Water Well Survey Program

Sol-Luce Kingston Solar PV Energy Project, Kingston, Ontario

Final Report
September 7, 2012

DILLON CONSULTING

Kingston Solar LP

Project No. 12-6428

Submitted by

Dillon Consulting Limited

September 7, 2012

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Attention: Mr. Simon Kim
Senior Manager, Solar Business Development

Water Well Survey Program
Sol-Luce Kingston Solar PV Energy Project

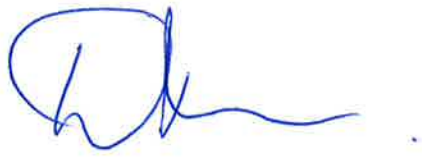
Dear Mr. Kim:

Dillon Consulting Limited is pleased to provide Kingston Solar LP with the results of the water well survey program that was conducted between May and July, 2012. This report presents the results of the investigation and outlines recommended mitigation, monitoring and contingency plans for the construction and operation phases of the Sol-Luce Kingston Solar PV Energy Project as it pertains to the protection of well water quality.

Should you have any questions or comments, please contact the undersigned at your convenience.

Yours sincerely,

DILLON CONSULTING LIMITED



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1. INTRODUCTION

Dillon Consulting Limited (Dillon) was retained by Kingston Solar LP to conduct a private water well survey for the Sol-Luce Kingston Solar PV Energy Project (referred herein as the "Project"). The purpose of the survey was to obtain background information on the use of local aquifers as a potable water supply, and to assess groundwater quality conditions prior to site construction. This information will be used as input into a future monitoring and contingency program that would be enacted during construction and operation of the Project. Implementation of a groundwater monitoring and contingency program is a requirement of the Renewable Energy Approval (REA) process for sites that have been identified as "sensitive areas." Recently completed source protection mapping conducted under the *Clean Water Act* has identified much of the lands within the proposed Project as having high groundwater vulnerability. High vulnerability areas are considered to be sensitive areas.

1.1 Objectives and Work Scope

The scope of work was detailed in our May 17, 2012 proposal and was based on discussions with Kingston Solar LP and the Eastern Regional office of the Ontario Ministry of the Environment (MOE). A summary of the work activities completed are as follows:

- review of available information on the area hydrogeology and an inventory of properties that may use the local aquifer as their water supply;
- consultation with the MOE and the local Conservation Authority on the study work scope;
- identification of select property owners for participation in the sampling program and notification of these residences;
- collection of untreated well water samples at participating addresses and submission of the samples to an analytical laboratory for testing; water samples were tested for general potability requirements including general chemistry, nutrients, select metals and bacteria;
- completion of a homeowner survey to provide knowledge on well construction, water quality/quantity characteristics and location of potential nearby activities (septic systems, fuel storage etc.) that may pose a groundwater quality threat to the groundwater supply;
- provision of the chemical testing results to homeowners via individual letters;
- reviewing the existing Draft Construction Plan Report and the Draft Design and Operations Report and providing recommendations for additional mitigative actions to reduce the risk of groundwater quality impacts during construction and operation of the proposed solar facility

- recommending a contingency program to respond to any future complaints regarding well water impacts during construction and operation; and,
- submission of a report to Kingston Solar LP documenting the results.

1.2 Report Organization

This report is divided into several sections. **Section 1** introduces the study and outlines the work scope and objectives. **Section 2** summarizes background information on the Project and describes the groundwater resources and hydrogeology of the area. Study methodologies are presented in **Section 3**. The results of the private well testing and residential survey are presented in **Section 4** and discussed in **Section 5**. A proposed monitoring and contingency program is outlined in **Section 6**, followed by the study conclusions in **Section 7**.

1.3 Initial Disclaimer and Limiting Conditions

This report was prepared by Dillon Consulting Limited for the sole benefit of Kingston Solar LP. The conclusions reflect Dillon's best judgment in light of the information available to Dillon at the time of the report's preparation. Any use which a third party makes of this report or any reliance on or decisions made based on it are the responsibilities of such said third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

2. BACKGROUND INFORMATION

2.1 Project Description

The proposed 100 MW (megawatt) Sol-Luce Kingston Solar PV Energy Project is located in eastern Ontario within the municipal boundaries of the City of Kingston and Loyalist Township (see **Figure 1** for Project location). The Project covers an area of approximately 261 ha, and is bounded by Quabbin Road to the north, Mud Lake Road/County Road 19 to the west, MacDonald Cartier Freeway (Highway 401) to the south and Highway 38 to the east. As outlined in the REA application (AMEC, 2012), the Project will consist of approximately 426,000 photovoltaic (PV) panels (arranged in approximately 1 MW blocks consisting of 4,260 PV panels each), inverter stations and transformers, a substation and an adjacent switchyard, a collector system of underground and/or overhead power lines and access roads. Temporary Project components that will be developed during the construction phase include laydown and storage areas, and access roadways. The proposed locations of the temporary and permanent infrastructure, as provided to Dillon by Kingston Solar LP, are reprinted in **Appendix A**.

2.2 Geological Setting

The proposed development is located in the physiographic area referred to as the Napanee Plain (Chapman and Putnam, 1984). This region is characterized by a flat to undulatory plain of exposed to shallow buried limestone bedrock. Provincial geological mapping (OGS, 1984) indicates that the limestone consists of the Paleozoic-age Gull River Formation which is dominant in the Kingston area (see **Figure 2**). This bedrock consists primarily of dolomitic limestone with minor interbedded shale. Underlying the Gull River Formation is arkosic sandstones, siltstone and shale of the Shadow Lake Formation; however, this unit is not present in all locations. Underling the Paleozoic-aged rocks is Precambrian-aged igneous and metamorphic bedrock. Water well records indicate that the Gull River Formation is >30 m thick in the Project area, and therefore the majority of wells in the area are expected to be completed in this formation. Overburden geological mapping (OGS, 1984) indicates that the surficial geology consists primarily of thin (<1 m) to absent glacial till that overlies the limestone bedrock. In some low lying areas, there are sporadic occurrences of laminated clays and silts that may attain thickness of a few metres. As shown in **Figure 2**, most of the Project area is located in areas of shallow to absent soils, however, thicker clay and silt deposits may be found in solar infrastructure areas P6A, P2 and P12.

2.3 Hydrogeology and Groundwater Flow

Aquifer Characteristics

The main aquifer in the Project area is the limestone bedrock. This aquifer is heavily fractured as a result of isostatic rebound, weathering and tectonic forces. In general, the amount of fractures will decrease with depth. Recharge to shallow water wells that tap the top portion of the bedrock aquifer will be from infiltrating precipitation that falls directly over the surrounding area. As a result of the unconfined nature of the fractured rock aquifer, recharge via an increase in aquifer storage is expected to be rapid following precipitation events. Recharge to deeper fractures that are intercepted by drilled wells will partially be from further upgradient locations. Shallow dug or blasted wells will likely recharge the quickest following precipitation events; however, they will also be more susceptible to water quantity problems during dry conditions. A water budget analysis (XCG, 2008) undertaken as part of the *Clean Water Act* (CWA) Assessment Report estimated an average groundwater recharge rate of 150 mm for the Millhaven Creek subwatershed, which encompasses the northern portions of the Project area. The estimated long-term average annual precipitation for the Millhaven subwatershed is 957 mm, of which 548 mm is lost to evapotranspiration (XCG, 2008).

Groundwater Flow

Groundwater flow directions in the shallow fractured rock aquifer are expected to be strongly influenced by local topography. Groundwater will be directed from areas of local topographic highs towards low lying areas such as creeks, lakes and wetlands. Deeper in the aquifer, groundwater flow directions are expected to be similar to the regional trend of a dominant southward flow towards Lake Ontario. Overall, shallow groundwater flow is expected to be influenced by local topography, while drilled wells, which often tap deeper water bearing horizons, will be subject to more regional flow conditions which may differ from the local topography. It is noted that most of the wells identified in the Ontario Water Well Record are drilled, and there is little information on shallow dug wells, even though survey results presented herein suggest that almost half of the wells in the area are of the dug/blasted type.

Estimation of groundwater flow directions in the Project area was based on a review of topographical information (MNR, 2012) and analysis of the mapped potentiometric surface. The potentiometric surface elevations were calculated as part of the Groundwater Vulnerability Assessment Report

(Dillon, 2008) and are based on data from the Ontario Water Well Records, processed following MOE protocols that were used in the Provincial regional groundwater studies. Topographic contours are most useful in estimating groundwater flow conditions for shallow dug or blasted wells, as flow in these wells will generally be from areas of high ground elevation to low elevation. Potentiometric surface contours, which primarily reflect conditions in drilled wells in the area, can be used to estimate general deeper regional groundwater flow directions. Note that the identified flow directions are very approximate considering the inaccuracies inherent to the well record database and the data interpolation methods. The actual direction of groundwater flow will depend upon local conditions such as actual well location, depth of well, depth of water table and properties of the fractures that are intercepted in each well. **Figure 3** shows the topographic contours (yellow contours) and the footprint of the proposed development areas within the Project. Arrows showing the estimated direction of groundwater flow based on the calculated potentiometric surface (shown as black lines) are presented. Based on this interpretation, shallow groundwater flow in the western portion of the development (infrastructure areas P19 to P23) is expected to be towards Odessa Lake; however, some flow in the southern portions of this area, including infrastructure area P24 may be southwards. Estimated groundwater flow near infrastructure areas P7-P10, P11A is expected to be northwest towards Odessa Lake. Shallow groundwater flow in infrastructure areas P1, P2, P3, P4, P6A, P12 and P14 is expected to be predominantly southeast, south or southwest. However groundwater flow near shallow wells may be more influenced by local topographic conditions resulting in deviations from the estimated regional flow directions. In these situations, shallow flow directions are potentially towards local creeks. For example, shallow groundwater flow directions near the northern portion of infrastructure area P12 maybe northward towards a tributary in this area; even though the regional groundwater flow conditions suggest a southerly component of flow. Groundwater flow rates within the aquifer are expected to be highly variable and are therefore difficult to predict. Nevertheless, rates between centimetres to metres per day can be expected in fractured limestone aquifers.

Aquifer Vulnerability

Recently completed hydrogeological mapping performed by the Cataraqui Region Conservation Authority (CRCA) indicates a large portion of the Cataraqui watershed, including the majority of the Project lands, has having a high aquifer vulnerability. The aquifer vulnerability map is reprinted in **Appendix A**, and was produced as part of technical studies required under the *Clean Water Act* (CWA). The CWA, and the associated regulations, define high vulnerability aquifers, as "*an aquifer*

on which external sources have or are likely to have a significant adverse effect, and include the land above the aquifer." In practice, high vulnerability aquifers are sensitive to contamination from land uses that may pose a risk of release of chemicals to the ground surface. High vulnerability aquifers often lack thick deposits of lower permeability surface units (such as clay, silt etc.) that would inhibit transportation of the chemicals from the surface into the aquifer.

2.4 Potable Water Use of Groundwater

The proposed Project is located in rural portions of the City of Kingston and Loyalist Township that are not municipally serviced. Potable water is supplied mainly by privately owned water wells that tap into the underlying limestone bedrock aquifer. Based on an air photo analysis of the number of developed properties within the study area, it is estimated that there are approximately 120 residences, farms or businesses within 500 m of the development that use groundwater as the potable water resource. The approximate locations of these wells, based on available information, are presented in **Figure 3**. Based on our review of the water well records and from survey information obtained from property owners during this investigation, both blasted and drilled wells exist.

No records of large water users that would require a permit to take water for groundwater use were identified in the immediate vicinity of the proposed Project. In addition, no municipal water supply wellhead protection areas are located within the Project area, based on our review of the most recent source protection mapping.

Based on the unconfined nature of the aquifer, lack of low permeability material overlying the bedrock, and the dominance of fractures near surface, it is expected that groundwater quality, and therefore raw water quality, will be sensitive to nearby land use activities that may potentially discharge chemicals, nutrients or animal/human waste to the subsurface.

3. STUDY METHODOLOGY

Investigative methodologies used during this study are presented in this section.

3.1 Consultation with Regulatory Officials

Prior to implementing the field work program, study team members consulted with the MOE and the local conservation authority (Cataraqui Region Conservation Authority) for their input. A summary of the consultation efforts is presented below.

Ontario Ministry of the Environment

Dillon contacted the MOE Eastern Regional Office via email on May 1, 2012, to inquire about methodologies and protocols associated with assessing potential groundwater impacts from solar installations. Mr. Frank Crossley, Senior Hydrogeologist, responded to Dillon via email on May 2, 2012, and provided guidance on the required assessment program. Mr. Crossley stated that if the project was located within an area classified as "environmentally sensitive," a groundwater monitoring program should be implemented prior to commencement of the construction phase of the project. The Ministry stated that the Eastern Region Groundwater Unit recommends that the monitoring program could consist of either: a) monitoring of a select number of existing private wells in the area, or b) proponent develop a monitoring network through the construction of new monitoring wells that collect water that is representative of the nearby wells. All collected water samples are to be analyzed by a qualified laboratory for general potability ("subdivision suite"). MOE provided a list of the recommended analysis parameters. Furthermore, MOE stated that following completion of the study, a report, including a contingency plan, be prepared by a qualified person, and submitted to the ministry. A copy of the correspondence between Dillon and the MOE is presented in **Appendix A**.

Cataraqui Region Conservation Authority

Mr. A. José De Armas of Kingston Solar LP, and Mr. Darin Burr of Dillon, met with Conservation Authority staff on June 1, 2012. Mr. Rob McRae, Source Protection Manager of the Cataraqui Source Protection Area and Mr. John C. Williamson, Source Protection Committee Chair, were in attendance. The purpose of the meeting was to present the scope and schedule of the proposed monitoring program, and to answer questions that the Conservation Authority may have regarding the project.

3.2 Public Communications

Prior to collection of the well water samples, a public communication program was developed through consultation with Kingston Solar LP. The communication program consisted of the following elements:

- issuance of project notification letters to select residences that were identified for participation in the survey; letters were hand delivered to individual mailboxes on June 1, 2012;
- contacting of homeowners by telephone, and scheduling of water sampling; questions on the water sampling program were also answered as needed; and,
- Provision of water quality testing results to homeowners.

Information that was developed as part of the communication program is presented in **Appendix B**.

3.3 Well Water Sampling and Resident Survey

Implementation of the well water sampling program was conducted between June 11, 2012 and July 4, 2012. The sampling program was designed to collect a representative number of water well samples over the geographic area that covers the majority of proposed major development sites. Selection of the residents to sample was based on several factors including proximity of the well to the proposed development area and position of the well relative to the estimated local groundwater flow direction. Preference was given to those wells located topographically downgradient and within 500 m of proposed major development areas. Where more than one well was present in a given direction (common condition along Mud Lake Road and Unity Road), the well closest to the proposed development was chosen for sampling. It should be noted that the ability to sample all selected properties relied on the willingness and/or availability of the homeowner to participate in the survey. Overall, 60 addresses were contacted and 32 addresses were available for sampling.

Sample Collection

Well water samples were collected following standard industry protocols and were analyzed for bacteria, alkalinity, ammonia, nitrate, nitrite, calcium, chloride, colour, conductivity, DOC, hardness, iron, magnesium, manganese, pH, potassium, sodium, sulphate, TDS and turbidity, as recommended by the MOE. Water samples were collected from each house participating in the groundwater study and placed immediately on ice. Where a treatment system was present (e.g., sediment filter, UV

light, or water softener etc.), an attempt was made to collect the sample prior to treatment. When collecting a sample from a water faucet, any garden hose, aerator, or spray-type attachment was removed and the surface of the tap cleaned with diluted bleach placed on a clean paper towel. The water was allowed to run for a minimum of five minutes prior to sample collection.

Samples were submitted to Exova laboratory in Kingston within 24 hours of collection, with the exception of samples collected on the weekend that were submitted directly to the Ottawa Exova laboratory within 48 hours of collection.

Overall, 32 properties were sampled, with one quality assurance/quality control duplicate sample obtained. Additionally, 19 locations were re-sampled to confirm detections of coliform and/or *Escherichia coli* (*E. coli*) bacteria. Four additional property owners were visited, but samples were not collected as the property did not use a well (e.g., cistern only). Eleven properties were contacted and declined to participate in the sampling program.

The majority of water samples were collected by Dillon staff between June 11 and June 16, 2012, with additional follow-up samples collected on July 4, 2012.

Sampling Survey

At the time of sample collection, property owners were asked to complete an information survey which included a series of questions covering topics related to their well. Topics covered included water quality and quantity, frequency of water testing, water use, etc. The level of completion of each survey varied considerably, depending on the amount of time the residence owner had occupied the dwelling and depending on the residents' knowledge of their water system. The survey form is reprinted in **Appendix C**.

Sampling Results Notification

The laboratory reports are presented in **Appendix E**. Bacteriological testing results including total coliform, and *E. Coli* were provided by the laboratory within two business days of sample collection. Where contact could be made, owners of wells where *E. Coli* was detected at concentrations significantly exceeding the Ontario Drinking Water Standards, were notified by telephone upon receipt of the laboratory report. At the completion of the study, the analytical reports were mailed to each sampling participant. A letter was provided with the reports identifying exceedances of the

health and non-health related Ontario Drinking Water Standards for the tested parameters. An example homeowner report is presented in **Appendix B**.

Quality Assurance/Quality Control

Quality Assurance and Quality Control was conducted for the field work, laboratory analysis and reporting elements of the project.

Quality assurance and quality control (QA/QC) procedures were implemented in the field and by the laboratory to demonstrate that the data generated was of a level of quality suitable for its intended purposes. Field QA/QC procedures included the collection of field duplicate samples, the use of new sampling equipment and/or appropriate equipment cleaning procedures, proper sample containment, preservation, handling and transportation and adherence to published standards for field methodologies. Laboratory QA/QC procedures included the use of an accredited laboratory, the use of detection limits appropriate for the required evaluation, the use of acceptable laboratory methods, analysis of laboratory blank and spike samples and laboratory reference standards. The results of the QA/QC program are presented in **Appendix D**. Overall, the results of the testing are deemed to be representative of site conditions.

4. STUDY RESULTS

4.1 Residential Sampling

A summary of the results of the well sampling are tabulated below. A detailed list of property owners that were contacted is presented in **Table 1** (following report text). The location of addresses contacted and those that were sampled are presented in **Figure 3**.

Category	# of Addresses
Initial Target for Properties to be Contacted/Wells sampled	50
Number of Addresses Contacted	60
Number of Samples Obtained	32
Addresses where well not present/not used	4
Addresses that could not be reached/unavailable	13
Addresses that declined sampling	11

The target number of sampled wells was 50; however, after contacting 60 properties, 32 addresses were available to be sampled. The remaining 28 properties that were contacted could not be sampled either because the owner declined sampling, was not home/unavailable for sampling, or did not use a well for their potable water supply. One property was not sampled as the well was recharged by rainwater that discharged into the well from the adjacent building's eaves trough. The water quality in this well was not considered representative of natural groundwater conditions.

4.2 Homeowner Survey

A summary of the survey results are tabulated below.

Category	Results*
Number of Residence who completed survey	32 (100%)
Well Type	
Number of dug wells Reported minimum, maximum and median depth of wells	15 (50% of total) 3 m, 8 m, 6 m
Number of drilled wells Reported minimum, maximum and median depth of wells	13 (44% of total) 8 m, 30 m, 18 m
Number of shore wells	2 (6% of total)
Wells of unknown construction	2
Water Quantity Comments	
Dug Wells - Reported number of wells where water quantity has been restricted from time to time, well has gone dry, or water has been trucked in	9 out of 15 (60% of reported total)

Category	Results*
Drilled Wells - Reported number of wells where water quantity has been restricted from time to time, well has gone dry, or water has been trucked in	3 out of 12 (25% of reported total)
Water Quality Comments	
Dug Wells	
- sulphur odour and/or taste or other smell	8 out of 12 (66%)
- occasional discolouration	1 out of 13 (8%)
- iron problems	0 out of 12 (0%)
- no problems reported	3 out of 12 (25%)
Drilled Wells	
- sulphur odour and/or taste	6 out of 12 (50%)
- occasional discolouration	0 out of 12 (0%)
- iron problems	4 out of 12 (33%)
- no problems reported	5 out of 12 (42%)

* % based only on those surveys that reported for question

Overall, the survey indicates that there are a large number of dug or blasted wells in the area. This information is in contrast to the MOE water well information system which indicates that only drilled wells are located near the Project. This discrepancy suggests that many of the dug wells in the area of the Project have not been registered in the provincial database or have been incorrectly registered as being drilled. In general, the survey indicates that many of the dug and/or blasted wells appear susceptible to low water yield problems, especially during times of drought. Homeowners with drilled wells reported fewer water quantity problems. The median depth of the reported well depths was 6 m for dug wells and 18 m for drilled wells.

With respect to water quality in terms of taste and odour, a majority of the residences reported sulphur odour/taste problems. These problems appear to be most reported for dug wells (66%) than drilled wells (50%). No problems were reported for 25% of the dug wells and 42% of the drilled wells. Iron problems are most predominantly reported by owners of drilled wells (33%) than dug wells (0%).

It is also noted that some owners of shore wells reported discolouration from time to time, especially in the spring or late summer, which is expected considering shore wells will be heavily influenced by conditions within the surface water body that they draw from.

4.3 Water Quality Testing Results

Water quality testing results are presented in **Table 2** (following text). Graphical plots of the data are presented in **Appendix D**. A summary of the main observations from the water quality tests are presented below. Results are grouped by well type (dug/blasted and drilled).

SUMMARY OF WATER QUALITY TESTING					
Parameter	**Units**	**Dug/Blasted* Wells**		**Drilled Wells**	
		Range/(median)	exceeding ODWS	Range/(median)	exceeding ODWS
Microbiology					
E. Coli	cts/100ml	0 – 12 (0)	27%	0 – 342 (0)	33%
Total Coliform	cts/100ml	0 – 260 (18)	80%	0 – 1900 (14)	58%
General Chemistry					
Alkalinity	mg/L	99 – 373 (289)	0%	213 – 375 (266)	0%
Chloride	mg/L	1 – 330 (10)	6%	4 – 364 (85)	25%
Colour	TCU	2 – 13 (5)	50%	2 – 30 (6)	50%
Dissolved Organic Carbon	mg/L	1.3 – 5.2 (2.7)	6%	1.4 – 7.4 (2.7)	8%
Nitrite	mg/L	<0.1 – <0.1 (<0.1)	0%	<0.1 – <0.1 (<0.1)	0%
Nitrate	mg/L	0 – 1.45 (0)	0%	0.22 – 3.64 (0.45)	0%
Sulphate	mg/L	7 – 57 (26)	0%	9 – 68 (26)	0%
TDS	mg/L	211 – 1050 (422)	25%	318 – 1200 (490)	50%
Turbidity	mg/L	0.1 – 1.2 (0.4)	0%	0.2 – 8.4 (0.9)	17%
Hardness	mg/L	111 – 370 (320)	100%	204 – 546 (270)	100%
Sodium	mg/L	3 – 190 (15)	0%	3 – 219 (42)	17%
Iron	mg/L	0 – 0.26 (0.02)	6%	0.08 – 2.09 (0.4)	42%
Manganese	mg/L	0 – 0.15 (0)	19%	0.01 – 0.54 (0.01)	8%

*Shore wells not included;
ODWS: Ontario Drinking Water Standards, June 2003, Revised, 2006

Key observations from this comparison are as follows:

- bacteria were detected in approximately 80% of the wells, with *E. Coli* detected in 33% of drilled wells and 27% of dug/blasted wells; both dug/blasted and drilled wells appear susceptible to bacteria contamination;
- nitrates were not detected in any of the wells above the ODWS;
- well water is hard, with the greatest hardness and total dissolved solids being in drilled wells; drilled wells are more prone to high iron content (63% of wells) and high manganese (17% of wells) compared with dug/blasted wells;
- sodium and chloride concentrations above ODWS are common, especially in drilled wells; the origin of the sodium and chloride is expected to be predominantly natural; however, contamination from water softeners (elevated sodium) or road salt is possible for some situations; and,
- raw water turbidity is generally within ODWS for most wells.

5. DISCUSSION

5.1 Vulnerability of Private Well Supply

Residences, businesses and farms in the vicinity of the Project use groundwater as their water supply. In most cases, the wells are also used for potable purposes, with some exceptions (such as irrigation use only). The utilized fractured limestone aquifer can be considered as unconfined, and in most areas, is not overlain by protective low permeability deposits. Furthermore, survey results indicate that many of the wells are of the dug/blasted type and will therefore be recharged by shallow groundwater. As a result of all these factors, the wells in the area of the Project are deemed to be susceptible to contamination from land use activities that would discharge chemicals to the ground surface or potentially increase suspended solids that would enter into the aquifer via shallow fractures. Susceptibility of the well to contamination will depend on individual well construction such as placement and condition of annular seals, and proximity of the well to the source of contamination.

As is evident by the water quality testing, many of the wells show evidence of contamination from human or animal source bacteria. Approximately 27% of the dug wells and 33% of the drilled wells contained *E. Coli*. The data supports the conclusion that the wells are in a vulnerable aquifer and well water is susceptible to contamination from surface activities. Common sources of bacterial contamination in rural areas include discharges from septic systems and the storage/application of agricultural source material (e.g., manure fertlizer, barnyards etc.).

5.2 Assessment of Water Quality Impacts from proposed Project Activities

An assessment of potential water quality impacts from the proposed Project was performed for both the construction and operation/maintenance project aspects. A detailed assessment of potential negative effects, mitigation strategies, monitoring plan and contingency measures is presented in the Draft Design and Operations Report (AMEC, 2012a) and the Draft Construction Plan Report (AMEC, 2012b). A review of particular Project related activities that may pose a risk to groundwater and an assessment of the significance of these risks is discussed in the sections below.

5.2.1 Design and Operation Activities

PV Panel Foundation Supports

The design of the solar installation will involve the construction of numerous solar panel support foundations that will extend to, or be embedded into, the limestone bedrock. Conservation Authority staff stated that some members of the local Source Protection Committee are concerned that the placement of foundations may increase the vulnerability of the aquifer. The expressed concern is that the placement of closely set support columns or foundation support anchors (depending on construction design chosen) may increase fracturing of the shallow bedrock, and that these fractures may enhance contaminant migration into the subsurface.

Dillon assessed this concern through the review of geological information and the preliminary design plans of the foundation footings supplied by Kingston Solar LP (reprinted in **Appendix A**). Design plans indicate that three potential types of footing supports are being considered. Kingston Solar LP stated that the type of foundation used will be decided by the contractor. The three potential foundations types are as follows.

Foundation Option 1: Overburden will be excavated to bedrock and the rock surface leveled with lean concrete prior to the placement of a concrete pad foundation. The foundation will be backfilled with compacted fill.

Foundation Option 2: Concrete foundation will be fastened to the bedrock surface with four anchors at each corner of the foundation. The annular space around the anchors and the bedrock would be filled with lean concrete.

Foundation Option 3: Asteel support post will be embedded into the bedrock. The post would penetrate the top 2 m of the bedrock, and will be cemented in place with grout.

Analysis of the potential impacts to groundwater quality was performed by considering whether the foundation design would increase the vulnerability of the aquifer compared with pre-existing conditions. For Option 1, the removal of the soil to the bedrock would cause a temporary increase in vulnerability, as the overburden provided a partial level of protection, albeit small because of its

limited thickness. The increase in aquifer vulnerability would be mitigated by backfilling of the excavation with compacted fill. Option 2 involves the installation of foundation anchors into the top portion of the bedrock surface, which could cause additional fracturing. Since the design requires that the cavities in the bedrock surface be filled with neat concrete, many of the shallow fractures would likely be sealed. Option 3 involves drilling/blasting a hole into the bedrock, which could cause additional fracturing along the edges of the hole. The risk of these fractures posing as potential groundwater flow pathways is deemed low as the hole is filled with grout that would seal the fractures. Regardless of the foundation option chosen, the risk of significantly increasing the vulnerability of the aquifer is deemed low when considering that the portion of the bedrock aquifer (top 2 m) that is affected during foundation construction is already heavily fractured. While it is reasonable to assume that the construction of the foundation may introduce new fractures, the incremental effect of these fractures on the vulnerability of the aquifer is considered small. Furthermore, considering that the operation of the solar installation will not involve the use of chemicals, pesticides or fuels, the potential incremental increase in fractures of the top portion of the bedrock surface will not result in an increased risk of groundwater contamination.

Sewage Disposal – Operations Building

The operations building will include a septic tank for holding of sanitary wastes from the washrooms and kitchen. Wastes will be removed by a licensed waste hauler. The septic tank will be equipped with a monitoring system and high level alarm. Considering that there is no potable water wells within 100 m of the proposed operations building, impacts to neighbouring water supplies from accidentals leaks/spills from the holding tank is not anticipated.

Waste Generation

The Draft Design and Operations Report (AMEC, 2012a) states that no significant quantities of wastes will be generated. Waste materials would be primarily limited to materials generated during maintenance activities such as batteries and minor amounts of domestic waste. For these wastes, a site-specific waste collection and disposal management plan will be implemented during operation. No adverse impacts are expected to nearby potable water supplies based on waste generation activities at the facility.

Storm Water Management

Increased sediment loading to the shallow portions of the aquifer as a result of erosion and runoff is identified as a potential concern if no mitigative actions are taken. As a result of the shallow fractured rock aquifer, potable wells in close proximity (< 100 m) to areas of erosion and sediment laden storm water may be susceptible to turbidity impact. A Draft Stormwater Management (SWM) Plan (AMEC, 2012c) has been developed for runoff control for the project. As part of this plan, mitigative actions have been identified to improve the quality of stormwater runoff by the inclusion of grassed filter strips. Areas under and within the panel array blocks will be seeded with grass that will also act as filter strips to improve run-off quality. The Draft Design and Operations Report also includes regular monitoring of the drainage system to ensure that erosion is not occurring and to mitigate detected issues in a timely manner. Once the mitigative actions identified in these reports are applied, together with implementation of additional mitigation actions recommended in **Section 5.2.2** of the current report, no significant potential for impacts to nearby water wells from storm water management are expected.

Contamination from Chemical/Fuel Usage/Accidental Releases

With the exception of transformer oil fluids associated with the substation, bulk storage of fuels or chemicals will not occur. Mitigative strategies identified in the Draft Design and Operations report include: a) implementation of an Emergency Response and Communications Plan to minimize spill impact and b) provision of secondary containment for the substation transformer that will allow detection of leaks. Once the mitigative actions are applied, no significant impacts to nearby potable water wells are identified.

Cleaning of the PV modules may be occasionally required. Cleaning will use potable water from off-site sources and not use chemical cleaners. As a result, no potential effects to groundwater are identified.

Weed control will be limited to removal of noxious weeds by manual or other means. No widespread application of herbicides is planned. Overall, no impacts to nearby potable water wells from weed control are identified.

5.2.2 Construction Activities

Impacts from Accidental Fuel Spillage/Releases from Equipment

Mitigative actions to prevent adverse impacts from accidental fuel spillage from equipment will be identified in the Construction and Emergency Response and Communication Plan. This plan will be implemented by the contractor as part of the construction contract (AMEC, 2012b). This plan requires that spills are cleaned up in an effective and timely manner. Procedures to ensure appropriate storage/handling/transportation of wastes generated during construction will be detailed in a Hazardous and Non-Hazardous Waste Management Plan (AMEC, 2012b).

In addition to the identified mitigative measures, we recommend no equipment refueling, or vehicle/equipment/machinery storage to occur within 100 m of a potable water well

Impacts from Stormwater Run-off

Potential water quality impacts could occur from increased erosion and sediment loading to temporary drainage areas during construction where bedrock is shallow, or excavation activities expose bedrock surfaces. Sediment containing runoff may potentially enter fractures, and could cause turbidity problems to wells in close proximity to the construction zone. The Draft Construction Plan Report (AMEC, 2012b) identifies an erosion and sediment control program that will be implemented to alleviate run-off related issues during construction.

In addition to the identified mitigative measures, we recommend that temporary stockpiles of soil not be placed within 100 m of water wells. Furthermore, run-off water should not be allowed to pond within 100 m of water well.

Impacts to Bedrock from Foundation Construction

The construction method that will be used to anchor the foundations of the PV module panels will be selected by the contractor. Should controlled blasting be selected as a construction option, it is recommended that this method not be used within 100 m of a water well. Blasting near water wells could result in opening new fractures in the bedrock, and change groundwater flow patterns to the well, resulting in potential changes to well yield and/or quality.

Waste Generation

As stated in the Draft Construction Plan Report, minor quantities of waste materials will be generated during construction such as packaging, pallets and scrap metal. Quantities of non-hazardous wastes and domestic waste will be removed to a licensed landfill. Minor amounts of hazardous waste that are generated by construction equipment maintenance will be stored in a secured area and removed by a licensed waste contractor. Washroom facilities for the construction crews will be portable and wastes removed by a licensed waste hauler. As a result of these mitigative actions, no potential negative effects to water wells from waste generation during construction is identified.

6. PROPOSED MONITORING AND CONTINGENCY PROGRAM

The following monitoring and contingency program is identified during the construction and operation phases of the Project. This program is specific to addressing potential impacts associated with groundwater quality to the nearby water wells. Additional information on mitigative and monitoring activities is presented in the Draft Design and Operations Report (AMEC, 2012a) and the Draft Construction Plan Report (AMEC, 2012b).

6.1 Construction Phase

The following monitoring program is recommended during construction:

- implementation of all monitoring and reporting activities identified in the Draft Construction Plan Report (AMEC, 2012b);
- ongoing monitoring of runoff conditions should be performed to ensure that runoff water not be allowed to pond within 100 m of nearby private wells;
- well water samples should be taken from all private wells located within 100 m of the active construction area. Samples should be analyzed for the same parameters as obtained during the baseline sampling program (conducted summer, 2012); analytical results should be provided to the homeowner; and,
- a qualified person should assess the sampling results to determine if there is evidence of unacceptable water quality degradation from construction activities; should such conditions exist, Kingston Solar LP should implement the protocols listed below under the Complaint Resolution and Contingency Plan.

6.2 Operations Phase

The need and extent of monitoring during operation will be based on further consultation with the MOE. It is our understanding the MOE (Approvals) has recently required groundwater monitoring programs to be implemented as a condition of approval on some large-scale solar projects in Ontario (e.g., Grand Renewal Energy Park – solar component). For the Grand Renewal Energy Park (Solar), the required monitoring program includes the installation of monitoring wells upgradient and downgradient of the solar installations, and monitoring of water quality and water levels for two years following construction. Monitoring of residential wells in the immediate vicinity of the solar infrastructure is also required.

6.3 Complaint Resolution and Contingency Plan

In the event that a complaint arises during the construction or operation of the Kingston Solar LP facility, it is recommended that the following contingency plan be implemented. This plan is based on input from the Eastern Regional MOE Office. We recommend that the contingency plan be adaptive in nature, as the course of action will depend upon the specific situation and severity of the identified issue. As a minimum, the contingency plan will include the following:

- a water sample will be obtained from the well water in question and submitted as "high priority" to a qualified laboratory; the data will be assessed by a qualified person, and if the problem is to be related to construction or operation activities at the site, then bottled water will be immediately provided to the impacted party;
- the MOE will be notified of any complaints and provided with an action plan to address these complaints; the action plan will be based on the nature and severity of the complaint; discussions will be held with MOE staff to confirm the appropriate frequency and duration of water quality testing for the affected well;
- implementation of the agreed upon monitoring program will occur and the results will be provided to the homeowner and the MOE; and,
- depending upon the outcome of the investigation, an alternate water supply will be provided to the affected property owner, as required.

7. SUMMARY AND CONCLUSIONS

The following conclusions are made based on the results of this study.

1) The proposed Project site is located in an area of high aquifer vulnerability. The MOE requires that as part of the REA approval, solar projects located in sensitive groundwater environments undergo a groundwater assessment. This assessment includes sampling a select number of private wells in the proposed area of the Project and developing a contingency program to address any future groundwater complaints from adjacent water users.

2) To address the requirements of the MOE, a water well sampling program was implemented. Design of the program was based on consultation with the MOE Eastern Regional office. The Cataraqui Region Conservation Authority was also consulted regarding the program. The sampling program focused on taking raw water quality samples from a select number of private wells that are within 500 m of the proposed Project area. This information was collected to assess the baseline groundwater conditions prior to construction.

3) A total of 60 addresses were contacted by letter, telephone or in person to request participation in the sampling program. Of the 60 contacted addresses, samples were collected from 32 addresses. The remaining 28 properties contacted could not be sampled because they either declined sampling, were not home/unavailable for sampling, or did not use a well for their potable water supply. Collected water samples were tested for general chemistry, select metals and bacteria and the results compared to the Ontario Drinking Water Standards. A homeowner survey was also completed at the time of the water sampling.

4) Raw water quality testing results indicated that the groundwater conditions are susceptible to contamination from land use activities. Approximately 80% of the tested wells contained bacterial contamination in excess of the Ontario Drinking Water Standards. Elevated hardness, iron, chloride and sodium were also detected; however, many of these parameters are expected to have a natural origin.

5) An assessment of water quality risk from the construction and operation of the Project was performed. Assessed activities included construction of foundation supports, sewage disposal, waste generation, stormwater management and chemical/fuel management. Mitigative actions previously outlined in the Draft Design and Operations Report (AMEC, 2012a) and the Draft Construction Plan Report (AMEC, 2012b) were highlighted. Additional mitigation actions specific to the protection of water wells were identified. The most significant risk identified was the potential introduction of sediment into the shallow fractures of the bedrock during construction as a result of storm runoff. The risk relates to potential increasing of turbidity in wells that are close (within 100 m) of the construction zone. Identified mitigative actions to reduce this risk (beyond those identified in the Construction Report) include restricting temporary stockpiling of soils and not allowing runoff water to pond within 100 m of water wells.

6) Based on the results of this assessment, a monitoring and contingency program was developed. The monitoring program should follow those activities outlined in the Draft Construction Plan Report and Draft Design and Operations Report such as monitoring for erosion. The monitoring program should include water quality testing of water wells that are in close proximity (within 100 m) of the construction activities during the active construction phases. The need for long term operational monitoring will be based on future consultation with the MOE.

7) A contingency program is identified for any well water complaints that may arise during the construction and operation of the facility. This contingency program includes notification and reporting requirements, assessment of the complaint by a qualified engineer or geoscientist, and the requirement to provide a temporary source of potable water to the complainant should the solar facility be identified as the cause of the well water quality issue.

8. LIMITATIONS

This report was prepared exclusively for the purposes, project and site location outlined in the report. The report is based on information provided to, or obtained by Dillon Consulting Limited (Dillon) as indicated in the report, and applies solely to site conditions existing at the time of the site investigation.

This report was prepared by Dillon for the sole benefit of Kingston Solar LP. The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party (i.e., a party other than our Client) makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

9. REFERENCES

AMEC, 2012a, Kingston Solar LP Sol-Luce Kingston, Solar PV Energy Project, Draft Design and Operations Report, 2012.

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FIGURES

KINGSTON SOLAR LP
WATER WELL SAMPLING PROGRAM

PROJECT LOCATION
FIGURE 1

- HIGHWAYS
- ARTERIAL ROADS
- CANADA/USA BORDER
- LEASED PROPERTIES
- WOODED AREA
- WATERBODY
- MUNICIPAL BOUNDARIES

0 1 2 4 km

SCALE 1:300,000

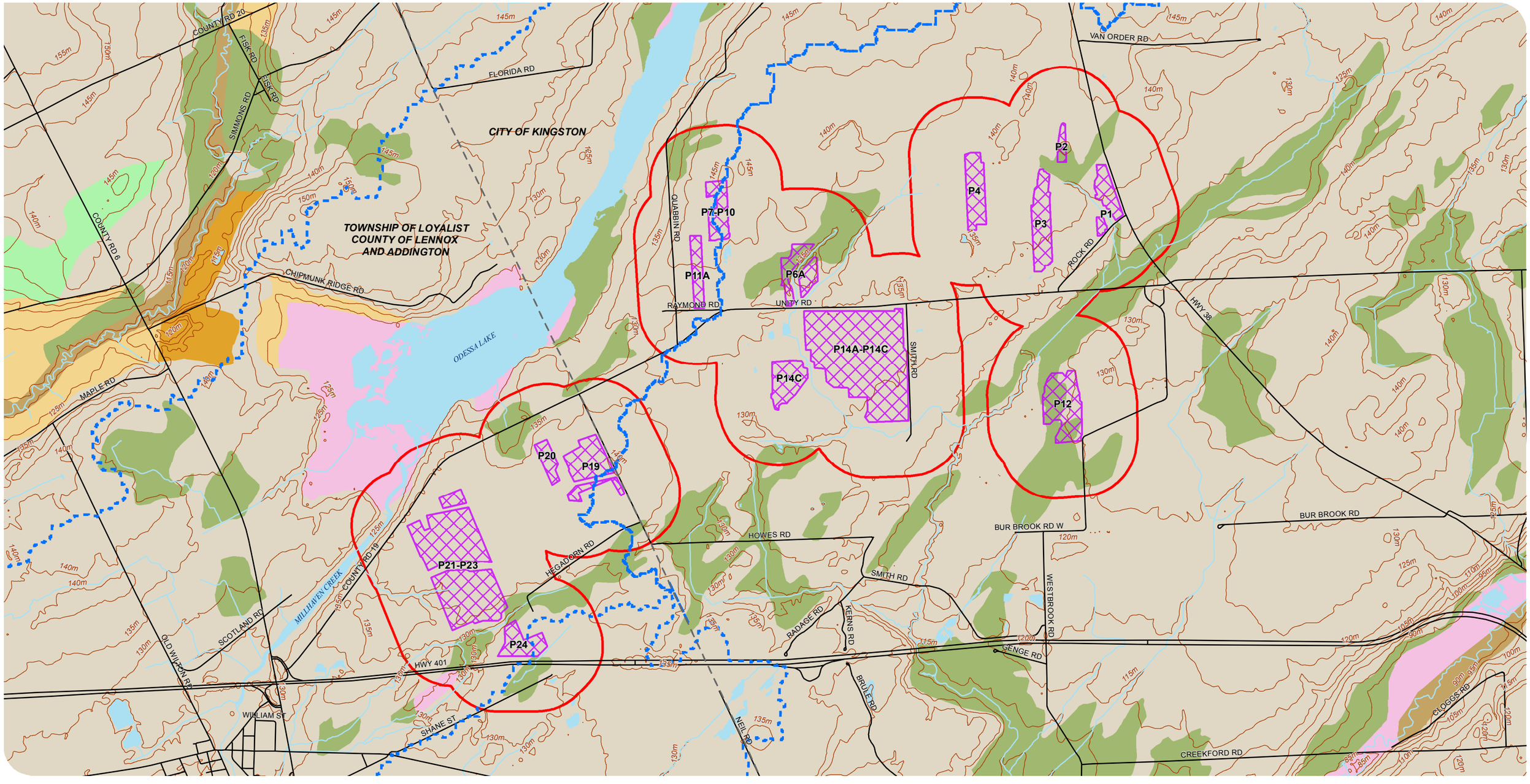
MAP DRAWING INFORMATION:
DATA PROVIDED BY MNR

MAP CREATED BY: PFM
MAP CHECKED BY: DB
MAP PROJECTION: NAD 1983 UTM Zone 18N

G:\GIS\126428 Kingston Solar\GIS Data\Design\Mxd
Name: Figure 1 - Key Plan.mxd

DILLON CONSULTING

PROJECT: 12-6428
STATUS: FINAL
DATE: 07/24/12



KINGSTON SOLAR LP
WATER WELL SAMPLING PROGRAM

SURFICIAL GEOLOGY
FIGURE 2

ROADS
WATERCOURSE
TOPOGRAPHY (MASL)
SOLAR PANEL AREA
SOLAR PANEL AREA 500M BUFFER
WATERBODY
3: LIMESTONE BEDROCK
5B: SILTY TO SANDY TILL
7A: SANDY DEPOSITS
7B: GRAVELLY DEPOSITS
8A: SILTY CLAY
19: MODERN ALLUVIAL DEPOSITS
20: ORGANIC DEPOSITS
WATERSHED BOUNDARY
MUNICIPAL BOUNDARY

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNR

MAP CREATED BY: PFM
MAP CHECKED BY: DB
MAP PROJECTION: NAD 1983 UTM Zone 18N

0 0.25 0.5 1 km

SCALE 1:33,000

N W E S

G:\GIS\126428 Kingston Solar\GIS Data\Design\Mxd
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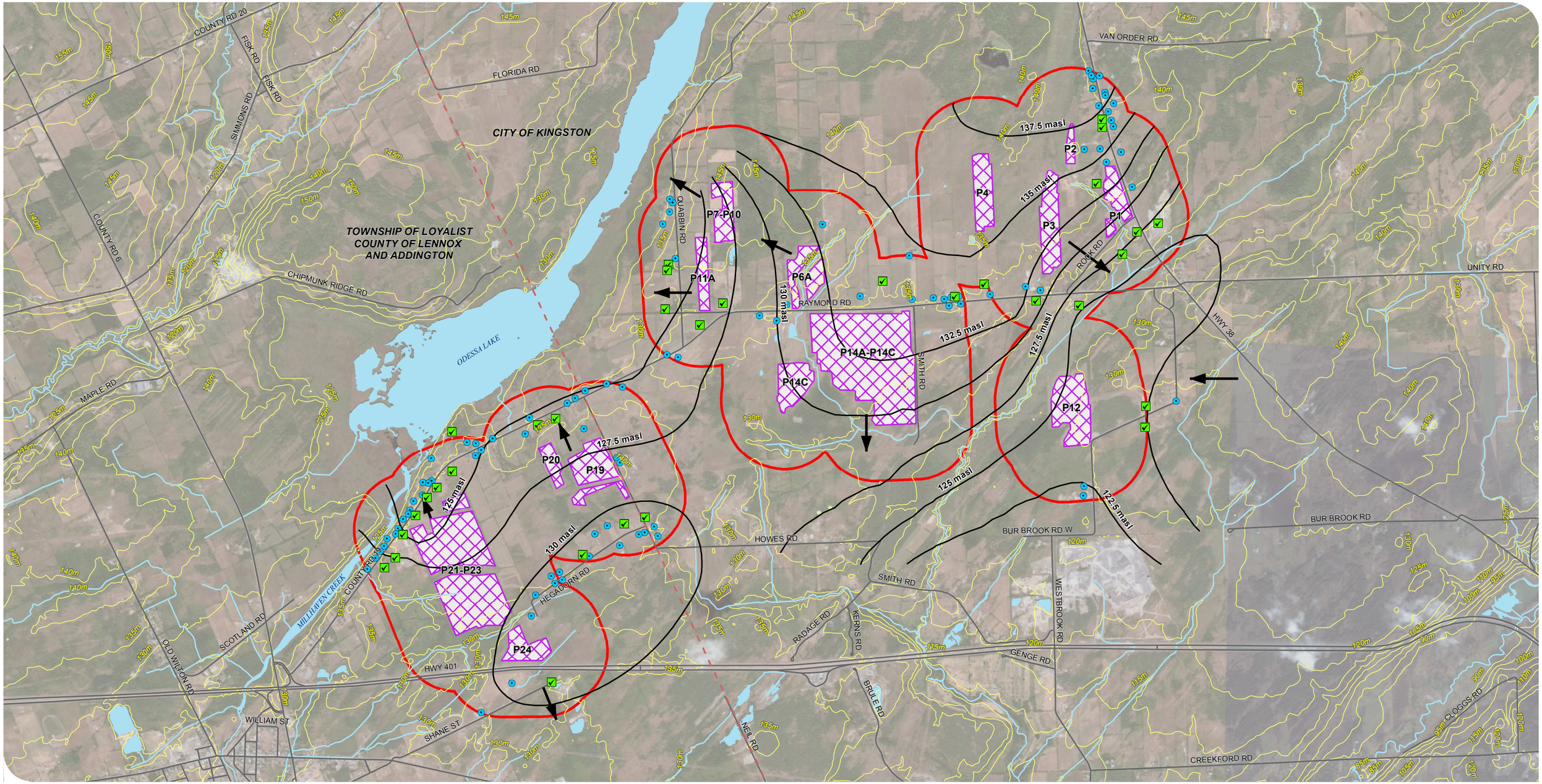
PROJECT: 12-6428 STATUS: FINAL DATE: 07/24/12



KINGSTON SOLAR LP
WATER WELL SAMPLING PROGRAM

PRIVATE WELL SAMPLING LOCATIONS
FIGURE 3

- WELL SAMPLED
- OTHER POTENTIAL WELL LOCATION (NOT SAMPLED)
- ESTIMATED DEEP GROUNDWATER FLOW DIRECTION
- ESTIMATED POTENTIOMETRIC SURFACE ELEVATION *
- ROADS
- WATERCOURSE
- TOPOGRAPHY
- SOLAR AREA
- SOLAR PANEL 500M BUFFER
- WATERBODY
- MUNICIPAL BOUNDARY

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNR

MAP CREATED BY: PFM
MAP CHECKED BY: DB
MAP PROJECTION: NAD 1983 UTM Zone 18N

* FROM GROUNDWATER VULNERABILITY ASSESSMENT REPORT (DILLON, 2008)

0 0.25 0.5 1 km

SCALE 1:33,000

G:\GIS\126428 Kingston Solar\GIS Data\Design\Mxd\Revised Report\
Name: Figure 3 - Private Well Sampling Locations (Public).mxd

PROJECT: 12-6428 STATUS: FINAL DATE: 09/13/12

TABLES

Table 1: Sampling Program
Kingston Solar LP, Kingston, Ontario

Site No.#	Current Status
1	Sampled
2	Sampled
3	Sampled
4	Sampled
7	Sampled
10	Sampled
13	Sampled
14	Sampled
17	Sampled
19	Sampled
23	Sampled
25	Sampled
26	Sampled
29	Sampled
30	Sampled
32	Sampled
33	Sampled
34	Sampled
35	Sampled
37	Sampled
38	Sampled
40	Sampled
41	Sampled
45	Sampled
46	Sampled
47	Sampled
48	Sampled
49	Sampled
50	Sampled
66	Sampled
67	Sampled
68	Sampled
22	Sampled
8	No Sample Taken - no well
31	No Sample Taken - no well
39	No Sample Taken - no well
42	No Sample Taken - no well
5	Attempted - Not available
11	Attempted - Not available
18	Attempted - Not available
20	Attempted - Not available
36	Attempted - Not available
44	Attempted - Not available
60	Attempted - Not available
61	Attempted - Not available
62	Attempted - Not available
63	Attempted - Not available
69	Attempted - Not available
70	Attempted - Not available
4	Declined
6	Declined
9	Declined
12	Declined
16	Declined
21	Declined
24	Declined
28	Declined
43	Declined
64	Declined
65	Declined

Table 2: Well Water Quality Results
Kingston Solar LP, Kingston, Ontario

Site	Ontario Drinking Water Standard	Units	Method Detection Limint	1	2	3	7	10	13	14
Address										
Lab ID				964807	963966	964470	964122	964468	964651	964078
Sample Date				16-Jun-12	11-Jun-12	13-Jun-12	12-Jun-12	13-Jun-12	14-Jun-12	13-Jun-12
Solar Area				P7 & P11	P7 & P11	P7 & P11	P4	P1	P2	P3
Well position relative to panels				downgradient	downgradient	downgradient	cross gradient	dowgradient	upgradient	downgradient
Well Depth (m)				8	7.62	3.7	5.2	unknown	~30	unknown
Construction				dug	dug	dug	dug	unknown	drilled	drilled
Microbiological										
Sample ID:				964665	964289	969339	969340	964074	969346	969350 -a
Sample Date:				16-Jun-12	15-Jun-12	4-Jul-12	4-Jul-12	13-Jun-12	4-Jul-12	4-Jul-12
E. Coli	0 (MAC)	cts/100ml	0	0	**12**	0	0	<2***	0	0/0**
Total Coliforms	0 (MAC)	cts/100ml	0	0	**230**	**32**	**144**	<2***	**6**	**2/0****
General Chemistry & Inorganics										
Alkalinity as CaCO3	30-500 (OG)	mg/L	5	284	292	330	277	237	335	375
Chloride	250 (AO)	mg/L	1	14	6	196	17	36	**340**	**348**
Colour	5 (AO)	TCU	2	**9**	2	2	**6**	**14**	2	4
Conductivity	NV	uS/cm	5	621	566	1300	587	565	1810	1840
Dissolved Organic Carbon	5 (AO)	mg/L	0.5	3.3	1.7	1.3	3.6	**5.1**	2.2	1.9
N-NH3 (Ammonia)	NV	mg/L	0.02	<0.02	<0.02	<0.02	0.08	0.07	0.12	0.13
N-NO2 (Nitrite)	1 (MAC)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	10 (MAC)	mg/L	0.1	<0.10	<0.10	1.11	0.36	<0.10	<0.10	0.22
pH	6.5 - 8.5 (OG)	NV	NV	7.88	7.83	7.92	8.02	7.92	7.97	7.85
Sulphate	500 (AO)	mg/L	3	24	18	45	16	10	68	50
Total Dissolved Solids (COND - CALC)	500 (AO)	mg/L	1	404	368	**845**	382	367	**1180**	**1200**
Turbidity	5 (AO)	NTU	0.1	0.3	0.1	0.2	0.8	0.2	4.0	0.3
Hardness as CaCO3	80-100 (OG)	mg/L	1	<1	**272**	**345**	**257**	**238**	**383**	**546**
Calcium	NV	mg/L	1	<1	86	105	83	79	112	138
Magnesium	NV	mg/L	1	<1	14	20	12	10	25	49
Potassium	NV	mg/L	1	<1	<1	1	2	2	5	6
Sodium	200 (AO)	mg/L	2	146	8	121	16	22	210	160
Iron	0.3 (AO)	mg/L	0.03	<0.03	<0.03	<0.03	0.15	0.08	**0.44**	0.08
Manganese	0.05 (AO)	mg/L	0.01	<0.01	<0.01	<0.01	0.03	<0.01	0.01	0.01

Notes

*	Analyzed by Health Unit; ** - duplicate.
ODWS	Ontario Drinking Water Standards, June 2003 (revised 2006): Operational Guidelines (OG); Aesthetic Objecctive (AO) Maximum Allowable Concentration (MAC)
0.09	Value exceeds ODWS
n/a	not available; *** - detection limit exceeds ODWS
NV	no value

Table 2: Well Water Quality Results
Kingston Solar LP, Kingston, Ontario

Site	Ontario Drinking Water Standard	Units	Method Detection Limint	17	19	22	23	23	25	26
Address										
Lab ID				964808	963970	963969	963971	963972	964124	964467
Sample Date				16-Jun-12	11-Jun-12	11-Jun-12	11-Jun-12	11-Jun-12	12-Jun-12	13-Jun-12
Solar Area				P19 & P20	P19 & P20	P21 to P24	P21 to P24	P21 to P24	P21 to P24	P21 to P24
Well position relative to panels				downgradient	downgradient	downgradient	downgradient	downgradient	downgradient	downgradient
Well Depth (m)				30	7.3	unknown	6	6	30	7.3
Construction				drilled	dug	Shore Well	dug	dug	drilled	dug
Microbiological										
Sample ID:				964666	964667	964292	964293	n/a	969580	969340
Sample Date:				16-Jun-12	16-Jun-12	15-Jun-12	15-Jun-12	n/a	5-Jul-12	4-Jul-12
E. Coli	0 (MAC)	cts/100ml	0	0	0	**117**	0	n/a	**100**	0
Total Coliforms	0 (MAC)	cts/100ml	0	0	**6**	**550**	0	n/a	**1000**	**2**
General Chemistry & Inorganics										
Alkalinity as CaCO3	30-500 (OG)	mg/L	5	266	239	176	373	371	303	290
Chloride	250 (AO)	mg/L	1	132	3	18	6	6	207	1
Colour	5 (AO)	TCU	2	**8**	4	**40**	2	3	**10**	3
Conductivity	NV	uS/cm	5	989	490	390	732	731	1360	554
Dissolved Organic Carbon	5 (AO)	mg/L	0.5	3.6	1.6	**8.3**	3.0	2.8	3.4	2.0
N-NH3 (Ammonia)	NV	mg/L	0.02	0.51	<0.02	0.06	0.03	0.03	<0.02	0.06
N-NO2 (Nitrite)	1 (MAC)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	10 (MAC)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	3.64	<0.10
pH	6.5 - 8.5 (OG)	NV	NV	7.99	7.89	7.90	7.63	7.71	8.13	7.93
Sulphate	500 (AO)	mg/L	3	34	26	5	36	36	47	21
Total Dissolved Solids (COND - CALC)	500 (AO)	mg/L	1	**643**	318	254	476	475	**884**	360
Turbidity	5 (AO)	NTU	0.1	1.1	0.1	1.3	0.3	0.3	1.8	0.4
Hardness as CaCO3	80-100 (OG)	mg/L	1	**276**	**246**	**158**	**341**	**349**	**349**	**284**
Calcium	NV	mg/L	1	79	92	50	112	115	120	89
Magnesium	NV	mg/L	1	19	4	8	15	15	12	15
Potassium	NV	mg/L	1	10	<1	1	2	2	6	4
Sodium	200 (AO)	mg/L	2	66	3	12	16	15	131	10
Iron	0.3 (AO)	mg/L	0.03	0.21	<0.03	**0.45**	0.04	0.05	0.14	0.11
Manganese	0.05 (AO)	mg/L	0.01	<0.01	<0.01	**0.09**	**0.15**	**0.15**	0.01	0.05

Notes

*	Analyzed by Health Unit; ** - duplicate.
ODWS	Ontario Drinking Water Standards, June 2003 (revised 2006): Operational Guidelines (OG); Aesthetic Objecctive (AO) Maximum Allowable Concentration (MAC)
0.09	Value exceeds ODWS
n/a	not available; *** - detection limit exceeds ODWS
NV	no value

Table 2: Well Water Quality Results
Kingston Solar LP, Kingston, Ontario

Site	Ontario Drinking Water Standard	Units	Method Detection Limint	29	30	32	33	34	35	37
Address										
Lab ID				964809	964079	964468	964655	963967	964125	964120
Sample Date				16-Jun-12	13-Jun-12	13-Jun-12	14-Jun-12	11-Jun-12	12-Jun-12	12-Jun-12
Solar Area				P21 to P24	P12	P19 & P20	P1	P1	P2	P21 to P24
Well position relative to panels				cross gradient	upgradient	downgradient	downgradient	downgradient	downgradient	downgradient
Well Depth (m)				3	6 to 11	3	21	6	11	unknown
Construction				shore well	drilled	dug	drilled	dug	drilled	dug
Microbiological										
Sample ID:				964668	969341	969343	n/a	964290	969352	969344
Sample Date:				16-Jun-12	4-Jul-12	4-Jul-12	6-Jun-12	15-Jun-12	4-Jul-12	4-Jul-12
E. Coli	0 (MAC)	cts/100ml	0	**78**	0/0**	0	0*	**2**	0	0
Total Coliforms	0 (MAC)	cts/100ml	0	**420**	0/0**	**60**	**5***	**81**	0	**1**
General Chemistry & Inorganics										
Alkalinity as CaCO3	30-500 (OG)	mg/L	5	174	240	224	213	265	216	287
Chloride	250 (AO)	mg/L	1	17	4	1	62	**330**	20	2
Colour	5 (AO)	TCU	2	**58**	**6**	**13**	**30**	5	**21**	2
Conductivity	NV	uS/cm	5	386	496	429	620	1620	489	563
Dissolved Organic Carbon	5 (AO)	mg/L	0.5	**8.4**	3.0	4.3	**7.4**	2.2	4.2	1.7
N-NH3 (Ammonia)	NV	mg/L	0.02	0.09	0.04	0.05	0.14	<0.02	0.06	0.03
N-NO2 (Nitrite)	1 (MAC)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	10 (MAC)	mg/L	0.1	<0.10	<0.10	0.49	<0.10	0.57	<0.10	<0.10
pH	6.5 - 8.5 (OG)	NV	NV	8.05	7.97	7.68	8.10	7.72	8.09	8.10
Sulphate	500 (AO)	mg/L	3	4	24	7	11	57	13	22
Total Dissolved Solids (COND - CALC)	500 (AO)	mg/L	1	251	322	279	403	**1050**	318	366
Turbidity	5 (AO)	NTU	0.1	1.9	3.4	1.2	0.7	0.4	**6.8**	0.6
Hardness as CaCO3	80-100 (OG)	mg/L	1	**153**	**233**	**229**	**204**	**344**	**216**	**302**
Calcium	NV	mg/L	1	54	78	82	67	123	75	98
Magnesium	NV	mg/L	1	10	10	6	9	9	7	14
Potassium	NV	mg/L	1	2	2	3	2	1	1	2
Sodium	200 (AO)	mg/L	2	12	3	<2	37	190	12	4
Iron	0.3 (AO)	mg/L	0.03	**1.13**	**1.51**	0.26	**0.37**	<0.03	**2.09**	0.15
Manganese	0.05 (AO)	mg/L	0.01	**0.08**	0.01	0.02	0.03	<0.01	**0.54**	**0.08**

Notes

*	Analyzed by Health Unit; ** - duplicate.
ODWS	Ontario Drinking Water Standards, June 2003 (revised 2006): Operational Guidelines (OG); Aesthetic Objecctive (AO) Maximum Allowable Concentration (MAC)
0.09	Value exceeds ODWS
n/a	not available; *** - detection limit exceeds ODWS
NV	no value

Table 2: Well Water Quality Results
Kingston Solar LP, Kingston, Ontario

Site	Ontario Drinking Water Standard	Units	Method Detection Limint	38	40	41	45	46	47	48
Address										
Lab ID				964810	964652	964123	963968	964121	964126	964811
Sample Date				16-Jun-12	14-Jun-12	12-Jun-12	11-Jun-12	12-Jun-12	12-Jun-12	16-Jun-12
Solar Area				P4	P21 to P24	P21 to P24	P19 & P20	P19 & P20	P7 & P11	P7 & P11
Well position relative to panels				downgradient	cross gradient	downgradient	downgradient	downgradient	downgradient	downgradient
Well Depth (m)				unknown	27	unknown	9 to 12	11	23	6.5
Construction				dug	drilled	unknown	drilled	drilled	drilled	dug
Microbiological										
Sample ID:				964669	969348	969353	964291	969354	969580	964670
Sample Date:				16-Jun-12	4-Jul-12	4-Jul-12	15-Jun-12	4-Jul-12	4-Jul-12	16-Jun-12
E. Coli	0 (MAC)	cts/100ml	0	**1**	**2**	0	**342**	0	**2**	0
Total Coliforms	0 (MAC)	cts/100ml	0	**260**	**14**	**2**	**1900**	**14**	**19**	**50**
General Chemistry & Inorganics										
Alkalinity as CaCO3	30-500 (OG)	mg/L	5	369	264	431	231	267	276	361
Chloride	250 (AO)	mg/L	1	22	7	**590**	19	5	109	16
Colour	5 (AO)	TCU	2	**7**	5	**7**	**6**	2	5	**6**
Conductivity	NV	uS/cm	5	784	571	2900	531	544	889	792
Dissolved Organic Carbon	5 (AO)	mg/L	0.5	**5.2**	2.7	4.9	1.4	2.5	2.7	3.0
N-NH3 (Ammonia)	NV	mg/L	0.02	<0.02	<0.02	0.05	<0.02	0.17	<0.02	0.03
N-NO2 (Nitrite)	1 (MAC)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	10 (MAC)	mg/L	0.1	0.31	0.45	<0.10	0.91	<0.10	<0.10	<0.10
pH	6.5 - 8.5 (OG)	NV	NV	8.00	7.99	7.98	7.83	8.10	8.03	7.92
Sulphate	500 (AO)	mg/L	3	27	32	73	23	23	9	51
Total Dissolved Solids (COND - CALC)	500 (AO)	mg/L	1	**510**	371	**1880**	345	354	**578**	**515**
Turbidity	5 (AO)	NTU	0.1	0.3	0.3	**8.1**	0.2	**8.4**	0.5	0.5
Hardness as CaCO3	80-100 (OG)	mg/L	1	**332**	**263**	**386**	**232**	**254**	**321**	**370**
Calcium	NV	mg/L	1	118	79	125	83	77	104	117
Magnesium	NV	mg/L	1	9	16	18	6	15	15	19
Potassium	NV	mg/L	1	5	<1	<1	2	4	2	3
Sodium	200 (AO)	mg/L	2	29	8	**388**	12	11	47	15
Iron	0.3 (AO)	mg/L	0.03	<0.03	<0.03	**1.07**	<0.03	**0.98**	<0.03	0.08
Manganese	0.05 (AO)	mg/L	0.01	<0.01	<0.01	**1.41**	<0.01	<0.01	<0.01	0.02

Notes

* Analyzed by Health Unit; ** - duplicate.

ODWS Ontario Drinking Water Standards, June 2003 (revised 2006):
Operational Guidelines (OG); Aesthetic Objecctive (AO)
Maximum Allowable Concentration (MAC)

0.09 Value exceeds ODWS

n/a not available; *** - detection limit exceeds ODWS

NV no value

Table 2: Well Water Quality Results
Kingston Solar LP, Kingston, Ontario

Site	Ontario Drinking Water Standard	Units	Method Detection Limint	49	50	66	67	68
Address								
Lab ID				964077	964076	964653	964654	964812
Sample Date				13-Jun-12	13-Jun-12	14-Jun-12	14-Jun-12	16-Jun-12
Solar Area				P21 to P24	P14	P3	P2	P12
Well position relative to panels				downgradient	upgradient	downgradient	upgradient	upgradient
Well Depth (m)				>3	unknown	unknown	14	10
Construction				dug	dug	dug	drilled	drilled
Microbiological								
Sample ID:				969345	969347	969356	969355	964671
Sample Date:				4-Jul-12	4-Jul-12	4-Jul-12	4-Jul-12	16-Jun-12
E. Coli	0 (MAC)	cts/100ml	0	**7**	0	0	0	0
Total Coliforms	0 (MAC)	cts/100ml	0	**18**	0	**1**	**1**	**6**
General Chemistry & Inorganics								
Alkalinity as CaCO3	30-500 (OG)	mg/L	5	275	335	99	326	223
Chloride	250 (AO)	mg/L	1	36	5	25	**364**	24
Colour	5 (AO)	TCU	2	**6**	**8**	2	2	**8**
Conductivity	NV	uS/cm	5	677	681	325	1830	510
Dissolved Organic Carbon	5 (AO)	mg/L	0.5	2.5	4.2	2.3	2.3	2.4
N-NH3 (Ammonia)	NV	mg/L	0.02	<0.02	0.04	<0.02	<0.02	0.02
N-NO2 (Nitrite)	1 (MAC)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	10 (MAC)	mg/L	0.1	1.45	0.31	0.27	0.40	<0.10
pH	6.5 - 8.5 (OG)	NV	NV	8.00	7.96	8.11	7.98	8.30
Sulphate	500 (AO)	mg/L	3	30	37	21	29	10
Total Dissolved Solids (COND - CALC)	500 (AO)	mg/L	1	440	443	211	**1190**	332
Turbidity	5 (AO)	NTU	0.1	0.2	0.4	0.5	0.2	0.3
Hardness as CaCO3	80-100 (OG)	mg/L	1	**320**	**325**	**111**	**356**	<1
Calcium	NV	mg/L	1	100	97	33	121	<1
Magnesium	NV	mg/L	1	17	20	7	13	<1
Potassium	NV	mg/L	1	1	7	1	1	<1
Sodium	200 (AO)	mg/L	2	9	15	13	**219**	120
Iron	0.3 (AO)	mg/L	0.03	<0.03	<0.03	0.11	<0.03	<0.03
Manganese	0.05 (AO)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

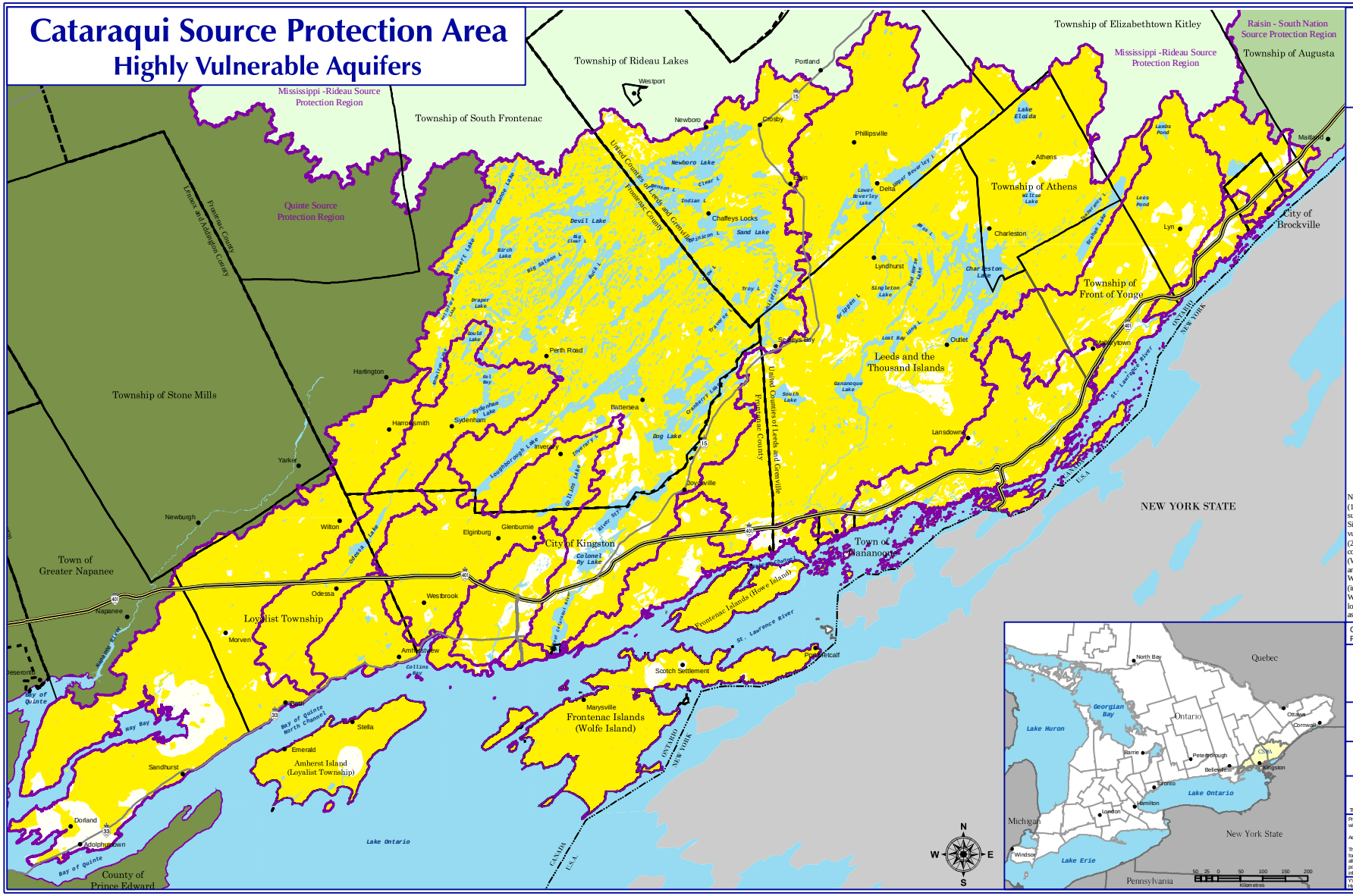
Notes

*	Analyzed by Health Unit; ** - duplicate.
ODWS	Ontario Drinking Water Standards, June 2003 (revised 2006): Operational Guidelines (OG); Aesthetic Objecctive (AO) Maximum Allowable Concentration (MAC)
0.09	Value exceeds ODWS
n/a	not available; *** - detection limit exceeds ODWS
NV	no value

APPENDIX A

BACKGROUND INFORMATION AND REGULATORY CORRESPONDENCE

Cataraqui Source Protection Area
Highly Vulnerable Aquifers



Map 5-1e

DRINKING WATER SOURCE PROTECTION

Legend

- International Boundary
- Upper Tier Municipalities
- Lower Tier Municipalities
- Communities
- Watersheds Boundary
- Waterbodies

Highly Vulnerable Aquifer - Vulnerability Scoring

6

Notes:
(1) The assessment of groundwater vulnerability that supports this map was undertaken on a Cataraqui-wide basis. Site-specific investigation is recommended to confirm the vulnerability of any given location.
(2) Local assessments of groundwater vulnerability were completed for each of the wellhead protection areas (WHPAs) in the Cataraqui area. The WHPAs are located around the Cana Well Supply (in Kingston), the Lansdowne Well Supply, and the Miller Manor Apartments Well Supply (in Mallorytown); in addition, part of the WHPA for the Westport Well Supply falls within the Cataraqui area. The local assessments for these WHPAs refine the Cataraqui-wide assessment that is shown on this map.

Created: August 20, 2009
Printed: February 23, 2011

Scale 1:330,000

0 1.5 3 6 9 12
Kilometres

Universal Transverse Mercator Projection
North American Datum 83

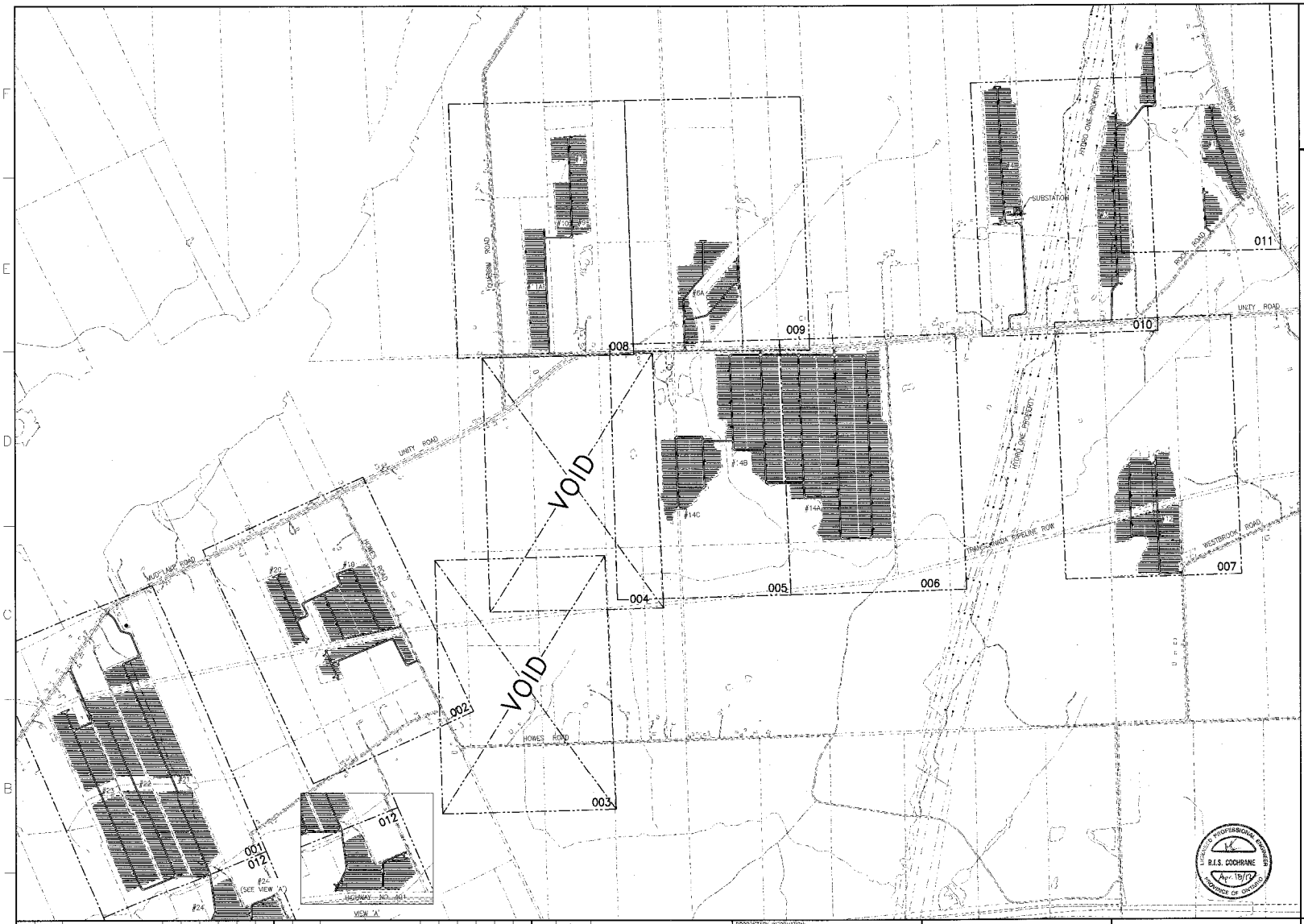
DILLON CONSULTING — August 2008

CATARAQUI Source Protection Area

Ontario

This map was funded by the Ontario Government, and the Ministry of Environment.

Y:\Base Data\Source Water\Maps\Assessment Report\Chapter 5\Map 5-1e Highly Vulnerable Aquifer



NOTES

1. BASE FILE PROPERTY LIMITS ARE APPROXIMATE ONLY AND ARE BASED ON AVAILABLE MAPPING AND MUNICIPAL DRAWINGS.
2. DEVELOPMENT AREA BOUNDARIES ARE BASED ON PRELIMINARY CONSTRAINTS AND ARE SUBJECT TO FINALIZATION OF REA STUDY.
3. PANEL SETBACK FROM PROPERTY LINES ASSUMED AT 10M FOR ACCESS AND MAINTENANCE.
4. MAIN ACCESS ROAD LAYOUT IS BASED ON 9.1M LONG MAINTENANCE VEHICLE.
5. UTM ZONE 18 N CSRS PROJECTION
6. ALL DRAWING SHEET REFERENCES SHOWN REFER TO DRAWING NOS. 168335-0002-L*0-0001-001 TO 011.
7. ALL FENCE AND GATE LOCATIONS ARE CONCEPTUAL AND SUBJECT TO FINAL ROAD AND PANEL LAYOUTS.

PROPERTY	AC POWER CAPACITY (MW)
1	3
1/2	1
3	5.5
4	1.5
5	–
6A	3
6B	–
7/9/10	3.5
11A	2.5
11B	–
12	6.5
13	–
14A	21
14B	8
14C	4
15	–
16	–
17	–
18	–
19	5
20	1
19/2C	1
21	9
22	5.5
23	8.5
24	3
TOTAL	93.5

PRELIMINARY

0m 100 200 300 400 500
1:10000

R.I.S. COCHRANE
Apr. 15/12
LICENCE OF PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

REV	DD/MMM/YY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP
J	15APR'12	RE-ISSUED FOR USE	SZ	RC			
2	13FEB'12	RE-ISSUED FOR USE	SZ	RC			
1	01FEB12	RE-ISSUED FOR USE	SZ	RC			
0	15DEC11	ISSUED FOR USE	SZ	RC	MP	SC	
G	09DEC11	ISSUED FOR CLIENT REVIEW	SZ	RC		SC	
C	30NOV11	ISSUED FOR CLIENT REVIEW	SZ	RC		SC	
B	14OCT11	ISSUED FOR CLIENT REVIEW	SZ	RC	MP	SC	
A	14OCT11	ISSUED FOR BOARD CHECK	SZ	RC	MP	SC	

REV	DD/MMM/YY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP

STAMP/SEAL

CONCEPTUAL DRAWING ONLY NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.
PROJECT PHASE: PRELIMINARY		
PROJECT NO.: 168335	ACTIVITY NO.:	
SCALE: 1:10000	PACKAGE CODE:	

	BY	DD/MMM/YY
DSN	R/RC	14OCT11
DRN	SZ	14OCT11
CHK	MP	14OCT11
APP	SC	14OCT11

KINGSTON SOLAR LP

AREA:

SUBJECT: SOL-LUCE KINGSTON ENERGY PROJECT GENERAL ARRANGEMENTS

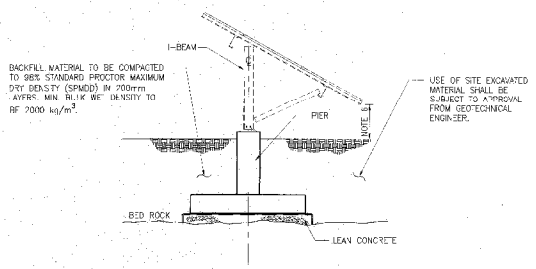
CLIENT DWG. NO.:

DRAWING NO.: 168335-0002-121-CAD-0001-001

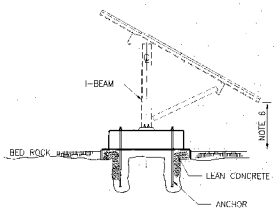
REV.: 3

amec

SAVED: 16-Apr-12 3:48 PM PLOTTED: 16-Apr-12 3:52 PM USER: SHABOUNI, PALMIR



SECTION A
NTS



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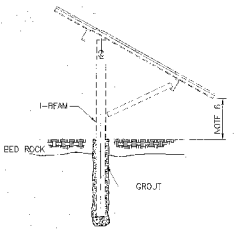
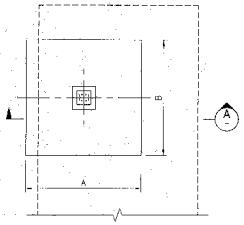
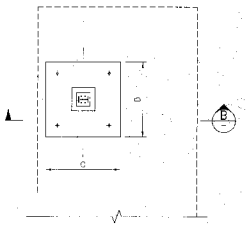


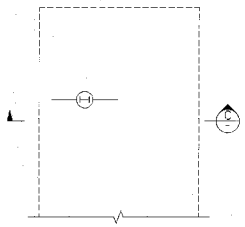
SECTION C
NTS



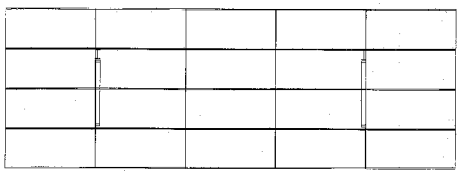
FOUNDATION OPTION 1 – PLAN
NTS



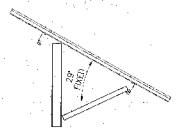
FOUNDATION OPTION 2 – PLAN
NTS



FOUNDATION OPTION 3 – PLAN
NTS



PLAN VIEW
NTS



SIDE VIEW
NTS

RACKING ARRANGEMENT

NOTES

1. ROCK SURFACE SHALL BE CLEANED UP AND LEVELLED WITH LEAN CONCRETE.
2. UNDISTURBED TILL OR ENGINEERED FILL CAN BOTH BE BEARING SOIL.
3. TOP SOIL SHALL BE REMOVED.
4. I-BEAM EMBEDMENT LENGTH TO BE DETERMINED IN DETAILED DESIGN.
5. THIS DRAWING IS FOR CONCEPT DESIGN ONLY SINCE I-BEAM IS NO WIND LOAD INFORMATION FROM SOLAR PANEL SUPPLIER.
6. MINIMUM DISTANCE FROM LOWER EDGE OF THE PV PANEL TO THE GROUND IS 800MM ± 5MM.

PRELIMINARY

LICENSED PROFESSIONAL ENGINEER
W. Z. LIU
100361647
PROVINCE OF ONTARIO
Foundation structural only

REV	DD/MMM/YY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP
0	10NOV11	ISSUED FOR USE	RS	SL	MP	SC	
C	26OCT11	ISSUED FOR REVIEW	RS	SL	MP	SC	
B	25OCT11	ISSUED FOR SIGNAD CHECK	RS	LH	MP	SC	
A	24OCT11	ISSUED FOR REVIEW	RS	LH	MP	SL	

REF. NUMBER	TITLE
REFERENCES	

STAMP/SEAL

CONCEPTUAL DRAWING ONLY NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

SAMSUN'S RENEWABLE ENERGY INC.

PROJECT PHASE		AREA
PRELIMINARY		

PROJECT NO.	ACTIVITY NO.		BY	DD/MMM/YY
168335		USN	SL	17OCT11
		DRN	RS	18OCT11
SCALE	PACKAGE CODE	CHK	LH	21OCT11
NTS		APP	SC	21OCT11

SUBJECT
SOLUCF KINGSTON ENERGY PROJECT
FOUNDATION – OPTIONS DESIGN LAYOUT

amec

CLIENT DWG. NO.

DRAWING NO. 168335-0002-121-LYD-0201-001

REV. 0

SAVED: 10-Nov-11 10:08 AM USER: SHANMUGAN, RAJAMK PLOTTED: 10-Nov-11 10:08 AM

CAD:\DOCS\CIV\MF\168335-0002-121-LYD-0201-001.DWG

APPENDIX B

COMMUNICATIONS RECORD

DILLON CONSULTING

Burr, Darin <dburr@dillon.ca>

RE: Kingston Solar Farm project

1 message

Crossley, Frank (ENE) <Frank.Crossley@ontario.ca> Wed, May 2, 2012 at 6:05 PM
To: "Burr, Darin" <dburr@dillon.ca>
Cc: "Taylor, Peter (ENE)" <Peter.G.Taylor@ontario.ca>, "Dobiech, Craig (ENE)" <Craig.Dobiech@ontario.ca>, "Arnott, David (ENE)" <David.Arnott@ontario.ca>, "Kaye, Brian (ENE)" <Brian.Kaye@ontario.ca>

Hello Darin

Thank you for your e-mail dated May 01, 2012 requesting a groundwater monitoring program at an upcoming proposed solar farm construction site by Samsung in the Kingston area (Unity Road & Mud Lake Road). If the proposed site is classified as an 'environmentally sensitive' site by a qualified person (P.Eng. or P.Geo.), then the Eastern Region Groundwater Unit recommends that a groundwater monitoring program be implemented prior to the commencement of the construction phase.

To this end, the Eastern Region Groundwater Unit recommends the following groundwater monitoring program:

- Contact all well owners within 500 metres of the site boundaries prior to the commencement of construction activities and seek permission to undertake a groundwater survey (if the number of well owners exceeds five then a representative number of well owners should be contacted). If permission is granted then:

  - interview the residents regarding well construction, groundwater quality, groundwater quantity and well locations to establish a history of the water well.
  - collect a water well sample from the well after allowing the distribution system to flow for approximately 5 minutes. The sample should be collected prior to any treatment systems ("raw").
  - submit the water sample for analysis to a qualified laboratory. The analysis should be the "subdivision suite" (alkalinity, ammonia, bacteria, calcium, chloride, colour, conductivity, DOC, hardness, iron, magnesium, manganese, nitrite, nitrate, pH, potassium, sodium, sulphate, TDS and turbidity).
  - establish a contingency plan by a qualified person.

Conversely, a monitoring well network can be constructed. The monitoring wells must be representative of the nearby water wells (similar depths). Appropriate water samples shall be collected from the monitoring wells and submitted to a qualified laboratory for the above listed parameters ('subdivision suite'). A contingency plan shall be established by a qualified person.

The groundwater monitoring program should be conducted under the supervision of a qualified person (P.Eng. or P.Geo.). The survey information should be summarized in a report by a qualified person and a copy forwarded to this Ministry.

In the event that a complaint arises against the construction activities, the proponent should sample the complainant's well and appropriate monitoring well, if present. The water samples should be submitted as "high priority" to a qualified laboratory. If a problem is confirmed related to the construction activities at the site, then the proponent should immediately provide bottled water to the impacted party and implement their contingency plan. This Ministry should be notified of any complaints and the company's actions to address the complaints.

F. Crossley, P.Geo.

Hydrogeologist

Technical Support

Eastern Region

1259 Gardiners Road, Unit 3

Kingston, Ontario K7P 3J6

(613)549-4000x2631

From: Burr, Darin [mailto:dburr@dillon.ca]

Sent: May 01, 2012 7:24 AM
To: Crossley, Frank (ENE)
Cc: Enright, Michael
Subject: Kingston Solar Farm project

Frank, further to our phone discussion yesterday afternoon, I am sending you this email to request information on your groundwater monitoring requirements/advice for this project. Our client (Samsung) is proposing to construct a solar farm project on Mud Lake Road/Unity Road, north east of Kingston. A preliminary map of the proposed solar farm panel locations is attached. The specific questions that I have for the MOE are as follows

1) What size of buffer area should be used when identifying potential private wells to sample?

2) What is the recommended timing of the monitoring program relative to the construction date, and are there any ongoing monitoring requirements during operation?

3) What type of information is required to be collected in the monitoring program, and what is the recommended chemical suite for analysis?

4) What are the reporting requirements?

5) Are there any other hydrogeology related investigations/assessments that are required/recommended.

Thank you for your assistance in this matter.

Regards, Darin

Darin Burr, M.Sc., P.Geo
Associate
Dillon Consulting Limited
130 Dufferin Avenue Suite 1400
London, Ontario, N6A 5R2
T - 519.438.1288 ext. 1236
F - 519.672.8209
M - 519.520.4773
dburr@dillon.ca
www.dillon.ca

KINGSTON SOLAR LP
9th Fl. 55 Standish Court, Mississauga, ON, L5R 4B2 TEL: 905-501-5658 FAX: 905-285-1852

Invitation to Participate in a Water Well Survey

Dear Resident:

As you may know, Kingston Solar LP is planning to develop a 100MW solar installation. The project to be known as the Sol-Luce Kingston Solar PV Energy Project will be located in both Loyalist Township and the City of Kingston. The project will require approval under Ontario Regulation 359/09 – Renewable Energy Approval (REA), which is being coordinated by the Ontario Ministry of Environment (MOE).

Under the guidance of the MOE, Kingston Solar LP has taken the initiative to conduct a background study of well water quality at a representative sample of properties within 500 m of the proposed solar farm. The purpose of the program is to gain a better understanding of the groundwater quality in your area. Your property has been selected as a potential site for the sampling program. Please note that this program is completely funded by Kingston Solar LP, and there is no cost to the homeowner.

In the next few weeks, a representative from our consulting firm, Dillon Consulting Limited (Dillon), will contact you regarding your interest in participating in the well water sampling program. The well water sampling program will involve taking a water sample from your water supply system at a point prior to treatment (i.e. prior to water passing through softeners, filters or disinfection equipment). The water sampling program will use existing taps and will not require alteration of the household plumbing. The water sample will be tested by a local laboratory for bacteriological parameters, metals and general chemistry. At the time of the visit, the Dillon representative will also ask you some questions about your well and your water quality. You will be provided with the laboratory results for your water sample once it has been received.

We would like to arrange for a brief meeting at your home to complete a questionnaire (approximate time is 30 minutes) and obtain a water sample for analysis, if permitted. Please contact Darin Burr at (888) 345-5668, ext. 1236 or email at dburr@dillon.ca to schedule an appointment at your earliest convenience.

Sincerely,

A. José De Armas
Manager, Project Development

FINAL

Sol-Luce Kingston Solar PV Energy Project
MINUTES OF MEETING

DATE:	June 1, 2012	
TIME:	9 am EST	
LOCATION:	Cataraqui Region Conservation Authority Offices	
PRESENT:	A. Jose De Armas	) Kingston Solar LP (Samsung)
	Rob McRae	) Project Manager, Source Water Protection, CRCA
	John Williamson	) Chair, Cataraqui Source Protection Committee
	Darin Burr	) Dillon Consulting Limited (Dillon)
FILE:	12-6428	

Action By	Item
None	CRCA noted that the meeting would focus on the hydrogeologic aspects of the project, and that the Conservation Authority had interests in other environmental aspects of the project, to be addressed separately.
None	Dillon provided general information on the area hydrogeology, location of vulnerable aquifers, anticipated groundwater flow conditions, and locations of private water wells within 500 m of the proposed solar installations. Dillon also provided photographs and conceptual drawings of typical solar installation projects. Conceptual plans for the Kingston PV Energy Project solar panel footings were shown.
None	Dillon provided an outline of the survey work program, including the identified private well sampling locations and analytical testing suite, with all sampling to be completed prior to construction. Dillon stated that the testing program was based on direction from the Ontario Ministry of the Environment (MOE) Regional office in Kingston. Well water sampling parameters included microbiology, general inorganics, select metals and nutrients. Program would also include completing a questionnaire for each homeowner. Dillon stated that not all homes that have wells within 500 m of the installations will be sampled, and that as per MOE instructions, sampling will be from a representative number of wells that are located downgradient of the proposed solar installations
None	CRCA stated that some members of the public had expressed concerns with solar projects to the Cataraqui Source Protection Committee, with respect to potential risk to the environment as a result of the prevalence of high vulnerability aquifers. Of special concern was the need to construct a large number of drill holes to support the solar panel foundations, and whether these holes would increase the vulnerability of the aquifer. Dillon and Samsung stated that the risk to the aquifers is very low as there is no bulk use of chemicals at the site, and environmental management plans will be followed during construction and operation of the facility. In addition, the depth of the foundation drill holes is shallow (~ 2 m), and that the area around the foundations is already highly fractured, therefore the boreholes will not act as a preferential pathway for groundwater movement. Boreholes used to install foundation piles will be sealed with concrete.

Action By	Item
	Furthermore, MOE requires the development and implementation of a contingency plan should there be complaints from local residences. The contingency plans will be identified in the survey report.
None	CRCA asked if the monitoring program will include the monitoring of private wells and/or the drilling of monitoring wells to allow monitoring of water levels and water quality during construction and site operations. CRCA suggests that data from this project could be used to address public concerns and for research purposes to examine if impacts from solar projects to groundwater are a concern. Samsung stated that at this time, the scope of the project will be based on the requirements of the MOE only.
Samsung	CRCA asked if the results of the study will be made available to the CRCA. Samsung stated that some of the data is confidential to the homeowners; however, Samsung will look into what information can be shared.
None	CRCA stated that the proposed Cataraqui Source Protection Plan does not address solar installations. CRCA is not aware of any documented concerns with solar farms as it relates to groundwater impacts. Nevertheless, CRCA does have the following main questions/concerns: 1) What are the potential impacts during construction from erosion and sediment control? CRCA stated that this has been a concern with previous installation projects and recommended that the Samsung project include and implement a "top-notch" sediment control plan. 2) What are the longer term water quantity impacts, and will the installation will change the water budget? 3) Are there any long-term water quality issues from the breakdown of chemicals from the solar panels and mounting apparatus, and site maintenance? Samsung/Dillon stated that erosion and sediment control plans will be part of the REA submission. No long term quantity impacts are expected, as precipitation will drip off the sides of the panels near to where it would recharge during pre-construction conditions. Also, groundwater is not used at the site. No large quantities of chemicals will be present that would pose an environmental risk. Environmental management programs will be in place during construction to mitigate risks from construction vehicles (e.g., risks from fuel spills, leaks etc.). Panels are made primarily of silicon, and there is no identified or previously documented risk from breakdown of the panels. Trace metals are contained in the panels; however, the risk of impacts to groundwater is very low as metal containing components are covered with silicon, and metals, if exposed to the elements, are not readily soluble or mobile in groundwater.

ERRORS AND/OR OMISSIONS

These minutes were prepared by Darin Burr who should be notified immediately of any errors and/or omissions.

FINAL

DILLON CONSULTING LIMITED
LONDON, ONTARIO

Other Distribution
DTB/File

EXAMPLE REPORT

July 24, 2012 Project # 12-6428-2000

Re: Private Well Water Quality Sample Results

Dear Mr. Norman

This letter presents the results of the laboratory analysis performed on an untreated water sample from your well that was collected at the above-mentioned location. Sampling was performed as part of a well water survey being conducted by Kingston Solar LP under the guidance of the Ontario Ministry of the Environment. Information obtained during the survey will be used to assess background water quality conditions in your area

The groundwater was analyzed for several parameters including bacteria, metals and general chemistry. The results of the analysis were compared to the ***Ministry of the Environment's Ontario Drinking Water Standards*** (ODWS) and are presented in the attached table and laboratory report. An information bulletin that describes the water quality standards for the tested parameters and an information bulletin from the local health department on how to interpret the bacteriological (*E Coli* and Total Coliform) results are also attached.

The results of the analysis indicate that the well water sample meets the ODWS for the measured parameters with the following exceptions:

- **Health Related** - Total Coliforms
- **Non-Health Related** – Total Dissolved Solids, Hardness

Thank you for participating in the well sampling program. If you have any questions, please do not hesitate to contact the undersigned.

Yours sincerely,

DILLON CONSULTING LIMITED

Darin Burr, M.Sc., P.Geo.
Hydrogeologist

Encls.

Well Water Quality Results
Kingston Solar LP, Kingston, Ontario

Address Lab ID Sample Date	Ontario Drinking Water Standard	Units	Method Detection Limit	964811 16-Jun-12
Microbiological				
Sample ID:				964670
Sample Date:				16-Jun-12
E. Coli	0 (MAC)	cts/100ml	0	0
Total Coliforms	0 (MAC)	cts/100ml	0	**50**
General Chemistry & Inorganics				
Alkalinity as CaCO3	30-500 (OG)	mg/L	5	361
Chloride	250 (AO)	mg/L	1	16
Colour	5 (AO)	TCU	2	**6**
Conductivity	NV	uS/cm	5	792
Dissolved Organic Carbon	5 (AO)	mg/L	0.5	3.0
N-NH3 (Ammonia)	NV	mg/L	0.02	0.03
N-NO2 (Nitrite)	1 (MAC)	mg/L	0.1	<0.10
N-NO3 (Nitrate)	10 (MAC)	mg/L	0.1	<0.10
pH	6.5 - 8.5 (OG)	NV	NV	7.92
Sulphate	500 (AO)	mg/L	3	51
Total Dissolved Solids (COND - CALC)	500 (AO)	mg/L	1	**515**
Turbidity	5 (AO)	NTU	0.1	0.5
Hardness as CaCO3	80-100 (OG)	mg/L	1	**370**
Calcium	NV	mg/L	1	117
Magnesium	NV	mg/L	1	19
Potassium	NV	mg/L	1	3
Sodium	200 (AO)	mg/L	2	15
Iron	0.3 (AO)	mg/L	0.03	0.08
Manganese	0.05 (AO)	mg/L	0.01	0.02

Notes

*	Analyzed by Health Unit; ** - duplicate.
ODWS	Ontario Drinking Water Standards, June 2003 (revised 2006): Operational Guidelines (OG); Aesthetic Objecctive (AO) Maximum Allowable Concentration (MAC)
	Value exceeds ODWS
n/a	not available; *** - detection limit exceeds ODWS
NV	no value

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212164
Date Submitted: 2012-06-18
Date Reported: 2012-06-19
Project: Kingston Solar
COC #: 149773

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: Dragana Dzeletovic 2012.06.19 10:55:47 -04'00'

Dragana Dzeletovic
Acting Supervisor, Microbiology

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212164
Date Submitted: 2012-06-18
Date Reported: 2012-06-19
Project: Kingston Solar
COC #: 149773

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.
					964670 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0
	Total Coliforms	0	ct/100mL	MAC-0	50*

Guideline = ODWSOG * = Guideline Exceedence
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212221
Date Submitted: 2012-06-18
Date Reported: 2012-06-26
Project: Kingston Solar
COC #: 149773

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: Lorna Wilson 2012.06.26 10:20:44 -04'00'

Lorna Wilson
Inorganic Laboratory Supervisor

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212221
Date Submitted: 2012-06-18
Date Reported: 2012-06-26
Project: Kingston Solar
COC #: 149773

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	964811 Water
Calculations	Hardness as CaCO3	1	mg/L			370
	TDS (COND - CALC)	1	mg/L			515
General Chemistry	Alkalinity as CaCO3	5	mg/L			361
	Cl	1	mg/L			16
	Colour	2	TCU			6
	Conductivity	5	uS/cm			792
	DOC	0.5	mg/L			3.0
	N-NO2	0.10	mg/L			<0.10
	N-NO3	0.10	mg/L			<0.10
	pH	1.00				7.92
	SO4	3	mg/L			51
	Turbidity	0.1	NTU			0.5
Metals	Ca	1	mg/L			117
	Fe	0.03	mg/L			0.08
	K	1	mg/L			3
	Mg	1	mg/L			19
	Mn	0.01	mg/L			0.02
	Na	2	mg/L			15
Nutrients	N-NH3	0.02	mg/L			0.03

Guideline = *** = Guideline Exceedence**
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

Water Quality Interpretation Information Sheet

Alkalinity as CaCO3 (inorganic)

Alkalinity is a measure of the resistance of water to the effects of acids added to water. The recommended range for alkalinity is 30 to 500 mg/L expressed as calcium carbonate. Water with low alkalinity may tend to accelerate natural corrosion leading to "red water" problems whereas high alkalinity waters may produce scale incrustations on utensils, service pipes and water heaters.

Ammonia (N-NH3)

This parameter is a nutrient related compound in water formed from the decay of organic material. It is not included in the Ontario Drinking Water Standards.

Calcium (Ca)

This parameter is natural in groundwater and is not included in the Ontario Drinking Water Standards.

Chloride (Cl)

Chloride is a common non-toxic material present in small amounts in drinking water and produces a detectable salty taste at the aesthetic objective level of 250 mg/L. Chloride is widely distributed in nature, generally as the sodium (NaCl), potassium (KCl) and calcium ($CaCl_2$) salts.

Colour (physical)

The aesthetic objective for colour in drinking water is 5 TCU (True Colour Units). Water can have a faint yellow/brown colour which is often caused by organic materials created by the decay of vegetation. Sometimes colour may be contributed to by iron and manganese compounds produced by processes occurring in natural sediments or in aquifers.

Conductivity

This parameter is not included in the Ontario Drinking Water Standards.

Dissolved Organic Carbon (DOC) (Organic)

The aesthetic objective for dissolved organic carbon (DOC) in drinking water is 5 mg/L. High DOC is an indicator of possible water quality deterioration during storage and

distribution due to the carbon being a growth nutrient for bacteria. High DOC is also an indicator of potential chlorination by-product problems.

Escherichia Coli (E. coli)

Escherichia Coli should not be detected/present in any drinking water sample. *Escherichia Coli* is a fecal coliform and is present in fecal matter and prevalent in sewage, but is rapidly destroyed by chorine. It is a strong indicator of recent fecal pollution. Contamination with sewage as shown by positive E-coli tests would strongly suggest presence of pathogenic bacteria and viruses, as well as more chlorine resistant pathogens such as *Giardia* and *Cryptosporidum*, which are much more difficult to detect. *Please refer to Public Health Unit Information Sheet on "Disinfection of Wells" for further information on how to interpret your water quality results for E. Coli.*

Hardness as CaCO3

Hardness is caused by dissolved calcium and magnesium, and is expressed as the equivalent quantity of calcium carbonate. On heating, hard water has a tendency to form scale deposits and can form excessive scum with regular soaps. However, certain detergents are largely unaffected by hardness. Conversely, soft water may result in accelerated corrosion of water pipes. Hardness levels between 80 and 100 mg/L as calcium carbonate ($CaCO_3$) are considered to provide an acceptable balance between corrosion and incrustation. Water supplies with hardness greater than 200 mg/L are considered poor but tolerable. Hardness in excess of 500 mg/L in drinking water is unacceptable for most domestic purposes.

Iron (Fe)

Iron may be present in ground water as a result of mineral deposits and chemically reducing underground conditions. It may also be present in surface waters as a result of anaerobic decay in sediments and complex formation. The aesthetic objective for iron, set by appearance effects, in drinking water is 0.3 mg/L. Excessive levels of iron in drinking water supplies may impart a brownish colour to laundered goods, plumbing fixtures and the water itself; it may produce a bitter, astringent taste in water and beverages; and the precipitation of iron can also promote the growth of iron bacteria in plumbing.

Magnesium (Mg)

This parameter is natural occurring in groundwater as a result of dissolution of minerals in the rock and is not included in the Ontario Drinking Water Standards.

Manganese (Mn)

The colour related aesthetic objective for manganese in drinking water is 0.05 mg/L. Like iron, manganese is objectionable in water supplies because it stains laundry and fixtures black, and at excessive concentrations causes undesirable tastes in beverages. Manganese

is present in some groundwaters because of chemically reducing underground conditions coupled with presence of manganese mineral deposits. Manganese is also occasionally present, seasonally, in surface waters when anaerobic decay processes in sediments is occurring.

N-NO3 (Nitrate)

The maximum acceptable concentration of nitrates in drinking water is 10 mg/L nitrogen. Nitrates are present in water (particular groundwater) as a result of decay of plant or animal material, the use of agricultural fertilizers, domestic sewage or treated wastewater contamination, or geological formations containing soluble nitrogen compounds. There is a risk that babies and small children may suffer blood related problems (methaemoglobinaemia) with excess nitrate intake.

N-NO2 (Nitrite)

The maximum acceptable concentration of nitrite in drinking water is 1.0 mg/L as nitrogen. Nitrate may occur in groundwater, however, if chlorination is practiced, the nitrate will usually be oxidized to nitrate

pH (physical-chemical)

pH is a parameter that indicates the acidity of a water sample. The operational guideline recommended in drinking water is to maintain a pH between 6.5 and 8.5. The principal objective in controlling pH is to produce a water that is neither corrosive nor produces incrustation. At pH levels above 8.5, mineral incrustations and bitter tastes can occur. Corrosion is commonly associated with pH levels below 6.5 and elevated levels of certain undesirable chemical parameters may result from corrosion of specific types of pipe.

Potassium (K)

This parameter is naturally occurring in groundwater as a result of dissolution of minerals in the rock, and is not included in the Ontario Drinking Water Standards.

Sodium (inorganic)

The aesthetic objective for sodium in drinking water is 200 mg/L at which it can be detected by a salty taste. Sodium is not toxic. Consumption of sodium in excess of 10 grams per day by normal adults does not result in any apparent adverse health effects. In addition, the average intake of sodium from water is only a small fraction of that consumed in a normal diet. A maximum acceptable concentration for sodium in drinking water has, therefore, not been specified. Persons suffering from hypertension or congestive heart disease may require a sodium-restricted diet, in which case, the intake of sodium from drinking water could become significant. It is therefore recommended that the measurement of sodium levels be included in routine monitoring programs of water supplies. The local Medical Officer of Health should be notified when the sodium

concentration exceeds 20 mg/L, so that this information may be passed on to local physicians.

Softening using a domestic water softener increases the sodium level in drinking water and may contribute a significant percentage to the daily sodium intake for a consumer on a sodium restricted diet. It is recommended that a separate unsoftened supply be retained for cooking and drinking purposes.

Sulfate (SO4)

The aesthetic objective for sulfate in drinking water is 500 mg/L. At levels above this concentration, sulfate can have a laxative effect, however, regular users adapt to high levels of sulfate in drinking water and problems are usually only experienced by visitors and new consumers. The presence of sulfate in drinking water above 150 mg/L may result in noticeable taste. The taste threshold concentration, however, depends on the associated metals present in the water. High levels of sulfate may be associated with calcium, which is a major component of scale in boilers and heat exchangers. In addition, sulfate can be converted into sulfide by some anaerobic bacteria creating odour problems and potentially greatly accelerating corrosion.

Total Coliforms

Total Coliforms include a large number of non-disease-causing bacteria arising from soil and vegetation. The Ontario Drinking Water standard for Total Coliforms is "not detected". The presence of any total coliform bacteria in water leaving a treatment unit or in any treated water immediately following treatment signifies inadequate treatment. *Please refer to Public Health Unit Information Sheet on "Disinfection of Wells" for further information on how to interpret your water quality results for Total Coliform.*

Total Dissolved Solids (TDS)

The aesthetic objective for total dissolved solids in drinking water is 500 mg/L. The term "total dissolved solids" (TDS) refers mainly to the inorganic substances dissolved in water. The principal constituents of TDS are chloride, sulphates, calcium, magnesium and bicarbonates. The effects of TDS on drinking water quality depend on the levels of the individual components. Excessive hardness, taste, mineral deposition or corrosion are common properties of highly mineralized water. The palatability of drinking water with a TDS level less than 500 mg/L is generally considered to be good.

Turbidity

Control of turbidity in drinking-water systems is important for both health and aesthetic reasons. The substances and particles that cause turbidity can be responsible for significant interference with disinfection, can be a source of disease-causing organisms and can shield pathogenic organisms from the disinfection process.

Turbidity in excess of 5.0 NTU becomes visible to the naked eye and as such a majority of consumers may object to its presence. Therefore, an aesthetic objective of 5.0 NTU has been set for all waters at the point of consumption.

Information Sources

Kingston, Frontenac and Lennox & Addington Public Health. Disinfection of Wells bulletin, FS 040 04/04/06.

Ministry of the Environment, 2006. Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines. File PIBS 4449e01

health info

Kingston, Frontenac and Lennox & Addington Public Health

KFL&A PublicHealth

An accredited local public health agency affiliated with Queen's University

Disinfection of Wells

Estimate the quantity of water in the well, for each 100 gallons (450 litres) add sixteen ounces (455 mL) of household hypochlorite solution (household bleach).

Calculate the amount of bleach needed:
Example: 150 ft. well X 1.22 gal. per ft. = 183 gal. of water (1.83 X 16 oz. = 29 oz. approx.). Therefore we would use 29 oz. of bleach to disinfect.

After adding bleach, open all taps to run the water through your pressure system until you can taste and smell the chlorine. Close taps. Let the chlorine stand in the system for 12 hours (overnight). The next day run the water, but not into your septic system, until the taste or odour of chlorine has gone.

NOTE: As you are adding the chlorine to the well, use some of the solution to disinfect the top of the well and inside the casing.

After 48 hours, a sample of the water should be submitted to the Provincial Laboratory for examination. If satisfactory, submit a second sample one week after disinfecting the well. Should the report be unsatisfactory, contact a public health inspector at KFL&A Public Health for further information.

(See back of this page for interpretation)

This table will help you estimate the number of gallons per foot of water in the well.

Inside Diameter	Gallons per foot of water in well
2 inches (5.0 cm)	0.14 (0.63 litres)
4 inches (10.0 cm)	0.53 (2.4 litres)
5 inches (12.7 cm)	0.86 (3.9 litres)
6 inches (15.2 cm)*	1.22 (5.5 litres)
7 inches (17.7 cm)	1.67 (7.5 litres)
8 inches (20.0 cm)	2.13 (9.6 litres)
24 inches (60.0 cm)	19.05 (86.6 litres)
30 inches (76.0 cm)	30.05 (136.0 litres)

*usual size of casing pipe for well

Add about 8 drops of liquid household bleach to 1 gallon (4.5 litres) of water. Stir it and let it sit for at least 15 minutes.

... over

Kingston
221 Portsmouth Avenue
Kingston, ON K7M 1V5
Tel: 613-549-1232
1-800-267-7875
Fax: 613-549-7896

Cloyne
P.O. Box 59
14209 Highway 41
Cloyne, ON K0H 1K0
Tel: 613-336-8989
Fax: 613-336-0522

Napanee
41 Dundas Street
Napanee, ON
K7R 1Z5
Tel: 613-354-3357
Fax: 354-6267

Sharbot Lake
P.O. Box 149
1130 Elizabeth Street
Sharbot Lake, ON K0H 2P0
Tel: 613-279-2151
Fax: 613-279-3997

How to interpret your laboratory results

Total Coliforms:
- This group of bacteria is always present in animal wastes and sewage, but is also found in soil and on vegetation.
- The presence of these bacteria in your well is usually the result of soil run-off or septic tank seepage.

Escherichia Coli (E. coli):
- This bacteria is found only in the stomachs of people and animals.
- The presence of E. coli bacteria in your well is usually the result of recent sewage contamination from a nearby source.
- These bacteria are the ones that may cause disease.

Interpretation of laboratory results:

TOTAL COLIFORMS	E. COLI	WHAT IT MEANS
0	0	Safe for drinking. Repeat samples may not show exactly the same results because bacteria are not distributed uniformly in water, contamination tends to enter intermittently and numbers can change during sample transit time.
1 ⟶ 5	0	Doubtful for a single sample, but safe for drinking if condition remains stable based on three samples.
6 ⟶>80	0	Unsafe for drinking. Contamination is not likely to be of sewage origin unless far removed from the water source or unless there has been a delay in receipt of sample. Common with new wells before disinfection and shallow dug wells which are not properly sealed.
1 ⟶ >80	1 ⟶ 60	Unsafe for drinking. Pollution source may be some distance from the water source, or diluted with large volumes of pure water, or the sample may not have been received within 48 hours of being taken. Samples older than 48 hours cannot provide reliable results.
>80	>60	Unsafe for drinking. This water is contaminated and should not be used for drinking under any circumstances. Do not attempt to apply these standards and interpretations to surface waters used for swimming.
EST		Unsafe for drinking. Number has been estimated due to some interference with the test. Exact number is not really critical, especially if in excess of limits shown above, for judging safety.
O/G		Doubtful condition and not recommended for drinking. No coliform bacteria could be detected because of "overgrowth" by other bacteria. This condition frequently occurs with new wells, dug wells receiving soil drainage, or wells which have been idle for some time. Collect another sample and identify clearly "REPEAT SAMPLE".

APPENDIX C

WELL USER SURVEY FORM

WATER WELL SURVEY FORM
Kingston Solar LP

PROPERTY LOCATION & USE

Address (911 Number):	***Municipality, Postal Code:***
Mailing Address (if different from above):	***Municipality, Postal Code:***

RESIDENT / OWNER INFORMATION

Person Interviewed ☐ Resident ☐ Owner ☐ Other	***Address*:** ***Telephone*:**
***If Resident is not Owner, indicate Owner's name*:**	***Address:*** ***Telephone*:**
Were there any previous owners? ☐ Yes ☐ No	***If yes, please indicate previous owner's name(s)*:**

WATER WELL CONSTRUCTION

☐ **Photos Taken**

Note: ***All information below is to be provided by well owner or resident. Do not open the well under any circumstances.***

Number of wells on property (use one form per well on property):	***Usage Activity (active, dormant):***
MOE Well Number: # (☐ *Not available*)	***Well usage (e.g. domestic, irrigation, washing):***
Well Type: ☐ Drilled ☐ Dug ☐ N/A-Unknown ☐ Overburden ☐ Bedrock ☐ N/A-Unknown	***Date Installed:*** ***Name of Well Driller:*** ***Is driller's borehole record available (Yes/No)?***
Well depth (ft/m):	***Static water level (ft/m bgs):***
Casing material (steel, concrete):	***Diameter of Well Casing (inches or mm):***

Screen presence, depth (open hole in bedrock):	***Pump Type (submersible, jet, hand, etc.):***
Well Coordinates (GPS) ***Easting:*** ***Northing:*** ***Datum:***	***Screen presence, depth (open hole in bedrock):***

WATER QUANTITY

How many years has the interviewed person used the well?	***How often does the well run dry (never, daily, weekly, monthly, annually, once)?***
If so, what activity is associated with the well running dry (washing, irrigation, etc.)?	***Is the well ever recharged by water truck (Yes/No)?***

WATER TREATMENT SYSTEMS

☐ **Photos Taken**

Indicate all applicable components below:

☐ Water Softener ☐ Iron Filter ☐ UV ☐ Other (specify)_____

☐ Reverse Osmosis ☐ Sediment Filter ☐ Chlorination ☐ Other (specify)_____

WELL VULNERABILITY

☐ **Photos Taken**

Direction of ground slope:	***Well head stick-up above ground (inches/centimetres):***
Casing condition (cracks, decayed wood, holes, etc.):	***Drainage at wellhead (level, mound, even slope, inward ditch, pit?):***
Condition of well lid (material, cracks, holes, rotted wood, insects, etc.):	***Do livestock/pets have access to wellhead area?:***

WATER QUALITY HISTORY	
Odour concerns/problems:	***Taste concerns/problems:***
Colour concerns/problems:	***Staining of fixtures or laundry:***
Encrustation at fixtures or pipes:	***Is the water used for drinking by occupants?***
Is there any history with illness associated with the water? Frequency?	***Was the water tested for chemistry/microbiology by a laboratory and what were the results?***
Has the water quality changed over time?	***Additional comments by interviewed well user:***
WATER SAMPLING RECORD	
Date and time of sample:	***Sampling point:***
Confirm sampling point is off-line from treatment systems (Yes/No):	***Number of bottles:***
Was the water sampled purged before sampling?	***If sample water was purged, how much?*** ***vol (L)_____ time (min)_____***

DRAFT PROPERTY SKETCH

Bring prepared background sketch prior to site visit. In the space provided below, indicate the following features:

Property boundary, houses and other buildings, well, septic tank, septic field, road, driveway, north arrow, distances between well and septic field, ground slope direction (downward), ditches, water pipe connections, fuel storage / heating oil tanks, and watercourses, ponds, lakes.

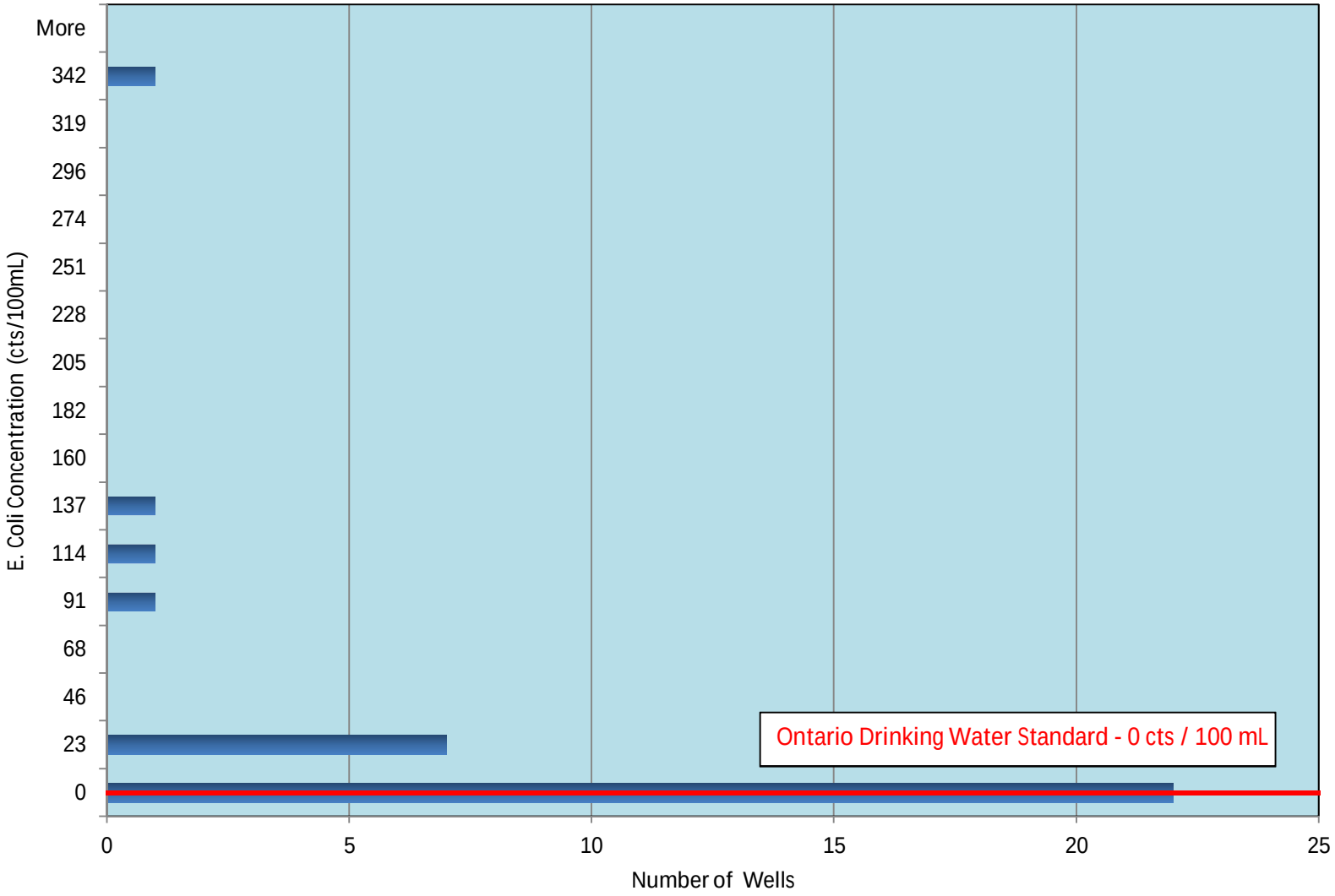
Completed By: _____

Date: _____

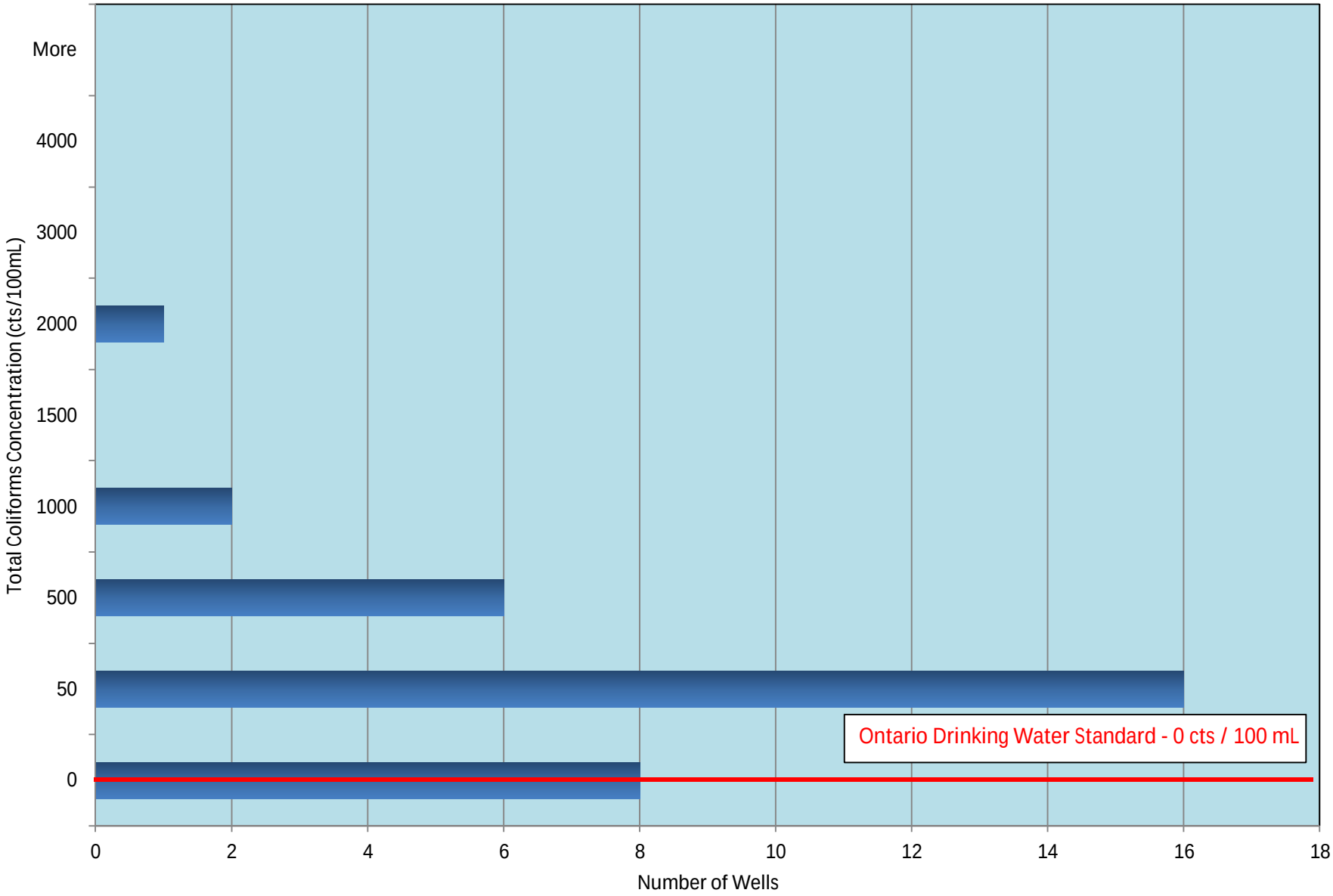
APPENDIX D

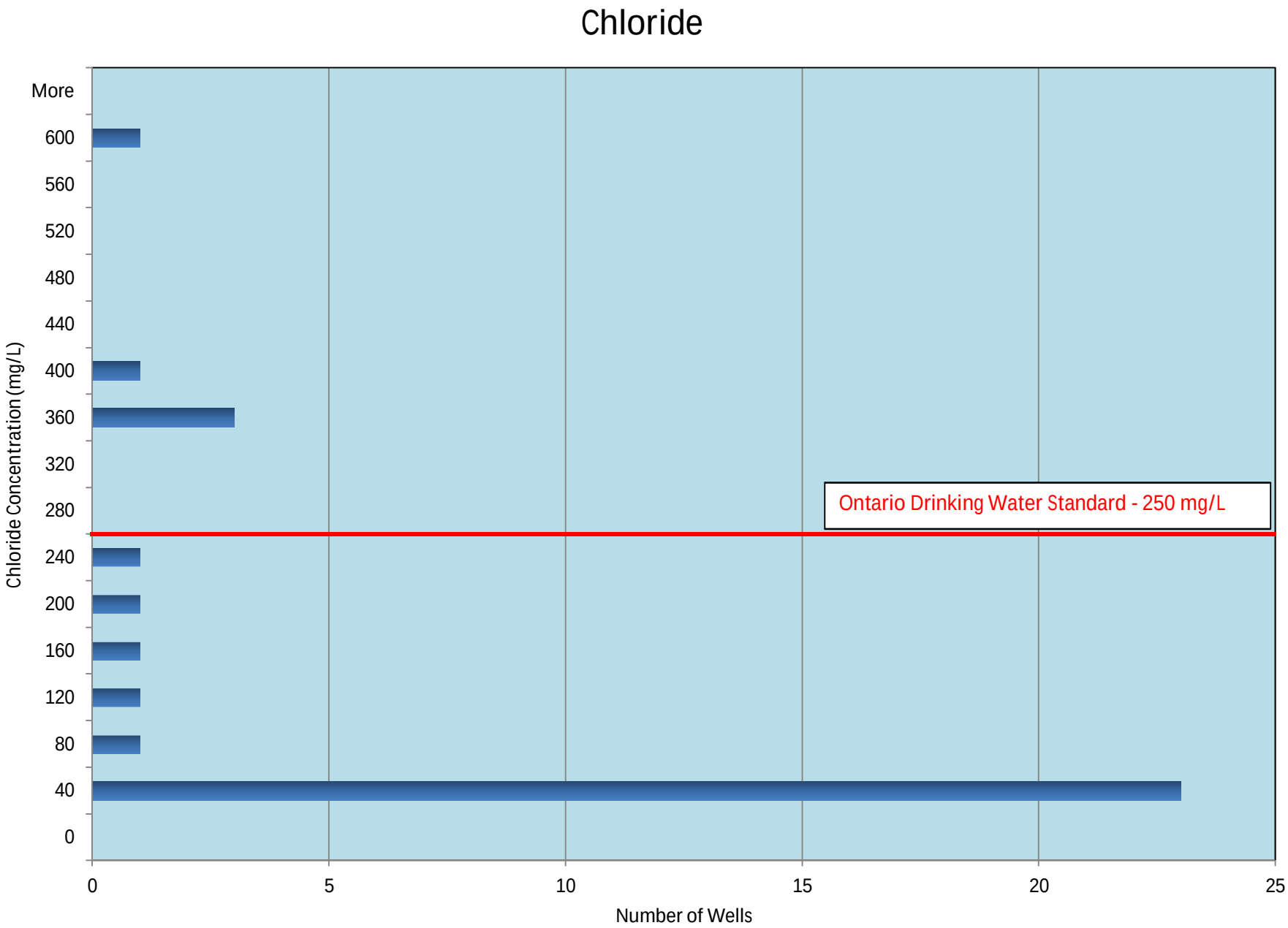
WATER QUALITY RESULTS AND ANALYTICAL DATA QA/QC EVALUATION

E.Coli

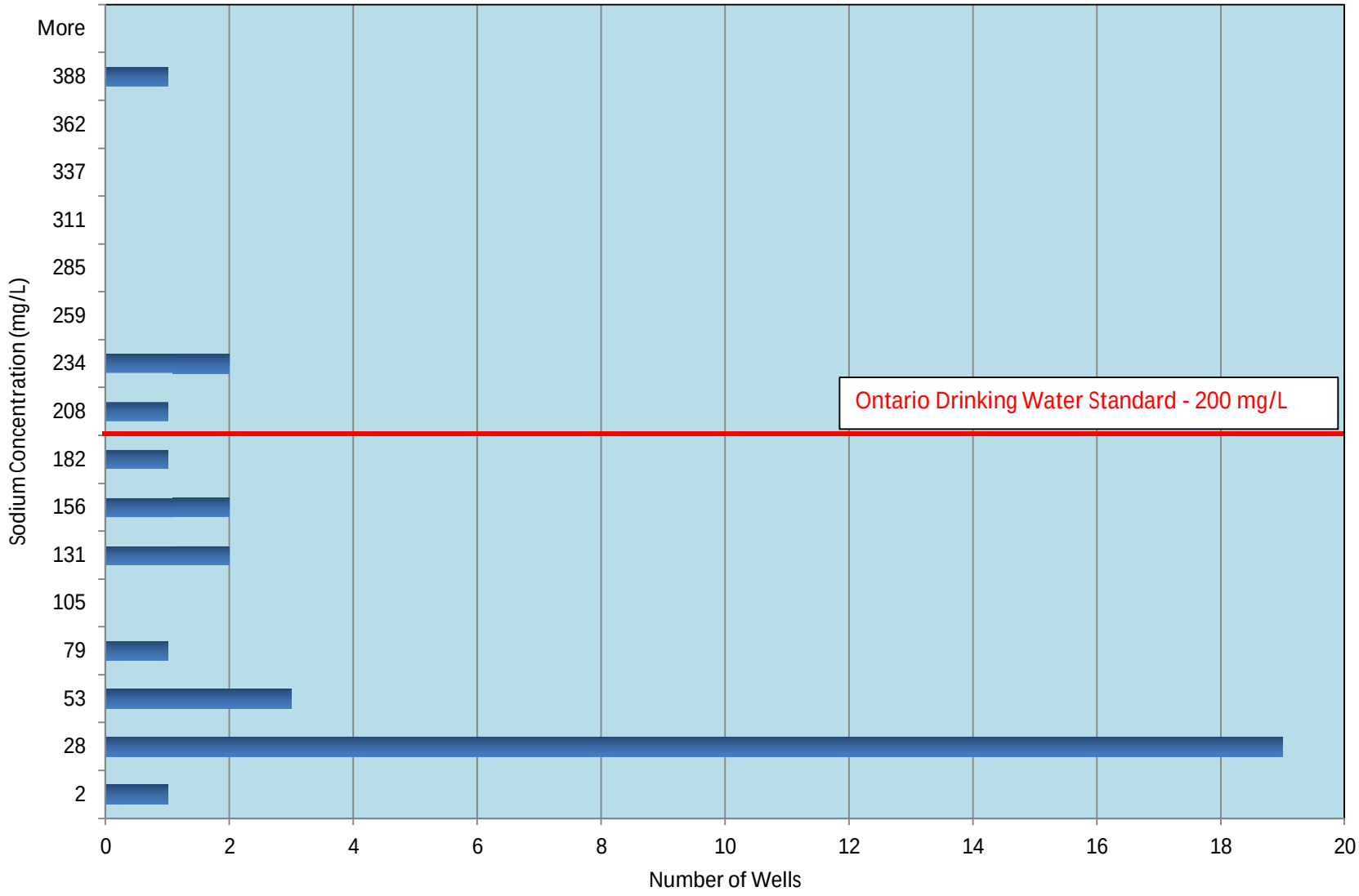

More
342
319
296
274
251
228
205
182
160
137
114
91
68
46
23
0
E. Coli Concentration (cts/100mL)
0
5
10
15
20
25
Number of Wells
Ontario Drinking Water Standard - 0 cts / 100 mL

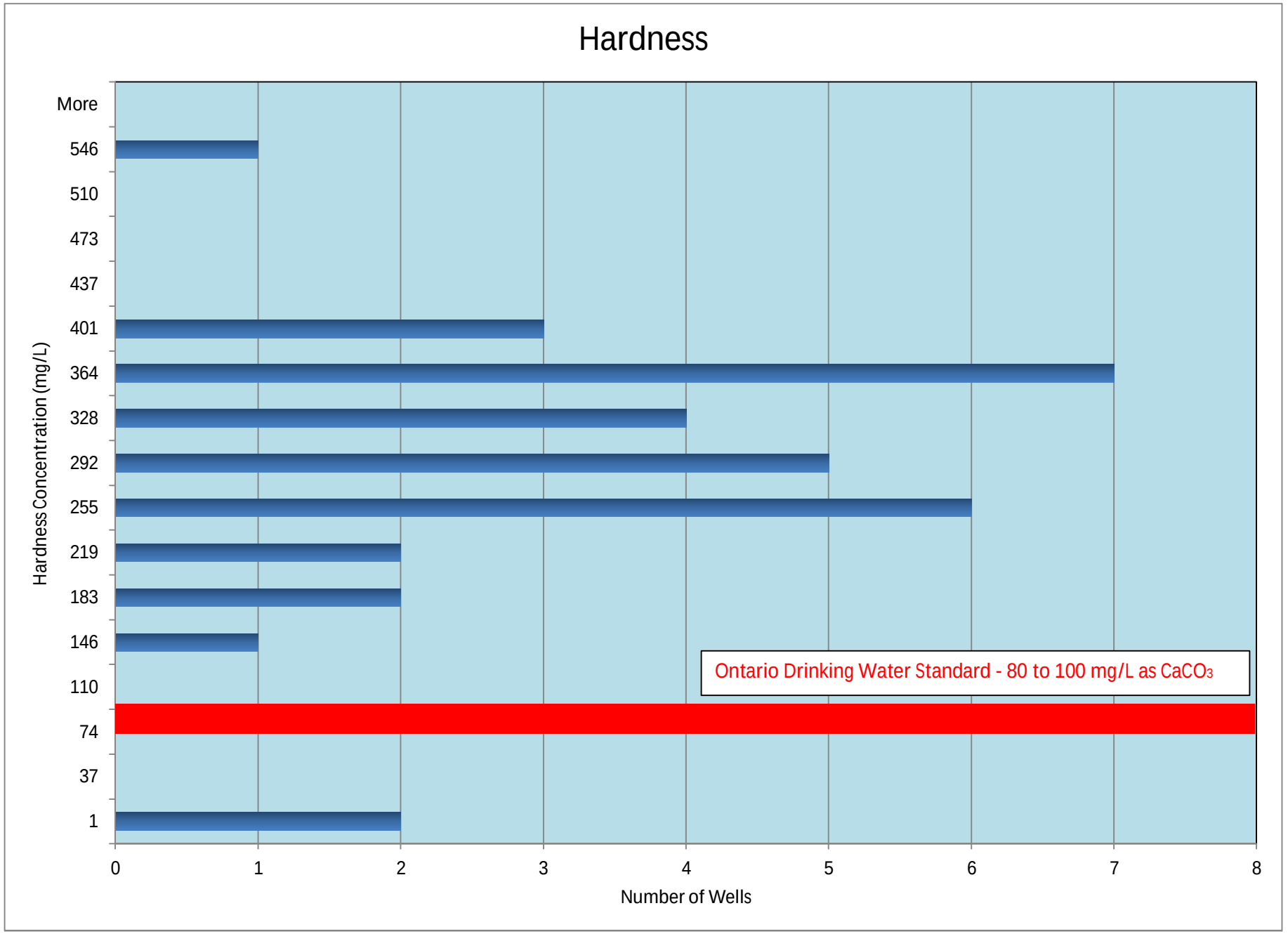
Total Coliforms



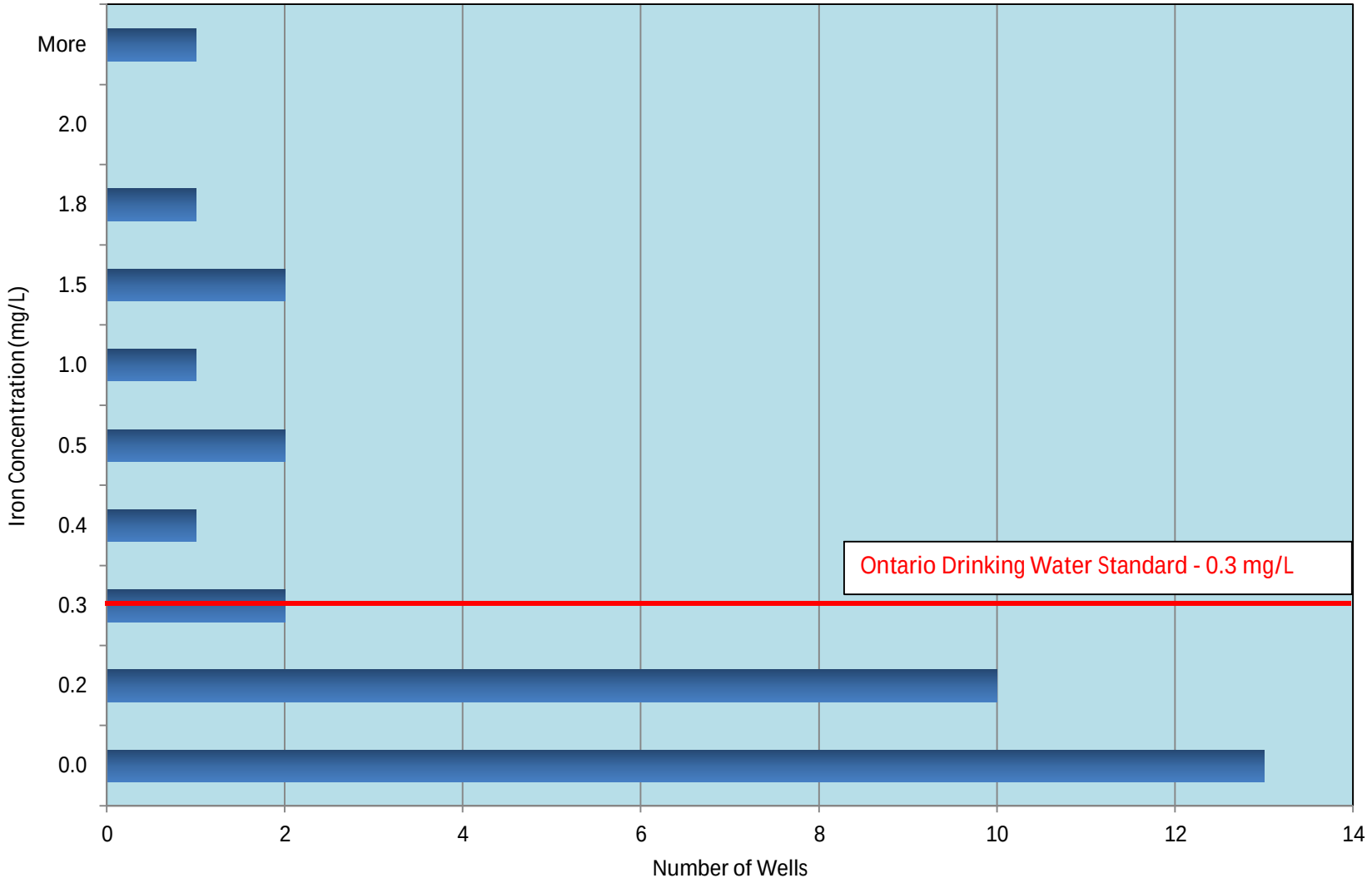

Chloride
More
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
Chloride Concentration (mg/L)
Ontario Drinking Water Standard - 250 mg/L
0
5
10
15
20
25
Number of Wells

Sodium

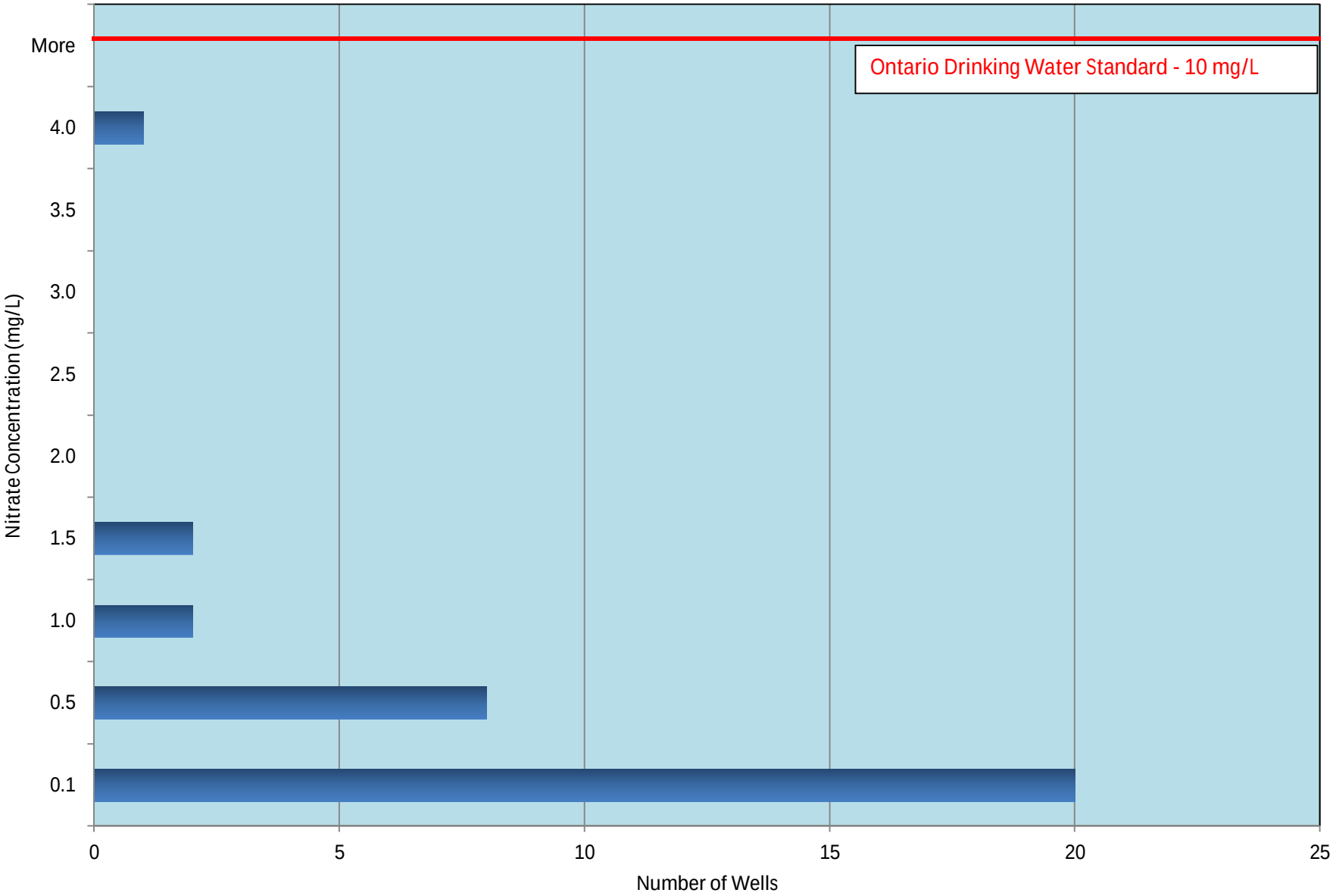

More
388
362
337
311
285
259
234
208
182
156
131
105
79
53
28
2
Sodium Concentration (mg/L)
Ontario Drinking Water Standard - 200 mg/L
0
2
4
6
8
10
12
14
16
18
20
Number of Wells


Hardness
More
546
510
473
437
401
364
328
292
255
219
183
146
110
74
37
1
Hardness Concentration (mg/L)
0
1
2
3
4
5
6
7
8
Number of Wells
Ontario Drinking Water Standard - 80 to 100 mg/L as CaCO3

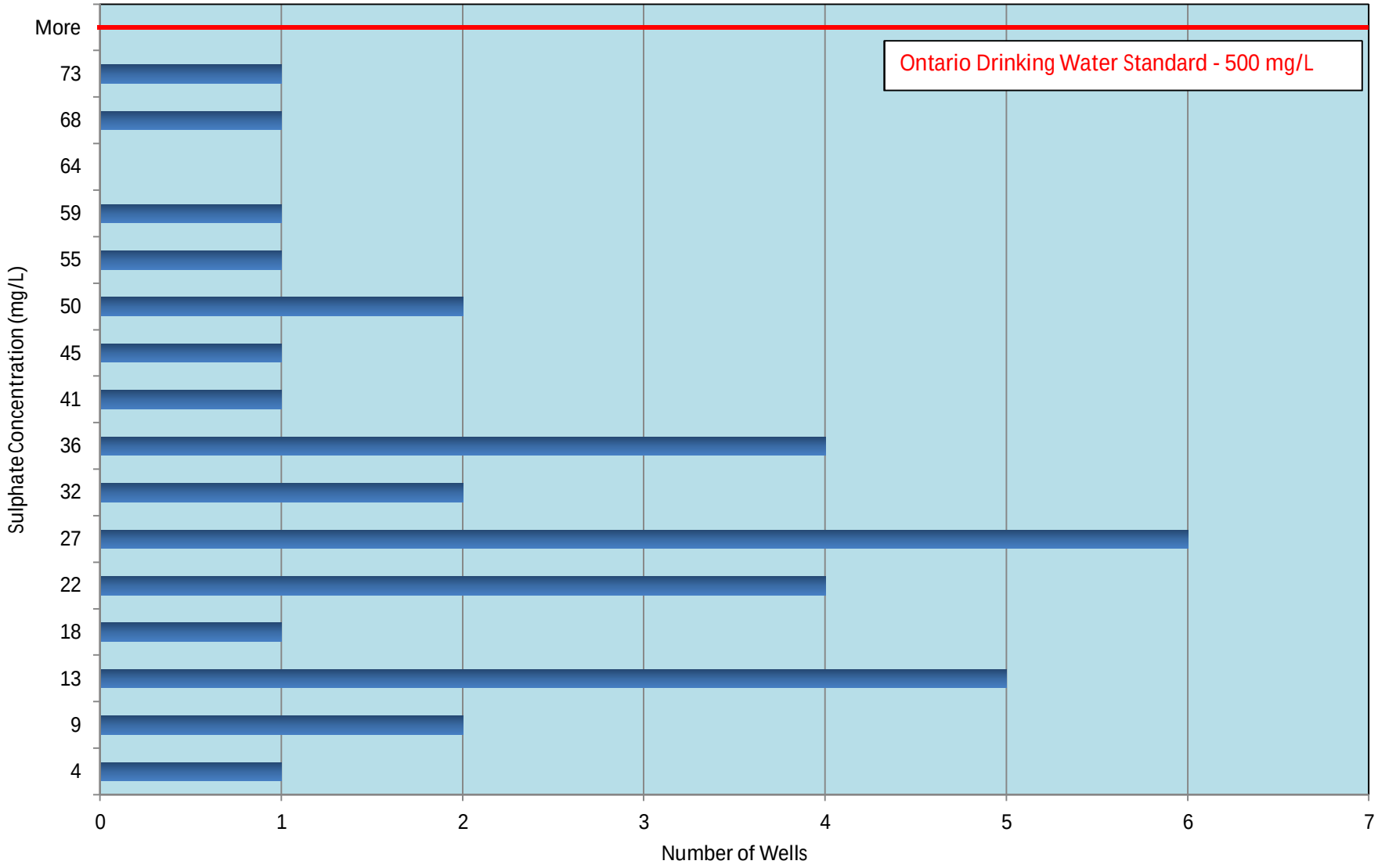
Iron

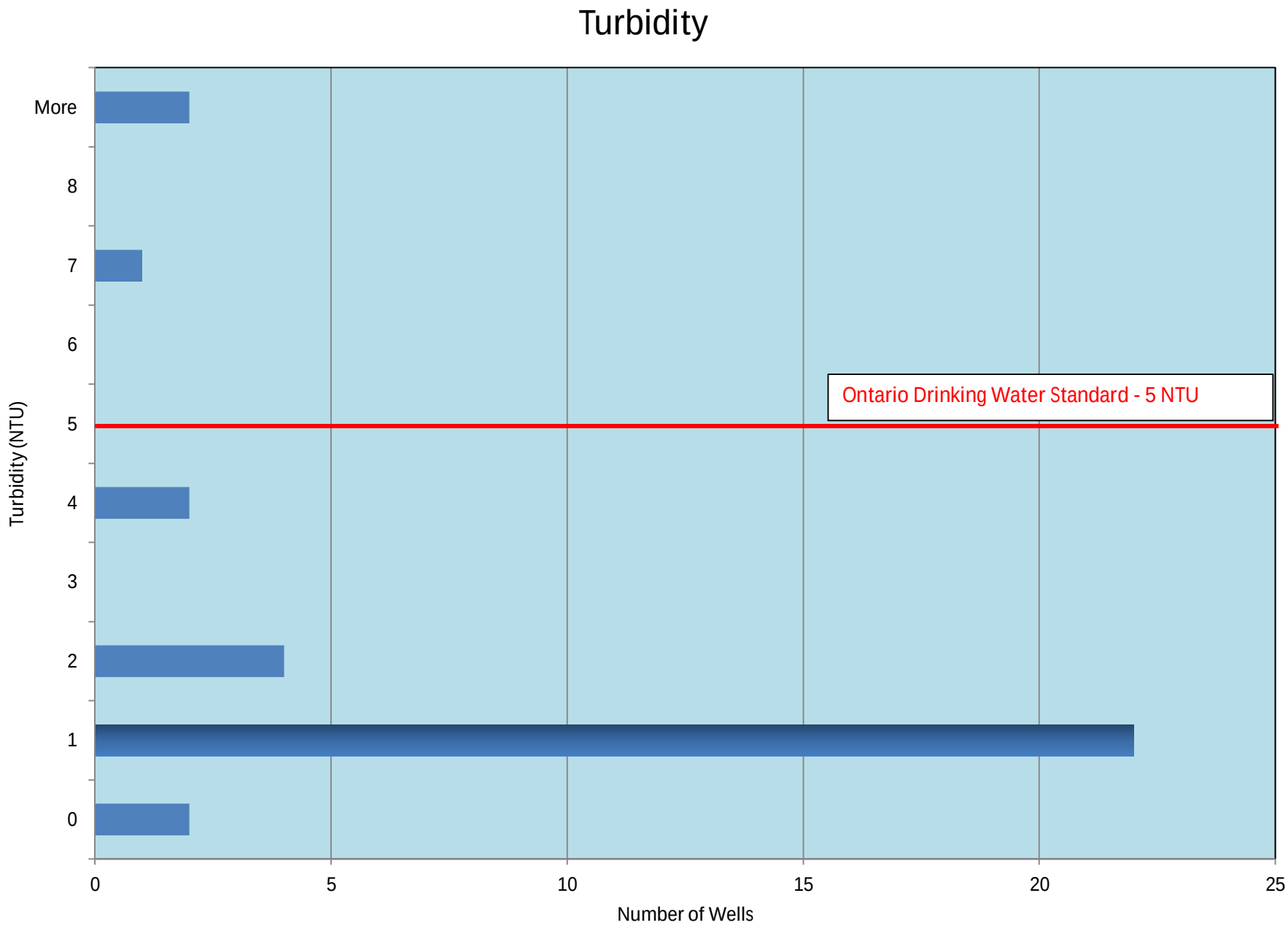

More
2.0
1.8
1.5
1.0
0.5
0.4
0.3
0.2
0.0
Iron Concentration (mg/L)
Ontario Drinking Water Standard - 0.3 mg/L
0
2
4
6
8
10
12
14
Number of Wells

Nitrates


Ontario Drinking Water Standard - 10 mg/L
More
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.1
Nitrate Concentration (mg/L)
0
5
10
15
20
25
Number of Wells

Sulphate


Ontario Drinking Water Standard - 500 mg/L
Sulphate Concentration (mg/L)
More
73
68
64
59
55
50
45
41
36
32
27
22
18
13
9
4
0
1
2
3
4
5
6
7
Number of Wells


Turbidity
More
8
7
6
5
4
3
2
1
0
Turbidity (NTU)
Ontario Drinking Water Standard - 5 NTU
0
5
10
15
20
25
Number of Wells

Groundwater Analytical Results - QA/QC Assessment

Kingston Solar LP

			Site	23	23	RPD
			Laboratory ID	963971	963972	
			Sample Date	6/11/2012	6/11/2012	
Parameter	**Units**	**RDL**	**ODWS**			
Inorganics						
Alkalinity as CaCO3	mg/L	5	30-500 (OG)	373	371	1%
Chloride	mg/L	1	250 (AO)	6	6	0%
Colour	TCU	2	5 (AO)	2	3	40%
Conductivity	uS/cm	5	NV	732	731	0%
Dissolved Organic Carbon	mg/L	0.5	5 (AO)	3	2.8	7%
N-NH3 (Ammonia)	mg/L	0.02	NV	0.03	0.03	0%
N-NO2 (Nitrite)	mg/L	0.1	1 (MAC)	<0.10	<0.10	N/V
N-NO3 (Nitrate)	mg/L	0.1	10 (MAC)	<0.10	<0.10	N/V
pH	NV	NV	6.5 - 8.5 (OG)	7.63	7.71	1%
Sulphate	mg/L	3	500 (AO)	36	36	0%
Total Dissolved Solids (COND - CALC)	mg/L	1	500 (AO)	476	475	0%
Turbidity	NTU	0.1	5 (AO)	0.3	0.3	0%
Hardness as CaCO3	mg/L	1	80-100 (OG)	341	349	2%
Calcium	mg/L	1	NV	112	115	3%
Magnesium	mg/L	1	NV	15	15	0%
Potassium	mg/L	1	NV	2	2	0%
Sodium	mg/L	2	200 (AO)	16	15	6%
Iron	mg/L	0.03	0.3 (AO)	0.04	0.05	22%
Manganese	mg/L	0.01	0.05 (AO)	0.15	0.15	0%

RDL Laboratory Reported Detection Limit
RPD Relative Percent Difference
NV No Value
ODWS Ontario Drinking Water Standards, June, 2003 (Revised, 2006)
MAC (Maximum Acceptable Concentration, AO - Aesthetic Objective; OG - Operational Guidelines
Prepared By: D.Burr

APPENDIX E

LABORATORY CERTIFICATES OF ANALYSIS

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Dillon Consulting Limited (London)
	130 Dufferin Ave., Suite 1400
	London, ON
	N6A 5R2
Attention:	Mr. Darin Burr
PO#:	
Invoice to:	Dillon Consulting Limited (London)

Kingston Report:	K12-1478
Report Number:	1212082
Date Submitted:	2012-06-15
Date Reported:	2012-06-20
Project:	Kingston Solar
COC #:	149766

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Dragana Dzeletovic 2012.06.20 09:40:53 -04'00'

Dragana Dzeletovic
Acting Supervisor, Microbiology

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAF, Ontario Ministry of Agriculture, Food and Rural Affairs(for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1478
Report Number: 1212082
Date Submitted: 2012-06-15
Date Reported: 2012-06-20
Project: Kingston Solar
COC #: 149766

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	964461 Water	964462 Water	964463 Water	964464 Water
Microbiology	Escherichia Coli	0	ct/100mL			<20	320	<20	<20
	Total Coliforms	0	ct/100mL			<20	620	<20	20

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	964465 Water
Microbiology	Escherichia Coli	0	ct/100mL			<20
	Total Coliforms	0	ct/100mL			80

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Dillon Consulting Limited (London)
	130 Dufferin Ave., Suite 1400
	London, ON
	N6A 5R2
Attention:	Mr. Darin Burr
PO#:	
Invoice to:	Dillon Consulting Limited (London)

Kingston Report:	K12-1478
Report Number:	1212156
Date Submitted:	2012-06-15
Date Reported:	2012-06-22
Project:	Kingston Solar
COC #:	149766

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Lorna Wilson 2012.06.22 15:00:19 -04'00'

Lorna Wilson
Inorganic Laboratory Supervisor

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAF, Ontario Ministry of Agriculture, Food and Rural Affairs(for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1478
Report Number: 1212156
Date Submitted: 2012-06-15
Date Reported: 2012-06-22
Project: Kingston Solar
COC #: 149766

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	964651 Water	964652 Water	964653 Water	964654 Water
Calculations	Hardness as CaCO3	1	mg/L			383	263	111	356
	TDS (COND - CALC)	1	mg/L			1180	371	211	1190
General Chemistry	Alkalinity as CaCO3	5	mg/L			335	264	99	326
	Cl	1	mg/L			340	7	25	364
	Colour	2	TCU			2	5	2	2
	Conductivity	5	uS/cm			1810	571	325	1830
	DOC	0.5	mg/L			2.2	2.7	2.3	2.3
	N-NO2	0.10	mg/L			<0.10	<0.10	<0.10	<0.10
	N-NO3	0.10	mg/L			<0.10	0.45	0.27	0.40
	pH	1.00				7.97	7.99	8.11	7.98
	SO4	3	mg/L			68	32	21	29
	Turbidity	0.1	NTU			4.0	0.3	0.5	0.2
Metals	Ca	1	mg/L			112	79	33	121
	Fe	0.03	mg/L			0.44	<0.03	0.11	<0.03
	K	1	mg/L			5	<1	1	1
	Mg	1	mg/L			25	16	7	13
	Mn	0.01	mg/L			0.01	<0.01	<0.01	<0.01
	Na	2	mg/L			210	8	13	219
Nutrients	N-NH3	0.02	mg/L			0.12	<0.02	<0.02	<0.02

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1478
Report Number: 1212156
Date Submitted: 2012-06-15
Date Reported: 2012-06-22
Project: Kingston Solar
COC #: 149766

Group	Analyte	MRL	Units	Guideline	964655 Water
				Lab I.D.	964655
				Sample Matrix	Water
				Sample Type	
				Sampling Date	
				Sample I.D.	
Calculations	Hardness as CaCO3	1	mg/L		204
	TDS (COND - CALC)	1	mg/L		403
General Chemistry	Alkalinity as CaCO3	5	mg/L		213
	Cl	1	mg/L		62
	Colour	2	TCU		30
	Conductivity	5	uS/cm		620
	DOC	0.5	mg/L		7.4
	N-NO2	0.10	mg/L		<0.10
	N-NO3	0.10	mg/L		<0.10
	pH	1.00			8.10
	SO4	3	mg/L		11
	Turbidity	0.1	NTU		0.7
Metals	Ca	1	mg/L		67
	Fe	0.03	mg/L		0.37
	K	1	mg/L		2
	Mg	1	mg/L		9
	Mn	0.01	mg/L		0.03
	Na	2	mg/L		37
Nutrients	N-NH3	0.02	mg/L		0.14

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Dillon Consulting Limited (London) 130 Dufferin Ave., Suite 1400 London, ON N6A 5R2	**Kingston Report:**	K12-1668
		Report Number:	1213871
		Date Submitted:	2012-07-05
		Date Reported:	2012-07-06
Attention:	Mr. Darin Burr	Project:	Kingston Solar
PO#:		COC #:	149944
Invoice to:	Dillon Consulting Limited (London)		

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Krista Quantrill 2012.07.06 13:38:20 -04'00'

Krista Quantrill
Microbiology Laboratory Supervisor

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1668
Report Number: 1213871
Date Submitted: 2012-07-05
Date Reported: 2012-07-06
Project: Kingston Solar
COC #: 149944

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					969339 Water	969340 Water	969341 Water	969342 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0	0	0	0
	Total Coliforms	0	ct/100mL	MAC-0	32*	144*	0	0

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					969343 Water	969344 Water	969345 Water	969346 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0	0	7*	0
	Total Coliforms	0	ct/100mL	MAC-0	60*	1*	18*	6*

Guideline = ODWSOG *** = Guideline Exceedence**
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1668
Report Number: 1213871
Date Submitted: 2012-07-05
Date Reported: 2012-07-06
Project: Kingston Solar
COC #: 149944

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					969347 Water	969348 Water	969349 Water	969350 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0	2*	0	0
	Total Coliforms	0	ct/100mL	MAC-0	0	14*	2*	2*

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					969351 Water	969352 Water	969353 Water	969354 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0	0	0	0
	Total Coliforms	0	ct/100mL	MAC-0	0	0	2*	14*

Guideline = ODWSOG *** = Guideline Exceedence**
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1668
Report Number: 1213871
Date Submitted: 2012-07-05
Date Reported: 2012-07-06
Project: Kingston Solar
COC #: 149944

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	969355 Water	969356 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0		0	0
	Total Coliforms	0	ct/100mL	MAC-0		1*	1*

Guideline = ODWSOG *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Kingston Report: K12-1669
Report Number: 1213966
Date Submitted: 2012-07-05
Date Reported: 2012-07-09
Project: Kingston Solar
COC #: 149946

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	969580 Water	969581 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0		2*	100*
	Total Coliforms	0	ct/100mL	MAC-0		19*	1000*

Guideline = ODWSOG *** = Guideline Exceedence**
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Dillon Consulting Limited (London) 130 Dufferin Ave., Suite 1400 London, ON N6A 5R2	**Kingston Report:**	K12-1669
		Report Number:	1213966
		Date Submitted:	2012-07-05
		Date Reported:	2012-07-09
Attention:	Mr. Darin Burr	Project:	Kingston Solar
PO#:		COC #:	149946
Invoice to:	Dillon Consulting Limited (London)		

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Krista Quantrill 2012.07.09 10:05:52 -04'00'

Krista Quantrill
Microbiology Laboratory Supervisor

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Dillon Consulting Limited (London)
	130 Dufferin Ave., Suite 1400
	London, ON
	N6A 5R2
Attention:	Mr. Darin Burr
PO#:	
Invoice to:	Dillon Consulting Limited (London)

Niagara Report:	N12-1053
Report Number:	1212002
Date Submitted:	2012-06-15
Date Reported:	2012-06-20
Project:	Kingston Solar
COC #:	753633

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Dragana Dzeletovic 2012.06.20 12:02:20 -04'00'

Dragana Dzeletovic
Acting Supervisor, Microbiology

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAF, Ontario Ministry of Agriculture, Food and Rural Affairs(for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Niagara Report: N12-1053
Report Number: 1212002
Date Submitted: 2012-06-15
Date Reported: 2012-06-20
Project: Kingston Solar
COC #: 753633

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	964289 Water	964290 Water	964291 Water	964292 Water
Microbiology	Escherichia Coli	0	ct/100mL			12	2	342	117
	Total Coliforms	0	ct/100mL			230	81	1900	550

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	964293 Water
Microbiology	Escherichia Coli	0	ct/100mL			0
	Total Coliforms	0	ct/100mL			0

Guideline = *** = Guideline Exceedence**
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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Niagara Report: N12-1053
Report Number: 1211865
Date Submitted: 2012-06-12
Date Reported: 2012-06-21
Project: Kingston Solar
COC #: 149816

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Lorna Wilson 2012.06.21 12:14:50 -04'00'

Lorna Wilson
Inorganic Laboratory Supervisor

Exova (Ottawa) is certified and accredited for specific parameters by:
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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Niagara Report: N12-1053
Report Number: 1211865
Date Submitted: 2012-06-12
Date Reported: 2012-06-21
Project: Kingston Solar
COC #: 149816

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	963966 Water	963967 Water	963968 Water	963969 Water
Calculations	Hardness as CaCO3	1	mg/L			272	344	232	158
	TDS (COND - CALC)	1	mg/L			368	1050	345	254
General Chemistry	Alkalinity as CaCO3	5	mg/L			292	265	231	176
	Cl	1	mg/L			6	330	19	18
	Colour	2	TCU			2	5	6	40
	Conductivity	5	uS/cm			566	1620	531	390
	DOC	0.5	mg/L			1.7	2.2	1.4	8.3
	N-NO2	0.10	mg/L			<0.10	<0.10	<0.10	<0.10
	N-NO3	0.10	mg/L			<0.10	0.57	0.91	<0.10
	pH	1.00				7.83	7.72	7.83	7.90
	SO4	3	mg/L			18	57	23	5
	Turbidity	0.1	NTU			0.1	0.4	0.2	1.3
Metals	Ca	1	mg/L			86	123	83	50
	Fe	0.03	mg/L			<0.03	<0.03	<0.03	0.45
	K	1	mg/L			<1	1	2	1
	Mg	1	mg/L			14	9	6	8
	Mn	0.01	mg/L			<0.01	<0.01	<0.01	0.09
	Na	2	mg/L			8	190	12	12
Nutrients	N-NH3	0.02	mg/L			<0.02	<0.02	<0.02	0.06

Guideline = *** = Guideline Exceedence**

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MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective.

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Niagara Report: N12-1053
Report Number: 1211865
Date Submitted: 2012-06-12
Date Reported: 2012-06-21
Project: Kingston Solar
COC #: 149816

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	963970 Water	963971 Water	963972 Water
Calculations	Hardness as CaCO3	1	mg/L			246	341	349
	TDS (COND - CALC)	1	mg/L			318	476	475
General Chemistry	Alkalinity as CaCO3	5	mg/L			239	373	371
	Cl	1	mg/L			3	6	6
	Colour	2	TCU			4	2	3
	Conductivity	5	uS/cm			490	732	731
	DOC	0.5	mg/L			1.6	3.0	2.8
	N-NO2	0.10	mg/L			<0.10	<0.10	<0.10
	N-NO3	0.10	mg/L			<0.10	<0.10	<0.10
	pH	1.00				7.89	7.63	7.71
	SO4	3	mg/L			26	36	36
	Turbidity	0.1	NTU			0.1	0.3	0.3
Metals	Ca	1	mg/L			92	112	115
	Fe	0.03	mg/L			<0.03	0.04	0.05
	K	1	mg/L			<1	2	2
	Mg	1	mg/L			4	15	15
	Mn	0.01	mg/L			<0.01	0.15	0.15
	Na	2	mg/L			3	16	15
Nutrients	N-NH3	0.02	mg/L			<0.02	0.03	0.03

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EXOVA OTTAWA

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Client: Dillon Consulting Limited (London)
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N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212164
Date Submitted: 2012-06-18
Date Reported: 2012-06-19
Project: Kingston Solar
COC #: 149773

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Dragana Dzeletovic 2012.06.19 10:55:47 -04'00'

Dragana Dzeletovic
Acting Supervisor, Microbiology

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212164
Date Submitted: 2012-06-18
Date Reported: 2012-06-19
Project: Kingston Solar
COC #: 149773

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					964665 Water	964666 Water	964667 Water	964668 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0	0	0	78*
	Total Coliforms	0	ct/100mL	MAC-0	0	0	6*	420*

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.		
					964669 Water	964670 Water	964671 Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	1*	0	0
	Total Coliforms	0	ct/100mL	MAC-0	260*	50*	6*

Guideline = ODWSOG *** = Guideline Exceedence**

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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212221
Date Submitted: 2012-06-18
Date Reported: 2012-06-26
Project: Kingston Solar
COC #: 149773

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Lorna Wilson 2012.06.26 10:20:44 -04'00'

Lorna Wilson
Inorganic Laboratory Supervisor

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Dillon Consulting Limited (London)
130 Dufferin Ave., Suite 1400
London, ON
N6A 5R2
Attention: Mr. Darin Burr
PO#:
Invoice to: Dillon Consulting Limited (London)

Report Number: 1212221
Date Submitted: 2012-06-18
Date Reported: 2012-06-26
Project: Kingston Solar
COC #: 149773

				Lab I.D.	964807
				Sample Matrix	Water
				Sample Type	
				Sampling Date	
				Sample I.D.	
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Calculations	Hardness as CaCO3	1	mg/L		<1
	TDS (COND - CALC)	1	mg/L		404
General Chemistry	Alkalinity as CaCO3	5	mg/L		284
	Cl	1	mg/L		14
	Colour	2	TCU		9
	Conductivity	5	uS/cm		621
	DOC	0.5	mg/L		3.3
	N-NO2	0.10	mg/L		<0.10
	N-NO3	0.10	mg/L		<0.10
	pH	1.00			7.88
	SO4	3	mg/L		24
	Turbidity	0.1	NTU		0.3
Metals	Ca	1	mg/L		<1
	Fe	0.03	mg/L		<0.03
	K	1	mg/L		<1
	Mg	1	mg/L		<1
	Mn	0.01	mg/L		<0.01
	Na	2	mg/L		146
Nutrients	N-NH3	0.02	mg/L		<0.02

Guideline = *** = Guideline Exceedence**

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Report Number: 1212221
Date Submitted: 2012-06-18
Date Reported: 2012-06-26
Project: Kingston Solar
COC #: 149773

Group	Analyte	MRL	Units	Guideline	964808 Water	964809 Water	964810 Water	964811 Water
	Lab I.D.				964808	964809	964810	964811
	Sample Matrix				Water	Water	Water	Water
	Sample Type							
	Sampling Date							
	Sample I.D.							
Calculations	Hardness as CaCO3	1	mg/L		276	153	332	370
	TDS (COND - CALC)	1	mg/L		643	251	510	515
General Chemistry	Alkalinity as CaCO3	5	mg/L		266	174	369	361
	Cl	1	mg/L		132	17	22	16
	Colour	2	TCU		8	58	7	6
	Conductivity	5	uS/cm		989	386	784	792
	DOC	0.5	mg/L		3.6	8.4	5.2	3.0
	N-NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10
	N-NO3	0.10	mg/L		<0.10	<0.10	0.31	<0.10
	pH	1.00			7.99	8.05	8.00	7.92
	SO4	3	mg/L		34	4	27	51
	Turbidity	0.1	NTU		1.1	1.9	0.3	0.5
Metals	Ca	1	mg/L		79	54	118	117
	Fe	0.03	mg/L		0.21	1.13	<0.03	0.08
	K	1	mg/L		10	2	5	3
	Mg	1	mg/L		19	10	9	19
	Mn	0.01	mg/L		<0.01	0.08	<0.01	0.02
	Na	2	mg/L		66	12	29	15
Nutrients	N-NH3	0.02	mg/L		0.51	0.09	<0.02	0.03

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Report Number: 1212221
Date Submitted: 2012-06-18
Date Reported: 2012-06-26
Project: Kingston Solar
COC #: 149773

				Lab I.D.	964812
				Sample Matrix	Water
				Sample Type	
				Sampling Date	
				Sample I.D.	
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Calculations	Hardness as CaCO3	1	mg/L		<1
	TDS (COND - CALC)	1	mg/L		332
General Chemistry	Alkalinity as CaCO3	5	mg/L		223
	Cl	1	mg/L		24
	Colour	2	TCU		8
	Conductivity	5	uS/cm		510
	DOC	0.5	mg/L		2.4
	N-NO2	0.10	mg/L		<0.10
	N-NO3	0.10	mg/L		<0.10
	pH	1.00			8.30
	SO4	3	mg/L		10
	Turbidity	0.1	NTU		0.3
Metals	Ca	1	mg/L		<1
	Fe	0.03	mg/L		<0.03
	K	1	mg/L		<1
	Mg	1	mg/L		<1
	Mn	0.01	mg/L		<0.01
	Na	2	mg/L		120
Nutrients	N-NH3	0.02	mg/L		0.02

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Attention:	Mr. Darin Burr
PO#:	
Invoice to:	Dillon Consulting Limited (London)

Niagara Report:	N12-1069
Report Number:	1211831
Date Submitted:	2012-06-12
Date Reported:	2012-06-27
Project:	Kingston Solar
COC #:	149764

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: [redacted] Dragana Dzeletovic 2012.06.27 16:17:24 -04'00'

Dragana Dzeletovic
Acting Supervisor, Microbiology

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Invoice to: Dillon Consulting Limited (London)

Niagara Report: N12-1069
Report Number: 1211831
Date Submitted: 2012-06-12
Date Reported: 2012-06-27
Project: Kingston Solar
COC #: 149764

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					963883 Water	963884 Water	963885 Water	963886 Water
Microbiology	Escherichia Coli	0	ct/100mL		0	4	OG	OG
	Total Coliforms	0	ct/100mL		35	15	OG	OG

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.		
					963887 Water	963888 Water	963889 Water
Microbiology	Escherichia Coli	0	ct/100mL		OG	OG	OG
	Total Coliforms	0	ct/100mL		OG	OG	OG

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	N6A 5R2
Attention:	Mr. Darin Burr
PO#:	
Invoice to:	Dillon Consulting Limited (London)

Niagara Report:	N12-1069
Report Number:	1211922
Date Submitted:	2012-06-13
Date Reported:	2012-06-21
Project:	Kingston Solar
COC #:	149764

Dear Darin Burr:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

[redacted] Lorna Wilson
2012.06.21
16:48:18
-04'00'

APPROVAL: _____

Lorna Wilson
Inorganic Laboratory Supervisor

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Niagara Report: N12-1069
Report Number: 1211922
Date Submitted: 2012-06-13
Date Reported: 2012-06-21
Project: Kingston Solar
COC #: 149764

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	964120 Water	964121 Water	964122 Water	964123 Water
Calculations	Hardness as CaCO3	1	mg/L			302	254	257	386
	TDS (COND - CALC)	1	mg/L			366	354	382	1880
General Chemistry	Alkalinity as CaCO3	5	mg/L			287	267	277	431
	Cl	1	mg/L			2	5	17	590
	Colour	2	TCU			2	2	6	7
	Conductivity	5	uS/cm			563	544	587	2900
	DOC	0.5	mg/L			1.7	2.5	3.6	4.9
	N-NO2	0.10	mg/L			<0.10	<0.10	<0.10	<0.10
	N-NO3	0.10	mg/L			<0.10	<0.10	0.36	<0.10
	pH	1.00				8.10	8.10	8.02	7.98
	SO4	3	mg/L			22	23	16	73
	Turbidity	0.1	NTU			0.6	8.4	0.8	8.1
Metals	Ca	1	mg/L			98	77	83	125
	Fe	0.03	mg/L			0.15	0.98	0.15	1.07
	K	1	mg/L			2	4	2	<1
	Mg	1	mg/L			14	15	12	18
	Mn	0.01	mg/L			0.08	<0.01	0.03	1.41
	Na	2	mg/L			4	11	16	388
Nutrients	N-NH3	0.02	mg/L			0.03	0.17	0.08	0.05

Guideline = *** = Guideline Exceedence**

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Niagara Report: N12-1069
Report Number: 1211922
Date Submitted: 2012-06-13
Date Reported: 2012-06-21
Project: Kingston Solar
COC #: 149764

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	964124 Water	964125 Water	964126 Water
Calculations	Hardness as CaCO3	1	mg/L			349	216	321
	TDS (COND - CALC)	1	mg/L			884	318	578
General Chemistry	Alkalinity as CaCO3	5	mg/L			303	216	276
	Cl	1	mg/L			207	20	109
	Colour	2	TCU			10	21	5
	Conductivity	5	uS/cm			1360	489	889
	DOC	0.5	mg/L			3.4	4.2	2.7
	N-NO2	0.10	mg/L			<0.10	<0.10	<0.10
	N-NO3	0.10	mg/L			3.64	<0.10	<0.10
	pH	1.00				8.13	8.09	8.03
	SO4	3	mg/L			47	13	9
	Turbidity	0.1	NTU			1.8	6.8	0.5
Metals	Ca	1	mg/L			120	75	104
	Fe	0.03	mg/L			0.14	2.09	<0.03
	K	1	mg/L			6	1	2
	Mg	1	mg/L			12	7	15
	Mn	0.01	mg/L			0.01	0.54	<0.01
	Na	2	mg/L			131	12	47
Nutrients	N-NH3	0.02	mg/L			<0.02	0.06	<0.02

Guideline = *** = Guideline Exceedence**

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