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## Project Relating to the Aging of Lakes

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### Lac St-Pierre



DÉCEMBER 2015

FÉDÉRATION DES LACS DE VAL-DES-MONTS

This project was realized thanks to the collaboration of the TD Friends of the Environment, associations of Val-des-Monts lakes and the Municipality of Val-des-Monts



**Fondation TD  
des amis de  
l'environnement**



# Project On the Aging of Lakes

## Lake St-Pierre

Lake St. Pierre is located in the center of Municipality of Val-des-Monts and it pours to the east into Lake McArthur. It is fed mainly by lake McMullin from the north, lake Robinson from the central west, the White River originating from lake Butor (to the east) and lake Lockhart (center east). It is part of the West White River watershed.

### Physical chemistry

The water samples were collected at three locations on the lake (LSP2, LSP4 and LSP6 ) and three (3) times during the summer, that is on June 21, July 25 and August 14, 2015. The inventoried parameters were total phosphorus, chlorophyll a and dissolved organic carbon. The water clarity was also identified three (3) times on the same dates as the three samples of the water.

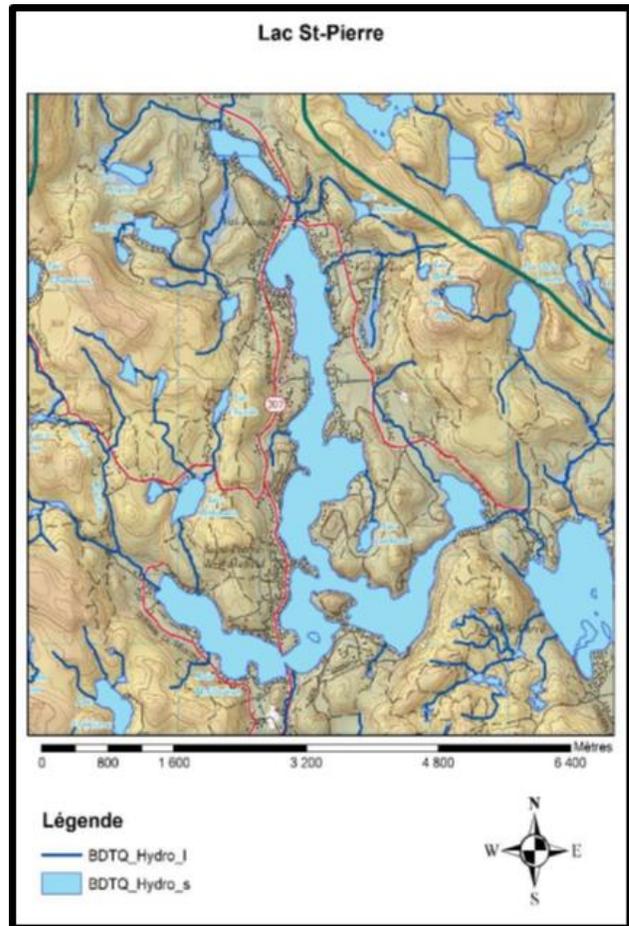


Figure1. Map of the watershed of Lake St-Pierre in Val-des-Monts.

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Table I. Classification of trophic level of lakes according to the values of total phosphorus, chlorophyll a and transparency of water.

Classification	TOTAL PHOSPHOR (µg/l)	CHLOROPHYLL a (µg/l)	TRANSPARENCY (mètre)
Ultra-oligotrophe	< 4	< 1	> 12
Oligotrophe	4 à 10	1 à 3	12 à 5
Oligomésotrophe	7 à 13	2,5 à 3,5	6 à 4
Mésotrophe	10 à 30	3 à 8	5 à 2,5
Méso-eutrophe	20 à 35	6,5 à 10	3 à 2
Eutrophe	30 à 100	8 à 25	2,5 à 1
Hypereutrophe	> 100	> 25	< 1

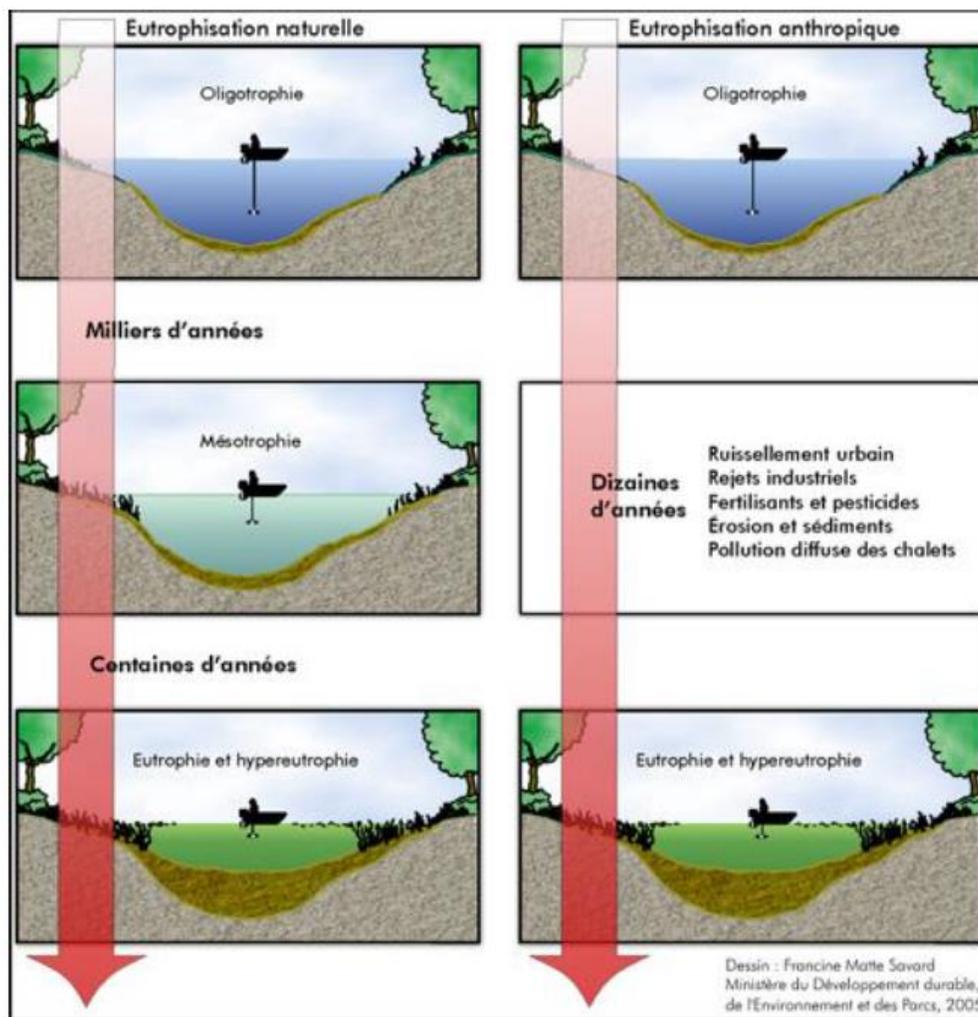


Figure2. The process of eutrophication.

Source: <http://www.mddelcc.gouv.qc.ca/eau/rsvl/processus.jpg>

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### Transparency

Transparency is the property of water to transmit light. It is measured using a Secchi disk and it tells us the amount of suspended matter in water. The more water is transparent, the better. Transparency decreases with the increase of microscopic algae in the lake.

### Water transparency of Lake St-Pierre

The average water clarity of Lake St-Pierre is 4.4 meters. Its trophic ranking is in the transition zone between the mesotrophic classification and the oligo-mesotrophic classification.

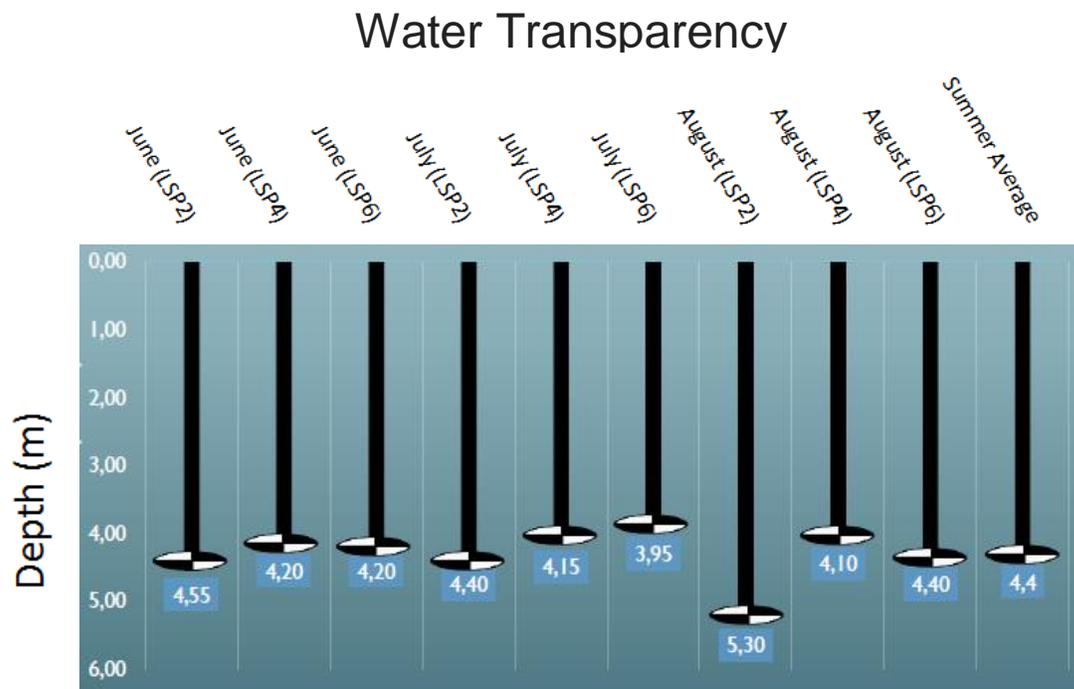


Figure3. Results of transparency tests on lake St-Pierre (summer 2015)

### Total phosphorus

Phosphorus is an essential nutrient for the growth of plants and algae. Phosphorus is directly linked to eutrophication (premature aging) of a lake (see Figure 2). According to some studies (Carignan et al., 2003), three (3) main factors are related to the concentration of phosphorus in a lake. They are the presence of wetlands, the renewal time of lake water and the impact of human activity (including disruptions to the shoreline). A phosphorus content of 10 mg / liter is considered to be the limit before

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premature eutrophication problems (plant growth and algae) become serious, according to Richard Carignan.

### Origin

Phosphorus is a natural lake nutrient and it comes mainly from rain and debris carried by the wind (which accumulates in lakes), and other debris from streams, wetlands and beaver ponds. Phosphorus inputs of human origin are primarily from non-conforming septic systems, from fertilizers in gardens and lawn, from excessive deforestation of shorelines, from industrial effluents, from erosion of shorelines and from unsustainable agriculture.

### Effects on water quality

When the phosphorus content in water is too high, it can significantly increase the growth of aquatic plants and algae (cyanobacteria). It can affect the taste and smell of the water, create anoxia (lack of oxygen) in deep waters and displace fish salmonids (trout) by more tolerant species. In summary, increased phosphorus in a lake is directly related to the eutrophication of the lake (aging).

### Total phosphorus concentration of Lac St-Pierre

The average concentration of total phosphorus measured for the entire lake during the summer of 2015 was 6.6 mg / l, indicating that the water was very rich in this nutrient. This measure is the lake as oligotrophic.

Table II. Sampling results of the physical chemistry of the lake St-Pierre for summer 2015

DATE	Total PHOSPHORE (UG/L)	CHLOROPHYLLE A (UG/L)	Dissolved Organic CARBON (MG/L)
21 June 2015 (LSP2-4-6)	6,2	1,16	3,43
26 July 2015 (LSP2-4-6)	7,1	0,62	3,40
14 August 2015 (LSP2-4-6)	6,4	0,96	3,83
Summer Average	6,6	0,91	3,55

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### Chlorophyll *a*

#### What is chlorophyll *a* and why do we sample it?

Chlorophyll is a pigment that gives the green color to plants, algae and cyanobacteria. It indicates the abundance of microscopic algae (phytoplankton) present in the lake. These algae determine the organic matter production levels in the lake and they increase with the concentration of phosphorus in the lake. Eutrophic lakes produce a large amount of algae.

#### Chlorophyll concentration in the lake St-Pierre

The average concentration of chlorophyll *a* in the lake is 0.91 mg / l, which indicates that the biomass of microscopic algae suspended in the water is very low. This puts the lake in the transition zone between oligotrophic and ultra-oligotrophic.

### Dissolved organic carbon

#### What dissolved organic carbon and therefore the sample?

Dissolved organic carbon (DOC) from the decomposition of organic material (plants, microorganisms, dead animals, contaminants introduced by man) is responsible for the yellowish or brownish water. It determines the evolution of organic pollution which, in high concentrations, affects the oxygen supply in the water.

#### Concentration of dissolved organic carbon in the lake St-Pierre

The average concentration of organic carbon dissolved in the lake is 3.55 mg / l for summer 2015. This measure indicates that the lake water is slightly colored and this has a low impact on water clarity.

Table III. Classification of organic carbon concentration results dissolved in water and its impact on transparency.

Dissolved Organic Carbon (mg/l)	Color	Effect on transparency
< 3	Very lightly colored	Very little effect
≥ 3 < 4	Lightly colored	Light effect
≥ 4 < 6	Colored	Some effect
≥ 6	Very colored	Strong effect

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#### Blue Green Algae

The blue green algae (also called cyanobacteria) are aquatic micro-organisms that produce natural poisons or cyano-toxins. Even though they are naturally present in water, cyanobacteria are problematic if they become abundant. If conditions are favorable, e.g. when there are large amounts of phosphorus in the water, the cyanobacteria can reproduce rapidly. They then form what is called a bloom (or bloom) which is visible to the naked eye and generally found on the surface of the water. The blooms are usually green or turquoise and they resemble a surface paint spills, in the foam on the shores or pea soup (or broccoli). In addition, some cyanobacteria (rare) have red pigments and can look like extended or diffuse masses (even under the ice) in varying shades of red. For examples of cyanobacterial blooms, **see “*Guide d’identification des fleurs d’eau de cyanobactéries*”** available in the **Ministère du Développement durable, de l’Environnement et Lutte Contre les Changements Climatiques** or online at ...

[http://www.mddelcc.gouv.qc.ca/eau/eco\\_aqua/cyanobacteries/guide-identif.pdf](http://www.mddelcc.gouv.qc.ca/eau/eco_aqua/cyanobacteries/guide-identif.pdf).

#### Health risks

When cyanobacteria produce toxins, they can be harmful to health. It is strongly recommended not to become in contact with the water and not to consume it. The ailments are mainly diarrhea, nausea and vomiting, abdominal pain when there is ingestion and skin irritations, eyes and ears if there is contact. If eaten in quantity, ingestion of cyanobacterial toxins can affect the digestive system, liver and nervous system.

#### Measures to Undertake

If you suspect the presence of a bloom on a lake, you should contact the **Ministère du Développement durable, de l’Environnement et Lutte Contre les Changements Climatiques** without delay to 819-772-3434 or **Urgence-Environnement** at 1 866 694-5454 outside the opening hours. You can fill in the form of visual observation of the presence of cyanobacterial blooms here:

[http://www.mddelcc.gouv.qc.ca/eau/eco\\_aqua/cyanobacteries/formulaire/formulaire.asp](http://www.mddelcc.gouv.qc.ca/eau/eco_aqua/cyanobacteries/formulaire/formulaire.asp)

#### Blue green algae and the lake St-Pierre

Lake St. Pierre was listed in 2015 by the Ministry of Sustainable Development, Environment and Fight against Climate Change (MDDELCC) among lakes affected by a bloom of blue green algae. He was also in 2011 and remains on the board of the lakes

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affected by a bloom of blue-green algae from 2004 to 2014 and recurring water bodies reported since 2013 MDDELCC Quebec.

### Trophic status and recommendations

The results of all parameters measured at the three (3) sampling locations of Lake St-Pierre were used to classify the lake as being oligotrophic with a transition to ultra-oligotrophic for *chlorophyll a* and oligo-mesotrophic for *transparency*. This means that the lake shows some signs of premature aging (eutrophication). However, monitoring and protection are essential to preserve, or even improve this ranking. The Federation of Val-des-Monts lakes recommends that residents and users of the St-Pierre Lake and its watershed to strictly implement good environmental practices to prevent nutrient inputs from human activity.

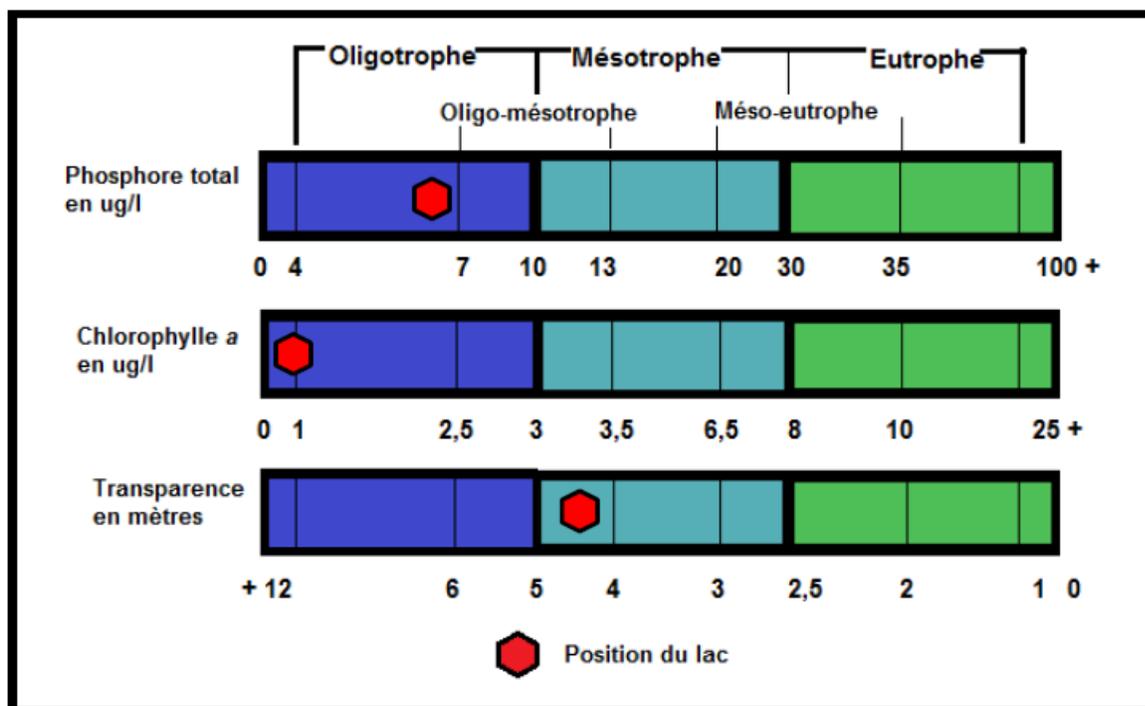


Figure4. Ranking of the trophic status of Lake St-Pierre for the summer 2015

- Respect the integrity of the shoreline, do not mow the lawn and replant if necessary.
- Do not remove the fill or materials that may leach or pollute inside the buffer strip.
- Become a member and take part in the community life of the lake.

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- Maintain and inspected septic tanks. Make sure all the plumbing drains into the septic tank (washbasin, washing machine, etc.) and not into the French drain in the house or directly in the natural environment.
- Use non-motorized pleasure craft or restrict speed limits or reduce wave heights to reduce the impact of waves on shorelines.
- Restrict the use of pesticides, herbicides and household products based on phosphorus.
- Reduce the contamination of aquatic invasive species by washing boats before moving a boat to another body of water.
- Do not mow the lawn or deposit of fill or other materials inside the buffer strip.
- Ensuring the stability of culverts on private roads may lead to leaching of the sand or other materials in water bodies.

To learn more about good environmental practices, visit

<http://www.mddelcc.gouv.qc.ca/eau/algues-bv/guide-synth-bonne-pratiq.pdf>

### Additional Sources and references

Sampling of our lakes – Article by Mélanie Renaud appeared in the Echo lakes volume 10 number 1.

<http://federationdeslacs.ca/projects/projectdocs/EchoesVol.10No1-f.pdf>

Video - phosphorus sampling technique and transparency of water - Federation of Lakes of Val-des-Monts

[https://www.youtube.com/watch?v=\\_9jt5WoBB-s](https://www.youtube.com/watch?v=_9jt5WoBB-s)

The lakes kit - Tools for the Health of Lakes

<http://www.troussedeslacs.org/>

The volunteer network for monitoring of lakes - MDDELCC

<http://www.mddelcc.gouv.qc.ca/eau/rsvl/methodes.htm>

List of water plants affected by a bloom of blue-green algae from 2004 to 2014 and recurring water bodies reported since 2013 - MDDELCC

<http://www.mddelcc.gouv.qc.ca/eau/algues-bv/bilan/listedeslacs2004-2014.pdf>