6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Many studies have been undertaken in that past for Scotland Island that relate in some way or another to the roads, road drainage and other components of the road reserve. In particular the recent work by Rooney (*ie the 1998 Catherine Park and 2004 South Precinct catchment studies*), Witheridge (*ie the 2004 draft road reserve Masterplan*) and Brian Barry and Associates (*ie bushfire management plan*).

This report has entailed review of all of these relevant reports as well as undertaking our own strategic investigation of all facets of the Islands road reserves.

A critical precursor to this Road Reserve Strategy was the WP Stormwater Management Strategy (*SMS*). The SMS highlights the need for improved drainage system planning and provides a framework for the way forward.

It appears that the existing level of development on the Island cannot be sustained by the road reserve infrastructure that is currently in place.

The road audit undertaken as part of this study revealed that many of the Island roads are akin to those that are found in rural areas. These types of roads do not seem so out of place for the rural atmosphere that is embraced by the residents. However the unique characteristics of the Island (*ie dispersive soils and very steep slopes*) combined with the level of development on the Island is placing great stress on the road infrastructure in this form and it is leading to substantial erosion and sediment export from the Island during wet weather.

It is evident from the majority of past studies and independent investigations undertaken by PBP that ultimately the majority of roads on the Island will need to be sealed in some form or another for both environmental and safety reasons. Due to financial constraints it is recognised that this cannot be undertaken in the short term but it is critical that when roads are progressively sealed that they do not need to be revisited prematurely which would have the effect of slowing the overall progress or even going backwards.

Based on the above this Road Reserve Strategy has recommended both long and short to medium term recommendations. The long term recommendations provide a bigger picture for the island that can guide the way forward. Whilst the short to medium term recommendations allow for effective progress now.

The existing road hierarchy/layout was found to be illogical in some areas with a need to rationalise. It is thought that this was primarily due to past planning decisions that did not take into account the physical constraints of the Island. As a result several recommendations have been put forward to

ensure roads that are currently located within open space reserves are dedicated as public roads and vice versa. Sale of some surplus road reserves for private use (*ie further development*) to possible fund future upgrades is considered possible subject to vigorous assessment of any environmental impact. Converting these to public reserves (*ie open space*) is also an option which allows them to still be controlled by Council for the purposes of drainage whilst continuing to support existing vegetation. Consideration was given to converting the existing fire trail within Elizabeth Park to a dedicated public road, however the impacts on Elizabeth Park and its environment was concluded to be too great. Due to the extent of existing damage and the resulting environmental issues it is considered that Hilda Avenue be closed to vehicular traffic and stabilised as a pedestrian walkway only. Road network changes have also been recommended that improve fire fighting operations.

Based on the road audit it was determined that the average width available for road construction on the Island was 3.7m. It was also determined that the average existing carriageway width was 3.0m. Consideration of these results along with road safety, fire fighting requirements, road drainage, future utility service requirements and future traffic management systems concluded in a typical road detail for the Island (*refer to* ***Figure 6***).

In keeping with the above and the widely held view of the Island community that public roads on the Island should primarily serve as pedestrian/cyclist pathways and secondarily as vehicular roads, it was concluded that a traffic management system that defines all Island roads as "*Shareways*", provides mechanisms to discourage increased vehicular use but allows occasional heavy vehicle use was most appropriate. As part of the proposed traffic management system parking is proposed to be banned on all Island roads, apart from two or three designated parking zones.

Road drainage is an area that warrants careful consideration in any future road reserve management decisions on the Island. The inadequacy of existing drainage systems is leading to many of the environmental and safety issues that have occurred in the past. In addition, it is slowing the progression of a positive way forward (*ie leading to premature deterioration of already stabilised surfaces*). Careful attention in design and a substantial investment in suitable drainage infrastructure is required before making any substantial improvements in road surface condition.

Finally, the study found that improvements to existing road safety were required at several locations. In addition recommendations relating to existing walking tracks, street furniture, utility services, cycling facilities, street lighting, retaining structures, batter stabilisation, road reserve landscaping and road maintenance have been made to guide future management of these features.

6.2 Recommendations

This section contains our recommended actions both strategically (*ie for the long term*) and in the interim (*ie short to medium term*). It is expected that the long term recommendations would have a timeframe in the order of 50 years before they are fully implemented.

These recommendations should not be seen as fixed as Island conditions and technologies may change with time. Hence, review of these recommendations should be undertaken on an annual basis.

6.2.1 Long Term Recommendations

Table 8 contains a summary of the long term recommendations for the road reserves of Scotland Island.

Table 8 – Long Term Road Reserve Recommendations

No.	Measure Number	Measure Description	Associated Measure
Road Hierarchy(refer to Figure 5)			
1	H1	Dedicate the section of road/track within Catherine Park (*ie Catherine Park Rd*) as a public road (*12m wide*)	
2	H2	Dedicate the surplus section of existing public road (*ie part of Thompson St*) to the immediate south of Catherine Park as public reserve	
3	H3	Dedicate the surplus sections of public road (*ie Aoma St, Fitzpatrick Avenue, Unnamed Road*, *Bayview Street and Elsie Street*) as public reserve or potentially sell some as private property to fund future road upgrades	
4	H4	Dedicate the concrete road within Leavera Reserve as a public road (*20m wide – Cargo Wharf Road?*)	
5	H5	Convert Hilda Ave to a walking track only (*ie no vehicular access*) but leave as road reserve	S2
6	H6	Extend a fire trail from Elizabeth Park within Fitzpatrick Ave down to the end of Thompson Street. Provide gates at either end for emergency vehicle access only. Refer to **Diagram 3** for typical treatment of proposed fire trail	P18
7	H7	Provide turning areas (*ie hammer head or similar*) at the "dead ends" on Florence Tce, and Thompson Street and investigate the viability of a turning head at the end of Robertson Road	
8	H8	Extend Kevin Ave along the rear of 114 to 120 Thompson St and provide turning area at dead end. Dedicate as public road. This road is required to provide a public road frontage for these lots	H2

No.	Measure Number	Measure Description	Associated Measure
		(*legally required*) as the existing public road frontage of Thompson St is to be converted to public reserve	
9	H9	Investigate the possibility of purchase of 112 Thompson St and dedication/construction of road over this lot to connect Robertson Road to the proposed extended section of Kevin Ave	
10	H10	Construct fire trail for emergency access within the section of Elsie Street between Florence Tce and Thompson St. Provide gates at either end for emergency vehicle access only. Refer to **Diagram 3** for typical treatment of proposed fire trail	P19
11	H11	Investigate the possibility of relocating some sections of the Elizabeth Park fire trail closer to private property and revegetating the disused sections of fire trail (*refer to **Figure 5***)	
12	H12	Investigate the possibility of extending the existing fire trail in Elizabeth Park along the southern boundary in accordance with the recommendation of the Scotland Island Bushfire Management Plan	
Typical Road Detail			
13	TP1	Adopt a typical road detail for all future road construction as detailed in **Section 5.3 and Figure 6**	
Traffic Management			
14	TM1	Adopt a future traffic management system for the Island as detailed in **Section 5.4**	
Road Safety (refer to Figure 7)			
15	S1	Construct retaining structures (*gabion or similar*) on steep road embankments along Richard Road north of the Unnamed Rd	
16	S2	Close Hilda Ave to vehicular traffic and construct stabilised walking track with associated drainage along full length of Hilda Ave. Provide vehicle barriers at both ends of Hilda Ave	H5
17	S3	Stabilise steep section of carriageway on Thompson Street between Hilda Ave and concrete dish crossing at low point (ie *construct grooved rigid pavement similar to treatment on Cargo Wharf Rd*)	P6
18	S4	Provide grooved rigid pavement (*ie concrete*) on sharp bend in fire	P10

No.	Measure Number	Measure Description	Associated Measure
		trail at end of Kevin Ave as well as installation of warning signage, safety barriers (ie *guard rail*) and posted mirrors	
19	S5	Construct retaining structures (*gabion or similar*) on steep road embankments along Elizabeth Park fire trail	
20	S6	Stabilise steep section of carriageway at start of Thompson Street just south-east of intersection with Kevin St (ie *concrete*)	P2
21	S7	Stabilise steep section of carriageway in Thompson Street just east of intersection with Cecil St (*ie concrete*) and provide signage and regular speed humps/cross banks to slow vehicles	P5
22	S8	Provide turning area at end of Robertson Road (*ie chainage 1500*) and convert section of Thompson Rd to the east of its intersection with Robertson Road to a stabilised walking track. Provide barriers to prevent unauthorised vehicular access along Thompson Street to the west	
23	S9	Provide guard rail on Florence Tce at Pathilda Reserve and in the vicinity of Lowanna Street	
24	S10	Stabilise road surface (*ie flush seal*) and provide safety signs on sharp bends and steep sections of Florence Terrace	
25	S11	Provide guard rail on steep down slope drop along Richard Road just north of the Unnamed Road	
26	S12	~~Provide guard rail on steep down slope drop along Robertson Road near Aoma St~~	
27	S13	~~Provide guard rail on steep down slope drop along Richard Road at location of recent landslip and culvert upgrade works~~	
28	S14	Provide guard rail on steep down slope drop along Harold Avenue	
29	S15	Provide guard rail, turning area and vehicle barrier at end of Thompson Street with Intersection of Fitzpatrick	H6
30	S16	Provide pedestrian handrail along walking track on Thompson Street between Fitzpatrick and Robertson and general track rehabilitation	W11
31	S17	Incorporation of passing bays at regular intervals within the road reserve	

No.	Measure Number	Measure Description	Associated Measure
32	S18	Regular removal of loose gravel/material from the road surface, cleaning of ditches/drains and stockpile of suitable material for reuse	
33	S19	Regularly filling/removing potholes and other depressions within roads and tracks	
33.5	S20	Construct road embankment retaining structures on high side of Robertson Road at Fitzpatrick Avenue (*ie above walking track/future road*)	
Pedestrian Facilities and Walking Tracks (refer to Figure 8)			
34	W1	Realignment of upper Fitzpatrick Avenue above Thompson Street because it is badly eroded and currently runs within private property	
35	W2	Cross banks installed at 20 metre interval along fire trail above the Fitzpatrick Avenue walking track to decrease the volume of runoff flowing down the track	
36	W3	Installation of cross banks on the Fitzpatrick Avenue walking track between Robertson Road and Thompson Street to divert runoff off away from the track	
37	W4	The Catherine Park western pathway should be re-profiled to spread stormwater runoff. Possibly reform the pathway using a 'structural soil'. Structural Soil involves the placement of approximately a 100mm layer of aggregate of uniform size in the range 15–25mm. This aggregate layer is lightly topsoiled to fill only the voids, then grass seeded. The main disadvantage of this method of path stabilisation is that it needs to be fenced off from traffic for at least 3 months while the grass grows	
38	W5	Open soil pathways through Harold Reserve to be rehabilitated, steps at Harold to accommodate step free section for bicycles	
39	W6	Closure of the unstable walking tracks passing through Harold Reserve	
40	W7	Steps placed along the lower half of the Aoma Street walking track to provide all weather access	
41	W8	Additional steps placed on the Fitzpatrick Avenue walking track between Robertson Road and Thompson Street possible between the existing rock steps	

No.	Measure Number	Measure Description	Associated Measure
42	W9	Monitor and upgrade/repair as necessary walking tracks/stairways leading to/from all public wharfs (*ie Vivian Street, Harold Reserve and Lowanna Street*)	
43	W10	Close off Hilda Ave to vehicular traffic and construct new stable walkway and associate drainage	H5 & S2
44	W11	General rehabilitation as well as provision of handrail for walking track on Thompson Street between chainages 1140 to 1500 (*refer to **Figure 3** for chainage details*)	S16
Parking			
45	PK1	Provide a parking management system in accordance with **Section 5.7**	
Road Drainage			
46	DL1	Stabilise and seal all public road/shareway surfaces (*ie bitumen, concrete or other*)	P1 toP22
47	DL2	Define and construct 100yr ARI capacity major trunk drainage routes for all major catchments. These are envisaged to consist of naturalistic rock lined creeks/overland flow channels (*refer to **Figure 12**)* in combination with culverts at all road crossings (*refer to **Figure 12***)	
48	DL3	Install 5yr ARI capacity minor piped drainage lines within the public roads/shareways feeding into all trunk drainage culverts (*refer to **Figure 13***)	
49	DL4	Provide a typical 1 way cross fall road/shareway incorporating stabilised dish drain (*rock, bitumen or concrete*) on the cut side of all roads (*refer to **Figure 13***)	
50	DL5	All future road and road drainage measures should be designed by a qualified engineer backed up by construction supervision by a qualified engineer	
51	DL6	Implement and maintain public stormwater treatment measures as detailed in the WP Sept. 2009 "*Scotland Island Stormwater Management Strategy*" report. Note that this includes construction of road side bio-retention swales at some locations, GPT's and other	

No.	Measure Number	Measure Description	Associated Measure
		public based treatment measures	
Cycling Facilities			
52	C1	Provide cycling facilities in accordance with **Section 5.9** and **Figure 10**	
Street Furniture			
53	RF1	Provide street furniture in accordance with **Section 5.10**	
Street Lighting			
54	SL1	Provide street lighting in accordance with **Section 5.11**	
Utility Services			
55	US1	Provide utility services with road reserve in accordance with **Section 5.12**	
Road Construction (refer to Figure 10)			
56	P1	Construct rigid pavement *(or equivalent)* on steep section of Robertson Road from intersection with Cargo Wharf Road/Fitzpatrick Ave between approx. chainages 840 and 880 (*refer to **Figure 3** for road chainage details*)	
57	P2	Construct rigid pavement *(or equivalent)* on steep section of Thompson Road from intersection with Kevin Ave between approx. chainages 0 and 35 (*refer to **Figure 3** for road chainage details*)	S6
58	P3	Construct rigid pavement *(or equivalent)*on steep section of Thompson Road between approx. chainages 130 and 250 (*refer to **Figure 3** for road chainage details*)	
59	P4	Construct rigid pavement *(or equivalent)*on steep section of Thompson Road between approx. chainages 400 and 500 (*refer to **Figure 3** for road chainage details*)	
60	P5	Construct rigid pavement *(or equivalent)*on steep section of Thompson Road between approx. chainages 740 and 830 (*refer to **Figure 3** for road chainage details*)	S7
61	P6	Construct rigid pavement *(or equivalent)*on steep section of Thompson Road between approx. chainages 940 and 1010 (*refer to*	S3

No.	Measure Number	Measure Description	Associated Measure
		Figure 3 *for road chainage details*)	
62	P7	Construct rigid pavement *(or equivalent)* for full length of Cecil Street	
63	P8	Construct rigid pavement *(or equivalent)* for full length of Harold Ave and round the corner into the start of Richard Road	
64	P9	Construct rigid pavement *(or equivalent)* on steep section of Richard Road between approx. chainages 260 and 320 (*refer to* ***Figure 3*** *for road chainage details*)	
65	P10	Construct rigid pavement *(or equivalent)* on steep section of fire trail extending from the end of Kevin Ave between approx. chainages 190 and 300 (*refer to* ***Figure 3*** *for road chainage details*)	S4
66	P11	Construct resin seal on Catherine Park Road (*ie full length*) incorporating regular crossbanks/waterbars	
67	P12	Construct/rehabilitate existing flexible pavement (*ie insitu profiled and stabilised basecourse over two coat flush seal*) for full length of Pitt View Street	
68	P13	Construct/rehabilitate existing flexible pavement (*ie insitu profiled and stabilised basecourse over two coat flush seal*) for full length of Kevin Ave	
69	P14	Construct/rehabilitate existing flexible pavement (*ie insitu profiled and stabilised basecourse over two coat flush seal*) for full length of Florence Terrace	
70	P15	Construct/rehabilitate existing flexible pavement (*ie insitu profiled and stabilised basecourse over two coat flush seal*) for full length of Richard Road except at locations of proposed rigid pavement (*refer to Measure P9*)	P9
71	P16	Construct/rehabilitate existing flexible pavement (*ie insitu profiled and stabilised basecourse over two coat flush seal*) along Thompson Street between chainages 0 and 1140 (*refer to* ***Figure 3*** *for road chainage details*) except at locations of proposed rigid pavement (*refer to Measures P2 to P6*)	P2 to P6
72	P17	Construct/rehabilitate existing flexible pavement (*ie insitu profiled and stabilised basecourse over two coat flush seal*) along Robertson	P1

No.	Measure Number	Measure Description	Associated Measure
		Road between chainages 850 and 1340 (*refer to **Figure 3** for road chainage details*) except at locations of proposed rigid pavement (*refer to Measure P1*)	
73	P18	Construct stabilised emergency fire fighting track as per *Diagram 3* on Fitzpatrick Ave between Thompson Street and Elizabeth Park	H6
74	P19	Construct stabilised emergency fire fighting track as per *Diagram 3* on Elsie Street between Thompson Street and Florence Terrace	H10
75	P20	Rehabilitate fire trail (*ongoing*) within Elizabeth Park (*ie typical fire trail treatment of unsealed track incorporating regular water bars and stabilised dish drain or discharge points*)	
76	P21	Convert vehicular section of Thompson Road between chainages 1460 to 1500 back to a walking track only (*ie close off to vehicles*)	
77	P22	Rehabilitate Robertson Road between chainages 1340 and 1500 as a stabilised fire trail (*ie typical fire trail treatment of unsealed track incorporating regular water bars and stabilised dish drain or discharge points*)	
77.5	P23	Provide new access ramp at Cargo Wharf for large construction/maintenance vehicles	
Road Retaining Structures and Batter Stabilisation			
78	RW1	Provide road retaining structures and batter stabilisation within the road reserve in accordance with **Section 5.14**	
Road Environment/Landscaping			
79	RL1	Provide road landscaping in accordance with **Section 5.15**	
Road Reserve Maintenance			
80	M1	Develop maintenance program and regularly maintain all roads and fire trails (*ie ongoing*)	
81	M2	Maintenance/clean out of all major stormwater pits, culverts, table drains and sediment basins	
82	M3	Establish a grass cutting maintenance program for the table drains	
83	M4	To individually maintain private pathway/driveway access culverts	

No.	Measure Number	Measure Description	Associated Measure
		constructed across table drains	
84	M5	Consideration to be given to residents "*adopting*" the regular maintenance of a section of road or walking track adjacent to their residential property	
85	M6	Sediment storage areas are to be established on the island for the purpose of stockpiling sediment removed from watercourses, drains and table drains. This material should be suitably treated and used to seal any exposed, dispersive subsoils prior to revegetation	

6.2.2 Short To Medium Term Recommendations

Table 9 contains a summary of the short to medium term recommendations for the road reserves of Scotland Island.

Table 9 – Short to Medium Term Road Reserve Recommendations

No.	Measure Number	Measure Description	Associated Measure
Short to Medium Term Drainage Solutions			
1	DS1	Prevent road runoff discharging through private property immediately south of Cecil Street. Instead, improvements should be made to the table drain in Richard Road to allow stormwater to flow down the road reserve and enter the creek	
2	DS2	Prevent stormwater runoff from Florence Terrace discharging through private property approximately 8 lots north of Lowanna Street. Instead, modify the profile of Florence Terrace to allow this water to flow north to the existing grated stormwater inlet	
3	DS3	Where practical all new sections of sealed road that cannot drain directly to a dish drain or other trunk drainage system should be profiled to allow sheet flow off the road (*ie do not concentrate flows*). A minimum cross fall of 3-4% should be adopted on all new sealed roads	
4	DS4	Install waterbars/cross banks as shown in Plan SIR021(*refer to*	

No.	Measure Number	Measure Description	Associated Measure
		Appendix F) for all unsealed roads. The recommended 'maximum' spacing of cross banks has been determined from SCS (*1984*) and is presented in **Table 3**	
5	DS5	Install litter trap on the Cargo Hill stormwater outlet	
6	DS6	Install silt traps as shown in Plan SIR023 (*refer to **Appendix F**).* The invert of all silt traps is to be set well below the elevation of the road (*ie when placed at the end of a cross bank*) or below the invert of the stormwater pipe such that neither water or sediment will pond/collect on the roadway or within the pipe	
7	DS7	Pathway or driveway culvert crossing to be established at each pathway/driveway crossing of a table drain. Typical table drain vehicular and pedestrian culvert crossing is presented in **Diagram 8**	
8	DS8	Construct table drains for all Island roads. Table drains should represent the primary drainage path within road reserves rather than the trafficable road surface (*refer to DL4 also*)	DL4
9	DS9	All watercourses with defined bed and banks to be officially named	
10	DS10	Existing horizontal roadside stormwater grates to be progressively replaced to prevent vehicular damage to the grates and to minimise the risk of full debris blockage (*ie minimum Class C galvanised steel grate, account for 50% blockage in design of inlet and provide flexible pit marking poles*)	
11	DS11	Silt traps should be constructed on the end of stormwater outlets that discharge to relatively flat areas	
12	DS12	Stormwater outlets that discharge to steep gullies should principally be stabilised by stabilising the outlet gully	
Relevant Witheridge 2004 Draft Road Reserve Masterplan Short to Medium Term Action Items (refer to Plan SIR025 at Appendix F)			
13		Repair bitumen potholes intersection of Harold and Thompson	78*
14		Repair potholes in bitumen on Robertson Rd adjacent to Aoma Street.	44*
15		Repair potholes in bitumen at intersection of Thompson Street and	77*

No.	Measure Number	Measure Description	Associated Measure
		Elsie Street	
16		Build-up windrow on Richard Road to prevent flow down private property opposite Cecil Street	16*
17		Cut through earth windrow to allow drainage south off the Elizabeth Park track	96*
18		Close north loop of the Elizabeth Park track to traffic and then rehabilitate/stabilise this area	103*
19		Install temporary timber safety bollards on the two creeks culvert crossings on Richard Road north of the unnamed (40ft wide) road reserve	11, 22, & 34*
20		Conduct tree survey of all road reserves on the island	119*
21		Construct an elevated footpath/stairway on the inside of the sharp bend on the Elizabeth park track just up-slope of Kevin Street, or otherwise make this track safe for all-weather pedestrian access	113*
22		Adopt short-term solution to the stabilisation of the trafficable area and drainage for Hilda Avenue if the road closure has not been completed	
23		Re-profile Thompson St & Hilda Ave intersection and direct flow down Thompson St instead of Hilda Ave	89*
24		Modify the private driveway entries of Richard Road east of the eastern creek crossing to allow flow down a newly reshaped and stabilised table drain. Then re-profile the road as necessary to regularly direct stormwater runoff into the table drain possibly with the use of cross banks	8*
25		Construct cross banks and reprofile surface on the steep section of Thompson Street west of Robertson Road if not closed off to traffic yet	52*
26		Re-profile Florence Terrace between north of Lowanna Street to allow drainage infall to a table drain and to prevent stormwater runoff flowing off the road into the down-slope private property	71*
27		Place vehicle barrier across entrance to Harold Reserve to control	2*

No.	Measure Number	Measure Description	Associated Measure
		traffic	
28		Install cross banks on Elizabeth Park track through western cutting	93*
29		Install a cross bank at top of eastern cutting on the Elizabeth Park track and allow drainage to the south	97*
30		Install two cross banks on the Elizabeth Park track east of summit between the two cuttings	95*
31		Install two cross banks on southern arm of the Elizabeth Park track	111*
32		Re-profile the Thompson Street – Cecil Street intersection to control the direction of stormwater runoff	85*
33		Construct suitable stormwater drainage down Cecil Street	19*
34		Stabilise the drains that enter the eastern creek crossing on Richard Road	10*
35		Replace the stormwater inlet grate on the intersection of Harold Avenue and Richard Road	5*
36		Remove potholes on Florence Terrace north of Pathilda Reserve	66*
37		Remove potholes on Florence Terrace immediately south of Pathilda Reserve	68*
38		Remove potholes on Florence Terrace north of Lowanna Street	72*
39		Remove potholes on Florence Terrace south of Lowanna Street	73*
40		De-silt cross bank at base of eastern cutting on the Elizabeth Park track	99*
41		Remove potholes in Thompson Street west of Cecil Street	86*
42		Fix the log sediment trap on the western cutting of the Elizabeth Park track	92*
43		Replace the stormwater inlet grates on Cargo Hill	38*
44		~~Replace the stormwater inlet grates on Robertson Road east of Yamba~~	45*
45		Stabilise the gully erosion downstream of the stormwater outlet on the intersection of Harold Avenue and Richard Road	3*

No.	Measure Number	Measure Description	Associated Measure
46		~~Re-profile Robertson Road east of Yamba to form infall drainage and form a table drain. One or more cross banks may be required to direct water of the road~~	46*
47		Re-profile the intersection of Florence Terrace and Elsie Street to prevent stormwater runoff bypassing the stormwater inlet	75*
48		Add a cross bank to the south loop of the Elizabeth Park track	104*
49		Stabilise the gully erosion forming in Pathilda Reserve up-slope of Florence Terrace	67*
50		Stabilise gully erosion upstream of Harold Reserve extending up to Thompson Street	4*
51		Install additional cross banks on upper Kevin Street	115*
52		Stabilise north loop of the Elizabeth Park track if this section has not already been closed to traffic and rehabilitated	106*
53		Form a table drain on Florence Terrace immediately south of Pathilda Reserve	69*
54		Re-profile Florence Terrace between Lowanna Street and Elsie Street to form infall drainage and form a table drain	74*
55		Re-profile the intersection of Thompson Street and Robertson Road to sheet stormwater off Robertson Road and through the upper section of Catherine Park	50*
56		Construct formal culvert crossings into private properties along Robertson Road between Cargo Hill and Yamba to allow flow down the table drain. The table drain may need to be reinstated in some locations	43*
57		Re-profile Richard Road west of the eastern creek crossing to allow flow to enter the existing concrete table drain. Or otherwise, remove the concrete drain and form a new rock-lined table drain	15*
58		Formalise a table drain along Florence Terrace north of Pathilda Reserve	65*
59		Construct and stabilise a table drain along Thompson Street between Harold Avenue and Cecil Street. Where necessary, install cross	82*

No.	Measure Number	Measure Description	Associated Measure
		banks to direct stormwater into the table drain	
60		Construct culvert under Thompson Road at creek crossing between Harold Avenue and Cecil Street	83*
61		Remove the dead tree on Cargo Hill	37*
62		Remove fallen tree upstream of the Catherine Park road culvert	55*
63		Establish silt storage areas in Elizabeth Park or any other suitable location. Use these areas to store silt collected from table drain maintenance operations. Treat with gypsum and mix with organise to form a source of topsoil for the rehabilitation of road banks and table drains	109*
64		Revegetate sections of southern arm of the Elizabeth Park track to minimise the amount of exposed soil	112*
65		Stabilise (*rock line*) the table drain in Thompson Street south of Kevin Avenue	118*
66		Revegetate the road batter east of the eastern creek crossing on Richard Road.	9*
67		Clean out the sediment trap in Catherine Park down-slope of Kevin Street	56*
68		Direct flow off Thompson Street down the unnamed (40ft wide) road reserve	91*
69		Form a silt trap at base of eastern cutting on the Elizabeth Park track	100*
70		Cut drains through earth windrow on north side of the Elizabeth Park track east of eastern cutting	101*
71		Clean out the silt trap on north loop on the Elizabeth Park track	105*
72		Clean the culvert on the Elizabeth Park loop	107*
73		Re-profile the bend on Richard Road north-west of Hilda Avenue to prevent excess runoff down through private property	31*
74		Fix the drainage on Richard Road opposite unnamed (40ft wide) road	32*
75		Fix the drainage on Florence Terrace east of Pitt View Street. Possible remove the concrete table drain and replace with a rock-	64*

No.	Measure Number	Measure Description	Associated Measure
		lined drain set lower into the road profile	
76		Duplicate the Catherine Park road culvert	53*
77		Install additional cross bank to the eastern side of the loop road on the Elizabeth Park track	108*
78		Replace the stormwater pits in Catherine Park with traps that have sediment trapping ability	58*
79		Enlarge the detention basin upstream of the Catherine Park culvert	54*

Note * denotes Witheridge Action Item No

6.3 Preliminary Costing

Estimates of the capital cost of each long term measure have been made as part of the study. Short to medium term costs have not been determined as part of this study as the focus is on strategic long term measures.

Note that these cost estimates are preliminary only and are based on WP's experience and judgement as a firm of practising professional engineers familiar with the construction industry. However, they can NOT be guaranteed as we have no control over Contractor's prices, market forces and competitive bids from tenderers. The estimates may exclude items which should be considered in an overall cost plan. Examples of such items are design fees, project management fees, authority approval fees, contractors risk and project contingencies (*e.g. to account for construction and site conditions, weather conditions, ground conditions and unknown services*). Any cost estimate by WP is not to be relied upon in any way. If a reliable cost estimate is required, then an appropriately qualified Quantity Surveyor should be engaged.

The predicted capital costs of each proposed measure are summarised in **Table 10**. Note these estimates do not include any ongoing maintenance, decommissioning costs, land acquisition costs and/or legal/administration/consultant costs.

Table 10 – Long Term Measure Cost Estimates

No.	Measure No.	Capital Cost Estimate *($AUS 2007)*
1	H1	-
2	H2	-
3	H3	-

No.	Measure No.	Capital Cost Estimate *($AUS 2007)*
4	H4	-
5	H5	$81,000 (*see Measures S2&W10*)
6	H6	$220,000 (*See Measure P18*)
7	H7	$195,000
8	H8	$165,000
9	H9	$110,000 + purchase of land
10	H10	$160,000
11	H11	$25,000
12	H12	-
13	TP1	-
14	TM1	-
15	S1	$200,000
16	S2	$81,000 (*See Measures H5 & W10*)
17	S3	$119,000 (*see Measure P6*)
18	S4	$186,000 (*see Measure P10*)
19	S5	$54,000
20	S6	$59,000 (*see Measure P2*)
21	S7	$152,000 (*see Measure P5*)
22	S8	$100,000
23	S9	$10,000
24	S10	$10,000
25	S11	$5,000
26	S12	$6,000
27	S13	$5,000
28	S14	$8,000
29	S15	$80,000 (*see Measure H6*)

No.	Measure No.	Capital Cost Estimate *($AUS 2007)*
30	S16	$25,000
31	S17	-
32	S18	-
33	S19	-
33.5	S20	$55,000
34	W1	$6,000
35	W2	$2,000
36	W3	$2,000
37	W4	$6,000
38	W5	$11,000
39	W6	$3,500
40	W7	$7,000
41	W8	$8,500
42	W9	-
43	W10	$81,000 (*See Measures S2 & H5*)
44	W11	$25,000
45	PK1	-
46	DL1	$2,887,000 (*See Measures P1 to P19*)
47	DL2	$950,000
48	DL3	$350,000
49	DL4	$400,000 (*Note costs for seal and stabilisation included in Measure DL1*)
50	DL5	-
51	DL6	$1,060,000 (*all public based measures*)
52	C1	-
53	RF1	-

No.	Measure No.	Capital Cost Estimate *($AUS 2007)*
54	SL1	-
55	US1	-
56	P1	$68,000
57	P2	$59,000 (*see Measure S6*)
58	P3	$202,000
59	P4	$168,000
60	P5	$152,000 (*see Measure S7*)
61	P6	$119,000 (*See Measure P6*)
62	P7	$101,000
63	P8	$194,000
64	P9	$101,000
65	P10	$186,000 (*see Measure S4)*
66	P11	$61,000
67	P12	$41,500
68	P13	$66,000
69	P14	$310,500
70	P15	$273,000
71	P16	$250,000
72	P17	$155,000
73	P18	$220,000 (*see Measure H6*)
74	P19	$160,000
75	P20	-
76	P21	$40,000
77	P22	$19,000
78	RW1	-
79	RL1	-

No.	Measure No.	Capital Cost Estimate *($AUS 2007)*
80	M1	-
81	M2	-
82	M3	-
83	M4	-
84	M5	-
85	M6	-

Note : - denotes measures with costs that are difficult to define at this strategic stage (ie subject of future detailed investigation)

6.4 Implementation

Implementation of measures should be undertaken on a priority basis. It was not within the scope of this study to prioritise the importance of individual measures. However, Witheridge in his August 2004 road reserve Masterplan did place a priority on many of the short to medium term measures that have been included in **Table 9** (*ie those marked with an asterisk*). For details of these priority rankings refer to the following: "*Draft Scotland Island Road Reserve Masterplan*" G Witheridge, August 2004.

Determination of measure priorities for all long term recommendations should be the subject of a future study which concentrates on quantifying cost versus benefit.

6.5 Possible Funding Sources

Possible sources of future funding for the works recommended as part of this Road Reserve Strategy are summarised as follows:

1. Council (*Local Government*) funding;
2. State or Federal Government grants;
3. Special Island Vehicle Levy's;
4. Sale of surplus land (*subject to vigorous environmental impact assessment*);
5. Public contributions/donations (*ie community, groups of property owners etc*);
6. Developer contributions (*ie levied as part of development application*). and