Review of Stormwater Systems at Bryans Beach

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Cover Photo: One of the Bryans Road stream culverts

Contents

Tables and Figures

Chapter 1: Introduction

1.1 Background

The settlement of Bryans Beach has had little specific design in terms of public stormwater and drainage infrastructure. Damage from landslides, at least partially attributed to stormwater mismanagement, and stormwater erosion experienced during the July 2004 major storm event have indicated that a review of the stormwater management system is due.

Opotiki District Council have commissioned this review along with a report by Riley Consultants to review the landslide risks at Bryans Beach. The Riley report found that many of the slips were at least partially caused through the inadequate management of stormwater runoff in the upper catchments.

1.2 Purpose and scope

The purpose of this report is to quantify the design stormwater flows to be expected at key locations in the settlement area and recommend sound ways to deal with these in keeping with engineering best practice. Through discussion with some effected landowners, other issues and concerns were highlighted and attempts were made to address these within the scope of a stormwater system review.

The design criteria adopted for this plan are that stormwater be contained within pipes in the immediate vicinity of dwellings to the level of the 10-year Return Period Rainstorm. Flows in excess of this, up to the 50-year event, are to be conveyed through designated overland flow paths and are to be shown to give 500mm vertical freeboard below a level at which they would enter a dwelling space.

The road culverts have been sized to pass the 100 year event by not heading up higher than 500mm below the road surface, and to pass the 10 year flow by not heading up at all, as recommended in Environment Bay of Plenty's Hydrological and Hydraulic Guidelines.

A further design criteria was adopted that any collected, concentrated, or otherwise managed stormwater in the upper catchment be safely conveyed to the toe of the slope at the floor of the valley. These flows were estimated at 20-year return period levels in keeping with erosion control management as outlined in Environment Bay of Plenty's guidelines.

It must be remembered that the solutions here are proposals only, highlighting only some of the many possible solutions. Alternatives may become implemented for whatever reason following discussion with the parties involved. Also this report does not indicate who should fund the various proposals described. This is intended as a technical outline of a workable solution.

Although the designer met with many of the residents on site, it is not to be assumed that any of the proposals described here are supported by all the affected parties, and therefore thorough consultation may be still required.

In cases on private land where the occupier is satisfied with the level of flood protection, even though calculations show this to be below the adopted design criteria, I have tried to quantify the existing system as well as recommending an option that meets the design objectives. Of course it is up to the landowner whether he/she follows the recommendation or not. There is no legal requirement that I know of to update an existing private stormwater management system if it can be shown that no other parties are effected.

Chapter 2: Hydrology

For the purposes of estimating design flows by the Rational Method, the upper catchments at Bryans Beach were been taken to consist of Medium Soakage soil types with bush and scrub cover. Runoff Coefficients were adjusted to account for steepness by way of the Average Channel Slope. The catchment areas and Runoff Coefficients adopted are shown in Table 2. Normalised sub-catchments were also evaluated to enable design of the general specification for pipe flumes. The design discharges at the catchment at 33 Bryans Road, due to its larger size, was taken to be an average of the values estimated by the Rational Method and the TM61 method.

Rainfall intensities were taken from the HIRDS (High Intensity Rainfall Design System) database developed by the National Institute of Water and Atmospheric Research. These values were increased by 10% to account for the expected effects of Global Climate Change in the next 50 years. The design rainstorm duration was taken to coincide with the estimated Time of Concentration for the larger catchment. In this case: 10 minutes. Table 1 shows the adopted rainfall intensities for various return period events. Table 2 gives the resulting Design Flows.

Table 1 Rainfall Intensities for Storms of 10 Minute Duration at Bryans Beach

Return Period	Years	5	10	20	50	100
Rainfall Intensity	mm/hour	99	119	139	158	178

Table 2 Design Flows for Catchments at 239 Ohiwa Beach Road

Location	Area		Runoff Coefficient	Q5	Q10	Q20	Q50	Q100
	ha	m^2	C	L/s				
33 Byrans Road	35.9	359000	0.27	1820	2170	2520	2930	3230
Bryans Road Outfall	43.7	437000	0.27	2130	2540	2949	3429	3780
21 Bryans Road	3.1	31000	0.35	307	359	419	476	536
273a Ohiwa Beach Road	3.8	38000	0.35	377	440	514	584	658
239 Ohiwa Beach Road	6.1	61000	0.3	519	605	707	803	905
Outfall at 239 Ohiwa Beach Road	7.3	73000	0.3	621	724	846	961	1083
Per m Sealed Road Length		6	0.85	0.145	0.169	0.197	0.224	0.252
Per m Unsealed Road		6	0.50	0.085	0.099	0.116	0.132	0.148
Per m^2 Roof Area		1	0.90	0.26	0.030	0.035	0.040	0.045
Per m^2 Paving Area		1	0.85	0.024	0.028	0.033	0.037	0.042
Per m^2 Mown Area		1	0.30	0.009	0.010	0.012	0.013	0.015
Per m^2 Long Grass/Scrub		1	0.27	0.008	0.009	0.010	0.012	0.013

Chapter 3: Catchment at 239 Ohiwa Beach Road

(Consisting of land occupied by Lamont, Witt, Gould, Stephens, Hayes, Opotiki District Council and others)

3.1 Existing System

Around the upper edge of the catchment water is collected at culverts/drains on the ridge-top access road that services several of the properties. Stormwater is also collected from roofs and paved areas, and some grassed areas. In most cases this is piped to the lower slopes in flexible 100mm or 160mm diameter pipe. In a few cases it is discharged directly to the steep upper slopes.

Stormwater from the upper part of the catchment is carried down through the Opotiki District Council Reserve and to the West of the Hayes/Stephens buildings in an open drain. It crosses under the Hayes/Stephens/Tollemache driveway in a 300mm concrete pipe into a concrete well/manhole. Downstream of this point it appears that a 600mm concrete pipe leads to a 450mm diameter concrete pipe which crosses under the road. The actual pipe layout here has not been confirmed. Discharge is direct to the sand dunes from there.

3.2 Recognised issues/concerns

3.2.1 Sediment/debris load

The debris and sediment load in the lower catchment channel is causing concern for residents, they routinely clear grass and sticks from steel mesh gratings placed across the channel. The sediment load is due to erosion; some of which can be attributed to landslides, but also to modifications to the land immediately upstream of the reserve. In this location recently cut drainage channels are yet to stabilise and are actively eroding.

3.2.2 Erosion in Channel against Driveway

The open channel beside the Hayes/Stephens/Tollemache driveway is eroding, causing the driveway to collapse in several places.

3.2.3 Size of Channels and Pipes

The 450mm diameter road culvert is undersized. It will not pass the Q10 flow without overtopping of the makeshift manhole/sump at its inlet. The true configuration of pipes at this point could not be confirmed. An optimistic estimate shows that its capacity is not sufficient.

In a 50-year event, the culvert is estimated to head up to Reduced Level: 6.315m (Moturiki Datum). This would be 200mm deep in the garage at number 243 Ohiwa Beach Road and gives 0.85m freeboard to the house itself. This is assuming that the entrance is not constricted with debris as is likely and that the downstream channel isn't compromised by sand build-up from the dunes.

The new timber lined open channel beside Jack Stephens' house (0.8m wide x .35m deep) is just large enough to pass the 50-year event. This gives a freeboard of 0.64m to the floor in the room at the back of the house. Assuming no debris or silt build up in the channel. This new channel restricts the accessway around the side of the house. Considering that the only external access to the rear of the house is beside this channel and that people could normally walk there in the dark the widened box channel increases the risk to occupants and should be covered.

3.2.4 Dune build up and partial blockage of the culvert mouth

The existing culvert mouth is located hard against the road shoulder and requires periodic clearing of sand to maintain an open channel through the dunes. Apart from the risk of system failure and the cost of maintaining the channel, this clearing is not in keeping with current best practices of dune establishment to protect against coastal erosion, wave run-up etc. The culvert should be extended and the (shortened) channel maintained through appropriate dune plantings on either side (detailed in section 3.3.2 below).

3.2.5 Contamination of runoff from septic tank effluent

Septic tank effluent is seeping into the pipes in the lower catchment immediately upstream of the road contaminating the stream and creating a potential health hazard in the dunes.

3.2.6 Debris/silt in Road runoff

Debris and soil from the road cutting immediately to the West of the valley mouth is being deposited on the driveway during heavy rain. District Council recently installed a head-works on the smaller road culvert to capture this material but the flow is crossing the road and bypassing this. A formed water table on the seaward side of the road is required.

3.2.7 Concentrated discharge to steep slopes from roadways and roofs in the upper catchment

As emphasised during the July 2004 event, direct discharge to ground at or near steep slopes can lead to slope failure. One practical solution to this is to collect all managed stormwater at source and convey it to the valley floor in flexible plastic flumes. In most cases investigated this is already being implemented. A general specification has been developed for the sizing and installation of these flumes (Drawing Sheet 4).

3.2.8 Risk of diversion of roadway water collection system in the upper catchment

The section of access road from Ohiwa Beach Road to the ridge top currently performs as a collection and removal system. The road is sealed and a low concrete bund and/or dish shape runs the length of the road, collecting water to concentration points for fluming to the valley floor. Difficulties arise in storm situations when debris can block the flume entrances causing the water to spill onto the slope. Also, as happened in July, a slip onto the road can block the dish shape thereby diverting water over the edge and down the slope.

3.3 Design proposal

The following design solution is proposed to address the above concerns.

3.3.1 Upper catchment water collection and conveyance system

All concentrated stormwater in the upper catchment is to be collected and conveyed to the valley floor. This includes roof-water and overflow from roof-water collection tanks, road gutter water and runoff from paved or mown areas.

A general specification for hill slope stormwater collection and fluming is included in Appendix 2.

The risks to the existing collection and fluming system associated with the access road outlined in 3.2.8 are inevitable and very difficult to eliminate. Therefore it is recommended that collection points and flumes be spaced at closer intervals along the roadway to reduce the amount of water released in any one future spill. This also eases the load on flume entrances in the case of partial debris blockages. Flume entrances can be designed with increased capacity by building higher headwall-bunds and lowering the entrance by retreating it further off the road (see Drawing Sheet 4). Flumes to be 160mm OD lined non-perforated drain-coil type, extended down-slope to the toe of the slope in the valley floor. Flume entrances are to be designed so that in the event of them being overwhelmed, they spill back onto the road-way or towards the next collection point (if possible). Debris racks are also recommended at flume entrances and must be maintained if fitted. These flume entrances are to be adequately anchored to the slope to stop them being carried away.

It is recommended that no additional runoff be discharged to the concrete dished driveway (steep initial section) due to the risk of slips blocking the dish as in 3.2.8 above. Therefore the collected flow from the Campbell, Reynolds and Brown properties should be conveyed to the bottom of the valley in pipe flumes. The existing PVC pipe conveying this water to the concrete dish driveway appears to be leaking and may have contributed to the small slip on the lower slopes of the Brown Property. This should be checked and repaired if necessary.

3.3.2 Road culvert

The layout and details of this design proposal is outlined in Drawing Sheet 1 attached.

The road culvert under Ohiwa Beach Road at the mouth of the valley is to be removed and backfilled, and a 600mm Rubber-Ring-Jointed pipe installed to sewer-line standards. This is to give the necessary capacity and also to seal the stormwater system against septic tank effluent. The alignment of the pipe is parallel and immediately to the West of the driveway. It is to extend from the northern boundary of the Hayes/Stephens property to about 10m short of the toe of the dune (70m long). A safety grill is to be installed on the beach end to exclude children. The upstream debris screen at the entrance is to be childproof. Upstream inside invert at 6.0m R.L. Outlet invert at 3.5m R.L.

Ground surface level grates and cesspits are to be installed at the lowest points on the Chesterman and Wilson/McFlinn properties.

To guard against sand inundation at the mouth of the culvert it is proposed that the outlet be extended 10m further towards the sea and protected by two living-bunds (shaped and planted dunes) extending perpendicular to the coastline on either side of the outlet for a further 15m. These bunds are established with plantings of sand-gathering native dune grasses onto a pre-shaped sand surface. Use pingao and

Kowhangatara (Spinifex), plus Hinarepe (Sand Fescue) and Waiuu-o-kahukura (Beach Spurge). A 4m bare corridor is to be left in between the bunds and is meandered gently to screen the pipe outlet from the view of beach users. The dunes are expected to increase in height naturally over time. Some minor maintenance is to be expected to maintain the open corridor (periodic weeding).

3.3.3 Formed water table to seaward of Ohiwa Beach Road

A formed roadside water table is required on the seaward side of the road to the West of the driveway entrance. This water table is to convey road runoff and debris/sediment to the outlet of the smaller road culvert.

3.3.4 Debris rack at southern boundary of the reserve

A debris rack is recommended for the stream channel where it enters the District Council Reserve from the Gould property. This is to be a galvanised steel trash rack mounted in a ground treated timber wing-wall as shown in Drawing Sheet 1. The advantage of this type of rack is that it can be cleaned quickly and easily by residents with a garden rake as there are no horizontal members to foul the rake tines.

3.3.5 Channel protection upstream of district council reserve

It is proposed that the drainage ditches on the Gould property adjacent to the vineyard are to be replaced with a sub-surface drain and swale arrangement. The ditches are to be cleaned to achieve a more uniform grade before lining with perforated flexible pipe and backfilled. The lower 300mm of the drain cross section is to be backfilled with clean gravel. Above this level the ditches can be filled with available local soil.

After backfilling, the surface is to be formed into a shallow dish/swale with very relaxed side slopes to facilitate mowing with a ride-on mower (bottom width no less than 1.2m; side slopes: 5H:1V; side height: 0.3m). Gravel risers can be installed in locations where drainage to the subsurface pipe is desirable. These consist of small areas, perhaps $1m^2$ where clean gravel only, is used to backfill the trench. The swale is to be grassed immediately following its construction to reduce scouring of the surface. During the time taken for grass to establish, sandbags (natural fabric filled with earth) can be placed across the full bottom width of the swale at 15 metre intervals to control erosion in the interim.

Chapter 4: Catchment at 273 Ohiwa Beach Road

(Consisting of land occupied by Pierson, Hopcroft, Sutton, Opotiki District Council and others)

4.1 Recognised issues/concerns

4.1.1 Pipe sizing

In the past stormwater runoff has been conveyed from the Opotiki District Council Reserve through the Hopcroft property in a pipe made from plastic barrels laid end to end. From what I could see of this pipe it has almost completely collapsed. It has recently been augmented with a series of PVC pipes: one 250mm leads to a 300mm. On their own these pipes will only carry about $1/5^{th}$ of the 5-year ARI flow.

4.1.2 Debris

This site was subject to a mud flow in July 2004. Due to the difficulty of keeping pipes operating during such events, an overflow channel/designated flood path is required to carry the entire Q50 flow as per the New Zealand Building Code.

Mrs Hopcroft reports that she regularly cleans the makeshift debris rack at the mouth of her culvert. She recognises a need for an easier method of removing twigs and leaves from the flow.

4.1.3 Erosion in channel against driveway

The open channel beside the Hopcroft/Sutton driveway is eroding.

4.1.4 Overland flow

The overland flow to be expected during a 50 year ARI event is to be quantified and a suitable flow path designated.

4.2 Design solution

4.2.1 Pipe Sizing

To meet the design criteria of carrying a Q10, the Hopcroft Culvert would have to be replaced with a 450mm diameter pipe with at least 0.8m Head-Water (level difference between the pipe invert and the level at which it spills).

A 450mm diameter concrete pipe is also to be installed running the length of and to the West of the driveway (Drawing Sheet 2). This pipe is to have a 675 x 450 x 1220 flat top cess pit installed at the upstream end and a 1050 x 1500 manhole with grated, ground level lid, at the lower end. A new 600mm diameter pipe is to run under Ohiwa Beach Road from the lower of these cess pits to discharge into the dunes. The finished level of the backfill around the driveway pipe is to be below the ground level on the adjacent Nott property.

4.2.2 Mud flow debris and overland flows

Although dealing with mudflows is outside of the scope of this report, it is anticipated that such a flow is likely in this catchment in the future and could block any piped stormwater system. Therefore the overland flow paths have been sized to carry the entire 50-year ARI flow.

A preferred overland flow path is to be established behind and to the West of the Hopcroft house (Drawing Sheet 2). This will take the form of a shallow swale with a bottom width of 2.0m; side slopes of 5H:1V; long slope: 3%; depth: 0.15m below the level of the existing concrete curb. During a Q50 event this will flow at about 50mm above the curb level for a short time. Although this is higher than the floor level in the lower storey of the house, it is contended that the wall (concrete block) is waterproof to the level of the window sills, giving the required protection. Stormwater is to be diverted into this swale by a low (200mm) earth bund as shown. A further earth bund may be required to divert water to the East of the Nott house into a large cess pit to be located beside the driveway at the Hopcroft/Nott boundary. The crest of this lower bund is to be at least 1.2m above the inlet invert to the 450mm driveway pipe.

To facilitate vehicle access in case of a mudslide, an easement may be required to restrict development to the West of the Hopcroft house. It is recommended that this be extended to protect the physical formation of the overland flow-path swale.

During the 50-year ARI flow, stormwater will spill (as it does now) across the driveway onto the Cherrington Murray property. As this property becomes developed allowance must be made for this occasional flow. This will be best achieved by way of a shallow grassed swale with bottom width 2.0m; side slopes 5H:1V; depth at least 200mm; long slope:3%. Any building floor level should be at least 500mm above ground level on that property (notwithstanding coastal hazards).

4.2.3 Debris Rack

A debris rack as outlined on Drawing Sheet 1 is to be installed upstream of and near the boundary between the Hopcroft property and Opotiki District Council. On the drawings this is shown as between two mudslide deflection bunds (as outlined in the Riley report on landslide risks). This need not necessarily be the case. The advantage of this type of rack is that it can be cleaned quickly and easily with a garden rake by residents as there are no horizontal members to foul the rake tines.

4.2.4 Upper catchment channel form, and stream bound sediment

As recommended in the Riley Report, the valley floor within the Opotiki District Council reserve is to be re-shaped to reduce the risk from future mudslides. As this is an ephemeral stream flow it is recommended that the channel be formed into a shallow vegetated swale rather than an incised vee channel. During times of high runoff the vegetation will maintain the surface, thereby reducing in-stream sediment, which becomes a maintenance problem in the culvert pipes.

Chapter 5: Catchment at 19 and 21 Bryans Road

5.1 Recognised issues/concerns, recommendation

5.1.1 Central shared driveway

In July 2004 mud and debris from several landslides flowed onto the upper half of both properties at this site. Both buildings were destroyed and one life was lost. The Riley report dealing with mitigation measures to reduce the risk from landslides at Bryans Beach recommends a system of earth bund deflection barriers on the valley floor to absorb much of the energy of a future mudslide.

As these bunds cannot be guaranteed to stop all potential mud flows in the valley, it has been proposed that the new buildings be placed so that the preferred route of a flow will pass between them. It is here proposed that this open space between the buildings be used as a driveway shared between the two properties, and stormwater conveyance.

This driveway can be shaped as a very shallow vee, (cross fall of 5% towards the centre) with curb sides to carry the 50-year ARI flow (Drawing Sheet 2). The total width of sealed driveway is to be 4.3m; just wide enough for two vehicles.

The piped conveyance (Q10 standard) will be provided with 300mm (internal dimension) concrete box-channel sections with lids, running down the centre line of the driveway. These are much easier to clean than standard culvert pipes. And can be readily maintained by residents.

In order to pass the Q10 flow with this size of channel, it is necessary that the lids for the first 5.0m or so be the steel mesh type. The remaining 40m is to be covered with slotted concrete lids.

5.1.2 Debris rack

A debris rack as outlined on Drawing Sheet 1 is to be installed upstream of and near the boundary between the Freeman/Wilson and Shobden Limited properties and Opotiki District Council. On the drawings this is shown as between two mudslide deflection bunds (as outlined in the Riley report on landslide risks). This need not necessarily be the case. The advantage of this type of rack is that it can be cleaned quickly and easily with a garden rake by residents as there are no horizontal members to foul the rake tines.

5.1.3 Pipe sizing on Bryans Road

The 110m long 750mm diameter concrete pipe that flows beneath houses from the upper catchment to the open channel on Bryans Road is considered undersized. It is estimated to barely convey the 2-year flow.

It is recommended to replace and re-align this pipe as shown in Drawing Sheet 3, with a 1200mm sealed rubber-ring-joint type pipe to eliminate infiltration by septage.

The old pipe is receiving septage from soakage fields alongside. This pipe should be removed where possible and the trench backfilled with low permeability soil (relative to surrounding soil).

The existing 70m long 900mm pipe at the stream outfall will convey the 5-year flow assuming that no debris obstructs its entrance. As this is not a road culvert, its capacity is marginally lower that the design criteria, but not so much as to justify its replacement. A debris rack should be fitted to each tributary stream. The one in the small western catchment (Gawns property) can be as shown in Drawing Sheet 1. The debris rack on the main tributary can be of similar design but 2.0m wide and 1.0m deep with a main beam of 75x75x10EA galvanised equal angle rolled steel section.

5.1.4 Secondary flow path

The secondary flow path for Bryans Road catchment is straight down the road. This appears to have ample capacity for the required 50-year ARI flow, with the flow being shared between the roadside swale, curb and channel, and open drain. The neighbouring houses appear to be well up out of the way, and there are no reports of flooding in July 2004.

Chapter 6: 257 and 233 Ohiwa Beach Road

6.1 Erosion undercutting retaining wall on Purdue/Fraser boundary

Following a landslide that occurred in July, an excavator was used to remove earth and debris from the foot of retaining wall that supports part of the Purdue Property. As part of the operation a vee trench was cut into the g by residents round surface to channel water. This vee channel has since eroded and is threatening to undermine the retaining wall structure. The ground surface there is formed into terraces each about 2-3m deep with edges roughly 500mm high.

After discussion with the Purdues the following is proposed:

(i) That the vee channel be filled in with good quality fill;

(ii) That the terrace surfaces be carefully levelled to encourage stormwater to spread out and dissipate. The surfaces should slope gently up across-slope towards the Purdue boundary to deflect water away from the foot of the wall. These surfaces are to be grassed.

(iii) That the edge of the terraces could be reinforced with a timber retaining wall also levelled in the way detailed above. This measure may prove to be unnecessary if measures one and two are achieved.

6.2 Dangerous headwall on water table culvert at Purdue entrance

The culvert beneath the Purdue entrance has a large headwall that restricts the accessway. It is also difficult to see in some situations and guests often back over it and damage their cars.

The culvert can be extended so that its headwall is well back out of the way.

6.3 Pipe sizing at 233 Ohiwa Beach Road

The 450mm road culvert is estimated to convey the Q5 flow. To meet the adopted design criteria for a road culvert, this pipe is to be replaced with a 600mm diameter pipe, with the upstream invert at 4.4m R.L. and laid at a 1% slope.

The newly installed plastic pipes running beside the Leeder/Egan driveway have a marginal capacity for the 5 year flow.

Chapter 7: General Notes

7.1 Open grassed swales

The general system for management of stormwater at Bryans Beach consists of pipes only where they have been deemed necessary for some amenity value, typically to convey runoff beneath roads and where open drains have shown some nuisance value. Open drains/ditches are less than desirable because they require routine weeding and are difficult to mow. They also restrict the site as far as foot and vehicle access.

Following the upgrades outlined in this report, the majority of the system will still comprise of shallow grassed swales to collect and convey diffuse runoff especially alongside roads. Traditionally these systems were considered sub-standard, but recently grassed swales and curb-less roadways have been recognised as being very effective. They facilitate diffuse soakage of road runoff to subsurface flows; in-soil treatment of waterborne pollutants, such as oils and heavy metals; grass filtering of debris, including litter, helping to keep this out of streams and other permanent waterways. Grassed swales are also low capital cost, have an extended (infinite) working life, and allow for other uses during times of no flow. They are to be shallow, wide, and with side slopes gentle enough for ease of mowing.

A swale and subsurface drain combination is specified for beside the road near the intersection of Ohiwa Beach Road and Bryans Road (Drawing Sheet 3). It is also applicable to any areas where a ditch has been dug to lower groundwater.

7.2 Road culverts not already mentioned

All of the existing road culverts beneath Bryans Road and Ohiwa Beach Road were analysed in light of the adopted design standard outlined in Section 1.2. Table 3 outlines the required replacement sizes where appropriate and any additional installation requirements.

Table 3 Road Culverts to be replaced

Address	Existing size	Replacement size	Notes
233 Ohiwa Road	450mm ID	600mm ID	U/s invert to be below 4.4m R.L. Laid on 1% grade
257 Ohiwa Road	Unknown	375mm ID	U/s invert to be 0.9m lower than road surface, 1% grade
269 Ohiwa Road	225mm ID	375mm ID	U/s invert to be 1.1m lower than the road surface, 1% grade
273 Ohiwa Road	300mm ID	600mm ID	U/s invert at 3.1m R.L. 1% grade
Cnr Ohiwa Road and Bryans Road	225mm ID	600mm ID	U/s invert at 3.4m R.L. 1% grade

7.3 Septic tank effluent infiltration of pipes and streams

There is an on-going problem with septage infiltration into the stormwater system at Bryans Beach. Limited space for septic tank soakage fields combined with some very free-draining sandy soil layers has led to some very short residence times for septage in the soil before discharging to the stream. This is the case in the stream alongside Bryans Road and also into the Road Culvert pipe at 239 Ohiwa Beach Road. At the Bryans Road outfall this has led to the stream water being declared unsafe for bathing.

A design alternative was considered whereby the entire stormwater conveyance system within the built up area of the settlement be contained within sealed rubber-ring-joint pipes. Conceivably, this could effectively separate the pollutant from the stream flow. Septic tank effluent would then be forced to travel through the soil for the full distance to the beach before discharging in a diffuse way though the sand.

Such a solution however is not only expensive to implement, but it also works in the wrong direction: such pipes would, in the future, age and leak, requiring expensive repairs.

The only true solution is to cease to discharge effluent into the ground, but rather to collect, treat and discharge it at a safer location. While this is option is also expensive, it is moving in the right direction, without the certainty of future system failure.

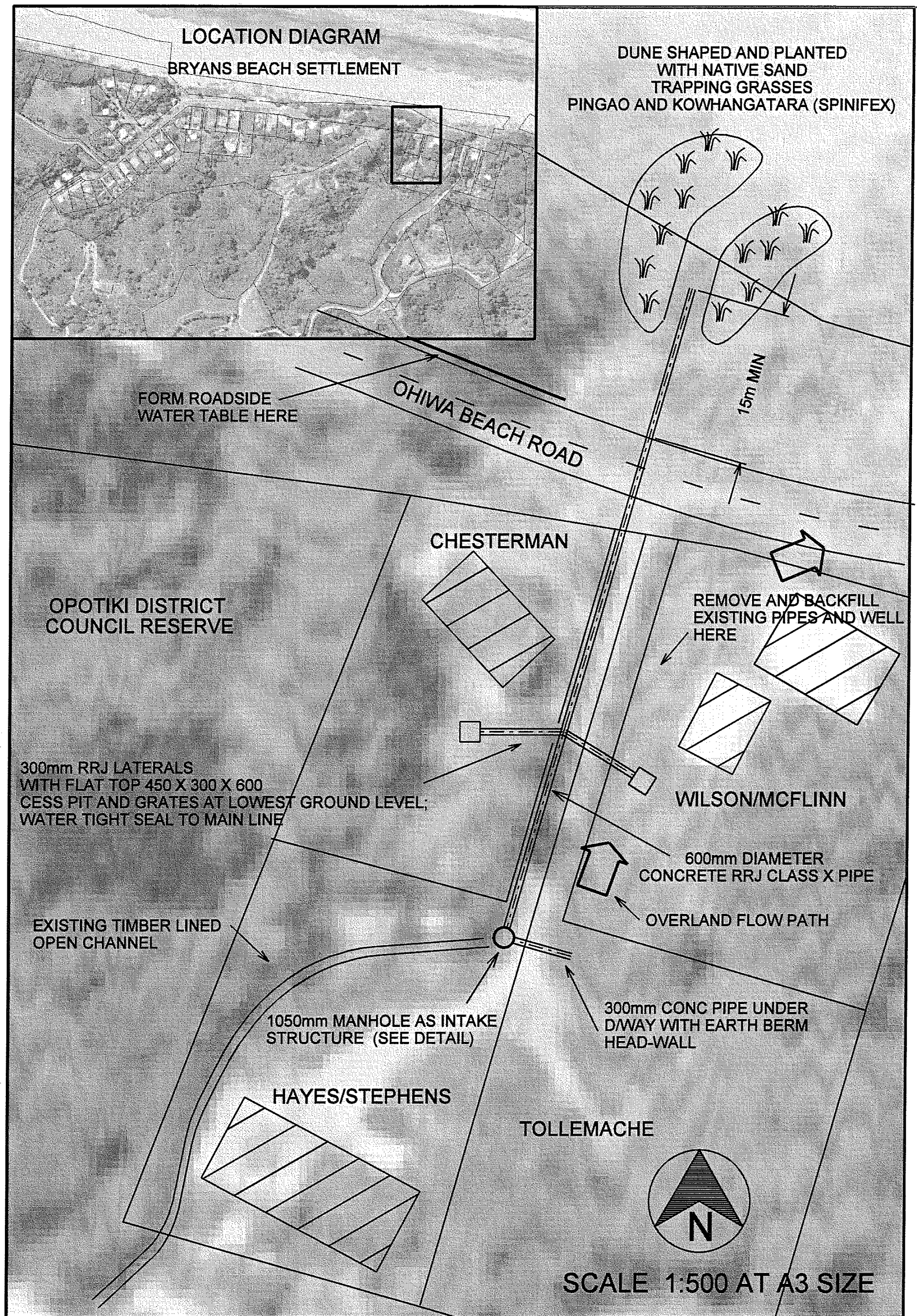
While a review of the human waste discharge system at Bryans Beach is outside of the scope of this report, it is relevant in that some of the negative effects can be reduced for the near future through the selection of sealed pipes. Therefore, where new pipes are required as part of the recommendations of this review, they have been specified to sewer-line standards.

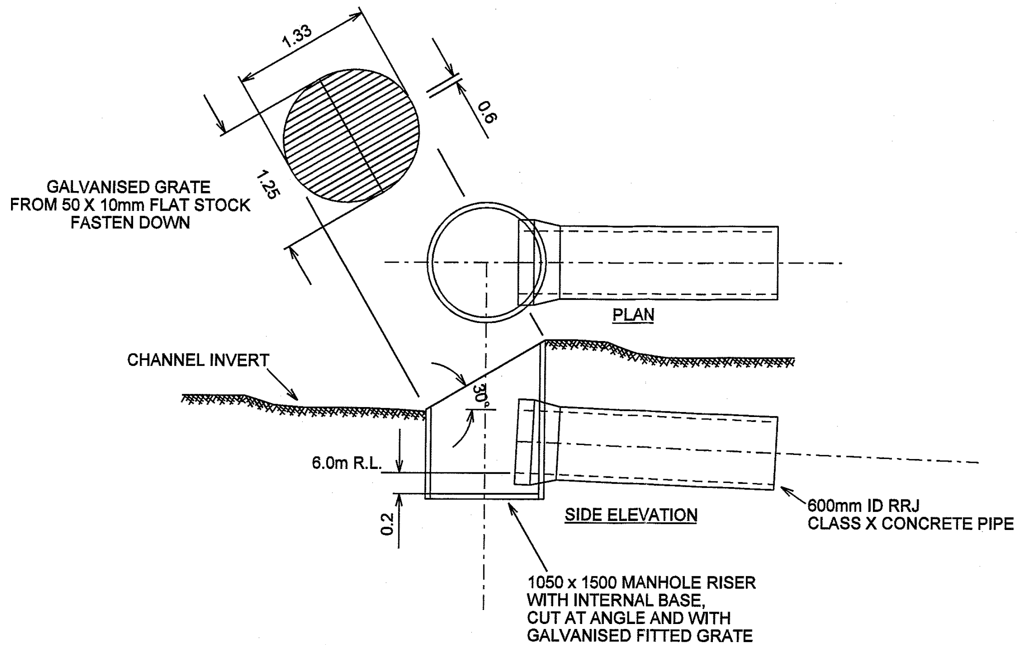
Appendices

Appendix I Drawing Sheets 1-3

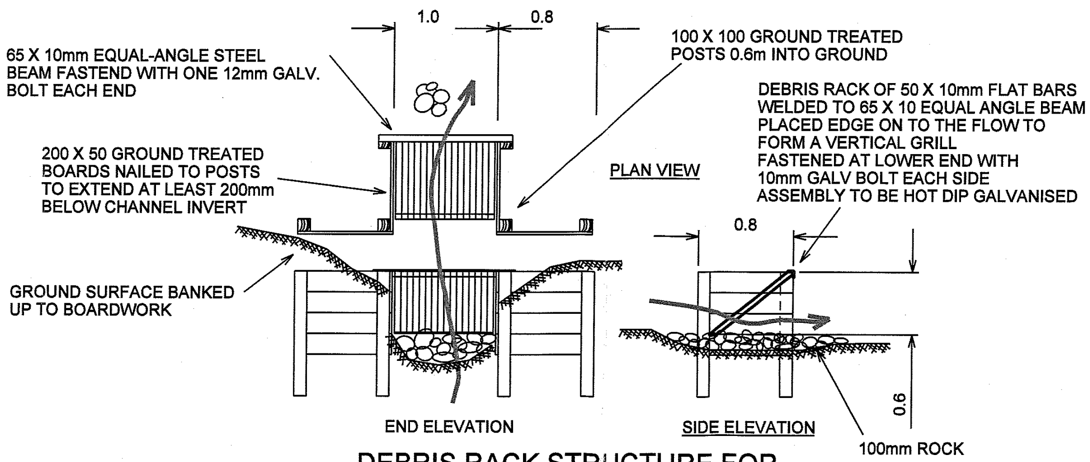
Appendix II General Specification for Flexible Pipe Flumes at Bryans Beach

Appendix 1– Drawing Sheets 1-3





INTAKE STRUCTURE ON MAIN 600mm PIPE



DEBRIS RACK STRUCTURE FOR AT GOULD/ODC; HOPCROFT/ODC; FREEMAN/CORBOY/ODC BOUNDARIES

NOT TO SCALE

ENVIRONMENT B·O·P
Bay of Plenty Regional Council

ENVIRONMENT B · O · P

BRYANS BEACH STORMWATER MANAGEMENT DESIGN

CATCHMENT AT 239 OHIWA BEACH ROAD

SURVEYED	PMW, CBR	1/05
DRAWN	PMW	3/05
DESIGNED	PMW	2/05
TRACED	PMW	3/05
DESIGN CHECK	RJB	3/05
DR. CHECK	GNOR	3/05

APPROVED

REFERENCE

SCALE AS SHOWN

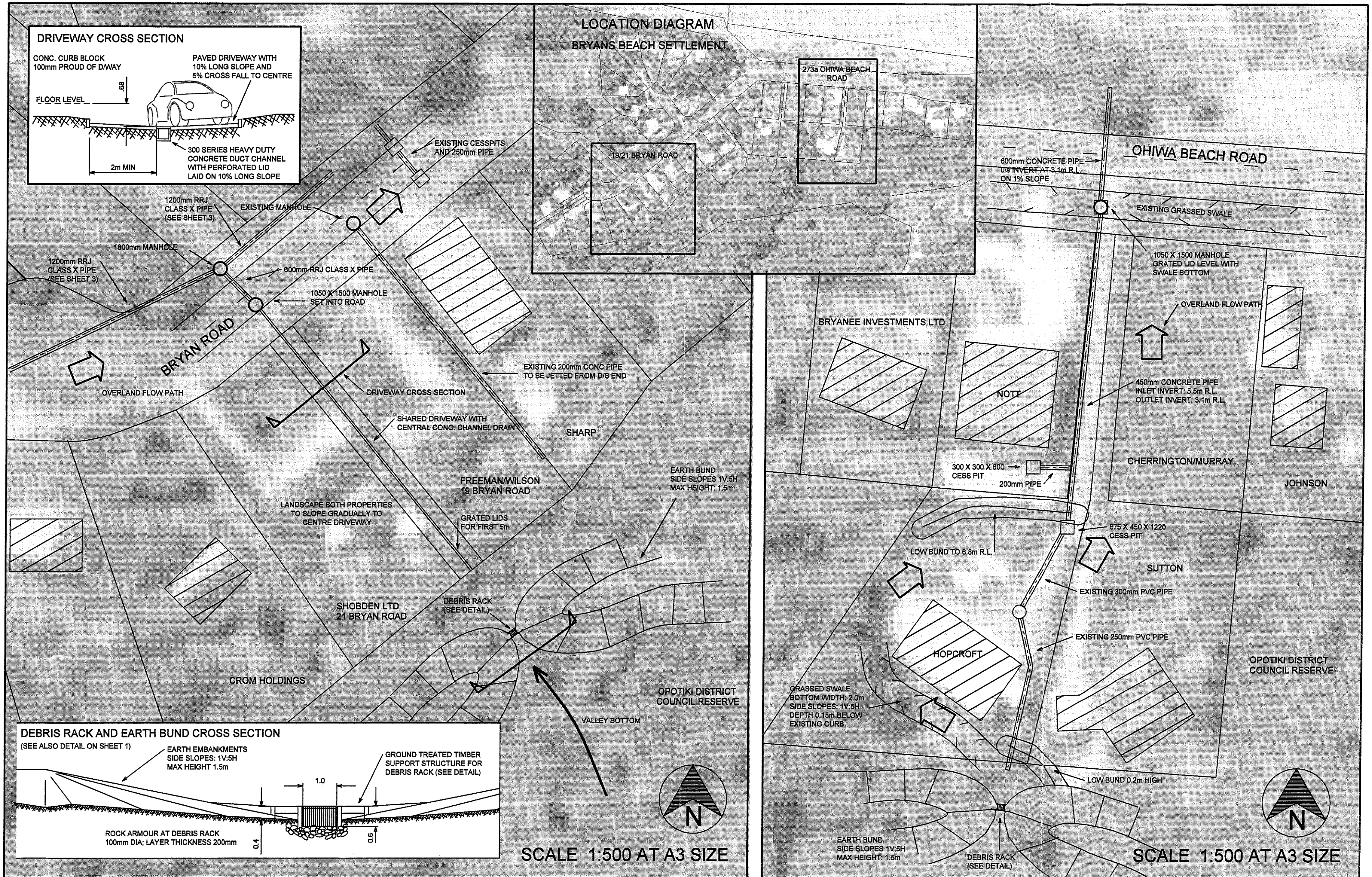
AMENDMENTS

A	
B	
C	
D	

PLAN No. EC 5041

AMENDMENT:

SHEET 1 OF 4



ENVIRONMENT B·O·P
Bay of Plenty Regional Council

ENVIRONMENT B · O · P

BRYANS BEACH STORMWATER MANAGEMENT DESIGN

SITES AT 19/21 BRYAN ROAD AND 273a OHIWA BEACH ROAD

SURVEYED	PMW, CBRI	1/05
DRAWN	PMW	3/05
DESIGNED	PMW	2/05
TRACED	PMW	3/05
DESIGN CHECK	RJB	3/05
DR. CHECK	GNOR	3/05

APPROVED

REFERENCE

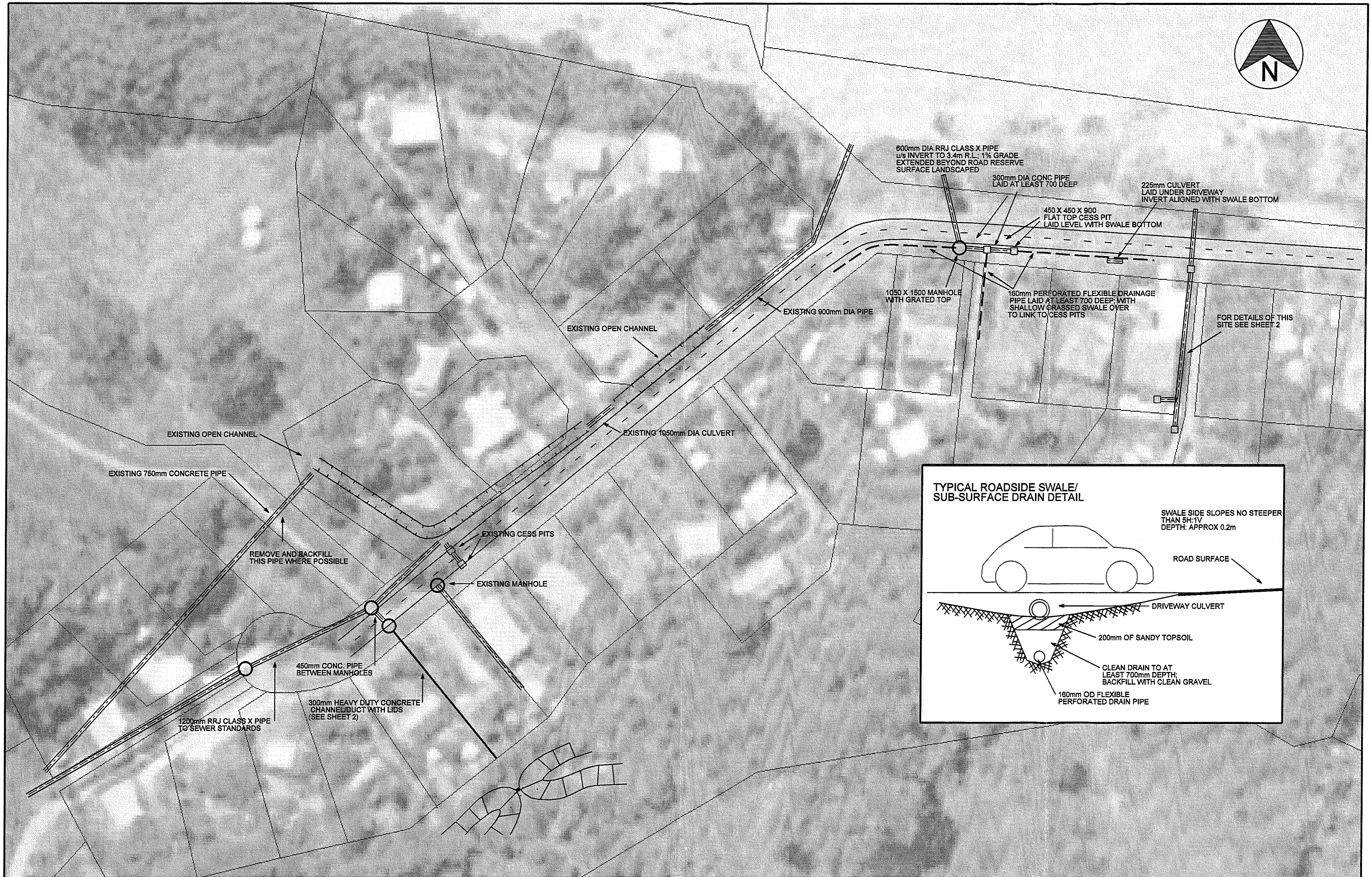
SCALE: AS SHOWN

AMENDMENTS: A, B, C, D

PLAN No. EC 5041

AMENDMENT:

SHEET 2 OF 4



ENVIRONMENT B·O·P
Bay of Plenty Regional Council

ENVIRONMENT B · O · P

BRYANS BEACH STORMWATER MANAGEMENT DESIGN
SYSTEM AT BRYANS ROAD

SURVEYED	PMW, CBR!	1/05
DRAWN	PMW	3/05
DESIGNED	PMW	2/05
TRACED	PMW	3/05
DESIGN CHECK	RJB	3/05
DR. CHECK	GNOR	3/05

APPROVED

REFERENCE

SCALE 1:1000 AT A3 SIZE

AMMENDMENTS	
A	
B	
C	
D	

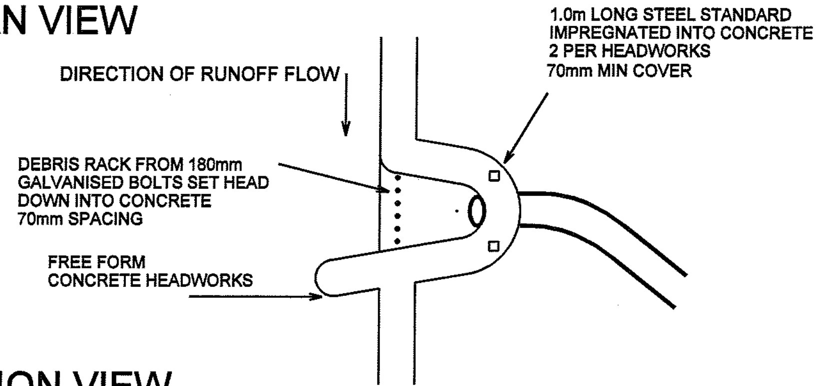
PLAN No. EC 5041

AMENDMENT:

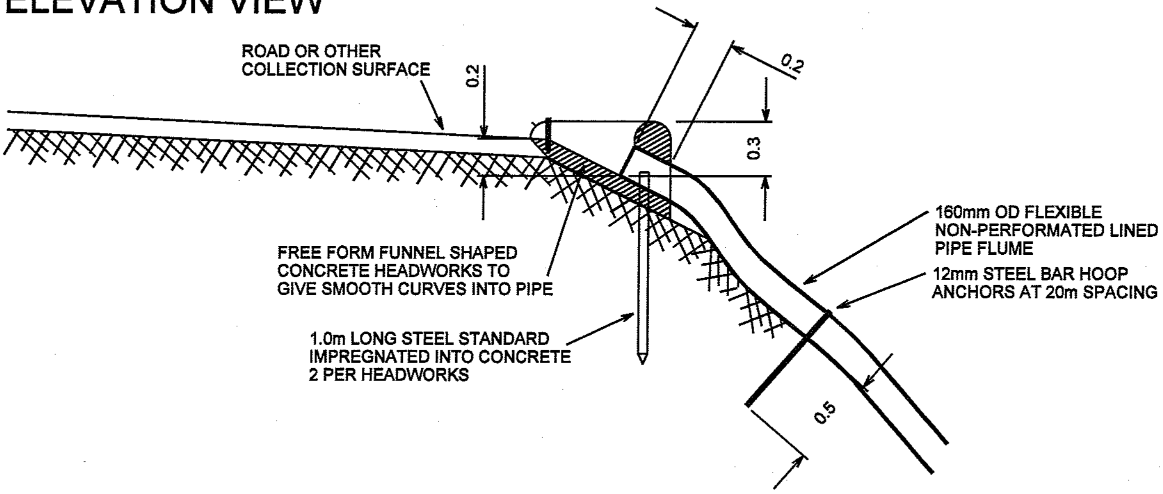
SHEET 3 OF 4

Appendix 2 – General Specification for Flexible Pipe Flumes at Bryans Beach

PLAN VIEW



ELEVATION VIEW



EACH PIPE FLUME AS DETAILED HERE WILL CONVEY STORMWATER RUNOFF TO A Q20 STANDARD FROM THE FOLLOWING CATCHMENT SIZES; OR PART THEREOF.

LENGTH OF SEALED ACCESSWAY	110m
LENGTH OF UNSEALED ACCESSWAY	200m
AREA OF BUILDING ROOF	$650m^2$
AREA OF PAVED SURFACE	$700m^2$
AREA OF MOWN LAWN	$1900m^2$
AREA OF SCRUB OR LONG GRASS	$2200m^2$

EXAMPLE: A CATCHMENT COMPRISED OF:

150m2 ROOF AREA
300m2 PAVED SURFACE
1000m2 MOWED LAWN
1500m2 LONG GRASS/SCRUB

REQUIRES: $\frac{150}{650} + \frac{300}{700} + \frac{1000}{1900} + \frac{1500}{2200} = 1.87$ SO 2 FLUMES

ADDITIONAL SPECIFICATIONS:

1) SPILL LEVEL TO BE AT LEAST 0.3m ABOVE THE INLET INVERT OF THE PIPE
2) AN EFFECTIVE DEBRIS RACK IS TO BE INSTALLED
3) PIPES TO EXTEND TO THE VALLEY FLOOR
4) ROAD AND ACCESSWAY DRAINS TO BE SPACED NO MORE THAN 60m REGARDLESS OF CATCHMENT SIZE

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ENVIRONMENT B · O · P

GENERAL SPECIFICATION FOR STORMWATER FLUMES
AT BRYANS BEACH OPOTIKI

SURVEYED	PMW, CBRI	1/05	APPROVED	REFERENCE
DRAWN	PMW	3/05		
DESIGNED	PMW	2/05		
TRACED	PMW	3/05	SCALE	NOT TO SCALE
DESIGN CHECK	RJB	3/05		
DR. CHECK	GNOR	3/05		

AMMENDMENTS: A, B, C, D

PLAN No. EC 5041

AMENDMENT:

SHEET 4 OF 4