

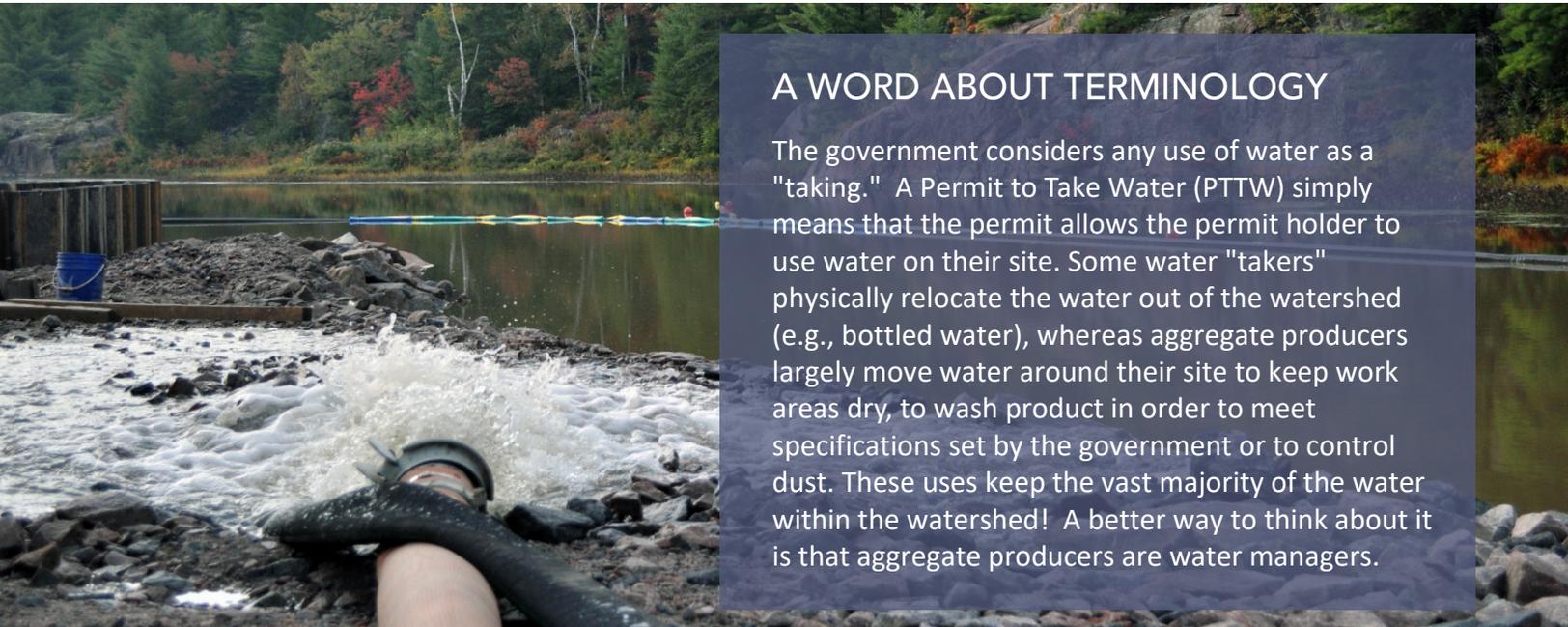
Water Handling in Pits & Quarries

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ONTARIO STONE, SAND
& GRAVEL ASSOCIATION

One of the largest myths about pits and quarries is that they use a significant amount of water. Aggregate operations are permitted to 'take' large volumes of water each day for a number of reasons. It is a common misunderstanding that because aggregate operations have permits to take large volumes of water each day, that they do.

The truth is the aggregate industry only uses a small portion of water in comparison to what their permit allows. During the spring or after a heavy rainstorm, operations may need to remove their daily allowable maximum – but for most of the year, they take significantly less or nothing at all. For example, after a heavy rainfall they may need to relocate large volumes of water to keep the quarry floor dry so that workers can extract the rock. And even when water is pumped, it doesn't leave the watershed. This Gravel Fact sheet is designed to help you understand water usage in a pit or quarry.



A WORD ABOUT TERMINOLOGY

The government considers any use of water as a "taking." A Permit to Take Water (PTTW) simply means that the permit allows the permit holder to use water on their site. Some water "takers" physically relocate the water out of the watershed (e.g., bottled water), whereas aggregate producers largely move water around their site to keep work areas dry, to wash product in order to meet specifications set by the government or to control dust. These uses keep the vast majority of the water within the watershed! A better way to think about it is that aggregate producers are water managers.

AGGREGATE PRODUCERS ARE WATER MANAGERS

Aggregate operators are primarily water managers. More than 90% of the water that is pumped out of a quarry to maintain dry operating conditions is released into nearby streams and/or recharged into the groundwater system. Water used for washing stone, sand and gravel is recycled to conserve water resources.

In Ontario, any industry (or individual) removing more than 50,000 litres of water in a day must obtain a Permit To Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks (MECP). A PTTW is required for many purposes such as for municipal water supplies, agriculture, food and beverage and industrial uses such as power generation. The Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation (O.Reg. 387/04) under the Act govern these water takings.

Based on the MECP PTTW database, the total permitted maximum annual taking in the province in 2022 was over 150 trillion litres (Table 1). But not all the water that is permitted is actually taken. The MECP tracks the actual water taking by requiring PTTW holders to monitor their daily water use and report these takings annually through the Water Taking Reporting System (WTRS).



The WTRS provides a comprehensive understanding of actual water takings in the province, which again, is considerably less than what is permitted. For example, Table 1 summarizes the permitted and actual water takings for 2020. The actual annual total water taking reported is only 14% of the total annual permitted water taking across the province. (Table 1).

TABLE 1: SUMMARY OF WATER TAKINGS IN ONTARIO

Purpose/Sub-Purpose	Total Annual Permitted (Million L)	Total Annual Actual (Million L)
Agricultural	394,871	69,400
Commercial	517,797	308,258
Construction	245,313	22,310
Dewatering	1,335,270	379,627
Dewatering - Pits & Quarries	813,094	303,224
Dewatering Construction	3,773,786	38,263
Industrial	132,481,372	20,250,291
Industrial - Aggregate Washing	443,534	107,719
Institutional	7,318	7,301
Miscellaneous	12,717,891	735,705
Recreational	144,195	10,058
Remediation	187,391	52,251
Water Supply	6,073,751	2,656,028
Total	159,135,585	24,940,435

**Whereas permitted water takings are from 2022, annual water taking data represents most recent data available (2020) and therefore a direct year to year comparison is not possible.*

Although the permitted water takings in the aggregate industry appear large, actual water takings are relatively small in comparison to other industries. Based on the MECP PTTW database, actual water taking at pits and quarries for dewatering and aggregate washing purposes is less than 2% of the total water taken in Ontario.



FIGURE 1. ACTUAL WATER TAKINGS IN ONTARIO

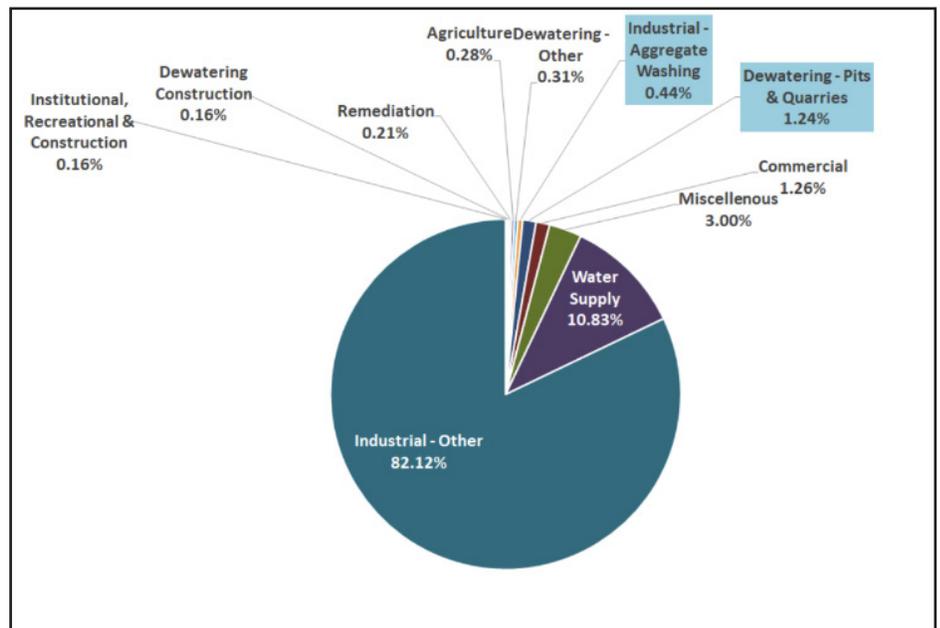
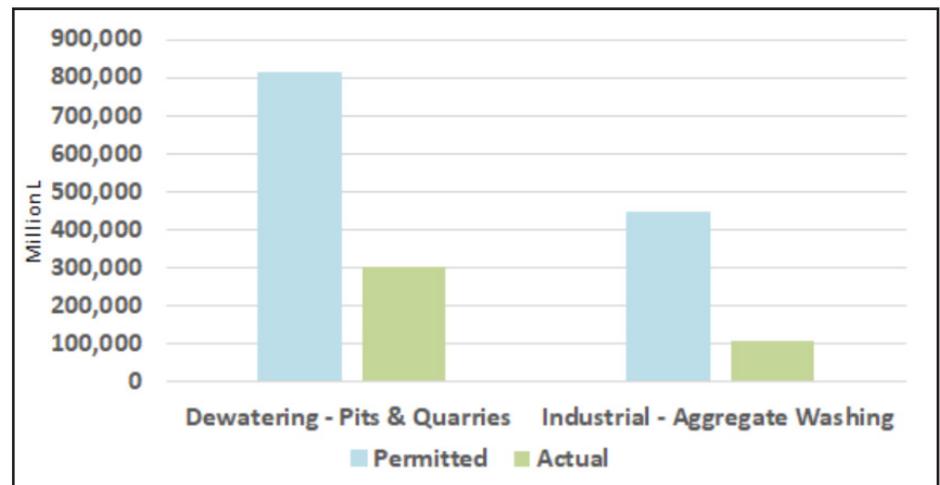


FIGURE 2. PERMITTED VS. ACTUAL WATER TAKINGS FOR PIT AND QUARRY DEWATERING & AGGREGATE WASHING



DID YOU KNOW?
Water taking at pits and quarries is only

1.67%

of total water taken in Ontario.

WATER TAKINGS IN THE AGGREGATE INDUSTRY

The aggregate industry often requires the management of water as part of day-to-day operations, where water is handled on-site and/or discharged off-site to local surface water systems. The following pumping activities at aggregate operations require a PTTW from the MECP:

- Dewatering (the term used when pumping water out of a pit or quarry to keep the floor of the pit or quarry dry)
- Industrial (aggregate washing and dust control)

WHY DO AGGREGATE OPERATIONS NEED LARGE PERMITTED WATER TAKINGS?

PTTW holders are restricted by maximum pumping rates (L/min) as well as the hours/day and days/year that they can pump. These permitted water takings represent worst case scenarios determined by a needs assessment. For dewatering, aggregate washing, and dust control, there is a standard approach to assessing the maximum water taking requirements. These calculations and resulting maximums will be site-specific within the aggregate industry. Unfortunately, the PTTW system in the province doesn't allow for variability but rather requires the maximum taking to be accounted for on the permit.

Although aggregate operators on average use only 37% of their permitted volume for dewatering each year, it is essential that operations are permitted to remove large volumes of water. A large rainfall event over a relatively short period of time would require maximum daily permitted pumping rates to pump water away from the quarry/pit floor. If water is not removed quickly enough, it would negatively impact operations and could cause flooding and geotechnical instability.

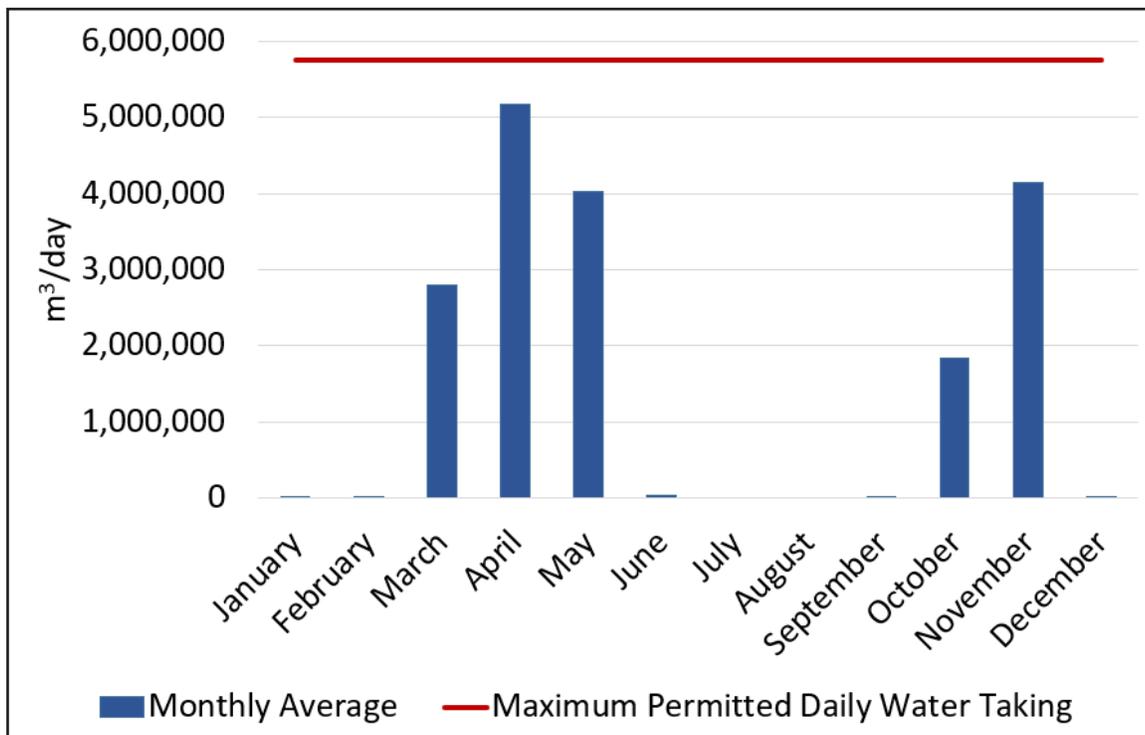


QUARRY DEWATERING

The largest water use within the aggregate industry is generally when a quarry requires dewatering to operate in dry conditions. Dewatering of quarries can require large 'takings' during the spring thaw and the fall wet periods. Quarries handle water through pumping from a sump area located in the lowest part of the quarry where internal drainage is ultimately directed. There are periods where the maximum daily takings are reached as a result (in spring and fall). Similarly, there are periods where no water is taken, such as during winter months when the water is frozen and, at times, during dry summer conditions.

Figure 3 shows a typical example of daily maximum permitted water taking compared to the actual daily water taking at a quarry. In this example, although some months had days where the maximum permitted daily volume was taken, annually the actual water taking was only 552 Million m³ of the 2,102 Million m³ permitted.

FIGURE 3. EXAMPLE OF QUARRY DEWATERING THROUGHOUT THE YEAR



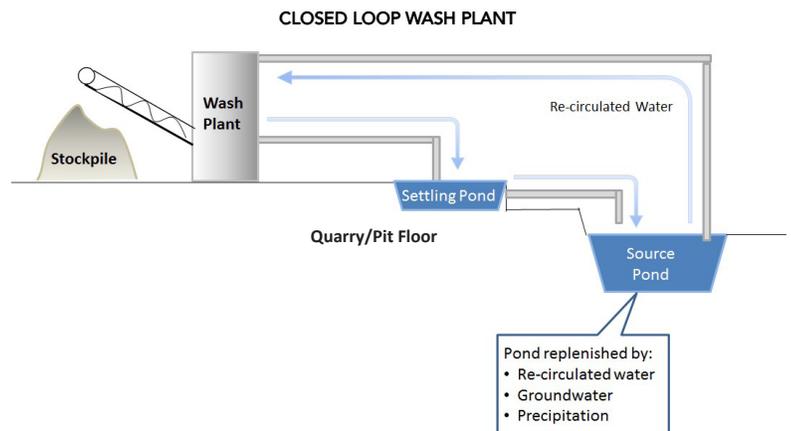
AGGREGATE WASHING

To meet specifications for road building and construction projects, sand, gravel and crushed stone often need to be washed to remove fine particles. The water is typically taken from an on-site source and fed to the wash plant which rinses the product with water only.

No chemicals are used in this process.

Aggregate wash plants use a closed loop system design, where the water used for washing the products is collected in a series of settling ponds to allow for fine particles to settle prior to the water being recirculated back for reuse in the process. The pumping rate is controlled by the capacity of the washing equipment. Washing plants typically use a pumping rate of 4,000 L/min for 10 to 12 hours on the days washing occurs. Washing does not occur during the winter months in Ontario, limiting the maximum number of days that washing can occur.

FIGURE 4. EXAMPLE OF WATER RECYCLING FOR AGGREGATE WASHING



It is estimated that less than 8% of the water used at an aggregate site is not directly returned to the wash pond in the washing cycle because of evaporation and residual soil moisture on the washed aggregate which also eventually evaporates back into the ecosystem (Source: Golder, 2006). Therefore, of the 107 Million m³ of water pumped through wash plants in 2020 only 8.56 Million m³ of water doesn't remain in the aquifer. This water taking represents approximately 0.44% of the total water taking in the province.

DUST CONTROL AND TRUCK WASHING

Similar to aggregate washing, dust control may be authorized in either Table 1 of the PTTW or as a condition within the PTTW. Although dust control is typically less than 50,000 L/day, it is recognized by the MECP as an additive water use under the PTTW. To minimize dust (a by-product of extracting and crushing rock) water is sprayed by truck on internal haul roads, processing equipment, stockpiles and trucks exiting the site.



EMERGING ADVANCEMENTS IN WATER CONSERVATION

The aggregate industry is investing in technological advancements that improve water management plans by reducing water handling at sites. Innovative improvements in wash plant technology have shown to decrease water use considerably. For example, traditional washing facilities use 4,000 L/min in a washing cycle. High-pressure aggregate washing plants trim that down to 90 L/min (under 50,000 L/day based on a 9-hour day).

So the next time you hear that aggregate operations use a lot of water – remember:

- The aggregate industry only takes a small percentage of the water volume allowed by permit, and makes up less than 2% of all water takings in Ontario.
- Aggregate operators are proficient water users, only using the water that is needed and helping to ensure the sustainable use of water on their sites.
- The majority of water the aggregate industry uses is returned to the watershed or recycled for aggregate washing purposes.

Visit **GravelFacts.ca** for more information about stone, sand and gravel in Ontario.

REFERENCES

- Cumming Cockburn (2000). Hurricane Hazel and Extreme Rainfall in Southern Ontario.
- Ontario Water Resources Act and Water Taking Regulation O.Reg 387/04
- Permit to Take Water Database - <https://www.ontario.ca/data/permit-take-water>
- Golder Associates (2006). Water Consumption Study.
- Grand River Conservation Authority (2011). Water Use Inventory Report for the Grand River Watershed.
- 2020 Annual Water Taking - <https://data.ontario.ca/dataset/water-taking>

ACKNOWLEDGEMENTS

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