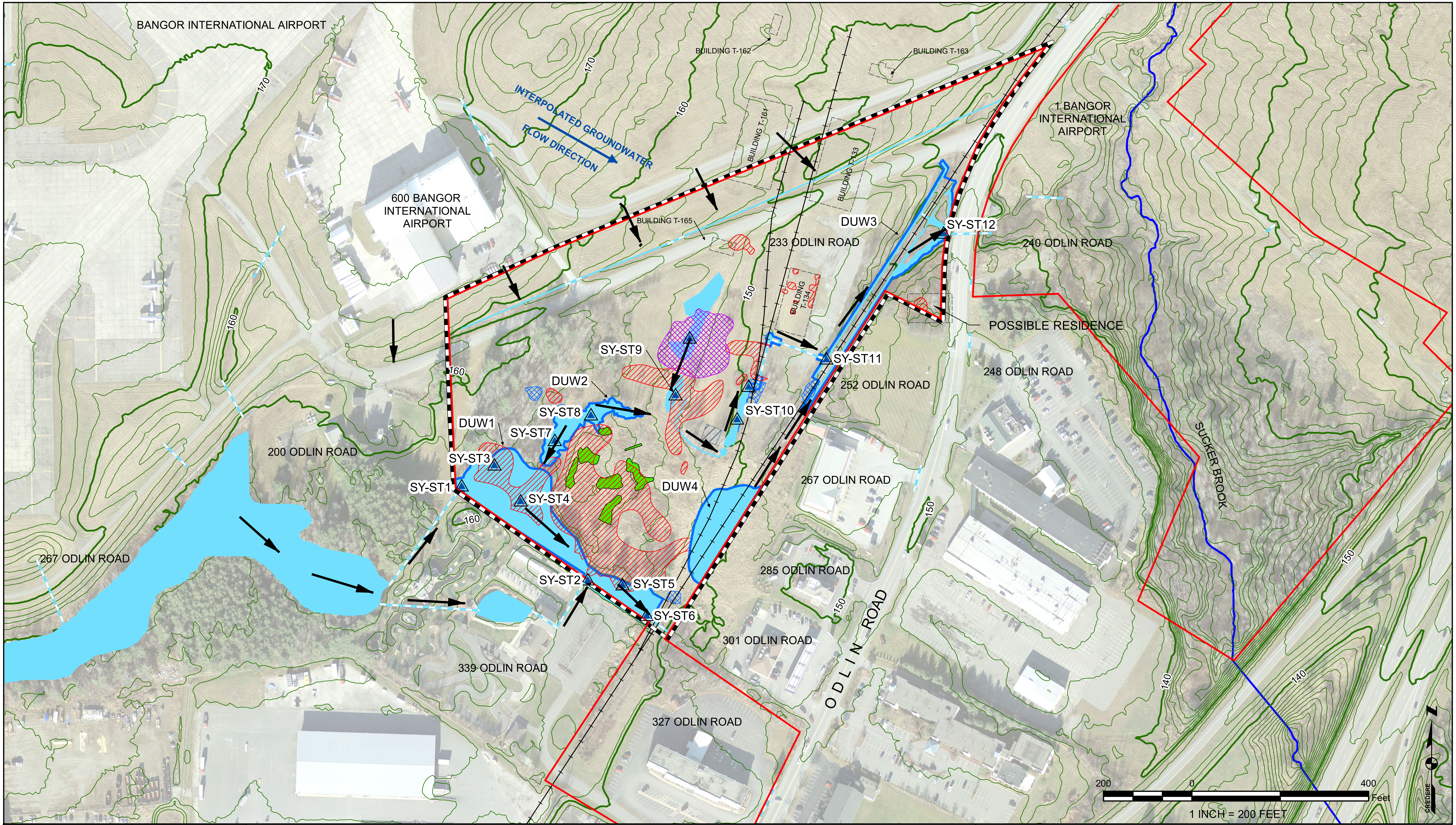

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FIGURE 6
WETLANDS DUs, SURFACE WATER, SEDIMENT, AND PORE WATER SAMPLE LOCATION PLAN

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

SURFACE WATER, SEDIMENT, AND PORE WATER SAMPLE STATION
CURRENT RI INVESTIGATION
RIGHT-OF-ENTRY PARCEL BOUNDARY
HISTORICAL SITE BUILDING
HISTORICAL RAILROAD TRACKS
EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
AREA OF ANOMALOUS SOIL
AREA OF POSSIBLE BURIED METAL
EM SURVEY ANOMALY
DRAINAGE CULVERTS
DRAINAGE SWALE
WETLAND DECISION UNIT
WETLAND
DRAINAGE STRUCTURE
SUCKER BROOK
APPROXIMATE PARCEL BOUNDARY
DIRECTION OF SURFACE STORM WATER FLOW
2' CONTOUR
10' CONTOUR

NOTES:
1. EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM HISTORICAL PHOTOGRAPHS AND GIS DATA FROM US ARMY CORPS OF ENGINEERS (USACE), USACE 1994 SITE INSPECTION, MAINE GEOLIBRARY (2009 AERIAL IMAGERY AND TOPOGRAPHIC DATA), AND FIELD WORK PERFORMED BY CREDERE IN SPRING/SUMMER 2016, FALL 2018, AND FALL 2019.
2. POSITIONS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

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Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 6 - Wetland DU_SW_PW_Sed Sampling Plan.mxd

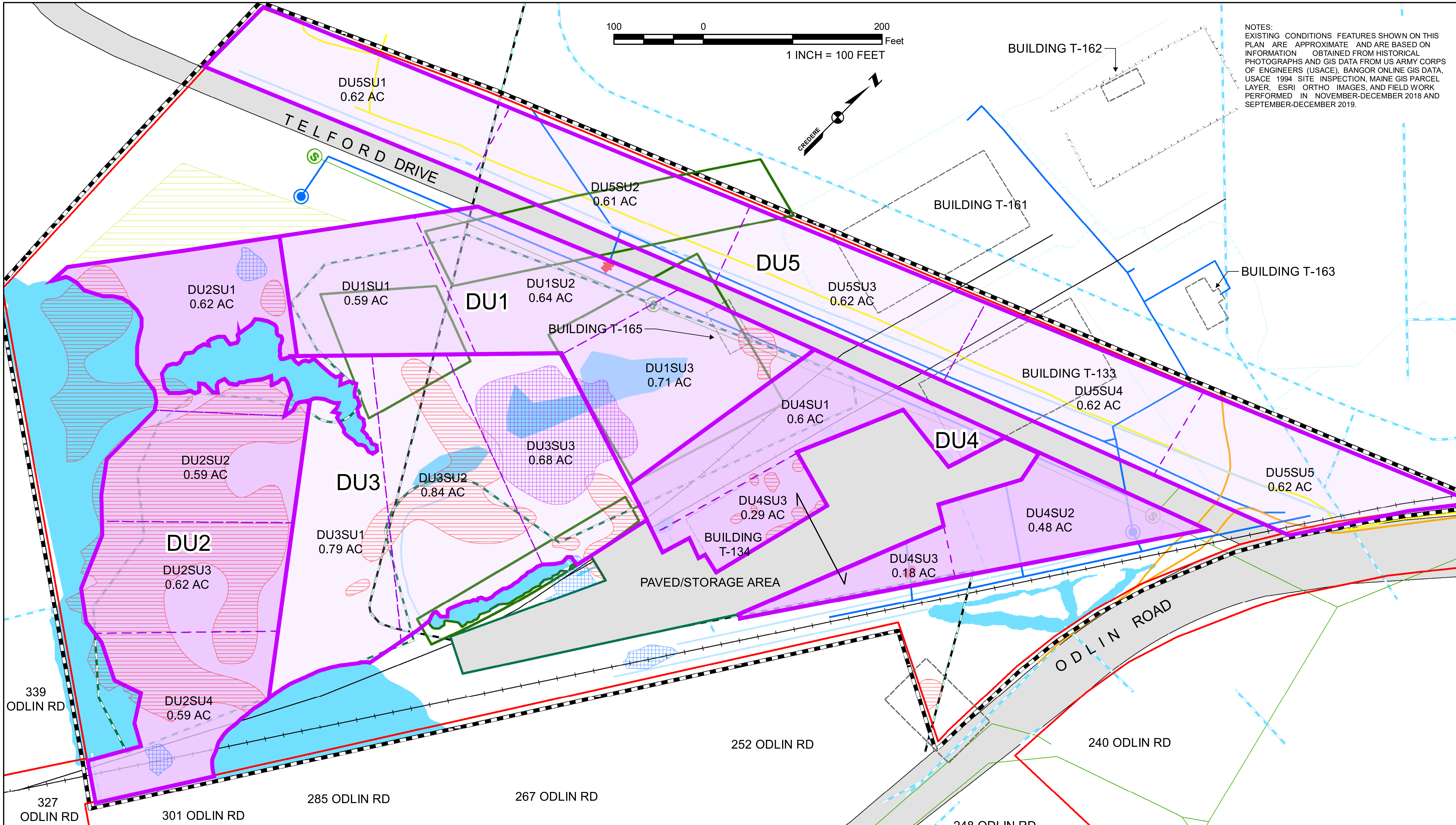

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FIGURE 7
UPLAND DU SAMPLE LOCATION PLAN

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

DECISION UNITS
SUB UNITS
UNDISTURBED
EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
AREA OF ANOMALOUS SOIL CONDUCTIVITY
AREA OF POSSIBLE BURIED METAL
STORAGE
1964 DEBRIS LOBES AND COAL
APPROXIMATE PARCEL BOUNDARY
WETLAND
HISTORICAL BUILDING
RIGHT-OF-ENTRY PARCEL BOUNDARY
CURRENT RI INVESTIGATION
HISTORICAL RAILROAD TRACKS
POWER LINES
FENCED YARD
HISTORICAL SWALE
DRAINAGE SWALE
WATER LINE
COMMUNICATIONS CABLE
STORMWATER SEWER/CULVERT
ELECTRICAL LINE
NATURAL GAS LINE
SEWER LINE
CATCH BASIN
HYDRANT
MANHOLE
VALVE TERMINUS

Coordinate System: NAD 1983 UTM Zone 19N
Projection: Transverse MercatorDatum: North American 1983

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 7 - Upland DUs.mxd

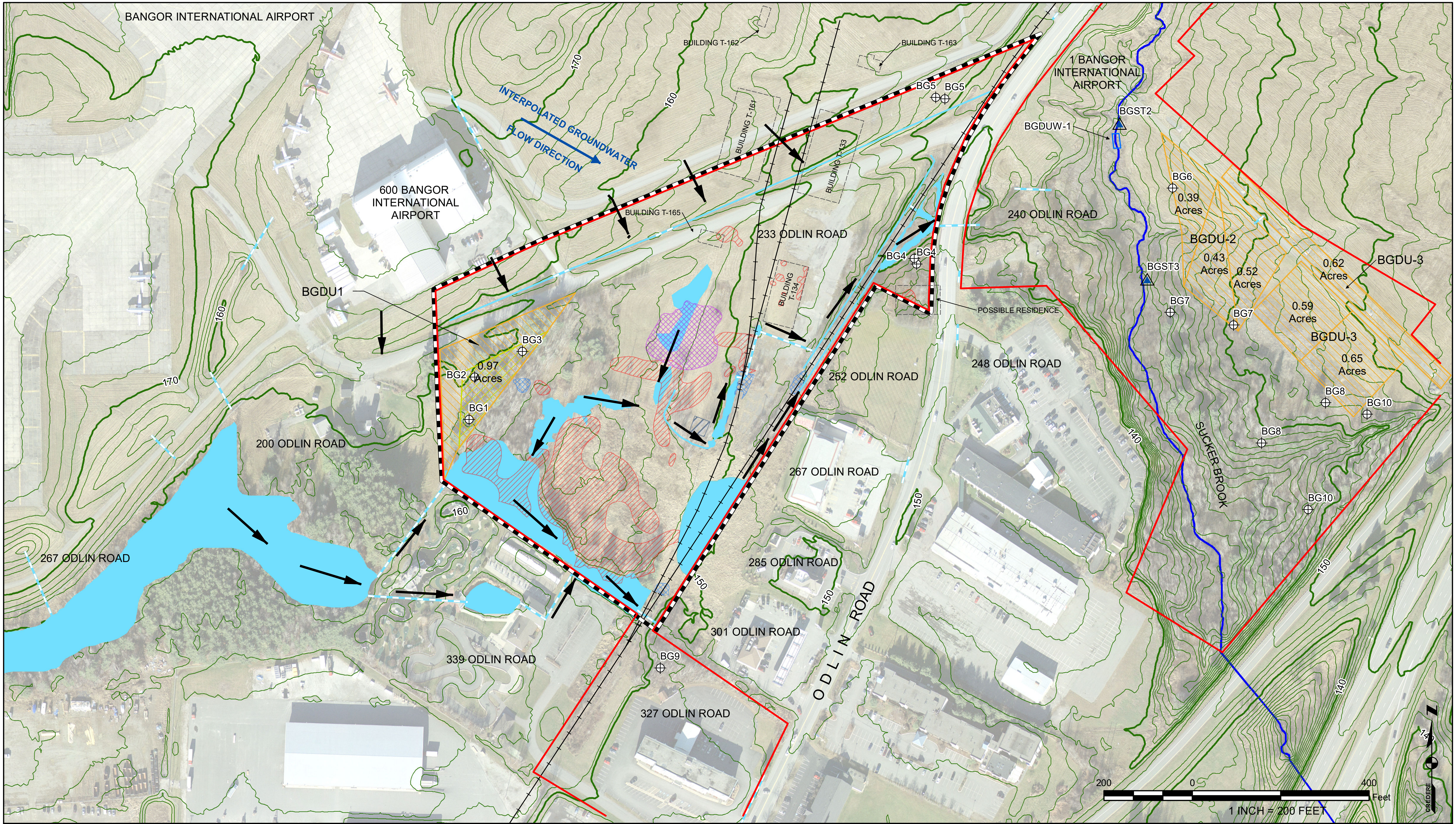

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FIGURE 8
BACKGROUND SAMPLE LOCATION PLAN

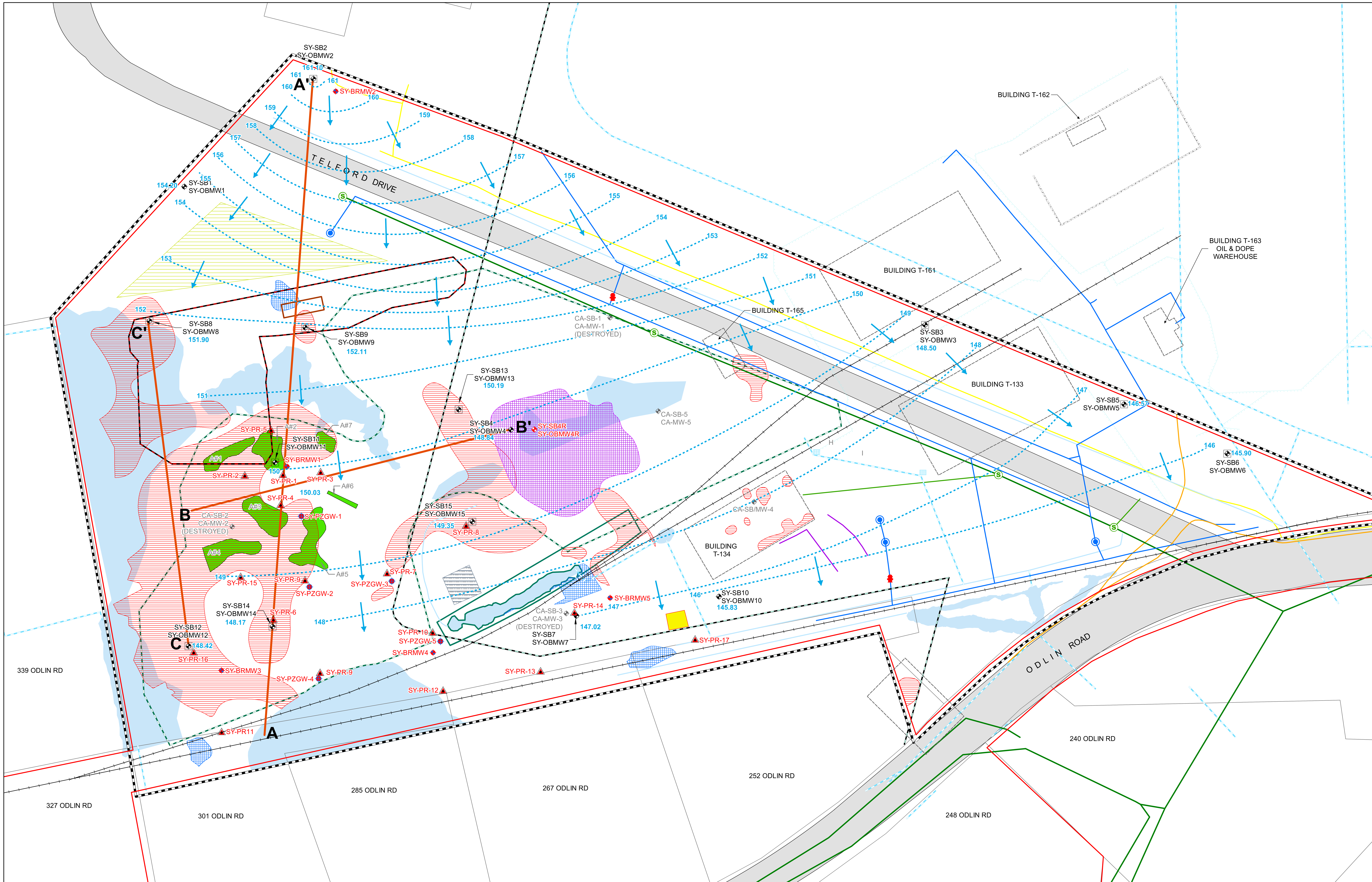
FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

- BACKGROUND SAMPLE STATION
- BACKGROUND SOIL BORING
- BACKGROUND DECISION UNIT WETLANDS
- CURRENT RI INVESTIGATION
- RIGHT-OF-ENTRY PARCEL BOUNDARY
- HISTORICAL SITE BUILDING
- HISTORICAL RAILROAD TRACKS
- DRAINAGE CULVERTS
- DRAINAGE SWALE
- HISTORICAL UNDISTURBED
- BACKGROUND DECISION UNIT
- EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
- AREA OF ANOMALOUS SOIL
- AREA OF POSSIBLE BURIED METAL
- WETLAND
- DRAINAGE STRUCTURE
- DIRECTION OF SURFACE STORM WATER FLOW
- SUCKER BROOK
- APPROXIMATE PARCEL BOUNDARY
- 2' CONTOUR
- 10' CONTOUR

NOTES:
1. EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM HISTORICAL PHOTOGRAPHS AND GIS DATA FROM US ARMY CORPS OF ENGINEERS (USACE), BANGOR ONLINE GIS DATA, USACE 1994 SITE INSPECTION, MAINE GIS PARCEL LAYER, ESRI ORTHO IMAGES, AND FIELD WORK PERFORMED IN NOVEMBER-DECEMBER 2018 AND SEPTEMBER-DECEMBER 2019.
2. POSITIONS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

https://gis.maine.gov/arcgis/services/imageryBaseMapsEarthCover/orthoMunicipalBangor2009/ImageServer   Service Layer Credits: Maine GeoLibrary

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 8 - Background Sample Plan.mxd



Feet

0 15 30 60 90 120

1 inch = 60 feet

- PROPOSED SOIL VAPOR SAMPLE LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED BEDROCK MONITORING WELL
- PROPOSED SOIL BORING/OVERBURDEN MONITORING WELL
- SOIL BORING/ HYBRID MONITORING WELL
- SOIL BORING/ OVERBURDEN MONITORING WELL
- PREVIOUS SOIL BORING/ OVERBURDEN MONITORING WELL
- HISTORICAL BUILDING
- RIGHT-OF-ENTRY PARCEL BOUNDARY
- CURRENT RI INVESTIGATION AREA
- HISTORICAL RAILROAD TRACKS
- POWER LINES
- FENCED YARD
- CROSS SECTION TRANSECT
- CATCH BASIN
- HYDRANT
- MANHOLE
- VALVE TERMINUS
- HISTORICAL SWALE
- DRAINAGE SWALE
- WATER LINE
- COMMUNICATIONS CABLE
- STORMWATER SEWER/CULVERT
- ELECTRICAL LINE
- NATURAL GAS LINE
- SEWER LINE
- APPROXIMATE PARCEL BOUNDARY
- TRENCH AT DUMPING
- DUMPING AREA
- EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
- AREA OF ANOMALOUS SOIL CONDUCTIVITY
- AREA OF POSSIBLE BURIED METAL
- EM SURVEY ANOMALY (2017)
- LAYDOWN/DECON AREA
- UNDISTURBED AREA
- PAVED/STORAGE AREA
- COAL AND DEBRIS
- DRAINAGE STRUCTURE
- WETLAND
- GROUNDWATER CONTOURS DECEMBER 2020
- INTERPOLATED GROUNDWATER FLOW DIRECTION

FIGURE 9A
CUMULATIVE GROUNDWATER MONITORING WELL AND SOIL VAPOR SAMPLE LOCATION PLAN

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

DRAWN BY: MTG/SCG NWW	DATE: 5/23/22
CHECKED BY: ASD	PROJECT: 18001468

NOTES
1. WATER LEVEL IN SY-OBMW4 CONSIDERED ANOMALOUSLY LOW AND EXCLUDED FOR THE PURPOSES OF GROUNDWATER CONTOUR INTERPOLATION. THIS WELL MAY BE LESS CONNECTED WITH THE BEDROCK AQUIFER DUE TO ITS CONSTRUCTION AND MAY REPRESENT A DEAD END IN HYBRID HYDRAULIC PATHWAYS. HYBRID WELLS AT THE SITE ARE GENERALLY CONSIDERED MORE CONNECTED WITH THE BEDROCK AQUIFER DUE TO BEING SCREENED WITHIN THE AQUITARD.

2. THE PROPOSED LOCATIONS OF SOIL GAS SAMPLING POINTS MAY BE REVISED DEPENDING ON OBSERVATIONS MADE OR ANALYTICAL DATA COLLECTED DURING THE INSTALLATION OF NEW BEDROCK GROUNDWATER MONITORING WELLS.

3. POSITIONS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

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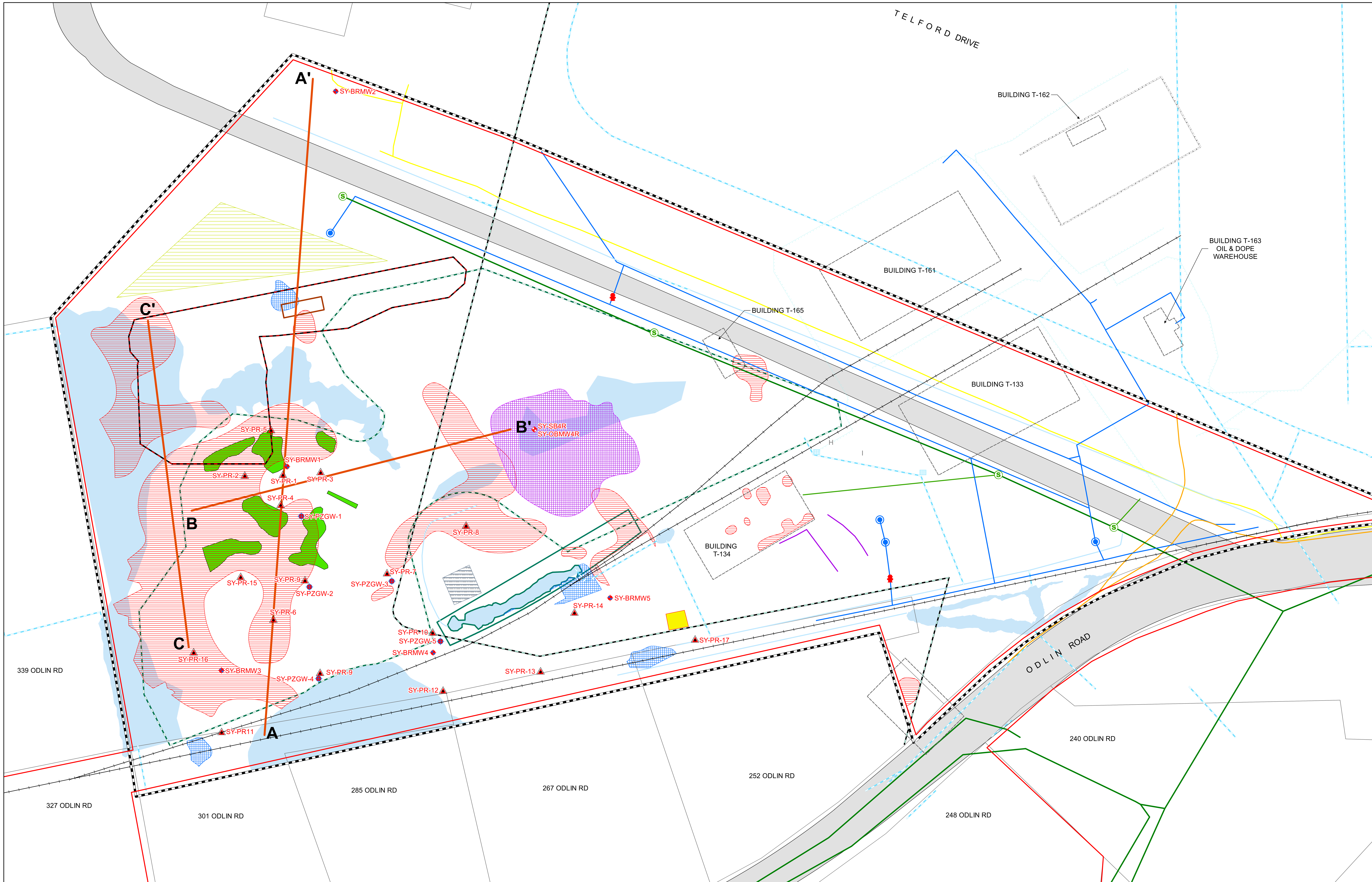
Coordinate System: NAD 1983 UTM Zone 19N
Projection: Transverse MercatorDatum: North American 1983
Reference Scale: 1:720

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 9A - Cumulative MW and Vapor Point Location Plan.mxd



Feet

0 15 30 60 90 120

1 inch = 60 feet

- PROPOSED SOIL VAPOR SAMPLE LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED BEDROCK MONITORING WELL
- PROPOSED SOIL BORING/OVERBURDEN MONITORING WELL
- HISTORICAL BUILDING
- RIGHT-OF-ENTRY PARCEL BOUNDARY
- CURRENT RI INVESTIGATION AREA
- HISTORICAL RAILROAD TRACKS
- POWER LINES
- FENCED YARD
- CROSS SECTION TRANSECT
- CATCH BASIN
- HYDRANT
- MANHOLE
- VALVE TERMINUS
- HISTORICAL SWALE
- DRAINAGE SWALE
- WATER LINE
- COMMUNICATIONS CABLE
- STORMWATER SEWER/CULVERT
- ELECTRICAL LINE
- NATURAL GAS LINE
- SEWER LINE
- APPROXIMATE PARCEL BOUNDARY
- TRENCH AT DUMPING
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- EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
- AREA OF ANOMALOUS SOIL CONDUCTIVITY
- AREA OF POSSIBLE BURIED METAL
- EM SURVEY ANOMALY (2017)
- LAYDOWN/DECON AREA
- UNDISTURBED AREA
- PAVED/STORAGE AREA
- COAL AND DEBRIS
- DRAINAGE STRUCTURE
- WETLAND

FIGURE 9B
NEW GROUNDWATER MONITORING WELL AND SOIL VAPOR SAMPLE LOCATION PLAN

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

DRAWN BY: MTG/SCG NWW	DATE: 5/23/22
CHECKED BY: ASD	PROJECT: 18001468

NOTES

1. WATER LEVEL IN SY-OBMW4 CONSIDERED ANOMALOUSLY LOW AND EXCLUDED FOR THE PURPOSES OF GROUNDWATER CONTOUR INTERPOLATION. THIS WELL MAY BE LESS CONNECTED WITH THE BEDROCK AQUIFER DUE TO ITS CONSTRUCTION AND MAY REPRESENT A DEAD END IN HYBRID HYDRAULIC PATHWAYS. HYBRID WELLS AT THE SITE ARE GENERALLY CONSIDERED MORE CONNECTED WITH THE BEDROCK AQUIFER DUE TO BE SCREENED WITHIN THE AQUITARD.

2. POSITIONS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

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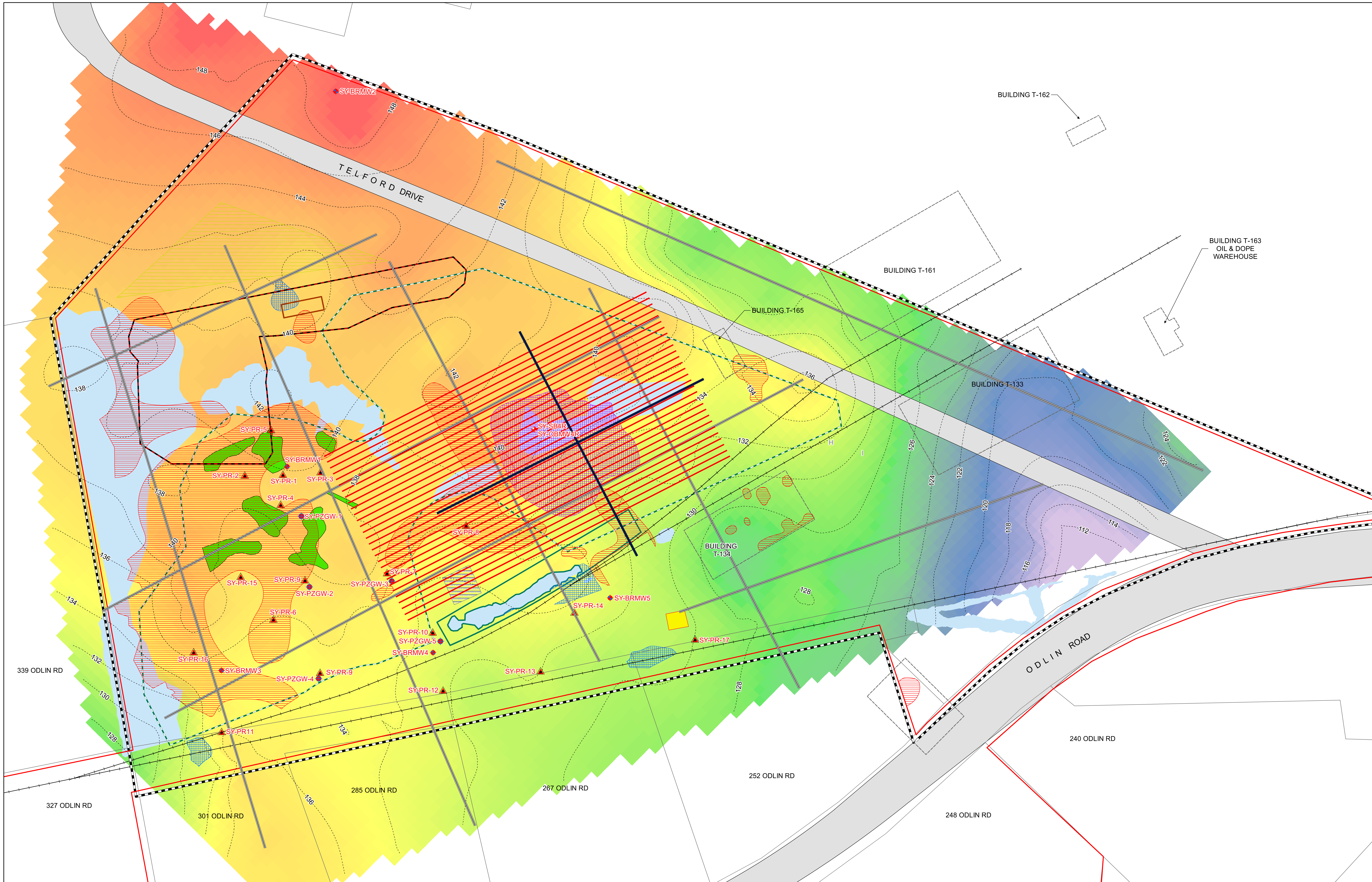
Coordinate System: NAD 1983 UTM Zone 19N
Projection: Transverse Mercator Datum: North American 1983

Reference Scale: 1:720

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 9B - New MW and Vapor Point Location Plan.mxd



Feet
0 15 30 60 90 120
1 inch = 60 feet

- PROPOSED SEISMIC TRANSECTS
- PROPOSED ERI TRANSECTS
- HISTORICAL SEISMIC TRANSECTS
- INTERPOLATED BEDROCK ELEVATION
- PROPOSED SOIL VAPOR SAMPLE LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED BEDROCK MONITORING WELL
- PROPOSED SOIL BORING/OVERBURDEN MONITORING WELL
- HISTORICAL BUILDING
- RIGHT-OF-ENTRY PARCEL BOUNDARY
- CURRENT RI INVESTIGATION AREA
- HISTORICAL RAILROAD TRACKS
- APPROXIMATE PARCEL BOUNDARY
- TRENCH AT DUMPING AREA
- DUMPING AREA
- EM ANOMALY ATTRIBUTED TO EFFECTS OF SURFACE OBJECTS
- AREA OF ANOMALOUS SOIL CONDUCTIVITY
- AREA OF POSSIBLE BURIED METAL
- EM SURVEY ANOMALY (2017)
- LAYDOWN/DECON AREA
- UNDISTURBED AREA
- PAVED/STORAGE AREA
- COAL AND DEBRIS
- DRAINAGE STRUCTURE
- WETLAND

BEDROCK ELEVATION (FEET NAVD88)
High : APPROX. 149'
Low : APPROX. 110'

FIGURE 9C
GEOPHYSICAL ASSESSMENT PLAN

FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

DRAWN BY: **MTG/SCG**	DATE: **03/24/2022**
CHECKED BY: **ASD**	PROJECT: **18001468**

NOTES

1. THE PROPOSED LOCATIONS OF SOIL GAS SAMPLING POINTS MAY BE REVISED DEPENDING ON OBSERVATIONS MADE OR ANALYTICAL DATA COLLECTED DURING THE INSTALLATION OF NEW BEDROCK GROUNDWATER MONITORING WELLS.

2. POSITIONS RECORDED BY PSILGA & DAY LAND SURVEYORS, NOVEMBER 15-22, 2019. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GPS TIED TO THE NGS CORS NETWORK (VIA MAINE DEPARTMENT OF TRANSPORTATION VRS GPS CONTROL NETWORK). ELEVATIONS COMPUTED FROM GEOID 18 BASED ON TWO PERMANENT BENCHMARKS INSTALLED AND OBSERVED IN NOVEMBER 2020, UPON WHICH AN OPUS SOLUTION WAS OBTAINED AND THREE WIRE LEVELS WERE RUN. DECEMBER 2020 POSITIONS RECORDED DURING RESURVEY BY PSILGA & DAY LAND SURVEYORS, AUGUST 10-12, 2020, AND NOVEMBER 9-20, 2020.

3. BEDROCK ELEVATION DATA GENERATED BY HAGER-RICHTER GEOSCIENCE, INC. BEDROCK ELEVATION CONTOUR INTERVAL = 2 FEET. BEDROCK ELEVATIONS REFERENCE NAVD88. ELEVATIONS ARE A NON-UNIQUE MODEL. CONTOURS REPRESENT INTERPOLATIONS BASED ON THE AVAILABLE DATA, INCLUDING SEISMIC REFRACTION DATA AND BORING INFORMATION. THE ELEVATIONS OF THE BEDROCK SURFACE AT ANY PARTICULAR LOCATION MAY DIFFER FROM THAT SHOWN. BEDROCK ELEVATIONS BASED ON ADDITIONAL DATA MAY DIFFER SIGNIFICANTLY.

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Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 9C - Geophysical Assessment Plan.mxd

DRAWN BY: **SCG** | DATE: **03/21/2022**
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FIGURE 10
OFFSITE GEOLOGIC MAPPING LOCATION PLAN

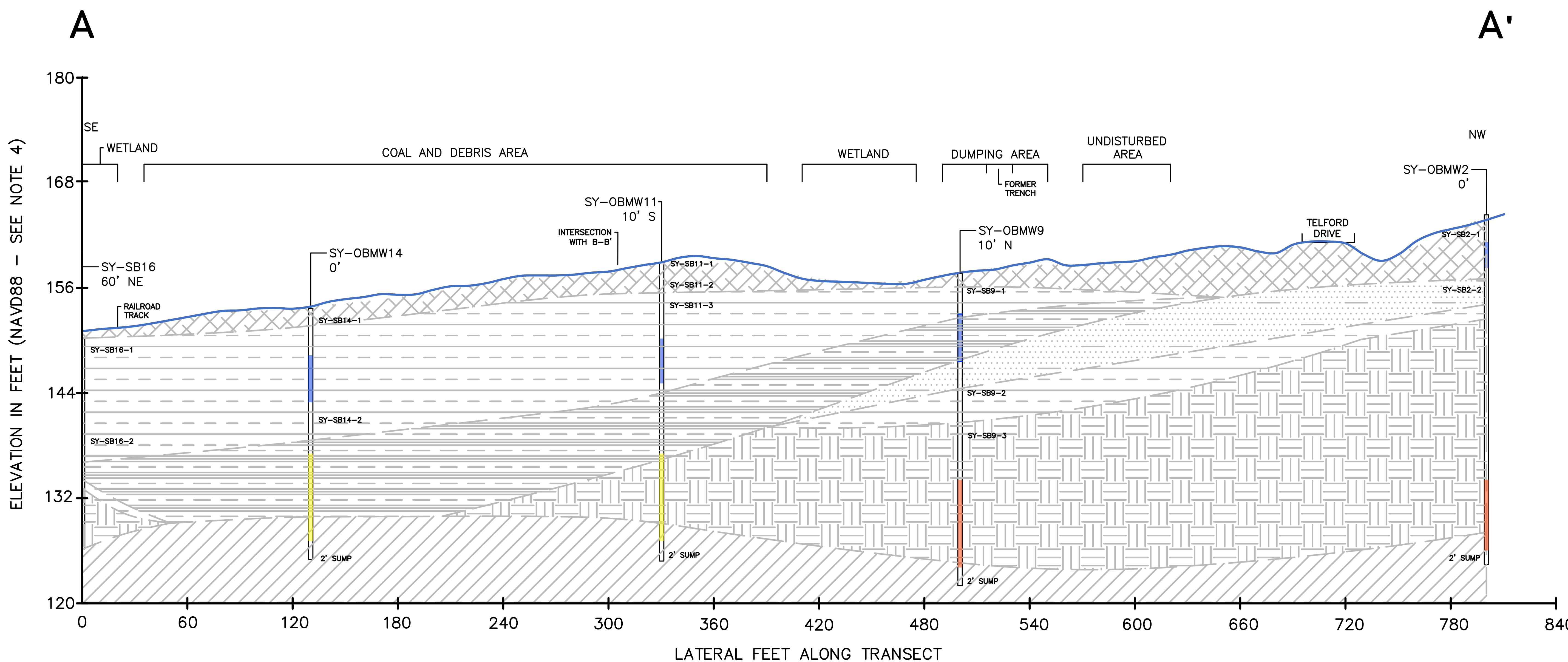
FORMER SALVAGE YARD
233 ODLIN ROAD
BANGOR, MAINE

SITE BOUNDARY
QUARRY SITE FOR POTENTIAL GEOLOGIC MAPPING
APPROXIMATE OFFSITE INVESTIGATION EXTENT

EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM BANGOR ONLINE GIS DATA AND ESRI ORTHO IMAGERY.

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

Document Path: T:\Data\ME\Town\Bangor\18001468 - USACE Dow Salvage Yard\QAPP Revision 2022\Figure 10 - Offsite Geologic Mapping Location Plan.mxd



LEGEND:

- GROUND SURFACE
- FILL
- SILT
- CLAY
- TILL
- SILT AND CLAY
- SILT AND SAND
- BEDROCK – WEATHERED, SEE NOTE 6

[SY-SB16 — BORING ID; 60' NE — HORIZONTAL OFFSET FROM TRANSECT]

- SYNOPTIC WATER LEVEL RANGE (DEC 2019 – DEC 2020) NOT INDICATIVE OF WATER TABLE EXTENT
- SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –04
- SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –05
- SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –06

NOTES:

1. REFER TO FIGURE 5 FOR TRANSECT LINE A–A'.
2. THE GEOLOGIC SECTION IS AN INTERPRETATION OF SUBSOIL CONDITIONS ENCOUNTERED AT THE SITE.
3. SOIL BORINGS/MONITORING WELLS WERE ADVANCED BY CASCADE DRILLING USING A BOART LONGYEAR 100C MINI SONIC DRILL RIG, AND LOGGED BY CREDERE PERSONNEL IN OCTOBER–NOVEMBER 2019.
4. SURFACE ELEVATIONS OF BORINGS AND MONITORING WELLS RECORDED BY PSILGA & DAY LAND SURVEYORS ON AUGUST 10–12, 2020 AND NOVEMBER 9–20, 2020 IN ACCORDANCE WITH EM–1110–1–1005. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). SEE TABLE 4 IN THE "CUMULATIVE FIELD REPORT, QUARTER 4 – REMEDIAL INVESTIGATION" BY CREDERE ASSOCIATES. GROUND SURFACE ELEVATION DERIVED FROM 2010 USGS LIDAR DATASET.
5. HYDRAULIC CONDUCTIVITY DATA BASED ON RISING HEAD TESTS PERFORMED DECEMBER 19–20, 2019 AND MARCH 20, 2020 (SY–OBMW6 ONLY).
6. SEISMICALLY INTERPRETED DEPTH TO COMPETENT BEDROCK RANGED FROM 13–23 FEET BELOW GROUND SURFACE, AND WAS GENERALLY OVERLAIN BY AN APPARENT THIN LAYER OF WEATHERED BEDROCK (HAGER–RICHTER SURFACE GEOPHYSICAL SURVEYS REPORT). 2019 DRILLING WAS LIMITED TO 5 FEET FROM TOP OF WEATHERED BEDROCK, THEREFORE, THICKNESS OF WEATHERED BEDROCK HAS NOT BEEN VERIFIED.

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FIGURE 11A - GEOLOGIC CROSS SECTION - TRANSECT A - A'

FORMER DOW MILITARY AIRFIELD
233 ODLIN ROAD
BANGOR, MAINE

HORIZONTAL SCALE: 1 INCH = 60 FEET
VERTICAL SCALE: 1 INCH = 12 FEET

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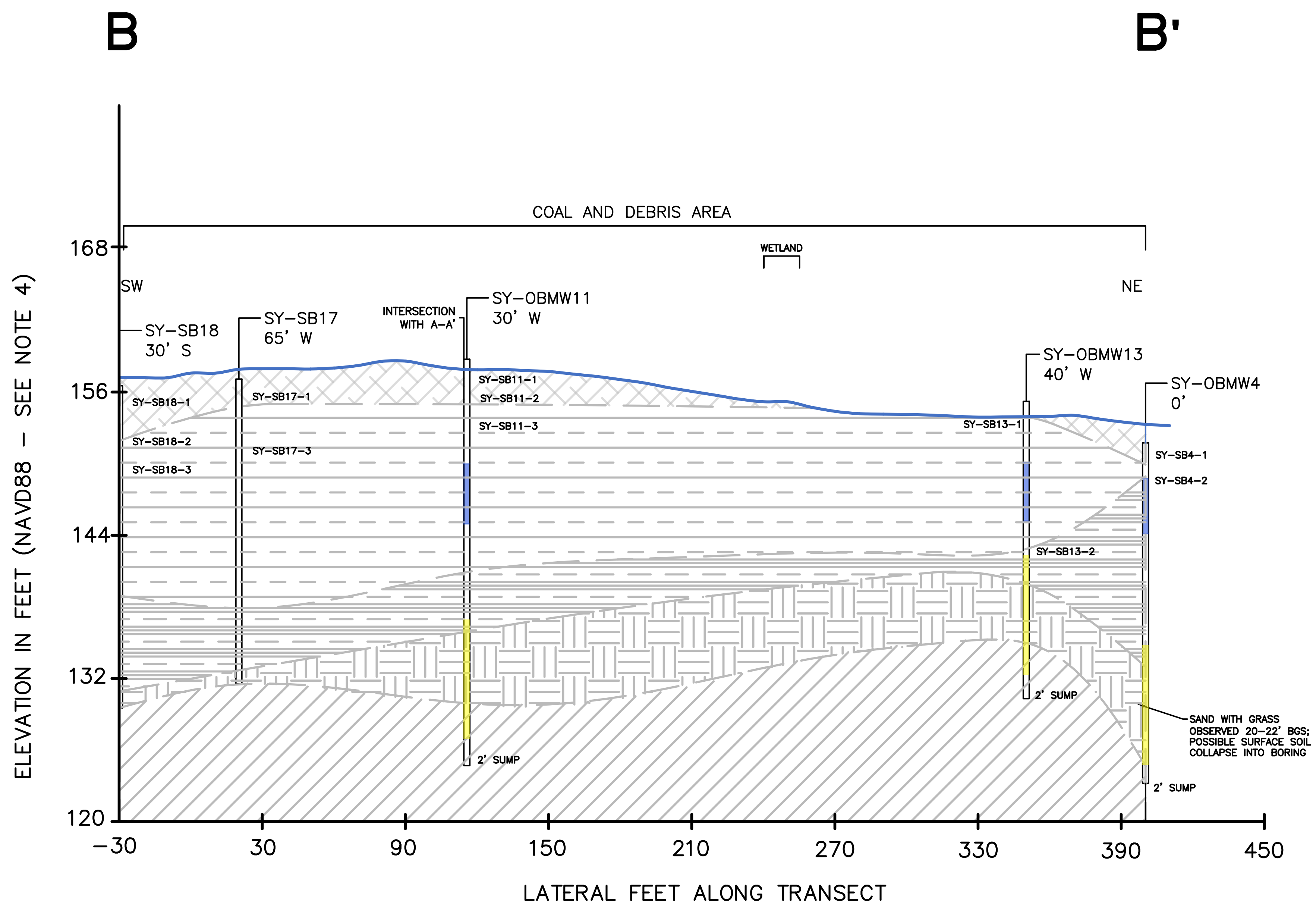

LEGEND:

- GROUND SURFACE
- FILL
- SILT
- CLAY
- TILL
- SILT AND CLAY
- SILT AND SAND
- BEDROCK – WEATHERED, SEE NOTE 6

SY-SB16 — BORING ID
60' NE — HORIZONTAL OFFSET FROM TRANSECT

- SYNOPTIC WATER LEVEL RANGE (DEC 2019 – DEC 2020) NOT INDICATIVE OF WATER TABLE EXTENT
- SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –04
- SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –05
- SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –06

NOTES:

1. REFER TO FIGURE 5 FOR TRANSECT LINE A–A'.
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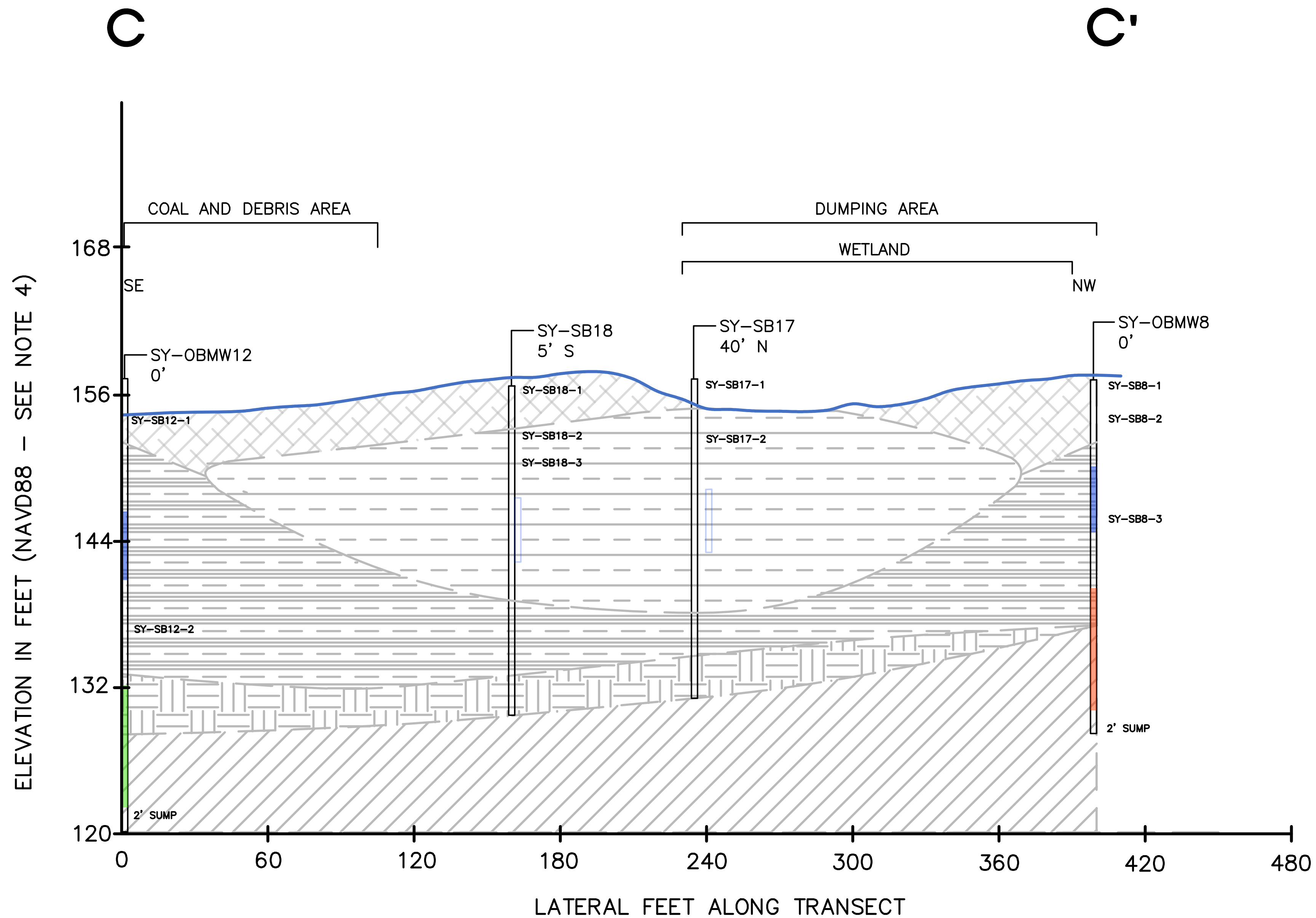
FIGURE 11B - GEOLOGIC CROSS SECTION - TRANSECT B - B'

FORMER DOW MILITARY AIRFIELD
233 ODLIN ROAD
BANGOR, MAINE

HORIZONTAL SCALE: 1 INCH = 60 FEET
VERTICAL SCALE: 1 INCH = 12 FEET



LEGEND:

GROUND SURFACE	
FILL	
SILT	
CLAY	
TILL	
SILT AND CLAY	
SILT AND SAND	
BEDROCK – WEATHERED, SEE NOTE 6	
SY–SB16	BORING ID
60' NE	HORIZONTAL OFFSET FROM TRANSECT
SYNOPTIC WATER LEVEL RANGE (DEC 2019 – DEC 2020) NOT INDICATIVE OF WATER TABLE EXTENT	
SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –04	
SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –05	
SCREENED INTERVAL – HYDRAULIC CONDUCTIVITY EXPONENT = –06	

NOTES:

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FIGURE 11C GEOLOGIC CROSS SECTION - TRANSECT C - C'

FORMER DOW MILITARY AIRFIELD
233 ODLIN ROAD
BANGOR, MAINE

HORIZONTAL SCALE: 1 INCH = 60 FEET
VERTICAL SCALE: 1 INCH = 12 FEET