Agenda Item 14.2 - Attachment 1

Onslow Flood Study Report

Onslow Drainage Infrastructure Upgrade Assessment

Stage 1 - Flood Assessment Report

08 June 2023 **Ref: 2**

PREPARED FOR:

Shire of Ashburton

PREPARED BY:

Davide Di Mauro

Stantec

Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
0	29/03/2023	Draft	Davide Di Mauro	Shafiqul Alam	Joan Deng	Steph Thompson
1	05/05/2023	Updated Draft	Davide Di Mauro	Joan Deng	Steph Thompson	Steph Thompson
2	08/06/2023	Final Report	Davide Di Mauro	Joan Deng	Steph Thompson	Steph Thompson

Executive Summary

This report should be conjunction with Onslow Stormwater Pumping Memo issued in May 2023.

Background

The Shire of Ashburton (the Shire) commissioned Stantec on 18 January 2023 to perform stormwater modelling and identify flooding issues and potential flood mitigation measures for the township of Onslow. Cardno (prior to the acquisition by Stantec) has closely worked with the Shire in providing drainage solutions and performed various assessments, concept designs, and a Coastal Hazard Risk Management & Adaptation Plan (CHRMAP). It is understood that the Shire's overarching objective is to revitalize the township of Onslow and to provide a medium/long-term drainage infrastructure upgrade strategy. Specifically, the Shire has identified the following key areas of focus:

- Assess the existing stormwater infrastructure in the northern part of Second Avenue - in preparation for Stage 1 of a proposed streetscape project.
- Assess the impact of a proposed artistic installation (Staircase to the Moon) in terms of its effect on stormwater/flood management.
- Assess existing issues associated with stormwater drainage in Third Avenue.
- Assess the performance of the three Detention Basins at the Southern end of Second Avenue.

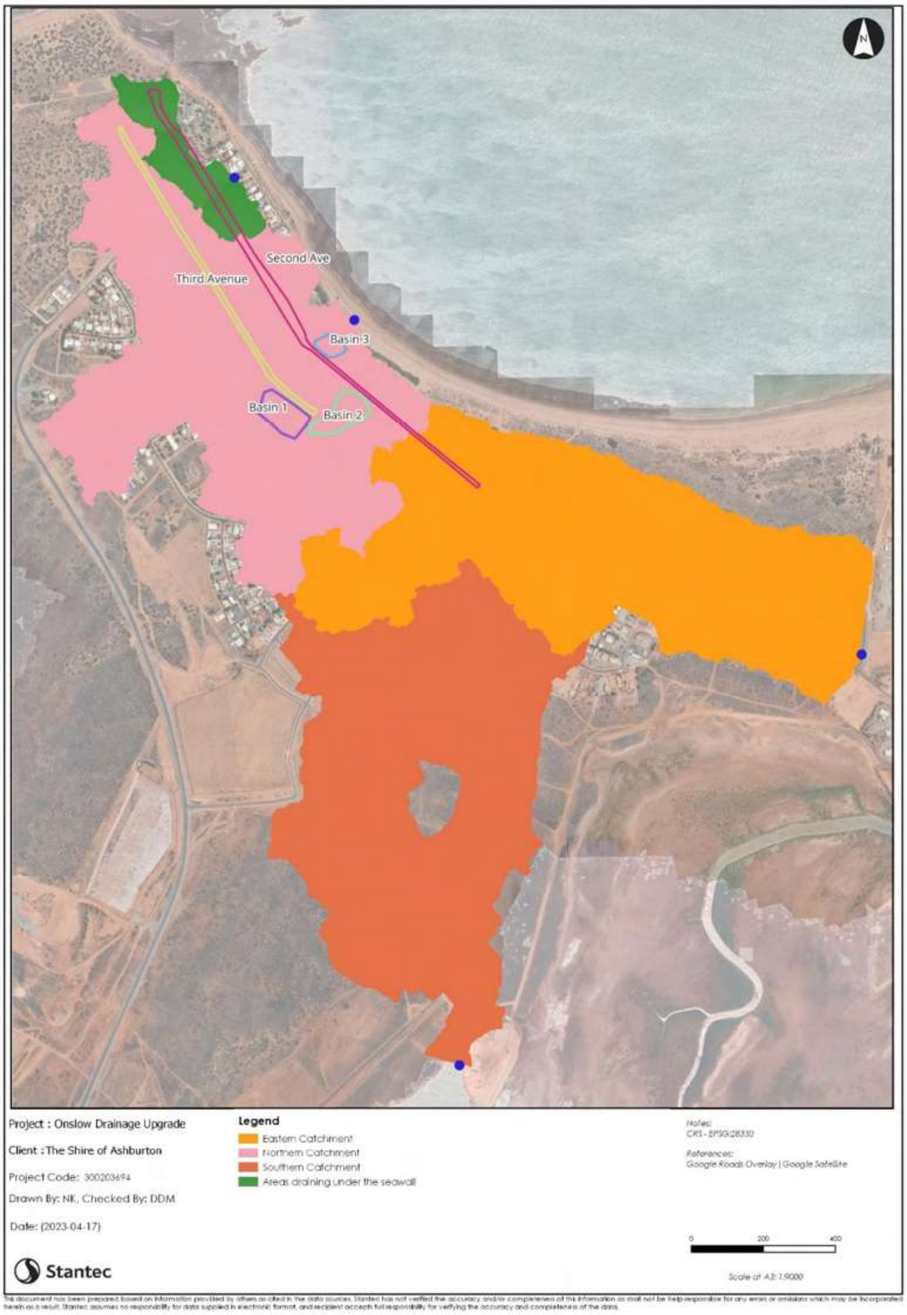
Scope of Works

The intent of this work is to define the existing flow regime and overall flooding condition for the whole township, in and around the subject sites. This is achieved through the development of hydrologic and hydraulic studies through desktop analyses and modelling simulations using a range of software packages. Specifically, the work involved:

- Comprehensive data review and preparation of modelling assumptions.
- Catchment delineation and development of a conceptualized hydrological model using the latest available LiDAR data and ultimate land use arrangement (where available).
- Flow estimation for the 63.2%, 20%, 10%, 5%, 2% and 1% Annual Exceedance Probability (AEP) events in accordance with the latest processes and best practices (a 1% AEP is typically referred to as a 1 in 100 year event).
- A baseline design scenario that encompasses the Staircase to the Moon footprint.
- Assessment of flood impacts for flood water level, velocity and hazard classification.
- Preparation of a technical report summarizing the methodology, modelling results and discussion (this report).
- Mapping of outputs based upon are depth, velocity, hazard and overview of existing stormwater drain performance.

Catchment Extent

The catchment extent and breakdown were derived using CatchmentSIM in conjunction with available LiDAR and stormwater network data. The overall catchment extent was delineated to encompass the township with regards to key areas of interest and is approximately 2 km^2. The catchments have been broken down into 4 as shown in Figure 14 (copied below).



Existing Conditions

The existing case represents the ‘baseline’ scenario. The flood model for the 1% AEP depth results is depicted in Figure 36 (copied below).

In summary:

- Throughout the northern catchment, slow-moving flows occupy all of Third Avenue from the intersection with Third Street and fill up all the retention basins from overland runoff at the start of the simulation.
- As First Street is impacted, ponding occurs within the surrounding residential areas and police precinct, which receives overland runoff from the northern precinct and the part of the caravan park next to Anzac Park.

- In frequent events, the Basin 3 outlet channel does not drain into the ocean due to the configuration of the foredunes and sand accumulation at the pipe outlets, creating a natural barrier that prevents discharging in Beadon Bay. Water ponding this way ponds behind the foredunes at the pipe outlets creating a natural plug.
- A series of three interconnected detention basins have been constructed. Basin 1 flows into Basin 2, which is then linked to Basin 3 via a sub-surface pipeline. Finally, the water is able to discharge into the ocean from the third basin. However, due to the town's low-lying geography, the basin network can only drain when downstream water levels are not elevated. During extreme rainfall events like a cyclone, coastal storm surge often coincides with heavy rain, preventing the basins from effectively draining excess water.
- Flows do not appear to discharge to the east where Beadon Creek meets with the ocean. The outlet that discharges into Beadon Creek (approximately at the marine support base through a series of culverts) is on high ground, therefore rainfall travels in a westward direction and ponds adjacent to Beadon Creek Road.

Performance of Existing Stormwater Pipe Systems

Second Avenue

In the 1% AEP event, all pipes on Second Avenue topped their capacities, except for the pipes adjacent and discharging to Basin 3 on Second Avenue. However, the modelling indicates that the configuration of the stormwater pipes and the pipe sizes in Stage 1 of the proposed Streetscape project perform adequately and as would be expected for a typical urban street. Based on the modelling, upgrading of the pipe sizes to cater for higher flows does not appear to be warranted. This would depend on the condition of the subsurface drainage system. Second Avenue experiences up to 0.3m of ponding in the 1% AEP event and clears off the majority of ponding in the 20% AEP event.

In terms of condition assessment, a number of sources were used to assess the condition of the pipes within Stage 1 of the Streetscape - for the purpose of planning replacement and/or relining ahead of any streetscape works. A 2019 jetting report detailed the service rating for pipes in Second Avenue, however it did not provide a structural rating. Many of the existing pipes have a service rating of 4 (poor) which can, in some cases, be rectified by simply cleaning the pipes.

Some structural ratings were available from Shire records (2017 Condition Assessment) however the data is now 6 years old and contains conflicting information. For example, some pipes have a structural rating of 5 (very poor) and a service rating of 1 (good) which is unlikely to occur. It is recommended that an additional condition inspection be organised to make a properly informed decision regarding the requirement to either replace, reline or simply clean and maintain existing pipes.

Third Avenue

Third Avenue experiences up to 0.4m of ponding and active runoff leads into Basin 1. The Onslow sports club oval also experiences ponding in all events and gets inundated almost completely in the 1% AEP event with up to 0.3m of runoff which drains onto Third Avenue. In the 1% AEP event, up to 0.6m of ponding and 0.5 m/s of moving waters are entering on Third Avenue from north-west: in this instance runoff from Third Avenue tends to move over to Second Avenue causing up to 0.2m of ponding. Third Avenue from approximately the sports club to the intersection with McRae Place is not only showing full capacity in all events, but also displays consistent surcharging highlighting either improper invert level assumptions or inadequate pipe sizing, or both.

The pits and pipes used in this flood assessment are a combination of feature survey data and interpolation based on topographic information. Stantec recommends that accurate survey information be obtained to ensure accurate modelling data. A critical area in which this information is required is Third Avenue. A data collection campaign should be conducted to collect accurate verifiable data on the size, levels, and conditions of this network. The flood model should then be updated to ensure an accurate flood condition has been derived from modelling.

Climate Change

The effects of Climate Change are expected to worsen the flood conditions within Onslow, due to increases in oceanic water levels and more intense storm events. The Climate Change scenario has been modelled based on the guidelines outlined in the AR&R19.

At the northern end of town, the extents of the tidal inundation are more evident as sea water level is higher than the seawall in some areas from the 5% AEP event. In the 10%, 20% and 63.2% AEP events, the seawall seems to withstand the rise in sea level. Fast moving waters (>1m/s) are experienced on Third Avenue and in proximity of the detention basins. Similarly, seaward assets are generally shown to be hazard-free in events more frequent than 5% AEP. Third Avenue and all the basins, being flooded, are deemed to be unsafe for people and vehicles even in small events.

In the eastern catchment, the augmentation from the ponding related to tidal fluxes is visible to the east in proximity to the Marine base. Similarly, in the southern catchment, the tidal waves claim the most part of Onslow Road from Beadon Creek at the junction with Eaglenest Road.

Detention Basin Performance

The Basin performance has been assessed based on several aspects, including the following:

- Stormwater management – infiltration
- Standing water – mosquito control and breeding.

The Shire has informed Stantec that the detention basins are believed to have been constructed with the intention to infiltrate stormwater. In recent years however, groundwater levels have risen to the point where the water table is now at ground level (or above ground level in the case of Basin 2), significantly reducing the infiltration functionality of the basins.

The Shire has informed Stantec that mosquito breeding is an issue in the area. Based on Department of Water and Environment Regulations (DWER), the basins must be completely drained within 72 hours to prevent mosquito breeding. The modelling has shown that all the detention basins do not completely drain after the 72-hour simulation. As Basin 3 is full throughout the entire simulation, Basin 2 is unable to discharge. Similarly, Basin 1, which is connected directly to Basin 2 via a culvert structure under McGrath Avenue, is also unable to fully discharge. It is noted that negligible surface differences can be observed within the basins at high and low tides.

Staircase to the Moon

Designed in 2022, this artwork is intended to beautify the area within Basin 2 by reshaping the retention basin and installing an artistic oval shaped feature with footpaths encircling the basin and extended carparks with a viewing area overlooking the installation. The design also includes an outlet channel across the foredunes opposite to Basin 2 and adjacent to Second Avenue, to allow potential overflowing from Basin 2 directly into the ocean. Figure 27 (as copied below) shows the extent of the batter slopes of all the elements of the design.

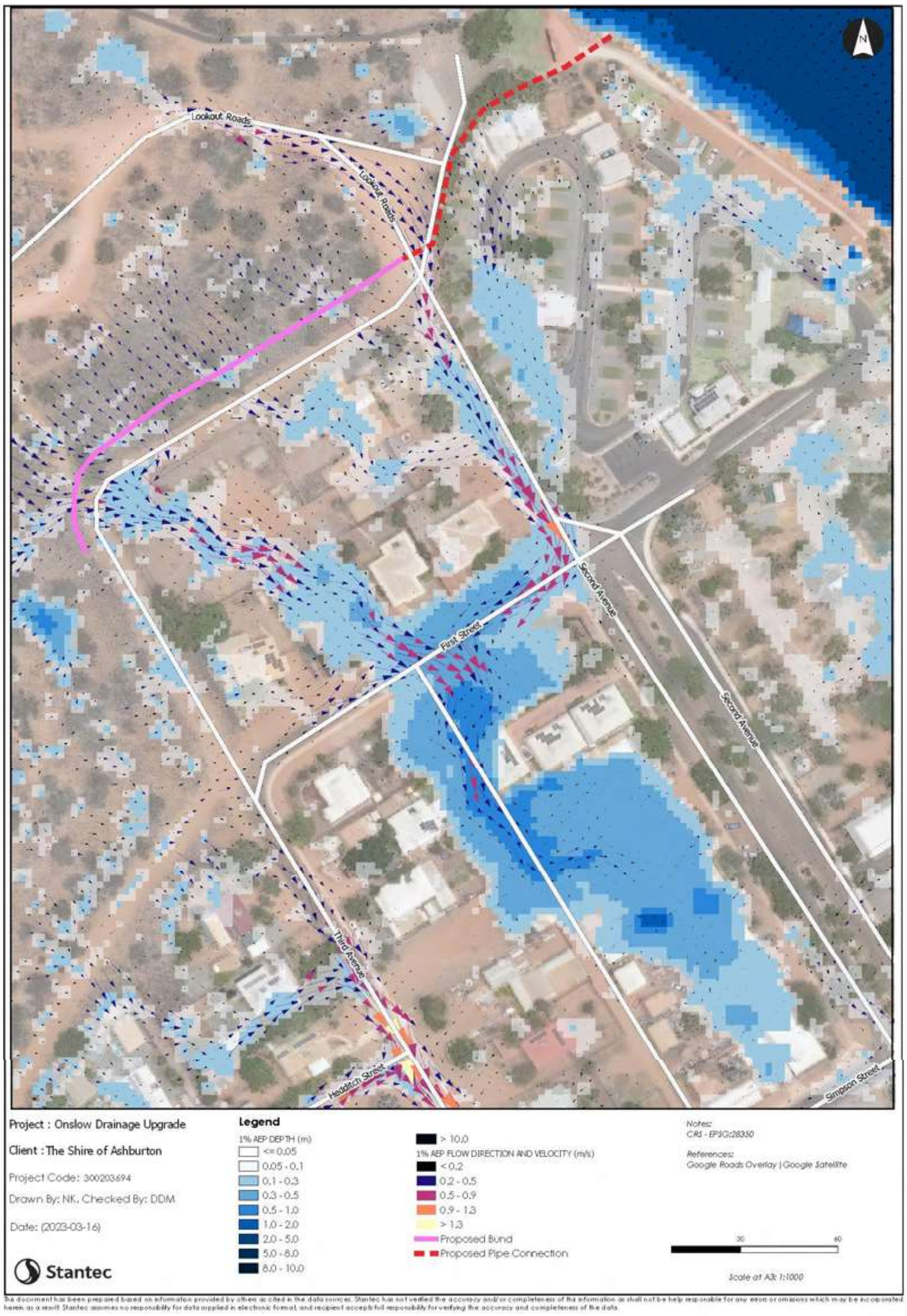
In the eastern catchment, the augmentation from the ponding related to tidal fluxes is visible to the east in proximity to the Marine base. Similarly, in the southern catchment, the tidal waves claim the most part of Onslow Road from Beadon Creek at the ju

Overflow of the basins are experienced up to 10% AEP event, whereas in the 20% and 63.2% AEP events, flows are relatively contained within the Basin 2 and Basin 1. When combined with high tide ingress in the open channel, this results in a relative increase in flood levels due to the raised pad associated with the Staircase to the Moon structure. Afflux levels (water level above the base case) are shown to be increased by up to 0.1m in Basin 1 and Basin 2. Any increase in water levels is considered highly undesirable. A developer for example, would not be allowed to proceed with a development which caused an increase in flood levels.

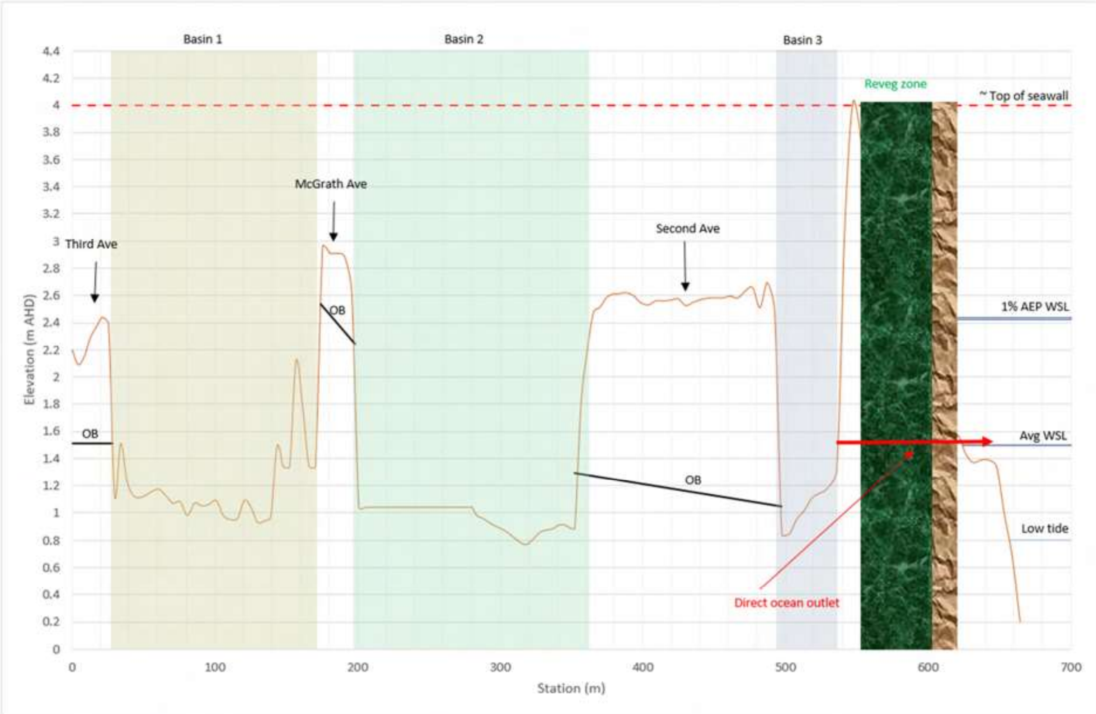
Placement of the Staircase to the Moon structure in Basin 2 is not recommended as it would remove flood storage from the system and cause an increase in flood levels in that area.

Potential Mitigation Options

At the intersection with First Street and Second Avenue, where ponding runoff is observed near the police station, a bund could prevent overland ingress from the northern precinct onto the service road parallel to First Street. Runoff could potentially be redirected directly to a new ocean outfall through a proposed pit and associated underground pipe. Figure 34 (as copied below) shows the approximate location of the proposed bund and stormwater drain in a 1% AEP flood map.



The Detention Basin system at the bottom end of Second Avenue sits below the high tide and storm surge water levels and does not work effectively in a severe weather event. The elevation of the town and the ocean levels make gravity driven mitigation options ineffective. The longitudinal profile from Basin 1 to Basin 2 to Basin 3 outlet is presented in Figure 35 (copied below) - note the ocean level of the 1%AEP event compared to the level of the Basins.



As a result, stormwater is effectively blocked from discharging to the ocean by high tides and storm surges. A pumped system or a combined system (pump ocean discharge and gravity-based ocean discharge) is a potential solution. Further simulations of the of these options are recommended as a variation to the Stage 1 commission.

Next Steps

The next steps for this project are to carry out additional modelling to determine the feasibility of a pumped system in Basin 2 and performance of the basins under several scenarios, namely:

- Option 1: Pump based system in Basin 2. Detention Basin 3 is filled in completely.
- Option 2: Pump based system in Basin 2. Detention Basin 3 modified – approximately 50% capacity and relocated closer to the seawall.

Prior to updating the model for pumped options, Stantec proposes to run several longer duration storm events to ensure that critical durations are correctly depicted in all basins in the existing configuration.

In addition, Stantec recommends that the following be completed prior to any design works commencing:

- Data collection to obtain accurate survey (particularly for Third Avenue).
- CCTV survey to determine condition of existing stormwater assets.
- Obtain accurate groundwater levels in the basins with the installation of a monitoring bore near the basins that would collect data on a long-term basis. This is intended to confirm modelling parameters regarding infiltration, seasonal variations in groundwater etc.
- Investigate storm surge and rainfall timing to determine the site-specific likelihood of these peaks coinciding at Onslow. This includes the coincidence between rainfall and storm surge.

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Agenda Item 14.2 - Attachment 2

Technical Memorandum - Pumping Options

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Memo

Project:	Onslow Drainage Upgrade	**Project No:**	300203694
To:	Alan Sheridan – Shire of Ashburton	**Date:**	02 June 2023
From:	Joan Deng		

RE: Stormwater Pumping Options

Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
0	02/06/2023	Draft for review	Stefan Yance / Joshua Williams	Zac McCosker / Amos Micallef	Joan Deng	Steph Thompson

Executive Summary

This memorandum presents the findings of stormwater pumping assessment to mitigate flooding in the town of Onslow. This memo should be read in conjunction with the Stantec Report: Onslow Drainage Infrastructure Upgrade Assessment – Stage 1 Flood Assessment Report, May 2023.

Hydraulic Modelling

Critical Storm Selection

The previous critical duration for the existing condition model was selected via peak flow; this has been found to be the 30 minutes storm duration. High intensity shorter rainfall events where the tailwater conditions would not adversely impact the area of interest are usually the controlling factor.

However, considering the location and minimal elevation change of the Onslow township, it was considered possible that the low intensity but constant rainfall will could have a greater impact than the shorter higher intensity rainfall events. As part of this current assessment, Stantec has run the full suite of durations and found that the 18-hour storm event produces the highest flood level for Onslow township. The 18-hour storm has been used to assess and compare the two pumping design options. For practicality reasons, the 30-minute storm has been checked to confirm the system is meeting requirements even for the more frequent and intense events. In addition, it is noted that the shorter duration events are more likely to overlap with the 2% AEP storm surcharge as opposed to a longer rainfall event. The proportion of the 18-hour storm that will completely overlap with the storm surge is unknown at this point of time as it's unique to the location.

Pump Size Selection

Stantec has performed hydraulic modelling to assess the impact of 2 potential pumped options:

Option	Description
Option 1	• Pump in Basin 2 discharging to dedicated ocean outfall.

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Option	Description
	• Basin 3 100% filled and removed from drainage system.
Option 2	• Pump in Basin 2 discharging to dedicated ocean outfall. • Gravity flow from Basin 2 to Basin 3. • Basin 3 50% filled, with gravity drainage to dedicated ocean outfall.

A review of various pumped flowrates was carried out and a peak flow of 7 m^3/s has been selected as additional pumping capacity produces negligible or no additional benefits to the flood hazard.

The results of the modelling are summarised below:

- Pumping cannot limit the flood hazard rating to H2 within the Third Avenue. This is likely due to the flatness of the area and the infrastructure pipe network.
- Option 1 and 2 have both decreased the flood levels for the 1% AEP 18-hour event by approximately 0.5m, thereby reducing the majority of the flood to the public open spaces and road reserves and also minimising the flooding within private residences.
- Locating the pump within Basin 1 will reduce the flood hazard without increasing the pump capacity. This was an additional option that was assessed at a high-level and may be reviewed in further detail as part of the next stage.

Infrastructure Options and Cost Estimates

Following the hydraulic modelling exercise, Stantec investigated and prepared a high-level cost estimate for the infrastructure required for Option 1 and Option 2. The infrastructure is summarised below:

Option 1 includes the decommissioning of Basin 3 as well as other ancillary works:

- New stormwater pipe from Second Avenue into Basin 2.
- Decommissioning Basin 3 and associated pipework.
- New pump station at Basin 2.
- New PS discharge pipe and ocean outfall from Basin 2.

Option 2 utilises all three existing basins with Basin 3 proposed to be partially filled in. New assets proposed for this option would include:

- Replace and extend the existing DN325 stormwater pipe connection from Basin 2 to Basin 3.
- Extend the existing inlet pipe to Basin 3 from Second Avenue.
- New gravity flow pipes and ocean outfall from Basin 3 beneath the proposed seawall.
- New dewatering pump station at Basin 2.
- New PS discharge pipe from Basin 2.

A high-level concept assessment was carried out for the pumped systems to provide order of magnitude estimates and to identify and fatal flaws in these options.

The cost estimate (with 50% contingency) for the proposed options are as follows:

- Option 1 $7,300,000 (Ex. GST)
- Option 2 $8,700,000 (Ex GST)

* Note that there are a number of assumptions and exclusions associated with these estimates that are detailed in Section 4.2.4 of this memo.

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Recommendations and Next Steps

It is recommended that further assessment be carried out to verify the pumping options presented in this memo. This includes the following next steps:

- The flood assessment has been conducted based on existing conditions this includes land use, climate conditions, infrastructure conditions. Future conditions should be assessed to determine that the pumps would be effective in future conditions.
- It should be noted that the pits and pipe networks on Third Avenue are not based accurate survey or design plans. Shire of Ashburton have commissioned feature survey at the time of this assessment. Stantec recommends rerunning the existing conditions and two pumping options with accurate drainage infrastructure to confirm the pump size requirements.
- Placing the pump station in Basin 1 has been found to improve the flood level using the same pump size. This option should be investigated to determine suitability.
- A Multi Criteria Assessment (MCA) should be conducted to identify the optimal option for the Shire. The various criteria can include flood risks, storm surge, costs etc to be determine in collaboration with Shire of Ashburton. Additional design may be required prior to the MCA, pending the criteria that is selected to be assessed.
- Following results of the MCA, a Concept level design should be prepared for the preferred option. This would provide a more definitive overview of the infrastructure required and the associated cost estimate.
- Placing of pump system in Basin 1 option should be investigated further to determine to determine a holistic assessment on all the available options.

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1. Introduction and Background

Onslow is situated in the northwest coastline of Western Australia, 1,386 km north of Perth. The Shire of Ashburton (the Shire) commissioned Stantec on 18 January 2023 to perform stormwater modelling and identify flooding issues and potential flood mitigation measures for the township of Onslow (refer to Stantec Report: Onslow Drainage Infrastructure Upgrade Assessment – Stage 1 Flood Assessment Report, May 2023). Refer to Figure 1 for a plan of the township and key stormwater infrastructure.

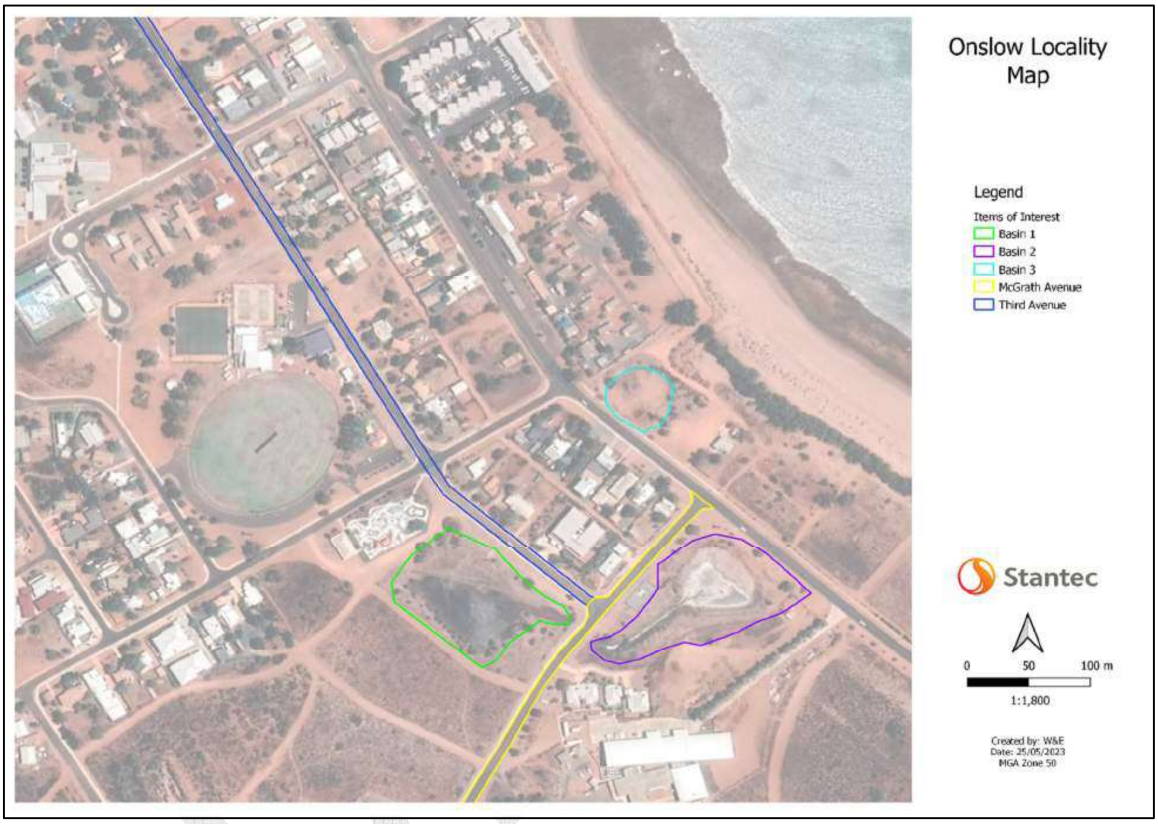

Figure 1 - Onslow Township

It is understood that the Shire's overarching objective is to revitalize the township of Onslow and to provide a medium/long-term drainage infrastructure upgrade strategy. Specifically, the Shire has identified the following key areas of focus:

- Assess the existing stormwater infrastructure in the northern part of Second Avenue - in preparation for Stage 1 of a proposed streetscape project.
- Assess the impact of a proposed artistic installation (Staircase to the Moon) in terms of its effect on stormwater/flood management.
- Assess existing issues associated with stormwater drainage in Third Avenue.
- Assess the performance of the three Detention Basins at the Southern end of Second Avenue.

As documented in our report, Stantec's identified several flooding issues in the town, and presented a few potential proposed mitigation measures, including a pumped option, which forms the scope of this memorandum. The flood assessment has found the flooding within Onslow is a combination of significant rainfall on land and high ocean levels due to storm or cyclone

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surges. Due to the topography of the town and it's location adjacent to the ocean, a gravity system would not be effective and therefore a pumped system has been investigated.

2. Scope of this Assessment

Stantec has investigated the feasibility of two options to improve the flood hazard within the township. Both options use a pump-based system to discharge water from the town. The two options and their modifications are explained below:

Option	Description
Option 1	• Pump in Basin 2 discharging to dedicated ocean outfall. • Basin 3 100% filled and removed from drainage system.
Option 2	• Pump in Basin 2 discharging to dedicated ocean outfall. • Gravity flow from Basin 2 to Basin 3. • Basin 3 50% filled, with gravity drainage to dedicated ocean outfall.

Both options have been assessed in terms of flooding and economic practicality to mitigate any flooding within the town and provide the Shire of Ashburton the next steps for the Staircase to the Moon project.

2.1 Option 1

Option 1 utilises two of the three existing basins with Basin 3 proposed to be entirely filled in, reducing the total storage capacity of the system. A proposed pump station (PS) at Basin 2 would be used to drain the basin network, pumping underneath the proposed sea wall, and discharging via a submerged ocean outfall.

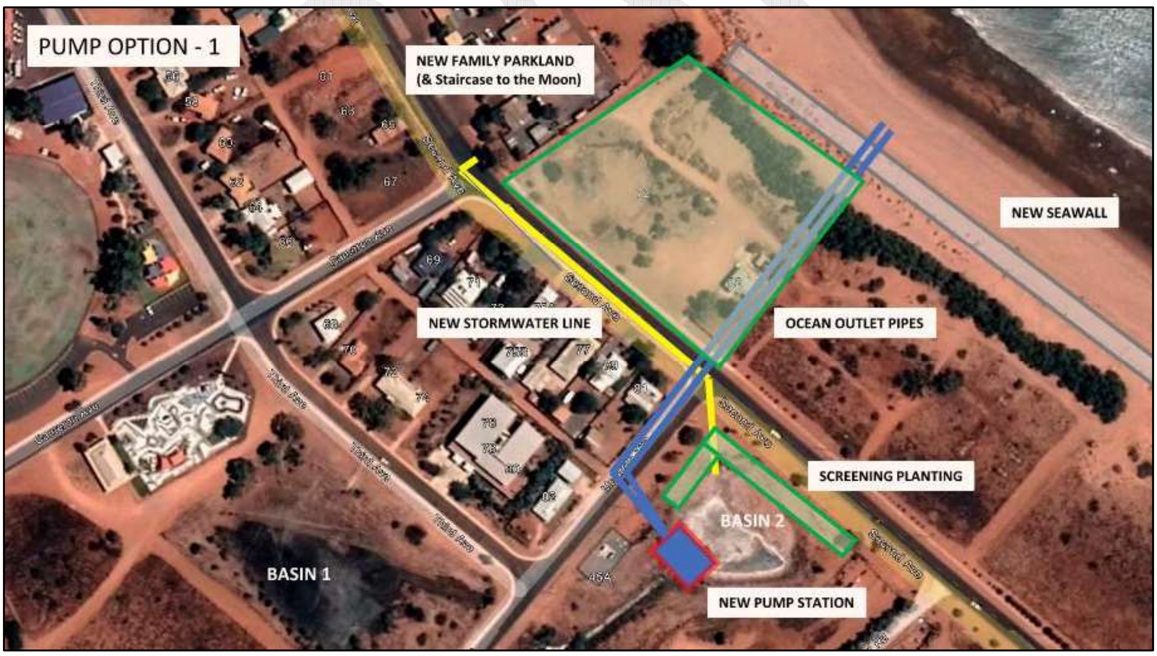

Figure 2 - Option 1 Concept Plan (Provide by Shire of Ashburton)

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2.2 Option 2

Option 2 utilises all three existing basins to maximise the total storage volume of the system. Basin 3 will be relocated and is proposed to be partially filled in, reducing its capacity to approximately 50% of its current size.

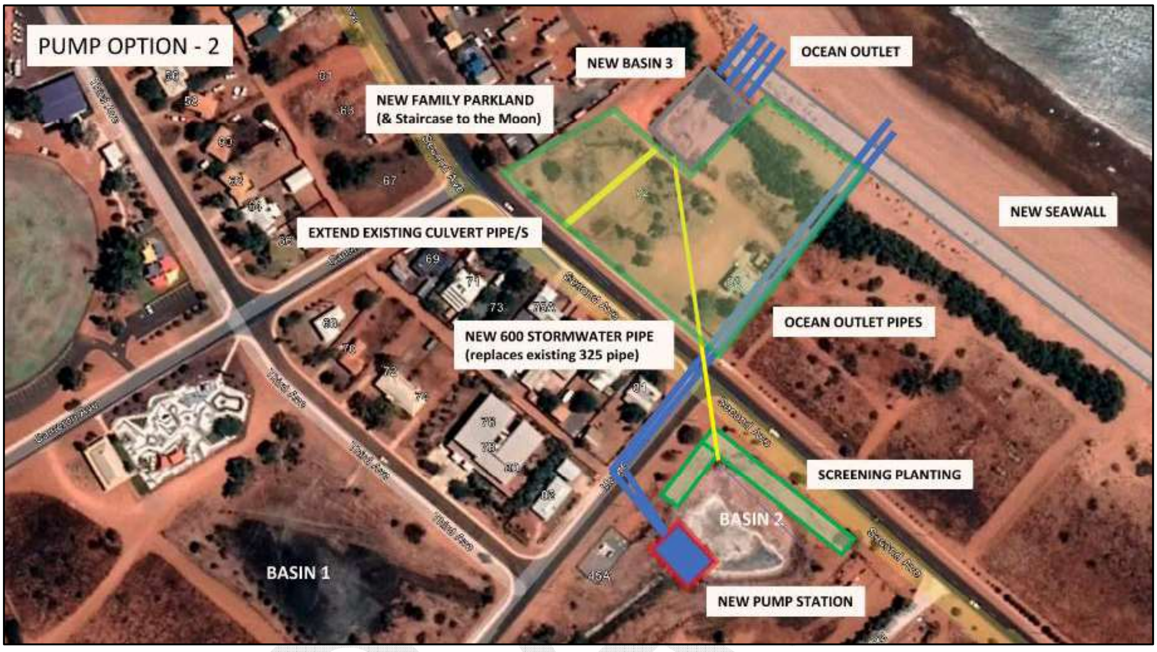

Figure 3 - Option 2 Concept Plan (Provide by Shire of Ashburton)

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3. Hydraulic Modelling

As part of previous works, Stantec built an existing TUFLOW model which will be used as the basis of this study. As part of the current assessment, the existing model was updated to provide improved accuracy between the surface water and costal interface including real-world tide data. The model was also run for the full suite of durations to confirm the critical storm that will provide the worst-case conditions. This model has been used to simulate the two design scenarios.

3.1 Tidal Data

The Stantec coastal team provided the storm surge tide to incorporate into the model as the downstream boundary. The 2% AEP storm surge event is recommended for the 1% AEP assessment. Since the model is assuming 'worst case scenario,' Stantec has assumed that the storm surge impacts the town at the same time as the rainfall.

The timing shown in Figure 4 below has been used which has a peak water level of 2.43 mAHD and a low of 0.4 mAHD.

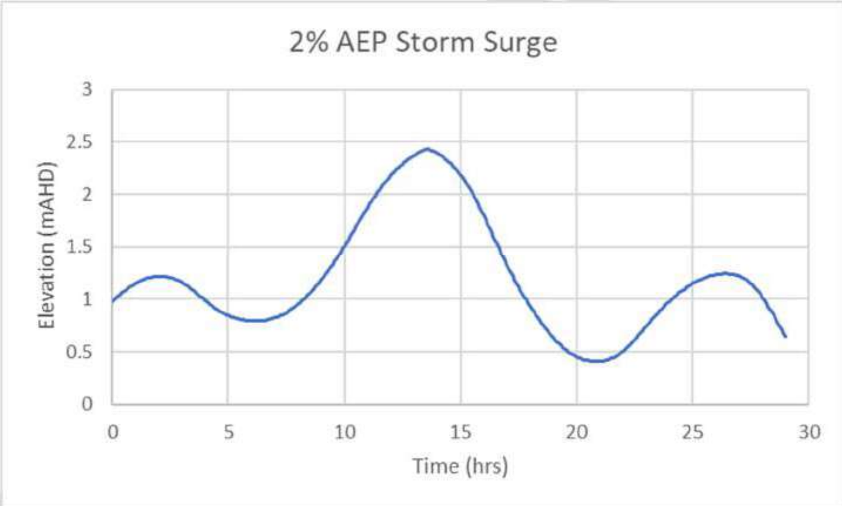

Figure 4 - 2% AEP storm surge timing

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3.2 Critical Duration Selection

The previous existing conditions model's critical duration was selected via peak flow. The duration with the highest peak flow was the 30-minute duration. High intensity shorter rainfall events where the tailwater conditions would not adversely impact the area of interest are usually the controlling factor.

Considering the location and minimal elevation change of the Onslow township, the low intensity but constant rainfall will more likely have a greater impact than the shorter higher intensity rainfall events. It should be noted that the smaller events are more likely to overlap with the 2% AEP storm surcharge instead of a longer rainfall with the storm surge event.

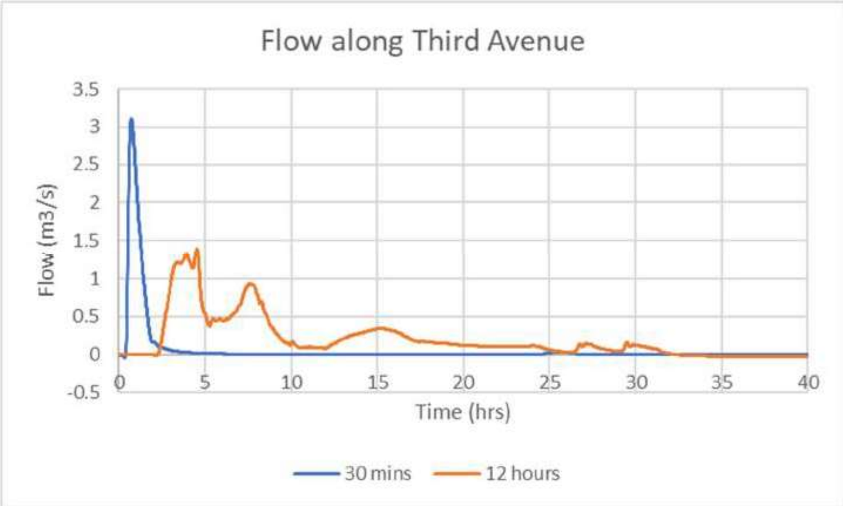

Figure 5 - Flow comparison between different storm events

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To further demonstrate the impact between the two events, Figure 6 compares the 18-hour to the 30-minute storm event maximum depths. As it can be seen the 18-hour storm water level extents are much wider compared to the 30-minute storm.

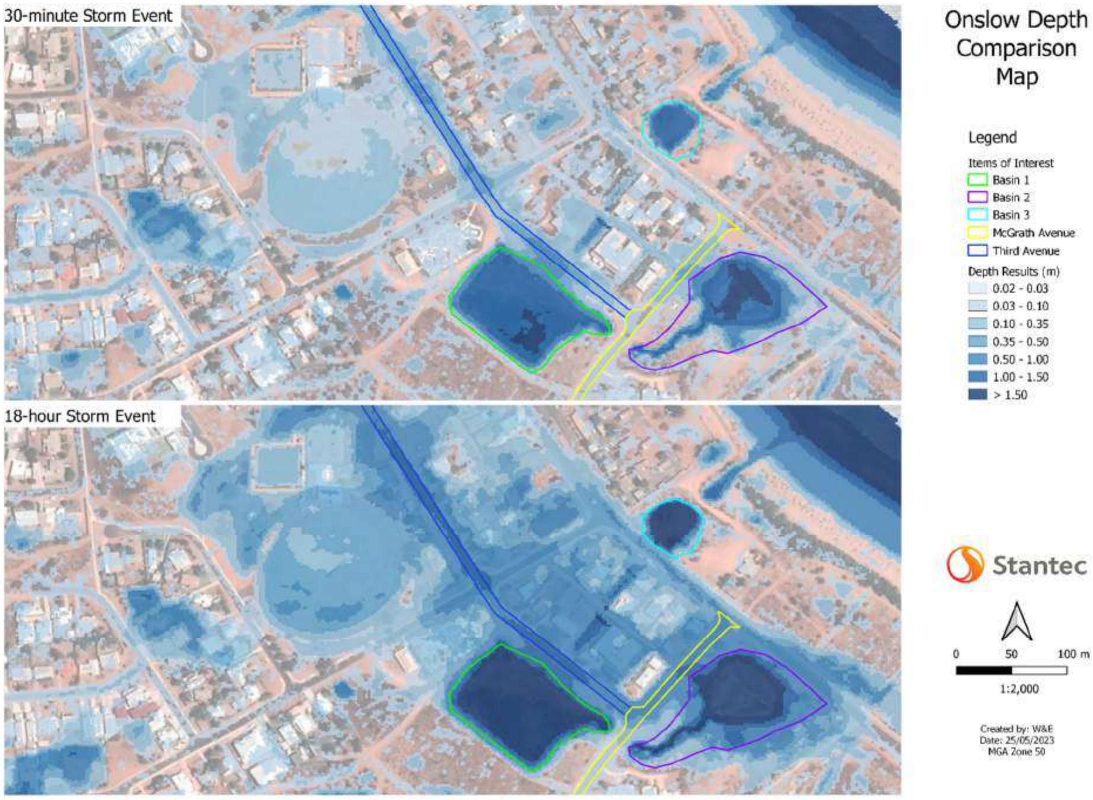

Figure 6 - Critical Duration Comparisons

Stantec has run the full suite of durations to capture the whole assessment and found that the 18-hour storm event produces the critical water level for Onslow township. The 18-hour storm has been used to assess and compare the two design options. For practicality reasons, the 30-minute storm will also be checked to confirm the system is meeting requirements for the more frequent and intense events.

3.3 Result Processing

Flood modelling raw outputs were processed using the methodology outlined in Table 1.

Table 1 - Results Processing Methodology

Process	Description
Depth Filtering	Results have been filtered to remove any cell where the depth of flooding is less than 0.01 m
Area Filtering	No area filtering has been applied to the results
Smoothing	No smoothing has been applied to the results

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As per AR&R 2019, the Australian Emergency Management Institute Hazard Categorisation (2014) has been used for the hazard mapping and classifications. Table 2 and Figure 7 show the categories.

Table 2 - Australian Emergency Management Institute Categories (2014)

Hazard Classification	Description
H1	Relatively benign flow conditions. No Vulnerability constraints.
H2	Unsafe for small vehicles.
H3	Unsafe for all vehicles, children and the elderly.
H4	Unsafe for all people and all vehicles.
H5	Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
H6	Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.

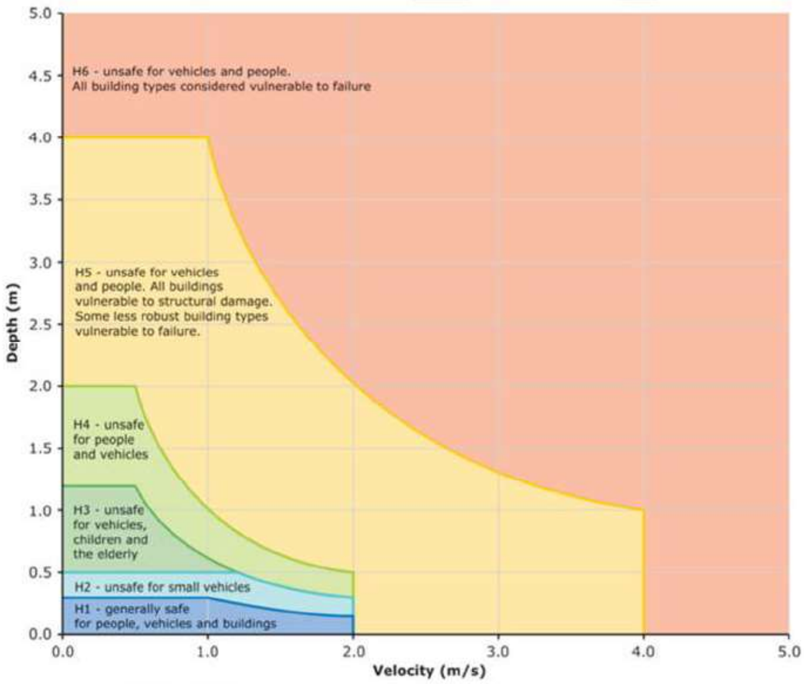

Figure 7 - Australian Emergency Management Institute Categories Graphed (2014)

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3.4 Existing Conditions

The existing conditions model has been updated as specified in Section 3.1. The major focus of this investigation is Third Avenue, McGrath Avenue, Basin 1, Basin 2, and Basin 3. All these assets fit within a depression where most of the stormwater pools until it flows out into the ocean.

Figure 8 shows the flood depth for the 18-hour storm event. As it can be seen, most water pools around Third Avenue and McGrath Avenue. Third Avenue, the water pools between 0.2 and 1.5 m. The surrounding properties along Third Avenue and McGrath Avenue pool between 0.2 and 1 m. The sporting oval pools between 0.2 to 0.5 m.

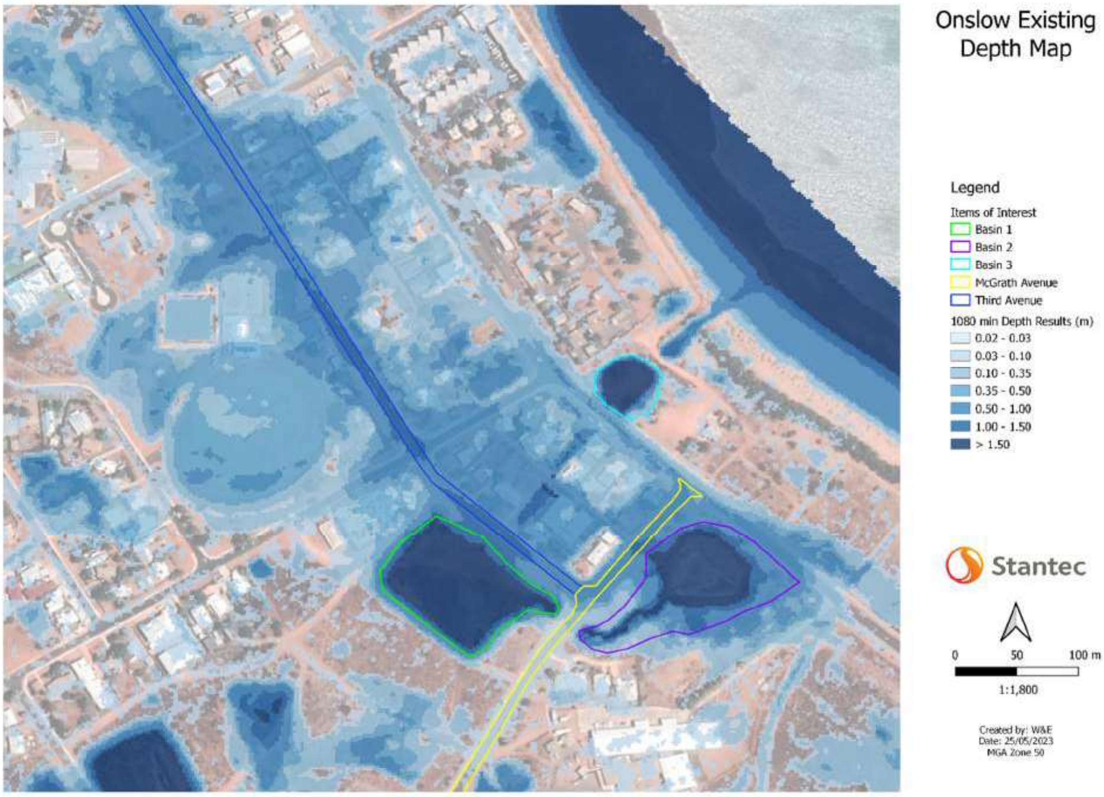

Figure 8 - Existing Conditions Depth Results (18 hour storm event).

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Figure 9 shows the flood hazard for the 18-hour storm event. As it can be seen, a H3 can be found along Third Avenue and McGrath Avenue. The properties lining Third avenue, McGrath Avenue and the sporting oval also have a H3 and H2 classification.

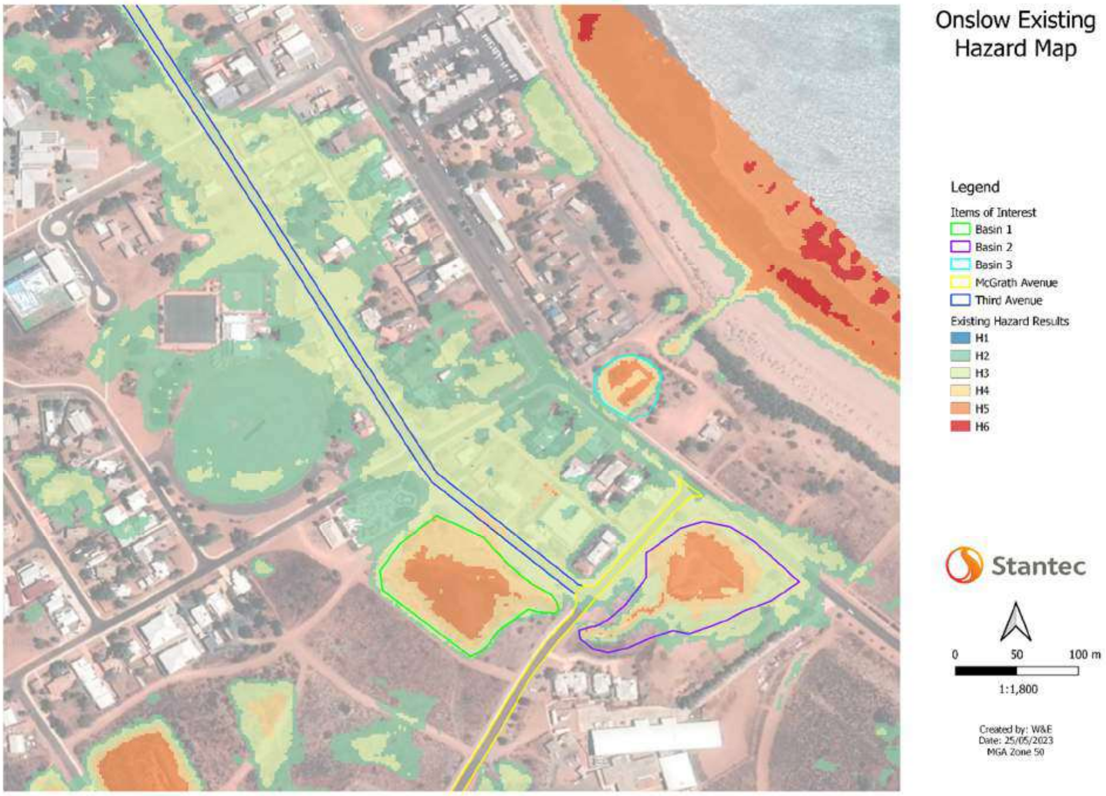

Figure 9 - Existing Conditions Hazard Results

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3.5 Pump Size Selection

Hydraulic modelling has been conducted to select a suitable pump size to reduce the flood hazard classification to less than H2. Several scenarios have been run to determine a suitable pump size; these include 0.5 to 15 m^3/s.

The existing topography of Onslow is extremely flat especially the area around Third Avenue and surrounding area. The build-up of water within the basins can cause backup of the sub-surface system, resulting in stormwater building up on to the roads.

Another critical issue with a flat terrain is that the water will move slowly. A pump located in one of the basins will have limited ability to transfer water out of the system as it depends on the water to flow to the basins. Due to this reason the initial criteria of selecting a pump size to achieve a flood hazard rating of H2 or less cannot be achieved. However, a pumped system can be seen to significantly reduce the flood levels in the areas surround Third Avenue and three Basins. In both options the H2 flood hazard has been mostly limited to public open space and road reserve rather than private property.

The flood simulation results for Table 5.

Table 3 – Flooding Simulation Results for different pump rates

Peak PS Design Flow Rate (m^3/s)	Pump Running Duration at Peak Flow (hours)	Time with flooding depth on Third Avenue above 0.5 m (hours)
1.5	19.0	25.5
2	17.0	18.0
5	11.7	11.0
7	8.4	9.5

A peak pump rate of 7 m^3/s has been selected for the pumping concept design and order of magnitude cost estimate as larger pump scenarios appear to have minor or negligible additional benefits in reducing the flood hazard.

It is noted that the details of the sub-surface infrastructure (i.e. pipework) are unknown at this point. This should be reviewed once accurate survey are available.

3.6 Option 1

Pump with peak pump rate of 7 m^3/s in Basin 2 discharging to dedicated ocean outfall.	Basin 3 100% filled and removed from drainage system.

As stated in Section 2.1, Option 1 utilises two of the three existing basins with Basin 3 proposed to be entirely filled in, reducing the total storage capacity of the system.

A proposed pump station (PS) at Basin 2 would be used to drain the basin network, pumping underneath the proposed sea wall, and discharging via a submerged ocean outfall (Refer Figure 2).

Figure 10 shows the flood depth for the 18-hour storm event. It can be seen that most water pools around Third Avenue and McGrath Avenue at a depth between 0.1 and 0.6 m, the surrounding properties along Third Avenue and McGrath Avenue pool between 0.1 and 0.6 m and the sporting oval pools between 0.01 to 0.25 m.

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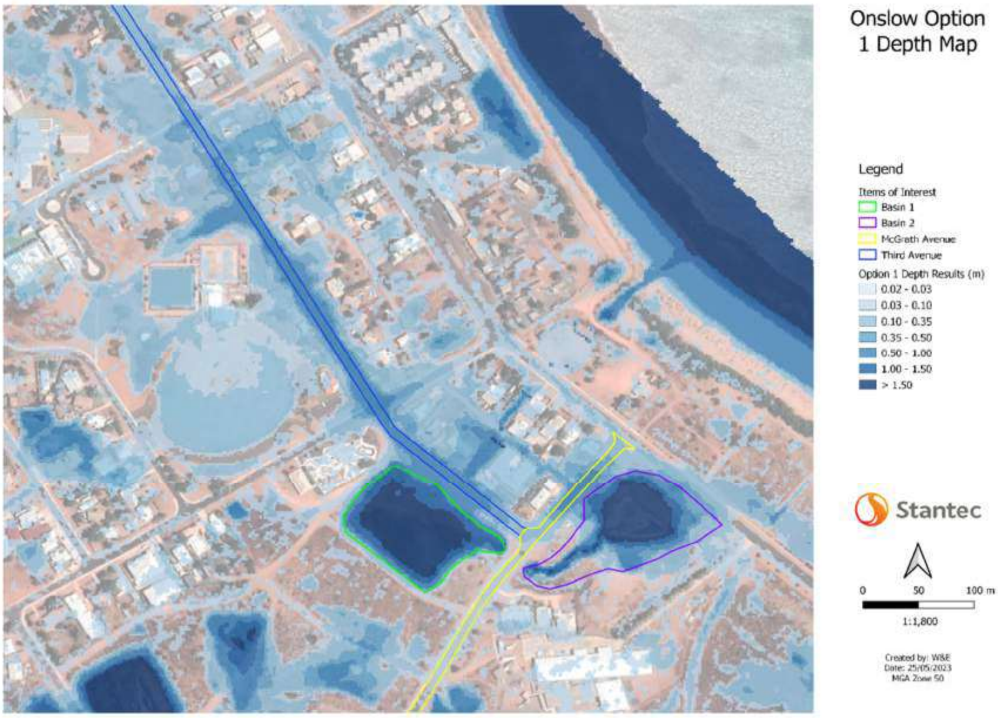

Figure 10 - Option 1 Post Pumping Flood Depth Results

Figure 11 shows the flood hazard for the 18-hour storm event. As it can be seen, the H3 is restricted to Third Avenue and McGrath Avenue. The majority of the Third Avenue and the low point between 74 and 76 Third Avenue have a H3 classification.

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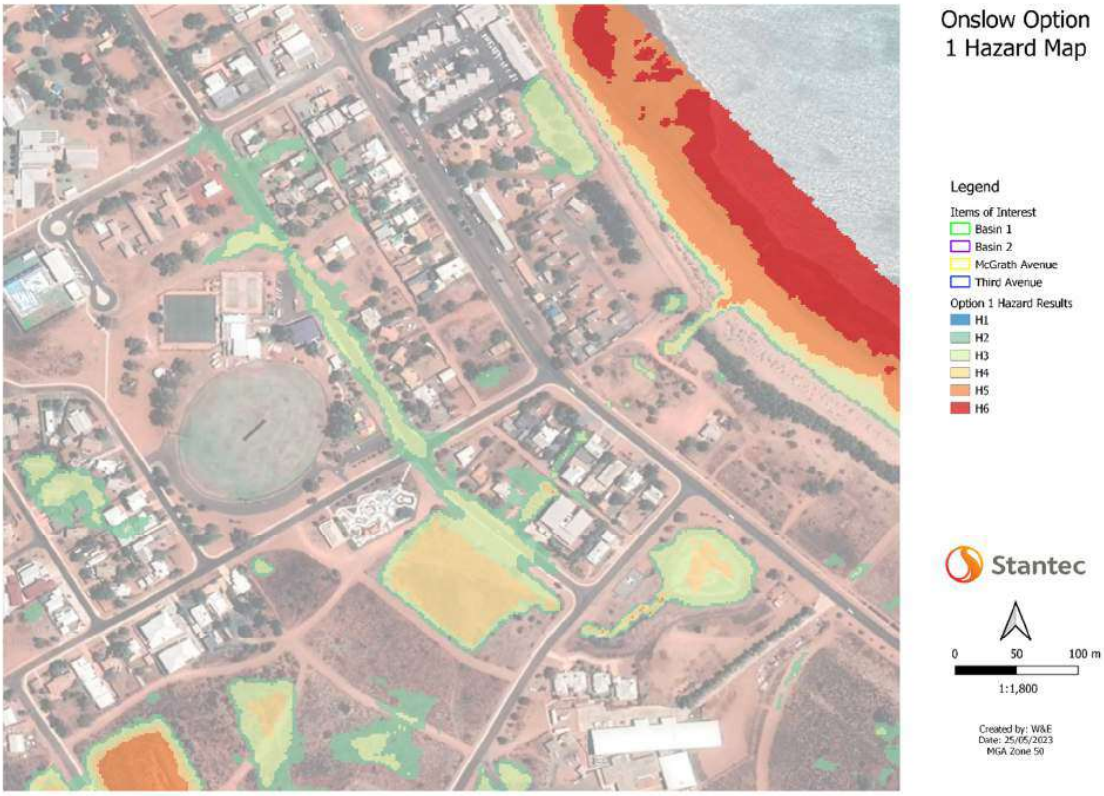

Figure 11 - Option 1 Post Pumping Conditions Hazard Results

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Figure 12 shows the afflux results comparing Option 1 to existing conditions. As it can be seen, the flood level within Third Avenue as well as its surrounding properties has reduced significantly, by 0.3 to 0.5 m. Properties beside Third avenue also show a reduction in flood level to between 0.1 to 0.5 m. Along McGrath Avenue, the afflux reduction is between 0.1 and 0.3 m. There has been an improvement in overall for afflux for the township due to the pumps.

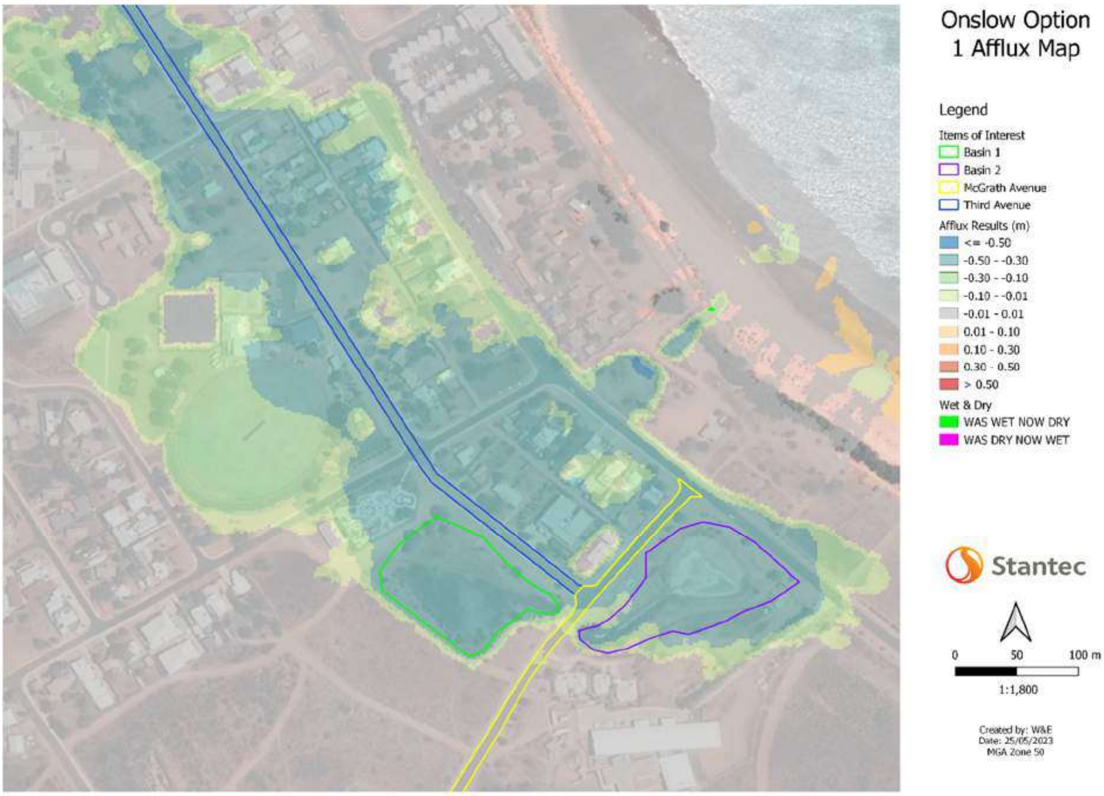

Figure 12 – Option 1 Conditions Afflux Results

3.7 Option 2

Pump with peak pump rate of 7 m^3/s in Basin 2 discharging to dedicated ocean outfall. Gravity flow from Basin 2 to Basin 3.	Basin 3 relocated and 50% filled, with gravity drainage to dedicated ocean outfall.

As stated in Section 2.2, Option 2 utilises all three existing basins to maximise the total storage volume of the system. Basin 3 will be relocated and is proposed to be partially filled in, reducing its capacity to approximately 50% of its current size.

The proposed pump station in this case would be used during high tide and storm surge scenarios where the sea level increases above the Basin water level, and gravity discharge is not possible. A gravity outlet pipe from Basin 2 into Basin 3 would be used during low tide scenarios to discharge into the sea via the Basin 3 outfall, reducing power consumption and reliance on the Basin 2 PS (Refer Figure 3).

Like the previous Option 2, a H2 rating or less cannot be achieved in all areas, however the hazard rating has dramatically reduced the hazard and limited to select areas in Third Avenue.

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Figure 13 shows the flood depth for the 18-hour storm event. As it can be seen, most water pools around Third Avenue and McGrath Avenue. Along Third Avenue, the water pools between 0.1 and 0.6 m. The surrounding properties along Third Avenue and McGrath Avenue Road pool between 0.1 and 0.6 m. The sporting oval pools between 0.01 to 0.25 m. The extents are slightly reduced when compared to Option 1.

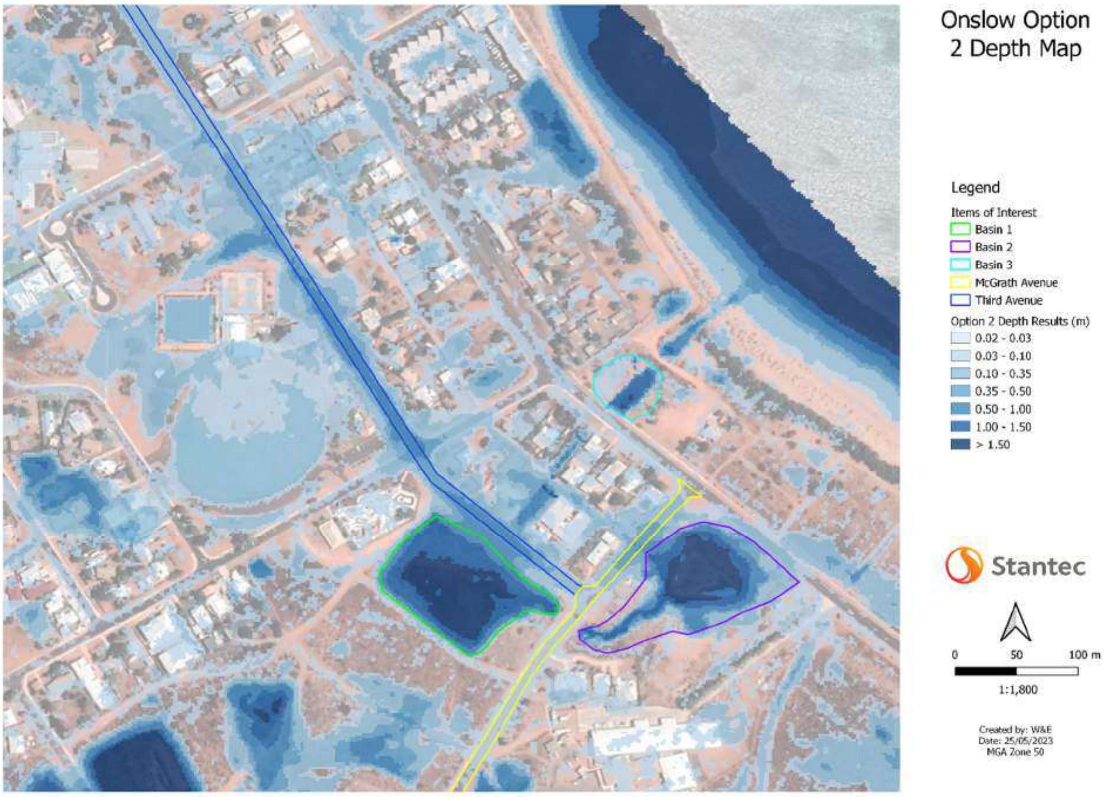

Figure 13 – Option 2 Conditions Depth Results

Figure 14 shows the flood hazard for the 18-hour storm event. The H3 classification is present on Third Avenue and McGrath Avenue. The properties lining Third avenue, McGrath Avenue and the sporting oval only have a H1 classification. The open space between 74 and 76 Third Avenue has a H3 classification as well.

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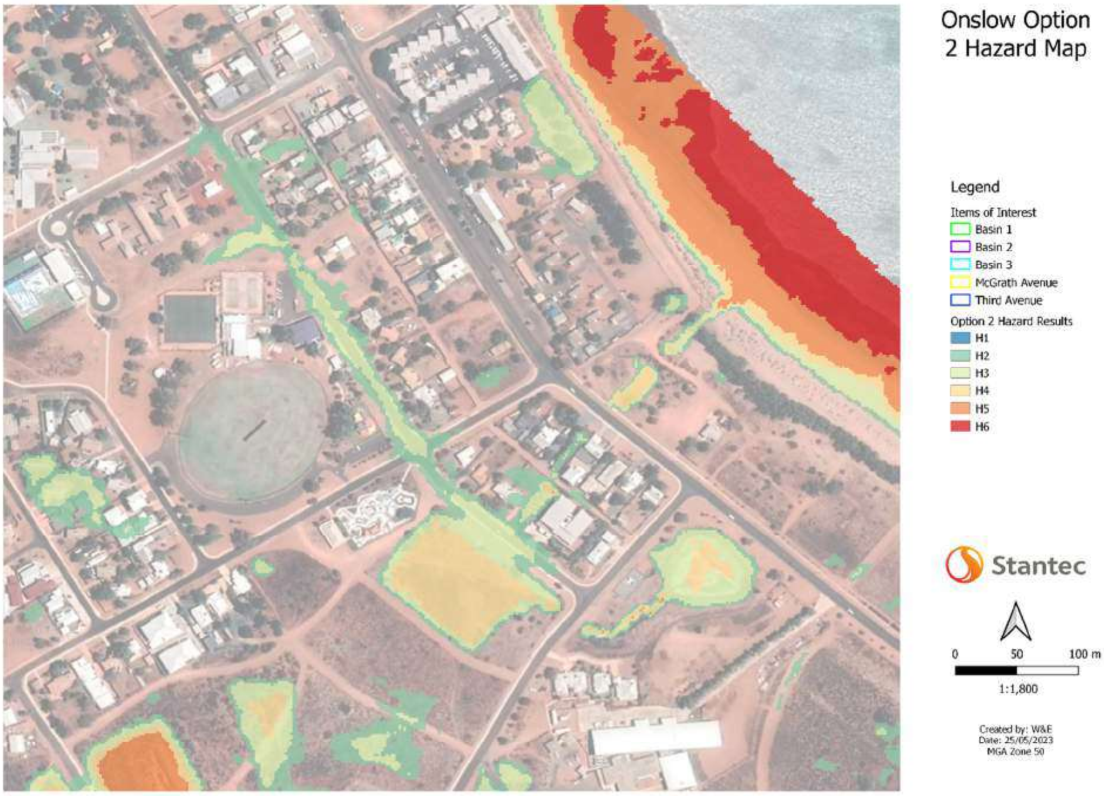

Figure 14 – Option 2 Conditions Hazard Results

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Figure 15 shows the afflux results comparing Option 2 to existing conditions. As it can be seen, the flood level within Third Avenue and its surrounding properties has reduced more than 0.5 m near the basin. Further past Cameron Avenue the afflux reduction is between 0.1 to 0.5 m. Along McGrath Avenue, the afflux reduction is greater than 0.5 m. There has been an improvement overall for afflux for the township due to the pumps.

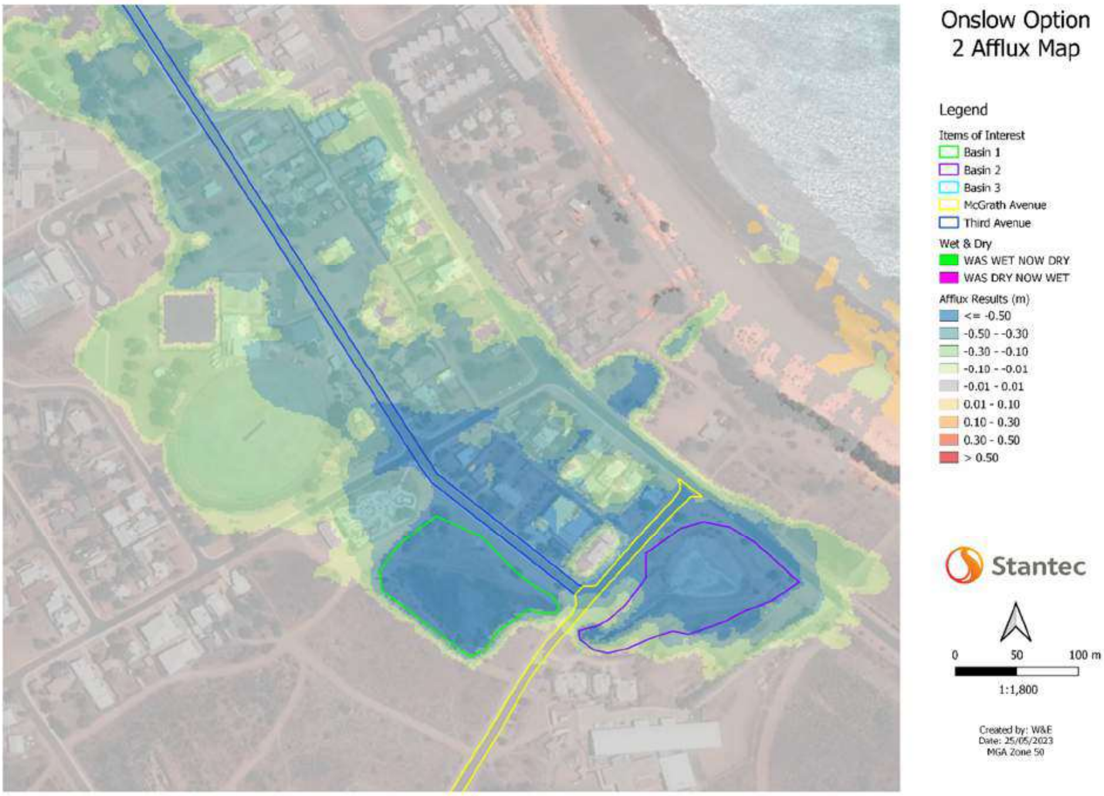

Figure 15 – Option 2 Conditions Afflux Results

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3.8 30-minute Results

The 30-minute Option 1 and 2 design event was also investigated to confirm whether the pump met Shire requirements. The 30 minutes event has shown to have significantly reduced flood levels compared to the 18-hour storm event. This is further improved with the effect of pumping. The flood hazard maps for the 30 minutes storm event are provided in Appendix A.

The Option 1 and 2 pumping option with a peak flow of 7 m3/s is sufficient to reduce the flood hazard rating for the 30 minutes storm event to less than or equal to H2 for the majority of the Third Avenue.

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4. Preliminary Infrastructure Options and Cost Estimates

The Shire of Ashburton provided Stantec with two initial infrastructure concepts for draining the basins in Options 1 and 2. The purpose of these options is to provide solutions to drain the floodwater from the town, aiming to reduce the maximum flooding depth on Third Avenue to 0.5 m. However, this was not able to be achieved at this current time. Pump size has been selected as 7 m^3/s as a larger pump would not provide significant additional benefits.

Stantec has adopted these options as the basis for providing high level pump selections and infrastructure cost estimates. These have been summarised in Section 4.1 below.

The top and bottom elevations, basin volumes, and key pumping level inputs have been summarised in Table 4 below.

Table 4 – Basin and Pump Station (PS) parameters

Parameter	Basin 1 Value	Basin 2 Value	Basin 3 Value
Top Elevation (mAHD)	1.6	2.6	3.9 (embankment top elevation) 1.6 (assumed top water level)
Bottom Elevation (mAHD)	0.9	0.8	1.16 (Assuming this does not change with Basin filling)
Total Storage Volume (m^3)	3354	1752	2166 (current) 1083 (assumed after 50% fill)
Storm Surge Level to 2% AEP	2.43 mAHD (Adopted as the maximum static head against the Basin discharges)		
Mean Sea Level (mAHD)	0 mAHD (Adopted as the minimum static head against the Basin discharges)		
Worst case PS static head	1.63 m		

4.1 Infrastructure Options

4.1.1 Option 1

Option 1 utilises two of the three existing basins with Basin 3 proposed to be entirely filled in, reducing the total storage capacity of the system. A proposed PS at Basin 2 would be used to drain the basin network, pumping underneath the proposed sea wall, and discharging via a submerged ocean outfall.

New assets proposed for this option would include:

- New stormwater pipe from Second Avenue into Basin 2.
- Decommission Basin 3 entirely, as well as associated pipework.
- New pump station at Basin 2.
- New PS discharge pipes to ocean outfall from Basin 2.

The proposed pump station in this case would be used during high tide and storm surge scenarios where the sea level increases above the Basin water level, and gravity discharge is not possible. A gravity flow outlet would be used to bypass

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the PS during low tide scenarios to reduce power consumption and reliance on the PS. However this would depend on the outlet's ability to completely seal and ongoing maintenance. This should be further explored at later stages of the project. A schematic concept of this option is presented in Figure 16 below.

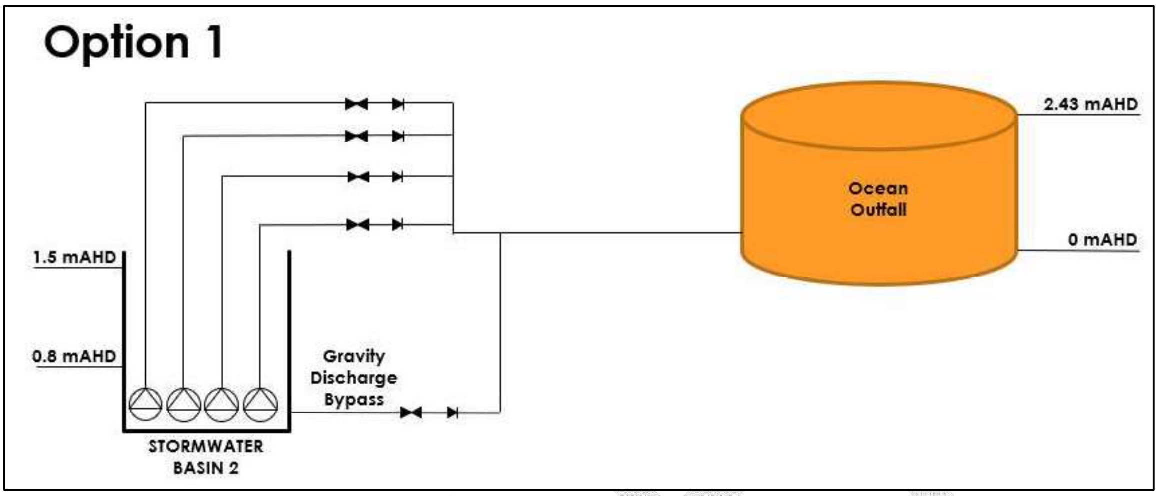

Figure 16 – Option 1 Concept Sketch

4.1.2 Option 2

Option 2 utilises all three existing basins to maximise the total storage volume of the system. Basin 3 is proposed to be partially filled in, reducing its capacity to approximately 50% of its current size.

New assets proposed for this option would include:

- Replace and extend the existing DN325 stormwater pipe connection from Basin 2 to Basin 3.
- Extend the existing inlet pipe to Basin 3 from Second Avenue.
- New gravity flow pipes and ocean outfall from Basin 3 beneath the proposed seawall.
- New pump station at Basin 2.
- New PS discharge pipes from Basin 2 to ocean outfall.

The proposed pump station in this case would be used during high tide and storm surge scenarios where the sea level increases above the Basin water level, and gravity discharge is not possible. A gravity outlet pipe from Basin 2 into Basin 3 would be used during low tide scenarios to discharge into the sea via the Basin 3 outfall, reducing power consumption and reliance on the Basin 2 PS. A schematic concept of this option is presented in Figure 17 below.

Due to the maximum adopted surge sea level (2.43 mAHD) being higher in elevation than the Basin 2 and 3 top water levels (1.5 mAHD and 1.6 mAHD respectively), gravity discharge will not be possible in high tide scenarios. In these situations, the Basin 2 PS will be the only discharge from the system, and so will need to be sized for the peak discharge rate. This will be the same sizing as the Option 1 Basin 2 PS. Pump sizing is discussed in Section 4.1.3 below.

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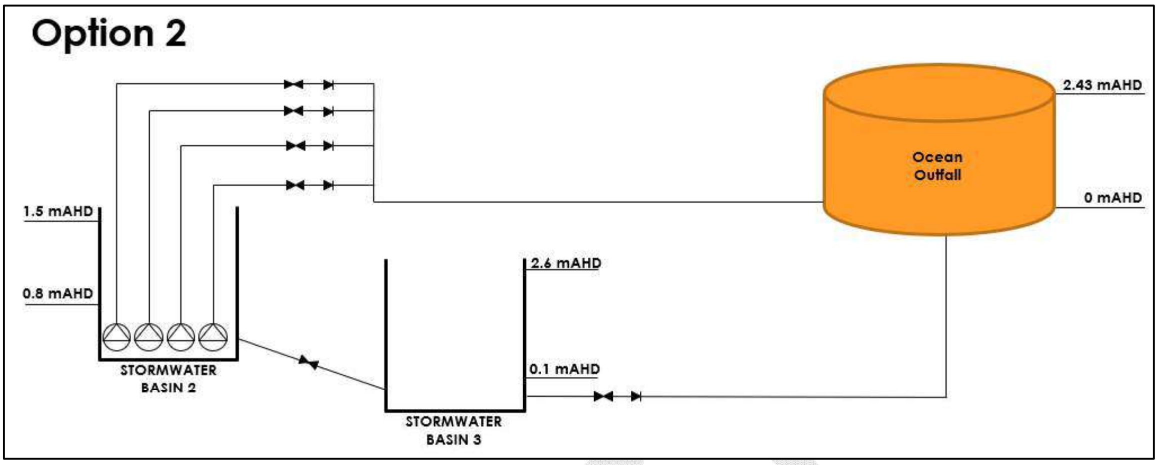

Figure 17 – Option 2 Concept Sketch

4.1.3 Basin 2 PS Pump Sizing and Selection

Pump Station flow requirement:

The Basin 2 PS duty flow rate has been selected to limit the maximum flooding depth on Third Avenue to 0.5 m. Simulations of the flooding within Onslow were conducted to assess the minimum required PS flow rate to achieve this. 1.5 to 7 m^3/s (7000 L/s) pump were tested to limit flooding depth on Third Avenue to 0.5 m. The results of these simulations are summarised in Table 5 below. Note that these results assume the pump is within Basin 2.

The inclusion or removal of the Basin 3 storage volume (after being 50% filled in) proved to provide negligible reduction to the required PS flow rate to achieve the target flooding depth at Third Avenue. For the purposes of this assessment, the PS sizing and cost estimate has therefore been kept consistent across the two options.

Table 5 – Flooding Simulation Results for PS Duty Flow Selection (design flood scenario)

Peak PS Design Flow Rate (m^3/s)	Pump Running Duration at Peak Flow (hours)	Time with flooding depth on Third Avenue above 0.5 m (hours)
1.5	19.0	25.5
2	17.0	18.0
5	11.7	11.0
7	8.4	9.5

Pump station duty and indicative selection:

Assuming a single Mild Steel Cement Lined (MSCL) discharge pipeline from the PS to the ocean outfall, the required pipe bore to limit the maximum flow velocity to less than 3 m/s is 1767 mm, corresponding to a MSCL pipe size of Outside Diameter (OD) 1829 mm and Wall Thickness (WT) 12 mm.

Adopting this pipe and the proposed pipeline alignment shown below in Figure 18, a system curve calculation for the pipeline was produced to size the required PS duty. Table 6 below summarises the parameters and results of the system calculation. It is noted that this system calculation would be revised at future design development stages to update pump sizing requirements.

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Table 6 – System curve calculation parameters summary

Adopted parameter	Value
Discharge pipeline length	500 m (approximately, depending on final outfall location) Single discharge pipeline.
Pipe internal diameter	1767 mm (MSCL OD1828 WT12)
Worst case pipeline roughness factor	0.6 mm (Worn concrete lined pipe)
Total pipeline head loss at duty flow rate (worst case)	5.7 m (at 7000 L/s, single discharge pipe)
Worst case static head	1.63 m

Considering the total required duty flow rate of 7000 L/s, and the relatively low static head and pipeline head losses for the proposed pipe size, a high flow and low head pump selection was required. Given the low elevation of the proposed PS site, and the flooding risk in the area, submersible pumps were selected as the most suitable type of pump in this application. These would be installed in a wet well connected to the basin, with screening to prevent large objects entering the pumps.

Due to the large total flow rate of the PS, and the assumption that the PS will also be required at lower flow rates (in flooding scenarios less severe and more common than the design flood), Variable Speed Drive (VSD) pump motor control has been assumed for the PS. To discharge both the expected lower PS discharge flow rates as well as the maximum design flow each at an acceptable efficiency point in terms of power consumption, the use of multiple pumps at the PS was assessed.

- Given the large maximum total flow requirement at the PS, the minimum number of commonly available submersible pumps to achieve this efficiently was found to be four.
- Decreasing to three total pumps was found to be possible with some commonly available submersible pumps, however the higher flow rate per pump required a much larger Net Positive Suction Head Required (NPSHR) (approximately 15 m), meaning that the PS wet well would need to be very deep for them to work effectively at the design discharge rate.

A pump selection was then made considering the likelihood of small solids or debris in the flood water entering the pump. Pumps with large throughlets were considered to ensure that clogging risk would be minimised. The resultant pump duty and initial pump selection (also used in option cost estimates) is summarised in Table 7 below.

Table 7 – Summary of indicative pump sizing

Parameter	Value
Number of pumps	4 in parallel (Duty/Assist/Assist/Assist)
Duty flow (design case)	7000 L/s (total) 1750 L/s (per pump)
Duty head (design case)	7.3 m (assuming 500m of OD1828 MSCL discharge pipe)
Net Positive Suction Head (NPSH)	Required NPSH at duty point: 5.2 m Worst case available NPSH: 9.45 m
Indicative pump selection	Flygt CP3800/905-1240 225 kW Submersible pump (Or approved equivalent).
Wet well depth	Approximately 4.5m

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Parameter	Value
	(To maintain minimum pump submergence level, and fit pump dimensions)

Figure 18 – Potential PS discharge pipeline alignment

Alternative selections

Alternative pump type selections, such as submersible axial pumps, may also be suitable in this application, and could deliver the maximum flow rate from a single pump. However, the discharge flow range of these pumps is quite narrow, meaning that lower flows would not be achievable without using multiple smaller pumps. More than four of these types of pumps would be required in order to achieve the same PS flow range as the four selected submersible pumps, resulting in a solution that would likely be more expensive.

During further design stages, the requirements for minimum pump duty flow should be investigated and the final pump type selection and number of pumps updated to suit. Submersible axial pumps may prove to be the most efficient selection depending on the minimum PS duty flow defined during further design stages.

For the purposes of this assessment, the selected submersible pumps are considered to provide a suitable basis for the high-level cost estimation completed.

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4.2 Cost Estimates

Cost estimates for each option were developed based on using the same pump station configuration and sizing for each, but with differing additional works around the system. The scope of the cost estimates includes the proposed pump station, pipeline and associated infrastructure and earthworks.

4.2.1 Option 1

Option 1 includes the decommissioning of Basin 3 as well as other ancillary works summarised below:

- New stormwater pipe from Second Avenue into Basin 2.
- Decommissioning Basin 3 and associated pipework.
- New pump station at Basin 2.
- New PS discharge pipe and ocean outfall from Basin 2.

4.2.2 Option 2

Option 2 utilises all three existing basins with Basin 3 proposed to be partially filled in. New assets proposed for this option would include:

- Replace and extend the existing DN325 stormwater pipe connection from Basin 2 to Basin 3.
- Extend the existing inlet pipe to Basin 3 from Second Avenue.
- New gravity flow pipes and ocean outfall from Basin 3 beneath the proposed seawall.
- New dewatering pump station at Basin 2.
- New PS discharge pipe from Basin 2.

4.2.3 Cost comparison

The cost estimates developed for each option are summarised in Table 8 below, where Option 2 is expected to be the most expensive.

The main differentiating element between the two options is the additional ocean outfalls at Basin 3 proposed in Option 2. To install the four outfall pipes as indicated in the provided concept sketches, approximately 480 m of pipework would be required as well as valving to prevent backflow from the ocean to the basin during storm surges. These gravity outfalls were assumed to be simple pipes discharging via a headwall at the typical low tide level, without any specialist outfall pipework underwater.

Table 8 – Summary of Concept Design Cost Estimates for each option

Total Estimated Cost - Including 50% Contingency	
Option 1	$7,300,000 (Ex. GST)
Option 2	$8,700,000 (Ex GST)

4.2.4 Assumptions and Exclusions

Assumptions and exclusions applied to the cost estimates for each options included:

- Option 1 and 2 configurations and concept layouts have been adopted according to the provided sketch plans from The Shire of Ashburton.
- Stantec has adopted the stormwater pipe sizes provided by The Shire of Ashburton in their concept designs (where applicable) and has not verified their sizing.
- Stantec has assumed a single Basin 2 PS discharge pipe would be the most cost-efficient infrastructure solution for this system. Future design development may result in dual PS discharge pipelines which would change the total cost of the project. The alignment of this pipeline has been assumed to pass through the proposed ‘Staircase to the Moon’ development area as indicated in Shire provided concept sketches.

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- Stantec has not completed a power supply assessment as part of this scope of work and has assumed that adequate power would be available at the site. Shire should consider a contingency cost for this if it is expected that the power supply would need to be upgraded, given the large pumps proposed.
- Stantec has included an allowance in the cost estimates for ocean outfall discharge elements or dissipators at the PS pipeline discharge point. This is a specialist fitting with limited available cost estimates and so Shire should consider further contingency cost for this item. As both options would utilise this, it isn't a differentiator when comparing the two, but should be accounted for by Shire when assessing total cost of this project.
- Cost estimates exclude the cost of the 'Staircase to the Moon' development, the cost of the proposed sea wall, and any other ancillary works associated with this project.
- A contingency margin of 50% for the option cost estimates has been applied to account for any likely design changes, as well as unknown additional costs that may arise in the design development at further stages.
- It is noted that these cost estimates have been developed for an order of magnitude comparison of the two options, and not as an engineer's estimate for use in the tendering phase of this project.
- Stantec has assumed that the PS would need to achieve both the maximum duty flow rate during the design flooding event, as well as an unspecified range of lower duty flows during less severe flooding cases. It is noted that the indicative pump selection should be checked and updated once this minimum duty flow rate has been confirmed.
- It is noted that the pump selections made in this assessment have been completed using numerous key assumptions due to the current stage of the design development. The indicative pump selection made should therefore be considered only as a high-level indication of the potential size of the pump station. These details should be reviewed and updated during further design development.
- This assessment does not include any redundancies in the system this includes:
    - Standby power/generator
    - Standby pump if one fails.

5. Options Comparison

The modelling shows that both pumping options provides significant improvement to the flooding within the town of Onslow.

In terms of flood management performance, Option 2 has a greater reduction in flood levels compared to Option 1. The afflux is a comparison between the flood levels in the Option 1 and Option 2. A negative value indicates a reduction is flood levels while a positive value indicate increase in flood levels.

Option 2 compared to Option 1 has had a reduction between 0.01 to 0.1 m at all areas of interest. The improvement is mainly due to Basin 3 still existing in Option 2 which provides extra storage for the system.

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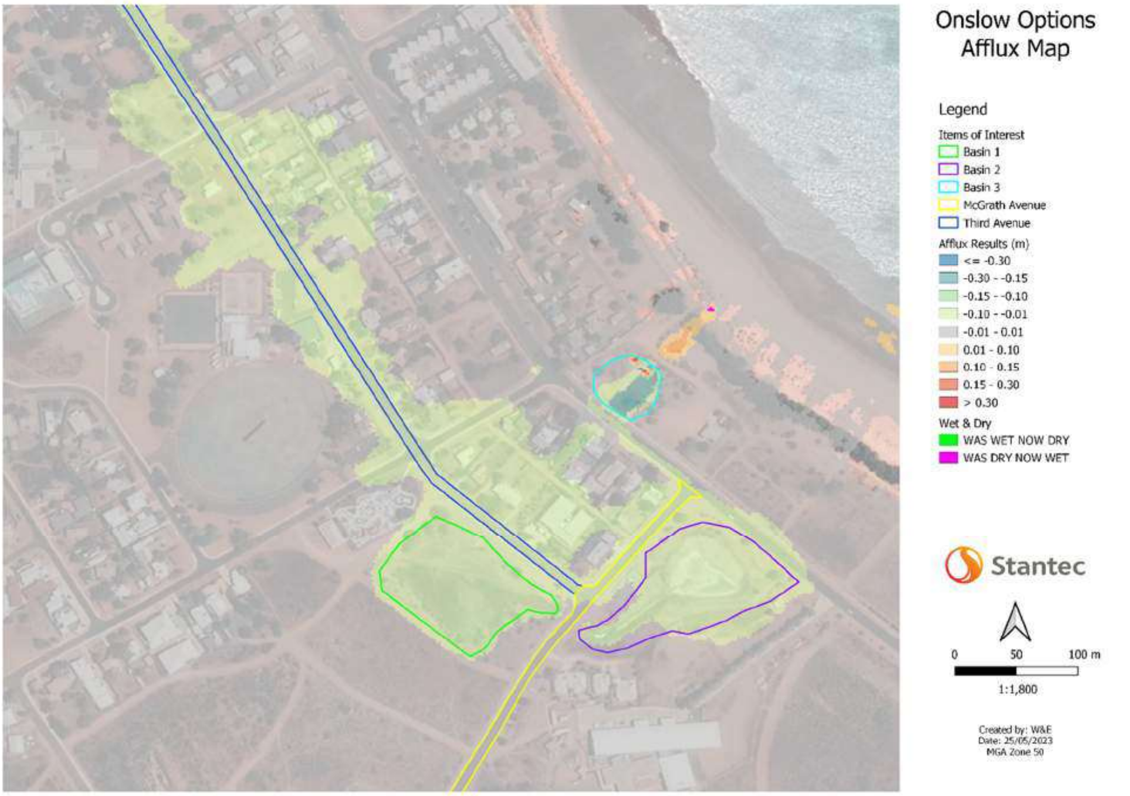

Figure 19 - Option 2 compared to Option 1 Conditions Afflux Results

The summary of the pros and cons are provided in Table 9.

Table 9: Summary of the Options

Option	Description	Pros	Cons
Option 1	Decommissioning of Basin 3 completely. Pumped discharge from new Basin 2 PS to Ocean Outfall during surge events. Gravity discharge to same ocean outfall during typical low tide events.	Lowest cost option. Provides combined gravity and pumped discharge point. Provides largest area for ‘Staircase to the Moon’ development.	Least amount of Basin storage for floodwater, resulting in minor worsening of flooding conditions. Gravity and pumped discharge cannot occur simultaneously.
Option 2	Reduction in size of Basin 3 by 50%. Discharge by gravity from Basin 3 Ocean Outfall. Pumped discharge from new Basin 2 PS to Ocean Outfall during surge events.	Basin 3 could be architecturally integrated into the ‘Staircase to the Moon’ development. Provides separate gravity and pumped discharges, which occur simultaneously.	Highest cost option. Multiple penetrations underneath sea wall. ‘Staircase to the Moon’ development would need to

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		Increased basin storage volume for floodwater provides minor improvement to flood levels.	accommodate the basin in its layout.

6. Alternative Option – Pump in Basin 1

A scenario with the pump inside Basin 1 was run to confirm whether the culverts were controlling the hazard classification along both roads. The same pump flow was used and the scenario where Basin 3 is filled was assessed. The results from this scenario are illustrated below in Table 10.

Table 10 - Pump in Basin 1 Flow Results

Peak PS Design Flow Rate (m^3/s)	Pump Running Duration at Peak Flow (hours)	Time with flooding depth on Third Avenue above 0.5 m (hours)
5	9.0	4.6
7	2.5	0

Compared to Table 5, having the pump in Basin 1 vastly improves the results of the flooding including reducing the hazard classification of H3 along Third Avenue and McGrath Avenue. The hazard results are shown in Figure 20.

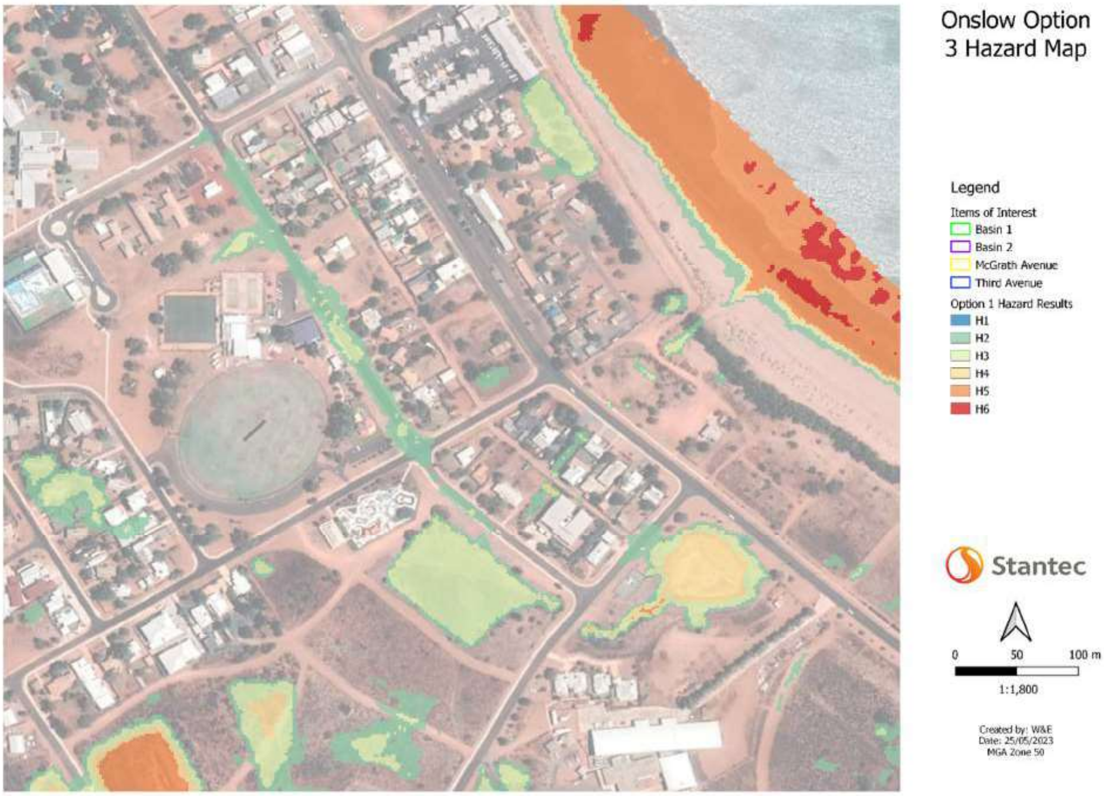

Figure 20 – 18-hour event Basin 1 Pump Hazard Classification

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7. Conclusions

This assessment has found that the pumping of the stormwater would significantly reduce the flood levels near the Third Avenue by up to 0.5m in flood depths across the whole area and reducing the flood extent for the 1% AEP for both options.

Both pumping options has found that peak rate of 7 m^3/s would only produce minor or negligible additional benefits in terms of flood hazard reduction.

Both pumping options investigated produced similar results however Option 2 produced minor improvements than Option 1. Both 30 minutes and 18 hours event have been investigated for the pumping sizing, to ensure the pump sizing process captures the unique flood behaviour unique to Onslow. Both pumping options did not reduce the hazard classification to H2 for the 18-hour event although it minimised H3 to the roads rather than to extensive flooding to public open space, private residents and road infrastructures.

The high-level concept assessment for pumping is aimed to provide order of magnitude to identify any fatal flaws and provide high level cost estimates. Please note the exclusions and limitations in the assumptions and exclusion in Section 4.2.4.

The cost estimate for proposed inclusions identified in Section 4.2, this cost estimate includes 50% contingency.

- Option 1 $7,300,000 (Ex. GST)
- Option 2 $8,700,000 (Ex GST)

8. Recommendations and Next Steps

It is recommended that further assessment be carried out to verify the pumping options presented in this memo. This includes the following next steps:

- The flood assessment has been conducted based on existing conditions this includes land use, climate conditions, infrastructure conditions. Future conditions should be assessed to determine that the pumps would be effective in future conditions.
- It should be noted that the pits and pipe networks on Third Avenue are not based accurate survey or design plans. Shire of Ashburton have commissioned feature survey at the time of this assessment. Stantec recommends rerunning existing conditions and 2 pumping scenarios with accurate drainage infrastructure to confirm the pump size requirements.
- Placing the pump station in Basin 1 has been found to improve the flood level with the same size pump. This option should be investigated to determine suitability.
- A Multi Criteria Assessment (MCA) should be conducted to identify the optimal option for the Shire. The various criteria can include flood risks, storm surge, costs etc to be determine in collaboration with Shire of Ashburton. Additional design may be required prior to the MCA, pending the criteria that is selected to be assessed.
- Following results of the MCA, a Concept level design should be prepared for the preferred option. This would provide a more definitive overview of the infrastructure required and the associated cost estimate.
- Placing of pump system in Basin 1 option should be investigated further to determine to determine a holistic assessment on all the available options.

Stantec warrants only that they will exercise the reasonable skill, care and diligence of a Consulting Engineer in the preparation of their professional opinion of those costs. Shire of Ashburton acknowledges that Stantec has no control over costs of labour, materials, competitive bidding environments and procedures, unidentified field conditions, financial and/or market conditions, or other factors likely to affect the probable cost of the works, all of which are and will unavoidably remain in a state of change. Shire of Ashburton agrees that Stantec cannot and does not make any warranty, promise, guarantee, or representation, either express or implied, that proposals, bids, project construction costs, or cost of operation or maintenance will not vary substantially from its good faith cost estimate.

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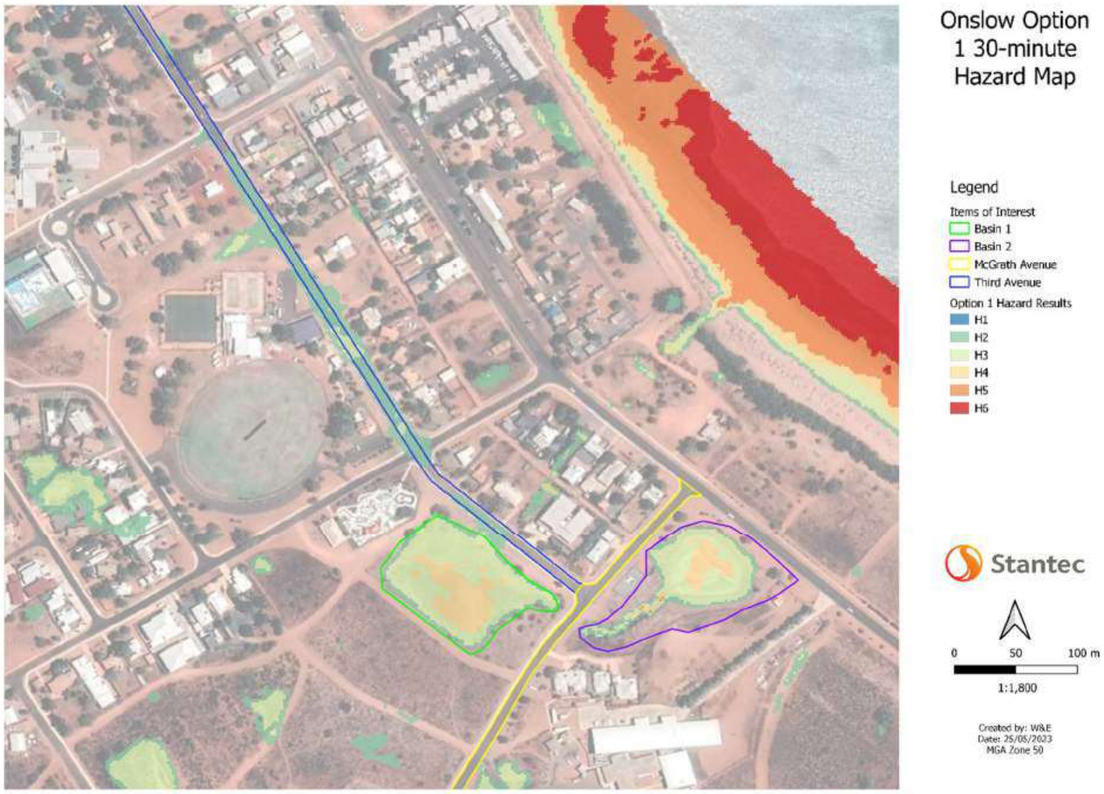
Appendix A



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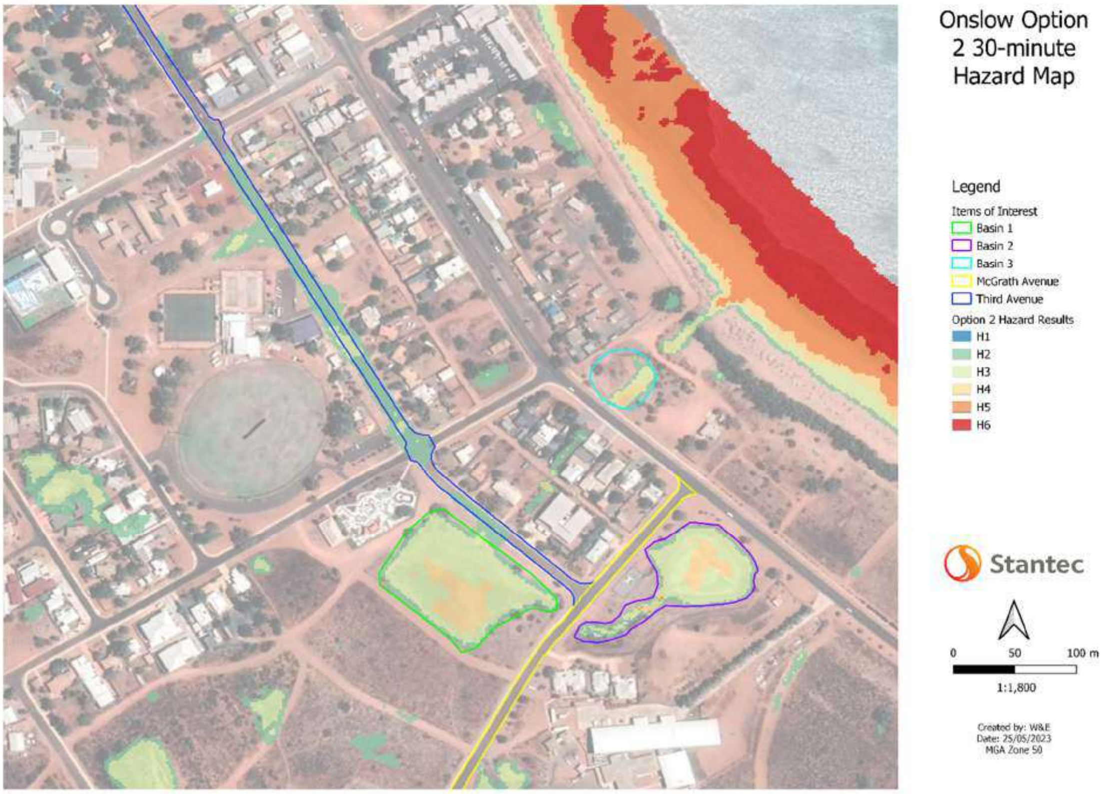

Agenda Item 14.2 - Attachment 3

Stormwater CCTV and Condition Assessment Report

Interflow

Stormwater CCTV and Condition Assessment Report at Onslow

FOR

Shire of Ashburton

shire of Ashburton
opportunity to community
Onslow · Pannawonica · Paraburdoo · Tom Price

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Creating the Future of Water

08 June 2023

Shire of Ashburton
PO Box 567,
Tom Price WA 6751

INTERFLOW REF: T48-12460-CCTV-REPORT V1

Attention: Alan Sheridan

Dear Sir

REF: Stormwater CCTV and condition assessment Report at Onslow

Please find attached Interflow's report on CCTV and condition assessment of the stormwater network undertaken for the Shire of Ashburton at Onslow town during May 2023

Should you have any questions please contact the undersigned on, mobile 0418 546 226 or email sparadiss@Interflow.com.au.

Yours faithfully,

Steven Paradiss
Business Development Manager – WA

INTERFLOW PTY LIMITED

interflow.com.au

Introduction

Interflow understands that Shire of Ashburton is planning delivery of a streetscaping project in the town of Onslow. Prior to committing to the streetscape improvement works, the Shire has taken the prudent step to de-risk the potential for future spoiling of the streetscape works that could be caused by civil works related to stormwater pipe replacement.

Trenchless relining of the stormwater system is an effective strategy to limit potential future impacts on the finished streetscape however the Shire still needed to understand the condition of the town of Onslow's stormwater assets. Interflow was thus engaged to undertake CCTV and Condition Assessment activities in May 2023 to provide the Shire with an informed view of what stormwater system upgrade works, if any, may be required prior to the streetscaping works proceeded.

In broad terms the following observations in terms of Structure Grade and Service Condition were made:

Structural Grade	No. lines	Length (m)
1	58	1931.1
2	7	209
3	26	765.2
4	4	101
5	6	136
	101	**3142.3**

Service Condition	No. lines	Length (m)
1	19	655
2	31	1209.5
3	24	640.2
4	10	249
5	17	388.6
	101	**3142.3**

The above findings are further discussed below.

Detailed Observations

The table below shows each storm water pipe(asset) that has been categorised with a structural grade of 1-5 and service grading of 1-5, 1 being good condition and 5 being poor condition.

A structural defect is one which has an impact on the structural integrity of the pipe itself. Commonly recognised structural defects could include cracking, breaking, or surface damage. Over time, structural defects may worsen significantly to the point that the pipe requires significant repair work, or even replacement.

Service defects are those that have an impact on the operational capacity of a pipe, impairing the pipes effectiveness to convey wastewater through the pipe network. Commonly recognised service defects include displaced joints, debris or root intrusions.

Line	Structural Grade	Service Grade	DN (mm)	Length (m)	Comments
1	1	3	375	10.0	
2	5	3	300	19.0	
3	2	4	380	16.0	
4	1	2	380	12.0	
5	3	5	380	32.0	
6	4	2	300	19.0	
7	1	3	450	6.0	
8	2	4	450	14.0	
9	1	2	450	37.0	
10	1	5	300	9.6	
11	1	3	300	4.5	
12	1	2	450	14.0	
13	1	1	380	6.0	
14	1	2	450	20.0	
15	3	2	300	30.0	
16	1	1	450	14.0	
17	1	1	450	54.0	
18	3	2	450	90.0	
19	1	4	300	16.0	
20			300	16.0	DELETE is duplication of line 19
21	3	3	525	24.0	
22	2	1	525	24.0	
23	1	1	525	24.0	
24	1	5	525	24.0	
25	1	2	600	102.0	
26	1	2	600	102.0	
27	1	2	600	8.5	
28	5	3	600	6.0	
29	5	5	600	22.0	
30	3	3	600	17.0	
31	3	2	300	19.0	
32	3	3	300	58.0	
33	4	3	300	32.0	
34	1	2	300	29.0	
35	3	3	300	33.0	
36	1	2	525	9.0	
37	1	2	525	49.0	
38			?	20?	REMOVED per clients direction
39	3	1	525	47.0	
40	3	3	525	9.0	
41	3	1	300	11.0	
42	1	1	525	54.0	
43	3	3	525	15.0	
44	3	3	525	13.2	
45	3	4	525	15.0	
46	2	2	250	58.0	
47	3	4	525	5.0	
48			525	29.0	DELETE is duplication of Line 49

Line	Structural Grade	Service Grade	DN (mm)	Length (m)	Comments
49	1	2	450	15.0	
50	3	1	450	25.0	
51	1	2	300	21.0	
52	1	2	375	15.0	
53	1	3	375	15.0	
54	1	3	375	44.0	Missing footage, Condition reported the same as Line 55
55	1	3	375	44.0	
56	1	1	375	58.0	
57	1	1	375	58.0	
58/58a	1	1	375	64.0	
58b	1	1	375	64.0	ADDED to scope Runs parallel with line 58/58a
59	3	1	225	11.0	
60	3	3	375	63.0	
61	3	2	375	85.0	
62	1	2	375	111.0	
63	5	5	375	66.0	
64	3	3	300	52.0	
65	1	3	600	22.5	
66	3	5	600	28.0	
67	1	4	375	13.0	
68	1	2	375	13.0	
69	3	2	375	34.0	
70	1	2	375	34.0	
71	1	3	375	56.0	
72	1	2	375	56.0	
73	1	2	375	68.0	
74	1	2	375	68.0	
75	1	2	375	37.0	
76	1	3	375	37.0	
77	1	3	375	19.0	
78	1	4	375	20.0	
79	1	5	450	8.0	
80	4	4	525	41.0	
81	1	5	600	39.0	
82	4	5	375	9.0	
83	1	5	375	17.0	
84	1	5	375	17.0	
85	2	5	375	24.0	
86	1	5	375	24.0	
87	2	5	650	42.0	
88	1	5	1200	10.0	Box culvert Between open drains
89	5	2	375	15.0	
90	1	4	375	101.0	
91	3	2	375	21.0	
92	3	2	375	8.0	
93	1	5	375	9.0	
94	1	1	900	16.0	
95	2	3	600	31.0	

Line	Structural Grade	Service Grade	DN (mm)	Length (m)	Comments
96	1	5	375	8.0	
97	1	1	600	62.0	
98	5	4	375	8.0	
99	1	1	600	43.0	
100			pit	1.0	Photos for inspection
101			pit	1.0	Photos for inspection
102			pit	1.0	Photos for inspection
103	1	1	675	10.0	
104	1	1	675	10.0	
105	3	2	675	10.0	
106	3	3	675	10.0	

Structural Grade

The table below shows a breakdown of the structural grade by size

Structural Grade	DN (mm)	Length (m)	No. of lines
1	300	80.1	5
	375	1080	27
	380	18	2
	450	168	8
	525	160	5
	600	379	7
	900	16	1
	1200	10	1
	675	20	2
1 Total		**1931.1**	**58**
2	250	58	1
	375	24	1
	380	16	1
	450	14	1
	525	24	1
	600	31	1
	650	42	1
2 Total		**209**	**7**
3	225	11	1
	300	203	6
	375	211	5
	380	32	1
	450	115	2
	525	128.2	7
	600	45	2
	675	20	2
3 Total		**765.2**	**26**
4	300	51	2
	375	9	1
	525	41	1
4 Total		**101**	**4**
5	300	19	1

	375	89	3
	600	28	2
5 Total		**136**	**6**
Grand Total		**3142.3**	**101**

Service Grade

The table below shows a breakdown of the service grade by size

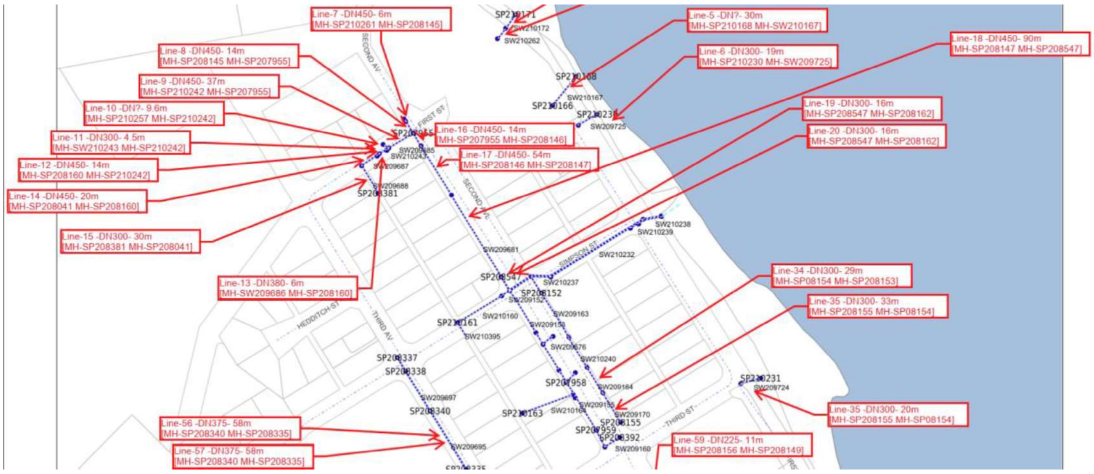
Service Grade	DN (mm)	Length (m)	No. of Lines
1	225	11	1
	300	11	1
	375	244	4
	380	6	1
	450	93	3
	525	149	4
	600	105	2
	900	16	1
	675	20	2
1 Total		**655**	**19**
2	250	58	1
	300	118	5
	375	565	13
	380	12	1
	450	176	5
	525	58	2
	600	212.5	3
	675	10	1
2 Total		**1209.5**	**31**
3	300	198.5	6
	375	288	8
	450	6	1
	525	61.2	4
	600	76.5	4
	675	10	1
3 Total		**640.2**	**24**
4	300	16	1
	375	142	4
	380	16	1
	450	14	1
	525	61	3
4 Total		**249**	**10**
5	300	9.6	1
	375	174	8
	380	32	1
	450	8	1
	525	24	1
	600	89	3
	650	42	1
	1200	10	1
5 Total		**388.6**	**17**
Grand Total		**3142.3**	**101**

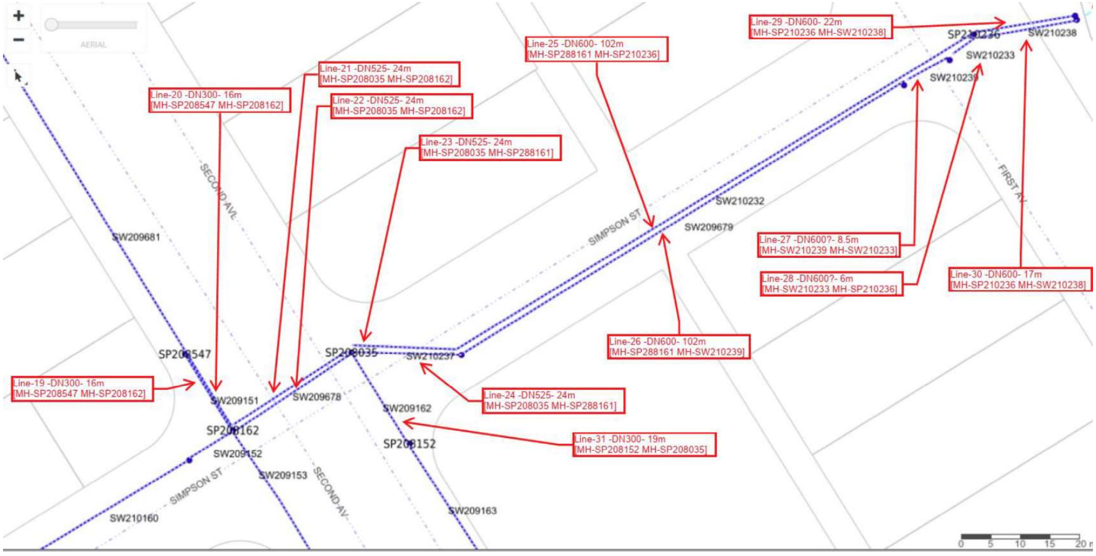
Key Observations

Interflow understands anecdotally that the north section of the storm water system is prone to filling during storm events. We observed that there are two (2) non-return valve gates at the ocean outfall of lines 29 and 30 which have a build-up of sediment (sand/debris) which could be preventing the northern section of the stormwater network from discharging and thus subsequently blocking and potentially flooding the upstream area in the town.

Shire of Ashburton could consider undertaking marine / civil at the outfall of lines 29 and 30 to improve discharge to the ocean.

Some information on a possible remedy (WAPRO WaStop in-line check valves) has been separately provided by Interflow to Stantec





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Recommendation

Relining will adequately rehabilitate the Onslow stormwater system with out the need for wholesale pipe replacement

We recommend that Shire liaises with the incumbent consultant (Stantec) on the streetscaping project to:

- Prioritise stormwater relining work to limit future impacts on the upgraded streetscape
- Assess the flood mitigation potential of WAPRO WaStop in-line check valves at the outfall of lines 29&30

Attachments

Appendix A – Onslow Stormwater Drainage layout

Appendix B – Onslow Stormwater Line list (developed by Interflow)

Appendix C – Onslow Stormwater CCTV outputs – May 2023

Inspection Report

Job Name:SHI003-001 - Shire of Ashburton - Onslow Storm water CCTV

VAPAR

Interflow

Client:	VAPAR ID:	Date:	Pipe Use:	Material:	Direction:	Diameter:
	93322	2023-05-16	Storm Water	concrete reinforced	Upstream	600

Length: 3.46
Asset No: LINE 29
US MH: O
DS MH: SW210238

Address: Onslow
Video File: line 29_0001.mp4
Video File: Play Video

Upload Time: UTC 2023-05-29, 08:43:51
File Size: 61.6MB
Uploaded By: AG

Inspection Notes: None

SW210238

	Code	Description	Qty and Clock Position
0.02	BM	BM - Breaking - Missing - 500-1000mm	500.00mm
?	STMH	STMH - Start node - Maintenance hole	At 6 o clock
0.71	FHMH	FHMH - Finish node - Maintenance hole	
?	STMH	STMH - Start node - Maintenance hole	
?	DES	DES - Deposits - Fine sediment - 30-40%	30.00%, At 1 to 10 o clock, J
?	DEZ	DEZ - Deposits - Other - 10-20%	10.00%, At 7 to 6 o clock, J
1.23	DEZ	DEZ - Deposits - Other - 0-5%	10.00%, At 7 to 6 o clock, J
?	DEZ	DEZ - Deposits - Other - 0-5%	10.00%, At 7 to 6 o clock
?	DEZ	DEZ - Deposits - Other - 0-5%	10.00%, At 7 to 6 o clock, J
?	JDR	JDR - Displaced joint - Radial - 05-10mm	5.00mm, At 6 o clock
?	DEZ	DEZ - Deposits - Other - 0-5%	10.00%, At 7 to 6 o clock
?	DEZ	DEZ - Deposits - Other - 0-5%	10.00%, At 7 to 6 o clock
?	JDR	JDR - Displaced joint - Radial - 05-10mm	5.00mm, At 6 o clock
2.96	JDR	JDR - Displaced joint - Radial - 05-10mm	5.00mm, At 1 o clock
3.46	DEZ	DEZ - Deposits - Other - 0-5%	10.00%, At 7 to 6 o clock, J

O

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
1	80	23.12	80	**5**	11	40	23.99	83	**5**

This report was dynamically generated at UTC 2023-06-08, 00:33:57
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Page 1 of 5

Inspection Report

Job Name:SHI003-001 - Shire of Ashburton - Onslow Storm water CCTV

VAPAR

Interflow®

Client:	VAPAR ID:	Date:	Pipe Use:	Material:	Direction:	Diameter:
	93322	2023-05-16	Storm Water	concrete reinforced	Upstream	600

Length:	3.46	**Address:**	Onslow	**Upload Time:**	UTC 2023-05-29, 08:43:51
Asset No:	LINE 29			**File Size:**	61.6MB
US MH:	O	**Video File:**	line 29_0001.mp4	**Uploaded By:**	AG
DS MH:	SW210238	**Video File:**	Play Video		

Inspection Notes: None

Chainage: 0.02 - BM - Breaking - Missing - 500-1000mm

Chainage: ? - STMH - Start node - Maintenance hole

Chainage: 0.71 - FHMH - Finish node - Maintenance hole

Chainage: ? - STMH - Start node - Maintenance hole

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
1	80	23.12	80	**5**	11	40	23.99	83	**5**

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Inspection Report

Job Name:SHI003-001 - Shire of Ashburton - Onslow Storm water CCTV

VAPAR

Client:	VAPAR ID:	Date:	Pipe Use:	Material:	Direction:	Diameter:
	93322	2023-05-16	Storm Water	concrete reinforced	Upstream	600

Length: 3.46
Asset No: LINE 29
US MH: O
DS MH: SW210238

Address: Onslow
Video File: line 29_0001.mp4
Video File: Play Video

Upload Time: UTC 2023-05-29, 08:43:51
File Size: 61.6MB
Uploaded By: AG

Inspection Notes: None

Chainage: ? - DES - Deposits - Fine sediment - 30-40%

Chainage: ? - DEZ - Deposits - Other - 10-20%

Chainage: 1.23 - DEZ - Deposits - Other - 0-5%

Chainage: ? - DEZ - Deposits - Other - 0-5%

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
1	80	23.12	80	**5**	11	40	23.99	83	**5**

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Inspection Report

Job Name:SHI003-001 - Shire of Ashburton - Onslow Storm water CCTV

VAPAR

Interflow

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	93322	2023-05-16	Storm Water	concrete reinforced	Upstream	600

Length:	3.46	**Address:**	Onslow	**Upload Time:**	UTC 2023-05-29, 08:43:51
Asset No:	LINE 29			**File Size:**	61.6MB
US MH:	O	**Video File:**	line 29_0001.mp4	**Uploaded By:**	AG
DS MH:	SW210238	**Video File:**	Play Video		

Inspection Notes: None

Chainage: ? - DEZ - Deposits - Other - 0-5%

Chainage: ? - JDR - Displaced joint - Radial - 05-10mm

Chainage: ? - DEZ - Deposits - Other - 0-5%

Chainage: ? - DEZ - Deposits - Other - 0-5%

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
1	80	23.12	80	**5**	11	40	23.99	83	**5**

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Inspection Report

Job Name:SHI003-001 - Shire of Ashburton - Onslow Storm water CCTV

VAPAR

Interflow

Client:	VAPAR ID:	Date:	Pipe Use:	Material:	Direction:	Diameter:
	93322	2023-05-16	Storm Water	concrete reinforced	Upstream	600

Length:	3.46	**Address:**	Onslow	**Upload Time:**	UTC 2023-05-29, 08:43:51
Asset No:	LINE 29			**File Size:**	61.6MB
US MH:	O	**Video File:**	line 29_0001.mp4	**Uploaded By:**	AG
DS MH:	SW210238	**Video File:**	Play Video		

Inspection Notes: None

Chainage: ? - JDR - Displaced joint - Radial - 05-10mm

Chainage: 2.96 - JDR - Displaced joint - Radial - 05-10mm

Chainage: 3.46 - DEZ - Deposits - Other - 0-5%

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
1	80	23.12	80	**5**	11	40	23.99	83	**5**

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