APPENDIX B – Northeast Community Centre Reference Materials

Attached as separate file: Appendix B – Reference Materials.

The accompanying table below provides details on the attached documents referenced in Section 3.9 of the RFP No. 24-089 – Reference Materials, including issuance dates and file names.

NO.	DATE ISSUED	FILE NAME
1	2021/04/29	Program Area Summary
2	2023/12/11	HDR Feasibility Study and Charrette Report
3	2020/09/14	Thurber Geotechnical Report
4	2024/07/29	Thurber Geotechnical Report – Phase 2
5	2021/04/20	COC Site Survey
6	2023/06/30	KWL Hydrotechnical Assessment Report
7	2023/07/19	KWL Flow Monitoring Briefing
8	2023/07/25	Blue Line Enviro. Water Sustainability Report
9	2024/07/25	NECC Proposed Subdivision Plan
10	2024/09/10	RJC - PreDesign Costing Considerations Memo

Appendix B - Facility Program
City of Coquitlam 64075 - North East Community Centre
City of Coquitlam
December 19, 2023

ROOM	NET AREA (SF)	NET AREA (M^2)
Outdoor		
Outdoor Washrooms	600	55.7
Outdoor Covered Space (no walls)	1,200	111.5
Sub-Total Outdoor	**600**	**55.7**
Gross Up Factor (1.3)	**180**	**16.7**
Total Outdoor Washrooms	**780**	**72.5**
Aquatics (PSLC Pool with Reductions)		
Lap Pool (6 lane)	4,150	385.5
Warm Water Leisure Pool without warm lap lanes	2,140	198.8
Whirlpool	430	39.9
Steam Room	125	11.6
Sauna	125	11.6
Change Facilities includes internal walls	3,200	297.3
Wet Multipurpose Room (includes storage)	500	46.5
Waterslide	excluded	-
Climbing Wall	excluded	-
Deck Circulation Space	4,500	418.1
Deck Viewing Space	300	27.9
Staff Spaces	500	46.5
Support Spaces incl. Pool Mechanical, excl. roof penthouses	4,400	408.8
Below Deck Service Corridor	excluded	-
Storage Space	550	51.1
Administration and Staff Areas	1,000	92.9
Sub-total Pool	**21,920**	**2,036.4**
Gross Up Factor (1.15)	**6,171**	**573.3**
Total Aquatics	**28,091**	**2,609.7**

ROOM	NET AREA (SF)	NET AREA (M^2)
Library (based on Richmond Public Library)		
Service	175	16.3
Collections	3,120	289.9
Digital Service, Computers	980	91.0
Children's Services	2,300	213.7
Teen Zone	430	39.9
Silent Study Rooms	600	55.7
Multi-purpose Room	470	43.7
Circulation Sorting Workroom, Office, Staff Spaces	1,250	116.1
Living Room	670	62.2
Group Meeting Rooms	375	34.8
Rental Library (Tools, Musical Instruments, Other)	excluded	-
Sub-total Library	**10,370**	**963**
Gross Up Factor (1.3)	**3,111**	**289.0**
Total Library	**13,481**	**1,252**

ROOM	NET AREA (SF)	NET AREA (M^2)
Community Centre		
Entry & Gathering (non-programmed)	2,000	185.8
Indoor Playground, Exploratorium	excluded	-
Administration and Control (1320 sf of list below)		
Reception 2-3 staff	200	18.6
Open Workroom 3-4 staff (65 sf each)	260	24.2
Manager	120	11.1
Meeting room	200	18.6
Fitness Office (40 sf each)	120	11.1
Staff Room	300	27.9
Maintenance Manager	120	11.1
Partnership Offices	excluded	-
Half Gymnasium	excluded	-
Double Gymnasium	12,000	1,114.8
Gym Storage	1,000	92.9
Fitness & Weights	5,000	464.5
Spin Room	0	
Active Studio	2,000	185.8
Active Studio Storage	200	18.6
Walking/Running Track	included (opportunity to discover efficiencies)	included (opportunity to discover efficiencies)
Visual Arts Instruction	excluded	-
Storage for Arts room	excluded	-
Visual Arts Display Space Included in overall Community Centre	excluded	-
Community Kitchen	300	27.9
Maker Space	excluded	-
Storage for Maker Space	excluded	-
Social Room (Youth, Seniors, etc.)	excluded	-
Sensory space	included (combined use with S MP)	included (combined use with S MP)
Multi-purpose Large	2,400	223.0
Storage for MP Large	240	22.3
Multi-purpose Medium	1,000	92.9
Storage for MP Medium	100	9.3

ROOM	NET AREA (SF)	NET AREA (M^2)
Multi-purpose Medium	1,000	92.9
Storage for MP Medium	100	9.3
Multi-purpose Small	600	55.7
Storage for MP Small	60	5.6
Multi-purpose SmallMeeting Room	600	55.7
Storage for MP Small	60	5.6
Board Room	excluded	-
Washrooms	1,500	139.4
Change Facilities	800	74.3
Community Storage	excluded	-
Sub-total Community Centre	**32,280**	**2,999**
Gross Up Factor (1.3)	**9,684.0**	**900**
Total Community Centre	**41,964**	**3,899**
Outdoor Covered Area	1,200	111.5
Outdoor Washrooms, Aquatics, Community Centre TOTAL GFA	**70,835**	**6580.8**
TOTAL GFA (Incl. Library)	**84,316**	**7,833**

NORTHEAST COMMUNITY CENTRE

FINAL FEASIBILITY STUDY AND CHARRETTE REPORT

April 29, 2021

HDR

Coquitlam

The Northeast Community Centre is a **CATALYST for COMMUNITY** immersed into the landscape and the life of the village. It **BUILDS CONNECTIONS** and **ENRICHES LIVES** by providing a **HUB** for socializing, life-long learning, health, creation and play.

The new centre will respond to the unique social, educational, physical, and economic well-being of the Burke Mountain community.

CONTENTS

INTRODUCTION

INTRODUCTION

A new integrated community is being developed on Burke Mountain. Named Burke Mountain Village (previously Partington Creek Village), this new neighbourhood is envisioned as a vibrant and exciting social gathering place, compact, diverse and walkable, and a future economic hub of Northeast Coquitlam*.

Along with the anticipated residential and commercial developments, a large community centre is being considered for the heart of the village, to serve existing and future residents and to draw visitors up the mountain, to this new community.

In August of 2019, HDR Architecture was retained by the City of Coquitlam to provide architectural services for the concept design of the new community centre. The scope of work focused on four key components:

1. Initial Site Test Fits
2. Stakeholder Engagement
3. Building Program
4. Concept Design

The study aimed to understand the development potential of a large community centre on a sloping site, the facility's internal programs, and possible synergies with external development opportunities. The ability or inability to support ice rinks alongside of the community centre was also investigated with respect to impact on program adjacencies, site and parking requirements.

This report formally documents the process for developing and evaluating conceptual scenarios for 3 sites in the village, with the focus on the designated site identified in the 2017 Master Plan.

A parking analysis and a Class D project estimate has also been completed and is also included in this report.

Project Understanding

Prior to making any assumptions or starting any design initiatives for the project, HDR collected background information in order to understand the concerns and aspirations of the community through the following reports and studies:

- Partington Creek Neighbourhood Centre Master Plan, March 2017
- Aquatic Services & Infrastructure Strategy 2015-2040
- Arena Services and Facilities Strategy 2016-2030
- Arts, Culture & Heritage Strategic Plan, March 2017
- Public Art Policy & Project Plan
- Facility Allocation Policy, April 2017
- Seniors Services Strategy 2018-2028
- Parks, Recreation and Culture Youth Strategy Key Findings Report, Feb 15, 2019
- Tennis and Pickleball Services and Facilities Strategy 2017-2037
- Public Consultation conducted via City Staff via surveys and focus group sessions

This study strives to provide a holistic analysis of the social, economic, and environmental forces, and cement the Northeast Community Centre as a vibrant, inclusive, development within the northeast quadrant of the City, and the greater context of Coquitlam.

**As described in the Partington Creek Neighbourhood Centre Master Plan (March 1, 2017)*

01 INITIAL TEST FIT

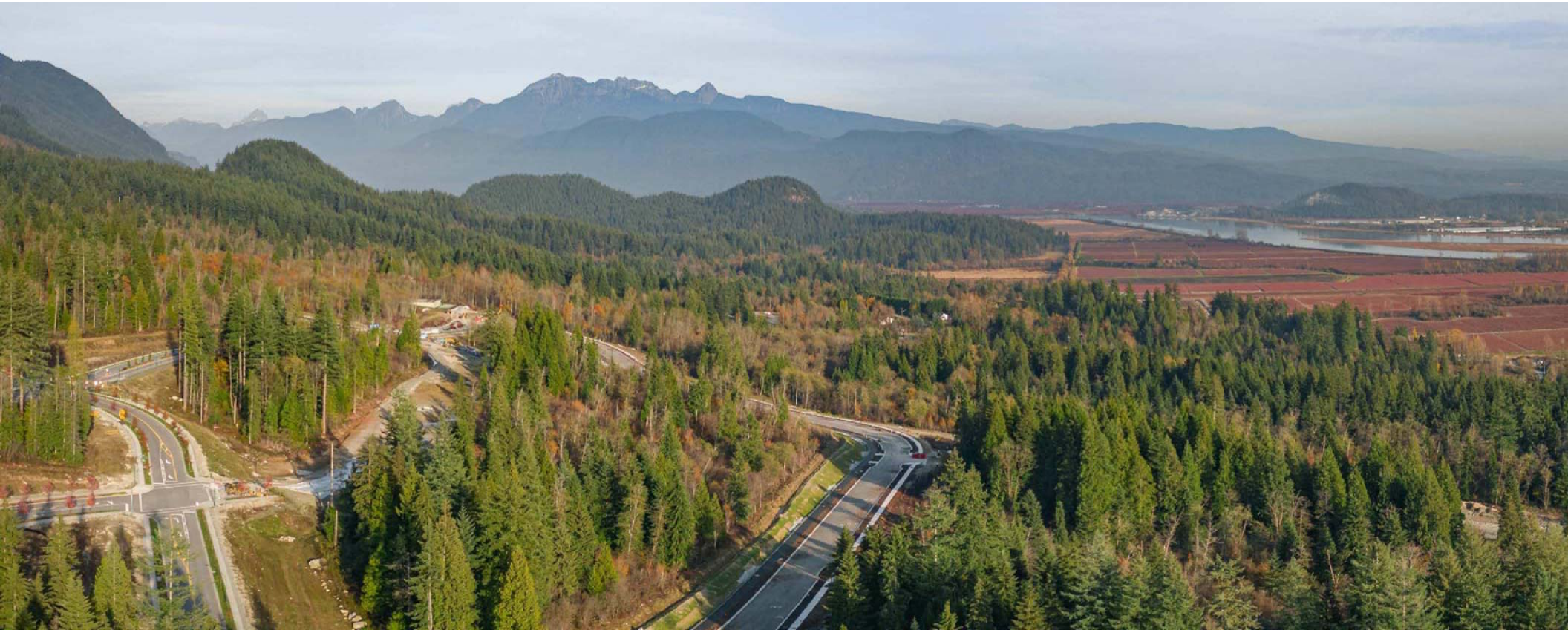
01 INITIAL TEST FIT

Initial Site Test Fit

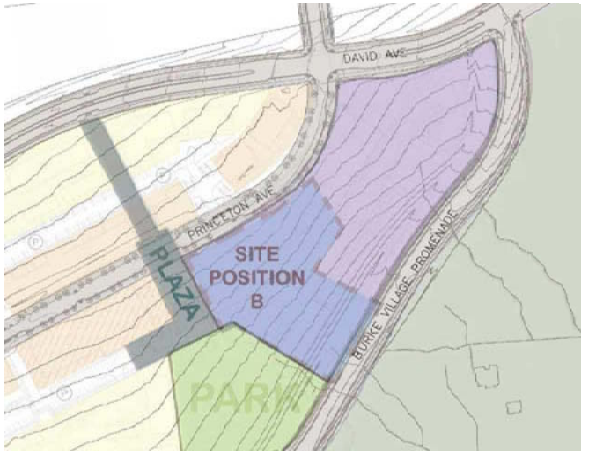
Since the preferred site location and site area were identified as part of the Master Plan, prior to the development of a building program, HDR's first task was to evaluate the size of the site. A number of existing community facilities in the lower mainland were identified for use on this test fit. Utilizing Delbrook Community Recreation Centre, Port Coquitlam Community Centre, and Poirier Sport and Leisure Complex as loose templates, the following diagrams showing potential building site placements were developed.

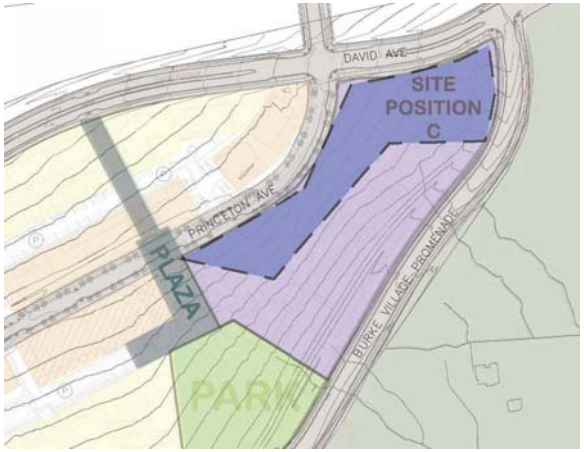
The test fits showed that a large community centre with arenas and suplus land with development potential is feasible on the preferred site in various locations.

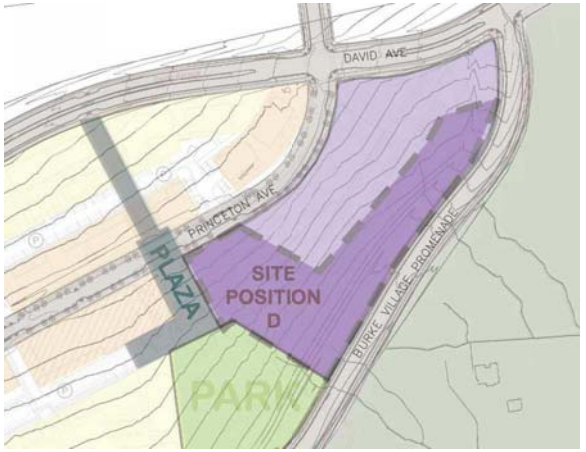
For Diagrams A through E, neither internal program adjacencies, nor parking was defined. Program and parking will be described in greater detail later in this report. Site topography however was taken into consideration.

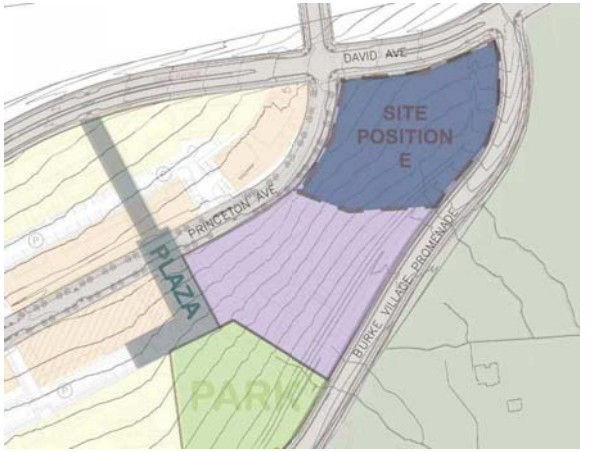


Site Position Options









02 STAKEHOLDER CONSULTATION

02 STAKEHOLDER CONSULTATION

Stakeholder Consultation

Public Consultation

Between February and June 2020, City of Coquitlam staff conducted a series of engagement sessions with community members and delivered a youth-specific survey. Due to COVID-19 the majority of the engagement sessions were conducted via videoconference. The City heard from over 225 people, including 11 staff members, regular user groups, cultural organizations, Council Committees, a Parent Advisory Council, outdoor users, and for the first time, three sessions with language interpreters for residents from the local Persian, Korean and Chinese communities. In seeking out what current and future residents would desire in a community centre, the City asked for thoughts and impressions regarding Northeast Coquitlam: what they liked about the area, what they felt is lacking, and what they would like to see in a community centre. Innovative ideas from across the region and around the world were also discussed.

Staff Consultation

A number for Staff engagement sessions were conducted to uncover City insights regarding community amenities, strategic direction for programming, and innovation for the new facility.

Facilities Tour

This full day tour included visiting Delbrook Community Recreation Centre, The Shipyards, Hollyburn Country Club, Hillcrest Recreation Centre, and Edmonds Community Centre. The facility tours enabled the City and HDR to share and discuss example projects that helped inform and influence what gets planned in Coquitlam. Of the facilities toured, Delbrook and Hollyburn are located on sloping sites.

Case Studies Workshop

Acknowledging that some projects are not easily accessible or within a reasonable distance from the lower mainland, virtual tours of case study projects were presented. The presentation built on the insights from the facility tours and highlighted how these example projects have found solutions to multi-leveled facilities.

Blue Sky Workshop

Blue Sky thinking allows us to gather feedback on what works and what's missing; develop ideas around placemaking, offerings, components, and synergies. This highly structured visioning session provided the opportunity for the City of Coquitlam's internal stakeholders to be involved in the 'needs' planning process. Structured to promote "out-of-the-box" thinking, the activities conducted informed HDR on the direction the new community centre should take.

Design Charrette

The previous stakeholder sessions set the background for a 3-day Charrette where City Staff together with HDR, Aspect Engineering, and Bunt Transportation Engineers worked collaboratively together to develop consensus driven concepts for the preferred site. Due to the global pandemic and the BC public health order to socially distance and limit gatherings, the Charrette was held virtually. It was well attended by City stakeholders and included representation from the following:

Project Team Members, Program Team Members, Community Planning, Development Services, CLF, Park Ops, Park Planning, ICT, Coquitlam Public Library, RCMP, Engineering, and Fire.

The Northeast Community Centre is a **CATALYST for COMMUNITY** immersed into the landscape and the life of the village. It **BUILDS CONNECTIONS** and **ENRICHES LIVES** by providing a **HUB** for socializing, life-long learning, health, creation and play.

The new centre will respond to the unique social, educational, physical, and economic well-being of the Burke Mountain community.

6
ENGAGEMENT EVENTS

1,000+
INDIVIDUAL THOUGHTS

5
MAJOR THEMES

1 GREAT OUTDOORS

KEYWORDS:

INTEGRATED into hilside / fitting into a community / public + private realm / indoor + outdoor amenities

CONNECTED program adjacencies / indoor + outdoor / to the community

AUTHENTIC sense of place / locally + regionally inspired design

2 CONNECTED

KEYWORDS:

COMMUNITY building / minded / relevant / vibrant / sense of belonging / welcoming

SOCIAL heart / mixed-use / public gathering / meeting place

GATHER big + small / adptable space for a variety of activities

EQUITY Inclusive / welcomes ALL

3 ACTIVE SPACES

KEYWORDS:

MULTI-FUNCTIONAL spaces have double functions / future-proofing + planning / multi-uses

FUN programmed + unprogrammed play / playful design

MOVEMENT move along contours of hillside / pedestrian experience at walking scale / create pass-throughs / design for slow movement

ACTIVATE public space / views in and out / people / the street

4 HOME AWAY FROM HOME

KEYWORDS:

LOCAL sense of place / locally + regionally inspired design

ONE STOP SHOP all in one / on the way / programming for all / ease of access

CONVENIENCE all encompassing programming / drop in / extended hours

5 LIFELONG LEARNING

KEYWORDS:

EDUCATION learning / teaching / programming / visual representation of learning in spaces

LEARNING OPPORTUNITIES All encompassing / programming / opportunity for drop-in

ENRICHING mind / body / soul inspiring spaces

02.1 Community Profile

Northeast Coquitlam Community Profile - 2019

Quick Facts

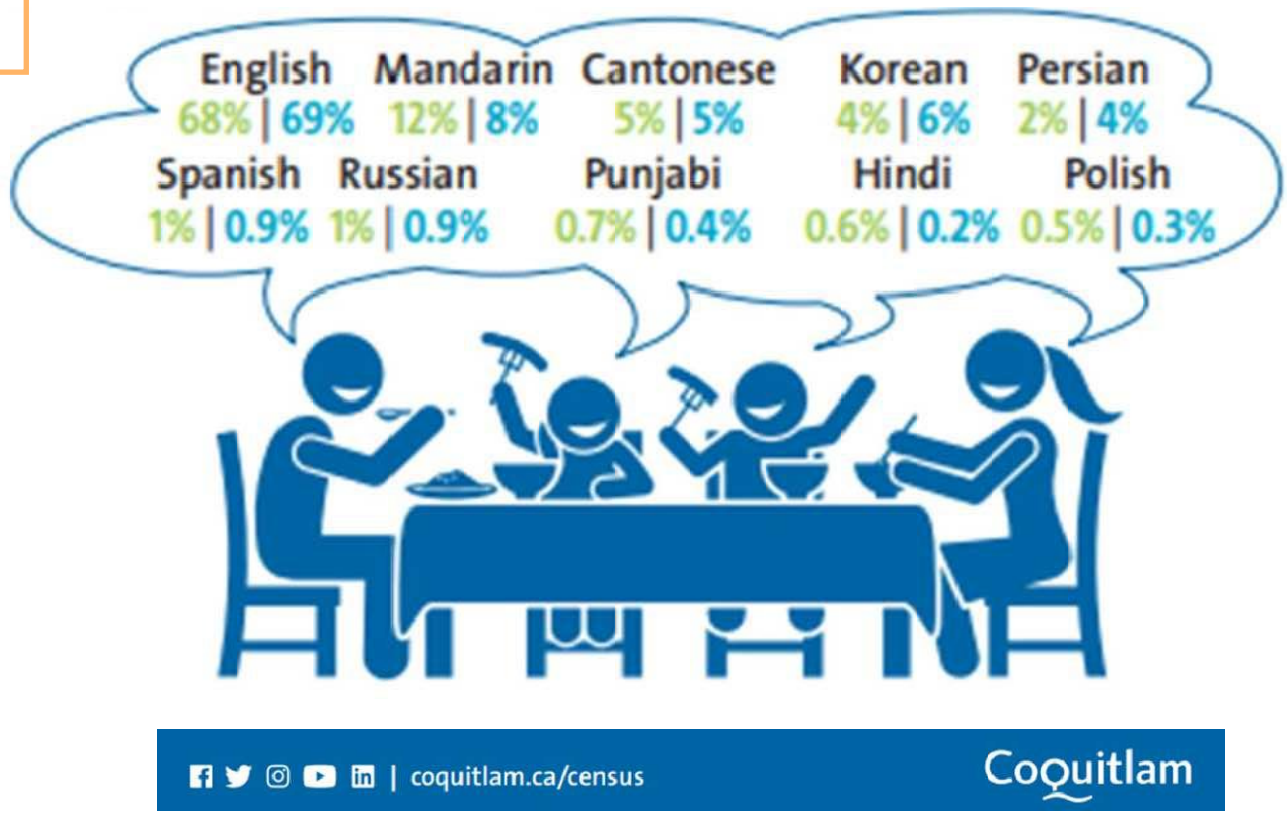
- Average household income: $123,577
- 64% post-secondary education
- 32% of residents speak a language other than English at home

2016 Northeast Coquitlam vs. Coquitlam

TOP 10 LANGUAGES SPOKEN MOST OFTEN AT HOME
Source: Census Canada 2016

(% of single responses)

Northeast Coquitlam
Coquitlam



Age of Residents

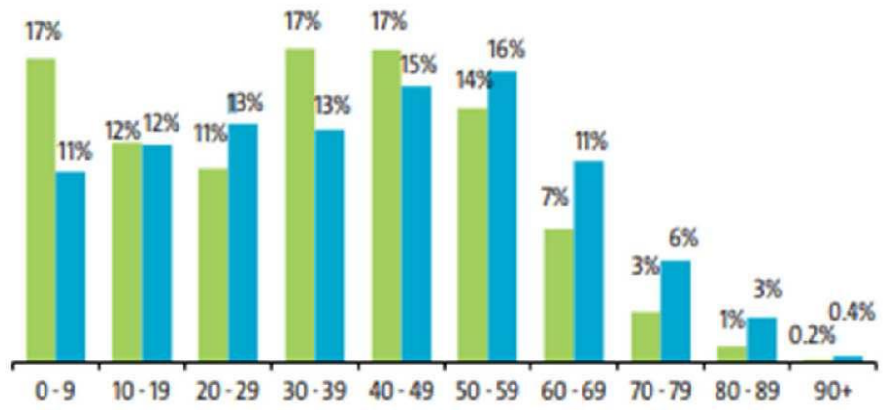
In Northeast Coquitlam, 2016 census data tells us that:

- 48% of people are between the ages 30 and 59
- With only 11% aged 60+
- 29% are under the age of 19
- 17% of those youth are under the age of 9

2016 Northeast Coquitlam vs. Coquitlam

POPULATION BY AGE GROUP
Source: Census Canada 2016

(% of single responses)



Where do Northeast Coquitlam residents work?

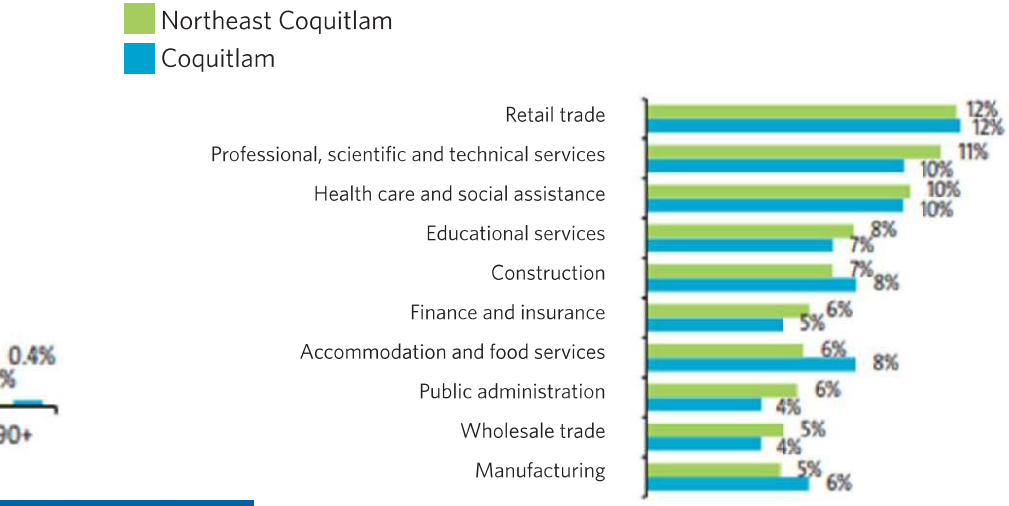
Top 10 Labour Force Industries:

1. Retail trade (12%)
2. Professional, Scientific + Tech Services (11%)
3. Health Care + Social Assistance (10%)
4. Educational Services (8%)
5. Construction (7%)
6. Finance + Insurance (6%)
7. Accommodation + Food Services (6%)
8. Public Administration (6%)
9. Wholesale Trade (5%)
10. Manufacturing (5%)

2016 Northeast Coquitlam vs. Coquitlam

TOP 10 LABOUR FORCE BY INDUSTRY
Source: Census Canada 2016

(% of single responses)



02.2 Public Consultation

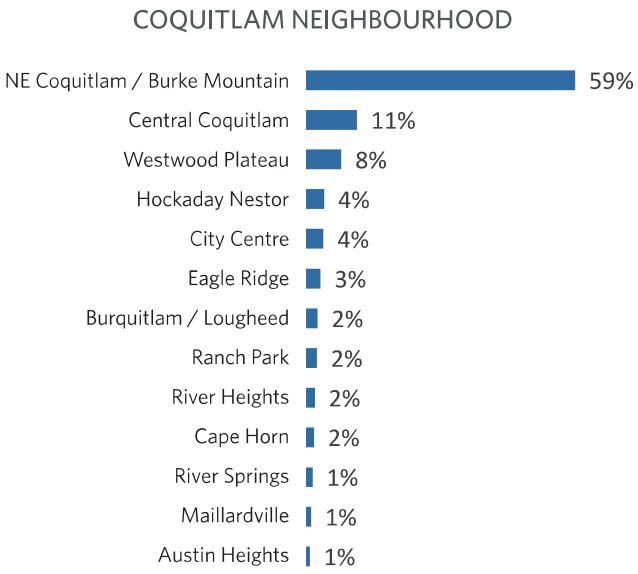
Northeast Recreation Centre Facility Planning Community Survey - January 6, 2020

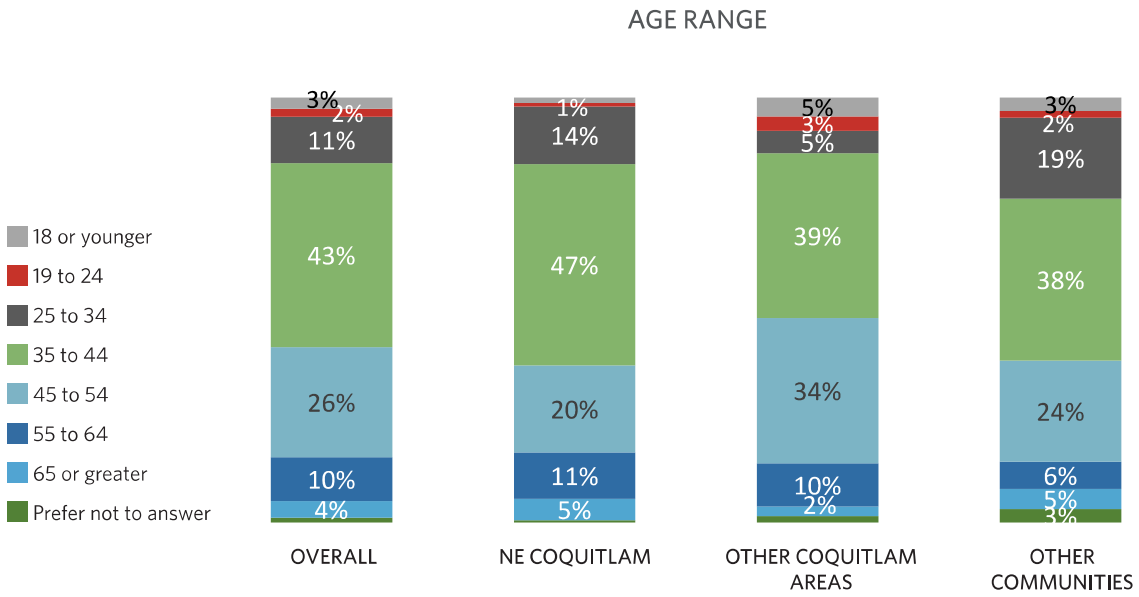
Who Participated?

823 survey responses gathered from **2** online surveys

89% of survey participants live in Coquitlam

59% live in Northeast Coquitlam / Burke Mountain area





The age range of the majority of participants was: 35 to 54

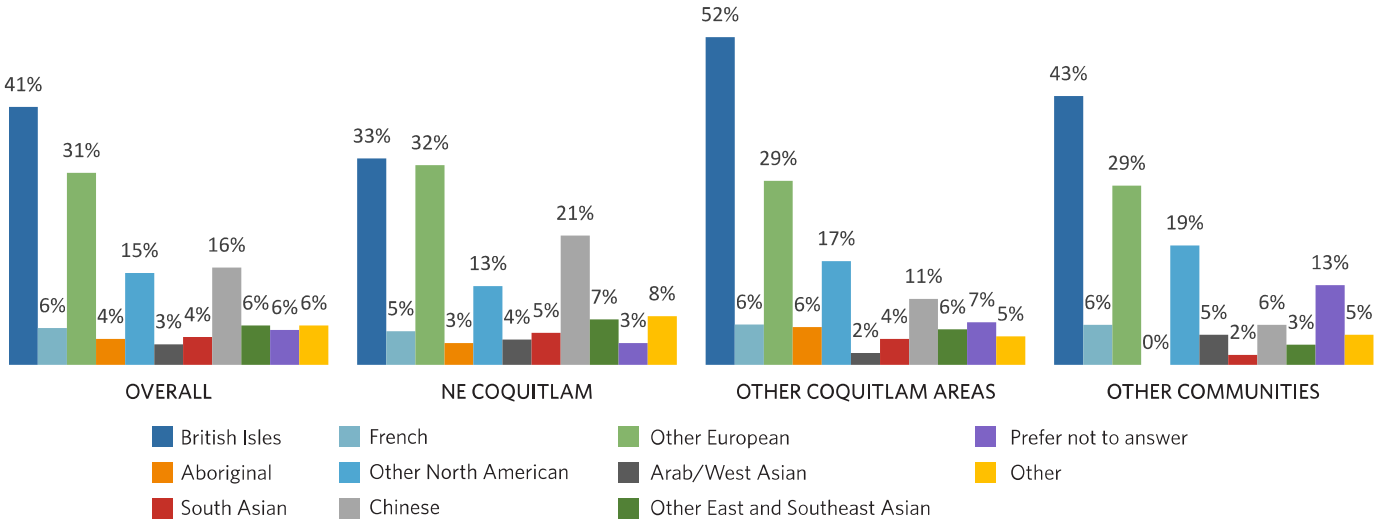
The majority of those participants, 54% identified as female.

Ethnic / Cultural Origins

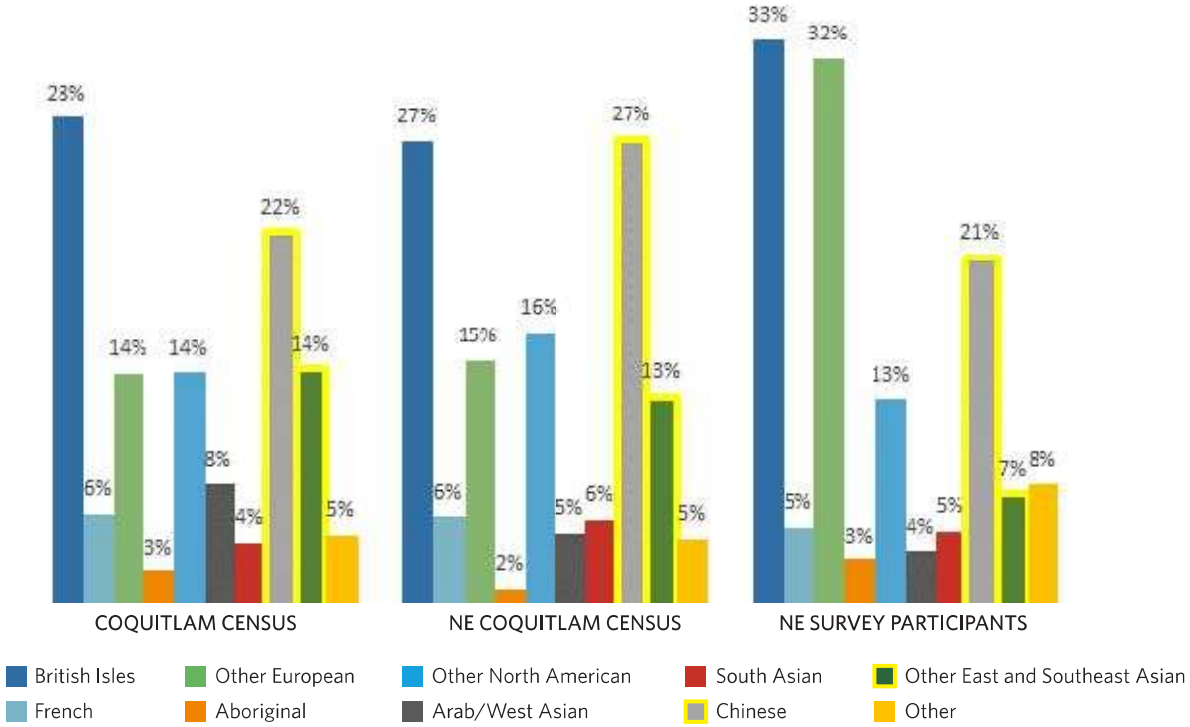
41% of participants identified as being from the British Isles

31% other European countries

16% Chinese and 15% Other North American



The survey results showed that there was insufficient representation from the whole community. Specifically, there lacked participation from Chinese and other East and Southeast Asian residents.

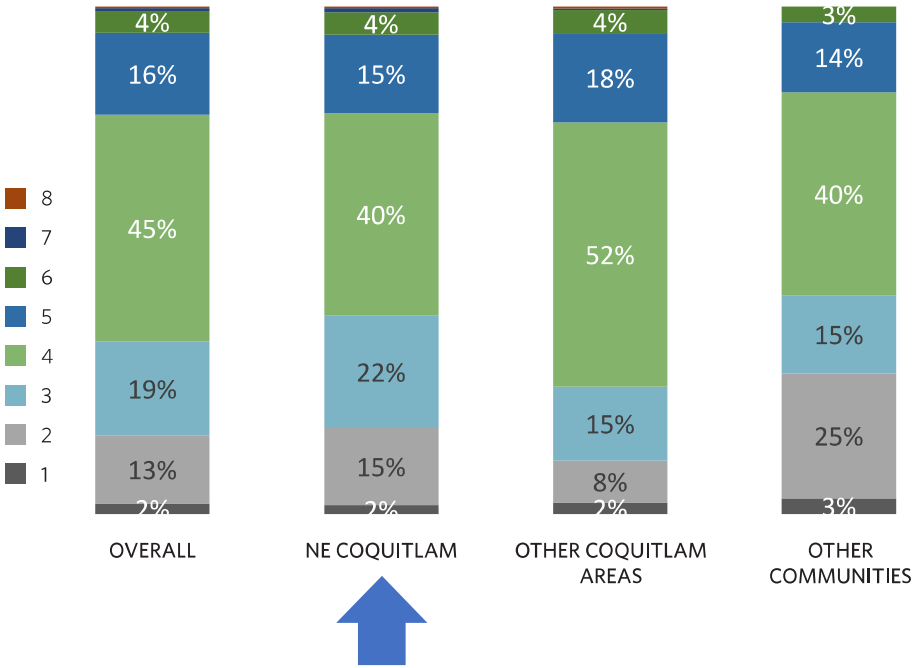


What else did we find out about the survey participants?

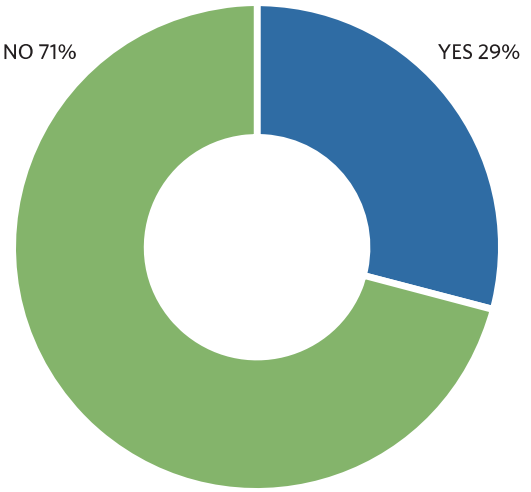
Who lives in the home?

According to the 2016 census, 58% of people live in single family homes + 90% of residents own their home.

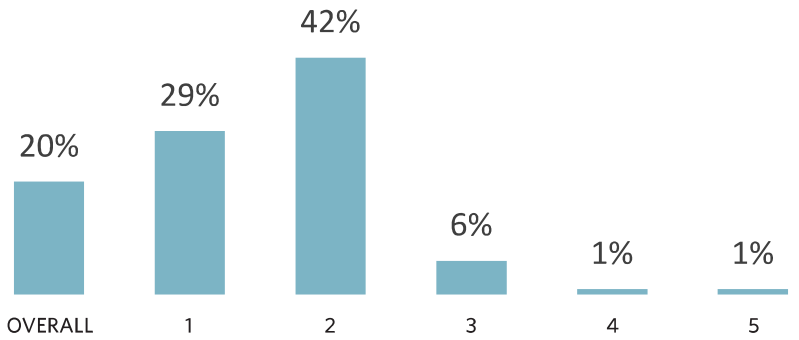
The survey told us that 40% of participant households have 4 people living in their home, 22% have 3 people, 15% have 5 and another 15% show living as a single person.

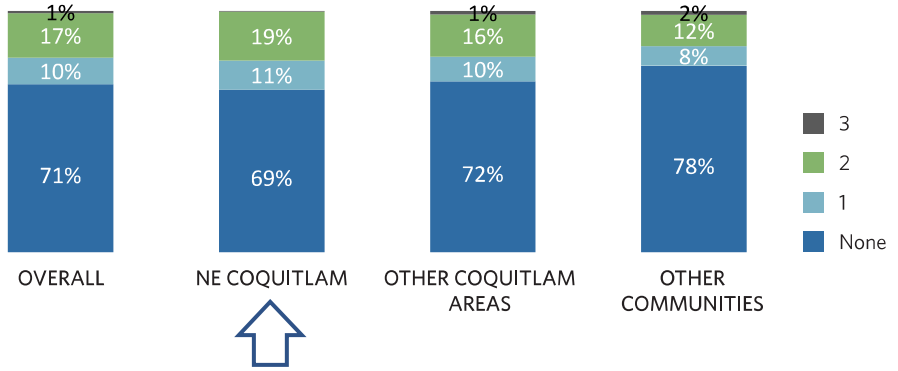


PRESENCE OF SECONDARY SUITE IN HOME

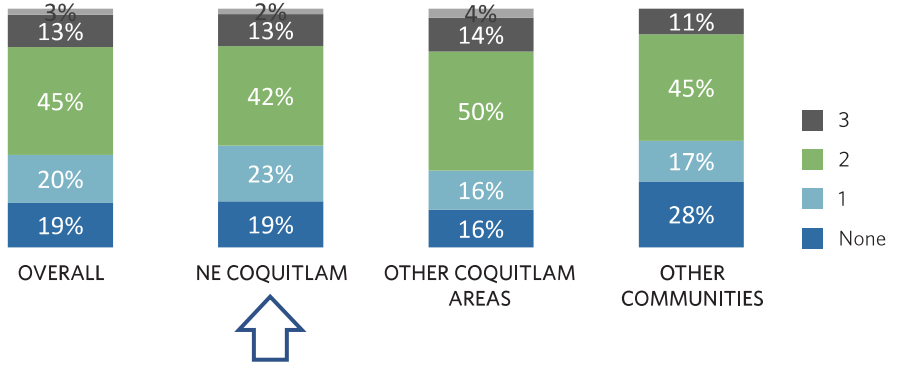


Of the 29%, 42% have 2 people living in the suite, and 29% have only 1 person living in the suite.



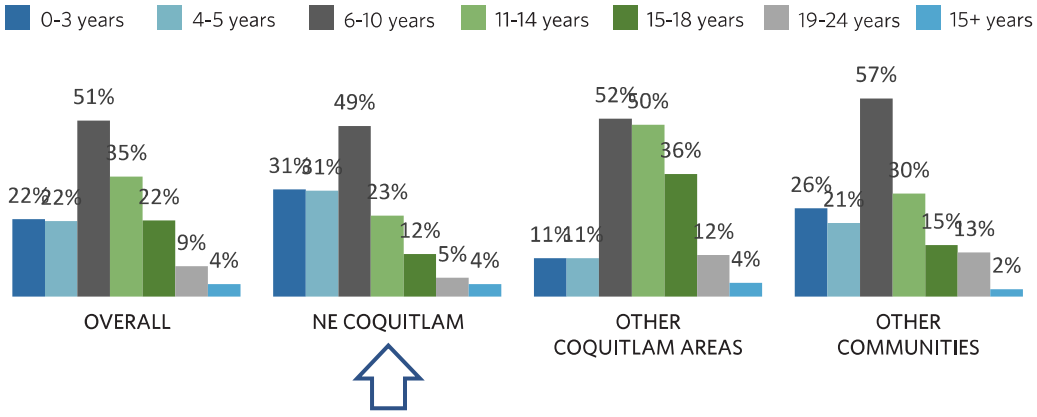


69% of households DO NOT have anyone over 55 living in their home.



42% of households have 2 children.

23% have 1 child, and 19% have no children at home.



Majority of children ages are in the range of 0 - 10 years old.

Favorite things to do / places to go in the - NE Coquitlam area

- Hiking
- Mountain Biking
- Nature walks / Exploring Nature / birdwatching
- Walking and running (trails and through the neighborhood)
- Visiting local parks (Minnekhada, Queenston, Victoria, Galloway, Lafarge Lake)
- Playgrounds
- Cycling
- Swimming
- Meeting friends (cafes and restaurants)
- Snow shoeing
- Archery
- Soccer / basketball pick-up games

Some of the other survey highlights:

- 35 % of survey participants said they did not use Rec Centres because they preferred outdoor / self-directed recreation
- High majority of NE residents were likely to incorporate their visit to NECC as part of trip to the Village, stopping at other Village retailers
- Other characteristics or activities to consider for the design of the NECC (most frequently mentioned):
  - Showcase the views and surrounding mountains and blend the rec centre in with the natural surroundings
  - Mountain biking / Hiking / walking trails
  - Accessibility, transit-friendly, provide sufficient and secure bicycle and vehicle parking
  - West Coast / Whistler Style, wood, glass, natural materials, and showcase indigenous art/culture.
  - Incorporate sustainable and environmentally friendly approaches to design
  - Ice rink for hockey and skating
  - Coffee shop, bakery, and other retail store
  - Emphasize / educate the public on environmental and wildlife protection
  - Creating gathering/social spaces and community gardens to foster a strong community spirit
  - Other amenities mentioned include: a playground, lacrosse box, zipline, climbing wall and curling facilities.

Engagement Session with Community Members

Themes of discussions during the engagement sessions with community members:

SENSE OF COMMUNITY

Almost every group spoke of the need for the Community Centre to provide a sense of belonging and community for users. The conversation took many forms, from accessibility of the site for people with mobility challenges, and for people without private vehicles, to the importance of having a variety of spaces for different uses and group sizes. The topic of inclusivity was also top of mind for many groups.

There was a strong desire to have a Community Centre that is welcoming and inclusive to all residents of Northeast Coquitlam. This looked different to different groups, with suggestions that signage and services should be available in different languages, washrooms be gender neutral and that some be setup without doors. Providing ancillary services like childcare, and programming at all times of day to accommodate different schedules were also mentioned as ways to create a sense of community in and around the centre. As were spaces that encourage people to interact with each other across age-groups and cultures.

AMENITIES

Unsurprisingly, every group we spoke with had quite specific ideas about the most important features of the new centre. One thing that was mentioned frequently is how long it takes to get from the Northeast to the existing facilities, so there was a strong desire to have a complete aquatic centre, including lap and leisure pools, ice rinks, performance and rehearsal halls, gymnasiums, a library, community kitchens and large bookable rooms, in addition to a library and dedicated spaces for arts, crafts, and exercise. There was a lot of interest expressed in having indoor/outdoor space, to take advantage of the natural environment of Burke Mountain. Participants really want to see a Community Centre that is in touch with nature, through outdoor programming as well as in the design of the building(s), but that can also be used comfortably year round, through covered outdoor spaces and pathways. People want to feel like they're close to nature. The most commonly requested amenity was a library, along with spaces for youth to gather, study and hang out. The library could meet many of the requests that participants had, from study spaces to learning and training opportunities, to rental of equipment beyond books (musical, tools, etc.).

DESIGN

The importance of consulting early and often with the public as well as experts was mentioned in several groups – we heard that it is essential to speak with arts practitioners to ensure spaces are appropriate for their intended activities, and to hire accessibility consultants to build a fully accessible building from the ground up. The environmental impact of the centre should be taken into consideration and mitigated as much as possible through the use of technology and environmentally friendly building materials and practices. Parking is also of concern, with enough to accommodate all users, but not overwhelming the site. Underground parking was suggested as a good option. Making a lot of the building useable by community members is important. Finding ways to build small rooms in corners, or using the roof for gardens/sitting areas/ sport courts. People are also looking forward to having opportunities to be inside or outside – and to have interconnected spaces inside, while also recognizing that different amenities have different security and operating needs. People seem very interested in being able to see other activities taking place – ie arriving for swimming lessons and seeing a performance or a group doing yoga. Spaces and rooms should be flexible, but not to the point that all uses must compromise to fit the space.

02.3 Staff Consultation

A number of Staff engagement sessions were conducted to uncover City insights regarding community amenities, strategic direction for programming, and innovation for the new facility.

Facilities Tour

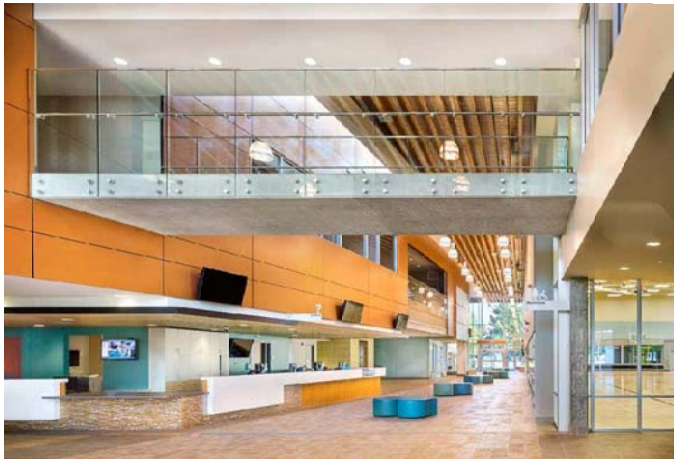
The Lower Mainland tour included visiting Delbrook Community Recreation Centre, The Shipyards, Hollyburn Country Club, Hillcrest Recreation Centre, and Edmonds Community Centre. The facility tours enabled the City and HDR to share and discuss example projects that helped inform and influence what gets planned in Coquitlam. Of the facilities toured, Delbrook and Hollyburn are located on sloping sites.

Facilities Tour Comments from Staff

After the tours, HDR asked Staff to share their feedback on the buildings that they toured. The following comments were made.

DELBROOK COMMUNITY RECREATION CENTRE, NORTH VANCOUVER

- Art elements should not be tucked in behind the administration offices. The public art in the floor and around the facility was excellent and fun elements can be explored by the users in the main entryway and hallway.
- Appreciated the larger building masses being on the downward slope side of the building. Liked the way the building steps into the slope and exterior massing.
- Youth centre with separate entrance is appealing, but also needs to be connected with the main facility. Seems too much of an afterthought and unattractive so probably not well used.
- Liked the high visibility into the fitness and active spaces.
- Way finding was confusing at the entry and to some parts of the building. Access to second floor was not intuitive.
- Adjacencies seem well positioned but still rely on corridors/hallways which is less than ideal.
- Lack of parking and complaints from users. This is in part due to lack of active transportation and transit options (or usage). Very comparable facility to Burke in that regard. Staff noted that they were not allowed to park on site.
- A beautiful building that fits nicely on the slope with glazing that makes it transparent in many ways.
- The extensive use of wood on the interior makes it feel warmer and more welcoming than many new recreation centres,
- Liked the scale and transparency of the rooms onto the halls, light capture between floors, the scale of the fitness and spin classes, co-location with an active park (but could have been better connected to that park).
- The terraced stair entry from the parking lot felt a bit massive and not an inviting entry compared to the street. For NECC there will be a significant number of users driving to the facility, the entry experience should be well thought out.
- Appealing interior finishing however hallways to the offices very “institutional”, the feeling of the visitor is that they are not allowed in that area.
- The integration between the indoor and the outdoor amenities seems to not be well thought through and a large missed opportunity.



HOLLYBURN COUNTRY CLUB, WEST VANCOUVER

- Appreciate how development in a phased approach without a master plan and flexibility for future code compliance is critical.
- The views were amazing, and really drove home the importance of ensuring to plan to capitalize on our view potentials in the design.
- So many corridors! Tough to renovate in small doses and the building really suffers from poorly planned circulation.
- Liked the fitness wing and how it nestles in the trees/slope.
- Great design considering the site constraints (steep slopes, squeezed between two watercourses).
- Parking likely to be a challenge if this were a publicly accessible building.
- Interior were quite dated and the lobby felt like a hotel, but perhaps on purpose.

EDMONDS COMMUNITY CENTRE, BURNABY

- It's too bad the seniors room ended up being off in a little corner, separated from the main activity room.
- The aquatic elements seemed really interesting, and I could see why it was full immediately.
- Liked the lights in the floor of the lobby.
- Would benefit from warmer, better material selections throughout (except seniors space which is kind of a fun juxtaposition).
- Circulation is complicated despite central spine (which nicely frames a tree in the adjacent park).
- Grades at front entrance are awkward with the attempt to keep a single indoor floor height.
- Daycare gets partially buried and seniors space.
- Loses contact with street – perhaps buildings on slightly sloping sites are more difficult to grade then steep slope sites?
- Liked the open corridor that connects through the building to the active park behind.
- Pool is lovely although change rooms are small. Pool has good accessibility.
- Liked the indoor playground but it was very small.
- Liked fairly generous gathering space pool side.
- Entry area off main street could have been more welcoming – maybe it is the materiality and colours that were not welcoming.
- There is not much of indoor and outdoor space integration.

THE SHIPYARDS, NORTH VANCOUVER *(DIALOG)*

- Really liked the multi-functionality of this outdoor plaza.
- The adjacency of retail to the plaza only helps to increase visibility of civic activities and recreation/culture.
- The water leakage from the design was problematic for ice making, and based on the photos included, the design also seems to have misjudged the water flow in the spray park season.
- Beautiful venue.
- Nice scale and great adaptive reuse of the structure but limited comparable to Burke.
- Covered outdoor recreation areas are valuable so keeping an eye out for opportunities to blend inside/outside spaces with covered areas is beneficial.
- The focus on leisure activity to build community is key. All ages, all abilities, all seasons, flexible covered outdoor space.
- Rink area felt a bit small.
- Good example of seamlessly integrating public/private realm. Design allows for opportunities to use for different events throughout the year (not just a seasonal ice rink).
- Potential to have integrated more commercial/retail space, particularly considering the views of the inlet and Downtown.
- Would be interested in the cost/benefit analysis of the outdoor rink as it appeared to have a lot of operational requirements (i.e. staffing).
- Unique sense of place that is developed integrating public amenities, private business, and historic and natural assets. Liked that they were trying to make the public space multi-functional and multi-purpose.

HILLCREST COMMUNITY CENTRE, VANCOUVER

(HCMA Architecture)

- Library was off on its own and not integrated, tucked away and unseen. Access to library is less than ideal but love the synergy of having it in the facility.
- While visibility to the multi-purpose spaces from the main lobby was good, the spaces were pretty far away because of the configuration of the arena and curling rink.
- Liked the indoor/outdoor pool planning and the scale of aquatic amenities.
- Circulation in this building is so good. Love the area between the rink and the pool though it could be even wider based on how busy it gets. The corridor that leads to the gym benefits greatly from the glazing looking out onto the rink.
- The use of wood in the pool and rink really adds to the attractiveness of the overall facility.
- The drop off plaza is a failure with rough materials and island trees. Picnic tables for waiting are an after thought.
- Liked the large hall that needs to be larger with even more seating!

- Pool is great, lacks enough deck space for hanging out – the birthday party/meeting room could have been better connected too.
- Outdoor pool is only a small leisure pool, could have been bigger with more deck space too.
- Liked the core universal change rooms, planning for volume of use and cleanliness has been a challenge.
- Also tucked away and unseen, is the childcare and fitness access is poor
- Fitness is a bit of an intimidating male dominated space – narrow entry and exits. Overall it's popularity is its detriment.
- Rink spectating could be better connected to the lobby and café space. Really feels like a giant pool and rink with community centre program areas as afterthoughts but a great pool!
- Quite a bit of retail considering the proximity to Main Street, but the staff noted that the coffee shop was successful.
- Liked that most of the large spaces had sunlight access.
- Does not seem like there is much if any integration between indoor and outdoor amenities.

Case Studies Workshop

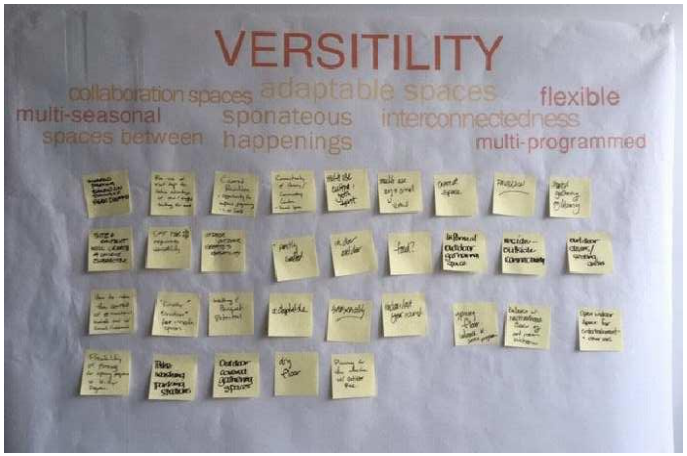
Senior City Staff and Planners were introduced to case studies that highlight innovation and trends in Community Recreation buildings. The case studies were presented in the themed groups of:

- Sloped Site
- Heart
- Versatility
- Play+

As a part of the workshop, the attendees worked in small groups to discuss ideas that would be beneficial for the Northeast Community Centre.

Trends in Recreation

WHO: Senior City Staff and Planners (x16), divided into groups of three, with HDR presenting and facilitating



COMMENTS (from City Staff)	SLOPED SITES	HEART	VERSATILITY	PLAY+	TOTAL
Transparency (inside + out)	2	3			5
Community Workshop / Makerspace				5	5
Pavilions Yes! Gathering spaces	1		1		5
Pavilions Do NOT feel welcoming	1				
Covered outdoor pavilion = opportunity to expand programing - Low Cost			1	1	
Views from roof would be an opportunity / Activated roof / courts on roof	2	1	1		4
Use of natural light	2	2			4
Covered outdoor space: play area / courts / plaza / gathering spaces	1	2	1		4
Stairs as seating outdoors / public viewing / terraced landscape for stairs / seating / Amphitheatre	3		1		4
Space for spontaneously planned central activity / comfortable setting for social gatherings / entertainment (indoor + outdoor)		2	2		4
Curved forms appeal / Curved bldg design	1	2			3
Outdoor plaza - entertainment / activation / animate neighborhood	2	1			3
Library / public living room / mixing chamber		3			3
Fun! Everywhere climbing wall?!		3			3
Indoor / Outdoor: creates versatility, year-round			3		3
Trail running through building / Outdoor-Indoor Track				3	3

Key Themes from Top Comments include:

- Connection to the outdoors and beautiful landscape through views, the use of transparency and roof tops; and the concept of moving people through the building and the outdoor space via trails and running/walking tracks.
- The concept of the building being a community hub, not just for sports, but to provide a place for cultural social activities, festivals and gathering, makerspaces, public art and spontaneous gathering both inside and out. Including spaces for a public library, arts classes and studio spaces could provide intergenerational and cross-cultural connectedness.
- There were some conflicting opinions around the concept of the pavilion. Some felt that the pavilion could disconnect and not be welcoming enough, others thought it could provide the in-between space for spontaneous social gathering. When shown the outdoor adaptable pavilion, some thought a covered outdoor space designed as a pavilion could provide an opportunity to expand programming at a low cost.
- Architectural elements that were noted consisted of: curves, plazas, indoor running tracks, climbing walls, natural light, transparency to view through building for programmatic interconnectedness and to have users see in and out of the building, stairs as seating, occupied and active rooftop.

What would make the Northeast Community Centre successful?

YOU ANSWERED...

If your grade 9 kid describes it as a 'really cool' place to go

Nails flexibility and versatility, is temporal and adaptable to community

Supports indoor + outdoor living and recreation

Connection with village + parks

Trail through building

Not just a living room, welcoming space throughout

Supports diversity + culture

Comfortable with flexible and moveable furniture, good access control

Central / living room / core area

View from every window

Pride in building regardless of demographics, sense of belonging.

Opportunity to create a unique building, burke village identity

Multi-faceted

Integrating all ideas with out getting program ideas cut due to budget, creative solutions

Hard time leaving it

Campus with pavilions

One-stop shop approach, medieval village (cathedral)

All of the diverse community can see themselves in the facility.

Blue Sky Workshop

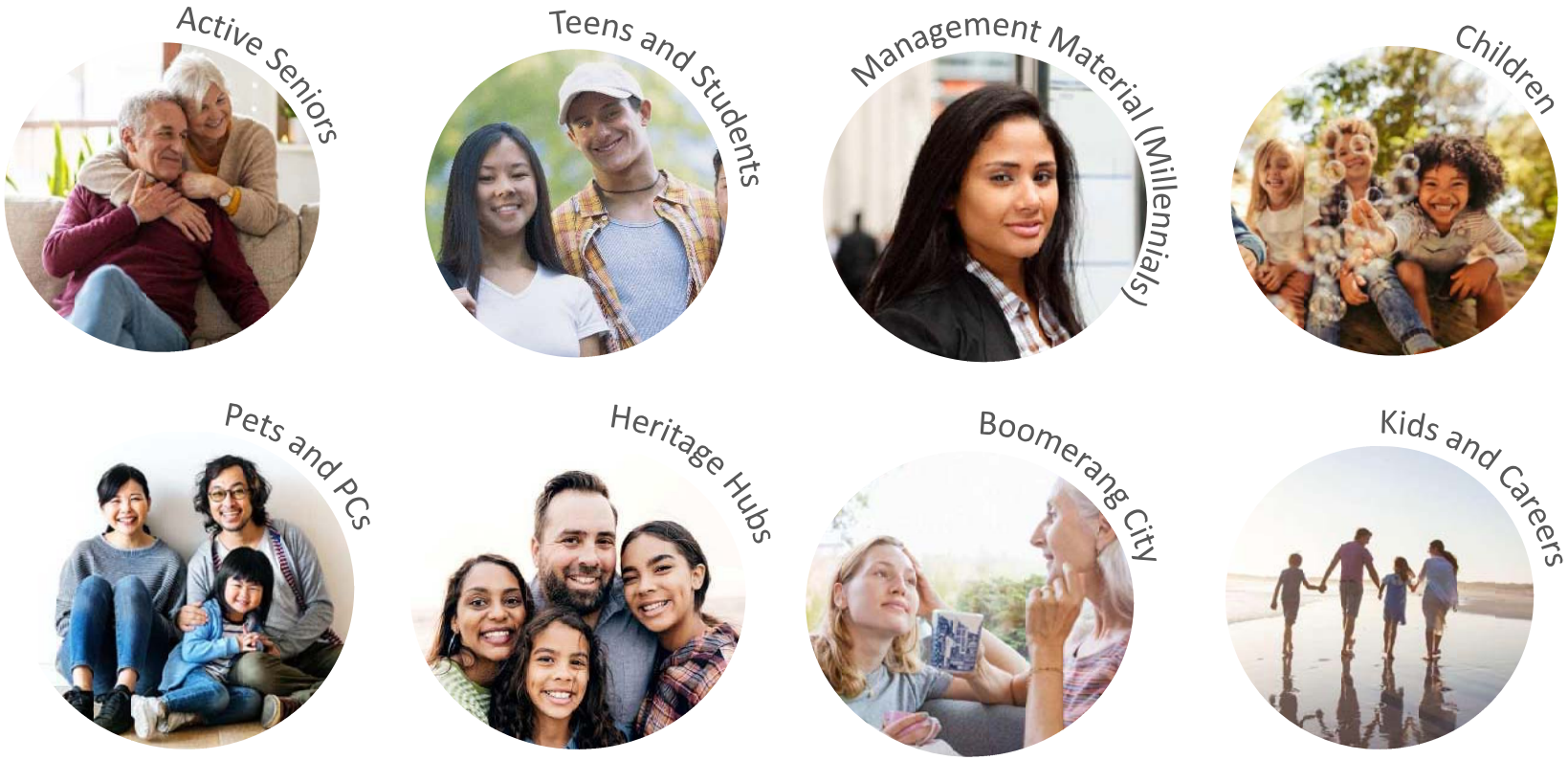
Different perspectives are important and can drive innovation.

It is easy to assume what community members may want from their facilities and services. However, often our assumptions are based on incomplete information. Even if the public tell us what they want, we might not know why OR end users might tell us they want one thing when in actuality, they need something else.

To combat typical assumptions, user personas were used in a workshop setting. 4 personas were provided by the City from previous work completed to understand the retail aspirations for the Village. These personas include Pets and PCs, Heritage Hubs, Boomerang City, Kids and Careers. In addition, 4 generic demographics were added – Active Seniors, Teens and Students, Millennials, and Children. By stepping into the shoes of these personas, a more relevant and successful destination can be designed.

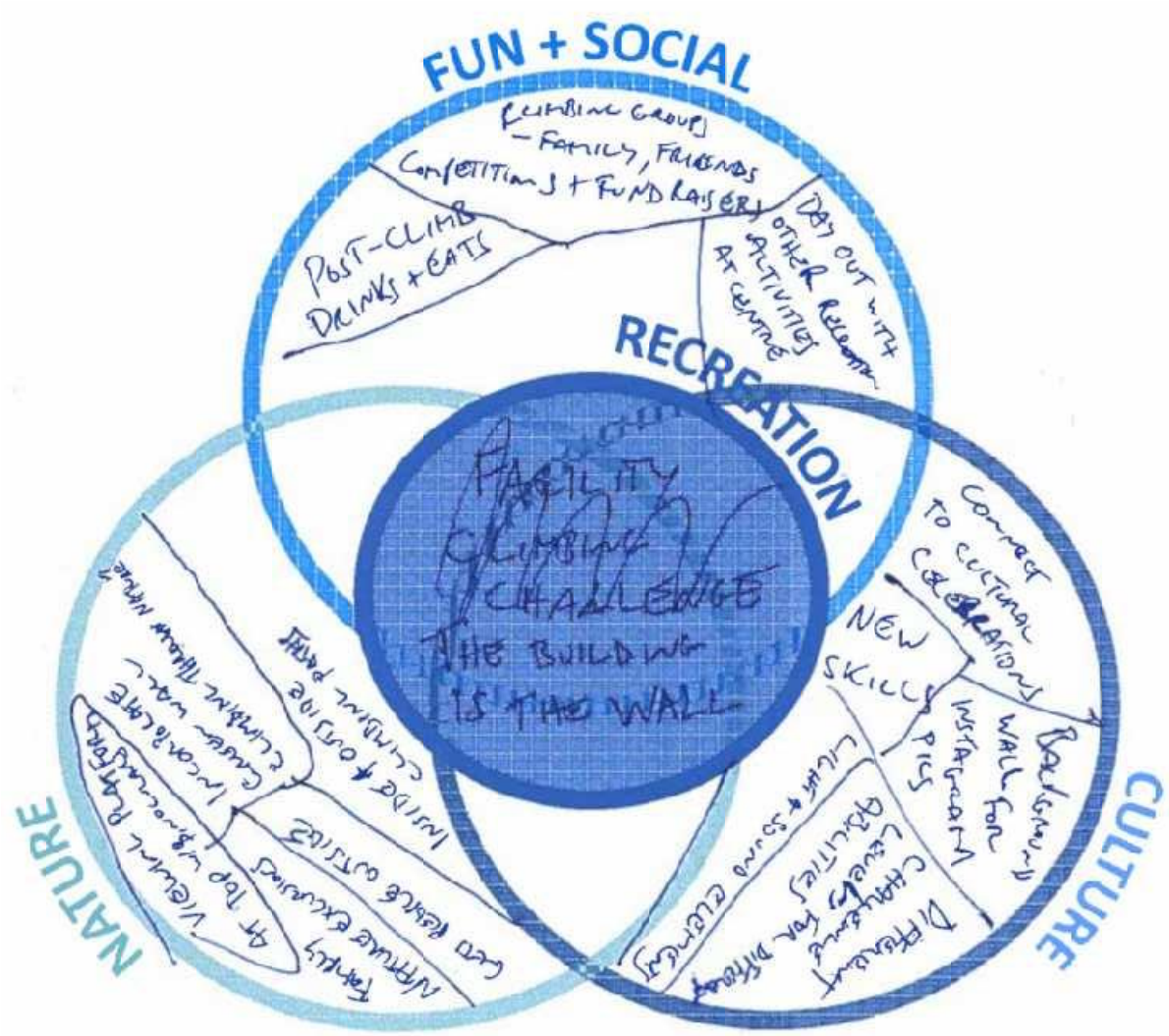
During the workshop City Staff were asked the question, "How might we create an authentic, social, integrated community destination on Burke Mountain?"

Solutions were developed through individual and group activities, and always with the perspective of community members.



Segmentation Behaviours and Attitudes - Summary

	PETS AND PCS	HERITAGE HUBS	BOOMERANG CITY	KIDS AND CAREERS
HOUSEHOLD INCOME	$137,272	$121,309	$134,182	$171,043
HOUSE TENURE	Own	Own	Own	Own
EDUCATION	College/University	College/University	College/University and High School	College/University
FAMILY	Younger, upscale, suburban families	Middle-aged, diverse, suburban families	Upscale, multi-generational urban households	Large, well-off, middle-aged suburban families
ETHNICITY	China, Philippines, India	Wide variety of nationalities but no one dominates	Low cultural diversity	No major ethnicity cluster
LEISURE	• Focused on children • Movies, bowling, zoo, hockey, aquarium, amusement parks	• Focused on leisure - playing soccer, skateboarding, water parks, fitness classes, amusement parks	• National, provincial parks • Yoga • Garden shows, boat shows, live theatre, music festivals, opera, art galleries • Youth adventure sports - motorcycling • Golf, curling	• Jogging • Skateboarding • Theme parks • Summer camp • Belong to golf and fitness clubs • Attend professional sporting events
PERSONALITY	• Risk takers • Want to be influencers • Status-conscious • Pursuit of happiness • Strong work ethic - but not necessarily in love with their jobs • Because of their ethnicity, believe that through hard work they will get ahead in life	• Work focused on moving ahead and good income but not necessarily in love with their jobs • Savers - want to pass things down to their children • Ostentatious - show off possessions as indicators of success • Want to save money but also want to show off • Non-conformists, break rules • Often connected to a local religious community	• Have well-paying jobs usually in science, education, government or arts • Wordly in their views • Well-travelled sophisticates • Share posts, podcasts and pictures online • Seek relationships with young people and consider them peers • Think of themselves as younger than they are • Work hard to get ahead • Natural inclination to help others • Embrance living in a cultural mosaic - social learners	• Work hard, play hard • Owe their success to mix of determination and education • Look to technology to save time (buy home furniture, movie tickets, catch up on sports news) • Do like spontaneity



Example Solution Mash-up Activity

THE BUILDING IS THE WALL solution mash-ups

Parents who fall into the PETS and PCs demographic are always looking for a way to provide opportunities for their children, whether this be socially, academically or otherwise. Teens, looking to connect with friends, and also satisfy family time requirements are often torn between their peer group and their family obligations. A unique focal point for family and friend interaction, which includes opportunities to meet new friends or engage with existing friends, in an active environment is required to appeal to this group.

The new 'Building Is the Wall' is an indoor/outdoor climbing experience for developing a new physical skill. Designed at varying levels of difficulty, it appeals to all. In order to charm the younger social media savvy generations, the Wall itself can be a canvas for incorporating media such as Instagram pics and TIK TOCs. The Wall for this community is connected to the outdoors, and has an indoor component for inclement weather. It holds the opportunity for "parallel play" where children and youth can be occupied socially in the same facility where parents can also participate in social activities, allowing for a 'Day Out' to meet social and family time needs.

Recreation	Fun+social	Culture	Nature	Fun + social
My Social Getaway	Dinner en blanc			
	Flexible schedule	Cultural Food and Drink	Afternoon tea garden	
	Movable tables and chairs	Expand social/support network		
	New experiences	Theme local, St Patricks, Chinese New Year		
	Local group	Food trucks		
		Café Festival		
			Solitude	
			Peaceful, quiet	
			connected to outside	
	Food Trucks			
The Building IS the Wall		Connect to cultural celebrations	Viewing platform at top with binoculars	
	Post-climb drinks	Background wall for instagram pics	Family nature excursions	
	Climbing groups, family and friends	New skills	Gets people outside	
	competitions + Fundraisers	Light & sound elements	Incorporate green wall " climbing trough	
	Day out with other recreation activities at centre	Different challenge levels for different abilities	Inside + outside climbing paths	
Urban Nature Plaza	Gathering places	Wine tasting or Beerfest	Urban Gardens	
	Connected to the trail	Library (Childcare drop-in + book reading with	Connected to trail and nature	
	wifi		waterplay	
	Organic food stores	Children's Program to enhance development (outdoor/indoor)		
			Bird watching	
			Stargazer observatory	
			Picnicing	
			Restaurant Café that provides outdoor seating	
Indoor/ Outdoor Library Café	Business meetings	Increase connections	Indoor / Outdoor gathering (scenery)	
	Meet friends	Mentoring	natural lighting	
	Living room	Outdoor recreation trail education		
	Gathering space	Transparency		
			green wall	
	Food Beverage			
	Book clubs			
Power Foods Class with George Foreman	Guest star chef	Different cuisines from around the world	Community garden	
	Group class	Class diversity	Learning about food	
	Shared food		Outdoor classes	
	Special team assignments		BBQ	
Adventures in Biking	Eat + Drink + Friends	Bike Festival	Trails + Trees	
	Meeting people with shared interests - trail guide		Forest	
		Cycling Club	Water + Rocks	
		Sharing	Skill development	
		Community Event		
		Mini crankworks		
Indoor/ Outdoor Library Café	Gathering space	Mix with new people	Indoor / Outdoor gathering	
	Living room	Music Entertainment	Natural light	
	Meet neighbours and friends	Book club	green wall	
		Outdoor education		
		Walking trail		
	Food and beverage			
			Transparency to outdoor activities	

From 29 Thoughts to 6 Principles

DO:

- Connect to outdoors
- Respect the environment
- Be Equitable and Appeal to ALL
- Enable Social Gathering
- Provide Diverse and Extended Programming, geared to this Community
- Create Safe Environments

RESULT:

- Community Pride
- Active, Healthy, and Engaged Community


REDUCE FOOTPRINT


REFLECTS THE COMMUNITY


APPEALS TO TEENS


SOCIAL GATHERING CONNECTION


EXTENDED PROGRAMMING


REDUCE FOOTPRINT


SOCIAL GATHERING CONNECTION


EQUITABLE FOR ALL


SOCIAL GATHERING ACTIVE, SAFE LIVING


EXTENDED PROGRAMMING


DIVERSE PROGRAMMING


FITNESS + HEALTH


ACTIVE OUTDOORS


SOCIAL GATHERING CONNECTION


FITNESS + HEALTH


ENVIRONMENT OF LEARNING


AQUATICS EXPERIENCE


DIVERSE PROGRAMMING


AFTER WORK PLAY


DIVERSE PROGRAMMING


DIVERSE PROGRAMMING


APPEALS TO TEENS


SOCIAL GATHERING CONNECTION


LOCAL AMENITIES

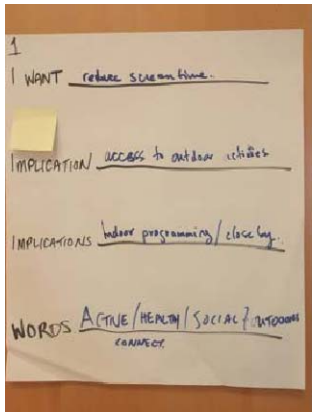

DIVERSE PROGRAMMING

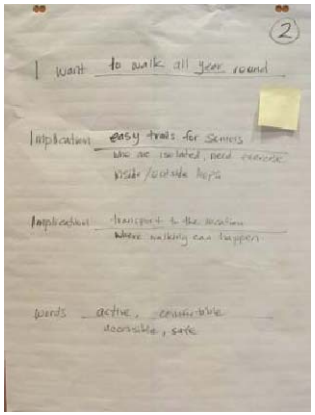

PEACEFUL OUTDOORS

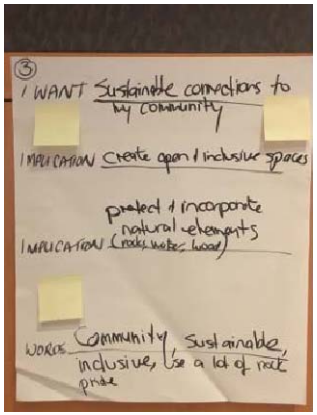

DIVERSE PROGRAMMING

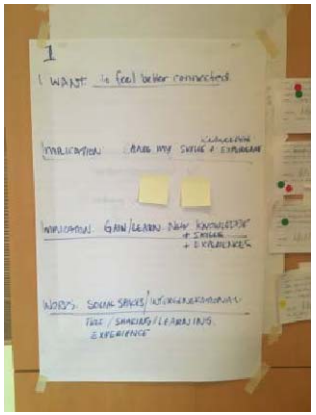

AFTER WORK PLAY

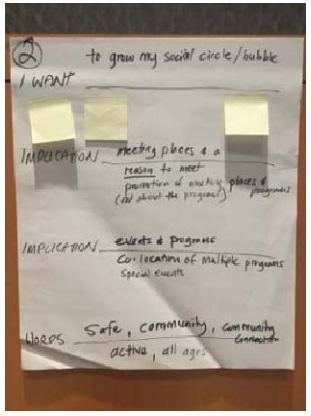

SOCIAL GATHERING CONNECTION

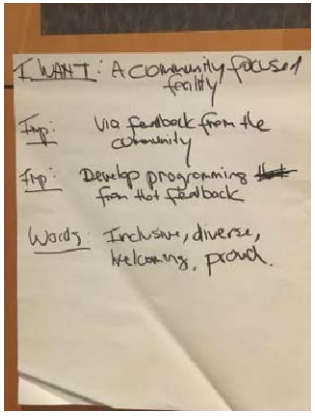












Needs Generation

PETS AND PCs needs statement:

I am a Small Business owner **TRYING TO GIVE MY KIDS A STEP UP SOCIALLY** by buying them all the newest things but my costs are higher than my income because my business is still growing which makes me feel inadequate and that I need to work harder.

TEEN needs statement

I am a Teen about to graduate **TRYING TO FIND TIME WITH MY FRIENDS** but my parents are very family focused on weekends because they are always working M-F which makes me feel sad.

CAREERS AND KIDS needs statement

I am a Fulltime Working Parent **TRYING TO GET SOME TIME FOR MYSELF** but I am spending too much time working and driving because everything is far which makes me feel exhausted, stressed out, bitter, and resentful.

BOOMERANG CITY needs statement

I am a Recent High School Graduate **TRYING TO KEEP SOME INDEPENDANCE** but I'm living at home because of COVID which makes me feel frustrated.

HERITAGE HUB needs statement

I am a Mother of Young Teens **TRYING TO JUGGLE FAMILY, WORK AND FIND TIME FOR MYSELF** but I am not able (fixed schedule) because programs are not offered when I am free which makes me feel frustrated.

ACTIVE SENIOR needs statement

I am a Recently Retired Mother **TRYING TO TOP UP MY PENSION**, but my kids are at home because of cost of living which makes me feel overwhelmed.

IMPLICATION: access to outdoor activities

IMPLICATION: easy trails for seniors who are isolated, need exercise

IMPLICATION: share and gain knowledge, skills + experience

IMPLICATION: meeting places and a reason to meet

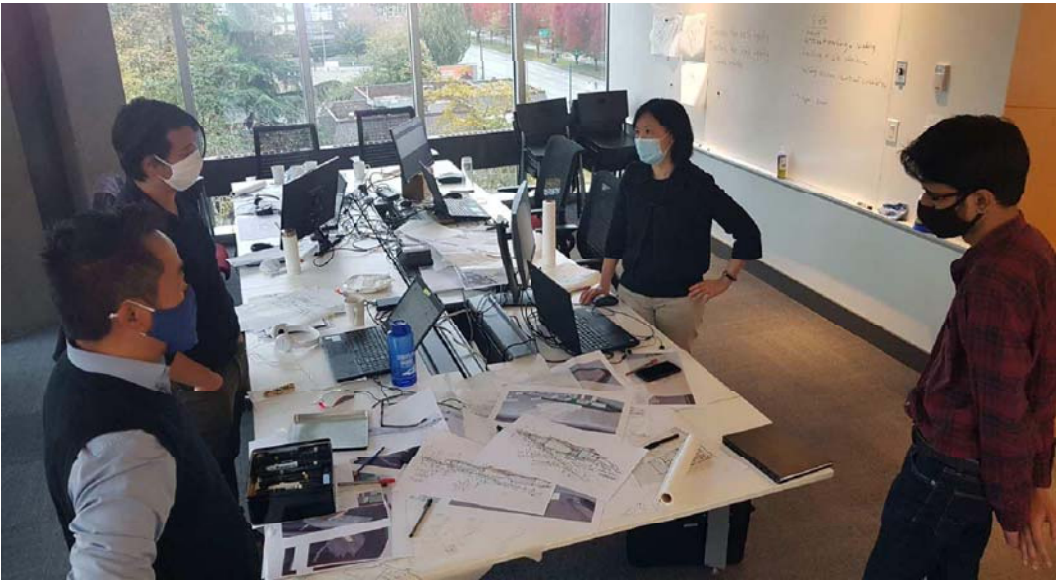
IMPLICATION: create open and inclusive spaces;

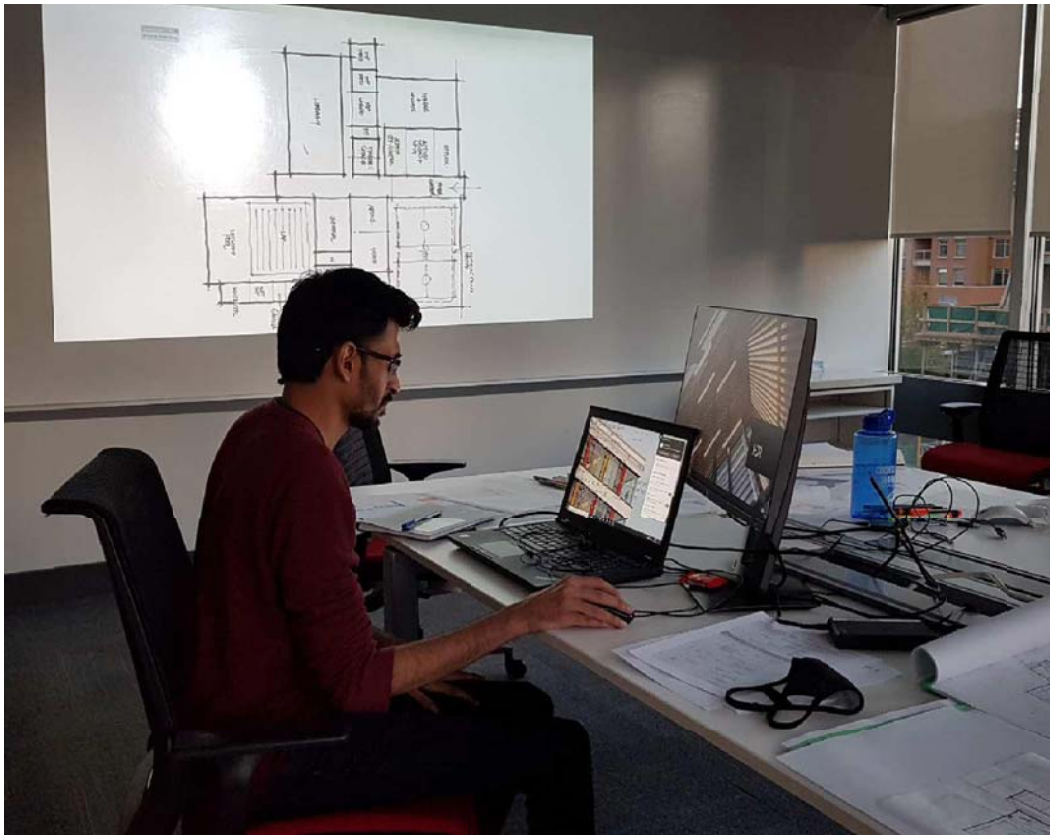
IMPLICATION: protect and incorporate natural elements (rocks, water, wood)

Design Charrette

Design Charrette Process

Over the course of three days, +/-40 City of Coquitlam expert stakeholders participated in an intensive three-session design charrette.





DAY 1

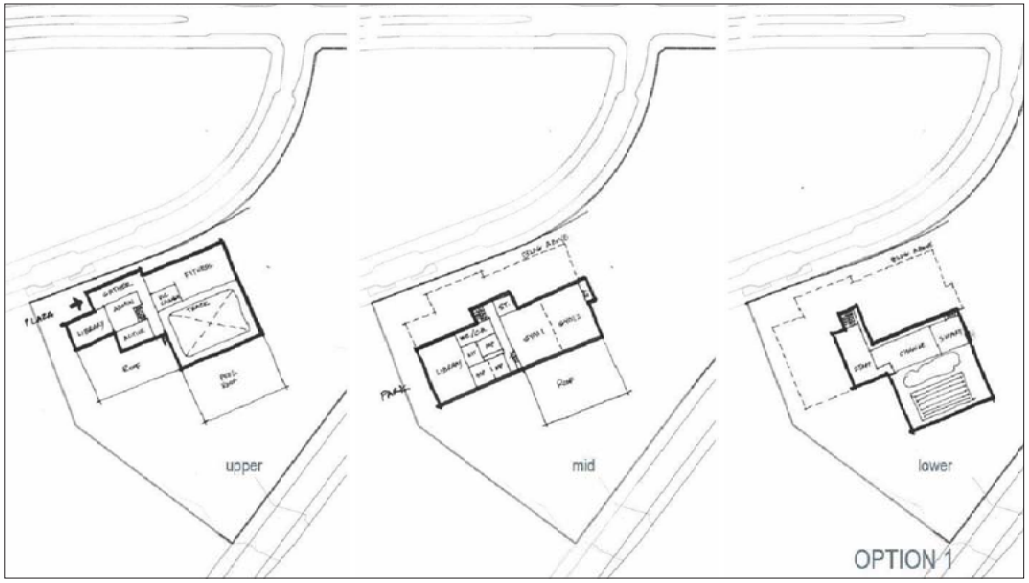
The first session was a fast paced, and interactive workshop specifically developed to translate quality of life insights discovered during the public and stakeholder engagement into opportunities for educational, social, health & wellness, and recreational programming. The discussion allowed HDR to create building plan layouts for review at the end of the first day.

DAY 2

In the second session the site context/site analysis, passive sustainability findings from background research was shared to elicit stakeholder feedback, ideas, and areas of concern. Opportunities for the building layouts developed in Day 1, site design, parking, programming, spatial adjacency, and stacking were also explored. The input received was captured and internalized to provide direction regarding preferred options for the project team to explore over the next day.

DAY 3

Based on the stakeholder input of sessions 1 and 2, the project team shared the concept alternatives that were developed over an intense couple days of internal project team collaboration. This session included a presentation of concepts and a group discussion to critique and respond to leading opportunities and constraints.



03 PROGRAM

03 PROGRAM

03.1 Comparison of City of Coquitlam Facilities

Program

The Major Recreation and Cultural Facilities Road Map ties into a number of existing strategies and policies, which are listed in the introduction of this report. Each of these strategies include at least one goal, objective, recommendation, or action relevant to the Major Recreation and Cultural Facilities Road Map, including:

Aquatic Services & Infrastructure Strategy:

- Maintaining and retrofitting existing indoor aquatic centres (CCAC and PSLC) as well as building new indoor aquatic centres in the Northeast and Southwest areas of Coquitlam.

Arena Services & Facilities Strategy:

- Examining options to increase the supply of arena services in Coquitlam to meet future ice needs, including options for new City facilities and/or a continued partnership opportunity or new P3 partnership.

Arts, Culture & Heritage Strategic Plan:

- Optimizing City-Owned Buildings and Spaces
- Assessing Long-Term Heritage Facility Requirements
- Planning for the Future Facility Requirements of Place des Arts
- Reviewing the Long-Term Need for a Larger Theatre

Public Art Policy:

- Including public art as part of the capital construction for proposed facility sites

Senior Services Strategy:

- Monitoring the concentration of seniors throughout the City, particularly with respect to the location of the different community facilities to ensure that adequate opportunities for engagement are available
- Incorporating flexible program space for seniors within the redevelopment of Place Maillardville, the planning of the Coquitlam YMCA and future facilities in the northeast.
- Ensuring seniors can easily and safely get to and from a recreation centre, park or an event.
- Continuing to create a welcoming, older adult focused facility environment during the day with programs and services that meet seniors' needs and interests

Tennis & Pickleball Services and Facilities Strategy:

- Ensure pickleball lines are added to the future Northeast recreation complex gymnasium

Youth Strategy:

- Creating Additional Youth-Friendly Areas in Existing Indoor Facilities
- Creating Youth and Young Adult Spaces in the Design of New Facilities

In addition to these, The Facility Allocation Policy guides the fair, equitable, transparent and consistent facility allocation decisions in the City.

A balanced approach to the program has been taken and consider the above strategies alongside of public engagement results. The first priority of Parks, Recreation, and Culture is to provide core services that serve the greatest number of residents.

Detailed room by room areas of three program options – Full Program "All In", Optimized Program, and Reduced Program are presented in comparison to each other in the following pages. The gross floor area of a two rink arena has been included at the end of the All In program and is separated so that it can be added or deleted in any of the proposed program options.

03.2 Storefronts

The use of storefronts along Princeton Avenue, in commercial developments may also be an opportunity for phasing in portions of the new community centre. Programs that are suited to be separated and remote from the main community centre include:

- Library
- Fitness
- Childcare

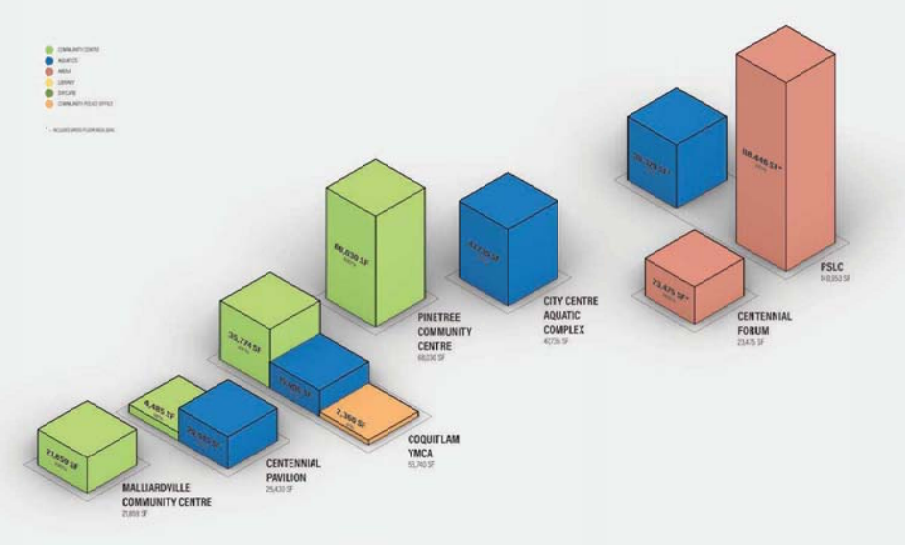
Ideally programs that could standalone would work best in a storefront environment. Having remote recreation staff at an alternate site from the main community centre is possible. However since there would be no supervisor at the storefront location, additional staff will be required to run those storefront programs.

Comparison of City of Coquitlam Facilities

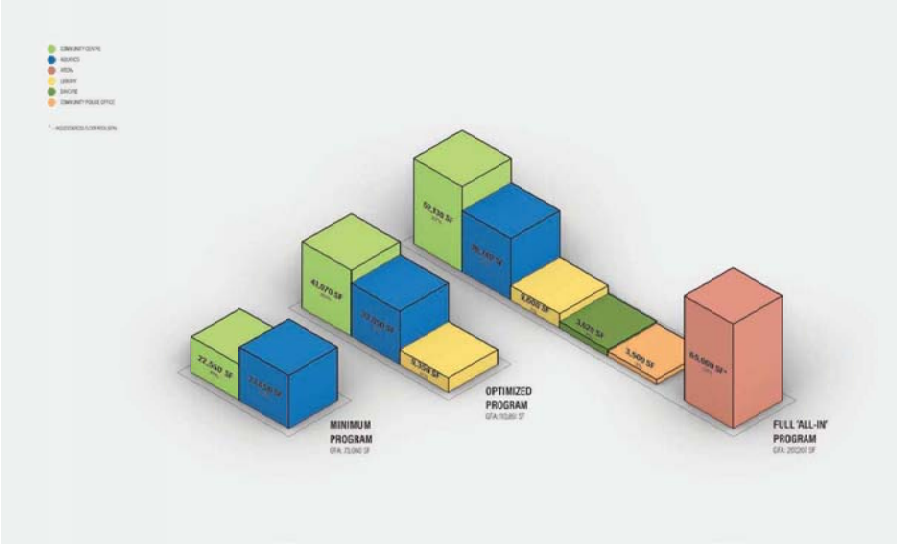
Seven Coquitlam facilities were reviewed with respect to program room type and sizes, and overall facility size. The review allows for a comparison of the new Northeast Community Centre program options with the following facilities:

- Centennial Forum
- Centennial Pavilion
- City Centre Aquatic Complex
- Maillardville Community Centre
- Coquitlam YMCA
- Pinetree Community Centre
- Poirier Sport and Leisure Centre

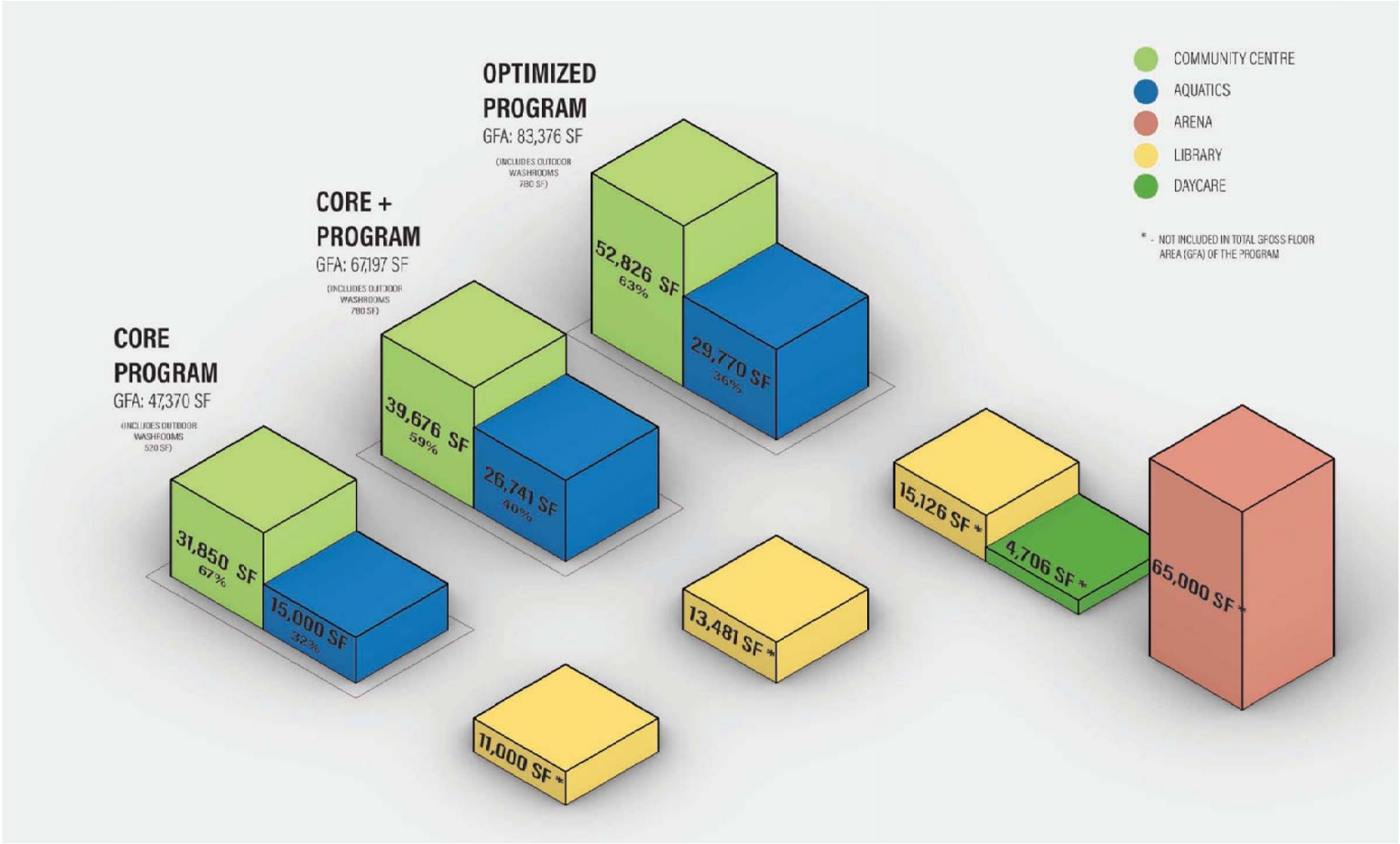
Existing Facilities Program Comparison



New Program Options Comparison



NECC Program Comparison



03.3 Program Table

FULL PROGRAM - 'ALL IN'			OPTIMIZED PROGRAM			REDUCED PROGRAM - 'MIN.'		
NET AREA (SF)	ROOM		NET AREA (SF)	ROOM		NET AREA (SF)	ROOM	
	Outdoor			**Outdoor**			**Outdoor**	
600	Outdoor Washrooms		600	Outdoor Washrooms		400	Outdoor Washrooms	
1,200	Outdoor Covered Space (no walls)		1,200	Outdoor Covered Space (no walls)		1,200	Outdoor Covered Space (no walls)	
	Sub-Total Outdoor	**1,800**		**Sub-Total Outdoor**	**1,800**		**Sub-Total Outdoor**	**1,600**
	Aquatics			**Aquatics**			**Aquatics**	
5,490	Lap Pool (8 lane)		4,150	Lap Pool (6 lane)		4,150	Lap Pool (6 lane)	
4,000	Warm Water Leisure Pool		3,500	Warm Water Leisure Pool		3,500	Warm Water Leisure Pool	
1,000	Whirlpool		600	Whirlpool		600	Whirlpool	
200	Steam Room		200	Steam Room		200	Steam Room	
200	Sauna		200	Sauna		200	Sauna	
6,000	Change Facilities		6,000	Change Facilities		6,000	Change Facilities	
600	Wet Multipurpose Room		600	Wet Multipurpose Room		600	Wet Multipurpose Room	
800	Waterslide		0	Waterslide		0	Waterslide	
200	Climbing Wall		200	Climbing Wall		200	Climbing Wall	
7,500	Deck Circulation Space		7,500	Deck Circulation Space		7,500	Deck Circulation Space	
500	Deck Viewing Space		0	Deck Viewing Space		0	Deck Viewing Space	
2,500	Staff Spaces		2,500	Staff Spaces		2,500	Staff Spaces	
5,000	Support Spaces including Pool Mechanical, excl. roof penthouses		5,000	Support Spaces including Pool Mechanical, excl. roof penthouses		5,000	Support Spaces including Pool Mechanical, excl. roof penthouses	
2,150	Below Deck Service Corridor		0	Below Deck Service Corridor		0	Below Deck Service Corridor	
600	Storage Space		600	Storage Space		600	Storage Space	
2,000	Administration and Staff Areas		2,000	Administration and Staff Areas		2,000	Administration and Staff Areas	
	Sub-Total Aquatics	**38,740**		**Sub-Total Aquatics**	**33,050**		**Sub-Total Aquatics**	**33,050**
	Library			**Library**			**Library**	
180	Service		180	Service		0	Service	
3,120	Collections		3,120	Collections		0	Collections	
1,000	Digital Service, Computers		1,000	Digital Service, Computers		0	Digital Service, Computers	
2,300	Children's Services		2,300	Children's Services		0	Children's Services	
450	Teen Zone		450	Teen Zone		0	Teen Zone	
600	Silent Study Rooms		600	Silent Study Rooms		0	Silent Study Rooms	
450	Multi-purpose Room		450	Multi-purpose Room		0	Multi-purpose Room	
1,250	Workroom, Office, Staff Spaces		1,250	Workroom, Office, Staff Spaces		0	Workroom, Office, Staff Spaces	
250	Rental Library		0	Rental Library		0	Rental Library	
	Sub-total Library	**9,600**		**Sub-total Library**	**9,350**		**Sub-total Library**	**0**
	Community Centre			**Community Centre**			**Community Centre**	
4,000	Entry & Gathering (non-programmed)		2,000	Entry & Gathering (non-programmed)		1,500	Entry & Gathering (non-programmed)	
2,000	Indoor Playground, Exploratorium		0	Indoor Playground, Exploratorium		0	Indoor Playground, Exploratorium	
2,000	Administration and Control		2,000	Administration and Control		1,800	Administration and Control	
0	Partnership Offices		0	Partnership Offices		0	Partnership Offices	
0	Half Gymnasium		0	Half Gymnasium		3,000	Half Gymnasium	
15,000	Double Gymnasium		14,000	Double Gymnasium		7,000	Single Gymnasium	
1,500	Gym Storage		1,400	Gym Storage		1,000	Gym Storage	
8,000	Fitness & Weights		7,000	Fitness & Weights		0	Fitness & Weights	
700	Spin Room		0	Spin Room		0	Spin Room	

NET AREA (SF)	ROOM		NET AREA (SF)	ROOM		NET AREA (SF)	ROOM	
2,000	Active Studio		2,000	Active Studio		0	Active Studio	
200	Active Studio Storage		200	Active Studio Storage		0	Active Studio Storage	
4,000	Walking/Running Track		4,000	Walking/Running Track		0	Walking/Running Track	
0	Visual Arts Instruction (locate in medium MP room)		0	Visual Arts Instruction		0	Visual Arts Instruction	
0	Storage for Arts room		0	Storage for Arts room		0	Storage for Arts room	
0	Visual Arts Display Space (included in overall Community Centre)		0	Visual Arts Display Space Included in overall Community Centre		0	Visual Arts Display Space Included in overall Community Centre	
500	Community Kitchen		500	Community Kitchen		300	Support Kitchen	
1,200	Maker Space		0	Maker Space		0	Maker Space	
360	Storage for Maker Space		0	Storage for Maker Space		0	Storage for Maker Space	
1,200	Social Room (Youth, Seniors, etc)		0	Social Room (Youth, Seniors, etc)		0	Social Room (Youth, Seniors, etc)	
150	Sensory space		0	Sensory space		0	Sensory space	
3,000	Multi-purpose Large		2,400	Multi-purpose Large		2,400	Multi-purpose Large	
300	Storage for MP Large		300	Storage for MP Large		240	Storage for MP Large	
1,100	Multi-purpose Medium		1,100	Multi-purpose Medium		1,100	Multi-purpose Medium	
110	Storage for MP Medium		110	Storage for MP Medium		110	Storage for MP Medium	
1,000	Multi-purpose Medium		1,000	Multi-purpose Medium		1,000	Multi-purpose Medium	
100	Storage for MP Medium		100	Storage for MP Medium		100	Storage for MP Medium	
0	Multi-purpose Small		600	Multi-purpose Small		0	Multi-purpose Small	
0	Storage for MP Small		60	Storage for MP Small		0	Storage for MP Small	
600	Multi-purpose SmallMeeting Room		0	Multi-purpose SmallMeeting Room		0	Multi-purpose SmallMeeting Room	
60	Storage for MP Small		0	Storage for MP Small		0	Storage for MP Small	
250	Board Room		0	Board Room		0	Board Room	
1,800	Washrooms		1,500	Washrooms		1,200	Washrooms	
1,000	Change Facilities		800	Change Facilities		800	Change Facilities	
0	Community Storage		0	Community Storage		0	Community Storage	
	Sub-total Community Centre	**52,130**		**Sub-total Community Centre**	**41,070**		**Sub-total Community Centre**	**21,550**
	Daycare			**Daycare**			**Daycare**	
0	Shared spaces (shared in Community Centre)		0	Shared spaces (shared in Community Centre)		0	Shared spaces (shared in Community Centre)	
120	Car Seat and Stroller Storage			Car Seat and Stroller Storage			Car Seat and Stroller Storage	
1,450	Combined Infant/Toddler up to 36 mos - 12 spaces		0	Combined Infant/Toddler up to 36 mos - 12 spaces		0	Combined Infant/Toddler up to 36 mos - 12 spaces	
2,050	School Age (30 mos up) 25 spaces		0	School Age (30 mos up) 25 spaces		0	School Age (30 mos up) 25 spaces	
0	Preschool (30 mos up for 4 hrs per day) 20 spaces (accommodated in Community Centre)		0	Preschool (30 mos up for 4 hrs per day) 20 spaces (accommodated in Community Centre)		0	Preschool (30 mos up for 4 hrs per day) 20 spaces (accommodated in Community Centre)	
0	K-12 years - 24 spaces (accommodated in Community Centre)		0	K-12 years - 24 spaces		0	K-12 years - 24 spaces	
	Sub-total Daycare	**3,620**		**Sub-total Daycare**	**0**		**Sub-total Daycare**	**0**
	Community Police			**Community Police**			**Community Police**	
3,500	Integrated RCMP Community Office	**3,500**	0	Integrated RCMP Community Office		0	Integrated RCMP Community Office	
109,390	subtotal		85,270	subtotal		56,200	subtotal	
1.3	gross up factor		1.3	gross up factor		1.3	gross up factor	
142,207	**TOTAL GFA**		**110,851**	**TOTAL GFA**		**73,060**	**TOTAL GFA**	
	Arena							
65,000	Ice Arena including Change Facilities and Support Spaces							
207,207	**TOTAL GFA INCLUDING 2 INDOOR RINKS**							

Subsequent to the Charrette, the staff and consultant team refined the program options to align with possible budget scenarios as follows:

OPTIMIZED PROGRAM			CORE+ PROGRAM			CORE PROGRAM		
NET AREA (SF)	ROOM		NET AREA (SF)	ROOM		NET AREA (SF)	ROOM	
	Outdoor			**Outdoor**			**Outdoor**	
600	Outdoor Washrooms		600	Outdoor Washrooms		400	Outdoor Washrooms	
1,200	Outdoor Covered Space (no walls)		1,200	Outdoor Covered Space (no walls)		0	Outdoor Covered Space (no walls)	
4,000	Outdoor Space for Licensed Daycare		4,000	Outdoor Space for Licensed Daycare		4,000	Outdoor Space for Licensed Daycare	
	Sub-Total Outdoor	**5,800**		**Sub-Total Outdoor**	**1,800**		**Sub-Total Outdoor**	**400**
	gross up for outdoor washrooms	**1.3**		**gross up for outdoor washrooms**	**1.3**		**gross up for outdoor washrooms**	**1.3**
	GFA Outdoor Washrooms	**780**		**GFA Outdoor Washrooms**	**780**		**GFA Outdoor Washrooms**	**520**
	Aquatics (PSLC Pool with increased lane width)			**Aquatics (PSLC Pool with Reductions)**			**Aquatics (POCO model)**	
4,150	Lap Pool (6 lane)		2,800	Lap Pool (4 lane)		1,400	Lap Pool (portion of combined tank)	
3,000	Warm Water Leisure Pool		2,140	Warm Water Leisure Pool without warm lap lanes		3,100	Warm Water Leisure Pool (portion of combined tank)	
430	Whirlpool		430	Whirlpool		400	Whirlpool	
125	Steam Room		125	Steam Room		125	Steam Room	
125	Sauna		125	Sauna		125	Sauna	
3,200	Change Facilities includes internal walls		3,200	Change Facilities		2,400	Change Facilities includes internal walls	
500	Wet Multipurpose Room (includes storage)		500	Wet Multipurpose Room (includes storage)		400	Wet Multipurpose Room	
excluded	Waterslide		excluded	Waterslide		n/a	Waterslide	
included	Climbing Wall		excluded	Climbing Wall		n/a	Climbing Wall	
4,620	Deck Circulation Space		4,500	Deck Circulation Space		3,200	Deck Circulation Space	
300	Deck Viewing Space		300	Deck Viewing Space		200	Deck Viewing Space	
500	Staff Spaces		500	Staff Spaces		500	Staff Spaces	
4,400	Support Spaces incl. Pool Mechanical, excl. roof penthouses		4,400	Support Spaces incl. Pool Mechanical, excl. roof penthouses		2,725	Support Spaces incl. Pool Mechanical, excl. roof penthouses	
excluded	Below Deck Service Corridor (2150 s.f. typical)		excluded	Below Deck Service Corridor		n/a	Below Deck Service Corridor	
550	Storage Space		550	Storage Space		425	Storage Space	
1,000	Administration and Staff Areas		1,000	Administration and Staff Areas		n/a	Administration and Staff Areas	
	Sub-total Pool	**22,900**		**Sub-total Pool**	**20,570**		**Sub-total Pool**	**15,000**
	gross up	**1.30**		**gross up**	**1.30**		**gross up**	**incl**
	Total Aquatics (GFA)	**29,770**		**Total Aquatics (GFA)**	**26,741**		**Total Aquatics (GFA)**	**15,000**
	Library (based on Richmond Public Library)			**Library (based on Richmond Public Library)**			**Library**	
108	Service		175	Service		0	Service	
3,014	Collections		3,120	Collections		0	Collections	
872	Digital Service, Computers		980	Digital Service, Computers		0	Digital Service, Computers	
2,260	Children's Services		2,300	Children's Services		0	Children's Services	
450	Teen Zone		430	Teen Zone		0	Teen Zone	
753	Silent Study Rooms		600	Silent Study Rooms		0	Silent Study Rooms	
861	Multi-purpose Room		470	Multi-purpose Room		0	Multi-purpose Room	
1,668	Circulation Sorting Workroom, Office, Staff Spaces		1,250	Circulation Sorting Workroom, Office, Staff Spaces		0	Circulation Sorting Workroom, Office, Staff Spaces	
1,076	Living Room		670	Living Room		0	Living Room	
323	Group Meeting Rooms		375	Group Meeting Rooms		0	Group Meeting Rooms	
250	Rental Library (Tools, Musical Instruments, Other)		0	Rental Library (Tools, Musical Instruments, Other)		0	Rental Library (Tools, Musical Instruments, Other)	
	Sub-total Library	**11,635**		**Sub-total Library**	**10,370**		**Sub-total Library**	**8,500**
	gross up	**1.3**		**gross up**	**1.3**		**gross up**	**1.3**
	GFA Library	**15,126**		**GFA Library**	**13,481**		**GFA Library**	**11,000**
	Community Centre			**Community Centre**			**Community Centre**	
2,800	Entry & Gathering (non-programmed)		2,000	Entry & Gathering (non-programmed)		1,500	Entry & Gathering (non-programmed)	
0	Indoor Playground, Exploratorium		0	Indoor Playground, Exploratorium		0	Indoor Playground, Exploratorium	
	Administration and Control 1320 sf of list below)			Administration and Control (1320 sf of list below)			Administration and Control 1320 sf of list below)	
200	Reception 2-3 staff		200	Reception 2-3 staff		200	Reception 2-3 staff	
325	Open Workroom 4-5 staff (65 sf each)		260	Open Workroom 3-4 staff (65 sf each)		260	Open Workroom 3-4 staff (65 sf each)	
120	Manager		120	Manager		120	Manager	
200	Meeting room		200	Meeting room		200	Meeting room	
120	Fitness Office (40 sf each)		120	Fitness Office (40 sf each)		120	Fitness Office (40 sf each)	
300	Staff Room		300	Staff Room		300	Staff Room	
120	Maintenance Manager		120	Maintenance Manager		120	Maintenance Manager	
0	Partnership Offices		0	Partnership Offices		0	Partnership Offices	
0	Half Gymnasium		0	Half Gymnasium		3,000	Half Gymnasium	
14,000	Double Gymnasium		12,000	Double Gymnasium		7,000	Single Gymnasium	
1,000	Gym Storage		1,000	Gym Storage		760	Gym Storage	
6,500	Fitness & Weights		5,000	Fitness & Weights		5,000	Fitness & Weights	

NET AREA (SF)	ROOM	
0	Spin Room	
2,000	Active Studio	
200	Active Studio Storage	
4,000	Walking/Running Track	
0	Visual Arts Instruction (locate in medium MP room)	
0	Storage for Arts room	
0	Visual Arts Display Space Included in overall Community Centre	
500	Community Kitchen	
0	Maker Space	
0	Storage for Maker Space	
0	Social Room (Youth, Seniors, etc)	
150	Sensory space	
2,400	Multi-purpose Large	
240	Storage for MP Large	
1,000	Multi-purpose Medium	
100	Storage for MP Medium	
1,000	Multi-purpose Medium	
100	Storage for MP Medium	
0	Multi-purpose Small	
0	Storage for MP Small	
600	Multi-purpose Small/Meeting Room	
60	Storage for MP Small	
0	Board Room	
1,800	Washrooms	
800	Change Facilities	
0	Community Storage	
	Sub-total Community Centre	**40,635**
	gross up	**1.3**
	GFA Community Centre	**52,826**
	Daycare (Integrated)	
0	Shared spaces (shared in Community Centre)	
120	Car Seat and Stroller Storage	
1,450	Combined Infant/Toddler up to 36 mos - 12 spaces	
2,050	School Age (30 mos up) 25 spaces	
0	Preschool (30 mos up for 4 hrs per day) 20 spaces (accommodated in Community Centre)	
0	K-12 years - 24 spaces (accommodated in Community Centre)	
	Sub-total Daycare	**3,620**
	gross up	**1.3**
	GFA Daycare	**4,706**
	Community Police	
0	Integrated RCMP Community Office	**0**
	Outdoor Covered Area (not included in Total GFA)	1,200
	Outdoor Washrooms, Aquatics, Community Centre TOTAL GFA	**83,376**
	ARENA GFA - 2 INDOOR RINKS	**65000**

NET AREA (SF)	ROOM	
0	Spin Room	
2,000	Active Studio	
200	Active Studio Storage	
0	Walking/Running Track	
0	Visual Arts Instruction	
0	Storage for Arts room	
0	Visual Arts Display Space Included in overall Community Centre	
300	Community Kitchen	
0	Maker Space	
0	Storage for Maker Space	
0	Social Room (Youth, Seniors, etc)	
0	Sensory space	
2,400	Multi-purpose Large	
240	Storage for MP Large	
1,000	Multi-purpose Medium	
100	Storage for MP Medium	
0	Multi-purpose Medium	
0	Storage for MP Medium	
600	Multi-purpose Small	
60	Storage for MP Small	
0	Multi-purpose Small/Meeting Room	
0	Storage for MP Small	
0	Board Room	
1,500	Washrooms	
800	Change Facilities	
0	Community Storage	
	Sub-total Community Centre	**30,520**
	gross up	**1.3**
	GFA Community Centre	**39,676**
	Daycare (Integrated)	
0	Shared spaces (shared in Community Centre)	
	Car Seat and Stroller Storage	
0	Combined Infant/Toddler up to 36 mos - 12 spaces	
0	School Age (30 mos up) 25 spaces	
0	Preschool (30 mos up for 4 hrs per day) 20 spaces (accommodated in Community Centre)	
0	K-12 years - 24 spaces	
	Sub-total Daycare	**0**
	gross up	**1.3**
	GFA Daycare	**0**
	Community Police	
0	Integrated RCMP Community Office	
	Outdoor Covered Area	1,200
	Outdoor Washrooms, Aquatics, Community Centre TOTAL GFA	**67,197**

NET AREA (SF)	ROOM	
0	Spin Room	
0	Active Studio	
0	Active Studio Storage	
0	Walking/Running Track	
0	Visual Arts Instruction	
0	Storage for Arts room	
0	Visual Arts Display Space Included in overall Community Centre	
180	Support Kitchen	
0	Maker Space	
0	Storage for Maker Space	
0	Social Room (Youth, Seniors, etc)	
0	Sensory space	
2,400	Multi-purpose Large	
240	Storage for MP Large	
1,000	Multi-purpose Medium	
100	Storage for MP Medium	
0	Multi-purpose Medium	
0	Storage for MP Medium	
0	Multi-purpose Small	
0	Storage for MP Small	
0	Multi-purpose Small/Meeting Room	
0	Storage for MP Small	
0	Board Room	
1,200	Washrooms	
800	Change Facilities	
0	Community Storage	
	Sub-total Community Centre	**24,500**
	gross up	**1.3**
	GFA Community Centre	**31,850**
	Daycare (Integrated)	
0	Shared spaces (shared in Community Centre)	
	Car Seat and Stroller Storage	
0	Combined Infant/Toddler up to 36 mos - 12 spaces	
0	School Age (30 mos up) 25 spaces	
0	Preschool (30 mos up for 4 hrs per day) 20 spaces (accommodated in Community Centre)	
0	K-12 years - 24 spaces	
	Sub-total Daycare	**0**
	gross up	**1.3**
	GFA Daycare	**0**
	Community Police	
0	Integrated RCMP Community Office	
	Outdoor Covered Area	0
	Outdoor Washrooms, Aquatics, Community Centre TOTAL GFA	**47,370**

Notes:

PSLC Pool	24750 footprint + 5038 basement mech	29788
Arena	65000 Ice Arena including Change Facilities and Support Spaces	65000

04 SITE ASSESSMENT

04 SITE ASSESSMENT

04.1 Overall Burke Mountain Context

Burke Mountain Village will be the commercial and social hub of Burke Mountain in Northeast Coquitlam. The 15.8-hectare (39-acre) site is located east of Burke Mountain Creek and south of David Avenue.

The City of Coquitlam is the primary landowner of the Village lands, which is expected to house over 2,000 residential units (apartments and townhomes) and include 120,000 square feet of retail.*

**As described on the City of Coquitlam website*

OVERALL SITE CONTEXT AERIAL MAP

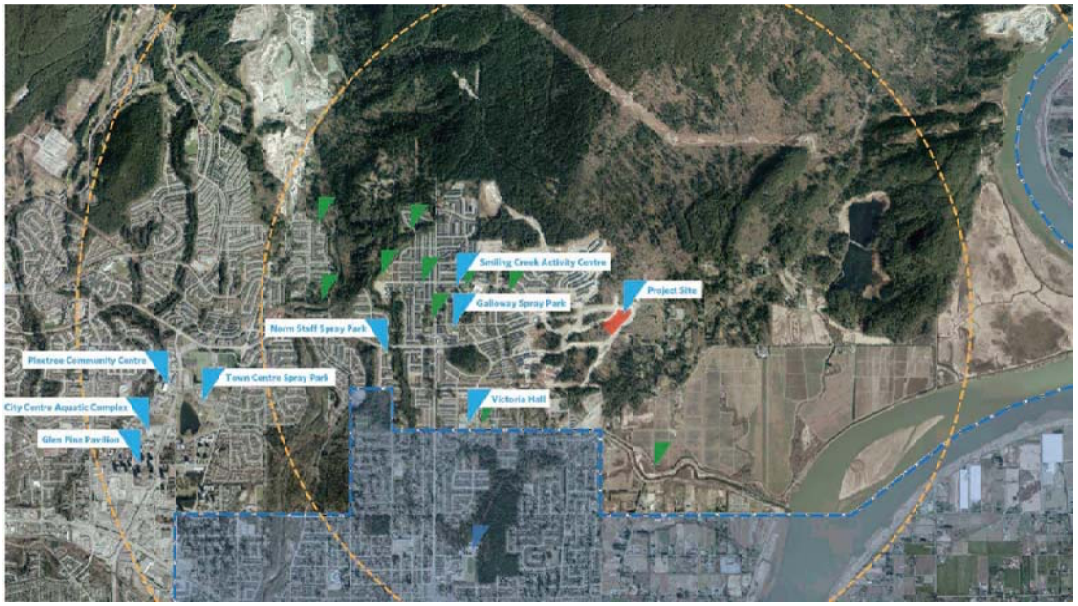
04.2 Immediate Context


Coquitlam Fire Station


Smiling Creek Elementary


Local Commercial


Local Residential



COMMUNITY PARKS AND AMENITIES

IMMEDIATE SITE CONTEXT

04.3 Three Sites

In addition to the primary site designated in the Partington Creek Neighbourhood Centre Master Plan, two additional sites were considered for the Northeast Community Centre to confirm that the selected location is optimal.

PROJECT SITE 1

Primary Community Centre site, located south of Princeton Avenue and bounded by David Avenue at the north and Burke Village Promenade to the southeast.

PROJECT SITE 2

Alternate Community Centre site, located north of Princeton Avenue and bounded by David Avenue at the north.

PROJECT SITE 3

Alternate Community Centre site, located south of Princeton Avenue and bounded by Mitchell Street at the west and Burke Village Promenade to the south.

Site Locations

Site Analysis: Site 1

Building Heights

Streetscapes

Terraces

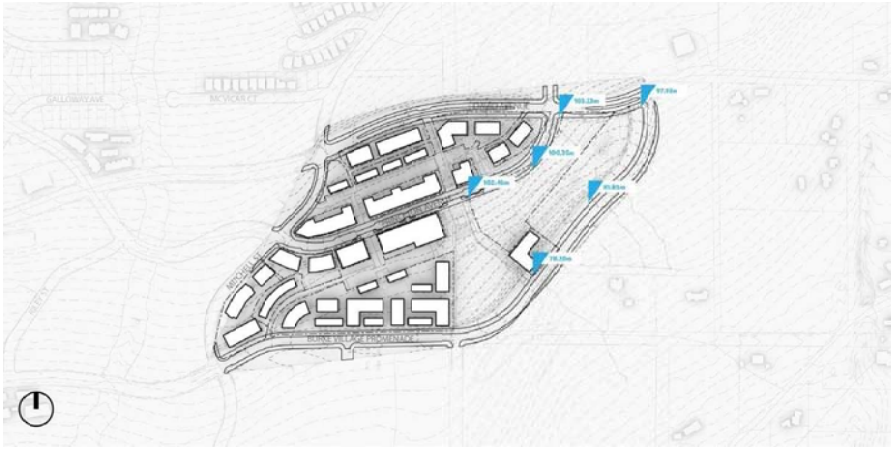
Land Use

Natural Water

Pedestrian

Cycling

Elevations



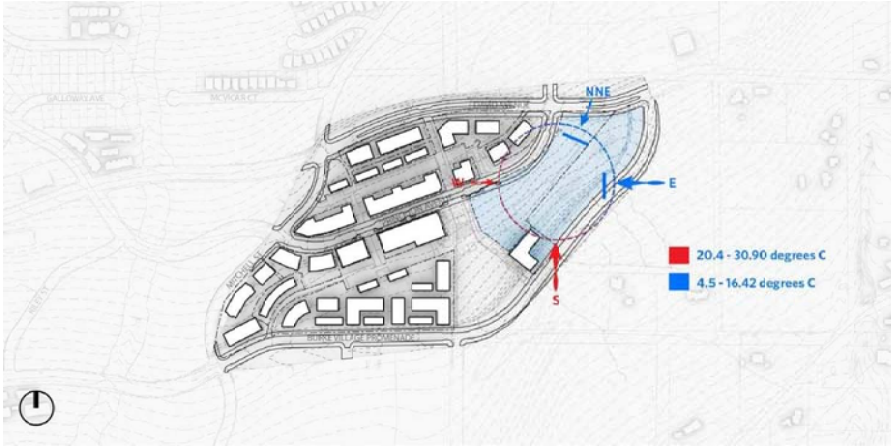
Parks

Fire Access

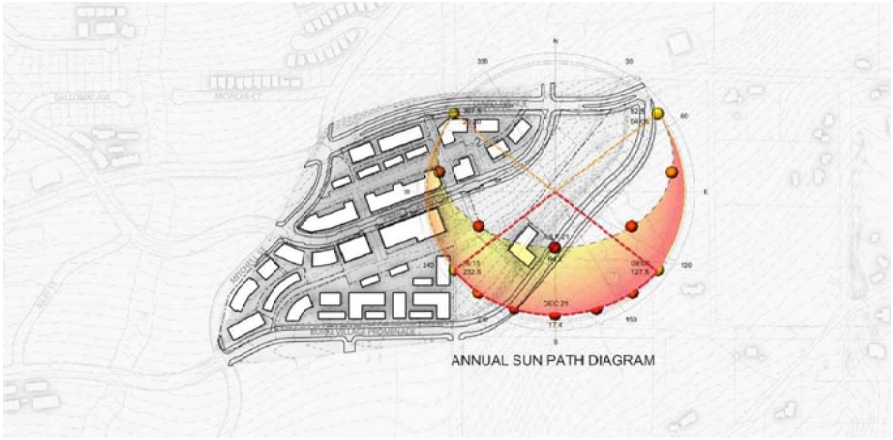
Vehicular

Site Drainage

Wind

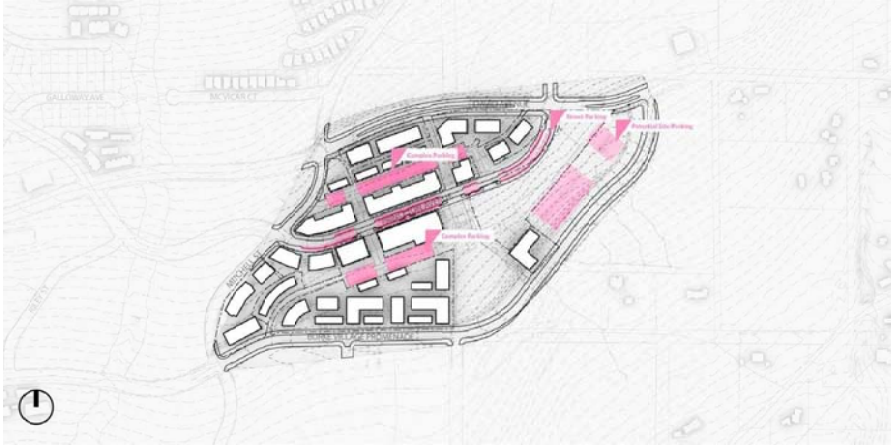


Solar

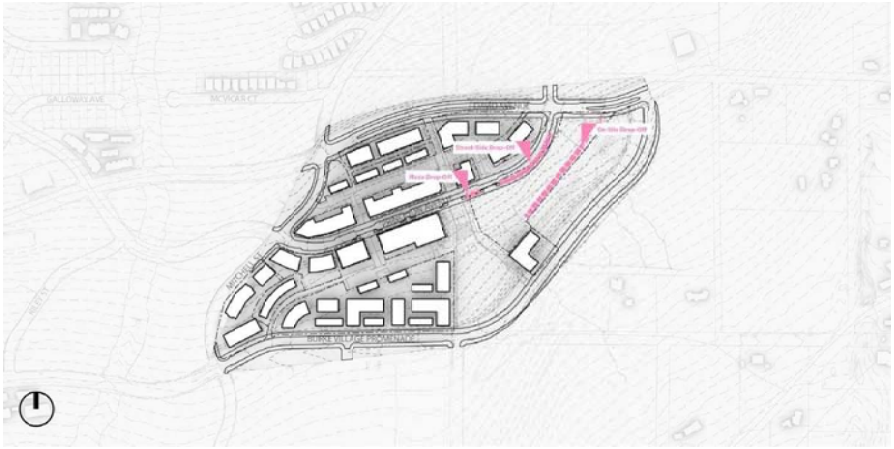


Future Parcels

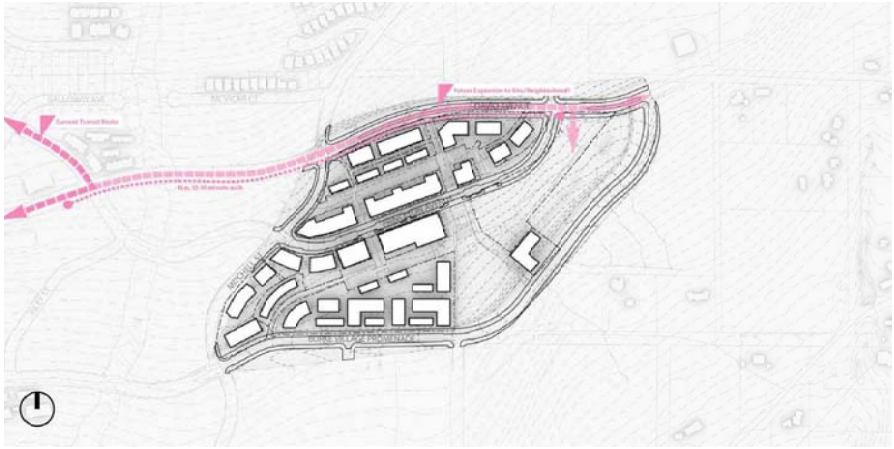
Parking



Drop-Off



Transit



Waste Collection

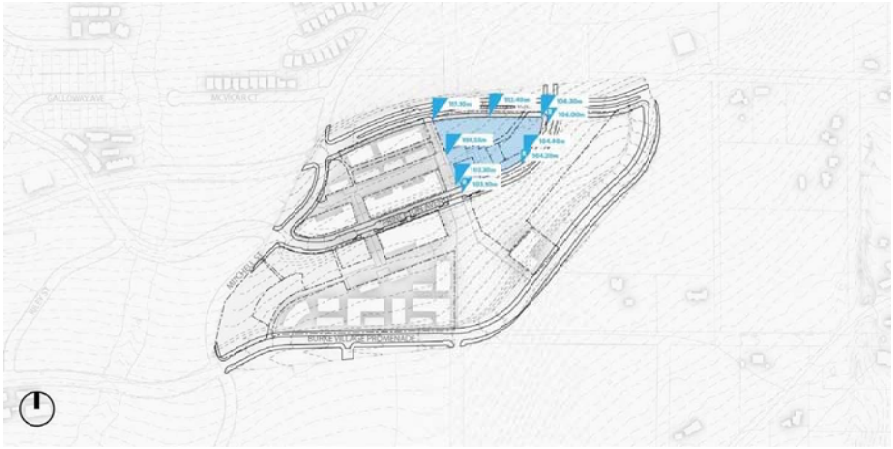
Site Analysis: Site 2

Terraces

Pedestrian

Cycling

Elevations



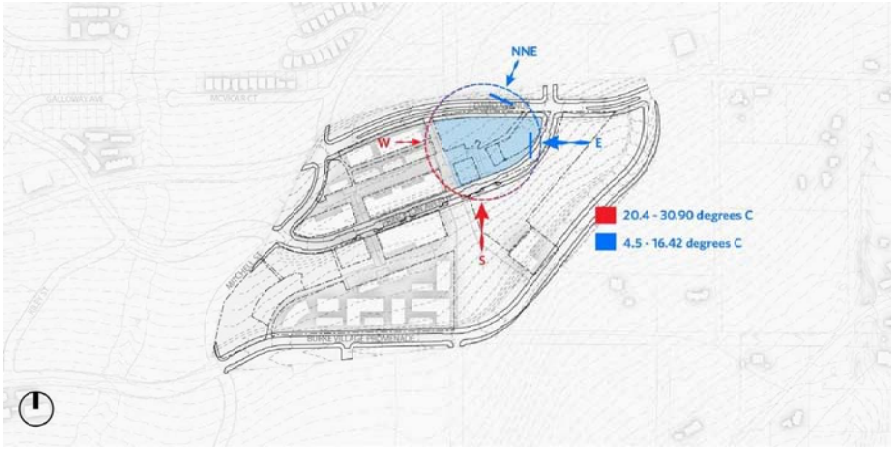
Parks

Fire Access

Vehicular

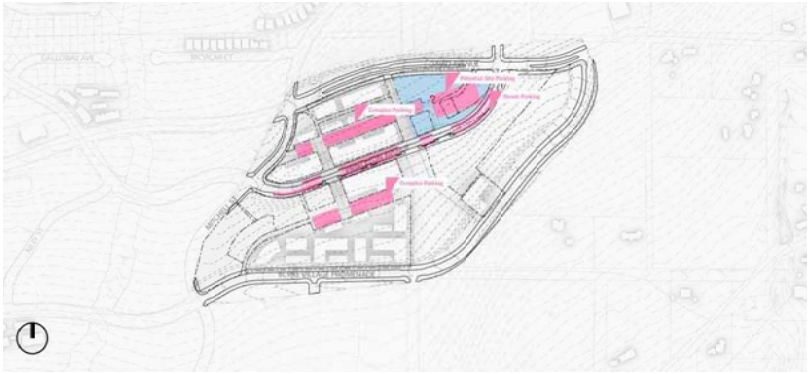
Drainage

Wind



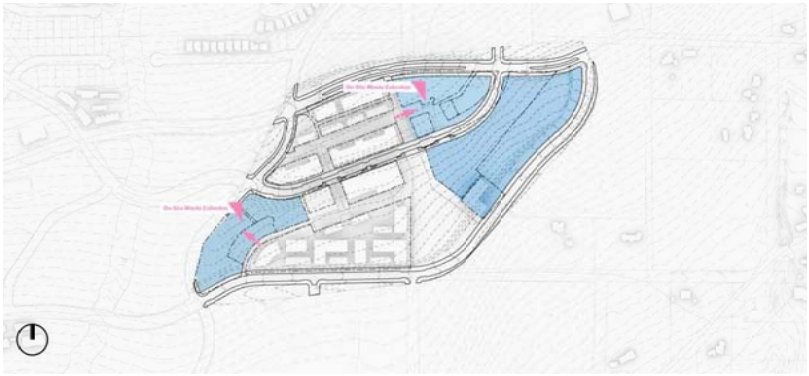
Drop-Off

Parking



Transit

Waste Collection



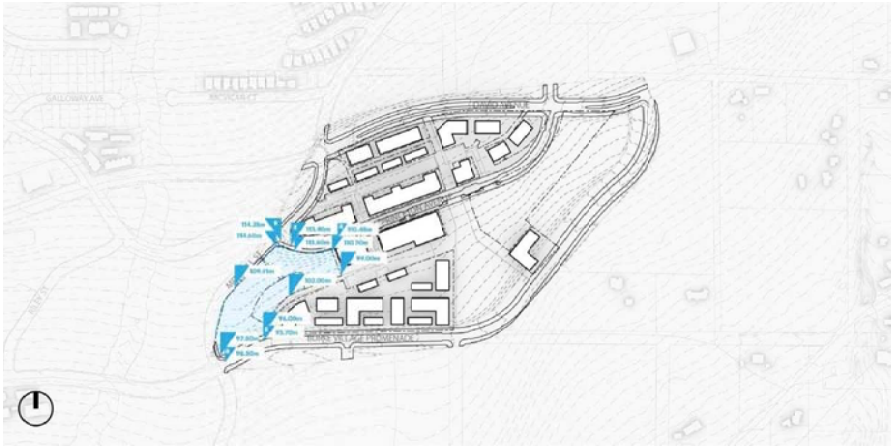
Site Analysis: Site 3

Terraces

Pedestrian

Cycling

Elevations

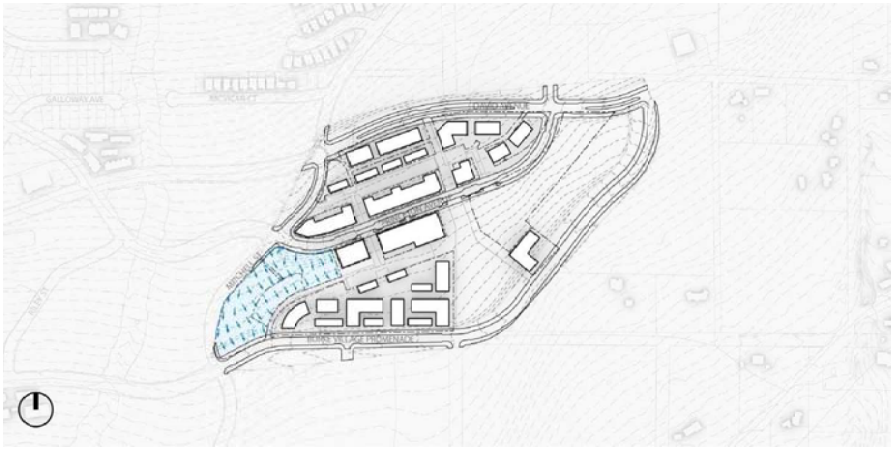


Parks

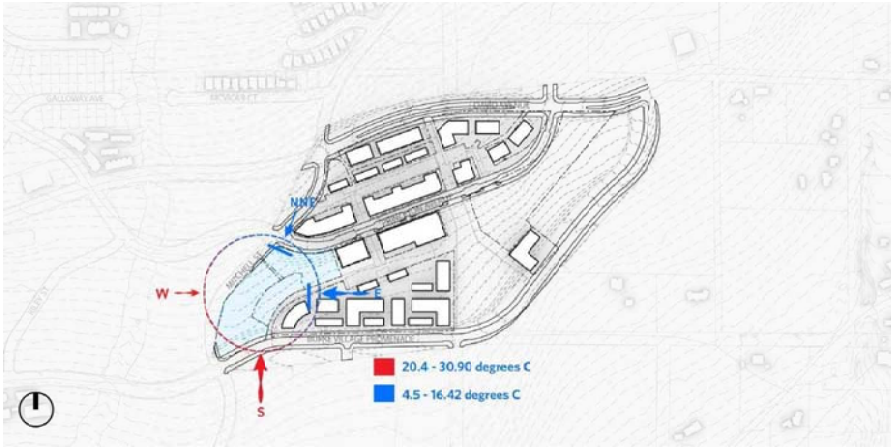
Fire Access

Vehicular

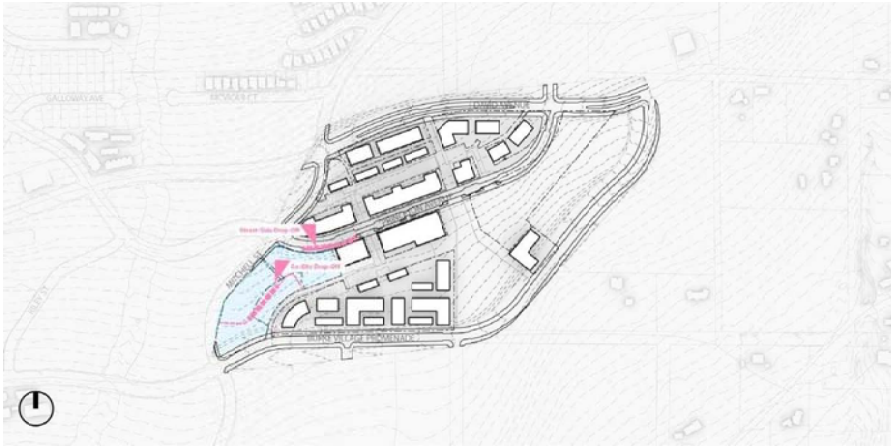
Drainage



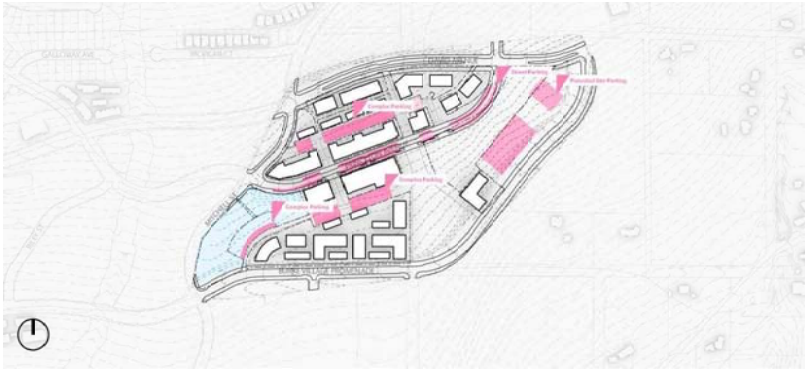
Wind



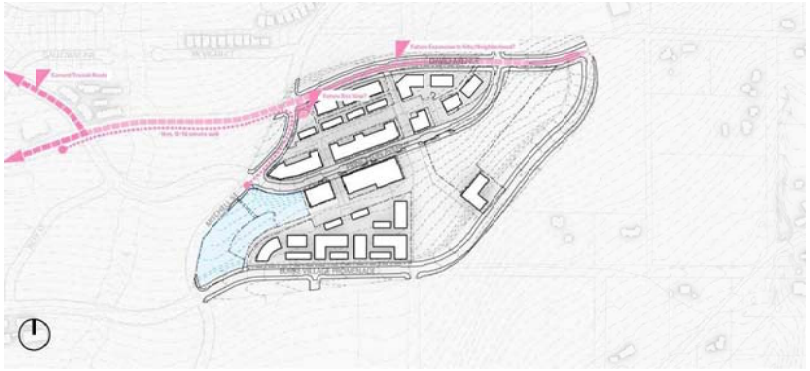
Drop-Off



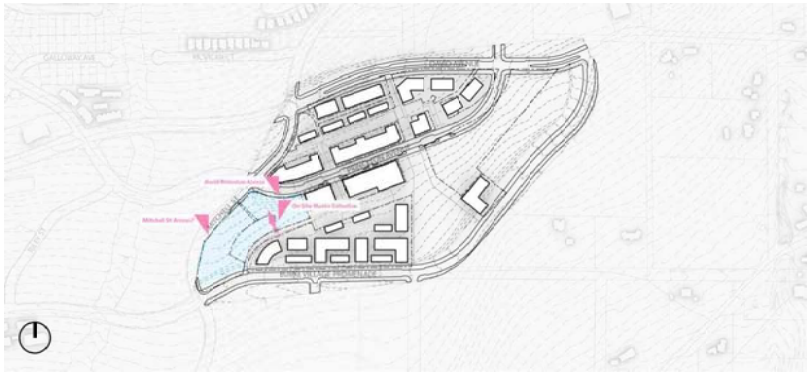
Parking



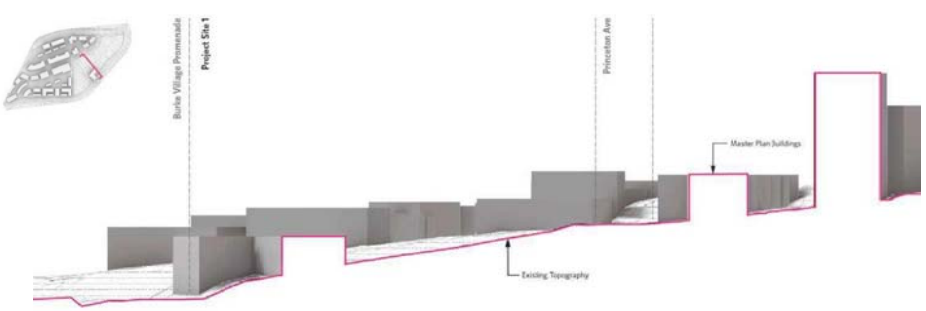
Transit



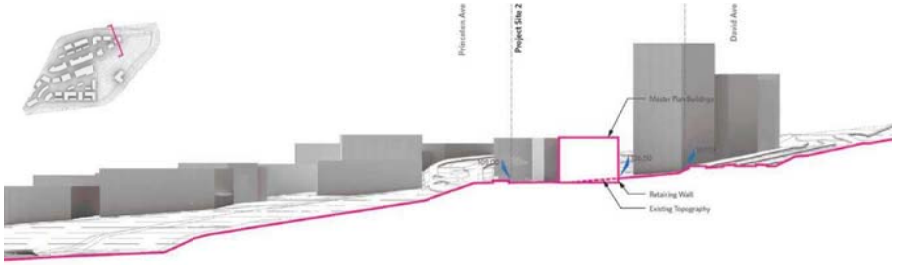
Waste Collection

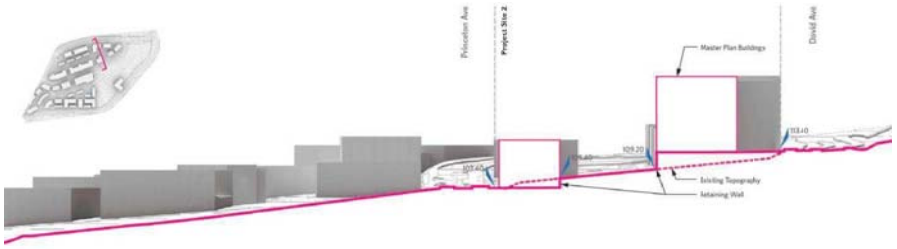


Site 1 Sections

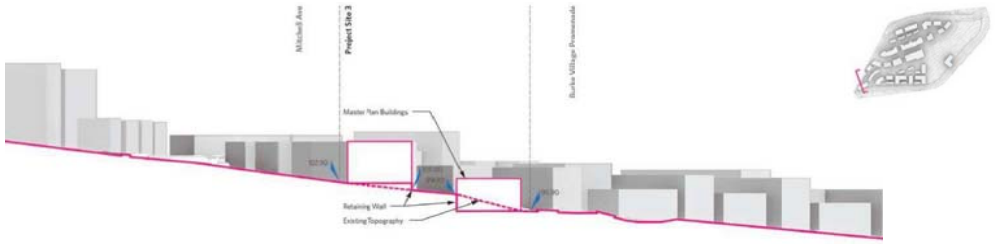


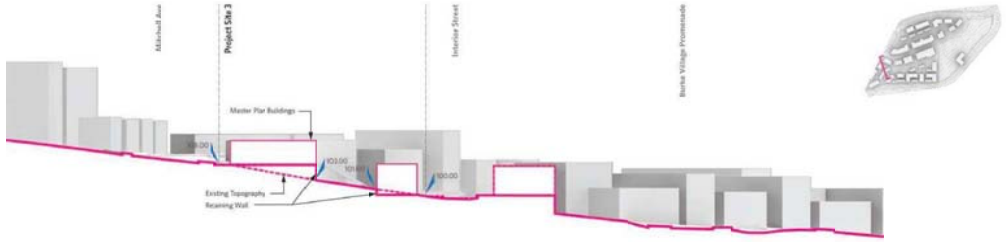
Site 2 Sections

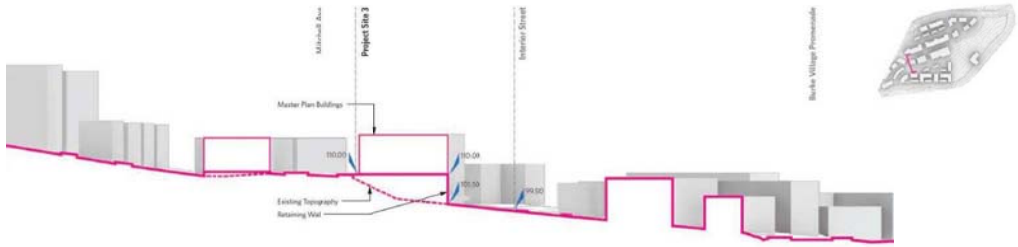




Site 3 Sections







05 CONCEPT DESIGN

05 CONCEPT DESIGN

05.1 Concept Design - Site 1

The Site

The concept design for Site 1 was explored during the 3 day Charrette and forms the basis of design for the Site 2 and Site 3 site analysis.

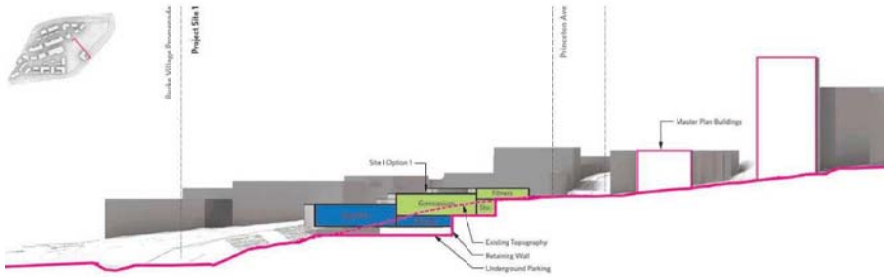
Key features of this site plan include:

- Corner entrance to the building is adjacent to the park to allow for maximum opportunities for a strong inside/outside connection.
- Continuation of building frontage along Princeton, aligned with buildings anticipated on adjacent parcel to the west.
- Opportunity for unobstructed views to the south.
- Location of parking and vehicle access from Burke Valley Parkway (BVP) is situated between the two natural watercourses.
- Main drop off at the south entrance of the building at the lower level. Limited drop off opportunities at main entrance along Princeton.
- Fire truck access to the main entrance, and emergency access to the south side of the building will be via BVP.
- Green areas to allow for surface water management and watercourse via rain gardens and bouldered swales.
- Parcel at the southwest corner of the site to be consolidated with the civic site in order to allow for parking access.
- Arenas can be accommodated to the east of the new facility.

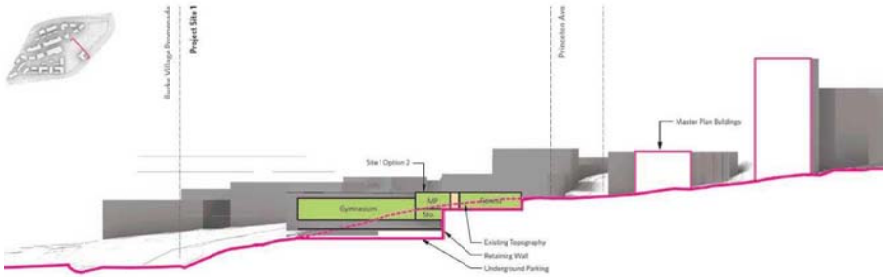
Option 1

Option 2

Option 1



Option 2



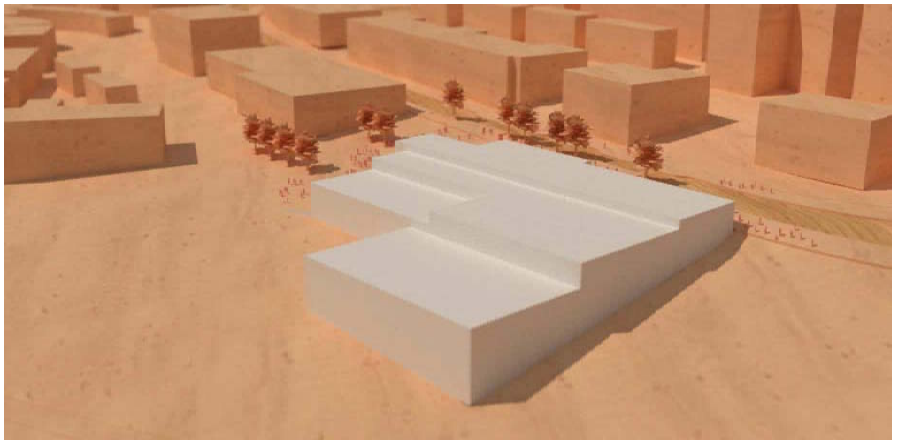
The Building and Massing

Two floor plan options were developed to show flexibility of the site to accommodate variation in placement and adjacency of programs components.

Key features of the floor plans and massing include:

- The Optimized Program was used to develop the plan layouts.
- Entrance and gathering space along Princeton and adjacent to the park provides strong opportunities to engage community members.
- Lower level parking entrance will be a significant entrance, utilized by those arriving to the facility by vehicle, and also by park users for vertical movement to Princeton Avenue.
- Southern facing glazing for passive solar opportunities and views for the Natatorium.
- Opportunity for either a Library adjacency to the park for outdoor learning opportunities, or a natatorium adjacency to the park for change room / washroom access, and connection to enhanced outdoor water feature.
- Location of multipurpose rooms close to the Library to allow for sharing of rooms for both community centre and library programs.
- Fitness centre in a double storey volume along Princeton frontage will showcase active programs. Library program could also benefit from the Princeton frontage, and be highly visible.
- Gymnasium at the lower level allows for fitness to running track connection at the upper level.

Option 1



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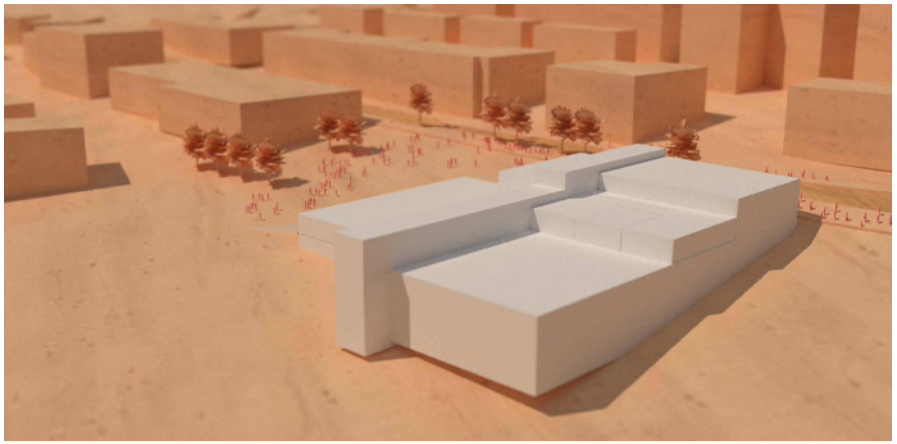
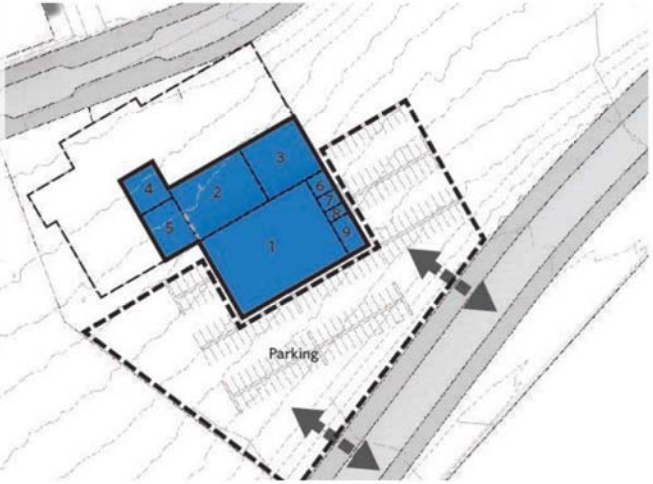


Plans

Option 1 Plans

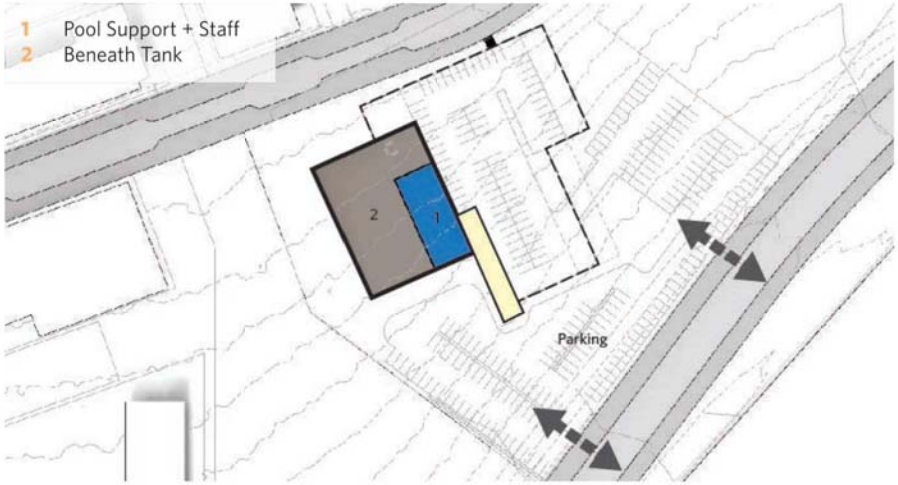
1 Natatorium
2 Change
3 Pool Support
4 Admin
5 Staff Support
6 Wet MP
7 Storage
8 Steam + Sauna
9 Whirlpool



10 Gymnasium
11 Storage
12 Washrooms
13 Multi-Purpose (S)
14 Common Kitchen
15 Multi-Purpose (M)
16 Multi-Purpose (M)
17 Library

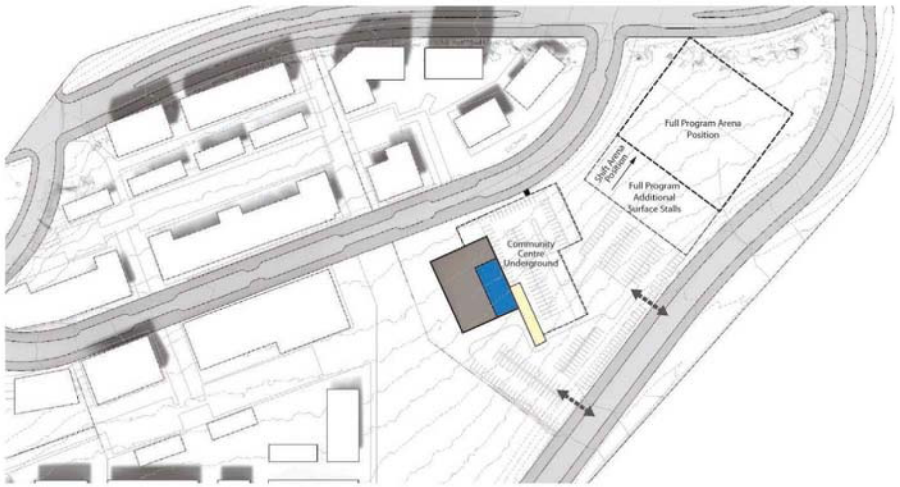
Option 2 Plans

1 Pool Support + Staff
2 Beneath Tank

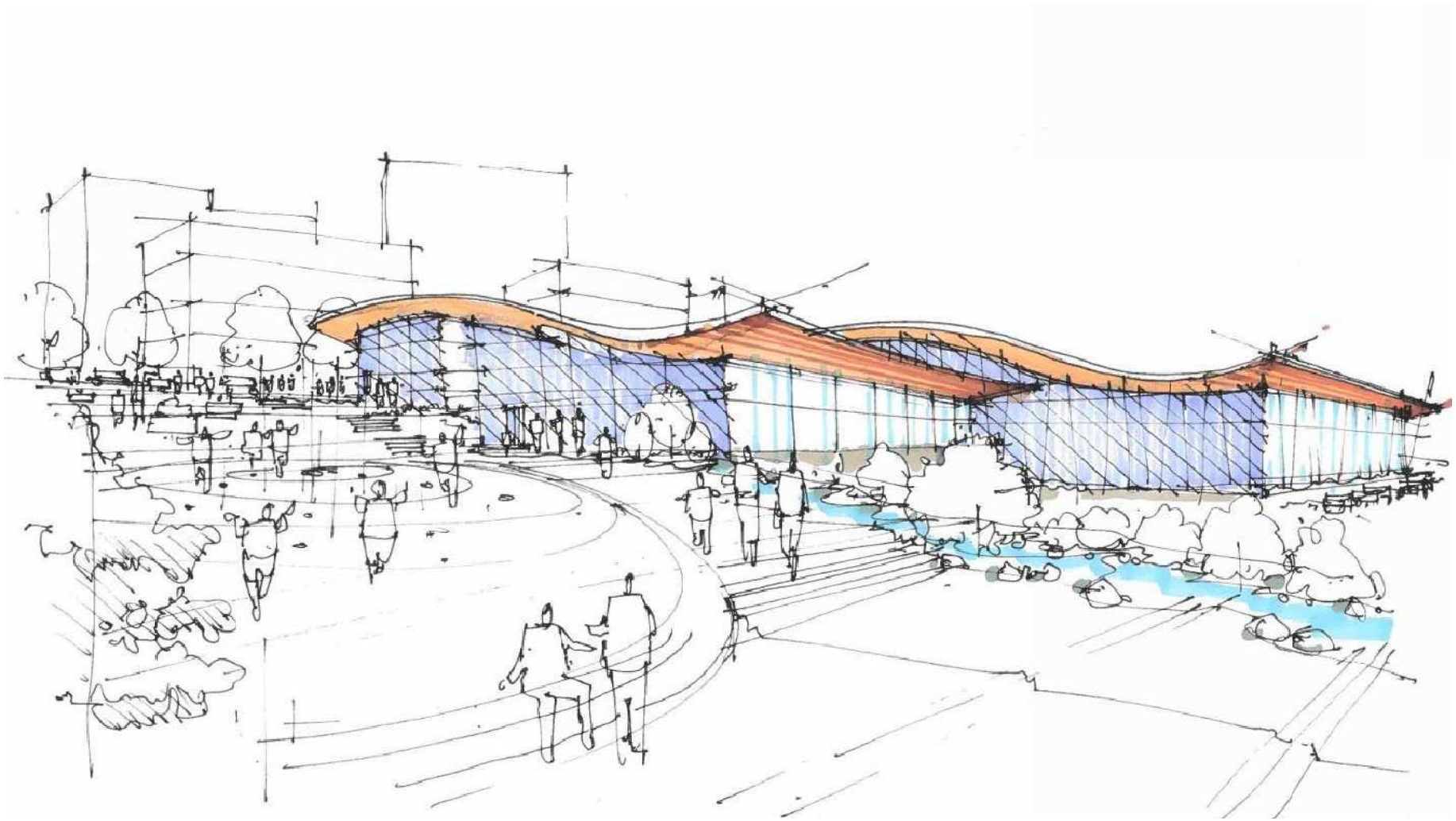


3 Natatorium
4 Change
5 Staff Support
6 Steam + Sauna
Whirlpool
Storage
7 Pool Support
8 Washrooms + Change
9 Storage
10 Gymasium
11 Library

Parking Plans



Option 1



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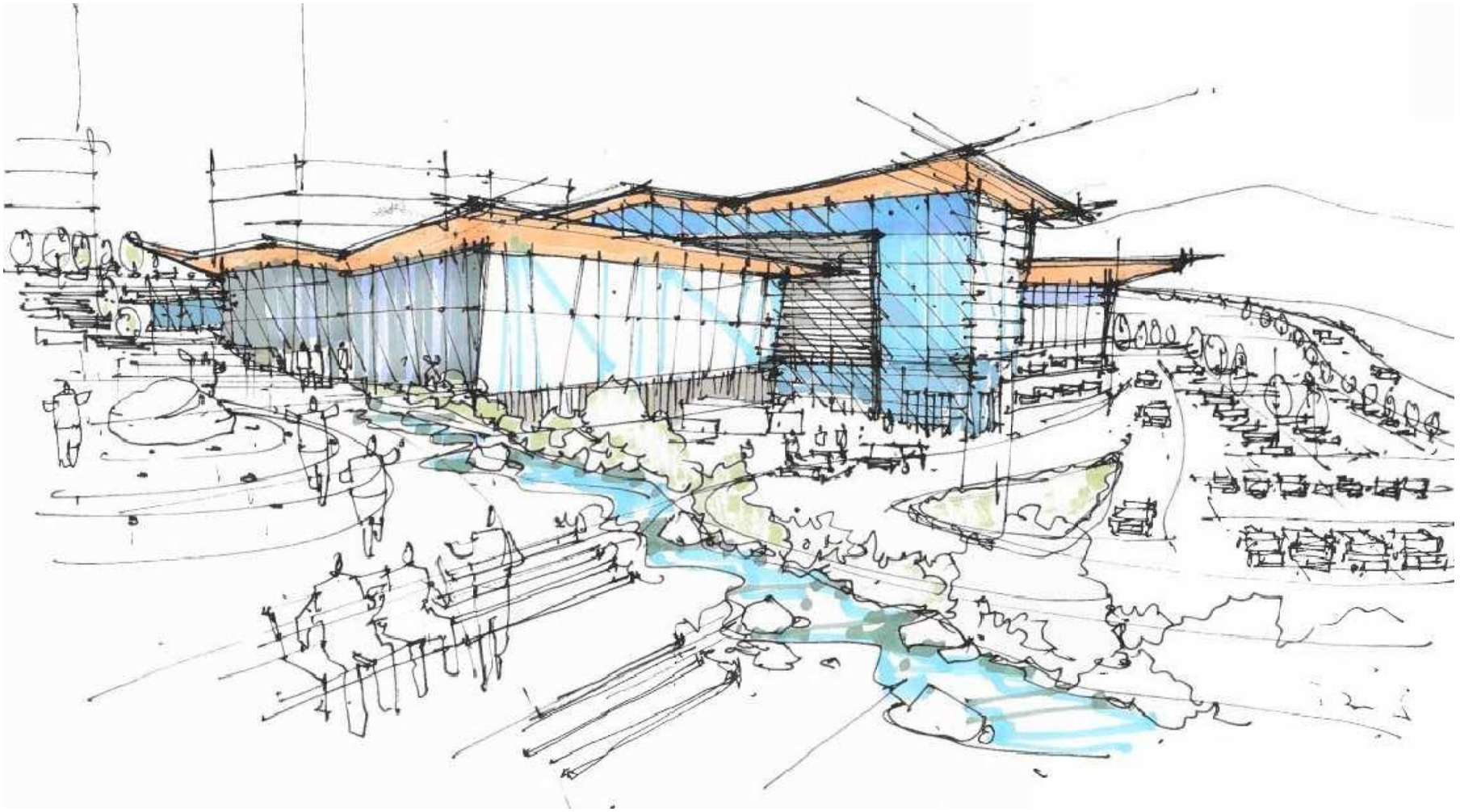
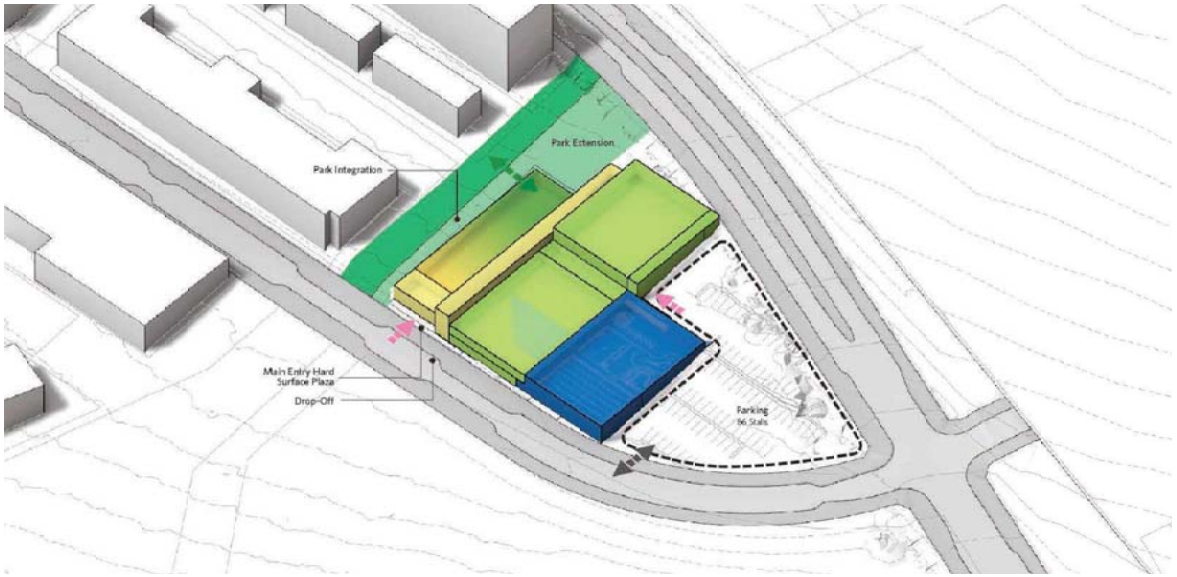


05.2 Alternate Site 2

Site 2 - Option 1



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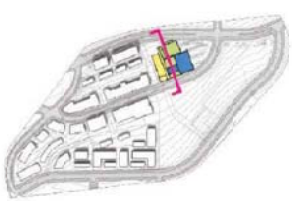
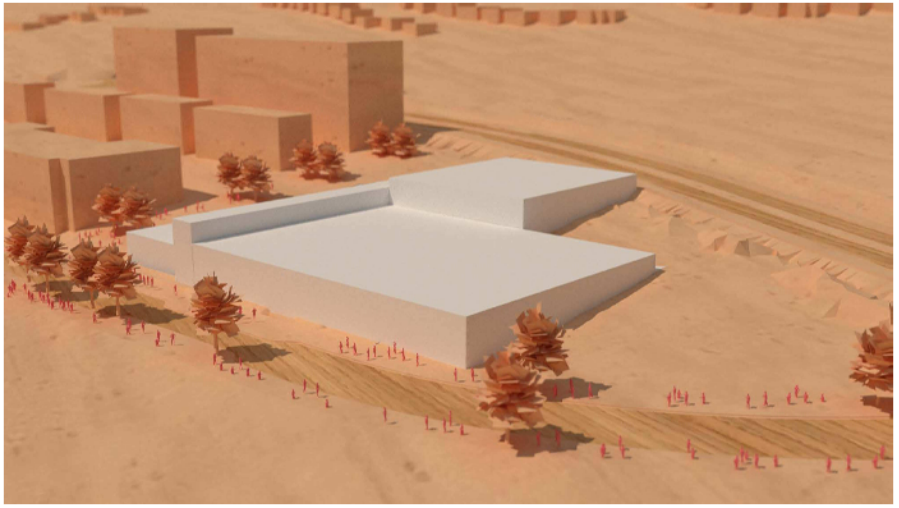
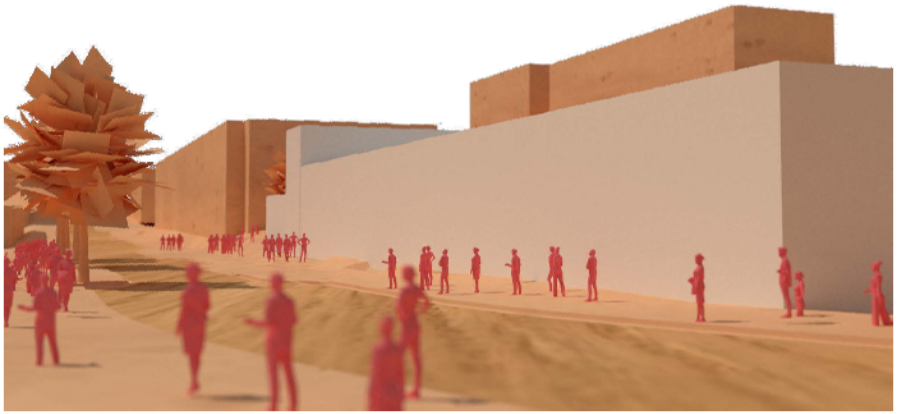


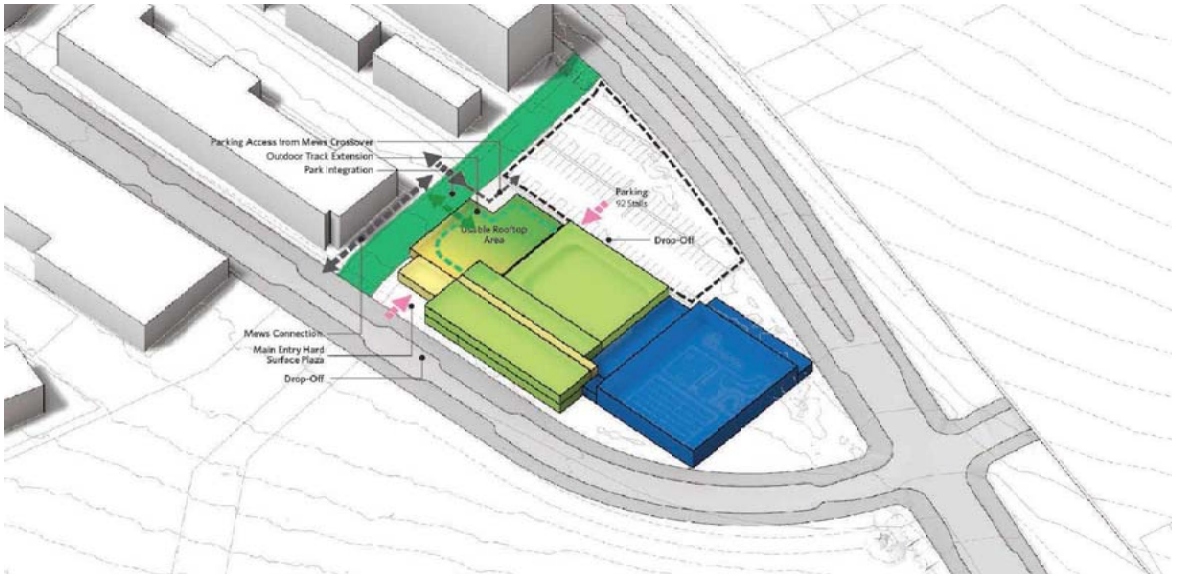
Plans

Renderings





Site 2 - Option 2



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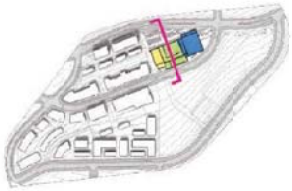
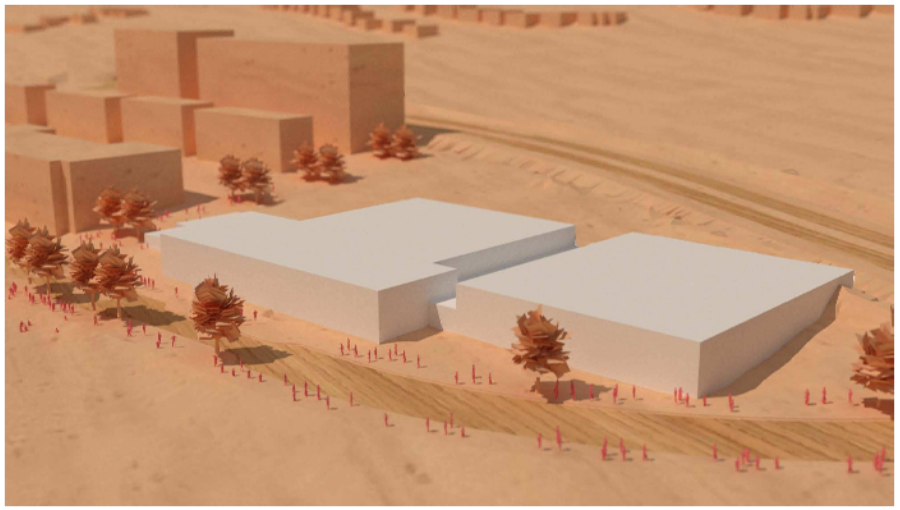
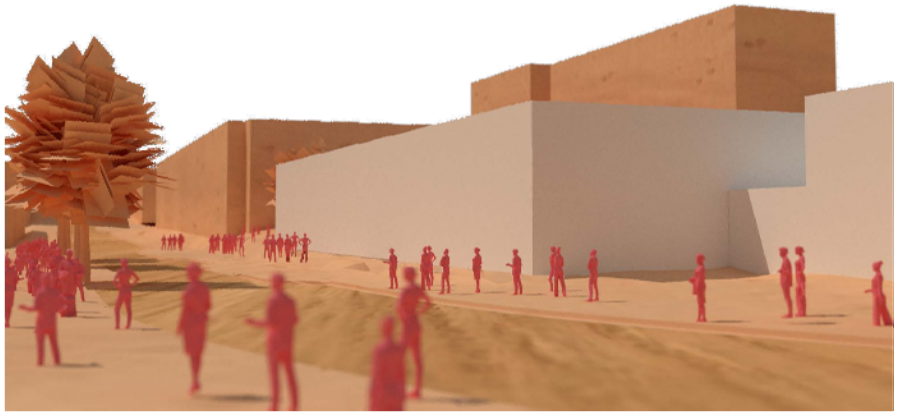


Plans

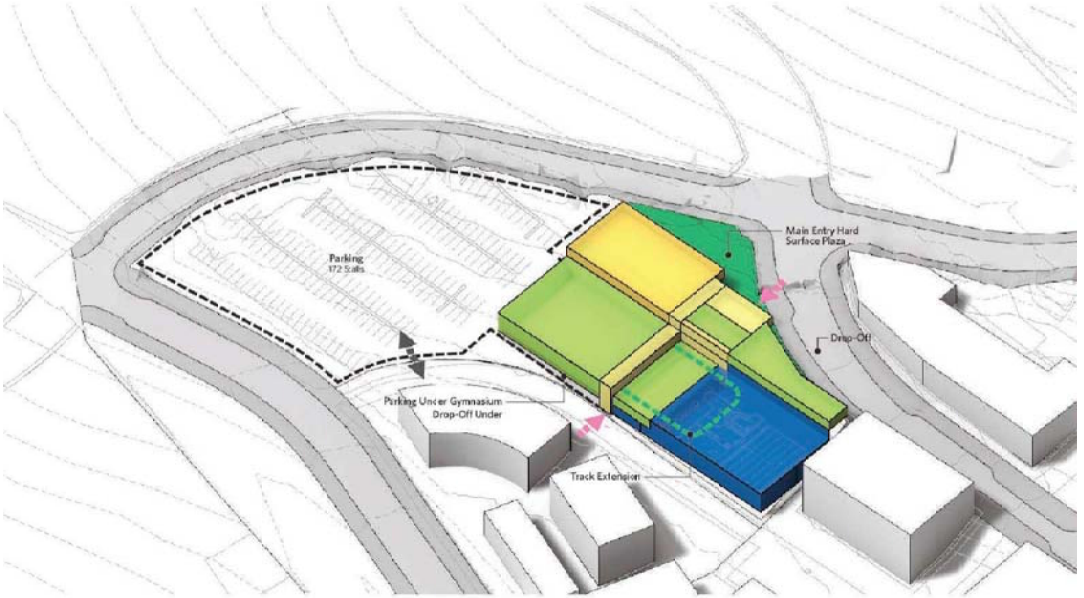
Renderings





05.3 Alternate Site 3

Site 3



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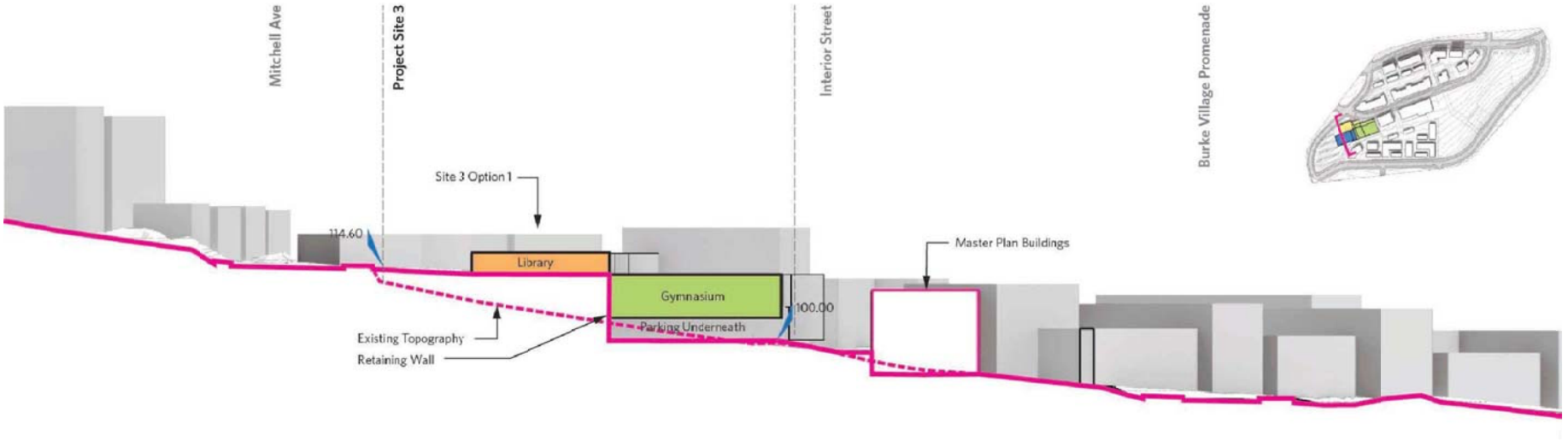
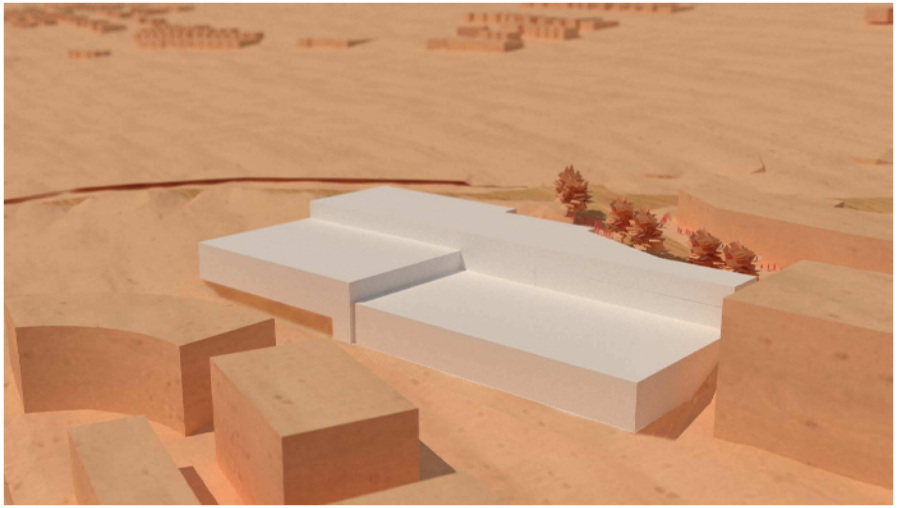
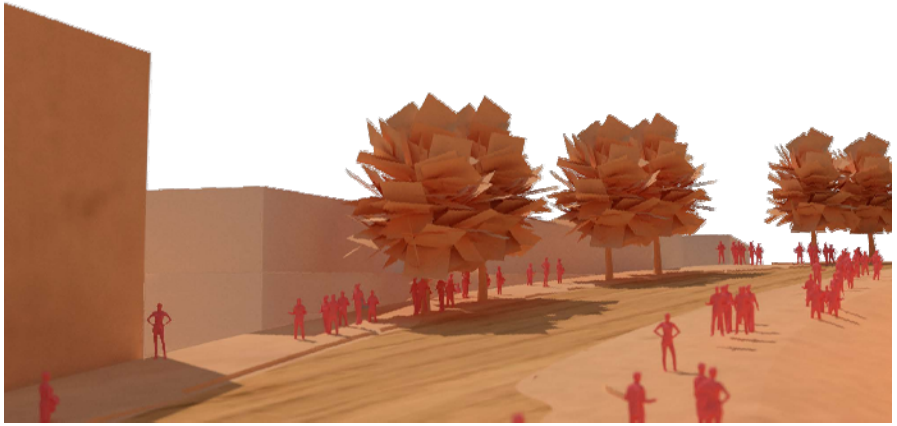


Plans

Renderings





05.4 Opportunities and Challenges

Site 1

Opportunities

- Building has good visibility from Princeton with pedestrian access.
- Strong connection to the Village park and park amenities.
- Parking is located at the lower BVP level and Princeton frontage can be predominately pedestrian.
- Views to the south are unobstructed.
- Due to site slope, pool tanks will likely be constructed above natural grade rather than underground This will allow for the opportunity to provide maintenance access around the tank and is less costly than excavation for pool tanks.
- Large site which can accommodate a significant amount of surface parking which is less costly than structured or below building/underground parking.
- Site area can accommodate arena development.

Challenges

- Multi-leveled building requires additional staff oversight of the facility.
- Site slope is significant, similar to Site 3 and vertical access to move from one level to the next will require care accessibility considerations.
- Height of building on the north side may result in additional costs if the building strives to be taller in order to better relate to frontage heights of adjacent developments along the south side of Princeton.
- Natural watercourses impact the parking layout and are an added component to be considered in the development.
- Parking and drop off at lower level suggest additional monitoring of parking entrance is required.

Site 2

Opportunities

- Prominent location at the corner of David and Princeton.
- Site slope is less than other 2 sites and allows for programs to be located on two levels.
- Driveway access does not conflict with intention to avoid crossings on Arterial Streets (David Avenue).
- Access by vehicle from all directions possible within the broader neighbourhood circuitous routing.

Challenges

- Site parcel was envisioned for the tallest building massing in the Master Plan. The NECC will be 2-3 stories in height along Princeton and may be dwarfed by the adjacent developments.
- Relationship to park is limited to the park extension on the north side of Princeton. Park users will likely need to cross Princeton to access more significant park amenities.
- Opportunity for views to the south will be limited by the development south of Princeton.
- No site area for future arena development.
- No ability to utilize the natural site slope for below building (and above grade) parking.
- Princeton Avenue is intended to be pedestrian oriented (low traffic volumes)
- Princeton Avenue general vehicle travel patterns will increase volumes on Princeton Street, which will also impact comfort for cyclists in mixed traffics.
- Vehicle sight distance views may be challenging for the David / Princeton intersection depending on the landscaping, the grades and the road curvature. Assumed 30 km/hr speed => Stopping distance of approximately 35m which can change depending on speed and grades.
- Drop-off at Princeton avenue can be successful, but pick-up will be more problematic and issues would cascade quickly. Short-term parking may complicate interactions along Princeton (bicycles, vehicles, etc.), and will need to be managed.

- Use of Princeton drop-off will need to be considered with respect to programs that may use it.
- Utilizing the Mews/Princeton connection that is west of the public route, towards Mitchell, although this would create a dead-end situation at the Community Centre.
- A dead-end condition at the end of the Mews will require additional accommodation for turning vehicles around, especially given the length of the dead-end driving aisle portion.
- Site Opt. 2: Access point to the Mews from Princeton near the public route would be quite problematic and would probably impact the alignment of the “public route” and require property from Site 2 itself or the adjacent property to the west to accommodate a revised Mews.
- Site Opt. 2: Access to parking across the park will divide the park into two halves.

Site 3

Opportunities

- Prominent location at the corner of Mitchell and Princeton.
- Curve of Princeton allows good views to the facility from the east.
- Lane access to the south provides good access from two frontages.
- Potential views to the west.
- As a result of the slope of the site, the site 3 concept is similar to site 1, in terms of layout and access.
- Good vehicular access from all possible directions to this site.
- Vehicle traffic remains on major roads and not on any intended Pedestrian focused streets.
- If additional access is added on BVP, the traffic volumes would only impact a small portion of BVP.
- Located immediately adjacent to the proposed multi-use pathway will encourage active transportation.
- Below building parking under the gym utilizes the natural site slope.

Challenges

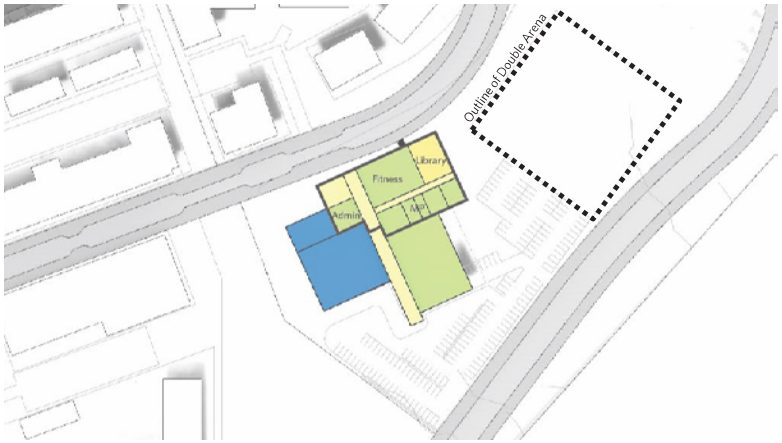
- No connection to the Village park and outdoor amenities. Many indoor/outdoor connections are lost.
- Site is narrow along Princeton and limits the proportions of the rooms/building.
- Corner presence and external views compromised from the Natatorium.
- Large parking lot along the corner of BVP and Mitchell is not desirable.
- Similar to the Site 1 concepts, the programs at the upper level will have control from the administration and a significant staff area on the lower level provides control for lower level programs.
- Views to the south will be obscured at the lower levels because of the development to the south.
- Natatorium can be shifted west and the Gym moved east to allow for views to and from the Natatorium, however, locating parking under the natatorium is much more expensive.
- A single rink arena will fit on this site, adjacent to the community centre but will displace surface parking which will need to be located below building or underground. A double rink will be more challenging to fit on site and as with the other sites, the slope of the site makes keeping the two rinks at one floor elevation, very expensive.

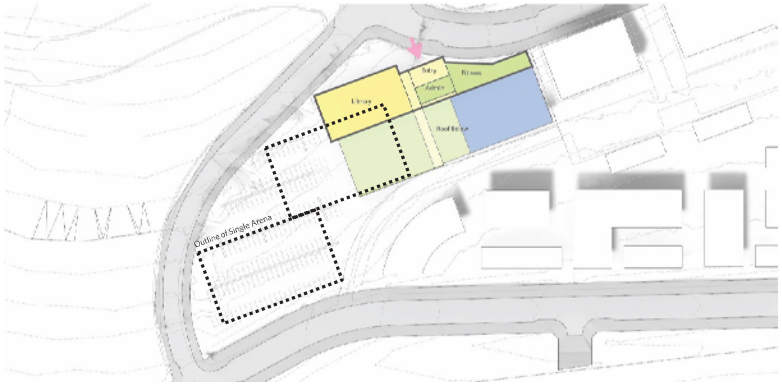
05.5 Ice Arenas

A two rink ice arena typically requires a building footprint of approximately 65,000 s.f.; and it is recommended that both ice sheets are located on the same floor elevation. This is particularly important for mitigating overall construction and operations costs relating to the ice resurfacer, header trenches / refrigeration system, and when considering flexibility in programming eg. ice tournaments and dry floor events such as trade shows where ease of moving from one rink to the other should not include stairs.

When considering all 3 sites, only Site 1 has the available site area to allow for a 2 rink arena with an efficient side-by-side layout. Site 3 has available site area for a single rink and the potential for integrating a second rink under the community centre building, at a significant added construction cost. Site 2 cannot support either a single nor a double rink arena.

In order to maintain both ice rinks at the same floor elevation, the natural slope for all sites will result in either one rink sunken into the ground or elevated above grade. This presents some opportunity to provide below building parking under the arena.





06 SUSTAINABILITY

06 SUSTAINABILITY

06.1 Swellness Measures

DESIGN FOR INTEGRATION

DESIGN FOR COMMUNITY

DESIGN FOR ECOLOGY

DESIGN FOR WATER

DESIGN FOR ECONOMY

DESIGN FOR ENERGY

DESIGN FOR WELLNESS

DESIGN FOR RESOURCES

DESIGN FOR CHANGE

DESIGN FOR DISCOVERY

06.2 Sustainability Meeting Summary

Northeast Community Centre
HDR Environmental Sustainability Plan

Date: November 30, 2020

Doc #: 3907962

Department: Parks, Recreation, and Culture Services

Attendees: Mary Chow, Tiina Mack, Jennifer Keefe, Scott Groves, Andre Isakov, Caresse Selk, Mariko Michasiw, Hagen Hordorf, Narita Ico

Summary

There are a number of different sustainability rating systems around the world, such as LEED, , WELL etc. HDR has summarized several rating systems and has categorized initiatives based on the AIA COTE 10 Measures. "Swellness" is a term that encompasses aspects and features of sustainability, health, and wellness. This meeting was a discussion of how to apply these measures to the design of the future Northeast Community Centre environment.

The city has an Environmental Sustainability Plan that has Climate Action as one of 5 key themes. City of Coquitlam held a public survey as a part of its draft Sustainability Plan that received over 3000 responses. The feedback led to tangible themes and recommendations that will help support and drive the project. Plan will be delivered to Council mid 2021.

Some of the main concerns that were expressed:

a. Tree removal (due to the Burke Mountain development)

b. GHG transmission reduction (climate change)

c. Transportation (bikeways, buses, etc.)

d. Waste (Recycling, compost, etc.)

e. Renewable Energy

10 Measures of Swellness

1. DESIGN FOR INTEGRATION

- Council has GHG reduction targets
- Require Council direction on sustainable measure to target
- Not a great candidate for district energy due to location
- This building and village may be built in phases over a span of 10-15 years
- We have a Community Greenhouse Gas Reduction Strategy and Corporate Climate Action Targets that will help support this section – see Building Division Report
- We haven't adopted Step Code yet – aspire for Step 3 (this is what our neighbouring muni's are doing); Step 2 is required from Developers
- Visual cues as a part of the building design should be implemented to highlight sustainable measures and distinguish the NECC in its integration with these measures

2. DESIGN FOR COMMUNITY

- Social equity at local, regional, and global scales
- The programming we need is in line with the public's needs, open spaces, multi-use spaces, multi-language, food, etc.
- We are predicting an older, family, population for this neighbourhood
- The Burke Mountain neighbourhood will not expand much after the full build-out
- Family affordable ($800,000 - $1,000,000 condo estimate) housing developments that will generate money for the city
- Rick Hansen accreditation (gold level) will be a priority
- It is unknown if there will be a homeless population on Burke Mountain

3. DESIGN FOR ECOLOGY

- Communal community gardens are preferred to allotment gardens to maximize access for participants and the Centre rooftop may provide an opportunity for a communal garden (precedent: communal roof garden at the Joyce-Collingwood Neighbourhood House)
- There are Extensive (mat on roof that helps with water quality and retention) vs Intensive (Trees and plants on roofs, very expensive, and hard to maintain) Green Roofs
- There may be more of a demand for a community garden in Burke Mountain because the housing will consist of mostly condos and apartments that have patios (not backyards)
- Community may benefit from an educational garden (on the ground, so there is flexibility with growth). However, educational gardens may attract bears and an educational garden may not be practical at this location.
- Community gardens can also be provided by private developments for strata use
- Burke mountain has a very steep slope
- This project could focus on reforestation and replanting. Difficult to retain trees during development (can have hazardous materials disrupted by development that can lead to unsafe circumstances)
- Rainwater collection and water courses: How can we offset the environmental disruption caused by this project? Canopy cover, street trees, retaining parkland, animal systems, developing a landscape strategy to attract birds and bees.
- There are rainwater guidelines for Burke Mountain development
- Attempt to put nature back! The naturalist group would like to hold walks up to the provincial park from the future NECC to show off local plants and make people aware of where they live
- Windows should have pubic art to prevent birds from crashing into glass (bird glass)
- Be Bear Aware!
- Concern about tree loss, clear cutting for this project should be addressed, as this is a public concern but is a reality of the future development

4. DESIGN FOR WATER

- There is a watercourse on site that is an opportunity for enhancement
- Recapturing grey water to reduce water consumption is expensive and not necessarily sustainable. However, we could have a grey water system to use for educational purposes
- We can look for sustainable water options for the pool (regenerative water features)
- Grey water gardens are not supported by Fraser Health but we can investigate this further during the design phase. We can look at harvesting stormwater runoff for reuse but need to be mindful of standing water and mosquitoes
- Opportunities for soft scaping. Look into permeable asphalt (its durability, longevity, etc.)
- Look into green water infrastructure practices
- Consider Vancouver's green blue roofs pilot in their rainwater strategy
- Roofs will be highly visible, can consider some sedum roofs that offer some rain capture to help with the stream recharge
- It is important for public to see sustainability measures in design and for the project to be intentional and celebrate water
- Grass-pave products could be utilized as the amount of impermeable surfaces are determined. Grass-pave is more suitable for overflow parking lots which has less traffic
- Permeable asphalt could be considered
- City of Vancouver Rain City Strategy

5. DESIGN FOR ECONOMY

- Lifecycle, operating, and improvement costs are a big concern for City Manager, so that the City may understand the total cost of building ownership. This contributes to a better understanding of annual costs and impacts operational budget requests.
- Green sustainability options tend to be a cost add instead of cost effective
- How to utilize materials on the buildings such that waste is minimized
- How to anticipate the least amount of waste, consider pre-fab systems
- The average lifespan of a building is 50 years, so we need to look at life cycling
- Design to the standard sizes of materials – be prudent with materials, reduce waste, consider cladding proportions and sizes
- Take this opportunity to promote IPD process

6. DESIGN FOR ENERGY

- Scott has done a passive house project, and this is what he has learned:
  - Energy profiles vary from user group projects
  - Cooling was a large issue (the number of people, computers, and equipment led to heat abundance). Therefore, find ways to cool through natural ventilation. The net heat was almost zero and insulation requirement was not as significant as anticipated
- Solar thermal may be an opportunity, especially related to BC Hydros upcoming time of day consumption premiums – make space for battery storage in case this is a future add item
- Ground conductivity of site is critical for geothermal: balance the energy you put in with what you pull out. NECC will not be a good source or cost effective. The system is hard to repair and may fail overtime. Therefore, do not use Geothermal for this site.
- Permanent meter system for energy may be a good option
- Envelope is most important factor, with our west face and heat from the west it will be a big consideration – cooling actually may be a bigger energy challenge here
- There is a high cost per square foot but there is energy benefit
- Consider mechanical systems, air movement – fresh air into space, passive vs. mechanical
- The building can work to draw heat and cooling from other spaces and relocate it to other areas. Therefore, we are using the air that is already present instead of drawing energy to produce it.
- There are passive methods that use natural ventilation
- This building should rely on heat exchange, so we are not exhausting the air
- There are currently no other heat exchange buildings the NECC could gain from
- We have a pool that will need heat, and without cooling (arenas) there is likely not sufficient energy to share with other buildings
- City already uses a Thermex heat exchange system at PSLC, CCAC
- Can send excess heat from cooling sources includeing kitchen, fitness, gyms to other parts of building; MP rooms will desire cooling in summer also
- Analyze PV for the site and anticipate for future when sustainability goals are higher

7. DESIGN FOR WELLNESS

- Healthy food choices – start there
- How much control should we offer to the public? For example, temperature control for groups so they can deal with the comfort level within their space (e.g. window tied to a mechanical system). Concern over giving too much control as this could take more energy
- Comfort should be directed to the staff who work in those spaces more (prioritize comfort)
- Acoustics and sound transference: need space for quiet or private conversations (this also helps with those on the autism spectrum)
- Use of biophilic materials (wood and plants)
- View to nature from the indoors contribute significantly to wellness (just as important as the view outside)
- Healthy building products often do not last as long. The City will want to use products that last
- Air exchange and proximity. (e.g. Concern over humidity and pool smell in between pool and library) Therefore, the pool system should be separate. In many locations you can smell the pool outside of the facility, so need to find where exhausting from

8. DESIGN FOR RESOURCES

- Use of natural materials and prefab
- Disassembly and use in systems need to be thought of (e.g. we have high use of concrete in our region and it is made locally. Wood is now coming from Europe and requires exported manufacturing (shipping).
- What can be recycled at end of life?
- IPD approach can help with resource planning too
- Use wood
- Consider more sustainable concrete - Carbon cure
- Design and Build simply

9. DESIGN FOR CHANGE

- The City does not design these public facilities for post disaster. Design for High Importance.
- Could the facility be repurposed to address at-risk and homeless population in event of fire, etc? Providing clean air, heating and cooling centres is recommended.
- This building will play a role in emergency situations where housing residents for a short period of time may be required

10. DESIGN FOR DISCOVERY

- How to showcase sustainable design throughout the facility?
- HDR did a tour of the UBC buildings, and interestingly only Thermenex met the designed energy standards after occupancy
- Typically there is no procedure for checking and rebalancing – measuring and monitoring is important and for extended periods of time
- LEED is a checklist that tends to be ineffective long-term. If we were to receive some sort of certification, we would prefer Passive house certification. (We have already lost LEED points due to tree removal and building on green spaces)
- All agreed NECC could be a pilot project – first city building to have a sustainability plan

07 TRANSPORTATION REPORT

07 TRANSPORTATION REPORT

January 28, 2021
04-19-0291

Mary Chow
Associate Vice President
HDR Architecture Associates, Inc.
500-1500 West Georgia Street
Vancouver, BC
V6G 2Z6

VIA E-MAIL: Mary.Chow@hdrinc.com

Dear Mary Chow:

Re: Coquitlam Northeast Community Centre
Parking Analysis DRAFT

The following report letter has been created to support HDR's planning efforts for the proposed community centre within northeast Coquitlam. The information and analysis contained below focuses on the estimation of vehicle parking supply for a set of potential scenarios for build-out of the community centre, which includes a range of programming uses and associated floor areas.

We are pleased to support this project and trust that the information within this letter will meet the requirements for this stage of planning and design work. Should you have any questions, please reach out to us.

Yours truly,
Bunt & Associates

Neal Peacocke, P.Eng.
Senior Transportation Engineer

Erin Tattrie, RSE, GradTech
Junior Transportation Technologist

1. INTRODUCTION

The City of Coquitlam (CoC) is set to experience significant population growth within the Northeast Neighbourhood Area, which includes the Partington Creek Neighbourhood that will be home to a neighbourhood centre that will form the future "heart of the Burke Mountain". To properly accommodate this impending population growth, planning efforts within the neighbourhood identified the need for a comprehensive multi-use community recreation centre within the growing neighbourhood centre. This project has generally been named the Northeast Community Centre (NECC), and will be referenced as such within this report letter.

CoC retained HDR to complete the planning and design of NECC and as part of this process CoC requested HDR incorporate parking estimates. HDR then commissioned Bunt & Associates (Bunt) to undertake a parking study for these proposed scenarios to help inform initial requirements for future parking supply. Based on additional direction from the CoC, HDR has investigated a range of scenarios for programming use on the site, as well as some other potential locations within the Partington Creek Neighbourhood for the community centre. Bunt prepared this letter to provide guidance on the parking required and a high-level review of the site access for each location.

The letter has been structured as follows:

- Proposed Programming Scenarios
- Parking Review and Analysis
- Location Access Review
- Conclusions and Recommendations

2. PROPOSED PROGRAMMING SCENARIOS

NECC has three potential programming scenarios, a full program, an optimized program, and a reduced program. The three program scenarios affect the Gross Floor Area (GFA), used to calculate the parking and loading requirements, and the scenarios may affect the potential location of NECC within the neighbourhood. **Table 2.1** summarizes the programming facilities.

Table 2.1: Programming Facilities Gross Floor Area (GFA) by Scenario

PROGRAMMING FACILITIES	SCENARIO 1 – FULL PROGRAM (SQM)	SCENARIO 2 – OPTIMIZED PROGRAM (SQM)				SCENARIO 3 – REDUCED PROGRAM (SQM)
		A	B	C	D	
Outdoor Space	217	217	217	217	217	193
Aquatics	4,679	3,992	3,992	3,992	3,992	3,992
Library	1,159	1,129	1,129	1,129	1,129	-
Community Centre	6,296	4,960	4,960	4,960	4,960	2,603
Child care	437	-	-	437	437	-
Community Police	423	-	-	-	-	-
Arena	6,039	-	6,039	-	6,039	-
GFA (SQM)[1]	**19,033**	**10,081**	**16,120**	**10,518**	**16,557**	**6,594**

Note(s): [1]- The Outdoor covered space was provided to maintain a record of it and is not included in bylaw calculations.

Scenario 1 – Full Program – 'All In'

Programming Scenario 1 includes all proposed facilities, including an arena which will support two indoor ice rinks. Scenario 1 is the largest option with a GFA of 19,033 SQM.

Scenario 2 – Optimized Program

Programming Scenario 2 has three sub-scenarios, allowing the child care and/or the arena to potentially be included. Scenario 2A does not include the child care or the arena and is the optimized program base. Scenario 2B adds the arena to the 2A base; while, Scenario 2C adds the child care instead of the arena. The final scenario, Scenario 2D, adds both the arena and the child care to the 2A base. The GFA ranges from 10,081 SQM to 16,557 SQM dependent on the scenario.

Scenario 3 – Reduced Program

Programming scenario 3 provides minimal programming facilities, and a reduced outdoor space.

3. PARKING REVIEW AND ANALYSIS

Bunt used the various programming scenarios for the proposed NECC and the associated GFA to compare the proposed scenarios with existing Metro Vancouver community centre and recreation centre facilities to establish a parking provision rate and then compared the provision rate with CoC Bylaw requirements.

3.1 Zoning Bylaw Review

The CoC *Zoning Bylaw Part 7 Off-Street Parking and Loading* does not have a specific community centre rate. Therefore, Bunt assumed NECC would be treated using the following rates:

Institutional – Extensive Recreation Use – Sports Club

Parking requirement of 1 parking space for each 40 SQM of gross floor area

Institutional – Civic Use

Parking requirement of 1 parking space for each 40 SQM of gross floor area

Institutional – Child-minding Services

Parking requirement of 1 parking space per staff member

Bunt applied the general bylaw rate of 1 space per 40 SQM for all uses proposed in each scenario except for the child care space.

As for the applicable child care scenarios, Bunt estimated the number of child care staff using the *BC Child Care Licensing Regulations Schedule E* and proposed child care capacity per age group, shown in **Table 3.2.**

Table 3.2: Proposed Child Care (Licensed Daycare) Programming, Capacity, and Staff

PROPOSED PROGRAMMING	CAPACITY (SPACES)	MAX GROUP SIZE[1]	NUMBER OF GROUPS	NUMBER OF STAFF PER GROUP[1]
Combined Infant/ Toddler up to 36 months	12	12	1	2
School Age (30 months up)	25	25	1	3
Preschool (30 Months up for 4 hrs per day) – *Accommodated in the Community Centre*	20	20	1	2
K-12 years – *Accommodated in the Community Centre*	24	24	1	2
TOTAL	**81**	**81**	**4**	**9**

Note(s): [1]Values obtained from the BC Child Care Licensing Regulations, Schedule E

Table 3.3 summarizes the CoC Bylaw requirements per scenario.

Table 3.3: City of Coquitlam Zoning Bylaw Parking Supply Requirements by Scenario

SCENARIO	GFA[1] (SQM)	NUMBER OF PARKING SPACES REQUIRED						TOTAL
		Aquatics	Library	Community Centre	Child Care	Community Police Office	Arena / Rink	
1 - Full	19,033	117	29	157	9	11	151	474
2A – Optimized (Without Arena or Child Care)	10,081	100	28	124	4	0	0	256
2B – Optimized (With Arena)	16,120	100	28	124	4	0	151	407
2C – Optimized (With Child Care)	10,518	100	28	124	9	0	0	261
2D – Optimized (With Arena & Child Care)	16,557	100	28	124	9	0	151	412
3 - Reduced	6,594	100	0	65	4	0	0	169

Note(s): [1]GFA does not include the Outdoor Space. The outdoor space does not have a bylaw requirement.

Based on the CoC *Zoning Bylaw*, the required parking supply ranges from 169 spaces to 474 spaces.

3.2 Institute of Transportation Engineers (ITE) Parking Generation 4th Edition

The ITE Parking Generation Manual, 4th Edition, for 'Recreation Community Centre' (Land Use 495) is described as a stand-alone public facility similar to and including YMCA's. They typically have classes and clubs for adults and children, a child care centre or nursery school, meeting rooms, swimming pools; tennis, racquetball, basketball and volleyball courts (i.e., gymnasiums), exercise rooms, etc. They are membership clubs that may allow access to the general public for a fee. Based on this description, it is Bunt's view this ITE land use category is applicable to NECC.

The observed ITE parking demand rate for Land Use 495 is included in **Table 3.4** below. Only suburban data is reported by ITE, although ITE does note that its single urban Recreation Centre study had a considerably lower parking demand than the suburban Recreation Centre sites in its database.

Table 3.4: Recreation Community Centre Parking Demand Rate (ITE)

PEAK PARKING DEMAND PERIOD	AVERAGE OCCUPIED STALLS PER 100M²	85TH PERCENTILE OCCUPIED STALLS PER 100M²	RANGE OF PEAK OCCUPIED STALLS PER 100M²
Weekday 6pm-8pm	3.44	5.41	1.40-7.38

Source: ITE Parking Generation 4th Edition, based on 7 studies of Recreation Centres ranging in sizes from 30,000ft² (2,800m²) to almost 60,000ft² (5,500m²) GFA

As indicated the average observed rate at ITE sites was 3.44 occupied stalls per 100m², which is approximately 38% higher than Coquitlam's bylaw rate. However, of interest is the significant range of demands observed over the relatively small ITE sample size. In the ITE studies, there was no correlation found between size of facility and parking demand rate.

In Bunt's view, other factors than facility GFA, such as presence of specific high-generating uses (gymnasiums, aquatic centre, etc.) at individual sites may have greater influence on peak parking demand rates than the size of the facility. Also, we expect seasonality of peaking associated with these high-generating uses would have a considerable impact on peak parking demand rates.

3.3 Bunt Parking Database

Bunt has undertaken various parking demand surveys at community and recreation centres throughout the Lower Mainland, as shown in **Table 3.5**.

Table 3.5: Parking Demand at Community and Recreation Centres in Metro Vancouver

CITY	GFA (1,000 SQ. FT.)	DESCRIPTION	WEEKDAY PEAK PARKING DEMAND PER 1,000 SQ. FT	WEEKDAY PEAK PARKING DEMAND PER 100 M^2	ON THE FTN?
Burnaby	116	Recreation Centre	3.3	3.5	Yes
Burnaby	56	Recreation Centre	3.6	3.8	Yes
Coquitlam	50	Community Centre	2.9	3.1	Yes
New Westminster	15	Community Centre	2.3	2.4	Yes
North Vancouver	27	Recreation Centre	2.7	2.9	No
Surrey	109	Recreation Centre	2.5	2.7	Yes
Surrey	34	Community Centre	2.4	2.6	No
Surrey	37	Community Centre	3.0	3.2	Yes
Vancouver	19	Community Centre	3.7	4.0	Yes
Vancouver	25	Community Centre	1.6	1.7	Yes
West Vancouver	75	Community Centre	4.1	4.4	No

Parking demands range considerably across the facilities with the lowest weekday parking demand recorded at 1.7 parking spaces per 100 SQM GFA, and the highest being 4.4 per 100 SQM GFA. This is mostly due to the different programming offered in the facility. Facilities with swimming pool and ice arena observed to generate higher parking demand. On average the parking demand was found to be 3.1 parking spaces per 100 SQM GFA while the 85th percentile parking demand came in at 3.9 parking spaces per 100 SQM GFA.

The database rates do not include any free boarding buffer and therefore reflect the exact parking demand that was observed on the survey dates. Free boarding is when vehicles circulate looking for a parking space and is anticipated to occur during busy periods. Bunt recommends a 15% buffer is applied to these peak observed rates which results in a parking provision of 3.5 parking spaces to 4.5 parking spaces per 100 SQM.

3.4 Provisional Parking Rate Analysis

NECC has three key points of difference to the Metro Vancouver community and recreation centres, size, proximity to transit and arena.

1. NECC, depending on the scenario, is on the larger side of the centres reviewed in Bunt's database. In a general comparison of GFA, NECC will require a similar range to the Metro Vancouver provision rate range of 3.5 spaces to 4.5 spaces per 100 SQM.

2. NECC is less accessible to transit than the Metro Vancouver community and recreation centres in Bunt's database. Burke Mountain is on the outskirts of Coquitlam with limited bus access. Bunt acknowledges the neighbourhood is still developing; and TransLink's Northeast Sector

Area Transit Plan indicates new bus service in NECC's neighbourhood is a near-term medium priority. However, Bunt assumes transit access is unlikely to be enhanced enough to discourage vehicle traffic and parking in a significant manner.

3. Bunt's database provided a small sample of community and recreation centres with ice rink arenas, but not enough to significantly review the impact of an arena on parking. Arenas are unique and are likely to have more vehicle traffic due to equipment for sports like hockey, lessons, practices, and events. They are likely to operate earlier in the morning and later in the evening than the rest of NECC's programming. Arena event management (e.g. weekend hockey tournaments) is another major consideration that should be reviewed in more detail at later stages of the development planning process.

Bunt recommends a provision rate range of 3.2 spaces to 3.7 spaces per 100 SQM based on the comparison of NECC to the Bunt Database which corresponds to the ITE parking rate, with the understanding that Pick-up and Drop-off (PUDO) requirements may need to be considered in addition to the vehicle parking needs to carefully integrate into the design, as well as arena event parking may need to be considered further depending on the programming scenario. **Table 3.6 and 3.7** summarize the provisional rate range by scenario.

Table 3.6: Provisional Parking Supply Rate Lower Bound by Scenario

SCENARIO	GFA[1] (SQM)	LOWER BOUND RATE	NUMBER OF SPACES						TOTAL
			Aquatics	Library	Community Centre	Child Care	Community Police Office	Arena / Rink	
1 - Full	19,033	3.2	150	37	201	14	14	193	609
2A – Optimized (Without Arena or Child Care)	10,081		128	36	159	0	0	0	323
2B – Optimized (With Arena)	16,120		128	36	159	0	0	193	516
2C – Optimized (With Child Care)	10,518		128	36	159	14	0	0	337
2D – Optimized (With Arena & Child Care)	16,557		128	36	159	14	0	193	530
3 - Reduced	6,594		128	0	83	0	0	0	211

Note(s): [1] GFA does not include the Outdoor Space. The outdoor space does not have a bylaw requirement.

Table 3.7: Provisional Parking Supply Rate Upper Bound by Scenario

SCENARIO	GFA[1] (SQM)	LOWER BOUND RATE	NUMBER OF SPACES						TOTAL
			Aquatics	Library	Community Centre	Child Care	Community Police Office	Arena / Rink	
1 - Full	19,033	3.7	173	43	233	16	16	223	704
2A – Optimized (Without Arena or Child Care)	10,081		148	42	184	0	0	0	373
2B – Optimized (With Arena)	16,120		148	42	184	0	0	223	596
2C – Optimized (With Child Care)	10,518		148	42	184	16	0	0	389
2D – Optimized (With Arena & Child Care)	16,557		148	42	184	16	0	223	613
3 - Reduced	6,594		148	0	96	0	0	0	244

Note(s): [1]GFA does not include the Outdoor Space. The outdoor space does not have a bylaw requirement.

The lower bound provisional rate of 3.2 spaces per 100 SQM would supply a range of 211 spaces to 609 spaces depending on the scenario while the upper bound rate of 3.7 spaces per 100 SQM would supply a range of 244 spaces to 704 spaces depending on the scenario.

Table 3.8 compares the provisional rate range with the CoC Bylaw requirements.

Table 3.8: Comparison of Provisional and Bylaw Rates

SCENARIO	GFA[1] (SQM)	TOTAL NUMBER OF SPACES		
		Bylaw	Lower Bound	Upper Bound
1 - Full	19,033	474	609	704
2A – Optimized (Without Arena or Child Care)	10,081	256	323	373
2B – Optimized (With Arena)	16,120	407	516	596
2C – Optimized (With Child Care)	10,518	261	337	389
2D – Optimized (With Arena & Child Care)	16,557	412	530	613
3 - Reduced	6,594	169	211	244

Note(s): [1]GFA does not include the Outdoor Space. The outdoor space does not have a bylaw requirement.

Bunt notes the provisional parking rates based on Bunt field observations are higher than the bylaw rates.

3.5 Additional Parking Demands

There is recognition from the project team and the City that the parking introduced by this project may also be desired by other adjacent uses that go beyond the NECC scenarios discussed within this report. Although it would take additional analysis to understand the potential demand of these adjacent uses, such as retail, it would appropriate to consider operational tools, such as time restrictions and pay parking, to help effectively manage the parking supply and ensure it meets the needs of the NECC and other priorities.

4. SITE LOCATION REVIEW

HDR was requested by the City to consider alternative locations for the community centre and as part of that feasibility assessment, HDR has asked Bunt for high-level commentary on three location options. Bunt's high-level review included advantages and disadvantages regarding the site driveway access that are primarily based on our understanding of planning policy for the community and additional directio

EVIEW

the City to consider alternative locations for the community centre and as

assessment, HDR has asked Bunt for high-level commentary on three location

evel review included advantages and disadvantages regarding the site

re primarily based on our understanding of planning policy for the community

For reference, Site 1 sh
Partington Creek Neigh
and Princeton Avenue
a lower elevation point
into account deviations
accessibility.

Land Use

Site 2 – Option 1

Site 2 – Option 1 is located on the southwest corner of David Avenue at Princeton Avenue, shown in **Figure 4.2**. The site driveway access would be off Princeton Avenue which is designated as community collector road and does not conflict with City policy to avoid crossings on arterial streets (David Avenue). Pedestrian access is possible from all directions. Cyclist accessibility utilizes the proposed Rocklin & Princeton shared bikeways, and the proposed David Multi-Use Pathway (MUP) routes with the Burke Village Promenade (BVP) MUP nearby.

Figure 4.2: Site 2 – Option 1

Disadvantages to the site location include directing traffic onto Princeton Avenue which is intended to be pedestrian oriented with low traffic volumes. Sight visibility at the site access to David Avenue and Princeton Avenue intersection may be challenging as it would be located at the inside curve depending on the landscaping, grades, and road curvature.

Site 2 – Option 2

Site 2 – Option 2, located in the same place as Option 1, provides driveway access directly off David Avenue shown in **Figure 4.3**. Option 2 provides better horizontal sightlines for the access, as

compared to Option 1, given the straight alignment of the road, although vertical sightlines may be a challenge given the grade change across the site.

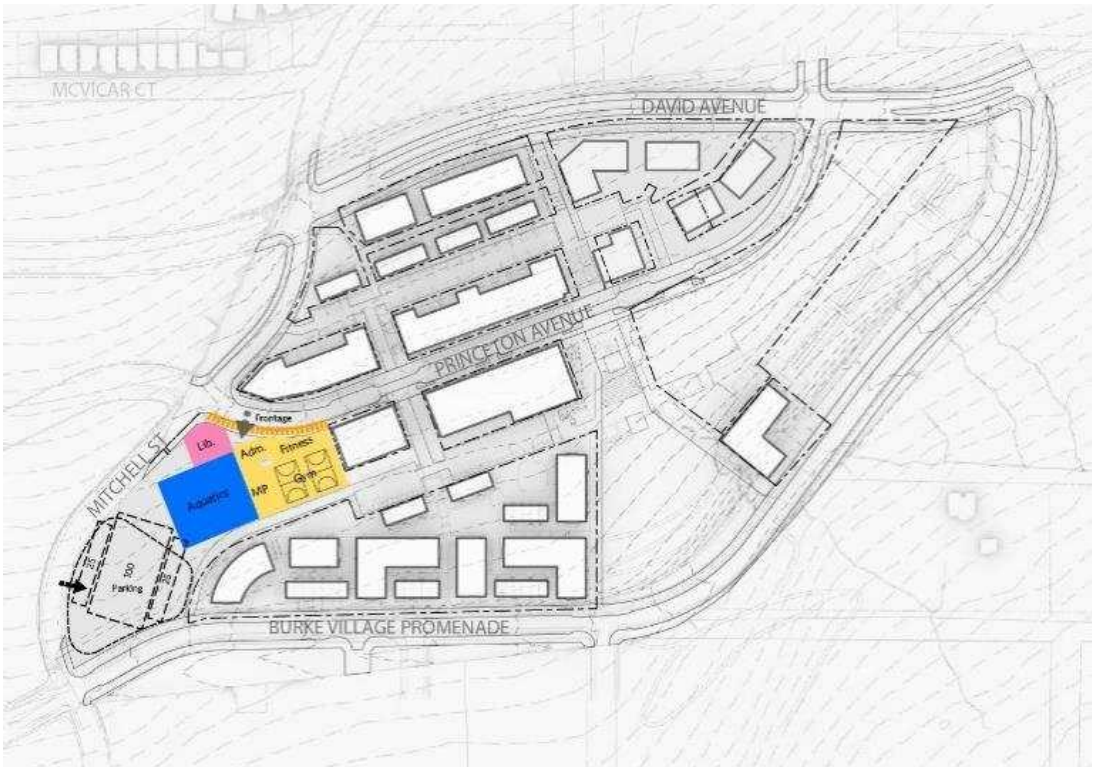
Figure 4.3: Site 2 – Option 2

Option 2 restricts the access to right-in right-out (RIRO) maneuvering due to the median. The restricted access will require patrons arriving from the east to circulate the neighbourhood to turn around for the access or to find alternative parking; the restriction may shift traffic volumes onto Princeton Avenue or BVP. Traffic heading south or east will likely use Princeton Avenue or BVP until the new David Avenue at Marigold Street connection to Victoria Drive is established.

Site 3

Site 3 is located at the northeast corner of Mitchell Street at BVP with the site access off Mitchell Street. The site is accessible from all directions and vehicle traffic remains restricted to major roads (i.e. not on any intended pedestrian focused streets). Cyclist accessibility would be primarily provided through the MUP proposed on BVP, but also supplemented by the proposed Rocklin and Princeton shared bikeways nearby.

Figure 4.4: Site 3



A disadvantage to the location is the potential difficulty of making a left turn onto Mitchell Street from the site driveway due to sightlines, road curvature, and the distance of the access from the intersection. Bunt suggests creating a secondary egress on BVP which would only impact the portion near the intersection. The second exit would make it easier for vehicles to transition to a southbound direction and reduce the burden of vehicle traffic movements on Mitchell Street.

All Options

A high-level review regarding the relation of GFA to the number of site accesses indicates a GFA range up to 82,000 SF (7,620 SQM) will manage with a single site access. However, a GFA range above 120,000 SF (11,150 SQM) may require a shift to two site accesses or a main access with a supplementary exit. Given that some of the scenarios are above this 120,000 SF threshold and may involve a phased deliver approach for the community centre, it would be appropriate to confirm the potential maximum programming for any potential site and plan accordingly.

5. TRIP GENERATION

In June 2020, Bunt completed a high-level trip generation estimate, which considered trip generation for an estimated minimum and maximum floor area for the future NECC. This technical

memo has been attached for reference, but for the purposes of consistency with the parking analysis above, these high-level PM peak period trip generation estimates have been updated to reflect the revised scenarios. **Table 5.1** below provides a summary of each scenario based on our surveyed rates for observations at similar facilities.

In general, the range of floor areas for updated programming scenarios are close to the previous minimum and maximum floor area estimates investigated in the June 2020, and therefore generate similar quantities of trips during the critical PM peak period.

Table 5.1: PM Peak Hour Trip Generation for Programming Scenarios (Bunt Surveyed Rates)

SCENARIO	GFA (SQM)	GFA (SF)	DIRECTIONAL DISTRIBUTION		TRIP RATE (/1000SF)	TRIPS		
			IN%	OUT%		IN	OUT	TOTAL
1 – Full Program	19,033	204,869	46%	54%	2.10	198	232	430
2A – Optimized (w/o Arena or Child Care)	10,081	108,511	46%	54%	2.10	105	123	228
2B – Optimized (w/ Arena)	16,120	173,514	46%	54%	2.10	168	197	364
2C – Optimized (w/ Child Care)	10,518	113,215	46%	54%	2.10	109	128	238
2D – Optimized (w/ Arena & Child Care)	16,557	178,218	46%	54%	2.10	172	202	374
3 – Reduced Program	6,594	70,977	46%	54%	2.10	69	80	149

These estimated trip generation volumes should be revisited as the NECC programming scenarios are refined and finalized. Once that process has led to a preferred option for delivery of the NECC, a more detailed analysis of trip assignment and network analysis can be completed to quantify the potential impacts to the broader transportation network, based on requirements that would be confirmed by the City.

6. CONCLUSIONS AND RECOMMENDATIONS

The introduction of a new Northeast Community Centre in the Burke Mountain neighbourhood will be a vital amenity for the existing and future residents of Coquitlam. Given the range of activities being supported at this future facility and the location of the site, relative to other land uses, it is important to carefully consider the transportation demands that are introduced by this development. A major component of this transportation assessment is vehicle parking and this report has provided an overview of proposed ranges for a variety of potential scenarios for the future NECC. Through the consideration of the City of Coquitlam's Bylaw and using regional data on similar recreational facilities, Bunt has been able to provide a recommended range for vehicle parking supply that can be used to help advance the project understanding on key components of the design and project costs.

The following presents key conclusions and recommendations from Bunt's analysis.

- Following the City of Coquitlam's *Zoning Bylaw* would result in a parking supply requirement in the range of 169 spaces to 474 spaces, depending on the specific programming scenario.
- ITE parking generation manual indicates an average rate of 3.34 per 100 SQM GFA for recreation facility.
- The Bunt Database parking demands range considerably across the facilities with the lowest weekday parking demand recorded at 1.7 parking spaces per 100 SQM GFA, and the highest being 4.4 per 100 SQM GFA. On average the parking demand was found to be 3.1 parking spaces per 100 SQM GFA while the 85th percentile parking demand came in at 3.9 parking spaces per 100 SQM GFA. A 15% free boarding buffer increases the rates to 3.5 spaces per 100 SQM and 4.5 spaces per 100 SQM.
- The NECC is less accessible to transit than the other community and recreation centres in Bunt's database and Burke Mountain is on the outskirts of Coquitlam. Due to the location and overall proposed land use for the neighbourhood, Bunt assumes transit access is unlikely to be enhanced enough to significantly reduce vehicle traffic and parking demand.
- Bunt recommends a provision rate range of 3.2 spaces to 3.7 spaces per 100 SQM based on the comparison of NECC to the Bunt Database, and the CoC *Zoning Bylaw* with the understanding that Pick-up / Drop-off (PUDO) will need to be considered carefully in the design and that arena event parking may need to be considered depending on the programming scenario. The lower bound provisional rate of 3.2 spaces per 100 SQM would supply a range of 211 spaces to 609 spaces depending on the scenario while the upper bound rate of 3.7 spaces per 100 SQM would supply a range of 244 spaces to 704 spaces depending on the scenario.
- Arenas are likely to have even more vehicle demand due to equipment for sports like hockey, lessons, practices, and events, which makes this a pivotal decision for the site planning. They are likely to operate earlier in the morning and later in the evening than the rest of NECC's programming. Special event management (e.g. youth hockey tournaments) should be considered early on in the process.
- The alternate site locations will have impacts to the vehicle circulation patterns within the Partington Creek Neighbourhood Centre area, as compared to the Master Plan, and should be carefully considered when selecting the NECC site.
- A GFA range up to 82,000 SF (7,620 SQM) will manage with a single site access; while a GFA range above 120,000 SF (11,150 SQM) may require a shift to two site accesses or a main access with a supplementary exit.

APPENDIX A

Northeast Community Centre

High-level Trip Generation Estimate

June 16, 2020

Bunt & Associates Engineering Ltd.
Suite 1550 – 1050 West Pender Street, Vancouver, BC V6E 3S7 **Tel** 604 685 6427 **Fax** 604 685 6579
Vancouver Victoria Calgary Edmonton **www.bunteng.com**

MEMO

DATE: June 16, 2020
PROJECT NO: 04-19-0291
PROJECT: NE Community Centre
SUBJECT: High Level Trip Generation Estimate

TO: Kristal Stevenot
HDR

PREPARED BY: Jordan Eccles, Bunt & Associates
REVIEWED BY: James Lee, Bunt & Associates

This memo outlines the estimated vehicle trip generation of the planned Northeast Community Centre within the Burke Mountain neighbourhood of Coquitlam, B.C.

HDR provided Bunt & Associates Engineering Ltd. (Bunt) the estimated net floor area for each main program within the community centre with a minimum and maximum size. Trip generation estimates have been derived for both the minimum and maximum size scenarios to provide a range of potential trip generation. In general, given the early stages of the project, Bunt's analysis findings were intended to be high level in nature and subject to change as the development plan progresses.

Trip generation for community centres is typically based on gross floor area and not the net/programmable floor area. For the purposes of this exercise and in lieu of readily available gross floor area projections, the provided program net floor area has been increased by 50% to estimate the gross floor area. This is a common conversion factor that Bunt has used for previous Community Centre studies.

1. METHODOLOGY

Bunt surveyed trip generation at seven comparable community centres in Metro Vancouver and Alberta and their PM peak hour trip generation rates are shown below in **Table 1**. The weekday PM Peak hour is expected to be the critical peak hour. The programs offered at each surveyed community centre vary and may not exactly match the programs expected at the NE Community Centre. However, the average of these comparable sites should provide a reasonable estimate of the expected trip generation at the NE Community Centre.

The programs were grouped into four facility categories for comparative purposes including:

- Recreation Centre (including fitness rooms, gymnasiums, childcare, multi-purpose rooms, etc.);
- Aquatic Centre;
- Library; and,
- Ice Rinks.

The NE community centre is expected to have all four these 4 main facilities.

Table 1: Bunt Surveyed Community Centres

COMMUNITY CENTRE	CITY	SIZE (FT²)[1]	PM PEAK HOUR TRIP RATE (PER 1,000 SQ.FT OF GFA)	FACILITIES
Cameron Rec Centre	Burnaby	56,000	2.50	Rec Centre, Library
Guildford Rec Centre	Surrey	109,290	1.76	Rec Centre, Library
Delbrook Community Centre	North Vancouver	52,000	2.98	Rec Centre
Millennium Place	Sherwood Park, AB	225,000	2.13	Rec Centre, Aquatic, Ice Rinks
Tri-Leisure Centre	Spruce Grove, AB	225,000	1.65	Rec Centre, Aquatic, Ice Rinks
Kinsmen Sports Centre	Edmonton, AB	200,000	1.90	Rec Centre, Aquatic
St. Albert Multi-use Centre	St. Albert, AB	277,800	1.80	Rec Centre, Aquatic, Ice Rinks

1. Size in terms of GFA.

As shown, Bunt's observed trips rates are all within the same general magnitude, ranging from 1.65 to 2.98 trips per 1,000 ft². The average PM peak hour trip rate of these community centres was **2.10 trips per 1,000 ft²**.

2. ANALYSIS FINDINGS

2.1 Bunt's Estimated Trip Generation

Table 2 summarizes the estimated trip generation of the NE Community Centre under the minimum and maximum floor area scenarios using the average trip rate found from Bunt's studies.

Table 2: PM Peak Hour Trip Generation (Bunt Rates)

SCENARIO	SIZE (FT²)[1]	DIRECTIONAL DISTRIBUTION		RATE	TRIPS		
		In%	Out%		In	Out	Total
Minimum Floor Area	129,825	46%	54%	2.10	126	147	273
Maximum Floor Area	227,850	46%	54%	2.10	220	259	479

1. Size in terms of GFA.

As the table indicates, when applying Bunt's average community centre rate, the estimated PM peak hour trip generation ranges from approximately **273 trips (126 in, 147 out)** to **479 trips (220 in, 259 out)** for the minimum and maximum potential floor area scenarios, respectively.

2.2 ITE Rate Comparison

For comparison, the estimated trip generation using rates from the ITE Trip Generation Manual (ITE 10) has been included in **Table 3**. Note, ITE does not mention libraries or ice rinks within the common facilities listed in the recreation centre land use code description. Both libraries and ice rinks have separate land use codes and trip generation rates.

While accounting for these rates separately likely leads to an overestimation of the trips given there is expected to be a number of patrons who would use recreation centre, library, and/or ice-skating facilities within the same trip, as a conservative approach to this comparative analysis, these rates have been accounted for separately.

Table 3: Trip Generation (ITE Rates)

LAND USE	CODE	SIZE (FT²)[1]	DIRECTIONAL DISTRIBUTION		RATE	TRIPS		
			In%	Out%		In	Out	Total
Minimum Floor Area Scenario								
Rec Centre	495	88,575	47%	53%	2.31	96	108	204
Library	590	7,500	48%	52%	8.16	29	32	61
Ice Skating Rink	465	33,750	55%	45%	1.33	25	20	45
					Total	**150**	**160**	**310**
Maximum Floor Area Scenario								
Rec Centre	495	136.350	47%	53%	2.31	148	167	315
Library	590	24,000	48%	52%	8.16	94	102	196
Ice Skating Rink	465	67,500	55%	45%	1.33	49	40	89
					Total	**291**	**309**	**600**

1. Size in terms of GFA.

When applying ITE rates, the estimated trip generation ranges from **310 trips (150 in, 160 out)** to **600 trips (291 in, 309 out)** for the minimum and maximum potential floor area scenarios, respectively. This translates to about 14% higher than when applying Bunt's rates to the minimum floor area scenario and 25% higher when applied to the maximum floor area scenario.

2.3 Summary

In summary, based on Bunt surveyed rates, the NE community centre is estimated to generate between **273 – 479 vehicle trips** in the critical weekday PM peak hour depending on the floor area size scenario. The trips are expected to be in a similar range during the Saturday mid-day peak hour and considerably lower in the weekday AM peak hour.

For comparison, when applying individual ITE rates for each use, the community centre trip generation estimate was slightly higher at **310 – 600 vehicle trips** in the PM peak hour. However, since this approach applied a separate rate to the recreation centre, library, and ice-skating facility uses, where in reality there would likely be shared trips between these uses, using ITE rates in this manner would likely be an overconservative approach to the analysis.

THURBER

July 29, 2024 File No.: 26791

City of Coquitlam
201-3007 Glen Drive
Coquitlam, BC
V3B 0L8

Attention: Christine Ng

NORTHEAST COMMUNITY CENTRE – PHASE 2
GEOTECHNICAL ENGINEERING REPORT

Dear Christine,

Thurber Engineering Ltd. (Thurber) has been retained by the City of Coquitlam (the City) to provide geotechnical engineering services for the proposed Burke Mountain Northeast Community Centre (NECC) in Coquitlam. This report presents the results of our June 2024 site investigation and provides our geotechnical design recommendations to support the design phase of this project.

Authorization to proceed with the work was received from the City via a purchase order executed on July 15, 2024.

It is a condition of this letter that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

1. INTRODUCTION

1.1 Site Description and Proposed Development

The Burke Mountain Village development is a proposed high-density residential and commercial hub on Burke Mountain in Coquitlam, BC. The development site is bounded by David Avenue to the north, Mitchell Street to the west, and Burke Village Promenade to the south. The existing site currently slopes down at about 12% to 20% grade towards the southeast.

As part of this development, the City of Coquitlam (the City) is planning a community centre and park. The proposed Northeast Community Centre (NECC) will consist of a two to three story building partially cut into the existing slope. It will have a two level partially underground parkade and surface parking lot. However, the building footprint and configuration has not yet been finalized and multiple design options are being considered.

The proposed NECC is to be designed in accordance with the 2024 British Columbia Building Code (2024 BCBC).

1.2 Thurber's Scope of Services

Thurber's scope of services for this project is outlined in our proposal of April 19, 2024. Our services include undertaking a geotechnical site investigation of the project area, providing geotechnical recommendations for the proposed NECC, and providing conceptual recommendations for shoring.

Our scope of services does not include the following: comment on geohazards affecting the proposed property, discussion of any slopes located outside of the property, or environmental engineering.

2. SITE INVESTIGATION

2.1 Previous Studies

Thurber completed a desktop study of available surficial geology information and past geotechnical reports in our files for developments at or near the project site. Our primary sources of information are past studies completed by Thurber including:

- Burke Mountain Village Lands, Coquitlam, BC, Geotechnical Investigation Results (2019)
- Burke Mountain Community Centre, Coquitlam, BC, Geotechnical Investigation Results (2020)
- Burke Mountain Community Centre, Coquitlam, BC, Long-Term Groundwater Measurements (2022)

As a part of these past studies, Thurber advanced a total of six sonic test holes to depths between 9.0 m and 10.5 m. Piezometers were installed in two of these test holes and were equipped with level loggers to allow automatic measurement and recording of long-term groundwater levels. Samples were collected and returned to our laboratory for routine visual classification and water content testing. The soils over the project site were generally found to consist of a thin layer of topsoil over very dense till-like soils which extended to the bottom of each test hole.

The location of these test holes and instruments are shown in Figure 1 and test hole logs from those investigations have been attached to this report.

2.2 Site Preparation

The test hole locations for our geotechnical investigation were located on vehicle trails which were previously cut through the site as part of past exploration work. However, access to these trails required cutting a ramp down from the future Princeton Avenue embankment currently under

construction to the north of the site. Some minor brush clearing and regrading along the access roads was also necessary to allow passage of the drill rig.

2.3 Utility Locates

Thurber submitted a BC One Call request to obtain underground utility information prior to drilling. Thurber also submitted a request to Shaw Communications (Dig Shaw) and checked the documented utilities on the Metro Vancouver and City of Coquitlam GIS websites.

As an additional precaution, Thurber retained Western Leakage Services Ltd. to perform a field locate of utilities around each proposed test hole location. Western used Electro-Magnetic (EM) and Ground Penetrating Radar (GPR) equipment to identify and mark underground utilities near the proposed locations before drilling.

2.4 Geotechnical Investigation

The geotechnical investigation was completed on June 24 and 25, 2024 using a track-mounted sonic rig, operated by Conetec Investigations Ltd. Sonic drilling utilizes a rotary-vibratory drill head to advance the drill rods and collect continuous core samples using a 1.5 m long, 89 mm inside-diameter core barrel mounted at the end of the drill rods. The drilling method also includes advancing a larger diameter casing (140 mm outside-diameter) around the core barrel and drill rods to prevent the hole from collapsing and reduce sloughing.

Three sonic test holes were completed within the proposed footprint of the NECC at the locations shown on the attached Figure 1. Each test hole was advanced to a planned depth of 15 m below existing grade. The soil and groundwater conditions at each test hole location were logged by an experienced Thurber geotechnical engineer in general accordance with the Canadian Foundation Engineering Manual (5th Edition). Representative disturbed soil samples were collected from the recovered core at select depths and returned to Thurber's Vancouver laboratory for testing.

All samples were subjected to routine visual classification according to the Unified Soil Classification System (ASTM D2488) and water content determination (ASTM D4959). Five selected samples were also subjected to grain size distribution testing (ASTM C136).

2.5 Piezometers and Backfilling

Standpipe piezometers were installed in all test holes. The piezometers comprised 50 mm diameter PVC pipe that extended to the bottom of the test hole, with the slotted zone set at the base of the hole. The test hole annulus was backfilled with filter sand and sealed with a bentonite cap. Following the stabilization of the groundwater levels, the wells were instrumented with water level loggers to obtain near continuous readings of groundwater levels.

3. INTERPRETED SUBSURFACE CONDITIONS

3.1 Geological Setting

Geological Survey of Canada's surficial geology map 1484A, indicates that the subsurface conditions in the area comprise Mesozoic bedrock overlain by glacial deposits and colluvium. As the NECC site has not been previously developed, significant layers of fill are not expected.

3.2 Interpreted Soil Conditions

The results of the investigation and laboratory testing are presented on the attached test hole logs. The logs provide a complete, detailed description of the conditions encountered in the investigation and must be used in preference to the generalized descriptions given below.

The soils encountered within the test holes (from top to bottom) generally comprise the following:

- **TOPSOIL** – The surface of the site consisted of an approximately 0.2 m to 0.6 m thick layer of forest liter and topsoil or topsoil-like material. The layer generally consisted of dark brown, wet, silty, gravelly sand with some organics.
- **WEATHERED TILL-LIKE SOILS** – The topsoil was typically underlain by a layer brown silty, gravelly sand with trace to some organics. This layer generally extended to depths of 0.3 m to 0.9 m below ground surface. Based on dynamic cone penetration test (DCPT) blowcounts from our 2020 drilling program and our observations during the current program, this soil is loose.
- **VERY DENSE TILL-LIKE SOILS** – The weathered till-like soils were underlain by dense to very dense till-like gravelly silt and sand with trace cobbles and trace boulders. The proportions of gravel, silt and sand varied in each test hole and with depth. Water contents in this material varied between 4% and 11%. These materials were encountered to the bottom of the three test holes. This layer contained boulders between 0.8 m and 2 m in diameter. It may also contain occasional silty sand and sand seams as observed in TH24-03. Our 2020 drilling indicates that the upper 2 m of this material may be compact to dense, whereas soils below typically become very dense.

3.3 Interpreted Groundwater Conditions

Data loggers installed within each of the 2024 piezometers have been continuously measuring data since their installation on June 24 and 25, 2024. Preliminary measurements were downloaded on July 19, 2024 and compared to manual measurements taken with a dip meter. Based on these preliminary results, the observed groundwater levels were between 6 m and 11.5 m below existing grade.

These groundwater levels will continue to be logged for a 12-month period. Following this monitoring period, Thurber will provide a standalone memorandum discussing our observations of recorded precipitation and groundwater levels during that period.

Previous groundwater measurements from this site were documented in a Thurber memorandum issued on January 14, 2022. As noted in the 2022 memorandum, typical groundwater levels were between 0.2 m and 2.2 m below grade. The groundwater levels were observed to vary seasonally and in response to precipitation.

The measured 2024 groundwater levels were far lower than the previously measured groundwater levels. We suspect that the wells could still be equalizing to static levels following the disturbance from site investigation. The groundwater levels identified in our 2022 memo are likely more representative than those observed so far in the 2024 piezometers. This will be confirmed over the 12-month monitoring period.

Artesian conditions have been observed in the Burke Mountain area where Quadra sand deposits were encountered. However, none of the test holes completed within the Burke Mountain Village Lands site have encountered Quadra sand deposits.

4. GEOTECHNICAL DESIGN RECOMMENDATIONS

4.1 General

Based on our understanding of the soil and groundwater conditions, the proposed low-rise development and site configuration is feasible. We recommend the proposed buildings be constructed using conventional pad and strip footings founded on engineered fill or directly on dense to very dense till-like soils.

Due to the presence of shallow groundwater indicated by the wells installed in 2019 and 2020, the foundations, floor slab and foundation walls will likely be located below local groundwater levels. A drainage system will be necessary to prevent hydraulic pressures from acting on these features. If such a drainage system cannot be established, the building will need to be designed to resist hydrostatic pressures.

Geotechnical input is provided in the sections below for foundation design, lateral earth pressure, site preparation, placement and compaction of granular fill, input on temporary excavations, permanent groundwater control, and seismic site classification.

The recommendations contained in this report are only valid for buildings founded at a maximum of 10 m below existing grade. Due to the risk associated with the presence of Quadra sands and artesian pressures, if the excavation for parking is required extend deeper, and additional deeper test holes will be needed to explore the effect of artesian pressures on the excavation.

4.2 Seismic Assessment

Seismic design for the proposed development is to be per the 2024 BCBC which is based upon the 2020 National Building Code of Canada (NBCC). In accordance the 2020 NBCC (Table 4.1.8.4.A), this site is classified as Site Class C.

The site classification is used to determine the relevant design seismic parameters, such as, appropriate spectral response acceleration values Sa(T) for period T, as well as acceleration and velocity based site coefficients, Fa (short period) and Fv (long period), as per NBCC 2020 (Tables 4.1.8.4 B and C, respectively). The firm ground response spectrum for the site was determined using the online National Building Code (NBC 2020) seismic hazard calculator and is attached at the end of this report. The design level seismic event has a 2% chance of exceedance in 50 years (1:2475 return period event).

The Site Class C assumption on which the firm ground response spectrum is based typically provides conservative/higher values of spectral accelerations than a determination based on actual site specific shearwave velocity measurements. If the structural engineer believes that significant savings can be achieved through reduced seismic demand, Thurber should be contacted to discuss site specific shearwave velocity testing to a depth of 30 m below grade.

Given the density, grain size distribution and expected age, the soils below the proposed development foundations are not considered to be liquefiable or cyclically mobile under the design earthquake.

4.3 Site Preparation

The site should be excavated to design subgrade beneath the parking area, utilities, retaining walls and buildings. Any remaining topsoil or loose weathered till-like soils should then be removed to expose the underlying compact to very dense till-like soil. Once this is complete, Thurber should review the exposed subgrade and advise on the extent of any additional subexcavation which may be necessary. Sub-excavations should be backfilled with engineered fill as discussed in Section 4.4.

Both the topsoil and till-like soils are expected to contain cobbles and boulders. The contractor should be prepared to remove and transport large boulders. This should include a contingency for hydraulic splitting or blasting of boulders encountered.

Final excavation should be carried out using an excavator equipped with a smooth-edge trimming bucket. The base of all excavations should be free of loose, organic, or disturbed material. All water must be drained away to prevent ponding. Large-sized granular particles (i.e., cobbles,

boulders or bedrock) protruding above the bearing surface must be eliminated, either by removal or splitting, to avoid hard-points on the underside of the foundations.

The native foundation soils will typically be sensitive to changes in water content and disturbance by construction and repeated pedestrian traffic. Therefore, unless the footing concrete will be placed within 24 hours of exposing the bearing surface, we recommend placing a nominal 25 mm thick concrete blinding layer (or equivalent) on the bearing surface to reduce the likelihood of disturbance.

4.4 Backfill

Fill placed beneath building and retaining wall foundations and placed against retaining walls should consist of engineered fill. Engineered fill should consist of imported sand and gravel fill with a maximum particle size of 75 mm and less than 5% by weight passing the 0.075 mm sieve. Engineered fill beneath roadways, below retaining wall foundations and against retaining walls should typically be compacted to 95% Modified Proctor Maximum Dry Density (MPMDD). Engineered fill within a 1H:1V projection below underside of building foundations should be compacted to 98% MPMDD. Generally, engineered fill may be placed in 300 mm thick loose lifts.

As a cost saving measure, use of material sourced from cut slopes as fill (till-fill) could potentially considered for site grading works beneath landscaped and parking areas. Where used, till-fill should generally be compacted to 95% MPMDD unless otherwise specified and the lift thickness decreased. Regardless, the use of till fill presents some challenges as till fill is highly variable in terms of composition, in-situ water content and proctor density values. The till fill is also extremely sensitive to moisture changes and could potentially be at or above optimum when excavated from cut areas, making it very difficult to use during and following periods of wet weather. It is typically not possible to properly compact till fill that is placed 1% to 2% wet of optimum. Till fill placed wet of optimum that can be compacted typically experiences ‘rolling’ deformations under construction traffic load and may need time to be dried, or removed and replaced before additional fill lifts can be placed. Material that is significantly wet of optimum will require moisture conditioning or removal from site.

The till fill is a transitional material from a compaction perspective in that it behaves partially like a granular soil, which tends to respond well to smooth drum vibratory compaction methods, and partially like a cohesive soil, which requires pad foot roller configurations to achieve compaction. However, the contractor should be prepared to use both smooth drum and pad foot rollers on the project if deemed appropriate by the contractor and Thurber. During excavation and placement, any boulders greater than about half the lift thickness should be removed prior to reuse of till fill.

Due to the potential challenges encountered and additional level of care required to work with till-fill, the frequency of quality control testing typically needs to be increased as well as the number

of geotechnical field reviews by Thurber in areas where this material is used. Even with precautionary measures such as increased quality control, use of till-fill could result in additional differential settlements above those calculated in this report. This could result in cracking of any overlying pavement or landscape features. If these risks are not acceptable, then till-fill should not be used.

4.5 Foundation Design

The proposed buildings and retaining walls can be founded on pad and strip footings constructed directly on the existing, undisturbed, dense to very dense till-like soils (but not till-fill or weathered till-like soils) or on compacted engineered fill overlying the existing, undisturbed dense to very dense till-like soils. The serviceability limit state (SLS) and factored ultimate limit state (ULS) bearing resistances for footings founded as discussed are provided in Table 4-1 for differing soil conditions. The SLS bearing resistance is based on less than 25 mm of settlement.

Table 4-1 - Proposed SLS and ULS Bearing Resistances

Foundation Soil	Depth Below Existing Site Grade (m)	SLS Bearing Resistance (kPa)	ULS Factored Bearing Resistance (kPa)
Engineered fill greater than 150 mm thick over existing till-like soil	N/A	150	200
Compact to Dense Till-Like Soils	< 3	200	300
Very Dense Till-Like Soils	> 6	300	450

Strip footings for the buildings should be at least 0.45 m wide and pad footings should have a minimum dimension of 0.6 m. For confinement and frost protection purposes, all footings should be located a minimum of 450 mm below the adjacent grade. Footings should be installed on level ground and any loads must be concentrically and vertically applied to the footing.

Footings founded at shallow depths may impart stresses onto adjacent foundations, utilities, etc. Bridging, deepening, or utility relocations may be required where this occurs. Footings should be located such that the risk of significant stress increase on the adjacent footings or foundation walls is mitigated. Footings should generally be founded below a plane projected up at 1H:1V from any lower footing excavation or load-sensitive structure. Utilities that fall below a line projected down at 1H:1V from any footing should be relocated or encased in concrete.

The sliding of foundations should be resisted by friction at the interface between concrete and the foundation soils. We recommend using a factored ULS coefficient of friction of 0.35 for footings founded on engineered fill or dense undisturbed till-like soil.

4.6 Slab-On-Grade

Slab-on-grade flooring should be underlain by a minimum 300 mm thick layer of compacted free-draining (less than 5% particles by weight finer than 0.075 mm) 19 mm clear crush gravel. It should be compacted to a minimum of 95% MPMDD. This lift of material will act as a drainage layer and capillary break. A layer of non-woven geotextile with a tensile strength of 700 N and an apparent opening size of 0.212 should be placed between any till-like soils and the clear crush to prevent fine particle migration.

A vapour barrier comprising 6-mil (minimum) polyethylene should be placed on top of the 19 mm clear crush gravel. The polyethylene sheets would normally be overlapped a minimum of 0.3 m. Depending on the angularity of the granular fill used and level of traffic on the sheeting, a lightweight non-woven geotextile could be placed on top of the granular fill, prior to the polyethylene sheeting, to reduce the risk of punctures.

4.7 Lateral Earth Pressures

Unfactored lateral earth pressures provided in Figure 2 may be used for design of basement walls for the proposed buildings. These pressures assume that perimeter wall and underslab drainage will be established as recommended in Section 4.8. It is critical that the perimeter drains and any associated pumping systems are properly maintained and remain functional during the life of the building otherwise hydrostatic pressures will result in higher than estimated lateral pressures acting on the building walls.

If the City chooses to tank the building instead of installing perimeter drains and an underslab drainage layer, the lateral earth pressures presented in this report should be revised by Thurber to account for hydrostatic water pressure.

Figure 2 provides allowances for traffic loading and a means of calculating the effect of generalized area loading. However, for all loads within a horizontal distance defined by a line extending up by 1H:1V from the bottom of any wall, Thurber should be provided with the area and magnitude of the loads for review and revision of the lateral earth pressures if necessary.

4.8 Slab and Wall Drainage

We expect that the majority of the foundations, foundation walls and slab-on-grades for this building will be located below the existing groundwater level. As such, perimeter drains should be installed around the perimeter of the proposed buildings at a minimum 300 mm below the finished

floor slab level, but not lower than the perimeter foundation elevation unless offset by a horizontal distance equal to the difference in elevation. The perimeter drains should be hydraulically connected to the under-slab drainage layer.

The perimeter drains should consist of a minimum 150 mm diameter perforated PVC pipe. The perimeter drains should be surrounded by at least 150 mm of 19 mm drain rock or clear crushed gravel and then wrapped in a non-woven geotextile specified in Section 4.6. Within 2 m of a building, the grade should be sloped at 2%for paved surfaces and 5% for landscaped surfaces to provide surface drainage away from the building.

The sub-drainage system, comprising both the perimeter drain and sub-floor drainage layer, should be designed and constructed in a manner that provides unimpeded discharge of the intercepted groundwater. This is typically achieved by connecting the sub-drainage system via gravity discharge to a suitable drainage system, which may require a dedicated pump(s). Other means of discharge may be considered at the discretion of the civil designer.

Backfill against basements and concrete retaining walls should consist of a minimum 600 mm thick chimney of coarse-grained fill with less than 5% passing the 0.075 mm sieve extending out horizontally from the wall. This layer should be constructed in 300 mm thick lifts compacted to 95% MPMDD. This backfill layer should extend up from the perimeter drains to near ground surface. A 600 mm capping layer of road base, till-fill or similarly graded material should be established over the top of the chimney drain material. A layer of non-woven geotextile as specified in Section 4.6 should be placed between the coarse-grained chimney drain material and any till-fill or existing till or any other soils. Alternatively, a geocomposite strip drain could be considered.

Perimeter drains may be on the interior of the building where the excavation shoring (if shoring is used) is tight to building line. Minimum 75 mm diameter weep holes should be provided through the foundation wall at 1 m centres if this approach is adopted.

At locations where the perimeter foundation walls will be poured against the shotcrete shoring (i.e., no gap for backfill), holes should be drilled through the shotcrete shoring and a geosynthetic drainage mat should be provided continuously against the shotcrete shoring to prevent the buildup of hydrostatic pressures against the perimeter foundation walls. The foundation wall weep holes should be hydraulically connected to the geosynthetic drainage mat to allow it to drain to the interior perimeter drainage system. The weep holes should be detailed by the Mechanical Consultant and the details provided to Thurber to assess if it meets the intent of our drainage recommendations.

We recommend that elevator pits or other depressed floor areas be structurally tanked and waterproofed to avoid the need for deep drainpipes around the perimeter of the pits. Elevator pits

should be designed for hydrostatic and buoyancy pressures based on a water level at the under-slab drainage layer of the main building.

The groundwater inflow rate should be confirmed during construction to determine if additional measures, such as the installation of sub-floor drains comprising perforated drainpipe, are required to maintain the unimpeded drainage criterion.

The purpose of these drainage and backfill provisions is to prevent the buildup of hydrostatic pressures against the floor slab and walls. Any waterproofing and damp-proofing requirements are the responsibility of the architect or building envelope consultant.

4.9 Slopes and Non-Basement Standalone Retaining Walls

We understand that the development will include terraced retaining walls and sloped areas. Details on wall heights, locations and overall site grading are not available as the architectural design has not begun. Once these designs are available, Thurber should be contacted for a review of site grading and any related slope stability and retaining wall analysis.

4.10 Pavement Structure

The pavement structure should be supported on a competent subgrade of engineered fill, compacted till-fill or unweathered dense till-like material. A proof-roll should be completed at the final subgrade design elevation and at the exposed subgrade level, where fill placement is required to achieve design grades, using a fully loaded dump truck to identify potential soft spots. Soft spots must be sub-excavated and replaced with engineered fill or granular subbase compacted to at least 95% MPMDD.

The pavement section from the City of Coquitlam Supplementary Specifications Master Municipal Construction Documents (dated March 2022) for lanes, local and collector streets is appropriate for the proposed NECC. The subgrade preparation and the granular base and sub-base layer should normally extend a minimum of 1.5 m beyond the perimeter of all paved areas. Pavement subgrade preparation and supply, placement and compaction of the pavement structure should be in accordance with specifications provided in the MMCD and City of Coquitlam specifications.

We recommend a pavement structure consisting of (from top to bottom):

- Minimum 75 mm of asphalt concrete surface course (50 mm base course, 25 mm surface course)
- Minimum 100 mm of minus 19 mm granular base course (MMCD Section 31 05 17, Item 2.10), compacted to at least 95% MPMDD
- Minimum 200 mm of select granular subbase (MMCD Section 31 05 17, Item 2.8) compacted to at least 95% MPMDD

To increase pavement life, construction traffic on paved areas should be avoided by delaying paving operations as late as possible in the construction schedule. Designated access and egress routes should be defined to limit potential pavement damage or failure. These routes will be susceptible to premature pavement damage/failure and may have a reduced service life compared with the remainder of the roadways.

4.11 Underground Services and Utilities

Underground services can be installed using conventional techniques and design details consistent with MMCD specifications. Underground services should be set back or protected from footing loads as discussed in Section 4.5.

We recommend that trench dams be installed along sloping sections of any utility mains which are sloped greater than 5% grade. This will reduce the risk of internal erosion due to the potential for groundwater seepage through the pipe bedding and backfill materials. Trench dams will also allow for easier maintenance excavations later in the project life. Where needed, we recommend that trench dams be placed at the top and bottom of utility sections and at intermediate intervals no greater than 50 m. Trench dams should consist of 300 mm wide barriers comprising manufactured products (e.g., Aquablok trench dam materials or approved alternative), placed and compacted across the entire vertical cross-section of the trench up to the bottom of the pavement subbase. The products proposed for use as trench dams should be submitted to Thurber for review prior to installation. If trench dams conflict with other uses of the trench, Thurber should be contacted for further discussion and revision of these trench dam recommendations.

4.12 Low Impact Developments Groundwater Infiltration System

We understand the City of Coquitlam prefers to use the low impact development (LID) model to manage the storm water in new land developments. LIDs use natural or engineered infiltration to control storm water. This generally is designed using perforated pipes that allow storm water to infiltrate into the surrounding soils.

Due to the high fines content of the native soil, possible presence of sand layers under artesian groundwater pressures and proposed use of till fill for grading works, the use of LIDs is not recommended from a geotechnical perspective as the low permeability of the native soil would limit the effectiveness. If LIDs were to be used at this site, they would provide limited drainage and could lead to softening of the till fill and thereby negatively affect the life cycle performance of the pavement structure.

4.13 Radon and Methane Gas Potential

Site specific testing for radon in the site soils was not requested nor included as a part of our scope. However, the BCBC 2024 has adopted a different approach concerning radon potential than was used in past BCBC. Based on this approach and a review of the current BC Centre of Disease Control – British Columbia Radon Map, the site is located within the "yellow" zone corresponding to typically between 0 to 200 Bq/m^3 (Becquerels per cubic metre) and possibly higher in 3% of buildings. This will need to be considered during design.

Methane gas is typically caused by the decomposition of peat and organic soil underlying a structure. However, neither peat nor thick deposits of organic soils were identified within this site, Methane gas is not expected beneath the proposed buildings.

5. TEMPORARY EXCAVATIONS

All temporary works including excavation, shoring and dewatering should be undertaken in conformance with WorkSafeBC Occupational Health and Safety Regulations (OHSR). In order to confirm geotechnical conditions, all excavations must be reviewed by a geotechnical engineer following excavation but prior to worker entry where required by OHSR Part 20.

An excavation on the order of up to about 8 m to 10 m into portions of the existing hillside will be required to accommodate the currently planned two levels of underground parking in the proposed building. Sloped excavations are typically preferable where no physical constraints, such as adjacent buildings, underground structures, roads or utilities, are present around the footprint of the proposed NECC.

For preliminary design purposes, temporary excavation slopes of 1.5H:1V or flatter in the overburden soils (i.e. soils above the till-like deposit) and 1H:1V in the undisturbed till-like soils can be used. The slopes must be protected at all times from surface water run-off and rainfall by polyethylene sheeting anchored into the slope with 600 mm long spikes. The temporary cut slopes should be reviewed by Thurber during construction to determine if modifications are required based on exposed soil conditions.

Where sloped excavations cannot be accommodated, some of the excavation may have to be supported using a shotcrete and anchor support system or similar. The temporary excavation shoring will likely consist of 100 mm to 150 mm thick reinforced vertical shotcrete with temporary tieback anchors. The tieback anchors will likely consist of conventional threadbar anchors which may need to encroach on adjacent properties. It is critical that the City establish encroachment agreements for neighbouring property not owned by the City. If these agreements are not in place sufficiently in advance of construction, owners of adjacent properties may refuse encroachment,

and the excavation may be forced to rely on a significantly more expensive internally braced shoring system.

Based on the observed groundwater conditions, the excavation will extend below the groundwater level. However, the soil conditions at the site are anticipated to have low permeability. As such, we expect that groundwater seepage and stormwater should be able to be managed using a conventional sump and pump system during construction. Control and disposal of water that enters the excavation will be the responsibility of the contractor.

The recommendations presented in this section are conceptual. Thurber should be retained to provide detailed shoring design drawings once the building design has progressed.

Significant seepage into shallow excavations is not generally anticipated unless Quadra sands or similar are encountered. Where Quadra sands are encountered, the potential exists for significant groundwater inflow and soil piping. If this is the case, a sump and pump arrangement may not be suitable and a well-point or similar dewatering system may be required.

6. FUTURE GEOTECHNICAL INVESTIGATION AND ENGINEERING

At the time this report was issued, the building and site layout have not yet been developed. As the design progresses and a building layout and site grading have been determined, additional geotechnical design services will be needed. Depending on the final configuration of the building and requests of the design team, some additional site investigation may also be needed. These services could potentially include:

- Slope stability analysis of to confirm factors of safety
- Design and analysis of mechanically stabilized earth retaining walls
- Design drawings for shoring and excavation
- Shearwave velocity measurements to a depth of 30 m below grade if requested by the structural engineer
- Additional or deeper test holes if the footprint of the building or depth of excavation has changed from that anticipated in this study.
- Geotechnical field review services during construction as required by the 2024 BCBC.

7. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact the undersigned at your convenience.

Yours truly,
Thurber Engineering Ltd.

David Tara, M.Sc.A., P.Eng.
Technical Specialist/Review Engineer

Ryan Mills, M.Eng., P. Eng.
Geotechnical Engineer

Thurber Engineering Ltd.
Permit to Practice #1001319

Attachment

- Statement of Limitations and Conditions
- Figure 1 – Test Hole Location Plan
- Figure 2 – Lateral Earth Pressures
- Test Hole Logs (2019, 2020, 2024)
- Grain Size Analysis Results
- 2020 National Building Code of Canada Seismic Hazard

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Plotted: July 24, 2024

26791-40.dwg

LEGEND:

- TEST HOLE (2019 & 2020)
- TEST HOLE (2024)

NOTES:

1. AERIAL IMAGE TAKEN FROM THE ESRI WORLD IMAGERY SERVER.
2. TEST HOLE LOCATIONS ARE APPROXIMATE.
3. PROPOSED BUILDING TAKEN FROM "CITYDOCS-#4669911-V1-PRCF_-_RCFP_-_NEC_-_P1_PARKING_PLAN_2021.PDF", BY HDR.

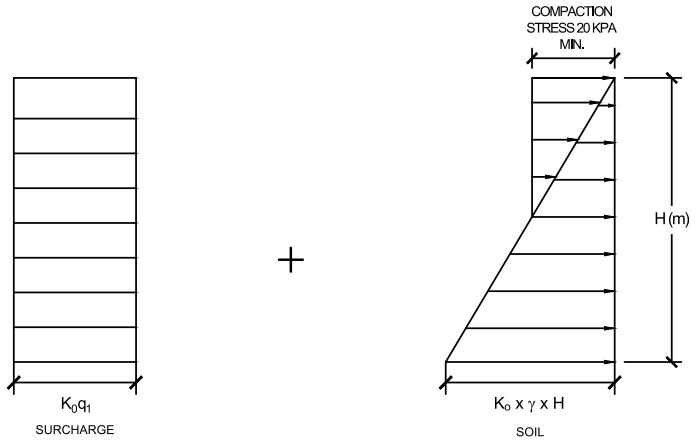
THURBER ENGINEERING LTD.

CITY OF COQUITLAM

TEST HOLE LOCATION PLAN

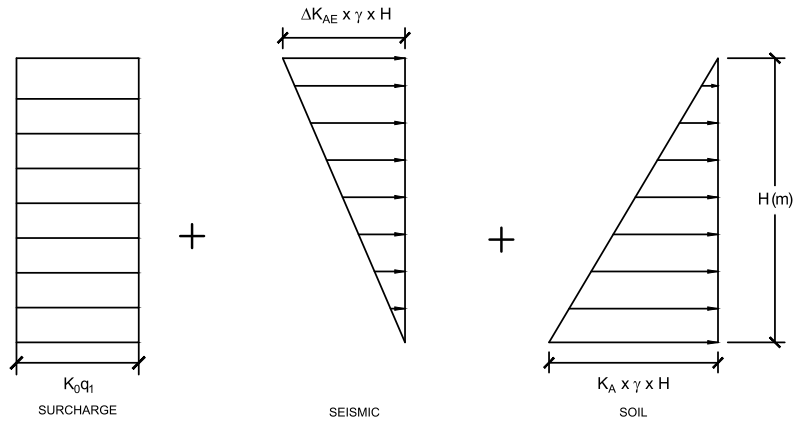
NORTHEAST COMMUNITY CENTRE
BURKE MOUNTAIN
COQUITLAM, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
RWJM	MOM		JULY 24, 2024	1:1500	26791-40 - 1		-



STATIC EARTH PRESSURES

PARAMETER	VALUE	COMMENTS
Ø	32°	WHERE TILL-FILL IS USED WITHIN 1H:1V EXTENDING UP FROM BASE OF WALL.
γ	21kN/m^3	-
K_o	0.47	-
K_A	0.28	-
ΔK_{AE}	0.20	-
H	BASEMENT DEPTH(m)	DEPTH OF BASEMENT
q_1	12 kPa (MIN.)	TRAFFIC OR CONSTRUCTION SURCHARGES



SEISMIC EARTH PRESSURES

NOTES:
1. ALL METRIC UNITS IN (m) AND (kPa).
2. PRESSURES GIVEN IN THIS DIAGRAM ARE UNFACTORED.
3. COMPACTION STRESS AND TRAFFIC SURCHARGE ARE NOT ADDITIVE.
4. ASSUMES NO HYDROSTATIC PRESSURES DUE TO A CHIMNEY DRAIN AS DISCUSSED IN THE GEOTECHNICAL REPORT AND A FUNCTIONING PERIMETER DRAINAGE SYSTEM. PRESSURE DIAGRAMS WILL BE DIFFERENT WHERE A PERMANENT DRAINAGE AND PUMPING SYSTEM IS NOT INSTALLED.
5. ASSUMES NO GRADE CHANGES OR FOUNDATION LOADS WITHIN HORIZONTAL DISTANCE FROM WALL EQUAL TO WALL HEIGHT. WHERE THIS OCCURS, PRESSURES WILL BE HIGHER THAN SHOWN ON THESE DIAGRAMS. THURBER SHOULD BE CONTACTED FOR ADDITIONAL REVIEW AND COMMENT.

LEGEND:

THURBER ENGINEERING LTD.

CITY OF COQUITLAM

LATERAL EARTH PRESSURE FOR YIELDING WALLS

NORTHEAST COMMNUNITY CENTRE
BURKE MOUNTAIN
COQUITLAM, BC

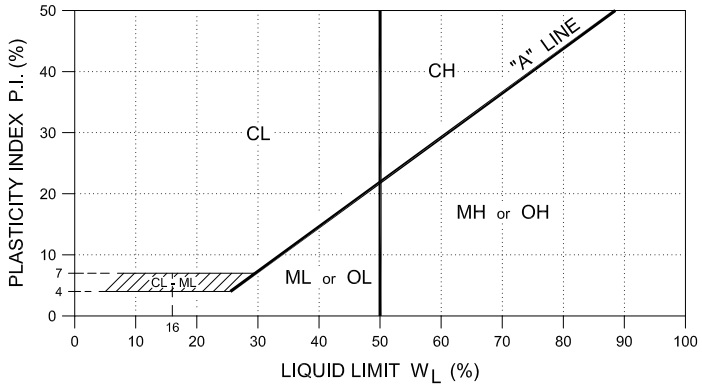
DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
RWJM	MOM	DJT	JULY 26, 2024	N.T.S.	26791-40 - **2**		0

THURBER

UNIFIED CLASSIFICATION SYSTEM FOR SOILS (ASTM D2487)

MAJOR DIVISION			SYMBOLS GROUP	SYMBOLS GRAPH	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS (MORE THAN 50% BY WEIGHT RETAINED ON No. 200 SIEVE)	GRAVELS MORE THAN 50% COARSE FRACTION RETAINED ON No. 4 SIEVE	CLEAN GRAVELS (< 5% FINES)	GW		WELL GRADED GRAVEL and WELL GRADED GRAVEL with SAND.	$C_U = \frac{D_{60}}{D_{10}} \geq 4 \quad C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			GP		POORLY GRADED GRAVEL and POORLY GRADED GRAVEL with SAND.	NOT MEETING ABOVE REQUIREMENTS
		GRAVELS WITH FINES (> 12% FINES)	GM		SILTY GRAVEL, GRAVEL - SAND - SILT MIXTURES.	FINES CLASSIFY AS ML or MH (3)
			GC		CLAYEY GRAVEL, GRAVEL - SAND - CLAY MIXTURES.	FINES CLASSIFY AS CL or CH (3)
	SANDS MORE THAN 50% COARSE FRACTION PASSES No. 4 SIEVE	CLEAN SANDS (< 5% FINES)	SW		WELL GRADED SAND and WELL GRADED SAND with GRAVEL	$C_U = \frac{D_{60}}{D_{10}} \geq 6 \quad C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			SP		POORLY GRADED SAND and POORLY GRADED SAND with GRAVEL.	NOT MEETING ABOVE REQUIREMENTS
		SANDS WITH FINES (> 12% FINES)	SM		SILTY SAND, SAND - SILT MIXTURES.	FINES CLASSIFY AS ML or MH (3)
			SC		CLAYEY SAND, SAND - CLAY MIXTURES.	FINES CLASSIFY AS CL or CH (3)
FINE-GRAINED SOILS (MORE THAN 50% BY WEIGHT PASSES No. 200 SIEVE)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML		INORGANIC SILTS, SILTS with SAND and SILTS with GRAVEL and SANDY or GRAVELLY SILTS.	P.I. < 4 or PLOTS BELOW THE "A" LINE
		W_L > 50%	MH		INORGANIC SILTS, SILTS with SAND & SILTS with GRAVEL & SANDY or GRAVELLY SILTS, FINE SANDY or SILTY SOILS.	P.I. PLOTS BELOW THE "A" LINE
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	CL		INORGANIC CLAYS of LOW PLASTICITY, GRAVELLY, SANDY, or SILTY CLAYS, LEAN CLAYS.	P.I. > 7 and PLOTS ON OR ABOVE THE "A" LINE
		W_L near 50%	CL-CH		BORDERLINE INORGANIC CLAYS and SILTY CLAYS with LIQUID LIMITS NEAR 50%.	(only used for visual identification)
		W_L > 50%	CH		INORGANIC CLAYS of HIGH PLASTICITY, FAT CLAYS.	P.I. PLOTS ON OR ABOVE THE "A" LINE
	ORGANIC SILTS and CLAYS	W_L < 50%	OL		ORGANIC SILTS and ORGANIC SILTY CLAYS of LOW PLASTICITY.	$\frac{W_L \text{ (oven dried)}}{W_L \text{ (not dried)}} < 0.75$
		W_L > 50%	OH		ORGANIC CLAYS OF HIGH PLASTICITY.	$\frac{W_L \text{ (oven dried)}}{W_L \text{ (not dried)}} < 0.75$
HIGHLY ORGANIC SOILS			PT		PEAT and other HIGHLY ORGANIC SOILS.	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE.

PLASTICITY CHART FOR SOILS PASSING No. 40 SIEVE



NOTES:

1. ALL SIEVE SIZES ARE U.S. STANDARD, A.S.T.M. E11-04.
2. COARSE GRAINED SOILS WITH 5 TO 12% FINES REQUIRE DUAL SYMBOLS (GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC).
3. IF FINES CLASSIFY CL-ML USE DUAL SYMBOL (GC-GM or SC-SM).
4. WHERE TESTING IS NOT CARRIED OUT, THE IDENTIFICATIONS ARE DETERMINED BY VISUAL-MANUAL PROCEDURES DESCRIBED IN ASTM D2488-06.

THURBER

SYMBOLS AND TERMS USED ON TEST LOGS

1. PARTICLE SIZE CLASSIFICATION OF MINERAL SOILS

DESCRIPTION		APPARENT PARTICLE SIZE
BOULDERS		> 200 mm
COBBLES		75 mm to 200 mm
GRAVEL	coarse	19 mm to 75 mm
	fine	4.75 mm to 19 mm
SAND	coarse	2 mm to 4.75 mm
	medium	0.475 mm to 2 mm
	fine	0.075 mm to 0.475 mm
SILT		Non-plastic particles, not visible to the naked eye
CLAY		Plastic particles, not visible to the naked eye

NOTE: Metric Conversion is approximate only

2. TERMS DESCRIBING CONSISTENCY (Cohesive Soils Only)

DESCRIPTION	APPROXIMATE UNDRAINED SHEAR STRENGTH
Very Soft	Less than 10 kPa (250 psf)
Soft	10 to 25 kPa (250 - 500 psf)
Firm	25 to 50 kPa (500 - 1000 psf)
Stiff	50 to 100 kPa (1000 - 2000 psf)
Very Stiff	100 to 200 kPa (2000 - 4000 psf)
Hard	Greater than 200 kPa (4000 psf)

NOTE: Metric Conversion is approximate only

3. TERMS DESCRIBING DENSITY (Cohesionless Soils Only)

DESCRIPTION	STANDARD PENETRATION TEST Number of blows per foot (300 mm) *
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

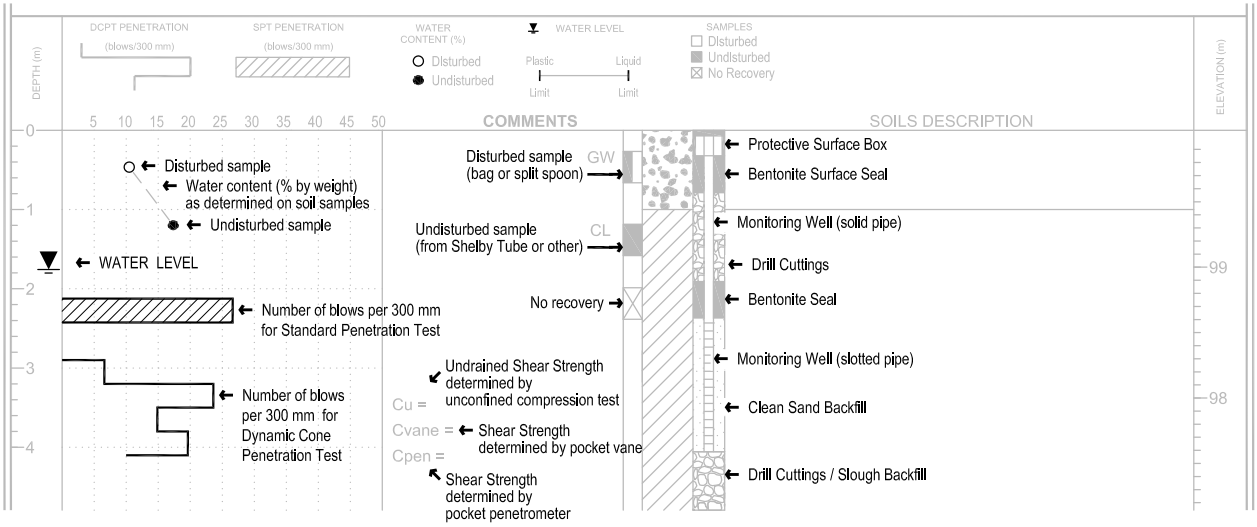
** Directly applicable to sands and, with interpretation, to gravels*

4. PROPORTION OF MINOR COMPONENTS BY WEIGHT

DESCRIPTION	PERCENT BY WEIGHT
and	35 to 50 %
y / ey	20 to 35 %
some	10 to 20 %
trace	less than 10 %

EXAMPLE: Silty SAND, trace of gravel = Sand with 20 to 35% silt and up to 10% gravel, by dry weight. (Percentages of secondary materials are estimates based on visual and tactile assessment of samples).

5. LEGEND FOR TEST HOLE LOGS *(Typical only showing commonly included elements)*



Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 19-1

LOCATION: See DWG.26791-1
N 5460352, E 519471 (est.)

TOP OF HOLE ELEV: 97.0 m (est.)
METHOD: Sonic
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands
DATE: October 1, 2019
FILE NO.: 26791

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: USCS Grab Sample, USCS Tube Sample, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded ⊕ Pocket Pen | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve

DEPTH (m)	COMMENTS			SOIL DESCRIPTION	ELEVATION (m)
0	Run 1: 0 to 1.2 m depth Recovery= 100%	SM	1	Dense to very dense, brown, silty, gravelly SAND with a trace of cobbles (TILL-FILL).	
1					96
	Run 2: 1.2 to 2.4 m depth Recovery= 100%			Very dense below 2.4 m depth	
2		ML/SM	2		95
	Run 3: 2.4 to 5.5 m depth Recovery= 100%				
3				Very dense, grey-brown, silty SAND with some gravel to gravelly and a trace of cobbles (TILL-like).	94
		SM	3		
4					93
5		SM	4		92
	Run 4: 5.5 to 7.3 m depth Recovery= 100%				
6		SM	5		91
7					90
	Run 5: 7.3 to 8.5 m depth Recovery= 100%	SM	6		
8					89
	Run 6: 8.5 to 11.6 m depth Recovery= 100%				
9					88
		GMJ/SM	7		
10					

LOG OF TH (COORDS & ELEV EST) 26791.GPJ PRACTICE MARLON.GDT 31/10/19- THURBER MOM.GLB

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 19-1

LOCATION: See DWG.26791-1
N 5460352, E 519471 (est.)

TOP OF HOLE ELEV: 97.0 m (est.)
METHOD: Sonic
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands
DATE: October 1, 2019
FILE NO.: 26791

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: USCS ◧ Grab Sample, USCS ■ Tube Sample, ⊠ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak, ◇ Residual, ◈ Remolded, ⊕ Pocket Pen | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS			SOIL DESCRIPTION	ELEVATION (m)
10						
11	○		SM	8	Very dense, grey-brown, silty SAND with some gravel to gravelly and a trace of cobbles (TILL-like).	86
12					End of hole at required depth. Water level could not be determined due to sonic drilling method.	85
13						84
14						83
15						82
16						81
17						80
18						79
19						78
20						

LOG OF TH (COORDS & ELEV EST) 26791.GPJ PRACTICE MARLON.GDT 31/10/19- THURBER MOM.GLB

LOG OF TEST HOLE

TEST HOLE NO. **19-2**

LOCATION: See DWG.26791-1
N 5460284, E 519341 (est.)

TOP OF HOLE ELEV: 101.0 m (est.)
METHOD: Sonic/ DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands
DATE: October 1, 2019
FILE NO.: 26791

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: USCS Grab Sample, USCS Tube Sample, ⊠ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak, ◇ Residual, ◆ Remolded, ⊕ Pocket Pen | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve

DEPTH (m)	COMMENTS			SOIL DESCRIPTION	ELEVATION (m)
0	Run 1: 0 to 2.4 m depth Recovery= 100%	SM	1	Compact to dense, brown, gravelly SAND with some silt (FILL).	
				Very dense, brown-grey, silty SAND with some gravel to gravelly and some cobbles (TILL-like).	
1		SM	2		100
	DCPT refusal at 1.5 m depth DCPT cone bouncing on rock				
2					99
	Run 2: 2.4 to 5.5 m depth Recovery= 100%			- cobbles between 2.4 and 2.6 m depth	
3		SM	3		98
4					97
5		SM	4	- cobbles between 4.9 and 5.2 m depth	96
	Run 3: 5.5 to 7.6 m depth Recovery= 70%				
6					95
7		SM	5		94
	Run 5: 7.6 to 8.5 m depth Recovery= 100%				
8		SM	6		93
	Run 6: 8.5 to 10.7 m depth Recovery= 50%			- a trace of gravel below 8.5 m depth	
9					92
10		SM	7		

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 19-2

LOCATION: See DWG.26791-1
N 5460284, E 519341 (est.)

TOP OF HOLE ELEV: 101.0 m (est.)
METHOD: Sonic/ DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands
DATE: October 1, 2019
FILE NO.: 26791

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: USCS ◧ Grab Sample, USCS ■ Tube Sample, ⊠ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak, ◇ Residual, ◈ Remolded, ⊕ Pocket Pen | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS	SOIL DESCRIPTION	ELEVATION (m)
10			Very dense, brown-grey, silty SAND with some gravel to gravelly and some cobbles (TILL-like).	
11			End of hole at required depth. Water level could not be determined due to sonic drilling method.	90
12				89
13				88
14				87
15				86
16				85
17				84
18				83
19				82
20				

LOG OF TH (COORDS & ELEV EST) 26791.GPJ PRACTICE MARLON.GDT 31/10/19- THURBER MOM.GLB

Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 19-3

LOCATION: See DWG.26791-1
N 5460250, E 519195 (est.)

TOP OF HOLE ELEV: 101.0 m (est.)
METHOD: Sonic/ DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands
DATE: October 1, 2019
FILE NO.: 26791

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL | Plastic Limit — Liquid Limit | SAMPLES: USCS Grab Sample, USCS Tube Sample, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◈ Remolded ⊕ Pocket Pen | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve

DEPTH (m)	COMMENTS			SOIL DESCRIPTION	ELEVATION (m)
0	Run 1: 0 to 2.4 m depth Recovery= 100%	GW-GM	1	Compact, grey, sandy GRAVEL with a trace of silt (FILL).	
				Firm to stiff, grey-rust mottled SILT with some sand and traces of gravel and clay.	
1					100
		CL/ML	2		
2				Dense, brown-grey SAND with some silt and gravel and a trace of cobbles.	99
		SM	3		
	Run 2: 2.4 to 5.5 m depth Recovery= 100% DCPT refusal at 2.4 m depth DCPT cone bouncing on rock			BOULDER.	
3				Very dense, brown-grey, silty SAND with some gravel to gravelly and a trace of cobbles (TILL-like).	98
		SM	4		
4					97
5		SM	5	- 150 mm thick layer of brown sand at 4.9 m depth	96
	Run 3: 5.5 to 7.3 m depth Recovery= 100%	SP-SM	6	Compact to dense, grey SAND with a trace of silt.	
				Very dense, brown-grey, silty, gravelly SAND with some cobbles (TILL-like).	
6					95
		SM	7		
7				COBBLES / BOULDERS.	94
	Run 4: 7.3 to 8.5 m depth Recovery= 100%			Very dense, grey, silty SAND with some gravel and cobbles (TILL-like).	
8					93
		SM	8		
	Run 5: 8.5 to 10.7 m depth Recovery= 100%				
9					92
				- cobbles at 9.2 m depth	
10					

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 19-3

LOCATION: See DWG.26791-1
N 5460250, E 519195 (est.)

TOP OF HOLE ELEV: 101.0 m (est.)
METHOD: Sonic/ DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands
DATE: October 1, 2019
FILE NO.: 26791

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: USCS ◧ Grab Sample, USCS ■ Tube Sample, ⊠ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak, ◇ Residual, ◈ Remolded, ⊕ Pocket Pen | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS			SOIL DESCRIPTION	ELEVATION (m)
10	○		SM	9	Very dense, grey, silty SAND with some gravel and cobbles (TILL-like).	
11					End of hole at required depth. Water level could not be determined due to sonic drilling method.	90
12						89
13						88
14						87
15						86
16						85
17						84
18						83
19						82
20						

LOG OF TH (COORDS & ELEV EST) 26791.GPJ PRACTICE MARLON.GDT 31/10/19- THURBER MOM.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. 20-1

LOCATION: See DWG.26791-20-1
N 5460300, E 519466 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 8, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	3001 LT Barologger Edge, M1.5 (SN: 2120927) installed within stick-up portion of the standpipe well		Compact, brown, sandy TOPSOIL with some gravel.
1	Run 1: 0 to 3.1 m depth Recovery= 100% DCPT refusal at 1.4 m depth.	SM	Very dense, grey-brown, silty, gravelly SAND with a trace to some cobbles (TILL-like).
2		SM	
3	Run 2: 3.1 to 6.1 m depth Recovery= 100%		- silty SAND to SILT and SAND with some gravel below 3.1 m depth
4		ML/SM	
5			- grey below 4.6 m depth
6	Run 3: 6.1 to 9.1 m depth Recovery= 100%	ML/SM	
7		ML/SM	- grey-brown below 7.0 m depth
8			
9	3001 LT Levelogger Junior Edge (SN: 2120927) installed at 8.6 m depth	ML/SM	End of hole at required depth. Water level measured at 0.5 m depth on July 2, 2020.
10			

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 20-2

LOCATION: See DWG.26791-20-1
N 5460255, E 519465 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 8, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	Run 1: 0 to 2.4 m depth Recovery= 100%		Very soft to soft, brown, sandy TOPSOIL with some gravel.
1	DCPT refusal at 1.1 m depth.	ML/SM	Compact to dense, grey-brown SILT and SAND with some gravel and a trace to some cobbles (TILL-like).
2		ML/SM	
3	Run 2: 2.4 to 4.9 m depth Recovery= 100%	ML/SM	- very dense below 2.4 m depth
4		ML/SM	
5	Run 3: 4.9 to 5.5 m depth Recovery= 100%	SM	
6	Run 4: 5.5 to 8.5 m depth Recovery= 100%	SM	- gravelly below 5.5 m depth - grey between 6.4 m and 8.0 m depth
7			
8		ML/SM	- cobbles between 7.9 and 8.5 m depth
9	Run 5: 8.5 to 10.7 m depth Recovery= 63%		
10		SM	

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 20-2

LOCATION: See DWG.26791-20-1
N 5460255, E 519465 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 8, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): ■ GASTECH reading ⊠ PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100 | **COMMENTS** | SOILS DESCRIPTION

10

Compact to dense, grey-brown SILT and SAND with some gravel and a trace to some cobbles (TILL-like).

End of hole at required depth.
Water level indeterminate due to sonic drilling method.

11 12 13 14 15 16 17 18 19 20

DEPTH (m)

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. 20-3

LOCATION: See DWG.26791-20-1
N 5460218, E 519413 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 9, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	Run 1: 0 to 3.1 m depth Recovery= 40%		Loose over compact to dense, brown SAND and GRAVEL with some silt and a trace of organics.
1	DCPT refusal at 1.0 m depth.	SM/GM	Very dense, grey SAND and GRAVEL with some silt and cobbles (TILL-like).
2			
3	Run 2: 3.1 to 4.0 m depth Recovery= 33%	GM/SM	
4	Run 3: 4 to 6.1 m depth Recovery= 100%	GM/SM	ROCK / BOULDER.
5			
6	Run 4: 6.1 to 9.1 m depth Recovery= 100%	SM	Very dense, grey, SILT and SAND to silty SAND with some gravel to gravelly, some cobbles and a trace of clay (TILL-like).
7		SM	
8			
9	3001 LT Levelogger Junior Edge (SN:2121297) installed at 8.5 m depth	ML/SM	End of hole at required depth. Water level measured at 0.3 m depth on July 2, 2020.
10			

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. 20-4

LOCATION: See DWG.26791-20-1
N 5460208, E 519383 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 9, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit, Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	Run 1: 0 to 0.8 m depth Recovery= 80%		Loose, dark brown TOPSOIL.
1	DCPT refusal at 0.9 m depth.		ROCK / BOULDER.
	Run 2: 0.8 to 3.1 m depth Recovery= 100%	ML/SM	Very dense, grey-brown SILT and SAND to silty SAND with some gravel to gravelly, some cobbles and a trace of clay (TILL-like).
2			
		SM	
3	Run 3: 3.1 to 6.1 m depth Recovery= 100%		- some oxidation between 3.1 m and 6.9 m depth
4		SM	
5			
		SM	
6	Run 4: 6.1 to 9.1 m depth Recovery= 100%		
7		ML/SM	- grey below 6.9 m depth
8			
		ML/SM	
9			End of hole at required depth. water level indeterminate due to sonic drilling method.
10			

Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 24-01

LOCATION: See DWG.26791-40-1
N 5460291, E 519428 (Est.)

TOP OF HOLE ELEV: 104.9 m (Est.)

METHOD: Sonic

DRILLING CO.: Mud Bay Drilling Ltd.

INSPECTOR: DKP

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands

DATE: June 25, 2024

FILE NO.: 26791-20

REVIEWED BY:

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0	○		OL/SM — Dark brown, wet, silty gravelly SAND with some organics (TOPSOIL).	
	○		SM — Brown, moist-wet, silty, gravelly SAND, trace to some organics, trace oxidation	104
1			Hard to very hard, grey, moist, gravelly, silty SAND to SILT and SAND with traces of cobbles and clay (TILL-LIKE).	
2	○		ML/SM	103
3				102
4	○ ▲ △		ML/SM	101
5				100
6	○		ML/SM	99
7				98
8	○		ML/SM	97
9				96
10	○		ML/SM	95

LOG OF TEST HOLE (COORDS+EL. EST.) 26791.GPJ THURBER_MOM.GDT 24-7-26- THURBER - BC OPERATIONS_2024.GLB

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 24-01

LOCATION: See DWG.26791-40-1
N 5460291, E 519428 (Est.)

TOP OF HOLE ELEV: 104.9 m (Est.)

METHOD: Sonic

DRILLING CO.: Mud Bay Drilling Ltd.

INSPECTOR: DKP

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands

DATE: June 25, 2024

FILE NO.: 26791-20

REVIEWED BY:

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
10	○		Hard to very hard, grey, moist, gravelly, silty SAND to SILT and SAND with traces of cobbles and clay (TILL-LIKE).	94
11		ML/SM		
12	○ ▲ △			93
13		ML/SM		92
14	○			
15		SM		91
16	○			90
17		SM	End of hole at required depth. Water level could not be determined due to sonic drilling method.	89
18				88
19				87
20				86
				85

LOG OF TEST HOLE (COORDS+EL. EST.) 26791.GPJ THURBER_MOM.GDT 24-7-26- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 24-02

LOCATION: See DWG.26791-40-1
N 5460267, E 519435 (Est.)

TOP OF HOLE ELEV: 100.9 m (Est.)

METHOD: Sonic

DRILLING CO.: Mud Bay Drilling Ltd.

INSPECTOR: DKP

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands

DATE: June 24, 2024

FILE NO.: 26791-20

REVIEWED BY:

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0	OH	Dark brown, wet, organic, gravelly SAND and SILT.	
0.6	ML/SM	Grey-brown, moist to wet, gravelly, silty SAND with some oxidation.	100
1		Hard to very hard, grey, moist, gravelly SILT and SAND with traces of cobbles, clay and oxidation (TILL-like).	
2	ML/SM		99
3			98
3.8	ML/SM		97
4			
5			96
5.6	ML/SM		95
6			
7			94
7.5	ML/SM		93
8			
9	ML/SM		92
10			91

LOG OF TEST HOLE (COORDS+EL. EST.) 26791.GPJ THURBER_MOM.GDT 24-7-26- THURBER - BC OPERATIONS_2024.GLB

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 24-02

LOCATION: See DWG.26791-40-1
N 5460267, E 519435 (Est.)

TOP OF HOLE ELEV: 100.9 m (Est.)

METHOD: Sonic

DRILLING CO.: Mud Bay Drilling Ltd.

INSPECTOR: DKP

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands

DATE: June 24, 2024

FILE NO.: 26791-20

REVIEWED BY:

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
10	○		ML/SM	Hard to very hard, grey, moist, gravelly SILT and SAND with traces of cobbles, clay and oxidation (TILL-like).	90
11					
12	○		ML/SM		89
13	○ ▲ △		SM		88
14					
15	○		ML/SM	BOULDER.	86
16				End of hole at required depth. Water level could not be determined due to sonic drilling method.	85
17					84
18					83
19					82
20					81

LOG OF TEST HOLE (COORDS+EL. EST.) 26791.GPJ THURBER_MOM.GDT 24-7-26- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 24-03

LOCATION: See DWG.26791-40-1
N 5460228, E 519476 (Est.)

TOP OF HOLE ELEV: 91.1 m (Est.)

METHOD: Sonic

DRILLING CO.: Mud Bay Drilling Ltd.

INSPECTOR: DKP

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands

DATE: June 24, 2024

FILE NO.: 26791-20

REVIEWED BY:

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0		OH: Dark brown, wet, organic SAND and SILT.	91
		ML/SM: Grey-brown, moist to wet, gravelly SILT and SAND with a trace of oxidation.	
1		ML/SM: Hard to very hard, grey, moist, gravelly SILT and SAND with traces of cobbles and clay (TILL-like).	90
2			89
3		ML/SM	88
4		ML/SM	87
5		ML/SM	86
6			85
7		ML/SM	84
8		SM: Grey, wet, silty SAND with a trace of gravel.	83
9		ML/SM: Very hard, grey, moist SILT, GRAVEL and SAND with a trace of cobbles (TILL-like).	82
10			

LOG OF TEST HOLE (COORDS+EL. EST.) 26791.GPJ THURBER_MOM.GDT 24-7-26- THURBER - BC OPERATIONS_2024.GLB

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 24-03

LOCATION: See DWG.26791-40-1
N 5460228, E 519476 (Est.)

TOP OF HOLE ELEV: 91.1 m (Est.)

METHOD: Sonic

DRILLING CO.: Mud Bay Drilling Ltd.

INSPECTOR: DKP

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Village Lands

DATE: June 24, 2024

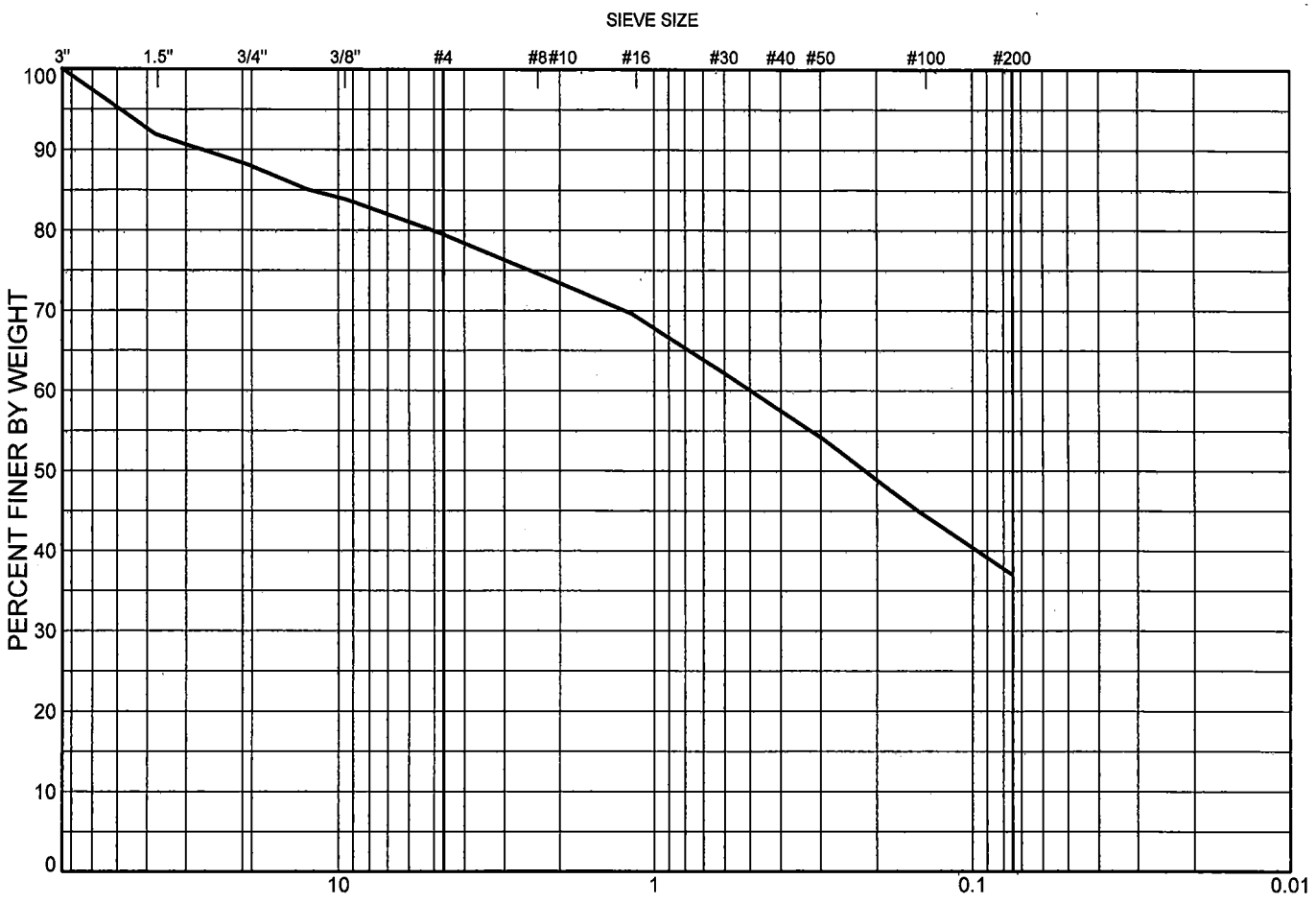
FILE NO.: 26791-20

REVIEWED BY:

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
10	○		Very hard, grey, moist SILT, GRAVEL and SAND with a trace of cobbles (TILL-like).	81
11		ML/GM/SM		80
12	○			79
13		ML/SM		78
14	○			77
15	○ ▲ △	SM		76
16			End of hole at required depth. Water level could not be determined due to sonic drilling method.	75
17				74
18				73
19				72
20				

LOG OF TEST HOLE (COORDS+EL. EST.) 26791.GPJ THURBER_MOM.GDT 24-7-26- THURBER - BC OPERATIONS_2024.GLB



GRAVEL		SAND			SILT
coarse	fine	coarse	medium	fine	

Sample Location: **24-01**
Sample: 4
Sample Depth: 4.0 m
Date Sampled: June 24, 2024
Sampled By: DKP
Date Received: July 4, 2024
Date Tested: July 23, 2024
Tested By: KM
Test Method: ASTM C136 and C117
Specification:

Gravel	**20.4%**
Sand	**42.6%**
Fines	**37.0%**
Moisture Content	**7.7%**

D10	
D30	
D60	**0.496**
Cu	
Cc	

Sieve Size		Percent Passing
inches	mm	
3	75	**100.0**
1.5	37.5	**91.9**
0.75	19	**88.1**
0.375	9.5	**83.8**
#4	4.75	**79.6**
#8	2.36	**74.6**
#16	1.18	**69.6**
#30	0.6	**62.2**
#50	0.3	**54.2**
#100	0.15	**45.1**
#200	0.075	**37.0**

Description: Gravelly SILT and SAND (ML/SM).

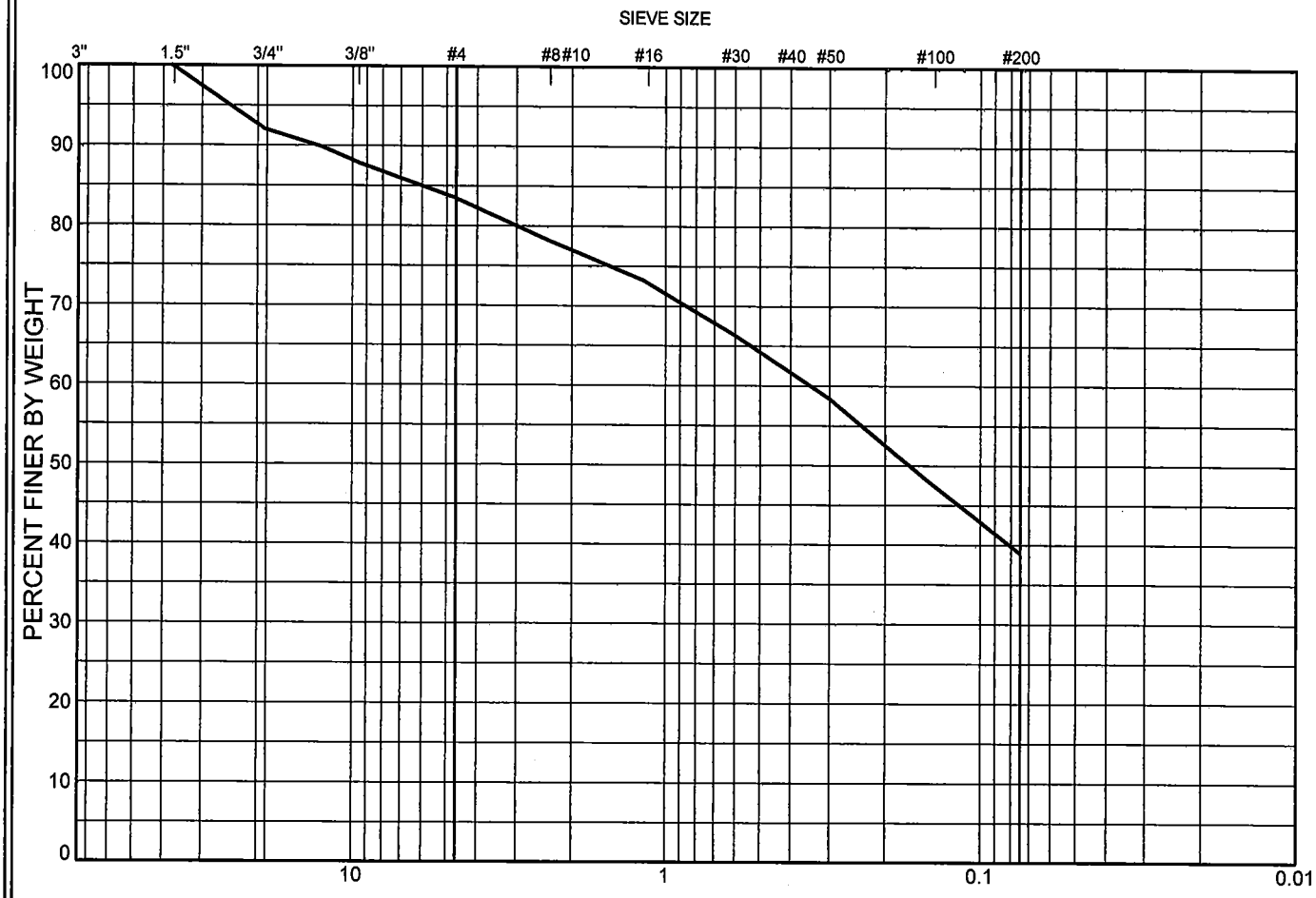
Comments:

THURBER
Thurber Engineering Ltd.
#900 - 1281 West Georgia Street
Vancouver, BC V6E 3J7
Telephone: (604) 684-4384
Fax: (604) 684-5124

GRAIN SIZE DISTRIBUTION

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands

FILE NO.: 26791-20



Sample Location: **24-01**
Sample: 9
Sample Depth: 11.9 m
Date Sampled: June 24, 2024
Sampled By: DKP
Date Received: July 4, 2024
Date Tested: July 23, 2024
Tested By: KM
Test Method: ASTM C136 and C117
Specification:

Gravel	**16.4%**
Sand	**44.6%**
Fines	**38.9%**
Moisture Content	**5.4%**

D10	
D30	
D60	**0.345**
Cu	
Cc	

Sieve Size inches	Sieve Size mm	Percent Passing
3	75	
1.5	37.5	**100.0**
0.75	19	**92.1**
0.375	9.5	**87.8**
#4	4.75	**83.6**
#8	2.36	**78.1**
#16	1.18	**73.2**
#30	0.6	**66.3**
#50	0.3	**58.4**
#100	0.15	**48.4**
#200	0.075	**38.9**

Description: SILT and SAND, some gravel (ML/SM).

Comments:

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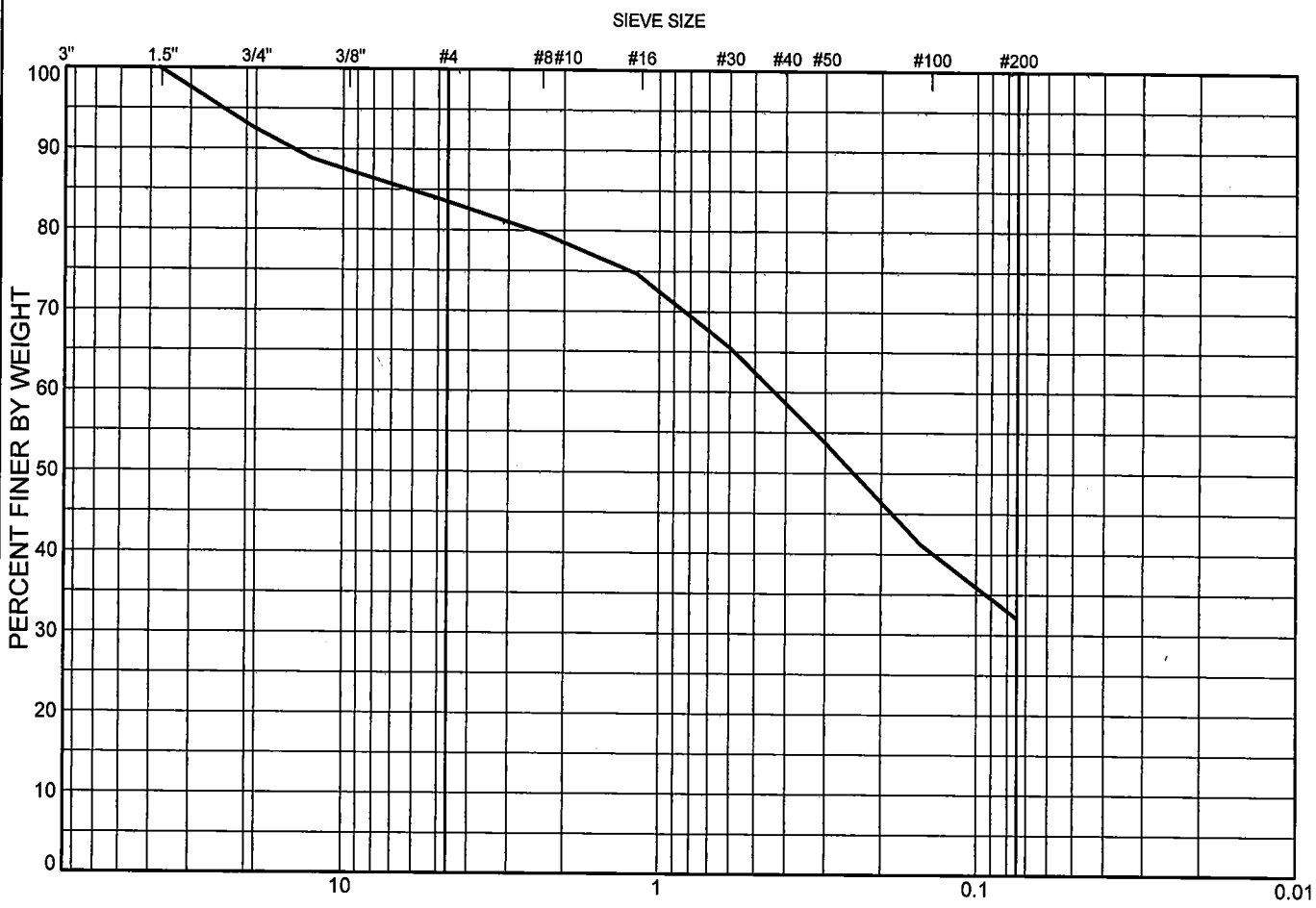
GRAIN SIZE DISTRIBUTION

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands

FILE NO.: 26791-20



GRAVEL		SAND			SILT
coarse	fine	coarse	medium	fine	

Sample Location: **24-02**
Sample: 10
Sample Depth: 13.4 m
Date Sampled: June 24, 2024
Sampled By: DKP
Date Received: July 4, 2024
Date Tested: July 23, 2024
Tested By: KM
Test Method: ASTM C136 and C117
Specification:

Gravel	**16.4%**
Sand	**51.5%**
Fines	**32.1%**
Moisture Content	**10.4%**

D10	
D30	
D60	**0.433**
Cu	
Cc	

Sieve Size		Percent Passing
inches	mm	
3	75	
1.5	37.5	**100.0**
0.75	19	**92.6**
0.375	9.5	**87.3**
#4	4.75	**83.6**
#8	2.36	**79.6**
#16	1.18	**74.7**
#30	0.6	**65.6**
#50	0.3	**53.8**
#100	0.15	**41.2**
#200	0.075	**32.1**

Description: Silty SAND, some gravel (SM).

Comments:

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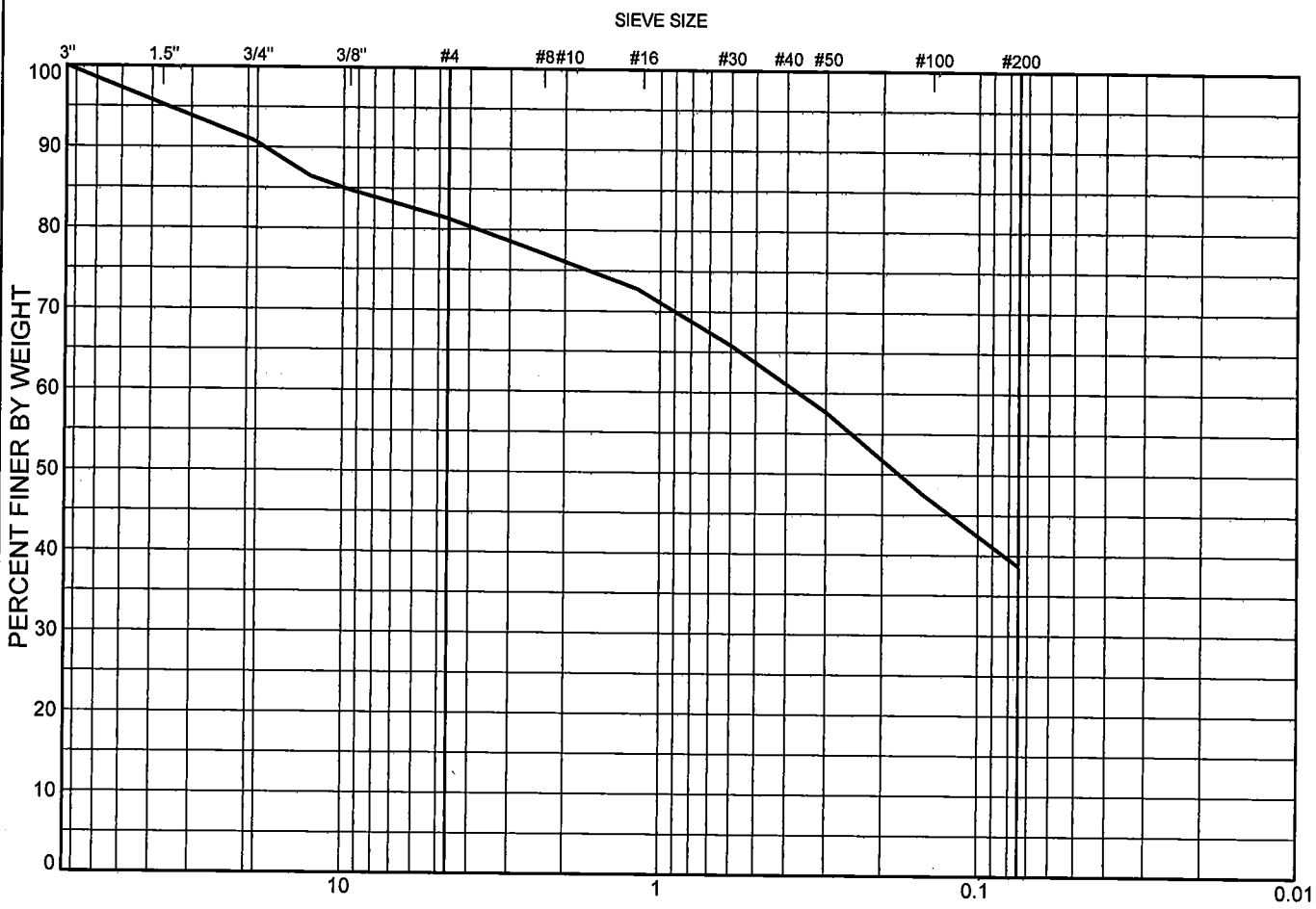
GRAIN SIZE DISTRIBUTION

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands

FILE NO.: 26791-20



GRAIN SIZE IN MILLIMETRES

GRAVEL		SAND			SILT
coarse	fine	coarse	medium	fine	

Sample Location: **24-03**
Sample: 6
Sample Depth: 5.2 m
Date Sampled: June 24, 2024
Sampled By: DKP
Date Received: July 4, 2024
Date Tested: July 23, 2024
Tested By: KM
Test Method: ASTM C136 and C117
Specification:

Gravel	**18.6%**
Sand	**42.6%**
Fines	**38.7%**
Moisture Content	**5.5%**

D10	
D30	
D60	**0.365**
Cu	
Cc	

Sieve Size		Percent Passing
inches	mm	
3	75	**100.0**
1.5	37.5	**95.3**
0.75	19	**90.8**
0.375	9.5	**84.7**
#4	4.75	**81.4**
#8	2.36	**77.1**
#16	1.18	**72.8**
#30	0.6	**65.9**
#50	0.3	**57.7**
#100	0.15	**47.6**
#200	0.075	**38.7**

Description: SILT and SAND, some gravel (ML/SM).

Comments:

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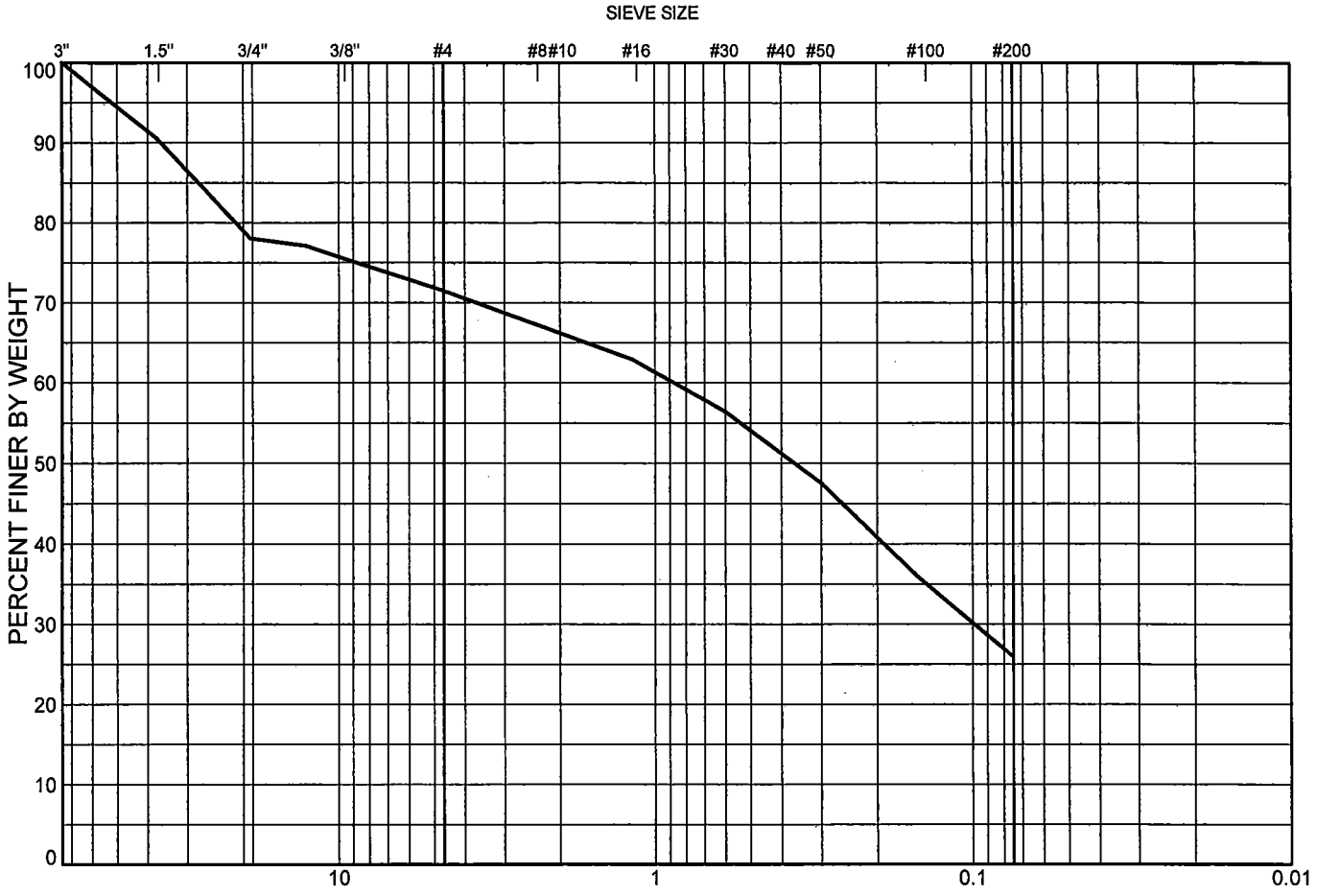
GRAIN SIZE DISTRIBUTION

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands

FILE NO.: 26791-20



GRAVEL		SAND			SILT
coarse	fine	coarse	medium	fine	

Sample Location: **24-03**
Sample: 13
Sample Depth: 14.9 m
Date Sampled: June 24, 2024
Sampled By: DKP
Date Received: July 4, 2024
Date Tested: July 23, 2024
Tested By: KM
Test Method: ASTM C136 and C117
Specification:

Gravel	**28.4%**
Sand	**45.5%**
Fines	**26.0%**
Moisture Content	**7.7%**

D10	
D30	**0.099**
D60	**0.874**
Cu	
Cc	

Sieve Size		Percent Passing
inches	mm	
3	75	**100.0**
1.5	37.5	**90.6**
0.75	19	**78.0**
0.375	9.5	**75.4**
#4	4.75	**71.6**
#8	2.36	**67.2**
#16	1.18	**62.9**
#30	0.6	**56.4**
#50	0.3	**47.5**
#100	0.15	**36.0**
#200	0.075	**26.0**

Description: Silty, gravelly SAND (SM).

Comments:

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GRAIN SIZE DISTRIBUTION

CLIENT: City of Coquitlam
PROJECT: Burke Mountain Village Lands

FILE NO.: 26791-20

2020 National Building Code of Canada Seismic Hazard Tool

This application provides seismic values for the design of buildings in Canada under Part 4 of the National Building Code of Canada (NBC) 2020 as prescribed in Article 1.1.3.1. of Division B of the NBC 2020.

Seismic Hazard Values

User requested values

Code edition	NBC 2020
Site designation X_S	X_C
Latitude (°)	49.293
Longitude (°)	-122.745

Please select one of the tabs below.

NBC 2020 | Additional Values | Plots | API

Background Information

The 5%-damped spectral acceleration ($S_a(T,X)$, where T is the period, in s, and X is the site designation) and peak ground acceleration (PGA(X)) values are given in units of acceleration due to gravity (g, 9.81 m/s^2). Peak

ground velocity (PGV(X)) values are given in m/s. Probability is expressed in terms of percent exceedance in 50 years. Further information on the calculation of seismic hazard is provided under the *Background Information* tab.

The 2%-in-50-year seismic hazard values are provided in accordance with Article 4.1.8.4. of the NBC 2020. The 5%- and 10%-in-50-year values are provided for additional performance checks in accordance with Article 4.1.8.23. of the NBC 2020.

See the *Additional Values* tab for additional seismic hazard values, including values for other site designations, periods, and probabilities not defined in the NBC 2020.

NBC 2020 - 2%/50 years (0.000404 per annum) probability

$S_a(0.2, X_C)$	$S_a(0.5, X_C)$	$S_a(1.0, X_C)$	$S_a(2.0, X_C)$	$S_a(5.0, X_C)$	$S_a(10.0, X_C)$	$PGA(X_C)$	$PGV(X_C)$
0.943	0.746	0.437	0.266	0.0787	0.0342	0.409	0.457

The log-log interpolated 2%/50 year $S_a(4.0, X_C)$ value is : **0.1059**

▶ Tables for 5% and 10% in 50 year values

Download CSV

← Go back to the seismic hazard calculator form

Date modified: 2021-04-06

THURBER ENGINEERING LTD.

September 14, 2020 File: 26791

City of Coquitlam
3000 Guilford Way
Coquitlam, B.C.
V3B 7N2

Attention: Ted Uhrich | Project Manager

BURKE MOUNTAIN COMMUNITY CENTRE, COQUITLAM, BC
GEOTECHNICAL INVESTIGATION RESULTS

Dear Ted:

As requested, Thurber completed a geotechnical investigation for the proposed Burke Mountain Community Centre. This report summarizes the results of our investigation and provides preliminary geotechnical recommendations. This report has been revised and supersedes our July 30, 2020 report.

It is a condition of this memorandum that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. INTRODUCTION

The Burke Mountain Village Lands is a proposed high-density residential and commercial development to be located on the lower slopes of Burke Mountain in Coquitlam, B.C. The development is bounded by David Avenue to the north, Mitchell Street to the west and Burke Village Promenade to the South, and measures approximately 0.15 km^2 in area.

Thurber completed a geotechnical investigation in 2019 at the proposed development that comprised three sonic test holes and dynamic cone penetration test (DCPT) profiling. The test holes were located along the Princeton Avenue right-of-way, which up to that point was the only area were the trees had been cleared.

The City of Coquitlam (the City) is proposing to construct a community centre within the proposed development. We understand that the community centre will include a maximum of two levels of underground parking. Our scope of services includes a geotechnical investigation within the proposed footprint of the community centre to characterize subsurface conditions, investigate the presence of Quadra sands deposits and install monitoring wells to evaluate long-term groundwater conditions. The information collected from the investigation will be used to assess whether permanent dewatering systems and waterproofing are required for basement structures and if special measures are required for temporary excavations.

Assessment of soil and groundwater contamination was not included in our scope of work.

2. BACKGROUND

The Community Centre is proposed to be located at the east end of the development's footprint, south of Princeton Avenue. The site is generally sloping downward in the southeast direction from about El. 102 m to El. 88 m.

The Burke Mountain Village Lands site is currently covered by trees, except along the right-of-way of Princeton Avenue, which bisects the site in the east-west direction, where the trees were removed and the road has been rough graded. Tree clearing was also carried out at the test hole locations, within the proposed footprint of the Community Centre.

3. INVESTIGATION

The geotechnical investigation was completed on June 8 and 9, 2020 and included test holes drilled using a sonic track rig, operated by On-track Drilling Inc. Sonic drilling utilizes a rotary-vibratory drill head to advance the drill rods and collect continuous core samples using a 1.5 m long, 89 mm inside-diameter core barrel mounted at the end of the drill rods. The drilling method also includes advancing a larger diameter casing (140 mm O.D.) around the core barrel and drill rods to prevent the hole from collapsing and reduce sloughing.

A total of four sonic test holes, THs 20-1 to -4, were completed within the proposed footprint of the community centre as shown on Dwg. 26791-20-1 (attached). THs 20-1, 20-3 and 20-4 were advanced to 9.1 m depth and TH 20-2 was advanced to 10.7 m depth. Representative disturbed soil samples were collected from the recovered core at select depths.

Dynamic cone penetration test (DCPT) profiling was completed at all test hole locations to refusal depths that ranged from 0.9 m to 1.4 m. The DCPT tip is similar in size and shape to the standard penetration test split spoon sampler and is driven using the same hammer and similar driving energy. The DCPT provides a qualitative estimate of in-situ density of soil and is useful for identifying stiffness and strength contrasts within and between strata.

THs 20-2 and 20-4 were backfilled with drilling cuttings and capped with bentonite chips in general accordance with the BC groundwater protection regulations. Standpipe wells were installed in THs 20-1 and 20-3. The wells comprised 25 mm diameter PVC pipe that extended to the bottom of the test hole, with the slotted zone set at the base of the hole. The test hole annulus was backfilled with filter sand and sealed with a bentonite cap. Following the stabilization of the groundwater levels, the wells were instrumented with water level loggers for long-term ground water monitoring.

The soil samples were transported to Thurber's materials laboratory where the samples were subjected to moisture content testing and visual classification.

3.1 Groundwater

At THs 20-1 and 20-3 standpipe wells, water level loggers were installed on June 17, 2020 following the stabilization of the groundwater levels, and were set approximately 500 mm above the base of the well. A barometric logger was also installed within the stick-up portion of the standpipe well in TH 20-1 (i.e. above the water level). The barologger measures the in-situ atmospheric pressure, which is used in the interpretation of the level logger readings.

4. GEOTECHNICAL AND GROUNDWATER CONDITIONS

The results of the investigation and laboratory testing are summarized on the attached test hole logs. The logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized soil description below.

In general, the subsurface profile comprised organic topsoil-like material of variable thickness, up to 0.6 m thick, over compact to very dense till-like soils. In TH 20-3, a 1.2 m thick, loose over compact to dense sand and gravel layer with a trace of organics was encountered at surface.

The till-like soil deposit was generally encountered below the surface materials. The deposit extended to the bottom of the test holes and comprised silty sand to sand and silt, with some gravel to gravelly and included cobbles and boulders (up to 2.2 m in thickness). This is consistent with field observations from our 2019 site reconnaissance where three large boulders, measuring approximately 2 m in diameter, and several other smaller sized boulders were encountered during the earthworks along the alignment of Princeton Avenue. Based on our observations from the previous investigation, the deposit may also include sand interbeds. According to the DCPT blow counts, the till-like soil deposit is generally very dense but may be compact to dense in the upper 1 m.

Continuous groundwater and barometric measurements have been collected since June 17, 2020. The groundwater level measurements are plotted in Figure 1 along with the precipitation records and in Figure 2 along with the barometric measurements. The measured groundwater levels range between 0.25 m and 1.75 m below ground surface in TH 20-1 and between 0.2 m and 0.75 m in TH 20-3 (TH 20-3 is located at a lower elevation than TH 20-1). Both groundwater level readings appear to fluctuate in similar manner and in sync with the precipitation events as can be seen in Figure 1. This suggests that the groundwater level may be expected to rise during periods of higher precipitation and conversely, drop during periods of dry weather. However, it appears that the groundwater level in TH 20-3 fluctuates less than TH 20-1. Based on Figure 2, it seems that the variation in atmospheric pressure has a lesser effect on groundwater levels.

Artesian conditions have been observed in the Burke Mountain area where Quadra sand deposits were encountered. However, none of the test holes completed within the Burke Mountain Village Lands site have encountered Quadra sand deposits.

5. GEOTECHNICAL RECOMMENDATIONS

The site is underlain by competent, dense to very dense till-like material at relatively shallow depth, with the ground surface dipping towards the southeast at an inclination that varies between 5H:1V and 8H:1V. To incorporate a maximum of two levels of underground parking, it is envisaged that lowest floor slab of the underground parking will primarily require grade reductions, with some fill placement likely be required towards the southern footprint of the proposed community centre unless the parking is stepped. As the design site grades will be similar to the existing elevations and grading, the foundations will be primarily founded in the native, competent till-like soils and below the groundwater level.

Based on the subsurface stratigraphy and the results of the DCPT profiling, it is feasible to support the proposed community centre on shallow foundations comprising strip or spread footings. As mentioned in Section 4 above, the till-like deposit includes cobbles and boulders that can measure in excess of 2 m in diameter. Where encountered, these large-sized particles will act as hard-points on the underside of the footings and slab-on-grade. Cobbles and boulders may also present a challenge from a constructability perspective for excavation faces.

Considering the shallow groundwater level conditions, however, there is a high likelihood that the foundations and foundation walls of some areas will be subject to hydrostatic groundwater conditions.

Geotechnical input is provided herein for foundation design including lateral earth pressure, site preparation, placement and compaction of granular fill, input on temporary excavations, permanent groundwater control, and a discussion on seismic site classification.

5.1 Foundations

Based on the subsurface stratigraphy and the results of the DCPT profiling, strip and pad footings are considered feasible for the support of the community centre that will include a maximum of two levels of underground parking.

Table 1 summarizes preliminary recommended factored ultimate and serviceability bearing resistance values for spread footings founded in the native, competent till-like soils at about 6 m embedment and at a shallower depth (< 3 m) in the till-like soils or structural fill.

Table 1 - Foundation Design Bearing Resistances and Pressures

Foundation Soil	Embedment Depth	Factored Ultimate Bearing Resistance[1] (kPa)	Serviceability Bearing Resistance (kPa)
Very Dense Till-like Soils	> 6 m	450	300
- Compact to Very Dense Till-Like Soils - Structural Fill	< 3 m	300	200

[1] Factored ultimate bearing resistance values include a geotechnical resistance factor Φ=0.5.

The bearing resistance was evaluated for strip and pad footings assuming minimum widths of 450 and 600 mm, respectively. Shallow footings must have a minimum embedment depth of 450 mm minimum below adjacent finished grade for frost protection. Anticipated total and differential settlements under service limit states (SLS) conditions are not expected to exceed 25 mm and 15 mm, respectively. These settlement estimates and bearing resistances must be confirmed during detailed design when the structural loads become available.

5.1.1 Subgrade Preparation and Fill Placement Requirements

All construction work must be completed in safe manner and must conform to the all applicable regulations such as WorkSafeBC, laws, codes and any other relevant regulations in the Province of British Columbia and to any applicable company-specific regulations.

Site preparation should proceed with the removal of any existing structures and landscaping within the area of the proposed addition. Any underground services and utilities crossing this area should also be relocated or terminated appropriately. Trench backfill material must be removed and replaced with compacted granular fill.

Excavation should be carried out using an excavator equipped with a smooth-edge trimming bucket. The base of all excavations should be free of loose, organic, or disturbed material. All water must be drained away to prevent ponding. Large-sized granular particles protruding above the bearing surface must be eliminated, either by removal or splitting, to avoid hard-points on the underside of the foundations.

The native foundation soils will typically be sensitive to changes in moisture content and disturbance by construction and repeated pedestrian traffic. Therefore, unless the footing concrete will be placed within 24 hours of exposing the bearing surface, we recommend placing a concrete blinding layer (or equivalent) on the bearing surface to reduce the likelihood of disturbance.

Structural / grade restoration fill should typically comprise free draining (<5% passing the 75 µm sieve) granular material, and must be free of organics and other deleterious material. Suitable materials include MMCD minus 75 mm well graded pit run sand and gravel. Other granular material may also be acceptable but samples or representative gradation curves of the material should be submitted to Thurber for review and approval prior to use. Fill should be placed in maximum 300 mm thick loose lifts and compacted to 100% Standard Proctor Maximum Dry Density (SPMDD).

Unless walls are specifically designed to support compaction-induced lateral stresses, backfill placed within 1 m of a foundation wall should be compacted using light weight equipment such as a plate tamper to avoid build-up of excessively high lateral soil pressure on the wall.

5.1.2 Re-Use of Existing Material

The bulk of the excavation will be in till-like deposits which are classified as SAND, some silt to silt, with some gravel to gravelly and trace to some cobbles. The excavated till-like material can be used for trench or landscape fill provided that it is handled, placed and compacted properly. This will also likely involve the removal of over-sized material (i.e. cobbles and boulders) in some instances. Till-fill can also be used for grade restoration under the footprint of the slab-on-grade provided that it is free from organics and other deleterious material.

The material will be sensitive to moisture content due to is relatively high fines content and it may not be possible to place and compact during wet weather. If the material cannot be compacted, clean, imported fill material will be required. Where used, the fill must be placed in maximum loose lifts of 300 mm and compacted to 100% Standard Proctor maximum dry density (SPMDD).

5.1.3 Slab-On-Grade

The concrete slab-on-grade should be underlain by a minimum of 300 mm thick layer of minus 19 mm, clean, crushed granular base course, conforming to MMCD gradation specifications, and compacted to at least 95% MPMDD. All loose material, organic, soft or wet soils, or other deleterious material must be removed before placement of the structural fill. Where the fill is placed on a high fines soil, a non-woven geotextile separator (i.e. Nilex 4553, or approved equivalent) should be placed on the subgrade prior to the placement of the fill.

A vapour barrier comprising 6-mil (minimum) polyethylene sheeting and conforming to ASTM E1745 should be placed below the slab. Adjacent sheets of polyethylene should be overlapped by a minimum of 300 mm.

5.2 Subsurface Drainage

Considering the shallow groundwater conditions, there is a high likelihood that some of the foundations and foundation walls founded in areas of cut will be situated below the groundwater table. Structures found partially or fully below the groundwater level must be designed to resist hydrostatic pressures, typically using permanent anchors, and the below-surface foundations and foundation walls waterproofed as required in the 2015 National Building Code of Canada (NBCC).

Where a subsurface drainage system is installed to prevent the build-up of hydrostatic pressure, we recommend that the system comprise a perimeter drain and a sub-floor drainage layer. The perimeter drain should comprise 100 mm to 150 mm diameter perforated PVC pipe (with perforations down) surrounded by a minimum of 150 mm of drain rock. The drain rock should be fully separated from the general backfill by a non-woven geotextile (such as Nilex 4553 or equivalent approved by Thurber). The perimeter drain should be installed with an invert level at or nominally below the underside of the granular base course layer.

The sub-floor drainage layer should comprise a 300 mm thick, 25 mm minus clean crushed gravel meeting MMCD specifications for Coarse Drain Rock, and should be separated from all adjacent

soils using a medium weight non-woven geotextile (filter fabric). The sub-floor drainage layer could be placed in-lieu of the 19 mm crushed gravel layer recommended in Section 5.1.2.

The sub-drainage system, comprising both the perimeter drain and sub-floor drainage layer, should be designed and constructed in a manner that provides unimpeded discharge of the intercepted groundwater. This is typically achieved by connecting the sub-drainage system to a suitable drainage system, which may require a dedicated pump(s). Other means of discharge may be considered at the discretion of the civil designer.

Within 2 m of a building, the yard grade should be sloped to provide surface drainage away from the building. With the exception of a low permeability soil cap, consideration should be given to the use of free draining sand and drain gravel as foundation wall backfill to ensure adequate drainage.

The groundwater inflow rate should be confirmed during construction to determine if additional measures, such as the installation of sub-floor drains comprising perforated drain pipe, are required to maintain the unimpeded drainage criterion.

5.3 Underground Services and Utilities

Underground services and utilities, including sub-drains that run parallel to the footings should not be located within a zone defined by a plane sloping down and away from the bottom perimeter edge of footing at 1 horizontal to 1 vertical (1H:1V). If services cannot be relocated, they must be fully encased in concrete or the affected footing must be lowered.

5.4 Susceptibility of Methane Gas Generation

The structure (footings/slab-on-grade) will be founded on either native, mineral soils (till-like soils, compact to dense silt and sand, and the compact silt layers) or on compacted granular fill or till-fill. The native soils and proposed granular fills and till-fills are free from organics and other deleterious material that have the potential to decompose and generate methane gas. As such, a sub-floor methane collection system is not required given the low potential for methane gas generation.

5.5 Lateral Earth Pressure

The foundation walls should be designed using the lateral earth pressure distribution shown on Dwg. 24509-20-2 (attached). The pressure distribution assumes fully-drained conditions, a “non-yielding” wall (i.e. a wall that is unable to rotate at least 0.005H) under static loading condition and a “yielding” wall (i.e. a wall that is able to rotate at least 0.005H) under seismic loading condition, no surcharge loading and that the backfill is comprised of material that conforms to the requirements of Sections 5.1.1 or 5.2 and that it is hydraulically connected to the sub-drainage system.

6. TEMPORARY EXCAVATIONS

Sloped excavations are typically preferable where no physical constraints, such as adjacent buildings, underground structures, roads or utilities, are present around the footprint of the proposed development. Where sloped excavations cannot be accommodated, some of the excavations may have to be supported using a shotcrete and anchor support system.

Considering the subsurface conditions, for preliminary design purposes temporary excavation slopes of 1.5H:1V or flatter in the overburden soils (i.e. soils above the till-like deposit) and at 0.75H:1V in the undisturbed till-like soils can be used for open-cut excavations. The slopes must be protected at all times from surface water run-off and rainfall. The temporary cut slopes should be reviewed by Thurber during construction to determine if modifications are required based on exposed soil conditions.

As noted above, the test holes completed to date suggest that the Quadra sand deposits are likely not present within the footprint of the Burke Mountain Village Lands. Nonetheless, our experience in the general area indicates that there is a potential for the presence of Quadra sand deposits with artesian conditions (i.e. pressurized groundwater). These deposits are susceptible to sloughing in unsupported excavations and may result in excessive sloughing during construction of the temporary facing for a shotcrete and anchor wall system. Where groundwater is present, Quadra sands are also prone to piping, loss of ground and the formation of sink holes. Where present, an alternative excavation support system, such as a secant pile wall that reduces the risk of exposing the Quadra sands, may be required.

We anticipate that temporary dewatering will be required during excavation work given the relatively shallow groundwater conditions.

7. SEISMIC CONSIDERATIONS AND LIQUEFACTION SUSCEPTIBILITY

The site is underlain by dense to very dense, till-like soils at relatively shallow depth. From Table 4.1.8.4.A of the British Columbia Building Code (2018) and based on the results of the DCPT profiling, the subsurface stratigraphy is classified as Site Class C. From the Natural Resources Canada website, the 2015 National Building of Canada Seismic Hazard Calculator provided a Firm Ground Peak Ground Acceleration (PGA) of 0.306 g for the 1:2475 seismic event at this location.

As the subsurface stratigraphy comprises dense to very dense, till-like soils at shallow depths, there is a low probability of liquefaction.

8. PAVEMENT RECOMMENDATIONS

In paved areas, the exposed subgrade must be relatively flat (a nominal slope is recommended to provide drainage) and free of loose, topsoil, organic, or disturbed material. All water must be drained away to prevent ponding. Where the exposed subgrade is below the design elevation, approved granular fill must be placed and compacted as outlined in Section 5.1.1.

A proof-roll should be completed at the final subgrade design elevation and at exposed subgrade level, where fill placement is required to achieve design grades, using a fully-loaded dump truck to identify potential soft spots. Soft spots must be sub-excavated and replaced with compacted granular fill.

The subgrade preparation and the granular base and sub-base layer should extend a minimum of 1.5 m beyond the perimeter of all paved areas.

According to the City of Coquitlam subdivision and development servicing document (Bylaw Number 3558, 2003), the recommended pavement structure for new roads (lanes, local and collectors streets) assuming MMCD compliant materials, is as follows:

- 75 mm Asphaltic Concrete (50 mm base course, 25 mm surface course)
- 100 mm Crushed Granular Base
- 200 mm Select Granular Sub-Base

The granular base and sub-base must be compacted to at least 95% MPMDD.

9. CONSTRUCTION INSPECTION

Geotechnical field reviews will be required during construction to satisfy the requirements of the Letters of Assurance in the BCBC and document that the recommendations of the geotechnical report are followed. Geotechnical field review will be required to address the following issues:

- Review of subgrade for slab-on-grade and pavement to confirm suitability for placement of permanent fill.
- Review of bearing surfaces for footings.
- Review and density testing of compacted granular fill.
- Review of geotechnical aspects of permanent drainage installation.
- Review of temporary slopes and potentially groundwater inflow rates during construction.

THURBER

10. CLOSURE

We trust that this information is sufficient for your needs. Should you require clarification of any item or additional information, please contact us at your convenience.

Yours truly,
Thurber Engineering Ltd.
David Regehr, P.Eng.
Review Principal

September 11, 2020

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
T. F. D. DAJANI
42524

Tareq Dajani, P.Eng.
Geotechnical Engineer

Attachments Statement of Limitations and Conditions (1 page)
Drawing 26791-20-1: Test Hole Location Plan (1 page)
Drawing 26791-20-2: Lateral Earth Pressure Distribution Drawing (1 page)
Symbols and Terms (1 page)
Test Hole Logs (5 pages)
Figures 1 and 2 (2 pages)

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

LEGEND:

- TEST HOLE (2019)
- TEST HOLE (2020)

NOTES:

1. BASE PLAN TAKEN FROM GOOGLE EARTH.
2. TEST HOLE LOCATIONS ARE APPROXIMATE.

THURBER ENGINEERING LTD.

CLIENT: CITY OF COQUITLAM

TEST HOLE LOCATION PLAN

BURKE MOUNTAIN COMMUNITY CENTRE

COQUITLAM, B.C.

DESIGNED	DRAWN	APPROVED
TFD	MOM	

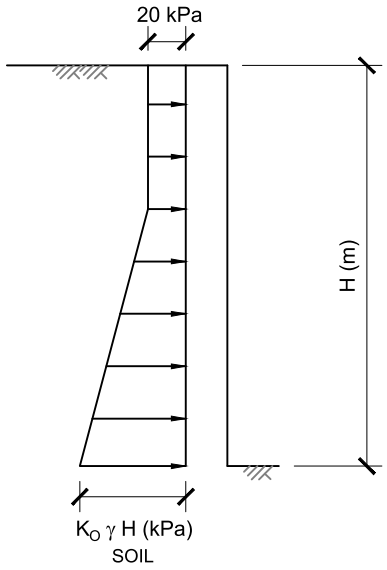
DATE	SCALE
27/07/20	1:1500

PROJECT No.	DWG. No.	REV.
26791-20	1	0

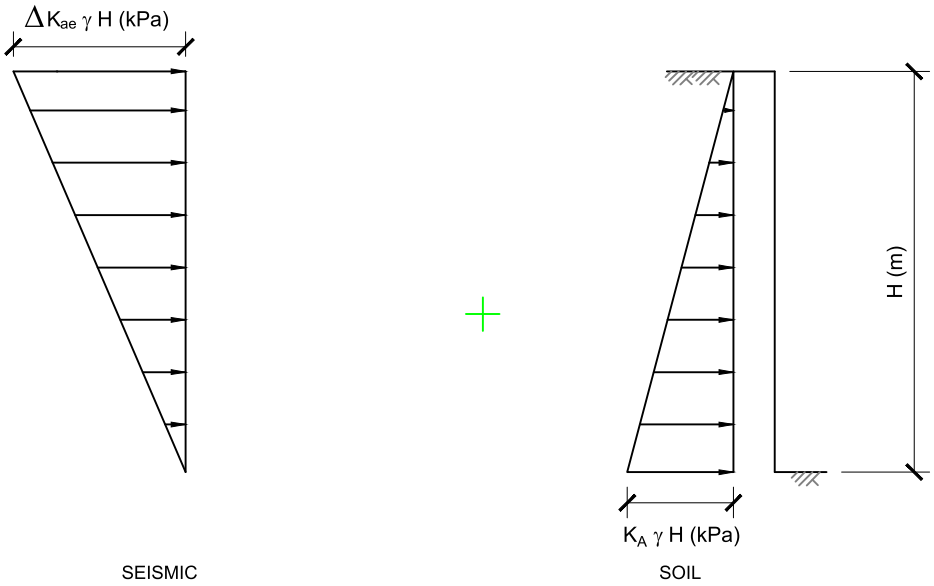
CANCEL PRINTS BEARING EARLIER NUMBER

Plotted: July 27, 2020

S:\Data\BST Projects\26xxx\26791\06_Drafting\03_Working\26791.dwg



STATIC LOADING CONDITION



SEISMIC LOADING CONDITION

LOADING CONDITIONS			
γ (kN/m^3)	K_O	K_A	ΔK_{ae} (2475 YR EQ)
20	0.43	0.27	0.19

THURBER ENGINEERING LTD.

CLIENT: CITY OF COQUITLAM

LATERAL EARTH PRESSURE DIAGRAM

BURKE MOUNTAIN COMMUNITY CENTRE COQUITLAM, B.C.

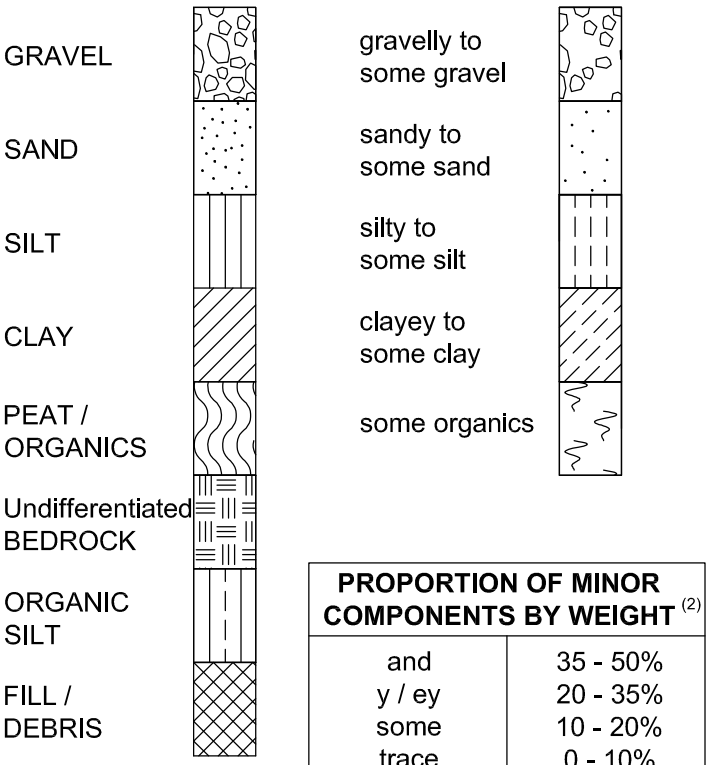
DESIGNED	DRAWN	APPROVED
TFD	MOM	

DATE	SCALE
27/07/20	N.T.S.

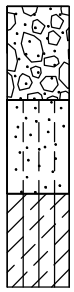
PROJECT No.	DWG. No.	REV.
26791-20	2	0

SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

BASIC SOIL SYMBOLS



SYMBOL VARIATIONS - EXAMPLES[1]



DENSITY OF GRANULAR SOILS	
Description	SPT N[5] [6]
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	> 50

PROPORTION OF MINOR COMPONENTS BY WEIGHT[2]	
and	35 - 50%
y / ey	20 - 35%
some	10 - 20%
trace	0 - 10%

CONSISTENCY OF COHESIVE SOILS	
Description	Undrained Shear Strength (kPa)[6]
Very Soft	< 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	> 200

PENETRATION TESTS	
Dynamic Cone Penetration	
Standard Penetration	
Becker Closed Casing	
Becker Open Casing	
Bounce Chamber Pressure	

CLASSIFICATION BY PARTICLE SIZE				
		Size Range[6]		
			U.S. Standard Sieve Size	
Name		(mm)[3]	Retained	Passing
Boulders		> 200	8 inch	-
Cobbles		75 - 200	3 inch	8 inch
Gravel:	coarse	19 - 75	0.75 inch	3 inch
	fine	5 - 19	No. 4	0.75 inch
Sand:	coarse	2 - 5	No. 10	No. 4
	medium	0.4 - 2	No. 40	No. 10
	fine	0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay)[4]		< 0.075	-	No. 200

(1) Only selected examples of the possible variations or combinations of the basic symbols are illustrated.
(2) Example: SAND, silty, trace of gravel = sand with 20 to 35% silt and up to 10% gravel, by dry weight. Percentages of secondary materials are estimates based on visual and tactile assessment of samples.
(3) Approximate metric conversion.
(4) Fines are classified as silt or clay on the basis of Atterberg limits.
(5) SPT N values on test hole logs are uncorrected field values.
(6) Reference Canadian Foundation Engineering Manual 4th Edition, 2006.

THURBER

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. 20-1

LOCATION: See DWG.26791-20-1
N 5460300, E 519466 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 8, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	3001 LT Barologger Edge, M1.5 (SN: 2120927) installed within stick-up portion of the standpipe well		Compact, brown, sandy TOPSOIL with some gravel.
1	Run 1: 0 to 3.1 m depth Recovery= 100% DCPT refusal at 1.4 m depth.	SM	Very dense, grey-brown, silty, gravelly SAND with a trace to some cobbles (TILL-like).
2		SM	
3	Run 2: 3.1 to 6.1 m depth Recovery= 100%		- silty SAND to SILT and SAND with some gravel below 3.1 m depth
4		ML/SM	
5			- grey below 4.6 m depth
6	Run 3: 6.1 to 9.1 m depth Recovery= 100%	ML/SM	
7		ML/SM	- grey-brown below 7.0 m depth
8			
9	3001 LT Levelogger Junior Edge (SN: 2120927) installed at 8.6 m depth	ML/SM	End of hole at required depth. Water level measured at 0.5 m depth on July 2, 2020.
10			

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 1 of 2

LOG OF TEST HOLE

TEST HOLE NO. 20-2

LOCATION: See DWG.26791-20-1
N 5460255, E 519465 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 8, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	Run 1: 0 to 2.4 m depth Recovery= 100%		Very soft to soft, brown, sandy TOPSOIL with some gravel.
1	DCPT refusal at 1.1 m depth.	ML/SM	Compact to dense, grey-brown SILT and SAND with some gravel and a trace to some cobbles (TILL-like).
2	Run 2: 2.4 to 4.9 m depth Recovery= 100%	ML/SM	- very dense below 2.4 m depth
3		ML/SM	
4		ML/SM	
5	Run 3: 4.9 to 5.5 m depth Recovery= 100%	SM	
	Run 4: 5.5 to 8.5 m depth Recovery= 100%		- gravelly below 5.5 m depth
6		SM	- grey between 6.4 m and 8.0 m depth
7			
8		ML/SM	- cobbles between 7.9 and 8.5 m depth
9	Run 5: 8.5 to 10.7 m depth Recovery= 63%		
10		SM	

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 2 of 2

LOG OF TEST HOLE

TEST HOLE NO. 20-2

LOCATION: See DWG.26791-20-1
N 5460255, E 519465 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 8, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): ■ GASTECH reading ⊠ PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100 | **COMMENTS** | SOILS DESCRIPTION

DEPTH (m)	SOILS DESCRIPTION
10	Compact to dense, grey-brown SILT and SAND with some gravel and a trace to some cobbles (TILL-like).
11	End of hole at required depth. Water level indeterminate due to sonic drilling method.
12	
13	
14	
15	
16	
17	
18	
19	
20	

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. 20-3

LOCATION: See DWG.26791-20-1
N 5460218, E 519413 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 9, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	Run 1: 0 to 3.1 m depth Recovery= 40%	SM/GM	Loose over compact to dense, brown SAND and GRAVEL with some silt and a trace of organics.
1	DCPT refusal at 1.0 m depth.		Very dense, grey SAND and GRAVEL with some silt and cobbles (TILL-like).
2		GM/SM	
3	Run 2: 3.1 to 4.0 m depth Recovery= 33%	GM/SM	
4	Run 3: 4 to 6.1 m depth Recovery= 100%		ROCK / BOULDER.
5		SM	
6	Run 4: 6.1 to 9.1 m depth Recovery= 100%		Very dense, grey, SILT and SAND to silty SAND with some gravel to gravelly, some cobbles and a trace of clay (TILL-like).
7		SM	
8			
9	3001 LT Levelogger Junior Edge (SN:2121297) installed at 8.5 m depth	ML/SM	End of hole at required depth. Water level measured at 0.3 m depth on July 2, 2020.
10			

LOG OF TEST HOLE (COORD EST) 26791-20.GPJ THURBER_MOM.GDT 30/7/20- THURBER MOM.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. 20-4

LOCATION: See DWG.26791-20-1
N 5460208, E 519383 (Est.)

TOP OF HOLE ELEV:

METHOD: Sonic/ DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: IFA

THURBER

CLIENT: City of Coquitlam

PROJECT: Burke Mountain Community Centre

DATE: June 9, 2020

FILE NO.: 26791-20

REVIEWED BY: TFD

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit – Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100

DEPTH (m)	COMMENTS		SOILS DESCRIPTION
0	Run 1: 0 to 0.8 m depth Recovery= 80%		Loose, dark brown TOPSOIL.
1	DCPT refusal at 0.9 m depth.		ROCK / BOULDER.
	Run 2: 0.8 to 3.1 m depth Recovery= 100%	ML/SM	Very dense, grey-brown SILT and SAND to silty SAND with some gravel to gravelly, some cobbles and a trace of clay (TILL-like).
2			
		SM	
3	Run 3: 3.1 to 6.1 m depth Recovery= 100%		- some oxidation between 3.1 m and 6.9 m depth
4		SM	
5			
		SM	
6	Run 4: 6.1 to 9.1 m depth Recovery= 100%		
7		ML/SM	- grey below 6.9 m depth
8			
		ML/SM	
9			End of hole at required depth. water level indeterminate due to sonic drilling method.
10			

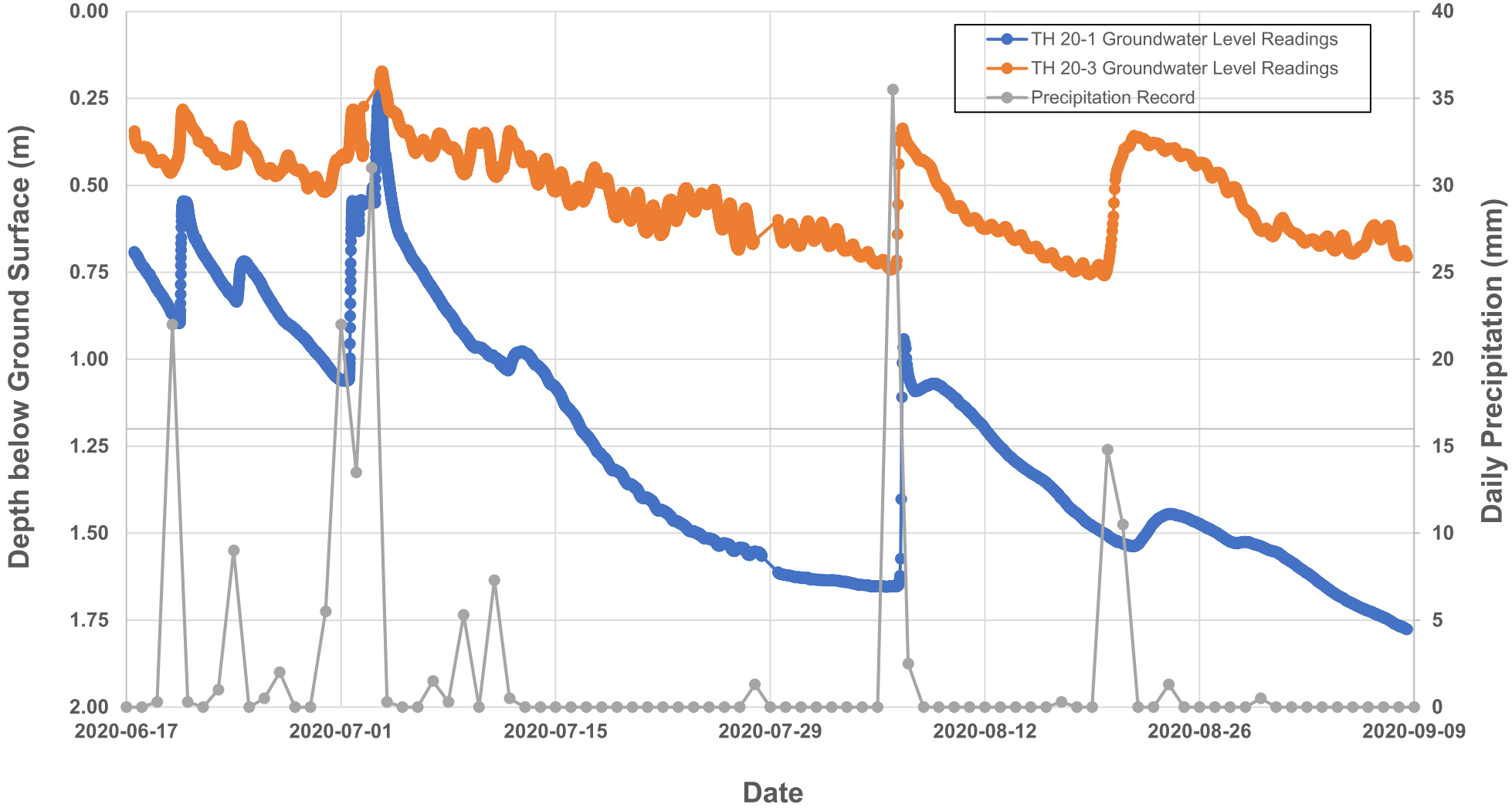
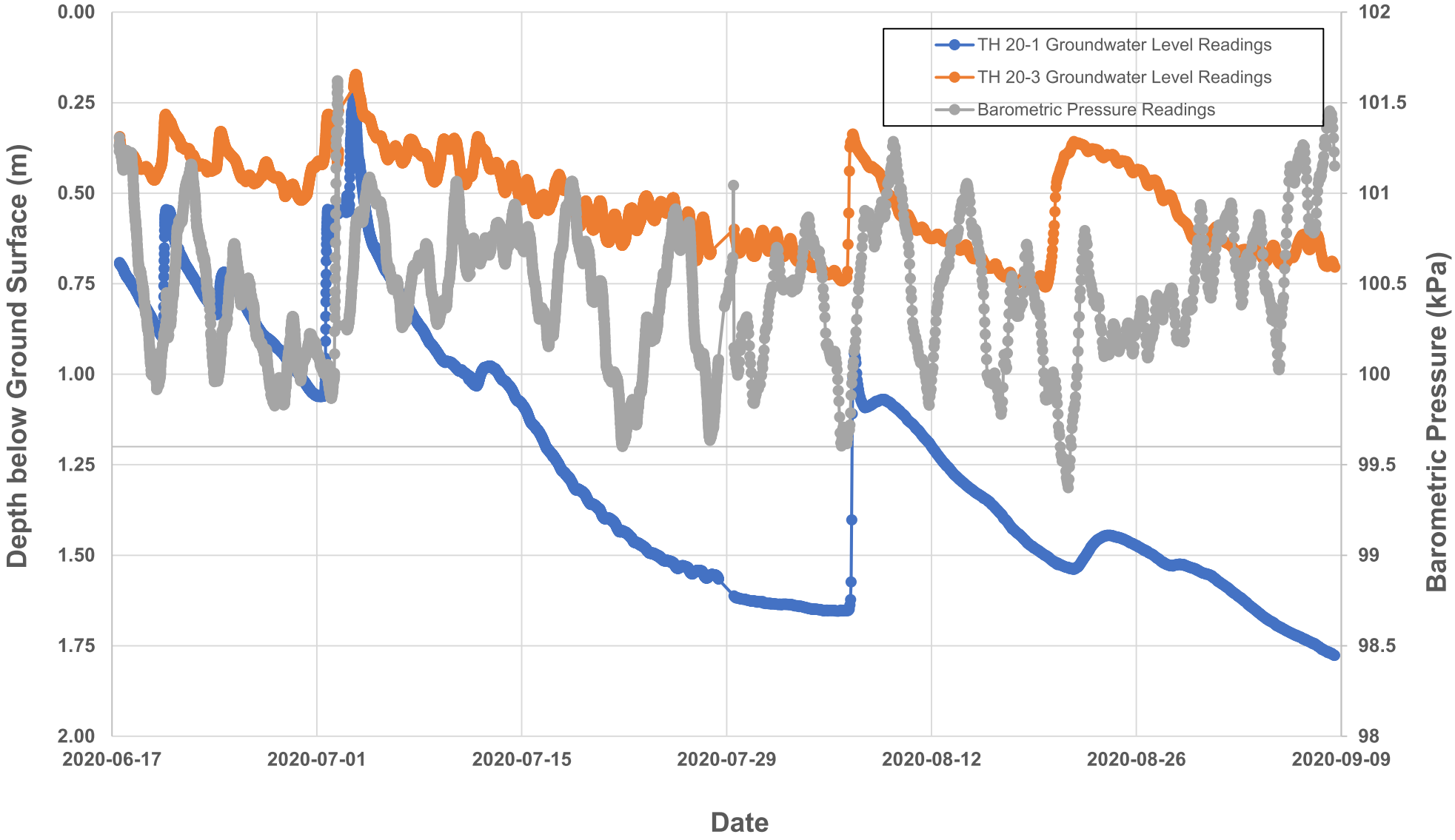


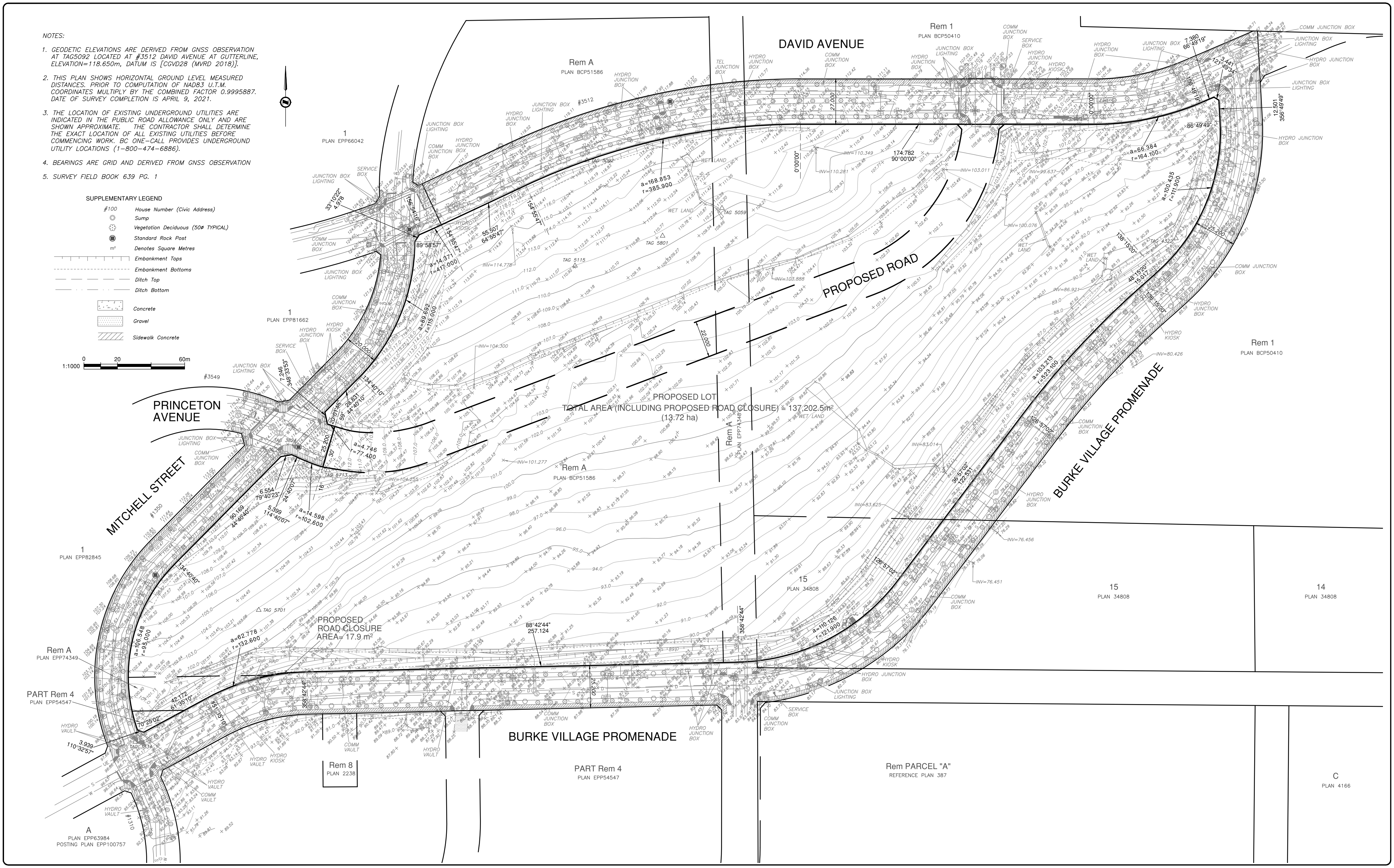
Figure 1: Groundwater Level Measurements and Precipitation Records (June 17 to September 8, 2020)

Client: City of Coquitlam
Project # 26791
Project: Burke Mountain Community Centre



Client: City of Coquitlam
Project # 26791
Project: Burke Mountain Community Centre

Figure 2: Groundwater Level and Barometric Measurements (June 17 to September 8, 2020)



NOTES:

1. GEODETIC ELEVATIONS ARE DERIVED FROM GNSS OBSERVATION AT TAG5092 LOCATED AT #3512 DAVID AVENUE AT GUTTERLINE, ELEVATION=118.650m, DATUM IS [CGVD28 (MVRD 2018)].
2. THIS PLAN SHOWS HORIZONTAL GROUND LEVEL MEASURED DISTANCES. PRIOR TO COMPUTATION OF NAD83 U.T.M. COORDINATES MULTIPLY BY THE COMBINED FACTOR 0.9995887. DATE OF SURVEY COMPLETION IS APRIL 9, 2021.
3. THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE INDICATED IN THE PUBLIC ROAD ALLOWANCE ONLY AND ARE SHOWN APPROXIMATE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. BC ONE-CALL PROVIDES UNDERGROUND UTILITY LOCATIONS (1-800-474-6886).
4. BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATION
5. SURVEY FIELD BOOK 639 PG. 1

SUPPLEMENTARY LEGEND

- #100 House Number (Civic Address)
- Sump
- Vegetation Deciduous (50ø TYPICAL)
- Standard Rock Post
- m² Denotes Square Metres
- Embankment Tops
- Embankment Bottoms
- Ditch Top
- Ditch Bottom
- Concrete
- Gravel
- Sidewalk Concrete

Edge of pavement	Hydrant	Hydro Guy Wire
Watermain and valve	Water air valve	Hydro Kiosk
Drainage sewer, MH	Water blowoff	Vegetation Conifer
Drainage ditch	Water service	Vegetation Deciduous
Sanitary sewer, MH	Catch basin, top inlet	Vegetation Shrub
Sanitary forcemain	Catch basin, side inlet	Survey Traverse Hub
Gasmain and valve	Catch basin, round	Survey Iron Pin
Hydro duct, MH	Drainage service	Survey Lead Plug
Telephone duct, MH	Drainage cleanout	Survey Monument
Sanitary service	Sanitary cleanout	Utility pole(joint pole)
Utility pole with light	Streetlight, davit	Streetlight, post top
Comb signal pole	Traffic signal pole	Junction box

No.	Date	By	Revisions

Design by — Date
Drawn by L.P. — Date APR 20 2021
Checked by — Date
Approved by — Date

Coquitlam
Engineering & Public Works
3000 Guildford Way, Coquitlam, B.C. V3B 7N2

Scale horiz. 1:1000 Scale vert.
Sheet 1 of 1
Eng. Project No.

Project: DAVID AVENUE AND MITCHELL STREET
Description: TOPOGRAPHIC SURVEY
File: 21BurkeVillage04131119T0

Plot Date: April 22, 2021

KERR WOOD LEIDAL
consulting engineers

Greater Vancouver
200 - 4185A Still Creek Drive
Burnaby, BC V5C 6G9
T 604 294 2088
F 604 294 2090

Technical Memorandum

DATE: July 19, 2023

TO: Burke Mountain Village Park and Promenad
Space2Place Design Inc.

FROM: Sean Lehky

RE: **Burke Mountain Monitoring Program**
Flow Monitoring Briefing
Our File 3486.017-300

1. Background

Kerr Wood Leidal Associates Ltd. (KWL) was retained by Space2Place Design Inc. to monitor the streamflow exiting a storm pipe from an underground baseflow augmentation tank on David Avenue. The monitoring location is immediately upslope of the proposed Burke Mountain Village. Streamflow draining from the outlet is a combination of the water released from the baseflow augmentation tank and the groundwater from the surrounding catchment area.

Installation and commissioning of the flow monitoring weir was completed on August 12, 2022.

2. Equipment

The Burke Mountain monitoring station consists of a wooden weir trenched into the cross-section of the water channel downstream of the outlet town centre pipe. The Weir has been built with aluminum edging that has a 120-degree V-notch to calculate discharge. A staff gauge was installed to record the water level and a Solinst Levelogger and Barometer, both contained within a stilling well, were installed to record water level.

The Stage-Discharge formula used with the 120-degree v-notch is $Q = 2391*(h-0.353)^{2.5}$, where “Q” is discharge and “h” is stage.

The data recorded from the Solinst loggers are manually downloaded on regularly scheduled maintenance visits in conjunction with general site upkeep.

3. Flow and Level Data Results

Through the months of August 2022 to May 2023, the data showed minimal changes in the water level and discharge over the weir. The water levels on the staff gauge ranged from ~0.35 m to ~0.42 m and the discharge rate was between less than 1 l/s and up to 5 l/s. The minimal range in discharge indicates that the data is likely limited to groundwater flow exclusively. From the onset of the program, initial estimates for flow were expected to reach >50 l/s during a typical storm event and in more intense rainfall events, 300 l/s could be anticipated.

As a result of the flow being held at groundwater flow levels, the two hydrographs attached are showing that summer dry periods and winter wet periods are very similar. The graphs look the same due to the lack of flow injected into the stream channel from the augmentation tank during rainfall events.

Below are two Hydrographs of the calculated flow data and the rainfall data collected from the Coquitlam Rain Gauge, the first one showing the data for the Winter season (October 2022 to March 2023) and the other showing the data for the Summer season (March 2023 to July 2023):

4. Recommendations

As discussed with the City of Coquitlam, the valve allowing water to flow from the holding tank was closed throughout the monitoring program. The recommendation to encapsulate the best results is for the city to open the valve allowing water to flow for a period of one year further with continued monitoring from KWL. This will allow KWL to see the range of the site's water dynamics with both groundwater and the additional flow from the augmentation tank.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Sean Lehky
Hydrometric Technician

Reviewed by:

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
2023 07 20
A. J. KOLPER
39153

Andrew Kolper, P.Eng.
Senior Hydrotechnical Engineer
Permit to Pratice Number 1000698

Encl.: Hydrographs

Statement of Limitations

This document has been prepared by Kerr Wood Leidal Associates Ltd. (KWL) for the exclusive use and benefit of the intended recipient. No other party is entitled to rely on any of the conclusions, data, opinions, or any other information contained in this document.

This document represents KWL's best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions. No warranty, express or implied, is made.

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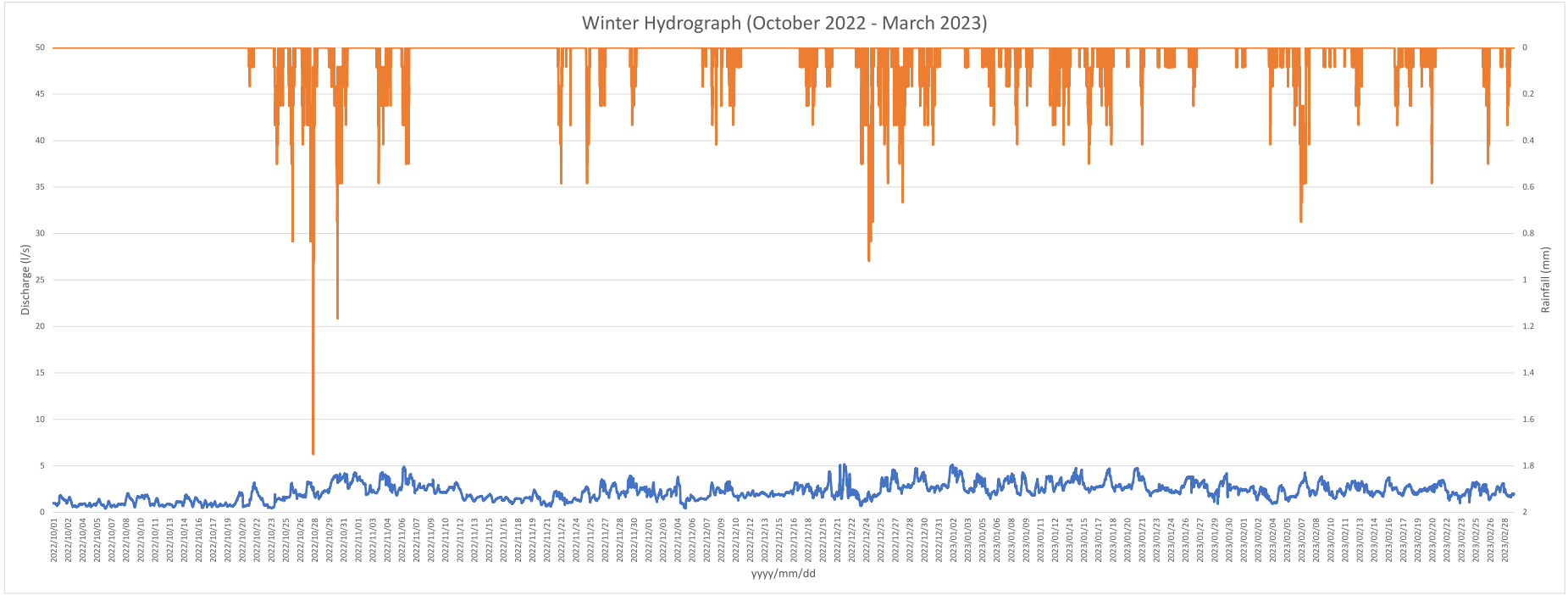
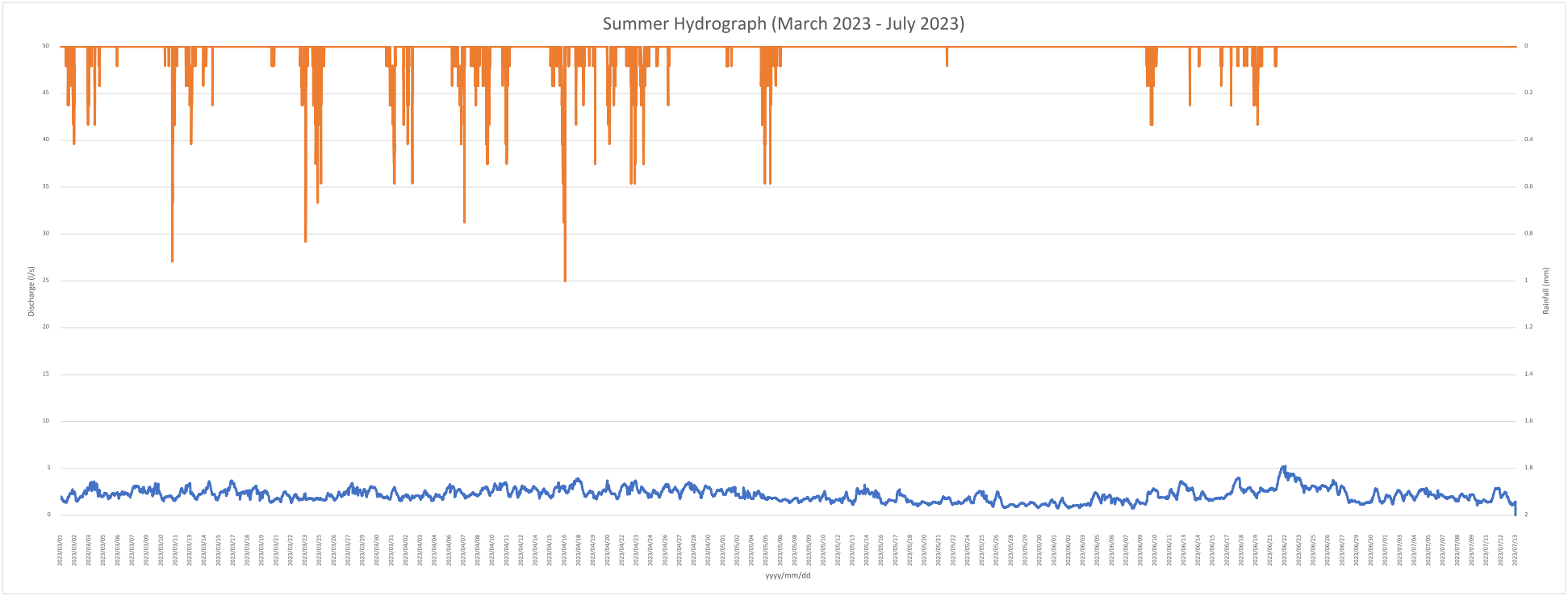
Revision History

Revision #	Date	Status	Revision Description	Author
0	July 19, 2023	Final		SSL


Winter Hydrograph (October 2022 - March 2023)
Discharge (l/s)
Rainfall (mm)
yyyy/mm/dd



KERR WOOD LEIDAL ASSOCIATES LTD.
consulting engineers

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Technical Memorandum

DATE: June 30, 2023

TO: Somaye Hooshmand
Landscape Architect
Space2Place Design Inc.

CC: Ryan Preston, B.SC, P.AG, CPESC

FROM: Andrew Kolper, P.Eng

RE: **BURKE MOUNTAIN VILLAGE CREEK HYDROTECHNICAL ASSESSMET**
Our File 3486.017-300

Introduction

In 2022, Space2Place (S2P) retained KWL to undertake and assessment of the maximum flows expected in the creek which is proposed to flow through Burke Mountain Village Park. In addition, KWL was requested to provide design comments and address whether the proposed channel capacity is suited to the source water and that the design allows for a stable channel substrate. The purpose of the above scope is to support an application for Provincial Approvals to undertake the proposed channel works.

Creek Flows

The proposed creek will be fed via from the City of Coquitlam's storm sewer network. Runoff from the development upstream is routed through a large flow augmentation tank which discharges at a controlled rate. The discharge is controlled via a 300mm orifice which allows a maximum of 450 l/s of flow to be discharged into the creek. In summer months when rainfall is minimal, the flow augmentation tank discharges approximately 2-5 l/s into the creek to provide environmental base flows for the downstream creek systems.

Channel Design

The proposed watercourse has been designed as with a step pool morphology to mimic typical mountain creeks found in the lower mainland. The creek section shown in Figure 1 has the capacity to convey approximately 1.2 m^3/s which is just less than 3(three) times the expected flow rate to allow for additional flows if additional sources of clean water are directed to the proposed creek.

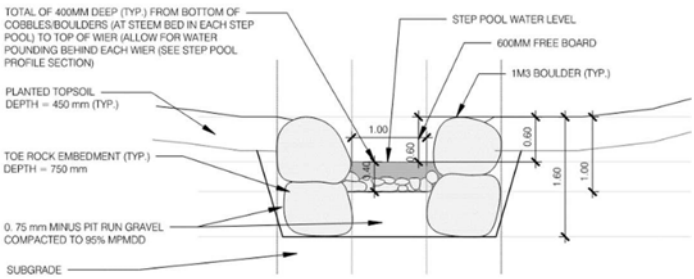

Figure 1: Channel Design Cross Section

The channel substrate is proposed to be a 200 mm minus rounded cobble and creek bed gravels. When coupled with the bed stabilization weirs which help to form the step pool morphology these elements will provide a stable creek bed with minimal risk of erosion and bed load movement.

Closing

The proposed Burke Mountain Village Creek as designed is fit for the intended purpose and is expected to convey the expected flows safely through the park

We trust that the above information is satisfies the permitting requirements of the Province however, please do not hesitate to contact the undersigned if further clarification is required.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Andrew Kolper, P.Eng.
Hydrotechnical Engineer

Statement of Limitations

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Revision History

Revision #	Date	Status	Revision Description	Author
A	June 1, 2023	DRAFT		CM/CQ

Water Sustainability Act
Section 11 Approval
Burke Village Promenade Park
Supplementary Information Package.

Prepared for:

City of Coquitlam
3000 Guildford Way
Coquitlam, B.C.
V3B 7N2

Prepared by:

BlueLines Environmental Ltd.
1265 East 29th Ave.
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July 25, 2023

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Executive Summary

The City of Coquitlam is advancing planning for the development of the Burke Mountain Village (formerly called Partington Creek Neighbourhood Centre) within the Northeast Coquitlam Area Plan, Partington Creek Neighbourhood Plan Area. Burke Mountain Village will be situated south from the recently completed David Avenue alignment, generally bound by Mitchell Street to the west, and by Burke Village Promenade defining the south and east boundaries. The village area will be developed over a 15.8-hectare (39-acre) site.

The City of Coquitlam is the primary landowner of the Village lands, which is expected to house over 2,000 residential units (apartments and townhomes) and include 120,000 square feet of retail. The Village will also include a state-of-the-art community centre, large public plaza, and neighbourhood park. Infrastructure developments have preceded development of residential, park, commercial deliverables with delivery of municipal roadways and associated civil infrastructure. David Avenue, Burke Village Promenade, and the initial clearing and site grading of the east extension of Princeton Avenue define the transportation and infrastructure systems upon with the village will be developed. Through the planning and development of roadways and civil infrastructure detailed environmental assessments have facilitated the updated mapping and classification of first-order headwater streams requiring explicit consideration in the development of Burke Mountain Village.

The updated environmental assessment and mapping, the limits of stream mapping have been extended upslope to the true incipient origin of the stream channel and based on seasonally representative evaluation of hydrologic expression and hydro-geomorphic process. The resulting mapping updates confirmed the headwater tributaries of an unnamed tributary stream system originating upland from the Burke Village Promenade alignment. The two first-order headwater tributaries have been the subject of prior *Water Sustainability Act* regulatory submittals with culvert crossings completed in 2019.

The development of Burke Mountain Promenade Park (BVPP) will mark the first phase of development to deliver an important community amenity feature supporting the forthcoming residential, commercial, and community centre. The development of the park is directly associated with a water management strategy dictated by the Partington Creek Integrated Watershed Management Plan (IWMP). The IWMP designated an unnamed tributary to the Star Creek and Partington Creek systems (Tributary T3A) as a priority site for the development of a significant underground retention tank to augment stream baseflows and mitigate the impacts of

hillside development. The headwater limits of Tributary T3A are located within the footprint of the proposed BVPP.

In recognition of the importance of baseflow maintenance to the headwater streams, interim operations have established an informal overland flow path routing and conservation of forested lands to sustain the headwater hydrology of the upstream limits of the Tributary T3A system. The development of the BVPP will include the formalization of the municipal drainage system and requires the consolidation of the two headwater tributary segments to yield an enhanced watercourse with sustained baseflow contributions to maintain the natural channel segments below the Burke Village Promenade alignment.

The proposed watercourse management strategy at BVPP achieves a 1:1 aquatic and riparian habitat balance with a design that will deliver a step-pool morphology stream channel within a designated riparian corridor and elevated pedestrian walkway to support public access and natural areas experience within the urban park setting. The consolidated compensation watercourse will sustain baseflows to both of the headwater reaches of the T3A tributary system and sustain ecosystem services with hydrologic contributions maintained down to the receiving environment at Partington Creek.

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1 Introduction

The City of Coquitlam has engaged a multi-disciplinary team to support the planning, design, and regulatory permitting requirements for the development of Burke Village Promenade Park (BVPP) located within the Northeast Coquitlam Area Plan, Partington Creek Neighbourhood Plan Area. The planning and design team has included Space2Place Landscape Architects, Kerr Wood Leidal, and BlueLines Environmental to advance the park design and consider the watershed values with specific focus on the management of two (2) ephemeral headwater tributary streams originating within the study area.

The BVPP project setting is central to the Burke Mountain Village (formerly Partington Creek Neighbourhood Centre) which is a 15.8-hectare (39-acre) site and will support the development of the adjacent Northeast Community Centre project. Within the park setting and adjacent community centre site, two (2) first-order headwater tributaries have been mapped and classified by BlueLines and are the subject of application for a *Water Sustainability Act*, Section 11 approval application for 'changes in and about a stream'.

1.1 Statement of Qualifications

The assessment presented herein has been completed by Mr. Ryan Preston, B.Sc, P.Ag, CPESC as a Qualified Environmental Professional (QEP) providing expertise in urban watershed management. The assessments, recommendations, and conclusions presented herein reflect best professional judgement based on the completion of seasonally representative surveys and review of published information from municipal and provincial databases and mapping resources.

2 Project Overview

The proposed BVPP and NECC project includes requirements to relocate two (2) headwater segments of a tributary to the Star Creek system to support the Burke Mountain Village land use objectives and establish a priority water management objective of the Partington Creek IWMP.

The two affected tributaries are proposed for consolidation and reconstruction within the BVPP boundaries to establish a protected natural area for natural areas protection and interpretive purposes. The watercourse will be formally connected to engineering infrastructure and conveyance of municipal drainage contributions to enhance the hydrologic dynamics and aquatic ecosystem values associated with Star Creek Tributary T3A.

2.1 Project Background & Rationale

The proposed development will include the delivery of Burke Village Promenade Park and establish the development area for the Northeast Community Centre (NECC) (Inset A), developments that will define the

basis for the Burke Mountain Village master plan[1]. The park design will require significant site grading to achieve the community and recreation objectives. The site regrading will directly affect the uppermost headwater origins of the incipient channels of two (2) ephemeral headwater stream segments associated with a tributary to the Star Creek and Partington Creek systems.

The impacts affecting the two tributaries (Tributary A and Tributary B) have been formally considered and integrated into a watercourse management strategy that expands on a broader system of municipal storm infrastructure based on recommendations of the Partington Creek Integrated Watershed Management Plan (IWMP) with a distributed system of water quality ponds and baseflow augmentation facilities.

A baseflow augmentation facility was originally constructed pursuant to the IWMP within David Avenue, immediately west from the Mitchell Street alignment. The baseflow insfrastructure and associated municipal drainage will be conveyed to the head of the proposed compensation stream channel to a discrete naturalized channel origin which will mark the transition from municipal drainage infrastructure to a regulatory stream channel. Streamflows will be intercepted at Burke Village Promenade and conveyed via municipal storm mains to the existing road culverts to deliver equivalent volumes to each of the headwater reaches which will be retained on the south margin of Burke Village Promenade.

Inset A - BVPP Park Setting and future NECC development site context.

[1] https://burkevillage.ca/village/master-plan/

The park development concept will achieve the aquatic and riparian habitat offsetting achieving the objectives of the Province of BC's environmental mitigation policy through the delivery of a reconstructed watercourse and establishment of a streamside protection and enhancement area which will be maintained to achieve a 'free to grow' status.

2.2 Associated Permits

Complementary regulatory oversight of the project will include the formal permitting under the City of Coquitlam's Watercourse Protection Development Permit process (WPDP). The WPDP will include project specific deliverables with respect to riparian restoration planting, survivorship, and the establishment of encroachment fencing and signage to achieve the environmental protection objectives.

The subject watercourses (Tributary A & B) are ephemeral non-fish bearing watercourses. Fish presence is prohibited by gradient, downstream barriers, and the stream hydroperiod and morphology; however, the water supply, food, and nutrient contributions to downstream fish bearing reaches in the Star and Partington Creek system dictate that the works will affect fish habitat. A formal referral to Fisheries and Oceans Canada will be submitted in anticipation of a DFO Letter of Advice.

2.3 Site Description and Environmental Context

The Burke Mountain Village setting includes the incipient stream channel origins of three (3) watercourses that are tributary to the Star Creek drainage system. Two (2) tributaries will be affected by the BVPP and NECC projects and are the subject of the *Water Sustainability Act*, S.11 application presented herein. Tribuary A and Tributary B are first-order ephemeral watercourses that were assessed, originally in support of the Burke Village Promenade roadworks and mapped to the uppermost limit of evidence of hydrologic expression and evidence of hydrogeomorphic process. The tributaries were physically delineated by a Qualified Environmental Professional and surveyed by City of Coquitlam survey crews, originally to support the *Water Sustainability Act* regulatory notifications in support of the road and civil servicing project. Culverts were installed under Water Act file No.2006312.

The subject watercourses are ephemeral headwater channels characterized as non-fish bearing non-alluvial streams reflecting the uppermost channel segments and incipient origin of streamflow from overland runoff and saturated return-flow processes driven by hillslope micro-topography. The project area's terrestrial habitats reflect a historically logged and burned second growth mixed forest community and are not associated with species at risk critical habitats.

The IWMP recognized the potential hydrologic influences of urban development within the upland watershed and earmarked three (3) baseflow augmentation tanks for construction within the Star Creek catchment. The David Avenue baseflow augmentation tank was constructed in 2017 (Inset B).

Inset B - 2017 aerial imagery illustrating construction of baseflow augmentation tank per Partington Creek IWMP.

Through the course of construction of David Avenue, Princeton Avenue, and Burke Village Promenade, additional measures to maintain the hydrologic functions and downstream aquatic ecosystem values included the construction and connection of temporary 'construction phase' water management measures. Ditches with surface discharge points or surface mounted 'level spreaders' were employed as corridor drainage/municipal drainage features to capture and convey intercepted hillslope runoff and interflow to forested hillslopes to maintain natural hillslope hydrologic processes rather than interception and diversion through stormwater infrastructure.

No watercourse or wetlands were historically present upland from the mapped upstream limits of hydrologic expression; however, with the advancing clearing and road construction and in recognition of the opportunities afforded by the pre-construction of the baseflow tank, the tank was partially commissioned to support the hydrology of the mapped upstream extent of the T3A tributaries. Geotechnical investigations confirm the underlying geology as a compact basal till overlying tertiary bedrock and recorded no incidences of groundwater beyond seasonally perched water reflecting interflow pathways.

A temporary surface flow path was established to disperse municipal stormwater to the vegetated upland slopes and convey drainage across the Princeton Avenue alignment in a temporary culvert to establish the hydrologic augmentation at the earliest opportunity to maintain stream function and hydrologic dynamics. The baseflow augmentation tank has been operated to 'recharge' the hillslope hydrologic pathways since the commencement of the Princeton Ave. and Burke Village Promenade road and utilities projects between 2018 and 2019 (Inset C).

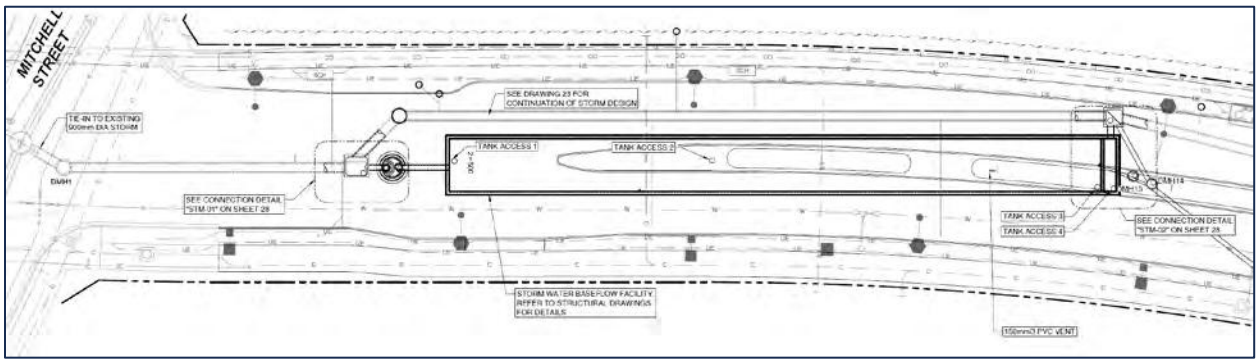
Inset C - Temporary surface flow paths established to maintain baseflow provisions to upstream limits of jurisdictional streams in association with municipal road development and civil servicing.

The development of the BVPP and NECC lands are proposed to formalize the baseflow augmentation tank with development of an open urban watercourse conveying the municipal drainage through the northern greenway

2.3.1 Baseflow Augmentation Tank

A baseflow augmentation tank forms the basis of the hydrology for the proposed watercourse relocation and enhancements. The baseflow augmentation tank was constructed to achieve the objectives of the IWMP and reflects a key component of municipal drainage infrastructure. The water supply reflects the capture and storage of stormwater runoff from upland developed areas through municipal storm mains and structural BMPs established to address water quality and rate control objectives prior to release to the environment.

Inset D articulates the configuration of the baseflow detention tank and the associated drainage system which will form the basis of the water supply for the proposed watercourse management strategy.

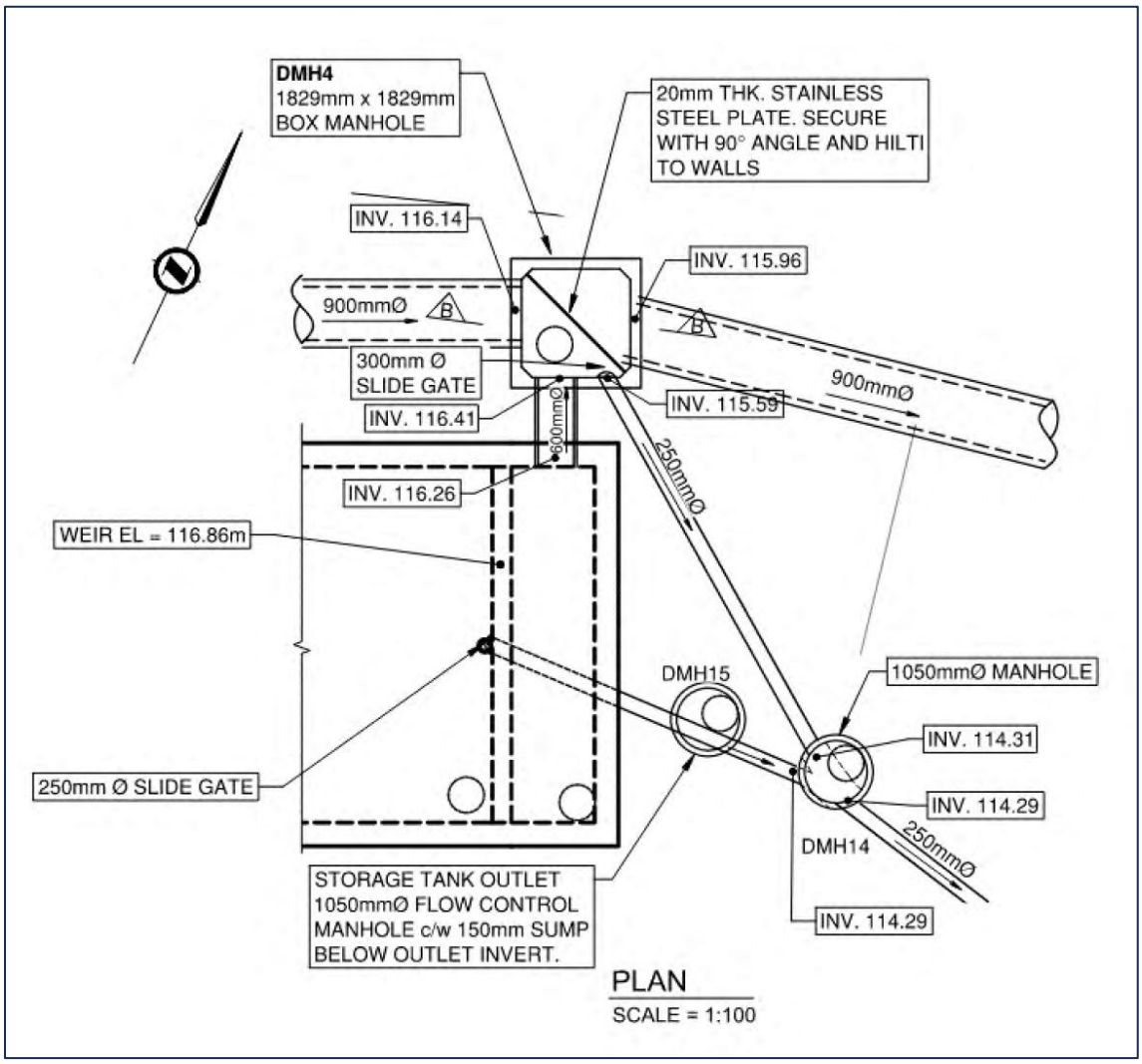


Inset D - David Ave. Baseflow Augmentation Tank Design.

The baseflow augmentation tank is owned and operated by the City of Coquitlam's engineering department and includes an operating manual which articulates the design and operation specifications from the inlet and outlet structures. Slide gate and orifice systems control the hydrology of the system. The baseflow tank provides storage to meet the following criteria:

- Store 1300 cu.m of storm water in a watertight facility
- Provide inlet treatment of TSS and hydrocarbons (stormceptor)
- Control the discharge to an outflow rate of +/- 5cu.m/hr (0.75 L/s) (
- Drawdown time is 22/23 days, and the tank was designed to be watertight as this is the only way to control the baseflow.

Inset E illustrates the 'as-built' design for the outlet structure which will control the hydrology of the proposed BVPP watercourse.



Inset E - Baseflow augmentation tank outlet control structure.

Monitoring of the interim hydrologic function and baseflow volumes provided through the system and as a result of passive groundwater drainage owing to the permeability of trench bedding associated with municipal infrastructure a hydrometric monitoring program has been initiated by KWL. A weir and pressure transducer has been established and will be maintained through to completion of construction of the BVPP project to support calibration of baseflow release through adjustments to drainage infrastructure (e.g. slide gates associated with design outlet structures from the detention tank – See Inset E).

Photograph 1 - Temporary baseflow monitoring weir illustrating typical baseflow to temporary ditch drainage below v-notch weir and hydrometric monitoring location.

3 Description of Proposed Works

A publicly accessible park setting has been designed to include a designated ecosystem reserve which will include an enhanced step-pool morphology headwater tributary and riparian buffer zone that will maintain the hydrology of the natural stream channel segments located immediately below the Burke Village Promenade alignment.

The existing upstream limits of the headwater tributaries to Tributary T3A as identified in the IWMP are proposed for relocation and reconstruction. The proposed works will influence 75 linear meters of open watercourse. A consolidated single channel to be constructed within the BVPP boundaries is proposed to provide habitat offsetting.

Figure 1 presents the existing conditions and impact assessment for the alterations of Tributary A and Tributary B. Figure 2 presents the proposed watercourse management strategy which will include the following:

- 78 linear meters of enhanced step-pool morphology channel.
- 25 boulder weir grade control structures
- Enhanced channel alluvium substrate to improve autochthonous food and nutrient production and invertebrate habitat
- 1763 riparian buffer zone enhanced with 1,643 native nursery stock plantings
- Establishment of temporary irrigation and maintenance program to establish 'free to grow' status

3.1 Description of Proposed Activities/Works

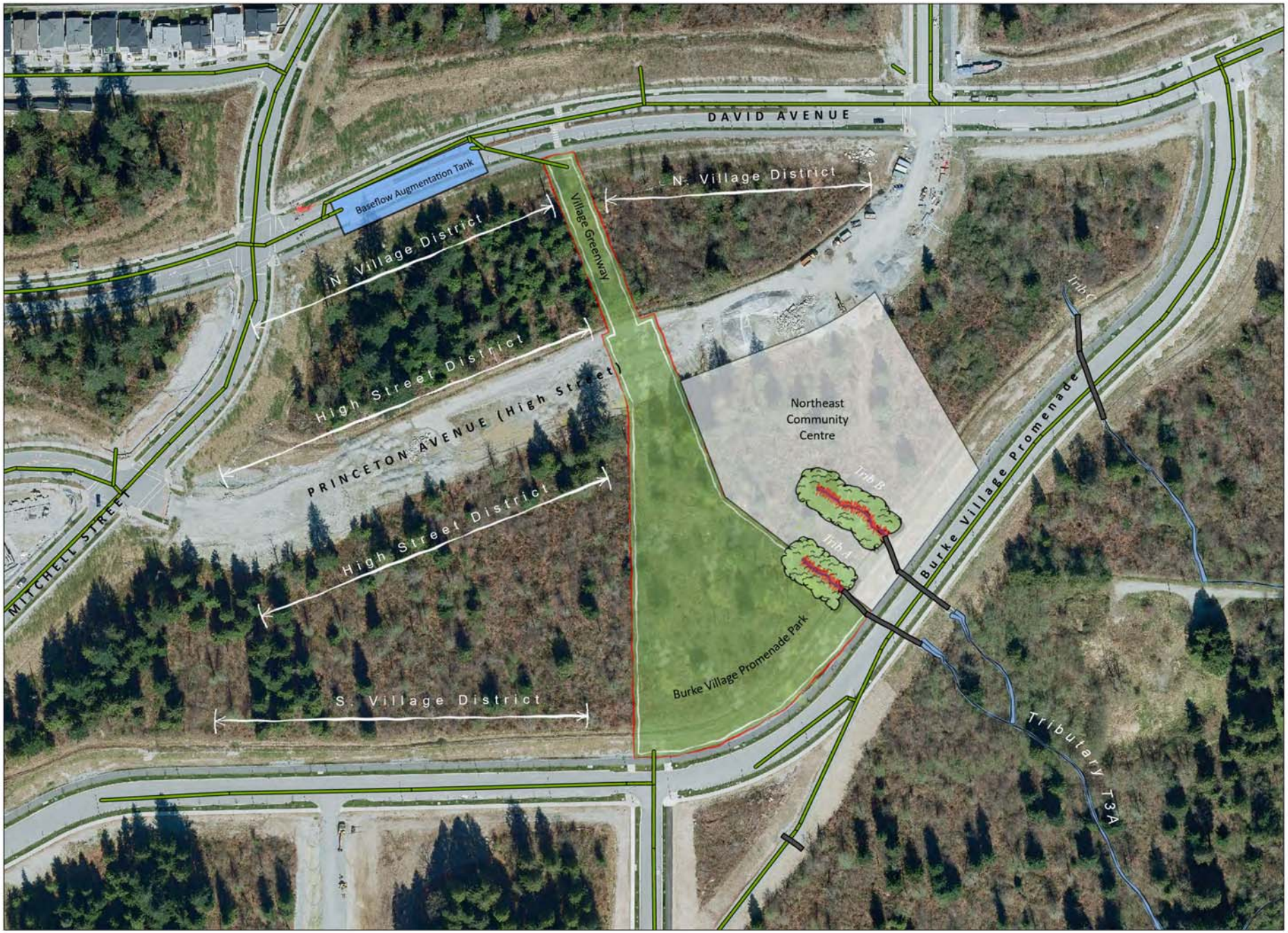
The BVPP project will directly affect 75 linear meters of existing ephemeral headwater stream channel located upstream from the present-day culvert inlets of the tributaries at the Burke Village Promenade alignment.

Table 1 presents a description of the project components, timelines and evaluation of impacts and ecosystem values.

The proposed project will involve the impacts affecting the existing non-alluvial, non-fish bearing ephemeral tributaries and the delivery of an enhanced compensation channel and pool feature inclusive of a designated riparian buffer zone.

Table 1 – Project Components & Timelines

Instream Activities/Works Construction Description and Construction Stage	Area of Impact (Dimensions and Footprint)	Proposed Duration and Time Of Year for Construction	Potential Aquatic and Riparian Benefits and/or Impacts			Proposed Avoidance/ Mitigation measures
			Aquatic Ecosystem Values	Water Quantity	Water Quality	
Tributary A	28 linear meters [31m2]	July – October 2024	Non-fish bearing/Food & Nutrient	Impact – loss of ephemeral/seasonal headwater	N/A	• Work in dry season • Worksite isolation/flow bypass • QEP monitoring
Tributary B	47 linear meters [41m2]				N/A	
Compensation Channel	78 linear meters [158m2]		Non-fish bearing/Food & Nutrient. Amphibian habitat potential @ downstream pool feature	Benefit – Permanent non-fish bearing watercourse	Stormwater source routed via structural BMP (stormceptor) and detention tank (settling) prior to discharge.	
Pool/Wetland Feature	51m2		Non-Fish bearing open water pool meso-habitat unit	Benefit – permanent open water pool feature suitable for amphibian habitat use and wildlife values		



BVPP Existing Conditions & Impacts

Client:
City of Coquitlam

Legend

- BVPP
- NECC
- Baseflow Tank
- Municipal Storm Sewer
- Municipal Culverts
- Existing Watercourses

Existing Conditions

- RAPR SPEA
- WSA Stream
- Impact Area

Scale: 1:1,750

Figure 1

N

BlueLines Environmental

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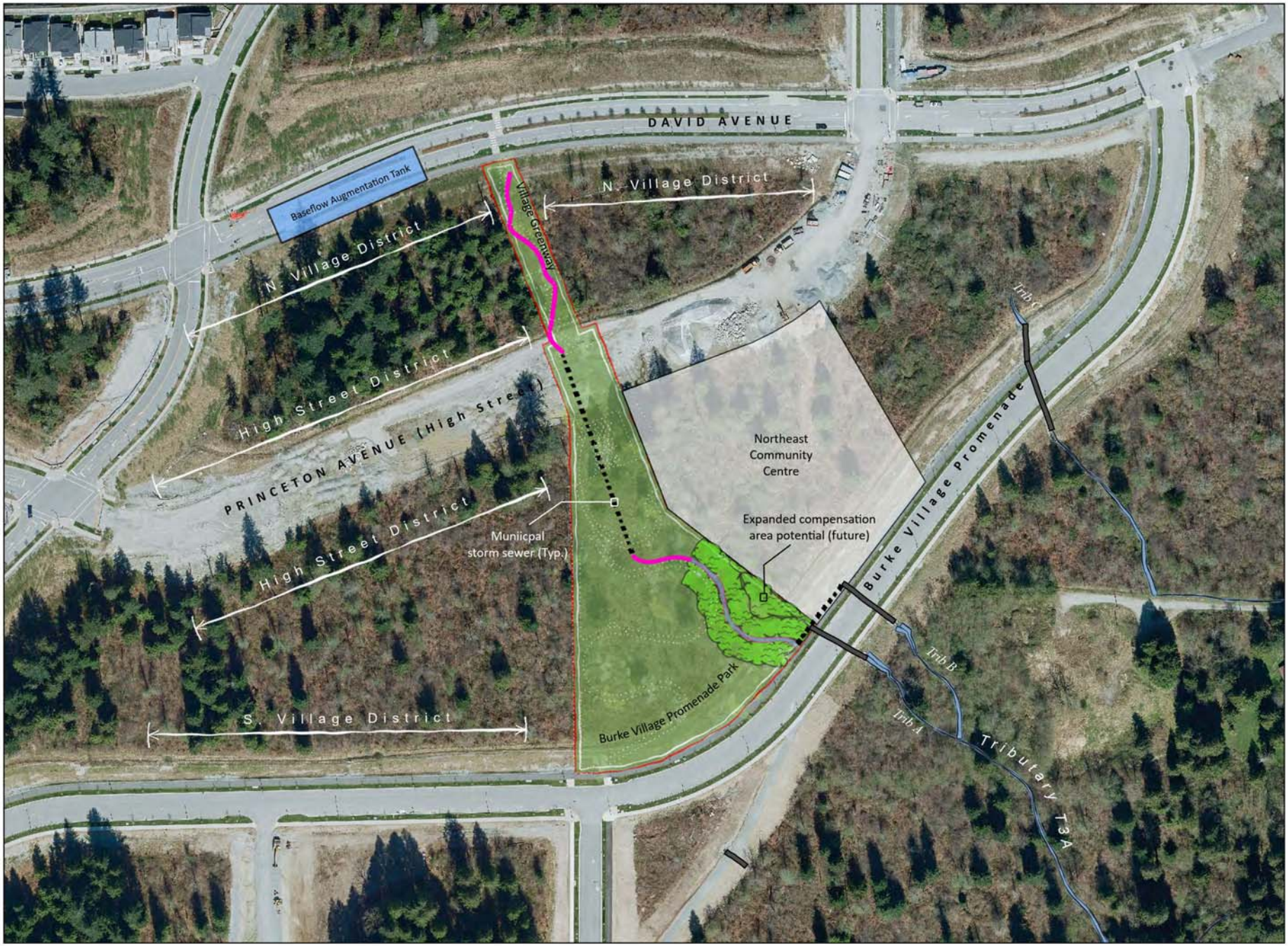

BVPP Habitat Compensation Strategy

Client:
City of Coquitlam

Legend

- BVPP
- NECC
- Baseflow Tank
- Storm Mains
- Storm Culverts
- WSA Stream

Habitat Compensation Strategy

- Aquatic
- Riparian
- Municipal Drainage (Urban Channel)
- Storm Sewer (Concept)

Figure 2

N

BlueLines Environmental

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3.2 Equipment & Machinery

Construction in relation to the proposed watercourse management strategy will include bulk site excavation and grading which will be accomplished with track mounted excavators and highway use dump trucks. Detailed stream channel restoration work will generally involve smaller equipment with excavators equipped with a hydraulic thumb to facilitate boulder placements associated with the bank armouring and grade control structures. During stream channel restoration work, the construction may be supported by a track mounted dump truck (e.g. Marooka).

All equipment will be equipped with mobile spill response kits. The overall project will include a larger spill response kit in the event of any hydraulic failures or incidental spills.

Worksite isolation will be accomplished with a combination of gravity bypass and pumping of baseflows associated with the retention tank to sustain hydrology to the two downstream tributary segments despite natural hydrology dictating historically dry conditions during the instream works window of least risk. Pumping will employ electrical submersible pumps, generally powered by a diesel generator to facilitate continuous operations.

3.3 Construction Steps & Timelines

Construction is proposed for the Summer 2024 instream works window of least risk. Owing to the requirements to undertake site clearing the anticipated construction period will coincide with the end of the typical breeding bird nesting season (e.g. Aug 15).

For the purposes of the tributary T3A works, the project schedule will include the August 15 through October 31, 2024 period. Early site clearing of the proposed compensation watercourse may be initiated in advance of the alterations affecting the existing headwater channel segments, subject to breeding bird nesting season considerations and implementation of project specific erosion and sediment control best practice.

The subject watercourses are non-fish bearing and provide no suitable habitats for amphibian breeding. No formal aquatic ecosystem salvage requirements are anticipated.

3.3.1 Timing Windows

Instream works will comply with the Lower Mainland Region instream works least risk window. Owing to the non-fish bearing status, the instream window would generally span the July 15 through October 31 period.

Instream works will adhere to instream works standards and best practices inclusive of completion under worksite isolation, during periods of favorable weather, and works will be pursued to completion as quickly as possible once started.

3.4 Roles and Responsibilities of QEP

All stages of construction activities will be subject to environmental monitoring oversight by a Qualified Environmental Professional. Site clearing will be subject to field reviews to evaluate wildlife occurrences with explicit consideration of breeding birds and incidental occurrences of wildlife.

Instream works will be completed under full-time environmental monitoring supervision with regular monitoring of in-situ water quality conducted at the existing culvert outlets of the Tributary A and Tributary B culverts below Burke Village Promenade to verify compliance with instream works BMPs and protection of water quality.

Direct supervision of the stream channel construction will be completed to ensure compliance with the environmental design objectives and the key geomorphic functions of the grade control weirs with the establishment of formal 'header and footer' rocks installed in compression to yield the intended step-pool morphology.

The QEP will provide adaptive recommendations for the mitigation of erosion and sediment control risks. Disturbed surfaces will receive temporary protection through application of wood residue mulch generated from site clearing or proprietary hydraulic erosion control products (HECP). Final site restoration within the riparian will receive growing medium augmentation and compost mulch inspected and certified by the QEP in association with nursery stock plantings.

The QEP and environmental monitoring designates will be afforded 'stop work' authority to prevent adverse effects to the environment.

3.5 Long Term Maintenance Requirements

Long-term maintenance is proposed to include a minimum 5-year period. The monitoring program will include bi-annual maintenance of invasive species and weeds, and replacement of plant mortalities to achieve the riparian restoration objectives.

Monitoring will include bi-annual assessments of the stream hydrology and physical stability to ensure proper functioning condition and provide adaptive prescriptions for channel maintenance on an 'as needed' basis.

Environmental monitoring reporting is intended to be provided to Ministry of Forest, stream management staff on an annual basis for the proposed 5-year period. Monitoring and reporting will also be provided to City of Coquitlam environment staff pursuant to anticipated WPDP conditions to assess compliance with the environmental objectives including plant survivorship and vigour, and stream channel physical stability and natural channel processes.

4 First Nations Consultation & Engagement

Review of the Province of BC's Consultative Areas Database (CAD) indicates that the proposed instream works are associated with the following First Nations areas of interest:

- Musqueam Nation
- People of the River Referrals Office
- Katzie First Nation
- Kwikwetlem First Nation

4.1 Kwikwetlem First Nation

A site meeting and review of the existing ecosystem values and proposed watercourse management strategy has been completed with representatives of both Kwikwetlem First Nation and City of Coquitlam. A site meeting was attended June 13 by the following Kwikwetlem First Nation Representatives:

- George Chaffey - Councillor
- Jessica Blesch – Referrals & Stewardship Project Lead - Archaeology
- Kathleen Cathcart – Project Coordinator, Referrals & Stewardship

Ongoing consultation is anticipated with representatives of the Kwikwetlem First Nation with a follow-up project meeting scheduled for August 16, 2023 and commitments to undertake ongoing liaison with representatives of the Guardian program through the project planning and construction phase of the project.

5 Impacts to Other Affected Lands & People

A review of downstream water users has been completed based on available municipal and provincial mapping datasets.

5.1 Landowners and Structures

Stream segments traverse the following properties – no anticipated change to hydrologic extremes owing to engineering design. No anticipated risk to bed and bank erosion of downstream channel segments traversing private properties owing to the increasing geomorphic significance and confinement of the Tributary T3A watercourse.

5.2 Water Licences / Water Rights

Province of BC records of existing water licenses and water rights located downstream from the proposed project have been reviewed based on available digital datasets/mapping. No water licenses are associated

with surface water. The subject watercourse is not mapped within existing freshwater atlas records or Province of BC Non-Trim Hydrography despite the known presence of defined stream channels.

Downstream development projects with issued *Water Sustainability Act* approvals are associated with the Tributary T3A system:

- A2009463
- A2010218
- A2009368

The proposed BVPP instream works will not pose any risks to the downstream instream works projects.

6 Supplemental Plans

Detailed environmental design plans have been prepared through collaboration of BlueLines Environmental Ltd. Space2Place Landscape Architects and KWL.

Appendix A includes the environmental design drawing package inclusive of stream channel profile and channel cross section and the riparian area restoration planting plans.

The project will incorporate additional terrestrial habitat complexing through installation of boulder clusters and coarse woody debris (CWD) structures within the riparian restoration planting zone to provide habitat diversity.

A target of 10 boulder clusters and 16 CWD features are proposed for inclusion at the direction of the QEP. CWD features will prioritize salvage and re-use of existing downed wood and materials generated from site clearing.

Appendix B includes a hydrotechnical memorandum prepared by KWL to confirm the technical feasibility and hydraulic suitability of the design with recommendations for the sizing of alluvium and grade control structures.

7 Impact Assessment

The proposed BVPP and NECC developments will result in impacts affecting 75 linear meters of the uppermost headwater limits of the Tributary T3A system. Table 2 presents the project habitat balance based on the proposed habitat compensation and offsetting plans. The habitat balance presents the stream channel segment intended as the formal offset for the existing limits of jurisdictional stream – additional open watercourse/conveyances will be associated with the project; however, owing to the municipal drainage water supply from the baseflow augmentation tank the drainage system components upstream of the habitat balance presented herein reflect municipal drainage facilities outside the jurisdiction of the *Water Sustainability Act*.

Notwithstanding the municipal drainage designation, the water supply will provide significant ecosystem services through the augmentation of stream baseflows yielding an enhanced aquatic ecosystem through the provision of a sustained and stable baseflow regime for the full extent of the Tributary T3A drainage through to its confluence with the Star Creek mainstem.

Table 2 – Habitat Balance per Environmental Mitigation Policy

HABITAT BALANCE

PREPARED BY: Ryan Preston, B.Sc, P.Ag, CPESC					DATED: 2023-07-28			APPROVAL:		
Stream (Please indicate each stream channel and/or reach of the stream)	Description of Works (Please describe type of works for indicated stream)	Stream Channel			Aquatic Ecosystems Impacts			Riparian Impacts		
		Length (m)	Width (m)	Riparian Setback (m)	Loss (m2)	Gain (m2)	Net (Loss-Gain) (m2)	Loss (m2)	Gain (m2)	Net (Loss-Gain) (m2)
Tributary A		28	1.1	31	-31.00		-31.00			0.00
Tributary B		47	0.9	41	-41.00		-41.00			0.00
Compensation Channel (step pool)	Step-pool channel construction and enhancements	78	1	78		78.00	78.00			0.00
Compensation Pool/Pond	Pool feature and associated drainage inlet infrastructure	n/a	n/a	51		51.00	51.00			0.00
IMPACT TOTAL		153	3	57	-72.00	129.00	57.00	0.00	0.00	0.00
PROJECT AQUATIC AND RIPARIAN NET LOSS/GAIN						AQUATIC ECOYSTEMS:	57.00		RIPARIAN:	0.00
Comments: Habitat balance based on GIS analysis of BCLS survey datasets and design drawing .dwg files provided by Space2Place. Project acheives a net gain in aquatic habitat area and yields a significant improvement to the stream system hydroperiod through connectivity with the David Ave. baseflow augmentation tank.										

A copy of the habitat balance worksheet is included as Appendix C.

8 Closure

The proposed Burke Village Promenade Park project will include impacts affecting the uppermost limits of two mapped first-order headwater stream segments of the Tributary T3A drainage system, a tributary to Star Creek. The affected channel segments have been the subject of prior works yielding culvert crossings associated with development of the municipal road network and civil services. Integral to the municipal servicing previously established in the local area is a formal baseflow augmentation tank constructed pursuant to the Partington Creek IWMP which will serve as the hydrologic source for a proposed watercourse relocation and enhancement.

The project will impact 75 linear meters of ephemeral headwater stream channel (72m2). A 78m compensation channel constructed to an enhanced standard (e.g. step pool morphology and enhanced alluvial substrate) is proposed with a small open water pond feature at the downstream limit which will be connected to the existing road crossing culverts. An outlet structure will be constructed to control the hydrologic connections to sustain both downstream channel segments prior to their confluence in the mainstem channel of Tributary T3A.

The subject watercourses and compensation channel are non-fish bearing watercourses providing food and nutrient and water supply values to downstream fish habitats. The proposed channel design will yield an enhanced channel with near permanent streamflows owing to the connection with the baseflow augmentation tank and integration of trench bedding through strategic construction and trench dam placements yielding a sustained baseflow provision to the stream system. The resulting enhancement to the stream hydrology and expansion of the functional hydroperiod will yield enhanced ecosystem values through both autochthonous and allochthonous food and nutrient contributions and aquatic habitats yielding improved suitability for wildlife.

If there are any questions related to the assessment or recommendations presented herein, please do not hesitate to contact us.

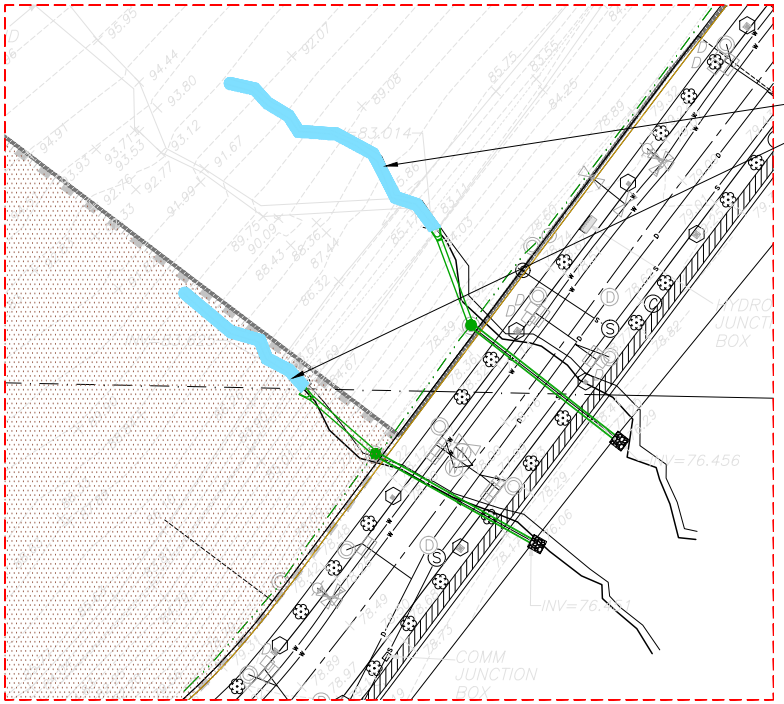
Sincerely,

Ryan Preston, B.Sc, P.Ag, CPESC
Principal | BlueLines Environmental Ltd.

Appendix A

Burke Village Promenade Park – Design Drawing Package

Space2Place Landscape Architects



INSET A
SCALE 1:400

The existing conditions include a total length of 75m stream channel subject to the authority of the Water Sustainability Act.

Project Site

INSET A
SEE L0.1

Intended Slopes:

1. C.I.P. Concrete Paving*: 2% min., 6.6% max.*
2. C.I.P. Concrete Water Channel: 2% min., 6% max.
3. Asphalt: 2% min., 5% max.*
4. Planted Slope: 3:1 max.
5. Bottom of Grass Swale: 2% min., 3:1 max.
6. unless otherwise noted

Notes:

1. All existing trees and groundcover to be removed.

2.The Contractor shall lay out and determine the elevations of all site elements for approval by the Landscape Architect prior to the start of construction. The Contractor shall report any conflicts between surface utility structures and proposed improvements to the Landscape Architect.

3. The Contractor shall be responsible for positive surface drainage in all areas. All newly graded ground surfaces shall be finished to uniform grades and sloped in such a manner as to drain properly and be free of depressions which cause areas of standing water. The Contractor shall report any conflicts with this requirement to the Landscape Architect for resolution prior to final grading operations.

4. All grading shall be completed in a way to maintain positive drainage away from all building foundations and all structures. The Contractor shall report any conflicts with this requirement to the Landscape Architect for resolution prior to final grading operations.

5. Where proposed grades meet existing, blend grades to provide a smooth transition between the new work and the existing work. Ponding at joints will not be accepted.

6. The Contractor shall adjust all utility elements or covers (including but not limited to: clean outs, manholes, catch basins, inlets, shutoff valve covers, etc.) to be flush with the finish grade of either shown on the drawings or site.

7. Location of perforated pipe and drainage inlets shall be staked by the contractor and approved by the Landscape Architect.

8. Stake out drainage inlet locations on site after rough grading is completed and prior to drain installation. Review with Landscape Architect and Civil Engineer to ensure drain locations are coordinated with low points.

REVISIONS:

Date	Description
2023.07.28	RDA Permit Drawings

LANDSCAPE ARCHITECT:

space2place
Suite 200, 291 East 2nd Avenue, Vancouver, BC. V5T 1B8
604.646.4110 StuSo0 space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

SITE PLAN - EXISTING CONDITIONS

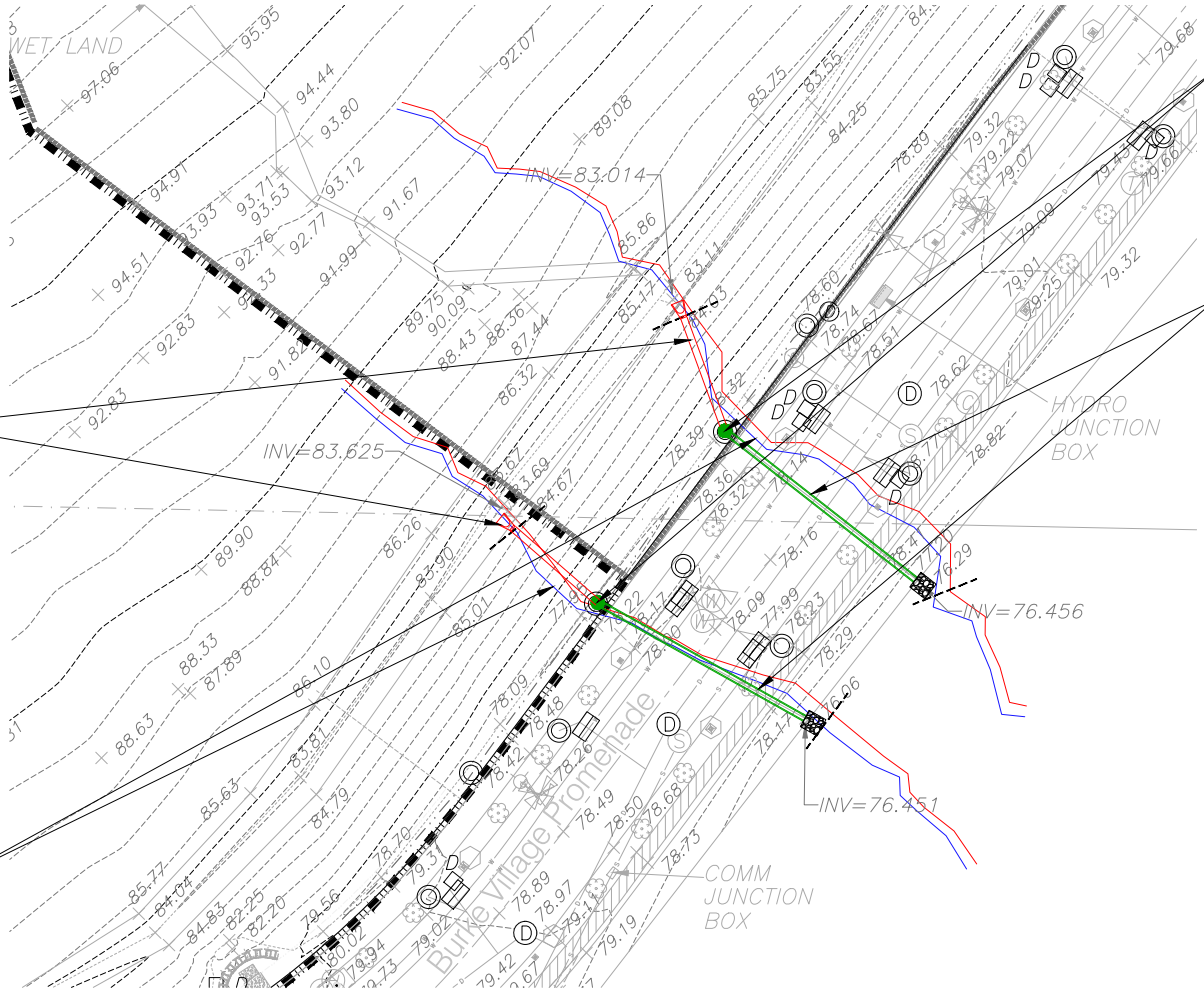
DRAWN BY:

DATE: 2023.07.28

SCALE: 1:1000 @ arch'D

SHEET:

L0.1



Existing culvert inlets and interceptor ditch at the upper limit of Burke Village Promenade (BVP) cut slope to be retained to convey flows across the road alignment

Existing culvert under Burke Village Promenade to be retained.

Existing drain pipe to be removed

High Water Mark (HWM) boundaries shown between dashed lines are no longer applicable with the construction of Burke Village Promenade

N

Notes:

HWM boundaries illustrated in the survey are no longer applicable with the construction of Burke Village Promenade

REVISIONS:

Date	Description
2023.07.28	RDA Permit Drawings

LANDSCAPE ARCHITECT:

space2place

Suite 200, 291 East 2nd Avenue, Vancouver, BC. V5T 1B8
604.646.4110 (studio)| space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

EXISTING CONDITION SURVEY INFO.

DRAWN BY:

DATE: 2023.07.28

SCALE: 1:300 @ arch'D

SHEET:

L0.2

N

REVISIONS:

Date	Description
2023.07.28	ISSA Permit Drawings

LANDSCAPE ARCHITECT:

space2place

Suite 200, 291 East 2nd Avenue, Vancouver, BC. V5T 1B8
604.646.4110 (studio)| space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

SITE PLAN - PROPOSED Riparian

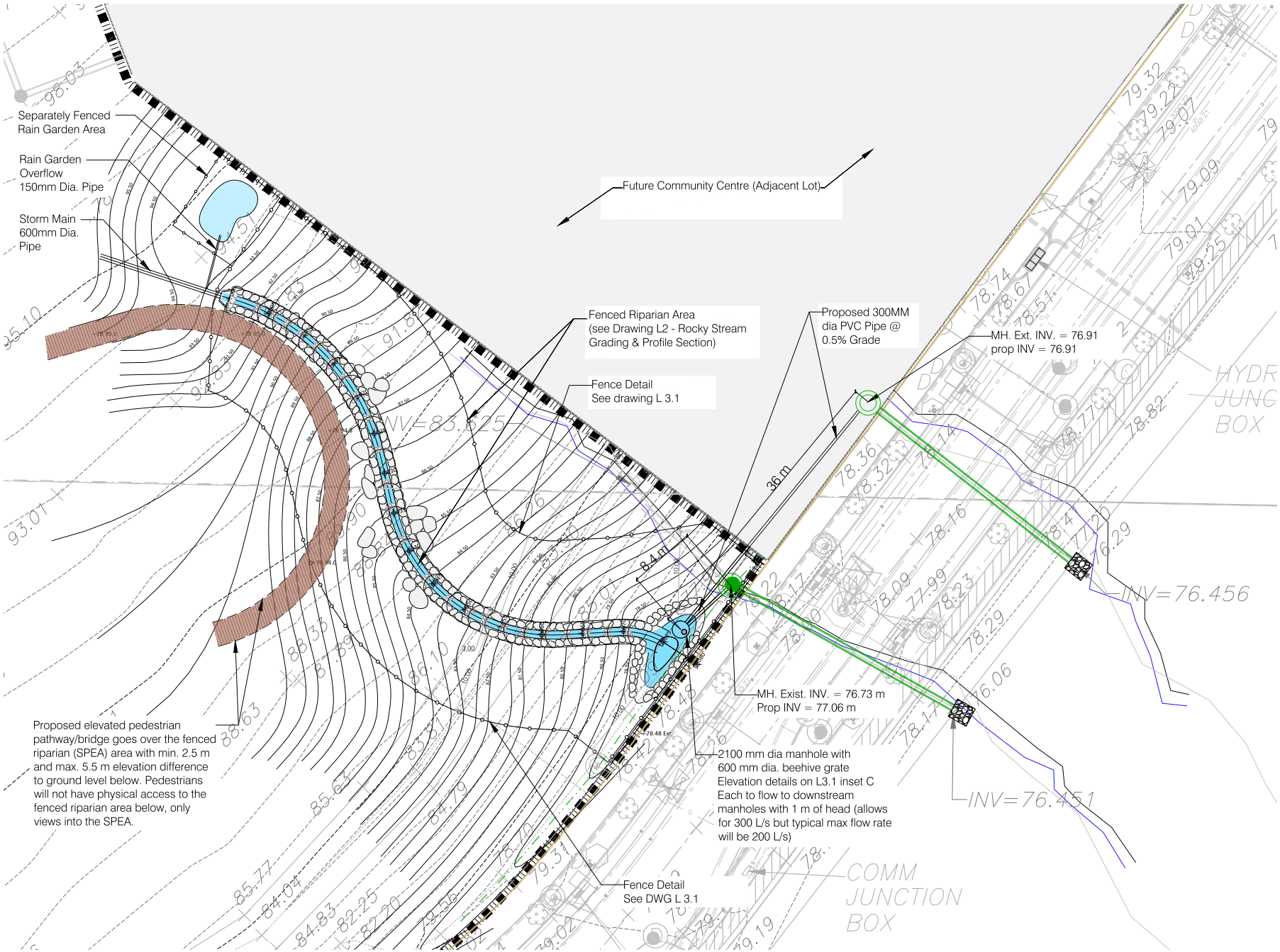
DRAWN BY:

DATE: 2023.07.28

SCALE: 1:1000 @ arch'D

SHEET:

L0.3



N

Intended Slopes:

1. Planted Slope: 3:1 max.
2. Bottom of Grass Swale: 2% min., 3:1 max.

Notes:

1. All existing trees and groundcover to be removed.

2.The Contractor shall lay out and determine the elevations of all site elements for approval by the Landscape Architect prior to the start of construction. The Contractor shall report any conflicts between surface utility structures and proposed improvements to the Landscape Architect.

3. The Contractor shall be responsible for positive surface drainage in all areas. All newly graded ground surfaces shall be finished to uniform grades and sloped in such a manner as to drain properly and be free of depressions which cause areas of standing water. The Contractor shall report any conflicts with this requirement to the Landscape Architect for resolution prior to final grading operations.

4. All grading shall be completed in a way to maintain positive drainage away from all building foundations and all structures. The Contractor shall report any conflicts with this requirement to the Landscape Architect for resolution prior to final grading operations.

5. Where proposed grades meet existing, blend grades to provide a smooth transition between the new work and the existing work. Ponding at joints will not be accepted.

6. The Contractor shall adjust all utility elements or covers (including but not limited to: clean-outs, manholes, catch basins, inlets, drywell drain covers, etc.) to be flush with the final finish grade whether shown on the IS drawings or not.

7. Location of pipe and drainage inlets shall be staked by the contractor and approved by the Landscape Architect.

8. Stake out drainage inlet locations on site after rough grading is completed and prior to drain installation. Review with Landscape Architect and Civil Engineer to ensure drain locations are coordinated with tree pits.

REVISIONS:

Date	Description
2023.07.28	RGA Permit Drawings

LANDSCAPE ARCHITECT:

space2place
Suite 200, 291 East 2nd Avenue, Vancouver, BC, V5T 1B8
604.646.4116 StuStoll space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

GRADING PLAN

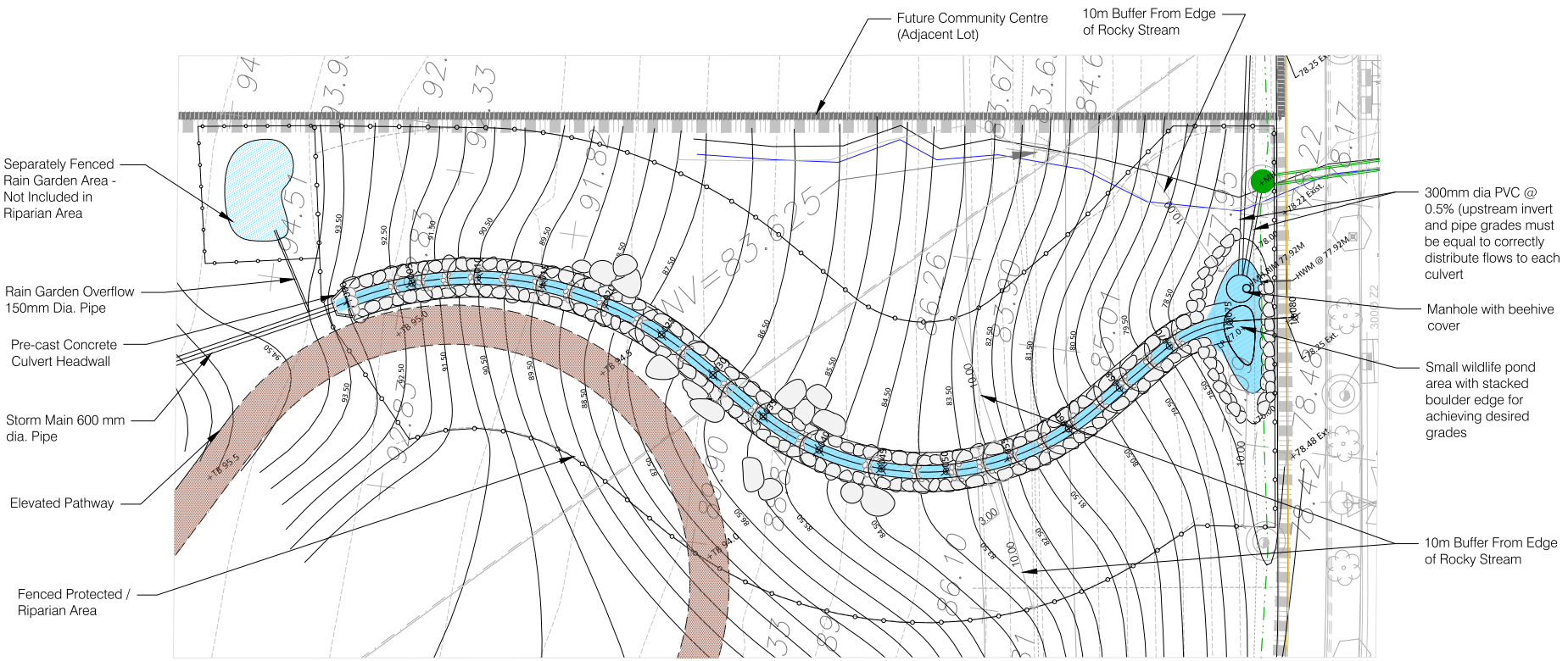
DRAWN BY:

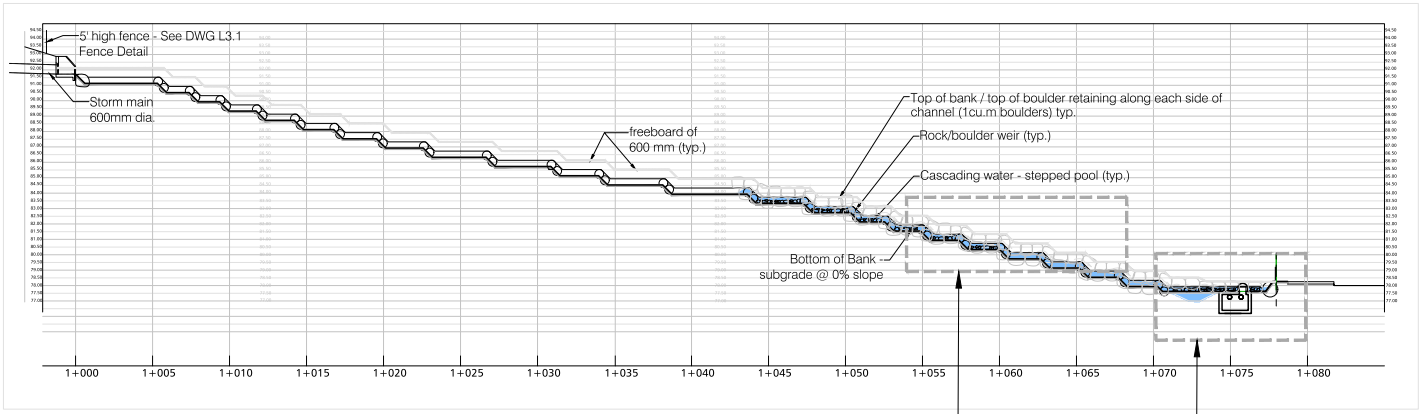
DATE: 2023.07.28

SCALE: 1:200 @ arch D

SHEET:

L1





REVISIONS:

Date	Description
2023.07.28	RGA Permit Drawings

LANDSCAPE ARCHITECT:

space2place
Suite 200, 291 East 2nd Avenue, Vancouver, BC. V5T 1B8
604.646.4116 (studio) space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

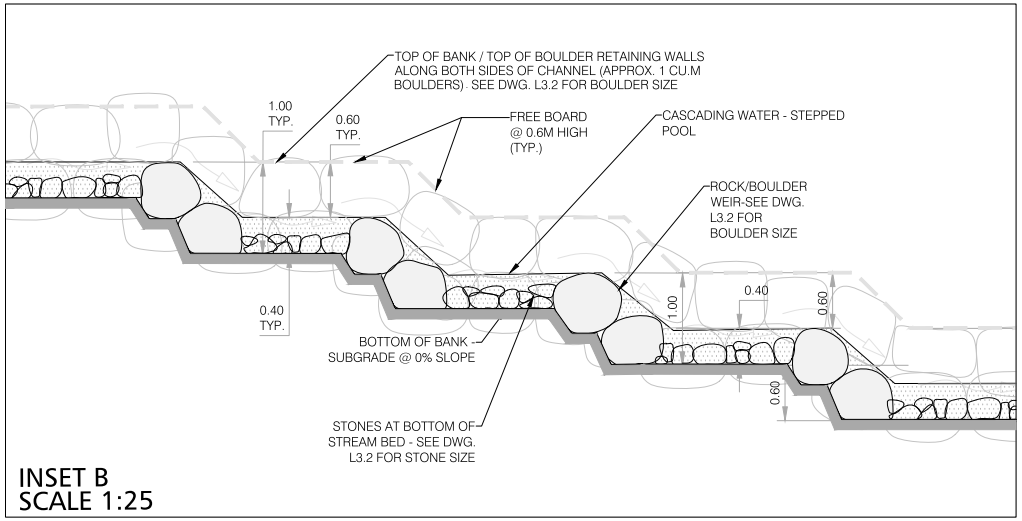
GRADING
ROCKY STREAM
PROFILE SECTION

DRAWN BY:

DATE: 2023.07.28

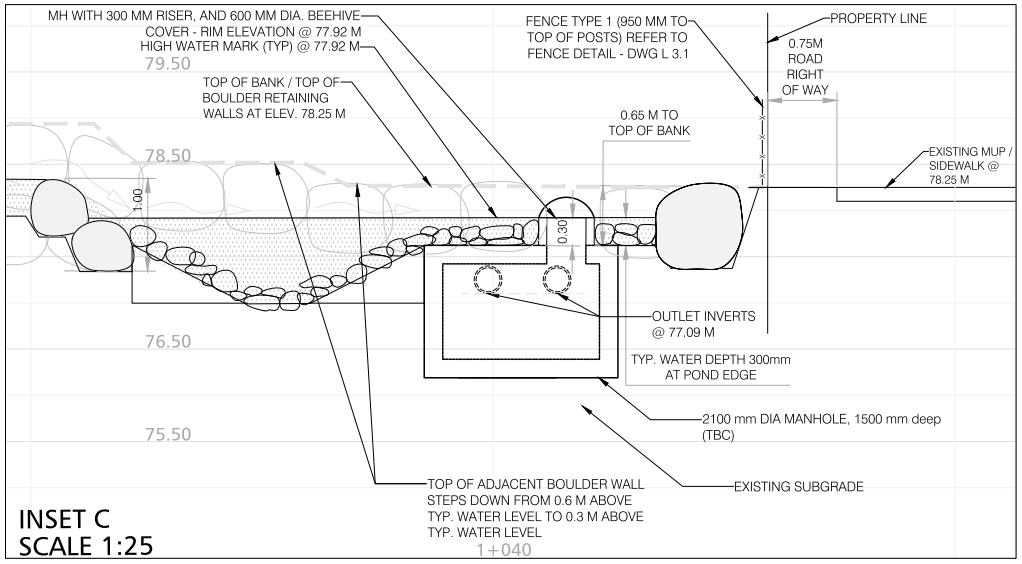
SCALE: 1:150 @ arch'D

SHEET: L2



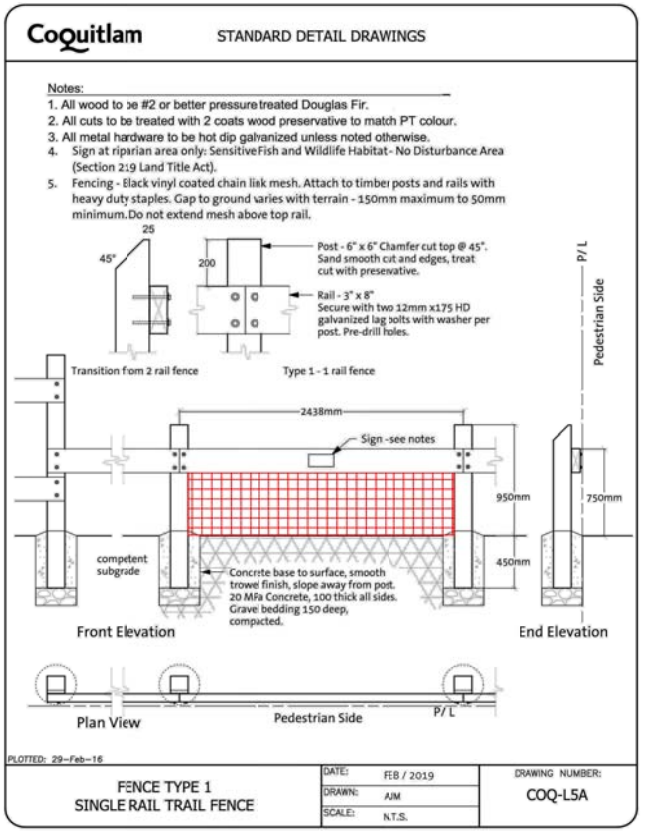
INSET B
SCALE 1:25

ROCKY STREAM - PROFILE SECTION



INSET C
SCALE 1:25

ROCKY STREAM - DRAINAGE INLET



FENCE DETAIL (LOW FENCE)
SCALE: NTS

CITY OF COQUITLAM STANDARD DETAIL

REVISIONS:

Date	Description
2023.07.28	ISSA Permit Drawings

LANDSCAPE ARCHITECT:

space2place

Suite 200, 291 East 2nd Avenue, Vancouver, BC, V5T 1B8
604 646 4110 (studio) space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

FENCE DETAIL ROCKY STREAM PROFILE

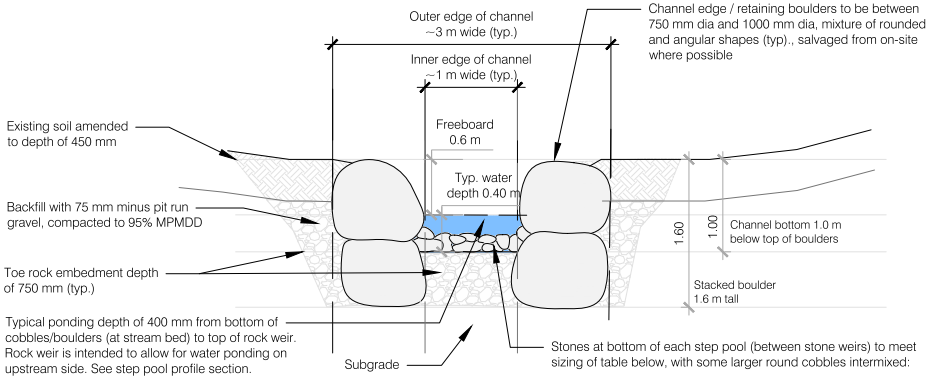
DRAWN BY:

SHEET:

DATE: 2023.07.28

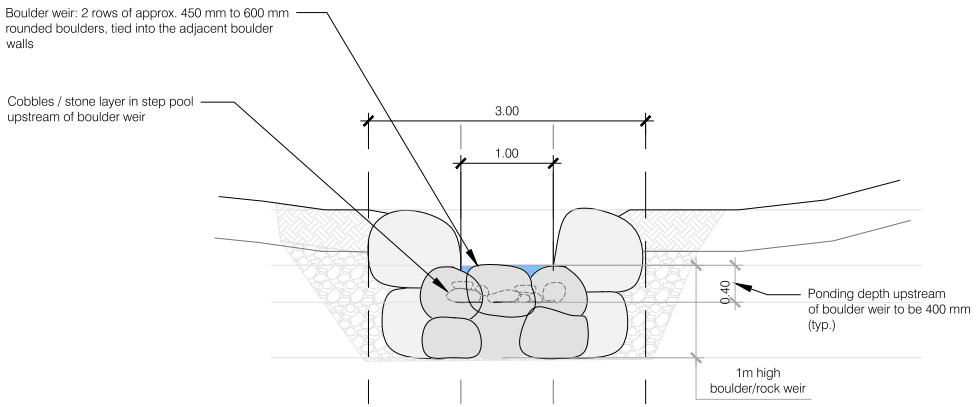
SCALE: as noted @ arch D

L3.1

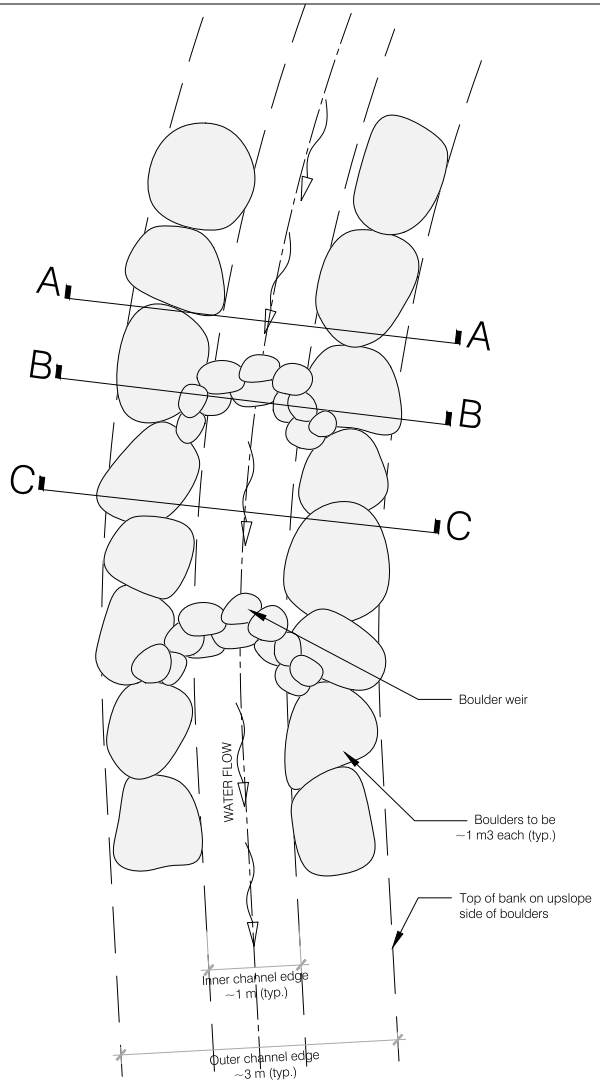


CREEK SUBSTRATE SIZE DISTRIBUTION	
SIEVE SIZE (mm)	PERCENT PASSING (%)
100	100
80	80
75	60
50	40
25	20
3	5

CROSS SECTION A & C - STEP-POOL
SCALE 1:25



CROSS SECTION B (TYP.) - WEIR, LOOKING UPSTREAM
SCALE 1:25



ROCKY STREAM - PLAN VIEW
SCALE 1:25

REVISIONS:

Date	Description
2023.07.28	ISSA Permit Drawings

LANDSCAPE ARCHITECT:

space2place
Suite 200, 291 East 2nd Avenue, Vancouver, BC, V5T 1B8
604.646.4110 (studio) space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

DETAILS
ROCKY STREAM

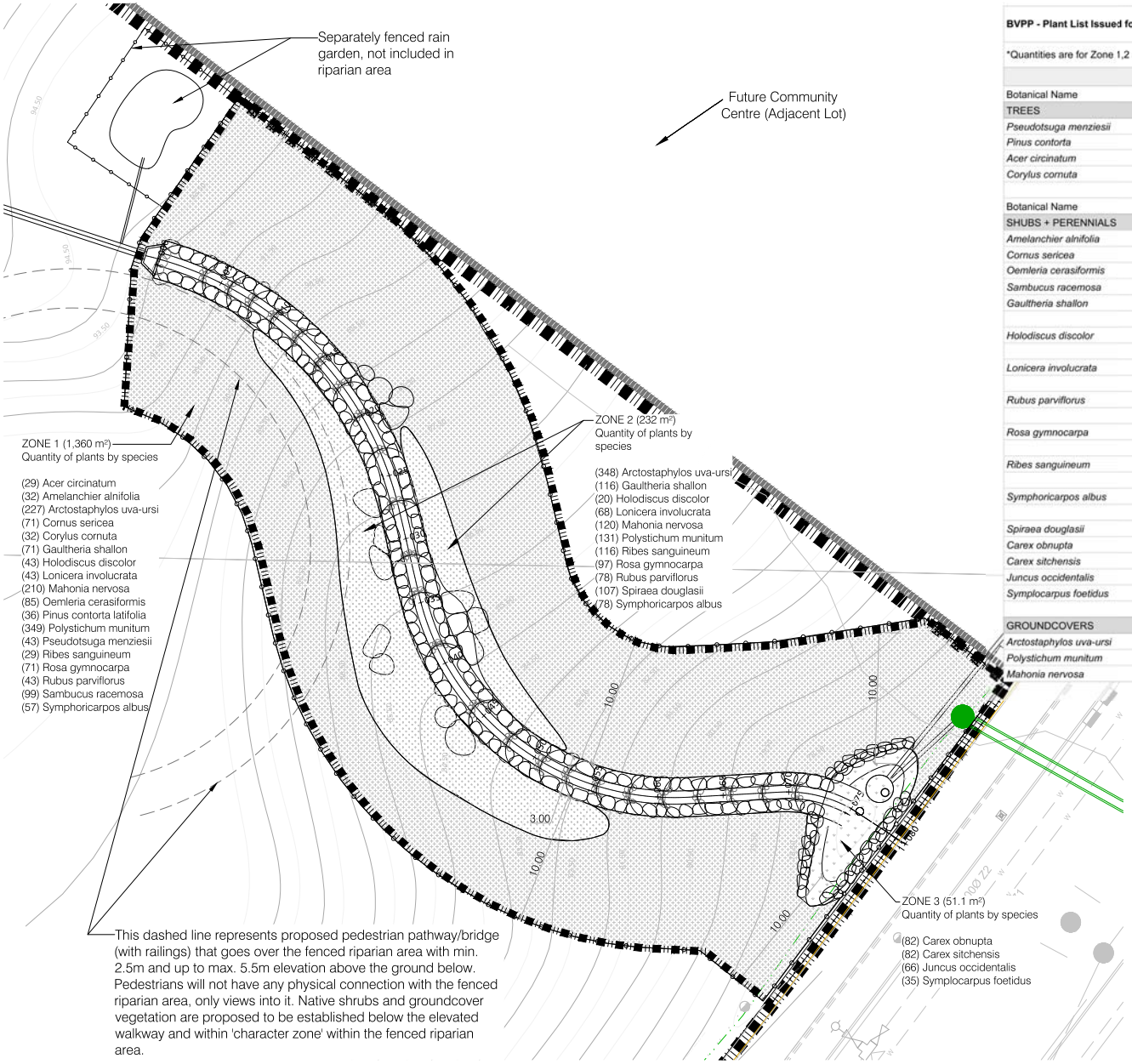
DRAWN BY:

DATE: 2023.07.28

SCALE: 1:25 @ arch D

SHEET:

L3.2



BVPP - Plant List Issued for WSA Permit Application (space2place + BlueLines) updated 2023.06.28

*Quantities are for Zone 1,2 and 3 combined. The breakdown of quantities by zone are provided in drawing call-outs

Botanical Name	Common Name	Zone	Size	Spacing		QTY
TREES						
Pseudotsuga menziesii	Douglas Fir	1	100cm ht.	200cm		43
Pinus contorta	Lodgepole pine	1	100cm ht.	200cm		36
Acer circinatum	Vine maple	1	100cm ht.	200cm		29
Corylus cornuta	Beaked hazelnut	1	100cm ht.	200cm		32
Botanical Name	Common Name		Size	Spacing	per sq.m	QTY
SHUBS + PERENNIALS						
Amelanchier alnifolia	Serviceberry	1	#1 pot	200cm	0.24	32
Cornus sericea	Red osier dogwood	1	#1 pot	100cm	1.0	71
Oemleria cerasiformis	Osoberry	1	#1 pot	100cm	1.0	85
Sambucus racemosa	Red elderberry	1	#1 pot	100cm	1.0	99
Gaultheria shallon	Salal	1	#1 pot	100cm	1.0	71
		2	#1 pot	50cm	3.6	116
Holodiscus discolor	Oceanspray	1	#1 pot	100cm	1.0	43
		2	#1 pot	50cm	3.6	20
Lonicera involucrata	Black twinberry	1	#1 pot	100cm	1.0	43
		2	#1 pot	50cm	3.6	68
Rubus parviflorus	Thimbleberry	1	#1 pot	100cm	1.0	43
		2	#1 pot	50cm	3.6	78
Rosa gymnocarpa	Baldhip rose	1	#1 pot	100cm	1.0	71
		2	#1 pot	50cm	3.6	97
Ribes sanguineum	Red-flowering currant	1	#1 pot	100cm	1.0	29
		2	#1 pot	50cm	3.6	116
Symphoricarpos albus	Snowberry	1	#1 pot	100cm	1.0	57
		2	#1 pot	50cm	3.6	78
Spiraea douglasii	Hardhack	2	#1 pot	50cm	3.6	107
Carex obnupta	Slough Sedge	3	#1 pot	45cm	4.75	82
Carex sitchensis	Sitka Sedge	3	#1 pot	45cm	4.75	82
Juncus occidentalis	Western Rush	3	#1 pot	45cm	4.75	66
Symplocarpus foetidus	Skunk Cabbage	3	#1 pot	45cm	4.75	35
GROUNDCOVERS						
Arctostaphylos uva-ursi	Kinnickinnick	1, 2	#1 pot	25cm	15.5	575
Polystichum munitum	Western sword fern	1, 2	#1 pot	45cm	4.75	480
Mahonia nervosa	Low Oregon grape	1, 2	#1 pot	45cm	4.75	330

N

Potential Ecosystem Enhancement Items

1. Riparian areas shall be enhanced with terrestrial coarse woody debris (CWD) features and boulder clusters to provide wildlife habitat enhancements.
2. Salvaged coarse woody debris and log structures to be installed at direction of the QEP (min 36 CWD features consisting of 4-6m long and min 30cm diameter logs, preference for salvage and re-use of existing natural CWD –generally CWD features should be comprised of 2-3 pieces).
3. Install artificial wildlife trees (min 3) consisting of western red cedar stems achieving 4-6m height above grade, offset from riparian boundary at distances equivalent to 1.2x the height of the stem.
4. Install bird nesting boxes within proposed riparian area (min 4 nest boxes).

Planting Zones

Zone 1 planting comprises a diversity of native species with groundcovers, shrubs, and mixed deciduous and coniferous trees.

Zone 2 planting comprises lower height plants at closer spacing, with a mix of deciduous and coniferous species. The intent is to create a lower height planting zone that allows views into and through the SPEA area from the elevated walkway.

Zone 3 planting comprises a mix of native wetland species.

REVISIONS:

Date	Description
2023.07.28	WSA Permit Drawings

LANDSCAPE ARCHITECT:

space2place
Suite 200, 291 East 2nd Avenue, Vancouver, BC, V5T 1B8
604.646.4116 (p)x0x0 space2place.ca

CLIENT:

PROJECT:

BURKE MOUNTAIN VILLAGE PARK AND PROMENADE

TITLE:

PLANTING PLAN

DRAWN BY:

DATE: 2023.07.28

SCALE: 1:150 @ arch0

SHEET: L4

Appendix B

Hydrotechnical Memo – Stream Channel Design & Substrate

Kerr Wood Leidal

KERR WOOD LEIDAL
consulting engineers

Greater Vancouver
200 - 4185A Still Creek Drive
Burnaby, BC V5C 6G9
T 604 294 2088
F 604 294 2090

Technical Memorandum

DATE: June 30, 2023

TO: Somaye Hooshmand
Landscape Architect
Space2Place Design Inc.

CC: Ryan Preston, B.SC, P.AG, CPESC

FROM: Andrew Kolper, P.Eng

RE: **BURKE MOUNTAIN VILLAGE CREEK HYDROTECHNICAL ASSESSMET**
Our File 3486.017-300

Introduction

In 2022, Space2Place (S2P) retained KWL to undertake and assessment of the maximum flows expected in the creek which is proposed to flow through Burke Mountain Village Park. In addition, KWL was requested to provide design comments and address whether the proposed channel capacity is suited to the source water and that the design allows for a stable channel substrate. The purpose of the above scope is to support an application for Provincial Approvals to undertake the proposed channel works.

Creek Flows

The proposed creek will be fed via from the City of Coquitlam's storm sewer network. Runoff from the development upstream is routed through a large flow augmentation tank which discharges at a controlled rate. The discharge is controlled via a 300mm orifice which allows a maximum of 450 l/s of flow to be discharged into the creek. In summer months when rainfall is minimal, the flow augmentation tank discharges approximately 2-5 l/s into the creek to provide environmental base flows for the downstream creek systems.

Channel Design

The proposed watercourse has been designed as with a step pool morphology to mimic typical mountain creeks found in the lower mainland. The creek section shown in Figure 1 has the capacity to convey approximately 1.2 m^3/s which is just less than 3(three) times the expected flow rate to allow for additional flows if additional sources of clean water are directed to the proposed creek.

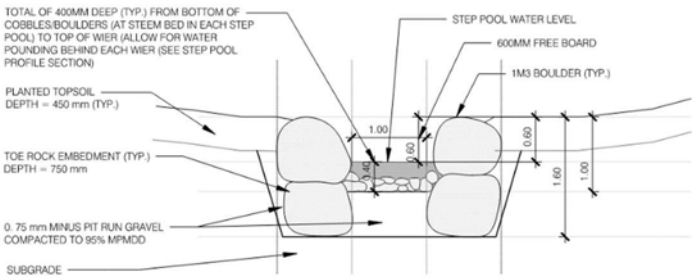


Figure 1: Channel Design Cross Section

The channel substrate is proposed to be a 200 mm minus rounded cobble and creek bed gravels. When coupled with the bed stabilization weirs which help to form the step pool morphology these elements will provide a stable creek bed with minimal risk of erosion and bed load movement.

Closing

The proposed Burke Mountain Village Creek as designed is fit for the intended purpose and is expected to convey the expected flows safely through the park

We trust that the above information is satisfies the permitting requirements of the Province however, please do not hesitate to contact the undersigned if further clarification is required.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Andrew Kolper, P.Eng.
Hydrotechnical Engineer

Statement of Limitations

Copyright Notice

Revision History

Revision #	Date	Status	Revision Description	Author
A	June 1, 2023	DRAFT		CM/CQ

Appendix C

BVPP Habitat Balance Table

HABITAT BALANCE

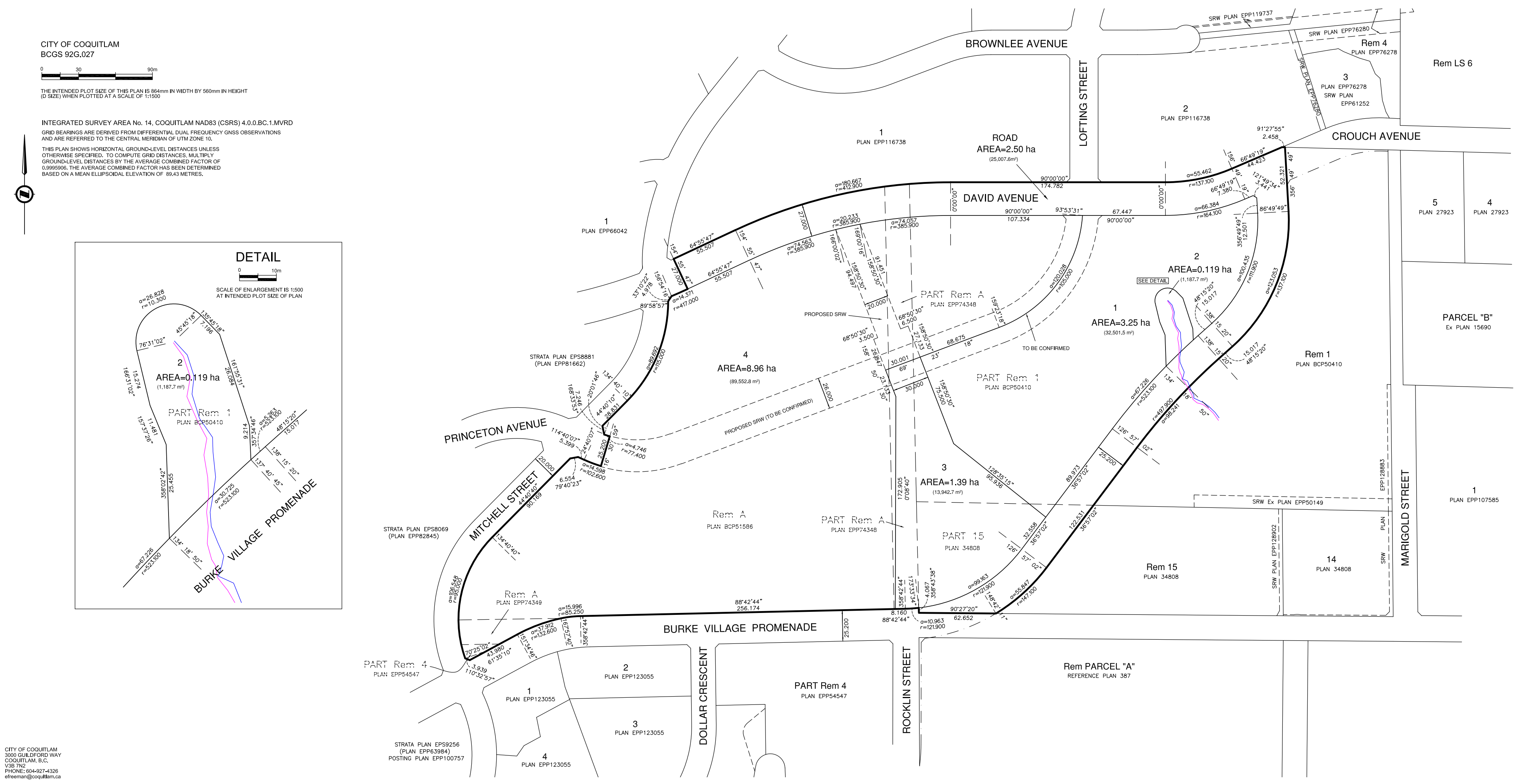
PREPARED BY: Ryan Preston, B.Sc, P.Ag, CPESC	DATED: 2023-07-28	APPROVAL:

Stream (Please indicate each stream channel and/or reach of the stream)	Description of Works (Please describe type of works for indicated stream)	Stream Channel			Aquatic Ecosystems Impacts			Riparian Impacts		
		Length (m)	Width (m)	Riparian Setback (m)	Loss (m2)	Gain (m2)	Net (Loss-Gain) (m2)	Loss (m2)	Gain (m2)	Net (Loss-Gain) (m2)
Tributary A		28	1.1	-31	-31.00		-31.00	-748.00		-748.00
Tributary B		47	0.9	-41	-41.00		-41.00	-1109.00		-1109.00
Compensation Channel (step pool)	Step-pool channel construction and enhancements	78	1	78		78.00	78.00			
Compensation Pool/Pond	Pool feature and associated drainage inlet infrastructure	n/a	n/a	51		51.00	51.00		1763.00	1763.00
SPEA Expansion	[illegible] equivalence on LB	n/a	n/a	n/a			0.00		393.00	393.00
IMPACT TOTAL		**153**	**3**	**57**	**-72.00**	**129.00**	**57.00**	**-1857.00**	**2156.00**	**299.00**
PROJECT AQUATIC AND RIPARIAN NET LOSS/GAIN					**AQUATIC ECOYSTEMS:**		**57.00**		**RIPARIAN:**	**299.00**

Comments: Habitat balance based on GIS analysis of BCLS survey datasets and design drawing .dwg files provided by Space2Place. Project acheives a net gain in aquatic habitat area and yields a significant improvement to the stream system hydroperiod through connectivity with the David Ave. baseflow augmentation tank.

SKETCH PLAN OF PROPOSED SUBDIVISION OF:

1) LOT A, Sec 18, Tp 40, NWD, PLAN BCP51586, EXCEPT PLANS EPP29180, EPP36729, EPP61635, EPP66042, EPP81662, EPP82845, EPP92199, EPP103755 AND EPP116738
2) LOT A, DISTRICT LOT 8246, GROUP 1, NWD, PLAN EPP74349, EXCEPT PLANS EPP82845 AND EPP92199
3) PART OF LOT 1, Sec 17, Tp 40, NWD, PLAN BCP50410, EXCEPT PLANS EPP76278, EPP76279 AND EPP116738
4) PART OF LOT 15, Sec 17, Tp 40, NWD, PLAN 34808
5) PART OF LOT A, DL 8248 GROUP 1, NWD, PLAN EPP74348, EXCEPT PLANS EPP76279, EPP103755 AND EPP116738
6) PART OF LOT 4, SECTION 7, TOWNSHIP 40, NWD, PLAN EPP54547, EXCEPT PLANS EPP63984, EPP82845, EPP103755, EPP111529 AND EPP123055



FB. 566B, 566C

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Pre-Design Structural Design Memo

Project Name:	Northeast Community Centre
Project Number:	VAN.138995.0001
Date:	September 23, 2024
Contact:	Meredith Anderson, P.Eng., Struct. Eng.
Email:	manderson@rjc.ca

Project Description

The Northeast Community Centre is a new facility located at the heart of the newly developing Burke Mountain Village in Coquitlam. The facility will be located on a sloped mountain site south of Princeton Avenue and adjacent to a community park. The building will contain both a library and recreational facilities including aquatics centre, double gymnasium, fitness studio and multipurpose spaces. Two levels of underground parking are proposed.

Although the development of structural systems is at a very preliminary stage, we propose the following systems can be assumed for the purposes of preliminary costing.

Design Code and Building Importance

The project schedule estimates a building permit submission in late 2025. The current BCBC 2024 is expected to be amended to adopt all provisions according to the NBCC 2020 in March of 2025. Anticipating this change, the building design is being developed based on the anticipated BCBC 2025 (NBCC 2020).

According to the NBCC 2020, Community Centres are designated High Importance for structural design parameters.

General Description of Structural Systems

Foundations

The preliminary geotechnical report by Thurber Engineering dated July 29, 2024, provides the following information and recommendations pertaining to the structural design of the building:

- The site is underlain with dense and very dense till-like soils.
- Conventional reinforced concrete pad and strip footings are recommended. For foundations located more than 6m below existing grade, the SLS bearing resistance is 300 kPa, ULS resistance is 450 kPa.
- The lowest level floor may be a grade-supported concrete slab

- Groundwater is present at the site. It is recommended that a drainage system be implemented to prevent hydraulic pressures from imposing loads on the building. “Tanking” of below grade pits, such as sumps and elevator pits, is recommended.
- The site is classified as Site Class C. RJC recommends that additional shear wave velocity testing (vs30) be conducted, as suggested by Thurber. This measurement provides a more refined approach to determining the seismic response spectrum under the NBCC 2020. Based on preliminary estimates, using the actual vs30 measured value can lead to a reduction in the seismic design forces for the building in the range of 0%-30%.
- It is possible that tension-only soil anchors will be required to resist sliding forces on the building. RJC requests that design parameters for soil anchors be provided in the final geotechnical report.

There are additional geotechnical considerations regarding the sloped site that will be discussed in the site topography section.

Superstructure

Table 1: Superstructure Gravity Systems

Building Component	Structural System
Level -2 and Level -1 Below Grade Parking	Reinforced concrete construction, including perimeter retaining walls, columns, and flat plate slabs. Level 02 is a grade supported concrete slab.
Level 0 and Level 01: Library and Recreation	Reinforced concrete slabs and beams supported on concrete columns and walls. Transfer beams may be needed, but efforts will be made to align parking column layouts with above grade structures to minimize transfers
Level 01 Aquatics	The pool deck, pools and tanks to be reinforced concrete, including water-resisting admixtures (such as KIM). Stainless steel pool construction may be considered.
Gymnasium Roof	The gymnasium roof requires long-span structure. Timber and structural steel systems are under consideration.
Natatorium Roof	The natatorium roof requires long-span structure. Timber and structural steel systems are under consideration.
Library and Lobby Roofs	The library and lobby roofs areas present more opportunities for interior columns than other areas of the building. Timber and structural steel systems are under consideration.

Lateral Load Resisting System

The proposed lateral load resisting system for the building will consist of moderately ductile concrete walls from foundations to the Level 01 floor and ductile or moderately ductile steel braced frames above Level 01. The steel braced frames are compatible with both timber and structural steel roof framing options.

The base seismic design forces (probability of exceedance of 2% in 50 years) for many buildings in the Lower Mainland are larger under the NBCC 2020 than under previous versions of the code. For the NECC, we estimate forces to increase between 0% - 15%, depending on the results of the vs30 testing noted above.

The NBCC 2020 also includes new requirements for High Importance structures as compared to previous versions of the code. These include checks of the building using a lower intensity seismic force (probability of exceedance of 10% in 50 years) to ensure the building behaves elastically, the interstorey drifts are limited to 0.005 * storey height, and seismic restraint of certain non-structural components also behave elastically.

Site Topography

The existing site slopes steeply from a high point at the northwest corner to a low point at the southeast corner. The building steps down to suit the site, being partially below grade at the northwest corner and at grade at the southeast. The maximum height of retaining is approximately 10m at the northwest corner, and slopes down to a retaining height of 6.5m at the northeast corner.

This creates a condition of unbalanced soil loading, having the effect of pushing the structure to the south. For larger structures, this type of sliding force can be resisted through sliding friction of the building foundations against the soil. However, based on our preliminary estimates of the imposed sliding force (based on the information provided in the geotechnical report) and the shear friction resistance based on the self weight of the building, friction alone will not be adequate. Additional measures will be required to prevent sliding.

Two options have been proposed and discussed with the geotechnical engineer.

Option 1: Permanent Earth Retaining Wall
A permanent earth retaining wall would be designed by the geotechnical engineer for all lateral earth pressures. In this case, the geotechnical retaining wall prevents any soil loading from being imposed onto the building.

A gap would be provided between the earth retaining wall and the building structural wall to allow movement between the two independent structures. A structural slab may be cantilevered from the building to create a seamless ground surface over the gap. A strategy for waterproofing of the gap and construction methodology for the double wall condition must be developed in coordination with the contractor and design team.

We would anticipate the earth retaining wall could be either a secant-wall or a shotcrete wall with permanent tie-back anchors. Thurber has indicated that this option is likely feasible and will be providing recommendations for review.

Option 2: Building Retaining Walls

Using conventional temporary excavation shoring, the building is built tight to the excavation and then designed to resist all lateral earth pressures. The forces affect below grade wall reinforcing (both perimeter walls and interior shear walls), diaphragm forces, and foundation designs.

Soil anchors at the foundations will be required. The tension-only anchors can be installed at a slope (battered) to more effectively resist the sliding forces. Design parameters for the soil anchors are currently being developed by the geotechnical engineer.

We anticipate further development of both of these options after geotechnical recommendations are available, with the goal of establishing of a recommended approach by the end of the schematic design phase.

We hope the above information meets your needs at this time.

Meredith Anderson, P.Eng., Struct. Eng.
Principal