MOHAWK COLLEGE • MARCH 2020

2018-2019

# Greenhouse Gas Inventory Report

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CENTRE FOR CLIMATE CHANGE MANAGEMENT AT MOHAWK COLLEGE

# Executive Summary

In 2011 Mohawk College completed its first greenhouse gas (GHG) inventory for the 2007 calendar year. This inventory was used to set a baseline against which Mohawk would set and measure progressive carbon goals. In the 2015-2019 Environmental Management Plan, Mohawk set a goal to reduce its GHG emissions by 30% by 2020.

The following report summarizes the findings of the GHG inventory for the 2018-2019 academic year. Building on the work of previous inventories (for 2007 and 2012 respectively), this report presents updated information on Mohawk's GHG emissions to ensure transparency and help support strategic decisions for future sustainability and climate change initiatives.

The table below summarizes Mohawk's GHG emissions over time compared to the 2007 baseline for all three emissions scopes.

| Scope | 2007 $tCO_2e$ | 2012 $tCO_2e$ | 2018/2019 $tCO_2e$ | Change since 2007 baseline (%) |
|---|---|---|---|---|
| 1 | 3,647 | 2,811 | 2842.86 | -22 |
| 2 | 4,876 | 2,108 | 341.5 | -93 |
| 3 | 5,201 | 5,535 | 11,143.69 | +214 |

Since 2007 Scope 1 and 2 emissions, directly caused by Mohawk operations, have reduced by 22% and 93% respectively. Scope 3 emissions, which are indirect emissions, have increased by 214%. This is likely due to the increase in students commuting to campus, as well as more accurate and available commuting data that better tracks Scope 3 emissions.

The following table summarizes two key intensity metrics within post-secondary institution emissions inventories: emissions per full-time equivalent (FTE, students only) and emissions per square metre ($m^2$) of building space. Emissions per FTE have reduced by 28% versus the 2007 baseline, with the 2018/2019 increase attributed to increased commuting-based emissions. Emissions per square metre of space have reduced significantly as a result of College growth, primarily due to the Joyce Centre for Partnership and Innovation.

| Metric | 2007 | 2012 | 2018/2019 | Change from 2007 baseline (%) |
|---|---|---|---|---|
| $tCO_2e$/FTE* | 1.17 | 0.66 | 0.84 | -28 |
| $tCO_2e/m^2$** | 0.063 | 0.038 | 0.020 | -68 |

*All scopes included as FTEs contribute to all GHG emission sources.
**Scope 3 emissions excluded in calculation as they do not impact the performance of the physical space.

Mohawk has made significant strides in reducing its emissions, and will use the information from this report to continue to set ambitious GHG emissions reduction targets. By doing so, Mohawk will continue to solidify its place as a leader in post-secondary sustainability and climate leadership



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## Mohawk College and Climate Action

Mohawk College has been providing a quality, higher education experience to students in Hamilton, Ontario and the surrounding area since 1967. The college educates and serves more than 31,700 full-time, part-time, apprenticeship and international students at three main campuses in Hamilton, at learning hubs across Hamilton through City School by Mohawk, and at the college's Aviation Facility at Hamilton International Airport. Mohawk is among the leading colleges in Canada for applied research. It has been named one of Canada's greenest employers for six consecutive years, and is also home to the country's largest net zero energy institutional building. More than 120,000 people have graduated from Mohawk since it was founded.

The college's involvement in sustainability and climate action began in 2008 with the creation of the Sustainability Office, which worked to introduce initiatives, programs, and incentives to promote and embed sustainability throughout the college. In 2011 the college completed its first greenhouse gas (GHG) inventory for the 2007 calendar year. By measuring and reporting on GHG emissions, the college assessed and baselined the college's environmental impact, by measuring the amount of greenhouse gases emitted by college operations. This baseline then informed the development of an Environmental Management Plan (EMP) in which Mohawk set its first emissions reduction target of 20% by 2020 (compared to the 2007 baseline). An additional inventory was completed in 2014 for 2012 to assess progress to date.

Mohawk understands the importance of climate mitigation to support the transition to a thriving, low carbon economy. As a result, Mohawk continues to work to reduce its greenhouse gas emissions and has incorporated its GHG reduction target into its strategic plan and dedicated resources and support to sustainability initiatives, often co-led by the Sustainability Office. To ensure effective emission reduction strategies, projects, and services, regular GHG inventories are necessary, and are completed every approximately five years.

## Success to Date

Mohawk has undertaken various projects and has participated in numerous reporting initiatives to build sustainability and climate leadership within the post-secondary sector. A selection of this work includes:

- In 2019 Mohawk was the first Ontario College to earn a Sustainability Tracking, Assessment, and Rating System (STARS) gold rating. STARS is a program offered by the Association for the Advancement Sustainability in Higher Education (AASHE) and is a self-reporting framework that evaluates post-secondary institutions' sustainability performance.
- Since 2013, Mohawk has implemented two Environmental Management Plans (EMPs) that guide campus sustainability activities that aim to educate and

engage students and employees in sustainability while reducing GHG emissions.

- The Sustainability Office, also established in 2013, manages over 30 sustainability-focused programs and services each year.
- In November 2017, Mohawk, in partnership with the Cities of Hamilton and Burlington launched the Centre for Climate Change Management at Mohawk (CCCM), a regional hub for climate action that supports the Hamilton-Burlington's transition to the low carbon economy.
- In September 2018 Mohawk opened The Joyce Centre for Partnership and Innovation, the first building in Canada to receive the Canada Green Building Council's Zero Carbon Building Standard certification for both Design and Performance.
- Mohawk has been named one of Canada's Greenest Employers six times.
- Since 2012, Mohawk's Sustainability Initiatives Fund (SIF) provides opportunities for students in all programs to gain sustainability skills and knowledge beyond the classroom. Students can submit sustainability related projects they would like to see on campus to the Idea Bank campaign, with winning ideas implemented on campus.

# Inventory Objectives, Emissions Quantification, and Boundaries

## Objectives

Mohawk reports on emissions approximately every five years to evaluate progress towards the reduction target set out in the environmental management plan (EMP). Mohawk's first EMP, released in 2011, set a reduction target of 20% by 2020 compared to the 2007 baseline. This target was then updated in 2014 to 30% by 2020, as the initial target was met in 2012, eight years ahead of schedule.

The results presented in this report are meant to identify and shape three main items:

1. Quantifying progress towards the 2020 emission reduction target;
2. Providing data to inform Mohawk's Environmental Management Plan (EMP) 3.0 and any new GHG emissions reductions targets set by that plan;
3. Reporting on the impact on campus sustainability by the addition of The Joyce Centre – the region's first Zero Carbon building, which opened in 2018.

## Quantification

The Greenhouse Gas Protocol (the Protocol) is a voluntary GHG accounting tool for understanding, quantifying, and managing GHG emissions, and is considered the standard for emissions quantification. The *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)* was used to guide the development of this inventory.

Within the Protocol GHG emissions are categorized into three "scopes", which are summarized in the following table. Within the Protocol reporting on Scopes 1 and 2 are mandatory, while Scope 3 reporting is optional.

**Table 1** Categorization of emission scopes as described in the Greenhouse Gas Protocol

| Scope | Definition | Mohawk's role in scope reductions |
|---|---|---|
| 1 | Direct emission from sources Mohawk owns or controls. This includes fossil fuels purchased by the college for heating, generator use, and fuel for Mohawk-owned vehicles. | Control |
| 2 | Indirect emissions from purchased electricity. | Control |
| 3 | Indirect emissions that are not owned or controlled by Mohawk College. This pertains to emitting activities that take place due to college business. | Influence |

This report presents emissions in tonnes of carbon dioxide equivalents ($tCO_2e$). For all numbers the following calculation was used:

**$tCO_2e$ = Fuel Use or Consumption of Emitting Activity * Emission Factor *Global Warming Potential**

## Inventory Boundaries

To help categorize and understand GHG emitting activities inventories must set boundaries pertaining to inclusions and exclusions of physical locations and emitting activities. Within the context of Mohawk College, organizational and operational boundaries were set as per the Protocol.

### Organizational Boundary

Setting organizational boundaries establishes emissions ownership, and therefore responsibility for action. Similar to the 2007 and 2012 inventories completed for the College, the control (operational) approach was used. The control approach specifies that a company accounts for 100% of emissions over which it has operational control. Within Mohawk College this includes the Fennel and Stoney Creek campuses, but does not include the Institute of Applied Health Sciences at McMaster University because it is reported as part of McMaster's campus operations.

### Operational Boundaries

Once organizational boundaries are set operational boundaries are determined to provide further clarification. Setting operational boundaries includes categorizing

emitting activities into one of the three Scopes. Additionally, setting out what will be included and excluded within Scope 3 reporting is important to ensure only emissions from activities the responsible party has control of influence over is critical.

A summary of emitting activities and their Scopes as determined by the Protocol are provided below.

**Table 2** Mohawk's reported emitting activities categorized by scope

| Activity | Scope |
|---|---|
| Fleet vehicle use | 1 |
| Natural gas use | 1 |
| Backup generator fuel consumption | 1 |
| Purchased electricity | 2 |
| Athletics department bus travel | 3 |
| Paper use | 3 |
| Employee travel | 3 |
| Student, staff, and faculty commuting | 3 |
| Waste | 3 |

### Inventory Timeline

The current inventory covers September 2018 – August 2019. Collected data and emissions calculations were compared to the revised 2007 inventory numbers presented in the 2012 inventory.

## Results and Discussion

### Comparison to Baseline

Total (absolute) emissions from September 2018 – August 2019 are 14,328 $tCO_2e$, representing an overall 1% increase in Scope 1, 2, and 3 emissions since the 2007 baseline. Scopes 1 and 2 emissions are 2,842 $tCO_2e$ and 341 $tCO_2e$, respectively. Scopes 1 and 2 are under the control of Mohawk College, whereas the college has only influence over Scope 3 emissions. Since the 2007 baseline Scope 1 and 2 emissions have reduced by 22 and 93%, respectively.

Scope 3 emissions are typically categorized as emissions that are not controlled, but can be influenced, have increased 214% since the 2007 baseline and are a result of increased commuting from students, staff, and faculty. The significant increase in Scope 3 emissions also may be attributed to changes in parking data collection methods, as the college's parking tracking system removes many of the assumptions made in previous reports, such as number of days on campus and total distance travelled round trip.

## Emission Summary – Scope Breakdown

Table 3 summarizes GHG emissions associated with college activities for the current inventory, outlining total consumption and units, associated emissions with consumption, and percent of total emissions that activity contributed.

The top emitting activities include:

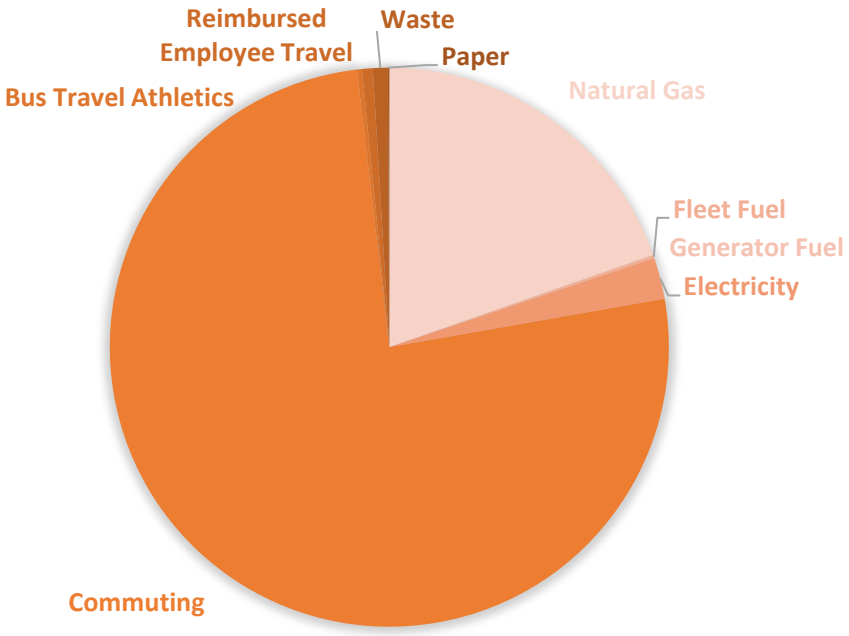
1. Student, Staff and Faculty Commuting (75.92%)
2. Natural Gas Consumption (19.65%)

**Table 3** 2018-2019 emissions data categorized by scope and activity

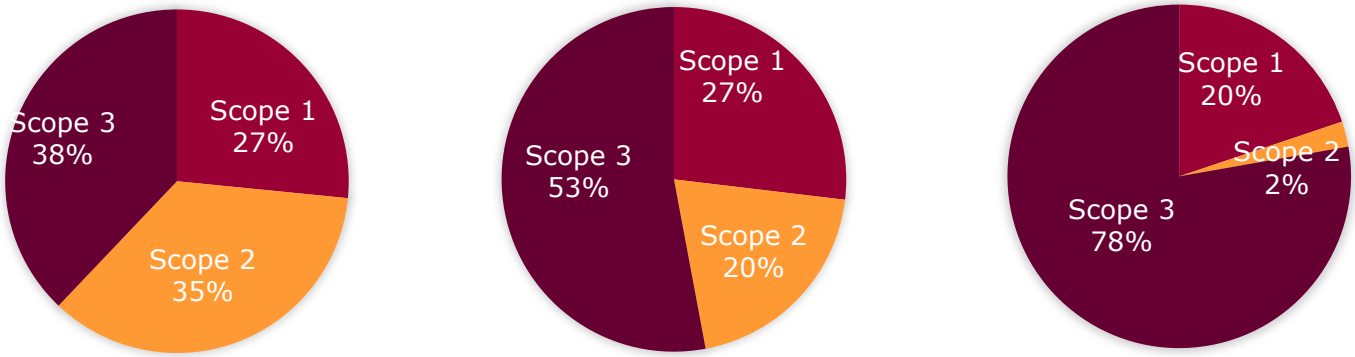
| Activity | Total consumption | Total GHG emissions ($tCO_2e$) | Percent of total emissions |
|---|---|---|---|
| *SCOPE 1* | | | |
| Fleet vehicle use | 11,175 Litres | 25.89 | 0.18 |
| Natural gas consumption | Fennell: 1,137,487.49 $m^3$<br>Stoney Creek: 345,432.70 $m^3$ | Fennell: 2,159.31<br>Stoney Creek: 655.74 | 19.65 |
| Backup generator fuel consumption | 690 Litres of diesel | 1.93 | 0.013 |
| **TOTAL SCOPE 1 EMISSIONS** | | | **2,842.86 $tCO_2e$** |
| **PERCENT OF TOTAL EMISSIONS** | | | **19.84** |
| *SCOPE 2* | | | |
| Purchased electricity | Fennell: 13,838,857.75<br>Stoney Creek: 3,176,140.08<br>Caroline Substation: 60,244.18 | Fennell: 276.78<br>Stoney Creek: 63.52<br>Caroline Substation: 1.2 | 2.38 |
| **TOTAL SCOPE 2 EMISSIONS** | | | **341.5 $tCO_2e$** |
| **PERCENT OF TOTAL EMISSIONS** | | | **2.38** |
| *SCOPE 3* | | | |
| Athletics department bus travel | 15,166 Litres | 41.31 | 0.29 |
| Paper use | 1,827,000 sheets | 11.8 | 0.082 |
| Reimbursed employee travel | 38,428 Litres of gasoline | 89.03 | 0.62 |
| Student and faculty commuting | 45,587,198.12 KM | 10,878.26 | 75.92 |
| Waste | 345.19 t | 123.31 | 0.86 |
| **TOTAL SCOPE 3 EMISSIONS $tCO_2e$** | | | **11,143.69** |
| **PERCENT OF TOTAL EMISSIONS** | | | **77.78** |
| **Total Emissions ($tCO_2E$)** | | | **14,328.08** |

The following graphs highlight inventory data over time and by Scope.

**Graph 1** Contribution of each GHG emitting activity included within the inventory, by percentage




**Graph 2** Breakdown of GHG emissions by scope for the 2007, 2012, and current inventory




2007 2012 2018/2019



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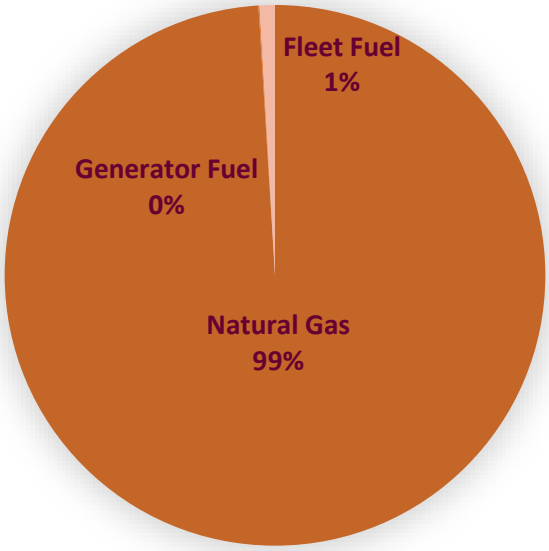
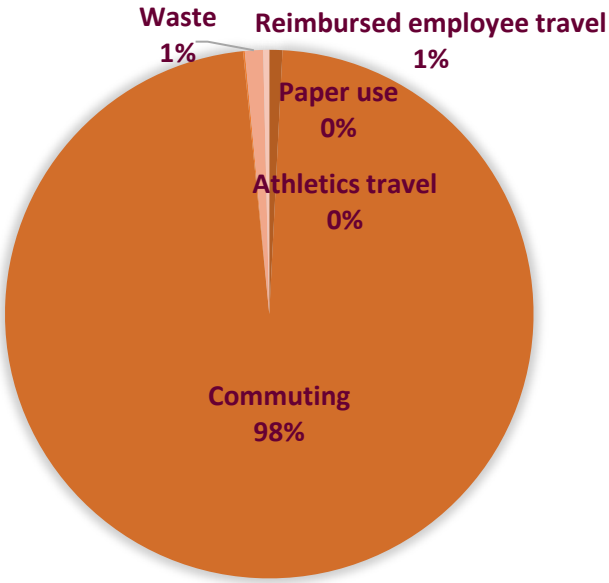
**Graph 3** GHG breakdown of Scope 1 activities for the current inventory




Note: Due to rounding, activities that appear as 0% are percentages representing less than 1% of total emissions.

**Graph 4** GHG breakdown of Scope 3 activities for the current inventory




Note: Due to rounding, activities that appear as 0% are percentages representing less than 1% of total emissions.

## Intensity Metrics

Within a post-secondary institution there are two primary intensity metrics used to evaluate emissions reduction progress, emissions per FTE and emissions per square metre of building space. The tables below summarize both metrics, comparing each to previous inventory results.

### *Emissions per FTE*

| Year | 2007 | 2012 | 2018/2019 | Change from Baseline (%) |
|---|---|---|---|---|
| FTE | 11,750 | 15,882 | 17,083 | 45 |
| Emissions/FTE (all Scopes) | 1.17 | 0.66 | 0.84 | -28 |

The student population at Mohawk has grown significantly since 2007. Mohawk's total FTEs have increased 45%. At the same time, emissions per FTE have decreased by 28%. This shows demonstrates success in reducing the environmental impact of individual students and staff while the campus community has grown.

### *Buildings*

| Year | 2007 | 2012 | 2018/2019 | Change from Baseline (%) |
|---|---|---|---|---|
| Square metre ($m^2$) total | 135,546 | 127,855 | 158,942 | 14.7 |
| $tCO_2e/m^2$ (Scopes 1 and 2) | 0.063 | 0.038 | 0.020 | -68 |

Mohawk's total space footprint has increased by 14.7% since 2007. Throughout this time Mohawk has realized an emission reduction of 68% per $m^2$. This reduction is a result of: energy efficiency initiatives completed by the college, removing coal from electricity generation in Ontario, and an increase in total physical space, much of it provided by the net zero Joyce Centre, which added 8,925 $m^2$ square feet to the campus but zero emissions. This reduces the overall burden of emission per square metre.

Unlike emissions per FTE, emissions per $m^2$ of building space did not include Scope 3 emissions, as they do not have a direct impact on building performance.

## The Joyce Centre for Partnership and Innovation

In 2017 Mohawk College was chosen by Canada's Green Building Council (CaGBC) to participate in a national zero carbon building pilot project. As one of 15 recipients throughout Canada Mohawk's newest building addition The Joyce Centre for Partnership and Innovation was built to CaGBC's Zero Carbon Building Standard, Canada's first green building program to make carbon emissions a key indicator in

building performance. Within the standard, a Zero Carbon building is defined as one that is "highly energy efficient and produces onsite renewable energy in an amount sufficiently to offset the annual carbon emissions associated with operations".

The Joyce Centre opened September 2018 as a sustainability-focused learning hub, and features seven storeys of labs, study spaces, and collaboration areas. According to the standard, for a building to successfully be designated zero-carbon one year of operational data is required. Performance monitoring took place between October 2018 and October 2019. The 8,981 $m^2$ building generated 620,600 kWh of onsite renewable energy, while consuming 537,000 kWh. Producing onsite renewable energy offsets operational emissions generated throughout the year. In November 2019 the Joyce Centre was Canada's first building to receive the Zero Carbon Building Certification for Design and Performance.

## Comparison to Previous Inventories

The following tables summarize how Mohawk's GHG emitting activities and associated consumption have changed over time.

**Table 4** GHG emitting activities consumption data over time

| Activity | Scope | 2007 (consumption) | 2012 (consumption) | 2018/2019 (consumption both campuses) | % Change from 2007 baseline |
|---|---|---|---|---|---|
| Natural gas ($m^3$) | 1 | 1,863,904 | 1,426,656 | 1,482,920 | -20.4 |
| Fleet fuel (L) | 1 | Gasoline 30,674<br>Diesel 14,169<br>TOTAL: 44,843 | Gasoline 43,677<br>Diesel 3,143<br>TOTAL: 46,820 | 11,175 | -76.1 |
| Generator fuel (L diesel) | 1 | 3,57z3 | 815 | 690 | -80.1 |
| Fertilizer (Kg) | 1 | 907 | 0 | 0 | -100 |
| Electricity (kWh) | 2 | 20,318,484 | 19,160,194 | 17,075,242 | -16% |
| Athletics bus travel (Km) | 3 | 19,065 | 22,671 | 15,166.00 | -20.5 |
| Athletics air travel (#) | 3 | 86 flights of varying length | 2,624 (Km) | Not reported | Unknown – reporting units incomparable |
| Faculty flights (#) | 3 | 59 flights of varying length | 326,532 (Km) | Not reported | Unknown – reporting units incomparable |
| Campus shuttle (L diesel) | 3 | 45,400 | 34,177 | 0 | -100 |
| Shuttle taxi service (Km driven) | 3 | 9,085 | 12,445 | 0 | -100 |
| Paper (pages) | 3 | 100,300,100 | 36,225,100 | 1,827,000 | -98.2 |

| | | | | | |
|---|---|---|---|---|---|
| Recycling (tonnes) | 3 | 246 | 0 | 0 | -100 |
| Waste (tonnes) | 3 | 185 | 174 | 345.19 | +186 |
| Reimbursed employee commuting (L gasoline) | 3 | Not reported | Not reported | 38,428 | N/A |
| Student, staff, and faculty commuting (Km) | 3 | 14,379,319 | 18,606,484 | 45,587,198.12 | +317 |

**Table 5** Emissions associated with Mohawks' emitting activities over time

| **Activity** | **Scope** | **2007** | **2012** | **2018/2019** | **% change from 2007 baseline** |
|---|---|---|---|---|---|
| Natural gas | 1 | 3,523.95 | 2,697 | 2,815.05 | -20.2 |
| Fleet fuel | 1 | 109.94 | 112 | 25.89 | -76.5 |
| Generator fuel | 1 | 11.47 | 2 | 1.93 | -83.2 |
| Fertilizer | 1 | 1.27 | 0 | 0 | -100 |
| **SCOPE 1 TOTAL** | | **3,646.63** | **2,811** | **2,842.87** | **-22.1** |
| Electricity | 2 | 4,876 | 2,108 | 341.50 | -93 |
| **SCOPE 2 TOTAL** | | **4,876** | **2,108** | **341.50** | **-93** |
| Athletics bus travel | 3 | 20.01 | 13 | 41.31 | +206 |
| Athletics air travel | 3 | 39.35 | 0.2 | NA | NA |
| Faculty air travel | 3 | 25.95 | 28 | NA | NA |
| Campus shuttle | 3 | 122.19 | 94 | 0 | -100 |
| Shuttle taxi service | 3 | 3.34 | 3 | 0 | -100 |
| Paper | 3 | 1,246.99 | 619 | 11.80 | -99 |
| Waste | 3 | 259 | 244 | 123.31 | -52.4 |
| Reimbursed employee commuting | 3 | NA | NA | 89.03 | NA |
| Student, staff, and faculty commuting | 3 | 3,504 | 4,534 | 10,878.26 | +310 |
| **SCOPE 3 TOTAL** | | 5,221 | 5,535 | 11,143.71 | NA |
| **TOTAL** | | 13,724 | 10,454 | 14,328.08 | NA |

## Scope Summary

### Scope 1

Scope 1 emissions have seen a reduction of just over 22% (compared to the 2007 baseline). Natural gas consumption, the largest source of Scope 1 emissions (99%), has been reduced by over 20%.

This can be attributed to three main areas:

1. Significant reduction and energy conservation initiatives spearheaded by the college.
2. The replacement of boilers with high efficiency models, and the introduction of an electric boiler and 1MW battery storage system.
3. Consolidation of the campuses with the closing of the Brantford campus, which resulted in emissions reductions of just over 400 $tCO_2e$ (2011 emission factor used).

Fleet fuel has seen a significant reduction of over 76%. This is a result of the conversion of many fleet vehicles to hybrid and/or electric (24% of fleet vehicles are either hybrid or electric), taking low-use vehicles offline, and instating a green fleet management strategy. Additionally, Mohawk has migrated to digital tracking of fleet vehicle use, allowing more accurate data to be collected for each vehicle.

Generator diesel use has also reduced significantly, which may be due to the removal of the Brantford campus, efficiencies as a result of college initiatives, or potentially changes in data gathering methods.

Finally, Mohawk does not use nitrogen fertilizers for grounds; a practice that was discontinued in 2011.

### Scope 2

The college has seen a 16% consumption reduction in electricity compared to the 2007 baseline. This can be attributed to removing the Brantford campus, facilities retrofits to improve energy efficiency (such as LED retrofits and the installation of building automation systems), and energy conservation efforts. This change corresponds to a reduction in GHG emissions of 93%, primarily as a result of the removal of coal as an electricity generator in Ontario.

### Scope 3

77.8% of total emission reported were categorized as Scope 3. Unlike Scopes 1 and 2, where Mohawk has direct control over emission reductions, Scope 3 emissions can only be influenced by the college via incentives, programs, services, etc. Information presented below corresponds to each reported Scope 3 activity.

## *Athletics*

### Air Travel

Athletics air travel data is not included within the Scope of this inventory due to changes in the college's data collection methods and data availability. Additionally, previous inventories have reported air travel information using metrics that cannot be compared. For these reasons, emissions associated with air travel are not included.

### Bus Travel

Athletics department bus travel has been reduced by 20.5% since 2007. This may be due to efficient changes in scheduling, game locations, or changes to reporting methodology.

## *Campus Shuttle and Taxi*

Both the campus shuttle and taxi were taken offline after the 2012 inventory and therefore have no associated emissions to report in 2020.

## *Paper*

Mohawk's paper consumption and associated emissions show significant variability throughout all inventories. This variability may have resulted from a combination of the kinds of paper used, data gathering methodology, and different emissions calculations tools. The baseline inventory included all paper types and sizes used by the college. Due to changes in tracking only paper seized 8.5x11 was included in this inventory.

Currently, no standard emission factor for paper exists. There are a large number of variables (type of paper, size of paper, recycled content, disposal processes etc.) for calculating emissions, making estimating accurate emissions difficult. Typically, estimating emissions is done via online tools that do not provide sources for emission factors, leading to potentially significant variations in emissions.

## *Waste*

Waste generation has increased by 186% since 2007. This can be explained by an increase in total FTEs, changes in acceptable materials, and easy access to single use items such as cups, plates etc. Emissions associated with waste were calculated to have reduced by 50%, which is attributed to a lack of standard emission factors for waste, variation in waste emission reporting tools, and the large number of variables that can impact waste-based emissions.

### *Reimbursed Employee Travel*

Emissions associated with reimbursed employee travel were calculated to be just under 90 $tCO_2e$. This was the first inventory where this data was reported, so no comparisons can be assessed. Total kilometers driven were tracked through staff expense claims.

### *Commuting*

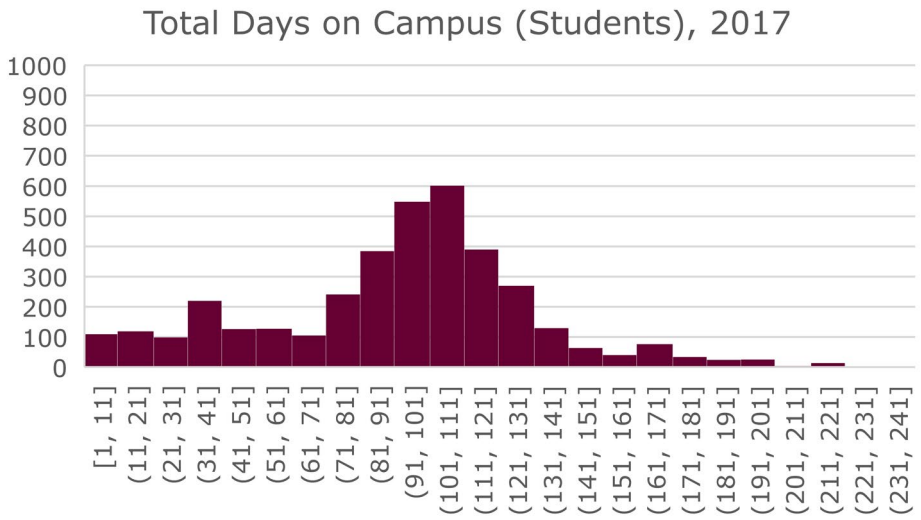
Student, staff, and faculty commuting is responsible for nearly 80% of total reported emissions. The contribution of commuting to overall inventory results has increased substantially since 2007, from 3,504 $tCO_2e$ to 10,878.26 $tCO_2e$.

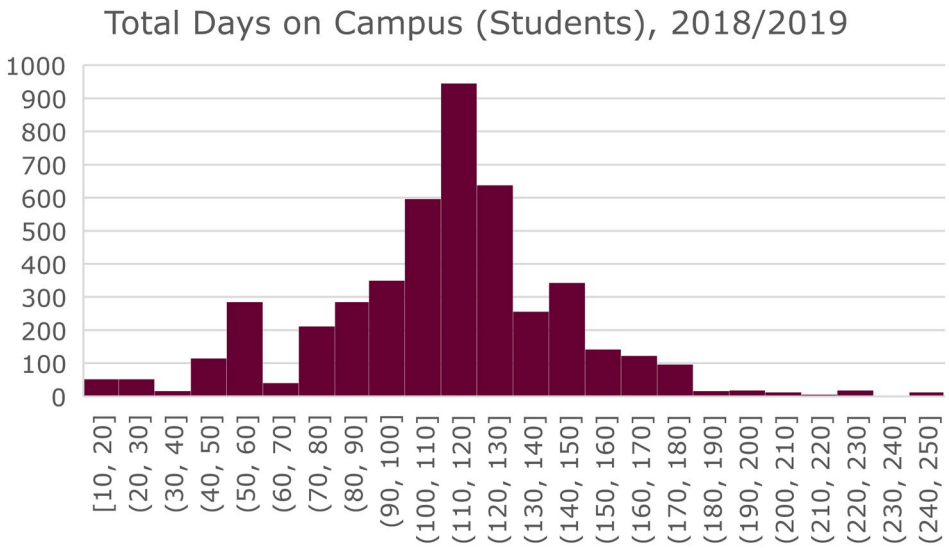
Since 2007 the college has seen an increase in total FTEs by 45%, which will significantly contribute to Scope 3/commuting emissions. Furthermore, the total number of days spent on campus has increased, as has total kilometers driven round trip (see graphs 5-7).

**Table 6** Total kilometers driven by students, staff, and faculty over time.

| 2007 | 2012 | 2018/2019 | Change since baseline (%) |
|---|---|---|---|
| 14,379,319 | 18,606,484 | 45,587,198 | 317 |

**Graphs 5 & 6** Total numbers of days students spend on campus, 2017 vs 2018/2019



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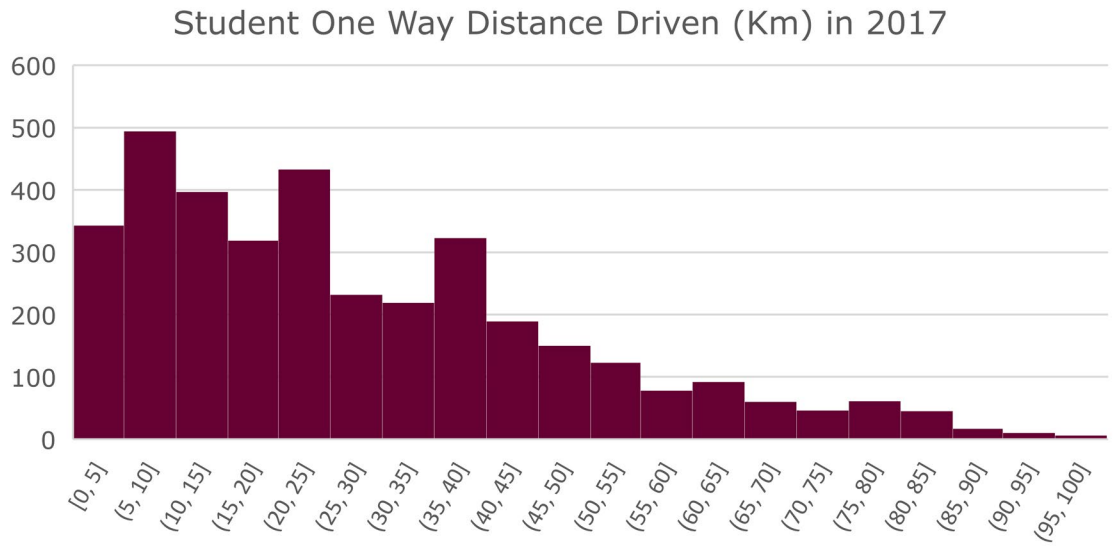
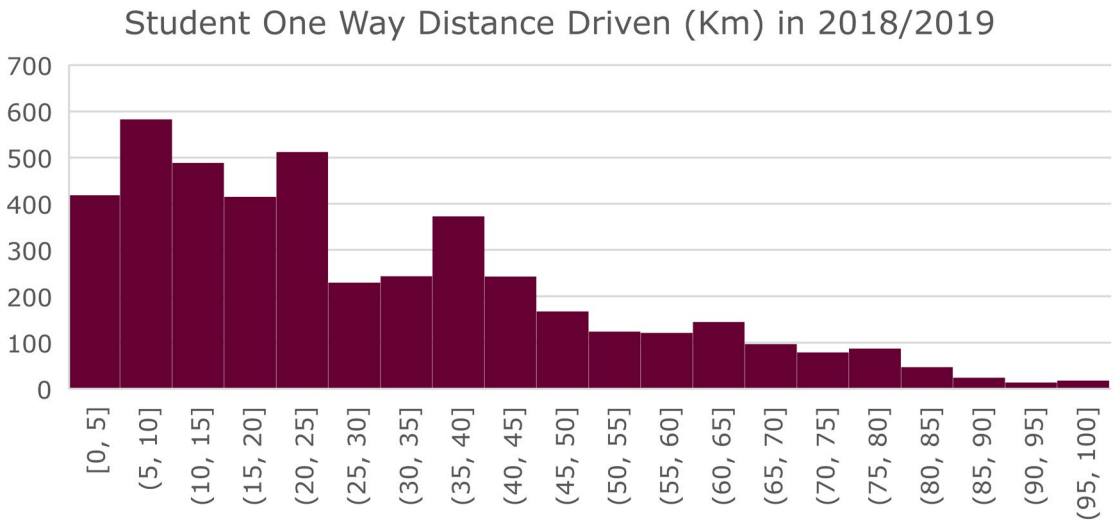
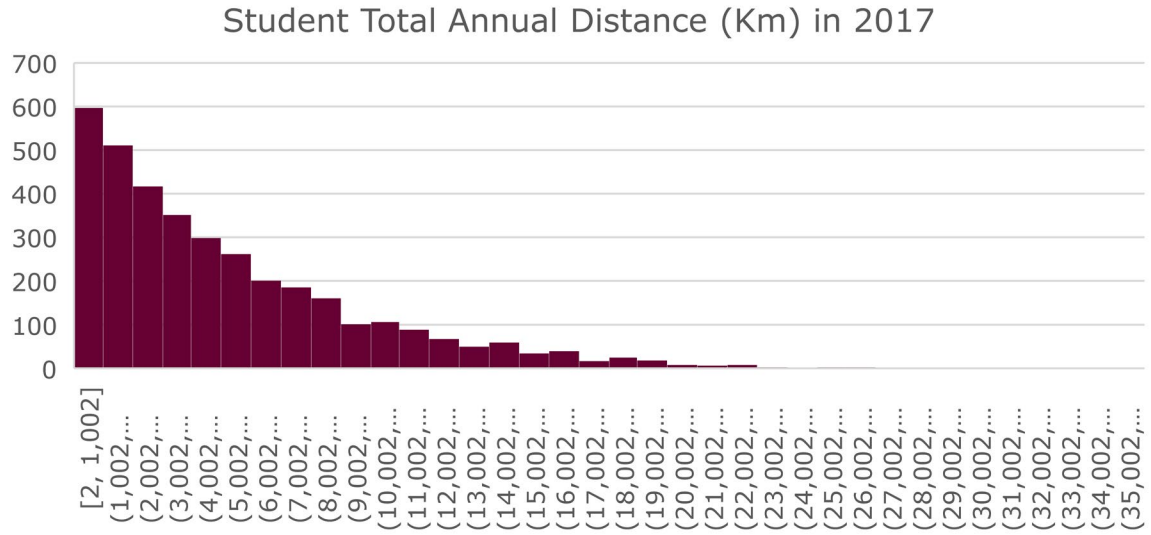
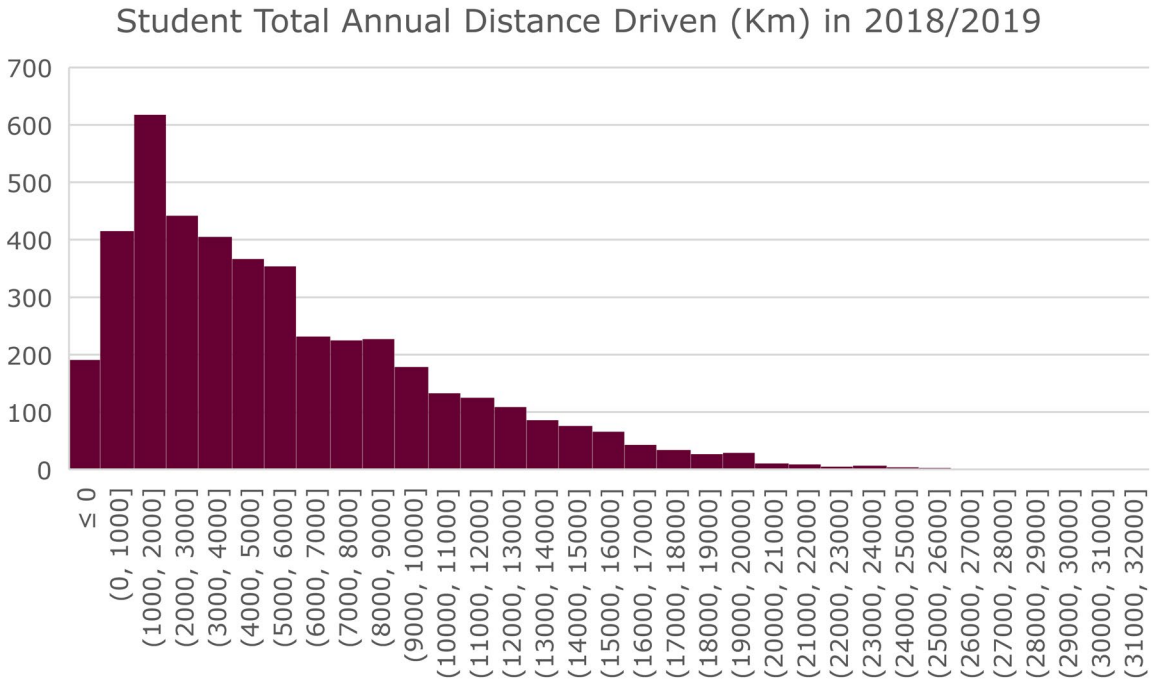
**Graphs 7 & 8** Student one-way driving distance in kilometers to and from Mohawk College, 2017 vs 2018/2019



**Graphs 9 & 10** Total distance in kilometers driven by students per year, 2017 vs 2018/2019



# Recommendations

Mohawk College has undertaken and continues to pursue emission reduction activities and initiatives. Recommendations will not include specific projects to undertake, as those can be determined by facilities based on budgets, college priorities, and past experience. Below recommendations outline how the college can set itself up for success to ensure future progress in meeting emission reduction targets.

## Targets and Reporting

Mohawk has spent the last decade working towards completing various college-wide changes, initiatives, and projects that have resulted in significant emissions reductions. As a result, larger portions of emissions are for emitting activities that can only be influenced, not controlled by, the college. As emissions from Scopes 1 and 2 are reduced, sources of Scope 3 emissions will increase, making meeting reduction targets more difficult to meet in the future.

Due to the shift of college emission sources to primarily Scope 3 it is recommend Mohawk separate out emission reduction targets and consider the following:

- One target for Scopes 1 and 2. The college controls Scopes 1 and 2 but can only influence Scope 3 emissions. By separating out Scopes the college can generate a clearer picture of emission reductions and college efforts.
- One target for Scope 3 emissions that excludes commuting (with reporting on commuting continued) OR monitoring only of Scope 3 emissions and maintaining transparency through continued reporting.
- One target for intensity metrics – emissions per FTE and emissions per square metre of building space. Targets that include absolute (total) emissions as well as intensity targets ensure the full story is told when variables such as increased FTEs or physical space change.
- Reduce reporting period to every three years instead of five. To ensure initiatives and strategies are effective in reducing emissions more frequent data is necessary.

## Project Focus and Proactive Planning

Information presented within this report is meant to support and drive future emission reduction strategies and initiatives. Continued success in college emission reductions will require the following points to be key areas of emphasis:

- Support and emphasis for natural gas reduction projects. Natural gas consumption is responsible for nearly one fifth of reported emissions and is under control of the college.

- Student, staff, and faculty commuting. The current emissions reduction target includes Scope 3 emissions, and meeting targets will be exceptionally difficult if commuting continues on its current trajectory without additional college intervention, programs, and incentives.
- Areas of interest for reducing emissions requires responsibility to be placed on specific roles within the college to ensure accountability for emissions reductions.

## Conclusion

Mohawk College has made significant strides in reducing emission under their control, with scope 1 and 2 emissions being reduced by 21% and 93% respectively, and per FTE (-28%) basis and square foot (-68%). This inventory demonstrates that Mohawk is on track to significantly reduce its GHG emissions and support the transition to a sustainable campus where students can Learn. Lead. Learn in Sustainability.™

# Appendix A
## Consumption Data

### Scope 1 Activity Consumption Data

*Fleet Fuel*

| Vehicle | September 2018 - August 2019 total Kilometers (Km) driven by Sept. | Fuel consumption (L/100Km) | Total litres used |
|---|---|---|---|
| 2016 Kia Soul | 21,543 | 0 | 0 |
| 2017 Kia Sedona | 4,299 | 11.5 | 374 |
| 2016 Ford F250 | 4,239 | 12.3 | 345 |
| 2008 Ford Cargo | 4,749 | 15.2 | 312 |
| 2010 Ford Fusion | 0 | 0 | 0 |
| 2010 Toyota Matrix | 3,258 | 8.3 | 393 |
| 2010 Chevy Silverado 2500 | 1,818 | 12.5 | 145 |
| 2009 Ford Econoline | 2,280 | 17.2 | 133 |
| 2010 Ford Ecoline | 5,284 | 10.4 | 508 |
| 2012 Ford F250 | 5,483 | 12.4 | 442 |
| 2012 Chevy Silverado 3500 | 2,562 | 13.8 | 186 |
| 2012 Chevy Volt | 305 | 0 | 0 |
| 2011 Chevy Express | 5,085 | 14.2 | 358 |
| 2012 Fuso FE160 | 6,251 | 16.3 | 383 |
| 2013 Chevy Volt | 1,262 | 0 | 0 |
| 2013 Ford Transit | 2,761 | 10.1 | 273 |
| 2014 Jeep Patriot | 6,332 | 9.7 | 653 |
| 2016 Ford F650 | 145 | 14.6 | 10 |
| 2018 Toyota Rav 4 | 11,745 | 9.4 | 1,249 |
| 2018 Toyota Rav 4 | 9,376 | 9.4 | 997 |
| 2018 Toyota CH-R | 12,738 | 9.4 | 1,355 |
| 2018 Toyota Rav 4 | 2,661 | 7.4 | 360 |
| 2019 Toyota Camry | 13,222 | 4.9 | 2,698 |
| | | | **Total Litres 11,175** |

## *Natural Gas*

| | Fennell Campus | | | Stoney Creek Campus | |
|---|---|---|---|---|---|
| **Month** | **Main campus ($m^3$)** | **DBARC ($m^3$)** | **Alumni House ($m^3$)** | **Barton ($m^3$)** | **Leaside ($m^3$)** |
| | | | | | |
| September 2018 | 10,931.70 | 742.35 | 8.46 | 1,557.86 | 188.35 |
| October 2018 | 56,263.30 | 603.63 | 890.85 | 4,035.19 | 1,084.42 |
| November 2018 | 140,278.30 | 798.58 | 3,786.11 | 25,340.20 | 6,580.71 |
| December 2018 | 151,717.00 | 558.63 | 4,513.45 | 35,663.99 | 9,537.18 |
| January 2019 | 210,628.90 | 858.57 | 6,543.23 | 36,716.86 | 10,787.12 |
| February 2019 | 172,763.10 | 734.85 | 6,909.72 | 60,832.69 | 16,537.40 |
| March 2019 | 164,564.30 | 746.10 | 5,066.00 | 49,870.51 | 13,452.51 |
| April 2019 | 97,172.10 | 821.08 | 3,177.17 | 26,850.42 | 8,118.87 |
| May 2019 | 49,473.40 | 753.60 | 1,911.38 | 17,417.52 | 6,155.51 |
| June 2019 | 17,270.60 | 618.62 | 279.10 | 8,966.02 | 2,731.03 |
| July 2019 | 12,199.10 | 678.61 | 552.55 | 2,386.81 | 191.20 |
| August 2019 | 11,945.70 | 716.10 | 11.28 | 233.44 | 196.91 |
| TOTAL | 1,095,207.50 | 8,630.71 | 33,649.28 | 269,871.51 | 75,561.20 |
| **Campus Totals ($m^3$)** | **1,137,487.49** | | | **345,432.70** | |
| **College Total ($m^3$)** | **1,482,920.19** | | | | |

## *Generator Fuel*

The table below outlines the information used to determine total litres of generator diesel used during the reporting period.

| Information required | Amount |
|---|---|
| Total diesel purchased by Mohawk College (CAD) | 824.45 |
| Average Southern Ontario diesel in Southern Ontario from September 2018 – August 2019 (CAD) | 1.1952/L |
| **Total litres** | **689.8** |

## Scope 2 Activity Consumption Data

### *Electricity*

| Fennell Campus (kWh) | | | | |
|---|---|---|---|---|
| **Month** | **Main Campus** | **Student Centre** | **Alumni House** | **Shed** |
| September | 1,250,417.67 | 95,040.00 | 554.93 | 3,495.23 |
| October | 1,190,689.04 | 62,640.00 | 443.24 | 3,658.05 |
| November | 1,262,601.65 | 66,240.00 | 440.18 | 3,936.16 |
| December | 1,084,871.47 | 69,120.00 | 462.90 | 4,883.87 |
| January | 1,265,137.82 | 82,080.00 | 420.82 | 4,367.71 |
| February | 1,126,170.62 | 137,520.00 | 0.00 | 6,904.94 |
| March | 1,248,817.25 | 15,840.00 | 349.77 | 4,815.86 |
| April | 1,032,058.86 | 64,800.00 | 356.00 | 3,570.38 |
| May | 1,040,532.00 | 68,400.00 | 358.08 | 2,878.76 |
| June | 1,048,353.87 | 72,720.00 | 586.41 | 2,077.09 |
| July | 1,174,193.40 | 79,200.00 | 724.45 | 2,490.96 |
| August | 1,064,118.72 | 71,280.00 | 630.00 | 2,489.59 |
| TOTAL | 13,787,962.37 | 884,880.00 | 5,326.79 | 45,568.59 |
| Campus Total | **13,838,857.75** | | | |

| Stoney Creek Campus (kWh) | | | | | |
|---|---|---|---|---|---|
| **Month** | **Barton Street** | **330 Leaside** | **336 Leaside** | **349 Leaside** | **Market Street** |
| September | 280,734.93 | 10,265.51 | 38,559.81 | 0.00 | 994.23 |
| October | 185,573.90 | 8,002.71 | 32,231.40 | 0.00 | 2,863.50 |
| November | 232,967.22 | 11,111.32 | 44,337.63 | 19.36 | 4,628.91 |
| December | 188,365.91 | 7,795.07 | 27,058.64 | 45.94 | 4,848.50 |
| January | 184,426.76 | 8,814.08 | 31,867.09 | 44.36 | 6,181.84 |
| February | 269,166.38 | 11,313.11 | 45,227.74 | 58.12 | 13,638.01 |
| March | 207,285.98 | 9,237.31 | 35,093.60 | 6.23 | 0.00 |
| April | 207,285.98 | 9,237.31 | 35,093.60 | 0.00 | 13,638.01 |
| May | 201,238.18 | 8,614.57 | 26,779.61 | 0.00 | 4,732.82 |
| June | 222,581.97 | 7,576.67 | 27,529.59 | 6.23 | 3,484.85 |
| July | 223,071.27 | 8,199.41 | 20,901.71 | 102.69 | 2,493.45 |
| August | 273,761.58 | 12,969.39 | 21,481.60 | 98.60 | 2,740.06 |
| TOTAL | 2,676,460.07 | 113,136.46 | 386,162.02 | 381.53 | 60,244.18 |
| Campus Total | **3,176,140.08** | | | | **60,244.18** |
| College Total | **17,075,242.01** | | | | |

## Scope 3 Activity Consumption Data

### *Waste*

| Month | Total Landfilled Tonnes (T) - Fennell | Total Landfilled Tonnes (T) – Stoney Creek |
|---|---|---|
| Sep-18 | 22.53 | 7.20 |
| Oct-18 | 25.46 | 4.38 |
| Nov-18 | 26.78 | 6.96 |
| Dec-18 | 19.72 | 5.44 |
| Jan-19 | 21.62 | 6.05 |
| Feb-19 | 19.04 | 7.79 |
| Mar-19 | 25.11 | 7.79 |
| Apr-19 | 21.33 | 18.93 |
| May-19 | 25.24 | 2.88 |
| Jun-19 | 15.45 | 0.00 |
| Jul-19 | 16.73 | 0.00 |
| Aug-19 | 11.86 | 8.87 |
| Campus Total (T) | **250.87** | **76.29** |
| College Total | **327.16** | |

### *Paper*

| Paper Type | Pages |
|---|---|
| 8.5 x 11 | 1,827,000 |

### *Athletics travel*

| | |
|---|---|
| **Total Kilometers Driven by Bus** | 40,812.8 |

### *Reimbursed Employee Travel*

373,086 Km

### *Student, Staff, and Faculty Commuting*

| Group | Km Travelled |
|---|---|
| Students | 34,105,041.06 |
| Staff | 8,453,146.12 |
| Faculty | 3,029,010.94 |

# Appendix 2
## Assumptions and Detailed Methodology

| Activity | Data unit | Assumption(s) | Methodology |
|---|---|---|---|
| Natural gas consumption | Cubic metres | • None. | • Calculations to generate $CO_2e$ based on total consumption information provided by Mohawk College. |
| Generator fuel consumption | Dollars spent (CAD) | • Average price of diesel in Southern Ontario over reporting period - $1.1952/ litre. | • Amount spent on generator diesel for inventory period was provided by Mohawk College. Average price of generator diesel used to determine litres of fuel. |
| Fleet fuel consumption | Litres of gasoline | • 50% highway and 50% city driving. | • Make, model, and year of fleet vehicles are known. Total kilometers driven for the reporting period and the fuel consumption (L/100 Km) were used for each vehicle to determine total litres of fuel purchased used for final calculation.<br>• Fuel efficiency identified by using Natural Resource Canada's 2019 Fuel Consumption Guide. "Comb" value of consumption (L/100 Km) was used. With multiple options based on engine type the most basic engine was used. |
| Purchased electricity | kWh | • None. | • Calculations to generate $CO_2e$ based on total consumption information provided by Mohawk College. |
| Reimbursed travel | Kilometers driven | • Assumed all vehicles are light duty gasoline vehicles (Tier 2). | • Total reimbursed km for reporting period was provided. Vehicle makes, models, and years were not provided. To determine total fuel efficiency the average of all vehicles reported in the 2019 Fuel Consumption Guide was calculated and resulting L/100 |

| | | | |
|---|---|---|---|
| | | | Km was used for calculations to generate total litres purchased. |
| Commuting | Kilometers driven | • One-way distances over 100 Km were assumed to be students home location, not college location. These were removed and replaced with average distance of all commuters in that group (students, staff, or faculty). | • Calculations to generate $CO_2e$ based on total consumption information provided by Mohawk College. |
| Waste | Tonnes | • None. | • WARM v.15 used to calculate emissions.<br>• Tonnes of landfilled waste input under "Analysis Inputs", "Mixed Materials" (Material Type), and "Mixed MSW" (Material) under "Tons Landfilled" column. Results found under "Summary report $MTCO_2e$" |
| Paper | 8.5 x 11 sheets | • 100% of paper recycled. | • WARM v.15 used to calculate emissions.<br>• Tonnes generated was input under "Analysis Inputs", "Paper" (Material Type), and "Mixed Paper (primarily from offices)" (Material). Results found under "Summary report $MTCO_2e$" |
| Athletics travel | Kilometers travelled | • All commuting done by a diesel powered 40-50 passenger bus. | • Calculations to generate $CO_2e$ based on total consumption information provided by Mohawk College. |

# Appendix 3

## Emission Factors and Global Warming Potentials

| Activity | $CO_2$ Emission Factor | $CH_4$ Emission Factor | $N_2O$ Emission Factor | Source | Details |
|---|---|---|---|---|---|
| **SCOPE 1** | | | | | |
| Natural Gas combustion | 1,888 $g/m^3$ | 0.037 $g/m^3$ | 0.035 $g/m^3$ | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6-1 and A6-2 | $CO_2$ emissions factor corresponds to "Ontario Marketable" amount.<br><br>$CH_4$ and $N_2O$ Emission Factor corresponds to "residential, Construction, Commercial/Institutional, Agriculture" amount. |
| Generator fuel | 2,681 g/L | 0.133 g/L | 0.4 g/L | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6-1 and A6-4 | Diesel – refineries and others |
| Fleet fuel | 2,307 g/L | 0.14 g/L | 0.022 g/L | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6-13 | Make and model of vehicles not available. Emission Factors correspond to Tier 2 Light-duty Gasoline Vehicles. |
| **SCOPE 2** | | | | | |
| Purchased electricity | 20 g $CO_2e$/kWh | NA | NA | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 3 Table A13-7 | Most recent year (2017) used. |

| SCOPE 3 | | | | | |
|---|---|---|---|---|---|
| Reimbursed travel | 2,307 g/L | 0.14 g/L | 0.022 g/L | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6-13 | None |
| Commuting | 2,307 g/L | 0.14 g/L | 0.022 g/L | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6-13 | None |
| Waste | NA | NA | NA | Waste Reduction Model (warm_v15) | Input under "Material" column "Mixed MSW" under "Analysis Inputs" tab. |
| Paper | NA | NA | NA | Waste Reduction Model (warm_v15) | Input under "Material" column "Mixed Paper primarily from offices" under "Analysis Inputs" tab. |
| Athletics travel | 2 681 g/L | 0.11 g/L | 0.151 g/L | 2019 National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6-13 | Heavy duty diesel fuelled heavy duty buses (advanced control) |

| Greenhouse gas | Global warming potential (100-year time horizon) | Source |
|---|---|---|
| Carbon dioxide | 1 | Intergovernmental Panel on Climate Change Fifth Assessment Report, the Physical Science Basis, page 731 |
| Methane | 28 | |
| Nitrous Oxide | 265 | |

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