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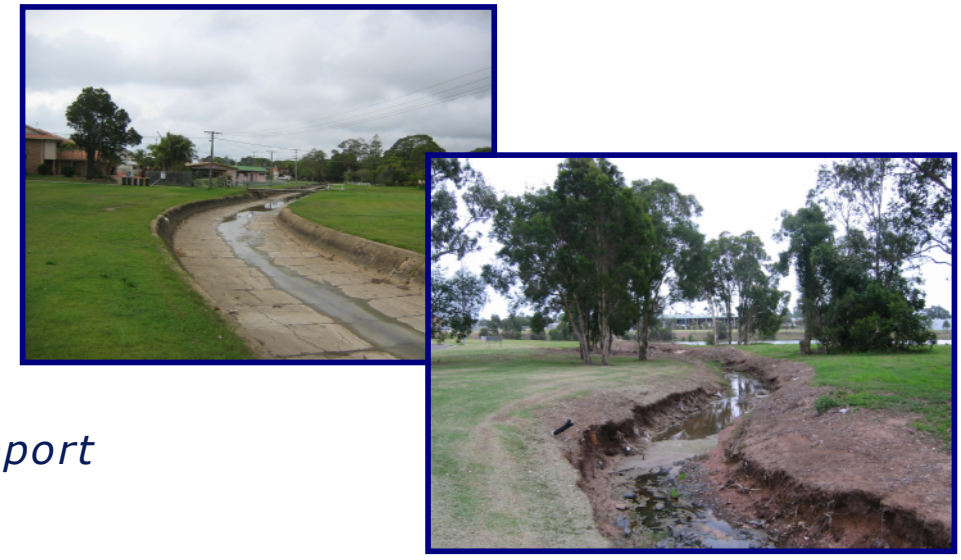
HERVEY BAY CITY COUNCIL

Tooan Tooan Creek Flood Risk Reduction Study



Report

November 2006

Hervey Bay City Council

Tooan Tooan Creek Flood Risk Reduction Study

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Appendices

1 Introduction

John Wilson & Partners (JWP) has been commissioned by Hervey Bay City Council (HBCC) to undertake a Flood Risk Reduction Study for the Tooan Tooan Creek Catchment area. The Tooan Tooan Creek catchment comprises two (2) separate study areas known as the Taylor and Stephenson Street Catchments. The purpose of the study includes: -

- Documenting the existing flooding and drainage characteristics throughout the catchment for a range of design flood events;
- Undertaking a board flood risk assessment for the catchments based upon the existing flooding characteristics. This includes the identification of areas of risk within the catchment; and
- Identifying at least in a broad sense the various options for managing and reducing existing flood risks in the catchment. These options will form the basis on which future flood risk reduction strategies will then be developed for the catchment.

It is the intent of this study to form the basis on which existing flooding problems are characterised including the assessment of flood risks for the purposes of providing the base information on which future flood risk reduction activities can be investigated and undertaken for the catchment. The management of catchment flood risks and the various strategies required to reduce these risks is outside the scope of works for this project and thus will be the subject of a more detailed assessment to be undertaken in the future.

The scope of works undertaken for this study has included:

- Consolidation of GIS data;
- The identification of existing drainage patterns including both piped systems (trunk drainage) and major overland flows via a detailed site inspections;
- Undertaking a review of the existing XP-STORM models for both the Taylor and Stephenson catchments as were provided by HBCC. This includes identifying model nodal and cross sectional locations, major drainage paths and systems along with sub-catchment boundaries;
- Model update and incorporation of recently constructed drainage works in the various catchments. These works have included constructed culverts and piped drainage works whereby it was necessary to incorporate into the model to represent the existing case scenario;
- Re-analysis of both catchment models for the 1 in 10, 20, 50 and 100 year ARI design events to ascertain existing case flood information;
- Preparation of summary water surface level results in addition with preparing GIS inundation plans for each of the modelled events across both catchments;
- Utilising the updated flood information, identify the board flood risks throughout the catchments. This included the assessment of flood risk areas of concern in terms of road and property inundation; and
- Prepare a consolidated flood risk report to include both catchments investigated and assessed. The report provides the study documentation and includes the methodology and outcomes prepared as a formal report on the investigation as well as including the outcomes from the flood risk assessment and identification works undertaken.

The following sections of this report aim to fully document the analysis works undertaken as part of this investigation of the Tooan Tooan Catchment.

2 Catchment Description and Supplied Data

2.1 Study Area

The Tooan Tooan Creek study area consists of two (2) adjacent catchments known as the Taylor and Stephenson Street catchments. Both catchments are in a state of heavy urbanisation and are located near the centre of the city of Hervey Bay. The natural drainage flow paths present in both catchments are highly modified and are typified by engineered open channels and formalised sub-surface stormwater drainage systems. Both catchments encompass predominantly commercial and industrial areas of the Pialba Precinct with existing tracts of residential and open space areas. The total area of the Tooan Tooan Catchment is approximately 305 hectares. Of this total area, the individual catchment areas of the Taylor Street and Stephenson Street catchments are approximately 200 and 105 hectares respectively.

2.2 Study Data

The works undertaken as part of this study have been prepared based upon a compilation of data sources as provided by Hervey Bay City Council for the purposes of the project. Although JWP were provided with existing hydraulic models for both the Taylor and Stephenson Street catchments, additional data was supplied to assist the investigation which is outlined and discussed separately below.

2.2.1 Topography Data

Topographical data for the study area was provided in the form of contour information at various contour intervals throughout the majority of the built environment of Hervey Bay. As the contour data represents the only available information for the catchment, it was subsequently adopted for the purposes of this study. To facilitate the use of this information, JWP has used the contour information to prepare a Digital Terrain Model (DTM) in order to facilitate data extraction for the various modelling tasks undertaken as part of this study. As the DTM was prepared using the contour information supplied and not from raw data, limitations in the degree of detail afforded by the DTM should be noted.

2.2.2 Model Data

The flood risk assessment of the Tooan Tooan Creek catchment is based on two (2) existing XP-STORM hydraulic models for both the Taylor and Stephenson catchments as were originally developed by Council for infrastructure upgrade purposes. These models represented the existing waterway conditions at the time of the original model development and as such did prescriptively include neither the various catchment changes which have since occurred nor the recent infrastructure upgrades as noted previously. Figure 1 overleaf illustrates the location of each model with regard to the overall Tooan Tooan Catchment study area.

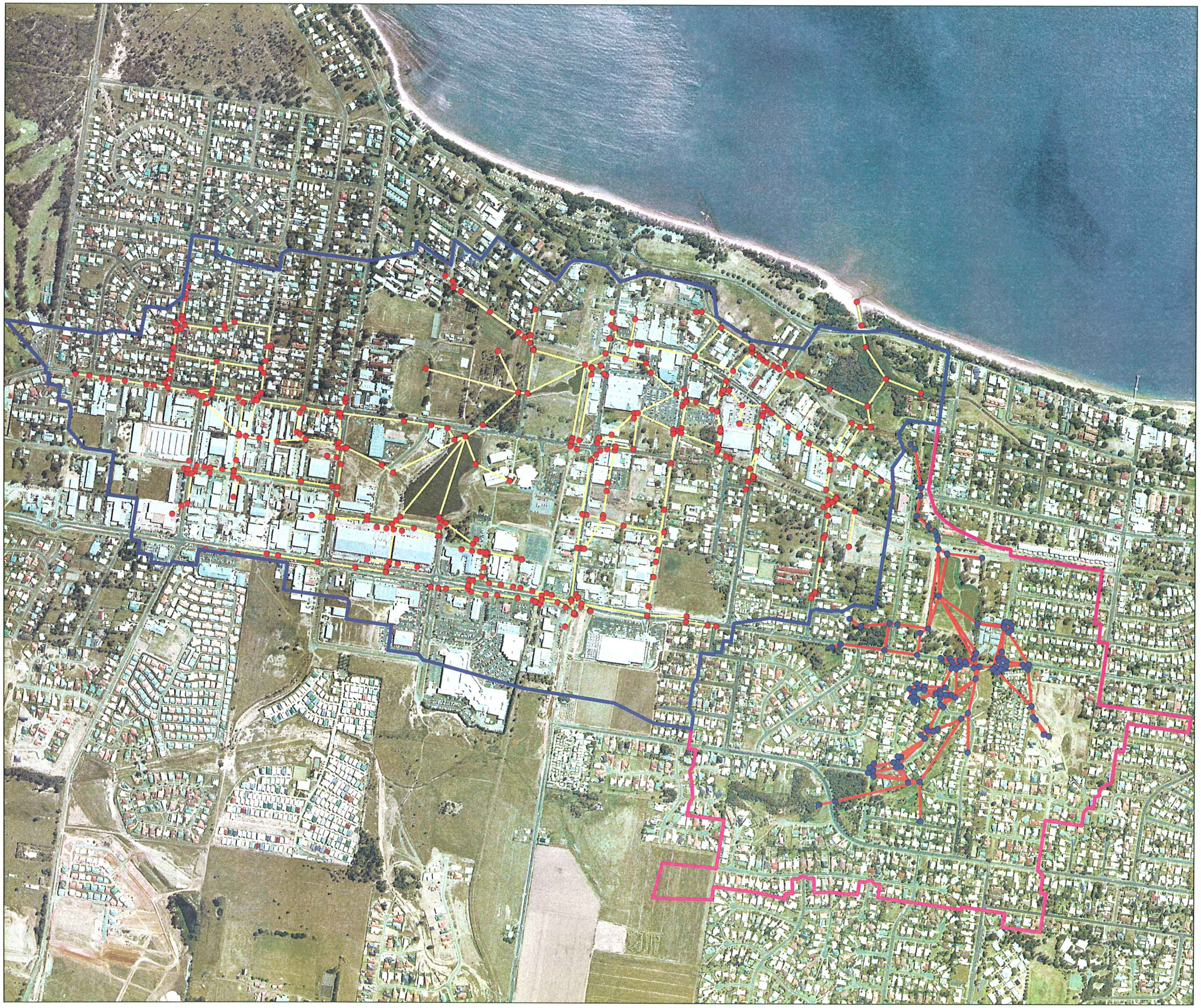
2.2.3 As-Constructed and Pipe Data

Prior to the commencement of the project, JWP was supplied with as-constructed data for the recent infrastructure upgrades now constructed within the Tooan Tooan Catchment. The infrastructure upgrades included new augmented pipe systems along with additional drainage structures within the various waterways. In addition to this data, existing pipe and culvert information throughout the catchment was also provided by Hervey Bay City Council for the purposes of this study. The various drainage information supplied included GIS format data which was extracted directly from Council's existing GIS system.

Details of the existing pipe information was provided through Council supplied GIS data, in addition with the aforementioned field survey data received during the project to confirm pipe sizes and invert level details.

2.3 Site Inspection

As part of the works for this study, JWP have undertaken a site inspection of the catchment. The site inspection was documented by way of site notes and photographs. Together, this information assisted in the definition of the catchment and existing drainage patterns, flow regimes and Council's existing models as well as benefiting in reviewing appropriate roughness parameters and verification of existing hydraulic structures.



N

Legend

- Stephenson Street Catchment Model Nodes
- Stephensen Street Catchment Model Links
- Taylor Street Catchment Model Nodes
- Taylor Street Catchment Model Links
- Stephenson Street Catchment
- Taylor Street Catchment

Scale: 1:10,000

TOOAN TOOAN CREEK FLOOD RISK REDUCTION ASSESSMENT

FIGURE 1

MODEL LAYOUT

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Projection Trans. Merc. MGA56(GDA 94)

3 Hydraulic Modelling

The original hydraulic modelling on the Tooan Tooan Catchment was undertaken by HBCC through the preparation of two (2) separate XP-STORM models. These models were previously developed by Council in order to establish a basis for determining the existing flood characteristics throughout the catchment as well as resulting stormwater infrastructure along with identifying potential areas of flooding problems. These models were supplied to JWP by HBCC along with supporting information in the form of project reports and strategic planning documents.

3.1 Existing Hydraulic Models

Existing hydraulic models for both the Taylor and Stephenson Street Catchments were supplied by Council for the purposes of this study. These models were reviewed and then re-analysed for a range of durations from 20 to 720 minutes to determine any specific modelling issues as well as assisting in the identification of model node and link locations for future GIS mapping activities. The preliminary analysis and review of the base models highlighted the following issues: -

- Some large instabilities in various pasts of the model and specifically in links upstream of Old Maryborough Road basin;
- Ground surface levels taken from the Stephenson Street Catchment model and those from the supplied DTM were found to be inconsistent. In some cases, large discrepancies were found to exist between the model inverts versus that of the DTM; and
- The presence of an open drain in various areas in both XP-STORM models was represented by a trapezoidal channel in the modelling environment. The DTM however reflected the fact that the channel was in fact a distinct open channel with different dimensions and configurations to that represented in the model.

The various differences and issues identified in the existing models were primarily due to the fact that the models had been originally prepared some time ago. Consequently, the main differences were a result of different catchment conditions and drainage characteristics that had since changed since the initial model development. These changes resulted in various issues being evident for this current study with the major problem being in the determination of flood extents and depths. The determination of flood extents requires that the reported water surface level at each model node location be draped over the natural cross section extracted using the DTM. As such, the extent generated is not always representative and relies on the fact that the model water depths are taken from the base topography defined in the DTM.

After consultation with HBCC regarding these issues and with consideration of the project scope being a board flood risk assessment study, a decision was made not to undertake a detailed update of the models as part of this study. It is acknowledged however that this work would be required at a future stage where a more detailed assessment of flood reduction strategies and mitigation works is undertaken. For the purposes of this study however, JWP has adopted the existing model as the basis on which constructed infrastructure upgrades of discrete areas have been represented in the model as were advised by Council.

3.2 Hydraulic Model Amendment

To represent the existing conditions and specifically the infrastructure items that have been since constructed, both XP-STORM models have been amended as part of this study. Following the site inspection and a discussion with HBCC, it was apparent that no upgrade works have been constructed or need to be considered in the Stephenson Street Catchment and consequently only the Taylor Street model needed to be amended for the purposes of this study. Table 3.1 below

summarises the structural changes to the Taylor Street model that have been undertaken as part of this project using as-constructed information supplied by Council.

Table 3.1: Model Upgrades - Taylor Street Catchment Model

Location	Model Upgrades
Hervey Bay High School	➢ Insertion of a detention basin in the High School grounds.
Neils St Drainage Plan	➢ Pipe upgrades along Neils Street and along Torquay Road between Stephenson Street and Taylor Street.
Old Maryborough Rd Drainage Works	➢ Create new concrete driveway on lot 84; ➢ Insert three storm water pipes below concrete driveway; ➢ Connect new storm water pipes to existing pipe network.
Pialba Main Drain Upgrade	➢ Construct 2 No. 1500mmx1200mm Reinforced Concrete Box Culverts and insert into the model.
Open Channel Improvements and Pollution Reduction Device Hillyard Street, Pialba	➢ Divert existing 150mm roof water pipes to new manholes; ➢ Create new concrete driveways; ➢ Insert new cast in-situ box culvert.
Drainage Improvements Works, Pialba Main Drain – 'The Village'	➢ Alter existing service pits and pipes to match proposed plans; ➢ Pave areas indicated on Proposed Drainage Improvement Works Plan; ➢ Concrete areas indicated on Proposed Drainage Improvement Works Plan; ➢ Add gardens indicated on Proposed Drainage Improvement Works Plan.

Model upgrades were completed with the assistance of as-constructed plans supplied to JWP by HBCC in addition to relevant documents with regards to proposed drainage improvement works.

3.3 Hydraulic Model Analysis

The hydraulic XP-STORM models for both the Taylor and Stephenson Street catchment areas were subsequently re-analysed following the model updates and revisions outlined above. In all cases, the models were re-analysed for the 1 in 10, 20, 50 and 100 year ARI design events for storm durations ranging from 20 to 720 minutes. The results of the analysis are discussed separately below.

4 Discussion of Existing Results

4.1 Flood Level and Depth Summaries

All calculated water surface levels and flood depths for the Taylor and Stephenson Street existing scenario XP-STORM models are summarised in Appendices A and B respectively. The results are presented based on flood level and discharge reporting locations and these are summarised in detail in tabular formats. The locations of the reporting points are illustrated on the GIS maps (refer separate discussion below).

4.2 GIS Flood Maps

The flood levels have been used as a basis on which GIS flood extent maps for the Taylor Street catchment have been prepared for each of the design events analysed. The flood extent plans for the existing scenario model for the Taylor Street catchment is attached in Appendix C. The extent maps include locations and labels to illustrate the various reporting locations and names to facilitate cross-reference with the tabular summaries presented in Appendix A.

Owing to the problems associated with the differences in the DTM levels compared to that in the XP-STORM model, it was not possible or practical to prepare accurate and representative flood extent plans for the Stephenson Street catchment. Rather, for the purposes of this study detailed plans have been prepared to highlight the water surface levels and depths at each of the model reporting locations throughout the Stephenson Street catchment. The reporting location GIS plans are provided in Appendix D of this report and include locations and labels to facilitate cross-reference with the tabular summaries presented in Appendix B.

4.3 Limitations of GIS Flood Maps

Flood extent maps have been prepared as part of this study to assist in illustrating areas of concern with regards to flooding and flood risk. The plans are presented to demonstrate the anticipated extent of flooding for the 1 in 10, 20, 50 and 100 year ARI events over the study area for the existing case. The flood extent plans have been prepared based upon the DTM and using the outcomes from the hydraulic model. This has been achieved based on the creation of a 3-dimensional (3D) flood surface using the model results within the GIS and the subsequent draping of this surface over the DTM in order to prepare a 3D flood depth surface. The 3D flood depth surface has then been contoured in a manner such that only positive flood depths greater than or equal to zero are displayed which by default defines the extent of flood inundation for the event under question.

The flood extent plans prepared as part of this study include extent of mapping limits as have been identified on the plans. These limits have been included to illustrate the point of which mapping has been prepared and this is based on both the extent of the XP-STORM model along with the extent of the DTM data for the catchment. Limit of mapping lines have also been included in other isolated areas whereby the extent of flooding was undiscernible, inaccurately defined or not representative based upon the information available. In all cases, water is expected to discharge from the catchment in these areas primarily in the form of sheet flows.

The flood inundation mapping prepared as part of this study is therefore subject to the following points: -

1. The flood extent and associated flood data prepared as part of this study is based on available survey data as supplied by Hervey Bay City Council. This includes aerial photogrammetric survey, limited field validation survey and stormwater pipe and pit information. The flood extents and flood results will therefore be subject to the accuracy and detail of the background study information and the models supplied to JWP; and

2. Initial model runs showed that ground surface levels in the models were different to that determined using the DTM and were therefore not consistent. In some areas throughout the models, large discrepancies existed between the corresponding ground levels. Other issues between the models versus the DTM included different channel configurations. As such, flood extents prepared as part of this study should be treated with caution and specifically for the Stephenson Street Catchment is the sole reason why flood extent plans have not been prepared.

5 Existing Scenario Risk Identification

5.1 Risk Identification Methodology

The method of evaluating flood risk prepared as part of this study is summarised in the following tables.

Likelihood parameters

Almost certain	A 99.5% chance of a hazard being exceeded in a 50 year period – a 1 in 10 year event.
Likely	Probability of exceedance is greater than 50% in a 50 year period, but less than 99.5% - a 1 in 50 year event.
Possible	Probability of exceedance is greater than 20% in a 50 year period, but less than 50% - a 1 in 100 - 200year event.
Unlikely	Probability of exceedance is greater than 5% in a 50 year period. but less than 20% - a 1 in 500 year event
Rare	Probability of exceedance is less than 5% in a 50 year period - a 1 in 500 year event.

Consequence parameters (based on 2000 AU$)

Insignificant	Natural hazards are experienced and cause some stress on community lifelines. Community agencies cope with some effort and total community financial loss is less than $1.0m.
Minor	No disaster is officially declared and effects lead to temporary failure of lifelines other than energy supply for up to 24 hours. Total community financial loss is less than $10m.
Moderate	Disruption lasts for more than 5 days including energy disruption. Recovery takes 14 – 21 days. Vulnerable elements are severely affected and all major agencies are involved. Hospitalisation of victims occurs and total community financial loss is less than $50m. State of emergency is declared during the event.
Major	All lifelines affected. Energy is disrupted for up to 14 days. Recovery takes 4 – 6 weeks. At least one death is suffered and temporary evacuation of area is required. State of Disaster is declared and total community loss is up to $200m.
Catastrophic	Effects are severe and all lifelines are affected. No energy for up to 8 weeks and recovery takes 6 – 24 months. At least 10 deaths suffered and significant evacuation required. Total community financial loss in hundreds of millions.

Risk Ranking

Return period	**Consequence / Likelihood**	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
10	Almost certain	H	H	E	E	E
50	Likely	M	H	H	E	E
100/200	Possible	L	M	H	E	E
500	Unlikely	L	L	M	H	E
1000	Rare	L	L	M	H	H

Where: E = extreme risk H = high risk M = moderate risk L = low risk

In addition to infrastructure lifelines, risk parameters for people, buildings, economic loss and loss of the natural environment are proposed as follows: -

Risk element	Extreme (unacceptable) risk
People	Vulnerability to natural hazards is generally measured by the risk to life and property from known hazards. An area may be prone to a known hazard, but if there is no possible risk to life or property, the vulnerability is low. Where life and property are at risk, the magnitude and likelihood of the hazard combine to create a measure of vulnerability. **Unacceptable risks are death, serious injury and major health hazard.**
Buildings	The built environment is at risk from a number of known hazards in Hervey Bay. Various regulations have been developed locally (e.g. Local Laws) and at a wider scale (e.g. the Building Code of Australia) to minimise the risk of damage to the built environment. All of these regulations are based on an acceptable level of risk which has been determined either by Council or a wider community of interest (e.g., 1:100 flood immunity). Inevitably there will be extreme events which go beyond the acceptable level of immunity and the only possible way to immunise against these events is avoidance. **Unacceptable risks are collapse or damage to buildings requiring demolition.**
Economic loss	In all disaster events there is bound to be some form of economic loss. The Federal Government under the Natural Disaster Relief Arrangements provides funding to victims of disaster events. This funding is generally short term and designed to minimise immediate suffering and loss. Businesses need to make their own assessment of potential economic loss through a natural disaster event and make plans accordingly. These would range from building construction, to choice of location to insurance. **Unacceptable risks are loss of livelihood for more than 10% of the working community.**
Natural environment	The natural environment is at risk from a number of known hazards in Hervey Bay. **Unacceptable risks are loss of ecological systems, major habitats or conservation areas. Significant disruption to natural drainage systems.**
Risk escalation Risk escalation is likely to happen when initial risk minimisation programs or event response mechanisms do not achieve their intended purpose. The risks outlined in this document may have follow-on or secondary effects (e.g. an earthquake may lead to a dam break, which may lead to flooding, which may lead to injury or isolation). **Unacceptable risks arise from the failure of initial risk minimisation and response mechanisms.**	
Risk frequency Risks to physical infrastructure are usually incorporated in design parameters (e.g. bridges are designed to withstand certain loads; drains are designed to accommodate mathematically derived flood levels). These are generally based on industry standards of acceptable levels of risk. These standards have until recently had very little legislative basis. The recent adoption of *State Planning 1/03 - Mitigating the adverse impacts of Flood, Bushfire and Landslide* introduces risk frequency levels (e.g. 1:100 years) which are required to be accommodated in planning and design documents (e.g. planning schemes and infrastructure codes). **Unacceptable risks are events which occur within the design capacity of infrastructure or industry accepted measures.**	

Legal and social justice implications Risk management is applied by Council across all parts of its jurisdiction in an equal manner and includes all persons. Council is required to make decisions on an annual basis about prioritising its expenditure on various competing items. Expenditure on risk minimisation is incorporated in most capital works projects by way of an in-built design standard. **Unacceptable risks are deliberate inequality of expenditure against any one group, or any one part of the city.**
Political implications Council's decisions are subject to scrutiny and influence from various elements and sectors of the community. It is Council's role to make informed and un-biased decisions. **Unacceptable risks are decisions made which reflect unlawful political bias.**

For both models investigated as part of the Tooan Tooan Creek Flood Risk Assessment, specific flood risks were identified through use of the above risk matrix and examination of modelling results as discussed previously in Section 4. The risk matrix was used in conjunction with a detailed assessment that was undertaken for each of the roads contained in the models to determine less obvious flooding risks such as minor overtopping and property inundation and to determine any risk (velocity x depth) issues. A risk ranking for each specific flooding risk was then determined. A description of flooding and risk ranking for each model is presented separately below.

The following tables summarise the risk analysis for each specific model, namely the Taylor Street and Stephenson Street Catchments which together represent the various drainage networks within the Tooan Tooan catchment.

5.2 Taylor Street Catchment

It is evident from the inundation plans that flooding is extensive throughout the Taylor Street Catchment. An examination of the flood inundation maps indicates that large sections of the catchment are inundated during relatively minor rainfall events. The maps prepared have been critically assessed and this has identified a total of nineteen (19) separate critical locations as being seriously inundated and as such has significant risks as are outlined in Table 5.1.

Table 5.1: Critical Areas of Flood Inundation – Taylor Street Catchment

Location	Mapping Node	Model Node	Q10 Depth	Q20 Depth	Q50 Depth	Q100 Depth	Maximum Velocity	Maximum Depth Velocity Ratio
			(m,AHD)	(m,AHD)	(m,AHD)	(m,AHD)	(m/s)	(dxv)
Jack Street	N130	SWP1593	0.21	0.26	0.31	0.35	2.62	0.92
Ripley Street	N125	SWP1611	0.31	0.33	0.34	0.36	0.68	0.24
Romney Street	N164	SWP1906	0.36	0.37	0.39	0.41	1.91	0.78
Winchelsea Street	N122	SWP1606	0.25	0.26	0.27	0.28	1.60	0.45
Old Maryborough Road	N356	OMR-4/1	0.32	0.34	0.37	0.39	2.60	1.01
Nissen Street	N140	SWP1857	0.52	0.55	0.58	0.61	1.60	0.98
Beach Road	N272	SWP4307	0.24	0.26	0.27	0.28	2.99	0.84
Islander Road	N152	SWP1915	0.27	0.29	0.30	0.30	2.71	0.81
Boat Harbour Drive	N84	SWP1657	0.65	0.91	1.04	1.12	0.16	0.18
Alice Street	N73	SWP1116	0.14	0.15	0.16	0.17	2.81	0.48
Charles Street	N61	SWP4182	0.15	0.16	0.17	0.34	1.73	0.59
Main Street	N60	SWP1478	0.00	0.05	0.07	0.21	1.48	0.31
Hunter Street	N37	SWP1095	0.61	0.83	0.86	0.97	2.31	2.24
Taylor Street	N5	SWP1060	0.27	0.28	0.29	0.31	2.12	0.66
Neils Street	N8	SWP1150	0.18	0.23	0.26	0.30	1.27	0.38
Andrew Street	N285	SWP3308	0.48	0.52	0.58	0.63	0.14	0.09
Torquay Road	N203	SWP1409	0.00	0.00	0.00	0.30	2.63	0.79
Bryant Street	N190	Bryant	0.11	0.12	0.13	0.14	1.38	0.19
Hillyard Street	N38	SWP4238	0.09	0.10	0.10	0.11	2.22	0.24

According to section 5.09 of the QUDM, it is recommended that the maximum depth of flow on any road be limited to 300mm and the product of depth (d) and average velocity (V_{ave}) in the kerb and channel should not exceed 0.4 m^2/s to limit pedestrian hazards within the roadways. This standard has been adopted for the purposes of this assessment due to the fact that the roads may be used by both pedestrians and vehicles. As highlighted in Table 5.1 above, the majority of the problem areas have depth-velocity ratios that exceed those recommended by the QUDM. The calculated depths in many of these areas also exceed 300mm and as such it can be seen that large sections of the Taylor Street Catchment are either seriously inundated or are at a high risk in terms of inundation. The flood extents also indicate that there is considerable inundation of residential and commercial properties throughout the Taylor Street Catchment and as such it is critical that flood risk reduction measures are implemented. Table 5.2 outlines the flood risk analysis for the critically inundated areas of the Taylor Street Catchment.

Table 5.2 - Flood Risk Analysis – Taylor Street Catchment

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Jack Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	×	Likely	Minor	**High**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Medium**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Ripley Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	×	Possible	Minor	**Medium**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Romney Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	×	Likely	Minor	**High**	✓
	Buildings	Q100 immunity	×	Likely	Minor	**High**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Winchelsea Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Possible	Insignificant	**Low**	×
	Buildings	Q100 immunity	✓	Possible	Minor	**Moderate**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Old Maryborough Road	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Moderate**	✓
	People - ease of egress	DV Product <0.4	×	Almost Certain	Minor	**High**	✓
	Buildings	Q100 immunity	×	Almost Certain	Minor	**High**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Nissen Street	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Moderate**	✓
	People - ease of egress	DV Product <0.4	×	Likely	Insignificant	**Moderate**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Moderate**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Beach Road	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Moderate**	✓
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Moderate**	✓
	Buildings	Q100 immunity	×	Likely	Minor	**High**	✓

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Islander Road	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Moderate**	✓
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Moderate**	✓
	Buildings	Q100 immunity	×	Likely	Minor	**High**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Boat Harbour Drive	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Moderate**	✓
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	×	Possible	Minor	**Moderate**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Alice Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Moderate**	✓
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Charles Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Moderate**	✓
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Main Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	×	Possible	Minor	**Moderate**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Hunter Street	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Moderate**	✓
	People - ease of egress	DV Product <0.4	×	Likely	Minor	**High**	✓
	Buildings	Q100 immunity	×	Likely	Minor	**High**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Taylor Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Moderate**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Moderate**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Neils Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Andrew Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	×	Likely	Minor	**High**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Torquay Road	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Moderate**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Moderate**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Bryant Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Hillyard Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

5.3 Stephenson Street Catchment

As highlighted previously, in many sections of the existing Stephensen Street Catchment model structural inverts did not match the corresponding levels with the supplied digital terrain model. As such, JWP were unable to create flood extents for the each of the events modelled. However, plans indicating the location of the XP-STORM reporting nodes with annotated water surface levels and depths have been included in Appendix D.

For the purposes of this risk assessment study, an assessment of existing flood risk has been undertaken based upon the available information from the modelling works. While the flood risk assessment could not be undertaken based on the flood extent maps as discussed above, and assessment of flood risk has been prepared based upon the following information: -

- Inspecting the XP-STORM model to ascertain the magnitude of flood depths at various locations throughout the catchment. These depths are the same as that presented on the plans attached in Appendix D. Note that the depths illustrated represent model depths and not depths based on the DTM; and
- Inspection of the XP-STORM model for the purposes of ascertaining average flow velocities along the various links represented in the model.

Using the flood depth information in conjunction with flow velocities based on the XP-STORM model, it was possible to undertake a board assessment of flood risk throughout the Stephenson Street catchment. Table 5.3 below summarises the critical locations identified as being seriously inundated and as such has significant risks for the Stephenson Street catchment.

Table 5.3: Critical Areas of Flood Inundation – Stephenson Street Catchment

Location	Mapping Node	Model Node	Q10 Depth	Q20 Depth	Q50 Depth	Q100 Depth	Maximum Velocity	Maximum Depth Velocity Ratio
			(m,AHD)	(m,AHD)	(m,AHD)	(m,AHD)	(m/s)	(dxv)
Banksia Park Drive	N46	A55-1-23	0.16	0.16	0.17	0.18	0.50	0.09
Shelley Street	N10	A45-5	0.26	0.27	0.29	0.31	3.88	1.20
Cassia Avenue	N59	A40-2-2-5	0.09	0.10	0.10	0.11	0.28	0.03
Boat Harbour Drive	N5	A25-10	0.39	0.41	0.45	0.48	1.20	0.58
Boat Harbour Drive	N38	A35-1-2o	0.19	0.25	0.27	0.31	1.49	0.46
McNally Street	N35	A30-5-5o	0.22	0.27	0.31	0.37	0.06	0.02

Table 5.4: Flood Risk Analysis – Stephenson Street Catchment

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Banksia Park Drive	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Shelley Street	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Medium**	✓
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Medium**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Medium**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Cassia Avenue	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	✓	Unlikely	Insignificant	**Low**	×
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

Location	Risk Element	Acceptable standard	Currently meets desired risk standard	Likelihood	Consequence	Risk Ranking	Mitigation Works Required
Boat Harbour Drive (West)	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Medium**	✓
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Medium**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Medium**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
Boat Harbour Drive (East)	People - drowning	No resultant deaths, injuries or major health hazards	×	Possible	Minor	**Medium**	✓
	People - ease of egress	DV Product <0.4	×	Possible	Minor	**Medium**	✓
	Buildings	Q100 immunity	×	Possible	Minor	**Medium**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×
McNally Street	People - drowning	No resultant deaths, injuries or major health hazards	✓	Unlikely	Insignificant	**Low**	×
	People - ease of egress	DV Product <0.4	✓	Unlikely	Insignificant	**Low**	×
	Buildings	Q100 immunity	×	Possible	Insignificant	**Low**	✓
	Economic loss	Loss of livelihood for less than 10% of working community	✓	Unlikely	Insignificant	**Low**	×
	Natural environment	N/A	✓	Unlikely	Insignificant	**Low**	×

6 Risk Treatment & Flood Mitigation

6.1 Overview of Mitigation

As was mentioned previously, there were some discrepancies resulting from the hydraulic model in terms of both the representation of various waterway systems as well as the differences in inverts compared to the DTM. Given these differences, it was extremely difficult to undertake a prescriptive assessment of mitigation options for the purposes of alleviating or reducing flood risks for all critical areas identified in Section 5 previously. These aspects were discussed with Hervey Bay City Council and it was decided that the prescriptive analysis of mitigation options using the existing models could not be undertaken effectively so as to provide a practical mitigation outcome. As such, no modelling works associated with the assessment of mitigation options have been undertaken for the purposes of this study.

It is noted that future mitigation options will need to be assessed in more detail in order to devise effective strategies for reducing flood risks in the Stephenson and Taylor Street catchments. These works will be scheduled at some future stage. When this work is undertaken the resulting models for both catchments will be revised and updated to reflect the existing catchment conditions and therefore will be suitable for the purposes of undertaking the detailed mitigation assessments as will be required.

For the purposes of this study and in order to maximise the outcomes from the flood risk assessment at least in a board context, JWP have utilised the existing case model results and have made a qualitative assessment of what is considered to be effective and viable mitigation options. While these options will be subject to more detailed scrutiny in the future, this none the less serves to provide a summary of the options that may be appropriate in the various systems. Specifically, flooding areas that were identified as medium risk (Stephenson Street catchment) and high risk (Taylor Street Catchment) have been investigated by means of drainage augmentation or other forms of mitigation works with the aim of an overall reduction of the flooding risk. A separate discussion of the various options is presented in the sections of this report which follow.

6.2 Taylor Street Catchment

The risk rankings for the Taylor Street catchment were generally low to moderate however there are several locations in the catchment whereby a high risk existed. As such, risk standards were not met for all locations and mitigation works are therefore necessary. The key aspect for the Taylor Street catchment is to focus specifically on reducing high flood risk in the first instance as being the greater priority. Therefore, it is recommended that mitigation works be undertaken at discrete locations throughout the catchment at the following locations to assist in reducing high flood risk: -

- Jack Street - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Drainage augmentation works and upgrades of the existing system. This includes augmented pipe systems, pipe diversions and duplicated pipes;

- Romney Street - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Drainage augmentation works and upgrades of the existing system. This includes augmented pipe systems, pipe diversions and duplicated pipes;

- Old Maryborough Road - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Augmenting the existing drainage system in the area. This includes increased pipe capacities and/or duplications and extending these along the road and into the existing lake system further downstream;

- Beach Road - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Augmenting the existing drainage system in the area. This includes increased pipe capacities and/or duplications at strategic locations upstream from Beach Road for the purposes of lowering the overland flow depths and maximising the existing road drainage capacities; and
  - Lowering the existing channel system invert downstream to the lake. This lowering will assist in reducing upstream flood depths in the catchment as well as providing additional conveyance capacity in the lower drainage system reaches;

- Islander Road - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Augmenting the existing drainage system in the area. This includes increased pipe capacities and/or duplications and ensuring that the augmented system connects into the proposed upgrade works associated with Beach Road previously. In particular, the open channel works proposed as part of the Beach Road works will also greatly assist in reducing flood risk along Islander Road where an augmented drainage system is constructed in combination;

- Hunter Street - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Augmenting the existing drainage system in the area. This area of the catchment is reasonably complex and the proposed mitigation works will need to focus specifically on reducing flood risk along Andrew Street with selective and effective drainage augmentation options. There are limited options in this area other than augmented pipe systems and even these will need to be selected carefully to minimise overall costs and maximise benefits;

- Andrew Street (as well as medium flood risk along Torquay Road) - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Augmenting the existing drainage system in the area. This includes increased pipe capacities and/or duplications at strategic and effective locations within the existing system;
  - Strategic pipe diversions. This includes new pipe systems which divert catchment flows directly to the outlet lake system downstream of Hillyard Street. This includes pipe systems collecting water at both Torquay Road as well as extending further upstream to Andrew Street;
  - Construction of the proposed detention basin downstream of Old Maryborough Road. It is noted that a detention basin in this area has been previously proposed by Council and the construction of this basin is considered to result in a beneficial lowering in flood risk in the downstream areas including Andrew Street and Torquay Road.

6.3 Stephenson Street Catchment

The risk rankings for the Stephenson Street catchment were generally low. However, risk standards were not met for all locations and this included areas classified as a medium risk. Therefore, it is recommended that mitigation works be undertaken at discrete locations throughout the catchment at the following locations: -

- Shelly Street - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Upgrade of the existing Shelly Street road crossing;
  - Increasing the effectiveness of the existing detention basin further upstream at Oleander Avenue (i.e. further basin augmentations); and
  - Undertaking channel improvements works both upstream and downstream of Shelly Street. This includes increasing channel conveyance through either widening or deepening.

- Boat Harbour Drive (west) - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Augmenting the existing drainage system in the area. This includes increased pipe capacities or duplications and extending these into the existing lake system further downstream; and
  - Provision of local detention facilities at strategic locations in the sub-catchment. This option is subject to physical site limitations and the existing drainage systems.

- Boat Harbour Drive (east) - Acceptable standards not met for DV Product < 0.4 and Q100 immunity. Possible upgrade options at this location include: -
  - Upgrade of the existing Boat Harbour Drive road crossings; and
  - Undertaking channel improvements works both upstream and downstream of Boat Harbour Drive. This includes increasing channel conveyance through either widening or deepening and ensuring that these works are extended into the downstream lake system.

6.4 Risk Treatment Summary

Whilst the Tooan Tooan Creek system has definitive areas of flood risk, a vast majority of the flooding/inundation experienced and specifically areas of most flood risk occur in the Taylor Street catchment. This catchment is extensively urbanised in a low lying and flat catchment and as such experiences significant inundation. While a majority of the existing flooding in this catchment is sheet flow over board areas and thus represent largely nuisance flooding, there are numerous areas which experience high risks. As such, future mitigation works in the Taylor and Stephenson Street catchments should be prioritised in terms of the risk such that critical and strategic areas are mitigated in a prioritised manner. While various mitigation and augmentation options have been proposed as above, future works will need to include more detailed analyses in order to focus specifically on achieving prioritised augmentation and mitigation upgrades.

7 Future Risk Treatment Works

For the reasons previously mentioned in this report, no detailed assessment of mitigation works has been undertaken as part of this study. Rather, the study has focused on identifying and quantifying flood risk across the Tooan Tooan Creek catchment in a broad sense. The assessment has also included the identification of possible mitigation options to alleviate the critical flood risk areas of both the Taylor and Stephenson Street catchments. It is important to note that further assessment works for both catchments will be required primarily for the purposes of defining and quantifying in detail the most effective and efficient mitigation options. This work would include more detailed hydraulic assessment works to be undertaken in the future in order to effectively undertake a flood risk treatment strategy.

8 Conclusions

This study has been successful in identifying and quantifying flooding risk for both the Taylor and Stephenson Street catchments. Due to model and GIS data inaccuracies, JWP were unable to develop detailed flood mitigation options for both catchments in order to mitigate flood risk. However, conceptual options for mitigation strategies to address all critical areas of flood risk in both catchments have been identified and discussed as part of this report. Specifically, the works completed have included: -

- The identification and assessment of existing drainage capacities, flow paths and flood information for the 1 in 10, 20, 50 and 100 year ARI design flood events for the Taylor and Stephenson Street catchments;

- Preparation of detailed flood data outputs to document the outcomes from the analysis works including flood summary data and flood extent plans for the Taylor Street catchment (plans for the Stephenson Street catchment included only annotated depth and water surface level values);

- Assessment of flood risk and the preparation of flood risk summaries for both the Taylor and Stephenson Street catchments;

- Identification of conceptual mitigation options for both catchments;

- Preparation of summary tables, models, flood extents, GIS mapping and reporting outputs to formally document the outcomes of the study; and

- Preparation of a report congruous with the Hervey Bay City Council Disaster Mitigation Plan.

JWP recommends that Council utilises the outcomes from this Flood Risk Assessment Study for the Taylor and Stephenson Street catchments in the management of existing and future stakeholders within the catchment in terms of reducing flood risk to an acceptable and manageable standard. Both catchment study areas were found to be adversely inundated by flooding for relatively minor flooding events. Due to the inconsistencies in model and GIS data, it is also recommended that further flood analysis works be instigated for both the Taylor and Stephenson Street catchments to accurately determine the full impacts of flooding on residential properties, road infrastructure and commercial sectors but more importantly for the purposes of focusing on risk treatment measures.

9 References

1. The Queensland Urban Drainage Manual (QUDM).

10 Qualification

1. In preparing the report and estimate of costs JWP has exercised the degree of skill and care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering design principles.

2. JWP has used all reasonable endeavours to inform itself of the parameters and requirements of the project and has taken all reasonable steps to ensure that the report and costs estimate is as accurate and comprehensive as possible given the information upon which it is based.

3. It is not intended that this report and costs estimate represent a final assessment of the feasibility of the project.

4. JWP reserves the right to review and amend all calculations, cost estimates and/or opinions included or referred to in the report if:

   (a) additional sources of information not presently available (for whatever reason) are provided or become known to JWP; or

   (b) JWP considers it prudent to revise the estimate in light of any information which becomes known to it after the date of submission.

5. JWP does not give any warranty nor accept any liability in relation to the completeness or accuracy of the report and cost estimate.

6. If any warranty would be implied whether by law, custom or otherwise, that warranty is to the full extent permitted by law excluded.

7. All limitations of liability shall apply for the benefit of the employees, agents and representatives of JWP to the same extent that they apply for the benefit of JWP.

8. This report and cost estimate is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this report and cost estimate.

9. If any claim or demand is made by any person against JWP on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the report and cost estimate or information therein, JWP will rely upon this provision as a defence to any such claim or demand.

APPENDIX A

Hydraulic Results (Taylor Street XP-STORM Model)

Taylor Street Catchment XP-STORM Model Results

Mapping_Node	Model_Node	X	Y	Surf_IL (m,AHD)	Q10_WSL (m,AHD)	Q20_WSL (m,AHD)	Q50_WSL (m,AHD)	Q100_WSL (m,AHD)	Q10_Depth (mm)	Q20_Depth (mm)	Q50_Depth (mm)	Q100_Depth (mm)
-	SWP1277	484401.27	7203248.63	9.99	10.12	10.13	10.14	10.15	130	140	150	160
-	SWP1274	484387.99	7203158.08	12.21	12.35	12.36	12.36	12.37	130	150	150	160
N1	SWP1275	484376.66	7203150.58	12.69	12.78	12.78	12.79	12.8	90	100	100	110
N2	SWP1276	484375.42	7203142.75	12.76	12.78	12.79	12.79	12.8	20	30	30	40
-	SWP1278	484388.44	7203248.48	10.18	10.22	10.22	10.22	10.23	40	40	40	50
-	SWP1279	484397.41	7203308.75	8.6	8.63	8.63	8.64	8.64	30	30	30	40
N3	SWP1435	484412.17	7203318.2	8.18	8.34	8.36	8.37	8.38	160	180	190	200
-	SWP1055	484403.29	7203546.86	4.55	4.57	4.58	4.58	4.58	20	30	30	30
N4	SWP1058	484171.83	7203628.85	3.46	3.7	3.74	3.78	3.81	240	280	320	350
-	SWP1059	484219.56	7203622.27	3.81	4.01	4.03	4.04	4.05	200	220	230	240
N5	SWP1060	484225.73	7203621.11	3.75	4.01	4.03	4.04	4.05	270	280	290	310
N6	SWP1067	484212.56	7203476.68	7.55	7.95	7.97	7.98	7.99	400	420	430	440
N7	SWP1068	484202.37	7203503.3	6.99	7.07	7.08	7.08	7.09	70	80	90	90
N8	SWP1150	484408.67	7203397.19	6.63	6.82	6.86	6.89	6.93	180	230	260	300
N9	SWP1152	484197.28	7203467.01	8.34	8.41	8.42	8.42	8.43	70	80	90	90
N10	SWP1280	484419.56	7203372.7	6.82	7.04	7.06	7.07	7.08	220	240	250	260
-	SWP1281	484406.04	7203368.51	7.16	7.2	7.2	7.2	7.21	40	50	50	50
N11	SWP1413	484337.82	7203591.21	4.22	4.15	4.22	4.25	4.28	0	0	40	60
-	SWP1468	484437.12	7203549.96	4.27	4.35	4.51	4.53	4.55	80	240	260	280
-	SWP1469	484434.22	7203550.4	4.6	4.35	4.51	4.53	4.54	0	0	0	0
-	SWP4173	484428.32	7203540.86	4.34	4.38	4.41	4.42	4.43	50	70	80	100
N12	SWP1057	484179.15	7203680.38	3.25	3.69	3.74	3.77	3.81	440	490	520	560
N13	SWP1063	484298.05	7203795.6	2.72	3.21	3.28	3.31	3.36	490	560	590	640
N14	SWP1407	484238.29	7203659.03	3.86	3.19	3.4	3.61	3.88	0	0	0	10
N15	SWP1408	484237.11	7203650.39	3.81	3.55	3.89	3.97	4.01	0	80	160	200
N16	SWP1414	484316.49	7203763.33	2.75	3.02	3.11	3.16	3.21	280	360	410	460
N17	SWP3413	484113.49	7203561.64	5.26	4.94	5.16	5.23	5.29	0	0	0	20
N18	SWP1125	483804.46	7203555.52	5.76	5.98	6	6.02	6.04	220	240	260	280
N19	SWP1127	483794.25	7203371.6	7.81	7.87	7.88	7.88	7.89	60	70	80	80
N20	SWP1136	483747.7	7203372.09	8.11	8.16	8.17	8.17	8.18	60	60	70	70
-	SWP1139	483769.22	7203516.89	6.56	6.64	6.65	6.66	6.66	90	90	100	110
N21	SWP1433	483773.74	7203540.02	6.52	6.64	6.65	6.66	6.66	120	130	140	150
N22	SWP1434	483759.27	7203525.48	7	7.09	7.1	7.11	7.12	90	100	110	120
N23	SWP1475	483815.88	7203596.37	5.99	5.17	5.32	5.77	5.99	0	0	0	0
N24	SWP2885	483780.22	7203587.01	5.98	6.18	6.22	6.27	6.28	200	240	290	300
N25	SWP4240	483825.73	7203552.76	6.31	6.36	6.36	6.39	6.4	50	60	80	100
N26	SWP4861	483803.53	7203439.21	6.65	6.74	6.74	6.75	6.76	90	90	100	110
N27	SWP4862	483806.52	7203462.21	6.4	6.6	6.6	6.64	6.65	200	210	240	250
-	SWP4275	483625.95	7203130.23	12.31	12.32	12.33	12.33	12.33	20	20	20	20
-	SWP4789	483461.14	7203103.72	12.4	11.66	11.77	11.84	11.92	0	0	0	0
N28	SWP1111	483704.82	7203575.87	7.88	7.9	7.9	7.9	7.91	20	20	20	30
N29	SWP1109	483720.39	7203555.61	7.46	7.46	7.46	7.46	7.46	0	0	0	0
N30	SWP1110	483701.87	7203563.27	8.02	8.06	8.06	8.07	8.07	40	50	50	60
N31	SWP1137	483733.85	7203278.73	9.09	9.13	9.13	9.13	9.14	40	40	40	50
N32	SWP1531	483735.81	7203373.97	8.11	8.18	8.19	8.19	8.2	70	80	80	90
-	SWP4782	483401.12	7203266.98	9.7	9.95	9.96	9.97	9.97	250	260	270	270
-	SWP4788	483414.02	7203129.22	12.5	11.1	11.22	11.33	11.6	0	0	0	0
N33	SWP4871	483733.49	7203114.92	13.28	13.33	13.37	13.43	13.47	40	90	140	190
N34	SWP4915	483650.63	7203148.48	12.25	11.79	11.86	11.88	11.96	0	0	0	0
-	SWP4267	483093.14	7203207.02	11.78	11.8	11.83	11.84	11.86	20	50	60	80
-	SWP4792	483086.58	7203176.65	12.5	12.51	12.52	12.52	12.52	10	20	20	20
N35	SWP4794	483022.96	7203533.79	9.8	9.82	9.82	9.82	9.83	20	20	30	30
N36	SWP4795	482979.73	7203368.13	12.4	12.42	12.42	12.43	12.43	20	30	30	30
-	SWP4930	482869.9	7203245.23	16.6	15.61	15.62	15.62	15.63	0	0	0	0
-	SWP4857	484067.66	7203663.59	3.6	3.53	3.66	3.7	3.76	0	60	110	170
-	SWP1091	484106.75	7203658.87	3.44	3.52	3.66	3.69	3.76	80	220	250	320
-	SWP1092	484102.18	7203625.05	3.8	3.5	3.6	3.66	3.72	0	0	0	0
N37	SWP1095	484016.71	7203724.38	3.06	3.67	3.89	3.92	4.03	610	830	860	970
-	SWP1075	484050.56	7203950.72	8.51	8.73	8.75	8.75	8.76	220	240	240	250
N38	SWP4238	484119.41	7203896.52	8.06	8.15	8.15	8.16	8.16	90	100	100	110
-	SWP4467	484064.68	7203949.01	9	8.73	8.75	8.76	8.77	0	0	0	0
-	SWP4468	484054.05	7203965.18	9.1	8.78	8.8	8.83	8.86	0	0	0	0
-	SWP1069	484135.35	7203531.98	6.56	6.58	6.59	6.59	6.59	20	30	30	30
-	SWP1070	484147.17	7203527.22	6.69	6.71	6.71	6.72	6.72	20	30	30	30
N39	SWP1094	484118.55	7203604.82	3.71	3.82	3.83	3.84	3.85	110	120	130	140
-	SWP1098	483992.86	7203515.42	8.37	8.57	8.59	8.61	8.62	200	220	240	250
-	SWP1101	483980.18	7203517.97	8.32	8.51	8.53	8.54	8.55	190	210	220	230
N40	SWP1477	484112.18	7203570.78	3.96	4.03	4.03	4.04	4.05	60	70	80	90
-	SWP1133	483945.03	7203274.34	11.19	11.16	11.17	11.18	11.21	0	0	0	20
N41	SWP1155	484086.63	7203066.62	19.22	18.8	19.07	19.22	19.26	0	0	0	30
N42	SWP1156	484026.13	7203075.47	18.19	18.22	18.22	18.23	18.23	40	40	40	50
-	SWP1270	483950.98	7203231.18	11.65	11.71	11.71	11.72	11.72	50	60	70	70
N43	SWP4700	483817.42	7203937.56	6.7	6.18	6.29	6.38	6.51	0	0	0	0
-	SWP1463	483889	7203862.03	4.8	4.37	4.45	4.63	4.81	0	0	0	10
N44	SWP1104	483866.43	7203851.82	4.66	4.22	4.53	4.56	4.68	0	0	0	20
N45	SWP1120	483808.58	7203865.23	5.07	4.31	4.67	4.71	4.88	0	0	0	0
N46	SWP1124	483761.43	7203781.09	4.5	4.47	4.73	4.75	4.89	0	240	260	400
N47	SWP1460	483813.72	7203901.83	5.78	5.8	5.8	5.8	5.81	20	20	20	20
N48	SWP1461	483824.9	7203894.82	5.63	5.78	5.79	5.79	5.8	150	160	170	170
N49	SWP1464	483896.95	7203847.13	4.56	4.72	4.75	4.79	4.83	150	190	230	260
-	SWP1465	483895.2	7203848.36	4.56	4.69	4.75	4.79	4.83	130	190	230	270
-	SWP1466	483900.24	7203860.26	4.66	4.72	4.75	4.79	4.83	60	90	130	170
-	SWP1130	483932.59	7203110.1	16.66	16.21	16.24	16.23	16.25	0	0	0	0
N50	SWP1129	483918.52	7203092.06	17.4	17.45	17.46	17.47	17.48	50	60	70	80
N51	SWP1131	483921.72	7203118.4	16.11	16.17	16.18	16.19	16.2	60	70	80	80
-	SWP1132	483939.92	7203242.63	11.34	11.69	11.7	11.71	11.72	350	360	370	380
-	SWP1134	483849.62	7203335.78	8.52	8.59	8.6	8.6	8.61	70	80	80	80
N52	SWP1144	483760.59	7203104.23	13.67	13.93	13.95	13.97	13.99	260	280	300	320
-	SWP1145	483771.35	7203105.17	14.21	13.52	13.6	13.67	13.77	0	0	0	0
-	SWP1146	483782.93	7203101.45	14.46	13.69	13.8	13.91	14.06	0	0	0	0
N53	SWP1147	483719.3	7203149.91	12.57	12.96	13.02	13.06	13.11	390	440	490	540
N54	SWP1148	483725.69	7203141.92	12.98	12.99	13.02	13.06	13.11	10	30	80	120

Taylor Street Catchment XP-STORM Model Results

Mapping_Node	Model_Node	X	Y	Surf_IL (m,AHD)	Q10_WSL (m,AHD)	Q20_WSL (m,AHD)	Q50_WSL (m,AHD)	Q100_WSL (m,AHD)	Q10_Depth (mm)	Q20_Depth (mm)	Q50_Depth (mm)	Q100_Depth (mm)
-	SWP1149	483781.8	7203123.8	14.36	13.68	13.8	13.91	14.07	0	0	0	0
N55	SWP1670	483722	7203280.3	9.04	9.13	9.13	9.14	9.14	90	90	100	100
N56	SWP1112	483595.45	7203832.75	5.58	5.75	5.77	5.79	5.81	170	190	210	220
-	SWP1113	483584.16	7203833.4	5.58	5.75	5.77	5.79	5.81	180	190	210	230
N57	SWP1114	483587.35	7203850.44	5.59	5.9	5.91	5.93	5.95	310	320	340	360
N58	SWP1118	483601.16	7203945.52	7.97	8.08	8.09	8.1	8.11	110	120	130	130
N59	SWP1119	483588.5	7203872.4	6.1	6.23	6.23	6.24	6.25	130	140	140	150
N60	SWP1478	483793.97	7203766.56	4.68	4.48	4.73	4.75	4.89	0	50	70	210
N61	SWP4182	483596.27	7203831.05	4.84	4.99	5	5	5.17	150	160	170	340
N62	SWP4183	483586.42	7203850.65	5.76	5.89	5.9	5.92	5.94	130	140	160	170
N63	SWP1530	483596.13	7203158.66	11.6	11.65	11.67	11.68	11.69	60	70	80	90
N64	SWP1140	483718.26	7203094.33	13.4	13.95	13.96	13.97	13.99	550	560	570	590
N65	SWP1141	483714.07	7203095.32	13.75	13.91	13.94	13.97	14	160	190	220	250
N66	SWP1509	483689.37	7203060.58	14.07	14.08	14.09	14.09	14.09	10	10	20	20
N67	SWP1510	483690.54	7203114.86	13.48	13	13.07	13.12	13.16	0	0	0	0
N68	SWP1511	483667.41	7203128.04	12.39	12.41	12.41	12.42	12.42	20	30	30	30
N69	SWP1512	483622.74	7203134.02	11.87	12.09	12.12	12.16	12.19	220	250	290	320
N70	SWP1515	483555.44	7203138.73	11.59	11.93	11.97	12.02	12.06	350	390	430	470
N71	SWP1628	483706.81	7203136.45	12.65	12.96	13.02	13.06	13.11	310	370	410	460
N72	SWP1115	483570.91	7203867.32	6.38	6.51	6.52	6.53	6.54	130	140	150	160
N73	SWP1116	483553.94	7203880.99	6.91	7.05	7.06	7.07	7.08	140	150	160	170
-	SWP1117	483553.6	7203894.85	7.03	7.06	7.06	7.07	7.08	30	30	40	50
N74	SWP1565	483371.36	7204022.43	10.82	10.93	10.94	10.95	10.95	110	120	120	130
N75	SWP1566	483350.47	7204037.14	11.03	11.15	11.16	11.17	11.17	120	130	140	140
N76	SWP1567	483373.93	7204006.13	10.6	10.73	10.75	10.75	10.76	140	150	150	160
N77	SWP1568	483394.01	7203994.15	10.46	10.57	10.58	10.59	10.6	110	130	130	140
-	SWP1569	483474.15	7203950.72	9.17	9.22	9.22	9.22	9.23	40	50	50	50
N78	SWP1570	483474.26	7203937.39	9.06	9.19	9.2	9.21	9.22	130	140	150	160
N79	SWP1516	483498.31	7203147.23	11.33	11.75	11.81	11.88	11.94	420	480	560	610
N80	SWP1520	483416.57	7203164.64	11.09	11.44	11.45	11.46	11.47	340	360	360	370
N81	SWP1523	483466.28	7203148.25	11.26	11.63	11.74	11.83	11.89	370	480	570	630
-	SWP1526	483399.99	7203274.08	9.65	9.95	9.96	9.97	9.97	300	310	310	320
N82	SWP1527	483399.14	7203274.25	9.58	9.95	9.96	9.97	9.97	380	390	390	400
N83	SWP1627	483430.68	7203187.85	10.58	10.72	10.77	10.8	11.06	150	200	220	480
N84	SWP1657	483475.14	7203180.64	9.3	9.95	10.2	10.33	10.42	650	910	1040	1120
-	SWP1658	483442.01	7203196.74	10.25	10.27	10.28	10.33	10.5	20	30	90	250
N85	SWP1668	483425.9	7203156.5	10.58	10.89	10.96	11.02	11.23	310	380	440	660
-	SWP1575	483289.48	7203610.73	7.92	7.93	7.95	7.96	7.97	10	30	40	50
N86	SWP1576	483312.95	7203620.95	7.8	7.93	7.95	7.96	7.97	130	140	150	170
N87	SWP1626	483532.01	7203466.07	7.79	7.52	7.58	7.67	7.79	0	0	0	0
N88	SWP1545	483220.88	7203233.63	9.83	9.88	9.89	9.9	9.91	60	70	70	90
N89	SWP1549	483135.69	7203246.27	9.97	10.04	10.05	10.06	10.06	80	90	90	100
N90	SWP1553	483187.8	7203211.02	10.4	10.39	10.43	10.47	10.51	0	30	70	120
-	SWP1554	483186.2	7203198.67	10.89	10.89	10.89	10.9	10.9	0	10	10	10
-	SWP1556	483193.46	7203192.47	11.04	10.09	10.22	10.3	10.42	0	0	0	0
-	SWP1557	483153.2	7203198.34	11.22	10.3	10.43	10.55	10.73	0	0	0	0
-	SWP1558	483152.51	7203143.39	12.01	11.24	11.27	11.29	11.35	0	0	0	0
-	SWP1623	483229.78	7203172.35	12.01	11.01	11.05	11.08	11.13	0	0	0	0
N91	SWP1624	483196.94	7203239.22	9.69	9.86	9.88	9.89	9.91	160	190	200	220
N92	SWP1640	483204.91	7203344.79	8.43	8.52	8.55	8.57	8.58	90	120	130	150
N93	SWP1540	483189.16	7203331.74	9.56	9.314	9.56	9.58	9.58	0	0	20	20
N94	SWP1536	483209.66	7203329.15	9.23	9.29	9.29	9.3	9.3	60	70	70	70
N95	SWP1537	483232.41	7203325.24	9.46	9.37	9.39	9.42	9.44	0	0	0	0
N96	SWP1625	483216.47	7203354.41	8.34	8.52	8.55	8.57	8.58	190	210	230	240
-	SWP1631	483166.69	7203472.33	8.07	7.06	7.13	7.19	7.32	0	0	0	0
-	SWP1632	483186.72	7203483.06	7.81	6.84	6.92	7.02	7.09	0	0	0	0
-	SWP1633	483175.25	7203494.47	7.84	6.84	6.92	7.02	7.09	0	0	0	0
N97	SWP1638	483135.93	7203366.86	9.13	9.25	9.26	9.27	9.28	120	130	140	150
N98	SWP1639	483134	7203355.37	9.15	9.25	9.26	9.27	9.28	100	120	130	130
N99	SWP1669	483161.93	7203335.82	9.91	9.49	9.53	9.56	9.67	0	0	0	0
N100	SWP1618	483020.96	7203658.9	10.7	10.64	10.68	10.7	10.72	0	0	0	20
N101	SWP1572	483073.4	7203684.53	10.71	10.87	10.88	10.89	10.9	160	180	190	200
N102	SWP1573	483075.14	7203695.35	10.79	10.96	10.97	10.98	10.99	180	190	200	210
N103	SWP1574	483237.15	7203632.15	9.07	9.15	9.17	9.17	9.18	90	100	110	120
-	SWP1598	482964.06	7203687.93	10.81	10.87	10.87	10.88	10.88	60	70	70	80
-	SWP1605	483048.15	7203669.73	10.47	10.58	10.59	10.6	10.61	110	120	130	140
-	SWP1619	483066.74	7203643.33	10.24	10.32	10.33	10.34	10.35	90	100	110	120
-	SWP1621	483041.03	7203214.56	13.08	12.13	12.14	12.14	12.14	0	0	0	0
-	SWP1533	482994.52	7203226.98	14.24	13.93	14.25	14.26	14.29	0	10	20	50
-	SWP1535	482998.68	7203250.51	13.78	13.47	13.71	13.79	13.81	0	0	0	30
N104	SWP1552	483102.54	7203223.63	11.13	11.16	11.19	11.2	11.21	30	60	70	80
-	SWP1650	483004.36	7203215.48	14.08	12.57	12.57	12.57	12.57	0	0	0	0
-	SWP1651	483025.5	7203211.45	13.9	12.14	12.13	12.13	12.13	0	0	0	0
N105	SWP1522	483356.2	7203164.77	11.31	11.55	11.58	11.59	11.61	240	270	280	310
N106	SWP1547	483275.46	7203225.54	9.83	9.92	9.93	9.93	9.94	90	100	100	110
N107	SWP1648	483313.03	7203169.55	11.53	11.66	11.67	11.67	11.68	130	140	140	150
N108	SWP1649	483334.35	7203166.6	11.58	11.64	11.65	11.65	11.66	60	60	70	70
N109	SWP1662	483334.55	7203312.23	8.01	8.15	8.19	8.22	8.24	140	170	200	220
N110	SWP1663	483338.16	7203336.39	7.95	7.62	7.87	7.97	7.97	0	0	20	20
N111	SWP1821	482684.86	7203272.69	17.54	17.35	17.44	17.58	17.61	0	0	40	70
N112	SWP1822	482731.97	7203265.65	16.98	16.78	16.84	17.03	17.09	0	0	50	110
-	SWP1824	482734.36	7203282	16.63	16.92	16.96	17.03	17.09	280	330	400	460
N113	SWP1825	482773.58	7203259.47	16.77	16.06	16.1	16.2	16.79	0	0	0	20
-	SWP1826	482884.24	7203243.26	16.46	15.38	15.39	15.39	15.39	0	0	0	0
-	SWP1829	482679.8	7203410.27	13.23	12.46	12.48	12.5	12.52	0	0	0	0
-	SWP1944	482687.58	7203291.03	17.02	17.37	17.45	17.58	17.61	350	430	560	590
N114	SWP1919	483056.2	7203571.75	9.03	9.05	9.06	9.06	9.07	20	30	30	40
N115	SWP1634	483061.46	7203510.81	9.25	9.47	9.49	9.5	9.51	220	230	250	260
N116	SWP1635	483051.65	7203447.36	10.03	10.21	10.22	10.23	10.24	180	190	200	210
N117	SWP1636	483049.02	7203427.11	10.31	10.41	10.41	10.42	10.42	100	100	110	110
N118	SWP1637	483026.14	7203364.38	11.39	11.43	11.43	11.43	11.44	40	40	40	50
-	SWP1828	482947.93	7203452.34	11.09	11.2	11.21	11.22	11.23	110	120	130	140

Taylor Street Catchment XP-STORM Model Results

Mapping_Node	Model_Node	X	Y	Surf_IL (m,AHD)	Q10_WSL (m,AHD)	Q20_WSL (m,AHD)	Q50_WSL (m,AHD)	Q100_WSL (m,AHD)	Q10_Depth (mm)	Q20_Depth (mm)	Q50_Depth (mm)	Q100_Depth (mm)
N120	SWP1921	483067.99	7203555.38	9.04	9.12	9.13	9.14	9.15	80	90	100	110
-	SWP1936	483034.49	7203434.6	10.18	10.21	10.22	10.23	10.25	30	50	60	70
N121	SWP1943	482763.22	7203493.45	11.04	11.19	11.21	11.23	11.24	140	170	190	200
N122	SWP1606	482865.04	7203839.86	14.72	14.97	14.98	14.99	15	250	260	270	280
N123	SWP1607	482857.33	7203838.88	14.88	14.97	14.98	14.99	14.99	90	100	110	120
N124	SWP1609	482851.36	7203798.15	13.68	13.79	13.8	13.81	13.82	110	120	130	140
-	SWP1610	482837.7	7203788.81	13.12	13.37	13.39	13.41	13.42	250	270	290	300
N125	SWP1611	482838.01	7203777.82	13.06	13.37	13.39	13.41	13.42	310	330	340	360
N126	SWP1612	482846.55	7203764.58	13.23	13.37	13.39	13.4	13.42	140	160	170	180
N127	SWP1613	482838.28	7203709.19	11.93	12.08	12.1	12.11	12.12	150	170	180	200
N128	SWP1614	482828.61	7203700.62	11.72	11.77	11.78	11.79	11.79	50	60	70	80
N129	SWP1898	482620.52	7203922.8	16.48	16.63	16.65	16.66	16.67	150	160	170	180
N130	SWP1593	482738.25	7203888.84	15.69	15.9	15.95	16	16.04	210	260	310	350
N131	SWP1608	482764.56	7203907.89	16.16	16.23	16.24	16.24	16.25	70	80	80	90
N132	SWP1630	482736.45	7203899.21	15.88	15.91	15.95	16	16.04	30	70	120	160
N133	SWP1865	482597.64	7203906.05	15.42	15.96	15.97	15.98	15.99	530	550	550	560
N134	SWP1899	482627.58	7203898.16	16.03	16.1	16.11	16.12	16.13	80	90	90	100
N135	SWP1900	482615.16	7203887.27	15.91	15.96	15.97	15.98	15.98	60	60	70	70
N136	SWP1901	482603.57	7203883.22	15.69	15.82	15.83	15.84	15.85	130	140	150	160
N137	SWP1902	482596.49	7203835.62	14.57	14.72	14.73	14.74	14.75	150	160	170	180
-	SWP1903	482607.45	7203834.24	14.63	14.72	14.73	14.74	14.75	90	100	110	120
N138	SWP3103	482711.52	7203887	15.72	15.89	15.95	16	16.04	170	220	270	320
-	SWP3104	482660.26	7203725.08	12.1	12.14	12.16	12.19	12.22	50	70	100	120
-	SWP1859	482701.27	7203807.69	13.3	13.4	13.43	13.45	13.46	110	130	150	160
N139	SWP1615	482704.32	7203719.08	11.96	11.99	12	12.01	12.02	30	40	50	60
N140	SWP1857	482678.29	7203699.88	11.65	12.17	12.2	12.23	12.26	520	550	580	610
N141	SWP1858	482715.44	7203796.36	13.21	13.41	13.43	13.45	13.46	190	220	240	250
N142	SWP1862	482587.8	7203769.71	13.04	13.18	13.19	13.2	13.2	140	150	160	170
N143	SWP1904	482591.84	7203804.74	13.96	14.07	14.08	14.09	14.09	110	120	130	140
-	SWP1905	482603.19	7203803.4	13.86	14.07	14.08	14.09	14.09	210	220	220	230
N144	SWP1909	482665.24	7203701.9	11.8	12.16	12.19	12.22	12.25	360	390	420	450
N145	SWP1595	482687.78	7203679.44	12	12.13	12.19	12.22	12.25	130	190	220	250
-	SWP1596	482940.57	7203683.24	10.8	10.94	10.95	10.96	10.97	140	150	160	170
N146	SWP1599	482945.86	7203654.59	10.57	10.71	10.72	10.73	10.75	140	160	170	180
N147	SWP1616	482817.72	7203688.75	11.59	11.66	11.66	11.67	11.67	70	80	80	90
N148	SWP1833	482634.37	7203485.75	13.12	13.64	13.64	13.64	13.64	520	520	520	520
N149	SWP1834	482625.38	7203498.14	13.3	13.54	13.55	13.55	13.56	250	250	260	260
N150	SWP1912	482763.27	7203491	11.11	11.2	11.22	11.24	11.25	90	120	130	140
N151	SWP1913	482762.34	7203476.68	11.21	11.22	11.23	11.24	11.25	10	20	30	40
N152	SWP1915	482696.12	7203486.32	11.59	11.86	11.88	11.88	11.89	270	290	300	300
N153	SWP1916	482639.32	7203519.19	13.44	13.64	13.65	13.66	13.67	200	210	210	220
N154	SWP1917	482654.92	7203492.56	12.82	12.95	12.97	12.97	12.97	140	150	150	150
N155	SWP1918	482645.86	7203483.68	13.28	13.3	13.31	13.31	13.31	30	30	30	30
N156	SWP4884	482938.7	7203600.2	9.76	9.91	9.93	9.94	9.96	150	170	180	200
N157	SWP1896	482633.44	7204006.34	17.13	17.3	17.31	17.32	17.33	170	190	190	200
N158	SWP1897	482628.13	7203972.64	16.93	17.1	17.12	17.13	17.14	170	190	200	210
-	SWP1945	482642.56	7203991.86	17.04	17.19	17.21	17.22	17.23	160	170	180	190
N159	SWP1934	482635	7203401.6	14.79	14.93	14.95	14.94	14.94	140	160	150	150
N160	SWP5024	482617.93	7203394.56	15	15.02	15.03	15.03	15.03	20	30	30	30
-	SWP1907	482594.48	7203747.06	12.74	13.04	13.06	13.07	13.09	300	320	340	350
N161	SWP1861	482572.42	7203737.72	12.49	13.03	13.05	13.07	13.08	550	560	580	600
N162	SWP1867	482519.91	7203733.08	13.1	13.32	13.33	13.34	13.35	220	230	250	260
-	SWP1868	482520.11	7203724.02	13.05	13.14	13.15	13.16	13.17	90	100	110	120
N163	SWP1869	482459.86	7203742.9	13.77	13.95	13.96	13.98	13.99	180	200	210	220
-	SWP1874	482354.99	7203770.62	15.46	15.5	15.5	15.51	15.51	40	40	50	50
N164	SWP1906	482583.56	7203748.19	12.68	13.04	13.06	13.07	13.09	360	370	390	410
-	SWP4805	482411.91	7203724.78	14.7	14.75	14.76	14.77	14.77	50	60	70	70
-	SWP4793	482779.25	7203299.69	17.1	15.87	15.98	16.05	16.17	0	0	0	0
N165	SWP4809	482762.65	7203418.65	12	12.15	12.2	12.25	12.3	150	200	250	300
-	SWP4812	482736.57	7203526.07	11.5	11.54	11.56	11.56	11.57	40	60	60	70
N166	SWP4813	482592.51	7203371.46	19.7	19.7	19.71	19.55	19.7	0	10	0	0
N167	Outlet Node	484497.98	7203969.57	0	1.81	1.81	1.81	1.81	1810	1810	1810	1810
N168	DS_Espl	484512.21	7203903.86	0.1	3.04	3.04	3.04	3.04	2940	2940	2940	2940
N169	US_Espl	484522.21	7203843.26	0.2	1.88	1.91	1.94	1.97	1680	1710	1740	1770
N170	US_OC01	484346.92	7203763.49	1.21	3.01	3.08	3.13	3.18	1800	1870	1920	1970
N171	Collect	484422.84	7203405.96	5.61	6.82	6.87	6.89	6.93	1210	1260	1280	1320
N172	Village_B	484206.68	7203828.25	1.43	3.31	3.4	3.44	3.49	1880	1970	2010	2060
N173	Park03	484121.22	7203713.04	1.65	3.51	3.65	3.68	3.74	1860	2000	2030	2090
N174	Park02	484095.51	7203667.76	1.9	3.52	3.66	3.69	3.76	1620	1760	1790	1860
N175	Carlo Node	483227.24	7203364.88	5.41	6.67	7.1	7.11	7.14	1260	1690	1700	1730
N176	Charles	483553.45	7203712.5	3.99	5.23	5.29	5.33	5.35	1240	1300	1340	1360
N177	Main St	483741.4	7203791.22	3.5	4.47	4.73	4.75	4.89	970	1230	1250	1390
N178	Conf01	484579.99	7203754.54	-0.39	2.02	2.08	2.13	2.18	2410	2470	2520	2570
N179	Tooan	484677.58	7203715.64	0.9	2.02	2.08	2.13	2.18	1120	1180	1230	1280
N180	Conf02	484528.14	7203678.8	0.93	2.17	2.25	2.31	2.36	1240	1320	1380	1440
N181	US_CO02	484422.95	7203726.3	1.5	2.29	2.37	2.43	2.5	790	870	930	1000
N182	Conf03	484537.78	7203620.9	1.4	2.52	2.55	2.59	2.63	1120	1150	1190	1230
N183	School2	483497.61	7203828.03	6.5	6.57	6.58	6.58	6.59	70	80	90	90
N184	School1	483296.76	7203778.22	8.2	8.29	8.3	8.3	8.31	90	100	110	110
N185	US Beach	482962.16	7203581.06	8.5	9.68	9.76	9.82	9.87	1180	1260	1320	1370
N186	Imelda	483964.03	7203324.83	11	11.05	11.05	11.05	11.05	50	50	50	60
N187	Park01	484050.87	7203689.92	1.9	3.53	3.67	3.7	3.76	1630	1770	1800	1860
N188	MessNode	483430.48	7203289.65	7.75	8.49	8.53	8.56	8.6	740	780	810	850
-	ORourk01	483347.32	7203311.1	8.01	8.12	8.13	8.13	8.14	100	110	120	120
N189	Carlo	483265.97	7203333.43	8	8.2	8.23	8.26	8.28	200	230	260	280
N190	Bryant	484046.62	7203816.17	4.75	4.86	4.87	4.88	4.89	110	120	130	140
N191	TorqSub	483879.79	7203919.03	6	6.02	6.02	6.02	6.03	20	20	20	30
N192	Unkn1	484479.07	7203286.33	6.6	6.73	6.75	6.75	6.76	130	150	150	170
N193	N_Inlet01	484494.7	7203385.69	5.4	6.61	6.65	6.71	6.76	1210	1250	1310	1360
N194	SWP3305	484485.6	7203631.69	3.25	3.6	3.7	3.76	3.8	350	450	510	550
N195	SWP1151	484191.83	7203445.41	8.77	8.87	8.87	8.88	8.88	100	110	110	120
N196	SWP4190	484399.39	7203250.56	9.99	10.12	10.13	10.14	10.15	130	150	150	160

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Mapping_Node	Model_Node	X	Y	Surf_IL (m,AHD)	Q10_WSL (m,AHD)	Q20_WSL (m,AHD)	Q50_WSL (m,AHD)	Q100_WSL (m,AHD)	Q10_Depth (mm)	Q20_Depth (mm)	Q50_Depth (mm)	Q100_Depth (mm)
N198	SWP4209	484415.04	7203445.83	6.44	5.67	6.19	6.41	6.54	0	0	0	100
N199	SWP4242	484386.23	7203159.54	12.26	12.35	12.36	12.36	12.37	90	100	110	110
-	SWP4168	484217.82	7203622.1	3.86	4.01	4.02	4.04	4.05	150	170	180	190
N200	SWP1065	484283.18	7203780.68	2.9	3.21	3.28	3.31	3.36	310	380	410	460
N201	SWP1415	484422.71	7203543.27	4.43	4.45	4.5	4.52	4.54	20	80	90	110
N202	SWP1411	484240.1	7203679.55	4.05	3.14	3.32	3.51	3.7	0	0	0	0
N203	SWP1409	484250.89	7203666.33	3.76	3.18	3.45	3.74	4.05	0	0	0	300
N204	SWP1410	484261.54	7203658.13	3.79	3.38	3.73	3.95	4.06	0	0	150	260
N205	SWP1470	484308.34	7203620.87	3.99	4.09	4.15	4.19	4.21	110	160	200	220
N206	SWP4174	484307.4	7203770.57	2.54	3.08	3.17	3.22	3.27	540	630	680	730
N207	SWP4175	484212.28	7203481.87	7.69	7.81	7.82	7.83	7.83	120	130	140	150
N208	SWP4683	484424.71	7203499.62	5.3	5.17	5.44	5.47	5.5	0	140	170	200
N209	SWP4682	484427.95	7203531.24	4.9	4.68	4.91	4.94	4.97	0	10	40	70
N210	SWP4691	483827.49	7203563.28	4.63	5.21	5.37	5.87	6.01	590	740	1240	1380
N211	SWP4799	482827.18	7203688.13	11.4	11.57	11.61	11.64	11.66	170	210	240	260
N212	SWP4858	484119.09	7203615.66	3.6	3.66	3.67	3.69	3.76	60	70	90	160
N213	SWP4859	484221.5	7203553.39	5	5.17	5.18	5.19	5.2	170	180	190	200
N214	SWP1412	484341.7	7203601.14	4	4.14	4.21	4.24	4.27	140	210	240	270
N215	SWP4909	483053.96	7203654.45	10.43	10.58	10.59	10.6	10.61	150	160	170	180
N216	SWP1074	484065.02	7203940.8	8.59	8.73	8.74	8.75	8.76	140	150	160	170
N217	SWP1089	484142.26	7203721.92	3.34	3.55	3.65	3.69	3.75	220	310	350	410
N218	SWP4177	484009.76	7203615.23	6.09	6.22	6.24	6.26	6.27	130	150	170	180
N219	SWP4178	483996.48	7203607.51	6.23	6.44	6.46	6.47	6.48	210	230	240	260
N220	SWP4179	483981.94	7203517.9	8.35	8.51	8.53	8.54	8.55	150	170	190	200
N221	SWP4687	484119.32	7203608.05	3.7	3.76	3.77	3.78	3.78	60	70	80	80
N222	SWP4690	484049.42	7203940.78	8.59	8.73	8.74	8.75	8.76	140	150	160	170
N223	SWP4941	483995.2	7203712.01	4.25	3.67	3.89	3.92	4.03	0	0	0	0
N224	SWP4943	484013.17	7203678.97	3.52	3.86	3.86	3.86	3.87	340	340	340	350
N225	SWP1143	483759.74	7203105.24	13.75	13.42	13.48	13.55	13.62	0	0	0	0
N226	SWP4184	483935.54	7203199.98	12.17	12.27	12.28	12.29	12.29	100	110	120	120
N227	SWP4185	483941.76	7203242.27	11.49	11.69	11.7	11.71	11.72	200	210	220	230
N228	SWP4186	483946.61	7203275.07	11.23	11.16	11.17	11.18	11.19	0	0	0	0
N229	SWP4188	484111.13	7203063.33	20.37	19.49	19.88	20.17	20.38	0	0	0	10
N230	SWP3697	483911.09	7203796.59	4.03	4	4.21	4.23	4.44	0	190	210	420
N231	SWP4162	483784.89	7203551.7	6.31	6.41	6.42	6.43	6.44	100	110	120	120
N232	SWP4187	483963.51	7203387.63	10.26	10.38	10.4	10.41	10.43	120	140	160	170
N233	SWP4239	483776.8	7203572.65	6.28	5.66	5.66	5.92	6.01	0	0	0	0
N234	SWP4688	483886.83	7203848.72	4.67	4.69	4.75	4.79	4.83	20	80	120	160
-	SWP4689	483899.55	7203839.53	4.56	4.71	4.75	4.79	4.83	150	190	230	270
N235	SWP4692	483793.16	7203362.48	7.9	7.97	7.98	7.99	7.99	70	80	90	90
N236	SWP4693	483850.84	7203342.37	8.5	8.54	8.55	8.55	8.55	40	50	50	50
N237	SWP4939	483799.98	7203761.6	4.9	4.49	4.74	4.75	4.9	0	0	0	0
N238	SWP4783	483449.39	7203268.1	9.7	9.73	9.74	9.74	9.74	30	40	40	40
N239	SWP4259	483597.52	7203132.97	11.78	12.08	12.12	12.16	12.19	300	340	380	410
N240	SWP4207	483713.88	7203099.09	13.86	13.88	13.94	13.97	13.99	30	80	110	140
N241	SWP1661	483566.92	7203246.86	10.39	10.42	10.42	10.42	10.43	30	30	30	40
N242	SWP1138	483741.72	7203277.48	8.95	8.61	8.61	8.64	8.7	0	0	0	0
N243	SWP1142	483735.18	7203124.49	13.28	13.33	13.37	13.43	13.47	40	90	140	190
N244	SWP1529	483636.11	7203153.57	11.97	11.67	11.71	11.71	11.73	0	0	0	0
N245	SWP1660	483551.66	7203251.65	10.25	9.59	9.63	9.67	9.71	0	0	0	0
N246	SWP1664	483428.34	7203269.86	9.92	9.93	9.94	9.95	9.95	10	30	30	40
N247	SWP3465	483471.25	7203265.58	8.78	8.84	8.9	8.95	9.09	70	120	170	310
N248	SWP4256	483420.86	7203190.14	10.58	10.91	10.96	11	11.08	330	380	420	500
N249	SWP4257	483418.05	7203174.07	11.33	11.37	11.38	11.38	11.39	50	50	60	60
N250	SWP4260	483622.1	7203146.13	12.34	12.41	12.42	12.42	12.43	70	80	90	90
N251	SWP4277	483455.25	7203198.6	10.14	10.03	10.28	10.33	10.47	0	140	200	340
N252	SWP4278	483460.58	7203224.27	9.72	9.64	9.83	9.88	10	0	120	170	280
N253	SWP8014	482886.04	7203256.04	16.17	14.78	14.79	14.79	14.85	0	0	0	0
N254	SWP8013	482854.66	7203260.81	16.59	15.15	15.17	15.18	15.22	0	0	0	0
-	SWP4787	483443.38	7203194.25	8.45	10.21	10.45	10.49	10.65	1770	2000	2040	2200
N255	SWP4916	483706.29	7203131.13	13.87	12.97	13.04	13.11	13.16	0	0	0	0
N256	SWP4800	482593.63	7203819.18	14.1	14.25	14.26	14.26	14.27	150	160	170	170
N257	SWP4801	482604	7203901.84	15.8	15.96	15.97	15.98	15.99	160	170	180	190
N258	SWP4802	482619.54	7203914.14	16.3	16.41	16.42	16.42	16.43	110	120	120	130
N259	SWP4803	482630.05	7203986.47	17	17.19	17.21	17.22	17.23	190	210	220	230
N260	SWP4804	482540.47	7203731.04	13	13.11	13.13	13.14	13.15	110	130	140	150
N261	SWP4806	482361.59	7203757.34	15.3	15.43	15.44	15.45	15.46	130	140	150	160
N262	SWP4808	482323.76	7203762.36	15.7	15.79	15.8	15.8	15.81	90	100	100	110
N263	SWP4273	483060.07	7203643.39	10.2	10.32	10.33	10.34	10.35	120	140	140	150
N264	SWP4255	483340.81	7203354.09	7.08	7.15	7.16	7.17	7.18	80	90	100	110
N265	SWP4271	483358.05	7203612.58	7.51	7.54	7.54	7.54	7.54	30	30	30	30
N266	SWP4272	483060.3	7203653.35	10.43	10.55	10.56	10.57	10.58	120	130	140	150
N267	SWP4325	483049.08	7203529.43	9.24	9.26	9.26	9.27	9.27	20	30	30	30
N268	SWP4264	483190	7203226.07	10.69	10.17	10.2	10.22	10.25	0	0	0	0
N269	SWP1617	482956	7203668.55	10.8	10.86	10.87	10.88	10.88	70	70	80	90
-	SWP1622	483222.79	7203187.57	11.34	10.16	10.26	10.34	10.45	0	0	0	0
N270	SWP4261	483037.75	7203363.03	11.3	11.37	11.38	11.38	11.39	70	70	80	80
N271	SWP4262	482996.63	7203239.15	14.63	12.92	12.97	12.99	13	0	0	0	0
-	SWP4265	483198.14	7203224.88	10.73	9.93	9.98	10.01	10.05	0	0	0	0
N272	SWP4307	483037.33	7203449.45	9.97	10.21	10.22	10.23	10.24	240	260	270	280
N273	SWP4333	482949.22	7203463.23	11.04	11.2	11.21	11.22	11.23	160	170	180	180
N274	SWP1908	482657.85	7203712.45	12.03	12.14	12.16	12.19	12.22	110	130	160	180
-	SWP4305	482775.23	7203271.92	17.04	15.57	15.6	15.62	15.74	0	0	0	0
N275	SWP4306	482776.87	7203470.02	12.27	11.31	11.33	11.34	11.42	0	0	0	0
N276	SWP4308	482731.03	7203495.57	11.31	11.54	11.56	11.56	11.57	230	240	250	260

Taylor Street Catchment XP-STORM Model Results

Mapping_Node	Model_Node	X	Y	Surf_IL (m,AHD)	Q10_WSL (m,AHD)	Q20_WSL (m,AHD)	Q50_WSL (m,AHD)	Q100_WSL (m,AHD)	Q10_Depth (mm)	Q20_Depth (mm)	Q50_Depth (mm)	Q100_Depth (mm)
N277	SWP4311	482635.92	7203496.41	13.44	13.53	13.54	13.54	13.54	90	100	100	110
N278	SWP4320	482579.86	7203724.09	12.78	13.03	13.05	13.07	13.08	260	280	290	310
N279	SWP4321	482415.7	7203748.57	14.58	14.74	14.75	14.76	14.77	160	170	180	190
N280	SWP4323	482697.89	7203500.57	11.67	11.86	11.88	11.88	11.89	190	210	210	210
N281	SWP4331	482660.44	7203505.51	12.55	12.66	12.68	12.68	12.68	110	130	130	130
N282	SWP4332	482681.39	7203502.96	11.91	12.07	12.08	12.08	12.08	150	170	170	170
N283	SWP4335	482396.39	7203751.24	14.86	14.99	15	15.01	15.02	130	140	150	160
N285	SWP3308	484419.94	7203416.72	6.13	6.6	6.65	6.71	6.75	480	520	580	630
N286	SWP3719	484426.59	7203409	5.52	6.82	6.86	6.89	6.93	1290	1340	1370	1400
N287	SWP3721	484437.87	7203412.48	5.39	6.6	6.65	6.71	6.75	1220	1260	1320	1370
N288	SWP3723	484443.27	7203425.14	5.31	6.28	6.61	6.68	6.74	980	1300	1370	1430
N289	SWP3326	484335.06	7203771.07	1.43	3.11	3.2	3.24	3.29	1680	1770	1810	1870
N290	SWP3720	484432.75	7203410.98	5.52	6.6	6.65	6.71	6.76	1090	1140	1200	1240
N291	SWP3722	484443.11	7203420.91	5.05	6.3	6.62	6.69	6.75	1250	1570	1650	1710
N292	SWP3845	484339.2	7203765.22	1.26	3.08	3.17	3.22	3.27	1820	1910	1960	2010
N293	SWP3846	484341.82	7203763.66	1.76	3.02	3.11	3.16	3.21	1270	1350	1400	1450
N361	SWP3711	484226.13	7203816.82	1.43	3.31	3.4	3.43	3.49	1880	1970	2000	2060
N362	SWP3713	484237.42	7203805.97	1.43	3.3	3.39	3.42	3.48	1870	1960	1990	2050
N294	SWP3715	484266.12	7203790.96	1.43	3.27	3.35	3.38	3.44	1840	1920	1950	2010
N295	SWP1071	484146.37	7203531.84	5.73	6.21	6.25	6.28	6.31	480	520	550	580
N296	SWP1084	484206.35	7203838.44	4.35	4.43	4.43	4.44	4.44	80	80	90	90
N297	SWP3707	484153.12	7203776.12	1.43	3.34	3.44	3.47	3.53	1920	2010	2040	2100
N363	SWP3714	484246.9	7203799.72	1.43	3.28	3.36	3.39	3.45	1850	1930	1960	2020
N365	SWP3716	484278.57	7203784.95	2.75	3.24	3.31	3.35	3.4	490	560	600	650
N298	SWP4938	484206.23	7203842.32	6.06	6.11	6.11	6.12	6.12	50	50	60	60
N299	SWP3706	484111.49	7203555.86	5.15	5.54	5.57	5.59	5.61	390	420	450	470
N300	SWP3388	484134.41	7203748.75	1.5	3.49	3.64	3.68	3.74	1990	2140	2180	2240
N301	SWP3703	484009.58	7203601.71	5.26	5.7	5.69	5.73	5.8	430	430	470	540
N302	SWP3705	484109.75	7203551.02	5.25	6.19	6.23	6.25	6.28	950	990	1010	1030
N303	SWP1072	484134.23	7203537.37	5.96	6.2	6.24	6.27	6.3	240	280	310	340
N304	SWP3704	484024.31	7203694.1	1.95	3.55	3.68	3.72	3.78	1600	1730	1770	1830
N305	SWP3708	484126.59	7203722.41	1.67	3.51	3.65	3.68	3.74	1830	1970	2010	2070
N306	SWP3710	484109.67	7203662.55	2.09	3.52	3.66	3.69	3.76	1440	1570	1610	1670
N307	SWP3460	483437.23	7203512.77	4.56	6.67	7.1	7.11	7.14	2110	2540	2550	2580
-	SWP3309	484420.96	7203403.5	5.72	6.82	6.86	6.89	6.93	1100	1150	1170	1210
N308	SWP3718	484420.05	7203403.06	5.93	6.82	6.87	6.89	6.93	890	940	960	1000
N309	SWP3467	483610.03	7203126.09	11.34	12.09	12.13	12.17	12.2	750	780	830	860
N310	SWP3466	483605.83	7203129.86	11.14	12.09	12.12	12.17	12.2	950	980	1030	1060
N311	SWP3409	483888.66	7203657.33	3.66	4.14	4.28	4.62	4.88	480	620	960	1220
N312	SWP3468	483619.02	7203123.93	11.91	12.09	12.13	12.17	12.2	180	210	260	290
N366	SWP3700	483877.76	7203642.71	6.03	5.2	5.22	5.24	5.26	0	0	0	0
N313	SWP3306	483726.41	7203579.67	6.26	6.3	6.3	6.31	6.31	40	40	50	50
N314	SWP3307	483707.32	7203585.52	6.52	6.68	6.7	6.72	6.73	160	180	200	210
N315	SWP3329	484028.01	7203091.02	18.04	18.18	18.19	18.19	18.2	140	150	150	160
N316	SWP3410	483878.69	7203656.73	3.93	5.01	5.03	5.07	5.08	1080	1100	1140	1150
-	SWP3699	483880.78	7203654.43	4.88	5.01	5.03	5.07	5.08	130	150	190	200
N317	SWP3701	483987.55	7203611.1	5.48	5.54	5.54	5.55	5.56	60	70	70	80
N318	SWP3702	483987.65	7203599.32	6.14	6.44	6.46	6.47	6.48	290	310	330	340
N319	SWP8033	483785.54	7203788.38	3.6	4.47	4.73	4.75	4.9	870	1130	1150	1300
N320	SWP4942	484023.1	7203688.09	2.6	3.55	3.68	3.71	3.77	950	1080	1110	1170
N321	SWP3455	483175.51	7203509.01	5.62	7.6	7.67	7.72	7.76	1970	2040	2090	2140
N322	OMR_Basin	483408.03	7203589.15	4.3	6.67	7.1	7.11	7.14	2370	2800	2810	2840
N323	SWP3462	483354.91	7203347.89	6.23	7.52	7.54	7.55	7.57	1290	1310	1320	1340
N324	SWP3470	483542.48	7203170.65	10.63	10.71	10.72	10.73	10.75	80	90	110	120
N325	SWP3529	483050.11	7203569.27	6.67	8.92	8.98	9.03	9.07	2250	2310	2360	2390
N326	SWP3453	483431.61	7203615.85	3.99	5.3	5.41	5.41	5.43	1310	1420	1420	1440
N327	SWP3454	483076.97	7203556.88	6.54	8.12	8.26	8.36	8.46	1590	1720	1830	1920
N328	SWP3456	483207.45	7203487.62	5.67	6.78	6.9	7.01	7.07	1110	1230	1340	1400
N329	SWP3458	483378.41	7203579.69	4.54	6.67	7.1	7.11	7.14	2140	2560	2570	2610
N330	SWP3461	483335.9	7203363.73	4.51	6.67	7.1	7.11	7.14	2170	2590	2600	2630
N331	SWP3463	483466.73	7203259.68	6.86	8.84	8.9	8.95	9.07	1980	2040	2090	2210
N332	SWP3464	483466.52	7203265.84	8.02	8.84	8.9	8.95	9.07	830	880	930	1050
N333	SWP3469	483508.29	7203176.78	10.43	10.45	10.45	10.45	10.46	20	20	30	30
N334	SWP3471	483562.78	7203167.71	10.64	10.74	10.76	10.77	10.79	100	120	130	150
N335	SWP4910	483438.84	7203302.76	8.01	8.49	8.53	8.56	8.6	480	520	550	590
N336	SWP4971	483457.48	7203266.89	9.1	9.12	9.13	9.14	9.14	20	30	40	40
N337	SWP1910	482777.81	7203589.78	9.45	10.74	10.79	10.84	10.87	1290	1340	1390	1420
N338	SWP3521	482946.68	7203594.56	8.97	9.7	9.78	9.84	9.9	720	800	860	920
N339	SWP1911	482883.19	7203574.61	8.83	10.27	10.34	10.4	10.45	1440	1510	1570	1630
N340	SWP1946	482776.91	7203595.28	10.9	10.93	11.01	11.09	11.15	30	110	190	250
N341	SWP4328	482796.19	7203588.72	10.63	10.76	10.81	10.85	10.88	140	190	220	260
N342	SWP4885	482769.22	7203521.48	10.61	10.98	11.02	11.04	11.05	370	410	430	440
N343	SWP3322	483758.76	7203763.79	4.26	4.47	4.73	4.75	4.89	210	480	500	640
N344	SWP3323	483798.3	7203823.05	3.18	4.27	4.63	4.66	4.83	1090	1450	1480	1650
N345	SWP3698	483924.32	7203769.68	4	3.73	4	4.02	4.19	0	0	10	190
N346	SWP3321	483759.36	7203784.56	3.7	4.47	4.91	4.75	4.89	770	1030	1050	1190
N347	SWP3324	483579.99	7203710.6	4.15	4.84	4.95	4.96	5.07	690	800	810	920
N348	NEW Old M	483876.63	7203556.55	4.02	5.32	5.44	5.87	6.01	1300	1420	1850	1990
N349	SWP4180	483853.68	7203808.22	4.9	4.21	4.51	4.53	4.67	0	0	0	0
N350	N-5/1	484452.72	7203531.23	4.66	4.29	4.66	4.74	4.8	0	0	80	150
N351	N-0/1	484508.06	7203619.82	1.6	3.33	3.42	3.48	3.55	1730	1820	1880	1950
N352	N-4/2	484493.56	7203509.63	4.88	4.49	4.83	4.96	5.01	0	0	80	120
N353	N-3/2	484525.7	7203492.89	5.04	5.09	5.15	5.18	5.2	50	110	140	160
N354	N-2/2	484567.7	7203470.03	5.27	5.2	5.29	5.31	5.33	0	30	50	70
N355	N-1/2	484600.28	7203452.83	5.4	5.45	5.47	5.48	5.49	60	80	90	100
N356	OMR-4/1	482640.16	7203714.93	12.1	12.42	12.44	12.47	12.49	320	340	370	390
N357	OMR-5/1	482649.57	7203713.58	12.07	12.36	12.38	12.4	12.43	290	310	330	360
N358	OMR-7/1	482700.91	7203706.33	11.72	11.93	11.96	12	12.03	210	240	280	310
N359	OMR-8/1	482775.95	7203695.2	11.61	11.13	11.26	11.43	11.62	0	0	0	10
N360	OMR-9/1	482788.8	7203682.19	11.48	11.08	11.2	11.35	11.5	0	0	0	30
N364	N-2/16	484366.79	7203574.32	4.33	4.36	4.38	4.39	4.4	30	50	60	70

APPENDIX B

Hydraulic Results (Stephenson Street XP-STORM Model)

Stephenson Street Catchment XP-STORM Model Results

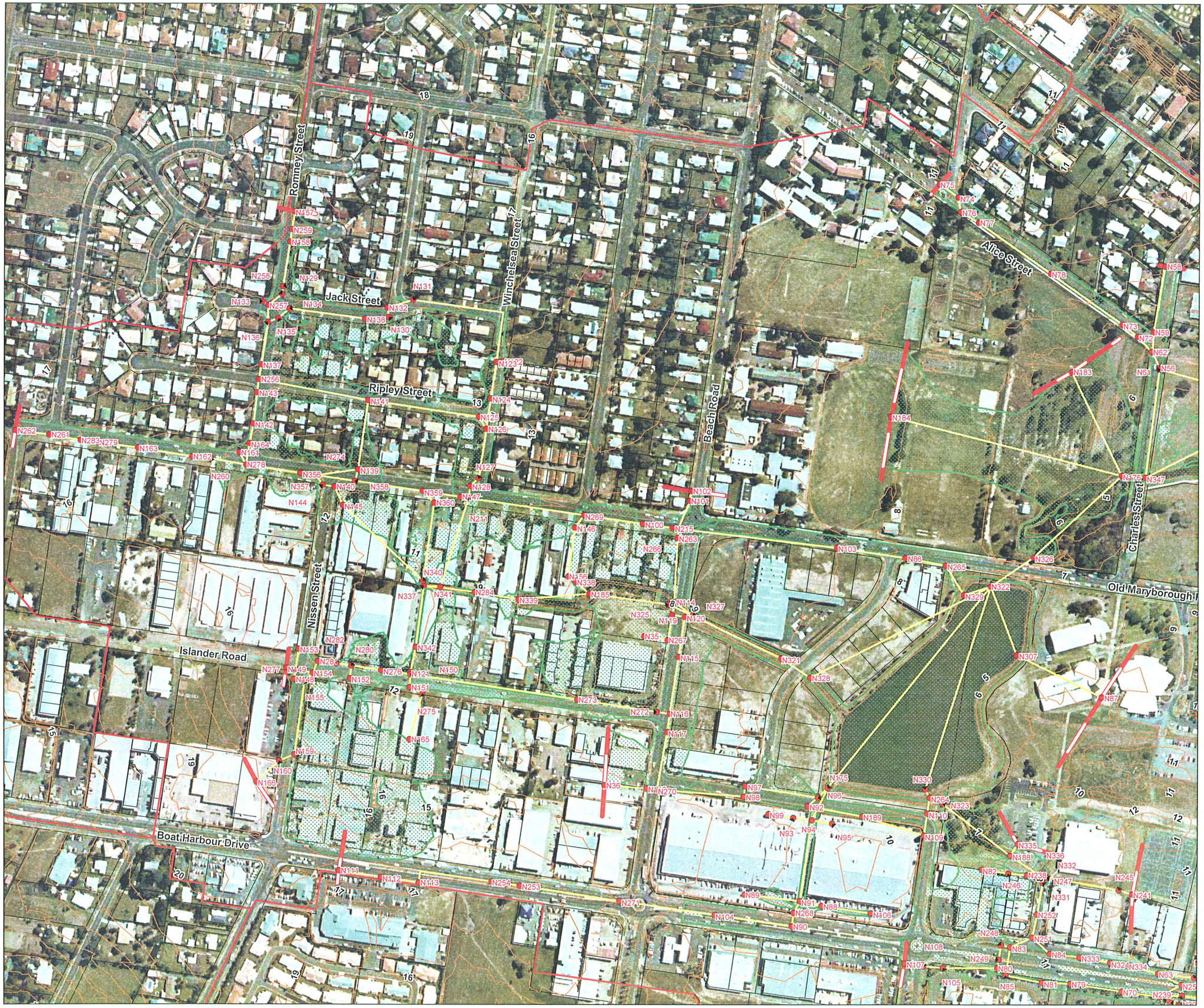
Mapping_Node	Model_Node	X	Y	Surf_IL (m,AHD)	Q10_WSL (m,AHD)	Q20_WSL (m,AHD)	Q50_WSL (m,AHD)	Q100_WSL (m,AHD)	Q10_Depth (mm)	Q20_Depth (mm)	Q50_Depth (mm)	Q100_Depth (mm)
N1	A10	484677.35	7203429.71	4.13	4.81	5.16	5.27	5.58	680	1030	1140	1450
N2	A15-5	484849.81	7203255.88	7.52	7.73	7.74	7.76	7.78	210	220	240	260
N3	A25-5u	484700.96	7203058.88	6.92	7.20	7.34	7.36	7.40	290	420	440	490
N4	A25-5-10	484482.28	7203084.98	11.3	11.38	11.39	11.39	11.40	80	90	100	100
N5	A25-10	484579.48	7202997.74	10.3	10.69	10.71	10.75	10.78	390	410	450	480
N6	A25-15	484434.11	7203005.82	11.95	12.70	12.76	12.86	12.95	750	810	910	1000
N7	A60	484400.62	7202566.88	12.9	14.62	14.79	14.94	15.02	1720	1890	2040	2120
-	A30-5u	484912.96	7203061.2	-	8.54	8.56	8.58	8.62	-	-	-	-
N8	A35	484828.71	7202974.83	7.3	7.79	7.85	7.86	7.88	490	550	560	580
N9	A40	484833.61	7202919.18	7.5	9.39	9.62	9.64	9.68	1890	2120	2140	2180
N10	A45-5	484812.28	7202713.5	11.5	11.76	11.77	11.79	11.80	260	270	290	310
N11	A55-5	484682.17	7202521.85	14.95	15.22	15.24	15.26	15.28	270	290	310	330
N12	A40-10	485001.1	7202804.69	14.3	14.82	14.86	14.91	14.97	520	560	620	670
N13	A40-15	485037.98	7202759.38	16.3	16.16	16.38	16.43	16.49	0	80	130	190
N14	A40-2	484794.21	7202807.44	9.34	10.23	10.38	10.45	10.50	890	1030	1110	1160
N15	A40-5	484981.8	7202958.98	10.2	10.38	10.39	10.40	10.41	180	190	200	210
N16	A25-5-5	484615.55	7203070.53	8.72	8.80	8.94	9.02	9.09	90	220	310	370
N17	A5-1	484679.29	7203451.39	3.28	4.66	4.96	5.01	5.15	1380	1680	1730	1870
N18	A10-2	484724.06	7203318.23	4.93	5.62	5.86	5.91	6.04	700	930	980	1110
N19	A40-1	484813.23	7202823.56	9.5	9.74	9.76	9.77	9.80	240	260	270	300
N20	A5	484662.47	7203560.46	2.1	3.63	3.63	3.63	3.66	1530	1530	1530	1560
N21	Outlet	484648.86	7203572.95	2	3.63	3.63	3.63	3.63	1630	1630	1630	1630
N22	A10-1	484667.16	7203372.97	4.3	5.27	5.49	5.55	5.74	970	1190	1250	1440
N23	A20-3	484730.15	7203150.12	5.5	6.93	7.34	7.36	7.41	1430	1840	1860	1910
N24	A20-1	484752.43	7203267.72	6.4	6.96	7.00	7.05	7.19	560	600	650	790
N25	A60-2	484445.8	7202576.41	12.67	13.17	13.18	13.21	13.28	500	520	550	610
N26	A30	484838.61	7203072.64	6.8	7.03	7.36	7.48	7.52	240	570	690	730
-	A25-5o	484678.52	7203046.34	-	8.15	8.29	8.33	8.37	-	-	-	-
N27	A25-5-8	484514.21	7203064.61	9.41	9.48	9.49	9.50	9.50	70	80	90	90
-	A25-10-1	484670.8	7202984.78	-	9.21	9.32	9.42	9.36	-	-	-	-
N28	A25-10-2	484458.14	7203015.25	10.9	11.26	11.27	11.29	11.31	360	370	390	410
N29	A50	484895.08	7202937.43	9.1	8.99	9.02	9.05	9.13	0	0	0	30
N30	A35-1	484844.62	7202953.29	9.2	9.32	9.43	9.44	9.47	120	230	240	270
N31	A10-5	484718.56	7203330.12	4.4	5.61	5.85	5.89	6.03	1210	1450	1490	1630
N32	A10-4	484700.29	7203343.69	4.3	5.55	5.79	5.83	5.98	1250	1490	1530	1680
N33	A25	484728.3	7203280.41	5	6.03	6.26	6.31	6.50	1030	1260	1310	1500
N34	A25-5-7	484592.79	7203073.38	8	9.09	9.13	9.16	9.19	1090	1130	1160	1190
-	A30-5-6	484898.42	7202968.91	-	8.55	8.57	8.59	8.63	-	-	-	-
-	A30-5-4	484897.27	7202976.62	-	8.57	8.59	8.61	8.65	-	-	-	-
N35	A30-5-5o	484906.16	7202994.2	8.45	8.67	8.72	8.76	8.82	220	270	310	370
N36	A30-5-5-1o	484919.7	7202967.32	8.58	8.67	8.72	8.76	8.82	90	140	180	240
-	A30-5-5-1u	484910.55	7202974.14	-	8.67	8.72	8.76	8.82	-	-	-	-
N37	A35-1-3o	484905.17	7202953.65	8.88	9.10	9.12	9.13	9.14	220	240	250	260
-	A35-1-3u	484904.55	7202946.86	-	9.08	9.10	9.11	9.13	-	-	-	-
N38	A35-1-2o	484887.35	7202952.69	8.82	9.01	9.07	9.09	9.13	190	250	270	310
-	A35-1-2u	484880.73	7202945.7	-	8.99	9.02	9.05	9.13	-	-	-	-
N39	A50-5	484989.68	7202842.75	11.4	11.90	11.93	11.97	12.00	500	530	570	600
-	A30-5-3o	484932.42	7203055.37	-	8.68	8.72	8.76	8.83	-	-	-	-
-	A30-5-3u	484924.4	7203048.8	-	8.66	8.71	8.75	8.80	-	-	-	-
-	A30-5-2o	484933.55	7203069.24	-	8.68	8.72	8.76	8.83	-	-	-	-
-	A30-5-2u	484927.51	7203076.16	-	8.68	8.72	8.76	8.82	-	-	-	-
-	A30-5-1o	484912.46	7203074.85	-	8.67	8.72	8.76	8.82	-	-	-	-
-	A30-5-1u	484917.62	7203078.07	-	8.66	8.70	8.74	8.79	-	-	-	-
N40	A30-5o	484911.61	7203067.35	8.3	8.67	8.72	8.76	8.82	370	420	460	520
N41	A35-10	484828.67	7202950.12	8.53	9.35	9.54	9.54	9.57	810	1000	1010	1030
N42	A40-6	484978.97	7202943.99	10.4	10.73	10.75	10.78	10.81	330	350	380	410
-	A40-21	485023.7	7202763.9	-	15.92	16.13	16.18	16.24	-	-	-	-
-	A50-7	484993.24	7202812.11	-	13.87	13.90	13.95	14.00	-	-	-	-
N43	A55-1	484679.01	7202631.94	11.19	11.49	11.50	11.51	11.52	310	310	320	330
N44	A10-11	484726.26	7203305.52	4.96	5.78	6.05	6.11	6.37	830	1090	1150	1410
-	A55-15	484550.03	7202663.57	-	13.58	13.63	13.71	13.75	-	-	-	-
-	A55-11	484550.58	7202646.92	-	13.10	13.14	13.21	13.25	-	-	-	-
-	A55-1-30	484627.12	7202700.49	-	12.48	12.75	12.94	13.07	-	-	-	-
-	A55-1-20	484617.69	7202685.47	-	12.47	12.75	12.93	13.07	-	-	-	-
-	A55-1-10	484627.31	7202673.81	-	12.32	12.54	12.68	12.79	-	-	-	-
-	A55-1-5	484647.02	7202629.24	-	11.94	11.97	11.98	11.99	-	-	-	-
-	A40-2-15	484681.4	7202762.25	-	11.46	11.77	11.94	11.97	-	-	-	-
-	A40-2-10	484697.44	7202782	-	11.31	11.59	11.72	11.73	-	-	-	-
-	A40-2-5	484728.98	7202778.53	-	10.92	11.17	11.29	11.32	-	-	-	-
-	A40-4-35	484662.42	7202853.04	-	13.37	13.37	13.37	13.37	-	-	-	-
-	A40-4-30	484654.28	7202865.63	-	13.02	13.03	13.06	13.10	-	-	-	-
-	A40-4-25	484650.2	7202890.54	-	12.94	12.97	13.02	13.06	-	-	-	-
-	A40-4-20	484670.55	7202905.23	-	12.49	12.53	12.56	12.58	-	-	-	-
-	A40-4-15	484691.5	7202897.16	-	11.89	11.91	11.94	11.98	-	-	-	-
-	A40-4-10	484749.44	7202894.63	-	9.93	10.04	10.17	10.29	-	-	-	-
-	A40-4	484765.65	7202873.44	-	9.74	9.80	9.87	9.94	-	-	-	-
-	A40-4-5	484743.64	7202840.01	-	10.64	10.76	10.78	10.78	-	-	-	-
-	A40-4-2	484750.91	7202874.14	-	10.39	10.49	10.51	10.53	-	-	-	-
N45	A40-2-12	484701.87	7202772.55	11.61	11.75	11.75	11.75	11.76	140	140	150	150
-	A55-14	484535.69	7202656	-	14.10	14.11	14.11	14.12	-	-	-	-
N46	A40-2-17	484693.91	7202752.38	11.84	11.99	12.00	12.00	12.01	160	160	170	180
N47	A40-4-6	484735.55	7202846.88	10.65	10.79	10.79	10.80	10.80	140	140	150	150
N48	A55-17	484539.83	7202671.59	14	14.11	14.13	14.14	14.15	110	130	150	160
N49	A40-2-7	484716.15	7202772.71	11.38	11.42	11.42	11.43	11.44	30	40	40	50
-	A55-1-13	484613.23	7202671.49	-	12.93	12.95	12.97	12.99	-	-	-	-
N62	A40-4-17	484690.57	7202886.99	13.08	13.17	13.18	13.18	13.19	90	90	100	100
N50	A40-4-37	484671.59	7202862.23	14.38	14.48	14.49	14.49	14.49	100	100	110	110
-	A55-1-32	484617.53	7202702.1	-	13.76	13.76	13.76	13.76	-	-	-	-
N51	A55-1-23	484605.89	7202685.47	13.01	13.16	13.17	13.18	13.18	150	150	160	170

Stephenson Street Catchment XP-STORM Model Results

Mapping_Node	*Model_Node*	*X*	*Y*	*Surf_IL (m,AHD)*	*Q10_WSL (m,AHD)*	*Q20_WSL (m,AHD)*	*Q50_WSL (m,AHD)*	*Q100_WSL (m,AHD)*	*Q10_Depth (mm)*	*Q20_Depth (mm)*	*Q50_Depth (mm)*	*Q100_Depth (mm)*
N52	A40-4-8	484777.32	7202867.22	10.29	10.37	10.38	10.39	10.40	80	80	100	110
-	A40-4-22	484674.2	7202891.39	-	13.61	13.62	13.62	13.63	-	-	-	-
-	A40-4-13	484734.25	7202885.96	-	10.46	10.47	10.47	10.48	-	-	-	-
-	A40-4-31	484663.77	7202870.12	-	14.25	14.25	14.26	14.26	-	-	-	-
N53	A40-4-2-1	484734.84	7202863.9	10.36	10.51	10.51	10.53	10.54	150	160	170	190
-	A40-4-27	484662.77	7202883.11	-	13.68	13.69	13.70	13.70	-	-	-	-
-	A55-20	484551.34	7202682.72	-	14.11	14.13	14.16	14.17	-	-	-	-
-	B35-40	484739.8	7202970.19	-	9.30	9.31	9.32	9.34	-	-	-	-
-	B35-30	484766.87	7202966.38	-	9.11	9.12	9.16	9.20	-	-	-	-
-	B35-20	484795.59	7202961.79	-	8.67	8.76	8.88	9.01	-	-	-	-
-	B35-10	484807.46	7202959.58	-	8.34	8.40	8.48	8.56	-	-	-	-
-	B35-20-20	484773.45	7202955.85	-	9.60	9.75	9.79	9.82	-	-	-	-
-	B35-20-10	484787.17	7202951.66	-	9.33	9.52	9.62	9.69	-	-	-	-
N54	B35-42	484736.18	7202976.72	10.02	10.16	10.17	10.18	10.19	140	150	160	170
N55	B35-32	484762.05	7202975.36	9.84	9.95	9.96	9.96	9.97	110	120	130	130
N56	B35-21	484789.13	7202970.14	9.49	9.60	9.62	9.64	9.65	120	130	150	170
N57	B35-11	484804.62	7202967.12	9.35	9.45	9.47	9.48	9.50	100	110	130	150
-	B35-20-21	484765.93	7202948.15	-	9.81	9.82	9.83	9.84	-	-	-	-
N58	B35-20-11	484779.53	7202946.31	9.56	9.73	9.75	9.77	9.79	170	190	210	230
N59	A40-2-2-5	484723.34	7202877.76	10.75	10.84	10.85	10.85	10.86	90	100	100	110
-	A40-2-2-3	484735.91	7202878.87	-	10.40	10.50	10.54	10.56	-	-	-	-
-	A40-5-13	484971.44	7202951.18	-	10.68	10.71	10.74	10.77	-	-	-	-
-	A35-1-3-2	484915.5	7202947.08	-	9.14	9.16	9.17	9.18	-	-	-	-
N60	A35-1-3-7	484917.85	7202954.39	8.93	9.14	9.16	9.17	9.18	210	240	250	260
N61	A40-5-9	484964.97	7202958.49	10.02	10.23	10.25	10.26	10.27	220	230	240	250
-	lowfla40	484834.64	7202990.66	-	7.88	8.05	8.06	8.10	-	-	-	-

APPENDIX C

Existing Model Flood Extent Results (Taylor Street Catchment)



TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 2A

Q10 FLOOD EXTENT

HERVEY BAY CITY COUNCIL

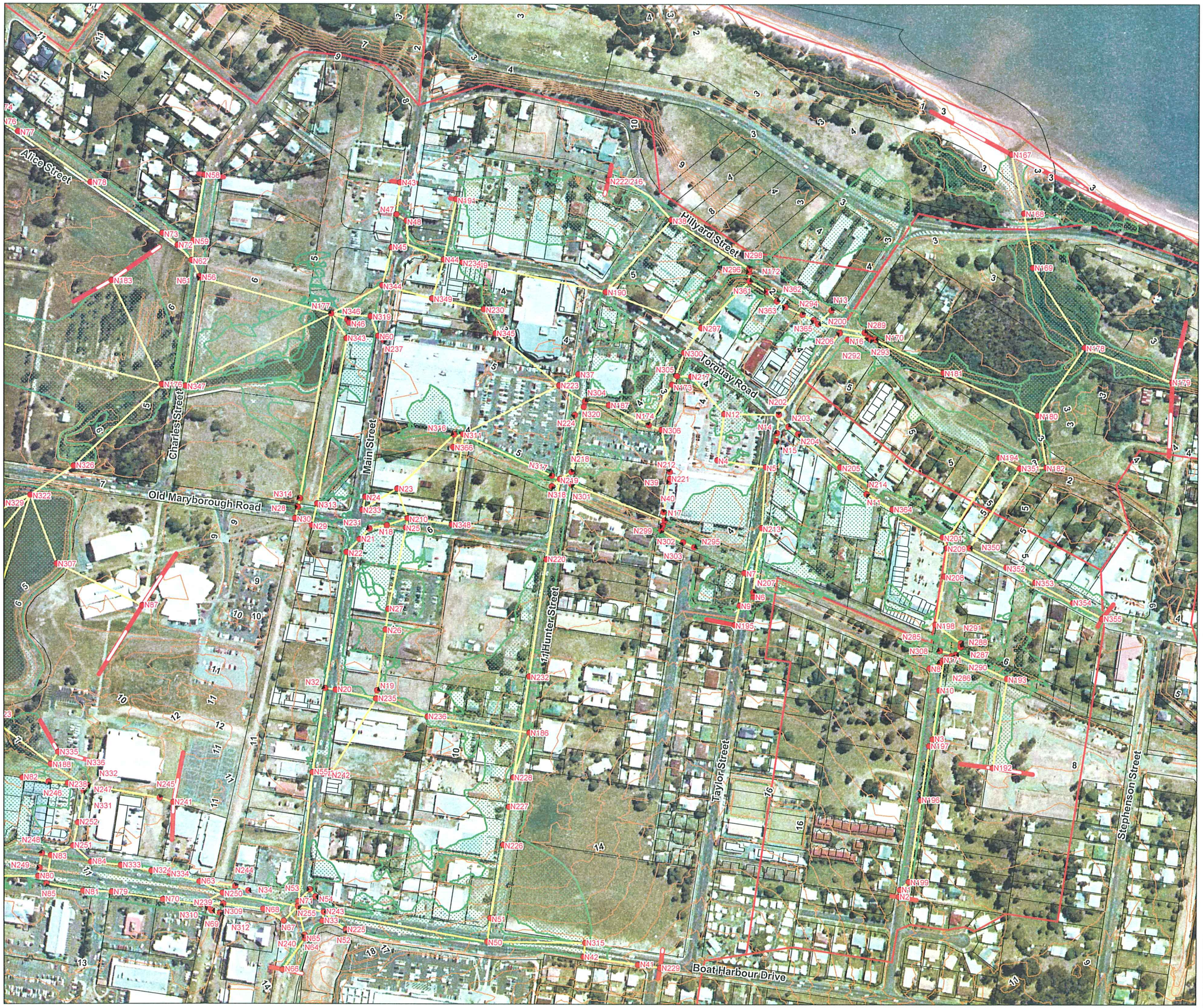
"Success through Partnership"

JWP

John Wilson and Partners Pty. Ltd.
ABN 85 011 022 503
PO Box 585, Fortitude Valley QLD 4006
Ph. 32449600 Fax. 32449699

File Path : Z:\42 Wways\050303-001 Tooan Tooan Creek Flood Risk\GIS\Workspaces\Extents

Projection Trans. Merc. MGA56(GDA 94)



N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q10 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 2B

Q10 FLOOD EXTENT

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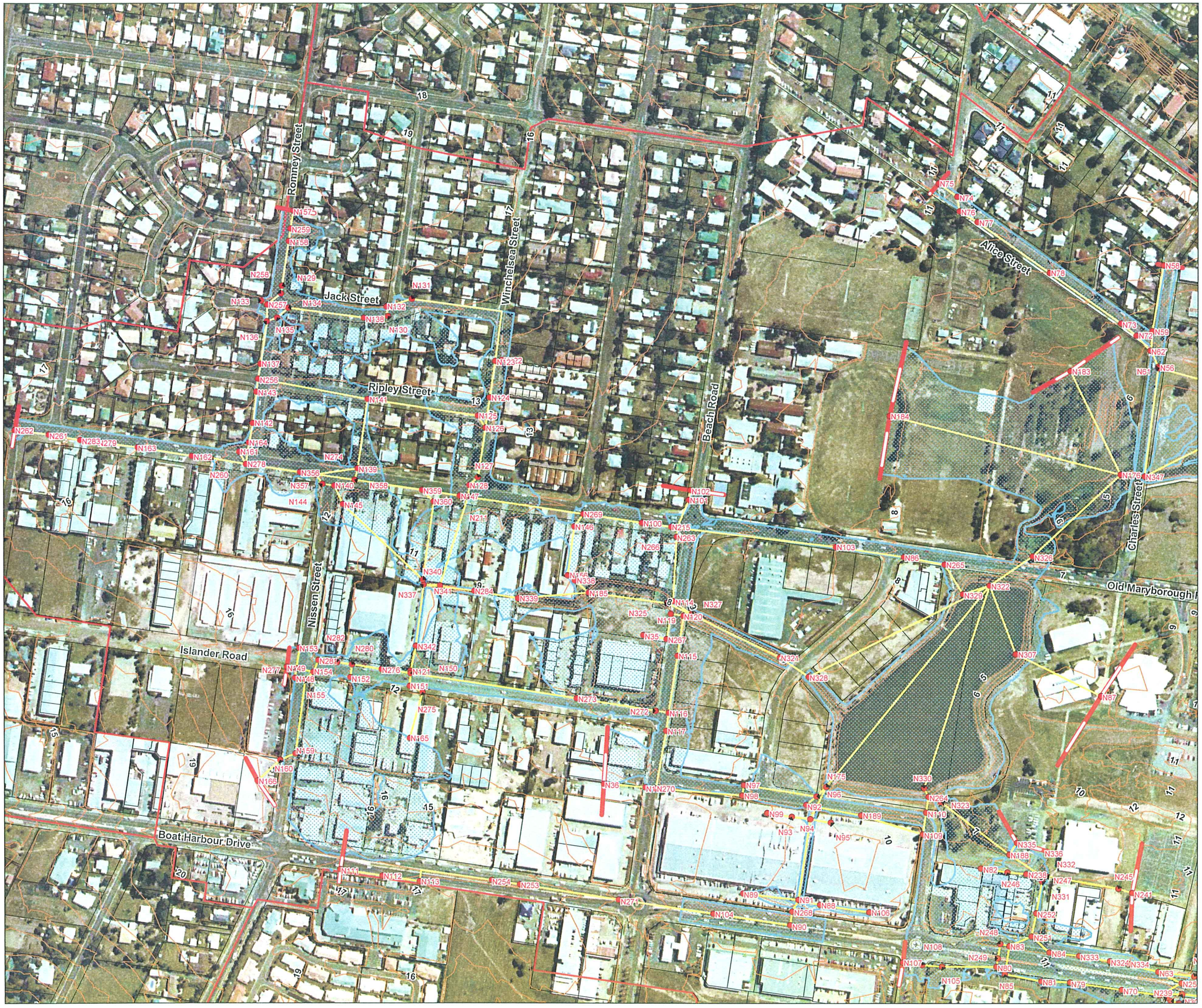

N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q20 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 3A

Q20 FLOOD EXTENT

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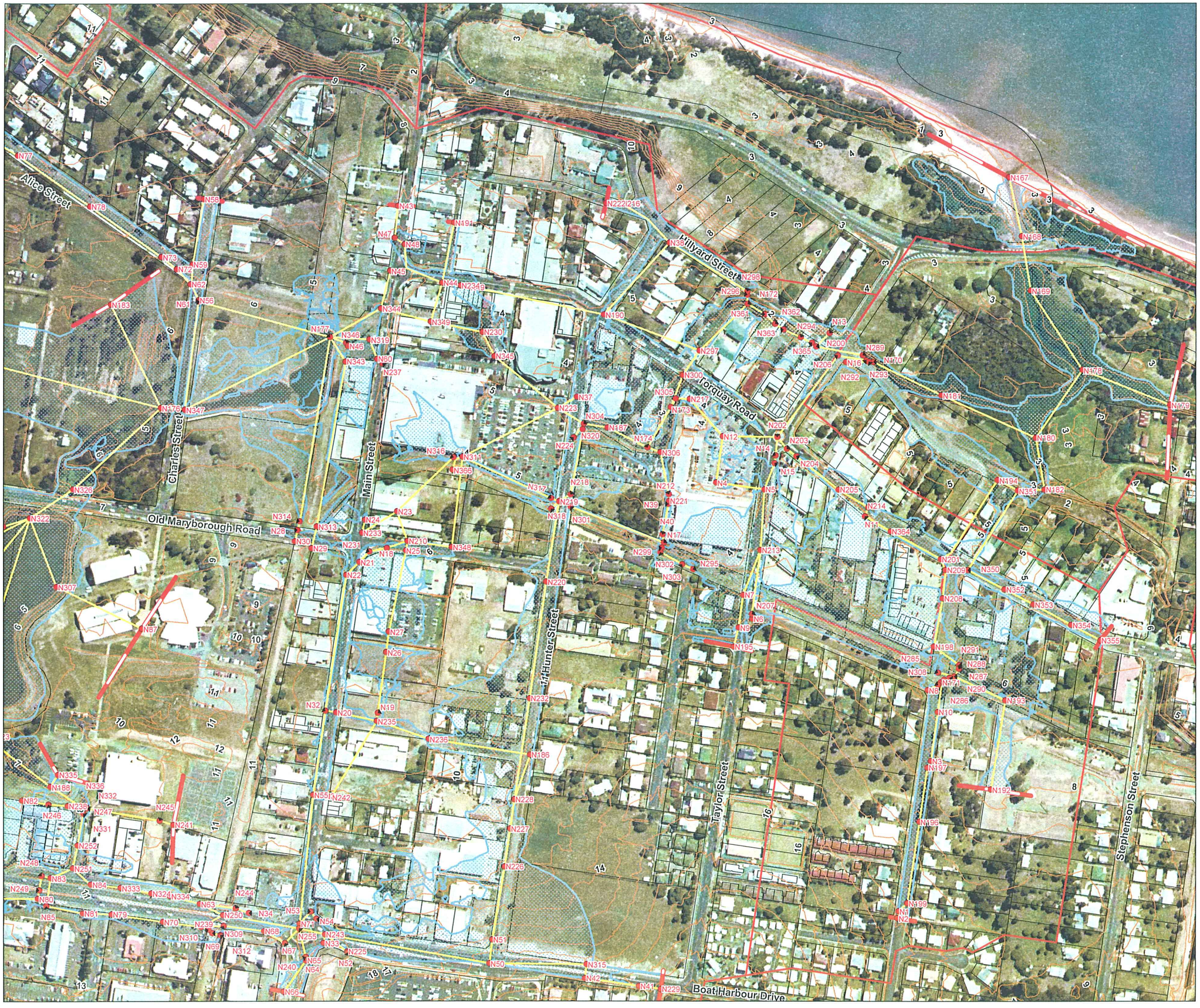

N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q20 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 3B

Q20 FLOOD EXTENT

HERVEY BAY CITY COUNCIL

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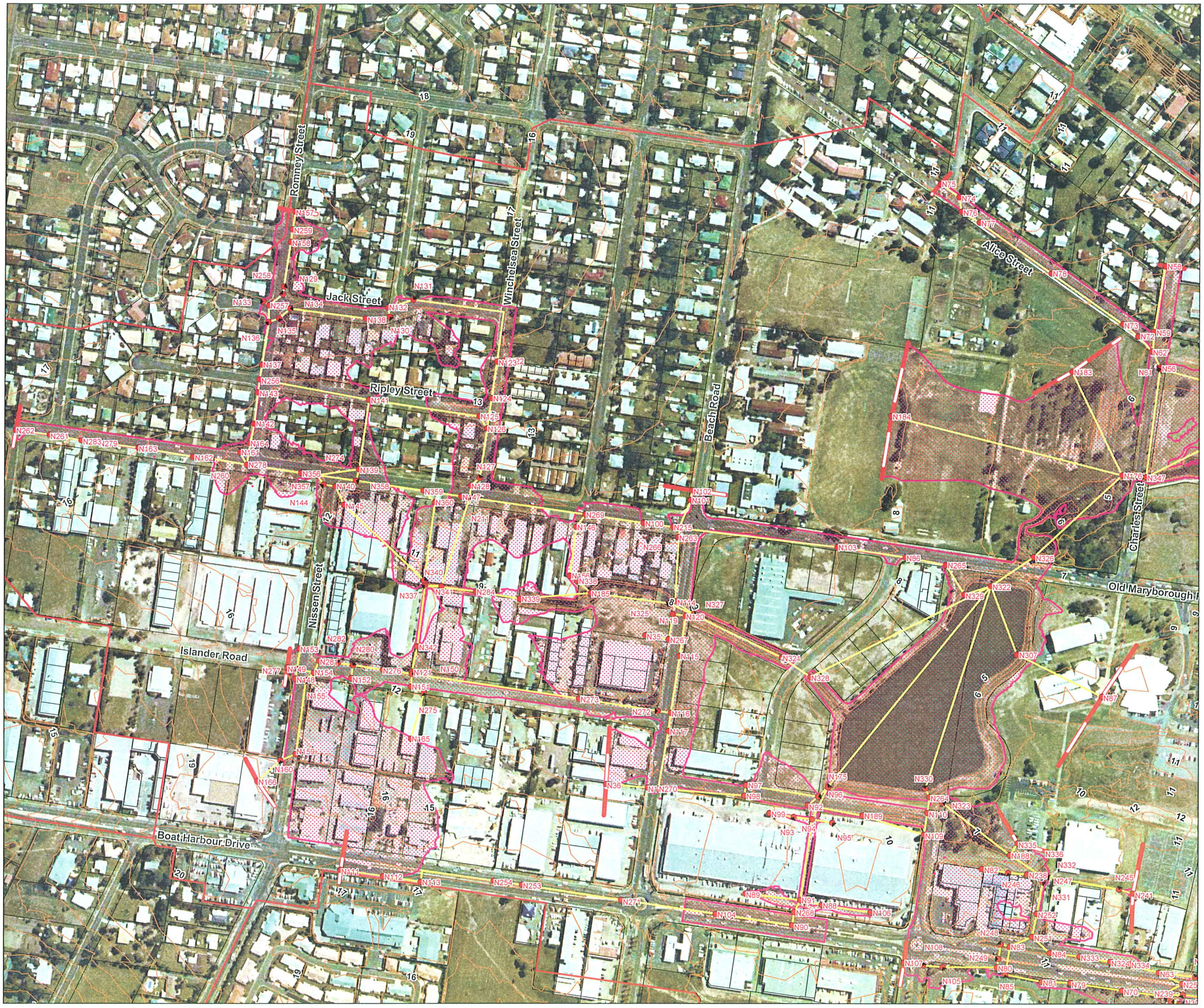

N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q50 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 4A

Q50 FLOOD EXTENT

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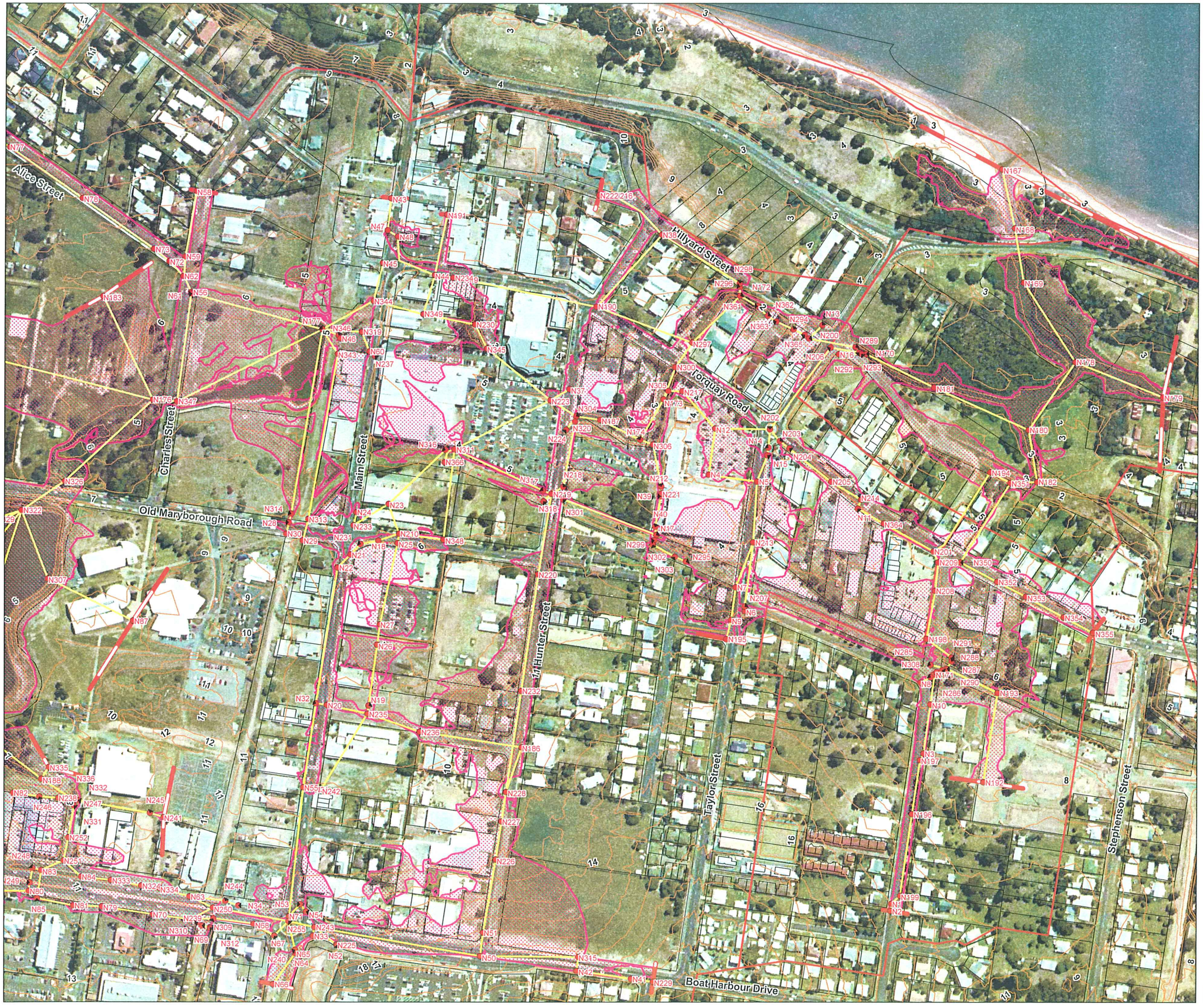

N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q50 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 4B

Q50 FLOOD EXTENT

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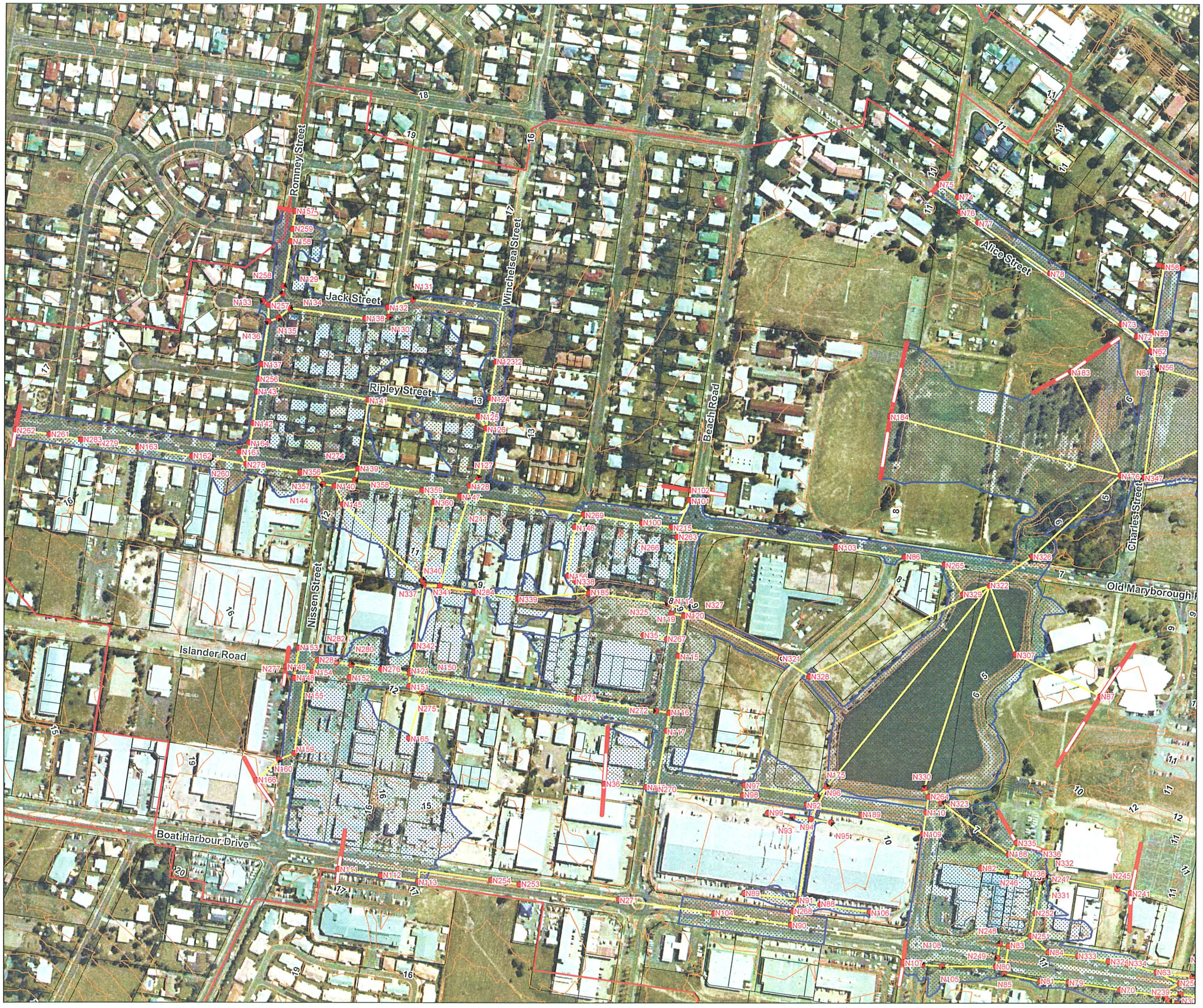

N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q100 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 5A

Q100 FLOOD EXTENT

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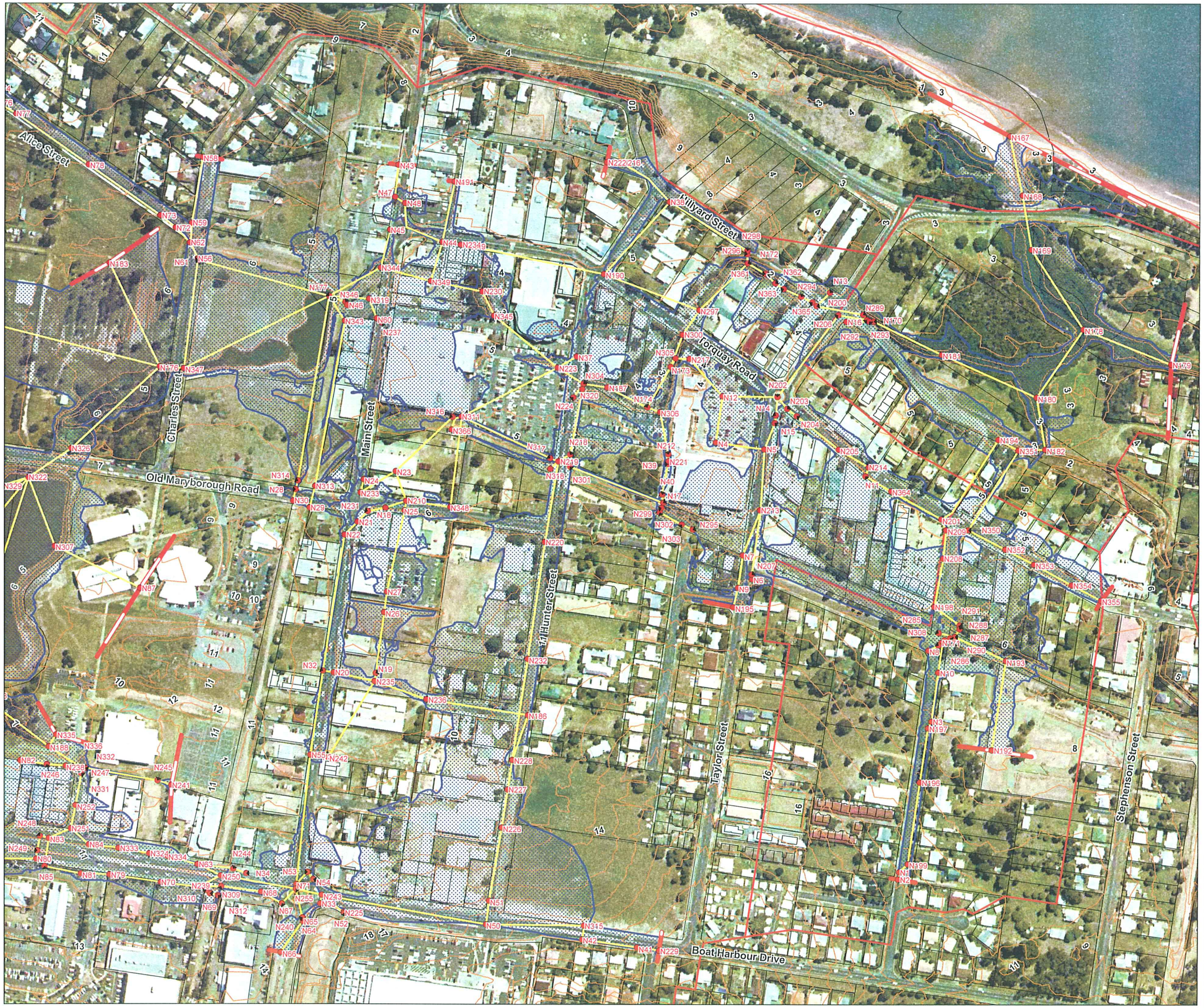

N

LEGEND

- Limit of Mapping
- Overland Links
- Overland Nodes
- Q100 Flood Extent
- Subcatchment Boundary

80 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

TAYLOR ST MODEL

FIGURE 5B

Q100 FLOOD EXTENT

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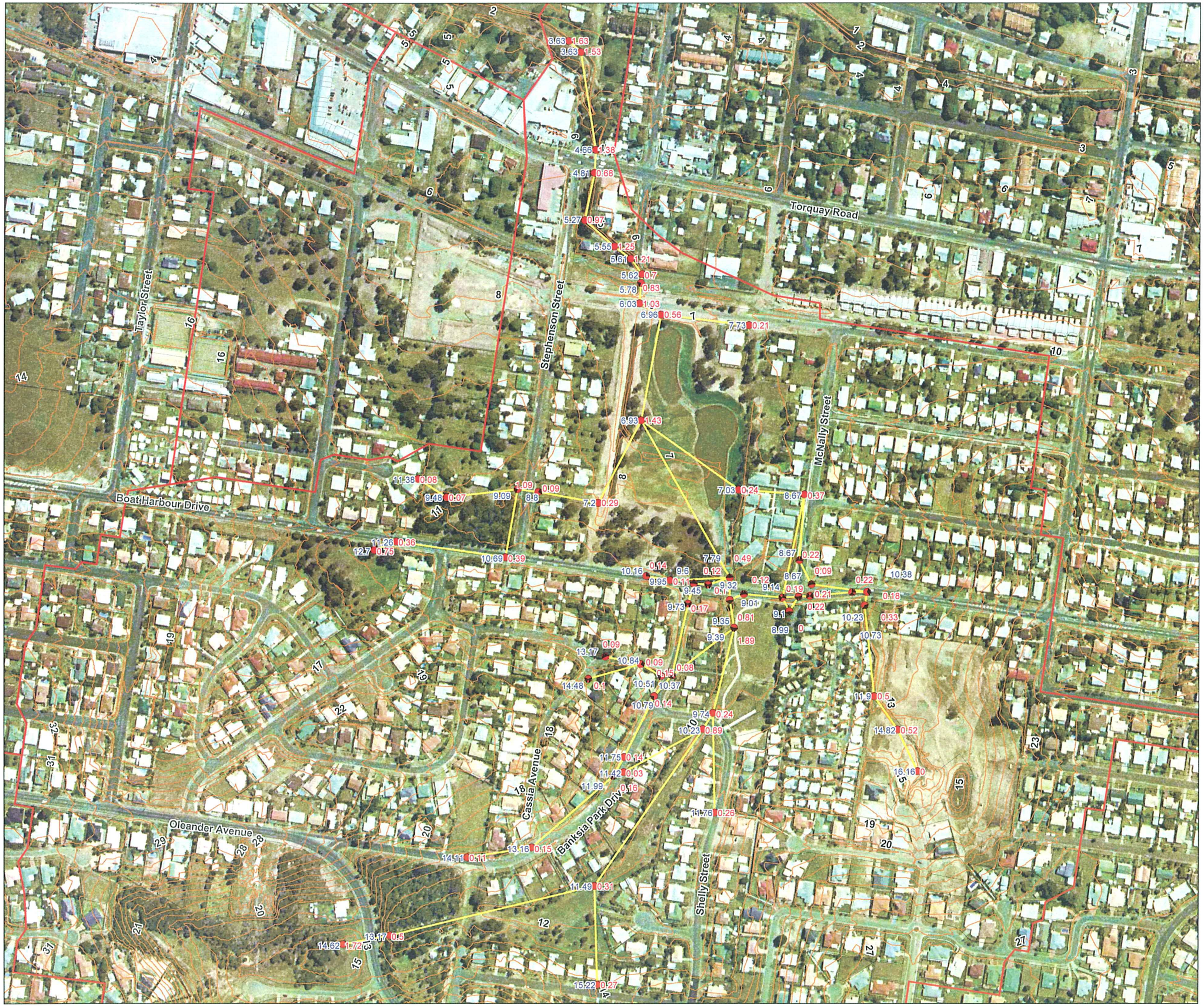
Projection Trans. Merc. MGA56(GDA 94)

APPENDIX D

Existing Model Flood Extent Results (Stephenson Street Catchment)



N

LEGEND

- Subcatchment Boundary
- Overland Links
- Overland Nodes

Q10 Water Surface Level

Q10 Depth

40 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

STEPHENSON ST. MODEL
FIGURE 6
Q10
WATER SURFACE LEVEL AND DEPTH

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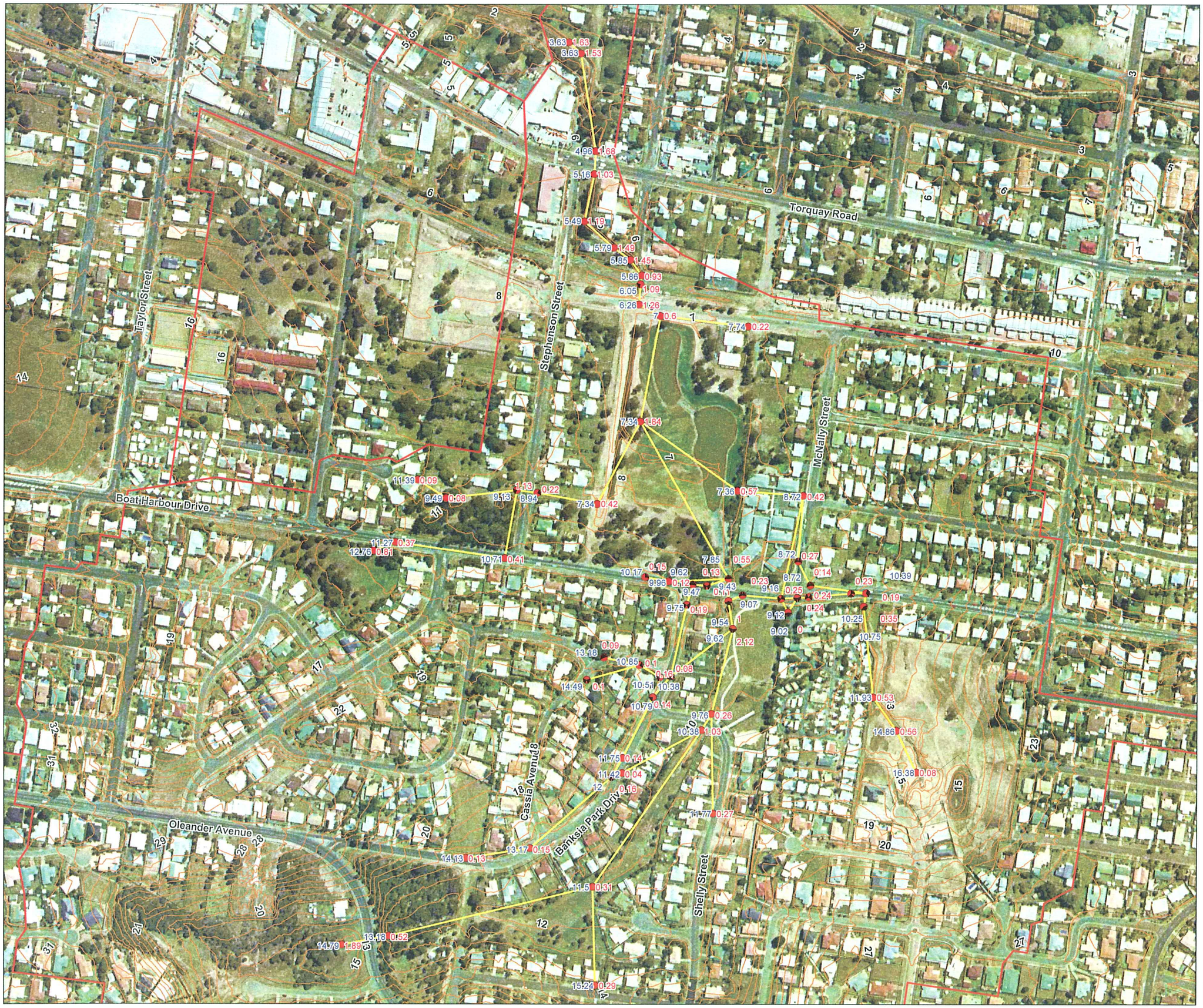
Projection Trans. Merc. MGA56(GDA 94)



N

LEGEND

- Subcatchment Boundary
- Overland Links
- Overland Nodes

Q20 Water Surface Level

Q20 Depth

40 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

STEPHENSON ST. MODEL

FIGURE 7
Q20
WATER SURFACE LEVEL AND DEPTH

HERVEY BAY CITY COUNCIL

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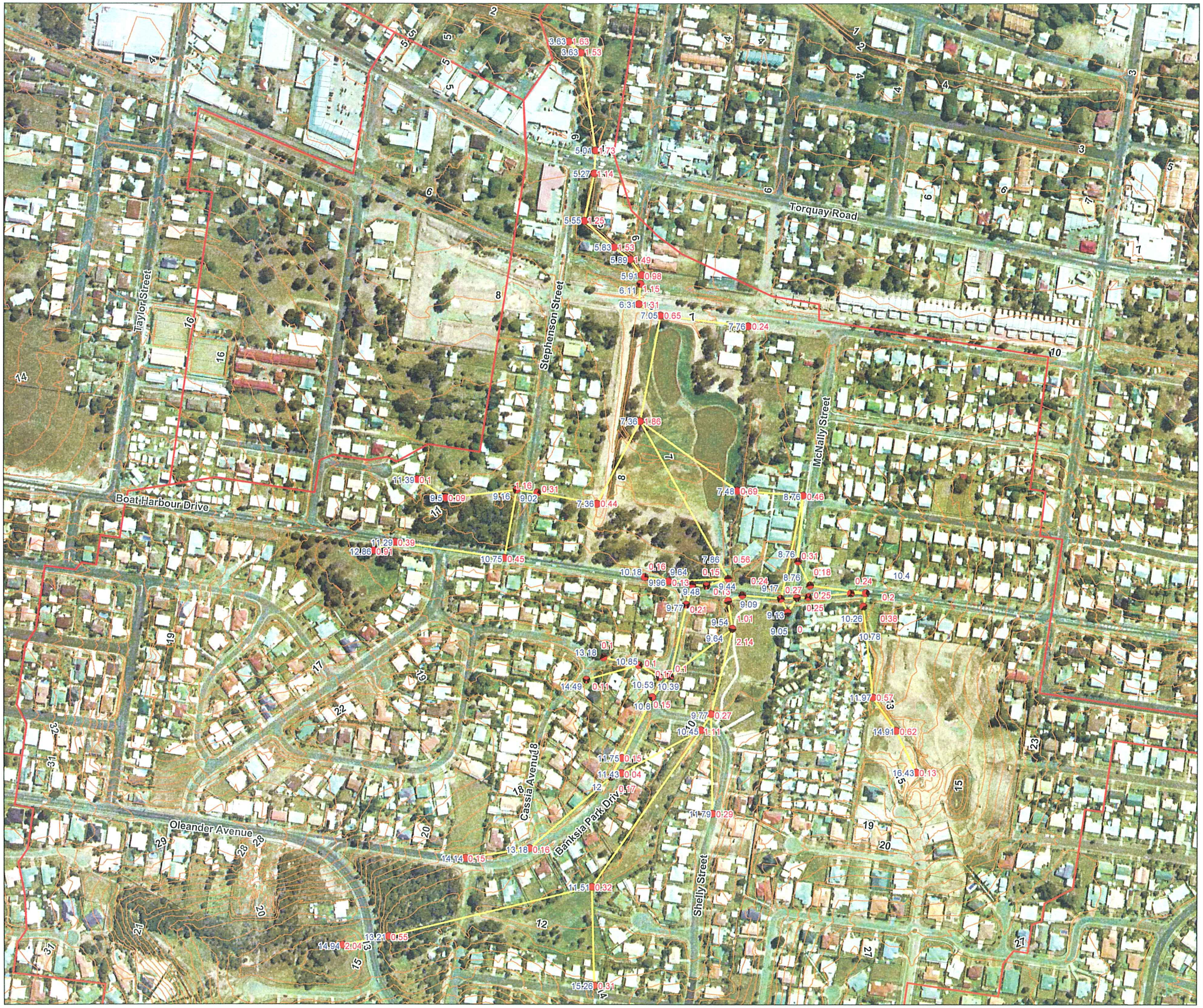

N

LEGEND

- Subcatchment Boundary
- Overland Links
- Overland Nodes

Q50 Water Surface Level

Q50 Depth

40 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

STEPHENSON ST. MODEL FIGURE 8 Q50 WATER SURFACE LEVEL AND DEPTH

HERVEY BAY CITY COUNCIL

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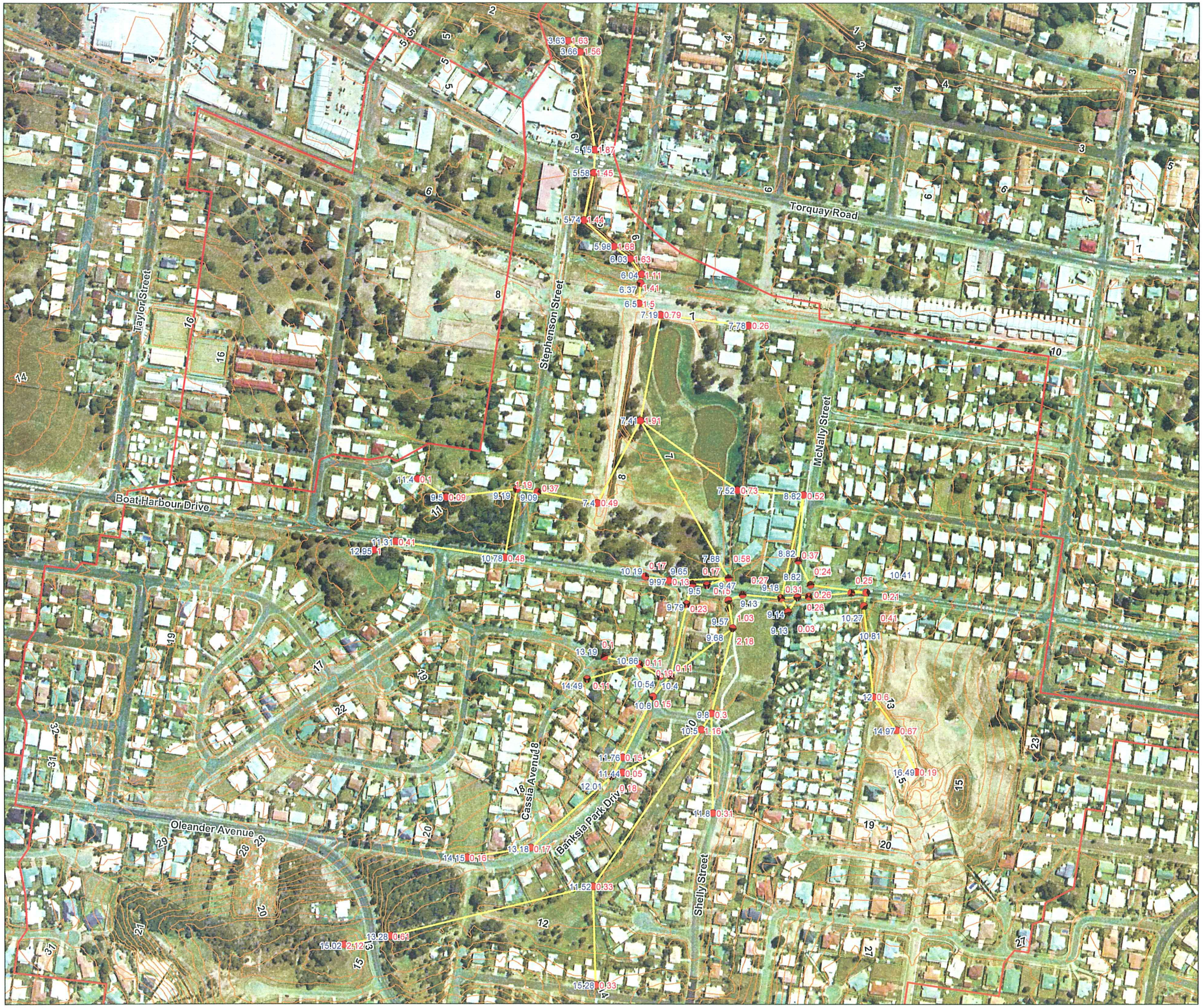

N

LEGEND

- Subcatchment Boundary
- Overland Links
- Overland Nodes

Q100 Water Surface Level

Q100 Depth

40 0 40 80 120

Metres

Scale: 1:4,000

TOOAN TOOAN CREEK

FLOOD RISK REDUCTION STUDY

STEPHENSON ST. MODEL FIGURE 9 Q100 WATER SURFACE LEVEL AND DEPTH

HERVEY BAY CITY COUNCIL

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Projection Trans. Merc. MGA56(GDA 94)