WRIGHT-PIERCE
Engineering a Better Environment

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December 9, 2024

Thomas Farrell, Director of Parks and Recreation Department
Town of Brunswick
220 Neptune Drive
Brunswick, ME 04011

SUBJECT: Hydrogeologic Investigation at the Former Maine Gravel Services Pond Site

Dear Mr. Farrell,

The Parks and Recreation Department of the Town of Brunswick, ME (Town) is looking to develop a public recreational facility between Old Bath Road and State Route 1 (the Site) and is shown on Figure 1, Attachment A. The Town acquired the Site in 2019 when Maine Gravel Services Inc. donated 163.4 acres with the vision of using the land for recreational purposes that include swimming, fishing, and/or non-motorized boating. Wright-Pierce is currently developing concept plans and management plan for the Site.

During recent committee meetings, the Town received comments from abutters who are concerned with recreational use of this area and the potential impacts to water quality and quantity for nearby private bedrock wells. The primary concern was received by the property owner of 310 Old Bath Road, whose parcel is shown in Figure 2, Attachment A. This document provides results of the hydrogeologic investigation regarding potential impacts to surrounding domestic wells and community wells. This document also provides a list of recommended activities that pose minimal risk to groundwater quality and quantity, and a list of activities that the Town should consider prohibiting at the Site due to elevated risks for groundwater contamination.

1 Site Description

1.1 Site Location

The Former Maine Gravel Services Pit Site (the Site) was donated to the Town of Brunswick under the condition that it will be used as a public recreational area. The Site consists of an abandoned gravel pit that has filled with water, creating a large pond that is approximately 53.5 acres (Photo 1). The water in the pond was notably clear during a site visit completed on October 25, 2024. The Maine Department of Inland Fisheries and Wildlife (ME IFW) reports the pond as having a maximum depth of 20.3 feet. The area surrounding the west side of the pond is dominated by open areas with shrubbery and grasses (Photo 2), and a large sand

Photo 1 – Sandy bottom of pond. Water clarity of the pond was notably clear during site visit.

pile with a wide access road (Photo 3). The area surrounding the northeast and east side of the pond is mostly undeveloped forest and forested wetlands with an outlet channel located on the east side of the pond that flows toward the north. There are a few houses located near the north side of the pond located no closer than 300 feet to the waterline.

Photo 2 – An area dominated by shrubbery growth on the western side of pond.

Photo 3 – Large sand pile on western side of pond.

1.2 Site Geology

Surficial geology at the Site is shown in Figure 3, Attachment A. Soils at the Site are mapped as fine-grained glaciomarine material with coarse-grained glaciomarine materials mapped to the south of the Site. According to the Maine Geological Survey's Surficial Geology of the Brunswick Quadrangle, Maine 1:24,000 (Open File 01-484), the Site is characterized as braided stream alluvium with regions of regressive marine delta to the west and southwest. Maine aquifer data is also shown in Figure 3 and classifies the Site area as a 10-50 gallons per minute (gpm) sand and gravel aquifer.

1.2.1 NRCS Soils

According to soil data obtained from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), the Site mostly consists of Windsor loamy fine sand with some smaller areas of Au Gres loamy sand which have a moderately high to high transmissivity. The soil surrounding the pond is categorized as gravel pits. A map of NRCS soils is shown in Figure 4 in Attachment A and a full description of each soil type is included in Attachment B.

1.2.2 Bedrock Geology

Soil thickness data points were obtained from the Maine Well Database and is shown on Figure 5, Attachment A. These data are derived from known public and private supply wells. The data indicates a bedrock trough between the pond and the Androscoggin River which may encourage groundwater flow to the north across

the Site (Figure 5). According to the Maine Geological Survey 1:24,000 Bedrock geology of the Brunswick quadrangle, Maine map (Open File 18-4, 2018), the Site is underlain by the Sebascodegan Formation (SOs) with the Bethel Point Formation (SObp) and an amphibolite subgroup of the Sebascodegan Formation (SOsa) mapped just south and west of the Site, respectively (Figure 5). The Boothbay Thrust Fault is located directly west of the amphibolite subgroup and is located between the Site and the 310 Old Bath Road property. Domestic bedrock wells in the area likely target fracture networks focused near major tectonic features, such as the Boothbay Thrust Fault. Data from this bedrock map is shown in Figure 5 and full descriptions of the bedrock formations can be found on Maine Geological Survey Open File 18-4.

1.3 Conceptual Model for Groundwater Flow

1.3.1 Groundwater Aquifers

This investigation discusses two distinct types of aquifers surrounding the Site: (1) sand and gravel aquifers and (2) bedrock aquifers. The Maine Geological Survey defines sand and gravel aquifers as unconsolidated sand and gravel deposits, which have excellent porosity (spaces between grains where groundwater is stored) and permeability (connection of spaces that allows groundwater to flow). Sand and gravel aquifers also provide natural filtration as groundwater flows through pore space.

Bedrock aquifers consist of groundwater that is stored within fractured bedrock underlying overburden soils. Overlying sand and gravel aquifers provide filtration and typically show minimal hydraulic connection with the underlying bedrock aquifer, except under significant head changes such as pumping a high yield well. Even in these cases, the influence of drawdown in the bedrock wells is typically a fraction of the head change in the overlying sand and gravel aquifer as the two aquifer types are typically isolated and bedrock fractured aquifers are supplied by recharge in upland areas. An example of this is a flowing artesian well where water levels in the well are above ground surface.

1.3.2 Drainage Basin

The U.S. Geological Survey's StreamStats application is a powerful tool that delineates drainage basins from a selected stream point. This application was used to generate a drainage basin for the outlet stream of the pond. This delineated basin and selected drainage point are shown in Figure 6, Attachment A and indicates the presence of a drainage divide between the Site and the 310 Old Bath Road property. In addition, most domestic wells surrounding the Site, including 310 Old Bath Road, are located outside of the delineated contribution area. The drainage basin of this Site is approximately 0.7 square miles. Precipitation that falls at the Site generally flows north through the outlet channel and into a small stream that eventually flows into the Androscoggin River to the north of the Site. No precipitation runoff will flow from the Site towards 310 Old Bath Road according to this model.

This data suggests that the contributing area to the pond is limited. While it is possible that groundwater flow can pass through topographic boundaries in a continuous aquifer, this data indicates that the primary area of recharge to the pond is limited by the topographic boundaries of the basin. This is based on the consistent hydrogeologic water budget established for the northeast (USGS WRI, Cirvone 1972). Approximately half of

water recharging a basin in a sand and gravel aquifer is from direct infiltration, with the remainder being runoff based on topography. This indicates that the boundary basin plays a significant role in groundwater flow under average conditions.

1.3.3 Regional Groundwater Flux

The aquifer is bound by the Androscoggin River to the west and mapped till overlying a bedrock ridge to the east (Figure 3). These features act as "Boundary Conditions" which control water movement within the aquifer. Generally, groundwater would flow to the northwest away from the bedrock ridge and sub-parallel to the river (Figure 7, Attachment A). However, the Androscoggin River water levels are in constant flux and a reversal of the groundwater flow direction would occur at above normal conditions (Figure 8, Attachment A). In the region of the pond, this would occur parallel to the bedrock trough. This data suggests that the limited aquifer is subject to change due to fluctuations in the Androscoggin River.

1.3.4 Pond Characteristics

The Maine Department of Inland Fisheries and Wildlife (ME IFW) completed an investigation at the pond in 2021 to assess the pond's suitability to support trout species. That investigation concluded that the pond was "homothermous," meaning temperatures were generally the same at different depths and was oxygen deficient below 10 feet. This suggests that current pond conditions are not well suited to support trout species in the long term. There have been some claims by a local neighbor that the pond is spring-fed, however, no springs or inlet streams were observed around the pond during the site walk. Generally, the pond is indicative of the natural groundwater level for the aquifer. A spring fed pond would have a significant thermal gradient due to the influx of groundwater.

1.4 Conceptual Model of Pond-Aquifer Interactions using Kettle Hole Pond Example

There are several similarities between kettle hole ponds and the excavated pond at the Site of this investigation. As such, a study published by the USGS involving kettle hole ponds in western Cape Cod was reviewed to guide a conceptual model of the interaction between the groundwater in the sand and gravel aquifer and the surface water in the pond (Water-Resources Investigations Report 99-4174). Kettle holes are depressions in glacial outwash sediments that formed from the burial and melting of a detached mass of glacial ice. These "holes" tend to fill with water once the ice melts forming kettle hole ponds. Many kettle hole ponds do not have inlet or outlet streams and rely on the inflow of groundwater to the pond and precipitation that falls within the pond's drainage basin for recharge. Outflow from the pond consists of recharge into the aquifer and evaporation. As long as precipitation exceeds evaporation rates, these ponds provide net recharge to the aquifer.

The gravel pit pond at the Site of this investigation has many similarities to kettle hole ponds, including minimal inlet and outlet streams and the presence of surrounding sandy soils with high transmissivity. Based on observations made during the site walk on October 25, 2024, it appeared that minimal outflow was occurring in the man-made outlet channel to the east. As such, it is assumed that the general interaction

between groundwater and the pond at the Site is similar to what is seen in kettle hole ponds as described above.

Given these conditions, the pond-aquifer interaction at the Site is characterized by a flow-through condition in which groundwater discharges into the pond in upgradient areas and surface water in the pond recharges the sand and gravel aquifer in downgradient areas, as illustrated in the diagram in Photo 4.

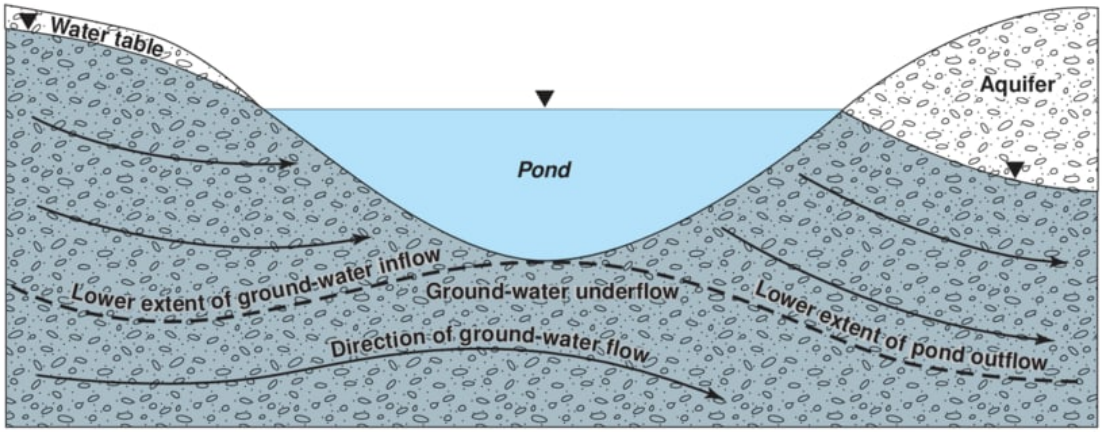


Photo 4 – Interactions between groundwater flow through a pond and the surrounding aquifer in an unconfined hydrogeologic environment. Source: WRI Report 99-4174.

2 Water Resources

Three bedrock community wells that source Bay Bridges Estate, LLC are identified just over 1,500 feet north of the Site boundary. The location of the community wells and associated wellhead radii are shown on Figure 3, Attachment A. The standard 1,000-foot radii does not overlap with the Site; however, the population-based wellhead protection radius of 2,300 feet does overlap onto the northern portion of the Site. Table 2-1 shows reported data for these three community wells:

Table 2-1 Summary of Nearby Community Wells

System	Well	Facility ID	Construction Date	Well Type	Well Depth	Well Yield
Bay Bridge Estates, LLC (System ID: ME0002175)	Well 1	2175103	1991	Bedrock	469 feet	120 gpm
	Well 2	2175104	2003	Bedrock	605 feet	60 gpm
	Well 3	2175102	2000	Bedrock	215 feet	60 gpm

Several domestic wells withdraw groundwater from the sand and gravel or bedrock aquifer, including the well at 310 Old Bath Road (Figure 3). The closest downgradient well is over 750 feet downgradient (north) of the Site and is reported to be in a portion of the aquifer that is over 100 feet deep. Given that natural groundwater flow is typically on the order of feet per day and the increasing thickness of the aquifer to the

north, there should be ample filtration and residence time for natural attenuation of surface derived bacteria to reach the wells. The rule for septic system setbacks from private wells in Maine is 100 feet indicating that any 'contamination' associated with non-motorized use of the pond would be naturally attenuated.

3 Potential Impacts to Groundwater

The following is a summary of the findings for potential impacts to groundwater levels at the Site.

- Surface water or groundwater withdrawals from the Site are not proposed per the proposed project description. Groundwater levels are unlikely to be impacted from proposed activities at the Site.

- Beaver dam activity was observed on the outflow stream during the site walk on October 25, 2024. The beaver dam is shown in Photo 5 and was observed to partially block the man-made outflow channel. This is a non-permanent structure and cannot be relied upon as a long-term means to stabilize water levels within the pond. It should be noted that beavers are known to cause giardia blooms, also known as "Beaver Fever". This can cause severe illness if water is ingested due to a parasitic infection. It would be advisable for the beaver to be removed. The beaver dam did not appear to result in any change in water level as water flows preferentially through the aquifer as noted in Section 1.6. It was also noted during the site walk that the water within the man-made drainage channel was stagnant, murky, and dark in color with organics in comparison with the clear water observed in the pond (Photo 6). This observation suggests that there is minimal flow occurring through the drainage channel under normal conditions.

Photo 5 – Beaver dam in man-made drainage channel partially blocks outlet and helps to stabilize water levels.

Photo 6 – Man-made drainage outlet channel (foreground) is stagnant and murky, unlike in the pond (background).

Natural fluctuations in the Androscoggin River are more likely to impact water levels in the 310 Old Bath Road well since it is located roughly 1,350 feet from the river's edge and upgradient of the Site. The Androscoggin River is tidally influenced in this area and upstream flow is controlled by several dams. Tide charts indicate a difference of about 6 feet between low tide and high tide. Additionally, the USGS stream gaging station in Auburn, Maine (No. 01059000) indicates fluctuations of 15 or more feet over the past year. Fluctuations in flow in the Androscoggin River likely play the largest role in water levels in the sand and gravel aquifer and surface water bodies.

- An ongoing hydrogeologic study at the Jordan Avenue Wellfield for the Brunswick and Topsham Water District indicates the surrounding groundwater next to the river fluctuates with each tidal cycle, as well as with any low flow event or high flow flooding event. The Jordan Avenue Well Site is located approximately 1.1 miles upstream from the area of the Site discussed in this investigation and is similar in geologic conditions.

- Tree and vegetation removal should be minimized wherever possible. Established vegetation stabilizes the ground surface and inhibits erosion and siltation. Maintaining as much existing vegetation cover as possible at the Site will help protect long term water quality of the pond.

- A public swimming area in the pond poses minimal risk to water quality of the overall aquifer since the surrounding sand and gravel material naturally filters the surface water as it recharges into the aquifer. Impacts to the pond's water quality are anticipated to be minimal. Microbiological contamination of surface water may occur through direct fecal input from man or animal, sewage overflow, surface runoff, or overgrowth of naturally occurring microorganisms (WHO, 2003). Other concerns to water quality may include litter associated with public facilities and undisposed pet waste. The Town should enforce "leave no trace" policies to minimize these impacts.

4 Conclusions and Response to Letter

The Town of Brunswick is proposing to repurpose the former Maine Gravel Services Site into land used for recreational purposes that include recreational playing fields, swimming, fishing, and/or non-motorized boating. Abutting property owners have raised concerns regarding the potential for Site activities to negatively impact water quality and quantity in nearby bedrock wells. In particular, a letter received from the property owner of 310 Old Bath Road, dated November 8, 2024 (the Letter), outlines specific concerns and the need for a hydrologic study to evaluate potential impacts as a result of the proposed project. This report provides the results of the hydrogeologic investigation conducted by Wright-Pierce. The following is a summary of significant findings and responses to concerns raised in the Letter.

- There are two distinct types of aquifers that surround the Site: (1) sand and gravel aquifers and (2) bedrock aquifers. The sand and gravel aquifer consists of glaciomarine sediments that are recharged by direct infiltration of precipitation and indirect runoff. The bedrock aquifer at the Site consists of groundwater stored within fractured bedrock underlying overburden soils. These two aquifer types

are typically isolated systems with minimal hydraulic connectivity, except under extreme pumping conditions. Because domestic bedrock wells in the area withdraw groundwater from the bedrock aquifer and not the sand and gravel aquifer, surficial activities at the Site are unlikely to have any impact to water quality or quantity of nearby bedrock wells.

- Drainage basin modeling of the Site indicates the basin is approximately 0.7 square miles in area with a contribution area that is limited by topographic basin boundaries (Figure 6). Most domestic bedrock wells surrounding the Site, including 310 Old Bath Road, are located outside of the delineated drainage area.

- According to the Letter, the Site is described as an open groundwater aquifer that is contained and small, with most of the aquifer's volume in the top 20-24 inches, when fully charged. It is unclear where these statistics were sourced from, but they do not accurately reflect the properties of the sand and gravel aquifer in this region. Figure 3 shows that the sand and gravel aquifer in this region is both horizontally and vertically extensive with transmissivity values that range from 10 to 50 gpm. Soil thickness data points from around the Site indicate thickness depths that reach up to approximately 95 feet to the west, 67 feet to the south, and 158 feet to the north (Figure 3). And the aquifer is characterized by a bedrock trough connected to the Androscoggin River. Although a well is potentially needed to serve the proposed restroom facility at the swimming area, the use will be limited to seasonal, and adverse effects to the aquifer are not anticipated.

- Historical aerial photographs of the Site ranging from 1940 to 2012 were obtained from the United States Geological Survey Earth Explorer database and are included in Attachment C. The 1940 aerial photograph shows that the Site consisted of undeveloped forest and grasslands, and that a private pond was not present on the 310 Old Bath Road property. Excavation at the Site appears to have initiated circa 1960; however, the exact date is unknown based on available information. The private pond at 310 Old Bath Road is not present on the 1960 aerial photograph. The 1972 photograph shows that excavations at the Site are filled with water and that a small, irregular-shaped pond is present at 310 Old Bath Road. The private pond on the 310 Old Bath Road property was expanded to its current shape and size by 1990. No major changes to the Site are noted in subsequent photos, other than the addition of a sand spit along the southeastern portion of the Site by 2009. The private pond on 310 Old Bath Road was reportedly deeded by the previous property owner and is now considered a wetland waterbody.

- The Letter describes multiple past activities at the Site that may have posed an impact to groundwater, including excavation at the Site, trenching of a ditch (Bonney Brook), the Site's use as a police firing range and potential lead contamination, and removal of a beaver dam. Unlike prior excavation and trenching activities, the physical altering of the pond's footprint is not proposed as part of this project. The Town of Brunswick Police Department (BPD) issued a letter summarizing firing range activity at the Site. The letter is included in Attachment D. Based on information provided in the

letter and correspondence with the BPD, a bermed area on the southeastern portion of the Site was used a police firing range between November 2021 and October 2024. The location of the firing range is shown on Figure 2. According to the BPD, the firing range was used approximately twice a year by 35 officers to satisfy the Maine Criminal Justice Academy (MCJA) qualifications. The MCJA requires each sworn officer to fire a minimum of 100 pistol rounds and 72 rifle rounds annually. Firing rounds consisted of full metal jacket and total metal jacket training rounds that are designed to encapsulate the lead core and limit lead contamination. All training rounds were reportedly fired at the constructed berm to reduce noise levels and contain detritus. Given the use of environmentally friendly rounds, the bermed area constructed for the firing range, and its limited use to approximately six times over the course of four years, there is little to no concern for lead contamination impacts to the aquifer. Should the Town wish to investigate the potential for lead contamination, water quality testing of the pond surface water at three locations are recommended to confirm water quality. Two of these samples should be located in water bodies adjacent to the shooting range and a third located at the proposed recreational swimming area. Water quality samples should be collected and field filtered using a 0.45 micron filter and analyzed for dissolved lead. If water quality results indicate lead concentrations above state regulatory thresholds, then a more comprehensive investigation (Phase II Environmental Site Assessment) should be implemented to determine the extent of contamination and applicable remediation methods. The town may consider removing and properly disposing of the soils at the shooting range. Ammunition typically will not penetrate more than 2 feet into sand, indicating that a limited volume of soil would be needed to be removed if this course of action is taken.

- Based on the findings of this study, the observed beaver dam has little to no effect on stabilizing pond water levels. Water in the pond will preferentially flow through the sand and gravel aquifer and bypass the beaver dam. Water levels observed during a site walk were noted to be similar both upstream and downstream of the beaver dam. Unfortunately, beavers are known to cause giardia blooms, also known as 'Beaver Fever" that can cause severe illness if water is ingested due to a parasitic infection. As such, it would be advisable to remove beaver activity prior to permitting recreational swimming in the pond.

- The primary concerns raised in the Letter are regarding the maintenance of groundwater retention and groundwater quality at the Site. This study shows that the gravel pit pond at the Site has similar physical and hydraulic properties as glacial-derived kettle hole ponds. This includes minimal inlet and outlet streams and the presence of surrounding sand and gravel aquifers with high transmissivity. The pond-aquifer interaction at the Site is characterized by a flow-through condition in which groundwater flows into the pond in upgradient areas and surface water in the pond recharges the sand and gravel aquifer in downgradient areas (Photo 4). Fluctuations in flow in the nearby Androscoggin River likely play the largest role in water levels in the sand and gravel aquifer and surface water bodies. The repurposing of the Site for recreational use is not expected to have an adverse impact on any of these factors controlling groundwater levels.

- The potential for large-scale tree and vegetation removal or the application of fertilizer or pesticides pose the highest risks to water quality at the Site. Maintaining as much existing vegetation cover as possible at the Site will help protect long term water quality and clarity of the pond. It is also recommended that limited fertilizer or pesticide products be applied to any proposed recreational fields. Artificial turf is not proposed at this Site. A public swimming area is considered low-risk to groundwater quality since the surrounding sand and gravel material naturally filters the surface water as it recharges back into the aquifer. The presence of Beavers pose a greater risk to water quality and human health.

5 Recommendations

The following is a summary list of recommendations that the town shall consider in the future phases of planning for this Site to minimize risk to the surrounding aquifer:

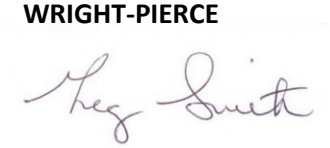
- Activities that pose minimal risk to the aquifer:
  - Hiking and biking trails
  - Non-motorized boating and vehicles
  - Recreational fishing; the Town will likely want to request recommendations from IFW on sustainable practices and schedules for fishing activities based on species.
  - Public swimming area
  - Restrooms with a properly designed septic system. If used, these facilities would ideally be located as far from the pond as is reasonable to allow for natural attenuation of grey water by naturally occurring microbes in overlying soils and within the aquifer. Given the short seasonal use of the pond for swimming, it is anticipated that the loading from a septic system would be de minimis in the aquifer.

- Other items for the town to consider:
  - Prohibit any motorized boats to minimize pollution risk from fuel.
  - Remove beavers to improve water quality and limit potential health issues due to giardia.
  - Enforce “leave no trace” principles to manage potential litter and pet waste.
  - Consider using best management practices to limit erosion and siltation migration.
  - Minimize tree and vegetation removal where possible to stabilize soils and protect water quality. However management of vegetation is recommended by minimizing the possibility for organics such as leaves to enter the water, resulting in anoxic conditions and degrading water quality, as observed in the outlet beyond the beaver dam.
  - If any recreational fields are to be constructed, application of fertilizers, pesticides, or herbicides shall not be permitted.

We appreciate the opportunity to provide this hydrogeologic investigation regarding water quality and quantity impacts from the proposed recreational activities at the Former Maine Gravel Services Site in

Brunswick. Please do not hesitate to reach out to me at 603-748-6390 with any further questions regarding this desktop investigation.

Sincerely,
WRIGHT-PIERCE



Greg J. Smith, PG, CG
Senior Hydrogeologist
greg.smith@wright-pierce.com

Attachments

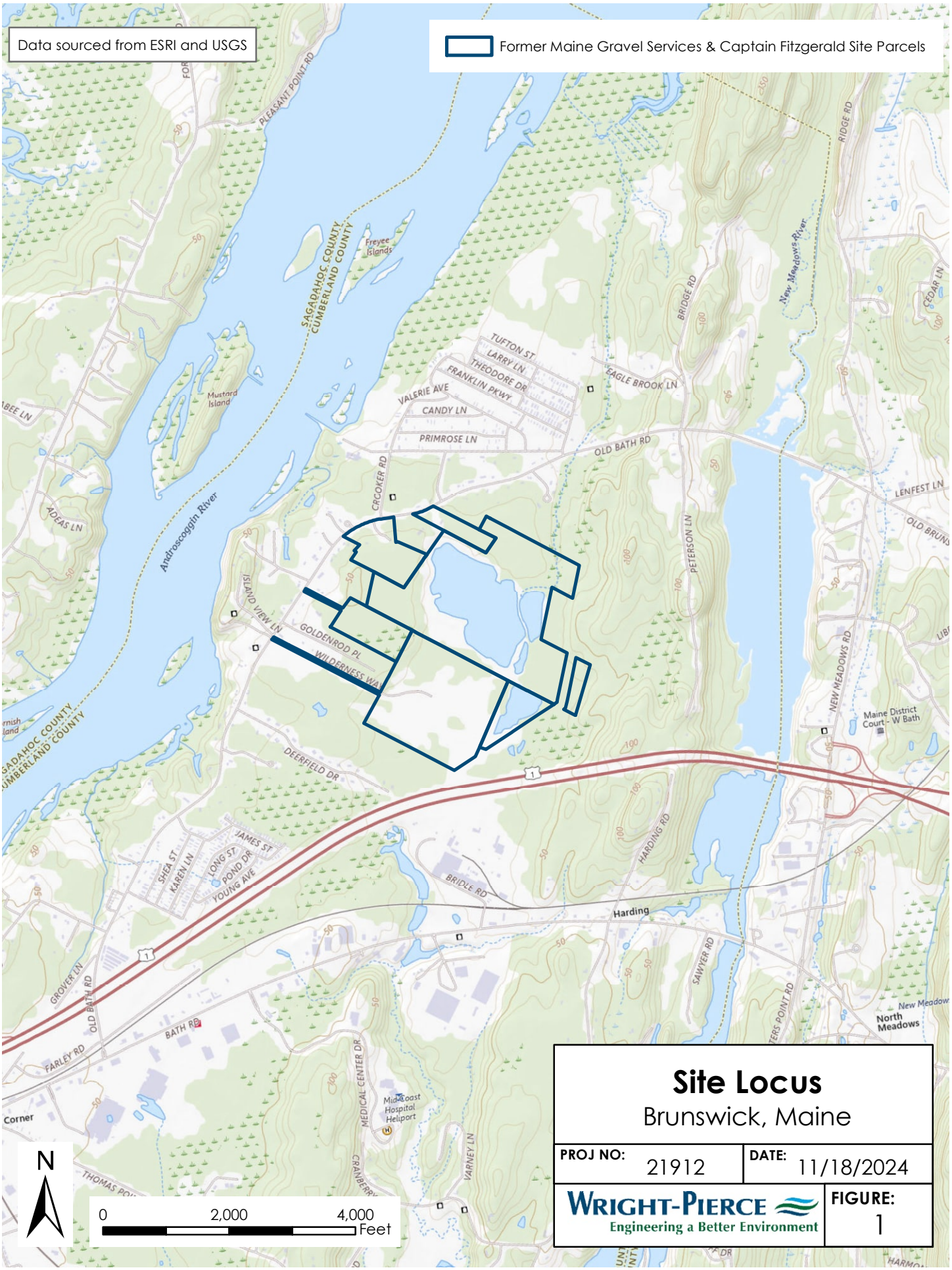
- Attachment A – Figures
  - Figure 1 – Site Locus
  - Figure 2 – Site Plan
  - Figure 3 – Surficial Geology
  - Figure 4 – Soil Map
  - Figure 5 – Bedrock Geology
  - Figure 6 – Drainage Basin
  - Figure 7 – Groundwater Flow Direction
  - Figure 8 – Reversal Groundwater Flow Direction
- Attachment B – Soil Descriptions
- Attachment C – Historical Aerial Photographs
- Attachment D – Brunswick Police Department Letter

Resources:

WALTER, DONALD & Masterson, John & LeBlanc, Denis. 2002. Simulated Pond-Aquifer Interactions under Natural and Stressed Conditions near Snake Pond, Cape Cod, Massachusetts. Water-Resources Investigations Report 99-4174.

World Health Organization (WHO), 2003. Guidelines for safe recreational water environments - Volume 1: Coastal and fresh waters.

Attachment A
Figures



Site Locus

Brunswick, Maine

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21912	11/18/2024

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FIGURE: 1

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\1. Site Locus (adjusted scale).mxd

Data sourced from ME Geological Survey

- Maine Elevation Contours -10 Feet
- Maine DOT Public Roads
- Site Parcels
- 310 Old Bath Road Parcel
- Delineated Wetland
- Delineated Waterbody

Maine Well Database - Well Yield

- 0 -1
- 1.1 - 2
- 2.1 - 4
- 4.1 - 6
- 8.1 - 10
- 10.1 - 15
- 15.1 - 20
- 25.1 - 50
- 100+

RD INV 05 10254

RD INV 05 10336

RD INV 05 10256

RD INV 3210195

US 1 SB

US 1

Former Brunswick Police Firing Range (Nov. 2021 - Oct. 2024)

N

0 500 1,000 Feet

Site Plan

Brunswick, Maine

PROJ NO:	DATE:
21912	11/21/2024

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FIGURE: 2

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\2_Site Plan (with contours).mxd

Data sourced from ME Geological Survey

RD INV 23 00382

RD INV 23 00365

RD INV 05 10253

RD INV 05 10254

RD INV 05 10336

RD INV 05 10255

RD INV 05 10252

RD INV 05 10256

US 1 SB

US 1

RD INV 32 10196

RD INV 32 10195

RD INV 05 10261

RD INV 05 10260

RD INV 23 00536

RD INV 23 00422

RD INV 23 00763

RD INV 23 A1061

Maine Well Database (Overburden Thickness (ft))

- No Overburden Thickness Provided
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 40
- 40 - 50
- 50 - 75
- 75 - 100
- 100 - 200

MaineDOT Public Roads

Site Parcels

310 Old Bath Road Parcel

1,000-foot Community Well Buffer

Population-Based Community Wellhead Buffer (2,300 ft)

Aquifer Transmissivity

<all other values>

10-50 GPM

Surficial Geology Type

Glaciomoraine deposits (coarse-grained facies)

Glaciomoraine deposits (fine-grained facies)

Swamp, marsh, and bog deposits

Till

N

0 1,000 2,000 Feet

Surficial Geology

Brunswick, Maine

PROJ NO:	DATE:
21912	11/18/2024

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FIGURE: 3

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\3. Surficial Geology (adjusted layers).mxd

Data sourced from ME Geological Survey

RD INV 05 10254

RD INV 05 10255

RD INV 05 10336

RD INV 05 10256

US 1 SB

Site Parcels

310 Old Bath Road Parcel

Maine DOT Public Roads

Soil Type

- Au Gres loamy sand
- Nicholville very fine sandy loam
- Lamoine silt loam
- Buxton silt loam
- Gravel pits
- Lyman-Tunbridge complex
- Limerick-Saco silt loam
- Scantic silt loam
- Swanton fine sandy loam
- Whately fine sandy loam
- Windsor loamy sand
- Woodbridge fine sandy loam

Maine Well Database - Overburden Thickness

- No Overburden Thickness Provided
- 0 - 5
- 5 - 10
- 15 - 20
- 40 - 50
- 50 - 75
- 75 - 100
- 100 - 200

N

0 500 1,000 Feet

NRCS Soils

Brunswick, Maine

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21912	11/18/2024

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FIGURE: 4

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\4. Soil Map.mxd

Data sourced from ME Geological Survey

Oca: Cushing Formation; Amphibolite Member

SOsa: Sebascodegan Formation Amphibolite Member

SOs: Sebascodegan Formation

Oce: Cape Elizabeth Formation

DSbH: Butler Head Granite Gness

SOsa: Sebascodegan Formatio; Amphibolite Member

SOsr: Sebascodegan Formation (Rusty-weathering granofels and schist)

SObp: Bethel Point Formation

Dg: Granite and Pegmatite

RD INV 23 00365

RD INV 23 20006

RD INV 05 10253

RD INV 05 10254

RD INV 05 10255

RD INV 05 10336

RD INV 05 10256

RD INV 05 10252

RD INV 32 10196

RD INV 32 10195

RD INV 05 10261

RD INV 05 10260

RD INV 05 10143

RD INV 05 10247

RD INV 23 01062

RD INV 23 00422

RD INV 23 D1061

RD INV 23 C1061

RD INV 23 00763

RD INV 23 A1061

RD INV 23 B1061

RD INV 32 10197

US 1 SB

US 1

Maine Well Database - Overburden Thickness

- No Overburden Thickness Provided
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 40
- 40 - 50
- 50 - 75
- 75 - 100
- 100 - 200
- Bedrock_Trough
- Site Parcels
- 310 Old Bath Road Parcel
- Maine DOT Public Roads

N

0 1,000 2,000 3,000 Feet

Bedrock Geology

Brunswick, Maine

PROJ NO:	DATE:
21912	11/20/2024

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FIGURE: 5

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\5. Bedrock Geology.mxd

Data sourced from ME Geological Survey

RD INV 05 10253
RD INV 05 10254
RD INV 05 10255
RD INV 05 10336
RD INV 05 10252
RD INV 05 10256
US 1 SB
US 1
RD INV 3210196
RD INV 3210195
RD INV 23 00536
RD INV 23 D1061
RD INV 23 C1061
RD INV 23 00763
RD INV 23 A1061
RD INV 23 B1061
RD INV 05 10261
RD INV 05 10260

Maine Geologic Survey Wells
- No Overburden Thickness Provided
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 40 - 50
- 50 - 75
- 75 - 100
- 100 - 200
- Basin Drainage Point
- StreamStats Drainage Basin
- Site Parcels
- 310 Old Bath Road Parcel
- Maine DOT Public Roads
- Delineated Wetland

N

0 750 1,500 Feet

Drainage Basin
Brunswick, Maine

PROJ NO:	DATE:
21912	11/19/2024

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FIGURE: 6

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\6. Drainage Basin.mxd

Data sourced from ME Geological Survey

Groundwater Flow Direction
Site Parcels
MaineDOT Public Roads

RD INV 23 00367
RD INV 28 00382
RD INV 23 00365
RD INV 23 00384
RD INV 23 00419
RD INV 23 00420
RD INV 05 10253
RD INV 05 10336
RD INV 05 10254
RD INV 05 10255
RD INV 05 10252
RD INV 05 10256
RD INV 23 20006
RD INV 05 10260
RD INV 05 10143
RD INV 05 10257
RD INV 05 10258
RD INV 05 10247
RD INV 23 00422
RD INV 23 00428
US 1
US 1 SB
BRUNSWICK NAS
Golf Course
Gravel Pit
Water Tank
Cemetery
Substa
Muddy
Freyee Islands
Mustard Island
Cornish Island
Driscoll Island
Harding
New Meadows
SAGADAHOC CO
CUMBERLAND CO
BRUNSWICK
RIVER
MEADOWS
FORESIDE
BATH ROAD
WHISKEAG

N

0 1,500 3,000 Feet

Normal Groundwater Flow Direction

Brunswick, Maine

PROJ NO:	DATE:
21912	11/18/2024

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FIGURE: 7

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\7. Groundwater flow.mxd

Data sourced from ME Geological Survey

High Surface Water - Groundwater Flow Direction
Bedrock Trough
Site Parcels
MaineDOT Public Roads

RD INV 23 00367
RD INV 28 00382
RD INV 23 00365
RD INV 23 00384
RD INV 23 00419
RD INV 23 00420
RD INV 05 10253
RD INV 05 10254
RD INV 05 10255
RD INV 05 10336
RD INV 05 10252
RD INV 05 10256
RD INV 23 20006
RD INV 32 01195
RD INV 32 01196
RD INV 32 01197
RD INV 05 10260
RD INV 05 10143
RD INV 05 10257
RD INV 05 10258
RD INV 32 00569
RD INV 05 10247
RD INV 23 00422
RD INV 23 C1061
RD INV 23 00763
RD INV 23 A1061
RD INV 23 00536
RD INV 32 00546
RD INV 23 01062
RD INV 23 00428
RD INV 23 01145
RD INV 23 10208
RD INV 32 00433
RD INV 23 10209

Muddy
Freyee Islands
Fry
Mustard Island
SAGADAHOC CO
CUMBERLAND CO
4WD
ROAD
Hunter
Ant
Cornish Island
Tidal Falls
FORESIDE
RIVER
BRUNSWICK NAS
Substa
Harding
Text
Driscoll Island
BM 36
Cem
BRUNSWICK
CUMBERLAND CO
SAGADAHOC CO
RIVER
MEADOWS
NEW
Gravel Pit
BATH ROAD
WHISKEAG
Water Tank
New Meadows
US 1
US 1 SB

N

0 1,500 3,000 Feet

High Surface Water Groundwater Flow Direction

Brunswick, Maine

PROJ NO:	DATE:
21912	11/18/2024

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Engineering a Better Environment

FIGURE: 8

NGN W:\GIS_Development\Projects\ME\Brunswick\21912_FormerMEGravel\MXDs\hydrogeo\8. High_Water_GW.mxd

Attachment B
Soil Descriptions

Cumberland County and Part of Oxford County, Maine

Au—Au Gres loamy sand

Map Unit Setting

National map unit symbol: blgr
Elevation: 10 to 1,800 feet
Mean annual precipitation: 29 to 50 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Au gres and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Au Gres

Setting

Landform: Outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

H1 - 0 to 10 inches: loamy sand
H2 - 10 to 32 inches: loamy sand
H3 - 32 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Saugatuck

Percent of map unit: 6 percent
Landform: Outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Scantic

Percent of map unit: 2 percent
Landform: Coastal plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Androscoggin and Sagadahoc Counties, Maine
Survey Area Data: Version 25, Aug 26, 2024

Soil Survey Area: Cumberland County and Part of Oxford County, Maine
Survey Area Data: Version 21, Aug 26, 2024

Cumberland County and Part of Oxford County, Maine

Gp—Gravel pits

Map Unit Composition

Gravel pits: 92 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gravel Pits

Typical profile

H1 - 0 to 6 inches: extremely gravelly sand
H2 - 6 to 60 inches: extremely gravelly sand

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Ecological site: F144BY601ME - Dry Sand
Hydric soil rating: No

Data Source Information

Soil Survey Area: Androscoggin and Sagadahoc Counties, Maine
Survey Area Data: Version 25, Aug 26, 2024

Soil Survey Area: Cumberland County and Part of Oxford County, Maine
Survey Area Data: Version 21, Aug 26, 2024

Cumberland County and Part of Oxford County, Maine

WmB—Windsor loamy sand, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w2x2
Elevation: 0 to 1,410 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Outwash terraces, deltas, outwash plains, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A

Ecological site: F144BY601ME - Dry Sand
Hydric soil rating: No

Data Source Information

Soil Survey Area: Androscoggin and Sagadahoc Counties, Maine
Survey Area Data: Version 25, Aug 26, 2024

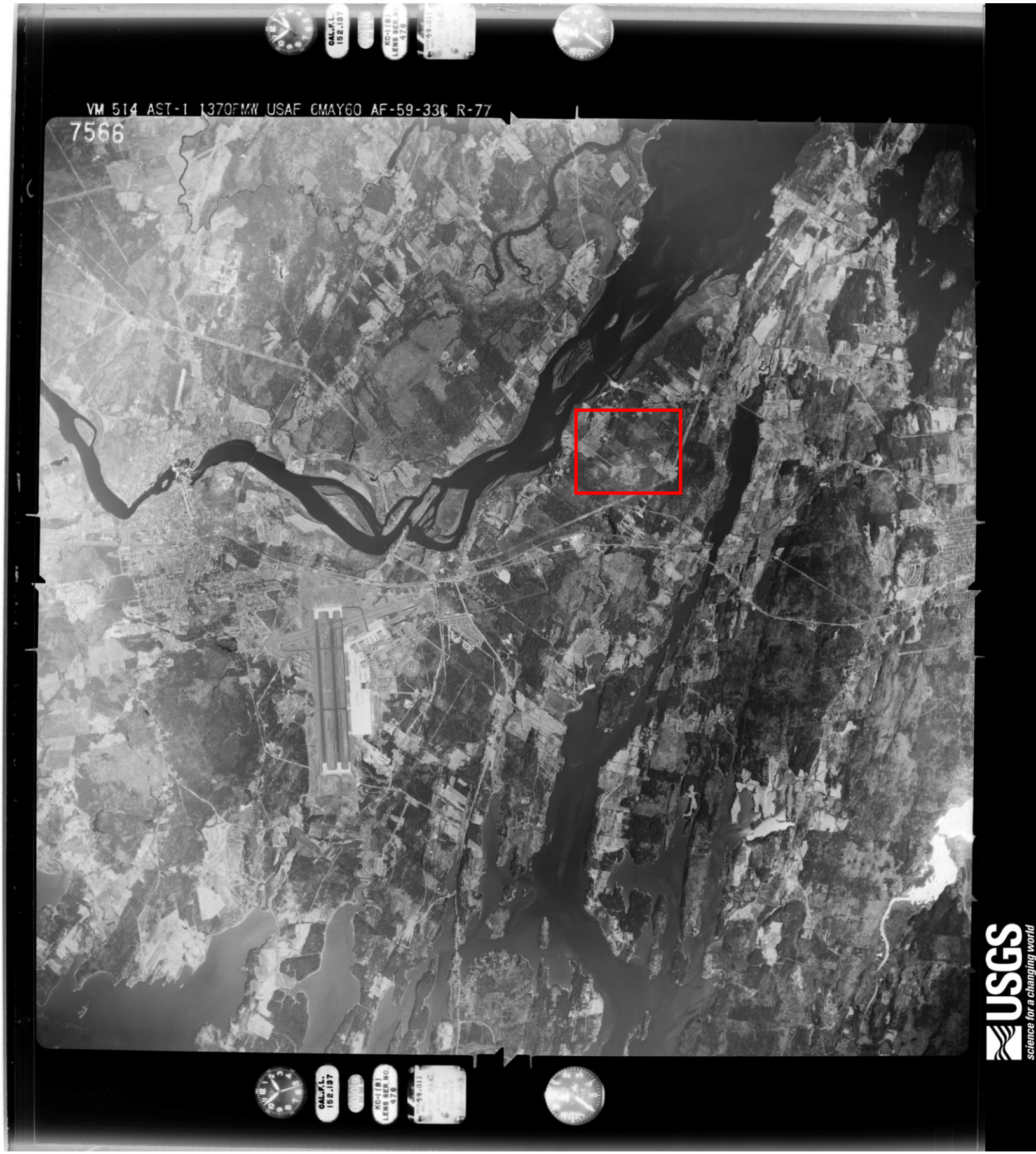
Soil Survey Area: Cumberland County and Part of Oxford County, Maine
Survey Area Data: Version 21, Aug 26, 2024

Attachment C
Historical Aerial Photographs

Aerial Photograph: 1940

Aerial Photograph: 1940

Aerial Photograph: 1960



Aerial Photograph: 1960

Aerial Photograph: 1972

Aerial Photograph: 1972

Aerial Photograph: 1990

Aerial Photograph: 1990

Aerial Photograph: 2003

Aerial Photograph: 2003

Aerial Photograph: 2006-A

Aerial Photograph: 2006-A

Aerial Photograph: 2006-B

Aerial Photograph: 2006-B

Aerial Photograph: 2009

Aerial Photograph: 2009

Aerial Photograph: 2012-A

Aerial Photograph: 2012-A

Aerial Photograph: 2012-B

Aerial Photograph: 2012-B

Attachment D
Brunswick Police Department Letter

Town of Brunswick, Maine
INCORPORATED 1739

Police Department

85 PLEASANT STREET BRUNSWICK, MAINE 04011

TELEPHONE (207) 725-5521 FAX (207) 725-6627

www.brunswickpd.org
email: info@brunswickpd.org

SCOTT J. STEWART
Chief of Police

MARTIN S. RINALDI
Commander, Support Services

PAUL R. HANSEN
Commander, Patrol Division

Estimate of PD Use of Sturgeon Ln Range

The Maine Criminal Justice Academy (MCJA) requires law enforcement officers to qualify on both pistol and rifle qualification courses annually to prove efficiency. The MCJA standard pistol course is a 50 round course that officers are required to obtain a passing score in back to back rounds. The MCJA standard rifle course is a 36 round course that officers are required to obtain a passing score in back to back rounds. At a minimum, each sworn officer will fire 100 pistol rounds and 72 rifle rounds annually to maintain MCJA standards.

The Brunswick Police Department recognizes the importance of officers' efficiency with these weapons systems and understands that the highest risk situations an officer can find themselves in is when they are required to use deadly force. With these factors in mind the Brunswick Police Department holds its officers to a higher standard and requires weapons qualifications twice annually.

With that in mind below is a rough estimate of the approved time the Brunswick Police Department spent at the Sturgeon Ln firing range from 2021-2024 based off of the current 35 sworn officers (SWAT members included.)

2021 – (only qualified once) 35 officers

- Pistol qualifications – 3500 rounds
- Rifle qualifications – 2,520 rounds

2022 – Two qualifications – 35 officers

- Pistol qualifications – 7,000 rounds
- Rifle qualifications – 5,040 rounds

2023 - Two qualifications – 35 officers

- Pistol qualifications – 7,000 rounds
- Rifle qualifications – 5,040 rounds

2024 - (only qualified once) 35 officers

- Pistol qualifications – 3500 rounds
- Rifle qualifications – 2,520 rounds

The aforenoted rounds were fired annually between a 2-3-day training period depending on scheduling/officer availability.

It should also be noted that the Brunswick Police Department only uses Total Metal Jacket (TMJ) and Full Metal Jacket (FMJ) rounds for practice ammunition. This is significant because TMJ rounds have a completely enclosed base meaning any lead is contained within a metal jacket (usually copper) and does not leave any lead behind when the round is fired. FMJ rounds have an exposed lead base, however during the firing process any exposed lead is vaporized and has only been an issue at indoor shooting ranges as these vapors are dissipated by the atmosphere when shooting outdoors. In both cases of the FMJ and TMJ rounds, the projectile that is left behind is a metal jacket with no exposed lead.

All numbers contained in this memorandum are an estimate and should not be considered exact totals.

Respectfully submitted,

Detective Sergeant Chris Balestra