



DSS Asset Concept Design

# Merrimu PSP Development Phase 4 Investigation

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Prepared for  
**Melbourne Water**  
August 2026





Alluvium Consulting recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Melissa Barton. This piece was commissioned by the Alluvium Group, and tells our story of caring for Country, through different forms of waterbodies, from creeklines to coastlines. The artwork depicts people linked by journey lines, sharing stories, understanding and learning to care for country and the waterways within.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for Melbourne Water under the contract titled Merrimu PSP Development Phase 4 Investigation.

|                     |                                                                                                                                                              |
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# Contents

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>1 Introduction .....</b>                                  | <b>1</b>  |
| 1.1 Study area .....                                         | 1         |
| <b>2 Previous investigations.....</b>                        | <b>3</b>  |
| Phase 1 – Geomorphology and vegetation assessment .....      | 3         |
| Phase 2 – Stormwater management risk assessment .....        | 3         |
| Phase 3 – Surface water and groundwater investigations ..... | 4         |
| Assessment of proposed stormwater outfalls .....             | 4         |
| <b>3 Existing conditions.....</b>                            | <b>4</b>  |
| <b>4 Post-development objectives and conditions.....</b>     | <b>5</b>  |
| 4.1 Aim.....                                                 | 5         |
| 4.2 Objectives .....                                         | 5         |
| 4.3 Approach .....                                           | 6         |
| 4.3.1 Stormwater quantity management .....                   | 6         |
| 4.3.2 Stormwater conveyance .....                            | 6         |
| 4.3.3 Stormwater quality treatment .....                     | 6         |
| 4.3.4 EPAV stormwater guidance .....                         | 7         |
| 4.4 Future land use .....                                    | 7         |
| <b>5 Catchment analysis .....</b>                            | <b>9</b>  |
| 5.1 Sub-catchment .....                                      | 9         |
| 5.2 Fraction impervious assumption .....                     | 11        |
| <b>6 Hydrologic analysis.....</b>                            | <b>14</b> |
| 6.1 Hydrologic modelling .....                               | 14        |
| 6.2 Input parameters .....                                   | 16        |
| 6.3 Existing condition RORB model .....                      | 17        |
| 6.4 Developed condition RORB model.....                      | 18        |
| 6.5 Climate change assessment.....                           | 18        |
| 6.6 Model results .....                                      | 20        |
| 6.7 Stormwater quantity – retardation .....                  | 22        |
| <b>7 Wetland and sediment basin design .....</b>             | <b>1</b>  |
| 7.1 Design approach.....                                     | 1         |

|                                          |           |
|------------------------------------------|-----------|
| 7.2 Stormwater treatment modelling ..... | 2         |
| 7.3 Modelling input.....                 | 2         |
| 7.4 Asset performance .....              | 3         |
| 7.5 Connections.....                     | 5         |
| 7.6 WLRB concept layout.....             | 6         |
| <b>8 Conclusions.....</b>                | <b>10</b> |

## Appendices

|                                                                                                                                                |           |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Appendix A: Merrimu Pre-PSP Development Phase 3: Surface Water and Groundwater Investigations (Alluvium, 2024).....</b>                     | <b>11</b> |
| <b>Appendix B: Environmental and Geomorphology Assessments for Selected Stormwater Outfalls in the Merrimu PSP Area (Alluvium, 2026) .....</b> | <b>12</b> |
| <b>Appendix C: Merrimu PSP Phase 4 Investigation - Task 1 Review Feedback and Scheme Refinement (Alluvium, 2026).....</b>                      | <b>13</b> |
| <b>Appendix D: Stormwater Treatment Modelling Results (Individual Asset).....</b>                                                              | <b>14</b> |
| <b>Appendix E: Individual Asset Concept Design Layout.....</b>                                                                                 | <b>18</b> |

## Tables

|                                                                                                                    |    |
|--------------------------------------------------------------------------------------------------------------------|----|
| Table 1. Adopted fraction impervious values for each proposed land use type.....                                   | 11 |
| Table 2. Existing and developed conditions effective imperviousness area for the four DSS sub-catchments .....     | 11 |
| Table 3. Phase 3 RORB modelling parameters .....                                                                   | 16 |
| Table 4. Updated RORB kc routing parameters .....                                                                  | 17 |
| Table 5. Rainfall depth Climate Change factors .....                                                               | 20 |
| Table 6. Initial Loss/Continuing Loss Factors.....                                                                 | 20 |
| Table 7. RORB modelling results (1% AEP) at outfall location of each catchment for pre development.....            | 20 |
| Table 8. RORB modelling results (1% AEP) at outfall location of each catchment for post development ...            | 21 |
| Table 9. RORB modelling results (1% AEP) under current and climate change scenarios - retarding basin design ..... | 1  |
| Table 10. Proposed wetland and sediment basin treatment areas.....                                                 | 4  |
| Table 11. Overall MUSIC modelling results for Buckleys Rd Outfall catchment.....                                   | 4  |

|                                                                                     |    |
|-------------------------------------------------------------------------------------|----|
| Table 12. Overall MUSIC modelling results for O’Connell Rd Outfall catchment .....  | 5  |
| Table 13. Overall MUSIC modelling results for Southern Outfall catchment.....       | 5  |
| Table 14. Overall MUSIC modelling results for Flanagans Run Outfall catchment ..... | 5  |
| Table 15. WLRB 2 treatment results.....                                             | 15 |
| Table 16. WLRB 5 treatment results.....                                             | 15 |
| Table 17. WLRB 6 treatment results.....                                             | 15 |
| Table 18. WLRB 7 treatment results.....                                             | 15 |
| Table 19. WLRB 8 treatment results.....                                             | 15 |
| Table 20. WLRB 9 treatment results.....                                             | 16 |
| Table 21. WLRB 10 treatment results .....                                           | 16 |
| Table 22. WLRB 11 treatment results .....                                           | 16 |
| Table 23. SBRB 15 treatment results.....                                            | 16 |
| Table 24. WLRB 13 treatment results .....                                           | 16 |
| Table 25. WLRB 14 treatment results .....                                           | 17 |

## Figures

|                                                                                                                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Figure 1. Merrimu PSP area (yellow dashed boundary) and the proposed four DSS boundaries (red solid boundaries) .....                                                             | 2  |
| Figure 2. Merrimu PSP – Place Based Plan (Draft) .....                                                                                                                            | 8  |
| Figure 3. Sub-catchment delineation .....                                                                                                                                         | 10 |
| Figure 4. RORB model configuration for Merrimu PSP area/four DSS catchments.....                                                                                                  | 15 |
| Figure 5. Climate change scenarios and SSPs (source: The Climate Systems Hub which is funded by the Australian Government under the National Environmental Science Program) ..... | 19 |
| Figure 6. MUSIC model layout for Merrimu PSP area .....                                                                                                                           | 3  |
| Figure 7. WLRB 02 Concept Plan .....                                                                                                                                              | 7  |
| Figure 8. WLRBs 05 and 06 Concept Plan .....                                                                                                                                      | 7  |
| Figure 9. WLRBs 07-12 and SBRB 15 Concept Plan.....                                                                                                                               | 8  |
| Figure 10. WLRBs 13 and 14 Concept Plan .....                                                                                                                                     | 9  |
| Figure 11. WLRB 02 concept design layout.....                                                                                                                                     | 19 |
| Figure 12. WLRB 05 concept design layout.....                                                                                                                                     | 20 |
| Figure 13. WLRB 06 concept design layout.....                                                                                                                                     | 21 |
| Figure 14. WLRB 07 concept design layout.....                                                                                                                                     | 22 |

|                                               |    |
|-----------------------------------------------|----|
| Figure 15. WLRB 08 concept design layout..... | 23 |
| Figure 16. WLRB 09 concept design layout..... | 24 |
| Figure 17. WLRB 10 concept design layout..... | 25 |
| Figure 18. WLRB 11 concept design layout..... | 26 |
| Figure 19. WLRB 13 concept design layout..... | 27 |
| Figure 20. WLRB 14 concept design layout..... | 28 |
| Figure 21. SBRB 15 concept design layout..... | 29 |

# 1 Introduction

Alluvium Consulting (Alluvium) has been engaged by Melbourne Water to undertake the Phase 4 investigations to support the ongoing stormwater management infrastructure planning of the proposed Melbourne Water Development Services Schemes (DSS's) to support the Merrimu Precinct Structure Plan (PSP) area. The Phase 4 investigations build upon the previous assessments undertaken between 2021 and 2026 and focuses on refining the DSS concept design arrangements following stakeholder consultation and public exhibition of the Merrimu PSP.

This report documents the outcomes of the Phase 4 investigations, including the updated DSS layout, revised hydrologic and water quality modelling, concept drainage asset design and climate change assessment. The report also provides a consolidated technical basis for the ongoing development of the Merrimu DSSs and should be read in conjunction with the previous Phase 1 to Phase 3 investigations and the subsequent environmental and engineering assessments of the proposed stormwater outfalls.

## 1.1 Study area

The Merrimu PSP is located approximately 45 km north-west of Melbourne's Central Business District and comprises four proposed catchments: Merrimu North DSS (8508), Possumtail Run DSS (8404), O'Connell Road DSS (8507), and Flanagans Drive DSS (8402). The DSSs are being developed to provide integrated stormwater management infrastructure to support future urban development within the PSP area while satisfying Melbourne Water's requirements for flood management, water quality treatment and drainage servicing.

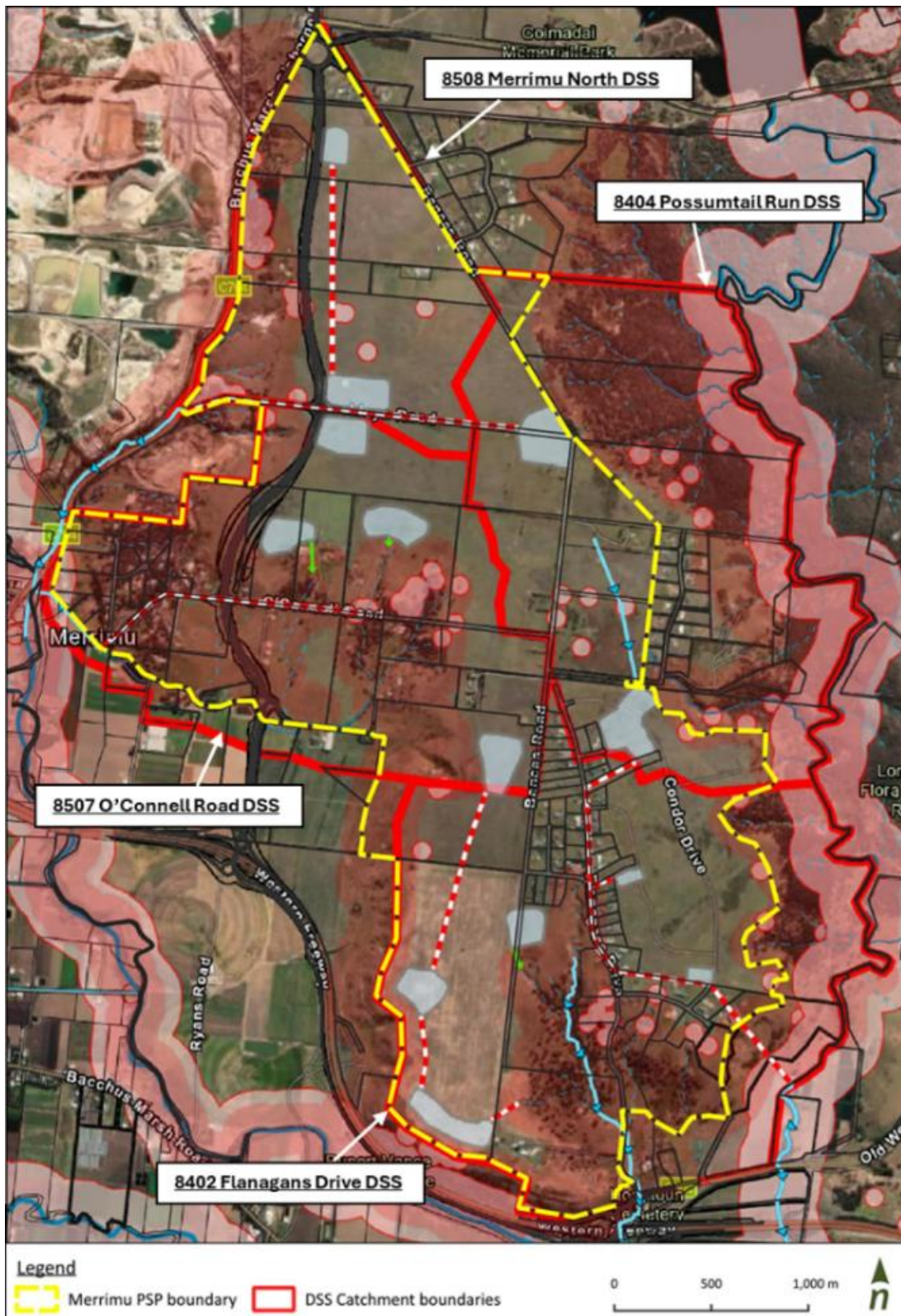


Figure 1. Merrimu PSP area (yellow dashed boundary) and the proposed four DSS boundaries (red solid boundaries)

## 2 Previous investigations

This project is the fourth phase of investigations undertaken by Alluvium on behalf of Melbourne Water to support development of the Merrimu Developer Services Schemes (DSSs). The investigations have progressively refined the stormwater management approach in response to the geomorphic sensitivity of the PSP area, the feasibility of managing additional runoff on the plateau, and the engineering and environmental constraints associated with conveying stormwater from the plateau. The previous investigations comprise:

- Phase 1 – Geomorphology and vegetation assessment
- Phase 2 – Stormwater management risk assessment
- Phase 3 – Surface water and groundwater investigations
- Environmental and engineering assessment of proposed stormwater outfalls

Together, these investigations established the basis for the drainage servicing approach developed further in this Phase 4 assessment. The earlier phases of investigation are summarised in greater detail below.

### Phase 1 – Geomorphology and vegetation assessment

Phase 1 was undertaken in 2019 as part of the initial vegetation and geomorphology assessment for the Merrimu PSP. A key finding was the high geomorphic sensitivity of the tributaries draining the plateau margins, where sodic and dispersive soils underlying the basalt cap are exposed and highly susceptible to erosion.

The assessment identified increased post-development runoff to these tributaries as a significant risk. It recommended that additional runoff either be retained, reused or infiltrated on the plateau, or conveyed past the sensitive tributaries to more suitable receiving waterways downstream. Further hydrologic, groundwater and risk investigations were recommended to test these options.

### Phase 2 – Stormwater management risk assessment

Phase 2 assessed these management options in greater detail through a stormwater risk assessment, conceptual hydrologic modelling, ecological assessment and preliminary investigation of subsurface geology and groundwater storage.

A distributed approach was identified as a potential means of retaining and infiltrating excess stormwater on the plateau, thereby limiting additional discharge to erosion-sensitive tributaries. However, the feasibility of this approach remained uncertain, particularly in relation to groundwater levels, storage capacity and potential groundwater mounding. Phase 2 therefore recommended more detailed surface water and groundwater investigations.

## Phase 3 – Surface water and groundwater investigations

Phase 3 investigated these uncertainties through detailed hydrologic and groundwater assessment. Surface water modelling quantified post-development runoff and informed preliminary catchment delineation and stormwater asset sizing, while groundwater monitoring and modelling assessed the feasibility and potential effects of infiltrating stormwater into the underlying Werribee Formation.

The work improved understanding of the runoff volumes requiring management and the potential groundwater response to infiltration. Following Phase 3, Melbourne Water and prospective asset owners determined that an infiltration-based servicing strategy was not preferred, reflecting the remaining uncertainty and the ownership, operation and maintenance requirements of the proposed infiltration assets.

The servicing strategy therefore shifted towards conveying excess post-development stormwater from the plateau while avoiding discharge to the highly erosion-sensitive tributaries along the plateau margins.

## Assessment of proposed stormwater outfalls

The subsequent environmental and engineering assessment examined how this revised servicing strategy could be implemented. Building on the earlier catchment and runoff assessments, the study identified potential locations where piped outfalls could convey stormwater from the plateau to more suitable receiving waterways.

Engineering investigations considered indicative pipe sizing, longitudinal profiles and constructability, while geomorphic and ecological assessments considered constraints along the proposed alignments and the sensitivity of receiving waterways to additional flows. The assessment confirmed that a piped outfall strategy was generally feasible in principle and identified preferred outfall locations and opportunities to refine the drainage network.

## 3 Existing conditions

The existing environmental and physical conditions within the Merrimu PSP area have been documented through the previous phases of investigation undertaken by Alluvium for Melbourne Water. These investigations describe the existing land use, topography, catchment setting, geology, geomorphology and ecological values across the Merrimu plateau and surrounding escarpment. In particular, the previous investigations identified the presence of sodic and highly dispersive soils along parts of the plateau margin and receiving tributaries, which are susceptible to erosion where runoff becomes concentrated.

Further environmental and geomorphic investigations undertaken as part of the assessment of the proposed DSS stormwater outfalls confirmed these conditions at selected locations, particularly within the Flanagans Run assessment area. The assessment identified exposed sodic soils, existing rilling, tunnelling and bank erosion, together with ecological values including Rocky Chenopod Woodland, Grassy Woodland and Escarpment Shrubland. These environmental and geomorphic constraints have informed the development and refinement of the DSS drainage strategy and proposed outfall arrangements.

Detailed descriptions of the existing conditions within the Merrimu PSP area are provided in the following previous investigations:

- Merrimu Pre-PSP Development Phase 3: Surface Water and Groundwater Investigations (Alluvium, 2024); and
- Environmental and Geomorphology Assessments for Selected Stormwater Outfalls in the Merrimu PSP Area (Alluvium, 2026).

## 4 Post-development objectives and conditions

The following sets out the aim, objectives and approach of the assessment for the post-development conditions.

### 4.1 Aim

The aim is to define the flood mitigation and stormwater quality management requirements for the post development area within the Merrimu PSP based on the future land use of the site. In doing so the work will define the stormwater quantity and stormwater quality assets required to control the impact of development downstream and comment upon the optimal layout of those assets. The design and layout of the proposed assets is provided at a conceptual level.

### 4.2 Objectives

As per Clause 14.02 -1S-2S of the Victorian Planning Provisions (VPP), the catchment planning, management and water quality objectives are:

- To assist the protection and restoration of catchments, waterways, estuaries, bays, water bodies, groundwater, and the marine environment
- To protect water quality

As per Clause 53.18 of the Victorian Planning Provisions (VPP), the purpose of stormwater management is:

- To ensure that stormwater in urban development, including retention and reuse, is managed to mitigate the impacts of stormwater on the environment, property and public safety, and to provide cooling, local habitat and amenity benefits.

As per Clause 56.07-4 of the Victorian Planning Provisions (VPP), the stormwater management objectives are:

- To minimise damage to properties and inconvenience to residents from stormwater.
- To ensure that the street operates adequately during major storm events and provides for public safety.

- To minimise increases in stormwater and protect the environmental values and physical characteristics of receiving waters from degradation by stormwater.
- To encourage stormwater management that maximises the retention and reuse of stormwater.
- To encourage stormwater management that contributes to cooling, local habitat improvements and provision of attractive and enjoyable spaces.

The following are the general stormwater drainage requirements that need to be followed in a stormwater assessment. These have been considered when identifying asset options.

## 4.3 Approach

### 4.3.1 Stormwater quantity management

In order to protect downstream environments from adverse impacts on flood conditions, typically, the fully developed 1% AEP stormwater peak runoff rates are to be retarded back to the equivalent 1% AEP pre-development peak flow rates, prior to discharging downstream.

This is typically achieved through the implementation of retention (or detention) systems within the catchment. Ultimately, a stormwater management strategy and design solution should demonstrate no impact on downstream environments, and that increases in stormwater discharges to receiving waters is minimised.

This is achieved through best practice approaches, integrating asset functionality for both quantity and quality management. This further allows consideration of broader community benefits through multi-outcome designs.

Any flood mitigation works must be designed and constructed in accordance with the requirements of the relevant floodplain management authority.

### 4.3.2 Stormwater conveyance

As per the Infrastructure Design Manual (IDM) and VPP clause 56.07-4, stormwater conveyance is typically designed to a major and minor flow regime where:

- Minor flows – that is, up to and including the 20% AEP storm event (approximately the 1 in 5-year ARI event) are conveyed via the sub-surface stormwater network (for residential areas)
- Major flows – that is, between the 20% AEP and 1% AEP event are typically conveyed on the surface via roadways, overland flow paths, open channels, and waterways.

### 4.3.3 Stormwater quality treatment

Stormwater treatment is required to meet the Urban Stormwater Best Practice Environmental Management (BPEM) Guidelines (CSIRO, 1999) pollution reduction targets as set out in the VPPs, before being discharged into stormwater networks and receiving waters. These targets are defined as:

- 70% removal of the Total Gross Pollutant load
- 80% removal of Total Suspended Solids (TSS)
- 45% removal of Total Nitrogen (TN)
- 45% removal of Total Phosphorus (TP).

#### 4.3.4 EPAV stormwater guidance

Stormwater volume reduction requirements are driven by an ecological and physical form response. The EPAV have published an Urban Stormwater Management Guidance (2021) which identifies the need to manage stormwater volumes within landscapes.

Recent updates to EPA stormwater guidance sets out flow volume reductions for different areas, based on the annual rainfall. These reductions are designed to reduce the impact of increased impermeable surfaces (and decreased vegetation) on the receiving environment by setting out a percentage of impervious runoff to be:

- either infiltrated or filtered to replace the water that would have permeated to the water table to support waterway baseflows, and
- harvested or evapotranspired to make up for water that would have been used by vegetation or evaporated from soils.

Reduction of stormwater volumes has not been investigated in detail as part of this functional design development stage. However, stormwater harvesting opportunities, including access to treated stormwater from wetlands present a way to contribute to volume reduction, along with reducing potable water consumption, and urban cooling should the water be used to irrigate nearby sports fields and open space. However, stormwater harvesting from these wetlands alone will not meet the above targets. A suite of harvesting opportunities would be required, as well as maximising demand (i.e. where farm irrigation opportunities may arise or looking at stormwater for indirect potable supply).

### 4.4 Future land use

The post-development conditions of the area have been modelled to determine the stormwater quality requirements of the four DSS catchments located within the Merrimu PSP area. While it is understood that the layout and proposed land use concepts are subject to change over time (and that the stormwater assessment will inform the proposed layout), a preliminary layout is required for modelling assumptions.

The layout of the Merrimu precinct, specifically the density of the proposed development and proportion of open space, will impact the volume of stormwater runoff and therefore the treatment and flood mitigation systems required.

The most recent update of the draft future land use has been included in Figure 2. Most of the site is proposed as general residential. This version provided by Melbourne Water has been adopted for all design modelling in terms of land use and fraction impervious assumptions.

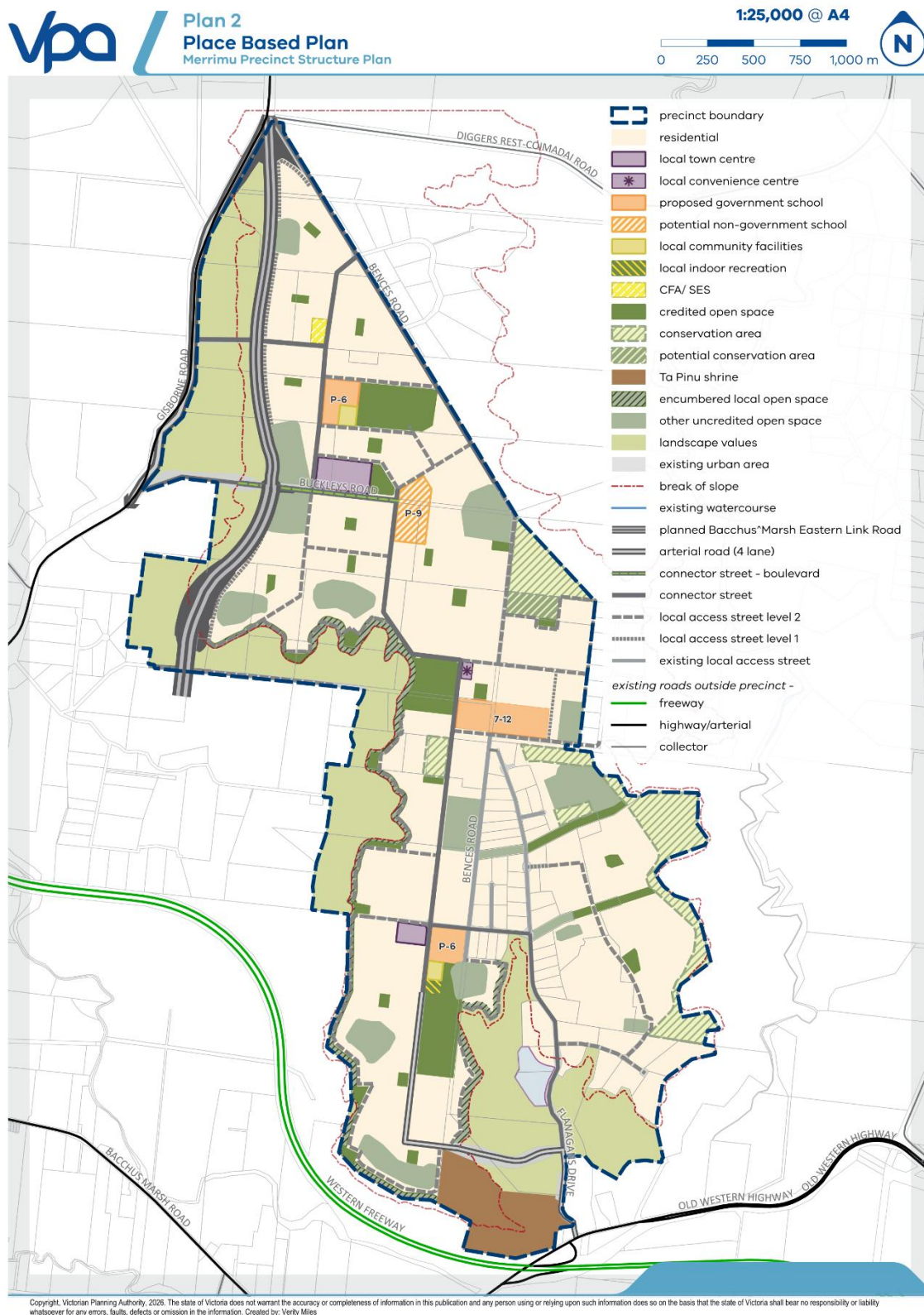


Figure 2. Merrimu PSP - Place Based Plan (Draft)

## 5 Catchment analysis

Stormwater drainage asset locations and contributing catchments were reviewed and refined as part of the Phase 4 investigations to reflect the updated Merrimu PSP layout and stakeholder feedback, while maintaining the design principles established through the previous environmental, geomorphic and engineering investigations. The review aimed to improve the integration of the DSS drainage infrastructure with the proposed land use, drainage network and future development layout.

The catchment review considered the following key inputs:

- Merrimu Pre-PSP Development Phase 3: Surface Water and Groundwater Investigations – Final Report (Alluvium Consulting, 2024)
- Environmental and Geomorphology Assessments for Selected Stormwater Outfalls in the Merrimu PSP Area – Interim Report (Alluvium Consulting, 2026)
- Merrimu Precinct Structure Plan – Place Based Plan (Draft)
- Feedback provided by Melbourne Water regarding opportunities to refine the conceptual layout of the DSS assets
- Feedback provided by Department of Transport and Planning (DTP) and land developers

Using these inputs, the Phase 3 DSS concept was reviewed and updated to refine drainage asset locations, revise contributing catchment boundaries, introduce new pipe outfall arrangements (compared to the previous evaporation/infiltration approach from Phase 3) and improve the overall drainage servicing strategy. Where appropriate, drainage infrastructure was relocated to better align with the proposed land use, future road network and developable areas, while remaining consistent with the preferred stormwater outfall strategy established during the previous investigations.

### 5.1 Sub-catchment

Sub-catchments and drainage flow paths were delineated based on a combination of existing site characteristics and the proposed urban layout. The delineation considered:

- Topography (LiDAR)
- Proposed major road alignments
- Parcel boundaries
- Drainage channels which may delineate between sub-catchments
- Future urban layout

Future road alignments identified in the Merrimu PSP Place Based Plan were incorporated into the catchment delineation, as these will ultimately define the post-development drainage network and influence the contributing catchments to each stormwater asset. The revised catchments formed the basis of the subsequent RORB and MUSIC modelling.

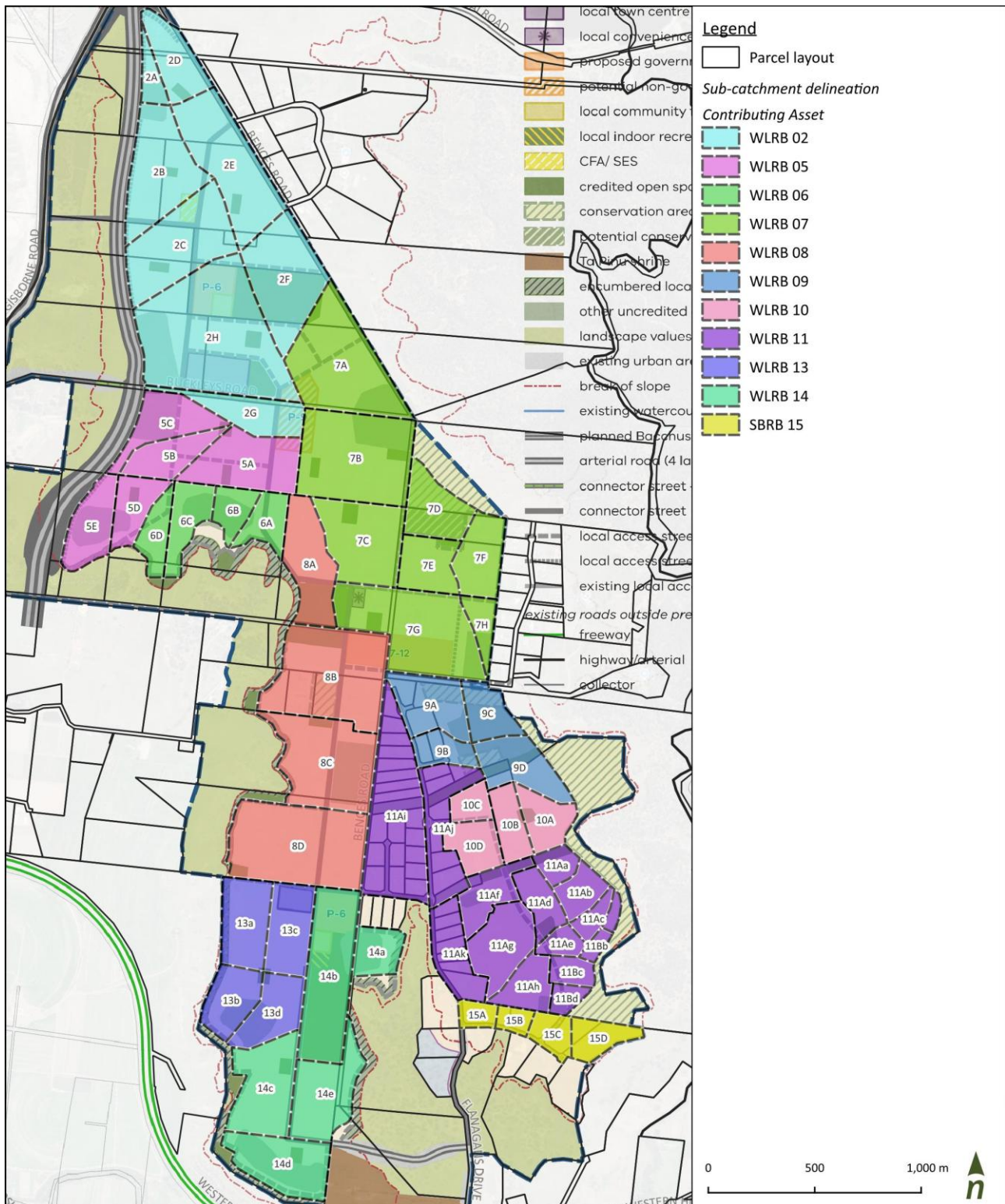


Figure 3. Sub-catchment delineation

## 5.2 Fraction impervious assumption

For the purposes of surface water modelling, each land use type was assigned a representative fraction impervious value to estimate the proportion of rainfall that becomes stormwater runoff following development. The adopted values were based on Melbourne Water's MUSIC Guidelines (Melbourne Water, 2024) and applied consistently throughout both the RORB and MUSIC models.

A fraction impervious value of 0.75 was adopted for all sub-catchments primarily consisting of residential development. This value incorporates the anticipated impervious surfaces associated with residential development, including roads, roofs and other paved areas. A fraction impervious value of 0.10 was adopted for large open space areas to represent their predominantly pervious nature.

The total impervious area for each catchment was calculated using the proposed land uses within the Merrimu PSP Place Based Plan together with the adopted fraction impervious values. The resulting effective impervious areas were used for hydrologic runoff estimation and water quality modelling, including the sizing of the proposed stormwater treatment and retardation assets.

The adopted fraction impervious values were applied consistently throughout both the RORB and MUSIC models to determine the effective impervious area for each contributing catchment. The calculated impervious areas were subsequently used for hydrologic runoff estimation and sizing of the proposed stormwater treatment and retardation assets.

**Table 1. Adopted fraction impervious values for each proposed land use type**

| PSP proposed land use | PSP proposed land use                        | Fraction imperviousness |
|-----------------------|----------------------------------------------|-------------------------|
| Parks and open space  | Credited open space                          | 0.1                     |
|                       | Conservation area                            | 0.1                     |
| Facilities            | Community facilities                         | 0.7                     |
|                       | Education                                    | 0.7                     |
|                       | Government services                          | 0.9                     |
| Residential           | Residential (including local access streets) | 0.75                    |

*\*Major Roads (i.e. arterial road proposed along the western boundary of Merrimu PSP area) is assumed to have the local stormwater management measures. Hence, it is excluded from the analysis.*

**Table 2. Existing and developed conditions effective imperviousness area for the four DSS sub-catchments**

| Sub-Catchment | Area (km <sup>2</sup> ) | Fraction Impervious (FI) - Existing | Fraction Impervious (FI) - Developed |
|---------------|-------------------------|-------------------------------------|--------------------------------------|
| 2A            | 0.026                   | 0.1                                 | 0.75                                 |
| 2B            | 0.149                   | 0.1                                 | 0.75                                 |
| 2C            | 0.165                   | 0.1                                 | 0.75                                 |
| 2D            | 0.075                   | 0.1                                 | 0.75                                 |

| Sub-Catchment | Area (km <sup>2</sup> ) | Fraction<br>Impervious (FI) -<br>Existing | Fraction<br>Impervious (FI) -<br>Developed |
|---------------|-------------------------|-------------------------------------------|--------------------------------------------|
| 2E            | 0.178                   | 0.1                                       | 0.75                                       |
| 2F            | 0.159                   | 0.1                                       | 0.46                                       |
| 2G            | 0.081                   | 0.1                                       | 0.75                                       |
| 2H            | 0.346                   | 0.1                                       | 0.68                                       |
| 5A            | 0.125                   | 0.1                                       | 0.75                                       |
| 5B            | 0.064                   | 0.1                                       | 0.75                                       |
| 5C            | 0.08                    | 0.1                                       | 0.75                                       |
| 5D            | 0.057                   | 0.1                                       | 0.75                                       |
| 5E            | 0.075                   | 0.1                                       | 0.75                                       |
| 6A            | 0.047                   | 0.1                                       | 0.75                                       |
| 6B            | 0.038                   | 0.1                                       | 0.75                                       |
| 6C            | 0.06                    | 0.1                                       | 0.75                                       |
| 6D            | 0.044                   | 0.1                                       | 0.75                                       |
| 7A            | 0.206                   | 0.1                                       | 0.75                                       |
| 7B            | 0.215                   | 0.1                                       | 0.75                                       |
| 7C            | 0.138                   | 0.1                                       | 0.75                                       |
| 7D            | 0.079                   | 0.1                                       | 0.1                                        |
| 7E            | 0.067                   | 0.1                                       | 0.75                                       |
| 7F            | 0.076                   | 0.1                                       | 0.75                                       |
| 7G            | 0.218                   | 0.1                                       | 0.75                                       |
| 7H            | 0.033                   | 0.1                                       | 0.75                                       |
| 8A            | 0.11                    | 0.1                                       | 0.54                                       |
| 8B            | 0.225                   | 0.1                                       | 0.64                                       |
| 8C            | 0.183                   | 0.1                                       | 0.75                                       |
| 8D            | 0.233                   | 0.1                                       | 0.75                                       |
| 9A            | 0.091                   | 0.1                                       | 0.64                                       |
| 9B            | 0.041                   | 0.1                                       | 0.75                                       |
| 9C            | 0.053                   | 0.1                                       | 0.58                                       |
| 9D            | 0.085                   | 0.1                                       | 0.75                                       |
| 10A           | 0.056                   | 0.1                                       | 0.75                                       |
| 10B           | 0.049                   | 0.1                                       | 0.75                                       |
| 10C           | 0.031                   | 0.1                                       | 0.75                                       |
| 10D           | 0.056                   | 0.1                                       | 0.75                                       |
| 11Aa          | 0.028                   | 0.1                                       | 0.75                                       |
| 11Ab          | 0.041                   | 0.1                                       | 0.75                                       |
| 11Ac          | 0.023                   | 0.1                                       | 0.75                                       |

| Sub-Catchment | Area (km <sup>2</sup> ) | Fraction<br>Impervious (FI) -<br>Existing | Fraction<br>Impervious (FI) -<br>Developed |
|---------------|-------------------------|-------------------------------------------|--------------------------------------------|
| 11Ad          | 0.046                   | 0.1                                       | 0.75                                       |
| 11Ae          | 0.025                   | 0.1                                       | 0.75                                       |
| 11Af          | 0.062                   | 0.1                                       | 0.75                                       |
| 11Ag          | 0.093                   | 0.1                                       | 0.75                                       |
| 11Ah          | 0.052                   | 0.1                                       | 0.75                                       |
| 11Ai          | 0.211                   | 0.1                                       | 0.75                                       |
| 11Aj          | 0.101                   | 0.1                                       | 0.75                                       |
| 11Ak          | 0.074                   | 0.1                                       | 0.75                                       |
| 11Ba          | 0.009                   | 0.1                                       | 0.75                                       |
| 11Bb          | 0.012                   | 0.1                                       | 0.75                                       |
| 11Bc          | 0.027                   | 0.1                                       | 0.75                                       |
| 11Bd          | 0.019                   | 0.1                                       | 0.75                                       |
| 13A           | 0.091                   | 0.1                                       | 0.75                                       |
| 13B           | 0.088                   | 0.1                                       | 0.75                                       |
| 13C           | 0.069                   | 0.1                                       | 0.75                                       |
| 13D           | 0.077                   | 0.1                                       | 0.75                                       |
| 14A           | 0.048                   | 0.1                                       | 0.75                                       |
| 14B           | 0.173                   | 0.1                                       | 0.75                                       |
| 14C           | 0.124                   | 0.1                                       | 0.75                                       |
| 14D           | 0.113                   | 0.1                                       | 0.75                                       |
| 14E           | 0.115                   | 0.1                                       | 0.75                                       |
| 15A           | 0.022                   | 0.1                                       | 0.75                                       |
| 15B           | 0.019                   | 0.1                                       | 0.75                                       |
| 15C           | 0.035                   | 0.1                                       | 0.75                                       |
| 15D           | 0.044                   | 0.1                                       | 0.75                                       |

## 6 Hydrologic analysis

The hydrologic analysis was undertaken to assess the change in peak stormwater runoff associated with the proposed development of the Merrimu Precinct Structure Plan (PSP) and to determine the retardation storage required for the proposed Development Services Scheme (DSS) assets.

The general approach to stormwater quantity management is to attenuate developed-condition peak flows to the corresponding existing-condition peak flows for the 1% Annual Exceedance Probability (AEP) event. This is achieved through the provision of retardation storage within the contributing catchments. The hydrologic modelling was therefore used to estimate:

- existing-condition peak flows;
- developed-condition peak flows without retardation; and
- the storage required to attenuate developed-condition 1% AEP peak flows to existing-condition levels.

The modelling also provides design inflows and peak flow rates to support the concept sizing of the proposed drainage infrastructure. This approach is consistent with the previous Phase 3 investigation, which used RORB to determine existing and developed peak flows and indicative retardation storage requirements at the proposed stormwater asset locations.

### 6.1 Hydrologic modelling

The hydrologic assessment was undertaken using RORB, a runoff-routing model used to simulate catchment runoff, flow routing and attenuation and to estimate flood hydrographs at selected locations within a catchment.

The Phase 3 investigation developed a combined RORB model for the Merrimu PSP to assess existing and developed conditions across the plateau. The Phase 3 model represented the change in drainage behaviour associated with urban development, including the collection and conveyance of runoff by proposed roads and pipes to selected regional stormwater management assets.

Under existing conditions, runoff generally discharged from the plateau through a number of tributaries, whereas the developed-condition model consolidated flows into selected asset and outfall locations.

As part of the Phase 4 investigations, the previous RORB model was reviewed and updated to reflect:

- the revised PSP land use;
- the updated sub-catchment delineation;
- proposed road alignments and post-development drainage paths;
- revised DSS asset locations;
- updated contributing catchments; and
- the current concept outfall arrangements

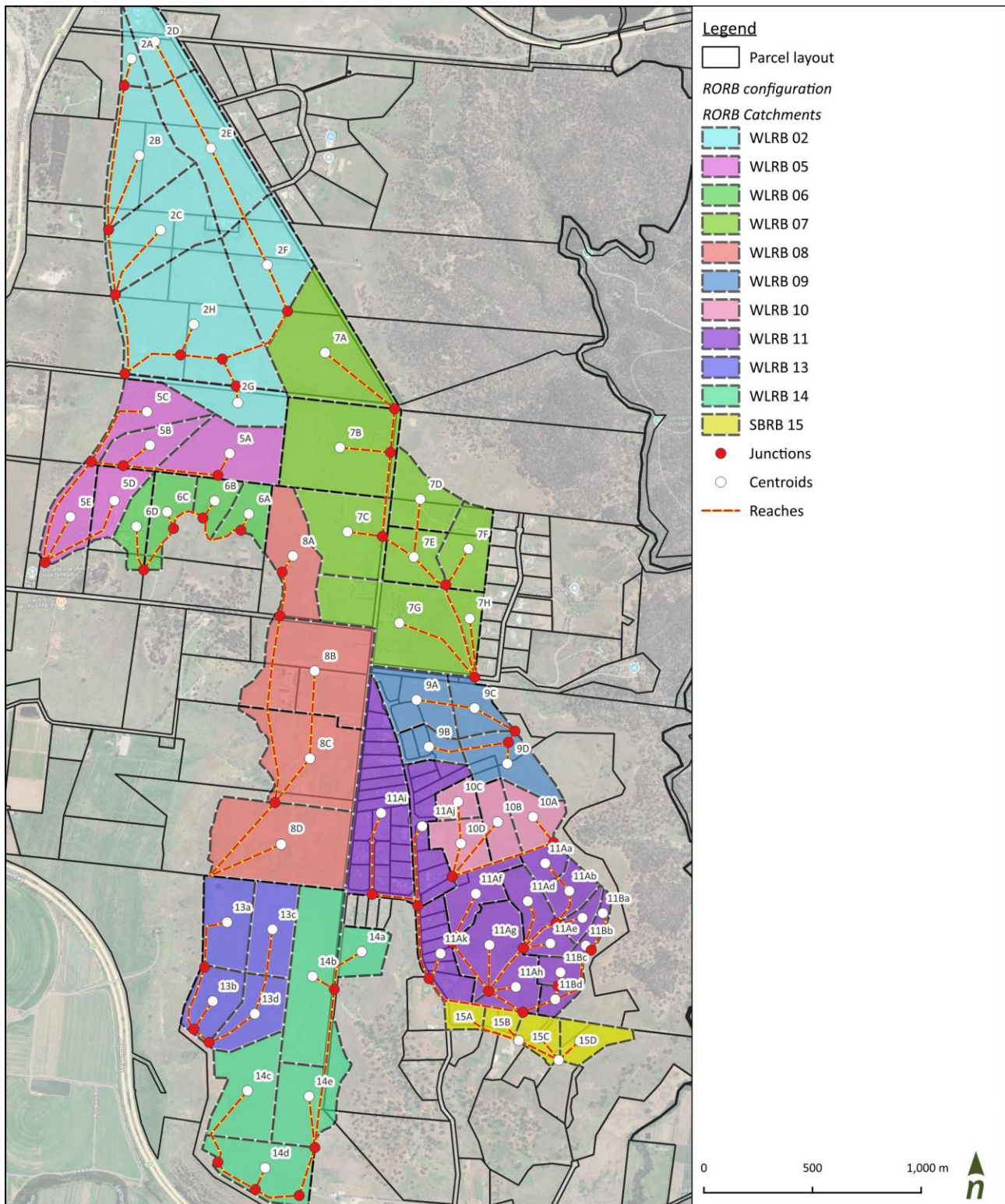


Figure 4. RORB model configuration for Merrimu PSP area/four DSS catchments

The updated Phase 4 RORB model comprises 65 sub-catchments distributed across the original Merrimu North, Possumtail Run, O'Connell Road and Flanagans Drive DSSs. The model arrangement reflects the revised DSS concept and represents the proposed transfer of runoff between sub-catchments, proposed drainage assets and ultimate outfall alignments.

## 6.2 Input parameters

The RORB modelling adopted design rainfall information obtained from the Bureau of Meteorology Intensity-Frequency-Duration data and Australian Rainfall and Runoff 2019 methods. The Phase 3 analysis considered the 1% AEP event across storm durations ranging from 10 minutes to 72 hours. Ensemble simulations were undertaken using ten temporal patterns for each duration, with the median peak flow adopted for assessment.

The key model parameters adopted during the Phase 3 investigation are summarised below.

### *Rainfall losses*

The Phase 3 model adopted an initial loss and continuing loss approach. The following values were applied (Table 3).

**Table 3. Phase 3 RORB modelling parameters**

| Parameter                   | Value      | Method of derivation                          |
|-----------------------------|------------|-----------------------------------------------|
| <b>Existing conditions</b>  |            |                                               |
| m                           | 0.8        | Standard value                                |
| IL                          | 23.00      | Sourced from ARR datahub                      |
| CL                          | 2.1        | Sourced from ARR datahub                      |
| Pre-burst                   | 50% Median | Sourced from ARR datahub                      |
| <b>Developed Conditions</b> |            |                                               |
| m                           | 0.8        | Standard value                                |
| IL                          | 16.1       | Median of 60% - 80% of existing conditions IL |
| CL                          | 2.1        | Same as existing conditions CL                |
| Pre-burst                   | 50% Median | Sourced from ARR datahub                      |

The existing-condition loss values were sourced from the ARR Data Hub. The developed-condition initial loss was derived using standard adjustment factors applied to the existing-condition value, while the continuing loss was retained at the existing-condition rate.

### *Routing parameter $k_c$*

For the ungauged Merrimu catchments, the previous Phase 3 investigation had considered a range of regional relationships for estimation of the RORB routing parameter  $k_c$ , including:

- Melbourne Water's regional relationship for the Yarra and Maribyrnong catchments ( $k_c = 1.19 * A^{0.56}$ );
- the Pearse et al. Victorian relationship ( $k_c = 1.25 * \text{dav}$ ); and
- Australian equation for Annual mean rainfall less than 800mm ( $k_c = 0.49 * A^{0.65}$ ).

The modelled flows were compared with other approximate flood-estimation methods, including the Regional Flood Frequency Estimation method (RFFE), Nikoloau/Vont Steen equations (DNRE) and rule of thumb methods (i.e. Rational method). As per completed Phase 3 investigation, The Pearse et al. region equation was adopted for all catchments as it produced flowrates within the confidence limits of the RFFE while being more in line with the other estimation method.

As per the Phase 4 investigation, the overall Merrimu PSP areas consists of four ultimate outfalls, which are:

- Buckley Road Outfall – An ultimate outfall of Merrimu North DSS catchment
- O'Connell Road Outfall – An ultimate outfall of O'Connell Road DSS catchment (Partially)
- Southern Outfall – An ultimate outfall of several DSS catchments, including
  - Part of O'Connell Road DSS catchment
  - Possumtail Run DSS catchment
  - Part of Flanagans Drive DSS catchment
- Flanagans Run Outfall – An ultimate outfall of Flanagans Drive DSS catchment (Partially)

The corresponding  $k_c$  for each of the ultimate outfall catchment is presented below (Table 4).

**Table 4. Updated RORB  $k_c$  routing parameters**

| Ultimate Outfalls      | Value | Method of derivation                                               |
|------------------------|-------|--------------------------------------------------------------------|
| Buckley Road Outfall   | 1.25  | Pearse et al. Victorian relationship ( $k_c = 1.25 * \text{dav}$ ) |
| O'Connell Road Outfall | 0.86  | Pearse et al. Victorian relationship ( $k_c = 1.25 * \text{dav}$ ) |
| Southern Outfall       | 1.00  | Pearse et al. Victorian relationship ( $k_c = 1.25 * \text{dav}$ ) |
| Flanagans Run Outfall  | 0.80  | Pearse et al. Victorian relationship ( $k_c = 1.25 * \text{dav}$ ) |

## 6.3 Existing condition RORB model

An existing-condition model was developed to estimate the pre-development 1% AEP peak flows at the proposed stormwater asset locations. These flows establish the target discharge rates for the proposed retardation assets.

For the existing-condition scenario, a fraction impervious value of 0.10 was applied across all sub-catchments to represent the predominantly pervious nature of the catchment under pre-development conditions. All model reaches were assigned as Type 1 – natural reaches to represent the existing surface flow paths through the catchment.

The Phase 3 investigation noted that existing- and developed-condition contributing catchments can differ because urban development changes the drainage paths across the plateau. Under existing conditions, runoff is conveyed via multiple natural tributaries draining from the plateau, whereas under developed conditions, runoff is collected and conveyed through the proposed drainage network to the proposed stormwater management assets.

For the Phase 4 analysis, the existing-condition catchments were reviewed against the revised asset locations to ensure that existing peak flows were estimated at locations corresponding with the updated DSS concept.

The model configuration shown in Figure 4 was retained for the existing-condition assessment, with the adopted fraction imperviousness and reach types used to represent pre-development runoff characteristics.

## 6.4 Developed condition RORB model

The developed-condition RORB model used the same overall model configuration as the existing-condition model, with model parameters updated to represent the proposed urban development and drainage arrangement.

Fraction impervious values were assigned based on the proposed land uses within the updated Merrimu PSP layout. As described in Section 5, a fraction impervious value of 0.75 was adopted for sub-catchments predominantly comprising residential development, while a value of 0.10 was adopted for large open space areas. Model reaches were converted to Type 2 - excavated but unlined reaches to better represent the altered flow paths and conveyance characteristics expected under developed conditions. This reflects the collection and conveyance of runoff through the proposed urban drainage network rather than the natural surface flow paths represented in the existing-condition model.

The developed-condition model was used to estimate the unmitigated 1% AEP peak flows at the proposed stormwater asset locations prior to the incorporation of retardation storage.

## 6.5 Climate change assessment

Engineers Australia recently released (Aug 2024) an update to the climate change considerations chapter in Australian Rainfall and Runoff (ARR). However, ARR does not prescribe the use of a particular climate scenario but just provides the science and data. There are a range of potential scenarios (ie Shared Socio-economic Pathway (SSP)) as outlined below.

SSPs are the latest version of 'what if' scenarios used to explore the consequences of greenhouse gases accumulating in the atmosphere. SSPs are needed because we can't know what future greenhouse gas levels in the atmosphere will be, but we know the higher they are the more warming will occur. Each SSP outlines ways the world might change in the future, including different types of energy generation, rates of population growth, economic development and land uses. These lead to different levels of greenhouse gas emissions over time.

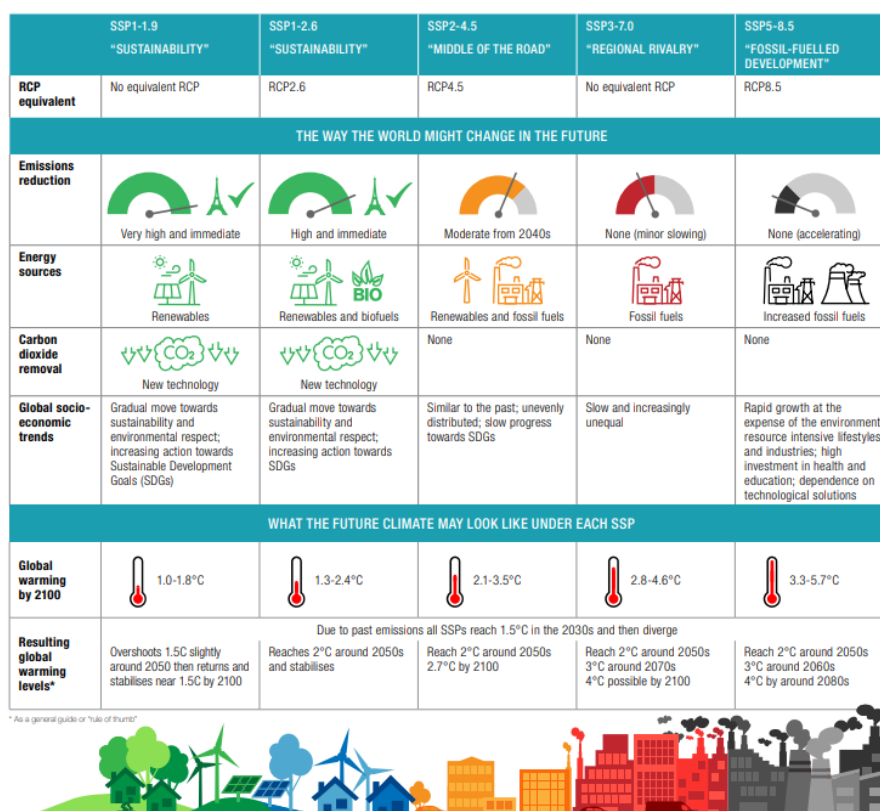


**Figure 5. Climate change scenarios and SSPs (source: The Climate Systems Hub which is funded by the Australian Government under the National Environmental Science Program)**

Based on recent advice from Melbourne Water in May 2026, the SSP3-7.0 2100 scenario is the appropriate pathway to adopt for future climate change assessments.

The climate change factors are directly applied to the rainfall depths and loss values in order to simulate the climate change scenarios. An overview of the factors applied to each SSP scenario are provided below.

Table 5. Rainfall depth Climate Change factors

| Durations | SPP3 - 7.0 (2100) |
|-----------|-------------------|
| <1 hour   | 1.66              |
| 1.5 hours | 1.59              |
| 2 hours   | 1.55              |
| 3 hours   | 1.50              |
| 4.5 hours | 1.45              |
| 6 hours   | 1.42              |
| 9 hours   | 1.39              |
| 12 hours  | 1.37              |
| 18 hours  | 1.34              |
| >24 hours | 1.32              |

Table 6. Initial Loss/Continuing Loss Factors

|                 | SPP3 - 7.0 (2100) |
|-----------------|-------------------|
| Initial Loss    | 1.15              |
| Continuing Loss | 1.34              |

## 6.6 Model results

The RORB model was run to estimate key design flows from the subject site, and more specifically the flow rates at the location of the proposed wetland/retarding basin. In accordance with best practice modelling procedures, at least 4 subareas exist upstream from the point of interest. The hydrologic modelling considered an ensemble of ten temporal patterns and a range of design storms, from 10 minutes duration through to 72 hours, in order to determine the critical duration event with respect to storage. An overview of the RORB model results for pre and post development is provided in Table 7 and Table 8, respectively.

Table 7. RORB modelling results (1% AEP) at outfall location of each catchment for pre development

| Catchment   | Scenario        | Critical duration/<br>Temporal Pattern | Post-developed conditions<br>(m <sup>3</sup> /s) |
|-------------|-----------------|----------------------------------------|--------------------------------------------------|
| Catchment 2 | Current climate | 3hr / TP28                             | 4.64                                             |
|             | Climate change  | 1.5hr / TP28                           | 9.49                                             |
| Catchment 5 | Current climate | 3hr / TP27                             | 1.54                                             |
|             | Climate change  | 1.5hr / TP29                           | 3.07                                             |
| Catchment 6 | Current climate | 1.5hr / TP29                           | 1.27                                             |
|             | Climate change  | 1hr / TP23                             | 2.62                                             |

| Catchment    | Scenario        | Critical duration/<br>Temporal Pattern | Post-developed conditions<br>(m <sup>3</sup> /s) |
|--------------|-----------------|----------------------------------------|--------------------------------------------------|
| Catchment 7  | Current climate | 3hr / TP27                             | 3.87                                             |
|              | Climate change  | 2hr / TP28                             | 7.33                                             |
| Catchment 8  | Current climate | 1.5hr / TP24                           | 3.10                                             |
|              | Climate change  | 1.5hr / TP28                           | 6.51                                             |
| Catchment 9  | Current climate | 1.5hr / TP24                           | 2.13                                             |
|              | Climate change  | 45min / TP26                           | 4.29                                             |
| Catchment 10 | Current climate | 1.5hr / TP27                           | 1.22                                             |
|              | Climate change  | 45min / TP22                           | 2.50                                             |
| Catchment 11 | Current climate | 3hr / TP27                             | 3.51                                             |
|              | Climate change  | 1.5hr / TP28                           | 7.26                                             |
| Catchment 13 | Current climate | 1.5hr / TP24                           | 1.90                                             |
|              | Climate change  | 1hr / TP29                             | 3.79                                             |
| Catchment 14 | Current climate | 1.5hr / TP26                           | 2.48                                             |
|              | Climate change  | 1.5hr / TP28                           | 5.17                                             |
| Catchment 15 | Current climate | 1.5hr / TP28                           | 0.99                                             |
|              | Climate change  | 45min / TP26                           | 2.22                                             |

Table 8. RORB modelling results (1% AEP) at outfall location of each catchment for post development

| Catchment    | Scenario        | Critical duration/<br>Temporal Pattern | Post-developed conditions<br>(m <sup>3</sup> /s) |
|--------------|-----------------|----------------------------------------|--------------------------------------------------|
| Catchment 2  | Current climate | 20min / TP28                           | 14.40                                            |
|              | Climate change  | 20min / TP28                           | 27.06                                            |
| Catchment 5  | Current climate | 25min / TP28                           | 5.52                                             |
|              | Climate change  | 25min / TP27                           | 10.18                                            |
| Catchment 6  | Current climate | 20min / TP28                           | 3.62                                             |
|              | Climate change  | 20min / TP27                           | 6.42                                             |
| Catchment 7  | Current climate | 45min / TP26                           | 12.23                                            |
|              | Climate change  | 25min / TP28                           | 23.04                                            |
| Catchment 8  | Current climate | 25min / TP26                           | 10.88                                            |
|              | Climate change  | 20min / TP28                           | 20.43                                            |
| Catchment 9  | Current climate | 20min / TP25                           | 5.80                                             |
|              | Climate change  | 20min / TP25                           | 10.90                                            |
| Catchment 10 | Current climate | 20min / TP28                           | 3.84                                             |
|              | Climate change  | 20min / TP28                           | 6.72                                             |
| Catchment 11 | Current climate | 20min / TP26                           | 12.41                                            |
|              | Climate change  | 20min / TP25                           | 22.64                                            |
| Catchment 13 | Current climate | 20min / TP26                           | 6.58                                             |

| Catchment    | Scenario        | Critical duration/<br>Temporal Pattern | Post-developed conditions<br>(m <sup>3</sup> /s) |
|--------------|-----------------|----------------------------------------|--------------------------------------------------|
| Catchment 14 | Climate change  | 20min / TP28                           | 11.60                                            |
|              | Current climate | 25min / TP21                           | 7.65                                             |
|              | Climate change  | 25min / TP21                           | 14.26                                            |
| Catchment 15 | Current climate | 20min / TP25                           | 2.67                                             |
|              | Climate change  | 10min / TP23                           | 4.65                                             |

## 6.7 Stormwater quantity - retardation

The aim of the RORB modelling is to establish critical peak flows and the retarding basin storage requirements within the study area. Retarding basins are proposed to be located at catchment low points to control ultimate developed conditions peak flow rates back to pre-developed conditions.

Retarding basin storage for each catchment has been determined based on the available airspace above the wetland treatment area identified in Section 7 (Table 10). Retarding basin outlet (weir) sizes were adjusted until the peak 1% AEP outflows from the RB were equal to or less than the current peaks. This was done through altering outlet properties in the hydrologic model. The results of the retarding basin requirements have been provided in Table 9.

Table 9. RORB modelling results (1% AEP) under current and climate change scenarios - retarding basin design

| Asset   | Scenario        | Pre-developed peak flow (m <sup>3</sup> /s) | Post-developed peak flow (m <sup>3</sup> /s) | Peak RB outflow (m <sup>3</sup> /s) | Critical duration/ Temporal Pattern | Peak RB storage (m <sup>3</sup> ) | Peak RB depth (m) |
|---------|-----------------|---------------------------------------------|----------------------------------------------|-------------------------------------|-------------------------------------|-----------------------------------|-------------------|
| WLRB 2  | Current climate | 4.64                                        | 14.40                                        | 4.42                                | 3hr / TP27                          | 33,000                            | 1.14              |
|         | Climate change  | 9.49                                        | 27.06                                        | 8.89                                | 1.5hr / TP28                        | 46,600                            | 1.61              |
| WLRB 5  | Current climate | 1.54                                        | 5.52                                         | 1.34                                | 4.5hr / TP26                        | 12,900                            | 1.19              |
|         | Climate change  | 3.07                                        | 10.18                                        | 2.56                                | 1.5hr / TP28                        | 17,900                            | 1.65              |
| WLRB 6  | Current climate | 1.27                                        | 3.62                                         | 0.98                                | 1.5hr / TP26                        | 5,120                             | 0.92              |
|         | Climate change  | 2.62                                        | 6.42                                         | 2.05                                | 1hr / TP29                          | 7,180                             | 1.29              |
| WLRB 7  | Current climate | 3.87                                        | 12.23                                        | 3.59                                | 4.5hr / TP26                        | 30,800                            | 1.20              |
|         | Climate change  | 7.33                                        | 23.04                                        | 7.08                                | 1.5hr / TP29                        | 43,400                            | 1.68              |
| WLRB 8  | Current climate | 3.10                                        | 10.88                                        | 2.77                                | 3hr / TP29                          | 21,900                            | 1.12              |
|         | Climate change  | 6.51                                        | 20.43                                        | 5.68                                | 1.5hr / TP28                        | 31,200                            | 1.59              |
| WLRB 9  | Current climate | 2.13                                        | 5.80                                         | 1.74                                | 1.5hr / TP26                        | 6,650                             | 0.90              |
|         | Climate change  | 4.29                                        | 10.90                                        | 3.69                                | 45min / TP26                        | 9,320                             | 1.26              |
| WLRB 10 | Current climate | 1.22                                        | 3.84                                         | 0.99                                | 1.5hr / TP26                        | 5,170                             | 0.96              |
|         | Climate change  | 2.50                                        | 6.72                                         | 2.05                                | 1hr / TP29                          | 7,250                             | 1.35              |
| WLRB 11 | Current climate | 3.51                                        | 12.41                                        | 3.36                                | 1.5hr / TP28                        | 23,200                            | 1.14              |
|         | Climate change  | 7.26                                        | 22.64                                        | 7.05                                | 1.5hr / TP28                        | 33,400                            | 1.65              |
| WLRB 13 | Current climate | 1.90                                        | 6.58                                         | 1.62                                | 1.5hr / TP26                        | 9,000                             | 1.05              |
|         | Climate change  | 3.79                                        | 11.60                                        | 3.37                                | 1hr / TP29                          | 12,800                            | 1.50              |
| WLRB 14 | Current climate | 2.48                                        | 7.65                                         | 2.18                                | 3hr / TP27                          | 16,500                            | 1.09              |
|         | Climate change  | 5.17                                        | 14.26                                        | 4.52                                | 1.5hr / TP29                        | 23,500                            | 1.55              |
| SBRB 15 | Current climate | 0.99                                        | 2.67                                         | 0.96                                | 45min / TP26                        | 2,220                             | 1.43              |
|         | Climate change  | 2.22                                        | 4.65                                         | 2.08                                | 1hr / TP28                          | 3,510                             | 1.87              |

## 7 Wetland and sediment basin design

This section details the analysis, modelling, and results for the treatment assets. The general principles used to design the wetlands and sediment basins in the original four DSSs (Merrimu North, Possumtail Run, O'Connell Road, Flanagans Drive) are detailed and thereafter the asset design results are presented for each DSS.

### 7.1 Design approach

The proposed stormwater treatment system has been developed to provide stormwater quality treatment for runoff generated within each Developer Services Scheme (DSS) while integrating with the stormwater retardation function of the proposed drainage assets.

The treatment system comprises a series of sediment basins and constructed wetlands located within the regional drainage network. Sediment basins have been incorporated upstream of selected wetlands to remove coarse sediment and reduce sediment loading to downstream treatment assets. Constructed wetlands provide the primary stormwater treatment prior to discharge from each DSS and are integrated within the proposed retarding basins where practicable.

Consistent with the Phase 3 investigations, the treatment system was developed using MUSIC to determine the treatment footprint required to achieve Melbourne Water's stormwater quality objectives, while RORB modelling was undertaken to size the associated flood retardation storage. The treatment and hydrologic models were developed iteratively to ensure that both water quality and stormwater attenuation objectives could be achieved within the proposed concept layout.

The design arrangement of the sediment basins and wetlands has been based off the following design principles:

- The assets are to be fed by the minor drainage network (20% AEP) from the contributing catchments.
- The sediment basins are sized using Fair and Geyer equation to capture 95% of coarse particles  $\geq 125\mu\text{m}$  diameter entering the system. Basins should have sufficient storage for accumulated sediment.
- The wetlands have been sized based on achieving best practice treatment targets.
- Design should allow for maintenance requirements.

A design arrangement for the assets was completed based on the design principles and arranged to fit within the existing topography and site constraints.

## 7.2 Stormwater treatment modelling

A key principle for the strategy is that all stormwater is to be treated to BPEM (Best Practice Environmental Management) Guidelines before being discharged from the study area. As such, the development site will require numerous treatment techniques in order to achieve the targeted reduction in pollutant load concentrations. The following BPEM targets have been adopted:

- 70% removal of the Total Gross Pollutant load
- 80% removal of Total Suspended Solids (TSS)
- 45% removal of Total Nitrogen (TN)
- 45% removal of Total Phosphorus (TP).

Stormwater treatment modelling was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to estimate the treatment performance of the proposed stormwater management assets under developed conditions. This allowed us to understand the target pollutant load reduction, and therefore test the sizing and treatment capacity of various opportunities required to meet the pollutant reduction targets

One MUSIC model was developed using the revised sub-catchments described in Section 5.1 together with the fraction impervious values adopted for the proposed land uses. Treatment modelling was undertaken for each stormwater management asset to determine the wetland footprint required to satisfy Melbourne Water's stormwater quality objectives.

## 7.3 Modelling input

The key modelling inputs for the MUSIC model are rainfall and evapotranspiration. Rainfall datasets at 6-minute intervals were obtained via eWater for rainfall gauges near Merrimu (Figure 6). The Parwan Gauge dataset for the period 1955-1973 was selected as it had the most consistent record.

Wetlands were selected as the preferred water quality assets due to their amenity, ease of maintenance, and ability to deliver a multi-asset when co-located within retarding basins (RBs). However, in the cases of small catchment sizes or where opportunities to enable staging were identified, a sediment basin was proposed.

It should be noted that in accordance with the Melbourne Water Music Guidelines (Melbourne Water, 2024), sediment basins do not remove nitrogen in the model. The deficit of nitrogen removal in the associated catchments is accounted for though surplus nitrogen removal in wetland treatment assets in the DSS's. The BPEM target of 45% total nitrogen removal is achieved when both DSS's are considered together.

When modelling wetlands in MUSIC, an Extended Detention Depth (EDD) of 0.35m is typically adopted and a detention time of 72 hours is aimed for. This allows sufficient contact time with the vegetation, and therefore treatment of the stormwater.

The sediment basin areas for each wetland were sized using Fair and Geyer equation. Sediment basins were given an average depth of 1m, and a volume was determined for use in the MUSIC modelling.

## 7.4 Asset performance

The catchment nodes used in the model have been calculated based on the areas, land use and associated FI values listed in Table 1. The MUSIC model layout is shown in Figure 6.

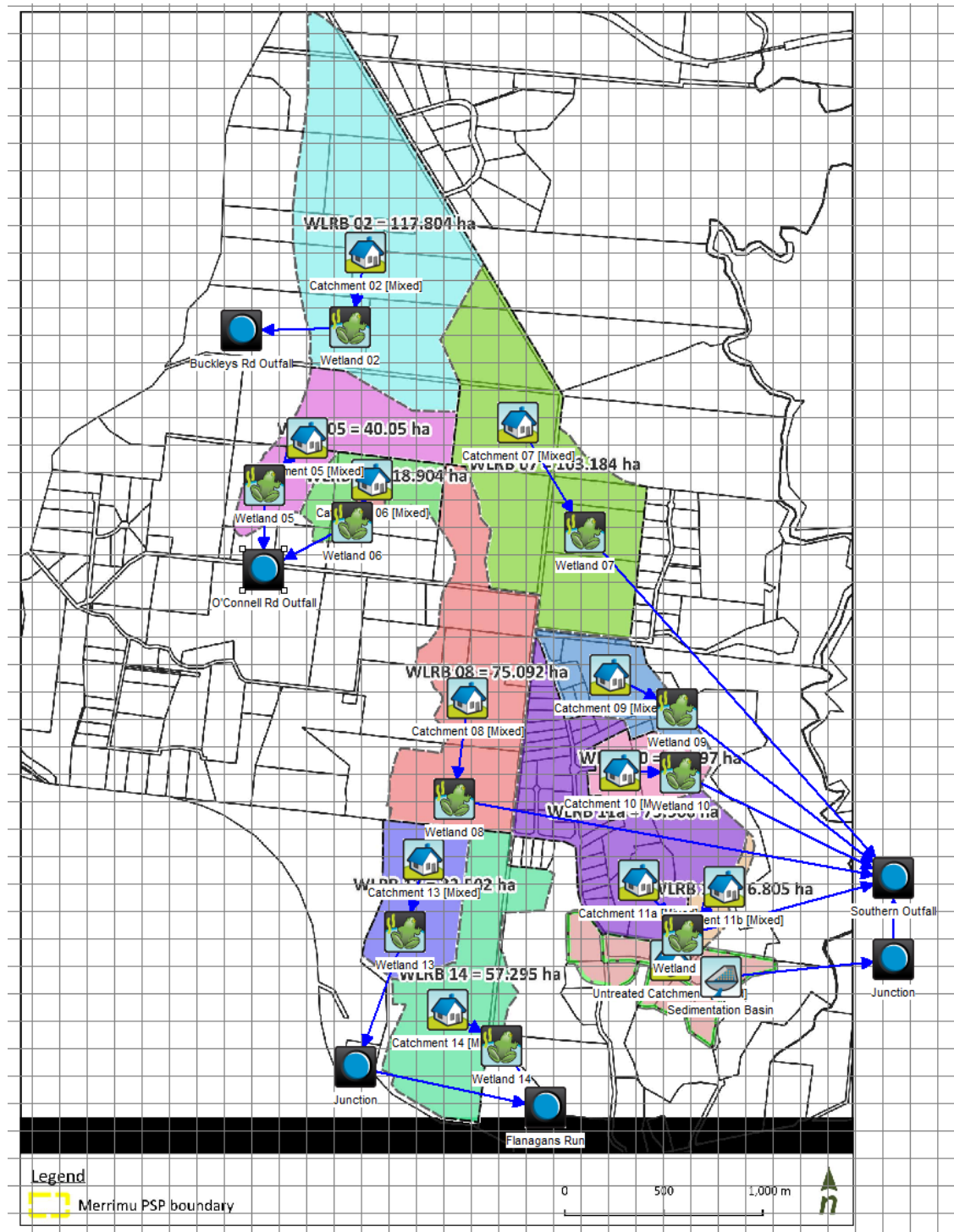


Figure 6. MUSIC model layout for Merrimu PSP area

The MUSIC modelling determined the sizing required for the wetland assets located at points identified through the discussion with Melbourne Water. The details of the required treatment systems are shown in Table 10.

**Table 10. Proposed wetland and sediment basin treatment areas**

|         | Catchment area (ha) | Macrophyte Zone area (m <sup>2</sup> ) | Inlet pond volume (m <sup>3</sup> )     | Average depth wetland (m) | Extended detention (m) |
|---------|---------------------|----------------------------------------|-----------------------------------------|---------------------------|------------------------|
| WLRB 2  | 117.80              | 27000                                  | 2000                                    | 0.4                       | 0.35                   |
| WLRB 5  | 40.05               | 10000                                  | 800                                     | 0.4                       | 0.35                   |
| WLRB 6  | 18.90               | 5000                                   | 550                                     | 0.4                       | 0.35                   |
| WLRB 7  | 103.18              | 24000                                  | 1800                                    | 0.4                       | 0.35                   |
| WLRB 8  | 75.09               | 18000                                  | 1550                                    | 0.4                       | 0.35                   |
| WLRB 9  | 27.00               | 6500                                   | 900                                     | 0.4                       | 0.35                   |
| WLRB 10 | 19.10*              | 4800                                   | 600                                     | 0.4                       | 0.35                   |
| WLRB 11 | 82.38*              | 18500                                  | 2100                                    | 0.4                       | 0.35                   |
|         |                     |                                        | (Western SB: 1800)<br>(Eastern SB: 300) |                           |                        |
| WLRB 13 | 32.50               | 7500                                   | 1000                                    | 0.4                       | 0.35                   |
| WLRB 14 | 57.29               | 14000                                  | 1150                                    | 0.4                       | 0.35                   |
| SBRB 15 | 12.00               | -                                      | 900                                     | -                         | -                      |

\*Treated flow discharged from WLRB 10 will have to be conveyed into WLRB 11 again due to the outfall limitation. The contributing catchment of 82.38ha only accounts for the untreated catchment contributing into WLRB 11, with the exclusion of 19.10ha contributing into WLRB 10 first.

The results of the MUSIC modelling analysis demonstrate that BPEM Guidelines / State pollutant reduction targets are met with the performance of those assets, as shown in Table 11 to Table 14.

**Table 11. Overall MUSIC modelling results for Buckleys Rd Outfall catchment**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 368    | 332           | 9.8         | -               |
| Total Suspended Solids (kg/yr) | 73500  | 14300         | 80.5        | 59200           |
| Total Phosphorus (kg/yr)       | 151    | 45.6          | 69.8        | 105.4           |
| Total Nitrogen (kg/yr)         | 1060   | 537           | 49.1        | 523             |
| Gross Pollutants (kg/yr)       | 15300  | 0             | 100         | 15300           |

**Table 12. Overall MUSIC modelling results for O'Connell Rd Outfall catchment**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 184    | 164           | 10.8        | -               |
| Total Suspended Solids (kg/yr) | 36700  | 7170          | 80.5        | 29530           |
| Total Phosphorus (kg/yr)       | 75.7   | 23            | 69.7        | 52.7            |
| Total Nitrogen (kg/yr)         | 528    | 261           | 50.6        | 267             |
| Gross Pollutants (kg/yr)       | 7650   | 0             | 100         | 7650            |

**Table 13. Overall MUSIC modelling results for Southern Outfall catchment**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 996    | 899           | 9.7         |                 |
| Total Suspended Solids (kg/yr) | 201000 | 39400         | 80.4        | 161600          |
| Total Phosphorus (kg/yr)       | 407    | 126           | 69          | 281             |
| Total Nitrogen (kg/yr)         | 2860   | 1500          | 47.6        | 1360            |
| Gross Pollutants (kg/yr)       | 41400  | 0             | 100         | 41400           |

**Table 14. Overall MUSIC modelling results for Flanagans Run Outfall catchment**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 281    | 252           | 10.2        | -               |
| Total Suspended Solids (kg/yr) | 56600  | 11300         | 80          | 45300           |
| Total Phosphorus (kg/yr)       | 115    | 35.3          | 69.4        | 79.7            |
| Total Nitrogen (kg/yr)         | 807    | 407           | 49.6        | 400             |
| Gross Pollutants (kg/yr)       | 11700  | 0             | 100         | 11700           |

## 7.5 Connections

### *Inflow into sediment basins*

The inflow to the sediment basins will be via the minor drainage network. The stormwater main for the catchment will outfall into the sediment basins. Typically, this will be via a rocked endwall.

### *Sediment basin to wetland transfer*

There will be piped connections between the sediment basins and the macrophyte zone to pass the 4EY AEP (3-month ARI) peak flow. The connections will be an outlet pit, with the top of the pit at the sediment basin NWL to control the water level. A transfer pipe at the bottom of the pit will pass flows through to the wetland. The invert of the pipe on the wetland side should be set 300mm above the base of the pool so to avoid being blocked by accumulated sediment. There are Melbourne Water standard drawings for these connection details (i.e. 7251/12/008 and 7251/12/001).

### *Balance pipes*

300mm diameter balance pipes connected to submerged offtake pits will be located in the base of the wetland pools, connecting them together. This is important to be able to drain the system for

maintenance purposes. This is as per Melbourne Water standard drawings 7251/12/015 and 7251/12/035.

### ***Wetland outfall***

The water level in a wetland is controlled by an outlet usually in the macrophyte zone. The macrophyte zone outlet provides the hydrologic control of the water level, and flows in the macrophyte zone, to achieve the design detention time for treatment performance.

Outlet structures should be designed and located so that they can be easily accessed for maintenance. Outlet or overflow pits located within the outlet pool of the macrophyte zone should be accessible from the edge of the wetland, this means that the edge of the pit closest to the wetland margin should be located in no more than 350mm depth.

The wetland outlet configuration consists of a submerged pipe connected to a twin chamber outfall pit (containing the controlled weir outlet) located adjacent to the wetland above TED. The outlet pit should be easily accessible and have a hinged grated lid to enable access to the outlet control structure for maintenance. These pits have been located next to the internal path.

An adjustable weir, such as a side-winding penstock, allows the inundation frequency to be adjusted easily. The control pit has an outlet pipe which will connect with the RB outlet pit.

There is a Melbourne Water standard drawing for this wetland pit detail (i.e. 7251/12/006).

## **7.6 WLRB concept layout**

Figure 7 to Figure 10 present the key parameters and concept design layout for each asset. These will be refined during subsequent design stages.

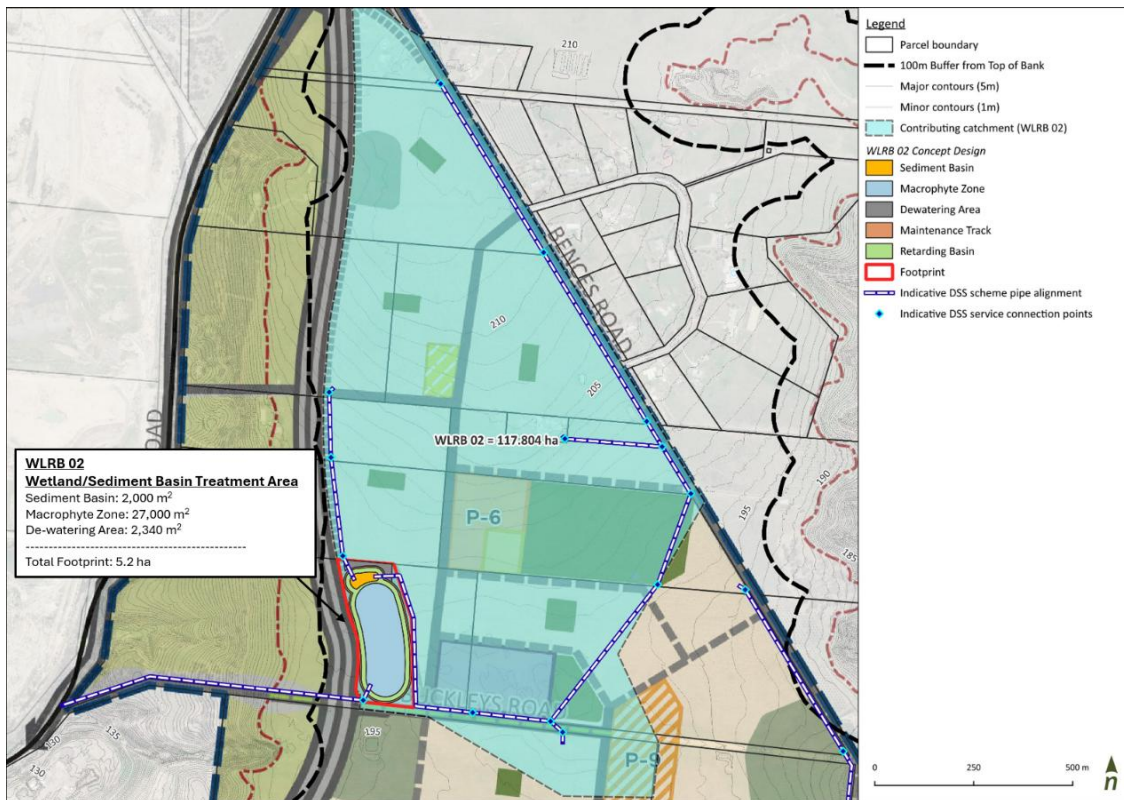


Figure 7. WLRB 02 Concept Plan

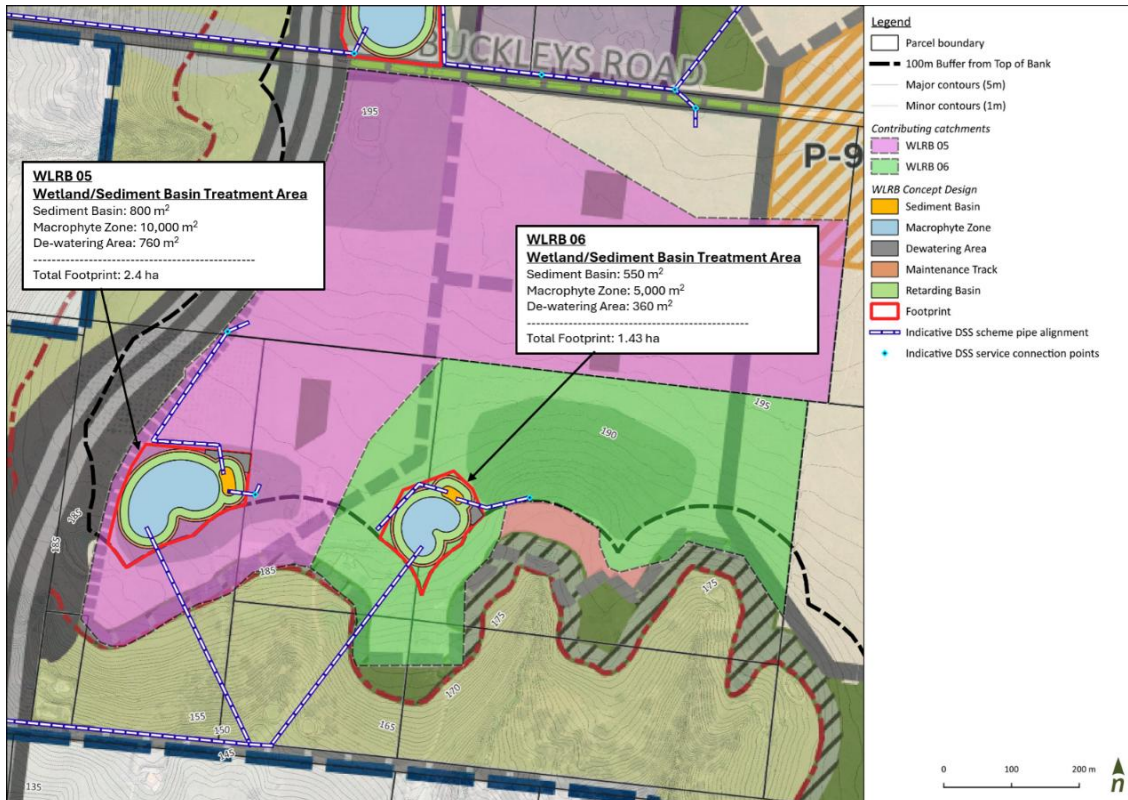


Figure 8. WLRBs 05 and 06 Concept Plan

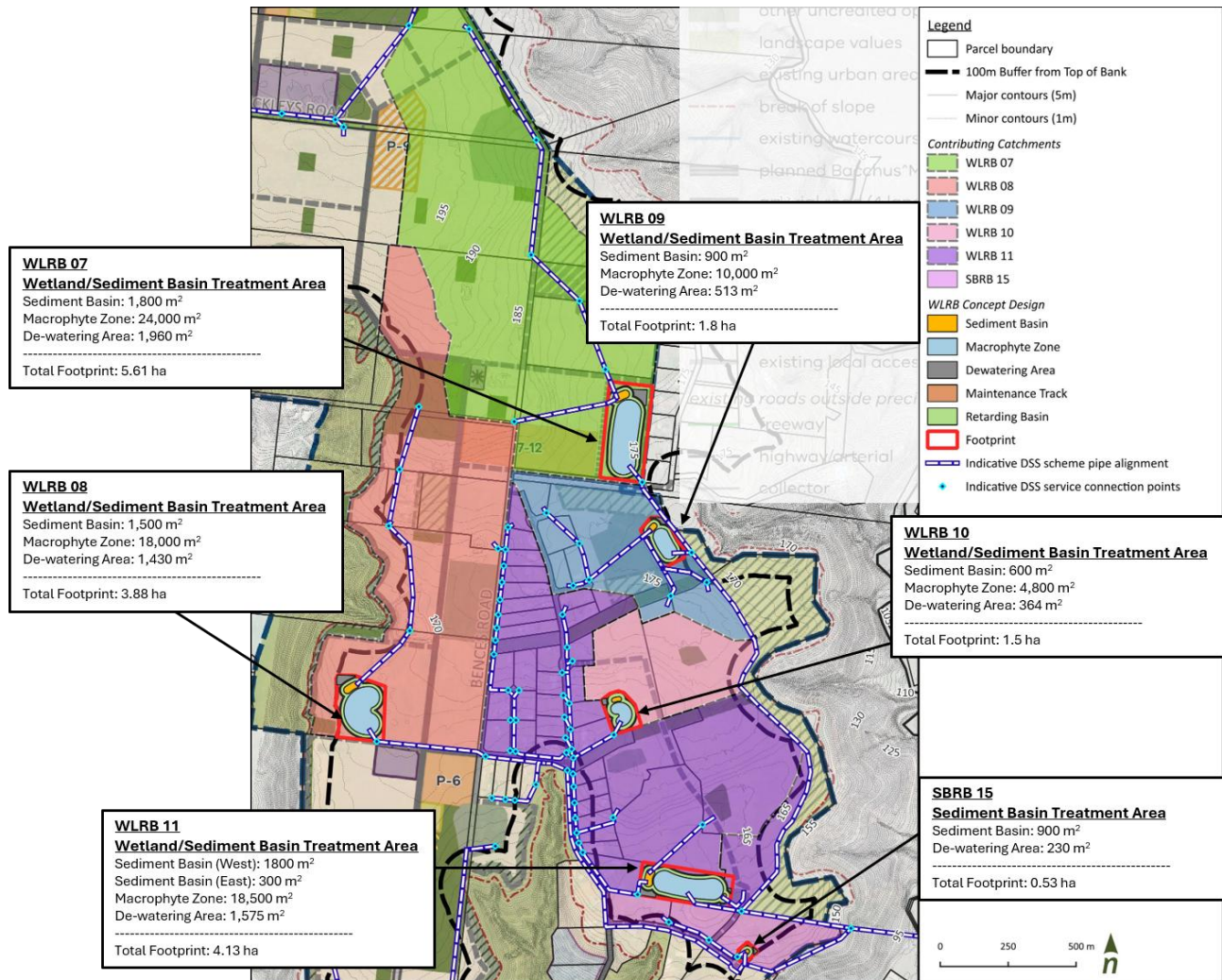


Figure 9. WLRBs 07-12 and SBRB 15 Concept Plan

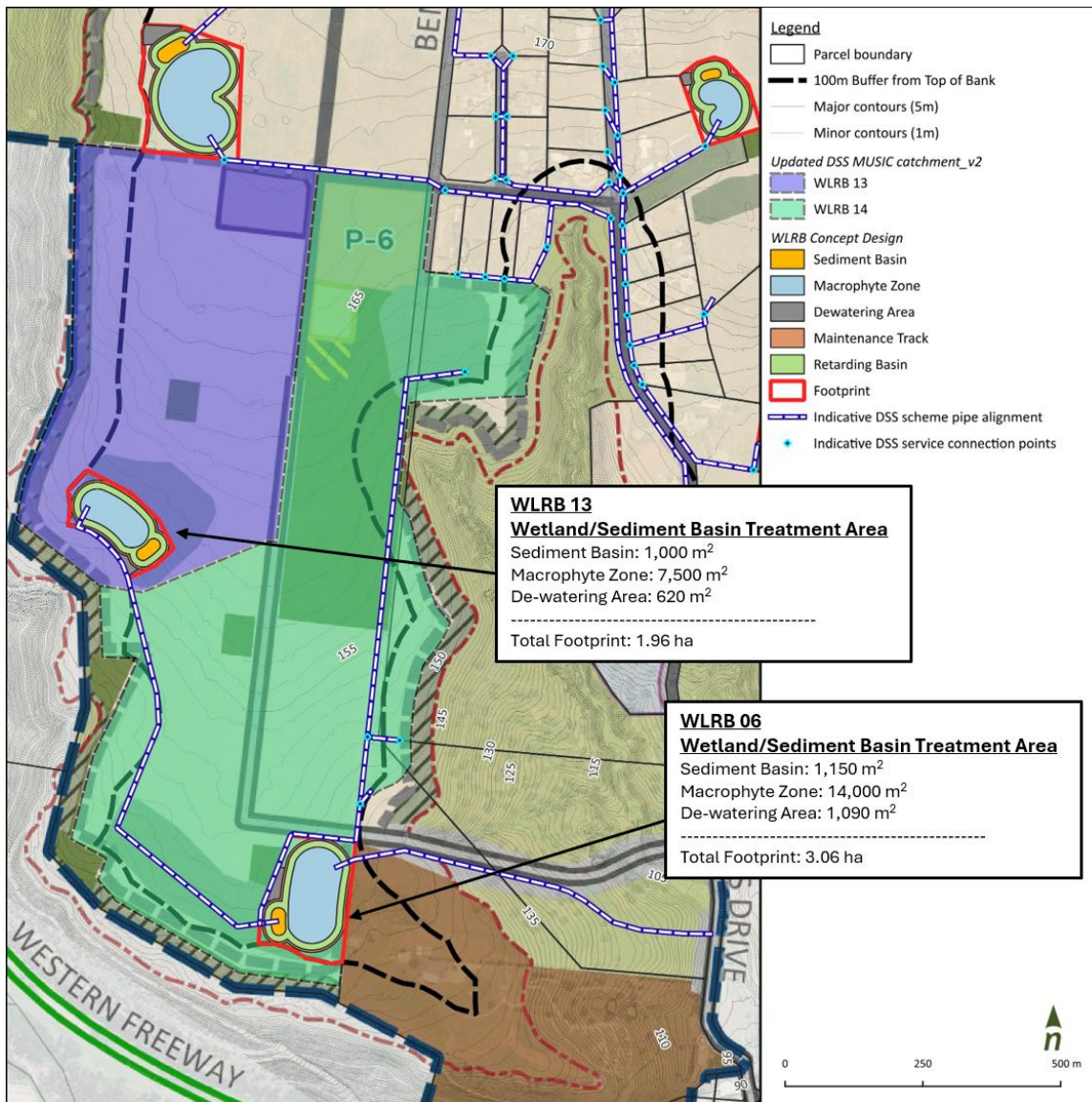


Figure 10. WLRBs 13 and 14 Concept Plan

## 8 Conclusions

Alluvium Consulting has been engaged by Melbourne Water to prepare concept design update for the four DSSs located within the Merrimu PSP area, which are:

- 8508 Merrimu North DSS
- 8404 Possumtail Run DSS
- 8507 O'Connell Road DSS
- 8402 Flanagans Drive DSS

Building on previous investigations and received feedback from Melbourne Water, Department of Transport and Planning (DTP), and land developers, the stormwater management assets for the Merrimu PSP area were refined to a concept design level.

The design process included:

- Review of received feedback
- Refine the scheme asset locations based on received feedback
- Refine treatment modelling to ensure best practice treatment targets were met
- Refine hydrologic modelling to ensure post-development flows are retarded back to pre-development flows
- Re-size stormwater management assets based on the refined stormwater treatment modelling results and hydrologic modelling results
- Re-size the required land take for the stormwater drainage assets

10 wetland/retarding basin assets and 1 sediment basin/retarding basin asset were developed:

| Buckley Road Outfall | O'Connell Road Outfall | Southern Outfall | Flanagans Run Outfall |
|----------------------|------------------------|------------------|-----------------------|
| WLRB 01              | WLRB 05                | WLRB 07          | WLRB 13               |
|                      | WLRB 06                | WLRB 08          | WLRB 14               |
|                      |                        | WLRB 09          |                       |
|                      |                        | WLRB 10          |                       |
|                      |                        | WLRB 11          |                       |
|                      |                        | SBRB 15          |                       |

## Appendix A: Merrimu Pre-PSP Development Phase 3: Surface Water and Groundwater Investigations (Alluvium, 2024)

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## Appendix B: Environmental and Geomorphology Assessments for Selected Stormwater Outfalls in the Merrimu PSP Area (Alluvium, 2026)

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## Appendix C: Merrimu PSP Phase 4 Investigation - Task 1 Review Feedback and Scheme Refinement (Alluvium, 2026)

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## Appendix D: Stormwater Treatment Modelling Results (Individual Asset)

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**Table 15. WLRB 2 treatment results**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 368    | 332           | 9.8         | -               |
| Total Suspended Solids (kg/yr) | 73500  | 14300         | 80.5        | 59200           |
| Total Phosphorus (kg/yr)       | 151    | 45.6          | 69.8        | 105.4           |
| Total Nitrogen (kg/yr)         | 1060   | 537           | 49.1        | 523             |
| Gross Pollutants (kg/yr)       | 15300  | 0             | 100         | 15300           |

**Table 16. WLRB 5 treatment results**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 125    | 112           | 10.6        | -               |
| Total Suspended Solids (kg/yr) | 25100  | 5000          | 80.1        | 20100           |
| Total Phosphorus (kg/yr)       | 51.4   | 15.9          | 69.1        | 35.5            |
| Total Nitrogen (kg/yr)         | 358    | 178           | 50.3        | 180             |
| Gross Pollutants (kg/yr)       | 5200   | 0             | 100         | 5200            |

**Table 17. WLRB 6 treatment results**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 59.1   | 52.4          | 11.3        | -               |
| Total Suspended Solids (kg/yr) | 11700  | 2170          | 81.4        | 9530            |
| Total Phosphorus (kg/yr)       | 24.3   | 7.09          | 70.9        | 17.21           |
| Total Nitrogen (kg/yr)         | 170    | 82.5          | 51.4        | 87.5            |
| Gross Pollutants (kg/yr)       | 2450   | 0             | 100         | 2450            |

**Table 18. WLRB 7 treatment results**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 323    | 291           | 9.9         | -               |
| Total Suspended Solids (kg/yr) | 65900  | 13000         | 80.3        | 52900           |
| Total Phosphorus (kg/yr)       | 131    | 40.2          | 69.3        | 90.8            |
| Total Nitrogen (kg/yr)         | 927    | 467           | 49.6        | 460             |
| Gross Pollutants (kg/yr)       | 13400  | 0             | 100         | 13400           |

**Table 19. WLRB 8 treatment results**

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 235    | 211           | 10.2        | -               |
| Total Suspended Solids (kg/yr) | 47400  | 8950          | 81.1        | 38450           |
| Total Phosphorus (kg/yr)       | 97     | 29.2          | 69.9        | 67.8            |
| Total Nitrogen (kg/yr)         | 677    | 339           | 49.9        | 338             |
| Gross Pollutants (kg/yr)       | 9750   | 0             | 100         | 9750            |

Table 20. WLRB 9 treatment results

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 84.4   | 75.8          | 10.3        | -               |
| Total Suspended Solids (kg/yr) | 16800  | 3200          | 81          | 13600           |
| Total Phosphorus (kg/yr)       | 34.6   | 10.5          | 69.8        | 24.1            |
| Total Nitrogen (kg/yr)         | 244    | 123           | 49.7        | 121             |
| Gross Pollutants (kg/yr)       | 3510   | 0             | 100         | 3510            |

Table 21. WLRB 10 treatment results

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 59.7   | 53.3          | 10.7        | -               |
| Total Suspended Solids (kg/yr) | 12000  | 2350          | 80.4        | 9650            |
| Total Phosphorus (kg/yr)       | 24.2   | 7.25          | 70          | 16.95           |
| Total Nitrogen (kg/yr)         | 172    | 84.6          | 50.8        | 87.4            |
| Gross Pollutants (kg/yr)       | 2480   | 0             | 100         | 2480            |

Table 22. WLRB 11 treatment results

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 258    | 233           | 9.6         | -               |
| Total Suspended Solids (kg/yr) | 51800  | 10000         | 80.6        | 41800           |
| Total Phosphorus (kg/yr)       | 105    | 32            | 69.5        | 73              |
| Total Nitrogen (kg/yr)         | 735    | 378           | 48.6        | 357             |
| Gross Pollutants (kg/yr)       | 10700  | 0             | 100         | 10700           |

Table 23. SBRB 15 treatment results

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 37     | 36.3          | 1.9         | -               |
| Total Suspended Solids (kg/yr) | 7500   | 1900          | 74.7        | 5600            |
| Total Phosphorus (kg/yr)       | 15.3   | 6.83          | 55.2        | 8.47            |
| Total Nitrogen (kg/yr)         | 107    | 107           | 0.1         | 0               |
| Gross Pollutants (kg/yr)       | 1570   | 0             | 100         | 1570            |

Table 24. WLRB 13 treatment results

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 102    | 91.6          | 9.8         | -               |
| Total Suspended Solids (kg/yr) | 20300  | 4080          | 80          | 16220           |
| Total Phosphorus (kg/yr)       | 41.9   | 13            | 69          | 28.9            |
| Total Nitrogen (kg/yr)         | 291    | 149           | 48.9        | 142             |
| Gross Pollutants (kg/yr)       | 4220   | 0             | 100         | 4220            |

Table 25. WLRB 14 treatment results

|                                | Source | Residual load | % reduction | kg/yr reduction |
|--------------------------------|--------|---------------|-------------|-----------------|
| Flow (ML/yr)                   | 179    | 160           | 10.4        | -               |
| Total Suspended Solids (kg/yr) | 36200  | 7250          | 80          | 28950           |
| Total Phosphorus (kg/yr)       | 73.3   | 22.3          | 69.5        | 51              |
| Total Nitrogen (kg/yr)         | 516    | 258           | 49.9        | 258             |
| Gross Pollutants (kg/yr)       | 7440   | 0             | 100         | 7440            |

## Appendix E: Individual Asset Concept Design Layout

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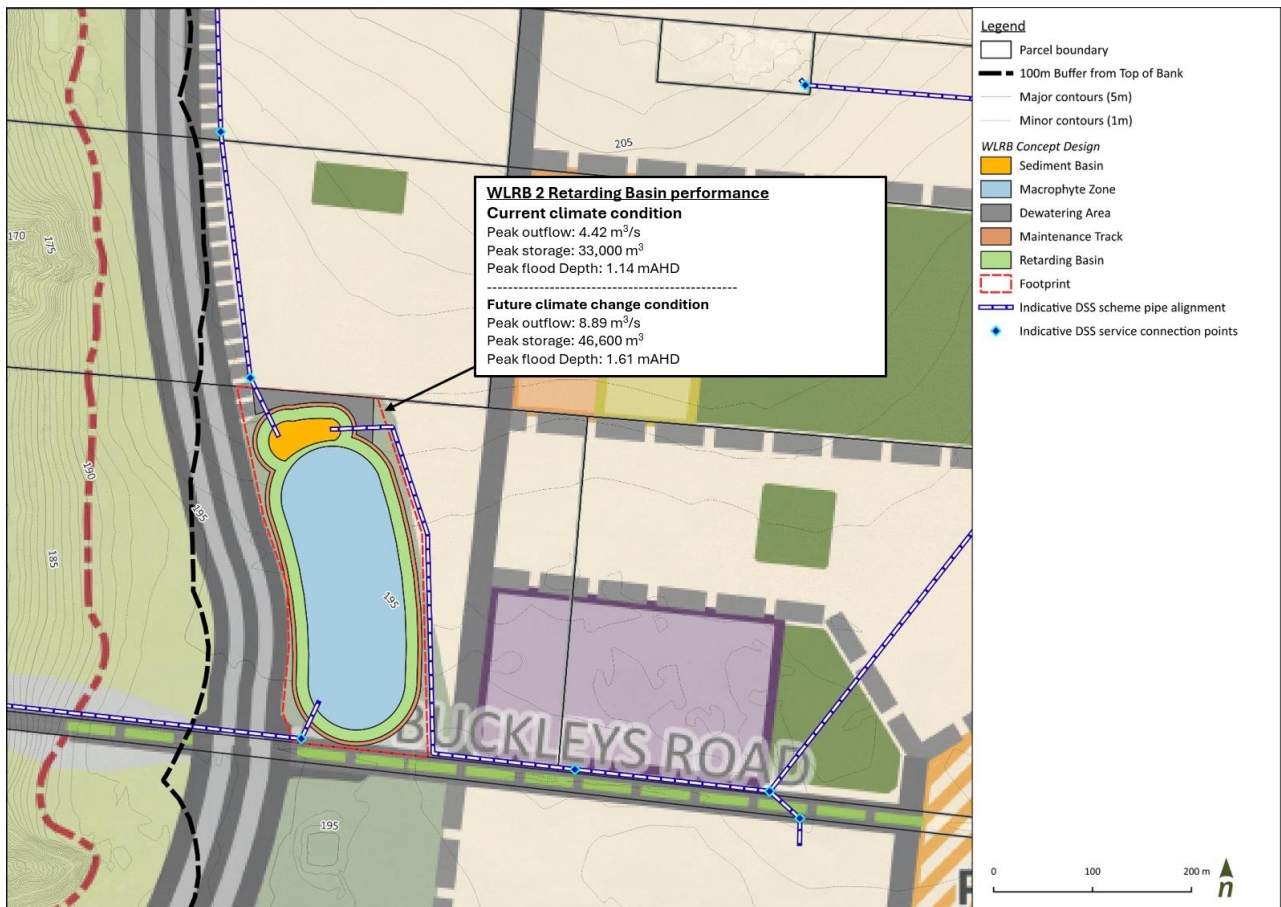


Figure 11. WLRB 02 concept design layout

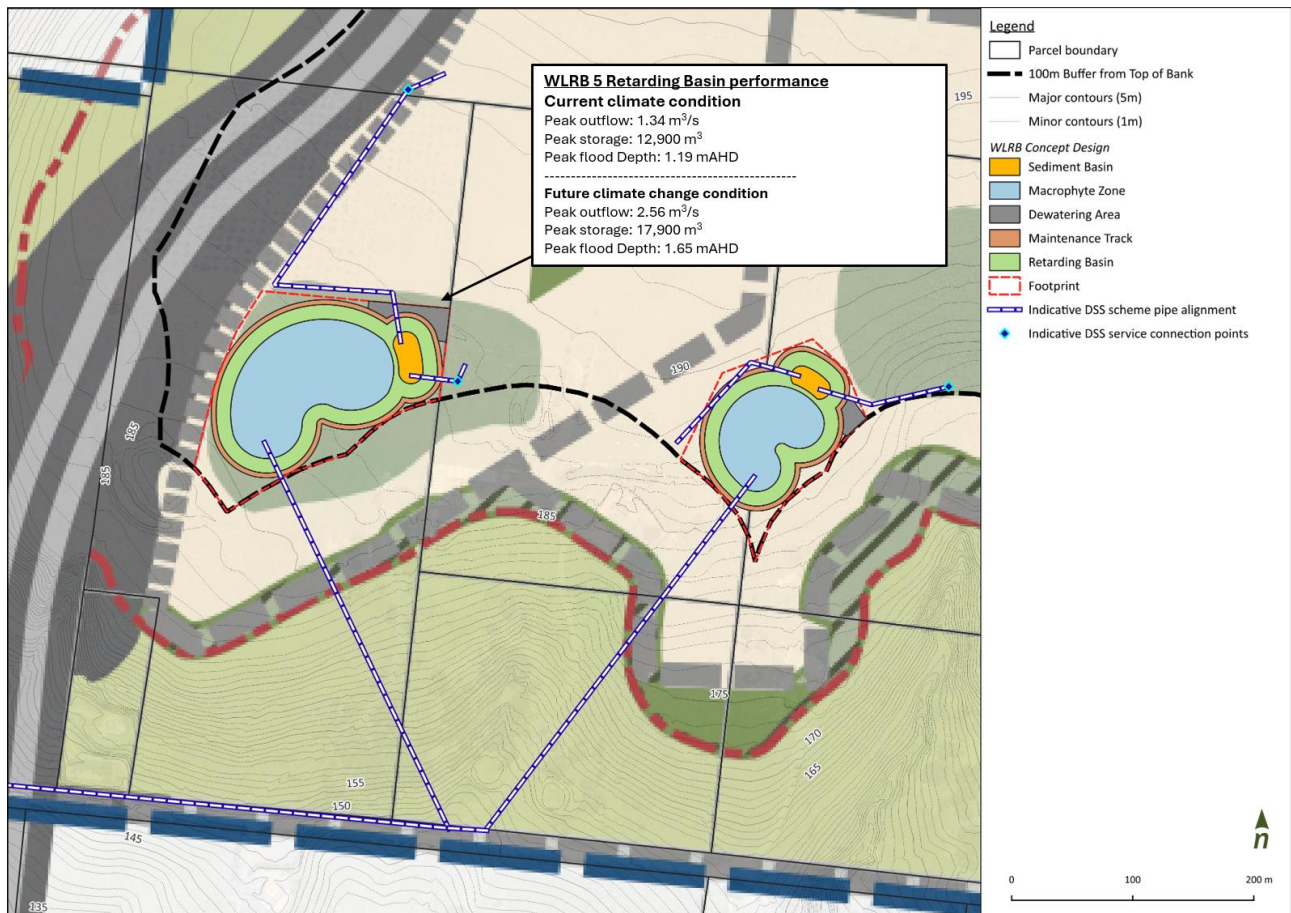


Figure 12. WLRB 05 concept design layout

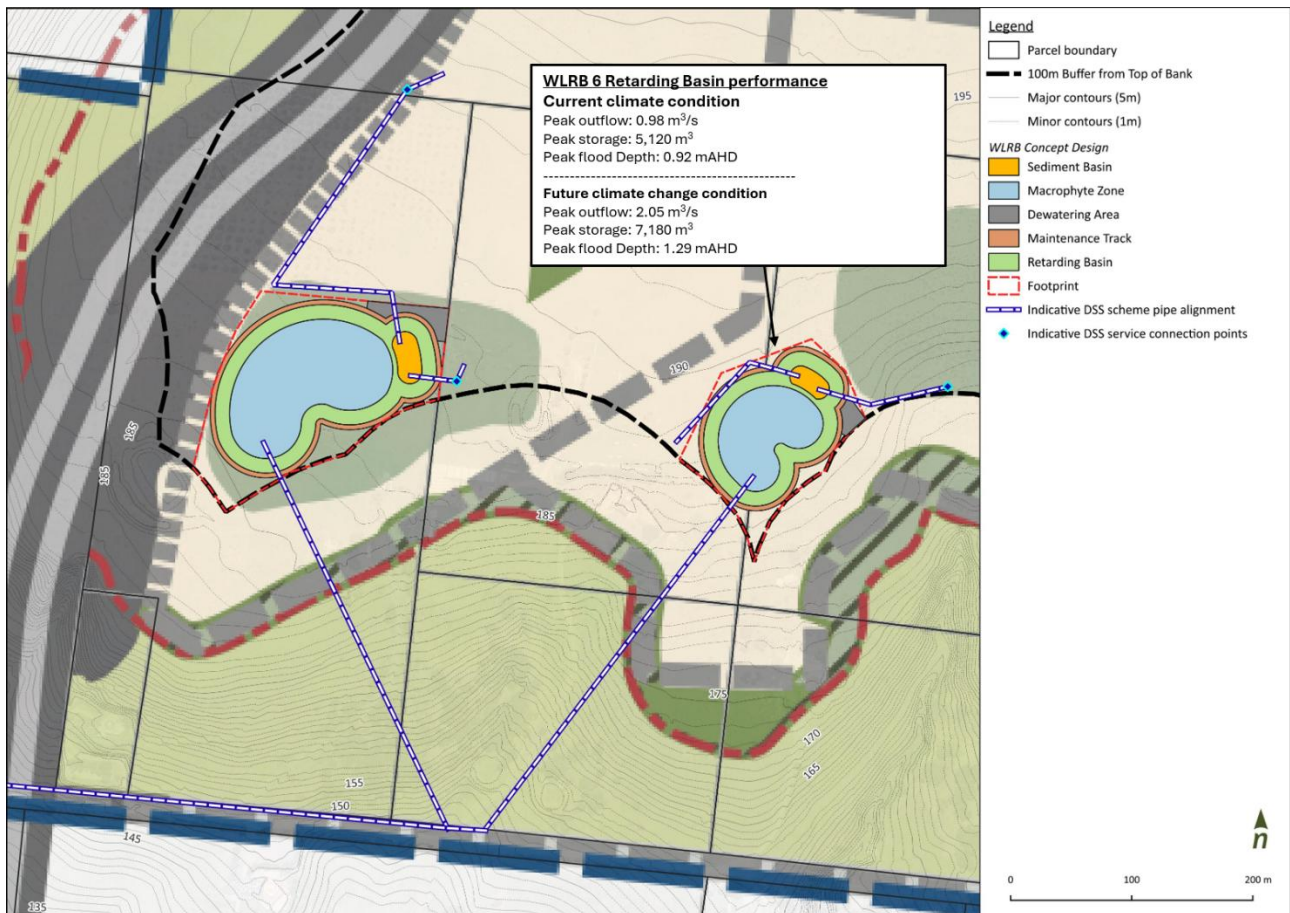


Figure 13. WLRB 06 concept design layout

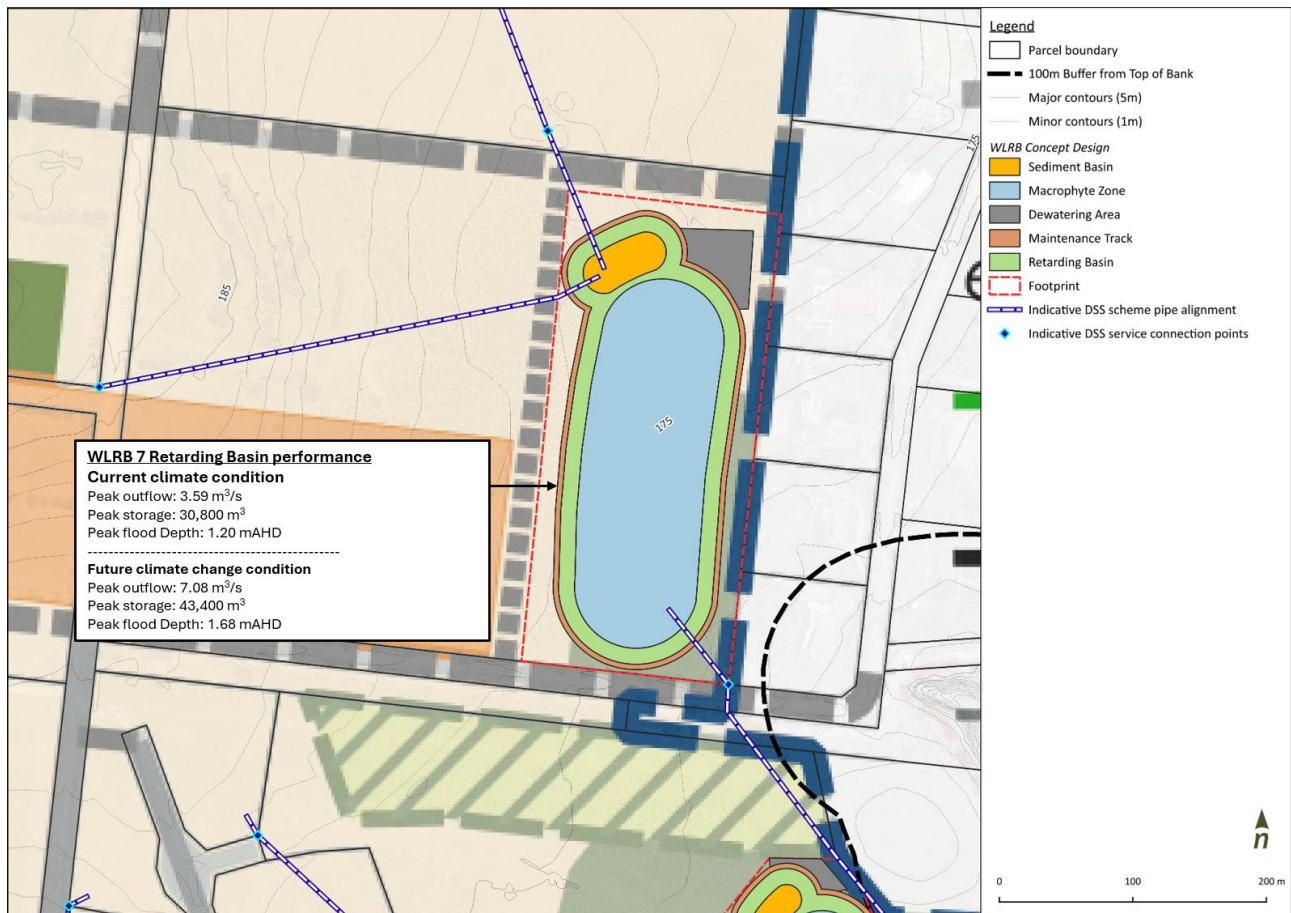


Figure 14. WLRB 07 concept design layout

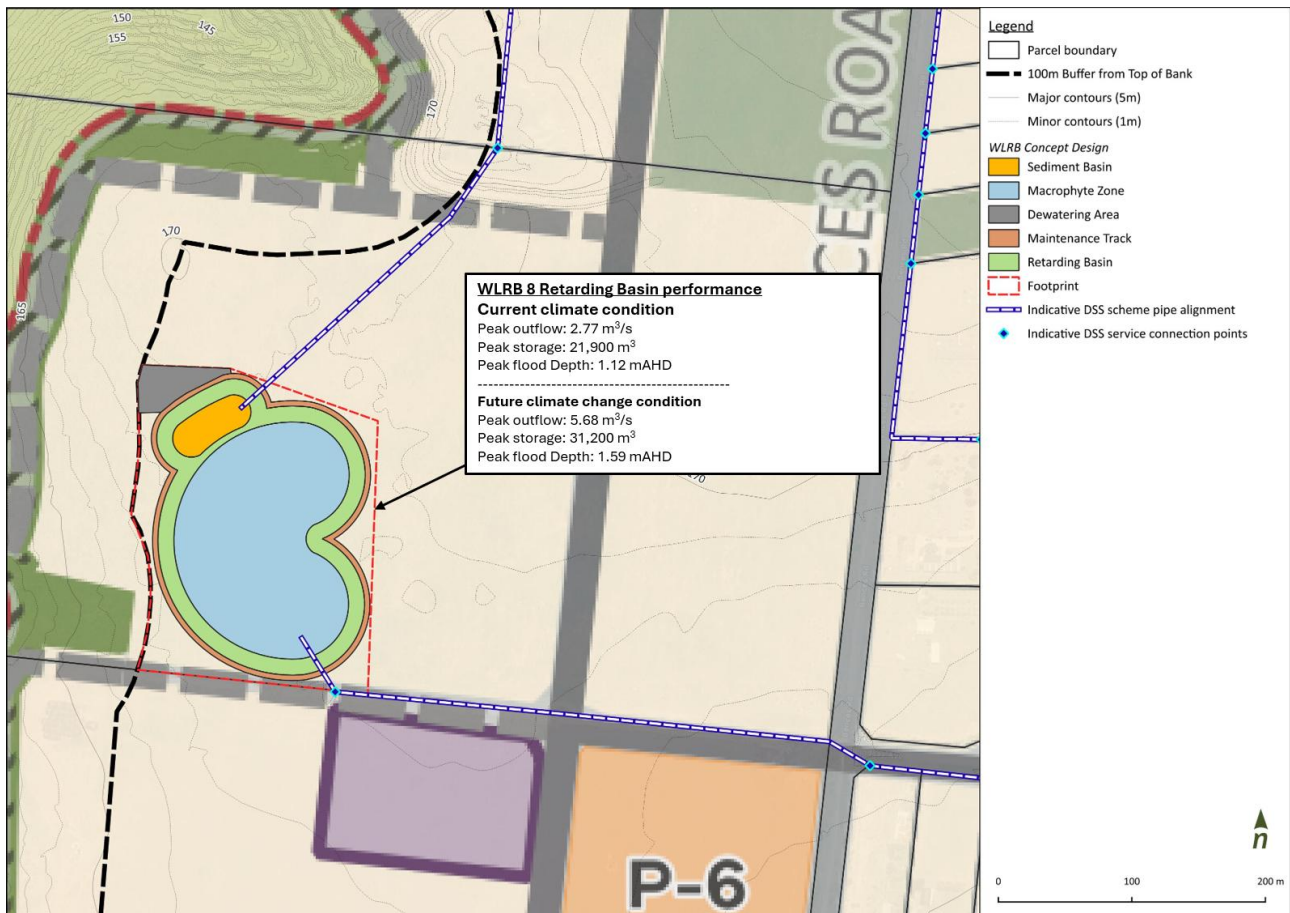


Figure 15. WLRB 08 concept design layout

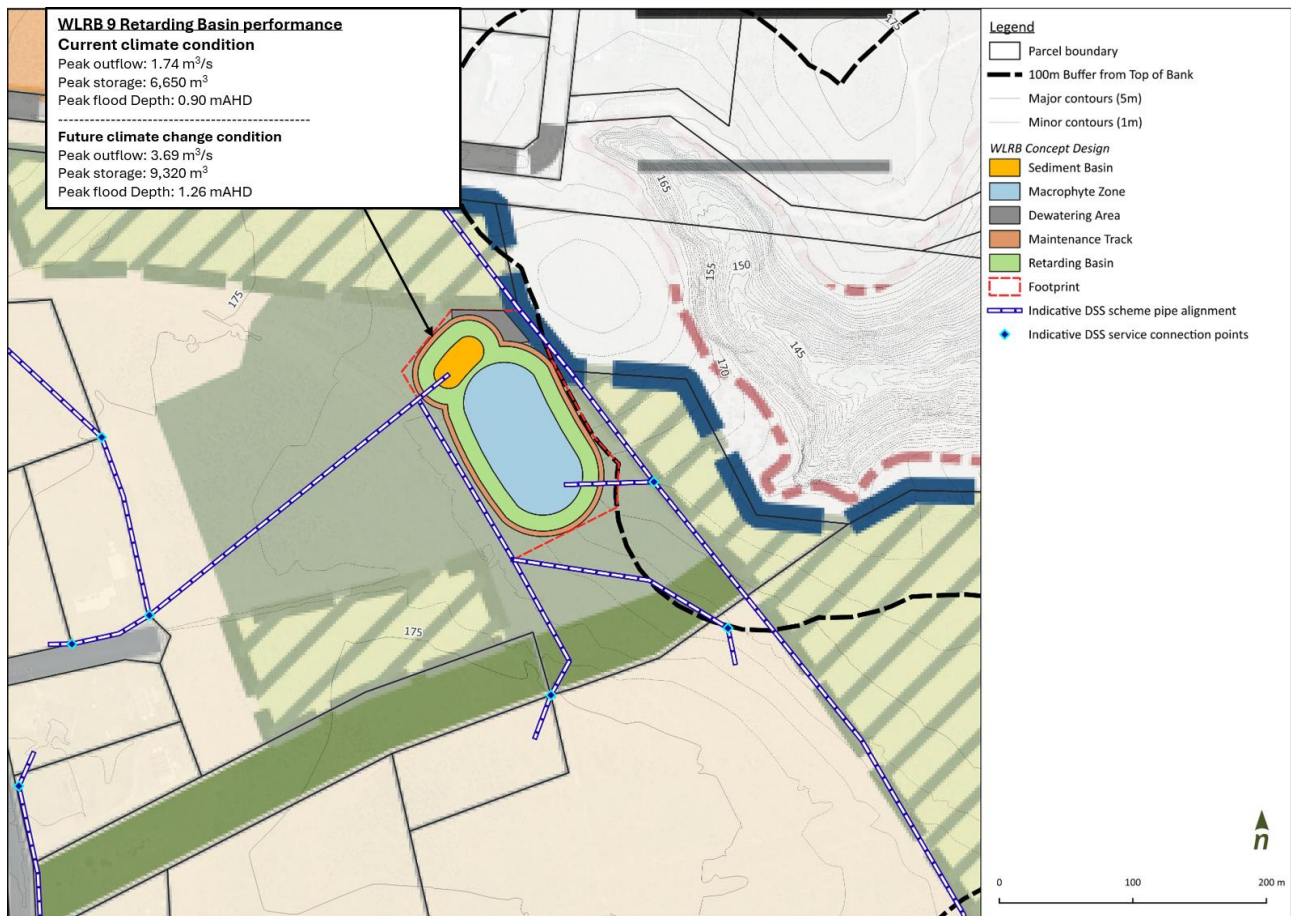


Figure 16. WLRB 09 concept design layout



Figure 17. WLRB 10 concept design layout

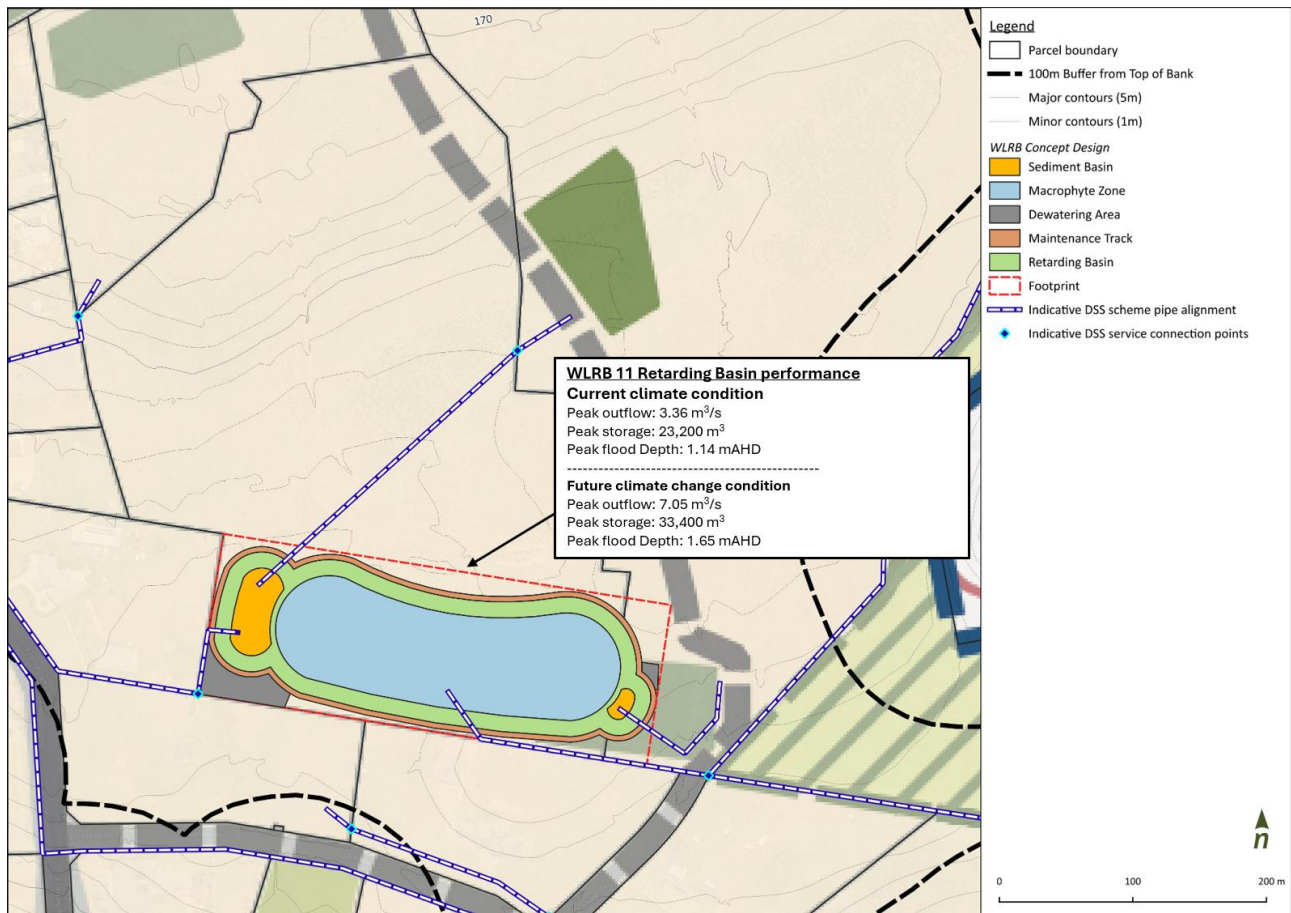


Figure 18. WLRB 11 concept design layout



Figure 19. WLRB 13 concept design layout

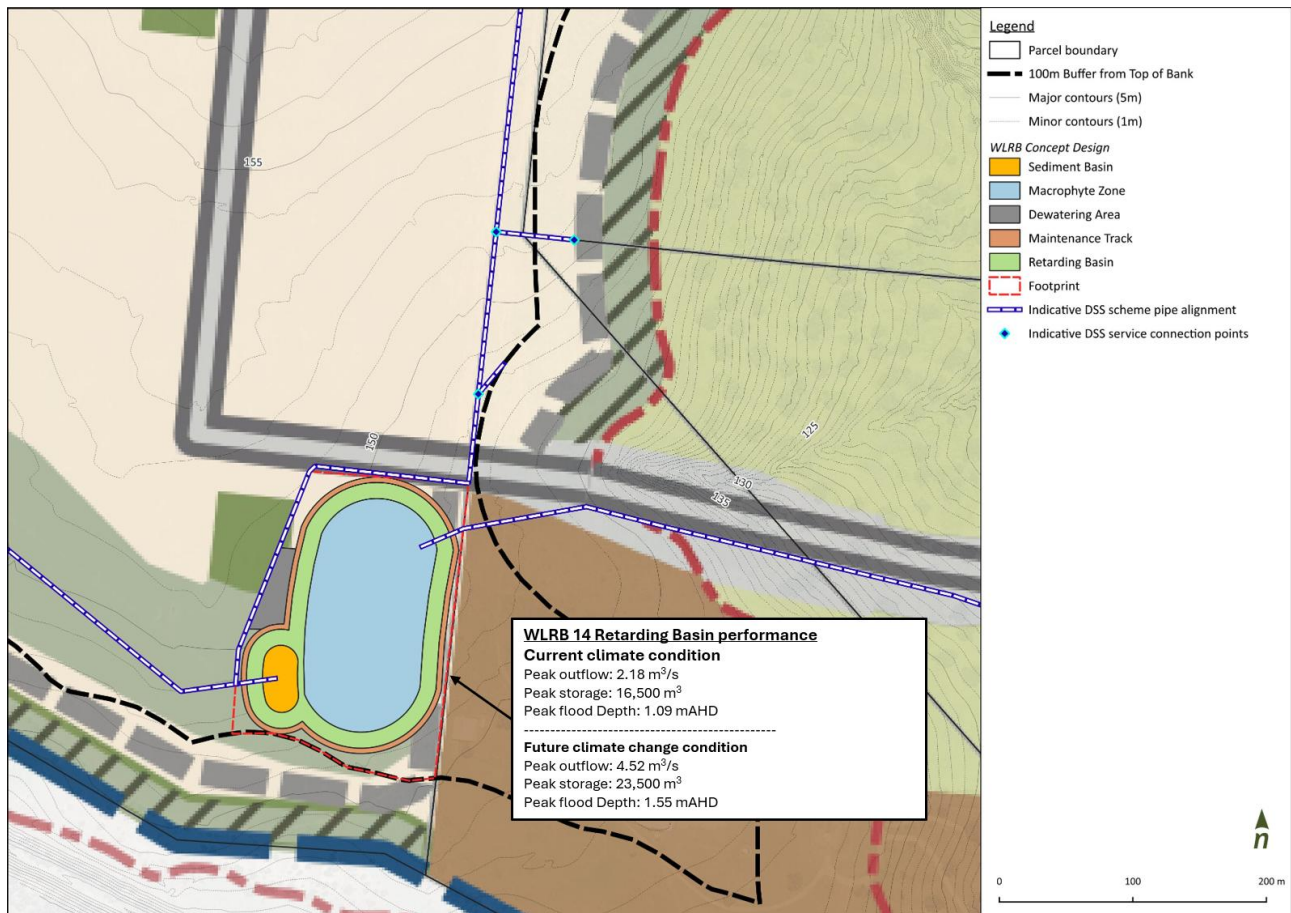


Figure 20. WLRB 14 concept design layout

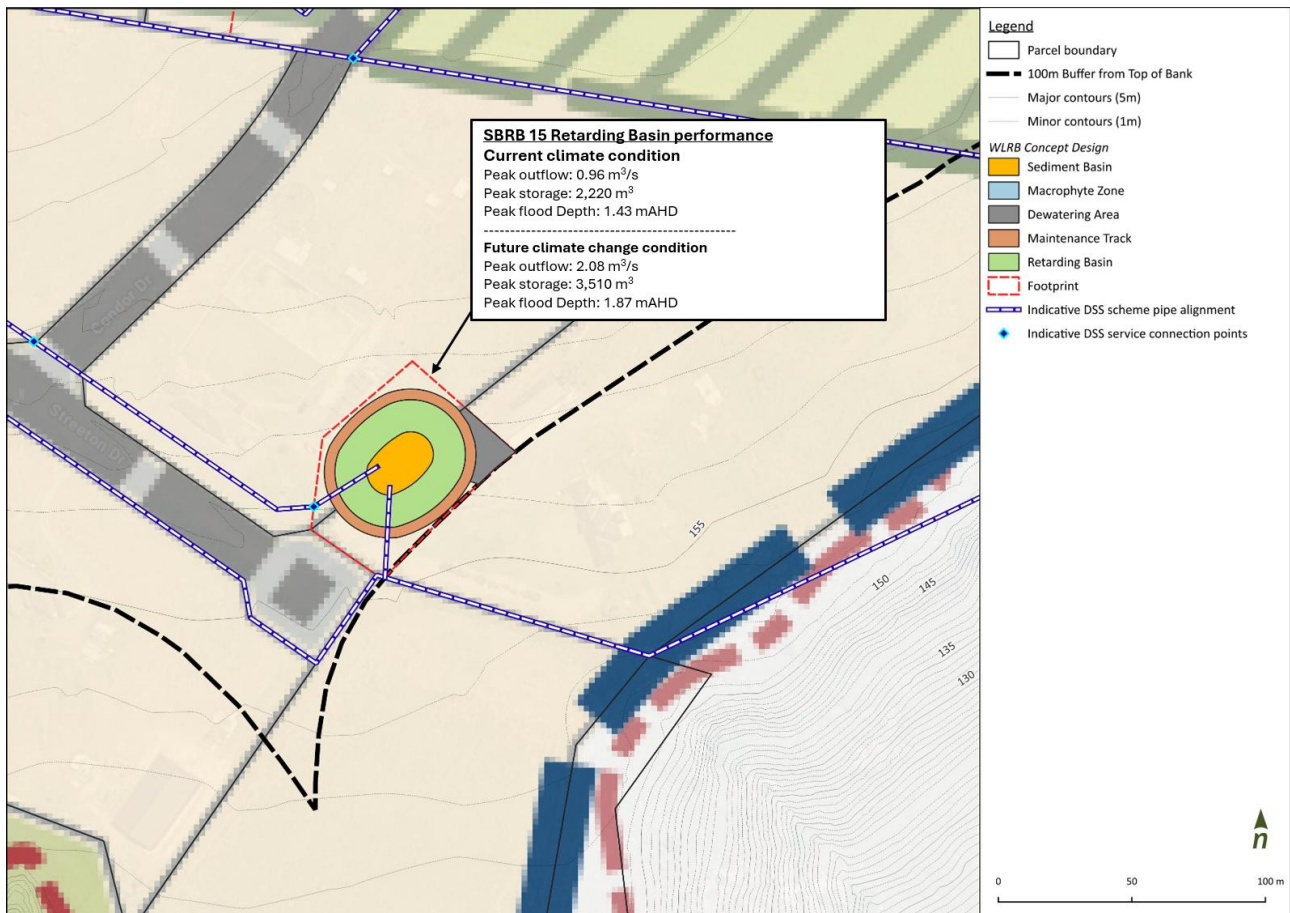


Figure 21. SBRB 15 concept design layout

