MAVEN

STORMWATER MANAGEMENT REPORT

57 & 57a Schnapper Rock Road, Schnapper Rock

CIVIL ENGINEERING ▼ SURVEYING ▼ LAND DEVELOPMENT

PROJECT INFORMATION

CLIENT	KBS Design Group
PROJECT	175006

DOCUMENT CONTROL

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EXECUTIVE SUMMARY

The proposal seeks Council Approval to rezone the site into Residential Mixed – Housing and Residential – Single House from its current Residential Large Lot zoning.

The development is classified as a greenfield site under Schedule 4 of the Regional Network Discharge Consent (NDC). This Stormwater Management Plan (SMP) is intended to address the overall development site in support of the plan change. Final staging of the development shall be confirmed at resource consent stage.

The site was a former Watercare asset which was recently subdivided off, and the balance sold for development by Watercare. The sites land coverage is considered 100% pervious as per large-greenfield site under the NDC.

The current concept plan indicates that the future development will support 93-lots, with access provided through a combination of public roading and private accessways. Primary access will be made from Schnapper Rock Road. The adjacent property (55 Schnapper Rock Road) is subject to an approved subdivision, which is currently under construction. A new roading network has been designed from Kyle Road. The public infrastructure has been designed for the upstream catchment, which is our development site.

The site is situated at the top of catchment contributing to the existing Overland Flow Paths (OLFPs) located within the site. The site is within a Stormwater Management Area– Flow 1 (SMAF) overlay which triggers hydrological mitigation through attenuation and re-use.

The SMP proposes to treat the new impervious areas in accordance with the guidelines of Auckland Council's GD04 Water Sensitive Design for Stormwater, GD01 Stormwater Management Devices: Design guidelines manual of the Auckland Unitary Plan – Operative in Part (AUP – OP).

A portion of the site is within a Significant Ecological Area (SEA). Works within the SEA shall require a specific construction methodology to protect and minimise disturbance to the SEA.

All future public roads proposed as part of the development will be supported by stormwater quality treatment via the use stormwater management devices that achieve 'best practical option' (BPO) and aligned with the values of mana whenua.

1 EXISTING SITE APPRAISAL

1.1 SUMMARY OF DATA SOURCES AND DATES

Existing site appraisal item	Source and date of data used
Topography	• Maven Associates, 2020 • Auckland Council GeoMaps, Contours, 2021
Geotechnical / soil conditions	• Geotechnical Feasibility Report KGA Geotechnical, 2021
Existing/Future stormwater network	• Auckland Council GeoMap, 2020 • Cato Bolam, 2020 – ENG60330592
Existing hydrological features	• Maven Associates, 2021 • Auckland Council GeoMaps, Catchments and Hydrology Layer, 2020
Stream, river, coastal erosion	• *NA*
Flooding and flowpaths	• Auckland Council GeoMaps, Overland Flow Paths Layer, 2021
Coastal Inundation	• NA
Ecological / environmental areas	• Auckland Council Unitary Plan Viewer, significant vegetation layer, 2021 • Wildlands, 2021
Cultural and heritage sites	• Auckland Council GeoMaps, cultural heritage site, 2021
Contaminated Land	• Preliminary Site Investigation Thomas Consultants, 2021

1.2 LOCATION AND GENERAL INFORMATION

The site is located south of the intersection of Schnapper Rock Road and Oakway Drive, with road frontage along the eastern and western boundaries. Much of the site is covered with overgrown vegetation with notable trees located within the western portion of the site, identified as an SEA. A Watercare facility is located within the eastern portion of the site with its site access provided along the east. Image 1 shows the location of the subject site with its surrounding features.

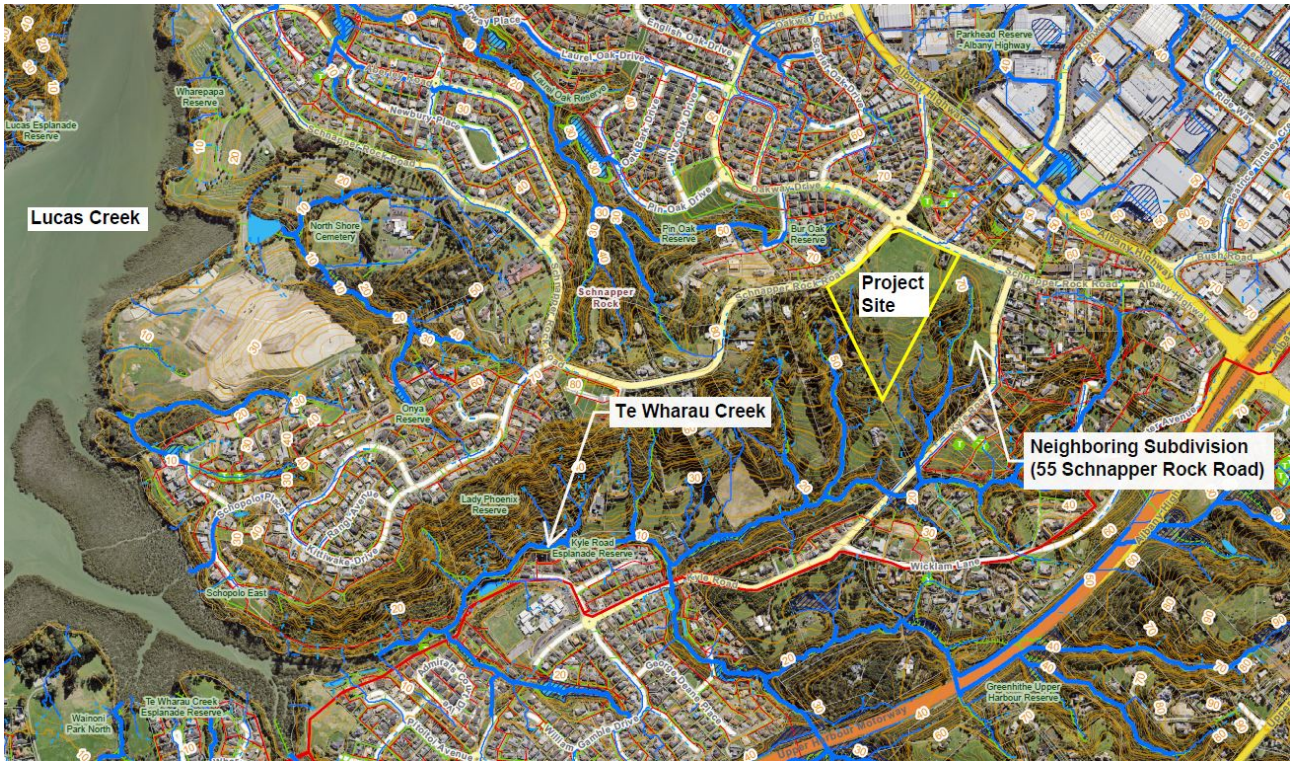

Image 1: Site Overview GeoMaps

The total site area is 3.99 Ha. The proposed plan change involves a mix of Mixed Housing, and Single-Lot zoning which allows for impervious areas of circa 60%. The total permitted impervious area allowable is expected to be 23, 927m² (2.39 Ha) under the plan change.

Existing site element		
Site address	•	57 & 57 aSchnapper Rock Road, Schnapper Rock
Legal description	•	SECT 2 SO 555200
Current Land Use	•	Greenfield
Current building coverage	•	NIL
Historical Land Use	•	Watercare Asset

1.3 TOPOGRAPHY

The topography of the site features a formed gully to the west with side slopes ranging from a 1:3 to 1:5. A secondary minor gully is located to the south with less defined slopes. A head scarp is identified along the eastern boundary which forms part of a gully in the adjacent neighbouring lot. The high point of the site is within the northern section which features a mound, generally elevated from the road carriageway of Schnapper Rock Road. The land formation south of the mound has a moderate gradient of 14%. The overall site contours vary between 83m to 50.5m RL.

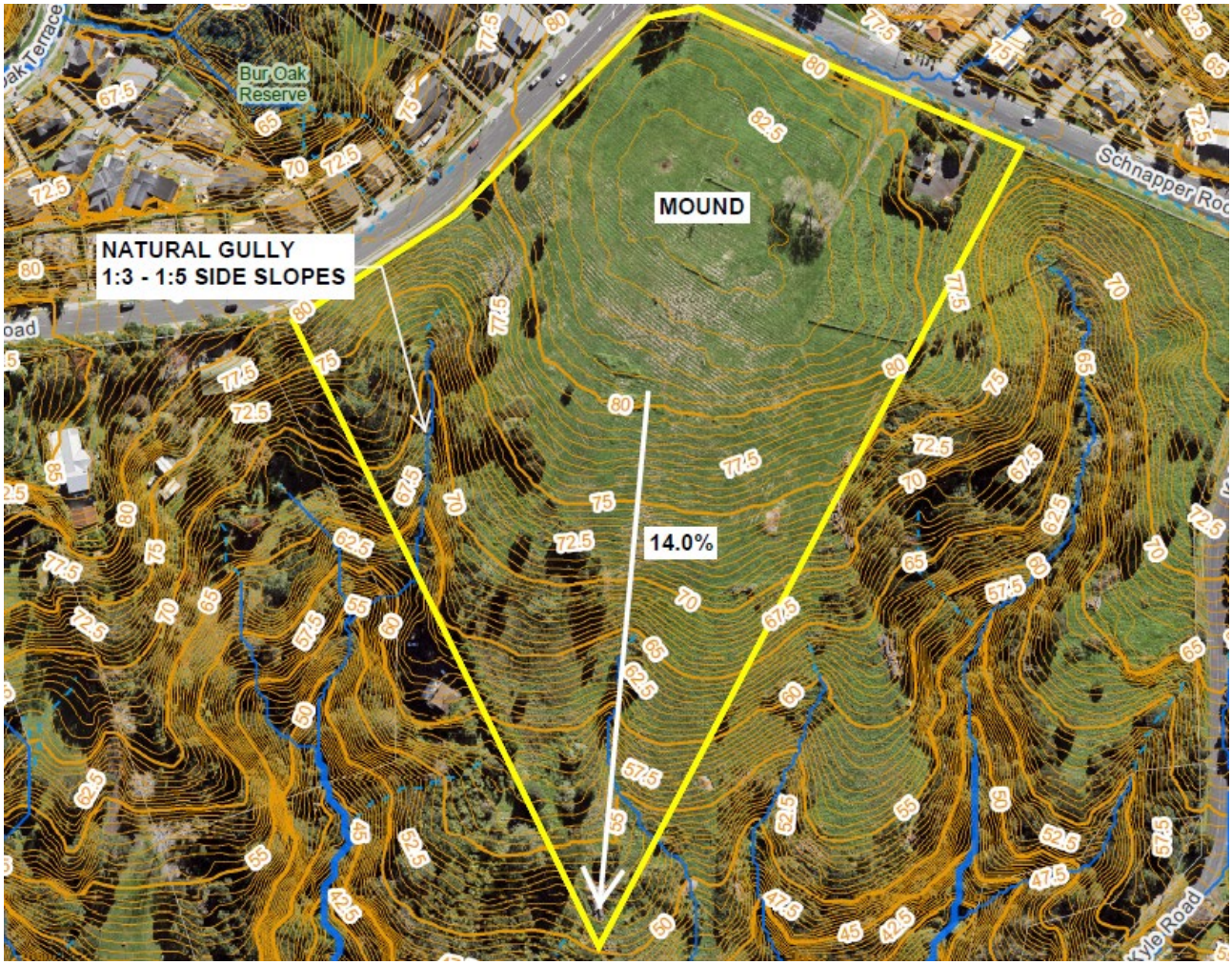

Image 2: Site Overview GeoMaps

1.4 GEOTECHNICAL

A geotechnical feasibility report has been prepared by KGA Geotechnical (dated 15.01.2021) which indicates that the site is suitable for development subject to detailed investigation at subdivision stage. It has been identified that slope stabilisation will be required within the gully to the west and head scarp to the east.

1.5 EXISTING DRAINAGE FEATURES AND STORMWATER INFRASTRUCTURE

Stormwater runoff for the site is conveyed through the gullies to the west and east which flow into Te Wharau Creek. A subdivision at 55 Schnapper Rock Road has approval for a new public stormwater extension, which has been designed to allow for portion of the development site. It is anticipated that the extended network will be constructed prior to the intended start date within the subject site, with the network currently under construction.

Completion of the adjacent subdivision will provide two points of stormwater reticulation which can be utilised for the future site. The connections features a 525Ømm and 300Ømm concrete lines, located north-east and south-east of the site. The 525Ømm discharges into the head of a defined gully within the adjacent subdivision flowing south into Te Wharau Creek. The 300Ømm reticulates further downstream through a new stormwater network discharging through a new outlet structure. The two networks discharge south into the receiving environment of Te Wharau Creek. An extract of the approved stormwater plan for the adjacent subdivision is shown in image 3 and 4 below.

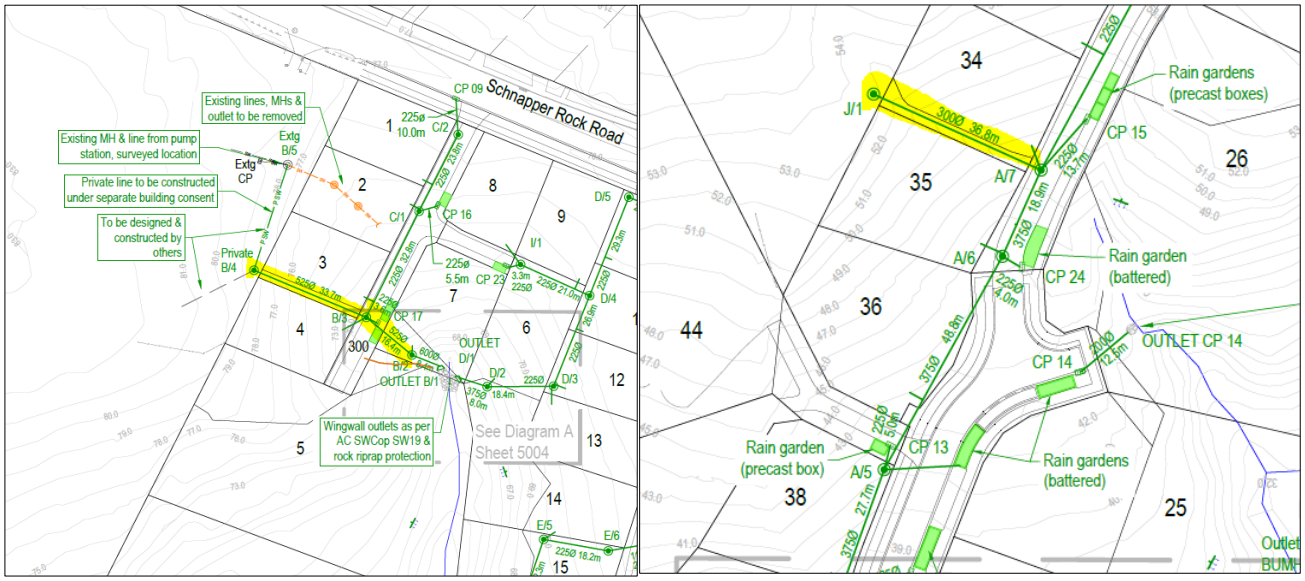

Image 3 & 4: Stormwater EPA plan for 55 Schnapper Rock Road

1.6 RECEIVING ENVIRONMENT

The site discharges via surface runoff into the naturally formed gullies in the east and west. The two gullies converge further downstream towards the south contributing to Te Wharau Creek which continues west into Lucas Creek. To the south of the site are two existing culverts under the carriageway of Kyle Road which provides conveyance of Te Wharau Creek.

1.7 EXISTING HYDROLOGICAL FEATURES

The site is a greenfield site with no existing structures. Majority of the site is made up of low-lying grass with a localised bush area to the west which is contained within the SEA overlay. Based on the information from GeoMaps, the site and neighbouring property discharges stormwater through surface run off into several natural formed gullies that contributes to Te Wharau Creek. The neighbouring dwellings/structures are assumed to discharge into the formed gullies via private outlet structures. Image 5 shows the location of existing hydrological features surrounding the site.

An interface between Te Wharau Creek and the road carriageway of Kyle Road features existing culverts to provide conveyance. It is noted that works are consented for relieving this area as part of the neighbouring subdivision at 55 Schnapper Rock Road.

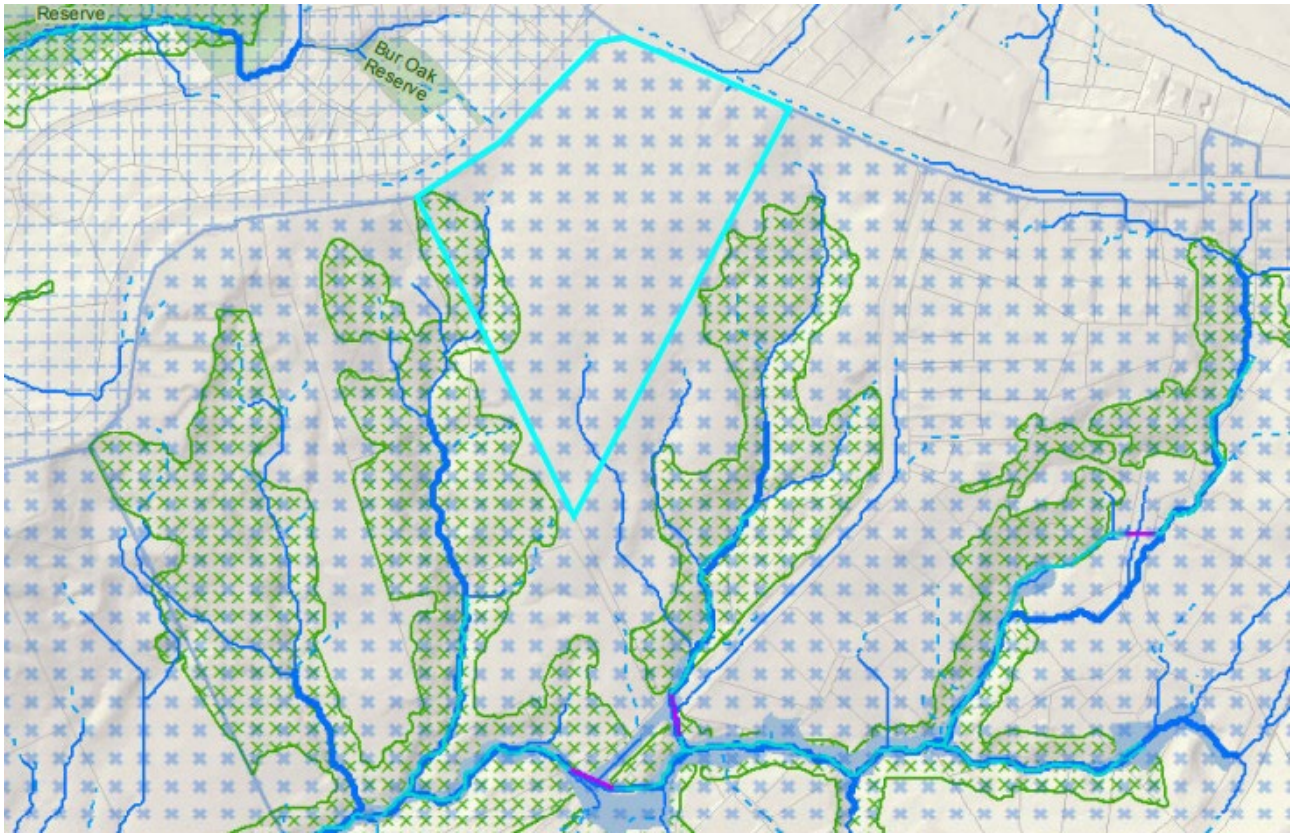

Image 5: Plan showing existing gullies and SEA

1.8 FLOODING AND FLOWPATHS

Council GeoMaps does not identify any flood sensitive, flood prone or flood plain immediate to the site. However, it is indicated that flooding occurs further downstream where Kyle Road and Te Wharau Creek converge. This flooding is caused by capacity issues associated with the two existing culverts. It is noted that the neighbouring development has an approved design for a new stormwater network to act as a bypass which will alleviate flooding of Kyle Road.

Auckland Council GeoMaps indicates two overland flow paths (OLFP) originating within the site which flow south into Te Wharau Creek. A catchment delineation was undertaken to determine the total areas contributing into the two OLFP as shown in Image 6 and summarised below.

- Western OLFP Catchment: 1.25 Hectares
- Southern OLFP Catchment: 0.95 Hectares

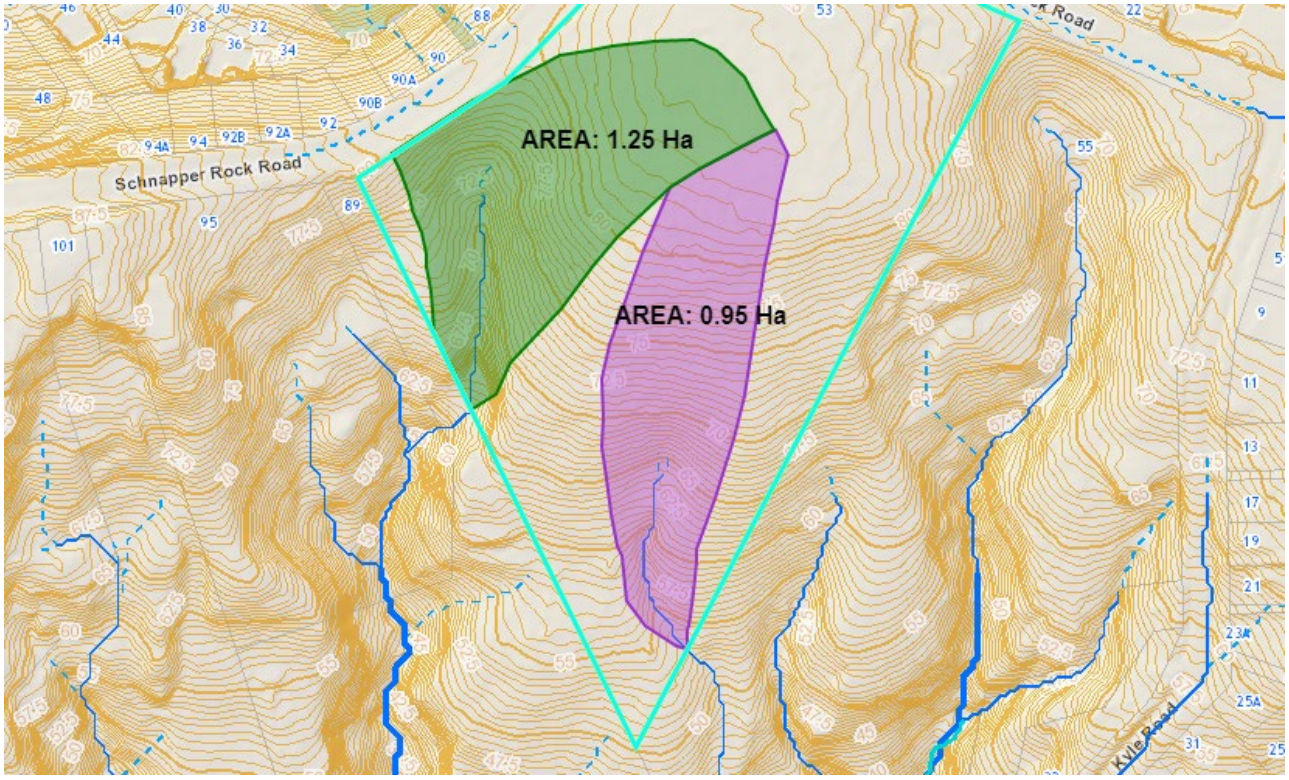

Image 6: GeoMaps catchment delineation plan

The approved subdivision at No. 55 has been designed to protect conveyance of the southern OLFP. Post development OLFP design for the neighbouring development considers part of the subject's sites catchment through engineered swales along the eastern boundary. Refer to **Appendix B** for the neighbouring developments post development OLFP design.

1.9 COASTAL INUNDATION

The site is not within the coastal inundation zone.

1.10 BIODIVERSITY

The western portion is the site is within a Significant Ecological Area – Terrestrial (SEA) which overlays the overall Te Wharau Creek up to Lucas Creek, approximate 1.5km west. Majority of the SEA area within the site comprise of indigenous trees.

An arborist report undertaken by Peers Brown Miller LTD confirms that notable trees (subject to further assessment) are located within the SEA and along the eastern boundary of the site.

An ecology report completed by Wildlands (01/2021) has identified the western SEA to be comprised majority largely woody habitats with the highest values associated with the indigenous Kanuka forest. Vegetation close by has high fauna values that provides habitats for indigenous reptiles and bird species.

1.11 CULTURAL AND HERITAGE SITES

*****Addressed within the plan change report*****

1.12 CONTAMINATED LAND

A preliminary site investigation completed by Thomas Consultants confirms that the site is unlikely to obtain significant quantities of contamination. It is considered that contaminated land rules under the AUP (OP) does not apply to the site.

2 DEVELOPMENT SUMMARY AND PLANNING CONTEXT

2.1 REGULATORY AND DESIGN REQUIREMENTS

Requirement	Relevant regulatory / design to follow
Unitary Plan – SMAF hydrology mitigation	• AUP Chapter E10 – Stormwater management area
High Contaminant Generating Areas	• AUP Chapter E9 – Stormwater quality •
Natural Hazards	• AUP Chapter E36 Natural hazards and flooding
Auckland Unitary Plan Precinct	• Greenhithe sub-precinct A
Existing Catchment Management Plan	• N/A
Auckland Council Regionwide Network Discharge Consent	• Site is located within the catchment of the Auckland-Wide NDC

3 MANA WHENUA MATTERS

3.1 MANA WHENUA OUTCOMES

An initial consultation with Ngati Manuhiri and Ngā Maunga Whakahii o Kaipara was undertaken to discuss the following key principles proposed within stormwater management plan.

- The holistic treatment of stormwater prior to discharging in the receiving environment through utilising treatment trains.
- Improvement of the western gully through defining a riparian margin and planting of native species.
- Utilising stormwater devices such as raingardens that treat sediments and trap gross polutants at localised areas and promotion of native planting.

The plan change proposal in respect to stormwater management was positively supported. It is noted that a pro-active involvement through the resource consenting stage will be undertaken.

4 STAKEHOLDER ENGAGEMENT AND CONSULTATION

*****Addressed within the plan change report*****

5 PROPOSED DEVELOPMENT

5.1 GENERAL DEVELOPMENT INFORMATION

The proposal seeks Council approval to rezone the site into Residential Mixed – Housing and Residential – Single House from its current Residential Large Lot zoning. The current concept plan indicates that the future development will support 93-lots, with access provided through a combination of public roading and private accessways. Primary access will be made from Schnapper Rock Road. It is noted that the concept plan is subject to detailed design and is intended only to be used for reference in support of the rezoning.

The proposed development is classified as a large greenfield site under Schedule 4 of the NDC. Staging of the project will be finalised during the resource consenting process and is not currently known. The Watercare designated area to the north-east has been recently subdivided separate to the subject site. The subjects site totals 39, 879m². Image 7 below, shows the current concept plan to supplement the rezoning request.

Image 7: Concept Plan

5.2 LOCATION AND AREA

The subject site is located directly south from the intersection of Schnapper Rock Road and Oakway Drive. The neighbouring residential lots to west of the site are large lots surrounded by notable vegetation with a lower housing density. Located north of the site, are a mix of residential and commercial areas. The ultimate receiving environment, Lucas Creek, is approximately 1.2km west of the site.

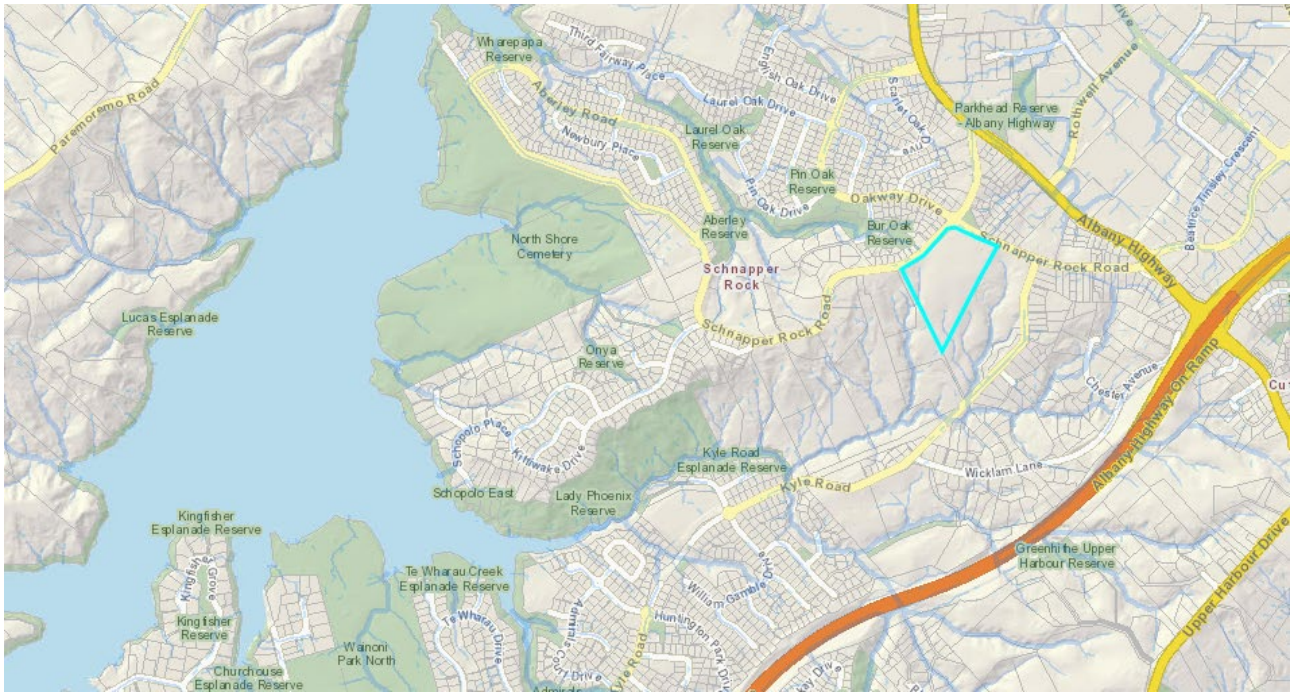

Image 9: Locality Plan

5.3 PURPOSE OF THE DEVELOPMENT

The purpose of the proposal is to create residential dwellings in line with the intention of the proposed rezoning application.

5.4 SITE LAYOUT AND URBAN FORM

The development will be guided by the envisaged masterplan which will be used as the basis for the future subdivision. Urban design will consider future upgrades of existing features. These include works such as, replanting a defined riparian margin and providing adequate landscaping to maintain the existing sites natural form.

5.5 EARTHWORKS

Earthworks will be required to prepare formation of building platforms, pavement areas and underground services. No mechanical earthworks shall be undertaken within the SEA and any works within this area will require specific methodology to minimise disturbance of the existing flora/fauna.

Sediment and erosion control measures will be designed and implemented under the guidelines of Auckland Council's GD05 document. Sediment erosion controls shall be inspected and approved by the Engineer before any commencement of earthworks and shall be regularly maintained. Prolonged exposed areas shall be mulched, or grass seeded to minimise erosion.

6 STORMWATER MANAGEMENT

6.1 PRINCIPLES OF STORMWATER MANAGEMENT

6.1.1 ORIGINAL PRINCIPLES

A stormwater strategy has been developed for the site to demonstrate the overarching principles of how stormwater will be managed, as required by the regional NDC, AUP and Stormwater Code of Practice (SWCoP).

The proposed SMP covers management of stormwater runoff from the subject site which works towards improving the current stormwater management onsite (effectively none) by implementing controls through the redevelopment. In turn, producing a positive impact on the receiving environment by managing the post development hydrology and discharge quality. The SMP approaches water sensitive design by maintaining the natural hydrological cycle in existing watercourse by mitigating stormwater runoff through source control, utilising natural systems and processes to manage the quality of stormwater discharging into the wider receiving environment.

Maven Associates considers that the proposed stormwater strategy aligns with mana whenua values ensuring stormwater quality and improvement of existing features that promote growth in the native flora and fauna. Stormwater management devices proposed within the SMP (ie raingardens, rainwater harvesting tanks and swales) are closely aligned closely with mana whenua principles as summarised below:

- **Kaitiakitanga:** The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Māori in relation to natural and physical resources; and includes the ethic of stewardship.
- **Mauri Tu:** The use of organic fertilisers and herbicides and provision for fish passage aligns with the principles of both Taiao and Mauri Tu. Hand weeding and hand maintenance are preferred.
- **Taiao:** Avoiding the mixing of contaminated water into marine and freshwater receiving environments.

6.1.2 UPDATED PRINCIPLES

The proposed stormwater management for the future development has been aligned with the design guidelines of GD01 and with the requirements of Schedule 4 – Regionwide Network Discharge Consent as a Greenfield site.

An assessment against the AUP E8 diversion and discharge of stormwater, E9 stormwater management- High generating car park or roads, E10 stormwater management – flow, has been undertaken and stormwater controls are consistent with these outcomes, as per the below.

- The intended development will create more than 1000m² of impervious area requiring multiple levels of stormwater management.
- Future development may include high generating car park (more than 30 spaces) and therefore could require stormwater quality treatment.
- Public roads discharge into a SEA area, and it is considered at-source treatment should be provided.
- The site is located within a SMAF – Flow 1 zone which requires retention and detention within the whole site as required by Chapter E10.

Water Sensitive Design (WSD) is a driving component of the SMP which requires treatment of new, public trafficable impervious areas to control the quality of stormwater.

The SMP proposes the treatment of new impervious areas (where relevant) in accordance with the guidelines of Auckland Council's GD04 Water Sensitive Design for Stormwater, GD01 Stormwater Management Devices: in the Auckland Region and E10 (Stormwater Management Area) of the AUP – OP.

6.2 PROPOSED STORMWATER MANAGEMENT

6.2.1 GENERAL

The Auckland Council SWCoP sets out the design and construction standards to enable a means of stormwater disposal for new proposed developments.

The future development of the site will utilise the new stormwater reticulation provided by the neighbouring subdivision to service the eastern catchment of the subject site. The total catchment discharged into the new network will be determined by the capacity downstream based on the 10-year storm event for the finalised scheme plan. The site area within the western and northern portion of the site close to Schnapper Rock Road will be provided with a new stormwater network with the western gully as the main discharge point via a new outlet structure. All new public pipe networks within the site will be designed to convey 10-yr flow. 10-year flow attenuation will be designed for each new lot if required.

Stormwater runoff up to the 100-year event will be directed into existing OLFP exit points of the site to align with the neighbouring developments. Stormwater runoff contributing to the western gully will be maintained.

The site contributes to a significant stream and hydrological mitigation is required to mitigate stormwater runoff as per the AUP – OP for areas within SMAF-1, through re-use and attenuation for storm events within the 95th percentile.

The table below summarises the NDC requirements triggered for the proposed development.

Stormwater Management Requirements	Design Approach
Water Quality	• Onsite treatment of high contaminant yielding impervious areas through use of raingardens or proprietary devices that treat equivalent to 75% TSS or better.
Stream Hydrology (SMAF or Stream Discharge)	• SMAF 1 mitigation, retention of the first 5mm runoff depth and temporary detention between the difference pre-post development runoff volumes within the 95th percentile storm event
Flooding 10% AEP Pipe Network	• Pipe network assessment on downstream network to determine attenuation requirements
Flooding 1% AEP Buildings	• No flood plain located within the vicinity of the site. Maintenance of OLFPs in consideration to the minimum freeboard requirements as per the SWCOP and NZBC

6.2.2 WATER QUALITY

High stormwater quality of discharge is required to protect the downstream receiving environment, inclusive of the SEA. The proposed development incorporates a water sensitive design (WSD) approach which focuses on reducing or eliminating stormwater contaminates through source control (inert materials) and utilising natural systems and processes to manage stormwater quality effects (biofiltration).

Future public roads require treatment as per AUP – E10 and the guidelines set out in GD01. The primary water quality objective of the treatment is to remove 75% of total suspended sediment on a long-term average basis prior to discharging into the receiving environment.

Due to the steep topography of the site, a centralised treatment device (wetland) becomes unfeasible as it requires a moderately flat terrain. It is also expected that the development will be restricted in space to allow for the future densification of the site. Localised stormwater devices such as specifically designed bioretention devices (raingardens or swales), are deemed to be the best practical option (BPO) in terms of providing treatment at-source for the future public roads. As much as practical, these stormwater treatment devices will be situated in concentrated areas by installing in long runs within the public road berm. For these treatment devices, a minimum designed surface area of 20m² shall be considered as a requirement of the Auckland Transport TDM.

Shared driveways will be subject to high yielding contaminants which will entail stormwater quality treatment through at-source raingardens, tree pits or use of proprietary devices (stormfilters) that achieve a similar treatment outcome. These treatment devices will be contained within the legal boundaries of the areas it is treating and shall be privately owned.

Table 16: Multiple benefits of devices

Opportunities to improve	Social & cultural values						Environmental values (in addition to water quality)				
● High potential ○ Some potential - Little/no potential	Potential alignment with mana whenua values	Incorporating Te Aranga design principles	Improved amenity	Improved community connectedness	Improved public safety	Education	Habitat improvement	Connecting green corridors	Plant diversity	Bird, insect and reptile diversity	Plant ecosourcing
Pervious pavement	●	○	○	●	●	●	-	-	-	-	-
Living roof	●	●	●	●	○	●	○	○	●	●	●
Rainwater tank	●	○	●	○	○	●	-	-	-	-	-
Infiltration device	○	○	-	○	○	●	-	-	-	-	-
Vegetated swale	●	●	○	○	○	●	○	○	○	○	●
Bioretention swale	●	●	○	○	○	●	○	○	○	○	○
Raingardens	●	●	○	●	●	●	○	○	●	●	●
Stormwater tree pits	○	●	○	●	●	●	○	-	○	○	●
Planter boxes	○	●	○	●	●	●	○	-	○	○	○
Constructed wetland	●	●	●	●	○	●	●	●	●	●	●
Wet pond	-	-	●	●	○	●	●	●	●	●	●
Dry pond (detention basin)	○	○	●	●	●	●	○	○	○	○	○

Large gross pollutants (litter) will be captured through utilising sumped catchpits which traps larger pollutants. WSD aims to treat stormwater run-off within the immediate site to achieve the required water quality levels prior to discharging into the wider receiving environment. Utilisation of natural treatment devices (raingardens) is considered to have positive impacts in the social/cultural values as highlighted in Table 16 of GD01.

The stormwater management strategy proposed in the SMP is consistent with the guidelines of Auckland Council's GD04 Water Sensitive Design for Stormwater and the AUP – OP.

All buildings will be roofed with inert roofing materials (e.g.Colorsteel roofing) where stormwater will conveyed. This removes the production of contaminants and thus removing stormwater quality treatment requirement.

6.2.3 STREAM HYDROLOGY

Stormwater Management Area – Flow 1

The site is within a SMAF – Flow 1 overlay in which attenuation and re-use is required as detailed in the AUP – OP to regulate stormwater discharge for frequent rainfall event within the 95% percentile event.

The future development incorporates at-source retention and detention devices for impervious areas as summarised below.

- Rainwater harvesting tanks to capture stormwater run-off for re-use for indoor and outdoor purposes such as watering lawn, plants, car washing and shall be plumbed for at least one toilet or indoor washing purposes.
- At-source private raingardens or underground detention/retention device (Chambermaxx) to capture commonly owned private driveways.
- At-source public raingardens to capture proposed public roading.

Testing of infiltration rates and groundwater shall be determined when the location and detailed design of the stormwater devices are finalised. An alternative option such as, permeable pavement for the common accessway can be utilised.

Stormwater management for areas of SMAF1 are applied as per the following:

- Retention of the first 5mm rainfall runoff depth volume generated from impervious areas; and
- Detention of the runoff volume generated from impervious areas for the 95% percentile rainfall event released over a 24-hour period.

The stormwater management methods proposed are as per the SMA - Flow 1 controls in the following table.

Table E10.6.3.1.1 Hydrology mitigation requirements

Stormwater management area control	Hydrology mitigation requirements
(1) Except as provided for in (2) below the following applies:	
Stormwater management area – Flow 1	(a) provide retention (volume reduction) of at least 5mm runoff depth for the impervious area for which hydrology mitigation is required; and (b) provide detention (temporary storage) and a drain down period of 24 hours for the difference between the pre-development and post-development runoff volumes from the 95th percentile, 24 hour rainfall event minus the 5 mm retention volume or any greater retention volume that is achieved, over the impervious area for which hydrology mitigation is required.
Stormwater management area – Flow 2	(a) provide retention (volume reduction) of at least 5mm runoff depth for the impervious area for which hydrology mitigation is required; and (b) provide detention (temporary storage) and a drain down period of 24 hours for the difference between the pre-development and post-development runoff volumes from the 90th percentile, 24 hour rainfall event minus the 5 mm retention volume or any greater retention volume that is achieved over the impervious area for which hydrology mitigation is required.

:

(2) Where:
- (a) a suitably qualified person has confirmed that soil infiltration rates are less than 2mm/hr or there is no area on the site of sufficient size to accommodate all required infiltration that is free of geotechnical limitations (including slope, setback from infrastructure, building structures or boundaries and water table depth); and
- (b) rainwater reuse is not available because:
  - (i) the quality of the stormwater runoff is not suitable for on-site reuse (i.e. for non-potable water supply, garden/crop irrigation or toilet flushing); or
  - (ii) there are no activities occurring on the site that can re-use the full 5mm retention volume of water.
- (c) the retention volume can be taken up by detention as follows:
  - (i) provide detention (temporary storage) and a drain down period of 24 hours for the difference between the pre-development and post-development runoff volumes from the 95th percentile (SMAF 1) / 90th percentile (SMAF 2), 24 hour rainfall event minus any retention volume that is achieved, over the impervious area for which hydrology mitigation is required.

The application of above ground rainwater harvesting tanks shall be utilised for each residential lot to cater the volumes required for the first 5mm of retention, and detention of 35mm of rainfall depth (as per the 95th rainfall even) to be detailed during subdivision stage.

Proposed Public Network

The neighbouring development provides upstream hydrological connectivity for the subject site through a 525Ømm and 300Ømm extension, located northeast and southeast of the site. An extension is proposed on the two connection points to provide servicing of catchments 2 and 3, as shown in image 9 below. Catchment 1 will discharge into the existing western gully via outlet structures. The outfall for catchment 1 shall be appropriately located to not cause erosion and shall be designed using green infrastructure principles at detailed design of the stormwater network.

Areas for catchments 2 and 3 were determined based on the allowances made from the neighbouring developments stormwater network design for the 10-year ARI. Further assessment on the downstream critical pipes has been undertaken to confirm the networks downstream capacity. The capacity calculation for the 10-year ARI can be found in Appendix D.

Peak flows have been calculated for each catchment based on the concept plan and used as the basis for the capacity assessment, summarised below.

Proposed Catchment #	Area (m2)	Peak Flow (L/s)	Discharge Point
1	10 390	256.00	Outlet structure via western stream
2	23 492	603.73*	525Ø pipe located east
3	15 990	392.63*	300Ø pipe located south

**Calculations are based on the TP108 rainfall depth of 158.5mm (climate change adjusted). Refer to capacity calculation in the appendix.*

Image 9: Stormwater Catchment Plan – 10 yr

The proposed stormwater pipe network will be subject to Engineering and Building Consent approval from Auckland Council for the future subdivision.

6.2.4 FLOODING

Flooding occurs downstream of the site, where Te Wharau Creek crosses Kyle Road through two existing culverts. The neighbouring subdivision has an approved design to alleviate flooding through a stormwater network bypass (the layout is shown below, in image 10). This removes flooding of Kyle Road, by redirecting additional flow directly to the stream on the northern side of the road, essentially removing the discharge through the two undersized culverts. As the network has been designed to discharge a portion of the site based on a designed MPD, Catchment 2 and 3 will be delineated within the limits of the downstream network to cause no further additional flow to the designed peak flow MPD.

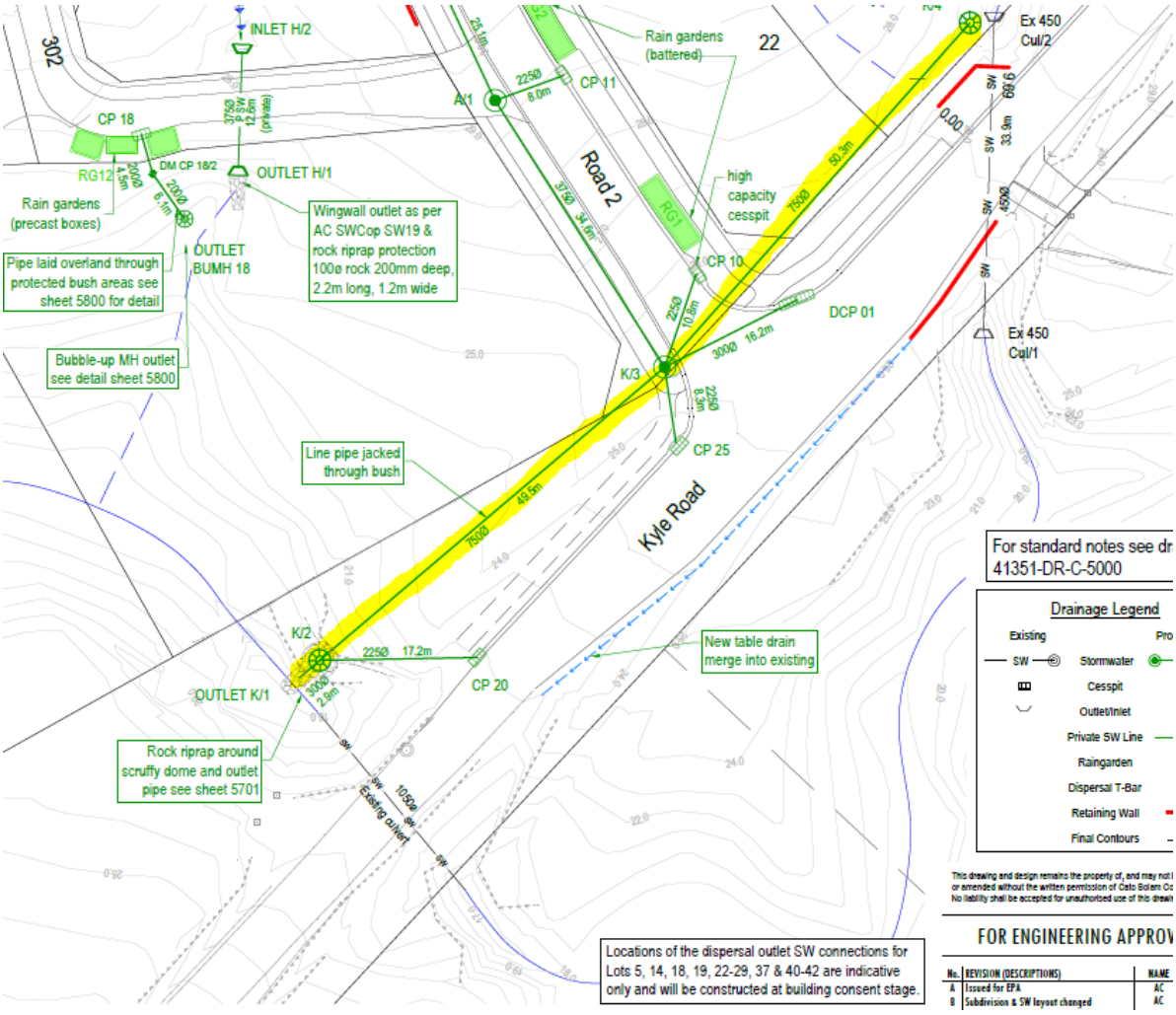

Image 10: SW Bypass Plan

The western catchment (Catchment 1) will discharge directly into the existing western gully to the west which contributes to Te Wharau Creek outside of the proximity of the Kyle Road flooding.

It is noted that properties in the vicinity of Te Wharau Creek are generally elevated above the flood prone/flood plain area due to the defined gully formation. It is expected that there are no downstream effects on the existing properties.

6.2.5 OVERLAND FLOWPATH AND FLOODPLAIN MANAGEMENT

Management of OLFP within the site has been designed to align with the neighbouring development OLFP plan ensuring conveyance is maintained. The neighbouring subdivision has allowed for several swales along the south-eastern boundary to allow for the existing upstream catchment. The proposed future development will be designed to ensure that the OLFP's conveyed through the swales do not exceed the designed peak flows allowable, an example catchment plan is provided below for the potential catchment delineation. Catchments 1-3 and 5 are conveyed through the OLFPs relief points to the east. It is expected that the engineered swales will not be able to cater for the entire site. Therefore, a portion of the site's catchment will be conveyed through the existing gully to the west (shown in catchment 5). The image below shows a typical catchment to be confirmed during subdivision stage.

OLFP allowance from 55 Schnapper Rock Road	
OLFP	Design Flow (Q) (m3/s)
1	0.349
2	0.173
3	0.169
TOTAL	0.691

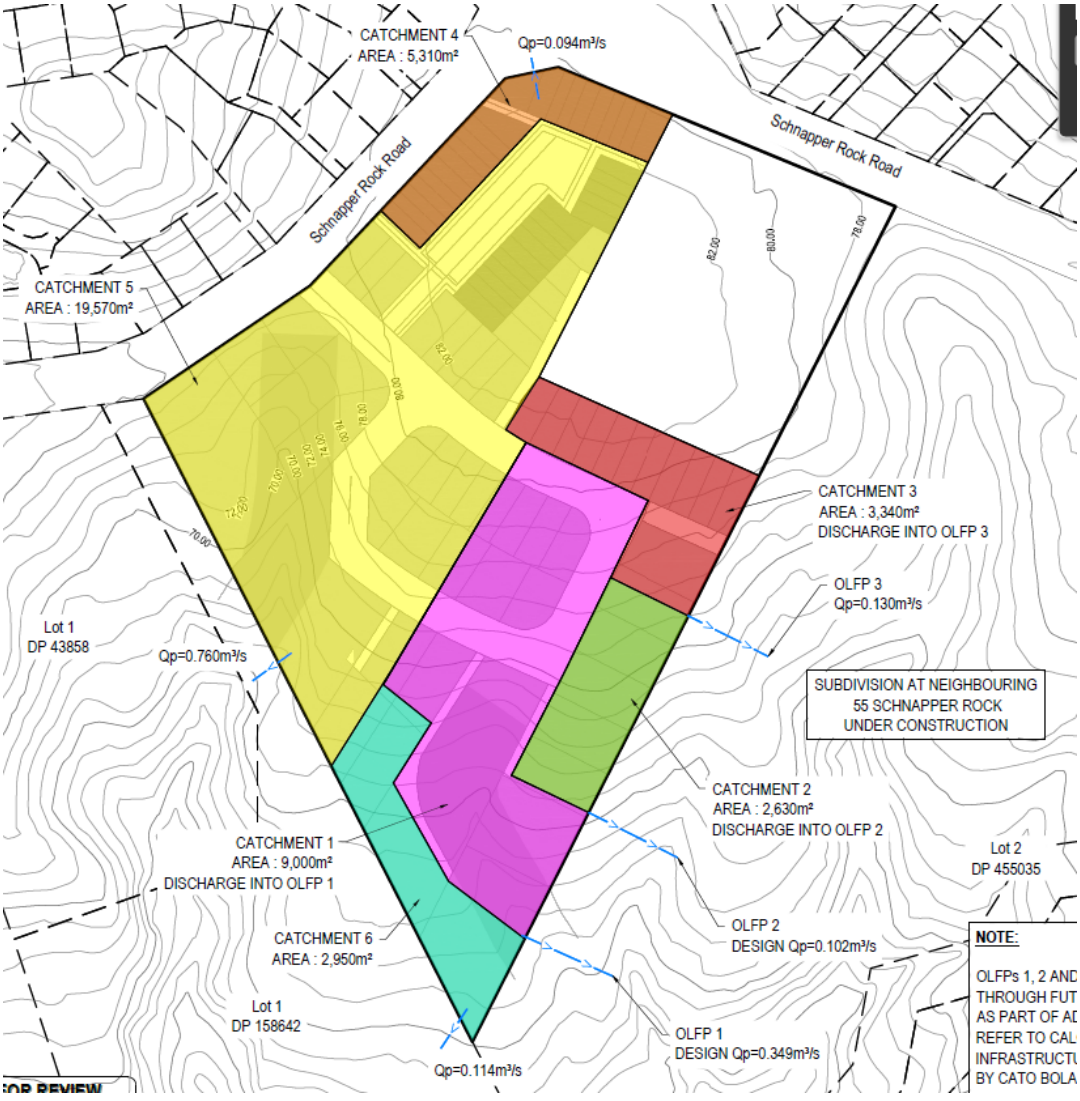

Image 11: Stormwater Catchment Plan – OLFP

6.2.6 DEVELOPMENT STAGING

The project is proposed to be undertaken in one stage.

6.3 HYDRAULIC CONNECTIVITY

The development site is identified to be the top of the catchment. Therefore, future extension from the development site is unlikely. Works within downstream network is currently under construction and the allowances provided has been taken into consideration within the subject site to ensure no further downstream effects occur.

6.4 ASSET OWNERSHIP

All proposed public stormwater network extension within the development will owned by Auckland Council or the relevant CCO (Healthy Waters). Raingardens treating the public roads shall be vested to Auckland Transport. Stormwater devices treating commonly owned private ways are to be owned through an incorporated society as required.

6.5 ONGOING MAINTENANCE REQUIREMENTS

All public stormwater extensions into the site, pipes and manholes forming the extent there of, are to be maintained by Auckland Council. All private devices are to be maintained by the landowners and any incorporated society formed.

It is proposed that all stormwater devices proposed are proprietary systems that have documented operation and maintenance schedules and plans for such activities.

Operation and maintenance plans will be provided for all stormwater management devices that will be vested with Council. This will be required as a condition of any approved consent, similar to the extract below.

Operations and Maintenance Plan

12. An Operation and Maintenance Plan for the operation and maintenance of the stormwater network shall be prepared and implemented to ensure the effective operation of the stormwater network. The Operation and Maintenance Plan may be prepared as part of a region-wide Operation and Maintenance Plan for the stormwater network and shall be submitted to the Team Leader Specialist Integration, Auckland Council within 24 months of commencement of this consent.

    At a minimum, the Operation and Maintenance Plan must include the following:

    a. The operation and maintenance of the stormwater network, including stormwater management devices that are part of the network to ensure the effective functioning of the stormwater network;

    b. Pre and post stormwater inspection of critical or at risk components of the network to minimise blockages and flood risk;

    c. An inspection and maintenance programme for outfalls and other network infrastructure to prevent or minimise erosion, obstructions to flows and hazards; and

    d. Processes to ensure that the Operation and Maintenance Plan is updated following commissioning of any new major stormwater network infrastructure or management devices.

Image 9: Operation and Maintenance Plan Condition

6.6 IMPLEMENTATION OF STORMWATER NETWORK

It is expected that the new stormwater network will be constructed initially but not commissioned until the appropriate stormwater devices are implemented. Provisions on protecting the downstream network shall be through implementing temporary sediment and erosion controls to ensure stormwater discharge is properly treated and discharged during construction.

The methodology for implementation of the proposed networks are as follows:

- Existing site structures, pavement, and minor drainage to be stripped and removed prior to bulk earthworks.
- Bulk Earthworks completed, discharging clean waters captured and treated 'dirty water' to specific existing public structures as part of a specific earthwork's management plan.
- Construction/Relocation of public stormwater infrastructure.
- Construction/installation of attenuation and treatment devices and private drainage under accessways.
- Stabilisation of the site and construction of accessways.
- Vesting of newly constructed public drainage assets.
- Construction of residential dwellings and associated private stormwater attenuation devices.

6.7 DEPENDENCIES

It is considered that the downstream network will have no negative effects from the development of the site for the mitigation highlighted in this report, which relates to primary the quality of stormwater discharging from the site.

6.8 RISKS

Construction risks entail working within proximity to the SEA, resulting in sediment runoff or damage to existing significant flora fauna. It is expected that conditions will be placed in the future resource consent for the protection and minimisation of these risks.

A potential delay on the adjoining subdivision is considered a risk to the development as it has allowed provisions for infrastructure that provide connectivity for the site. Consultation with the adjacent development will be undertaken prior to lodgement of resource consent to identify key milestones for the project. The risks is considered low as the civil works has already started.

DEPARTURES FROM REGULATORY OR DESIGN CODES

There are no known departures from Auckland regulatory and design standards.

7 CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE WORK

7.1 CONCLUSIONS

The SMP confirm that stormwater will be managed within the subject site. The future pipe network in the neighbouring subdivision and downstream stormwater bypass within Kyle Road has capacity to support the partial development 10-yr and 100-yr flows. Flows will be limited to the current design flows, to ensure no effects on the adjoining site. A new stormwater network is proposed to be discharged into the existing western stream.

Stormwater management devices proposed in the SMP have been chosen to align with the mana whenua values closely related to the principles of Kaitiakitanga, Mauri Tu, and Taiao.

Quality treatment will be provided for all public trafficable areas. This will be provided via either raingardens or stormwater filters. This is in accordance with the guidelines of Auckland Council's GD04 Water Sensitive Design for Stormwater, GD01 Stormwater Management Devices in the Auckland Region. Dependent on the future design, quality treatment will be required for common accessway subject to high-use. This approach is in line with the best practical stormwater management outcome for the site.

Subject to the adoption of the SMP, the proposed stormwater management of the site will accord with Schedule 4 of the Regional NDC.

7.2 RECOMMENDATIONS

It is recommended that the design principles of this SMP be generally acceptable for proposed site.

APPENDIX A: CONCEPT PLAN

CONCEPT MASTER PLAN

KEY:

- Terrace Housing 36 (39%
- Zero-lot Line Detached Housing 32 (34%)
- Standard Detached Housing 25 (27%)

Total 93 (100%)

- Proposed Public Road (14.0m road reserve)
- Proposed Private Accessway
- Significant Ecological Area(protected land)
- Riparian Margin (protected land)

Note:

This site layout is conceptual only, and is subject to further investigations into Planning, Survey, Ecological and Engineering feasibility and may be derived from inaccurate source information. This is also subject to necessary approval from Auckland Council, Auckland Transport and Watercare.

53 SCHNAPPER ROCK ROAD, ALBANY

Project:	Schnapper Rock Road Dev 2020
Date:	21 December 2020
Status:	Draft
Scale:	1:2000 @ A3

APPENDIX B:
SW ENG60330592 (55 SCHNAPPER ROCK ROAD)

NOTES

GENERAL

1. The Contractor shall be responsible for locating all existing services prior to commencement of works. The Contractor shall make good at their own expense any damage to existing services.
2. Levels are in terms of Auckland Vertical Datum 1946.
3. All works are to be installed as per
   - Auckland Transport's Code of Practice "ATCOP".
   - Auckland Council Code of Practice for Land Development and Subdivision - Chapter 4 Stormwater
   - Watercare Services Ltd's "Water and Wastewater Code of Practice for Land Development and Subdivision" and Accepted Materials List.
4. Standard Drawings available from their respective websites or the Engineer.
5. If discrepancies are found between the standards, confirmation shall be sought from the Engineer and supervising council field officer.

STORMWATER DRAINAGE

1. Pipes -
   - All pipes 200mm diameter or less are to be uPVC AS/NZSS 1260 Solid Wall SN16 otherwise shown.
   - All pipes 225mm diameter or greater are to be reinforced concrete rubber ring joint to NZS3107 - Depths :

     Class 2 < 2000mm cover,

     Class 3 < 2001mm - 3000mm cover,

     Class 4 > 3000mm cover or trafficable areas, unless otherwise shown.
2. All thrusted pipes are to be PE100 SDR17. All diameters shown are minimum inside diameters.
3. Bedding details as per SWCoP Standard Detail SW01 - SW03
4. Manholes and chambers in traffic areas are to be heavy duty.
5. All manholes up to 2.4m deep shall be constructed of a single riser to finished ground level.
6. Stormwater manhole throats are to be painted blue.
7. All service connections are to be ramped to within 1.2m of finished level. Connections shall terminate with a factory sealed stopper and marked with a 50mm x 50mm H4 Treated Stake painted blue.
8. Hardfill be placed where pipelines cross or where lines cross carriageways or trafficable areas.
9. Pipe Crossings - Hardfill Backfill. If clearance between pipes is less than 150mm, 55mm thick Polystyrene shall be placed against the underside of the pipe. Where clearance is less than 300mm the bell jointed pipes are used, there shall be no joints directly over the wastewater line.
10. All manholes 1050mmØ flanged base concrete riser unless otherwise shown.
11. Drop connections through Stormwater Manholes must not exceed 1m without approval from the Engineer. Benching through drop manholes must be finished with hard 40MPa Concrete.
12. Drainage Trenches to be backfilled with compacted clay or hardfill to Engineers requirements.

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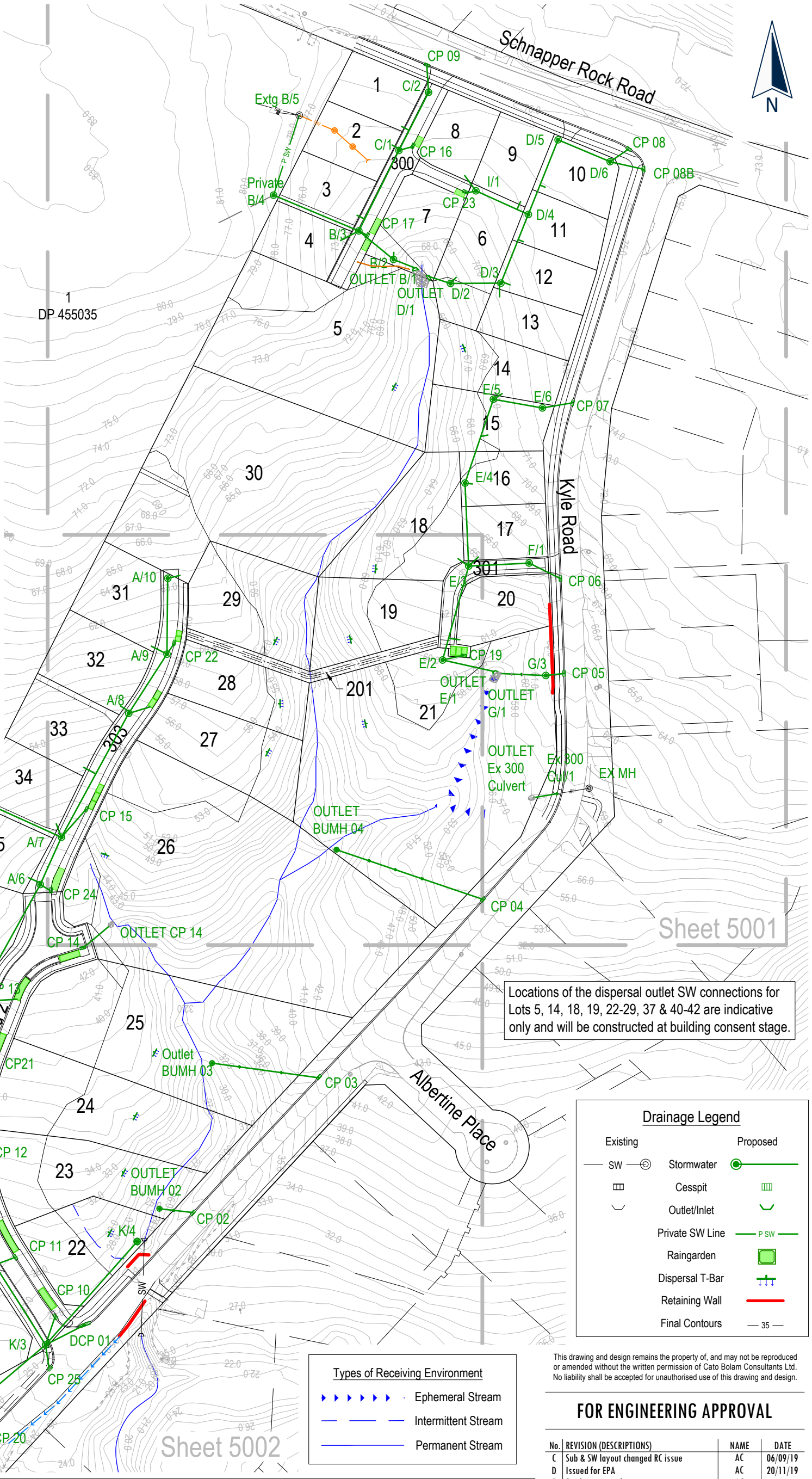

Drainage Legend

Existing	Proposed
SW — Stormwater	Stormwater
Cesspit	Cesspit
Outlet/Inlet	Outlet/Inlet
Private SW Line — P SW	Private SW Line — P SW
	Raingarden
	Dispersal T-Bar
	Retaining Wall
	Final Contours — 35 —

Types of Receiving Environment

- Ephemeral Stream
- Intermittent Stream
- Permanent Stream

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
C	Sub & SW layout changed RC issue	AC	06/09/19
D	Issued for EPA	AC	20/11/19
E	Swales removed	AC	03/04/2020
F	SW alignment & CP outlet edits	AC	22/06/2020
SURVEYED			
DESIGNED		PJT	25/09/18
DRAWN		PJT	25/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
22/06/2020	1:1500	A3

DRAWING NO. 41351-DR-C-5000

REVISION F

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Albany

Stormwater Layout
Overall Plan

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N

Schnapper Rock Road

Kyle Road

Existing lines, MHs & outlet to be removed

Existing MH & line from pump station, surveyed location

Private line to be constructed under separate building consent

To be designed & constructed by others

CP 09 225ø 10.0m C/2

225Ø 23.8m

CP 16

C/1

225ø 8.2m CP 08

D/5 225Ø 20.6m D/6 225Ø 12.5m CP 08B

225Ø 29.3m

225ø 5.5m CP 23 3.3m 225Ø 225Ø 21.0m D/4

I/1

225Ø 32.8m

Extg B/5

Extg CP

Private B/4 525Ø 33.7m B/3 CP 17

225Ø 3.6m

525Ø 16.4m 600Ø 8.4m B/2 OUTLET B/1

OUTLET D/1 D/2 225Ø D/3 375Ø 18.4m 8.0m

225Ø 26.9m

Wingwall outlets as per AC SWCop SW19 & rock riprap protection

See Diagram A Sheet 5004

E/5 E/6 225Ø 18.2m 11.2m 225Ø CP 07

225Ø 32.3m

E/4 16

225Ø 30.3m

225Ø 22.1m F/1 225Ø 12.7m CP 06

E/3 301

300Ø 35.6m

CP 19 E/2 225Ø 1.5m 300Ø 19.3m DM G/2 G/3 CP 05

OUTLET E/1 200Ø 7.8m 200Ø 8.8m 225Ø 6.7m

OUTLET G/1

Wingwall outlets as per AC SWCop SW19 & rock riprap protection

See Diagram B Sheet 5004

OUTLET Ex 300 Culvert

Ex 300 Cul/1 EX MH

300Ø 8.4m 300Ø 12.0m

Extend existing line and provide riprap protection at outlet . 100ø rock 200mm deep on geotextile cloth underlay 2.2m long x 1.0m wide

A/10 225Ø 27.7m

A/9 225Ø 25.7m 225Ø 4.9m CP 22

A/8 225Ø 51.4m

Rain gardens (precast boxes)

Rain gardens (precast boxes)

CP 15

Bubble-up MH outlet see detail sheet 5800

OUTLET BUMH 04

DM CP 04/1 DM CP 04/2 DM CP 04/3

200Ø 12.7m 200Ø 10.1m 200Ø 10.3m 200Ø 23.5m

CP 04

Pipe laid overland through protected bush areas see sheet 5800 for detail

Rain garden (battered)

OUTLET CP 14

201 Pedestrian Accessway

Locations of the dispersal outlet SW connections for Lots 5, 14, 18, 19, 22-29, 37 & 40-42 are indicative only and will be constructed at building consent stage.

For standard notes see drawing 41351-DR-C-5000

Drainage Legend

Existing		Proposed
SW	Stormwater	
	Cesspit	
	Outlet/Inlet	
P SW	Private SW Line	
	Raingarden	
	Dispersal T-Bar	
	Retaining Wall	
35	Final Contours	

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
B	Subdivision & SW layout changed	AC	20/08/19
C	Swales removed	AC	03/04/2020
D	SW alignment edits	AC	04/06/2020
E	CP & extg 300ø culvert outlet edits	AC	22/06/2020
SURVEYED			
DESIGNED		PJT	25/09/18
DRAWN		PJT	25/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
22/06/2020	1:1000	A3

DRAWING NO.	REVISION
41351-DR-C-5001	E

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Stormwater Layout
Sheet 1 of 4

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Rain gardens (precast boxes)

Rain gardens (precast boxes)

Rain gardens (battered)

Rain garden (battered)

Rain garden (precast box)

Rain gardens (battered)

Rain gardens (battered)

Rain gardens (battered)

Rain gardens (precast boxes)

Bubble-up MH outlet see detail sheet 5800

Bubble-up MH outlet see detail sheet 5800

Pipe laid overland through protected bush areas see sheet 5800 for detail

201 Pedestrian Accessway

Road 2

Kyle Road

Albertine Place

New table drain merge into existing

Existing culvert

Sheet 5003

Locations of the dispersal outlet SW connections for Lots 5, 14, 18, 19, 22-29, 37 & 40-42 are indicative only and will be constructed at building consent stage.

For standard notes see drawing 41351-DR-C-5000

Drainage Legend

Existing	Proposed
SW	Stormwater
	Cesspit
	Outlet/Inlet
	Private SW Line (P SW)
	Raingarden
	Dispersal T-Bar
	Retaining Wall
	Final Contours (35)

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision & SW layout changed	AC	20/08/19
C	CP outlets & other minor edits	AC	22/06/2020

SURVEYED			
DESIGNED		PJT	25/09/18
DRAWN		PJT	25/09/18
DATE	ORIGINAL SCALE	ORIGINAL SIZE	
22/06/2020	1:1000	A3	
DRAWING NO.		REVISION	
41351-DR-C-5002		C	

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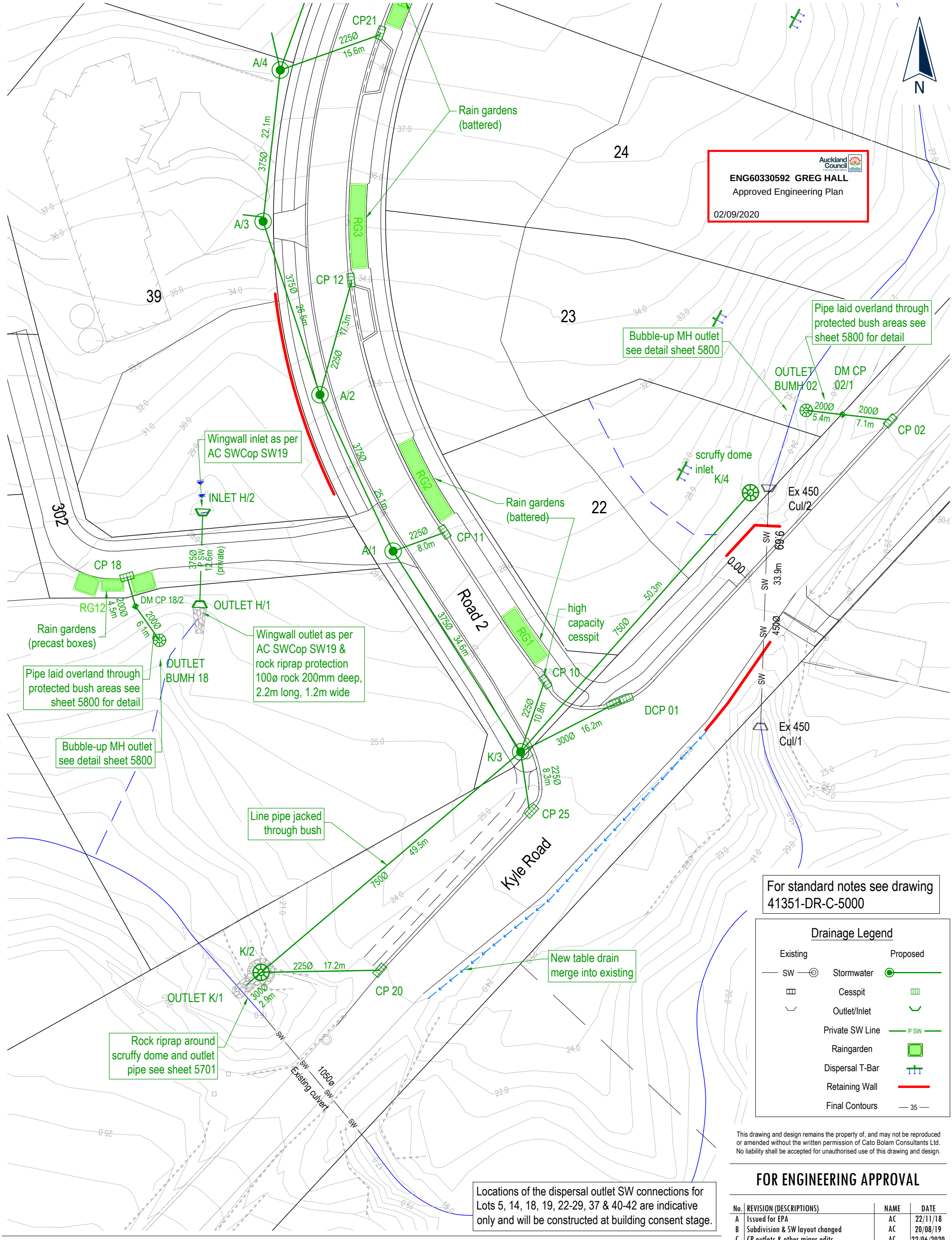
Stormwater Layout
Sheet 2 of 3



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No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision & SW layout changed	AC	20/08/19
C	CP outlets & other minor edits	AC	22/06/2020
SURVEYED			
DESIGNED		PJT	25/09/18
DRAWN		PJT	25/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
22/06/2020	1:500	A3

DRAWING NO. 41351-DR-C-5003 REVISION C

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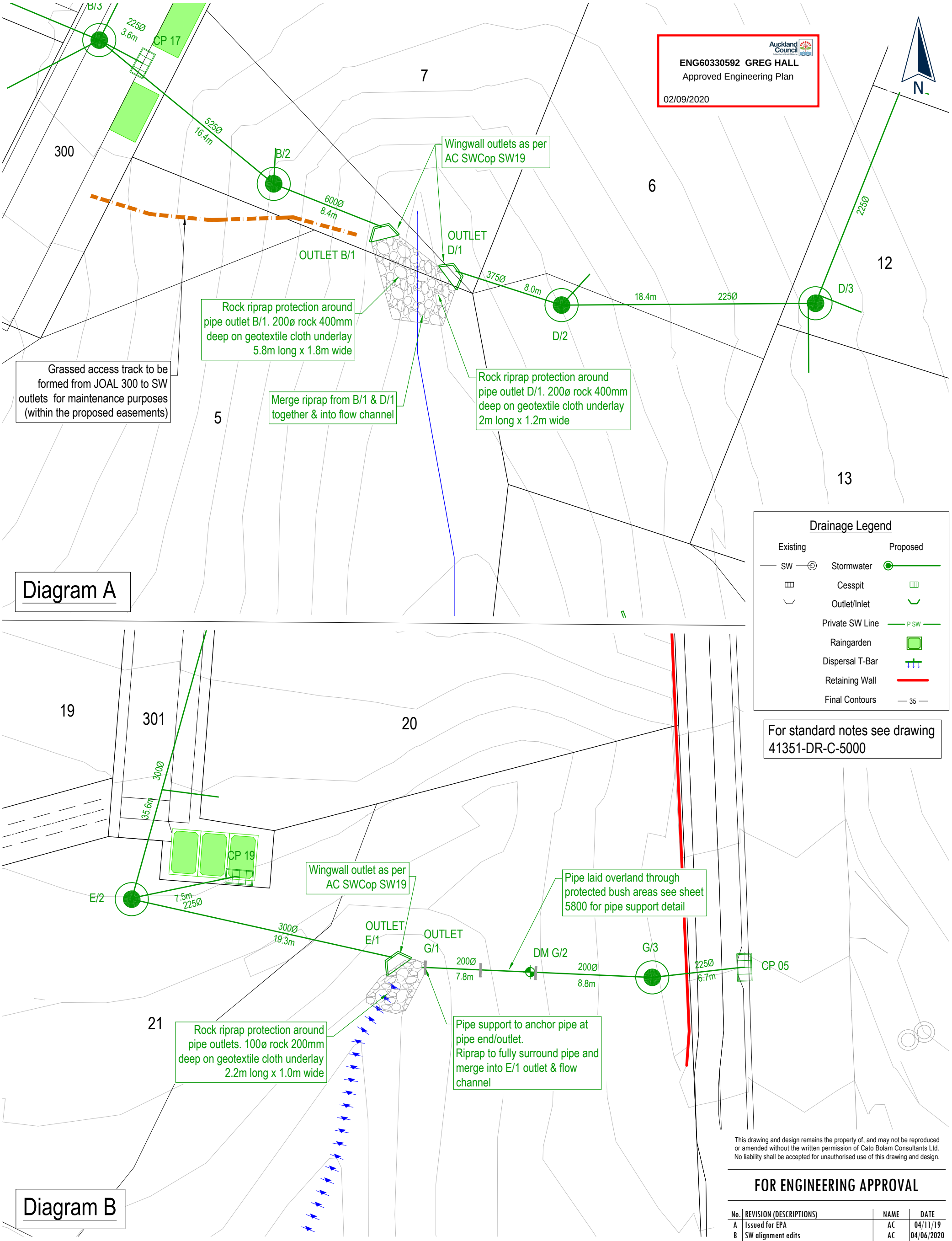
Stormwater Layout
Sheet 3 of 4



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Drainage Legend

Existing		Proposed
SW	Stormwater	
	Cesspit	
	Outlet/Inlet	
	Private SW Line	P SW
	Raingarden	
	Dispersal T-Bar	
	Retaining Wall	
	Final Contours	35

For standard notes see drawing 41351-DR-C-5000

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	04/11/19
B	SW alignment edits	AC	04/06/2020
C	Drive 2 RG's moved	AC	22/06/2020
SURVEYED			
DESIGNED		PJT	25/09/18
DRAWN		PJT	25/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
22/06/2020	1:250	A3

DRAWING NO. 41351-DR-C-5004 REVISION C

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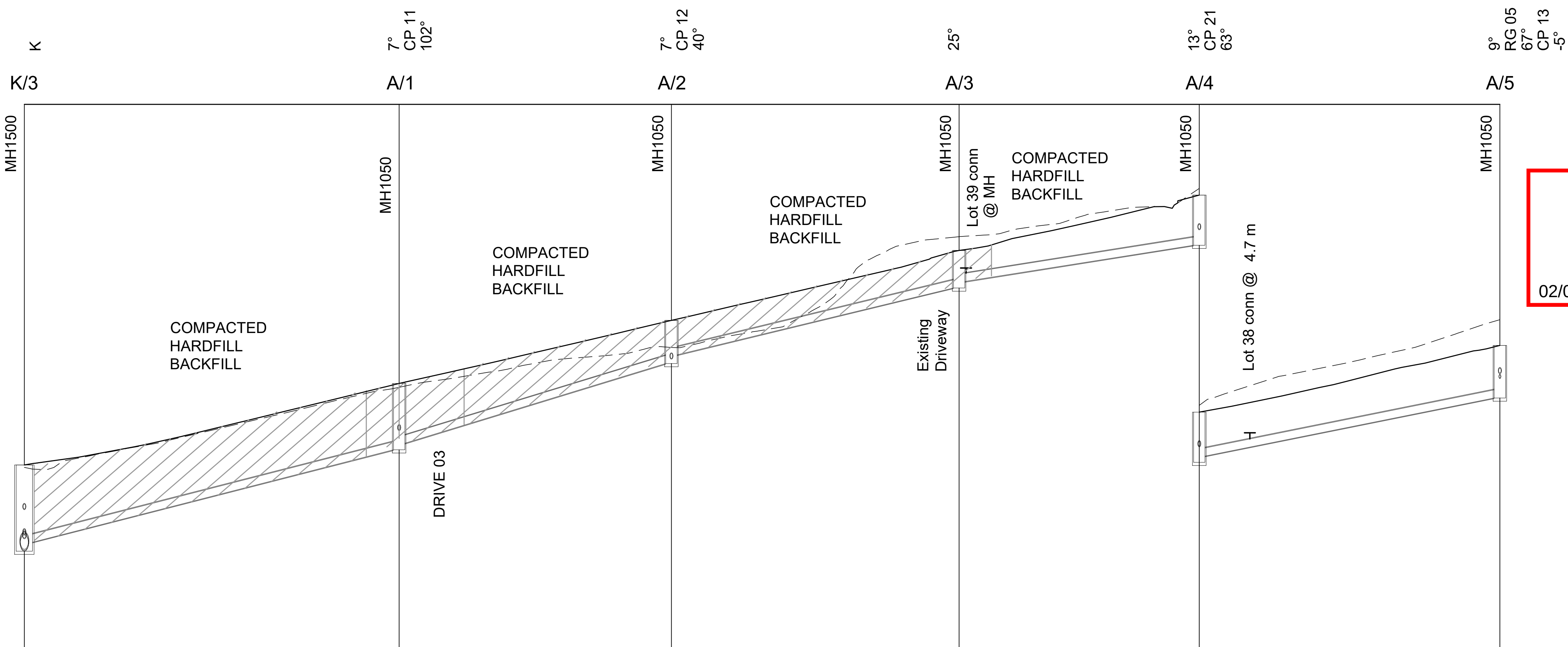
Sheet 4 of 4



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	K/3 – A/1	A/1 – A/2	A/2 – A/3	A/3 – A/4	A/4 – A/5
GRADE %	12.32%	14.63%	11.62%	7.54%	9.66%
DESIGN FLOW	574l/s	557l/s	540l/s	514l/s	488l/s
FLOW CAPACITY	706l/s	769l/s	686l/s	553l/s	625l/s
PIPE SIZE (mm)	375	375	375	375	375
PIPE TYPE	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 2 RCRRJ
BEDDING	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-03 H2 BEDDING	AC-SW-23 7MPa LOW STRENGTH CONCRETE
DISTANCE	34.55	25.1	26.52	22.14	27.71

	K/3	A/1	A/2	A/3	A/4	A/5
DATUM	5.000				15.000	
DEPTH TO INVERT	3.97 3.56	3.06 2.76	1.99 1.59	1.73 1.43	2.31 2.03	2.42
INVERT LEVEL	21.66 22.07	26.33 26.63	30.31 30.71	33.79 34.09	35.76 36.04	38.72
DESIGN SURFACE LEVEL	25.63	29.39	32.29	35.52	38.07	41.14
DISTANCE	0	34.55	59.65	86.18	108.32	136.03

STORMWATER LINE A

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Stormwater Longsections
Sheet 1 of 12

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5100
REVISION C

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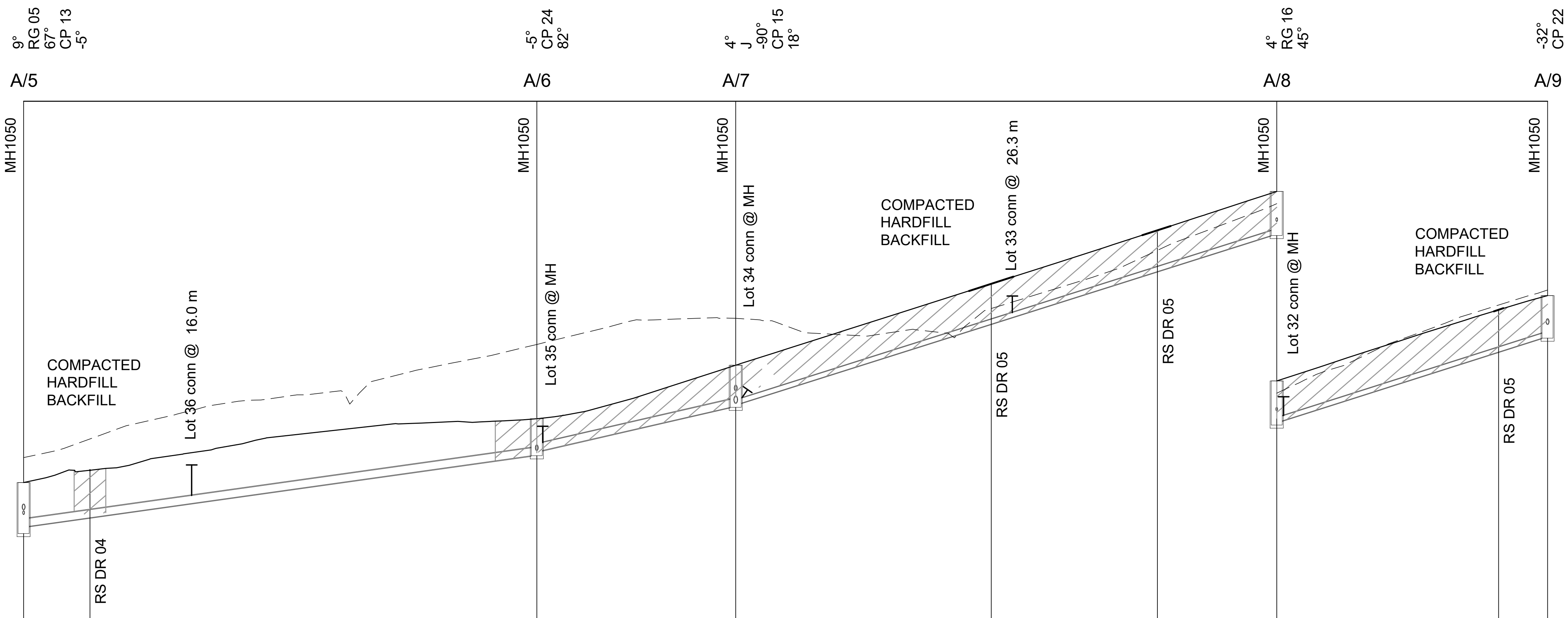

	A/5 – A/6	A/6 – A/7	A/7 – A/8	A/8 – A/9
GRADE %	6.86%	10.85%	15.48%	15.25%
DESIGN FLOW	473l/s	427l/s	78l/s	39l/s
FLOW CAPACITY	527l/s	663l/s	206l/s	205l/s
PIPE SIZE (mm)	375	375	225	225
PIPE TYPE	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ
BEDDING	AC-SW-03 H2 BEDDING	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-23 7MPa LOW STRENGTH CONCRETE
DATUM	22.000			31.000

	A/5	RS DR 04	A/6	A/7	RS DR 05	RS DR 05	A/8	RS DR 05	A/9
DEPTH TO INVERT	2.42 / 2.07		1.76 / 1.51	2.00 / 1.80			2.09 / 1.89		2.02
INVERT LEVEL	38.72 / 39.07	39.47	42.41 / 42.66	44.72 / 44.92	48.67	51.17	52.87 / 53.07	56.34	57.00
DESIGN SURFACE LEVEL	41.14		44.17	46.72			54.97		59.02
DISTANCE	136.03	6.3	184.8	203.7	24.1	40.1	255.12	21.1	280.86

Segment distances: 48.77 (A/5–A/6), 18.91 (A/6–A/7), 51.41 (A/7–A/8), 25.74 (A/8–A/9)

STORMWATER LINE A

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Stormwater Longsections
Sheet 2 of 12

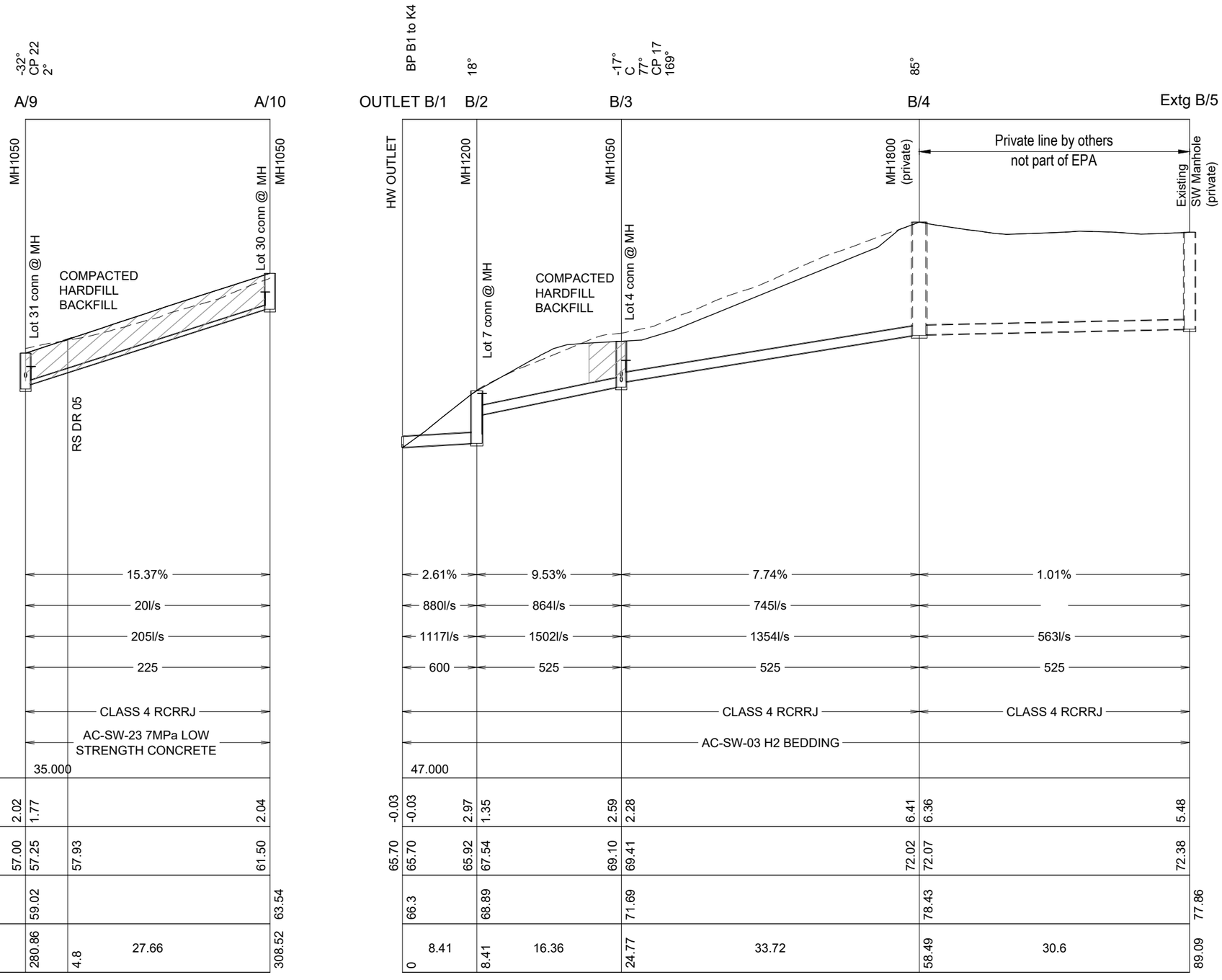
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO.	REVISION
41351-DR-C-5101	C



STORMWATER LINE A

STORMWATER LINE B

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Stormwater Longsections
Sheet 3 of 12

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Line B extended to existing MH	AC	17/02/2020
D	Line B4 - B5 labeled as outside EPA	AC	01/05/2020
E	MH B4 edit size & made private	AC	04/06/2020
F	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5102

REVISION F

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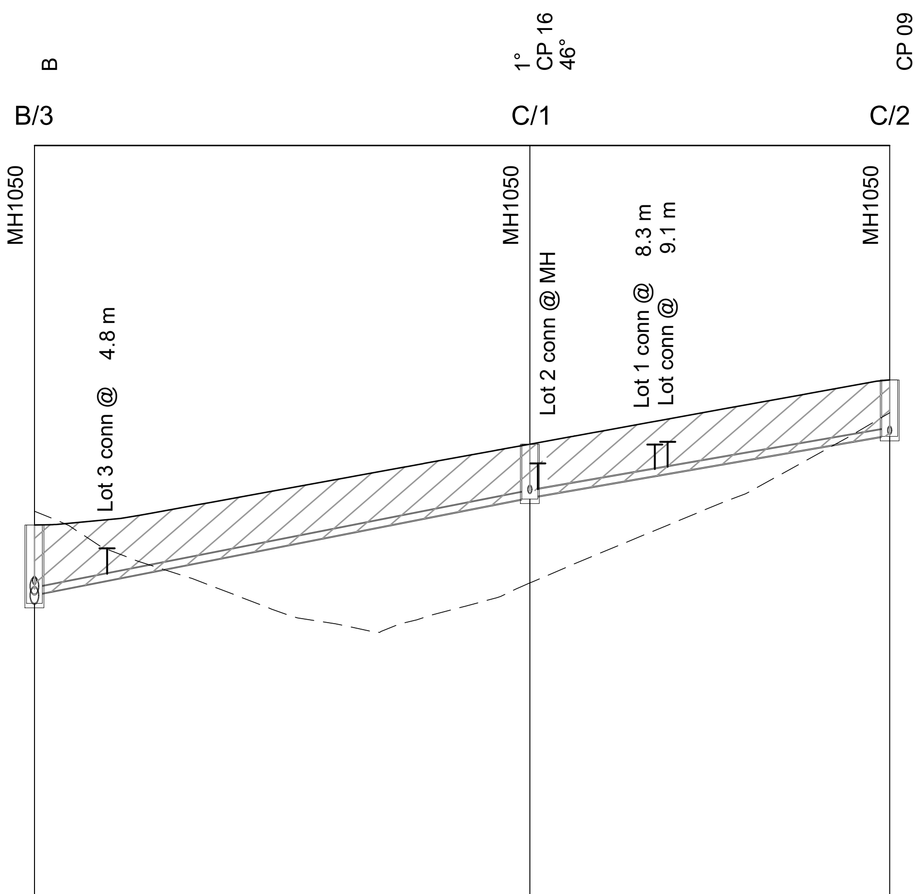
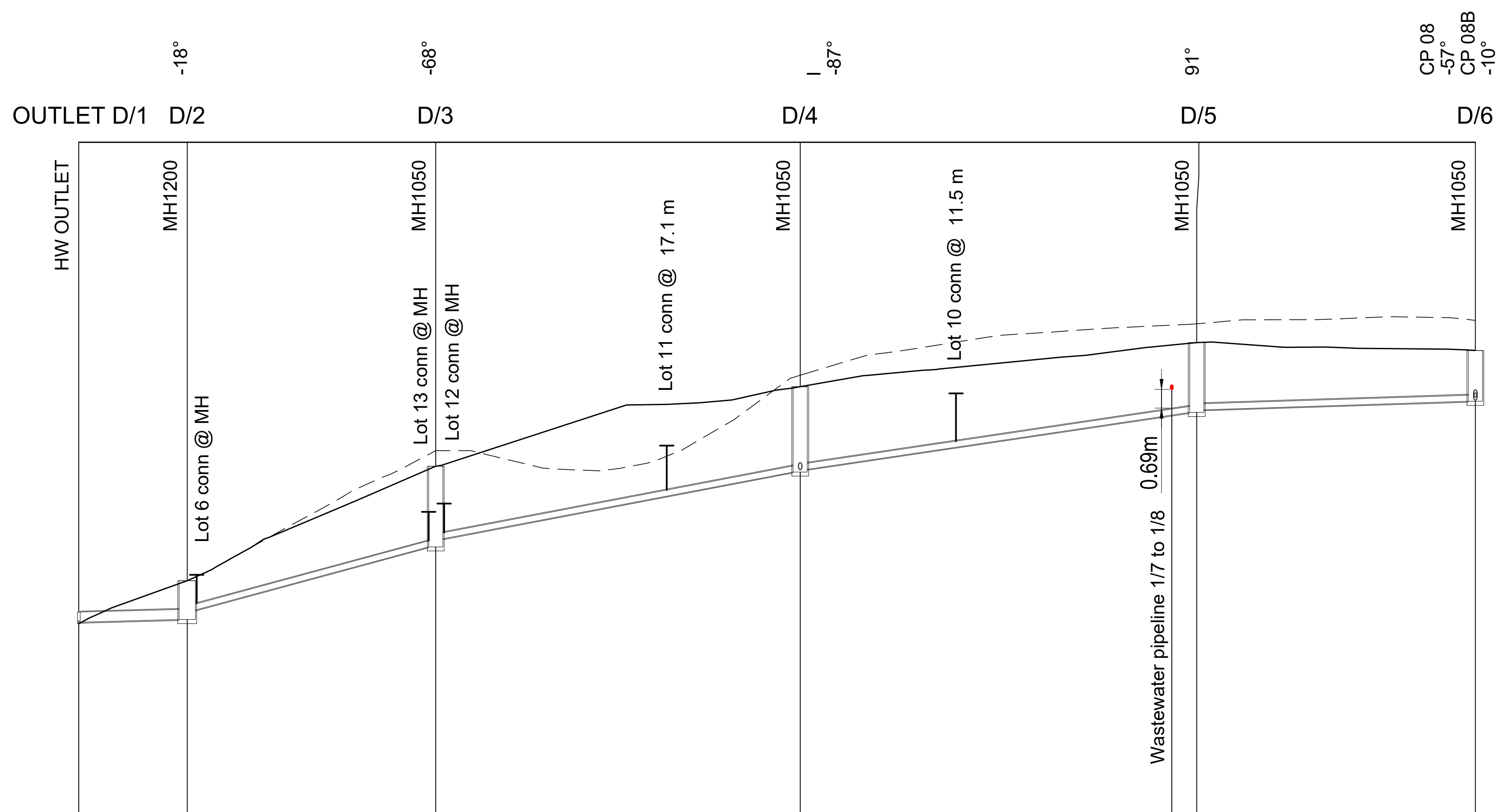
02/09/2020



	B/3	B/3–C/1	C/1	C/1–C/2	C/2
GRADE %		9.51%		8.29%	
DESIGN FLOW		84l/s		56l/s	
FLOW CAPACITY		162l/s		151l/s	
PIPE SIZE (mm)		225		225	
PIPE TYPE		CLASS 4 RCRRJ		CLASS 4 RCRRJ	
BEDDING		AC-SW-03 H2 BEDDING		AC-SW-03 H2 BEDDING	
DATUM	47.000				
DEPTH TO INVERT	2.59 / 2.26		1.82 / 1.72		1.87
INVERT LEVEL	69.10 / 69.43		72.55 / 72.65		74.62
DESIGN SURFACE LEVEL	71.69		74.37		76.49
DISTANCE	0	32.77	32.77	23.8	56.57

STORMWATER LINE C



	D/1	D/1–D/2	D/2	D/2–D/3	D/3	D/3–D/4	D/4	D/4–D/5	D/5	D/5–D/6	D/6
GRADE %		1.25%		12.71%		9.16%		7.17%		1.52%	
DESIGN FLOW		122l/s		102l/s		79l/s		40l/s		30l/s	
FLOW CAPACITY		225l/s		187l/s		159l/s		140l/s		65l/s	
PIPE SIZE (mm)		375		225		225		225		225	
PIPE TYPE		CLASS 4 RCRRJ		CLASS 4 RCRRJ		CLASS 4 RCRRJ		CLASS 4 RCRRJ		CLASS 2 RCRRJ	
BEDDING		AC-SW-03 H2 BEDDING		AC-SW-23 7MPa LOW STRENGTH CONCRETE		AC-SW-03 H2 BEDDING		AC-SW-03 H2 BEDDING		AC-SW-03 H2 BEDDING	
DATUM	46.000										
DEPTH TO INVERT	-0.02 / -0.06		1.44 / 1.09		2.98 / 2.68		3.16 / 3.06		2.59 / 2.49		1.88
INVERT LEVEL	65.46 / 65.50		65.60 / 65.95		68.29 / 68.59		71.05 / 71.15		73.26 / 73.36		73.67
DESIGN SURFACE LEVEL	65.88		67.04		71.27		74.21		75.84		75.55
DISTANCE	-11.11	8.02	-3.09	18.38	15.29	26.95	42.24	29.32	27.5 / 71.56	20.6	92.17

STORMWATER LINE D

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Stormwater Longsections
Sheet 4 of 12

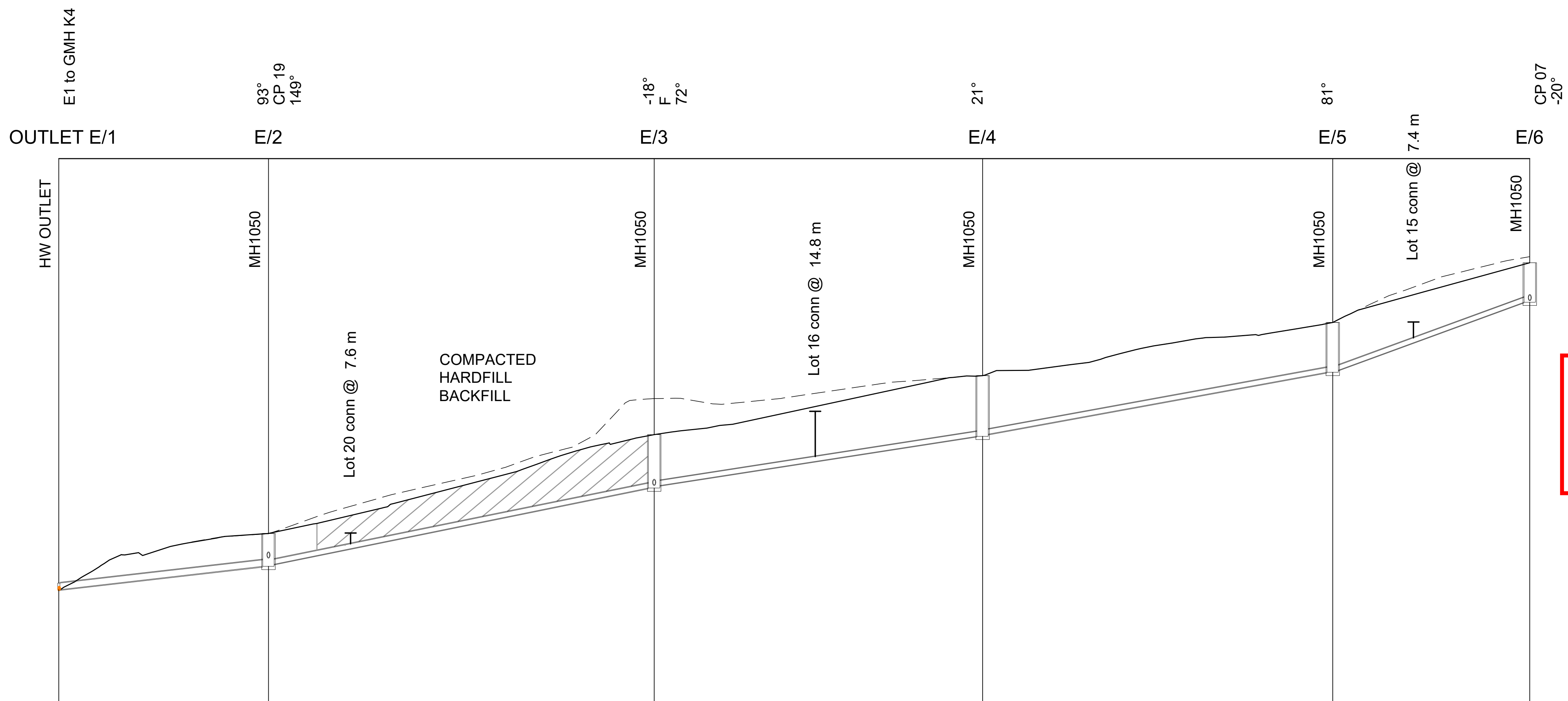
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	All of line C now on this sheet	AC	01/05/2020
D	Drainage alignment edits	AC	04/06/2020
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE 17/06/2020 | ORIGINAL SCALE H 1:500 V 1:250 | ORIGINAL SIZE A3

DRAWING NO. 41351-DR-C-5103 | REVISION E



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	E/1 – E/2	E/2 – E/3	E/3 – E/4	E/4 – E/5	E/5 – E/6
GRADE %	5.53%	9.87%	7.48%	8.83%	17.23%
DESIGN FLOW	163l/s	134l/s	84l/s	73l/s	51l/s
FLOW CAPACITY	263l/s	351l/s	143l/s	156l/s	218l/s
PIPE SIZE (mm)	300	300	225	225	225
PIPE TYPE	CLASS 2 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 3 RCRRJ	CLASS 4 RCRRJ
BEDDING	AC-SW-03 H2 BEDDING	AC-SW-03 H2 BEDDING	AC-SW-03 H2 BEDDING	AC-SW-03 H2 BEDDING	AC-SW-23 7MPa LOW STRENGTH CONCRETE

DATUM 40.000

	E/1		E/2		E/3		E/4		E/5		E/6
DEPTH TO INVERT	-0.06 / -0.06		1.51 / 1.41		2.46 / 2.34		2.80 / 2.70		2.30 / 2.20		1.82
INVERT LEVEL	57.39 / 57.39		58.46 / 58.56		62.07 / 62.19		64.45 / 64.55		67.40 / 67.50		70.63
DESIGN SURFACE LEVEL	57.69		59.97		64.53		67.25		69.7		72.45
DISTANCE	0	19.33	19.33	35.56	54.89	30.27	85.17	32.28	117.44	18.17	135.61

STORMWATER LINE E

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Stormwater Longsections
Sheet 5 of 12

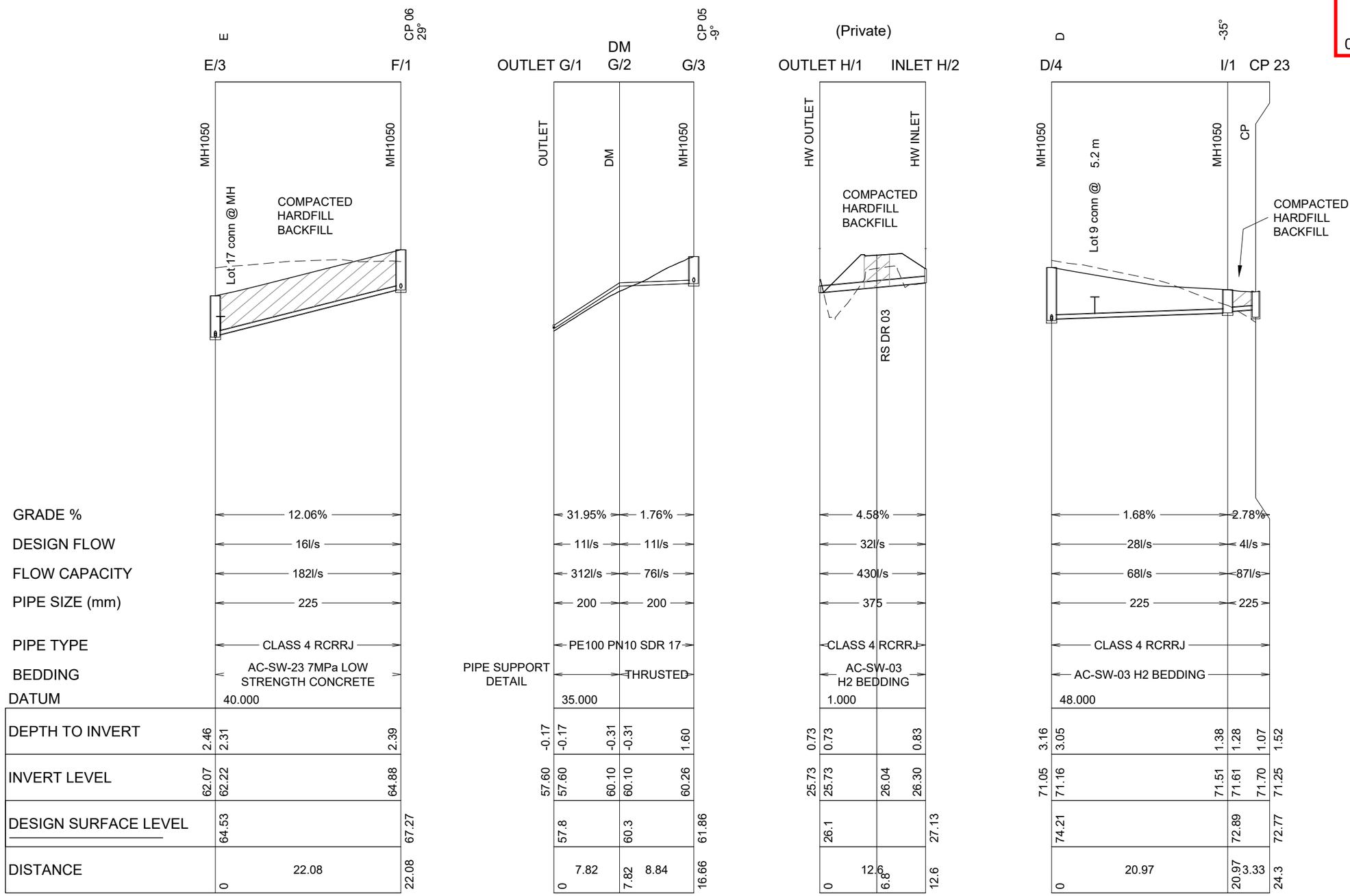
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Drainage alignment edits	AC	04/06/2020
D	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE 17/06/2020 | ORIGINAL SCALE H 1:500 V 1:250 | ORIGINAL SIZE A3

DRAWING NO. 41351-DR-C-5104 | REVISION D



STORMWATER LINE F

STORMWATER LINE G

STORMWATER LINE H

STORMWATER LINE I

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Stormwater Longsections
Sheet 6 of 12

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Drainage alignment edits	AC	04/06/2020
D	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

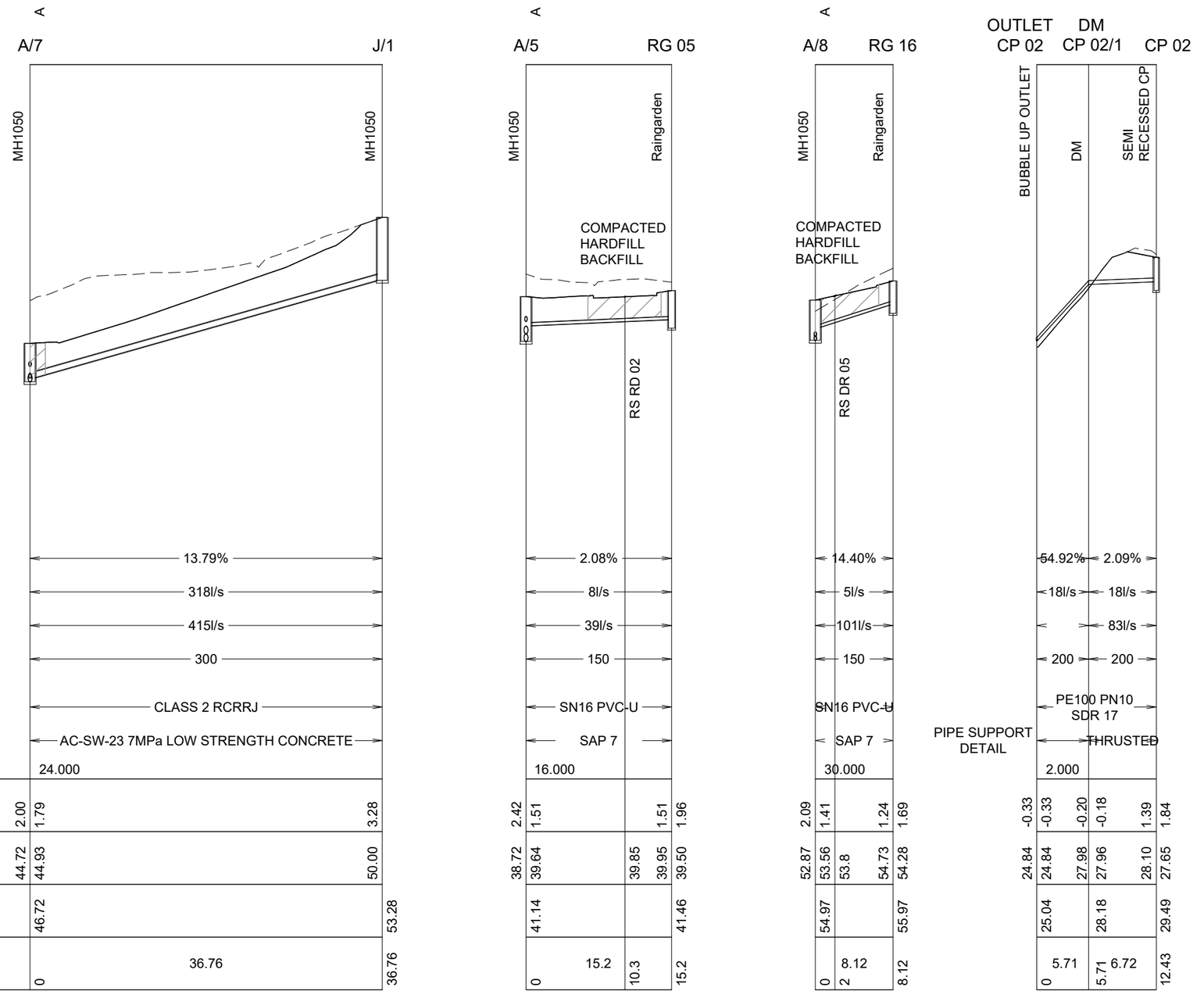
	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
04/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5105

REVISION D

For line K longsection
see plan 5700



STORMWATER LINE J

STORMWATER LINE RG 05

STORMWATER LINE RG 16

STORMWATER LINE CP 02

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Stormwater Longsections
Sheet 7 of 12

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Minor edits for EPA	AC	17/06/2020

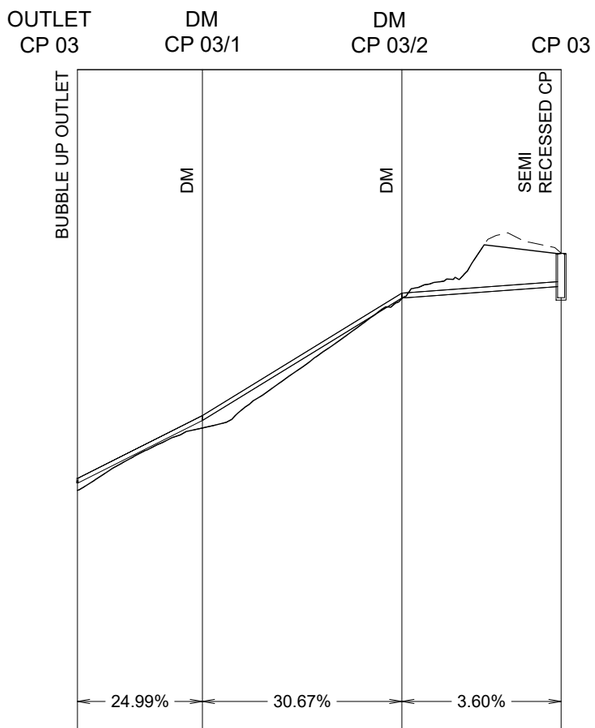
FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

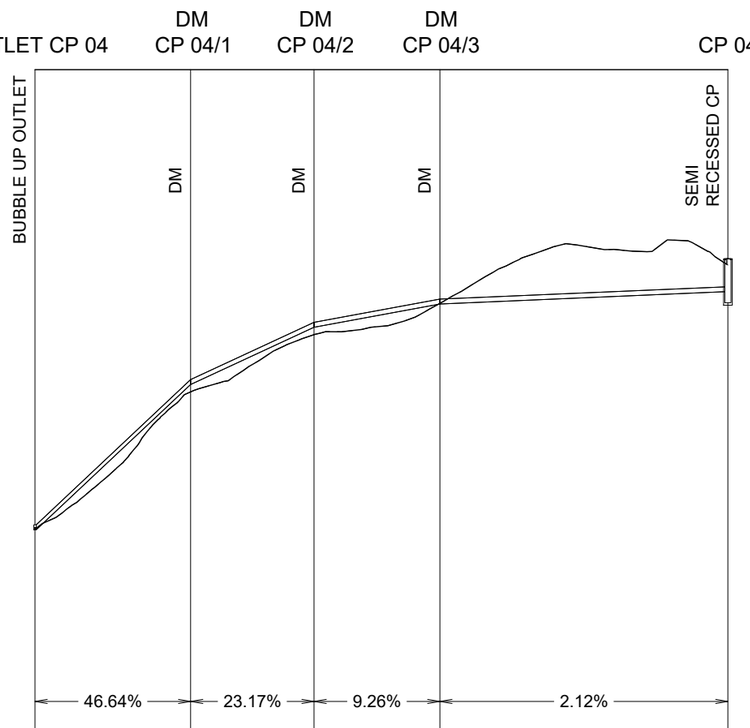
DRAWING NO. 41351-DR-C-5106

REVISION C



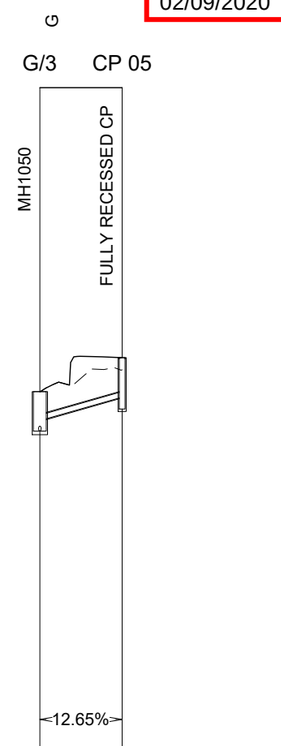
GRADE %		24.99%			30.67%			3.60%		
DESIGN FLOW		23l/s			23l/s			23l/s		
FLOW CAPACITY								108l/s		
PIPE SIZE (mm)		200			200			200		
PIPE TYPE		PE100 PN10 SDR 17			PE100 PN10 SDR 17			PE100 PN10 SDR 17		
BEDDING		PIPE SUPPORT DETAIL			PIPE SUPPORT DETAIL			THRUSTED		
DATUM		10.000								
DEPTH TO INVERT	-0.30	-0.30		-0.31	-0.31		-0.02	-0.02		1.35	1.80
INVERT LEVEL	30.40	30.40		32.95	32.95		37.94	37.94		38.41	37.96
DESIGN SURFACE LEVEL		30.6			33.15			38.14			39.76
DISTANCE	0	10.19			10.19	16.27		26.45	12.98		39.44

STORMWATER LINE CP 03



GRADE %		46.64%			23.17%			9.26%		2.12%
DESIGN FLOW		23l/s			23l/s			23l/s		23l/s
FLOW CAPACITY										84l/s
PIPE SIZE (mm)		200			200			200		200
PIPE TYPE		PE100 PN10 SDR 17								
BEDDING		PIPE SUPPORT DETAIL								THRUSTED
DATUM		24.000								
DEPTH TO INVERT	0.02	0.02		-0.30	-0.30		-0.30	-0.30		0.02	1.35	1.80
INVERT LEVEL	42.50	42.50		48.42	48.42		50.75	50.75		51.70	51.75	52.20
DESIGN SURFACE LEVEL		42.7			48.62			50.95		51.9		53.54
DISTANCE	0	12.69			12.69	10.06		22.75	10.26		33.01	23.49	56.5

STORMWATER LINE CP 04



GRADE %		12.65%		
DESIGN FLOW		11l/s		
FLOW CAPACITY		186l/s		
PIPE SIZE (mm)		225		
PIPE TYPE		CLASS 4 RCRRJ		
BEDDING		AC-SW-23 7MPa LOW STRENGTH CONCRETE		
DATUM		37.000		
DEPTH TO INVERT	1.60	1.10	1.65	2.10
INVERT LEVEL	60.26	60.76	61.60	61.15
DESIGN SURFACE LEVEL		61.86		63.25
DISTANCE	0	6.71		6.71

STORMWATER LINE CP 05

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Sheet 8 of 12

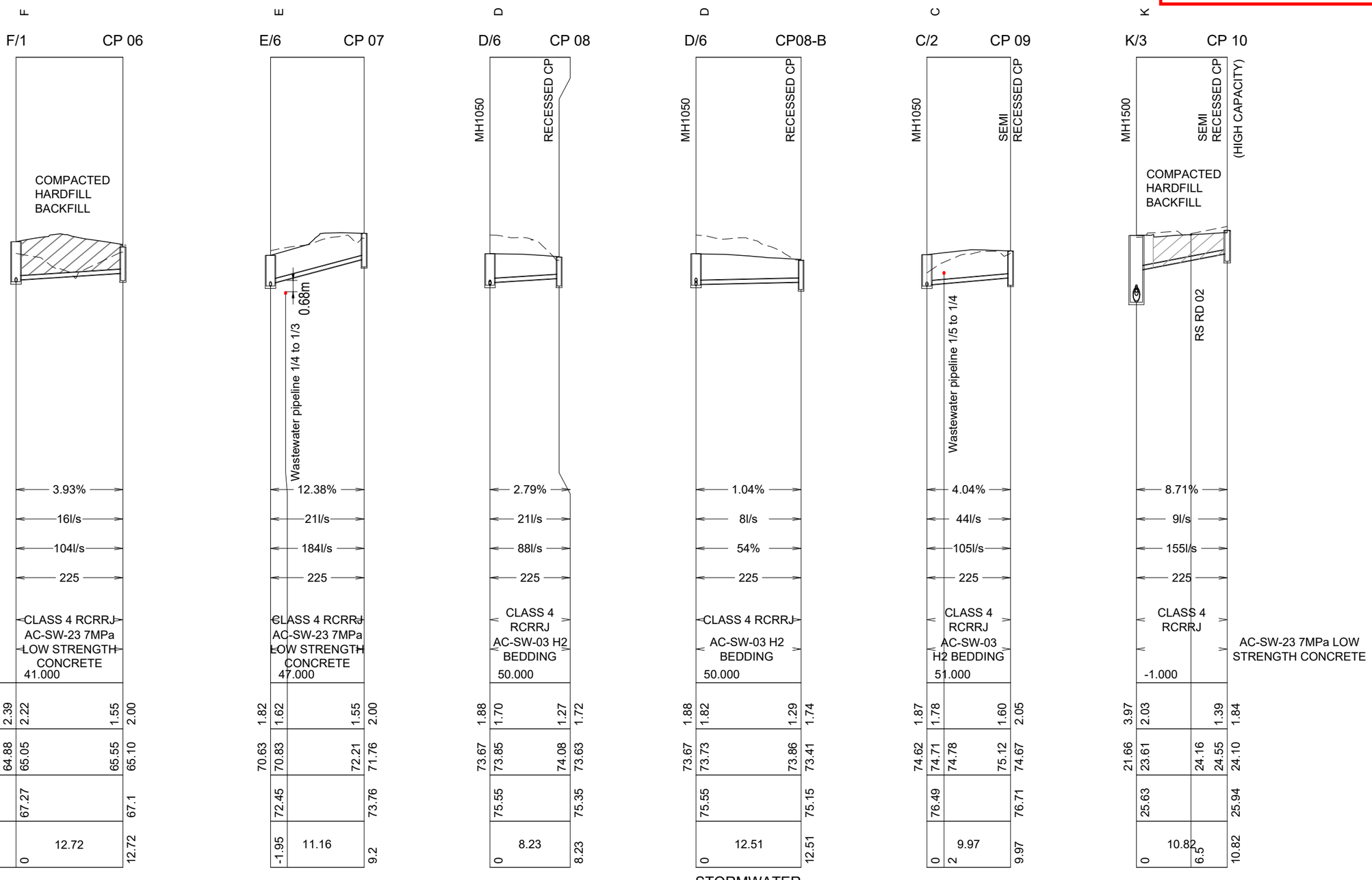
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5107
REVISION C



STORMWATER LINE CP 06 | STORMWATER LINE CP 07 | STORMWATER LINE CP 08 | STORMWATER LINE CP 08B | STORMWATER LINE CP 09 | STORMWATER LINE CP 10

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Stormwater Longsections
Sheet 9 of 12

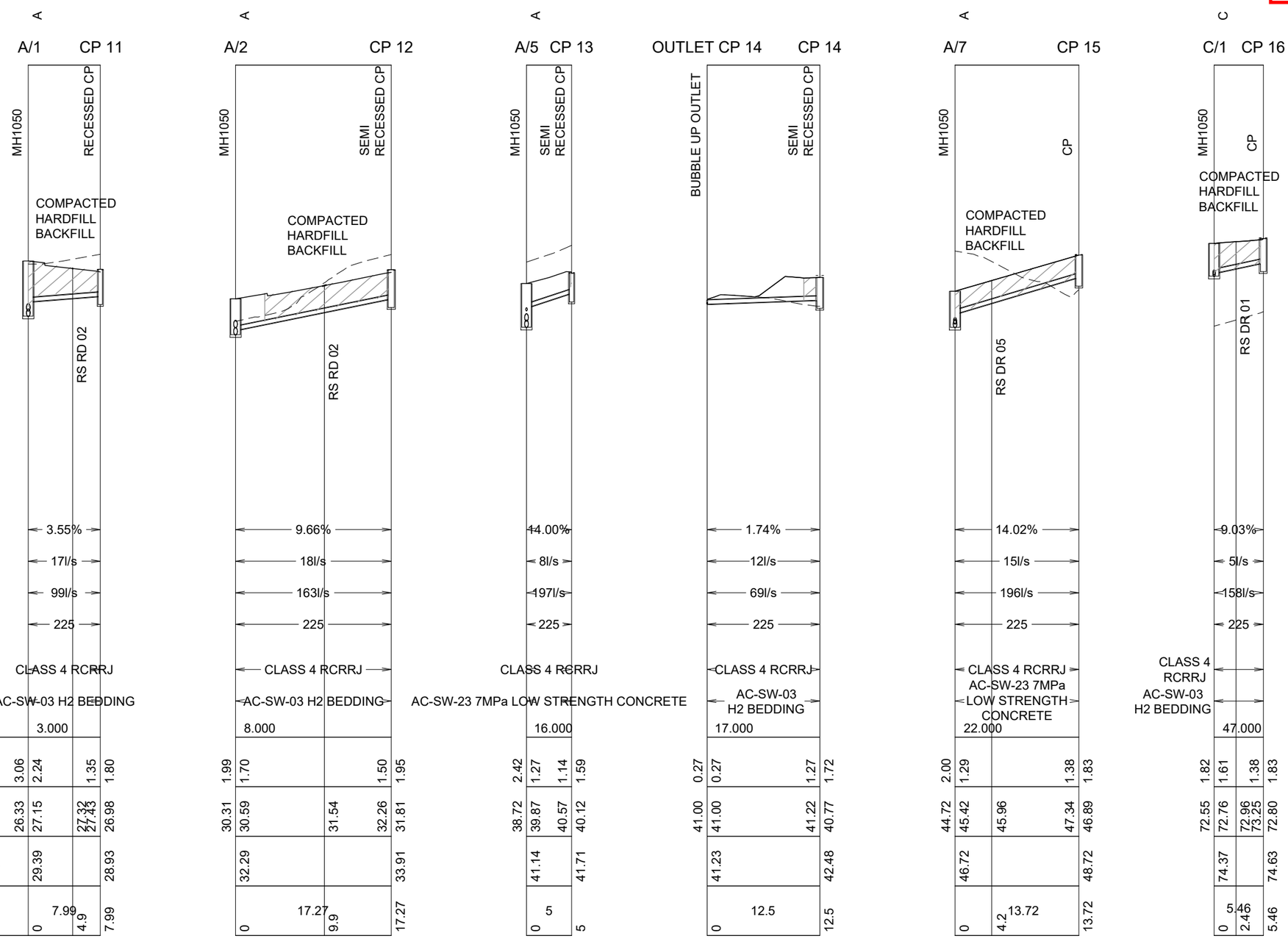
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Swales removed CPs 7, 8, 9 edits	AC	01/05/2020
D	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5108
REVISION D



	CP 11	CP 12	CP 13	CP 14	CP 15	CP 16
GRADE %	3.55%	9.66%	14.00%	1.74%	14.02%	9.03%
DESIGN FLOW	17l/s	18l/s	8l/s	12l/s	15l/s	5l/s
FLOW CAPACITY	99l/s	163l/s	197l/s	69l/s	196l/s	158l/s
PIPE SIZE (mm)	225	225	225	225	225	225
PIPE TYPE	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ	CLASS 4 RCRRJ
BEDDING	AC-SW-03 H2 BEDDING	AC-SW-03 H2 BEDDING	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-03 H2 BEDDING	AC-SW-23 7MPa LOW STRENGTH CONCRETE	AC-SW-03 H2 BEDDING
DATUM	3.000	8.000	16.000	17.000	22.000	47.000
DEPTH TO INVERT	3.06 / 2.24 / 1.35 / 1.80	1.99 / 1.70 / 1.50 / 1.95	2.42 / 1.27 / 1.14 / 1.59	0.27 / 0.27 / 1.27 / 1.72	2.00 / 1.29 / 1.38 / 1.83	1.82 / 1.61 / 1.38 / 1.83
INVERT LEVEL	26.33 / 27.15 / 27.32 / 27.43 / 26.98	30.31 / 30.59 / 31.54 / 32.26 / 31.81	38.72 / 39.87 / 40.57 / 40.12	41.00 / 41.00 / 41.22 / 40.77	44.72 / 45.42 / 45.96 / 47.34 / 46.89	72.55 / 72.76 / 72.96 / 73.25 / 72.80
DESIGN SURFACE LEVEL	29.39 / 28.93	32.29 / 33.91	41.14 / 41.71	41.23 / 42.48	46.72 / 48.72	74.37 / 74.63
DISTANCE	0 / 7.99 / 4.9 / 7.99	0 / 17.27 / 9.9 / 17.27	0 / 5 / 5	0 / 12.5 / 12.5	0 / 4.2 / 13.72 / 13.72	0 / 5.46 / 2.46 / 5.46
	STORMWATER LINE CP 11	STORMWATER LINE CP 12	STORMWATER LINE CP 13	STORMWATER LINE CP 14	STORMWATER LINE CP 15	STORMWATER LINE CP 16

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Stormwater Longsections
Sheet 10 of 12

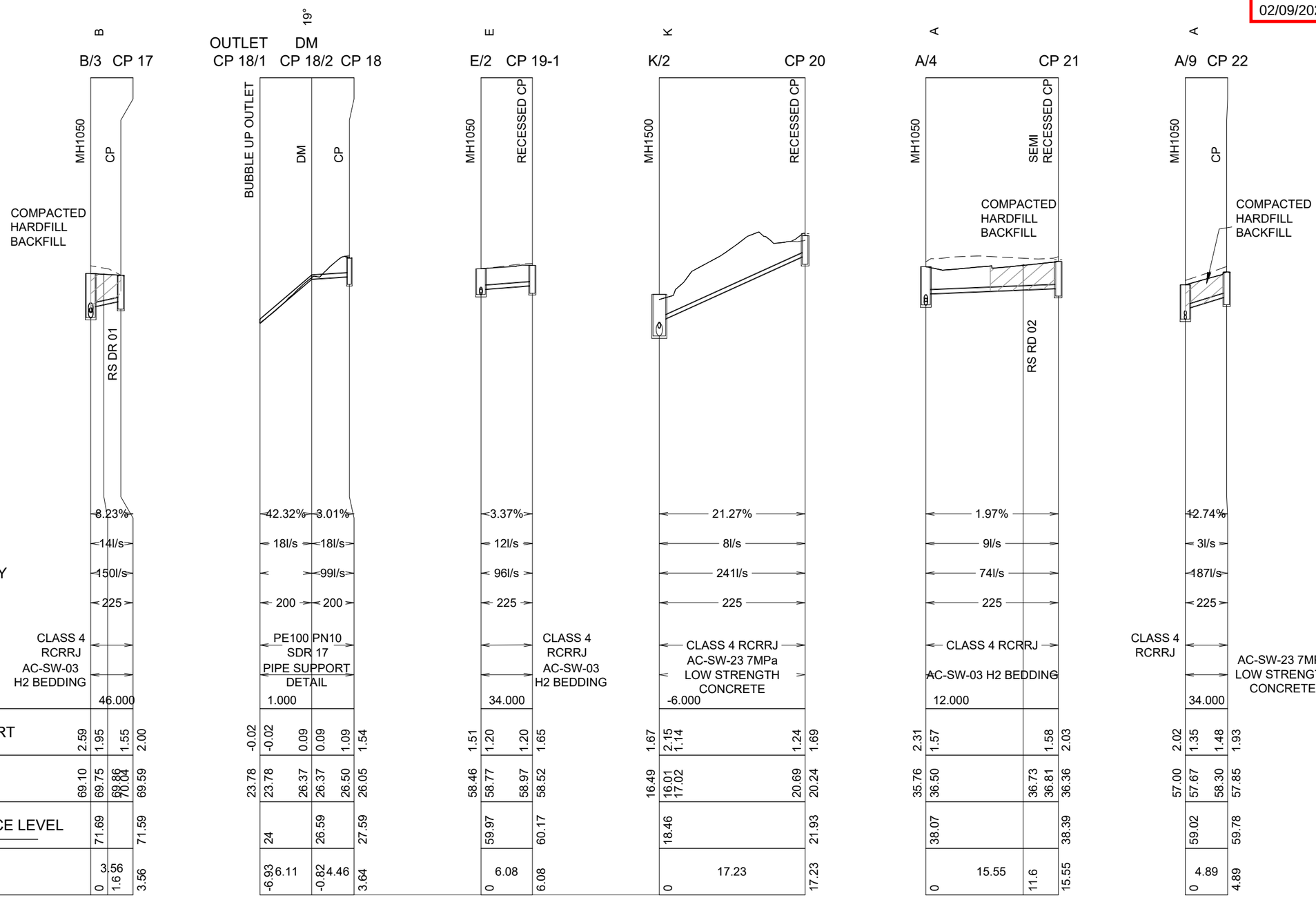
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO.	REVISION
41351-DR-C-5109	C



STORMWATER LINE CP 17 STORMWATER LINE CP 18 STORMWATER LINE CP 19 STORMWATER LINE CP 20 STORMWATER LINE CP 21 STORMWATER LINE CP 22

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Sheet 11 of 12

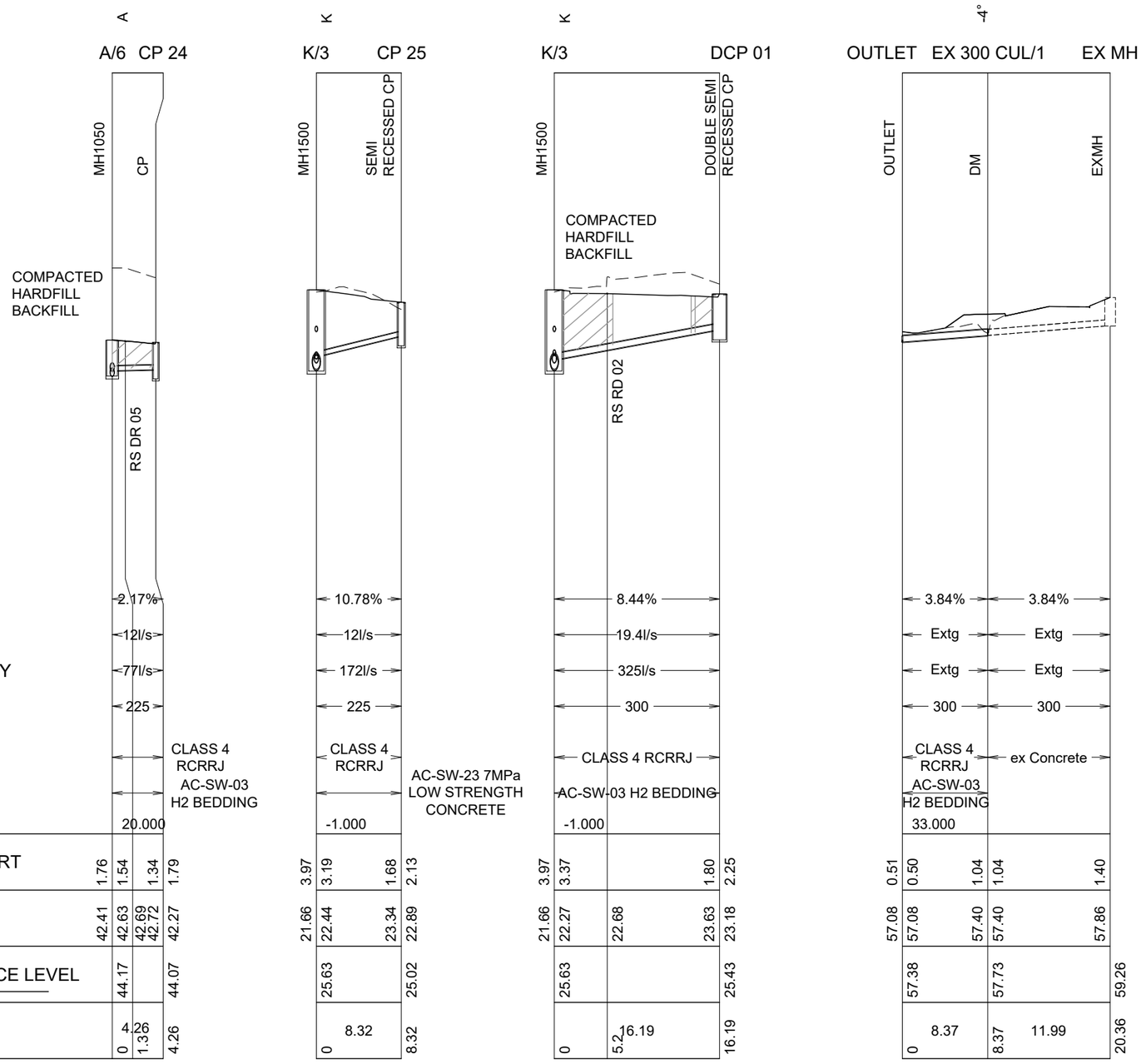
No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	TM	04/11/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	07/09/18
DRAWN	PJT	07/09/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5110
REVISION C



STORMWATER LINE CP 24 STORMWATER LINE CP 25 STORMWATER LINE DCP 01 STORMWATER LINE Ex 300 Culvert

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Stormwater Longsections
Sheet 12 of 12

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	23/09/19
B	New sheet	AC	04/11/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

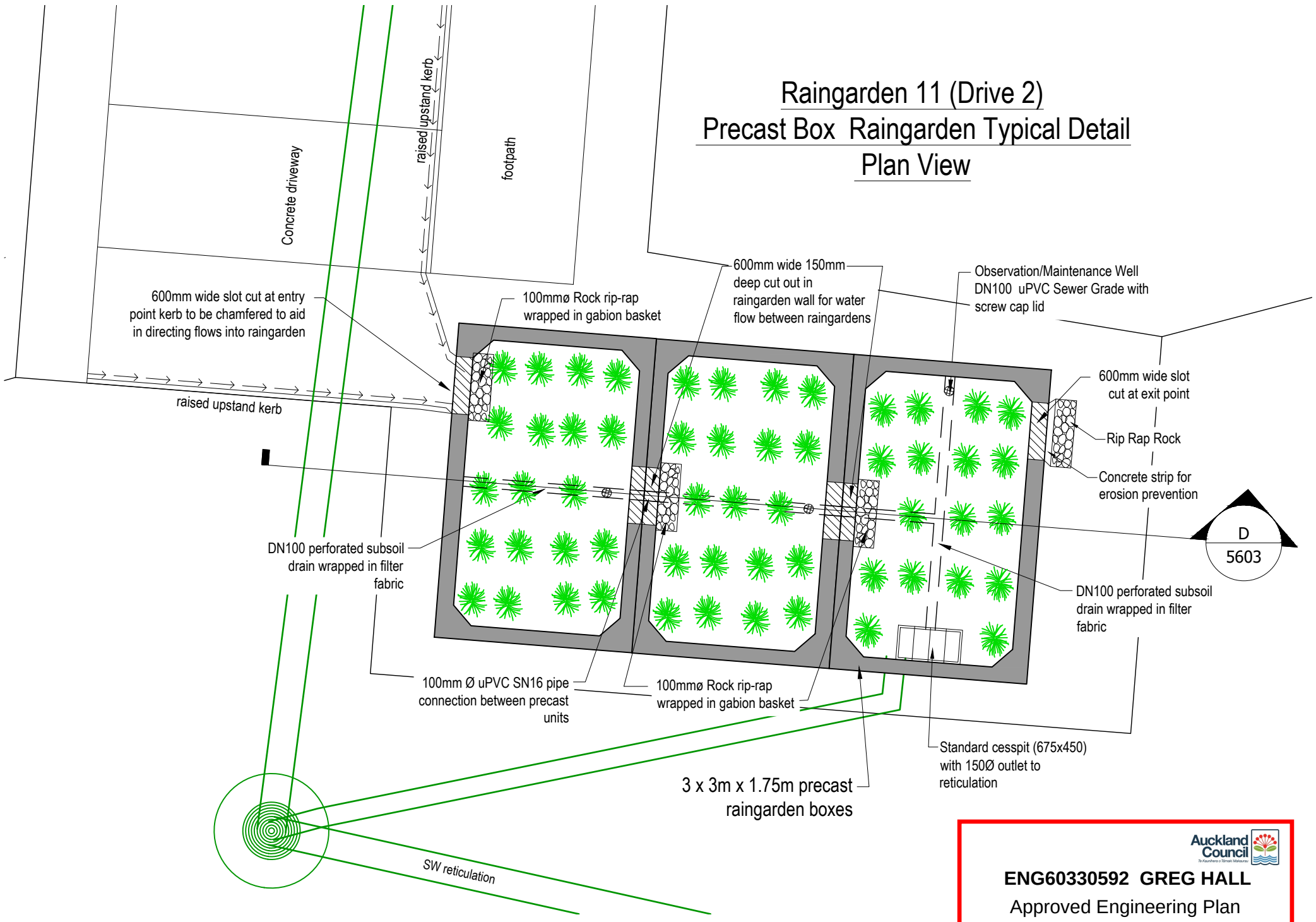
	NAME	DATE
SURVEYED		
DESIGNED	PJT	18/09/19
DRAWN	PJT	18/09/19

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/06/2020	H 1:500 V 1:250	A3

DRAWING NO. 41351-DR-C-5111

REVISION C

Raingarden 11 (Drive 2)
Precast Box Raingarden Typical Detail
Plan View



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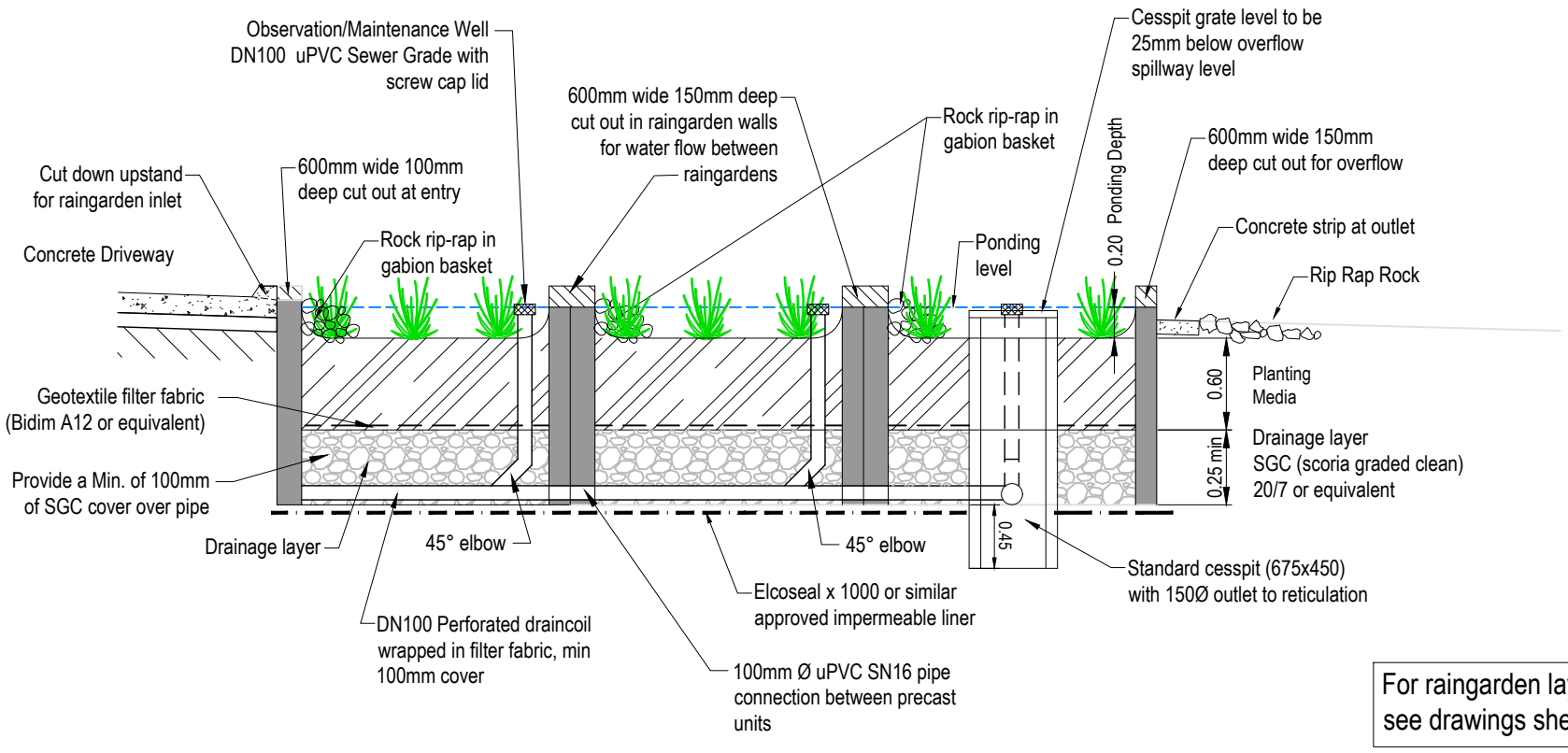

For raingarden layout and sizing see drawings sheets 5010 & 5011

Raingarden 11 - Precast Box Raingarden Typical Detail
Section D-D

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	18/11/19
B	RG entry edits	AC	22/06/2020
SURVEYED			
DESIGNED		AC	06/09/19
DRAWN		AC	18/11/19

DATE	ORIGINAL SCALE	ORIGINAL SIZE
22/06/2020	1:50	A3

DRAWING NO.	REVISION
41351-DR-C-5603	B

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Rain Garden Typical Details
Raingarden 11 - Drive 2

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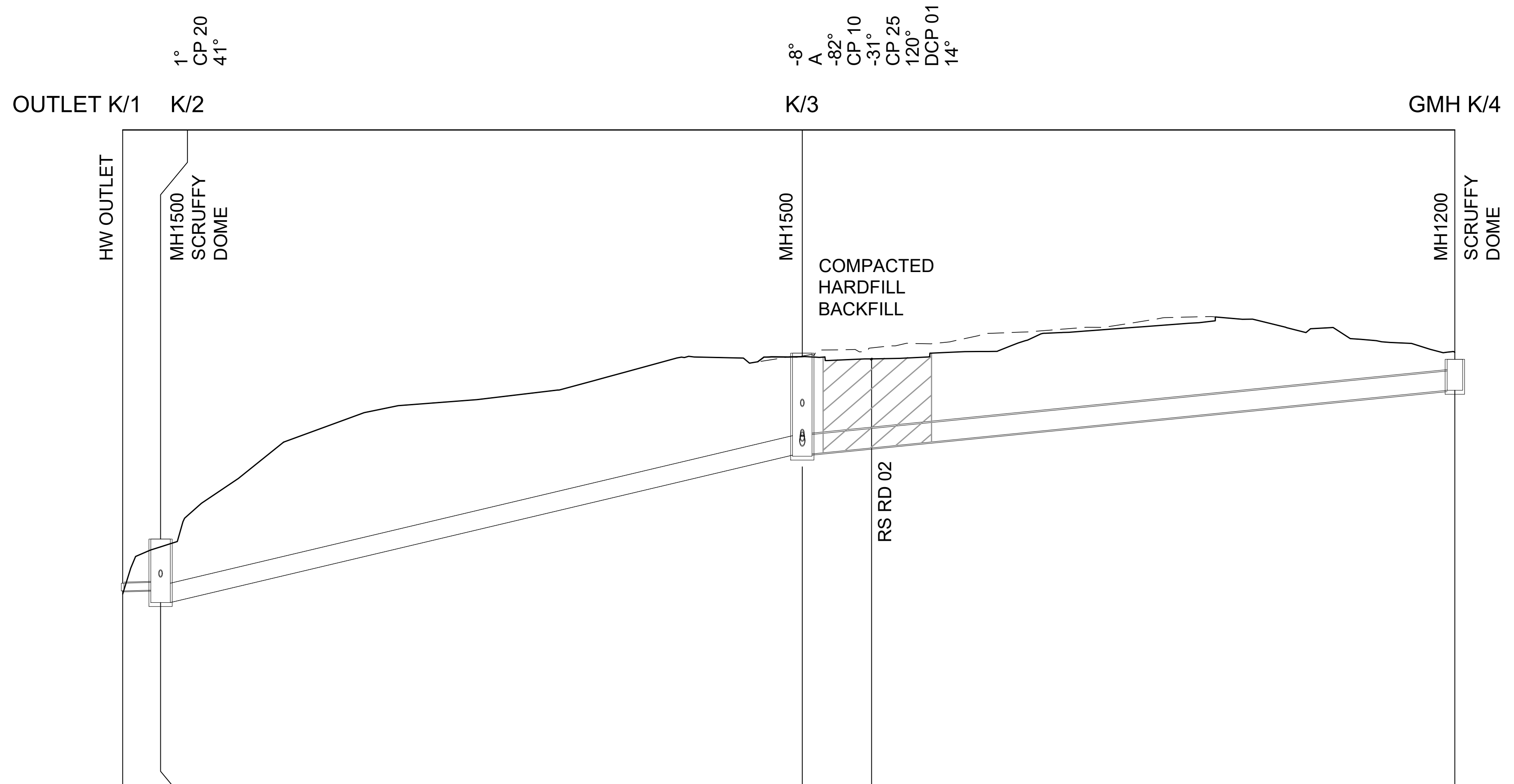
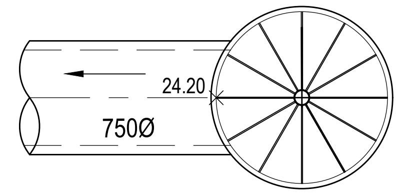
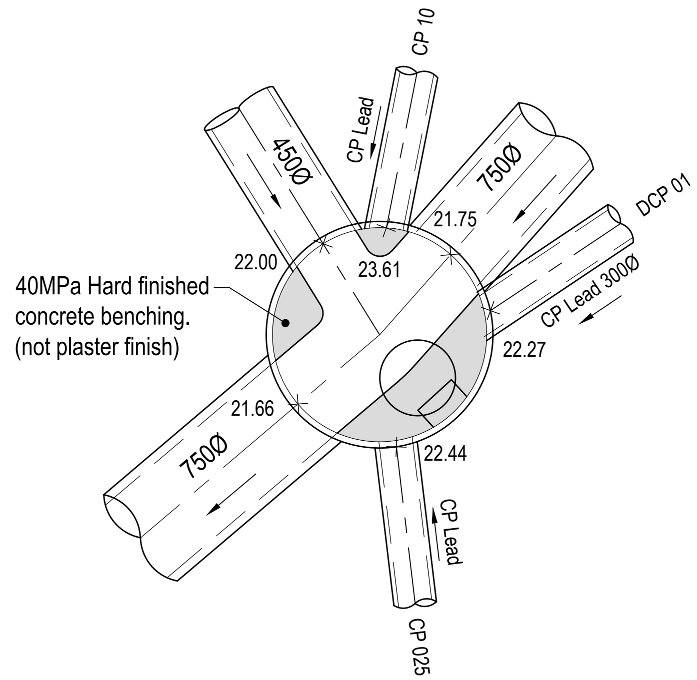


GRADE %	1.00%	11.42%		4.87%
DESIGN FLOW	1871l/s	1871l/s		1256l/s
FLOW CAPACITY	115l/s	4187l/s		2737l/s
PIPE SIZE (mm)	300	750		750
PIPE TYPE	CLASS 4 RCRRJ	RCFJ		CLASS 4 RCRRJ
BEDDING	AC-SW-03 H2 BEDDING	PIPE JACKED		AC-SW-03 H2 BEDDING
DATUM	-3.000			
DEPTH TO INVERT	-0.12 -0.12 1.67 2.15 2.15	3.97 3.88		1.47
INVERT LEVEL	16.46 16.46 16.49 16.01 16.01	21.66 21.75	21.98	24.20
DESIGN SURFACE LEVEL	16.76 18.46	25.63		25.4
DISTANCE	0 2.92 2.92	49.49 52.42	5.3	50.33 102.75

STORMWATER LINE K



Scruffy Dome Detail
K/4 1200Ø
Scale 1:50



Manhole Detail
K/3 1500Ø
Scale 1:50

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55 Schnapper Rock Rd & 52 Kyle Rd
Albany

Stormwater Bypass Detail (Line K - longsection) & Manhole Details

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	MF	09/07/19
C	Minor edits for EPA	AC	17/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	PJT	03/10/18
DRAWN	PJT	03/10/18

DATE: 17/06/2020 | ORIGINAL SCALE: H 1:500 V 1:250 | ORIGINAL SIZE: A3

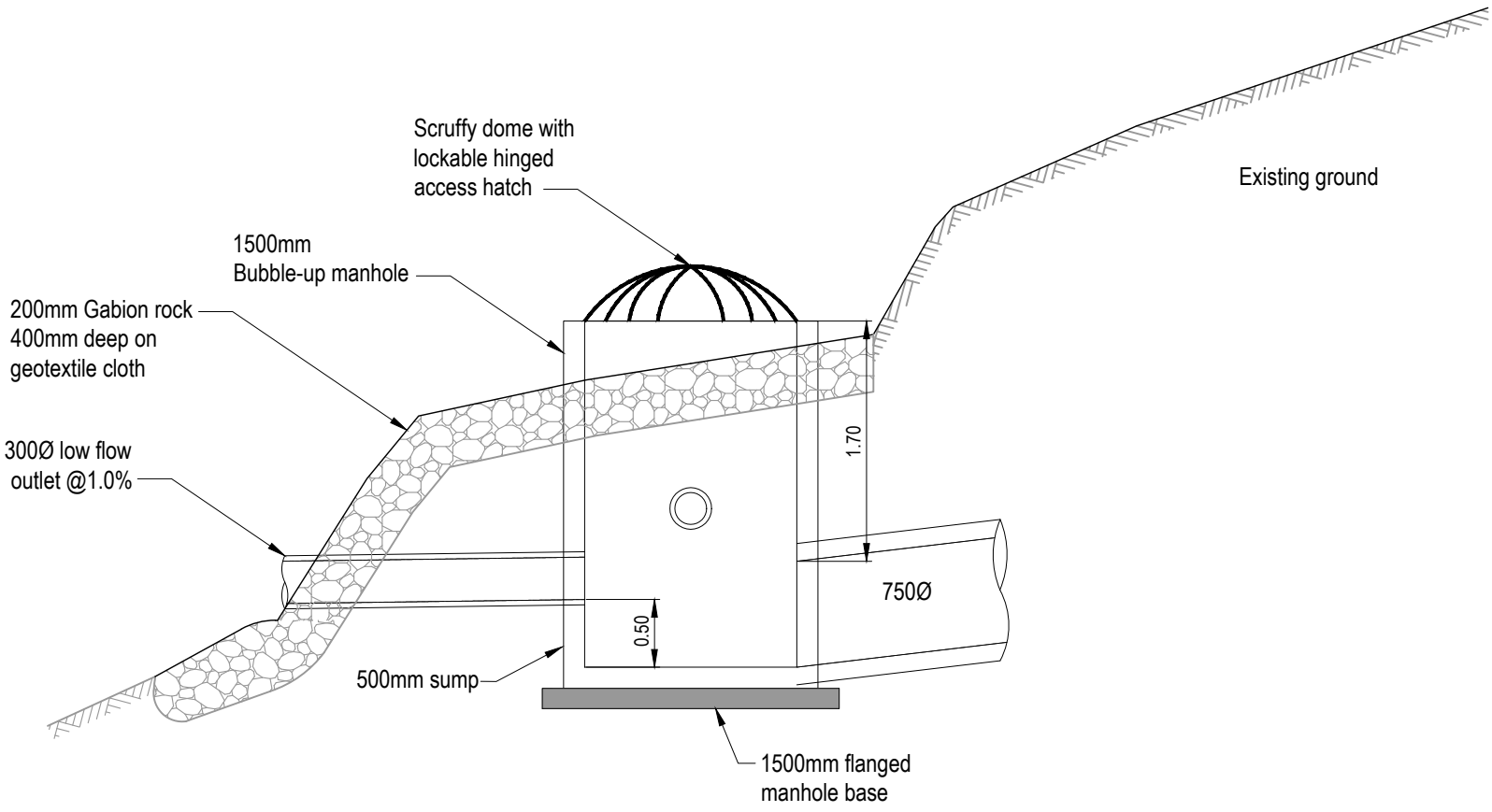
DRAWING NO. 41351-DR-C-5700 | REVISION C

Auckland Council

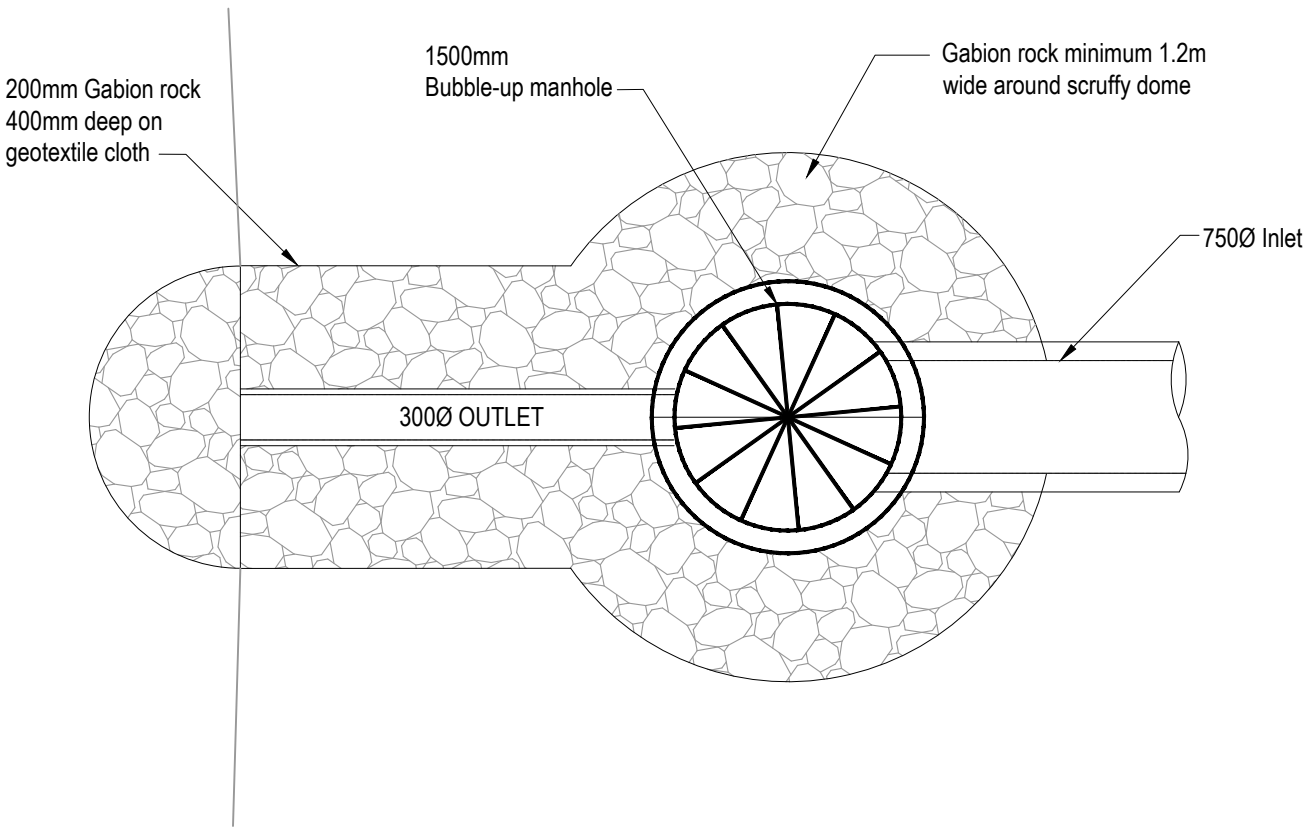
ENG60330592 GREG HALL

Approved Engineering Plan

02/09/2020



Stream Outlet Section
Scruffy Dome K/2



Stream Outlet Plan
Scruffy Dome K/2

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	MF	09/07/19
C	Hinged lid on scruffy dome	AC	19/06/2020
SURVEYED			
DESIGNED		AC	10/08/18
DRAWN		PJT	03/10/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
19/06/2020	1:50	A3

DRAWING NO.	REVISION
41351-DR-C-5701	C

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Stream Stormwater
Outlet Details

Auckland Council

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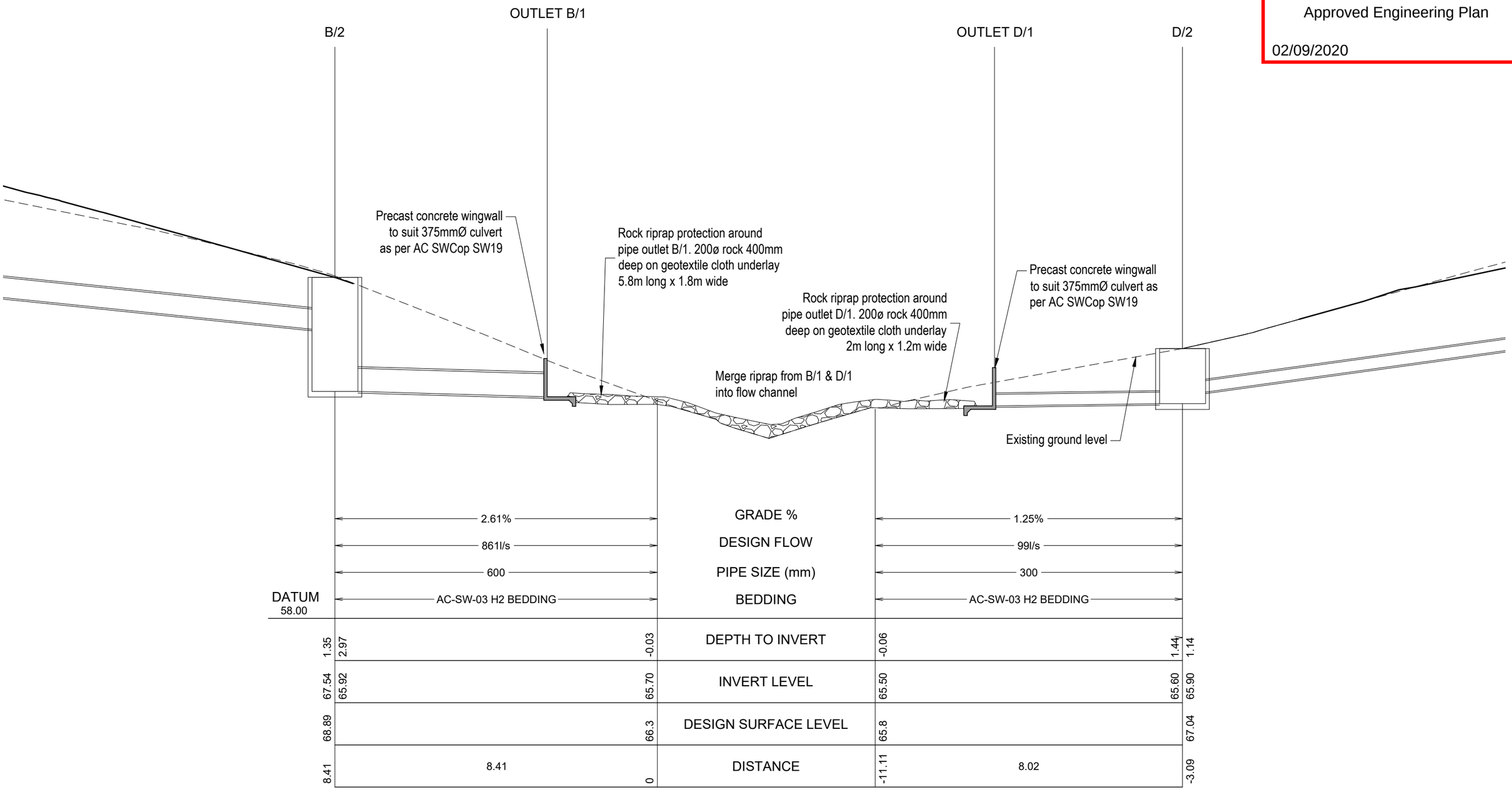
02/09/2020



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Stormwater Outlet Detail
Lines B & D

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for Engineering approval	AC	14/11/19
B	D/1 outlet rock chnaged	AC	19/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	AC	04/11/19
DRAWN	AC	04/11/19

DATE	ORIGINAL SCALE	ORIGINAL SIZE
19/06/2020	H 1:100 V 1:100	A3

DRAWING NO. 41351-DR-C-5702

REVISION B

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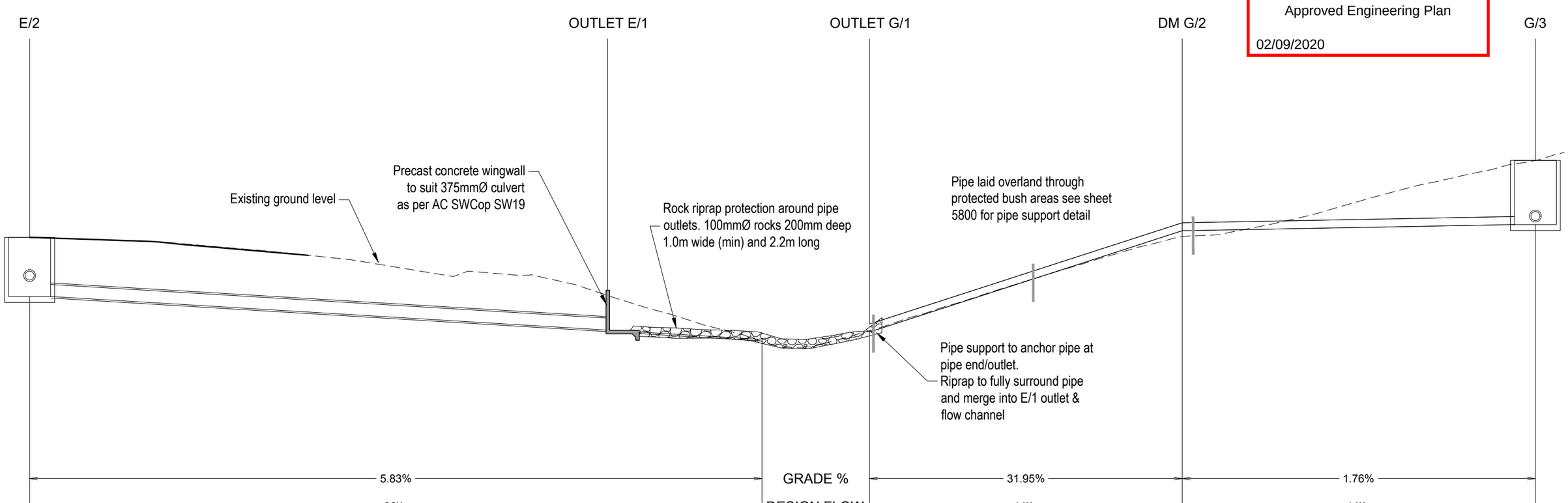
02/09/2020



		5.83%	GRADE %	31.95%	1.76%	
		96l/s	DESIGN FLOW	14l/s	14l/s	
		300	PIPE SIZE (mm)	200	200	
		CLASS 2 RCRRJ	PIPE TYPE	PE100 PN10 SDR 17	PE100 PN10 SDR 17	
		AC-SW-03 H2 BEDDING	BEDDING	PIPE SUPPORT DETAIL	THRUSTED	
		50.00	DATUM	50.00		
1.48	DEPTH TO INVERT	-0.06		-0.17	-0.31	1.60
58.46	INVERT LEVEL	57.39		57.60	60.10	60.26
59.94	DESIGN SURFACE LEVEL	57.69		57.8	60.3	61.86
18.33	DISTANCE	18.33		7.82	8.84	16.66
		0		0	7.82	

STORMWATER LINE E

STORMWATER LINE G

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Albany

Stormwater Outlet Detail
Lines E & G

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for Engineering approval	AC	14/11/19
B	G/1 outlet edited	AC	19/06/2020

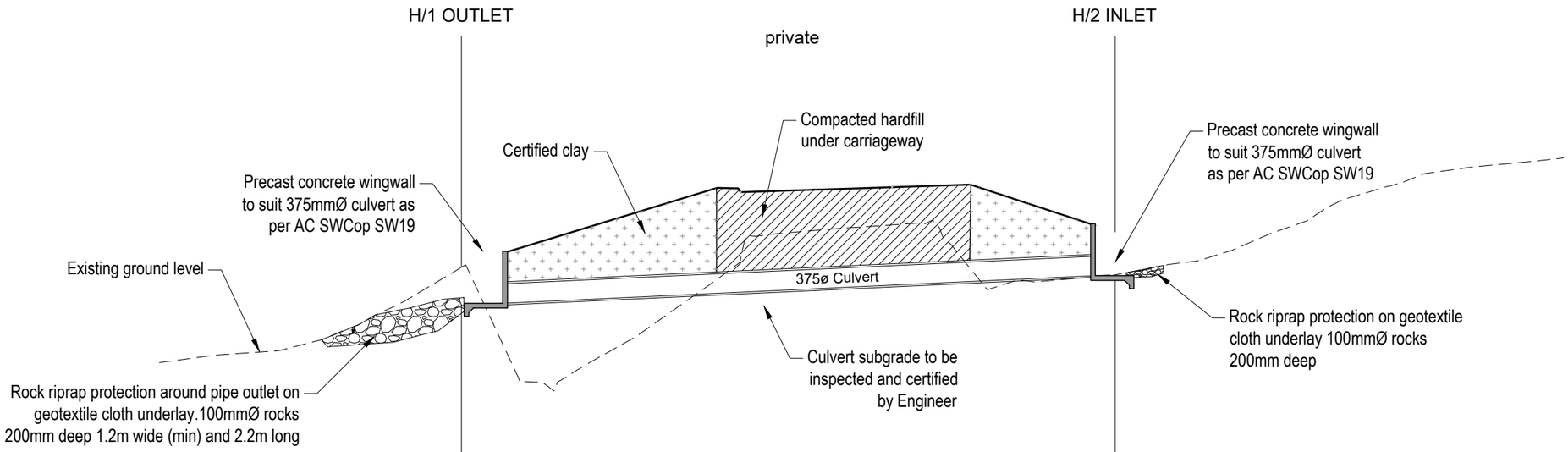
FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	AC	04/11/19
DRAWN	AC	04/11/19

DATE	ORIGINAL SCALE	ORIGINAL SIZE
19/06/2020	H 1:100 V 1:100	A3

DRAWING NO. 41351-DR-C-5703

REVISION B



GRADE %	4.58%	
DESIGN FLOW	32l/s	
PIPE SIZE (mm)	375	
PIPE TYPE	CLASS 4 RCRRJ	
BEDDING	AC-SW-03 H2 BEDDING	
DATUM R.L. 16.0m		
DEPTH TO INVERT	0.73	0.83
INVERT LEVEL	25.73	26.30
DESIGN SURFACE LEVEL	26.1	27.13
DISTANCE	0	12.6

STORMWATER LINE H

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Stormwater Outlet Detail
Line H (Private)

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for Engineering approval	AC	14/11/19
B	Line H labeled as private	AC	19/06/2020

FOR ENGINEERING APPROVAL

	NAME	DATE
SURVEYED		
DESIGNED	AC	04/11/19
DRAWN	AC	04/11/19

DATE	ORIGINAL SCALE	ORIGINAL SIZE
14/11/19	H 1:100 V 1:100	A3

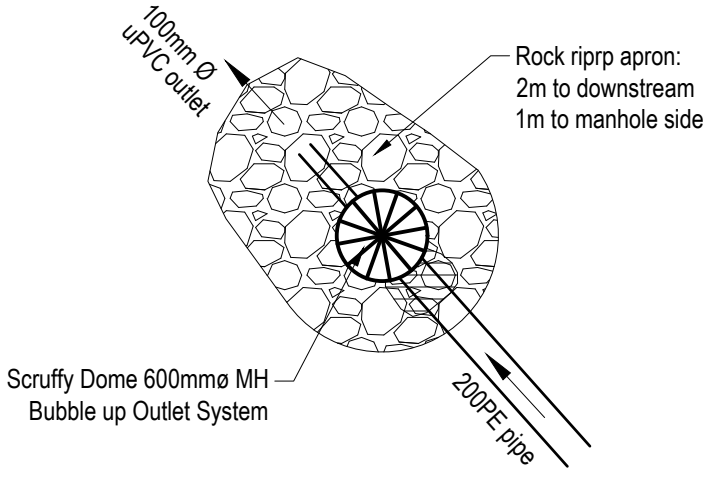
DRAWING NO. 41351-DR-C-5704
REVISION B

Auckland Council

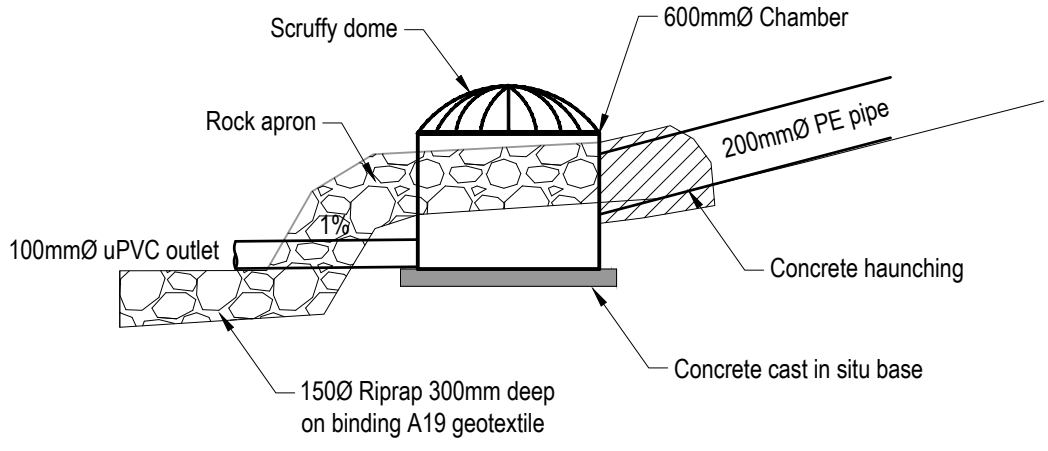
ENG60330592 GREG HALL

Approved Engineering Plan

02/09/2020



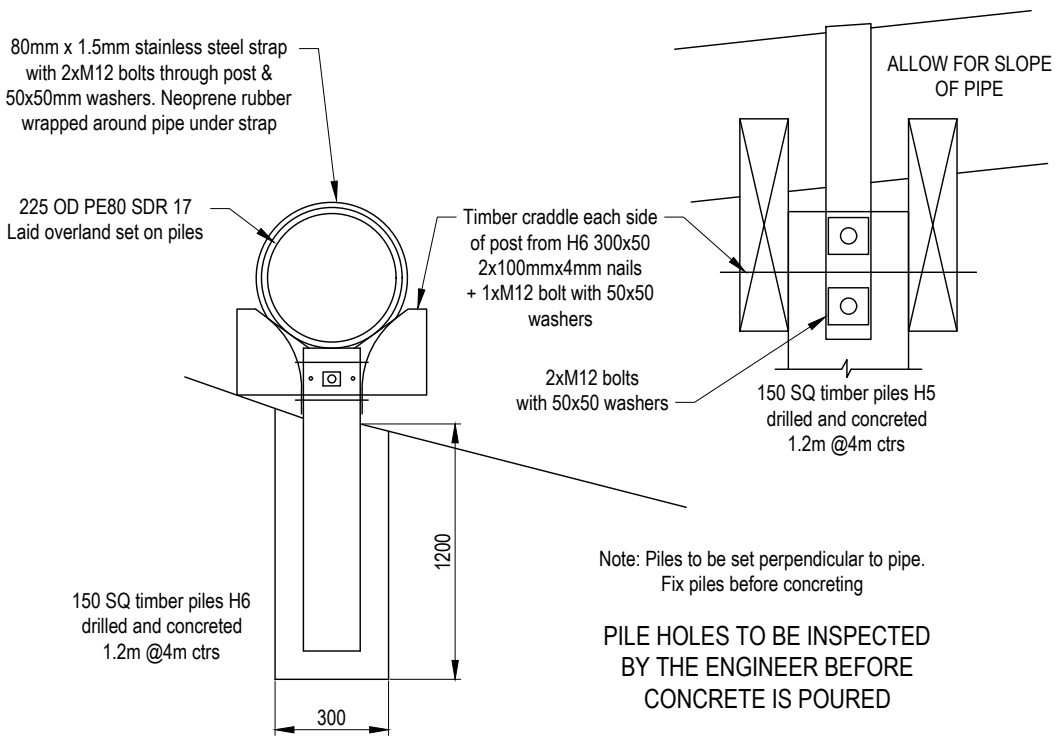
Plan View



Section View

Catchpit Bubble-Up Outlet Detail

Not to Scale



PILE SUPPORT FOR PE
PIPE LAID OVERLAND

Not to Scale

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	MF	09/07/19
C	Catchpit outlets changed to bubble ups	AC	22/06/2020

SURVEYED			
DESIGNED		AC	13/11/18
DRAWN		AC	13/11/18
DATE 22/06/2020	ORIGINAL SCALE As shown	ORIGINAL SIZE A3	
DRAWING NO. 41351-DR-C-5800		REVISION C	

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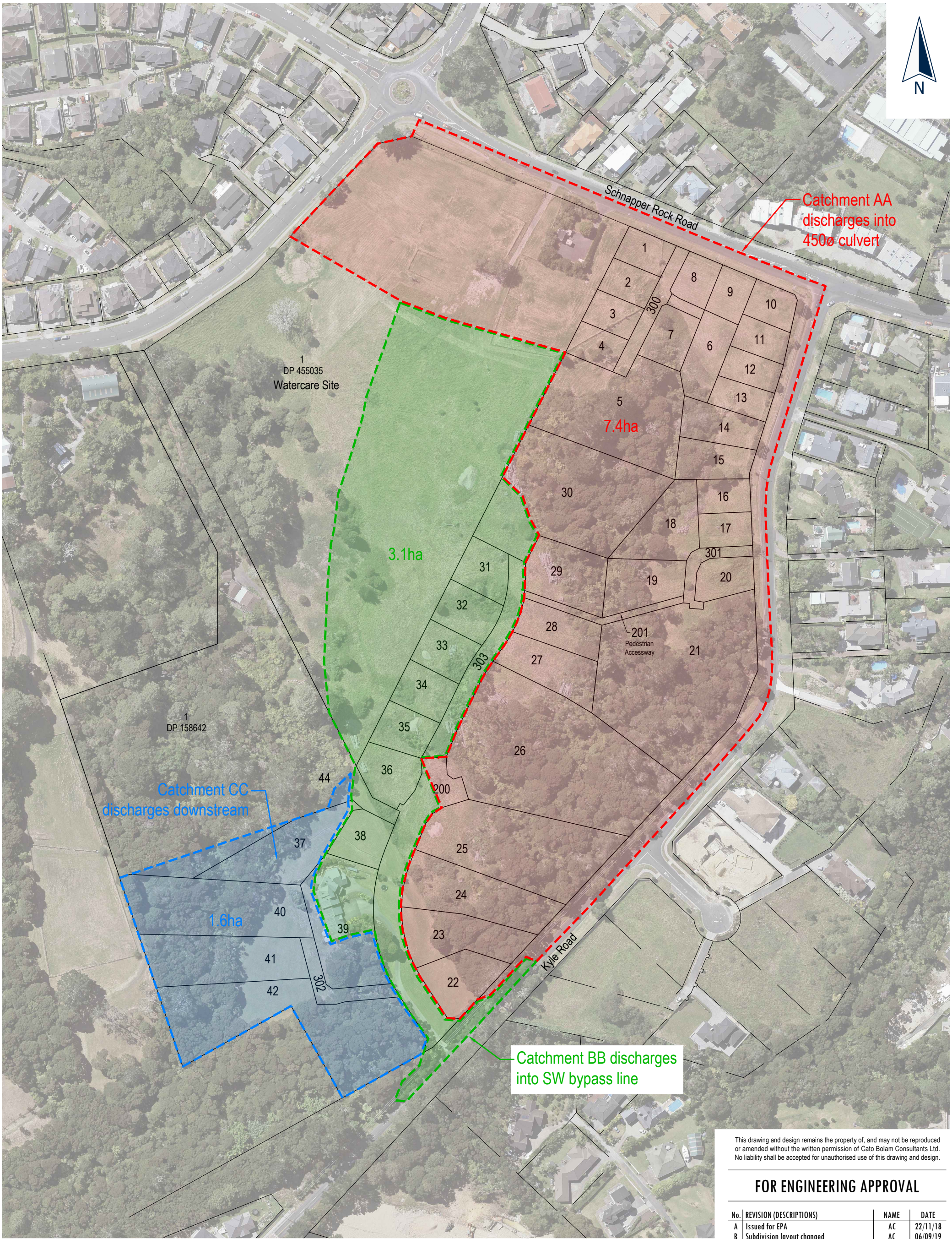
55 Schnapper Rock Rd & 52 Kyle Rd
Albany

Stormwater
Pipe Support & Dispersal T-Bar
Details

APPENDIX C: 55 SCHNAPPER ROCK - OLFP DESIGN



FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	AC	06/09/19

SURVEYED		
DESIGNED	AC	02/07/18
DRAWN	TM	02/07/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
06/09/19	1:2000	A3

DRAWING NO.	REVISION
41351-DR-C-5200	B

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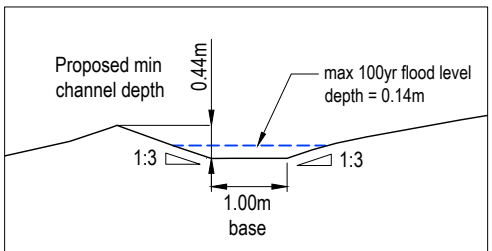
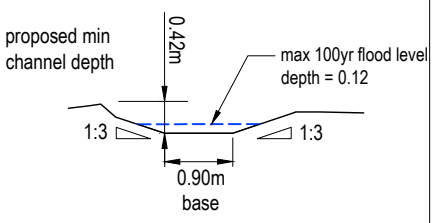
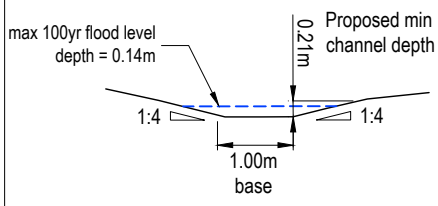
Stormwater Catchment Plan



OLFP 1



OLFP 2, 3 & 4



OLFP 5

Typical Cross Sections

LEGEND

- CATCHMENTS
- OVERLAND FLOW PATH
- 35 PROPOSED CONTOURS MAJOR
- PROPOSED CONTOURS MINOR

Existing Watercourse Types

- Ephemeral Stream
- Intermittent Stream
- Permanent Stream

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for EPA	AC	22/11/18
B	Subdivision layout changed	AC	29/08/19

SURVEYED			
DESIGNED		AC	02/07/18
DRAWN		TM	02/07/18
DATE 06/09/19	ORIGINAL SCALE 1:2000	ORIGINAL SIZE A3	
DRAWING NO. 41351-DR-C-5300		REVISION B	

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Albany

Overland Flowpath

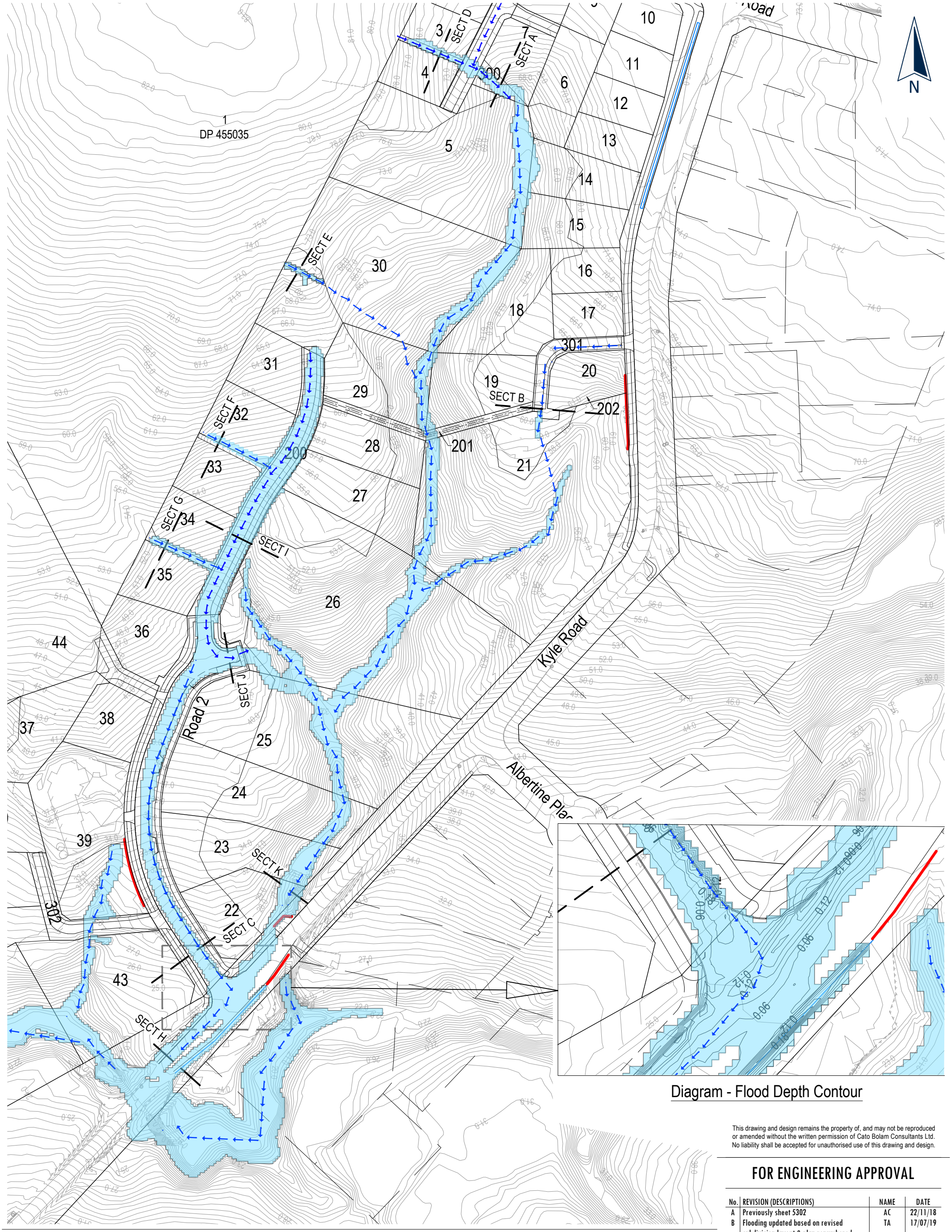

Diagram - Flood Depth Contour

FOR ENGINEERING APPROVAL

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Previously sheet 5302	AC	22/11/18
B	Flooding updated based on revised subdivision layout & plan renumbered	TA	17/07/19
SURVEYED			
DESIGNED		TA	15/10/18
DRAWN		TA	17/10/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
17/10/18	1:1500	A3

DRAWING NO.	REVISION
41351-DR-C-5303	B

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55 Schnapper Rock Rd & 52 Kyle Rd
Albany

Post-Development Flood Map

Manning Formula Calculation Sheet

Client	HL Develpoments Albany Ltd & Golden Horse Land Development Ltd
Job Address	55 Schnapper Rock Road & 52 Kyle Rd Albany

Job No:	41351
Date:	22-Aug-19
	Inputs
	Calculations
	Results

Manning Formula $V = 1/nR^{2/3}s^{1/2}$

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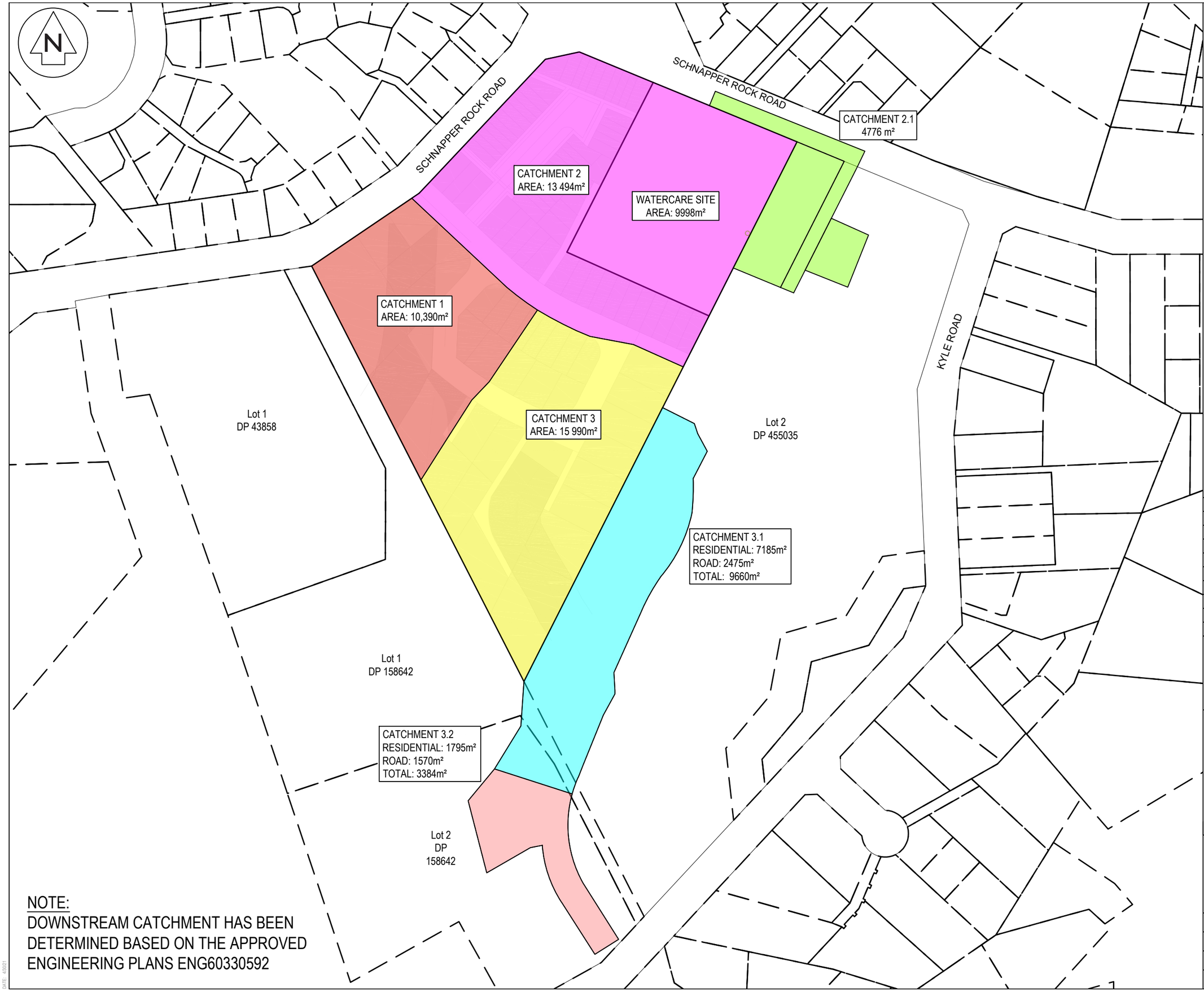
	Section A OLFP 5	Section B Drive lot 301	Section C Road 2 start	Section D OLFP 4	Section E OLFP 3	Section F OLFP 2	Section G OLFP1	Section H Kyle Rd (Bypass Blocked)	Section H Kyle Rd (Bypass working)	Section I Drive lot 303	Section J Road 2 end	
Parameters	**Values**	**Values**	**Values**	**Values**	**Values**	**Values**	**Values**	**Values**	**Values**	**Values**	**Values**	
Mannings Roughness Coefficient (n)	0.050	0.025	0.025	0.050	0.050	0.050	0.050	0.025	0.025	0.025	0.025	
Flow Area (A)	0.20	0.09	0.15	0.13	0.15	0.12	0.20	1.31	0.39	0.41	0.51	m^2
Wetted perimeter (P)	2.09	2.56	3.06	1.59	1.66	1.53	1.91	13.10	6.34	6.97	6.63	m
Hydraulic Radius R = A/P	0.096	0.037	0.049	0.084	0.090	0.078	0.105	0.100	0.062	0.059	0.077	
Slope S = H/L	0.26	0.12	0.12	0.20	0.08	0.16	0.15	0.10	0.10	0.11	0.05	
Velocity (V)	**2.134**	**1.543**	**1.879**	**1.719**	**1.134**	**1.443**	**1.744**	**2.670**	**1.931**	**2.007**	**1.618**	m/s
Flow (Q)	**0.427**	**0.145**	**0.282**	**0.230**	**0.169**	**0.173**	**0.349**	**3.498**	**0.753**	**0.823**	**0.825**	m^3/s
TP108 catchment flow	0.410	0.112	0.23	0.213	0.143	0.143	0.31	3.45	0.70	0.81	0.81	m^3/s
Channel capacity >= Catchment flow	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	
Flow Depth	0.14	0.075	0.09	0.11	0.12	0.1	0.14	0.2	0.16	0.14	0.16	m

APPENDIX D: CONCEPT CATCHMENT PLANS AND CALCULATION



NOTE:
DOWNSTREAM CATCHMENT HAS BEEN DETERMINED BASED ON THE APPROVED ENGINEERING PLANS ENG60330592

DATE: 4/30/21

Legend
EX BDY
PROP BDY

Rev	Description	By	Date
B	S92 CATCHMENT UPDATE	JD	04/21
A	PLAN CHANGE	AP	02/21

	By	Date
Survey	-	-
Design	AP	02/21
Drawn	AP	02/21
Checked	JD	02/21

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5 Owens Road, Epsom
Auckland 1023

Project
57 SCHNAPPER ROCK RD
SCHNAPPER ROCK
DEVELOPMENT
FOR
KBS DESIGN GROUP LTD.

Title
PROPOSED
10 YEAR CATCHMENT
PLAN

Project no.	175006		
Scale	1:1500 @ A3		
Cad file	C450 - SW CAPACITY.DWG		
Drawing no.	C450	Rev	A

Maven Associates

Job Number	Sheet	Rev		Author	Date	Checked
175006	1	B	Calc Title: Pipe Capacity Check	JD	23/04/2021	JP

Rainfall Depth ARI 10YR (mm)
TP108 rainfall data 140
Climate change Increase 158.48 (assuming 2.1C increase in temperature)

Pipe ks factor = 0.15 mm (pipes up to 1.0m dia)

	CN Number		CN Number	
Impervious area	98	Residential Lots	89.6	Equivalent CN - (65% impervious coverage, 35% pervious coverage)
Pervious	74	Proposed Roads	94.4	Equivalent CN - (85% impervious coverage, 15% pervious coverage)
		Proposed ROW	98	Equivalent CN - (100% impervious coverage, 0% pervious coverage)

Pipe Line *number*	Catchment *number*	Catchment Area *m2*	CN	Peak Flow rate - 10YR ARI *l/s*	Cum. Flow *l/s*	Pipe dia *m*	Gradient *%*	Capacity *l/s*	Velocity *m/s*	Check OK
LINE 1										
J/1 to A/7	*3 - Resi*	13740	89.6	334.898						
	3 - Road	2250	94.4	57.731	392.629	0.300	13.80	492.52	6.97	OK
A/4 - A/3	*3.1 - Resi*	7185	89.6	175.127						
	3.1 - Road	2475	94.4	63.504	631.259	0.375	7.54	651.82	5.90	OK
A/1 - K/3	*3.2 - Resi*	1795	89.6	43.751						
	3.2 - Road	1570	94.4	40.283	**715.294**	0.375	12.32	833.37	7.55	OK
LINE 2										
B/4 - B/3	*2- Resi*	6924	89.6	168.765						
	2- Road	6570	98	172.486						
	WATERCARE SITE	9998	98	262.484	603.735	0.525	7.74	1588.27	7.34	OK
B/2 - B/1	*3.1 - Resi*	7185	89.6	175.127						
	3.1 - Road	2475	98	64.978	843.840	0.600	2.61	1305.42	4.62	OK

Refer to ENG60330592 for designed gradients and sizing of downstream stormwater network.

N

CATCHMENT 4
AREA : 2,420m²

Qp=0.094m³/s

Schnapper Rock Road

Schnapper Rock Road

CATCHMENT 5
AREA : 19,570m²

82.00
80.00
78.00
76.00
74.00
72.00
70.00

CATCHMENT 3
AREA : 3,340m²
DISCHARGE INTO OLFP 3

OLFP 3
Qp=0.169m³/s

SUBDIVISION AT NEIGHBOURING
55 SCHNAPPER ROCK
UNDER CONSTRUCTION

Lot 1
DP 43858

Qp=0.760m³/s

CATCHMENT 2
AREA : 2,630m²
DISCHARGE INTO OLFP 2

CATCHMENT 1
AREA : 9,000m²
DISCHARGE INTO OLFP 1

Lot 2
DP 455035

CATCHMENT 6
AREA : 2,950m²

OLFP 2
DESIGN Qp=0.173m³/s

Lot 1
DP 158642

OLFP 1
DESIGN Qp=0.349m³/s

Qp=0.114m³/s

NOTE:

OLFPs 1, 2 AND 3 TO BE CONVEYED THROUGH FUTURE SWALE DESIGNED AS PART OF ADJACENT SUB-DIVISION. REFER TO CALCULATIONS IN INFRASTRUCTURE REPORT PREPARED BY CATO BOLAM (DATED 11/2019).

Legend
- EX BDY
- PROP BDY
- OVERLAND FLOWPATH

Rev	Description	By	Date
A	DRAFT	AP	FEB 2021

	By	Date
Survey	-	-
Design	AP	FEB 21
Drawn	AP	FEB 21
Checked	JD	FEB 21

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Auckland 1023

Project
57 SCHNAPPER ROCK RD
SCHNAPPER ROCK
DEVELOPMENT
FOR
KBS DESIGN GROUP LTD.

Title
PROPOSED
OVERLAND CATCHMENT
PLAN

Project no.	175006		
Scale	1:1500 @ A3		
Cad file	C450 - OLFP.DWG		
Drawing no.	C451	Rev	A

DATE: 4/03/21

MAVEN ASSOCIATES	Job Number 175006	Sheet 1	Rev A
Job Title 53 Schnapper Rock Road Calc Title TP108 Calculation - Catchment 1	Author AP	Date 12.02.21	Checked JD

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Impervious (60%)	98	0.5400	52.92
C	Pervious (40%)	74	0.3600	26.64
* from Appendix B		Totals =	0.900	79.56

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{79.56}{0.900} =$ 88.4

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 0.3600}{0.900}$ 2.0 mm

2. Time of Concentration

Channelisation factor C = 0.8 (From Table 4.2)

Catchment length L = 0.17 km (along drainage path)

Catchment Slope Sc= 0.01 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{88.4}{200-88.4} =$ 0.79

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

$= 0.14 \quad 0.8 \quad 0.31 \quad 1.14 \quad 3.98 =$ 0.16 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c =$ 0.11 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 175006	Sheet 2	Rev A
Job Title	53 Schnapper Rock Road	Author	Date	Checked
Calc Title	TP108 Calculation - Catchment 1	AP	12.02.21	JD

1. Data

Catchment Area	A=	0.009	km2(100ha =1km2)
Runoff curve number	CN=	88.4	(from worksheet 1)
Initial abstraction	Ia=	2.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 33.3 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth, P24	245.3	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.78	
6. Specific peak flow rate q*	0.158	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.349**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	214.0	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	1925.87	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 175006	Sheet 1	Rev A
Job Title 53 Schnapper Rock Road Calc Title TP108 Calculation - Catchment 2	Author AP	Date 12.02.21	Checked JD

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Impervious (60%)	98	0.1579	15.48
C	Pervious (40%)	74	0.1053	7.79
* from Appendix B		Totals =	0.263	23.27

CN (weighted) = total product / total area = 23.27 / 0.263 = 88.4

Ia (average) = 5 x pervious area / total area = 5 x 0.1053 / 0.263 = 2.0 mm

2. Time of Concentration

Channelisation factor C = 0.8 (From Table 4.2)

Catchment length L = 0.82 km (along drainage path)

Catchment Slope Sc= 0.01 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 88.4 / (200- 88.4) = 0.79

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.14 0.8 0.88 1.14 3.98 = 0.44 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.30 hrs

OK
use
0.444633 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 175006	Sheet 2	Rev A
Job Title	53 Schnapper Rock Road	Author	Date	Checked
Calc Title	TP108 Calculation - Catchment 2	AP	12.02.21	JD

1. Data

Catchment Area	A=	0.002632	km2(100ha =1km2)
Runoff curve number	CN=	88.4	(from worksheet 1)
Initial abstraction	Ia=	2.0	mm (from worksheet 1)
Time of concentration	tc=	0.44	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 33.3 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth, P24	245.3	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.78	
6. Specific peak flow rate q*	0.158	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.102**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	214.0	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	563.21	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 175006	Sheet 1	Rev A
Job Title 53 Schnapper Rock Road Calc Title TP108 Calculation - Catchment 3	Author AP	Date 12.02.21	Checked JD

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Impervious (60%)	98	0.2004	19.64
C	Pervious (40%)	74	0.1336	9.89
* from Appendix B		Totals =	0.334	29.53

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{29.53}{0.334} =$ 88.4

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 0.1336}{0.334}$ 2.0 mm

2. Time of Concentration

Channelisation factor C = 0.8 (From Table 4.2)

Catchment length L = 0.13 km (along drainage path)

Catchment Slope Sc= 0.01 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{88.4}{200- 88.4} =$ 0.79

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.14 0.8 0.26 1.14 3.98 = 0.13 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.09 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 175006	Sheet 2	Rev A
Job Title	53 Schnapper Rock Road	Author	Date	Checked
Calc Title	TP108 Calculation - Catchment 3	AP	12.02.21	JD

1. Data

Catchment Area	A=	0.00334	km2(100ha =1km2)
Runoff curve number	CN=	88.4	(from worksheet 1)
Initial abstraction	Ia=	2.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 33.3 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth, P24	245.3	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.78	
6. Specific peak flow rate q*	0.158	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.130**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	214.0	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	714.71	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 175006	Sheet 1	Rev A
Job Title 53 Schnapper Rock Road Calc Title TP108 Calculation - Catchment 4	Author AP	Date 12.02.21	Checked JD

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Impervious (60%)	98	0.1453	14.24
C	Pervious (40%)	74	0.0969	7.17
* from Appendix B		Totals =	0.242	21.41

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{21.41}{0.242} = 88.4$

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 0.0969}{0.242}$ 2.0 mm

2. Time of Concentration

Channelisation factor C = 0.8 (From Table 4.2)

Catchment length L = 0.05 km (along drainage path)

Catchment Slope Sc= 0.01 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{88.4}{200-88.4} = 0.79$

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

$= 0.14 \quad 0.8 \quad 0.14 \quad 1.14 \quad 3.98 = 0.07$ hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c = 0.05$ hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 175006	Sheet 2	Rev A
Job Title	53 Schnapper Rock Road	Author	Date	Checked
Calc Title	TP108 Calculation - Catchment 4	AP	12.02.21	JD

1. Data

Catchment Area	A=	0.002422	km2(100ha =1km2)
Runoff curve number	CN=	88.4	(from worksheet 1)
Initial abstraction	Ia=	2.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 33.3 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth, P24	245.3	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.78	
6. Specific peak flow rate q*	0.158	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.094**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	214.0	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	518.27	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 175006	Sheet 1	Rev A
Job Title 53 Schnapper Rock Road Calc Title TP108 Calculation - Catchment 5	Author AP	Date 12.02.21	Checked JD

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Impervious (60%)	98	1.1742	115.07
C	Pervious (40%)	74	0.7828	57.93
* from Appendix B		Totals =	1.957	173.00

CN (weighted) = total product / total area = 173.00 / 1.957 = 88.4

Ia (average) = 5 x pervious area / total area = 5 x 0.7828 / 1.957 = 2.0 mm

2. Time of Concentration

Channelisation factor C = 0.8 (From Table 4.2)

Catchment length L = 0.225 km (along drainage path)

Catchment Slope Sc= 0.01 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 88.4 / (200- 88.4) = 0.79

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.14 0.8 0.37 1.14 3.98 = 0.19 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.13 hrs

OK
use
0.189376 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 175006	Sheet 2	Rev A
Job Title	53 Schnapper Rock Road	Author	Date	Checked
Calc Title	TP108 Calculation - Catchment 5	AP	12.02.21	JD

1. Data

Catchment Area	A=	0.01957	km2(100ha =1km2)
Runoff curve number	CN=	88.4	(from worksheet 1)
Initial abstraction	Ia=	2.0	mm (from worksheet 1)
Time of concentration	tc=	0.19	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 33.3 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth, P24	245.3	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.78	
6. Specific peak flow rate q*	0.158	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.760**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	214.0	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	4187.70	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 175006	Sheet 1	Rev A
Job Title 53 Schnapper Rock Road Calc Title TP108 Calculation - Catchment 6	Author AP	Date 12.02.21	Checked JD

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Impervious (60%)	98	0.1768	17.32
C	Pervious (40%)	74	0.1178	8.72
* from Appendix B		Totals =	0.295	26.04

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{26.04}{0.295} =$ 88.4

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 0.1178}{0.295}$ 2.0 mm

2. Time of Concentration

Channelisation factor C = 0.8 (From Table 4.2)

Catchment length L = 0.13 km (along drainage path)

Catchment Slope Sc= 0.01 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{88.4}{200- 88.4} =$ 0.79

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.14 0.8 0.26 1.14 3.98 = 0.13 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.09 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 175006	Sheet 2	Rev A
Job Title	53 Schnapper Rock Road	Author	Date	Checked
Calc Title	TP108 Calculation - Catchment 6	AP	12.02.21	JD

1. Data

Catchment Area	A=	0.002946	km2(100ha =1km2)
Runoff curve number	CN=	88.4	(from worksheet 1)
Initial abstraction	Ia=	2.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 33.3 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth, P24	245.3	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.78	
6. Specific peak flow rate q*	0.158	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.114**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	214.0	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	630.40	(m3)

Worksheet 2: Graphical Peak Flow Rate

APPENDIX E: STORMWATER MANAGEMENT TABLE

PROPOSED STORMWATER MANAGEMENT

• Amendments to the SMP will need to include enough detail to complete the below table (as part of the SMP approval process). Please clarify the highlighted sections.

Stormwater management catchment	Proposed land use	Receiving environment (type & SEA)	Water quality management	Hydrology mitigation (retention)	Hydrology mitigation (detention)	Flood management	Outlet design	Assets to be vested with council	General comments
Catchment 1 Total area approx. 10,390	• Single house • Mixed housing suburban	Tributary of Te Wharau Creek	Public roads to be treated Commonly owned driveways to be treated, through a communal device.	SMAF 1 overlay 5mm retention required for all impervious surfaces. Reuse tanks for all roofs plumbed for non potable reuse. Retention achieved for public roads achieved through volume addition within raingarden Retention to be achieved for common accessways through infiltration	SMAF 1 overlay 95th percentile detention Detention volume included into the designed raingardens for public roads. Detention volume to be included in the designed underground tank (proprietary device)	Overland paths to be maintained through western gully	Erosion protection at new outlet for stream within SEA on western boundary of site. Green space principles shall be designed to minimise potential erosion	• Pipe Network • SW management devices located on public roads (to AT)	SW management devices located on private roads or private property to remain the responsibility and ownership of land owner.
Catchment 2 Total area 13,494 m2 (plus runoff from watercare site)	Mixed housing suburban	Connection to network in adjacent development. Discharges to tributary of Te Wharau Creek				Attenuation not required. Overland flow paths as allowed for by adjacent development Development cannot discharge to adjacent site until downstream pipes completed	n/a - Connection to network in adjacent development		
Catchment 3 Total area 15 990	• Single house • Mixed housing suburban								