

APPENDIX 40 **DETAILED VENUE ANALYSIS: PROPOSED FIELDHOUSE**

CALGARY BID EXPLORATION COMMITTEE

VENUE BRIEF:

PROPOSED Curling:

Potential New Foothills Field House

CALGARY, ALBERTA, CANADA

PREPARED FOR

CALGARY BID EXPLORATION COMMITTEE, Master Facilities Plan

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INTRODUCTION

As part of an exploratory exercise to determine the feasibility of Calgary presenting a bid to host another Olympic and Paralympic Winter Games, a high level survey and study was conducted to review potential major competition and non-competition sites. One of the primary components of the exercise was to look at where there were synergies between venues and maximize existing infrastructure and transportation links/corridors.

The potential new Fieldhouse for the City of Calgary has been identified as the potential site for Curling competition. The Calgary Bid Exploration Committee (CBEC) focused their attention on the potential new Fieldhouse for the City of Calgary, using the concept to maximizing existing infrastructure, providing substantial efficiencies in operational readiness, time, and costs.

The information contained in this document is to provide the Calgary Bid Exploration Committee (CBEC), Facility Owners, and Planning Teams further information on venue use, spatial requirements, and any challenges that need to be explored regarding this venue.

PROPOSED SCOPE & WORKING ASSUMPTIONS

The potential new Fieldhouse has been proposed as a competition venue, hosting the following events:

Sport:	Curling
Discipline:	Curling
Events:	Men's Tournament (10 Teams) Women's Tournament (10 Teams) Mixed Doubles

Throughout the exploratory discussions the following working assumptions have been applied:

- An ice surface does not exist and will need to be provided through temporary infrastructure;
- Ice plant and all ice maintenance facilities do not exist and will need to be provided for through temporary infrastructure;
- HVAC is fully operational and able to meet games requirements for temperature and humidity levels or is feasible for modification;
- Venue gross seating capacity meets a minimum of 4,500 seats;
- Seating bowl is code compliant and meets best practice for accessible and amenity seating. Any additional seating required to meet venue capacity to be provided for through temporary infrastructure;
- Full use of venue is available for Olympic use including external compounds, parking, and all ancillary spaces. Shared or exclusive use periods to be determined during venue use agreement planning phase;
- Venue is located within an operating sports complex, secure perimeters, vehicle and pedestrian screening, transport operations, and other amenities and services are required and will alter current access, use, and movements of the venue and surrounding areas;
- Lighting levels will require upgrades to meet the Olympic Games Broadcast requirements, see Appendix A;
- Roof structure has the capacity to hold additional loads for lighting, cameras, flags,

look banners and/or dimensional rings, audio, video boards, and score boards;

- Toilets are code compliant and meet all accessible guidelines and best practice;
- Concessions are in good working condition with all services operational, code compliant, and accessible;

The material below is a non-exhaustive listing of the major areas and will act as a preliminary benchmarking tool when assessing the overall venues ability to operate as the Curling competition venue. Using this material will provide the information needed to complete the next series of space studies to confirm flows, functional area space allocation, and develop further confirmation of required permanent works necessary.

As part of the sports complex, there needs to be further dialogue around the overall site access, egress, vehicular flows and Security Footprint, but as an initial phase of work the brief below will advise as to baseline requirements. There is minimal reference to the interior spatial requirements for the sport venues as most of the facilities have the primary requisites within their standard operating design, any gaps observed are noted at the end of the document for consideration. Further information on the Sport Federation and Media requirements will come later in the process.

CURLING BASELINE REQUIREMENTS

1 | General Venue Use

The Organizing Committee Olympic Games (OCOG) will need to take possession of the venue and its surrounding site areas to allow sufficient time for build out and overlay works. Build out requirements are based on the number of compounds, cabling requirements, and overall build scale and complexity.

A typical build out duration for a Curling venue is approximately 6-12 weeks prior to athlete training start, this includes venue lock down, technical rehearsals, and hand over to the games time operations team.

Coordination between venue owner and the OCOG is required to confirm non-exclusive use and exclusive use periods to allow for games build out, games operations, and remediation of the venue and site post games. Curling is an Olympic and Paralympic sport, which requires transition between Olympic Curling to Paralympic Wheelchair Curling. This transition includes works to the FOP and athlete areas, along with other minor venue elements. Remediation works to commence at the end of competition of the Paralympic Games.

Full use of the venue is required, including all exterior compounds, parking, facility and maintenance areas, suites, food service areas, retail outlets, storage areas, locker rooms, offices, and all operational spaces necessary to operate during the games.

2 | Front of House (FOH) Program Requirements

Front of House (FOH) areas are where spectator access, circulation, accommodations, and event viewing spaces are provided. FOH operations include spectator entry points, ticket scan, circulation concourses, concessions, ticket resolution, spectator services and information, retail outlets, toilets, water stations, spectator medical, and access to spectator seating and competition viewing areas.

The main entry and exit at the venue happens in the FOH through a secure venue perimeter fence line, spectator security screening, and ticket rip operations. Venue entry and exit points

will be determined through crowd modeling exercises with the surrounding sports complex to established through put rates to ensure optimal spectator flows around the venue and load-in of spectators to the Fieldhouse for competition.

General considerations for the front of house include providing spectator toilets and seating to meet best practices in accessibility, amenity seating, toilets, and concessions to ensure all spectators are able to enjoy the games without limitations. A thorough review of the venue's accommodations needs to be completed to determine where improvement works may be necessary to accommodate best practice and code compliance for an international sporting event.

FOH areas optimally occur in existing spaces internally, however, there may be a requirement for additional spectator spaces to be provided to meet operations and games planning requirements. These spaces would be provided through temporary infrastructure in the spectator plaza's, entry spaces, and concourses. Internal space allocation and the requirements for external temporary spaces will be confirmed in the next phase of the venue confirmation and detailed planning.

a. FOH External Program Requirements

i. Venue Perimeter

A secure venue perimeter [REDACTED] is required around the full perimeter of the venue, including compounds and entry plazas. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

ii. Ticket Box Office (TBO)

A ticket box office is required outside the venue secure perimeter, next to the spectator entry point for ticket sales, will-call, or ticket related services. This is a cabin structure with ticket portals, approximately 30m².

iii. Pedestrian Security Screening (PSA)

Entry into a venue, whether by spectators or accredited persons, happens through a PSA. The Pedestrian security screening (PSA)s process occurs in tent portals where each individual is scanned and checked prior to entry into the venue. The area and number of PSA's will be determined in the crowd modeling exercise, which will determine the spectator through put rates into the venue, establishing the number of PSA's required. One dedicated lane for accredited persons to be provided at the Spectator/FOH PSA's.

iv. Ticket Scan

Ticket scan will occur just after security screening operations at the venue perimeter, prior to access into the spectator plaza, as an extension to the entry process. The area and number of ticket scan portals will be determined once the PSA through put rates have been established.

v. Spectator Plaza

The spectator plaza occurs between the PSA's and the venue, with direct access to the spectator concourses, where spectator amenities and services are provided, as well as access to seating and competition areas. The size of the spectator plaza will be determined through the crowd modeling exercise and spectator load-in/egress rates. Based on the existing conditions of the venue, the spectator plaza, concourses, and amenities may be provided with temporary infrastructure including toilets, concessions, retail outlets, spectator medical, ticket resolution, and information, prior to entry into the seating bowl and competition areas.

vi. Spectator Services – Plaza

Spectator services storage and staging areas are required for golf carts, wheel chairs, and stroller storage – this area should be no larger than 25m². In addition, an animal relief area, with direct access to potable water and drainage, is required. This area should be no larger than 10m².

vii. Exit or Blow Out Gates

Exit gates or blow out gates are located adjacent to the entry ticket scan portals. The number of gates is determined based on the venue capacity and crowd modeling, to accept the exiting spectators from the Fieldhouse into the sports complex general population and circulation.

b. FOH Internal Program Requirements

i. Spectator Services – Information and Storage

An area, existing or temporary, to be provided for spectator information, lost and found, and additional wheel chair and stroller storage. This space should be located centrally in the main spectator concourse area, and should be approximately 25m² in area with provisions for a counter to provide separation between event services staff and spectators. Use of the existing venues information office is preferred.

ii. Ticket Resolution

A ticket resolution office or area, existing or temporary, to be provided centrally in the main spectator concourse area. This area should be approximately 10m² in area, with provisions for a counter to provide separation between ticketing staff and spectators. Use of the existing venues TBO is preferred, if located within the venue perimeter.

iii. Concessions

Use of the existing concession areas to be provided, and depending on the number of existing concession areas, additional temporary areas for concession sales may be required. Approximately 108 lm of concession counter space is required. A thorough review of the existing concessions conditions, operations, and services to be completed to determine if upgrades are required to ensure code compliance along with spectator accessibility best practice and compliance.

iv. Retail Outlets

Use of the existing retail store outlet to be provided, and depending on the size, additional

temporary retail outlets may be required. Approximately 108 lm of retail outlet counter space is required.

v. Spectator Toilets

Use of all existing spectator toilets to be provided, and additional temporary toilets may be required to accommodate the venue use. A thorough review of the existing toilets to be completed to determine if upgrades are required to ensure all toilets provide the required accessibility provisions to meet best practice and code compliance per the venue capacity.

vi. Spectator Medical

Use of the existing spectator medical area to be provided. If the existing spectator medical does not exist, a space of approximately 50m² is required. The space needs to have water and drainage, along with direct access to an accessible toilet.

vii. Water Stations

Water areas to be provided in the venue through existing drinking fountains or water fill stations. Water to be tested for drinking water use. Number of stations to be compliant with venue capacity and located throughout the spectator concourse areas.

c. Other Major FOH Program Requirements**i. Seating**

The venues existing spectator seating gross capacity will net 15-20% less to accommodate for accredited seating and seat kills due to FOP build out, camera platforms, broadcast and press tribunes, and photo positions. Spectator services requirements and compliance to be aligned with this net capacity number.

3 | Back of House (BOH) Program Requirements

Back of House (BOH) areas are where sport, competition management and all venue operational spaces are located. Several spaces are required to be internal to the venue, with others in compounds outside the venue, with access to the venue for servicing and

operations.

BOH operational areas include athlete areas, competition management, athlete medical, anti-doping, International Federation and Olympic Family areas, sport presentation, technology, food and beverage compound, cleaning and waste compound, workforce check-in and break areas, logistics compound, site compound, security, venue operations and management, broadcast compound, press operations (venue media center and press conference room), and venue accreditation. In addition, there are services compounds, parking, venue access points, and emergency services vehicle staging required in the BOH.

General considerations for the external BOH compound spaces include paved surfaces for high traffic use – vehicle and pedestrian, along with structures – tents, cabins, containers, and equipment. Connections to water and waste, along with fibre is a plus to minimize additional works that would be required for necessary service connections. Overall drainage of the BOH compounds is critical for proper surface water drainage. Considerations for internal BOH spaces include direct connections to the external BOH spaces for cabling and venue servicing.

a. BOH Internal Program Requirements

i. Athlete Areas

Space for all athlete areas should be provided inside the venue with direct access to the FOP on and off ice athlete areas. Curling specific athlete areas include (25) team locker rooms, athlete lounge, official's locker room, and sport information with an area of approximately 1000m². All areas to be accessible for Wheelchair Curling with minimal transition requirements.

ii. Competition Management

The competition management space is where sport operations offices and work areas are located. Specific spaces include competition management offices and conference room. The space should be located with direct access to the FOP level and easy access to timing and scoring, with an area of approximately 200m².

iii. Athlete Medical

Athlete medical to be located with direct access to the FOP level, the ice, and athlete areas, requiring a space allocation of approximately 200m², with connections to water and waste.

iv. Anti-Doping

If space is not available within the venue adjacent to the athlete locker and warm-up areas, anti-doping operations can be located outside the venue, with direct covered access to the athlete spaces within the venue. Anti-Doping space to be compliant with WADA space and processing guidelines, whether located within the venue or in a temporary cabin structure. The anti-doping space required is approximately 250m² and requires connections to water and waste.

v. International Federation

The International Federation (IF) for Curling and Wheelchair Curling is the World Curling Federation (WCF). There is a requirement for IF spaces within the venue for offices, meeting space, and a WCF lounge. This space is approximately 300m² and should provide direct access to toilets.

vi. Olympic Family

The Olympic Family (OF) lounge and protocol offices to be located in existing lounge or club spaces or areas directly adjacent to the Olympic Family seating areas, with dedicated toilets. This space needs to be a minimum of 250m².

vii. Sport Presentation

Sport presentation includes spaces for medals ceremonies offices, presenter staging and dressing rooms, and mascot changing. These areas need to be located on the FOP level with easy access to the FOP, with an area of approximately 150m².

viii. Technology Operations

Dependent on readily available connections to fibre, there may be a requirement for compound spaces for technology and cellular structures, staging, along with containers for

equipment and storage. This storage can be in the form of a tent or several containers. The compound space required is roughly 500m². Operational spaces for timing and scoring, work areas, and offices to be located on arena level with direct access to the FOP, this area is approximately 500m².

b. BOH External Program Requirements**i. Food and Beverage (FAB) Compound**

The food and beverage compound is the space for storage of both food and beverages, along with kitchen and food prep areas. Dependent on the venue, a temporary kitchen and additional storage is necessary to service all the additional lounges and food services outside concessions and standard venue operations. FAB sponsors, i.e. Coke, will also provide their own containers for storage on site and require a minimum of 1.5 days storage of products. This compound also requires offices, workforce areas, toilets, connections to water, waste, power, and easy truck access for daily off-hours food delivery. The compound space required is approximately 1000 – 1500m², depending on existing venue kitchen facilities.

ii. Cleaning and Waste (CNW) Compound

The cleaning and waste compound is an area for the staging of large mobile collection bins, bin wash down area, compactors for the required waste streams, storage of CAW cleaning and paper products, along with offices. The compound space required is approximately 800m² with an additional area of 1000-2000m² for snow removal equipment and snow storage.

iii. Workforce (WKF) Check-In and Break

An area to be provided for workforce check-in and break areas adjacent to the venue and workforce accredited entry to the venue. These spaces can be in a tent structure, with workforce check-in space allocation at approximately 100m² and workforce break at approximately 500m².

iv. Logistics (LOG) Compound

The logistics compound requires space for an office cabin, toilets, staging, and storage

space. Additionally, this compound will provide containers for storage for other functional teams, dependent on in-venue storage, as well as parking for large equipment and vehicles. This compound is approximately 1000m², and must be secured due to the equipment and goods stored.

v. Site (VED) Management Compound

The site compound requires space for offices, toilets, staging, and storage areas for Site Management along with Energy, Look of the Games, and Signage and Wayfinding. Additionally, this compound requires parking for large equipment, vehicles, and spares with an overall compound space requirement of approximately 1000m², and must be secured due to the equipment and goods stored.

vi. Security (SEC) Operations

As a venue within the sport complex, a full secure perimeter is required with control points and accredited PSA entry/exit access points. Accreditation access points are located BOH, with exception to one FOH accredited entry. Accredited entry points are provided for Staff, Olympic Family, Athletes, IF, and Media.

In addition, security operations require offices, control centre, briefing, and storage spaces – these can be in the venue or in an external compound tent or cabin structure, with a compound size of approximately 300m². Dedicated power and direct fibre connections are required to support their secure independent servers and operations.

vii. Venue Management Operations

If space is not available in the venue, a venue operations centre (VOC) is required. This space will house the offices for venue management and miscellaneous functional areas, event services offices and storage, venue briefing area, venue communications centre, and storage as required. If located externally, these spaces can be in a tent or cabin structure, and is approximately 300m².

viii. Broadcast Compound

The Curling broadcast compound for the Olympic Broadcast Service (OBS) at the Winter

Games, requires approximately 5000m² of clear open space immediately adjacent to the venue. The compound provides Rights Holder Broadcast (RHB) spaces and OBS technical operations, offices, and connections to the International Broadcast Centre (IBC) and in venue operations.

The compound will also require its own dedicated generator compound, dedicated to OBS operations in the compound and at the venue. This space is roughly an additional 500m² of required space, directly adjacent to the BRD compound.

In venue operations include camera positions and platforms, commentator positions, mixed zone, broadcast studio, commentator control room (CCR), and Broadcast Information Office (BIO). The studio space is approximately 30m², the CCR space is approximately 50m², with the BIO approximately 25m².

ix. Press Operations

Dependent on space available in the venue, a Media Centre may need to be located externally to the venue, with direct access for the media to travel between the tribunes, photo positions, mixed zone, and the media centre. The media centre can be housed in a tent, with requirements for offices, lounge, lockers, and workroom. A media centre for Speed Skating is approximately 800m².

In addition, there is a requirement for a Press Conference Room – if space is not available in the venue with connections to the media center and the tribunes, it can be located next to an external media center, adjacent to the venue with direct access for the press and athletes to and from the tribunes and mixed zone, and is approximately 300m².

x. Transport

A transport office, storage, and drivers lounge is required outside the venue secure perimeter to manage vehicle access, traffic, and venue load zones. This area is next to the VSA and parking areas. These structures can be tents or cabins and require space approximately 50m² for the Driver's lounge and 100m² for offices and storage.

xi. Venue Accreditation

A venue accreditation office is required outside the venue secure perimeter, next to the Olympic Family and Media entry points. This is a cabin structure approximately 30m².

c. Other Major BOH Program Requirements**i. Services and Access**

Access to water and waste, along with access to fibre connections is required for BOH compound spaces. In addition, there will be a Field of Play (FOP) and BOH energy requirement for prime generated power, along with redundancy generated power requirements. Energy compounds are broken into specific areas adjacent to the compounds and the venue with the most direct routes to reduce cable lengths. Roughly 4 compounds should be considered, outside the broadcast (BRD) compound, of approximately 500m² each.

ii. Parking and Vehicular Access

Each BOH compound will require parking within its compound for various operations. Additionally, Athlete's, officials, OBS and operational staff require parking – this can be as high as 150 parking stalls, with an area of approximately 4000m².

Further transportation planning with new and existing public and games transportation systems can reduce this number, but should not be less than 50 stalls for this venue.

BOH venue vehicle access is through a security vehicle screening area (VSA). A loop in and out of a venue is preferred, allowing for easy access of large trucks without backing up at any point of its entry into a venue. There is only one point of entry and exit for vehicles at a venue.

iii. Ambulance Staging

Emergency services vehicles will also require space within the venue BOH, dependent on the safety plans – fire trucks would be centrally located within the venue, however, two ambulances would be required for the venue – one dedicated to Athlete's and the other for Spectators. These ambulances are located adjacent to the building, with direct access to

both the FOP and spectator areas, and require connections to power.

4 | Field of Play (FOP) Space Requirements

The field of play (FOP) is the area where competition takes place, for Curling these areas are the ice sheets. In addition, to the FOP area, there are several areas that are directly adjacent to the FOP which are also considered as part of the FOP. These areas include athlete access to the FOP, infield areas, coaches and WCF platform, broadcast camera platforms and track camera, photographer risers, ice resurfacing operations and equipment storage, off-ice staging, medical staging, ice techs staging, and the mixed zone for both broadcast and press.

General considerations for the FOP include the requirement for the ice surface to meet World Curling Federation (WCF) Curling ice standards. In addition, humidification requirements for the ice, along with on ice temperature requirements for the athletes. HVAC systems need to be reviewed to confirm compliance for games, as modifications may be required.

Further, lighting levels are required to meet Broadcast lighting requirements, See Appendix A. Lighting may require modification to meet the lighting levels and to cover the ice surfaces.

a. FOP Ice Program Requirements

i. Ice Surface

There are (4) competition sheets required, and each must meet WCF Curling ice technical requirements.

ii. Ice Surface FOP Platform and Staging Zone

There is a zone, located at both target ends just off the ice sheets that expands the FOP approximately 2-4m in depth. This area houses the sport circulation, broadcast platforms, photographers risers, medical, ice staging, coaches and WCF platform.

b. FOP Off-Ice Program Requirements

i. Off-Ice Areas

Ice maintenance operations required to be located directly off ice and requires a space of approximately 100m² for staging of equipment.

ii. Mixed Zone (MZ)

The mixed zone (MZ) is the location where media interview the athletes immediately post competition, and is the pathway back to the athlete areas from the FOP. There are three areas required in a mixed zone, the athlete lane, broadcast and press corrals, and the circulation corridor to feed the broadcast and press areas. The athlete lane needs to be 2m deep minimum, the full length of the mixed zone. Broadcast requires roughly 12 (1.8m x 1.8m) positions with the circulation corridor behind, approximately 2m deep. Press requires roughly 25m length by 3m deep as a minimum, with the circulation corridor, 2m deep. Back drops are required on the Athlete side that may take an additional .5m space required the full length of the mixed zone. Access to the mixed zone is directly adjacent to the athlete off-ice area.

c. Other Major FOP Program Requirements

i. Training

Training and competition occur at the venue, creating long operational periods and requirements for services.

ii. Roof Loads

The FOP roof structure requires the capacity to hold additional loads for lighting, cameras, flags, look banners and/or dimensional rings, audio, internet and mobile antennas, video boards, and score boards. An estimated load requirement is 19 tons to meet games requirements. The structure should be surveyed to confirm load capacity.

iii. FOP Lighting

Requirements for broadcast level lighting must be provided at each venue to meet the OBS

technical specifications for broadcast lighting. See Appendix A for the OBS Broadcast Lighting Technical Specifications.

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VENUE TRANSPORT SUMMARY

Refer to the McMahon section of Appendix 4AA

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VENUE PROFILE SUMMARY

As the Curling venue is not existing, a profile summary has not be developed.

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VENUE GAPS, CHALLENGES, AND CAPITAL WORKS PROJECTS

As the Fieldhouse is in conceptual design, focus on working with the design development of this new arena is paramount to ensure games requirements are included into the venue design and program.

i. Venue Gaps

No gaps can be identified at this time, as the venue designs have not been confirmed for review and analysis.

ii. Venue Challenges

- Flow of spectators to the venue, during competition and the potential Opening and Closing Ceremonies at McMahon Stadium;
- Other challenges are unknown at this time, pending venue design.

iii. Capital Works Projects

Capital works projects are pending designs of the venues, the following listing is of areas that need special consideration during the design process to ensure games requirements are considered.

HVAC

Confirm humidification and temperature levels to meet IIHF requirements.

Roof Loads

Confirm roof loads of 19 tons.

Lighting

Confirm FOP lighting meets broadcast lighting requirements as noted in Appendix A.

Toilets

Confirm all toilets meet code for accessibility and best practice for family and amenity toilets.

Seating and Accessibility Compliance

Confirm seating meets code for accessibility and amenity seating, with locations at all levels of the seating bowl to ensure ability to provide accessible and amenity seating at all price points.

Exterior Services Connections

Confirm connections are readily available for fibre, water, and waste in exterior compounds, along with connections to power.

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APPENDIX A: BROADCAST LIGHTING TECHNICAL SPECIFICATIONS



Esteem Projects & Consultancy

Date: 8th February 2017

Re: Olympic Broadcasting Service (OBS) summary of current Broadcast Lighting Technical Specifications.

Following is a summary of the OBS technical specification for broadcast lighting. The IOC and OBS would provide a comprehensive specification on confirmation of the Olympics Host City.

Below sets out the key areas for consideration when planning and design for games time lighting.

In addition to the completion area that require quality lighting are the non field of play areas such as

- Mix zones
- Press conference rooms
- Announcer positions
- Athlete holding areas
- Athlete pathways to FOP
- Spectator areas
- Warm up areas and Fields of play
- Medal and Flower Ceremony's
- Flags of Nations and Ceremony Flags

The technical specifications provide the detailed requirement for all venues. Sport specific requirements can vary between sports and venues. Consideration should be given to these specific requirements when formulating designs and equipment.

OBS Technical Specifications Summary **Version February 2017**

Light source (lamp)

The specified requirements apply to all light source (lamp) technologies e.g. HID (MHN, HQI, HSI, HIT, MSR, MSD etc.), LED, fluorescent etc.

Flicker

To support HFR production requirements and irrespective of the lamp technology e.g. HID, LED etc., the lighting shall be flicker free; the lamp driver/control gear shall be of the electronic type with an output frequency $\geq 1,000\text{Hz}$.

Low wattage lamps are preferred. The lamps shall be from the same manufacturer and from the same production batch.

Colour temperature:

The colour temperature, Tk, shall be 5600K (standard TV camera preset).

All lamps shall have the same colour temperature. That is, the colour temperature shall be nominally one value e.g. 5600K. Differences in colour temperature between different wattage lamps (at the FOP in question) are not acceptable.

It follows that if the competition of a sport is held at two (or more) venues, the FOP broadcast lighting of each shall have the same colour temperature.

Colour rendering¹⁰:

The CIE CRI Ra shall be ≥ 85 ;

and if no proven international standard installations of the lamp/luminaire system exist, a live field test with the intended light source/luminaire and a broadcast quality camera in cooperation with a national sports broadcaster shall be conducted and the results made available for review;

or

- Alternatively, TLCI11 Qa ≥ 85 ; or
- Alternatively, CRI Ra ≥ 85 and a R9 ≥ 45 ; or
- Alternatively, CRI Re(R1-R15) ≥ 85 .

If, for practical reasons (legacy, economics etc.), the lighting over the spectators has different lamp technology luminaires to the FOP, the colour temperature of these (spectators) luminaires shall not be higher than the FOP lamps.

Lighting equipment and operating conditions

The lighting equipment shall be suitable for the operating environmental conditions of the venue in question; and ensure that the lamps operate at the correct colour temperature and light output characteristics. The lighting equipment shall comply with the relevant host country's electrical safety standards. Luminaires shall comply with IEC 60598. The lamps shall comply with the relevant IEC lamp standards.

Winter Games outdoor venues, cold weather and lamp performance.

Extreme cold weather affects the proper functioning of all lamps (HID, HMI, fluorescent, LED). Apart from a lower light output, in particular the colour temperature may change significantly even between individual lamps and become unacceptable.

Lamps shall be operated on control equipment designed for very low temperatures so that the lamp operates to the stated nominal performance characteristics and meets the above requirements; and be utilised in luminaires designed for cold temperatures.

Anticipated light output losses due to low temperatures shall be factored into the lighting design.

The projected Games time temperatures shall be established well in advance.

Secondary warming (heating) the localised ambient temperature and air space control to ensure compliance should be considered. If necessary tests should be carried out to ensure the equipment would operate at the Games time predicted operating temperatures.

Calculation and measurement grids

Calculation grid intervals shall nominally be 2m (varies per sport – see specific sport requirements).

Illuminance towards a camera - known as camera illuminance, E_c , shall be on a plane nominally at 1.5m above the FOP surface.

Vertical illuminance, E_v , towards a nominated side of the FOP shall be on a plane nominally at 1.5m above the FOP surface.

Horizontal illuminance, E_h , shall be calculated/measured on the FOP surface.

Compliance illuminance measurement grid intervals shall nominally be 4m.

Note: the calculation plane shall match the gradient/slope of the FOP; e.g. cycling track, alpine skiing slalom; and/or the athlete's principal competition 'line' through the space above the FOP which may be a vertical plane e.g. skiing freestyle aerials, diving and ski jumping.

Camera locations

The camera positions modelled in a lighting design shall be as specified by OBS. Nominal camera plans are provided as production teams can survey the venues and formulate related plans.

HD, 4k and HDR

The on-going evolution from standard definition to high definition and beyond raises the question of

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illuminance levels. The reality is that with most professional broadcast camera system cameras, the sensitivity remains the same. In other words, the illuminance criteria herein remain the same for HD and 4K.

Similarly, high dynamic range (HDR) provides no additional restriction. At the time of publication 8K is in the early stages but it likely that the same requirement will prevail. The reader should check with OBS for currency.

Minimum illuminance

The minimum vertical illuminance at any point of the FOP shall be $E_c \geq 1,600$ lux towards the main cameras.

Note: the minimum average illuminance and the average horizontal illuminance are determined by the uniformity ratios. For HDTV/4K it is imperative the uniformities are met or exceeded.

The minimum vertical illuminance at any point of the FOP towards the orthogonal directions of the FOP, where camera #1 is central to a side, or 45° to the 4 sides of the FOP where camera #1 is not central to a side shall not be less than 70% of the minimum illuminance towards any main camera.

Uniformities for FOP

Vertical illuminance uniformity for each relevant main camera.

The minimum to maximum camera illuminance ratio, $E_{c \min}/E_{c \max}$, shall be ≥ 0.7 for the FOP; and ≥ 0.4 for the FOP-surround.

The minimum to average ratio, $E_{c \min}/E_{c \text{ ave}}$, shall be ≥ 0.8 for the FOP; and ≥ 0.6 for the FOP-surround.

Horizontal illuminance uniformity

The minimum to maximum ratio $E_{h \min}/E_{h \max}$, shall be ≥ 0.7 for the FOP; and ≥ 0.4 for the FOP-surround and/or run-off

The minimum to average ratio, $E_{h \min}/E_{h \text{ ave}}$, shall be ≥ 0.8 for the FOP; and ≥ 0.6 for the FOP-surround and/or run-off

The ratio of vertical illuminances at any point on the FOP between the orthogonal planes (at either 90° or 45°; i.e. four calculation planes only) facing the four sides of the FOP shall be ≥ 0.75 and ≤ 0.9 .

The average vertical illuminance on the FOP towards camera #1, or the designated principal camera, shall be greater than the average vertical illuminance towards the other 3 orthogonal directions.

The uniformity gradient 12, UG, for both horizontal (UGh) and vertical illuminance to main cameras (UGc) shall nominally be $\leq 10\%$ on a 2m calculation grid (varies per sport by interpolating the appropriate calculation grid).

The UGv of the vertical illuminance towards the backlight side or sides where there are no fixed cameras shall nominally be $\leq 20\%$ at 4m grid intervals (varies per sport and interpolation).

The ratio of the average horizontal illuminance of the FOP surround to the average horizontal illuminance of the FOP shall be ≥ 0.6 and ≤ 0.8 , target 0.7.

Slow motion replay zone (SRZ): some sports will have a defined SRZ. In the absence of a specific SRZ requirement, the $E_{c \max}$ towards the main camera, shall be at the FOP centre.

Coefficient of variation (CV): the CV shall be ≤ 0.13 .

Maximum illuminance

Whilst firstly complying with the six basic specified uniformity criteria i.e. $E_{c \min}/E_{c \max}$, $E_{c \min}/E_{c \text{ ave}}$, $E_{h \min}/E_{h \max}$, $E_{h \min}/E_{h \text{ ave}}$, UGc and UGh, the maximum illuminance towards the main cameras, $E_{c \max}$, $\geq 2,000$ lux.

Luminaires and aiming logic

The luminaire-aiming angle shall be $\leq 65^\circ$. Light should reach any point within the total FOP from at least three directions where the third directional component should form a 'backlight' to one or both of the other two directions, with respect to the main cameras.

No luminaire shall be aimed directly at a camera, and not within a 50° cone centred on the camera lens. If the aiming point potentially coincides with a (hard/main) camera, the azimuth aiming angle shall be outside a cone of 50°.

A luminaire within the field-of-view (FOV) of the main cameras and aimed generally in a direction towards the cameras shall be constructed, or fitted with a glare-controlling device. The control shall be such that the light emitting area of the lamp is shielded from the camera's FOV or fitted with barn-doors, louvres or similarly acceptable devices.

Fit-for-purpose louvres, shields, hoods, barn-doors etc. may also be required to minimise the effects of glare, spill light and reflected (skip) light.

Equipment type and position shall be chosen to meet the specified glare limits.

Where the sport includes athlete action above the FOP surface (e.g. gymnastics, ski-jumping, diving etc.), there shall be light projected through the space above the FOP. The athlete's performance space in effect becomes the 'field of play' with respect to broadcast.

The total amount of light (luminous flux) projected from the camera #1 side shall not be less than the total luminous flux from the opposite side. Lighting equipment (luminaires, truss, cable looms, and chain motors etc.) located between the main cameras and the far side of the FOP shall be outside the cameras' field of view (FOV) when shooting the competition.

Noise – lamp control gear or drivers shall be silent (no ballast "hum"). Apart from aerial sports, in principle the luminaires should be designed, installed and aimed such that there is no light projected above the horizontal.

Multiple venues for one sport

Some sports take place at two or more venues accommodating preliminary rounds and the finals. The BRD LX quality of the two (or more) venues shall be the same, or as close as possible – a difference of not more than 5% of both the average horizontal and the average vertical illuminance (to camera 1). The colour temperature shall be the same or not more than a 5% differential.

The baseline lighting quality shall be set by the venue that stages the finals.

End of Technical Specifications

Report Author:

Steven Allen
Esteem Projects & Consultancy LTD. London UK

Broadcast Lighting Consultants to PyeongChang 2018 & Tokyo 2020
Previous Olympics: - Rio 2016, Sochi 2014, London 2012, Vancouver 2010

End of Report

[REDACTED]

[REDACTED]

DRAFT

APPENDIX C: NEW FIELD HOUSE—SCOPE OF WORK

The new field house at foothills is the proposed venue for curling. The venue is not existing and therefore this exercise will look at an overall square foot area that will be required to fit olympic curling as well as an assessment as to whether or not this program will fit within the proposed new field house. It is anticipated that many of the amenities will be provided within temporary facilities located outside the building, the focus of the study will be to determine if the field of play and spectator seating will fit within the proposed footprint, and if the structural, mechanical and electrical systems are able to support the increased loads.

Deliverables:

- Text document describing the anticipated new building including program and square footages. Also include text on the building engineering including roof load capacity, mechanical HVAC description, plumbing and electrical capacities.
- Text document outlining temporary works that will need to be completed on the site (that would be considered capital costs) as well as remediation measures that will need to be undertaken post games.
- Simple sketch outlining the field of play and seating which will be used as a test fit on the site.
 - *Deliverables as required to complete a Level 5 costing exercise.*

Format of Deliverables:

- The CBEC team will ensure that credit is given to all work completed by architectural and engineering professionals; however, information needs to be provided to CBEC in a 'raw' form as it will be included within an overall report that will require a consistent look.
- Text documents should be provided in WORD.
- Drawings - provide pdf drawings, as well as AutoCAD plans. AutoCAD plans are required by CBEC to complete an overlay analysis. Also provide your logo for inclusion in the CBEC title block for the overlay drawings. Ideally a CAD file of the plan will be provided for insertion into the site plan to complete our overlay analysis.

Below is a summary of the key requirements and areas to be assessed:

Field of play:

- 4 curling sheets (CBEC will provide sheet size and spacing between sheets)
- 2 meters of clearance should be provided at the sides of the field of play, and 4 meters on the ends. Seating to start right at these clearance lines.
- Assumed ice surface will be provided through temporary infrastructure. Provide a description that will allow for a level 5 estimate for the temporary ice - including the removal of it after the games. Ensure that the facility is 'air tight' to allow for the maintenance of a consistent temperature and humidity as the ice surface will need to be quite hard which is achieved with close climate control. (Luckily we are looking for low humidity).
- Will need accessible access onto the ice for paralympics.

Spectator Area:

- Ideally 7500 seats, mainly temporary seating which will need to be placed over existing track. Question if any permanent seats will be able to be used.
- Seats on three sides only (two long sides and one short side).
- Accessibility - accessible and amenity seating in multiple locations to serve 1% of the seating. (High level analysis - the specifics can be discussed at a later date).

Spectator Amenities:

- It is assumed the building will not be built to support 7500 spectators plus Athletes and Personnel - how many washrooms will be provided in the new facility?
- Washrooms to include family washrooms to serve people with disabilities.
- Concessions to be designed to accessible design standards. What is the number of concessions in the initial build? We will supplement with temporary as needed to serve the 7500 spectators.

Athlete & Support Amenities:

- What type and number of locker rooms, meeting spaces, lounges, etc. should be anticipated as a part of the permanent build? Please provide a breakdown with square footages - and

ideally a floor plan.

- Also outline the unused space within the field house (ie. track space and gyms) that would not be filled with curling and seats that could be used for other amenity / support spaces.

Roof:

- Roof to be able to support and additional 19 tons of hanging loads.
- Height over main area TBD

Electrical & Lighting:

- Lighting levels to meet Olympic Games Broadcast requirements of 2000 lux with zero flicker tolerances. What would the anticipated permanent build lighting be? How much will we need to supplement?

Mechanical/Civil:

- Refer to notes above in field of play. Allow for temporary dehumidification to maintain the ice surface.
- Will the existing services (water and sanitary) be able to handle the increased loads?

Spectator Plaza:

- What is the proposed site of the entry plaza? Information to be provided to CBEC to determine if a larger temporary plaza area will be required.
- What are the proposed fields, parking areas around? We are looking for an idea of overlay/ laydown spaces around the facility that we may be able to use for temporary facilities, tents, etc.

FULL VENUE REPORT:

Proposed Fieldhouse

Architectural (Lead): S2 Architecture

Structural: Read Jones Christoffersen Ltd.

Mechanical: Remedy Engineering

Electrical: SMP Engineering

Refrigeration: Thermocarb

Civil: Watt Consulting Group

Drawings: S2 Architecture

Cost Consultants: Altus Group



Fieldhouse/ Curling/ Hockey 2/ Para Hockey Venue

The proposed Foothills Fieldhouse, a planned facility that is part of the Foothills Athletic Park Master Plan, 2010, could provide appropriate facilities to host the 2026 Olympic Curling event. The relevant preliminary programming for the Fieldhouse is described below, along with the necessary modifications to accommodate the Olympic spectator venue for curling.

Preliminary Fieldhouse Program Components

- Indoor 400M track and soccer field in the "main" enclosure totaling approximately 16,725 SM (180,000 SF)
- 2,500 permanent seats within the track/field enclosure
- 7-8 basketball courts in extended enclosure along the long side of the facility, capable of accommodating up to 7500 temporary seats for a track or soccer event
- Spectator amenities, including washrooms and concessions, to serve the permanent seating (2,500)
- Multiple change rooms (Men's and Women's general change rooms and 4-6 team rooms) for general use and for team use during events

Upgrades to the Fieldhouse Required to Host 2026 Olympic Curling

Although the fieldhouse is presently proposed and not yet built, the assumption for this report is that the proposed building would have to be upgraded to accommodate the 2026 Olympic curling venue. The description below and the associated consultant reports, identifies what is required to be added or modified to the fieldhouse over and above the fieldhouse base building. Installation of four curling ice sheets would require the following modifications, at a minimum, or may require removal/replacement of the track and synthetic turf, depending on comparative cost:

Field and Track protection

- 1 layer of 10mm polyethylene sheet
- Hard surface i.e. Armour-deck interlocking concert flooring

Curling Venue

- Refrigeration equipment for ice installation would be installed outside the building. Three options have been provided within the ThermoCarb report. The first option is to rent a skid mounted ice plant intended for the Olympics. The second option is to purchase a portable ice plant on a skid which the City of Calgary could relocate to another site after the Olympics. The third option is to provide an ice plant that is to be permanently located at the fieldhouse which would be used for the 2026 Olympics as well as a future legacy twin ice arena that is planned to be located next to the fieldhouse.

Partnership of Limited Companies

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- Temporary aluminum grandstands providing 7,500 arena chairs (22" width) would be erected on three sides of the curling ice. Acceptable manufacturers include Hussey, American Seating, Irwin Seating and Interkal. Preliminary design studies suggest as many as 32 rows of seating at a height of approximately 15.24 metres (50 feet), will be required. A multi-level tribune providing broadcast positions, media seats and coaches' seats would be erected on the fourth side of the venue. This installation would require approximately half of the available area within the track/field enclosure. The proposed fieldhouse would have been designed with a clear height of approximately 20 metres or (65 feet) to the underside of the structure. This would leave a clear height of approximately 4.76 metres (15 feet) above the highest bleacher.
- Spectator access, venue ticketing and spectator services would be designated for development in the western portion of the fieldhouse where the primary entrances and permanent public services are planned. Additional concessions will be required to handle the additional spectators. We recommend one service line be provided for 250-300 spectators. Using this ratio, the curling venue would require an additional 16-20 service lines above what would be provided by the existing fieldhouse. Temporary concession carts could be provided in groups of 4-5, and then 4-5 concession carts would be adequate.
- More than half of the Field House floor (approximately 90,000 square feet of space on the track level) would be available for temporary configuration of back-of-house functional spaces for athletes, officials, media and venue management, or demountable partitions for rooms requiring privacy or special security. A suspended pipe and acoustic drape or demountable scaffold and wall system would be used to separate the back of house from the curling ice sheets.
- Existing permanent washrooms and other spectator service facilities for 2,500 permanent seats would be built in the fieldhouse and would be supplemented with approximately 20 male and 38 female temporary water closets to accommodate the additional 5000 spectators. Portable comfort stations or temporary construction washrooms behind and beneath the grandstands and on the fieldhouse sports courts would be recommended. Appropriate water, sewer and power connections for these temporary facilities would be available as they would be required to accommodate the planned temporary facilities that are proposed in the fieldhouse programme.
- An overhead rigging grid would be installed over the curling sheets for temporary installation of loudspeakers, supplemental lighting, flags, etc.

Hockey2/Parahockey Venue

- To incorporate an Olympic hockey venue in the fieldhouse it will be necessary to realign the seating from the curling venue into a bowl configuration instead of a horseshoe configuration for the curling. The area required is slightly larger than that required for curling.
- For the hockey it will be necessary to provide dasher boards, protective netting and glass on top of the dasher boards for this venue. In addition to these items

it will also be necessary to include space for a press box and box seats above the seats. These costs would be included in the overlay costing.

- For the option we have shown, the seating is for 8,180 bench seats as opposed to the 7,500 seats for curling. The seating could be reconfigured to provide seats as opposed to bench seating.
- The technical requirements regarding the ice slab and refrigeration are the same as for the curling venue, the areas are very similar in size.
- The hockey venue to be located in generally the same location as the curling, there will be less available space around the venue for the additional support space required.
- It will be necessary to add one additional comfort station for both the male and female temporary water closets, with an additional 2 concession carts.
- The height clearance requirements will not be impacted by putting hockey in the facility.

Site Development Opportunities

- Temporary sponsor facilities could be erected on the proposed tennis courts to the northwest or between the fieldhouse and University Drive to the west.
- The planned surface parking lot at the north side of the fieldhouse may be designated for Olympic Family vehicle parking, with a dedicated entrance at the northeast corner of the fieldhouse, providing direct access to Olympic Family and VIP hospitality functions.
- Credentialed access zones could be created toward the eastern half of the fieldhouse, with a secured bus drop-off on the existing drive between the fieldhouse site and McMahon Stadium, and designated entrances could be provided there for Athletes, Officials and event staff.
- External support functions would include trailers comprising the venue Broadcast Compound and logistical support.

Remediation

- It is anticipated that minor damage may be caused to the building as a result of the event(s). It is recommended that a budget allowance be carried to cover these unforeseen repairs.
- There will likely be minimal repairs required for the artificial turf if proper protection has been applied. The turf will depress from the weight of the bleachers, ice and equipment. This will recover adequately with field buffing equipment.
- Budget for removal is required for the ice sub surface, ice plant, bleachers, overhead rigging, temporary washrooms and concessions.

Note: This assessment is based on the preliminary programming and concept designs developed during the Master Plan for Foothills Athletic Park Field House in 2010. Upon

initiation of the fieldhouse project, the programming will be refined and may alter some of the components of the facility.

Background

A conceptual design for a field house has been proposed at Foothills park. This feasibility study assumes the field house would host the Olympic curling event. The proposed 145m by 180m field house is a single storey steel structure with a main event floor, with no basement. The assumed roof framing scheme for the facility is structural steel that will span the width of the building (145m). We have been asked to determine what structural revisions to the conceptual building are required to accommodate the design conditions below:

1. Increase the roof structure (as a percentage of steel weight) to support an additional 19 tons (38,000 lbs) of hanging load concentrated over the temporary bleachers and ice surface.
2. Support the weight of the ice surface on the event level slab.
3. Support the weight of 7500 spectators and temporary seating on the event level slab.

Please note, we have conducted our assessment at a conceptual level only. Further detailed engineering analysis will be required if the project proceeds beyond the feasibility stage.

Item 1 – Support Additional 19 Tons (38,000 lbs) Hanging Loads

No tangible concept of the roof structure, nor roof assembly, has been developed to understand the current cost of the roof structure. Therefore, we have assumed the following simplified framing system to estimate the costs associated with the conceptual roof structure, prior to adding the 19 tons (38,000 lbs).

- Field house footprint 26,100 m²
- Design service snow load..... 1.15 kPa
- Design service super-imposed dead load 0.7 kPa
- Metal roof deck 76mm x 0.91mm
- Steel delta roof trusses (9m deep by 7.5m wide) spaced at 20m on centre
- Steel columns supporting each top chord of the delta truss (10m on centre)
- A roof height of 32m (105 ft), clear height to top of steel roof truss
- Steel purlins spaced at 3750mm on centre, between the main delta roof trusses
- In-plane roof bracing

Note, a better understanding of the roof shape may allow for a more economical framing system than the conceptual framing system assumed above. Other roof framing options include: arched roofs, tapered trusses, a space frame or a tension structure.

Based on the truss assumptions we estimate the approximate weight of the conceptual steel roof structure, including columns, is between 140 kg/m² and 155 kg/m². Neither the metal deck nor roofing is included in the tonnage. Note, this estimated range in steel weight could be reduced with a better understanding of the roof shape and/or using the alternate framing schemes noted above.

To accommodate the additional 19 tons (38,000 lbs) of roof load concentrated over the temporary bleachers and ice surface, an approximate increase in total steel tonnage of 1.5% is required.

Item 2 – Support the Weight of the Curling Rink

The adjacent foothills athletic park is constructed from a traditional reinforced concrete slab cast directly on asphalt, founded on grade; therefore, it is reasonable to assume similar construction for the event level of the conceptual field house. With this understanding, the conceptual event floor structure would consist of a 150mm reinforced concrete slab-on-grade supported on well compacted gravel.

We have assumed a temporary portable exterior refrigeration plant will be used to produce ice on top of the event floor structure. As well, a protective surface would be applied to the field, minimizing damage to the floor assembly. With this assumption, no increase to the slab-on-grade thickness is required to support the temporary ice surface.

Item 3 – Support the Weight of the 7500 Spectators and Seating

Assuming the temporary bleachers are constructed from aluminum and have a maximum area self-weight of 2.4 kPa (50 psf), the following revisions to the event floor structure in the area of the seating would be required to temporary support the 7500 spectators

As noted in Item 2, the conceptual event floor structure would consist of a 150mm reinforced concrete slab-on-grade supported on well compacted gravel. An increase in the concrete slab-on-grade thickness to 250mm, directly below the temporary bleachers, would be required to support the seating of 7500 spectators.



Fieldhouse/ Curling/ Hockey 2/

Para Hockey Venue

Mechanical Assessment

Prepared By:

Remedy Engineering
#200, 1422 Kensington Road NW
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Jeff Swart, P.L. (Eng.) • Partner

February 2017





.1 Introduction

This report outlines the mechanical implications associated with operating the future proposed Calgary Field House as a curling venue for the 2026 Winter Olympics bid.

Design Criteria

The Winter Games will be hosted in February so only winter conditions are considered. External design conditions are as per the Alberta Building Code and ASHRAE recommendations:

- Outside design dry-bulb temperature: -35°C

Internal design comfort conditions are to be designed to comply with ASHRAE Standard 55 – 2010 for the occupied spaces:

- Curling rink venue – heating design temperature: 13 to 16°C
 - design humidity: 40 to 50%

It is assumed the remaining field house spaces will function as originally designed, only the curling rink venue will require climate alteration from its original design intent.

Curling Rink Venue

The existing field house will likely be designed to operate with an indoor temperature of 15 to 20°C without any ability to alter the space humidity. If the field house is operated as a temporary curling venue, the climate conditions will have to be altered appropriately with a maximum 50% RH but ideally a 40% RH. The field house will be designed for 10,000 occupants so the potential of 7,500 fans for curling means the HVAC system will have adequate outside air capacity so the issue will definitely be dehumidification. In February, our outside air is traditionally very dry so it's conceivable that the existing ventilation equipment will be able to maintain the required conditions for the curling venue. That said, mild weather could mean elevated outdoor humidity and it is recommended that temporary dehumidifiers be provided within the proposed field house space to allow it to operate as a curling venue. Preliminary calculations show that 300 kg/HR of moisture removal may be required due to the moisture generated from ice resurfacing and the occupant load. 2 options are available: either rental or purchase of a temporary system. Costs are as follows:

- Rental:

Test Event Budget: \$25,000.00
Olympic and Paralympics: \$35,000.00

- Purchase: The City of Calgary could purchase an outdoor unit and provide temporary ducting into the field house and use the unit at a future arena facility.

Budget: \$180,000.00



2500 of the occupants will be base seating design with 7500 additional occupants in temporary seating. The washroom facilities will utilize temporary washrooms for additional 5000 occupants and will be self-contained units without mechanical connection.

Any requirements for redundancy on HVAC systems would double the equipment and rental cost requirements.

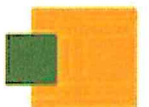
Ice Resurfacing

A temporary ice resurfacing room would also have to be created for the curling rinks. This room would require the following:

- A water treatment system equivalent to Jet Ice to control the waters PH and purity.
- A separate 150 gallon domestic hot water system. This could be tied into the field house hot water heating system.
- Floor drains to handle the water and equipment. Because the field house has not yet been constructed, this space allocation could easily be accommodated. It should be close to the field house loading dock.

Budget: \$100,000.00

Aside from the 2 issues identified above, there are no other major mechanical costs associated with the field house operating as a curling venue.





Foothills Sports Park Field House

Olympic Curling Venue

Mechanical Assessment

Prepared By:

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Fieldhouse Curling Venue

Electrical Concept Design Report

SMP Project No: 17-01-0104

February 27, 2017

Submitted By:

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1 INTRODUCTION

Electrical systems for complexes of this nature tend to be categorized into two major classifications; Power and Distribution Systems and Auxiliary Systems.

Power and Distribution systems generally comprise the following:

- Utility Service
- Distribution Panelboards
- Branch Panelboards
- Motor Control Centres
- Transformers
- Convenience Power
- Lighting Systems
- Emergency Power Systems
- Special Power Systems for ancillary equipment

Auxiliary Systems usually comprise the communication systems within the complex, they include:

- Telephone/Data Systems
- Paging, Intercom, and Sound Systems
- Fire Alarm Systems

This report provides an overview of the Electrical systems for this complex identifying key issues to foster discussion on user requirements and preliminary cost analysis. The recommendations proposed are intended to provide costing required to utilize this facility to host Olympic Curling in 2026 at the future Foothills Fieldhouse.

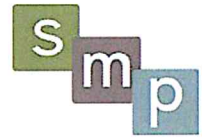
O – Identifies items that are required for the Olympics only

E – Identifies items that are enhancements to the current facility that could be legacy.

2 GENERAL – LIGHTING

2.1 Proposed lighting

- .1 The base building facility will be designed to approximately 600lux with the ability to be expanded for events as required.
- .2 O - Provide provision for additional temporary LED fixtures to get to 2000lux as per IOC broadcast standards. Power and control will be required in the ceiling space to allow for the additional fixtures. Wireways will be installed to accommodate all current and additional lighting fixtures.



- .3 O - Approximately 50% of the light fixtures in the fieldhouse will be backed up on emergency power.
- .4 E - Lighting control for the facility will be addressable and will need to have increased capacity to allow for the additional temporary fixtures to achieve the 2000lux. The lighting control will allow for full dimming capability.
- .5 All supplemental lighting to be supplied by a sports lighting manufacturer such as Musco or Ephesus
- .6 E - Provide an allowance for additional spot lights and theatrical type fixtures and associated power and DMX control.
- .7 O - Provide temporary lighting for connection between fieldhouse and McMahon Stadium.

3 GENERAL – POWER & DISTRIBUTION SYSTEMS

3.1 Proposed power distribution

- .1 E - The main distribution board would need to be a double ended board with a main-tie-main configuration. The board is estimated to be 3000A at 600V.
- .2 There would be a single feed from the utility at 13.2kV to a customer owner switch board outside the building. Two fused switches would feed two transformers to each end of the main-tie-main.
- .3 O - A second utility service will be provided from an electrically separate substation from Enmax. The second temporary feed from Enmax will come from Substation 34 on 32nd Ave. The budget cost for this is \$3.5 million.
- .4 O - The main board would have the ability to tie (2) 1MVA temporary diesel generators that would back up the entire facility. One generator would be tied into either side of the main board. There would need to be a control scheme for load shedding if required. A second disconnect would be allowed for in the event N+1 generators is required.
- .5 O - 4-400A, 2-200A, and 2-100A 208V 3phase disconnects would be proposed for broadcast and event power.
- .6 O - 800A 208V 3phase disconnect would be provided for temporary concessions power inside the building.
- .7 E - Distributed power will be required throughout the fieldhouse for cameras and other miscellaneous loads.



- .8 O - Power/communications will need to be provided to multiple scoreboards.
- .9 O - An allowance should be made for electronic message displays and signage power/communications.
- .10 O - Temporary 400A 208V power should be provided for temporary change rooms, and washroom facilities.
- .11 O - Additional power at the entrances to the facility will be added for additional site and feature lighting. 2-200A 208V disconnects will also be needed for possible event booths, concessions, or beer gardens outside.
- .12 E - Provide spare capacity for temporary power feeds to mechanical dehumidification units and ventilation units as required.
- .13 O - Two 800A 600V feeds would be provided to the temporary ice plant located exterior to the building. One feed would go to each of the redundant ice plant skids.

4 GENERAL – AUXILIARY SYSTEMS

4.1 Data / Communications

- .1 The base building would be fed with a single fibre source.
- .2 O - A second independent fibre feed would be added as a redundant source for this event.
- .3 E - Additional wireless access points will be distributed throughout the facility.
- .4 O - Temporary hard wired data drops should be allowed for throughout the fieldhouse area for potential ATMs, vending machines, POS stations, or other event requirements.

4.2 Proposed Sound Systems

- .1 O - New temporary sound systems will be required to enhance sound quality and intelligibility. Power will be allowed for this sound system.
- .2 Existing sound systems in the facility would not be expected to be used for this event.
- .3 O - Power for sound systems should be allowed for outside of the facility for beer gardens, bands, etc.



- .4 O - All sound systems will be fed off the broadcast power.

5 GENERAL – LIFE SAFETY SYSTEMS

5.1 Fire Alarm System

- .1 The fire alarm system in the building would be a two stage addressable type system. The signaling devices would be speaker/strobe combination. The panel would need to be sized to accommodate additional zones.
- .2 O - Additional fire alarm devices will be required for any temporary structures inside the building such as change rooms, concessions, washrooms, etc.

5.2 Exit Signs

- .1 O - There would need to be additional exit lights added to the temporary structures within the building. These exit lights would need to be fed from an emergency power source.

5.3 Emergency Power and Lighting

- .1 The emergency power for the base building is projected to be provided by a 150kW emergency diesel generator. This generator would backup emergency life safety loads and select mechanical loads. This system would be abandoned for the purposes of the Olympics.
- .2 O - New temporary (2) 1MVA diesel generators would be connected to back up the entire broadcast power and select loads within the building.
- .3 All exit signs, emergency lighting, and identified mechanical and other loads will be connected onto the emergency distribution system.
- .4 O - An allowance should be made for 100kW of UPS power for the data infrastructure.

PROJECT DETAILS:

CLIENT:	CALGARY BID EXPLORATION COMMITTEE (CBEC)
LOCATION:	FOOTHILLS SPORTS PARK FIELD HOUSE OLYMPIC CURLING VENUE
DESCRIPTION:	REFRIGERATION SYSTEM REVIEW
ATTENTION:	-
SUBMISSION DATE:	March 10, 2017

REPORT DETAILS:

FACILITY OVERVIEW

ThermoCarb Ltd. (ThermoCarb) is pleased to present the enclosed 'Facility Review' to inform of potential process improvements, mitigate future risks, and provide comprehensive corroborating estimates to optimize the facility. We trust you will find the following acceptable. Please do not hesitate to contact the undersigned (as titled in *ThermoCarb Contact Information*) should there be any comments or concerns.

CONFIDENTIALITY STATEMENT

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ABC OFFICE USE ONLY:


REV	DESCRIPTION	BY	DATE	APPR	DATE	CLIENT	DATE
1	ISSUED FOR REVIEW	NC	8-MAR-17	BA	9-MAR-17	CBEC	9-MAR-17
2	REVISION FOR PERMANENT COOLING SLAB	NC	8-MAR-17	BA	10-MAR-17	CBEC	10-MAR-17
3	REVISION FOR PERMANENT REFRIGERATION	NC	14-MAR-17	BA	14-MAR-17	CBEC	14-MAR-17

1. OVERVIEW

This report outlines the refrigeration implications associated with operating the future proposed Calgary Field House as a curling venue for the 2026 Winter Olympics bid.

The Calgary field house is a proposed building that includes an indoor field surfaced with field turf. The proposal is to install a temporary ice surface on the field turf similar to temporary surfaces that have been utilized on many outdoor fields for NHL games and other events such as the 1988 Olympic opening ceremonies. Alternatively, the curling ice could be provided by installing a refrigerated slab in the initial field house design and then temporally removing the field turf from the slab during the Olympics to make the curling ice. Since this ice is to be utilized as a curling venue, it will be required to have the highest level of ice temperature controls and redundancy in order to ensure elite ice quality.

1.1. Refrigeration System



A temporary refrigeration system will be required for a two-month period in 2025 to host a test event, and a four-month period to host the 2026 Olympic and Para Olympic games. The system will be designed to provide cooling to four curling sheets and account for the additional refrigeration load related to 7500 spectators and up to 2500 additional people including athletes, support staff, security and broadcast personnel. The refrigeration system will be required to have fully redundant equipment, glycol pump flow control and detailed ice temperature controls. The system will be located outside of the fieldhouse and glycol piping will be run from the unit to the temporary floor system. The refrigeration system will be a skid or trailer mounted unit that can be brought to site for temporary use and then removed. Power for the unit can be provided by a feed from the main building power or from a dedicated generator. There are three options available for procuring the refrigeration system:

1.1.1. Rental Unit

A rental unit could be utilized to provide the required refrigeration for the test event and Olympic games.

Budget for Olympics:	\$200,000
Budget to Add Test Event:	\$100,000

1.1.2. 75 tons of refrigeration purchased unit

A unit designed to handle the refrigeration load required for the Olympic curling event could be purchased by the City. The refrigeration unit will be mounted on a skid and enclosed in a building. The system will utilize a halocarbon refrigerant and include dual brine pumps, dual compressors, single DX chiller, air cooled condenser and single high pressure receiver. After the games the unit will have the flexibility to either be sold or used by the City at an alternate facility to refrigerate a small rink, outdoor rink, or seasonal use NHL size arena of similar capacity.

Budget:	\$600,000
---------	-----------

1.1.3. 170 tons of refrigeration permanent purchased unit

A unit sized to provide refrigeration for a future twin arena as a legacy to the Olympics could be purchased by the City. The initial capital cost will increase as twin arenas require a higher refrigeration load than is required for the curling event at the Olympics. Additionally, the year-round operation of an arena and higher yearly energy use justifies a change in refrigerant to ammonia as well as a few additional items to ensure the unit provides an energy efficient solution for the future arena. The twin arena refrigeration plant would have no issues operating at the lower capacity of the curling event and would provide excellent redundancy. This refrigeration unit would be a skid mounted unit enclosed in a building for the Olympics and then moved to the twin arena in the future, or it could be incorporated into the original design of the field house. The unit will include a chiller, condenser, multiple compressors, twin glycol pumps, motor control center, plant automation, enclosure for Olympic use, ventilation and gas detection as required by code.

Budget:	\$1,200,000
---------	-------------

1.1.4. Miscellaneous Costs

The costs to connect and install a rental unit or a purchased unit are approximately the same. This includes some miscellaneous items such as temporary piping, the glycol charge and storage of materials between the test event and Olympic games.

Budget: \$100,000

1.2. Refrigerated Slab:

There are two options when considering a refrigerated slab suitable to host curling for the 2026 Olympic Games:

1.2.1. Temporary Floor

A temporary floor consisting of a protective layer of poly, insulation and plywood will be required to be installed on the turf. A final layer of sand will be used to level the surface and contain the cooling pipes. As this is an indoor field, very little levelling is expected to be required. It is recommended the floor base consist of 10mm polyethylene sheet, three layers of plywood, two inches of ridged Styrofoam insulation and four inches of sand. The floor piping will be installed on wire chairs or wood pipe supports within the sand base and back filled level. The glycol piping mains connecting the refrigeration unit outside to the headers at one end of the rink will be installed above grade on temporary pipe supports and covered as required.


Budget for Test event and Olympics: \$200,000

*This does not include the costs associated with the plywood, insulation and sand base

1.2.2. Permanent Floor

The concrete floor of the field house could be constructed with the cooling pipes permanently built into the floor and the mains terminated with a blind flange at a location adjacent to where the temporary refrigeration system would most likely be located. The cooling floor will consist of a layer of insulation and then a cooling slab complete with cooling pipes on support chairs providing 100 mm pipe spacing. A heated underfloor is not required unless the surface was planned to be used more than 8 months of the year. During the games and test event the turf of the field house would be removed and the ice surface would be built up directly on the concrete floor.

Budget: \$200,000



*This does not include the costs associated with the cooling slab concrete, or removal and re-installation of the turf.

DESIGN BRIEF

To: Brian Corkum
Company: S2 Architecture
File: 3419.E01
Re: Fieldhouse/ Curling/ Hockey 2/ Para Hockey Venue

From: Terry Van Staden
Date: March 3, 2017
Pages: 2

The Calgary Bid Exploration Committee (CBEC) has proposed that the Olympic Curling Venue be held at the proposed Field House that is currently under design. This Venue is located in the Foothills Athletic Park and is situated between McMahon Stadium to the south and the University of Calgary to the north.

An analysis of the Civil related items has been performed based on the proposed venue layout and is described below.

SITE SERVICING

Assumptions

- Proposed Field House will be designed for a capacity of 10,000 people (one off events approximately once per year). Any servicing requirements to support this capacity will be built into the base building. No site servicing upgrades will be required to turn this into a Curling Venue.
- Servicing requirements for Temporary facilities outside of the building footprint will be addressed by others.

Based on the above assumptions there is no anticipated servicing costs associated with using this facility for the Curling Venue.

SITE GRADING

The proposed development of this site shows the construction of a field house along with some new outdoor playing fields. We have assumed that these playing fields will have relatively flat grades which would be ideal for the placement of temporary facilities. As such we would not anticipate any grading requirements for this site to support the temporary facilities that may be erected for the Olympic Games.

To: Brian Corkum, S2

March 3, 2017

Re: Fieldhouse/ Curling/ Hockey2/ Para Hockey Venue

page 2

SITE REHABILITATION

Once the games have been completed it is anticipated that as a result of the temporary facilities repairs will need to be made to the playing fields. These repairs are assumed to be limited to the removal and replacement of the grass on the playing fields and around the field house building. The total area of repair is estimated to be 6,000 square meters.

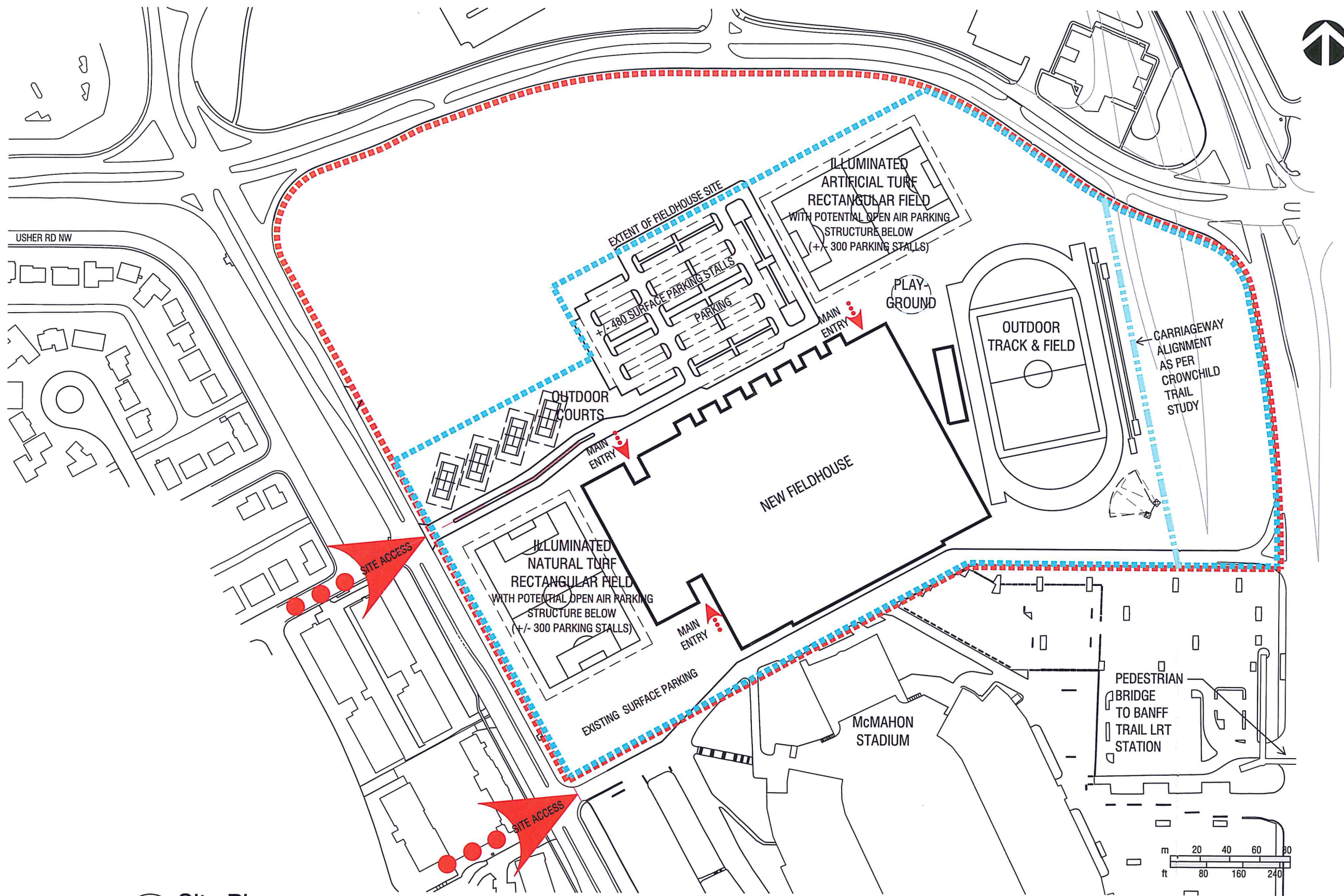
Respectfully Submitted,
Watt Consulting Group

Terry Van Staden
Project Manager

D 403.569.8720

C 403.829.8964

tvanstaden@wattconsultinggroup.com



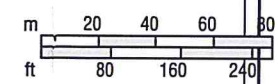
1 Site Plan
SK-01 SCALE: 1:2500

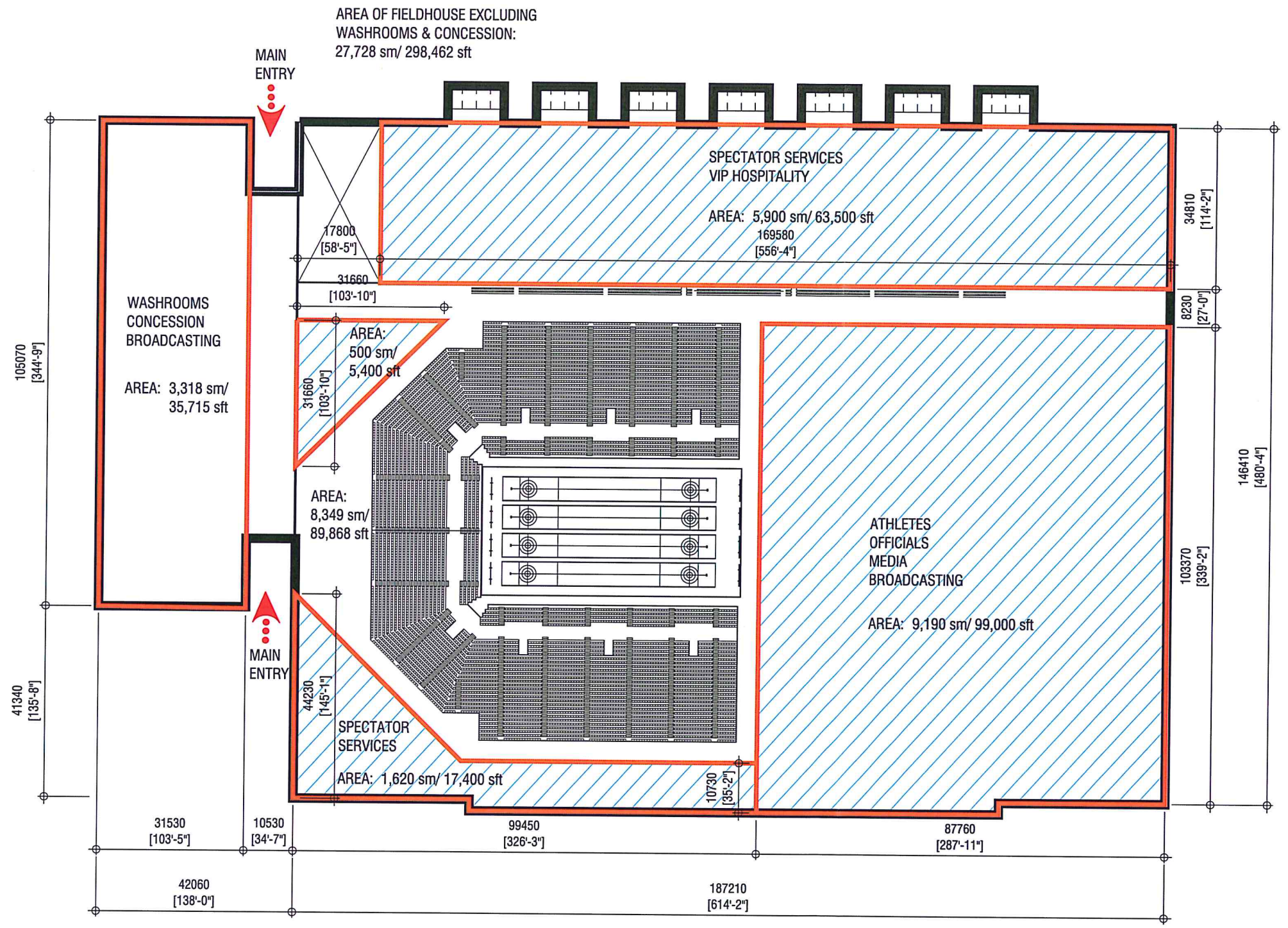
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SK-01





1 Floor Plan with potential Program
SK-02 SCALE: 1:1000

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Floor Plan

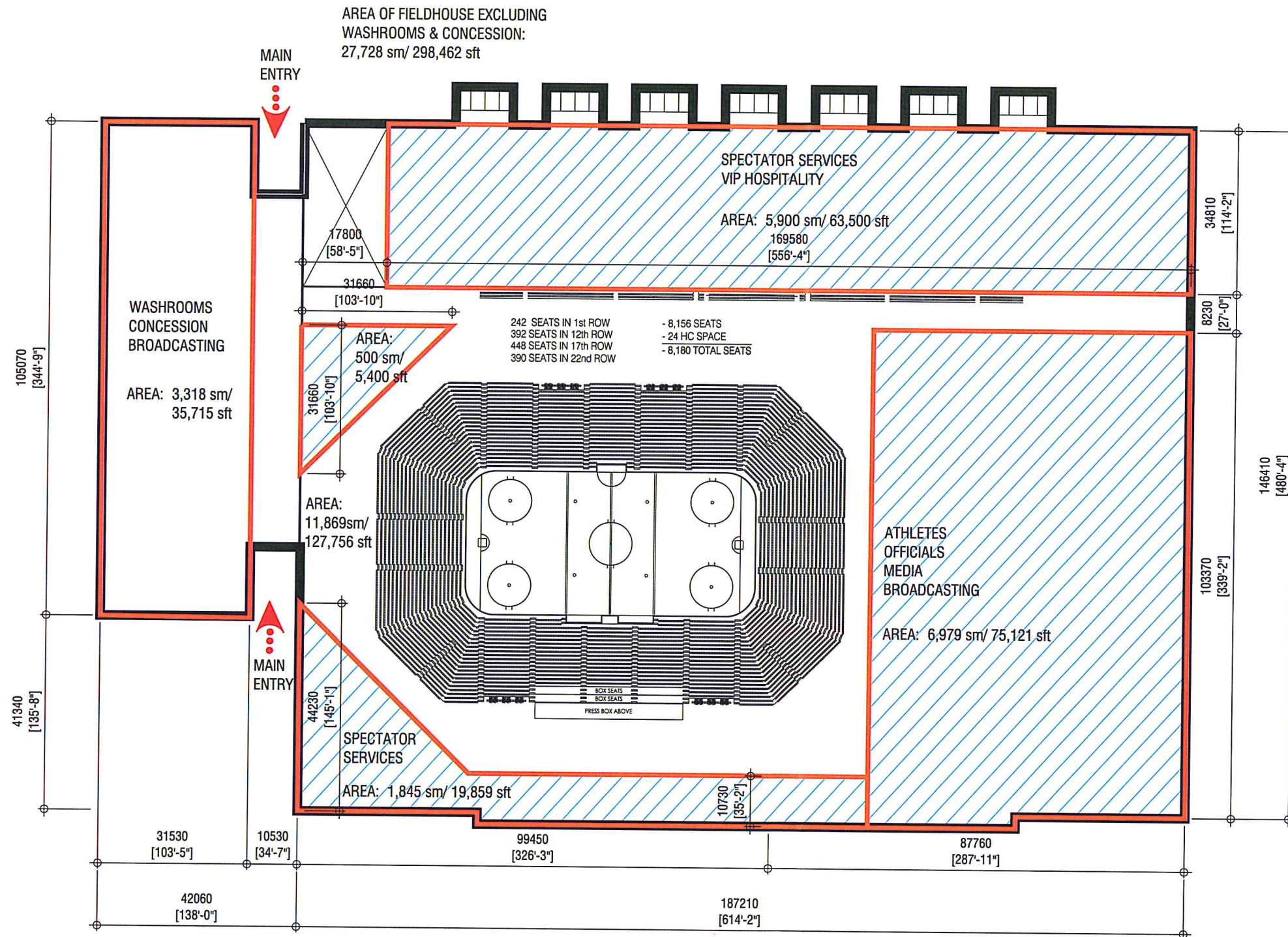
2431 Crowchild TR NW
Fieldhouse/ Curling/ Hockey 2/ Para Hockey Venue

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SK-02



1 Floor Plan with potential Program
SK-03 SCALE: 1:1000



Component

1. Field House Curling Venue

	Notes	Revitalisation	Estimated Cost \$ Legacy	Olympic
Original Anticipated Capital Hard Cost for proposed Field House	Excluded	N/A	~	~
Original Anticipated Capital Soft Cost for proposed Field House	Excluded	N/A	~	~
Field/Track Protection (Poly x2, Armour Deck, Sand Base with refrigeration piping)	Altus Group Allowance	~	1,000,000	50,000
Temporary Aluminum Grandstands providing 7,500 spectator seating capacity	Supplied by CBECC	~	~	TBC
Multi-level tribune (Media/coaches)	Supplied by CBECC	~	~	TBC
16-20 temporary additional Service lines for event to this scale	Supplied by CBECC	~	~	TBC
4-5 concession carts/trailers	Supplied by CBECC	~	~	TBC
Temp back of house (partitions, floor protection, security)	Supplied by CBECC	~	~	TBC
Temp washrooms/comfort stations for additioanl 5000 spectators	Supplied by CBECC	~	~	TBC
Additional water and sewer connections for above	Altus Group Allowance	~	100,000	~
Overhead rigging for speaker, lighting, flags, etc.	Altus Group Allowance	~	~	100,000
Remediation allowance (Building and artificial turf repair)	Altus Group Allowance	~	~	100,000
Removal and transportation of temporary major event components	Supplied by CBECC	~	~	TBC
Structure Legacy Upgrades	Per R/C report	~	1,080,000	~
Structure (Item 1) - 1.5% steel tonnage increase for roof event equipment	Per R/C report	~	~	~
Structure (Item 2) - Curling rink slab thickness, as original design	Per R/C report	~	~	~
Structure (Item 3) - 6,000m2 of slab thickening from 150mm to 250mm below temp seating	Per R/C report	~	~	~
Mechanical Legacy Upgrades	Per Remedy	~	336,000	~
Mechanical - City upgrade humidification requirements (not including redundancy)	Per Remedy	~	~	~
Mechanical - Ice resurfacing including hot water system & drains	Per Remedy	~	~	~
Mechanical - Temporary humidification Olympic requirements	Per Remedy	~	~	Option List Below
Electrical - (2.1.1/2.1.2/2.1.4) Power and control in ceiling space for additional temp lighting	Per Remedy	~	~	~
Electrical Legacy Upgrades	SMP	~	~	~
Electrical Olympic Upgrades	Altus Group Allowance	~	550,000	~
Refrigeration - Allow for Permanent Refrigeration Unit for use with future twin arenas	Allowance	~	~	5,200,000
Refrigeration - Temporary backup refrigeration for olympic events	Per Thermo Carb	~	~	~
Temporary sponsor facilities on existing tennis courts	Per Thermo Carb	~	~	300,000
Temporary parking and site transportation adjustments	Supplied by CBECC	~	~	TBC
Temporary access zones and bus drop off	Supplied by CBECC	~	~	TBC
Temporary support functions (broadcast & logistical support)	Supplied by CBECC	~	~	TBC
Remediation allowance to site	Supplied by CBECC	~	~	TBC
	Altus Group Allowance	~	~	150,000



Electrical - Temp lighting between Field House and McMahon Stadium			Altus Group Allowance	~	~	75,000
Temporary seating (10,000 seats, set-up, tear down rental etc.)			Altus Group Allowance	~	~	1,150,000
Sub-total	0	4,066,000				7,125,000
General Requirements and Fee				~	610,000	1,069,000
Sub-total	0	4,676,000				8,194,000
Design and Pricing Contingency (10%)				~	468,000	820,000
Post-contract Contingency (5%)				~	234,000	410,000
Escalation (Excluded)				~		~
Sub-total	0					
Soft Costs (23% of Construction)				~	1,237,000	2,168,000
PROJECT TOTAL	0	6,615,000				11,592,000

Alternatives

	Add / Deduct Cost Options
• Alternate to rent humidification equipment for Olympic use vs. City purchase (Legacy) of humidification equipment included in base cost above;	\$ (156,000) Includes soft costs & contingencies
• Premium to allow for redundancy of additional humidification equipment during olympic and paralympic event;	\$ 60,000 Includes soft costs & contingencies
• Alternate cost to rent refrigeration unit for olympic events (one unit only, backup system included above in base olympic cost);	\$ (700,000) Includes soft costs & contingencies
• Alternate cost to install a portable refrigeration system (Legacy item) Backup system included above.	\$ (400,000) Includes soft costs & contingencies

Exclusions:

- G.S.T.
- Land and financing costs
- Compounds for press, media, broadcasting, waste, food and beverage
- Judges and timing stands
- Spectator areas
- Entry, exit, ticketing, security and fencing
- First aid rooms, doping control, technical inspection rooms
- Press centre and international federation lounges
- Medical services
- Equipment storage facilities
- Changing rooms and sanitary facilities
- Athletes lounge and sport information
- Video walls, interview walls, sports boards
- Voice communication
- Loudspeakers, electronic timing systems, video surveillance
- Score boards
- Temporary lighting
- Temporary structures/facilities (tents, trailers, temporary washrooms & concessions)

