Decision on a resource consent application under section 88 of the Resource Management Act 1991

Applicant:	Watercare Services Limited
Permit Number:	R/REG/2013/3743 (overflows to land and water) R/REG/2013/3755 (overflows to the coastal marine area)
Site address:	This consent covers all discharges throughout the Auckland region from the wastewater network which is under the control and management of Watercare Services Limited, and in particular: • Wastewater discharges within the *Existing Urban Areas* in *Auckland* (shown in Attachment 1) that are currently serviced by the *Existing Network* or may be serviced by a *Future Network*; and • Wastewater discharges within the *Indicative Future Urban Areas* in *Auckland* (shown in Attachment 1) that are to be serviced by *Future Networks*. This consent does not authorise any discharges outside the *Existing Urban Area* or *Indicative Future Urban Area* shown in Attachment 1. For the avoidance of doubt, the wastewater network operated by United Water in the Papakura area is not covered by this consent.
Proposal:	This consent authorises the discharge of wastewater from the Consent Holder's existing and identified future public wastewater networks to land, freshwater and coastal receiving environments in accordance with section 15(1)(a) and (b) of the Resource Management Act 1991, during times of dry and wet weather flow, that may occur as a result of network blockages and failures; network damage by third parties; failure at pump stations or storage facilities; and capacity constraints. This consent also authorises any wastewater discharges authorised under other resource consents obtained in the future by the Consent Holder or third parties, once transferred to the Consent Holder for inclusion as part of this comprehensive consent. This consent includes planned future growth areas identified in the consent and derived from the Auckland Plan and Proposed Auckland Unitary Plan (30 September 2013).

This consent is for the Consent Holder's *Existing Network* and *Future Network* as specified in the Site Location, within the Auckland metropolitan area and including other urban satellite networks.

Resource consents:

Auckland Council Regional Plan: Air, Land and Water (ACRP: ALW)

- Discharge consent

Auckland Council Regional Plan: Coastal (ACRP: C)

- Discharge consent

Proposed Auckland Unitary Plan (PAUP)

- Discharge consent – objectives and policies

The application has been assessed overall as a restricted discretionary activity.

Decision

Having read the application, supporting documents, specialist comments and the report and recommendations on the application, the Commissioners are satisfied there is sufficient information to consider the matters required by the Resource Management Act 1991 ("the RMA") and make a decision.

For completeness, we record that the Commissioners sat with Independent Commissioner Kirkpatrick in the determination of the notification decision on this application. For conciseness, we do not repeat that formal decision here. Nevertheless, we record that the notification decision sets out in part our rationale and thinking in granting this consent.

In the notification decision report, we concluded that the application is for a restricted discretionary activity; and rule 5.5.11 of the Auckland Regional Plan: Air Land and Water, requires the application to be non-notified. We also concluded that there were no special circumstances which warranted limited notification or notification of the application.

In reaching this substantive decision, a fundamental consideration for us is the fact that this is a consent to formalise the discharges from the existing and proposed wastewater network. These discharges largely already occur. In our view it is far preferable to deal with the significant number of discharges through a comprehensive integrated consent; rather than let the network continue to operate under the large number of different and in many cases significantly outdated consents. In our view the network needs to be operated in a comprehensive

manner and the best way to achieve this is to do that under an integrated consent framework. This consent will achieve that.

In reaching this conclusion, we are conscious of the variable state of knowledge and information about the operation of the current network. Some overflow points and related aspects of the network are well understood. Other overflow points have little information about the frequency of discharges or operational aspects of the network.

We have considered carefully the approach put forward by Watercare and recommended by Council officers for dealing with this. We concur with the officers' recommendation that it is preferable to grant the consent now and impose conditions which will require the significant improvement in the information base and analysis about operation of the network, so that the strategy for operating the network can be reviewed and updated. This is the Wastewater Network Strategy to be developed in 2017, and thereafter reviewed at six yearly intervals.

We have placed due weight on the Wastewater Network Strategy, which is a condition of this report. It is this strategic document and its regular updating which will in our opinion help ensure that the network is progressively upgraded and that the management of the network continues on the basis of improved information and understanding on how best to manage the effects on the environment and on cultural values.

We are mindful that this consent is for 35 years. It may well be that changes in the knowledge of wastewater environmental science may occur over that period or indeed new policies may be introduced through the relevant Resource Management Act statutory documents affecting wastewater discharges which should be addressed.

We consider that the review clauses which form part of our decision provide the relevant mechanism to deal with any necessary future changes.

We note that this consent records the number of discharges from the existing network – some 756 outfall points. Of these, approximately 15% discharge more than twice per year on average.

This consent is about progressively improving the performance of the network and reducing the frequency and duration of overflows. This consent for the first time introduces a prioritisation process across the entire network based on an agreed set of environmental and cultural parameters. This approach is far better than the current multiple consents regime of the legacy Councils.

We have carefully considered the statutory criteria in terms of the Regional Plan: Air Land Water, Regional Plan: Coastal and Proposed Auckland Unitary Plan in terms of the objectives and policies relating to discharges.

We concur and accept the analysis of the statutory criteria set out in the primary report by officers.

Under sections 104, 104C, 105, 106, 107, and Part 2, these resource consents are

GRANTED.

The reasons for this decision are:

1. The granting of this consent will provide a comprehensive, integrated management approach for the Auckland public wastewater network.

2. The prioritisation process for enhancements to the network which are a requirement of this consent will result in the planned, committed upgrade of the network over time, with those overflow points which have the greatest impact being prioritised in terms of upgrading.

3. This consent puts in place a robust BPO system which reflects current good practice in New Zealand and provides a framework for the identification of receiving environments, the assessment of the options and impacts of development, and the approach that enables the prioritisation process to occur.

4. While this consent has been prepared on the practical, available information, it recognises the current information gaps in the existing system and provides a process to improve information about the network.

5. The inclusion of a wastewater network strategy and the regular review and update of this document ensures that the level of knowledge, management and prioritisation for upgrades to the network will be reviewed at appropriate regular intervals, ensuring that the focus of upgrades to the network remain appropriate over the 35 year life of this consent.

6. This consent includes a range of operational and procedural commitments by the consent holder which will ensure the successful operation of the network and appropriate response to any issues or problems that occur within the network.

7. The proposed conditions of consent ensure the adequate management of the effects of discharge.

8. The review condition provides a ‘safety valve’ that should there be any major new and different advances in wastewater technology, or should unexpected and significant information come to hand over the life of this consent, then there is the opportunity for a full review of the discharges from the network.

9. The mechanisms put in place through the conditions to this consent enable future expansion of the network following urban rezoning to be appropriately managed and successfully integrated within the parameters of this consent.

10. This consent embodies discharge frequency targets consistent with the Auckland Plan.

11. This application meets the requirements of Rule 5.5.11 of the Regional Plan: Air Land Water relating to restricted discretionary activities for wastewater discharges.

12. The consent meets the criteria of section 104 and 104C of the Resource Management Act. In terms of those matters, the Council has preserved its discretion in considering wastewater network discharges.

13. While there are six potential discharge locations that may affect areas subject to the Marine Reserves Act, there is no history of any of these potential discharge points being triggered.

14. Any discharges are temporary in nature and short term. Furthermore, the granting of this consent will enable a prioritised process which will address the outfalls with high incidents of overflows and over time lead to significantly improved environmental outcomes. Consequently, and in the circumstances, we consider that this consent will be consistent with the New Zealand Coastal Policy Statement and the Hauraki Gulf Marine Park.

15. The granting of this consent will in our view meet the requirements of Part 2 in terms of enabling the better management of Auckland's growth and development, while meeting required environmental outcomes and setting in place a mechanism to ensure ongoing prioritisation and improvement of the wastewater network.

16. Any new development in greenfields areas can only take place once that area has been zoned for urban activity. The conditions appropriately require the discharge point to have holding tanks of four hours and otherwise comply with the permitted activity standards of the current proposed Auckland Unitary Plan.

Conditions

This consent is subject to the following conditions:

Site Access

1. The Consent Holder shall ensure that access to relevant parts of the *Network* is available at all reasonable times to the Auckland Council or its agents for the purpose of carrying out inspections, surveys, investigations, tests, measurements and to take samples.

Documentation

2. Subject to such amendments as may be required by the conditions of this consent, the consent shall be exercised in general accordance with the following documents:

a. **Attachment 1:** Maps of the *Existing Network* and *Indicative Future Urban Areas*, current in February 2014
b. **Attachment 2:** Schedule of *Engineered Overflow Points* in the *Existing Network*, current in February 2014
c. **Attachment 3**: *Best Practicable Option* (BPO) Methodology
d. **Attachment 4:** Methodology for Prioritising Catchments and Wastewater Network Improvement Works
e. **Attachment 5:** Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows
f. **Attachment 6:** Matters to be addressed in the Wastewater Network Strategy
g. **Attachment 7:** Operation and Maintenance Procedures for the Conventional (Gravity) Wastewater Network
h. **Attachment 8:** The Wastewater Overflow Regional Response Manual
i. **Attachment 9:** Template for the Annual Network Performance Report
j. **Attachment 10:** Definitions
k. **Attachment 11:** Uncontrolled Overflows to Private Property, current in February 2014
l. **Attachment 12:** Auckland-wide Wastewater Network Discharge Consent Application – Generic Assessment of Ecological and Recreational Effects (NIWA, April 2013)

Manager's Certification Process

3. The Consent Holder shall obtain *Manager's* Certification for:
   - The Wastewater Network Improvement Works Programme set out in the *Wastewater Network Strategy* (condition 13);
   - The *Wastewater Network Strategy* (condition 23)

- A *New or Replacement Overflow Point* that does not comply with condition 24; and
- A *New* or *Replacement Overflow Point* that does not comply with condition 26.

4. In seeking the *Manager's* Certification required under condition 23, the Consent Holder shall provide sufficient information to demonstrate that:
   a. the *Wastewater Network Strategy* (including the Wastewater Network Improvement Works Programme) has addressed the matters set out in **Attachment 6;**
   b. the *Wastewater Network Strategy* (including the Wastewater Network Improvement Works Programme) was developed in accordance with the *Best Practicable Option* (BPO) Methodology set out in **Attachment 3;**
   c. the *Wastewater Network Strategy* (including the Wastewater Network Improvement Works Programme) was prioritised in accordance with the Methodology for Prioritising Catchments and Wastewater Network Improvement Works set out in **Attachment 4;**
   d. any assessment of effects and risk necessary to develop the *Wastewater Network Strategy* (including the Wastewater Network Improvement Works Programme) was undertaken in accordance with the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows set out in **Attachment 5.**
   e. the *Wastewater Network Strategy* (including the Wastewater Improvement Works Programme) accounts for the specified population scenario and planning horizon set out in the previous Wastewater Network Strategy as updated to include the relevant proposed or operative Unitary Plan zoning, densities and population growth trends.

5. In seeking the *Manager's* Certification required under Conditions 24 and 26 the Consent Holder shall provide sufficient information to demonstrate that:
   a. the receiving environment for the discharges has been identified and classified in accordance with the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows (**Attachment 5**);
   b. the public health and ecological risk of the discharges has been determined in accordance with the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows (**Attachment 5**);
   c. the programme of works specifies the performance standards, scope of the works and other measures that define the *Best Practicable Option*, with the likely timing for implementation of the works.

6. For the purpose of conditions 4 and 5 on request of either the *Manager* or the Consent Holder, the Council may appoint an independent reviewer or

planning technician to undertake a planning assessment and recommendation report, and may submit a request and any assessment report to an Independent Commissioner for the decision on the issuance of the *Manager*'s Certification.

CONSULTATION

General Consultation

7. During the preparation and review of the *Wastewater Network Strategy* (including the Wastewater Improvement Works Programme) that is prepared in accordance with condition 13, the Consent Holder shall *consult* with the parties listed below on the proposed Wastewater Network Improvement Works Programme, the effects of discharges on receiving environments, and how the proposed Wastewater Network Improvement Works are prioritised:
    a. Auckland Council;
    b. Local Boards;
    c. Auckland Regional Public Health Service;
    d. Other wastewater network utility operators within *Auckland,* where the networks of those operators are directly or indirectly affected, or affect the same receiving environment;
    e. Stormwater network utility operators within *Auckland*.

    The Consent Holder shall report back to those parties listed above who engaged in consultation on the outcomes and final form of the *Wastewater Network Strategy*.

Iwi Consultation

8. Prior to and during the preparation and review of the *Wastewater Network Strategy* (including the Wastewater Improvement Works Programme), the Consent Holder shall:
    a. Inform Iwi Authorities with mana whenua interests within *Auckland* of the intention to prepare a *Wastewater Network Strategy* three (3) months prior to commencing the preparation or review, and the timetable and opportunities for these authorities to engage in the preparation of the *Wastewater Network Strategy.*
    b. Consult with Iwi Authorities with mana whenua interests within *Auckland* over the draft *Wastewater Network Strategy,* including receiving environment classifications cultural values and all discharges to land and water.
    c. Report back to Iwi Authorities with mana whenua interests within *Auckland*, and Auckland Council, on the outcomes and final form of the *Wastewater Network Strategy.*

DISCHARGE FREQUENCY

9. The Consent Holder shall manage the *Existing Network* to achieve either:
   a. an average of no more than two *Wet Weather Overflow Events* per *Engineered Overflow Point* (as listed in **Attachment 2**) per year as assessed by *computer modelling* or actual recorded performance; or
   b. if (a) is not achieved for a particular *Engineered Overflow Point*, the Consent Holder shall determine an alternative discharge frequency (ADF) for that *Engineered Overflow Point* using the BPO methodology set out in **Chapter 3 of Attachment 3** and the Methodology Prioritising Catchments and Wastewater Network Improvement Works set out in **Attachment 4** (where condition 10b is used); and document this in the *Wastewater Network Strategy* that is prepared in accordance with condition13.

10. For the purpose of condition 9b, the Consent Holder may determine an ADF either:
   a. for an individual *Engineered Overflow Point*; or
   b. for more than one *Engineered Overflow Point*, and undertake the assessment for discharges that are rated high or very high on a catchment basis. Discharges and/or sub-catchments may be aggregated to allow for the integrated management of multiple sub-catchments and receiving environments.

11. The Consent Holder shall manage the *Existing Network* so that *Dry Weather Overflows* only occur as a result of network failure including breakages, blockages, third party damage and mechanical or power failure at pump stations or storage facilities.

WASTEWATER NETWORK PLANNING

Interim Approach to Wastewater Network Planning

12. Prior to adoption of the first *Wastewater Network Strategy* in 2017, the Consent Holder shall undertake wastewater network planning in accordance with the conditions of this consent, and Volumes 2.1 to 2.35 of the Auckland Wastewater Network Application for Comprehensive Discharge Permit and Assessment of Effects on the Environment; on the basis that the works outlined in the Wastewater Network Improvement Works Programme set out in Volume 1, Table 3.3 of the Auckland Wastewater Network Application for Comprehensive Discharge Permit and Assessment of Effects on the Environment are approved as part of this consent..

Wastewater Network Strategy

13. The Consent Holder shall prepare, review and update a *Wastewater Network Strategy* every six years, and implement the Wastewater Network Improvement Works Programme set out in the *Wastewater Network Strategy.*

14. The Consent Holder shall prepare the first *Wastewater Network Strategy* by 30 June 2017.

15. The *Wastewater Network Strategy* shall address the matters set out in **Attachment 6** and conditions 16 to 22**.**

16. Prior to the 2017 *Wastewater Network Strategy,* the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows in **Attachment** 5 shall be amended to include**:**
    a. A Wetland receiving environment type category. This receiving environment type shall be described and assessed using the same principles and approach used for the existing receiving environment types, set out in the Auckland wide Wastewater Network Discharge Consent Application – Generic Assessment of Ecological and Recreational Effects (NIWA, April 2013) in **Attachment 12**.
    b. An assessment of the potential temporal and spatial cumulative public health and ecological effects of wastewater discharges, using the same principles and approach set out in the Auckland wide Wastewater Network Discharge Consent Application – Generic Assessment of Ecological and Recreational Effects (NIWA, April 2013) in **Attachment 12**.

17. The *Wastewater Network Strategy* shall:
    a. Address any changes in discharge characteristics (as set out in updates of Schedule 2); and
    b. In the case of the 2017 *Wastewater Network Strategy,* address any changes in receiving environment classification, including reclassifying all commonly used beaches where contact recreation (bathing) occurs as a *Class 1 Recreational Receiving Environment*.

18. The preparation of the *Wastewater Network Strategy* shall have particular regard to those *Engineered Overflows Points* that have a very high or high public health or ecological risk profile (as established through applying the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows in **Attachment 5**).

19. When preparing the *Wastewater Network Strategy*, the Consent Holder shall

investigate *Engineered Overflow Points* that are known to discharge more than 12 times per year to determine whether there are any appropriate short-term measures to manage conspicuous oil or grease films, scum or foam, or floatable or suspended materials that may be visible at the point of discharge to the environment, and provide this analysis together with the details and timing of any proposed works with the Wastewater Network Strategy.

20. The *Wastewater Network Strategy* population assumptions shall be based on an assessment of future growth taking into account the proposed or operative Unitary Plan zonings, densities and population growth trends.

21. The *Wastewater Network Strategy* shall:
    a. update the information on discharge frequency, duration and assumed volumes for the *Engineered Overflow Points* in **Attachment 2** so that any BPO assessments that may be necessary are based on the most recent information available;
    b. comment on the extent to which the Wastewater Network Improvement Works Programme undertaken over the previous six years has resulted in improved compliance with the frequency target in condition 9a;
    c. comment on the extent to which the Wastewater Network Improvement Works Programme to be undertaken over the next six years is expected to result in compliance with the frequency target in condition 9a.

22. The Wastewater Network Improvement Works Programme set out in the *Wastewater Network Strategy* shall be determined using the *Best Practicable Option* (BPO) Methodology set out in **Chapter 2 of Attachment 3.**

23. The Consent Holder shall provide a copy of the *Wastewater Network Strategy* to the *Manager* and obtain *Manager's* Certification that the Wastewater Network Improvement Works Programme set out in the *Wastewater Network Strategy* has been determined in accordance with the BPO methodology set out in **Chapter 2 of Attachment 3** and following the catchment and wastewater network improvement works prioritisation process set out in **Attachment 4**.

Existing Network

24. The Consent Holder may discharge from any *Replacement Engineered Overflow Point* within the *Existing Network* provided that the discharge frequency remains the same or is less frequent.

25. Where the Consent Holder seeks to undertake works under condition 24, the Consent Holder shall give written notice to the *Manager* as soon as

practicable after the *Replacement Engineered Overflow Point* has been commissioned, but prior to the commencement of construction.

26. The Consent Holder may discharge from any *New Engineered Overflow Point* within the *Existing Network* provided that the discharge frequency under condition 9a is satisfied, and the location of the *New Engineered Overflow Point* is not in a *Class 1 Recreational Receiving Environment.*

27. If a *Replacement* or *New Engineered Overflow Point* within the *Existing Network* does not comply with the requirements set out in conditions 24 or 26 respectively, or discharges to a SEA-M1 Area, the Consent Holder shall:
    a. determine an alternative discharge frequency (ADF) for that *Engineered Overflow Point* using the BPO methodology set out in **Chapter 3 of Attachment 3**; and / or
    b. determine the location of that *Engineered Overflow Point* using the BPO methodology set out in **Chapter 4 of Attachment 3.**

    The work required by the Consent Holder shall depend on whether a new location is proposed, and whether the *Discharge Frequency Targets* are met.

28. No discharge is allowed to a *Tangata Whenua Management Area* as identified in the *Regional Plan: Coastal,* or an equivalent area in the Unitary Plan where discharges are a *Prohibited Activity.*

29. Prior to construction of the *Replacement* or *New Engineered Overflow Point*, or concurrent with the lodgement of other necessary resource consent applications, the Consent Holder shall obtain *Manager*'s Certification that the determination of the ADF in accordance with condition 27a and/or the determination of the location of the discharge from the *Replacement* or *New Engineered Overflow Point* in accordance with condition 27b was undertaken in accordance with the BPO methodology set out in **Chapters 3 and/or 4 of Attachment 3.**

Future Network

30. The Consent Holder may discharge from any *New Engineered Overflow Point* which is zoned for urban activity under the relevant Resource Management Act statutory document, and is within a *Future Network* provided that:
    a. The *New Engineered Overflow Point* is located in the location shown on the relevant map of the *Indicative Future Urban Area* in **Attachment 1** or a *Similar Location;* and
    b. The *New Engineered Overflow Point* is designed and managed to achieve the discharge frequency set out in condition 9a; and

c. A minimum of four (4) hours storage at *Dry Weather Flow* is provided at or near the *New Engineered Overflow Point.*

31. The Consent Holder may discharge from a *New Engineered Overflow Point* in a location within a *Future Network* not identified in **Attachment 1,** but within the *Indicative Future Urban Area* shown in **Attachment 1** if it obtains *Manager's* Certification prior to construction that the discharge meets the following standards:
    a. The potential overall risk of the discharge is very low or low, as determined through an assessment undertaken in accordance with the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows (**Attachment 5**); and
    b. The *New Engineered Overflow Point* is designed to achieve the discharge frequency set out in condition 9a, and
    c. The location of the *New Engineered Overflow Point* represents the BPO, as assessed using the BPO methodology set out in **Chapter 4 of Attachment 3**; and
    d. Direct discharges to the *Coastal Marine Area* shall be avoided unless an assessment using the BPO methodology in in **Chapter 4 of Attachment 3** demonstrates that this is the most suitable location, taking into account cultural and ecological factors.

32. The Consent Holder shall provide the following to the *Manager* prior to construction of a *New Engineered Overflow Point* in accordance with conditions 30 and 31:
    a. a site plan showing the proposed pump station and/or formal overflow point location; and
    b. design drawings or preliminary drawings showing the pump station design configuration and/or formal outfall structure designs.

33. No discharge is allowed to a *Tangata Whenua Management Area* as identified in the *Regional Plan: Coastal,* or an equivalent area in the Unitary Plan where discharges are a *Prohibited Activity.*

34. No *New Engineered Overflow Point* shall be located on private property without the *Manager* receiving written consent from the property owner that they agree to the location of the *Engineered Overflow Point*.

Provisions for Urban Growth and Intensification

35. Upon request from Auckland Council, the Consent Holder shall review any Wastewater Capacity Assessment prepared by an applicant relating to a

proposed subdivision, development or rezoning to determine whether any issues with the capacity of the network or scope of this consent arise.

WASTEWATER NETWORK OPERATION

Minimisation of Wastewater Discharges

36. The Consent Holder shall minimise wastewater discharges from the *Network* through undertaking the following activities:
    a. Scheduling planned maintenance of *Engineered Overflow Points* for times of expected *Dry Weather Flow.*
    b. Continuously monitoring, through telemetry, pump stations (*Type 1 Overflow Points*) that have the potential to overflow wastewater to the environment and have a contributing catchment equivalent population of 100 or more persons.
    c. Inspecting, maintaining and assessing the condition of *Network* assets, specifically pipelines, pipe bridges, siphons, rising mains, overflow structures, storage facilities and pump stations in general accordance with the Operations and Maintenance Procedures for the Conventional (Gravity) Wastewater Network (**Attachment 7**).
    d. Investigating the cause of *Repeat Dry Weather Overflows* and implementing measures to avoid a re-occurrence of similar *Dry Weather Overflows* in the future.

37. The Consent Holder may review and update the Operations and Maintenance Procedures for the Conventional (Gravity) Wastewater Network (**Attachment 7)** and/or the Wastewater Overflow Regional Response Manual **(Attachment 8)** as required.

38. The Consent Holder shall, on request, provide a copy of the current Operations and Maintenance Procedures for the Conventional (Gravity) Wastewater Network **(Attachment 7)** and/or the Wastewater Overflow Regional Response Manual **(Attachment 8)** to the *Manager*.

Minimisation of Effects of Wastewater Discharges

39. The Consent Holder shall minimise the adverse effects of wastewater discharges from the *Network* by responding to *Wastewater Overflows* in general accordance with the Wastewater Overflow Regional Response Manual provided in **Attachment 8**, and specifically the following requirements:
    a. Appropriately experienced personnel must visit the *Engineered Overflow Point* within 60 minutes of a *Dry Weather Overflow* being reported to the Consent Holder, for 80% of the reported *Dry Weather Overflows*.

b. Where numerous *Wet Weather Overflows* and/or numerous *Dry Weather Overflows* occur simultaneously across the *Network*, the visits required under condition 39a shall be prioritised on the basis of the following criteria (in order of importance):
   i. any public health issues;
   ii. the scale and significance of environmental effects;
   iii. the consequences of delay, compared to the consequences of visiting other *Engineered Overflow Points* in the *Network*.

40. Any *Dry Weather Overflow* responded to in accordance with condition 39 shall:
   a. Be contained to prevent wastewater from entering water;
   b. Where this is not possible, the volume of wastewater entering water shall be minimised to the extent practicable;
   c. Be cleaned up so that all visible residue is removed;
   d. Be disinfected to prevent people coming into contact with wastewater or wastewater residue.

Discharges to Land

41. The Consent Holder shall manage any *wastewater overflows* to private property in accordance with the procedures set out in the Wastewater Overflow Regional Response Manual in **Attachment 8**.

42. Within six (6) months of the grant of this consent, the Consent Holder shall complete an investigation of the fifteen (15) existing uncontrolled overflows (*Type 3 Overflows*) listed in **Attachment 11** to private property, and prepare a plan of improvement works to address or manage these private property overflows.

43. The 2017 *Wastewater Network Strategy* shall include the prioritisation and improvement works to address any of the fifteen (15) existing uncontrolled overflows (*Type 3 Overflows*)) listed in **Attachment 11** to private property that have not been rectified by that time, or describe the approach to managing those overflows to private property.

44. No *New* or *Replacement Engineered Overflow Point* shall be located on private property without the *Manager* receiving written consent from the property owner that they agree to the location of the *Engineered Overflow Point*.

Other Operational Measures

45. The Consent Holder shall notify *Reported Wastewater Overflows* to the

Auckland Council and the Auckland Regional Public Health Service in accordance with the timeframes set out in clause 8.2.3 of the Wastewater Overflow Regional Response Manual in **Attachment 8**, and shall respond to the incident in accordance with the processes set out in this Manual, including information updates to the Council.

46. The Consent Holder shall maintain records of *Wastewater Overflows* and make them available, on request, to the *Manager*.

Management of Inflow and Infiltration

47. The Consent Holder shall establish an ongoing programme to investigate the extent of inflow and infiltration within the wastewater network, and identify where specific inflow and infiltration remedial works are likely to reduce wastewater overflows.

48. The Consent Holder shall undertake specific inflow and infiltration remedial works identified through the wastewater network inflow and infiltration programme required under condition 47 within two years of the need for the specific remedial works being identified.

49. The Annual Network Performance Report required under condition 57 shall include reporting on the wastewater network inflow and infiltration programme and any specific remedial works.

Erosion Protection

50. The Consent Holder shall ensure that all *Type 1 Engineered Overflow Points* and their associated structures, where a discharge may cause scouring, incorporate operational erosion control measures.

51. The overflow structures associated with *Type 1 engineered overflow points* shall be inspected in accordance with the procedures set out in the Operation and Maintenance Procedures for the Conventional (Gravity) Wastewater Network (**Attachment 7**).

52. Following the inspection undertaken in accordance with condition 51, the Consent Holder shall undertake any necessary remediation works to ensure bank erosion and bed scour effects from overflows are minimised.

53. The Consent Holder shall make records relating to inspections undertaken in accordance with condition 51 available to the *Manager* upon request.

MONITORING AND REPORTING

Wastewater Network Performance

54. The Consent Holder shall ensure that the performance of the *Network* is monitored in accordance with condition 36b and provide the relevant records to the *Manager* upon request.

55. The Consent Holder shall give written notice to the *Manager* as soon as practicable after a *New Engineered Overflow Point* has been commissioned, but prior to the commencement of construction.

56. The Consent Holder shall, on an annual basis, update the Schedule of Engineered Overflow Points (**Attachment 2**) to identify the following:
    a. Any further *Engineered Overflow Points* identified by the Consent Holder within the *Existing Network* not already listed in **Attachment 2**. Once identified, these further *Engineered Overflow Points* become subject to this consent;
    b. Any *Engineered Overflow Points* that have been *decommissioned* and are no longer subject to this consent and are therefore to be deleted;
    c. Any *New Engineered Overflow Points* within the *Existing Network* authorised under conditions 24, 26 or 27;
    d. Any *New Engineered Overflow Points* within a *Future Network* authorised under conditions 30 or 31.
    e. Any *Engineered Overflow Points* previously authorised by another consent that has been included in this comprehensive discharge permit.

57. The Consent Holder shall provide an Annual Wastewater Network Performance Report to the *Manager* on 30 September of each year. This report shall provide the information specified in the Template for the Annual Network Performance Report (**Attachment 9)**, and include the annually updated version of **Attachment 2.**

Recreational and Ecological Effects

58. The Consent Holder shall undertake a targeted monitoring programme with the objective of confirming that the application of the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows in **Attachment 5** results in an appropriate assessment of recreational, public health and ecological effects.

59. The Consent Holder shall, within 12 months of this consent being granted, provide an outline monitoring plan setting out the scope, methodology, and

timing of the proposed targeted monitoring programme to the satisfaction of the *Manager* for approval.

60. On request of either the *Manager* or the Consent Holder, the Council may appoint an independent expert reviewer to undertake an assessment of the appropriateness of the outline monitoring plan.

61. The scope, methodology, and timing shall include:
    a. A methodology for collecting appropriate data on wastewater overflows, their characteristics and the changes (if any) caused in identified receiving environments.
    b. A methodology for analysing the data collected to ensure that the results are capable of achieving the targeted monitoring programme's objective.
    c. A description of how the monitoring design will take account of and integrate data from existing monitoring programmes undertaken by third parties (if any) to support spatial and temporal trend analysis and assessing the influence of other factors (not related to wastewater overflows).
    d. The expected timeframe over which the monitoring programme will be undertaken to achieve its objective, which must be a minimum of three years duration but not exceeding five years duration.

62. Following the conclusion of the targeted monitoring programme required under condition 58, the Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows in **Attachment 5** shall be revised (if necessary) to reflect the increased accuracy derived from the collected and analysed data.

63. The status of the targeted monitoring programme shall be reported in the Annual Network Performance Report required under condition 57.

Telemetry Monitoring Devices

64. The Consent Holder shall install telemetry devices for *Type 1 Overflow Points* in accordance with condition 36b) to measure occurrence, frequency and duration of overflows by February 2016, to enable the monitoring results to inform the 2017 *Wastewater Network Strategy* and subsequent reviews of the *Wastewater Network Strategy*.

INFORMATION

Provision of Information to the Public

65. The Consent Holder shall make the following information publicly available

and update this information when necessary:

a. General information on the wastewater network and material about undertaking works in the vicinity of wastewater pipes, to help prevent accidental damage that could result in wastewater discharges.
b. Information about wastewater and stormwater drainage, and the need and reasons for ensuring that service connections on properties drain into the appropriate system, including advice for property owners on how this can be achieved.
c. General information for private property owners who believe they may have cross connections about how they can test for this and rectify it.
d. Information about the general function and operation of the wastewater network, including information about the nature of wet weather wastewater overflows and information directed at raising awareness about the potential effects on the receiving environment.
e. Information about the location of *Engineered Overflow Points* that are known to discharge at high volume more than 12 times per year, and the risk of contact recreation at these locations following periods of heavy rain.

66. The Annual Network Performance Report required under condition 57 shall include an overview of the information provided, including whether any updates have occurred and how the information was made available.

REVIEW

67. The Auckland Council may review the conditions of this consent pursuant to section 128 of the RMA, by giving notice pursuant to section 129 of the RMA, five years after commencement of this consent, and thereafter not more frequently than five years, in order to deal with any significant adverse effect on the environment that may arise from the exercise of the consent and that was not apparent at the time of the granting of the consent, or to enable water quality standards set by a rule in an operative Unitary Plan to be met.

68. Auckland Council may, every 12 months after the date of the commencement of this consent, serve notice on the Consent Holder under section 128(1)(a)(i) and/or (iii) of the RMA to review the conditions of this consent, to ensure the conditions of this consent adequately address any adverse effects that are the subject of specific conditions in either a privately held consent within the Existing or Future Network that has been transferred to the Consent Holder, or other resource consents obtained by the Consent Holder that the Consent Holder wishes to include as part of this Comprehensive Wastewater Network Discharge Permit.

ADMINISTRATIVE CHARGES

69. The consent holder shall pay the Council's full and reasonable costs in carrying out its functions in terms of certification and monitoring under this consent. The consent holder shall pay the appropriate Council time charge for professional and management staff involved in exercising the functions under this consent.

LIST OF ATTACHMENTS

Attachment 1: Maps of the *Existing Network* and *Indicative Future Urban Areas*, current in February 2014

Attachment 2: Schedule of *Engineered Overflow Points* in the *Existing Network*, current in February 2014

Attachment 3: *Best Practicable Option* (BPO) Methodology

Attachment 4: Methodology for Prioritising Catchments and Wastewater Network Improvement Works

Attachment 5: Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows

Attachment 6: Matters to be addressed in the Wastewater Network Strategy

Attachment 7: Operation and Maintenance Procedures for the Conventional (Gravity) Wastewater Network

Attachment 8: The Wastewater Overflow Regional Response Manual

Attachment 9: Template for the Annual Network Performance Report

Attachment 10: Definitions

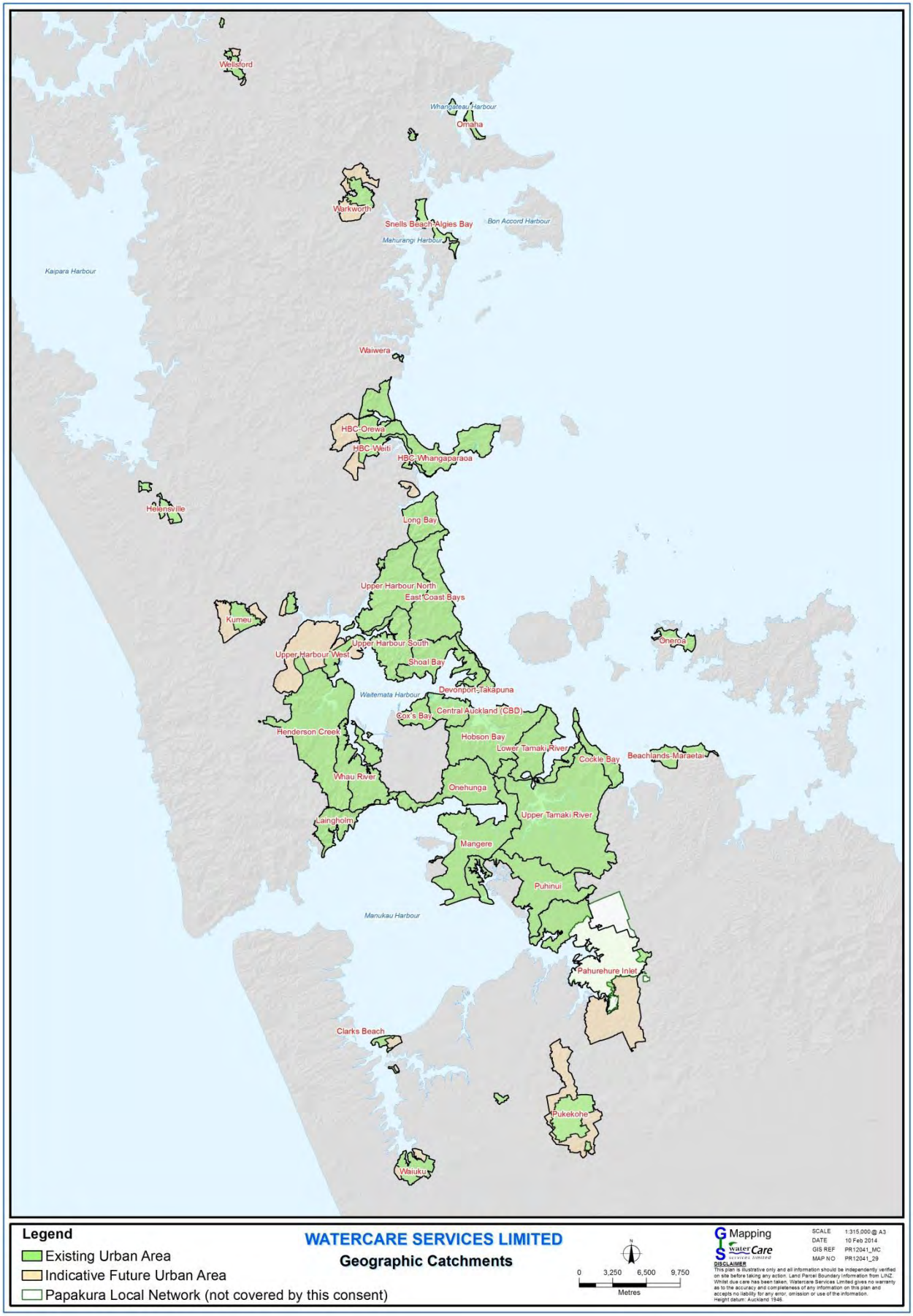
Attachment 11: Uncontrolled Overflows to Private Property, current in February 2014

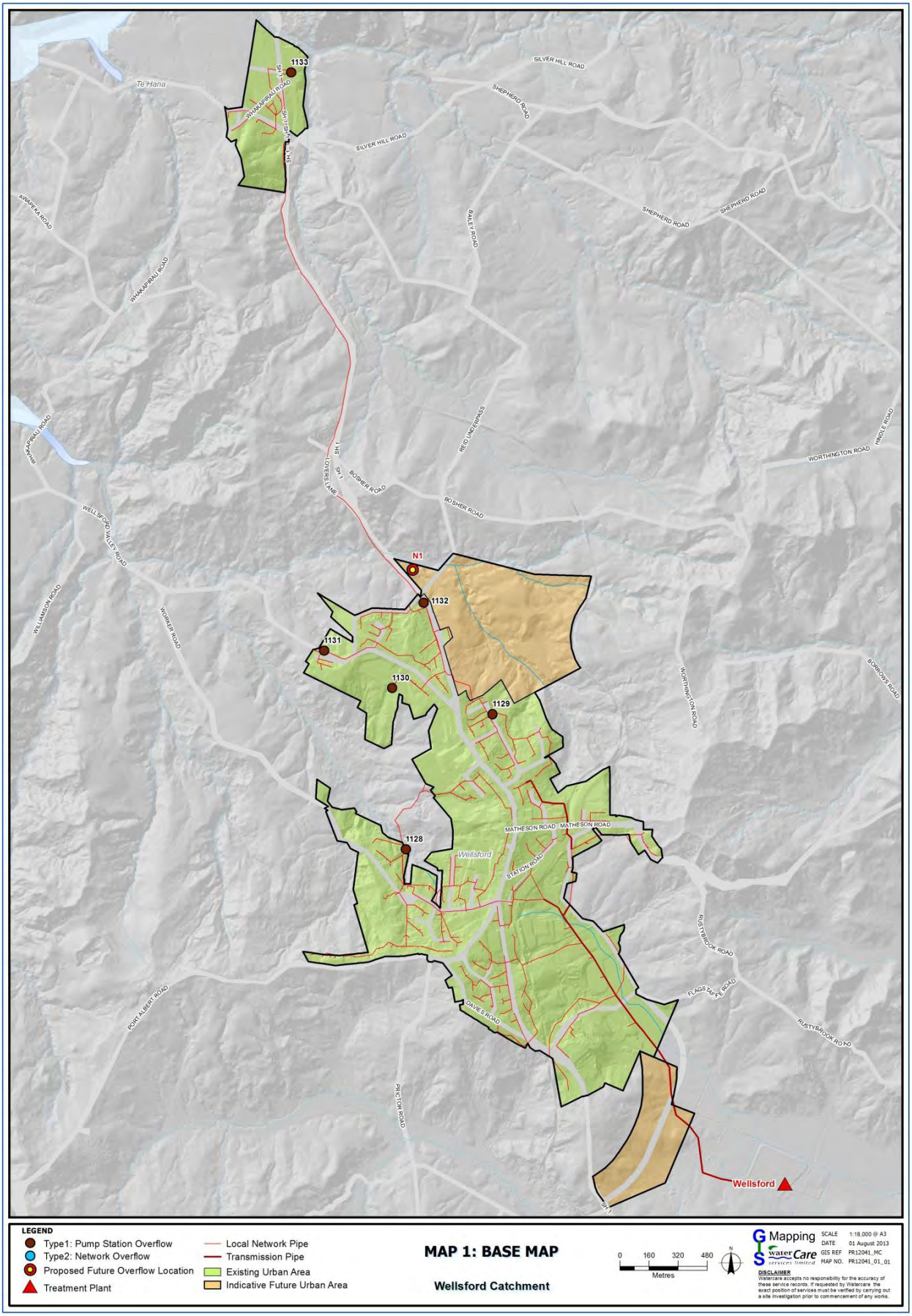
Attachment 12: Auckland-wide Wastewater Network Discharge Consent Application – Generic Assessment of Ecological and Recreational Effects (NIWA, April 2013)

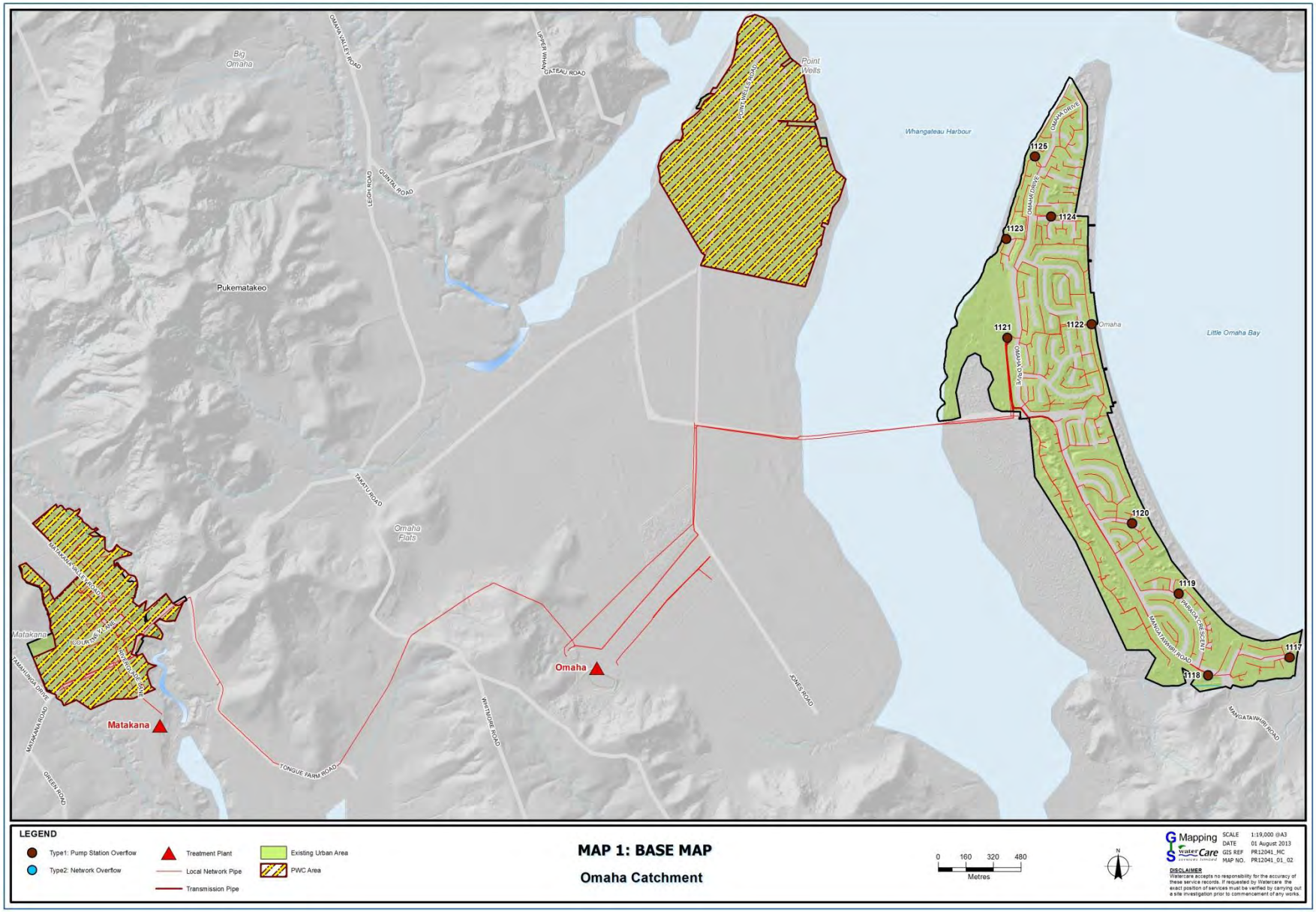
Greg Hill (Chair) for the Commissioners: **Mr Greg Hill and** **Mr William Kapea** **Independent Commissioners**	Date 17th June 2014

Attachment 1:
Maps of the Existing Network and Indicative Future Urban Areas

[current in February 2014]


Wellsford
Whangateau Harbour
Omaha
Warkworth
Snells Beach
Algies Bay
Bon Accord Harbour
Mahurangi Harbour
Kaipara Harbour
Waiwera
HBC-Orewa
HBC-Weiti
HBC-Whangaparaoa
Helensville
Long Bay
Upper Harbour North
East Coast Bays
Kumeu
Upper Harbour South
Upper Harbour West
Shoal Bay
Devonport-Takapuna
Waitemata Harbour
Central Auckland (CBD)
Cox's Bay
Henderson Creek
Hobson Bay
Lower Tamaki River
Cockle Bay
Beachlands-Maraetai
Whau River
Onehunga
Upper Tamaki River
Laingholm
Mangere
Puhinui
Manukau Harbour
Pahurehure Inlet
Clarks Beach
Pukekohe
Waiuku
Legend
Existing Urban Area
Indicative Future Urban Area
Papakura Local Network (not covered by this consent)
WATERCARE SERVICES LIMITED
Geographic Catchments
N
0 3,250 6,500 9,750
Metres
Mapping
Watercare Services Limited
SCALE 1:315,000 @ A3
DATE 10 Feb 2014
GIS REF PR12041_MC
MAP NO PR12041_29
DISCLAIMER
This plan is illustrative only and all information should be independently verified on site before taking any action. Land Parcel Boundary Information from LINZ. Whilst due care has been taken, Watercare Services Limited gives no warranty as to the accuracy and completeness of any information on this plan and accepts no liability for any error, omission or use of the information.
Height datum: Auckland 1946.


1133
1132
1131
1130
1129
1128
N1
Te Hana
SILVER HILL ROAD
SHEPHERD ROAD
BAILEY ROAD
REID UNDERPASS
BOSHER ROAD
LOVERS LANE
WORTHINGTON ROAD
HINDLE ROAD
WORKNER ROAD
WILLIAMSON ROAD
WELLSFORD VALLEY ROAD
MATHESON ROAD
STATION ROAD
Wellsford
RUSTYBROOK ROAD
FLAGSTAFF ROAD
DAVIES ROAD
PORT ALBERT ROAD
PRICTOR ROAD
Wellsford
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
Indicative Future Urban Area
MAP 1: BASE MAP
Wellsford Catchment
0 160 320 480
Metres
Mapping
Water Care services limited
SCALE 1:18,000 @ A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_01
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Big Omaha
OMAHA VALLEY ROAD
UPPER WHANGATEAU ROAD
Point Wells
POINT WELLS ROAD
Whangateau Harbour
OMAHA DRIVE
1125
1124
1123
LEIGH ROAD
QUINTAL ROAD
Pukematakeo
1121
1122
Omaha
Little Omaha Bay
OMAHA CREEK
TAMATI ROAD
Omaha Flats
1120
1119
PAKIAKA CRESCENT
MANGATAWHIRI ROAD
1117
1118
Matakana
MATAKANA ISLAND ROAD
MATAKANA VALLEY ROAD
TAMARIMOA DRIVE
MATAKANA ROAD
GREEN ROAD
TONGUE FARM ROAD
WHITMORE ROAD
JONES ROAD
Omaha
Matakana
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
PWC Area
MAP 1: BASE MAP
Omaha Catchment
0 160 320 480
Metres
N
GIS Mapping
Watercare services limited
SCALE 1:19,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_02
DISCLAIMER
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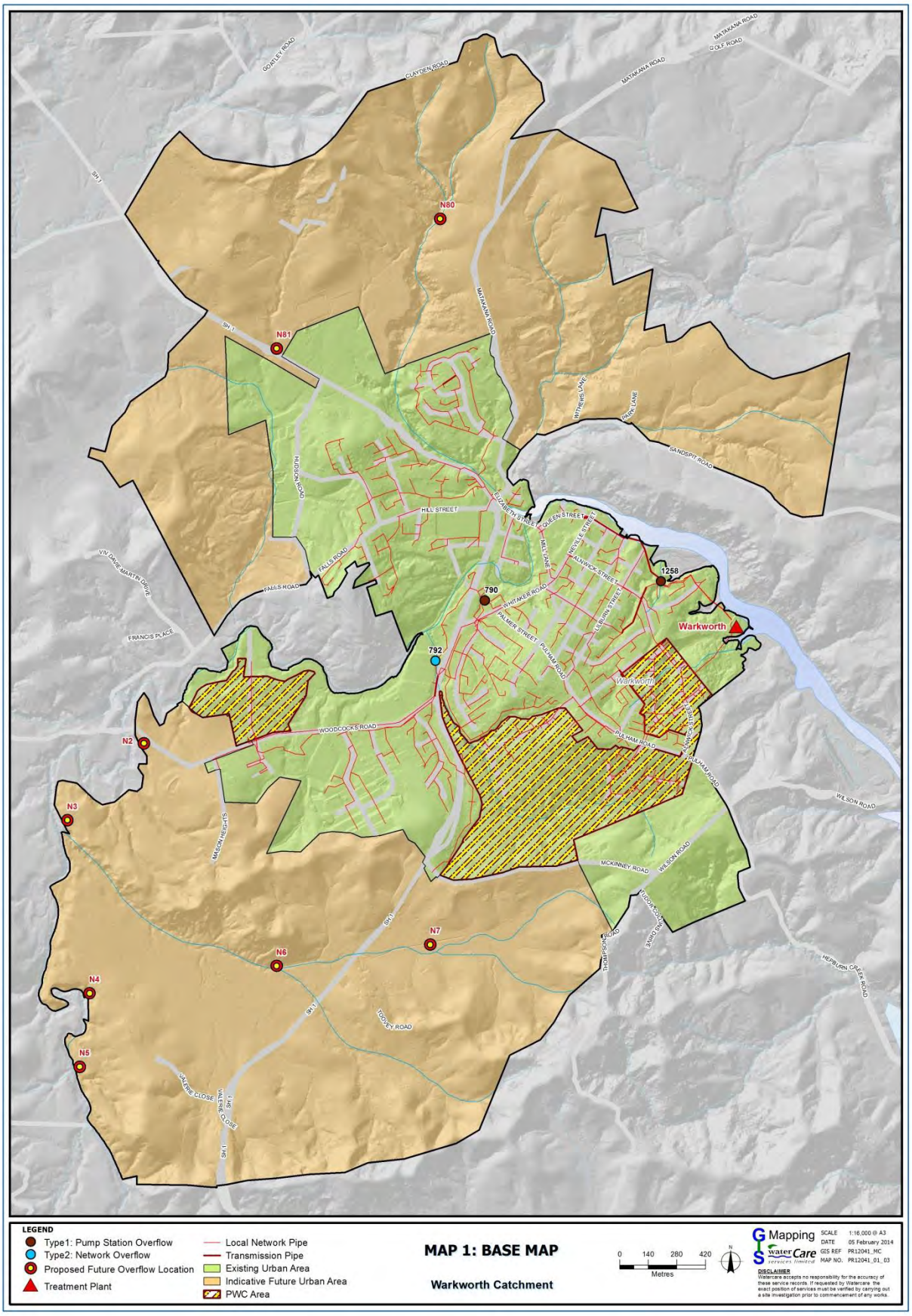
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
Indicative Future Urban Area
PWC Area
MAP 1: BASE MAP
Warkworth Catchment
0 140 280 420
Metres
N
Mapping
watercare services limited
SCALE 1:16,000 @ A3
DATE 05 February 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_03
DISCLAIMER
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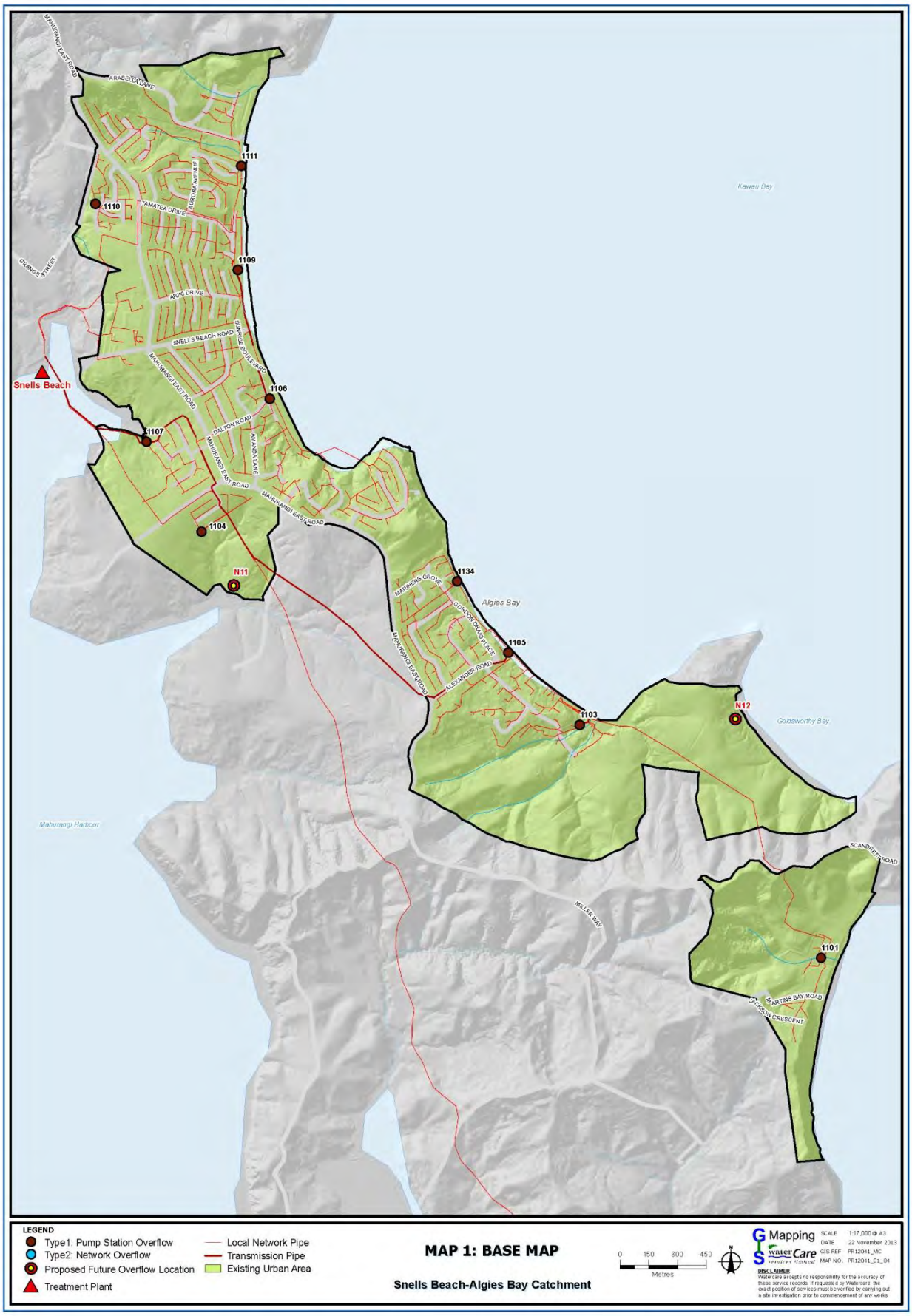
N80
N81
N2
N3
N4
N5
N6
N7
790
792
1258
Warkworth
CLAYDEN ROAD
GOATLEY ROAD
MATAKANA ROAD
GOLF ROAD
SH1
HUDSON ROAD
FALLS ROAD
HILL STREET
QUEEN STREET
ELIZABETH STREET
MILL LANE
NEVILLE STREET
ALNWICK STREET
WHITAKER ROAD
PALMER STREET
PULHAM ROAD
WITHELS LANE
PARK LANE
SANDSPIT ROAD
VW DRIVE MARTIN DRIVE
FRANCIS PLACE
WOODCOCKS ROAD
MAKORA HEIGHTS
MCKINNEY ROAD
WILSON ROAD
THOMPSONS ROAD
TOOLEY ROAD
HEPBURN CREEK ROAD
VALERIE CLOSE
LINKS VIEW CLOSE


Snells Beach
1111
1110
1109
1106
1107
1104
N11
1134
1105
1103
N12
1101
Kawau Bay
Algies Bay
Goldsworthy Bay
Mahurangi Harbour
ARABELLA LANE
TAMATEA DRIVE
AURORA AVENUE
ARIKI DRIVE
SNELLS BEACH ROAD
SUNRISE BOULEVARD
MAHURANGI EAST ROAD
DALTON ROAD
AMANDA LANE
MAHURANGI BAY ROAD
MARINERS GROVE
GORDON CRAIG PLACE
ALEXANDER ROAD
SCANDRETT ROAD
MILLER WAY
MARTINS BAY ROAD
JACKSON CRESCENT
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Snells Beach-Algies Bay Catchment
0 150 300 450
Metres
GIS Mapping
Watercare Services Limited
SCALE 1:17,000 @ A3
DATE 22 November 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_04
DISCLAIMER
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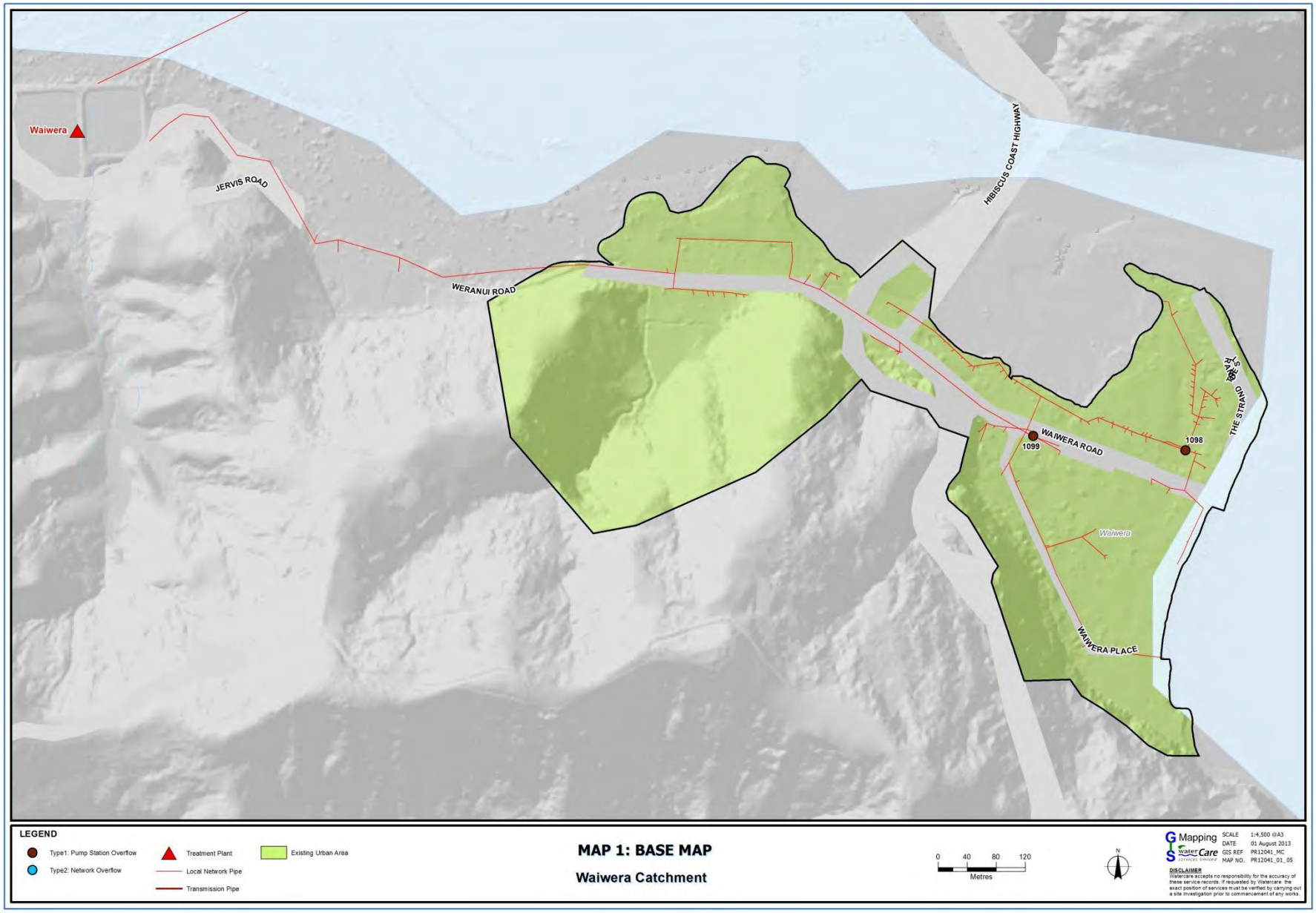
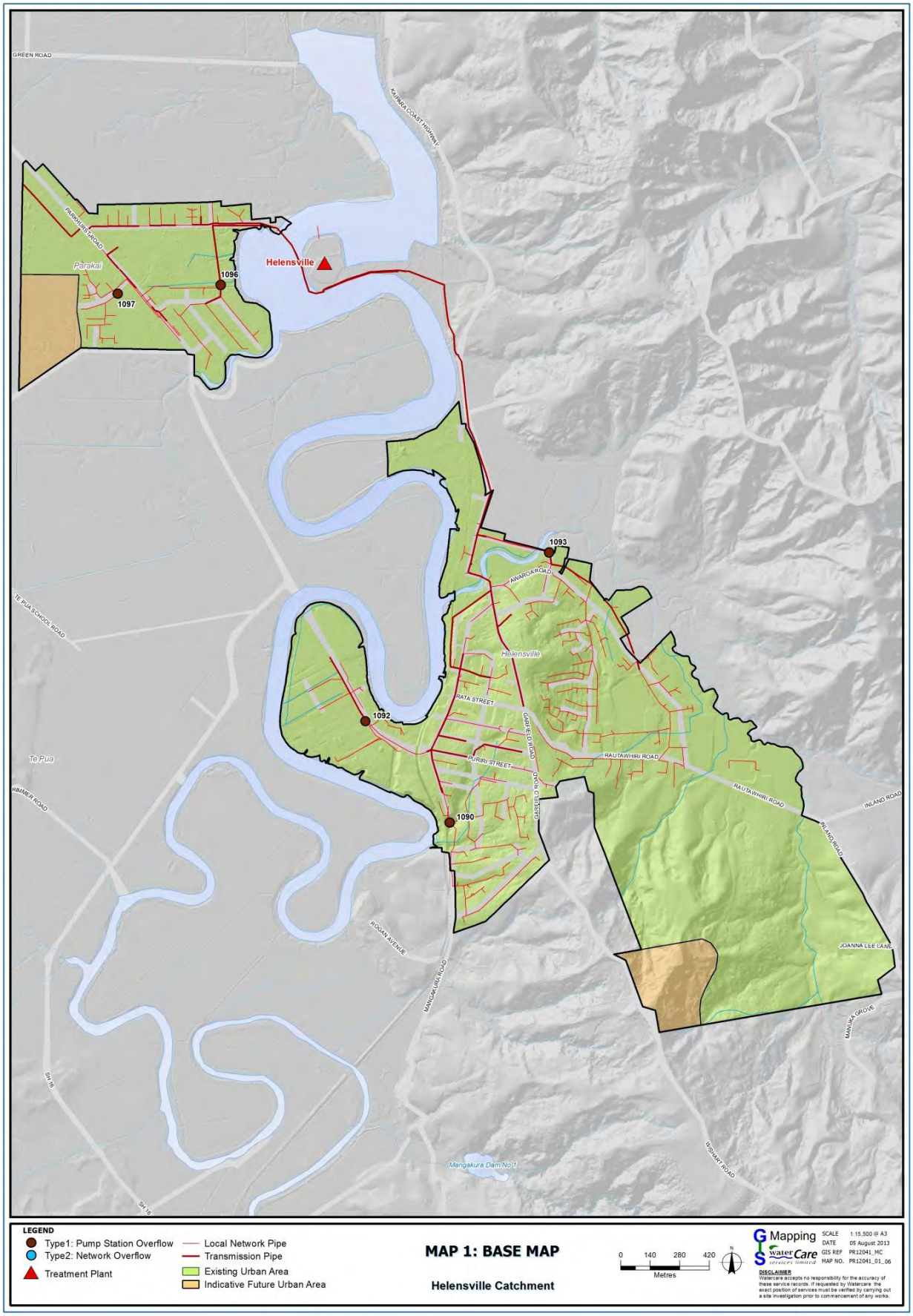
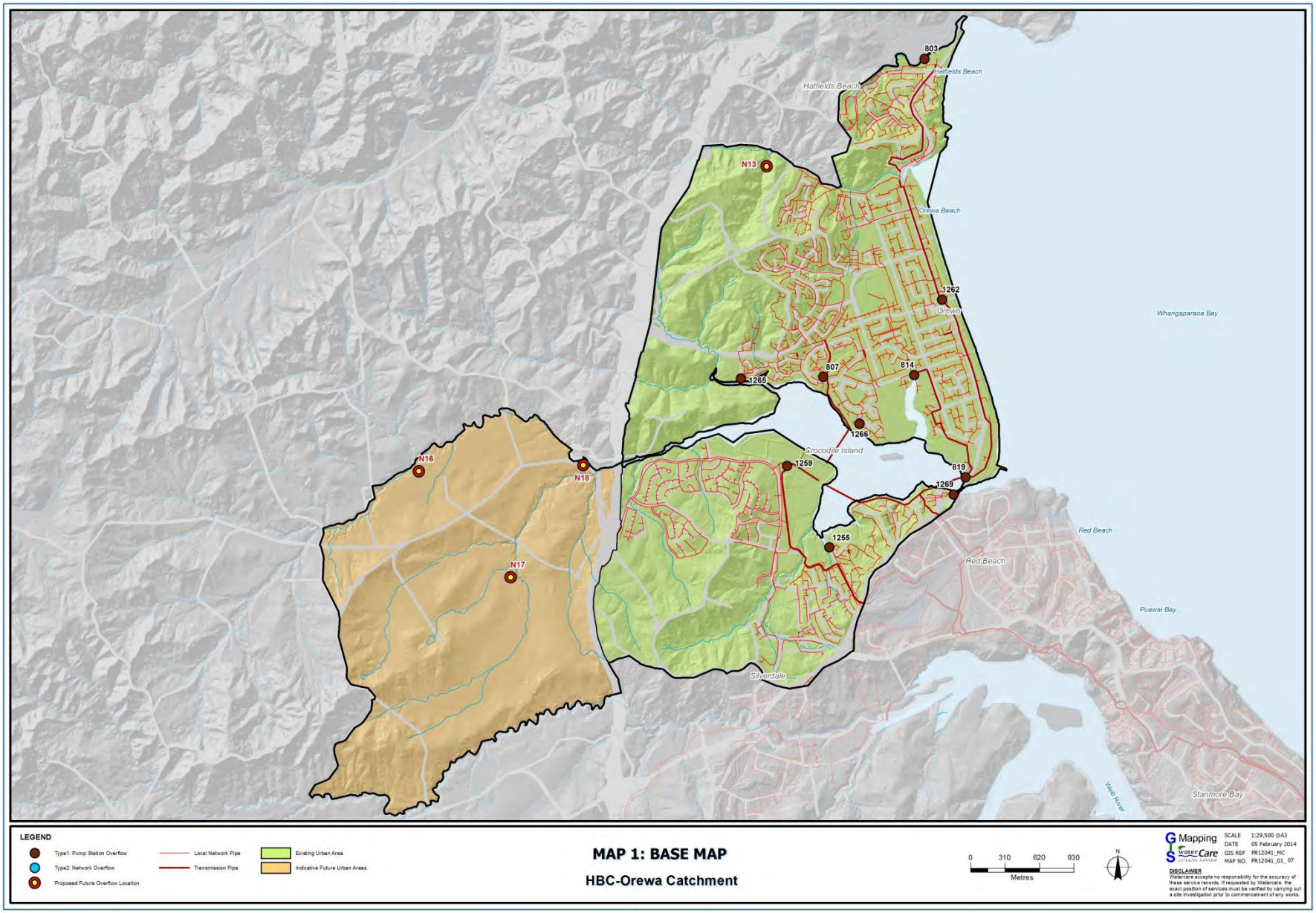
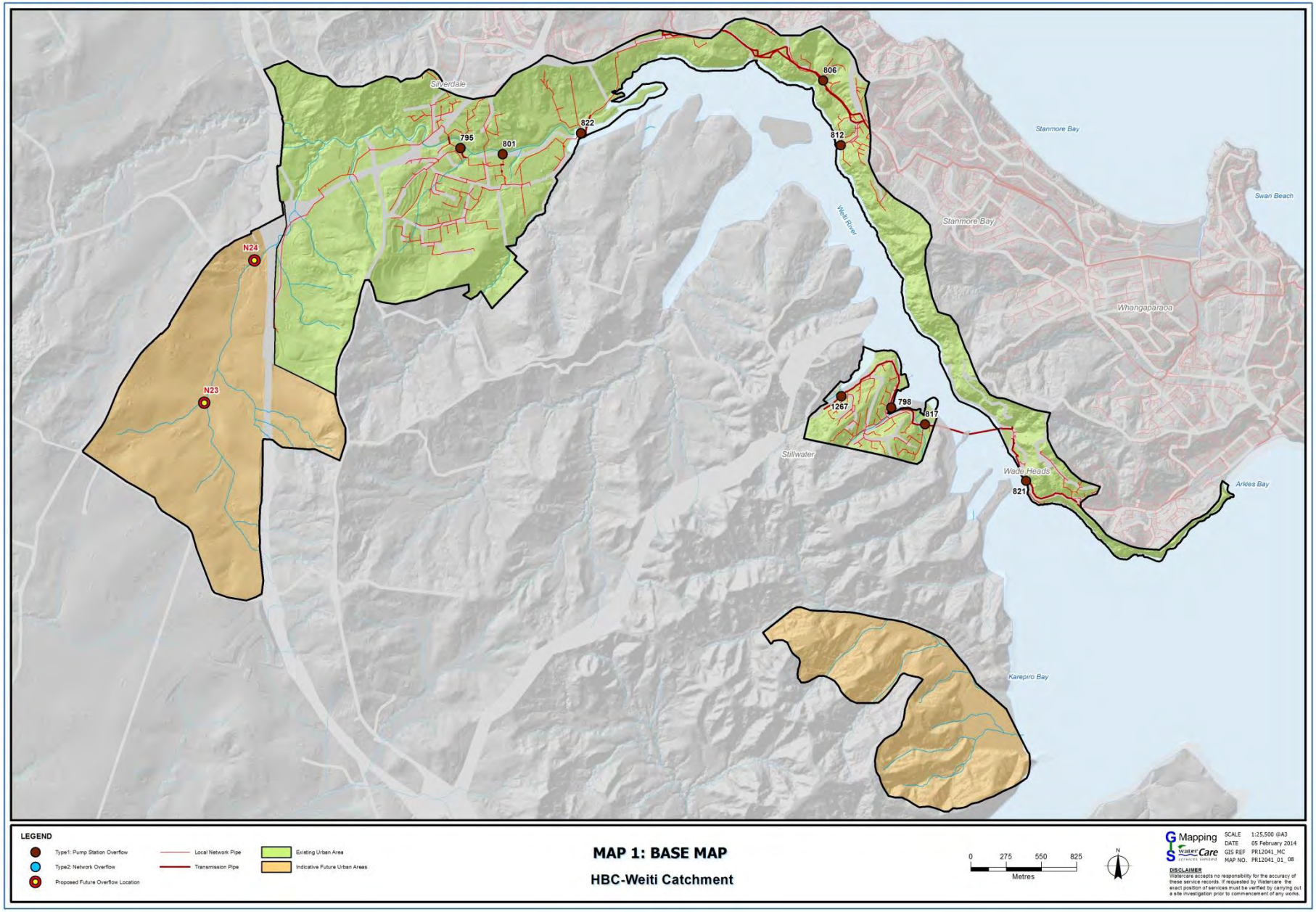

Waiwera
JERVIS ROAD
WERANUI ROAD
HIBISCUS COAST HIGHWAY
WAIWERA ROAD
1099
1098
THE STRAND
Waiwera
WAIWERA PLACE
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Waiwera Catchment
0 40 80 120
Metres
N
Mapping
Water Care
SCALE 1:4,500 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_05
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


GREEN ROAD
KAIPARA COAST HIGHWAY
PARKHILL ROAD
Parakai
1096
1097
Helensville
1093
AWAROA ROAD
Helensville
RATA STREET
1092
GARFIELD ROAD
PURIRI STREET
RAUTAWHIRI ROAD
1090
INLAND ROAD
PLAND ROAD
JOANNA LEE LANE
MANUKA GROVE
TE PUA SCHOOL ROAD
Te Pua
HAMMER ROAD
ROGAN AVENUE
MANGAKURA ROAD
SH 16
W SMART ROAD
Mangakura Dam No 1
SH 16
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
Indicative Future Urban Area
MAP 1: BASE MAP
Helensville Catchment
0 140 280 420
Metres
N
GIS Mapping
Water Care services limited
SCALE 1:15,500 @ A3
DATE 05 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_06
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


803
Hatfields Beach
N13
Orewa Beach
1262
Orewa
Whangaparaoa Bay
807
814
1265
1266
Crocodile Island
N16
N18
1259
819
1269
1255
Red Beach
N17
Red Beach
Puaiwai Bay
Silverdale
Weiti River
Stanmore Bay
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Local Network Pipe
Transmission Pipe
Existing Urban Area
Indicative Future Urban Areas
MAP 1: BASE MAP
HBC-Orewa Catchment
0 310 620 930
Metres
N
Mapping
Watercare services limited
SCALE 1:29,500 @A3
DATE 05 February 2014
GIS REF PR12041_HC
MAP NO. PR12041_01_07
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Silverdale
Stanmore Bay
Swan Beach
Stanmore Bay
Whangaparaoa
Weiti River
Stillwater
Wade Heads
Arkles Bay
Karepiro Bay
806
812
822
795
801
N24
N23
1267
798
817
821
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Local Network Pipe
Transmission Pipe
Existing Urban Area
Indicative Future Urban Areas
MAP 1: BASE MAP
HBC-Weiti Catchment
0 275 550 825
Metres
N
Mapping
watercare services limited
SCALE 1:25,500 @A3
DATE 05 February 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_08
DISCLAIMER
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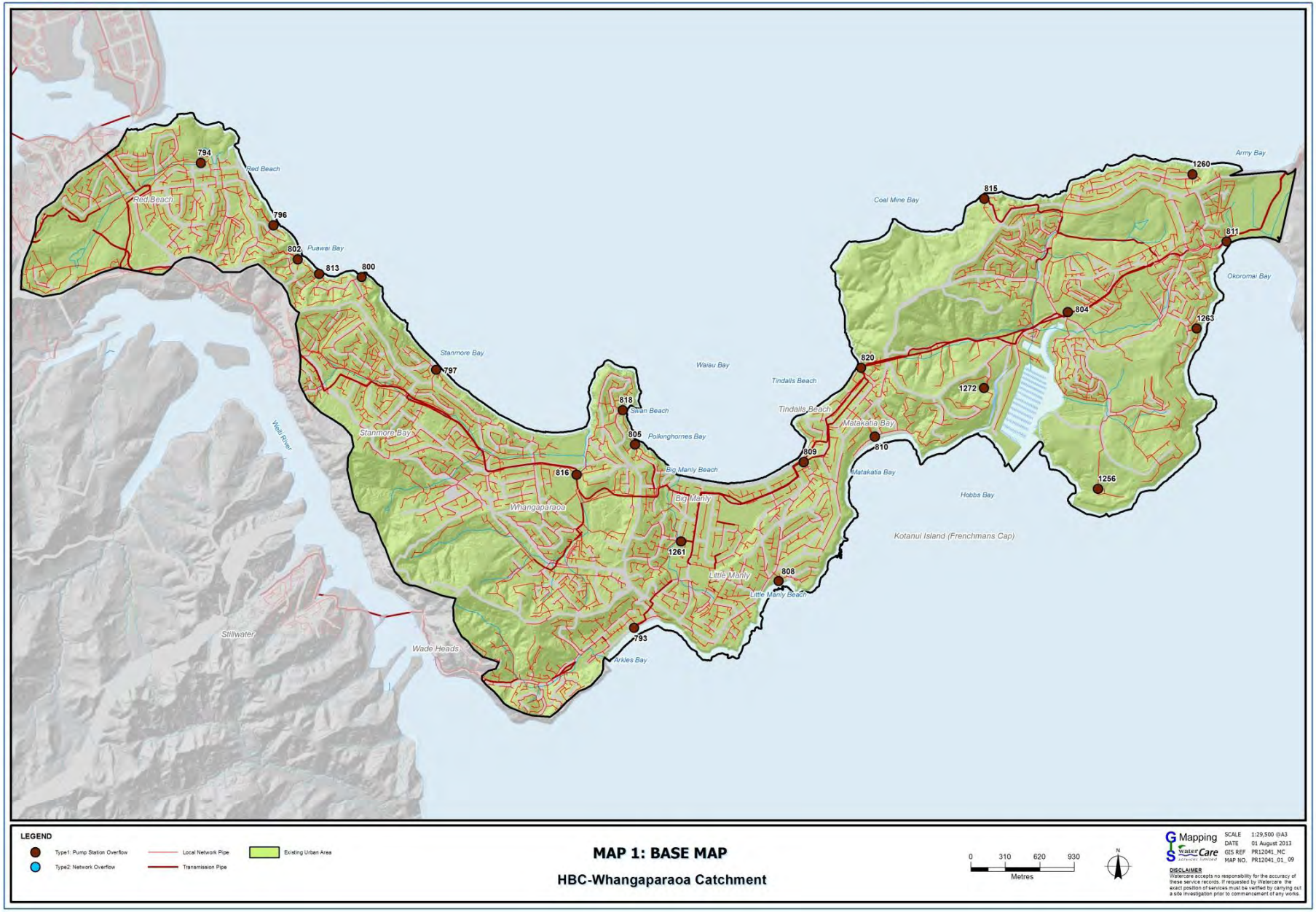
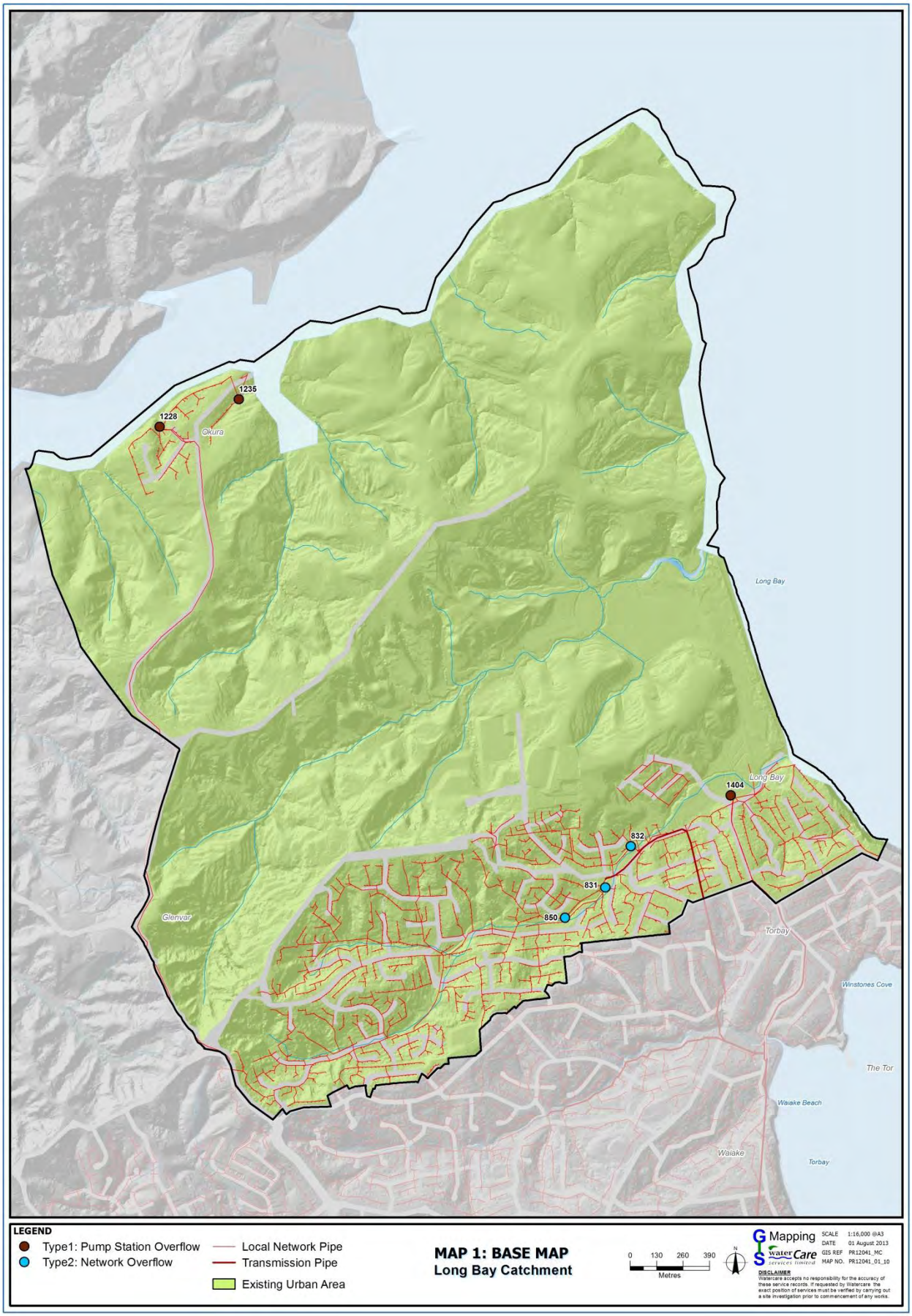
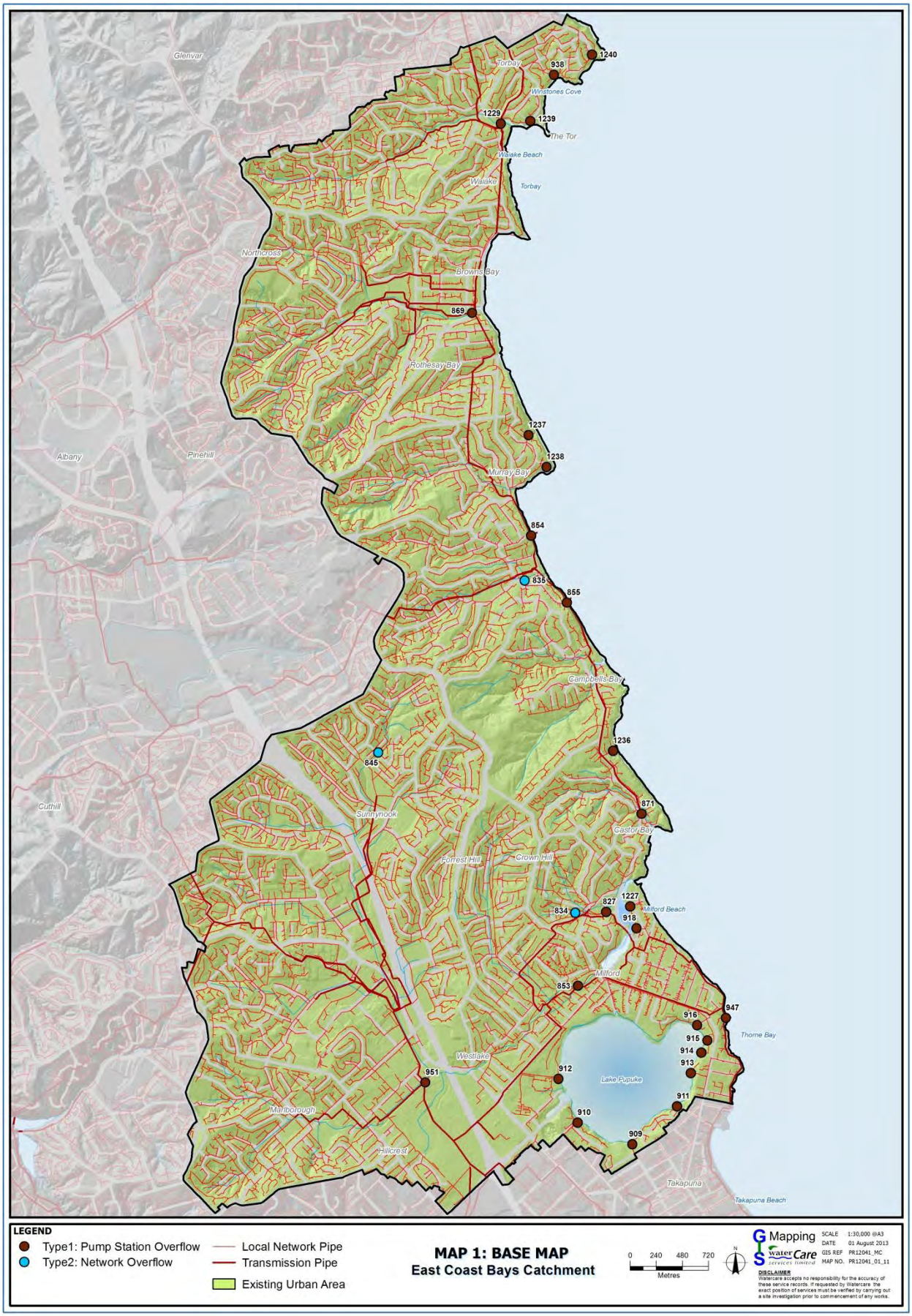
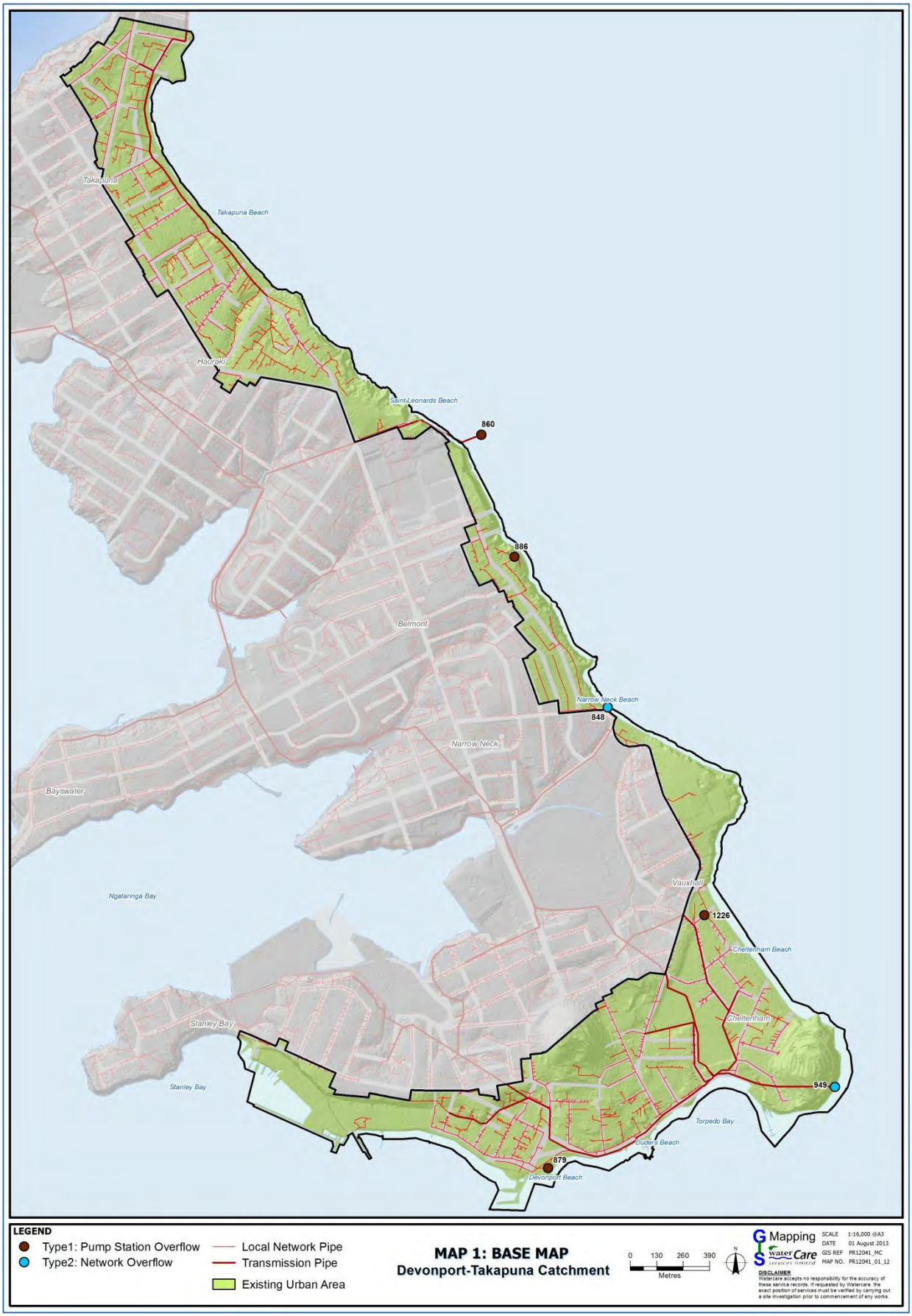
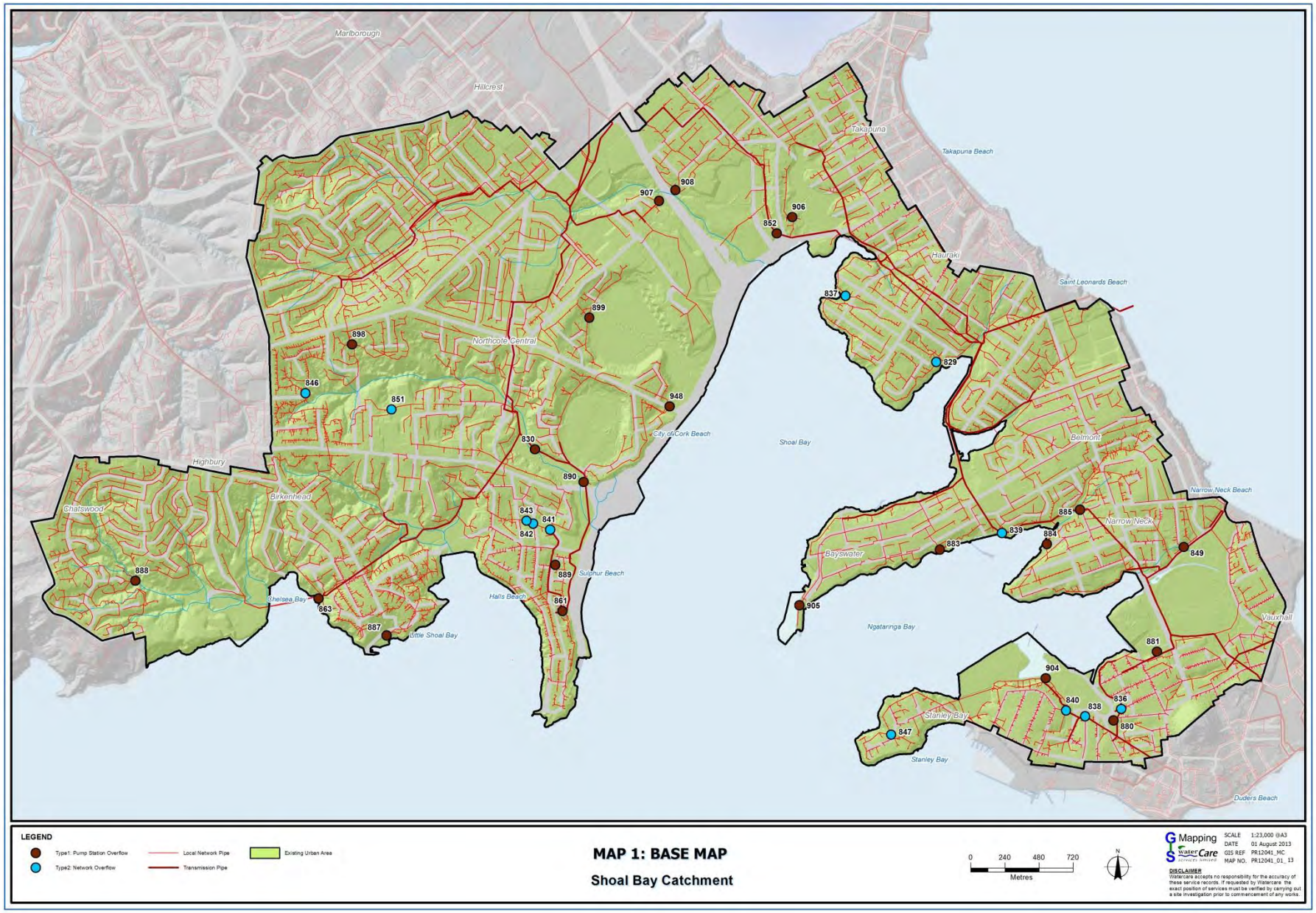
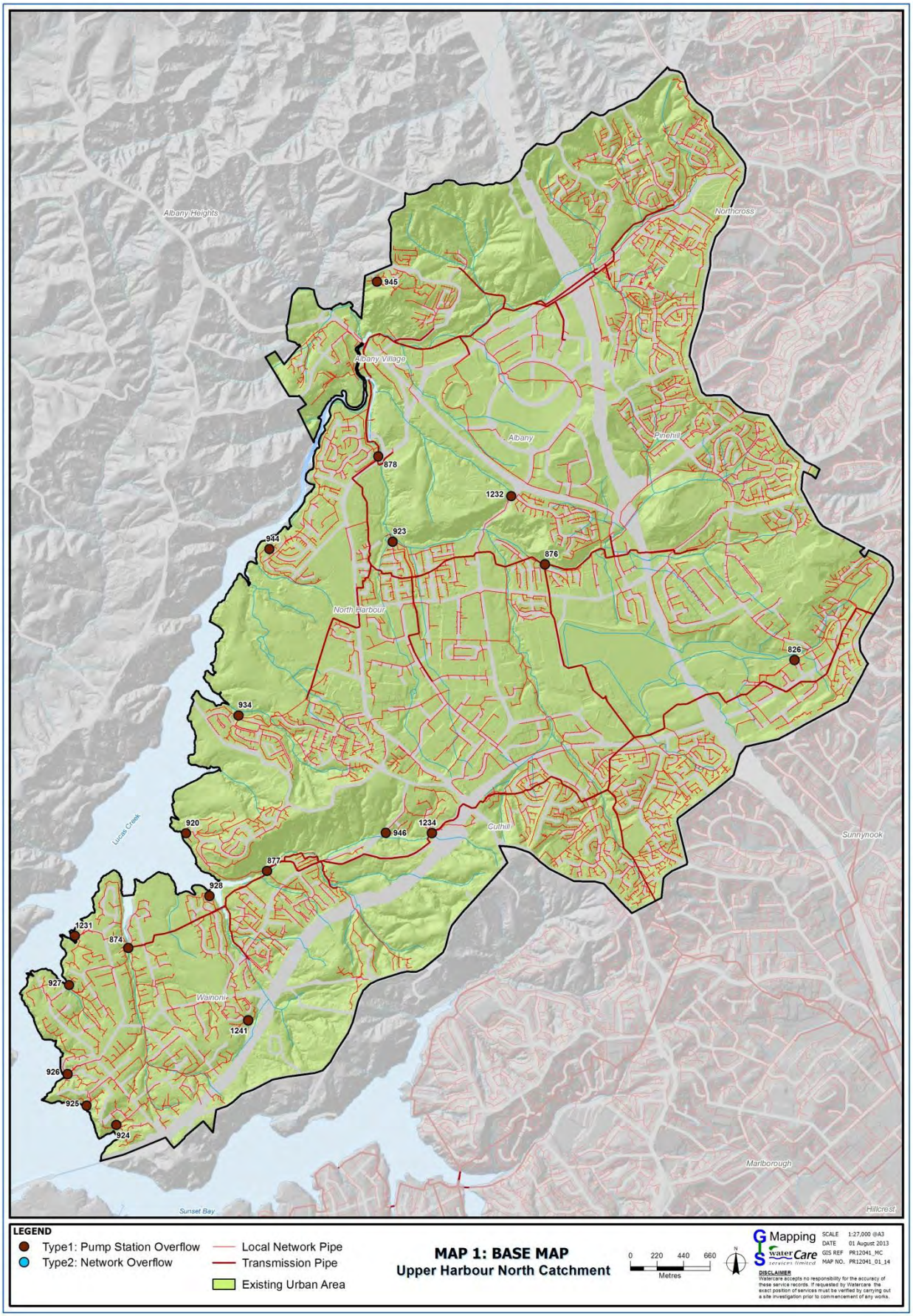

794
Red Beach
Red Beach
796
802
Puawai Bay
813
800
Stanmore Bay
797
Stanmore Bay
Waiau Bay
Tindalls Beach
818
Swan Beach
Tindalls Beach
Matakatia Bay
805
Polkinghornes Bay
809
810
816
Big Manly Beach
Matakatia Bay
Big Manly
Hobbs Bay
Whangaparaoa
1261
Kotanui Island (Frenchmans Cap)
Little Manly
808
Little Manly Beach
793
Arkles Bay
Wade Heads
Stillwater
Weiti River
Army Bay
1260
815
Coal Mine Bay
811
Okoromai Bay
804
1263
820
1272
1256
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
HBC-Whangaparaoa Catchment
0
310
620
930
Metres
N
GIS Mapping
Watercare Services Limited
SCALE 1:29,500 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_09
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.

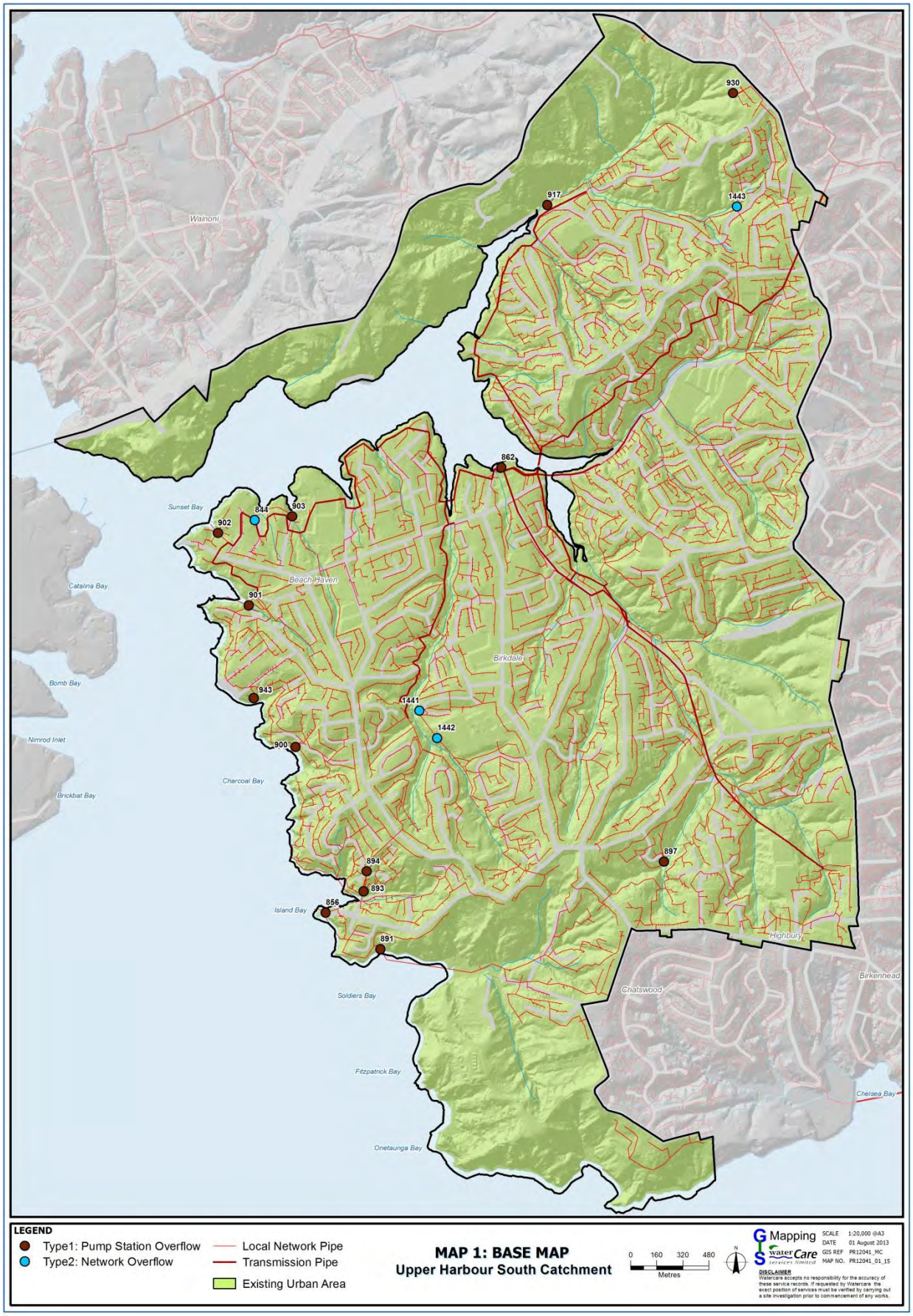

1235
1228
Okura
Long Bay
1404
Long Bay
832
831
850
Glenvar
Torbay
Winstones Cove
The Tor
Waiake Beach
Waiake
Torbay
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Long Bay Catchment
0 130 260 390
Metres
N
Mapping
WaterCare services limited
SCALE 1:16,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_10
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Glenvar
Torbay
1240
938
Winstones Cove
1229
1239
The Tor
Waiake Beach
Waiake
Torbay
Northcross
Browns Bay
869
Rothesay Bay
1237
Albany
Pinehill
1238
Murray Bay
854
835
855
Campbells Bay
1236
845
Cuthill
Sunnynook
871
Castor Bay
Forrest Hill
Crown Hill
1227
827
Milford Beach
834
918
Milford
853
947
916
Thorne Bay
915
914
913
Westlake
951
912
Lake Pupuke
911
Marlborough
910
909
Hillcrest
Takapuna
Takapuna Beach
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
East Coast Bays Catchment
0 240 480 720
Metres
N
GIS Mapping
WaterCare services limited
SCALE 1:30,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_11
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Takapuna
Takapuna Beach
Hauraki
Saint Leonards Beach
860
886
Belmont
Narrow Neck Beach
848
Narrow Neck
Bayswater
Ngataringa Bay
Vauxhall
1226
Cheltenham Beach
Cheltenham
Stanley Bay
Stanley Bay
949
Torpedo Bay
Ducks Beach
879
Devonport Beach
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Devonport-Takapuna Catchment
0 130 260 390
Metres
N
GIS Mapping
Watercare Services Limited
SCALE 1:16,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_12
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Marlborough
Hillcrest
Takapuna
Takapuna Beach
Hauraki
Saint Leonards Beach
Northcote Central
City of Cork Beach
Shoal Bay
Belmont
Highbury
Birkenhead
Chatswood
Narrow Neck Beach
Narrow Neck
Bayswater
Sulphur Beach
Halls Beach
Chelsea Bay
Little Shoal Bay
Ngataringa Bay
Vauxhall
Stanley Bay
Duders Beach
907
908
906
852
837
899
898
846
851
948
829
830
890
843
841
842
889
861
863
887
888
839
884
883
885
849
905
881
904
840
838
836
880
847
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Shoal Bay Catchment
0 240 480 720
Metres
N
Mapping
WaterCare
SCALE 1:23,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_13
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Albany Heights
Northcross
945
Albany Village
Albany
Pinehill
878
1232
923
944
876
North Harbour
826
934
Lucas Creek
920
946
1234
Cuthill
Sunnynook
877
926
1231
874
927
Waiwhiri
1241
926
925
924
Marlborough
Sunset Bay
Hillcrest
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Upper Harbour North Catchment
0 220 440 660
Metres
N
Mapping
waterCare services limited
SCALE 1:27,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_14
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


930
917
1443
Waiheke
862
Sunset Bay
844
903
902
Beach Haven
Catalina Bay
901
Birkdale
Bomb Bay
943
1441
1442
Nimrod Inlet
900
Charcoal Bay
Brickbat Bay
897
894
893
856
Island Bay
891
Highbury
Birkenhead
Chatswood
Soldiers Bay
Fitzpatrick Bay
Chelsea Bay
Onetaunga Bay
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Upper Harbour South Catchment
0 160 320 480
Metres
N
GIS Mapping
watercare services limited
SCALE 1:20,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_15
DISCLAIMER
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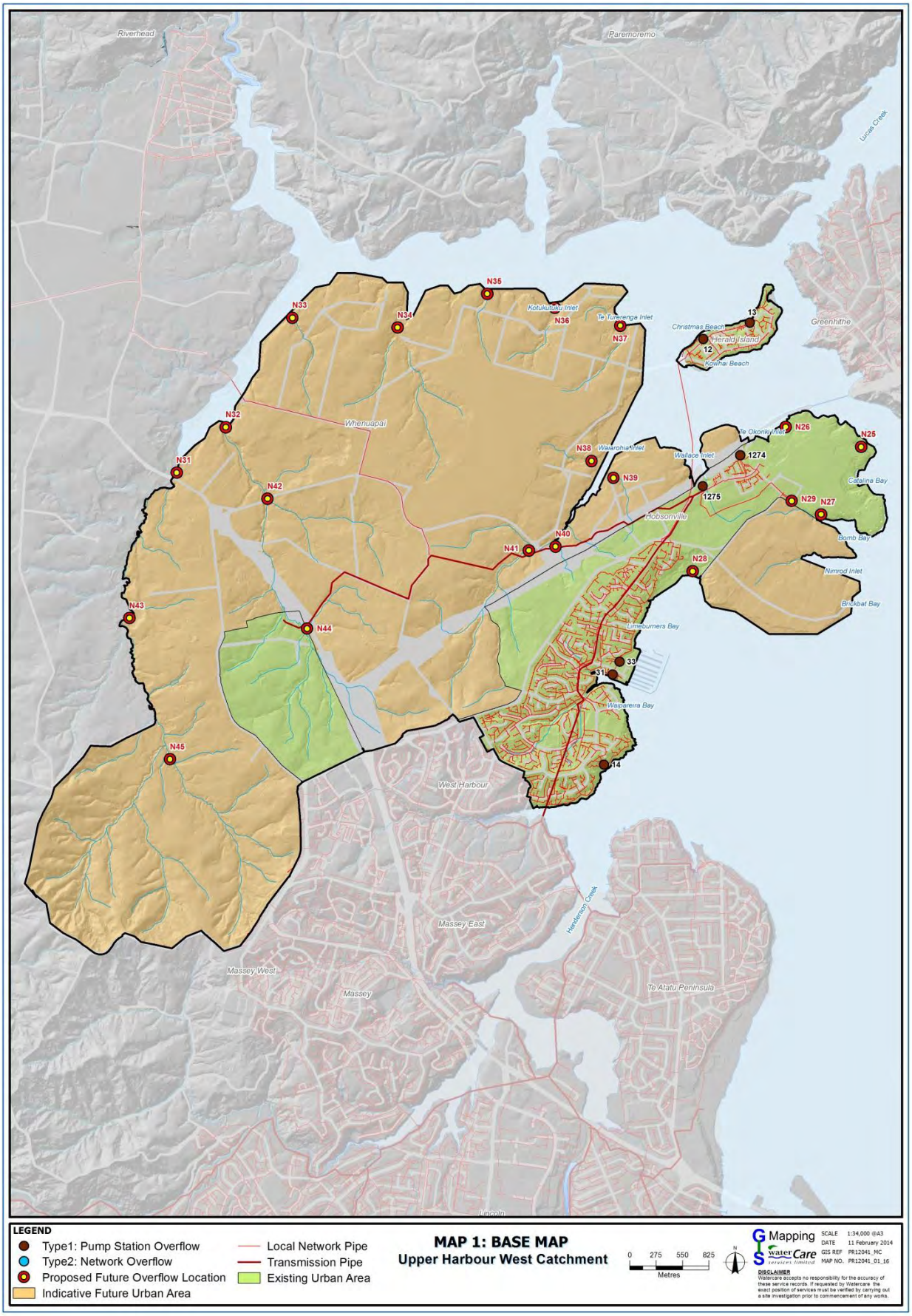
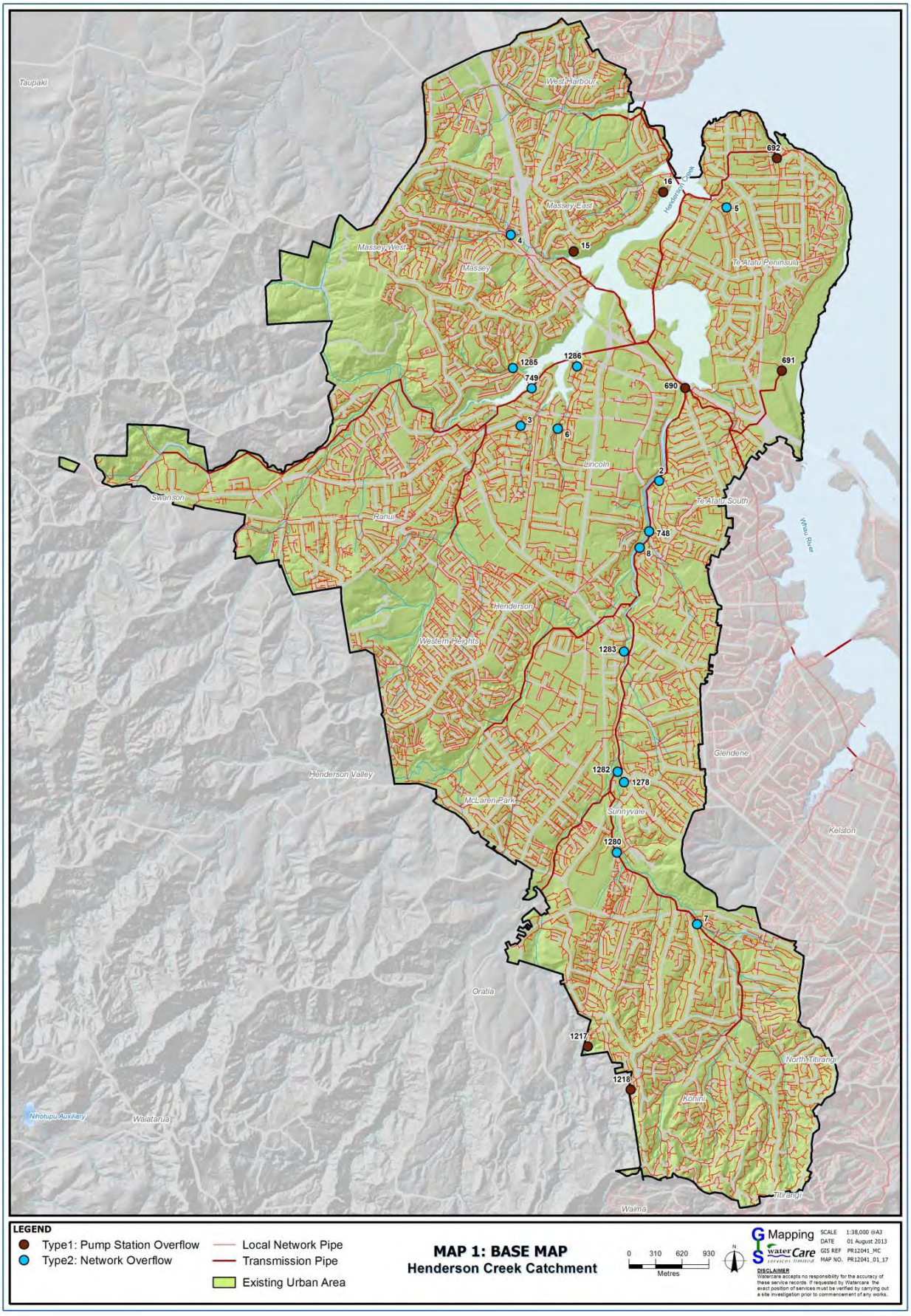
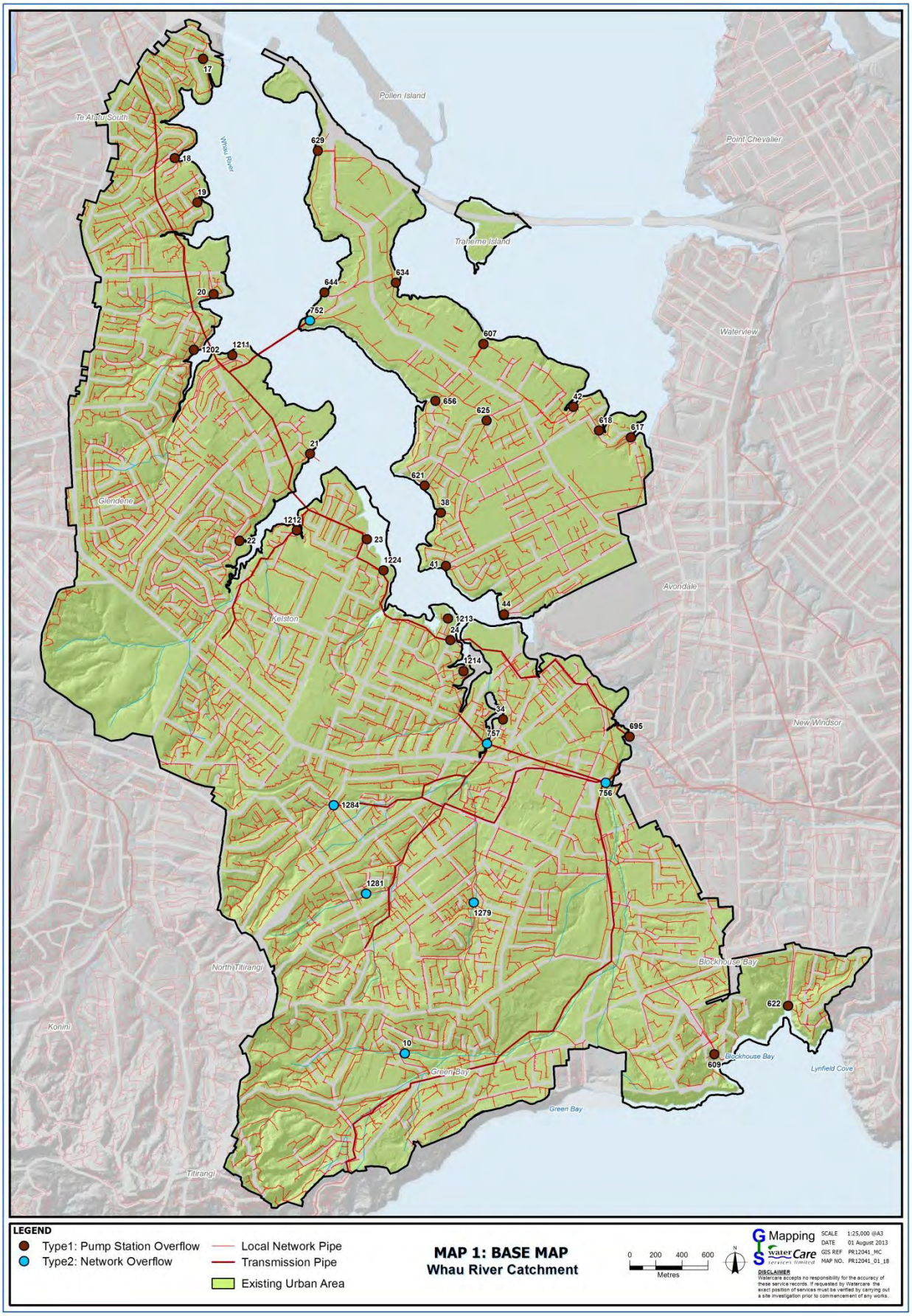
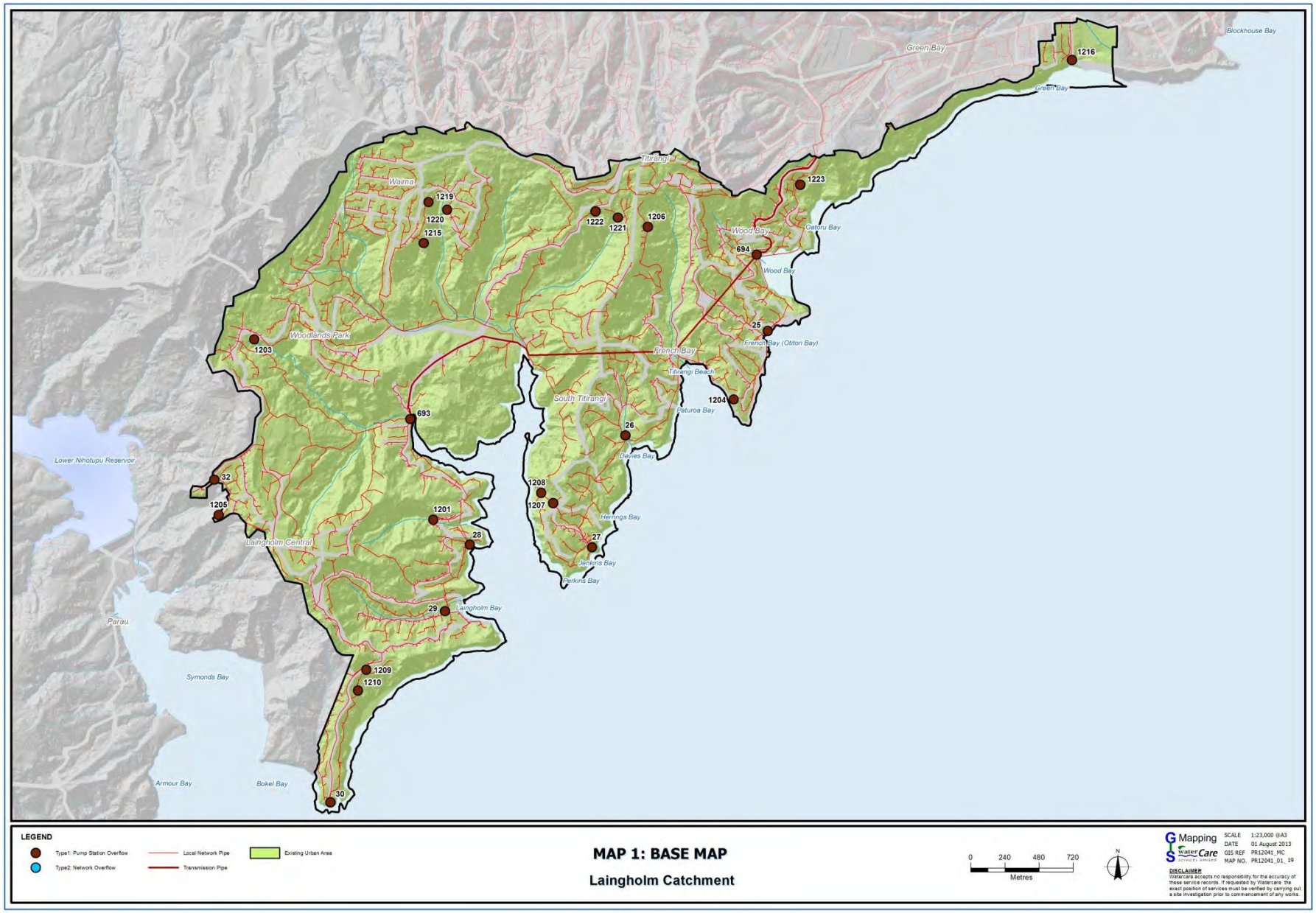
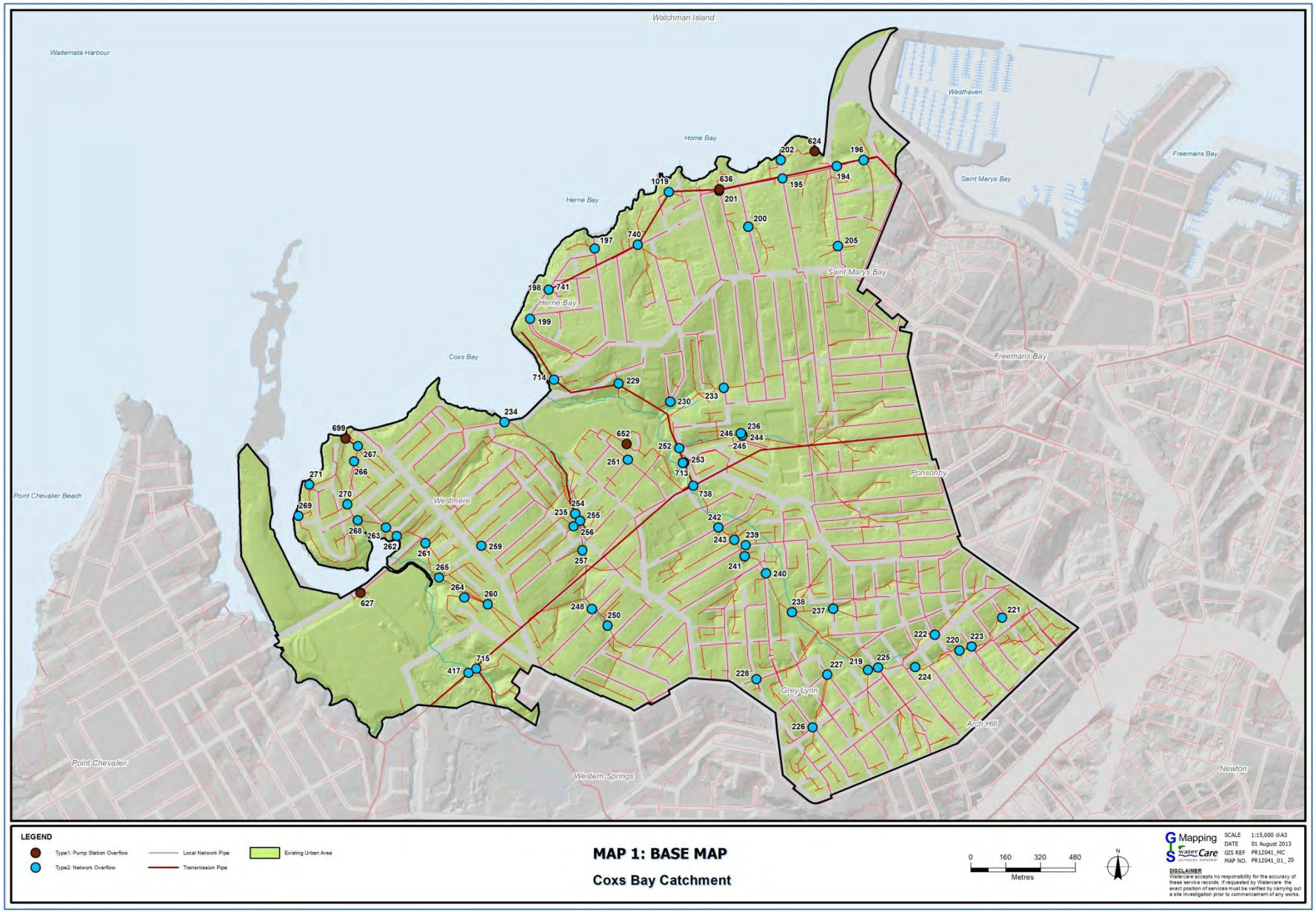
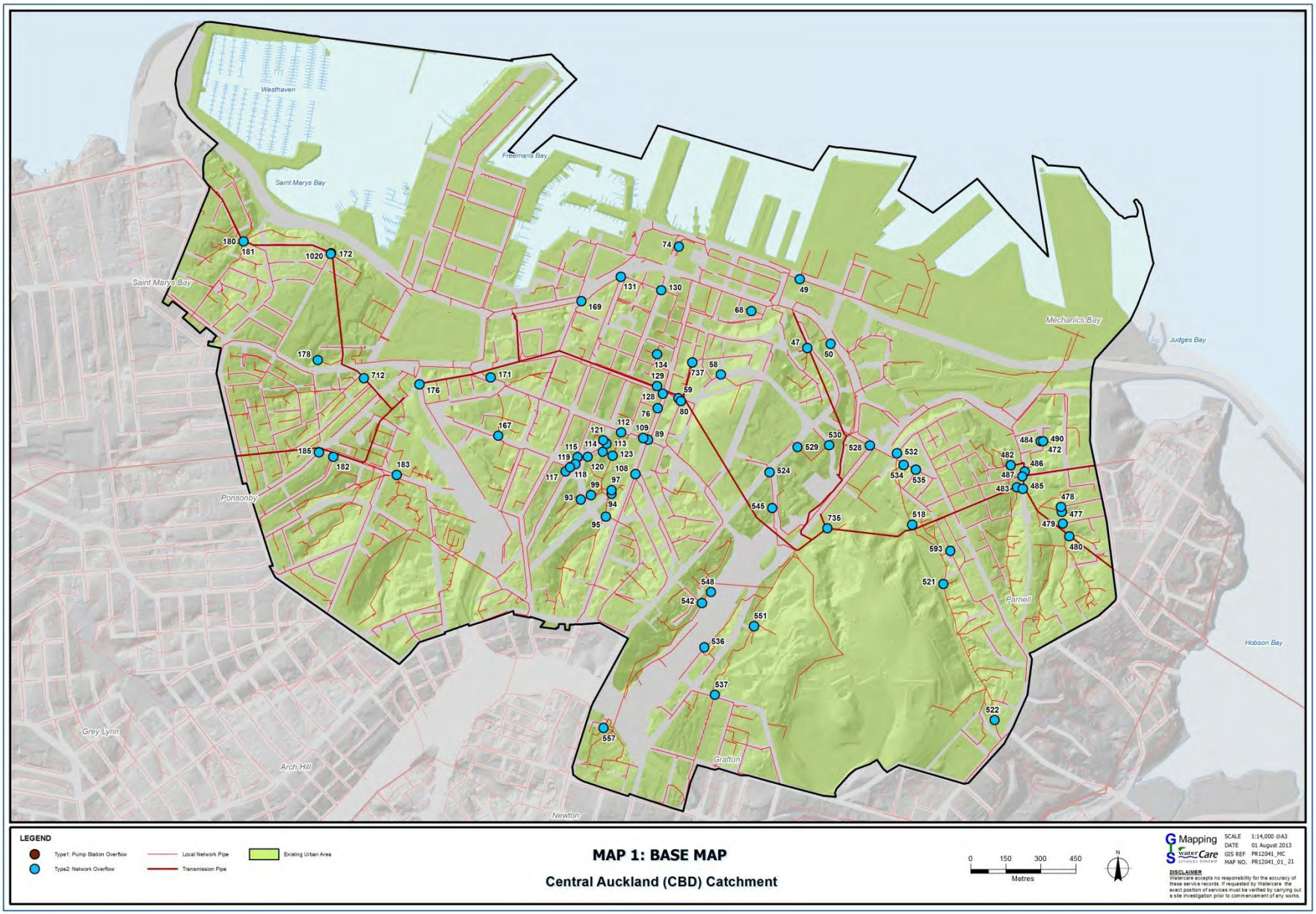

Riverhead
Paremoremo
Lucas Creek
Greenhithe
Christmas Beach
Heraldi Island
Kowhai Beach
Kotukutuku Inlet
Te Tuterenga Inlet
Whenuapai
Te Okonki Inlet
Waiarohia Inlet
Wallace Inlet
Catalina Bay
Hobsonville
Bomb Bay
Nimrod Inlet
Brickbat Bay
Limeburners Bay
Waipareira Bay
West Harbour
Massey East
Massey West
Massey
Te Atatu Peninsula
Henderson Creek
Lincoln
N25
N26
N27
N28
N29
N31
N32
N33
N34
N35
N36
N37
N38
N39
N40
N41
N42
N43
N44
N45
1274
1275
12
13
14
31
33
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Indicative Future Urban Area
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Upper Harbour West Catchment
0 275 550 825
Metres
GIS Mapping
Watercare services limited
SCALE 1:34,000 @A3
DATE 11 February 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_16
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.

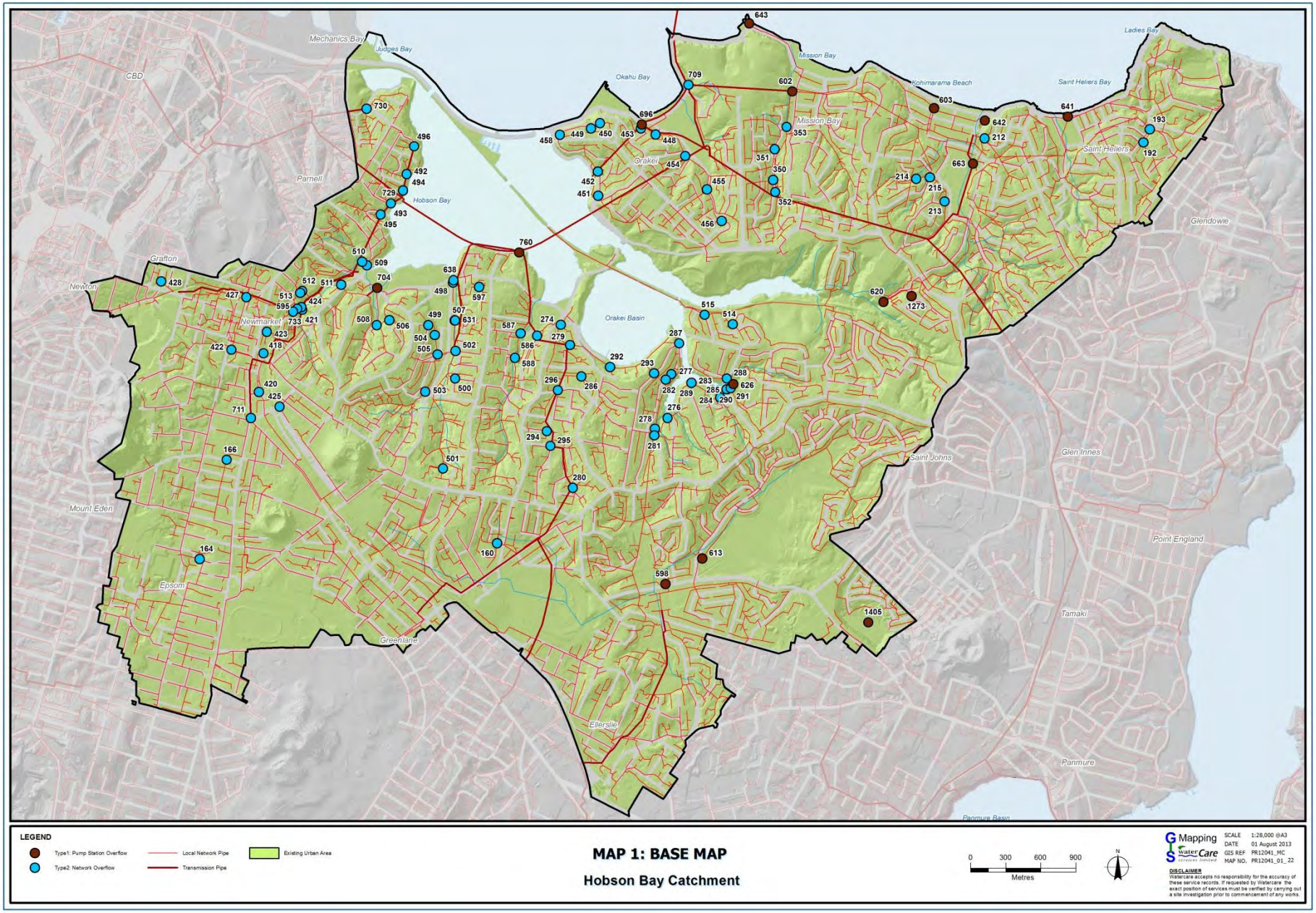

Taupaki
West Harbour
Massey East
Massey West
Massey
Te Atatu Peninsula
Te Atatu South
Lincoln
Swanson
Ranui
Henderson
Western Heights
Henderson Valley
McLaren Park
Sunnyvale
Glendene
Kelston
Oratia
North Titirangi
Konini
Titirangi
Waima
Waiatarua
Ninotupu Auxiliary
Whau River
Henderson Creek
692
16
5
4
15
691
1285
1286
749
690
3
6
2
748
8
1283
1282
1278
1280
7
1217
1218
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Henderson Creek Catchment
0 310 620 930
Metres
N
GIS Mapping
water Care services limited
SCALE 1:38,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_17
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.

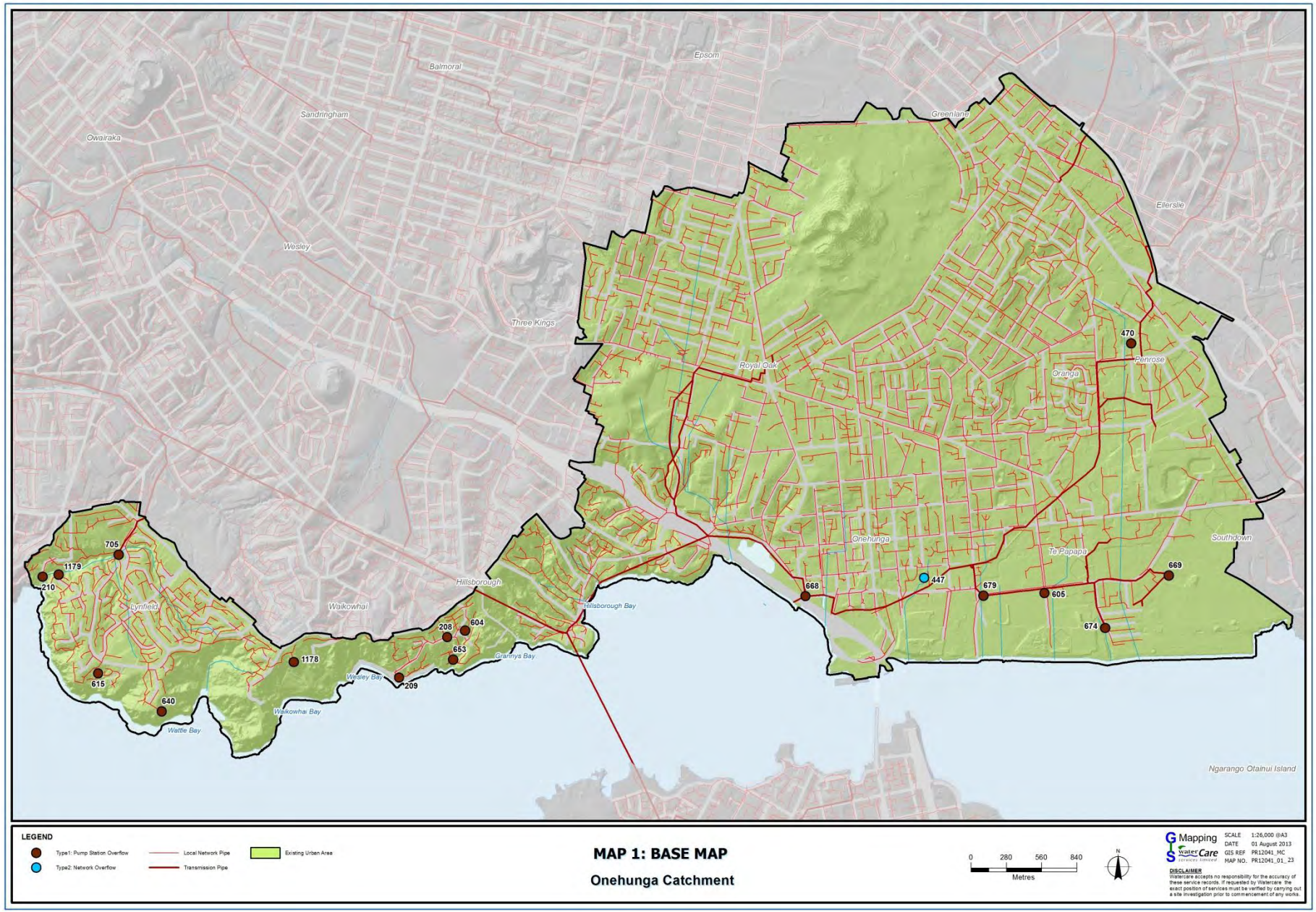

Pollen Island
Te Atatu South
Point Chevalier
Traherne Island
Waterview
Glendene
Kelston
Avondale
New Windsor
North Titirangi
Blockhouse Bay
Konini
Green Bay
Lynfield Cove
Titirangi
17
18
19
20
1202
1211
629
644
752
634
607
656
625
42
618
617
21
621
38
1212
22
23
1224
41
44
1213
24
1214
34
757
695
756
1284
1281
1279
622
10
609
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Whau River Catchment
0 200 400 600
Metres
GIS Mapping
watercare services limited
SCALE 1:25,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_18
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Blockhouse Bay
Green Bay
1216
Green Bay
Titirangi
Waima
1219
1220
1215
1222
1221
1206
1223
Wood Bay
Oaktaru Bay
694
Wood Bay
25
French Bay (Otitori Bay)
French Bay
Titirangi Beach
Woodlands Park
1203
South Titirangi
1204
Peturoa Bay
693
26
Davies Bay
Lower Nihotupu Reservoir
32
1205
1208
1207
1201
Hennings Bay
28
Laingholm Central
27
Jenkins Bay
Perkins Bay
29
Laingholm Bay
Parau
1209
1210
Symonds Bay
Armour Bay
Bokel Bay
30
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Laingholm Catchment
0
240
480
720
Metres
N
Mapping
WaterCare
SCALE 1:23,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_19
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Watchman Island
Waitemata Harbour
Westhaven
Home Bay
Freemans Bay
Saint Marys Bay
Herne Bay
Coxs Bay
Ponsonby
Point Chevalier Beach
Westmere
Grey Lynn
Arch Hill
Point Chevalier
Western Springs
Newton
624
202
196
194
1019
636
195
201
200
205
197
740
198
741
199
714
229
230
233
234
699
652
246
236
244
245
252
253
251
713
738
267
266
271
270
269
268
263
262
254
235
255
256
242
239
243
241
240
259
257
261
265
264
260
627
248
250
238
237
221
222
220
223
715
417
219
225
227
228
224
226
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Coxs Bay Catchment
0
160
320
480
Metres
N
Mapping
Watercare services limited
SCALE 1:15,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_ 20
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Westhaven
Freemans Bay
Saint Marys Bay
Saint Marys Bay
Mechanics Bay
Judges Bay
Ponsonby
Parnell
Hobson Bay
Grey Lynn
Arch Hill
Grafton
Newton
180
181
1020
172
74
131
130
49
169
68
47
50
178
712
176
171
134
129
128
76
737
58
59
80
167
112
109
89
121
113
123
115
114
119
120
118
117
108
97
99
93
94
95
185
182
183
524
529
530
528
532
534
535
484
490
472
482
486
487
483
485
478
477
479
480
545
735
518
593
521
548
542
551
536
537
557
522
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Central Auckland (CBD) Catchment
0
150
300
450
Metres
N
GIS Mapping
Watercare services limited
SCALE 1:14,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_21
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Mechanics Bay
Judges Bay
CBD
Okahu Bay
Mission Bay
Kohimarama Beach
Ladies Bay
Saint Heliers Bay
Saint Heliers
Glendowie
Parnell
Hobson Bay
Grafton
Newton
Newmarket
Orakei
Orakei Basin
Mount Eden
Epsom
Greenlane
Ellerslie
Saint Johns
Glen Innes
Point England
Tamaki
Panmure
Panmure Basin
643
709
602
603
641
642
212
193
192
730
696
458
449
450
453
448
454
353
351
350
663
214
215
213
496
492
494
729
493
495
455
452
451
352
456
760
510
509
704
638
498
597
512
511
428
427
513
595
424
421
733
423
418
422
508
506
499
504
505
507
631
502
503
500
587
274
279
586
588
296
286
292
293
287
277
282
283
289
285
284
288
626
291
290
276
278
281
294
295
280
501
166
711
420
425
164
160
515
514
620
1273
613
598
1405
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Hobson Bay Catchment
0
300
600
900
Metres
N
GIS Mapping
Watercare
SCALE 1:28,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_22
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Balmoral
Epsom
Sandringham
Greenlane
Owairaka
Ellerslie
Wesley
Three Kings
Royal Oak
Penrose
Orainga
Onehunga
Southdown
Te Papapa
Hillsborough
Waikowhai
Hillsborough Bay
Lynfield
Grannys Bay
Wesley Bay
Waikowhai Bay
Wattle Bay
Ngarango Otainui Island
705
1179
210
208
604
653
1178
615
209
640
470
668
447
679
605
669
674
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Onehunga Catchment
0 280 560 840
Metres
N
Mapping
Water Care services limited
SCALE 1:26,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_ 23
DISCLAIMER
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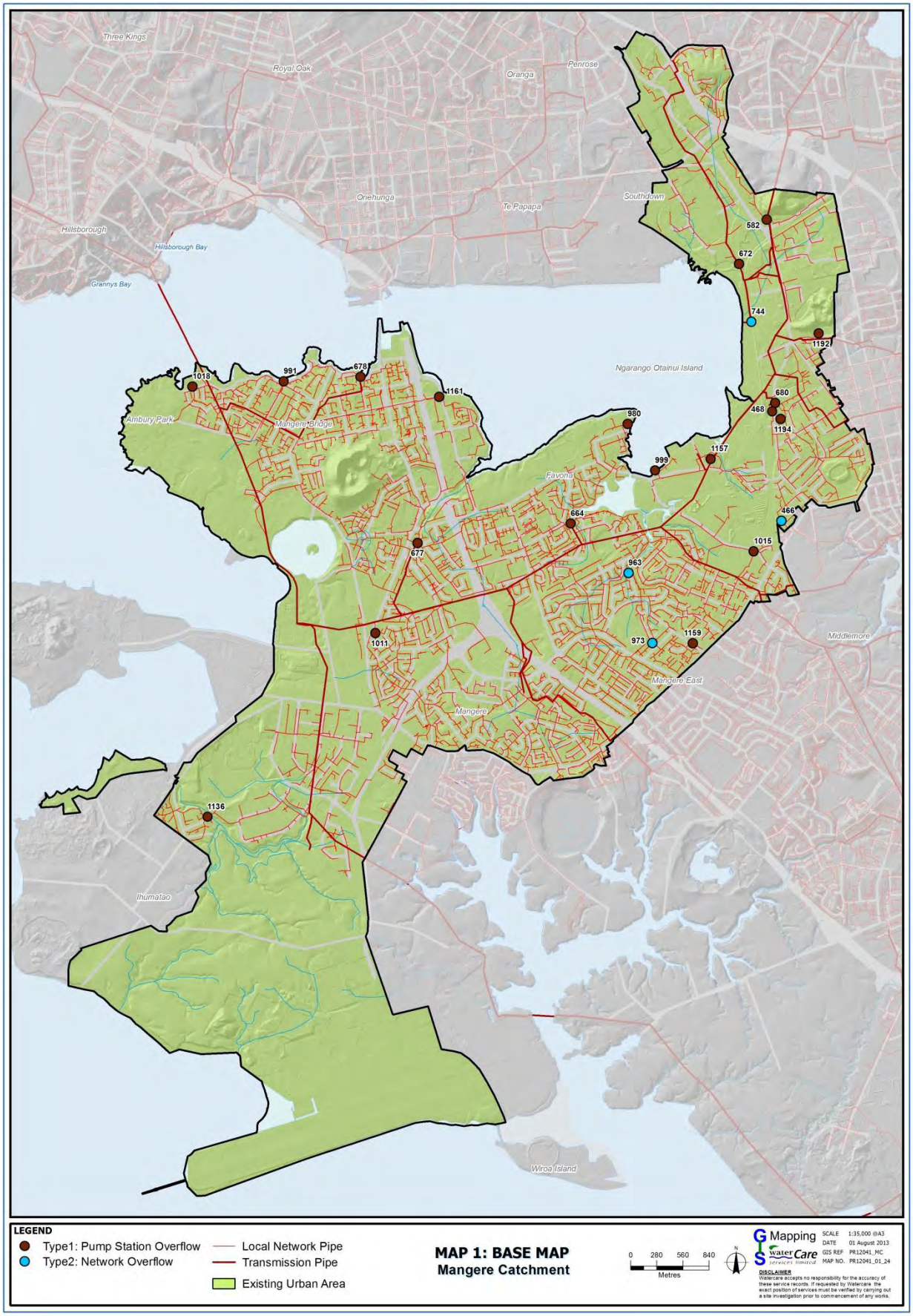
Three Kings
Royal Oak
Oranga
Penrose
Onehunga
Te Papapa
Southdown
Hillsborough
Hillsborough Bay
Grannys Bay
Ngarangi Otainui Island
Ambury Park
Mangere Bridge
Favona
Middlemore
Mangere East
Mangere
Ihumatao
Wiroa Island
582
672
744
1192
680
468
1194
1157
999
980
1161
678
991
1018
664
677
963
1015
466
1011
973
1159
1136
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Mangere Catchment
0 280 560 840
Metres
N
Mapping
Water Care
services limited
SCALE 1:35,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_24
DISCLAIMER
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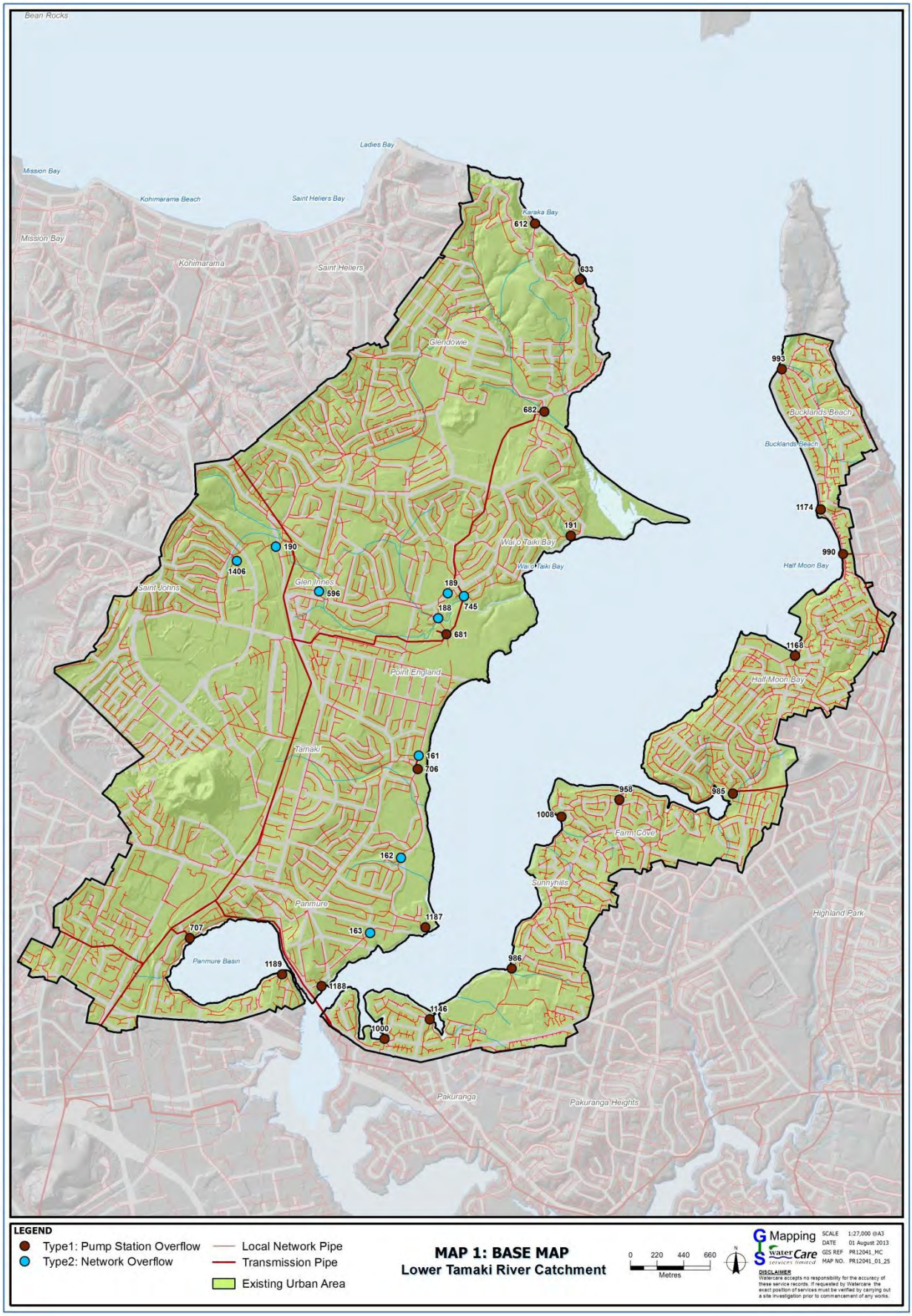
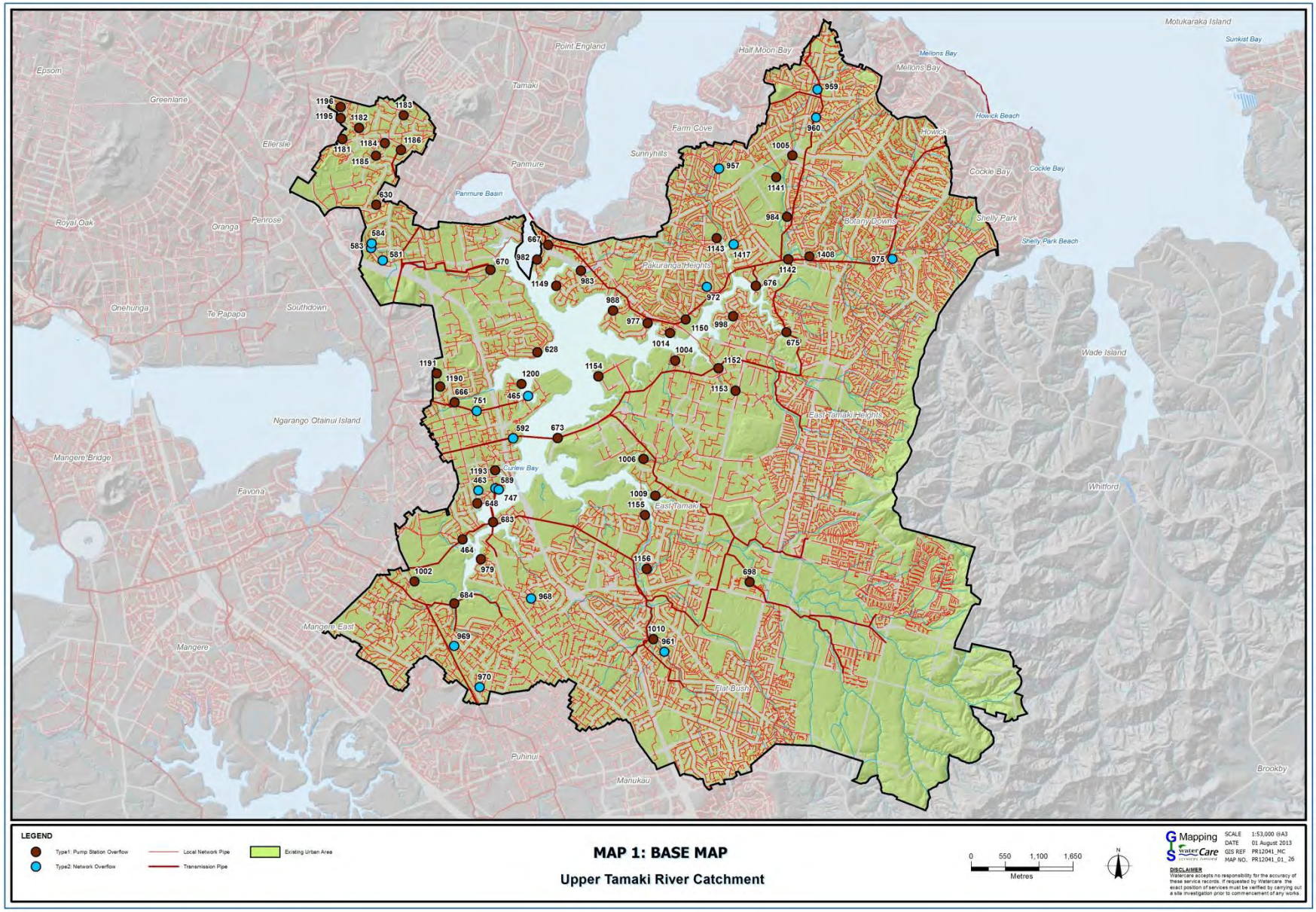

Bean Rocks
Ladies Bay
Mission Bay
Kohimarama Beach
Saint Heliers Bay
Karaka Bay
612
633
Kohimarama
Saint Heliers
Glendowie
993
682
Bucklands Beach
1174
191
Waiō Taiki Bay
990
190
1406
Half Moon Bay
Glen Innes
596
189
745
188
Saint Johns
681
1168
Point England
Half Moon Bay
Tamaki
161
706
958
985
1008
Farm Cove
162
Sunnyhills
Panmure
Highland Park
1187
707
163
Panmure Basin
986
1189
1188
1146
1000
Pakuranga
Pakuranga Heights
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Lower Tamaki River Catchment
0 220 440 660
Metres
N
Mapping
Water Care Services Limited
SCALE 1:27,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_25
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.



LEGEND

Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area

MAP 1: BASE MAP

Upper Tamaki River Catchment

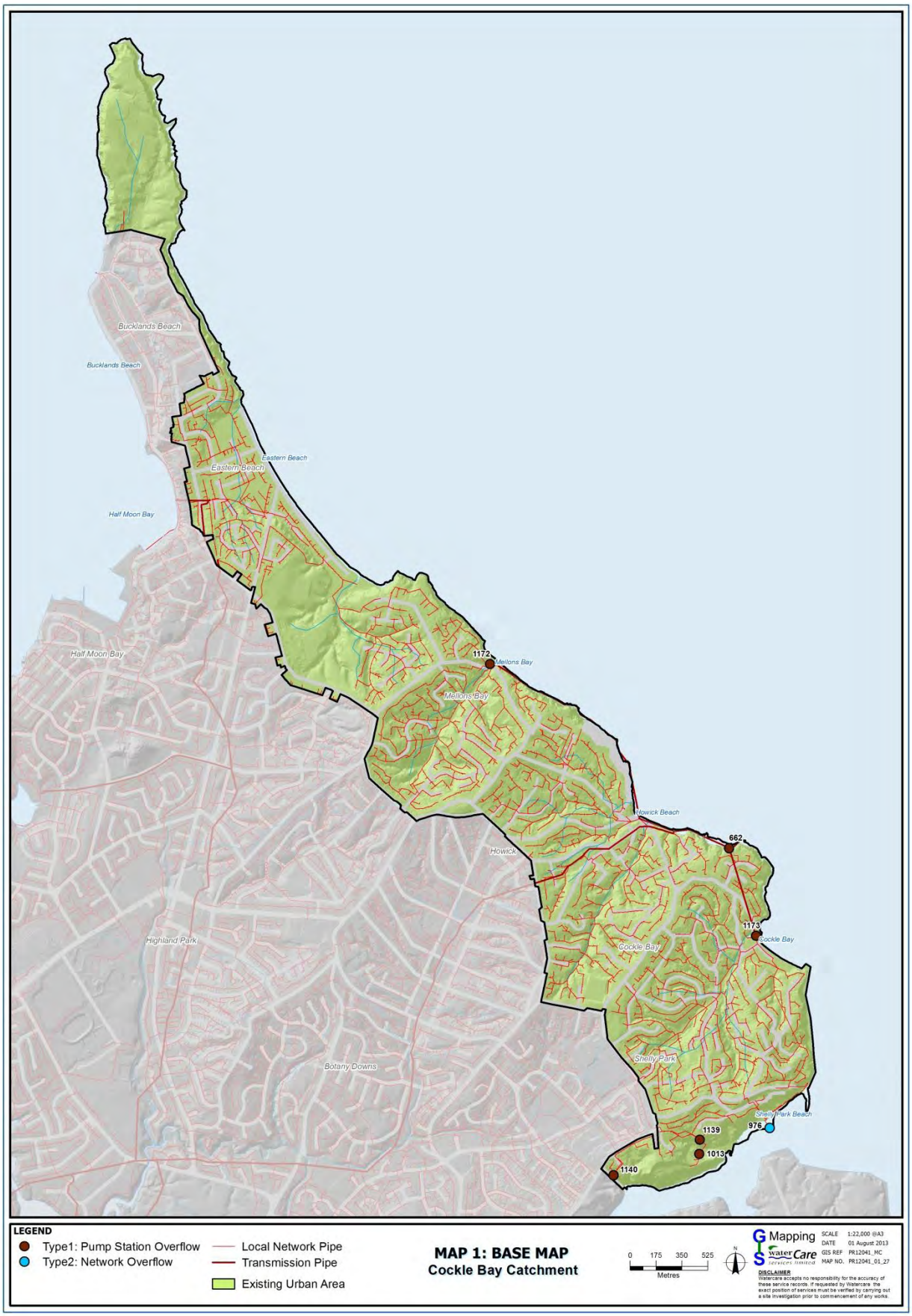
0 550 1,100 1,650
Metres

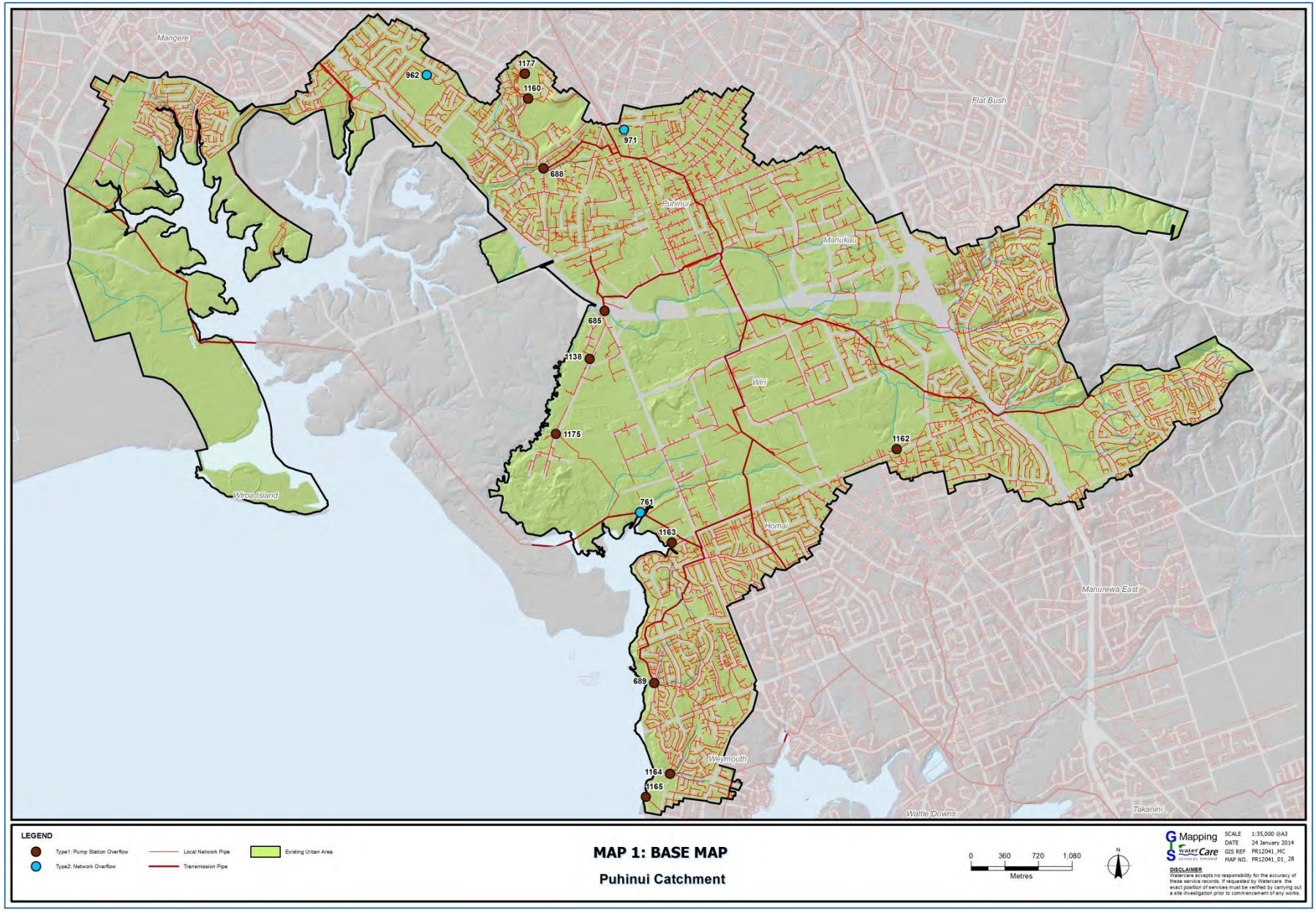
N

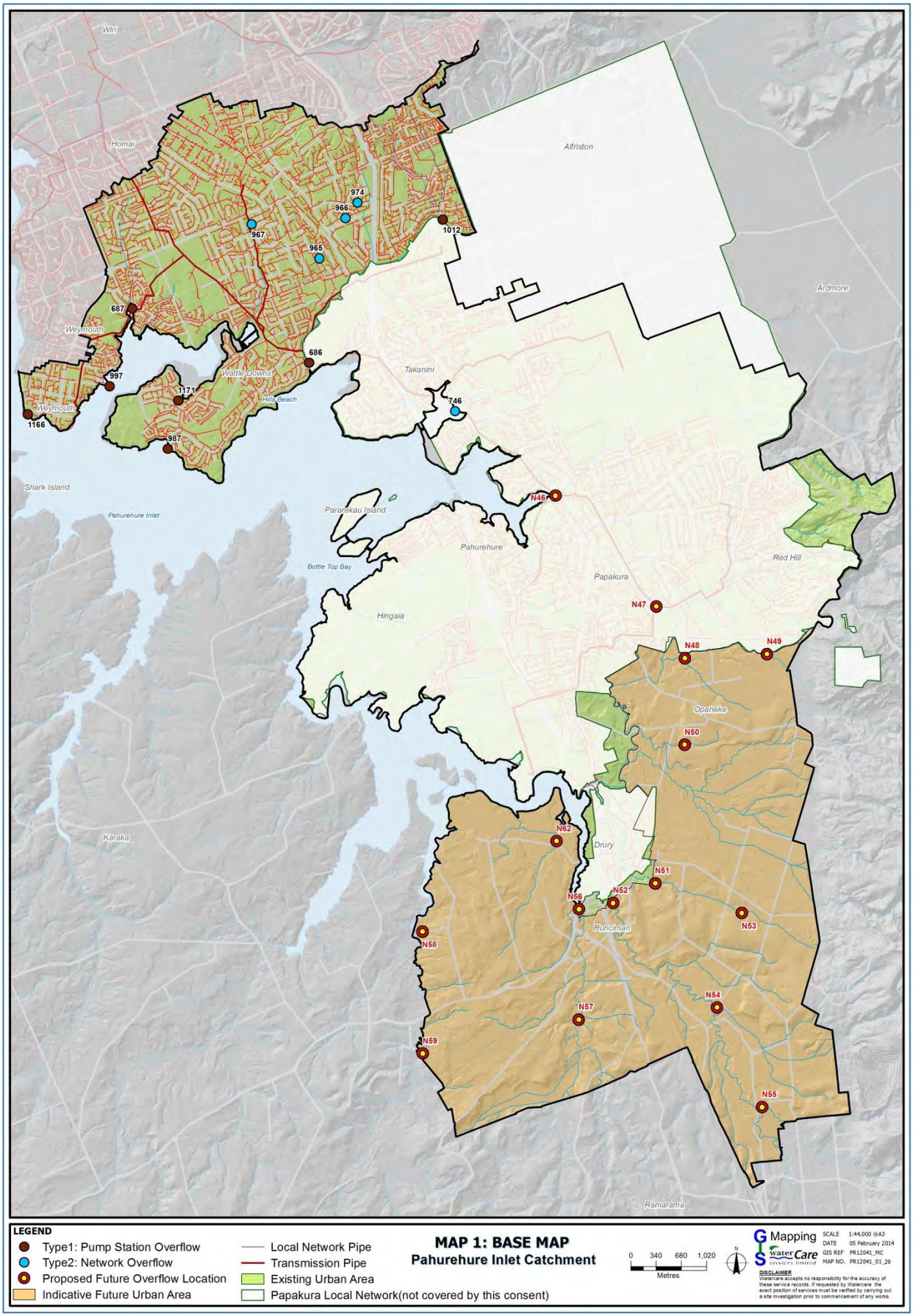
GIS Mapping
Watercare Services Limited

SCALE 1:53,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_26

DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare, the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Bucklands Beach
Bucklands Beach
Eastern Beach
Eastern Beach
Half Moon Bay
Half Moon Bay
1172
Mellons Bay
Mellons Bay
Howick Beach
662
Howick
1173
Cockle Bay
Cockle Bay
Highland Park
Shelly Park
Botany Downs
Shelly Park Beach
976
1139
1013
1140
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Cockle Bay Catchment
0 175 350 525
Metres
N
GIS Mapping
Water Care Services Limited
SCALE 1:22,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_27
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Mangere
Flat Bush
Puhinui
Manukau
Wiri
Wiroa Island
Homai
Manurewa East
Weymouth
Wattle Downs
Takanini
962
1177
1160
971
688
685
1138
1175
1162
761
1163
689
1164
1165
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Puhinui Catchment
0 360 720 1,080
Metres
N
GIS Mapping
Water Care
SCALE 1:35,000 @A3
DATE 24 January 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_28
DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.



LEGEND

- Type1: Pump Station Overflow
- Type2: Network Overflow
- Proposed Future Overflow Location
- Indicative Future Urban Area
- Local Network Pipe
- Transmission Pipe
- Existing Urban Area
- Papakura Local Network(not covered by this consent)

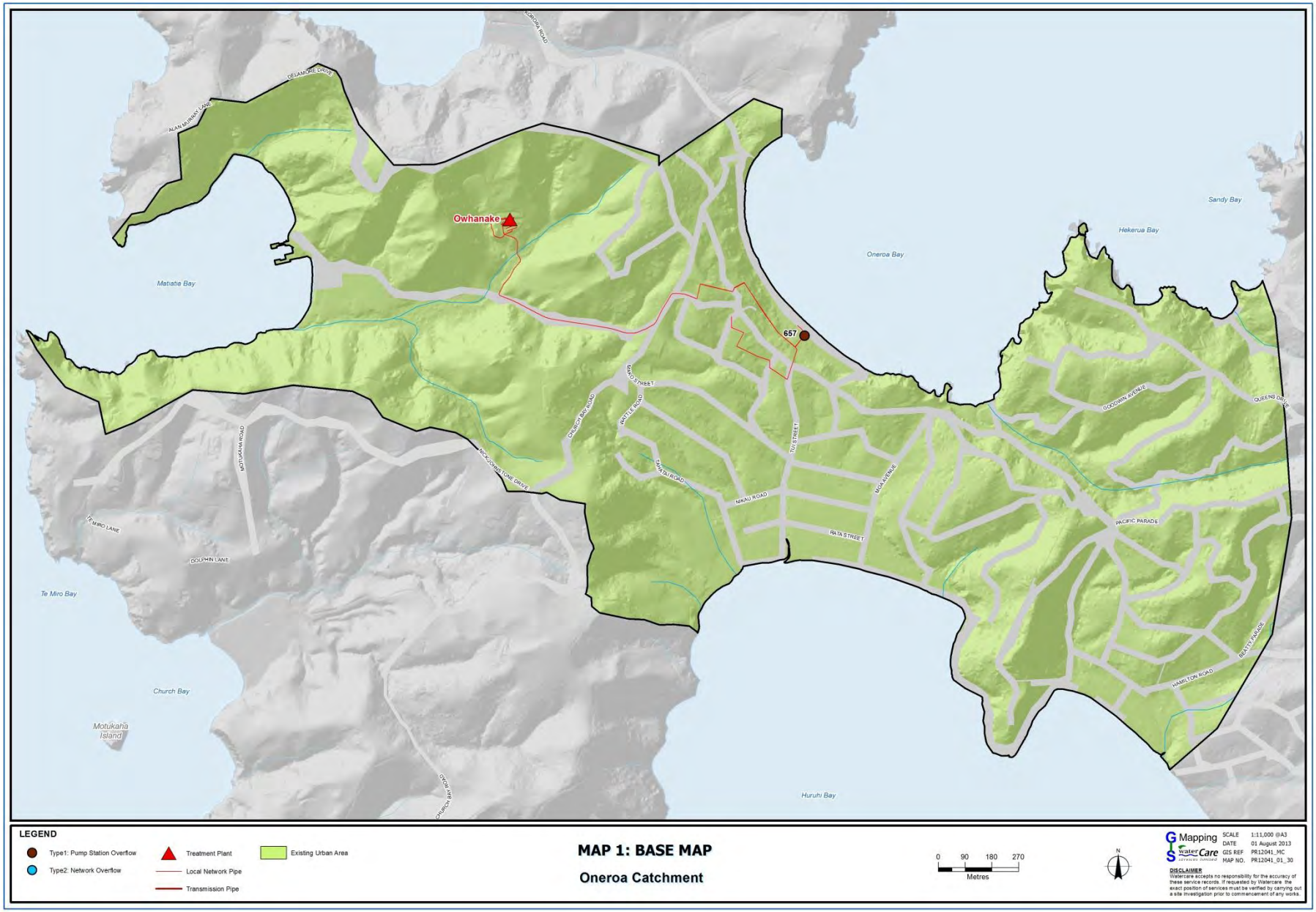
MAP 1: BASE MAP
Pahurehure Inlet Catchment

0 340 680 1,020
Metres

GIS Mapping
WaterCare services limited

SCALE 1:44,000 @A3
DATE 05 February 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_29

DISCLAIMER
Watercare accepts no responsibility for the accuracy of these service records. If requested by Watercare the exact position of services must be verified by carrying out a site investigation prior to commencement of any works.


Owhanake
657
Matiatia Bay
Oneroa Bay
Hekerua Bay
Sandy Bay
Te Miro Bay
Church Bay
Motukaha Island
Huruhi Bay
GORDON ROAD
DELAMORE DRIVE
ALAN MOANA LANE
MAYO STREET
CHURCH BAY ROAD
WHITTLE ROAD
TUI STREET
GOODWIN AVENUE
QUEENS DRIVE
MOTUKAHA ROAD
NICK JOHNSTONE DRIVE
TAKATA ROAD
NIKAU ROAD
MOA AVENUE
PACIFIC PARADE
RATA STREET
TE MIRO LANE
DOLPHIN LANE
BEATTY PARADE
HAMILTON ROAD
CHURCH BAY ROAD
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Oneroa Catchment
0 90 180 270
Metres
N
GIS Mapping
Watercare services limited
SCALE 1:11,000 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_30
DISCLAIMER
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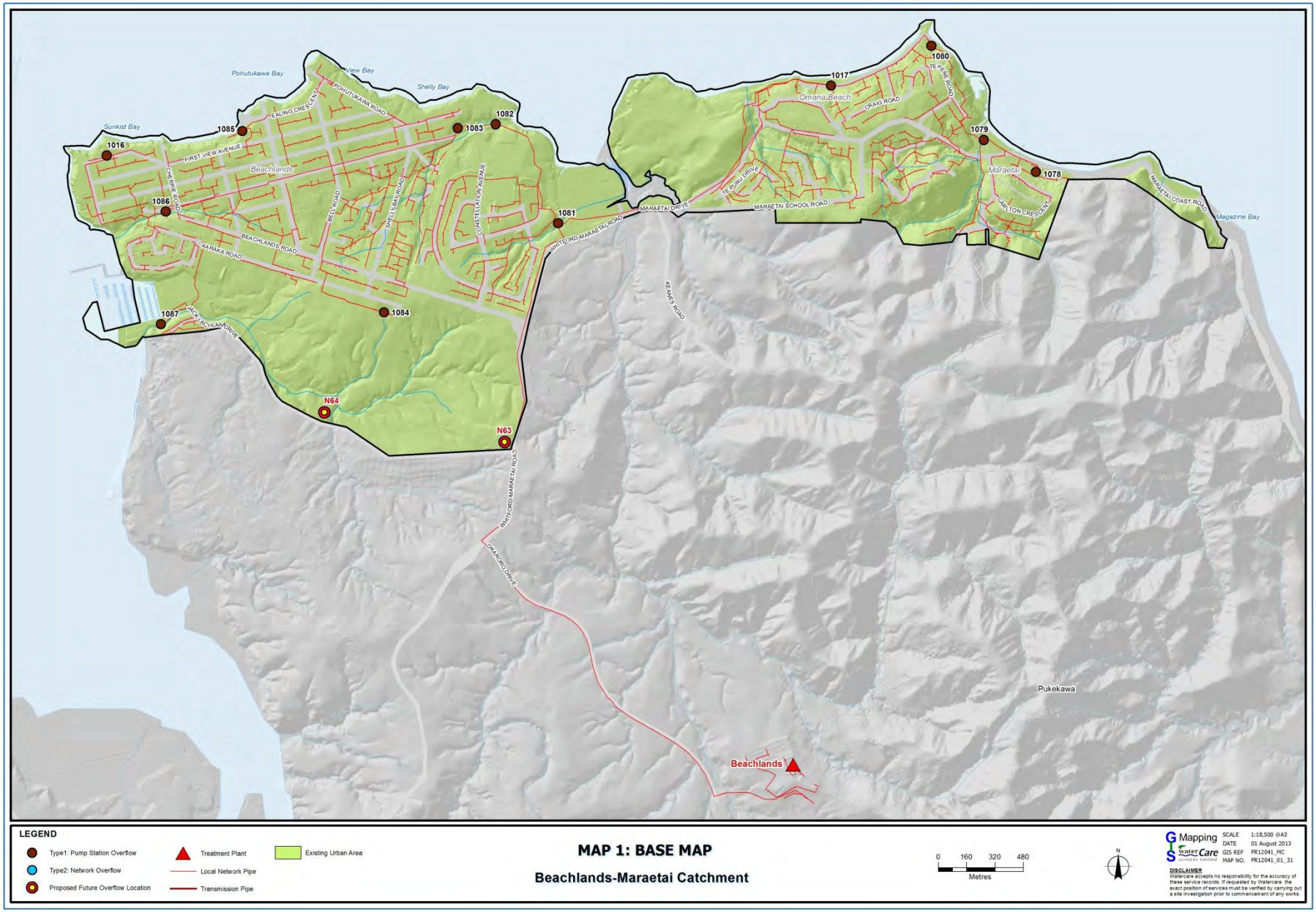
Pohutukawa Bay
Shelly Bay
Sunkist Bay
Beachlands
Omana Beach
Maraetai
Magazine Bay
Pukekawa
Beachlands
1016
1085
1086
1087
1084
1083
1082
1081
1017
1080
1079
1078
N64
N63
FIRST VIEW AVENUE
CHERRIE ROAD
BEACHLANDS ROAD
KARAKA ROAD
JACK HACHLAN DRIVE
BEE ROAD
SHELLY BAY ROAD
CONSTELLATION AVENUE
EALING CRESCENT
POHUTUKAWA ROAD
WHITFORD-MARAETAI ROAD
MARAETAI DRIVE
MARAETAI SCHOOL ROAD
TE PURU DRIVE
CRAIG ROAD
TE O'TER ROAD
CARLTON CRESCENT
MARAETAI COAST ROAD
KEAHES ROAD
OKARORO DRIVE
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
MAP 1: BASE MAP
Beachlands-Maraetai Catchment
0 160 320 480
Metres
N
Mapping
Water Care services limited
SCALE 1:18,500 @A3
DATE 01 August 2013
GIS REF PR12041_MC
MAP NO. PR12041_01_31
DISCLAIMER
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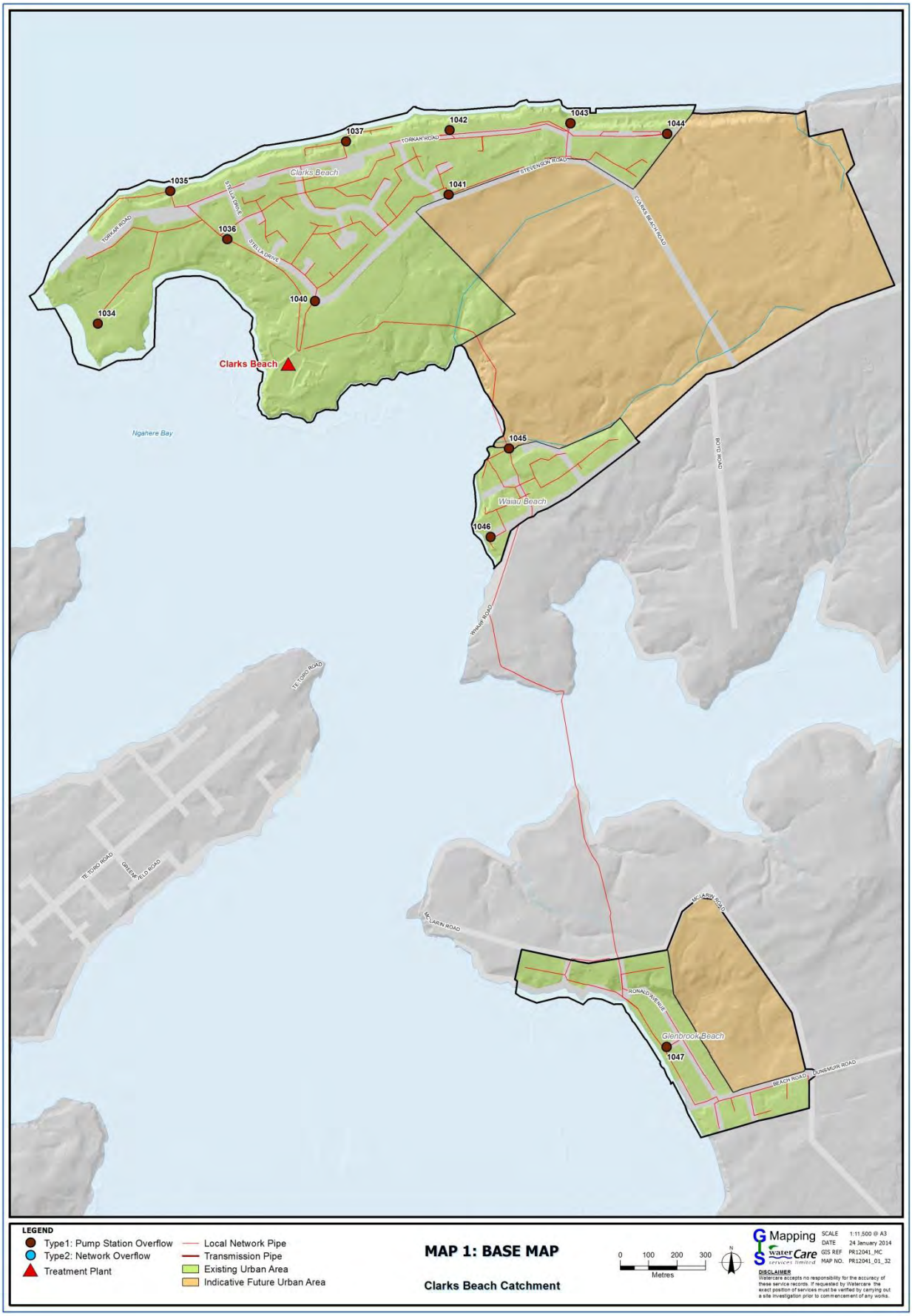
1034
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Clarks Beach
Ngahere Bay
Waiau Beach
Glenbrook Beach
TORKAR ROAD
STELLA DRIVE
STEVENSON ROAD
CLARKS BEACH ROAD
BOYD ROAD
WHARF ROAD
TE TORO ROAD
GREENFIELD ROAD
MCLARIN ROAD
RONALD AVENUE
BEACH ROAD
DUNSMUIR ROAD
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
Indicative Future Urban Area
MAP 1: BASE MAP
Clarks Beach Catchment
0 100 200 300
Metres
N
GIS Mapping
Watercare Services Limited
SCALE 1:11,500 @ A3
DATE 24 January 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_32
DISCLAIMER
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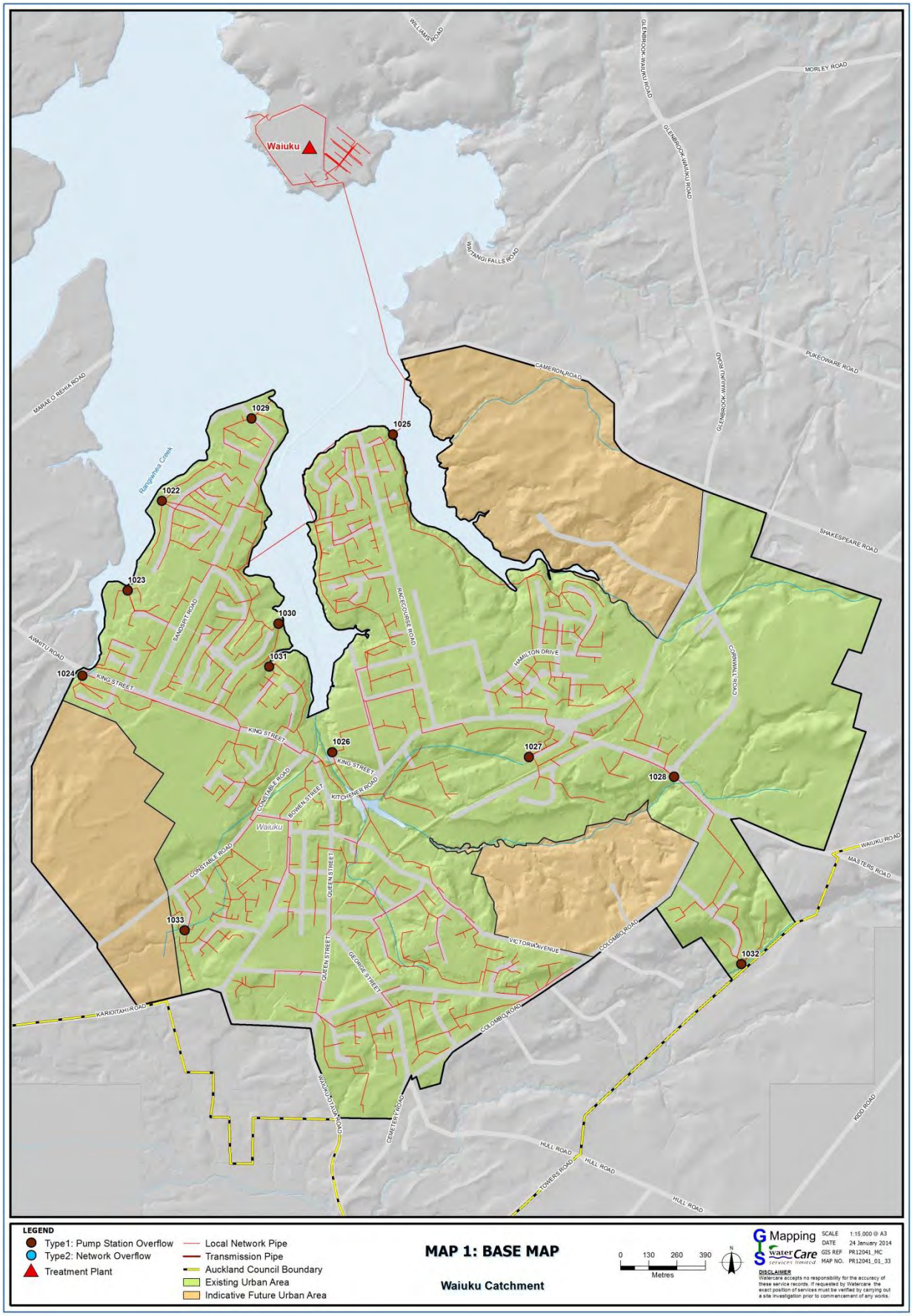
Waiuku
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
KING STREET
CONSTABLE ROAD
QUEEN STREET
GEORGE STREET
VICTORIA AVENUE
COLOMBO ROAD
KITCHENER ROAD
ROWEN STREET
RACECOURSE ROAD
HAMILTON DRIVE
CORNWALL ROAD
SHAKESPEARE ROAD
CAMERON ROAD
PUKEOWARE ROAD
GLENBROOK-WAIUKU ROAD
MORLEY ROAD
WAIUKU ROAD
MASTERS ROAD
KARIOITAHI ROAD
HULL ROAD
TOWERS ROAD
KIDD ROAD
CEMETERY ROAD
SANDSPIT ROAD
AWHITU ROAD
MARAE O REHIA ROAD
WAIPANGI FALLS ROAD
Ranginui Creek
Waiuku
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Treatment Plant
Local Network Pipe
Transmission Pipe
Auckland Council Boundary
Existing Urban Area
Indicative Future Urban Area
MAP 1: BASE MAP
Waiuku Catchment
0 130 260 390
Metres
N
GIS Mapping
Watercare Services Limited
SCALE 1:15,000 @ A3
DATE 24 January 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_33
DISCLAIMER
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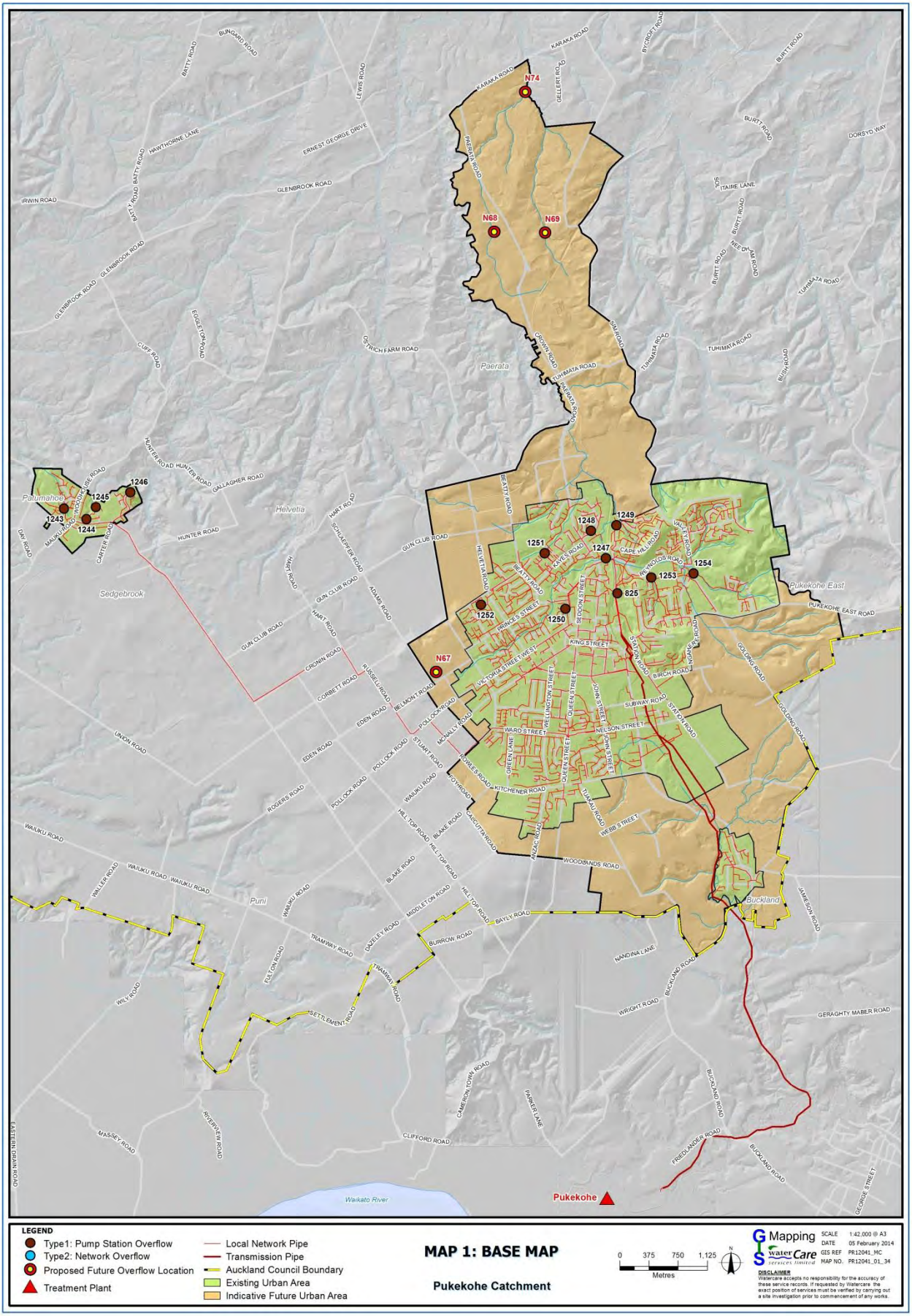
N74
N68
N69
N67
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
825
Paerata
Helvetia
Pukekohe East
Pukekohe
Buckland
Puni
Sedgebrook
Patumahoe
Waikato River
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Treatment Plant
Local Network Pipe
Transmission Pipe
Auckland Council Boundary
Existing Urban Area
Indicative Future Urban Area
MAP 1: BASE MAP
Pukekohe Catchment
0 375 750 1,125
Metres
GIS Mapping
Watercare services limited
SCALE 1:42,000 @ A3
DATE 05 February 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_34
DISCLAIMER
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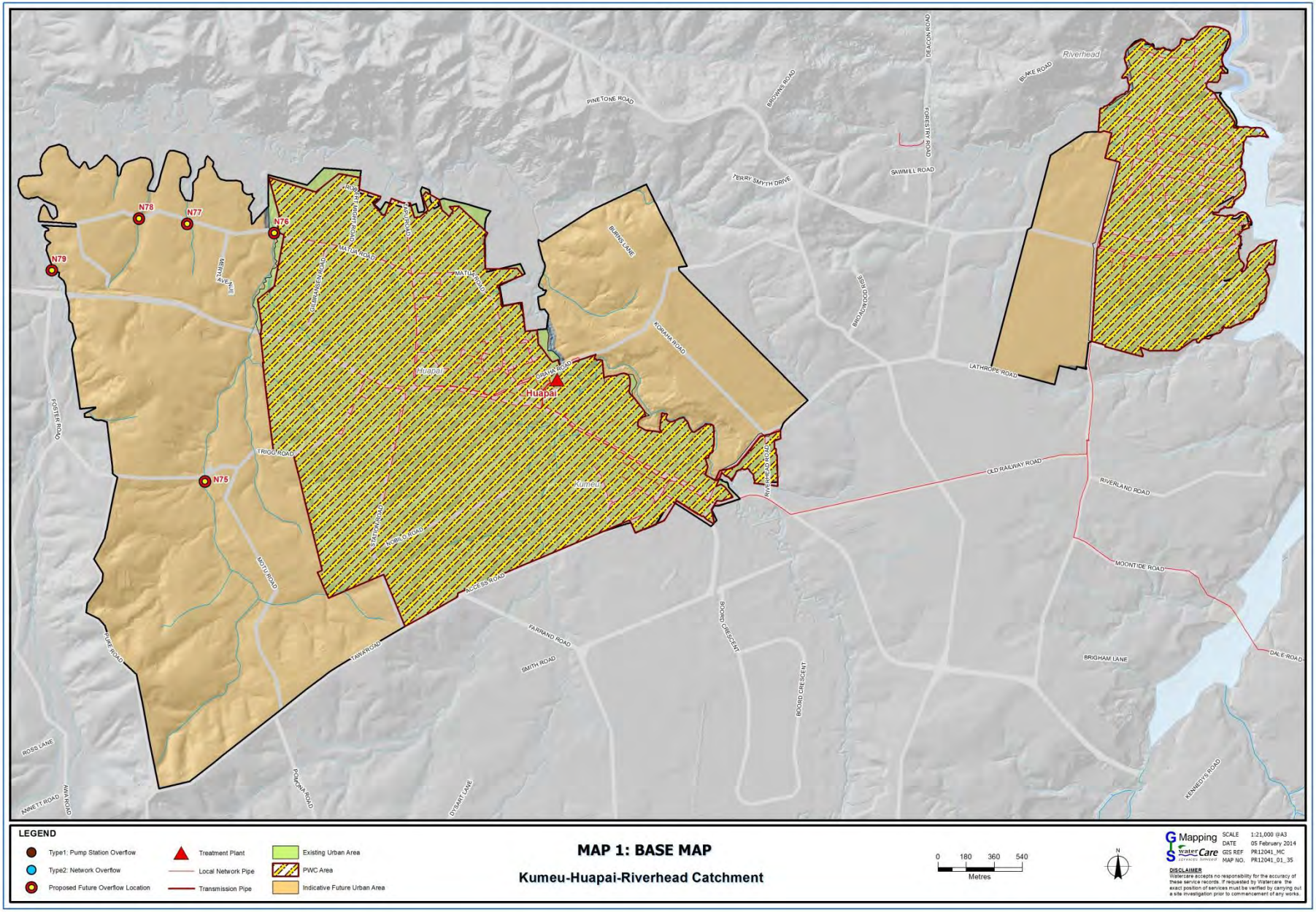
N78
N77
N76
N79
N75
Huapai
Kumeu
Riverhead
PINETONE ROAD
BROWNS ROAD
DEACON ROAD
BLAKE ROAD
FERRY SMYTH DRIVE
SAWMILL ROAD
BURNS LANE
KORMA ROAD
BROADWOOD RISE
LATHROPE ROAD
GRATTAN ROAD
MATUA ROAD
GUTHRIE ROAD
HENLEY AVE
FOSTER ROAD
TRIGG ROAD
OLD RAILWAY ROAD
RIVERLAND ROAD
MOONTIDE ROAD
HOBBS ROAD
ACCESS ROAD
MOTU ROAD
FARRAND ROAD
SMITH ROAD
BOORD CRESCENT
BRIGHAM LANE
DALE ROAD
ROSS LANE
ANNETT ROAD
POMONA ROAD
DYSART LANE
KENNEDYS ROAD
LEGEND
Type1: Pump Station Overflow
Type2: Network Overflow
Proposed Future Overflow Location
Treatment Plant
Local Network Pipe
Transmission Pipe
Existing Urban Area
PWC Area
Indicative Future Urban Area
MAP 1: BASE MAP
Kumeu-Huapai-Riverhead Catchment
0 180 360 540
Metres
N
GIS Mapping
Watercare
SCALE 1:21,000 @A3
DATE 05 February 2014
GIS REF PR12041_MC
MAP NO. PR12041_01_35
DISCLAIMER
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Attachment 2:
Schedules of Engineered Overflow Points

Schedule 1 -
Engineered Overflow Points in the Existing Network
[current in February 2014]

Schedule 2 -
Proposed Future Engineered Overflow Points in Indicative Future Urban Areas

Schedule 1 - Engineered Overflow Points in the Existing Network (Overflow Points potentially discharging to the CMA are highlighted in blue)

Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
DPWOR	1128	Low	Low	1	1	Wellsford	Worker Rd PS	60a Worker Road, Wellsford	1736279	5982449		Unnamed tributary (south) of Whakapirau Creek	3	Very low	2	Moderate	2	2
DPARM	1129	Low	Low	1	1	Wellsford	Armitage Rd PS	46 Armitage Road, Wellsford	1736756	5983193		Unnamed tributary (north) of Whakapirau Creek	3	Very low	2	Moderate	2	1
DPSHR	1130	Low	Low	1	1	Wellsford	School Rd PS	43 School Road, Wellsford	1736204	5983336		Unnamed tributary (south) of Whakapirau Creek	3	Very low	2	Moderate	2	2
DPCEM	1131	Low	Low	1	1	Wellsford	Cemetery PS, School Rd	72 School Road, Wellsford	1735829	5983542		To Land						
DPKYH	1132	Low	Low	1	1	Wellsford	Kellys Hill PS, Rodney St	375 Rodney Street, Wellsford	1736377	5983805		Stormwater Detention Pond	3	Very low	3	Very low	2	2
DPTHA	1133	Low	Low	1	1	Wellsford	Te Hana PS	310 SH1, Te Hana	1735648	5986724		Unnamed tributary of Te Hana Creek.	3	Very low	2	Moderate	2	2
DPTAU	1117	Low	Low	1	2	Omaha	Taumata Rd PS	83 Taumata Road, Omaha	1760815	5975465	4 - 8 hours	To Land						
DPMRI	1118	Low	Low	1	2	Omaha	Mangatawhiri Rd PS	198 Mangatawhiri Road, Omaha	1760342	5975363	4 - 8 hours	To Land						
DPPOA	1119	Low	Low	1	2	Omaha	Paraoa Cres PS	17 Paraoa Crescent, Omaha	1760171	5975837	4 - 8 hours	To Land						
DPKOK	1120	Low	Low	1	2	Omaha	Kokopu St PS	18 Kokopu Street, Omaha	1759899	5976245	4 - 8 hours	To Land						
DPBRO	1121	Low	Low	1	2	Omaha	Broadlands PS	31 Omaha Drive, Omaha	1759175	5977324	< 1 hour	To Land						
DPEGV	1122	Low	Low	1	2	Omaha	Esme Grove PS	14 Esme Grove, Omaha	1759663	5977402	> 8 hours	To Land						
DPANC	1123	Low	Low	1	2	Omaha	North West Anchorage PS	41 North West Anchorage, Omaha	1759169	5977899	4 - 8 hours	Whangateau Harbour Beach	1	Very low	1	Very low	1	1
DPSUC	1124	Low	Low	1	2	Omaha	Success Court PS	25 Success Court, Omaha	1759430	5978028	4 - 8 hours	To Land						
DPBOA	1125	Low	Low	1	2	Omaha	Boat Ramp PS	223 Omaha Drive, Omaha	1759333	5978378	4 - 8 hours	To Land						
DPPAL	790	Low	Medium	1	3	Warkworth	Palmer St PS	44 Whitaker Road, Warkworth	1748873	5970256	< 1 hour	Mahurangi River	2	Low	1	Moderate	1	1
DSAUC	792	Low	Low	2	3	Warkworth	Auckland Road Manhole	2-30 Woodcocks Road, Warkworth	1748632	5969960	-	Unnamed tributary (1) of Mahurangi River	3	Very Low	2	Moderate	1	1
DPLIL	1258	Low	Low	1	3	Warkworth	Lilburn St PS	Lucy Moore Memorial Park, Warkworth	1749735	5970349	1 - 4 hours	Stormwater detention pond (Lucy Moore Memorial Park)	3	Very Low	3	Very low	2	1

[1] Available storage at Dry Weather Flow (DWF) is expressed as one of the following:
< 1 hour 1 – 4 hours 4 – 8 hours > 8 hours

Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
DPMBC	1101	Low	Low	1	4	Snells Beach/ Algies Bay	Martins Bay Camp PS	Martins Bay Recreational Reserve, Martin's Bay	1758060	5964849	1 - 4 hours	Martins Bay Beach	1	Low	2	Very low	2	1
DPWLI	1103	Low	Low	1	4	Snells Beach/ Algies Bay	Willjames PS	91 Willjames Ave, Algies Bay	1756803	5966064	> 8 hours	Unnamed stream (flowing to Algies Bay)	3	Very low	2	Moderate	1	1
DPBTE	1104	Low	Low	1	4	Snells Beach/ Algies Bay	Brigitte View PS	33 Brigitte View, Snells Beach	1754836	5967070	> 8 hours	Stormwater pond (Brigitte View Road)	3	Very low	3	Very low	2	1
DPALE	1105	Low	Low	1	4	Snells Beach/ Algies Bay	Alexander PS	Alexander Road Recreational Reserve, Algies Bay	1756431	5966439	4 - 8 hours	Algies Bay Beach	1	Low	2	Very low	1	1
DPDAL	1106	Low	Low	1	4	Snells Beach/ Algies Bay	Dalton PS	11 Dalton Road, Snells Beach	1755189	5967762	4 - 8 hours	Snells Beach	1	Low	2	Very low	1	1
DPCNL	1107	Low	Low	1	4	Snells Beach/ Algies Bay	Cornell Circle PS	31 Cornel Circle, Snell's Beach	1754548	5967539	> 8 hours	Northern arm of Mahurangi Harbour (Cornell Circle)	2	Very low	1	Very low	2	1
-	1108	Low	Low	1	4	Snells Beach/ Algies Bay	Hamatana PS	Hamatana Road, Snell's Beach	1754240	5968116	Overflows back into gravity line	WWTP						
DPTMT	1109	Low	Low	1	4	Snells Beach/ Algies Bay	Tamatea PS	Ariki Drive Recreational Reserve, Snell's Beach	1755024	5968434	> 8 hours	Snells Beach	1	Low	2	Very low	1	1
DPRGH	1110	Low	Low	1	4	Snells Beach/ Algies Bay	Riverleigh PS	26 Riverleigh Drive, Snell's Beach	1754283	5968777	4 - 8 hours	Stormwater pond (Riverleigh Drive)	3	Very low	3	Very low	2	1
DPSNB	1111	Low	Low	1	4	Snells Beach/ Algies Bay	Sunburst PS	32 Schooner Avenue, Snells Beach	1755042	5968975	4 - 8 hours	Snells Beach	1	Low	2	Very low	1	1
DPMRN	1134	Low	Low	1	4	Snells Beach/ Algies Bay	Mariners Grove PS	47 Mariners Grove, Algies Bay	1756165	5966812	1 - 4 hours	Algies Bay Beach	1	Low	2	Very low	1	1
DPWAC	1098	Low	Low	1	5	Waiwera	Waiwera Camp PS	52, The Strand, Waiwera	1752910	5954269	> 8 hours	To Land						
DPWWR	1099	Low	Low	1	5	Waiwera	Waiwera Town PS	26, Waiwera Road, Waiwera	1752701	5954288	4 - 8 hours	Waiwera Estuary	1	Low	1	Low	1	1
DPKOW	1090	Low	Low	1	6	Helensville	Kowhai PS	39 Kowhai Street, Helensville	1729564	5939266	1 - 4 hours	Kaipara River	2	Very low	2	Very low	1	1
DPMIL	1092	Low	Low	1	6	Helensville	Mill PS	43 MIll Road, Helensville	1729166	5939746	> 8 hours	Kaipara River	2	Very low	2	Very low	1	1
DPMRO	1093	Low	Low	1	6	Helensville	Miro PS	Cnr Stewart Street & Miro Street, Helensville	1730036	5940548	4 - 8 hours	Awaroa Stream	3	Very low	2	Very low	2	1
DPPAI	1096	Low	Low	1	6	Helensville	Parakai PS	Parakai Reserve Parakai Reserve, Parakai	1728479	5941816	1 - 4 hours	Kaipara River	2	Very low	2	Very low	1	1
DPCIC	1097	Low	Low	1	6	Helensville	Chic Gardens PS	5 Chic Gardens, Parakai	1727990	5941774	4 - 8 hours	Kaipara River	2	Very low	2	Very low	1	1

Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
DPHAT	803	Low	Low	1	7	Orewa	Hatfields Beach PS	Hatfields Bay Domain, Hatfields Beach	1751471	5952039	4 - 8 hours	Otanerua Stream	2	Moderate	2	Moderate	2	2
DPLKE	807	Low	Low	1	7	Orewa	Lakeside PS	3 Judd Place, Orewa	1750555	5949169	4 - 8 hours	Orewa River Estuary	1	Very low	1	Very low	1	1
DPRVS	814	Low	Low	1	7	Orewa	Riverside Rd PS	39 Riverside Road, Orewa	1751377	5949184	1 - 4 hours	Unnamed tributary of Orewa River Estuary (east)	3	Very low	1	Very low	1	1
DPTER	819	Low	Low	1	7	Orewa	Terminal PS	Western Reserve, Orewa	1751841	5948263	1 - 4 hours	Orewa River Estuary	1	Very low	1	Very low	1	1
DPJEL	1255	Low	Low	1	7	Orewa	Jelas Rd PS	7 Matija Place, Orewa	1750612	5947630	> 8 hours	Southern arm of Orewa River Estuary	2	Very low	1	Very low	1	1
DPORE	1259	Medium	Low	1	7	Orewa	Orewa PS	228 Millwater Parkway, Silverdale	1750231	5948366	> 8 hours	Orewa River Estuary	1	Low	1	Low	1	1
DPFLO	1262	Low	Low	1	7	Orewa	Florence Ave PS	329 Hibiscus Coast Highway, Orewa	1751627	5949864	> 8 hours	To Land						
DPTAP	1265	Low	Low	1	7	Orewa	Tauranga Place PS	31 Tauranga Place, Orewa	1749815	5949155	1 - 4 hours	Northern arm of Orewa River Estuary	3	Very low	2	Very low	1	1
DPMAY	1266	Low	Low	1	7	Orewa	Maygrove PS	11 Settlers Grove, Orewa	1750884	5948748	4 - 8 hours	Orewa River Estuary	1	Very low	1	Very low	1	1
DPORB	1269	Low	Low	1	7	Orewa	Orewa Bridge, PS	212 Hibiscus Coast Highway, Orewa	1751733	5948109	4 - 8 hours	Orewa River Estuary	1	Very low	1	Very low	1	1
DPBLU	795	Low	Low	1	8	Weiti	Blue Gum PS	1 Blue Gum Avenue, Silverdale	1750151	5945974	4 - 8 hours	Weiti River	2	Very low	2	Very low	2	2
DPDUC	798	Low	Low	1	8	Weiti	Duck Creek PS	45 Duck Creek Road, Stillwater	1753512	5943950	4 - 8 hours	Weiti Estuary	2	Very low	1	Very low	1	1
DPFOU	801	Low	Low	1	8	Weiti	Foundry PS	84 Foundry Road, Silverdale	1750481	5945927	> 8 hours	Weiti River	2	Very low	2	Very low	2	2
DPKKC	806	Low	Low	1	8	Weiti	Karaka Cove PS	37 Matheson Road, Red Beach	1752983	5946501	4 - 8 hours	Unnamed Stream (Karaka Cove)	2	Moderate	3	Very low	2	2
DPPOP	812	Low	Low	1	8	Weiti	Poplar PS	23 Poplar Road, Stanmore Bay	1753119	5945996	> 8 hours	Weiti Estuary	2	Very low	1	Very low	1	1
DPSTW	817	Low	Low	1	8	Weiti	Stillwater PS	1 Duck Creek Road, Stillwater	1753777	5943819	> 8 hours	Weiti Estuary	2	Very low	1	Very low	1	1
DPWAD	821	Low	Low	1	8	Weiti	Wade River PS	249 Wade River Road, Wade Heads	1754566	5943378	> 8 hours	Weiti Estuary	2	Very low	1	Very low	1	1
DPWEI	822	Low	Medium	2	8	Weiti	Weiti PS	178 Foundry Road, Silverdale	1751093	5946091	4 - 8 hours	Weiti River	2	Low	2	Low	2	2
DPCOA	1267	Low	Low	1	8	Weiti	Coastal Heights PS	137 Duck Creek Road, Stillwater	1753122	5944039	4 - 8 hours	Weiti Estuary	2	Very low	1	Very low	1	1
DPARK	793	Low	Low	1	9	Whangaparaoa	Arkles Bay PS	13, Arkles Strand, Arkles Bay	1756363	5943642	4 – 8 hours	Arkles Bay Beach	1	Low	2	Very low	1	1
DPBAY	794	Low	Medium	1	9	Whangaparaoa	Bay St PS	45A, Walton Street, Red Beach	1752454	5947838	1 - 4 hours	Unnamed stream flowing to Red Beach	3	Low	3	Low	2	1

February 2014

Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
DPCHE	796	Low	Low	1	9	Whangaparaoa	Chelverton PS	Chelverton Reserve, Chelverton Terrace, Red Beach	1753109	5947276	4 - 8 hours	Red Beach	1	Low	2	Very low	1	1
DPCOO	797	Low	Low	1	9	Whangaparaoa	Cooper PS	Cooper - Lea Reserve, Cooper Road, Stanmore Bay	1754577	5945971	4 - 8 hours	Stanmore Bay Beach	1	Low	2	Very low	1	1
DPDUN	800	Low	Low	1	9	Whangaparaoa	Duncansby PS	37, Duncansby Road, Stanmore Bay	1753905	5946809	> 8 hours	Puawai Bay Beach	2	Low	2	Very low	1	1
DPGLG	802	Medium	Medium	1	9	Whangaparaoa	Glenelg PS	Glenelg Reserve, Chelverton Terrace, Red Beach	1753327	5946967	1 - 4 hours	Puawai Bay Beach	2	High	2	Moderate	1	1
DPHBB	804	Low	Low	1	9	Whangaparaoa	Hobbs Bay PS	67, Gulf Harbour Drive, Gulf Harbour	1760277	5946490	1 - 4 hours	Laurie Southwick Parade Stream	3	Very low	2	Moderate	2	1
DPHUR	805	Low	Low	1	9	Whangaparaoa	Hurdlow PS	9C, Melandra Road, Stanmore bay	1756371	5945296	> 8 hours	Swann Beach	1	Low	2	Very low	1	1
DPLIT	808	Low	Low	1	9	Whangaparaoa	Little Manly PS	9, South Avenue, Manly	1757667	5944064	> 8 hours	Little Manly Beach	1	Low	2	Very low	1	1
DPMLY	809	Low	Low	1	9	Whangaparaoa	Manly PS	The Esplanade, Brown Street, Manly	1757892	5945140	1 - 4 hours	Big Manly Beach	1	Low	2	Very low	1	1
DPMIA	810	Low	Low	1	9	Whangaparaoa	Matakatia PS	34, Matakatia Parade, Matakatia	1758535	5945370	> 8 hours	Matakatia Bay Beach	1	Low	2	Very low	1	1
DPOKO	811	Low	Low	1	9	Whangaparaoa	Okoromai PS	94, Shakespear Road, Okoromai Bay	1761709	5947127	> 8 hours	Okoromai Bay Beach	1	Low	1	Very low	1	1
DPPUA	813	Low	Low	1	9	Whangaparaoa	Puawai Bay PS	24, Whale Cove, Red Beach	1753520	5946836	4 - 8 hours	Puawai Bay Beach	2	Low	2	Very low	1	1
DPSIE	815	Low	Low	1	9	Whangaparaoa	Siesta PS	26, Siesta Terrace, Gulf harbour	1759524	5947516	> 8 hours	Coal Mine Bay Beach	2	Low	2	Very low	1	1
DPSTA	816	Low	Low	1	9	Whangaparaoa	Stanmore PS	177, Brightside Road, Stanmore Bay	1755844	5945025	> 8 hours	Unnamed stream flowing to Stanmore Bay	3	Very low	2	Moderate	2	1
DPSWB	818	Low	Low	1	9	Whangaparaoa	Swann Beach PS	Hurdlow Place Esplanade Reserve, Swann Beach Road, Stanmore Bay	1756260	5945606	> 8 hours	Swann Beach	1	Low	2	Very low	1	1
DPTDL	820	Low	Low	1	9	Whangaparaoa	Tindalls PS	42B, Tindalls Bay Road, Tindalls Beach	1758411	5945990	1 - 4 hours	Tindalls Beach	1	Low	2	Very low	1	1
DPPIN	1256	Low	Low	1	9	Whangaparaoa	Pine Crest PS	180, Gulf Harbour Drive, Gulf Harbour	1760549	5944898	4 - 8 hours	Stormwater pond at Gulf Harbour Country Club	3	Very low	3	Very low	2	1

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									Ref X	Ref Y								
DPPAC	1260	Low	Low	1	9	Whangaparaoa	Pacific Parade PS	Pacific Parade Coastal Reserve, Pacific Parade, Army Bay	1761402	5947736	> 8 hours	Army Bay Beach	2	Low	2	Very low	1	1
DPOPU	1261	Low	Low	1	9	Whangaparaoa	Onepu PS	Edith Hopper Park, Ladies Mile, Manly	1756785	5944423	4 - 8 hours	To Land						
DPISV	1263	Low	Low	1	9	Whangaparaoa	Island View PS	29, Island View Drive, Okoromai Bay	1761439	5946344	4 - 8 hours	Okoromai Bay	1	Low	1	Very low	1	1
DPROB	1272	Low	Low	1	9	Whangaparaoa	Roberts Road PS	Lot 200, DP 205511, Laguna Place, Hobbs Bay	1759521	5945805	4 - 8 hours	Laurie Southwick Parade Stream	3	Very low	2	Moderate	2	1
-	831	Low	Low	2	10	Long Bay	Network overflow	97, Awaruku Road, Long Bay	1755672	5937545	-	Awaruku Creek	2	Moderate	2	Moderate	1	1
-	832	Low	Low	2	10	Long Bay	Network overflow	47, Glenvar Road, Torbay	1755797	5937747	-	Awaruku Creek	2	Moderate	2	Moderate	1	1
-	850	Low	Low	2	10	Long Bay	Network overflow	14, Battenburg Place, Torbay	1755476	5937398	-	Awaruku Creek	2	Moderate	2	Moderate	1	1
DPDEB	1228	Low	Low	1	10	Long Bay	Deborah PS	10, Okura River Road, Okura	1753490	5939800	4 - 8 hours	Okura Estuary	2	Very low	1	Very low	1	1
DPOKU	1235	Low	Low	1	10	Long Bay	Okura PS	R43 Okura River Road, Okura	1753878	5939934	4 - 8 hours	Okura Estuary	2	Very low	1	Very low	1	1
DPLGB	1404	Low	Low	1	10	Long Bay	Long Bay PS	1096, Beach Road, Long Bay	1756398	5937991	> 8 hours	Awaruku Creek	2	Moderate	2	Moderate	1	1
DPSEW	827	Low	Low	1	11	East Coast Bays	Seaview PS	R16, Inga Road, Milford	1757411	5929545	1 - 4 hours	Unnamed tributary of Wairau Creek	3	Very low	2	Very low	2	1
-	834	Low	Medium	2	11	East Coast Bays	Network overflow	28, Penning Road, Milford	1757130	5929535		Unnamed tributary of Wairau Creek	3	Low	2	Low	2	1
-	835	Low	Medium	2	11	East Coast Bays	Network overflow	3, Sidmouth Road, Mairangi Bay	1756665	5932586		Mairangi Bay Stream	3	Low	2	High	2	2
-	845	Low	High	2	11	East Coast Bays	Network overflow	1, Jonathan Place, Sunnynook	1755319	5931007		Unnamed tributary of Wairau Stream	3	Moderate	3	Moderate	2	1
DPALM	853	Low	Low	1	11	East Coast Bays	Alma PS	47, Shakespeare Road, Takapuna	1757153	5928865	< 1 hour	Wairau Stream	3	Very low	3	Very low	2	1
DPSI1	854	Medium	Medium	1	11	East Coast Bays	Sidmouth PS (overflow point north)	R16, Brighton Terrace, Mairangi Bay	1756723	5932997	< 1 hour	Mairangi Bay	1	High	2	Moderate	2	1
DPSI1	855	Medium	Medium	1	11	East Coast Bays	Sidmouth PS (overflow point south)	52, Whitby Crescent, Mairangi Bay	1757051	5932383	< 1 hour	Mairangi Bay	1	High	2	Moderate	2	1
DPBRB	869	Low	Low	1	11	East Coast Bays	Browns Bay PS	5, Browns Bay Road, Browns Bay	1756183	5935040	4 - 8 hours	Taiaotea Creek	2	Moderate	2	Moderate	2	1
DPCBY	871	Low	Low	1	11	East Coast Bays	Castor Bay PS	1b, The Esplanade, Castor Bay	1757736	5930443	1 - 4 hours	Castor Bay Stream	3	Very low	3	Very low	1	2
DPKIL	909	Low	Low	1	11	East Coast Bays	Killarney PS	R39, Killarney Street, Takapuna	1757653	5927412	4 - 8 hours	Lake Pupuke	1	Low	1	Low	1	1

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									Ref X	Ref Y								
DPLAK	910	Low	Low	1	11	East Coast Bays	Lake View PS	45, Lake View Road, Takapuna	1757149	5927609	4 - 8 hours	Lake Pupuke	1	Low	1	Low	1	1
DPPRO	911	Low	Low	1	11	East Coast Bays	Promenade PS	36, Manurere Ave, Takapuna	1758062	5927759	> 8 hours	Lake Pupuke via stormwater pipe	1	Low	1	Low	1	1
DPSHE	912	Low	Low	1	11	East Coast Bays	Shea Hospital PS	132, Shakespeare Road, Takapuna	1756975	5928012	1 - 4 hours	Lake Pupuke	1	Low	1	Low	1	1
DPHM3	913	Low	Low	1	11	East Coast Bays	Hurstmere 3 PS	244, Hurstmere Road, Takapuna	1758188	5928064	> 8 hours	Lake Pupuke	1	Low	1	Low	1	1
DPHM2	914	Low	Low	1	11	East Coast Bays	Hurstmere 2 PS	294, Hurstmere Road, Takapuna	1758285	5928253	> 8 hours	Lake Pupuke	1	Low	1	Low	1	1
DPHM1	915	Low	Low	1	11	East Coast Bays	Hurstmere 1 PS	312, Hurstmere Road, Takapuna	1758340	5928365	4 - 8 hours	Lake Pupuke	1	Low	1	Low	1	1
DPERI	916	Low	Low	1	11	East Coast Bays	Eric Place PS	41128, Eric Price Avenue, Takapuna	1758248	5928503	> 8 hours	Lake Pupuke	1	Low	1	Low	1	1
DPONA	918	Low	Low	1	11	East Coast Bays	Omana PS	5, Omana Road, Milford	1757690	5929393	> 8 hours	Wairau Creek	2	Very low	3	Very low	1	1
DPGYS	938	Low	Low	1	11	East Coast Bays	Gray PS	10, Gray Cr, Torbay	1756934	5937225	1 - 4 hours	Winstones Cove	2	Low	2	Very low	2	1
DPBLA	947	Medium	Low	1	11	East Coast Bays	Black Rock PS	R21, Tiri Road, Takapuna	1758510	5928571	1 - 4 hours	Thorne Bay	2	Moderate	1	Low	1	1
SSSIL, DPWAU	951	Medium	Low	1	11	East Coast Bays	Silverfield Storage Tank	R21, Northcote Road, Glenfield	1755753	5927979	4 - 8 hours	Wairau Stream	3	Low	3	Low	2	1
DPCRA	1227	Low	Low	1	11	East Coast Bays	Craig Road PS	24, Craig Road, Milford	1757633	5929593	4 - 8 hours	Wairau Creek	2	Very low	3	Very low	1	1
DPBE2	1229	Low	Low	1	11	East Coast Bays	Beach 2 (Torbay) PS	948, Beach Road, Torbay	1756445	5936777	4 - 8 hours	Deep Creek	3	Very low	2	Moderate	1	1
DPBE2	1236	Low	Low	1	11	East Coast Bays	Beach 1 PS	R7, The Esplanade, Castor Bay	1757474	5931022	1 - 4 hours	Beach at Kennedy Park	2	Low	2	Very low	2	1
DPCHU	1237	Low	Low	1	11	East Coast Bays	Churchill Road PS	57, Churchill Road, Murrays Bay	1756699	5933919	1 - 4 hours	Churchill Coast	1	Low	2	Very low	2	1
DPPTL	1238	Low	Low	1	11	East Coast Bays	Portal Place PS	R5, Portal Place, Murrays Bay	1756864	5933627	4 - 8 hours	Churchill Coast	1	Low	2	Very low	2	1
DPRO2	1239	Low	Low	1	11	East Coast Bays	Rock Isle Rd 2 PS	57, Rock Isle Road, Torbay	1756715	5936801	> 8 hours	Waiake Beach	1	Very low	2	Very low	1	1
DPCLI	1240	Low	Low	1	11	East Coast Bays	Cliff Road PS	80, Cliff Road, Torbay	1757281	5937410	4 - 8 hours	Toroa Point via open stormwater channel	2	Low	2	Very low	2	1
-	848	Low	Low	2	12	Devonport/ Takapuna	Network overflow	1, Old Lake Road, Narrow Neck	1760613	5924477	-	Narrow Neck Beach	Class 1	Low	Class 1	Very low	Class 1	Class 1
DPNRO	860	High	Medium	1	12	Devonport/ Takapuna	Northboro PS	6, St Leonards Road, Devonport	1759994	5925810	< 1 hour	St Leonards Beach	Class 2	High	Class 1	High	Class 1	Class 1
DPKED	879	Low	Low	1	12	Devonport/ Takapuna	King Edward Parade PS	Windsor Reserve, King Edward Parade, Devonport	1760320	5922221	1 - 4 hours	Devonport Beach	Class 1	Low	Class 2	Very low	Class 1	Class 1
DPSFE	886	Low	Low	1	12	Devonport/ Takapuna	Seacliffe PS	28, Seacliffe Avenue, Belmont	1760156	5925212	4 - 8 hours	Seacliffe Coast	Class 2	Low	Class 1	Very low	Class 1	Class 1

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									Ref X	Ref Y								
DSKED	949	High	Medium	2	12	Devonport/ Takapuna	King Edward Parade Storage Tank	North Head Reserve, King Edward Parade, Devonport	1761724	5922618	> 8 hours	North Head Reserve	Class 2	High	Class 1	High	Class 1	Class 1
DPAAW	1226	Low	Low	1	12	Devonport/ Takapuna	Arawa PS	6, Arawa Avenue, Cheltenham Beach	1761086	5923458	4 - 8 hours	Cheltenham Beach	Class 1	Low	Class 1	Very low	Class 1	Class 1
-	829	Low	Low	2	13	Shoal Bay	Network overflow	28, Waitemata Road, Hauraki Corner	1758606	5925415		Shoal Bay via stormwater pipe	2	Very low	1	Very low	1	1
DPLNO	830	Medium	Medium	1	13	Shoal Bay	Lake Northcote PS	14, Matanui St, Northcote	1755780	5924800	1 - 4 hours	Onepoto Stream	3	Very low	1	Moderate	1	1
-	836	Low	Medium	2	13	Shoal Bay	Network overflow	24, Patuone Place, Devonport	1759907	5922974		Ngataringa Bay via stormwater pipe	2	Low	1	Low	1	1
-	837	Low	Low	2	13	Shoal Bay	Network overflow	10, Charles St, Takapuna	1757966	5925882		Shoal Bay via stormwater pipe	2	Very low	1	Very low	1	1
-	838	Low	Low	2	13	Shoal Bay	Network overflow	39, Kiwi Road, Devonport	1759655	5922922		Ngataringa Bay via stormwater pipe	2	Very low	1	Very low	1	1
-	839	Low	Low	2	13	Shoal Bay	Network overflow	51, Plymouth Cres, Devonport	1759069	5924212		Ngataringa Bay	2	Very low	1	Very low	1	1
-	840	Low	Medium	2	13	Shoal Bay	Network overflow	44, William Bond St, Devonport	1759519	5922963		Ngataringa Bay via stormwater pipe	2	Low	1	Low	1	1
-	841	Low	Medium	2	13	Shoal Bay	Network overflow	14, Denby Lane, Northcote Point	1755886	5924236		Shoal Bay via stormwater pipe	2		1		1	1
-	842	Low	Medium	2	13	Shoal Bay	Network overflow	48, Richmond Ave, Northcote Point	1755768	5924278		Shoal Bay via stormwater pipe	2		1		1	1
-	843	Low	Low	2	13	Shoal Bay	Network overflow	52, Richmond Ave, Northcote	1755722	5924297		Shoal Bay via stormwater pipe	2		1		1	1
-	846	Low	Low	2	13	Shoal Bay	Network overflow	26, Waratah Street, Birkenhead	1754165	5925196		Waiurutoa Stream	3	Very low	1	High	1	1
-	847	Low	Low	2	13	Shoal Bay	Network overflow	66, Stanley Point Road, Stanley Point	1758289	5922793		Ngataringa Bay via stormwater pipe	2	Very low	1	Very low	1	1
DPSEA	849	Low	Low	1	13	Shoal Bay	Seabreeze PS.	34, Seabreeze Road, Devonport	1760347	5924112	1 - 4 hours	Ngataringa Stream	2	Very low	1	Very low	1	1
-	851	Low	Low	2	13	Shoal Bay	Network overflow	1, Kauri Glen Road, Birkenhead	1754771	5925081		Waiurutoa Stream	3	Very low	1	High	1	1
DPBRP	852	Medium	Medium	1	13	Shoal Bay	Barrys Point PS	87, Barrys Point Road, Takapuna	1757482	5926320	1 - 4 hours	Stormwater pond						
DPSUL	861	Low	Low	1	13	Shoal Bay	Sulphur Beach PS)	5, Sulphur Beach Road, Northcote Point	1755974	5923663	> 8 hours	Shoal Bay via stormwater pipe	2	Very low	1	Very low	1	1
DPMNI	863	High	Medium	1	13	Shoal Bay	Maunganui PS	R28, Palmerston Road, Birkenhead	1754257	5923750	1 - 4 hours	Chelsea Bay	2	High	2	High	1	1
DPEWE	880	Low	Low	1	13	Shoal Bay	Ewen Alison PS	43, Ewen Alison Avenue, Devonport	1759853	5922893	> 8 hours	Ngataringa Bay via stormwater pipe	2	Very low	1	Very low	1	1

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DPLDE	881	Low	Low	1	13	Shoal Bay	Lake Devonport PS	R29, Lake Road, Devonport	1760158	5923377	> 8 hours	To land (public)						
DPNOD	883	Low	Low	1	13	Shoal Bay	Norwood PS	73A, Norwood Road, Bayswater	1758631	5924095	1 - 4 hours	Ngataringa Bay	2	Very low	1	Very low	1	1
DPKAW	884	Low	Low	1	13	Shoal Bay	Kawerau PS	52, Kawerau Avenue, Devonport	1759385	5924135	1 - 4 hours	Ngataringa Bay	2	Very low	1	Very low	1	1
DPREG	885	Low	Low	1	13	Shoal Bay	Regent PS	23, Regent St, Devonport	1759617	5924376	1 - 4 hours	Unnamed tributary of Ngataringa Bay	2	Moderate	2	Moderate	2	1
DPHNM	887	Low	Low	1	13	Shoal Bay	Hinemoa PS	Hinemoa Park, Hinemoa Street, Birkenhead	1754736	5923492	> 8 hours	Little Shoal Bay	2	Low	2	Very low	2	1
DPHOM	888	Low	Low	1	13	Shoal Bay	Homewood PS	24, Homewood Place, Chatswood	1752967	5923875	> 8 hours	Duck Creek and Chelsea Ponds	3	Very low	2	Moderate	2	1
DPAFD	889	Low	Low	1	13	Shoal Bay	Alfred PS	23, Alfred Street, Northcote Point	1755924	5923988	> 8 hours	Shoal Bay via stormwater pipe	2	Very low	1	Very low	1	1
DPSYV	890	Low	Medium	1	13	Shoal Bay	Sylvan PS	7, Sylvan Ave, Northcote	1756123	5924570	> 8 hours	Onepoto Stream	3	Very low	1	Low	1	1
DPHVN	898	Low	Low	1	13	Shoal Bay	Havenwood	R18, Havenwood Place, Birkenhead	1754493	5925539	1 - 4 hours	Waiurutoa Stream	3	Very low	1	High	1	1
DPARH	899	Low	Medium	1	13	Shoal Bay	Arahia PS	11, Arahia Street, Northcote	1756163	5925728	1 - 4 hours	Tuff Crater	3	Very low	1	Moderate	1	2
DPJIM	904	Low	Low	1	13	Shoal Bay	Jim Titchener PS	Jim Titchener Parade, Devonport	1759376	5923189	4 - 8 hours	Ngataringa Bay via stormwater pipe						
DPBYS	905	Low	Low	1	13	Shoal Bay	Bayswater PS	Bayswater Marina, Sir Peter Blake Parade, Bayswater	1757642	5923703	> 8 hours	Shoal Bay	2	Very low	1	Very low	1	1
DPBPO	906	Low	Low	1	13	Shoal Bay	Barrys Point Local PS	56, Barrys Point Road, Takapuna	1757591	5926435	4 - 8 hours	Shoal Bay	2	Very low	1	Very low	1	1
DPKWO	907	Low	Low	1	13	Shoal Bay	Kitewao PS	23, Kitewao Street, Northcote	1756654	5926549	4 - 8 hours	Hillcrest Creek	3	Very low	2	Moderate	1	1
DPDMN	908	Low	Low	1	13	Shoal Bay	Dominion PS	72, Dominion Street, Takapuna	1756770	5926625	4 - 8 hours	Hillcrest Creek via stormwater pipe	3	Very low	2	Moderate	1	1
DPEXM	948	Low	Low	1	13	Shoal Bay	Exmouth PS	140, Exmouth Road, Northcote	1756729	5925102	4 - 8 hours	Tuff Crater via stormwater pipe	3	Very low	1	Low	1	2
DPATL	826	Low	Low	1	14	Upper Harbour North	Atlas PS	8 Ascension Place, Rosedale	1754741	5931884	4 - 8 hours	Alexandra Stream	3	Very low	1	High	2	1
DPCHH	874	Low	Low	1	14	Upper Harbour North	Church House PS	51 Churchhouse Rd, Greenhithe	1749242	5929508	1 - 4 hours	Greenhithe Stream	3	Very low	1	High	2	1
DPRLE	876	Low	Low	1	14	Upper Harbour North	Rosedale PS	12 Rosedale Rd, Albany	1752681	5932674	< 1 hour	Oteha Stream	3	Very low	2	Moderate	1	1
DPKY1	877	Low	Low	1	14	Upper Harbour North	Kyle No. 1 PS	R27 Miromiro Street, Greenhithe	1750389	5930143	1 - 4 hours	Kyle Stream	3	Very low	2	Moderate	1	1
DPALB	878	Low	Low	1	14	Upper Harbour North	Albany PS	500 Albany Highway, Albany	1751307	5933566	4 - 8 hours	Oteha Stream	3	Very low	2	Moderate	1	1

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DPKER	920	Low	Low	1	14	Upper Harbour North	Kerema PS	14 Kerema Way, Schnapper Rock	1749720	5930454	> 8 hours	Lucas Creek	2	Very low	1	Very low	1	1
DPVAN	923	Low	Low	1	14	Upper Harbour North	Van Der Bilt PS	17 Vanderbilt Parade, Albany	1751427	5932861	4 - 8 hours	Oteha Stream	3	Very low	2	Moderate	1	1
DPREM	924	Low	Low	1	14	Upper Harbour North	Remu PS	R20 Remu Place, Greenhithe	1749145	5928046	1 - 4 hours	Greenhithe Coast	2	Very low	2	Very low	2	1
DPKKI	925	Low	Low	1	14	Upper Harbour North	Koki PS	3 Koki Road, Greenhithe	1748900	5928205	1 - 4 hours	Greenhithe Coast	2	Very low	2	Very low	2	1
DPRAH	926	Low	Low	1	14	Upper Harbour North	Rahui PS	17 Rahui Road, Greenhithe	1748741	5928466	4 - 8 hours	Greenhithe Coast	2	Very low	2	Very low	2	1
DPAWA	927	Low	Low	1	14	Upper Harbour North	Awatahi PS	4 Awatahi Place, Greenhithe	1748755	5929200	1 - 4 hours	Lucas Creek	2	Very low	1	Very low	1	1
DPWNI	928	Low	Low	1	14	Upper Harbour North	Wainoni PS	7 Samuel Cross Place, Greenhithe	1749913	5929936	4 - 8 hours	Te Wharau Creek	3	Very low	1	Very low	2	1
DPALY	934	Low	Low	1	14	Upper Harbour North	Aberly PS	91 Aberley Rd, Albany	1750153	5931426	1 - 4 hours	Aberley Creek	3	Very low	1	Moderate	2	1
DPMHO	944	Low	Low	1	14	Upper Harbour North	Mahoney PS	40 Mahoney Drive, Albany	1750407	5932799	> 8 hours	Lucas Creek	2	Very low	1	Very low	1	1
DPCLP	945	Low	Low	1	14	Upper Harbour North	Carol Lee Place PS	19 Carol Lee Place, Albany Heights	1751295	5935005	4 - 8 hours	To Land						
DPKY2	946	Low	Low	1	14	Upper Harbour North	Kyle No. 2 PS	5 Albertine Place, Greenhithe	1751368	5930457	4 - 8 hours	Kyle Stream	3	Very low	2	Moderate	1	1
DPOSC	1231	Low	Low	1	14	Upper Harbour North	Oscar PS	29 Oscar Road, Greenhithe	1748801	5929607	4 - 8 hours	Lucas Creek	2	Very low	1	Very low	1	1
DPBUS	1232	Low	Low	1	14	Upper Harbour North	Bush PS	1 Bushlands Park Drive, Albany	1752405	5933236	4 - 8 hours	Oteha Stream	3	Very low	2	Moderate	1	1
DPCHS	1234	Low	Low	1	14	Upper Harbour North	Chester PS	31 Chester Ave, Greenhithe	1751748	5930456	4 - 8 hours	Kyle Stream	3	Very low	2	Moderate	1	1
DPDRE	1241	Low	Low	1	14	Upper Harbour North	Dressage PS	27 Durbin Court, Greenhithe	1750231	5928910	4 - 8 hours	Orwell Stream	3	Very low	2	Moderate	2	2
-	844	Low	Low	2	15	Upper Harbour South	Network overflow	28 Gazelle Rd, Beach Haven	1750235	5927255	-	Hellyers Creek	2	Very low	1	Very low	1	1
DPISL	856	Medium	Low	1		Upper Harbour South	Island Bay PS	103 Island Bay Road, Beach Haven	1750669	5924854	1 - 4 hours	Island Bay	2	Moderate	2	Low	1	1
DPKAH	862	Medium	Low	1		Upper Harbour South	Kahika PS	19 Kahika Road, Birkdale	1751743	5927577	4 - 8 hours	Kaipatiki Creek	3	Very low	1	Low	1	1
DPVIA	891	Low	Low	1		Upper Harbour South	Valkyria PS	2 Valkyria Place, Beach Haven	1751003	5924630	1 - 4 hours	Soldiers Bay	2	Low	1	Very low	2	1
DPHD1	893	Low	Low	1		Upper Harbour South	Hadfield 1 PS	95 Hadfield Street, Beach Haven	1750899	5924984	1 - 4 hours	Island Bay	2	Low	2	Very low	1	1
DPHD2	894	Low	Low	1		Upper Harbour South	Hadfield 2 PS	90 Hadfield Street, Beach Haven	1750919	5925105	1 - 4 hours	Island Bay	2	Low	2	Very low	1	1
DPCAM	897	Low	Low	1		Upper Harbour South	Caram PS	14 Caram Place, Birkenhead	1752739	5925165	> 8 hours	Eskdale Stream	3	Very low	2	Moderate	1	1

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DPRMP	900	Low	Low	1		Upper Harbour South	Rosecamp PS	52 Rosecamp Road, Beach Haven	1750483	5925867	1 - 4 hours	Charcoal Bay	2	Low	2	Very low	1	1
DPCRO	901	Low	Low	1		Upper Harbour South	Cronin PS	6 Cronin Place, Beach Haven	1750198	5926733	1 - 4 hours	Beach Haven Beach	1	Low	2	Very low	1	1
DPBEN	902	Low	Low	1		Upper Harbour South	Beachaven PS	28 Beach Haven Road, Beach Haven	1750008	5927176	1 - 4 hours	Hellyers Creek	2	Very low	1	Very low	1	1
DPCRE	903	Low	Low	1		Upper Harbour South	Cresta PS	40 Cresta Avenue, Beach Haven	1750462	5927278	1 - 4 hours	Hellyers Creek	2	Very low	1	Very low	1	1
DPGLU	917	Low	Low	1		Upper Harbour South	Glendhu PS	164 Glendhu Road, Beach Haven	1752025	5929183	> 8 hours	Lignite Stream	3	Very low	1	High	2	1
DPALC	930	Low	Low	1		Upper Harbour South	Albany Church PS	26 Albany Highway, Albany	1753162	5929868	1 - 4 hours	Lignite Stream	3	Very low	1	High	2	1
DPNEP	943	Low	Low	1		Upper Harbour South	Neptune PS	42 Neptune Avenue, Beach Haven	1750227	5926166	4 - 8 hours	Beach Haven Coast	3	Very low	2	Very low	1	1
-	1441	Low	Low	2	13	Upper Harbour South	Network overflow	47 Saffron Street, Birkdale	1751241	5926089	-	Rangatira Stream	3	Low	2	Moderate	2	1
-	1442	Low	Low	2	13	Upper Harbour South	Network overflow	Birkenhead College, 140 Birkdale Road, Birkdale	1751455	5925801	-	Rangatira Stream	3	Low	2	Moderate	2	1
-	1443	Low	Low	2		Upper Harbour South	Network overflow	128 Spinella Drive, Bayview	1753182	5929167	-	Glendhu Reserve Stream	3	Very low	2	Moderate	2	1
DPHI1	12	Low	Low	1	16	Upper Harbour West	Herald Island No. 1 PS	Landing Reserve, The Terrace, Herald Island	1747504	5928324	> 8 hours	To Land						
DPHI2	13	Low	Low	1	16	Upper Harbour West	Herald Island No. 2 PS	84 The Terrace, Herald Island	1747989	5928493	> 8 hours	Christmas Beach	1	Low	1	Very low	1	1
DPCNS	14	Low	Low	1	16	Upper Harbour West	Constable Lane PS	17B Constable Lane, West Harbour	1746472	5923896	> 8 hours	To Land						
DPTCV	31	Low	Low	1	16	Upper Harbour West	The Cove PS	38-48 Clearwater Cove, Hobsonville	1746559	5924834	> 8 hours	To Land						
DPWEM	33	Low	Low	1	16	Upper Harbour West	West Park Marina PS	8A Clearwater Cove, Hobsonville	1746631	5924966	> 8 hours	To Land						
DPHOB	1274	Low	Low	1	16	Upper Harbour West	Hobsonville No. 1 PS	44 to 50 Station Street, Hobsonville	1747889	5927115	> 8 hours	Te Okoriki Inlet	3	Very low	2	Very low	1	1
DPHOP	1275	Low	Low	1	16	Upper Harbour West	Hobsonville PS	2A Buckley Avenue, Hobsonville	1747498	5926793	4 - 8 hours	Wallace Inlet	2	Very low	2	Very low	1	1
-	2	Low	Low	2	17	Henderson Creek	Network overflow	25 Blethyn Place, Te Atatu South	1746034	5919032		Henderson Creek (southern arm)	2	Very low	1	Very low	1	1
-	3	Low	Low	2	17	Henderson Creek	Network overflow	13 Ascot Avenue, Henderson	1744420	5919675		Taikata Stream	3	Very low	3	Very low	2	1

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									Ref X	Ref Y								
-	4	Low	Medium	2	17	Henderson Creek	Network overflow	144-160 Triangle Road, Massey	1744306	5921899		Rarawaru Stream	3	Low	2	High	2	1
-	5	Low	Low	2	17	Henderson Creek	Network overflow	9 Glenford Lane, Te Atatu Peninsula	1746820	5922215		Henderson Creek	1	Very low	1	Very low	1	1
-	6	Medium	Medium	2	17	Henderson Creek	Network overflow	50 Kingdale Road, Henderson	1744853	5919642		Lincoln Stream	3	Low	2	High	2	1
-	7	Low	Low	2	17	Henderson Creek	Network overflow	14B Woodglen Road, Glen Eden	1746473	5913873		Waikumete Stream	3	Very low	2	Very low	2	1
-	8	Low	Low	2	17	Henderson Creek	Network overflow	16 Chilcot Road, Te Atatu South	1745804	5918257	> 8 hours	Henderson Creek (southern arm)	2	Very low	1	Very low	1	1
DPDAR	15	Low	Low	1	17	Henderson Creek	Darcy Place PS	23-25 Darcy Place, Massey East	1745040	5921706	> 8 hours	Henderson Creek	1	Very low	1	Very low	1	1
DPCLL	16	Low	Low	1	17	Henderson Creek	Colwill Rd PS	161C Colwill Road, Massey East	1746081	5922398	4 - 8 hours	Henderson Creek	1	Very low	1	Very low	1	1
DPFLN	690	Low	Low	1	17	Henderson Creek	Western PS	143 Flanshaw Road, Te Atatu South	1746336	5920116	4 - 8 hours	Henderson Creek (southern arm)	2	Very low	1	Very low	1	1
DPTEA	691	Low	Low	1	17	Henderson Creek	Te Atatu Central PS	415a Te Atatu Road, Te Atatu Peninsula	1747461	5920317	1 - 4 hours	Harbourview Beach	2	Low	1	Very low	2	2
DPTEN	692	Low	Low	1	17	Henderson Creek	Te Atatu North PS	9 Kelvin Crescent, Te Atatu Peninsula	1747405	5922789	> 8 hours	Estuary at Orukuwai Point	3	Very low	1	Very low	2	1
DSGLE MH16	748	High	High	2	17	Henderson Creek	Network overflow: Glen Eden Branch MH16	16 Coletta Lane, Te Atatu South	1745917	5918448		Henderson Creek (southern arm)	2	Very high	1	Very high	1	1
DSSWN MH15	749	High	Medium	2	17	Henderson Creek	Network overflow: Swanson Branch MH15	95 Riverpark Cresent, Henderson	1744549	5920113		Huruhuru Creek	2	High	1	High	2	1
DPEAS	1217	Low	Low	1	17	Henderson Creek	Easter Parade PS	22A Easter Parade, Glen Eden	1745202	5912452	> 8 hours	Sharpe/Kaurimu Stream	3	Very low	1	High	2	2
DPPHI	1218	Low	Low	1	17	Henderson Creek	Phillips Ave PS	47A Philip Avenue, Glen Eden	1745700	5911951	> 8 hours	Sharpe/Kaurimu Stream	3	Very low	1	High	2	2
-	1278	Low	Low	2	17	Henderson Creek	Network overflow	Serwayne Place Reserve, Sunnyvale	1745625	5915528		Waikumete Stream	3	Very low	2	Very low	2	1
-	1280	Low	Low	2	17	Henderson Creek	Network overflow	60 Sherrybrook Place , Sunnyvale	1745541	5914713		Waikumete Stream	3	Very low	2	Very low	2	1
-	1282	Low	Low	2	17	Henderson Creek	Network overflow	121A Millbrook Road, Henderson	1745549	5915651		Waikumete Stream	3	Very low	2	Very low	2	1
-	1283	Low	Low	2	17	Henderson Creek	Network overflow	4 Edsel Street, Henderson	1745623	5917049		Oratia Stream	3	Very low	1	Low	2	1
-	1285	Low	Low	2	17	Henderson Creek	Network overflow	Sunline Avenue Reserve, Massey	1744331	5920348		Huruhuru Creek	2	Very low	1	Very low	2	1

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-	1286	Low	Low	2	17	Henderson Creek	Network overflow	Daytona Road Reserve, Henderson	1745077	5920367		Huruhuru Creek	2	Very low	1	Very low	2	1
-	10	Low	Low	2	18	Whau River	Network overflow	38 La Rosa Street, Green Bay	1749083	5911643		Avondale Stream	3	Very low	3	Very low	1	1
DPCOV	17	Low	Low	1	18	Whau River	Covil PS	28 Bridge Avenue, Te Atatu South	1747540	5919251	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPWRT	18	Low	Low	1	18	Whau River	Wairata PS	126 Tiroroa Avenue, Te Atatu South	1747322	5918490	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPBED	19	Low	Low	1	18	Whau River	Bedford St PS	4 Bedford Street, Te Atatu South	1747497	5918151	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPMLD	20	Low	Low	1	18	Whau River	McLeod PS	27 Riverglade Parkway, Te Atatu South	1747620	5917450	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPBNC	21	Low	Low	1	18	Whau River	Bancroft Cres PS	30 Bancroft Crescent, Glendene	1748358	5916229	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPHRM	22	Low	Low	1	18	Whau River	Harmel Rd PS	76a Harmel Road, Glendene	1747818	5915565	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPARC	23	Low	Low	1	18	Whau River	Archibald Rd PS	109a Archibald Road, Kelston	1748792	5915574	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPQM1	24	Low	Low	1	18	Whau River	Queen Mary Ave No. 1 PS	33 Queen Mary Avenue, Kelston	1749432	5914804	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPHUG	34	Low	Low	1	18	Whau River	Hugh Brown Dr PS.	8 Hugh Brown Drive, New Lynn	1749833	5914198	> 8 hours	Rewarewa Creek	3	Very low	2	Moderate	1	1
DPSTR	38	Low	Low	1	18	Whau River	Sceptre Place PS	20 Sceptre Place, Avondale	1749357	5915778	4 - 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPRVD	41	Low	Low	1	18	Whau River	Riversdale Rd PS	46 Tony Segedin Drive, Avondale	1749398	5915371	4 - 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPLID	42	Low	Low	1	18	Whau River	Lidcombe Place PS	11a Lidcombe Place, Avondale	1750371	5916589	4 - 8 hours	Waterview Embayment	2	Low	1	Low	1	1
DPASH	44	Low	Low	1	18	Whau River	Ash St PS	159 Ash Street, Avondale	1749842	5915002	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPRB1	607	Low	Low	1	18	Whau River	Rosebank Rd No.1 PS	407 Rosebank Rd, Avondale	1749684	5917070	> 8 hours	Waterview Embayment	2	Low	1	Low	1	1
DPEND	609	Low	Low	1	18	Whau River	Endeavour St PS	69 - 79 Endeavour St, Blockhouse Bay	1751453	5911636	> 8 hours	Blockhouse Bay	1	Low	2	Very low	1	1
DPHS1	617	Low	Low	1	18	Whau River	Holly St No .1 PS	72c Holly St, Avondale	1750812	5916355	1 - 4 hours	Waterview Embayment	2	Low	1	Low	1	1
DPHS2	618	Low	Low	1	18	Whau River	Holly St No. 2 PS	107 Holly St, Avondale	1750568	5916407	> 8 hours	Waterview Embayment	2	Low	1	Low	1	1
DPKEY	621	Low	Low	1	18	Whau River	Kenley Place PS	22 Kenley Pl, Avondale	1749236	5915985	1 - 4 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPLEW	622	Low	Low	1	18	Whau River	Lewis St PS	52 Lewis St, Blockhouse Bay	1752015	5912008	> 8 hours	Blockhouse Bay	1	Low	2	Very low	1	1
DPMED	625	Low	Low	1	18	Whau River	Mead St PS	38 Mead St, Avondale	1749709	5916482	4 - 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1

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DPPKI	629	Low	Low	1	18	Whau River	Patiki Rd PS	100 Patiki Rd, Avondale	1748419	5918548	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPRB2	634	Low	Low	1	18	Whau River	Rosebank Rd No. 2 PS	591 Rosebank Rd, Avondale	1749015	5917538	4 - 8 hours	Waterview Embayment	2	Low	1	Low	1	1
DPTIM	644	Low	Low	1	18	Whau River	Timothy Place PS	39 Timothy Pl, Avondale	1748468	5917464	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPESM	656	Low	Low	1	18	Whau River	Esmeralda Ave PS	50 Esmeralda Ave, Avondale	1749318	5916633	1 - 4 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPWIN	695	High	Medium	1	18	Whau River	St George PS	49a Arran Street, Avondale	1750801	5914066	< 1 hour	Whau Creek	3	Low	1	Very high	1	1
DSRSB	752	Low	Low	2	18	Whau River	Network overflow, Rose Bank siphon	26 Saunders Place, Avondale	1748357	5917248		Whau River Estuary	2	Very low	1	Very low	1	1
DSTIT MH4	756	Low	Low	2	18	Whau River	Network overflow, Titirangi Branch MH4	23 Clark Street, New Lynn	1750619	5913714		Avondale Stream	3	Very low	3	Very low	1	1
DSNWL MH3	757	Low	Low	2	18	Whau River	Network overflow, New Lynn Branch MH3	3111 Great North Road, New Lynn	1749711	5914013		Rewarewa Creek	3	Very low	2	Moderate	1	1
DPTIR	1202	Low	Low	1	18	Whau River	Tirimoana Road PS	129 Tirimoana Rd, Te Atatu South	1747469	5917025	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPGMP	1211	Low	Low	1	18	Whau River	Glen Marine Parade PS	94 Glen Marine Parade, Glendene	1747764	5916985	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPARO	1212	Low	Low	1	18	Whau River	Aronui Terrace PS	15 Aronui Terrace, Kelston	1748256	5915644	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPQM2	1213	Low	Low	1	18	Whau River	Queen Mary Ave No. 2 PS	49 Queen Mary AVE, New Lynn	1749413	5914969	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
DPKUA	1214	Low	Low	1	18	Whau River	Kuaka Place PS	21 Kuaka Pl, New Lynn	1749530	5914568	> 8 hours	Rewarewa Creek	3	Very low	2	Moderate	1	1
DPARP	1224	Low	Low	1	18	Whau River	Archibald Park PS	Beaubank Road, Kelston	1748920	5915338	> 8 hours	Whau River Estuary	2	Very low	1	Very low	1	1
-	1279	Medium	Medium	2	18	Whau River	Network overflow	91 Gardner Road,, New Lynn	1749609	5912797		Rewarewa Creek via stormwater pipe	3	Low	2	High	1	1
-	1281	Low	Low	2	18	Whau River	Network overflow	115 Seabrook Ave, , New Lynn	1748786	5912865		Manawa Stream via stormwater pipe	3	Very low	2	Moderate	2	1
-	1284	Low	Low	2	18	Whau River	Network overflow	28d Fruitvale Road,, New Lynn	1748539	5913542		Scroggy Stream	3	Very low	2	Moderate	2	1
DPFRE	25	Low	Low	1	19	Laingholm	French Bay PS	87 Otitori Bay Rd,Titirangi	1748316	5909509	> 8 hours	French Bay	1	Low	2	Very low	1	1
DPDAV	26	Low	Low	1	19	Laingholm	Davies Bay PS	41A McEldowney Rd,Titirangi	1747313	5908774	> 8 hours	Woonton Creek	3	Very low	2	Moderate	1	1
DPJEN	27	Low	Low	1	19	Laingholm	Jenkins Bay PS	812 South Titirangi Rd,Titirangi	1747079	5907986	> 8 hours	Jenkins Bay	2	Low	2	Very low	1	1
DPDOR	28	Low	Low	1	19	Laingholm	Dorothy Rd PS	15 Dorothy Rd,Laingholm	1746217	5908006	> 8 hours	Unnamed beach at Dorothy Road	1	Low	2	Very low	1	1
DPWST	29	Low	Low	1	19	Laingholm	Western Rd PS	4 Western Rd, Laingholm	1746042	5907537	> 8 hours	Unnamed stream flowing to Laingholm Bay	3	Low	2	Very low	1	1

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DPKA1	30	Low	Low	1	19	Laingholm	Kauri Point Road PS	105 Kauri Point Rd, Laingholm	1745236	5906193	> 8 hours	Taumatarea Esplanade	2	Low	2	Very low	1	1
DPHU3	32	Low	Low	1	19	Laingholm	486 Huia Rd PS	486 Huia Rd,Laingholm	1744418	5908462	> 8 hours	Williams Stream	3	Very low	2	Moderate	2	1
DPLNG	693	Low	Low	1	19	Laingholm	Laingholm PS	Laingholm Drive, Laingholm	1745799	5908889	4 - 8 hours	Waiohua Creek	3	Very low	1	Very low	1	1
DPWDB	694	Low	Low	1	19	Laingholm	Wood Bay PS	Wood Bay Reserve, Wood Bay	1748238	5910044	1 - 4 hours	Wood Bay	1	Low	2	Very low	1	1
DPLAI	1201	Low	Low	1	19	Laingholm	99 Laingholm Dr PS	99 Laingholm DRV, Laingholm	1745960	5908180	> 8 hours	Unnamed stream flowing to Little Muddy Creek (#1)	3	Very low	2	Low	2	2
DPHU2	1203	Low	Low	1	19	Laingholm	358 Huia Rd PS	358 Huia Rd,Titirangi	1744700	5909449	> 8 hours	Woodlands Stream	3	Very low	1	High	2	2
DPOKE	1204	Low	Low	1	19	Laingholm	7 Okewa Rd PS	7 Okewa Rd,Titirangi	1748075	5909026	> 8 hours	Titirangi Beach	1	Very Low	2	Very Low	1	1
DPKRN	1205	Low	Low	1	19	Laingholm	27 Karen Rd PS	27 Karen Rd,Laingholm	1744450	5908215	> 8 hours	Williams Stream	3	Very low	2	Moderate	2	1
DPST1	1206	Low	Low	1	19	Laingholm	530 Sth Titirangi Rd PS	526 South Titirangi Rd,Titirangi	1747470	5910241	> 8 hours	Paturoa Stream	3	Very Low	2	Moderate	2	1
DPTR1	1207	Low	Low	1	19	Laingholm	Tamariki Res A PS	753 South Titirangi Rd,Titirangi	1746804	5908298	1 - 4 hours	Unnamed Stream flowing to Little Muddy Creek (#3)	3	Very low	2	Moderate	2	1
DPTR2	1208	Low	Low	1	19	Laingholm	Tamariki Res B PS	753 South Titirangi Rd,Titirangi	1746721	5908369	> 8 hours	Unnamed Stream flowing to Little Muddy Creek (#3)	3	Very low	2	Moderate	2	1
DPPLA	1209	Low	Low	1	19	Laingholm	Plantation Res PS	18 Kauri Point Rd,Laingholm	1745488	5907126	> 8 hours	Unnamed stream flowing to Taumatarea Esplanade	3	Very low	2	Moderate	2	1
DPKA2	1210	Low	Low	1	19	Laingholm	32 Kauri Pt Rd PS	32 Kauri Point Rd,Laingholm	1745432	5906980	> 8 hours	Unnamed stream flowing to Taumatarea Esplanade	3	Very low	2	Moderate	2	1
DPHW2	1215	Low	Low	1	19	Laingholm	44 Hollywood Rd PS	46 Hollywood Ave, Titirangi	1745893	5910127	> 8 hours	Armstrong Gully	3	Very low	2	Moderate	1	2
DPPO2	1216	Low	Low	1	19	Laingholm	Portage Rd PS	235A Portage Rd,Green Bay	1750457	5911416	> 8 hours	Green Bay	1	Low	2	Very low	1	1
DPHW1	1219	Low	Low	1	19	Laingholm	6 Hollywood Rd PS	6 Hollywood Ave, Titirangi	1745928	5910415	> 8 hours	Armstrong Gully	3	Very low	2	Moderate	1	2
DPVVW	1220	Low	Low	1	19	Laingholm	13 Valley View PS	15 Valley View Rd,Titirangi	1746057	5910362	> 8 hours	Armstrong Gully	3	Very low	2	Moderate	1	2
DPST2	1221	Low	Low	1	19	Laingholm	541c Sth Titirangi Rd PS	541C South Titirangi Rd,Titirangi	1747260	5910307	> 8 hours	Unnamed Stream flowing to Little Muddy Creek (#2)	3	Very low	2	Moderate	2	2
DPHU1	1222	Low	Low	1	19	Laingholm	44 Huia Rd PS	44 Huia Rd,Titirangi	1747103	5910350	> 8 hours	Unnamed Stream flowing to Little Muddy Creek (#2)	3	Very low	2	Moderate	2	2
DPWOO	1223	Low	Low	1	19	Laingholm	136 Wood Bay Rd PS	136 Wood Bay Rd,Titirangi	1748544	5910537	> 8 hours	Oatoru Bay	2	Low	2	Very low	1	1

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-	194	High	High	2	20	Cox's Bay	Network overflow	28 Sarsfield Street, Herne Bay	1755138	5921375		Home Bay	1	Very high	2	Very high	1	1
-	195	Low	Low	2	20	Cox's Bay	Network overflow	54 Sarsfield Street, Herne Bay	1754890	5921317		Home Bay	1	Very high	2	Very high	1	1
-	196	High	High	2	20	Cox's Bay	Network overflow	8 Sarsfield Street, Herne Bay	1755262	5921402		Home Bay	1	Very high	2	Very high	1	1
-	197	Low	High	2	20	Cox's Bay	Network overflow	33 Herne Bay Road, Herne Bay	1754026	5920996		Herne Bay	1	Moderate	2	Moderate	1	1
-	198	High	High	2	20	Cox's Bay	Network overflow	22 Marine Parade, Herne Bay	1753816	5920806		Cox's Bay	3	Moderate	2	Very high	1	1
-	199	Low	High	2	20	Cox's Bay	Network overflow	57 Marine Parade, Herne Bay	1753732	5920673		Cox's Bay	3	Moderate	2	Very high	1	1
-	200	Low	High	2	20	Cox's Bay	Network overflow	28 Sentinel Road, Herne Bay	1754732	5921097		Home Bay	1	Very high	2	Very high	1	1
-	201	High	High	2	20	Cox's Bay	Network overflow	97 Sarsfield Street, Herne Bay	1754599	5921262		Home Bay	1	Very high	2	Very high	1	1
-	202	Low	High	2	20	Cox's Bay	Network overflow	69 Hamilton Road, Ponsonby	1754881	5921403		Home Bay	1	Very high	2	Very high	1	1
.-	205	Low	Low	2	20	Cox's Bay	Network overflow	6 Curran Street, Herne Bay	1755143	5921008		Home Bay	1	Very high	2	Very high	1	1
-	219	Low	Low	2	20	Cox's Bay	Network overflow	71 Williamson Avenue, Grey Lynn	1755282	5919063		Cox's Creek	3	Moderate	2	Very high	1	1
-	220	Low	Low	2	20	Cox's Bay	Network overflow	35 Sussex Street, Grey Lynn	1755701	5919152		Cox's Creek	3	Moderate	2	Very high	1	1
-	221	Low	Low	2	20	Cox's Bay	Network overflow	36 Pollen Street, Grey Lynn	1755898	5919301		Cox's Creek	3	Moderate	2	Very high	1	1
-	222	Low	Low	2	20	Cox's Bay	Network overflow	33 Williamson Avenue, Grey Lynn	1755588	5919224		Cox's Creek	3	Moderate	2	Very high	1	1
-	223	Low	Low	2	20	Cox's Bay	Network overflow	36 Scanlan Street, Grey Lynn	1755757	5919170		Cox's Creek	3	Moderate	2	Very high	1	1
-	224	Low	Low	2	20	Cox's Bay	Network overflow	49 Ariki Street, Grey Lynn	1755498	5919076		Cox's Creek	3	Moderate	2	Very high	1	1
-	225	Medium	Medium	2	20	Cox's Bay	Network overflow	71 Williamson Avenue, Grey Lynn	1755327	5919073		Cox's Creek	3	Moderate	2	Very high	1	1
-	226	Low	Medium	2	20	Cox's Bay	Network overflow	123 Williamson Avenue, Grey Lynn	1755028	5918798		Cox's Creek	3	Moderate	2	Very high	1	1
-	227	Low	Low	2	20	Cox's Bay	Network overflow	34 Prime Rd, Grey Lynn	1755095	5919042		Cox's Creek	3	Moderate	2	Very high	1	1
-	228	Low	Low	2	20	Cox's Bay	Network overflow	10 Firth Road, Grey Lynn	1754769	5919020		Cox's Creek	3	Moderate	2	Very high	1	1

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Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
-	229	Medium	High	2	20	Cox's Bay	Network overflow	30 West End Road, Herne Bay	1754138	5920376		Cox's Creek	3	Moderate	2	Very high	1	1
-	230	Medium	High	2	20	Cox's Bay	Network overflow	29b Wharf Road, Herne Bay	1754373	5920294		Kelmarna Creek	3	Moderate	2	Very high	2	1
-	233	High	High	2	20	Cox's Bay	Network overflow	65 Kelmarna Avenue, Ponsonby	1754620	5920358		Kelmarna Creek	3	Low	2	High	2	1
-	234	Low	Low	2	20	Cox's Bay	Network overflow	75 West End Road, Herne Bay	1753612	5920199		Cox's Bay	3	Moderate	2	Very high	1	1
-	235	High	High	2	20	Cox's Bay	Network overflow	52 Fife Street, Westmere	1753938	5919779		Edgars Creek	3	Very low	3	Very low	1	1
-	236	Low	Low	2	20	Cox's Bay	Network overflow	32 Tawariki Street, Grey Lynn	1754703	5920144		Cox's Creek	3	Moderate	2	Very high	1	1
-	237	Low	Low	2	20	Cox's Bay	Network overflow	93 Rose Road, Grey Lynn	1755122	5919343		Cox's Creek	3	Moderate	2	Very high	1	1
-	238	High	High	2	20	Cox's Bay	Network overflow	61 Dryden Street, Grey Lynn	1754932	5919327		Cox's Creek	3	Moderate	2	Very high	1	1
--	239	Low	Low	2	20	Cox's Bay	Network overflow	31 Cockburn Street, Grey Lynn	1754720	5919634		Cox's Creek	3	Moderate	2	Very high	1	1
-	240	Low	Medium	2	20	Cox's Bay	Network overflow	73 Dryden Street, Grey Lynn	1754813	5919506		Cox's Creek	3	Moderate	2	Very high	1	1
-	241	Medium	Medium	2	20	Cox's Bay	Network overflow	55 Hakanoa Street, Grey Lynn	1754715	5919584		Cox's Creek	3	Moderate	2	Very high	1	1
-	242	High	High	2	20	Cox's Bay	Network overflow	38 Sackville Street, Grey Lynn	1754594	5919716		Cox's Creek	3	Moderate	2	Very high	1	1
-	243	Low	Low	2	20	Cox's Bay	Network overflow	58 Hakanoa Street, Grey Lynn	1754669	5919660		Cox's Creek	3	Moderate	2	Very high	1	1
-	244	High	High	2	20	Cox's Bay	Network overflow	32 Tawariki Street, Ponsonby	1754706	5920141		Cox's Creek	3	Moderate	2	Very high	1	1
-	245	High	High	2	20	Cox's Bay	Network overflow	32 Tawariki Street, Ponsonby	1754705	5920138		Cox's Creek	3	Moderate	2	Very high	1	1
-	246	High	Medium	2	20	Cox's Bay	Network overflow	32 Tawariki Street, Ponsonby	1754698	5920149		Cox's Creek	3	Moderate	2	Very high	1	1
-	248	Low	Low	2	20	Cox's Bay	Network overflow	31 Wellpark Avenue, Westmere	1754014	5919342		Edgars Creek	3	Very low	3	Very low	1	1
-	250	Low	Low	2	20	Cox's Bay	Network overflow	25 Francis Street, Grey Lynn	1754087	5919267		Edgars Creek	3	Very low	3	Very low	1	1
-	251	Low	Low	2	20	Cox's Bay	Network overflow	33 Regina Street, Grey Lynn	1754180	5920027		Cox's Creek	3	Moderate	2	Very high	1	1
-	252	High	High	2	20	Cox's Bay	Network overflow	22 Parawai Crescent, Ponsonby	1754415	5920080		Cox's Creek	3	Moderate	2	Very high	1	1

Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
-	253	Low	Low	2	20	Cox's Bay	Network overflow	14 Parawai Cr, Grey Lyn	1754437	5920015		Cox's Creek	3	Moderate	2	Very high	1	1
-	254	Low	Low	2	20	Cox's Bay	Network overflow	58B Fife Street, Westmere	1753938	5919779		Edgars Creek	3	Very low	3	Very low	1	1
-	255	Low	Low	2	20	Cox's Bay	Network overflow	56 Fife Street, Westmere	1753960	5919746		Edgars Creek	3	Very low	3	Very low	1	1
-	256	Low	Medium	2	20	Cox's Bay	Network overflow	63a Warnock Street, Westmere	1753931	5919721		Edgars Creek	3	Very low	3	Very low	1	1
-	257	Low	Low	2	20	Cox's Bay	Network overflow	3 Larchwood Avenue, Westmere	1753971	5919612		Edgars Creek	3	Very low	3	Very low	1	1
-	259	Low	Low	2	20	Cox's Bay	Network overflow	Dorset Street, Westmere	1753507	5919632		Motions Creek	2	Very high	2	Very high	1	1
-	260	Low	Low	2	20	Cox's Bay	Network overflow	3/34 Notley Street, Westmere	1753537	5919364		Motions Creek	2	Very high	2	Very high	1	1
-	261	Low	Low	2	20	Cox's Bay	Network overflow	18 Meola Road, Westmere	1753251	5919645		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	262	Medium	High	2	20	Cox's Bay	Network overflow	26 Westmere Crescent, Westmere	1753119	5919677		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	263	Medium	High	2	20	Cox's Bay	Network overflow	36a Westmere Crescent, Westmere	1753069	5919716		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	264	Low	High	2	20	Cox's Bay	Network overflow	23 Savage Street, Grey Lynn	1753429	5919394		Motions Creek	2	Very high	2	Very high	1	1
-	265	High	High	2	20	Cox's Bay	Network overflow	15 Notley Street, Grey Lynn	1753313	5919486		Motions Creek	2	Very high	2	Very high	1	1
-	266	Low	Low	2	20	Cox's Bay	Network overflow	25 Tirotai Crescent, Westmere	1752923	5920019		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	267	Low	Low	2	20	Cox's Bay	Network overflow	216 Garnet Road, Westmere	1752941	5920089		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	268	Low	Medium	2	20	Cox's Bay	Network overflow	40 Lemington Road, Westmere	1752940	5919748		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	269	Low	Low	2	20	Cox's Bay	Network overflow	7 Weona Place, Westmere	1752668	5919768		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	270	Low	Low	2	20	Cox's Bay	Network overflow	1 Westmere Park Avenue, Westmere	1752892	5919822		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	271	Low	Low	2	20	Cox's Bay	Network overflow	22a Winsomere Crescent, Westmere	1752718	5919913		Motions Creek Estuary	2	Very high	2	Very high	1	1
-	417	Low	Low	2	20	Cox's Bay	Network overflow	Auckland Zoo Motions Road, Western Springs	1753448	5919049		Motions Creek	2	Very high	2	Very high	1	1
DPMAC	624	Low	Low	1	20	Cox's Bay	Macefield Ave PS	1f Masefield Ave, Herne Bay	1755037	5921442	> 8 hours	Home Bay	1	Very high	2	Very high	1	1
DPMLA	627	Low	Low	1	20	Cox's Bay	Meola Rd PS	Meola Rd, Point Chevalier-Westmere	1752953	5919416	1 - 4 hours	Motions Creek Estuary	2	Very high	2	Very high	1	1

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									Ref X	Ref Y								
DPSAR	636	Low	Low	1	20	Cox's Bay	Sarsfield Ave PS	91 Sarsfield St, Herne Bay	1754600	5921267	4 - 8 hours	Home Bay	1	Very high	2	Very high	1	1
DPWEB	652	Low	Low	1	20	Cox's Bay	38 Webber St PS	38 Webber St, Westmere	1754174	5920100	> 8 hours	Cox's Creek	3	Moderate	2	Very high	1	1
DPWPA	699	Low	Low	1	20	Cox's Bay	Westmere Park PS	36 Westmere Park Avenue, Westmere	1752884	5920125	1 - 4 hours	Motions Creek Estuary		Very high		Very high		
DSB06 MH 2	713	Medium	High	2	20	Cox's Bay	Network overflow Branch 6 Cox's Creek MH2	14 Parawai Crescent, Ponsonby	1754433	5920013		Cox's Creek	3	Moderate	2	Very high	1	1
DSB06 MH11	714	Low	Low	2	20	Cox's Bay	Network overflow Branch 6 Cox's Creek MH1	Jervois Road, Herne Bay	1753840	5920394		Cox's Bay	3	Moderate	2	Very high	1	1
DSB07 MH1	715	High	High	2	20	Cox's Bay	Network overflow Branch 7 Arch Hill MH1	Auckland Zoo Motions Road, Western Springs	1753485	5919068		Motions Creek	2	Very high	2	Very high	1	1
DSORM MH31	738	Low	Low	2	20	Cox's Bay	Network overflow Orakei Main Sewer MH31	254 Richmond Road, Grey Lynn	1754481	5919908		Cox's Creek	3	Moderate	2	Very high	1	1
DSB05 MH23	740	High	High	2	20	Cox's Bay	Network overflow Branch 5 Herne Bay MH23	49 Argle St, Herne Bay	1754226	5921014		Herne Bay	1	Very high	2	Very high	1	1
DSB05 MH25	741	Medium	High	2	20	Cox's Bay	Network overflow Branch 5 Herne Bay MH25	22 Marine Parade, Herne Bay	1753816	5920806		Cox's Bay	3	Moderate	2	Very high	1	1
-	1019	Medium	High	2	20	Cox's Bay	Network overflow	15 Cremorne, Herne Bay	1754367	5921256		Home Bay	1	Very high	2	Very high	1	1
-	47	Low	Low	2	21	Central Auckland (CBD)	Network overflow	57 Anzac Ave	1757993	5920609		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	49	Low	Low	2	21	Central Auckland (CBD)	Network overflow	1 - 19 Quay St	1757961	5920903		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	50	Low	Low	2	21	Central Auckland (CBD)	Network overflow	69 Beach Rd	1758094	5920626		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	58	Low	Low	2	21	Central Auckland (CBD)	Network overflow	41 Kitchener Street	1757623	5920495		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	59	Low	Low	2	21	Central Auckland (CBD)	Network overflow	27 Victoria Street East	1757441	5920394		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	68	Low	Low	2	21	Central Auckland (CBD)	Network overflow	1 Gore St Lane	1757754	5920766		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	74	Low	Low	2	21	Central Auckland (CBD)	Network overflow	3a Lower Albert St	1757444	5921042		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	76	Low	Low	2	21	Central Auckland (CBD)	Network overflow	242 Queen Street	1757352	5920351		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	80	Low	Low	2	21	Central Auckland (CBD)	Network overflow	27 Victoria Street East	1757452	5920381		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	89	Low	Low	2	21	Central Auckland (CBD)	Network overflow	292 Queen Street	1757312	5920216		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	93	Low	Low	2	21	Central Auckland (CBD)	Network overflow	89 Mayoral Drive	1757025	5919960		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	94	Low	Low	2	21	Central Auckland (CBD)	Network overflow	303 Queen Street	1757156	5919985		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1

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									Ref X	Ref Y								
-	95	Low	Low	2	21	Central Auckland (CBD)	Network overflow	327 Queen Street	1757131	5919887		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	97	Low	Low	2	21	Central Auckland (CBD)	Network overflow	301 Queen Street	1757155	5920000		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	99	Low	Low	2	21	Central Auckland (CBD)	Network overflow	1 Greys Ave	1757067	5919979		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	108	Low	Low	2	21	Central Auckland (CBD)	Network overflow	301 Queen Street	1757258	5920069		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	109	Low	Low	2	21	Central Auckland (CBD)	Network overflow	267 Queen Street	1757291	5920223		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	112	Low	Low	2	21	Central Auckland (CBD)	Network overflow	42 Wellesley Street West, Freemans Bay	1757197	5920247		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	113	Low	Low	2	21	Central Auckland (CBD)	Network overflow	8 Mayoral Drive	1757134	5920200		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	114	Low	Low	2	21	Central Auckland (CBD)	Network overflow	15 Mayoral Drive	1757118	5920164		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	115	Low	Low	2	21	Central Auckland (CBD)	Network overflow	12 Mayoral Drive	1757010	5920142		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	117	Low	Low	2	21	Central Auckland (CBD)	Network overflow	67 Vincent Street	1756959	5920079		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	118	Low	Low	2	21	Central Auckland (CBD)	Network overflow	162 Cook Street	1757001	5920112		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	119	Low	Low	2	21	Central Auckland (CBD)	Network overflow	67 Vincent Street	1756978	5920098		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	120	Low	Low	2	21	Central Auckland (CBD)	Network overflow	14 Mayoral Drive	1757054	5920142		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	121	Low	Low	2	21	Central Auckland (CBD)	Network overflow	15 Mayoral Drive	1757120	5920214		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	123	Low	Low	2	21	Central Auckland (CBD)	Network overflow	12 Mayoral Dr	1757159	5920147		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	128	Low	Low	2	21	Central Auckland (CBD)	Network overflow	11 Victoria Street West	1757375	5920413		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	129	Low	Low	2	21	Central Auckland (CBD)	Network overflow	11 Victoria Street West	1757350	5920445		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	130	Low	Low	2	21	Central Auckland (CBD)	Network overflow	15 Albert Street	1757368	5920856		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	131	Low	Low	2	21	Central Auckland (CBD)	Network overflow	1 Hobson Street	1757195	5920913		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	134	Low	Low	2	21	Central Auckland (CBD)	Network overflow	9 - 11 Durham Lane	1757350	5920581		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	167	Low	Low	2	21	Central Auckland (CBD)	Network overflow	74 Cook St, Freemans Bay	1756671	5920233		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	169	Low	Low	2	21	Central Auckland (CBD)	Network overflow	10 Nelson Street	1757026	5920810		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	171	Low	Low	2	21	Central Auckland (CBD)	Network overflow	200 Wellesley Street West, Freemans Bay	1756638	5920483		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	172	Low	Low	2	21	Central Auckland (CBD)	Network overflow	1 London Street, Ponsonby	1755956	5921014		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1

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									Ref X	Ref Y								
-	176	Medium	High	2	21	Central Auckland (CBD)	Network overflow	Union Street	1756333	5920453		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	178	Low	Low	2	21	Central Auckland (CBD)	Network overflow	43 College Hill, Freemans Bay	1755898	5920557		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	180	Low	Low	2	21	Central Auckland (CBD)	Network overflow	16 Hackett Street, Ponsonby	1755581	5921065		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	181	High	High	2	21	Central Auckland (CBD)	Network overflow	16 Hackett Street, Ponsonby	1755581	5921065		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	182	High	High	2	21	Central Auckland (CBD)	Network overflow	122 Wellington Street, Ponsonby	1755965	5920143		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
DPWTN	183	Low	Low	1	21	Central Auckland (CBD)	Wellington Street PS	79 Wellington Street, Freemans Bay	1756236	5920065		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	185	Low	Low	2	21	Central Auckland (CBD)	Network overflow	36 Franklin Road, Freemans Bay	1755903	5920161		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	472	Low	Low	2	22	Hobson Bay	Network overflow	2 Watt Street, Parnell	1759002	5920209		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	477	Low	Low	2	22	Hobson Bay	Network overflow	69 St Georges Bay Road, Parnell	1759083	5919907		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	478	Low	Low	2	22	Hobson Bay	Network overflow	22 Avon Street, Parnell	1759080	5919928		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	479	Low	Low	2	22	Hobson Bay	Network overflow	22 Stratford Street, Parnell	1759088	5919857		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	480	Low	Low	2	22	Hobson Bay	Network overflow	20 Stratford Street, Parnell	1759115	5919802		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	482	Low	Low	2	22	Hobson Bay	Network overflow	11 Farnham Street, Parnell	1758864	5920107		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	483	Low	Low	2	22	Hobson Bay	Network overflow	90 St Georges Bay Road, Parnell	1758891	5920012		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	484	Low	Low	2	22	Hobson Bay	Network overflow	2 Watt Street, Parnell	1758993	5920209		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	485	Low	Low	2	22	Hobson Bay	Network overflow	91 St Georges Bay Road, Parnell	1758916	5920007		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	486	Low	Low	2	22	Hobson Bay	Network overflow	99 St Georges Bay Road, Parnell	1758925	5920080		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	487	Low	Low	2	22	Hobson Bay	Network overflow	106 St Georges Bay Road, Parnell	1758914	5920059		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	490	Low	Low	2	22	Hobson Bay	Network overflow	2 2 Watt Street, Parnell	1759003	5920209		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	518	Low	Low	2	21	Central Auckland (CBD)	Network overflow	5 Cheshire Street, Parnell	1758443	5919852		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	521	Low	Low	2	21	Central Auckland (CBD)	Network overflow	6 Ngahere Terrace, Stanley	1758576	5919599		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	522	Low	Low	2	21	Central Auckland (CBD)	Network overflow	3 Domain Dr, Parnell	1758796	5919017		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1

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									Ref X	Ref Y								
-	524	Low	Low	2	21	Central Auckland (CBD)	Network overflow	8 Grafton Road, Grafton	1757831	5920076		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	528	Low	Low	2	21	Central Auckland (CBD)	Network overflow	2 Stanley Street	1758261	5920192		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	529	Low	Low	2	21	Central Auckland (CBD)	Network overflow	6 Symond Street, Parnell	1757952	5920184		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	530	Low	Low	2	21	Central Auckland (CBD)	Network overflow	5 Alten Road	1758087	5920192		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	532	Low	Low	2	21	Central Auckland (CBD)	Network overflow	1 Augustus Terrace, Parnell	1758377	5920158		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	534	Low	Low	2	21	Central Auckland (CBD)	Network overflow	Mutu Street, Stanley	1758405	5920108		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	535	Low	Low	2	21	Central Auckland (CBD)	Network overflow	Bedford Street, Stanley	1758458	5920088		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	536	Low	Low	2	21	Central Auckland (CBD)	Network overflow	3 Ferncroft Street, Grafton	1757553	5919328		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	537	Low	Low	2	21	Central Auckland (CBD)	Network overflow	41 Park Road, Grafton	1757598	5919124		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	542	Low	Low	2	21	Central Auckland (CBD)	Network overflow	38 Whitaker Place, Grafton	1757542	5919516		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	545	Low	Low	2	21	Central Auckland (CBD)	Network overflow	20 - 26 Symonds Street, Grafton	1757844	5919923		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	548	Low	Low	2	21	Central Auckland (CBD)	Network overflow	30 Whitaker Place, Grafton	1757582	5919564		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	551	Low	Low	2	21	Central Auckland (CBD)	Network overflow	2 Kari Street, Grafton	1757765	5919418		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	557	Low	Low	2	21	Central Auckland (CBD)	Network overflow	3 Glenside Crescent, Stanley	1757122	5918983		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	593	Low	Low	2	21	Central Auckland (CBD)	Network overflow	31 Cheshire Terrace, Parnell	1758606	5919740		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
DSB05, MH2A	712	Low	Low	2	21	Central Auckland (CBD)	Branch 5 Herne Bay MH2A	1 Scotland Street, Freemans Bay	1756096	5920479		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
DSORM, MH19A	735	High	High	2	21	Central Auckland (CBD)	Orakei Main Sewer MH19A	20 Park Road, Grafton	1758080	5919837		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
DSB4B, MH2A	737	High	High	2	21	Central Auckland (CBD)	Branch 4B High St MH2A	41 High Street	1757500	5920547		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	1020	Medium	Medium	2	21	Central Auckland (CBD)	Network overflow	27 New Street, Herne Bay	1755954	5921011		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	47	Low	High	2	21	Central Auckland (CBD)	Network overflow	57 Anzac Ave	1757993	5920609		Waitemata Harbour, CBD Edge	2	Very high	3	Moderate	1	1
-	160	Low	Low	2	22	Hobson Bay	Network overflow	45 Ascot Avenue, Remuera	1760504	5916412		Waiatarua Reserve Stream	3	Very low	3	Very low	2	1
-	164	Low	Low	2	22	Hobson Bay	Network overflow	23a Inverary Avenue, Epsom	1757959	5916278		To Land						
-	166	Low	Low	2	22	Hobson Bay	Network overflow	10 Owens Road, Epsom	1758191	5917127		Newmarket Stream	2	Moderate	2	Very high	1	1

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Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
-	192	Low	Low	2	22	Hobson Bay	Network overflow	21 Yattendon Road, St Heliers	1766038	5919842		St Heliers Bay	1	Very High	2	High	1	1
-	193	Medium	High	2	22	Hobson Bay	Network overflow	35 Yattendon Road, St Heliers	1766093	5919956		St Heliers Bay	1	Very High	2	High	1	1
-	212	Low	Medium	2	22	Hobson Bay	Network overflow	54 Speight Road, Kohimarama	1764680	5919878		Madill's Stream	3	Very low	2	Moderate	1	1
-	213	Low	Low	2	22	Hobson Bay	Network overflow	59 Baddeley Avenue, Kohimarama	1764338	5919338		Madill's Stream	3	Very low	2	Moderate	1	1
-	214	Low	Low	2	22	Hobson Bay	Network overflow	64 Hawera Road, Kohimarama	1764096	5919532		Madill's Stream	3	Very low	2	Moderate	1	1
-	215	Low	Low	2	22	Hobson Bay	Network overflow	74 Hawera Road, Kohimarama	1764212	5919542		Madill's Stream	3	Very low	2	Moderate	1	1
DPTON	274	Low	Low	1	22	Hobson Bay	Tonks Street PS	3 Tonks Street, Remuera	1761052	5918282	> 8 hours	Hobson Bay	2	Very high	1	Very high	1	1
-	276	Low	Low	2	22	Hobson Bay	Network overflow	58 Kelvin Road, Remuera	1761965	5917486		Meadowbank Stream West	3	Very low	2	Moderate	2	1
-	277	Low	Low	2	22	Hobson Bay	Network overflow	126 Ngapuhi Road, Remuera	1761999	5917859		Orakei Creek	2	Moderate	1	Moderate	1	1
-	278	Low	Low	2	22	Hobson Bay	Network overflow	55 Ngapuhi Road, Remuera	1761858	5917392		Meadowbank Stream West	3	Very low	2	Moderate	2	1
-	279	Low	Low	2	22	Hobson Bay	Network overflow	188 Upland Road, Remuera	1761132	5918109		Hobson Bay	2	Very high	1	Very high	1	1
-	280	Low	Low	2	22	Hobson Bay	Network overflow	12 Woodley Avenue, Remuera	1761154	5916888		Orakei Basin	1	Moderate	1	High	1	1
-	281	Low	Low	2	22	Hobson Bay	Network overflow	47 Ngapuhi Road, Remuera	1761853	5917335		Meadowbank Stream West	3	Very low	2	Moderate	2	1
-	282	Low	Low	2	22	Hobson Bay	Network overflow	118 Ngapuhi Road, Remuera	1761950	5917811		Orakei Creek	2	Moderate	1	Moderate	1	1
-	283	Low	Low	2	22	Hobson Bay	Network overflow	93 Waiatarua Road, Remuera	1762170	5917785		Orakei Creek	2	Moderate	1	Moderate	1	1
-	284	Low	Low	2	22	Hobson Bay	Network overflow	84 Meadowbank Road, Meadowbank	1762417	5917660		Orakei Creek	2	Moderate	1	Moderate	1	1
-	285	Low	Low	2	22	Hobson Bay	Network overflow	77 Meadowbank Road, Meadowbank	1762477	5917730		Orakei Creek	2	Moderate	1	Moderate	1	1
-	286	Low	Low	2	22	Hobson Bay	Network overflow	44a Benson Road, Remuera	1761229	5917840		Orakei Basin	2	Moderate	1	High	1	1
-	287	Low	Low	2	22	Hobson Bay	Network overflow	148 Lucerne Road, Remuera	1762065	5918123		Orakei Creek	2	Moderate	1	Moderate	1	1
-	288	Low	Low	2	22	Hobson Bay	Network overflow	100 Meadowbank Road, Meadowbank	1762472	5917822		Orakei Creek	2	Moderate	1	Moderate	1	1
-	289	Low	Low	2	22	Hobson Bay	Network overflow	108 Waiatarua Road, Meadowbank	1762170	5917785		Orakei Creek	2	Moderate	1	Moderate	1	1
-	290	Low	Low	2	22	Hobson Bay	Network overflow	77 Meadowbank Road, Meadowbank	1762472	5917729		Orakei Creek	2	Moderate	1	Moderate	1	1

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									Ref X	Ref Y								
-	291	Low	Low	2	22	Hobson Bay	Network overflow	77 Meadowbank Road, Meadowbank	1762507	5917742		Orakei Creek	2	Moderate	1	Moderate	1	1
-	292	Low	Low	2	22	Hobson Bay	Network overflow	149 Upland Road, Remuera	1761473	5917922		Orakei Basin	1	Moderate	1	High	1	1
-	293	Low	Medium	2	22	Hobson Bay	Network overflow	28 Crescent Road, Parnell	1761849	5917866		Orakei Creek	2	Moderate	1	Moderate	1	1
-	294	Low	Low	2	22	Hobson Bay	Network overflow	19 Ara Street, Remuera	1760931	5917371		Orakei Basin	2	Moderate	1	High	1	1
-	295	Low	Low	2	22	Hobson Bay	Network overflow	14 Rangitoto Avenue, Remuera	1760962	5917244		Orakei Basin	1	Moderate	1	High	1	1
-	296	Low	Low	2	22	Hobson Bay	Network overflow	17 Benson Road, Remuera	1761028	5917721		Orakei Basin	1	Moderate	1	High	1	1
-	350	Low	Medium	2	22	Hobson Bay	Network overflow	44 Rukutai Street, Orakei	1762869	5919523		Unnamed stream - Mission Bay	3	Low	3	Low	1	1
-	351	Low	Low	2	22	Hobson Bay	Network overflow	125 Aotea Street, Orakei	1762885	5919784		Unnamed stream - Mission Bay	3	Low	3	Low	1	1
-	352	Low	Low	2	22	Hobson Bay	Network overflow	49 Rukutai Street, Orakei	1762889	5919418		Unnamed stream - Mission Bay	3	Low	3	Low	1	1
-	353	Low	Medium	2	22	Hobson Bay	Network overflow	2b Nihill Crescent, Mission Bay	1762985	5919974		Unnamed stream - Mission Bay	3	Low	3	Low	1	1
-	418	Low	Low	2	22	Hobson Bay	Network overflow	8 Remuera Road, Newmarket	1758506	5918038		Newmarket Stream	3	Moderate	2	Very high	1	1
-	420	Low	Low	2	22	Hobson Bay	Network overflow	14 Mahuru Street, Newmarket	1758465	5917707		Newmarket Stream	3	Moderate	2	Very high	1	1
-	421	Medium	High	2	22	Hobson Bay	Network overflow	29 Ayr Street, Newmarket	1758837	5918410		Newmarket Stream	3	Moderate	2	Very high	1	1
-	422	Low	Low	2	22	Hobson Bay	Network overflow	27 Morrow Street, Newmarket	1758230	5918067		Newmarket Stream	3	Moderate	2	Very high	1	1
-	423	Low	Low	2	22	Hobson Bay	Network overflow	8 Remuera Road, Newmarket	1758534	5918223		Newmarket Stream	3	Moderate	2	Very high	1	1
-	424	Low	Low	2	22	Hobson Bay	Network overflow	29 Ayr Street, Newmarket	1758831	5918434		Newmarket Stream	3	Moderate	2	Very high	1	1
-	425	Low	Low	2	22	Hobson Bay	Network overflow	10 St Marks Road, Remuera	1758644	5917583		Newmarket Stream	3	Moderate	2	Very high	1	1
-	427	Low	Low	2	22	Hobson Bay	Network overflow	Kingdon Street, Newmarket	1758359	5918520		Newmarket Stream	3	Moderate	2	Very high	1	1
-	428	Low	Low	2	22	Hobson Bay	Network overflow	12 Parkfield Terrace, Grafton	1757628	5918653		Newmarket Stream	3	Moderate	2	Very high	1	1
-	448	Medium	High	2	22	Hobson Bay	Network overflow	17 Watene Crescent, Orakei	1761865	5919910		Okahu Bay	1	Very high	2	Very high	1	1
-	449	Low	Medium	2	22	Hobson Bay	Network overflow	66 Paratai Drive, Orakei	1761309	5919963		Orakei Marina	2	Moderate	2	Moderate	2	1
-	450	Low	Low	2	22	Hobson Bay	Network overflow	56 Paratai Drive, Orakei	1761387	5920008		Orakei Marina	2	Moderate	2	Moderate	2	1

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									Ref X	Ref Y								
-	451	Low	Low	2	22	Hobson Bay	Network overflow	36 Ngapipi Road, Orakei	1761371	5919385		Lower Purewa Creek	2	Very low	1	Very low	1	1
-	452	Low	Low	2	22	Hobson Bay	Network overflow	18 Ngapipi Road, Orakei	1761368	5919593		Lower Purewa Creek	2	Very low	1	Very low	1	1
-	453	Low	Low	2	22	Hobson Bay	Network overflow	12a Okahu Street, Orakei	1761738	5919963		Okahu Bay	1	Very high	2	Very high	1	1
-	454	Medium	High	2	22	Hobson Bay	Network overflow	34-36 Apihai Street, Orakei	1762117	5919727		Okahu Bay	1	Very high	2	Very high	1	1
-	455	Medium	High	2	22	Hobson Bay	Network overflow	63 Reihana Street, Orakei	1762302	5919440		Okahu Bay	1	Very high	2	Very high	1	1
-	456	Low	Medium	2	22	Hobson Bay	Network overflow	88 Reihana Street, Orakei	1762429	5919171		Okahu Bay	1	Very high	2	Very high	1	1
-	458	Low	Low	2	22	Hobson Bay	Network overflow	88 Paratai Drive, Orakei	1761043	5919909		Lower Purewa Creek	2	Very low	1	Very low	1	1
-	492	Low	Medium	2	22	Hobson Bay	Network overflow	57 Anzac Ave, City	1759731	5919573		Hobson Bay	2	Very high	1	Very high	1	1
-	493	Low	Low	2	22	Hobson Bay	Network overflow	32 Takutai Street, Parnell	1759598	5919319		Hobson Bay	2	Very high	1	Very high	1	1
-	494	Low	Medium	2	22	Hobson Bay	Network overflow	3 Papahia Street, Parnell	1759731	5919573		Hobson Bay	2	Very high	1	Very high	1	1
-	495	Low	Low	2	22	Hobson Bay	Network overflow	43 Tohunga Street, Parnell	1759509	5919226		Hobson Bay	2	Very high	1	Very high	1	1
-	496	Low	Medium	2	22	Hobson Bay	Network overflow	28 Crescent, Parnell	1759796	5919809		Hobson Bay	2	Very high	1	Very high	1	1
-	498	Low	Medium	2	22	Hobson Bay	Network overflow	201 Portland Road, Remuera	1760129	5918642		Waitaramoa Stream	3	Low	1	Very high	1	1
-	499	Low	Low	2	22	Hobson Bay	Network overflow	6 Wharua Road, Remuera	1759917	5918280		Waitaramoa Stream	3	Low	1	Very high	1	1
-	500	Low	Low	2	22	Hobson Bay	Network overflow	Spencer Street, Remuera	1760146	5917822		Waitaramoa Stream	3	Low	1	Very high	1	1
-	501	Low	Low	2	22	Hobson Bay	Network overflow	23a Portland Road, Remuera	1760043	5917053		Waitaramoa Stream	3	Low	1	Very high	1	1
-	502	Medium	Medium	2	22	Hobson Bay	Network overflow	21 Ingram Road, Remuera	1760150	5918058		Waitaramoa Stream	3	Low	1	Very high	1	1
-	503	Medium	High	2	22	Hobson Bay	Network overflow	68 Portland Road, Remuera	1759891	5917711		Waitaramoa Stream	3	Low	1	Very high	1	1
-	504	Low	Medium	2	22	Hobson Bay	Network overflow	20 Standen Avenue, Remuera	1759973	5918193		Waitaramoa Stream	3	Low	1	Very high	1	1
-	505	Medium	Medium	2	22	Hobson Bay	Network overflow	9 Scherff Road, Remuera	1759996	5918027		Waitaramoa Stream	3	Low	1	Very high	1	1
-	506	High	High	2	22	Hobson Bay	Network overflow	20 Hapua Street, Remuera	1759581	5918322		Unnamed stream in Thomas Bloodworth Park	2	Very high	2	Very high	1	1
-	507	Low	Low	2	22	Hobson Bay	Network overflow	157 Portland Road, Remuera	1760143	5918319		Waitaramoa Stream	3	Low	1	Very high	1	1
-	508	High	High	2	22	Hobson Bay	Network overflow	32 Hapua Street, Remuera	1759477	5918279		Unnamed stream in Thomas Bloodworth Park	2	Very high	2	Very high	1	1

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									Ref X	Ref Y								
-	509	Low	Low	2	22	Hobson Bay	Network overflow	Brighton Road, Parnell	1759391	5918792		Newmarket Stream	3	Moderate	2	Very high	1	1
-	510	Low	Low	2	22	Hobson Bay	Network overflow	Brighton Road, Parnell	1759350	5918822		Newmarket Stream	3	Moderate	2	Very high	1	1
-	511	Medium	Low	2	22	Hobson Bay	Network overflow	158 Bassett Road, Remuera	1759171	5918625		Newmarket Stream	3	Moderate	2	Very high	1	1
-	512	Low	Low	2	22	Hobson Bay	Network overflow	3a Laxon Terrace, Newmarket	1758837	5918571		Newmarket Stream	3	Moderate	2	Very high	1	1
-	513	Low	Low	2	22	Hobson Bay	Network overflow	3a Laxon Terrace, Newmarket	1758820	5918555		Newmarket Stream	3	Moderate	2	Very high	1	1
-	514	Medium	Low	2	22	Hobson Bay	Network overflow	63 Tahapa Crescent, Meadowbank	1762523	5918286		Upper Purewa Creek	3	Very low	1	Low	1	2
-	515	Low	Low	2	22	Hobson Bay	Network overflow	11 Purewa Road, Meadowbank	1762283	5918367		Upper Purewa Creek	3	Very low	1	Very low	1	2
-	586	Low	Low	2	22	Hobson Bay	Network overflow	36 Manawa Road, Remuera	1760848	5918189		Remuera Stream	3	Low	1	Very high	1	1
-	587	Low	Low	2	22	Hobson Bay	Network overflow	26 Manawa Road, Remuera	1760707	5918208		Remuera Stream	3	Low	1	Very high	1	1
-	588	Low	Medium	2	22	Hobson Bay	Network overflow	26 Mahoe Avenue, Remuera	1760659	5917998		Remuera Stream	3	Low	1	Very high	1	1
-	595	Low	Low	2	22	Hobson Bay	Network overflow	Furneaux Way, New Market	1758794	5918419		Newmarket Stream	3	Moderate	2	Very high	1	1
-	597	Low	Low	2	22	Hobson Bay	Network overflow	296 Victoria Avenue, Remuera	1760351	5918606		Waitaramoa Stream	3	Low	1	Very high	1	1
DPABB	598	Low	Low	1	22	Hobson Bay	Abbots Way PS	68-76 Abbotts Way, Remuera	1761947	5916064	4 - 8 hours	Waiatarua Reserve Stream	3	Very low	3	Very low	2	1
DPATK	602	Low	Low	1	22	Hobson Bay	Atkin Ave PS	21 Atkin Ave, Mission Bay	1763032	5920278	4 - 8 hours	Unnamed Stream – Mission Bay	3	Low	3	Low	1	1
DPAVE	603	Low	Low	1	22	Hobson Bay	Averill Ave PS	4 Averill Ave, Kohimarama	1764246	5920135	> 8 hours	Kohimarama Beach	1	Moderate	2	Low	1	1
DPGRA	613	Low	Low	1	22	Hobson Bay	Grand Drive PS	31 Grand Drive, Remuera	1762261	5916282	> 8 hours	Waiatarua Reserve Stream	3	Very low	3	Very low	2	1
DPJRP	620	Low	Low	1	22	Hobson Bay	John Rymer Place PS	64 John Rymer Pl, Kohimarama	1763816	5918478	> 8 hours	Purewa Stream	3	Very low	2	Moderate	2	1
DPMEA	626	Low	Low	1	22	Hobson Bay	Meadowbank Rd PS	83 Meadowbank Rd, Meadowbank	1762527	5917774	> 8 hours	Meadowbank Stream East	3	Very low	3	Very low	2	1
DPPL2	631	Low	Low	1	22	Hobson Bay	Portland Rd South PS	155 Portland Rd, Remuera	1760147	5918319	> 8 hours	Waitaramoa Stream	3	Low	1	Very high	1	1
DPPL1	638	Low	Low	1	22	Hobson Bay	Portland Rd North PS	201 Portland Rd, Remuera	1760132	5918664	4 - 8 hours	Waitaramoa Stream	3	Low	1	Very high	1	1
DPSTH	641	Low	Medium	1	22	Hobson Bay	St Heliers PS	92 Tamaki Drive, St Heliers	1765393	5920063	4 - 8 hours	St Heliers Bay	1	Very High	2	High	1	1
DPTAM	642	Low	Low	1	22	Hobson Bay	305 Tamaki Dr PS	305 Tamaki Drive, Kohimarama	1764684	5920029	> 8 hours	Madill's Stream	3	Very low	2	Moderate	1	1

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									Ref X	Ref Y								
DPTYC	643	Low	Low	1	22	Hobson Bay	Tamaki Yacht Club PS	30c Tamaki Yacht Club, Orakei	1762666	5920862	> 8 hours	Tamaki Yacht Club	2	Low	2	Very low	1	1
DPKOH, DSKOH, MH6	663	Medium	Medium	1	22	Hobson Bay	Kohimarama PS	6 Baddeley Avenue, Kohimarama	1764582	5919662	1 - 4 hours	Madill's Stream	3	Very low	2	Moderate	1	1
DPORM, DSORM, MH3	696	High	Low	1	22	Hobson Bay	Network overflow Orakei Main Sewer MH3	Okahu Street, Orakei	1761744	5919995	4 - 8 hours	Okahu Bay	1	Very high	2	Very high	1	1
DPSHO	704	Low	Low	1	22	Hobson Bay	Shore Rd PS	Shore Road, Remuera	1759479	5918598	1 - 4 hours	Unnamed stream in Thomas Bloodworth Park	2	Very high	2	Very high	1	1
DSB1A, MH1	709	Medium	Medium	2	22	Hobson Bay	Network overflow Branch 1A Mission Bay	Tamaki Drive, Orakei	1762143	5920335		Okahu Bay	1	Very high	2	Very high	1	1
DSB03, MH29	711	Medium	Low	2	22	Hobson Bay	Network overflow Branch 3 Newmarket	Manukau Road, New Market	1758396	5917486		Newmarket Stream	3	Moderate	2	Very high	1	1
DSB3A, MH2	729	Low	Low	2	22	Hobson Bay	Network overflow Branch 3A Parnell MH2	13a Waitoa Street, Parnell	1759701	5919432		Hobson Bay	2	Very high	1	Very high	1	1
DSB3B, MH2	730	Medium	Medium	2	22	Hobson Bay	Network overflow Branch 3B Judges Bay	Judges Bay Road, Parnell	1759388	5920131		Judges Bay	1	High	1	High	1	1
DSB3C, MH1	733	High	High	2	22	Hobson Bay	Network overflow Branch 3C Khyber Pass	Furneaux Way, Remuera	1758759	5918397		Newmarket Stream	3	Moderate	2	Very high	1	1
DSB1H, MH1	760	Low	Low	2	22	Hobson Bay	Network overflow Branch 1 Hobson Diversion	Victoria Avenue, Hobson Bay	1760696	5918901		Hobson Bay	2	Very high	1	Very high	1	1
-	1273	Low	Low	1	22	Hobson Bay	Whytehead Cres PS	19B Whytehead Crescent, St Heliers	1764055.68	5918529.28	No information available	To Land						
DPSTF	1405	Low	Low	1	22	Hobson Bay	Stonefields PS	Stonefields, Mt Wellington	1763686	5915736	> 8 hours	Waiatarua Reserve Stream	3	Very low	3	Very low	2	1
DPAL1	208	Low	Low	1	23	Onehunga	25 Aldersgate Rd PS	25 Aldersgate Road, Hillsborough	1755658	5911422	1 - 4 hours	Unnamed stream (flowing to Wesley Bay)	2	Moderate	2	Moderate	1	1
DPAL2	209	Low	Medium	1	23	Onehunga	72 Aldersgate Rd PS	72 Aldersgate Road, Waikowhai	1755277	5911100	4 - 8 hours	Wesley Bay	2	Moderate	1	Low	1	1
DPGLT	210	Low	Low	1	23	Onehunga	Gilleta Rd PS	70a Gilletta Road, Blockhouse Bay	1752438	5911903	> 8 hours	Lynfield Cove	2	Low	2	Very low	2	1
-	447	Low	Low	2	23	Onehunga		102-104 Neilson Street, Onehunga	1759454	5911892		Mangere Inlet North	2	Low	1	Low	1	2
DPWAL	470	Low	Low	1	23	Onehunga	Walls Rd PS	45 Walls Road, Penrose	1761102	5913758	> 8 hours	Stormwater Detention Pond	3	Very low	3	Very low	2	2
DPBJD	604	Low	Low	1	23	Onehunga	Ben James Dr PS	2 Ben James Drive, Hillsborough	1755800	5911474	> 8 hours	Unnamed stream (flowing to Wesley Bay)	2	Moderate	2	Moderate	1	1
DPCSR	605	Low	Low	1	23	Onehunga	Captain Springs Rd PS	Captain Springs Rd, Onehunga	1760412	5911772	> 8 hours	Mangere Inlet North	2	Low	1	Low	1	2

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									Ref X	Ref Y								
DPHIM	615	Low	Low	1	23	Onehunga	Himalaya Cr PS	12 Himalaya Cres, Lynfield	1752881	5911134	> 8 hours	Manukau Harbour edge (between Lynfield Cove and Wattle Bay)	3	Very low	1	Very low	2	2
DPSY2	640	Low	Low	1	23	Onehunga	44 Sylvania Cr PS	42 Sylvania Cres, Lynfield	1753386	5910832	> 8 hours	Manukau Harbour edge (between Lynfield Cove and Wattle Bay)	3	Very low	1	Very low	2	2
DPWBG	653	Low	Low	1	23	Onehunga	Wesley Bay Glade PS	6 Wesley Bay Glade, Hillsborough	1755705	5911244	1 - 4 hours	Unnamed stream (flowing to Wesley Bay)	2	Moderate	2	Moderate	1	1
DPONE	668	Medium	Low	1	23	Onehunga	Hillsborough PS	Wharangi Street, Onehunga	1758511	5911748	1 - 4 hours	Onehunga Bay	2	Low	2	Low	1	1
DPSMT	669	Low	Low	1	23	Onehunga	Mt Smart PS	343 Neilson Street, Te Papapa	1761401	5911912	1 - 4 hours	Mangere Inlet North	2	Low	1	Low	1	2
DPPPT	674	Low	Low	1	23	Onehunga	Pikes Point PS	5a Miami Parade, Te Papapa	1760896	5911494	1 - 4 hours	Unnamed stream (Miami Parade)	3	Very low	3	Very low	2	2
DPONT	679	Medium	Low	1	23	Onehunga	Onehunga PS	Neilson Street, Onehunga	1759926	5911752	1 - 4 hours	Mangere Inlet North	2	Moderate	1	Moderate	1	2
DPLYF	705	Low	Low	1	23	Onehunga	Lynnfield PS	21 Commodore Drive, Lynfield	1753044	5912078	1 - 4 hours	Wairaki Stream	2	Moderate	2	Moderate	2	1
DPHBH	1178	Low	Low	1	23	Onehunga	420 Hillsborough Rd PS	420 Hillsborough Road, Mt Roskill	1754437	5911225	> 8 hours	Waikowhai Bay	1	Low	1	Very low	2	1
DPRVK	1179	Low	Low	1	23	Onehunga	25 Royal Viking PS	25 Royal Viking Way, Lynfield	1752565	5911919	4 - 8 hours	Wairaki Stream	2	Moderate	2	Moderate	2	1
-	466	Low	Low	2	24	Mangere	Network overflow	20 Chelsea Avenue, Otahuhu	1763374	5908741		To Land						
DPSAL	468	Low	Low	1	24	Mangere	Saleyards Rd	31a Salesyard Road, Otahuhu	1763277	5909912	4 - 8 hours	Tui Creek	3	Very low	2	Moderate	2	2
DPSYL	582	Low	Low	1	24	Mangere	Sylvia Park PS	1018 Great South Road, Otahuhu	1763219	5911966	4 - 8 hours	Ann's Creek	3	Very low	1	Low	1	2
DPFAV	664	Medium	Low	1	24	Mangere	Favona Rd	137 Gadsby Road, Favona	1761120	5908712	1 - 4 hours	Harania Creek	3	Very low	2	Low	1	2
DPWTF	672	Low	Medium	1	24	Mangere	Westfield PS	Hugo Johnston Drive, Penrose	1762920	5911492	< 1 hour	Ann's Creek	3	Low	1	Low	1	2
DPTRC	677	High	Medium	1	24	Mangere	Black Bridge	6 Hinau Road, Mangere Bridge	1759480	5908505	1 - 4 hours	Tararata Creek	3	Low	2	High	1	1
DPMGB	678	Low	Low	1	24	Mangere	Mangere Bridge	7D Woodward Avenue, Mangere	1758869	5910282	1 - 4 hours	Ambury Shoreline via stormwater pipe	1	Low	1	Very low	1	1
DPOTW	680	Low	Low	1	24	Mangere	Otahuhu West	20 Salesyard Road, Otahuhu	1763311	5910003	1 - 4 hours	Tui Creek	3	Very low	2	Moderate	2	2
DSHLT	744	Low	Low	2	24	Mangere	Hellabys Trade Waste network overflow	Bell Avenue, Mount Wellington	1763054	5910871		Ann's Creek	3	Very low	1	Low	1	2
-	963	Low	Low	2	24	Mangere	Network overflow	62 Chelburn Crescent, Mangere	1761739	5908182		Unnamed tributary to Harania Creek (south)	3	Very low	2	Moderate	2	1

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									Ref X	Ref Y								
-	973	Low	Low	2	24	Mangere	Network overflow	4 Chalfont St, Mangere East	1761994	5907434		Unnamed tributary to Harania Creek (south)	3	Very low	2	Moderate	2	1
DPNRN	980	Low	Low	1	24	Mangere	Norana Avenue	61 Norana Ave, Favona	1761730	5909779	1 - 4 hours	Harania Creek	3	Very low	2	Very low	1	2
DPKIW	991	Low	Medium	1	24	Mangere	Kiwi Esplanade	50 Kiwi Esplanade, Mangere Bridge	1758047	5910235	1 - 4 hours	Ambury Shoreline	1	Moderate	1	Very low	1	1
DPJFD	999	Low	Low	1	24	Mangere	James Fletcher Drive	178R Favona Road, Favona	1762022	5909280	1 - 4 hours	Harania Creek	3	Very low	2	Very low	1	2
DPMCK	1011	Low	Low	1	24	Mangere	Mackenzie Road	142R McKenzie Rd, Mangere	1759031	5907540	1 - 4 hours	Tararata Creek	3	Very low	2	Moderate	1	1
DPSAV	1015	Low	Low	1	24	Mangere	Savil Drive Link	20R Savil Dr, Papatoetoe	1763080	5908414	1 - 4 hours	Unnamed tributary of Harania Creek (East)	3	Very low	2	Moderate	2	1
DPAMB	1018	Low	Low	1	24	Mangere	Ambury Park	68R kiwi Esplanade, Mangere	1757071	5910177	1 - 4 hours	Ambury Shoreline	1	Low	1	Very low	1	1
DPRUA	1136	Low	Low	1	24	Mangere	Ruaiti Road	25 Ruaiti Road, Mangere	1757232	5905572	No information available	Oruarangi Creek	1	High	2	Moderate	1	1
DPBCH	1157	Low	Low	1	24	Mangere	Beach Road	4R Beach Road, Mangere Station	1762619	5909403	1 - 4 hours	Harania Creek	3	Very low	2	Very low	1	2
DPLAM	1159	Low	Low	1	24	Mangere	Lambie Court	11 Yates Road, Mangere	1762428	5907431	No information available	To Land						
DPMIR	1161	Low	Low	1	24	Mangere	Miro Road	48 Miro Road, Mangere Bridge	1759713	5910067	1 - 4 hours	Mangere Inlet	1	Low	1	Low	1	2
DPPO1	1192	Low	Low	1	24	Mangere	Portage Rd PS	63 Portage Rd, Mount Wellington	1763776	5910746	> 8 hours	Ann's Creek	3	Very low	1	Low	1	2
DPHRD	1194	Low	Low	1	24	Mangere	Huia Rd	81a Huia Road, Otahuhu	1763367	5909830	> 8 hours	To Land						
-	161	Low	Low	2	25	Lower Tamaki River	Network Overflow	155 Riverside Ave, Tamaki	1766365.42	5915757.58		Lower Tamaki River	2	Very low	1	Very low	1	1
-	162	Medium	Medium	2	25	Lower Tamaki River	Network Overflow	49 Dunkirk Road, Panmure	1766219.50	5914915.96		Lower Tamaki River	2	Moderate	1	Moderate	1	1
-	163	Low	Medium	2	25	Lower Tamaki River	Network Overflow	34 Riverview Road, Panmure	1765963.82	5914294.90		Lower Tamaki River	2	Low	1	Low	1	1
-	188	Low	Low	1	25	Lower Tamaki River	Network Overflow	8 Concord Place, Glen Innes	1766525.72	5916893.50		Omaru Creek	3	Very low	3	Very low	1	1
-	189	High	High	2	25	Lower Tamaki River	Network Overflow	109 Taniwha Street, Glen Innes	1766606.52	5917098.21		Omaru Creek	3	Moderate	3	Moderate	1	1
-	190	Low	Medium	2	25	Lower Tamaki River	Network Overflow	121 Apirana Ave, Glen Innes	1765187.28	5917484.56		Omaru Creek	3	Low	3	Low	1	1
DPWTR	191	Low	Low	1	25	Lower Tamaki River	West Tamaki Rd PS	5 Tahaki Road, Wai O Taiki Bay	1767621.65	5917575.41	> 8 hours	Lower Tamaki River	2	Very low	1	Very low	1	1
-	596	Low	Low	2	25	Lower Tamaki River	Network Overflow PS	197-209 Taniwha Street, Point England	1765544.30	5917114.30		Omaru Creek	3	Very low	3	Very low	1	1
DPKRA	612	Low	Low	1	25	Lower Tamaki River	Karaka Bay PS	Karaka Bay, Glendowie	1767327.99	5920150.60	> 8 hours	Karaka Bay	2	Low	2	Very low	1	1

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									Ref X	Ref Y								
DPRID	633	Low	Low	1	25	Lower Tamaki River	Riddell Rd PS	417 Riddell Rd, St Heliers	1767698.34	5919688.77	4 - 8 hours	Riddell Road Beach	2	Low	2	Very low	2	2
DPENG	681	High	Medium	1	25	Lower Tamaki River	Pt England PS	254 Point England Road, Point England	1766595.53	5916759.38	1 - 4 hours	Omaru Creek	3	Low	3	Low	1	1
DPGND	682	Low	Low	1	25	Lower Tamaki River	Glendowie PS	22 Roberta Avenue, Glendowie	1767403.78	5918597.96	1 - 4 hours	Glendowie Stream	3	Very low	3	Very low	2	1
DPDNK	706	Medium	Low	1	25	Lower Tamaki River	Dunkirk PS	192a Dunkirk Road,, Panmure	1766356.78	5915646.94	1 - 4 hours	Lower Tamaki River	2	Low	1	Low	1	1
DPS018	707	Low	Low	1	25	Lower Tamaki River	Panmure Basin PS	100 Ireland Rd, Panmure	1764475.63	5914251.22	1 - 4 hours	Panmure Basin	2	Low	1	Low	1	1
DSGLD	745	Low	Low	2	25	Lower Tamaki River	Glendowie Branch Sewer Relief MH13	94 Taniwha Street, Glen Innes	1766739.88	5917075.67		Omaru Creek	3	Very low	3	Very low	1	1
DPBEL	958	Low	Low	1	25	Lower Tamaki River	Belmire Rise PS	94r Bramley Drive, Pakuranga	1768024.00	5915394.00	No information available	Wakaaranga Creek	3	Very low	1	Very low	1	1
DPPKN	985	Low	Low	1	25	Lower Tamaki River	Pakuranga North PS	103r Prince Regent Drive, Half Moon Bay	1768961.00	5915446.00	1 - 4 hours	Wakaaranga Creek	3	Very low	1	Very low	1	1
DPMNR	986	Low	Low	1	25	Lower Tamaki River	Manor Park PS	140r Manor Park, Sunnyhills	1767135.00	5914000.00	4 - 8 hours	Lower Tamaki River	2	Very low	1	Very low	1	1
DPBBH	990	Low	Low	1	25	Lower Tamaki River	Buckland Beach PS	73a The Parade, Bucklands Beach	1769873.00	5917423.00	1 - 4 hours	Little Bucklands Beach	2	Low	2	Very low	1	1
DPTPD	993	Low	Low	1	25	Lower Tamaki River	The Parade PS	1 The Parade, Bucklands Beach	1769367.00	5918950.00	1 - 4 hours	Bucklands Beach	1	Low	1	Very low	1	1
DPPAK	1000	Low	Low	1	25	Lower Tamaki River	Pakuranga Road PS	46a Pakuranga Road, Half Moon Bay	1766083.00	5913419.00	1 - 4 hours	Lower Tamaki River	2	Very low	1	Very low	1	1
DPBRA	1008	Low	Low	1	25	Lower Tamaki River	Bramley Drive PS	18r Bramley Dr, Pakuranga	1767546.90	5915253.90	No information available	Lower Tamaki River	2	Very low	1	Very low	1	1
DPTBD	1146	Low	Low	1	25	Lower Tamaki River	Tamaki Bay Drive PS	30r Tamaki Bay Drive, Pakuranga	1766457.82	5913581.97	1 - 4 hours	Lower Tamaki River	2	Very low	1	Very low	1	1
DPHMB	1168	Low	Low	1	25	Lower Tamaki River	Halfmoon Bay Marina PS	Half Moon Bay Marina, Howick	1769473.75	5916584.52	4 - 8 hours	Half Moon Bay Marina via stormwater pipe	2	Low	3	Very low	1	1
DPGRP	1174	Low	Low	1	25	Lower Tamaki River	Granger Point PS	56r The Parade, Bucklands Beach	1769687.42	5917792.03	No information available	Lower Tamaki River	2	Very low	1	Very low	1	1
DPPNM	1187	Low	Low	1	25	Lower Tamaki River	Panmure Wharf PS	102 Kings Road, Panmure	1766421.13	5914341.45	> 8 hours	Lower Tamaki River	2	Very low	1	Very low	1	1
DPBDG	1188	Low	Low	1	25	Lower Tamaki River	Bridge St PS	13 Bridge Street, Panmure	1765563.04	5913855.67	> 8 hours	Lower Tamaki River	2	Very low	1	Very low	1	1
DPWAT	1189	Low	Low	1	25	Lower Tamaki River	Watene Rd PS	17 Watene Road, Panmure	1765237.61	5913953.15	> 8 hours	Panmure Basin	2	Low	1	Low	1	1
-	1406	Low	Medium	2	25	Lower Tamaki River	Network Overflow	61 - 67 Felton Matthew Ave, St Johns	1764865.00	5917367.00		Omaru Creek	3	Low	3	Low	1	1
-	463	Low	Low	2	26	Upper Tamaki River	Network overflow	7 Pukeora Avenue, Otahuhu	1764687	5909239		Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1

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									Ref X	Ref Y								
DPJAN	464	Low	Low	1	26	Upper Tamaki River	Jane Cowie Place PS	17899 Jane Cowie Avenue, Otahuhu	1764430	5908446	4 - 8 hours	Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
DPOTA	465	Low	Low	2	26	Upper Tamaki River	Otahuhu Northeast PS	25 Murdoch Street, Otahuhu	1765491	5910775		Otahuhu Creek	3	Very low	2	Very low	1	2
-	581	Low	Low	2	26	Upper Tamaki River	Network overflow	5 Johnson Road, Mt Wellington	1763131	5912975		Unnamed stream (Mt Wellington)	3	Very low	3	Very low	1	2
-	583	Low	Low	2	26	Upper Tamaki River	Network overflow	18 Skinner Road, Mt Wellington	1762944	5913171		Unnamed stream (Mt Wellington)	3	Very low	3	Very low	1	2
-	584	Low	Low	2	26	Upper Tamaki River	Network overflow	14 Skinner Road, Mt Wellington	1762952	5913248		Unnamed stream (Mt Wellington)	3	Very low	3	Very low	1	2
-	589	Low	Low	2	26	Upper Tamaki River	Network overflow	17 Monterery Avenue, Otahuhu	1764959	5909275		Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
-	592	Low	Low	2	26	Upper Tamaki River	Network overflow	145 Avenue Road East, Otahuhu	1765247	5910090		Upper Tamaki River	1	Very low	1	Very low	1	1
DPPNA	628	Low	Low	1	26	Upper Tamaki River	Panama Rd PS	350 Panama Rd, Mount Wellington	1765642	5911484	4 - 8 hours	Otahuhu Creek	3	Very low	2	Very low	1	2
DPPEN	630	Low	Low	1	26	Upper Tamaki River	Penrose Rd PS	184 Penrose Rd, Mount Wellington	1763031	5913878	4 - 8 hours	To Land						
DPTAH	648	Low	Low	1	26	Upper Tamaki River	Tahatai St PS	Tahatai St, Otahuhu	1764668	5909033	4 - 8 hours	Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
DPOTN	666	Medium	Medium	1	26	Upper Tamaki River	Otahuhu North PS	32 Meadow Street, Mount Wellington	1764301	5910673	1 - 4 hours	Otahuhu Creek	3	Low	2	Moderate	1	2
DPHIN	667	High	Medium	1	26	Upper Tamaki River	Pakuranga PS	13 Millen Ave, Pakuranga	1765815	5913224	1 - 4 hours	Upper Tamaki River	1	High	1	High	1	1
DPSPK	670	Medium	Low	1	26	Upper Tamaki River	Sylvia Park PS	20 Bowden Road, Mount Wellington	1764880	5912820	< 1 hour	Upper Tamaki River	1	Very low	1	Very low	1	1
DPTIN	673	Low	Low	1	26	Upper Tamaki River	Tamaki East PS	207 Highbrook Drive, East Tamaki	1765968	5910094	1 - 4 hours	Upper Tamaki River	1	Very low	1	Very low	1	1
DPBOT	675	Low	Low	1	26	Upper Tamaki River	Botany PS	107 Golfland Drive, Howick	1769682	5911806	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPPKS	676	Low	Low	1	26	Upper Tamaki River	Pakuranga South PS	51 Ben Lomond Crescent, Pakuranga Heights	1769184	5912560	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPOTB	683	Low	Low	1	26	Upper Tamaki River	Otara PS	84R Wymondley Road, Otara	1764926	5908728	< 1 hour	Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
DPMID	684	Medium	Medium	1	26	Upper Tamaki River	Middlemore PS	2 Grange Road, Papatoetoe	1764297	5907411	< 1 hour	Upper Tamaki River (Middlemore Arm)	3	Low	2	Moderate	1	1
DPOSN	698	Low	Low	1	26	Upper Tamaki River	Ormiston Road PS	10 Progressive Way, East Tamaki	1769082	5907756	4 - 8 hours	Unnamed tributary of Otara Creek (east)	3	Very low	2	Very low	1	1
DSOTE	747	Low	Low	2	26	Upper Tamaki River	Otahuhu East Branch network overflow	24 Montery Avenue, Otahuhu	1765015	5909252		Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
DSOTN	751	Low	Low	2	26	Upper Tamaki River	Otahuhu North Branch network overflow	32 Luke Street, Otahuhu	1764660	5910533		Otahuhu Creek	3	Very low	2	Very low	1	2

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									Ref X	Ref Y								
-	957	Medium	Low	2	26	Upper Tamaki River	Network overflow	38 Whiteacres Drive, Pakuranga	1768586	5914465		Unnamed tributary of Pakuranga Creek (Whiteacres Drive)	3	Low	3	Low	1	2
-	959	Low	Low	2	26	Upper Tamaki River	Network overflow	12 Udall Place, Howick	1770183	5915749		Unnamed tributary of Pakuranga Creek (Highland Park)	3	Very low	2	Moderate	1	1
-	960	Low	Low	2	26	Upper Tamaki River	Network overflow	30 Minaret Drive, Howick	1770164	5915289		Unnamed tributary of Pakuranga Creek (Highland Park)	3	Very low	2	Moderate	1	1
-	961	Medium	Low	2	26	Upper Tamaki River	Network overflow	16 Ingram Crescent, Otara	1767702	5906624		Unnamed tributary of Otara Creek (west)	3	Very low	3	Very low	1	1
-	968	Low	Low	2	26	Upper Tamaki River	Network overflow	34 Kautami Avenue, Papatoetoe	1765540	5907490		Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
-	969	Low	Low	2	26	Upper Tamaki River	Network overflow	3 Ross Avenue, Papatoetoe	1764292	5906717		Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
-	970	Low	Low	2	26	Upper Tamaki River	Network overflow	77 Shirley Road, Papatoetoe	1764703	5906048		Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
-	972	Low	Low	2	26	Upper Tamaki River	Network overflow	123 Ennis Ave, Pakuranga	1768389	5912544		Pakuranga Creek	3	Very low	1	Low	1	1
-	975	Low	Low	2	26	Upper Tamaki River	Network overflow	16 Windsong Ct, Howick	1771400	5912996		Unnamed tributary of Pakuranga Creek (Botany Downs)	3	Very low	3	Very low	2	1
DPEDG	977	Low	Low	1	26	Upper Tamaki River	Edgewater Drive PS	159R Edgewater Drive, Pakuranga	1767429	5911955	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPLAU	979	Low	Low	1	26	Upper Tamaki River	Laureston Avenue PS	21R Laureston Avenue, Papatoetoe	1764725	5908128	1 - 4 hours	Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
DPMEN	982	Low	Low	1	26	Upper Tamaki River	Millen Ave PS	43 R Millen Ave, Pakuranga	1765639	5912989	4 - 8 hours	Upper Tamaki River	1	Very low	1	Very low	1	1
DPUND	983	Low	Low	1	26	Upper Tamaki River	Undine St PS	14 Undine St, Pakuranga	1766345	5912808	4 - 8 hours	Upper Tamaki River	1	Very low	1	Very low	1	1
DPAVI	984	Low	Low	1	26	Upper Tamaki River	Aviemore Drive PS	101R Aviemore Drive, Highland Park	1769689	5913679	No information available	Unnamed tributary of Pakuranga Creek (Highland Park)	3	Very low	2	Moderate	1	1
DPMNG	988	Low	Low	1	26	Upper Tamaki River	Mangos Place PS	35 Edgewater Drive, Pakuranga	1766869	5912164	1 - 4 hours	Upper Tamaki River	1	Very low	1	Very low	1	1
DPBUR	998	Low	Low	1	26	Upper Tamaki River	Burswood Drive PS	177R Burswood Drive, Otara	1768817	5912070	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPRLA	1002	Low	Low	1	26	Upper Tamaki River	Rosella Road PS	64 Rosella Road, Mangere East	1763649	5907765	1 - 4 hours	Unnamed tributary of Tamaki River (Middlemore Arm)	3	Very low	2	Moderate	1	1
DPSDN	1004	Low	Low	1	26	Upper Tamaki River	Stonedon Drive PS	56R Stonedon Dr, Otara	1767875	5911352	No information available	Pakuranga Creek	3	Very low	1	Low	1	1
DPHIP	1005	Low	Low	1	26	Upper Tamaki River	Highland Park PS	Pakuranga Rd/ Aviemore Dr, Highland Park	1769778	5914677	1 - 4 hours	Unnamed tributary of Pakuranga Creek (Highland Park)	3	Very low	2	Moderate	1	1
DPLOR	1006	Low	Low	1	26	Upper Tamaki River	Lorien Place PS	19R Lorien Pl., Otara	1767361	5909751	> 8 hours	Otara Creek	2	Very low	1	Very low	1	1

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									Ref X	Ref Y								
DPARW	1009	Low	Low	1	26	Upper Tamaki River	Arwen Place PS	24R Arwen Pl, Otara	1767552	5909155	No information available	Otara Creek	2	Very low	1	Very low	1	1
DPHAN	1010	Low	Low	1	26	Upper Tamaki River	Hannah Road PS	45R Hannah Rd, Otara	1767521	5906830	No information available	Unnamed tributary of Otara Creek (west)	3	Very low	3	Very low	1	1
DPFLE	1014	Low	Low	1	26	Upper Tamaki River	Fremantle Place PS	10R Fremantle Pl, Pakuranga	1767790	5911793	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPLLO	1141	Low	Low	1	26	Upper Tamaki River	Lloyd Elsmore Park PS	Lloyd Elsmore Park Reserve, Pakuranga	1769514	5914322	1 - 4 hours	Unnamed tributary of Pakuranga Creek (Highland Park)	3	Very low	2	Moderate	1	1
DPCAS	1142	Low	Low	1	26	Upper Tamaki River	Cascades Road PS	194R Cascades Road, Pakuranga	1769709	5912994	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPGOS	1143	Low	Medium	1	26	Upper Tamaki River	Gossamer Drive PS	52R Gossamer Drive, Pakuranga	1768549	5913332	1 - 4 hours	Pakuranga Creek	3	Low	1	Moderate	1	1
DPPEL	1149	Low	Low	1	26	Upper Tamaki River	Pelorus Place PS	12 Pelorus Place, Pakuranga	1765945	5912562	No information available	Upper Tamaki River	1	Very low	1	Very low	1	1
DPRHP	1150	Low	Low	1	26	Upper Tamaki River	Riverhills Park PS	Riverhills Park, Pakuranga	1768048	5912012	No information available	Pakuranga Creek	3	Very low	1	Low	1	1
DPCRY	1152	Low	Low	1	26	Upper Tamaki River	Cryers Road PS	110R Cryers Road, Otara	1768575	5911223	No information available	Pakuranga Creek	3	Very low	1	Low	1	1
DPHIS	1153	Low	Low	1	26	Upper Tamaki River	Harris Road PS	102R Harris Road, Otara	1768857	5910858	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
DPHIB	1154	Low	Low	1	26	Upper Tamaki River	Highbrook Park PS	Highbrook Park	1766630	5911095	4 - 8 hours	Upper Tamaki River	1	Very low	1	Very low	1	1
DPLUK	1155	Low	Low	1	26	Upper Tamaki River	Luke Place PS	9R Luke Place, Otara	1767388	5908843	No information available	Otara Creek	2	Very low	1	Very low	1	1
DPLAW	1156	Low	Low	1	26	Upper Tamaki River	Lawrence Place PS	13 Lawrence Place, Otara	1767416	5907970	No information available	Unnamed tributary of Otara Creek (east)	3	Very low	2	Very low	1	1
DPBA1	1181	Low	Low	1	26	Upper Tamaki River	Ballarat St PS	5 Ballarat Street, Mount Wellington	1762478	5914944	4 - 8 hours	To Land						
DPMCD	1182	Low	Low	1	26	Upper Tamaki River	McDonald Cr PS	10 McDonald Cr, Mount Wellington	1762750	5915126	> 8 hours	To Land						
DPHAR	1183	Low	Low	1	26	Upper Tamaki River	Harris Rd PS	203a Harris Rd, Mount Wellington	1763474	5915326	> 8 hours	To Land						
DPMOT	1184	Low	Low	1	26	Upper Tamaki River	Motu Pl PS	6 Motu Pl, Mount Wellington	1763168	5914877	4 - 8 hours	To Land						
DPFER	1185	Low	Low	1	26	Upper Tamaki River	Ferndale Rd PS	44 Ferndale Rd, Mount Wellington	1763023	5914673	> 8 hours	To Land						
DPBNK	1186	Low	Low	1	26	Upper Tamaki River	Banks St PS	4 Thompson Park Road, Mount Wellington	1763431	5914765	4 - 8 hours	To Land						
DPRD1	1190	Low	Low	1	26	Upper Tamaki River	Mt Richmond FC PS	Mt Richmond FC, behind 659 Mount Wellington Highway, Mount Wellington	1764068	5910928	4 - 8 hours	Otahuhu Creek	3	Very low	2	Very low	1	2

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Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
DPRD2	1191	Low	Low	1	26	Upper Tamaki River	Mt Richmond League PS	Mt Richmond League, Bert Henham Park, Mount Wellington	1764012	5911139	> 8 hours	Otahuhu Creek	3	Very low	2	Very low	1	2
DPRNY	1193	Low	Low	1	26	Upper Tamaki River	Rodney St PS	11 Rodney St, Otahuhu	1764955	5909569	4 - 8 hours	Upper Tamaki River (Middlemore Arm)	3	Very low	2	Very low	1	1
DPBA2	1195	Low	Low	1	26	Upper Tamaki River	Ballarat St (House) PS	50 Ballarat Street, Ellerslie	1762451	5915282	4 - 8 hours	To Land						
DPCAR	1196	Low	Low	1	26	Upper Tamaki River	Carrs Pl PS	14 Carrs Place, Ellerslie	1762449	5915462	> 8 hours	To Land						
DPJOE	1200	Low	Low	1	26	Upper Tamaki River	Joe Stanley Pl	37 Joe F Stanley Pl, Otahuhu	1765388	5910968	4 - 8 hours	Otahuhu Creek	3	Very low	2	Very low	1	2
To be advised	1408	Low	Low	1	26	Upper Tamaki River	Howick PS	172 R Aviemore Drive, Howick	1770051	5913035	1 - 4 hours	Pakuranga Creek	3	Very low	1	Low	1	1
-	1417	Low	Low	2	26	Upper Tamaki River	Network overflow	13 Lynley Place, Pakuranga	1768826	5913233		Pakuranga Creek	3	Very low	1	Low	1	1
DPHOW	662	Low	Low	1	27	Cockle Bay	Howick PS	3 Colleen Court, Cockle Bay	1773589	5915082	1 - 4 hours	Howick Beach	1	Low	1	Very low	1	1
DPSAN	976	Low	Low	1	27	Cockle Bay	Sandspit Road PS	41 Pohutukawa Avenue, Shelly Park	1773861	5913198	1 - 4 hours	Shelly Park Beach	2	Low	1	Very low	1	1
DPEST	1013	Low	Low	1	27	Cockle Bay	Estuary Views PS	24R Estuary Views, Howick	1773388	5913022	1 - 4 hours	Maungamaungaroa Creek	2	Very low	1	Very low	1	1
DPCHI	1139	Low	Low	1	27	Cockle Bay	Chisbury Terrace PS	18R Chisbury Terrace, Howick	1773393	5913117	1 - 4 hours	Maungamaungaroa Creek	2	Very low	1	Very low	1	1
DPRNA	1140	Low	Low	1	27	Cockle Bay	Ramoana Mews PS	11 Ramoana Mews, Howick	1772811	5912879	1 - 4 hours	Maungamaungaroa Creek	2	Very low	1	Very low	1	1
DPMEB	1172	Low	Low	1	27	Cockle Bay	Mellons Bay PS	End of Mellons Bay Road, Mellons Bay	1771981	5916319	No information available	Mellons Bay	1	Low	2	Very low	1	1
DPCOC	1173	Low	Low	1	27	Cockle Bay	Cockle Bay PS	Reserve Shelly Beach Parade, Cockle Bay	1773770	5914489	No information available	Cockle Bay	1	Low	1	Very low	1	1
DPPUH	685	Low	Low	1	28	Puhinui	Puhinui PS	Cavendish Drive On Ramp, Manukau	1764676	5903778	< 1 hour	Puhinui Stream	2	Moderate	2	Moderate	1	1
DPPPW	688	Low	Low	1	28	Puhinui	Papatoetoe West PS	51 Hillside Road, Papatoetoe	1764021	5905306	< 1 hour	Unnamed stream – Hillside Rd	3	Very Low	2	Moderate	1	2
DPWYN	689	Low	Low	1	28	Puhinui	Weymouth North PS	54R Pitt Ave, Clendon	1765208	5899792	1 - 4 hours	Puhinui Creek	2	Very Low	1	Very Low	1	1
DSSWI	761	Low	Low	2	28	Puhinui	Network relief point	Kiwi Tamaki Road, Manurewa	1765057	5901621		Puhinui Creek	2	Very Low	1	Very Low	1	1
-	962	Low	Low	2	28	Puhinui	Network relief point	53 R Raglan St, Mangere East	1762772	5906304		Unnamed Stream in Aorere Park	3	Very low	2	Moderate	1	1
-	971	Low	Low	2	28	Puhinui	Network relief point	35 St George Street, Papatoetoe	1764884	5905718		Unnamed stream – Hillside Rd	3	Very Low	2	Moderate	1	2
DPMC1	1138	Low	Low	1	28	Puhinui	McLaughlins Road 1 PS	39R McLaughlins Road, Manurewa	1764516	5903264	4 - 8 hours	Puhinui Stream	2	Moderate	2	Moderate	1	1

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Facility Code	Overflow ID	Volume Range	Frequency Range	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Available Storage at DWF (hours[1])	Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
									Ref X	Ref Y								
DPMP2	1160	Low	Low	1	28	Puhinui	Malaspina Place 2 PS	2 Malaspina Place, Papatoetoe	1763858	5906054	No information available	Unnamed stream – Kohuora Park	3	Low	2	Moderate	1	1
DPBWN	1162	Low	Low	1	28	Puhinui	Browns Road PS	33A Browns Road, Manurewa	1767805	5902298	No information available	Unnamed tributary of Puhinui Stream – Browns Rd	3	Very Low	2	Moderate	2	2
DPMNW	1163	Low	Low	1	28	Puhinui	Manurewa West PS	End of Browns Road in reserve	1765398	5901299	No information available	Puhinui Creek	2	Very Low	1	Very Low	1	1
DPSET	1164	Low	Low	1	28	Puhinui	Settlers Cove PS	Entrance end of Settlers Cove, 21R Bretts Road, Manurewa	1765376	5898820	No information available	Unnamed stream (flowing to Weymouth Beach)	3	Very Low	3	Very Low	1	1
DPWEY	1165	Low	Low	1	28	Puhinui	Weymouth Domain PS	38R Gibbons Road, Weymouth	1765118	5898575	No information available	Weymouth Beach	1	Very Low	1	Very Low	1	1
DPREE	1169	Low	Low	1	28	Puhinui	Reef Place PS	28R Cyclamen Way, Mangere	1760089	5905868	1 - 4 hours	To Land						
DPMC2	1175	Low	Low	1	28	Puhinui	McLaughlins Road 2 PS	55R McLaughlins Road, Wiri	1764155	5902460	No information available	Unnamed tributary of Puhinui Stream – McLaughlin Rd	3	Very Low	2	Moderate	2	2
DPMP1	1177	Low	Low	1	28	Puhinui	Malaspina Place 1 PS	31R Malaspina Place, Papatoetoe	1763822	5906318	No information available	Unnamed stream – Kohuora Park	3	Low	2	Moderate	1	1
DPWFP DSSWI MH82	686	Medium	Low	1	29	Pahurehure Inlet	Wattle Farm PS	1 Great South Road, Conifer Grove	1769015	5898534	< 1 hour	Papakura Stream	3	Very low	2	Very low	1	1
DPMAW	687	Medium	Medium	1	29	Pahurehure Inlet	Manurewa West PS	283R Mahia Road, Manurewa	1766639	5899262	1 - 4 hours	Waimahia Creek	2	Moderate	2	Moderate	1	1
DSSIN MH93	746	High	Medium	2	29	Pahurehure Inlet	Southern Interceptor transmission system overflow	The Furlong, Takanini	1770983	5897881		Pahurehure Inlet Basin 1	3	Moderate	2	Very high	1	2
-	965	Low	Low	2	29	Pahurehure Inlet	Network overflow	105R Beaumonts Way, Manurewa	1769155	5899937		Papakura Stream	3	Very low	2	Very low	1	1
-	966	Low	Low	2	29	Pahurehure Inlet	Network overflow	17 McDougall Street, Manurewa	1769504	5900477		Papakura Stream	3	Very low	2	Very low	1	1
-	967	Low	Low	2	29	Pahurehure Inlet	Network overflow	14 Percival Street, Manurewa	1768244	5900395		Unnamed stream near Percival Street	3	Very low	2	Moderate	2	1
-	974	Low	Low	2	29	Pahurehure Inlet	Network overflow	2 Browning St, Manurewa	1769670	5900687		Papakura Stream	3	Very low	2	Very low	1	1
DPSAC	987	Low	Low	1	29	Pahurehure Inlet	St Anne's Cres PS	33R St Anne's Crescent, Wattle Downs	1767118	5897373	> 8 hours	St Anne's Foreshore	2	Low	2	Very low	2	1
DPWNO	997	Low	Low	1	29	Pahurehure Inlet	Waimarino Rd PS	16R Lucas Place, Weymouth	1766336	5898218	No information available	Waimahia Creek	2	Very low	2	Very low	1	1
DPHOR	1012	Low	Low	1	29	Pahurehure Inlet	Horlicks Place PS	28R Horlicks Pl, Manurewa	1770813	5900460	< 1 hour	Papakura Stream	3	Very low	2	Very low	1	1

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									Ref X	Ref Y								
DPRYS	1166	Low	Low	1	29	Pahurehure Inlet	Roys Road PS	20R Roys Road, Weymouth	1765236	5897841	No information available	Te Pua Point	2	Low	2	Very low	1	1
DPABE	1171	Low	Low	1	29	Pahurehure Inlet	Aberdeen Cres PS	201R Wattle Farm Road, Wattle Downs	1767257	5898024	No information available	To Land						
DPONR	657	Low	Low	1	30	Oneroa	Oneroa PS	18 Beach Parade, Oneroa	1779482	5927363	> 8 hours	Oneroa Beach	1	Low	2	Very Low	1	1
DPHAW	1016	Low	Low	1	31	Beachlands-Maraetai	Hawke Crescent PS	25A Hawke Crescent, Beachlands	1777009	5916400	No information available	Sunkist Bay (via stormwater pipe)	1	Low	1	Very Low	1	1
DPOMA	1017	Low	Low	1	31	Beachlands-Maraetai	Omana Esplanade PS	26R Omana Esplanade, Beachlands	1781107	5916795	No information available	Omana Beach (via stormwater pipe)	1	Low	1	Very Low	1	1
DPCOL	1078	Low	Low	1	31	Beachlands-Maraetai	Colson Lane PS	243 Maraetai Drive, Maraetai	1782266	5916306	No information available	Maraetai Beach	1	Low	2	Very Low	1	1
DPMTI	1079	Low	Low	1	31	Beachlands-Maraetai	Maraetai Domain PS	188R Maraetai Drive, Maraetai	1781973	5916489	No information available	Unnamed stream flowing to Maraetai Beach	2	Moderate	2	Moderate	1	2
DPTPN	1080	Low	Low	1	31	Beachlands-Maraetai	Te Pene PS	59R Te Pene Road, Maraetai	1781675	5917021	No information available	To Land						
DPTPP	1081	Low	Low	1	31	Beachlands-Maraetai	Te Puru Park PS	954R Whitford Maraetai Road, Beachlands	1779562	5916016	No information available	Unnamed stream flowing to Kelly's Beach (south)	3	Very Low	2	Moderate	1	1
DPTPR	1082	Low	Low	1	31	Beachlands-Maraetai	Te Puru PS	115R Third View Avenue, Beachlands	1779210	5916577	No information available	Unnamed stream flowing to Kelly's Beach (north)	3	Very Low	2	Moderate	1	2
DPTVW	1083	Low	Low	1	31	Beachlands-Maraetai	Third view PS	115R Third View Avenue, Beachlands	1778995	5916555	No information available	Unnamed stream flowing to Kelly's Beach (north) (via stormwater pipe)	3	Very Low	3	Moderate	1	2
DPKKA	1084	Low	Low	1	31	Beachlands-Maraetai	Karaka Road PS	8a Karaka Road, Beachlands	1778578	5915511	No information available	Unnamed stream flowing to Pine Harbour Marina (south)	3	Very Low	2	Moderate	1	2
DPSKB	1085	Low	Low	1	31	Beachlands-Maraetai	Sunkist Bay Reserve PS	Sunkist Bay Reserve, Beachlands	1777777	5916537	No information available	Sunkist Bay Beach	1	Low	1	Very Low	1	1
DPTOO	1086	Low	Low	1	31	Beachlands-Maraetai	Toomer Place PS	4R Toomer Place, Beachlands	1777342	5916082	No information available	Unnamed stream flowing to Pine Harbour Marina (north)	3	Very Low	2	Moderate	1	1
DPPHM	1087	Low	Low	1	31	Beachlands-Maraetai	Pine Harbour Marina PS	190 Jack Lachlan Drive, Beachlands	1777316	5915445	No information available	Unnamed stream flowing to Pine Harbour Marina (south)	3	Very Low	2	Moderate	1	2
DPYAC	1034	Low	Low	1	32	Clarks Beach	Yacht Club PS	226 Torkar Road, Clarks Beach	1750089.74	5888181.39	> 8 hours	Waiuku Estuary (via stormwater pipe)	1	Very Low	1	Very Low	1	1
DPWAS	1035	Low	Low	1	32	Clarks Beach	Wilsons Access PS	135-137 Torkar Road, Clarks Beach	1750344.45	5888648.27	> 8 hours	Clarks Beach (via stormwater pipe)	1	Low	1	Very Low	1	1
DPSLA	1036	Low	Low	1	32	Clarks Beach	Stella Dr PS	Stella Drive, Clarks Beach	1750544.85	5888479.1	> 8 hours	To Land						

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									Ref X	Ref Y								
DPHLA	1037	Low	Low	1	32	Clarks Beach	Halls Access PS	75 Torkar Road, Clarks Beach	1750962.69	5888822.36	> 8 hours	Clarks Beach (via stormwater pipe)	1	Low	1	Very Low	1	1
DPCBO	1040	Low	Low	1	32	Clarks Beach	Clarks Beach Oxidation Ponds PS	Stella Drive, Clarks Beach	1750853.82	5888261.56	> 8 hours	To Land						
DPSTV	1041	Low	Low	1	32	Clarks Beach	Stevenson Rd PS	21 Seaway Road. Clarks Beach	1751323.64	5888635.22	> 8 hours	To Land						
DPKNI	1042	Low	Low	1	32	Clarks Beach	Knights Walkway PS	39-41 Torkar Road, Clarks Beach	1751326.71	5888862.73	> 8 hours	Clarks Beach (via stormwater pipe)	1	Low	1	Very Low	1	1
DPHOS	1043	Low	Low	1	32	Clarks Beach	Hoskins Clarks Beach PS	Clarks Beach Road, Clark's Beach	1751752.11	5888887.07	> 8 hours	Clarks Beach (via stormwater pipe)	1	Low	1	Very Low	1	1
DPCRI	1044	Low	Low	1	32	Clarks Beach	Crisp Rd PS	34 Crisp Road, Clarks Beach	1752091.23	5888849.83	1 - 4 hours	Clarks Beach (via open stormwater channel)	1	Low	1	Very Low	1	1
DPKEV	1045	Low	Low	1	32	Clarks Beach	Keven Rd PS	88 Clarks Beach Road, Waiau Beach	1751535.03	5887742.49	> 8 hours	Waiau Beach	2	Low	2	Very Low	1	1
DPCHV	1046	Low	Low	1	32	Clarks Beach	Channel View Rd PS	11 Channel View Road, Waiau Beach	1751471.15	5887431.63	> 8 hours	Waiau Beach	2	Low	2	Very Low	1	1
DPGLB	1047	Low	Low	1	32	Clarks Beach	Glenbrook Beach St PS	3 Fleet Street, Glenbrook Beach	1752090.01	5885638.25	> 8 hours	Glenbrook Beach	2	Low	2	Very Low	1	1
DPNZS	1022	Low	Low	1	33	Waiuku	NZ Steel PS	49 Elsie Drive, Waiuku	1752730	5877396	> 8 hours	Rangiwhea Creek	2	Very Low	1	Very Low	1	1
DPBYV	1023	Low	Low	1	33	Waiuku	Bayview PS	Bayview Esplanade Reserve, Waiuku	1752572	5876985	> 8 hours	Rangiwhea Creek	2	Very Low	1	Very Low	1	1
DPLNA	1024	Low	Low	1	33	Waiuku	Lina Place PS	Lina Place Reserve, Waiuku	1752364	5876593	> 8 hours	Rangiwhea Creek Tributary	2	Moderate	1	High	1	1
DPKAI	1025	Low	Low	1	33	Waiuku	Kowhai Place PS	Kowhai Place, Waiuku	1753790	5877701	> 8 hours	Golf Course Creek	1	Very Low	1	Very Low	1	1
DPKNG	1026	Low	Low	1	33	Waiuku	King St PS	Off King Street, Waiuku	1753511	5876242	1 - 4 hours	Waiuku Creek	2	Very Low	1	Very Low	1	1
DPFGH	1027	Low	Low	1	33	Waiuku	Fernleigh Ave PS	28 Fernleigh Avenue, Waiuku	1754414	5876220	> 8 hours	Waiuku Stream Tributary	3	Very Low	1	High	1	1
DPKAO	1028	Low	Low	1	33	Waiuku	Kitchener Rd PS	243/135 Kitchener Road, Waiuku	1755080	5876130	> 8 hours	Waiuku Stream	2	Moderate	1	High	1	1
DPRGW	1029	Low	Low	1	33	Waiuku	Rangiwhea Rd PS	10 Rangiwhea Road, Waiuku	1753141	5877773	> 8 hours	Sandspit Beach	1	Low	1	Very Low	1	1
DPEDP	1030	Low	Low	1	33	Waiuku	Edgewater Parade PS	Edgewater Parade, Waiuku	1753264	5876833	> 8 hours	Waiuku Creek	2	Very Low	1	Very Low	1	1
DPOWE	1031	Low	Low	1	33	Waiuku	Owens Rd PS	Owens Road, Waiuku	1753223	5876634	> 8 hours	Waiuku Creek	2	Very Low	1	Very Low	1	1
DPKEN	1032	Low	Low	1	33	Waiuku	Kendallvale Dr PS	41 Kendallvale Road, Waiuku	1755389	5875270	> 8 hours	Awaroa River Tributary	3	Very Low	2	Moderate	1	1
DPBCR	1033	Low	Low	1	33	Waiuku	Breaker Grove PS	Breaker Grove, Waiuku	1752833	5875425	> 8 hours	To Land						

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									Ref X	Ref Y								
DPFRA	825	Low	Low	1	34	Pukekohe	Franklin Rd PS	Recreation Centre Franklin Road, Pukekohe	1769246	5881820	< 1 hour	Unnamed tributary of Whangapouri Creek (Franklin Rd)	3	Very low	2	Moderate	2	1
DPFRS	1243	Low	Low	1	34	Pukekohe	Fletchers PS	Searle Drive, Patumahoe	1762139	5882908	> 8 hours	Stormwater pond (Fletcher Lane)	3	Very low	3	Very low	2	1
DPWEC	1244	Low	Low	1	34	Pukekohe	Wecks PS	14 Patumahoe Road, Pukekohe	1762427	5882772	> 8 hours	To Land						
DPMTU	1245	Low	Low	1	34	Pukekohe	Mareretu PS	27B Mareretu Ave., Patumahoe	1762549	5882925	> 8 hours	To Land						
DPNES	1246	Low	Low	1	34	Pukekohe	North east PS	15 Clive Howe Road, Pukekohe	1762989	5883117	> 8 hours	To Land						
DPCHR	1247	Low	Low	1	34	Pukekohe	Cape Hill Rd PS	10 Cape Hill Road, Pukekohe	1769096	5882270	1 - 4 hours	Whangapouri Creek	3	Very low	2	Very low	2	1
DPLOC	1248	Low	Low	1	34	Pukekohe	Lochview PS	Lochview Reserve Adams Drive, Pukekohe	1768906	5882623	> 8 hours	Stormwater pond (Lochview Reserve)	3	Very low	3	Very low	2	1
DPISA	1249	Low	Low	1	34	Pukekohe	Isabella Dr PS	Isabella Drive Recreational Reserve Isabella Drive, Pukekohe	1769233	5882696	> 8 hours	To Land						
DPDUB	1250	Low	Low	1	34	Pukekohe	Dublin Rd PS	16 Princess Street, Pukekohe	1768579	5881619	> 8 hours	To Land						
DPMRW	1251	Low	Low	1	34	Pukekohe	Marble Wood PS	21 Marblewood Grove, Pukekohe	1768312	5882336	1 - 4 hours	To Land						
DPKRD	1252	Low	Low	1	34	Pukekohe	Kauri Road PS	7 Four Oakes Place, Pukekohe	1767492	5881673	1 - 4 hours	To Land						
DPCL2	1253	Low	Low	1	34	Pukekohe	Colin Lawrie 2 PS	Colin Lawrie Reserve Reynolds Road, Pukekohe	1769680	5882022	> 8 hours	Whangapouri Creek	3	Very low	2	Very low	2	1
DPANS	1254	Low	Low	1	34	Pukekohe	Anselmi Ridge PS	Pukekohe East Road, Pukekohe	1770225	5882075	> 8 hours	Whangapouri Creek	3	Very low	2	Very low	2	1

Schedule 2 – Proposed Future Engineered Overflow Points in Indicative Future Urban Areas (Overflow Points potentially discharging to the CMA are highlighted in blue)

Facility Code	Overflow ID	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
							Ref X	Ref Y							
	N1	1	1	Wellsford	Proposed Future Overflow Point	SH1,Wellsford	1738318	5983987	Unnamed tributary (north) of Whakapirau Creek	3	Very Low	2	Moderate	2	1
-	N2	1	3	Warkworth	Proposed Future Overflow Point	Woodcocks Rd, Warkworth	1747148	5969550	Mahurangi River (Right Branch)	3	Very Low	2	Low	2	2
-	N3	1	3	Warkworth	Proposed Future Overflow Point	Wyllie Rd, Warkworth	1746781	5969159	Mahurangi River (Right Branch)	3	Very Low	2	Low	2	2
-	N4	1	3	Warkworth	Proposed Future Overflow Point	Wyllie Rd, Warkworth	1746905	5968306	Mahurangi River (Right Branch)	3	Very Low	2	Low	2	2
-	N5	1	3	Warkworth	Proposed Future Overflow Point	Wyllie Rd, Warkworth	1746843	5967959	Mahurangi River (Right Branch)	3	Very Low	2	Low	2	2
-	N6	1	3	Warkworth	Proposed Future Overflow Point	SH1, Warkworth	1747853	5968464	Unnamed tributary of Mahurangi River (Right Branch)	3	Very Low	2	Low	2	2
-	N7	1	3	Warkworth	Proposed Future Overflow Point	SH1, Warkworth	1748606	5968568	Unnamed tributary of Mahurangi River (Right Branch)	3	Very Low	2	Low	2	2
-	N8	1	3	Warkworth	Proposed Future Overflow Point	Wilson Rd South, Warkworth	1750964	5968869	Unnamed tributary (1) to Mahurangi River Estuary	3	Very Low	2	Very Low	2	1
-	N9	1	3	Warkworth	Proposed Future Overflow Point	Hepburn Creek Rd, Warkworth	1750488	5968478	Unnamed tributary (2) to Mahurangi River Estuary	3	Very Low	2	Very Low	2	2
-	N10	1	3	Warkworth	Proposed Future Overflow Point	Hepburn Creek Rd, Warkworth	1750483	5968240	Unnamed tributary (3) to Mahurangi River Estuary	3	Very Low	2	Very Low	2	1
-	N80	1	3	Warkworth	Proposed Future Overflow Point	Matakana Rd, Warkworth	1748654	5972125	Unnamed tributary (2) of Mahurangi River	3	Very Low	2	Moderate	2	1
-	N81	1	3	Warkworth	Proposed Future Overflow Point	Great North Rd, Warkworth	1736318	5971490	Unnamed tributary (3) of Mahurangi River	3	Very Low	3	Very Low	2	1
-	N11	1	4	Snells Beach/ Algies Bay	Proposed Future Overflow Point	Goodall Road, Snells Beach	1755002	5966789	Northern Arm of Mahurangi Harbour	3	Very Low	1	Very Low	2	2
-	N12	1	4	Snells Beach/ Algies Bay	Proposed Future Overflow Point	Goldsworthy Bay	1757614	5966094	Goldsworthy Bay beach	2	Very Low	2	Very Low	1	1

Facility Code	Overflow ID	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
							Ref X	Ref Y							
	N13	1	7	Orewa	Proposed Pump Station, West Hoe Heights	-	1750045	5951068	Nukumea Stream	3	Very Low	1	High	2	1
	N16	1	7	Orewa	Proposed Future Overflow Point	-	1746908	5948318	Orewa River	2	Very Low	2	Very Low	2	2
	N17	1	7	Orewa	Proposed Pump station, Lysnar Road	-	1747736	5947361	Waterloo Creek	3	Very Low	2	Very Low	2	2
	N18	1	7	Orewa	Proposed Pump Station, Kowhai Road (2)	-	1748393	5948373	Western arm of Orewa River Estuary	1	Very Low	2	Very Low	1	1
	N23	1	8	Weiti	Proposed Future Overflow Point	-	1748153	5943987	John Creek	3	Very Low	2	Very Low	2	2
	N24	1	8	Weiti	Proposed Future Overflow Point	-	1748544	5945098	John Creek	3	Very Low	2	Very Low	2	2
-	N25	1	16	Upper Harbour West	Proposed Future Overflow Point	Boundary Road, Hobsonville	1749147	5927201	Harrier Point	2	Low	2	Very Low	2	2
-	N26	1	16	Upper Harbour West	Proposed Future Overflow Point	Buckley Avenue, Hobsonville	1748361	5927409	Te Okoriki Inlet	3	Very Low	2	Very Low	1	1
-	N27	1	16	Upper Harbour West	Proposed Future Overflow Point	Iroquois Place, Hobsonville	1748728	5926497	Bomb Bay	3	Very Low	1	Very Low	1	2
-	N28	1	16	Upper Harbour West	Proposed Future Overflow Point	Scott Road, Hobsonville	1747394	5925907	Limeburners Bay	2	Very Low	2	Very Low	1	2
-	N29	1	16	Upper Harbour West	Proposed Future Overflow Point	Clark Road, Hobsonville	1748424	5926639	Bomb Bay	3	Very Low	1	Very Low	1	2
-	N31	1	16	Upper Harbour West	Proposed Future Overflow Point	SH 16, Whenuapai	1742024	5926933	Brighams Creek	2	Very Low	1	Very Low	1	1
-	N32	1	16	Upper Harbour West	Proposed Future Overflow Point	Kennedys Road, Whenuapai	1742536	5927406	Brighams Creek	2	Very Low	1	Very Low	1	1
-	N33	1	16	Upper Harbour West	Proposed Future Overflow Point	Bristol Road, Whenuapai	1743228	5928544	Brighams Creek	2	Very Low	1	Very Low	1	1
-	N34	1	16	Upper Harbour West	Proposed Future Overflow Point	Totara Road, Whenuapai	1744325	5928440	Rarawaru Creek	2	Very Low	1	Very Low	2	1
-	N35	1	16	Upper Harbour West	Proposed Future Overflow Point	Totara Road, Whenuapai	1745255	5928792	Orchard Stream Estuary	3	Very Low	1	Very Low	2	1
-	N36	1	16	Upper Harbour West	Proposed Future Overflow Point	Totara Road, Whenuapai	1745958	5928647	Kotukutuku Inlet	3	Very Low	1	Very Low	2	1
-	N37	1	16	Upper Harbour West	Proposed Future Overflow Point	Puriri Road, Whenuapai	1746641	5928461	Te Turerenga Inlet	2	Very Low	1	Very Low	2	1
-	N38	1	16	Upper Harbour West	Proposed Future Overflow Point	Kauri Road, Whenuapai	1746341	5927054	Waiarohia Inlet	2	Very Low	2	Very Low	1	1

Facility Code	Overflow ID	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
							Ref X	Ref Y							
-	N39	1	16	Upper Harbour West	Proposed Future Overflow Point	Sinton Road, Hobsonville	1746569	5926879	Waiarohia Inlet	2	Very Low	2	Very Low	1	1
-	N40	1	16	Upper Harbour West	Proposed Future Overflow Point	Brighams Creek Road, Hobsonville	1745969	5926165	Waiarohia Stream	3	Very Low	2	Very Low	2	1
-	N41	1	16	Upper Harbour West	Proposed Future Overflow Point	Brighams Creek Road, Hobsonville	1745690	5926124	Waiarohia Stream	3	Very Low	2	Very Low	2	1
-	N42	1	16	Upper Harbour West	Proposed Future Overflow Point	Brighams Creek Road, Whenuapai	1742970	5926662	Totara Creek Estuary	3	Very Low	1	Very Low	1	1
-	N43	1	16	Upper Harbour West	Proposed Future Overflow Point	Hailes Road, Whenuapai	1741532	5925421	Ngongetepara Stream	3	Very Low	2	Very Low	2	1
-	N44	1	16	Upper Harbour West	Proposed Future Overflow Point	North-Western Motorway, Whenuapai	1743383	5925312	Totara Creek	3	Very Low	2	Moderate	2	2
-	N45	1	16	Upper Harbour West	Proposed Future Overflow Point	Henwood Road, Taupaki	1741956	5923952	Ngongetepara Stream	3	Very Low	2	Very Low	2	1
	N46	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Gills Avenue, Papakura	1772331	5896744	Pahurehure Inlet Basin 2	3	Very Low	2	Low	2	1
	N47	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Marne Road, Papakura	1773687	5895253	Unnamed tributary to Hays Stream	3	Very Low	2	Moderate	2	1
	N48	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Boundary Road, Papakura	1774071	5894558	Hays Stream	3	Very Low	2	Very Low	2	2
	N49	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Hunua Road, Red Hill	1775173	5894614	Hays Stream	3	Very Low	2	Very Low	2	2
	N50	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Sutton Road, Opaheke	1774066	5893394	Unnamed tributary of Slippery Creek	3	Very Low	2	Very Low	2	2
	N51	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Waihoehoe Road, Drury	1773670	5891529	Unnamed tributary of Hingaia Stream	3	Very Low	2	Moderate	2	2
	N52	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Flanagan Road, Drury	1773105	5891264	Hingaia Stream	3	Very Low	2	Very Low	2	2
	N53	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Fielding Road, Drury	1774834	5891128	Unnamed tributary of Hingaia Stream	3	Very Low	2	Moderate	2	2
	N54	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Quarry Road, Drury	1774501	5889857	Hingaia Stream	3	Very Low	2	Very Low	2	2
	N55	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Maketu Road, Drury	1775105	5888518	Hingaia Stream	3	Very Low	2	Very Low	2	2
	N56	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Mercer St, Drury	1772645	5891181	Ngakoroa Stream	3	Very Low	2	Very Low	2	1
	N57	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Burtt Road, Runciman	1772645	5889696	Ngakoroa Stream	3	Very Low	2	Very Low	2	1
	N58	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Oira Road, Runciman	1770540	5890878	Oira Creek	3	Very Low	2	Very Low	2	1

Facility Code	Overflow ID	Overflow Type	Catchment No	Catchment Name	Facility Name/ Description	Address	Coordinates		Receiving Environment Name	RE Recreational Class	RE Potential Public Health Risk	RE Ecological Class	RE Potential Ecological Risk	RE Cultural Class	RE Aesthetic Class
							Ref X	Ref Y							
	N59	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Woodlyn Drive, Runciman	1770546	5889239	Oira Creek	3	Very Low	2	Very Low	2	1
	N62	1	29	Pahurehure Inlet	Proposed Future Overflow Point	Bremner Road, Drury	1772346	5892097	Unnamed tributary (1) to Drury Creek	3	Very Low	2	Moderate	2	1
	N63	1	31	Beachlands-Maraetai	Proposed Future Overflow Point	-	1779259	5914778	Pine Harbour Marina Stream South	3	Low	2	Very Low	1	1
	N64	1	31	Beachlands-Maraetai	Proposed Future Overflow Point	-	1778240	5914947	Pine Harbour Marina Stream South	3	Low	2	Very Low	1	1
-	N65	1	32	Clarks Beach	Proposed Future Overflow Point	-	1751539	5888319	Unnamed tributary to Taihiki River	1	Very Low	1	Very Low	1	1
	N67	1	34	Pukekohe	Proposed Future Overflow Point	Belmont Rd, Pukekohe	1766916	5880809	Unnamed tributary of Whangapouri Creek (Adams Rd)	3	Very Low	2	Moderate	2	1
	N68	1	34	Pukekohe	Proposed Future Overflow Point	Paerata Rd, Paerata	1767663	5886462	Unnamed tributary of Whangapouri Creek (Paerata Rd)	3	Very Low	2	Moderate	2	2
	N69	1	34	Pukekohe	Proposed Future Overflow Point	Sim Rd, Paerata	1768320	5886450	Unnamed tributary of Whangapouri Creek (Sim Rd)	3	Very Low	2	Moderate	2	2
	N73	1	34	Pukekohe	Proposed Future Overflow Point	Schlaepfer Rd, Pukekohe	1766350	5881531	Unnamed tributary of Whangapouri Creek (Schlaepfer Rd)	3	Very Low	2	Moderate	2	2
	N74	1	34	Pukekohe	Proposed Future Overflow Point	Karaka Rd, Paerata	1768061	5888259	Unnamed tributary of Whangapouri Creek (Paerata Rd)	3	Very Low	2	Moderate	2	
	N75	1	35	Kumeu-Huapai-Riverhead	Proposed Future Overflow Point	Trigg Road, Huapai	1735835	5930423	Unnamed tributary (1) to Kumeu River	3	Very Low	2	Moderate	2	2
	N76	1	35	Kumeu-Huapai-Riverhead	Proposed Future Overflow Point	Matua Road, Huapai	1735565	5930438	Unnamed tributary (1) to Kumeu River	3	Very Low	2	Moderate	2	2
	N77	1	35	Kumeu-Huapai-Riverhead	Proposed Future Overflow Point	Matua Road, Huapai	1735286	5926541	Unnamed tributary (2) to Kumeu River	3	Very Low	2	Moderate	2	1
	N78	1	35	Kumeu-Huapai-Riverhead	Proposed Future Overflow Point	Matua Road, Huapai	1735244	5926927	Unnamed tributary (3) to Kumeu River	3	Very Low	2	Moderate	2	1
	N79	1	35	Kumeu-Huapai-Riverhead	Proposed Future Overflow Point	State Highway 16, Huapai	1735012	5930101	Ahukuramu Stream	3	Very Low	2	Moderate	2	2

Attachment 3:
Best Practicable Option (BPO) Methodology

1 PURPOSE OF THE BPO

Section 2 of the RMA defines Best Practicable Option (BPO) in relation to a discharge of a contaminant or an emission of noise as "*the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*

(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and

(b) the financial implications, and the effects on the environment, of that option when compared with other options; and

(c) the current state of technical knowledge and the likelihood that the option can be successfully applied."

Watercare has developed a BPO methodology based on the principles identified above that is dedicated to managing the wastewater network, and is specifically used for the following:

(1) Prioritisation of expenditure for wastewater network improvements and high-level options to inform the six-yearly Wastewater Network Improvement Works Programme set out in the Wastewater Network Strategy (set out in Chapter 3).

(2) Determination of alternative discharge frequencies (ADF) for specific engineered overflow points (set out in Chapter 4), predominantly those that are located in the combined system or in parts of the wastewater network that behave like a combined system. This will usually be undertaken as part of developing the Wastewater Network Improvement Works Programme set out in the Wastewater Network Strategy, but may also become necessary on a once-off basis where specific works need to be undertaken that were not identified in the Wastewater Network Strategy.

(3) Determination of the most appropriate location of engineered overflow points where receiving environments are generally of high value (set out in Chapter 5). Again, this will normally be part of preparing the Wastewater Network Improvement Works Programme but may be necessary in isolated cases if a project was not included in the Wastewater Network Strategy.

The specific aspects of the BPO Methodology applying to each of these three uses are further described below.

In addition, the BPO approach is also used:

- at an organisational level for asset management planning to prioritise funding between water supply, water treatment, wastewater network and wastewater treatment expenditure.
- at the project level, determining the best technical solution from a range of available options.

Both of these additional uses are outside the scope of this consent and only referred to here for reasons of completion. However, the asset management planning process at the organisational level does generally determine the amount of funding available for the Wastewater Network Improvement Works Programme.

2 GENERAL APPLICATION OF THE BPO METHODOLOGY

The following sections set out the application of the BPO methodology relating to wastewater network improvement works, determining alternate discharge frequencies, and determining the location of the engineered overflow points.

In each case, the BPO methodology follows on from an analysis of alternatives where the available options for preventing or minimising adverse effects of wastewater overflows are compared in terms of their effects on the environment, their whole-of-life costs, and their technical feasibility.

This analysis and the criteria set out in the following relevant sections are the basis of the BPO process.

3 APPLICATION OF THE BPO METHODOLOGY TO THE WASTEWATER NETWORK IMPROVEMENT WORKS PROGRAMME

The primary objective of the BPO process is to prevent or minimise adverse effects resulting from wet weather wastewater overflows, and therefore achieve the best level of public health protection, environmental quality and cultural and community well-being for the Auckland Council area as a whole, with the funding that is available.

With respect to minimising wastewater overflows and the potentially adverse effects of such overflows, the principal application of the BPO methodology occurs at the strategic level, i.e. long-term wastewater network improvement planning. The key implementation tool for wastewater network planning is the Wastewater Network Strategy, which is revised at regular six yearly intervals. The first Wastewater Network Strategy is required in 2017. Subsequent revisions will be prepared in 2023, 2029, 2035, 2041 and 2047, in accordance with the conditions of the Comprehensive Wastewater Network Discharge Permit.

The Wastewater Network Strategy sets out Watercare's six year wastewater network works programme, as required by conditions 10 to 16 of the Comprehensive Wastewater Network Discharge Permit, providing - with respect to wastewater network matters - more detail and analysis than can be included in the Asset Management Plan (AMP).

As is the case with the AMP, the prioritisation of works in the Wastewater Network Strategy is based on consideration of **risk (loss of service)** and **environmental effects and risk**.

The assessment of risk considers the urgency with which the works should be undertaken, which is usually linked to asset conditions and/or network capacity. The latter in turn is directly related to urban growth, both through intensification and greenfield development. Risk is also determined by the frequency with which wastewater overflows occur – the more frequently discharges occur, the higher the risk that environmental effects may occur.

The assessment of effects considers the location of existing or new wastewater overflows as well as the volume of these overflows. Overflows to highly valued aquatic receiving environments are generally deemed to generate larger effects than those to environments that are of less importance.

Cost-effectiveness is also an important factor because Watercare must be able to demonstrate that it complies with legal requirements.

Other BPO criteria are normally taken into account following the broad prioritisation of works and determination of options based on risk.

The BPO criteria applicable to developing the wastewater network improvement programme for the Wastewater Network Strategy are set out below.

Criteria	**(1) Risk (Loss of Service)**
Explanation	Loss of service is primarily due to total or partial failure of the system as a result of poor asset condition. Deterioration of service occurs when the potential for overflows increases due to lack of capacity in the system, generally as a result of urban development.
Matters to be considered	(a) Options for operational procedures that may improve asset conditions and/or prolong asset life. (b) Asset condition and likely time remaining until asset replacement becomes necessary, after relevant operational procedures (for example, re-lining of pipes) have been undertaken. (c) Results of relevant investigations and/or wastewater network modelling. (d) Expected changes/increases in population density (urban development), as advised by Auckland Council. (e) Potential effects of increased urban development upstream of the overflow points/catchment.
Criteria	**(2) Environmental Risk** (**Effects on the Environment)**
Explanation	Wastewater overflows have the potential to adversely affect public health, the ecology of the aquatic receiving environment into which they discharge, the cultural values of these receiving environments and the aesthetic enjoyment people may derive from the landscape or amenity in the vicinity of an overflow location. The frequency of overflows is an important factor as this determines the likelihood with which an adverse effect may occur.
Matters to be considered	(a) The value and sensitivity of the receiving environment, as determined through Watercare's *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows*. (b) The volume of the overflow. (c) Frequency of wastewater overflows under current conditions and/or future frequencies expected as a result of increased urban development. (d) The potential for cumulative effects from wastewater overflows. (e) The characteristics of the discharge, i.e. whether the discharge originates in the combined system or the separated system.
Criteria	**(3) Cost-effectiveness**
Explanation	Watercare is required by legislation to minimise the costs of providing an effective service and maintaining the long-term integrity of its assets. It is therefore necessary to compare the cost-effectiveness of the improvement works being considered, both in terms of available options for specific projects and with respect to the relative effectiveness of different projects.
Matters to be considered	(a) Cost-effectiveness of specific works when compared to

	works of similar urgency. (b) Estimated costs of available options for specific works to determine the best-value option.
Criteria	**(4) Short-Term Need**
Explanation	This factor is usually taken into account where an overflow causes a significant and direct public health effect, for example by discharging onto private property or public land that is in frequent use. If the long-term solution (for example, network upgrades to accommodate additional flow) cannot be provided within a short time frame, or there is no feasible long-term solution, other methods to minimise the public health effect will need to be implemented.
Matters to be considered	(a) The extent of the public health effect, with particular consideration of overflow frequency. (b) Availability and timing of a long-term solution that would provide the required Network capacity to eliminate or reduce the discharge. (c) Range of available options.
Criteria	**(5) Effectiveness of Available Options**
Explanation	In most instances, there is more than one option for reducing wastewater overflows and their potential effects.
Matters to be considered	(a) The reduction in frequency and/or volume that may be achieved by a particular option. (b) The degree to which the option depends on the implementation of other works.
Criteria	**(6) Opportunity to benefit from and/or link with projects undertaken by other network utility operators**
Explanation	The performance of the wastewater network depends, to a large degree, on the availability of a functioning stormwater network. In areas where the system is still combined, or was combined and has been separated, or where stormwater is intended to be absorbed by soakage, the wastewater system generally performs less well than in separated areas with relatively recent infrastructure. Where it is possible to undertake work on both the stormwater system and the wastewater system at the same time, or where other major infrastructure providers also work in an area and disruption to the public can be minimised, projects may be elevated in priority.
Matters to be considered	(a) Options for joint projects with the Auckland Council Stormwater Unit, to achieve improved project outcome and/or cost savings. (b) Options for undertaking a Watercare project in conjunction with another network utility operator to minimise disruption to the public and/or save in construction costs.

Criteria	**(7) Consequential project/planning linkages**
Explanation	A specific project may, in itself, not achieve a significant reduction in overflows at a specific location, or present the best investment for the anticipated outcome. However, the project may be a key factor in minimising wastewater overflows within the catchment over time, in combination with other works.
Matters to be considered	(a) Sequencing of projects to optimise short-term benefits as well as overall outcomes.
Criteria	**(8) Step-change effect of options**
Explanation	The degree of change brought about by a particular option is an important consideration. For example, a single improvement project may result in an immediate significant reduction of overflows in a given location, or it may require a series of smaller projects within the general area to achieve the same improvement over a longer time period. Unless there are valid reasons for the more gradual improvements, projects that yield large step changes are generally preferred.
Matters to be considered	(a) The degree to which several linked and staged projects (as per Criterion 7) may achieve a better outcome in terms of reducing effects on the environment than one project focusing on a specific location.
Criteria	**(9) Ability to future-proof**
Explanation	Improvement projects that will allow for future-proofing of the network without significant additional cost (provided that population density is expected to increase in the area) are normally ranked above those that cannot achieve this additional benefit.
Matters to be considered	(a) The extent to which population density in the area serviced is expected to increase, and the time frame of this growth. (b) The cost of providing additional capacity now in comparison to undertaking the works at a later stage.
Criteria	**(10) Time-related funding limitations (related to size of project)**
Explanation	Some projects are so large that they require substantial expenditure and very long time frames for construction – works relating to the large interceptors are an example. The financial implications of funding such projects play a significant role in the prioritisation process.
Matters to be considered	(a) Options for financing the project.
Criteria	**(11) Quality of Existing Data**
Explanation	Because network investigations and network modelling are both lengthy and costly, existing information may be of limited accuracy and reliability. Where major expenditure is required

	for an improvement project, additional and up-to-date data may be required to ensure that the project is scoped correctly and will achieve the desired outcome.	
Matters to be considered	(a)	Quality and age of data needed to scope and define the works.
	(b)	Cost and timeframes for obtaining additional information.
Criteria	**(12)**	**Regulatory requirements**
Explanation	Depending on the nature of the improvement works, various resource consents may be required to be able to proceed.	
Matters to be considered	(a)	The nature of the works and what resource consents will be required, including the time frame for securing the necessary consents.
	(b)	Consent compliance issues, i.e. whether consent is already in place that requires specific works within a defined timeframe.
Criteria	**(13)**	**Odour and visual nuisance**
Explanation	A particular overflow location may have a recent and ongoing history of complaints about odour and/or visual effects due to the presence of gross floatable solids.	
Matters to be considered	(a)	The number of people affected and the frequency of overflows that generate the odour or visual effects.
	(b)	Available options, if necessary, to reduce the extent of odour and visual effects.
Criteria	**(14)**	**Historical community concerns**
Explanation	Circumstances may exist that may result in historical community concerns about a particular overflow location although neither the likelihood of discharges associated with it nor the potential effects are sufficient to prioritise the works.	
Matters to be considered	(a)	Known community concerns about a particular overflow location, and the reasons for this concern.
	(b)	Options, if necessary, for reducing the adverse effects.

4 APPLICATION OF THE BPO METHODOLOGY TO DETERMINING ALTERNATIVE DISCHARGE FREQUENCIES

Condition 7 of the Comprehensive Wastewater Network Discharge Permit sets out the discharge frequencies to be achieved for the wastewater network, specifically an average of no more than two *Wet Weather Overflow Events* per *Engineered Overflow Point* per year. This discharge frequency generally applies to the separated wastewater network, particularly those parts of the network that have been designed to function as a separated network.

An alternative discharge frequency may be determined through the BPO methodology where this frequency cannot be achieved, generally because the network is old, was designed as a combined network and retains many of the features of a combined network, or is still combined.

This determination is generally made when the Wastewater Network Improvement Works Programme is developed, as part of the Wastewater Network Strategy. However, there may be occasions when *Engineered Overflow Points* need to be constructed that have not been identified as part of the Wastewater Network Improvement Works Programme. Such works are authorised through conditions 17 to 21 of the Comprehensive Wastewater Network Discharge Permit.

The BPO methodology applicable to the determination of alternative discharge frequencies for specific overflow points uses the same criteria considering risk and effects that are the basis of the Wastewater Network Improvement Works Programme BPO. However, as the decision-making process is limited to determining an acceptable overflow frequency for a specific overflow point, the level of detail required is less, and some criteria with a strategic focus are unnecessary.

The BPO criteria applicable to the determination of alternative discharge frequencies are set out below.

Criteria	**(1) Risk**
Explanation	Loss of service is primarily due to total or partial failure of the system as a result of poor asset condition. Deterioration of service occurs when the potential for overflows increases due to lack of capacity in the system, generally as a result of urban development. With respect to determining an acceptable discharge frequency for a single overflow point, the degree of risk (i.e. likelihood of asset failure) is important as this determines the urgency of the required works.
Matters to be considered	(a) Options for operational procedures that may improve asset conditions and/or prolong asset life. (b) Asset condition and likely time remaining until asset replacement becomes necessary, after relevant operational procedures (for example, re-lining of pipes) have been undertaken. (c) Results of relevant investigations and/or wastewater network modelling. (d) Expected changes/increases in population density (urban development), as advised by Auckland Council. (e) Frequency of wastewater overflows under current conditions and/or future frequencies expected as a result of increased urban development, or if asset failure occurs.

	(f) Potential effects of increased urban development upstream of the overflow points/catchment.
Criteria	**(2) Environmental Risk (Effects on the Environment)**
Explanation	Wastewater overflows have the potential to adversely affect public health, the ecology of the aquatic receiving environment into which they discharge, the cultural values of these receiving environments and the aesthetic enjoyment people may derive from the landscape or amenity in the vicinity of an overflow location. The frequency of overflows is an important factor as this determines the likelihood with which an adverse effect may occur. An assessment of effects in accordance with the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* is therefore an essential component of this BPO methodology.
Matters to be considered	(a) The value and sensitivity of the receiving environment, as determined through Watercare's *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows*. (b) The volume of the overflow. (c) The frequency of the wastewater overflow under current conditions and/or future frequencies expected as a result of increased urban development. (d) The potential for cumulative effects from wastewater overflows. (e) The characteristics of the discharge, i.e. whether the discharge originates in the combined system or the separated system.
Criteria	**(3) Cost-effectiveness**
Explanation	Watercare is required by legislation to minimise the costs of providing an effective service and maintaining the long-term integrity of its assets. It is therefore necessary to compare the cost-effectiveness of the available improvement options for the specific overflow location.
Matters to be considered	(a) Cost-effectiveness of available options.
Criteria	**(4) Short-Term Need**
Explanation	This factor is of particular importance in this context, as any available long-term solutions would have been considered in the Wastewater Network Strategy.
Matters to be considered	(a) The extent of the public health effect, with particular consideration of overflow frequency. (b) Availability and timing of a long-term solution that would provide the required Network capacity to eliminate or reduce the discharge. (c) Range of available options.

Criteria	**(5) Effectiveness of Available Options**
Explanation	In most instances, there is more than one option for reducing wastewater overflows and their potential effects.
Matters to be considered	(a) The reduction in frequency and/or volume that may be achieved by a particular option. (b) The degree to which the option depends on the implementation of other works.

Criteria	**(6) Opportunity to benefit from and/or link with projects undertaken by other network utility operators**
Explanation	Although it is likely that opportunities for joint projects would be identified at a more strategic level (i.e. the Wastewater Network Strategy) the potential for links to smaller scale projects exist.
Matters to be considered	(a) Options for joint projects with the Auckland Council Stormwater Unit, to achieve improved project outcome and/or cost savings. (b) Options for undertaking a Watercare project in conjunction with another network utility operator to minimise disruption to the public and/or save in construction costs.

Criteria	**(7) Consequential project/planning linkages**
Explanation	A specific project may, in itself, not achieve a significant reduction in overflows at a specific location, or present the best investment for the anticipated outcome. However, the project may be a key factor in minimising wastewater overflows within the catchment over time, in combination with other works. The need for an alternative discharge frequency may therefore exist only for a limited time, until associated projects can be implemented.
Matters to be considered	(a) Relationship of improvement works at the specific overflow location with other projects.

5 APPLICATION OF THE BPO METHODOLOGY TO DETERMINING THE LOCATION OF ENGINEERED OVERFLOW POINTS

In most cases, the location of Replacement or New Engineered Overflow Points will be determined when the Wastewater Network Improvement Works Programme is developed, as part of the Wastewater Network Strategy. However, there may be occasions when *Engineered Overflow Points* need to be constructed that have not been identified as part of the Wastewater Network Improvement Works Programme. Such works are authorised through conditions 17 to 21 of the Comprehensive Wastewater Network Discharge Permit.

Watercare is committed to ensuring that wastewater overflows from Engineered Overflow Points do not discharge directly to Class 1 (high value) recreational, ecological or cultural aquatic receiving environments. However, in some cases topographical or other constraints may severely limit the available options for determining the location of a potential wastewater overflow discharge.

The BPO methodology applicable to the determination of acceptable locations for specific overflow points uses the same criteria considering risk and effects that are the basis of the Wastewater Network Improvement Works Programme BPO. However, as the decision-making process is limited to matters of location, the level of detail required is less, and some criteria with a strategic focus are unnecessary.

The BPO criteria applicable to the determination of the location of engineered overflow points are set out below.

Criteria	**(1) Risk**
Explanation	Loss of service is primarily due to total or partial failure of the system as a result of poor asset condition. Deterioration of service occurs when the potential for overflows increases due to lack of capacity in the system, generally as a result of urban development. Where an existing asset is at risk, locational options are likely to be limited.
Matters to be considered	(a) Options for operational procedures that may improve asset conditions and/or prolong asset life. (b) Asset condition and likely time remaining until asset replacement becomes necessary, after relevant operational procedures (for example, re-lining of pipes) have been undertaken. (c) Results of relevant investigations and/or wastewater network modelling. (d) Expected changes/increases in population density (urban development), as advised by Auckland Council. (e) Potential effects of increased urban development upstream of the overflow points/catchment.

Criteria	**(2) Environmental Risk (Effects on the Environment)**
Explanation	Wastewater overflows have the potential to adversely affect public health, the ecology of the aquatic receiving environment into which they discharge, the cultural values of these receiving environments and the aesthetic enjoyment

	people may derive from the landscape or amenity in the vicinity of an overflow location. The frequency of overflows is an important factor as this determines the likelihood with which an adverse effect may occur. An assessment of effects in accordance with the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* is therefore an essential component of this BPO methodology, where these have not previously been undertaken.
Matters to be considered	(a) The value and sensitivity of the receiving environment, as determined through Watercare's *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows*. (b) The volume of the overflow. (c) The frequency of the wastewater overflow under current conditions and/or future frequencies expected as a result of increased urban development. (d) The potential for cumulative effects from wastewater overflows. (e) The characteristics of the discharge, i.e. whether the discharge originates in the combined system or the separated system.
Criteria	**(3) Cost-effectiveness**
Explanation	Watercare is required by legislation to minimise the costs of providing an effective service and maintaining the long-term integrity of its assets. It is therefore necessary to compare the cost-effectiveness of the improvement works being considered, both in terms of available options for specific projects and with respect to the relative effectiveness of different projects.
Matters to be considered	(a) Cost-effectiveness of available options/locations.
Criteria	**(4) Short-Term Need**
Explanation	This factor is of particular importance in this context, as any available long-term solutions would have been considered in the Wastewater Network Strategy.
Matters to be considered	(a) The extent of the public health effect, with particular consideration of overflow frequency. (b) Availability and timing of a long-term solution that would provide the required Network capacity to eliminate or reduce the discharge. (c) Range of available options.
Criteria	**(5) Effectiveness of Available Options**
Explanation	In most instances, there is more than one option for reducing wastewater overflows and their potential effects.
Matters to be considered	(a) The reduction in frequency and/or volume that may be

	achieved by a particular option. (b) The degree to which the option depends on the implementation of other works.
Criteria	**(6) Opportunity to benefit from and/or link with projects undertaken by other network utility operators**
Explanation	Although it is likely that opportunities for joint projects would be identified at a more strategic level (i.e. the Wastewater Network Strategy) the potential for links to smaller scale projects exist.
Matters to be considered	(a) Options for joint projects with the Auckland Council Stormwater Unit, to achieve improved project outcome and/or cost savings. (b) Options for undertaking a Watercare project in conjunction with another network utility operator to minimise disruption to the public and/or save in construction costs.
Criteria	**(7) Consequential project/planning linkages**
Explanation	A specific project may, in itself, not achieve a significant reduction in overflows at a specific location, or present the best investment for the anticipated outcome. However, the project may be a key factor in minimising wastewater overflows within the catchment over time, in combination with other works. The need for an overflow point in the location being considered may not be permanent as other improvement works may allow for relocation at a later stage.
Matters to be considered	(a) Relationship of improvement works with other related works.

Attachment 4:
Methodology for Prioritising Catchments and Wastewater Network Improvement Works

1 INTRODUCTION

This attachment to the Comprehensive Wastewater Network Discharge Permit has been prepared so the Council can certify that the Consent Holder has prioritised catchments and wastewater network improvement works in accordance with the process and considerations set out in this methodology.

The amount of funding available to maintain, operate and upgrade the wastewater network, as well as providing new network in areas of urban growth, is finite. In addition, wastewater infrastructure "competes" with other types of infrastructure such as water supply, transport and social infrastructure, which are also publicly funded. Therefore, expenditure needs to be justified and prioritised to achieve the maximum possible benefit for the users of the wastewater network.

Watercare manages its assets on the basis of risk. The prioritisation criteria that determine the prioritisation of catchments and wastewater network improvement works are derived from this risk management approach, and incorporate risk of loss of service, public health and environmental risk, and financial risk. These risks are described in detail in Section 3, where it is also noted whether a particular criterion applies predominantly to catchment prioritisation, improvement works prioritisation, or both.

Section 4 describes the catchment ranking categories and presents the baseline ranking undertaken in September 2013. This ranking will be reviewed and, if necessary, changed through applying the criteria set out below, and as documented in subsequent reviews of Watercare's Wastewater Network Strategy.

It is important to note that a ranking of 'High Priority" does not necessarily correspond with short timeframes for achieving improvements. Generally, catchments with a high priority are in this category because the risk of losing services and/or the risk to public health and ecological values are high throughout the catchment, and the available options for improving the network are costly and require major works, which usually have long timeframes.

2 OBJECTIVE

The objective of this prioritisation process is to commit resources to the highest priority areas, meaning those where the risk of wastewater overflows is assessed as being very high, high or medium, in accordance with the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows*. It is acknowledged that exceptions may arise where:

a. assets have reached the end of their life cycle and replacement is required;

b. in catchments that have a low priority overall, but where a particular overflow point is assessed as having a high or medium risk, improvement works would have significant benefit across the catchment;

c. improvement works that would normally be targeted at catchments assessed as having a very high or high risk may need to be deferred because they are dependent on other significant improvement works (for example, improvement projects that depend on completion of the Central Interceptor).

3 PRIORITISATION CRITERIA

As noted above, the prioritisation of catchments and the improvement works in these catchments occur on the basis of risk - risk of loss of service, risk to public health and ecological values, and financial risk.

Risk related to wastewater network assets (risk of loss of service) and financial risk is determined by Watercare staff on the basis of professional judgement and knowledge of the asset base. The prioritisation process is qualitative rather than quantifiable, so there is no pre-determined formula or similar mechanism. There are instead a number of criteria to be taken into account in reaching decisions regarding prioritisation of catchments and wastewater network improvement works.

Risk related to public health and ecological values is determined by applying the process outlined in the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* (Attachment 5).

Other factors are also taken into account, to ensure that the prioritisation process is sufficiently robust.

The 15 prioritisation criteria and explanations are set out below, in approximate order of importance and applicability. Catchment prioritisation is predominantly based on the first seven criteria. The remaining eight are generally of lesser importance with respect to determining catchment priority as they are relatively specific, although they may be used to provide an additional level of detail in the analysis.

Wastewater network improvement works are prioritised in the same manner, but the more specific criteria are accounted for in more detail.

(1) **Network Capacity** (existing and future). Insufficient capacity within the network to convey wastewater flows during normal operation of the system (i.e. during times of dry weather flow) is one of the key criteria for prioritisation. Watercare designs and operates the wastewater network to prevent wastewater overflows during dry weather conditions. Where this cannot be guaranteed due to anticipated population increases, wastewater network upgrades will be required. In the context of network capacity, the potential effects of increased urban development upstream of a catchment (or overflow point) are also taken into account. Network capacity is determined on the basis of urban growth projections provided by census data and Auckland Council information, and the results of relevant network investigations and/or wastewater network modelling.

(2) **Asset condition**. The condition of the wastewater network is another key consideration for catchment and improvement works prioritisation, as collapse of an asset will result in total or at least partial loss of service, and most likely consequential effects on public health and ecological values as well. Aging and deteriorated assets are therefore given high priority. The likely time remaining until asset replacement becomes necessary (after relevant operational procedures that may improve asset conditions and/or prolong asset life, such as re-lining of pipes, have been undertaken) is the key information to determine priority.

(3) **Risk to public health and ecological values.** This risk is determined on the basis of overflow characteristics (frequency and volume) and receiving environment values, in accordance with the process established in the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* (Attachment 5). Catchments with a high proportion of very high or high public health and ecological risk are generally prioritised above other catchments.

(4) **Short-term need.** This is taken into account if a particular overflow is likely to cause a significant and direct public health effect, for example by discharging onto private property or public land that is in frequent use. If the long-term solution (for example, network upgrades to accommodate additional flow) cannot be provided within a short time frame, or there is no feasible long-term solution, other methods to minimise the public health effect will need to be implemented. Depending on the extent of the risk to public health this factor is more likely to prioritise relevant improvement works than, it is unlikely that this factor will contribute significantly to catchment prioritisation, but it is likely to prioritise relevant improvement works.

(5) **Cost.** Watercare is required by legislation to minimise the costs of providing an effective service and maintaining the long-term integrity of its assets. It is therefore necessary to ensure that the available options for improving the wastewater network are as cost-effective as possible. In terms of prioritising catchments, this means that other financial considerations such as time-related funding limitations for major projects (Criterion 6), and the ability to undertake joint projects with other infrastructure providers (Criterion 8) are important contributing factors. In terms of prioritising improvement works, the estimated costs of the available options need to be compared to provide the best value. The cost-effectiveness of specific works when compared to works of similar urgency is also taken into account.

(6) **Time-related funding limitations.** Some projects are so large that they require substantial expenditure and very long time frames for construction – works relating to the large interceptors are an example. The financial implications of funding such projects play a significant role in the prioritisation process. There are usually a range of options for financing large projects, which need to be analysed and comply with Watercare's funding policy.

(7) **Quality of information**. The quality of the information required to determine asset condition and/or network capacity and/or public health and ecological risk (as this required information about the frequency and volume of wastewater overflows) within a catchment may not always be sufficient to accurately determine what priority the catchment should have. Where this is the case, network investigations and/or network modelling may need to be undertaken (or updated) first, which would increase the priority of the catchment. Depending on the extent of the investigation or modelling exercise, this may take some time. Similarly, if major expenditure is required for an improvement project, additional and up-to-date data may be required to ensure that the project is scoped correctly and will achieve the desired outcome.

(8) **Opportunity for joint projects.** The performance of the wastewater network depends, to a large degree, on the availability of a functioning stormwater network. In areas where the system is still combined, or was combined and has been separated, or where stormwater is intended to be absorbed by soakage, the wastewater system generally performs less well than in separated areas with relatively recent infrastructure. Where it is possible to undertake work on both the stormwater system and the wastewater system at the same time, or where other major infrastructure providers also work in an area and disruption to the public can be minimised, projects may be elevated in priority to take advantage of this and potentially save costs, as well as improving the overall outcome. This factor mostly applies to undertaking improvement works, as the opportunity for joint projects with the stormwater network operator are largely confined to the Auckland Isthmus catchments, which already have high priority.

(9) **Ability to future-proof**. In some cases, the ability to future-proof the network without significant additional cost (provided that population is expected to increase in the area) contributes to prioritising a particular catchment or specific improvement project, as this provides additional benefit. This is determined by the anticipated population growth and the time frame of this growth, and the cost of providing additional capacity now in comparison to undertaking the works at a later stage.

(10) **Effectiveness of available options.** This criterion is closely related to Criteria 11 and 12. In terms of catchment prioritisation, it is of relevance where upgrades to the transmission network are involved that would affect more than one catchment, meaning that one large project may be more effective overall than many smaller ones in individual catchments. The Central Interceptor, which will receive flows from multiple catchments, is an example of such a major improvement project. Generally, such works (and the catchments affected) are prioritised due to the scale of the works and their financial implications.

(11) **Step change effect of available options.** The degree of change brought about by a particular option is an important prioritisation consideration. For example, a single

improvement project may result in an immediate significant reduction of overflows in a given location, or it may require a series of smaller projects within the general area to achieve the same improvement over a longer time period. Unless there are valid reasons for the more gradual improvements, projects that yield large step changes are generally preferred. This also affects catchment prioritisation to some degree, as a catchment with only one or few issues that may be remedied by specific works is likely to be elevated above one where more complex solutions are required.

(12) **Consequential project/planning linkages.** A specific project may, in itself, not achieve a significant reduction in overflows at a specific location, or even present the best investment for the anticipated outcome. However, the project may be a key factor in minimising wastewater overflows within the catchment over time, in combination with other works. In particular, upgrades of the transmission network (which may be located in a different catchment) are often necessary to enable upgrades within the upstream local network. This factor is closely linked to the effectiveness of available options (Criterion 10) and the step change effect of available options (Criterion 11) and the three are usually evaluated together.

(13) **Regulatory requirements**. Many wastewater network improvement works will require one or more consents, for example to authorise earthworks, or where trees may be affected. Depending on the scale of the improvement project, the consenting timeframe may be considerable. Where large scale works are likely to be required within a catchment, this may affect catchment prioritisation due to the potentially lengthy process of acquiring all relevant consents.

(14) **Odour and visual nuisance**. A particular overflow location may have a recent and ongoing history of complaints about odour and/or visual effects due to the presence of gross floatable solids. This may contribute to the prioritisation of specific improvement works but is unlikely to affect catchment prioritisation.

(15) **Historical considerations.** Circumstances may exist that could result in historical community concerns about a particular overflow location, although neither the likelihood of discharges associated with it nor the potential effects are sufficient to prioritise the works. In some instances, known community concerns may need to be taken into account to prioritise works. This factor is not normally considered for catchment prioritisation.

4 CATCHMENT RANKING

For the purpose of managing the wastewater network, Watercare has identified 35 geographical catchments, to split the large network into assessable and manageable areas. A further catchment (Central Interceptor Catchment) was excluded from the original consent application due to the large scale of improvement works occurring in this catchment.

Based on the prioritisation criteria listed in Section 3, these catchments have been ranked (i.e. prioritised) to provide an overall framework for allocating improvement works. The initial ranking undertaken in 2013 is shown in Table 1. This ranking will be updated on a regular basis as part of developing the Wastewater Network Strategy and its subsequent reviews, and in accordance with this methodology.

Catchment ranking is predominantly undertaken on the basis of **current** network performance, as known at the time that the ranking is undertaken, **and the anticipated change** in network performance that may occur as the result of urban growth (identified at the time that the ranking is undertaken). For example, a particular catchment may perform well at present, but significant growth is forecast within the next decade. Unless appropriate improvement works to service this growth have already been identified, this catchment would be ranked as having Medium or High Priority to ensure that the current good performance is maintained.

There are four prioritisation categories:

Low Priority (1)	Overall, the risk of adverse public health and ecological effects[1] in this catchment is low or very low, because the overflow points in this catchment are known not to discharge or discharge with a low frequency and low volume. Asset condition is generally good and system capacity is sufficient to provide for the existing and anticipated (at the time of assessment) population. There may be some high value receiving environments, but because of the low frequency and volume of any discharges, the potential risk of effects to these receiving environments is low or very low.
Low Priority (2)	Overall, the risk of adverse public health and ecological effects in this catchment is low or very low (as for Low Priority (1)). Asset condition is generally good and system capacity is sufficient to provide for the existing and anticipated (at the time of assessment) population. There may be some high value receiving environments, but because of the low frequency and volume of any discharges, the potential risk of effects to these receiving environments is low or very low. However, there are a limited number of cases where the potential risk of public health and ecological effects to receiving environments is moderate or high and a more detailed level of investigation is required to determine if any improvement works are necessary.
Medium Priority	Overall, the risk of adverse public health and ecological effects in this catchment is moderate, because several of the overflow points in this catchment discharge with a medium frequency (more than twice but less than 12 times a year), generally to a receiving environment of high value. Asset condition may be compromised in parts of the catchment, and system capacity may not be sufficient to provide for additional population. Investigation is required to determine the nature and timing of improvement works.
High Priority	Overall, the risk of adverse public health and ecological effects in this catchment is high, because a considerable number of the overflow points in this catchment discharge with a high frequency (more than 12 times a year) and a high volume, generally to a receiving environment of high value. Asset condition may be compromised in parts or much of the catchment, and system capacity may not be sufficient to provide for additional population. Improvement works are required.

Using this approach, catchments with high frequency/high volume discharges and high receiving environment values generally receive the highest ranking, especially if asset condition and system capacity are likely to affect the level of service. Catchments with high frequency/high volume discharges to receiving environments of lesser value would be ranked above catchments with high receiving environment values where the risk of overflows is low, which reflects the underlying risk management approach. Other aspects may influence the ranking, for example where urban growth is known to occur in the short to medium term and new wastewater infrastructure needs to be provided.

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1 As determined through applying the *Methodology for the Assessment of Effects of Wey Weather Wastewater Overflows*.

The initial catchment ranking undertaken in 2013 is shown in Table 1 below. It provides the basis for the subsequent catchment prioritisation undertaken as part of the Wastewater Network Strategy development and subsequent reviews.

Table 1: Initial prioritisation of geographical catchments (September 2013)

Catchment	Preliminary Ranking
1 – Wellsford	Low (1)
2 – Omaha	Low (1)
3 – Warkworth	Low (1)
4 – Snells Beach/Algies Bay	Low (1)
5 – Waiwera	Low (1)
6 – Helensville	Low (1)
7 – Orewa	Low (2)
8 – Weiti	Low (1)
9 – Whangaparaoa	Low (2)
10 - Long Bay	Low (1)
11 - East Coast Bays	Low (2)
12 - Devonport-Takapuna	Low (2)
13 - Shoal Bay	Medium
14 - Upper Harbour North	Low (1)
15 - Upper Harbour South	Low (1)
16 - Upper Harbour West	Low (1)
17 – Henderson Creek	Medium
18 - Whau River	Medium
19 – Laingholm	Low (1)
20 - Cox's Bay	High
21 - Central Auckland (CBD)	High
22 – Hobson Bay	High
23 – Onehunga	Medium
24 – Mangere	Low (2)
25 - Lower Tamaki River	Medium
26 - Upper Tamaki River	Medium
27 - Cockle Bay	Low (1)
28 – Puhinui	Low (2)
29 - Pahurehure Inlet	Medium
30 – Oneroa	Low (1)
31 - Beachlands-Maraetai	Low (1)
32 - Clarks Beach	Low (1)
33 – Waiuku	Low (1)
34 – Pukekohe	Low (1)
35 – Kumeu-Huapai	Low (1)

Attachment 5:
Methodology for
the Assessment of Effects of
Wet Weather Wastewater Overflows

Auckland Wastewater Network

Methodology
for the
Assessment of Effects
of
Wet Weather Wastewater Overflows

Version 1.0

August 2013

Watercare
An Auckland Council Organisation

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PART 1

Assessment of Effects
of
Wet Weather Wastewater Overflows
on
Aquatic Receiving Environments

1 INTRODUCTION

1.1 Overview

The *Methodology for the Assessment of Effects on the Environment* (the Methodology) described in this document has been specifically developed to allow for the comparative assessment of public health, ecological, cultural and aesthetic effects on aquatic receiving environments (REs) that may occur following a wet weather wastewater overflow.

The Methodology is an important component of Watercare's overall approach to managing wastewater overflows from the public wastewater network (hereafter referred to as the Network) and prioritisation of Network improvement works. It provides a consistent, repeatable and auditable process for broadly assessing the potential public health, ecological, cultural and aesthetic effects of Network overflows during wet weather, and the associated risk of these effects occurring. It caters for a diverse range of aquatic REs and considers the two most important characterises of wet weather overflows, namely frequency and volume. By adopting a generic approach that allows for a comparative assessment, the Methodology serves as a key tool for the prioritisation of network improvement works.

The assessment process utilises existing information and data and recognises that the amount and quality of information on wastewater overflow characteristics and REs varies significantly across the Network, and may be limited in some instances. It allows for the consideration of site-specific information while generating outputs that are comparable between individual overflow points as well as catchments.

1.2 Purpose

The purpose of this document is to provide a 'step by step' guide to the Methodology, to enable the revision of any existing AEEs (for example, when new information has become available) and the preparation of new assessments, for example, when new aquatic REs in greenfield areas need to be considered. The Methodology is therefore also an important tool for the preparation of the Wastewater Network Strategy, which determines the prioritisation of improvement projects in Watercare's Wastewater Network Improvement Works Programme at six-yearly intervals.

1.3 Outline of the Process

The Methodology has been broken down into 12 steps, as illustrated in Figure 1.1. The document is structured to follow these steps.

'Example Boxes' are provided where relevant to demonstrate how the assessment process is carried out, using two REs as appropriate:

- Blockhouse Bay, and
- Whau River Estuary.

Both are aquatic receiving environments in the Whau River Catchment. The complete assessments are provided in Appendix 3 to serve as a template and example for future revisions and assessments.

1.4 Reference Information

Specific reference information is required to implement the Methodology and complete an aquatic RE assessment.

1.4.1 Required Information

(1) Overflow volumes and frequency data. This may be modelled information or monitored (SCADA) data and can be obtained from the Watercare Overflow Database held by Watercare's Wastewater Planning Unit.

(2) The report entitled '*Auckland-wide Wastewater Network Discharge Consent Applications - Generic Assessment of Ecological and Recreational Effects*' (NIWA, 2013), to provide background and assistance for determining the potential public health and ecological effects associated with wet weather wastewater overflows (held by Watercare's Statutory Planning Unit).

(3) The tables of effects summarising the results of the NIWA report (2013) (Appendix 1);

(4) Aerial images and maps;

(5) Watercare GIS information.

(6) Proposed and operative statutory planning documents (Unitary Plan).

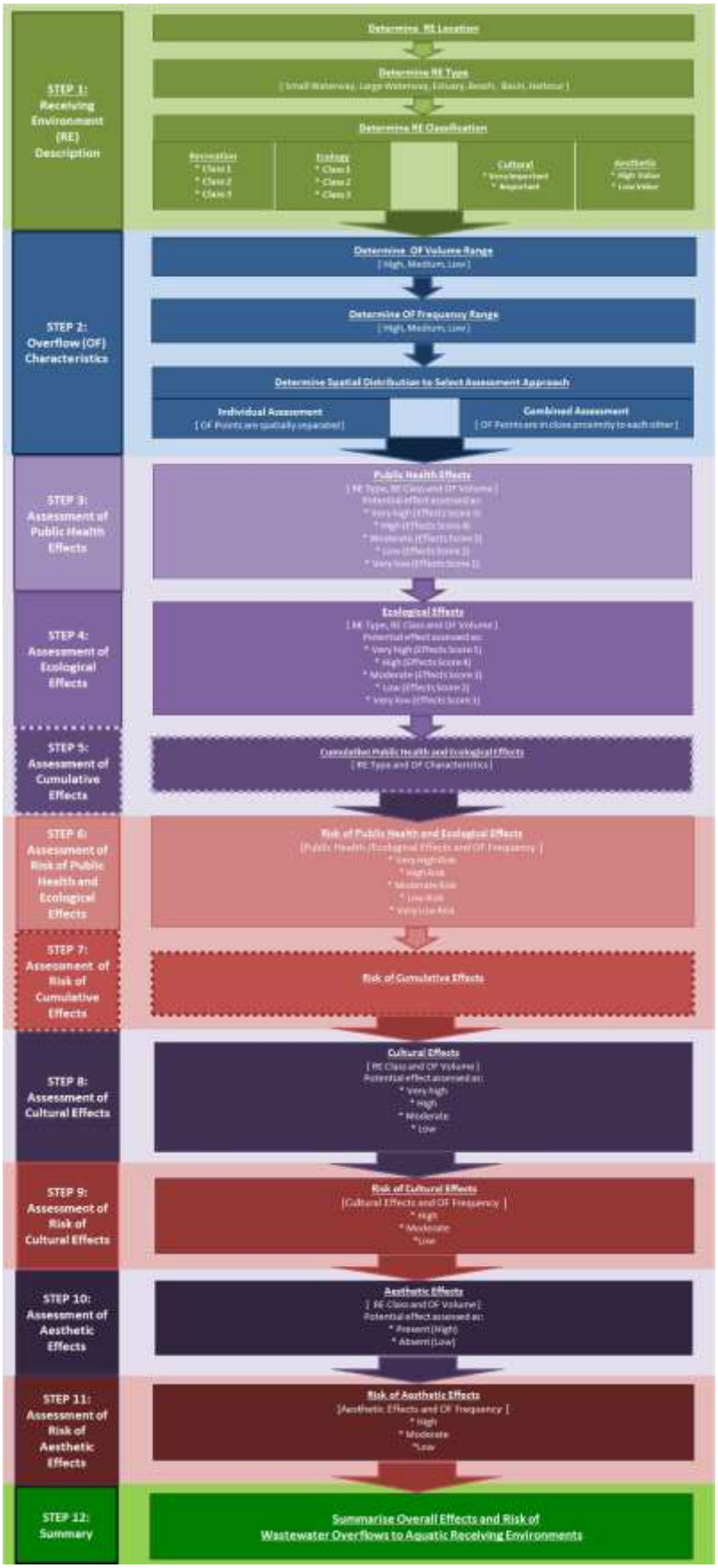
(7) Recreational water quality monitoring data (Safeswim).

1.4.2 Additional Information

Other existing information relating to the catchment or specific RE may also be useful, for example:

- Assessment of Environmental Effects reports undertaken for other purposes
- Reserve Management Plans
- Catchment Management Plans
- Stream classification assessments undertaken for stormwater management purposes.

Figure 1.1: Methodology for Assessing Effects and Determining Risk from Wastewater Overflows



2 RECEIVING ENVIRONMENT DESCRIPTION (STEP 1)

The Auckland region is home to a variety of freshwater and marine aquatic receiving environments that may be subject to wastewater overflows. The first step in the Methodology requires the categorisation of these REs and their values. The purpose of this step is to broadly characterise specific aquatic environments to establish how they may be affected by wastewater overflows. It is important to note here that this assessment relates to aquatic REs only.

First, the RE must be identified. In some instances this is challenging, particularly where there is limited information on the catchment, or the exact location of an overflow is uncertain (which may be the case in a combined network). Once the RE is identified, it can then be classified as a 'Type' (e.g. 'Beach' or 'Harbour'). The 'Type' provides some assumptions around the processes that operate in these environments and the potential for dilution. Following this, the recreational, ecological, cultural and aesthetic values of the RE are determined.

The RE characteristics established through the processes in Step 1 should be set out in brief descriptive paragraphs, followed by a summary of the relevant information in the Receiving Environment Characteristics table (Example Boxes 1 to 6).

2.1 Identification of the Receiving Environment

Identifying the relevant RE requires determining the location of the wastewater overflow in relation to a water body. Watercare's GIS and associated information layers on wastewater overflow locations can be used for this task.

For each overflow, both the 'direct' and 'indirect' RE must be identified to allow for subsequent assessment. These are defined as follows:

- **Direct Receiving Environments** are located at the point of discharge and are therefore immediately affected by an overflow.
- **Indirect Receiving Environments** are downstream environments that may be affected by discharges from one or more overflow locations. These environments are generally associated with the coastal environment, i.e. basins, estuaries and harbours. It is assumed that indirect discharges to these environments will be more diluted than a direct discharge because they have already "travelled" some distance from the original overflow point.

It is important to note that the RE is determined by the location of the overflow point, rather than the asset with which it is associated. For example, an overflow structure associated with a pump station (Type 1) may discharge into a stormwater pipe rather than directly to an aquatic receiving environment because the next natural water course is some distance away (refer to Example Box 1). The RE is therefore not the stormwater pipe, but the natural environment at the point where the stormwater pipe outfall is located.

Generally, it is easier to determine the RE in areas serviced by a separated network, as there is usually a recognisable point-source overflow location. In contrast, it can be difficult to determine the RE for an overflow in the combined (or previously combined) network, as is the case for a large part of central Auckland. Many of the engineered overflow points in these areas are network overflow points (Type 2) rather than overflows associated with a pump station. The overflow location data for such overflows relates to the controlled point at which the wastewater overflows into the combined network (combined sewer overflow, or CSO), rather than the point at which the combined network discharges, via stormwater outfalls, into the RE. The location where these CSOs actually enter the environment may therefore not be known precisely, if the associated stormwater outfall cannot be located. CSOs should be assessed by combining their volume (refer Chapter 3.2) to account for this.

Because overflows do not always discharge directly into a natural water course[1] or the coastal marine area, the Methodology recognises three scenarios:

(1) The overflow structure connects into a stormwater pipe, defined as an enclosed structure usually located underground. The direct RE is located at the point where the stormwater pipe ends and discharges to a natural water course or the coastal marine area.

(2) The overflow structure connects into a stormwater channel, defined as an open artificial drain. The direct RE is located at the point where the stormwater channel ends and discharges to a natural water course or the coastal marine area.

(3) The overflow structure discharges directly into a natural water course or the coastal marine area, which is the direct RE. This situation applies even where the water course has been highly modified or the area into which the overflow discharges has been culverted.

It is important to note that in scenarios (1) and (2) the wastewater overflow is diluted with the stormwater flows being conveyed. This additional dilution is not provided for in the assessment of effects, thus adding a further degree of conservatism to the assessment.

Example Box 1 illustrates how an overflow point is located.

2.2 Establishment of the Receiving Environment Type

Aquatic REs are categorised into six generic types, as outlined in Table 2.1 below. These 'Types' consist of Small Waterways, Large Waterways, Estuaries, Basins and Lakes, Beaches and Harbours.

The determination of RE 'Type' provides a general understanding of the potential dilution available in certain environments. Small Waterways are assumed to have a minor level of dilution. Large Waterways, Estuaries and Basins are assumed to have a higher level of dilution when compared to Small Waterways. Beaches and Harbours are considered to have - comparatively - the highest level of dilution because they are large, open water bodies and are influenced by currents and tidal flows. This basic assumption is of importance when assessing the potential effects of a wet weather wastewater overflow. For example, the potential effects of wastewater overflows of the same volume are greater in a small freshwater stream than a large harbour.

The types of REs are not intended to be a definitive list of all receiving environment types throughout the Auckland Council area. The purpose of categorising aquatic REs in this generic manner is to allow for a comparison of REs and the potential effects of wastewater overflows in a consistent and repeatable way.

Determining the appropriate RE Type can be undertaken by viewing aerial images and/or environmental descriptions located within existing documents, such as previous resource consent applications, ecological assessments or management plans. An example is provided in **Example Box 2**.

[1] For the purpose of this Methodology, the definition water course is the same as the definition of 'River' in the Resource Management Act 1991: *"***River** *means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)."*

Example Box 1: **Identifying the RE for Overflows 609 and 622 in the Whau River Catchment**

Overflow 609 is associated with the Endeavour Street pump station, which is located on the edge of the Blockhouse Bay Beach Reserve. The overflow is connected to a stormwater pipe, which eventually discharges to the environment close to the Blockhouse Bay Boat Club.

Overflow 622 is associated with the Lewis Street pump station, which is located at the end of Lewis Street close to the water's edge. This overflow is also connected a stormwater pipe, which discharges to a small inlet in Blockhouse Bay close to the pump station itself.

The image below is a screenshot of Watercare's GIS aerial viewer, showing the location of the pump stations. Wastewater pipes are shown in red, and stormwater pipes in green.

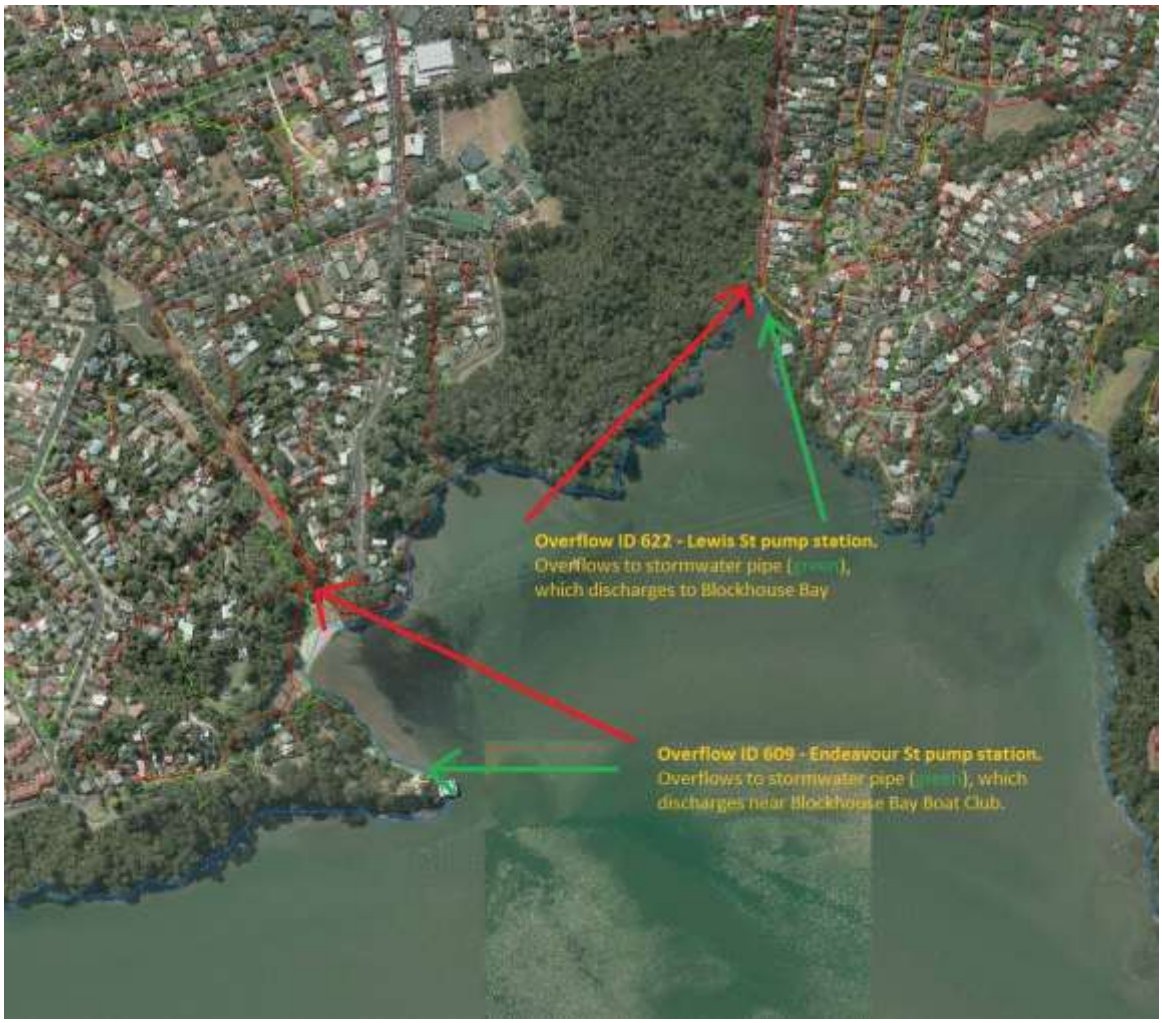


Table 2.1: Receiving Environment Types

RE Type	Description
Small Waterway	Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Low-Order (stream order 1 and 2), for example Upper Lucas Creek.
Large Waterway	Fresh water flowing along a definite course classified by the River Environment Classification[2] (REC) as Middle-Order (stream order 3 and 4) and High-Order (stream order greater than 4) for example the Lower Oratia Stream.
Estuaries (tidal creeks)	The wide lower course of a river where it flows into the sea, for example the lower Whau River and Hellyers Creek. Estuaries are characterised by tidal flows, and their water is a changing mixture of fresh and salt.

[2] River Environment Classification (2010). Produced by NIWA for the Ministry for the Environment.

RE Type	Description
Basins and Lakes	Artificially or naturally enclosed areas of a river or harbour, for example the Orakei Basin.
Beaches (including open coast)	The water body between mean high water springs and the open coast, for example the East Coast Beaches of the former Rodney District and North Shore City.
Harbours	Enclosed areas of water where ships either historically or currently seek shelter, for example the Waitemata Harbour.

Example Box 2: Determining the Blockhouse Bay RE Type

Aerial images and existing reports were used to determine the specific characteristics of Blockhouse Bay and derive the RE Type. Blockhouse Bay is described as a 'mostly coarse sand beach with shell in the upper intertidal zone' (Metrowater, 2001).

Using this information and the description of RE types in Table 2.1 above, Blockhouse Bay is determined to be a '**Beach'** Environment.

2.3 Classification of the Receiving Environment

To determine the potential effect of a wastewater overflow on a RE, the values of that environment must be ascertained. To this end, the Methodology provides for four value categories:

(1) Recreation
(2) Ecology
(3) Cultural
(4) Aesthetic values.

Each value is associated with specific effects, as shown below:

(1) Recreational value is linked to public health effects caused by elevated levels of pathogens.

(2) Ecological value is affected by increased pollutant loads and/or concentrations.

(3) Natural waterways are of cultural significance to all iwi. Cultural value is compromised by the discharge of untreated wastewater to waterways, which is offensive to Maori.

(4) Aesthetic value is linked to public accessibility and use and is reduced by adverse visual and odour effects caused by gross floatable solids and other visible pollutants, or offensive odour.

For each of the four value categories, a RE classification (or ranking) is assigned, as described in more detail below.

2.3.1 Recreational Value

Recreational value is determined through a three-point ranking system, represented as Class 1, Class 2 and Class 3. Generally, Class 1 represents a RE with 'High' recreational values and Class 3 represents a RE with 'Low' or no recreational values.

Assigning a recreational value Class to a RE requires an understanding of the level of contact recreation, if any, that occurs within that environment. Recreational value also encompasses food gathering, specifically the collection of shellfish and seaweed (or watercress in freshwater environments), and fishing.

Table 2.2 below identifies the level of contact recreation associated with each Class. For example, where contact recreation is known to occur and/or the location is known as a shellfish gathering site, then the environment is identified as a Class 1 environment. All known bathing beaches in the Auckland Council area, especially those monitored by Auckland Council as part of the Safeswim monitoring programme [3] are automatically assigned a Class 1 category. Given the often limited information available, a conservative approach is always taken.

[3] Auckland Council's Safeswim monitoring programme is designed to provide regular assessments of water quality at a range of beaches.

Class 2 recreational REs are those that are accessible and may be used for contact recreation and/or food gathering, but to a lesser degree because of the inherent characteristics of the water body. For example, a sandy beach will normally be categorised as a Class 1, but a rocky beach where entering the water is more difficult would be considered to be a Class 2 recreational RE.

Recreation Class 3 is assigned to waterways that are unlikely to be used for contact recreation and/or food gathering, generally because they are practically inaccessible or the characteristics of the waterway are such that contact recreation and/or food gathering activities are limited, for example because of a muddy substrate or obstruction from vegetation.

An example is provided in **Example Box 3**.

Table 2.2: Classification of Recreational Value

Receiving Environment Classification	Definition	Sources of Information
Class 1	• An area where contact recreation is known to occur (i.e. located on a known bathing beach). If the beach is also a Safe Swim site this is deemed to be an indicator of high use; and/or • A known shellfish gathering site; and/or • Aquaculture areas.	• Safeswim programme (Auckland Council). • Consultation (shellfish gathering sites). • Aquaculture sites • Aerial photos. • Relevant planning documents.
Class 2	• An area where contact recreation may occur.	
Class 3	• An area where contact recreation is unlikely to occur.	

Example Box 3: Determining the Recreational Value Class for the Blockhouse Bay RE

Blockhouse Bay is a popular shellfish gathering site (Metrowater, 2001). Fishing is also popular, both from the shore and from boats in the channel immediately off the coast. Blockhouse Bay is a Safeswim site, which highlights its popularity for contact recreation (Auckland Council, 2012). As contact recreation is known to occur here and the area is a known shellfish gathering site, the beach is assigned a **Class 1** recreational value.

2.3.2 Ecological Value

Determining the ecological value of a RE requires some knowledge of the ecological characteristics of the site. As is the case for recreational value, a three-point scale is applied when identifying ecological values, as shown in Table 2.3 below.

Auckland Council planning documents and maps are necessary sources of information for determining whether the site is noted for any significant ecological values, or is otherwise classified as being of high ecological value. Resource consent applications and management plans may also provide useful information.

Example Box 4 outlines the classification of ecological value.

Table 2.3: Classification of Ecological Value

Receiving Environment Classification	Definition	Sources of Information
Class 1	Identified by applicable planning documents as having special protection for ecological reasons, or a Significant Conservation Area for ecology purposes. This includes stream reach types 2 and 3 in Auckland urban areas.	• Coastal Plan/Unitary Plan • District Plans/Unitary Plan • Reserve Management Plans • Previous Assessments of Environmental Effects
Class 2	Non-classified areas of local ecological conservation value of a habitat type known to have some ecological value (i.e. mangroves). This includes stream reach types 4 in Auckland urban areas.	
Class 3	Highly modified and disturbed coastal and freshwater areas such as stream reach types 5 and 6 in Auckland urban areas. Coastal areas could include ports and marinas. Freshwater areas could include highly modified channels and piped streams.	

Example Box 4: Determining the Ecological Value Class for the Blockhouse Bay RE

Blockhouse Bay is not identified as a Coastal Protection Area in the Auckland Council Regional Plan: Coastal. However, pied shags roost in the trees along this coast and the inshore sand flats and the offshore mud flats are important feeding areas for birds (Metrowater, 2001).

As Blockhouse Bay is known to have some ecological value, but is not classified, it is assigned a **Class 2** ecological value.

2.3.3 Cultural Value

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value.

Cultural value is included as a distinct value category to ensure that they are specifically and separately acknowledged, rather than being included and possibly overshadowed by an assessment that only refers to public health and ecological values.

For the cultural effects category, REs are classified as Important (Class 2) or Very Important (Class 1). The use of only two "classes" was a considered decision to reflect the fact that the Maori worldview considers all natural water to be of value, both for practical and spiritual reasons. Cultural value sites of great importance to iwi that are polluted or destroyed have psychological effects on that iwi, as the identity of iwi is intertwined with the natural environment.

Receiving environments where an overflow point is in the vicinity (defined as being within a radius of 50 m) of a cultural value site are categorised as a Class 1 RE. A cultural value site is defined as follows:

- Any site of relevance to Maori noted on the Cultural Heritage Inventory (CHI) such as an archaeological site, a midden or similar
- Waahi tapu sites
- Pa sites
- Urupa
- Waka landing sites

- Food gathering areas
- Battle sites
- Sites where significant events occurred, for example Treaty of Waitangi signing sites.

Table 2.4 shows the classification of cultural values.

Table 2.4: Classification of Cultural Value

Receiving Environment Classification	Definition	Sources of Information
Very Important	Aquatic receiving environment where the overflow point is in the vicinity (within 50m) of a cultural value site.	• Regional and District Plans (Unitary Plan) • Archsite • Cultural Heritage Inventory • Iwi consultation
Important	Every other aquatic receiving environment.	

Iwi consultation is an important source of information for determining the cultural value of an RE. In some instances, different iwi may disagree about the value category. If this is the case, the most conservative value (Class 1 – Very important) should be adopted.

Example Box 5: Determining the Cultural Value Class for the Blockhouse Bay RE

Four midden sites were identified along the western end of Blockhouse Bay beach and in close proximity to Overflow 609 (within 50m). The eastern headland is also identified as a pa site. The cultural value of Blockhouse Bay has therefore been identified to be '**Very important'** (Class 1).

2.3.4 Aesthetic Value

For the purpose of this Methodology, aesthetic value refers to the potential aesthetic enjoyment people may derive from land-based recreational activities in the vicinity of the overflow location. Aesthetic value is therefore limited to a two-point scale (Table 2.5):

(1) Where the overflow point or area in the vicinity of the overflow is accessible to the public (either through public open space or a residential area), aesthetic value is deemed to be High (Class 1).

(2) Where the overflow point or area in the vicinity of the overflow is not accessible by the public the aesthetic value is deemed to be Low (Class 2).

In some situations, there may be several overflow points in one RE, with different levels of public accessibility. If this is the case, the most conservative value (High Value) should be adopted.

Example Box 6 illustrates this approach for the Blockhouse Bay RE.

Table 2.5: Classification of Aesthetic Value

Receiving Environment Classification	Definition	Sources of Information
High Value	• Directly adjacent to publicly accessible open space and/or areas where people live, with direct access to waterways or coastal areas.	• Auckland Council planning documents and maps • Aerial photos
Low Value	• Not located adjacent to known areas of publicly accessible open space, nor residential areas.	

Example Box 6: Determining the Aesthetic Value Class for the Blockhouse Bay RE

Blockhouse Bay is accessible from Blockhouse Bay Beach Reserve, an open space area at the western end of the Bay. Overflow 609 is located on the edge of this reserve. The area is also flanked by residential areas. The overflow location is accessible to members of the public.

Because of its accessibility, the Blockhouse Bay RE is deemed to have **High** aesthetic value.

3 DETERMINATION OF OVERFLOW CHARACTERISTICS (STEP 2)

3.1 Volume and Frequency Ranges

Information about the volume and frequency of individual overflows may be variable and/or limited, but is expected to improve over time with the standardisation of telemetry equipment and data, and improved modelling.

To enable a consistent approach in the future, overflow volumes and frequencies are grouped into three 'ranges' - high, medium and low, as shown and defined in Tables 3.1 and 3.2 respectively.

Information on overflow characteristics can be sourced from the Watercare database. In the first instance, data is sourced from relevant wastewater models. Where modelled data is not available, monitoring (measured) data (SCADA) may be available.

Where neither modelled nor measured data is available, this usually indicates that there are no known overflows associated with the overflow point. In this case, both volume and frequency of the overflow are deemed to be Low.

Data on overflow characteristics is provided in two chapters in the AEE:

(1) Table 1 in Chapter 3, which is a list of all overflow points in the catchment and associated information; and

(2) In Chapter 4, as a brief summary at the beginning of the assessment of effects for individual REs. At this point, information about the potentially cumulative nature of effects is also addressed (Step 5 of this Methodology).

Table 3.1: Overflow Volume Ranges

Overflow Volume Range	Definition	Sources of Information
High	Actual or estimated annual volume of 10,000m³ or greater.	• Modelled overflow information • Watercare telemetry (SCADA) records • Watercare operational records
Medium	Actual or estimated annual volume of between 1,000 and 10,000m³.	
Low	Actual or estimated annual volume of less than 1,000m³, including zero volume.	

Table 3.2: Overflow Frequency Ranges

Overflow Frequency Range	Definition	Sources of Information
High	More than 12 overflow events per year.	• Modelled overflow information • Watercare telemetry (SCADA) records • Watercare operational records
Medium	Between 3 and 12 overflow events per year.	
Low	2 or fewer overflow events per year.	

Example Box 7 demonstrates how specific overflow characteristics for the Blockhouse Bay overflow points (IDs 609 and 622) are determined.

Example Box 7: Determining the Characteristics of Overflows to the Blockhouse Bay RE

Modelled data for Blockhouse Bay was used to identify overflow volume and frequency. Overflows 609 and 622 are modelled to each discharge 500m³ once a year, and both are therefore **Low** volume and **Low** frequency overflows.

3.2 Spatial Distribution of Overflow Points

An aquatic receiving environment may receive wastewater overflows from a single or several overflow points. In situations where multiple overflow points discharge to the same RE, it may be appropriate to "combine" them and assess them as one overflow.

The "normal" approach to assessing effects is to assess each overflow point individually. This is the case for the two overflow points in Blockhouse Bay, which are located at some distance from each other.

A combined assessment should be undertaken in the following situations:

(1) There are two or more overflow points in close proximity to each other.

Example: Overflows 473 and 730, which both discharge to Judges Bay. OF 473 has an annual overflow volume of 499 m^3, and OF 730 has an overflow volume of 1,364 m^3 per year. Together, these overflows can be considered as one medium volume overflow (1,863 m^3).

(2) There are two or more combined sewer overflow points (CSOs) into the same stormwater pipe.

Example: Overflows 477, 478, 479, 480, 482, 483, 484, 485, 486, 487 and 490, for which the direct RE is the port area (Waitemata Harbour). The overflow volume for each individual overflow has been modelled as 499 m^3 per year. Combined, they would discharge an annual volume of approximately 5,500 m^3 and can therefore be considered as one medium volume overflow.

A combined assessment approach is useful where individual assessments of overflow points are unlikely to provide a more detailed level of information about potential effects on the receiving environment. It does not, however, replace the need to undertake an assessment of potential cumulative effects in situations where these may arise.

Cumulative effects are discussed in detail in Chapter 6 (Step 5).

4 ASSESSMENT OF POTENTIAL PUBLIC HEALTH EFFECTS (STEP 3)

4.1 Introduction

The assessment of public health (and ecological effects) is based on the report entitled '*Auckland-wide Wastewater Network Discharge Consent Applications - Generic Assessment of Ecological and Recreational Effects*' (NIWA, 2012). The assessment methodology was developed specifically for the purpose of determining the potential effects of wet weather wastewater overflows from Auckland's public wastewater network on aquatic receiving environments, with the aim of comparing how different REs may be affected and to what extent.

The assessment methodology focuses on contaminant load and concentration, and is based on a two-step process that:

(1) Considers the potential physical, chemical and biological changes generated by wastewater overflows, followed by
(2) Determining the potential effect, which arises from these environmental changes and the characteristics of the RE.

The assessment of the potential public health effects requires the following information (collated in Steps 1 and 2):

(1) The type of RE (i.e. Small Waterway, Large Waterway, Estuary, Basin/Lake, Beach or Harbour).
(2) The value classification of the RE (i.e. Class 1, 2 or 3 for recreational and ecological values).
(3) The volume range of the overflow (high, medium, low).

Assessments are undertaken for both the direct and indirect receiving environments of a particular wastewater overflow.

4.2 Assessment of Potential Public Health Effects

NIWA identified the following changes that may occur in the environment as a result of wastewater overflows:

Physical changes:
- Elevated stream flows
- Elevated water temperature
- Elevated total suspended solid (TSS) concentrations
- Elevated organic solids concentrations

Chemical changes:
- Elevated nutrient concentrations
- Elevated levels of potential toxicants in the water column
- Accumulation of metals in bed sediments
- Elevated biochemical oxygen demand (BOD)
- Reduced dissolved oxygen (DO), including anoxia
- Elevated pharmaceuticals and endocrine disruptors in bed sediments

Biological changes:
- Organic enrichment of bed sediments
- Elevated pathogen concentrations (measured through indicators and directly)

Each of these changes was given a score between 1 (very low potential for change) and 5 (very high potential for change) to determine its likelihood for a particular type of RE and overflow volume.

The second step assumes that a particular physical, chemical or biological change, or combination of changes, will give rise to one or more effect on recreational values, as shown in Table 5.1.

The possible public health effects on recreational values are:

(1) Loss of suitability for contact/partial contact recreation. This effect is predominantly linked to the elevated levels of pathogens in the receiving environment water.
(2) Loss of suitability for collecting shellfish.
(3) Loss of suitability for fishing.
(4) Loss of suitability for harvesting water-cress/seaweed.

The last three effects can be grouped together as they effectively represent the loss of opportunity to gather food. These effects are generally linked to elevated levels of potential toxicants in the water column, accumulation of metals in bed sediments and elevated pathogen concentrations.

Each of the effects described above was also given a score[4] between 1 (very low potential effect) to 5 (very high potential effect), which depends on the type of RE and the value (Class 1, 2 or 3) of the RE. In total, there are 54 variations[5] of public health effects, which have been summarised in 18 tables in Appendix 1.

Example Box 8 outlines the potential public health effects on the Blockhouse Bay RE.

Example Box 8: Assessing the Potential Public Health Effects in the Blockhouse Bay RE

Blockhouse Bay is a '**Beach**' environment with **Class 1** recreational values. There are two direct overflows to Blockhouse Bay, each discharging at a **low volume.** They are assessed individually as they are not in close proximity to each other.

The Effects Table for Public Health Effects/Beach/Class 1 in Appendix 1 provides the following information for low volume overflows:

Low volume discharges to beaches with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below.

(1) Loss of suitability for contact or partial contact recreation has an **Effects Score of 3 (moderate)** because microbial pathogen indicator contact recreation guidelines may be exceeded.

(2) Loss of suitability for collecting shellfish has an **Effects Score of 3 (moderate)** because shellfish have the potential to filter pathogens and metals from water and sediments.

(3) Loss of suitability for fishing has an **Effects Score of 3 (moderate)** because microbial pathogen indicator contact recreation guidelines may be exceeded.

(4) Loss of suitability for harvesting seaweed has an **Effects Score of 3 (moderate)** because seaweed can be a hydraulic trap for particulate contaminants.

[4] 1 - Very low potential effect
2 - Low potential effect
3 - Moderate potential effect
4 - High potential effect
5 - Very high potential effect

[5] Six types of receiving environments, each with 3 value classes (18 RE combinations). For each RE combination, there are 3 overflow volume ranges (high, medium and low) that need to be considered, resulting in 54 combinations of public health effects.

Table 5.1: Relationship between Potential Changes in Aquatic Environments and Resulting Public Health Effects

Public Health Effect	Potential changes in aquatic environments associated with wastewater overflows												
	Physical Change					Chemical Change						Biological Change	
	Elevated stream flow	Elevated water temperature	Elevated TSS concentration	Elevated organic solid concentration	Elevated nutrient concentration	Elevated toxicant concentration in water column	Metal accumulation in bed sediment	Nutrient enrichment of bed sediment	Elevated BOD	Reduced DO	Elevated pharmaceuticals in bed sediment	Organic enrichment of bed sediment	Elevated pathogen concentration
(1) Loss of suitability for contact and/or partial contact recreation			✓									✓	✓
(2) Loss of suitability for collecting shellfish			✓			✓	✓	✓		✓	✓		✓
(3) Loss of suitability for fishing			✓			✓	✓	✓		✓	✓		✓
(4) Loss of suitability for harvesting water-cress and/or seaweed						✓	✓					✓	✓

5 ASSESSMENT OF POTENTIAL ECOLOGICAL EFFECTS (STEP 4)

5.1 Introduction

The assessment of ecological effects is also based on the assessment methodology provided by NIWA (2012). To undertake an assessment of ecological effects, the same information is required as was needed for assessing public health effects, namely:

(1) The type of RE (i.e. Small Waterway, Large Waterway, Estuary, Basin/Lake, Beach or Harbour)
(2) The value classification of the RE (i.e. Class 1, 2 or 3 for recreational and ecological values)
(3) The volume range of the overflow (high, medium, low).

Assessments are undertaken for both the direct and indirect receiving environments of a particular wastewater overflow.

5.2 Assessment of Potential Ecological Effects

As is the case for public health effects, ecological effects also arise from changes that may occur in the environment as a result of wastewater overflows. However, the change-effect relationship differs for ecological effects, as shown in Table 5.2.

The possible effects on ecological values are:

(1) Change in physical habitat suitability. This effect is the result of elevated stream flow, elevated water temperature, elevated TSS concentration, elevated organic solid concentration, elevated nutrient concentration, metal accumulation in bed sediment, nutrient enrichment of bed sediment, reduced DO, and organic enrichment of bed sediment.
(2) Toxic concentrations of ammonia, sulphide, metals and nitrate. This effect is the result of elevated toxicant concentration in the water column, metal accumulation in bed sediment, nutrient enrichment of bed sediment and elevated pharmaceuticals in bed sediment.
(3) Change in community structure and/or loss of sensitive species. This effect is the result of elevated stream flow, elevated water temperature, elevated TSS concentration, elevated organic solid concentration, elevated nutrient concentration, elevated toxicant concentration in the water column, metal accumulation in bed sediment, nutrient enrichment of bed sediment, elevated BOD, reduced DO, elevated pharmaceuticals in bed sediment and organic enrichment of bed sediment.
(4) Behavioural changes in fin fish. This effect is the result of elevated TSS concentration and elevated pharmaceuticals in bed sediment.
(5) Increase in nuisance plants, including *Ulva* (sea lettuce) and diatom mats. This effect is the result of elevated water temperature, elevated nutrient concentration and nutrient enrichment of bed sediment.
(6) More frequent phytoplankton blooms in the water column. This effect is the result of elevated water temperature and elevated nutrient concentration.
(7) Reduced quantities of fin fish. This effect is the result of elevated TSS concentration, elevated toxicant concentration in the water column, metal accumulation in bed sediment, nutrient enrichment of bed sediment, reduced DO and elevated pharmaceuticals in bed sediment.
(8) Reduced quantities of shellfish. This effect is the result of elevated TSS concentration, elevated toxicant concentration in the water column, metal accumulation in bed sediment, nutrient enrichment of bed sediment, reduced DO and elevated pharmaceuticals in bed sediment.

(9) Degradation of aquaculture and/or loss of opportunity for aquaculture. This effect is the result of elevated TSS concentration, elevated toxicant concentration in the water column, metal accumulation in bed sediment, nutrient enrichment of bed sediment, reduced DO and elevated pharmaceuticals in bed sediment.

(10) Loss of suitability for livestock watering. This effect is the result of elevated TSS concentration, elevated organic solid concentration, elevated toxicant concentration in the water column, elevated pharmaceuticals in bed sediment and elevated pathogen concentration.

(11) Loss of suitability for irrigation use. This effect is the result of elevated toxicant concentration in the water column, elevated pharmaceuticals and elevated pathogen concentration.

(12) Growth of sewage fungus and/or *Beggiatoa*[6]. This effect is the result of elevated BOD.

Each of the effects described above was also given a score between 1 (very low potential effect) to 5 (very high potential effect), depending on the type of RE and the value (Class 1, 2 or 3) of the RE. As is the case for public health effects, there are 54 variations of ecological effects, which have been summarised in 18 tables in Appendix 2. Not all of the identified 12 effects may arise in each RE; for example, the loss of opportunity for livestock watering only applies to small and large waterways. Only the relevant ecological effects are described.

In some cases, the different types of effects display a range of effects scores. For example, the effects table for ecological effects in Class 2 Large Waterways for medium volume overflows (Ecological Effects/Large Waterways/Class 2/Medium Volume) shows that 10 out of the identified 12 types of effects may occur. Effects scores include 1 (very low) for "Increase in nuisance plants", 2 (low) for seven types of effects and 5 (very high) for two types of effects (Loss of suitability for livestock watering and Loss of suitability for irrigation use). The overall level of effect (and risk, as assessed in Step 6) should be determined by the dominant effects score, with an accompanying narrative highlighting the outlying scores. For this example, the overall potential ecological effects are low (effects score 2), although the potential loss of livestock watering and irrigation use is rated as very high because of the potentially high levels of toxicants, organic solids and BOD in the water column.

Example Box 9 outlines the potential ecological effects on the Blockhouse Bay RE.

[6] *Beggiatoa* is a genus of bacteria in the order Thiotrichales that can be considered as an indicator species for pollution.

Example Box 9: Assessing the Potential Ecological Effects in the Blockhouse Bay RE

Blockhouse Bay is a '**Beach**' environment with **Class 2** ecological values. There are two direct overflows to Blockhouse Bay, each discharging at a **low volume.** They are assessed individually as they are not in close proximity to each other.

The Effects Table for Ecological Effects/Beach/Class 2/Low Volume in Appendix 2 provides the following information:

Low volume discharges to beaches with Class 2 ecological values are assessed as having **very low to low potential effects** on ecological values, as shown below. Beaches are likely to have high dilution rates, and are generally able to absorb low volume overflows.

(1) Change in physical habitat suitability has an **Effects Score of 2 (low)**, because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an **Effects Score of 2 (low)**, because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels.

(3) Change in community structure/loss of sensitive species has an **Effects Score of 2 (low)**, because the limited extent of changes in physico-chemical habitat suitability is unlikely to affect sensitive species.

(4) Behavioural changes in fin fish has an **Effects Score of 1 (very low)**, because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.

(6) More frequent phytoplankton blooms in the water column has an **Effects Score of 1 (very low)**, because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels**.**

(7) Reduced quantities of fin fish has an **Effects Score of 2 (low)**, because of the lack of changes in physico-chemical habitat suitability.

(8) Reduced quantities of shellfish has an **Effects Score of 2 (low)**, because of the lack of changes in physico-chemical habitat suitability.

Table 5.2: Relationship between Potential Changes in Aquatic Environments and Resulting Ecological Effects

Ecological Effect	Potential changes in aquatic environments associated with wastewater overflows												
	Physical Change				Chemical Change							Biological Change	
	Elevated stream flow	Elevated water temperature	Elevated TSS concentration	Elevated organic solid concentration	Elevated nutrient concentration	Elevated toxicant concentration in water column	Metal accumulation in bed sediment	Nutrient enrichment of bed sediment	Elevated BOD	Reduced DO	Elevated pharmaceuticals in bed sediment	Organic enrichment of bed sediment	Elevated pathogen concentration
(1) Change in physical habitat suitability	✓	✓	✓	✓	✓		✓	✓		✓		✓	
(2) Toxic concentrations of ammonia, sulphide, metals and nitrate						✓	✓	✓			✓		
(3) Change in community structure and/or loss of sensitive species	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
(4) Behavioural changes in fin fish			✓								✓		
(5) Increase in nuisance plants, including *Ulva* (sea lettuce) and diatom mats		✓			✓			✓					
(6) More frequent phytoplankton blooms in the water column		✓			✓								
(7) Reduced quantities of fin fish			✓			✓	✓	✓		✓	✓		
(8) Reduced quantities of shellfish			✓			✓	✓	✓		✓	✓		
(9) Degradation of aquaculture and/or loss of opportunity for aquaculture			✓			✓	✓	✓		✓	✓		
(10) Loss of suitability for livestock watering			✓	✓		✓					✓		✓
(11) Loss of suitability for irrigation use						✓					✓		✓
(12) Growth of sewage fungus and/or *Beggiatoa*									✓				

6 ASSESSMENT OF POTENTIAL CUMULATIVE EFFECTS (STEP 5)

Cumulative effects are included in the definition of 'effect' in Section 3(d) of the RMA:

"3 (d) Any cumulative effect which arises over time or in combination with other effects regardless of the scale, intensity, duration, or frequency of the effect."

For the purpose of this Methodology, this has been interpreted to mean:

- Effects arising in **combination** with other effects, namely when several wastewater overflows in close proximity to each other are likely to occur at the same time and together generate a larger volume than a single overflow would (spatial cumulative effect).
- Effects arising **over time**, namely when one or more overflows of a given volume discharge so frequently that the receiving environment cannot readily assimilate or flush the contaminant loads and/or concentrations between discharge events (temporal cumulative effect).

The potential for cumulative effects to occur is contingent on the characteristics of the receiving environment (the RE Type and associated available dilution) and the characteristics of the overflows into that environment, specifically how many overflow points there are, their volume and frequency, as well as the spatial proximity of overflow points to each other. As is the case with other aspects of the Methodology, the underlying approach is inherently conservative, meaning that effects are potentially overestimated because a worst-case scenario is usually considered. This includes the following assumptions:

- Overflow points that discharge to the same receiving environment are generally deemed to "activate" together at times of wet weather flow. This assumption is applied to both system types (combined system and separated system), although the frequency of discharges from the combined system is generally higher than those from the separated system.
- The contaminants of concern in wastewater overflows are pathogens, which are not normally persistent in the environment. Temporal cumulative effects are therefore less likely (depending on the type of receiving environment) than for types of discharges which contain contaminants that tend to accumulate in the environment over time, such as metals.
- Where there is a mixed range of overflow volumes, the largest volume generally determines the potential cumulative effect. In other words, in situations where there is a single overflow with a high volume range, the potential public health and ecological effects are already high or very high (depending on the RE Type). The addition of several overflows with a low volume range will not change this assessment.

As noted above, cumulative effects of wastewater overflows may be:

(1) spatial cumulative effects (i.e. several overflows discharge to the same RE at the same time, and their combined volume increases the potential effect); or
(2) temporal cumulative effects (i.e. a discharge occurs so frequently that residual effects build up over time); or
(3) Both, where a number of overflows discharge at the same time and at a frequency that does not allow for the effect of the previous discharge to dissipate.

To determine if cumulative effects may arise and an assessment should be undertaken, the following information is necessary:

(1) The number and location of overflow points.
(2) The volume of each discharge in m^3, rather than just the range of the overflow volume, to determine whether the combined volume of several discharges would be less than

1,000 m^3 per year (low) or would need to be considered as a medium or high volume range. Where there is no monitored or modelled data, a conservative approach is taken, i.e. an individual overflow point without associated data is assumed to discharge a volume of 1,000 m^3 per year. Conversely, where an overflow is known not to discharge the volume is deemed to be 0.

(3) The frequency of the overflows, to determine whether a temporal cumulative effect should be considered. Overflows in the low frequency range are generally unlikely to give rise to temporal cumulative effects, even if there are several of them discharging together. Generally, a temporal cumulative effects is only likely where an overflow discharges at a high frequency (i.e. more than once per month) and to a RE with limited available dilution (i.e. a Small Waterway).

(4) The wastewater system type. Discharges from the combined system contain a lesser component of wastewater than discharges from a separated system.

(5) The distance between the RE and the overflow point, where the RE is an indirect one. In some cases, the distance may be considerable and the dilution provided by the "travelling time" may render a cumulative effect in the indirect receiving environment unlikely.

Using this information, it is usually possible to arrive at a judgement of whether cumulative effects are likely or not.

Cumulative effects are only considered in the context of public health and ecological effects because they arise primarily as a result of elevated contaminant loads. Therefore, the same Effects Scores used to determine individual public health and ecological effects can be used.

In many cases, the Effects Scores will not change where the cumulative effect is generated by one high volume and several low volume overflows, because the individual assessment is already based on a high volume overflow. However, there may be instances where several low volume discharges overflowing together would increase the total volume of wastewater in the receiving environment to the medium volume range. In such cases, the medium volume Effects Score for public health and ecological effects should be assigned to determine the potential cumulative effects. As is the case for individual effects assessments, the Effects Score is used to assess the risk of cumulative effects (Step 7).

If cumulative effects are considered likely, a qualitative narrative statement should be provided, as shown in Example Box 10.

If cumulative effects are unlikely, this should also be clearly stated, as illustrated in Example Box 11.

Example Box 10: Assessing the Potential Cumulative Effects in the Whau River Estuary RE

For the Whau River Estuary RE, cumulative effects were considered possible because:

- There are a comparatively large number of overflow points that could potentially discharge (23 direct and five indirect overflows), although these are spatially separated, especially the indirect overflow points.
- Although most overflows are of low frequency, two of the indirect overflows are of medium and high frequency.

For a spatial cumulative effect to arise, all direct and indirect overflows would need to discharge at the same time. This would elevate the total volume of wastewater overflows to the high volume range, and result in high potential public health and ecological effects. This assessment includes the medium and high volume indirect discharges, which are the dominant contributor to a potential cumulative effect (rather than the various direct discharges). As these indirect discharges have already been assessed as having potentially moderate to high effects individually, the potential cumulative effect would not be notably different.

In addition, the indirect discharges occur a significant distance from the estuary and are likely to be diluted by the time they reach Whau River Estuary.

Example Box 11: Assessing the Potential Cumulative Effects in the Blockhouse Bay RE

For the Blockhouse Bay RE, cumulative effects are considered unlikely because both overflows discharge with low volume and at some distance from each other:

7 ASSESSMENT OF THE RISK OF PUBLIC HEALTH AND ECOLOGICAL EFFECTS (STEP 6)

The Methodology developed by NIWA (2012) focuses on assessing the potential public health and ecological effects that may arise, in a particular receiving environment, as a result of different volumes of wastewater overflows. It does not, however, consider the likelihood of these effects actually occurring.

Risk is conventionally defined as the combination of the likelihood of an event (with respect to wastewater overflows, this is expressed as frequency) and the consequences of an event (with respect to wastewater overflows, the potential effects as assessed in Steps 3 and 4).

Considering the risk of a given effect or group of effects is important to ensure that potential effects are not overestimated. For example, a medium volume overflow that discharges into a Small Waterway with Class 1 ecological values may (for most types of effects including change in physical habitat suitability, toxic concentrations of ammonia, sulphide, metals and nitrate) result in very high potential effects. However, if the overflow frequency indicates that this discharge does not occur more than once or twice per year, then the actual risk of these effects can be considered as low.

The "risk profile" for public health and ecological effects is generated by combining the potential effects with the overflow frequency range, as shown in Table 5.3 below. As noted in Chapter 5.2, in cases where different types of effects display a range of Effects Scores, the dominant Effects Score should be used to assess the risk, although the risk for the "outlying" effects should be commented on if appropriate.

Table 5.3: Risk Profile for Potential Public Health and Ecological Effects

Overflow Frequency Range	Effects Score				
	5 Very High	4 High	3 Moderate	2 Low	1 Very Low
High	Very high	Very high	High	Moderate	Low
Medium	Very high	High	Moderate	Low	Very low
Low	High	Moderate	Low	Very low	Very low

Example Box 12 demonstrates how the risk profile for public health effects in Blockhouse Bay is arrived at. **Example Box 13** demonstrates how the risk profile for ecological effects in Blockhouse Bay is determined.

Example Box 12: Assessing the Risk of Public Health Effects in the Blockhouse Bay RE

Overflows 609 and 622 were each assessed as generating potentially **moderate** public health effects.

When considering that the overflows discharge in the low frequency range, this results in a **low** risk of public health effects, as highlighted below.

Overflow Frequency Range	Effects Score				
	5 Very High	4 High	3 Moderate	2 Low	1 Very Low
High	Very high	Very high	High	Moderate	Low
Medium	Very high	High	Moderate	Low	Very low
Low	High	Moderate	Low	Very low	Very low

Example Box 13: Assessing the Risk of Ecological Effects in the Blockhouse Bay RE

Overflow 609 and 622 were each assessed as generating potentially **low to very low** ecological effects.

When considering that the overflow discharges in the low frequency range, this results in a **very low** risk of ecological effects, as highlighted below.

Overflow Frequency Range	Potential for Effect				
	5 Very High	**4 High**	**3 Moderate**	**2 Low**	**1 Very Low**
High	Very high	Very high	High	Moderate	Low
Medium	Very high	High	Moderate	Low	Very low
Low	High	Moderate	Low	Very low	Very low

8 ASSESSMENT OF THE RISK OF CUMULATIVE EFFECTS (STEP 7)

As is the case for assessing the risk of effects from individual overflows, overflow frequency is also essential to determine the risk of cumulative effects. Assessing the risk of cumulative effects is based on the same approach as assessing the risk of individual public health and ecological effects, but with an additional Effects Score of 0, as shown in Table 5.4. The reason for introducing the additional Effects Score is because cumulative effects can clearly be ruled out when:

- There is only one overflow to a receiving environment, and that overflow discharges at a frequency where pathogens would not normally persist in the receiving environment.
- The overflows are sufficiently spatially separated.
- The potential cumulative effect will not exceed the effect of the individual overflows.

Table 5.4: Risk Profile for Potential Cumulative Effects

Overflow Frequency Range	Effects Score					
	5 Very High	4 High	3 Moderate	2 Low	1 Very Low	0 Not Expected
High	Very high	Very high	High	Moderate	Low	Very low
Medium	Very high	High	Moderate	Low	Very low	Very low
Low	High	Moderate	Low	Very low	Very low	Very low

Further, in contrast to assessing effects, where the overflow with the highest volume is usually the dominant factor for determining the potential cumulative effect, the key driver for determining the risk of cumulative effects is the overflow with the lowest frequency, as shown in Table 4.4:

- In Example 1, all overflows are of low frequency and only occur once per year. The risk of a cumulative effect is therefore generally low, unless the effects are high or very high.
- In Example 2, there are two overflows of low frequency that occur twice per year, and one overflow that occurs every month. In this case, a spatial cumulative effect can only take place a maximum of twice per year, i.e. the risk of a spatial cumulative effect is driven by the lowest frequency overflow (as above). The potential for a temporal cumulative effect would have been addressed in the effects assessment and does not contribute to the risk profile.
- In Example 3, there is a mixed range of overflows and the risk of cumulative effects consequently ranges from low (determined by the lowest frequency) to moderate, because the medium frequency overflow could discharge up to five times per year, which results in five occasions where overflow volumes could be elevated and increase effects.
- In Example 4, all overflows discharge at a high frequency range, and the resulting risk of cumulative effects is generally high, unless the cumulative effect is assessed as low. However, in such a situation, temporal cumulative effects are likely and would have been noted in the effects assessment.

In summary, there are three basic scenarios that need to be considered:

(1) Two or more low frequency overflows. This generally results in a low risk of cumulative effects because the discharge events do not occur more than twice per year at the most.
(2) Mixed frequency overflows (two or more overflows occurring at different overflow frequencies). This may result in a low or moderate (or both) risk profile, depending on the mix of frequencies.
(3) Two or more high frequency overflows. This scenario generally results in a high risk of cumulative effects occurring.

Example Box 14 outlines how the risk of cumulative overflows is described.

Example Box 14: Assessing the Risk of Cumulative Effects in the Whau River Estuary

There are 23 direct and five indirect overflows discharging to the Whau River Estuary. With the exception of two of the indirect overflows, all discharge in the low frequency range. The risk of cumulative effects is generally determined by the lowest frequency range. For discharges to the Whau River estuary, the most common frequency range is 'Low', and the risk of cumulative effects is consequently deemed to be low.

Table 4.4: Possible Scenarios for Risk of Cumulative Effects

	Overflow Frequency Range	Month												Risk
		1	2	3	4	5	6	7	8	9	10	11	12	
EXAMPLE 1 (3 OF Points)	**Low**					✓								**Low**
	Low					✓								
	Low					✓								
EXAMPLE 2 (3 OF Points)	**Low**				✓								✓	**Low**
	Low				✓								✓	
	High	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
EXAMPLE 3 (4 OF Points)	**Low**				✓								✓	**Low to Moderate**
	Low				✓								✓	
	Medium			✓	✓	✓						✓	✓	
	High	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
EXAMPLE 4 (3 OF Points)	**High**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	**High**
	High	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	High	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

9 ASSESSMENT OF POTENTIAL CULTURAL EFFECTS (STEP 8)

Unlike the assessment of public health and ecological effects, a cultural effects assessment does not take account of the contaminant load or concentration of the discharge, but is solely assessed on the basis of overflow volume and RE Class.

Although it is acknowledged that even low volumes of wastewater in any natural water body are considered to have some cultural effects, the cultural effects assessment does distinguish between low, medium and high volume overflows so that a comparative basis for prioritising improvement works can be established.

The cultural effects assessment follows the principles established for the assessment of public health and ecological effects. It adopts a four-point scale (Very High, High, Moderate and Low), similar to the scores used for assessing public health and ecological effects. However, the lowest score (very low) is omitted because even low volumes of wastewater in any natural body are considered to have some cultural effects.

The assessment process requires the following information:

1. The RE classification for cultural value (Very important – Class 1 or Important – Class 2);
2. The overflow volume range; and
3. The overflow frequency range.

A low effect only occurs in Class 2 REs that receive low volume discharges. The potential effect increases to moderate in Class 1 REs that receive low volume overflows, to clearly establish the difference in the importance of these environments. The scale then increases in a linear fashion, identifying high volume discharges to Class 1 cultural environments as having very high effects. The cultural effects scale is shown in Table 5.5.

Table 5.5: Cultural Effects Scale

Overflow Volume Range	Cultural RE Class	
	Very Important (1)	Important (2)
High	Very High	High
Medium	High	Moderate
Low	Moderate	Low

Example Box 15 shows the cultural effects assessment for the Blockhouse Bay RE.

Example Box 15: Assessing the Potential Cultural Effects in the Blockhouse Bay RE

Blockhouse Bay is described as a Very Important (Class 1) cultural RE. Each of the direct overflows discharges at a **low volume.** Cultural effects are therefore assessed as moderate.

10 ASSESSMENT OF THE RISK OF CULTURAL EFFECTS (STEP 9)

Once the potential effect of each overflow is assessed, the next step is to address risk. The assessment of risk is directly linked to overflow frequency, and is therefore independent of the class of receiving environment (meaning that if the frequency of the discharge is low, then the risk of the effect occurring is low whether it happens in an important or very important cultural environment. The risk profiles are shown in Table 5.6.

Table 5.6: Risk Profile for Potential Cultural Effects

Overflow Frequency Range	Cultural Effect			
	Very High	**High**	**Moderate**	**Low**
High	High	High	High	High
Medium	Moderate	Moderate	Moderate	Moderate
Low	Low	Low	Low	Low

Example Box 16 demonstrates how the risk of cultural effects is assessed for the Blockhouse Bay RE.

Example Box 16: Assessing the Risk of Cultural Effects in the Blockhouse Bay RE

The overflows to Blockhouse Bay occur with a low frequency. Therefore, the risk is assessed as being low.

11 ASSESSMENT OF POTENTIAL AESTHETIC EFFECTS (STEP 10)

The assessment of effects on aesthetic values relates to the loss of aesthetic enjoyment because of clearly visible and identifiable residue from wastewater overflows (visual effects), and readily detectable smell of wastewater (odour effects). Visual and odour effects are primarily experienced by people, and therefore these effects are directly related to public access.

For example, where the location of an overflow is directly accessible to the public or is adjacent to a residential area, there is potential for aesthetic effects to occur. Overflow locations where public access is restricted, or where the site is a significant distance from residential dwellings, are unlikely to result in aesthetic effects. Consequently, the assessment of aesthetic effects is limited to two outcomes – High or Low, as shown in Table 5.7.

Table 5.7: Aesthetic Effects Scale

Overflow Volume Range	Aesthetic RE Class	
	High Value	Low Value
High	High	Low
Medium	High	Low
Low	High	Low

Example Box 17 shows the cultural effects assessment for the Blockhouse Bay RE.

Example Box 17: Assessing the Potential Aesthetic Effects in the Blockhouse Bay RE

Blockhouse Bay is described as having **High** aesthetic value. Low volume discharges to such an environment have a **high** potential effect on these values.

12 ASSESSMENT OF THE RISK OF AESTHETIC EFFECTS (STEP 11)

Once the potential effect of each overflow is assessed, the next step is to address risk. The assessment of risk is directly linked to overflow frequency, and is therefore independent of the class of receiving environment. The risk profile for aesthetic is outlined in Table 5.8.

Table 5.8: Risk Profile for Potential Aesthetic Effects

Overflow Frequency Range	Aesthetic Effect	
	High	**Low**
High	High	Low
Medium	Moderate	Low
Low	Low	Low

Example Box 18 demonstrates how the risk of aesthetic effects is assessed for the Blockhouse Bay RE.

Example Box 18: Assessing the Risk of Aesthetic Effects in the Blockhouse Bay RE

Blockhouse Bay has been identified as having **High** aesthetic value. Because the overflows occur with a low frequency, the risk is assessed as being low.

13 SUMMARY (STEP 12)

Although the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows to Aquatic REs* is based on specific, repeatable steps and uses relatively basic and generally available information, an explanatory narrative is required for the following steps:

- **Description of the Receiving Environment.** This section provides the justification and references for assigning the RE Type and value class for all four value categories. It is important to identify the information used for categorising receiving environments so that in future revisions undertaken as part of the Wastewater Network Strategy process, the validity of the information can be confirmed or updated accordingly.
- **Assessment of Potential Ecological Effects.** The assessment of ecological effects is based on pre-determined text and requires no additional explanation. However, some judgement is required to determine the overall ecological effects, where the effects scores are not the same for each individual effect described.
- **Assessment of Potential Cumulative Effects.** Where cumulative effects are deemed to occur, explanatory comment will be necessary. Specifically, the assessment of cumulative effects requires some judgement and interpretation by the assessor to ensure that these effects (and the associated risk) are not over (or under) rated. The narrative should describe the specific factors that were considered to identify potential cumulative effects, to ensure that these can be confirmed or updated in later revisions.
- **Summary.** The summary of the Assessment of Effects is provided in two ways:
  - in the form of a brief narrative summary at the end of each RE assessment that focuses on the most significant effects (if any) occurring in the RE, and
  - a summary table at the end of each catchment report (listing the RE name, whether it is a direct or indirect RE, the RE Type and value classification, overflow characteristics and whether the potential effects and risks range from very high to very low).

  Both methods serve as a quick reference for identifying the most important effects, both at the RE level and for the catchment as a whole, and enable the ongoing prioritisation of wastewater network improvement works over time.

PART 2

Assessment of Effects
of
Wet Weather Wastewater Overflows
on
Terrestrial Receiving Environments

1 INTRODUCTION

Wastewater network design generally seeks to avoid the direct discharge of untreated wastewater to land. If such discharges occur, they are usually the result of uncontrolled (Type 3) overflows from manholes (in the public system) or gully traps (in private drainage). In some rare cases, an engineered overflow structure associated with a pump station may potentially discharge to land, where no suitable alternative is available. This is only the case for small pump stations, which are unlikely to overflow. Watercare has management procedures in place that minimise adverse effects if overflows to land do occur, by implementing procedures that seek to first contain the overflow and second to carry out clean-up procedures as rapidly as possible. In the case of pump stations, alarms are used to provide warning of a potential overflow and initiate the relevant procedures.

2 ASSESSMENT OF POTENTIAL EFFECTS

The assessment of effects of wastewater overflows to land is based on the same principles used for assessing effects on aquatic receiving environments, meaning that the process considers both the potential effects (consequence) and the likelihood of wastewater overflows (frequency) to provide an overall evaluation of risk. However, the potential effects of wastewater overflows to land are generally limited to public health and aesthetic effects, for the following reasons:

(1) Where the soil is relatively impermeable or already water-logged, the wastewater may "pond" and present a source of unsightly (if unscreened) solid matter and associated odour. Depending on the in-pipe dilution provided by stormwater, the wastewater may have a high concentration of pathogens and therefore be a risk to public health if people come into contact with it.

(2) After the liquid component of the overflow has soaked into the ground, potentially pathogen-contaminated residue may remain for some time before the pathogens are destroyed through natural process, particularly under the influence of sunlight.

Ecological effects are considered to be unlikely as terrestrial ecological communities are not as sensitive to pathogens and other contaminants (such as suspended solids) as aquatic communities.

As is the case for aquatic receiving environments, the location of the wastewater overflow influences the scale of the effect. There are two "types" of terrestrial receiving environments – public land and private land. However, for public health and/or aesthetic effects to occur, the presence of people who could be affected is necessary (similar to the occurrence of aesthetic effects in aquatic receiving environments). Therefore, the determining factor for whether a public health effect and/or an aesthetic effect resulting from overflows to land is high, medium or low is access to the overflow location. Accessibility may be good, limited or - for practical purposes – non-existing, regardless of whether the overflow location is on public or private land. Accessibility depends on topographical and other site-specific features. For the purpose of this assessment methodology, accessibility is categorised as follows:

- Good accessibility – the overflow point is on public land and any person regardless of age or physical ability can access the location of the overflow.
- Limited accessibility – the overflow location is on private land and access is therefore restricted, or where it is on public land, access is difficult and would require some level of physical fitness or mobility, for example to climb a fence or descend into a low-lying area.

- No access – regardless of whether the overflow point is on public or private land, the overflow location is remote or barred by dense vegetation, at the bottom of a steep cliff or blocked by a similar obstruction. Access would require considerable and determined effort.

Table 2.1 shows how the scale of potential public health effects of wastewater overflows to land are determined, following a simplified approach based on the assessment of effects on aquatic receiving environments. The assessment is conservative, and based on the assumption that even in difficult-to-access locations public health effects need to be considered, because of the presence of untreated wastewater. Table 2.2 presents a similar scale for aesthetic effects.

Table 2.1: Public Health Effects Scale for Wastewater Overflows to Land

Overflow Volume Range	Accessibility		
	Good	**Limited**	**None**
High	High	Medium	Low
Medium	High	Medium	Low
Low	High	Medium	Low

Table 2.2: Aesthetic Effects Scale for Wastewater Overflows to Land

Overflow Volume Range	Accessibility		
	Good	**Limited**	**None**
High	High	Low	Low
Medium	High	Low	Low
Low	High	Low	Low

3 ASSESSMENT OF THE RISK OF POTENTIAL EFFECTS

The assessment of risk is linked to overflow frequency (likelihood) as well as the potential effects (consequence) of the overflow. Based on the aquatic receiving environment methodology, the risk profile for potential public health and/or aesthetic effects is shown in Tables 3.1 and 3.2 respectively.

Table 3.1: Risk Profile for Potential Public Health Effects

Overflow Frequency Range	Public Health Effects Score		
	High	**Medium**	**Low**
High	High	High	Moderate
Medium	High	Moderate	Low
Low	Moderate	Low	Low

Table 3.2: Risk Profile for Potential Aesthetic Effects

Overflow Frequency Range	Aesthetic Effects Score	
	High	**Low**
High	High	Moderate
Medium	Moderate	Low
Low	Low	Low

As noted above, Watercare is alerted to overflows to land by telemetry alarms where an engineered overflow point is known to potentially discharge to land. This allows for appropriate risk mitigation measures to be implemented to avoid the overflows. The risk of potential public health and/or aesthetic effects is therefore further reduced. Where Type 3 overflows are reported, the response procedures set out in the *Wastewater Overflow Regional Response Manual* are carried out.

4 PRESENTATION OF RESULTS

The results of assessing the potential effects and risk of overflows to land should be presented as a narrative. Where there is more than one such overflow in a catchment, a summary table may also be required.

Example Box 1 provides an assessment for a Type 1 overflow point, and **Example Box 2** shows an assessment for a Type 3 overflow point.

Example Box 1: Assessing Potential Effects and Risk of a Type 1 Overflow to Land

Overflows to Public Land

There is one small pump station that potentially discharges directly to public land via an overflow structure:

- Overflow 630 (Penrose Road pump station)

There is no record of the pump station actually discharging, although for the purpose of this assessment the overflow has been categorised as low volume and low frequency.

Accessibility to the overflow location is good as it is in a public reserve.

Based on the overflow characteristics noted above, the potential public health effects are assessed as high. The potential aesthetic effects are assessed as high.

Because the overflows discharge at a low frequency, the risk of public health effects is moderate, and the risk of aesthetic effects is low.

Ecological effects are considered to be unlikely as terrestrial ecological communities are not as sensitive to pathogens and other contaminants (such as suspended solids) as aquatic ecological communities.

The potential effects of wastewater overflows to land are managed through appropriate prevention and clean-up procedures, as set out in the Wastewater Overflow Regional Response Manual.

The overflow point is associated with small pump stations that are monitored so that Operations staff receive warning of a possible imminent overflow and can initiate the relevant management procedures. Containment of the overflow is always the primary response. Where this is not possible, clean-up and disinfection of the affected area is undertaken as soon as possible.

Example Box 2: Assessing Potential Effects and Risk of a Type 3 Overflow to Land

Overflow 1410 at 11 Crown Crescent, Otara

This overflow discharges from a manhole at the back of a private property. Overflows have been reported 12 times between 1 January 2007 and May 2013 (average of 2 per year – low frequency) and are in the low volume range.

Accessibility to this overflow location is limited, as the overflow location is on private land.

Based on the overflow characteristics noted above, the potential public health effects are assessed as moderate. The potential aesthetic effects are assessed as low.

Because the overflows discharge at a low frequency, the risk of public health effects is low. The risk of aesthetic effects is also low.

Ecological effects are considered to be unlikely as terrestrial ecological communities are not as sensitive to pathogens and other contaminants (such as suspended solids) as aquatic ecological communities.

The potential effects of wastewater overflows to land are managed through appropriate prevention and clean-up procedures, as set out in the Wastewater Overflow Regional Response Manual.

This uncontrolled overflow will be removed as a result of the planned Otara branch sewer upgrades.

The summary table outlining the effects and risks of overflows to land is provided in Table 4.1.

Table 4.1: Summary of receiving environments, overflow characteristics, potential effects and associated risk of overflows to land

OF ID	Name	Type	Volume Range	Frequency Range	Receiving Environment	Potential Public Health Effect	Potential Aesthetic Effect	Potential Public Health Risk	Potential Aesthetic Risk	Comment
630	Penrose Rd PS	1	Low	Low	Public Land	High	High	Moderate	Low	Does not discharge.
1410	11 Crown Crescent	3	Low	Low	Private Property	Moderate	Low	Low	Low	Will be removed as result of Otara branch sewer upgrades.

APPENDIX 1: EFFECTS TABLES FOR PUBLIC HEALTH EFFECTS

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to small waterways with Class 1 recreational values are assessed as having a **very high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 5 (very high), because watercress can be a hydraulic trap for particulate contaminants.	Medium volume discharges to small waterways with Class 1 recreational values are assessed as having a **very high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 5 (very high), because watercress can be a hydraulic trap for particulate contaminants.	High volume discharges to small waterways with Class 1 recreational values are assessed as having a **very high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 5 (very high), because watercress can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to small waterways with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 4 (high), because watercress can be a hydraulic trap for particulate contaminants.	Medium volume discharges to small waterways with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 4 (high), because watercress can be a hydraulic trap for particulate contaminants.	High volume discharges to small waterways with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 4 (high), because watercress can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.	Medium volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.	High volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to large waterways with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities, because large waterways are generally able to absorb low volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 3 (moderate), because watercress can be a hydraulic trap for particulate contaminants.	Medium volume discharges to large waterways with Class 1 recreational values are assessed as having a **very high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 5 (very high), because watercress can be a hydraulic trap for particulate contaminants.	High volume discharges to large waterways with Class 1 recreational values are assessed as having a **very high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 5 (very high), because watercress can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to large waterways with Class 2 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting), because large waterways are generally able to absorb low volume overflows.	Medium volume discharges to large waterways with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. The available dilution is of less relevance for medium volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 4 (high), because watercress can be a hydraulic trap for particulate contaminants.	High volume discharges to large waterways with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. The available dilution is of less relevance for high volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress has an Effects Score of 4 (high), because watercress can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to large waterways with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.	Medium volume discharges to large waterways with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.	High volume discharges to large waterways with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to estuaries with Class 1 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because estuaries provide some dilution and/or flushing and are generally able to absorb low volume overflows.	Medium volume discharges to estuaries with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities. The available dilution is of less relevance for medium volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because watercress or seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to estuaries with Class 1 recreational values are assessed as having a **high potential effect** on all recreational activities. The available dilution is of less relevance for high volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to estuaries with Class 2 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because estuaries provide some dilution and/or flushing and are generally able to absorb low volume overflows.	Medium volume discharges to estuaries with Class 2 recreational values are assessed as having a **moderate potential effect** on all recreational activities. The available dilution is of less relevance for medium volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because watercress or seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to estuaries with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities. The available dilution is of less relevance for high volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to estuaries with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because estuaries provide some dilution and/or flushing, and because the value categorisation indicates that these activities are unlikely to occur.	Medium volume discharges to estuaries with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.	High volume discharges to estuaries with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to basins or lakes with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because watercress or seaweed can be a hydraulic trap for particulate contaminants.	Medium volume discharges to basins or lakes with Class 1 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to basins or lakes with Class 1 recreational values are assessed as having **high to very high potential effects,** as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to basins or lakes with Class 2 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because watercress or seaweed can be a hydraulic trap for particulate contaminants.	Medium volume discharges to basins or lakes with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to basins or lakes with Class 2 recreational values are assessed as having **high to very high potential effects,** as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 5 (very high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 5 (very high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to basins or lakes with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.	Medium volume discharges to basins or lakes with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or watercress or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.	High volume discharges to basins or lakes with Class 3 recreational values are assessed as having **low to moderate potential effects,** as shown below. While the value categorisation indicates that these activities are unlikely to occur, the potential build-up of contaminants in shellfish and sediments is somewhat more likely for high volume discharges because of the lack of flushing. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 2 (low). (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate). (3) Loss of suitability for fishing has an Effects Score of 3 (moderate). (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 2 (low).

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to beaches with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.	Medium volume discharges to beaches with Class 1 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting seaweed has an Effects Score of 4 (high), because seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to beaches with Class 1 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. **(**1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting seaweed has an Effects Score of 4 (high), because seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to beaches with Class 2 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.	Medium volume discharges to beaches with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting seaweed has an Effects Score of 4 (high), because seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to beaches with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting seaweed has an Effects Score of 4 (high), because seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to beaches with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because beaches provide dilution and flushing, and the value categorisation indicates that these activities are unlikely to occur.	Medium volume discharges to beaches with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.	High volume discharges to beaches with Class 3 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to harbours with Class 1 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because harbours provide dilution and flushing and are generally able to absorb low volume overflows.	Medium volume discharges to harbours with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities. The available dilution is of less relevance for medium volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to harbours with Class 1 recreational values are assessed as having **moderate to high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to harbours with Class 2 recreational values are assessed as having a **low potential effect (Effects Score of 2)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because harbours provide dilution and flushing and are generally able to absorb low volume overflows.	Medium volume discharges to harbours with Class 2 recreational values are assessed as having a **moderate potential effect** on all recreational activities. The available dilution is of less relevance for medium volume overflows. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.	High volume discharges to harbours with Class 2 recreational values are assessed as having **moderate to high potential effect** on all recreational activities, as shown below. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded. (2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments. (3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded. (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.

PUBLIC HEALTH EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to harbours with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because harbours provide dilution and flushing and are generally able to absorb low volume overflows, and because the value categorisation indicates that these activities are unlikely to occur.	Medium volume discharges to harbours with Class 3 recreational values are assessed as having a **very low potential effect (Effects Score of 1)** on all recreational activities (contact or partial contact recreation, shellfish collecting, fishing and/or seaweed collecting), because the value categorisation indicates that these activities are unlikely to occur.	High volume discharges to harbours with Class 3 recreational values are assessed as having **very low to low potential effects** on all recreational activities, as shown below, because the value categorisation indicates that these activities are unlikely to occur. (1) Loss of suitability for contact or partial contact recreation has an Effects Score of 1 (very low). (2) Loss of suitability for collecting shellfish has an Effects Score of 2 (low). (3) Loss of suitability for fishing has an Effects Score of 2 (low). (4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 1 (very low).

APPENDIX 2: EFFECTS TABLES FOR ECOLOGICAL EFFECTS

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to small waterways with Class 1 ecological values are assessed as having **predominantly very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 5 (very high) because of the extent of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 5 (very high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants). (3) Change in community structure/loss of sensitive species has an Effects Score of 5 (very high), because changes in physico-chemical habitat are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	Medium volume discharges to small waterways with Class 1 ecological values are assessed as having **predominantly very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 5 (very high) because of the extent of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 5 (very high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants). (3) Change in community structure/loss of sensitive species has an Effects Score of 5 (very high), because changes in physico-chemical habitat are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	High volume discharges to small waterways with Class 1 ecological values are assessed as having **predominantly very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 5 (very high) because of the extent of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 5 (very high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants). (3) Change in community structure/loss of sensitive species has an Effects Score of 5 (very high), because changes in physico-chemical habitat are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
(7) Reduced quantities of fin fish has an Effects Score of 5 (very high), because changes in physio-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 4 (high), because BOD enrichment is likely to stimulate the growth of these organisms.	(7) Reduced quantities of fin fish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 5 (very high), because BOD enrichment is likely to stimulate the growth of these organisms.	(7) Reduced quantities of fin fish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 5 (very high), because BOD enrichment is likely to stimulate the growth of these organisms.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to small waterways with Class 2 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because of the extent of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants). (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	Medium volume discharges to small waterways with Class 2 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below. **(**1) Change in physical habitat suitability has an Effects Score of 4 (high), because of the extent of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants). (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	High volume discharges to small waterways with Class 2 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because of the extent of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants). (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.	(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 4 (high), because BOD enrichment is likely to stimulate the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.	(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 4 (high), because BOD enrichment is likely to stimulate the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to small waterways with Class 3 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	Medium discharges to small waterways with Class 3 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	High discharges to small waterways with Class 3 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Small Waterways	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because BOD enrichment is unlikely to add to the potential for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because BOD enrichment is unlikely to add to the potential for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to large waterways with Class 1 ecological values are assessed as having **low to moderate potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because toxicant concentrations may increase up to 10-fold above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration. (5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	Medium volume discharges to large waterways with Class 1 ecological values are assessed as having a range from **low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because toxicant concentrations may increase up to 10-fold above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	High volume discharges to large waterways with Class 1 ecological values are assessed as having a range from **low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because toxicant concentrations may increase up to 10-fold above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
(7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (10) Loss of suitability for livestock watering has an Effects Score of 3 (moderate), because there may be elevated levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 3 (moderate), because there may be elevated levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be moderate.	(7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be moderate, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be moderate, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to large waterways with Class 2 ecological values are assessed as having **very low to moderate potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the general lack of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because toxicant concentrations are likely to be only moderately elevated above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat are unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	Medium volume discharges to large waterways with Class 2 ecological values are assessed as having **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because toxicant concentrations are likely to be only moderately elevated above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat are unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	High volume discharges to large waterways with Class 2 ecological values are assessed as having **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because toxicant concentrations are likely to be only moderately elevated above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat are unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low) because of the lack of changes in physico-chemical habitat suitability. (10) Loss of suitability for livestock watering has an Effects Score of 3 (moderate), because there may be elevated levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 3 (moderate), because there may be elevated levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low, as the moderate (3) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to large waterways with Class 3 ecological values are assessed as having **very low to moderate potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the general lack of physical and chemical changes resulting from a wastewater overflow and the high degree of background disturbance in these streams. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	Medium volume discharges to large waterways with Class 3 ecological values are assessed as having **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the general lack of physical and chemical changes resulting from a wastewater overflow and the high degree of background disturbance in these streams. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.	High volume discharges to large waterways with Class 3 ecological values are assessed as having **very low to very high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the general lack of physical and chemical changes resulting from a wastewater overflow and the high degree of background disturbance in these streams. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Large Waterways	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
(7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (10) Loss of suitability for livestock watering has an Effects Score of 3 (moderate), because there may be elevated levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 3 (moderate), because there may be elevated levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be very low, as the moderate (3) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because BOD enrichment is unlikely to add to the potential for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be very low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.	(7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams. (10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because BOD enrichment is unlikely to add to the potential for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be very low, as the very high (5) Effects Score relates to agricultural use rather than effects on ecological processes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to estuaries with Class 1 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	Medium volume discharges to estuaries with Class 1 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a medium volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.	High volume discharges to estuaries with Class 1 ecological values are assessed as having **a range of low to high potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 2 (low), because of the lack of elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 3 (moderate), because there may be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 4 (high), because there are likely to be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to estuaries with Class 2 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability are unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	Medium volume discharges to estuaries with Class 2 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a medium volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.	High volume discharges to estuaries with Class 2 ecological values are assessed as having **a range of low to high potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. **(**1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 2 (low), because of the lack of elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 3 (moderate), because there may be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 4 (high), because there are likely to be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to estuaries with Class 3 ecological values are assessed as having **very low potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	Medium volume discharges to estuaries with Class 3 ecological values are assessed as having **very low potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	High volume discharges to estuaries with Class 3 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH4, sulphide, metals, nitrate has an Effects Score of 2 (low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Estuaries (Tidal Creeks)	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 1 (very low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 1 (very low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 2 (low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to basins or lakes with Class 1 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.	Medium volume discharges to basins or lakes with Class 1 ecological values are assessed as having **predominantly high potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. **(**1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.	High volume discharges to basins or lakes with Class 1 ecological values are assessed as having a range of **moderate to very high potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. **(**1) Change in physical habitat suitability has an Effects Score of 5 (very high), because physical and chemical changes resulting from a wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH4, sulphide, metals, nitrate has an Effects Score of 5 (very high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and lack of elevated water temperature. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate phytoplankton growth. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 5 (very high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate phytoplankton growth. (7) Reduced quantities of fin fish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 4 (high), because BOD enrichment is likely to stimulate the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be very high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to basins or lakes with Class 2 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.	Medium volume discharges to basins or lakes with Class 2 ecological values are assessed as having **predominantly high potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high),because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.	High volume discharges to basins or lakes with Class 2 ecological values are assessed as having a range of **moderate to very high potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. (1) Change in physical habitat suitability has an Effects Score of 5 (very high), because physical and chemical changes resulting from a wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 5 (very high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score 5 (very high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and lack of elevated water temperature. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate phytoplankton growth. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because there changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 5 (very high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate phytoplankton growth. (7) Reduced quantities of fin fish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 4 (high), because BOD enrichment is likely to stimulate the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be very high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to basins or lakes with Class 3 ecological values are assessed as having **predominantly very low potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. However, the value categorisation indicates that ecological function is already compromised. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance	Medium volume discharges to basins or lakes with Class 3 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. However, the value categorisation indicates that ecological function is already compromised. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance	High volume discharges to basins or lakes with Class 3 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours. However, the value categorisation indicates that ecological function is already compromised. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a wastewater overflow, despite the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species, despite the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Basins and Lakes	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the high degree of background disturbance. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 2 (low), because of the high degree of background disturbance. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate phytoplankton growth. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because BOD enrichment is unlikely to add opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth, despite the high degree of background disturbance. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate phytoplankton growth. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability, despite the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability, despite the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because BOD enrichment is unlikely to add opportunity for the growth of these organisms.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to beaches with Class 1 ecological values are assessed as having **very low to low potential effects** on ecological values, as shown below. Beaches are likely to have high dilution rates, and are generally able to absorb low volume overflows. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability are unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	Medium volume discharges to beaches with Class 1 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a medium volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes..	High volume discharges to beaches with Class 1 ecological values are assessed as having **predominantly high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability.	(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.	(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to beaches with Class 2 ecological values are assessed as having **very low to low potential effects** on ecological values, as shown below. Beaches are likely to have high dilution rates, and are generally able to absorb low volume overflows. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	Medium volume discharges to beaches with Class 2 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a medium volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	High volume discharges to beaches with Class 2 ecological values are assessed as having **predominantly high potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability.	(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.	(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to beaches with Class 3 ecological values are assessed as having **very low potential effects** on ecological values, as shown below. Beaches are likely to have high dilution rates, and are generally able to absorb low volume overflows. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	Medium volume discharges to beaches with Class 3 ecological values are assessed as having **very low potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	High volume discharges to beaches with Class 3 ecological values are assessed as having **very low to low potential effects** on ecological values, as shown below. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Beaches	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
Low volume discharges to harbours with Class 1 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	Medium volume discharges to harbours with Class 1 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a medium volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	High volume discharges to harbours with Class 1 ecological values are assessed as having **a range of low to high potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	1	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 2 (low), because of the lack of elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 3 (moderate), because there may be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 4 (high), because there are likely to be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
Low volume discharges to harbours with Class 2 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability are unlikely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	Medium volume discharges to harbours with Class 2 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a medium volume wastewater overflow. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.	High volume discharges to harbours with Class 2 ecological values are assessed as having **a range of low to high potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species. (4) Behavioural changes in fin fish has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	2	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 2 (low), because of the lack of elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 3 (moderate), because there may be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 4 (high), because there are likely to be elevated pathogen concentrations. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms. In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
Low volume discharges to harbours with Class 3 ecological values are assessed as having **very low potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	Medium volume discharges to harbours with Class 3 ecological values are assessed as having **very low potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 1 (very low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 1 (very low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 1 (very low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.	High volume discharges to harbours with Class 3 ecological values are assessed as having **predominantly low potential effects** on ecological values, as shown below. Harbours provide some dilution and/or flushing. (1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance. (2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because nutrient concentrations and toxicants are unlikely to increase above background levels. (3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance. (4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance.

ECOLOGICAL EFFECTS		
Receiving Environment Type:	Harbours	
Receiving Environment Class:	3	
Overflow Volume		
Low	Medium	High
(5) Increase in nuisance plants has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 1 (very low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score 1 (very low), because of the high degree of background disturbance. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 1 (very low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.	(5) Increase in nuisance plants has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations are unlikely to increase above background levels. (6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels. (7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance. (8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance. (9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 2 (low), because of the high degree of background disturbance. (12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.

APPENDIX 3: TEMPLATE FOR PRESENTING THE ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

PREFACE

The following text is an excerpt from Volume 2.18 (Whau River – Assessment of Effects on the Environment) of the application for the Auckland Wastewater Network Comprehensive Discharge Permit, lodged in August 2013.

It is intended to provide guidance for the completion of an Assessment of Effects on the Environment that may be required during the development of Watercare's Wastewater Network Strategy, or where a re-assessment of one or more overflow points or catchment(s) is necessary.

1 THE WHAU RIVER CATCHMENT ENVIRONMENT

The Whau River catchment covers an area of approximately 25 km² in the western part of the Auckland Isthmus. Map 1 in Appendix 2 illustrates the catchment and identifies existing overflow locations. The Whau River catchment boundary reflects a combination of the topographic and wastewater network catchment boundaries.

The catchment includes all or part of the suburbs Te Atatu South, Glendene, Kelston, North Titirangi, Green Bay, Glen Eden, New Lynn, Blockhouse Bay and Avondale. It takes in the catchments of a number of streams, including the Rewarewa Creek, Whau Creek and Avondale Stream, along with smaller tributaries including Taroa Stream, Scroggy Stream and Manawa Stream. The coastal receiving environments that lie adjacent to the Whau catchment include the Whau River estuary, the Waterview Inlet and the wider Waitemata Harbour. A small part of the catchment discharges to Blockhouse Bay and the wider Manukau Harbour receiving environment.

The Whau has a long history of commercial and industrial development. Current land use in the catchment is predominantly residential, with substantial pockets of light industrial and commercial development in the Rosebank, Avondale, New Lynn and Glendene areas.

The catchment is known to have important Maori cultural values and sites of cultural significance have been identified in close proximity to coastal receiving environments. The Waitahurangi Stream drains into Te Whau River which was the northern most waka portage for the Manukau Harbour. Comings and goings on the Manukau and the portage itself would be monitored by those who lived at Te Whau Pa and village near Blockhouse Bay Reserve, the remains of which are visible within the eroding headland above the boat club. There are numerous archaeological sites on the Avondale Peninsula that have survived early market gardening and industry. The Motu Manawa wetlands are of significance to Maori.

2 THE WASTEWATER NETWORK

2.1 Overview

The wastewater network servicing the Auckland Isthmus, including the Whau River catchment, comprises a system of large trunk interceptor sewers and branch sewers for bulk wastewater conveyance (the transmission network), and a system of smaller local sewers for service connections to Watercare's customers (the local network). The Auckland Isthmus area is serviced by the Mangere Wastewater Treatment Plant.

Auckland's western catchments gravity flow, via the Swanson, Whenuapai and Glen Eden Branch sewers, to the Western pump station (DPFLN), where flows are then pumped into the Western Interceptor (DSWIN). From there, wastewater gravity flows to the St. Georges pump station (DPWIN) at Miranda Reserve in Blockhouse Bay, and then is transmitted via the Hillsborough Tunnel and Manukau Siphon to the Mangere WWTP.

The Western Interceptor is the main large trunk interceptor which operates within the Whau River catchment. It was constructed in the late 1950s in conjunction with the Manukau WWTP. The main sewer as constructed is approximately 22 km long.

Key network issues within the catchment include effects associated with a high water table which puts the reticulation in Rosebank under pressure. No inflow and infiltration (I&I) works have currently been implemented in this area and the stormwater has to be pumped. An extensive I&I programme was undertaken in the New Lynn area approximately five years ago, which has led to the elimination of a large number of Type 3 overflows.

2.2 Engineered Wastewater Overflow Locations

There are 38 engineered overflow points in the Whau River Catchment. Of these, 31 are Type 1 overflows associated with pump stations. The remaining seven are Type 2 overflows from engineered network relief points. Thirty overflow points discharge to the coastal environment, with the remainder discharging to freshwater environments. A description of the overflow points and their associated receiving environments is provided in Table 3.1 below. Generally, monitored frequency data of <1 relates to equipment (float) testing and does not represent actual overflow information.

A list of the overflow points in this catchment is also provided in Appendix 1.

Nine of the Type 1 overflows have been sealed, and overflows no longer discharge from these points. The Type 1 sealed overflows have been included in this assessment as these may be utilised again in the future.

Modelled overflow volume and frequency information (where available) was sourced from the Watercare Overflow Database. For the overflows that have no associated modelling data, information was sourced from SCADA records. Where neither modelling data nor SCADA data were available, the overflow frequency and volume data was assumed to be low.

2.3 Trade Waste

There are currently eight trade waste permits for discharges to the network in the Whau River catchment, as indicated in Map 8 in Appendix 2. Three of these are located on the eastern side of the catchment in the Avondale/Rosebank business area, two being in close proximity to the Whau Creek. One of these permits authorises potentially elevated BOD concentrations, and seven potentially elevated toxic substances. Where the trade waste sites have the potential to affect specific overflow locations, this has been addressed in the relevant sections of Chapter 4.

As noted in Chapter 3.5.1.5 in Volume 1, trade waste is managed through a trade waste bylaw and associated permitting process that prohibits some substances from entering the wastewater system, and minimises the inflow of other specified contaminants.

Table 3.1: Engineered Wastewater Overflow Locations

Overflow ID	Discharge Location and Details	Facility Code	Type	Annual OF Volume (m^3)		Annual OF Frequency		Source of Information	Direct RE	Indirect RE
				No	Range	No	Range			
10	La Rosa St, Green Bay		2	0	Low	0	Low	Frequency - Waitakere System Performance and Options Report (2009) - Existing system	Avondale Stream	Whau Creek
17	Covil pump station, Bridge Ave Reserve, Te Atatu South. Sealed.	DPCOV	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
18	Wairata pump station, Tiroroa Esplanade Reserve, Te Atatu South. Sealed.	DPWRT	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
19	Bedford St pump station, Te Atatu South. Sealed.	DPBED	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
20	McLeod pump station, Riverglade Parkway, Te Atatu South. Sealed..	DPMLD	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
21	Bancroft Cres pump station, Glendene. Sealed.	DPBNC	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
22	Harmel Rd pump station, Glendene: Sealed.	DPHRM	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
23	Archibald Rd pump station, Kelston. Sealed.	DPARC	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
24	Queen Mary Ave No. 1 pump station, Kelston. Sealed.	DPQM1	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour

Overflow ID	Discharge Location and Details	Facility Code	Type	Annual OF Volume (m^3)		Annual OF Frequency		Source of Information	Direct RE	Indirect RE
				No	Range	No	Range			
34	Hugh Brown Dr pump station, New Lynn. Sealed.	DPHUG	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Rewarewa Creek	Whau River Estuary
38	Sceptre Place pump station, Avondale.	DPSTR	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
41	Riversdale Rd pump station, Avondale	DPRVD	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
42	Lidcombe Place pump station, Avondale	DPLID	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Waterview Embayment	Waitemata Harbour
44	Ash St pump station, Avondale	DPASH	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
607	Rosebank Rd No .1 pump station, Avondale	DPRB1	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Waterview Embayment	Waitemata Harbour
609	Endeavour St pump station, Blockhouse Bay	DPEND	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Blockhouse Bay	Manukau Harbour
617	Holly St No .1 pump station, Avondale	DPHS1	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Waterview Embayment	Waitemata Harbour
618	Holly St No. 2 pump station, Avondale	DPHS2	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Waterview Embayment	Waitemata Harbour
621	Kenley Place pump station, Avondale	DPKEY	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
622	Lewis St pump station, Blockhouse Bay	DPLEW	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Blockhouse Bay	Manukau Harbour

Overflow ID	Discharge Location and Details	Facility Code	Type	Annual OF Volume (m^3)		Annual OF Frequency		Source of Information	Direct RE	Indirect RE
				No	Range	No	Range			
625	Mead St pump station, Avondale	DPMED	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
629	Patiki Rd pump station, Avondale	DPPKI	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
634	Rosebank Rd No. 2 pump station, Avondale	DPRB2	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Waterview Embayment	Waitemata Harbour
644	Timothy Place pump station, Avondale	DPTIM	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
656	Esmeralda Ave pump station, Avondale	DPESM	1	499	Low	1	Low	Volume and Frequency - ICS - TSM Modelling (2005) - Existing System	Whau River Estuary	Waitemata Harbour
695	St George pump station, Arran St, Avondale (Transmission System)	DPWIN MH25	1	11493	High	3.4	Med	Volume and Frequency - Project Storm 2 - Stage 4 - System Performance Report (2008)	Whau Creek	Whau River Estuary
752	Rose Bank siphon, Saunders Place, Avondale (Transmission System)	DSRSB	2	211	Low	0.5	Low	Volume and Frequency - Project Storm 2 - Stage 4 - System Performance Report (2008	Whau River Estuary	Waitemata Harbour
756	Titirangi Branch MH4,Olympic Park, Clark St, New Lynn (Transmission System)	DSTIT MH4	2	-	Low	-	Low	No information available	Avondale Stream	Whau Creek
757	New Lynn Branch MH3,Great North Rd, New Lynn (Transmission System)	DSNWL MH3	2	-	Low	-	Low	No information available	Rewarewa Creek	Whau River Estuary

Overflow ID	Discharge Location and Details	Facility Code	Type	Annual OF Volume (m^3)		Annual OF Frequency		Source of Information	Direct RE	Indirect RE
				No	Range	No	Range			
1202	Tirimoana Road pump station	DPTIR	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
1211	Glen Marine Parade pump station	DPGMP	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
1212	Aronui Terrace Wastewater pump station	DPARO	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
1213	Queen Mary Ave No. 2 pump station, New Lynn	DPQM2	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
1214	Kuaka Place pump station, New Lynn	DPKUA	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Rewarewa Creek	Whau River Estuary
1224	Archibald Park pump station	DPARP	1	-	Low	0	Low	Frequency – Watercare records (SCADA data Jan 07 - Dec 11)	Whau River Estuary	Waitemata Harbour
1279	Gardner Rd, New Lynn		2	4944	Med	12	Med	Volume and Frequency - Monitored by AWT (July 2012)	Rewarewa Creek via stormwater pipe	Whau River Estuary
1281	Seabrook Ave, New Lynn		2	-	Low	-	Low	No information available	Manawa Stream via stormwater pipe	Rewarewa Creek
1284	Fruitvale Rd, New Lynn		2	-	Low	-	Low	No information available	Scroggy Stream	Rewarewa Creek

3 ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

This section describes the values of freshwater and coastal receiving environments that lie within and adjacent to the Whau River catchment, assesses the potential effects from overflows, and determines the associated environmental risks. Maps provided in Appendix 2 present known recreational, ecological and cultural values in areas related to the overflows. This assessment is based on the following documents and existing GIS data sourced through Auckland Council and Watercare:

- Watercare (2012). Network Discharges Assessment of Environmental Effects: Central Interceptor Catchment; and
- Environmental Condition and Values of Mangere Inlet, Whau Estuary and Tamaki Estuary. Prepared by Coast and Catchment Ltd for Auckland Regional Council. ARC Technical Report 2008/031.

The assessment is undertaken in accordance with the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* (Watercare, 2013).

The 38 overflow points discharge to the following 10 receiving environments:

1. Blockhouse Bay (direct Overflows 609 and 622);
2. Scroggy Stream (direct Overflow 1284);
3. Manawa Stream (direct Overflow 1281);
4. Rewarewa Creek (direct Overflows 34, 757, 1214 and 1279; indirect Overflows 1281 and 1284);
5. Avondale Stream (direct Overflows 10 and 756);
6. Whau Creek (direct Overflow 695, indirect Overflows 10 and 756);
7. Whau River Estuary (direct Overflows 17, 18, 19, 20, 21, 22, 23, 24, 38, 41, 44, 621, 625, 629, 644, 656, 752, 1202, 1211, 1212, 1213 and 1224, indirect Overflows 34, 695, 757, 1214 and 1279);
8. Waterview Embayment (Overflows 42, 607, 617, 618 and 634); and
9. Waitemata Harbour (indirect Overflows 17, 18, 19, 20, 21, 22, 23, 24, 38, 41, 42, 44, 607, 617, 618, 621, 625, 629, 634, 644, 656, 752, 1202, 1211, 1212, 1213 and 1224);
10. Manukau Harbour (indirect Overflows 609 and 322).

Indirect receiving environments include the Waitemata and Manukau Harbours (see 9 and 10 above). The cumulative effects from indirect discharges to these harbours are addressed in Chapter 5 in Volume 1 of this application.

3.1 Blockhouse Bay

3.1.1 Description of the Receiving Environment

Blockhouse Bay receives potential discharges from Overflows 609 (Endeavour Street pump station) and 622 (Lewis Street pump station).

Blockhouse Bay is located on the northern coastline of the Manukau Harbour, between Green Bay and Lynfield Cove. There are a series of bays in this area which are separated by cliffs and headlands and backed almost entirely by reserves.

Blockhouse Bay beach is mostly a coarse sand beach with shell in the upper intertidal zone. This changes abruptly to muddy sand flats in the lower intertidal zone. Exposed sandstones occur across the bay.

Pied shags roost in the trees along this coast, and the inshore sand flats and, particularly, the offshore mud flats are important feeding areas for birds. Blockhouse Bay is located in a

General Management Area and is identified as a Regionally Significant Landscape and an Area of Significant Conservation Value (ASCV 7) in the Coastal Plan.

Blockhouse Bay is a popular shellfish gathering site. Species commonly collected include cockles, crab, pipis, Pacific oysters and whelks. Scallops are occasionally found along this section of the coast, but they are more plentiful further to the west. Fishing is a popular activity both from off the shore and from boats in the channel immediately off the coast. Blockhouse Bay is identified as a Safeswim site which highlights its popularity for contact recreation (Metrowater AEE, 2001).

The bay is accessible from Blockhouse Bay Beach Reserve, an open space area at the western end of the bay. The area is largely residential. The aesthetic value of Blockhouse Bay is therefore identified to be high.

Four midden sites were identified along the western end of Blockhouse Bay beach (NZAA site IDs: R11/442, R11/443, R11/1510, R11/1923, R11/2547). The eastern headland is also identified as a pa site (R11/102). Ngai Tai Ki Tamaki have assessed the stream as having Very Important cultural values (Class 1).

On the basis of the discussion above, the receiving environment values have been categorised as outlined in Table 4.1.

Table 4.1: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Blockhouse Bay	Beach	Class 1	Class 2	Very Important (Class 1)	High Value (Class 1)

3.1.2 Assessment of Potential Effects and Associated Risk

Overflows 609 and 622 are both low volume and frequency discharges to Blockhouse Bay.

Table 4.2: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
609, 622	Direct	499	Low	1	Low	Operative	ICS-TSM Modelling (2005)

The potential effects of discharges of this nature on the identified environmental values are discussed below.

3.1.2.1 Potential Public Health Effects

Low volume discharges to beaches with Class 1 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below.

(1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded.

(2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments.

(3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded.

(4) Loss of suitability for harvesting seaweed has an Effects Score of 3 (moderate), because seaweed can be a hydraulic trap for particulate contaminants.

3.1.2.2 Potential Ecological Effects

Low volume discharges to beaches with Class 2 ecological values are assessed as having **very low to low potential effects** on ecological values, as shown below. Beaches are likely to have high dilution rates, and are generally able to absorb low volume overflows.

(1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the general lack of physical and chemical changes resulting from a low volume wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and toxicants are unlikely to increase above background levels.

(3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because the limited extent of changes in physico-chemical habitat suitability is unlikely to generate behavioural changes.

(6) More frequent phytoplankton blooms in the water column has an Effects Score of 1 (very low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels.

(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability.

(8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the lack of changes in physico-chemical habitat suitability.

3.1.2.3 Potential Cumulative Effects

The two overflows are of a low volume and frequency, discharging at opposite sides of Blockhouse Bay. Therefore, cumulative effects are not expected.

3.1.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.3. The assessed risk at this location ranges from very low to low.

Table 4.3: Risk Profile for Potential Public Health and Ecological Effects

Direct/Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Low	609, 622	Very low	Low

3.1.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.1.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value.

The overflow discharges are of low volume and cultural effects are assessed as moderate.

Because the overflows occur with low frequency, the risk is assessed as being low.

3.1.2.7 Potential Aesthetic Effects and Associated Risk

Blockhouse Bay has been identified as having high aesthetic value.

Low volume discharges to such an environment have a high potential effect on these values.

Because the overflows occur with low frequency, the risk is assessed as being low.

3.1.2.8 Summary

The potential effects of wastewater overflows to this receiving environment range from low (ecological effects) to moderate (public health and cultural effects) and high (aesthetic effects). The risk of public health effects is very low and the risk of ecological, cultural and aesthetic effects is low.

3.2 Scroggy Stream

3.2.1 Description of the Receiving Environment

Scroggy Stream receives one potential discharge from Overflow 1284, a network overflow on Fruitvale Road, New Lynn.

This stream is a small channel within New Lynn catchment and drains predominantly urbanised areas. It has little base flow and is dominated by runoff from hard standing areas (Waitakere City Council, 2010). The stream is piped in sections and the open channel is highly modified, running into Manawa Wetland Reserve before joining with Rewarewa Creek and discharging into Whau River Estuary. Manawa Wetland is identified as a restoration area in the Auckland Council District Plan: Waitakere Section. The stream is not recognised as having any particular ecological significance.

Restoration projects have occurred along the banks of the stream, the work largely undertaken by the Seabrook Sustainable Neighbourhood Group and the Scroggy Stream Sustainable Neighbourhood Group. This highlights the value of the streams to the local community. However, recreation within the stream has not been identified and is considered unlikely. The stream is bordered by areas of residential and public open space, highlighting the high aesthetic value.

No cultural heritage sites have been identified in the vicinity of this stream environment. Ngai Tai Ki Tamaki has assessed the stream as having Important cultural values (Class 2).

Based on the available information, the receiving environment values have been categorised as outlined in Table 4.7.

Table 4.7: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Scroggy Stream	Small Waterway	Class 3	Class 2	Important (Class 2)	High Value (Class 1)

3.2.2 Assessment of Potential Effects and Associated Risk

Overflow 1284 is a low frequency, low volume discharge. Watercare Operations have confirmed that Overflow 1284 no longer discharges due to the inflow and infiltration rehabilitation works that were undertaken in 2008. It has been included here as it may discharge in the future. There are no other overflows to Scroggy Stream.

Table 4.8: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
1284	Direct	-	Low	-	Low	Operational	No information available

The potential effects of a discharge of this nature on the identified environmental values are discussed below.

3.2.2.1 Potential Public Health Effects

Low volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect** (Effects Score of 2) on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

3.2.2.2 Potential Ecological Effects

Low volume discharges to small waterways with Class 2 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below.

(1) Change in physical habitat suitability has an Effects Score of 4 (high), because of the extent of physical and chemical changes resulting from a wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants).

(3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat are likely to affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 2 (low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration.

(5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.

In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

3.2.2.3 Potential Cumulative Effects

There is only one overflow to the Scroggy Stream and it discharges with low volume. Therefore, cumulative effects are not expected.

3.2.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.9. The assessed risk ranges from very low to moderate.

Table 4.9: Risk Profile for Potential Public Health and Ecological Effects

Direct/ Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Low	1284	Very low	Moderate

3.2.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.2.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Scroggy Stream has been assessed as having Important cultural values (Class 2).

The overflow is of low volume and cultural effects are assessed as low.

Low frequency discharges have low risk.

3.2.2.7 Potential Aesthetic Effects and Associated Risk

Scroggy Stream has been identified as having high aesthetic value.

Low volume discharges to such an environment have a high potential effect on these values.

Because the overflow occurs with low frequency, the risk is assessed as low.

3.2.2.8 Summary

The potential effects of wastewater overflows to this receiving environment range from low (public health and cultural effects) to high (ecological and aesthetic effects). The risk of public health effects is very low, the risk of cultural and aesthetic effects is low and the risk of ecological effects is moderate. Overflow 1284 no longer discharges due to the inflow and infiltration rehabilitation works that were undertaken in 2008.

3.3 Manawa Stream

3.3.1 Description of the Receiving Environment

Manawa Stream receives one potential discharge, from Overflow 1281, which is a network overflow on Seabrook Avenue in New Lynn. The South Lynn Trunk upgrade project to increase capacity in the New Lynn area will eliminate discharges from Overflow 1281 into Manawa Stream (refer to Chapter 5 below).

This stream is a small channel within New Lynn catchment and drains predominantly urbanised areas. The stream has little base flow and is dominated by runoff from hard standing areas (Waitakere City Council, 2010).

The stream is piped in sections and the open channel is highly modified, running into Manawa Wetland Reserve before joining with Rewarewa Creek and discharging into Whau River Estuary. Manawa Wetland is identified as a restoration area in the Auckland Council District Plan: Waitakere Section. The stream is not recognised as having any particular ecological significance.

Restoration projects have occurred along the banks of the stream, the work largely undertaken by the Seabrook Sustainable Neighbourhood Group and the Scroggy Stream Sustainable Neighbourhood Group. This highlights the value of the streams to the local community. However, recreation within the stream is unlikely to occur. The stream is

bordered by areas of residential and public open space and aesthetic values are considered to be high.

No cultural heritage sites have been identified in the vicinity of this stream environment. Ngai Tai Ki Tamaki have assessed the stream as having Important cultural values (Class 2).

On the basis of the discussion above, the receiving environment values have been categorised as outlined in Table 4.10.

Table 4.10: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Manawa Stream	Small waterway	Class 3	Class 2	Important (Class 2)	High Value (Class 1)

3.3.2 Assessment of Potential Effects and Associated Risk

Overflow 1281 is a low volume discharge of low frequency that discharges to Manawa Stream.

Table 4.11: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
1281	Direct	-	Low	-	Low	Operational	No information

The potential effects of a discharge of this nature on the identified environmental values are discussed below.

3.3.2.1 Potential Public Health Effects

Low volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect** (Effects Score of 2) on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

3.3.2.2 Potential Ecological Effects

Low volume discharges to small waterways with Class 2 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below.

(1) Change in physical habitat suitability has an Effects Score of 4 (high), because of the extent of physical and chemical changes resulting from a wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants).

(3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat are likely to affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 2 (low), because changes in physico-chemical habitat suitability are likely to be of relatively short duration.

(5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.

In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

3.3.2.3 Potential Cumulative Effects

Overflow 1281 is the only discharge to this receiving environment and it discharges at low frequency. Therefore cumulative effects are not expected.

3.3.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.12. The assessed risk at this location ranges from very low to moderate.

Table 4.12: Risk Profile for Potential Public Health and Ecological Effects

Direct/Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Low	1281	Very low	Moderate

3.3.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.3.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Manawa Stream has been assessed as having Important cultural values (Class 2).

The overflow discharge is of low volume and cultural effects are assessed as low.

The risk is assessed as being low.

3.3.2.7 Potential Aesthetic Effects and Associated Risk

Manawa Stream has been identified as having high aesthetic value.

Low volume discharges to such an environment have a high potential effect on these values.

Because the overflow occurs with low frequency, the risk is assessed as being low.

3.3.2.8 Summary

The potential effects of wastewater overflows to this receiving environment range from low (public health and cultural effects) to high (ecological and aesthetic effects). The risk of public health effects is very low, the risk of cultural and aesthetic effects is low and the risk of ecological effects is moderate. The planned improvement works will further reduce these potential effects by preventing discharges from Overflow 1281 into Manawa Stream.

3.4 Rewarewa Creek

3.4.1 Description of the Receiving Environment

Rewarewa Creek receives potential direct discharges from four overflows and indirect discharges from two overflows.

Rewarewa Creek is one of the tidal creeks feeding into Whau River Estuary. The stream flows through New Lynn town centre, having passed under Great North Road and the railway line from Manawa Wetland. Rewarewa Creek links a number of reserves and is flanked by a walkway for much of its length. The lower end of Rewarewa Creek, in the location of the overflows, is largely mangrove-lined and therefore public access is likely to be limited and contact recreation is unlikely in the creek.

Parts of Rewarewa Creek have strong habitat values for waterfowl, such as pukeko, kingfisher and mallard duck. The New Lynn Reserves Management Plan (2004) identified that 30% of the Rewarewa catchment was piped and less than 20% of waterways had riparian vegetation cover. The freshwater fishery of Rewarewa Creek was surveyed in 1998, prior to the construction of the Manawa Wetland. The survey concluded that macro-invertebrate diversity and abundances were very low, indicative of poor water quality and or habitat degradation. The Manawa Wetland restoration project is likely to have improved water quality of Rewarewa Stream since this time.

No sites of significant cultural value were identified along Rewarewa Creek. Ngai Tai Ki Tamaki have assessed the creek as having Very Important cultural values (Class 1).

The stream passes adjacent to a number of open space and residential areas so is considered to have high aesthetic value.

On the basis of the discussion above, the receiving environment values have been categorised as outlined in Table 4.13.

Table 4.13: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Rewarewa Creek	Small Waterway	Class 3	Class 2	Very Important (Class 1)	High Value (Class 1)

3.4.2 Assessment of Potential Effects and Associated Risk

Overflows 34 and 1214 are sealed pump stations and no longer discharge and Overflow 757 is assessed as a low volume, low frequency discharge. Overflow 1279 is a medium volume and frequency discharge.

Overflows 1281 and 1284 are indirect discharges of low volume and low frequency.

Table 4.14: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
34	Direct	-	Low	0	Low	Operational	No information
757	Direct	-	Low	-	Low	Operational	No information
1214	Direct	-	Low	0	Low	Operational	Watercare records (SCADA data Jan 07 - Dec 11)
1279	Direct	4,944	Medium	12	Medium	Operational	Monitored by AWT (July 2012)

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
1281	Indirect	-	Low	-	Low	Operational	No information
1284	Indirect	-	Low	-	Low	Operational	No information available

The potential effects of discharges of this nature on the identified environmental values are discussed below. Where there is a range of discharge volumes, a conservative approach has been taken and the highest volume discharge (medium) has been assessed. As most of the discharges are of low volume, the effects of these would be lower.

3.4.2.1 Potential Public Health Effects

Medium volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect** (Effects Score of 2) on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

3.4.2.2 Potential Ecological Effects

Medium volume discharges to small waterways with Class 2 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below.

(1) Change in physical habitat suitability has an Effects Score of 4 (high), because of the extent of physical and chemical changes resulting from a wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants).

(3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat are likely to affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

(5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 4 (high), because BOD enrichment is likely to stimulate the growth of these organisms.

In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

3.4.2.3 Potential Cumulative Effects

Overflow 1279 discharges a considerable distance from the other overflow points and is likely to be significantly diluted by the time the discharge reaches the next closest discharge point. Overflow 34 is sealed and Overflow 757 is a low volume discharge. These two overflows are located approximately 250m apart. All other discharges are separated by significant distances. Overflows 1281 and 1284 are indirect discharges and will likely be significantly diluted by the time they reach Rewarewa Creek.

Due to the spatial separation and low volumes of the discharges, cumulative effects are considered to be unlikely.

3.4.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.15. The assessed risk ranges from very low to high.

Table 4.15: Risk Profile for Potential Public Health and Ecological Effects

Direct/Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Medium	1279	Low	High
Direct	Low	34,757, 1214	Very low	Moderate
Indirect	Low	1281, 1284	Very low	Moderate

3.4.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.4.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Rewarewa Creek has been assessed as having Very Important cultural values (Class 1).

The largest overflow is of medium volume and cultural effects are assessed as high.

Because one of the discharges is of medium frequency, the risk is assessed as being moderate.

3.4.2.7 Potential Aesthetic Effects and Associated Risk

Rewarewa Creek has been identified as having high aesthetic value.

Medium volume discharges to such an environment have a high potential effect on these values.

Because the largest overflow occurs with medium frequency, the risk is assessed as being moderate.

3.4.2.8 Summary

The potential effects of wastewater overflows to this receiving environment range from low (public health effects) to high (ecological, cultural and aesthetic effects). The risk of public health effects is low, the risk of cultural and aesthetic effects is moderate and the risk of ecological effects is high. This is due to the potentially high ecological effects, as risk is a function of likelihood (frequency) and consequence (effect). Two of the direct overflow points have been sealed and are unlikely to discharge.

3.5 Avondale Stream

3.5.1 Description of the Receiving Environment

Avondale Stream potentially receives direct discharges from Overflows 10 and 756, both of which are network overflows.

Avondale Stream is approximately 5.6 km long. The main headwater is found at Crum Park, Green Bay. Here the stream is forced underground, piped through Crum Park and through residential land before surfacing at La Rosa Gardens, Green Bay (Gardner, Varaine and Atkinson, 1999). The stream flows largely through residential and open space land before reaching Great North Road Bridge. At this point, the stream becomes estuarine.

Where the stream flows through reserve areas, the stream bed is largely shaded. Vegetation cover on the stream banks varies from less than 25% to 80%. Large sections of the stream are modified with concrete-lined culverts and reinforced channels are present. The lower end of the stream, closer to the Whau River entrance, is largely unmodified with a natural stream meander pattern (Gardner, Varaine and Atkinson, 1999). The stream is not noted to have any particular ecological value.

Recreational activity in the stream is unknown and is highly unlikely, given the modified nature of the environment. The stream runs adjacent to residential properties and open space areas. As such, the aesthetic value of the stream is considered to be high.

There are no known cultural sites in the vicinity of the overflow points. Ngai Tai Ki Tamaki have assessed the stream as having Very Important cultural values (Class 1).

On the basis of the discussion above, the receiving environment values have been categorised as outlined in Table 4.16.

Table 4.16: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Avondale Stream	Small Waterway	Class 3	Class 3	Very Important (Class 1)	High Value (Class 1)

3.5.2 Assessment of Potential Effects and Associated Risk

Overflows 10 and 756 are both of low volume and frequency.

Table 4.17: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
10	Direct	0	Low	0	Low	Operational	Waitakere System Performance and Options Report (2009)
756	Direct	-	Low	-	Low	Operational	No information available

The potential effects of discharges of this nature on the identified environmental values are discussed below.

3.5.2.1 Potential Public Health Effects

Low volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect** (Effects Score of 2) on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

3.5.2.2 Potential Ecological Effects

Low volume discharges to small waterways with Class 3 ecological values are assessed as having a range of **very low to very high potential effects** on ecological values, as shown below.

(1) Change in physical habitat suitability has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams.

(3) Change in community structure/loss of sensitive species has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams.

(4) Behavioural changes in fin fish has an Effects Score of 1 (very low), because of the high degree of background disturbance in these streams.

(5) Increase in nuisance plants has an Effects Score of 1 (very low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

(7) Reduced quantities of fin fish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams.

(8) Reduced quantities of shellfish has an Effects Score of 2 (low), because of the high degree of background disturbance in these streams.

(10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 1 (very low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.

In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be low.

3.5.2.3 Potential Cumulative Effects

Both overflows are low in volume and are located several kilometres apart. Therefore, cumulative effects are unlikely.

3.5.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.18. The assessed risk at this location is very low.

Table 4.18: Risk Profile for Potential Public Health and Ecological Effects

Direct/Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Low	10, 756	Very low	Very low

3.5.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.5.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Avondale Stream has been assessed as having Very Important cultural values (Class 1).

The overflows discharge with low volume and cultural effects are assessed as being moderate.

Because the overflows occur with low frequency, the risk is assessed as being low.

3.5.2.7 Potential Aesthetic Effects and Associated Risk

Avondale Stream has been identified as having high aesthetic value.

Low volume discharges to such an environment have a high potential effect on these values.

Because the overflows occur with low frequency, the risk is assessed as being low.

3.5.2.8 Trade Waste Effects

Overflow 756 receives potential trade wastes from one premise with a trade waste permit for elevated BOD. This overflow point is categorised as a low volume, low frequency overflow.

Potential public health and ecological effects for this overflow point are assessed as low. The potential additional contaminant load contributed by the trade waste discharges above the discharge point could elevate the potential public health and ecological effects to the next Effects Score (moderate).

However, the discharge is of low frequency. The risk of effects at this location is low.

3.5.2.9 Summary

The potential effects of wastewater overflows to this receiving environment range from low (public health and ecological effects) to moderate (cultural effects) and high (aesthetic effects). The risk of public health and ecological effects is very low and the risk of cultural and aesthetic effects is low.

3.6 Whau Creek

3.6.1 Description of the Receiving Environment

Whau Creek receives one potential direct discharge from Overflow 695 and two indirect discharges from Overflows 10 and 756.

Whau Creek is a tributary of Whau River Estuary. The creek originates south of Mt. Roskill and flows to the west through Blockhouse Bay and then northwest through New Lynn. The Creek meets Avondale Stream at Olympic Park and continues, widening after Great North Road, and merging into Whau River Estuary. The majority of Whau Creek catchment is residential and runs through both residential and open space zoning. The stream channel is modified and piped in places.

The banks of Whau Creek are largely vegetated, with mangroves becoming more common further downstream as the water becomes more saline.

The stream is not accessible at the location of Overflow 695 due to the presence of mangroves. Due to the modified nature of the creek and limited accessibility, the recreational values of the stream were identified to be low as contact recreation and food gathering are unlikely.

Downstream of the railway bridge and Olympic Park, the creek is noted as being part of the Whau River Coastal Protection Area (CPA 2 No. 54). The river is described in the Coastal Plan as follows:

"The Whau River contains substantial quantities of saline vegetation. There are around 40 hectares of mangroves with the taller trees growing in the lower intertidal areas and mangroves of smaller stature growing in the firmer high intertidal regions. These in turn grade into a fringe of saltmarsh lining the coast. The saline vegetation is an important habitat for threatened secretive coastal fringe birds particularly where it abuts terrestrial vegetation which provides roosts for the birds at high tide and potential nesting sites".

There are no known cultural sites in the vicinity of this overflow point. Ngai Tai Ki Tamaki have assessed the stream as having Very Important cultural values (Class 1).

Based on the available information, the receiving environment values have been categorised as outlined in Table 4.19.

Table 4.19: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Whau Creek	Small Waterway	Class 3	Class 1	Very Important (Class 1)	High Value (Class 1)

3.6.2 Assessment of Potential Effects and Associated Risk

Overflow 695 is the only direct overflow to Whau Creek. This is a high volume, medium frequency discharge. Overflows 10 and 756 are indirect discharges of low volume and frequency.

Table 4.20: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
695	Direct	11,493	High	3.4	Medium	Operational	Project Storm 2-Stage 4-Stystem Performance Report (2008)
10	Indirect	0	Low	0	Low	Operational	Waitakere System Performance and Options Report (2009)
756	Indirect	-	Low	-	Low	Operational	No information available

Where there is a range of discharge volumes, a conservative approach has been taken and the highest volume discharge has been assessed (in this case high volume).

3.6.2.1 Potential Public Health Effects

High volume discharges to small waterways with Class 3 recreational values are assessed as having a **low potential effect** (Effects Score of 2) on all recreational activities, because the value categorisation indicates that contact or partial contact recreation, shellfish collecting, fishing and/or watercress collecting are unlikely to occur.

3.6.2.2 Potential Ecological Effects

High volume discharges to small waterways with Class 1 ecological values are assessed as having **predominantly very high potential effects** on ecological values, as shown below.

(1) Change in physical habitat suitability has an Effects Score of 5 (very high) because of the extent of physical and chemical changes resulting from a wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 5 (very high), because nutrient concentrations and toxicants are likely to increase above background levels (up to10-fold for nutrients and 2-100-fold for toxicants).

(3) Change in community structure/loss of sensitive species has an Effects Score of 5 (very high), because changes in physico-chemical habitat are likely to affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(5) Increase in nuisance plants has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and other constraints on plant growth.

(7) Reduced quantities of fin fish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely.

(8) Reduced quantities of shellfish has an Effects Score of 5 (very high), because changes in physico-chemical habitat suitability are likely.

(10) Loss of suitability for livestock watering has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(11) Loss of suitability for irrigation use has an Effects Score of 5 (very high), because of the potentially high levels of toxicants, organic solids and BOD in the water column.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 5 (very high), because BOD enrichment is likely to stimulate the growth of these organisms.

3.6.2.3 Potential Cumulative Effects

There is one direct and two indirect discharges to Whau Creek. The indirect discharges are spatially separated by several kilometres and are both of low volume. It is likely that they would be significantly diluted when they enter Whau Creek. The discharge point for the indirect discharges is approximately 200m upstream of the discharge point for Overflow 695. Due to the low volumes of two of the discharges and the spatial separation of the overflows, cumulative effects are not expected.

3.6.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.21. The assessed risk ranges from very low to very high.

Table 4.21: Risk Profile for Potential Public Health and Ecological Effects

Direct/ Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Medium	695	Low	Very high
Indirect	Low	10, 756	Very low	High

3.6.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.6.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Whau Creek has been assessed as having Very Important cultural values (Class 1).

The largest overflow discharge is of high volume and cultural effects are assessed as very high.

Because one of the overflows discharges with medium frequency, the risk is assessed as being moderate.

3.6.2.7 Potential Aesthetic Effects and Associated Risk

Whau Creek has been identified as having high aesthetic value.

Low volume discharges to such an environment have a high potential effect on these values.

Because one of the overflows occurs with medium frequency, the risk is assessed as being moderate.

3.6.2.8 Summary

The potential effects of wastewater overflows to this receiving environment range from low (public health effects) to high (aesthetic effects) and very high (ecological and cultural effects). The risk of public health effects is low, the risk of cultural and aesthetic effects is moderate and the risk of ecological effects is very high.

3.7 Whau River Estuary

3.7.1 Description of the Receiving Environment

The Whau River Estuary is an arm of the south-western Waitemata Harbour. It flows north for approximately 5.5 km from its origin at Whau Creek to its mouth between Te Atatu Peninsula and Rosebank Peninsula in Avondale. The area at the mouth of the estuary is protected and identified as the Motu Manawa (Pollen Island) Marine Reserve (ARC, 2008).

The eastern shore of Whau River estuary is formed by Rosebank Peninsula, which separates the estuary from the Waterview Embayment. Much of the inner estuary consists of a single channel, flanked by mud flats and mangrove forest. The North-Western Motorway crosses the sand and shell banks at the tip of Rosebank Peninsula and passes over the outer Whau Estuary (ARC, 2008).

As noted previously, land use in the catchment is predominantly residential, while the Rosebank peninsula to the east of the Whau Estuary is dominated by commercial and industrial land use. There are also a number of parks bordering the estuary, including Hepburn Park, Archibald Park and Ken Maunder Park as well as public walkways and boat ramps. A Mooring Management Area in the outer estuary contains the capacity for around 300 moorings and an adjacent Special Activity Area, providing for water skiing, is identified in the Coastal Plan.

Based on issues regarding water quality, as well as the tidal and muddy mangrove-lined nature of much of the estuary, the Whau River estuary is considered unlikely to be an area of high recreation use. While some fishing may occur, recreational use is likely to be predominantly associated with boating and kayaking activities, particularly towards the middle and outer reaches of the estuary and around the adjacent reserve areas.

The Whau River Estuary is identified as a Coastal Protection Area 2 (No. 54) and is an area of significant conservation value (ASCV 30). The saline vegetation is an important habitat for threatened coastal fringe birds.

Benthic invertebrates in Whau River Estuary were sampled as part of the Auckland Regional Council's stormwater contaminant monitoring programme. The condition of the benthic community at the entrance to Whau River Estuary was ranked as 'moderately degraded' to 'good'. A gradient of the ecological condition of benthic communities was apparent, with conditions declining up the estuary.

These results are consistent with the Auckland Regional Council Technical Report 2008/031 which notes that the inner Whau is one of the most contaminated coastal waterways in the Auckland region, with particularly high concentrations of zinc in estuarine sediments, and elevated concentrations of copper, lead, mercury and PAH. The most likely cause of contamination is diffuse urban stormwater run-off, although isolated hot spots associated with unauthorised discharges of industrial waste and/or stormwater still occur within the inlet.

In contrast, Technical Report 2008/031 notes that sediment contaminant levels are low and water quality is relatively good in the outer Whau.

The proximity of the Whau's headwaters to the Manukau Harbour meant that the Whau Estuary was an important link between the east and west coast both for Maori and early Europeans. The Whau was also rich in food resources and Maori cultivated food and gathered food resources, such as eels and mullet in the streams and estuaries, and kai moana along the stream banks and harbour coastline. Over the centuries, a number of related hapu or sub tribes lived around the Whau district, including Te Kawerau a Maki and Ngati Whatua.

There are a number of cultural heritage sites identified along the banks of the Whau River, including a number of midden sites. Ngai Tai Ki Tamaki have identified Whau River Estuary as having Very Important cultural values (Class 1).

While Whau River Estuary is adjacent to some industrial areas, it is also flanked by residential and open space properties. Therefore aesthetic values are high.

On the basis of the discussion above, the receiving environment values have been categorised as outlined in Table 4.22.

Table 4.22: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Whau River Estuary	Estuary	Class 2	Class 1	Very Important (Class 1)	High Value (Class 1)

3.7.2 Assessment of Potential Effects and Associated Risk

There are 28 overflows to Whau River Estuary, 22 of which are direct overflows and four of which are indirect overflows.

All direct overflows to this receiving environment are low volume, low frequency overflows. Direct Overflows 17- 24, 1202, 1211 to 1213 and 1224 are noted as being 'sealed' and do not currently overflow. These have been included in the assessment as they are pump station overflows (Type 1) and may be utilised in the future.

Of the indirect overflows, Overflow 695 is a high volume and medium frequency overflow, and OF 1279 is of medium volume and frequency. The remaining three are of low volume and frequency.

Table 4.23: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
17, 18, 19, 20, 21, 22, 23, 24, 1202, 1211, 1212, 1213, 1224	Direct	-	Low	0	Low	Pump station operational but overflow sealed	Watercare records (SCADA data Jan 07 - Dec 11)
38, 41, 44, 621, 625, 629, 644, 656	Direct	499	Low	1	Low	Operational	ICS - TSM Modelling (2005) - Existing System

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
752	Direct	211	Low	0.5	Low	Operational	Volume and Frequency - Project Storm 2 - Stage 4 - System Performance Report (2008
34	Indirect	-	Low	0	Low	Operational	Watercare records (SCADA data Jan 07-Dec 11)
695	Indirect	11,493	High	3.4	Med	Operational	Project storm 2-Stage 4-System performance report
757	Indirect	-	Low	-	Low	Operational	No information
1279	Indirect	4,944	Med	12	Med	Operational	Monitored by AWT (July 2012)

The potential effects of discharges of this nature are outlined below. Where there is a range of discharge volumes, a conservative approach has been taken and the highest volume discharge has been assessed. As most of the discharges are of low volume, the effects of these would be lower.

3.7.2.1 Potential Public Health Effects

High volume discharges to estuaries with Class 2 recreational values are assessed as having a **high potential effect** on all recreational activities. The available dilution is of less relevance for high volume overflows.

(1) Loss of suitability for contact or partial contact recreation has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded.

(2) Loss of suitability for collecting shellfish has an Effects Score of 4 (high), because shellfish have the potential to filter pathogens and metals from water and sediments.

(3) Loss of suitability for fishing has an Effects Score of 4 (high), because microbial pathogen indicator contact recreation guidelines may be significantly exceeded.

(4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 4 (high), because watercress or seaweed can be a hydraulic trap for particulate contaminants.

3.7.2.2 Potential Ecological Effects

High volume discharges to estuaries with Class 1 ecological values are assessed as having **a range of low to high potential effects** on ecological values, as shown below. Estuaries provide some dilution and/or flushing.

(1) Change in physical habitat suitability has an Effects Score of 4 (high), because physical and chemical changes resulting from a high volume wastewater overflow are likely.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 4 (high), because nutrient concentrations and toxicants are likely to increase above background levels.

(3) Change in community structure/loss of sensitive species has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely to affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

(5) Increase in nuisance plants has an Effects Score of 4 (high), because elevated nutrient concentrations are likely to stimulate plant growth.

(6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because the dilution of overflows means that nutrient concentrations and temperature are unlikely to increase above background levels.

(7) Reduced quantities of fin fish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(8) Reduced quantities of shellfish has an Effects Score of 4 (high), because changes in physico-chemical habitat suitability are likely.

(9) Degradation of aquaculture and/or loss of opportunity for aquaculture has an Effects Score of 4 (high), because there are likely to be elevated pathogen concentrations.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 2 (low), because the lack of BOD enrichment provides little opportunity for the growth of these organisms.

In situations where potential ecological effects range across more than one Effects Score, the overall level of effect is determined by the dominant Effects Score, which is then used to generate the risk profile. In this case, the overall ecological effect is considered to be high.

3.7.2.3 Potential Cumulative Effects

For the Whau estuary receiving environment, consideration of cumulative effects was deemed to be appropriate because:

- There are a comparatively large number of overflow points that could potentially discharge (22 direct and four indirect overflows), although these are spatially separated, especially the indirect overflow points.
- Although most overflows are of low volume, two of the indirect overflows are of medium and high volume.

For a spatial cumulative effect to arise, all direct and indirect overflows would need to discharge at the same time. This would result in the total volume of wastewater overflows falling within the high volume range and result in high potential public health and ecological effects. This assessment includes the medium and high volume indirect discharges, which are the dominant contributor to a potential cumulative effect (rather than the various direct discharges which are all low volume). As these indirect discharges have already been assessed in earlier parts of this AEE as having potentially high effects individually, the potential cumulative effect would not be notably different.

In addition, the indirect discharges occur a significant distance from the estuary and are likely to be diluted by the time they reach Whau River Estuary.

3.7.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.24. The assessed risk at this location ranges from very low to high.

Table 4.24: Risk Profile for Potential Public Health and Ecological Effects

Direct Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Low	17, 18, 19, 20, 21, 22, 23, 24, 38, 41, 44, 621, 625, 629, 634, 644, 656, 752, 1202, 1211, 1212, 1213 and 1224	Very low	Very low
Indirect	Medium	695	High	High
Indirect	Medium	1279	Moderate	Moderate

Direct Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Indirect	Low	34, 757, and 1214	Very low	Very low

3.7.2.5 Risk of Cumulative Effects

There are 22 direct and four indirect overflows discharging to the Whau River Estuary. With the exception of two of the indirect overflows, all discharge in the low frequency range. The risk of cumulative effects is generally determined by the lowest frequency range. For discharges to the Whau River Estuary, the most common frequency range is 'Low', and the risk of cumulative effects is consequently deemed to be moderate. This is due to the potentially high public health and ecological cumulative effects, as risk is a function of likelihood (frequency) and consequence (effect).

3.7.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Whau River Estuary is assessed as having Very Important cultural values (Class 1).

The largest overflow discharge is of high volume and cultural effects are assessed as very high.

Because one of the overflows occurs with medium frequency, the risk is assessed as being moderate.

3.7.2.7 Potential Aesthetic Effects and Associated Risk

Whau Creek Estuary has been identified as having high aesthetic value.

High volume discharges to such an environment have a high potential effect on these values.

Because two of the overflows occur with medium frequency, the risk is assessed as being moderate.

3.7.2.8 Trade Waste Effects

Overflows 23, 1212 and 752 receive potential trade wastes from six premises with trade waste permits for elevated toxic substances (each overflow point is downstream of 2 trade waste discharges). All overflow points are categorised as a low volume, low frequency overflows.

Potential public health and ecological effects for these overflow points are assessed as low. The potential additional contaminant load contributed by the trade waste discharges above the discharge point could elevate the potential public health and ecological effects to the next Effects Score (moderate).

However, the discharge is of low frequency. The risk of effects at this location is low.

3.7.2.9 Summary

The potential effects of wastewater overflows to this receiving environment range are high for public health, ecological, and aesthetic values, and very high for cultural values. The risk of public health and ecological effects is high and the risk of cultural and aesthetic effects is moderate. The potential cumulative public health and ecological effects would be in the same range as assessed for individual effects. The risk of cumulative public health and ecological effects is moderate.

3.8 Waterview Embayment

3.8.1 Description of the Receiving Environment

Waterview Embayment receives five potential direct discharges.

Waterview Embayment is a shallow, mainly intertidal basin enclosed by the causeway of the North-Western Motorway, but flushed by the tide through the large culvert under the motorway. Within the inlet, there are areas of firm, shell substrate near the channel, but otherwise much of the substrate is soft mud. Mangrove fringes the shoreline and salt marsh is common.

The area is zoned a Coastal Protection Area 1 (No. 53) and is part of the Motu-Manawa Pollen Island Marine Reserve. The Coastal Plan describes the area as follows:

"This is an area of saltmarsh, mangroves, shellbanks, and estuarine and harbour mud flats. It is the best remaining largely unmodified area of its type in the Waitemata Harbour and is considered to be a nationally important landform. It is also a complex habitat for a variety of animal and plant communities. Pollen and Traherne Islands and the surrounding shellbanks are the major high tide roost on the Waitemata Harbour for thousands of international migratory and New Zealand endemic wading birds as well as a variety of coastal birds. This includes a number of threatened species. They are also an important breeding and flocking area for the threatened New Zealand Dotterel on the Waitemata Harbour. The surrounding intertidal banks and waters are a feeding ground for all of these birds.

The biggest and least disturbed area of saltmarsh remaining in the Waitemata Harbour grows in the shelter of the Island. Here is found an important intergrading of vegetation from intertidal flats up onto shellbank. Mangroves give way to glasswort herbfields which in turn are replaced by rush and sedge saltmarsh which grades into saltmarsh ribbonwood shrubland on Pollen Island itself. The saline vegetation is an important habitat for a variety of threatened secretive coastal fringe birds. The habitat quality is enhanced by the adjoining thick low saltmarsh ribbonwood vegetation on the Island which provides shelter for the birds and offers potential nesting sites. Here is found a valuable population of the regionally threatened fernbird. The majority of this area was protected as the Motu Manawa (Pollen Island) Marine Reserve in late 1995. The Department of Conservation has selected this area as an Area of Significant Conservation Value (ASCV)".

The embayment is very tidal and muddy at low tide. It is also mangrove-lined and largely inaccessible from its western edge due to the presence of industrial activities. For these reasons, fishing and kayaking may occur around mid-high tide periods but it is unlikely that contact recreation frequently occurs. In addition, aesthetic values of the embayment are considered to be low with the exception of the south-western edge of the embayment, where the surrounding land use is residential and reserve (Heron Park).

There are a number of cultural heritage sites located around the western edge of Waterview embayment. These are largely midden features. Overflows 617, 618 and 634 discharge in close proximity to midden sites. Ngai Tai Ki Tamaki have assessed the embayment as having Very Important cultural values (Class 1).

On the basis of the discussion above, the receiving environment values have been categorised in Table 4.25 below.

Table 4.25: Receiving Environment Categorisation

RE Name	Type	Recreation	Ecology	Cultural	Aesthetic
Waterview Embayment	Basin	Class 2	Class 1	Very Important (Class 1)	High Value (Class 1)

3.8.2 Assessment of Potential Effects and Associated Risk

There are five direct overflows to Waterview Embayment, all of which are low volume and frequency.

Table 4.26: Summary of Overflow Characteristics

Overflow ID	Direct/ Indirect	Volume (m^3)	Range	Frequency	Range	Status	Data Source
42, 607, 617, 618, 634	Direct	499	Low	1	Low	Operational	ICS-TSM Modelling (2005)

The potential effects of discharges of this nature on the identified environmental values are discussed below.

3.8.2.1 Potential Public Health Effects

Low volume discharges to basins or lakes with Class 2 recreational values are assessed as having a **moderate potential effect** on all recreational activities, as shown below.

(1) Loss of suitability for contact or partial contact recreation has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded.

(2) Loss of suitability for collecting shellfish has an Effects Score of 3 (moderate), because shellfish have the potential to filter pathogens and metals from water and sediments.

(3) Loss of suitability for fishing has an Effects Score of 3 (moderate), because microbial pathogen indicator contact recreation guidelines may be exceeded.

(4) Loss of suitability for harvesting watercress or seaweed has an Effects Score of 3 (moderate), because watercress or seaweed can be a hydraulic trap for particulate contaminants.

3.8.2.2 Potential Ecological Effects

Low volume discharges to basins or lakes with Class 1 ecological values are assessed as having **predominantly moderate potential effects** on ecological values, as shown below. Although basins or lakes are likely to provide some dilution, the potential for flushing is less than for beaches and harbours.

(1) Change in physical habitat suitability has an Effects Score of 3 (moderate), because there may be physical and chemical changes resulting from a wastewater overflow.

(2) Relatively frequent toxic concentrations of NH_4, sulphide, metals, nitrate has an Effects Score of 3 (moderate), because nutrient concentrations and toxicants may increase above background levels.

(3) Change in community structure/loss of sensitive species has an Effects Score of 3 (moderate), because changes in physico-chemical habitat suitability may affect sensitive species.

(4) Behavioural changes in fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

(5) Increase in nuisance plants has an Effects Score of 3 (moderate), because elevated nutrient concentrations may stimulate plant growth.

(6) More frequent phytoplankton blooms in the water column has an Effects Score of 2 (low), because of the generally short residence time of elevated nutrient concentrations and lack of elevated water temperature.

(7) Reduced quantities of fin fish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

(8) Reduced quantities of shellfish has an Effects Score of 3 (moderate), because there may be changes in physico-chemical habitat suitability.

(12) Growth of sewage fungus/*Beggiatoa* has an Effects Score of 3 (moderate), because BOD enrichment may provide opportunity for the growth of these organisms.

3.8.2.3 Potential Cumulative Effects

All overflows to Waterview Embayment are of low volume and are separated by at least 250m. Therefore, cumulative effects are not expected.

3.8.2.4 Risk of Public Health and Ecological Effects

The risk profile for potential public health and ecological effects is shown in Table 4.27. The assessed risk at this location ranges is low.

Table 4.27: Risk Profile for Potential Public Health and Ecological Effects

Direct/ Indirect	Frequency Range	Overflow ID	Public Health Risk	Ecological Risk
Direct	Low	42, 607, 617, 618, 634	Low	Low

3.8.2.5 Risk of Cumulative Effects

Because cumulative effects are unlikely, the risk of these effects is assessed as being very low.

3.8.2.6 Potential Cultural Effects and Associated Risk

Water is considered by tangata whenua to be a taonga and the essential element of life, therefore all natural water bodies have cultural value. Waterview Embayment has been assessed as having Very Important cultural values (Class 1).

The overflows discharge at low volume and cultural effects are assessed as moderate.

The overflows discharge with low frequency and the risk is assessed as being low.

3.8.2.7 Potential Aesthetic Effects and Associated Risk

Waterview Embayment has been identified as having high aesthetic value.

Low volume discharges to such an environment have a high potential effect on these values.

Because the overflows occur with low frequency, the risk is assessed as being low.

3.8.2.8 Trade Waste Effects

Overflow 634 receives potential trade wastes from one premise with a trade waste permit for elevated toxic substances. This overflow point is categorised as a low volume, low frequency overflows.

Potential public health and ecological effects for this overflow point are assessed as low. The potential additional contaminant load contributed by the trade waste discharges above the discharge point could elevate the potential public health and ecological effects to the next Effects Score (moderate).

However, the discharge is of low frequency. The risk of effects at this location is low.

3.8.2.9 Summary

The potential effects of wastewater overflows to this receiving environment range from moderate (public health, ecological and cultural effects) to high (aesthetic effects). The risk of any of these effects is low.

This receiving environment is categorised as a CPA 1, and consequently has a Class 1 ecological value. The assessment provided in Chapter 4.8.2.2 above concludes that potential effects on the values that have resulted in the area being a CPA 1 are of a moderate nature. However, as the overflows are of low frequency, the risk of these effects is low.

APPENDIX 4: DEFINITIONS

Aesthetic Value	The natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness and aesthetic coherence.
Amenity Value	The natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.
Archaeological Site	An archaeological site is defined by the Historic Places Act 1993 as a place associated with pre-1900 human activity, where there may be evidence relating to the history of New Zealand, and any site that meets this definition is afforded automatic statutory protection under the Act.
Area of Significant Conservation Value	Defined by the Department of Conservation. These areas are noted on the Maps of the Auckland Council Regional Plan: Coastal.
Asset Management Plan	A plan covering an organisation's asset strategy together with other related matters, for example, the organisational structure and governance, roles and responsibilities, data and performance management arrangements and performance measurement information. Asset management plans are required under the LGA 2002 to ensure good asset stewardship and performance.
Auckland	The geographical area defined in section 4(1) of the Local Government (Auckland Council) Act 2009.
Average Recurrence Interval	The average time period between rainfall or flow events that equal or exceed a given magnitude.
Basin	Artificially or naturally enclosed area of a river or harbour, for example Panmure Basin and Lake Pupuke.
Beach	The water body between mean high water springs and another receiving environment.
Best Practicable Option	In relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to— (a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and (b) the financial implications, and the effects on the environment, of that option when compared with other options; and (c) the current state of technical knowledge and the likelihood that the option can be successfully applied. (Resource Management Act 1991)

$cBOD_5$	Carbonaceous biochemical oxygen demand ($cBOD_5$) (measured as 5 day standard test) is a measure of the organic strength or load of wastewater.
cfu/100ml	Colony forming units (of micro-organisms) per 100ml of liquid sample.
Chemical Oxygen Demand	A measure of the amount of oxygen required for the total chemical breakdown of organic substances in water.
Choke	An obstruction in the network caused by foreign matter including but not limited to wastewater solids, debris, paper, grit, gravel, tree roots, and fat; or pipe collapse or disjointing that results in an overflow.
Class 1 Cultural Receiving Environment	A water body where an overflow point is within a radius of 50 metres of the following: (a) Any site of relevance to Maori noted on the Cultural Heritage Index (CHI) such as an archaeological site, a midden or similar (b) Waahi tapu sites (c) Pa sites (d) Urupa (e) Waka landing sites (f) Food gathering areas (g) Battle sites (h) Sites where significant events occurred, for example Treaty of Waitangi signing sites. (i) Any site identified by iwi authorities as being of cultural significance.
Class 1 Ecological Receiving Environment	A water body that is: (a) identified by the Auckland Council Regional Plan: Coastal as a Coastal Protection Area (CPA) for ecological purposes, and/or (b) a Significant Conservation Area for ecology purposes, and/or (c) identified by relevant District Plans and/or the Unitary Plan as having ecological value, and/or (d) characterised as stream reach type 2 or 3 in Auckland urban areas, as defined by TP32 – Framework for Assessment and Management of Urban Streams in the Auckland Region (Auckland Regional Council, 2004).
Class 1 Recreational Receiving Environment	A water body that: (a) a location where contact recreation is known to occur (i.e. located on a known bathing beach or Safeswim site), and/or (b) a known shellfish gathering site, and/or (c) an aquaculture area.
Coastal Protection Area	Coastal Protection Areas are noted on the Maps of the Auckland Council Regional Plan: Coastal.

Combined Sewer Network /Combined Wastewater Network	A wastewater network that intentionally conveys both stormwater and wastewater in the same pipes.
Combined Sewer Overflow	An overflow from a combined sewer/wastewater network
Computer Modelling	The formal simulation of the wastewater network using a mathematical model to predict network performance from a set of parameters and conditions, using a combination of hydrologic (such as MOUSE-ROI) and hydraulic (such as MOUSE) programmes.
Consultation	Engagement in a spirit of good will and open-mindedness to ensure that the consent holder is fully informed of the other parties' concerns and issues when preparing and reviewing the Wastewater Network Strategy.
Contact Recreation	Recreational activities that bring people physically in contact with water, involving a risk of involuntary ingestion or inhalation. (MfE/MoH Water Quality Guidelines)
Contaminant	Includes any substance (including gases, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat – a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or b) When discharged onto or into land or into air, changes or is likely to change. (Resource Management Act 1991)
Discharge Outfall	The point at the end of an enclosed pipe where wastewater flows can enter the environment.
Dry Weather Flow	The flow in the wastewater network that would occur during a normal day in a dry weather period, including wastewater, trade waste and groundwater infiltration. Groundwater is defined as any natural water, including salt water, which has not become mixed with wastewater or trade waste.
Dry Weather Overflow	An overflow that occurs during dry weather flow from any part of the network, usually as a result of blockage, breakage, mechanical or power failure at pump stations or storage facilities, system failure or the lack of hydraulic capacity in the network during periods of dry weather flow.

Effect	Includes: a) Any positive or adverse effect; and b) Any temporary or permanent effect; and c) Any past, present, or future effect; and d) Any cumulative effect which arises over time or in combination with other effects – regardless of the scale, intensity, duration, or frequency of the effect, and also includes e) Any potential effect of high probability; and f) Any potential effect of low probability which has a high potential impact. (Resource Management Act 1991)
Engineered Overflow Point	A location where a discharge from an engineered overflow structure occurs.
Engineered Overflow Structure	A structure in the network that has been specifically designed and constructed to allow for wet weather overflows to occur.
Enterococci	Enterococci bacteria are an indicator for pathogenic micro-organisms, measured as number of n/100ml of water or wastewater sample.
Environment	Includes: a) Ecosystems and their constituent parts, including people and communities; and b) All natural and physical resources; and c) Amenity values; and d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters. (Resource Management Act 1991)
Escherichia coli (E.coli)	A species of bacterium normally present in the intestinal tract of humans and other animals, and which is used as an indicator of faecal contamination.
Estuary	The wide lower course of a river where it flows into the sea. Estuaries are characterised by tidal flows and their water is a changing mixture of fresh and salt.
Exfiltration	The leakage of wastewater from a wastewater network via pipes, pipe joints, manholes and other network structures, but not including planned or unforeseen discharges from pump stations or formal overflow points.

Existing Network	The wastewater network owned and operated by Watercare Services Limited (as the Auckland water organisation) at the time the Auckland Wastewater Network Comprehensive Discharge Permit commences. For avoidance of doubt, any additional or New Engineered Overflow Points become part of the Existing Network after the engineered overflow structure has been built.
Existing Urban Area	• Any area within the metropolitan urban limits, and • Any area included within the urban zones (under an operative district plan) of a rural or coastal settlement. at the time the Auckland Wastewater Network Comprehensive Discharge Permit commences.
Faecal Coliform	Faecal coliform bacteria are an indicator for pathogenic micro-organisms, measured as number or n/100ml of water or wastewater sample.
Future Network	The *Network*, including Engineered Overflow Points and other Network assets, • in currently unserviced areas within any *Existing Urban Area*; or • to be constructed within any *Indicative Future Urban Area* after the area has been given an urban zoning; or • to be constructed within the altered boundaries of any *Indicative Future Urban Area* that is necessary to accord with the *Rural Urban Boundary* in the operative Auckland Unitary Plan or changes to the *Metropolitan Urban Limit* resulting from a plan change process, after the altered area has been given an urban zoning.
Greenfield Catchments	A catchment within which the constructed urban land use area is less than 50% of the total catchment area. A catchment extends from the nominated point of discharge to the receiving water body and includes all of the land draining to that point.
Gross Floatable Solids	Organic and inorganic solid material that is visible to the naked eye, including but not limited to items such as faeces, condoms, tampons, toilet paper, nappies, litter, plastic bottles, and packaging material.
Gully Trap	A gully trap is a basin in the ground which receives piped wastewater from kitchen, bathroom and laundry before it is emptied into the sewer. The basin has a water seal to prevent foul odours of the sewer reaching the surface. The top or surround is raised above ground level to prevent stormwater and other foreign matter entering the sewer.

Harbour	Generally enclosed area of water where ships either historically or currently seek shelter.
High Level Alarm	An alarm automatically reported by telemetry to the network control room, with a water level sensor installed above the highest pump start level within the pump station wet well (nominally at a height of 150mm above the highest pump start).
Indicative Future Urban Area	Any area which is likely to require a future Network that is: • outside the Metropolitan Urban Limit or the urban zones of coastal settlements that is proposed to be given an urban zoning by a Proposed Plan or Plan Change that either - has been notified and is awaiting a decision[7], or - has had a decision[8] released. by the time the Auckland Wastewater Network Comprehensive Discharge Permit commences. • Any area identified in the Draft Auckland Unitary Plan (March 2013) as being intended to be zoned Future Urban Zone within the Rural Urban Boundary.
Indicator Organism	Bacteria (E.Coli, faecal coliforms and enterococci) that are used to indicate the possible presence of pathogens (disease causing microorganisms).
Infiltration	The ingress of groundwater into the wastewater network.
Inflow	The direct flow of stormwater into a wastewater network from sources other than infiltration, such as gully traps, downpipes and manholes.
Infrastructure Growth Charge	A fee for all new developments connecting to Watercare's networks, or to existing non-residential customers that increase demand for water and wastewater.
Lake	A body of fresh water that is entirely or nearly surrounded by land.
Large Waterway	Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Middle-Order (stream order 3 and 4) and High-Order (stream order greater than 4).

[7] As per Clause 10 of the 1st Schedule of the RMA.

[8] As per Clause 10 of the 1st Schedule of the RMA

Legacy Organisations	Pre-integration Watercare and the former Local Network Operators, specifically Rodney District Council (RDC), North Shore City Council (NSCC), Ecowater, a business unit of Waitakere City Council (WCC), Metrowater, a Council Controlled Organisation of Auckland City Council (ACC), Manukau Water, a Council Controlled Organisation of Manukau City Council (MCC), and Franklin District Council (FDC).
Level of Service	In relation to managing a wastewater network, Level of Service defines the acceptable number of dry weather wastewater overflows per km of pipe, and the acceptable number of wet weather wastewater overflows per year.
Local Network	The smaller pipes that convey wastewater from individual properties or housing or commercial developments to the transmission network.
Local Network Operator	Those bodies or companies formerly providing stormwater or wastewater collection and management services within the Auckland Region, being: i. in the district of Rodney District, the Rodney District Council; ii. in the district of North Shore City, the North Shore City Council; iii. in the district of Waitakere City, the Waitakere City Council; iv. in the district of Auckland City, the Auckland City Council and Metrowater; v. in the district of Manukau City, the Manukau City Council and Manukau Water; vi. in the district of Papakura District, the Papakura District Council and United Water; vii. in the district of Franklin District, the Franklin District Council; viii. In the Region as a whole, Watercare.
Mana Whenua Kaitiaki Forum	A governance body established in 2012 to assist and advise Watercare on matters of concern to iwi, and vice versa, relating to major projects.
Manager	The designated person authorised by the Auckland Council, or their delegate.
Marina	A boat basin that has docks, moorings, supplies, and other facilities for boats.
Metropolitan Urban Limit	The boundary between rural area and urban area delineated on the Map Series 1, Sheets 1- 20 of the Auckland Council Regional Policy Statement (July 1999) and subsequent amendments.
MfE/MoH Water Quality Guidelines	The Ministry for the Environment and the Ministry of Health Water Quality Guidelines for Marine and Freshwater Recreational Areas (June 2003, or subsequent version approved by the Manager).

Network	The wastewater network owned and operated by Watercare Services Limited (as the Auckland water organisation), including all assets necessary for the operation of the network, including but not limited to pipelines, pipe bridges, siphons, rising mains, overflow structures, storage facilities and pump stations. The Network includes the transmission system (the larger pipes that convey wastewater collected by local network pipes to the wastewater treatment plant.) and the local system (the smaller pipes that convey wastewater from individual properties or housing or commercial developments to the transmission network.).
Network Failure	Failure of the Network that results in a limitation in hydraulic capacity from a pipe collapse or breakage and/or from power or mechanical failure.
New Engineered Overflow Point	An Engineered Overflow Point that is an addition to the Network after the Auckland Wastewater Network Comprehensive Discharge Permit commences.
Non-Greenfield Catchment	With respect to wastewater activities, catchments that do not meet the definition of a greenfield catchment.
Normal Operation (of the Network)	Excludes events which are due to circumstances beyond the Consent Holder's control and which cannot be provided against, and are defined as follows: (a) Chokes. Network Failure, a force majeure (including vandalism and for terrorism): (b) heavy rain which occurs at the same time maintenance or construction or re-construction of the Network and is beyond the diversion capacity.
Overflow/Wastewater Overflow	A discharge from the Network that occurs in either a controlled manner from an Engineered Overflow Point or in an uncontrolled manner from any other point in the network, either during times of Dry Weather Flow or Wet Weather Flow.
Overflow Point	An existing or future physical discharge location where the discharge is from an engineered overflow structure in the wastewater network.
Overland Flow Path	The natural flow path of stormwater over the ground.
Peak Wet Weather Flow	The assumed maximum design flow per person or population equivalent used for network design. The Watercare design standard is 1,500 litres per person per day.
Peaking Factor	With respect to dry weather flows, the peaking factor is the higher than average flow that occurs in the pipes from domestic sources twice a day (morning and evening). This is also known as “the diurnal peak”.

Pressure Wastewater Collection System	A wastewater collection system from which domestic wastewater is discharged periodically into a pressure main by means of a grinder pump, rather than using gravity to convey the wastewater
Public Access	Unobstructed admission to space that is available for public use.
Public Recreation Area	A public park, reserve or coastal area, including bathing beaches.
Public Wastewater Network	Wastewater network assets owned and operated by Watercare.
Real Time Control	Continuous observation of system parameters (levels, flows, etc.) and the use of control equipment (weirs, pumps, gates, etc.) to maximise system performance.
Receiving Environment	The water body that receives a wastewater discharge from an Engineered Overflow Point.
Recreation	Any activity carried out in a person's free time which enhances life experiences and enjoyment. This concept is broad and includes all activities: passive, physical, artistic and cultural, as well as community service.
Red Zone	An area where new wastewater connections are restricted because the wastewater network has reached or is nearing capacity.
Repeat Dry Weather Overflow	A Dry Weather Overflow that occurs more than once at the same location within a 12 month period.
Replacement Engineered Overflow Point	A like-for-like replacement (including a minor upgrade of the Engineered Overflow Structure) of the existing Engineered Overflow Point.
Reported Overflow	An Overflow that is reported by any person to the Watercare Control Room or that has been identified as having occurred by Watercare's telemetry system.
Rural-Urban Boundary	The boundary that defines the maximum extent of urban development to 2040 in the form of a permanent rural urban interface as set by the Operative Auckland Unitary Plan.
Safeswim Programme	An Auckland Council monitoring programme that is designed to provide regular assessments of water quality at a range of beaches in the region in an effort to reduce the risk to public health.
SCADA	Supervisory Control and Data Acquisition. A process control system that is used in various applications including manufacturing, communications and infrastructure. A SCADA system collects data from sensors in local and remote locations and sends them to central computers to control local machinery.

Septicity	Septicity in wastewater systems results from the activity of bacteria growing in sewage and on submerged surfaces which, under anaerobic conditions, reduce sulphur-containing organic compounds and sulphates to sulphides and other odorous sulphur compounds. This situation will occur where there is inadequate ventilation.
Similar Location	A location within a radius of 500 metres of the original location.
Small Waterway	Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Low-Order (stream order 1 and 2).
Stormwater	The surface water runoff (and any contaminants contained therein) from land or the external surface of any structure which is diverted or discharged to a water body or land as a result of rainfall.
Trade Waste	Any liquid, with or without matter in suspension or solution therein, which is or may be discharged in the course of any industrial or trade process, excluding the separated domestic wastewater from the premises.
Transmission Network (Transmission System)	The larger pipes that convey wastewater collected by local network pipes to the wastewater treatment plant.
Type 1 Overflow	A wet weather overflow from an engineered overflow point associated with a pump station. This may or may not be in close proximity of the pump station.
Type 2 Overflow	A wet weather overflow from an engineered overflow point not associated with a pump station (relief point).
Type 3 Overflow	A wet weather overflow that does not discharge from an engineered overflow point but from any other point on the network (usually a manhole) not designed for discharges as the result of surcharging during wet weather.
Urban Rivers and Streams	All permanent rivers and streams located within Urban Areas.
Waahi Tapu	A place sacred to Maori in the traditional, spiritual, religious, ritual or mythological sense.
Wastewater	Liquid (and liquids containing solids) waste from domestic, industrial, institutional or commercial premises including (but not limited to) toilet wastes, sullage, trade wastes and gross solids.
Wastewater Network	A system of pipes, open channels and associated ancillary structures for the purpose of conveying, diverting, storing, treating or discharging wastewater.
Wastewater Network Strategy	The document that describes Network improvement planning and prioritisation of Network improvements for a period of six years.

Wastewater Overflow/Overflow	A discharge from the Network that occurs in either a controlled manner from an Engineered Overflow Point or in an uncontrolled manner from any other point in the network, either during times of Dry Weather Flow or Wet Weather Flow.
Watercourse	A river or lake (as defined in Section 2 of the Resource Management Act 1991).
Wet Weather Flow	The flow within a wastewater network that is greater than the Dry Weather Flow, and which occurs as a result of rainfall (directly or indirectly) entering the Network.
Wet Weather Overflow	A Wastewater Overflow during times of Wet Weather Flow.
Wet Weather Overflow Event	One or more wet weather overflows that end(s) when all overflows have ceased discharging for more than 24 hours. Where the overflow stops and then recommences within 24 hours as a result of a single continuous or intermittent rainfall event, it is considered a single wet weather overflow event.
Work Order	Instruction to contractor or internal service provider to carry out specified work.

Attachment 6:
Matters to be Addressed in the
Wastewater Network Strategy

1 PURPOSE OF THE WASTEWATER NETWORK STRATEGY

The Wastewater Network Strategy (WWNS) is the key implementation tool for Watercare's Comprehensive Wastewater Network Discharge Permit. It fulfils three important functions:

(1) Setting the strategic framework under which Watercare manages the waste water network; and

(2) Reporting on network performance; and

(3) Describing the wastewater network improvement works programme.

The specific matters that are addressed in the WWNS are set out below. As the WWNS is prepared at six-yearly intervals, the reporting and planning period is six years.

The WWNS will use the same geographic catchments described in the application for consent (August 2013) to provide consistency. However, catchment boundaries are subject to change due to future urban growth and development.

The first Wastewater Network Strategy is due in June 2017. Subsequent Wastewater Network Strategy revisions will be prepared in 2023, 2029, 2035, 2041 and 2047.

The Wastewater Network Strategy will be prepared using the *Best Practicable Option (BPO) Methodology* (Attachment 3 of the Comprehensive Wastewater Network Discharge Permit), the *Methodology for Prioritising Catchments and Wastewater Network Improvement Works* (Attachment 4 of the Comprehensive Wastewater Network Discharge Permit), and the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* (Attachment 5 of the Comprehensive Wastewater Network Discharge Permit). It will be certified by the *Manager* in accordance with condition 3 of the Comprehensive Wastewater Network Discharge Permit.

2 NETWORK PERFORMANCE REPORT

Describing wastewater network performance over the preceding six years will cover the following matters:

(1) Setting the strategic framework under which Watercare manages the waste water network; and

(2) Extent of the wastewater network. Each WWNS will show the extent of the public wastewater network at the time, identifying new overflow locations, additions to the Area of Service and other relevant changes to the network that may affect the management of wastewater overflows. Where necessary, changes to geographic catchment boundaries will be identified.

(3) Current network performance. Network performance is described in terms of wastewater overflow frequencies for identified engineered overflow points, using both measured (telemetry) and modelled overflow data. Where appropriate, improvement works that were completed in the preceding six years will be described, and their effects noted.

(4) Improvement works in progress. Improvement works under way, including sewer separation programmes and major works that require several years to complete and/or that affect more than one geographical catchment, will be described and information about progress provided.

(5) Inflow and Infiltration (I&I) programmes and other operational projects. The performance of the wastewater network in terms of wastewater overflows may also be improved though the implementation of I&I programmes and other operational (rather

than capital) projects. Relevant programmes that were undertaken over the preceding six years and their outcomes will be described.

(6) Environmental monitoring. Environmental monitoring information gathered by others, specifically the Auckland Council Safeswim programme will be provided (if relevant) to demonstrate improvements in the performance of the wastewater network.

3 WASTEWATER NETWORK IMPROVEMENT WORKS PROGRAMME

The Wastewater Network Improvement Works Programme sets out how wastewater network performance will be improved over the next six-yearly planning period, and how works are prioritised. Specifically, the following will be described:

(1) Current wastewater network performance issues. Based on the description of current network performance, specific issues will be highlighted, both on a catchment basis and for the wider network. This will form the basis for describing the wastewater network improvement programme for the next planning period.

(2) Urban growth. Existing information relating to urban growth (both greenfield development and urban intensification), specifically the urban growth provisions in the Unitary Plan, will be reviewed to identify the works necessary to service new developments, both over the next six-year planning period and over the longer term (up to 20 years).

(3) Catchment prioritisation. The existing catchment prioritisation will be updated, taking into account the outcome(s) of the previous six-year improvement programme, potential changes in the classification of aquatic receiving environments and feedback obtained through consultation. The prioritisation process is described in Attachment 4 of the Comprehensive Wastewater Network Discharge Permit.

(4) Wastewater network improvement programme. The improvement programme for the next six years will identify the works necessary to improve network performance and provide for urban growth. This will include:

a. Wastewater catchment investigation and modelling projects.

b. Short, medium and long-term physical improvement projects, including any that may be appropriate to manage conspicuous oil or grease films, scum or foam, or floatable or suspended materials that may be visible at the point of discharge to the environment at Engineered Overflow Points that are known to discharge more than 12 times per year.

c. Operational projects.

d. Major network improvement works that cover more than one geographical catchment.

Where relevant, the BPO analysis that was undertaken to inform the works programme will be provided.

4. OTHER MATTERS

The Wastewater Network Strategy will also address other matters, specifically:

(1) Iwi and community consultation. Watercare is committed to seeking input from its key stakeholders. The feedback received from the community (via consultation with Local

Boards and the Long Term Plan), Iwi Authorities with mana whenua interests within Auckland (via direct consultation with individual Iwi Authorities and feedback obtained through other processes) and established collaborative procedures (for example with Auckland Transport and the Auckland Council Stormwater Unit) will be noted.

(2) Matters outside of Watercare's control. Where legislative and/or regulatory changes or other matters outside of Watercare's control (for example, lack of access to relevant information, lack of enforcement powers or changes in urban growth that were not anticipated and/or communicated by Auckland Council) may affect Watercare's ability to comply with the conditions of the Comprehensive Wastewater Network Discharge Permit, these will be identified and reported in the WWNS.

5. SPECIFIC MATTERS TO BE ADDRESSED IN 2017

There are three specific issues that will be addressed in the 2017 Wastewater Network Strategy, and carried forward into subsequent strategies as appropriate. In the case of 4.1 and 4.3 below, no further evaluation will be required after the 2017 Wastewater Network Strategy other than the general review set out in sections 2 and 3 above. In the case of 4.2 below, any monitoring information received after 2017 will be used to inform the subsequent Wastewater Network Strategies. The issues to be addressed in the 2017 Wastewater Network Strategy are set out below.

4.1 Revision of Receiving Environment Classification

Condition 16 of the Comprehensive Wastewater Network Discharge Permit requires that the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* (Attachment 5) shall be amended to include:

a. A Wetland receiving environment type category, and

b. An assessment of the potential temporal and spatial cumulative public health and ecological effects of wastewater discharges.

Condition 17 requires that the Wastewater Network Strategy shall:

a. […]

b. In the case of the 2017 Wastewater Network Strategy, address any changes in receiving environment classification, including reclassifying all commonly used beaches where contact recreation (bathing) occurs, as a Class 1 Recreational Receiving Environment.

To reflect these changes, the 2017 Wastewater Network Strategy will include:

- The revised version of the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows*.
- A list of receiving environments that have been reclassified from Class 2 Recreational Receiving Environments to Class 1 Recreational Receiving Environments, with a description of the changes in the Wastewater Network Improvement Works Programme (if any) that have resulted from this re-classification.

4.2 Targeted Monitoring Programme

Condition 58 of the Comprehensive Wastewater Network Discharge Permit requires a targeted monitoring programme with the objective of confirming that the application of the *Methodology for the Assessment of Effects of Wet Weather Wastewater Overflows* results in an appropriate assessment of recreational, public health and ecological effects. This monitoring programme will be reported in the Annual Network Performance Report. An overview of the targeted monitoring programme and any results available at the time will also

be included in the 2017 Wastewater Network Strategy.

4.3 Improvement Works to Address Type 3 Overflows to Private Land

Condition 43 of the Comprehensive Wastewater Network Discharge Permit requires that any of the fifteen existing Type 3 Overflows listed in Attachment 11 that have not been rectified by 2017 shall be prioritised in the Wastewater Network Improvement Works Programme set out in the 2017 Wastewater Network Strategy.

Attachment 7:
Operation and Maintenance Procedures
for the Conventional (Gravity) Wastewater Network

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1 PURPOSE AND SCOPE

This document describes the operation and maintenance activities carried out by Watercare Services Limited (Watercare) in performing its duties as the Auckland water organisation[1] to ensure that the performance of the wastewater network (hereafter referred to as the Network) is optimised and potential adverse effects from wastewater overflows on public health, the environment and cultural values are avoided, remedied or mitigated.

The implementation of the procedures described here is supported by a range of systems, documents, forms and specific manuals that are subject to continuous organisational improvement processes and form part of Watercare's normal business procedures. This supporting material is held and accessed by Watercare staff and not part of this document.

The operational and maintenance procedures set out in this document apply to the conventional (gravity) wastewater networks (Network) that may generate the discharges that are authorised by the Comprehensive Wastewater Network Discharge Permit.

Operation and maintenance procedures for alternative wastewater systems owned and operated by Watercare (vacuum sewer systems, Pressure Wastewater Collection (PWC) systems and septic tank effluent pumping (STEP) sewer systems) are not included in the scope of this document, because these systems do not require engineered overflow points. These systems are not subject to inflow and infiltration and therefore do not give rise to wastewater overflows.

The scope also excludes the operation and maintenance of wastewater treatment plants and outfalls.

This document is subject to review on a regular basis.

[1] The Local Government (Auckland Council) Act 2009 defines *Auckland water organisation* as follows:
(a) until 1 July 2015, means Watercare Services Limited; and
(b) on and after 1 July 2015, means—
(i) the Auckland Council (except in section 61); and
(ii) a council-controlled organisation of the Auckland Council that provides water supply or wastewater services, or both, in Auckland.

2 ASSET MANAGEMENT AND MAINTENANCE

2.1 Overview

This section identifies the types of assets that collectively make up the Network and describes Watercare's approach to their management and maintenance, with particular emphasis on three types of activities:

- Routine – Carrying out regular (scheduled) maintenance and inspections of Network assets and facilities.
- Reactive – Dealing with the day-to-day operation of the Network, such as responding to complaints about wastewater overflows, blockages, odour, and/or public health issues.
- Proactive – carrying out risk assessments, identifying critical assets, initiating condition inspections, monitoring, contingency planning, dealing with recurring problems in the Network, managing demand (including inflow and infiltration programmes) and providing sufficient capacity for current and future demand.

2.2 Risk Management

Watercare's approach to managing Network assets is based on the following needs and principles:

- Protection of public health.
- Protection of the environment.
- Efficient operation of the wastewater network.
- Self-regulation.
- A high standard of service delivery.
- Commitment to being a minimum cost service provider, consistent with effective operation and maintenance as required by legislation.
- Effective asset management (appropriate investment).
- Proactive wastewater network management.

Watercare uses a risk management framework consistent with the joint *Australian and New Zealand International Standard AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.*

Watercare's Enterprise Risk Management Framework (ERMF) sets out the management policies, procedures and practices to be applied to identifying, analysing, evaluating, treating and monitoring risk. The ERMF is used regularly to score and prioritise risks across the entire Network.

Where there is a low risk that asset failure may adversely affect public health and the environment, assets are generally managed on a 'run to failure' basis as this is generally the most cost-effective response. Low risk is usually only associated with local network assets.

Assets with a high level of risk (generally transmission assets) are managed differently. A detailed risk assessment based on the ERMF is carried out and a suite of measures is used to monitor and manage the risk effectively. Using the ERMF process, a risk class is assigned to help identify priority for action. The higher risk classes (Class 4 or 5 risks) are classified as Enterprise Risks and managed by the Watercare Board. These risks generally require significant capital expenditure in order to manage them. Examples of such major projects are the Hobson Tunnel and the Central Interceptor.

For major assets such as transmission system pump stations Watercare uses a Reliability-Centred Maintenance (RCM) process for determining maintenance strategies based on reliability techniques. This process encompasses analytical methods such as Failure Mode

Effects and Criticality Analysis (FMECA). The RCM process addresses the following objectives:

- Meeting Health & Safety requirements.
- Meeting environmental requirements.
- Meeting operational requirements.
- Improving asset reliability and availability.
- Minimising costs.

In addition to the ERMF and RCM processes outlined above, Watercare's Wastewater Planning Unit undertakes detailed analyses of wastewater asset criticality. This includes working with Operations staff to identify the most critical wastewater assets and ensuring that they become subject to monitoring and inspection programmes to enable renewals of these critical assets to be scheduled in a timely manner.
Maintenance work is managed with two asset management systems (AMS):

- SAP for transmission system assets, and
- Hansen for local network assets.

The systems are populated with all of Watercare's wastewater assets and are used to record maintenance activities, maintenance costs and condition information against individual assets. They are also used to schedule routine maintenance by generating Work Orders according to a planned schedule.

Because each asset type has different risk management and maintenance requirements, the relevant procedures for each asset category are set out separately in Sections 2.3 to 2.11 below, with particular reference to:

- Asset Description and Risk Assessment
- Inspection and Condition Assessment
- Preventative Maintenance
- Renewal.

Network assets are also subject to external risk, i.e. third party damage, which usually occurs as the result of accidental interference. This risk is managed through the Works Over Approval process described in Section 3.11 of this document.

2.3 Pipelines

2.3.1 Asset Description and Risk Assessment

Pipelines are made from a number of different materials:

- Asbestos cement
- Polyvinyl chloride (PVC)
- Ceramics (earthenware)
- Polyethylene (PE)
- Concrete
- Concrete-lined steel (CLS)
- Concrete-lined mild steel (CLMS).

The most common material used for local network wastewater pipes is asbestos cement, followed by PVC and ceramics. The most common material used for transmission pipes is concrete.

Pipeline failure is generally due to asset deterioration or structural failure. Asset deterioration occurs primarily due to attack by organic and corrosive compounds (e.g. hydrogen sulphide and components of trade waste) within the pipe or ground conditions outside the pipe. Structural failure is mostly due to ground movement or excessive loading. The rate of pipe deterioration may vary due to poor quality of initial construction or specific site conditions (e.g. flow turbulence inside the pipe, changes in ground use in the vicinity of the pipe, etc.).

The degree of risk associated with wastewater pipelines is generally determined by consequence (of failure). For wastewater pipelines, the main consequence of pipeline failure will be the public health risks associated with a discharge, the adverse effects of the discharge to the environment, and the loss of wastewater service for a number of properties. In addition there are the financial, reputation and health and safety risks of a failure event. Generally, the potential adverse effects caused by pipeline failure are related to the size of the network – the consequences of failure in the transmission system are generally more significant than in the local network.

The likelihood of failure is generally determined by the condition of the asset, which is investigated using the techniques described in Section 2.3.2 below. This information provides the basis for determining which pipelines are critical assets and need to be managed accordingly.

2.3.2 Inspection and Condition Assessment

The primary method for inspecting the condition of conventional gravity wastewater network assets is CCTV (Closed-Circuit Television) surveying. This technique provides condition information about the state of the internal surface of the pipe, pipe joints, and how well service connection junctions have been made. Occasionally data is also obtained by material sampling and mapping concrete reinforcing, although this usually provides only very localised information. It is sometimes possible to extrapolate this information by comparing the relative appearance of the pipe surface over the remainder of the CCTV survey, which may assist in assessing and rating overall asset condition.

Transmission pipelines are inspected using CCTV on a 5-yearly (maximum) cycle. Each section of pipeline is given a risk score based on the results of the inspection. Monthly asset investigation meetings are held to review the risk determination and to make decisions regarding maintenance requirements, frequency of future inspections, and recommendations for rehabilitation or replacement. The asset condition rating used for transmission assets is shown below.

Rating 1: Expected lifespan: 50 – 100 years

- Sound modern pipe, well maintained, no signs of damage.
- Near-new condition.
- No action required - re-survey in 10 or more years.

Rating 2: Expected lifespan: 20 – 50 years

- Sound pipe but showing superficial signs of wear and tear.
- Good condition.
- No action required - re-survey within 10 years.

Rating 3: Expected lifespan: 5 – 20 years

- Functionally sound pipe but with heavy wear and tear and some joint failures. Deterioration is beginning to affect performance.
- Average condition.
- No action required - re-survey (CCTV and/or LLL) within 5 years.

Rating 4: Expected lifespan: 1 – 5 years

- Questionable pipe showing significant failures that is likely to cause a marked deterioration in performance in the medium term.
- Poor condition.
- Possible remedial action required within 3 years, according to condition - re-survey within 1 year.

Rating 5: Expected lifespan: < 1 year

- Unacceptable pipe with no reliable lifespan; likely to fail in the near term.
- Warrants immediate replacement.

Where asset criticality analysis work has identified critical pipeline assets, priority CCTV inspection work can be programmed to obtain urgent condition information.

Reactive or targeted CCTV condition inspection work is carried out on both transmission and local network pipelines when operational issues are being investigated or when confirmation of a past condition assessment is required. The results of these individual inspections are used to decide what course of action is to be taken.

Laser light line is a survey technique which provides a means of more objectively measuring changes in pipes e.g. loss of wall thickness in concrete pipes, ovality in PE/plastic pipes, or deformation due to load cracking in ceramic pipes. Laser light line is normally only used when CCTV surveys have identified potentially significant risk features.

A further means of pipeline condition assessment used for pipelines in coastal areas is monitoring chloride levels in the treated wastewater effluent. High levels indicate the ingress of seawater into the wastewater network, either through the pipeline or manholes. Regular testing is carried out in pipelines that are potentially affected by seawater ingress, for example in Snells Beach or parts of the North Shore.

2.3.3 Preventative Maintenance

Preventative maintenance for wastewater pipelines generally involves scheduled flushing and/or cleaning. This is typically required for pipelines with a very flat or undulating grade where fat or sediment build-up occurs. The frequency of flushing is based on the extent to which fat or sediment accumulates. This is related to the flow rates in the pipeline and its physical characteristics (e.g. size, slope, troughs). The routine flushing of pipelines is managed using scheduled Work Orders generated by the relevant asset management system (SAP or Hansen).

Intrusion of tree roots is an issue for many pipelines and regular scheduled root cutting is undertaken using the same Work Order process. For local network assets the frequency of the scheduled maintenance activities ranges from monthly up to five yearly. Transmission assets are cleaned at least once every four to five years.

The type of pipe material is an important factor in determining the frequency and type of pipeline cleaning. Asbestos cement pipes, for example, can be damaged by high pressure cleaning.

Whether a pipeline remains on a regular cleaning (incorporating both flushing and tree root removal) schedule or not is an economic decision based on long-term maintenance versus renewal cost. In some cases, due to the limited ability to increase the gradient of a pipeline (due to upstream and downstream constraints), renewal of the section of pipeline may not resolve the fat or sediment build-up issue.

Once a pipeline has been identified for renewal, scheduled maintenance is often required in the intervening period between when a decision is made to replace the pipeline, and when the new pipeline is commissioned.

Cathodic protection is used on some transmission steel mains to minimise corrosion of the pipeline.

2.3.4 Renewal

Wastewater pipelines are generally replaced for one or more of the following reasons:

- Condition: the pipeline is in a state of advanced deterioration and/or is structurally unsound, or has a history of failures.
- Performance: the capacity of the pipeline is insufficient for current flows and needs to be upgraded with a larger diameter pipeline.
- Location: pipelines which are unserviceable due to location (depth or alignment) are sometimes renewed along an improved alignment to avoid potential operational issues

(prolonged loss of service and high cost) or when required for development (build-over) reasons.

- Grade: if the pipeline has very flat grades requiring continual cleaning, it may be replaced with a better graded pipe to improve maintenance.
- Damage by third parties: occasionally wastewater pipelines are damaged by third parties to such an extent that renewal is required, for example when concrete from a foundation pour enters a wastewater pipe.

The renewal decision making process utilises the following information:

- SCADA (Supervisory Control and Data Acquisition) or manhole monitoring alarm statistics;
- Overflow frequency;
- Complaint records;
- Planned preventative maintenance programme;
- Flow modelling (undertaken by Wastewater Planning); and
- Condition assessment.

Most of the information identified above is identified and/or reported to Operations staff. A history of repetitive faults or multiple overflows indicate a significant risk and the need for follow-up action. Such action may consist of root cause analysis, investigation, and identifying the most cost-effective remedial action. The outcome may be an operational change, planned corrective maintenance, new or amended preventative maintenance or, alternatively, a capital project such as renewal of the asset.

For local network assets, the Wastewater Planning Unit holds and maintains the Issues and Awareness Register lists and tracks wastewater pipelines with operational issues that potentially require renewal. The Wastewater Planning Unit relies on Operations staff to forward relevant information about individual assets such as pipelines, pipe bridges, siphons and other Network components.

Planned Renewal programmes are developed as part of the wastewater asset criticality work undertaken by the Wastewater Planning Unit. This process identifies the most critical assets in the Network to ensure that there are monitoring and inspection programmes in place for these assets, and to prepare a prioritised renewal programme.

2.4 Pipe Bridges

2.4.1 Asset Description and Risk Assessment

All pipe bridges are identified as critical assets. Pipe bridges are vulnerable components of the Network because they may be subject to:

- Corrosion due to the elements.
- Instability due to stream erosion around piers or bank support.
- Settlement of piers and displaced joints.
- Structural failure of piers and supporting structures.
- Instability due to flooding/washout.
- Third party damage (including vandalism) of exposed sections of pipe.

Pipe bridges are subject to risk assessments based on pipe size, pipe coating and the environment they are exposed to.

2.4.2 Inspection and Condition Assessment

All pipe bridges are inspected on a nominal five-yearly cycle. The frequency of inspection for high risk transmission pipe bridges is once a year. An overall condition grade of between 1 (excellent) and 5 (very poor – replacement required) is used.

The asset criticality work undertaken by the Wastewater Planning Unit identifies the most critical pipe bridges, and these are inspected on a greater frequency (up to a three yearly cycle).

2.4.3 Preventative Maintenance

There is no scheduled preventative maintenance programme for pipe bridges as all maintenance (minor or major), further investigation work or replacement is scheduled on the basis of condition inspections.

Minor maintenance work on pipe bridges generally involves the removal of vegetation and spot rust/corrosion treatment. Major maintenance works are normally required to rectify pipe bridge instability, stream erosion, subsidence of piers and displaced joints.

2.4.4 Renewal

Pipe bridges are replaced as and when required, generally because of major pipe corrosion, or for structural or stability reasons. Replacement is generally independent from the in-ground pipeline either side of the pipe bridge.

The renewal of pipe bridges is managed by the Wastewater Planning Unit through the wastewater asset criticality work programme.

2.5 Siphons

2.5.1 Asset Description and Risk Assessment

All siphons are identified as critical assets. A siphon is a gravity sewer pipe that dips below grade ('sags') in order to pass under an obstruction, such as a stream or harbour. Because there is a low point, there is potential for debris to accumulate in the siphon. For this reason, and the fact that siphons often pass beneath environmentally sensitive streams or harbours, all siphons are considered critical assets. The carrying capacity of the siphon (size and length) is generally the basis for establishing the degree of criticality.

A high proportion of siphons were duplicated when they were originally constructed (or have two or three barrels for high/low flows) due to the risks associated with these assets. This included construction of an inlet structure for the two pipelines to allow each siphon to be flushed or cleaned by waterblasting while the other pipeline remains in service.

Significant transmission siphons which have been duplicated through work projects (i.e. after construction) include:

- Whenuapai Branch sewer (Royal Road MH 14 – MH15);
- Rosebank Branch sewer (MH66A Western Interceptor to MH1 Rosebank Bridge);
- Otahuhu East Branch sewer (MH2 Tamaki Bridge to MH1);
- Regent Street Siphon (Devonport).

2.5.2 Inspection and Condition Assessment

Siphons are "flooded pipes" and therefore difficult to inspect. For this reason, CCTV is not normally a viable option. Some multi-barrel siphons may be isolated, drained and cleaned, and can then undergo internal inspection by CCTV. Internal inspection of siphon pipes using ultrasonic technology is another option, although this technology is not currently readily available in New Zealand.

The wastewater asset criticality work undertaken by the Wastewater Planning Unit identifies the most critical siphons and ensures that there is an adequate and appropriate condition assessment programme for these assets.

2.5.3 Preventative Maintenance

Because there is a low point in the 'sag' of a siphon there is potential for debris to accumulate. To flush a siphon, the penstock at the upstream manhole (inlet chamber or flushing tank) is closed and a head of wastewater is allowed to build up. This is then released to give a high velocity flush through the siphon. This process is used for some transmission siphons. Other siphons are cleaned using a hydrojet. Waterblasting is also used on a regular basis to flush siphons.

Flushing of transmission siphons can be carried out remotely by the Operator in the Central Control Room, or manually on-site. All transmission siphons are flushed on a regular basis. The increased flow from a siphon being flushed is a potential health and safety hazard for any maintenance staff working on the downstream Network, and relevant safety protocols must be observed.

Flushing of local network siphons ranges in frequency from six-monthly to two-yearly. The flushing is carried out to avoid the build-up of sediments and to ensure the siphons are in good working order.

2.5.4 Renewal

Renewal of siphons is treated in a similar manner to wastewater pipelines except that the threshold for condition grade for siphon renewal is set at a more conservative level due to the higher risk ranking of these assets.

Asbestos cement pipes require replacing earlier than other pipe materials. For new siphons or siphon replacements PE pipe (with butt fusion welded joints) is used.

The renewal of siphons is managed by the Wastewater Planning Unit through the wastewater asset criticality work programme.

2.6 Rising Mains

2.6.1 Asset Description and Risk Assessment

All rising mains are identified as critical assets, mainly due to their construction materials. Concrete-lined mild steel (CLMS) rising main pipes are the most vulnerable, particularly at bends, because the grit transported in wastewater flows is leading to the wear and erosion of the pipe from the inside. Asbestos cement rising main pipes in the transmission network are also subject to a higher rate of deterioration than pipes constructed with other materials. De-lamination of the pipe wall is a common mode of deterioration which eventually leads to pipe failure.

Rising main pipe work within pump stations, especially when made of cast iron, also presents potential risk due to the corrosion that may occur.

2.6.2 Inspection and Condition Assessment

Like siphons, rising mains are difficult to inspect because they are "flooded pipes". The pump station needs to be shut down, and the rising main drained, flushed and cleaned before a CCTV camera can be inserted. This requires adequate wastewater storage at the pump station, which is often not available. For this reason CCTV is usually not a viable option for the condition inspection of a rising main.

Obtaining pipe condition data during rising main failures is a more appropriate means of establishing the remaining life of these assets. Asset maintenance history records are an important source of information as they document the number and type of failures. Additional tools for assessing pipe condition are pipe sampling for photographic record and laboratory analysis. Laboratory analysis may include physical and chemical tests on pipe samples to determine both the cause of damage and the likelihood of further failure.

2.6.3 Renewal

All critical rising main steel bends have been replaced, and the remaining CLMS pipes and fittings and critical asbestos cement rising mains in the transmission network are subject to a high priority replacement programme (as in June 2013). All new or replacement rising mains are constructed from PE pipe with butt fusion welded joints.

Other rising mains will be inspected when failures occur and replacement will be scheduled accordingly.

The programmed renewal of rising mains is managed by the Wastewater Planning Unit under the wastewater asset criticality work programme.

2.7 Manholes

2.7.1 Asset Description and Risk Assessment

Manholes provide access to wastewater pipelines to carry out work such as CCTV inspections or clearing a blockage. Without manholes it would be necessary to excavate access pits to gain access to a pipeline. Once constructed, functional issues with wastewater manholes are minimal. Typical problems with manholes involve damaged lids and covers, broken benching, and leaking (stormwater inflow and infiltration between manhole joints, risers). Manholes on transmission pipelines are generally constructed to a higher standard, and are therefore less likely to fail structurally or be damaged by third parties.

Manholes are not subject to risk assessments as they are sufficiently robust and do not normally present an operational risk. Condition assessments are normally undertaken when adjoining pipes are inspected.

2.7.2 Inspection and Condition Assessment

Manholes are normally checked while other maintenance or inspection tasks are being carried out (e.g. clearing a blockage, CCTV inspection, pipe cleaning). If maintenance services staff detect damage or deterioration in a manhole this is reported to Operations staff, and a detailed inspection is undertaken. Repairs are then undertaken as appropriate on a case-by-case basis. The results of manhole condition inspections are recorded in the relevant asset management system.

Watercare does not undertake a structured programme for manhole inspections, because manholes usually deteriorate at the same or a lesser rate than the sections of adjoining pipework. Manhole inspection and potential renewal is therefore undertaken as part of the pipeline inspection programme outlined in Section 2.3 above.

2.7.3 Preventative Maintenance

There is no planned preventative maintenance programme for manholes. Where a specific fault is identified as the result of a pipeline CCTV inspection or during other maintenance activities, follow-up maintenance works or, where the fault is severe, a capital works upgrade or replacement is carries out.

For local network manholes there is an increasing trend to eliminate rungs, platforms and ladders in some chambers. Current health and safety requirements require the use of a tripod and pulley retrieval system for confined space access and egress, which eliminates the need for ladders and similar structures.

2.7.4 Renewal

Manholes typically deteriorate at the same or a lesser rate than the adjoining pipeline. Manholes are generally replaced when the adjoining pipeline is replaced or rehabilitated.

2.8 Overflow Structures

2.8.1 Asset Description and Risk Assessment

Overflow structures allow for hydraulic pressure to be relieved from the wastewater network when design capacity is exceeded, usually as a consequence of excessive inflow or infiltration of stormwater during or immediately following a heavy rainfall event. All pump stations are equipped with overflow structures, and structures can also be found on sections of the Network independent of pump stations. The combined Network has a large number of overflow structures equipped with screens, some of which are mechanised.

2.8.2 Inspection and Condition Assessment

Overflow points are visually inspected following overflow events and at more frequent intervals (either six-monthly or annually) as part of the planned preventative maintenance programme. Overflow structure pipes associated with the transmission network serviced by the Mangere Wastewater Treatment Plant (WWTP) are also inspected by CCTV as part of the pipeline asset inspection programme.

The overflow structure servicing the Reihana Street Pump Station in Orakei, which is Watercare's largest pump station, is subject to a more rigorous inspection regime. Diver inspections are carried out annually, and soundings of the sea floor in the vicinity of the outfall are carried out every two years.

2.8.3 Preventative Maintenance

Screens associated with overflow structures are cleaned on a regular basis, in some cases twice weekly. Pump station overflow structures with overflow 'baskets' or 'fences' are cleaned immediately following an overflow event.

2.8.4 Renewal

Overflow structures are subject to normal renewal processes, meaning they are replaced or upgraded when a particular need is identified during normal inspection and/or maintenance.

2.9 Storage Facilities

2.9.1 Asset Description and Risk Assessment

Storage facilities reduce the risk of wastewater overflows when Network capacity is exceeded as a result of storm events, or at times of pump station failure. Although important assets in an operational context, the storage facilities themselves are not a critical asset in terms of risk.

The major network storage facilities in the region used for flow balancing after a storm event (rather than storage associated with pump station failure) include:

- Silverfield (North Shore);
- Northboro (North Shore);
- Mairangi Bay (North Shore);
- Birkdale (North Shore);
- Swanson Branch Storage Tank (The Concourse, Henderson);
- Hobson Bay Storage Tunnel**.**

These facilities have all been constructed since 1995.

2.9.2 Inspection and Condition Assessment

As the purpose-built storage facilities (other than those associated with pump stations) are relatively new structures and of concrete construction, there is currently no need for a regular condition inspection programme. Any equipment associated with the storage facility such as penstocks, pumps, valves etc. is subject to a regular maintenance inspection programme.

2.9.3 Preventative Maintenance

The larger storage facilities are cleaned after each use, as confirmed by SCADA. Cleaning is carried out automatically or manually, or through a combination of both. The larger storage facilities have their own flushing systems to prevent the accumulation of solids.

2.9.4 Renewals

The purpose-built storage facilities are relatively new (as in June 2013) and are therefore not part of a renewal programme.

Pump station storage is augmented and renewed when a particular need is identified.

2.10 Pump Stations

2.10.1 Asset Description and Risk Assessment

Pump stations are broadly categorised in terms of their flow rate:

- Pump rate greater than 200 litres/second
- Pump rate between 20 litres/sec and 200 litres/second
- Pump rate of less than 20 litres/second.

As for pipelines, the main consequence of pump station failure is the adverse effects of the discharge on public health and the environment, and the loss of wastewater service for a number of properties as well as the financial, reputation and health and safety risks of an overflow event.

Pump stations are critical components of the wastewater network and its operation. The failure of major pump stations is a key aspect of the Enterprise Risk Management Framework (ERMF) planning.

If a pump station is in danger of overflowing before a fault can be rectified, the on-call duty engineer is responsible for reviewing interim options for managing flow (tankering, generator call-out, etc.) in order to minimise the risk of an overflow.

2.10.2 Inspection and Condition Assessment

All pump stations are subject to a regular inspection programme. Generally, the frequency of inspections is:

- Weekly for transmission pump stations
- Weekly, fortnightly, monthly or six-weekly for local network pump stations.

Pump station inspections include collecting condition information on the pump station key components, and recording and actioning minor maintenance requirements. Other maintenance work is identified using inspection results and scheduled as needed.

The condition of pump units at local network pump stations is not normally monitored as back-up pumps are available and they are subject to a ‘run to failure’ policy. However, infrared testing (for hot spots on switch gear) is undertaken.

Transmission pump station pump units are critical assets and are managed differently. Regular maintenance inspections are undertaken to determine maintenance requirements. SCADA monitoring provides a wide range of pump unit data (such as current and bearing temperature), and vibration testing is carried out on pump units (dry mounted centrifugal pumps) associated with the system servicing the Mangere WWTP to provide early warning of pump failure. The major pump stations are checked every 3 to 6 months.

2.10.3 Preventative Maintenance

Maintenance requirements for the transmission pump stations are identified using the process summarised below:

- Failure mode and effects analysis identifies the critical plant failure modes in a systematic and structured manner.
- Examination of each critical failure mode determines the optimum maintenance policy to reduce the severity of each failure.
- Selection of a maintenance strategy takes into account:
- Cost, safety, environmental and operational consequences.
- Effects of redundancy, spares costs, maintenance labour costs, equipment ageing and repair times.
- Optimal maintenance policies are recorded
- The following outputs are provided:
- System performance predictions and costs.
- Expected spares requirements.
- Maintenance labour manning levels.

2.10.4 Renewal

Pump units are generally replaced when the pump unit fails. Stand-by pumps are normally available to provide continuity of service and SCADA alarms alert Operations staff to the failure. At major pump stations, SCADA alarms initiate a warning prior to failure of the pump unit.

Components such as valves, fittings, ladders, landings and piping within a pump station are renewed when condition requires it. Where the internal environmental conditions at the pump station have caused structural degradation, the structural elements are renewed.

3 OPERATIONS

3.1 Overview

This section identifies the systems and procedures essential for the day-to-day operation of the Network, specifically:

- Network monitoring and control (SCADA)
- Alarms and alarm management
- Real time control
- Management of trade waste
- Incident response
- Management of storm events, electrical outage and natural disaster or civil emergencies
- Management of inflow and infiltration
- Management of repeat overflows
- Contingency planning
- Complaint procedures
- Works over approvals
- Linkage to wastewater network planning.

3.2 Network Monitoring and Control

Monitoring in real time is provided through SCADA. It allows information about how the network is operating at any given time to be monitored and recorded. Monitoring, particularly wastewater flow monitoring, is also necessary to inform maintenance and wastewater network improvement planning.

3.2.1 SCADA System

Watercare's telemetry network, the SCADA system, is a centralised control and data-collection system for all wastewater network, water network and treatment facilities. All major pump stations and most local pump stations are monitored by the centralised SCADA system.

SCADA communicates with control rooms at the three operational hubs at Mangere, Newmarket and Rosedale, where the information received triggers the appropriate operational response.

All SCADA data is stored and retained in the centralised system at Newmarket where it is used for reporting, planning and monitoring of network performance.

The SCADA system includes:

- Continuous telemetry links with remote sites to receive data and send control signals
- Alarm, monitoring and control functions
- Data collection and storage of information received from remote sites
- Remote control and data access for on-call and stand-by maintenance staff.

Monitoring parameters include wastewater levels and pump operation. The types of alarms that may be triggered are described in Section 3.2.4.

3.2.2 Flow Monitoring

In addition to the normal monitoring of the main facilities, wastewater flow is measured at key locations. Data from all flow meters is transmitted to the SCADA system.

There are two main types of flow meter in use: open channel flow meters and pressure pipe meters (usually magflow).

3.2.2.1 Open Channel Flow Meters

The three open channel flow meters currently in use are located in the transmission network servicing Mangere WWTP. Operation of the flow meters, including annual calibration tests statistical analysis of data, and call-out response is outsourced.

The instrumentation calculates flow based on a Doppler instrument that measures the flow velocity, and an ultrasonic level instrument that determines the cross-sectional area of the fluid in the pipe based on a measured depth. The two instruments are mounted in the wastewater pipe at or near a manhole.

3.2.2.2 Magflow Meters

Magflow meters are installed at 65 % of the transmission pump stations associated with the Mangere WWTP collection network (90 % of system pumped flows are measured), and all of the other transmission pump stations.

3.2.3 Manhole Monitoring and Alarms

Some manholes, especially those where overflows could potentially occur, are equipped with a manhole alarm (digital or analogue level sensor).

3.2.4 Alarms and Alarm Management

The SCADA system captures data recorded by monitoring instrumentation installed at key facilities in the wastewater network. If an item of data differs from set values, the SCADA system will generate an alarm. Alarms may be received in the control room, or sent directly to maintenance staff (in-house or term maintenance contractor staff) for action.

SCADA alarms are managed according to risk. Most alarms require an immediate response 24/7. Some SCADA alarms have time delays to enable the system to verify that the alarm is valid and not caused by a brief sensor or signal interruption. Control room operators respond to all transmission system SCADA alarms.

Alarms are assigned a priority and if necessary, incidents are responded to in accordance with the Wastewater Overflow Regional Response Manual.

Protocols for the Central Control Room operation have been developed to:

- Capture consistent, useful information from alarms and initiate alarm response
- Facilitate communication between all personnel especially during shut-downs
- Minimise the potential for accidents and incidents
- Record and respond to complaints from site neighbours and the public.

The main types of alarm are:

Wet Well High Alarm:	Indicates that the wastewater level has risen beyond 150 mm above the programmed pump start level in a pump station. This usually indicates that there is a problem with the pumping set (partial blockage, loss in efficiency, etc.).
High Flow Alarm:	For pump stations with flow meters where a threshold flow rate is exceeded.
Overflow Alarm:	An Overflow Alarm at a pump station indicates that the wastewater level has risen to a level at which wastewater is about to overflow. All transmission overflow structures also have an alarm to indicate that an overflow is actually occurring.

Standby Pump Started:	Indicates that there is a high wet well condition, that the duty pump(s) are not achieving the required output and that a stand-by pump has started. The alarm generally applies to pump stations where there is limited storage and therefore a limited time to respond before an overflow may occur (at average flow conditions). In this case, the reason for the reduction in the first duty pump output needs to be investigated and rectified as soon as possible.
Urgent Pumps Unavailable: (transmission only)	Indicates that a critical number of pumps are unavailable at a pump station. At specific sites, individual pump trip/ unavailable alarms may be raised from low priority to high priority when this occurs. This alarm allows for a response to be initiated before a high wet well level is reached, giving more time to reset the affected pumps and minimising the risk of an overflow. The elevation of low priority to high priority for individual pump trip/ unavailable alarms applies to those pump stations where there is limited storage, and therefore limited time to respond before an overflow might occur.
Security Alarm:	If any Watercare security system alarm is triggered, the alarm is received by the SCADA system and displayed at the Central Control Room. The Control Room operator initiates a security call-out procedure.
Siphon, Flow Meter, Overflow Site, and Biofilter Alarms	Siphons, flow meters, overflow sites, and biofilters can generate a number of alarms to alert Operations staff to a malfunction.

3.2.5 Real Time Control

Real Time Control (RTC) is a management procedure that can be implemented during rainfall events to redirect wastewater flows, usually to available storage facilities. RTC is also referred to as Inter-Station Control. In some sections of the network, especially the North Shore, this practice is a normal part of operating the system. ISC is used to maximise system storage and direct flows to preferential overflow points where the receiving environment is less sensitive or better able to assimilate an overflow.

In other parts of the network, predominantly the transmission system on the Auckland Isthmus, RTC is based on a linkage between some pump stations and level measurements in the downstream pipe. If the flow level in the pipe rises above a certain level, the pump station output is restricted so that potential overflows occur from the pump station overflow structure rather than from a manhole along the pipe. This approach minimises potential public health effects and flooding from uncontrolled overflows.

3.2.5.1 Real Time Control of Pump Stations

All networks operate with capacity constraints at some stage. To maximise the conveyance and storage within the network and to minimise overflows, many pump stations are operated in a Real Time Control environment that interlinks the operation of certain pump stations and storage facilities. This management approach is mostly used in the transmission system, although some local pump stations are also included. An example is the Hibiscus Coast Network. During a significant rainfall event, the system is operated to reduce flows from pump stations, or shut them down altogether. This is carefully sequenced to maximise the

use of the storage facilities at Orewa, Tindalls Bay and Stanmore Bay pump stations before overflows occur.

3.3 Management of Trade Waste

Trade waste is any liquid that discharges to the wastewater network from a trade or industrial process. Trade waste discharged directly into the wastewater system in an uncontrolled manner poses a high risk of harm to the wastewater system and treatment plant processes, the health and safety of wastewater personnel, and the environment.

The potential system risks associated with trade waste discharges include:

- Damage to the infrastructure e.g. Corrosion of network pipes;
- Blockage or choking of the network system e.g. Fat blockages;
- Harm to the treatment processes e.g. Toxic effects on biological processes or physical blinding of inlet screens;
- Harm to maintenance personnel e.g. Toxic gases or vapours;
- Harm to the environment e.g. Discharge of toxic compounds.

Watercare's Trade Waste Unit regulates trade waste discharges to the wastewater system in accordance with one of four trade waste bylaws, depending on the area (Auckland, Franklin, North Shore or Rodney).

Those discharging trade waste are required to hold a trade waste consent. In conjunction with the relevant trade wastes bylaw, trade waste consents detail the rules and conditions that must be adhered to by the consent holder. These may include contaminant limits, pre-treatment requirements, maximum flow rates, incident management plans, and self-monitoring and reporting requirements. A risk assessment is carried out for each trade waste consent application which assists in determining the conditions that are applied to a consent.

A comprehensive monitoring programme measures wastewater quality from the source of the discharge through to where the waste is received at the wastewater treatment plant. Monitoring programmes include:

- Self-monitoring – undertaken by the customer and reported to Watercare.
- Audit monitoring – undertaken by Watercare to verify discharges meet the terms of the bylaw and consents and to verify self-monitoring results.
- Remote sewer monitoring – remote sewer monitors measure parameters such as pH, temperature and conductivity on a 24/7 basis. If measurements go outside pre-set ranges then an auto sampler is automatically triggered to collect samples of the wastewater. The wastewater is then sent for analysis to assist in determining the source of the incident.
- Catchment investigations - investigations targeted to specific catchments to characterise the waste discharged in the catchment to identify any issues that may exist.
- Incident investigations – initiated in response to an incident such as the triggering of a remote sewer monitor or a reported incident from network staff. These investigations seek to track the incident back to source.
- Wastewater treatment plant monitoring – monitoring of influent at the inlet works to the treatment plants is carried out to determine the wastewater quality as it enters the plant.

In 2010/2011, Watercare administered approximately 1,600 trade waste consents. Around 14,000 individual tests were undertaken in the same time period as part of the above monitoring programmes to verify the quality of wastewater received in the wastewater system.

When a trade waste discharge is found to be non-compliant, a non-compliance notice is raised against the customer consent and the customer is required to investigate and explain the cause of the non-compliance, what has been done to correct it the steps put in place to ensure that the non-compliance does not recur.

Generally, working with customers to resolve the issue is sufficient. In some circumstances, additional measures such as prosecution and/or cancellation of consent may be required, as provided for by trade waste bylaws.

Education is an effective tool in controlling trade waste discharges. This includes:

- Site tours of the wastewater treatment plant to demonstrate the effects on the treatment plant of non-compliant discharge.
- Information brochures.
- Assignment of a compliance advisor to the consent holder.
- Free access to a wastewater technical specialist.

3.4 Incident Response

Watercare's response to both dry and wet weather overflows is set out in the *Wastewater Overflow Regional Response Manual*. These requirements are part of all maintenance contracts to ensure that all wastewater overflows are managed consistently.

Generally, wet weather overflows are treated as Level 1 Incidents unless significant and extensive flooding occurs or multiple properties are involved, with significant potential for property damage. During severe weather when wet weather overflows can be reasonably expected, maintenance contractors attend known significant wet weather overflow locations and initiate the appropriate response.

Generally, incident response involves the following steps, in the order set out below:

(1) Securing public health and safety.
(2) Determining appropriate containment options.
(3) Containing the overflow.
(4) Repairing the fault and/or removing the blockage.
(5) Clean-up and recovery.
(6) Reporting.

3.5 Management of Storm Events, Electrical Outage and Natural Disaster or Civil Emergencies

3.5.1 Storm Events

In the event of a severe weather warning, Watercare prepares for the event and alerts its term maintenance contractors to enable appropriate preparations.

During and immediately following storm conditions, Watercare carries out 'trouble spot' checks on the transmission system. This includes an inspection of specific manholes known to have been affected by previous significant storm events, to check for overflows and clean up after any overflows.

3.5.2 Electrical Outage

Electrical power outage is one of the most significant risks to the operation of the wastewater network due to the large number of wastewater pump stations in continuous operation. To minimise overflows in the event of a power failure, most pump stations can store wastewater for a period of time. Emergency storage at wastewater pump stations varies from site to site. The small pump stations have relatively large storage (up to 24 hours of dry weather flow), but the large pump stations have only one or two hours storage on site, due to the cost and space requirements to provide a large storage volume.

In order to mitigate the risk of electrical outage, Watercare has the following measures in place:

- Fixed generators: Fixed generators are provided at selected high risk critical facilities to provide alternative power during an electrical outage.
- Mobile generators: Watercare has several mobile generators located in specific locations and that can be moved to service pump stations in the event of a prolonged power outage.
- Generator hire: Watercare has a formal service level agreement with a major power generation supplier who provides for the urgent deployment of suitably sized generators to wastewater pump stations. Under the service level agreement the required response time for a generator to be deployed on site is one hour during normal working hours and two hours outside normal working hours. All wastewater pump stations have generator connectability.
- Dual power feeds: Critical pump stations have dual power feeds.

If a power outage affects both water and wastewater services then generally water sites will take first priority. Under these circumstances, communication with the Duty Controller (or Networks team during working hours) must occur. Proposed mobile generator deployment routes have been prepared for some areas.

The ranking of transmission wastewater sites in terms of criticality is available in the SCADA system, so that this information is readily available during an incident.

3.5.3 Response to Natural Disaster or Civil Emergencies

Watercare is a member of the Auckland Engineering Lifelines Group (AELG), a group of key Auckland utility operators who have agreed to work together to formulate an integrated and prioritised response to a significant regional natural disaster or civil emergency. Projects undertaken by the AELG include response to tsunami, volcanic activity and an extreme weather event. Watercare is also involved with the National Engineering Lifelines Group.

Watercare has an Operations Incident Management Plan for use in a natural disaster or civil emergency.

3.6 Management of Inflow and Infiltration

Inflow and Infiltration (I&I) occurs in all wastewater systems to varying degrees. It is defined as follows:

- **Inflow** is the direct entry of stormwater into private drains[2], either through a downpipe from the roof connected to the gully trap, or a low gully trap that allows water from the hard stand to flow into it. In some rare case, inflow can also occur into the public wastewater system through low-lying manholes.
- **Infiltration** refers to the water (groundwater) that enters the wastewater pipe system through cracks, joints, broken or poorly constructed pipes.

Generally, inflow occurs in private drains (with minor exceptions) while infiltration is a “shared” issue, occurring both in the private and public section of the network. A common water industry estimate is that 50-65% of I&I occurs in the private system.

Management of I&I is an important contributor to reducing wastewater overflows. I&I reduction programmes are normally implemented at catchment level as they may not always represent the most effective, financially sound, or easily implemented option.

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2 Private drains are private pipes that convey wastewater from buildings to the public wastewater system.

3.7 Management of Repeat Overflows

3.7.1 Dry Weather Overflows

Within each of the wastewater network operational areas a planning engineer has responsibility for regularly checking for repeat overflow occurrences and examining the history of the occurrences to establish the cause of the overflows. Where necessary, investigative work such as a CCTV inspection of the pipe is carried out to ascertain the cause. Following consultation with the network manager, appropriate remedial action is identified and implemented. This may include one or more of the following:

- Carrying out a spot repair on the pipe.
- Renewing or rehabilitating the pipe, which requires action by the Wastewater Planning Unit.
- Cleaning and/or including the pipe in the regular flushing programme.

Transmission pipelines are generally unlikely to block due to their size and flow rates. However, repeat overflows can potentially occur due to pumps being stopped by debris or other materials, and are investigated as above.

3.7.2 Wet Weather Overflows

Repeat overflows caused by storm events are generally managed as follows:

- The network in the vicinity of the repeat overflows is checked to ensure that all pipes are operating at full capacity and that there is no pipe failure or network blockage.
- If an individual property is affected, consideration is given to installing a non-return valve on the private drain to prevent reverse flows from the network causing overflows on the property (gulley trap). In difficult cases, a private pump station may be installed so that the property can be disconnected from the wastewater network at this point, and pumped into the network at an alternative location via a rising main.
- If the repeat wastewater overflows are more widespread, the matter is formally reported to the wastewater planning unit for investigation. The first stage will be an assessment of whether inflow and infiltration work in the catchment is appropriate, and/or whether network capacity issues need to be addressed with a capital project such as upgrading a pipeline or installing a storage facility.

Because stormwater management is an essential factor in minimising wastewater overflows, different units within Watercare regularly meet with the Auckland Council Stormwater Section.

3.7.3 Uncontrolled Overflows

Uncontrolled overflows are discharges at locations not specifically designed as an overflow point. They generally occur in the local network, when lack of capacity or partial blockages cause constraints during wet weather. However, some uncontrolled overflows may also occur from the transmission network.

Management of uncontrolled wastewater overflows is undertaken in two ways:

(1) Short-term response in accordance with the overflow response and management procedures set out in the wastewater overflow regional response manual.

(2) Investigation and remediation. Overflow incidents are recorded and reported in accordance with the procedures set out in the wastewater overflow regional response manual. Through this process, watercare determines whether an uncontrolled overflow presents a public health risk, and whether it does so on a recurring basis. Where an unacceptable public health risk is confirmed, remedial action will be initiated.

3.8 Contingency Plans

As part of its risk management approach Watercare has prepared a range of contingency planning responses for failures within the network. These comprise:

- Generic response plans (procedures) for incidents and emergencies in the network (emergency management plans, standard operating procedures).
- Logistics plans for interceptors, siphons, rising mains and large pump stations.
- Specific plans for high risk assets or events.

3.8.1 Generic Contingency Response Procedures

Generic contingency response procedures describe key steps for response to the failure of pipeline assets such as rising mains or gravity sewers. The procedures are largely based on those already in place for dry weather overflow response. However, they elaborate on specific key elements of a response, such as short-term and permanent repair options, and liaison with site neighbours.

3.8.2 Logistical Plans

Logistical plans focus on minimising the flow to the failed asset by managing pump station operation and available storage. Logistical plans are in place for a number of wastewater pipes, interceptors, siphons, and rising mains.

3.8.3 Specific Contingency Plans

Specific contingency plans describe the response to the failure of specific higher risk assets. These are normally prepared to cover the period during which a short term 'high risk' exists, either during a critical phase of a construction project or following discovery of a highly deteriorated asset, until the asset is repaired or replaced. For major pump stations, specific contingency planning involves ensuring that there are critical spares available at short notice for the pump station, such as pump units, switching equipment, valves and pipework.

3.8.4 Support for Contingency Plans

All contingency plans are supported by:

- Plant redundancy in pump stations (stand-by pumps).
- 24 hour/7 day manned control room.
- Maintenance staff stand-by roster.
- Operations staff on-call roster.
- Inventory of watercare-owned safety/operational equipment.
- Service agreement with generator supplier.
- Contact lists for key service providers – vacuum suction tankers, bypass pump systems, excavators/trucks, hire plant and equipment.
- List of (preferred) civil contractors.
- Inventory of pressure pipe repair clamps.

3.9 Customer Complaint Process

A key aspect of managing a wastewater network is dealing with day-to-day complaints and service requests.

Complaints are normally received by the Customer Service Centre and given a problem code relating to the type of issue reported. Responses to complaints are tracked using the asset management system, and Key Performance Indicators (KPIs) are used to monitor overall performance in dealing with customer complaints. KPIs typically cover response times

(depending on the level of urgency of the issue) and repair times (to restore service). A summary of the complaint process and response is shown below.

Call logged by Customer Service Centre ↓	• Each complaint/request receives a service request number. • Each complaint/request receives a problem code.
Maintenance staff respond ↓	• Response time to urgent requests is normally within 1 hour. • Response is undertaken as per relevant documented procedures. • Any overflows are contained and removed. • Blockages are cleared and/or the fault is repaired.
Operations staff follow-up ↓	• Repeat overflows or problems are investigated. • If necessary, regular flushing is programmed through the relevant asset management system. • Spot repairs are programmed if required. • Renewal is considered and a brief prepared.
Wastewater Planning Unit ↓	• Pipe capacity is assessed if a replacement is necessary. • Design requirements are determined. • Inflow & infiltration programmes are considered. • Detailed design is commenced to facilitate replacement.
Projects Unit	• Construction of the new asset is initiated. • As-built information is received from contractor. • As-built information is recorded in GIS. • Completion of project is communicated to Operations and Maintenance staff.

In addition to the measures outlined above, Watercare has customer service level standards that are set out in Watercare's Customer Charter (available on Watercare's website).

3.10 Works Over Approvals

Third party damage is one of the most common causes of asset failure. Due to the risk of third party damage, Watercare has a specialist team to monitor and control third party activity in close proximity to its assets.

There are two types of activities Watercare is concerned with - construction activities within private property and construction activities within road or public reserves. Each is managed through different but related processes. If the works are inside the clearance distances from Watercare's networks, a Works Over Approval is required before they can proceed.

Clearance distances are:

(1) For water and wastewater pipes 300mm in diameter and greater (including connected manholes and structures):

For general excavation	10 metres
For Piling	10 metres
For Blasting	15 metres

(2) For water and wastewater pipes less than 300mm in diameter (including connected manholes and structures):

For general excavation	2 metres
For Piling	2 metres
For Blasting	15 metres

Watercare does not normally give permission to build over a water main or a wastewater pressure pipes. To accommodate a building, these pipes need to be relocated at the customer's cost, and the proposed diversion must be approved by Watercare prior to starting the relocation.

The Works Over Approval process for construction activities within private property requires the completion of a Works Over Application Form, which is available on Watercare's website. The process of granting permission may require a CCTV inspection of the pipes on the property, and generally takes a minimum of 13 working days (more if the pipe requires cleaning before a CCTV inspection can be carried out). Building consent is only issued by Council if the applicant can provide a Watercare Works Over Approval.

The Works Over Approval process for construction activities within road or public reserves is different in that it is undertaken through the BeforeUDig service. This is a national online service where registered contractors obtain information about the presence of underground pipes and cables. Any request for plans is automatically directed to the asset owner/utility services. The BeforeUDig response is generated within 48 hours, and will confirm whether Watercare assets are in the vicinity of the proposed works and if Works Over Approval is required.

3.11 Linkage to Wastewater Network Planning

The Wastewater Planning Unit has an important role in minimising network discharges. Its responsibilities include:

- Arranging for the timely design, construction and commissioning of network renewal projects, as requested by operations. These projects are typically generated as a result of network operational issues, asset investigations and asset condition assessments. For network renewal projects it is important that network capacity is assessed to ensure the new pipeline is adequately sized for current and future (50 year) design flows.
- Ensuring that new infrastructure is designed appropriately. Design objectives include the operability and maintainability of the installation. Inherent flaws in the design can cause higher maintenance costs and result in higher potential for overflow. The design should also meet the desired life expectancy objectives.
- Planning for growth. Auckland is experiencing steady growth through intensification and greenfield development. Watercare plans for this growth to ensure greenfield areas are serviced in a timely manner and that the network has sufficient capacity for the increased customer base.

4 DATA MANAGEMENT

4.1 Approach

A comprehensive dataset of assets is essential for the successful operation and maintenance of a wastewater network. Watercare has both a Geographical Information System (GIS) system and an asset management system to meet data requirements. The GIS database is available to all on-line users within Watercare and provides for the following:

- Accurate spatial identification of all assets, including but not limited to pipelines, manholes, pump stations and overflow structures.
- Key attributes of the assets such as size, material and age (date installed) to facilitate maintenance and repair work.
- Information showing if the assets are currently in service, decommissioned or abandoned).
- Ability to record asset condition and criticality against individual assets.

The asset management systems record maintenance history against individual assets (and the cause of problems), the inspection history of individual assets, and maintenance costs against each asset, and schedule regular inspections or preventative maintenance work for individual assets.

For transmission assets, engineering and asset condition assessment reports and photographs relating to specific facilities or assets are stored in the appropriate vault in the Document Management System (Projectwise). Where appropriate, links are set up between the Document Management System and GIS. This allows information to be accessed via the GIS system.

4.2 GIS and As-Built Data

In Watercare's asset management system each asset is assigned a unique identifier (Equipment Code). Assets are grouped into facilities and described in the GIS database, which contains physical attribute information on every asset in the wastewater network. This information is mostly represented in map form, showing the physical location of each asset as well as the surrounding geography, infrastructure and buildings. Additional information is available in data form (for example material, diameter, length). Separate map layers are also available, depicting inspection data, condition, and pipe condition rating (risk) information. GIS maps are routinely created in either hard copy or electronic form for:

- Providing CCTV contractors with sufficient information to provide quotes.
- Cost estimates for inspection work.
- Accurate location of manhole entry/exit points for inspection work.
- Presenting inspection, condition, and risk information for analysis and reporting.
- CAPEX requests.

Maintenance of as-built plan records ensures that accurate, up-to-date information relating to the location, nature, and configuration of assets is always available to Operators and Maintenance staff.

4.3 Network Data Improvement

Network data is continually improved to facilitate more sophisticated asset management planning practices, such as identifying trends in operational statistics and asset deterioration and performance.

Maintenance contractors are required to have the technology to interface with the GIS and asset management systems to ensure that relevant asset information such as pipe diameter,

pipe material, pipe condition and cause of blockage is captured and recorded when maintenance work is being carried out.

4.4 Overflow Database

Wastewater overflows are recorded in a Microsoft Access database using the following parameters:

- Type of overflow - from a pump station, network relief point or manhole.
- Facility - name of pump station, facility code, branch trunk sewer, or local network area (northwest, central, south).
- Manhole - the number or location of the manhole which overflowed.
- The cause of the overflow - heavy rain, power failure, mechanical/maintenance failure (plant failure) or other.
- The date of the overflow.
- The start time of the overflow.
- The duration of the overflow.

The information is used for reporting and planning purposes. Repeat overflow occurrences are monitored and investigated as required (refer Section 3.8).

Attachment 8:
The Wastewater Overflow
Regional Response Manual

Wastewater Overflow Regional Response Manual

Version 1.0
May 2013

Signatories

Signed on behalf of Auckland Council Pollution Response Team

……..

Name……

Designation…….

Date…….

Signed on behalf of Auckland Council Licensing and Compliance Team

……..

Name……

Designation…….

Date…….

Signed on Behalf of Watercare Services Limited

……..

Name……..

Designation……

Date…….

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Wastewater Overflow Regional Response Plan

1. Introduction

1.1 Purpose

The purpose of this manual is to set out the roles and responsibilities between Watercare and Auckland Council in providing a regional response plan in responding to a wastewater overflow incident.

1.2 Scope

This guideline focuses on the processes required to achieve best practice when responding to a wastewater overflow. The parties jointly responsible for ensuring this are:

- Watercare Incident Controllers;
- Auckland Council Pollution Response Advisors; and
- Auckland Council Licensing and Compliance, Responsible Officers

1.3 Background

The following document has been developed using the principles behind the Dry Weather Wastewater Overflows Best Management Practice Guidelines 2006 (BMP) and outlines in more detail the operating procedures for each party responding to a Wastewater overflow incident.

In 2006, the BMP was established to create a set of processes required to achieve best practice when responding to Dry Weather Wastewater Overflows (DWSO) incidents. It is a non-statutory guideline, developed to assist and guide those involved in incident response and provide general principles for responding to DWSO incidents.

The Auckland Region is serviced by an extensive wastewater network. With the amalgamation of the region's councils in 2010 Watercare took on the majority of this network. Up until 2010, this network was operated by various Wastewater Network Operators including Franklin District Council, United Water, Manukau Water, Metrowater, Waitakere City Council, North Shore City Council, Rodney District Council and Watercare Services Ltd. The different network operators had different operating procedures and escalation requirements for remedying and cleaning up after a Wastewater overflow. Each Council also had different requirements and procedures for evaluating the health risk of a Wastewater overflow.

All Wastewater overflows present a potential risk to both the public and the receiving environment. This document differs from the 2006 BMP in that the response is based on the Wastewater overflow incident level that has been determined by the potential impact of the Wastewater overflow rather than the cause. The Wastewater Overflow Regional Response Plan will provide a consistency in approach to managing a Wastewater overflow incident across the Auckland Network, and provide the guidance and support to enable Watercare to respond to and clean-up Wastewater overflows in a consistent and efficient manner with minimal direction from the Auckland Council.

It must be noted that not all wastewater overflows are from the wastewater network. Some are caused by issues with private wastewater systems. Private overflows are the responsibility of the property owner and are not covered in this manual.

2. Environmental and Public Health Effects from Wastewater Overflows

Where Wastewater overflows result in the contamination of a waterbody or sensitive land area a wide range of potential public health and environmental effects may occur.

2.1 Ecological effects

The potential ecological effects of wastewater contamination of freshwater and marine receiving environments can be many and varied:

- Oxygen depletion – the organic matter and / or chemicals present in wastewater will strip oxygen from the water column during breakdown and chemical reaction process. If the oxygen demand of this material exceeds the receiving waters oxygen content then oxygen depletion will occur, and in extreme situations, anaerobic (lacking oxygen) conditions can develop. Under these conditions serious stress is placed on all biological life and adverse changes to biological communities can occur. The commonly observed acute effect of oxygen depletion is fish kills.

- Nutrient enrichment – nutrients in sewage (nitrogen & phosphorus) can enhance the potential for algal and aquatic plant growths. Where discharges occur to enclosed water bodies (ponds, lakes, estuaries) nutrients can cause algal blooms. High levels of algal blooms and other aquatic plants can result in adverse diurnal sags in dissolved oxygen levels. Algal bloom die-off can also lead to oxygen depletion as the associated organic matter is broken down.

- Habitat degradation – the deposition of organic material and other debris in wastewater on stream beds, on the foreshore and other receiving environments can smother and change the nature of habitats. In extreme situations, these changes can result in changes to the overall quality of the habitat, reducing the diversity of inhabiting organisms.

- Toxic effects – Chemicals such as trade wastes, ammonia, heavy metals, and organic chemicals may all be present in wastewater at varying concentrations and can be directly toxic to aquatic life.

- Water quality – A number of the ecological effects identified above result from the consequences of Wastewater discharges on water quality: oxygen depletion; reduced clarity; increased nutrient levels; toxicity.

To the observer, the most obvious adverse ecological effects of wastewater contamination are acute effects such as fish kills or algal blooms. Such effects, while rare, occur generally under situations when dilution of wastewater in the receiving environment is limited. Less obvious, though more common, are ecological changes in biological communities that may also occur when receiving environment contamination is not as extreme. These effects may often be subtle (such as reduced biological diversity and the disappearance of sensitive species) and will require expert and detailed evaluation to detect.

2.2 Public Health Effects

Wastewater overflows present a public health risk to people that may be exposed to contamination. Human wastewater will contain a range of pathogenic (disease causing) micro-organisms, such as viruses, bacteria and protozoa.

The principal public health risk associated with ingestion of soil or water contaminated by sewage includes diseases and illnesses mainly of the gastrointestinal tract. However enteric pathogens can also lead to eye and skin infections.

Possible illnesses are summarised as follows:

- bacterial diseases such as salmonellosis, campylobacter, shigellosis, cholera, typhoid, bacterial gastroenteritis;
- leptospirosis, skin infections such as staphylococcus;
- enteric viral infections caused by enteroviruses, Norovirus, rotaviruses, reoviruses adenoviruses;
- hepatitis A;
- diseases produced by parasitic micro-organisms, such as Entoameba, Ascaris, Giardia, Cryptosporidium.

The likelihood of contracting these symptoms increases with the concentration of pollution and length of exposure to polluted water. Volume of water ingested, volume of soil ingested, level of an individual's immunity, contact with mucus membranes or contact with broken skin of this polluted water could result in the development of the above diseases.

In coastal waters and freshwater bodies pathogens from human wastewater can also contaminate filter feeding shellfish, be a hazard to recreational water users such as swimmers and surfers, presenting a risk a health risk to users.

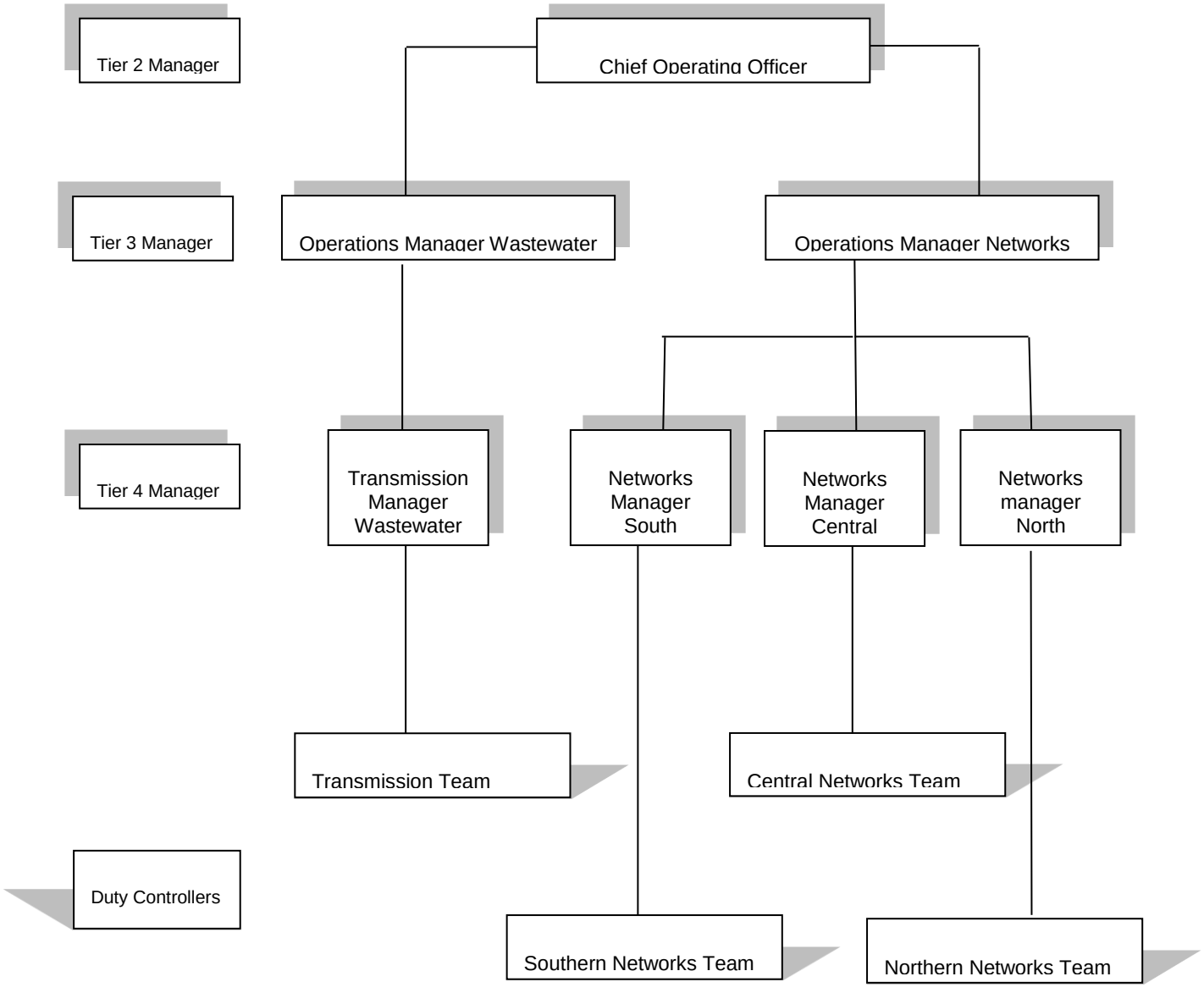
3. Key organisations Involved in a Wastewater Overflow

3.1 Watercare Watercare is owned by the Auckland Council. It is the main provider of water and wastewater services to the Auckland Region, and as such controls a large network of assets.

Watercare provides water and wastewater services to around 1.3 million people in the Auckland Region. Each day, Watercare supplies around 370 million litres of drinking water and treats around 350 million litres of wastewater and trade waste.

The management structure of the team within Watercare who are responsible for attending to Wastewater overflow incidents is shown in the below organisation chart.

Watercare Operations Organisation Chart



3.2 Watercare Service Providers

The Watercare service providers are usually the first onsite at a networks Wastewater overflow incident. They are responsible for the initial assessment and escalation of the incident and they carry out the containment, repair and clean-up actions.

3.5. Auckland Regional Public Health Service

Auckland Regional Public Health Service (ARPHS) has responsibilities under the Health Act in relation to public health issues. Its primary role in this respect is to provide technical advice and auditing of public health incidents. The ARPHS is notified by Watercare of Wastewater overflow incidents which pose significant public health risks and is contracted by the Ministry of Health to undertake investigations of outbreaks of infectious disease or illness.

The Incident Controller is responsible for ensuring that the ARPHS is notified for all level 3 incidents.

3.3 Auckland Council Licensing and Compliance Team

Auckland Council employs Licensing and Compliance, Environmental Health Officers who have responsibilities for the management of a range of public health related activities across the Region (e.g. noise, odour, environmental and public health). Where Wastewater overflow incidents pose a risk to public health the Licensing and Compliance, Environmental Health Officers have roles in:

- identifying if a health nuisance exists;
- requiring the maker of the nuisance to take appropriate remedial action to abate nuisance.

The Incident Controller is responsible for ensuring that the Licensing and Compliance Team is notified for all level 3 (covered later in this document) and above incidents.

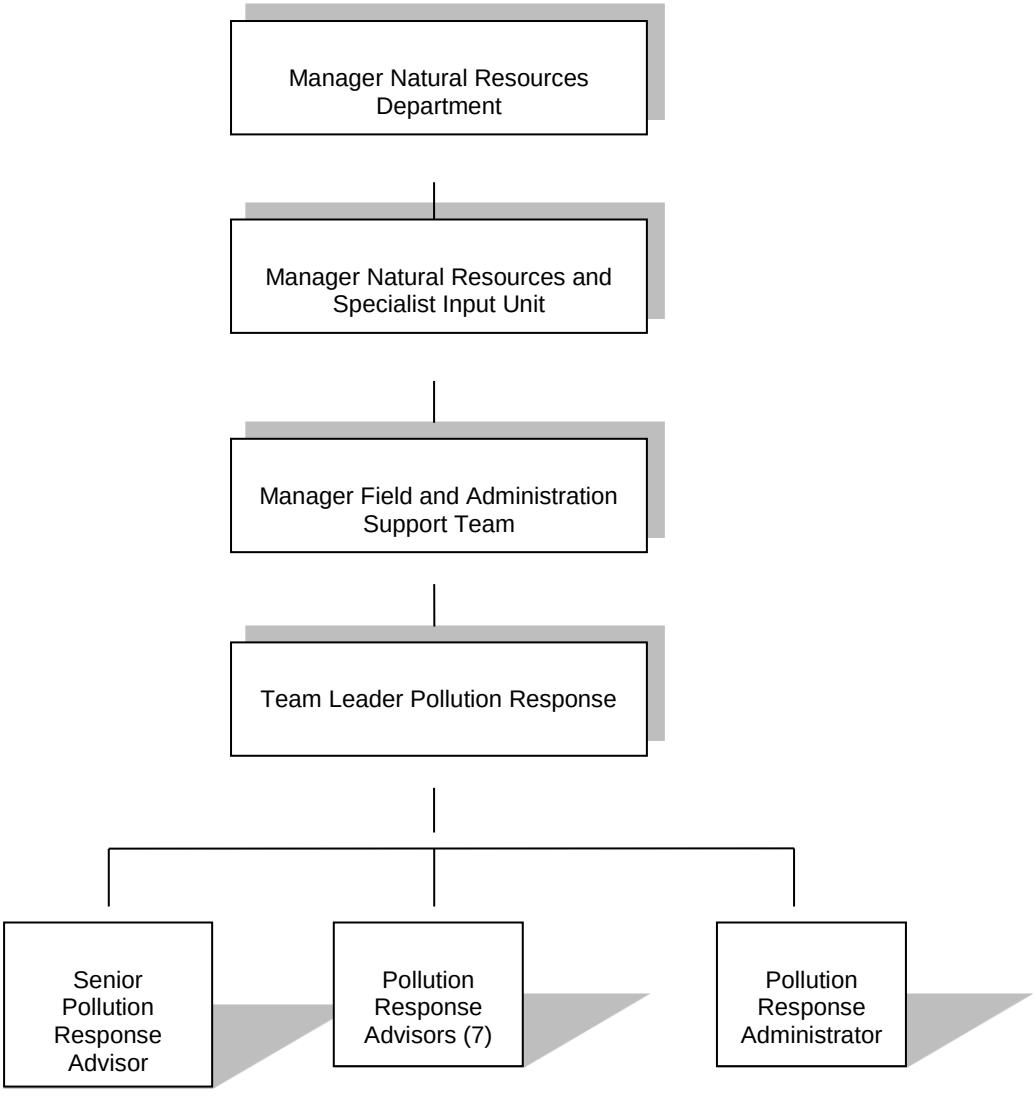
3.4 Auckland Council Pollution Response Team

The Auckland Council Pollution Response Team (PRT) provides a 24 hour pollution response service across the region in relation to its duties under the Resource Management Act (RMA) to mitigate risk to the ecological systems and responds to Wastewater overflow incidents where there is contamination, or risk of contamination, of a waterbody. This response may involve elements of:

- assessing the appropriateness of Watercare's incident response;
- investigating the incident;
- providing response advice to Watercare;
- assessing follow-up actions;
- reporting; and
- when necessary, enforcement.

The Incident Controller is responsible for ensuring that the PRT is notified for all level 2 and above incidents.

Pollution Response Team Chart



4. Definitions

Best Practicable Option

Reference is made in this manual to a best practicable option' approach to aspects of the incident management process. For the purpose of this manual, a 'best practicable option' approach is taken to mean:

- The Incident Controller and Service Providers will do what is reasonable in the circumstances, having regard to factors such as health & safety, the available resources, the physical site, access, the extent of contamination, the nature of the waterbody, and the nature of the Wastewater overflow.

Combined System

Combined systems involve a one pipe network for both waste water and stormwater. Overflows from the combined system are by nature significantly more dilute than those from separated systems. Although a separated system in some cases may act as a combined system due to illegal stormwater connections.

Duty Controller

The Duty Controller is the on-call Watercare Staff Member.

Incident Controller

The Incident Controller is a Watercare staff member with the appropriate skills and authorisations to manage a Wastewater overflow level 2 or higher incident. As an incident develops, the role of Incident Controller may need to be transferred from one individual to another, or escalated, as circumstances or needs change. The Incident Controller is responsible for ensuring the overall coordination of the response is done to best practice. All communication and reporting goes through the Watercare Incident Controller.

Land

When assessing the potential for environmental risk, land includes:

- area which does not channel water either permanently or ephemerally;
- stormwater reticulation.

Responsible Officer

An Auckland Council Licensing and Compliance staff member responsible for ensuring that the risk to public health from a Wastewater overflow is minimised or managed in accordance with best practice. They are responsible for ensuring that health nuisances in their area are not occurring and to take enforcement action to ensure mitigation where they are.

Network

- The wastewater network owned and operated by Watercare Services Limited (as the Auckland water organisation) and incorporating all assets necessary for the operation of the network, including but not limited to pipelines, pipe bridges, siphons, rising mains, overflow structures, storage facilities and pump stations. The Network is comprised of:Local network, which is the smaller pipes that convey wastewater from individual properties or housing or commercial developments to the transmission network, and
- Transmission system, which is the larger pipes that convey wastewater collected by local network pipes to the wastewater treatment plant.

Pollution Hotline Provides a 24 hour reporting system for urgent air, water, or land pollution incidents. The pollution hotline will field all the Wastewater overflow incidents for Council.

Pollution Response Advisor An Auckland Council staff member responsible for ensuring that any environmental issues relating to ecological health as a result of a Wastewater overflow are minimised and managed in accordance with best practice.

Primary Response For network overflows, the primary response phase is initiated by Watercare's service provider being dispatched to the site to commence the overflow response operation. This crew will first undertake an assessment of the nature of the incident and determine response requirements.

Safeswim Auckland Council's Safeswim monitoring programme is designed to provide regular assessments of water quality during the summer months at a range of recreational beaches in the region in an effort to reduce the risk to public health.

Secondary Response The secondary response phase focuses on incidents involving overflow to a waterbody or a sensitive land area that are classified by Watercare as a Level 2, 3 or higher incident.

Sensitive Land Includes land areas where the general public will normally have access to or are likely to congregate or there is significant risk to public or environmental health including but not limited to:

- stormwater reticulation;
- council play grounds;
- parks and reserves;
- roadways;
- residences;
- schools and childcare centres;
- playing fields;
- accommodation complexes under multiple ownership; and
- tourist attractions.

Separate System Separate systems provide a dedicated pipe network solely for waste water while stormwater from the same area goes to a different pipe system.

Wastewater Overflows Wastewater overflows can occur from emergency overflow outlets at, or upstream of pump stations, from manholes, or from the ground in the case of Wastewater breakages and may result in wastewater contamination of land and waterbodies. They can be categorised as either:

Spill A spill is a Wastewater overflow that involves an overflow onto adjacent land without any wider environmental contamination and potential health risk is limited to one household (private

property). These incidents can be remedied without any adverse public health or environmental consequences. This is a level 1 incident.

Wastewater Overflow Incident

A Wastewater overflow is an incident where the conveyance failure results or has potential to result in a discharge to a waterbody, or onto sensitive land. This is a level 2 or higher incident. These can be further categorised as a Wet Weather Overflow (WWO) or a Dry Weather Wastewater Overflow (DWSO)

WWO

WWOs are most commonly caused by high flow resulting from heavy rain. Inflow and infiltration of stormwater results in excess flow, which can exceed the design capacity of Wastewater pipelines and pump stations.

WWOs are usually predictable as to location e.g. flood points.

DWSO

A DWSO is a discharge from the wastewater network that occurs when conveyance capacity is reduced by a break, blockage, bottleneck or some other failure in the reticulation.

For the purposes of this manual all notified Wastewater overflows whether caused by a wet weather or dry weather event are escalated in accordance with 5.2 Wastewater Overflow Incident Levels.

Site Manager

The Site Manager may be part of the Watercare service provider team or a Watercare staff member with the appropriate skills to manage a Wastewater overflow level 2 incident. The Site Manager is responsible for the coordination of the incident on site in the absence of the Incident Controller. The Site Manager reports directly to the Incident Controller who remains responsible for delegating the appropriate tasks to the Site Manager and ensuring the overall coordination of the response is done to best practice.

Waterbodies

When assessing the potential for environmental risk, waterbodies includes:

- streams;
- wetlands;
- ponds/lakes;
- groundwater aquifers;
- beaches;
- open coasts; and
- harbours and estuaries.

When assessing potential for public health issues, a recreational water area is a water body that has potential use for contact recreation activities. This may include a beach, lake area or a stream that runs through a public reserve and is likely to be accessed by the public for contact recreation activities and/ or food gathering.

5. Incident Escalation

5.1 Introduction

A Wastewater overflow incident follows the escalation process according to each agency's Incident Management Plan.

Where the overflow involves discharge to a sensitive land area, a waterbody, where there is risk of discharge to a waterbody, or there are other significant triggers identified, a range of parties may need to be involved in the response. For example, Watercare staff and Service Providers, the Auckland Council Pollution Response Team and Licensing and Compliance Team or the Auckland Regional Public Health Service. A higher level of technical support, supervision, incident control and management will be required to ensure that the response is appropriate and to manage communications between the parties. In this instance a Watercare Incident Controller is required to coordinate the overall response. Incident levels are assigned based on the nature, management complexity and scale of an incident. A Wastewater Overflow Incident generally falls into a Level 2 or higher incident. The sections below summarise the escalation levels as it relates to a Wastewater overflow Incident for each agency.

Where Watercare has been notified of a Wastewater overflow during a wet weather event then the overflow is escalated as below. In the case of a wet weather overflow, the immediate effects can be diluted with the volume of stormwater also present. This should be taken into account when determining the incident level.

5.2 Wastewater Overflow Incident Levels

Escalation Level	**For all teams**
One (Spill)	A level 1 incident is capable of being managed as a matter of routine operations, resolved in a reasonable timeframe and where there is one or more of the following: • ground containment; • no discharge to a water course; • contamination of less than 50 sqm of adjacent ground; • no property damage; • public health risk limited to one household (Private property); and • no effect on in-stream ecology.
Two (Minor Overflow)	A level 2 incident is capable of being managed as a matter of routine operations, resolved in a reasonable timeframe and where there is one or more of the following: • a discharge to an open water course or piped storm water system and where natural dilution or containment minimises the impact on the water body; • there is a low ammonia reading 100m downstream (<3ppm); • potential impact on fish/wildlife; • contamination of greater than 50 sqm of adjacent ground; • minimal effect on in-stream ecology; • property damage less than $1000; • potential health risk limited to 2 households (private property); or • potential health risk limited to less than 10 people (sensitive public place).

Three (Significant Overflow)	A level 3 incident requires escalation due to complexity, consequential effects and involvement of communications and other specialist support where there is one or more of the following: • short term of less than 4 hours of high volume/rate or an extended duration of less than 12 hours (from time of notification) of low volume/rate discharge to water body or sensitive land and where minimal dilution or containment is possible; • there is obvious contamination of stream/water body or the stream is anoxic and or black; • there is reasonably high ammonia readings (>3ppm) 100m downstream; • potential impact on in-stream ecology; • in-stream ecology is stressed; • potential impact on shellfish gathering; • potential impact on recreational bathing; • property damage less than $10,000; • health risk to more than 2 households (private property); • heath risk to more than 10 people (sensitive public place); or • prosecution is possible.
Four (Major Overflow)	A level 4 incident requires escalation due to complexity, consequential effects and involvement of communications and other specialist support where there is: • prolonged duration of greater than 4 hours of high volume/rate or greater than 12 hours (from time of notification) of low volume discharge to waterbody or sensitive land where no containment is possible; • the stream is anoxic and/or black; • definite impact on fish/wildlife, severely stressed or dead; • definite impact on shellfish gathering; • definite impact on recreational bathing; • property damage greater than $10,000; • definite health risk to more than 10 households (private property); • definite health risk to more than 100 people (sensitive public place); or • prosecution is likely.
Five (Catastrophe)	A level 5 incident is a catastrophe or a Civil Defence State of Emergency. A level 5 incident is coordinated by the Executive Management Team due to consequential effects, incident management complexity and multi-agency involvement and may be triggered by a Regional or National Civil Defence Emergency or a regional Water Services event of extreme nature.

6. Key Timelines –KPI's

Watercare Service Provider on site	Within 1 hour of receipt of a dry weather sewer overflow notification. For local network WWOs, the Watercare Service Provider can be sent to site after the weather event has occurred.
Initial notification to the Auckland Council	As soon as practical within 1 hour of the Incident Controller confirming the overflow as a level 2 or above.
Initial notification to the Auckland Regional Public Health Service	As soon as practical within 1 hour of the Incident Controller confirming a level 3 or higher Wastewater overflow incident.
Incident Controller on-site	Within 1 hour of being notified of the circumstances requiring attendance to a level 2 incident.
Close-out notification to the Auckland Council and Auckland Regional Public Health Service.	Within 10 working days of incident closeout.

Wastewater Overflow Incident Response Procedures

Watercare Incident Controller Procedures Manual

Watercare Incident Controllers

7. Watercare Escalation and Response Process

The key components of a Wastewater Overflow response and escalation process from Watercare can be described in three interrelated phases:

- incident notification and initial assessment;
- primary response;
- secondary response.

7.1 Notification and Assessment

Potential Wastewater overflow incidents should be assessed in the first instance by the Control Room Operator, Call Centre and Service Provider.

The Watercare Control Room Operator and the Watercare Call Centre can become aware of Wastewater overflow incidents via the following sources:

- notification from a Watercare Service Provider;
- member of the public or Watercare staff;
- referrals from Auckland Council Pollution Response Team;
- referrals from the Licensing and Compliance Team;
- referrals from Auckland Regional Public Health Service; or
- SCADA alarms.

For a transmission incident, the Watercare Control Room Operator will immediately notify the appropriate Watercare Duty Controller who will then attend the incident as the Watercare Incident Controller.

For a local network incident the Watercare Call Centre will immediately notify the Watercare Service Provider who will then initiate the primary response process. Where the notification has been called in by the Auckland Council Pollution Response Advisor or Licensing and Compliance, Environmental Health Officer then the Watercare Call Centre would also immediately notify the appropriate Watercare Duty Controller who would then manage the incident as the Watercare Incident Controller, unless notified as a level 1 incident.

When a severe weather warning is made, the Watercare call centre will alert the Service Provider who will attend to some of the known trouble spots and any call outs as required during the event. The Service Provider will generally commence the clean-up operation after the weather event has occurred.

Preliminary details are logged into Watercare's HANSEN/SAP Database.

Primary Response

For network overflows, the primary response phase is initiated by Watercare's Service Provider being dispatched to the site to commence the overflow response operation. This crew will first undertake an assessment of the nature of the incident and determine response requirements.

It is recognised that clean-up of paved or impervious surfaces requires different processes compared to clean-up of porous surfaces such as garden soil.

Where the incident is level 2 or higher the Service Provider will escalate the incident to the Watercare Duty Controller who will initiate the secondary response phase.

Escalation Level For all teams

One (Spill) A level 1 incident is capable of being managed as a matter of routine operations, resolved in a reasonable timeframe and where there is one or more of the following:

- ground containment;
- no discharge to a water course;
- contamination of less than 50 sqm of adjacent ground;
- no property damage;
- public health risk limited to one household (Private property); and
- no effect on in-stream ecology.

Two (Minor Overflow) A level 2 incident is capable of being managed as a matter of routine operations, resolved in a reasonable timeframe and where there is one or more of the following:

- a discharge to an open water course or piped storm water system and where natural dilution or containment minimises the impact on the water body;
- there is a low ammonia reading 100m downstream (<3ppm);
- potential impact on fish/wildlife;
- contamination of greater than 50 sqm of adjacent ground;
- minimal effect on in-stream ecology;
- property damage less than $1000;
- potential health risk limited to 2 households (private property); or
- potential health risk limited to less than 10 people (sensitive public place).

Three (Significant Overflow) A level 3 incident requires escalation due to complexity, consequential effects and involvement of communications and other specialist support where there is one or more of the following:

- short term of less than 4 hours of high volume/rate or an extended duration of less than 12 hours (from time of notification) of low volume/rate discharge to water body or sensitive land and where minimal dilution or containment is possible;
- there is obvious contamination of stream/water body or the stream is anoxic and or black;
- there is reasonably high ammonia readings (>3ppm) 100m downstream;
- potential impact on in-stream ecology;
- in-stream ecology is stressed;
- potential impact on shellfish gathering;
- potential impact on recreational bathing;
- property damage less than $10,000;
- health risk to more than 2 households (private property);
- heath risk to more than 10 people (sensitive public place); or
- prosecution is possible.

Four (Major Overflow) A level 4 incident requires escalation due to complexity, consequential effects and involvement of communications and other specialist support where there is:

- prolonged duration of greater than 4 hours of high volume/rate or greater than 12 hours (from time of notification) of low volume discharge to waterbody or sensitive land where no containment is possible;
- the stream is anoxic and/or black;
- definite impact on fish/wildlife, severely stressed or dead;
- definite impact on shellfish gathering;
- definite impact on recreational bathing;
- property damage greater than $10,000;
- definite health risk to more than 10 households (private property);
- definite health risk to more than 100 people (sensitive public place); or
- prosecution is likely.

Five (Catastrophe) A level 5 incident is a catastrophe or a Civil Defence State of Emergency. A level 5 incident is coordinated by the Executive Management Team due to consequential effects, incident management complexity and multi-agency involvement and may be triggered by a Regional or National Civil Defence Emergency or a regional Water Services event of extreme nature.

7.2 Appointment Incident Controller

Once an incident is confirmed to the Duty Controller, the Duty Controller is responsible for escalating the incident to the appropriate Tier 4 Manager, who will assess the situation against the classifications for each incident level described in Chapter, 5.2 Wastewater Overflow Incident Levels, and decide if an incident needs to be declared and escalated to the next level of seniority. The Tier 4 Manager appoints an Incident Controller who then manages the incident through to resolution, by creating an action plan and mobilising required resources and facilities in accordance with chapter 8.0Watercare Incident Controller Procedures in this manual.

Level 1 Level one incident's are normally handled as business as usual by the Watercare Service Provider. No involvement is required by a Watercare Incident Controller.

Level 2 During business hours, the Incident Management Team reflects the Watercare organisational structure and in this instance the Tier 4 Manager/ Operations Controller assumes or delegates the role of Incident Controller.

After hours, the rostered Duty Controller has primary responsibility for responding to and managing overflow incidents and assumes the role of "Incident Controller". Depending on the nature and scale of the incident, other Watercare staff may be required to assist or assume specific duties.

Level 3 The Tier 3 Manager assumes or delegates the role of Incident Controller.

Level 4 The Tier 2 Manager / COO assumes or delegates the role of Incident Controller.

Level 5 The Chief Executive assumes or delegates the role of Incident Controller.

7.3 Incident Escalation

The Incident Controller is responsible for continually revaluating the incident against the classifications identified in chapter 5.2 Wastewater Overflow Incident Levels and escalating as required.

Incidents that are identified as Level 3 and above are formally declared by the Incident Controller. This can be done via direct contact, group email and/or SMS. All resources required to respond to the incident are mobilised by direct personal voice contact over the telephone, or in person.

When declaring an incident, the following information is required to be included as a minimum:

- incident description;
- Incident Controller;
- contact;
- location;
- level of service effects (as known); and
- date / time.

7.4 Incident Management

The same incident response processes are followed independent of incident level and are covered in chapter 8.0 Watercare Incident Controller Procedures of this manual. The seniority of the Incident Controller and the size and seniority of the incident management team changes based on the risks identified at each incident level.

7.5 Incident Controller Onsite Attendance

For a level 2 incident it may be appropriate for the incident to be managed on site by a Site Manager under the direction of an Incident Controller who is based off site. The Incident Controller remains responsible for ensuring that the incident is managed in accordance with the Watercare procedures for Wastewater Overflows.

The Incident Controller **must attend** the site in person within 1 hour of notification, when the incident involves:

- distressed public;
- key customers;
- care customers*;
- habitable floor contamination;
- damage to property or people;
- an expected timeframe of greater than 4 hours to stop flow to waterbody or sensitive land and clean-up; or
- all incidents classified by Watercare as a level 3 or higher.

Whenever on-site the Incident Controller should be clearly identifiable.

* **Care Customers**: Needs based. These customers have a higher reliance on uninterrupted supply and cannot tolerate a decrease in water quality services i.e. hospitals and home dialysis customers. While the services required by these customers are primarily the same, uninterrupted supply and no decrease in water quality, each has a slightly different set of relationship requirements. In most cases there are also customer specific requirements.

8. Watercare Incident Controller Procedures

8.1 The Incident Controller Role

It is the role of the Incident Controller to manage the response to a level 2 or higher Wastewater overflow incident. This role includes;

- **incident assessment** and incident escalation**;**
- **notifying** the Auckland Council and Auckland Regional Public Health Service;
- **managing the response** including, action plans for containment, repair clean-up and community relations;
- ensuring that all appropriate health and safety measures are taken,
- ensuring that the overflow response is in accordance with best practice;
- providing technical support and direction to the Watercare Service Provider;
- ensuring appropriate activities are undertaken by Watercare Service Provider;
- ensuring that environmental monitoring is undertaken as required in support with the Environmental Health or Public Health Officer;
- reviewing and assessing the Watercare Service Provider response and the ongoing overall assessment of incident to ensure no activity has been over-looked;
- reviewing and assessing the clean-up process;
- keeping a detailed log of events, actions, and impacts, in particular noting the nature and times of specific response times and recording of causes and required repairs;
- providing situation reports as required;
- upgrading or downgrading incident with changing situation;
- developing work plans for the next work period if needed;
- **establishing and maintaining effective communication** the Incident Controller is the central point of contact for all parties involved in the response;
- **closing-out the incident**;
- confirming that clean-up has been completed;
- assessing the need for any additional remedial works to prevent recurrence;
- confirming that the incident has been managed in accordance with best practice;
- **incident reporting** including conducting incident debriefs; and
- confirming that the process has been appropriately documented.

A copy of the key roles and responsibilities for an Incident Controller is included in Appendix A. This is quick guide and reference that can be used on site.

8.2 Watercare Incident Controller Key Responsibilities

8.2.1 Introduction

This section details the key responsibilities for an Incident Controller in managing the secondary response to a Wastewater overflow incident level 2 or higher.

A comprehensive checklist of responsibilities that follow this section is found in Appendix B. This should be filled in during the response to ensure all of the key steps have been undertaken and will help form the basis of the incident log and action plan.

A Wastewater Overflow Assessment Form is required to be filled in during the management of the Incident. Refer to Appendix C for a copy of this form.

8.2.2 Incident Assessment

The Incident Controller, once appointed, shall ascertain and/or confirm with the Service Provider and /or the Control Room Operator or Call Centre or Pollution Response Team Advisor:

- the site;
- time of original notification;
- reason for the overflow;
- the duration of the overflow (if available) (the overflow may still be in progress at the time of notification);
- description of incident, (what proportions is it?);
- discharge flow rate, (can it be easily contained?); and
- where the overflow is going to determine sensitivity of the area, (is the overflow going for example to a waterbody, beach, playground or similar?).

Determine Incident level

The Incident Controller shall determine from the details provided whether the overflow is a level 2 incident or if it needs to be escalated and is a level 3 or higher Incident following the procedures in chapter 5.0 Incident Escalation and Control.

Determine Onsite Attendance

The Incident Controller shall determine if there is a need to attend the site in person, as detailed chapter 7.5 Incident Controller Onsite Attendance.

Confirm Immediate Actions

The Incident Controller shall confirm that the Service Provider has implemented the steps outlined below while awaiting additional resources:

- the Health & Safety procedures;
- evaluated containment options utilising available resources. A best practicable option approach should be made to installing preliminary containment utilising the resources available. The primary options might include:
  - excavation of shallow storage trench at or around point of discharge;
  - creation of cut-off bund around point of discharge or to divert flow;
  - sandbagging (if available); or
  - if overflow might enter or is entering the stormwater system, blocking stormwater grates (or other points of entry).
- commence repairs having either installed preliminary containment or established that preliminary containment is not feasible or needed with the resources on-hand, commence repair of the overflow.

8.2.3 Notification of Auckland Council and Auckland Regional Public Health Services

The Incident Controller shall ensure that for all incidents level 2 and above;

- the Auckland Council is notified using the pollution hotline number as soon as practical within 15 minutes of the Incident Controller confirming a level 2 or higher overflow;
- the Auckland Regional Public Health Service is notified as soon as practical within 1 hour of the Incident Controller confirming a level 3 or higher overflow;
- an email notification is also to be sent to both the Auckland Council Pollution Response Team and the Auckland Regional Public Health Team to advise of level 3 responses and above.
- the information given to the Council includes:
  - address and location of incident;
  - incident level;
  - if it has entered or has the potential to enter a watercourse or sensitive land area; and
  - Incident Controllers name and contact details; and
  - the Site Managers name and contact details.

This notification may be undertaken by the Service Provider under the direction of the Incident Controller.

8.2.4 Response Management

The Incident Controller is responsible for ensuring the processes below are followed and that the appropriate actions are taken.

Depending on the nature of the incident some of the below procedures may be delegated to the Site Manager.

Ensure Health and Safety

The Site Manager (and when on site the Incident Controller) must ensure that appropriate on-site health & safety provisions and site controls are established and maintained throughout the incident. For requirements on health and safety refer to Watercare's Health and Safety Policy.

Ensure Public Safety

The Site Manager (and when on site the Incident Controller) must protect public health and safety where the public have access to areas contaminated by Wastewater overflows, or where the public may be placed at risk by works associated with the response. This will likely involve establishing appropriate site perimeter controls to secure the site, possibly including the placement of site safety warning signage, cones and warning tape at the site perimeter or at public access points. These controls should remain in place until risks to the public created by the Wastewater overflow incident have been removed.

Use appropriate Public Health signage

The Incident Controller shall be responsible for ensuring appropriate temporary public health warning signage is in place within the immediate vicinity of the overflow where it is required. This should be done as soon as possible following the contamination.

This task may be delegated to the Site Manager who is to report back to the Incident Controller that it has been done with photos where appropriate.

A decision on deploying and locating other public health warning signage will be undertaken by the Environmental Health Officer.

Assess the Situation

The Incident Controller shall, once on site or through discussions with the Site Manager, evaluate the seriousness of the incident and establish the details of the current situation.

For example;

- what is the cause of the overflow?
- what is the flow rate? (record)
- estimate how long the overflow may have been occurring prior to notification;
- has the overflow been stopped? If not how long it may take to fix?
- what is the sensitivity of area where overflow it is going to? i.e. has the overflow reached a waterbody or likely to before containment and/or is there significant risk to public health?
- has the overflow been contained? Can it be contained?
- identifying environmental compliance issues (for example protected areas/sites or working within the drip line of trees).

The Incident Controller shall re-evaluate the need for escalation in accordance with chapter 5.0 Escalation and Control.

Undertake Environmental Monitoring

The Incident Controller is responsible for ensuring that environmental monitoring is undertaken where the overflow is going to a waterbody.

The Incident Controller shall, following the procedures outlined in Appendix D Environmental Monitoring, investigate how far downstream the waterbody has been contaminated by measuring the ammonia levels at point of entry, 5m downstream and 100m downstream.

Where the responsibility for undertaking the environmental monitoring is delegated to the Site Manager, the Site Manager is to report back to the Incident Controller that it has been undertaken and keep records of the results.

The results of the environmental monitoring will identify requirements for containment/ repair and clean-up needed within the waterbody.

For fish relocation processes please refer to Appendix G.

Create Action Plan

The Incident Controller in consultation with the Site Manager shall develop an action plan using the Incident Controller Action Plan Checklist as a guide (Appendix B). The Action Plan provides a direction and focus for the response and is a reference point for all members of the Incident Response Team. It also provides essential continuity during change-over periods.

The Incident Controller shall:

- identify causes and develop recovery plans;
- provide technical support and direction to the Service Provider;
- ensure that the response is in accordance with best practice; and
- regularly review and update the action plan as required.

Identify Resources Required

The Incident Controller shall, in consultation with the Site Manager, identify the resources required for repair and containment and ensure that the required resources are or will be attending (e.g. clean-up crew(s), water blaster(s), sucker truck(s), pump(s) etc).

Personnel resources will reflect normal business organisational structures, or the on-call roster if after hours. Additional personnel can be seconded from other business units as may be required, particularly in extended duration or large scale incidents and when a changeover team is required.

The Pollution Response Team will provide advice on resources required where possible.

Evaluate Containment Options

The Incident Controller, in consultation with the Site Manager, shall ensure suitable containment is in place including determining:

- the best approach for minimising or containing the overflow;
- priorities for siting the containment:- what should be done to minimise effect of overflow (e.g. deployment of a sucker truck at or near the source of the overflow);
- the best containment options i.e. how the overflow should best be contained (e.g. plugging of cesspits, isolation of overflow area by means sandbags, deployment of sucker trucks/pumps etc); and
- the best containment options for overflows to a waterbody, e.g. containment in stream or pumping contaminated water from the stream. For more information on containment and repair options refer to Appendix E.

The Pollution Response Team will provide advice on containment where possible.

Undertake Containment and Repair

The Incident Controller shall review and direct containment and repair measures.

Containment and repairs are mostly undertaken by the Watercare Service Providers.

- Can the repair be done immediately or will a temporary repair be needed with further work at a later stage?

Where the Incident Controller is off-site the Site Manager will in discussion with the Incident Controller undertake the required responses. The Site Manager is to report to the Incident Controller all actions taken with photos where appropriate.

The Incident Controller shall maintain a record of the cause and required repair.

Undertake Clean-up and Recovery

The clean-up will normally be undertaken by Watercare's Service Providers and this will generally commence following the establishment of containment and repair of the overflow.

The Site Manager is to report to the Incident Controller all actions taken with photos where appropriate.

Clean-up may include removal of;

- solids;
- paper;
- sanitary goods/debris;
- dead fish;
- downstream contaminated water; and
- contaminated soil.

If flushing of a watercourse is to be undertaken, the following process should be followed:

- Incident Controller is to confirm clean-up is complete to a point where only flushing could further improve the environment;
- Incident Controller to confirm with Auckland Council Pollution Response Team that flushing can be undertaken. This confirmation shall be documented;
- the Pollution Response Team will provide advice on flushing where possible;
- if mains source chlorinated drinking water is used, then flushing should be undertaken using Watercare's Best Management Plan for Treated Drinking Water Discharges; and
- the flushing discharge should occur in accordance with guidance from the Auckland Council Pollution Response Team.

If stream drying is required, this should only be done under the guidance of the Pollution Response Advisor.

For more information on clean-up procedures refer to Appendix F Contaminated Soils and for flushing procedures please refer to Appendix H.

Disinfecting the Area of Contamination

The Incident Controller will ensure that where disinfecting of the site is required, best practice procedures are identified according to the location and site requirements.

Discharges of disinfectant to stormwater or natural water should not occur.

The Incident Controller will be responsible for liaison with the Auckland Regional Public Health Service.

For more information please refer to appendix I.

8.2.5 External Communications Management

The Incident Controller is the central point of contact for all parties involved in the response including but not limited to:

- the Watercare Call Centre;
- the Watercare Service Provider;
- the Site Manager;
- the appropriate people within the Auckland Council's Pollution Response Team and Licensing and Compliance Team and the Auckland Regional Public Health Service;
- other Watercare personnel and network team members; and
- neighbourhood and public.

Where either the Auckland Council Pollution Response Team or Licensing and Compliance, Environmental Health Officer offers advice on aspects of the response, this advice must be directed through the Incident Controller at all times.

The Incident Controller will assess and act on that advice, having regard to any health & safety implications of the advice, and to the feasibility and likely effectiveness of any associated actions.

Media

All media enquiries must be directed to Watercare's Communications Team. Where any of the response team receives an enquiry from media they must refer them to Watercare's Communications Team and advise the Incident Controller of the media enquiry, who will then advise the appropriate Tier 3 Manager.

Community Relations

The Incident Controller is responsible for neighbour and public relations and minimising neighbour disturbance, where activities may require access onto private land, or involve emergency work after hours and/or require the use of noisy equipment.

Where appropriate a standard letter with general information shall be given to residences affected by the incident. Refer to Watercare specific appendix. for a copy of the standard letter.

When the Incident Controller is not on site, the Site Manager is responsible for ensuring that this is done. The Site Manager is to report back to the Incident Controller on actions taken.

Where significant adverse neighbourhood disturbance may occur as a consequence of works, consideration of limiting the extent of after-hours work may be appropriate. The Incident Controller shall make a decision in limiting afterhours works in consultation with the Licensing and Compliance, Environmental Health Officer, and where the incident involves contamination of a waterbody, from the Auckland Council Pollution Response Team.

8.2.6 Incident Closeout

Overflow close-out can occur when confirmation of clean-up and all phases of the response have been completed.

The Incident Controller is responsible for:

- confirming that clean-up has been completed;
- confirming the results from environmental monitoring;
- assessing the status of public health warnings, establishing whether existing warning signage can be removed from the immediate vicinity in consultation with an Environmental Health Officer;
- approving of and confirming that containment works (e.g. sandbags) have been removed;
- assessing the need for any additional remedial works to prevent recurrence;
- confirming that the incident has been managed in accordance with best practice;
- confirming that the process has been appropriately documented; and
- Determining and recording if the Wastewater overflow was caused by a dry weather or wet weather event.

8.2.7 Incident Reporting

The cause of all Wastewater overflows level 2 or higher must be investigated as soon after the incident as possible. There is an expectation that the outcome of investigation will be the implementation of measures to prevent (similar) recurrences.

Incident Response Form

The Incident Controller shall ensure that the Wastewater Overflow Incident Assessment Form is competed.

External Reporting

The Incident Controller shall ensure that the Auckland Council and the Auckland Regional Public Health Team is emailed within 10 working days of close out being completed, a short summary of relevant key details including:

- type of receiving environment;
- actions taken such as:
  - level of containment and clean-up;
  - ammonia testing results if undertaken;
  - treatment used, deployment;
  - removal of signage; and
  - Auckland Council involvement.
- The name of the service provider

Note: Emailed report summaries for overflow incidents will include copies of the Wastewater Overflow Incident Assessment Form.

Internal Reporting

The Incident Controller is responsible for ensuring the appropriate reporting is undertaken as per Watercare incident reporting requirements.

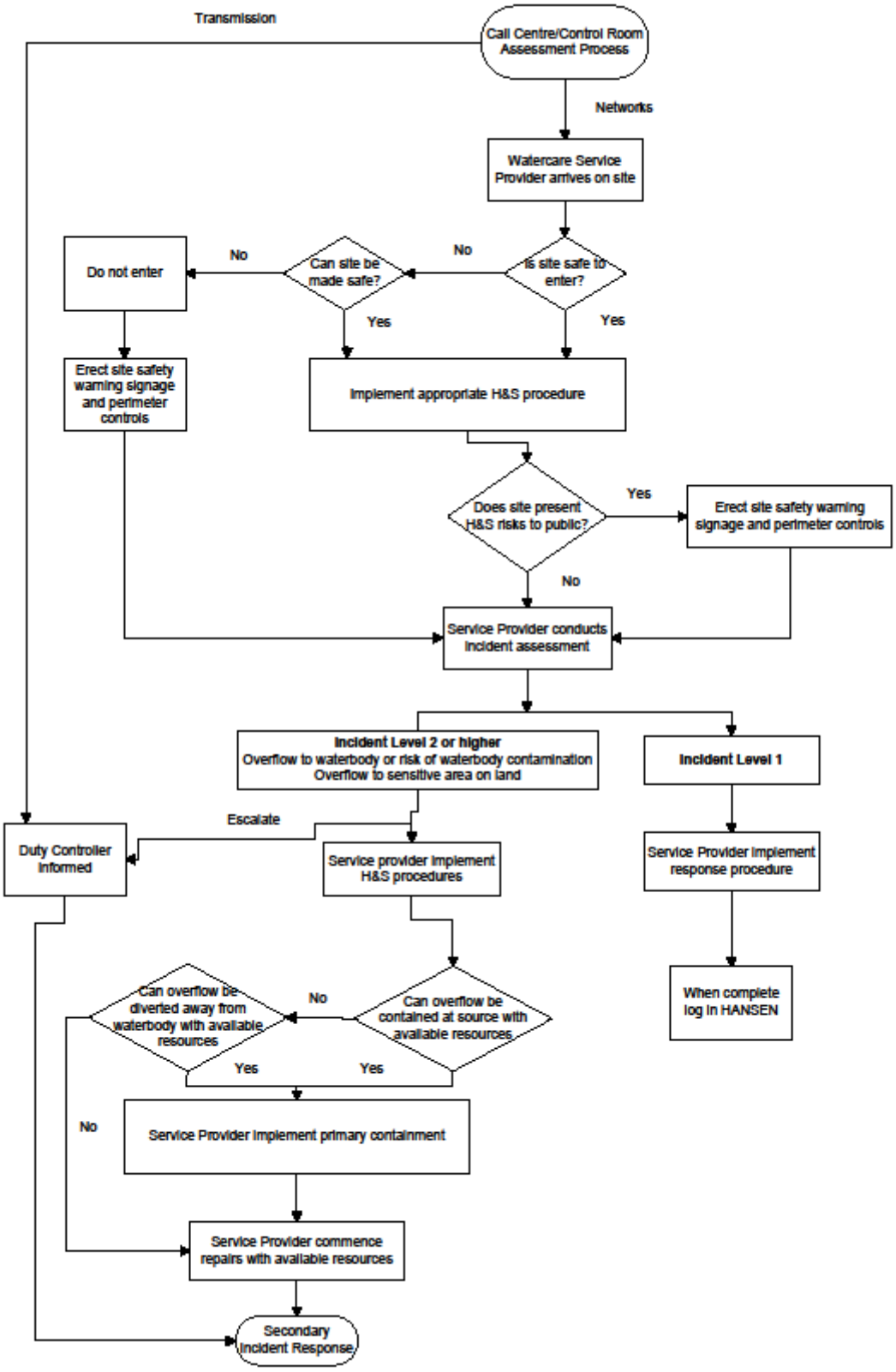
8.2.8 Incident Debrief

De-briefings maybe conducted after level 3, 4 and 5 incidents and planned exercises or as directed by Chief Operations Officer, as appropriate. The purpose of a de-brief is to use the experiences and lessons learned during the incident or exercise to make improvements, so that incidents can either be prevented from occurring again or, if they do occur, they are managed more effectively. De-briefings are also used to identify and recommend other risk mitigation measures that may be required e.g. capital works.

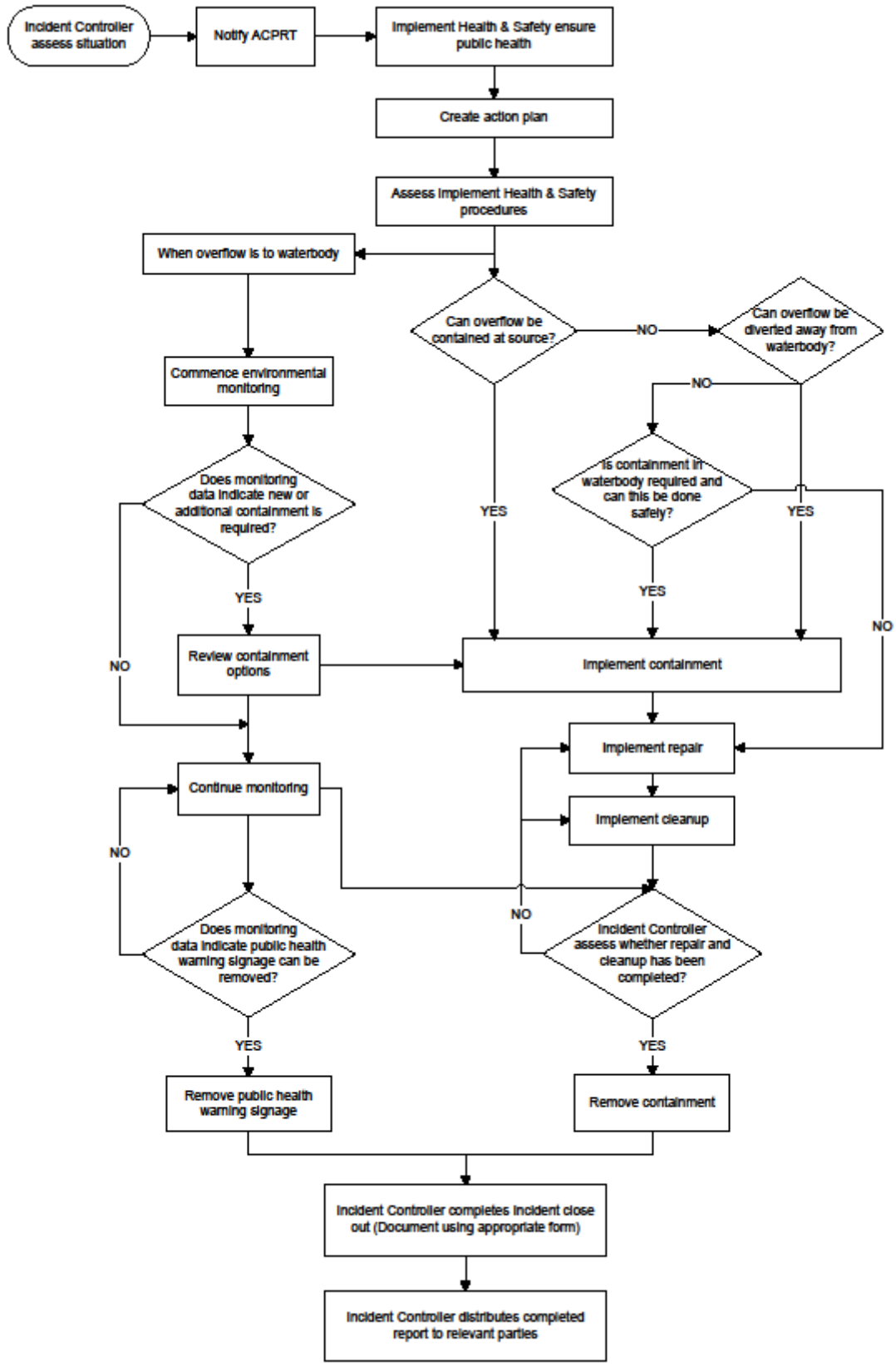
De-briefing is to be undertaken as per the Watercare Incident Management Plan.

9. Watercare Incident Response Flow Charts

9.1 Primary Response



9.2 Secondary Response Watercare



Pollution Response Team Procedures Manual

Auckland Council Pollution Response Team

10. Pollution Response Team Escalation Process

10.1 Notification

Watercare will notify the Pollution Hotline of all Wastewater overflow incidents level 2 and above.

Any reports of Wastewater overflows received from Watercare by the Auckland Customer Services Call Centre should be re-directed to the Pollution Hotline.

Where a call is received from a member of the public, and where it is identified from the conversation that the Wastewater overflow is from a Watercare asset, the customer should be asked to report the incident to Watercare directly.

When a call is received from Watercare, the Pollution Hotline should record:

- location of overflow;
- where the overflow is going (is the overflow going for example to a waterbody, beach, playground or similar?);
- incident level (1-5);
- who the Incident Controller is and contact details;
- who the Site Manager is and contact details (this is normally the Watercare Service Provider on site).

For all reported incidents classified as a level 2 and above the Pollution Hotline staff will notify the relevant Pollution Response Advisor (PRA) on call.

10.2 Incident Escalation

Once an incident is confirmed, the PRA must assess the risk to the environment based on the receiving environment and ammonia readings (where known) or the risk based on other factors such as hydrological parameters (flow rates and size) and duration of overflow.

The PRA is responsible for assessing the information received and classifying the incident in accordance with chapter 5.2 Wastewater Overflow Incident Levels.

Level 1 There is normally no involvement by the Pollution Response Team.

Level 2 PRA will record the information but defer to the Watercare Incident Controller (see below PRA Onsite Attendance) with probable site attendance required.

Level 3 The on-call PRA to attend to the site in person.

Level 4 and above The on-call PRA will prioritise the response to a level 4 and 5 incident.

10.3 Pollution Response Advisor Onsite Attendance

The PRA will likely attend a level 2 incident and will attend significant incidents (level 3 or over) as soon as possible.

The PRA may attend a Wastewater overflow incident on a random basis to ensure consistent and comprehensive clean-up is being undertaken region wide.

For a level 2 incident, it may be appropriate for the incident to be managed over the phone with the Watercare Incident Controller, where there is:

- a low flow rate to a waterbody; and
- low risk of contamination; or
- there are low ammonia readings (<3ppm) 100m downstream.

The PRA will attend the site in person, when any of the following parameters are present:

- an overflow has been flowing steadily into stormwater/stream for more than 4 hours;
- there is a reasonably high ammonia reading 100 (<3ppm) downstream; or
- the discharge is from an industrial catchment or the stream is anoxic or black.

The PRA will prioritise the incident and attend the site in person when:

- an overflow is flowing steadily into stormwater/stream for more than one day;
- there is a high ammonia reading (<6ppm) 100m downstream;
- when requested by the Watercare Incident Controller; or
- the incident is classified as a level 3 or higher incident.

11. Pollution Response Team Procedures

11.1 The Pollution Response Advisor's Role

This section outlines the role that the PRA has when responding to a Wastewater overflow incident. This role includes:

- incident assessment;
- undertaking a pollution incident investigation;
- working and communicating with the Incident Controller to ensure that the overflow response is in accordance with best practice;
- following all health and safety requirements as determined by the Watercare Incident Controller or Watercare Site Manager and in accordance with the Auckland Council Health and Safety policy when on site;
- providing technical support to the Watercare Incident Controller;
- assessing the need for flushing and/or stream drying procedures;
- providing guidance on flushing and/or stream drying processes;
- ensuring appropriate activities are undertaken by the Watercare incident team;
- ensuring that environmental monitoring is undertaken as required;
- establishing and maintaining effective communication with the Incident Controller;
- reviewing and assessing Watercare's response and clean-up of incident to ensure consistent and comprehensive clean-ups are being undertaken region-wide;
- reporting; and
- when necessary, enforcement.

A copy of the key roles and responsibilities for an Incident Controller is included in Appendix A. This is a quick guide and reference that can be used on site.

11.2 Pollution Response Advisor's Key Responsibilities

11.2.1 Introduction

This section details the key responsibilities for a PRA when attending to a Wastewater overflow incident level 2 or higher.

A comprehensive checklist of responsibilities that follow this section is found in Appendix B.

A Wastewater Overflow Assessment Form is required to be filled in by the Watercare Incident Controller during the management of the incident. Refer to Appendix C for a copy of this form. This form also includes an area for the PRA to fill in when flushing or stream drying is required to be undertaken.

11.2.2 Incident Assessment

When the PRA is the primary respondent to the Wastewater overflow:

- undertake an assessment of the nature of the incident and determine response requirements following the Watercare Escalation Process in Chapter 7.0 Watercare Escalation and Response Process.

The PRA shall:

- notify the Watercare Call Centre; and
- where any of the escalation triggers are present, ask to be put through to a Watercare Duty Controller to escalate the incident immediately to a Watercare level 2 or higher incident.

When the PRA is notified by the Watercare Incident Controller or Site Manager, the PRA must ascertain and/or confirm:

- the site location and where the overflow is discharging to, to determine the sensitivity of the area;
- who the Watercare Incident Controller is if contacted by the Site Manager;
- Watercare's Incident level;
- parties on site;
- flow rate of overflow;
- flow rate of receiving water (if known at this time);
- the likely total duration of the overflow, i.e. how long it may have been flowing before time of notification;
- ammonia levels (if known at this time);
- other signs of water contamination (if visible at this time); and
- has the Wastewater overflow been contained?, how has the containment been implemented?

Determine Incident level

The PRA shall determine from the details provided the incident level and determine whether the overflow needs to be escalated and is a level 2 or higher incident.

Determine Onsite Attendance

The PRA shall determine if there is a need to attend the site in person as detailed chapter 10.3 Pollution Response Advisor On-site Attendance.

If the PRA is not able to be on-site and where:

- the overflow is flowing steadily, for 1-2 hours into stormwater/stream; and
- there are low ammonia readings (<3ppm) 100m downstream.

the PRA must ensure that:

- the Watercare Incident Controller notifies the PRA of any changes or escalation of the Wastewater overflow as soon as practical to determine if there is a need for attendance;
- a new job is set up in the Site Information, Incidents and Enforcement Database (SIIED) and that all notes are recorded and entered into a job file; and
- the Wastewater overflow assessment form is received and entered into the job file.

11.2.3 Response Management

When attending the site in person, the PRA is responsible for ensuring the processes below are followed and that the appropriate actions are taken to ensure that the environmental impact is minimised.

Ensure Health and Safety

When on-site, the PRA must ensure that appropriate on-site health & safety provisions and site controls are followed as established by the Watercare Incident Controller or Site Manager and maintained throughout the incident. For requirements on health and safety where the PRA is the first respondent, refer to Auckland Council's Health and Safety Policy.

Assess the Situation

The environmental impact of the overflow will depend on the rate of discharge, the time over which the discharge has been occurring and the nature of the receiving environment.

Once on-site, the PRA shall, in discussions with the Watercare Incident Controller, evaluate the seriousness of the incident and establish the details of the current situation.

For example;

- what is the cause of the overflow;
- what are the flows of discharge and receiving environments;
- estimate how long the overflow may have been occurring;
- has the overflow been stopped? if not how long it may take to fix;
- what is the sensitivity of area where overflow it is going to, i.e. has the overflow reached a waterbody or is likely to before containment is installed and/or is there significant risk to the surrounding environment;
- has the overflow been contained, can it be contained; and
- identifying environmental compliance issues (for example protected areas/sites or working within the drip line of trees).

Undertake Environmental Monitoring

The PRA will obtain the test results from the Incident Controller, or undertake testing following the procedures outlined in Appendix D Environmental Monitoring, and investigate how far downstream the waterbody has been contaminated by measuring the ammonia levels at point of discharge entry, 5m downstream and 100m downstream. Ammonia levels should be checked further downstream if necessary.

The results of the environmental monitoring will identify requirements for containment/ repair and clean-up needed within the waterbody.

Create Action Plan

The PRA may contribute to the action plan being developed by the Incident Controller and:

- provide technical support and direction to the Incident Controller and Site Manager;
- ensure that the response is in accordance with best practice; and
- regularly review and provide feedback as required.

Identify Resources Required

The PRA will identify the resources put in place or requested by the Incident Controller and or Site Manager and, where required, identify any further resources required for repair and containment and ensure that the required resources are or will be attending (e.g. clean-up crew(s), water blaster(s), sucker truck(s), pump(s) fish excluders etc).

Evaluate Containment Options

The PRA may provide advice to the Incident Controller, or Site Manager on:

- the best approach for minimising or containing the overflow;
- priorities for siting the containment:- what should be done to minimise effect of overflow (e.g. deployment of a sucker truck at or near the source of the overflow);
- the best containment options i.e. how the overflow should best be contained (e.g. plugging of cesspits, isolation of overflow area by means of sandbags, deployment of sucker trucks/pumps etc); and
- the best containment options for overflows to a waterbody, e.g. containment in stream or pumping contaminated water from the stream. For more information on containment and repair options refer to Appendix E.

Evaluate Containment and Repair

Containment and repairs are mostly undertaken by the Watercare Service Providers.

Undertake Clean-up and Recovery

The PRA may provide further advice to the Incident Controller or Site Manager in regards to the level expected of the clean-up and types of processes that may be required to be undertaken.

The clean-up will normally be undertaken by Watercare's Service Providers and this will generally commence following the establishment of containment and repair of the overflow.

Clean-up may include removal of;

- solids;
- paper;
- sanitary goods/debris;
- dead fish; and/or
- contaminated water.

The PRA is responsible for approving (or not) any flushing that is undertaken. This approval is noted on the Incident Controller's Wastewater Over Flow Assessment Form.

Prior to approval for flushing the Watercare Incident Controller must confirm that clean-up is completed to a point where flushing is the only remaining option to improve the affected environment.

In deciding to approve or not, the PRA must take into account:

- the receiving environment;
- the potential effects of chlorinated water;
- the flow of the receiving environment;
- the level of containment;
- the ability of the affected area to recover from the Wastewater overflow;
- if mains source chlorinated drinking water is used, then flushing should be undertaken using Watercare's best management plan for treated drinking water discharges; and
- the flushing discharge should occur only once and be duration of no more than an hour, unless in exceptional circumstances.

For more information on clean-up and flushing procedures refer to Appendices F, G and H.

11.2.4 External Communications Management

Where the PRT offers advice on aspects of the response, this advice must be directed through the Incident Controller at all times.

The Incident Controller will assess and act on that advice, having regard to any health & safety implications of the advice, and to the feasibility and likely effectiveness of any associated actions.

The Watercare Incident Controller is the central point of contact for all parties involved in the response including but not limited to:

- the Watercare Call Centre;
- the Watercare Service Provider;
- the Site Manager
- the appropriate people within the Auckland Council's Pollution Response Team and Licensing and Compliance Team and the Auckland Regional Public Health Service;
- other Watercare personnel and network team members; and
- neighbourhood and public.

Media

All media enquiries while on-site must be directed to Watercare's Communications Team. Where the PRT receives an enquiry from media, they must refer them to Watercare's Communications Team and advise the Incident Controller of the media enquiry, the Incident Controller will then advise the appropriate Tier 3 Manager.

Community Relations

Where significant adverse neighbourhood disturbance may occur as a consequence of works, consideration of limiting the extent of after-hours work may be appropriate. The PRA may provide advice to the Incident Controller and support them in making a decision in limiting after-hours work.

The Watercare Incident Controller is responsible for neighbour and public relations and minimising neighbour disturbance, where activities may require access onto private land, or involve emergency work after hours and/or require the use of noisy equipment.

11.2.5 Incident Closeout

The Watercare Incident Controller is responsible for closing out the incident and for sending into the PRT the completed Wastewater Overflow Incident Assessment Form.

11.2.6 Incident Reporting

The PRA is responsible for filling in all internal reporting forms and filing the information received from Watercare.

Licencing and Compliance Team Procedures Manual

Auckland Council Licensing and Compliance Team

The purpose of this section is to provide Licensing and Compliance (L&C) with a regional procedure for responding to Wastewater overflow incidents and focuses on the procedure for Environmental Health Responsible Officers to achieve best practice if and when they are attending a Wastewater overflow where a risk to public health has been identified.

12. Licensing and Compliance Team Roles and Responsibilities

The roles and responsibilities of each person involved in the process is listed as follows

Manager Environmental Health & Licensing	Ensures that the appropriate numbers of staff are available to respond to Wastewater overflow incidents and that they understand the process/procedure for efficiently investigating incidents and resolving them appropriately.
Team Leader – Environmental Health & Licensing	Ensures that sufficient Environmental Health Officers (EHO's) are available to respond to Wastewater overflow incidents and that they understand the process/procedure to follow for efficiently investigating incidents and resolving them appropriately.
Responsible Environmental Health Officer	An EHO responsible for managing a Request for Service (RFS) investigation, from receipt of the request for service, through to its appropriate resolution.
Pollution Hotline	Provides a 24hr reporting system for urgent air, water, or land pollution incidents. The pollution hotline will field all the Wastewater overflow incidents for Council.
The Customer Services Department	Provides the first point of contact for customers (members of the public), The call centre takes general information and routes this to the correct department.

13. Licensing and Compliance Notification and Escalation Process

13.1 Notification

Watercare will notify the Pollution Hotline of all Wastewater overflow incidents level 2 and above.

Any reports of Wastewater overflows received from Watercare by the Auckland Customer Services Call Centre should be re-directed to the Pollution Hotline.

Where a call is received from a member of the public, and where it is identified from the conversation that the Wastewater overflow is from a Watercare asset, the customer should be asked to report the incident to Watercare directly.

When a call is received from Watercare, the Pollution Hotline should record:

- location of overflow;
- where the overflow is going (is the overflow going for example to a waterbody, beach, playground or similar?);
- incident level (1-5);
- who the Incident Controller is and contact details;
- who the Site Manager is and contact details (this is normally the Watercare Service Provider on site).

The Pollution Hot line emails all of the reported incidents classified as a level 2 by Watercare to the Licencing and Compliance general email.

For all incidences classified as a level 3 and above by Watercare the Pollution Hotline will re-log the call with the Auckland Customer Services department to request an Environmental Health Officer.

13.2 Incident Escalation

The Incident is classified in accordance with Chapter 5.0 Incident Escalation, normally by Watercare. Once the information has been received by L&C then the incident is escalated as per the following process.

Incident Level 1

There is normally no involvement by the Licencing and Compliance Team.

Incident Level 2

The Team Leaders are responsible for checking the general email for any emailed incidents from the Pollution Hotline.

The Team Leaders are responsible for ensuring that the incidents are cross checked against any known events or factors that could increase the incident level.

- Where there is an identified known event the incident is treated as a level 3 and above and the process for this should be followed;
- Where there are no identified known events then no further action is required on behalf of the licencing and compliance team.

Incident Level 3 and above

The Customer Services Call Centre will log the incident as a Request for Service (or equivalent for regional legacy systems) with the Environmental Health Officer who is responsible for the area in which the incident has occurred.

The Customer Services Call Centre should follow the procedure as set out in the I-Know system.

Out of hour's procedure.

The Customer services Call Centre should follow the procedure as set out in the I-Know system for a request for service out of hours.

Where a specific request has been made by Watercare or the pollution response team for an EHO officer to attend site then, the person lodging the incident must handshake the Request for Service by phoning and/or e-mailing the responsible officer so that he/she is aware of the incident.

During out of office periods the procedures for contacting the duty EHO apply.

13.3 Responsible Officer Onsite Attendance

For all level three and above incidents the responsible officer shall determine, based on the evidence obtained, if there is a need to attend the site in person. Examples where attendance on site may be required are summarised, but not limited to the below:

- there is imminent danger to public health due to location, size and quantity of overflow;
- Watercare or the Pollution team has asked for on-site support.

14. Licensing and Compliance Team Procedures

14.1 Responsible Environmental Health Officer's Role

This section outlines the role that the Responsible Officer has when responding to a Wastewater overflow incident. This role includes:

- incident assessment;
- assessing the risk to public health;
- ensuring that the safety of the public is maintained**;**
- ensuring that the Site Manager and when on site the Incident Controller have mitigated any risks to public health and safety arising from access to contaminated Wastewater overflows or works associated with the response;
- identifying the appropriate resources required to take to site to ascertain the existence of a potential statutory nuisance, remediating this nuisance, and to gather such evidence as to serve notice for the abatement of such nuisance;
- following all health and safety requirements as determined by the Watercare Incident Controller or Watercare Site Manager and in accordance with the Auckland Council Health and Safety policy when on site;
- ensuring that environmental monitoring is undertaken as required;
- ensuring public health signs are installed on sensitive land areas or recreational waterbodies;
- ensuring that where needed the appropriate Auckland Council personnel are notified;
- notifying the Environmental Service Team to update the Safeswim website (where to beaches monitored by safeswim);
- establishing and maintaining effective communication with the Incident Controller;
- ensuring all media enquiries are handled by the Watercare Communications team
- confirming that cleanup has been completed and contamination levels are within National Guidelines;
- removal of any signage; and
- updating and closing the Request for Service.

A copy of the key roles and responsibilities for the Responsible Officer is included in Appendix A. This is a quick guide and reference that can be used on site.

14.2 Responsible Environmental Health Officer's Key Responsibilities

14.2.1 Introduction

This section details the key responsibilities for a Responsible Officer (Officer) when attending to a Wastewater overflow incident level 3 or higher.

A comprehensive checklist of responsibilities that follow this section is found in Appendix B. This should be filled in during the response to ensure all of the key steps have been undertaken.

A Wastewater Overflow Assessment Form is required to be filled in by the Watercare Incident Controller during the management of the incident. A copy of this is sent to the Licencing and Compliance team once the incident has been closed. Refer to Appendix C for a copy of this form.

14.2.2 Incident Assessment

The Officer on receiving notification of a level 3 and above incident shall contact the Watercare Incident Controller or Site Manager and confirm any additional information required to assess the incident.

The Officer should ascertain and/or confirm

- the site location and where the overflow is discharging to, to determine the sensitivity of the area; (is the overflow going for example to a waterbody, beach, playground or similar?);
- the Watercare incident level;
- what steps Watercare have taken to mitigate Public Health risks:
- cordons in place or being put in place by Watercare;
- ammonia levels (if testing has been carried out);
- other signs of water contamination (if visible at this time);
- clean up steps to be undertaken;
- time of original notification;
- reason/cause for the overflow;
- the duration of the overflow;
- flow rates, (can it be easily contained?);
- health & safety issues on site as notified by Watercare;
- access issues; and
- are there any other agencies involved or need to be advised.

The Officer shall also conduct a search for any information held on file relevant to the incident.

The information is to be recorded on the Licencing and Compliance Assessment Checklist. Refer to Appendix B for a copy of this form.

Determine Onsite Attendance

The Officer shall determine, based on the evidence obtained, if there is a need to attend the site in person.

Examples where attendance on site may be required are summarised, but not limited to the below:

- there is imminent danger to public health due to size and quantity of overflow; or
- Watercare or the Pollution team has asked for on-site support.

If the responsible officer is not required to be on site, they must ensure that:

- they Inform the Watercare Incident controller that attendance is not required;
- Keep in regular contact with the Watercare Incident controller with regards to any changes or escalation;
- the incident is recorded in the relevant team system and that all notes are recorded and entered into the job file; and
- the Wastewater overflow assessment form is received and entered into the job file.

14.2.3 Response Management

When attending the site in person, the Officer is responsible for ensuring the processes below are followed. During inspection the Officer's primary responsibility is to ensure that the Site Manager and when on site the Incident Controller have mitigated any risks to public health and safety arising from access to contaminated Wastewater overflows or works associated with the response. Notes should be taken during the inspection.

Identify Resources Required

The Officer is responsible for identifying the appropriate resources required to take to site to ascertain the existence of a potential statutory nuisance, remediating this nuisance, and to gather such evidence as to serve notice for the abatement of such nuisance if required, this could include:

- copies of site or drainage plans;
- personal protective clothing;
- camera;
- ammonia testing kits;
- water sample collection kits; and
- health warning signage and appropriate tools for installation.

Ensure Health and Safety

When on site the Officer must ensure that appropriate on-site health & safety provisions and site controls are followed as established by the Watercare Incident Controller or Site Manager and maintained throughout the incident and in accordance with Auckland Council's Health and Safety Policy.

Assess the Situation

The Officer shall, once on site re-evaluate the seriousness of the incident and establish the details of the current situation. This can be received from either the Incident Controller or Site Manager.

For example;

- What is the sensitivity of area where overflow it is going to? I.e. has the overflow reached a waterbody or likely to before containment and/or is there significant risk to public health?
- What is the cause of the overflow?
- What are the flow rates?
- Estimate how long the overflow may have been occurring;
- Cordons in place or being put in place by Watercare;
- Has the overflow been stopped? If not how long it may take to fix?
- Has the overflow been contained? Can it be contained? and
- Are there any other agencies involved or need to be advised.

This information should be updated on the Licensing and Compliance Assessment Checklist. Refer to Refer to Appendix B for a copy of this form.

If the incident scale is likely to attract media attention then the Officer must inform the relevant Auckland Council Personal as set out in 3.2.4 Internal Communications.

Undertake Environmental Monitoring

The Officer will obtain any environmental test results from the Incident Controller/Site Manager or Pollution Response Advisor.

Where there is an identified risk to public health, The Officer shall undertake further environmental monitoring and/or testing to areas directly and/or consequentially affected by a Wastewater overflow, following the procedures outlined in Appendix D Environmental Monitoring.

Where recreational swimming areas are affected the Officer will collect water samples within 24 hours of the event occurring and deliver them to a Watercare testing laboratory.

Sampling and testing is undertaken daily until results are within the National Guidelines.

Where an overflow is outside of working hours the Incident Controller or Site Manager must be notified to ensure that the Watercare testing laboratory is able to receive the samples.

Where barriers and public health signs have been installed, these must stay in situ until the Officer has confirmed testing and environmental monitoring has been satisfactorily completed.

Determine Need for Public Health Signage

The Officer will deploy and locate appropriate public health warning signage in circumstances where a public health risk has been identified outside the immediate vicinity of the overflow.

The Incident Controller or Site Manager will ensure that where required, and as soon as practical after notification of the Wastewater Overflow, appropriate temporary warning signage is in place within the immediate vicinity of the overflow.

Signage should be erected as soon as practical after notification of the Wastewater overflow where:

- there is a perceivable danger to public health either through large deposits of solid waste, strong odours, or localised dead or stressed fauna or flora;
- the overflow will, or has, extended to reach a costal or recreational bathing area;
- the clean-up process will take longer than 24hrs and/or will be left unattended; or
- The result of Environmental Monitoring has identified need for additional signage.

Use appropriate Public Health Signage

Signage should be clean, securely located, and erected within the immediate vicinity, as well as situated where access to the overflow is likely.

All signs should be:

- clean and securely fixed;
- located at all entrances and exits of ancillary features such as car parks;
- spaced at approximately 50m intervals along the perimeter of the overflow;
- where the overflow impacts on bathing, at 50m intervals along the coastline; and
- inspected and replaced as necessary on a daily basis.

Signage may not always be required. Public health warning signage is not intended to prohibit the use of recreational areas, unless posted otherwise, but to provide a warning of potential public health risks due to sewage contamination.

The Officer must evaluate the need for warning signage on a daily basis and remove immediately after the public health risk has been mitigated.

14.2.4 Internal Communications Management

Where the incident scale is likely to attract media attention then the Officer must update:

- The Council Media Team;
- Relevant Auckland Council Local Board Communications Advisor;
- Auckland Council Call Centre; and
- Safe Swim.

Where the Wastewater overflow is likely to affect a bathing area, the Officer shall liaise with the Councils Environmental Service Team who in turn will update the Safeswim website.

The Environmental Service Team should relay any relevant Safeswim sampling data back to the Officer.

Should Safeswim sampling identify high levels of contaminates the Officer should notify the Incident Controller or Site Manager immediately.

14.2.5 External Communications Management

Where the Officer offers advice on aspects of the response, this advice must be directed through the **Incident Controller** at all times.

The Officer must provide advice to the Incident controller on what the public health risks are and how best to mitigate them, where, the Officer is not satisfied that risks to public health have been mitigated or when specifically asked by Watercare.

All concerns regarding the clean-up and remediation being implemented must be raised on site with the Incident Controller and then forwarded in writing to the Incident Controller at Watercare as soon as possible including where relevant, appropriate timescales.

Results from environmental monitoring, and if necessary, any recommendations as to the clean-up and remediation process, must be submitted to the Incident Controller for immediate action.

The Incident Controller will assess and act on the recommendations, having regard to any health & safety implications of the advice, and to the feasibility and likely effectiveness of any associated actions.

The Officer must be satisfied that the clean-up and remediation works being implemented by the Incident Controller or Site Manager will mitigate the public health risk, where advice has not been followed up the officer will follow the procedures for abating statutory nuisance.

Media

All media enquiries received on site must be directed to Watercare's Communications Team. Where any of the response team receives an enquiry from media they must refer them to Watercare's Communications team and advise the Incident Controller of the media enquiry.

Any Watercare media releases or reactive media statements should also be emailed to:

- Auckland Council media team acmedia@aucklandcouncil.govt.nz;
- Relevant Auckland Council Local Board communications advisor; and
- Auckland Council Customer Services.

Community Relations

The Watercare Incident Controller is responsible for neighbour and public relations and minimising neighbour disturbance, where activities may require access onto private land, or involve emergency work after hours and/or require the use of noisy equipment.

Where significant adverse neighbourhood disturbance may occur as a consequence of works, consideration of limiting the extent of after-hours work may be appropriate. The Officer may provide advice to the Incident Controller and support them in making a decision in limiting any after-hours works.

14.2.6 Incident Closeout

The Watercare Incident Controller is responsible for closing out the incident and for sending to the Auckland Council the completed Wastewater overflow Incident assessment form.

The Officer will receive and check the Wastewater Overflow Incident Assessment form and review his/her notes.

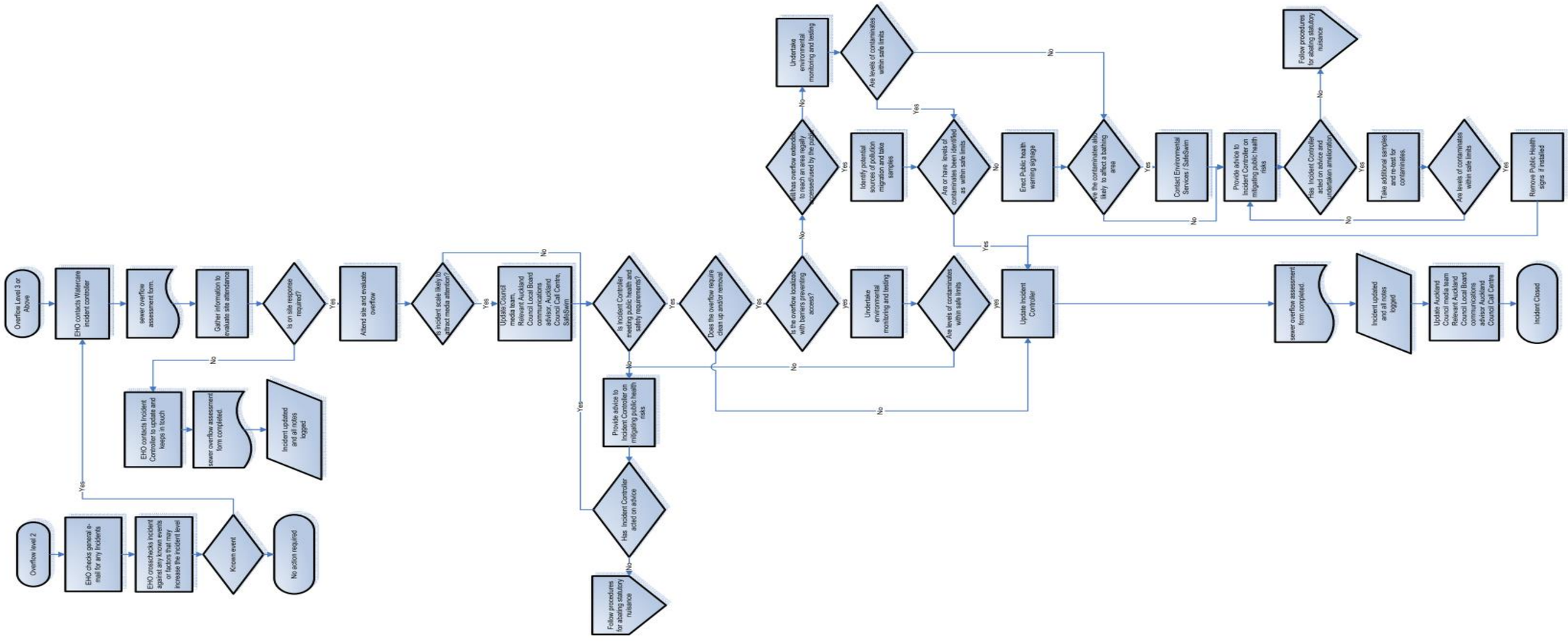
Where the Officer is not satisfied that the remedial work has been undertaken to satisfactory level then the Officer will:

- contact the Watercare incident controller to discuss the issue and advise him/her of the possible options available. These may include:
    - suggesting suitable, acceptable, alternative mitigation measures;
    - issuing a notice;
    - carrying out the works in default and invoicing Watercare;
    - prosecution; or
    - obtaining a court order to make the Watercare carry out the required works;
- continue to monitor the incident and proactively attempt to mitigate the health risk as quickly as possible; and
- ensure that all the information concerning the incident is captured.

Where the Officer is satisfied that the remedial work has been undertaken to a satisfactory level then the Officer will:

- communicate the outcome internally to:
    - Auckland Council Customer Services;
    - the Environmental Services team to update the Safeswim website;
    - Auckland Council media team acmedia@aucklandcouncil.govt.nz (where required); and
    - Relevant Auckland Council Local Board communications advisor (where required);
- update the RFS and close the Incident.

15. Licencing and Compliance Flow Charts



Appendices

Appendix A. Key Roles and Responsibilities

Watercare Incident Controller Key Roles and Responsibilities

It is the Role of the Incident Controller to manage the response to a level 2 or higher Wastewater overflow incident. This role includes;

- **incident assessment** and incident escalation**;**
- **notifying** the Auckland Council and Auckland Regional Public Health Service;
- **managing the response** including, action plans for containment, repair clean-up and community relations;
- ensuring that all appropriate health and safety measures are taken;
- ensuring that the overflow response is in accordance with best practice;
- providing technical support and direction to the Watercare Service Provider;
- ensuring appropriate activities are undertaken by Watercare Service Provider;
- ensuring that environmental monitoring is undertaken as required with support from Environmental Health or Public Health Officer;
- reviewing and assessing the Watercare Service Provider response and the ongoing overall assessment of incident to ensure no activity has been over looked;
- reviewing and assessing the clean-up process;
- keeping a detailed log of events, actions, and impacts, in particular noting the nature and times of specific response times and recording of causes and required repairs;
- providing situation reports as required;
- upgrading or downgrading incident with changing situation;
- developing work plans for the next work period if needed;
- **establishing and maintaining effective communication** The Incident Controller is the central point of contact for all parties involved in the response;
- **closing-out the incident**;
- confirming that clean-up has been completed;
- assessing the need for any additional remedial works to prevent recurrence;
- confirming that the incident has been managed in accordance with best practice;
- **incident reporting** including conducting incident debriefs; and
- confirming that the process has been appropriately documented.

Pollution Response Advisor Key Roles and Responsibilities

The role that the Pollution Response Advisor has when responding to a Wastewater overflow incident includes:

- incident assessment;
- undertaking a pollution incident investigation;
- working and communicating with the incident controller to ensure that the overflow response is in accordance with best practice;
- following all health and safety requirements as determined by the Watercare Incident Controller or Watercare Site Manager and in accordance with the Auckland Council Health and Safety Policy when on site;
- providing technical support to the Watercare Incident Controller;
- assessing the need for flushing and/or stream drying procedures;
- providing guidance on flushing and/or stream drying processes;
- ensuring appropriate activities are undertaken by the Watercare incident team;
- ensuring that environmental monitoring is undertaken as required;
- establishing and maintaining effective communication with the Incident Controller;
- reviewing and assessing Watercare's response and clean-up of incident to ensure consistent and comprehensive clean-ups are being undertaken region wide;
- reporting; and
- when necessary, enforcement.

Licensing and Compliance, Environmental Health Officer Key Roles and Responsibilities

The role that the Responsible, Environmental Health Officer has when responding to a Wastewater overflow incident includes:

- incident assessment;
- assessing the risk to public health;
- ensuring that the safety of the public is maintained;
- ensuring that the Site Manager and when on site the Incident Controller have mitigated any risks to public health and safety arising from access to contaminated Wastewater overflows or works associated with the response;
- identifying the appropriate resources required to take to site to ascertain the existence of a potential statutory nuisance, remediating this nuisance, and to gather such evidence as to serve notice for the abatement of such nuisance;
- following all health and safety requirements as determined by the Watercare Incident Controller or Watercare Site Manager and in accordance with the Auckland Council Health and Safety policy when on site;
- ensuring that environmental monitoring is undertaken as required;
- ensuring public health signs are installed on sensitive land areas or recreational waterbodies;
- ensuring that where needed the appropriate Auckland Council personnel are notified;
- notifying the Environmental Service Team to update the Safeswim website (where to beaches monitored by safeswim);
- establishing and maintaining effective communication with the Incident Controller;
- ensuring all media enquiries are handled by the Watercare Communications team
- confirming that cleanup has been completed and contamination levels are within National Guidelines;
- removal of any signage; and
- updating and closing the Request for Service.

Appendix B. Action Plan Checklists

Incident Controller Action Plan Checklist

Where the symbol ⓘ appears this Information is to be recorded on the Wastewater Overflow Incident Assessment Form and updated as required.

Incident Assessment Information gained from Watercare Service Provider Primary Response team	Name of Incident Controller ⓘ				
	Name(s) and details of Service Providers on site ⓘ				
	Location of Wastewater overflow ⓘ				
	Event/incident description ⓘ				
	Time of original notification of Wastewater overflow ⓘ				
	Cause of overflow ⓘ				
	Likely total duration of overflow ⓘ				
	Have you ascertained?	Where the overflow is going or has potential to go? (Tick all that apply)			
			Sensitive Land		**Waterways**
			stormwater reticulation		streams;
			council play grounds		wetlands;
			parks and reserves		ponds/lakes;
			roadways;		groundwater aquifers;
			residences		beaches;
			schools and childcare centres;		open coasts
			playing fields;		harbours and estuaries
			accommodation complexes		
			tourist attractions		
		The approximate discharge flow rate?			
		The approximate receiving water flow rate? (if to water)			
		Who is involved? I.e. key customers, care customers*, distressed public?			
		Any damage to property people or habitable floor?			
		Is attendance on site required?			
	Determined Incident Level? ⓘ				
Auckland Council and Public Health	Notify Auckland Council and the Regional Public Health Team. firstly by phone and then by email ⓘ				
	Record who is onsite and what time ⓘ				
Response Management	Health and safety procedures ⓘ				
	Public Safety ⓘ				
	Install Public Health Warning signs ⓘ				
Assess the Situation (Incident Controller on site or through discussions with the Site Manager when not on site)	Cause of overflow. ⓘ				
	Discharge flow rates. ⓘ				
	Expected time to fix. ⓘ				
	Environmental compliance issues.ⓘ				
	Undertake Environmental monitoring. ⓘ				
	Overflow has been contained or can be contained?				
	Evaluate	Discharge to water body			

		Discharge to sensitive land	
Create Action Plan and Identify Resources Required	Create Strategies	for containment	
		for required resolution steps	
		for communication, resources and personnel	
	Identify	Resources required and ensure attendance of resources ⓘ	
		Any technical specialisation required	
		Any other resources or facilities required	
	Include	notifications and update schedules	
		estimated restoration time	
		changeover plans	
Containment and Repair	best containment options		
	best siting for containment		
	Has containment been established? ⓘ		
	Environmental Monitoring ⓘ		
	Has repair been completed? ⓘ		
	Is this a temporary repair requiring repairs later? ⓘ		
Clean-up and Recovery	Appropriate measures are undertaken to clean-up ⓘ		
	Is clean-up complete? ⓘ		
	Is flushing required?		
	Establish that flushing can be undertaken ⓘ		
	Ensure signage can be removed		
Communication Management	That advice from outside parties handled through Incident Controller at all times?		
	Media is handled by Watercare Communications team at all times?		
	Neighbours / public advised? And any Disturbance is minimised?		
Event/ Incident Closeout	Confirm clean-up is complete		
	Confirm results environmental monitoring within National Guidelines		
	Approve containment works to be removed		
	Confirm any need for remedial works		
	Confirm status of Public health Warnings		
	Confirm Incident managed in accordance with best practice		
	Confirm appropriate process documentation		
Reporting	Incident Response form filled in		
	Email sent to Auckland Council and Auckland Regional Public Health Services		
	Appropriate records are kept		
	Complete an incident debrief		
Key Timelines	Auckland Council notified		
	Auckland Regional Public Health Service notified		
	Incident controller on site within 60 minutes		
	Close out notifications 10 working days		

*** Care Customers**: Needs based. These customers have a higher reliance on uninterrupted supply and cannot tolerate a decrease in water quality services i.e. hospitals and home dialysis customers. While the services required by these customers are primarily the same, uninterrupted supply and no decrease in water quality, each has a slightly different set of relationship requirements. In most cases there are also customer specific requirements.

Pollution Response Advisor Action Plan Checklist

Incident Assessment When primary respondent	Establish escalation level	
	Notify Watercare Time:.....	
	Spoken to Watercare Duty Engineer if necessary	
Incident Assessment Information gained from Watercare Service Provider or Incident Controller	Name of Incident Controller: ☐ *Watercare* ☐ *Sub-contractor*	
	Parties Onsite: ☐ *Watercare* ☐ *Thiess* ☐ *Lend Lease* ☐ *City Care* ☐ *Downers*	
	Location:	
	Time of original notification of Wastewater overflow:	
	Likely total duration of overflow:	
	Have you ascertained? — Where the overflow is going? (tick all that apply)	
	Waterways	
	☐ streams; ☐ wetlands; ☐ ponds/lakes; ☐ groundwater aquifers; ☐ beaches; ☐ open coasts ☐ harbours and estuaries	
	The approximate discharge flow rate?	
	The approximate receiving water flow rate? (if to water)	
	Other signs of contamination (if visible)	
	Ammonia levels	
	Determined Incident Level? ☐ *1* ☐ *2* ☐ *3* ☐ *4* ☐ *5*	
	Is attendance on site required?	
Response Management	Health and safety procedures	
Assess the Situation (Incident Controller on site or through discussions with the Site Manager when not on site)	Cause of overflow :	
	Discharge flow rates.:	
	Expected time to fix.	
	Environmental compliance issues.	

Environmental monitoring	Site location		Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	
	1	From outflow to stream					<u>< 3 ppm: Low reading</u> <u>> 3 ppm: Moderate</u> <u>> 6 ppm: High reading*</u> <u>see incident escalation process</u>
	2	5m downstream from outflow					
	3	100m downstream from outflow					
	4	……					

Evaluate Containment Options	provide input where needed to the Incident Controller	best containment options	
		best siting for containment	
		Has containment been established?	
Clean-up and Recovery		Have appropriate measures been undertaken to clean-up	
		Is flushing required? (If Y enter details recommended) …… …… …… ……	
Communication Management	Advice is handled through Incident Controller at all times?		
Event/ Incident Closeout	Confirm clean-up is complete		
Reporting	Confirm results of final environmental monitoring		
	Confirm Incident managed in accordance with best practice		
	Incident Response form filled in by Incident controller and has been received		

Responsible Environmental Health Officer Action Plan Checklist

Where the symbol ⓘ appears this Information has been recorded on the Wastewater Overflow Incident Assessment Form by the Incident Controller

Incident Assessment

Information gained from Watercare Service Provider or Incident Controller and updated when on site

Have you ascertained?

Where the overflow is going or has potential to go? (Tick all that apply)

	Sensitive Land		Waterways
	stormwater reticulation		streams;
	council play grounds		wetlands;
	parks and reserves		ponds/lakes;
	roadways;		groundwater aquifers;
	residences		beaches;
	schools and childcare centres;		open coasts
	playing fields;		harbours and estuaries
	accommodation complexes		
	tourist attractions		

Name of Incident Controller ⓘ

……

Name(s) and details Service Providers on site ⓘ

……

Incident Level? ⓘ (3,4,5)

Time of original notification of Wastewater overflow ⓘ

Likely total duration of overflow ⓘ ……

What steps has Watercare taken to mitigate public health risk?

……

……

Ammonia levels

……

……

Other signs of contamination (if visible)

……

……

The approximate flow rate? I.e. can it be easily contained

……

Reason/Cause of overflow ⓘ

……

……

Is attendance on site required?

……

……

Any Access issues?

……

……

Are there any other agencies involved or needing to be involved?

……

……

Incident Assessment

Any information held on current files?

……

In house information	……	
Response Management	Resources required? ……	
	Health and safety procedures ⓘ	
Assess the Situation (Incident Controller on site or through discussions with the Site Manager when not on site)	Sensitivity of area? (update on first page)	
	Cause of overflow. ⓘ (update on first page)	
	Discharge flow rates. ⓘ	
	Has overflow stopped? Expected time to fix. ⓘ	
	Is overflow contained? Can it be contained? ……	
	Are there any other agencies involved or needing to be involved? (update on first page)	
Undertake Environmental Monitoring	Take samples where there is an identified risk to public health	
	Is there a need for samples from a recreational beach area?	

Site location		Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	
1						<u>< 3 ppm: Low reading</u> <u>> 3 ppm: Moderate</u> <u>> 6 ppm: High reading*</u> <u>see incident escalation process</u>
2						
3						
4						

Public Health Signage	Is public health signage needed? ……	
	Where has the signage been located? ……	
	Has the signs been removed once the risk has been mitigated? ……	
Communication Management	Advice is handled through Incident Controller at all times? (what advice given?) …… ……	
	Has Watercare acted on this advice? ……	
	Media is handled by Watercare Communications team at all times?	
	Any neighbour disturbance is minimised by Incident Controller?	
	Who needs to be informed? (Media team, Environmental services team? ETC) ……	
Event/ Incident Closeout	Confirm clean-up is complete	
	Confirm results environmental monitoring	
	Confirm Incident managed in accordance with best practice	
	Confirm appropriate process documentation	
Reporting	Incident Response form filled in by Incident controller and has been received	
	RFS completed and closed	

Appendix C. Wastewater Overflow Incident Assessment Form

Wastewater Overflow Incident Assessment Form

Site Location		Date	
Incident Controller		Time onsite	
Site Manager		Hansen/SAP #:	

Parties onsite:				
Time:				

Initial Assessment	Flow rate of overflow	□ *<0.5 l/s (trickle)*	□ *0.5-2 l/s (flow)*	□ *>2 l/s (gushing)*	
	Flow rate of receiving water	□ *<0.5 l/s (trickle)*	□ *0.5-2 l/s (flow)*	□ *>2 l/s (gushing)*	□ N/A
	Is the overflow into or onto:	□ Land	□ Stormwater	□ Natural Water	
	Is the overflow into/onto a sensitive area?	□ Recreational	□ Beach	□ Residential	□ Other.....
		□ School/Daycare	□ Public area		
	Duration of overflow from time of notification	□ < 1 Hour	□ 1-4 Hours	□ >4 hours	□ >12 hours
	Expected time to repair/restore service to normal	□ < 1 Hour	□ 1-4 Hours	□ >4 hours	□ >12 hours
	Likely total duration of overflow	□ < 2 Hours	□ 2-6 Hours	□ 6-24 Hours	□ > 24 Hours

Incident Level +time of Declaration	1	2……	3……	4……	5……

Site Safety	Personal H&S assessment has been assessed prior to entering site?	Yes	No
	Do site safety hazards exist that preclude safe site access? (If yes, explain what they are below)	Yes	No
	…… …… ……		
	Does the site presents H&S risks to the public (i.e. does access need to be restricted)? If yes, explain below what measures have been implemented (e.g. warning signs, including public health signage, tapes, cones etc):	Yes	No
	…… …… …… ……	**Date / time** ……	

Details	Incident description:	□ Transmission	□ Network	□ Combined System □ Separate System
		……		
	Resources required/deployed:	……		
	Reason/cause of Wastewater overflow	……		
	Describe any environmental compliance issues?	……		

Environmental Monitoring:	Is Environmental Monitoring Required?					Yes	No
	Site location		Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	<u>< 3 ppm: Low reading</u> <u>> 3 ppm: Moderate</u> <u>> 6 ppm: High reading*</u> <u>see incident escalation process (mg/L = ppm)</u>
	1	From outflow to stream					
	2	5m downstream from outflow					
	3	100m downstream from outflow					
	4						

Containment			
	Is containment established?	Yes	No
	At source (how):	**Time:** ……	
	Diversion (how):	**Time:** ……	
	In stream (how):	**Time:** ……	
	New containment (If required):	**Time:** ……	

Repair			
	Is repair completed / service restored? And How? (explain below)	Yes	No
	…… ……	**Date/Time:** ……	
	Has discharge ceased?	Yes	No
	Is this a temporarily fix?	Yes	No
	Is follow up work required?	Yes	No
	If yes what?	……	
	By whom?	……	

Clean-up			
	Has clean-up been satisfactorily completed? i.e. Removal of solids, paper, sanitary goods/debris, dead fish, downstream contaminated water etc.	Yes	No
	Work undertaken	**Date/time** ……	

PRT Instruction						
	Is flushing required?				Yes	No
	If yes is approval given by Auckland Council Pollution Response Team (PRT)?				Yes	No
	Is PRT staff onsite?				Yes	No
	Details of process to be used.	……			**Date/time** ……	
	Fish relocation requirements:	……			**Date/time** ……	
	Other requirements	……			**Date/time** ……	
	PRT Signoff (Name and Signature) ……	**Date** ……	**Time** ……	PRT Verbal Signoff	**Date** ……	**Time** ……

Closeout				
	Containment removal approved by Incident Controller:			Yes / No
	Site safety works removed:			Yes / No
	Environmental monitoring complete:			Yes / No
	Is rehabilitation / reinstatement required?			Yes / No
	If yes what?	……		
	By whom?	……		
	Overflow Classification	☐ **SPILL**	☐ **DWSO**	☐ **WWO**
	Is there a history of incidents in same location?			**Yes** / **No**
	Watercare Incident Controller sign off			**Date** / **Time**
	Incident signoff by WSL Engineer			**Date** / **Time**

Appendix D. Environmental Monitoring

Environmental monitoring in a Wastewater overflow contaminated waterbody will assist in the incident response to:

- Identify the extent of downstream contamination and hence the location of any required in-stream containment;
- Assess and confirm the clean-up process;
- To monitor and assess environmental health risks; and
- To monitor and assess public health risks.

For the incident response to be effective, waterbody monitoring must feature as an early task in the incident response. The Incident Controller has responsibility for ensuring that monitoring is undertaken.

As environmental monitoring may typically be completed by non-specialist staff this Guideline suggests utilising a range of relatively straight forward environmental indicators to flag the potential for sewage contamination:

- Visual and odour cues and
- Ammonia (utilising indicator tests)

There is no single test that will readily and without question identify or confirm the presence of sewage contamination. Ammonia testing has been adopted as a tool to indicate the presence of sewage contamination. However, ammonia testing alone may not reliably confirm sewage contamination and should always be used in conjunction with other indicators (e.g. visual, odour).

The Incident Controller is responsible for ensuring the appropriate visual/odour and ammonia testing is undertaken.

Environmental sampling

Gathering useful environmental monitoring data requires consideration of a number of important factors:

- Spatial distribution of sampling points – to gain an understanding of the extent of any contamination it is necessary to gather data over as wide an area as possible. This will mean that accessible points upstream and downstream of an overflow discharge will need to be visited to build up a picture of the spatial extent of contamination.
- Temporal distribution of sampling data – just as spatial data will help build up a picture of the extent of contamination, data gathered over the course of the clean-up exercise and over the following days may be required to confirm the success of the clean-up.
- Control samples – data on conditions at a site (or sites) unaffected by the discharge are needed to establish baseline information. Ideally, this would be obtained from sites upstream of the discharge. This information will serve as the basis for comparison and assessment of the data gathered from affected waters.
- Collecting samples using appropriate sampling techniques – it is important that any data gathered is representative of the conditions. Any samples collected must therefore be collected using appropriate techniques and care must be taken not to contaminate the sample.
- Health & Safety – appropriate care is required when sampling in waterbodies and extra precaution is required where sewage contamination may be present. Utilising a pole sampler will make sample collection from the bank easier and reduce the risk of sample contamination. Where contact with contaminated water is required waders may prove necessary and disposable rubber gloves should be worn

Data interpretation

Data gathered utilising the approach suggested above will help develop an indicative basis for the possible presence of gross sewage contamination. Using the base parameters suggested above, indicators of possible sewage contamination would include;

• Visual and odour cues:	➢ Presence of faecal solids, paper, sanitary products ➢ Black / grey water ➢ Sewage fungus growths ➢ Sewage odour
• Ammonia	➢ < 3 ppm: Low reading ➢ > 3 ppm: Moderate ➢ > 6 ppm: High reading

The results would be indicative of how the

Note: These guides are indicative only and a combination of measures may be required to establish the likelihood of contamination. Of these measures ammonia testing provides the strongest practical tool for assessing the likelihood of contamination. To establish a definitive basis for any contamination would require specialist and possibly detailed sampling and analysis.

Training

Specialist training in environmental monitoring may be required to ensure that samples are collected properly, monitoring equipment is utilised correctly and data is interpreted appropriately. In some situations specialist assistance may be required to conduct monitoring, undertake data analysis and provide specialist interpretation.

Appendix E. Containment and Repair Options

Installation of containment

Approach

The evaluation and implementation of containment options is undertaken by the Incident Controller in conjunction with the Service Provider. Where resources allow, containment is most effective when implemented in parallel with the repair phase. Where resources do not allow, the evaluation and implementation of containment options must, if possible, be undertaken in advance of the repair phase.

Containing an overflow involves establishing a physical barrier to limit overflow dispersal, thus reducing impacts on downstream areas (including land and waterbodies), and minimising the extent of the clean-up. In this respect, containment must focus on the overflow as a whole (the solids and contaminated water) and not simply focus on solids.

Containment options will vary on a case-by-case basis. There will be situations where containment is not feasible (e.g. where there is a high rate of discharge from the reticulation, in remote locations, or where site access limitations exist). Consideration will also need to be given to the environmental setting – if overflow has occurred upstream of a bathing beach then high priority might be given to establishing containment to minimise downstream contamination.

Overall, however, a 'best practicable option' approach to establishing containment is required to help minimise potential adverse public health or environmental effects. This means that in all cases where overflow has resulted in, or may result in contamination of a waterbody, the feasibility of establishing containment must be assessed and best efforts must be applied to establishing it. Examples of where containment may not be feasible include:

- Health & safety risks preclude safe site access or safe deployment of containment.
- Physical constraints (e.g. topography, vegetation, buildings) preclude access.
- Stream flow rates make safe containment impracticable.
- Wastewater overflow rates make containment impracticable.

Prioritising the Siting of Containment

Priorities for the location of containment solutions should consider (in this order):

- at source containment – minimises off-site escape;
- diversion of overflow away from waterbody – minimises contamination of waterbody;
- containment in a waterbody – minimises downstream contamination, however, should only be considered if prior containment has not been possible, contamination of the waterbody has occurred, and stream and overflow flow rates are such that containment can be implemented effectively and safely.

Where instream containment is required it may prove necessary to install this both above and below overflow discharges to minimise the rate of downstream dispersion. In these situations diversion of the upstream flow to below the downstream containment location may be necessary, possibly utilising by-pass pumping. Similarly, it may be necessary to shift containment to expand the contained area following environmental monitoring advice.

Containment Options

A summary of containment options and an indication of the tools and equipment that may be required is presented in the below table.

Containment Site	**Method**	**Tools required**
At-source containment	Protection of stormwater systems by blocking stormwater grates or other points of entry	Sandbags, plastic sheets, pipe plugs
	Establishment of temporary storage using temporary weirs / bunds, excavation of detention area, or provision of containment storage.	Sandbags, inflatable bunds, shovels, excavator, mobile storage, temporary ponding.
	Bypass pumping from ponding area or direct from upstream Wastewater to downstream Wastewater to bypass the affected section.	Pumps, hose, generator
	Vacuum truck removal from ponding area and discharge to Wastewater or approved disposal site.	Vacuum truck, hose
	Cessation or diversion of upstream discharges where feasible.	Contact contributing catchment and request cessation of discharges to Wastewater.
	Where liquid cannot be contained, installation of screening equipment at the overflow source to remove & recover floatables and coarse solids.	Screen
Diversion	Similar to at-source options, however, deployment will be remote from the point of discharge. The objective is to capture the overflow before it enters a waterbody or divert to it away.	As for at-source options

Containment in a waterbody	Temporary instream dams / weirs formed by placement of sandbags, inflatable bunds to form dam across stream channel.	Sandbags, inflatable bunds, shovels
	Upstream and downstream containment with stream flow diversion pumping to convey clean flow from upstream to downstream past the contained area.	Sandbags, inflatable bunds, shovels, pump, hose
	Having established instream containment, vacuum pumping to remove and recover contamination would proceed.	Vacuum truck, hose

Catchment Specific Incident Planning

In areas with multiple or frequent Wastewater overflows, catchment specific response planning may be appropriate. Such planning should focus on measures to enhance the speed and effectiveness of the response, such as:

- reticulation plans, highlighting known frequent overflow locations;
- landowner contact details where access to private land is required;
- telemetered overflow alarms;
- identification of accessible sites for overflow containment;
- identification of site specific containment solutions;
- deployment of containment and clean-up equipment at satellite storage facilities.

Implementing the Repair

Repairs to return the Wastewater to service and cease the overflow discharge may involve a wide range of measures.

It is essential that repair and return to service be completed as soon as practicable. Where resources allow, implementing the containment and repair phases in parallel is the most effective response. However, where resources do not allow, the repair phase should follow the containment phase as described above.

Some Wastewater overflow causes may require a two stage remedial approach, involving temporary repairs to stop the overflow followed by permanent remedial works.

In all cases it is essential that a record be kept of the cause and required repair. Multiple overflow events at locations are indicative of a wider maintenance issue that may require additional works to address.

Appendix F. Clean-up and Disinfection Procedures

The clean-up of a contaminated waterbody will be undertaken by the service provider under the direction of the Incident Controller and will generally commence following the establishment of containment and repair of the overflow.

Clean-up performance target

The performance target for clean-up of a contaminated waterbody is set out as follows:

- Removal of contaminated water from above point of containment; and
- Removal of solids and sludge; and
- Removal of sanitary products & other debris; and
- Removal of dead fish.

A '*best practicable option*' approach to achieving this target has been adopted.

Clean-up of contaminated soil and specialist disinfection is covered in Appendix I

Methods

Clean-up may involve the following methods:

- Pumping / vacuum recovery of contaminated water;
- Vacuum recovery of sludge;
- Rake / spade /sweep to recover solids & debris & then bagging of material for appropriate disposal;
- Areas with prolonged exposure may require excavation, regrading and regrassing.

Washdown of affected areas should only be undertaken where washdown water can be captured by the containment system. All washdown water should be collected for disposal at an appropriate facility or discharged back into the wastewater network.

Disinfection

Clean-up and disinfection of sewage contamination in houses and buildings requires specialist public health advice. This level of disinfection and clean-up of contaminated soils is covered under Appendix I.

Where contamination of land has occurred disinfection following the clean-up may be appropriate where a public health risks exist. A range of disinfection methods are possible, including the application of disinfectant chemicals and the application of hydrated lime. UV disinfection by sunlight will also, overtime, render many potentially harmful pathogens inert.

It must be noted that disinfectants can adversely affect aquatic life and should only be used with appropriate controls to ensure contamination of a waterbody does not occur as a result of the application or subsequent rainfall. Lime must not be used in a situation where contamination of water could occur. Spray application of chemical disinfectants using a back-pack sprayer may be appropriate where there is a risk of lime contaminating a waterbody.

Where foul odours are affecting aesthetic values odours can be masked using odour masking sprays.

Appendix G. Fish Rescue, Recovery & Screening

Appropriate fish screens must be placed on pump and vacuum intakes when operating these in natural waterbodies. These screens should be a pre-fabricated coarse wire / steel mesh screens (mesh size no greater than 10 mm) capable of being fitted to a range of pump intakes.

Where significant contamination of a waterbody has occurred it may be necessary as part of the clean-up exercise for the response crew to undertake recovery of dead fish and possibly also the rescue of stressed fish or fish that have become trapped behind containment barriers. Eels will probably be most common, however smaller native fish may also be seen.

The equipment needed for fish capture and relocation should be present in each of the Watercare Contractors and Incident Controllers vehicles and the Auckland Council Pollution Response vehicles is listed below:

- Landing net - the bag should be made out of a soft, knotless mesh material and be deep enough to accommodate medium-sized eels. A telescopic handle is preferable to reduce the storage space needed. These type of nets can be purchased at any fishing supply store.
- Bucket – at least 10 litres in size with a secure lid
- AmmoLock – small bottles of this ammonia neutralising solution can be bought relatively cheaply from any aquarium store
- Portable oxygen pump – small battery-operated oxygen pumps can be bought at aquarium stores for around $20

Dead fish should be removed from site and disposed of to an appropriate waste disposal facility.

Note: The below protocol deals with native freshwater fish species only. Exotic species, especially gambusia (mosquitofish) and koi carp must never be transferred to a new locality.

Destroy these species if they are discovered.

Mosquitofish

Koi Carp

Fish Rescue Process

Effects of Wastewater overflows on fish

The presence of raw sewage and other contaminants associated with wastewater overflows into waterbodies has two main effects on fish living in these environments:

- Chemical effects
- Depletion in dissolved oxygen levels

Chemical effects are largely due to the very high levels of ammonia present in wastewater, although other chemicals, such as cleaning products and detergents may also be a factor. These chemicals irritate sensitive tissues, such as the eyes and gills, affecting the fish's ability to see and breathe effectively. If fish are exposed to these chemicals for extended periods of time then they are likely to die through stress and secondary infections.

The dissolved oxygen levels in a waterbody will decline rapidly in the event of a wastewater overflow, due to the high bacterial activity that is generated. Often this effect will be exacerbated in small streams with low flow or when temperatures are high during summer, with water sometimes becoming black, stagnant and foul-smelling. In these situations mass fish mortalities are likely to occur due to asphyxiation. Hardier species such as eels may be seen gulping air at the water's surface.

Fish capture

If fish are seen in distress at a Wastewater overflow and it is practical to attempt to capture and relocate them then this should be done as soon as possible, with due regard for health and safety as well as incident response priorities.

Fish should be captured using a long-handled landing net, with a bag made out of soft, knotless mesh material. Because many of our native fish species lack scales, having instead a thin layer of mucus on their skin, they can be easily damaged through rough handling. In order to reduce stress on the fish, handling time should be kept to a minimum and they should never be touched with dry hands, as this can affect the protective mucus coating on their skin.

Upon capture, fish should be transferred to a bucket of preferably clean water with a portable oxygen pump running. Having a high level of dissolved oxygen in the water is essential to reduce stress in the fish and to help them recover if they have been removed from stagnant conditions.

Eels and kokopu are particularly good at escaping from buckets, so a secure lid should always be used to keep them contained.

AmmoLock, a chemical that neutralises ammonia, should be added to the bucket in accordance with the instructions on the bottle. This is especially important when the only source of water to store fish in has to come from the area already contaminated with wastewater, as without AmmoLock added the ammonia levels will continue to affect the fish.

Native fish are very sensitive to high water temperatures, so they should be kept in the shade and released to a clean area as soon as practicable. If they have to be kept in a bucket for long periods then the water should be changed approximately every half hour.

Releasing fish

Ideally, affected fish should be released back into the same waterway that they were captured from, at a point well upstream of the contamination source. Sometimes this may not be possible, due to a lack of available fish habitat or the entire waterway having been contaminated. In this situation it may be necessary to find another site in the general locality that is suitable for the release.

When releasing fish they should always be treated with care and handling should be kept to a bare minimum. The best technique is simply to partially submerge the bucket and let the fish swim out of it. Fish should never be tossed or tipped into water from a height, as this can damage their internal organs.

Appendix H. Flushing Procedures

Where contamination of the stormwater system has occurred or where residual material remains in a watercourse following clean-up, flushing using reticulated water supply may be appropriate. Flushing may be particularly effective during summer or when extended low flow periods exist in a watercourse as the additional baseflow will dilute and disperse contaminated water.

Flushing should not, however, be seen as a clean-up method for every Wastewater overflow. Flushing is a tool that should be utilised when conditions are such that the impact of flushing will not cause any further environmental damage.

Before commencing any flushing utilising reticulated water supply, agreement should be reached with the Auckland Council Pollution Response Staff that this action is appropriate. If reticulated water is used for flushing, it may be necessary in some situations to dechlorinate the flushing water before discharging it to a watercourse.

If flushing of a watercourse is to be undertaken the following process should be followed:

- *Incident Controller* confirms clean-up is undertaken to a point where only flushing could further improve the environment..
- *Incident Controller* confirms with Auckland Council Pollution Response Team that flushing can be undertaken. This confirmation shall be documented
- If mains source chlorinated drinking water is used, then flushing should be undertaken using Watercare's Best Management Plan for Treated Drinking Water Discharges.
- The flushing chlorinated water should be run across open ground for 100m or more where possible to allow chlorine to evaporate.
- The flushing discharge should occur only once and be a duration of no more than an hour.

Flush Using Treated Drinking Water

Flushing should be undertaken using Watercare's Best Management Plan for Treated Drinking Water Discharges.

The potential environmental effects of drinking water discharges relate to the toxic effects of residual chlorine on aquatic ecosystems, and the effects of sediment erosion in the discharge plume.

Any flushing process should minimise:

- the potential for adverse environmental effects on natural water courses associated with residual chlorine in treated drinking water; and
- potential for adverse environmental effects on natural water courses associated with any scour and erosion that might occur during a discharge.

Before undertaking and flushing process ensure appropriate environmental protection measures are used. These could include:

- establishing a stabilised discharge flow path – this reduces the risks of sediment erosion, and could include;
  - direct discharge to curb & channel;
  - using sandbags and a geotextile fabric to reinforce a discharge flow path;
  - riprap rock protection may be required at transmission discharge locations.

- checking receiving environment – assess channel capacity, remove debris that might become mobilised;
- using dechlorination measures;
- sediment & erosion control measures; and
- capturing all contaminated water for disposal.

Through the flushing process the effectiveness of environmental controls should be monitored:

- monitor operation of dechlorination methods;
- Field testing of residual chlorine levels in receiving waters and adjustments to dechlorination procedures if needed.
- Receiving environment checks downstream of discharge point to confirm downstream channel capacity, bank stability.
- Controls and disposal methods to ensure complete capture of contaminants.

Appendix I. Contaminated Soil and Specialist Disinfection Procedures

Under development.

Watercare Incident Controller Key Roles and Responsibilities

It is the Role of the Incident Controller to manage the response to a level 2 or higher Wastewater overflow incident. This role includes;

- **incident assessment** and incident escalation**;**
- **notifying** the Auckland Council and Auckland Regional Public Health Service;
- **managing the response** including, action plans for containment, repair clean-up and community relations;
- ensuring that all appropriate health and safety measures are taken;
- ensuring that the overflow response is in accordance with best practice;
- providing technical support and direction to the Watercare Service Provider;
- ensuring appropriate activities are undertaken by Watercare Service Provider;
- ensuring that environmental monitoring is undertaken as required with support from Environmental Health or Public Health Officer;
- reviewing and assessing the Watercare Service Provider response and the ongoing overall assessment of incident to ensure no activity has been over looked;
- reviewing and assessing the clean-up process;
- keeping a detailed log of events, actions, and impacts, in particular noting the nature and times of specific response times and recording of causes and required repairs;
- providing situation reports as required;
- upgrading or downgrading incident with changing situation;
- developing work plans for the next work period if needed;
- **establishing and maintaining effective communication** The Incident Controller is the central point of contact for all parties involved in the response;
- **closing-out the incident**;
- confirming that clean-up has been completed;
- assessing the need for any additional remedial works to prevent recurrence;
- confirming that the incident has been managed in accordance with best practice;
- **incident reporting** including conducting incident debriefs; and
- confirming that the process has been appropriately documented.

Incident Controller Action Plan Checklist

Where the symbol ⓘ appears this Information is to be recorded on the Wastewater Overflow Incident Assessment Form and updated as required.

Incident Assessment Information gained from Watercare Service Provider Primary Response team	Name of Incident Controller ⓘ				
	Name(s) and details of Service Providers on site ⓘ				
	Location of Wastewater overflow ⓘ				
	Event/incident description ⓘ				
	Time of original notification of Wastewater overflow ⓘ				
	Cause of overflow ⓘ				
	Likely total duration of overflow ⓘ				
	Have you ascertained?	Where the overflow is going or has potential to go? (Tick all that apply)			
			Sensitive Land		**Waterways**
			stormwater reticulation		streams;
			council play grounds		wetlands;
			parks and reserves		ponds/lakes;
			roadways;		groundwater aquifers;
			residences		beaches;
			schools and childcare centres;		open coasts
			playing fields;		harbours and estuaries
			accommodation complexes		
			tourist attractions		
		The approximate discharge flow rate?			
		The approximate receiving water flow rate? (if to water)			
		Who is involved? I.e. key customers, care customers*, distressed public?			
		Any damage to property people or habitable floor?			
		Is attendance on site required?			
	Determined Incident Level? ⓘ				
Auckland Council and Public Health	Notify Auckland Council and the Regional Public Health Team. firstly by phone and then by email ⓘ				
	Record who is onsite and what time ⓘ				
Response Management	Health and safety procedures ⓘ				
	Public Safety ⓘ				
	Install Public Health Warning signs ⓘ				
Assess the Situation (Incident Controller on site or through discussions with the Site Manager when not on site)	Cause of overflow. ⓘ				
	Discharge flow rates. ⓘ				
	Expected time to fix. ⓘ				
	Environmental compliance issues.ⓘ				
	Undertake Environmental monitoring. ⓘ				
	Overflow has been contained or can be contained?				
	Evaluate	Discharge to water body			
		Discharge to sensitive land			
Create Action	Create	for containment			

Plan and Identify Resources Required	Strategies	for required resolution steps	
		for communication, resources and personnel	
	Identify	Resources required and ensure attendance of resources ⓘ	
		Any technical specialisation required	
		Any other resources or facilities required	
	Include	notifications and update schedules	
		estimated restoration time	
		changeover plans	
Containment and Repair	best containment options		
	best siting for containment		
	Has containment been established? ⓘ		
	Environmental Monitoring ⓘ		
	Has repair been completed? ⓘ		
	Is this a temporary repair requiring repairs later? ⓘ		
Clean-up and Recovery	Appropriate measures are undertaken to clean-up ⓘ		
	Is clean-up complete? ⓘ		
	Is flushing required?		
	Establish that flushing can be undertaken ⓘ		
	Ensure signage can be removed		
Communication Management	That advice from outside parties handled through Incident Controller at all times?		
	Media is handled by Watercare Communications team at all times?		
	Neighbours / public advised? And any Disturbance is minimised?		
Event/ Incident Closeout	Confirm clean-up is complete		
	Confirm results environmental monitoring within National Guidelines		
	Approve containment works to be removed		
	Confirm any need for remedial works		
	Confirm status of Public health Warnings		
	Confirm Incident managed in accordance with best practice		
	Confirm appropriate process documentation		
Reporting	Incident Response form filled in		
	Email sent to Auckland Council and Auckland Regional Public Health Services		
	Appropriate records are kept		
	Complete an incident debrief		
Key Timelines	Auckland Council notified		
	Auckland Regional Public Health Service notified		
	Incident controller on site within 60 minutes		
	Close out notifications 10 working days		

* **Care Customers**: Needs based. These customers have a higher reliance on uninterrupted supply and cannot tolerate a decrease in water quality services i.e. hospitals and home dialysis customers. While the services required by these customers are primarily the same, uninterrupted supply and no decrease in water quality, each has a slightly different set of relationship requirements. In most cases there are also customer specific requirements.

Wastewater Overflow Incident Assessment Form

Site Location		Date	
Incident Controller		Time onsite	
Site Manager		Hansen/SAP #:	

Parties onsite:				
Time:				

Initial Assessment	Flow rate of overflow	☐ *<0.5 l/s (trickle)*	☐ *0.5-2 l/s (flow)*	☐ *>2 l/s (gushing)*	
	Flow rate of receiving water	☐ *<0.5 l/s (trickle)*	☐ *0.5-2 l/s (flow)*	☐ *>2 l/s (gushing)*	☐ N/A
	Is the overflow into or onto:	☐ Land	☐ Stormwater	☐ Natural Water	
	Is the overflow into/onto a sensitive area?	☐ Recreational	☐ Beach	☐ Residential	☐ Other.....
		☐ School/Daycare	☐ Public area		
	Duration of overflow from time of notification	☐ < 1 Hour	☐ 1-4 Hours	☐ >4 hours	☐ >12 hours
	Expected time to repair/restore service to normal	☐ < 1 Hour	☐ 1-4 Hours	☐ >4 hours	☐ >12 hours
	Likely total duration of overflow	☐ < 2 Hours	☐ 2-6 Hours	☐ 6-24 Hours	☐ > 24 Hours

Incident Level +time of Declaration	1	2……	3……	4……	5……

Site Safety	Personal H&S assessment has been assessed prior to entering site?	Yes	No
	Do site safety hazards exist that preclude safe site access? (If yes, explain what they are below)	Yes	No
	…… …… ……		
	Does the site presents H&S risks to the public (i.e. does access need to be restricted)? If yes, explain below what measures have been implemented (e.g. warning signs, including public health signage, tapes, cones etc):	Yes	No
	…… …… …… ……	**Date / time** ……	

Details	Incident description:	☐ Transmission	☐ Network	☐ Combined System ☐ Separate System
		……		
	Resources required/deployed:	……		
	Reason/cause of Wastewater overflow	……		
	Describe any environmental compliance issues?	……		

Environmental Monitoring:	Is Environmental Monitoring Required?					Yes	No
	Site location		Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	<u>< 3 ppm: Low reading</u> <u>> 3 ppm: Moderate</u> <u>> 6 ppm: High reading*</u> <u>see incident escalation process (mg/L = ppm)</u>
	1	From outflow to stream					
	2	5m downstream from outflow					
	3	100m downstream from outflow					
	4						

Containment			
	Is containment established?	Yes	No
	At source (how):	**Time:** ……	
	Diversion (how):	**Time:** ……	
	In stream (how):	**Time:** ……	
	New containment (If required):	**Time:** ……	

Repair			
	Is repair completed / service restored? And How? (explain below)	Yes	No
	…… ……	**Date/Time:** ……	
	Has discharge ceased?	Yes	No
	Is this a temporarily fix?	Yes	No
	Is follow up work required?	Yes	No
	If yes what?	…… …… ……	
	By whom?	…… …… ……	

Clean-up			
	Has clean-up been satisfactorily completed? i.e. Removal of solids, paper, sanitary goods/debris, dead fish, downstream contaminated water etc.	Yes	No
	Work undertaken …… …… ……	**Date/time** …… ……	

PRT Instruction						
	Is flushing required?				Yes	No
	If yes is approval given by Auckland Council Pollution Response Team (PRT)?				Yes	No
	Is PRT staff onsite?				Yes	No
	Details of process to be used. …… …… ……				**Date/time** ……	
	Fish relocation requirements: …… …… ……				**Date/time** ……	
	Other requirements …… …… ……				**Date/time** ……	
	PRT Signoff (Name and Signature) ……	**Date** ……	**Time** ……	PRT Verbal Signoff	**Date** ……	**Time** ……

Closeout				
	Containment removal approved by Incident Controller:			Yes / No
	Site safety works removed:			Yes / No
	Environmental monitoring complete:			Yes / No
	Is rehabilitation / reinstatement required?			Yes / No
	If yes what? …… …… ……			
	By whom? …… …… ……			
	Overflow Classification	☐ **SPILL**	☐ **DWSO**	☐ **WWO**
	Is there a history of incidents in same location?			**Yes** / **No**
	Watercare Incident Controller sign off			**Date** / **Time**
	Incident signoff by WSL Engineer			**Date** / **Time**

Pollution Response Advisor Key Roles and Responsibilities

The role that the Pollution Response Advisor has when responding to a Wastewater overflow incident includes:

- incident assessment;
- undertaking a pollution incident investigation;
- working and communicating with the incident controller to ensure that the overflow response is in accordance with best practice;
- following all health and safety requirements as determined by the Watercare Incident Controller or Watercare Site Manager and in accordance with the Auckland Council Health and Safety Policy when on site;
- providing technical support to the Watercare Incident Controller;
- assessing the need for flushing and/or stream drying procedures;
- providing guidance on flushing and/or stream drying processes;
- ensuring appropriate activities are undertaken by the Watercare incident team;
- ensuring that environmental monitoring is undertaken as required;
- establishing and maintaining effective communication with the Incident Controller;
- reviewing and assessing Watercare's response and clean-up of incident to ensure consistent and comprehensive clean-ups are being undertaken region wide;
- reporting; and
- when necessary, enforcement.

Licensing and Compliance, Environmental Health Officer Key Roles and Responsibilities

The role that the Responsible, Environmental Health Officer has when responding to a Wastewater overflow incident includes:

- incident assessment;
- assessing the risk to public health;
- ensuring that the safety of the public is maintained;
- ensuring that the Site Manager and when on site the Incident Controller have mitigated any risks to public health and safety arising from access to contaminated Wastewater overflows or works associated with the response;
- identifying the appropriate resources required to take to site to ascertain the existence of a potential statutory nuisance, remediating this nuisance, and to gather such evidence as to serve notice for the abatement of such nuisance;
- following all health and safety requirements as determined by the Watercare Incident Controller or Watercare Site Manager and in accordance with the Auckland Council Health and Safety policy when on site;
- ensuring that environmental monitoring is undertaken as required;
- ensuring public health signs are installed on sensitive land areas or recreational waterbodies;
- ensuring that where needed the appropriate Auckland Council personnel are notified;
- notifying the Environmental Service Team to update the Safeswim website (where to beaches monitored by safeswim);
- establishing and maintaining effective communication with the Incident Controller;
- ensuring all media enquiries are handled by the Watercare Communications team
- confirming that cleanup has been completed and contamination levels are within National Guidelines;
- removal of any signage; and
- updating and closing the Request for Service.

Pollution Response Advisor Action Plan Checklist

Incident Assessment When primary respondent	Establish escalation level	
	Notify Watercare Time:.....	
	Spoken to Watercare Duty Engineer if necessary	
Incident Assessment Information gained from Watercare Service Provider or Incident Controller	Name of Incident Controller: ☐ *Watercare* ☐ *Sub-contractor*	
	Parties Onsite: ☐ *Watercare* ☐ *Thiess* ☐ *Lend Lease* ☐ *City Care* ☐ *Downers*	
	Location:	
	Time of original notification of Wastewater overflow:	
	Likely total duration of overflow:	
	Have you ascertained? Where the overflow is going? (tick all that apply)	
	Waterways	
	☐ streams; ☐ beaches; ☐ wetlands; ☐ open coasts ☐ ponds/lakes; ☐ harbours and estuaries ☐ groundwater aquifers;	
	The approximate discharge flow rate?	
	The approximate receiving water flow rate? (if to water)	
	Other signs of contamination (if visible)	
	Ammonia levels	
	Determined Incident Level? ☐ *1* ☐ *2* ☐ *3* ☐ *4* ☐ *5*	
	Is attendance on site required?	
Response Management	Health and safety procedures	
Assess the Situation (Incident Controller on site or through discussions with the Site Manager when not on site)	Cause of overflow :	
	Discharge flow rates.:	
	Expected time to fix.	
	Environmental compliance issues.	

Environmental monitoring	Site location		Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	< 3 ppm: Low reading > 3 ppm: Moderate > 6 ppm: High reading* see incident escalation process
	1	From outflow to stream					
	2	5m downstream from outflow					
	3	100m downstream from outflow					
	4	.....					

Evaluate Containment Options	provide input where needed to the Incident Controller	best containment options	
		best siting for containment	
		Has containment been established?	
Clean-up and Recovery		Have appropriate measures been undertaken to clean-up	
		Is flushing required? (If Y enter details recommended) …… …… …… ……	
Communication Management	Advice is handled through Incident Controller at all times?		
Event/ Incident Closeout	Confirm clean-up is complete		
Reporting	Confirm results of final environmental monitoring		
	Confirm Incident managed in accordance with best practice		
	Incident Response form filled in by Incident controller and has been received		

Responsible Environmental Health Officer Action Plan Checklist

Where the symbol ⓘ appears this Information has been recorded on the Wastewater Overflow Incident Assessment Form by the Incident Controller

Incident Assessment

Information gained from Watercare Service Provider or Incident Controller and updated when on site

Have you ascertained?

Where the overflow is going or has potential to go? (Tick all that apply)

	Sensitive Land		**Waterways**
	stormwater reticulation		streams;
	council play grounds		wetlands;
	parks and reserves		ponds/lakes;
	roadways;		groundwater aquifers;
	residences		beaches;
	schools and childcare centres;		open coasts
	playing fields;		harbours and estuaries
	accommodation complexes		
	tourist attractions		

Name of Incident Controller ⓘ

……

Name(s) and details Service Providers on site ⓘ

……

Incident Level? ⓘ (3,4,5)

Time of original notification of Wastewater overflow ⓘ

Likely total duration of overflow ⓘ ……

What steps has Watercare taken to mitigate public health risk?

……

……

Ammonia levels

……

……

Other signs of contamination (if visible)

……

……

The approximate flow rate? I.e. can it be easily contained

……

Reason/Cause of overflow ⓘ

……

……

Is attendance on site required?

……

……

Any Access issues?

……

……

Are there any other agencies involved or needing to be involved?

……

……

Incident Assessment

Any information held on current files?

……

In house information	……	
Response Management	Resources required? ……	
	Health and safety procedures ⓘ	
Assess the Situation (Incident Controller on site or through discussions with the Site Manager when not on site)	Sensitivity of area? (update on first page)	
	Cause of overflow. ⓘ (update on first page)	
	Discharge flow rates. ⓘ	
	Has overflow stopped? Expected time to fix. ⓘ	
	Is overflow contained? Can it be contained? ……	
	Are there any other agencies involved or needing to be involved? (update on first page)	
Undertake Environmental Monitoring	Take samples where there is an identified risk to public health	
	Is there a need for samples from a recreational beach area?	

Site location		Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	
1						<u>< 3 ppm: Low reading</u> <u>> 3 ppm: Moderate</u> <u>> 6 ppm: High reading* see incident escalation process</u>
2						
3						
4						

Public Health Signage	Is public health signage needed? ……	
	Where has the signage been located? ……	
	Has the signs been removed once the risk has been mitigated? ……	
Communication Management	Advice is handled through Incident Controller at all times? (what advice given?) …… ……	
	Has Watercare acted on this advice? ……	
	Media is handled by Watercare Communications team at all times?	
	Any neighbour disturbance is minimised by Incident Controller?	
	Who needs to be informed? (Media team, Environmental services team? ETC) ……	
Event/ Incident Closeout	Confirm clean-up is complete	
	Confirm results environmental monitoring	
	Confirm Incident managed in accordance with best practice	
	Confirm appropriate process documentation	
Reporting	Incident Response form filled in by Incident controller and has been received	
	RFS completed and closed	

Wastewater Overflow Incident Assessment Form

Site Location		Date	
Incident Controller		Time onsite	
Site Manager		Hansen/SAP #:	

Parties onsite:				
Time:				

Initial Assessment	Flow rate of overflow	☐ *<0.5 l/s (trickle)*	☐ *0.5-2 l/s (flow)*	☐ *>2 l/s (gushing)*	
	Flow rate of receiving water	☐ *<0.5 l/s (trickle)*	☐ *0.5-2 l/s (flow)*	☐ *>2 l/s (gushing)*	☐ N/A
	Is the overflow into or onto:	☐ Land	☐ Stormwater	☐ Natural Water	
	Is the overflow into/onto a sensitive area?	☐ Recreational	☐ Beach	☐ Residential	☐ Other.....
		☐ School/Daycare	☐ Public area		
	Duration of overflow from time of notification	☐ < 1 Hour	☐ 1-4 Hours	☐ >4 hours	☐ >12 hours
	Expected time to repair/restore service to normal	☐ < 1 Hour	☐ 1-4 Hours	☐ >4 hours	☐ >12 hours
	Likely total duration of overflow	☐ < 2 Hours	☐ 2-6 Hours	☐ 6-24 Hours	☐ > 24 Hours

Incident Level +time of Declaration	1	2……	3……	4……	5……

Site Safety	Personal H&S assessment has been assessed prior to entering site?	Yes	No
	Do site safety hazards exist that preclude safe site access? (If yes, explain what they are below)	Yes	No
	…… …… ……		
	Does the site presents H&S risks to the public (i.e. does access need to be restricted)? If yes, explain below what measures have been implemented (e.g. warning signs, including public health signage, tapes, cones etc):	Yes	No
	……	**Date / time**	
	……	……	
	……	…	
	……		

Details	Incident description:	☐ Transmission	☐ Network	☐ Combined System ☐ Separate System
		……		
	Resources required/deployed:	……		
	Reason/cause of Wastewater overflow	……		
	Describe any environmental compliance issues?	……		

Environmental Monitoring:	Is Environmental Monitoring Required?				Yes	No
	Site location	Time taken	Ammonia level (mg/L)	Time taken	Ammonia level (mg/L)	<u>< 3 ppm: Low reading</u> <u>> 3 ppm: Moderate</u> <u>> 6 ppm: High reading*</u> <u>see incident escalation process (mg/L = ppm)</u>
	1 From outflow to stream					
	2 5m downstream from outflow					
	3 100m downstream from outflow					
	4					

Containment	Is containment established?	Yes	No
	At source (how):	**Time:** ……	
	Diversion (how):	**Time:** ……	
	In stream (how):	**Time:** ……	
	New containment (If required):	**Time:** ……	

Repair	Is repair completed / service restored? And How? (explain below)	Yes	No
	…… ……	**Date/Time:** ……	
	Has discharge ceased?	Yes	No
	Is this a temporarily fix?	Yes	No
	Is follow up work required?	Yes	No
	If yes what? …… …… ……		
	By whom? …… …… ……		

Clean-up	Has clean-up been satisfactorily completed? i.e. Removal of solids, paper, sanitary goods/debris, dead fish, downstream contaminated water etc.	Yes	No
	Work undertaken …… …… ……	**Date/time** …… ……	

PRT Instruction	Is flushing required?				Yes	No
	If yes is approval given by Auckland Council Pollution Response Team (PRT)?				Yes	No
	Is PRT staff onsite?				Yes	No
	Details of process to be used. …… …… ……				**Date/time** ……	
	Fish relocation requirements: …… …… ……				**Date/time** ……	
	Other requirements …… …… ……				**Date/time** ……	
	PRT Signoff (Name and Signature) ……	**Date** ……	**Time** ……	PRT Verbal Signoff	**Date** ……	**Time** ……

Closeout	Containment removal approved by Incident Controller:		Yes	No
	Site safety works removed:		Yes	No
	Environmental monitoring complete:		Yes	No
	Is rehabilitation / reinstatement required?		Yes	No
	If yes what? …… …… ……			
	By whom? …… …… ……			
	Overflow Classification	☐ **SPILL**	☐ **DWSO**	☐ **WWO**
	Is there a history of incidents in same location?		**Yes**	**No**
	Watercare Incident Controller sign off		**Date**	**Time**
	Incident signoff by WSL Engineer		**Date**	**Time**

Attachment 9:
Template for the
Annual Wastewater Network Performance Report

1 INTRODUCTION

This chapter outlines the contents of and reasons for this report.

2 OVERVIEW OF THE WASTEWATER NETWORK

This chapter provides an overview of the wastewater network at reporting time, and provides a brief summary of activities and changes to the network (if any) for each of the AEE catchments.

2.1 Catchment 1 – Wellsford
2.2 Catchment 2 – Omaha
2.3 Catchment 3 – Warkworth
2.4 Catchment 4 – Snells Beach/Algies Bay
2.5 Catchment 5 – Waiwera
2.6 Catchment 6 – Helensville
2.7 Catchment 7 – Orewa
2.8 Catchment 8 – Weiti
2.9 Catchment 9 – Whangaparaoa
2.10 Catchment 10 – Long Bay
2.11 Catchment 11 – East Coast Bays
2.12 Catchment 12 – Devonport-Takapuna
2.13 Catchment 13 – Shoal Bay
2.14 Catchment 14 – Upper Harbour North
2.15 Catchment 15 – Upper Harbour South
2.16 Catchment 16 – Upper Harbour West
2.17 Catchment 17 – Henderson Creek
2.18 Catchment 18 – Whau River
2.19 Catchment 19 – Laingholm
2.20 Catchment 20 – Cox's Bay
2.21 Catchment 21 – Central Auckland (CBD)
2.22 Catchment 22 – Hobson Bay
2.23 Catchment 23 – Onehunga
2.24 Catchment 24 – Mangere
2.25 Catchment 25 – Lower Tamaki River
2.26 Catchment 26 – Upper Tamaki River
2.27 Catchment 27 – Cockle Bay
2.28 Catchment 28 – Puhinui
2.29 Catchment 29 – Pahurehure Inlet
2.30 Catchment 30 – Oneroa
2.31 Catchment 31 – Beachlands-Maraetai
2.32 Catchment 32 – Clarks Beach
2.33 Catchment 33 – Waiuku
2.34 Catchment 34 – Pukekohe
2.35 Catchment 35 – Kumeu-Huapai-Riverhead

3 DRY WEATHER OVERFLOWS

3.1 Dry Weather Overflows between 1 July XXXX and 30 June XXXX

This chapter contains a table listing reported dry weather overflows that occurred in the reporting period, with the following information:

Overflow Identification:	*Date, Asset ID, Facility, Address, Catchment*
Duration and Cause:	*Start Time, Duration, Cause, Repeat Overflow (Yes or No)*
Additional Information:	*Risk to the public from the initial discharge (Yes or No), Risk of downstream contamination via stream flow (Yes or No), Risk of downstream contamination via the stormwater system (Yes or No), Receiving Environment (beach or recreational area), Contamination risk to a beach or recreational area (Yes or No), Overflow monitoring (Yes or No), Monitoring site location, Ammonia level, Containment (Yes or No), Measures to prevent re-occurrence of overflow (if any).*

3.2 Trend Analysis

Based on the information shown in 3.1 above, a comparison with reported dry weather overflows in previous years is undertaken and trends (if any) are identified, for example whether dry weather overflows occur more often in some catchments.

4 WET WEATHER OVERFLOWS

4.1 Wet Weather Overflows between 1 July XXXX and 30 June XXXX

This chapter contains a table listing wet weather overflows that occurred in the reporting period. Wet weather overflow reporting will be provided for all engineered overflow points associated with wastewater pump stations (Type 1 overflow points), as these are equipped with telemetry. Type 2 overflow points (Network Relief Points) are not normally equipped with telemetry (including the combined sewer overflow points). However, all reported wet weather overflows will be included.

The following information is provided in the table:

Overflow Point Identification:	*Overflow ID, Asset ID, Facility Name, Overflow Type, Address, Receiving Environment, Catchment, Data Source (telemetry or other)*
Overflow Information:	*Date, Start Time, Duration, Total number of overflows at this location*
Additional information:	*Risk to the public from the initial discharge (Yes or No), Risk of downstream contamination via stream flow (Yes or No), Risk of downstream contamination via the stormwater system (Yes or No), Improvement works (in progress or planned) relating to the overflow point.*

4.2 Trend Analysis

Based on the information shown in 4.1 above, a comparison with wet weather overflows in previous years is undertaken and trends (if any) are identified. Where applicable, the influence of wastewater network improvement works in the catchment is taken into account to determine the effectiveness.

5 INFLOW & INFILTRATION PROGRAMME

This chapter describes the status of the Inflow & Infiltration Programme during the reporting period, and summarises any specific remedial work projects undertaken during the reporting period.

6 WASTEWATER NETWORK UPGRADE AND IMPROVEMENT WORKS

6.1 Works Completed between 1 July XXXX and 30 June XXXX

This chapter provides a brief description of wastewater network improvement works completed during the reporting period, and their anticipated results.

6.2 Works in Progress between 1 July XXXX and 30 June XXXX

This chapter provides a brief description of wastewater network improvement works under way during the reporting period, and their anticipated results.

6.3 Works Planned for the Next Reporting Period (1 July XXXX and 30 June XXXX)

This chapter provides a brief description of wastewater network improvement works that are expected to commence in the next reporting period.

7 ADDITIONS TO THE WASTEWATER NETWORK

This chapter provides an overview of new assets required to service greenfield growth or urban intensification that were added to the wastewater network during the reporting period.

8 PUBLIC INFORMATION

This chapter sets out any changes, updates or additions to the public information provided in accordance with Condition xx of the Comprehensive Wastewater Network Discharge Permit.

9 SUMMARY AND CONCLUSION

This chapter will summarise important findings in terms of wastewater network performance over the reporting period and comment on wastewater network improvement works where relevant.

APPENDICES

APPENDIX 1: DEFINITIONS

APPENDIX 2: SCHEDULE OF ENGINEERED OVERFLOW POINTS IN THE EXISTING NETWORK (Current on 30 June XXXX)

This is an update of the Schedule provided in of Attachment 2 of the Comprehensive Wastewater Network Discharge Permit, as required by Condition xx.

Attachment 10:
Definitions

Definitions

Auckland	The geographical area defined in section 4(1) of the Local Government (Auckland Council) Act 2009.
Best Practicable Option (BPO)	In relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to— (a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and (b) the financial implications, and the effects on the environment, of that option when compared with other options; and (c) the current state of technical knowledge and the likelihood that the option can be successfully applied. (Resource Management Act 1991)
Class 1 Recreational Receiving Environment	1. An area where contact recreation is known to occur (i.e. located on a known bathing beach). If the beach is a Safe Swim site this is deemed to be an indicator of high use; and/or 2. A known shellfish gathering site; and/or 3. Aquaculture areas.
Computer Modelling	The formal simulation of the wastewater network using a mathematical model to predict network performance from a set of parameters and conditions, using a combination of hydrologic (such as MOUSE-ROI) and hydraulic (such as MOUSE) programmes.
Consultation	Engagement in a spirit of good will and open-mindedness to ensure that the Consent Holder is fully informed of the other parties' concerns and issues when preparing and reviewing the Wastewater Network Strategy.
Dry Weather Flow	The flow in the wastewater network that would occur during a normal day in a dry weather period, including wastewater, trade waste and groundwater infiltration. Groundwater is defined as any natural water, including salt water, which has not become mixed with wastewater or trade waste.

Dry Weather Overflow	An overflow that occurs during dry weather flow from any part of the network, usually as a result of blockage, breakage, mechanical or power failure at pump stations or storage facilities, system failure or the lack of hydraulic capacity in the network during periods of dry weather flow.
Engineered Overflow Point	A location where a discharge from an engineered overflow structure occurs.
Existing Network	The separated and combined wastewater network owned and operated by Watercare Services Limited (as the Auckland water organisation) at the time the Auckland Wastewater Network Comprehensive Discharge Permit commences. For avoidance of doubt, any additional or New Engineered Overflow Points become part of the Existing Network after the engineered overflow structure has been built.
Existing Urban Area	• Any area within the metropolitan urban limits, and • Any area included within the urban zones (under an operative district plan) of a rural or coastal settlement. at the time the Auckland Wastewater Network Comprehensive Discharge Permit commences.
Future Network	The *Network*, including Engineered Overflow Points and other Network assets, • in currently unserviced areas within any *Existing Urban Area*; or • to be constructed within any *Indicative Future Urban Area* after the area has been given an urban zoning.
Indicative Future Urban Area	Any area shown in the maps in Attachment 1 as Indicative Future Urban Area.
Manager	The designated person authorised by the Auckland Council, or their delegate.
Metropolitan Urban Limit	The boundary between rural area and urban area delineated on the Map Series 1, Sheets 1- 20 of the Auckland Council Regional Policy Statement (July 1999) and subsequent amendments.

Network	The wastewater network owned and operated by Watercare Services Limited (as the Auckland water organisation), including all assets necessary for the operation of the network, including but not limited to pipelines, pipe bridges, siphons, rising mains, overflow structures, storage facilities and pump stations. The Network includes the transmission system (the larger pipes that convey wastewater collected by local network pipes to the wastewater treatment plant.) and the local system (the smaller pipes that convey wastewater from individual properties or housing or commercial developments to the transmission network.).
New Engineered Overflow Point	An Engineered Overflow Point that is an addition to the Network after the Auckland Wastewater Network Comprehensive Discharge Permit commences.
Normal Operation (of the Network)	Excludes events which are due to circumstances beyond the Consent Holder's control and which cannot be provided against, and are defined as follows: (a) Chokes. Network Failure, a force majeure (including vandalism and for terrorism): (b) heavy rain which occurs at the same time maintenance or construction or re-construction of the Network and is beyond the diversion capacity.
Overflow or Wastewater Overflow	A discharge from the Network that occurs in either a controlled manner from an Engineered Overflow Point or in an uncontrolled manner from any other point in the network, either during times of Dry Weather Flow or Wet Weather Flow.
Overflow Point	An existing or future physical discharge location where the discharge is from an engineered overflow structure in the wastewater network.
Repeat Dry Weather Overflow	A Dry Weather Overflow that occurs more than once at the same location within a 12 month period.
Replacement Engineered Overflow Point	A like-for-like replacement (including a minor upgrade of the Engineered Overflow Structure) of the existing Engineered Overflow Point.
Reported Wastewater Overflow	An Overflow that is reported by any person to the Watercare Control Room or that has been identified as having occurred by Watercare's telemetry system.
SEA-M1	Significant Ecological Area – Marine 1, as defined in the The Proposed Auckland Unitary Plan notified 30 September 2013. An area which, due to its physical form, scale or inherent values, is considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development.

Similar Location	A location within a radius of 500 metres of the original location provided that it is within the same receiving environment.
Type 1 Overflow Points	Engineered structures associated with a wastewater pump station.
Type 2 Overflow Points	Engineered structures that provide a relief point on the network, including combined sewer overflows (CSOs).
Type 3 Overflows Points	Uncontrolled overflow points that usually discharge from a manhole as the result of surcharging during wet weather.
Wastewater	Liquid (and liquids containing solids) waste from domestic, industrial, institutional or commercial premises including (but not limited to) toilet wastes, sullage, trade wastes and gross solids.
Wastewater Network	A system of pipes, open channels and associated ancillary structures for the purpose of conveying, diverting, storing, treating or discharging wastewater.
Wastewater Network Strategy	The document that describes Network improvement planning and prioritisation of Network improvements for a period of six years.
Wastewater Overflow or Overflow	A discharge from the Network that occurs in either a controlled manner from an Engineered Overflow Point or in an uncontrolled manner from any other point in the network, either during times of Dry Weather Flow or Wet Weather Flow.
Wet Weather Flow	The flow within a wastewater network that is greater than the Dry Weather Flow, and which occurs as a result of rainfall (directly or indirectly) entering the Network.
Wet Weather Overflow	A Wastewater Overflow during times of Wet Weather Flow.
Wet Weather Overflow Event	One or more wet weather overflows that end(s) when all overflows have ceased discharging for more than 24 hours. Where the overflow stops and then recommences within 24 hours as a result of a single continuous or intermittent rainfall event, it is considered a single wet weather overflow event.

Attachment 11:
Type 3 Overflows to Private Property

[current in February 2014]

Type 3 Overflows to Private Property [current in February 2014]

Catchment No.	Catchment Name	Overflow ID	Address	Estimated Frequency	Frequency Range	Source of Information	Comment
18	Whau River	S10	15A Firle Place	0.7	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges at the back of a private property and is being monitored to determine probable cause.
24	Mangere	S1	36 Mascot Avenue	1.3	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole on private property that is located in the immediate vicinity of the road berm.
26	Upper Tamaki River	S2	36 Wedgwood Avenue	1.3	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of a private property.
26	Upper Tamaki River	S3	22 Graeme Avenue	1.2	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of a private property.
24	Mangere	S4	22 Royton Avenue	0.7	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a gully trap on private property at the back of the section.
26	Upper Tamaki River	S5	68 Hain Ave	1.3	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of a private property.
26	Upper Tamaki River	S7	11 Crown Crescent, Otara	2	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the vegetated back of a private property.
29	Pahurehure Inlet	S8	27 Buller Crescent	1.3	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow is discharges from a manhole at the back of a private property in a vegetated area.
29	Pahurehure Inlet	S9	46 Coxhead Road	1.5	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of a private property near the garage.
17	Henderson Creek	S14	Glen Eden Branch Sewer MH 69A	1.2	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of an industrial private property and enters a heavily vegetated area approximately 15 m away from the manhole.

Type 3 Overflows to Private Property [current in February 2014]

Catchment No.	Catchment Name	Overflow ID	Address	Estimated Frequency	Frequency Range	Source of Information	Comment
17	Henderson Creek	S15	Glen Eden Branch Sewer MH 79	0.9	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of a residential private property, by the fence line, and enters a vegetated area.
17	Henderson Creek	S16	Glen Eden Branch Sewer MH 88	0.8	Low	Watercare Complaints Database Jan 07 – Jul13	This overflow discharges from a manhole at the back of a residential private property, in a heavily vegetated area.
11	East Coast Bays	S27	81 Selwyn Crescent	3.6	Medium	Milford Takapuna Forrest Hill Model System Performance Assessment Report 2010	This overflow has been modelled and actual overflows have been recorded.
11	East Coast Bays	S28	129A Nile Road	8.1	Medium	Milford Takapuna Forrest Hill Model System Performance Assessment Report 2010	This overflow has been modelled but actual reported overflows are less than the model data indicates.
11	East Coast Bays	S29	11 Montrose Terrace	6.2	Medium	Mairangi Bay, Campbell's Bay and Castor Bay Wastewater Modelling System Performance Assessment 2011	This overflow has been modelled but actual reported overflows are less than the model data indicates.

Attachment 12:
Auckland-wide Wastewater Network Discharge Consent Application –
Generic Assessment of Ecological and Recreational Effects
(NIWA, April 2013)

NIWA
Taihoro Nukurangi

Auckland-wide Wastewater Network Discharge Consent Applications

Generic Assessment of Ecological and Recreational Effects

Prepared for Watercare Services Ltd

April 2013

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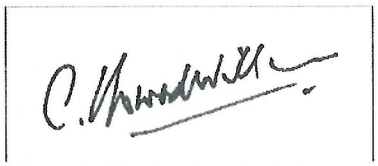

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Executive summary

This report describes the development and results of a generic assessment of the effects of wet-weather discharges of untreated wastewater on the ecological and recreational values of receiving water bodies throughout the Auckland Region. The assessment was conducted by developing and populating a matrix in which the potential for effects were scored from very high to very low for each of the six types of receiving environment, taking into account variations in receiving environment ecological and recreational values and the volume of discharges. Scores were assigned on the basis of expert judgement, supported by prior knowledge of the physical, chemical and biological processes and interactions operating in Auckland's streams, estuaries, harbours and other receiving waters.

The assessment followed a two-step process. Firstly, scores were assigned in relation to the potential for physical, chemical and biological changes resulting from wet-weather wastewater discharges to each type of receiving environment, taking account of variations in the volume of discharges and their dilution in the receiving water body. Secondly, scores were generated in relation to the potential for ecological and recreational effects associated with the physical, chemical and biological changes assessed in step 1. These effects scores were generated for three classes of ecological and recreational values: 'Class 1' (highest value), 'Class 2' and 'Class 3' (lowest value).

Ecological effects scores were generated for 504 combinations of receiving environment type, ecological values class and discharge volume. Three quarters of all scores were in the range 'very low' to 'moderate' potential for an effect. In the case of Large Waterways, all ecological effects were scored as having 'very low' to 'moderate' potential, except for loss of suitability for livestock watering and irrigation use. In the case of Estuaries, Harbours and Beaches, all ecological effects were also scored as having 'very low' to 'moderate' potential, except for certain effects associated with combinations of high discharge volumes and high to moderate ecological value (Class 1 and 2 ecological values).

The proportion of combinations scored as having a 'high' or 'very high' potential for an effect was highest for Small Waterways (more than half of all combinations) and Basins (approximately a third of all combinations). This reflects the physical characteristics of these environments: the size of Small Waterways limits the potential dilution of contaminants discharged into them while the limited flushing of Basins leads to conditions under which the accumulation of contaminants can occur.

Recreational effects scores were generated for 216 combinations of receiving environment type, recreational values class and discharge volume. Approximately two thirds of all scores were in the range 'very low' to 'moderate' potential for an effect, including 'very low' or 'low' scores in all receiving environments with Class 3 recreational values (waters where no contact recreation is likely to occur). In the case of Estuaries and Harbours, all recreational effects were scored as having 'very low' to 'moderate' potential, except for certain effects associated with combinations of high discharge volumes and high to moderate recreational value (Class 1 and 2 recreational values). In the case of all other receiving environment types, recreational effects were scored as 'high' or 'very high' for all combinations of high and medium volume discharges and high to moderate recreational values. For Small Waterways, recreational effects were also scored high to very high for low volume discharges, again reflecting the limited dilution available in these receiving environments.

1 Introduction

1.1 Background

This report describes a generic assessment of the effects of wet-weather discharges of untreated wastewater on the ecological and recreational values of receiving water bodies throughout the Auckland Region. The assessment has been conducted in order to support Watercare Services Ltd's ("Watercare') applications for resource consents for the continued operation of its 'Auckland-wide' wastewater network[1]. These applications seek consent to authorise intermittent discharges from pump stations, relief points and uncontrolled discharge points on the wastewater network.

Watercare are adopting a generic approach to the assessment of effects required in support of the consent applications. Under this approach, the potential effects of any discharge are to be assessed based on the following characteristics:

- Receiving environment type: six types of receiving environment have been identified including estuaries, harbours and two different classes of river;
- Receiving environment values: classes of each type of receiving environment have been identified which reflect variations in attributes such as ecological sensitivity and the potential for recreational activities;
- Volume of discharge: three levels of discharge have been identified (high, medium and low) - these are distinguished in terms of the annual average volume of wastewater discharged; and
- Degree of dilution, reflecting the volume of the discharge and the size and hydrodynamic characteristics of the receiving water body.

Watercare has engaged a team of consultants to prepare the consent applications. The team requires a basis for assigning the potential effects of each individual discharge based on the combination of characteristics set out above. The purpose of this report is to describe the development and results of a generic assessment that will provide the basis for Watercare's project team to describe the potential effects of individual discharges at any location on the wastewater network.

The Watercare project team's assessment will also involve considering the likelihood of the overflow (based on observations or estimates of frequency) to assess the potential risk posed by the discharge. A measure of confidence, reflecting the source of information used in the assessment, will also be assigned.

1.2 Scope

NIWA's task was to provide an assessment of the potential ecological and recreational[2] effects of wet-weather wastewater discharges for each of the six types of receiving

[1] Excluding much of the western part of the Auckland isthmus, which is being dealt with through consent applications for the Central Interceptor project.
[2] Assessments of cultural and amenity effects are also being made by Watercare's project team but these lie outside the scope the work described in this report.

environment, taking into account variations in receiving environment values, volume of discharges and dilution. This assessment was to be generic in nature (rather than site-specific) but was required to consider effects operating at different temporal and spatial scales. In particular, the assessment needed to:

- consider both short-term (acute) and long-term (chronic) effects;
- consider localised effects close to the point of discharge and far-field effects in water bodies receiving discharges indirectly (such as an estuary to which wastewater is discharged via a river or stream); and
- provide guidance on which of the effects have the potential to have cumulative impacts resulting from several coincidental discharges to a given receiving environment.

The assessment of the effects of dry-weather discharges lay outside of the scope of this project. This is because, although potentially significant in terms of their effects, dry-weather discharges typically result from system failures rather than by design and are therefore unpredictable and unquantifiable. It is understood that Watercare proposes to describe a generic assessment of the effects of dry-weather discharges as part of the AEE supporting the network consent applications.

1.3 Contents of this Report

Section 2 of this report describes the methods developed and employed as part of the generic assessment of effects. Section 3 presents the results, the focus of which is a matrix of scores representing the potential for a range of ecological and recreational effects in each of the receiving environment types. The derivation of these scores is then discussed in Section 4 while Section 5 summarises the assessment by listing the effects considered to have a relatively high potential of occurrence in each type of receiving environment. A number of appendices contain supporting information used in the assessment.

2 Method

2.1 Overview

The assessment was conducted by developing and populating a matrix in which the potential for effects were scored from very high to very low for each of the six types of receiving environment, taking into account variations in receiving environment ecological and recreational values, volume of discharges and dilution. Scores were assigned on the basis of expert judgement, supported by prior knowledge of the physical, chemical and biological processes and interactions operating in Auckland's streams, estuaries, harbours and other receiving waters. While a detailed literature review was not undertaken, the assessment was informed by knowledge of relevant publications, guidelines and data in the fields of each of the experts involved.

The assessment was undertaken prior to, during and following a workshop held at NIWA's Auckland office on 26 April 2012. Tasks undertaken prior to the workshop included developing a draft matrix (in MS Excel), listing the effects that would need to be considered and assembling a range of supporting information for the assessment.

At the workshop a panel of NIWA scientists met to make an initial attempt at populating the matrix with scores for each of the potential effects. The panel comprised scientists with particular expertise in the fields of: water quality and toxicology; public health risk assessment; estuarine and coastal physical processes; freshwater ecology; and marine ecology. Members of Watercare's project team were also involved in the workshop in order to make sure that the outputs generated would be fit-for-purpose. The workshop was also attended by staff from Auckland Council's regulatory, policy and research groups. Appendix A lists the workshop attendees.

The assessment followed a two-step process. Firstly, scores were assigned in relation to the potential for physical, chemical and biological changes resulting from wet-weather wastewater discharges to each type of receiving environment, taking account of variations in the volume of discharges. Secondly, scores were generated in relation to the potential for ecological and recreational effects associated with the physical, chemical and biological changes assessed in step 1. The assessment conducted in step 2 again took account of variations in discharge volume and dilution but also considered the potential for effects to vary in relation to differences in the ecological and recreational values of the receiving environment. The two steps are described in more detail in Sections 2.3 and 2.4.

Following the workshop, the NIWA panel made refinements to the scores assigned at the workshop and further developed and described the rationale upon which the scores are based (see Section 4).

2.2 Definitions and Assumptions

Watercare's project team have developed a methodology[3] under which the assessments of effects for each individual discharge will be conducted. This methodology determined the combinations of receiving environment types, receiving environment values and discharge volumes with which NIWA's generic assessment was required to fit (see Table 1 to Table 4).

[3] Provided to NIWA as MS Excel spreadsheet "WSL_Method_Draft_Template_v4.xlsm" dated 20 April 2012.

Examples of each type of receiving environment were provided by the Watercare project team (see Appendix B)

Table 1: Receiving Environment Types.

Receiving Environment Type	Definition
Basins	Artificially or naturally enclosed areas of a river or harbour e.g. Panmure Basin.
Beaches[a]	Water body between mean high water springs and another receiving environment. The East Coast Beaches of the former Rodney District and North Shore City and the Waitemata Harbour including the Eastern Beaches e.g. Mission Bay. Also includes the Manukau Harbour beaches.
Estuaries[b]	The wide lower course of a river where it flows into the sea. Estuaries are characterised by tidal flows and their water is a changing mixture of fresh and salt e.g. Whau River/Waiuku River.
Harbours	Generally enclosed areas of water where ships either historically or currently seek shelter. Includes the Waitemata and Manukau Harbours.
Large Waterways	Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Middle-Order (stream order 3 and 4) and High-Order (stream order greater than 4).
Small Waterways	Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Low-Order (stream order 1 and 2).

Notes:
[a] includes the open coast
[b] NIWA suggests renaming these 'Tidal Creeks' to provide greater distinction from harbours.

Table 2: Receiving Environment Ecological Values.

Receiving Environment Values - Ecology	Definition
Class 1	Identified by the Auckland Regional Plan: Coastal (ARP:C) as a Coastal Protection Area (CPA)* or a Significant Conservation Area* for ecology purposes. Also stream reach types* 2 and 3 in Auckland urban areas.
Class 2	Non-classified areas of local ecological conservation value. Areas may be identified through District Plan or of a habitat type known to have some ecological value (i.e. mangroves). Also stream reach types* 4 in Auckland urban areas.
Class 3	Highly modified and disturbed coastal and freshwater areas. Stream reach type* 5 and 6 in Auckland urban areas. Coastal areas could include for example ports and marinas. Freshwater areas could include highly modified channels and piped streams etc.

* Refer to Appendix C for further details.

Table 3: Receiving Environment Recreational Values.

Receiving Environment Values -Recreation	Definition
Class 1	Water where contact recreation is known to occur (i.e. located on a known bathing beach or Safe Swim site) and/or known shellfish gathering site. It has been assumed that a beach on the Safe Swim programme is indicative of high use.
Class 2	Water where contact recreation may occur (i.e. beach not located on Safe Swim programme, however contact recreation may occur). It has been assumed that a beach not on the Safe Swim programme is indicative of lower use.
Class 3	Water where contact recreation is unlikely to occur (i.e. mangrove lined estuary with no physical access to the water).

Table 4: Discharge Volumes.

Discharge Volume	Definition
High	From modelled information an annual average volume of 10,000 m^3 or greater and/or estimated annual average volume of 10,000 m^3 or greater from operators experience.
Medium	From modelled information an annual average volume of between 1,000 and 10,000 m^3 and / or estimated annual average volume of between of between 1,000 and 10,000 m^3 from operators experience.
Low	From modelled information an annual average volume of between 0 and 1,000 m^3 and / or estimated annual average volume of between of between 0 and 1,000 m^3 from operators experience.

It was necessary to make a number of assumptions in relation to other characteristics of wastewater discharges and receiving environments in order to ensure consistency in the assessment across all combinations of receiving environment type, values and discharge volumes.

The following assumptions were adopted:

- Discharge quality is represented by the 90th percentile concentrations of a range of constituents measured in influent to Watercare's Mangere Wastewater Treatment Plant (or other published 'upper' level concentrations where not available from Mangere WWTP data – see Table 5). These concentrations are appropriate for situations in which a 'plug' of wastewater is discharged at the onset of an overflow. While concentrations are likely to be lower where greater in-pipe dilution occurs, it was considered appropriate to adopt a conservative approach in undertaking the assessment.

Table 5: 90th percentile concentrations of constituents in influent to Mangere WWTP (as reported in Moores et al., 2012). All data g m^{-3} except norovirus (no. per L) and *E.Coli* (no CFU per 100 ml).

Constituent	90th percentile concentration
TSS	531
BOD	550
NH_4-N	47
TN	78
TP	7.9
Sulfide [1]	5
Copper	0.096
Zinc	0.31
Norovirus [2]	1 x 10^6
E.Coli [3]	4 x 10^7

Notes:
[1] obtained from literature search.
[2] from Rijal et al. (2009) and Hewitt et al. (2011).
[3] estimated from reported concentrations of faecal coliforms in influent to Mangere WWTP.

- The duration of individual overflow events varies in proportion to discharge volume. Watercare records[4] provided the basis for adopting the following durations:
  - low volume – 30 minutes duration
  - medium volume – six hours duration
  - high volume – twelve hours duration
- For the estimation of representative dilution rates in Small and Large Waterways, stream flow is represented by wet weather events that occur in the range 1-10 times per year[5]. Representative stream flows for events of this frequency were obtained by, firstly, generating 1% AEP flood flow estimates for 1st / 2nd order and >3rd order streams using NIWA's Water Resources Explorer tool[6] and, secondly, downscaling these estimates based on ratios between 1% AEP floods and annual floods estimated for stream flow recorder sites in the Auckland Region[7]. Based on this analysis, wet weather flows of:
  - 1 m^3/s for Small Waterways; and
  - 10 m^3/s for Large Waterways.

  were assumed to be representative of wet weather events occurring 1-10 times a year.
- Discharge impacts on dissolved oxygen (DO) at 0.1 km steps downstream of discharge points in streams and rivers were estimated using a spreadsheet model from the Streeter-Phelps solutions for a uniform single-input based on formulae in McBride (1982), allowing for the effects of dilution of anoxic sewage into fully oxygenated stream water (background DO = 10 g m^{-3}). The calculations used the initial BOD calculated from dilution of the 90%ile Mangere WWTP inflow (Table 5), a stream deoxygenation coefficient (k_1) of 1 day^{-1}, reaeration coefficient (k_2) of 10 day^{-1}, cross-section average velocity of 0.75 m s^{-1} and assumed that $BOD_5 = BOD_{ultimate}$ (see Appendix D).
- Discharges to coastal receiving environments are by way of sub-tidal outfalls.
- The characteristics of receiving environments will not change over time. The assessment of effects therefore had no regard to the potential influence of other activities, including degradation due to other sources of pollution or improvements due to environmental restoration activities, on the potential effects of wastewater overflows[8].
- The assessment of effects on recreational values is based on consideration of public health risk to communities, not individuals. This assumption is consistent

[4] P.Paschke, pers. comm., 26 April 2012
[5] Watercare's site-specific assessments are based on overflow frequencies of <2, 2-12 and >12 for low, medium and high volume discharges, respectively (P.Paschke, pers. comm., 5 June 2012).
[6] http://wrenz.niwa.co.nz/webmodel/
[7] Data accessed using Auckland Council's GIS viewer http://maps.aucklandcouncil.govt.nz/aucklandcouncilviewer
[8] However, while this assumption was adopted for the purpose of populating the matrix, comments on the potential influence of other activities are made in Section 3 of this report.

with the distinctions between recreational values Class 1, 2 and 3 (Table 3) which reflect the level of use and hence likelihood of exposure.

2.3 Step 1 – Physical, Chemical and Biological Changes

In Step 1, expert judgement was used to assign scores in relation to the potential for each of the following changes to occur as a result of wet weather wastewater overflows:

- physical
  - elevated stream flows
  - elevated water temperature
  - elevated total suspended solids concentrations
  - elevated organic solids concentrations
- chemical
  - elevated nutrient concentrations
  - elevated levels of potential toxicants in water column
  - accumulation of metals in bed sediments
  - nutrient enrichment of bed sediments
  - elevated biochemical oxygen demand (BOD)
  - reduced dissolved oxygen (DO), including anoxia
  - elevated pharmaceuticals and endocrine disrupters in bed sediments
- biological
  - organic enrichment of bed sediments
  - elevated pathogen concentrations (indicators and direct)

Scores were assigned for each combination of receiving environment type and discharge volume adopting the scoring system set out in Table 6. This involved populating 18 cells in the matrix for each physical, chemical and biological change (6 types of receiving environment x 3 categories of discharge volume).

Table 6: Scoring system used in the assessment.

Score	Description
5	Very high potential for change / effect
4	High potential for change / effect
3	Moderate potential for change / effect
2	Low potential for change / effect
1	Very low potential for change / effect

The assessment was conducted in the following order: Small Waterways, Large Waterways, Estuaries, Harbours, Beaches and Basins. This allowed the assessment to make a sensible progression whereby potential changes could be assessed relative to scores assigned to 'upstream' water bodies.

The following factors were taken into account in assigning the scores:

- the magnitude of the potential change relative to background conditions (during wet weather) and effects thresholds, taking account of the likely dilution of wastewater contaminants in each of the types of receiving environment. For instance, estimates of the diluted concentrations of toxicants in receiving water bodies resulting from overflows were made and compared with representative values for rivers during flood events and acute toxicity guidelines. The calculation of changes in the quality of receiving waters was made on the basis of assumptions relating to discharge quality and duration and stream flows described in Section 2.2. The calculations and guidelines used are provided in Appendix E.
- the potential duration of the change for high, medium and low volume events (see Section 2.2).
- the potential frequency of the change for high, medium and low volume events (see Section 2.2).

Consideration was also given to the temporal and spatial characteristics of the changes, in particular whether the changes are likely to:

- be short-term (acute) or long-term (chronic);
- be localised close to the point of discharge or have far-field effects in water bodies receiving discharges indirectly (such as an estuary to which wastewater is discharged via a river or stream); and
- have the potential to have cumulative effects resulting from several coincidental discharges to a given receiving environment.

Changes were assumed to be short-term and localised unless flagged otherwise.

2.4 Step 2 – Ecological and Recreational Effects

In Step 2, scores were generated in relation to the potential for each of the following effects to occur:

- ecological
  - change in physical habitat suitability
  - toxic concentrations of ammonia, sulphide, metals and nitrate
  - change in community structure / loss of sensitive species
  - behavioural changes in finfish
  - increase in nuisance plants (including Ulva and diatom mats in Estuaries)

- more frequent phytoplankton blooms (in the water column)
- reduced quantities of finfish
- reduced quantities of shellfish
- aquaculture degraded / opportunities lost
- loss of suitability for livestock watering
- loss of suitability for irrigation use
- growth of sewage fungus / *Beggiatoa* (bacteria which live in habitats that have high levels of hydrogen sulphide)

- recreational
  - unsuitability for contact / partial-contact recreation
  - unsuitability for collecting shellfish
  - unsuitability for fishing
  - unsuitability for harvesting water-cress / seaweed

The scores for each these effects were generated from those assigned to each of the physical, chemical and biological changes (in step 1) for most, but not all, combinations of receiving environment type, discharge volume and receiving environment classes (see Table 2 and Table 3). The assessment excluded effects on certain combinations where these were considered to be not applicable or highly unlikely. For example, it made no sense to assess the loss of aquaculture opportunities in relation to rivers or loss of suitability for irrigation use in relation to coastal receiving environments[9]. Other than these exclusions, Step 2 therefore involved populating 54 cells in the matrix for each ecological and recreational effect (6 types of receiving environment x 3 categories of discharge volume x 3 ecological or recreational value classes). The scoring system was identical to that used in step 1 (see Table 6).

Scores were generated as follows:

- an assessment was made of the relationships between the physical, chemical and biological changes considered in step 1 and each potential ecological and recreational effect (see Table 7).
- an assessment was made of whether or not the potential for each effect is likely to vary with receiving environment values (see Table 7)
- for each combination of receiving environment type, discharge volume and 'Class 1' receiving environment values (i.e. receiving environments with the highest ecological and recreational values, see Tables 2 and 3) the score for each potential effect was taken as the maximum of the scores of the contributing physical, chemical or biological changes. For example, if an effect was considered to be a function of three physical, chemical or biological changes with scores 2, 3 and 4, then the score for the effect would be 4.

[9] The excluded combinations are 'blacked out' in the matrix, see Table 8.

- for those effects which were considered not to vary with receiving environment values, the score generated for the 'Class 1' values was also adopted for the 'Class 2' and 'Class 3' values.
- for those effects which were considered to vary with receiving environment value, then:
  - for Small Waterways and Large Waterways, the scores for receiving environments with Class 2 and Class 3 values were generated by applying the following rules:

    Score(Class 2) = Score(Class1) – 1

    (e.g. if a score of 4 was generated for a river with Class 1 ecological values then a score of 3 was generated for a river with Class 2 ecological values); and

    Score(Class 3) = Score(Class1) – 3

    (e.g. if a score of 4 was generated for a waterway with Class 1 ecological values then a score of 1 was generated for a river with Class 3 ecological values).

  This approach reflects the panel's judgement of the influence of the differences between Class 1, 2 and 3 ecological and recreational values. The differences between Class 2 and 3 values are judged to be more significant than differences between Class 1 and 2 values. By definition, waterways with Class 3 ecological and recreational values are highly modified and unlikely to be used for contact recreation (see Table 2 and Table 3).

  - for Estuaries, Harbours, Beaches and Basins, the scores for receiving environments with Class 2 and Class 3 values were generated by applying the following rules:

    Score(Class 2) = Score(Class1)

    (e.g. if a score of 4 was generated for an Estuary with Class 1 ecological values then a score of 4 was also generated for an Estuary with Class 2 ecological values); and

    Score(Class 3) = Score(Class1) – 2

    (e.g. if a score of 4 was generated for an Estuary with Class 1 ecological values then a score of 2 was generated for an Estuary with Class 3 ecological values).

  This approach again reflects the panel's judgement of the influence of the differences between Class 1, 2 and 3 values. The distinction between Class 1 and 2 values is judged to be, to some extent, an artefact of the provisions of statutory plans, rather than being necessarily indicative of differences in

the ecological and recreational values of coastal receiving environments.[10] In contrast, coastal receiving environments with Class 3 ecological and recreational values are, by definition highly modified and unlikely to be used for contact recreation (see Table 2 and Table 3).

- for all types of receiving environment scores were constrained to the 5 point system set out in Table 6 such that the operation of the rules described above could not result in a score of more than 5 or less than 1.

As was the case in step 1, consideration was also given to the temporal and spatial characteristics of each effect, in particular whether the effects are likely to:

- be short-term (acute) or long-term (chronic);
- be localised close to the point of discharge or have far-field effects in water bodies receiving discharges indirectly (such as an estuary to which wastewater is discharged via a river or stream); and
- have the potential to be cumulative in nature, resulting from several coincidental discharges to a given receiving environment.

Effects were assumed to be short-term and localised unless flagged otherwise.

[10] for instance, refer to Appendix C for a description of the values taken into consideration in determining Coastal Protection Areas.

Table 7: Relationships between physical, chemical and biological changes and ecological and recreational effects. '✓' indicates those changes which have the potential to contribute to each effect[11].

Potential Physical, Chemical and Biological Changes to Characteristics of Receiving Environments Resulting from Discharge of Wastewater			Physical				Chemical							Biological	
Effects on Values of Receiving Environments (REs) Resulting from Changed Physical, Chemical and Biological Characteristics		Effect varies with RE values ?	Elevated stream flows	Elevated water temperature	Elevated TSS concs.	Elevated organic solid concs.	Elevated nutrient concs.	Elevated toxicant concs in water column	metal accumulation in bed sediments	Nutrient enrichment of bed sediments	Elevated BOD	Reduced DO	Elevated pharmac's / endocrine disrupters in bed	Organic enrichment of bed sediments	Elevated pathogen concs.
Ecological	Change in physical habitat suitability	Yes	✓	✓	✓	✓	✓*		✓	✓		✓		✓	
	Toxic concentrations of ammonia, sulphide, metals and nitrate	Yes						✓	✓	✓			✓		
	Change in community structure / loss of sensitive species	Yes	✓	✓	✓	✓	✓*	✓	✓	✓	✓	✓	✓	✓	
	Behavioural changes in finfish	Yes			✓								✓		
	Increase in nuisance plants (including Ulva and diatom mats in estuaries)	Yes		✓			✓*			✓					
	More frequent phytoplankton blooms (water column)	No		✓			✓*								
	Reduced quantities of finfish	Yes			✓			✓	✓	✓		✓	✓		
	Reduced quantities of shellfish	Yes			✓			✓	✓	✓		✓	✓		
	Aquaculture degraded / opportunities lost	Yes			✓			✓	✓	✓		✓	✓		
	Loss of suitability for livestock watering	No			✓	✓		✓					✓		✓
	Loss of suitability for irrigation use	No						✓					✓		✓
	Growth of sewage fungus / Beggiatoa	Yes									✓				

[11] Only positive relationships were considered, i.e. where an increase in the magnitude of change results in an increase in the magnitude of effect.

Potential Physical, Chemical and Biological Changes to Characteristics of Receiving Environments Resulting from Discharge of Wastewater			Physical				Chemical							Biological	
Effects on Values of Receiving Environments (REs) Resulting from Changed Physical, Chemical and Biological Characteristics		Effect varies with RE values ?	Elevated stream flows	Elevated water temperature	Elevated TSS concs.	Elevated organic solid concs.	Elevated nutrient concs.	Elevated toxicant concs in water column	metal accumulation in bed sediments	Nutrient enrichment of bed sediments	Elevated BOD	Reduced DO	Elevated pharmac's / endocrine disrupters in bed	Organic enrichment of bed sediments	Elevated pathogen concs.
Recreational	Unsuitable for contact / partial-contact recreation	Yes			✓									✓	✓
	Unsuitable for collecting shellfish	Yes			✓			✓	✓	✓		✓	✓		✓
	Unsuitable for fishing	Yes			✓			✓	✓	✓		✓	✓		✓
	Unsuitable for harvesting water-cress / seaweed	Yes						✓	✓					✓	✓

Note: * Applies to Estuaries, Harbours, Beaches and Basins but not Small or Large Waterways.

3 Results

3.1 Effects Matrix

Table 8 presents the scores for each physical, chemical and biological change and each ecological and recreational effect by receiving environment class. Scores are provided for each of the 'changes' by discharge volume. Scores are provided for each of the 'effects' by discharge volume and ecological or recreational value class. Blacked out cells indicate situations in which an effect is not considered applicable to a given receiving environment type.

The scores are discussed in Section 4.

3.2 Temporal Characteristics of Effects

Table 9 indicates which of the physical, chemical and biological changes and ecological and recreational effects are most likely to be long-term (or chronic) in nature. These are effects which reflect the accumulation over time of contaminants or other stressors as a result of repeated overflow discharges to a given receiving environment. The changes which contribute to long-term effects therefore tend to be 'load driven,' in contrast with short-term (or acute) effects which are mainly 'concentration-driven.' For example, the potential nutrient enrichment of estuary bed sediments is likely to be a function of elevated loads of nutrients deposited over years or decades while the exceedance of toxicity guidelines in a river is a relatively short-lived impact resulting from elevated concentrations of ammonia, sulphide and metals during (and perhaps immediately following) an individual overflow event.

3.3 Spatial Characteristics of Effects

Table 9 also indicates which of the physical, chemical and biological changes and ecological and recreational effects have the potential to be 'far-field' in nature, meaning that the changes or effects may result from discharges to other, upstream, receiving environments (including distant parts of the same receiving environment). The majority of changes and effects are considered to have this potential because, by the very nature of 'wet weather' events, many of the contaminants or other stressors associated with wastewater discharges are subject to transport from the immediate post-discharge environment. The outputs of the simulations of the discharge effects on downstream dissolved oxygen that informed the effects ratings are shown in Appendix D.

The exceptions are those changes or effects which are likely to be quickly overwhelmed as a result of dilution or by other changes to the receiving environment . For example, localised increases in stream flow or the concentrations of toxicants are unlikely to be measurable further downstream below successive river confluences.

3.4 Cumulative Effects

This generic assessment has not been able to distinguish which of the changes and effects are of most concern in terms of their potential cumulative impact. It seems obvious that many coincidental overflows to a given receiving environment have the potential to give rise to more marked changes and effects than those associated with a single discharge. This

potential is, of course, contingent on the characteristics of each situation: the number, volume, duration and frequency of the discharges.

However, while this assessment has not highlighted any cumulative effects of particular concern, it does provide a way of scoring the effects of many concurrent discharges. The suggested approach is, in the case of multiple overflows, to treat 'volume' as a surrogate for number of discharges. The scores assigned to the 'high' columns of the matrix can be considered to be applicable not only to one (or more) high volume discharges, but to several lower volume discharges that may occur concurrently and which have a similar combined volume to that used in the definition of a high volume overflow.

3.5 Influence of Other Activities and Restoration

While this assessment has not considered the influence of other activities such as stormwater discharges or environmental restoration, again it does provide a way of taking these other activities into account when scoring the effects of a wastewater discharge. Where the effects of other activities have the potential to exacerbate the effects of wastewater discharges, for instance the further elevation of metal concentrations due to stormwater discharges, then a conservative approach is to adopt the same approach as that outlined for cumulative effects above.

The panel also considered it important to emphasise that the ecological and recreational values (Classes 1, 2 and 3) associated with any given receiving environment will not necessarily remain fixed over time. In particular, it may be well be possible to return currently degraded environments to a better condition over the medium- to long-term. Where restoration activities have the potential to change the values of a receiving environment at some point in the future, for instance changing a stream from having Class 2 to Class 1 ecological values due to the maturation of riparian planting, then the assessment can deal with this by considering the score for that future state alongside the scores for the current state.

Table 8: Scores of potential physical, chemical and biological changes and potential ecological and recreational effects associated with wet weather wastewater overflows. Scores are provided for each receiving environment type by discharge volume and, for ecological and recreational effects, by ecological and recreational values class. Blacked out cells indicate situations in which effects are not applicable.

Receiving Environment Type		Small Waterways			Large Waterways			Estuaries (tidal creeks)			Harbours			Beaches (open coast)			Basins		
Discharge Volume		High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
Potential for physical, chemical and biological change																			
Physical	elevated stream flows	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	elevated water temperature	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	elevated total suspended solids concs	4	4	3	2	2	1	1	1	1	1	1	1	1	1	1	3	3	2
	elevated organic solids concs	5	5	4	3	3	2	2	2	1	2	2	1	2	2	1	3	3	2
Chemical	elevated concs of nutrients	4	4	4	2	2	2	2	2	1	1	1	1	1	1	1	3	3	2
	elevated levels of potential toxicants in water column	5	5	5	3	3	3	3	3	2	2	2	1	2	2	1	4	4	3
	accumulation of metals in bed sediments	2	2	2	2	2	2	2	2	2	2	1	1	2	1	1	3	2	2
	nutrient enrichment of bed sediments	2	2	2	2	2	2	4	3	2	4	3	2	4	3	2	5	4	3
	elevated BOD	5	5	4	3	3	2	2	2	2	1	1	1	1	1	1	4	3	3
	reduced DO, including anoxia	5	5	5	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2
	elevated pharmaceuticals and endocrine disrupters in sediment	2	2	2	3	3	2	3	3	2	2	1	1	2	1	1	4	4	3
Biological	organic enrichment of bed sediments	3	3	3	2	2	1	3	3	2	3	3	2	3	3	2	4	3	2
	elevated pathogen concs (indicators & direct)	5	5	5	5	5	3	4	3	2	3	3	2	4	4	3	4	4	3
Potential for effects on ecological values of receiving environments																			
Ecological values class		1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
Ecological	change in physical habitat suitability	5 4 2	5 4 2	5 4 2	3 2 1	3 2 1	2 1 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	5 5 3	4 4 2	3 3 1
	toxic concs of NH4, sulphide, metals, nitrate	5 4 2	5 4 2	5 4 2	3 2 1	3 2 1	3 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	5 5 3	4 4 2	3 3 1
	change in community structure / loss of sensitive species	5 4 2	5 4 2	5 4 2	3 2 1	3 2 1	3 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	5 5 3	4 4 2	3 3 1
	behavioural changes in fin fish	4 3 1	4 3 1	3 2 1	3 2 1	3 2 1	2 1 1	3 3 1	3 3 1	2 2 1	2 2 1	1 1 1	1 1 1	2 2 1	1 1 1	1 1 1	4 4 2	4 4 2	3 3 1
	increase in nuisance plants (including Ulva, diatom mats etc)	2 1 1	2 1 1	2 1 1	2 1 1	2 1 1	2 1 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1				5 5 3	4 4 2	3 3 1
	more frequent phytoplankton blooms (water column)							2 2 2	2 2 2	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	3 3 3	3 3 3	2 2 2
	reduced quantities of finfish	5 4 2	5 4 2	5 4 2	3 2 1	3 2 1	3 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	5 5 3	4 4 2	3 3 1
	reduced quantities of shellfish	5 4 2	5 4 2	5 4 2	3 2 1	3 2 1	3 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	5 5 3	4 4 2	3 3 1
	aquaculture degraded / opportunities lost							4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1						
	loss of suitability for livestock watering	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	3 3 3												
	loss of suitability for irrigation use	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	3 3 3												
	growth of sewage fungus / Beggiatoa	5 4 2	5 4 2	4 3 1	3 2 1	3 2 1	2 1 1	2 2 1	2 2 1	2 2 1	1 1 1	1 1 1	1 1 1				4 4 2	3 3 1	3 3 1
Potential for effects on recreational values of receiving environments																			
Recreational values class		1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
Recreational	unsuitable for contact / partial-contact recreation	5 4 2	5 4 2	5 4 2	5 4 2	5 4 2	3 2 1	4 4 2	3 3 1	2 2 1	3 3 1	3 3 1	2 2 1	4 4 2	4 4 2	3 3 1	4 4 2	4 4 2	3 3 1
	unsuitable for collecting shell fish	5 4 2	5 4 2	5 4 2	5 4 2	5 4 2	3 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	4 4 2	3 3 1	5 5 3	4 4 2	3 3 1
	unsuitable for fishing	5 4 2	5 4 2	5 4 2	5 4 2	5 4 2	3 2 1	4 4 2	3 3 1	2 2 1	4 4 2	3 3 1	2 2 1	4 4 2	4 4 2	3 3 1	5 5 3	4 4 2	3 3 1
	unsuitable for harvesting water-cress / seaweed	5 4 2	5 4 2	5 4 2	5 4 2	5 4 2	3 2 1	4 4 2	3 3 1	2 2 1	3 3 1	3 3 1	2 2 1	4 4 2	4 4 2	3 3 1	4 4 2	4 4 2	3 3 1

Scores: 1 - Very low potential for change / effect; 2 - Low potential for change / effect; 3 - Moderate potential for change / effect; 4 - High potenial for change / effect; 5 - Very high potential for change / effect

Table 9: Physical, chemical and biological changes and ecological and recreational effects of a potentially long-term and far-field nature.

	Change / Effect	Long Term	Far-field	Receiving Environment Types Affected
Physical Changes	Elevated stream flows			
	Elevated water temperature			
	Elevated TSS concs.	✓	✓	Estuaries, Harbours, Beaches, Basins
	Elevated organic solid concs.		✓	Estuaries, Harbours, Beaches, Basins
Chemical Changes	Elevated nutrient concs.		✓	Estuaries, Harbours, Beaches, Basins
	Elevated toxicant concs in water column			
	metal accumulation in bed sediments	✓	✓	Estuaries, Harbours, Beaches, Basins
	Nutrient enrichment of bed sediments	✓	✓	Estuaries, Harbours, Beaches, Basins
	Elevated BOD			
	Reduced DO	✓	✓	Long term – Basins. Far- field - Rivers, Estuaries, Basins
	Elevated pharmaceuticals / endocrine disrupters in bed sediments	✓	✓	Estuaries, Harbours, Beaches, Basins
Biological Changes	Organic enrichment of bed sediments	✓	✓	Estuaries, Harbours, Beaches, Basins
	Elevated pathogen concs.		✓	All
Ecological Effects	Change in physical habitat suitability	✓	✓	Estuaries, Harbours, Beaches, Basins
	Relatively frequent toxic concs of NH4, sulphide, metals, nitrate	✓	✓	All
	Change in community structure / loss of sensitive species	✓	✓	All
	Behavioural changes in finfish	✓	✓	All
	Increase in nuisance plants (including Ulva, diatom mats etc. in estuaries)	✓	✓	Estuaries, Harbours, Beaches, Basins
	More frequent phytoplankton blooms (water column)	✓	✓	Estuaries, Harbours, Beaches, Basins
	Reduced quantities of finfish	✓	✓	All
	Reduced quantities of shellfish	✓	✓	All
	Aquaculture degraded / opportunities lost	✓	✓	Estuaries, Harbours
	Loss of suitability for livestock watering			
	Loss of suitability for irrigation use			
	Growth of sewage fungus / *Beggiatoa*			
Recreational Effects	Unsuitable for contact / partial-contact recreation		✓	All
	Unsuitable for collecting shellfish	✓	✓	All
	Unsuitable for fishing		✓	All
	Unsuitable for harvesting water-cress / seaweed	✓	✓	All

4 Discussion

4.1 Small Waterways

4.1.1 Physical Changes

Small streams have relatively low dilution to absorb wet-weather wastewater discharges (assumed to be approximately. 4-fold for this exercise, see Appendix E) and consequently are susceptible to many discharge effects. "Low" volume overflows are expected to produce similar initial concentrations of contaminants but are likely to occur for much shorter durations than "medium" and "high" volume overflows and their impacts were down-weighted accordingly.

Wastewater discharges are likely to cause a moderate increase in streams flows (around 20-30%) but are unlikely to cause elevation of stream temperature because sewage is expected to be at the groundwater temperature (pers. comm. Patricia Paschke, Watercare). The discharges have a high potential for change in suspended solids, with downstream levels likely to be double the background. However, the organic nature of the sewage solids (Metcalf and Eddy 1991) and the lower stream background levels for VSS than for SS result in a very high potential for effects on organic solids (about a 7-fold increase, see Appendix E) below discharge points.

4.1.2 Chemical Changes

Wet-weather wastewater discharges are expected to increase background nutrient levels in the water column by about 10-fold in small streams (see Appendix E). This effect was down-weighted somewhat because under high flow conditions the effects of these nutrients are likely to be low due to plant response being restricted by the high flow and low clarity conditions (Biggs 1996).

Toxicant levels have a very high potential for impacts being predicted to be 2- to 100-fold above background levels. Notably, ammonium and sulfide concentrations in the water column below discharge points are expected to be about 2-fold and 10-fold higher than their respective freshwater guideline values for protection of aquatic life (see Appendix E).

Wastewater discharges are expected to be anoxic and have an immediate effect by reducing dissolved oxygen of small streams by about 20% immediately after mixing. The greater impact on DO, however, occurs downstream due to the oxidation of high concentrations of very degradable organics introduced by the discharges. The Streeter-Phelps type model (McBride 1982) used for this assessment predicts that the combined effects of the anoxic input and BOD would reduce the stream DO to less than 4 g m^{-3} at about 3 km below a discharge point, and to 2 g m^{-3} at about 9 km downstream (see Appendix E). These calculations indicate the potential for very high impacts from wet-weather wastewater discharges to small streams that run for more than 3 km before joining a large river with much higher dilution by relatively well-oxygenated water.

Relatively minor effects on the accumulation of metals, nutrients and pharmaceuticals in the bed sediments of small streams are likely because the erosional conditions during wet weather overflows are more likely to transport these contaminants downstream than promote storage (Hicks et al. 2004). However, there is a risk of sediment accumulation occurring if

discharges occur at times that wet weather flows are receding (when more depositional conditions may occur).

4.1.3 Biological Changes

Discharges to small streams produce high concentrations of organic solids (see Appendix E). However, the erosional conditions during wet weather (Hicks et al. 2004) were judged to result in only moderate potential for organic enrichment of stream sediments.

The very high level of pathogenic microorganisms in the discharges combined with relatively low dilution available in small streams (see Appendix E) results in very high potential for change.

4.1.4 Ecological Effects

The physical, chemical and biological changes to small streams described above have flow-on ecological effects. The severity of these is influenced by the degree of background disturbance of stream habitat, as summarised in the Auckland Council Urban Stream Framework (ARC, 2004). Streams with Class 1 ecological values are "low-moderately disturbed natural channels" with <25% catchment imperviousness. Streams with Class 2 ecological values are "highly disturbed natural channels" with >25% catchment imperviousness while streams with Class 3 ecological values are ">50% artificial channel".

Streams with Class 1 ecological values are expected to have invertebrate and fish communities that include relatively sensitive species, particularly those with catchments having <10% imperviousness, whereas the hydrological and water quality effects of higher levels of imperviousness (in streams with Class 2 ecological values) and high level of artificial channel modification (streams with Class 3 ecological values) produces progressive loss of sensitive species and natural ecological values (Walsh 2004, Walsh et al 2005). Hence the panel judged that the changes in the physical, chemical and biological attributes due to discharge to small streams will have a very high potential for effects on physico-chemical habitat suitability resulting in loss of sensitive species, shellfish and finfish in streams with Class 1 ecological values, with high and low effects predicted in small streams with Class 2 and 3 ecological values, respectively (Table 8). Despite large increases in nutrient concentrations, discharges were predicted to have a low potential for effects on growth of nuisance plants (Table 8) because of the short duration of high nutrients in small streams and the lighting and scour constraints of plant growth the high flow and turbid wet weather (Biggs 1996). For similar reasons, effects on phytoplankton were dismissed in small streams. The high levels of toxicants, organic solids and BOD in small streams below discharges result in a very high potential for effects on their suitability as sources of water for livestock watering and irrigation use across all stream classes (Table 8), due to effects on animal and plant health (toxicants and microbes), organic solids clogging delivery systems and potential anoxia within pipes resulting in corrosion and foul odours.

The very high level of BOD enrichment creates a corresponding level of risk of sewage fungus growth (Quinn & McFarlane 1988, MFE 1992)

4.1.5 Recreational Effects

Wet weather wastewater discharges to small streams are expected to have very high potential for effects on recreational uses in streams with Class 1 and 2 recreational values,

due to strong exceedance of microbial pathogen indicator for contact recreation guidelines (MFE/MOH 2003), and accumulation of pathogens and metals in stream sediments, shellfish, that filter particles from the water (James 1987), and watercress that acts a hydraulic trap for particles (Edmonds and Hawke 2004, Donnison et al 2009). Streams with Class 3 recreational values have a low potential for these effects because their relative inaccessibility means that recreational uses are already compromised.

4.1.6 Summary

Table 10 summarises the effects scores generated for Small Waterways.

Table 10: Scores of potential ecological and recreational effects associated with wet weather wastewater overflows to Small Waterways.

Receiving Environment Type		Small Waterways								
Discharge Volume		High			Medium			Low		
Ecological values class		1	2	3	1	2	3	1	2	3
Ecological effects	change in physical habitat suitability	V High	High	Low	V High	High	Low	V High	High	Low
	toxic concs of NH4, sulphide, metals, nitrate	V High	High	Low	V High	High	Low	V High	High	Low
	change in community structure / loss of sensitive species	V High	High	Low	V High	High	Low	V High	High	Low
	behavioural changes in fin fish	High	Mod	V Low	High	Mod	V Low	Mod	Low	V Low
	increase in nuisance plants (including Ulva, diatom mats etc)	Low	V Low	V Low	Low	V Low	V Low	Low	V Low	V Low
	more frequent phytoplankton blooms (water column)									
	reduced quantities of finfish	V High	High	Low	V High	High	Low	V High	High	Low
	reduced quantities of shellfish	V High	High	Low	V High	High	Low	V High	High	Low
	aquaculture degraded / opportunities lost									
	loss of suitability for livestock watering	V High	V High	V High	V High	V High	V High	V High	V High	V High
	loss of suitability for irrigation use	V High	V High	V High	V High	V High	V High	V High	V High	V High
	growth of sewage fungus / Beggiatoa	V High	High	Low	V High	High	Low	High	Mod	V Low
Recreational values class		1	2	3	1	2	3	1	2	3
Recreational effects	unsuitable for contact / partial-contact recreation	V High	High	Low	V High	High	Low	V High	High	Low
	unsuitable for collecting shell fish	V High	High	Low	V High	High	Low	V High	High	Low
	unsuitable for fishing	V High	High	Low	V High	High	Low	V High	High	Low
	unsuitable for harvesting water-cress / seaweed	V High	High	Low	V High	High	Low	V High	High	Low

4.2 Large Waterways

4.2.1 Physical Changes

Large streams and rivers have relatively high dilution (assumed to be 35-fold, see Appendix E) and are therefore better able to absorb wastewater discharges than the small streams discussed above. Discharges to these steams have very low potential to increase stream flows significantly (increase <3%) and are unlikely to cause elevation of stream temperature because of the relatively high dilution of the wastewater input and the expectation it will enter at the temperature of groundwater (pers. comm. Patricia Paschke, Watercare). Wastewater inputs are not expected to increase the background SS by more than 10% (i.e. very low potential for change) .However, the impact on organic solids is expected to be moderate because organic solids dominate the sewage solids strongly (Metcalf and Eddy 1991) and background levels of organic solids are much lower than SS in rivers (Quinn and Stroud 2002).

4.2.2 Chemical Changes

Toxicant levels below wastewater discharge points to rivers were predicted to be in the range background to 10-fold above background levels (highest relative for background for sulphide, although still below the freshwater guideline for protection of aquatic life, see Appendix E). Levels of zinc and copper are predicted to be near or slightly above guideline values. Overall the level of toxicant elevation above background is rated as moderate (Table 8).

The discharge effects on DO were predicted to be minor in large streams and rivers with the Streeter-Phelps type model (McBride 1982) predicting stream DO will remain above 8 $g.m^{-3}$ at the lowest part of the DO sag from 10-20 km below a discharge (Appendix D).

As with small streams, only minor effects on accumulation of metals, nutrients and pharmaceuticals in the bed sediments of rivers are likely because the erosional conditions during wet weather overflows are more likely to transport these contaminants downstream than promote storage (Hicks et al. 2004). However, there is a risk of storage sediment accumulation occurring if discharges occur at times that wet weather flows are receding (when more depositional conditions may occur).

4.2.3 Biological Changes

Discharges to rivers are likely to increase concentrations of organic solids by approximately 50% (see Appendix E), but the erosional conditions during wet weather (Hicks et al. 2004) result in only moderate potential for organic enrichment of stream sediments.

The very high level of pathogenic microorganisms in the discharges result in predicted E coli levels that are about 1000-fold higher than the MFE/MOH (2003) red alert level for contact recreation despite the higher dilution available in rivers than streams (see Appendix E). Pathogenic effects were down-rated to moderate in rivers with Type 3 ecological values because these are less likely to be used for recreation.

4.2.4 Ecological Effects

The 10-fold or greater dilution of discharges provided in rivers than small streams results in generally lower contaminant levels and ecological impacts of sewage overflows (see Appendix E). The panel judged that the changes in the physical, chemical and biological

attributes due to discharge to rivers will have a moderate potential for effects on physico-chemical habitat suitability resulting in loss of sensitive species, shellfish and finfish in rivers with Class 1 ecological values, whereas effects are predicted to be low or very low in rivers with Class 2 and 3 ecological values, respectively (Table 8). Despite doubling nutrient concentrations, discharges are predicted to have a low potential for effects on growth of nuisance plants (Table 8) because of the short duration of high nutrients in rivers and the lighting and scour constraints of plant growth the high flow and turbid wet weather (Biggs 1996). For similar reasons, effects on phytoplankton were dismissed in rivers.

The moderately elevated levels of toxicants, and highly elevated levels of organic solids, BOD and pathogen indicators in rivers below discharges result in a very high potential for effects on their suitability for livestock watering and irrigation use across all river classes (Table 8). This is because of potential effects on animal and plant health (toxicants and microbes), organic solids clogging delivery systems and potential anoxia within pipes resulting in corrosion and foul odours.

Discharges to rivers cause a high level of BOD enrichment, but due to the relatively short duration of sewage overflows this only results in a moderate level of risk of sewage fungus growth (Quinn & McFarlane 1988, MFE 1992).

4.2.5 Recreational Effects

Wet-weather wastewater discharges are expected to have very high potential for effects on rivers with Class 1 and Class 2 recreational values, due to strong exceedance of microbial pathogen indicator for contact recreation guidelines (MFE/MOH 2003), and accumulation of pathogens and metals in shellfish, and watercress. Note that even though the dilution available is considerably larger than is the case for small streams, the risks are not much different. That is because the infection dose-response curves for significant pathogens (especially norovirus) are very "flat" over the range of doses that a water user would receive via recreational activities or from consumption of raw shellfish. Rivers with Class 3 recreational values have a low potential for these effects because their relative inaccessibility means that recreational uses are already compromised.

4.2.6 Summary

Table 11 summarises the effects scores generated for River 1 receiving environments.

Table 11: Scores of potential ecological and recreational effects associated with wet weather wastewater overflows to Large Waterways.

Receiving Environment Type		Large Waterways								
Discharge Volume		High			Medium			Low		
Ecological values class		1	2	3	1	2	3	1	2	3
Ecological effects	change in physical habitat suitability	Mod	Low	V Low	Mod	Low	V Low	Low	V Low	V Low
	toxic concs of NH4, sulphide, metals, nitrate	Mod	Low	V Low	Mod	Low	V Low	Mod	Low	V Low
	change in community structure / loss of sensitive species	Mod	Low	V Low	Mod	Low	V Low	Mod	Low	V Low
	behavioural changes in fin fish	Mod	Low	V Low	Mod	Low	V Low	Low	V Low	V Low
	increase in nuisance plants (including Ulva, diatom mats etc)	Low	V Low	V Low	Low	V Low	V Low	Low	V Low	V Low
	more frequent phytoplankton blooms (water column)									
	reduced quantities of finfish	Mod	Low	V Low	Mod	Low	V Low	Mod	Low	V Low
	reduced quantities of shellfish	Mod	Low	V Low	Mod	Low	V Low	Mod	Low	V Low
	aquaculture degraded / opportunities lost									
	loss of suitability for livestock watering	V High	V High	V High	V High	V High	V High	Mod	Mod	Mod
	loss of suitability for irrigation use	V High	V High	V High	V High	V High	V High	Mod	Mod	Mod
	growth of sewage fungus / Beggiatoa	Mod	Low	V Low	Mod	Low	V Low	Low	V Low	V Low
Recreational values class		1	2	3	1	2	3	1	2	3
Recreational effects	unsuitable for contact / partial-contact recreation	V High	High	Low	V High	High	Low	Mod	Low	V Low
	unsuitable for collecting shell fish	V High	High	Low	V High	High	Low	Mod	Low	V Low
	unsuitable for fishing	V High	High	Low	V High	High	Low	Mod	Low	V Low
	unsuitable for harvesting water-cress / seaweed	V High	High	Low	V High	High	Low	Mod	Low	V Low

4.3 Estuaries (Tidal Creeks)

4.3.1 Physical Changes

Freshwater runoff is mixed with saltwater in tidal creeks, and there is tidal exchange with the harbour. The mixing and dilution of wet-weather wastewater discharges will vary depending on when, in the tidal cycle, the discharge occurs. Dilution will be maximum for discharges that occur just after high water (maximum volume of water in the tidal creek; subsequent seaward flushing over the remainder of the tidal cycle), but "ponding" may occur for a short time if the discharge occurs just before high water (Green and Oldman, 1999). However, the larger discharges are anticipated to occur over 1–2 tidal cycles, which will promote mixing and dilution. Smaller discharges are anticipated to occur over periods much shorter than a

tidal cycle, which could occur at a critical stage of the tide when ponding occurs. However, the volume of the smaller discharges is, of course, smaller, so the potential for less dilution in this case is of less concern. Hence, the panel estimated dilution in tidal creeks to be much larger than in Small and Large Waterways. Discharges to tidal creeks therefore have very low potential to increase flows significantly, and are unlikely to cause temperature elevation. Due to a range of physical processes, background total suspended solids concentrations tend to be larger at the head of the tidal creek than at the mouth or in the freshwater that discharges into the tidal creek (Green and Hancock, in press). Therefore, and with the expected dilution, the panel scored the potential for elevated total suspended solids as very low. However, following the reasoning applied to the Rivers (organic solids dominate in sewage), a higher score was given for the potential for elevated organic solids.

4.3.2 Chemical Changes

The higher dilution in tidal creeks compared to Large Waterways has to be balanced against the much lower concentrations of nutrients found in sea water (~1umol/L for ammonia and nitrogen oxides (NOx), and half as much for phosphate which apply in both wet and dry weather, unlike rivers). Thus, the potential for elevated nutrient concentrations was scored as low, for both high and medium volume discharges and one level lower (in the same way as was done for Large Waterways) for low volume discharges. The potential for elevated levels of toxicants in the water column was scored the same as for Large Waterways (moderate), except for the low discharge scenario, for which the higher dilution in the tidal creeks is expected to decrease this potential to low.

Tidal creeks are depositional basins; thus, potential for accumulation of metals, nutrients, organic solids and pharmaceuticals in bed sediments is high. Nevertheless, with the high dilution, the potential for accumulation of metals and organic solids was judged to be low to moderate for all discharge volumes. Potential for accumulation is higher for nutrients, due both to low levels of nutrients in sediments and because nutrient recycling is enhanced by the activity of the numerous benthic organisms inhabiting these areas (Thrush 2006, Sandwell 2009, Needham 2010).

The panel's assessment of the potential effects of pharmaceuticals and emerging contaminants in sediments took account of the results of sampling that has been undertaken at a wide range of sites around Auckland estuaries. Sediment characterisation studies undertaken by NIWA have identified a range of pharmaceuticals in the estuarine sediments. The primary source of these contaminants is most likely to be discharges from untreated wastewater overflows, however, the concentration of pharmaceuticals in treated wastewater discharges is not known and these sources may also contribute to the background concentrations.

The adsorption and settling of organic sediments are the primary fate for most organic contaminants in sewage discharges. The data for emerging contaminants of potential concern has been reported (Stewart et al 2008), while the pharmaceutical measurements have been analysed but not finalised to a report. Most of the emerging contaminants of potential concern would not be considered a significant issue for discharge from intermittent sewage overflows. However, the pharmaceutical concentrations in raw sewage are known to be elevated from international studies (M. Stewart, NIWA, pers. comm.) and to accumulate in receiving water sediments.

The panel assessed the potential for elevated concentrations of pharmaceuticals and endocrine disrupters in estuarine sediments to be moderate for high and medium volume discharges and low for low discharges. In view of the fact that there is only a limited body of knowledge on emerging contaminants, the panel noted the relatively high level of uncertainty associated with this part of the assessment. As more results from studies to measure and identify source of emerging contaminants become available, it may be possible to better evaluate the extent of any associated ecological effects..

The effects of discharges on elevated BOD and reduced DO in tidal creeks are expected to be similar to those in their river inflows at low tide, but much smaller at high tide when inflows are greatly diluted by coastal inflows. Consequently, for the purposes of this study, the panel scored the overall effects on BOD and DO depletion one level lower than in Large Waterways.

4.3.3 Biological Changes

Discharges to tidal creeks are moderately likely to increase organic enrichment of the sediments. Enrichment effects will be increased by the presence of suspension-feeding organisms filtering out some of the organic solid load. This is less likely to occur for the low-volume, short-duration discharges, as the probability that animals will be feeding during the discharge is decreased.

4.3.4 Ecological Effects

The potential for effects on physical habitat suitability ranges from low to high in Estuaries with Class 1 and 2 ecological values, depending on the volume of discharge. This is mainly driven by the potential for nutrient and organic enrichment of the sediments, due to the depositional nature of these environments and elevated pathogen and toxic substances in the water column. Changes to habitats (benthic and water column) will flow on to changes in community structure, loss of sensitive species, including finfish and shellfish. Increased nutrient concentrations in sediments also leads to a low to high potential for an increase in Ulva, Gracilaria and diatom mats, which in turn will lead to a change in habitat suitability for many sediment dwelling species. Interactions between ecological effects increase risks (Thrush et al. in press)

There is a low potential for increased numbers of phytoplankton blooms resulting from moderate to high volume discharges, driven by the similarly low potential for increased nutrient concentrations in the water column. The potential for aquaculture degradation also ranges from low to high in Estuaries with Class 1 and 2 ecological values, depending on the volume of discharge. This is mainly a result of the effects of elevated pathogen concentrations. The potential for growth of Beggiatoa bacterial mats is low, with the potential risk of elevated BOD low and reduced oxygen or anoxia very low.

4.3.5 Recreational Effects

Discharges to Estuaries are expected to have high potential for effects on recreational uses, due to substantial exceedance of microbial pathogen indicator for contact recreation guidelines (MFE/MOH 2003), and accumulation of pathogens and metals in sediments and shellfish that filter particles from the water (James 1987). As is the case when comparing small and large streams, the extra dilution achieved on discharge to a greater volume of water does not necessarily imply a concomitant reduction in health risk (appealing again to

the nature of the appropriate dose-response curves for human infections). Estuaries with Class 3 recreational values have a lower potential for these effects because their relative inaccessibility means that recreational uses are already compromised.

4.3.6 Summary

Table 12 summarises the effects scores generated for Estuaries.

Table 12: Scores of potential ecological and recreational effects associated with wet weather wastewater overflows to Estuaries.

Receiving Environment Type		Estuaries (tidal creeks)								
Discharge Volume		High			Medium			Low		
Ecological values class		1	2	3	1	2	3	1	2	3
Ecological effects	change in physical habitat suitability	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	toxic concs of NH4, sulphide, metals, nitrate	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	change in community structure / loss of sensitive species	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	behavioural changes in fin fish	Mod	Mod	V Low	Mod	Mod	V Low	Low	Low	V Low
	increase in nuisance plants (including Ulva, diatom mats etc)	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	more frequent phytoplankton blooms (water column)	Low	Low	Low	Low	Low	Low	V Low	V Low	V Low
	reduced quantities of finfish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	reduced quantities of shellfish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	aquaculture degraded / opportunities lost	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	loss of suitability for livestock watering									
	loss of suitability for irrigation use									
	growth of sewage fungus / Beggiatoa	Low	Low	V Low	Low	Low	V Low	Low	Low	V Low
Recreational values class		1	2	3	1	2	3	1	2	3
Recreational effects	unsuitable for contact / partial-contact recreation	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	unsuitable for collecting shell fish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	unsuitable for fishing	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	unsuitable for harvesting water-cress / seaweed	High	High	Low	Mod	Mod	V Low	Low	Low	V Low

4.4 Harbours

4.4.1 Physical Changes

Where wet weather enter Harbours through tidal creeks, mixing and dilution will be high as currents are likely to be relatively strong and able to penetrate some distance into the interior of the harbour. Therefore, dilution will be higher in Harbours than in tidal creeks. Wet-weather discharges in this case have very low potential to increase flows significantly, and are unlikely to elevate temperature. Given high dilution, the low proportion of inorganic solids in sewage, and compared to background levels that are likely to be elevated anyway under the conditions that discharges are likely to occur (Green and Coco, 2007), the panel estimated that discharges have very low potential to significantly raise total suspended solids concentrations in Harbours. However, following the reasoning applied to the Rivers (organic solids dominate in sewage), the panel gave a higher score for the potential for elevated organic solids. Where discharges enter a harbour directly around the fringes, the potential for local effects are greater (compared to the case of discharges entering a harbour via a tidal creek).

4.4.2 Chemical Changes

Given that dilution will be higher in Harbours than in tidal creeks, the potential for elevated concentrations of nutrients and toxicants was scored as lower than for tidal creeks.

Given the higher dilution in Harbours, the potential for accumulation of metals in the bed sediments was scored as slightly lower than in tidal creeks for the low-volume discharges. The potential for nutrient enrichment is higher (varying from low to high, depending on discharge volume) due to the higher concentrations of these in the discharges (compared with metals).

The comments made in relation to pharmaceuticals and emerging contaminants in estuary bed sediments also apply to Harbours.

Effects on BOD and DO of discharges were expected to be less in Harbours than in tidal creeks due to the greater dilution in Harbours and this is reflected in the scores for these effects being one level lower in Harbours than the corresponding scores in tidal creeks.

4.4.3 Biological Changes

The potential for organic enrichment of the sediments was scored as moderate (similar to that for tidal creeks), primarily due to the naturally low organic enrichment of the sediments (average <2%), and the presence of numerous suspension-feeding organisms (especially shellfish) filtering out some of the organic solid load. This is less likely to occur for the low-volume, short-duration discharges as the probability that animals will be feeding during the discharge is decreased.

4.4.4 Ecological Effects

The potential for ecological effects are generally the same as those for tidal creeks, as these are primarily driven by the potential for nutrient enrichment of the sediment. Thus, the potential for changes in the habitat suitability ranges from low to high in Harbours with Class 1 and 2 ecological values, depending on the volume of discharge, with concomitant changes in community structure and loss of sensitive species, including finfish and shellfish.

Increased nutrient concentrations in sediments also leads to low to high potential for an increase in Ulva and diatom mats, which in turn will lead to a change in habitat suitability for many sediment dwelling species.

The potential for aquaculture degradation remains low to high for Harbours with Class 1 and 2 ecological values, driven by the potential for nutrient enriched sediments. However, the potential for growth of *Beggiatoa* bacterial mats decreases to a very low risk for all environments and discharges due to the very low risk of elevated BOD low and reduced oxygen concentrations.

There is a very low potential for an increased number of phytoplankton blooms. Increased nutrient concentrations in the water column was assessed as being of very low potential and would frequently be offset by water turbidity. Within Harbours, wind patterns can be a primary driver of bloom occurrence, as wind can concentrate surface phytoplankton into relatively small areas (Doyon et al 2000).

4.4.5 Recreational Effects

Discharges to Harbours are expected to have potential for effects on recreational uses in Harbours with Class 1 and 2 recreational values, slightly less than is the case for Estuaries. This is via swimmer contact (e.g., in the case of sporting events) and accumulation of pathogens and metals in filter-feeding shellfish (James 1987). Harbours with Class 3 recreational values have a low potential for these effects because their relative inaccessibility means their recreational uses are already compromised.

4.4.6 Summary

Table 13 summarises the effects scores generated for Harbours.

Table 13: Scores of potential ecological and recreational effects associated with wet weather wastewater overflows to Harbours.

Receiving Environment Type		Harbours								
Discharge Volume		High			Medium			Low		
Ecological values class		1	2	3	1	2	3	1	2	3
Ecological effects	change in physical habitat suitability	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	toxic concs of NH4, sulphide, metals, nitrate	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	change in community structure / loss of sensitive species	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	behavioural changes in fin fish	Low	Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low
	increase in nuisance plants (including Ulva, diatom mats etc)	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	more frequent phytoplankton blooms (water column)	V Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low
	reduced quantities of finfish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	reduced quantities of shellfish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	aquaculture degraded / opportunities lost	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	loss of suitability for livestock watering									
	loss of suitability for irrigation use									
	growth of sewage fungus / Beggiatoa	V Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low
Recreational values class		1	2	3	1	2	3	1	2	3
Recreational effects	unsuitable for contact / partial-contact recreation	Mod	Mod	V Low	Mod	Mod	V Low	Low	Low	V Low
	unsuitable for collecting shell fish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	unsuitable for fishing	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	unsuitable for harvesting water-cress / seaweed	Mod	Mod	V Low	Mod	Mod	V Low	Low	Low	V Low

4.5 Beaches

4.5.1 Physical Changes

Given the large volume of the receiving waters and free connection to the coastal ocean, open-coast beaches are likely to have high dilution rates, even though wet-weather discharge may discharge directly to water immediately offshore of the beach. (It was assumed that no discharges directly to the beach will occur). Hence, the panel estimated the potential for elevated flows and elevated temperatures to be very low. Although background concentrations of total suspended solids are likely to be smaller than in Harbours (which are more enclosed), dilution should mitigate any effects, and hence the panel scored the potential for elevated total suspended solids as very low. Following previous reasoning, the

potential for elevated organic solids was scored higher. Depending on the location of the discharge, timing of the discharge relative to the tide, and the wind at the time of discharge, potential effects could be greater.

4.5.2 Chemical Changes

Because of the high dilution, the potential for elevated concentrations of nutrients and BOD was scored as very low for all discharge cases, although this will be dependent on wind direction during the period of discharge. The potential for elevated levels of toxicants in the water column was scored as slightly higher for the moderate- and high-discharge scenarios, due to the difference between background and WDW concentrations.

Beaches are fundamentally depositional environments. However, since dilution and exchange with the coastal ocean is high, the potential for accumulation of metals was scored as very low for low- to moderate-volume discharges, and as low for high-volume discharges. The potential for nutrient enrichment was scored as higher, varying from low to high.

4.5.3 Biological Changes

The potential for organic enrichment of the sediments was scored in the range low to moderate, (varying with discharge volume), due to the naturally low organic enrichment of the sediments (average <2%), and the presence of suspension-feeding organisms (especially shellfish).

4.5.4 Ecological Effects

The potential for ecological effects is the same as those for tidal creeks and Harbours, as these are primarily driven by the potential for nutrient enrichment of the sediment. Thus, the potential for changes habitat suitability ranges from low to high in Beaches with Class 1 and 2 ecological values environments, depending on the volume of discharge, with concomitant changes in community structure and loss of sensitive species, including finfish and shellfish.

Similar to the Harbours, there is a very low potential for increased number of phytoplankton blooms, the occurrence of which will be primarily driven by oceanic up-welling events and wind patterns.

4.5.5 Recreational Effects

Discharges impacting Beaches will have a higher potential for recreational effects than those impacting Harbours, for two reasons: (a) Beaches with Class 1 and 2 recreational values will often have much larger populations of recreators and they will visit these waters more often; and (b) dilution available is less than in Harbours, and the travel time of discharge plumes can be shorter. There will be substantial exceedances of microbial pathogen indicator for contact recreation guidelines (MFE/MOH 2003), and accumulation of pathogens and metals in shellfish, that filter particles from the water (James 1987). The elevated risks will occur over a shorter time period than is the case for rivers however, because the latter waters tend to store pathogens in sediments (especially during moderate flows) only to "bleed" them out later and so maintain elevated microbial contamination for longer periods. "Plume visitation" on Beaches will be of short duration and sediment accumulation will be less. Beaches with Class 3 recreational values have a lower potential for these effects because their relative inaccessibility means their recreational uses are already compromised (a situation that could change given extensive remedial and restoration activity – see Section 3.5).

4.5.6 Summary

Table 14 summarises the effects scores generated for Beaches.

Table 14: Scores of potential ecological and recreational effects associated with wet weather wastewater overflows to Beaches.

Receiving Environment Type		Beaches (open coast)								
Discharge Volume		High			Medium			Low		
Ecological values class		1	2	3	1	2	3	1	2	3
Ecological effects	change in physical habitat suitability	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	toxic concs of NH4, sulphide, metals, nitrate	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	change in community structure / loss of sensitive species	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	behavioural changes in fin fish	Low	Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low
	increase in nuisance plants (including Ulva, diatom mats etc)									
	more frequent phytoplankton blooms (water column)	V Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low	V Low
	reduced quantities of finfish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	reduced quantities of shellfish	High	High	Low	Mod	Mod	V Low	Low	Low	V Low
	aquaculture degraded / opportunities lost									
	loss of suitability for livestock watering									
	loss of suitability for irrigation use									
	growth of sewage fungus / Beggiatoa									
Recreational values class		1	2	3	1	2	3	1	2	3
Recreational effects	unsuitable for contact / partial-contact recreation	High	High	Low	High	High	Low	Mod	Mod	V Low
	unsuitable for collecting shell fish	High	High	Low	High	High	Low	Mod	Mod	V Low
	unsuitable for fishing	High	High	Low	High	High	Low	Mod	Mod	V Low
	unsuitable for harvesting water-cress / seaweed	High	High	Low	High	High	Low	Mod	Mod	V Low

4.6 Basins

4.6.1 Physical Changes

Although Basins have volumes that are comparable to smaller tidal creeks, flushing of Basins is much smaller and internal currents and associated mixing much less energetic. Therefore, the potential for dilution of wet-weather wastewater discharges is less than in tidal creeks. Also, background suspended solids concentrations are likely to be lower in less energetic

Basins. Hence, the panel scored the potential for elevated total suspended solids and organic solids as moderate.

4.6.2 Chemical Changes

Given the assessment of dilution and mixing, the potential for elevated concentrations of BOD, nutrients and toxicants was scored as higher than in tidal creeks.

Basins are depositional, which, together with the reduced mixing and dilution, led the panel to score the potential for metal and nutrient accumulation in the bed sediments of Basins to be higher than in tidal creeks.

4.6.3 Biological Changes

The potential for organic enrichment of the sediments is higher than for Harbours, Beaches and tidal creeks. The panel scored the risk in the range moderate to very high, varying with discharge volume.

4.6.4 Ecological Effects

The potential for ecological effects are higher in Basins than in any other of the marine environments, again driven by their hydrodynamics. Thus, the potential for changes in habitat suitability ranges from moderate to very high in Basins with Class 1 and 2 ecological values, depending on the volume of discharge, with concomitant changes in community structure and loss of sensitive species, including finfish and shellfish. The potential for increases in nuisance plants is also increased, varying from moderate to very high with discharge volume. The potential for frequent phytoplankton blooms varies from moderate to high in Basins with Class 1 and 2 ecological values. Even the potential for growth of *Beggiatoa* bacterial mats increases to moderate for all environments, with low and moderate volume discharges to high for high discharges.

4.6.5 Recreational Effects

Human health risks for Basins with Class 1 and 2 recreational values are expected to be very similar to those occurring at Beaches. While the travel times to sites of recreational activities may be longer, there is much less flushing and so build-up in shellfish and sediments will be more substantial.

4.6.6 Summary

Table 15 summarises the effects scores generated for Basins.

Table 15: Scores of potential ecological and recreational effects associated with wet weather wastewater overflows to Basins.

Receiving Environment Type		Basins								
Discharge Volume		High			Medium			Low		
Ecological values class		1	2	3	1	2	3	1	2	3
Ecological effects	change in physical habitat suitability	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	toxic concs of NH4, sulphide, metals, nitrate	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	change in community structure / loss of sensitive species	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	behavioural changes in fin fish	High	High	Low	High	High	Low	Mod	Mod	V Low
	increase in nuisance plants (including Ulva, diatom mats etc)	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	more frequent phytoplankton blooms (water column)	Mod	Mod	Mod	Mod	Mod	Mod	Low	Low	Low
	reduced quantities of finfish	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	reduced quantities of shellfish	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	aquaculture degraded / opportunities lost									
	loss of suitability for livestock watering									
	loss of suitability for irrigation use									
	growth of sewage fungus / Beggiatoa	High	High	Low	Mod	Mod	V Low	Mod	Mod	V Low
Recreational values class		1	2	3	1	2	3	1	2	3
Recreational effects	unsuitable for contact / partial-contact recreation	High	High	Low	High	High	Low	Mod	Mod	V Low
	unsuitable for collecting shell fish	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	unsuitable for fishing	V High	V High	Mod	High	High	Low	Mod	Mod	V Low
	unsuitable for harvesting water-cress / seaweed	High	High	Low	High	High	Low	Mod	Mod	V Low

5 Summary

This report describes the development and results of a generic assessment of the effects of wet-weather discharges of untreated wastewater on the ecological and recreational values of receiving water bodies throughout the Auckland Region. The assessment was conducted by developing and populating a matrix in which the potential for effects were scored from very high to very low for each of the six types of receiving environment, taking into account variations in receiving environment ecological and recreational values and the volume of discharges. Scores were assigned on the basis of expert judgement, supported by prior knowledge of the physical, chemical and biological processes and interactions operating in Auckland's streams, estuaries, harbours and other receiving waters.

The assessment followed a two-step process. Firstly, scores were assigned in relation to the potential for physical, chemical and biological changes resulting from wet-weather wastewater discharges to each type of receiving environment, taking account of variations in the volume of discharges and their dilution in the receiving water body. Secondly, scores were generated in relation to the potential for ecological and recreational effects associated with the physical, chemical and biological changes assessed in step 1. These effects scores were generated for three classes of ecological and recreational values: 'Class 1' (highest value), 'Class 2' and 'Class 3' (lowest value).

Ecological effects scores were generated for 504 combinations of receiving environment type, ecological values class and discharge volume. Three quarters of all scores were in the range 'very low' to 'moderate' potential for an effect. In the case of Large Waterways, all ecological effects were scored as having 'very low' to 'moderate' potential, except for loss of suitability for livestock watering and irrigation use. In the case of Estuaries, Harbours and Beaches, all ecological effects were also scored as having 'very low' to 'moderate' potential, except for certain effects associated with combinations of high discharge volumes and high to moderate ecological value (Class 1 and 2 ecological values).

The proportion of combinations scored as having a 'high' or 'very high' potential for an effect was highest for Small Waterways (more than half of all combinations) and Basins (approximately a third of all combinations). This reflects the physical characteristics of these environments: the size of Small Waterways limits the potential dilution of contaminants discharged into them while the limited flushing of Basins leads to conditions under which the accumulation of contaminants can occur.

Recreational effects scores were generated for 216 combinations of receiving environment type, recreational values class and discharge volume. Approximately two thirds of all scores were in the range 'very low' to 'moderate' potential for an effect, including 'very low' or 'low' scores in all receiving environments with Class 3 recreational values (waters where no contact recreation is likely to occur). In the case of Estuaries and Harbours, all recreational effects were scored as having 'very low' to 'moderate' potential, except for certain effects associated with combinations of high discharge volumes and high to moderate recreational value (Class 1 and 2 recreational values). In the case of all other receiving environment types, recreational effects were scored as 'high' or 'very high' for all combinations of high and medium volume discharges and high to moderate recreational values. For Small Waterways, recreational effects were also scored high to very high for low volume discharges, again reflecting the limited dilution available in these receiving environments.

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Appendix A Workshop Attendees

NIWA Panel

- Jonathan Moores (Group Manager, Urban Aquatics Environment)
- Graham McBride (Principal Scientist, Water Quality)
- Dr Chris Hickey (Principal Scientist, Chemistry and Ecotoxicology)
- Dr John Quinn (Principal Scientist, Freshwater Ecology)
- Dr Malcolm Green (Principal Scientist, Coastal and Estuarine Physical Processes)
- Dr Judi Hewitt (Principal Scientist, Marine Ecology)

Watercare Project Team

- Patricia Paschke (Project Manager, Greater Auckland Wastewater Network Consents)
- Garrett Hall (Senior Environmental Scientist, MWH New Zealand Ltd)
- Ian Wiseman (Environmental Scientist, Sinclair Knight Merz)

Auckland Council Staff

- Raul Galimidi (Regulatory Services)
- Andrew Millar (Environmental Policy)
- Marcus Cameron (Scientist – Stormwater Contaminants, Research, Investigations and Monitoring Unit)
- Scott Speed (Coastal Specialist, Research, Investigations and Monitoring Unit)

Appendix B Receiving Environment Types

(Provided by Garrett Hall, MWH New Zealand Ltd on behalf of Watercare Services Ltd)

Basins

"*Artificially or naturally enclosed areas of a river or harbour e.g. Panmure Basin. Also includes lakes.*"

Characterised by moderate dilution when compared to other receiving environment types.

Examples

Panmure Basin

Orakei Basin

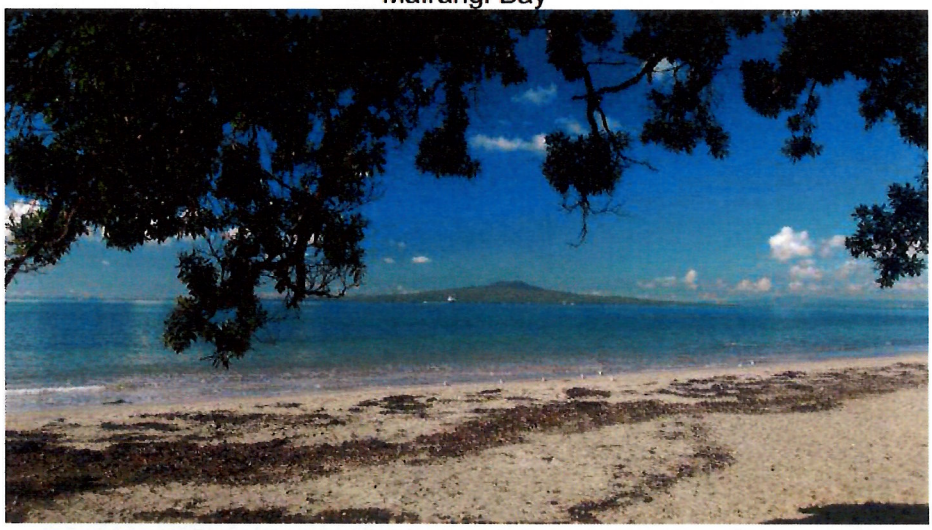
Beaches

"*Water body between mean high water springs and another receiving environment. The East Coast Beaches of the former Rodney District and North Shore City and the Waitemata Harbour including the Eastern Beaches e.g. Mission Bay. Also includes the Manukau Harbour beaches.*"

Characterised by high dilution when compared to other receiving environment types.

Examples

Mairangi Bay



Mission Bay

Estuaries

"The wide lower course of a river where it flows into the sea. Estuaries are characterised by tidal flows and their water is a changing mixture of fresh and salt e.g. Whau River/Waiuku River."

Characterised by moderate dilution when compared to other receiving environments.

Examples

Hellyers Creek

Whau River

Harbours

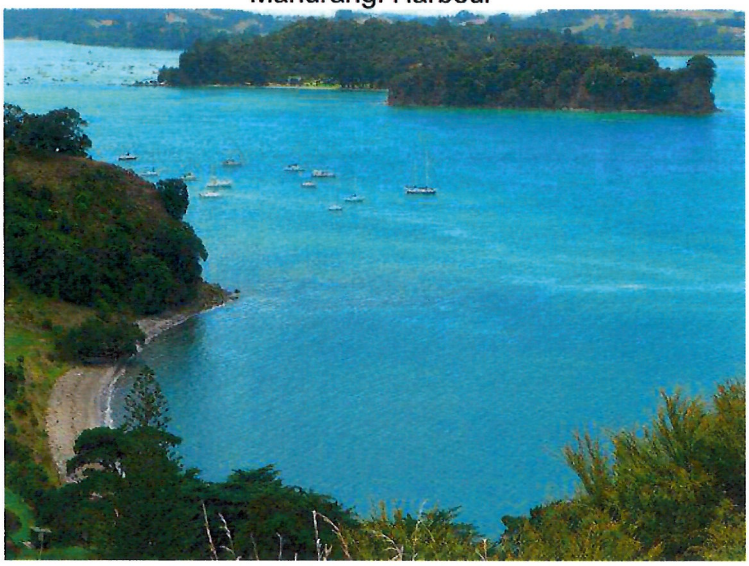
"*Generally enclosed areas of water where ships either historically or currently seek shelter. Includes the Waitemata and Manukau Harbours.*"

Characterised by high dilution when compared to other receiving environments.

Examples

Waitemata Harbour

Mahurangi Harbour



Large Waterways

"*Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Middle-Order (stream order 3 and 4) and High-Order (stream order greater than 4).*"

Characterised by moderate dilution when compared to other receiving environment types.

Examples

Lower Oratia Stream, Waitakere

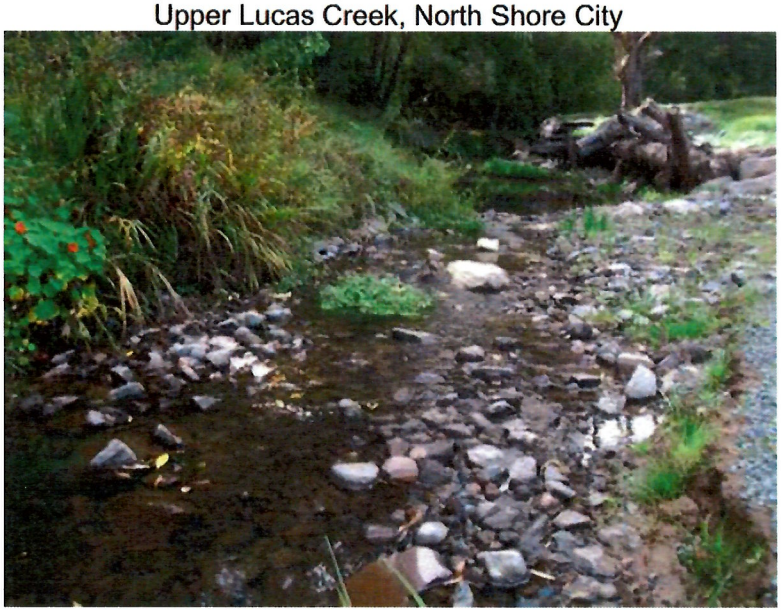
Small Waterways

"*Fresh water flowing along a definite course classified by the River Environment Classification (REC) as Low-Order (stream order 1 and 2).*"

Characterised by minor dilution when compared to other receiving environment types.

Examples

Upper Lucas Creek, North Shore City



Appendix C Extracts from the Auckland Regional Plan: Coastal and the Auckland Council Regional Plan: Air, land and Water

The rules relating to Mooring Management Areas are contained in Chapter 24: Moorings of Part IV: Use and Development.

2.7 AQUACULTURE MANAGEMENT AREAS

Aquaculture Management Areas define those parts of the coastal marine area which are used primarily for the activities and structures associated with aquaculture. The purpose of Aquaculture Management Areas is to provide for the effective and efficient functioning of aquaculture activities within defined locations and to ensure efficient use is made of the coastal marine area. Aquaculture Management Areas recognise existing aquaculture activities and provide for appropriate future expansion of aquaculture in the Auckland Region. Aquaculture activities located outside Aquaculture Management Areas are prohibited.

Aquaculture Management Areas are defined in Map Series 1 of the Plan Maps. The objectives, policies and rules relating to Aquaculture Management Areas are contained in Chapter 22: Aquaculture of Part IV: Use and Development.

2.8 SPECIAL ACTIVITY AREAS

There are five areas in the Waitemata Harbour (Upper Tamaki River, Lower Tamaki River, Whau River, Henderson Creek, Orakei Basin) that have been identified to allow organised events to occur. When a special event is planned, the organisers may request 'exclusive use' of the Management Area. However outside these times, the Special Activity Areas will be available for use by the public. Permanent structures which affect the ability of the Special Activity Area to operate will generally not be permitted within these areas.

The main purposes of the Special Activity Areas are to:

a allow for temporary exclusive use; and

b maintain areas suitable for boating events, free of structures and moorings.

While these areas are particularly suited for some activities, eg. rowing, or water skiing, any special event which meets certain conditions may apply for temporary exclusive use of a Special Activity Area. The rules relating to the Special Activity Areas are contained in Chapter 11: Activities of Part IV: Use and Development. Chapter 12: Structures may also need to be considered.

2.9 COASTAL PROTECTION AREAS

2.9.1 Areas that are of regional, national or international significance due to their ecological, landform or geological values are defined as Coastal Protection Areas. There are two types of Coastal Protection Areas, 1 and 2, which reflect the different values, size and the degree of vulnerability of the significant areas and sites. Objectives, policies and rules are stated for both types of Coastal Protection Area in Part III: Values and Part IV: Use and Development. The purpose of the Coastal Protection Areas is to give effect to the requirements of sections 6 (a), (b) and (c) of the RMA by;

a Preserving the natural character of the coastal marine environment (including the coastal marine area) and the protection of them from inappropriate subdivision, use and development;

b The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development;

c The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;

in recognition of their contribution to the natural character and heritage of the Auckland Region. At the same time, it is recognised that some activities and structures continue to exist within these areas.

The ARC will, as and when appropriate, review the Coastal Protection Areas shown on the Plan Maps and listed in Schedule 3. The introduction to Schedule 3 explains the purpose of the schedule and the schedule itself describes the significance and type of values to be protected by the Coastal Protection Areas. Any amendments would be based on the presence of these types of values and will be made following procedures described in Chapter 40: Review of and Changes to the Plan.

2.9.2 Coastal Protection Areas 1

Coastal Protection Areas 1 include those areas which, due to their physical form, scale or inherent values, are considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development. These areas include regionally or nationally rare habitat types, such as saline herbfields, as well as the best examples of saltmarshes and mangroves in the Auckland Region. Some ecological areas form part of an ecotone (sequence) of coastal vegetation which extends from significant native vegetation on the land into saline vegetation and intertidal and subtidal seaweed communities. Where areas in the coastal marine area have been identified as part of such an ecotone, they are included in the Coastal Protection Area 1.

Parts of the Auckland coastal marine area are of national and international significance as a seasonal home to tens of thousands of migratory wading birds from the arctic and sub-arctic and from the South Island, as well as a permanent home to many more birds. The Manukau and Kaipara Harbours and the Firth of Thames are the most important roosting and feeding areas, but other harbours and estuaries form part of a regional network of feeding and roosting sites. Other birds, both threatened and endangered and more commonplace, breed and roost in sand dunes and areas of coastal vegetation above Mean High Water Springs and feed in the adjacent coastal marine area. Coastal Protection Area 1 status has been given to the key areas of unconsolidated shell and sand within the harbours and estuaries used for roosting purposes and to those parts of the foreshore adjoining known bird nesting areas above Mean High Water Springs.

The Coastal Protection Area 1 also includes those regionally, nationally and internationally significant landforms and geological sites (natural features) which are considered to be vulnerable to damage or destruction because of their small size, their location or the balance of biological and physical processes which lead to their formation. Due to their vulnerable nature, the Plan provides for the protection of areas identified as Coastal Protection Area 1 by avoiding the actual and potential adverse effects of activities on these areas.

2.9.3 Coastal Protection Areas 2

These areas are of regional, national or international significance which do not warrant a Coastal Protection Area 1 identification as they are generally more robust. However many areas still require more protection than that accorded under a general management area as their physical form or inherent values make it more difficult to avoid, remedy or mitigate any adverse effects on the environment of which they form part. Coastal Protection Areas 2 include the main intertidal banks of the region's harbours and estuaries, which are the key feeding grounds for international and national migratory wading birds. Often these areas surround the high tide roosts contained within a Coastal Protection Area 1. Coastal Protection Area 2 also includes areas of the foreshore which form part of a wider habitat for coastal birds, such as at Pakiri Beach.

Areas of mangroves which are of regional importance because of their size and degree of intactness, or areas of rare or uncommon coastal vegetation such as saltmarshes, have been given Coastal Protection Area 2 status. In many cases areas of saltmarsh and small areas of herbfields grow in association with mangroves to form a regionally significant saline vegetation community.

Larger landforms and geological sites, such as South Kaipara Head and the Orakei Basin Tuff Ring and Explosion Crater, are included in Coastal Protection Area 2 in recognition of the robustness associated with their size.

Relatively little is known about the values of subtidal areas within the coastal marine area of the Auckland Region, compared with the intertidal and coastal margin areas. Subtidal areas which are known to contain a rich diversity of species and habitats or which are considered to be good examples of the variety of habitat types found within the Auckland Region are included in Coastal Protection Area 2. An example of one such area is the Upper Waitemata Harbour. Other smaller subtidal areas range from soft intertidal flats through to rocky shores and shore platforms. Several Coastal Protection Areas 2 adjoin land held in public ownership by the Department of Conservation or as regional parks by the ARC.

Many of the individual biological and physical values identified above come together in the estuaries and smaller harbours of the region. For these reasons most of these areas are included as Coastal Protection Areas.

The Plan provides for the protection of areas given Coastal Protection Area 2 status by protecting the values identified in these areas.

2.9.4 Areas notated above Mean High Water Springs

Many Coastal Protection Areas contain biological and physical values and processes which cross the boundary of Mean High Water Springs. Some ecological areas are part of an ecotone (sequence) of coastal vegetation, where birds and other animals move between terrestrial or freshwater habitats and the coastal marine area to feed or breed. Landforms and geological sites may extend from subtidal areas across the foreshore and into the backshore or coastal cliffs. Where Coastal Protection Areas within the coastal marine area adjoin or are functionally linked to areas of biological and physical value above Mean High Water Springs, the land areas are notated in the Plan Maps in order to better achieve integrated management. This notation is to inform users of the Plan of the links between terrestrial and marine values and to assist in the administration of the provisions as they apply to the coastal marine area. All rules relating to the subdivision, use and development within the Coastal Protection Areas apply only to the coastal marine area. Control of the effects of the use of land within the areas notated on the Plan Maps above Mean High Water Springs is through the provisions of the relevant district plan, or other management plans where the land is designated. Refer to Other Methods (5.6) in Chapter 5 Natural Features and Ecosystems.

Further information on the values of each Coastal Protection Area is contained in Schedule 3. Objectives and policies relating to Coastal Protection Areas are contained in Part III: Values; Chapter 5 Natural Features and Ecosystems, while rules relating to activities within Coastal Protection Areas are contained in Part IV: Use and Development.

2.10 TANGATA WHENUA MANAGEMENT AREAS

Two areas in the Manukau Harbour have been identified as Tangata Whenua Management Areas. These are:

- Whatapaka Creek
- Pukaki-Waiokauri Creek

2.10.1 Whatapaka Creek

Whatapaka Creek is located on the southern shore of the Manukau Harbour adjacent to Whatapaka Marae. In 1985 the Waitangi Tribunal recommended that the creek be reserved for the exclusive use of the Hapu of Whatapaka. An application to the Maori Land Court by Whatapaka Marae resulted in the establishment in 1992 of Whatapaka Creek as a Maori Reservation under the Maori Affairs Act 1953, (now Te Ture Whenua Maori Act 1993) for the purpose, *inter alia* of a place of significance for the common use and benefit of Whatapaka Marae.

2.10.2 Pukaki-Waiokauri Creek

The Pukaki-Waiokauri Creek is located on the northern shore of the Manukau Harbour. The Waitangi Tribunal has recommended that the creek be reserved for the exclusive use of the Pukaki Marae. As with Whatapaka Creek, the creek was the subject of a Waitangi Tribunal recommendation and an application to the Maori Land Court resulted in the establishment in 1992 of Pukaki-Waiokauri Creek as a Maori Reservation for the purpose, inter alia of a place of significance for the common use and benefit of the Hapu of Te Akitai and Te Ahiwaru o Waiohua.

The local Tangata Whenua are Kaitiaki of the lands in question, and have maintained the natural and ecological values over several centuries, despite significant development pressures over the last century. These Tangata Whenua Management Areas recognise this, and the customary rights, responsibilities, and relationships of the Tangata Whenua with their ancestral taonga.

Had these areas not been identified as Tangata Whenua Management Areas, they would have been Coastal Protecton Area 2s. The provisions which apply to Coastal Protection Area 2 areas shall also apply to the Tangata Whenua Management Areas, unless otherwise stated. These provisions do not affect the provisions already established under the Te Ture Whenua Maori Act 1993.

2.11 GENERAL MANAGEMENT AREA

The General Management Area is all of the rest of the coastal marine area which is not within one of the specific management areas. It is by far the largest management area.

The rules relating to the General Management Area are contained throughout Part IV: Use and Development. The chapters in Part IV contain objectives, policies and rules with which any application for subdivision, use and development in the coastal marine area must comply.

2.12 AREAS OF SIGNIFICANT CONSERVATION VALUE (ASCV)

The Minister of Conservation has identified sixty two areas and sites within the coastal marine area as Areas of Significant Conservation Value. These areas are described in Schedule 4 and identified on the Plan Maps in Volume 2. Most of the harbours and estuaries on the east coast of the region and the Manukau and Kaipara Harbours on the west coast have been identified as Areas of Significant Conservation Value. This reflects the high biological productivity of these areas, and their role as nursery and feeding areas for fish and birds. Smaller Areas of Significant Conservation Value have also been identified within the larger areas. These are sites of national and international importance for breeding, feeding and roosting by birds, and areas containing threatened ecosystems, plants or animal species or nationally significant landforms and geological features. Some Areas of Significant Conservation Value have been identified because of their national historical or cultural significance. A number of Areas of Significant Conservation Value are also protected areas under other legislation such as the Marine Reserves Act 1971 and the Conservation Act 1987.

Smaller Areas of Significant Conservation Value that have been identified for their ecological and landform values are included in Coastal Protection Area 1 or Coastal Protection Area 2, depending on their values and vulnerability to adverse effects of subdivision, use and development. Those Areas of Significant Conservation Value that have been identified for their historical or cultural significance are included in the Cultural Heritage Schedules 1 and 2. The remaining Areas of Significant Conservation Value not included in the Coastal Protection Areas are protected through the general provisions of the Plan.

3.6.2.3 Urban River and Stream Types

Six river and stream management types have been defined and are described below. Figure 3.1 illustrates how they are assigned using reach and catchment scale attributes.

Type 1 – Stream Mouths and Tidal Reaches of *Urban Rivers and Streams*

This category includes the lower reaches of ***urban rivers and streams*** affected directly by tidal flow. The interface between rivers and streams and the marine ***receiving environment*** at the river and stream mouth are particularly important habitats for inanga spawning. Key spawning zones are grasses or native vegetation on banks around the lower and upper tidal zones.

This category is adjacent to the Coastal Marine Area. Objectives, policies and rules associated with Coastal Protection Areas 1 and 2 in the Auckland Regional Plan: Coastal (ARP: C) have the potential to affect the management of streams in this category. The provisions for network discharges in Chapter 20 of the ARP: C are also linked to the stormwater and wastewater discharge provisions of Chapter 5 of this Plan, including the preparation of ***Integrated Catchment Management Plans*** and network resource consents.

Type 2 – High Value Low Disturbance *Urban Rivers and Streams*

These reaches are relatively unaffected by urban development, characterised by a low amount of impervious area (< 10 percent) in the catchment. Water quality and habitat value in these reaches would be expected to be high. However habitat may be affected by past land management and use. This quality of habitat is rare in ***Urban Areas*** and is valued for ecological function and ***amenity*** value.

Type 3 – Moderately Disturbed *Urban Rivers and Streams*

These reaches occur in catchments with moderate amounts of impervious area (10 – 25 percent), and have been affected by their surroundings, but are typically not highly modified. Natural values are somewhat degraded, however these reaches offer some of the best opportunities for restorative action. Moderately disturbed natural channels are likely to be important for ***fish passage*** and provide habitat for a diverse range of aquatic biota.

Type 4 – Highly Disturbed *Urban Rivers and Streams*

Type 4 ***urban rivers and streams*** have a higher proportion of impervious area (>25 percent) in the catchment, and have often suffered significant erosion. In many cases, the banks of the stream have been modified, but the channel bed is not deemed 'artificial'. Bank side modification may include concrete walls, gabions, and battering. These reaches have lower natural value, but may allow ***fish passage*** to higher quality upper reaches and have populations of more tolerant species present. Within this type a range of values may be present; higher stream quality will likely be represented by a greater complexity of habitat, morphology and vegetation.

Type 5 – Artificial or Concrete Channelised *Urban Rivers and Streams*

Where greater than 50 percent of the channel bed within a reach is constructed of artificial material it is most likely that the catchment is highly urbanised (and tends to have a high proportion of impervious area), and channel modification is the result of works to manage flooding and erosion. Often the natural floodplain has also been confined by development or infilling, and the opportunities for full riparian restoration works are limited, although planting to provide for shade is often feasible.

Type 5 streams tend to have higher and more uniform flow velocities than natural channels. High velocities restrict ***fish passage*** and the uniform channel shape also removes the features that fish and aquatic biota need for shelter such as pools, undercut banks, instream debris and bends. A smooth concrete base also limits the variety of channel substrata (e.g. rocks and woody debris) available to be colonised by plants and animals within the channel, which further limits habitat diversity and food sources. Generally Type 5 ***Urban Rivers and Streams*** have limited riparian cover and this results in higher water temperatures which adversely affect water quality for aquatic biota.

Type 6 – Piped *Urban Rivers and Streams*

Where more than 50 percent of a reach is piped, the reach can be categorised as a 'piped section'. Piped sections are usually located in highly urbanised areas and are/were often installed for flood protection and to maximise the density of development. Piped reaches represent an almost complete loss of ecosystem function and provide little or no removal of contaminants. The lack of light precludes the establishment of plants and other aquatic biota. A smooth concrete base does not provide the protection needed by fish and other aquatic biota for breeding and resting. Piped reaches have little or no natural value, and represent the maximum degree of stream alteration.

Piped channels affect ***fish passage*** and the movement of other aquatic biota. Flows in a pipe tend to exhibit higher velocities than natural channels. This can be a barrier to ***fish passage*** if velocities exceed fish swimming ability. Channel length can also be a problem where no resting areas (low flow zones) exist. ***Fish passage*** can be restricted through a combination of stream velocity, drop structures, and ***culvert*** length.

3.6.3 Objectives

3.6.3.1 To manage ***urban rivers and streams*** in a way that:

(a) Maintains high values and enhances degraded values of ***urban rivers and streams*** in terms of in-stream, amenity, natural character and public access values;

(b) Recognises the essential function of ***urban rivers and streams*** in conveying stormwater; and

(c) Provides for the appropriate use and development of ***urban rivers and streams*** to accommodate existing development and future growth within ***Urban Areas***.

3.6.4 Policies

3.6.4.1 In preparing an ***Integrated Catchment Management Plan***, a territorial authority should categorise ***urban rivers and streams*** within the catchment based on the quality of individual reaches and then identify and implement a management approach for those ***urban rivers and streams***.

3.6.4.2 In ***Urban Areas*** which have undergone urban development, ***urban rivers and streams*** categorisation shall be either:

(a) The default as defined in Figure 3.1 of this Plan, or

(b) As contained within a district plan, structure plan, or an ***Integrated Catchment Management Plan***, or

(c) Undertaken as part of a resource consent process.

3.6.4.3 In ***Urban Areas*** which have yet to undergo urban development, the categorisation in Figure 3.1 of this Plan does not apply. An assessment of the quality of ***urban rivers and streams*** in these areas should include, but is not limited to the following matters:

(a) The extent and quality of riparian vegetation (with greater value placed on larger areas of riparian vegetation and native vegetation);

(b) Stream morphology (with greater value placed upon greater complexity);

(c) The number and type of macro-invertebrate species present;

(d) The number and type of native fish present (with greater value placed upon higher numbers of fish and greater variety of fish species);

(e) The value of the stream in relation to the presence of flood flows;

(f) The value of the stream in relation to natural character and amenity values;

(g) Whether the river or stream provides a connection to an area of high in-stream value upstream.

3.6.4.4 The management of ***urban rivers and streams*** shall recognise the categorisation of the rivers and streams and:

(a) Provide for their use and development in a manner consistent with the growth projections developed under the Auckland Regional Growth Strategy and related Sector Agreements, and in particular provide for the conveyance of stormwater;

And where practicable

(b) Avoid adverse effects on ***urban rivers and streams*** with high in-stream values;

(c) Maintain and enhance public access;

(d) Maintain high quality and enhance degraded natural character values;

(e) Maintain and enhance amenity values;

(f) Maintain and enhance fish passage having regard to the matters in Policy 2.1.4.7;

(g) Maintain and enhance riparian vegetation;

(h) Avoid, remedy or mitigate the adverse effects of erosion on the banks and bed;

(i) Minimise modification of the bed and banks, particularly in those streams that have low levels of modification or high in-stream values.

3.6.4.5 In addition to the matters in Policy 3.6.4.4 the management of ***urban rivers and streams*** in ***Urban Areas*** undergoing development shall:

(a) Be consistent with any structure plan adopted into a district plan for the area;

(b) Take opportunities to enhance in-stream, natural character, public access and amenity values.

3.6.4.6 In managing ***urban rivers and streams***, the highest priority is to maintain those ***urban rivers and streams*** with a large proportion of high quality reaches.

3.6.4.7 Those effects on ***urban rivers and streams*** that are related to catchment wide factors (such as non-point source contaminants and hydrology) shall be managed as part of the Best Practicable Option determined in the relevant ***Integrated Catchment Management Plan*** or network resource consents.

3.6.5 Management Methods

A range of management methods will be required for ***urban rivers and streams*** including:

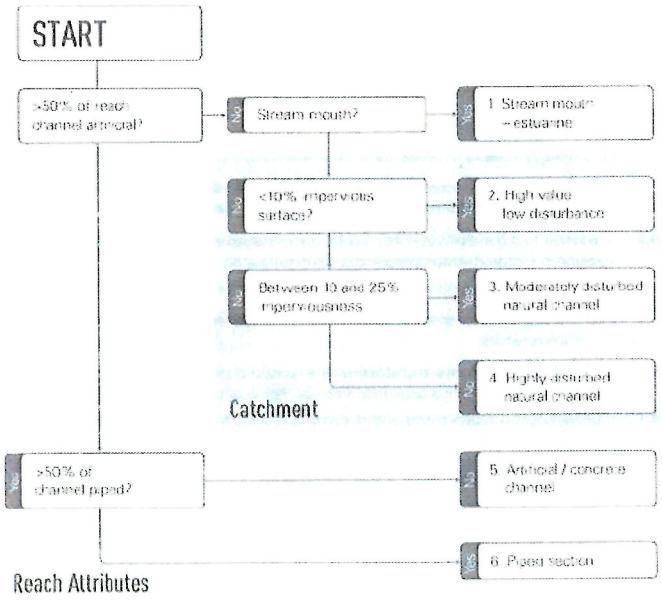
- Catchment scale methods to manage the adverse effects of impervious area on water quality and hydrology,
- Reach scale methods to manage the adverse effects on structural modifications and lack of riparian cover on habitat quality; and
- Site scale methods to manage the adverse effects of structures and activities.

The objectives and policies set out in Sections 3.6.3 and 3.6.4 provide a framework for the development of policies and actions which should be considered in the development of structure plans, ***Integrated Catchment Management Plans*** and the processing of resource consents.

TAs must inevitably prioritise the implementation of management actions, taking into account the resources that are available. A district or catchment wide prioritisation process could be used to ensure the greatest benefit to ecosystems and the community is achieved. Urban catchments with native bush, semi-rural land use, and in the early stages of urban development should receive the highest priority for implementation through local and district plans, catchment management plans, and ***structure plans***. Alternatives to ***culverting*** and piping of ***urban rivers and streams*** should also be considered as part of development and ***structure planning*** processes and by resource consent applications for regionally significant infrastructure or other development affecting significant areas of land.

A Technical Publication called "Framework for the Assessment and Management of Urban Streams in the Auckland Region" has been developed and is available to assist in the implementation of these management areas (ARC TP 232 August 2004). Note that this document may be updated to reflect changing management methods over time.

Figure 3.1 Flow Chart for Assigning Urban River and Stream Types Described in Section 3.6.2.2.



Appendix D Results of simulations for effects of discharges on downstream dissolved oxygen in Small and Large Waterways in the Auckland region

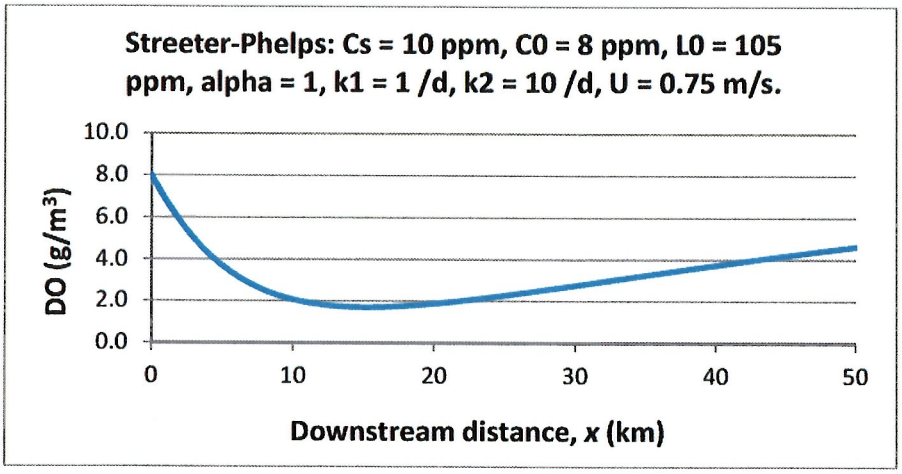


Figure D1: Predicted effects of WDW on dissolved oxygen in a small Auckland stream (Small Waterway) for stated conditions of saturation DO (C_s), Initial DO (C_0), Initial BOD_5 (L_0), $BOD_{ultimate}$:BOD_5 ratio (α), Stream deoxygenation coefficient (k_1), Stream reaeration coefficient (k_2) and Cross-section average stream velocity (U). NOTE the underlying (Streeter-Phelps) model's assumptions have been breached once about 4 km downstream distance has been reached, because the stream is there predicted to be devoid of dissolved oxygen. Other, more elaborate, models would have to be used after that point is reached (as in McBride & Rutherford 1984).

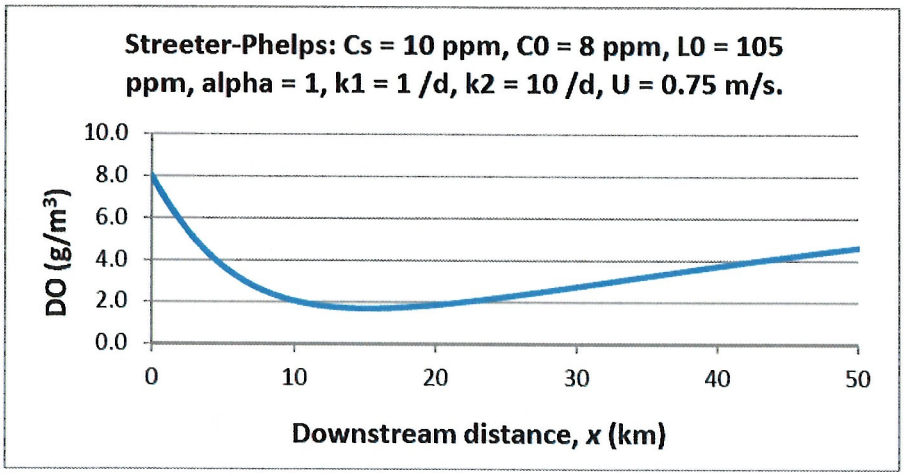


Figure D2: Predicted effects of WDW on dissolved oxygen in a large Auckland stream or river (Large Waterway) for stated conditions of saturation DO (C_s), Initial DO (C_0), Initial BOD_5 (L_0), $BOD_{ultimate}$:BOD_5 ratio (α), Stream deoxygenation coefficient (k_1), Stream reaeration coefficient (k_2) and Cross-section average stream velocity (U).

Appendix E Wastewater, Stream Background and Freshwater Guideline Concentrations of Water Quality Parameters Considered in the Assessment

Units for values shown in italics differ from those in column headings (see notes below table)

Parameter	Discharge Characteristics					Discharge Quality			Wet Weather Stream Flow		Stream Water Quality					
									Small Waterways	Large Waterways	Small Waterways	Large Waterways	Background conc., wet weather		Freshwater guideline concs.	
	Overflow Type	Volume m^3	Duration hours	Duration sec	Discharge m^3/s	conc. g/m^3	load g/sec	mass load kg	m^3/s	m^3/s	g/m^3	g/m^3	g/m^3	source	g/m^3	source
TSS	Low	500	0.5	1800	0.28	531	147.5	265.5	1	10	225	150.6	140	Annual mean SS 93g/m^3 calulated from sediment yield and runoff data for Auckland urban streams from data in ARC (2000)	1000	derived from NIWA DSS http://www.niwa.co.nz/our-science/freshwater/tools/turbidity/peak
	Med	5000	6	21600	0.23	531	122.9	2655	1	10	213	148.8	140		1000	
	High	10000	12	43200	0.23	531	122.9	5310	1	10	213	148.8	140		1000	
VSS[1]	Low	500	0.5	1800	0.28	531	147.5	265.5	1	10	131	33.8	20	Quinn and Stroud (2002)	NA	
	Med	5000	6	21600	0.23	531	122.9	2655	1	10	116	31.6	20		NA	
	High	10000	12	43200	0.23	531	122.9	5310	1	10	116	31.6	20		NA	
BOD	Low	500	0.5	1800	0.28	550	152.8	275	1	10	121	16.8	2	Maasdam and Smith (1994)	2-3	MFE (1992)
	Med	5000	6	21600	0.23	550	127.3	2750	1	10	105	14.4	2		2-3	
	High	10000	12	43200	0.23	550	127.3	5500	1	10	105	14.4	2		2-3	
NH4-N	Low	500	0.5	1800	0.28	47	13.1	23.5	1	10	10.3	1.4	0.1	Maasdam and Smith (1994)	1.76	USEPA (2009a)
	Med	5000	6	21600	0.23	47	10.9	235	1	10	8.9	1.2	0.1		1.76	
	High	10000	12	43200	0.23	47	10.9	470	1	10	8.9	1.2	0.1		1.76	
TN	Low	500	0.5	1800	0.28	78	21.7	39	1	10	18.5	4.1	2	Maasdam and Smith (1994)	NA	
	Med	5000	6	21600	0.23	78	18.1	390	1	10	16.3	3.7	2		NA	
	High	10000	12	43200	0.23	78	18.1	780	1	10	16.3	3.7	2		NA	
TP	Low	500	0.5	1800	0.28	7.9	2.19	3.95	1	10	1.9	0.4	0.2	Maasdam and Smith (1994)	NA	
	Med	5000	6	21600	0.23	7.9	1.83	39.5	1	10	1.6	0.4	0.2		NA	
	High	10000	12	43200	0.23	7.9	1.83	79	1	10	1.6	0.4	0.2		NA	
Sulfide	Low	500	0.5	1800	0.28	5	1.39	2.5	1	10	1.1	0.1	0	Assumption of no background sulfide	0.12	derived from Hickey (2000b)
	Med	5000	6	21600	0.23	5	1.16	25	1	10	0.9	0.1	0		0.12	
	High	10000	12	43200	0.23	5	1.16	50	1	10	0.9	0.1	0		0.12	
Cu	Low	500	0.5	1800	0.28	0.096	0.03	0.048	1	10	0.024	0.006	0.0034	Reed and Timperley (2004), Moores et al. (2006)	0.0045	USEPA (2009b) acute criteria at 30 g/m^3 hardness based on Hickey (2000a)
	Med	5000	6	21600	0.23	0.096	0.02	0.48	1	10	0.021	0.005	0.0034		0.0045	
	High	10000	12	43200	0.23	0.096	0.02	0.96	1	10	0.021	0.005	0.0034		0.0045	
Zn	Low	500	0.5	1800	0.28	0.31	0.09	0.155	1	10	0.096	0.043	0.036	Reed and Timperley (2004), Moores et al. (2006)	0.043	USEPA (2009b) acute criteria at 30 g/m^3 hardness based on Hickey (2000a)
	Med	5000	6	21600	0.23	0.31	0.07	1.55	1	10	0.088	0.042	0.036		0.043	
	High	10000	12	43200	0.23	0.31	0.07	3.1	1	10	0.088	0.042	0.036		0.043	
Norovirus[2]	Low	500	0.5	1800	0.28	*1.E+09*	*3.E+08*	*5.E+11*	1	10	*2.E+08*	*3.E+07*	*0*	Assumption of no background infectious viruses	NA	
	Med	5000	6	21600	0.23	*1.E+09*	*2.E+08*	*5.E+12*	1	10	*2.E+08*	*3.E+07*	*0*		NA	
	High	10000	12	43200	0.23	*1.E+09*	*2.E+08*	*1.E+13*	1	10	*2.E+08*	*3.E+07*	*0*		NA	
DO (immediate)	Low	500	0.5	1800	0.28	0	0.00	0	1	10	7.83	9.73	10	Maasdam and Smith (1994)	4	USEPA (1986) and Landman et al. (2005)
	Med	5000	6	21600	0.23	0	0.00	0	1	10	8.12	9.77	10		4	
	High	10000	12	43200	0.23	0	0.00	0	1	10	8.12	9.77	10		4	
DO (far field)	Low	500	0.5	1800	0.28	0	0.00	0	1	10	<4 at >1.8 km DS for 1h	>8	10	Maasdam and Smith (1994)	4	USEPA (1986) and Landman et al. (2005)
	Med	5000	6	21600	0.23	0	0.00	0	1	10	<4 at >2.3 km DS 8 hrs	>8.8	10		4	
	High	10000	12	43200	0.23	0	0.00	0	1	10	<4 at >2.3 km DS 14 hrs	>8.8	10		4	
E.coli[3]	Low	500	0.5	1800	0.28	*4.00E+07*	*1.11E+12*	*2E+15*	1	10	*8.70E+06*	*1.08E+06*	*50*		530	MFE/MOH 2003
	Med	5000	6	21600	0.23	*4.00E+07*	*9.26E+11*	*2E+16*	1	10	*7.52E+06*	*9.05E+05*	*50*		530	
	High	10000	12	43200	0.23	*4.00E+07*	*9.26E+11*	*4E+16*	1	10	*7.52E+06*	*9.05E+05*	*50*		530	

Notes

[1] For this exercise, VSS concentrations in wastewater were assumed to equal TSS concentrations - i.e. all solids were assumed to be organic

[2] Units: concentrations are number/m^3, loads are number/sec, mass loads are number

[3] Units: concentrations are no CFU/100ml, loads are no CFU/sec, mass loads are no CFU

Notes on Freshwater Guideline Values for Toxicants

Ammonia

The discharge of ammoniacal-nitrogen (N) is associated with intermittent discharges of sewage overflows. As such it is appropriate to consider compliance with an acute water quality guideline. The ANZECC (2000) guidelines are only derived for chronic (long-term) exposures and were not considered appropriate for this assessment. The U.S. EPA has published the most recent acute ammoniacal-N guideline (US EPA 2009), which included sensitivity data for the juvenile life-stage of freshwater mussels. As freshwater mussels are present in some Auckland streams, the panel considered it appropriate to use the acute guideline value for "mussels present".

The ammoniacal-N guidelines are dependent on both the pH and temperature of the receiving water. This assessment utilised an acute guideline value of 1.76 g NH4-N/m^3, based on the maximum pH (8.3) and a temperature of 24°C. The acute guideline for sites lacking freshwater mussels at 25°C and pH 8, c.f. 2.9 if mussels are present (which is possible for some better quality Auckland streams).

Sulfide

Freshwater fish have a narrow range of sensitivity to hydrogen sulfide and are generally more sensitive than invertebrates. Toxicity experiments have shown that the tolerance of common bullies to pollutants lies between that of trout and eels (with trout being more sensitive), while smelt are known to be more sensitive to hydrogen sulfide than rainbow trout. Site-specific water quality guidelines for hydrogen sulfide were developed by NIWA for the upper Waikato River, as follows (Hickey 2000b):

Acute (1.5-hour): 68 mg H_2S/m^3 (i.e., 0.068 g/m^3)

Acute (96-hour): 3.2 mg H_2S/m^3

Chronic (>7 days): 1.8 mg H_2S/m^3

These data showed that fish are markedly more tolerant to short-duration hydrogen sulfide exposures. For individual discharges to small streams the duration is likely to be short, however, multiple discharges and major rainfall events may result in longer discharge events. For such conditions the acute guideline would be more appropriate.

The proportion of unionised hydrogen sulfide is dependent on temperature, pH and salinity. The unionised proportion increases at lower pH and temperatures. At pH 7.0 and 15°C the hydrogen sulphide is 56% of the total sulfide. The panel considered that this would provide a suitable basis for the assessment of potential effects.

The total sulfide values for the assessment are:

Single discharge assessments (short-term acute): 120 mg S/m^3 (i.e., 0.12 g/m^3)

Multiple discharge assessments (acute): 5.7 mg S/m^3 (i.e., 0.0057 g/m^3)

Metals

US EPA (2009b) acute guidelines at 30 g/m^3 hardness: Copper 0.0045 g/m^3, Zinc 0.043 g/m^3. Hardness basis for NZ waters from Hickey, C.W. (2000). Note that the most conservative assessment for metals is based on total metals. Total metals are the most relevant measure for discharges to a depositional environment (e.g., Estuaries) – where the mass discharged is the key measure for potential effect. The river and estuarine water column assessments could be refined to assess compliance with guidelines for dissolved metals. This is consistent with the ANZECC (2000) guidance.