QAPP Worksheet #10: Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)

This worksheet presents an integrated discussion of the project background and the preliminary conceptual site model (CSM), describing what is currently known about the Site based on prior studies including the 2008 Site Investigation (SI), 2017 Phase I Remedial Investigation (RI), and 2018 Phase II surficial media sampling event. This worksheet includes the following information:

- Site location, operational history, and physical setting
- Sources of known or suspected constituents or classes of constituents of interest
- Primary release mechanism(s)
- Secondary and other release and transport mechanisms
- Potential receptors and exposure pathways

These aspects of the Site and how they were used to develop the Phase III sampling plan are discussed in the following subsections.

10-1.0 SITE BACKGROUND AND SETTING

The physical setting, operational history, and findings from previous investigations within and proximate to the FUDS Project Area are summarized below. Background and operational histories, along with summaries of past investigations presented below are based on information presented in reports and information packages listed in the reference section at the end of the QAPP.

The understanding of Site conditions was also informed by additional research, data collection efforts, and discussions that USACE has held with project stakeholders.

10-1.1 Site Location

The Dow Disposal Site is located approximately 3 miles west of the City of Bangor, south of the Bangor International Airport (BIA) in Penobscot County, Maine (Figure 1). For the purposes of this FUDS investigation and future Site management decisions, the Site refers to approximately 13 acres of land possibly impacted from former military operations within the area labeled “FUDS Project Area” depicted on Figure 2 (the terms “Site” and “FUDS Project Area” are used interchangeably throughout this document). The FUDS Project Area is partially intersected and bounded by a former fighter parking stub and taxiway, which is currently used as an access road to the BIA perimeter fence accessed from Hildreth Street North. The FUDS Project Area boundary will be adjusted during implementation of the RI/FS, if needed, based on the interpretation of sampling results, to include only those areas determined to have been impacted by a FUDS release(s).

The former Fire Training Area (FTA), which abuts the FUDS Project Area to the northwest (Figure 2), was used by the United States Air Force (USAF), the Maine Air National Guard (MEANG), and the city of Bangor Fire Department over the period from 1947 through 1984.

Intermittent streams drain from the northeast, west (culverted under Hildreth Street North) and east of the FUDS Project Area, converging south of the area and eventually draining towards Shaw Brook. Surface water, pore water, sediment and soil associated with these streams, wetland and vernal pools were sampled during a 2018 Phase II RI sampling event. A recreational all-terrain vehicle (ATV) and snowmobile trail traverses the southern portion to the Site (Figure 2).

The Penobscot River is located approximately 3 miles to the east-southeast of the Site and drains to the south to Penobscot Bay. Hermon Bog, a raised bog physical feature roughly 1 square mile in size is located approximately 1.25 miles to the west of the center of the FUDS Project Area.

A former orchard, shown on historical imagery from 1947, existed to the north of Cram Road less than ½ mile to the north of the FUDS Project Area. The extent of this orchard and years of operation are currently unknown.

The former Searsport-Loring Fuel Pipeline, an abandoned 6-inch pipeline that previously delivered jet fuel to the former Dow Airfield and Loring Air Force Base, is located approximately 1,000 feet west of the center of the FUDS Project Area. This pipeline was decommissioned in 1994 and filled with nitrogen to inhibit corrosion. The pipeline lease was purchased by Gas Natural, Inc. in September of 2012, with its subsidiary Bangor Natural Gas responsible for maintaining the pipeline right-of-way. Portions of this pipeline north of the FUDS Project Area have been converted for the delivery of natural gas from Bangor to Lincoln, Maine (*Bangor Daily News, July 3, 2012)*.

10-1.2 Operational History

The property currently being operated as the BIA was originally developed in 1921 as a municipal airfield known as Godfrey Field. In early 1940 the U.S. government acquired the property and re-named it the Bangor Army Air Base for subsequent use as an airfield in support of World War II efforts. Federal funds were used for the airfield development for defense projects (Air Transport Commend, 1945). The property was renamed as the Dow Army Airfield in 1942 and re-designated as an aerial port of embarkation and debarkation for planes flying to and from Europe and as a prisoner of war camp (USACE, 1989). The facility was subsequently renamed Dow Air Force Base in 1947 and was deactivated in 1949 with jurisdiction transferred over to the City of Bangor.

The facility was reactivated in 1951 for use as a Strategic Air Command (SAC), Tactical Air Command (TAC), and Air Defense Command (ADC) installation during the Korean conflict with jurisdiction given back to the SAC. Improvements to the airfield made during this era included realignment and replacement of original runways into longer runways and construction of runway aprons, support facilities, aircraft hangars, and fuel storage facilities. Additional details about the historical construction of the Dow AFB can be found in the book, “Bangor in World War II, From the Homefront to the Embattled Skies” (Bergquist, 2015). The base was deactivated again in 1964 but continued operating under military ownership until 1968 when approximately 75 percent of the land (1,591 acres) was transferred to the City of Bangor for use at what is now the BIA (USACE, 1993). The remainder of the land was transferred to the MEANG.

An historical aerial imagery analysis was completed by the Army Geospatial Center (AGC) in 2016 (AGC, 2016). The AGC report interpreted visible operational activities at the former FTA and the FUDS Project Area during the time period between 1944 and 2014. The aerial analysis performed by the AGC suggests military activities occurred within the northern portion of the FUDS Project Area, but few, if any, activities were observed in the southern portion of the FUDS Project Area. Additionally, the AGC report helped support the USACE determination that the location of the reported TCE disposal activity (described in a 1967 letter) was mis-identified in the 1994 SI and was more likely located approximately 500 feet to the east of the Fuel Filter/Tetraethyl Lead Disposal Area previously investigated during the 2008 SI. See Section 10-2.1.2 for additional discussion on the fill area and the pit theorized to be the TCE disposal pit.

10-1.3 Climatic Setting

The Bangor area is situated in a humid continental climate, with cold, snowy winters, and warm summers characterized by U.S. Department of Agriculture (USDA) hardiness zone 5a. The monthly daily average temperature, as officially recorded at the abutting BIA, ranges from 17.0° F in January to 68.5° F in July with an average of 21 nights annually that drop to 0° F or below and 57 days where the temperature stays below freezing, including 49 days from December through February. There is an average of 5.3 days annually with highs at or

above 90° F; these higher temperatures have generally occurred since 2014. Record temperatures for the Bangor area range from −32° F as recorded on February 10, 1948, up to 104° F as documented on August 19, 1935. The first freeze in the Bangor area generally occurs during the first week of October and runs through the first month of May, corresponding to a yearly average freeze-free season of approximately 150 days.

Precipitation in the Bangor area averages approximately 42 inches (of water) per year with November generally the wettest month averaging 4.2 inches of precipitation and February, the driest month, with an average of 2.5 inches of precipitation. The average seasonal snowfall for Bangor is approximately 66 inches with snowfall accumulation ranging from roughly 22 inches in 1979-80 to approximately 182 inches in 1962-63 with the record monthly snowfall amount of 58 inches recorded in February 1969. Measurable snow in May occurs in Bangor approximately every 4 years, and measurable snowfall occurs rarely in September.

According to the National Oceanic and Atmospheric Administration (NOAA), total precipitation at BIA through the month of October 2021 was a total of approximately 35 inches with 27.5 inches of total snowfall. Although much of the state was in drought conditions during the spring and summer of 2021, a wet summer and fall has improved conditions such that by November 2021 only limited portions of northwest Maine are experiencing drought conditions (United Stated Drought Monitor, 2021).

10-1.4 Topography

The elevation (NAVD 88) of the main runway at the BIA ranges from 192 feet at the northeastern-most edge of the main runway to 163 feet at the southeastern edge of the main runway. The topography of the BIA generally slopes downward to the northeast, away from the main runway.

The FUDS Project Area is situated at elevations ranging from approximately 153 to 165 feet based on survey data collected during the 2008 SI and the 2017 Phase I RI. The topography then generally slopes to the south/southwest from the FUDS Project Area. The FUDS Project Area is located adjacent to the southwest boundary of an approximately 1,900-acre watershed, which drains the airfield and discharges to Birch Stream, which is located to the northeast of the airfield (Figure 1). The FUDS Project Area is, therefore, generally described as being located along this drainage divide: locations north of the FUDS Project Area ultimately drain to the northeast, while the FUDS Project Area and areas south drain to the south/southwest.

As previously described and evident in the Light Detection and Ranging (LiDAR) 2-meter hillshade imagery shown on Figure 3, the general topography at the FUDS Project Area appears to have been modified as part of the former Dow Military Airfield development. The northern portion of the FUDS Project Area is generally flat and at an elevation approximately 4 to 6 feet above the underlying native soil to the south of the FUDS Project Area. The hillshade imagery shows a clear delineation between historically filled portions of the FUDS Project Area and portions that have not been filled. The filled portion of the FUDS Project Area is at approximately 164 feet and is at a slightly lower elevation than the FTA to the north (approximately 174 feet) and beyond. This elevation difference influences overland surface water run-off originating at the southern portion of the former FTA to flow south onto the FUDS Project Area. Surface water drainage from the western side of the FTA area also drains to a small surface water stream that is culverted under Hildreth Street North, southward through the Site and ultimately to Shaw Brook to the south (Figure 3). Similarly, the predominant direction of surface water flow within the FUDS Project Area is from the northern, filled portion toward the unfilled portion toward the wetlands and streams in a south/southwesterly direction.

10-1.5 Geology, Hydrology, and Hydrogeology

This section includes a discussion of surface soils and available information about bedrock. Published soils and bedrock data (Maine Geological Survey, 2011) are included on Figures 4 and 5, respectively; and bedrock information from the 2017 geophysical survey (Hager-Richter 2021) is shown on Figure 6. A conceptual geological

cross section through the FUDS Project Area, based on the available information from previous investigations, is shown on Figure 7. More detailed geological cross sections will be developed following the subsurface investigation program discussed in this QAPP.

Known information about surface water and groundwater are included at the end of this subsection. Note that surface water and pore water were sampled extensively in the Phase II RI program and are not targeted for additional sampling in this next Phase III RI. Deep overburden groundwater is one of the media targeted for characterization in this next phase of the RI program.

10-1.5.1 Soils

Regional geology in the Bangor area influences the soils of the New England Upland, a section or subdivision of the New England Province of the Appalachian Highland (Thompson, 1977). The New England Upland is an area of complex geology dissected by fluvial processes and later subjected to intense glaciation. This glaciation resulted in thick deposits of glacial till, a heterogeneous mixture of cobbles, sand, silt, and clay. The glacial deposit of predominantly marine clays and silts is known as the Presumpscot Formation. This unit is glacio-marine deposit commonly consisting of clayey silt but with abundant sand in places. These materials typically have low permeabilities. As noted in a historical report about the construction of the Dow AFB, the airfield was constructed by filling swampy, poorly drained soils (Air Transport Command, 1945). This is consistent with the hillshade depicted on Figure 3.

A review of the Bangor Surficial Geology Quadrangle (Figure 4) identifies local geology in the FUDS Project Area as glaciomarine sand, silt, and clay deposits typically associated with the Presumpscot Formation. The areas immediately surrounding the FUDS Project Area are documented on the Bangor Quadrangle as till, a loose to very compact, poorly-sorted massive to weakly stratified mixture of sand, silt, and gravel-sized rock debris deposited by glacial ice with boulders common at the ground surface interface.

Soil borings completed in the former FTA encountered Presumpscot Formation strata having thicknesses ranging 6.0 to 13.5 feet with two layers encountered: very stiff olive brown mottled weathered facies arid medium stiff blue grey unweathered facies (GZA, 1994). Medium to very dense glacial till was found below the Presumpscot Formation. Soil boring logs generated as part of the 2008 SI indicate sand and gravel deposits from grade to approximately 2 feet bgs with a transition to clayey silt down to approximately 12 feet bgs followed by a transition to silty clay down to the terminal depths of the boring program, which was 14 feet bgs (Watermark, 2013). Soil profiles observed during the Phase I RI test pitting program were similar to those described during prior investigations: fill soil, consisting of a dark brown silty sand with fine to coarse sand, was present at variably thicknesses ranging from 4 to 6 feet depending on position, followed by Presumpscot Formation tight silt and clays to depths of up to 8 feet bgs. Auger refusal was encountered in three offsite (to the northwest) wells MW-4 (10.5'), MW-2 (17'), and MW-1 (17').

During the Phase I RI geophysical survey, ground penetrating radar (GPR) was able to detect the top of the Presumpscot Formation in areas where fill soil was placed over the formation and where the water table was not above the formation at the time of the survey (in October and November, 2017). The GPR method was less effective at mapping the top of the Presumpscot Formation elsewhere within the FUDS Project Area. The lack of clear reflections from the top of the tight silt layer in GPR survey data suggests that either: 1) the top of the tight silt layer is at or very near the ground surface and not distinguishable as a soil interface; or 2) the irregular forest floor ground surface was inhibiting good ground coupling of the GPR antenna resulting in weaker amplitude GPR reflections and reduced GPR signal penetration. However, the subsequent surficial soil sampling program and test pitting program performed during the Phase I RI confirmed the presence of the tight silt at the near surface in the Native Area, and directly underling 4-6 feet of fill soil in the northern portion of the FUDS Project Area, in all

sampled locations, suggesting the Presumpscot Formation may be continuous within the FUDS Project Area and surrounding area.

10-1.5.2 Bedrock

The area around the BIA is underlain by two rock formations separated by a northeast-southwest trending contact crossing the main runway at BIA (Figure 5). The northwest formation is defined as the Brewer Formation, consisting of dark gray to black siltstone and claystone slate. The southeast bedrock formation is defined as the Bangor Formation described as a medium to dark gray, medium-grained to very fine-grained feldspathic metawacke.

In 2017, Hager-Richter conducted a geophysical survey using seismic refraction and electrical resistivity imaging (ERI). These data along with the available subsurface data from previous investigations were reported in the Hager-Richter report, dated April 2021, to provide an interpretation of the topography of the bedrock surface. The interpreted bedrock topography is shown on Figure 6 and summarized as follows:

- The bedrock surface generally deepens from north to south within the seismic refraction survey area.
- The depth of competent bedrock varies from approximately 8- to 20-feet bgs, and bedrock elevation varies from approximately 134- to 157-feet, for a total apparent relief of approximately 23 feet.
- The compressional wave velocity of bedrock ranges from 11,000- to 16,000-feet per second.

Additional detail on the geophysical survey and corresponding cross-sectional profiles that display the interpreted overburden-bedrock contact and possible bedrock fracture zones along each of the seven transects in the FUDS Project Area is provided in the Hager-Richter report (2021) submitted under separate cover. Bedrock was not encountered during the Phase I RI test pit program, which extended approximately 8 feet below grade. Boring logs from the 2008 SI indicate that bedrock was not encountered during advancement of soil borings for monitoring wells. Therefore, an objective of this Phase III RI program will be to confirm the interpretations of the Phase I RI geophysics data by providing quantitative data on the depth and condition of bedrock within the FUDS Project Area.

Based on the Phase I RI data, the approximate bedrock interface displayed in the inverted resistivity profiles was determined by Generalized Reciprocal Method (GRM) analysis of the seismic refraction data, which is a more accurate method of determining the depth of the bedrock surface than the ERI method. The quality of the seismic refraction and ERI data ranged from good to very good. The tomographic model interpretation of the depths to bedrock agrees relatively well with the discrete layer interpretation determined from the GRM analysis of the seismic data. The interpreted shape of the bedrock surfaces agree well, however, the tomographic analysis indicates competent bedrock deeper than the GRM analysis.

Geologic boring logs for borings previously completed near and within the FUDS Project Area stated that refusal “assumed to be bedrock” was encountered at 10.5 feet below grade in MW-4 (located near the northeastern boundary of the tarmac) and 17 feet below grade in MW-1 (located at the western end of the tarmac near Hildreth Street North). Bedrock cores were not collected (GZA, 1991). Borings completed during the 2008 SI were terminated at 12- to 14-feet below grade and before refusal was encountered (Watermark, 2013). Therefore, the consistency of the seismic refraction data was measured by comparing the depths determined from the separate seismic refraction survey lines; the estimated standard deviation of the depths of competent bedrock determined by the surveys is approximately 2 feet.

These data improve the understanding of bedrock characteristics within the FUDS Project Area. The bedrock topography data suggests it may have an influence on overburden groundwater flow direction at and proximate

to the FUDS Project Area. These data are used (Worksheets 17 and 18) to inform the placement of monitoring wells planned for the Phase III RI field program.

10-1.5.3 Surface Water

Surface water within the FUDS project area and in the surrounding area is shown on Figure 8 and discussed in the following subsections. Note that surface water and pore water were sampled extensively in the initial Phase II RI program and are not targeted for additional sampling in the Phase III RI.

Surface Water Within the FUDS Project Area

Within the FUDS Project Area are two segments of an un-named intermittent stream channel. The western segment of the un-named intermittent stream originates up to approximately 600 feet northwest of the FUDS Project Area, in a low area on the western side of Hildreth Street North in the former FTA. The stream flows south until reaching Hildreth Street North, where it may pool and terminate when there is no sufficient water volume. When there is sufficient surface water volume, the stream continues flowing south into a 30-inch diameter corrugated metal culvert under Hildreth Street North, then discharges into a stream channel along the western side of the Expanded Aviation Fuel Filter Disposal Area. The stream channel continues south for approximately 500 feet, passing through wetlands along the approximately western border of the FUDS Project Area, and then it combines with the eastern segment of the un-named stream, as discussed in the following paragraph.

The eastern segment of the un-named intermittent stream channel originates approximately 800 feet east of the FUDS Project Area, near the location of the Former Drum Disposal Area, where there is a former fighter turning spur and where nine 55-gallon drums reportedly containing 1,1,1-trichloroethane (TCA) were disposed of prior to property transfer in 1968 (USEPA, 1992). Additional discussion about the Former Drum Disposal Area is presented in Section 10-4.2. Starting from the Former Drum Disposal Area, the stream channel follows a linear west-east path along the grass-covered access road along the southwestern border of the BIA. Approximately 200 feet of the western end of the stream channel is considered to extend into the filled portion of the FUDS Project Area. Where the western end of the channel stream reaches the fighter turning spur (which is comprised of approximately 4 to 6 feet of fill above the native ground elevation), the stream channel veers due south, following the eastern border of the fighter turning spur, and then curves to the southwest where it passes through wetlands for approximately 500 feet. At this point, the western and eastern stream segments converge and form a single stream channel.

The single stream channel continues southwest from the FUDS Project Area for approximately 1,500 feet, where it then enters a culvert on the eastern side of Hildreth Street North. After passing through the culvert under the western side of Hildreth Street North, the stream channel flows southwest for approximately 300 feet until it discharges into Shaw Brook.

The un-named intermittent stream is a seasonal water feature that is dry during some summers or periods of prolonged drought. The surface water volume in the un-named intermittent stream is largely dictated by precipitation amounts, with the prolonged drought conditions in the region up though the end of 2016 and near normal precipitation amounts through the first six-months of 2017 and 2018 affecting surface water availability within and proximate to the FUDS Project Area. The western stream segment was noted as being dry during the USACE PDT site walk in October 2016 with no water evident in the culvert, the intermittent stream, or the previously (in 2008) wet area north of Hildreth Street North. USACE PDT site visits in mid- and late-May 2017 identified the existence of multiple wetland types and enhanced stream bed positioning due to wetter than average conditions for the first six months of 2017. A series of vernal pool ecosystems and a scrub wetland bound on three sides by running water south of the FUDS Project Area were also identified and mapped by the PDT as depicted in Figure 8.

Surface Water Beyond the FUDS Project Area

The City of Bangor is located at the navigable terminus of the Penobscot River, 30 miles north of the Atlantic Ocean. In addition to the Penobscot River, which defines part of the City's eastern boundary, the Kenduskeag Stream flows through the City, emptying into the Penobscot River in the downtown area.

Within a 2.5-mile radius of the FUDS Project Area are several surface water bodies, including the Penobscot River, its tributary the Kenduskeag Stream, the Souadabscook Stream, Wheeler Stream, Birch Stream, Hermon Pond, Hammond Pond, Georges Pond, Osgood Brook, Pug Brook, Sucker Brook, and Shaw Brook.

Shaw Brook is situated approximately 1,800 feet to the west of the FUDS Project Area, and generally runs along the western edge of Hildreth Street North (Figure 1). Shaw Brook is included on the MEDEP 303(d) list of urban impaired streams for not meeting the water quality standards for aquatic life use based on results of a Total Maximum Daily Load (TMDL) Assessment of pollutants conducted by MEDEP in 2006. Shaw Brook flows for approximately 3 miles to the south-southwest until discharging into the Souadabscook Stream, which is classified as a Class B freshwater stream; the Souadabscook Stream ultimately discharges to the Penobscot River.

Sucker Brook, a small tributary of the Penobscot River located approximately 2 miles to east-southeast of the FUDS Project Area, is also classified as a Class B freshwater stream and has been listed as an urban impaired stream under MEDEP 303(d) based on results of a TMDL Assessment conducted by MEDEP in 2004.

10-1.5.4 Groundwater

Groundwater resource maps depicting the location, depth, and use of existing water wells within a 2.5-mile radius of the FUDS Project Area were identified in the February 2017 Data Gaps Analysis report prepared by Mabbett in advance of the Phase I RI (Mabbett, 2017). These maps identified bedrock wells used for potable water within a 2.5-mile radius of the FUDS Project Area (from data published by MEDEP) and further identified the selected wells anticipated to be hydrologically downgradient from the FUDS Project Area based on local and regional surface topography.

The depth to groundwater is influenced by the location of the well and seasonal factors which include the potential presence of perched water at the interface between the more transmissive shallow fill-containing interval and the underlying Presumpscot Formation clayey silt. In wells located within the northern portion of the FUDS Project Area, groundwater was documented at depths ranging from 4 to 6 feet below top of casing during well development, purging, and groundwater sampling efforts during the 2008 SI (Watermark, 2013). However, depths to groundwater measured during the USACE PDT site visit on October 25, 2016 indicated static water levels at several existing monitoring wells at much deeper depths than those observed in 2008; this was likely due to the prolonged drought experienced in the region; depths ranged from 10 to 12 feet below top of casing. Later, significant precipitation throughout the first six months of 2017 resulted in a substantial rebound of static water levels as noted from water level depths measured in these wells in late May 2017. As the existing monitoring wells do not isolate the well screens from the fill interval, and do not extend into the till layer underlying the Presumpscot Formation clayey silt, water levels at these monitoring locations are likely to be drastically affected by the presence or absence of perched water. Additionally, during the Phase I RI test pitting program in October-November 2017 (following and during periods of high rainfall), groundwater in the southern portion of the FUDS Project Area was observed just below the ground surface, and in the northern portion of the FUDS Project Area test pits at approximately 1 to 3 feet bgs.

Prior investigations reported the hydraulic conductivity (based on field slug test data) was 0.2 feet/day in wells screened in tight silt, which was higher than the range typically reported for Presumpscot Formation ($2x10^{-5}$ to $2x10^{-2}$ feet/day) (GZA, 1994). However, the values are within the range reported for Biddeford Silt Loam soils that are derived from weathering of the Presumpscot (0.1 to 0.5 feet/day) (GZA, 1994; PEER Consultants, 1988). The

relatively elevated permeability values reflect the degree of weathering of these soils and in particular the presence of joints and fractures. Hydraulic conductivity was 0.06 feet/day in one well (MW-5) screened in dense silty glacial till and considered to be within typical ranges encountered for similar materials at other sites (GZA, 1994).

Results of the 2008 SI indicated a groundwater to surface water hydraulic connection based on the seasonal wetlands, flowing channel stream surface water, and water levels in the monitoring wells, as documented at that time in 2008 (Watermark, 2013).

Local overburden groundwater flow direction has not been definitively confirmed. Based on elevation data from five shallow overburden groundwater monitoring wells, overburden groundwater flow direction in the former FTA was reported to be to the south/southwest, toward the FUDS Project Area (GZA, 1994). However, others have suggested flow is to the southeast (Watermark, 2013).

10-1.6 Ecological Setting

The FUDS Project Area is set within an area abutting the BIA that has been substantially re-worked, as seen on the historical aerial photographs and the LiDAR 2-meter hillshade map, presumably as part of changing operations and needs as a former military airfield. Currently, the FUDS Project Area includes a mix of upland and wetland habitats. Mixed open grassy fields are present in the FTA to the north and west of the FUDS Project Area, with woodlands to the west, south, and east of the FUDS Project Area.

As previously described, within the FUDS Project Area, only the portion of the native mixed hardwood forest within the southern, unfilled area appears to be unaffected by past DoD operations. While the previously denuded filled area has revegetated since property transfer (AGC, 2016), past DoD operations required substantial land clearing and grading efforts, particularly where the fighter turning spurs were constructed.

During the 2008 SI, ecological observations identified seasonal water accumulation and potential freshwater wetland resources on the northern portion of the FUDS Project Area. Standing water was also noted in vast areas of the southern portion of the FUDS Project Area. A U.S. Fish and Wildlife Service (USFWS) mapped wetland also exists to the east-southeast of the FUDS Project Area as observed initially during field efforts in 2008 and verified during the USACE PDT site visit completed in late October 2016.

Wetlands were delineated by USACE staff in May 2017 and are depicted on Figure 8. Forested areas are vegetated with small to medium diameter trees, most of which have a diameter at breast height (dbh) less than 12 inches. Balsam fir, grey birch, white birch, white pine, and red oak occur in forested uplands. Balsam fir, grey birch, and red maple are common in forested wetlands. Standing dead snags and downed habitat logs are common in both forested wetlands and uplands. Scrub-shrub wetlands occurring along streams and to the south of the project area are vegetated with alder, high bush blueberry, winterberry, red osier dogwood, sweet pepperbush, and other shrubs. The understory flora in both wetlands and uplands is diverse. Species noted include sensitive fern, cinnamon fern, interrupted fern, bracken fern, horsetails, Canada mayflower, starflower, wild sarsaparilla, Jack in the pulpit, bunchberry, grasses, sedges, Sphagnum moss, and other mosses. Invasive species are rare and occur mostly near the former aircraft parking stub. Invasive species noted include bush honeysuckle, multiflora rose, and Japanese barberry.

Numerous depressions exist within the boundaries of the FUDS Project Area (see Figure 3). Many appear to be vernal pools. Some depressions support dense stands of a robust sedge, species undetermined. Spotted salamander and wood frog egg masses and/or larvae were noted in some of the depressions by USACE staff in late May 2017, May 2018, and June 2018. Wood frog egg masses were also observed in the wetland north of Hildreth Street North.

10-2.0 POTENTIAL SOURCE AREAS

The description of the physical setting of the Site is focused on the FUDS Project Area. The FUDS Project Area encompasses an approximately 13-acre area whose northern boundary is roughly defined by Hildreth Street North and the former tarmac; eastern boundary is just beyond an ephemeral stream that originates east of the Site; and southern and western boundaries terminate in a forested area. The current assumed boundary of the FUDS Project Area is depicted on Figure 2. This boundary is expected to be adjusted based on the findings of this next phase of the RI as the extent of FUDS-related contamination is defined.

Initially, the FUDS Project Area was established to encompass two primary focus areas: the "Aviation Fuel Filter Disposal Area" and the "TCE Disposal Area". These two areas are physically located on the east and west sides, respectively, of the FUDS Project Area. The rationale for defining these two focus areas was based on the observation of surficial debris in the Expanded Filter Disposal Area and the location of a pit (as described in the 1967 NOC letter) where TCE may have been released within the TCE Disposal Area. The 2008 SI and 2017 Phase I RI were focused on the identification and characterization of environmental media associated with these two potential source areas.

The 2008 SI and 2017 Phase I RI, and other evidence, (i.e., the hillshade topography [Figure 3]) suggest that the FUDS Project Area may more appropriately be separated into two areas: (1) the northern portion of the FUDS Project Area where historical site operations placed fill material (the "Historical Fill Area"), and (2) the southern portion of the FUDS Project Area which, because it is not filled, includes a significant portion of wetland areas and no evidence of former DoD activities (the "Native Soil Area"). Separating the FUDS Project Area into these two areas more closely aligns with the historical activities depicted in aerial photographs (AGC, 2016) and observed during prior investigations.

The Historical Fill Area encompasses the expanded Aviation Fuel Filter Disposal Area and the TCE Disposal Area, as well as several potential source areas and areas where surficial and subsurface debris was identified during the 2008 SI and the 2017 Phase I RI. The Native Soil Area is located to the south of the Historical Fill Area and, based on groundwater elevations measured during the 2008 SI, hydrologically downgradient from the Historical Fill Area. The Historical Fill Area and Native Soil Area are described in more detail in the following subsections.

10-2.1 Historical Fill Area

Based on an analysis of 2-meter LiDAR data published by MEDEP and historical aerial imagery (AGC, 2016), a distinctive topographic feature is apparent to the south of the northern border of the FUDS Project Area, as shown on Figure 3. Along this border, the elevation of the ground (on the airfield side) is approximately 4 to 6 feet higher than the area to the south (away from the airfield). Historical reports suggest that during construction of the Dow Military Airfield, wetlands and native tight silty soils in this area were unsuitable for construction without amendments, so a suitable fill material was used to cover these soils (Air Transport Command, 1945). The specific source of the fill material and the specific limits of its placement were not described in the historical reports. However, based on on-site observations, LiDAR, aerial imagery, and prior investigation data, it appears that fill material observed in the vicinity of the FUDS Project Area extends south from the main airfield, through the former FTA, and into the northern portion of the FUDS Project Area. The outline of the historical fill area (to the north) and the natural soils area to the south is evident in the hillshade imagery (USGS; 3DEP, 2021) shown on Figure 3.

The Historical Fill Area covers approximately 3 acres of the northern portion of the FUDS Project Area. Based on prior investigations, including the 2008 SI and the test pitting program conducted during the 2017 Phase I RI, the fill material in the FUDS Project Area is primarily a brown fine to coarse sand, is approximately 4 to 6 feet thick, and was observed above native tight silt soils.

Historical DoD activities associated with the airfield have resulted in several areas within the Historical Fill Area where residual debris is present, potentially representing sources of contamination to environmental media. The following sections describe potential source areas identified within the Historical Fill Area portion of the FUDS Project Area. The approximate location of each potential source area is depicted on Figure 9. A primary objective of the RI will be to determine the extent to which contaminants encountered during the 2008 SI and 2017 Phase I RI are associated with these source areas or can be attributed to the fill material itself. Furthermore, as discussed in more detail in the following subsections, previous investigations found and removed multiple empty, damaged, and intact containers of hazardous materials. The possibility that other containers are still present in subsurface fill in various states of corrosion over time remains a concern that is addressed by the installation of groundwater monitoring wells and the groundwater sampling program.

10-2.1.1 Potential Source Area 1 – North-South Anomaly

Within the eastern portion of the Historical Fill Area is a constructed taxiway extending south from the tarmac to the fighter turning spur, as depicted on Figure 9. This roadway is approximately 150 feet wide by 320 feet long, and its grade is approximately 4 to 6 feet above the surrounding Native Soil Area ground. As depicted in the 1944 aerial photograph in the AGC report (AGC, 2016), the roadway allowed aircraft to access the fighter turning spur at the end of this roadway.

The geophysical survey conducted during the Phase I RI identified a nearly continuous subsurface anomalous area, approximately 150 feet long by 20 feet wide, located beneath the taxiway surface. Three test pits completed within the anomalous area revealed the presence of substantial amounts debris, primarily consisting of airplane parts and several empty 55-gallon drums (two drums had inward punctures similar to what a pickaxe or fire axe would make). The debris was buried beneath the upper 2 feet of fill and extended at least 2 to 3 feet lower, potentially within the underlying tight silt. The depth to the bottom of the debris could not be observed due to the presence of turbid groundwater that rapidly infiltrated each test pit within 1 to 2 feet of the ground surface; the groundwater obscured a view of the bottom of the test pit and the vertical extent of buried debris. This anomalous area has since been designated the North-South Anomaly (N-S Anomaly) area.

Evidence of charring on some of the metallic debris encountered in the N-S Anomaly was somewhat inconclusive, given the visual similarities between charring and rusted black metal. However, in other cases, there was clear evidence of black soot/staining as well as deformed (apparently from melting) aluminum and/or aluminum that had been exposed to high heat, as evidenced by a blue crystalline residue. Also, at least one aircraft component had clear manufacturer's markings that were used to identify the component as a specific actuator for the landing gear doors for a B-59 and is likely a specific aircraft which made an emergency landing at the Dow AFB in 1959 after a mid-air collision with a B-52. This chronology suggests the debris is associated with DoD activity.

Review of historical aerial photographs in the AGC report did not identify evidence of debris burial in this roadway (AGC, 2016). However, it is important to note that the AGC Report (or any historical aerial photographic survey) cannot provide a fully comprehensive understanding of all activities that occurred during the use of this property, therefore the lack of evidence in the photographic analysis for the origin of the N-S Anomaly does not rule out its association with DoD operations. To the contrary, the abundance of DoD activity in this area suggests that the anomaly was indeed associated with historical DoD operations in this area.

10-2.1.2 Potential Source Area 2 – Suspected TCE Disposal Pit

The Suspected TCE Disposal Pit covers an approximately 1-acre area and is generally centered on the Fighter Parking Stub (concrete pad), which was identified as a former "aircraft parking stub" and labeled "stub #5" on several images provided in the AGC report (AGC, 2016) (Figure 9). This component of the FUDS Project Area is situated at the approximate geographical coordinates of 44°48'17.25" N, 68°49'56.62" W.

Based on the LiDAR imagery, Phase I RI data, and the AGC report, the Suspected TCE Disposal Pit appears to be a constructed feature resembling an approximately 350-foot long and 115-foot-wide roadway connecting the tarmac to the Fighter Parking Stub. Based on the Phase I surficial soil samples and test pits, the roadway appeared to be constructed of fill soil placed on top of native soil and wetlands. Based on the AGC report and the Phase I findings, historical waste disposal activities in this portion of the FUDS Project Area appeared to occur primary within the 1-acre Suspected TCE Disposal Pit boundary.

The Suspected TCE Disposal Pit encompasses several important features that were investigated during the Phase I RI including the TCE burial pit, the northern earthen mound, and the eastern fuel filter mound. Each of these features is described in the following subsections.

TCE Burial Pit

The USAF issued the NOC letter dated April 1, 1967, which was part of the property transfer package and identified areas used for disposal purposes directly adjacent to former fighter dispersal parking stubs. The NOC letter described the anticipated disposal of TCE to the west of the Fighter Parking Stub. The NOC letter stated, “The Trichloroethylene is or will be buried in a small pit, not over 30 feet by 10 feet by 6 feet deep. It is estimated that by base closure in June 1968 approximately 1,050 gallons will be buried in the pit." No additional information was provided regarding where, or in what manner (e.g., within drums, dumped on the ground, discharged to a sump or trench) the TCE was to be disposed of. The timeframe of the disposal in this location is interpreted based on the Historic Air Photo Analysis and is believed to have occurred within a brief period (approximately 1-2 years near the end of USAF Ownership).

The AGC report presented an aerial image dated 1960, pre-dating the NOC letter by 7 years. The 1960 image shows the presence of a "Pit with vegetation approximately 20'x15'” (AGC, 2016). Additionally, the AGC report clearly distinguishes the “Future (1968) TCE Burial” location separately from the "pit with vegetation." It may be mere coincidence that the description of the “Future (1968) TCE Burial” area is similar to the dimensions of the "pit with vegetation". Therefore, we cannot be certain where the “Future (1968) TCE Burial” occurred; it may have been at the location depicted on the AGC report or within the "pit with vegetation."

As discussed further in this QAPP, additional investigation is warranted in this area. See the Phase I RI Trip Report and the Phase I and Phase II data summary report, provided under separate cover, for currently available information. The Phase I and initial Phase II investigations did not identify TCE or other wastes in this general vicinity and a focus of this Phase III RI will be to confirm or refute the possibility that this is a potential on-going source area.

Northern Earthen Mound

The former earthen northern mound was located along the northern boundary of the TCE Disposal Area. It was approximately 125 feet long, 20 to 40 feet wide, and 3 to 5 feet high and had small to medium diameter (1 to 6 inches) deciduous trees (e.g., white birch) and shrubs growing on its surface. Portions of approximately 20 to 30 moss-covered fuel filters protruded from a small area on the southern side of the mound. The origin and purpose of the mound is unknown; it is not described or mentioned or identified in any available historical documents.

As part of the Phase I RI, the mound soil was sampled, analyzed for waste profile characteristics, placed in roll-off containers using an excavator, and then transported off-site as non-hazardous waste, under manifest, to a nearby landfill. During removal, many hundreds of discarded fuel filters were discovered buried within the southwestern portion of the mound. These fuel filters were also characterized, removed, and disposed of off-site during the Phase I RI program.

Additionally, following removal of the mound, a catch-basin was discovered beneath the eastern end of the former mound. Additional research about the site history determined the catch-basin was part of the original Dow AFB

construction of an extensive underground stormwater system network. The network is still in place, but its condition is unknown. The catch-basin at the FUDS Project Area is near the western end of a drainage line that flows to the northeast and connects to other drainage lines, which eventually discharge to outfalls located on the northern side of the BIA airfield.

Eastern Fuel Filter Mound

The former Eastern Fuel Filter Mound was approximately 30 feet long, 10 feet wide, and 3 feet high. It was located just beyond the eastern boundary of the Fighter Parking Stub (concrete pad) and contained hundreds of fuel filters, which were subsequently characterized, removed, and disposed of off-site during the Phase I RI program. Some of these filters had white plastic end caps that were labeled with numbers later presumed to be dates. Some of the dates were from 1981, which suggested some of these filters were placed in this mound after the DoD transferred the property to the City of Bangor.

Chemical analysis of the fuel filters and of the underlying surficial soil suggested that the fuel filters may not have contaminated the underlying surficial soil. However, it is possible that chemicals could have been present in fuel filters at the time the filters were disposed of, and that these chemicals subsequently leached into the ground, below the surficial soils, such that the current chemical profile of the filters was not representative of their former chemical profile.

10-2.1.3 Potential Source Area 3 – Man-Made Depression

A man-made depression with surficial metallic debris is located near the central northern boundary of the Historical Fill Area (Figure 9). This man-made depression area was first identified by the PDT during a site visit in May 2017 and was not defined or identified in the AGC report. During the Phase I RI, the vegetation from this area was cleared to reveal a partially buried section of an airplane wing (approximately 15-feet long) and fuselage, along with numerous empty 5-gallon metallic containers labeled as "Foam Liquid 5". This area has since been defined as the "Man-Made Depression".

However, it is noted that the 1994 SI report included the following information under "*3.1.3 POL* [Petroleum, Oil, Lubricant] *Area and Dump Site*" (USACE, 1994):

> *"This area is in the vicinity of the [former] FTA next to the pavement, part of it is an open field and the remainder is thick overgrown woods. The historical survey by CENED found this area was used for storage of 55-gallon drums of JP-4 fuel. Another employee suggested that this site may be the location of buried aircraft. Both men [organization or names not provided] seemed quite sure that this site was not part of the [former] FTA. During the site visit [in] March 1990 by CENED, some discarded filters and rusted empty drum [sic] were seen in the woods."*

The POL area was reportedly saturated with petroleum products and used for storage of 55-gallon waste drums of JP-4 fuel (USACE, 1994; AGC, 2016). However, during an earlier field investigation in 1991 (GZA, 1991), the "POL Area and Dump Site" was observed to be:

> *"…marked with a sign indicating 'No Fuel Dumping Without Approval by the Fire Department'. It was observed to be covered with to 2-foot thick growth of weedy open field vegetation. Visual surficial evidence of the petroleum stained soils referenced in CENED documents was not apparent but may have been obscured by the vegetation.*
>
> *Remains of demolished automobile were observed at the edge of pavement adjacent to the POL Area Other miscellaneous debris including what appeared to be aircraft parts and white fibrous material possibly asbestos-containing were observed on the ground surface within the area Atmospheric monitoring did not suggest the presence of volatile organic vapors."*

Therefore, it is somewhat unclear from historical reports whether the man-made depression is geographically distinct from the POL area (Section 10-2.1.6), or if the two areas are one and the same. For the purposes of this Phase III RI investigation, the two areas will be considered separate potential source areas.

10-2.1.4 Potential Source Area 4 – Southern Slope

During the 2008 SI, partially buried and buried debris was unearthed in the southern portion of the expanded Aviation Fuel Filter Disposal Area. Materials were excavated, removed from the Site, and disposed of off-site. Debris included two intact drums characterized as hazardous waste, two intact 5-gallon containers categorized as non-hazardous, approximately 105 fuel filters contained in five 55-gallon drums disposed of as benzene-containing waste, and other miscellaneous metallic debris and refuse. Most of this debris was present on or within the slope of the Fighter Parking Stub. Buried debris was present within the fill to the top of the underlying native and undisturbed tight silt. This area has since been defined as the "Southern Slope" (Figure 9).

The 2008 SI included the collection of surface soil, shallow subsurface soil, sediment, surface water samples; installation and sampling of six shallow overburden groundwater monitoring wells; surficial geophysics survey; and surficial debris removal. None of the overburden groundwater samples collected during the 2008 SI contained VOCs, SVOCs, polychlorinated biphenyls (PCBs), or pesticides above human health risk-based screening levels. In soils and sediment, constituents were reported above risk-based screening criteria. Neither TCE nor its degradation products were detected in this area.

Surface geophysical data obtained during the 2008 SI efforts indicated the presence of additional buried metallic materials. During the Phase I RI, partially buried and buried debris was unearthed in the southern portion of the expanded Aviation Fuel Filter Disposal Area. Debris included numerous empty 55-gallon drums, creosote-coated utility poles, railroad ties, metal guardrails, and other miscellaneous metallic debris and refuse. Numerous empty metal 5-gallon-sized cans labeled "Foam Liquid 5" were present within the buried airplane area. These empty cans were removed and disposed offsite during the 2017 investigation. Most of this debris was present on or within the slope of the Fighter Parking Stub. Buried debris was present within the fill to the top of the underlying native and undisturbed tight silt.

10-2.1.5 Potential Source Area 5 – Hildreth Street Debris Field

The Hildreth Street Debris Field is located on the western side of Hildreth Street North and is a part of the property that was reportedly used as a fire training area. On the western side of North Hildreth Avenue, across from the Southern Slope, was a disposal area observed with FUDS-related materials. Specifically, used fuel filters, similar to those found in other areas of the FUDS Project Area, were present in this area. That is, the fuel filters were apparently the type used for the fuel lines serving aircraft, rather than aircraft fuel filters.

10-2.1.6 Potential Source Area 6 – POL Source Area

As mentioned above in the description of the Man-Made Depression, an area of former fuel storage and petroleum-stained soil was reported in the northern portion of the FUDS Project Area at the edge of the pavement. This area of unknown size or dimension is referred to as the "POL Source Area" and will be investigated during this next phase of the RI.

10-2.1.7 Underground Utility Corridor

The review of historical utility plans and interpretation of surface geophysics identified an underground drainage line that runs west to east through the northern portion of the FUDS Project Area (Figure 9). The subsurface utility corridor could also act as a preferential pathway for potential contaminant migration. The location of the corridor was found during the geophysical survey work, manholes can be observed in the field, and it is reasonably well documented on BIA plans.

10-2.2 Off-Site Sources

Potential off-site sources are discussed in Section 10-4.0.

10-3.0 NATIVE SOIL AREAS

The native soil areas are divided into two general areas. The Downgradient Native Soil Area is the unfilled portion of the FUDS Project Area that is potentially impacted by releases from the seven potential disposal areas identified within the Historical Fill Area. The Native Soil Background Area is located beyond the FUDS Project Area, outside of the influence of the Site, and was chosen as representative of local soil types (for metals) and potentially influenced by off-Site sources of anthropogenic background (especially for PAHs). These areas are discussed further below.

10-3.1 Downgradient Native Soil Area

To the south of the Historical Fill Area is the Downgradient Native Soil Area. The northern boundary of the Downgradient Native Soil Area is drawn based on the evidence of fill in the hillshade image (Figure 3) and begins where the Historical Fill Area ends, where fill material or other evidence of former DoD activities are absent. Although sparse miscellaneous surficial debris (metal scraps, empty drums) was observed in the northern portion of the Downgradient Native Soil Area, the density and type of debris suggests that the Downgradient Native Soil Area was not a primary debris disposal area, and that the debris was haphazardly placed here (much of this debris was identified and removed during the 2008 SI and the 2017 Phase I RI). Based on the earliest available aerial photograph dated 1944 in the AGC report, to present day observations, the Downgradient Native Soil Area was heavily wooded and dominated by wetlands, further suggesting that large-scale waste disposal activities, which likely would have required clearing and would be evident on historical aerial photographs, probably did not occur in this area. This premise is further supported by the Phase I RI geophysical survey data that did not identify major subsurface anomalies in the Downgradient Native Soil Area. The Downgradient Native Soil Area is further divided into upland soil areas and wetland soil areas (Figure 10).

10-3.2 Native Soil Background

The native soils beyond the current boundaries of the FUDS Project Area are considered to represent natural conditions that have not been impacted by DoD operations within the FUDS Project Area. This next phase of the investigation includes a characterization of metals and PAHs in surface upland soils within Native Soil Background Areas that will provide an indication of naturally occurring and anthropogenic background levels of these constituents. The impact of atmospheric dispersion (anthropogenic background) of contaminants, particularly PAHs, from nearby airport operations may also be captured from sampling this area.

10-4.0 POTENTIAL OFF-SITE SOURCES

The Site and surrounding area are known to be developed on an area of urban and industrial fill. In addition to the FUDS Project Area, multiple other industrial activities are near the Site that store, use, and dispose of various hazardous materials. A preliminary understanding of the abutting properties and their uses may be helpful in refining the CSM. Preliminary information for nearby sites is discussed below.

10-4.1 Former Fire Training Area (FTA) Debris Field

The former FTA encompasses approximately 33 acres to the north of and adjacent to the FUDS Project Area, as shown on Figure 2. The FTA is not included as a part of the Dow FUDS Project Area. According to the Dow Military Airfield Document Review, fire pits at the former FTA were excavated and moved often from the 1940s through transfer in 1968 (AGC, 2016).

It has been reported that numerous types of materials including petroleum products, tetraethyl lead aviation fuel filters, aircraft and aircraft parts, solvents, paints, various debris, and other materials were either disposed of or used in fire response training at the FTA and vicinity (GZA, 1994). Based on historical information, flammable materials including fuels and cleaning solvents that were generated by the USAF, the Maine Air National Guard, the City of Bangor, and other groups were transported to the FTA and dumped in several areas (USACE, 1993). These areas were used for joint fire training exercises with the MEANG and the Bangor Airport Fire Department.

Additionally, a "former underground storage tank (UST) area" reportedly contained a UST used for TCE storage at the former FTA. The subject UST was reportedly removed in 1991, and no documented history of a release was noted (USACE, 1994). It is noted that TCE typically is not a good flammable source unless mixed with other flammable materials.

It is likely that the primary migration mechanisms from the former FTA would be through overland surface run-off, leaching into soil, and transport in groundwater. The subsurface stormwater catch basin network, which has a segment between the FTA and the FUDS Project Area (Figure 11), could also act as a preferential migration pathway.

10-4.2 Former Drum Burial Area

The former drum burial area is located approximately 1,000 feet east of the FUDS Project Area and is managed separately from the Dow Disposal Site. Surface water from the former drum disposal area flows to the west and southwest toward the FUDS Project Area (Figure 2).

The drum burial area was discovered on August 7, 1989, when Maine Army National Guard personnel were excavating gravel for road construction (USEPA, 1992). Workers accidentally punctured two buried 18-gallon drums during excavation. One of the drums was marked "DOW 1,1,1-TRI", and the other drum was unmarked. MEDEP response personnel sampled the drum contents; laboratory analyses indicated that samples from each drum contained 1,1,1-trichloroethane (26,000 ppm and 390,000 ppm). In 1990, USACE/Omaha Division began a removal action that was overseen by MEDEP. In total, USACE recovered nine 55-gallon drums, noted as being "very old, crushed and rusted through, containing little or no liquid." As part of the removal action, approximately 40 to 45 cubic yards of soil were removed from the area. Data were reported for only one soil sample, which was collected at 10 feet below ground surface (bgs) by MEDEP (1,1,1-TCA at 3.4 mg/kg) (USEPA, 1992). It is possible that surface water from the former drum burial area could migrate to the un-named intermittent stream channel present at the FUDS Project Area.

10-4.3 Other Potential Off-Site Sources

Potential off-site point and non-point sources could also be contributing to environmental conditions on the Site. These off-site sources may include:

- Airborne dispersion from off-site sources.
- Municipal or urban sources.
- Industrial sources.
- Commercial sources.
- Naturally occurring environmental sources.
- BIA-related aircraft-sources.

Potential off-site pollutants from municipal or urban activities can contribute as non-point sources of contamination to a site. Examples of potential municipal or urban sources can include stormwater runoff, National Pollutant Discharge Elimination System (NPDES)-permitted and non-permitted discharges to nearby water bodies, or particulate fallout from vehicular traffic. Based on the relative remoteness of the FUDS Project Area to

municipal and urban operations, the potential of off-site pollutants from municipal or urban activities adversely affecting the quality of environmental media at the FUDS Project Area is expected to be limited.

The proximity of the main runway at BIA creates the potential for municipal sources of constituents to the FUDS Project Area via surface water runoff and wind dispersion. Several commercial entities are located on Hildreth Street North as shown on Figure 2. The distance of these businesses, which include a construction company, a pump equipment firm, and a transportation company, range from 0.25 to 0.5 miles to the west-southwest from the FUDS Project Area. In addition, the US Army Reserve Center and the Maine Army National Guard Training facilities are located approximately 0.25 miles to the west-northwest of the FUDS Project Area.

Naturally occurring elements may also exceed screening levels due to the regional geology or from anthropogenic sources. Similarly, concentrations of some organic compounds (particularly PAHs) may be attributable to regional anthropogenic sources distributed via surface water run off and/or wind dispersion.

Except for naturally occurring background, discussed below, this next phase of investigation does not explore off-site sources of potential constituents of interest (COIs). Depending on the findings from this investigation and if they indicate additional potential sources areas, either on or off the Site, additional investigations may be recommended to identify the source(s), and the extent of impacts to the Site.

10-5.0 CONCEPTUAL SITE MODEL

The CSM, based on what is currently understood about the Site, is discussed in the following subsection. The CSM is based on:

- Known use of the Site as a military disposal area.
- Identification and removal of disposal areas.
- Evidence that the developed area, including the former disposal areas, are geographically limited to the filled area located on the northern portion of the Site.
- Preliminary evidence to indicate that potential source removals have been effective and that downgradient migration, if occurring, is on a relatively small scale.

One of the purposes of this next phase will be to further verify and quantify these essential elements of the CSM. The sampling will also provide information about naturally occurring and anthropogenic background and will provide preliminary characterization information to understand whether COIs are from FUDS-related activities or potentially from upgradient or off-site sources. As more data are available, the CSM will be updated, as appropriate, in forthcoming reports.

Because of its location and based on the findings from previous investigations, the CSM is straightforward. COIs may be present from FUDS-related activities in the filled portions of the FUDS Project Area. If COIs are present in source areas, they would migrate primarily via overland flow or leach into groundwater. The heavier COIs that are most often absorbed on to fine-grained particulate are most likely to be transported via overland flow and eventually captured in wetland areas or further transported via surface water and suspended sediment. Non-aqueous phase liquid (LNAPL or DNAPL), if released on the Site, would likely travel with groundwater, or over the impermeable subsurface materials (Presumpscot formation or bedrock). Phase II RI investigations of sediment and surface water provided data with low concentrations relative to screening levels, suggesting that surface water migration is a relatively minor concern. Constituents that are more soluble or mobile in water, especially VOCs and certain metals, are most likely transported through precipitation infiltration to groundwater and then transported further in the direction of groundwater flow. The following subsections discuss these possibilities in additional detail.

In addition to Figures 1 and 2 which show the Site and surrounding area, a series of figures is included to show available information about the Site. These are referenced throughout the following subsections and include the following:

Figure 3: Hillshade Relief Map
Figure 4: Area Surficial Geology Map
Figure 5: Area Bedrock Map
Figure 6: Bedrock Topography
Figure 7: Conceptual Cross Section
Figure 8: Wetland Delineation and Vernal Pool Locations
Figure 9: Potential Source Areas
Figure 10: Proposed Soil Sampling Locations
Figure 11: Storm Drainage Plan
Figure 12: Risk Conceptual Site Model
Figure 13: Proposed Soil Boring and Monitoring Well Location Map

10-5.1 Site-Related Constituents of Interest

A preliminary list of site-related COIs at the FUDS Project Area was developed using information obtained from prior investigations at and in proximity to the FUDS Project Area and based on the potential sources listed in Section 10-2.0. The COI list includes:

- VOCs, including chlorinated VOCs
- PAHs
- PCBs
- Metals

During previous investigations, samples were also analyzed for petroleum constituents as volatile and extractable hydrocarbons (VPH/EPH) or as gasoline-range and diesel-range organic compounds (GRO/DRO). Grouped petroleum hydrocarbons were detected in soil and groundwater samples at relatively low concentrations in comparison with risk-based screening levels. Levels of individual PAHs in the same samples were detected at concentrations above their respective risk-based screening levels, although petroleum-related VOCs (e.g., benzene, ethylbenzene, toluene, xylene [BTEX]) were not detected above risk-based screening levels. Grouped petroleum-related chemical analyses such as VPH/EPH and GRO/DRO are not included in this next phase of investigation, as the individual BTEX and PAH analyses tend to have lower screening levels than the cleanup goals for the grouped constituents and the individual compound results will identify the presence of petroleum constituents and are more useful in assessing potential site risks. The PAH and VOC analyses will be sufficient to identify petroleum releases from fuel filters or other sources on the Site.

This COI list has been refined to address those COIs that were identified in previous investigations or known to be associated with the types of waste materials observed on the Site. The COI list may be updated to include additional chemical groups if new information about sources or detected chemicals is obtained during investigations. The COI list will be further refined through the CERCLA risk assessment process to define the chemicals of potential concern (COPCs) and, if risks are outside of USEPA target risk ranges, the chemicals of concern (COCs). A discussion of each of the COI groups is provided in the following sections.

10-5.1.1 Volatile Organic Compounds

VOCs, particularly chlorinated VOCs including TCE and its breakdown products, are of particular concern because TCE was reportedly released at the FUDS Project Area as noted in the 1967 NOC letter. Of the several empty drums recovered from the surface and subsurface during the Phase I RI, one had a label suggesting it may have contained

TCE ("DOW NEU-TRI"), while several others were labeled as having contained methanol. Chlorinated VOCs have not been detected on the Site to date. This next investigation will further assess potential source areas and down gradient areas for these chemicals in soil and overburden groundwater.

Analysis for VOCs will also identify BTEX, if these compounds are present from on-Site or upgradient releases. BTEX is typically associated with petroleum products and could be present from the uses of fuel oils, fuel filters, or lubricants.

10-5.1.2 Polycyclic Aromatic Hydrocarbons

PAHs are a broad class of compounds produced naturally and by human activity. PAHs can be derived from plants or produced by burning fossil fuels. It is noted that based on an analysis of the ratio of selected low- to high-molecular weight PAHs detected in three surficial soil samples (0- to 1-foot bgs) collected from fill material during the Phase I RI, the PAHs detected during the Phase I RI appear to be of a petrogenic nature, and possibly associated with the use, storage, release, and combustion of petroleum products.

10-5.1.3 Polychlorinated Biphenyls

PCBs were detected in several soil samples collected during the Phase I RI and the 2008 SI. Detections were sporadic and were in concentrations that were less than 10 mg/kg. PCBs are persistent in the environment and were historically used in a wide variety of applications (e.g., transformers, capacitors). Although PCBs were not widely detected at the Site, they are a concern for both human and ecological receptors due to their persistence and toxicity. The next phase of investigation will include additional investigation for PCBs in soil.

10-5.1.4 Metals

Metals, namely arsenic, chromium, cadmium, lead, and zinc, have been detected in surface and subsurface soils throughout the FUDS Project Area (2008 SI; Phase I RI). The source(s) of these metals has not been confirmed and some may be naturally occurring. Metals may also be present from miscellaneous debris that was disposed of at the Site. Metals were also detected in sediment samples collected from the western segment of the un-named stream during the 2008 SI. These metals in sediment were believed to have been transported from an unspecified source location through surface water run-off and wind transport.

Previous site reconnaissance identified yellow paint on surfaces and in disposal areas. Accordingly, hexavalent chromium is included on the COI list for soils and overburden groundwater.

10-5.2 Release Mechanisms and Environmental Transport Model

The primary release mechanisms from potential source areas into the environment include direct discharge, surface water runoff, leaching, and infiltration from primary and secondary source areas (e.g., previously impacted shallow overburden) into the surrounding soil and groundwater, and volatilization. Secondary transport mechanisms are often related to the type of chemical constituent. Heavy metals and higher molecular weight organic compounds are often absorbed on to fine grained particulate and transported with that particulate via overland or culverted surface water runoff, eventually being redeposited in sediment depositional areas. More volatile and lighter molecular weight organic compounds are often transported via precipitation, ground infiltration, leaching, and finally, to overburden groundwater. Once in groundwater, migration of constituents tends to follow groundwater flow direction(s).

Because previous work on the Site included removal of obvious possible sources, disposal areas as source areas are most likely under control, especially for larger molecular weight constituents such as PAHs, metals, and PCBs, as they pertain to migration via overland flow. The potential source areas identified in Section 10-2.0 will be investigated further to understand the nature and extent of possible historical releases, to characterize current risks, and to confirm that these do not represent on-going source areas.

This next phase of investigation will further assess potential source areas vertically and horizontally downgradient for chlorinated VOCs to determine whether leaching and migration via groundwater flow has occurred. Additionally, contaminants that reach the underground utility corridor (Figure 9) could potentially migrate along the subsurface piping network (as a preferential pathway).

10-5.3 Potential Human Receptors and Exposure Pathways

Based on the potential release mechanisms, the primary exposure pathways for humans are identified as incidental ingestion or dermal contact with surface soil, subsurface soil, sediments, surface water, and groundwater. Additionally, the inhalation exposure pathway from volatilization to the air will be evaluated.

Based on multiple site observations in 2008 and 2015-2018 by USACE, the area is currently used for recreational purposes (e.g., dog walking, ATV/snowmobiling, hunting), Physical Training (PT) by MEANG personnel and Reservists using Hildreth Street North. Other potential receptors include BIA staff and construction workers and site visitors. Additionally, nearby local businesses are currently using the local bedrock aquifer. A more detailed discussion of potential human receptors and exposure scenarios that will be evaluated in the baseline HHRA is provided in Appendix E.

10-5.4 Potential Ecological Receptors and Exposure Pathways

The ecological risk assessment will evaluate the possibility of ingestion and dermal contact for terrestrial and semi-aquatic receptors such as amphibians via sediment, wetland soils, and surface water. Because of the intermittent and seasonal nature of the surface water flows, exposure to fully aquatic organisms will not be evaluated further. The groundwater to surface water discharge mechanism at the FUDS Project Area will be evaluated for the freshwater wetland resource area and un-named stream channel. A more detailed discussion of potential ecological receptors and the methodology for evaluating potential exposures for the SLERA is provided in Appendix E.

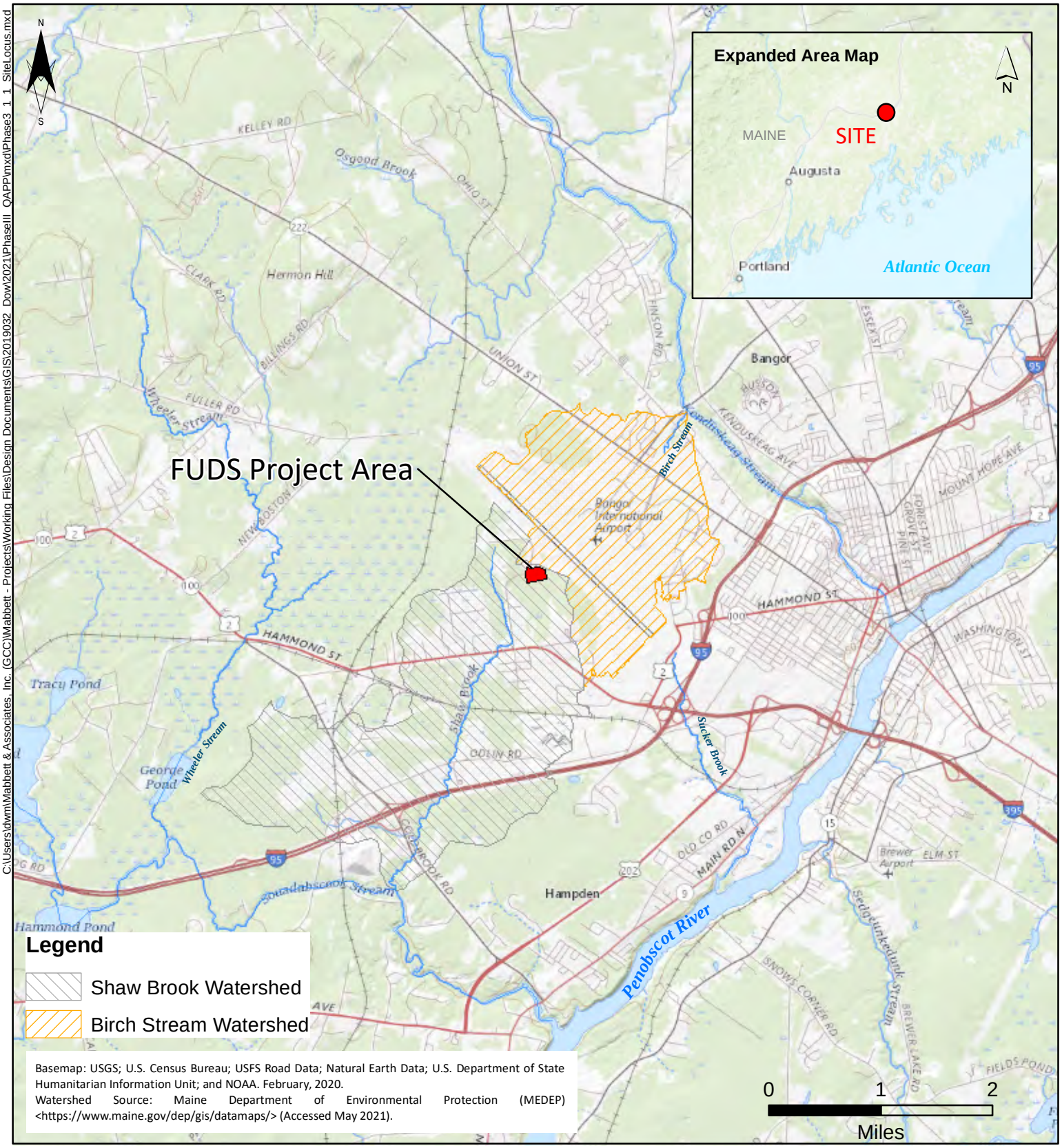
10-6.0 CONCEPTUAL SITE MODEL DATA GAPS

Based on what is currently known about the Site as described previously in this worksheet, and what is understood about the CSM, the following data gaps were identified and provide the basis for this next phase of investigation:

- Historical environmental investigations and other available military documentation suggest that VOCs, PAHs, PCBs, and metals may have been released to the environment in the Dow Disposal Site FUDS. Constituents may also be present in the fill materials used in the creation of the airfield and located on the northern side of the Site (Figure 3). The nature and extent of impacts has not been fully delineated.
- COIs may be present in downgradient media (upland soil and wetland soil) following migration from the disposal area portion of the Site. Specifically, downgradient media could be impacted by an identified potential source area or an additional, as yet unidentified and uncontrolled source area(s).
- Constituents, particularly those that are prone to downward migration, such as chlorinated solvents, may be present in subsurface soils and overburden groundwater.
- The depth and thickness of the low permeability layers and the condition of the bedrock surface are unknown and weathering could serve to facilitate migration to and within bedrock. Overburden hydrogeology and controls on groundwater flow need to be further understood to determine potential migration pathways in the overburden aquifer.
- Regional natural and anthropogenic background concentrations of COIs are not well understood.
- The potential risks to human health and ecological receptors associated with exposure to FUDS-related COPCs requires quantitative assessment.

- The identified storm drain corridor could act as a potential preferential migration pathway, especially for more mobile constituents, such as chlorinated VOCs.

FIGURES



Basemap: USGS; U.S. Census Bureau; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA. February, 2020.
Watershed Source: Maine Department of Environmental Protection (MEDEP) <https://www.maine.gov/dep/gis/datamaps/> (Accessed May 2021).

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US Army Corps of Engineers.

Former Dow Air Force Base

Bangor, Maine

Formerly Used Defense Site (FUDS)
Property and Project Number D01ME0004 02

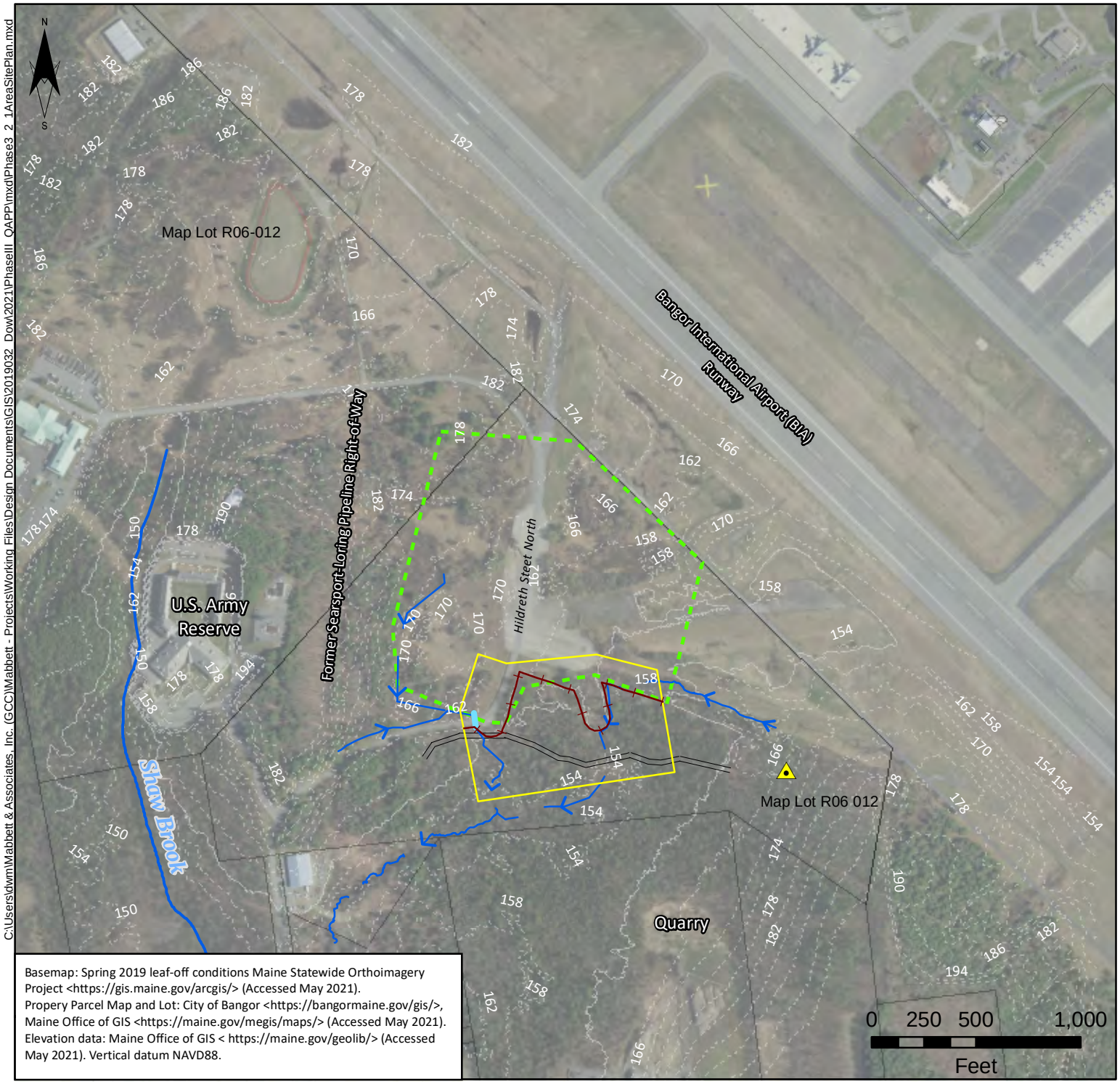
SITE LOCUS MAP

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 1

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023



Basemap: Spring 2019 leaf-off conditions Maine Statewide Orthoimagery Project <https://gis.maine.gov/arcgis/> (Accessed May 2021).
Propery Parcel Map and Lot: City of Bangor <https://bangormaine.gov/gis/>, Maine Office of GIS <https://maine.gov/megis/maps/> (Accessed May 2021).
Elevation data: Maine Office of GIS < https://maine.gov/geolib/> (Accessed May 2021). Vertical datum NAVD88.

Legend

- FUDS Project Area
- Former Fire Training Area Boundary
- Property Boundary
- Elevation Contours (4 ft)
- Intermittent Stream With Flow Direction
- Culvert
- Recreational Trail
- Native Soil (south) / Historical Fill (north) Delineation
- Approximate Location of Former Drum Disposal Area

US Army Corps of Engineers.

Former Dow Air Force Base

Bangor, Maine

Formerly Used Defense Site (FUDS)
Property and Project Number D01ME0004 02

AREA SITE PLAN

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 2

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

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Native Soil (south)/Historical Fill (north) Delineation

Hildreth Street North

Intermittent Stream With Flow Direction

Legend

- FUDS Project Area
- Approximate Boundary of 2008 Watermark Site Investigation
- Elevation Contours (4 ft)
- Catch Basin
- RecreationalTrail
- Culvert
- Utility Line

0 250 500

Feet

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US Army Corps of Engineers.

Former Dow Air Force Base

Bangor, Maine

Formerly Used Defense Site (FUDS)

Property and Project Number D01ME0004 02

HILLSHADE RELIEF MAP

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 3

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Hillshade imagery: USGS National Map 3D Elevation Program (3DEP) <https://www.usgs.gov/> (Accessed May 2021).
Elevation data: Maine Office of GIS < https://maine.gov/geolib/> (Accessed May 2021). Vertical datum NAVD88.
Utility Line and Catch Basin locations: Hager-Richter Geoscience, Inc. Surface Geophysical Surveys Report, April 2021.
2008 Watermark Site Investigation Boundary: Watermark Environmental, Inc., Final Site Investigation Summary Report, January 2013.

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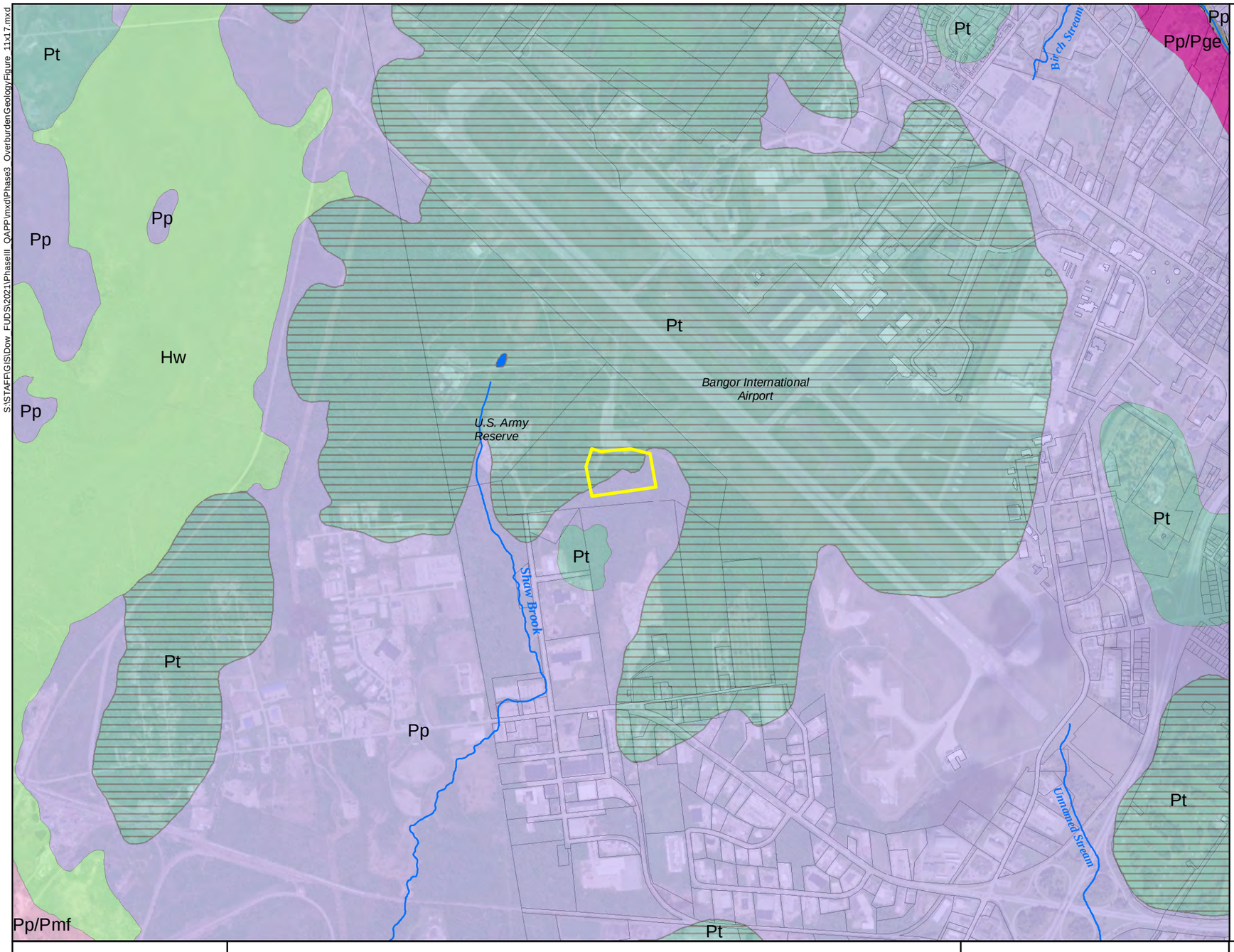

Legend

FUDS Project Area

Bangor Property Boundary

Surficial Geology

UNIT

Pt	Till - Loose to very compact, poorly sorted, massive to weakly stratified mixture of sand, silt, and gravel-size rock debris deposited by glacial ice. Locally includes lenses of waterlaid sand and gravel. Boulders commonly present on ground surface.
Pp	Presumpscot Formation - Glaciomarine silt, clay, and sand deposited on the late-glacial sea floor.
Hw	Wetland sediment - Peat, muck, silt, and clay in poorly drained areas.
Pp/Pge	Presumpscot Formation overlying esker sediment - Areas of sand and gravel (Pge) deposited by glacial meltwater streams in tunnels beneath the ice. After tunnel sediment was exposed during recession of the ice sheet, then a variable thickness of glacioma.
Pp/Pmf	Presumpscot Formation overlying glaciomarine fan sediment - Glaciomarine silt, clay, and sand (Pp) overlying submarine fan sediment (Pmf) containing well stratified sand and gravel.
	Bedrock outcrops/thin-drift area - Ruled pattern indicates areas where bedrock outcrops are common and/or surficial sediments are generally less than 10 ft thick. Mapped from air photos and ground observations. Actual thin-drift areas are probably more extensive than shown.

0 0.5 1

Miles

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Bangor, Maine

Formerly Used Defense Site (FUDS)

Property and Project Number D01ME0004 02

AREA SURFICIAL GEOLOGY MAP

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 4

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Base Imagery Source: Spring 2019 leaf-off conditions Maine Statewide Orthoimagery Project - https://www.maine.gov
Property Parcel Data: https://bangormaine.gov/ and https://maine.gov/
Surficial Geology Data: https://digitalmaine.com/mgs_maps/2034, Surficial geology of the Bangor quadrangle, Maine: Maine Geological Survey, Open-File Map 11-6, map. 2011

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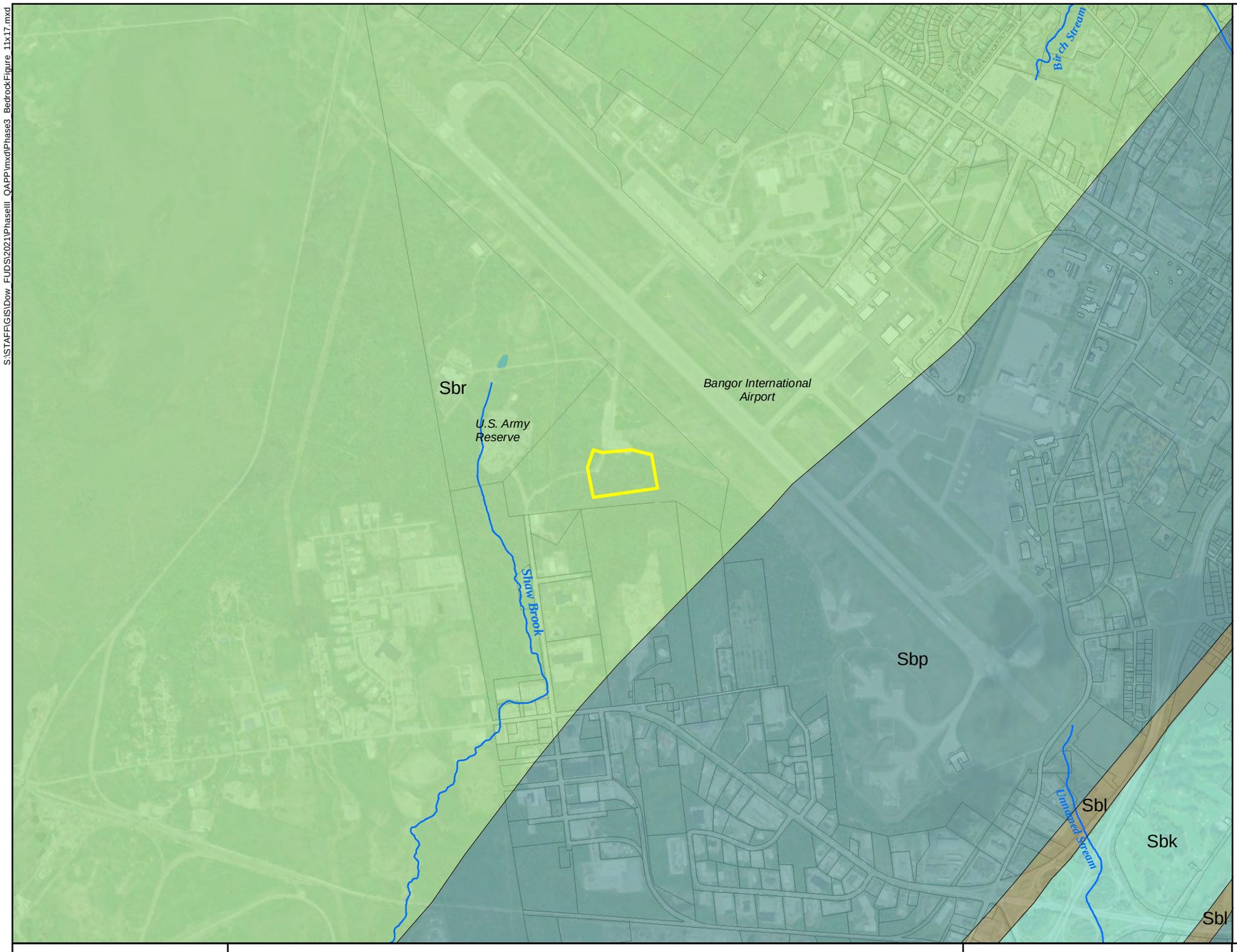

Legend

FUDS Project Area

Bangor Property Boundary

Bedrock Geology

UNIT

Sbr — Brewer Formation. Dominantly dark gray to black, siltstone and claystone slate. Slate beds are commonly less than 30 cm thick. Locally common within the slates are thin, discontinuous, parallel laminae of quartz-rich metasiltstone.

Sbp — Bangor Formation - Penobscot River Member. Medium gray to dark gray, medium-grained to very fine-grained feldspathic metawacke. Muscovite is locally a common accessory mineral. Siltstone and claystone slate is a minor lithology.

Sbk — Bangor Formation - Kenduskeag Stream Member. Medium greenish gray to dark greenish gray very fine-grained to fine-grained feldspathic metawacke and greenish gray slate. Muscovite is locally a common accessory mineral in the metawackes.

Sbl — Bangor Formation - Lover's Leap Member. Dark gray to grayish black siltstone slate with laminae and very thin beds of very fine-grained quartz-rich sandstone. Rusty weathering, calcareous, very fine-grained, quartz-rich metasandstone is locally common.

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Miles

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Bangor, Maine

Formerly Used Defense Site (FUDS)

Property and Project Number D01ME0004 02

AREA BEDROCK MAP

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

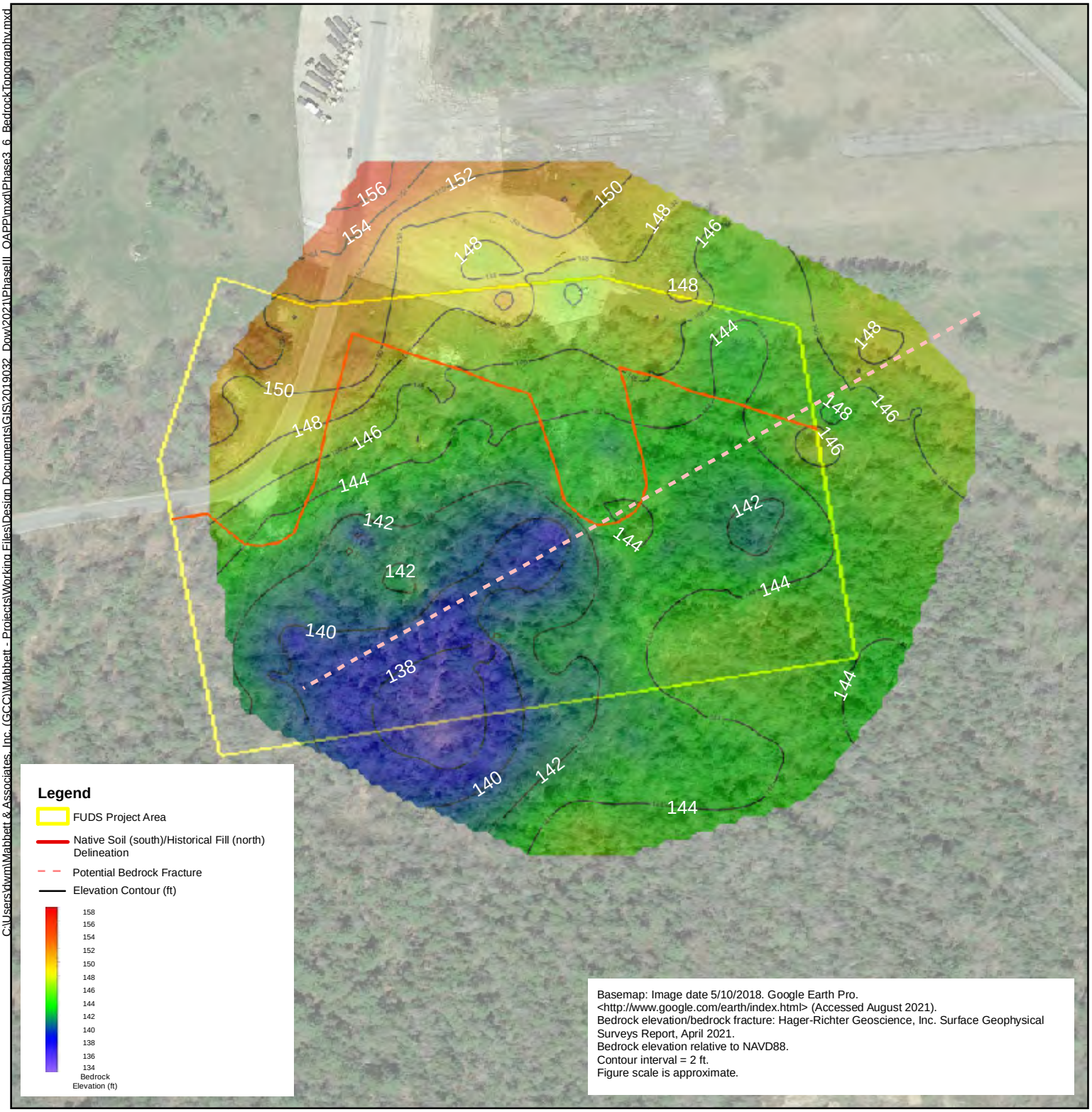
Figure 5

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Base Imagery Source: Spring 2019 leaf-off conditions Maine Statewide Orthoimagery Project - https://www.maine.gov

Property Parcel Data: https://bangormaine.gov/ and https://maine.gov/

Bedrock Geology Data: Maine Department of Agriculture, Conservation, and Forestry, Maine Geological Survey, Open-File Map 11-57 - https://maine.gov/. 2011



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US Army Corps of Engineers.

Former Dow Air Force Base

Formerly Used Defense Site (FUDS)
Property and Project Number D01ME0004 02

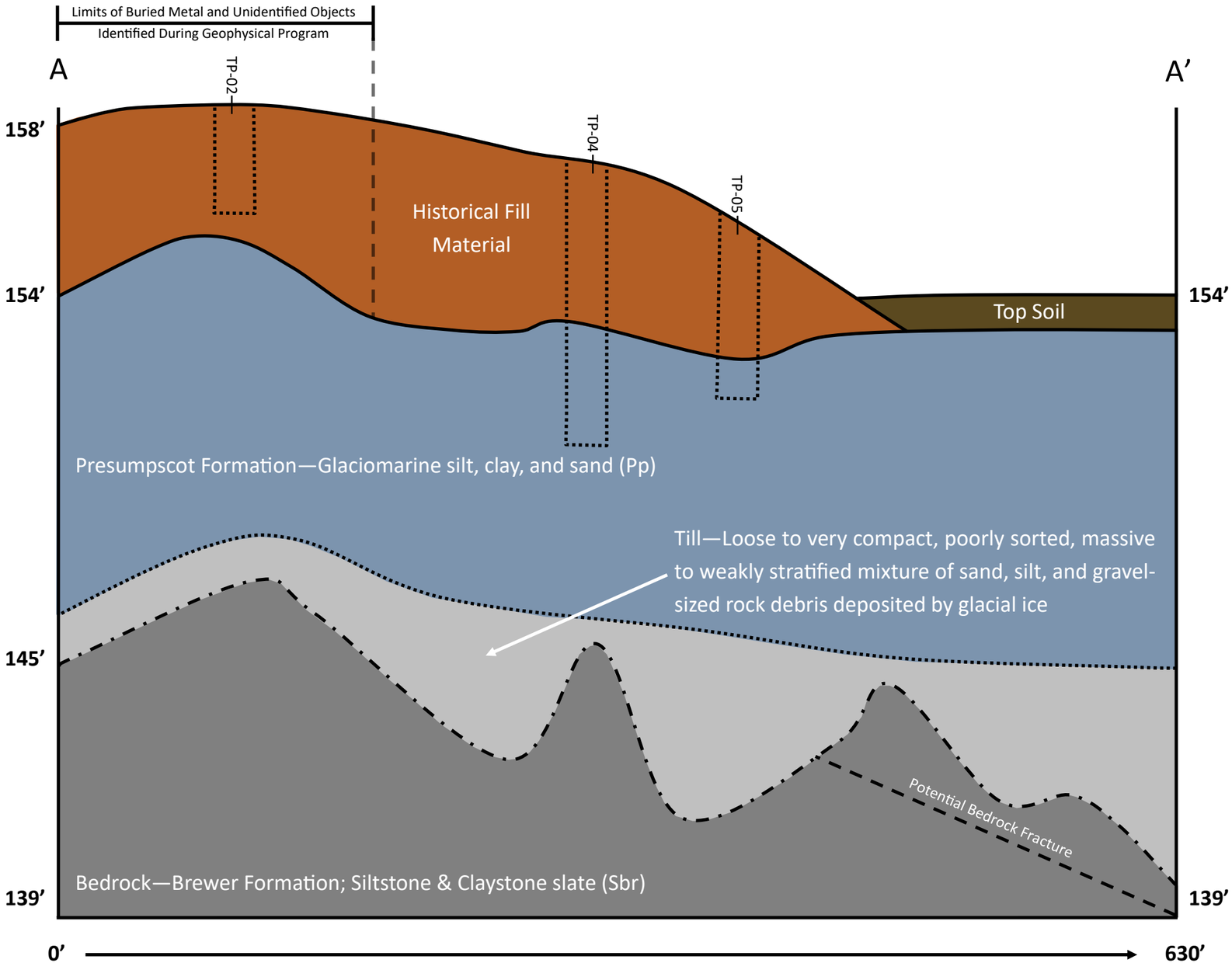
BEDROCK TOPOGRAPHY

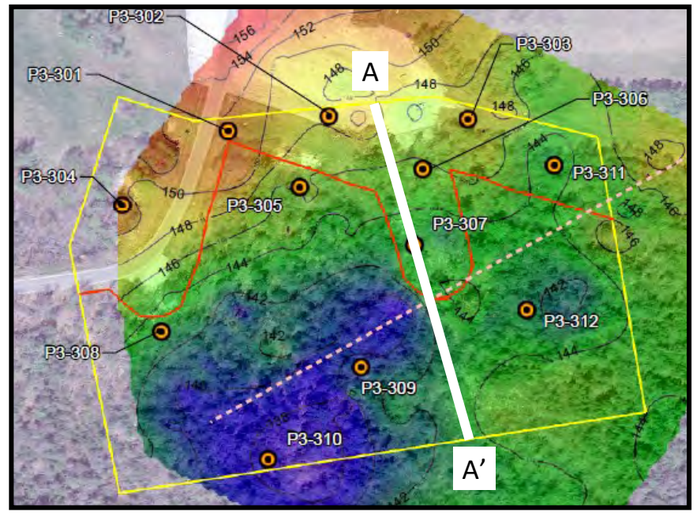
Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 6

Drawn: DWM	Approved: SAV
Projection: WGS Word Mercator	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023





References:

1. Bedrock Geology Map, Maine Department of Agriculture, Conservation, and Forestry, Maine Geological Survey, Open-File Map 11-57. 2011.
2. Surficial Geology of the Bangor Quadrangle, Maine: Maine Geological Survey, Open-File Map 11-6. 2011.
3. Watermark, Final Site Investigation Summary Report—Aviation Fuel-Filter/Tetraethyl Lead Disposal Area and Trichloroethylene Disposal Area, Former Dow Air Force Base. January 2013.
4. Mabbett, Phase I Remedial Investigation Trip Report, FUDS Project Area Former Dow Military Airfield. March 2018.
5. Hager-Richter Geosciences, Inc., Surface Geophysical Surveys, Former Dow Military Airfield Site. April 2021.

Figure 7

Conceptual Geological Cross Section

Former Dow Air Force Base
Bangor, Maine
Formerly Used Defense Site (FUDS)
Property and Project Number D01ME0004 02

Drawn: CEW	Approved: MLB
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Legend

- FUDS Project Area
- USACE Delineated Wetlands
- USFWS National Wetlands Inventory
- Vernal Pool
- Property Boundary
- Recreational Trail
- Culvert
- Utility Line
- Catch Basin

0 250 500
Feet

N
S

US Army Corps of Engineers.

Former Dow Air Force Base

Bangor, Maine
Formerly Used Defense Site (FUDS)
Property and Project No. D01ME0004 02

WETLAND DELINEATION AND VERNAL POOL LOCATIONS

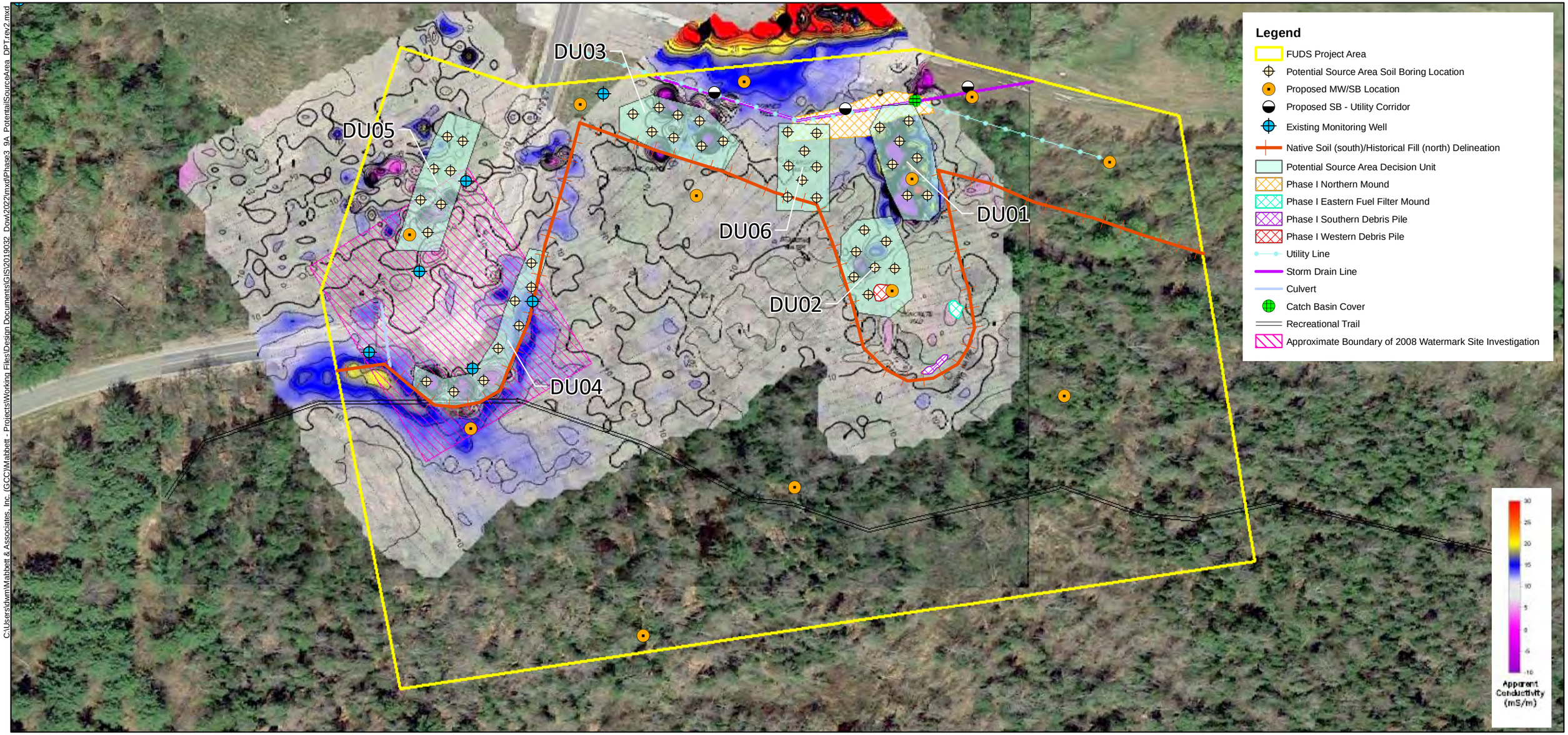
Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 8

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Basemap: Spring 2019 leaf-off conditions Maine Statewide Orthoimagery Project <https://gis.maine.gov/arcgis/> (Accessed May 2021).
Propery boundaries: City of Bangor <https://bangormaine.gov/gis/>, Maine Office of GIS <https://maine.gov/megis/maps/> (Accessed May 2021).
Maine wetlands: U.S. Fish and Wildlife Services (USFWS) <https://www.fws.gov/> (Accessed May 2021).
Utility Line and Catch Basin locations: Hager-Richter Geoscience, Inc. Surface Geophysical Surveys Report, April 2021.
U.S. Army Corp of Engineers (USACE) delineated wetlands and vernal pool locations: Watermark Environmental, Inc., Final Site Investigation Summary Report, January 2013.



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US Army Corps of Engineers.

Former Dow Air Force Base

Bangor, Maine

Formerly Used Defense Site (FUDS)
Property and Project No. D01ME0004 02

POTENTIAL SOURCE AREA SOIL BORINGS

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 9

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Notes:
Basemap: Spring 2019 leaf-off conditions Maine Statewide Orthoimagery Project <https://gis.maine.gov/arcgis/> (Accessed May 2021).
2008 Watermark Site Investigation Boundary: Watermark Environmental, Inc., Final Site Investigation Summary Report, January 2013.
Utility Line and Catch Basin locations: Hager-Richter Geoscience, Inc. Surface Geophysical Surveys Report, April 2021.
Storm Drain Line location James W. Sewall Consulting Engineers, Bangor International Airport Peripheral Land Study Infrastructure Plan, Storm Drainage, May 1989. Utility locations and scale are considered approximate.

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Approximate Boundary of 2008 Watermark Site Investigation

Catch Basin

Storm Drain Line

Utility Line

Native Soil (south)/Historical Fill (north) Delineation

Recreational Trail

Culvert

Intermittent Stream With Flow Direction

BIA

DU01

DU02

DU03

DU04

DU05

DU06

DU07-01

DU07-02

DU07-03

DU07-04

DU07-05

DU07-06

DU07-07

DU08-01

DU08-02

DU08-03

DU08-04

DU08-05

DU08-06

DU08-07

DU09-01

DU09-02

DU09-03

DU09-04

DU09-05

DU09-06

DU09-07

Legend

- FUDS Project Area
- Property Boundary
- USACE Delineated Wetlands
- USFWS National Wetlands Inventory
- Proposed Soil Boring Location

Soil Sampling Decision Units (DUs)

- Potential Source Area Decision Unit
  - DU01- North South Anomaly
  - DU02 - Suspected TCE Disposal Pit
  - DU03 - Man-Made Depression
  - DU04 - Southern Slope
  - DU05 - Hildreth Street Debris Field
  - DU06 - POL Source Area
- Downgradient Upland Soil Decision Unit (DU07)
- Wetland Soil Decision Unit (DU08)
- Native Soil Background Decision Unit (DU09)

0 300 600

Feet

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S

US Army Corps of Engineers.

Former Dow Air Force Base

Bangor, Maine

Formerly Used Defense Site (FUDS)
Property and Project No. D01ME0004 02

PROPOSED SOIL SAMPLING LOCATIONS

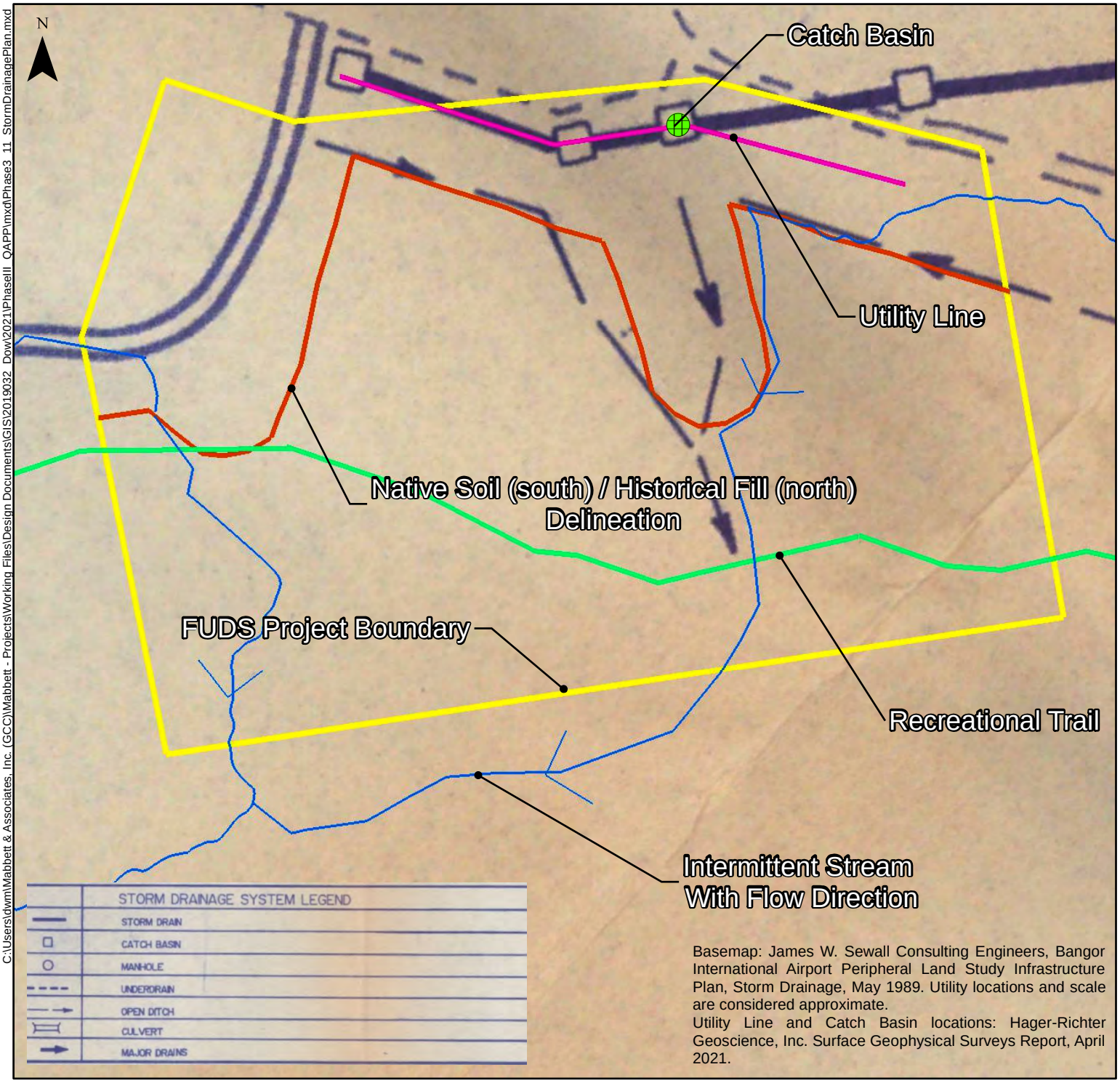
Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 10

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

Notes:
Basemap: Spring 2019 leaf-off conditions Maine Statewide Orthoimagery Project <https://gis.maine.gov/arcgis/> (Accessed May 2021).
Propery boundaries: City of Bangor <https://bangormaine.gov/gis/>, Maine Office of GIS <https://maine.gov/megis/maps/> (Accessed May 2021).
Utility Line and Catch Basin locations: Hager-Richter Geoscience, Inc. Surface Geophysical Surveys Report, April 2021.
2008 Watermark Site Investigation Boundary and U.S. Army Corp of Engineers (USACE) delineated wetlands locations: Watermark Environmental, Inc., Final Site Investigation Summary Report, January 2013.
Maine wetland data: U.S. Fish and Wildlife Services (USFWS) <https://www.fws.gov/> (Accessed May 2021).
Storm Drain Line location: James W. Sewall Consulting Engineers, Bangor International Airport Peripheral Land Study Infrastructure Plan, Storm Drainage, May 1989. Utility locations and scale are considered approximate.



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US Army Corps of Engineers.

Former Dow Air Force Base
Bangor, Maine
Formerly Used Defense Site (FUDS)
Property and Project Number D01ME0004 02

STORM DRAINAGE PLAN

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 11

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plane Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023

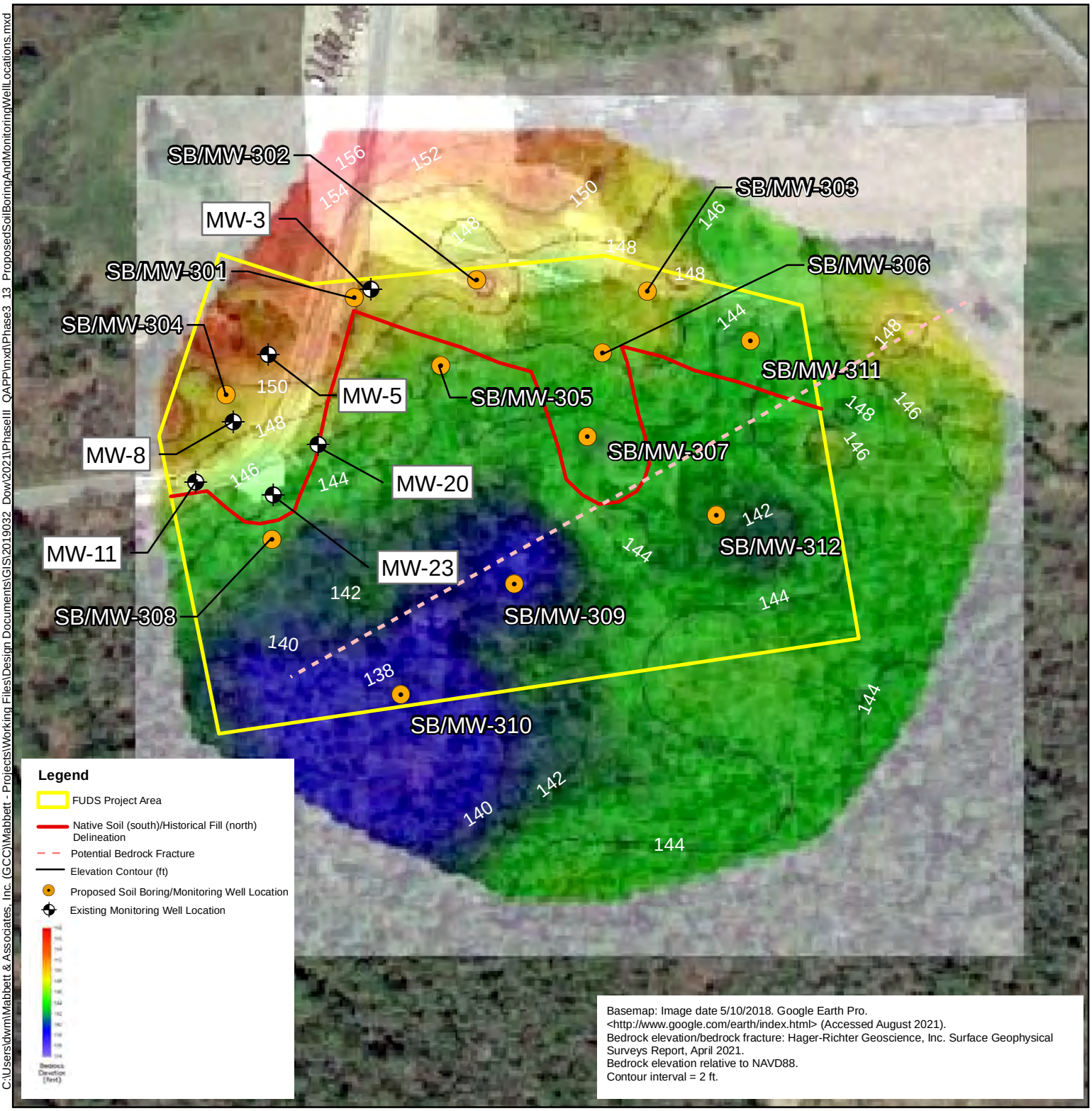
Source Area	Primary Sources	Source Media	Exposure Media	Potential Exposure Route	Potential Human Health Receptors/Exposure Pathways: Current/Future On-Site Recreational User (Adult/Child)	Future On-Site Construction/ Excavation Worker	Future On-Site Outdoor Commercial/ Industrial Worker	Future Off-Site Commercial/ Industrial Worker	Current/ Future Off-Site Resident (Adult/Child)	Potential Ecological Receptors/Exposure Pathways: Terrestrial Plants	Soil Invertebrates	Aquatic Invertebrates	Benthic Invertebrates	Birds and Mammals
Former Dow Military Airfield Formerly Used Defense Site	Historic Fill Area and Potential Source Areas (See Section 10-2 of the QAPP)	Upland Soil	Surface Soil (0 to 1 ft bgs)	Incidental Ingestion	I	I	I	o	o	o	I	o	o	I [c]
				Dermal/Direct Contact	I	I	I	o	o	I	I	o	o	o
			Outdoor Air	Inhalation	I	I	I	o	o	o	o	o	o	o
			Subsurface Soil (>1 to 10 ft bgs) (a)	Incidental Ingestion	o	I	I	o	o	o	o	o	o	o
				Dermal/Direct Contact	o	I	I	o	o	o	o	o	o	o
			Outdoor Air	Inhalation	o	I	I	o	o	o	o	o	o	o
		Wetland Soil	Surface Soil (a)	Incidental Ingestion	I	o	o	o	o	o	I	o	o	I [c]
				Dermal/Direct Contact	I	o	o	o	o	I	I	o	o	o
			Outdoor Air	Inhalation	I	o	o	o	o	o	o	o	o	o
		Stream Sediment	Sediment	Incidental Ingestion	I	I	o	o	o	o	o	o	I	I [c]
				Dermal/Direct Contact	I	I	o	o	o	o	o	o	I	o
		Stream Surface Water	Surface Water	Incidental Ingestion	o	o	o	o	o	o	o	I	o	I [c]
				Dermal/Direct Contact	I	I	o	o	o	o	o	I	o	o
		Stream Porewater	Porewater	Incidental Ingestion	o	o	o	o	o	o	o	o	I	o
				Dermal/Direct Contact	o	o	o	o	o	o	o	o	I	o
		Groundwater	Shallow Groundwater (0 to 15 ft bgs)	Incidental Ingestion	o	I	o	o	o	o	o	o	o	o
				Dermal/Direct Contact	o	I	o	o	o	o	o	o	o	o
			Trench Air	Inhalation	o	I	o	o	o	o	o	o	o	o
			Indoor Air	Inhalation	o	o	o	I [b]	I [b]	o	o	o	o	o
			Drinking Water	Ingestion	o	o	o	I	I	o	o	o	o	o
				Dermal/Direct Contact	o	o	o	o	I	o	o	o	o	o
			Shower Air	Inhalation	o	o	o	o	I	o	o	o	o	o

Notes:
- Blank cell indicates pathway is not applicable
- I — Potentially complete pathway
- o — Pathway considered to be incomplete or insignificant
- → — Potential release mechanism
- ft bgs — Feet below ground surface
- QAPP — Quality Assurance Project Plan

(a) Evaluation of potential exposure to subsurface soil is performed to evaluate a future scenario in which subsurface soil is brought to the surface and becomes available for contact.
(b) A screening level evaluation of potential exposure to indoor air via volatilization from groundwater (i.e., vapor intrusion) will be performed.
(c) Bioaccumulation pathway also expected to be potentially complete.

FIGURE 12
RISK CONCEPTUAL SITE MODEL

FORMER DOW AIR FORCE BASE
BANGOR, MAINE



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US Army Corps of Engineers.

Former Dow Air Force Base

Formerly Used Defense Site (FUDS)
Property and Project Number D01ME0004 02

PROPOSED SOIL BORING AND MONITORING WELL LOCATION MAP

Phase III Remedial Investigation

U.S. Army Corps of Engineers, New England District

Figure 13

Drawn: DWM	Approved: SAV
Projection: NAD83 2011 State Plain Maine East FIPS 1801 (US Feet)	
Contract No. W912WJ-19-D-0005	Date: 4/7/2023