

November 21, 2012



**Town of Grand Bay-Westfield**  
P.O. Box 3001  
Grand Bay-Westfield, NB  
E5K 4V3

ATTENTION: Mr. David Taylor  
Development Officer

**RE: Town of Grand Bay-Westfield Groundwater Technical Memorandum**

Dillon Consulting Limited (Dillon) is pleased to submit this Technical Memorandum summarizing the results of our work to assist the Town of Grand Bay-Westfield with gathering information on existing groundwater supply quality and quantity, and identification of future risks to the groundwater supply.

**BACKGROUND**

Godfrey Associates carried out a municipal groundwater investigation study for the Town in 2004. The purpose of this study was to identify potential sources for a supply of potable water as well as investigate potential supply and transmission options, pumping and storage requirements, and preliminary construction cost estimates.

As part of that report, three options were recommended for future study for development of a municipal water supply in the Town:

1. High yield groundwater well(s) from one or more gravel aquifers in the Town, likely in the Sunset Valley area.
2. Surface water supply from Loch Alva.
3. Securing a working agreement with the City of Saint John for raw or untreated water from the City's Spruce Lake system or the Loch Lomond System.

Upon completion of the 2004 study, the Town determined that further pursuit of development of a municipal water supply was not feasible at that time. In the interim, the Town chose to focus on maintaining and protecting the quality and quantity of the existing groundwater supply.

To that end, the Town recently applied for and received funding from the New Brunswick Environmental Trust Fund to carry out a Residential Water Resource Conservation Campaign to assist residents in protecting their drinking water quality and quantity. As part of that work, the Town proposed to complete a well inventory and retained Dillon to assist with that process, identify areas of existing groundwater supply risk, aid in the Conservation Campaign efforts and provide a brief review and update of the 2004 recommended water supply options.

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## **WELL INVENTORY**

### **Data Collection**

Maps of bedrock and superficial geology were prepared for the study area, as shown in Figures 1 and 2 respectively.

In order to identify areas of existing groundwater supply risk, Dillon worked with the Department of Environment and Local Government (NBDELG) in an attempt to acquire well log information for private wells within the Town. NBDELG maintains a database of well log information. NBDELG has recently made efforts to make well logs more accessible by making them available to the public via an online database referred to as the Online Well Log System (OWLS). However, in an effort to maintain privacy of property owners, spatial identifiers have been removed from the online well logs so that they can not be linked to an individual property. As a result, the information provided through OWLS is not overly useful for the purpose of this study because it is not possible to link the well log data to a specific property within the town.

In order to complete this study an alternative approach was required to access geo-referenced well log data. Prior to the launch of OWLS, Water Supply Source Assessments (WSSA) Reports contained well log data with spatial identifiers. Fortunately, three previously prepared WSSA reports were available for the study area:

- Panoramic Subdivision, Phase 6 and Phase 7, Grand Bay-Westfield, NB, Fundy Engineering, Feb 2010
- Proposed Valleyview Estates Subdivision Phase 10, Grand Bay-Westfield, NB, Fundy Engineering, Oct 2008
- Commercial Core Collector Road EIA, Fundy Engineering, Nov 2008

Additionally, Fundy Engineering Limited completed a Preliminary Siting Report for a Large Capacity Potable Well (March, 2004) for the Town of Grand Bay-Westfield. The generation of this report also predates the OWLS changes therefore additional well logs from this report were also incorporated into this assessment.

Dillon collected geo-referenced information on well logs from these reports in order to compile a Geographic Information System (GIS) database with considerable, although not complete, coverage of hydrogeological information for the study area. This database is presented in Table 1. Additionally, limited site reconnaissance was completed by Dillon staff to better understand the local geology, topography, drainage and locations of existing community.

### **Well Log Database**

A spreadsheet summarizing hydrogeological information provided via the above noted information sources was developed for usage in the GIS. Available GIS information compiled for this database included; well tag information, PID numbers, date of well

completion, depth of casing, total well depth, bedrock depth, estimated safe yield, water bearing fracture depths and water bearing fracture flow rates.

Well depths and estimated safe yields for each well with an associated PID were plotted on an aerial map to show relative spatial variation. This data was overlain onto both the bedrock and surficial geology maps of the area to identify trends in relation to horizontal geological variance (see Figures 3A and 3B). Estimated safe yields ranged from 0.5 to 100 igpm and total well depths ranged from 60 to 575 feet below ground surface.

The bedrock geology of the Grand Bay-Westfield area is typically of a crystalline nature having little to no porosity with the exception of varying degrees of fractures. The presence and variation in fractures as well as fracture density are likely attributing to the lateral differences in estimated yields and well depths throughout the Town. As shown on Figure 1, in blue and orange, some sedimentary rocks do exist with the potential to produce higher yielding wells. However, minimal development is located within these areas and well log data within these specific units was not available.

An attempt to obtain additional well logs within the specific geological units of interest (previously defined) was completed by providing a list of PIDs within the area of interest to NBDELG. Crystale Harty of the NBDELG performed a search of all PIDs given and returned two well logs. Both of the available logs were relatively low yielding wells compared to others within the study area, which may indicate that the geologic unit of significance may not be ideal for aquifer development. The available logs however represent a relatively limited depicting of the geographic coverage for the hydrogeologic unit and potential may still exist for significant water bearing fractures within this aquifer as this unit expands further to the southwest.

The maximum yielding well within the study area exhibited an estimated safe yield of 100 igpm. However, based on an estimate of water demand (92 gal/day per person) for a population nearing 5,000 it is estimated that water requirements to satisfy the current needs of Grand Bay-Westfield would be 460,000 gal/day. Therefore a potable water source would have to produce over 300 igpm. Implementation of a municipal water supply would likely be phased in over a period of time. This would require smaller volumes of water initially. However most of the currently identified wells in the study area produce less than 20 igpm. Therefore, it may be difficult to develop a suitable water supply to meet predicted demand. High yielding wells (~100 igpm) identified were associated with glacial outwash deposits of sand and gravel located in the Sunset Valley region. These deposits are suspected to be recharged directly from surface water from the Nerepis River (Fundy, 2004). The significant volume of these deposits in conjunction with immediate recharge associated with the river may provide a potential option for significant generation of potable water. Although this area has the potential to provide significant potable groundwater, it is likely that it would not meet the Town's requirements. Therefore, multiple wells within this aquifer would be required to support the entire Town should sufficient storage be available in this location. Determination of available storage cannot be achieved without exploration wells in addition to hydrogeological assessment.

Fundy indicated that wells located in these areas would likely require treatment to address elevated turbidity, iron and manganese. Should potential drilling be considered within the gravel deposit, careful consideration should be given to the proposed location of the wells to provide an opportunity for filtration within the gravel deposit which may decrease the risk of commissioning a Groundwater Under the Direct Influence of Surface water (GUDI) source. Of note, potential GUDI sources in New Brunswick require more complex treatment options.

#### **Potable Well Survey**

In an effort to further expand our knowledge of the broader study area Dillon prepared a newsletter and survey for residents, which was mailed by the Town to all residents. The intent of the newsletter was to update/remind residents about the on-going work; the intent of the survey was to gather well water quality and quantity information from residents. The surveys were voluntary and included questions related to: resident name and address, construction details of their well, whether they had water quantity or quality issues, has their well been cleaned or other maintenance efforts, if they have a treatment system and details from their well log if available (well depth, water bearing fracture zones, pump type, etc). The survey also provided direction to residents on how to read their well log and extract pertinent information for inclusion in the well log database. The survey also provided a mechanism for residents to provide empirical information which could be used for a qualitative database.

Upon receiving the results, the Town forwarded the surveys to Dillon where this information was entered into a database and PIDs were determined for each survey. Data gathered from the survey is shown in Table 2. Based on the results of the survey a score was given for water quantity and quality for each PID. Groundwater quantity was determined to be either acceptable or good and groundwater quality was determined to be poor, acceptable or good. These results were then plotted on an aerial map showing the distribution of data (Figures 5 and 6). Overall the responses to the survey suggest most responding residents have no or limited water quantity or quality issues.

The Town of Grand-Bay Westfield initiated a door-to-door approach to obtain written consent for the NBDELG to release additional well log records to Dillon. Certain civic addresses were selected based on the locations of known highest yielding wells in the Town (in combination with the identification of the hydrogeologic unit of interest). Upon submission of the consent forms to Crystale Harty of the NBDELG the results turned up no available well logs indicating that addresses for which consent forms were submitted pre-date the OWLS database. NBDELG representatives additionally completed a search of the historic log database which resulted in the identification of no supplementary well logs. The historic well log database was commonly associated with names of well owners as opposed to civic addresses and/or PIDs and therefore commonly well logs are difficult to locate.



## REVIEW OF 2004 RECOMMENDED WATER SUPPLY OPTIONS

In 2004, Godfrey Associates carried out a municipal groundwater investigation study. The purpose of the study was to identify potential sources for a municipal supply of potable water as well as to investigate potential supply and transmission options, pumping and storage requirements, and preliminary construction cost estimates. As part of the report, three options were recommended for future study for development of a municipal water supply in the Town; high yielding groundwater well(s) from one or more gravel aquifers in the Town, surface water supply from Loch Alva, and securing a working agreement with the City of Saint John for raw or untreated water from the City's Spruce Lake system or Loch Lomond system. A brief update on the status of each of these options is provided below.

**Groundwater from Gravel Aquifers.** Based on the well log information, DNR surficial mapping obtained during this hydrogeological study as well as the Preliminary Siting Report for a Large Capacity Potable Well completed by Fundy in 2004, high yielding sand and/or gravel aquifers may represent a viable option within the Town limits. It should be noted that DNR mapping suggest that some of the Sunset Valley gravel deposit may be located on the south side of Nerepis River and therefore within Town limits. It was also noted in the Fundy report that high yielding wells were present within the Hillandale and Brandy Point locations, however evidence supporting this was not identified in the well logs accessed in the development of the database. DNR mapping does suggest the presence of sand and gravel deposits in these areas; however available well log data does not support the groundwater supply potential of this deposit. High yielding wells were identified by Fundy in the Sunset Valley location in sand and gravel glacial outwash deposit making up the Nerepis Stream valley. Due to the fact that high yielding wells are located in unconfined glacio-fluvial sediments, it is expected that wells commissioned in this deposit could potentially GUDI.

**Treated Water from the Saint John System.** The City of Saint John recently adopted their new Municipal Plan – PlanSJ. A key principle of the plan is focusing growth and infrastructure investment into the core of the City and limiting the expansion of services into rural areas. This fact, combined with the reality of the City's current fiscal challenges and focus on developing its own new water treatment facility on the east side of the City, makes it unlikely that the City would be interested in pursuing the required service extensions and agreement to provide treated water to the Town.

**Surface Water from Loch Alva.** Surface water from Loch Alva continues to exist as a potential water supply. However, given the significant financial investments that would be required to pursue this option (particularly those associated with required treatment); the priorities of the Town remain with protecting the quality and quantity of the existing groundwater supply as this time.

## RECOMMENDATIONS

Although the Town is not prepared to proceed with selection of a municipal water supply option at this time, it is important that the Town maintain future water supply options for when future infrastructure funding is available to proceed with further investigation into and/or development of a water supply. Given that a supply of surface water from Loch Alva and development of a groundwater source in the previously indicated geologic unit of interest (Sedimentary Terrestrial Sediments) are likely the most viable future water supply options, the following recommendations are made.

### With respect to the Loch Alva option:

- **That the Town continues to monitor and consider land acquisition opportunities along the potential corridor that could connect Loch Alva to the Town.** Should suitable land become available, the Town may wish to consider purchasing that land. Similarly, should development proposals come forward to develop land within that corridor; those proposals should be evaluated to consider whether they would limit possibilities for the water supply corridor to be constructed in the future.
- **Continue to support source water protection for Loch Alva.** Loch Alva is currently part of a provincially designated watershed and nearby land is part of a forest protection reserve. These restrictions serve to maintain the quality of this potential surface water source. Development pressures in these areas may arise; should that occur, the Town should support efforts to maintain these source water protection designations in order to preserve the viability of this potential future water supply option.

### With respect to development of a groundwater source in the area of Sedimentary Bedrock:

- **That the Town carry out a door-to-door survey to obtain additional information on existing wells in this area.** Using the well survey developed as part of this work, a Town summer student or employee could carry out a door-to-door survey in this area of interest to gather additional information that could help better define the potential of this area as a future water source. Depending on staff availability, additional areas of interest such as Sunnyside and/or Sunset Valley could be added to the door-to-door survey as well. Information gathered through this survey would help determine whether it would make sense to proceed with a door-to-door survey to gather additional information (see next recommendation).
- **That the Town consider drilling one or more exploratory wells in the areas of interest.** Depending on the results of the door-to-door survey, the Town may wish to consider drilling an exploratory well to better understand the potential of this area as a future groundwater source. The Town owns a large parcel of undeveloped land within the area of interest and could be an ideal site for an

exploratory well. The Town may also wish to pursue an additional exploratory well elsewhere within the area of interest – this would require permission from the property owner. The results of this task would determine whether continued focus on this area is worthwhile or whether the Loch Alva option should be the primary option for future consideration.

- **That the Town closely monitors future development in the area where Sedimentary Bedrock has been identified.** The Town's Municipal Plan Future Land Use Map indicates that an area of future residential development is intended southwest of Highway 7 near Negro Lake, which falls within the geologic unit of interest (Figure 7). As development progresses into this area additional hydrogeological data will become available and will provide the Town with insight into what potential exists with respect to water supply in that geological unit of interest. If a high yielding bedrock well is discovered, the Town will likely need to consider NBDELG's Wellfield Projection Program with respect to land use restriction; the Town may wish to consider limiting future potential contamination sources (e.g. gas stations, chemical storage, etc) within this area.

**With respect to development of a groundwater source in the area of the Sunset Valley Gravel Deposit:**

- **That the Town closely monitors future development in the area where the Sunset Valley gravel deposit has been identified.** As development progresses into the area of interest additional hydrogeological data will become available and will provide the Town with insight into what potential exists with respect to water supply in that geological unit of interest. The Town will likely need to consider NBDELG's Wellfield Projection Program with respect to land use restriction; the Town may wish to consider limiting future potential contamination sources (e.g. gas stations, chemical storage, etc) within this area. Further consideration to the completion of exploration wells in the vicinity of this gravel deposit within the Town limits may be considered given the high potential for this deposit to represent sufficient groundwater supply to meet the Town's requirements.

**With respect to the well log database:**

- A significant effort has been made to develop a well log database for the Town as part of this project. As new development progresses, it is recommended that the Town arrange to obtain well log information as part of approvals for new developments and that new data be added to the database as it becomes available. Similarly, information gathered from activities such as a door-to-door well survey should also be added so that the database can be kept current and up-to-date.

Page 8 of 8  
Town of Grand Bay - Westfield  
November 21, 2012

**CLOSING**

Should you have any further questions or concerns please contact the undersigned at (506)633-5000.

Yours Truly,

**DILLON CONSULTING LIMITED**

Holly McMackin, MCIP, RPP