APPENDIX 4R

DETAILED VENUE ANALYSIS: CANMORE NORDIC CENTRE

CALGARY BID EXPLORATION COMMITTEE

VENUE BRIEF:

CANMORE NORDIC CENTRE:

Venue Requirement Overview

CANMORE, ALBERTA, CANADA

PREPARED FOR

CALGARY BID EXPLORATION COMMITTEE, Master Facilities Plan

PREPARED BY

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DATE

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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 in 2013 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 maximise existing infrastructure and transportation links/corridors.

The ability to cluster venues into precincts parks provides substantial efficiencies in operations readiness, time and costs. The existing Canmore Nordic Centre, a legacy from the 1988 Winter Olympics, offers up the opportunity to re-use the existing facilities for Cross Country and Biathlon. The Sport recommendation and assumption for this report, is that the Ski Jumping venue [redacted] Proximity to the town of Canmore will help minimize the amount of transportation and other operational requirements, and provide adjacent accommodations for this venue.

The information contained in this document is to provide the Calgary Bid Exploration Committee (CBEC), Facility Owners and Planning Teams, further insight into the spatial requirements that would be required by the International Federations, Olympic Broadcast Services, International Media Agencies, etc.

PROPOSED SCOPE & WORKING ASSUMPTIONS

The Canmore Nordic Centre venue is proposed to host the following events:

1) Cross Country Skiing
2) Biathlon
3) Ski Jumping
4) Nordic Combined

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

- The existing Cross Country and Biathlon trails/courses would be used with some capital upgrades required. See Sport venue assessments for details.
- All ancillary support buildings, day lodges, operational facilities to be made available for Olympic and Paralympic use. Shared and exclusive usage periods will be determined at a later date.
- [redacted]
- Venue capacities will be 7500 gross for each stadium area with approximately 3750 seats and 3750 standing for Cross Country, Ski Jumping and Nordic Combined. Biathlon shall have 5000 seats and 2500 standing. This includes the assumption that spectators will be allowed to view along the trail network.
- A total of 3 stadiums will be required. Cross Country and Biathlon will be able to share operational spaces [redacted]
- The Biathlon venue will require capital construction improvements such as relocating the technical building and removing the ramps and tunnels immediately located behind the range on the parking lot side.
- All Back of House (BOH)/Operational Space within secured perimeter will be deemed useable.
- Main Spectator transportation access, loading zones will be located outside of secured perimeter on East sided of facility. (pending review from Transportation

consultant)

- All references to Security related items (perimeters, fence lines, compounds, etc.) are dependent on the baseline Security Strategy provided by the appropriate committee / Agencies.
- On site parking to be limited to critical functions. Will assume the need for accredited park and ride shuttles from outside lots.
- Existing parking areas, open parkland (east of facility) on approach road to the facility will be required for venue loading and staging.
- Access road to the east of the facility will need to be at the exclusive use of the games. Exact timing to be determined at a later date. (pending review from Transportation consultant)
- Facility will be made available for early building of seating bowls, cabling, compound buildout, etc. Staged access will be considered to minimize disruption of existing operations.
- Canmore Nordic Centre will continue to maintain all facilities and site in proper working condition.

The Canmore Nordic Centre management is looking at future improvements with its Master Planning Consultants and therefore it is important for them to gain a further understanding of what the potential external spatial requirements are, when considering the staging of an Olympic Games. The material below is a non-exhaustive list of the major areas and will act as a preliminary benchmarking tool when assessing the overall venues ability to maintain its proposed legacy growth as well as consider a Games time application.

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. Further information on the Sport Federation and Venue Operational requirements will come later in the process.

VENUE BASELINE REQUIREMENTS

1 | General Venue Use

The spatial and operational requirements for staging of an Olympic Games can have a large impact on existing facilities and their operations. It is very important that venue owners understand early on all of the potential impacts to their facilities. It is also very important that they are involved with the planning process as they have direct knowledge of their venue and its operations, and can assist in mitigating unnecessary impacts and associated costs.

The City/Ice venues have different buildout durations from the Mountain/Snow venues, and can also vary greatly between venues. City/Ice venues typically have a shorter buildout timeline due to the prime fact that the buildings usually exist. Mountain/Snow venues tend to have much longer buildout durations due to the fact that much of the infrastructure needs to be in place before the snowfall. This is particularly important around the finish areas and the temporary seating buildout. It is common practice to have the Broadcast Commentator positions and Timing/Results buildings in place prior to snowfall as they require access for cranes and various speciality equipment.

Compound build out requirements are based on the number of compounds, cabling requirements, and build scale and complexity. They are also typically staged build outs, Back of House (BOH) compounds first, Front of House (FOH) compounds or areas follow. A typical build out duration for Mountain/Snow venues is roughly 12-16 weeks prior to athlete training start, this includes venue lock down, technical rehearsals, and hand over to the games time operations team. The Canmore Nordic Centre will be a Paralympic venue and therefore will have a Transition period between Olympics and Paralympics where limited modifications will occur. Remediation works can begin immediately post the end of Paralympic competition. Coordination of this work needs to be aligned with the venue operators.

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 areas, concessions, ticket resolution, spectator services and information, retail outlets, toilets, water stations, spectator medical, and access to spectator seating and competition viewing areas.

The Canmore Nordic Centre front of house operations will have to be temporarily extended to accommodate security screening for both vehicles and pedestrians. The planning assumption for this facility will be that there will be one Spectator entry for all 3 stadiums located to the East of the facility. A venue perimeter fence line will still be required at the venue, where spectator entry and exits gates will be located with access to the venue through ticket scan portals. The entry and exit points will be determined through crowd modeling exercises with the park to established ticket scan through put rates to ensure optimal spectator flows in the facility and load-in of spectators to the venue 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. In addition to ensuring all existing and temporary seating is accessible and code compliant, all existing building spaces will need to be available for use in operations, sport production, international federation spaces, etc.

There will 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 Program Requirements

i. Venue Perimeter

A venue perimeter fence line is required around the facility. It is recognized that there may be areas in the mountains that cannot accommodate fence lines and that other security measures will be used. Large snowfall typically renders fence lines located in outlying areas ineffective. This fence should be a minimum of 1.8m high, and ballasted to ensure stability in the event of heavy winds, creating a perimeter footprint of roughly 1-2m in depth. The fence will be covered in fence fabric with the look of the games with entry and egress points.

ii. Ticket Box Office (TBO)

A venue typically has a ticket box office located outside the venue perimeter, for ticket sales, will-call, or ticket related services. The ticket box offices will be located centrally with an area of approximately 40m^2.

iii. Ticket Scan

Ticket scan will occur in tent portals at the venue perimeter, the area and number of ticket scan portals will be determined based on the crowd modeling exercise, which will determine the spectator through put rates into the venue, establishing the number of ticket scan portals required. Preliminary planning assumption is approximately 150m^2. It is also possible that the ticket scan may be placed nearer the stadium entrances of which there would be 3 spaces of approximately 30 to 40m^2 each.

iv. Spectator Plaza

The spectator plaza occurs between the ticket scan 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 venue spectator capacities and park crowd modeling. Also, due to multiple sessions, a spectator holding area may be required. Due to limited space on the facility, a central spectator plaza

for both Cross Country and Biathlon should be considered. [redacted]

v. Spectator Services – Plaza

Spectator services storage and staging areas are required for accessible motorized carts, wheel chairs, and stroller storage – this area should be no larger than 50m^2. In addition, an animal relief area, with direct access to potable water and drainage, is required. This area should be no larger than 10m^2.

vi. 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 park crowd modeling.

vii. 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 25m^2 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.

viii. 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 10m^2 in area, with provisions for a counter to provide separation between ticketing staff and spectators.

ix. Concessions

Use of the existing concession areas is most likely not an option due to different programming of the existing buildings. Additional temporary areas for concession sales will be required. Approximately 50 lm to 75 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.

x. 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 50 lm of retail outlet counter space is required.

xi. Spectator Toilets

Use of all existing spectator toilets to be provided. 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. Level of service discussions will determine the type of temporary facilities, either cabins or portolets, or a combination.

xii. Spectator Medical

Use of the existing spectator medical area to be provided. If the existing spectator medical does not exist, a space of approximately 100m^2 is required. The space needs to have water and drainage, along with direct access to an accessible toilet.

xiii. 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.

b. Other Major FOH Program Requirements

i. Seating

The venues 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. Current planning assumption for each stadium is 7500 gross. Cross Country [redacted] Biathlon will have 5000 seats and 2500 standing.

Accessible seating quantities will be determined at a later date through discussions with appropriate authorities, Olympic planning function and best practices.

3 | Back of House (BOH) Program Requirements

Back of House (BOH) areas are where sport, competition management, Broadcast, Media 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.

BOH venue design for mountain venues must consider snow accumulation, spacing between commodities, removal process and temporary storage. Existing venue owners are a great

resource to determine the proper requirements. Snow storage areas may be required throughout the venue to facilitate the removal process.

a. BOH Program Requirements

i. Athlete Compounds

Each Stadium will require a separate Athlete compound which contains the Team wax cabins, Athlete Lounge, change rooms, washrooms, sport information, equipment storage, athlete medical, etc. They are typically adjacent to the FOP. There must be separate compounds for Cross Country and Biathlon with limited opportunity to share services. [redacted]

- Cross Country will require approximately 6500m2
- Biathlon will require approximately 6000m2
- [redacted]
- Nordic combined will use both Cross Country and Ski Jumping compounds

ii. Competition Management

The competition management space is where the sport operations offices and work areas are located. The space should be located on/near the FOP level, with access to the FOP and the timing and scoring/judges areas, with an area of approximately 250m^2. The sport Technical Buildings, depending on their size and configuration, can be an excellent location to house this functional group. Each Sport discipline will have their own set of requirements.

iii. Athlete Medical

Athlete medical to be located adjacent to the FOP with a larger space within the athlete compound. Space allocation of approximately 200m^2, 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 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 200m^2 and requires connections to water and waste.

v. International Federation

The International Federation (IF) [redacted] is the Federation International de Ski (FIS). Biathlon is the International Biathlon Union (IBU). There is a requirement for IF spaces within the venue for offices, meeting space, and a lounge. This space is approximately 400m^2 for each stadium 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 300m^2.

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 near the FOP with easy access to the FOP, with an area of approximately 150m^2.

viii. Technology Operations

There will 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 500m^2. It is assumed that Cross Country and Biathlon can share one compound but Ski Jumping may require an additional area. Operational spaces for timing and scoring, work areas, and offices to be located in Technical buildings with direct access to the FOP, this area is approximately 850m^2 per stadium. Typically, the technical buildings for Nordic disciplines are located on multiple

levels.

ix. 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. 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 – 1500m^2, depending on existing venue kitchen facilities.

x. Cleaning and Waste (CNW) Compound

The cleaning and waste compound is an area for the staging of the 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 800m^2 with an additional area of 1000-2000m^2 of snow removal equipment and snow storage.

xi. 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 225m^2 and workforce break at approximately 1000m^2. Ski Jumping will require an additional area of approximately 500m^2

xii. 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 1000m^2, and must be secured due to the equipment and

goods stored.

xiii. Site (VED) Management Compound

The site compound requires space for office space, toilets, staging, and storage area 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 1000m^2, and must be secured due to the equipment and goods stored.

xiv. Security (SEC) Operations

As the Canmore Nordic Centre is a mountain venue located on the outskirts of Canmore, a full PIDS system may not required, only a secure fence line and controlled entry points to separate and delineate the venue from other park venues and operations. These control points have accredited security check-points for operations and ticket scan entry areas and exits for spectators.

Accreditation access points are located BOH, with exception to one FOH staff 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 300m^2. Dedicated power and direct fibre connections are required to support their secure independent servers and operations.

xv. 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 400m^2.

xvi. Broadcast Compound

The broadcast compound will be one of the largest compounds required on the venue. This compound requires approximately 6000m^2 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, camera positions, commentator positions, mixed zone, commentator control room (CCR), and Broadcast Information Office (BIO). 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 500m^2 of required space, directly adjacent to the BRD compound. Based on distance and venue layout, Cross Country and Biathlon may share one compound of approximately 6000m^{2}and Ski Jumping will require an additional compound of approximately 3500m^2.

xvii. 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. The media centre for Cross Country and Biathlon should be approximately 1500m^2. [redacted]

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. The press conference room can be a shared space with Sport for the SS team leader conference room, and is approximately 250m^2. [redacted]. An area of approximately 150m^2 will be required.

xviii. Venue Accreditation

A central venue accreditation office is required for this venue. A space of approximately 40m^2 is required.

b. 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 to 6 compounds should be considered, outside the broadcast (BRD) compound, of approximately 500m^2 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 4000m^2.

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

BOH road access is dependent on available access routes in and out of the venue from the Park BOH transport and service roads in within the park. A loop in an out of a venue is preferred. All security VSA's (Vehicle Screening Areas) will occur at park entries and not at this venue. [redacted]

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 park, 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.

There is typically a requirement for a helicopter landing area for each mountain venue. This can be shared for both Medical and Security functions. The space required depends on the type of aircraft being used but a diameter of 30m clear of any obstruction on the ground, overhead and adjacent trees.

4 | Field of Play (FOP) Space Requirements

The field of play (FOP) is the area where competition takes place, ski courses, Biathlon range and Ski Jumps. 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 wax testing, broadcast camera platforms, photographer risers, judges/timing and scoring platform, equipment storage, medical staging, and the mixed zone for both broadcast and press. There are also several on course locations for team trainers, coaches and equipment technicians.

Technical buildings (start huts, timing/results, competition mgmt., protest, etc.) at each stadium are also considered both FOP access and BOH technical access.

All Sport FOP specific requirements can be found in the International Federations regulations as well as the Sport Consultant Venue review documents.

It is assumed that all competitions at the Canmore Nordic Centre will be during the day and that no Broadcast lighting will be provided. However, there are requirements to light the mixed zones, press conference rooms and other areas to broadcast levels. Please refer to Appendix A for further details.

a. FOP Off-Piste Program Requirements

i. Off-Piste Areas

For each stadium, the athletes exit the course in the same location. Off-Piste areas include official's area, snow operations and equipment storage, marker storage and staging area, and medical staging. The area required for these spaces is approximately 650m^2 for each stadium.

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 20 (1.8m x 1.8m) positions with the circulation corridor behind approximately 2m deep. Press requires roughly 45m length by 3m deep as a minimum, with the circulation corridor, 2m deep. Back drops typically are not required on the Athlete side for Mountain venues. Access to the mixed zone is directly adjacent to the athlete finish area.

b. Other Major FOP Program Requirements

i. Training

Training for all disciplines will occur on the existing courses [redacted]. There are typically additional warmup courses and loops for Cross Country and Biathlon. Cross Country and Biathlon have wax testing areas adjacent to the Athlete compounds.

VENUE TRANSPORT SUMMARY

Refer to Appendix 4AA

VENUE PROFILE SUMMARY

Venue: Canmore Nordic Centre

Location: 1988 Olympic Way, Canmore, Alberta, T1W 2T6

Key Contact: Michael Roycroft (Area Manager, Specialized Facilities & Trails, Kananaskis reg., Peaks Division)

Owner/operator: Province of Alberta (owner)

Current use: Multi use facility including: Public Cross Country Skiing trails c/w day lodge, Biathlon course and range, High performance training centre (Bill Warren centre), retail and rental shop. Summer activities: hiking, mountain biking, etc.

	Yes/No	Comments:
FOP standards/IF approval:	Yes	Cross Country and Biathlon trail systems meet the IF requirements and regularly host World Cup and regional events. Ski Jumping may be a new facility that will meet all current criteria.
Operational space	Yes	Existing operational spaces to be used with opportunity in large lots for temporary buildouts.
External space – FOH	Yes	Limited space as most parking lots will become operational compounds for games use
External space – BOH	Yes	Large parking lots can be used for BOH operational compounds.
Parking	Yes	Multiple locations within venue footprint as well as outside of current venue on East side.

Utilities services (gas/water):	Yes	All existing and may require further upgrades for temporary hook ups.
Mechanical/electrical:	Yes	All existing for current facilities. Will require additional temporary systems for games buildout.
Technology/BMS:	Yes	All existing for current facilities. Will require additional temporary systems for games buildout.
Fiber connectivity:	Yes	All existing for current facilities. Will require additional temporary systems for games buildout.
Access & Egress Transit:	Yes	All existing for current facilities. Will require proper design and study based on current games competition schedule, load in/out schedules, etc. Additional scope will be required.
Access & Egress Pedestrian:	Yes	All existing for current facilities. Will require proper design and study based on current games competition schedule, load in/out schedules, etc. Additional scope will be required.
Long term use contracts:	Yes	Provincial Park operations lease 2032
Capital improvement plan:	Yes	Current $10 million improvement plan available
Adjacent land (plans in use):	Yes	All available lots to the east of the facility, outside of the facility boundary will be required for Games usage.
Lighting levels for broadcast use:	No	None required. Assuming Ski Jumping will not be held at night.
Sponsorship rights and agreements:	Yes	Corporate partners and official suppliers

VENUE GAPS, CHALLENGES, AND CAPITAL WORKS PROJECTS

Along with identifying the Games requirements, this exploratory exercise takes into consideration the existing venue conditions and proposed capital works/master planning projects. The preliminary planning assumptions and criteria listed throughout this document raises potential venue gaps and challenges. The Sport Venue Briefs developed by the Sport consultants should be reviewed in conjunction with the list below. They address the overall Sport requirements, competition schedule/sport challenges and sport capital construction program.

Venue Gaps

- [redacted]
- Confirmation that Competition schedule can accommodate all of the disciplines noted in the proposed scope at the beginning of this document.

Venue Challenges

- [redacted]
- Biathlon stadium is very compressed and does not allow for easy temporary buildout. Technical building, raised ski course and tunnels will have to be removed and reconfigured.
- Wax cabin location for Biathlon will require another site, possible stacked cabins.
- Due to the large amount of disciplines proposed for this site, the need for additional Front of House and Back of House compounds may increase.
- Venue operations functions such as Venue management, Security, Spectator Services will be significantly impacted due to the Venue load in timing and compressed competition schedule. PSA quantities and queuing space will be a challenge.

- Transportation load zones, PSA locations are yet to be confirmed. The current planning assumptions places this access from the East side of the facility.
- On venue parking will be limited requiring lots adjacent to facility be made available for games usage.

Capital Works Projects

There are several proposed capital construction projects being planned by the Canmore Nordic Centre venue. These have been taken into consideration and are included in the assumptions list at the beginning of this document. Timing of anticipated works are yet to be determined. Below is a non-exhaustive list of the current proposed projects:

- [redacted]
- [redacted]
- [redacted]
- Biathlon stadium reconfiguration of technical building, removal of existing raised ski course and tunnels. This area will require a substantial re-design to accommodate the spectators area, in particular the 5000 seat temporary grandstand which is approximately 30m x 90m. The existing Technical building will have to be either relocated or a new construction. The Athlete compound area will require additional levelling and civil works to accommodate the team wax cabins, athlete services buildings, etc. Please refer to the Overlay drawings for approximate location and size.

APPENDIX A: BROADCAST LIGHTING TECHNICAL SPECIFICATIONS

EPC
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 ≥ 1,000Hz.
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.

Esteem Projects & Consultancy LTD- 126 FAIRLIE ROAD- SLOUGH- BERKSHIRE SL1 0AG
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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, Ec, shall be on a plane nominally at 1.5m above the FOP surface.
Vertical illuminance, Ev, towards a nominated side of the FOP shall be on a plane nominally at 1.5m above the FOP surface.

Horizontal illuminance, Eh, 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 Ec ≥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, Ec min/Ec max, shall be ≥0.7 for the FOP; and ≥0.4 for the FOP-surround.

The minimum to average ratio, Ec min/Ec ave, shall be ≥0.8 for the FOP; and ≥0.6 for the FOP-surround.

Horizontal illuminance uniformity

The minimum to maximum ratio Eh min/Eh ma, shall be ≥0.7 for the FOP; and ≥0.4 for the FOP-surround and/or run-off
The minimum to average ratio, Eh min/Eh 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 gradient12, UG, for both horizontal (UGh) and vertical illuminance to main cameras (UGc) shall nominally be ≤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 ≤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 Ec 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. Ec min/Ec max, Ec min/Ec ave, Eh min/Eh max, Eh min/Eh ave, UGc and UGh, the maximum illuminance towards the main cameras, Ec max, ≥2,000 lux.

Luminaires and aiming logic
The luminaire-aiming angle shall be ≤65°. 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

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End of Report

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[redacted]

[redacted]

APPENDIX C: CANMORE NORDIC CENTER – SCOPE OF WORK

The Canmore Nordic Centre is being proposed as a potential location for Cross Country and Biathlon. The Sport recommendation, and assumption for this work, [redacted] This will allow the Nordic Combined event to be held in the same venue as Cross Country Skiing. Proximity to the town of Canmore will help minimize the amount of transportation and other operational requirements, and provide adjacent accommodations for this venue.

The goal of this exercise is to test the existing venue give the criteria below and outline any capital improvements that will need to be made.

Deliverables:

- 11x17 document that outlines all findings, sketches, text and supporting documents.
- Text document describing the anticipated capital improvements (including 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 plan sketches showing the proposed biathlon upgrades, any site improvements, and the ski jump including access roads and paths.

- *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 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.

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

Cross-Country:

- Existing course to be used with minimal upgrades - refer to separate report.
- Capacity of 7500: 3750 temporary stadium seats, standing room for 3750.
- Accessibility - accessible and amenity seating in multiple locations to serve 1% + 1% of the temporary seating (1% accessible, 1% amenity).

Biathlon:

- Existing course to be used with capital upgrades.
- The Biathlon venue will require capital construction improvements such as relocating the technical building and removing the ramps and tunnels immediately located behind the range on the parking lot side. Capacity of 7500: 5000 temporary stadium seats, standing room for 2500 - assumed that spectators will be allowed to view along the trail network.
- Accessibility - accessible and amenity seating in multiple locations to serve 1% + 1% of the temporary seating (1% accessible, 1% amenity).

[redacted]

Spectator Amenities:

- Assess the current washroom amenities and determine the required capital improvement required to add/improve existing washrooms based on legacy build. Temporary washrooms will be allowed for to serve the additional spectators in temporary seating. Exploration of temporary washrooms is not a part of this scope.
- Use of the existing concession areas is most likely not an option due to different programming of the existing buildings. Additional temporary areas for concession sales will be required - temporary concessions will not be explored as a part of this scope of work.

Electrical, Lighting & A/V:

- Lighting levels to be confirmed. It is assumed that all competitions at the Canmore Nordic Centre will be during the day and that no Broadcast lighting will be provided. However, there are requirements to light the mixed zones, press conference rooms and other areas to broadcast levels.

- Identify if there is a readily available connection to fiber.
- Energy requirements will include prime generated power along with redundancy generated power requirements.

Mechanical/Civil:

- Will the existing services (water and sanitary) be able to handle the increased loads?

Temporary Works:

- Any other works that may need to be completed that would alter the existing conditions that would need to be put back should be identified and outlined now.

Items that require consideration:

- Mountain/Snow venues tend to have much longer buildout durations due to the fact that much of the infrastructure needs to be in place before the snowfall. This is particularly important around the finish areas and the temporary seating buildout. It is common practice to have the Broadcast Commentator positions and Timing/Results buildings in place prior to snowfall as they require access for cranes and various specialty equipment.