55 Walkers Brook Dr., Suite 100, Reading, MA 01867 (HQ)
Tel: 978.532.1900

MEMORANDUM

TO: FILE; Brandon Kunkel

FROM: Frank Getchell, PG

DATE: July 11, 2023

SUBJECT: Viability of Proposed Irrigation Well at Loker Conservation and Recreation Area – Town of Wayland

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As requested, Weston & Sampson has reviewed available hydrogeologic and environmental information and data regarding the Loker Conservation and Recreation Area (the Site) in the Town of Wayland (Wayland) as to how it relates to the viability of developing an on-site irrigation well for an approximately 76,000 square foot recreational field and related access/parking facilities under construction at the Site property. The development of an on-site irrigation water supply for the field is being considered as an alternative to using water from the Town's potable community water supply. Based on our review of the current irrigation system design information the delivery of over 40 gallons per minute (gpm) is expected to be needed to meet the sprinkler head system demand. As such, the potential for developing an on-site irrigation supply from the on-site groundwater resources assumes that a minimum yield of 40 gpm would need to be available for pumping by a single well.

The review completed as part of this viability assessment focused on locale-specific information regarding geologic and hydrogeologic characterizations regarding the local soil (overburden) and bedrock, groundwater depths and potential flow directions, well-construction and yield information for nearby residential irrigation wells (i.e., MassDEP Well Completion Reports), and environmental data associated with the former use of the site and legacy contaminants detected in the on-site soil and groundwater (historic and recent). Site-specific subsurface information and data regarding soil and groundwater characteristics (e.g., origins, grain-size based classification, and depth to bedrock and groundwater) have been collected since about 1987 in connection with the environmental investigations and geotechnical evaluations related to the impacts from past site usage as well as the design of the ongoing recreational field and access/parking facilities. This information along with the previously described areal information are considered to provide a reliable basis for the conclusions and recommendations provided in this assessment.

The Site is located immediately northeast of the intersection of Rice and Commonwealth Roads and was previously the location of the Dow Chemical testing facility (1964 and 1988). The former Dow facility was demolished between 1999 and 2000. As a result of Dow's historic activities that occurred at the property and the related environmental impacts (as determined between 1987 and 1994), the Site has

been listed with the Massachusetts Department of Environmental Protection (MassDEP) under Release Tracking Number (RTN) 3-3866. Based on the available data, the occurrence of on-site soil and groundwater contamination has been detected in connection with these past site use activities. It should be noted that the proposed development of the Site for use as a recreational field is consistent with usage currently allowed by the MassDEP for RTN 3-3866. However, the viability of developing an on-site irrigation supply well from the local groundwater resources will need to consider not only yield potential related to the local groundwater resources but also the potential for future water quality impacts resulting from the on-site residual contaminants as described below.

Potentially Available Local Groundwater Resources

Based on the available geological mapping for the Town of Wayland area, as well as the conditions encountered during the advancement of numerous borings, and at on-site and nearby well completions, the majority of the surficial materials or "overburden" (soil and underlying "parent geologic materials") that naturally underlies the Site area consists of mixtures of clay through cobble size material associated with past glacier activity that occurred over 12,000 years ago in the New England region. These materials can be divided into those that were deposited directly by the glacial ice ("till") as it passed over the underlying bedrock surface, and those that were deposited by glacial meltwater as layers (strata) of clay, silt, sand, and gravel and are classified as "stratified drift." Of these two types of overburden materials, the stratified drift is commonly considered to have a high potential for supporting high yielding groundwater supplies (e.g., community wells) due to its generally more favorable thicknesses (generally tens of feet thick), lateral extent, and composition (typically consists of layers of permeable sand and gravel). Till on the other hand, though commonly serving as a resource associated with groundwater storage and recharge to underlying and abutting geologic formations, is generally not considered to be a geologic formation capable of supporting groundwater supplies due to its relatively limited thickness, discontinuous lateral extent (often sporadically punctuated by bedrock outcrops), and dense, fine-grain size composition (matrix dominated by clay, silt, and fine sand).

Based on the available geologic mapping and locally encountered subsurface conditions, the Site and immediately surrounding area to the north and east are underlain by a thin veneer of till (less than 20 feet thick) punctuated by locally occurring bedrock outcrops. Stratified drift occurs in the Site area primarily to the west and south. As such, the overburden materials underlying the Site are not considered to be available as a reliable source of groundwater capable of supporting the anticipated irrigation water supply for the recreational field in the Area.

The naturally occurring overburden materials underlying the Site and immediately surrounding area of the Town are underlain by igneous and metamorphic bedrock consisting primarily of diorite and gabbro (hard, crystalline rock types). Though the diorite and gabbro that comprise the bedrock formation underlying the Site and surrounding area of the Town are generally massive in nature, they can locally exhibit features reflective of the presence and/or influence of geologic structures (e.g., folds and faults) related to the development of the encompassing geologic host terrain known as the Milford-Dedham Zone. These features include discontinuities or "breaks" in the rock mass identified and/or related to joints, fractures, brittle fold structures (e.g., axes and foliation partings), and faults, many of which are oriented in directions reflective of the directional influences of geologic stresses responsible for their

formation (e.g., either parallel or perpendicular to). In the Town area, the predominant direction of these features is northeasterly-southwesterly. The less extensive of these features as identifiable on maps and aerial photography are often referred to as fracture traces (typically tens to less than several hundred feet), while the more extensive of these features (either linearly or widthwise) are often referred to as lineaments (typically hundreds to thousands of feet). A determination of the occurrence of such features at the Site was not part of this effort, however it is likely that such features exist in the Site area.

Where these features are open to the atmosphere, either directly or by way of the intergranular pore spaces of the covering overburden, or indirectly as part of an interconnected network at depth in the bedrock mass, they can act as conduits for movement and storage of groundwater (and contaminants). The more extensive and frequent these features, the more potential for groundwater storage and yield potential. Wells that penetrate these features are more likely to exhibit higher groundwater yield than those that do not. Based on the available residential irrigation well information, and the prevalence of till, the bedrock underlying the Site is considered to be the sole possibility for developing an on-site groundwater irrigation supply for the recreational field.

The reported yields of several six nearby residential wells tapping the local bedrock range from 0.5 gpm to 50 gpm. However, when looking at the reported yield testing results recorded on the respective well records, the testing was completed for short durations (15 minutes to 4 hours) and the corresponding post-pumping water level recovery was slow to moderate. When considered relative to the respective well yields, the long-term groundwater yields available from these wells are more likely on the order of 0.5 to 10 gpm, which is considered typical for bedrock under massive to slightly fractured conditions. Besides yield, the completion depths of the respective wells, which is reflective of the penetrated bedrock at the respective location to yield groundwater commensurate with the desired demand, also varied, ranging between 345 feet below grade (ft bg) and 920 ft bg. Given this information, it can be concluded that a single well installed at the Site and tapping the local bedrock would need to be drilled to a depth in excess of 300 feet and the anticipated yield would be at best about 10 gpm, assuming that no significant groundwater bearing fractures (as reflected by on-site fracture traces or lineaments) were penetrated. *As such, the on-site bedrock aquifer is not anticipated to have a high potential for supporting the long-term irrigation water supply demand (excess of 40 gpm) of the recreational field by way of a single well.*

Environmental Considerations

As discussed above, where fractures are open to the atmosphere, either directly (e.g., as reflected by fracture traces) or by way of the infiltration through the intergranular pore spaces of the covering overburden, or indirectly as part of an interconnected network at depth in the bedrock mass, they can act as conduits for movement and storage of groundwater. It is this movement of groundwater that replenishes the water pumped from a well and allows it to be a supply source of water. If the groundwater is impacted by contaminants, then the corresponding well can be a conduit for moving these contaminants through the subsurface and into the connected water supply.

As previously discussed, the Site was formerly occupied by the Dow Chemical testing facility. Besides the handling, storage and disposal of hazardous materials, the facility also provided the local fire

department with the opportunity for staff to practice fire extinguishing procedures at an on-site burn area where chemicals were disposed of by way of ignition. To date, several volatile organic compounds (VOCs) have been detected in the groundwater in the Site bedrock including 1,1, trichloroethane (TCA), trichloroethylene (TCE), benzene, chloroform, and acetone. In addition, more recent groundwater sampling completed by Weston & Sampson using monitor wells completed in overburden and bedrock indicate the occurrence of elevated concentrations of all six per- and polyfluoroalkyl substances (PFAS) regulated in drinking water by the MassDEP [i.e., Perflouroheptanoic Acid (PFHpA), Perflourohexanesulfonic Acid (PFHxS), Perflourooctanoic Acid (PFOA), Perflourononanoic Acid (PFNA), Perfluorooctanesulfonic Acid (PFOS), and Perfluorodecanoic Acid (PFDA)]. The presence of the detected VOCs and PFAS compounds in the on-site bedrock groundwater is currently occurring under presumably natural migration mechanisms driven by infiltrating precipitation. Under pumping conditions, such as those related to an on-site irrigation well, the transport and concentration of these compounds could be exacerbated and provide exposure to the surface environment as irrigation water delivered from the proposed sprinkler system for the recreational field. As such, without further investigations regarding the long-term persistence, migration, and concentration variations of these compound under future irrigation well pumping conditions, the possible receptors and nature of impacts cannot be established. ***Hence the use of an irrigation well deriving groundwater from the local bedrock is not recommended at this time.***

Summary

As described above, Weston & Sampson has reviewed available hydrogeologic and environmental information for the Loker Conservation and Recreation Area Site in connection with the possibility of developing an on-site irrigation water supply well capable of supporting an anticipated field sprinkler system demand of about 40 gpm. ***Based on our review we do not believe that the existing hydrogeologic and groundwater quality conditions at the Site are favorable for supporting an on-site irrigation water supply well and recommend that the Town not pursue the installation of one at the Site given the currently available limited and unfavorable hydrogeologic information and potential environmental risks.*** This recommendation is based on the following:

1. Only one groundwater bearing formation is potentially available for the development of an on-site irrigation water supply, and it is characterized as an igneous/ bedrock formation consisting of hard, crystalline rock types identified as diorite and gabbro. This formation is typically massive with generally limited to no groundwater transmitting and storage capacity potential. Exceptions to this condition can occur only where the bedrock is penetrated by fractures that are located below the groundwater surface and are hydraulically connected to local recharge sources (e.g., overburden and wetlands). Based on the yields, scarcity of encountered fractures during drilling, and completion depths reported for existing residential wells in the Site vicinity, the potential for an on-site irrigation well to “tap” such features is probably very low, and if such features were penetrated by an on-site well, the anticipated yield is expected to be much less than the desired 40 gpm yield. As such, the locally available groundwater bearing formation is not expected to have a high potential for supporting the desired 40-gpm irrigation demand for the recreational field at the Site.

2. Residual contaminants related to the past activities conducted at the Site by Dow Chemical currently occur in the overburden and bedrock groundwater at the Site. As such, the water quality of a future irrigation well installed at the Site would most likely reflect the occurrence of one or more of these contaminants, including VOCs and PFAS. The potential concentrations of the respective contaminants that could be pumped from a future irrigation well can not be determined based on the existing information, but it is highly likely that they would be detectable. Furthermore, as mentioned above, the currently available groundwater bearing formation at the Site relies primarily on fractures to replenish groundwater pumped from a well. The extent and orientation of groundwater bearing fractures is difficult to predict without extensive hydrogeologic investigation. Without such information the impact on the movement of the contaminants in the on-site groundwater by a pumping well cannot be projected, though it can safely be assumed that pumping will affect the local groundwater flow and contaminant migration beyond what naturally occurs. As such, well-pumping induced deviations in existing groundwater movement could result in the off-site migration of these contaminants beyond what may already occur, and the potential for on-site discharge of contaminated groundwater from a future well onto the land surface via the recreational field irrigation sprinkler system could enhance this migration via runoff movement. As such, the future use of an on-site irrigation well could be of concern regarding the potential spread throughout the Site and surrounding area of contaminants existing in the on-site groundwater.

Hopefully, the above discussion provides the information necessary for the Town to determine its next course of action regarding whether or not to develop an on-site irrigation water supply from the local groundwater resources. If you have any questions or wish to discuss this memo further, please do not hesitate to contact me.