From: Wilson Hannah [mailto:hWilson4@anglianwater.co.uk]
Sent: 13 November 2017 12:02
To: Yee Cheung
Subject: Fambridge

Dear Yee Cheung

Please find attached Anglian Waters briefing note in relation to Land off The Avenue and Manor Farm, North Fambridge.

If you have any questions please contact me.

Kind regards,

Hannah Wilson
Pre-Development Planning Manager

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Pre-development Briefing Note

Development Site:	Land off The Avenue and Manor Farm, North Fambridge
AWS Site Reference:	S-2977
Purpose:	Planning condition
Date:	10th November 2017

1.0 Preface

This assessment has been undertaken to provide an up to date and site specific foul water drainage strategy for the development proposed by David Wilson Homes on land off The Avenue and Manor Farm, North Fambridge.

This assessment supersedes the earlier assessment undertaken at pre-planning stage in December 2015. The purpose of assessment at the pre-planning stage is to specify the solution that can be determined with most certainty ahead of detailed design.

Subsequent to outline planning approval more detailed analysis was underwritten by the developer. This has provided more reliable definition of the potential deficit, employing additional analytical techniques that are not available to the pre-planning assessment.

Whereas the pre-planning assessment will generally emphasise a single connection scenario and one feasible mitigation solution, the more detailed analysis will allow for a range scenarios and consider alternative solutions.

2.0 Development details

This is a residential development comprising two parcels of land to a total of 105 residential properties (30 and 75 respectively) in land off The Avenue, North Fambridge.

The development site is approximately 5km from Latchingdon Water Recycling Centre (WRC). The sewerage network to which the development will connect is shown in Figure 1 below.

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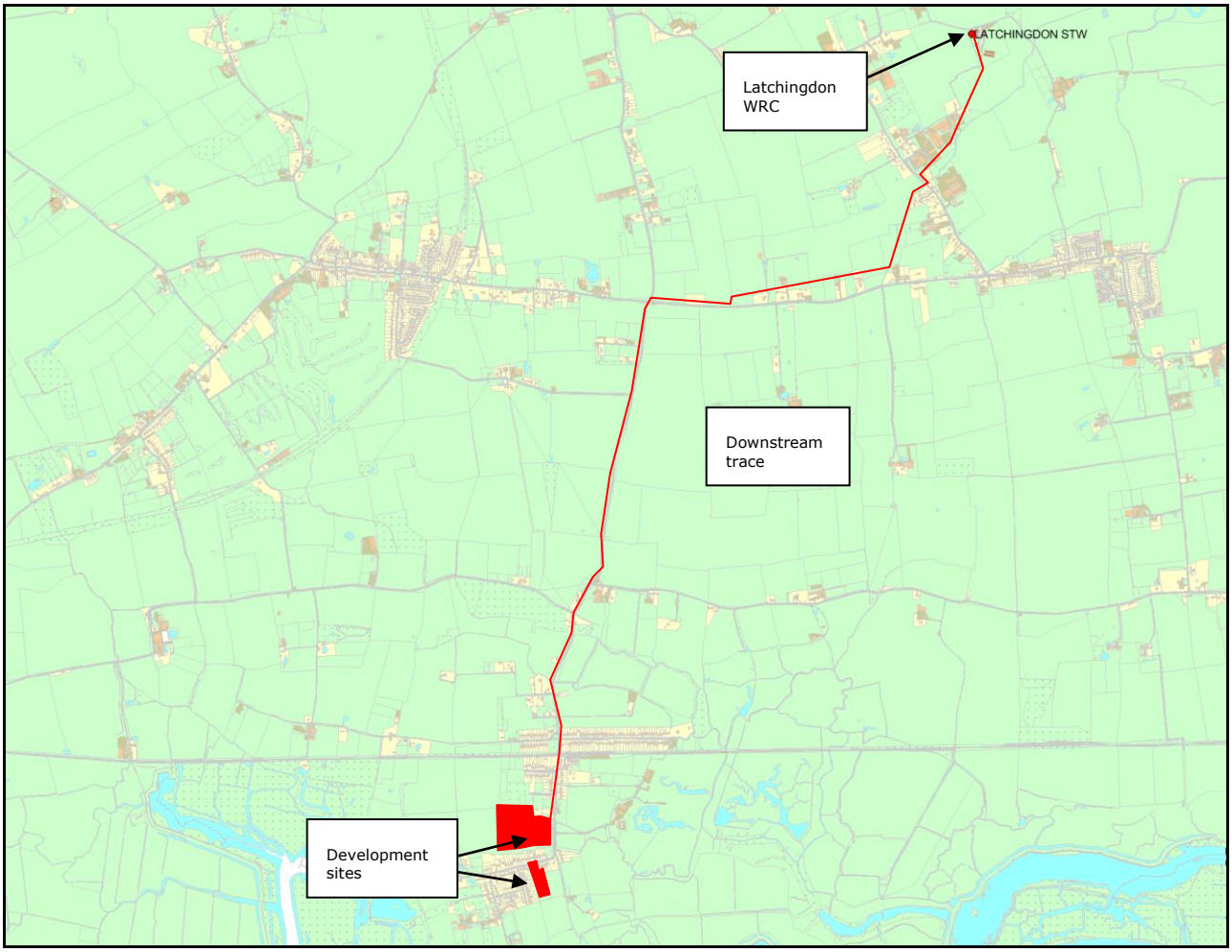

Figure 1 showing the development site and downstream trace of the sewerage network to the WRC

2.1 Latchingdon water recycling centre

Foul water from the development site will drain to the catchment served by the Latchingdon Water Recycling Centre (WRC). The WRC operates under a dry weather flow permit with reference to a hydraulic flow rate and a sanitary consent standard that specifies limits for specific contaminants in the treated effluent discharged.

Our current calculation indicates that there is insufficient hydraulic capacity, within the dry weather flow permit to receive the development flows.

Although the WRC process may still have hydraulic capacity, the assumptions around the implications for water quality in the receiving watercourse would no longer be certain. Therefore a prevailing exceedence of the dry weather flow permit will trigger a review of the sanitary consent standard, which may ultimately necessitate some increase in the process capacity at the WRC.

In contrast to network detriment, where the outcome of exceeding hydraulic capacity in sewerage can be accurately defined, the impact on water quality of exceeding the

dry weather flow permit is dependant upon a much wider range of factors. The permit will reflect a number of assumptions relating to the strength or characteristics of the sewage and the prevailing condition of the receiving watercourse.

Investment to increase process capacity would follow a position agreed with the Environment Agency and involve analysis over a much longer period than usually required for sewerage network detriment. Discussion toward this agreed position would begin when reliably predicted growth or outline approved development is calculated to exceed the dry weather flow permit.

Such investment as is deemed necessary will be prioritised, in consultation with the Environment Agency, with reference to the level of risk posed and the allowable funding constraints. The investment will also form part of a wider treatment strategy for the WRC that will also address changing environmental conditions and asset deterioration.

This composition of investment needs is reflected in the WRC Asset Plan and it is the purpose of pre-development assessments to ensure that the proposed growth is accounted for in the Asset Plan for Latchingdon WRC.

It is Anglian Water's responsibility to ensure that the Asset Plan and consequent investment planning is sufficiently robust to sustain an effective treatment strategy at Latchingdon WRC.

2.2 Calculated flow rates

From the development composition detail provided, the calculated flow rates for each scenario are as follows:

DWF Calculations				
	Attribute	**Value**	**Totals**	**Unit / Calculation**
A	Residential dwellings	105		No.
B	Residential occupancy	2.35		No.
C	Residential population (P)	247		No. (A x B)
D	Residential PCC (G)	125		l/h/d
$E_{(avg)}$	*Residential demand - Average*		**0.36**	l/s (C x D)/86400
$E_{(peak)}$	*Residential demand - Peak*		**0.76**	l/s ($E_{(avg)}$ x 2.12)
F	**Infiltration**		**0.09**	l/s (0.25 x $E_{(avg)}$)
$O_{(avg)}$	**Total Discharge - Average**		**0.45**	l/s($O_{(avg)}$ + F)
$O_{(peak)}$	**Total Discharge - Peak**		**0.85**	l/s($O_{(peak)}$ + F)

Table 1: Calculated flow rates for each Scenario

The occupancy and consumption rates used in the flow calculations reflect research undertaken across the UK water industry. These rates along with the factors applied for infiltration and peak flow are incorporated into the design standard that Anglian Water applies across our region.

There is not evidence to justify deviation from these standards in this case.

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2.3 Connection point

The proposed connection point for the Manor Farm parcel is manhole TQ8597 4201 (NGR TQ8543897250) just outside the site entrance located in The Avenue (see Figure 2). The diameter of the sewer to which the proposed development will connect is 150mm. A gravity connection is feasible for this parcel.

The proposed connection point for the northern parcel is manhole TQ8597 5301 (NGR TQ8554597318) the manhole immediately upstream of The Avenue PS (see Figure 2). The diameter of the sewer to which the proposed development will connect is 150mm.

A review of the site topography indicates that a gravity connection is not viable for the whole development area and a pumped conveyance would be required.

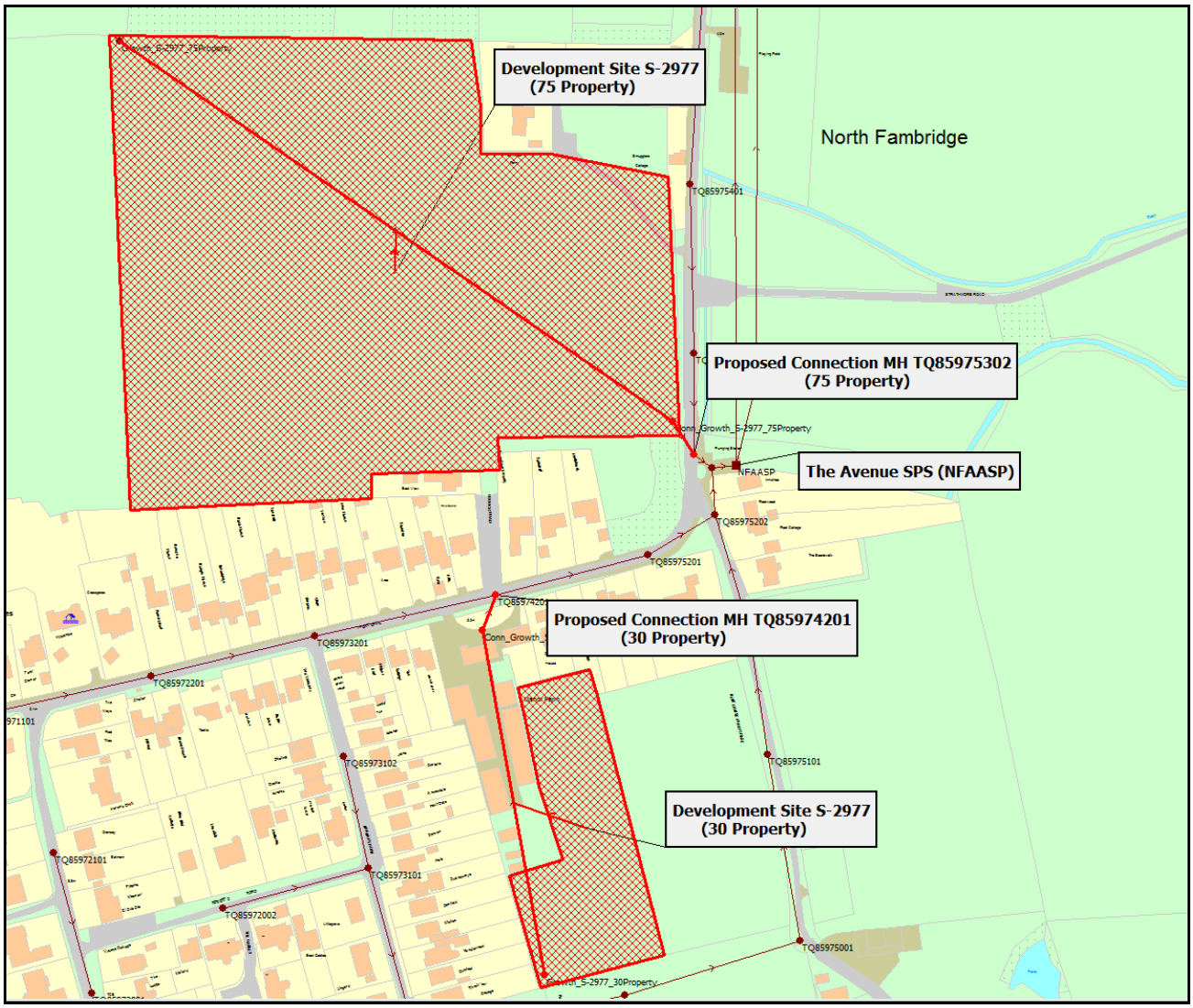

Figure 2 showing the proposed connection points in relation to the development parcels

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2.4 Sewerage network

The network to which this development will connect is a combined system, serving foul and surface water. As such it is susceptible to surcharging during storm conditions.

The immediate network drains to The Avenue pumping station (NFAASP), located close to the connection manholes. The pass forward flow rate at NFAASP is 4.8 l/s. The rising man from NFAASP discharges approx. 595m to the north at m/h TQ8597 5901 (NGR TQ8556697912), located in the junction of Fambridge Road and Franklin Road.

There is no directly linked combined sewer overflow at NFAASP, so storm conditions will surcharge the upstream sewerage and cause the pump events to increase in duration as the additional flow is passed forward to the sewer in Franklin Road.

The sewer in Franklin Road is formed of 150mm nominal bore pipework and discharges at the Franklin Road pumping station (NFAFSP), located at the eastern end of the road. The pass forward flow rate at NFAFSP is 12.9 l/s. The rising man from NFAFSP discharges to the sewerage on Cold Norton Road approx. 3km to the north.

In storm conditions, flows in excess of this pass forward rate at NFAFSP will spill to a watercourse via a consented CSO.

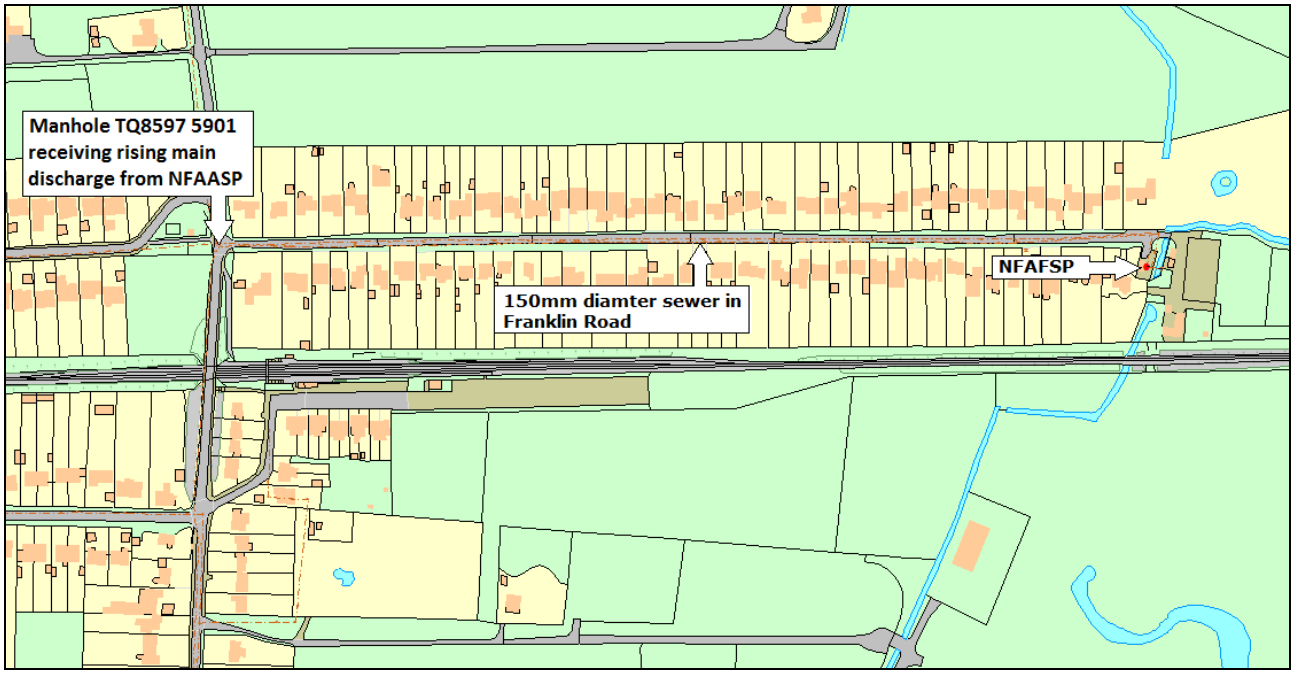

Figure 3 showing the immediate network draining to Franklin Road pumping station (NFAFSP)

The development site is approximately 5km from Latchingdon Water Recycling Centre (WRC).

3.0 Analysis results

In order to evaluate the impact of this development on the existing network, the analysis has examined the hydraulic performance of the network when the development flows connect during a storm event.

For flood risk analysis the model runs used a 20 year critical length storms for the standard range of durations up to 1440min to establish the baseline condition, against which the future scenarios were tested. Overflow operation analysis is based on an average of 10 year time series rainfall (TSR) data.

Solutions for detriment mitigation are based on 30 year storm events.

3.1 Baseline hydraulic performance

The baseline condition before the development flows connect indicates that the existing network discharging to NFAASP is susceptible to high surcharge conditions during the critical storm. The model predicted flooding during 20 year design storm event at two points close by The Avenue PS.

This flooding prediction is not corroborated by reported incidents and given its extent, this is considered to be an over-prediction and further historical verification would be required to establish a more reliable quantity.

3.2 Predicted detriment - flooding

The detriment analysis assumes that the development is generating flow at the peak dry weather rate during the critical storm condition.

With the development flows added, the model predicted flooding detriment at 3 locations. The largest increase in flooding is at NFAASP; the predicted volume of 75.8m^3 represents a 5.25% increase on the baseline prediction (see Figure 4).

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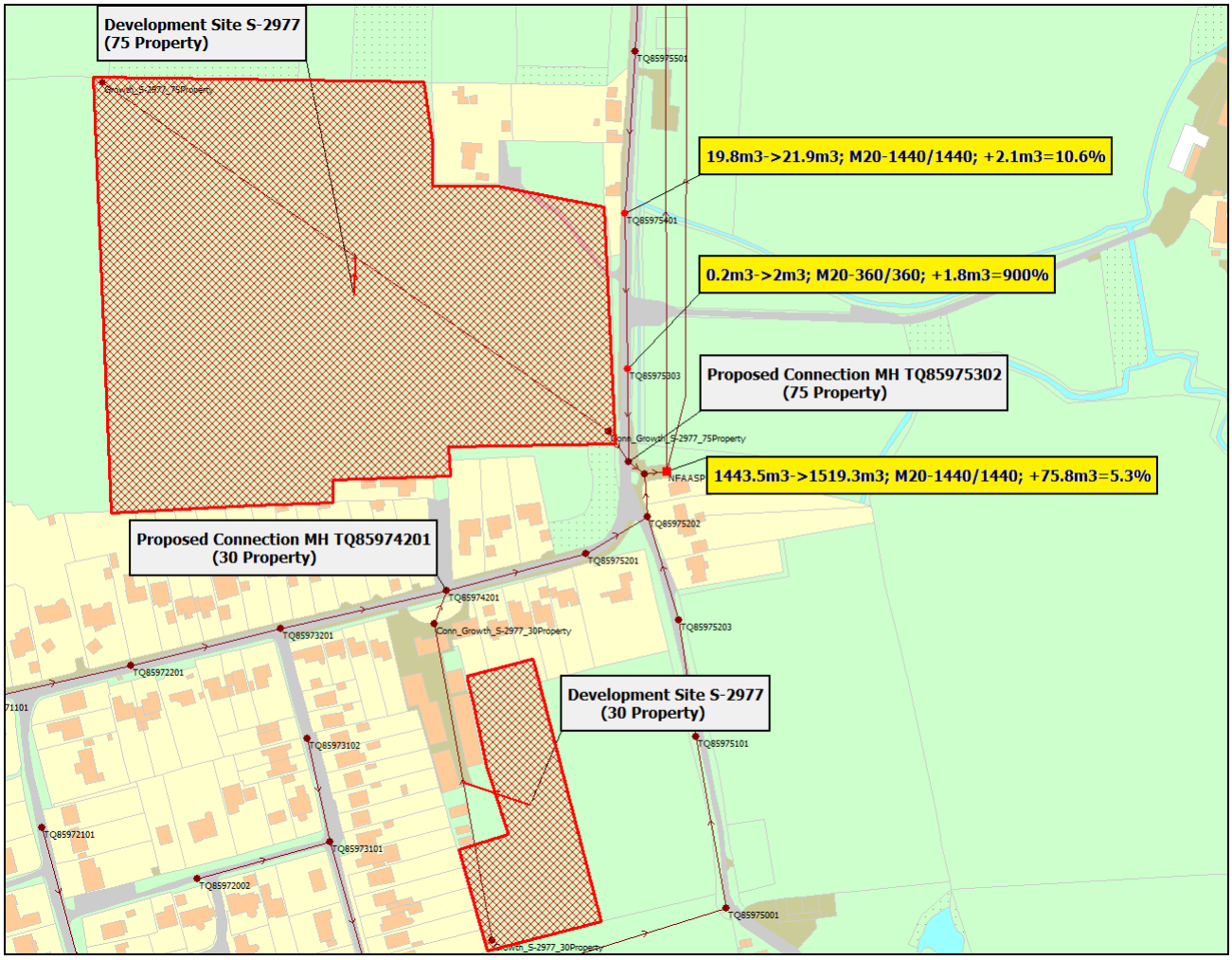

Figure 4 showing the extent of predicted flood detriment with the development connected

The flooding detriment results mainly due to the pass forward flow capacity of NFAASP. The predicted increase in flooding at the three locations is considered to be of high risk and mitigation would be needed to resolve this.

3.3 Predicted detriment – overflow and water quality

There is only one overflow within the network that is impacted by the development flow. This is located at NFAFSP at the eastern end of Franklin Road. The model has been assessed using 10 year TSR event. The assessment is detailed below.

CSO/EO (Spill link)	Average of 10 years (per year)					
	Baseline		Future		Increase	
	Spill frequency	Spill volume (m^3)	Spill frequency	Spill volume (m^3)	Spill frequency	Spill volume (m^3)
North Fambridge-Franklin Road SP (NFAFSP) EO (TQ86971902.2)	0.300	3.702	0.200	3.89	-0.100	+0.188 (+5.078%)

Table 2: Effect of the growth site S-2977 on overflows compared to base model.

This increase reflects the marginal increase in pump running at NFAASP to convey the additional flows generated by the development during the storm event. An increase in excess of 1% would generally be considered sufficient to justify mitigation; however, this increase in spill volume is negligible and would be considered to be of low risk.

3.4 Residual capacity

Sensitivity analysis indicates that with the 30 units connected by gravity, the level of predicted additional detriment is negligible and below the threshold requiring attention. Therefore the analysis supports the original assessment conclusion that the Manor Farm parcel can be connected before mitigation is required.

4.0 Mitigation solutions

Mitigation solutions are designed to prevent detriment to the existing sewerage network performance during a 1 in 30 year critical duration storm event.

The analysis indicates that the foul water connection strategy identified in the original drainage impact assessment (DIA) is viable. This allows for the 30 houses comprising the Manor Farm parcel to connect by gravity at manhole TQ8597 4201 and the 75 houses comprising the northern parcel to connect via pump to manhole TQ8597 5301.

The DIA recommended solution comprised a combination of upstream attenuation with active control on the discharge and network reinforcement at NFAASP as follows:

- Provision of 68m^3 of off-line on-site storage with gravity return to the conveyance pumping station with active control linked to the existing The Avenue PS.
- Provision of 33m^3 of storage The Avenue PS.

4.1 Recommended solution

Active discharge control (also referred to as real-time control or RTC) involves using signals from level monitors located downstream of the connection, to inhibit the development conveyance pump operation. This allows the development flows to be stored within the development drainage until the storm condition has abated and the level in the receiving sewer reduced sufficiently to accommodate the discharge from the development.

In this situation the critical receiving sewerage asset is NFAASP, which already has constant level monitoring as part of its existing pump control system.

The recommended solution envisages a signals link between NFAASP and the conveyance pumping station on the northern parcel development, so that high wet well levels at NFAASP are used to inhibit the conveyance pump operation.

The analysis indicates that in the critical 30 year event the worst case inhibit duration is almost 23 hours. During this period the development drainage would need to be able to store its flow while the conveyance pump is inhibited. This would require up to 30m^3 of additional storage within the development drainage, which could be utilised

without surcharging connecting laterals or compromising a free outfall from connected property.

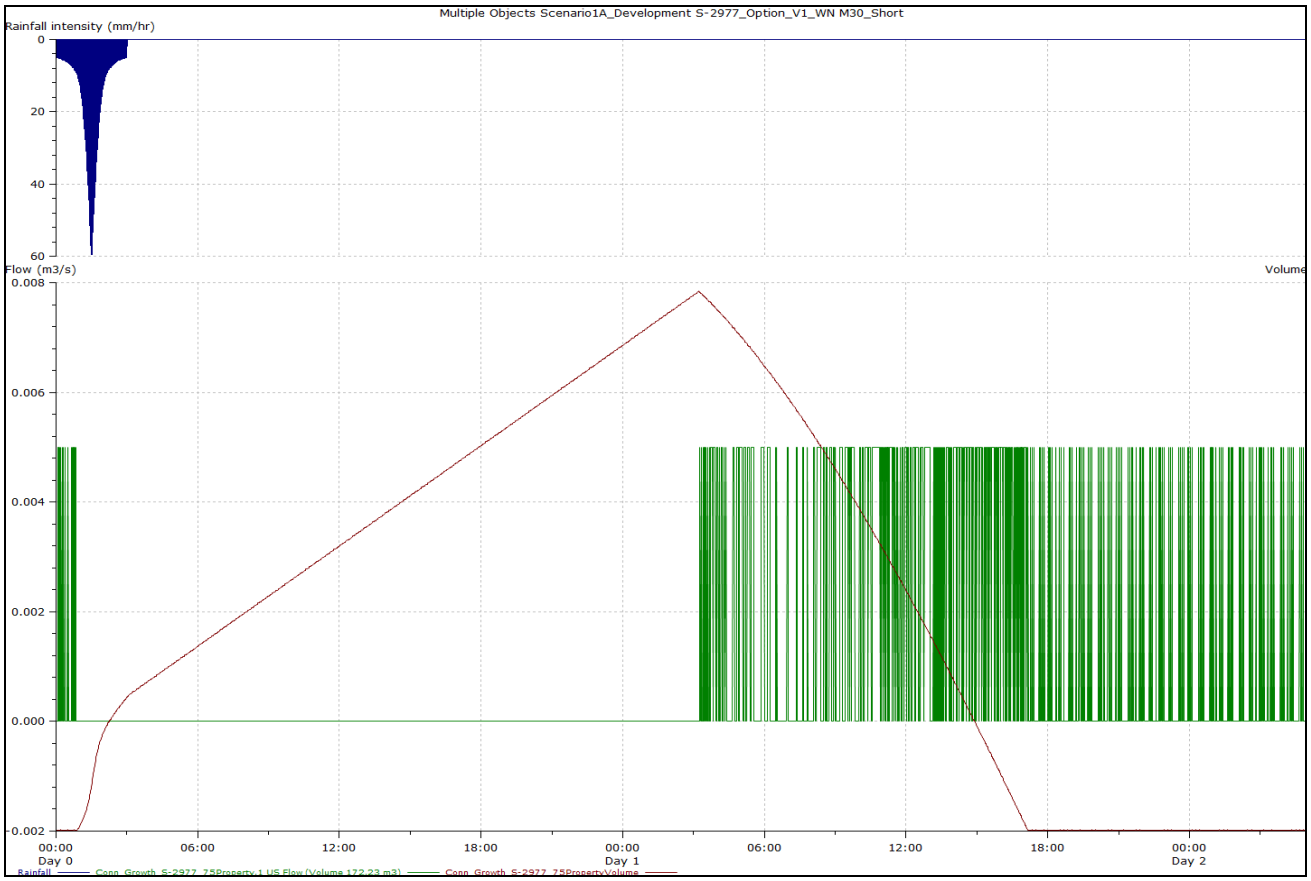

Figure 5 showing the flow pattern and RTC operation from the conveyance PS during 30 year design event (this assumes a discharge rate of 5 l/s)

The diagram in Figure 5 above shows the flow and level profile at the conveyance pumping station during this critical storm event. The rainfall profile at the top of the graph represents the storm profile that provides this worst case scenario.

A further refinement on the DIA solution considered a reduced conveyance pump rate. This previous assessment assumed a conveyance pump rate of 5l/s, based on prevailing Anglian Water minimum asset standards favouring rising mains of not less than 100mm nominal bore. Since the DIA was issued, we have undertaken a review of adoptable standards for small developments. We would now take a view that the risk of rising main blockage for smaller bore pipes is not significant at relatively short distances.

Using a smaller rising main bore of 80mm allows for a reduced rate broadly averaging 3.8l/s. With this reduced rate the network reinforcement element of the original DIA solution is no longer required.

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5.0 Summary of recommended foul water drainage strategy

The analysis concludes that the Manor Farm (southern) development parcel, comprising 30 houses, should connect by gravity to manhole TQ8597 4201 (NGR TQ8543897250) located in The Avenue. No mitigation solution is required for this parcel.

The northern development parcel in land off The Avenue, comprising 75 houses, should connect via pumped conveyance at 3.8l/s to manhole TQ8597 5301 (NGR TQ8554597318) the manhole immediately upstream of The Avenue PS. This parcel should not be occupied until the following mitigation is installed:

1. Provision of a signal link between NFAASP and the conveyance pumping station control.
2. Configuration of conveyance pumping control to enable an inhibiting of the pump operation based on levels measured at NFAASP.
3. Provision of 30m^3 of additional storage within the development drainage. This may be installed within the wet well or in over-sized upstream sewers.

It is assumed that the developer will install the conveyance pumping station and rising main, along with the storage capacity in *item 3*. Therefore, a requisition scheme under Section 98 Water Industry Act would involve only items 1 and 2 of the recommended solution.