I.B. STOREY
Rink Engineering Experts

REPORT

MUNICIPALITY OF BROCKTON

REPORT FOR

FEASIBILITY STUDY

WALKERTON ARENA AND COMMUNITY CENTRE
LOT 25B, WALKERTON, ON

FEBRUARY 24, 2023

VERSION 1.0

I.B. Storey Inc
Charlottetown PE ♦ Vaughan ON ♦ Redington Shores FL
902-367-3545 ♦416-800-1482♦ 813-333-7684
info@ibstorey.com

Official Rink Engineering Consultant of the NHL®

REVISION DOCUMENTATION

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EXECUTIVE SUMMARY

Introduction

The Walkerton Community Centre, located in the Municipality of Brockton, ON, is the community's source of many recreational activities and social events. It also acts as an emergency gathering station in the case of a substantial disaster. However, its advanced age (constructed in 1972) is leading to increased upkeep costs, and the physical location of the building makes additional upgrades difficult. Recreational facilities of this age are energy intensive to operate and is reaching the end of its useful lifecycle. The Municipality of Brockton has expressed its interest in the construction of a new facility to resume these community duties, as well as provide surrounding communities with a state of the art, energy efficient, and sustainable space to enjoy. This report will detail the design of such a new facility with heavy consideration of operation optimization and the pathway to net-zero carbon emissions.

Goal of Report

This report is intended to summarize the envisioned project approach for the Municipality of Brockton, as well as the detailed analysis findings which are used to govern the planned construction. The condition of the existing facility will be examined to highlight the reasons a new building is being pursued. Two new building designs have been analyzed and will be detailed and compared to show the difference between a standard new ice rink and I.B. Storey's innovative Proposed Net-Zero Ready ice rink design. These findings will be summarized and the overall avoided savings and building footprint presented. This report is intended to be concise and not vague, however, as I.B. Storey is very emersed in this subject matter, some of the details, which is obvious to our firm, is less so to those unfamiliar with certain performance approaches. As such, please reach out to us directly should any further information be sought.

Summary of Report

The Municipality of Brockton has expressed keen interest in energy efficiency, with the ultimate goal of reaching a net-zero facility. The Proposed Net-Zero Ready design and the pathway to net-zero described in this report will allow the Municipality to reach these goals. By following these steps, the council can expect to not be reliant on natural gas and reduce greenhouse gas emissions with ice rink refrigeration and HVAC systems that operate at a much higher efficiency than traditional recreational buildings.

The presented solution pays very careful attention to reducing the carbon footprint with a wise investment strategy. The clear intention is to pursue an environmentally advanced approach in a fiscally responsible manner to maximize the results delivered to the Municipality for generations to come.

Findings & Recommendations

The Proposed Net-Zero Ready design will provide a net-zero ready facility with a 44% GHG emission reduction from the standard new facility as well as incorporating innovative features that reduce the ongoing maintenance costs in parallel. Further pursuing solar energy generation will allow the Municipality to reach its goal of net-zero. Based on the analysis of this report, I.B. Storey recommends that the net-zero ready approach be taken, followed by the solar pathway presented in Section 4.1.

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1.0 INTRODUCTION

Brockton is a municipality in Bruce County, Ontario that consists of the Town of Walkerton as well as its many surrounding communities. The Municipality of Brockton currently has a growing population which is creating demand for additional space that can be used to offer recreational services such as sports and other community activities. Brockton is interested in the design and construction of a new energy efficient and fully accessible arena and community centre to provide the required recreational services.

1.1 SITUATIONAL OVERVIEW

The existing Walkerton Community Centre was built in 1972 and is reaching the end of its useful lifespan. A building condition assessment conducted in 2019 reported deficiencies in the roof systems, building envelope, structural elements, interior finishes, vertical transportation, and parking lot of the facility. These deficiencies will result in significant maintenance being required to keep current service levels. An assessment for asbestos-containing materials was conducted in 2012 which reported that there were 7 materials which contained asbestos located across at least 19 areas of the building. The facility also has various other major issues preventing expansion as it does not meet current building codes, is at risk of flooding as it sits in the floodplain of the Saugeen River, it cannot be renovated until the costly asbestos removal work is done, and it cannot be easily expanded due to surrounding infrastructure.

The Municipality is looking to design a new Community Centre that addresses the issues they have been experiencing with the current facility. Key features include:

- More arena seating and parking to allow hosting larger special events or tournaments;
- A raised walking track to allow seniors and local track groups a space to access;
- An indoor sports floor for the municipality to play sports or have community groups host events at;
- Accessibility for all citizens

2.0 STANDARD FACILITY ENERGY MODELLING

For the purposes of comparison for the Proposed Net-Zero Ready building, I.B. Storey has prepared a conventional industrial standard arena design. This design uses standard features and mechanical equipment used in conventional arenas throughout Canada, and has been modeled on an hourly basis to provide an accurate baseline.

2.1 BUILDING LAYOUT AND PROGRAMMING

The required interior configuration and services in the building were developed in communication with Municipal staff. The key features included in the design include:

- Standard NHL size rink (200 ft x 85 ft)
- Rink spectator seating for 750
- Six (6) full dressing rooms
- Separate referee room and flex dressing room
- Second floor viewing area
- Raised walking track
- Concessions area
- Multi-purpose room, with an indoor sport floor, kitchen and storage for tables, chairs, equipment, and supplies
- Central lobby area for visitors
- Year-round rink operation with open hours from 7am to 1am daily
- LED Lighting in use throughout the building
- Back-up natural gas generator for emergency power generation

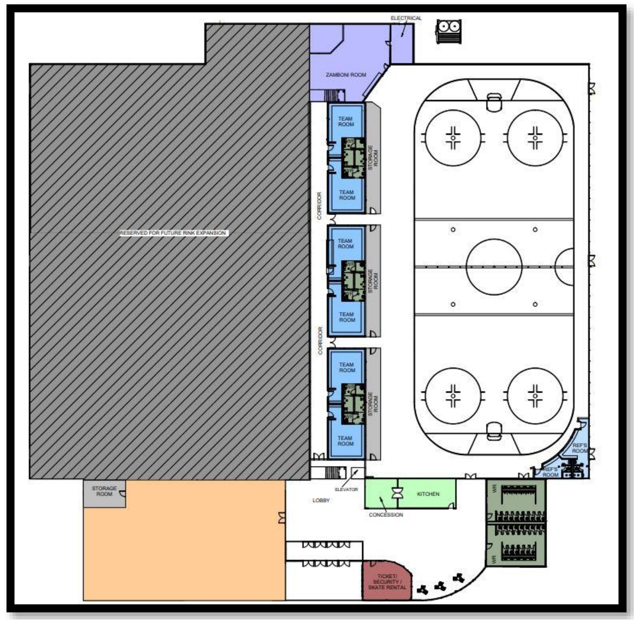


Figure 1. Proposed new Walkerton Community Centre (1st Floor)

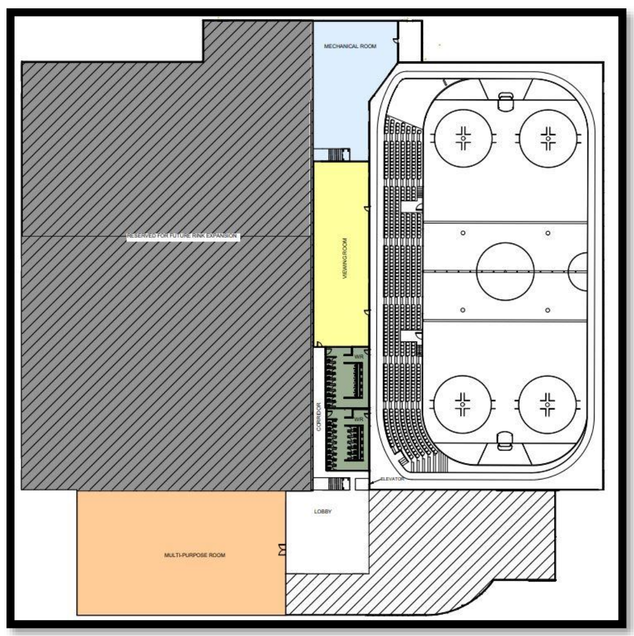


Figure 2. Proposed new Walkerton Community Centre (2nd Floor)

These standard building features were continued in the proposed building to ensure an accurate comparison between the two options.

The rendering in Figure 3 below shows a view of the ice surface from the raised indoor walking track:

Figure 3. View of the Ice Surface from the Raised Indoor Walking Track

2.2 INDUSTRY STANDARD DESIGN

In order to model the energy footprint of the building, the following industry standard mechanical systems have been used:

- **Ammonia Refrigeration Plant** –
  - A single ammonia refrigeration plant that serves the ice rink.
    - Note: Ammonia is a toxic, lightly flammable refrigerant that poses a serious potential health risk to operators, visitors at the rink, and the community around the building.
  - 150 TR refrigeration capacity
  - Three (3) standard reciprocating compressors.
    - Reciprocating compressors include dedicated oil cooling pump and oil circulation system. Regular oil changes required.
  - One (1) 20 hp dedicated cooling pump
  - One (1) 7.5 hp dedicated heat rejection (condenser) pump
  - One (1) 3 hp underfloor heating pump for frost protection
  - One (1) standard 15 hp evaporative condenser installed on elevated structure outside of the rink with remote sump tank in mechanical room
  - Basic temperature start/stop controls to maintain cold slab temperature setpoint

- **HVAC Systems** –
  - Ventilation provided through exhaust fans and unitary HVAC units serving zones or small zone groups.
  - Unit onboard compressors for air conditioning with assumed SEER (efficiency) of 13.4.
  - Unit onboard natural gas combustion burners with assumed AFUE (efficiency) of 81%.

Figure 4. Example Packaged Heating/Cooling Unit

- **Domestic Hot Water and Flood Water Heating** –
  - Typical standard efficiency (80%) natural-gas fired boiler in the mechanical room to provide domestic hot water.
  - Typical standard efficiency (80%) natural-gas fired tank-style heater in the ice resurfacer room to provide flood-water heating.

Figure 5. Example tank-style heater for flood water heating

2.3 MODELLING AND RESULTS

To accurately predict the baseline of the industry standard rink, a full hourly model was constructed using a year of local weather data. I.B. Storey's proprietary ice rink model was used to determine the refrigeration and dehumidification loads for the ice rink. ASHRAE 62.1 code ventilation requirements and hourly weather data were used to determine the required heating and cooling loads.

Additional building electrical loads for lighting and plug loads throughout the building were simulated hourly based on National Energy Code for Buildings (NECB) standard building load profiles.

The following figure and table summarize the resulting energy profile:

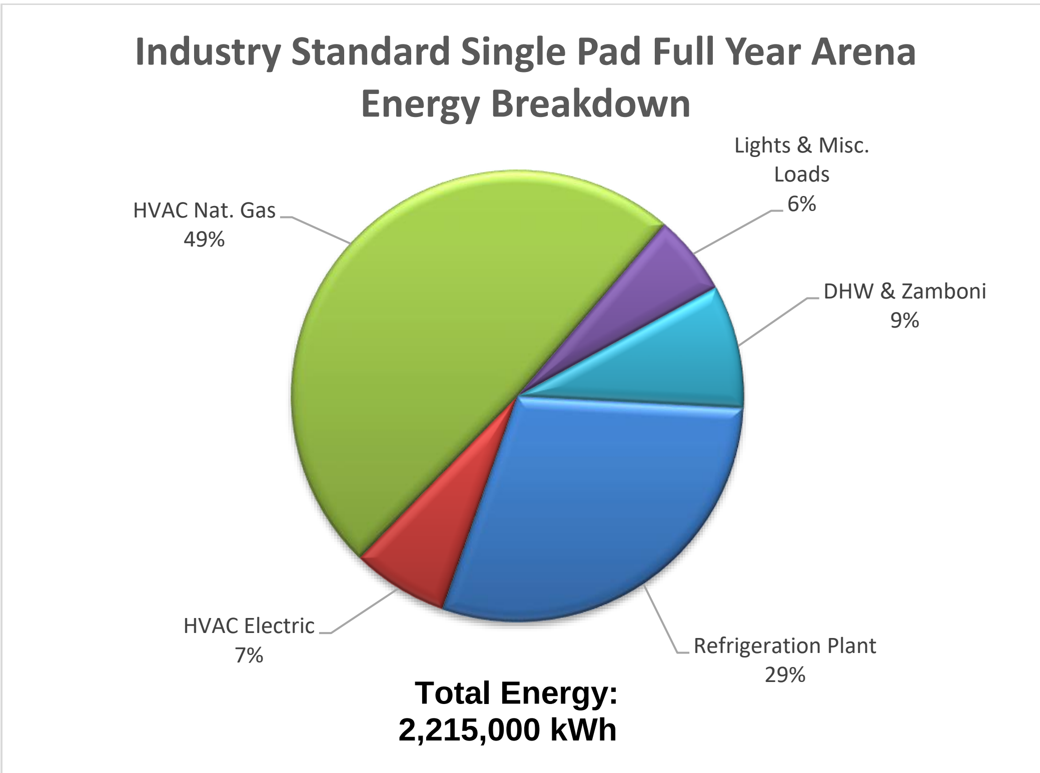


Figure 6. Industry Standard Brockton Arena Energy Breakdown.

Table 1. Industry Standard Brockton Arena Energy Summary.

Industry Standard Summary	
Electricity Consumption (kWh)	935,000
Natural Gas Consumption (ekWh)	1,280,000
GHG Emissions (tCO_2)	263
EUI ($ekWh/ft^2$)	45

The validity of the modeling was compared to utility data from similar sites in Ontario:

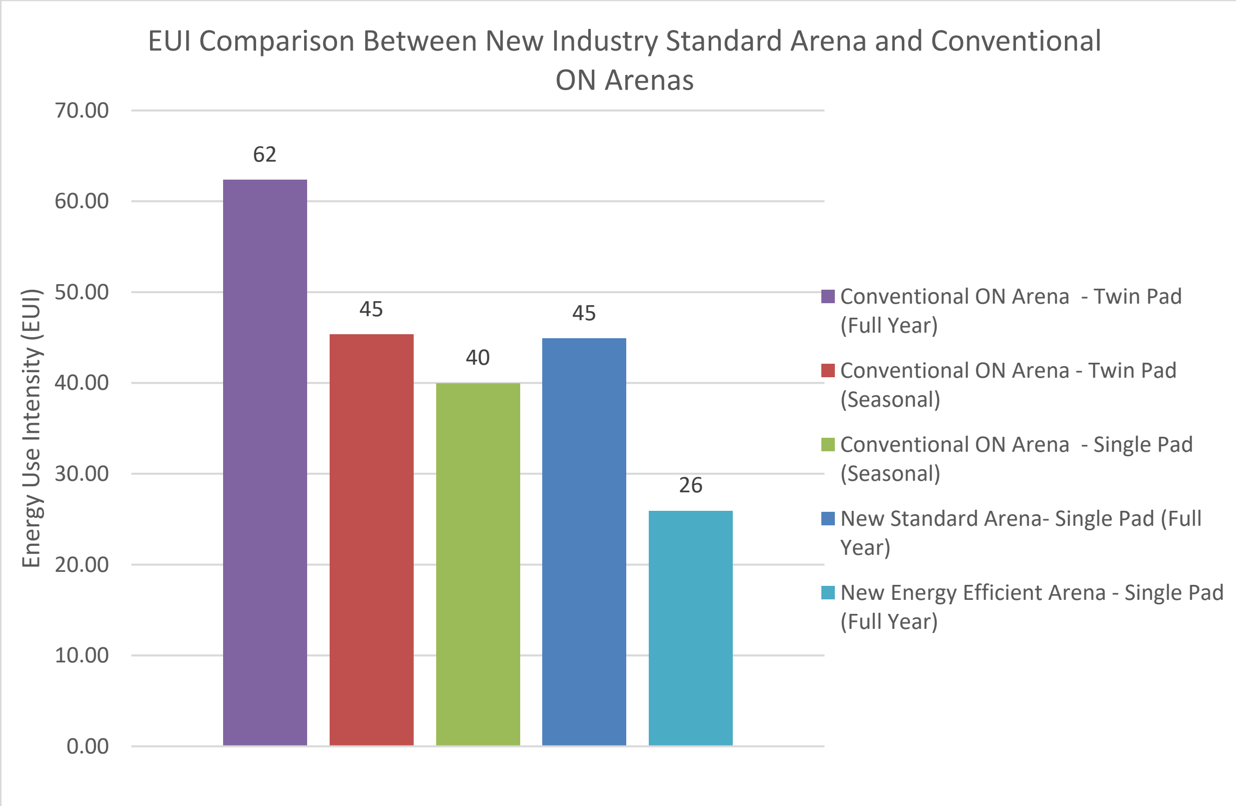


Figure 7. Graph Showing EUI Comparison Between New Industry Standard Arena and Conventional Ontario Arenas

Observations and Analysis:

- The expected EUI for the New Industry Standard Arena is 45 ekWh/sq.ft.
- This is directly in line with a seasonal twin-pad rink measured in Ontario, and significantly lower than the twin pad full year rink
- The calculated EUI of the industry standard is a close match with contemporary facilities, and supports the use of the base case as an accurate model for comparison.

3.0 PROPOSED FACILITY ENERGY MODELLING

As stated in Section 2.1, the facility layout and programming remain constant in the Proposed Net-Zero Ready design for accurate comparison between the two. All amenities described above will be seen in the proposed design; the only functional change is in how the facility will operate. The following sections will detail such changes.

Figure 8. View of Facility from Outside

Figure 9. View through windows in facility lobby

Figure 10. Inside the lobby showing second floor balcony.

3.1 Proposed Net-Zero Ready Design

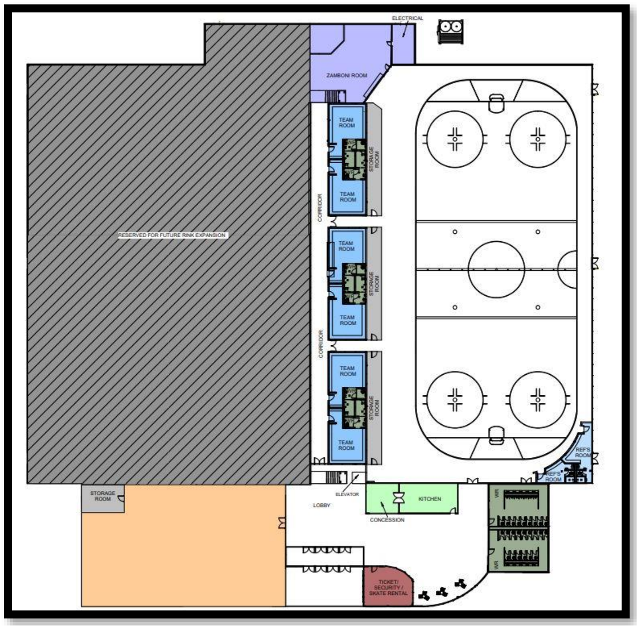


Figure 11. Proposed Net-Zero Ready Design with Expansion Room.

The same building floor plan from Section 2.0 is used for the Proposed Net-Zero Ready design to ensure continuity in programming and facility features; however, the building is converted to an integrated thermal plant design utilizing a higher efficiency refrigeration plant and heat recovery to greatly reduce the heating and cooling energy of the building. The following mechanical systems have been utilized in this design:

- **Innovative Refrigeration Plant with Advanced Controls**
  - Three (3) Integrated Thermal Plants
    - 150 TR of refrigeration capacity to provide enough refrigeration for redundancy in the current pad as well as for future considerations of a second pad.
    - A total of three refrigeration packages to ensure both pads are able to run in the unlikely event of mechanical failures.
    - Reduces maintenance costs and oil waste through the oil-less magnetic bearing compressors.
    - Safe, non-toxic refrigerant to cut health and safety risk for staff and the community.
    - Integrated variable speed motor control for optimal efficiency.
    - Heat recovery potential, up to 105°F to use waste heat for space heating and water pre-heat.
  - One (1) Adiabatic Fluid Cooler
    - Install an adiabatic fluid cooler to provide heat rejection for the new refrigeration plant.

Figure 12. Second Generation Integrated Thermal Package

        - Only uses water when required, operating dry when possible.
        - Eliminates water treatment.
        - Typically reduces water usage over 75% for seasonal rink operations.
    - Two (2) cold glycol pumps
    - Two (2) condenser pumps
    - Two (2) AC pumps
    - Two (2) warm floor pump
    - Glycol Components
        - All supporting glycol components such as feeders, heat exchangers, air separators, and expansion tanks for a fully functional, efficient refrigeration system.

Figure 13. Adiabatic Fluid Cooler Example

- **HVAC Systems**
    - The proposed design includes seven (7) air handling units to provide conditioned air per applicable codes and standards to all required spaces.
    - One (1) overcool dehumidifier will condition the rink zone and surrounding walking track space.
- **Domestic Hot Water and Flood Water Heating**
    - Two (2) high efficiency electric water heaters in the mechanical room to provide domestic hot water.
    - One (1) high efficiency electric water heater in the ice resurfacer room to provide flood water heating.
- **Open-Source Automation System**
    - Web-based remote access enhances system stability and allows operators to monitor the plant from any computer or smartphone/tablet.
    - Open source, non-proprietary programming with integrated tools allows any person or company with the technical skill required to serve or upgrade the system. The facility would not be tied to a specific vendor.
    - Offers optimal capacity controls, variable speed pumping, automatic ice temperature setpoints, and specialized ice rink optimization strategies through advanced controls for energy management.

Figure 14. Tridium JACE 8000 Controller, Example of Open-Source Hardware

- **Heat Recovery Implementation**

   - With the installation of the Integrated Thermal Plants, waste heat that is typically released outdoors through an evaporative condenser or cooling tower will be recaptured and reused throughout the facility.
   - The air handling units include built-in glycol heating coils sized to use the 105F glycol provided by the ice rink refrigeration system to heat all building areas.
   - During periods of excess heat availability, the system automatically adjusts to send energy to the loads. During periods of non-availability of recovered energy, the system will attempt to delay utilization of purchased energy sources, to "wait" for reclaimed energy. This is all managed using a load-management system which ranks and re-categorizes requirements to service loading with reclaim to the greatest extent possible without starving any areas.
- **Electrification**
   - Traditionally, the equipment listed below runs off natural gas or other GHG intensive sources. The proposed design of the new facility will see all installed equipment be high efficiency electric to reduce GHG emissions and operating costs.
      - Ice Resurfacer Room Heater
      - Refrigeration Plant Room Heater
      - DHW Heaters
      - Floodwater Heater
- **Solar Implementation (Future Consideration)**
   - The final step in moving towards net zero carbon emissions is the installation of solar panels to generate the shortfall of all previous mitigation methods. The system has been sufficiently sized to make up the entirety of the left-over energy, and ultimately achieve the goal of a full net-zero facility.
   - To achieve this goal, the approximate size of the system has been calculated as 1,000 kW, needing 91,500 square feet of space. The expectation is that the facility will be sufficiently constructed to allow for the install of panels on the roof of the building, above car ports, and ground mounting. This is a solar system of significant size, however, achieving net-zero will serve as a sustainable alternative while also greatly reducing annual operating costs. I.B. Storey has also laid out a potential pathway for this installation and is fully defined in Section 4.1 below.

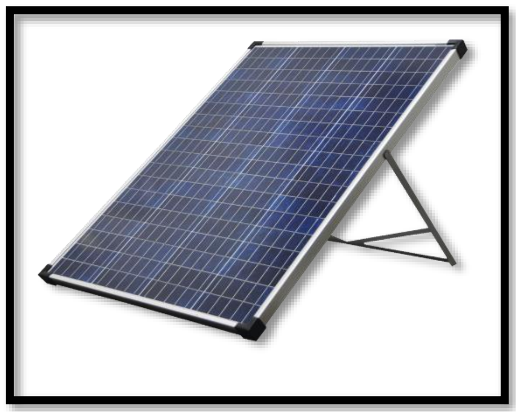


Figure 15. Solar Panel Example

- **Expansion Ready** –
   - The proposed building layout and mechanical systems are designed to accommodate a future "twinning" of the rink, where a second ice sheet can be added.
   - By planning for the future growth of the facility to accommodate growing community now, the long-term costs of the project will be minimized.

3.2 ENERGY BREAKDOWN

Similar to the Industry Standard design in the section above, the Proposed design outlined above was all modelled to describe the operation of such an arena. This model justifies the local weather data, basic building parameters, and expected operating conditions to calculate the total heat load for the facility. Occupancy rates and design peak occupancy were used to determine the ventilation requirements in accordance to applicable standards and codes. Pulling from this model, total facility requirements amount to approximately 1,279,000 kWh of energy, after heat recovery and considerable energy reduction measures outlined in following sections. For the purposes of this report, the energy consumption has been split into sections and is visualized in the Figure 14 below.

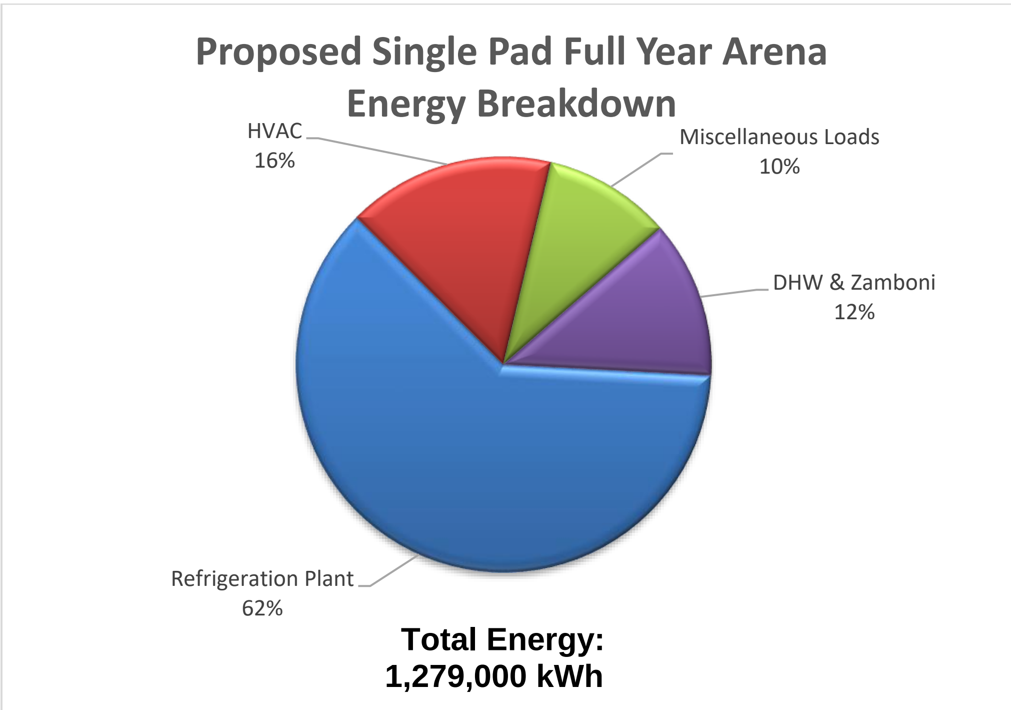


Figure 16. Proposed New Brockton Arena Energy Breakdown.

Observations and Analysis Summary

- All energy consumed from this facility is electric, considerably reducing GHG emissions that come from using natural gas or other GHG intensive energy sources.
- The 'Refrigeration Plant' is the largest consumer of energy at 62%. This includes the compressors, pumps, and fluid coolers.
- Next is 'HVAC' at 16%, consisting of the air handling units and rink zone dehumidifier.
- 'DHW & Zamboni is the measure of all domestic water and ice resurfacer water heating, and totals 12% of energy. Included in this design is a dedicated hot water connection with electric heaters to remove the need for natural gas boilers.
- Finally, 'Miscellaneous Loads' surmount to 10% of the total consumption. This measures the building lighting as well as various plug loads.
- Comparing the energy consumption of the proposed design to the new standard arena in the previous section, this facility will see a reduction of 936,000 ekWh, or 42%.

3.3 FACILITY BENCHMARK

The Energy Usage Intensity (EUI) was again measured for the proposed new facility and looked at other efficient arenas. Also shown is the industry standard facility from Section 2 for reference. It is important to note, however, that the comparable arenas are seasonal, whereas the proposed new Brockton facility will be year-round. See Figure 15 below.

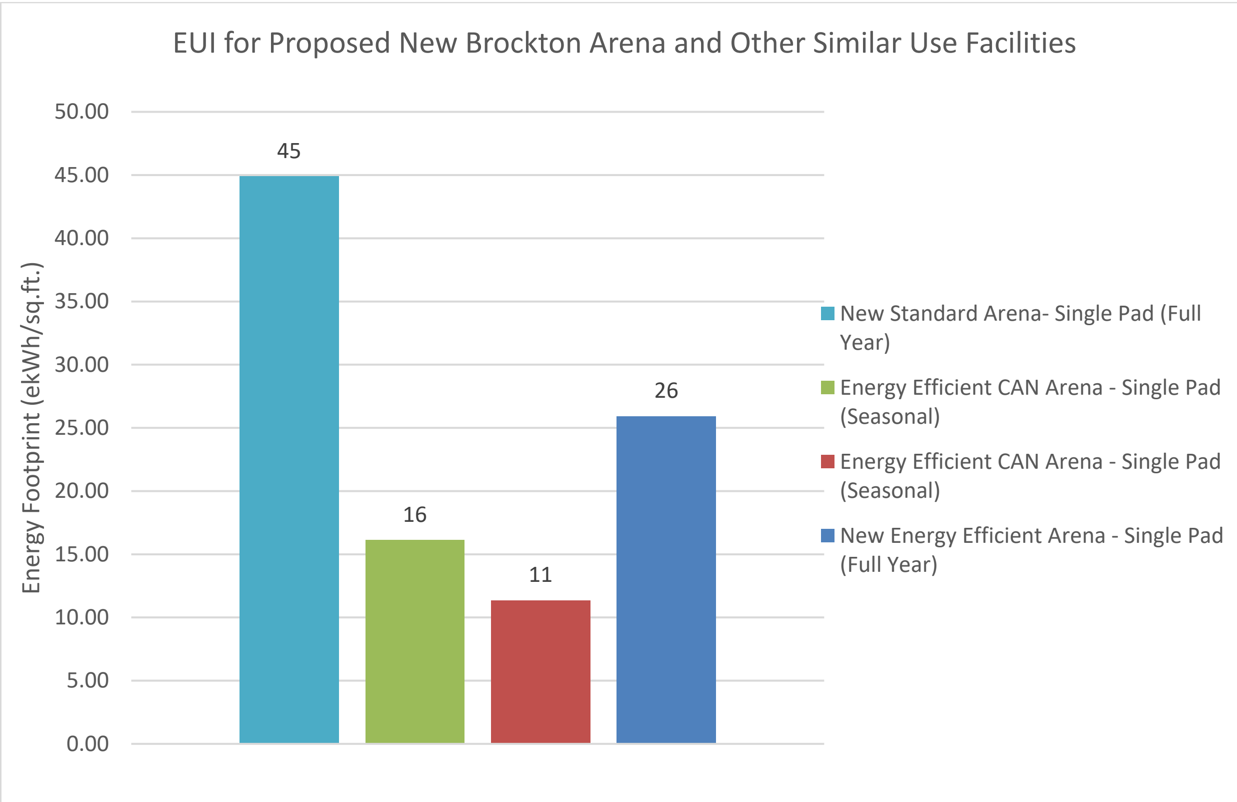


Figure 17. EUI measurements for similar ice rinks (shown in ekWh/sq.ft.).

Observations and Analysis Summary

- The proposed new energy efficient design can be seen with an EUI reading of 26 ekWh/sq.ft. In comparison with the 45 ekWh/sq.ft. of the industry standard arena presented in Section 2, this is a reduction of 42%.
- The average of two similar sized facilities has an EUI of 13.5 ekWh/sq.ft. However, note that these arenas are only seasonal and considerable energy would be added should they switch to full-year operation.

3.4 CLIMATE RESILIENCY

The design of this facility took careful considerations in regards to the challenge of climate-influenced risks, and has incorporated the following techniques to mitigate these risks:

- The Municipality of Brockton has communicated concerns of floods in the area. As such, the facility will be located outside of the flood plain of the Saugeen River. Also, major mechanical systems in the facility will be on the second floor which will mitigate the damage done in the event of a flood.
- The building envelope shall also be fully insulated and low-E thermal glass will be used throughout to cover any increases in average temperature in the future, reduce solar radiation damage to the interior, and reduce the cooling load in the summer months.
- The refrigeration equipment and ventilation system shall be designed such that any increases will be accounted for over the life-cycle of the infrastructure, based on SSP2-4.5 climate change expectations.
- The mechanical systems will reuse waste energy and have been designed for redundancy to ensure continual operation. Future solar generation will further reduce dependency on the electrical grid.

3.5 PROJECT SUMMARY

As outlined in this section, the construction of the new facility has been meticulously designed such that net-zero can be met in the future. Through the rink model, which leverages historical weather data against building loads developed throughout, determines the significance of waste heat that can be recaptured. During regular use of the compressors from the Integrated Thermal Plants, heat must be rejected in order to cool the ice rink. Rather than wasting this energy by throwing it outside, the automation system communicates with the building loads and reduces the amount of energy needed to be bought from external sources. Electrification of the equipment will also help in reducing the buildings footprint. Gas operated equipment have losses associated with their lower efficiencies. This leads to wasted energy and typically electricity has a lower GHG consumption intensity emissions factor. The result is savings in terms of both operation and environmental considerations. Finally, with the addition of solar implementation, the facility can reach net-zero. The following table will summarize critical information for the Municipality of Brockton for the construction of the overall project.

Table 2. Proposed Net-Zero Ready Brockton Arena Energy Summary.

Municipality of Brockton New Arena Facility Project Summary	
Electricity Savings (kWh)[1]	-345,000
Natural Gas Savings (ekWh)	1,280,000
GHG Emission Reduction (tCO_2)	225
Project Cost – Without Contingency ($)[2]	$31,245,000
Project Cost – With Contingency ($)	$37,494,000

[1] Note that electricity savings are negative due to electrification, however, overall net ekWh savings are positive.

[2] See Appendix A for the full project budgets.

4.0 PATH TO NET ZERO

In keeping with I.B. Storey's core aspects of sustainable design the proposed new rink construction is designed to be fully Net-Zero ready. The path to net-zero includes several key steps that have been incorporated into this project:

1. **Reduce** – The proposed system includes many energy-reducing features, including:
   a. **Enhanced Insulation** – Minimize envelope heat losses by incorporating high insulation values in the walls and ceiling.
   b. **Improved HVAC Controls** – Using demand control ventilation (DCV) and sensors throughout the building the air quality in the building can be maintained while keeping outdoor air introduction and treatment requirements low.
   c. **Heat Recovery Integration** – Recovered heat from the ice rink refrigeration plant is used to provide all of the building space heating needs, removing extra energy use for heating.
   d. **Mechanical Controls** – The control system for the building incorporates aggressive pump variable speed management to minimize pumping energy loss.
   e. **Water Reduction Strategies** – The adiabatic fluid cooler used in the design decreases water use for heat rejection, limiting the buildings overall water consumption compared to similar facilities.
2. **Electrification** – Only electricity is used in the building, with no gas appliances used for space or water heating as the heat is sourced from the integrated thermal plant and electric hot water heaters. An emergency generator for use during power outages is the only gas connection on site.

By keeping electricity use low and using electricity as a source of low-GHG energy rather than conventional combustion equipment, the design has paved the way for net-zero operation through added renewable energy projects (or carbon offset purchases).

The path to net-zero provided in this section is based on the Canada Green Building Council (CGBC) Zero Carbon Building Design Standard v3 Option 1: "Flexible Approach." As the system as designed already has no onsite combustion, no Thermal Energy Demand Intensity (TEDI) requirements exist, but the emissions for electricity used in regular operations must be offset.

4.1 RENEWABLES – SOLAR ENERGY

As the rink has been designed for year-round operation, including maintaining ice throughout the summer months, the solar power infrastructure required to offset the electricity used will require a significant investment. The following figure shows a potential configuration:

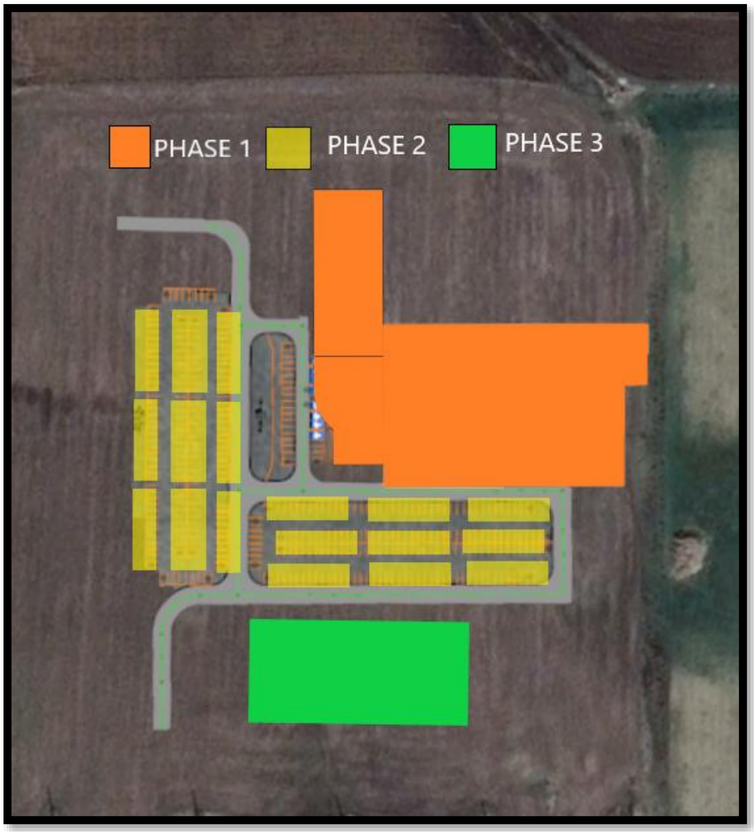


Figure 18. Solar Panel Phased Plan Approach

In order to prepare for this investment, the following must be incorporated into the design:

- Enhanced structural considerations for extra load – The building must be designed to accommodate a full solar array on the roof.
- Building orientation – In order to maximize the effectiveness of the solar setup, the building should be oriented to provide as much south-facing area for the solar panels as possible.

Key features of the proposed approach:

- Maximize the roof space of the building to produce as much electricity as possible.
- Use solar panel mounted car ports extensively in the parking lot, providing shade for improved user comfort.
- Minimize use of surrounding green space as much as possible to maintain an inviting environment for the community.

Based on the amount of solar power equipment required for the project, it may be advisable to proceed in phases. The following offers a potential roadmap to this approach:

Phase 1 – Building-mounted Solar

- Initially the roof of the structure can be covered with solar panels
- This makes use of otherwise unused space, and provides good value.
  - Estimated area: 45,000 ft^2
  - Estimated capacity: 500 kW
  - Estimated cost: $2,100,000

Phase 2 – Solar Car Ports

- Car ports in the new ice rink parking lot to improve user comfort and generate electricity
- Some additional infrastructure cost associated with the new car ports
- Plan for approximately 70% parking lot coverage to maximize energy
  - Estimated Area: 31,500 ft^2
  - Estimated capacity: 350 kW
  - Estimated cost: $1,500,000

Phase 3 – Ground Mounted Solar

- Remaining solar arrangement can be made up using ground-mounted arrays
  - Alternately, nearby buildings may be used to provide additional solar installations if they are municipally owned, or through long-term deals with owners
  - Estimated area: 21,000 ft^2
  - Estimated capacity: 230 kW
  - Estimated cost: $1,000,000

Table 3. Path to Net Zero Solar Addition Summary.

Solar Addition Summary	
Total Area for Net Zero (ft^2)	97,500
Total Capacity for Net Zero	1,080 kW
Total Cost for Net Zero	$4,600,000

5.0 SUMMARY/NEXT STEPS

The existing Walkerton Community Centre is reaching the end of its useful lifecycle and is presented with notable challenges for any retrofit or renovation projects. The specific design requirements and goals laid out by the Municipality of Brockton was for a new facility with a strong focus on energy efficiency, sustainability, and ultimately reaching net-zero. The Proposed Net-Zero Ready design has done just that. The combination of an innovative refrigeration plant, heat recovery infrastructure, and solar energy has significant savings; it is projected that this design will consume 44% less energy and reduce GHG emissions by the same amount in comparison to an industry standard design. A path-way toward Net Zero in keeping with the GCBC Zero Carbon Building Design Standard v3 "Flexible Approach" option has been included to provide the Municipality with the information needed to plan future upgrades to reach full Net Zero compliance.

I.B. Storey recommends that the Municipality of Brockton moves forward with their plan to construct a new Walkerton Arena and Community Centre as it would be an excellent replacement to their current existing facility. It is recommended that the facility first be constructed as a highly energy efficient net-zero-carbon-ready building, then be transitioned to a net-zero carbon building after the facility is in operation using the plan discussed in this study.

The Municipality has expressed interest in the possibility of having an additional ice sheet in the future. This was taken into consideration and the building was designed such that a second ice sheet can be added to the facility as simply as possible in the future if necessary.

Appendix A
Budget Estimates

I.B. STOREY Rink Engineering Experts	Project: 23-002 Walkerton Community Center	Client Name: Municipality of Brockton	Date: 24-Feb-23

AACE Budget Estimate Class[1]	Location	Currency
3	Walkerton, ON	CAD

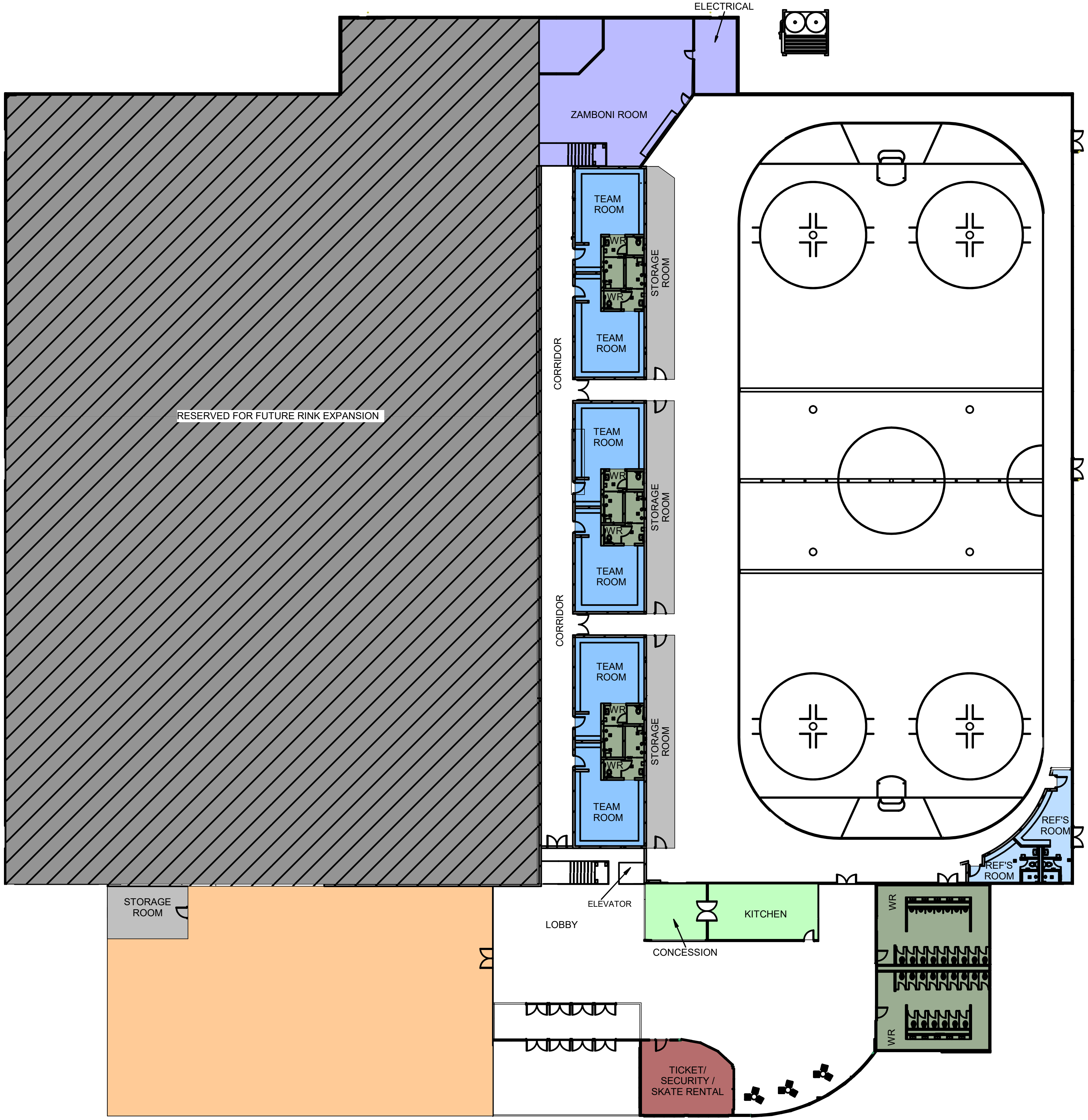
Recommended Project Budget		
Division	***Description***	***Sub-total***
Construction Materials/Equipment		$22,657,489
DIV 01	**General Requirements**	$4,722,836
DIV 05	**Metals**	$3,616,293
DIV 07	**Thermal & Moisture Protection**	$3,630,693
DIV 08	**Openings**	$1,108,708
DIV 09	**Finishes**	$858,058
DIV 11	**Equipment**	$3,061,277
DIV 21	**Fire Suppression**	$176,400
DIV 22	**Plumbing**	$529,343
DIV 26	**Electrical**	$2,024,258
DIV 31	**Earthwork**	$2,880,900
DIV 25	**Integration Automation**	$48,723
Special Construction		$4,568,764
13 18 00 Special Construction: Ice Rinks	**Integrated Thermal Packages - Gen II**	$563,882
	Steel Piping & Glycol	$340,733
	Piping Insulation	$216,220
	Ductwork	$425,835
	Pumps & Accessories	$90,624
	Airhandling Packages	$451,279
	Adiabatic Fluid Cooler	$170,096
	Grilles & Diffusers, Louvers	$75,141
	Heat Exchangers	$39,628
	Domestic Water	$157,753
	Rink Playing Slab	$833,047
	Snow Melt System	$13,426
	Water Treatment System	$71,676
	Building Automation & Controls	$601,561
	Dasher Board System	$325,791
	Building Permits	$192,075
Construction Fees		1,295,970
Consulting Fees		2,722,625
Project Estimate		31,244,848
Contingency Cost (20% of Project Estimate)		6,248,970
Project Estimate (Including Contingency Cost)		37,493,817

Note: Insurance/bonding costs not inlcuded.

	Primary Characteristic	**Secondary Characteristic**			
Estimate Class	**Level of Project Definition Expressed as % of complete definition**	**End Usage Typical purpose of estimate**	**Methodology Typical estimating method**	**Expected Accuracy Range Typical Variation in low and high ranges {a}**	**Preparation Effort Typical degree of effort relative to least cost index of 1 {b}**
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgement or Analogy	L: -20% to -50% H:+30% to -100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H:+30% to +100%	2 to 4
Class 3	10% to 40%	Budget Authorization or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L:-10% to -20% H:+10% to 30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L:-5% to -15% H: 5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L:-3% to -10% H:3% to +15%	5 to 100

Appendix B

Drawings



RINK FLOOR PLAN
SCALE 1:400

BY AREA TYPE LEGEND
- TEAM ROOMS
- REF'S ROOMS
- WASHROOMS
- OPERATIONS
- FOOD SERVICES
- MULTI-PURPOSE ROOM
- ZAMBONI SPACE
- STORAGE ROOMS
- RINK EXPANSION

VER #	REVISIONS	DATE	BY
1.0	ISSUED FOR FEASIBILITY STUDY	24-FEB-23	H.A.

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I.B. STOREY
Rink Engineering Experts

CHARLOTTETOWN PE
VAUGHAN ON
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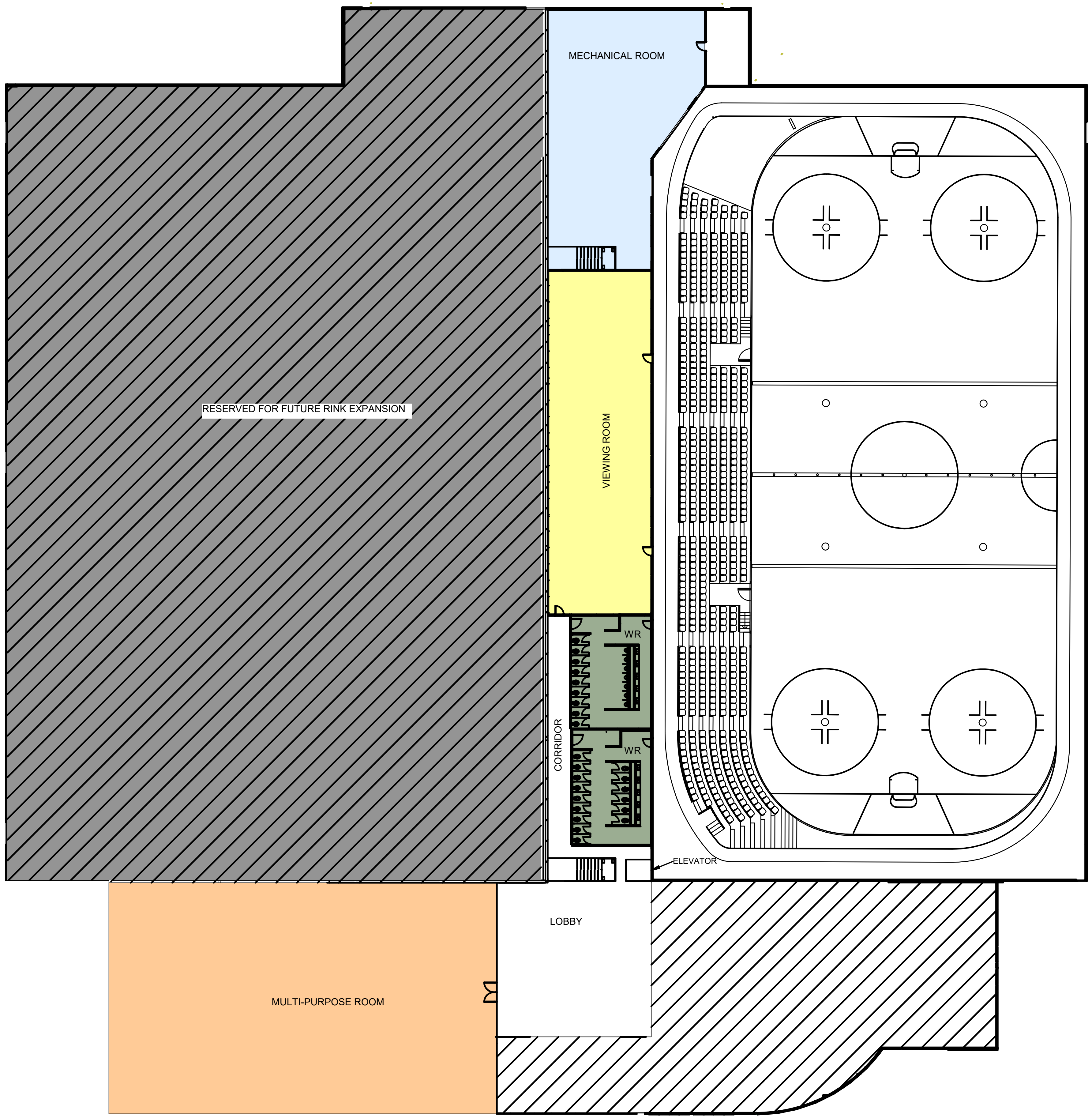
DRAWING NAME CONCEPTUAL FLOOR PLAN	
CLIENT MUNICIPALITY OF BROCKTON	
PROJECT WALKERTON COMMUNITY CENTER FEASIBILITY STUDY	
DRAWN BY H. AKAR	**CHECKED BY** C. CUDMORE
DATE 24-FEB-23	**REVISION** 1.0
SHEET SIZE B	**SHEET NO.** 1 OF 2



SECOND FLOOR PLAN
SCALE 1:400

BY AREA TYPE LEGEND

- MECHANICAL ROOM
- VIEWING ROOM
- WASHROOMS
- MULTI-PURPOSE ROOM
- ROOFTOP
- RINK EXPANSION

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DRAWING NAME
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CLIENT
MUNICIPALITY OF BROCKTON

PROJECT
WALKERTON COMMUNITY CENTER FEASIBILITY STUDY

DRAWN BY	**CHECKED BY**
H. AKAR	C. CUDMORE
DATE	**REVISION**
24-FEB-23	1.0
SHEET SIZE	**SHEET NO.**
B	2 OF 2