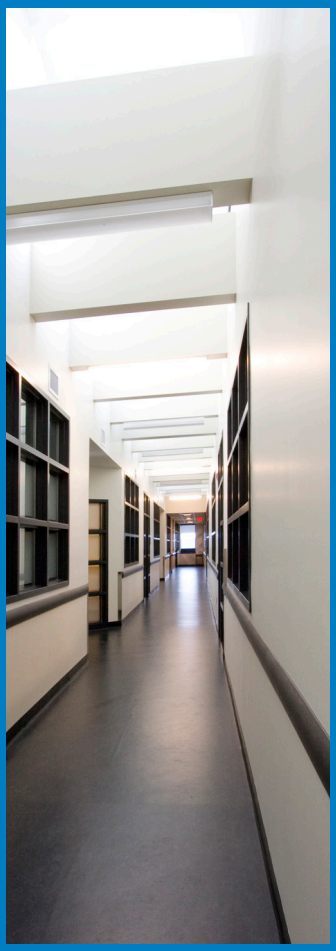

WATERLOO REGIONAL POLICE SERVICE INVESTIGATIVE SERVICES BUILDING

Prepared for:
Canadian Consulting Engineering Awards

ENERMODAL ENGINEERING

Creating energy and resource efficient buildings

A member of MMM GROUP

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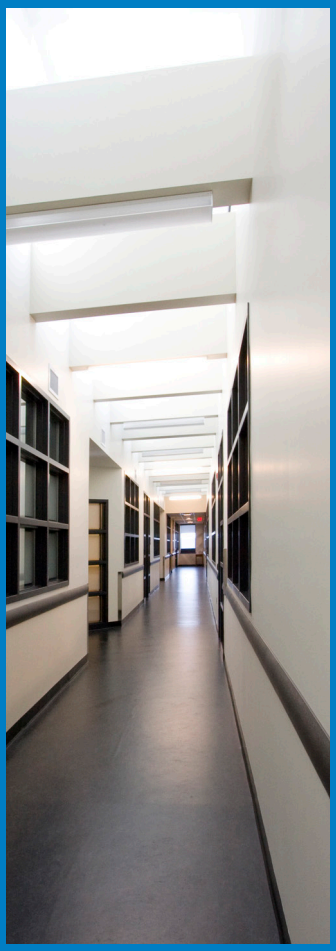


WATERLOO
REGIONAL
POLICE SERVICE
INVESTIGATIVE
SERVICES
BUILDING

PROJECT HIGHLIGHTS

PROJECT HIGHLIGHTS

Waterloo Region Police Service Investigative Services Building

The *Waterloo Regional Police Service Investigative Services Building* demonstrates the commitment to environmental stewardship shared by the Region of Waterloo and the Waterloo Regional Police Service. The LEED Gold certified building incorporates complex, state-of-the-art security considerations with innovative sustainable "green" building design.

This two-storey, 4,148 m² facility houses office space, meeting and interview rooms, and forensic laboratories. The facility was designed and constructed to meet many important green building objectives: minimizing the building's ecological footprint, conserving energy, water, and material resources, and providing a healthy place to work.

The WRPS Annex achieved a metered over 60% reduction in annual energy costs through the following conservation measures:

- heat recovery ventilators that pre-heat ventilation air using heat recovered from exhaust air
- high efficiency condensing boiler and domestic hot water heaters
- high performance windows
- energy-efficient lighting design
- occupancy sensors that turn off lights when a space is unoccupied
- a long-term building performance monitoring

The WRPS Annex was designed to save a 68% reduction in the water used for sewage conveyance. Measurement & Verification monitoring over the first year of operation demonstrated that the facility is actually using less energy and water than predicted – an unusual result particularly in the first year of operation for most new buildings which typically require expensive commissioning to meet their energy saving potential.

As a police lab that conducts high tech evidence investigations, it is important to completely compartmentalize the labs and provide a dedicated ventilation system to preserve the integrity of the evidence and protect the building occupants from the lab chemicals. This presents an added challenge to that of creating an energy-efficient facility. High levels of filtration and long operating hours drive up fan power and energy, and normal methods of ventilation heat

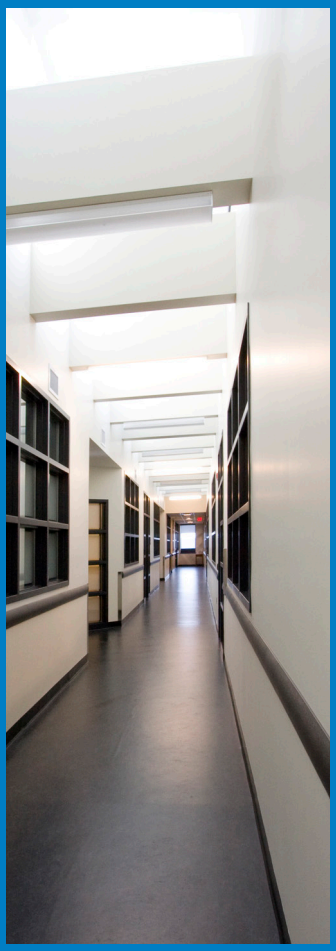
recovery are not allowed because of risk of cross contamination. These issues were addressed in a dedicated 100% outside air heat recovery air handler with these features:

- oversized cabinet to accommodate low face velocity, low pressure drop coils
- premium duty, variable speed fans, selected for maximum efficiency, and speed controlled to minimize operating energy
- heat pipe heat recovery with zero cross contamination
- glycol preheat coil to maintain heat pipe heat recovery performance during frosting conditions
- bypass sections around coils and heat pipes for reduced fan power requirement during low loads
- HEPA filtration on supply and exhaust air
- redundant fans to permit uninterrupted lab ventilation during service to AHU
- All ducts were sealed to SMACNA Class A and tested to leak less than 30 cfm @ 2" H_2O for the entire system. Each duct feeding a compartment also had to leak less than 2% @ 2" H_2O including through branch isolation dampers – an extremely airtight standard.

Airflow in each lab was controlled by high precision VAV terminals on supply and exhaust. Differential pressure was monitored, controlled, and locally displayed to inform the operators of actual pressure conditions. The entire lab section of the building was air-sealed from the rest of the building.

Meeting rooms which have periodically high occupancy have a third airflow path – a transfer fan which injects air from adjacent corridor ceilings, controlled by CO_2 sensor or manual switch. Designed to meet the provisions of ASHRAE Standard 62.1 for secondary ventilation using recirculated "unused" air, this is an effective way to maintain good air quality in meeting rooms in an energy-efficient manner.

Although the HVAC system normally functions with high ventilation efficiency using the dedication 100% OA AHU and displacement terminals, the air conditioning AHU also has full 100% OA cooling capability, allowing cooling with no mechanical refrigeration equipment running. This is an unusual benefit with a DOAS/DV system.



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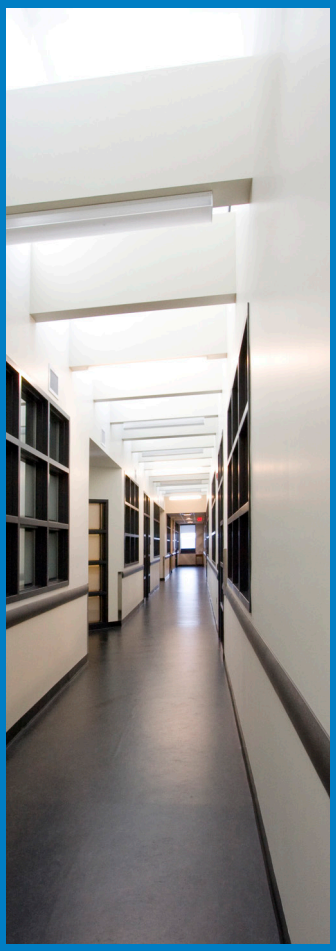
FULL PROJECT DETAILS



WATERLOO REGIONAL POLICE SERVICE INVESTIGATIVE SERVICES BUILDING

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"...commitment to environmental stewardship shared by the Region of Waterloo and the Waterloo Regional Police Service."

INTRODUCTION

The *Waterloo Regional Police Service Investigative Services Building* demonstrates the commitment to environmental stewardship shared by the Region of Waterloo and the Waterloo Regional Police Service. The LEED Gold certified building incorporates complex, state-of-the-art security considerations with innovative sustainable "green" building design.

This two-storey, 4,148 m² facility houses office space, meeting and interview rooms, and forensic laboratories. The facility was designed and constructed to meet many important green building objectives: minimize the building's ecological footprint, conserve energy, water, and material resources, and provide a healthy place to work. The over-riding functional program requirement was to protect the security of evidence under investigation, which for the HVAC design meant protecting it from air-borne contamination.

Thanks to the carefully considered mechanical/electrical design, the building achieved and exceeded the ambitious energy and water saving goals.

"...dedicated 100% outside air heat recovery air handler"

HIGH TECH VENTILATION AND COMPARTMEN-TALIZATION

As a police lab that conducts high tech evidence investigations, it is important to completely compartmentalize the labs and provide a dedicated ventilation system to preserve the integrity of the evidence and protect the building occupants from the lab chemicals. This presents an added challenge to that of creating an energy-efficient facility. High levels of filtration and long operating hours drive up fan power and energy, and normal methods of ventilation heat recovery are not allowed because of risk of cross contamination. These issues were addressed in a dedicated 100% outside air heat recovery air handler with these features:

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HIGH TECH VENTILATION AND COMPARTMEN-TALIZATION

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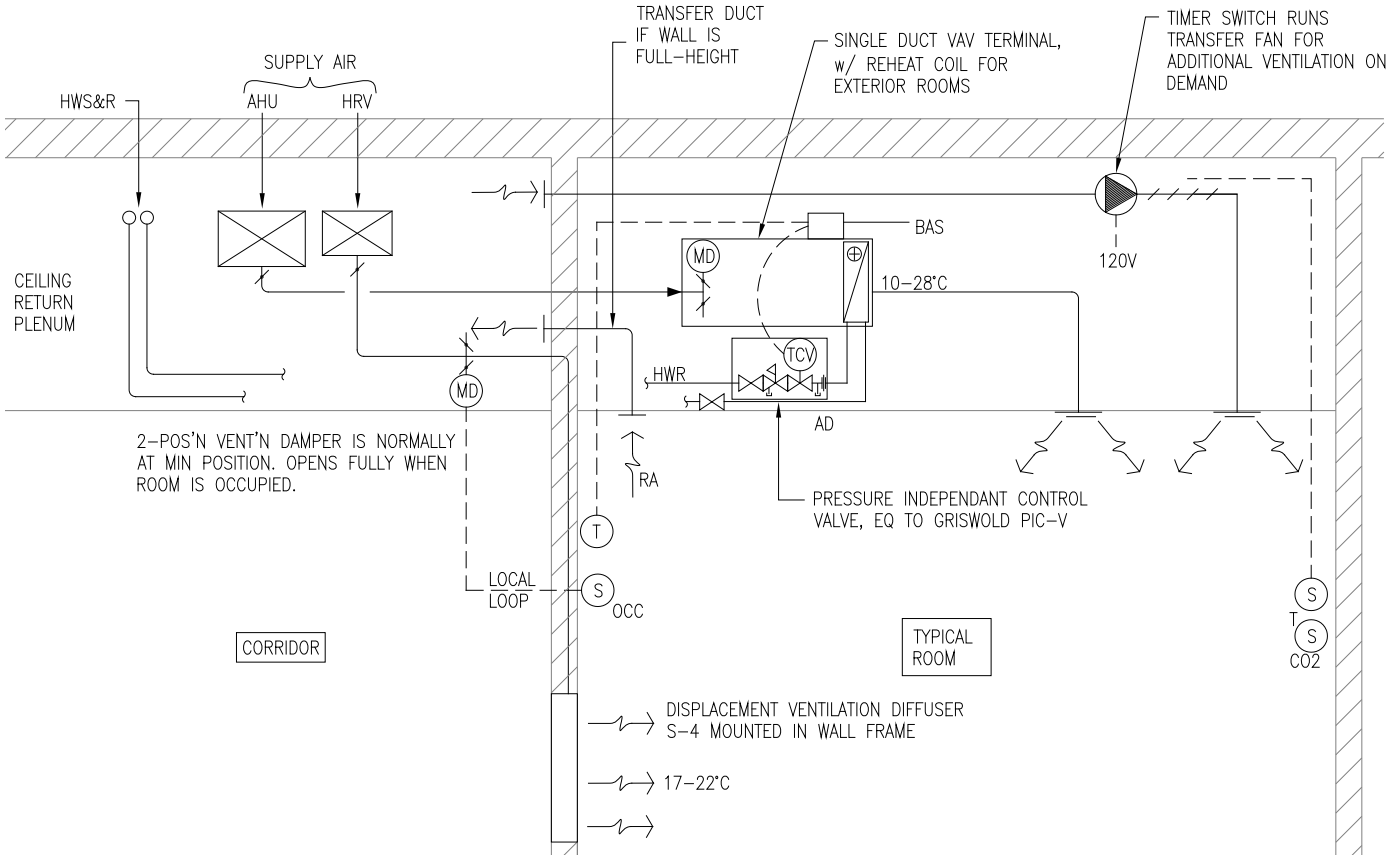


"...airflow is controlled by occupancy sensors integrated into the lighting control so that ventilation is controlled based on actual occupancy."

DUAL DUCT WITH HEAT RECOVERY

The rest of the building (non-lab) is heated, ventilated, and cooled with a dual duct system supplied by two separate air handlers, one a dedicated 100% outside air supply heat recovery unit (DOAS) , the other a recirculating air conditioning unit with 100% outside air economizer cooling capability. The heat recovery unit is a reversing flow type, promising at least 85% efficiency with no defrost requirement.

Innovation: The ventilation air handler is ducted to a displacement ventilation (DV) terminal in each space, where airflow is controlled by occupancy sensors integrated into the lighting control so that ventilation is controlled based on actual occupancy. The occupancy sensors give a more accurate signal than CO_2 sensors do for actual room occupancy, and are cheaper, more reliable and easier to maintain.

Air conditioning air is delivered to VAV terminals via the second duct system, so ventilation is controlled independently from temperature. Heating is by hot water reheat coils or heated floors, fed from two condensing natural gas boilers.

"...an effective way to maintain good air quality in meeting rooms in an energy-efficient manner."

DUAL DUCT WITH HEAT RECOVERY

Innovation: Meeting rooms which have periodically high occupancy have a third airflow path – a transfer fan which injects air from adjacent corridor ceilings, controlled by co2 sensor or manual switch. Designed to meet the provisions of ashrae Standard 62.1 for secondary ventilation using recirculated "unused" air, this is an effective way to maintain good air quality in meeting rooms in an energy-efficient manner.

Indoor Air Quality

In addition to the HEPA filtration for the laboratories, good indoor air quality is maintained by: recessed building entryway grates to capture contaminants

- ultra violet air sterilizers and steam humidifiers in all air handlers
- partitions, self-closing doors, and dedicated exhaust ducts in all rooms where hazardous chemicals are used

LEED® Project Facts

Gross Floor Area: 4148 (m^2)

Energy Density: 121 (kWh/m^2)

Category	% Performance
Water Savings	
Irrigation	100 %
Indoor Use	65 %
Energy Savings	60 %
Waste Diversion	84 %
Recycled Content	31 %
Regional Content	35 %

LEED® Gold Certified

“...an effective way to maintain good air quality in meeting rooms in an energy-efficient manner.”

LIGHTING

Lighting for a forensics lab and office building produce a number of challenges in providing suitable light levels for general as well as fine detail investigation work. We utilized extensive use of task lighting at the lab work benches to keep the general lighting power as low as possible while providing higher light levels where the investigators need it.

The interior lighting for the project utilized a highly efficient series of recessed fixtures for general illumination that achieved a lighting power density between 9 and 10 watts per metre square while keeping a maintained light level of over 50 foot candles on the work surface. Daylight harvesting was used in fixtures along window areas to further reduce the running lighting load.

Occupancy controls were used throughout the facility to keep lights off in areas not in use. This is particularly useful with a quick payback on this type of facility that has a 24 hour operation, but not necessarily at full capacity all of the time.

Garages utilized high bay T5HO fixtures for an even and white light source throughout the space and also controlled by occupancy sensors.

"Operable skylights provide natural relief venting during free-cooling."

REAL ENERGY SAVINGS

In addition to the measures mentioned above to reduce fan energy, then lab fume hoods were designed for variable flow, using sash position sensors and modulating dampers at the fan inlet and hoods, which both reduced fume hood exhaust flow when the sash was closed, while maintaining the exhaust fan volume and discharge velocity.

Innovation: Although the HVAC system normally functions with high ventilation efficiency using the dedication 100% OA AHU and displacement terminals, the air conditioning AHU also has full 100% OA cooling capability, allowing cooling with no mechanical refrigeration equipment running. This is an unusual benefit with a DOAS/DV system.

Operable skylights provide natural relief venting during free-cooling. The same skylight structure serves as the return plenum in winter, harvesting the solar gain from the skylights and distributing the warm air to the building.

Heating water pumping energy was minimized by:

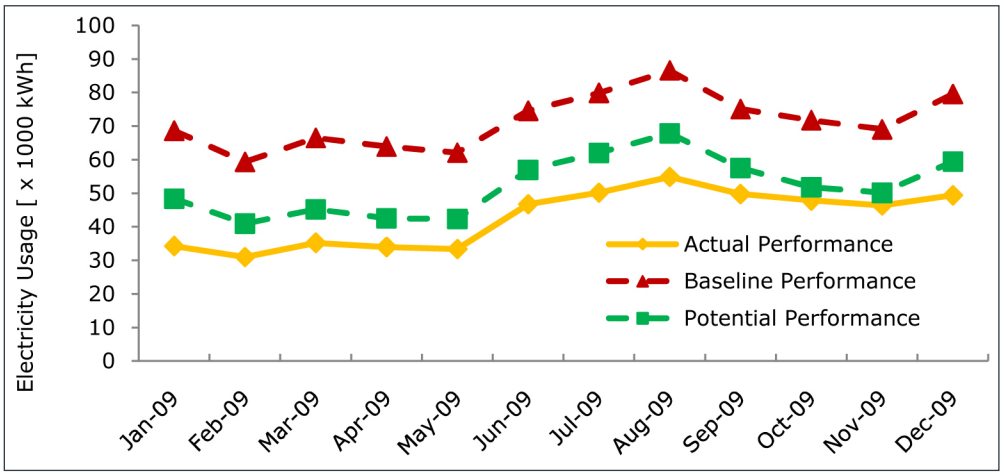
- selecting pumps for best efficiency
- minimizing the need for and use of circuit balancing valves, and
- designing the piping as a single, variable flow loop with boilers piped on low-flow, high delta-T injection loops, instead of the normal primary-secondary piping arrangement.

"...monitoring over the first year of operation demonstrated that the facility is actually using less energy and water than predicted"

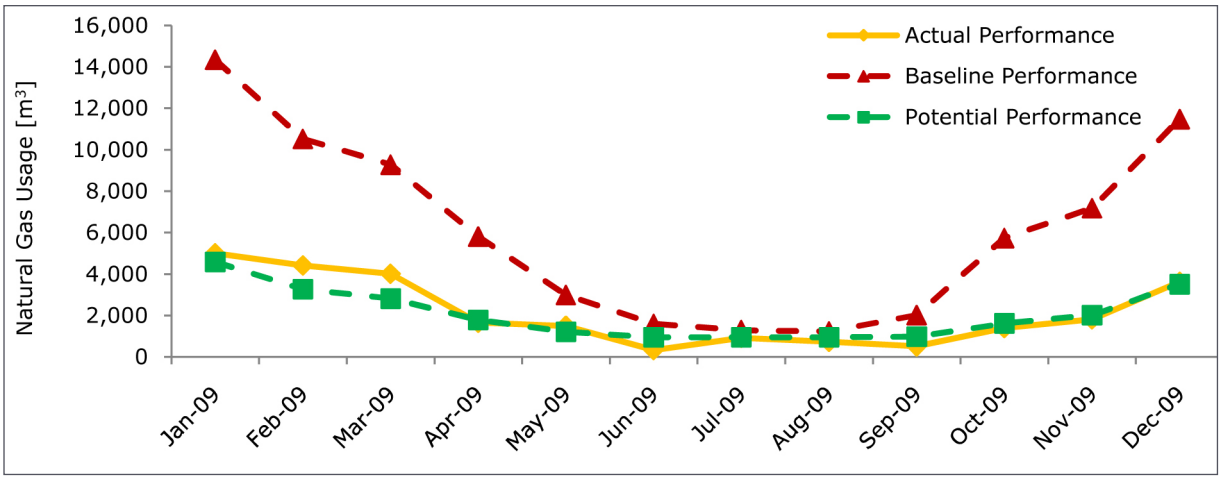
REAL ENERGY SAVINGS

Results: The WRPS building was designed to achieve a 60% reduction in indoor water use and a 68% reduction in the water used for sewage conveyance. Measurement & Verification monitoring over the first year of operation demonstrated that the facility is actually using less energy and water than predicted – an unusually good result particularly in the first year of operation – when most buildings require extensive commissioning to meet their energy saving potential. And beyond this, the building was constructed on budget.

Electricity Report



Natural Gas Report



"...materials from local sources reduces the transportation impacts from fuel consumption and air pollution and strengthens the local economy."

WATER EFFICIENCY

The WRPS building was designed to achieve a 60% reduction in indoor water use and a 68% reduction in the water used for sewage conveyance. The building exceeded this target. Water use at a combination office and lab facility can be a significant environmental impact. All water fixtures in the facility are low-flow fixtures, e.g., 0.5 litre/flush urinals. The WRPS building has a 5 m3 rainwater cistern that supplies water for toilets, urinals, and mechanical equipment makeup.

Innovation: To provide excellent cistern water quality, the mechanical designer made the innovative decision to adapt standard septic tank effluent filters as sediment pre-filters, mounted inside a standard precast catch basin to also provide primary settling and overflow control. The effluent filters are widely commercially available, easily serviced, and have high flow rate capability.

These design features were estimated to help the building use 68% less indoor water than a conventional building – representing approximately 840,000 litres of potable water saved each year. In fact, water meters specified by the Measurement & Verification consultant found that the building is actually using 96% less water (combined indoor and outdoor) than the baseline building in the original model.

MATERIAL SELECTION: A LOCAL STORY

Using materials from local sources reduces the transportation impacts from fuel consumption and air pollution and strengthens the local economy. About 34% of the construction materials used at the WRPS building are from local sources; gravel, gypsum board, insulation, steel studs, asphalt, concrete block, concrete, and structural steel make the greatest contribution.

Approximately 30% of the materials used in this building have high recycled content. These materials include concrete, rebar, structural steel, insulation, gypsum board, acoustic ceiling tile, particleboard, siding, carpet, and asphalt.