



RQM Future Aquatics Centre

Building Type Comparison and Costing

19 January 2016

Study Intent

To review what the Region of Queens Municipality can expect if an air supported structure was designed and constructed to house an aquatic centre expansion to the Queens Place Emera Centre.

Also to provide a comparison to a structure that would be built using methods and materials similar to the existing building (conventional structure).

Building Types

Conventional Structure



Photo courtesy of Architecture49

Air-Supported Structure



Photo from www.thefarleygroup.com

Study Considerations

Program and Site

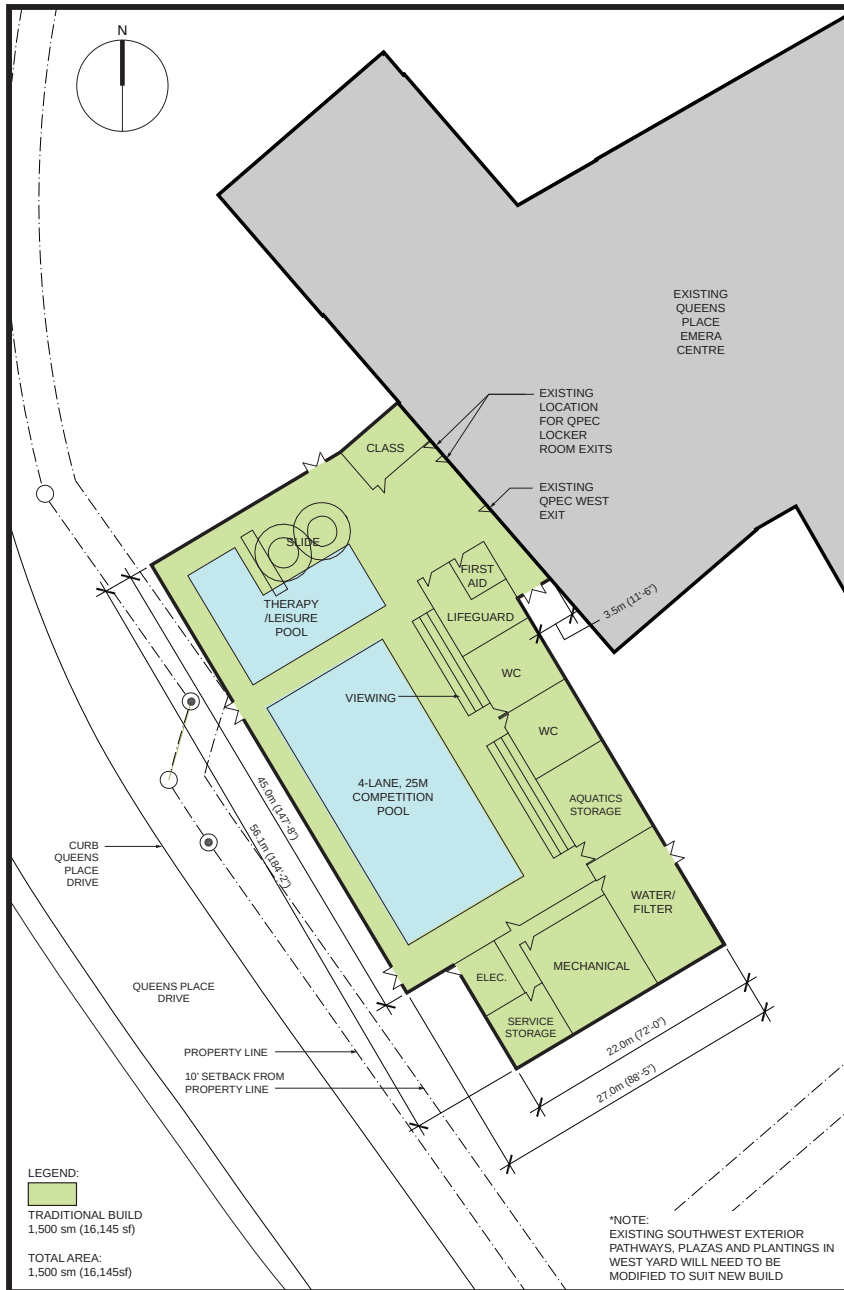
Preliminary Building Code Review

Multiple Criteria Comparison

Cost Estimation Over 20 Years

Program

- 25m Competition Pool
- Leisure Pool w/ slide
- Aquatics Viewing
- Lifeguard Office
- First Aid Room
- Small Classroom
- Aquatics Storage
- Pool Services Storage
- Mechanical Ventilation Room
- Water/Filter Room
- Electrical Room
- Public Washrooms

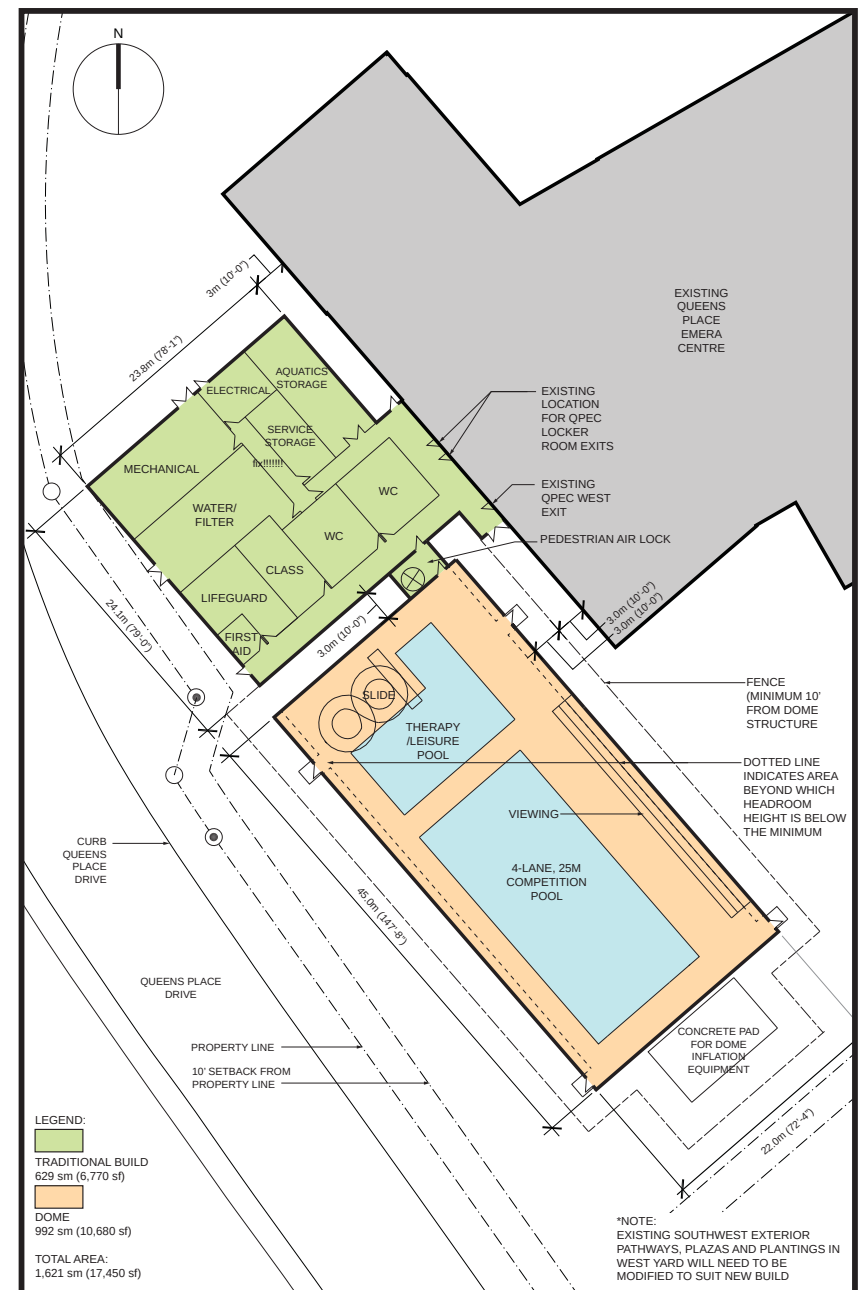


NOVEMBER 23, 2015

FLOOR PLAN DIAGRAM - CONVENTIONAL STRUCTURE

REGION OF QUEENS AQUATIC CENTRE
BUILDING TYPE COMPARISON AND COSTING STUDY

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FLOOR PLAN DIAGRAM - DOME STRUCTURE

REGION OF QUEENS AQUATIC CENTRE
BUILDING TYPE COMPARISON AND COSTING STUDY

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Preliminary Building Code Review

Appendix A – “These assemblies or structures are normally designed and evaluated on the basis of alternative solutions as permitted by Article 1.2.1.1. of Division A.” If alternative solutions are designed, they will require approval by the local Authorities Having Jurisdiction.

Preliminary Building Code Review

3.1.6.2 (3)

An air supported structure will not be designed to have any walls, mezzanines, or intermediate floors.

Preliminary Building Code Review

Fire Alarm System: Refer to subsection 3.2.4.2(6). The air supported structure would be connected to the aquatics building by a walkway that is to be of non-combustible construction and separated by a fire rated wall with a fire resistance rating of 45min. The local Authorities Having Jurisdiction will have to be consulted during the design phase to determine if the fire alarm system of Queens Place may need to be extended to the dome.

Preliminary Building Code Review

Subsection 3.2.3.14 (2) states that the exterior wall of each fire compartment would have to be the same fire resistance rating as that of the vertical fire separation between fire compartments. This would not be possible with the dome and will require an alternate solution that is acceptable to the local Authorities Having Jurisdiction.

Criteria For Comparison

- Construction Schedule
- Durability/Longevity
- Building Envelope
- Architectural Observations
- Flexibility
- Maintenance Requirements
- Compatibility with Site and Existing Conditions
- Building Code
- Design Restrictions
- Pool Filtration and Water Heating
- Ventilation and Dehumidification
- Space Heating
- Accessibility
- Interior Finish

Construction Schedule

Conventional

Approximately 8-10 months construction

Air Supported

Approximately 3-4 months construction.

Building services annex would take approximately 6-7 months to construct.

Durability/Longevity

Conventional

Built to last 50 years.

Air Supported

Built to last 15-20 years

Building Envelope

Conventional

Envelope will be designed to meet new 2011 National Energy Code of Canada for Buildings.

Air Supported

Envelope has a low R-value of 2 and cannot meet the 2011 National Energy Code of Canada for Buildings.

Architectural Observations

Conventional

Design can be integrated into existing facility's aesthetic to create a seamless look.

Glazing in structure will create views into and from the facility.

Air Supported

Limited to air supported structure aesthetic, shape and form.

Glazing not permitted in walls limiting visual connections.

Flexibility

Conventional

Flexibility of facility limited to design.

Air Supported

Though not the intent in this study the air supported structure can be removed and facility made an outdoor pool if desired in the future.

Maintenance Requirements

Conventional

Requires maintenance schedule for capital improvements and annual repairs.

Air Supported

Snow removal at the air supported structure edges is required to avoid snow and ice build up.

Requires maintenance schedule for capital improvements and annual repairs.

Compatibility with Site and Existing Conditions

Conventional

Building expansion restricted by site area.

Form can be modified to suit site and minimize negative impact on existing building spaces.

Air Supported

Air supported structure placement restricted by site area.

Long narrow and rectangular form restricts the way the dome can integrate with the existing building, blocking daylight openings, entrances and landscaping.

Fence creates narrow pathway to mandatory building exit.

Building Code

Conventional

Adheres to National Building Code and Provincial Codes.

Air Supported

Some communities have experienced permitting issues related to fire protection.

Alternate compliance paths to be verified with AHJ.

Design Restrictions

Conventional

Limited by site, program, existing building, and cost.

Air Supported

Footprint increased somewhat by area at edges of air supported structure where headroom clearance is low.

Footprint increased if a fence is desired.

Limited proportions (height is 30%-40% of width).

Pool Filtration and Pool Water Heating

Conventional

Standard pool filter.

No significant variation in filtration needs.

Variable Speed Pump based on pool Turbidity levels.

Air Supported

Standard pool filter with bypass for additional filtration requirements.

Variant in filtration needs expected should the dome be removed in the future.

Variable Speed Pump based on pool Turbidity levels.

Ventilation and Dehumidification

Conventional

Dedicated Heat Recovery Ventilation Unit.

Supply air distribution system.

Adequate fresh air supply.

Maintain Negative pressure to limit dispersion of “Chlorine Smell”.

Ventilated year round.

Dehumidification incorporated with ventilation.

Automated Control over humidity level.

Heat recovery from dehumidification compressors to preheat pool water.

Air Supported

Dedicated furnace and inflation unit.

No air distribution system.

Inflation unit will need to supply additional fresh air for the space.

Cannot maintain negative air pressure.

Ventilated year round.

Dehumidification not incorporated with ventilation.

Manual control over humidity level

Heat recovery not applicable.

Space Heating

Conventional

Gas fired / heat recovery from refrigeration plant.

Automated control for space temperature.

Integrated heat recovery from pool return air.

Air Supported

Gas fired inflation unit / heat recovery from refrigeration plant.

Automated control for space temperature.

Heat recovery not applicable.

Accessibility

Conventional

Will be designed to meet and exceed all barrier free code requirements.

Air Supported

Will be designed to meet and exceed all barrier free code requirements.

Interior Finish

Conventional

Can be designed to various levels of finish.

Air Supported

Limited to finish of dome structure.

Building services annex similar to conventional structure.

Estimated Capital Costs

Conventional

\$5,785,100

Air Supported & B.S.A.

\$4,697,200

(including air supported structure
quoted at \$298,940)

Estimated Soft Costs (25% project costs)

Conventional

\$1,446,275

Air Supported & B.S.A.

\$1,174,300

Utility Costs

Conventional

Pool Filtration	\$98,693
Pool Water Heating	\$580,125
Ventilation Heating	\$716,776
Ventilation Electricity	\$164,905
Dehumidification	\$282,337
Pool Space Heating	\$194,664
Pool Lighting	\$67,461
Support Space Heating	\$203,688
Support Space Electricity	\$119,931
Total Over 20 Years	\$2,428,579

Air Supported & B.S.A.

Pool Filtration	\$98,693
Pool Water Heating	\$1,392,299
Ventilation Heating	\$1,441,287
Ventilation Electricity	\$312,319
Dehumidification	\$0
Pool Space Heating	\$1,503,167
Pool Lighting	\$67,461
B.S.A. Heat	\$203,688
B.S.A. Electricity	\$119,931
Total Over 20 Years	\$ 5,138,846

Maintenance Costs

Conventional

\$2.92/sf/year
Repair, Replacements and Capital Improvements

\$942,868

Air Supported & B.S.A.

\$2.92/sf/year
Repair, Replacements and Capital Improvements
for Building Services Annex

\$1.80/sf/year
Repair, Replacements and Capital Improvements
for Air Supported Structure

Additional snow removal costs to maintain the
perimeter of the air supported structure are
estimated to be approximately \$25,000/yr

Total Estimate: \$1,279,848

Overall Costs

20 YEAR COST COMPARISON CHART		
Cost Type	Conventional Build	Air Supported Structure and Building Services Annex
Capital Costs	\$5,785,100	\$4,697,200
Soft Costs	\$1,446,275	\$1,174,300
Utility Costs (20 Years)	\$2,428,579	\$5,138,846
Maintenance Costs (20 Years)	\$942,868	\$1,279,848
Overall Costs	\$10,602,822	\$12,290,194

Conclusions

- Air supported structure + building services annex will cost more than conventional structure over 20 years.
- Air supported structure creates design limitations related to the site and the function of the facility.
- Air supported structure greatly relies on an operator who understands how to maintain its internal environment.
- Confirmation of alternative paths to meet the necessary life safety and fire protection requirements is required by AHJ.