

MANGAWHAI COMMUNITY PARK WETLANDS HYDROLOGY ASSESSMENT

PREPARED FOR KAIPARA DISTRICT COUNCIL

04/07/2019

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Kaipara District Council

Mangawhai Community Park Wetlands Hydrology Assessment

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1. Introduction

A hydrology assessment of the existing Mangawhai Community Park wetlands has been requested by the Kaipara District Council (KDC) to inform the future Resource Consent application for the development of the Park. In particular, this assessment was requested to cover the areas affected by the proposed shared path from the Historic Village area northeast of the Fire station.

The purpose of this assessment is to understand the existing hydrological situation of the wetlands and the ponding areas at the back of the Mangawhai Activity Zone (MAZ) in relation to the stage 1 of the shared path, the impacts of the works that have been recently carried out in the area and the potential impacts of the future interaction of the wetlands with the proposed shared (cycling/walking) paths. For this purpose, the assessment includes:

- Review of existing background information to understand the hydrological situation of the wetlands.
- Analysis of the current hydrology of the existing wetlands based on the available information and site visit.
- Identification of the existing stormwater issues in relation to the portion of the Mangawhai Community Park affected by the shared path.
- High level recommendations for the future long-term stormwater management of the Mangawhai Community Park wetlands.

Environmental, ecological and biological assessment of the wetlands is excluded from this assessment.

2. Background Information

This Mangawhai Community Park Wetland hydrology assessment references a range of existing documents and sources of information in order to identify the existing hydrological situation of the wetlands and understand the current and future interaction of the wetlands with the proposed shared paths. Items of information include:

- Mangawhai Community Park Master Plan, adopted by KDC on November 2014, Mangawhai Community Park Steering Group.
- Existing survey information around the wetlands near the Historic Village.
- Tender Design drawings of the recent Molesworth Drive Rehabilitation Project, 2015, KDC.
- Seabreeze Road improvements project survey information and scope, 2019, Broadspectrum.
- Mangawhai Stormwater Infrastructure Strategy, March 2018, Stantec.
- Mangawhai Stormwater Management Plan, 2006, Duffill Watts & King Ltd 2006.
- Kaipara District Council Engineering Standards, 2011, KDC.
- Resource Management Act (RMA) 1991.
- Discussion with key Kaipara District Council stormwater, parks and roading staff, 2019.
- Stantec site visit with community representative, 24 April 2019.

3. Mangawhai Community Park Master Plan

According to the Mangawhai Community Park Master Plan prepared by Mangawhai Community Park Steering group and adopted by Council in November 2014, the Mangawhai Community Park comprises 33Ha of land situated along Molesworth Drive between the Mangawhai Village and Mangawhai Heads. It is zoned "rural" with a harbour overlay in the Operative District Plan.

Sourced from the Mangawhai Community Park Master Plan, showing the Mangawhai community Park location and main facilities.

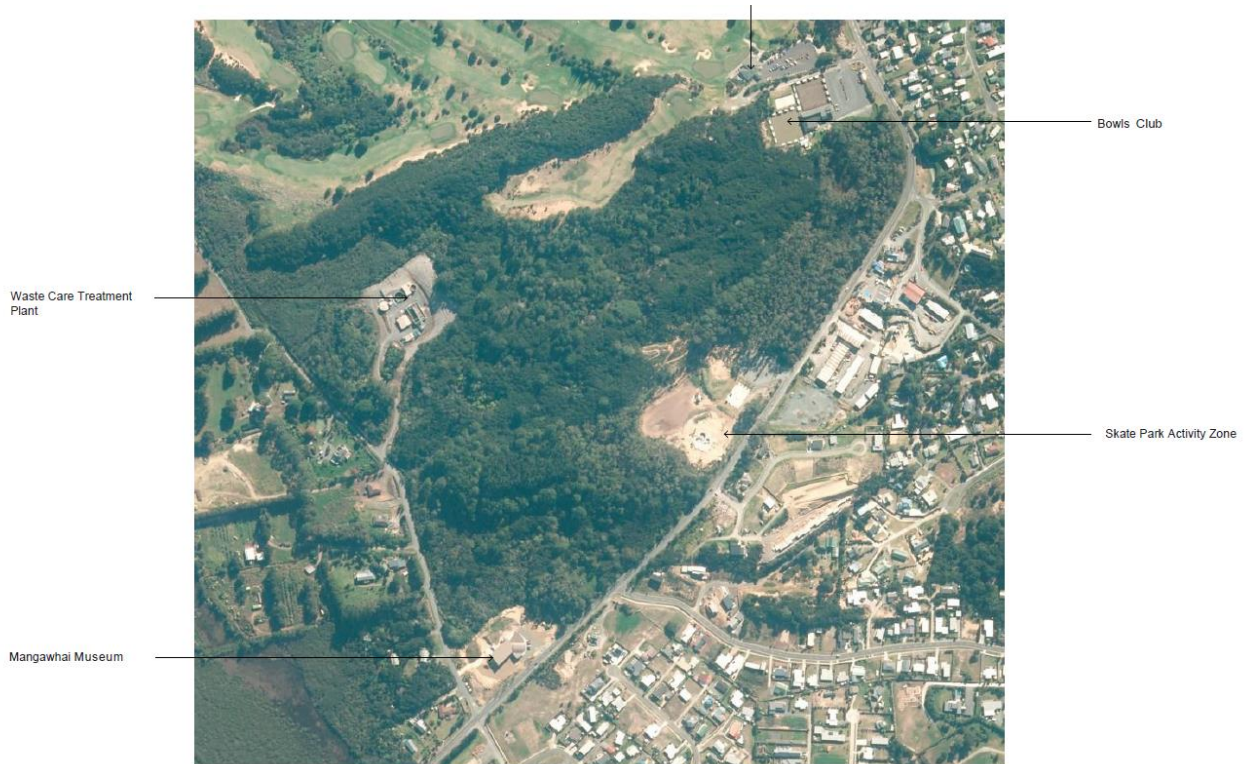


Figure 1. Mangawhai Community Park Location and Main Facilities from the Mangawhai Community Park Master Plan

Most of the Park is steep or undulating creating lower lying hollows that have developed into wetlands or soakage areas. The high value ecological features of the park are identified in the Mangawhai Community Park Master Plan are shown in Figure 2 below which is sourced from that document.



Figure 2. Mangawhai Community Park Category 1 Areas from the Mangawhai Community Park Master Plan

The Mangawhai Community Park Steering Group created a Mangawhai Park Master Plan based on the following objectives:

- Protecting the valuable natural features of the Park.
- Limiting the uses of the Park to recreation, arts and cultural activities.
- Connecting the Park to Mangawhai Heads and Village.

The Mangawhai Community Park Master Plan, shown in Figure 3, is to create a built precinct that engages with the Park-lands and has the potential to become a destination in itself providing amenity, recreation, entertainment and locations of cultural and natural significance that support long-term community sustainability.

- LEGEND**
- SPECIAL IMPORTANCE
NOTABLE POHUTUKAWA TREES & HISTORICAL SITE (GEORGE MEZE HUTS
& SANDSTONE GILLY)
 - CATEGORY I
HIGHEST VALUE & PROTECTION, INCLUDING KANUKA FOREST
 - CATEGORY II
VALUABLE COVER INCLUDING KANUKA FOREST BUT HAS INVASION OF EXOTIC
WEEDS (ACACIA, PINES, GORSE, ETC.)
 - WETLAND
FRESHWATER DUNE WETLANDS WITH LIMITED WEED INVASION. AREA OF
PRIORITY FOR WEED CONTROL & RESTORATION
 - EXOTIC TREES
PLANTATIONS OF EXOTIC TREES (SILVER PINE & BARKUA PINES) WITH THICK
UNDERGROWTH OF ASPHAGNUM MOSS, MATRIS GRASS SPECIES ETC.
 - IDENTIFY NATIVE PLANT SPECIES
MOSAIC TO CONTAIN INVASIVE DAMPENING COVER OF ASPHAGNUM MOSS
 - DEGRADED
MOSAIC MIXTURE OF KANUKA AND INVASION OF EXOTIC WEED
SPECIES - POTENTIAL DEVELOPMENT SITES
 - EXISTING ROADS
 - PROPOSED ROAD WIDENING & POTENTIAL
VEHICULAR ACCESS THROUGH PARK
 - EXISTING PROPOSED WALKING TRACKS
THROUGH PARK
 - POSSIBLE FUTURE DEVELOPMENT SITES



Figure 3. Mangawhai Community Park Master Plan Drawing, from the Mangawhai Community Park Master Plan

4. Site Visit Findings

The site visit was undertaken on the 24th of April and was coordinated to enable a meeting with a Mangawhai Community Park representative and KDC stormwater engineer, followed by a meeting with KDC's transport engineer to ensure understanding of Mangawhai Community Park development plans, the existing situation and the long-term stormwater planning expectations.

The main findings of this site visit, photos and documentation of the site visit has been used as a base to develop the hydrology assessment of the Mangawhai Community Park wetland in relation to the Stage 1 shared path.

4.1 Ambulance and Fire Station Catchment

The main findings from the site visit that informed the hydrology assessment at the Ambulance and Fire station catchment included:

- The catchment that drains to this area includes portions of Molesworth Drive, the Ambulance station and Fire station development area and an area upstream of these within the park to around the intersection of Molesworth Drive and Moir Point Road.
- Upstream of the existing Ambulance and Fire station there is a bushed area with small rises and depressions which includes the upstream wetland as referred to on the Mangawhai Community Park Master Plan (refer to Figure 2). Water normally ponds in these depressions and then soaks into the ground, there is no overland flowpath out of these depression areas.
- There are three existing stormwater discharges from Molesworth drive to the catchment, one of them adjacent to the Molesworth Drive intersection, one on 198 Molesworth Drive and one in front of the Fire Station. The stormwater discharge in front of the Fire Station site has been extended to now discharge to the rear of the site. Photos from the site visit of the area are shown in Figure 4 and Figure 5.



Upstream wetland



198 Molesworth Drive outlet to existing hollow area

Figure 4 Upstream of Ambulance and Fire Station Site Photos

- Drainage in the region of the Ambulance and Fire stations has historically been into a depression at the rear of the sites and then via soakage into the sands. The recent construction of these two facilities has increased the impervious surface coverage and partially filled the depression. The consequence of these works has been to reduce storage and soakage ability of the area which will lead to future extended ponding and possibly flooding of the proposed shared path. Photos from the site visit of the area are shown in Figure 5.
- Further development is proposed to be carried out to the rear of the Fire station site. The intention of the development is to clear the Eucalyptus Gum trees and further fill the depressions occupied by the trees using fill from the high ground adjacent to the carpark. This filling will increase the stormwater to be disposed of in the affected area and reduce the storage and soakage ability of the area. As described above there is no overland flow path or pipe outlet currently available to alleviate flooding in the area.

Photos from the site visit of the area are shown in Figure 5.



Existing Ambulance and Fire station filled area on the back of the site looking up towards the intersection between Molesworth Drive and Heather Street

Eucalyptus Gum trees to be cleared on the back of the new development on the Fire station site looking down in the direction to the MAZ area



New pipe crossing Molesworth Drive in front of Fire Station development running through the Fire Station development site and discharging to a depression at the rear of the site.

Figure 5 Ambulance and Fire Station Site Photos

4.2 MAZ Catchment

The main findings from the site visit that informed the hydrology assessment at the MAZ catchment included:

- The whole MAZ area drains down to a low point to the Southwest.
- There is no overland or piped discharge from this area, stormwater has historically soaked into the sandy soils.
- It is possible that the low point drains via groundwater flow to help recharge the Museum wetland, but this has not been confirmed as part of this report.
- Through the development of the MAZ some of the local storage and soakage in this area has been paved reducing the ability for infiltration into the ground.
- The existing carpark is proposed to be resealed, which is likely to increase the volume of stormwater runoff to be managed.
- The proposed shared paths will run through near the low point to the Southwest of the catchment, putting it at future risk of inundation.

Photos from the site visit of the area are shown in Figure 6.



Existing MAZ area recontoured and paved draining to the low point on the Southwest



Low point on the southwest of the MAZ area



Existing MAZ carpark to be resealed

Figure 6 MAZ Site Photos

4.3 Museum Wetland Catchment

The main findings from the site visit that informed the hydrology assessment at the Museum wetland catchment included:

- The catchment draining to this area includes parts of Molesworth Drive up to and including parts of the industrial area above Nautical Heights Drive and parts of the Nautical Heights Drive subdivision.
- There are historical and more recent proposals to reconnect the drainage from Seabreeze Road to the wetlands. Local advice has been that this proposed connection was historically lost by the construction and raising of Molesworth Drive.
- Surface drainage from the upstream area is through the wetland system northwest of the Museum, with some historical modifications (thought to be related to gum digging activities) and then to Thelma Road.
- There is a recently installed fascine drain¹ at the outlet from the upstream wetland to the lower wetland which will restrict the extreme flows from the upstream catchment. No overland flow path has been allowed for the upper wetland to drain during extreme flows from this upstream catchment
- New pipes draining Molesworth Drive and some of the industrial area have been extended from Molesworth Drive to the Museum catchment area adding stormwater to be passed through the wetland.
- Existing wetland infiltrates down to Thelma Road and drains away through the existing roadside channels before passing through the road culverts.
- There is a current proposal from the KDC transportation department to connect drainage from Seabreeze Road to the upper wetland.

Photos from the site visit of the area are shown in Figure 7.

¹ Fascine Drain – A rough bundle of brushwood or other material used for strengthening an earthen structure, or making a path across uneven or wet terrain.



Fascine drain at the outlet from the upstream catchment



Early shared path works around the Museum area over the fascine drain



Early works for the construction of the shared paths



Crossing under the shared path as part of early works



Molesworth Drive stormwater discharge



Outlet from the wetland to Thelma Road

Figure 7 Museum Wetland Site Photos

5. Catchment Description

The wider catchment defined in the Mangawhai Stormwater Infrastructure Strategy, which includes the Mangawhai Community Park, comprises a large area of rural zoned land and an area of residentially zone land that drains into a concentrated discharge point to the Coastal marine area upstream of the Molesworth Drive Bridge. The topography of the catchment though suggests that the wider catchment is divided in two main catchments by a ridge as shown in Figure 8.

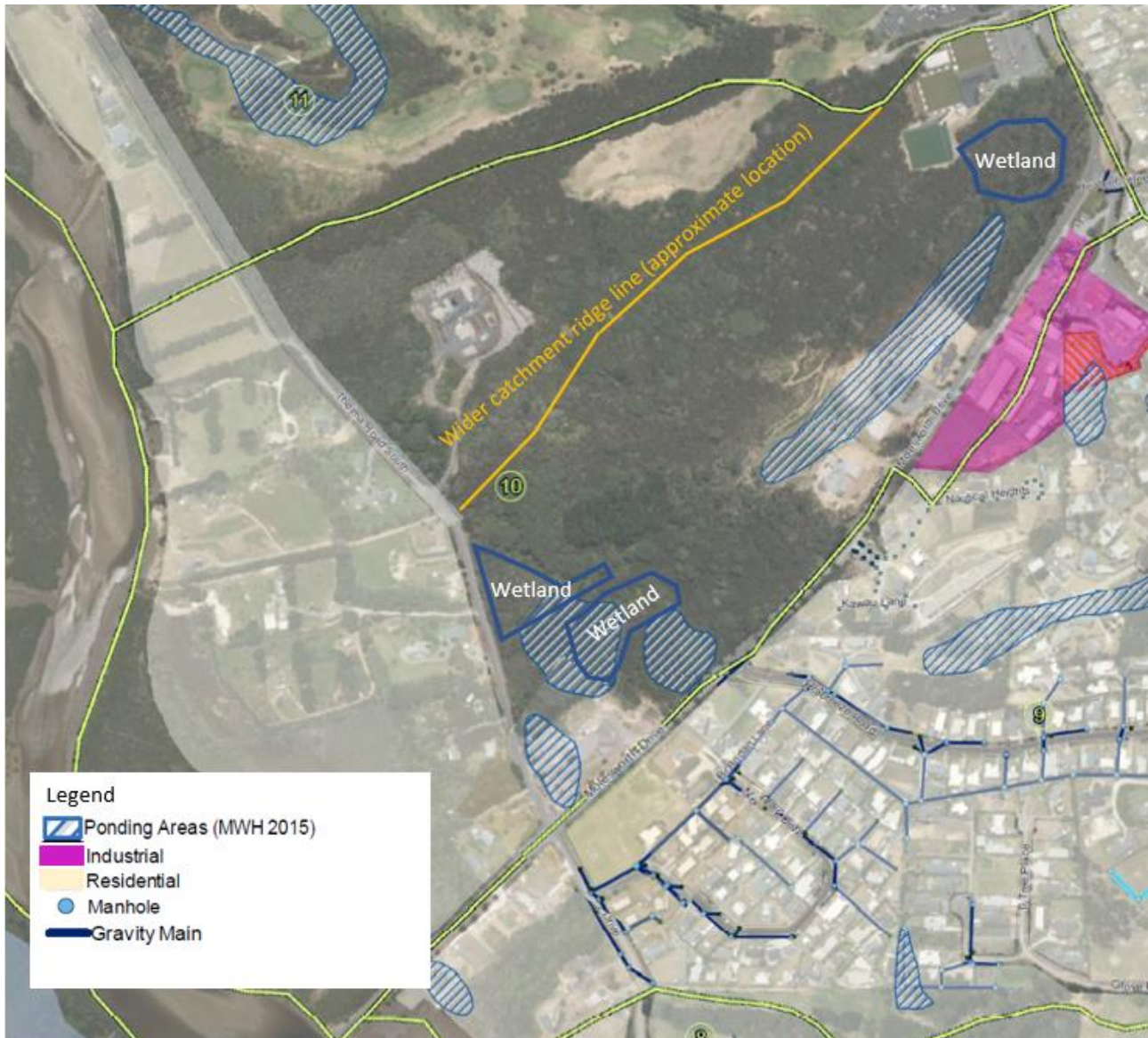


Figure 8 Wider Catchment Ridge Line (Approximate Location)

The Community Park land has historically been covered in woody vegetation and includes the natural wetlands to the south of the site close to the Mangawhai Museum and the natural wetland north of the Ambulance and Fire Station as identified in Figure 8.

The Mangawhai Stormwater Infrastructure Strategy highlighted the south wetland area as a possible location for a demonstration wetland including recreational and educational possibilities. Figure 9 includes an overview of the catchment and main issues as identified in the high level Mangawhai Stormwater Infrastructure Strategy and Figure 10 includes the main recommendations for the catchment included within the Mangawhai Stormwater Infrastructure Strategy.

Key to Mangawhai Stormwater Issues:

- 2. Performance of the existing public or private stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems and blockage consequences
- 3. A number of private properties and houses are in existing low lying land, hollows or depressions and are potentially subject to a flood hazard. There is no or limited primary stormwater network
- 5. Lack of design of Roads to act as overland flow paths
- 14. Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified
- 20. Blind hollow back of Mangawhai Activity Zone
- 22. Wetland behind the Museum site being filled

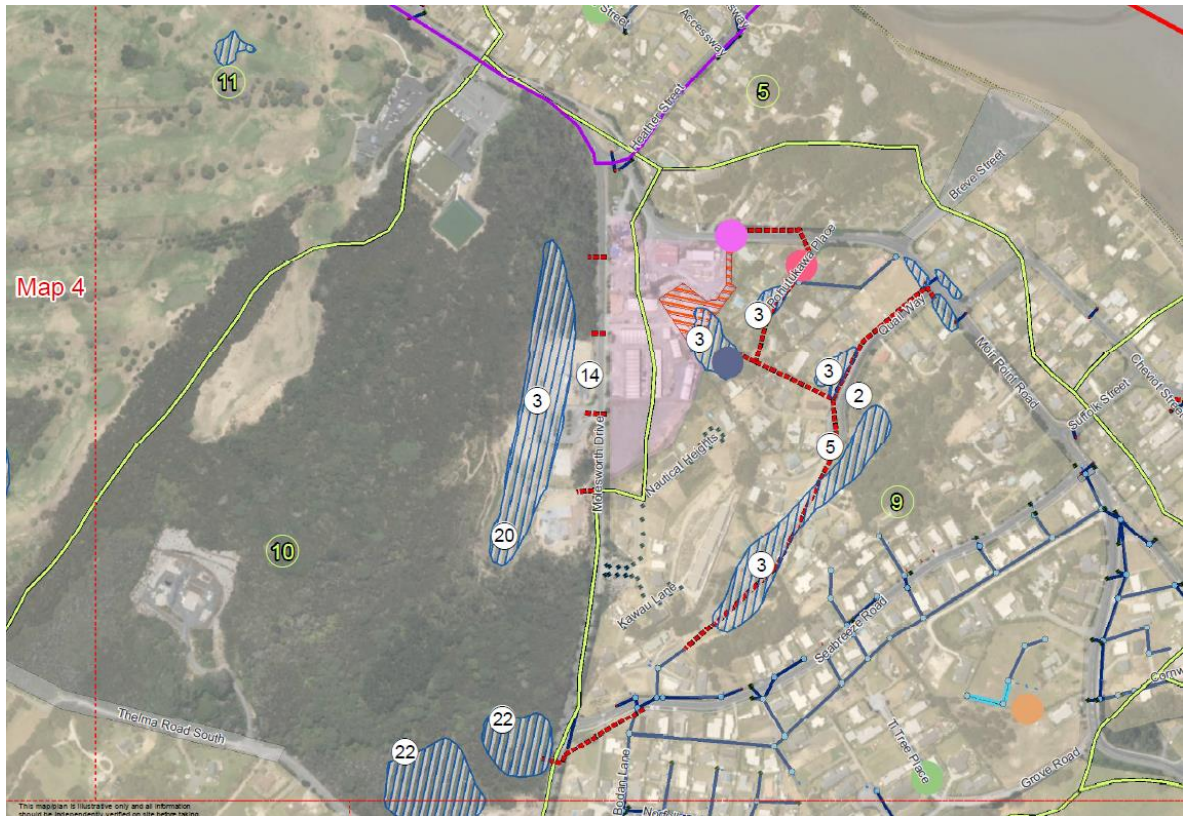


Figure 9 Wider Catchment and Main Issues as per Mangawhai Stormwater Infrastructure Strategy

The individual catchment assessments are developed based on the information shown in Figure 8, Figure 9 and Figure 10, the review of the available information on the recent projects of the Molesworth Drive Rehabilitation Project, the Seabreeze Road Improvements Project and the main findings from the April site visit. These three sub-catchments were mapped during the site visit and are shown in Figure 11 below:

- The catchment of the Ambulance and Fire station catchment consists of the area upstream of the MAZ including the area referred as a wetland in the Mangawhai Community Park Master Plan (refer to Figure 2). It is defined by Molesworth Drive and Mangawhai Golf Club and it extends to the high point at Heather Point in the intersection with Moir Point Road as shown in Figure 11.
- Water normally ponds in the depressions at the bush area upstream of the existing Ambulance and Fire station and then soaks into the ground. Behind the Ambulance and Fire Station sites a similar process would have occurred.
- The MAZ area catchment comprises of the MAZ area itself (including the carpark) and the area from the wider catchment ridge discharging to the MAZ area as shown in Figure 11.
- Runoff generally drains to depressions at the back of the MAZ development and ultimately to the Southwest corner of the MAZ area through overland flow. Some of the pre-existing local storage areas have been filled and/or paved throughout the development of the MAZ and no formal overland flow path or stormwater disposal area has been provided.
- The Museum wetland catchment compromises the existing wetland catchment itself, the museum and school area in the south corner of the Mangawhai Community Park, the industrial area east of Molesworth Drive and the possible future connection from the residential area east of Molesworth Drive limited by Seabreeze Road and Nautical Heights as shown in Figure 11.
- Runoff to the wetland area will soak into the ground with overflows flowing through the wetland system to Thelma Road. Some of the interconnections within the wetland area have been restricted during the shared path construction works restricting the flow draining to the south.

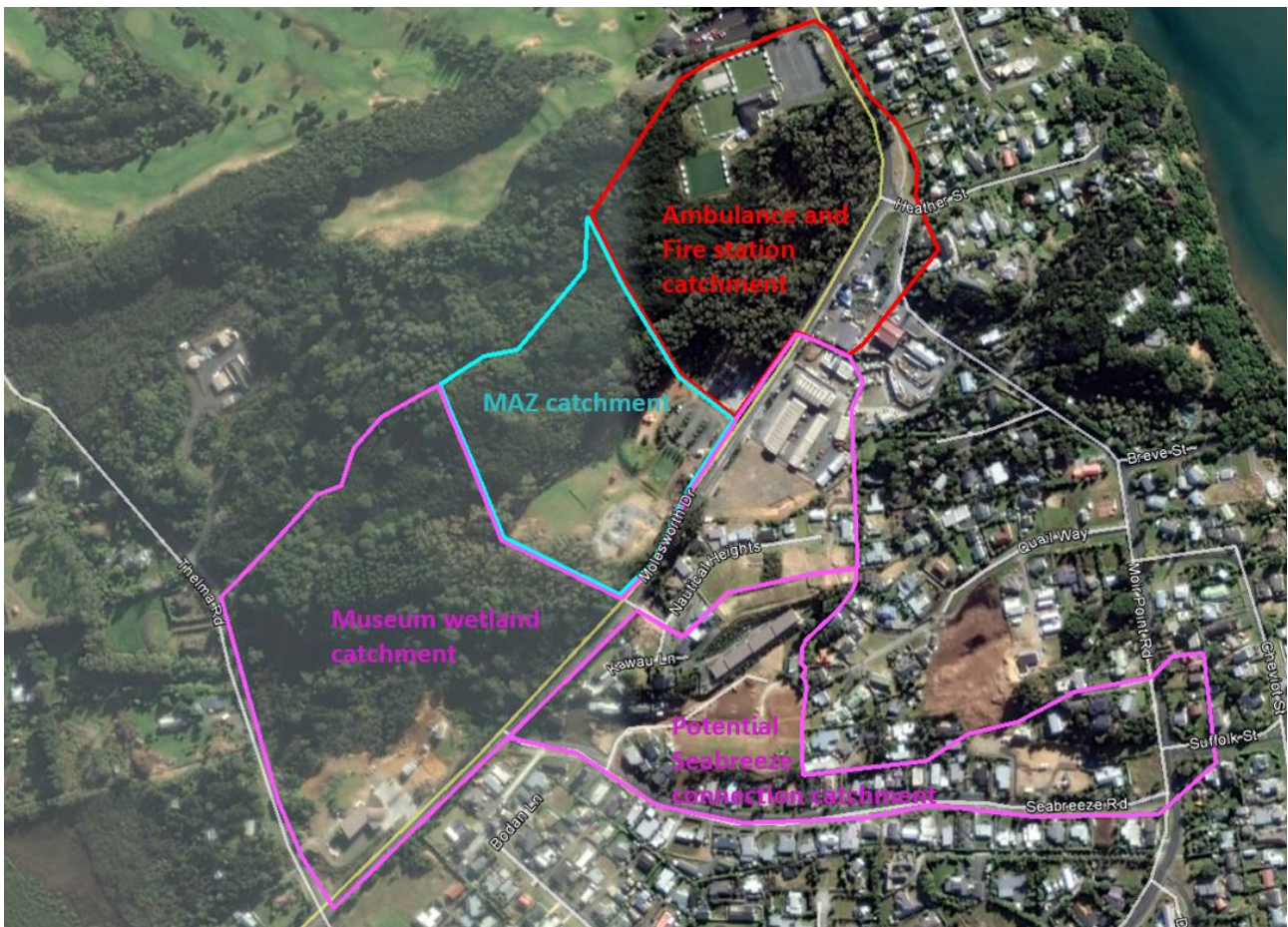


Figure 11 Sub-Catchments Areas

6. Mangawhai Community Park Wetlands Hydrology Assessment

The Resource Management Act (RMA) 1991 provides the following definition of a Wetland: ' "Wetland" includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.'

Based on this definition, the hydrology of a wetland, which defines how the storage and the movement of water happens in the wetland, is one of the most important factors to determine the wetland type and function. Changes in hydrology may lead to wetland degradation, deterioration and physical or environmental destruction.

Based on the review of the background information and the main findings of the site visit, the hydrology assessment of the Mangawhai Community Park Wetlands has been undertaken in order to confirm the existing catchments to the wetlands, analyse the existing scenario and identifying the main issues and high level recommendations to be considered with the future long-term vision of the Mangawhai Community Park.

6.1 Mangawhai Community Park Wetlands Hydrology Issues

Due to the nature of the background information available and the limitations of it in a quantitative form, the Mangawhai Community Park Wetlands hydrology issues identification is focussed initially on a qualitative assessment. A number of limitations have been identified as part of issues identification. The principal limitations include:

- There is no existing comprehensive stormwater modelling for the area, therefore issues are qualitative and based on available information review and observations on the site visit.
- The existing assets data is limited. Main discharges to the wetlands from surrounding roads were found during the site visit. No levels or verification was undertaken.
- There is very limited topographical information available of the wetlands and the catchment that drains to them. Note that these catchments are undergoing change, in particular in the MAZ areas and behind the Ambulance and fire Station.

The main existing hydrological issues affecting the Mangawhai Community Park Wetlands have been identified based on the holistic review of the available information and the hydrology assessment of the current situation for each of the sub-catchments.

6.1.1 Ambulance and Fire Station Catchment

The main existing hydrology issues affecting the Ambulance and Fire Station catchment include:

- Discharges from and under Molesworth Drive increasing the impervious areas draining to the wetlands. No documentation has been identified documenting these discharges.
- The construction of the Ambulance and Fire Stations has increased the impervious surface coverage and partially filled the pre-existing depression. The consequence of these works has been to increase flow rates and volumes, reduce storage and soakage ability of the area which will lead to future extended ponding and possibly flooding of the area and the proposed shared path.
- Further proposed development behind the Fire station site with the intention of clearing the Eucalyptus Gum trees and further filling the depressions occupied by the trees will increase the stormwater to be disposed while reducing the storage and soakage ability of the area.
- Lack of overland flow path provision from the primary soakage area behind the Ambulance and Fire stations.

6.1.2 MAZ Catchment

The main existing hydrology issues affecting the MAZ catchment include:

- Throughout the development of the MAZ area, the local storage areas have been paved through the development of the MAZ area reducing the ability of infiltration into the ground.
- Flows from much of the MAZ area are flowing to the depression in the southwest, with no current plans for how to manage these flows, what the extent of ponding may be and how this will affect the proposed cycleway alignment.
- Lack of an overland flowpath from the children's playground.
- Proposed improvements to and sealing of the carpark area, with limited options for the disposal of stormwater and no overland flowpaths from the area.

6.1.3 Museum Wetland Catchment

The main existing hydrology issues affecting the Museum wetland catchment include:

- It is unknown what the ultimate catchment draining to these wetlands may be, especially upstream of Seabreeze Road, or whether the MAZ carpark will be drained to Molesworth Drive and then to these wetlands.
- Lack of overland flow path provision for extreme flows at the recently installed fascine drain and as part of the early works of the shared path in other locations of this catchment.
- New pipes draining Molesworth Drive and some of the industrial area have been extended from Molesworth Drive to discharge into the Museum wetland area adding stormwater to be passed through the wetlands.

6.2 Mangawhai Community Park Wetlands High-level Recommendations

The following section provides a summary of the high-level recommendations.

From a wider catchment perspective these include:

- Development of a Catchment Management Plan (CMP) considering the long-term stormwater management implications to the Mangawhai Community Park wetlands. The CMP should also include:
 - A clear definition of the expected or desired stormwater outcomes for the area.
 - Confirmation of the catchment areas defined in this report.
 - Develop a coordinated approach on how to handle flows in the future.
 - Definition of no-go or future flood hazard areas, for example the existing ponding area at the back of the MAZ development.
 - Identification of which depressions are proposed to be filled.
 - How the filled depressions will be managed to avoid future flooding or overland flow risks.
 - Integration with ecological goals for the Mangawhai Community Park.
 - Integration with development goals for the Mangawhai Community Park.
 - Consideration of a fully developed scenario for the wetlands overland flowpaths and stormwater features.
 - Options to enhance the existing wetlands considering stormwater treatment, disposal and education outcomes.
 - Enhance the existing infiltration systems, assess the hazard and provide protection to the infiltration systems on the existing especially from redevelopment and at the low-lying areas of the Mangawhai Community Park.

- Carry out more detailed stormwater modelling of the system to confirm and quantify the existing issues and enable better scoping of the solutions.
- Development of an Operation, Maintenance and Monitoring plan for infiltration systems, soakage systems, overland flow paths and wetlands within the Mangawhai Community Park.
- Gather, verify and update KDC GIS data including; accurate topographic information, accurate existing asset infrastructure data (including condition of pipe, location, size, length, invert levels and connections), accurate existing open drain information and soakage capacity information such as groundwater levels and soil type.

More specific catchment recommendations are included below.

6.2.1 Ambulance and Fire Station Catchment

The main existing high-level recommendations for the Ambulance and Fire station catchment include:

- Retain existing depressions and bush area upstream (uphill) of the Fire Station development.
- Prioritise the cycleway bridging over depressions with low suspended paths.
- Enhance existing storage areas and protect them using non-intrusive construction methodologies for the shared path such as low suspended bridges.
- Provide, formalise and protect infiltration and soakage areas behind the Ambulance and Fire Stations. Where these areas cannot be protected allow for overland flowpaths from them to protected soakage/infiltration areas and align the cycleway to minimize impact on it from ponding and overland flow.

6.2.2 MAZ Catchment

The main existing high-level recommendations for the MAZ catchment include:

- Consider a treatment train type approach for runoff from the carpark, including primary and secondary treatment, soakage and then overland flow to the low point at the southwest of the MAZ area.
- Formalise and protect an overland flow path to the Southwest of the MAZ area.
- Retain and formalise the existing ponding/infiltration area to the Southwest of the MAZ area and identify possible maximum flood levels in this area.
- Develop the cycleway route considering the ponding in the low area including route selection and possible bridging over the area subject to ponding.

6.2.3 Museum Wetland Catchment

The main existing high-level recommendations for the Museum wetland catchment include:

- Define no-go areas around the margins of the wetlands for earthworks activities.
- Co-ordinate with transport and stormwater engineers to confirm the total future catchment to be passed through this area.
 - Calculate the peak flows to be passed through this area.
 - Carry out detailed definition of likely maximum water levels within the wetlands to inform future development.
 - Provide for peak flows to be passed at the fascine drain location. Passage of these flows could either be by modifying the fascine drain to pass flows or to provide and protect an overland flow path across the path at this location. This flow path might for example include construction of a bridge over the overland flowpath to avoid loss of use of the path during or following high flows.

7. Conclusion

Based on the review of the background information available and the main findings during the site visit, it has been observed that the existing wetland and park hydrology has been affected by historical and recent modifications, including the initial works for the construction of the shared path in the Mangawhai Community Park.

Future proposed works are also likely to further impact on the stormwater management in the park and need to be carefully considered. Retention of the existing wetlands hydrology is important to avoid degradation and destruction of the wetlands as well as to mitigate possible adverse effects on Park users.

This Mangawhai Community Park Hydrology Report has given specific recommendations to avoid further effects to the existing wetland hydrology and to support the future planning and development of the Mangawhai Community Park. These recommendations include further investigations and improvement activities required to fully support the recommendations including:

- Development of a Catchment Management Plan (CMP) considering the long-term stormwater management implications to the various Mangawhai Community Park wetlands.
- Gather, verify and update KDC GIS including accurate topographic information, accurate existing asset infrastructure data (including condition of pipe, location, size, length, invert levels and connections), accurate existing open drain information and soakage capacity information such as groundwater levels and soil type.

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