01.06 Existing Environment

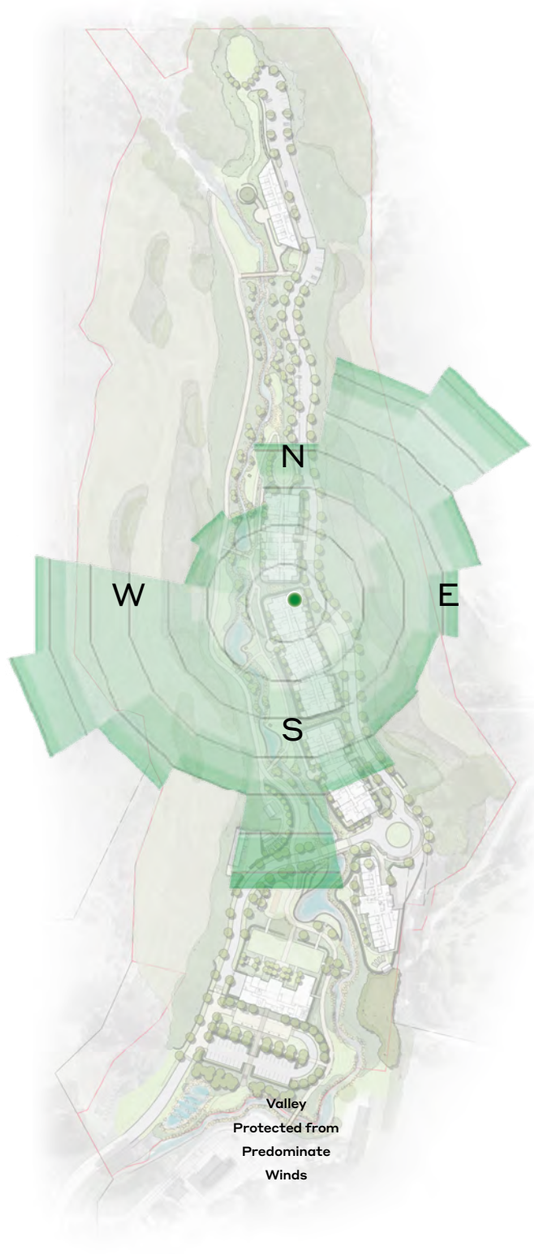
Environmental

Due to the topography and extensive established vegetation of the area, the proposed site has its own microclimate within the Wakatipu Basin. The valley experiences higher and lower temperatures than the surrounding upper Millbrook shelf and lower Speargrass Flats plateau.

There is good solar access to most of the site, while shading does occur along with permafrost in the northern areas of the site during winter.

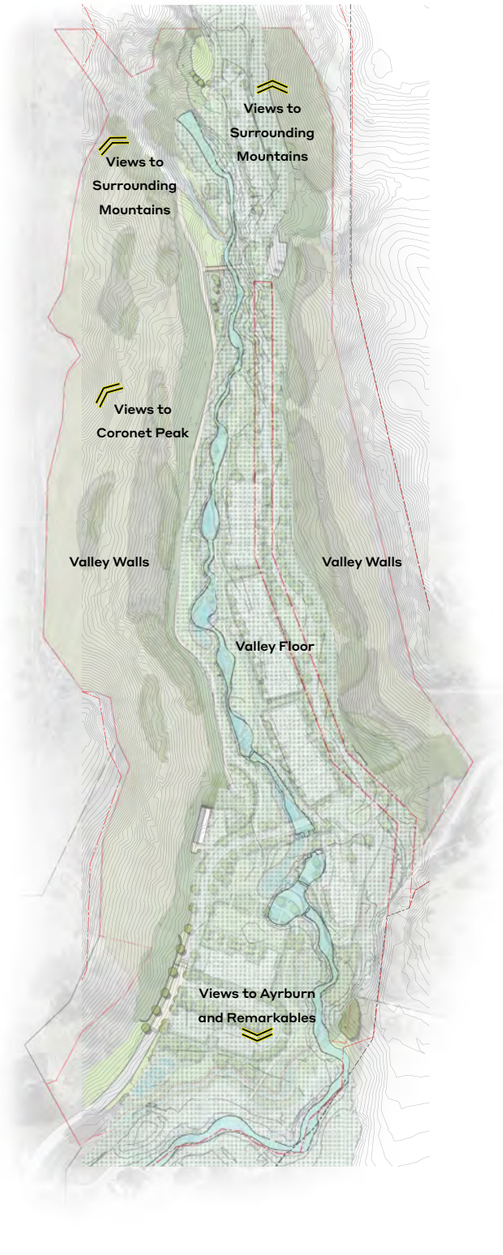
The valley is relatively sheltered from most wind directions.

Although the valley walls restrict views to the east and west, once further up into the valley there are many opportunities to view the ridgelines of Coronet Peak, Feehly Hill and the ranges beyond Arrowtown to the north as well as across the Wakatipu Basin towards Lake Hayes and on to the Remarkables to the south.



Windrose

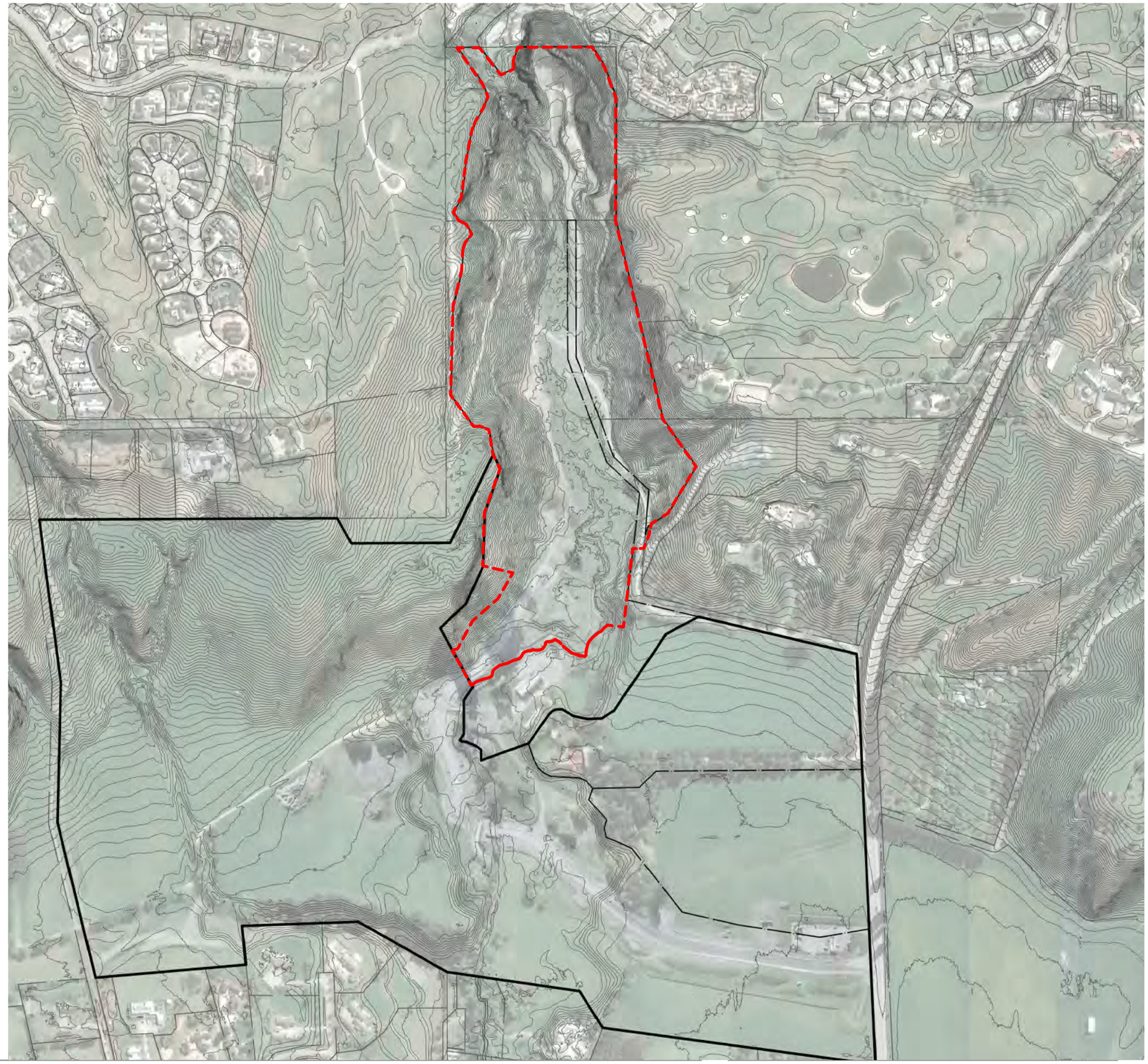
Solar



Views

01.07 Existing Site Plan

01.08 Topographic Survey Plan



02

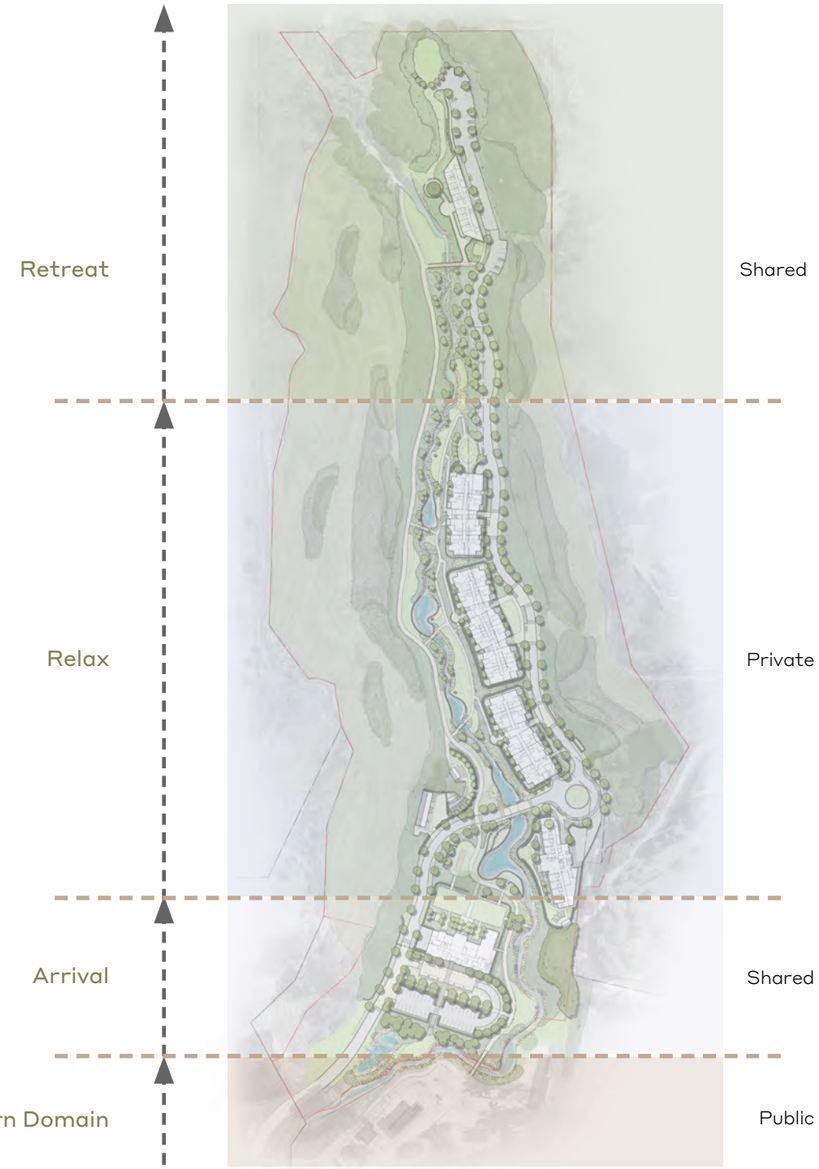
Design Concept

02.01 Functional Zoning

Public / Private

The masterplan narrative is to negotiate from the established character of Ayrburn Domain towards more contemporary forms in the north.

In a similar sense, the scheme transitions between a public engagement with Ayrburn Domain towards a more secluded program through the mid-site where residential accommodations are positioned to a shared area for retreat at the north. The variation of public/ private zones across the site promotes the development of strong community & interactions



Function Diagram

A open lawn landscape defines the arrival experience into the Arrival & Amenity functions housed in Building A inviting public use that is cohesive with the interface of the scheme to Ayrburn Domain

Care facilities are positioned at the centre of the site, overlooking the public lawn and arrival areas to provide high dependency residents a greater sense of connection.

Resident accommodation is provided along Mill Creek set amongst landscaped terraces that provide physical separation to public areas whilst maintaining visual connection.

A Boutique Hotel & Spa at the base of the waterfall to the northern end of the site is to become a focal destination for social interactions, set apart from the intimate residential and care programmes this social function will have dedicated parking and amenity.

02.02 Architectural Vision & Design Narrative

A reinterpretation of the traditional vernacular building in the landscape, Northbrook Arrowtown is an escape to the rural cabin in the valley.

The project is sited alongside the meandering Mill Creek stream, at the base of a unique valley which opens to the south and narrows towards the north, culminating with a spectacular waterfall. The landscape is distinctly New Zealand, a tranquil surrounding with vistas towards the distant hillside and mountain landscape.

The secluded and private valley setting provides an opportunity to create a unique contemporary later-living community with focus on resident wellbeing & experience. The proposal draws references to local rural vernacular through articulation of form and materiality. The buildings are conceived as objects in the landscape, with a direct relationship to the natural environment. A cohesive approach to landscape, topography and architecture brings together indoor and outdoor spaces for a holistic design approach that enhances resident experience of the valley.

Residents and visitors arrive via Ayrburn Domain where a series of heritage farm buildings are adaptively re-used to form a hospitality precinct. From here visitors can continue to access the waterfall via a network of pathways that lead through the valley.

Beyond Ayrburn Domain, residents and guests alike first arrive at the main Facilities Building, Building A, which contains reception, wellness, and lifestyle facilities. From here residents are led up the valley floor alongside the sequence of residential buildings that follow the meandering creek towards the waterfall and pavilion facilities at the north of the valley.

Integrated paths along the valley provide pedestrian, cycling and buggy access to and from the Residential Buildings to the Arrival and Amenities Building and Ayrburn Domain beyond. Vehicle access is provided which crosses Mill Stream and weaves behind residential buildings to the east providing accessible path and service vehicle access to the residential buildings.

A considered design approach to landscape integrates changes in building platform levels with a series of stone retaining walls which are embedded into contours. Terraced levels are merged via a continuous landscape path along Mill Stream with planting used to screen changes in ground level and provide views into a wooded oasis.

The integrated design response has a simplicity and robustness sympathetic to the strong sculptural forms, natural textures, and seasonal colours of the valley setting.

↖
Concept Sketch
Objects in the valley

02.03 Masterplan Design Narrative

A Consistent Architectural Approach

The masterplan narrative draws upon the rich natural beauty of the Northbrook Arrowtown valley while blending its architectural language with that of the Historic Ayrburn Domain. Through the interpretation of its historic context, the design will make controlled 'sculptural' moves to enforce the idea of an object in the landscape, forming a language unique to Northbrook Arrowtown. Through the development of these principles, the scheme seeks to provide later living facilities with a contemporary feel that celebrates the surrounding landscape and architecture of Arrowtown that provides a unique experience to both residents and visitors.

Drawing from these core principles, the design develops a progressive architectural language as the buildings move up the creek, beginning at Building A, which acts as a gateway to the rest of the scheme. As the main point of arrival, Building A interfaces with the historic Ayrbun Domain and is more sensitive in-built form to the historic architectural language of these existing heritage buildings. Building A establishes a traditional architectural language that is then manipulated through the introduction of contemporary materials and form as the development progresses northward along Mill Creek towards the residential buildings.

The residential building's point of departure is the traditional hipped roof shed - this form is then manipulated to reduce the overall mass and scale of the multi-level residential buildings. Furthermore, residential buildings are broken along the creek edge to reduce scale and respond to the meandering flow of the stream. The consistent selection of textured claddings across all residential building refers to both the natural stone materiality of the creek and mountains whilst reflecting traditional building methodologies. The combination of bold form and consistent material section heightens the ‘sculptural’ concept of the scheme, creating a contemporary architectural form that sits confidential in its rural landscape.

Located at the northern end of the valley Building F - a Boutique Hotel & Spa - which is to provide a final iteration of this progressive architectural language and creates a sculptural destination point at the end of the creek.

Building A
Gateway

Northbrook
Arrowtown

Ayrburn
Domain

Sculptural beauty,
grown from nature.

02.04 Bulk, Form & Architectural Character

Ecology & Landscape

Preservation and enhancement of the local eco-system and landscape are critical aspects of the design proposal.

The development offers a unique experience within the region allowing both locals and visitors to engage and feel immersed in the natural environment and access the waterfall.

The relationship between the proposed buildings, existing topography, ecology and proposed landscape have been carefully considered. There is a close relationship between buildings and the landscape, where architecture takes a passive role, encouraging residents and visitors to overlook, enter and engage with the landscape.

Character & Scale

The landscape plays an important role in the design proposal, the development interprets its buildings as objects in the landscape, gently touching the terrain, coexisting and reflecting the surroundings. The buildings follow a linear arrangement along the valley and Mill Creek.

The Arrival and Amenity building (Building A), to the south of the site, provides the 'gateway' between the development and Ayrburn Domain. Through its traditional gable forms and materiality, the building introduces the architectural language of the development whilst echoing the traditional nature of Ayrburn Domain, allowing a consistent and fluent environment with its context.

As the buildings progress up the valley towards the waterfall, the architectural expression slowly evolves with the landscape, twisting and turning to emulate the land it is planted within. Four otherwise large masses are broken into small clusters glued together with social spaces, this reduces the impact of large buildings within the landscape, further cementing the concept of objects within the landscape. To provide identity and break the scale down, every other cluster possesses a mansard roof reflecting the traditional gables of the Arrival and Amenity building.

The residential building levels ascend as they climb towards to waterfall at the very north of the site, imitating the terrain. The existing trees and dramatic slope of the valley provide an appropriate setting for buildings of this scale, helping to ground and support the architectural form.

The architecture is wrapped in a skin of glass reinforced concrete tiles. The tone of the material reflects the stones of the Arrowtown river. Every surface that interacts directly with the residents is clad with timber, creating warm and intimate external spaces.

At the very north of the site, overlooking the waterfall, sits the jewel of the development, Building F, a boutique hotel and spa. Gently perched on a stone base of the same stacked stone as the arrival and amenity building, the final object in the landscape is fully clad in timber. The purity of the form allows for the building to be stripped of all distraction and act successfully as a place for relaxation and reflection.

Topography & Footprint

The proposed building footprints and massing have been established upon careful consideration of site boundary, creek setbacks & existing landscape features, minimising modification to the landform. As a result, most of the building platforms follow Mill Creek.

At the south of the site the road and pedestrian/cycle routes are separated and continue up the valley as it narrows from the site entry to the waterfall destination at the top.

Outlook, Sun & Privacy

From the beginning of the design process, the intention was to celebrate every single home. Therefore, outlook, sun and privacy of each individual home were top priority. By breaking the buildings down into small clusters of four homes then twisting and turning the clusters following the topography, each apartment has double aspect and generous outlook.

The site affords morning and afternoon sun as well as views across and down the valley to Lake Hayes and the Remarkables. Each accommodation building has been orientated to take advantage of the range of views the valley offers.

Public access routes are separated from private accommodation and terraces in the proposal to define these two spaces and preserve privacy for the latter. In the west, the pedestrian pathway is distanced from the rooms by the riparian zone and creek. In the east, the access road is separated from the rooms by way of road-side planting, guest parking and private patio screening.

02.05 Masterplan

- Waterfall

F

Boutique Hotel and Spa

16 Guest Rooms

3 Private Onsen Rooms

3 Consultation Rooms

Sauna, Steam and Plunge Pool

E

Residential

24 Two Bedroom LtO Apartments

15 Three Bedroom LtO Apartments

Total: 39 Units

D
Residential

50 Two Bedroom LtO Apartments

10 Three Bedroom LtO Apartments

Total: 60 Units

C
Residential

44 Two Bedroom LtO Apartments

5 Three Bedroom LtO Apartments

Total: 49 Units

B
Care Building and Serviced Apartments

23 High Care Units

10 One Bedroom LtO Apartments

3 Two Bedroom LtO Apartments

10 One Bedroom Serviced Apartments

2 Two Bedroom Serviced Apartments

A
Arrivals / Amenities

Cafe
Reception
Gym
Yoga
Pool
Cinema
Library
BOH

02.06 Building Conceptual Response

Objects in the Landscape

Object in the landscape
Nature as feature
Secluded
Wellbeing
Relax

Macro and micro communities
Social spaces inbetween clusters
Connection to nature
Each home is the best home
Double aspect views for every home

Contemporary barn
Object in the landscape
Arrival and Amenities
Wellness
Embracing the valley and creek

Public area
Agricultural character
Gateway

Retreat

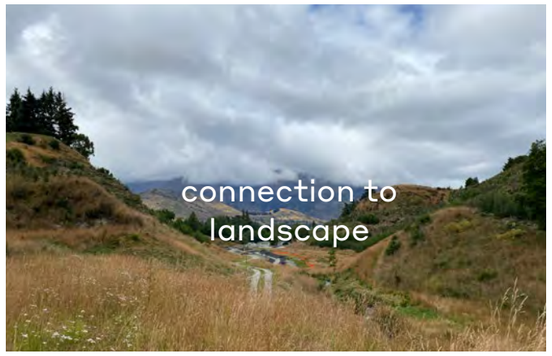
Accommodation

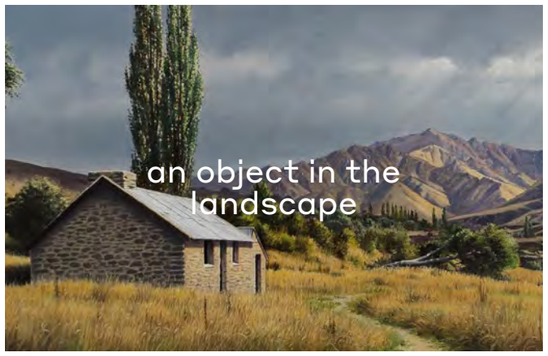
Arrival

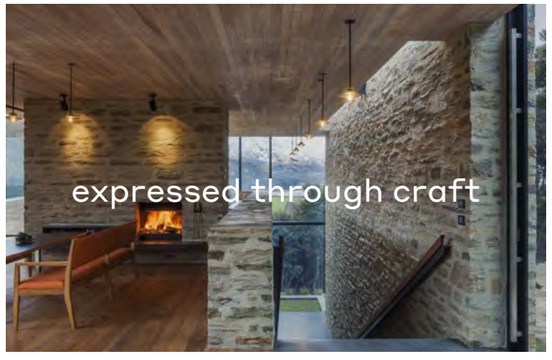
Ayrburn Domain

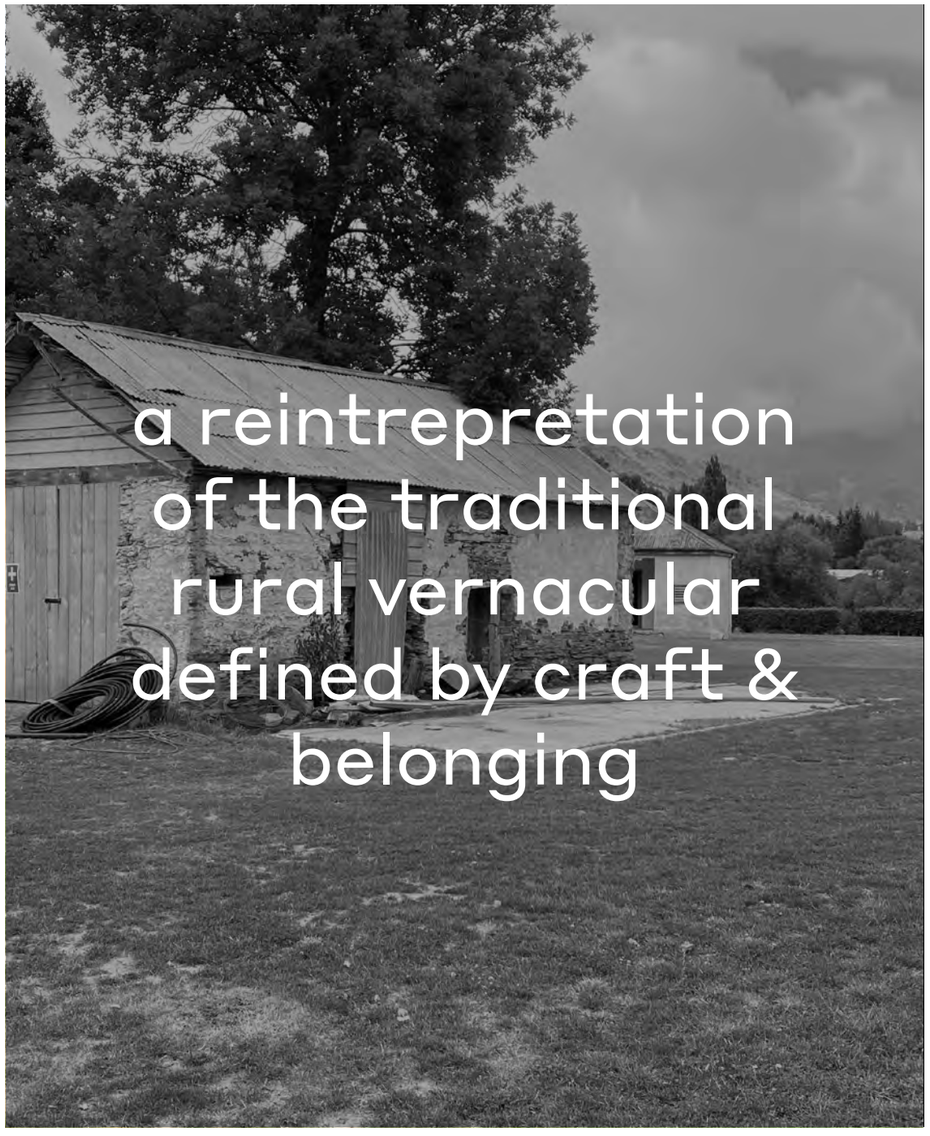
02.07 Local Inspiration

An architectural language creating luxury out of tradition, function and craft.

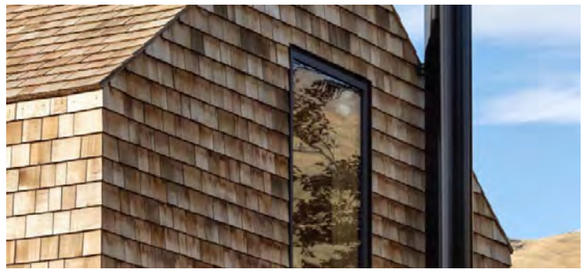




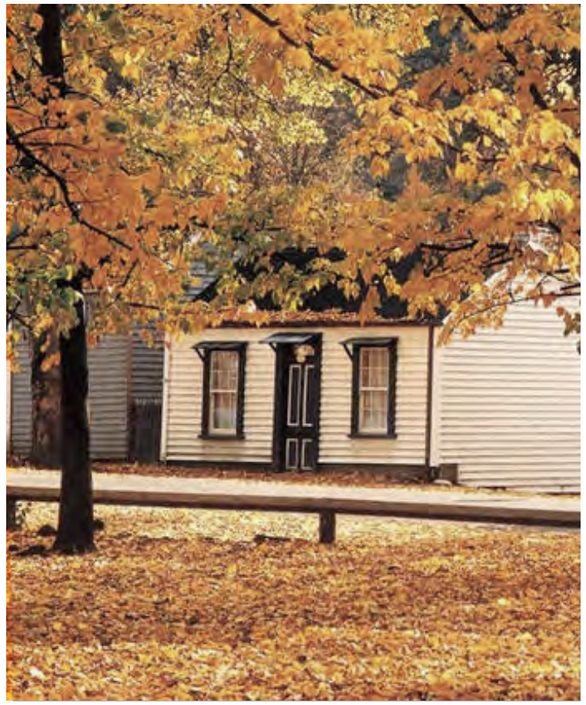


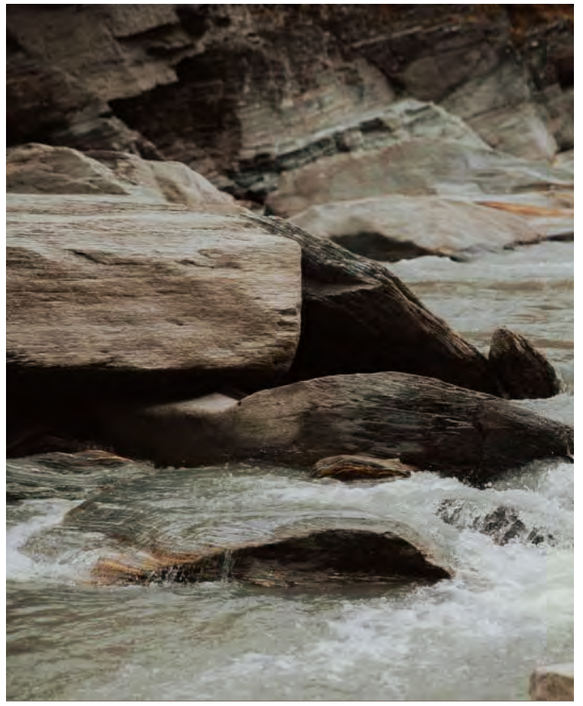


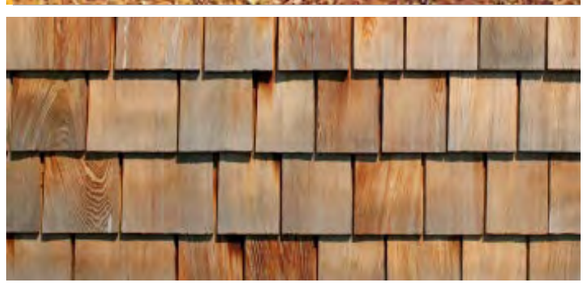
02.08 Colour Palette

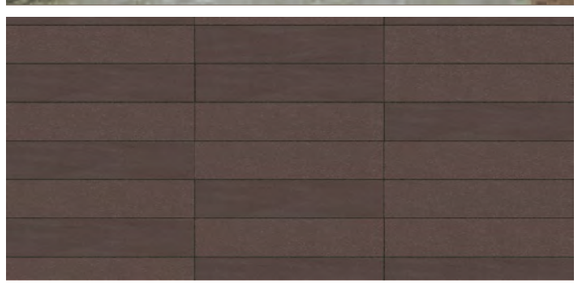
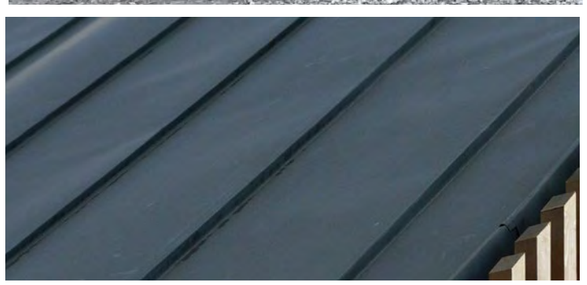










02.09 Overall Material Palette

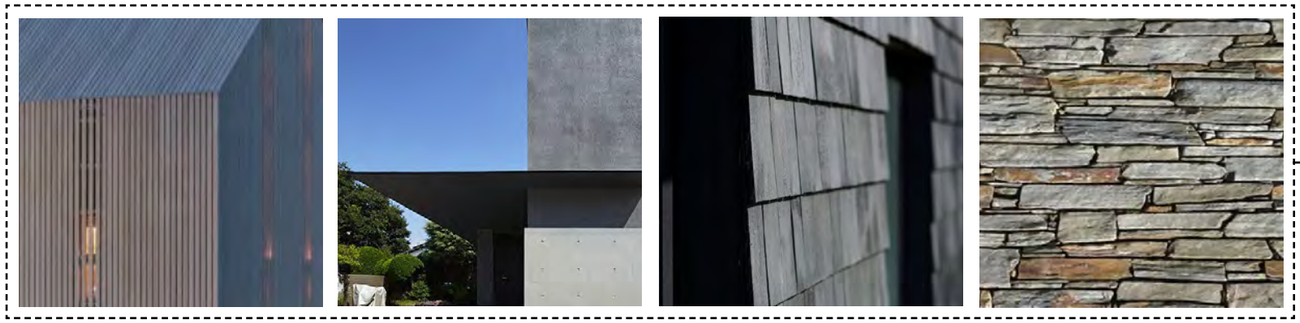
Material Palette & Character

The palette has been informed by the traditional architecture and natural resources of the surrounding area. In particular, the material choice for the development looks to embrace the natural beauty of the site whilst facilitating a contemporary architectural approach.

To do this, each building has a tailored approach that facilitates the progressive architectural language through the valley.

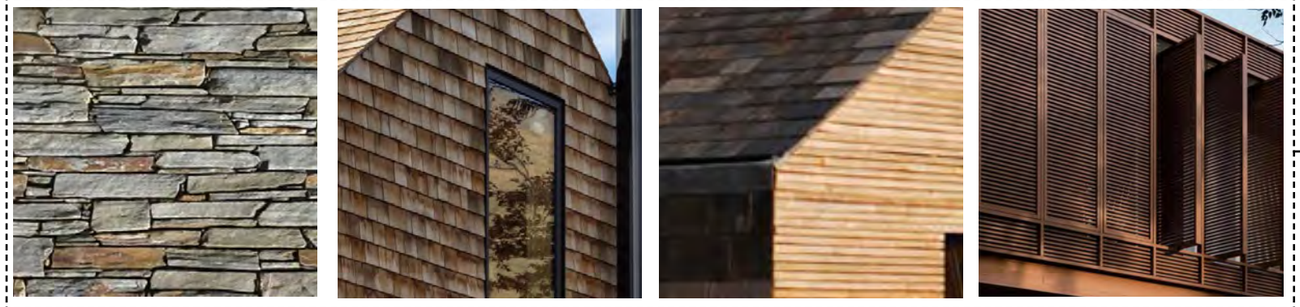
The tones, colours and textures of the selected materials are the result of a lengthy design process to determine an approach that allows each building to have a unique sense of character whilst allowing them to complement each other.

Lighting is subtle and generally located within the landscape. The proposal does not include extensive up-lights to buildings in order to further enhance their role as subservient to the landscape experience. Refer to Landscape Stategy for lighting concepts and plans.

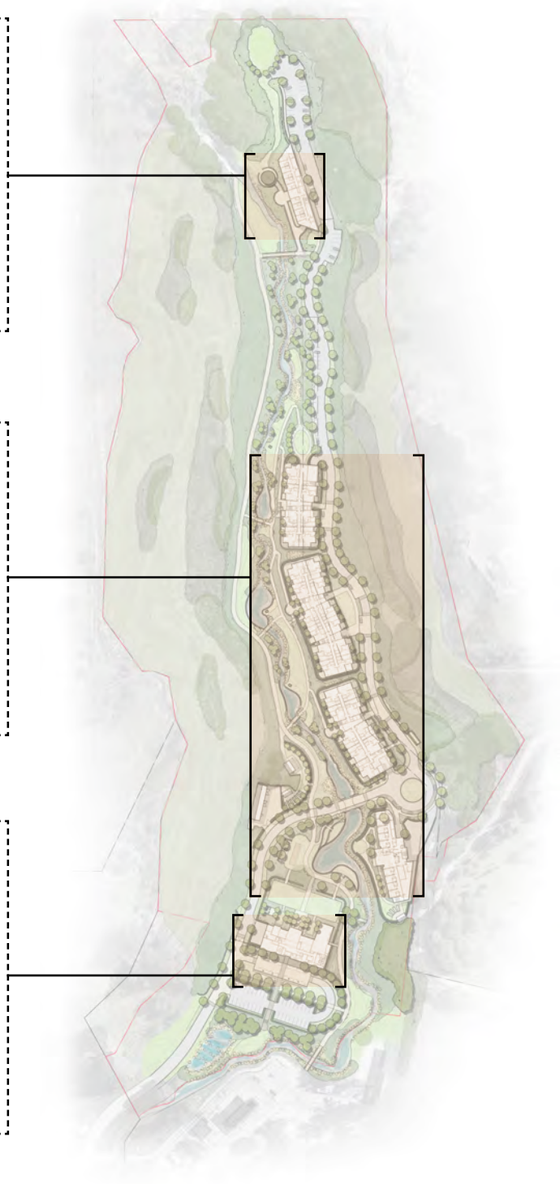


Boutique Hotel & Spa (Buildings F)

Residential, Care and Serviced Apartments(Building B-E)



Arrival & Amenity (Building A)



Building A Materiality

03

Functional Diagrams

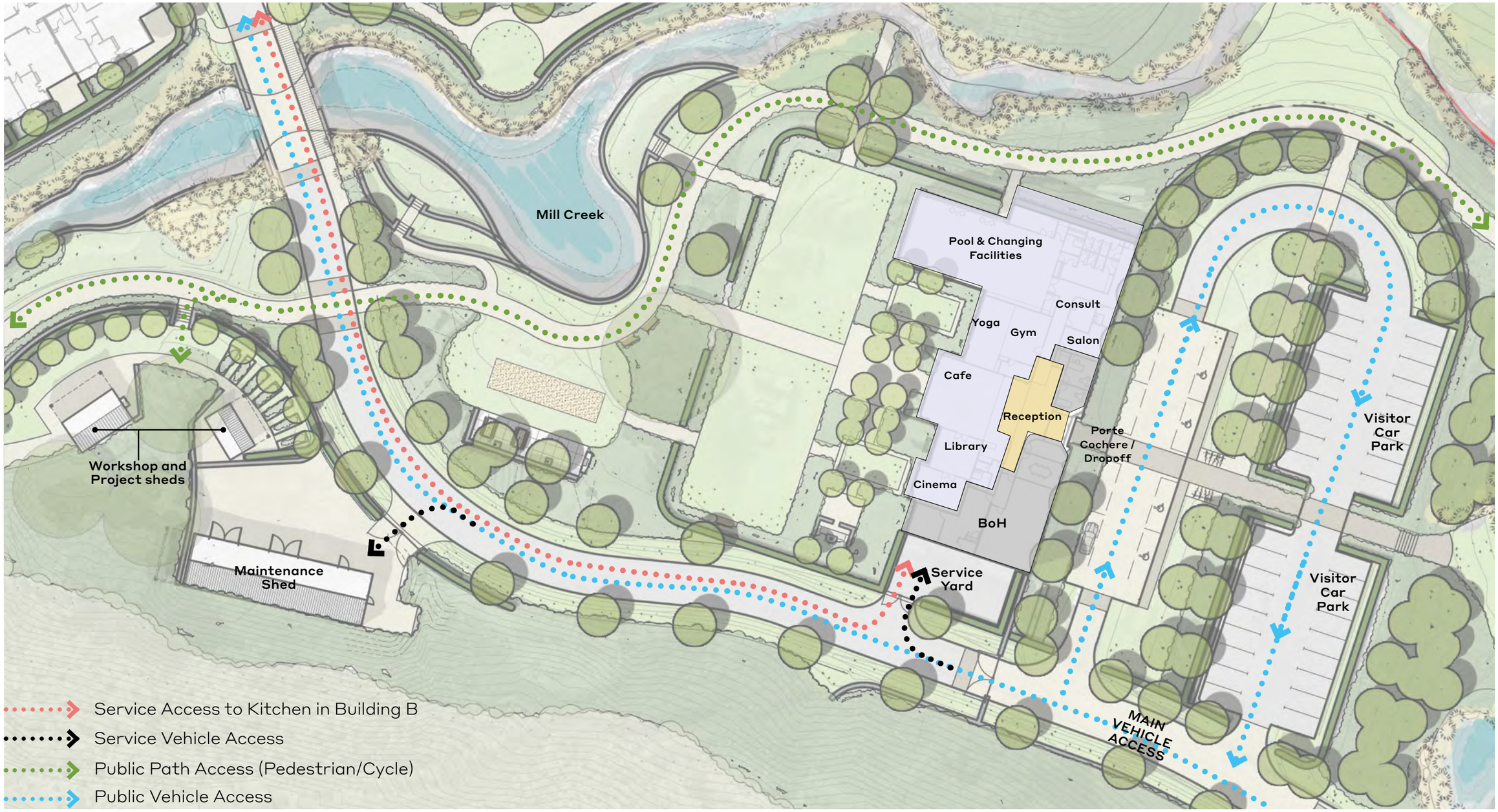
03.01 Public Site Access & Networks

Service Vehicle Access

Public Path Access (Pedestrian/Cycle)

Public Vehicle Access

03.02 Main Facilities Functional Plan Diagram



03.03 Functional Plan Diagrams

BOH Service

Service vehicle access is positioned to the rear of the residential buildings at the east. A small scale laneway is to provide access to service collection points.

To be read in conjunction with the Traffic Report

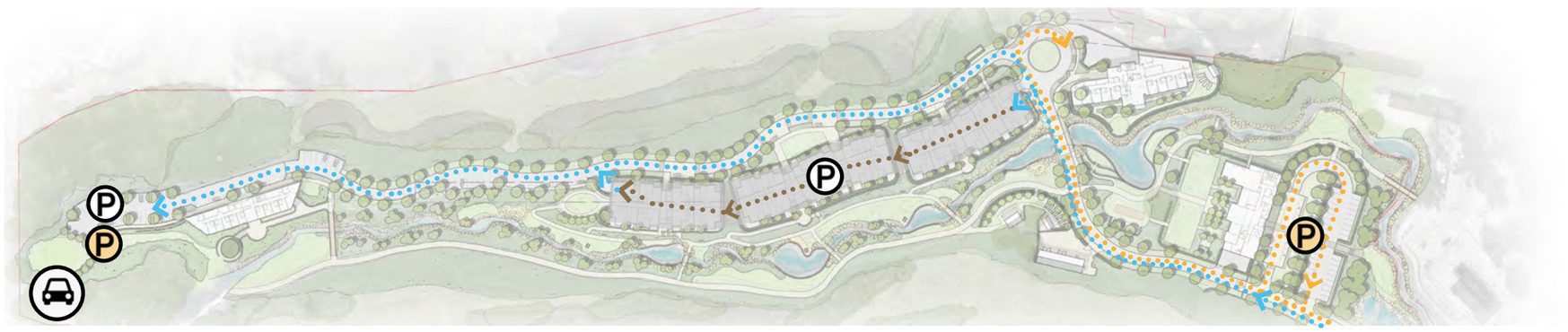
Service Vehicle Access

BoH Service Areas

Pedestrian & Cycle Routes

Pedestrian walkways and cycle paths are prioritised to the west of residential buildings along Mill Stream. Paths are intregrated with building entrances to define points of arrival and bring natural elements into residential buildings

Pedestrian and Cycle Route



Resident & Guest Parking

Resident Parking is to be accomodated at Basement Level. Provision of visitor parking at Building A ensures limited traffic flows into the site.
To be read in conjunction with the Traffic Report

Resident Park
Below Grade Basement Parking

Visitor Parking

Residents Basement Access

Residents Vehicle Access

Visitor Access

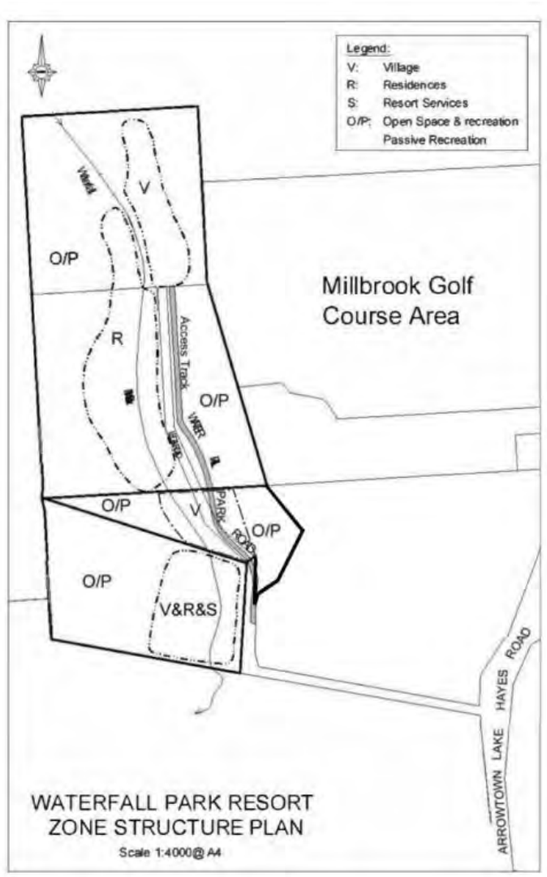
03.05 Building Platform Levels

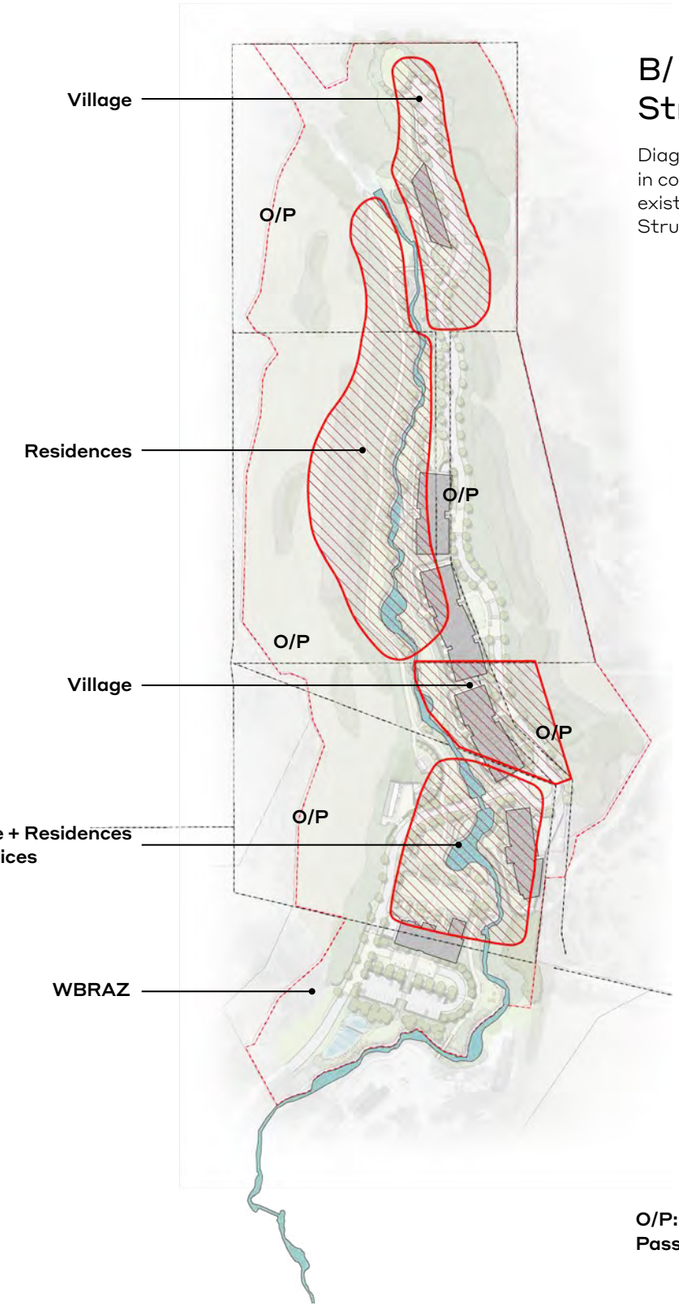
04

Compliance Diagrams

04.01 Comparative Zone/Title Plan

A/ Zone Structure Plan Diagram from QLDC District Plan





B/ Building Masterplan with Zone Structure Plan Overlay

Diagram showing proposed building footprints in comparison to existing title boundaries, existing legal roads, Waterfall Park Zone Structure Plan & Activity Areas

O/P: Open Spaces and Recreation Passive Recreation

04.02 Site Coverage Diagrams

1/ Total Site Areas

Waterfall Park Zone (WPZ)
= 135,477.15m²

Wakatipu Basin Rural Amenity Zone / Rural General Zone
= 13,417.08m²

All excluding proposed relocated legal road area as shown white.

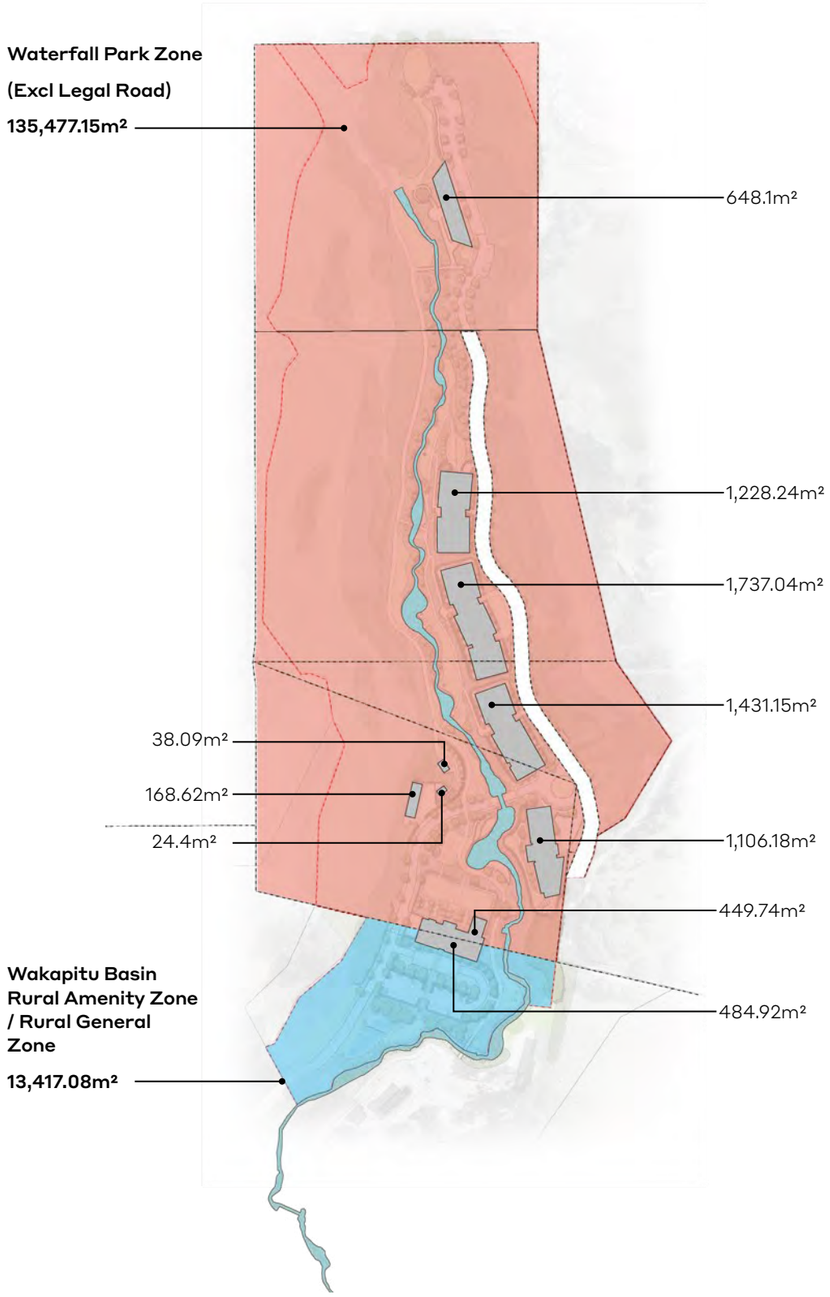
BUILDING COVERAGE (QLDC District Plan Definition):

Means that portion of the net area of a site which is covered by buildings or parts of buildings, including overhanging or cantilevered parts of buildings, expressed as a percentage or area. Building coverage shall only apply to buildings at ground, or above ground level.
The following shall not be included in building coverage:

- pergolas
- that part of eaves and/or spouting, fire aprons or bay or box windows projecting 600mm or less horizontally from any exterior wall.
- uncovered terraces or decks which are not more than 1m above ground level.
- uncovered swimming pools no higher than 1m above ground level.
- fences, walls and retaining walls.
- driveways and outdoor paved surfaces.

ZONE STANDARD 42.5.5 Maximum Total Site Coverage

The maximum site coverage shall not exceed 5% of the total area of the Zone. For the purposes of this Rule, site coverage excludes bridges, roads and parking areas.



2/ Site Coverage Calculations

Waterfall Park Zone

Site Area WPZ = 135,477.15m²

Building Footprint = 6,831.56m²

Site Coverage = 5.04%

Wakatipu Basin Rural Amenity Zone / Rural General Zone

Site Area = 13,417.08m²

Building Footprint = 484.92m²

Site Coverage = 3.6%

Overall Site Coverage

WPZ + WBRAZ / Rural Zone = 148,894.23m²

Building Footprint = 7,316.48m²

Site Coverage = 4.9%

04.03 Site Setback Diagrams

3/ Waterfall Park Zone & Wakatipu Basin Rural Amenity Zone Setbacks

Diagram showing Boundary Setbacks

Waterfall Park Zone 42.5.1

No building or structure shall be located closer than 6m to the Zone boundary, and in addition:

No building shall be located closer than 7m to Mill Creek.

Non-complying - Building B

Rural General Zone 5.3.5.1Vi(a)

The minimum setback from internal boundaries for buildings shall be 15 m

Complies

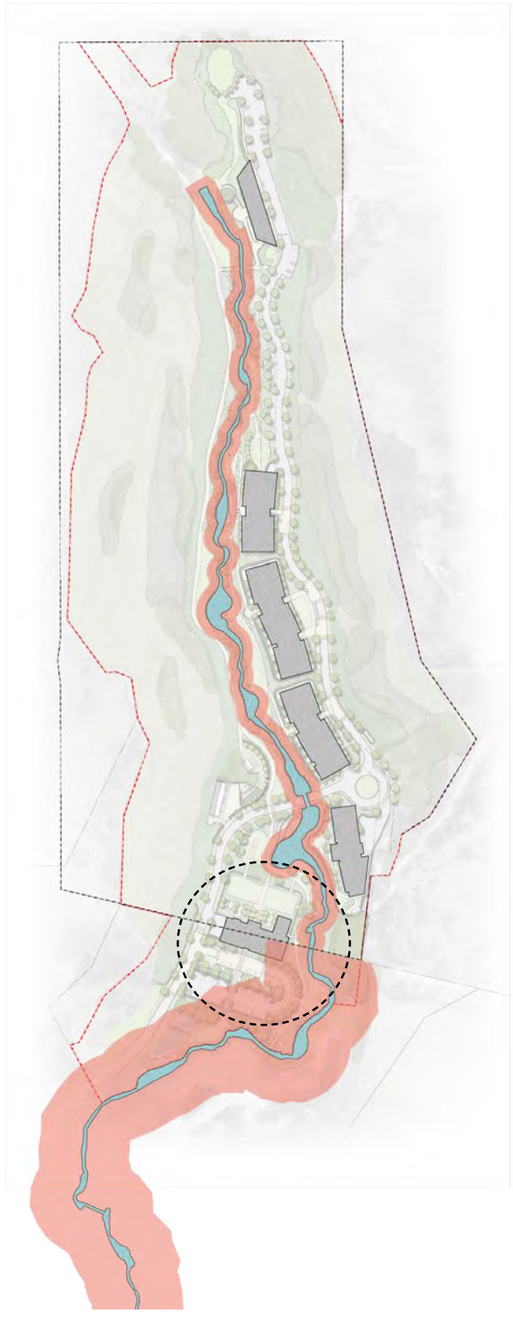
Wakatipu Basin Rural Amenity Zone 24.5.7

The minimum setback from internal boundaries for buildings shall be 10 m

Complies

Infringement Length: **3m**

Infringement area: **55.5m²**



4/ Mill Creek Setbacks

Diagram showing Boundary Setbacks

Waterfall Park Zone 42.5.1

No building shall be located closer than 7m to Mill Creek.

Complies

Wakatipu Basin Rural Amenity Zone 24.5.12

The minimum setback of any building from the bed of a wetland, river or lake shall be 30m.

Non-complying - Building A

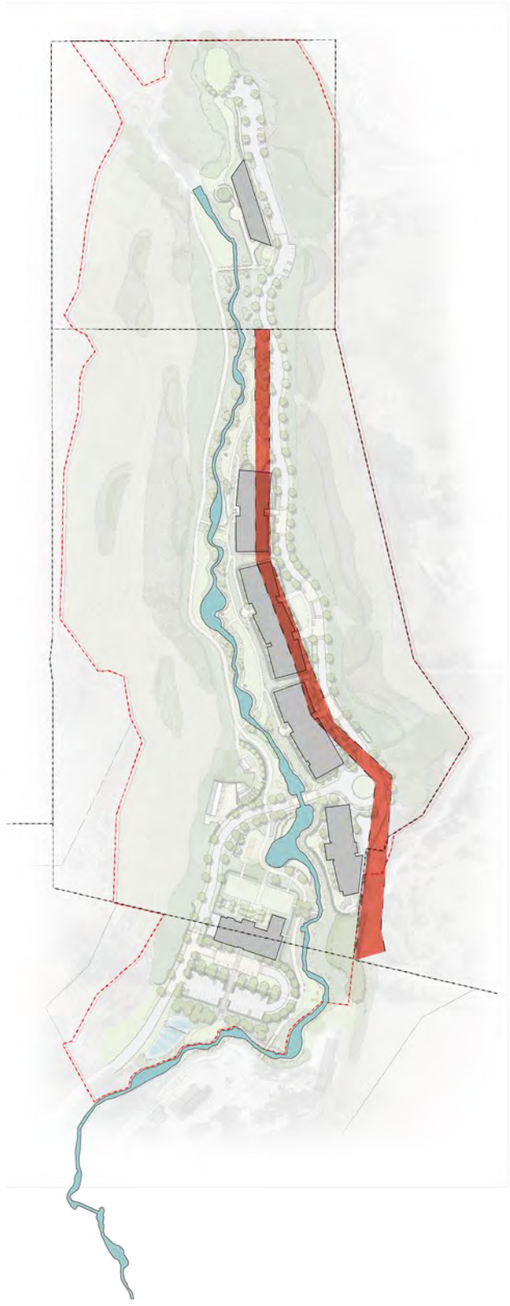
Infringement Length: **14m**

Infringement area: **161.36m²**

04.04 Legal Road Diagrams

5/ WPZ EXISTING LEGAL ROAD

Diagram showing existing legal road



6/ WPZ PROPOSED LEGAL ROAD

Diagram showing proposed legal road

04.05 3D Height Compliance Diagram

F

Boutique Hotel and Spa
Overall Building Height:
375.350m

E

Residential LtO Buildings
Overall Building Height:
379.725m

D

Residential LtO Buildings
Overall Building Height:
377.925m

C

Residential LtO Buildings
Overall Building Height:
375.825m

B

Care and Serviced Apartment
Overall Building Height:
370.629m

A

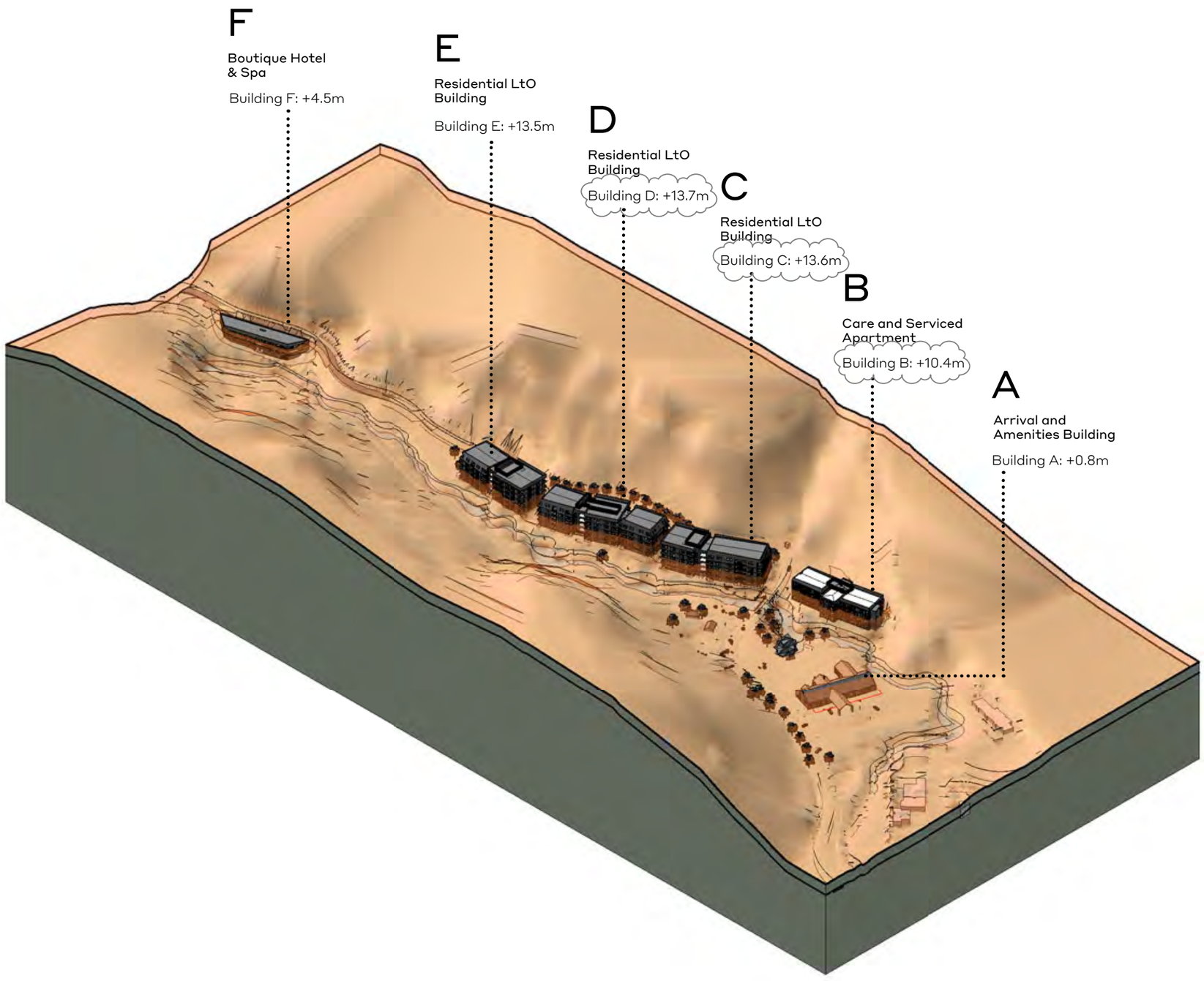
Arrival and Amenities Building
Overall Building Height:
360.711m

04.05 3D Height Compliance Diagram

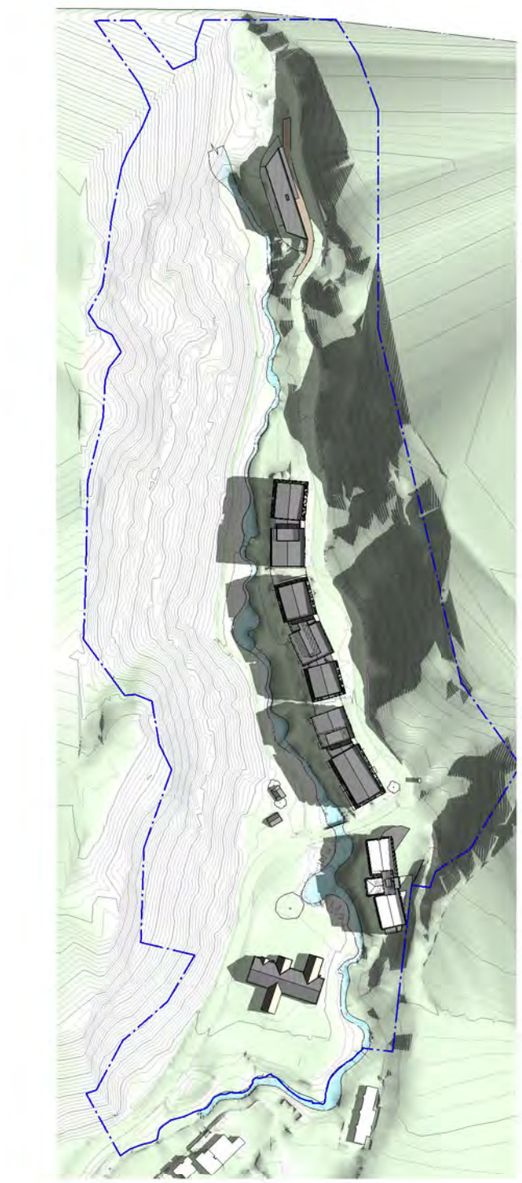
8m Ground Plane offset

Non Compliant

Building A: +0.8m
Building B: +10.4m
Building C: +13.6m
Building D: +13.7m
Building E: +13.5m
Building F: +4.5m



04.06 Sunshading Diagrams - December



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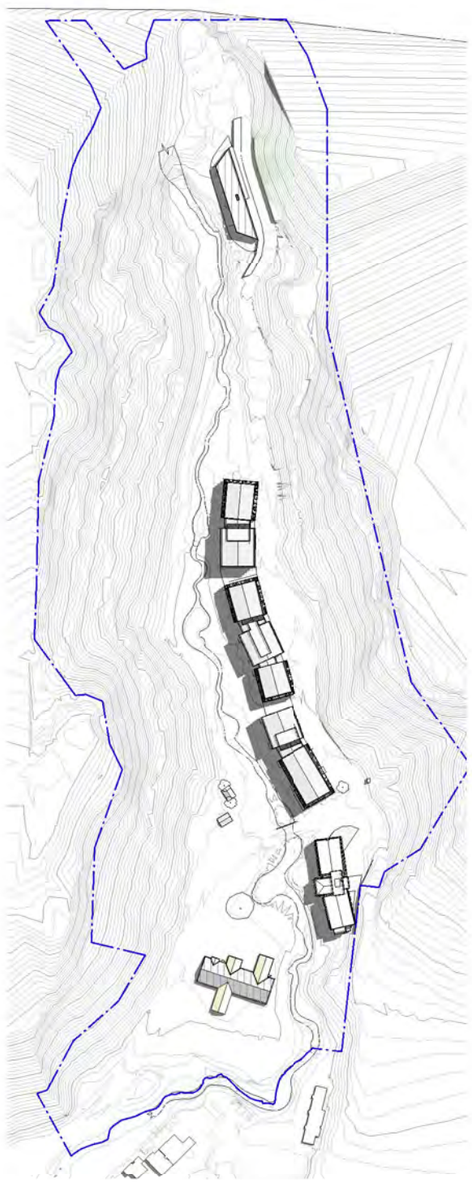

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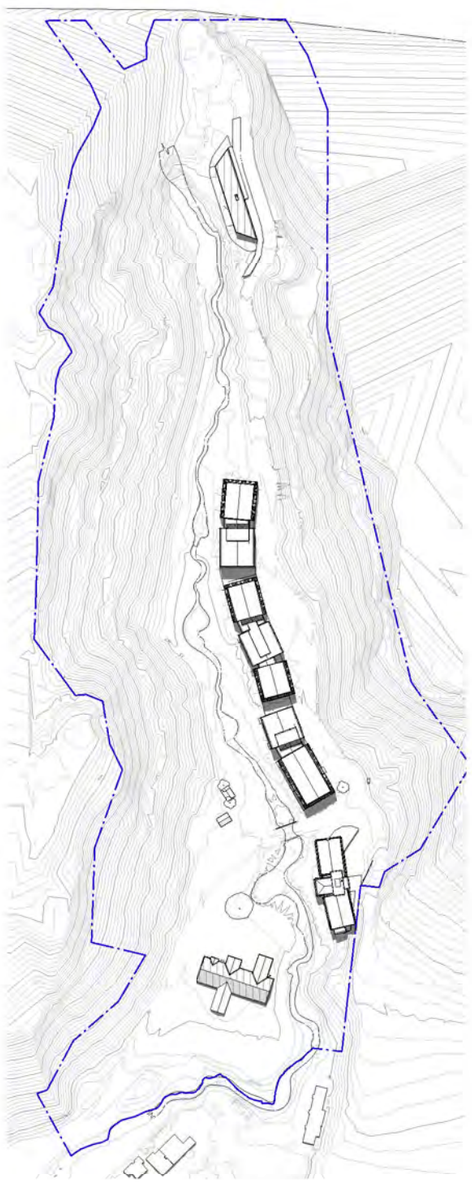
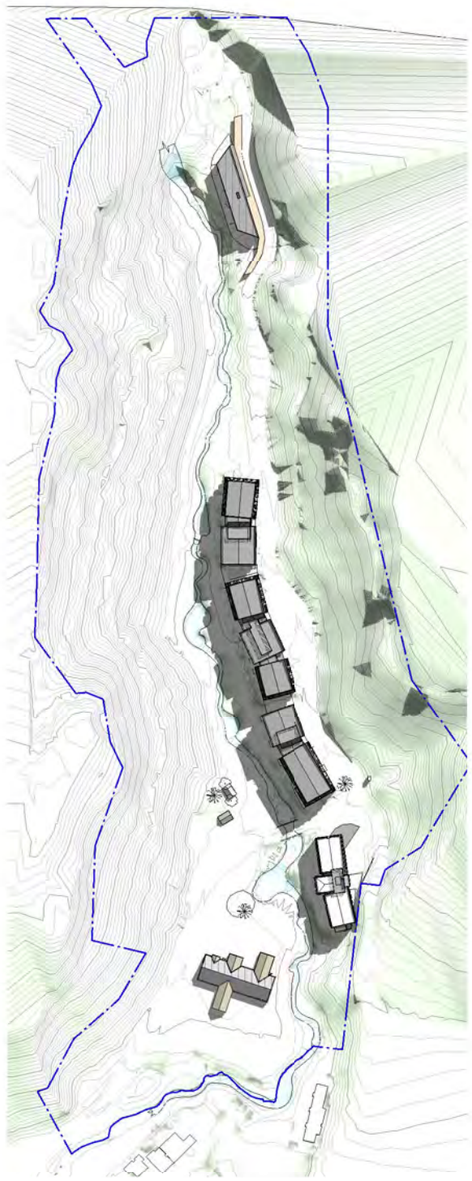


3. GROUND FLOOR_21/12_1400

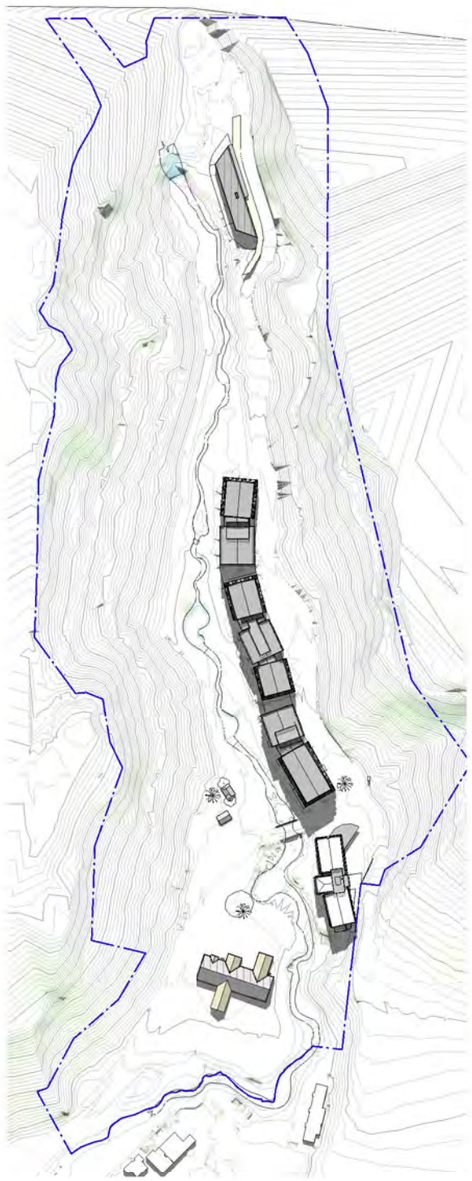
4. GROUND FLOOR_21/12_1700

04.07 Sunshading Diagrams - March

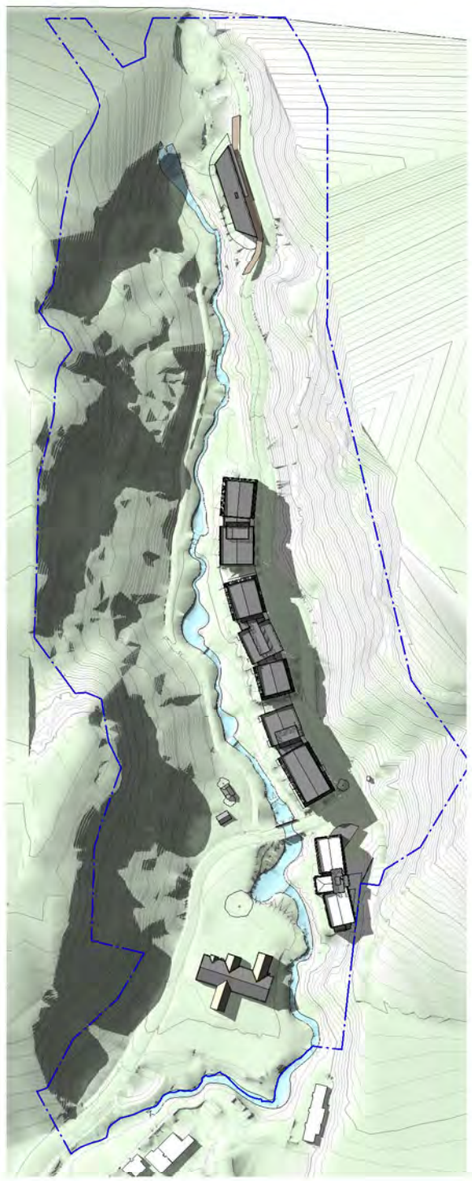
1. GROUND FLOOR_21/03_1000



2. GROUND FLOOR_21/03_1200

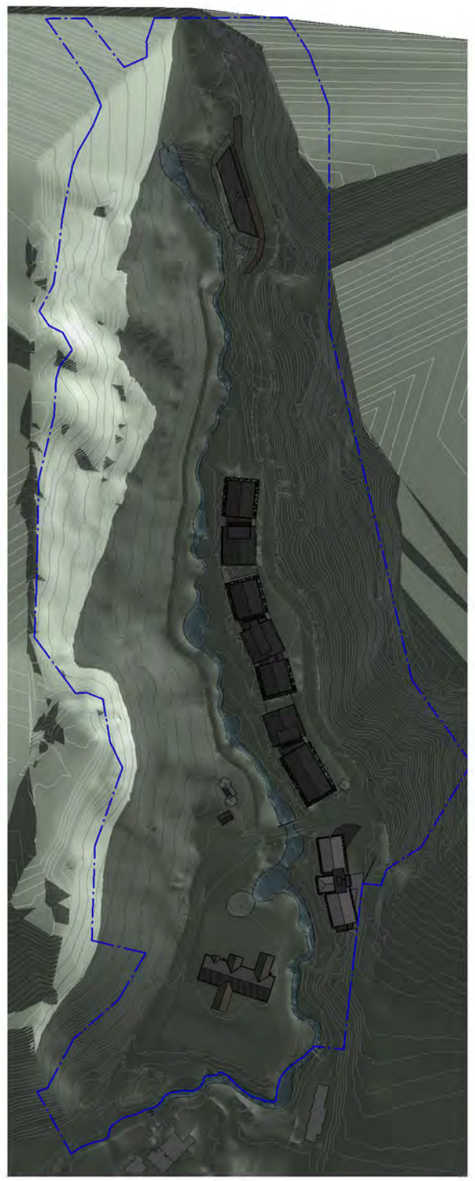


3. GROUND FLOOR_21/03_1400



4. GROUND FLOOR_21/03_1700

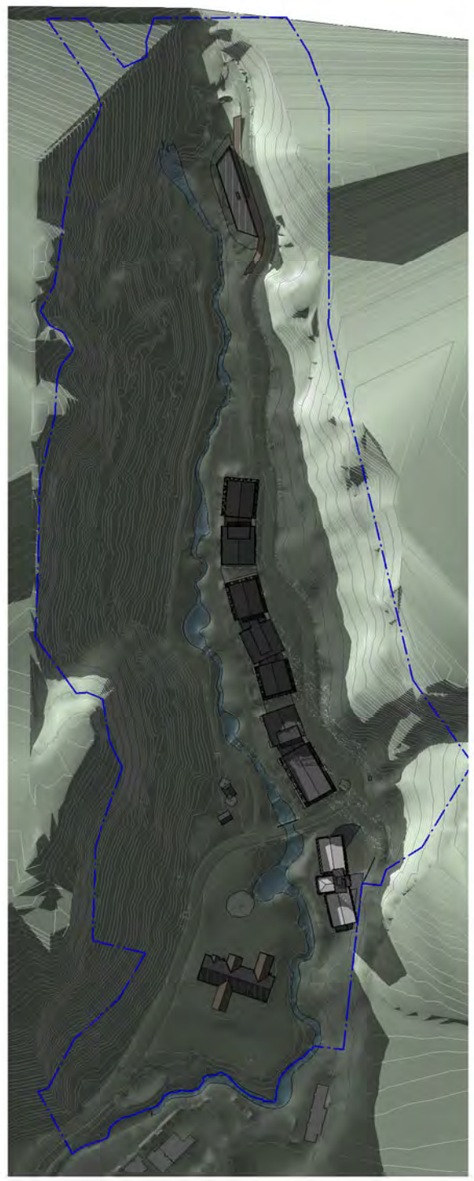
04.08 Sunshading Diagrams - June



1. GROUND FLOOR_21/06_1000

2. GROUND FLOOR_21/06_1200

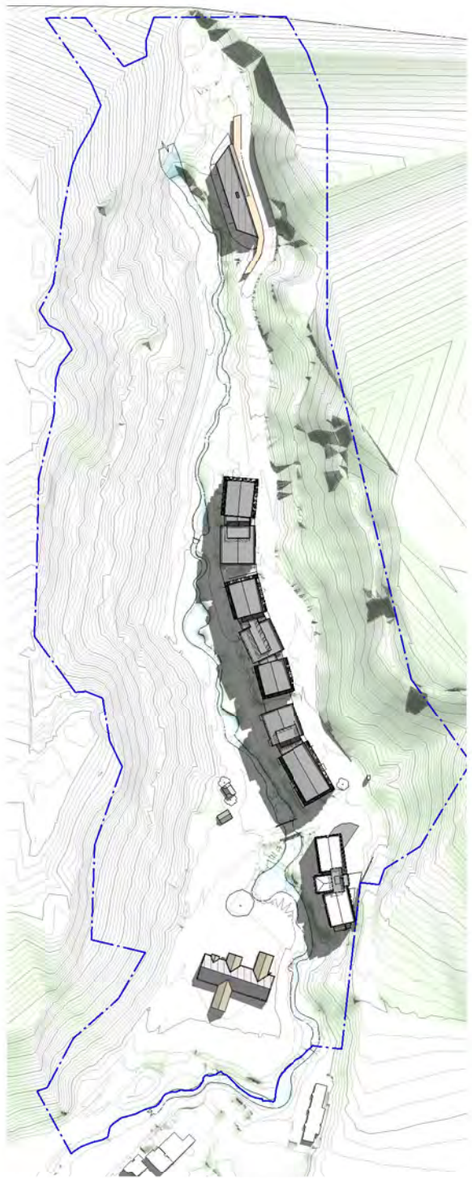
3. GROUND FLOOR_21/06_1400



4. GROUND FLOOR_21/06_1700

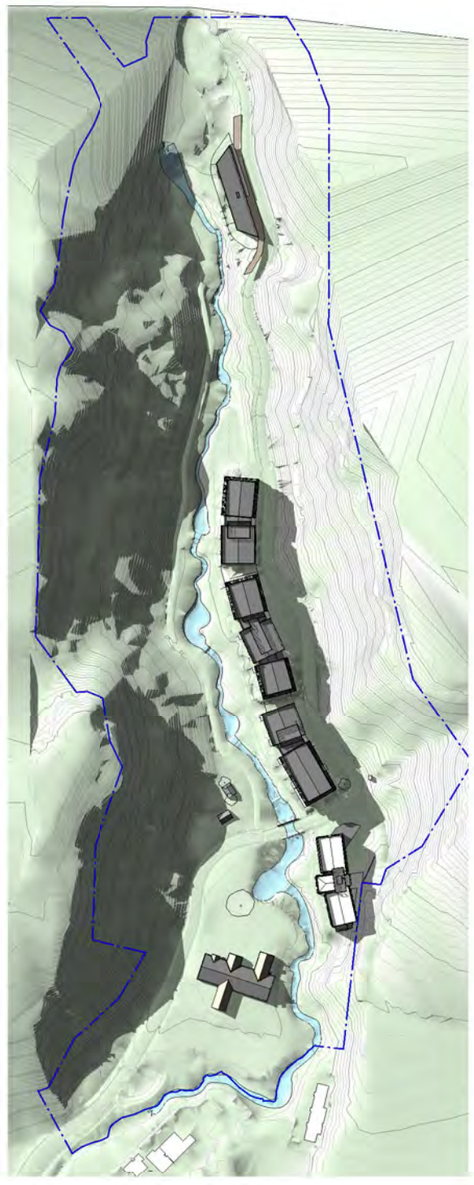
04.09 Sunshading Diagrams - September

1. GROUND FLOOR_21/09_1000



2. GROUND FLOOR_21/09_1200

3. GROUND FLOOR_21/09_1400



4. GROUND FLOOR_21/09_1700

05

Area Schedule

05.01 Masterplan Area Schedule

Development Yield Review

	GFA	NSA
1 Bed Apartments (LtO)	547	
2 Bed Apartments (LtO)		12714
3 Bed Apartments (LtO)		3955
Patio	398	
Balcony	1037	
LtO GFA Total	**18651**	
Serviced Apartments 1 Bed	547	
Serviced Apartments 2 Bed	149	
Serviced Apartments Common	100	
Care Units	832	
Care Commons	540	
Amenity	578	
Lobby	316	
BOH	1075	
Reception	10	
Circulation	3214	
Core	1177	
Total Development	**27189**	

Unit Breakdown

	Count	NSA Average (m²)	NSA Total (m²)	GFA Total (m²)	Unit Mix
LtO Apartments					
1 Bed Apartment	10	54.7	547		6%
2 Bed Apartment	121	105.07	12714		75%
3 Bed Apartment	30	131.83	3955		19%
Subtotal	**161**		**17216**	**18651**	
Serviced Apartments					
Serviced Apt 1 Bed	10	54.7	547		
Serrviced Apt 2 Bed	2	74.5	74.5		
Subtotal	**12**		**696**		
Lto + Serviced Apt Total	**173**	**103.54**	**17912**		
Care Units 1 Bed	**23**	**36.17**	**832**		

Basement Carpark	Area	Single	Accessible	Total
	5456	89	5	**94**

Boutique Hotel & Spa Breakdown

	Count	NSA Total (m²)	GFA Total (m²)
Hotel			
Rooms	10	568	568
BOH			115
Circulation			202
Core			81
Lobby			59
Lounge			65
Reception			19
Risers			42
Subtotal			**1151**
Spa			
Onsens	3	59	59
Concult Rooms	3	60	60
Acc WC	1		7
Changing	1		30
Lounge			30
Outdoor Spa			13
Sauna			16
Steam			10
Spa Reception			17
Subtotal			**242**
Boutique Hotel & Spa Total			**1393**

Unit Type Breakdown by Building

	Building B			Building C			Building D			Building E			Total			
	1 Bed	2 Bed	3 Bed	1 Bed	2 Bed	3 Bed	1 Bed	2 Bed	3 Bed	1 Bed	2 Bed	3 Bed	1 Bed	2 Bed	3 Bed	Total
Level G					8	1		10	2		4	3		22	6	28
Level 01					9	1		10	2		5	3		24	6	30
Level 02					9	1		10	2		5	3		24	6	30
Level 03	10	3			9	1		10	2		5	3	10	27	6	41
Level 04					9	1		10	2		5	3		24	6	30
Total	**10**	**3**		**44**	**5**		**50**	**10**		**24**	**15**		**10**	**121**	**30**	**161**
Ratio													6%	75%	19%	

Part 2

Building Design & Drawings

06

Masterplan

06.01 Development Overview

F

Boutique Hotel
and Spa

C-E

Residential
Buildings

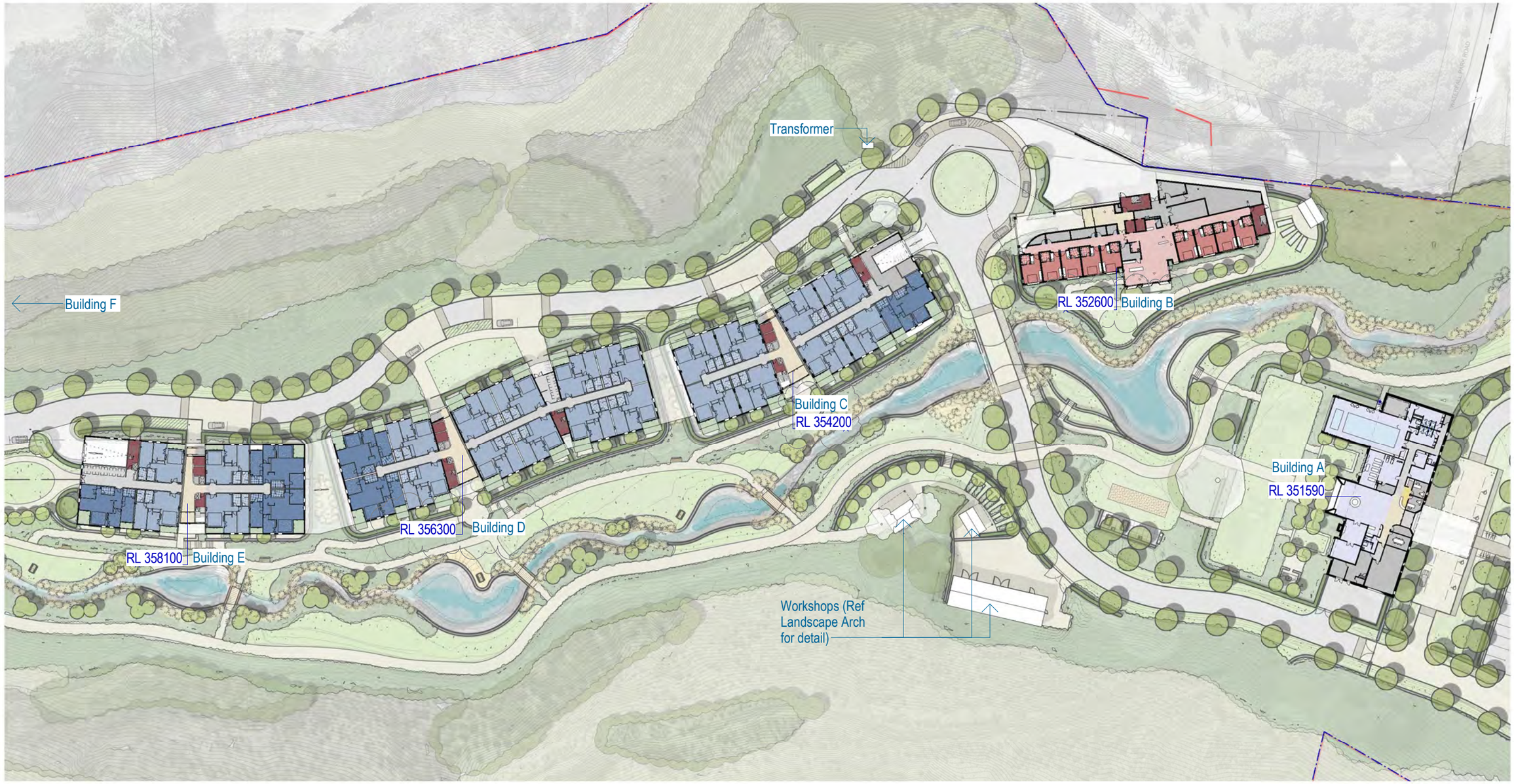
B

Care and
Serviced
Apartment

A

Arrival and
Amenities
Building

06.02 Masterplan



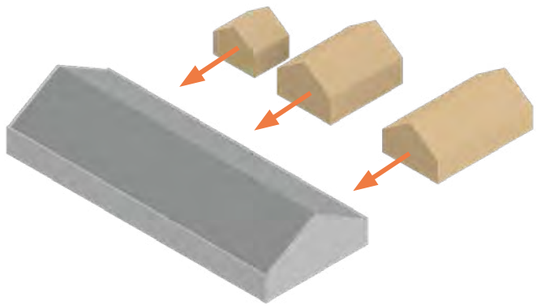
06.03 Site Plan

07

Building A

Arrival & Amenity Building

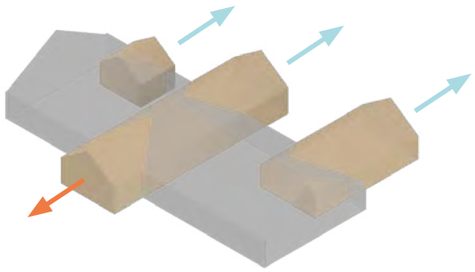
07.01 Building A Conceptual Response



Tradition Gable Form

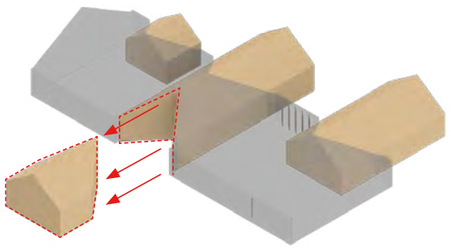
A traditional gable architecture is presented to the Ayrburn Domain

Contemporary elements are inserted to the north to define the courtyard and pool facilities



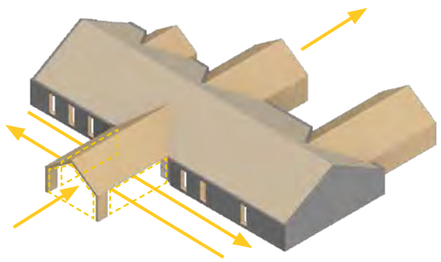
Programme & Spatial Organisation

Programme is expressed via the insertion of contemporary forms treated as independent elements with expressed materiality



Expressed Entrance

The entry is carved out of the traditional form to strength the axial organisation of the building and provide a clear point of entry



Building Elements

The addition of the Porte Cochere deriving from the carved element provides shelter upon arrival and further strengthens the central axis.

Window openings provide rhythm and respond to the interior organisation of the building

07.02 Amenity Strategy

Wellbeing Amenity

Interfacing with the historic Ayrburn Domain, Building A is the public facing arrival point to the Northbrook Arrowtown development. Crafted around user experience the building facilitates a wide range of shared uses, comprising a series of complementary offerings available to residents to enjoy.

Connected directly to the arrival and reception, a front of house lounge and café is open to both residents and visitors alike. The lounge is positioned on the central axis of the building providing sweeping views to the courtyard and development beyond. The lounge features a central fireplace as a space dividing mechanism and sculptural fireplace feature as an anchor to the space.

Adjacent to the lounge is the coupling of intimate cinema & library alcoves providing residents with comfortable, luxurious areas for escape and retreat. Collectively the lounge, and cinema feature bifold openings enabling connection to the outdoor lawn and courtyard beyond.

The entry reception provides a touchpoint for residents to book an appointment for lifestyle and wellness offers - health consult or massage treatment. A generous pool area offers luxury change facilities leading to a spa and swimming pool with views to Mill Creek.

Additional gym facilities are provided that give residents access to specialised equipment. The gym space is flexible by way of room divider to offer the opportunity for separate classes to be held such as yoga or pilates.

Staff offices and support facilities are incorporated which further centralises services to a single amenity location for the site.

Key

- Resident
- Staff
- Public/Visitor
- Operable Louvres
- Pool Facilities
- Gym / Yoga Facilities
- Wellness Spa
- Beauty Salon
- Cafe
- Cinema
- Library

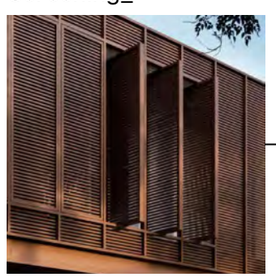
07.03 Materiality and Facade Principles

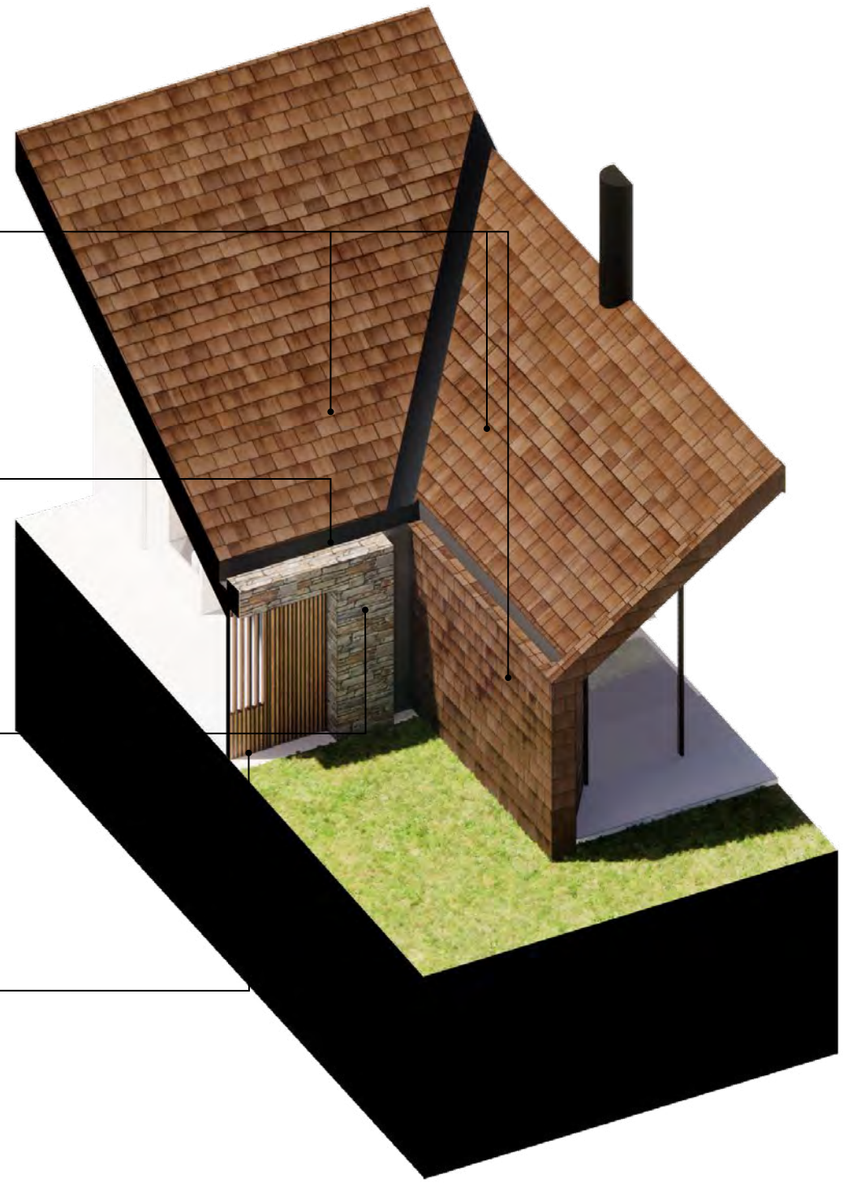
Timber shingle roofing & cladding_

Timber shingle roofing w concealed gutter_

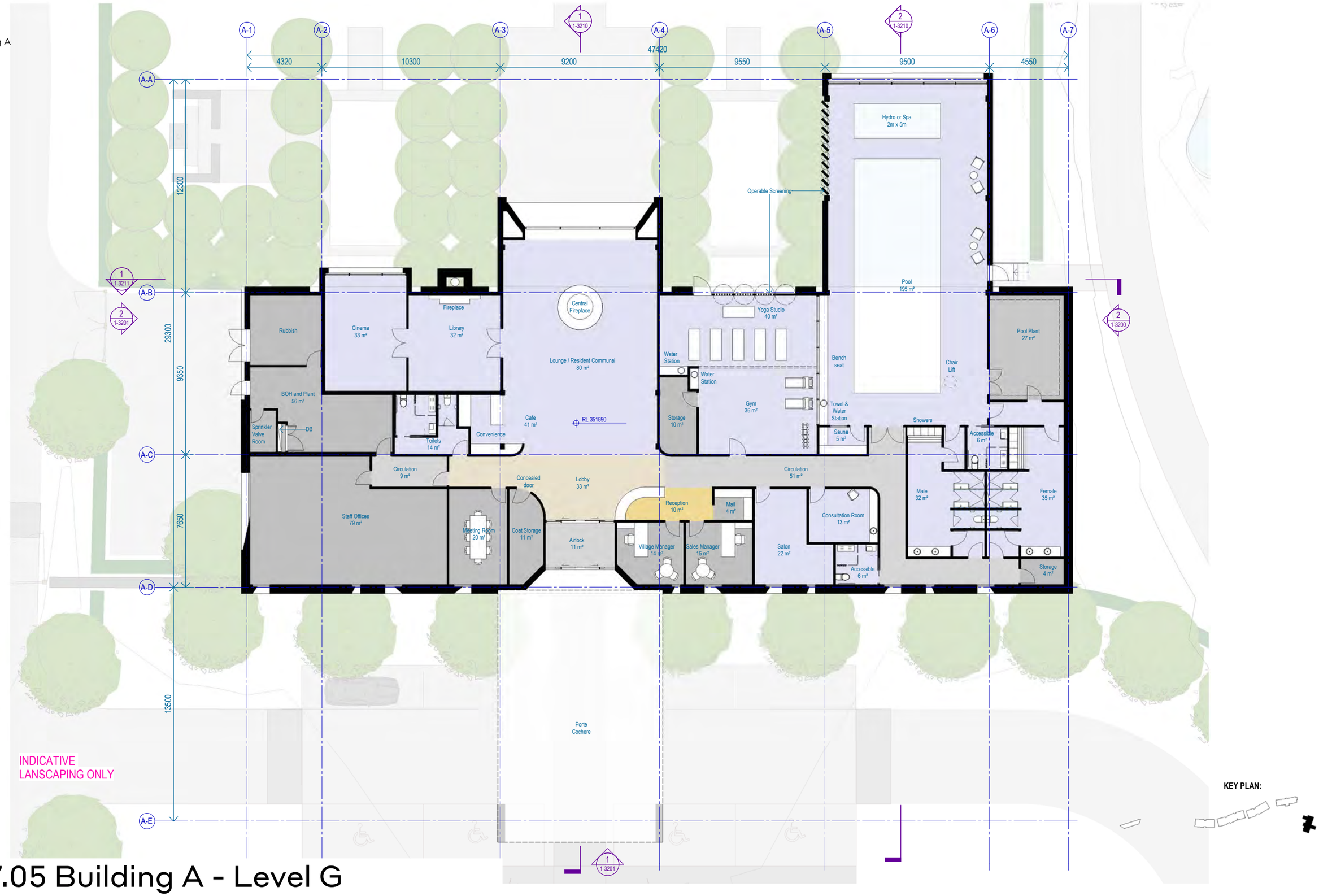
Stacked stone cladding_

Operable timber Screening_

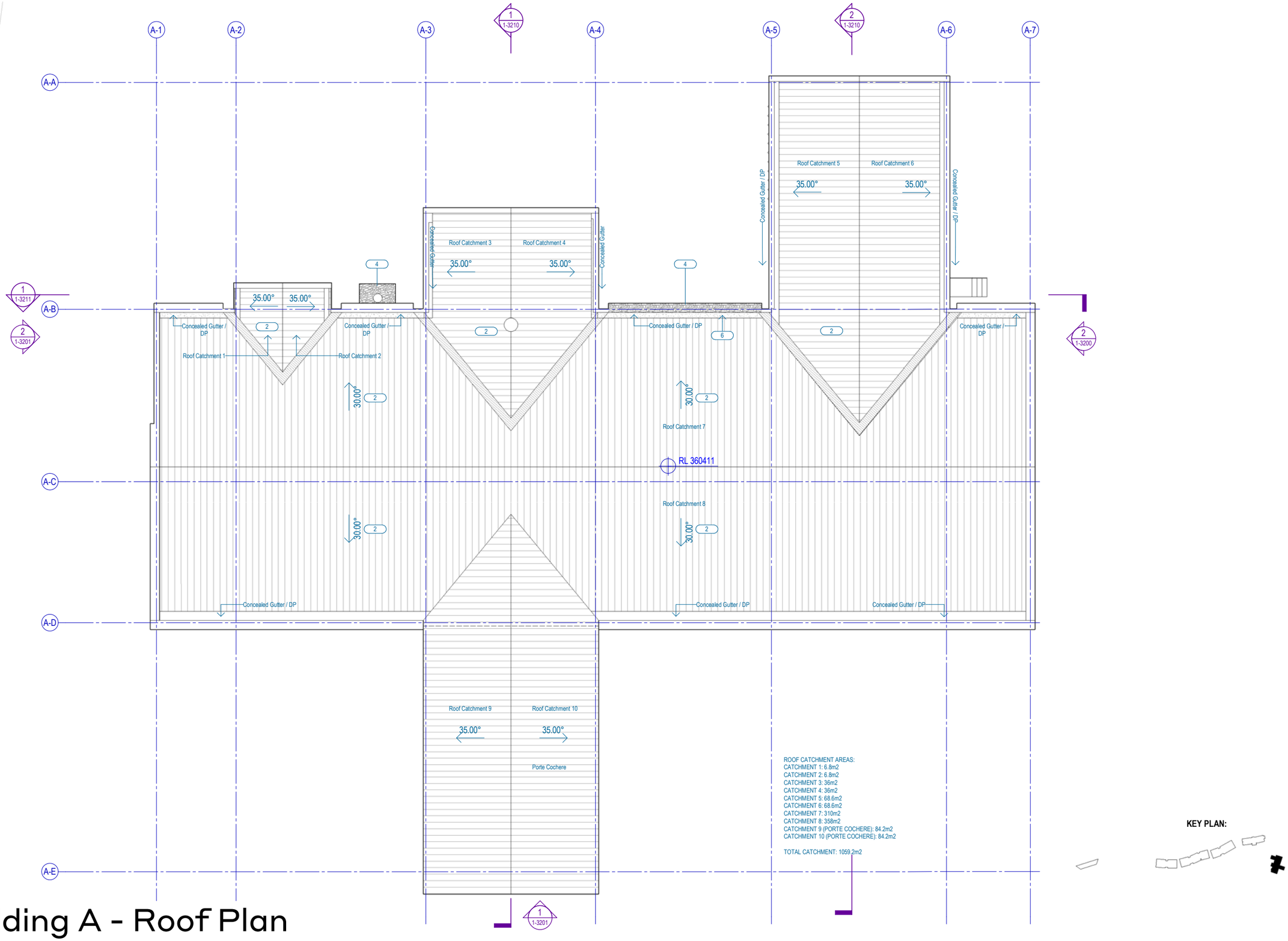




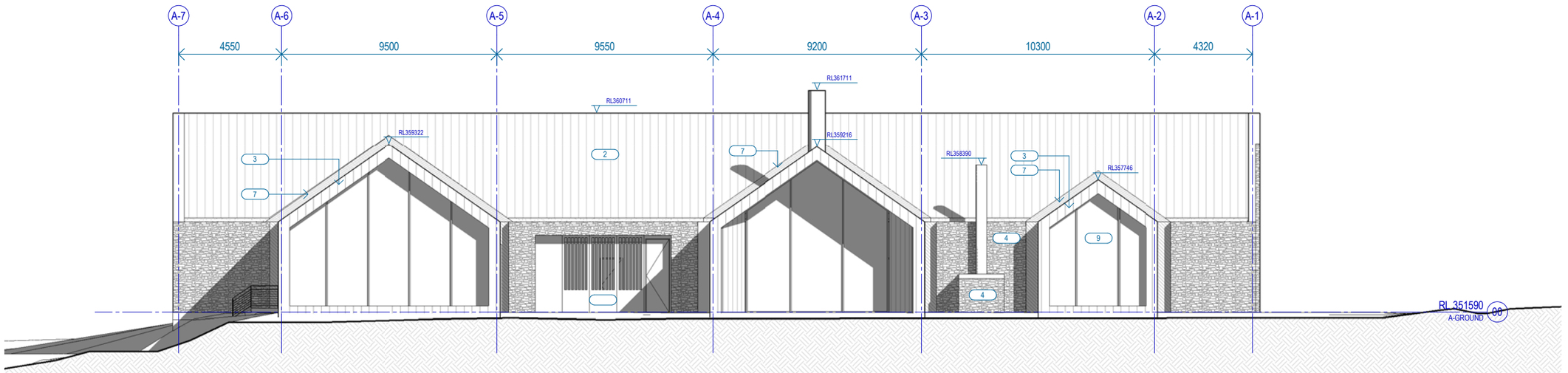
07.04 Building A - 3D Visualisation



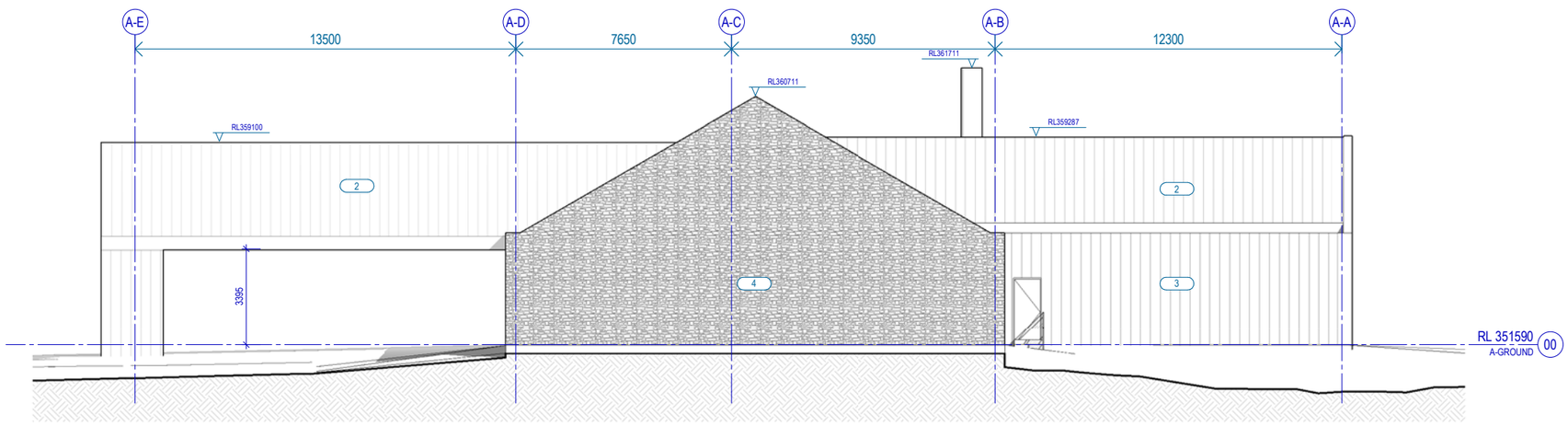
07.05 Building A - Level G



07.06 Building A - Roof Plan



1 A-NORTH ELEVATION
SCALE 1 : 100



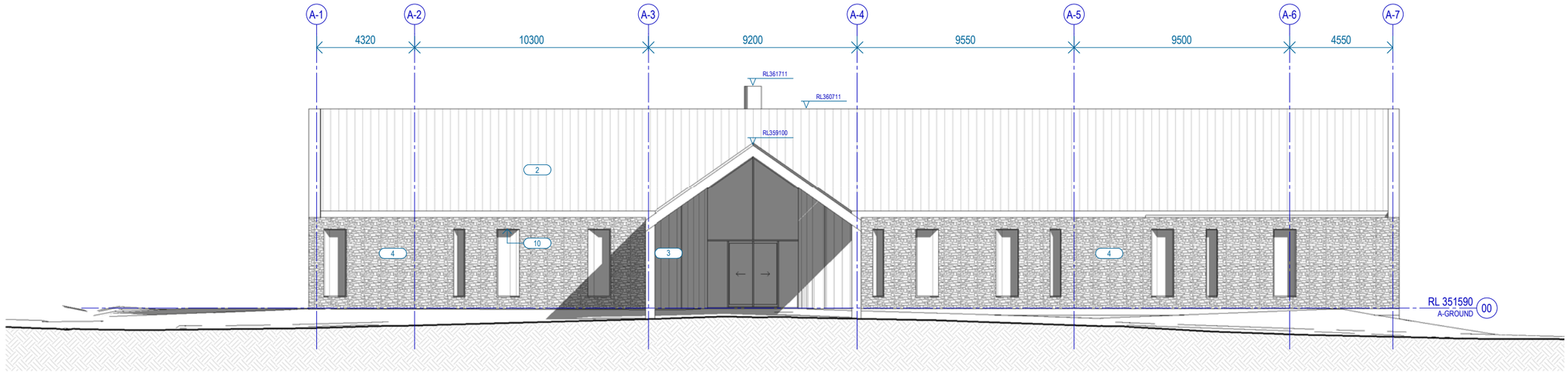
2 A-EAST ELEVATION
SCALE 1 : 100

MATERIALS LEGEND:

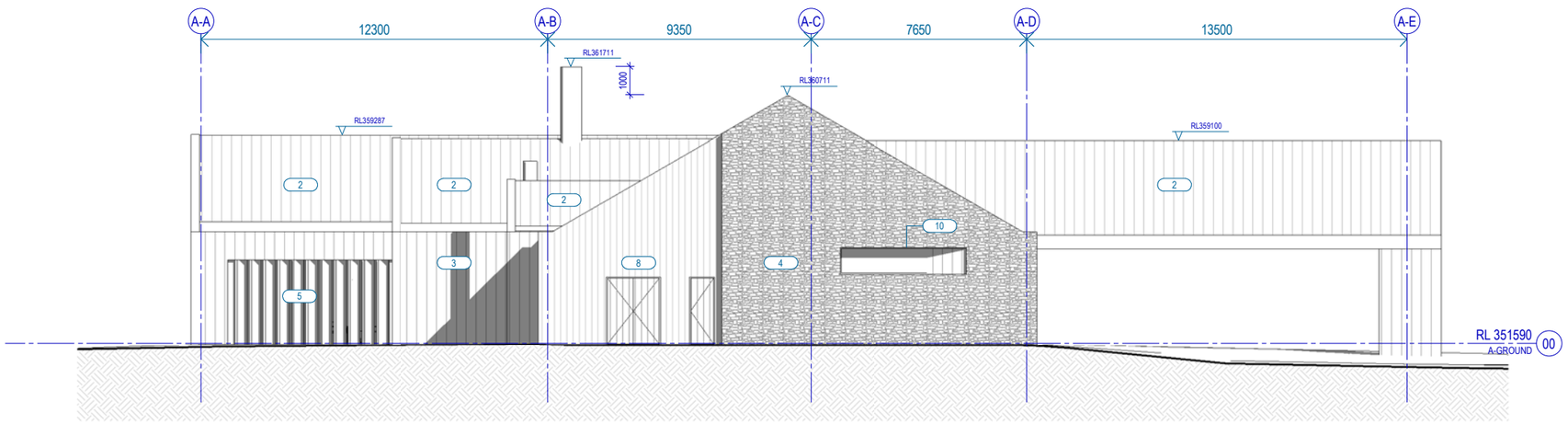
1	STANDING SEAM METAL ROOFING
2	TIMBER SHINGLE ROOFING
3	TIMBER SHINGLE CLADDING
4	STACKED STONE
5	OPERABLE TIMBER LOUVRES
6	MEMBRANE GUTTER
7	POWDERCOATED ALUMINIUM COVER
8	WEB FORGE
9	BLACK POWDERCOATED ALUMUMINIUM JOINERY
10	CHAMFERED STEEL PLATE REVEAL
11	TIMBER SURROUND
12	GRC CLADDING
13	GLAZED JULIET BALUSTRADE
14	TIMBER CLADDING
15	GRC PLANTER BOX
16	STEEL BALUSTRADE
17	TEXTURED PRECAST CONCRETE
18	TIMBER SOFFIT
19	TIMBER RAINSCREEN CLADDING
20	FOLDED METAL CANOPY
21	BIFOLD TIMBER PANELS

KEY PLAN:

07.07 Building A - Elevations

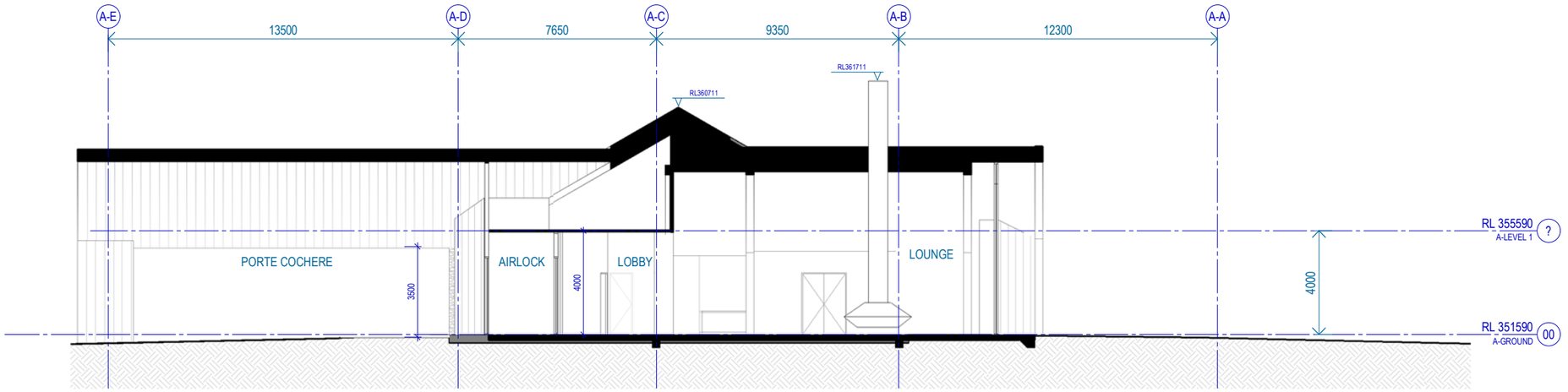


1 A-SOUTH ELEVATION
SCALE 1 : 100

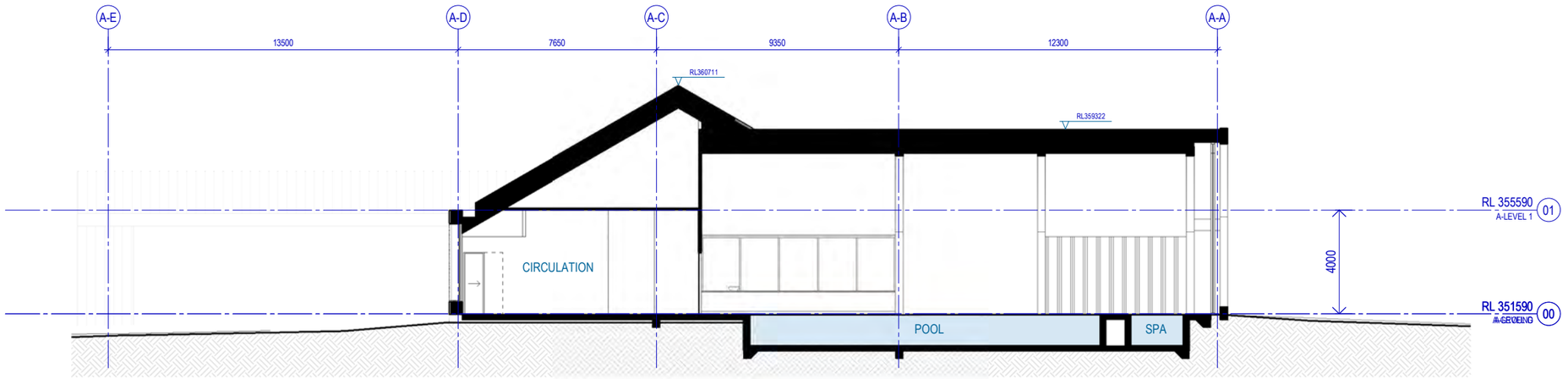


2 A-WEST ELEVATION
SCALE 1 : 100

07.08 Building A - Elevations



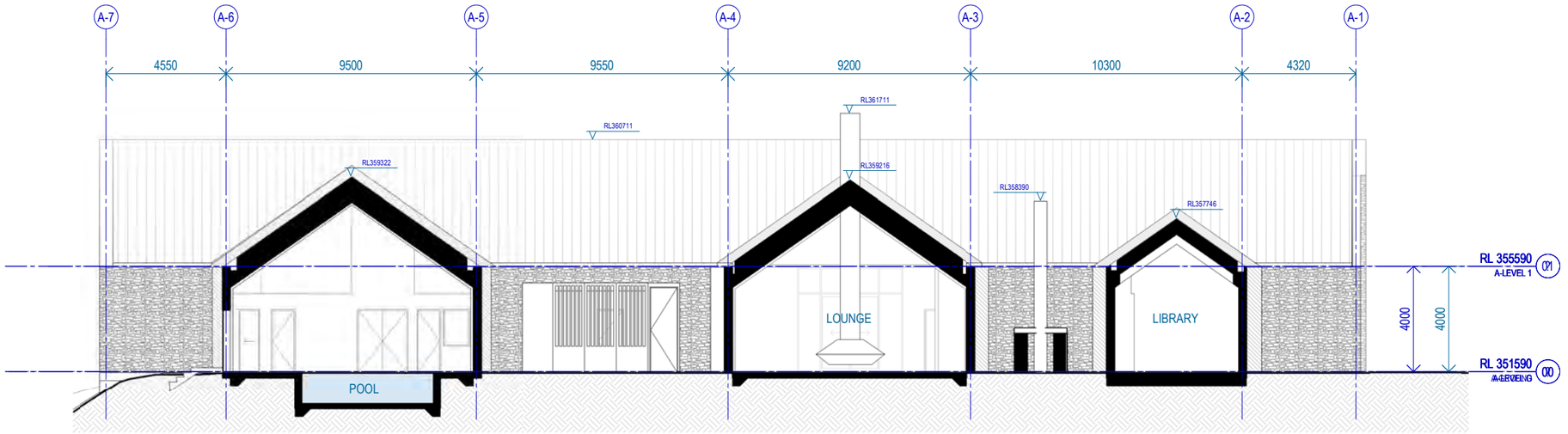
1 A-SECTION (N-S - PORTE COCHERE)
SCALE 1 : 100



2 A-SECTION (N-S - WELLNESS)
SCALE 1 : 100

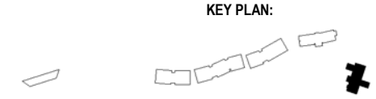
KEY PLAN:

07.09 Building A - Sections



1 A-SECTION (E-W)
SCALE 1 : 100

KEY PLAN:



07.10 Building A - Sections

08

Building B–E

Architectural Concept

08.01 Building B-E Conceptual Response

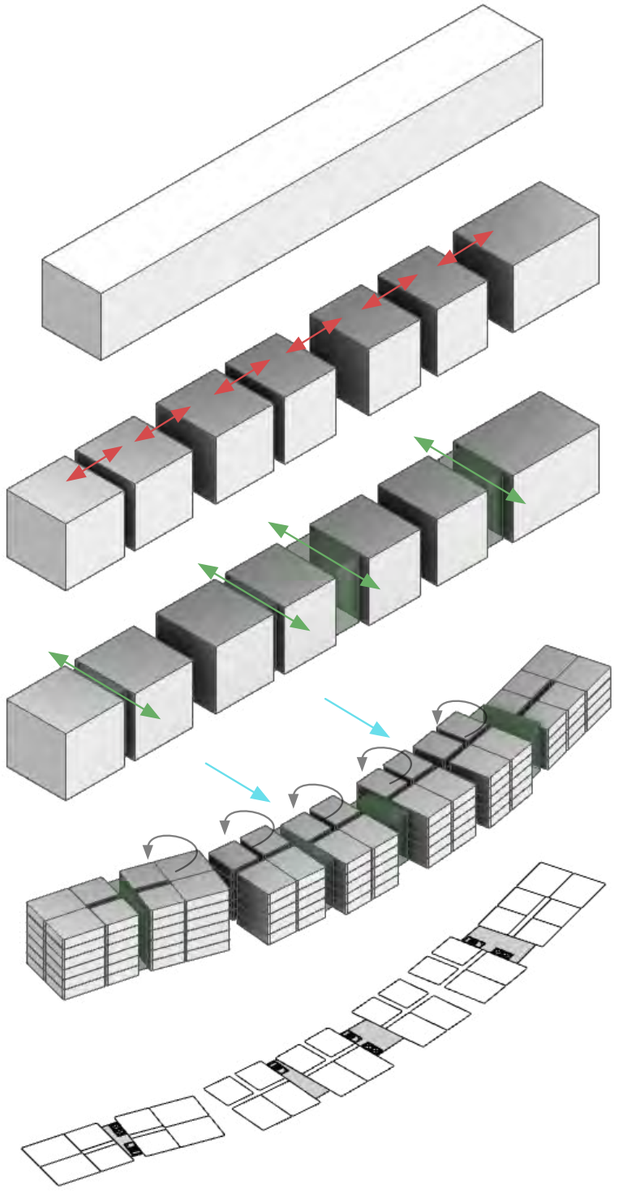
Design Strategy - Residential and High Care (Building B-E)

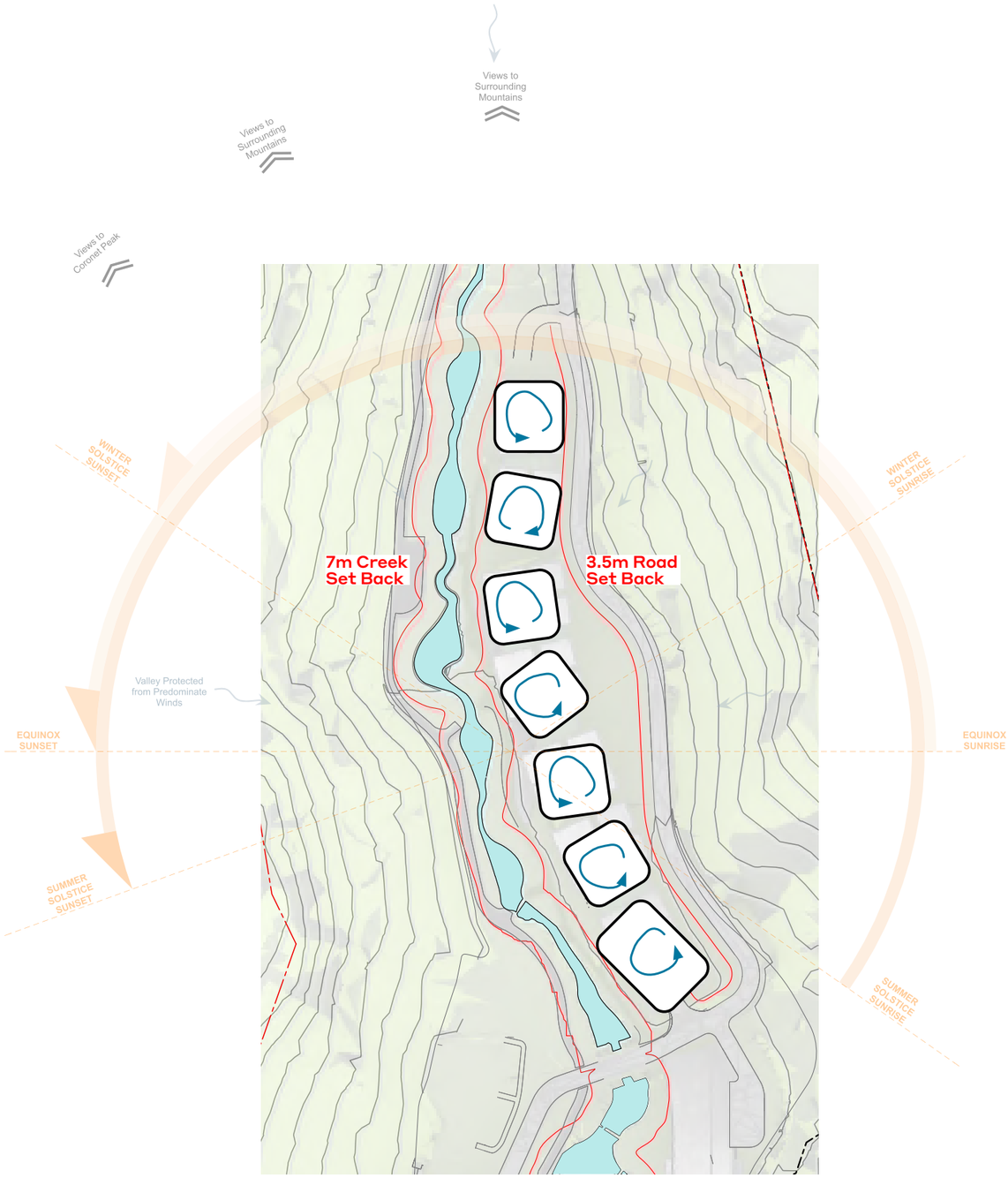
Pure Form

Broken into clusters of communities

Social spaces as glue between communities

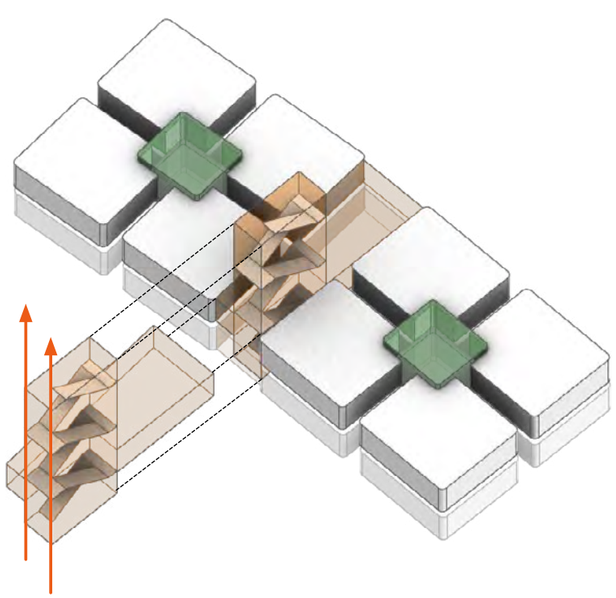
Mass push, pulled and rotated for sun, outlook and topography





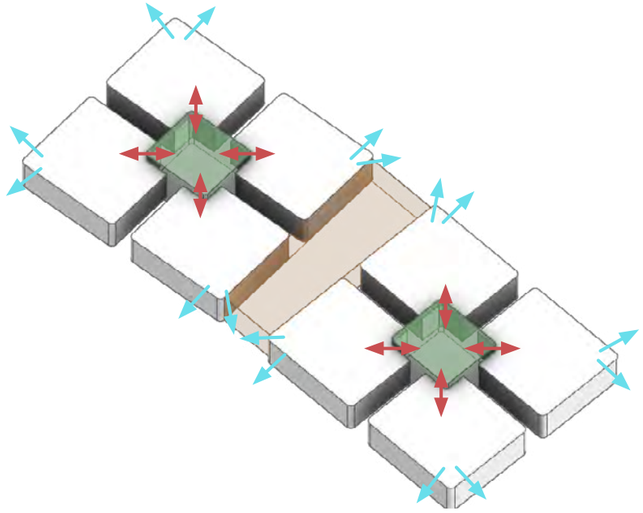
Clusters of homes on site, positioned for sun and outlook

Planning Principles - Every home is celebrated



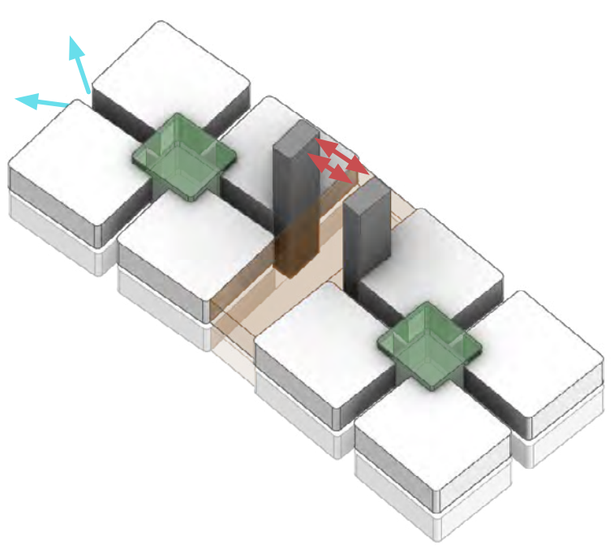
Central Atrium

An atrium space is created with secondary stair as a welcoming space, this promotes the social experience of the building and creates a vertical "stoop", activating a social community whilst drawing landcsape elements into the building.



Apartment Views

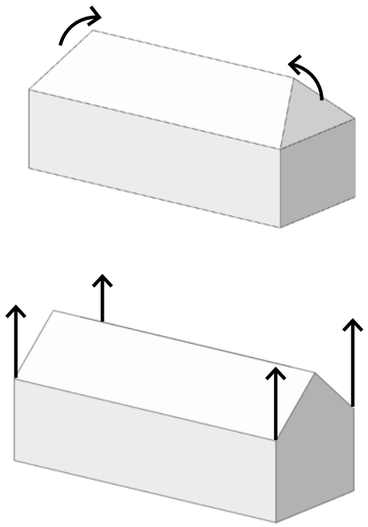
Each unit has dual aspect outlook and opens into a community social space with living on the corners.

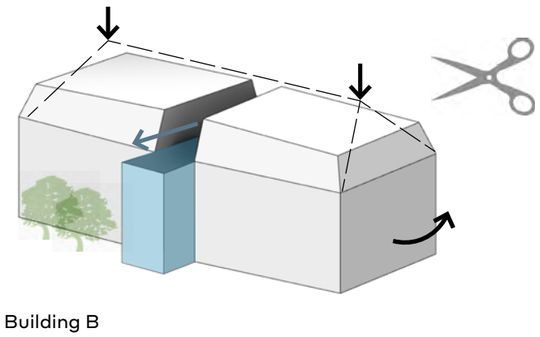


Core & Vertical Circulation

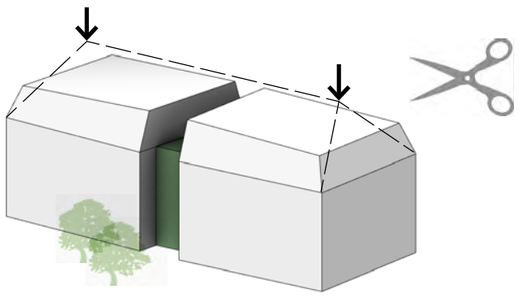
Fire Stair and Lift Cores setting into building form providing pure communal spaces, circulations end in a view outwards.

Design Strategy - Residential, Care and Serviced Apartments (Building B-E)





Building B



Building C-E

Traditional Hipped Form

A traditional hipped roof form is the basis for the articulation of the mass.

The hipped form is extended upwards to accomodate the required yield. The increased scaling of the traditional form becomes the point of departure for further development.

Massing is Shaped to Constraints

A tapering of the resultant mansard roof further reduces the overall builk of the form.

The central atrium becomes recessed or projected between apartment wings to emphasis the point of entry while drawing landscape elements into the building.

Building Elements

The combination of bold form and consistent material section heightens the ‘sculptural’ concept of the scheme.

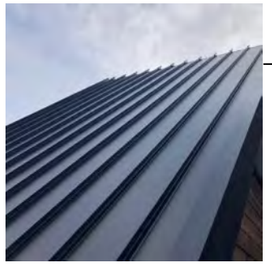
Consistent treatment of window openings & balcony creates texture across the facade and reduces scale.

Application of timber cladding into balcony spaces alongside the use of warm materials to window surrounds provides increased texture and intimacy to the building where residents engage with architectural elements

08.02 Buildings B-D Materiality & Facade Principles

Residential & High Care (Buildings B-E)

Standing seam metal roofing_



Timber cladding_

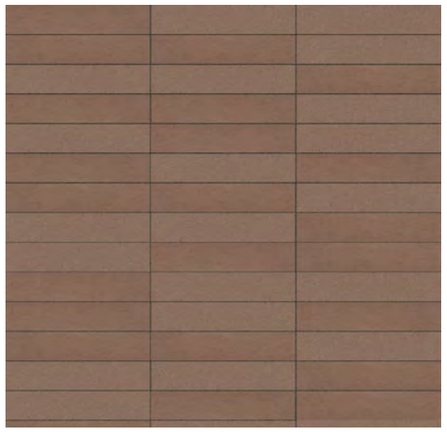
GRC panels_

Timber surrounds_

08.03 Building B-E - 3D Visualisation

08.04 Facade Strategy

Facade Colour and Pattern Strategy



Oak

Oko Glassfibre Reinforced Concrete Panels

TI03

Matt

Ferro Light

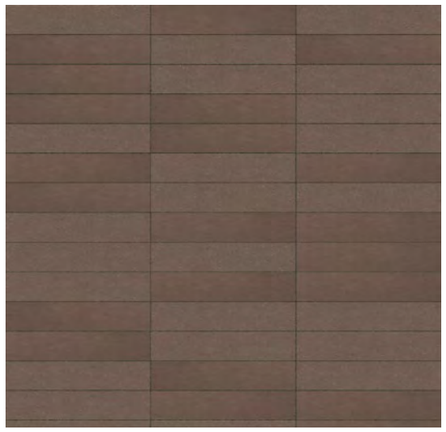
Terra

Oko Glassfibre Reinforced Concrete Panels

TI01

Matt

Ferro Light



Walnut

Oko Glassfibre Reinforced Concrete Panels

TI04

Matt

Ferro Light

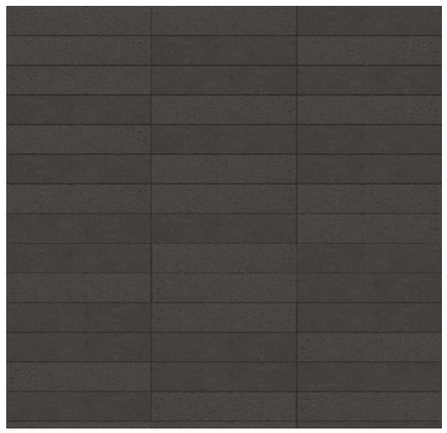
Ebony

Oko Glassfibre Reinforced Concrete Panels

TI05

Matt

Ferro Light



Liquid Black

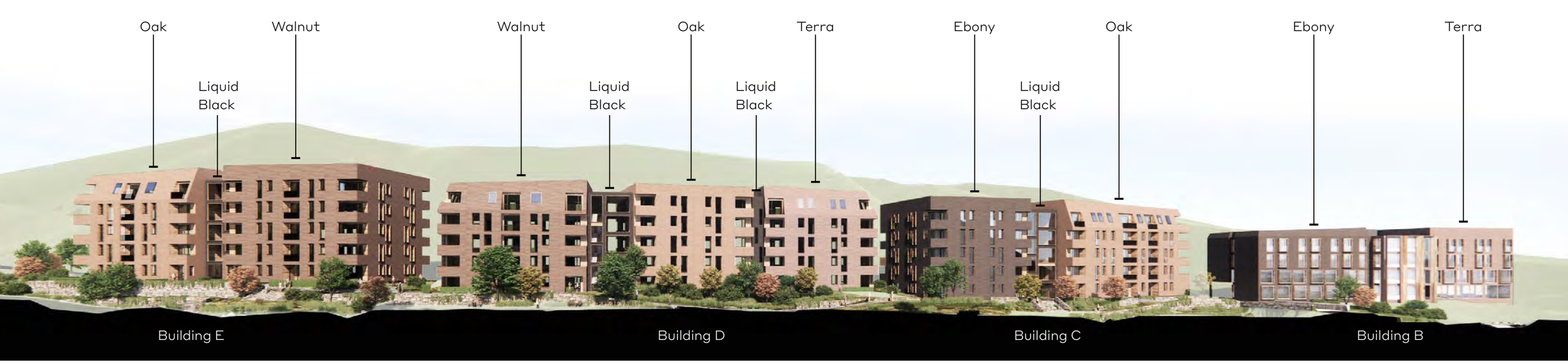
Oko Glassfibre Reinforced Concrete Panels

GR07

Matt

Ferro Light

08.02 Materiality & Facade Perspective Elevation



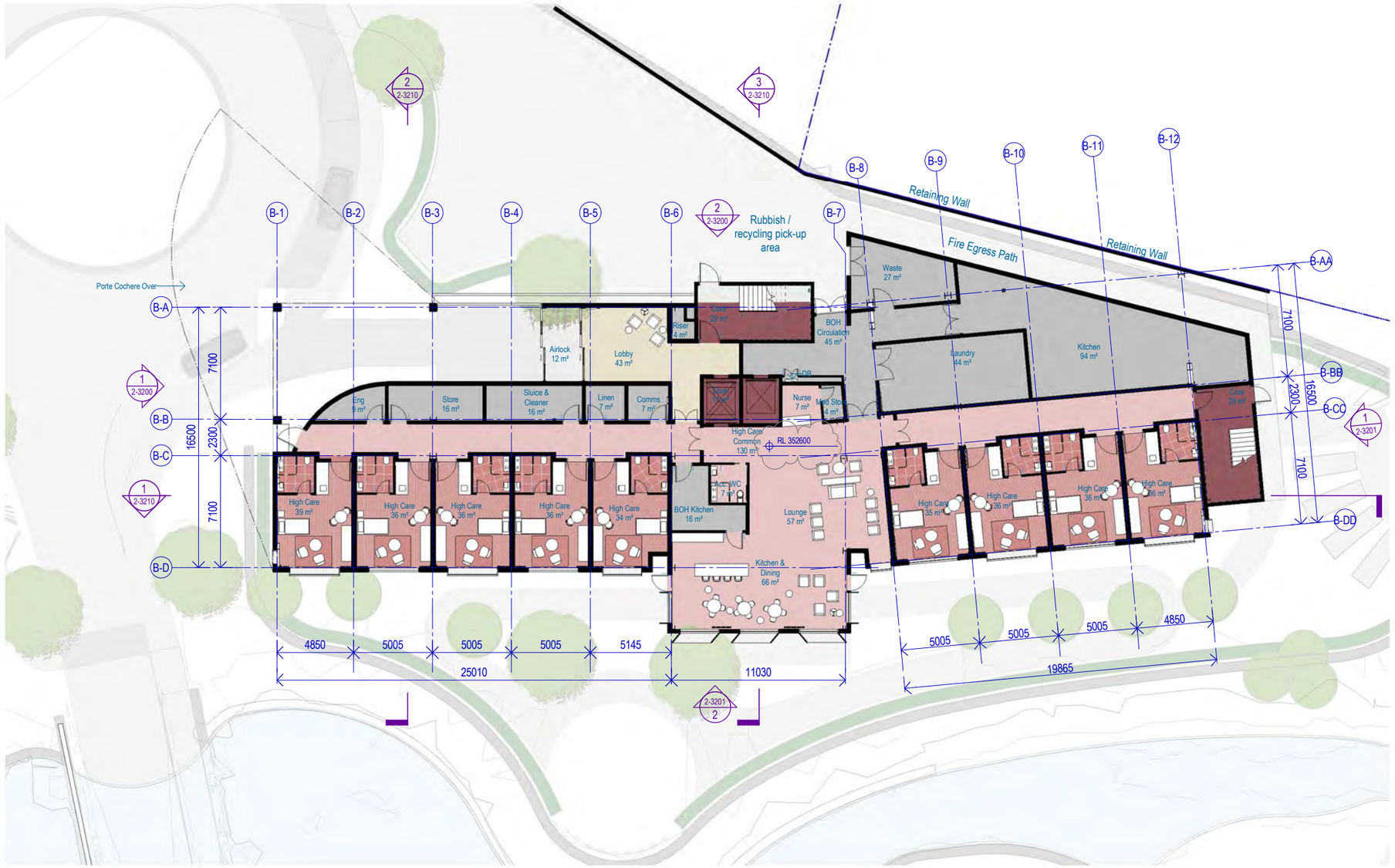
09

Building B

Care Apartments

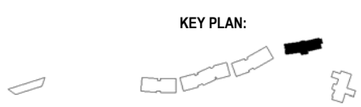
Serviced Apartments

LtO Apartments



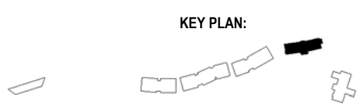
09.01 Building B - Level G (Care Apartments)

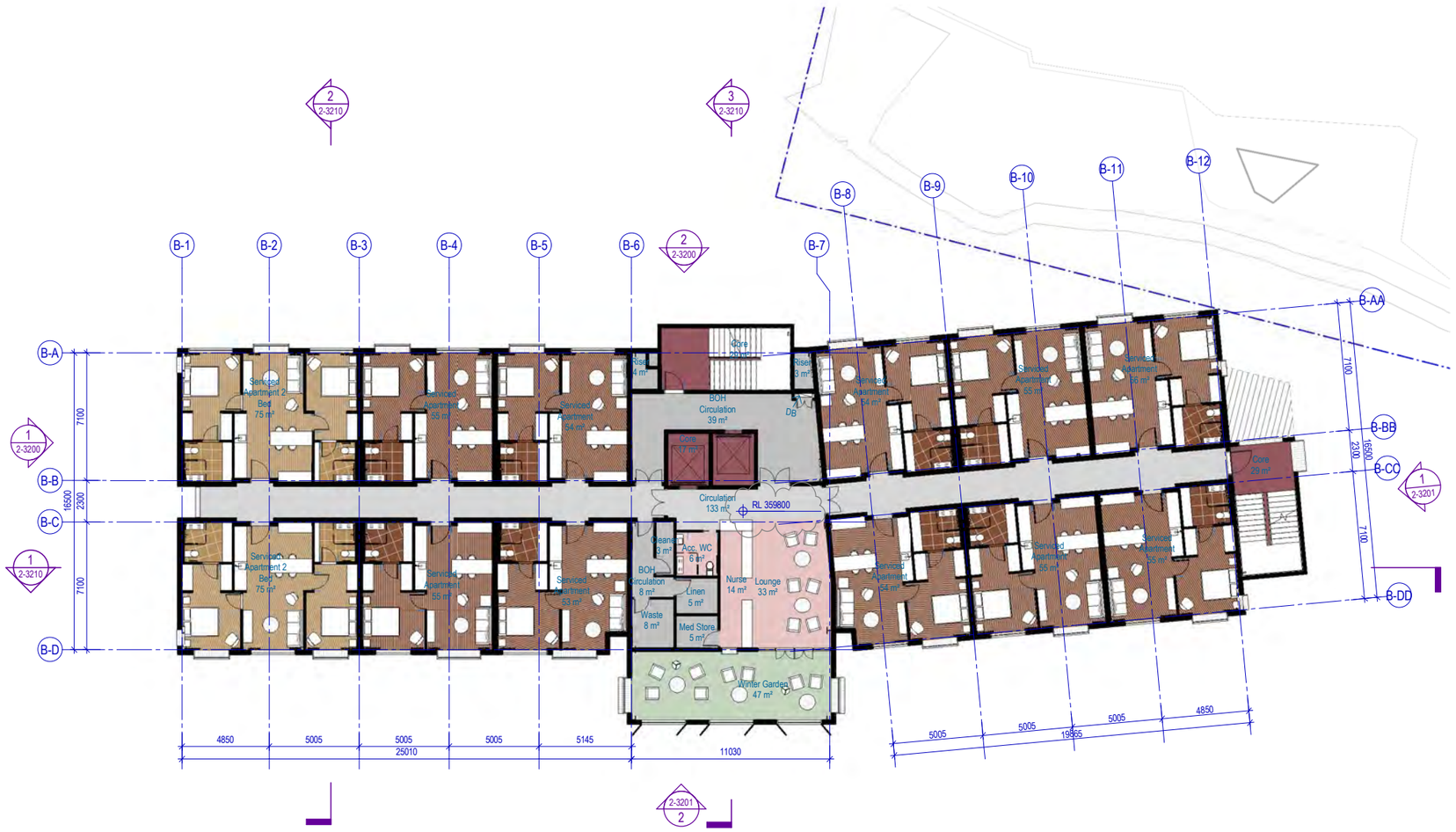
KEY PLAN:



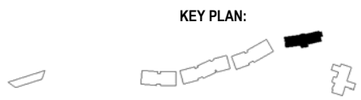
09.02 Building B - Level 01 (Care Apartments)

KEY PLAN:





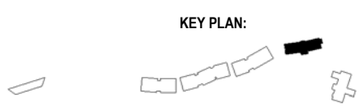
KEY PLAN:

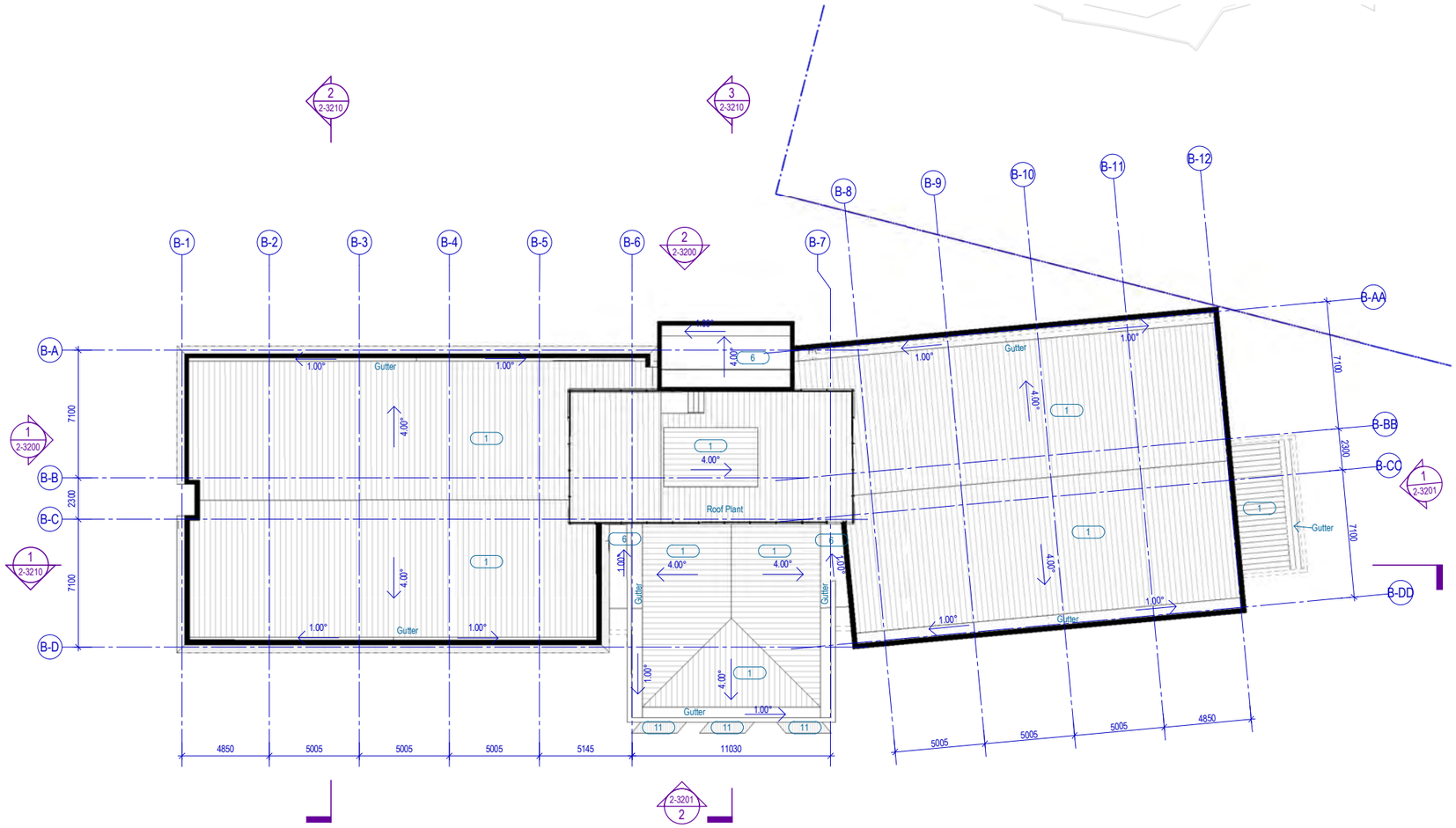


09.03 Building B - Levels 02 (Serviced Apartments)

09.04 Building B - Level 03 (LtO Apartments)

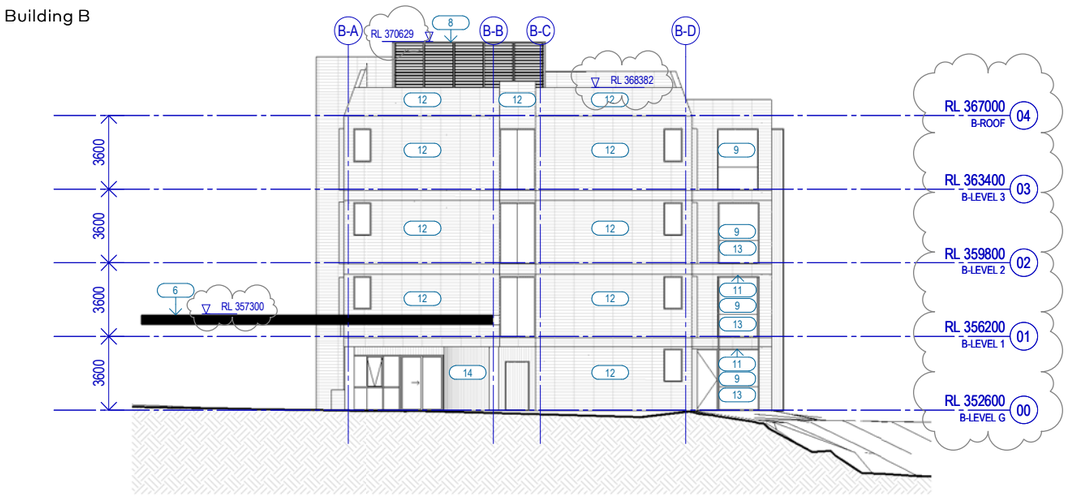
KEY PLAN:



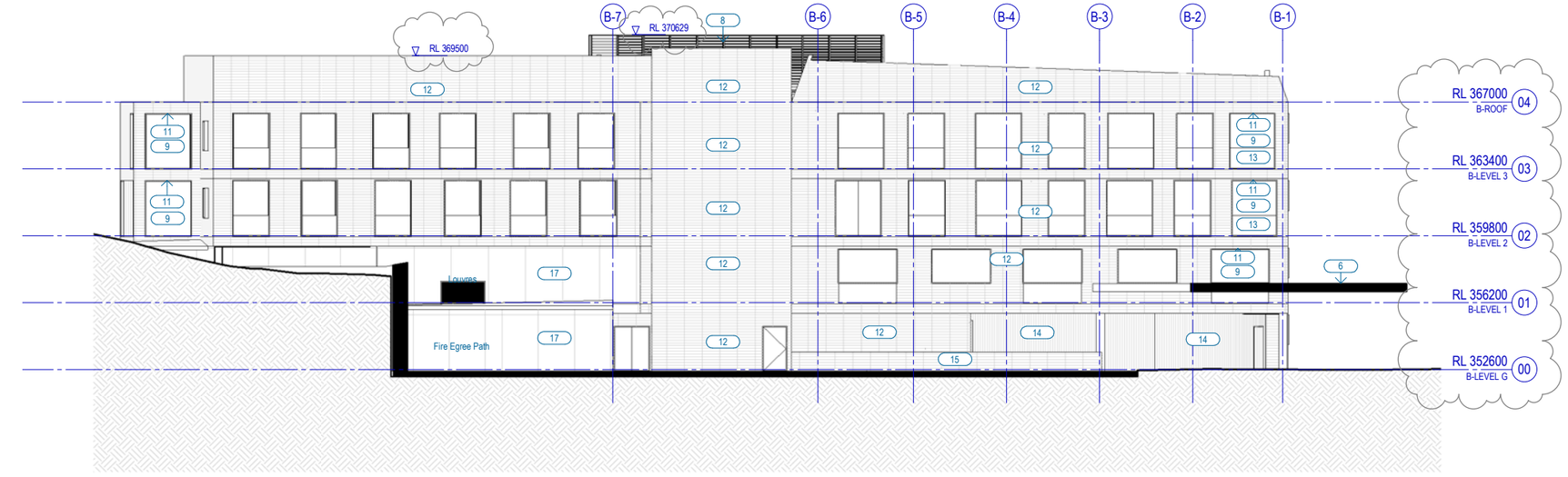


09.05 Building B - Roof Plan

KEY PLAN:



1 B-NORTH ELEVATION
SCALE 1 : 150



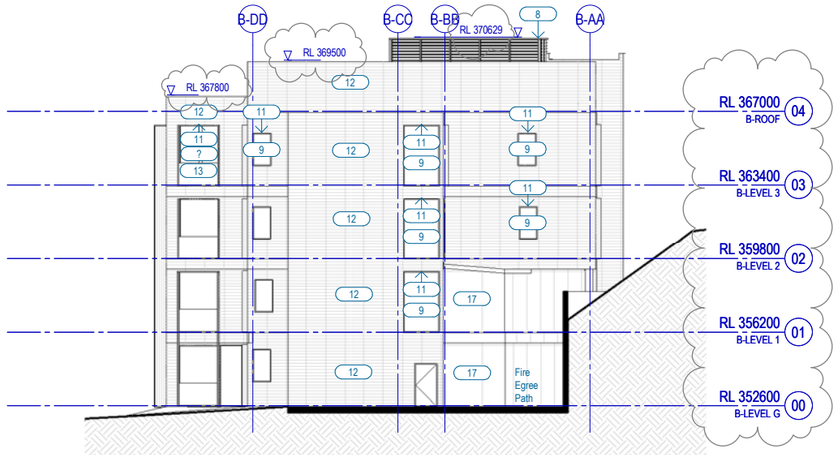
2 B-EAST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

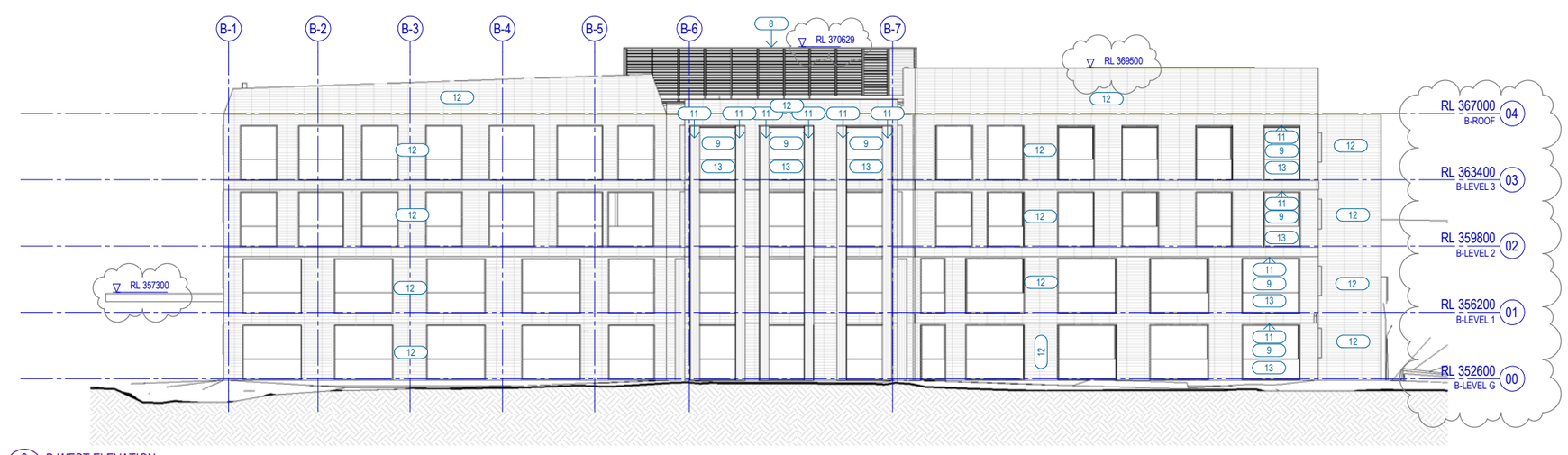
1	STANDING SEAM METAL ROOFING
2	TIMBER SHINGLE ROOFING
3	TIMBER SHINGLE CLADDING
4	STACKED STONE
5	OPERABLE TIMBER LOUVRES
6	MEMBRANE GUTTER
7	POWDERCOATED ALUMINIUM COVER
8	WEB FORGE
9	BLACK POWDERCOATED ALUMUMINIUM JOINERY
10	CHAMFERED STEEL PLATE REVEAL
11	TIMBER SURROUND
12	GRC CLADDING
13	GLAZED JULIET BALUSTRADE
14	TIMBER CLADDING
15	GRC PLANTER BOX
16	STEEL BALUSTRADE
17	TEXTURED PRECAST CONCRETE
18	TIMBER SOFFIT
19	TIMBER RAINSCREEN CLADDING
20	FOLDED METAL CANOPY
21	BIFOLD TIMBER PANELS

KEY PLAN:

09.06 Building B - Elevations



1 B-SOUTH ELEVATION
SCALE 1 : 150



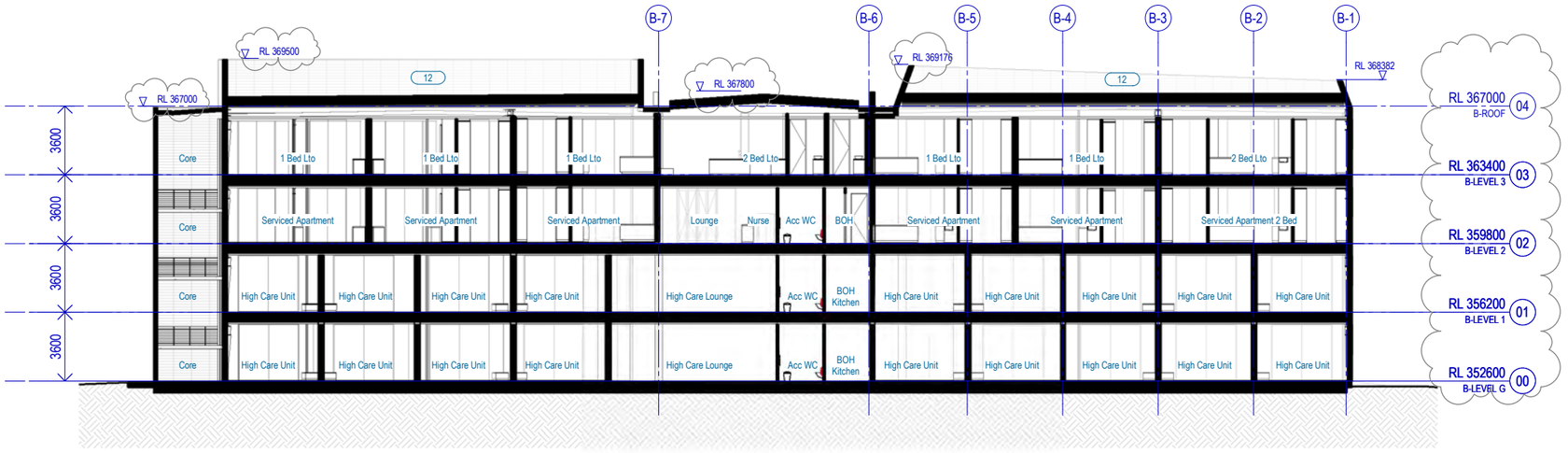
2 B-WEST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

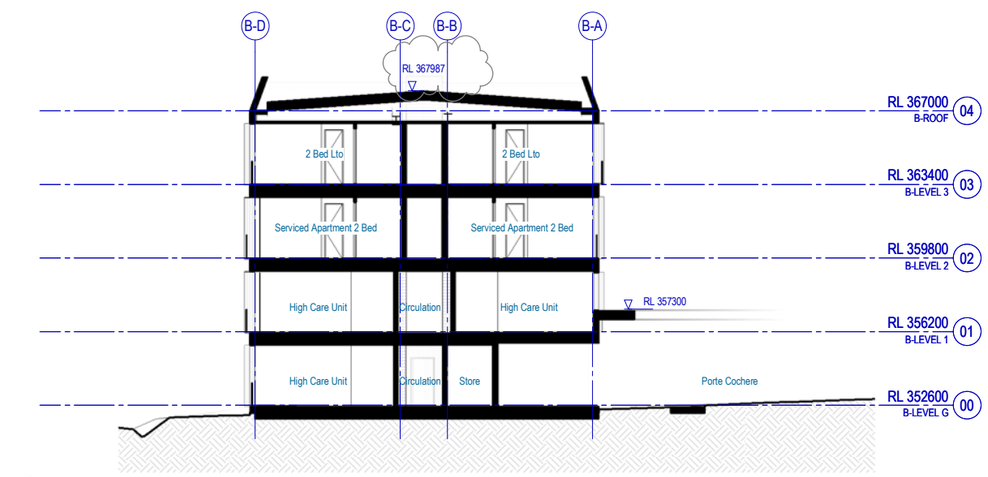
1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

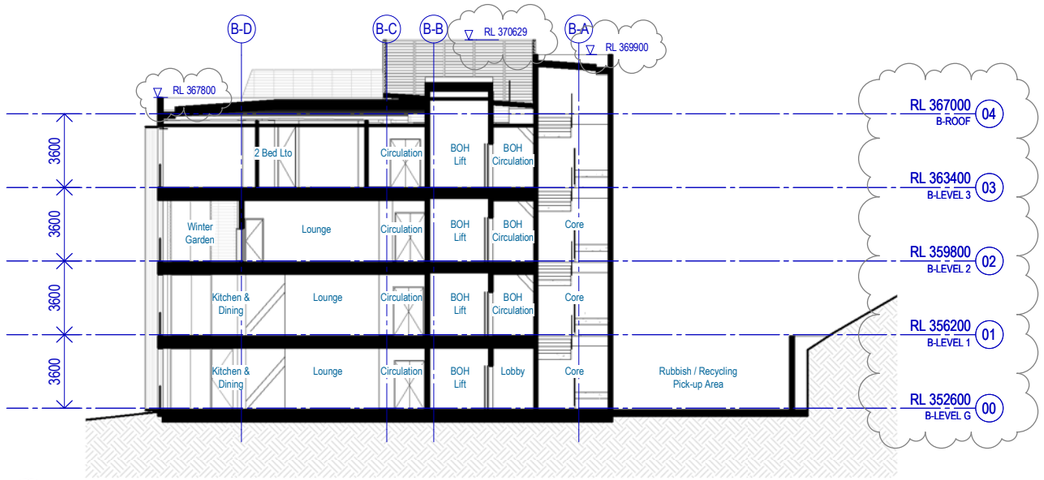
09.07 Building B - Elevations



1 B-SECTION
SCALE 1 : 150



2 B-SECTION 1
SCALE 1 : 150



3 B-SECTION 2
SCALE 1 : 150

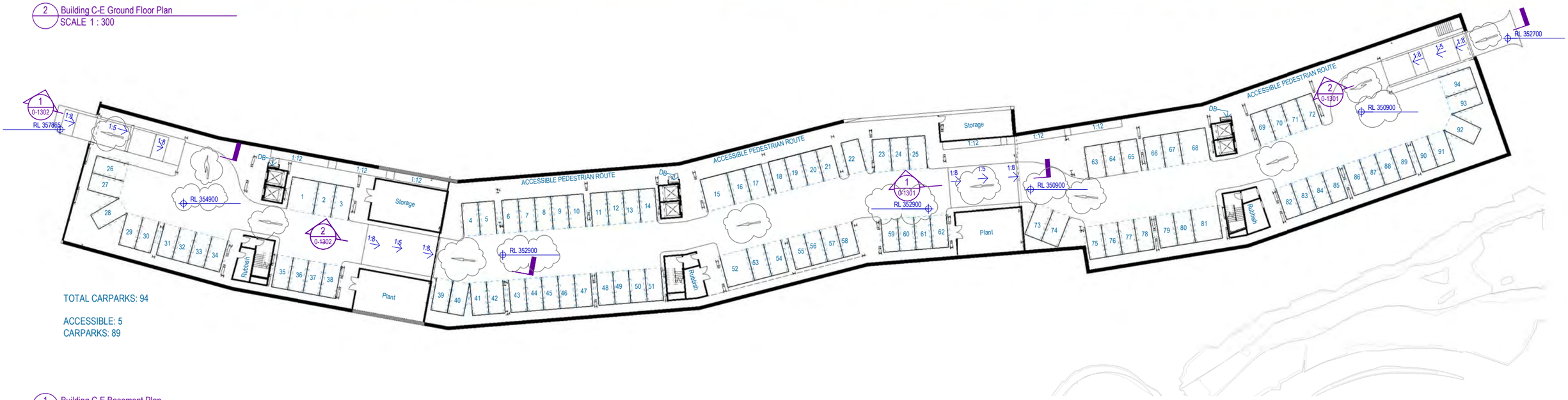
KEY PLAN:

09.08 Building B - Sections

10

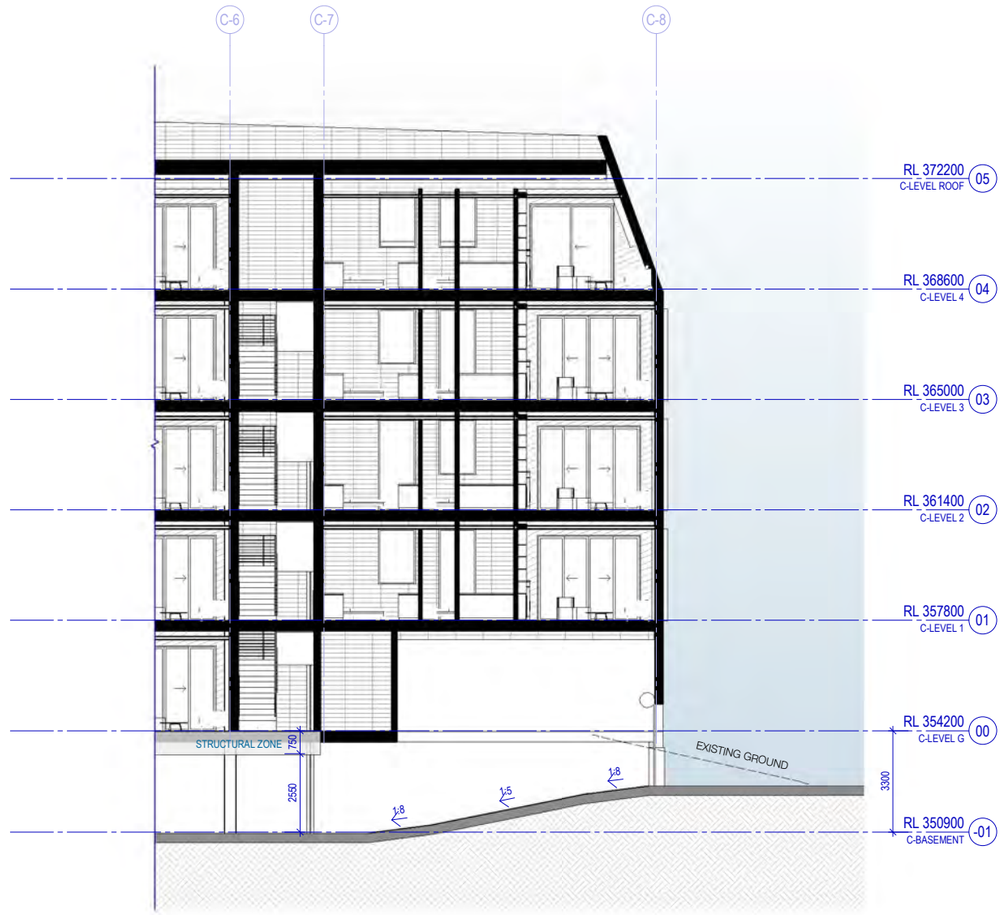
Building C - E Basement

Carparking



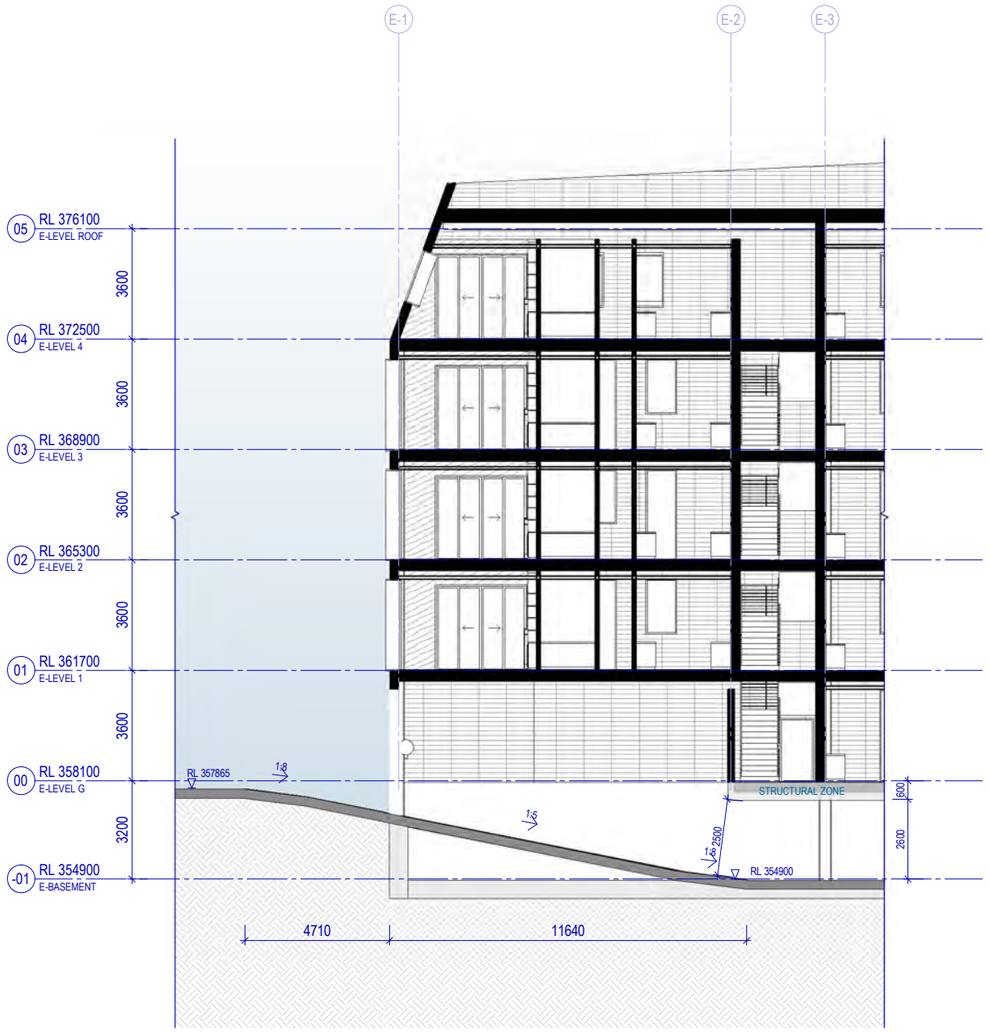
10.01 Basement Plan (Under Building C-E)

1 Building C-D Basement Ramp Section
SCALE 1 : 100



2 Building C Basement Entry Ramp Section
SCALE 1 : 100

10.02 Basement Sections



1 Building E Basement Entry Ramp Section
SCALE 1 : 100

2 Building D-E Basement Ramp Section
SCALE 1 : 100

10.03 Basement Sections

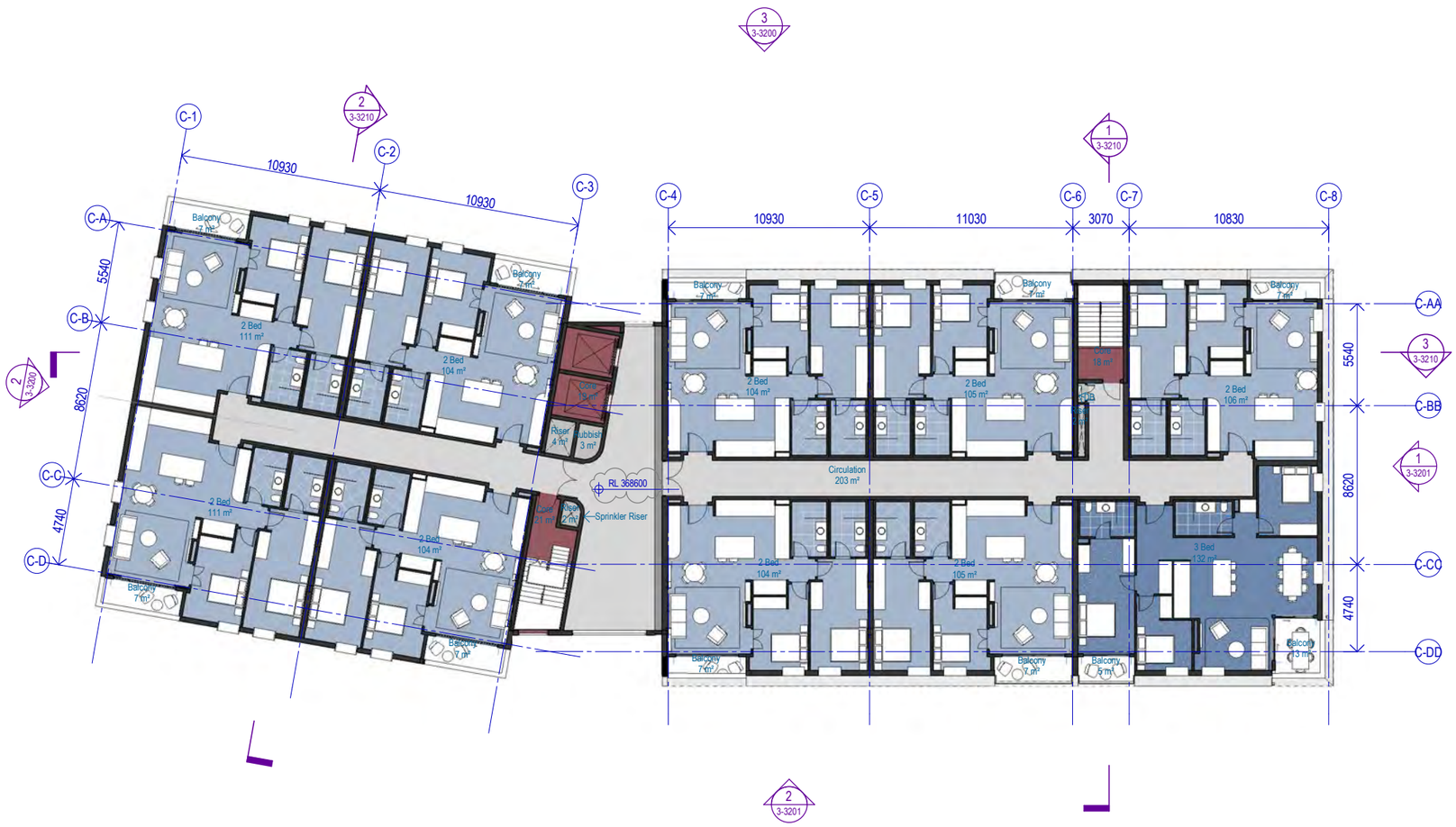
11

Building C

LtO Apartments

KEY PLAN:

11.01 Building C - Level G

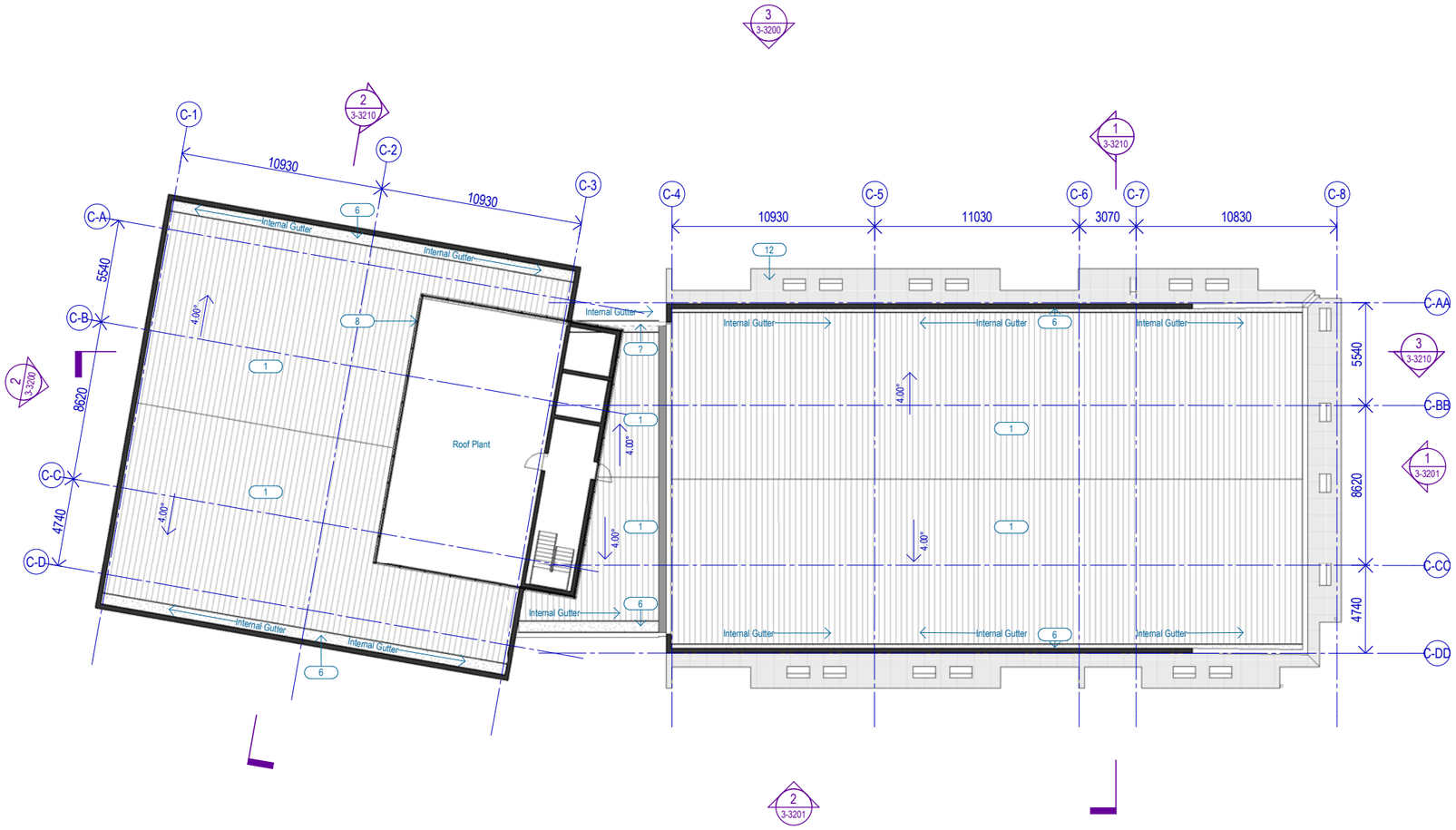


KEY PLAN:

11.02 Building C - Levels 01-03

KEY PLAN:

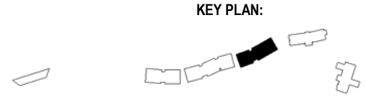
11.03 Building C - Level 04



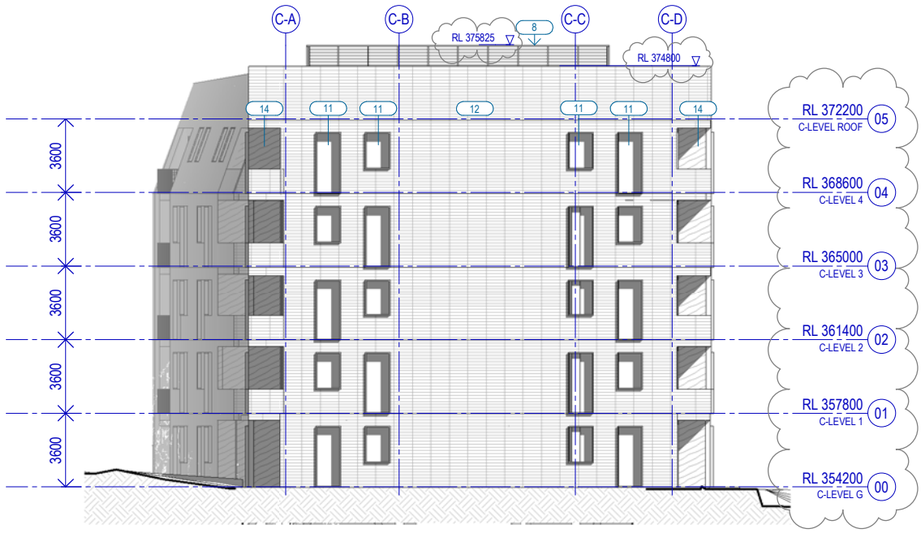
MATERIALS LEGEND:

1	STANDING SEAM METAL ROOFING
2	TIMBER SHINGLE ROOFING
3	TIMBER SHINGLE CLADDING
4	STACKED STONE
5	OPERABLE TIMBER LOUVRES
6	MEMBRANE GUTTER
7	POWDERCOATED ALUMINIUM COVER
8	WEB FORGE
9	BLACK POWDERCOATED ALUMUMINIUM JOINERY
10	CHAMFERED STEEL PLATE REVEAL
11	TIMBER SURROUND
12	GRC CLADDING
13	GLAZED JULIET BALUSTRADE
14	TIMBER CLADDING
15	GRC PLANTER BOX
16	STEEL BALUSTRADE
17	TEXTURED PRECAST CONCRETE
18	TIMBER SOFFIT
19	TIMBER RAINSCREEN CLADDING
20	FOLDED METAL CANOPY
21	BIFOLD TIMBER PANELS

KEY PLAN:



11.04 Building C - Roof Plan



2 C-NORTH ELEVATION
SCALE 1 : 150

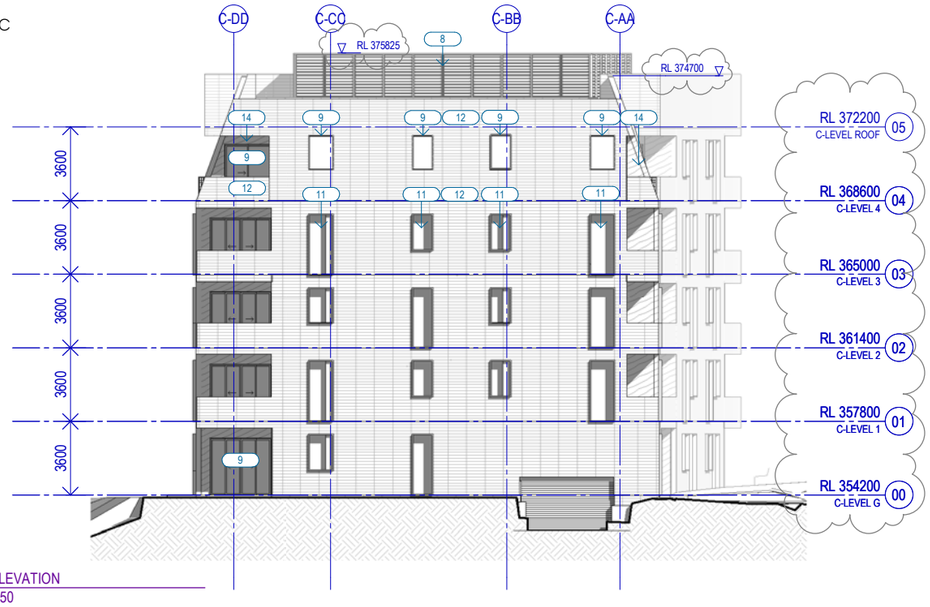
3 C-EAST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

11.05 Building C - Elevations



1 C-SOUTH ELEVATION
SCALE 1 : 150

2 C-WEST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
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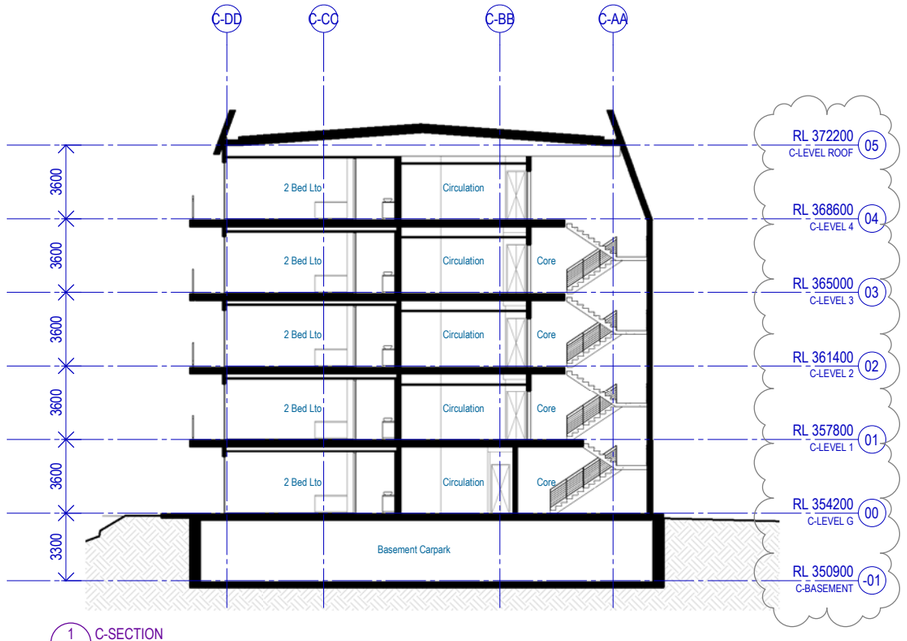
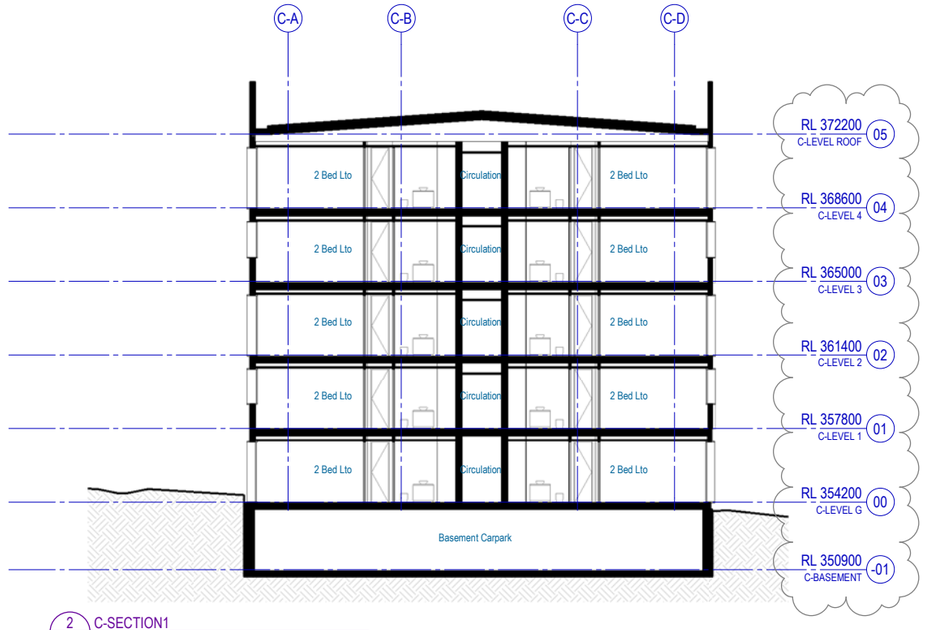
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

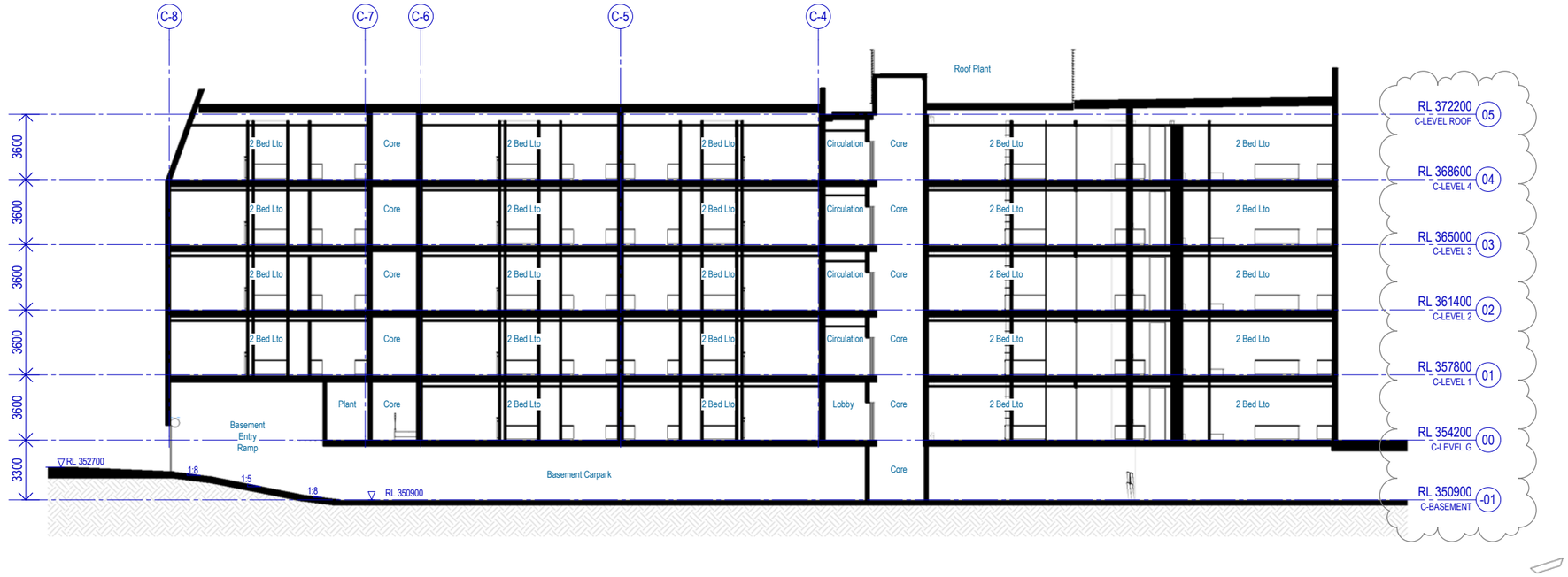
11.06 Building C - Elevations



1 C-SECTION
SCALE 1 : 150



2 C-SECTION1
SCALE 1 : 150



3 C-SECTION2
SCALE 1 : 150

KEY PLAN:

11.07 Building C - Sections

12

Building D

LtO Apartments

KEY PLAN:

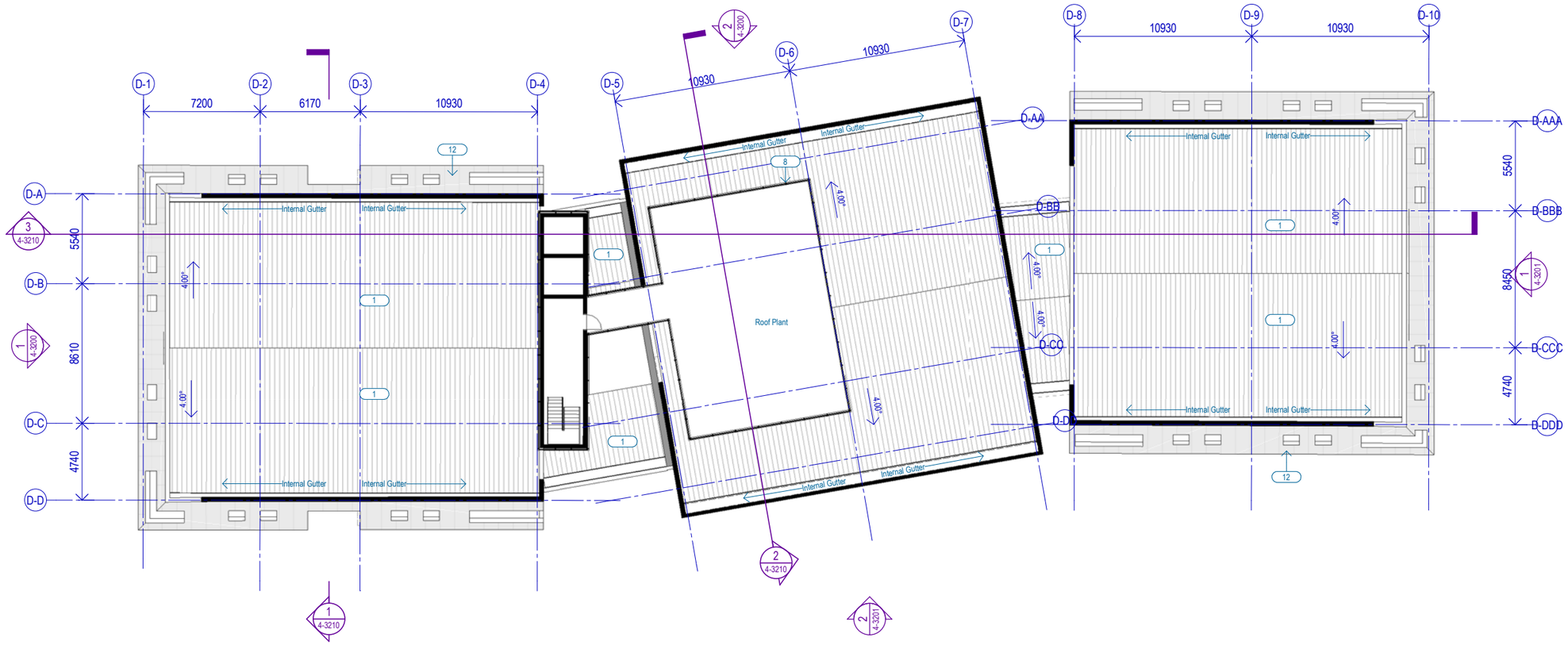
12.01 Building D - Level G

KEY PLAN:

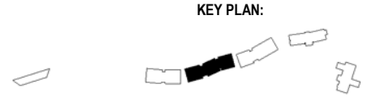
12.02 Building D - Levels 01-03

KEY PLAN:

12.03 Building D - Level 04



KEY PLAN:



12.04 Building D - Roof Plan

1 D-NORTH ELEVATION
SCALE 1 : 150

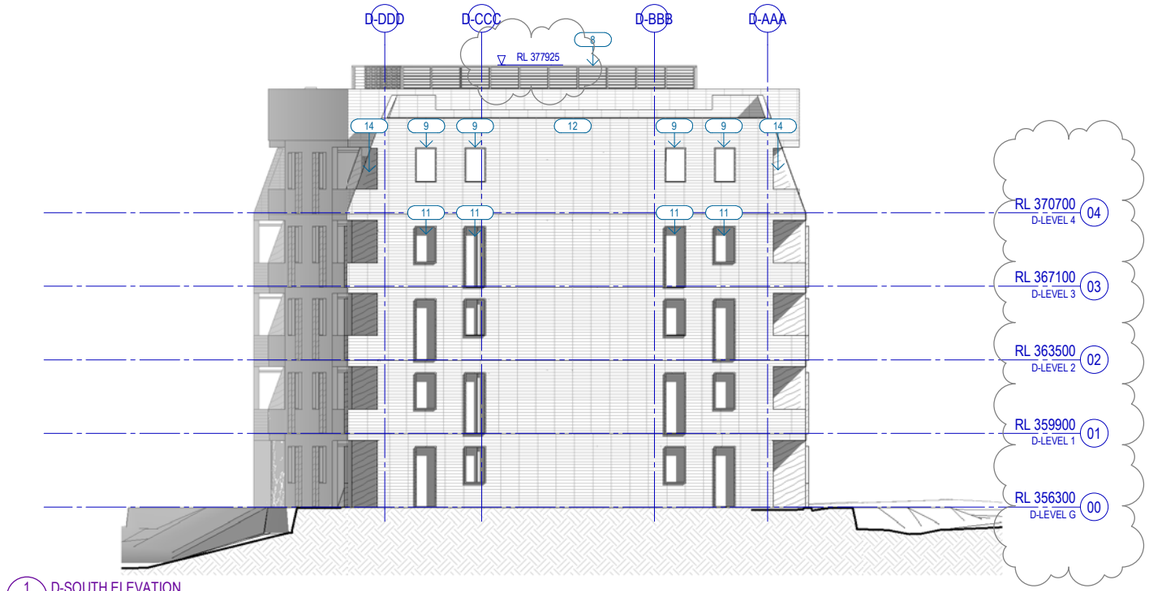
2 D-EAST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

12.05 Building D - Elevations



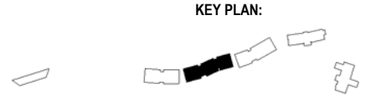
1 D-SOUTH ELEVATION
SCALE 1 : 150

2 D-WEST ELEVATION
SCALE 1 : 150

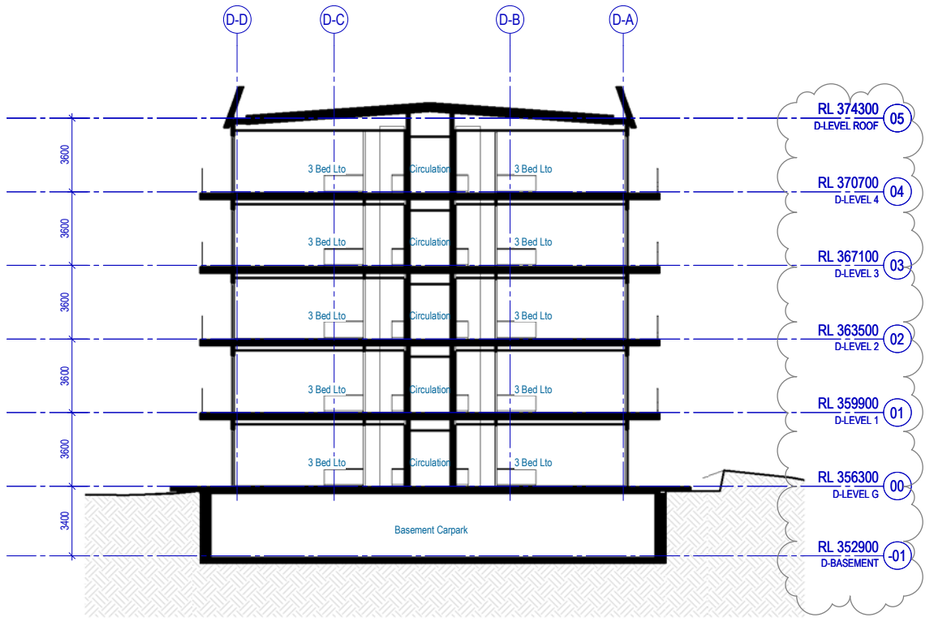
MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

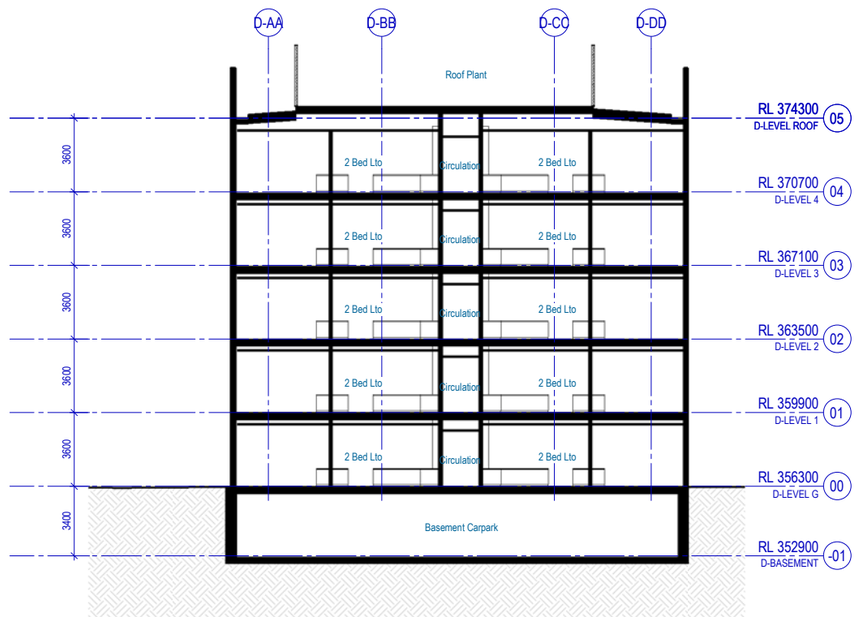
KEY PLAN:



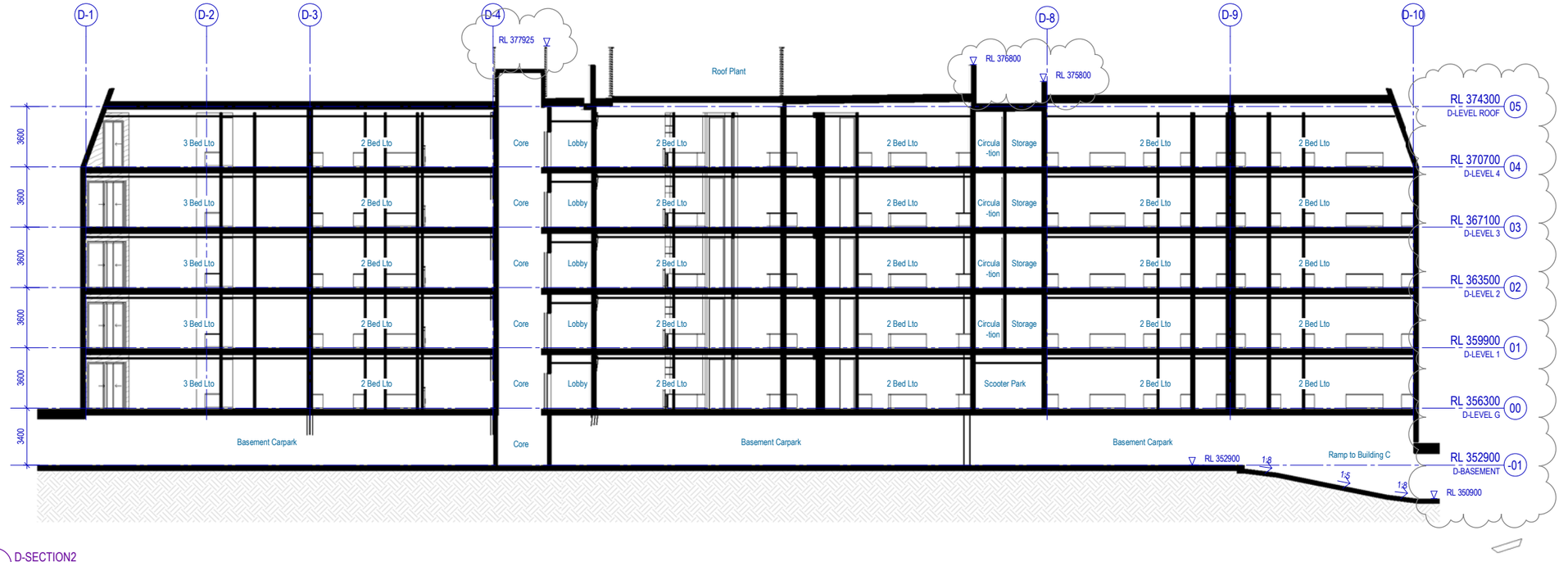
12.06 Building D - Elevations



1 D-SECTION
SCALE 1 : 150



2 D-SECTION1
SCALE 1 : 150



3 D-SECTION2
SCALE 1 : 150

KEY PLAN:

12.07 Building D - Sections

13

Building E

LtO Apartments

KEY PLAN:

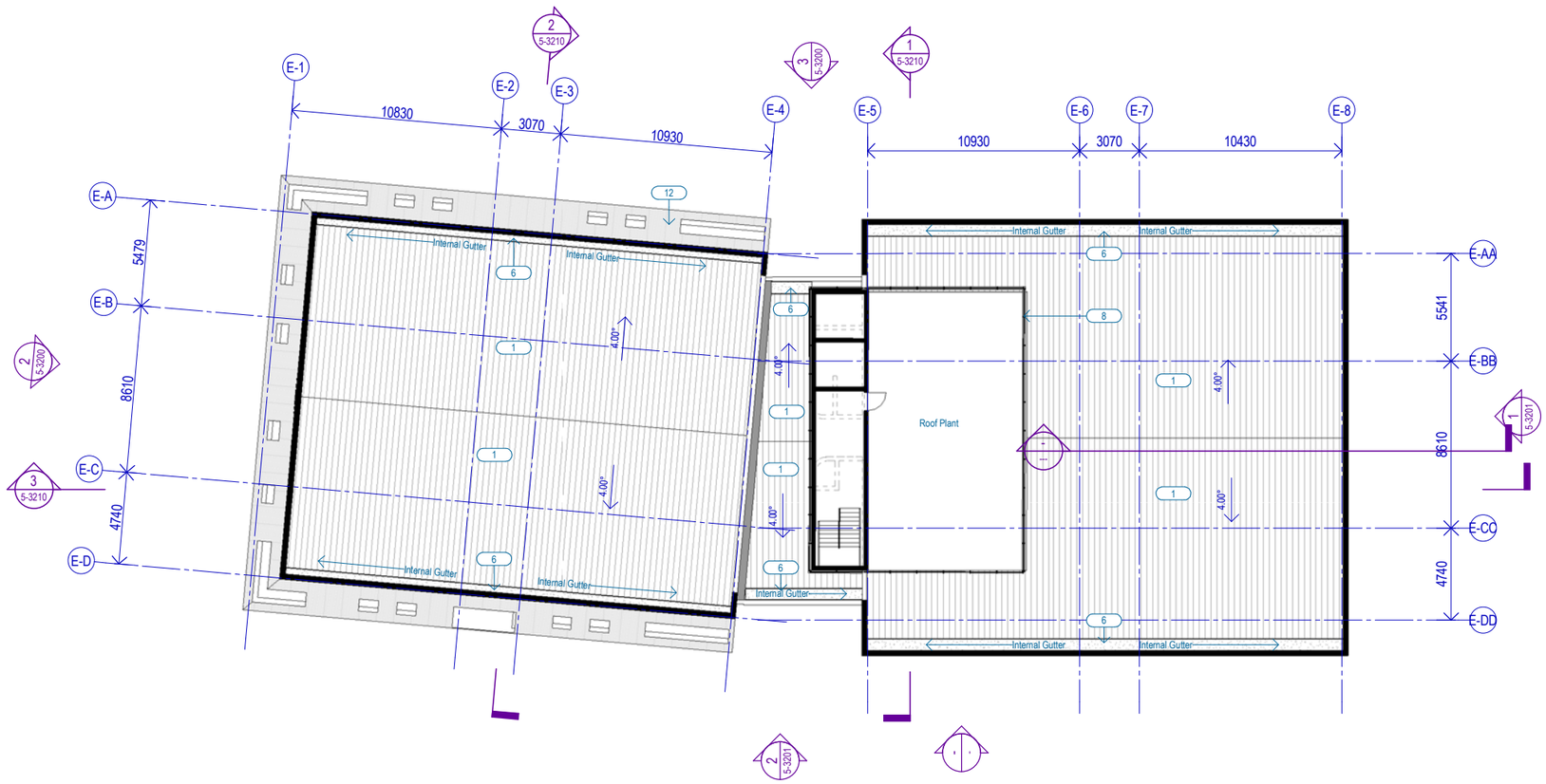
13.01 Building E - Level G

KEY PLAN:

13.02 Building E - Level 01-03

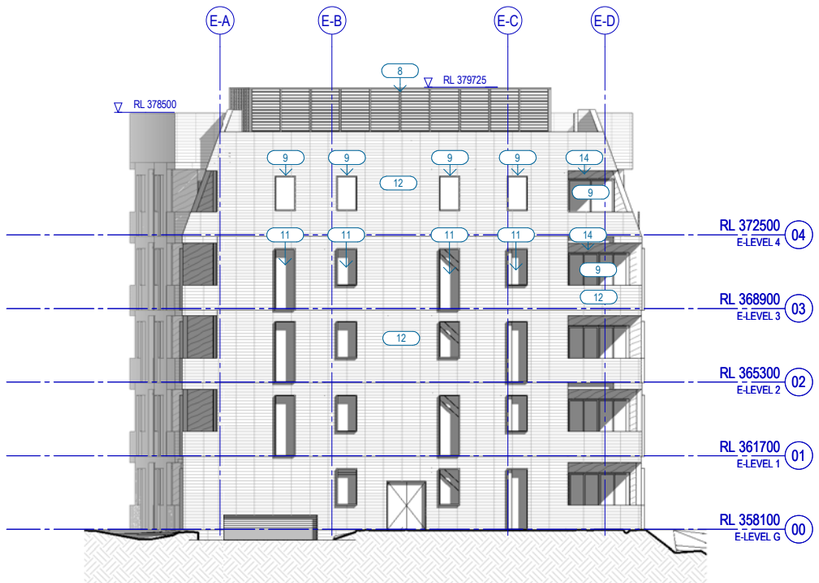
KEY PLAN:

13.03 Building E - Level 04



KEY PLAN:

13.04 Building E - Roof Plan



2 E-NORTH ELEVATION
SCALE 1 : 150

3 E-EAST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
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12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

13.05 Building E - Elevations

1 E-SOUTH ELEVATION
SCALE 1 : 150

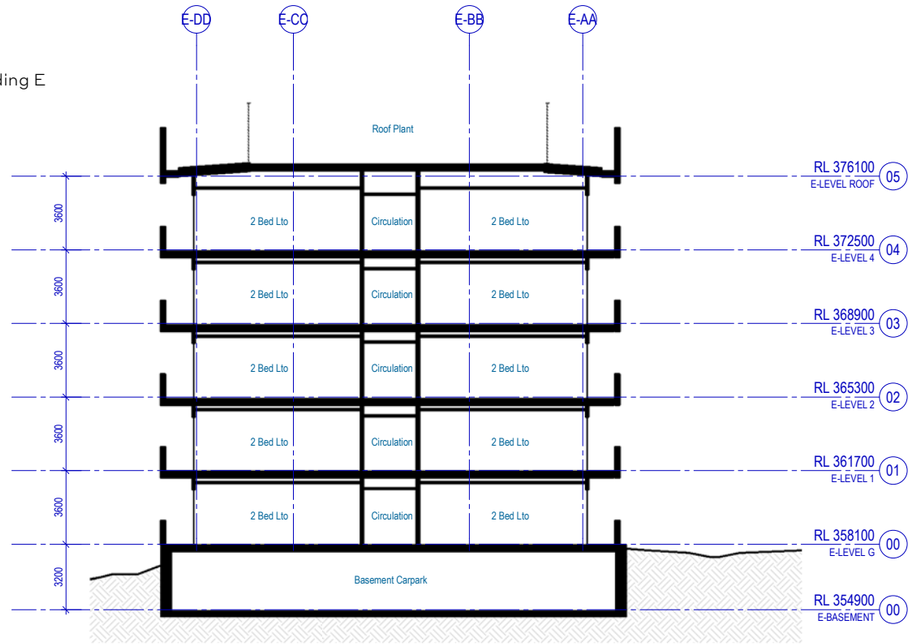
2 E-WEST ELEVATION
SCALE 1 : 150

MATERIALS LEGEND:

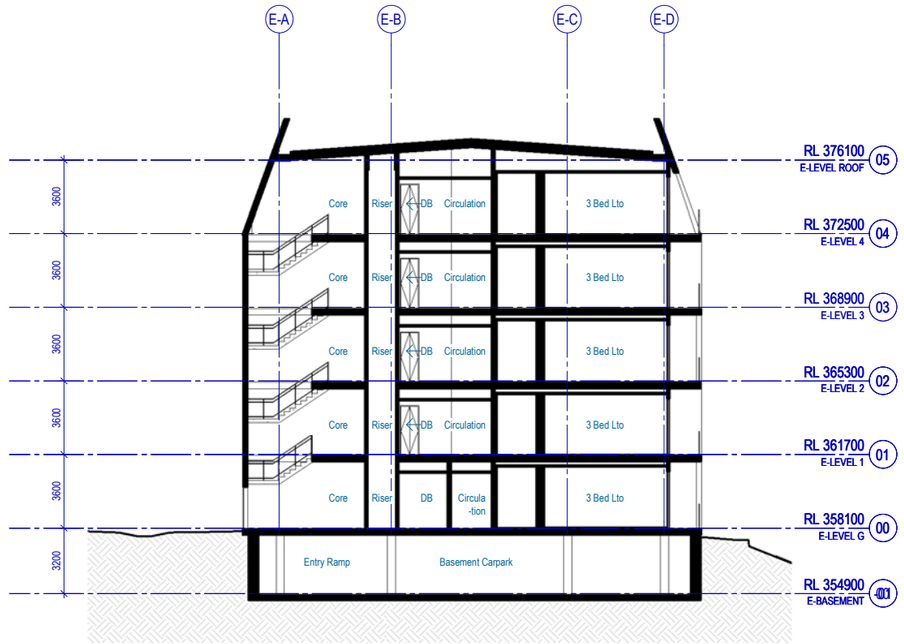
1	STANDING SEAM METAL ROOFING
2	TIMBER SHINGLE ROOFING
3	TIMBER SHINGLE CLADDING
4	STACKED STONE
5	OPERABLE TIMBER LOUVRES
6	MEMBRANE GUTTER
7	POWDERCOATED ALUMINIUM COVER
8	WEB FORGE
9	BLACK POWDERCOATED ALUMUMINIUM JOINERY
10	CHAMFERED STEEL PLATE REVEAL
11	TIMBER SURROUND
12	GRC CLADDING
13	GLAZED JULIET BALUSTRADE
14	TIMBER CLADDING
15	GRC PLANTER BOX
16	STEEL BALUSTRADE
17	TEXTURED PRECAST CONCRETE
18	TIMBER SOFFIT
19	TIMBER RAINSCREEN CLADDING
20	FOLDED METAL CANOPY
21	BIFOLD TIMBER PANELS

KEY PLAN:

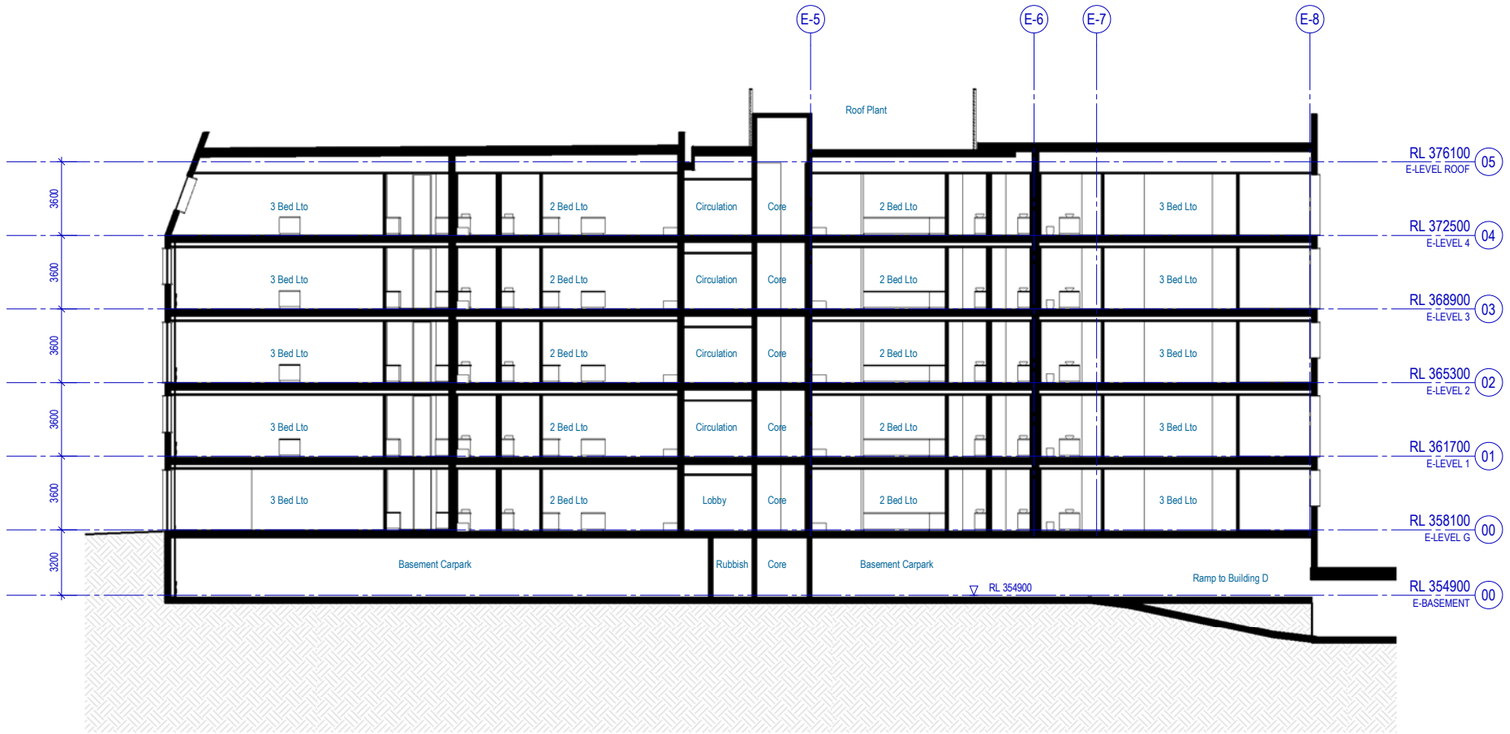
13.06 Building E - Elevations



1 E-SECTION
SCALE 1 : 150



2 E-SECTION1
SCALE 1 : 150



3 E-SECTION2
SCALE 1 : 150

MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

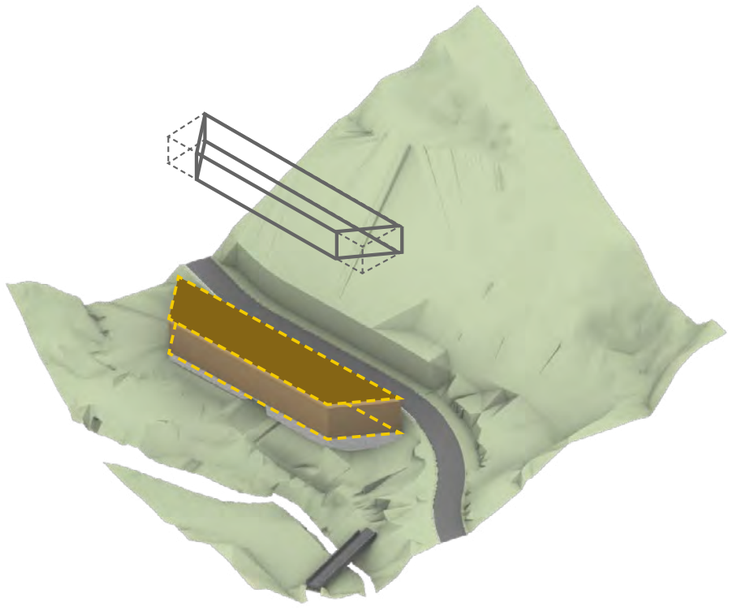
13.07 Building E - Sections

14

Building F

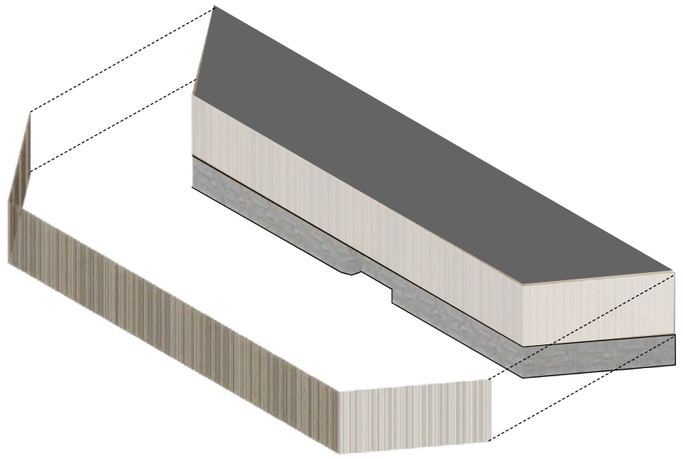
Boutique Hotel & Spa

14.01 Building F Conceptual Response



Object in the Landscape

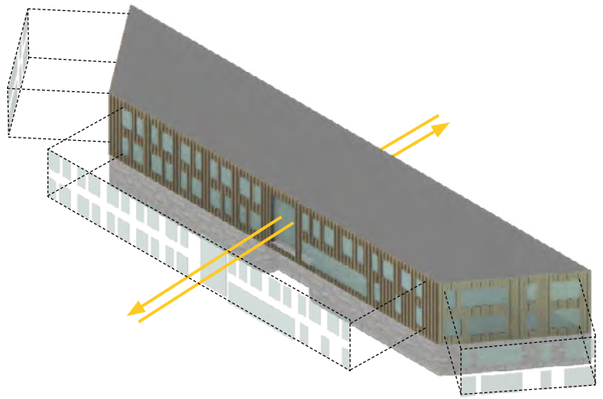
A pure rectangular box chamfered to respond to the context is placed within the landscape to continue the concept of an Object in the landscape. The northern end is sliced to create views to the landscape, and the southern end is sliced for the view down the valley to the Remarkables.



Plinth and Skin

Sitting on a stone plinth, the jewel at the end of the valley is elevated providing improved outlook to the landscape.

A timber rainscreen skin is draped over the pure form, softening it while preserving the nature of the chamfered rectangular box.



Views and Program

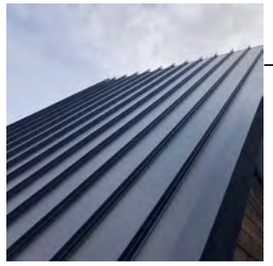
Window openings are penetrated and recessed into the form, arranged to respond to surrounding views and internal arrangments adding texture and providing rhythm to the facade.

The central double height window opening enables a view through the building into the landscape from the discreet main entrance.

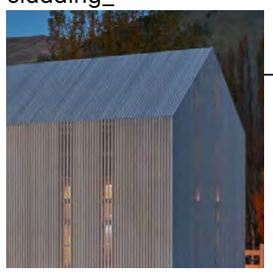
14.02 Building F Materiality & Facade Principles

Folded metal canopy_

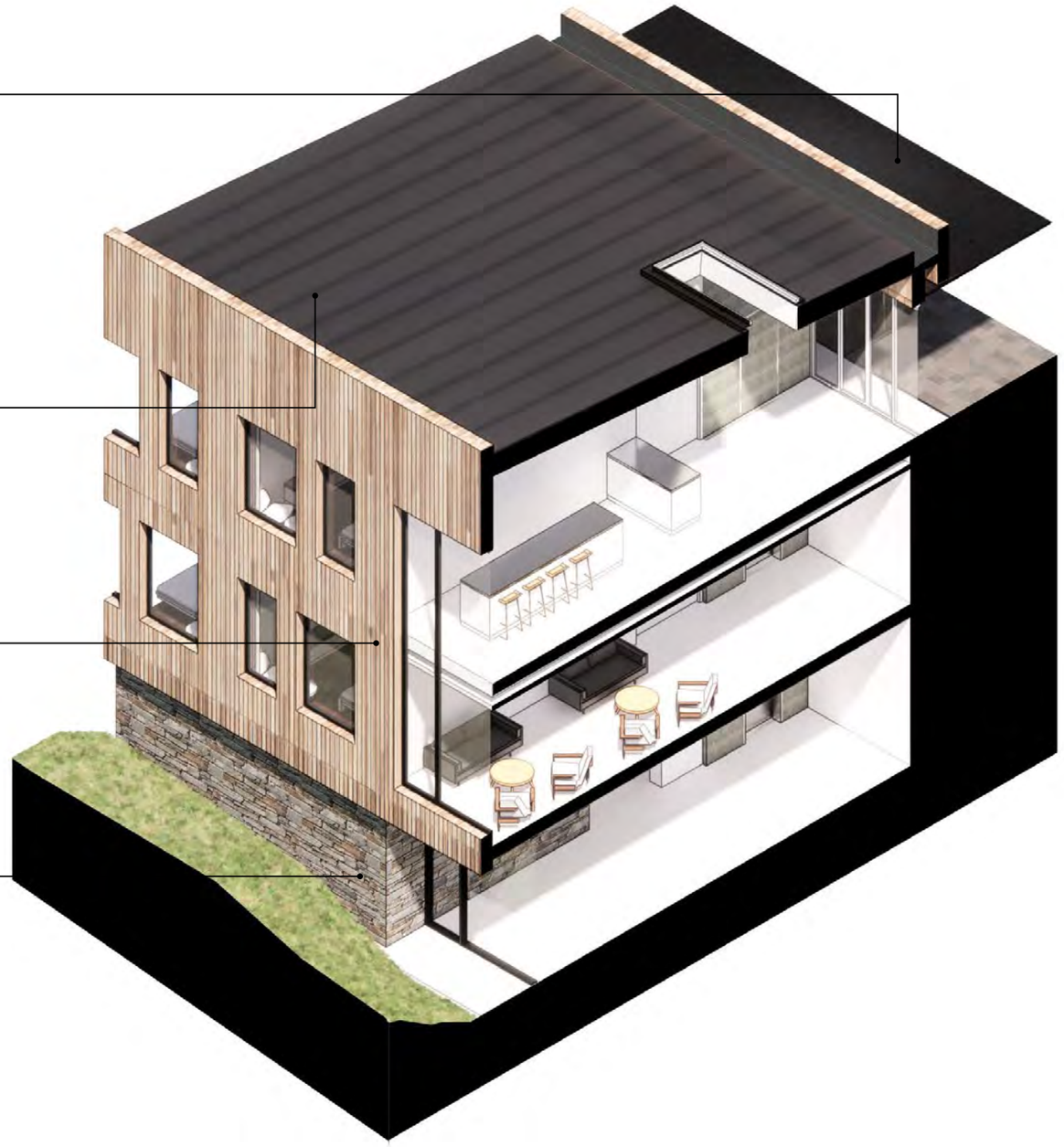
Standing seam metal roofing_



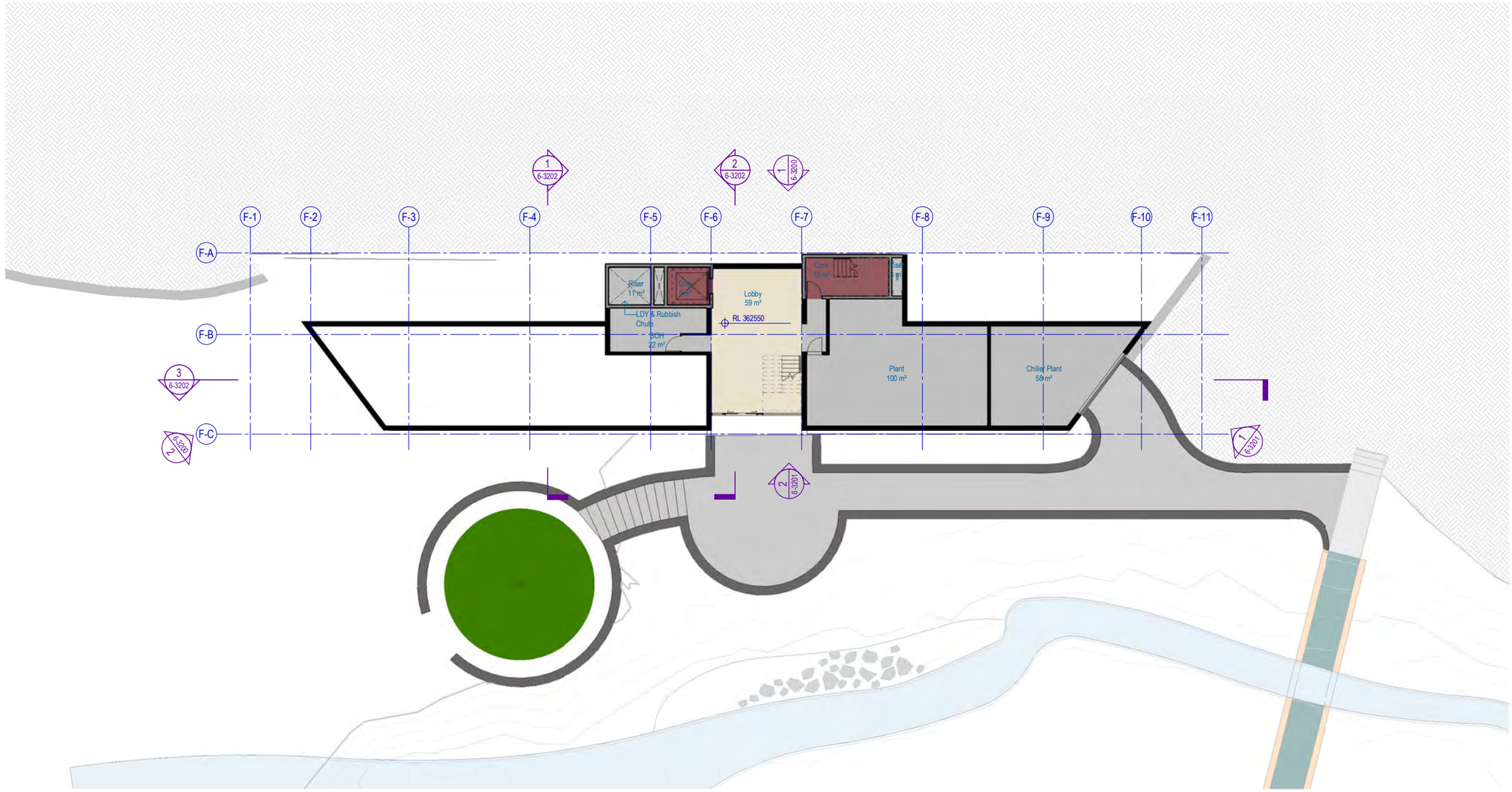
Timber rainscreen cladding_



Stacked stone cladding_



14.03 Building F - 3D Visualisation



KEY PLAN:

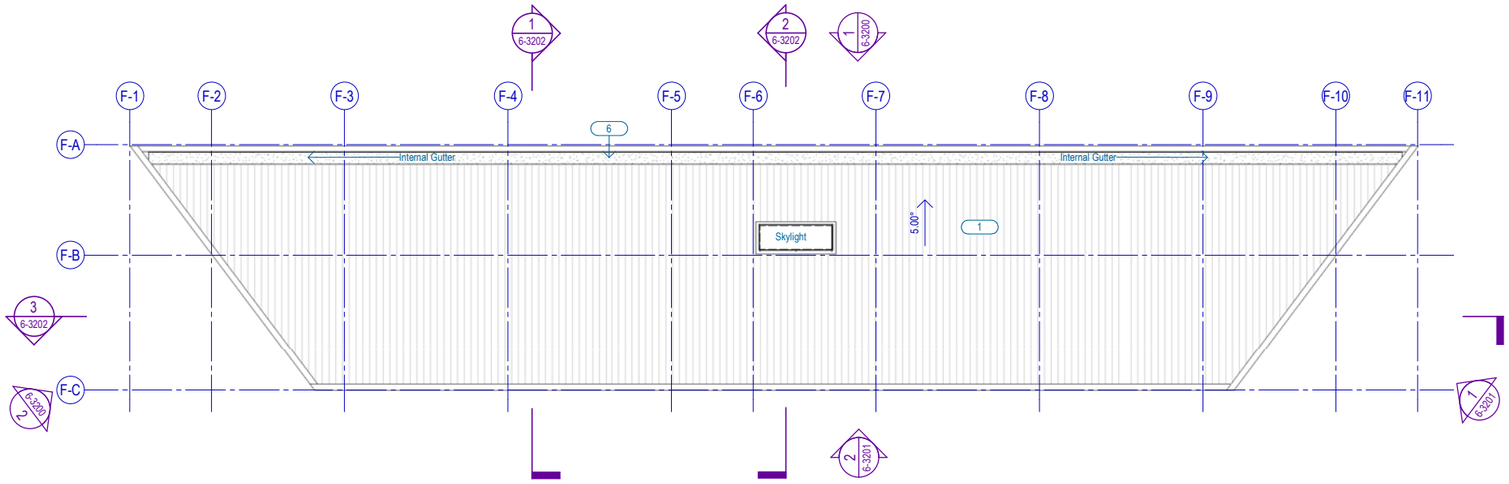
14.04 Building F - Level -G

KEY PLAN:

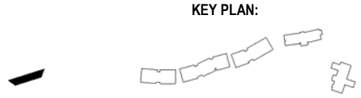
14.05 Building F - Level 01

KEY PLAN:

14.06 Building F - Level 02

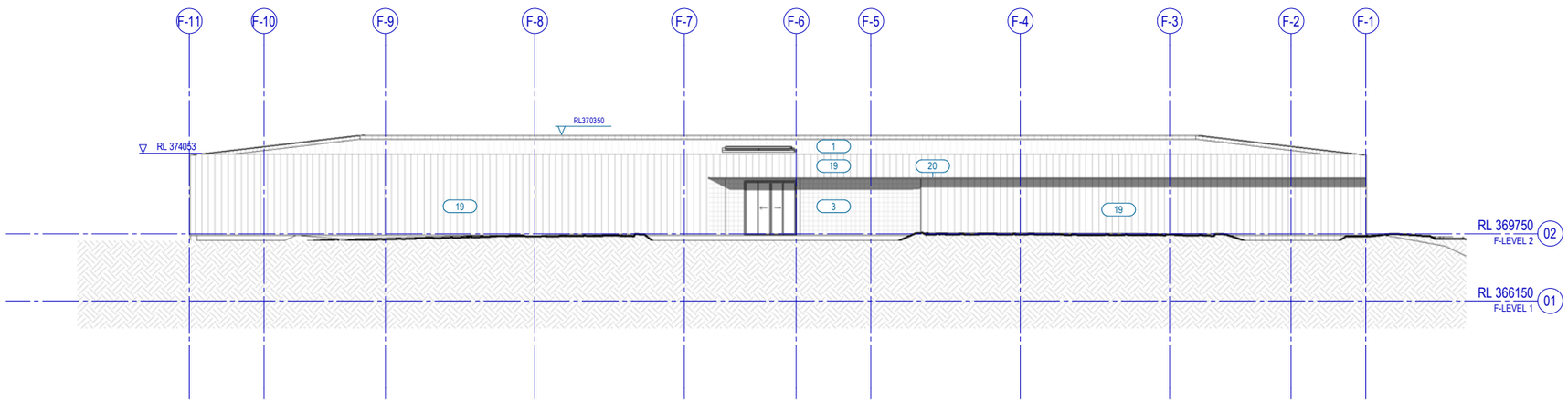


KEY PLAN:



14.07 Building F - Roof Plan

2 F-NORTH ELEVATION
SCALE 1 : 150



1 F-EAST ELEVATION
SCALE 1 : 150

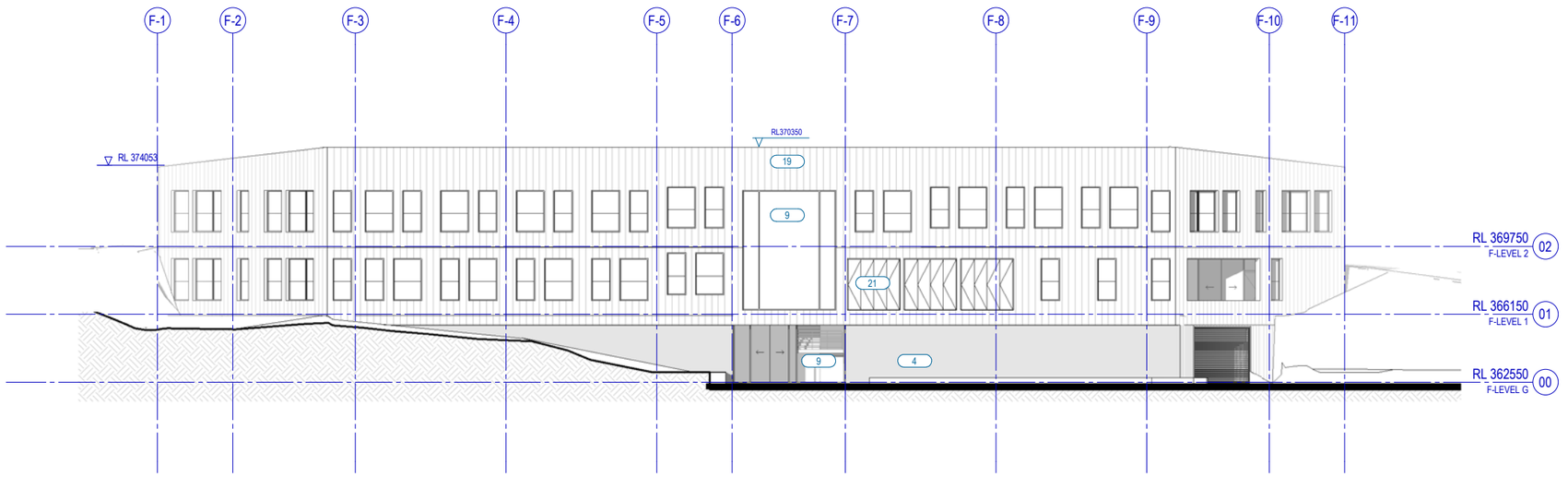
MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

KEY PLAN:

14.08 Building F - Elevations

1 F-SOUTH ELEVATION
SCALE 1 : 150

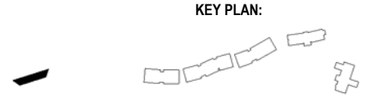


2 F-WEST ELEVATION
SCALE 1 : 150

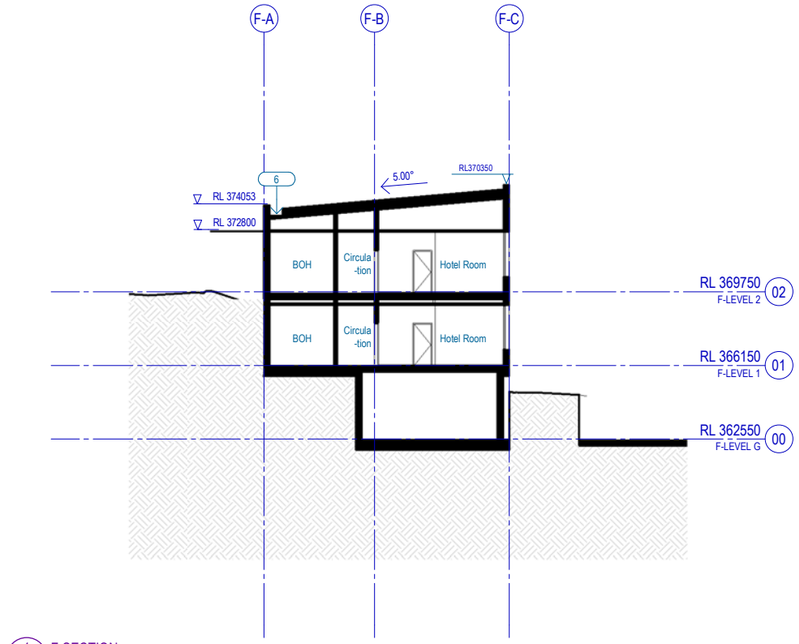
MATERIALS LEGEND:

1 STANDING SEAM METAL ROOFING
2 TIMBER SHINGLE ROOFING
3 TIMBER SHINGLE CLADDING
4 STACKED STONE
5 OPERABLE TIMBER LOUVRES
6 MEMBRANE GUTTER
7 POWDERCOATED ALUMINIUM COVER
8 WEB FORGE
9 BLACK POWDERCOATED ALUMUMINIUM JOINERY
10 CHAMFERED STEEL PLATE REVEAL
11 TIMBER SURROUND
12 GRC CLADDING
13 GLAZED JULIET BALUSTRADE
14 TIMBER CLADDING
15 GRC PLANTER BOX
16 STEEL BALUSTRADE
17 TEXTURED PRECAST CONCRETE
18 TIMBER SOFFIT
19 TIMBER RAINSCREEN CLADDING
20 FOLDED METAL CANOPY
21 BIFOLD TIMBER PANELS

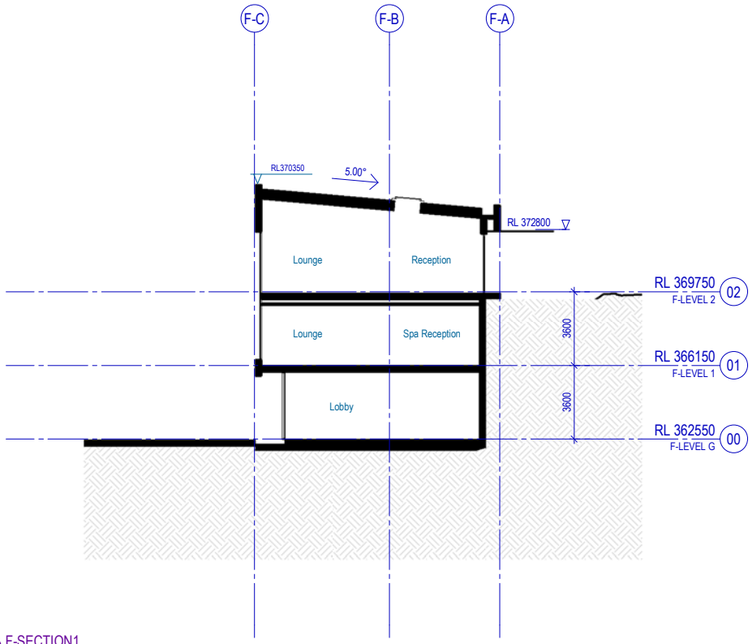
KEY PLAN:



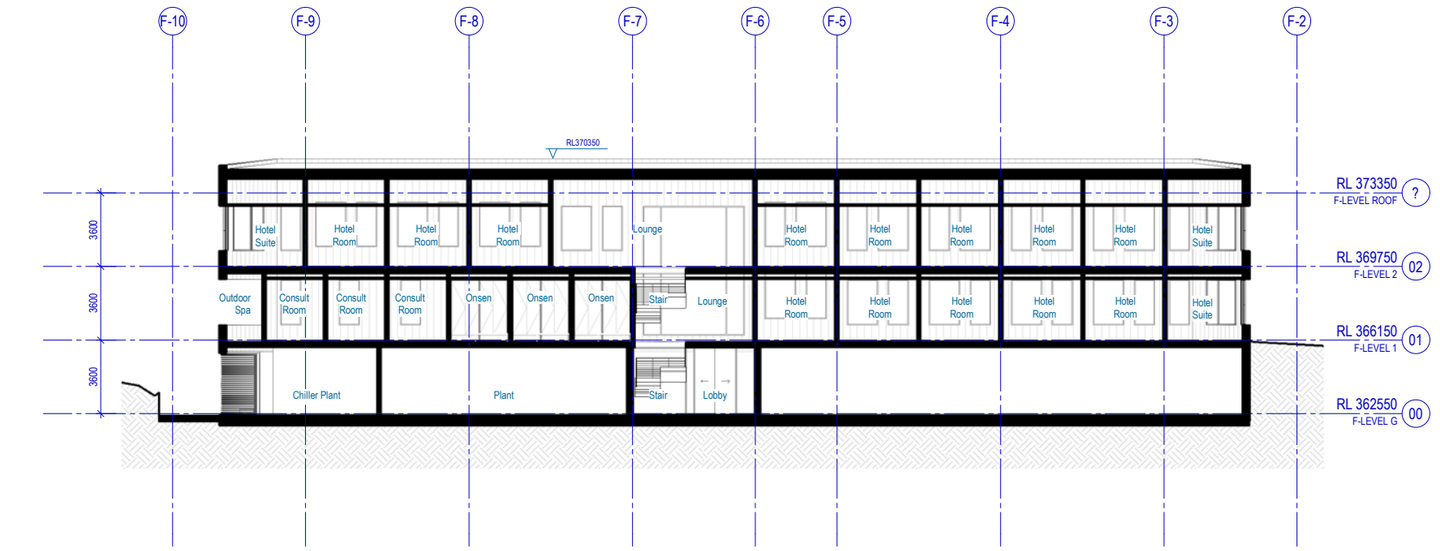
14.09 Building F - Elevations



1 F-SECTION
SCALE 1 : 150



2 F-SECTION1
SCALE 1 : 150



3 F-SECTION2
SCALE 1 : 150

KEY PLAN:

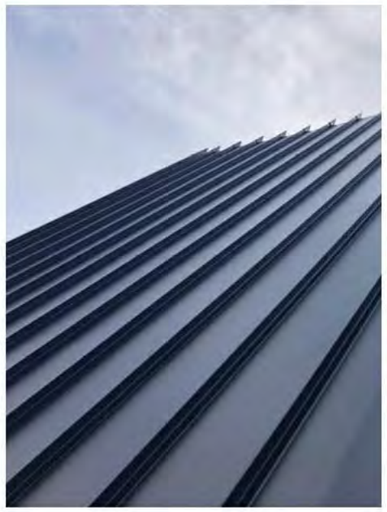
14.10 Building F - Sections

08.03 Building F - 3D Visualisation

15

Materiality & Typical Apartment Layouts

15.01 Materiality



1

Standing seam metal roofing

2

Timber shingle roofing

3

Timber shingle cladding

4

Stacked stone cladding

5

Operable timber louvres

6

Membrane gutter

7

Powdercoated aluminium cover

8

Web forge on backing

9

Black powdercoated aluminium joinery

10

Chamfered steel plate reveal

11

Timber surround

12

GRC panels - Greyscale

13

Glazed juliet balustrade

14

Timber cladding

15

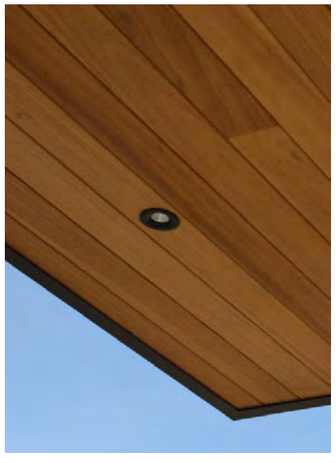
GRC planter box

16

Steel balustrade

17

Precast concrete

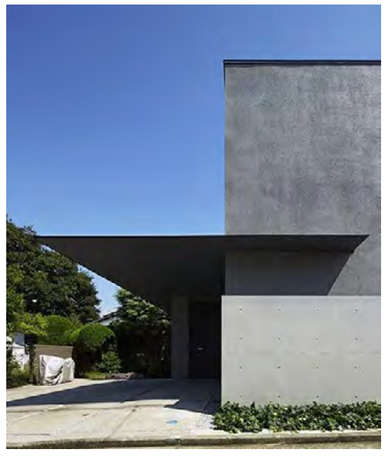


18

Timber soffit

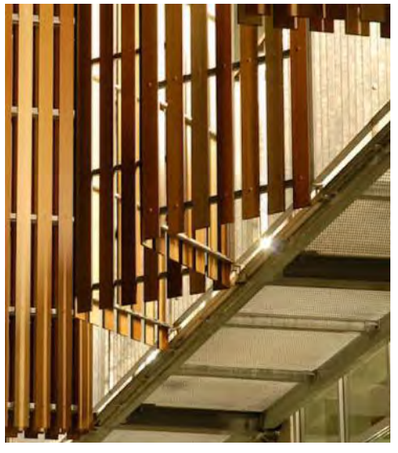
19

Timber rainscreen cladding



20

Folded metal Canopy



21

Bifold timber panels

15.02 2 Bedroom Typical Layout

Layouts mirrored in some instances

15.03 3 Bedroom Typical Layouts

Layouts mirrored in some instances

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Planning | Surveying | Engineering | Environmental

WATER & WASTEWATER INFRASTRUCTURE ASSESSMENT

Northbrook Arrowtown

Waterfall Park Developments Ltd

APPLICATION PRÉCIS

CLIENT	Waterfall Park Developments Ltd
SITE LOCATION	Ayr Avenue, Arrowtown
LEGAL DESCRIPTION	Lot 1 DP 540788
TERRITORIAL AUTHORITY	Queenstown Lakes District Council

DOCUMENT CONTROL

CKL REFERENCE	A20254
DOCUMENT STATUS	Approved
REVISION NO.	3 (Date: 2 March 2023)
FILE NAME	A20254-Ed-Engdata-Water & Wastewater Demands
AUTHOR	Kylin Gunkel Senior Engineer-BEng Tech (Civil) CMEngNZ
AUTHORISED BY	John Sternberg Engineering Manager-BSc MSc CPEng IntPE CMEngNZ MBA
OFFICE OF ORIGIN	Hamilton

TABLE OF CONTENTS

1.0 Introduction

CKL Ltd has been appointed by Waterfall Park Developments Ltd (WPDL) to undertake a water and wastewater demand assessment for the proposed Northbrook Arrowtown later living development (Northbrook Arrowtown).

A comprehensive consent was granted in March 2019 (RM180584) for the development of a hotel and associated facilities at the site (the Hotel Consent). This consent also included a conference centre, wellness centre, wedding chapel, outdoor pavilion and the restoration and repurposing of the heritage farm building at Ayrburn into a hospitality precinct (Ayrburn Domain).

The purpose of this report is to inform the application for resource consent for the Northbrook Arrowtown and to compare findings with the Hotel Consent. It is also noted that this report does not include an assessment of available capacities in the surrounding existing Queenstown Lakes District Council (QLDC) infrastructure as these assessments have already been undertaken as part of previous resource consent applications. The assessments can be found in the following reports:

- Waterfall Park Hotel: Water, Wastewater and Stormwater Infrastructure Assessment, dated May 2018, prepared by Fluent Solutions Ltd (RM180584)
- Ayrburn Domain Extension: Water Supply and Wastewater Infrastructure Assessment. Dated December 2021, prepared by Fluent Solutions Ltd (RM211193)
- Water Modelling Report prepared by Mott MacDonald dated 18 March 2018
- Wastewater Network Assessment prepared by HAL dated 16 January 2019
- Waterfall Park Development Wastewater Modelling prepared by BECA dated 7 February 2018
- Water supply modelling results for Waterfall Park development – Lake Hayes – Prepared by Tonkin + Taylor dated November 2016

The above reports have been referred to throughout this report and a copy of the December 2021 Fluent Solutions report can be found in ***Appendix 2*** for ease of reference.

2.0 Background

2.1 Existing Site & Topography

Northbrook Arrowtown is situated approximately 1.2km north of Lake Hayes and approximately 2km southwest of Arrowtown. The Northbrook Arrowtown Development Area (the Site) is indicated in ***Figure 1*** below. The Site is located in relatively rolling land, with part of the development extending into a relatively incised valley with a natural waterfall feature. A small spring fed tributary named Mill Creek meanders through the site south and discharges into Lake Hayes (Fluent Solutions Ltd, Waterfall Park Hotel: Water, Wastewater and Stormwater Infrastructure Assessment, May 2018). ***Figure 2*** shows the topography of the area.

The area is bounded by Millbrook Resort to the north, north-east and west, and lifestyle residential blocks to the east and beyond Ayrburn Farm to the south, adjacent to Speargrass Flat Road. (Woods Bagot, February 2023)

Access to the site is via Ayr Avenue, off Arrowtown-Lake Hayes Road.

Figure 1: Site Location **(Woods Bagot, February 2023)**

Figure 2: Topography of Area. **(Woods Bagot, February 2023)**

2.2 Proposed Development

The scope of this report includes for the assessment of the facilities listed in ***Table 1*** below, some of which will require water usage and some which will not;

Table 1: Proposed Facilities

Building A – Arrivals & Amenities	Water Usage	Building B – Care and Serviced Apartments	Water Usage
• Café • Reception • Gym • Yoga • Pool • Cinema • Library • BOH (Back of House)	Y N Y N Y Y Y Y	• 23 Care Units • 10 One Bedroom LtO Apartments • 3 Two Bedroom LtO Apartments • 10 One Bedroom Serviced Apartments • 2 Two Bedroom Serviced Apartments • Total: 48 Units	Y Y Y Y Y
Building C- Residential	**Water Usage**	**Building D-Residential**	**Water Usage**
• 44 Two Bedroom Apartments • 5 Three Bedroom Apartments • Total: 49 Units	Y Y	• 50 Two Bedroom Apartments • 10 Three Bedroom Apartments • Total: 60 Units	Y Y
Building E-Residential	**Water Usage**	**Building F-Boutique Hotel & Spa**	**Water Usage**
• 24 Two Bedroom Apartments • 15 Three Bedroom Apartments • Total: 39 Units	Y Y	• 16 hotel rooms • Lounge • Reception • Spa	Y Y N Y

The following assumptions were made in the estimation of water demands and wastewater production:

- To determine the specific water demands for Northbrook Arrowtown the following occupancy rates were applied.
    - Each 2 room or 3 room apartments on the Site will have an occupancy rate of 1.3. This is based on the average occupancy rate across similar New Zealand retirement villages;
    - Serviced apartments with an occupancy rate of 1.2 per apartment;
    - Care units and hotel rooms, have an occupancy rate of 1; and
    - An allowance is made for 60 staff and 50 visitors per day.
- Ayrburn Domain (and change of use buildings) are assumed to be unchanged from previous resource consent submissions.
- Ayrburn Domain Extension is assumed to be unchanged from previous resource consent submissions.

Figure 3 below indicates a layout of Northbrook Arrowtown.

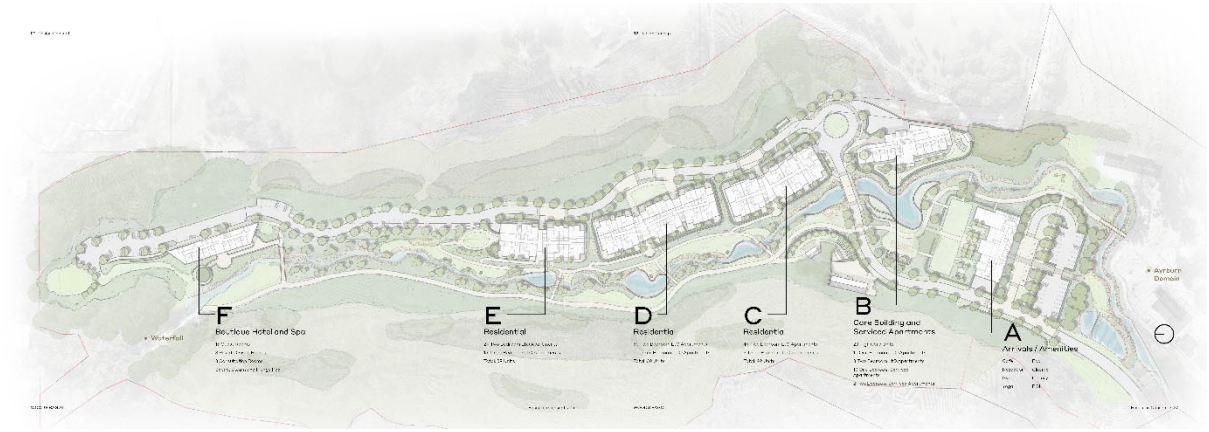

Figure 3: Northbrook Arrowtown Layout. ***(Woods Bagot, February 2023)***

3.0 Wastewater

This section of the report assesses the wastewater demand for Northbrook Arrowtown. It assesses whether the proposed change from the Hotel Consent (estimated peak wet weather flow PWWF projection of 14.3 l/s) to Northbrook Arrowtown will increase (or decrease) peak wastewater flows. Previous discussions around existing and proposed wastewater infrastructure that will service the development have been summarised.

3.1 Wastewater Flows

The conceptualisation of the proposed wastewater solution for the development includes gaining an understanding of the facilities to be provided, the staff population to be served and the capacity of the existing QLDC wastewater network, particularly under PWWF scenarios.

The following aspects have been investigated:

- Proposed number of residents, staff numbers and visitors
- Wastewater flows including PWWF and peak dry weather flows
- Available capacity of the existing QLDC wastewater network supported by previous modelling exercises undertaken by BECA
- High-level assessment of wastewater pumping requirements

The revised design flows for the proposed development are summarised in **Table 2** below.

Table 2: Proposed Wastewater Flows for Northbrook Arrowtown Retirement Village

Unit Type	No. of Units	Max No. of People / Unit / Day	Average Per Capita Daily WasteWater Demand (l/p/d)	Average Daily Wastewater Demand (m³/d)	Dry Weather Diurnal Peaking Factor	Peak Dry Weather Flow (L/s)	Wet Weather Peaking Factor	Peak Wet Weather Wastewater Flow (L/s)	Comments
Northbrook Arrowtown Retirement Village									
Building A - Arrivals & Amenities									
Café / Lounge	1	250	20	5	2.5	0.14	2	0.29	*AS/NZS 1547:2012, Table H4: Accommodate for Bar trade. Assume maximimum of 250 customers per day.*
Wellness Centre - Pool, gym, yoga	1	200	40	8	2.5	0.23	2	0.46	*Metcalfe and Eddy Table 3.4. Assumption that pool is filled overnight when irrigation is not running*
Cinema	1	50	40	2	2.5	0.06	2	0.12	
Library	1	50	40	2	2.5	0.06	2	0.12	
Visitors	1	50	125	6.25	2.5	0.18	2	0.36	*Assume 50 visitors per day @ half daily water demand*
Non -residential staff	1	25	30	0.75	2.5	0.02	2	0.04	*AS/NZS 1547:2012, Table H4*
Building B - Care & Services Apartments									
Care Units 1 Bed One Bedroom Apartments Two Bedroom Apartments	23 10 3	1 1.3 1.3	250 250 250	5.75 3.25 0.975	2.5 2.5 2.5	0.17 0.09 0.03	2 2 2	0.33 0.19 0.06	*Woods Bagot 100% Concept Report, October 2022*
Serviced Apartments 1 Bed	10	1.3	250	3.25	2.5	0.09	2	0.19	
Serviced Apartments 2 Bed	2	1.3	250	0.65	2.5	0.02	2	0.04	*AS/NZS 1547:2012, Table H4*
Kitchen	1	1.3	250	0.325	2.5	0.01	2	0.02	
Laundry	1	7	30	0.21	2.5	0.01	2	0.01	
Residential Staff	1	25	50	1.25	2.5	0.04	2	0.07	
Building C - Residential									
Two Bedroom Apartments	44	1.3	250	14.3	2.5	0.41	2	0.83	*Woods Bagot wŜă2ŀŎŜ /2ÿăŜÿĺ, October 2022*
Three Bedroom Apartments	5	1.3	250	1.625	2.5	0.05	2	0.09	
Building D - Residential									
Two Bedroom Apartments	50	1.3	250	16.25	2.5	0.47	2	0.94	
Three Bedroom Apartments	10	1.3	250	3.25	2.5	0.09	2	0.19	
Building E - Residential									
Two Bedroom Apartments	24	1.3	250	7.8	2.5	0.23	2	0.45	
Three Bedroom Apartments	15	1.3	250	4.875	2.5	0.14	2	0.28	
Building F - Boutique Hotel & Spa									
Hotel Room	16	2	250	8	2.5	0.231	2	0.463	*AS/NZS 1547:2012, Table H4*
Spa	1	64	40	2.56	2.5	0.074	2	0.148	*Assume 32 visitors per day with factor of 2*
Non-residential Staff	1	10	30	0.3	2.5	0.009	2	0.017	
Miscellaneous									
Maintenance Shed	1	5	20	0.1	2.5	0.00	2	0.01	
Workshop	1	15	20	0.3	2.5	0.01	2	0.02	
Projects shed	1	15	20	0.3	2.5	0.01	2	0.02	
Sub Total (Domestic)				**99.3**		**2.9**		**5.7**	

Table 2 indicates a daily wastewater production volume of 99.3m^3 at a PWWF rate of 5.7 l/s which is considerably less than the currently consented daily volume of 247.4m^3 and PWWF of 14.3 l/s for the hotel. This is a decrease of approximately 60 % in the consented PWWF rate.

3.2 Design Criteria

Northbrook Arrowtown is not considered to be a residential type of subdivision and is not directly covered by the design parameters described in the QLDC Land Development and Subdivision Code of Practice 2020 (QLDC COP 2020)

The following design criteria have been assumed:

- An average daily flow of 250 l/p/d was assumed for the residential units ~ *QLDC* LDSC 2018 V1.1
- A diurnal peaking factor of 2.5 has been assumed for all facilities. For small contributing catchments, peak factors can be significantly higher however, due to the requirement for a minimum pipe size of DN 150, such flows will not govern the design ~ *QLDC* LDSC 2018 V1.1
- A wet weather peaking factor of 2 to accommodate for infiltration ~ *QLDC* LDSC 2018 V1.1
- The wastewater demands in **Table 2** above have been derived from multiple sources including AS/NZS 1547:2012.
- Staff numbers have been derived from similar facilities across the country

3.3 Existing Infrastructure

A 160 OD PE100 PN12.5 wastewater rising main has been installed between the proposed Waterfall Park wastewater pumpstation (WP WWPS), along Ayr Avenue and connects into the existing 300mm diameter Arrowtown-Lake Hayes trunk main which terminates at the Bedeemer Wastewater Pump Station, located east of Lake Hayes. The proposed WP WWPS and existing rising main are intended to service the Waterfall Park Hotel (or Northbrook Arrowtown), Ayrburn Domain, and Ayrburn Domain Extension.

3.4 Capacity of Existing Infrastructure

Previous modelling undertaken by BECA in 2018, HAL in 2019, and summarised in section 4.3 of Fluent Solutions report dated December 2021, indicates that the existing 300mm uPVC trunk main in Arrowtown-Lake Hayes and the existing 160 OD rising main in Waterfall Park Road both have adequate capacity to service the flows from the Hotel Consent (including Ayrburn Domain) and previously proposed Ayrburn Farm residential development.

At the time of the wastewater modelling, WPDL was considering progressing Ayrburn Farm and the Hotel which was modelled at a PWWF of 9 l/s and 14.3 l/s respectively.

The Ayrburn Domain Extension was not included in the modelling undertaken by BECA however, as the flows from the Ayrburn Domain Extension only represent approximately 12% of the residential flows that were modelled, it can be assumed that the existing infrastructure has adequate capacity to accommodate the flows from the Hotel Consent and Ayrburn Domain Extension (as outlined in RM211193).

The Hotel is currently consented for a PWWF of 14.3 l/s as per ***Table 3*** below. The estimated peak flow from Northbrook Arrowtown is 5.7 l/s, considerably less than the hotel. Wastewater modelling of the Northbrook Arrowtown is therefore not considered necessary and the conclusion that the existing infrastructure has available capacity for the current, 2028 and 2058 design horizons remain unchanged.

Table 3: Modelled wastewater flows compared to currently proposed wastewater flows

Development Area	Modelled (HAL January 2019)		Proposed Development	
	Peak Daily Volume (m^3)	PWWF (l/s)	Peak Daily Volume (m^3)	PWWF (l/s)
Waterfall Park Hotel	247.4	14.3	-	-
Northbrook Arrowtown	-	-	99.3	5.7
Ayrburn Domain (Consented as part of RM 180584)	-	-	18.8	1.1
Ayrburn Domain change of use buildings	-	-	2.6	0.2
Ayrburn Domain Extension			32.5	1.9
Ayrburn Farm - No longer proposed Residential Development	150.0	9.0	-	-
Barrel Room (Lodged for Consent in September 2022 RM220829)			-	-
Bakehouse Variation (Lodged for Consent in September 2022 RM220874)			-	-
Sub-total (Current Proposal)			**153.2**	**8.9**
Future Capacity (Subject to Future RC applications)	-	-	263.0	14.5
Total	**416.2**	**23.4**	**416.2**	**23.4**

***Includes wastewater for Barrel Room and Bakehouse in Future Capacity*

As indicated in ***Table 3*** above, the consented totals for the Peak Daily Volume and the PWWF has not changed (these have been previously accepted by QLDC). The consented flows for the Ayrburn Domain, change of use buildings, and Ayrburn Domain Extension have not changed either. With the addition of Northbrook Arrowtown, the additional future capacity figure has increased from 114.9 m^3 and 6.4 l/s to 263 m^3 and 14.5 l/s respectively.

This results in more capacity being made available for future developments that will be subject to resource consent.

3.5 Wastewater Servicing for the Proposed Development

It is proposed that Northbrook Arrowtown wastewater will gravitate to the proposed WP WWPS which has been previously consented but is still to be constructed.

The previously consented Ayrburn Domain buildings and the Homestead will also convey wastewater to the WP WWPS via a 63 OD PE100 PN12.5 rising main (a significant portion of

this rising main has already been installed across the bridge over Mill Creek and along Waterfall Park Road). The pump stations that will service these two areas is referred to as the Ayrburn Domain WWPS and the Ayrburn Homestead WWPS.

It is proposed to have a temporary rising main installed to service the Ayrburn Domain and the Homestead if the WP WWPS is not constructed prior to the Ayrburn Domain and Homestead being operational. This temporary rising main will be connected to the existing 160 OD rising main in Waterfall Park Road just before the connection to the existing 300mm diameter trunk main in Arrowtown-Lake Hayes Road. ***Figure 4*** below indicates the existing and proposed infrastructure that will service Ayrburn and Waterfall Park.

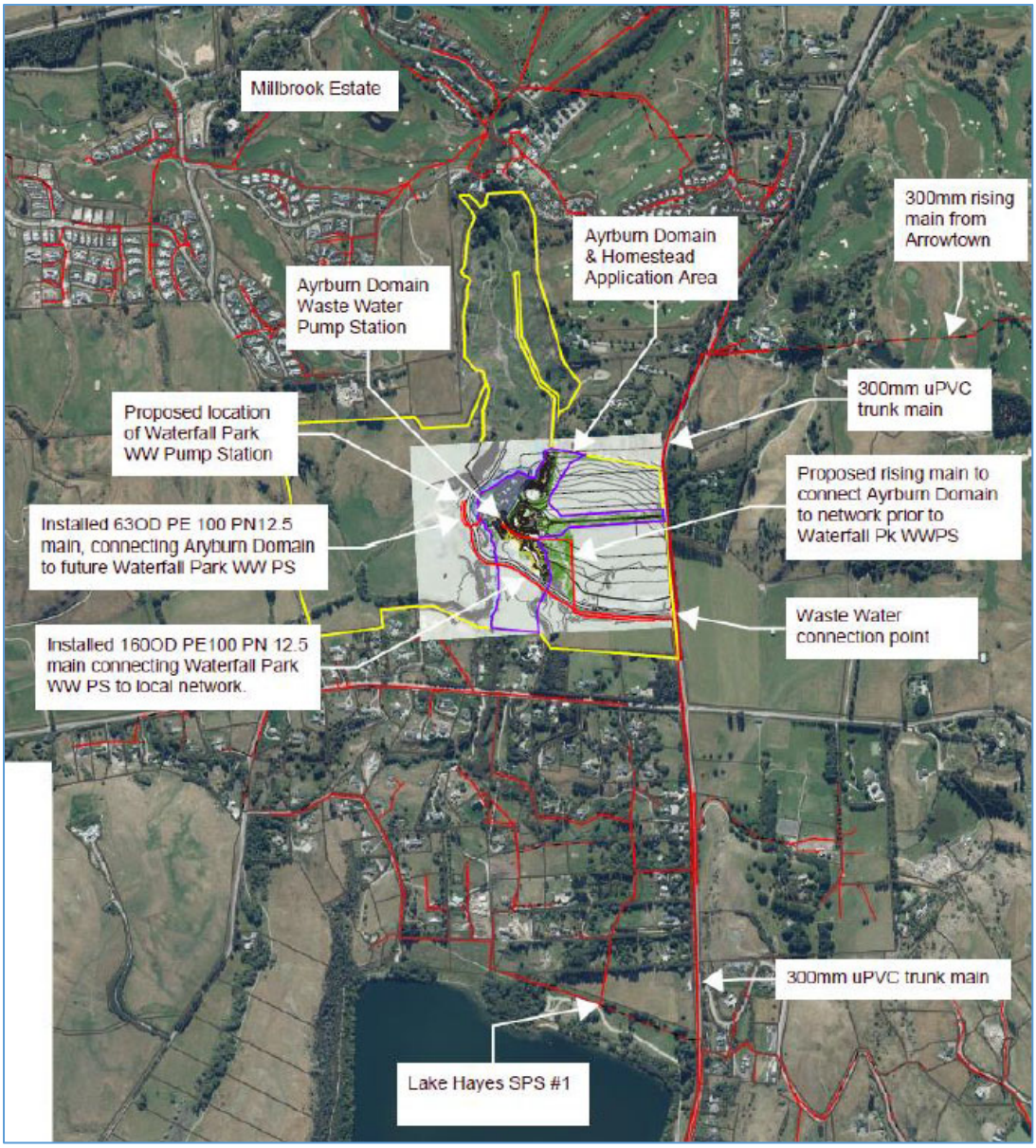

Figure 3: Schematic Overview of Existing and Proposed Wastewater Infrastructure **(Fluent, Ayrburn Domain Extension Water Supply and Wastewater Infrastructure Assessment, December 2021)**

The total consented flow for all these developments is 23.4 l/s* (PWWF). Assuming a pumped wastewater velocity between 0.8m/s (min scour velocity) and 2m/s (generally max.), the capacity of the 160mm OD rising main is in the order of 11-25l/s, pending pump capacity.

As pumping arrangements will be staged (discussed in section 3.3 of this report), consideration must be given to a minimum scour velocity of 0.8m/s in the existing 160mm OD rising main. This may dictate the size of the wet well, pump selection and emergency storage requirements. This can be further assessed at a later stage.

3.6 Wastewater Conclusion

The following points have been summarised to conclude this assessment:

- The estimated peak flow from Northbrook Arrowtown is 5.7 l/s, considerably less than that consented under RM 180584.
- The proposed WW Pump Station and existing rising main will need to be able to accommodate at least 23.4 l/s of PWWF which is less than what was provided for the Hotel Consent. The capacity of the existing infrastructure to service the proposed hotel and surrounding development (assumed unchanged) has been assessed by others and found to be acceptable.
- It can therefore be assumed that the bulk infrastructure (160 OD rising main and council receiving infrastructure) is adequate for the proposed development.
- Phasing of the proposed pumpstation could be considered if needed, however minimum scour velocity in the existing 160 OD rising main will need consideration. The capacity of the 160 OD rising main is approximately 11-25 l/s, considering minimum (scour) and maximum (recommended) velocities. This will suffice for the development as a whole.
- There are no adverse downstream effects and therefore no on-site mitigation measures are required.

4.0 Water Supply

4.1 Water Supply System Design

This section of the report assesses the water demand for Northbrook Arrowtown. It assesses whether the proposed change from the Hotel Consent (peak water consumption 18.9l/s) to Northbrook Arrowtown will increase (or decrease) peak water demand. It also summarises previous discussions around existing and proposed water infrastructure that will service the development.

The estimate of water demand (average and peak) for the development includes gaining an understanding of the facilities to be provided, the resident population including staff and visitors to be served, the irrigation requirements, water pressure requirements and the capacity of the existing QLDC water network, particularly under peak instantaneous flow.

The following aspects have been investigated:

- Proposed occupancy including residents, staff and visitors
- Potable water demand including peak factors
- Irrigation requirements (refer WPDL)
- Minimum pressure requirements in terms of QLDC COP 2020.
- Firefighting requirements for hydrants and sprinklers in terms of SNZ PAS 4509:2008, "New Zealand Fire Service Fire Fighting Water Supplies Code of Practice" (advised by Cosgroves Ltd)
- Available capacity of the existing QLDC water network, supported by previous modelling exercises undertaken by Mott MacDonald
- Comparison of proposed water demands for Northbrook Arrowtown against currently consented demands under RM150584.
- It is assumed that water demands for the Ayrburn Domain Extension, and other allowances have remained unchanged and have not been included in the above.
- No assessment has been conducted on any internal water reticulation as this is proposed to be covered under detailed design.

4.2 Water Demand Assessment

Retirement villages are not classed as typical residential sub-divisions in relation to their water demand requirements. Residential subdivisions vary between their occupancy rates and irrigation usage is largely uncontrolled when compared to retirement villages. For these reasons, Territorial Authorities provide a more conservative approach in terms of per capita usage to accommodate for these unknowns. The QLDC COP 2020 requires a per capita usage rate of 700 l/p/d for residential subdivisions. Northbrook Arrowtown will offer greater control over domestic water consumption and irrigation requirements. A more realistic per capita water demand usage figure for a retirement village of this nature is around 250 l/p/d which is what has been adopted for this assessment.

The revised water demand requirements for Northbrook Arrowtown along with more specific usage rates are summarised in **Table 4** below.

Table 4: Water Demand Estimates from Proposed Northbrook -Arrowtown Retirement Village

Unit Type	No. of Facilities	Max No. of People Fascility / Day	Daily Water Demand (L/p/d)	Daily Water Demand (m^3/d)	Daily Water Demand (L/s)	Case 1: Domestic Peak Hour (daytime only), no irrigation		Case 2: Domestic Peak Hour (overnight, with irrigation)		Comments/Assumptions
						Peak Hour Peaking Factor	Peak Hour Demand (L/s)	Peak Hour Peaking Factor (50% peak)	Peak Hour Demand (L/S)	
Northbrook Arrowtown Retirement Village										
Building A - Arrivals & Amenities										
Café / Lounge	1	250	20	5	0.06	6.6	0.38	3.3	0.19	*AS/NZS 1547:2012, Table H4: Accommodate for Bar trade. Assume maximum of 250 customers per day.*
Wellness Centre - Pool, gym, yoga	1	200	40	8	0.09	10	0.93	5.0	0.46	Metcalfe and Eddy Table 3.4. Assumption that pool is filled overnight when irrigation is not running
Visitors	1	50	125	6.25	0.07	6.6	0.48	3.3	0.24	Assume 50 visitors per day @ half daily water demand
Cinema	1	50	40	2	0.02	6.6	0.15	3.3	0.08	
Library	1	50	40	2	0.02	6.6	0.15	3.3	0.08	
Non -residential staff	1	25	30	0.75	0.01	6.6	0.06	3.3	0.03	*AS/NZS 1547:2012, Table H4*
Building B - Care & Services Apartments										
Care Units 1 Bed	23	1	250	5.75	0.07	6.6	0.44	3.3	0.22	*Woods Bagot 100% Concept Report, October 2022*
One Bedroom Apartments	10	1.3	250	3.25	0.04	6.6	0.25	3.3	0.12	
Two Bedroom Apartments	3	1.3	250	0.975	0.01	6.6	0.07	3.3	0.04	
Serviced Apartments 1 Bed	10	1.3	250	3.25	0.04	6.6	0.25	3.3	0.12	
Serviced Apartments 2 Bed	2	1.3	250	0.65	0.01	6.6	0.05	3.3	0.02	
Kitchen	1	7	30	0.21	0.00	6.6	0.02	3.3	0.01	
Laundry	1	4	50	0.2	0.00	10	0.02	5.0	0.01	*AS/NZS 1547:2012, Table H4*
Residential Staff	1	25	50	1.25	0.01	6.6	0.10	3.3	0.05	
Building C - Residential										
Two Bedroom Apartments	44	1.3	250	14.3	0.17	6.6	1.09	3.3	0.55	*Woods Bagot 100% Concept Report, October 2022*
Three Bedroom Apartments	5	1.3	250	1.625	0.02	6.6	0.12	3.3	0.06	
Building D - Residential										
Two Bedroom Apartments	50	1.3	250	16.25	0.19	6.6	1.24	3.3	0.62	
Three Bedroom Apartments	10	1.3	250	3.25	0.04	6.6	0.25	3.3	0.12	
Building E - Residential										
Two Bedroom Apartments	24	1.3	250	7.8	0.09	6.6	0.60	3.3	0.30	
Three Bedroom Apartments	15	1.3	250	4.875	0.06	6.6	0.37	3.3	0.19	
Building F - Boutique Hotel & Spa										
Hotel Room	16	2	250	8	0.09	6.6	0.61	3.3	0.31	*AS/NZS 1547:2012, Table H4*
Spa	1	64	40	2.56	0.03	10	0.30	3.3	0.10	*Assume 32 visitors per day with factor of 2*
Non-residential Staff	1	10	30	0.3	0.00	6.6	0.02	3.3	0.01	
Miscellaneous										
Maintenance Shed	1	5	20	0.1	0.00	6.6	0.01	3.3	0.00	
Workshop	1	15	20	0.3	0.00	6.6	0.02	3.3	0.01	
Projects shed	1	15	20	0.3	0.00	6.6	0.02	3.3	0.01	
Sub Total (Domestic)				**99.2**	**27.6**		**8.0**		**4.0**	
Add Irrigation Demand							**1.1**		**1.1**	
Total (Domestic + Irrigation)							**9.1**		**5.0**	

A peak factor of 6.6 has been assumed for most facilities in line with the QLDC COP 2020. A peak factor of 10 has been assumed for the following facilities to provide a more conservative approach as these facilities are anticipated to operate for between 12-16 hours per day:

1. Pool, gym, yoga (Building A)

2. Laundry (Building B)
3. Boutique Hotel spa (Building F)

The building occupancy rates reflect the maximum estimated water demand. Staff numbers have been adopted from averages of other similar retirement villages.

4.3 Domestic and Irrigation Water Demands

Two scenarios have been considered regarding peak flows and irrigation for landscaping. They are as follows:

- Scenario 1: Daytime peak with controlled irrigation
- Scenario 2: Night-time peak (50% of daytime peak) with full irrigation over 8 hours

Scenario 1 will be restricted to limited areas of dripline irrigation with sprinklered areas only being used during off-peak hours. This scenario has been used in the hydraulic modelling undertaken by Mott MacDonald and is the selected scenario for this exercise as it produces the most conservative demands.

Scenario 2 will be carefully managed over an 8-hour period overnight avoiding peak times. Scenario 2 includes for a 50% reduction in the peak factor to account for lower night-time peaks.

The irrigation rate and proposed landscaping area have been provided by WPDL as follows;

Table 5: Irrigation Demand Estimate

Irrigation Zone	Landscape Area Approx (m2)	Daily Irrigation Rate Approx (mm/m2/day)	Irrigation Demand (m3/day)	Scenario 2: Full irrigation over 8 hours (l/s)
Landscaped Areas	10,500	3	31.5	1.09

It is proposed that irrigation will happen overnight during off-peak times at a rate of 1.09 l/s over an 8-hour period. The domestic peak will happen in the early mornings and late afternoons therefore the two peak periods will not overlap with the irrigation period. This means that adding the irrigation rate to the peak hour demand figure of 8.0 l/s in **Table 4** above will produce an overly conservative flow rate of 9.1 l/s (peak domestic + irrigation). This still produces a flow rate of less than the consented flow rate of 18.9 l/s for the Hotel.

4.4 Fire Fighting & Pressure Demands

The following requirements need to be met by the proposed development in terms of pressure and fire demand:

1. A minimum residual peak hour pressure of 300 kPa and maximum of 900 kPa is required as per the QLDC COP 2020.
2. A total of 25 l/s is required from within 270 m of each non-sprinklered, residential dwelling for Class FW2 fire fighting as per SNZ PAS 4509:2013.
3. A minimum of 12.5 l/sec is required from each hydrant as per SNZ PAS 4509:2008.

In terms of firefighting requirements for Northbrook Arrowtown, Cosgroves has provided a high-level assessment in terms of SNZ PAS 4509 – NZ Fire Service Firefighting Water Supplies Code of Practice 2013. A summary of the recommended firefighting requirements from Cosgroves is listed below:

- FW2 classification for firefighting water supplies: 1500 L/min with residual towns mains pressure of 100 kPa. This is on the assumption that all buildings will be sprinkler protected.
- Sprinkler system: 1200 L/min @ 400 kPa, and 500 L/min @ 550 kPa. This is marginally more than it was for the consented hotel due to additional parking facilities.
- In order to estimate the highest firewater demand the highest sprinkler demand plus the FW2 demand need to be combined - the maximum concurrent fire demand therefore is 2700 L/min with a residual towns' mains pressure of 100 kPa for hydrants and 400kPa for sprinklers.
- Mott MacDonald has confirmed that the anticipated operating pressures for the proposed development will be in the normal operating range of between 30m and 90m of residual head as set in the QLDC COP 2020 through to year 2058. It has also confirmed that the residential fire flow + sprinkler fire flow can be accommodated with a residual pressure of 47m at RL 368m. The highest elevation that could be serviceable for the residential development is 395m.
- Cosgroves has confirmed that that the site could be serviced with the required 2700 l/min flow rate at a residual pressure of 47m. This was confirmed in an email from Cosgroves dated 18 May 2022, a copy of which can be found in Appendix A of this report.
- However, subject to pressure and flow testing;
    - If the required flow of 1500l/min (90m^3/hr) for FW2 cannot be supplied then, in terms of **SNZ PAS 4509 Table 2,** ½ hr storage (45 kl) is required. A 45kl tank would need to be provided with suction connections for the Fire Service. A pump is not required provided the Fire Service can draw the required flow from the tank.
    - If there is insufficient flow for the sprinkler system then a tank is required which provides 60 minutes of supply, namely 1200 L/min and 60 min = 72kl.
    - If there is insufficient residual pressure for the sprinklers system, then a diesel booster pump would be required.

It should be noted that, according to the modelling undertaken by Mott MacDonald, the domestic demand was not added to the FW2 and sprinkler flow. The fire flow consisted only of FW2 and sprinkler flow. This is on the assumption that during a fire event, residents, staff or visitors will not be making use of the building's facilities during emergency/evacuation procedures.

4.5 Existing Water Supply System

A 315 OD PE100 PN 12.5 water main has been installed along Ayr Avenue to service the consented Hotel development. This watermain is connected to the existing DN 225 mPVC watermain in the Arrowtown-Lake Hayes Road. A 180 OD PE100 PN12.5 watermain branches off from the existing 315 OD watermain to service Ayrburn Domain.

It is proposed that the existing 315 OD watermain will service Northbrook Arrowtown.

Further detailed information on existing infrastructure servicing other parts of the development including layout plans can be found in section 5.3 of Fluent Solutions Ayrburn Domain Extension Report dated December 2021. Refer to ***Figure 5*** below for a layout of proposed and existing water infrastructure.

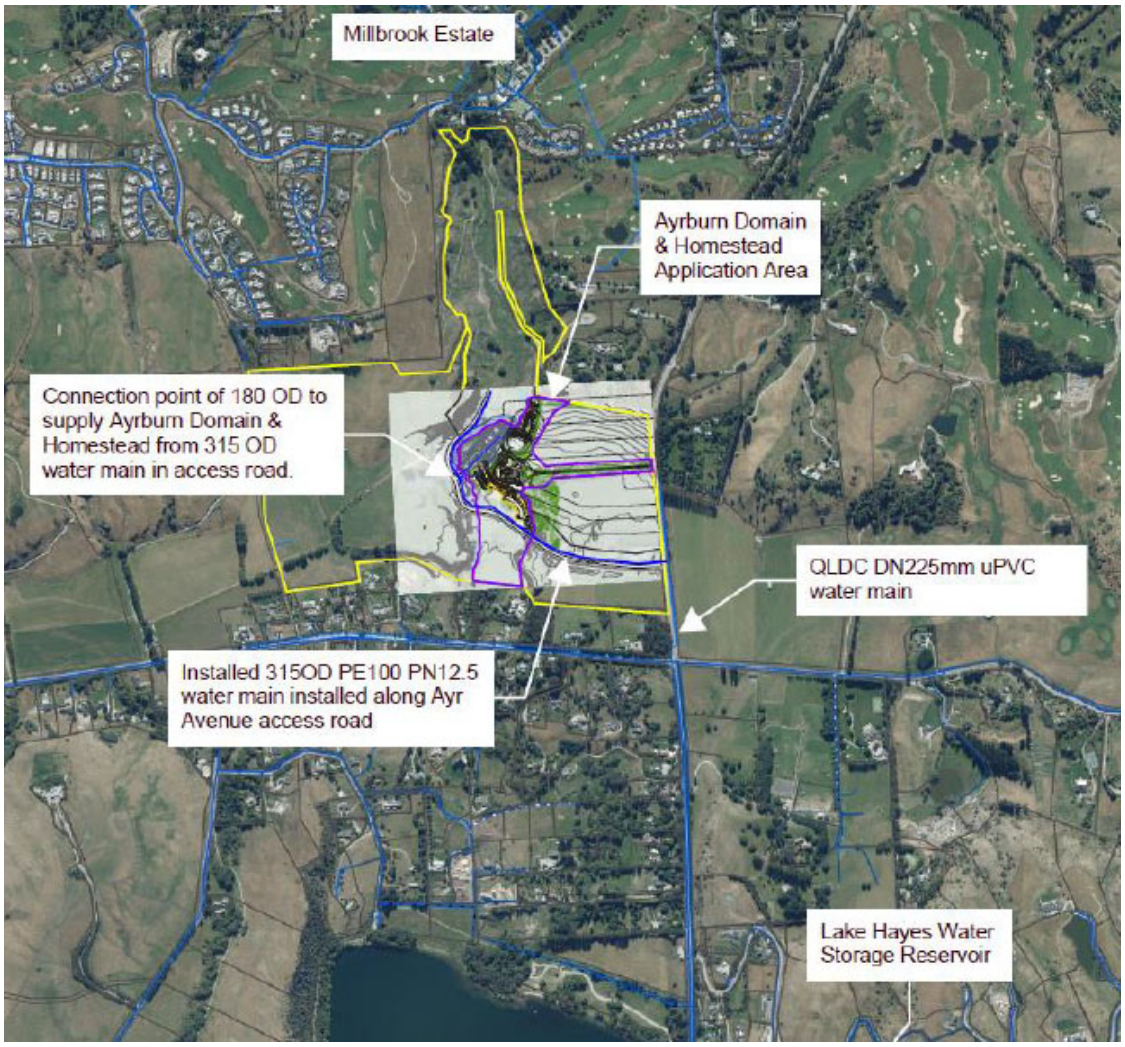

Figure 4: Schematic Layout of Existing & Proposed Water Infrastructure **(Fluent, Ayrburn Domain Extension Water Supply and Wastewater Infrastructure Assessment, December 2021)**

4.6 Capacity of Existing Infrastructure

Previous modelling was undertaken by Mott MacDonald, as summarised in section 5.4 of Fluent Solutions' report dated December 2021 and indicates that the existing DN225 mPVC watermain in the Arrowtown-Lake Hayes Road and the 315 OD watermain in Ayr Avenue has adequate capacity to service the consented Hotel, Ayrburn Domain (including the extension) and other future developments.

Table 6 below summarises the existing consented flows and proposed flows for the Northbrook Arrowtown.

Table 6: Modelled water flows compared to currently proposed wastewater flows

Development Area	Modelled (Mott MacDonald - 2018) Peak Hour (l/s)	Proposed Development
Waterfall Park Hotel	18.90	-
Northbrook Arrowtown	-	9.1
Ayrburn Domain (Consented as part of RM 180584)	1.40	1.40
Ayrburn Domain Change of use buildings		0.15
Ayrburn Farm - No longer proposed Residential Development	24.70	-
Ayrburn Domain Extension (RM211193)	-	9.40
Barrel Room (Lodged for Consent in September 2022 RM220829)		
Bakehouse Variation (Lodged for Consent in September 2022 RM220874)		
Sub-total (Current Proposal)		**20.04**
Future Capacity (subject to future RC applications)	-	24.96
Total	**45.00**	**45.00**

***Includes wastewater for Barrel Room and Bakehouse in Future Capacity*

As indicated in ***Table 6*** above, the consented totals for the water demand have not changed (These have been previously accepted by QLDC at 45 l/s). The flows for the Ayrburn Domain, the change of use buildings, and Ayrburn Domain Extension have not changed either. With the addition of Northbrook Arrowtown, the additional future capacity figure has increased from 14.81 l/s to 24.96 l/s

This results in more capacity being made available for any future developments that will be subject to resource consent.

4.7 Water Conclusion

The following points have been summarised to conclude this assessment:

- The estimated peak potable water demand of 9.1 l/s is less than the currently consented 18.9 l/s even with an allowance for irrigation, therefore it can be assumed that the current bulk supply infrastructure will have sufficient capacity, based on previous modelling by Mott MacDonald.
- Irrigation demand is estimated at 1.09 l/s and is included in the 9.1 l/s potable water demand
- Estimated total fire flow peak (hydrants and sprinklers) is marginally more than for the Hotel consent due to the additional requirement of basement car parking.

APPENDIX 1

Cosgroves Email

RE: CQ21113 Winton Northbrook Waterfall Park - Sprinkler and firefighting water supply demand

MR Martin Robertson <martin.robertson@cosgroves.com>

To John Sternberg

Cc Kylin Gunkel; Alex du Plessis; Daniel Jessop; Nicola Tristram

Reply | Reply All | Forward

Wed 18/05/2022 5:00 pm

Hi John,

Further to our meeting.

The highest sprinkler demand plus the FW2 demand have to be added for the highest expected fire demand. 1200 L/min plus 1500 L/min = 2700 L/min.

If there is not sufficient flow for FW2 then a 45 m3 tank is required with suction connections for the Fire Service. A pump is not required provided the Fire Service can draw the required flow from the tank.

If there is not sufficient flow for the sprinkler system then a tank is required which provides 60 minutes of supply, 1200 L/min and 60 min = 72,000 litres.

If there is not sufficient residual pressure for the sprinklers system then a diesel booster pump is required.

I have found an old email from Fluent which suggested the Mott MacDonald report stated that 2500 L/min would be available at the stie at a residual pressure of 48m.

Regards

Martin Robertson | Associate/Engineering Leader (Fire)
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APPENDIX 2

Fluent Solutions, Dec 2021

Waterfall Park Developments Ltd

Ayrburn Domain Extension

Water Supply and Wastewater Infrastructure Assessment

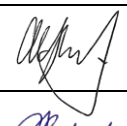
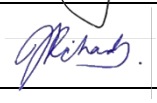
December 2021

Fluent SOLUTIONS

www.fluentsolutions.co.nz

Waterfall Park Developments Ltd

Ayrburn Domain Extension
Water Supply and Wastewater Infrastructure Assessment

Task	Responsibility	Signature
Project Manager:	Alexis Patrylak	
Prepared By:	Louise Clarke	
Reviewed By:	Anthony Steel	
Approved For Issue By:	Jayne Richards	

Issue Date	Revision No.	Author	Checked	Approved
10 November 2021	1	L Clarke	Jayne Richards	Jayne Richards

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Job No.: Q000492
Date: 8 December 2021
Reference: RP 21-12-05 LC Q000492.Docx

Waterfall Park Developments Ltd

Ayrburn Domain Extension
Water Supply and Wastewater Infrastructure Assessment

1.0 Executive Summary

This report covers a high level three-waters infrastructure overview of the proposed Ayrburn Domain Extension. It finds that all infrastructure requirements for the development can be met by existing and proposed new services.

Wastewater servicing will be met by internal gravity sewer networks that will run to the Ayrburn Domain pump station which then pumps via a rising main to the main Waterfall Park Wastewater Pumping Station (RM 180854). An existing wastewater rising main along Ayr Avenue will convey wastewater from the main Waterfall Park wastewater pumping station to the connection point with the existing sewer reticulation on Arrowtown-Lake Hayes Road. Due to the development staging, Ayrburn Domain is proposed to be constructed prior to construction of the main Waterfall Park wastewater pumping station. If required due to timing, an alternative route to the existing rising main will be used for the Ayrburn Domain Extension buildings until the main Waterfall Park wastewater pumping station is constructed. This alternative route is as approved under EA180584.04.

Water demand can be met by gravity supply from the Lake Hayes scheme via an existing main on Ayr Avenue and an existing connection from this main to the Ayrburn Domain development area.

2.0 Introduction

2.1 General

Fluent Infrastructure Solutions Limited (FS) has been engaged by Waterfall Park Developments Ltd to undertake a water supply and wastewater infrastructure assessment for the proposed Ayrburn Domain Extension.

Infrastructure for the Ayr Avenue and adjacent Waterfall Park Hotel developments were assessed in previous resource consent applications (RM171280 and RM180584), which included the development of the Stables and Annex buildings, Cart Shed and Dairy within the Ayrburn Domain Area.

This report has been prepared to support an application for resource consent for the Ayrburn Domain Extension.

2.2 Site Locality and Features

The Site is located at Ayrburn, between Lakes Hayes and Arrowtown (refer Figure 2.1). It is accessed by William Paterson Close via Arrowtown – Lake Hayes Road and Ayr Avenue.

Figure 2.1: Site Location and Features

3.0 The Proposed Development Plan

The proposed development includes an extension to Ayrburn Domain consented under RM180584 (refer Figure 3.1). Ayrburn Domain is currently under construction and includes the consented adaptive reuse of the stone farm buildings (the Stables, Cart Shed and Dairy) into a hospitality precinct.

The Ayrburn Domain Extension includes:

1. The adaptive reuse of the Ayrburn Homestead (the Homestead) as a high-end restaurant, and the stone cookhouse (the Cookhouse) as an outdoor bar folly;
2. The construction of a café and office building (the Bakehouse), including the operational management of Ayrburn;
3. Allowance for 12 temporary activities a year including markets and small concerts (e.g.: 2-piece band); and
4. Ancillary activities such as carparking and a sprinkler valve room (SVR).

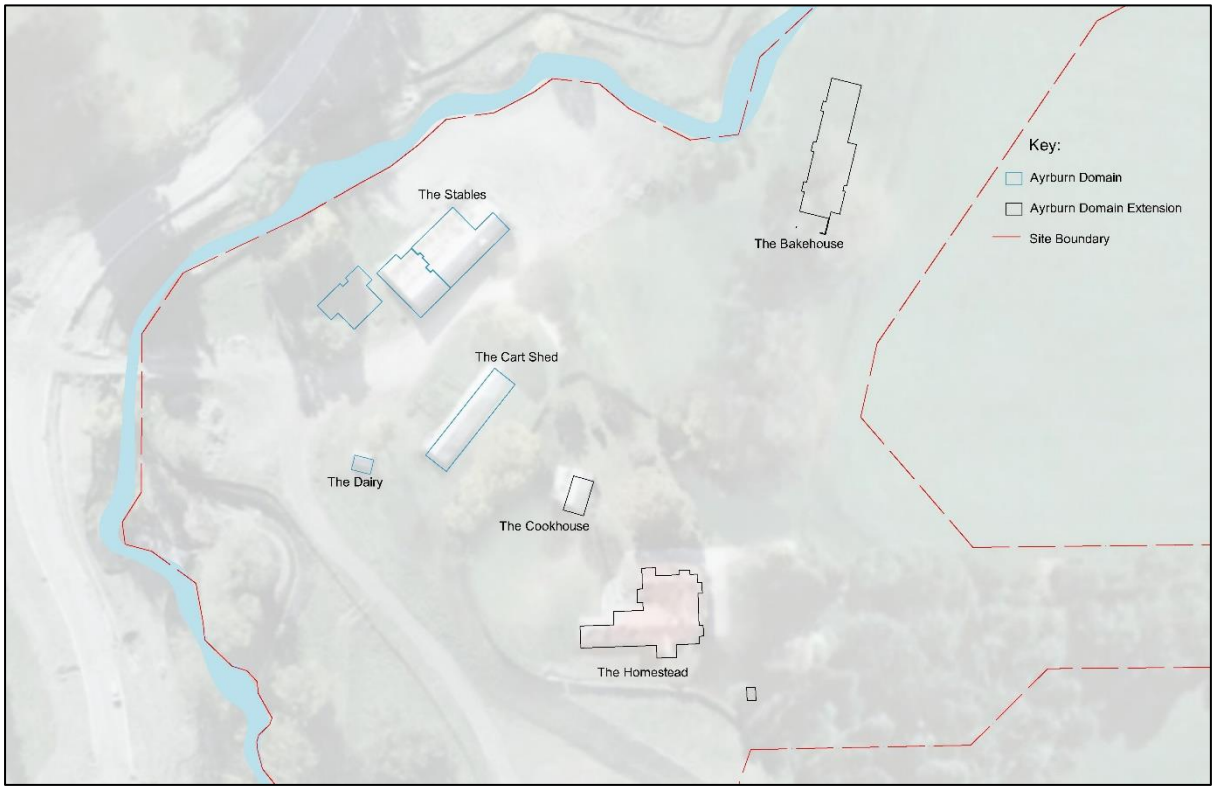


Figure 3.1: Existing Ayrburn Domain and buildings associated with the Ayrburn Domain Extension

4.0 Wastewater

4.1 Wastewater Collection and Conveyance System Design

The design, sizing, and layout of the wastewater collection and conveyance network to service the proposed Ayrburn Domain extension is related to the population served, the facilities to be provided, and the capacity of the existing QLDC wastewater network. The following aspects have been investigated to assess wastewater collection and conveyance requirements:

- Population (i.e.: the number of patrons of the other proposed facilities);
- Wastewater production – both peak wet weather and peak dry weather;
- Capacity of the existing QLDC infrastructure to convey the wastewater loads; and
- Wastewater pumping requirements.

4.2 Wastewater Flows

The following wastewater design flows have been established for the proposed Ayrburn Domain development as shown in Table 4.1 below.

Table 4.1: Wastewater Design Flows

	No. of Facilities	Max No. of People / Facility / Day	Average Per Capita Daily Wastewater Production (L/p/d)	Daily Wastewater Production (m^3/d)	Dry Weather Diurnal Peaking Factor	Peak Dry Weather Flow (L/s)	Wet Weather Peaking Factor	Peak Wet Weather Wastewater Flow (L/s)
Ayrburn Domain - Stables Bar & Lounge (Previously consented RM180584)								
Restaurant	1	572	30	17.2	2.5	0.5	2	0.99
Bar	1	52	20	1.0	2.5	0.03	2	0.06
Non-residential Staff	1	19	30	0.6	2.5	0.02	2	0.03
		Sub Total		**18.8**		**0.5**		**1.1**
Ayrburn Domain - Consented Change of Use (RM210591 s95)								
Cart Shed	1	96	20	1.9	2.5	0.06	2	0.11
Dairy	1	48	15	0.7	2.5	0.02	2	0.04
		Sub Total		**2.6**		**0.1**		**0.2**
Ayrburn Extension - Additional Facilities								
The Bakehouse	1	240	20	4.8	2.5	0.14	2	0.28
The Bakehouse (office space)	1	24	35	0.8	2.5	0.02	2	0.05
Homestead	1	504	30	15.1	2.5	0.44	2	0.88
Future Capacity	1	350	30	10.5	2.5	0.30	2	0.61
Non residential staff	1	40	30	1.2	2.5	0.03	2	0.07
Outdoor Events	1	500	0	0.0	2.5	0.00	2	0.00
		Sub Total		**32.5**		**0.9**		**1.9**
Total for Ayrburn Domain				**53.9**		**1.6**		**3.1**

The building occupancies in Table 4.1 above reflect maximum estimated daily wastewater production. For the purpose of a conservative wastewater assessment this takes into consideration the operating hours of these facilities, estimated to be between 12-16 hours each per day.

Average dry weather design flows are estimated to be 15-30 litres per person per day (l/p/d) based on AS/NZS 1547:2012, depending on the type of services provided.

A peaking factor of 2.5 for the dry weather diurnal and a dilution / infiltration factor of 2 for wet weather has been applied.

Outdoor events will be organised with a provision of portable toilets, which will be emptied off site. These events will have no impact on the wastewater network.

4.3 Existing Infrastructure

A 160 OD PE100 PN12.5 wastewater rising main has been installed along Ayr Avenue under RM180584. The connection of the new rising main to the Arrowtown-Lake Hayes Road wastewater trunk main has also been installed (RM180584).

The proposed Waterfall Park Wastewater Pump Station (WP WWPS) will pump wastewater flows from the Waterfall Park and Ayrburn development area into the 160 OD PE100 PN12.5 main, as assessed in RM180584. The previously consented Ayrburn Domain buildings also convey wastewater to the WP WWPS via a 63 OD PE100 PN12.5 main, which has already been approved and installed. A small pump station (Ayrburn Domain WWPS) will be installed to convey the flows from Ayrburn Domain to the WP WWPS. Engineering Acceptance has been obtained for the Ayrburn Domain WWPS (refer RM180584.EA.00.04). The Ayrburn Domain WWPS has not been installed to date however the previously consented Ayrburn Domain buildings are currently under construction at the time of this report.

If required due to the timing of the installation of the main WP WWPS, the Ayrburn Domain WWPS will pump through a temporary rising main which connects directly into the 160 OD PE100 PN12.5 main on Ayr Avenue, shortly before the existing connection to Arrowtown-Lake Hayes Road trunk main. This rising main and temporary connection have received Engineering Acceptance (refer RM180584.EA.00.04) but have not been installed yet.

These features are indicated in Figure 4.1 below.

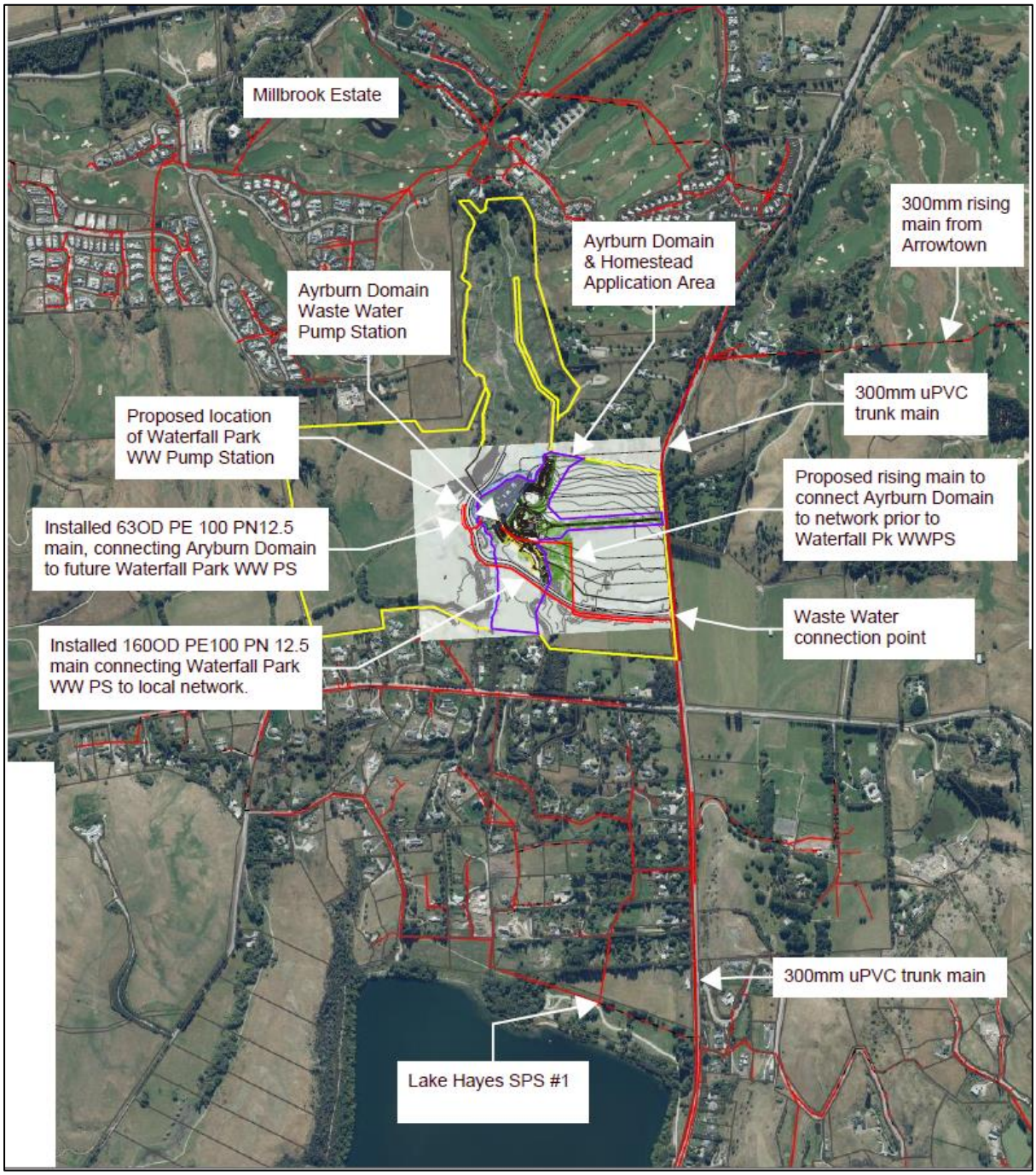


Figure 4.1: Schematic overview of existing sewer services in the vicinity of the Ayrburn Domain and Homestead development with the location of the sewer pump station indicated

4.3.1 Capacity of Existing Infrastructure

The capacity of the existing wastewater infrastructure to convey the additional flows from the proposed Waterfall Park Hotel and an adjacent residential development was modelled by QLDC's modelling consultants, BECA, during February 2018. An addendum to the report was provided by HAL consultants in January 2019. The reports are provided in the Appendices.

At the time of the wastewater modelling, Waterfall Park Developments Ltd was considering a residential development (referred to as Ayrburn Farm). This land is still subject to a rezoning appeal, and a future resource consent application will be required.

The results of the modelling found that the existing 300mm uPVC trunk main, has adequate capacity for the modelled load (23.4 l/s) without the need for any infrastructure upgrades. The breakdown of the wastewater flows by development area differ from those modelled in 2019, however the overall total flows are estimated to remain the same. This is shown in Table 4.2 below.

Table 4.2: Modelled wastewater flows compared to currently proposed wastewater flows

Development Area	Modelled (HAL January 2019)		Proposed Development	
	Peak Daily Volume (m^3)	PWWF (l/s)	Peak Daily Volume (m^3)	PWWF (l/s)
Waterfall Park Hotel	247.4	14.3	247.4	14.3
Ayrburn Domain (consented as part of RM180584)	-	-	18.8	1.1
Ayrburn Domain – change of use buildings			2.6	0.2
Ayrburn Extension – additional facilities	-	-	32.5	1.9
Ayrburn Farm (assessed as residential development)	150.0	9.0	-	-
Additional Future Capacity (subject to future RC application)	-	-	*~114.9**	*~6.0**
Total	**416.2**	**23.4**	**416.2**	**23.4**

** Future Capacity will be assessed for Peak Daily Volume and Peak Wet Weather Flow rate but is not currently anticipated to exceed the values indicated.*

The proposed development comprises of Waterfall Park Hotel, Ayrburn Domain, the Ayrburn Domain additional facilities and a future development west of Mill Creek.

The current assessment for wastewater flows has retained a total outflow from the site at the modelled peak wet weather flow rate (23.4 l/s), which has previously been accepted by QLDC.

Therefore, the results of the modelling, which found that the existing 300mm uPVC trunk main running along Arrowtown-Lake Hayes Road has adequate capacity for both the current, 2028 and 2058 design horizons, are still applicable.

4.4 Wastewater Servicing for the Proposed Development

4.4 Wastewater Servicing for the Proposed Development

Based on the modelling undertaken and investigations to date, the existing 300mm uPVC trunk main along Arrowtown-Lake Hayes Road has adequate capacity to accept wastewater flows from Ayrburn Domain, the proposed Ayrburn Domain Extension, as well as other Waterfall Park developments. The installed 160 OD PE 100 PN12.5 rising main also has capacity to convey flows from the WP WWPS to the 300 uPVC trunk main in the Arrowtown-Lake Hayes Road.

Within the Ayrburn Domain site, two wastewater sub-catchments are proposed to service the consented and proposed buildings. Both of these sub-catchments will be pumped from two separate pump stations to the main WP WWPS via a 63 OD rising main. A significant portion of this 63 OD main is already installed across the bridge over Mill Creek and along Ayr Avenue.

The two wastewater sub-catchments are proposed to be divided as follows:

- Ayrburn Domain Pump Station Catchment

  (Engineering Acceptance provided in RM180584.EA00.05)

  - Stables and annex building (bar, lounge and restaurant)
  - Cart Shed (deli)
  - Dairy (ice cream parlour)
  - Bakehouse (restaurant and office)
- Ayrburn Homestead Pump Station Catchment
  - Homestead Building (restaurant)
  - Additional future capacity

If required prior to the installation of the main WP WWPS, both the Ayrburn Domain WWPS and the Ayrburn Homestead Pump Station will pump through the temporary rising main which connects directly into the 160 OD PE100 PN12.5 main on Ayr Avenue, shortly before the existing connection to Arrowtown-Lake Hayes Road trunk main (refer RM180584.EA.00.04).

5.0 Water Supply

5.1 Water Supply System Design

The design, sizing and layout of the water supply network to service the proposed Ayrburn development is related to the population served, the facilities to be provided and the water required to maintain the site landscaping. The following aspects relating to the water supply have been investigated to assess water supply requirements:

- Population (i.e.: the number of patrons of the proposed facilities);
- Water demands – both peak and fire fighting requirements;
- Water supply availability;
- Water pressure requirements;
- Water storage requirements;
- Landscaping irrigation requirements; and
- Water quality requirements.

5.2 Water Demand Assessment

5.2.1 Domestic and Irrigation Water Demands

Table 5.1 below sets out the assessed water demands for the proposed development. The peaking factors provided in the QLDC COP 2020 have been used for the peak hour water demand.

Building occupancies in Table 5.1 below have been selected to reflect maximum estimated daily water demand. These occupancies may vary from building occupancies relevant to fire safety / vehicle numbers, etc.

Two peaking factor scenarios have been considered:

- Case 1 – peak hour, with controlled irrigation (i.e. daytime peak)
- Case 2 – peak hour (50% domestic peak) plus full irrigation over maximum 12 hours (i.e.: night-time peak)

During the daytime (Case 1), irrigation will be restricted to limited areas of dripline irrigation. Other elements of the irrigation network, such as sprinklers, etc will be controlled such that they do not occur during periods of peak domestic demand.

Case 2 assesses the use of full irrigation on a managed basis over an 8-12 hour period per day, generally overnight and more particularly avoiding peak domestic water demand periods during the day. The domestic peak hour has been reduced by 50% as it considers the night time peak which would be significantly lower than daytime peak.

Table 5.1: Assessed Water Supply Design Volumes and Flows

	No. of Facilities	Max No. of People / Facility / Day	Daily Water Demand (L/p/d)	Peak Daily Water Demand (m^3/d)	Case 1: daytime peak flow with controlled irrigation		Case 2: nighttime peak flow (50% of daytime peak) with full irrigation	
					Peak Hour Peaking Factor	Peak Hour Demand (L/s)	Peak Hour Peaking Factor	Peak Hour Demand (L/s)
Ayrburn Domain - Stables Bar & Lounge (Previously consented RM180584)								
Restaurant	1	572	30	17.2	6.6	1.3	3.3	0.66
Bar	1	52	20	1.0	6.6	0.08	3.3	0.04
Non-residential Staff	1	19	30	0.6	6.6	0.04	3.3	0.02
		Sub Total		**18.8**		**1.4**		**0.7**
Ayrburn Domain - Consented Change of Use (RM210591 s95)								
Cart Shed	1	96	20	1.9	6.6	0.15	3.3	0.07
Dairy	1	48	15	0.7	6.6	0.06	3.3	0.03
		Sub Total		**2.6**		**0.2**		**0.1**
Ayrburn Extension - Additional Facilities								
The Bakehouse	1	240	20	4.8	6.6	0.37	3.3	0.18
The Bakehouse (office space)	1	24	35	0.8	6.6	0.06	3.3	0.03
Homestead	1	504	30	15.1	6.6	1.16	3.3	0.58
Future Capacity	2	350	30	21.0	6.6	1.60	3.3	0.80
Non residential staff	2	40	30	2.4	6.6	0.18	3.3	0.09
Outdoor Events	2	500	2	2.0	6.6	0.15	3.3	0.08
		Sub Total		**46.2**		**3.5**		**1.8**
Additional Irrigation				130		1.6		6.0
		Sub Total		**130**		**1.6**		**6.0**
Total for Additional Water Demand				**178.8**		**5.3**		**7.9**
Total for Ayrburn Domain				**197.6**		**6.7**		**8.6**

Specific irrigation demands are outlined further in Table 5.2 below.

The irrigation demands were provided by the irrigation designer (Waterforce) and were estimated based on an irrigation rate ranging from 3.4-5.5mm/m^2/day over the landscaped area, as shown in Table 5.2 below. For Case 2 (night time irrigation), the total period of irrigation is up to 12 hours however each zone operates for less than 12 hours per night.

Any additional irrigation required during the early years of the development for plant establishment has not been included in the overall demand estimates in Table 5.2 as this irrigation will not occur when the buildings are occupied.

Table 5.2: Irrigation Assessment

Irrigation Zone	Landscaped Area (m^2)	Daily Irrigation Rate (avg) (mm / m^2 / day)	Irrigation Demand (m^3/day)	Case 1: Controlled irrigation (day time – drip lines only) (l/s)	Case 2: Full irrigation over 11 hour night time period (l/s)
Flood Plain Area	10,000	4.5	45	0.0	3.1
Lower Domain	9,200	5.0	45	1.1	1.2
Domain Extension	7,300	5.5	40	0.5	1.7
	26,500		**130**	**1.6**	**6.0**

From Tables 5.1 and 5.2, the following water demand requirements (excluding fire fighting) have been established:

- Peak Day Demand 197.6m^3/day
- Domestic Peak Hour (daytime only, controlled irrigation) (Case 1) 6.7 l/s
- Domestic Peak Hour (overnight, with irrigation) (Case 2) 8.6 l/s

5.2.2 Fire Fighting Demands

The design of the water supply system is also required to meet the fire fighting flow and pressure requirements of *SNZ PAS 4509 – NZ Fire Service Firefighting Water Supplies Code of Practice 2013.* The fire fighting requirements for each building have been assessed by others. These requirements are summarised in Table 5.3 below.

Facilities that fall under the FW2 water supply classification require a minimum fire fighting supply of a total of 25 l/s from two hydrants, at a minimum pressure of 100kPa. An FW 3 water supply classification requires a building to have a minimum fire fighting supply of a total of 50 l/s from a maximum of three hydrants at a minimum pressure of 100kPa.

Table 5.3: Fire Fighting Requirements of Buildings

Building	Water Supply Classification	Sprinkler Protection
Stables Building	FW2	Yes
Cart Shed	FW2	Yes
Dairy	FW3	No
Homestead Building	FW2	Yes
Bakehouse Building	FW2	Yes
Future Capacity	FW2	Yes

The Fire Engineers, Oceania Fire Protection, identified that the maximum sprinkler demand for any of the buildings will not exceed 800 l/min (13.3 l/s) at a pressure of 300 kPa. A copy of the correspondence is in the Appendices. As the sprinkler system is in addition to the FW2 requirement, the total fire fighting demand of these buildings is estimated to be 38.3 l/s (13.3 l/s + 25 l/s) with a minimum residual pressure of 100kPa at the fire hydrants.

The ability of the existing water supply network to provide these firefighting demands is discussed in Section 5.3 below.

5.3 Existing Water Supply System

Properties south of the Waterfall Park Development area are supplied from the Lake Hayes water storage reservoir, located east of Lake Hayes. The Lake Hayes water storage reservoir has a minimum water level of 435m, compared to building levels of around 347-358m in the Waterfall Park Development area. These levels indicate that there should be adequate pressure available to supply the development from the Lake Hayes reservoir.

The existing water reticulation network in the vicinity of the proposed development is shown in Figure 5.1 below. A 315 OD PE100 PN12.5 water main has been installed along Ayr Avenue to service the consented Waterfall Park Hotel development (RM180584). A connection has been made from QLDC's DN225 water main in the Arrowtown-Lake Hayes Road to the new 315 OD water main in Ayr Ave. A 180 OD PE100 PN12.5 offtake has been installed to service Ayrburn Domain (as part of RM180584). As part of this, a pressure reducing valve has been installed close to the offtake from the 315 OD PE100 PN12.5 water main to account of the slightly higher building elevations on the terrace around the Ayrburn Domain.

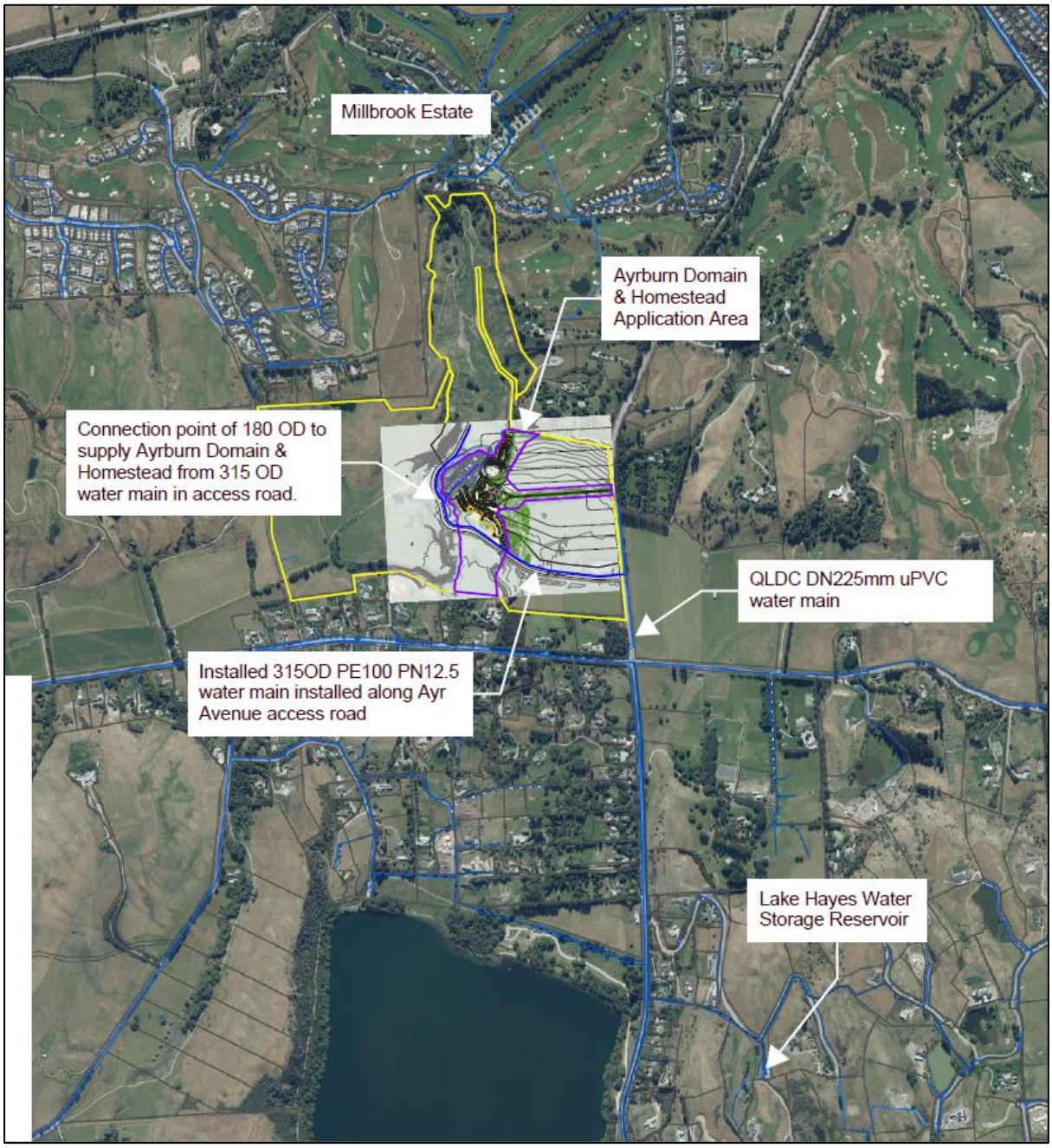


Figure 5.1: Schematic overview of existing water services in the vicinity of Ayrburn Domain Extension Area

5.3.1 Capacity of Existing Infrastructure – Peak Hour Demand

The capacity of the existing water supply infrastructure to service the Waterfall Park Hotel and an adjacent residential development was modelled by QLDC's modelling consultants, Mott MacDonald, during March and April 2018. Their report is provided in Appendix B.

At the time of the water modelling, Waterfall Park Developments Ltd were considering a residential development, the Ayrburn Farm residential development to the west of Mill Creek. In 2018, Mott Macdonald modelled a combined peak flow of 45 l/s including 18.9 l/s for the Waterfall Park Hotel, 1.4 l/s for Ayrburn Domain and 24.7 l/s for the Ayrburn Farm residential development (refer to Table 5.4 below).

Table 5.4: Summary of peak hour flows modelled by Mott MacDonald in 2018 and updated peak hour flows considering the current Waterfall Park Development.

Development Area	Modelled (Mott McDonald – 2018) Peak Hour (l/s)	Current Proposed Development Peak Hour (l/s)
Waterfall Park Hotel	18.9	18.9
Ayrburn Domain (consented as part of RM180584)	1.4	1.4
Ayrburn Farm – residential	24.7	-
Ayrburn Domain – additional facilities	-	9.5
Subtotal (current proposal):	**45.0**	**29.8**
Future Capacity (subject to future RC applications)	-	*15.2**
Total	**45.0**	**45.0**

** Future Capacity will be assessed for Peak Hour Flow, but is not currently anticipated to exceed the values indicated.*

The combined estimated peak hour flows for the proposed Waterfall Park Hotel, Ayrburn Domain and Ayrburn Domain additional facilities is 29.8 l/s. An additional 15.2 l/s is allowed for future capacity. It is not anticipated that the total peak hour water demand for the Waterfall Park development will exceed the 45.0 l/s modelled in 2018.

Due to uncertainty of extent of demand and timing, we have assessed the peak hour demand based on the current proposal; a peak hour demand of 29.8 l/s.

Assessing the peak hour demand of 29.8 l/s does not preclude future resource consent applications to increase the peak hour flow to the previously modelled flows of 45.0 l/s.

The results of the 2018 modelling found that the existing DN225mm mPVC Arrowtown-Lake Hayes Road water main has adequate capacity for the additional demand for both the

Waterfall Park Hotel and proposed residential development (45.0 l/s), for both the current and the 2028 design horizons without the need for any infrastructure upgrades. The modelling also identified high headlosses in the DN225 Arrowtown-Lake Hayes Road water main during the 2058 design horizon that exceeded the QLDC levels of service.

A hydraulic review using the lower peak hour flow rate for the currently proposed peak hour demand of 2938 l/s, has found that the estimated headloss in the DN225 pipe along the Arrowtown-Lake Hayes Road reduces significantly during the 2058 design horizon and only slightly exceeds the QLDC levels of service. This is summarised in Table 5.5 below and the hydraulic calculations are provided in the Appendices.

Table 5.5: Summary of peak hour flows modelled by Mott MacDonald in 2018 and updated peak hour flows considering the proposed Ayrburn Domain Development

	Waterfall Park Hotel Peak Hour (l/s)	Ayrburn Farm Residential Peak Hour (l/s)	Ayrburn Domain Peak Hour (l/s)	Ayrburn Domain Peak Hour (l/s)	Combined Peak Hour Demand (l/s)	2058 Headloss in DN225 (m/km)
Original Flows Modelled by Mott MacDonald – 2018	18.9	24.7	1.4		**45**	**7.8**
Updated Flows with Ayrburn Domain	18.9	-	1.4	9.5	**29.8**	**5.1***

**Assuming roughness coefficient k of 0.015mm. Headloss in DN225 is calculated based on Mott Macdonald's predicted 'existing' flows plus the additional flows from the Waterfall Park Hotel and Northbrook Retirement Village.*

The estimated 2058 headloss in the DN225 water main along the Arrowtown Lake Hayes Road is considered to be acceptable due to the high level of uncertainty associated with estimating flows 40 years in the future.

5.4 Water Servicing for the Proposed Development

From the investigations undertaken, it is clear that the existing DN225 mPVC water main in the Arrowtown-Lake Hayes Road and the 315 OD PE100 PN12.5 water main installed in Ayr Avenue to service the consented Waterfall Park Hotel development has adequate capacity to provide the combined demands to the proposed Waterfall Park Hotel, Ayrburn Domain (including the additional facilities) and other future developments.

Water servicing within the proposed Ayrburn Domain area will comprise of conventional water reticulation sized to ensure that domestic, fire, and irrigation flows can be maintained at adequate pressures meeting the QLDC COP.

Pressure reducing of the water supply will be required where it services some of the buildings in Ayrburn Domain as the pressure to these areas of the development has the potential to exceed the QLDC level of service of 90m due to their elevation, especially during periods of low demand. The pressure reducing valve has already been installed as part of the Access Road works.

APPENDIX A

Wastewater Modelling Report

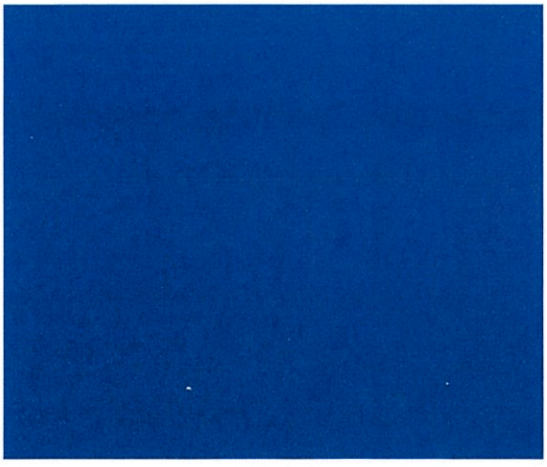
Report

Waterfall Park Development Wastewater Modelling

Prepared for Queenstown Lakes District Council (Client)

By Beca Limited (Beca)

7 February 2018



Revision History

Revision Nº	Prepared By	Description	Date
A	Tracey Myers	Draft Report	8/2/18
B	Tracey Myers	Report updated with Developer's Comments	16/2/18
C	Tracey Myers	Final Report	19/04/18

Document Acceptance

Action	Name	Signed	Date
Prepared by	Tracey Myers	TMyers	23/04/18
Reviewed by	Dan Stevens	D.R.Stevens	24/04/18
Approved by	Dan Stevens	D.R.Stevens	24/04/18
on behalf of	Beca Limited		

Contents

Appendices

1 Background

Beca Limited (Beca) have been engaged by Queenstown Lakes District Council (QLDC) to model a new development at Waterfall Park, Lake Hayes (see Appendix A, Development Plan). Modelling work has been completed previously for this development. However, the development has now expanded, and further modelling work is required.

2 Demand and Loads to the Wastewater Network

2.1 Development Demand Assessment

We have been given average, and peak flow information by the developer. We have converted these flows into population equivalents, as this is what the model uses. The daily flow per person in the QLDC Land Development and Subdivision Code of Practice is 250 L/day. The population equivalent for the average flows are given in Table 1 below.

Table 1 - Population Equivalent for Flows

Development Type	Average Daily Flows (L/s)	Total Daily Flows (m^3)	Population Equivalent (rounded)
Hotel	2.9	247.1	988
Residential	1.8	156.4	626

We have, therefore, used a population equivalent of 1,614 in the wastewater model to represent the flows.

Appendix A, **Figure 1** shows the sewer network in the vicinity of the new development, and includes the modelled network for the development.

2.2 Loads in the Wastewater Network

The peak wet weather flows entering the Lake Hayes #1 and #2, and Bendemeer pump stations are given in Table 2 below. Appendix B, **Figures 2 to 10**, show the peak wet weather flows entering the pump stations during the 2 year ARI event. Appendix C, **Figures 11 to 19**, show the flows discharging from the pump stations during the same period. No pump curve has been provided for the Lake Hayes #2 pump station, and a fixed flow rate has been set at 16 L/s for both pumps.

Table 2 - Peak Flows Entering Lake Hayes #1 and #2 Pump Stations

Pump Station	Current WWF (L/s)	2028 WWF Including Growth Model (L/s)	2028 WWF with Growth Model and Waterfall Park Flows (L/s)
Lake Hayes #1	15	21	21
Lake Hayes #2	24	25	25
Bendemeer	146	148	157

We removed the Waterfall Park flows that were previously included in the growth model before we simulated the runs. The Waterfall Park development has a peak dry weather flow of 11.7 L/s, and a peak wet weather flow of 23.4 L/s.

3 Design Horizon Checks

We have simulated three scenarios, using the 2028, and 2058 design horizons. The simulations have been run with a 2year ARI design storm event, which is the standard Level of Service for QLDC. Appendix D, **Figures 20 to 23** show the peak wet weather flow in the long sections.

3.1 Scenario 1 – DWF Gravity Fed to Speargrass Flat Road

This is the developer's preferred option. In the previous modelling work, the network had insufficient capacity to take the extra flows from Waterfall Park. Therefore, we were requested to initially simulate dry weather flow from the development, but with wet weather flows in the rest of the model. Simulating the dry weather flow only allows us to see the impact of minimising the development inflow and infiltration on the existing network.

Without the development, one manhole (SM11957) floods downstream of the Lake Hayes #1 PS.

When the full development is added, three manholes flood upstream of the Lake Hayes #1 PS. These manholes are SM11804, SM11807, and SM11930.

The capacity in the current network is 7.1 L/s. Adding a peak residential flow of 4.5 L/s leaves the remaining capacity as 2.6 L/s, without adding any storage at the development. Therefore, the remaining flow from the development will need to be stored.

3.1.1 Scenario 1a – Residential DWF Gravity Fed to Speargrass Flat Road

We simulated the DWF for only the residential development, with the wet weather flows in the rest of the model. The network upstream of the Lake Hayes #1 pump station has capacity to take these flows.

3.1.2 Scenario 1b – Hotel DWF Gravity Fed to Speargrass Flat Road

We simulated the DWF for only the hotel development, with the wet weather flows in the rest of the model. One manhole (SM11930) floods. Therefore, the network upstream of the Lake Hayes #1 pump station does not have the capacity to take the hotel flows.

3.2 Scenario 2 – DWF Pumped to Arrowtown-Lake Hayes Road

We modelled a pump station, and 300mm diameter rising main to take the flows to connect into the existing network on Arrowtown-Lake Hayes Road. The pump rate is 15 L/s. We then simulated the model with dry weather flow from the development, but with wet weather flows in the rest of the model. We considered whether or not the new pump station could run at the same time as the peak flows from the Arrowtown-Lake Hayes pump station. We found that the new pump station has insignificant impact on the existing pump station.

Without the development, one manhole (SM11957) floods downstream of the Lake Hayes #1 PS. Adding the development does not create any more areas of flooding.

3.3 Scenario 3 – WWF Pumped to Arrowtown-Lake Hayes Road

This scenario is the same as scenario 2, except we simulated the 2 year ARI event through the development as well. The pump rate remains 15 L/s. As before, we managed the pumping from the development using Real-Time Control. We also simulated the model without the Real-Time Control.

During the 2028 design horizon, SM11957 floods. This is regardless of whether the development is modelled or not. The flood volume is 75m^3, during the 2028 design horizon.

During the 2058 design horizon, two manholes flood (SM11952 and SM11957) downstream of the Lake Hayes #1 PS without the development. The flood volume is 75m^3.

With the development included, no extra manholes flood. As with Scenario 2, the new pump station has an insignificant impact on the existing pump station. Table 3 below details the pressure in the 300mm diameter pipe at the connection point for the 2058 design horizon.

Table 3 – Pressure at Connection Point for Scenario 3

Design Horizon	Static Pressure (m)	Pressure with No Waterfall Park Flow (m)	Pressure with Arrowtown and Waterfall Park Flows (m)
2058	4.6	4.8	5

4 Future Upgrades Required

Jayne Richards at Fluent Solutions Ltd requested that we look at the maximum flow that can be added to both Scenarios 1 and 3.

4.1 Scenario 1a

The capacity in the current network is 7.1 L/s. Adding a peak residential flow of 4.5 L/s leaves the remaining capacity as 2.6 L/s, without adding any storage at the development. Therefore, the remaining flow from the development will need to be stored.

4.2 Scenario 3

A Capital Scheme, Lake Hayes #2 PS, is already included in the current Capital Programme. This scheme includes upgrades that will relieve the flooding anticipated in 2028. In terms of effect on the network, we would recommend that Scenarios 2 and 3 are taken further. Neither of those scenarios affect the current flooding.

No other upgrades are required to contain the extra flows from Waterfall Park development during the 2028 or 2058 design horizons.

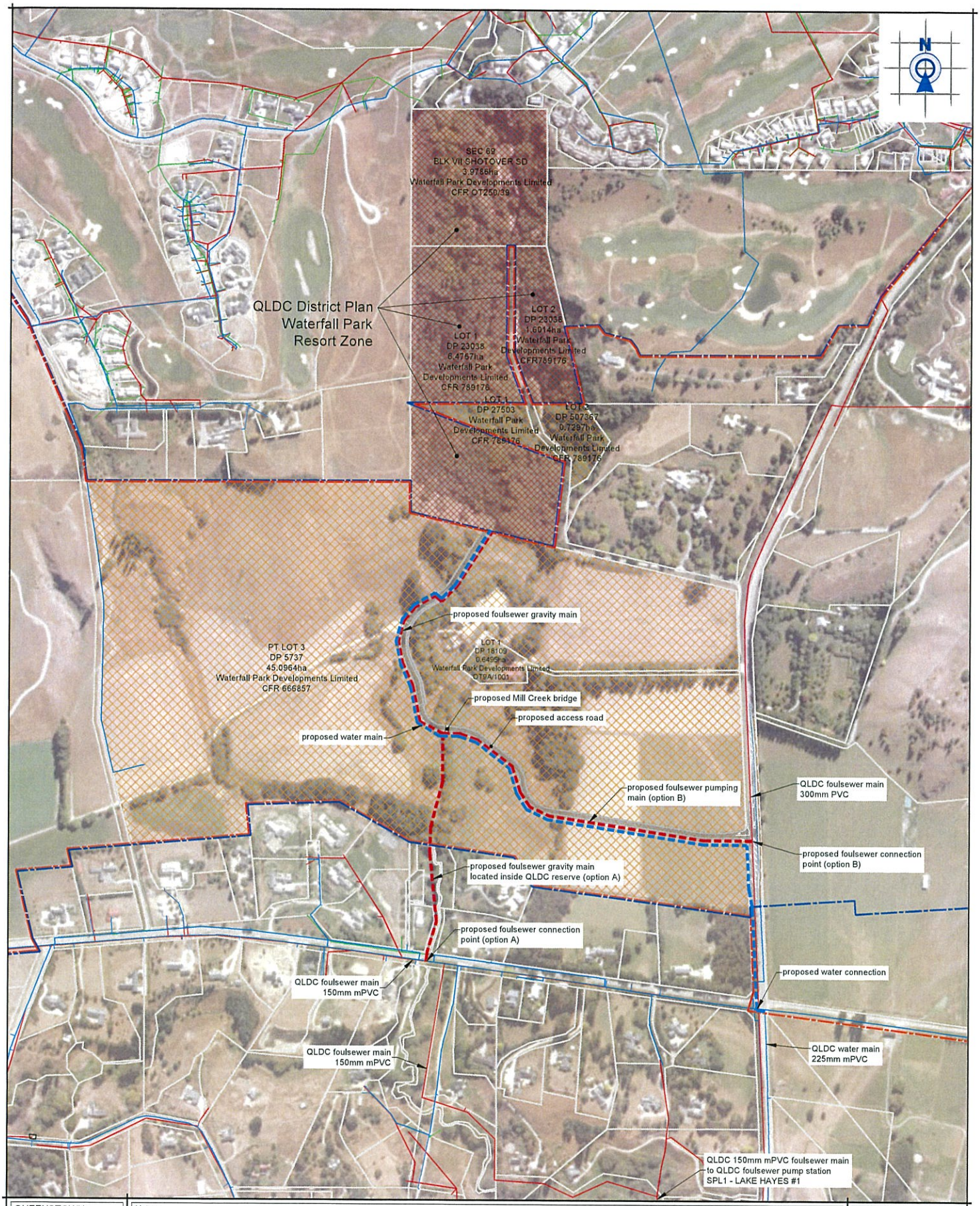
5 Conclusion

The sewer network between Speargrass Flat Road and Lake Hayes #1 PS has insufficient capacity to take all of the dry weather flows from the Waterfall Park development. After adding the residential development only, there is spare capacity of 2.6 L/s peak flow in the Speargrass Flat Road network.

A Capital Scheme, Lake Hayes #2 PS, is already included in the current Capital Programme. This scheme includes upgrades that will relieve the flooding anticipated in 2028. In terms of effect on the network, we would recommend that Scenarios 2 and 3 are taken further. Neither of those scenarios affect the current flooding, and no other upgrades would be required to the sewer network.

Appendix A

Plans



QUEENSTOWN:
Terrace Junction,
1092 Frankton Road,
PO Box 2645,
Queenstown 9349.
T 03 441 4715
E queenstown@ppgroup.co.nz

Notes:
1. Lot boundaries shown in grey
2. Existing QLDC services from QLDC GIS (15/12/17)

QLDC sewer scheme boundary
QLDC water scheme boundary
QLDC sewer infrastructure
QLDC water infrastructure
QLDC drainage infrastructure

0m 100m 200m 300m

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Client/Location:
Waterfall Park Developments Ltd
Sec 69 Blk VII Shotover SD, Lots 1 & 2
DP 23038, Lot 1 DP 27503, Lots 1 & 2
DP 507367, Pt Lot 3 DP 5737 and Lot 1 DP 18109

Purpose/Drawing Title:
Proposed Connections to
Council Services
Plan for Discussion

Surveyed by:		Original Size:	Scale:
Designed by:		A3	1:5000
Drawn by:	SJP		DO NOT SCALE
Checked by:			
Approved by:			
Job Ref: Q6388 - 26 - 2		Sheet No: 1	Revision No: C
			Date Created: 19/12/2017

PLOT DATE: 19 December 2017 - 6:25 PM BY: Stephen Popenhagen

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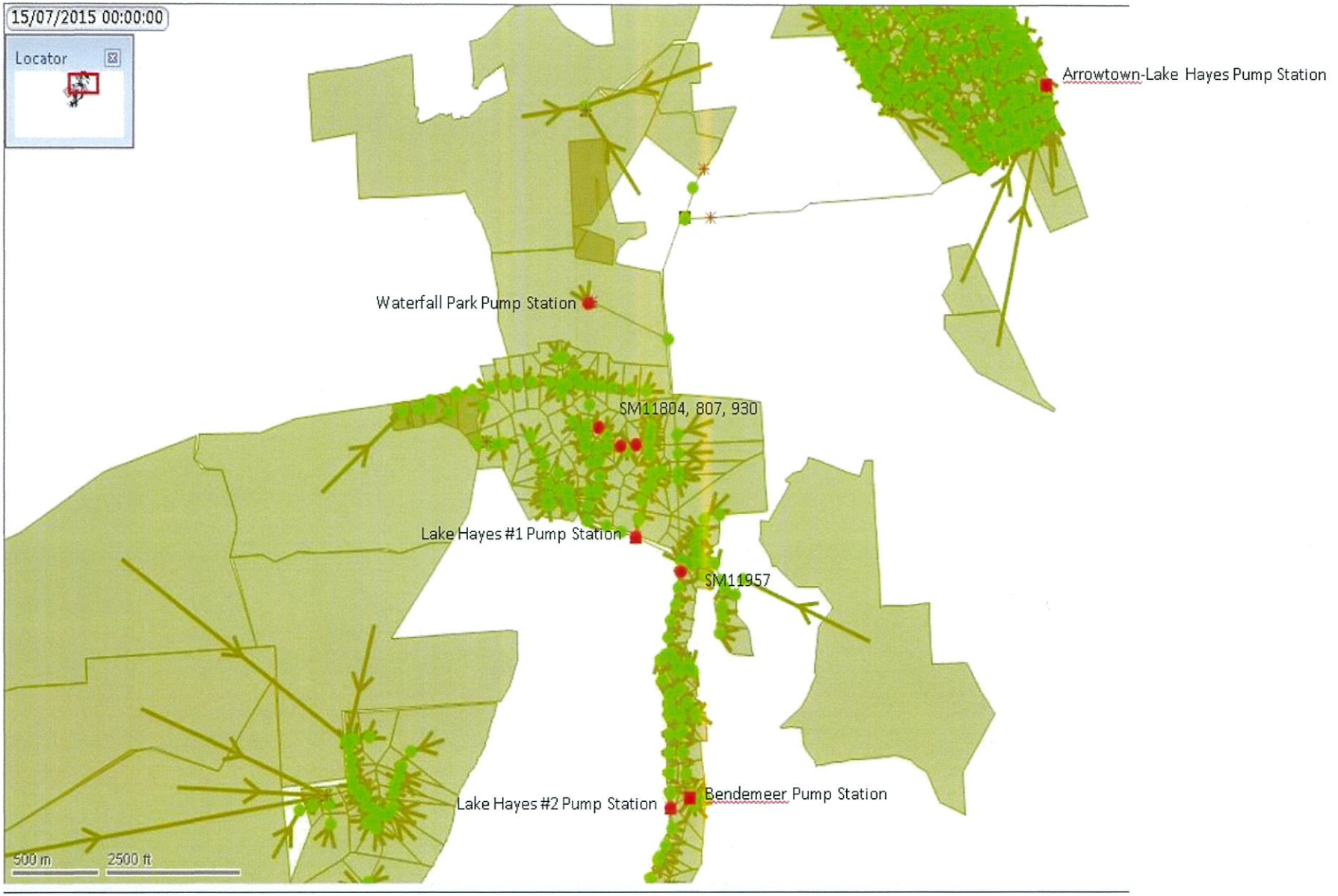
Figure 1: Sewer network, with pump stations, and flooding manholes highlighted (add note showing SM11957)



Appendix B

Inflows to the Lake Hayes Pump Stations

Figure 2: Current peak wet weather inflow to Lake Hayes #1 PS

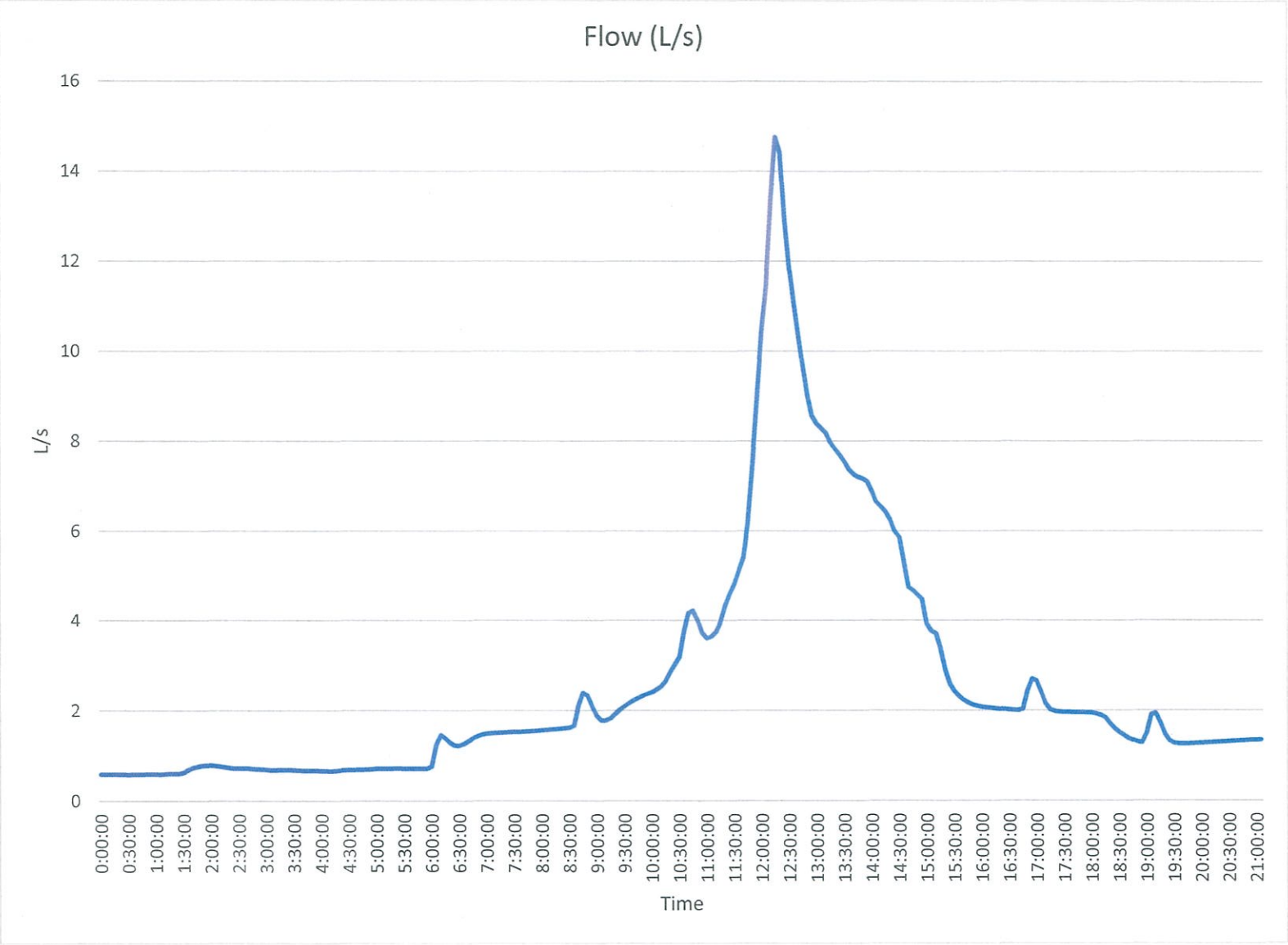


Figure 3: Peak wet weather inflow to Lake Hayes #1 PS using 2028 Growth Model (No Waterfall Park Development)

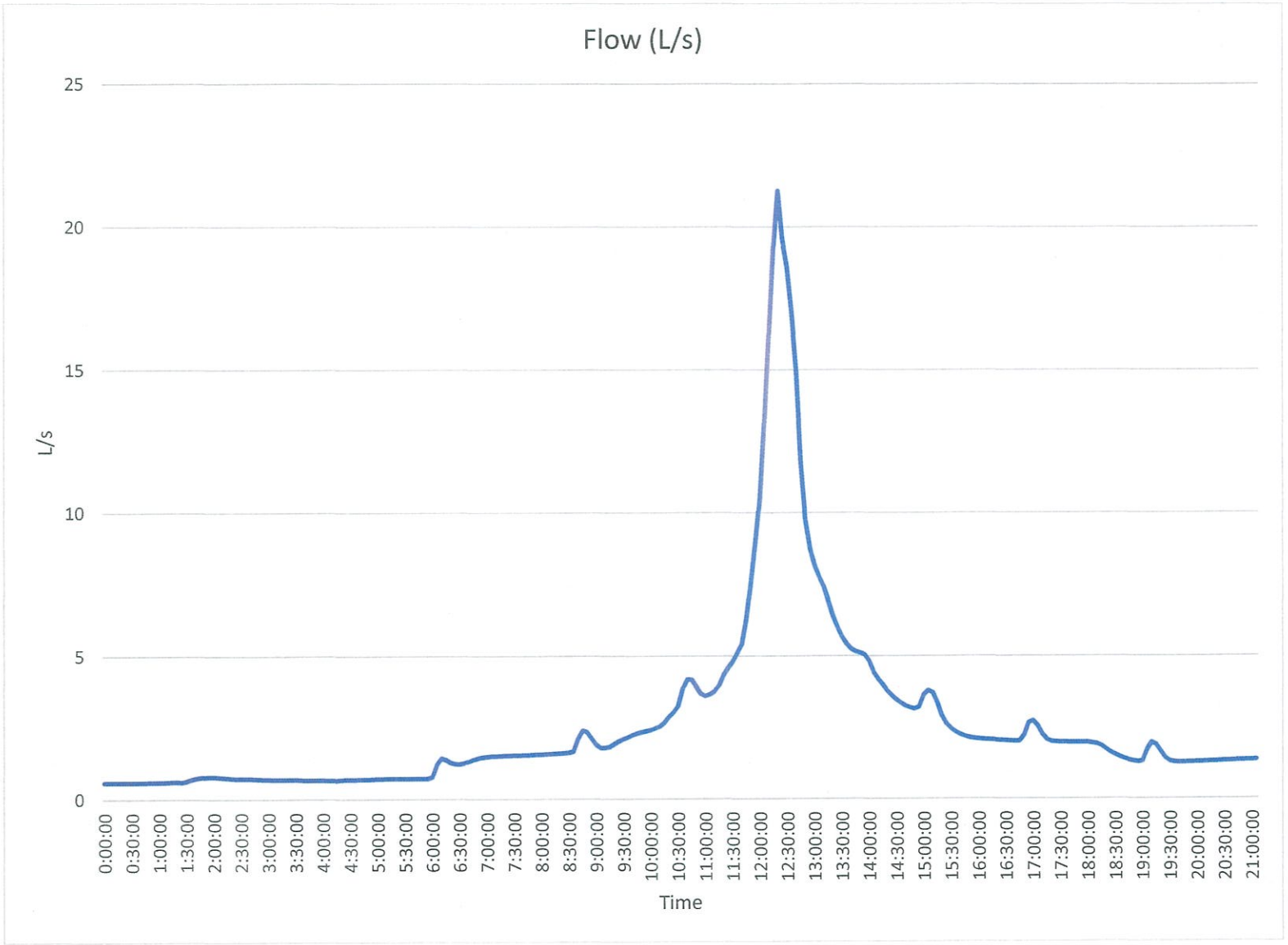


Figure 4: Peak wet weather inflow to Lake Hayes #1 PS using 2028 Growth Model, including Waterfall Park Development

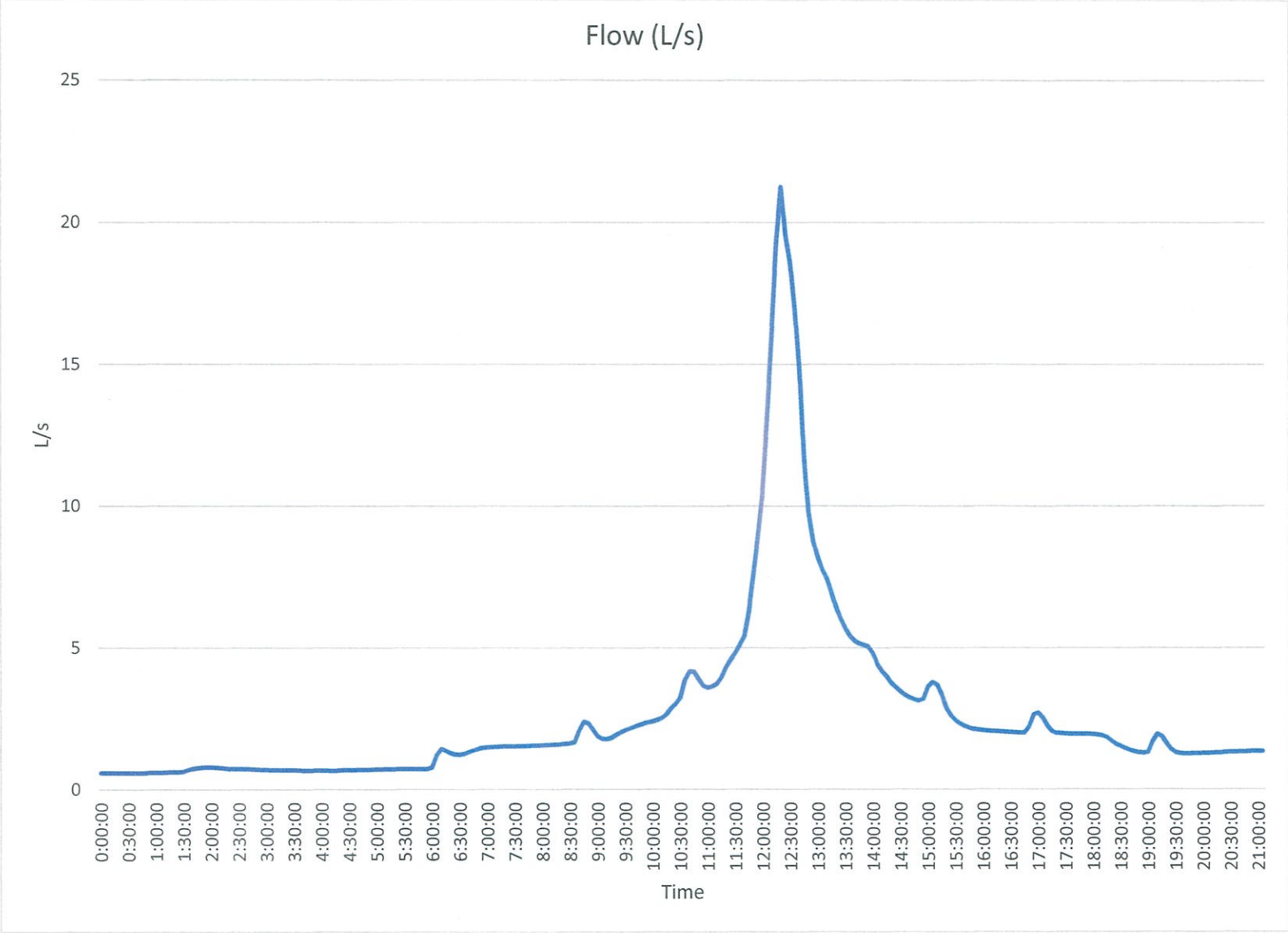


Figure 5: Current peak wet weather inflow to Lake Hayes #2 PS

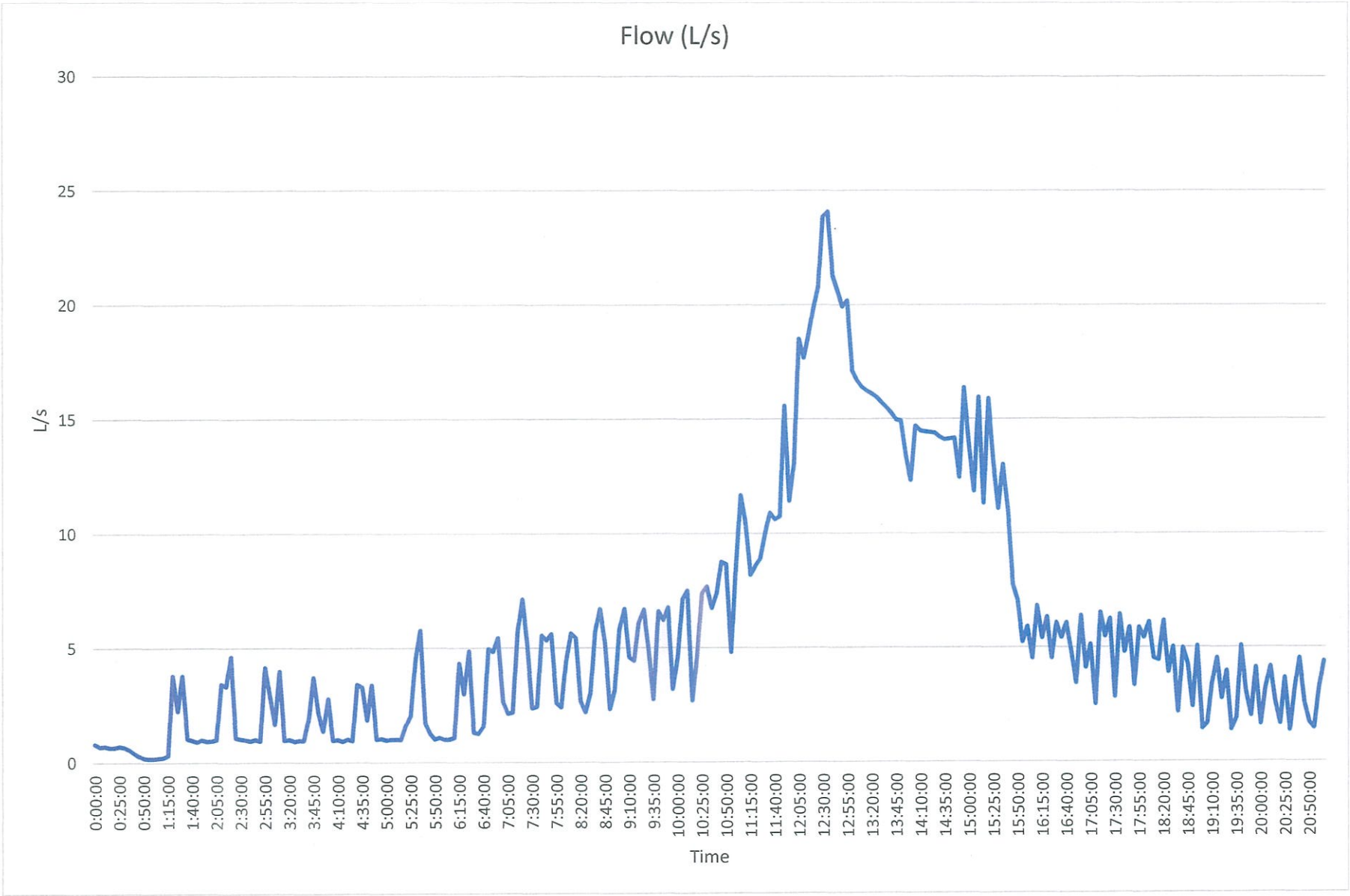


Figure 6: Peak wet weather inflow to Lake Hayes #2 PS using 2028 Growth Model (No Waterfall Park Development)

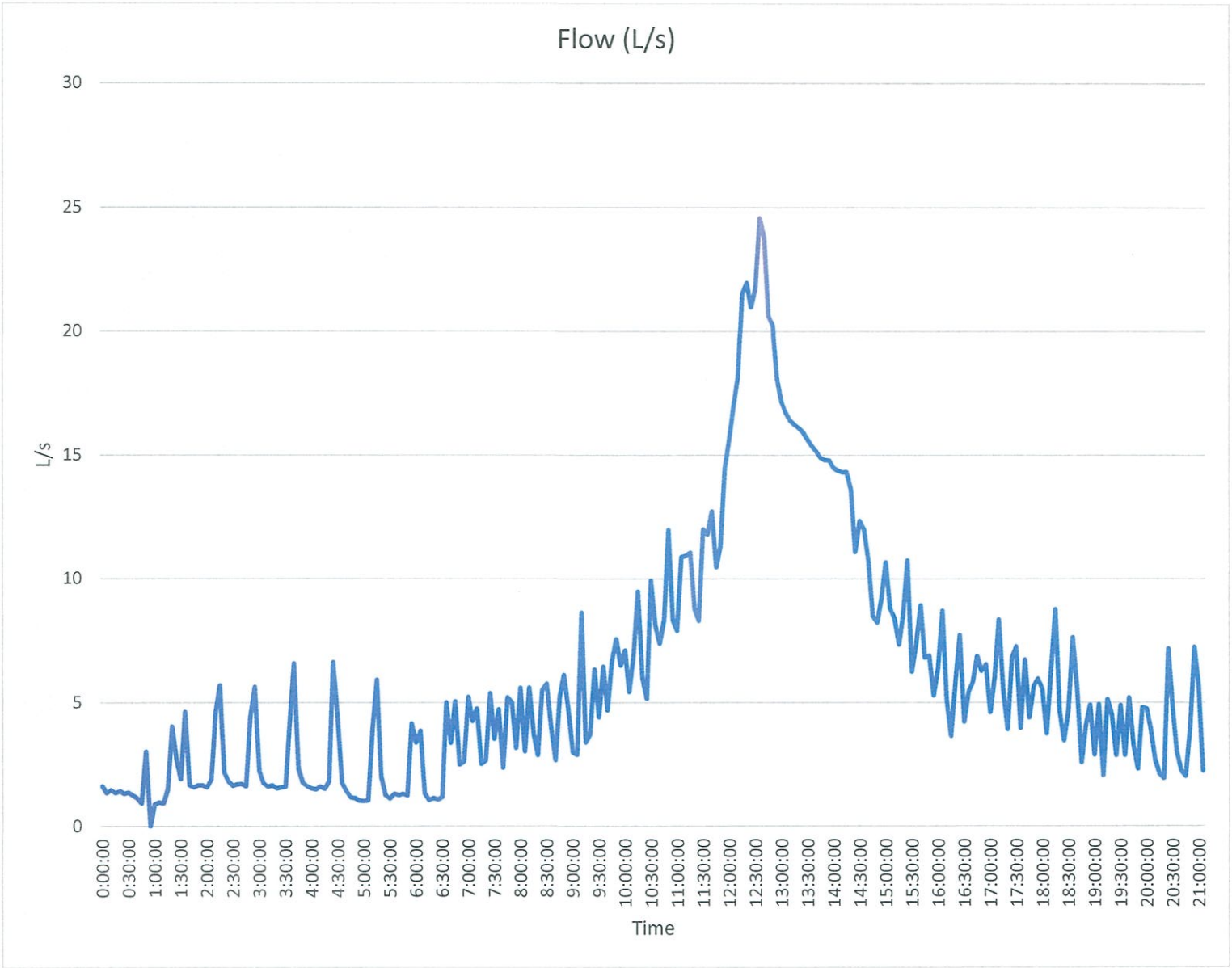


Figure 7: Peak wet weather inflow to Lake Hayes #2 PS using 2028 Growth Model, including Waterfall Park Development

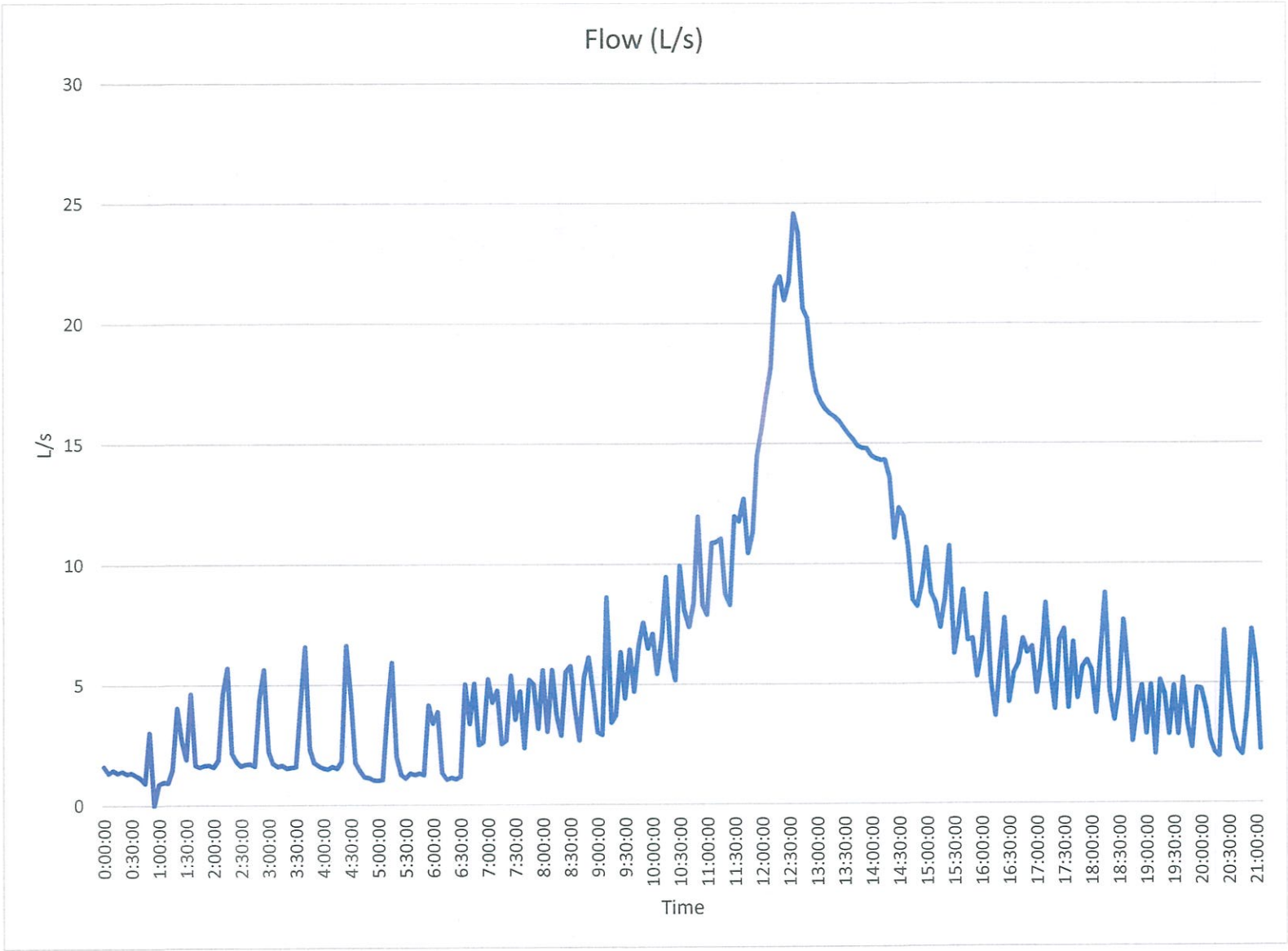


Figure 8: Current peak wet weather inflow to Bendemeer PS

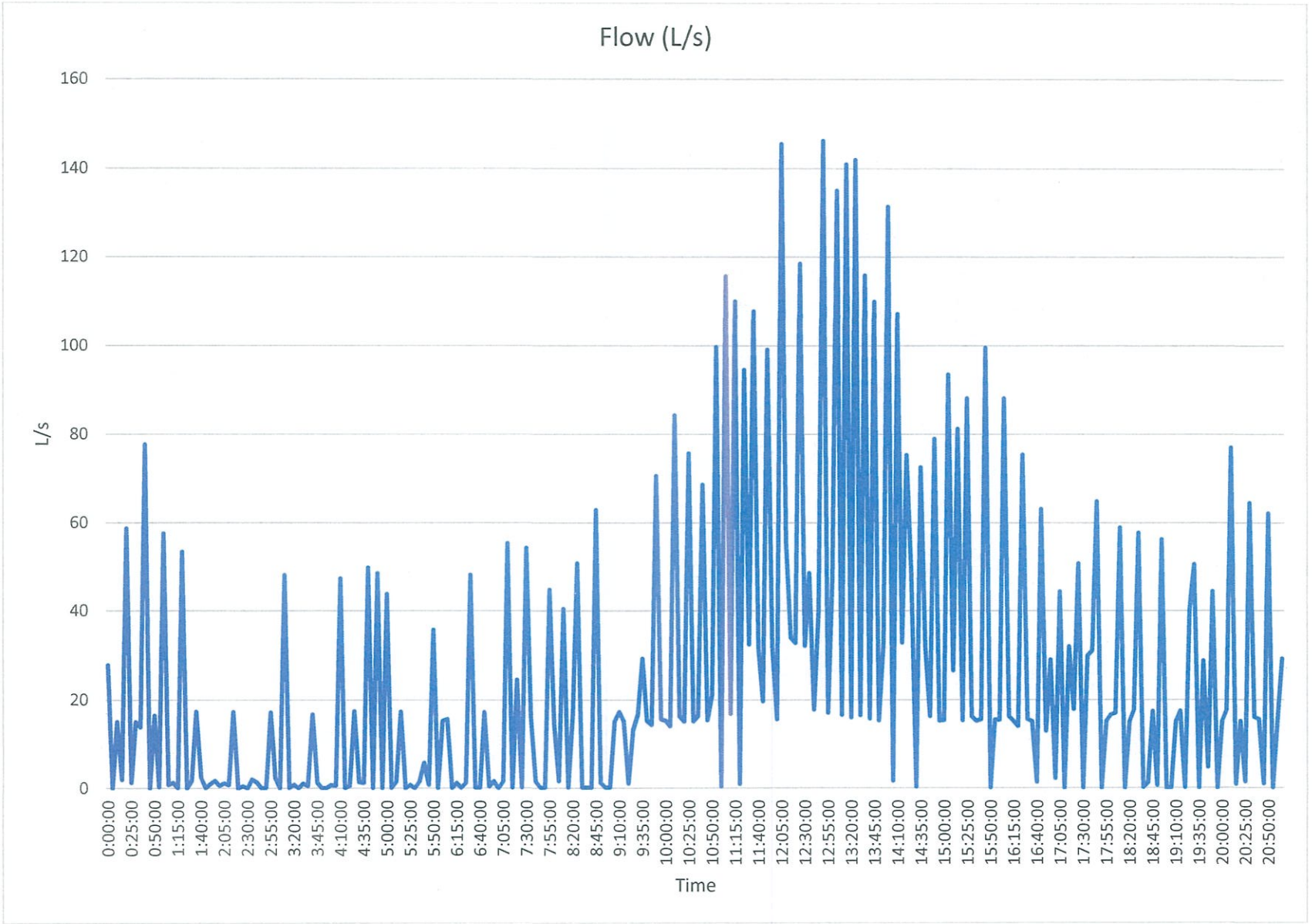


Figure 9: Peak wet weather inflow to Bendemeer PS using 2028 Growth Model (No Waterfall Park Development)

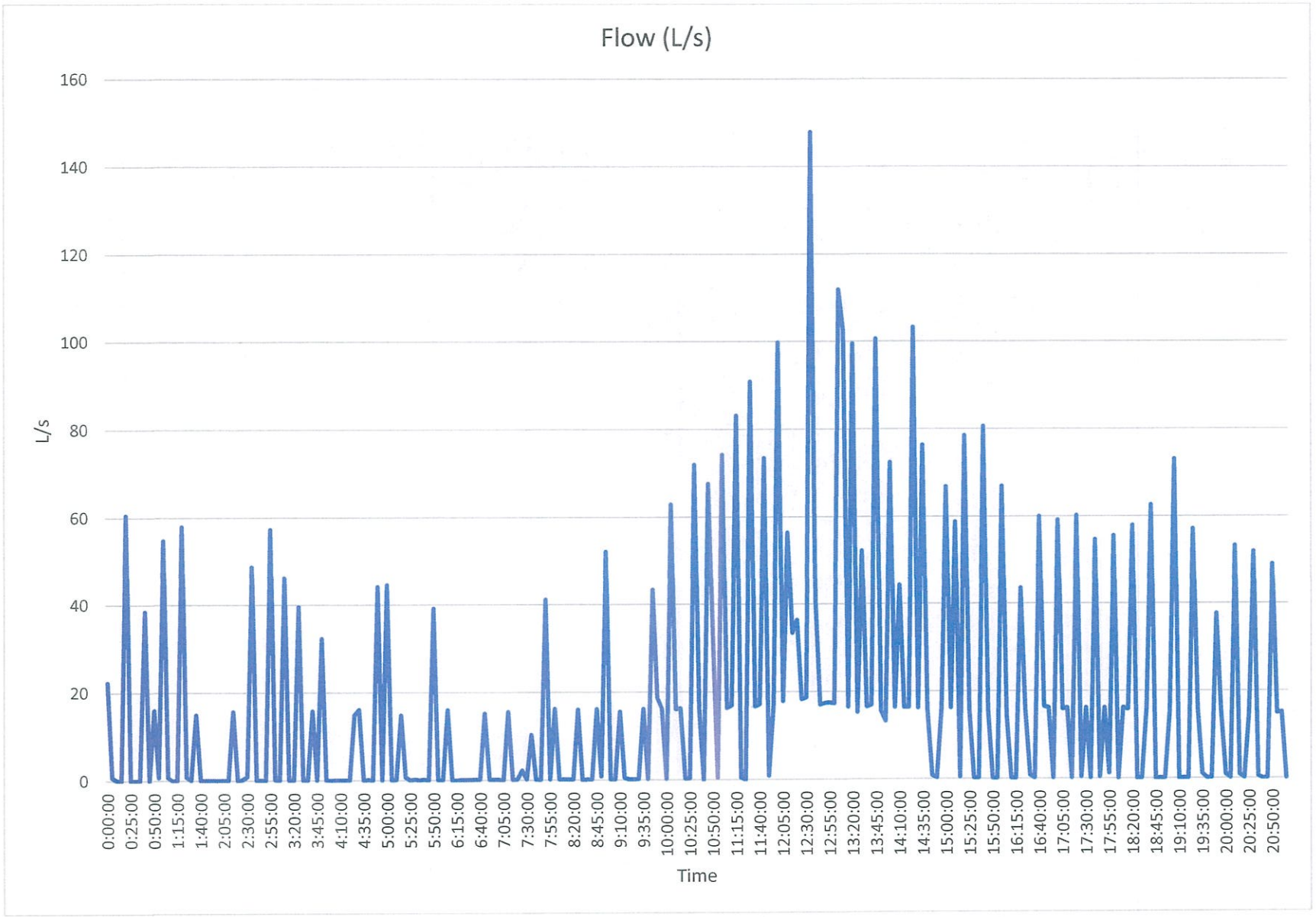
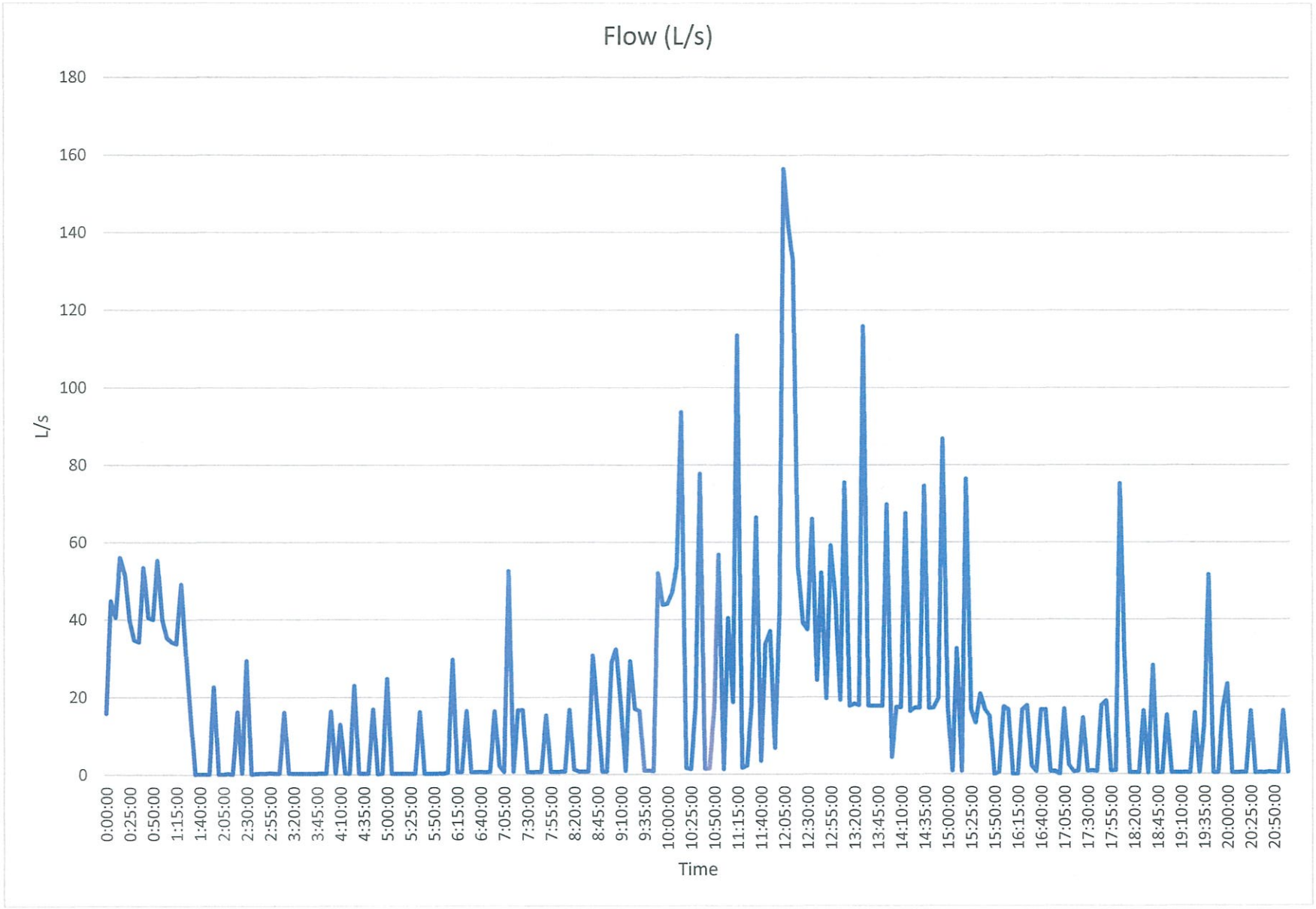


Figure 10: Peak wet weather inflow to Bendemeer PS using 2028 Growth Model, including Waterfall Park Development



Appendix C

Outflows from the Lake Hayes Pump Stations

Figure 11: Current peak wet weather outflow from Lake Hayes #1 PS

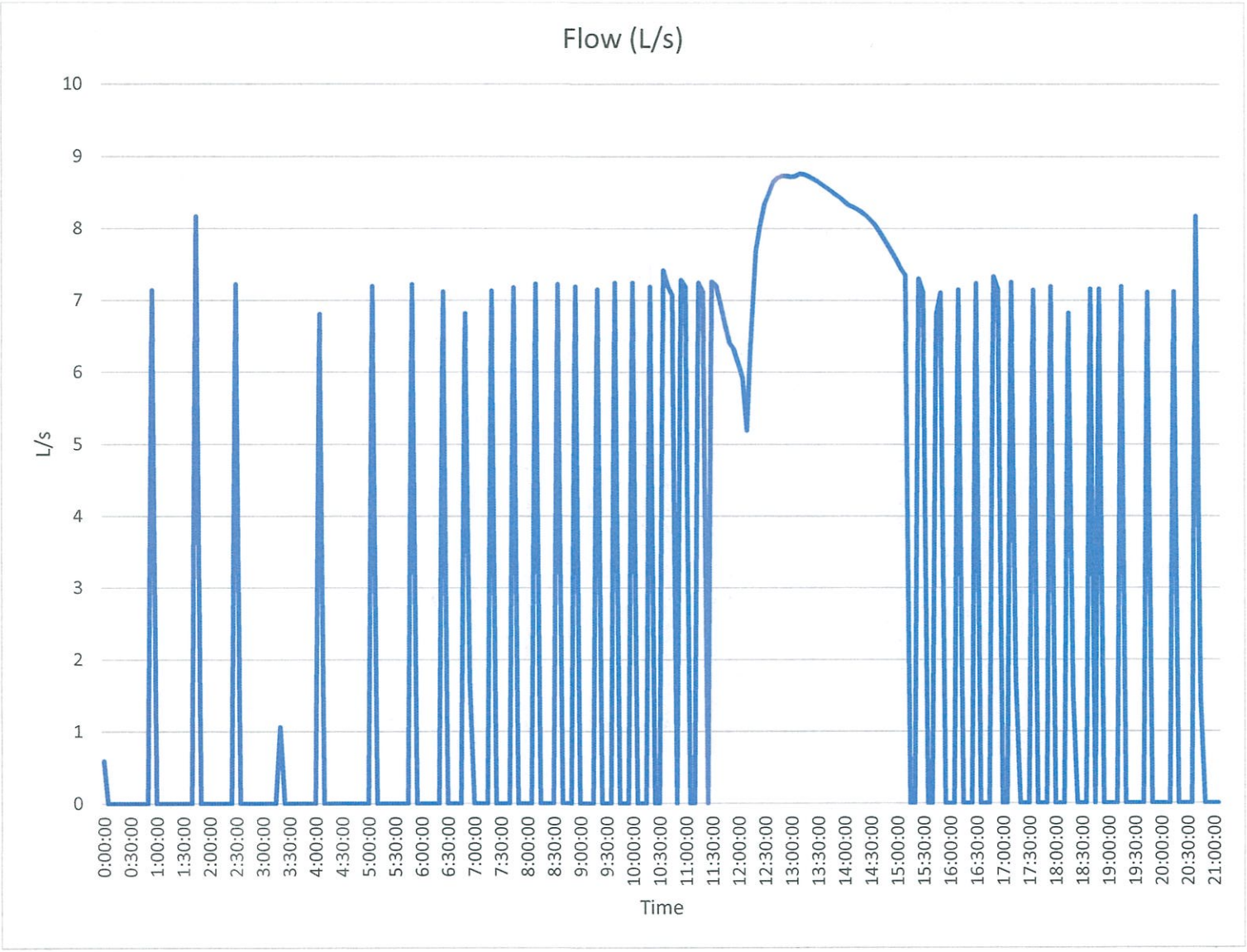


Figure 12: Peak wet weather outflow from Lake Hayes #1 PS using 2028 Growth Model (No Waterfall Park Development)

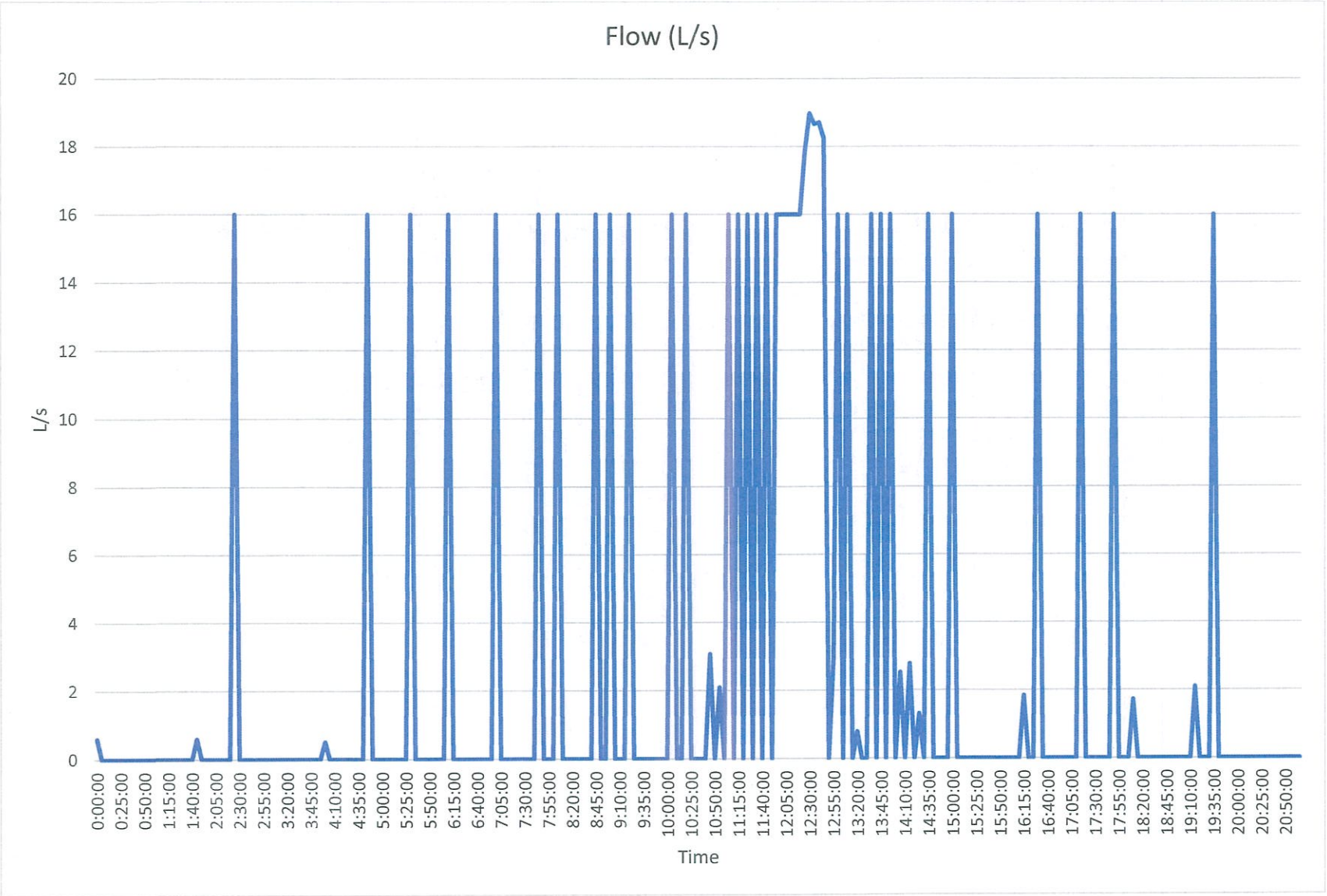


Figure 13: Peak wet weather outflow from Lake Hayes #1 PS using 2028 Growth Model, and Including Waterfall Park Development