Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

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800, rue de La Gauchetière Ouest
7 ième étage
Montréal
Québec
H5A 1L6
FAX pour soumissions: (514) 496-3822

SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

Comments - Commentaires

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H5A 1L6

Title - Sujet Observation de la terre - ASC	
Solicitation No. - N° de l'invitation EE010-151057/A	**Amendment No. - N° modif.** 001
Client Reference No. - N° de référence du client R.068728.004	**Date** 2014-10-16
GETS Reference No. - N° de référence de SEAG PW-$MTC-775-12934	
File No. - N° de dossier MTC-4-37205 (775)	**CCC No./N° CCC - FMS No./N° VME**
Solicitation Closes - L'invitation prend fin **at - à 02:00 PM** **on - le 2014-10-28**	**Time Zone** **Fuseau horaire** Heure Avancée de l'Est HAE
F.O.B. - F.A.B. **Plant-Usine:** ☐ **Destination:** ☑ **Other-Autre:** ☐	
Address Enquiries to: - Adresser toutes questions à: Aguilera, Maria Pia	**Buyer Id - Id de l'acheteur** mtc775
Telephone No. - N° de téléphone (514) 496-3573 ( )	**FAX No. - N° de FAX** (514) 496-3822
Destination - of Goods, Services, and Construction: **Destination - des biens, services et construction:**	

Instructions: See Herein

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Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)

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Canada

EE010-151057: EARTH OBSERVATION

AMENDMENT No. 001

EXTENSION OF TIME

PLEASE NOTE THAT THE TIME LIMIT FOR THE RECEPTION OF TENDERS PREVIOUSLY SET FOR OCTOBER 24TH, 2014 IS REPORTED TO **OCTOBER 28TH, 2014 AT 02:00 PM (EASTERN DAYLIGHT TIME)**.

QUESTIONS AND ANSWERS:

Q1: Annex A, paragraph 2: Given that Phase 1 of the project, done in collaboration with the Canadian Space Agency during the 2010/11 year (VIASAT 2010), is the stage that allowed PWGSC to develop its strategy in EO and will serve as input for the subsequent phases, we believe it is important that each bidder can access the report by Viasat. Does this report can be sent to us?

A1: The report has been attached to amendment 001

Q2: Part 4, subsection 1.1 (Technical Evaluation): On what basis PWGSC intends to proceed with the evaluation of the mandatory technical criteria? Do you have an assesment grid and if so, what is the passing score for establishing that the firm adequately meets the mandatory criteria?

*A2: As indicated in the Request for Proposal the bidder must comply with the requirements of the bid solicitation and meet all **mandatory technical evaluation criteria** to be declared responsive. The responsive bid with the lowest evaluated price will be recommended for award of a contract.*
*There is no need for an assesment grid given that the criteria are **mandatory** and failing to comply to any criterium will result in the inmediate disqualification.*

Q3: In the Mandatory Technical Criteria (Setion 1.1.1), the solicitation states that "...This expertise should be demonstrated by the presentation of at least two similar projects executed during the past 4 years... " – *does this experience have to be experience of the bidding firms, or can the firm work with an expert sub-contractor to meet this criteria* (assuming the bid meets the other mandatory criteria of course)

*A3: As indicated in the Mandatory Technical Criteria (Setion 1.1.1), "**The bidding firm** should have an expertise in Earth observation (EO) technology via satellite. This expertise should be demonstrated by the presentation of at least two similar projects executed during the past 4 years..." **The expertise must be held by the bidding firm.***

Table 10: Information needed for inventorying and monitoring species at risk

INFORMATION NEEDED BY PWGSC	LOCATION OF SITES	SIZE OF SITES	PRECISION OF INFORMATION	USE OF ARCHIVAL IMAGES	CONSTRAINTS	FREQUENCY	SCALE/ RESOLUTION
B1. Description of wildlife habitat (vegetation) on federal infrastructure sites	Federal sites and a buffer zone	Generally small (several hectares)	Presence or absence	Yes, combined with new acquisitions	Visible: cloud cover / Radar: none / Potentially coordinated with work	Occasional, 1x/year	Medium / 5.0–15.0 m
B2. Field surveys to identify animal and plant species on federal infrastructure sites and to verify, using the registry, whether species at risk are present	Federal sites and a buffer zone	Generally small (several hectares)	Presence or absence	Yes, combined with new acquisitions	Visible: cloud cover / Radar: none / Potentially coordinated with work	Occasional, 1x/year	Medium / 5.0–15.0 m
B3. Detection and location of marine mammals during wharf repair work involving blasting	Federal sites and a buffer zone	Generally small (several hectares)	Presence or absence	Yes, combined with new acquisitions	Visible: cloud cover / Radar: none / Potentially coordinated with work	Occasional	Medium / 5.0–15.0 m

B. Potential for use

EO data cannot be used to detect and locate species at risk at PWGSC sites (need B2), except in a few cases (certain species that live in colonies, e.g. mammals such as prairie dogs) through direct location. The same is true for detecting and locating marine mammals as part of wharf repair work involving blasting (need B3), except in the case of groups of large marine mammals at the surface of the water when the satellite passes. However, most species cannot be identified, counted or mapped using satellite or airborne remote sensing for a number of reasons: the size of the species compared with the resolution of the sensors, the species' life cycle (nocturnal species cannot be identified by optical sensors), and the generally long revisit time make it difficult to monitor populations (Colby and Leimgruber 2007).

However, EO data can be used to indirectly locate and describe wildlife habitat, particularly on sites covering a large geographic area (e.g. several square kilometres). In such cases, a species-habitat relationship is established using models. The relationship between species richness and environmental variables depends on habitat variables such as vegetation cover and density, fragmentation, structure, productivity, land management and anthropogenic disturbance (Goetz et al. 2007). Biophysical and environmental characteristics that can be measured in the field can be used to develop empirical models that can be applied over a much greater area (Manley et al. 2004). EO data can quickly provide information that can be used to anticipate habitat losses for existing populations.

In that regard, remote sensing is a potentially valuable tool that can be used to characterize habitat and thus to draw inferences, by means of models, on the distribution of plant and animal species. However, it can be highly complex and may not be appropriate for small urbanized areas. The results of these models must always be analyzed with caution. Furthermore, although indirect, this approach to inventorying species at risk populations still requires fieldwork.

Passive multispectral optical satellite sensors such as LANDSAT, Terra-ASTER, SPOT, MODIS, IKONOS and QuickBird could be used to describe wildlife habitat on larger federal sites (e.g. several hectares), distinguish between types of vegetation and determine the horizontal structure of wildlife habitat vegetation cover (need B1). A number of studies have demonstrated the potential of these sensors for mapping terrestrial wildlife habitat using satellite imagery.

Table 11 provides an estimate of the potential of EO data from each sensor to be used for each need in the “Species at Risk Inventorying and Monitoring” field of application.

Table 11: Estimated potential of EO data to be used for needs related to species at risk inventorying and monitoring

Sensor [3]	Need 1 [1]				Need 2				Need 3				Acquisition Cost [2]
	Spectral Bands	Spatial Res.	Revisit Time	Potential	Spectral Bands	Spatial Res.	Revisit Time	Potential	Spectral Bands	Spatial Res.	Revisit Time	Potential	
GeoEye-1	**	****	****		*	****	****		**	****	**		$$$$$
WorldView-2	**	****	****		*	****	****		**	****	**		$$$$$
WorldView-1													
QuickBird-2	**	****	****		*	****	****		**	***	**		$$$$
IKONOS-2	**	****	****		*	****	****		**	**	**		$$$$
OrbView-3													
Kompsat-2	**	****	****		*	****	****		**	**	**		$$$$
ALOS PRISM													
CARTOSAT-1													
CARTOSAT-2													
Formosat-2 +	*	***	****										$$$$
RapidEye	*	**	****										$$$
SPOT-5	*	***	****										$$$$
ALOS-AVNIR-2													
SPOT-1 to -4													
Terra-ASTER													
Landsat-5													
Landsat-7 ++													
MERIS													
MODIS													
AVHRR													
Cosmo-Skymed													
TerraSAR-X													
TanDEM-X													
RADARSAT-2													
RADARSAT-1													
ALOS-PALSAR													
ENVISAT-ASAR													
Thermography													
Hyperspectral													
LiDAR													

(1)	
+	Partial coverage, depending on location
++	Sensor problems: image area with no data
-	n/a: not applicable
	Does not meet any requirements
?	Information not available
*	Meets few requirements
**	Meets some requirements
***	Meets most requirements
****	Meets all requirements

(2)	
$ to $$$$$	Low cost to high cost

(3)
Optical satellite sensors
Radar satellite sensors
Airborne sensors

(4)	
	None
	Unknown
	Low
	Moderate
	High

Note: Variable weighting of spectral, spatial and temporal resolution may result in different potential levels for the same number of stars.

C. Conclusion

B1- Description of wildlife habitat (vegetation) on sites containing new federal infrastructure

- ✓ High-resolution satellite data has the potential to be used to map and describe wildlife habitat vegetation on large federal sites (at least several hectares) and corresponding buffer zones. From a practical and operational standpoint, however, its potential is limited for small sites in urbanized areas (most of the sites managed by PWGSC), since biologists and other wildlife specialists can easily conduct inventories in the field. The potential is greater for large sites.

B2- Field surveys to identify animal and plant species on sites containing new federal infrastructure and to verify, using the registry, whether species at risk are present

- ✓ Satellite data cannot be used for direct detection and location of species at risk.
- ✓ There is some potential to identify species using models to infer the presence of species on the basis of habitat data. However, that potential is generally low, given the complexity of the models that would have to be developed.

B3- Detection and location of marine mammals during wharf repair work involving blasting

- ✓ Satellite data generally cannot be used for direct detection and location of marine mammals, except in the case of large mammals on the surface at the time of the satellite's passage.
- ✓ There is some potential to identify mammals using models to infer the presence of species on the basis of habitat data. However, that potential is generally low, given the complexity of the models that would have to be developed.

3.2.7 Monitoring of access points to the St. Lawrence River and visitor traffic

A. Background, issue and needs

The public uses the St. Lawrence and its shoreline for many purposes: walking, nature observation, relaxing, swimming, recreational boating and fishing. However, a number of users have identified an inability or difficulty accessing sites, whether supervised beaches, wharves, marinas or boat launches, or in cities, fishing grounds, or even areas for walking (2002 survey). The work of the Shoreline Access Coordination Committee (CCAR), which has conducted an exhaustive inventory of access points and their use, shows the need for a detailed inventory to be carried out in the field, which will require substantial resources.

The professional and technical services provided by PWGSC to the CCAR include the development, validation and updating of a database of access points. For example, it is hoped that imagery could be used to gather information on the number of vessels moored in a bay, marina or water body, the number of cars in a parking lot adjacent to a marina or to any activity related to the river (fishing, shell harvesting, kayaking or other sports), as well as the number of swimmers at given locations. The study area includes the St. Lawrence River and the following tributaries: L'Assomption River, Batiscan River, Boyer River, Bonaventure River, Chaudière River, Jacques Cartier River, Ottawa River, Richelieu River, Saguenay River, Saint-François River, Saint-Maurice River and Yamaska River.

PWGSC therefore wishes to explore the applicability of EO technology to the validation of the inventory data and implementation of a detailed inventory (complementing field observations) and to the detection and monitoring of visitor traffic for various uses at the various access points.

Through interviews with PWGSC staff, two specific needs were identified with regard to monitoring access points to the St. Lawrence River and visitor traffic:

B1- Validation and updating of the current database (access to the river)

B2- Detection and monitoring of visitor traffic for various uses (at the access points)

The requirements for meeting the needs of PWGSC are described in Table 19.

Table 19: Information needs for monitoring access points to the St. Lawrence River and visitor traffic

INFORMATION NEEDED BY PWGSC	LOCATION OF SITES	SIZE OF SITES	PRECISION OF INFORMATION	USE OF ARCHIVAL IMAGES	CONSTRAINTS	FREQUENCY	SCALE / RESOLUTION
B1. Validation and updating of existing PWGSC database of river access points	St. Lawrence River and the following tributaries: L'Assomption River, Batiscan River, Boyer River, Bonaventure River, Chaudière River, Jacques Cartier River, Ottawa River, Richelieu River, Saguenay River, Saint-François River, Saint-Maurice River and Yamaska River	Several square metres to several hectares	Presence or absence and recognition of type of access point	Yes	Visible: cloud cover / Radar: none	One-time acquisition	Large 1.0–2.0 m
B2. Detection and monitoring of visitor traffic for various uses at the various access points. For example: 1) number of vessels moored in a bay, marina or water body; 2) number of cars in a parking lot adjacent to a marina or to any other activity related to the river (fishing, shellfish harvesting, kayaking); 3) number of swimmers or fishers at given locations; 4) number of hikers or cyclists on the shoreline		Several square metres to several hectares	Presence and number or absence	Yes	Visible: cloud cover / Radar: none / Period of activity	Periodical / Daily or weekly	Very large 0.5–1.0 m

B. Potential for use

Multispectral sensors

No studies on the use of EO data to monitor access points to the St. Lawrence River or visitor traffic were found in the literature. However, the elements to be located and identified (marina, vessel, wharf, parking lot, harbour infrastructure, etc.) are comparable to urban infrastructure in terms of the size and shape of the targets. The studies mentioned in section 3.2.2 (Remote Monitoring of Work Progress), which show the potential of high-resolution satellite imagery for monitoring urban infrastructure, also demonstrate its strong potential for identification in the context of monitoring access points to the St. Lawrence River and visitor traffic.

High-resolution imagery from satellites such as GeoEye-1 (0.5 m), WorldView-1 and -2 (0.5 m), QuickBird-2 (0.6 m) and IKONOS-2 (1 m) has strong potential for use by PWGSC for this application. Given the high degree of availability of these satellite sensors and their potential for identifying land-based infrastructure, PWGSC could use this technology to monitor shoreline access paths and trails, harbour infrastructure, wharves, vessels and other marina infrastructure. The QuickBird image at right illustrates its potential for identifying elements at the Neuville marina in Quebec. This type of imagery is appropriate for validating and updating the existing PWGSC database of access points to the St. Lawrence River (need B1).

High-resolution (<1 m) multispectral satellite data also have strong potential for detecting various elements related to visitor traffic, such as the number of cars in a parking lot adjacent to a marina or to any other activity related to the river, or the presence of pedestrians, fishers or cyclists (need B2). In the latter case, however, there is a risk of confusion in image interpretation. Furthermore, the time of passage of optical satellites (always between about 9:30 a.m. and 10:00 a.m.) restricts the monitoring of visitor traffic to that time of day. A methodology would have to be developed (through a pilot project, for example) to determine the actual potential.

Radar sensors

Although high-resolution radar imagery from satellites such as RADARSAT-2 or TerraSAR-X has some potential for detecting urban infrastructure, even through cloud cover, its potential for monitoring access points to the St. Lawrence River and visitor traffic is somewhat limited.

Table 20 provides an estimate of the potential of EO data from each sensor to be used for each need in the “Monitoring of Access Points to the St. Lawrence River and Visitor Traffic” field of application.

Table 20: Estimated potential of EO data to be used for needs related to monitoring access points to the St. Lawrence River and visitor traffic

Sensor [3]	Need 1 [1]				Need 2				Acquisition Cost [2]
	Spectral Bands	Spatial Res.	Revisit Time	Potential	Spectral Bands	Spatial Res.	Revisit Time	Potential	
GeoEye-1	****	****	****		****	***	**		$$$$$
WorldView-2	****	****	****		****	***	**		$$$$$
WorldView-1	**	****	****		**	***	**		$$$$$
QuickBird-2	****	***	****		****	**	**		$$$$
IKONOS-2	****	**	****		****	**	**		$$$$
OrbView-3									
Kompsat-2	****	**	*		****	**	**		$$$$
ALOS PRISM	**	*	*						$$
CARTOSAT-1	**	*	****						$$
CARTOSAT-2	**	**	****		**	**	**		$$
Formosat-2 +	****	*	**		***	**	**		$$$$
RapidEye	****	*	****						$$$
SPOT-5	****	*	****						$$$$
ALOS-AVNIR-2									
SPOT-1 to -4									
Terra-ASTER									
Landsat-5									
Landsat-7 ++									
MERIS									
MODIS									
AVHRR									
Cosmo-Skymed	*	**	****						$$$$$
TerraSAR-X	*	**	**						$$$$$
TanDEM-X	*	**	**						$$$$$
RADARSAT-2	*	*	**						$
RADARSAT-1									$
ALOS-PALSAR									
ENVISAT-ASAR									
Thermography									
Hyperspectral									
LiDAR									

(1)	
+	Partial coverage, depending on location
++	Sensor problems: image area with no data
-	n/a: not applicable
	Does not meet any requirements
?	Information not available
*	Meets few requirements
**	Meets some requirements
***	Meets most requirements
****	Meets all requirements

(2)	
$ to $$$$$	Low cost to high cost

(3)
Optical satellite sensors
Radar satellite sensors
Airborne sensors

(4)	
	None
	Unknown
	Low
	Moderate
	High

Note: Variable weighting of spectral, spatial and temporal resolution may result in different potential levels for the same number of stars.

C. Conclusion

B1- Validation and updating of the existing PWGSC database of access points to the St. Lawrence River

- ✓ High-resolution (<1 m) multispectral satellite data have strong potential. Such data could be regularly obtained and used to view shoreline access paths and trails, harbour infrastructure, wharves, vessels and other marine infrastructure.

B2- Detection and monitoring of visitor traffic for various uses at the various access points

- ✓ High-resolution (<1 m) multispectral satellite data have strong potential for detecting various elements realted to visitor traffic, but they also have limitations: satellites pass at set times in the morning, the spatial resolution is sometimes too limited to detect targets (pedestrians, cyclists, etc.), and there is a risk of confusion in image interpretation. A methodology would have to be developed (through a pilot project, for example) to determine the actual potential.

Table 21: Recommended sensors for needs related to monitoring access points to the St. Lawrence River and visitor traffic

Needs	Name	EO Potential	Recommended EO Sensors	Comments/Recommendations
B1	Validation and updating of existing database	High	GeoEye-1 WorldView-2 QuickBird-2 IKONOS-2	Appropriate for updating elements such as shoreline access paths and trails, harbour infrastructure, wharves, vessels and other marina infrastructure.
B2	Detection and monitoring of visitor traffic for various uses	Moderate	GeoEye-1 WorldView-2	Appropriate for detecting and monitoring number of vessels moored, number of cars in a parking lot at the satellites' time of passage (in the morning). Reduced potential for number of swimmers or fishers and number of hikers or cyclists on the shoreline. A higher resolution would give more precise results in those cases.
Overall		**Moderate**		

3.2.8 Identification of ice fishing sites

A. Background, issue and needs

Ice fishing generally begins in late December and runs until mid-March. Some sites have only a handful of ice fishing huts, while others, such as Sainte-Anne-de-la-Pérade and La Baie au Saguenay, can have several hundred (see image at right). The fishing huts are about 4 m by 6 m and are usually clustered together. These small "ice villages" even have their own road networks for cars, snowmobiles and other vehicles, not to mention the many pedestrians. Some structures built to sell supplies or rent huts to fishers are larger.

Waste left on the ice at the end of the ice fishing season can have many harmful effects, such as water quality deterioration due to spills of lamp and heating oil, fishing gear and other fishing equipment, floating debris, which can cause safety problems for recreational boaters and other water users, and financial costs for cleaning up fishing debris that has washed up on the shoreline. The risk is higher in isolated areas (New Brunswick).

The CCAR's work has shown that ice fishing is relatively widespread in Quebec, but that there is no means of identifying sites and impacts on the ecosystem. PWGSC would like to explore the applicability of EO technology to the detection and monitoring of ice fishing sites during the winter and to the monitoring of the sites during the spring melt.

Through interviews with PWGSC staff, three specific needs were identified with regard to identifying ice fishing sites:

B1- Detection and location of ice fishing sites

B2- Monitoring of ice fishing sites during the fishing season (number of huts, access routes to sites, vehicles on sites, waste that is harmful to the environmental)

B3- Monitoring of ice fishing sites during the spring melt (abandoned huts, other debris and waste that is harmful to the environment)

The requirements for meeting PWGSC's needs are described in Table 22.

Table 22: Information needed for identifying ice fishing sites

INFORMATION NEEDED BY PWGSC	LOCATION OF SITES	SIZE OF SITES	PRECISION OF INFORMATION	USE OF ARCHIVAL IMAGES	CONSTRAINTS	FREQUENCY	SCALE / RESOLUTION
B1. Detection and location of ice fishing sites	St. Lawrence River and the following tributaries: L'Assomption River, Batiscan River, Boyer River, Bonaventure River, Chaudière River, Jacques Cartier River, Ottawa River, Richelieu River, Saguenay River, Saint-François River, Saint-Maurice River and Yamaska River	Tens of square metres to several hectares (several huts to several hundred)	Detection or absence	Yes	During the fishing season / January to March only / Visible: cloud cover	One-time acquisition	Large / 1.0–2.0 m
B2. Monitoring of ice fishing sites during the fishing season (number of huts, access routes to sites, vehicles on sites, waste that is harmful to the environment)		Tens of square metres to several hectares (several huts to several hundred)	Detection or absence	No	During the fishing season / January to March only / Visible: cloud cover	Occurrence - Weekly	Large / 1.0–2.0 m
B3. Monitoring of ice fishing sites **during the spring melt** (abandoned huts, other debris and waste that is harmful to the environment)		Tens of square metres to several hectares (several huts to several hundred)	Detection or absence	No	During the spring melt / March to April only / Visible: cloud cover	Occurrence - Weekly	Large / 1.0–2.0 m

B. Potential for use

Multispectral sensors

No studies on the identification of ice fishing sites were found in the literature. However, the elements to be located and identified (fishing huts and other infrastructure, cars, access routes, debris, etc.) are partially comparable to small urban infrastructure in terms of the size and shape of the targets. The studies mentioned in section 3.2.2 (Remote Monitoring of Work Progress), which show the potential of high-resolution satellite imagery for monitoring urban infrastructure, also suggest some potential for identifying ice fishing sites.

High-resolution imagery from satellites such as GeoEye-1 (0.5 m), WorldView-1 and -2 (0.5 m), QuickBird-2 (0.6 m) and IKONOS-2 (1 m) has strong potential for use by PWGSC for this application. Given the high degree of availability of these multispectral sensors and their potential for identifying land-based infrastructure in the presence of snow cover, PWGSC could use this technology to identify ice fishing sites (need B1). For example, it could monitor fishing huts and other infrastructure, cars, access routes to sites, and large debris or waste left on the ice during the fishing season (need B2).

However, monitoring of ice fishing sites during the spring melt (abandoned huts, other debris and waste that is harmful to the environment) has some limitations in terms of acquiring imagery when needed (need B3). The short duration of the season and the difficulty of anticipating the exact closing date of the fishing season could constitute a major limitation to EO data acquisition. It is important that data be acquired between the end of the fishing season and ice breakup in order to detect any debris left on the ice that could alter water quality. The small size of some debris and other waste may also be a limitation, given the spatial resolution of current satellite imagery. Some sites that are more isolated and whose exact location is not known will also be difficult to target. Because they are isolated, the environmental risk for those sites could be higher. However, the locations of a number of sites are well known. An initial phase could involve launching pilot project for well-known sites.

Radar sensors

High-resolution radar imagery from satellites such as RADARSAT-2 or TerraSAR-X has some potential for detecting urban infrastructure, even through cloud cover. However, studies would have to be conducted to assess its actual potential for detecting fishing huts and other structures present at ice fishing sites.

Table 23 provides an estimate of the potential of the EO data from each sensor to be used for each need in the “Identification of Ice Fishing Sites” field of application.

Table 23: Estimated potential of EO data to be used for needs related to identification of ice fishing sites

Sensor [3]	Need 1 [1]				Need 2				Need 3				Acquisition Cost [2]
	Spectral Bands	Spatial Res.	Revisit Time	Potential	Spectral Bands	Spatial Res.	Revisit Time	Potential	Spectral Bands	Spatial Res.	Revisit Time	Potential	
GeoEye-1	****	****	****		***	***	***		***	***	**		$$$$$
WorldView-2	****	****	****		***	***	***		***	***	**		$$$$$
WorldView-1	**	****	****		*	***	***		*	***	**		$$$$$
QuickBird-2	****	****	****		***	**	***		***	**	**		$$$$
IKONOS-2	****	**	****		***	**	***		***	**	**		$$$$
OrbView-3													
Kompsat-2	****	***	*		***	**	****		***	**	**		$$$$
ALOS PRISM	**	*	*										
CARTOSAT-1	**	*	****										
CARTOSAT-2	**	**	****		*	**	****		*	**	**		$$
Formosat-2 +	***	*	**		***	**	****		***	**	**		$$$$
RapidEye	***	*	****										
SPOT-5	***	*	****										
ALOS-AVNIR-2													
SPOT-1 to -4													
Terra-ASTER													
Landsat-5													
Landsat-7 ++													
MERIS													
MODIS													
AVHRR													
Cosmo-Skymed	*	**	****										$$$$$
TerraSAR-X	*	**	**										$$$$$
TanDEM-X	*	**	***										$$$$$
RADARSAT-2	*	*	**										$
RADARSAT-1													$
ALOS-PALSAR													
ENVISAT-ASAR													
Thermography													
Hyperspectral													
LiDAR													

(1)	
+	Partial coverage, depending on location
++	Sensor problems: image area with no data
-	n/a: not applicable
	Does not meet any requirements
?	Information not available
*	Meets few requirements
**	Meets some requirements
***	Meets most requirements
****	Meets all requirements

(2)	
$ to $$$$$	Low cost to high cost

(3)
Optical satellite sensors
Radar satellite sensors
Airborne sensors

(4)	
	None
	Unknown
	Low
	Moderate
	High

Note: Variable weighting of spectral, spatial and temporal resolution may result in different potential levels for the same number of stars.

C. Conclusion

B1- Detection and location of ice fishing sites

- ✓ High-resolution (<1 m) multispectral imagery has relatively strong potential. However, lack of knowledge about the location of most of the sites on St. Lawrence tributaries is a major challenge to planning image acquisition.

B2- Monitoring of ice fishing sites during the fishing season (number of huts, access routes to sites, vehicles on sites, waste that is harmful to the environment)

- ✓ High-resolution (<1 m) multispectral imagery has relatively strong potential.

B3- Monitoring of ice fishing sites during the spring melt (abandoned huts, other debris and waste that is harmful to the environment)

- ✓ High-resolution (<1 m) multispectral imagery has some potential, but has major limitations in terms of acquiring imagery at the time required.

Table 24: Recommended sensors for needs related to the identification of ice fishing sites

Needs	Name	EO Potential	Recommended EO Sensors	Comments/Recommendations
B1	Detection and location of ice fishing sites	High	GeoEye-1 WorldView-2 QuickBird-2 IKONOS-2	Appropriate for detecting and locating sites, but planning image acquisition will be complex and costly because the sites are scattered.
B2	Monitoring of ice fishing sites during the fishing season	High	GeoEye-1 WorldView-2 QuickBird-2 IKONOS-2	Appropriate for the number of huts, access routes to sites, vehicles on sites. Potential is more limited for monitoring waste that is harmful to the environment.
B3	Monitoring of ice fishing sites during the spring melt	Moderate	GeoEye-1 WorldView-2 QuickBird-2 IKONOS-2	Monitoring is possible, but uncertainty about the timing and speed of the spring melt may sometimes make it difficult to know whether high-quality imagery will be available.
Overall		**High**		