Christchurch City Council

CRC190445 Comprehensive Stormwater Network Discharge Consent Annual Report
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June 2020

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1 Introduction

On 20 December 2019 the Environment Court issued a consent order for the Comprehensive Stormwater Network Discharge Consent (CSNDC) CRC190445 authorising the majority of stormwater discharges into surface water and onto land within the Christchurch City area and from the Council's reticulated stormwater system.

As part of the consent application process for the CSNDC CCC developed the "Environmental Monitoring Programme for the Comprehensive Stormwater Network Discharge Consent for Ōtautahi/Christchurch City and Te Pātaka o Rākaihautū/Banks Peninsula" that provides a holistic approach to monitoring the impacts of stormwater discharges on the environment and to assess compliance with the environmental objectives.

1.1 Background of the CSNDC Consent

Prior to the granting of the CSNDC consent, CCC held four primary resource consents. CRC090292, also known as the Interim Global Stormwater Consent (IGSC), which authorised all existing stormwater discharges within Christchurch City Council (CCC), excluding Banks Peninsula, except those authorised by the catchment specific consents. The IGSC was a short term consent that was intended to allow CCC to develop SMP's for the catchments within the Christchurch area. As SMP's were developed and resource consents granted by ECan the SMP areas were authorised by their own consents. The first of these was known as the South West Consent CRC120223. The second was known as the Styx Consent CRC131249. Once all SMP areas possessed individual consents the IGSC would no longer be required. The final of the four consents was an older consent authorising discharge to land CRC000315. Subsequent to the Styx Consent being granted a change in philosophy was agreed between CCC and ECan and resulted in CCC seeking the now granted CSNDC, one consent for all catchments.

1.2 Purpose of the Annual Report

Council is required by Condition 61 of the CSNDC to provide an annual report to Environment Canterbury, the Zone Committees and Mahaanui Kurataiao Limited by 30th June each year. The report must cover the previous Calendar year and be made available on the Council website. Given that CRC190445 was only issued on 20 December 2019 the wording of condition 61 suggest the first report is not required until 30 June 2021. However it seems more transparent to provide as much information as we have available and that is relevant from the 2019 year.

2 Developments authorised CRC190445

CCC has authorised stormwater discharges under consent CRC190445 since 20 December 2019 when the consent order was issued. This occurs when an applicant (e.g. developer, customer building a new residential dwelling) apply for a resource consent, building consent or subdivision consent and is required to ensure that the discharge of stormwater from the building or site is legally authorised. An applicant may then choose to request authorisation from CCC to discharge stormwater under consent CRC190445 or to obtain their own resource consent from ECan.

The authorisations given by CCC to applicants have been for sites including subdivisions, redevelopment of commercial and industrial sites, residential housing units, schools and individual house lots. Attached as Appendix 1 is a list of the 273 sites that have been authorised to discharge up to 31 May 2020 (required by Condition 61h.

ECan are notified of sites authorised to discharge under the consent on a monthly basis. CCC request advice from Environment Canterbury on applications for discharge approval which might be unacceptably high risk. In accordance with Condition 2(d), those sites Environment Canterbury advise should be considered unacceptably high risk consent are not provided Stormwater approval by Council. Rather their discharge is managed via resource consent with Environment Canterbury.

3 Implementation of Environmental Monitoring Programme

CCC have undertaken environmental monitoring over the period of 1 January 2019 to 31 December 2019 in general accordance with the "Environmental Monitoring Programme for the Comprehensive Stormwater Network Discharge Consent for Ōtautahi/Christchurch City and Te Pātaka o Rākaihautū/Banks Peninsula". The results and assessments of the results are provided in this report (Appendix 2). Please note the version provided in this report is a Final Draft and is now subject to Environment Canterbury review.

4 Stormwater Projects by SMP Area

The milestone timetables as at 9 June 2020 for Council Stormwater mitigation systems are provided in Appendix 3.

5 Schedule 1

Schedule 1 as a concept originally began with the South West Catchment consent granted in 2012. The schedule is a list of properties deemed by Council to be too high risk for us to extend authorisation to these sites. Sites excluded under previous consents have been carried in the CSNDC and formed the original CSNDC schedule 1. Some additional sites have been excluded in recent months and the latest Schedule 1 of properties excluded from authorisation under CRC190445 is provided in Appendix 4.

6 Industrial Site Audit Programme

The industrial site audit programme is intended to identify potential or actual sites or industrial activities that pose an unacceptable risk to the quality of stormwater discharge. The programme is anticipated to identify these sites and assist site owners and/or operators to identify on-site risks, onsite infrastructure and site management practices that could impact the quality of stormwater being discharged from their sites. Ultimately, it is anticipated that this will assist in improving the habitat of waterways which will reduce the impact on instream biota. In this regard there is a great deal of commonality between the proposed site audit programme and the Pollution Prevention Programme run by ECan. The purpose of both programmes is to improve stormwater discharges from individual sites, resolving problems at the source, therefore improving the overall stormwater quality which will reduce the impact on waterway health and instream biota.

In 2019 13 industrial site audits were undertaken however two site were allowed, by Environment Canterbury, to account for two audits due the size and completely of the sites and therefore scale of work involved in completing a thorough audit. Details of the audit sites can be found in Appendix 5

7 Discussion

The resource consent condition 61 of CRC190445 requiring an annual report appears to only require a report following the first full year after the consent commenced. However it seems sensible at this point to produce the relevant information we do have and share that with the necessary parties. To that end this annual report has been produced and is being circulated in line with the consent requirements.

Appendix 1 Developments authorised under CRC190445 to 31 May 2020

ADDRESS	*Description* Developer/Project	*dd-mm-yyyy* Approval Date	# Prupi.	# Lot No.	*ha* Site Area	# # of Lots	*Res/Non/Com* Site Type	*Flat/Hill* Site Loc	# BCN/RMA	# TRIM - Approval	*Global/Styx/SW* Consent	*Exercised?* Discretion	Attenuation Reqs.	Treatment Reqs.	*misc.* Notes
5 Harry Fergus Lane Moncks Spur	New dwelling	18/02/2020	737227	Lot 26 DP 79052	0.1584	1	Res	Hill	BCN/2020/759	20/178554	CRC190445	No	9 m3 tank as per the global consent	Nil	
9 Woodills Road, Akaroa	New dwelling	19/02/2020	886460	Lot 4 DP 304685	0.0647	1	Res	Hill	BCN/2020/319	20/179203	CRC190445	No	5 m3 as per the bylaw	Nil	
58 Hoani Street, Papanui	3 detached dwellings for HNZ	19/02/2020	739821	Lot 22 DP 16540	0.0756	1	Res	Flat	BCN/2020/756	20/179237	CRC190445	No	3 x 4 m3 tanks i.e. 11 per roof	Nil	Meets the small sites guide requirements
20 Nautilus Place Spencerville	New dwelling	20/02/2020	866122	Lot 66 DP 311069	0.1	1	Res	Flat	BCN/2020/883	20/185152	CRC190445	No	Discharge to ground via a soakpit	Nil	
110 Sawyers Arms Road, Papanui	New carparking area	20/02/2020	771352	Lot 1 DP 17730	0.0718	1	Com	Flat	BCN/2020/813	20/185169	CRC190445	No	Nil	Stormwater360 Stormfilter	New carpark
367 Port Hills Road Hillsborough	New dwelling	20/02/2020	763842	Lot 7 DP 16775	0.0809	1	Res	Hill	BCN/2020/631	20/179268	CRC190445	No	Nil	Nil	Almost like for like replacement
51 Sullivan Avenue, Woolston	Two new dwellings replacing one dwelling	20/02/2020	776957	Lot 23 DP 2116	0.087	1	Res	Flat	BCN/2020/348	20/185081	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
23 Mt Pleasant Road, Mt Pleasant	New dwelling	20/02/2020	756567	Lot 54 DP 3838, Pt Lot 63 DP 383	0.0703	1	Res	Hill	BCN/2020/626	20/185089	CRC190445	No	Nil	Nil	Stormwater pumped to Mt Pleasant Road and discharged into the Council pipe.
130 Olliviers Road, Linwood	Three new units	20/02/2020	759446	Lot 52 DP 623	0.043	1	Res	Flat	BCN/2020/861	20/185141	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
184 Rocking Horse Road, Southshore	New dwelling	20/02/2020	768190	Lot 27 DP 19427	0.0668	1	Res	Flat	BCN/2020/843	20/185143	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
3 Chewy Place Hoon Hay	24 m2 extension to the existing dwelling	20/02/2020	718725	Lot 44 DP 22401	0.0607	1	Res	Flat	BCN/2020/888	20/185150	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
50 Idris Road, Fendalton	Two units	20/02/2020	741524	Pt Lot 3 DP 3123	0.0991	1	Res	Flat	BCN/2019/8129	20/185153	CRC190445	No	Permeable pavers installed to meet the 70% requirement		Meets the small sites guide requirements
2 Marama Crescent St Andrews Hill	New dwelling	21/02/2020	751749	Pt Lot 17 DP 11358	0.0779	1	Res	Hill	BCN/2020/896	20/185170	CRC190445	No	Nil	Nil	Almost like for like replacement
165A Baker Street, New Brighton	New dwelling	21/02/2020	901287	Lot 2 DP 410661	0.0582	1	Res	Flat	BCN/2020/799	20/185174	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
363 Eastern Terrace, Sydenham	New dwelling	21/02/2020	726095	Lot 7 DP 10814	0.0615	1	Res	Flat	BCN/2020/801	20/185180	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
143 Peterborough Street Central City	New dwelling	21/02/2020	762872	Pt Lot 11 DP 2600	0.0519	1	Res	Flat	BCN/2020/887	20/185181	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
134B Richmond Hill Road, Clifton	New dwelling	21/02/2020	903304	Lot 1 DP 408966	0.1166	1	Res	Hill	BCN/2020/777	20/185186	CRC190445	No	9 m3 tank required for hill sites	Nil	
140 Moncks Spur Road	New dwelling	21/02/2020	919189	Lot 5 DP 468069	0.1672	1	Res	Hill	BCN/2019/8289	20/190439	CRC190445	No	9 m3 tank required for hill sites	Nil	
67 Barnes Road, Styx	Warehouse and offices	21/02/2020	925824	Lot 3 DP 514245	0.6204	1	Com	Flat	BCN/2020/384	20/190497	CRC190445	No	Nil	Hynds Upflow Filter	Attenuation provided in the previous stage
8 Highview Lane Scarborough	Swimming pool discharge	22/02/2020	739183	Lot 37 DP 68127	0.1431	1	Res	Hill	BCN/2002/10450/A	20/190756	CRC190445	No	Nil	Nil	Discharge of sswimming pool stormwater from the deck
2 Albert Terrace, St Martins	New dwelling	22/02/2020	704211	Lot 2 DP 5960	0.0799	1	Res	Hill	BCN/2020/749	20/190770	CRC190445	No	Nil	Nil	Like for like replacement
460 Cashel Street Linwood	Four new dwellings	22/02/2020	716881	Pt RS 175 Canterbury Dist	0.0602	1	Res	Flat	BCN/2020/920	20/190775	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
5 Sowerby Place Clifton	New dwelling	22/02/2020	926975	Lot 125 DP 482014	0.092	1	Res	Hill	BCN/2020/899	20/190776	CRC190445	No	Nil	Nil	Attenuation provideed as part of the subdvision
60 Godley Drive, Scarborough	Subdvision drainage	22/02/2020	928630	Lot 3 DP 333879, Lot 2 DP 34613(	27.9	3	Res	Hill	BCN/2020/634	20/190777	CRC190445	No	Nil	Nil	Subdivision connection requirements met.
257 Wainoni Road, Avondale	5 detahced units	25/02/2020	782526	Lot 3 DP 14448	0.1547	1	Res	Flat	BCN/2020/916	20/198187	CRC190445	No	5 m3 tank foreach of the 5 units	Nil	Attenuation provided at a rate of 5 m3 per 100 m2.
27A Aylesford Street St Albans	New dwelling	26/02/2020	926607	Lot 1 DP 460893	0.046	1	Res	Flat	BCN/2020/606	20/205326	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
142E Lyttelton Street Spreydon	New shops	26/02/2020	819067	Unit D DP 43470 on Lot 3 DP 798	0.0675	1	Com	Flat	BCN/2020/1001	20/205457	CRC190445	No	Nil	Nil	No additional impervious area
528 Moorhouse Avenue, Waltham	New warehouse	26/02/2020	756165	Lot 1 DP 35276	0.0797	1	Com	Flat	BCN/2020/523	20/208277	CRC190445	No	Nil	Nil	No additional impervious areas.
80 Vernon Terrace, St Martins	New dwelling	26/02/2020	781716	Lot 5 DP 18841	0.1224	1	Res	Flat	BCN/2019/8300	20/208616	CRC190445	No	Nil	Nil	Almost like for like replacement
5 Montgomery Terrace, St Martins	New dwelling	26/02/2020	755918	Lot 2 DP 28675	0.0526	1	Res	Flat	BCN/2019/4958	20/208842	CRC190445	No	Nil	Nil	Almost like for like replacement
257 Wilsons Road Waltham	Two new dwellings	26/02/2020	786531	Lot 2 DP 20991	0.0491	1	Res	Flat	BCN/2020/1027	20/209128	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
96 Wairakei Road Bryndwr	New dwelling	26/02/2020	932755	Lot 1 DP 517386	0.0731	1	Res	Flat	BCN/2020/1000	20/209191	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
83 Beachville Road Redcliffs	New garage	27/02/2020	709578	Lot 2 DP 35319	0.623	1	Res	Flat	BCN/2020/1063	20/213019	CRC190445	No	Nil	Nil	No additional impervious area
32 Guernsey Street Aranui	New tiny house	27/02/2020	734742	Lot 57 DP 37325	0.0766	1	Res	Flat	BCN/2020/1059	20/213174	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
16 Fairfield Avenue, Addington	9 units	27/02/2020	728201	Lot 75 DP 1499	0.1113	1	Res	Flat	BCN/2020/983	20/216136	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
84D Avonhead Road Avonhead	New dwelling	27/02/2020	706993	Lot 6 DP 25199	0.112	1	Res	Flat	BCN/2020/1091	20/216149	CRC190445	No	Nil	Nil	Almost like for like replacement
6 Shortland Street Wainoni	Relocated dwelling and garage	27/02/2020	772869	Lot 7 DP 14249	0.0612	1	Res	Flat	BCN/2020/1068	20/216180	CRC190445	No	Nil	Nil	Almost like for like replacement
31 Amuri Street Hei Hei	Minor dwelling	27/02/2020	704807	Lot 29 DP 18600	0.0693	1	Res	Flat	BCN/2020/1056	20/216186	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
50 Ward Street, Addington	12 townhouses	27/02/2020	784009	Pt Lot 103 DP 63	0.0779	1	Res	Flat	BCN/2020/11	20/213330	CRC190445	No	10 m3 storage	Nil	Maximum discharge from the site = 24.5 L/s
9 Totara Drive Duvauchelle	New dwelling	28/02/2020	919162	Lot 27 DP 471355	0.0595	1	Res	Hill	BCN/2020/1066	20/217376	CRC190445	No	7 m3 storage via two tanks	Nil	Minimum storage required is 9 m3 but 7 m3 installed as the roof area is only 105 m2.
280 Beach Road, Travis	New board walk	28/02/2020	877763	Lot 1 DP 45936, Lots 1,2 DP 7323	120.1	1	Com	Flat	CP503385	20/218474	CRC190445	No	Nil	Nil	Low risk. Area of works is just the narrow boadwalk.
177 Richmond Hill Road Clifton	New dwelling	28/02/2020	892089	Lot 94 DP 374322	0.0966	1	Res	Hill	BCN/2020/1133	20/221435	CRC190445	No	Nil	Nil	Attenuation provided at the subdivision stage
55 Linwood Avenue North Linwood	5 one bedroomed units	28/02/2020	747916	Pt Lot 16 DP 1252	0.0842	1	Res	Flat	BCN/2020/1124	20/221436	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
2 Roseneath Place Cashmere	Retaining wall drainage	3/03/2020	768804	Lot 22 DP 25596	0.0782	1	Res	Hill	BCN/2020/262	20/228624	CRC190445	No	Nil	Nil	No additional impervious area just retaining wall
52 Andersons Road Diamond Harbour	New dwelling	3/03/2020	882518	Lot 4 DP 30024	0.0809	1	Res	Hill	BCN/2019/8781	20/228903	CRC190445	No	Nil	Nil	
20 Kaiwara Street Hoon Hay	New dwelling	3/03/2020	743416	Lot 8 DP 21105	0.1237	1	Res	Flat	BCN/2020/1155	20/229220	CRC190445	No	Nil	Nil	Additional impervious area within the small sites
47 Lindsay Street St Albans	Additions and alterations	3/03/2020	747794	Lot 21 DP 6589	0.00511	1	Res	Flat	BCN/2020/1145	20/229995	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
116 Champion Street St Albans	Four new units replacing one	3/03/2020	717812	Lot 1 DP 2686	0.0959	1	Res	Flat	BCN/2020/1142	20/230137	CRC190445	No	3 x 2m tanks and + 1 x 4 m3 tank	Nil	Units 1-3 have 2 m3 tanks and Unit 4 has 1 x 4 m3 tank.
56 Bengal Drive Cashmere	New dwelling	3/03/2020	804635	Lot 5 DP 80163	0.086	1	Res	Hill	BCN/2020/1144	20/230368	CRC190445	No	9 m3 tank in compliance with the requirements for hills	Nil	9 m3 tank installed and connects to the existing lateral.
80 Poulson Street, Addington	Twelve attached dwellings	4/03/2020	937979	Pt Lot 77 DP 63, Lot 77 DP 63	0.1416	1	Res	Flat	BCN/2020/807	20/234706	CRC190445	No	Nil	Oil and Grit Interceptor	
233 Richmond Hill Road Clifton	Earthquake repairs	4/03/2020	892068	Lot 7 DP 374322	0.1267	1	Res	Hill	BCN/2020/1174	20/233818	CRC190445	No	Nil	Nil	Small additional impervious areas
6 Old West Coast Road Yaldhurst	New pole shed	4/03/2020	759255	Lot 1 DP 25431	4.04	1	Res	Flat	BCN/2020/1199	20/234020	CRC190445	No	Nil	Nil	Stormwater dispersed to ground
2 Cornwall Road, Lyttelton	33 lot subdivision	4/03/2020	884127	Lot 55 DP303270	2.7	33	Res	Hill	RMA/2004/3314	20/235777	CRC190445	No	Nil	Nil	Acceptance of an old ECan consent subdivision under
30 Glenstrae Road, Balmoral Hill	New dwelling replacing an EQ damaged home	4/03/2020	830868	Lot 30 DP 47379	0.1211	1	Res	Hill	BCN/2020/738	20/236037	CRC190445	No	Nil	Nil	Almost like for like replacement
152 MacKenzie Avenue, Woolston	Earthquake repairs	5/03/2020	749543	Lot 2 DP 8070	0.0822	1	Res	Flat	BCN/2019/8254	20/245693	CRC190445	No	Nil	Nil	No additional impervious area
7A Mathesons Road Phillipstown	New dwelling	6/03/2020	931443	Lot 2 DP 520982	0.0715	1	Res	Flat	BCN/2020/1154	20/246083	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
34 Rutland Street St Albans	New garage	6/03/2020	770210	Lot 8 DP 6614	0.0647	1	Res	Flat	BCN/2020/1142	20/246460	CRC190445	No	Nil	Nil	No additional impervious area
27 Cascade Place Sumner	New sleepout	6/03/2020	7126776	Lot 12 DP 46654	0.1003	1	Res	Hill	BCN/2020/1188	20/247281	CRC190445	No	Nil	Nil	Small additional impervious area
20 Lychgate Close Linwood	New church	6/03/2020	825634	Pt Lot 1 DP 12070, Pt Lots 2,2 DP	1.2	1	Com	Flat	BCN/2020/1131	20/247397	CRC190445	No	Nil	Stormwater360 Stormfilter	Almost like for likeimpervious areas
243B Sparks Road Hoon Hay	New shed	6/03/2020	774267	Lot 2 DP 72348	1.01	1	Res	Flat	BCN/2020/719	20/247633	CRC190445	No	2 m3 tank for attenuation	Nil	
26 Reading Street Upper Riccarton	New minor dwelling	6/03/2020	766053	Lot 16 DP 23219	0.0635	1	Res	Flat	BCN/2020/1254	20/247741	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
8 Desmond Street Merivale	New sleepout	6/03/2020	896812	Lot 2 DP 399130	0.1232	1	Res	Flat	BCN/2020/1260	20/247909	CRC190445	No	nil	Nil	Small additional impervious area
180 Weston Road St Albans	Additions and alterations	6/03/2020	785521	Lot 22 DP 11679	0.0647	1	Res	Flat	BCN/2020/1265	20/248158	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
10/12 Wilmers Road, Hornby	Industrial subdvision	6/03/2020	817675	Lot 4 DP 20669	2.7	1	Com	Flat	RMA/2019/2184	20/234632	CRC190445	No	Nil	Nil	Discharge to the existing CCC basins.
47 Old West Coast Road Yaldhurst	Additions and alterations	6/03/2020	759298	RS 40324 Canterbury Dist, Lot 4 D	2.5	1	Res	Flat	BCN/2020/1275	20/248971	CRC190445	No	Nil	Nil	Discharge to grounf via an existing soakpit
29 Ottawa Road Wainoni	New dwelling	6/03/2020	760338	Pt Lot 34 DP 1070	0.0726	1	Res	Flat	BCN/2020/1309	20/249274	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
395 Breezes Road, Aranui	New minor dwelling	6/03/2020	713175	Lot 3 DP 14776	0.0835	1	Res	Flat	BCN/2020/203	20/249447	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
6 John Monck Lane Moncks Spur	Pool House	6/03/2020	742908	Lot 43 DP 79052	0.2232	1	Res	Hill	BCN/2020/1270	20/249495	CRC190445	No	Nil	Nil	Small increase in impervious
13 Hackthorne Road Cashmere	New replacement garage	6/03/2020	842528	Lot 3 DP 4919	0.0811	1	Res	Hill	BCN/2015/6208/A	20/249573	CRC190445	No	Nil	Nil	Small increase in impervious
152 Fendalton Road Fendalton	New concerete pad - 37 m2	9/03/2020	728862	Pt Lot 1 DP 14950	0.0818	1	Res	Flat	BCN/2019/3193/a	20/250912	CRC190445	No	Nil	Nil	No additional impervious area
2 Stronsay Lane Hillsborough	New 44 m2 dwelling	9/03/2020	864155	Lot 21 DP 304078	0.0945	1	Res	Hill	BCN/20208/688	20/250914	CRC190445	No	Nil	Nil	44 m2 dwelling on a hill. No attenuation requested.

32 Heywood Terrace Richmond	4 units	9/03/2020	738882	Lot 1 DP 10558	0.0974	1	Res	Flat	BCN/2020/1248	20/250924	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
65 Arnold Street, Sumner	Additions and alterations	9/03/2020	706004	Lot 1 DP 13034	0.0769	1	Res	Hill	BCN/2020/1273	20/250954	CRC190445	No	Nil	Nil	Small increase in impervious
14 Bishop Street, St Albans	5 attached dwellings	9/03/2020	711196	Pt Lot 5 DP 2914	0.1388	1	Res	Flat	BCN/2019/1424	20/250960	CRC190445	No	2x 3 m3 + 3 x 4 m3 storage	Nil	
476 Sparks Road Halswell	77 m2 New shed	10/03/2020	774196	Lot 22 DP 16937, Lot 1 DP 50981	0.1748	1	Res	Flat	BCN/2020/1276	20/259489	CRC190445	No	Nil	Nil	Small increase in impervious
45 Division Street, Riccarton	4 units	10/03/2020	724461	Lot 7 DP 12220	0.0847	1	Res	Flat	BCN/2020/1016	20/259902	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
157 Taylors Mistake Road. Scarborough	New dwelling	11/03/2020	875532	Pt Lot 37 DP 6419	0.0577	1	Res	Hill	BCN/2018/7233/A	20/264565	CRC190445	No	2 x 30 m3 tanks for on site water use	Nil	Small increase in impervious
15 Parkstone Avenue Avonhead	Additions and alterations and a replacement garage	11/03/2020	761788	Lot 3 DP 49650	0.0737	1	Res	Flat	BCN/2020/1316	20/264707	CRC190445	No	Nil	Nil	
91 Springfield Road St Albans	8 units	11/03/2020	774425	Lot 4 DP 9474	0.085	1	Res	Flat	BCN/2020/1325	20/264865	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
1/43 Wroxton Terrace Fendalton	Flat rebuild	11/03/2020	804066	Flat 1 DP 54424 on Lot 1 DP 4513	0.789	1	Res	Flat	BCN/2019/85	20/265512	CRC190445	No	Nil	Nil	Almost like for like
502 Armagh Street, Linwood	Four detached dwellings	13/03/2020	705887	Pt Lot 64 DP 421	0.0818	1	Res	Flat	BCN/2020/680	20/280310	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
102A Woodham Road, North Linwood, Christchu	New dwellingh	13/03/2020	917111	Lot 2 DP 471008	0.0577	1	Res	Flat	BCN/2018/3963	20/280313	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
55 Leinster Road, Merivale	New drainage connection to the street	16/03/2020	833062	Flat 2 DP 67893 on Lot 1 DP 6737	0.1172	1	Res	Flat	BCN/2020/1301	20/281560	CRC190445	No	Nil	Nil	Realignment of drains - no additional impervious area.
260 Linwood Avenue Linwood	New relocated classroom	16/03/2020	811928	Pt RS 347 Canterbury Dist	2.3244	1	Com	Flat	BCN/2020/1064	20/284891	CRC190445	No	Nil	Nil	No additional impervious area
9 Kahu Road Fendalton	Replacement dwellings	16/03/2020	826129	Lot 3 DP 67720	0.0544	1	Res	Flat	BCN/2020/1425	20/285340	CRC190445	No	Nil	Nil	Almost like for like replacement
1/3 Claridges Road Casebrook	New replacement dwelling	16/03/2020	7792100	Flat 1 DP 48539 on Lot 14 DP 180	0.0809	1	Res	Flat	BCN/2020/1417	20/285418	CRC190445	No	Nil	Nil	Almost like for like replacement
112 Carmen Road Hornby	New boiler building	16/03/2020	930551	Sec 27 SO 459717	4.27	1	Com	Flat	BCN/2020/1368	20/285519	CRC190445	No	Nil	Nil	No additional impervious area
294 Ilam Road Fendalton	New classroom block	16/03/2020	741631	Pt RSs 70,70,70 Canterbury Dist	4.76	1	Com	Flat	BCN/2020/1383	20/285643	CRC190445	No	Nil	Nil	146 m2 additional impervious area
39 Winton Street St Albans	Two new dwellings replacing one dwelling	16/03/2020	787027	Pt Lot 24 DP 1527	0.0637	1	Res	Flat	BCN/2020/1	20/285682	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
5 Lucknow Place Cashmere	New dwelling	16/03/2020	748939	Lot 16 DP 55417	0.0922	1	Res	Hill	BCN/2019/8059	20/282438	CRC190445	No	9 m3 tank for a hill site	Nil	
547 Pound Road Yaldhurst	Ne shed - 100 m2	16/03/2020	764050	Lot 4 DP 17050	0.4024	1	Res	Flat	BCN/2020/1392	20/285812	CRC190445	No	Discharge to a soakpit	Nil	Meets the small sites guide requirements
11 Troon Place Shirley	New garage	17/03/2020	780350	Lot 18 DP 21794	0.0984	1	Res	Flat	BCN/2020/1419	20/286507	CRC190445	No	Nil	Nil	No additional impervious area
36 Soleares Avenue McCormacks Bay	New dwelling	17/03/2020	809013	Lot 1 DP 74158	0.0829	1	Res	Hill	BCN/2020/1471	20/292140	CRC190445	No	Nil	Nil	No additional impervious area
10 Tui Street, Fendalton, Christchurch	New dwelling	18/03/2020	780658	Lot 7 DP 2528	0.1138	1	Res	Flat	BCN/2020/1494	20/292898	CRC190445	No	Nil	Nil	Small additional impervious area
60 Browns Road St Albans	Two new units	18/03/2020	714519	Pt Lot 1 DP 8297	0.2147	1	Com	Flat	BCN/2020/1495	20/292989	CRC190445	No	Nil	Nil	No additional impervious area
7 Garden Road, Fendalton	Replacement units	18/03/2020	794013	Lot 1 DP 28364	0.0801	1	Res	Flat	BCN/2020/615	20/293146	CRC190445	No	Nil	Nil	No additional impervious area
12 Cliff Street Moncks Bay	Subdvision drainage	18/03/2020	719580	Lot 3 DP 12567	0.1894	1	Res	Hill	BCN/2020/1439	20/295552	CRC190445	No	Nil	Nil	Construction Phase consent for the drainage works
351B Worsleys Road, Cracroft	New garage	19/03/2020	915845	Lot 1 DP 461327	0.3	1	Res	Hill	BCN/2020/1416	20/299144	CRC190445	No	Nil	Nil	Discharge into the existing tank
87 Langdons Road, Papanui	Three units	19/03/2020	746777	Pt Lot 25 DP 587	0.0577	1	Res	Flat	BCN/2019/8630	20/299302	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
51 Prestons Road Redwood	School Redevelopment	19/03/2020	817304	Pt Lot 31 DP 18745, Pt Lots 1,1 DI	2.34	1	Com	Flat	BCN/2020/1527	20/300224	CRC190445	No	Nil	Nil	No additional impervious area
9 Bolton Avenue, Spreydon	Seven OPHs	23/03/2020	711923	Lot 5 DP 6072	0.0794	1	Res	Flat	BCN/2020/1067	20/309564	CRC190445	No	Nil	Nil	Have added permeable pavers and this has reduced the pervious areas to <70%.
44 Petrie Street Richmond	New dwelling	23/03/2020	762933	Lot 1 DP 5613	0.0508	1	Res	Flat	BCN/2020/1549	20/310016	CRC190445	No	Nil	Nil	Almost like for like replacement
140 Leinster Road, Merivale	19 detached dwellings	23/03/2020	747331	Lot 1 DP 16511	0.2412	1	Res	Flat	BCN/2020/341	20/309691	CRC190445	No	5 m3 storage	Filterra	
143 Marine Drive, Diamond Harbour	New business complex	23/03/2020	894572	Lot 138 DP 354226	0.6793	1	Com	Hill	BCN/2020/525	20/305851	CRC190445	No	60 m3	Stormwater360 Stormfilter	
116 Sherborne Street, St Albans	Two new units	23/03/2020	772651	Pt Lot 1 DP 4510	0.0508	1	Res	Flat	BCN/2019/8019	20/312888	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
55 Normans Road Papanui	replacement dwelling	23/03/2020	758176	Lot 2 DP 13474	0.0966	1	Res	Flat	BCN/2020/1546	20/313023	CRC190445	No	Nil	Nil	Almost like for like replacement
32 Bligh Road, Bryndwr	Additions and alterations	23/03/2020	711784	Lot 3 DP 21533	0.0878	1	Res	Flat	BCN/2019/6482	20/312374	CRC190445	No	Soakpit - 4.1 m x 4.1 m x 0.9 m	Nil	
165 Racecourse Road, Riccarton, Christchurch	New dwelling	23/03/2020	931465	Sec 1 SO 486359	82.3	1	Res	Flat	BCN/2020/446	20/313156	CRC190445	No	8 x 2 m3 storage tanks with 20-25 mm outlets	First flush basin	Discharge into a tank then to the kerb
17 Roberta Drive Spreydon	Replacement garage	25/03/2020	767659	Lot 19 DP 21770	0.0739	1	Res	Flat	BCN/2020/1592	20/319205	CRC190445	No	Nil	Nil	Almost like for like replacement
2 & 4 Tweed Street Richmond	8 units	26/03/2020	874539	Lot 1 DP 339829	0.1002	1	Res	Flat	BCN/2020/1684	20/326537	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
16 the Crescent St Martins	Replacement dwelling	26/03/2020	778736	Lot 1 DP 45370	0.0909	1	Res	Hill	BCN/2020/1706	20/326538	CRC190445	No	Nil	Nil	Almost like for like replacement
47A Studholme Street Somerfield	Replacement garage	26/03/2020	776688	Lot 2 DP 27703	0.1212	1	Res	Flat	BCN/2020/1656	20/326539	CRC190445	No	Nil	Nil	Almost like for like replacement
92 Neill Street Hornby	Three units	26/03/2020	757271	Lot 1 DP 36577	0.0971	1	Res	Flat	BCN/2020/1651	20/326543	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
153 Prestons Road Redwood	75 m2 two bedroomed dwelling	26/03/2020	764239	Lot 17 DP 19819	0.0845	1	Res	Flat	BCN/2020/1639	20/326553	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
26B Maffeys Road McCormacks Bay	New replacement dweling	26/03/2020	853471	Flat 2 DP 59509 on Lot 4 DP 1341	0.1012	1	Res	Hill	BCN/2020/1635	20/326556	CRC190445	No	Nil	Nil	Almost like for like replacement
64 Paparoa Street Papanui	New replacement dwelling	27/03/2020	761530	Lot 2 DP 34366	0.1563	1	Res	Flat	BCN/2020/1631	20/326608	CRC190445	No	Nil	Nil	Almost like for like replacement
20 Mariners Cove Lyttelton	New dwelling	27/03/2020	909187	Lot 3 DP 414474	0.0514	1	Res	Hill	BCN/2020/1093	20/326621	CRC190445	No	9 m3 tank required for hill sites	Nil	9 m3 tank required for hill sites
71 Byron Street, Sydenham	EQ repairs and drainage works	27/03/2020	814776	Lot 2 DP 38158	0.2177	1	Com	Flat	BCN/2019/4463	20/330138	CRC190445	Ecan approval	Nil	Nil	No change to the impervious area
51 Straven Road, Fendalton	New dwelling	27/03/2020	776468	Lot 2 DP 18260	0.1012	1	Res	Flat	BCN/2020/859	20/330145	CRC190445	No	Nil	Nil	Almost like for like replacement
16 Brittan Terrace Lyttelton	New garage	27/03/2020	884536	Lots 2,3 DP 9330	0.1473	1	Res	Hill	BCN/2020/1644	20/330148	CRC190445	No	Nil	Nil	Small additional impervious area - no attenuation
2/31 Flockton Street St Albans	New dwelling	30/03/2020	8218991	Flat 2 DP 52590 on Lot 3 DP 4913	0.0748	1	Res	Flat	BCN/2019/8120	20/333710	CRC190445	No	Nil	Nil	Almost like for like replacement
3 Glenstrae Road Balmoral Hill	New dwelling	30/03/2020	830865	Flat 2 DP 65116 on Lot 1 DP 4946	0.0774	1	Res	Hill	BCN/2020/1722	20/334382	CRC190445	No	Nil	Nil	Almost like for like replacement
16 Bainton Street Bishopdale	New garage	31/03/2020	707810	Lot 1 DP 19222	0.0784	1	Res	Flat	BCN/2020/1788	20/335000	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
158 High Street Central City	New office building	31/03/2020	811510	Pt Sec 981 Christchurch Town	0.0227	1	Com	Flat	BCN/2020/1748	20/305004	CRC190445	No	Nil	Nil	Almost like for like replacement
103 Kerr Road	Additional dwelling for HNZ	31/03/2020	744406	Lot 122 DP 15124	0.0888	1	Res	Flat	BCN/2020/1634	20/339249	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
48 Elizabeth Street, Riccarton	New carpark	31/03/2020	830125	Lot 2 DP 21277	0.2538	1	Com	Flat	BCN/2020/1720	20/335019	CRC190445	No	4.2 m3	Swale	4.2 m3 storage in the treatment swale
22 Riccarton Road, Riccarton	New motel units and upgrade of the carpark	31/03/2020	932710	Lot 1 DP 12251	0.4237	1	Com	Flat	BCN/2020/875	20/339261	CRC190445	No	Nil	Stormwater360 Stormfilter	Stormwater360 Stormfilter
28 Ticehurst Road, Lyttelton	New retaining wall and additions and alterations	31/03/2020	881663	Pt RS 40 Canterbury Dist	0.0551	1	Res	Hill	BCN/2020/1783	20/339273	CRC190445	No	Nil	Nil	No additional impervious area
24 Balmoral Lane, Redcliffs	New dwelling	31/03/2020	886752	Lot 1 DP 351937	0.0962	1	Res	Hill	BCN/2020/1617	20/339254	CRC190445	No	2 x 5 m3 tanks	Nil	2 x 5 m3 tanks
64A Huntsbury Avenue, Huntsbury	New dwelling	31/03/2020	894931	Lot 2 DP 384315	0.0654	1	Res	Hill	BCN/2020/576	20/339288	CRC190445	No	2 x 2.5 m3 tanks for	Nil	2 x 2.5 m3 tanks for storage
456 Marine Drive Diamond Harbour	Replacement dwelling	31/03/2020	882967	Lot 43 DP 12000	0.0986	1	Res	Hill	BCN/2020/1815	20/339836	CRC190445	No	Nil	Nil	Almost like for like replacement
98 Hills Road Richmond	3 new units and associated hardstand	31/03/2020	739421	Pt Lot 62 DP 2740	0.00595	1	Res	Flat	bcn/2020/1862	20/340280	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
47 Shirley Road Shirley	3 detached dwellings	3/04/2020	772741	Pt Lot 2 DP 4897	0.0617	1	Res	Flat	BCN/2020/1653	20/346919	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
54 Aotea Terrace Huntsbury	New double garage	3/04/2020	705285	Lot 32 DP 7182	0.1123	1	Res	Hill	BCN/2020/1866	20/346921	CRC190445	No	Nil	Nil	Almost like for like replacement
9 Hays Rise, Governors Bay	New garage	3/04/2020	884052	Lot 2 DP 351295	0.3732	1	Res	Flat	BCN/2020/677	20/349098	CRC190445	No	Nil	Nil	Small additional impervious area
565 Manchester Street St Albans	6 attached dwellings	3/04/2020	930668	Pt Lots 1,2 DP 3204, Lot 3 DP 320	0.1523	1	Res	Flat	BCN/2020/1830	20/349566	CRC190445	No	Nil	Nil	Almost like for like replacement
199 Springfield Road St Albans	2 new units	3/04/2020	774486	Lot 3 DP 2871	0.0473	1	Res	Flat	BCN/2020/1922	20/349671	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
370 Linwood Avenue Linwood	Two new detached dwelling	3/04/2020	747903	Lot 5 DP 17855	0.0607	1	Res	Flat	BCN/2020/1924	20/349771	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
256 Wairakei Road Bryndwr	New school building	3/04/2020	838060	Pt RSs 2219,459 Canterbury Dist,	2.6	1	Com	Flat	BCN/2020/1264	20/348342	CRC190445	No	2 x 15 m3 tanks	Nil	2 x 15 m3 tanks
345 Mairehau Road Travis	New shed	3/04/2020	750916	Lot 1 DP 20347	0.6404	1	Res	Flat	BCN/2020/1856	20/350401	CRC190445	No	Soakpit -2 x 2.5 x 0.9 m	Nil	Soakpit -2 x 2.5 x 0.9 m
604 Ferry Road Woolston	New service station	6/04/2020	729244	Pt RS 32 Canterbury Dist	0.3693	1	Com	Flat	BCN/2020/1901	20/351505	CRC190445	Yes Ecan approval given	Nil	SPEL pureceptor for the forecourt and a SW360 Stormwafillter for all the hardstanding	SPEL pureceptor for the forecourt and a SW360 Stormwafillter for all the hardstanding
2 Waddell Lane Avondale	Two new units	3/04/2020	782101	Lot 23 DP 52812	0.0809	1	Res	Flat	BCN/2020/1873	20/350701	CRC190445	No	Nil	Nil	Almost like for like replacement
60 Hawford Road Opawa	New 18 care rooms	6/04/2020	931091	Lot 3 DP 3252	1.18	1	Com	Flat	BCN/2020/1910	20/351474	CRC190445	No	Nil	Nil	Attenuation provided in the previous stage
177 Clyde Road Fendalton	New replacement dwelling	6/04/2020	720011	Lot 2 DP 8458	0.1012	1	Res	Flat	BCN/2020/1913	20/351475	CRC190445	No	Nil	Nil	Almost like for like replacement
91 Sparks Road Hoon Hay	School Redevelopment	6/04/2020	815863	Lot 32 DP 16639	2.45	1	Com	Flat	BCN/2020/1930	20/351510	CRC190445	No	Nil	Nil	Attenuation provided under the court subbase

91 Hoon Hay Valley Road Hoon Hay Valley	Retaining wall drainage	7/04/2020	740742	Lot 2 DP 63155	0.2535	1	Res	Hill	BCN/2020/1917	20/355737	CRC190445	No	Nil	Nil	Retaining wall drainage to a gulley
96 Tuam Street, Central City	New office building and carpark	7/04/2020	809444	Lot 1 DP 23470	0.2038	1	Com	Flat	BCN/2020/1190	20/348511	CRC190445	No	Nil	Raingarden	Stormwater treatment via a raingarden
17 Harbour View Terrace Lyttelton	Additions and alterations	7/04/2020	881406	Lot 15 DP 24151	0.1106	1	Res	Hill	BCN/2020/1891	20/355765	CRC190445	No	Nil	Nil	Small change in impervious area
9 Roker Street, Spreydon	Six new dwellings	8/04/2020	768299	Lot 3 DP 16435	0.1328	1	Res	Flat	BCN/2020/1283	20/360110	CRC190445	No	Nil	2 x 20 m3 storage tanks	2 x 20 m3 storage tanks
270 Knowles Street St Albans	Eight dwellings	8/04/2020	745827	Lot 43 DP 15961	0.1571	1	Res	Flat	BCN/2020/1970	20/360315	CRC190445	Yes Ecan approval	8 x 6 m3 storage tanks	Nil	8 x 6 m3 storage tanks
411 Sawyers Arms Road Bishopdale	New dwelling	8/04/2020	771233	Lot 1 DP 61653	0.2617	1	Res	Flat	BCN/2020/1701	20/360682	CRC190445	No	2 x 5 m3 tanks	Nil	2 x 5 m3 tanks
29 Main South Road, Upper Riccarton	New residential development	8/04/2020	750729	Lot 7 DP 24223	0.277	1	Res	Flat	BCN/2019/8708	20/360968	CRC190445	No	8 x 7.7 m3 tanks	Stormwater360 Stormfilter	Stormwater360 Stormfilter for treatment and 8 x 7.7 m3 attenuation tanks
9 De Thier Lane Richmond Hill	Additions and alterations	8/04/2020	723563	Lot 2 DP 71029	0.0915	1	Res	Hill	BCN/2020/1919	20/360562	CRC190445	No	Nil	Nil	Small additional impervious area.
6079A Chch Akaroa Rd	Bathroom facilities	8/04/2020	881435	Lot 3 DP 302088	0.056	1	Res	Hill	BCN/2020/485	20/361527	CRC190445	No	Nil	Nil	Small additional impervious area. 2 m3 tank installed as
91 Hoon Hay Valley Road Hoon Hay Valley	New Garage	8/04/2020	740742	Lot 2 DP 63155	0.2535	1	Res	Hill	BCN/2020/1962	20/361271	CRC190445	No	Nil	Nil	Small additional impervious area
53 Rayburn Avenue Papanui	New garage	14/04/2020	765991	Pt Lot 37 DP 3841	0.0673	1	Res	Flat	BCN/2020/2003	20/368552	CRC190445	No	Nil	Nil	Almost like for like replacement
127B St Albans Street St Albans	Two units	14/04/2020	927755	Lot 6 DP 518677	0.1053	1	Res	Flat	BCN/2020/1978	20/368556	CRC190445	No	Nil	Nil	Permeable pavers installed to meet the small sites
1 Division Street Riccarton	7 units	14/04/2020	724444	Pt Lot 3 DP 1108	0.00885	1	Res	Flat	BCN/2020/2032	20/369132	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
185 Marine Parade New Brighton	Surf club redevelopment	14/04/2020	815462	Lot 2 DP 50951	0.1698	1	Res	Flat	BCN/2020/2016	20/369425	CRC190445	No	Nil	Nil	Almost like for like replacement
300 Hasketts Road Yaldhurst	New Garage	15/04/2020	737344	Lot 7 DP 24132	2.02	1	Res	Flat	BCN/2020/2062	20/374265	CRC190445	No	2 m x 2 m x 1.5 m Soakpit	Nil	2 m x 2 m x 1.5 m Soakpit
41 Gracefield Avenue Central City	6 units	16/04/2020	733328	Lot 8 DP 2392	0.0522	1	Res	Flat	BCN/2020/2057	20/378828	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
4/74 Middleton Road, Upper Riccarton	New dwelling	16/04/2020	939360	Lot 4 DP 527263	0.04	1	Res	Flat	BCN/2020/1927	20/378921	CRC190445	No	Nil	Nil	No attenuationrequired as per the subdivision consent
6/74 Middleton Road, Upper Riccarton	New dwelling	16/04/2020	939360	Lot 4 DP 527263	0.04	1	Res	Flat	BCN/2020/1824	20/378920	CRC190445	No	Nil	Nil	No attenuationrequired as per the subdivision consent
426 Manchester Street St Albans	6 detached dwellings	16/04/2020	751430	Lot 10 DP 3133	0.0913	1	Res	Flat	BCN/2020/1921	20/378923	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
407 Hereford Street, Linwood	Five detached dwellings	16/04/2020	738655	Pt RS 29 Canterbury DistPt RS 29	0.0832	1	Res	Flat	BCN/2020/1134	20/378925	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
323 Gardiners Road Belfast	New 14.6m X 8m garage.	16/04/2020	731082	Lot 1 DP 79795	0.1262	1	Res	Flat	BCN/2020/2085	20/378926	CRC190445	No	Nil	Nil	Small net increase in area
28 Waiwetu Street Fendalton	Addition to the garage	17/04/2020	898750	Lot 1 DP 397313	0.189	1	Res	Flat	BCN/2020/2121	20/383371	CRC190445	No	Nil	Nil	Small net increase in area
14 Denvir Street Bryndwr	New relocated 44m2 dwelling	17/04/2020	724060	Lot 10 DP 15118	0.0736	1	Res	Flat	BCN/2020/2094	20/383435	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
201 Salisbury Street Central City	17 unit apartment dwelling	20/04/2020	770607	Lot 2 DP 17021	0.1735	1	Res	Flat	BCN/2020/2155	20/387966	CRC190445	No	Nil	Nil	No additionl impervious area
189 Wigram Road Sockburn	New shed	20/04/2020	910296	Lot 37 DP 28868	43.7	1	Res	Flat	BCN/2020/2145	20/387967	CRC190445	No	Nil	Nil	Small additional impervious area
304 Clyde Road Bryndwr	Two new units	20/04/2020	719882	Lot 65 DP 15128	0.0706	1	Res	Flat	BCN/2020/1047	20/388003	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
44 Tui Street Fendalton	New dwelling	20/04/2020	780677	Lot 463 DP 8340	0.1093	1	Res	Flat	BCN/2020/2090	20/391325	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
44 Tui Street Fendalton	New dwelling	20/04/2020	780677	Lot 463 DP 8340	0.1093	1	Res	Flat	BCN/2020/2090	20/391325	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
11 Woodills Road Akaroa	New dwelling	20/04/2020	883087	Lot 3 DP 35235	0.103	1	Res	Flat	BCN/2020/1903	20/391733	CRC190445	No	9 m3 tank as per the Ecan requirements	Nil	9 m3 tank as per the Ecan requirements
269 Opawa Road Hillsborough	New dwelling	20/04/2020	890012	Pt Lot 1 DP 19432	0.0584	1	Res	Flat	BCN/2020/2095	20/394746	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
276 Greers Road Bryndwr	Minor dwelling - 80 m2	21/04/2020	734247	Lot 2 DP 15497	0.0766	1	Res	Flat	BCN/2020/2176	20/396976	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
47 Bletsoe Avenue Spreydon	Five detached dwellings	22/04/2020	711738	Lot 30 DP 3974	0.0647	1	Res	Flat	BCN/2020/2219	20/401277	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
11 Hammond Place Spreydon, 17 Hammond Pla	Six new dwellings	23/04/2020	736056	Lot 16 DP 14965	0.0731	1	Res	Flat	BCN/2020/1150	20/401794	CRC190445	No	8 x 2 m3 storage tanks with 20-25 mm outlets	Nil	8 x 2 m3 storage tanks with 20-25 mm outlets
30 Campbell Street Sumner	Replacement garage	23/04/2020	715843	Pt Lot 3 DP 17415	0.0574	1	Res	Flat	BCN/2017/5926	20/402258	CRC190445	No	Nil	Nil	Almost like for like replacement
141 Champion Street St Albans	Two new dwellings	23/04/2020	874035	Lot 1 DP 337259	0.0742	1	Res	Flat	BCN/2020/2249	20/402404	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
13 Main Road Governors Bay	Convert carport to a garage	23/04/2020	884067	Lot 4 DP 38746	0.1165	1	Res	Hill	BCN/2020/2231	20/402591	CRC190445	No	Nil	Nil	No additional impervious area.
49 McBeath Avenue Hoon Hay 49 McBeath Ave	New garage	27/04/2020	753659	Lot 7 DP 16456	0.0809	1	Res	Flat	BCN/2020/2256	20/408861	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
305 Armagh Street Central City	17 residential units	29/04/2020	705808	Pt Res 91 Christchurch Town	0.0506	1	Res	Flat	BCN/2020/2001	20/414956	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
26 Yukon Place	Concrete pllinth	29/04/2020	788978	Lot 48 DP 41650	0.5097	1	Com	Flat	BCN/2020/2277	20/408924	CRC190445	No	Nil	Nil	No additional impervious areas.
37 Fendalton Road Fendalton	New dwelling	29/04/2020	925507	Lot 1 DP 506160	0.06	1	Res	Flat	BCN/2020/2268	20/415025	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
127 Hoon Hay Road, Hoon Hay	Three townhouse developeent	29/04/2020	740320	Lot 7 DP 15540	0.0809	1	Res	Flat	BCN/2019/8680	20/415609	CRC190445	No	3 x 5 m3 tanks - one for each roof	Nil	3 x 5 m3 tanks - one for each roof
200 Kilmore Street Central City	Fire station redevelopment	29/04/2020	867580	Lot 1 DP 53863	0.7396	1	Com	Flat	BCN/2020/2220	20/415775	CRC190445	No	Nil	Stormwater360 Stormfilter	Stormwater360 Stormfilter
17 Millar Street Sydenham	two detached dwellings	29/04/2020	755255	Lot 1 DP 21339	0.0544	1	Res	Flat	BCN/2020/2325	20/416553	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
18 Dacre Street North Linwood	Minor dwelling - 79 m2	29/04/2020	723114	Lot 38 DP 7368	0.0688	1	Res	Flat	BCN/2020/2348	20/416711	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
28 Palmers Road New Brighton	New dwelling	29/04/2020	761012	Lot 28 DP 22267	0.0948	1	Res	Flat	BCN/2020/1940	20/416810	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
70 Wilsons Road South St Martins	New dwelling	29/04/2020	786472	Lot 3 DP 8494	0.0708	1	Res	Flat	BCN/2020/2328	20/417258	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
95 and 119 Sutherlands Road, Halswell,	61 lot subduvision	29/04/2020	874031	Lot 3 DP 24511	5.745	61	Res	Flat	RMA/2020/176	20/417272	CRC190445	No	Nil	Nil	Attenuation and treament provided for downstream via the Council infrstructure.
68 Sawyers Arms Road Papanui	New garage	30/04/2020	771333	Lot 4 DP 16161	0.95	1	Res	Flat	BCN/2020/2327	20/417566	CRC190445	No	Nil	Nil	No additional impervious area.
92 Picton Avenue Riccarton	Four unit development replacing a single dwelling	30/04/2020	763202	Pt Lot 129 DP 552	0.0622	1	Res	Flat	BCN/2020/2347	20/421525	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
44C Glandovey Road Fendalton	New dwelling	30/04/2020	732099	Lot 4 DP 35275	0.1245	1	Res	Flat	BCN/2020/2395	20/421557	CRC190445	No	Nil	Nil	Small additional impervious area
25A Wairarapa Terrace Fendalton	89m 2 garage	30/04/2020	809658	Lot 3 DP 30123	0.0641	1	Res	Flat	BCN/2020/2381	20/421558	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
248 Manchester Street Central City	Church redevelopment	30/04/2020	927758	Lot 1 DP 494166	0.3029	1	Com	Flat	BCN/2020/2017	20/421610	CRC190445	No	Nil	Swale	Treatment and detention via a swale
24 Galway Avenue, Bryndwr	Swimming	4/05/2020	730976	Lot 10 DP 11695	0.1037	1	Res	Flat	BCN/2019/8377	20/426798	CRC190445	No	Nil	Nil	No additional impervious area
12 Sophora Place, Parklands	Additions and alterations	4/05/2020	774053	Lot 18 DP 37884	0.0574	1	Res	Flat	BCN/2020/949	20/427016	CRC190445	No	Nil	Nil	Small additional ipervious area
15 School Road Duvauchelle	Implement shed	4/05/2020	884482	Pt RS 11153 Canterbury Dist	1.36	1	Res	Hill	BCN/2020/2408	20/427431	CRC190445	No	Nil	Nil	Small additional roof area
249 Hoon Hay Road	New dwelling	4/05/2020	740411	Lot 15 DP 16284	0.0923	1	Res	Flat	BCN/2020/1249	20/430843	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
3 Rapanui Lane Moncks Spur	New dwelling	4/05/2020	880508	Lot 13 DP 361257	0.0834	1	Res	Hill	BCN/2020/2413	20/430878	CRC190445	No	9 m3 tank as per the global consent	Nil	9 m3 tank as per the global consent
2 Dove Grove Westmorland	New dwelling	4/05/2020	918385	Lot 19 DP 458630	0.0697	1	Res	Hill	BCN/2020/2411	20/430894	CRC190445	No	9 m3 tank as per the global consent	Nil	9 m3 tank as per the global consent
333 Buchanans Road Yaldhurst	New dwelling	4/05/2020	816381	Lot 4 DP 22982	2.62	1	Res	Flat	BCN/2020/2416	20/430900	CRC190445	No	Soakpit	Nil	Soakpit
93 Pages Road Wainoni	New dwelling and garage	5/05/2020	760810	Pt Lot 30 DP 15205	0.0818	1	Res	Flat	BCN/2020/2417	20/433389	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
353 Manchester Street, Central City	Temporary Carpark	5/05/2020	751414	Lot 1 DP 11985	0.0511	1	Com	Flat	RMA/2020/408	20/435160	CRC190445	No	Nil	Nil	Temporary carpark - no treatment required
50 Amyes Road Hornby	New relocated dwelling - 44 m2	6/05/2020	704851	Lot 33 DP 13550	0.0911	1	Res	Flat	BCN/2020/2500	20/435326	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
48 Marriner Street Sumner	Change of use to a café with a carpark	6/05/2020	752329	Lot 1 DP 2224	0.0597	1	Res	Flat	BCN/2020/2504	20/435367	CRC190445	No	Nil	Nil	Discharge to ground via an infiltration chamber to mitigate the additional stormwater
88 Poulson Street Addington	Four attached dwellings	6/05/2020	763983	Lot 2 DP 23617	0.0878	1	Res	Flat	BCN/2020/2450	20/431181	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
3 Kairuri Lane Heathcote	New dwelling	7/05/2020	939313	Lot 5 DP 535116	0.082	1	Res	Hill	BCN/2020/2467	20/439691	CRC190445	No	9 m3 tank as per the global consent	Nil	9 m3 tank as per the global consent
36 Nga Mahi Road Sockburn	Warehouse and offices	7/05/2020	925068	Lot 1 DP 494085	0.2854	1	Res	Flat	BCN/2020/2462	20/439710	CRC190445	No	Nil	Nil	Pretreatment via a swale and first flush in the Wigram
274 Kilmore Street Central City	7 attached units	7/05/2020	938124	Lot 1 DP 540433	0.1035	1	Res	Flat	BCN/2020/2526	20/439800	CRC190445	No	Nil	Nil	No additionl impervious area
304 Papanui Road St Albans	New childcare centre	7/05/2020	761501	Pt Lot 93 DP 2374	0.084	1	Res	Flat	BCN/2020/2496	20/439864	CRC190445	No	Nil	Nil	No additionl impervious area
136 North Parade Richmond	New dwelling	11/05/2020	870329	Lot 1 DP 326158	0.0562	1	Res	Flat	BCN/2020/2501	20/432427	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
27 Centennial Avenue Riccarton	two detached dwellings	11/05/2020	717696	Lot 264 DP 15016	0.0766	1	Res	Flat	BCN/2020/2451	20/567254	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
177A Ilam Road Ilam	New dwelling	11/05/2020	741713	Pt Lot 5 DP 19763	0.2223	1	Res	Flat	BCN/2020/1765	20/567968	CRC190445	No	10 m3 storage	Nil	10 m3 storage to reduce the effects of the development
793 McLeans Island Road	New Lean to shed for rhinos	11/05/2020	875297	Lot 1 DP 35430	80.5	1	Res	Flat	BCN/2020/2479	20/574115	CRC190445	No	Nil	Nil	Discharge to a soakpit within the site
11 Errol Lane Huntsbury	New dwelling	12/05/2020	936140	Lot 2 DP 48460	0.0681	1	Res	Hill	BCN/2020/2577	20/567304	CRC190445	No	Nil	Nil	Replacement dwelling - almost like for like
2 Dobson Street, Spreydon	Seven detached dwellings	12/05/2020	850678	Lot 13 DP 14996	0.1552	1	Res	Flat	BCN/2019/7298	20/577798	CRC190445	No	50 m3 CIRTEX system	Jellyfish	50 m3 attenuation via a Cirtex system and treatment via a Jelly fish system
151-155 Peverel Street, Riccarton	13 detached dwellings	12/05/2020	825770	Lot 1 DP 80887	0.3862	1	Res	Flat	BCN/2020/1331	20/577856	CRC190445	No	59 m3 via a Cirtex sytem	SPEL Hydrosystem 400	59 m3 attenuation via a Cirtex system and treatment via a SW360 Stormfilter.
19 Totara Street Riccarton	New dwelling	12/05/2020	779853	Lot 1 DP 17448	0.0746	1	Res	Flat	BCN/2020/2611	20/578034	CRC190445	No	Nil	Nil	Meets the small sites guide requirements

355 Centaurus Road Opawa	New replacement garage	13/05/2020	717594	Lot 1 DP 39560	0.0625	1	Res	Hill	BCN/2020/2543	20/582987	CRC190445	No	Nil	Nil	Small additional impervious area
150 Wilsons Road South St Martins	New classroom blocks	13/05/2020	921805	Lot 4 DP 38139	1.5	1	Res	Flat	BCN/2020/2613	20/582990	CRC190445	No	Nil	Nil	Small additional impervios areas
45 Ranger Street Mairehau	Minor dwelling - 67.7 m2	13/05/2020	765627	Lot 147 DP 14046	0.0607	1	Res	Flat	BCN/2020/2589	20/582991	CRC190445	No	Nil	Nil	No additional impervious area
458 Sparks Road	11 lot subdivision	13/05/2020	774193	Lot 1 DP 68682	1.33	11	Res	Flat	RMA/2019/2480	20/582996	CRC190445	No	Treatment and attenuation via the Sutherland basin	Treatment and attenuation via the Sutherland basin	Treatment and attenuation via the Sutherland basin
4 Chilcombe Street Ilam	Additions and alterations	13/05/2020	718842	Lot 1 DP 12719	0.0642	1	Res	Flat	BCN/2020/2647	20/583061	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
21 Epsom Road, Sockburn	Retail/office building	13/05/2020	934091	Lot 42 DP 266	1.47	1	Com	Flat	BCN/2020/1444	20/583007	CRC190445	No	Roof stormwater to a soakpit	Raingarden	Roof stormwater to a soakpit to reduce the discharge and treatment via a raingarden
554 Madras Street, St Albans	Eight dwellings	14/05/2020	749804	Pt Lot 45 DP 953	0.055	1	Res	Flat	BCN/20219/5753	20/588565	CRC190445	No	3 x 4 m3 tanks i.e. 1 per	Hynds Upflow Filter	Storage via 3 x 4 m3 tanks and treatment via a Hynds Attenuation via a 5 m3 tank. This has been reduced
17 Totara Drive Duvauchelle	New dwelling	14/05/2020	919159	Lot 24 DP 471355	0.0621	1	Res	Flat	BCN/2020/2559	20/588689	CRC190445	No	5 m3 tank	Nil	from the sandard 9 m3 due to the roof area.
190B Rocking Horse Road Southshore	New replacement dwelling	14/05/2020	768203	Lot 3 DP 54006	0.0571	1	Res	Flat	BCN/2020/2639	20/582989	CRC190445	No	Nil	Nil	Almost like for like replacement
38 Pawsons Valley Road Duvauchelle	New dwelling	16/05/2020	932753	Lot 3 DP 504405	15.3	1	Res	Hill	BCN/2020/2516	20/626363	CRC190445	No	Nil	Nil	Existing water tanks used for attenuation
32 St Lukes Street, Woolston	New dwelling	16/05/2020	877703	Lot 18 DP 345855	0.227	1	Res	Flat	BCN/2020/610	20/626388	CRC190445	No	Nil	Nil	No additional impervious area
655 Yaldhurst Road	New garade	16/05/2020	859727	Lot 2 DP 83725	4.02	1	Res	Flat	BCN/2020/2671	20/626394	CRC190445	No	Nil	Nil	Discharge to ground vaia dispersal to a tree line
1115 Main North Road Chaneys	Replacement shed	16/05/2020	750392	Lot 1 DP 29806	1.2	1	Com	Flat	BCN/20202710	20/626408	CRC190445	Ecan consent	Nil	Nil	Operational phase onlu. Construction phase covered by CRC203608
4-8 Riccarton Road and 159 Deans Avenue, Ric	43 units	19/05/2020	903899	Pt RS 163 Canterbury Dist	0.3928	1	Res	Flat	BCN/2020/1711	20/631316	CRC190445	No	Nil	2 x Hyndys Smartpod Filters - permitted because of the shallowness of the council pipes	2 x Hyndys Smartpod Filters - permitted because of the shallowness of the council pipes
38A McDougall Avenue St Albans	New garage	19/05/2020	753890	Lot 2 DP 33500	0.1007	1	Res	Flat	BCN/2020/2693	20/626361	CRC190445	No	Nil	Nil	No additional impervious area
89F Taylors Mistake Road Scarborough	New dwelling	19/05/2020	903644	Lot 3 DP 424114	0.0975	1	Res	Flat	BCN/2020/2623	20/631327	CRC190445	No	9 m3 tank as required by the global consent	Nil	9 m3 tank as required by the global consent
1/198 Idris Road Bryndwr	6 attached dwellings	19/05/2020	806741	Lot 1 DP 12624	0.1447	1	Res	Flat	BCN/2020/2282	20/631492	CRC190445	No	4 m3 storage via 2 x 2 m3 tanks	Nil	4 m3 storage via 2 x 2 m3 tanks
23 Waipapa Avenue Diamond Harbour	17 m2 shed	20/05/2020	881952	Lot 36 DP 4319	0.11	1	Res	Hill	BCN/2020/2753	20/639347	CRC190445	No	Nil	Nil	17 m2 shed
14 Assisi Street Mt Pleasant	New replacement dwelling	20/05/2020	928707	Flat 2 DP 54410 on Lot 1 DP 4667	0.0878	1	Res	Hill	BCN/2020/2772	20/639768	CRC190445	No	Nil	Nil	Almost like for like
29 Swanns Road Richmond	4 dwellings	20/05/2020	777319	Pt RS 41 Canterbury Dist	0.061	1	Res	Flat	BCN/2020/2782	20/639954	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
34 Kenwyn Avenue St Albans	two detached dwellings	20/05/2020	744328	Lot 1 DP 16997	0.083	1	Res	Flat	BCN/2020/2777	20/640161	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
28 Hillview Road Birdlings Flat	New dwelling	20/05/2020	888036	Lot 63 DP 81934	0.0664	1	Res	Flat	BCN/2020/2719	20/631422	CRC190445	No	Nil	Nil	Discharge to ground via a soakpit
20-22 Beanland Avenue Spreydon	Two attached dwelling	21/05/2020	709726	Lot 5 DP 14951, Lot 4 DP 14951	0.147	1	Res	Flat	BCN/2019/6996	20/642882	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
8 Gazelle Lane Balmoral Hill	New carport	25/05/2020	731492	Lot 8 DP 77841	0.0927	1	Res	Hill	BCN/2020/2861	20/652053	CRC190445	No	Nil	Nil	9 3 provided as part of the original building consent
14 Rossmore Terrace Cashmere	New garage	25/05/2020	768958	Lot 3 DP 7753	0.0946	1	Res	Flat	BCN/2020/2901	20/652056	CRC190445	No	Nil	Nil	30 m2 replacement garage
218 Blenheim Road Riccarton	New dwelling	25/05/2020	711642	Lot 32 DP 15023	0.0696	1	Res	Flat	BCN/2020/2856	20/652065	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
43 Teesdale Street Burnside	New garage	25/05/2020	778383	Lot 33 DP 22232	0.0615	1	Res	Flat	BC/2020/2875	20/652078	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
160 Estuary Road South New Brighton	Replacement classroom buildings	25/05/2020	810666	Lot 7 DP 12850	2.4	1	Com	Flat	BCN/2020/2821	20/652096	CRC190445	No	Nil	Nil	No changes to the impervious areas
32 Jacksons Road Lyttelton	Additions and alterations	25/05/2020	881982	Lot 1 DP 13150	0.0513	1	Res	Hill	BCN/2020/2818	20/652138	CRC190445	No	3 m3 tank installed as a pumping chamber	Nil	3 m3 tank installed as a pumping chamber
510 Hagley Avenue Central City	Wainuku Education hub	26/05/2020	891221	Sec 1 SO 537583	3.73	1	Com	Flat	BCN/2020/2237	20/658002	CRC190445	No	Nil	Nil	Additional imperion area = 250 m2 will be offset in the next phase of the development.
115 North Avon Road Richmond	Replacement units	26/05/2020	825196	Lot 1 DP 63857	0.0511	1	Res	Flat	BCN/2020/2848	20/658007	CRC190445	No	Nil	Nil	Almost like for like replacement
74 Beatty Street South New Brighton	New boat she	26/05/2020	811740	Res 4874 Canterbury Dist	28.4	1	Com	Flat	BCN/2020/2839	20/658014	CRC190445	No	Nil	Nil	No additional impervious area
375 Marine Parade South New Brighton	New dwelling	26/05/2020	751993	Lot 4 DP 5129	0.0531	1	Res	Hill	BCN/2020/2908	20/658019	CRC190445	No	Nil	Nil	Almost like for like replacement
52 Colenso Street Sumner	Additions and alterations	26/05/2020	720407	Lot 1 DP 8132	0.0516	1	Res	Flat	BCN/2020/2930	20/652036	CRC190445	No	Nil	Nil	24 m2 extension
30 the Terrace Governors Bay	New dwelling	26/05/2020	891143	Lot 24 DP 372956	0.1	1	Res	Hill	BCN/2020/2840	20/657974	CRC190445	No	9 m3 tank as required by the global consent	Nil	9 m3 tank as required by the global consent
171 Pages Road, Wainoni	New carpark and warehouse	27/05/2020	891582	Lot 2 DP 33303	1.13	1	Com	Flat	BCN/2019/5309	20/663026	CRC190445	No	Soakage to ground via an infiltration system	Raingarden	Carpark stormwater treated using a raingarden and discharge to ground
6 Grenville Street Waltham	7 attached units	27/05/2020	734410	Lot 65 DP 27	0.1012	1	Res	Flat	BCN/2020/1506	20/663030	CRC190445	No	Nil	Nil	54 m2 of impermeable pavers installed to meet the small guide requirements
34 Glamis Place Cashmere	New replacement dwelling	27/05/2020	732026	Lot 10 DP 22538	0.0678	1	Res	Hill	BCN/2020/2960	20/663157	CRC190445	No	Nil	Nil	Almost like for like replacement
250 Cashmere Road Hoon Hay	New Shed	27/05/2020	864971	Lot 24 DP 3217	6.3	1	Com	Flat	BCN/2020/2946	20/663178	CRC190445	No	Nil	Nil	Discharge to ground - overland
30 the Terrace Governors Bay	New dwelling	26/05/2020	891143	Lot 24 DP 372956	0.1	1	Res	Hill	BCN/2020/2840	20/657974	CRC190445	No	9 m3 tank as required by the global consent	Nil	9 m3 tank as required by the global consent
28 Hawkshead Way Westmorland	New dwelling	28/05/2020	934174	Lot 171 DP 521122	0.0881	1	Res	Hill	BCN/2020/2139	20/668953	CRC190445	No	9 m3 tank as required by the global consent	Nil	9 m3 tank as required by the global consent
1/9 Nairn Street Spreydon,	New garage	28/05/2020	798342	Lot 1 DP 2975	0.0484	1	Res	Flat	BCN/2020/2950	20/668952	CRC190445	No	Nil	Nil	Replacement garage
6 Youngston Lane Woolston	New minor dwelling	29/05/2020	926038	Lot 5 DP 495733	0.0376	1	Res	Flat	BCN/2020/3005	20/668960	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
9 Frank Coxon Road Belfast	New warehouse	29/05/2020	936851	Lot 16 DP 540180	0.1906	1	Com	Flat	BCN/2020/2768	20/674896	CRC190445	No	Nil	Nil	Attenuation and treament provided for downstream via the Council infrstructure.
82 Port Hills Road Heathcote	New garage	29/05/2020	763762	Lot 2 DP 18221	0.1007	1	Res	Flat	BCN/2020/2853	20/675070	CRC190445	No	Nil	Nil	Replacement garage
10 Head Street, Sumner	Extension to the existing dwelling + alterations	31/05/2020	737971	Pt Lot 5 DP 2147	0.0364	1	Res	Flat	BCN/2020/3027	20/679421	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
115 Petrie Street Richmond	Single garage	31/05/2020	762957	Lot 6 DP 7989	0.0744	1	Res	Flat	BCN/2020/3010	20/679424	CRC190445	No	Nil	Nil	Meets the small sites guide requirements
85 Factory Road Ouruhia	Office and shed	31/05/2020	930412	Lot 4 DP 509549	3.6	1	Com	Flat	BCN/2020/2984	20/679425	CRC190445	No	Nil	Nil	Small additional impervious area and stormwater discharged to the ground within the site
58 Richmond Hill Road Richmond Hill	New garage and retaining wall	31/05/2020	767163	Lot 30 DP 3057	0.0632	1	Res	Hill	BCN/2020/2993	20/679426	CRC190445	No	Nil	Nil	Small additional impervious area
43 Spencer Street Addington	New dwelling	31/05/2020	774344	Pt Lot 156 DP 63	0.0304	1	Res	Flat	BCN/2020/3075	20/679433	CRC190445	No	Nil	Nil	Almost like for like replacement
9 Gwynfa Avenue Cashmere	New dwelling	31/05/2020	734882	Lot 2 DP 61770	0.0907	1	Res	Flat	BCN/2020/3002	20/679434	CRC190445	No	Nil	Nil	Almost like for like replacement
13 Glynne Crescent Spreydon	Five units	31/05/2020	857073	Lot 2 DP 82080	0.0778	1	Res	Flat	BCN/2020/1515	20/679447	CRC190445	No	2 x 3m3 tanks + 2 x 1 m3 tanks	Nil	2 x 3m3 tanks + 2 x 1 m3 tanks

Surface Water Quality Monitoring Report for Christchurch City Waterways: January – December 2019

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3 July 2020

Surface Water Quality Monitoring Report: January – December 2019

Figures

Tables

Executive Summary

- This report summarises the results of the Christchurch City Council (CCC) surface water quality monitoring for the period January to December 2019, in accordance with the CCC Interim Global Stormwater Consent, South-West Stormwater Management Plan and the Styx Stormwater Management Plan.
- Monthly water samples were collected from 42 sites within the five major river catchments of Christchurch City (the Ōtākaro/ Avon, Ōpāwaho/ Heathcote, Huritini/ Halswell, Pūharakekenui/ Styx and Ōtūkaikino Rivers) and Linwood Canal, as well as two sites within Halswell Retention Basin.
- Wet weather sampling was conducted at four of the eight monthly sampling sites in the Pūharakekenui/ Styx River catchment, and at seven of the thirteen monthly sampling sites in the Ōtākaro/ Avon River catchment. The Pūharakekenui/ Styx River sampling was due to be collected in 2018; however, unfavourable weather meant that only one suitable event occurred, and the final sample was not collected until 2019.
- Results of community monitoring at eleven sites in the Pūharakekenui/ Styx River catchment by the Styx Living Laboratory Trust are also presented in this report.
- The water quality parameters specifically assessed in this report for monthly samples include metals (copper, lead and zinc), pH, conductivity, total suspended solids (TSS), turbidity, dissolved oxygen, temperature, biochemical oxygen demand (BOD_5), ammonia, nitrogen, phosphorus and *Escherichia coli* (as an indicator of pathogens).
- Over 11,000 tests were conducted for the monthly monitoring, with 7,440 of these allowing the assessment of each waterway site against relevant guideline levels. There were several parameters that were recorded at levels unlikely to cause adverse effects, including dissolved lead, total ammonia and pH. However, 20% of all samples did not meet the guideline level, with 98% of sites not meeting the guideline for at least one parameter. The contaminants of most concern were nitrogen, phosphorus, *E. coli*, dissolved zinc, and dissolved copper, as well as turbidity, dissolved oxygen, TSS and nitrate at certain sites. The concentrations of all parameters have mostly remained steady over time, with some improvements and declines in water quality.
- Most waterways recorded a Water Quality Index (WQI) of 'poor'. The Ōpāwaho/ Heathcote catchment recorded the poorest water quality of all the catchments overall. Changes in catchment WQI between 2013 and 2018 were variable. The site with the lowest WQI was Curletts at Motorway, followed by Heathcote at Tunnel Rd site, and then the Haytons Stm and Heathcote at Ferrymead Bridge sites. The Ōtūkaikino River catchment recorded the best WQI of all the catchments, and the site with the highest WQI was Styx at Main North Rd in the Pūharakekenui/ Styx River catchment.
- The results of this year's monitoring are largely consistent with those recorded in previous years, indicating that many of the waterways are historically and currently subjected to contamination, potentially from stormwater, waterfowl and other inputs. These contaminants may be causing short-term and long-term adverse effects on biota, proliferation of aquatic plants and/or algae, human health risks from contact recreation, and deterioration of the aesthetics of the water column.
- The sites and parameters of concern in this report should be the focus of improved catchment management practices in Christchurch. Recommendations are made in the report for priority areas of focus.

1 Introduction & Sampling Sites

This report summarises the results of the Christchurch City Council (CCC) surface water quality monitoring for the period January 2019 to December 2019. This monitoring is in accordance with the requirements of the Interim Global Stormwater Consent (IGSC; CRC090292; Dewson & Rodrigo 2009), South-West Stormwater Management Plan (SMP) (CRC120223; Golder Associates 2012) and Styx SMP (CRC131249; Golder Associates 2013).

Monthly water samples were collected by CCC from 42 waterway sites: 41 sites within the five major river catchments of Christchurch City (the Ōtākaro/ Avon, Ōpāwaho/ Heathcote, Huritini/ Halswell, Pūharakekenui/ Styx and Ōtūkaikino Rivers), and one site in Linwood Canal (Table 1, Figure 1). Although not waterway sites, two sites within the Halswell Retention Basin (inlet and outlet) were also sampled. Six of the waterway sites were specifically chosen because they are in proximity to stormwater outfalls[1]. However, it should be noted that there are hundreds of outfalls throughout the catchments and many of the other sites are also located near stormwater discharge pipes. There are five sites that are in strongly tidal areas, where sampling is undertaken at low tide (± 30 minutes)[2].

The results of community monitoring at 11 sites in the Pūharakekenui/ Styx River catchment by the Styx Living Laboratory Trust (SLLT)[3] are also presented in this report (Table 1). The Styx River catchment was due to be monitored during two wet weather occasions in 2018; however, a lack of suitable rain events meant that sampling extended into 2019. The Avon River catchment was monitored during two wet weather occasions in 2019. The results of both wet weather monitoring rounds are presented in this report.

[1] Avon at Carlton Mill, Avon at Avondale Rd, Heathcote at Catherine St, Heathcote at Mackenzie Ave, Haytons Stm, Curletts at Motorway
[2] Avon at Bridge St, Avon at Pages Rd, Heathcote at Ferrymead Bridge, Heathcote at Tunnel Rd and Linwood Canal
[3] More information about this community group, including their monitoring programme, can be found at https://www.thestyx.org.nz/styx-living-laboratory-trust

Table 1. Christchurch City Council water quality monitoring sites required under the four Environment Canterbury (ECan) stormwater consents

Catchment	Site ID	Site	Easting (NZTM)	Northing (NZTM)	ECan Consent	LWRP or WRRP Classification
Ōtākaro/ Avon	AVON01	Avon River at Pages/Seaview Bridge[4]	1577484	5182589	IGSC	Spring-fed – plains – urban (LWRP)
	AVON02	Avon River at Bridge Street[4]	1577691	5180813	IGSC	Spring-fed – plains – urban (LWRP)
	AVON03	Avon River at Dallington Terrace/Gayhurst Road[4]	1573560	5181210	IGSC	Spring-fed – plains – urban (LWRP)
	AVON04	Avon River at Manchester Street	1570890	5180481	IGSC	Spring-fed – plains – urban (LWRP)
	AVON05	Wairarapa Stream	1568250	5181303	IGSC	Spring-fed – plains – urban (LWRP)
	AVON06	Waimairi Stream	1568233	5181172	IGSC	Spring-fed – plains – urban (LWRP)
	AVON07	Avon River at Mona Vale	1568334	5181046	IGSC	Spring-fed – plains – urban (LWRP)
	AVON08	Riccarton Main Drain	1568683	5180019	IGSC	Spring-fed – plains – urban (LWRP)
	AVON09	Addington Brook	1569427	5179826	IGSC	Spring-fed – plains – urban (LWRP)
	AVON10	Dudley Creek	1572574	5182150	IGSC	Spring-fed – plains – urban (LWRP)
	AVON11	Horseshoe Lake Discharge[4]	1574342	5183294	IGSC	Spring-fed – plains – urban (LWRP)
	AVON12	Avon River at Carlton Mill Corner[5]	1569737	5181259	IGSC	Spring-fed – plains – urban (LWRP)
	AVON13	Avon River at Avondale Road[4,5]	1574752	5183557	IGSC	Spring-fed – plains – urban (LWRP)

IGSC = Interim Global Stormwater Consent; SMP = Stormwater Management Plan; LWRP = Land & Water Regional Plan; WRRP = Waimakariri River Regional Plan; SLLT = Styx Living Laboratory Trust.

[4] Tidally influenced site
[5] These sites are specifically located in proximity to stormwater outfalls

Catchment	Site ID	Site	Easting (NZTM)	Northing (NZTM)	ECan Consent	LWRP or WRRP Classification
Ōpāwaho/ Heathcote	HEATH01	Heathcote River at Ferrymead Bridge[4]	1576491	5177150	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH02	Heathcote River at Tunnel Road[4]	1575074	5177543	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH03	Heathcote River at Opawa Road/Clarendon Terrace[4]	1573071	5177615	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH04	Heathcote River at Bowenvale Avenue	1571198	5175780	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH05	Cashmere Stream at Worsleys Road	1569030	5175155	South-West SMP	Banks Peninsula (LWRP)
	HEATH06	Heathcote River at Rose Street	1568701	5175918	South-West SMP	Spring-fed – plains – urban (LWRP)
	HEATH07	Heathcote River at Ferniehurst Street	1569157	5175612	South-West SMP	Spring-fed – plains – urban (LWRP)
	HEATH08	Heathcote River at Templetons Road	1565915	5176897	South-West SMP	Spring-fed – plains – urban (LWRP)
	HEATH09	Haytons Stream at Retention Basin[5]	1566020	5177596	South-West SMP	Spring-fed – plains – urban (LWRP)
	HEATH10	Curletts Road Stream Upstream of Heathcote River Confluence	1566928	5177711	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH11	Heathcote River at Catherine Street[5]	1574413	5177883	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH12	Heathcote River at Mackenzie Avenue Footbridge[5]	1573520	5177917	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH14	Curletts Road Stream at Southern Motorway[5]	1566405	5178358	IGSC	Spring-fed – plains – urban (LWRP)
	HEATH16	Cashmere Stream at Sutherlands Road	1566086	5173988	South-West SMP	Not classified[6]

[6] But considered in this report a Banks Peninsula waterway, as per the lower reaches

Catchment	Site ID	Site	Easting (NZTM)	Northing (NZTM)	ECan Consent	LWRP or WRRP Classification
Pūharakekenui / Styx	STYX01	Smacks Creek at Gardiners Road near Styx Mill Road	1566804	5187956	Styx SMP	Unclassified[7]
	STYX02	Styx River at Gardiners Road	1566790	5187226	Styx SMP	Unclassified[7]
	STYX03	Styx River at Main North Road	1569066	5187219	Styx SMP	Unclassified[7]
	STYX04	Kā Pūtahi[8] Creek at Blakes Road	1570401	5188030	Styx SMP	Unclassified[7]
	STYX05	Kā Pūtahi[8] Creek at Belfast Road	1572194	5188267	Styx SMP	Unclassified[7]
	STYX06	Styx River at Marshland Road Bridge	1572358	5187778	Styx SMP	Unclassified[7]
	STYX07	Styx River at Richards Bridge	1573975	5189640	Styx SMP	Unclassified[7]
	STYX08	Styx River at Harbour Road Bridge[4]	1574998	5194749	Styx SMP	Unclassified[7]
Huritini/ Halswell	HALS01	Halswell Retention Basin Inlet	1561701	5177022	IGSC	Not relevant
	HALS02	Halswell Retention Basin Outlet	1561796	5176914	IGSC	Not relevant
	HALS03	Nottingham Stream at Candys Road	1564532	5173080	South-West SMP	Spring-fed – plains (LWRP)
	HALS04	Halswell River at Akaroa Highway (Tai Tapu Road)	1564446	5171721	South-West SMP	Spring-fed – plains (LWRP)
	HALS05	Knights Stream at Sabys Road	1563723	5172852	South-West SMP	Spring-fed – plains (LWRP)
Ōtūkaikino	OTUKAI01	Ōtūkaikino River at Groynes Inlet	1567878	5188869	IGSC	OTU/GROYNES (WRRP)
	OTUKAI02	Wilsons Drain at Main North Road	1571241	5190793	Styx SMP	WAIM-TRIB (WRRP)
	OTUKAI03	Ōtūkaikino Creek at Omaka Scout Camp	1565664	5188038	IGSC	OTU/GROYNES (WRRP)
Linwood	OUT01	Linwood Canal/City Outfall Drain[4]	1575952	5178026	IGSC	Unclassified[9]

[7] Proposed Plan Change 7 to the LWRP proposes that these locations are classified as 'spring-fed - plains'. As such these sites are treated as spring-fed - plains' in this report.
[8] While officially shown on maps as Kaputone Creek, CCC has recently endorsed the use of the original Māori name for the area, Kā Pūtahi Creek.
[9] It is considered that 'spring-fed – plains – urban' is the most appropriate classification for this waterway under the LWRP

Catchment	Site ID	Site	Easting (NZTM)	Northing (NZTM)	ECan Consent	LWRP or WRRP Classification
Pūharakekenui / Styx (SLLT sites)	N/A	Smacks Creek at Wilkinsons Road	1567089	5068802	N/A	Unclassified[7]
	N/A	Styx River at Willowbank	1567218	5187641	N/A	Unclassified[7]
	N/A	Styx River at Styx Mill Conservation Reserve	1567918	5187613	N/A	Unclassified[7]
	N/A	Styx Drain at Redbrook Road	1568628	5069246	N/A	Unclassified[7]
	N/A	Rhodes Drain at Hawkins Rd	1571548	5187060	N/A	Unclassified[7]
	N/A	Horner's Drain at Hawkins Rd	1571569	5187095	N/A	Unclassified[7]
	N/A	Styx River at Radcliffe Road	1571720	5187413	N/A	Unclassified[7]
	N/A	Kā Pūtahi Creek at Blakes Road	1570925	5068237	N/A	Unclassified[7]
	N/A	Kā Pūtahi Creek at Ouruhia Domain	1571771	5190129	N/A	Unclassified[7]
	N/A	Kā Pūtahi Creek at Everglades Golf Course	1571798	5189270	N/A	Unclassified[7]
	N/A	Styx River at Brooklands	1575110	5193308	N/A	Unclassified[7]

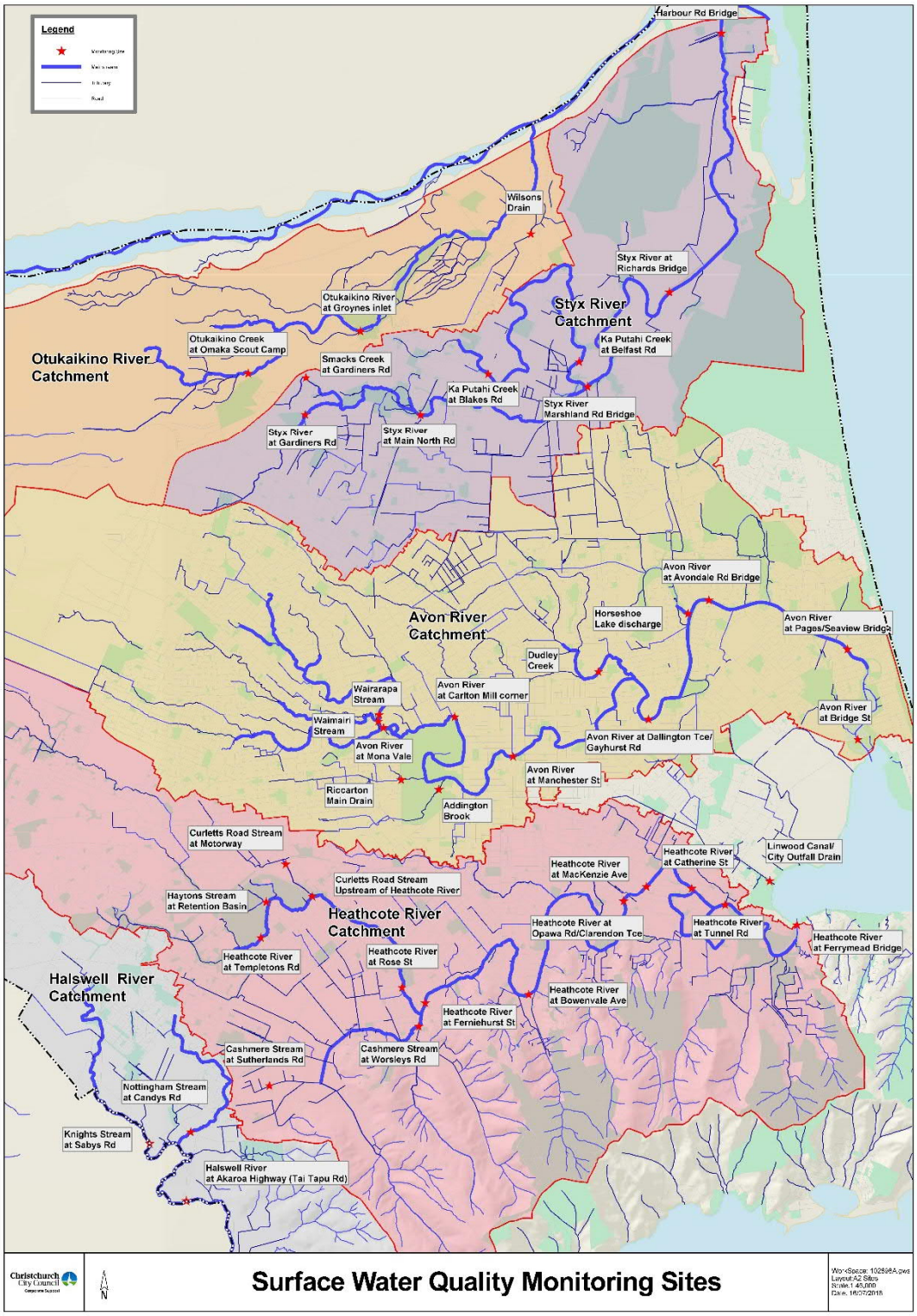

Figure 1. Location of Christchurch City Council surface water quality monitoring sites

2 Methods

2.1 Sample Collection and Testing

CCC monthly samples were collected predominantly via grab sampling, with field testing of temperature and oxygen using a hand-held meter (YSI Pro ODO meter). During the 2019 monitoring year, no monitoring was undertaken at the Haytons Stm site (March and June) as it was dry, and at the Kā Pūtahi at Blakes Rd (August) and Ōtūkaikino at Scout Camp (February) sites, as they could not be accessed.

SLLT volunteers have analysed water in the field for pH (Eutech pH pocket testers 30), conductivity (Eutech Cybernetics TDScan 3), water clarity (clarity tube) and water temperature (glass spirit thermometer) since 2004. Samples were aimed to be taken every third Saturday of the month, but as this was based on volunteer availability, the number of samples taken annually at each site ranged from 6 – 10. Of note:

- There was no data available for 2016
- 2015 and 2017 had a small number of recordings
- pH readings changed from using test strips to a handheld meter in February 2010; therefore, pH data prior to this time have been excluded from this report

The wet weather samples from the Pūharakekenui/ Styx River catchment were collected on the 3rd of September 2018 and 4th of September 2019. Total Petroleum Hydrocarbons (TPH) were unable to be analysed during the first event due to a sampling error. Wet weather samples collected from the Ōtākaro/ Avon River catchment were collected on the 18th of October and 17th of December 2019. Samples were collected via grab sampling, and field testing of temperature and oxygen using a hand-held meter (YSI Pro ODO meter). Wet weather events were required to meet the following criteria:

- Minimum of a three-day dry period prior to sampling[11]
- Minimum of 5 mm total rainfall depth[12]
- Catching of the “First Flush” (considered to be up to the first 15-25mm; Christchurch City Council, 2003), by sampling within 1 – 2 hours of the desired rainfall depth being achieved

The CCC monthly samples were analysed at the CCC International Accreditation New Zealand (IANZ) laboratory for the parameters outlined in Table 2 (except for those measured in the field). Not all parameters were tested at all sites, and only the most pertinent parameters (typically with guideline levels) are analysed and discussed in this report. The methods used to analyse each parameter, including laboratory Limits of Detection (LOD), are presented in Table i in Appendix A. Some of these methods have changed over time, as more advanced equipment has become available, and timeframes for changes are detailed in this table.

[11] On advice from Dr Aisling O’Sullivan (University of Canterbury) that even 24 hours is sufficient time for contaminants to accumulate

[12] Based on modelling by Peter Christensen (CCC) for Avon SMP that shows this is a ‘typical’ Christchurch storm event

Table 2. Parameters analysed in CCC monthly and wet weather water samples taken in accordance with consenting requirements

Parameter	Units of Measurement
Total ammonia (ammoniacal nitrogen)	mg/L
Dissolved arsenic*	mg/L
Biochemical Oxygen Demand (BOD_5)	mg/L
Conductivity	µS/cm
Total and dissolved copper	mg/L
Dissolved Oxygen (DO)	mg/L and % saturation
Enterococci	MPN/100ml
Escherichia coli	MPN/100ml
Total water hardness	g/m^3 as calcium carbonate
Total and dissolved lead	mg/L
Nitrate nitrogen	mg/L
Nitrite nitrogen	mg/L
Nitrate Nitrite Nitrogen (NNN)	mg/L
Dissolved Inorganic Nitrogen (DIN)	mg/L
pH	
Dissolved Reactive Phosphorus (DRP)	mg/L
Total Petroleum Hydrocarbons (TPH)*	mg/L
Total phosphorus	mg/L
Total Suspended Solids (TSS)	mg/L
Water temperature	°C
Total nitrogen	mg/L
Turbidity	NTU
Total and dissolved zinc	mg/L

* Wet weather samples only

2.2 Stream Classifications for Guideline Levels

The classification of each waterway site with respect to the Environment Canterbury (ECan) Land and Water Regional Plan (LWRP; Environment Canterbury, 2019) and the Waimakariri River Regional Plan (WRRP; Environment Canterbury, 2011) are shown in Table 1. These classifications determine the relevant guideline levels for each of the measured parameters for the various sites. The highest species protection level (99%) applies to 'Banks Peninsula' waterways, while 'spring-fed – plains' waterways are given a 95% species protection level, and 'spring-fed – plains – urban' waterways have 90% species protection (Environment Canterbury, 2019). These species protection levels apply to toxicants (metals and ammonia), Dissolved Oxygen (DO), Dissolved Inorganic Nitrogen (DIN) and Dissolved Reactive Phosphorous (DRP).

The WRRP does not have guideline levels for several of the parameters analysed in this report. It was considered most appropriate in these cases, given these sites are all within the Ōtūkaikino River catchment, that the LWRP 'spring-fed – plains' guidelines be used. Proposed Plan Change 7 to the LWRP proposes to classify the currently unclassified Pūharakekenui/ Styx River as 'spring-fed – plains'. The two stormwater basin sites (Halswell Retention Basin Inlet and Outlet) are not classified as waterways and therefore are not compared to receiving water guidelines in this report.

2.3 Water Quality Parameters and Guideline Levels

Metals, in particular, *copper*, *lead* and *zinc*, can be toxic to aquatic organisms, negatively affecting fecundity, maturation, respiration, physical structure and behaviour (Harding, 2005). The toxicity of lead and zinc in freshwater, and therefore the risk of adverse

biological effects, alters depending on several abiotic factors. These factors include, but are not limited to, organic carbon, hardness, pH, temperature, alkalinity and inorganic ligands (Warne *et al*., 2018). The LWRP refers to default ANZG (2018) guidelines for metals. However, current recommendations are to modify these default guideline levels by water hardness (ANZG, 2018; Warne *et al*., 2018). As such, CCC has recently updated the Hardness Modified Guideline Values (HMGV) for dissolved lead and zinc, in accordance with ANZG (2018) and Warne *et al*., (2018) (see Appendix B). In contrast to ANZECC (2000), it is no longer recommended to modify the default copper guideline by water hardness (ANZG, 2018; Warne *et al*., 2018).

pH is a measure of acidity or alkalinity, on a scale from 0 to 14; a pH value of seven is neutral, less than seven is acidic and greater than seven is alkaline. Appropriate pH levels are essential for the physiological functions of biota, such as respiration and excretion (Environment Canterbury, 2009). Aquatic species typically have tolerances for certain pH levels and alteration of pH can result in changes in the composition of fish and invertebrate communities, with generally a positive relationship between pH and the number of species present (Collier *et al*., 1990). The guidelines in the LWRP for all waterways are a lower limit of 6.5 and an upper limit of 8.5. The WRRP, which covers the Ōtūkaikino River catchment sites in this report, does not detail a guideline level.

Conductivity is a measure of how well water conducts an electrical current. Pure water has very low conductivity, but dissolved ions in the water (e.g. contaminants such as metals and nutrients) increase conductivity. Traditionally, conductivity has been compared to the guideline value of <175 µS/cm recommended by Biggs (1988) to avoid excessive periphyton growth. However, this guideline may be less relevant in urban waterways, where other contaminants that will not encourage periphyton growth may be contributing to high conductivity, such as metals. It is also noted that ECan do not consider this guideline value is useful, due to natural variations in levels (Abigail Bartram, ECan, personal communication 2013). They instead consider that analysis of trends is more useful, which is the approach adopted in this report.

Elevated levels of suspended sediment (*Total Suspended Solids*, TSS) in the water column decrease the clarity of the water and can adversely affect aquatic plants, invertebrates and fish (Crowe & Hay, 2004; Ryan, 1991). For example, sediment can affect photosynthesis of plants and therefore primary productivity within streams, interfere with feeding through the smothering of food supply, and can clog suitable habitat for species (Crowe & Hay, 2004; Ryan, 1991). The LWRP details in Rule 5.95 standards for TSS in stormwater prior to discharge but does not detail specifically a guideline value within waterways (Environment Canterbury, 2019). The WRRP also does not detail a guideline level. A guideline level of 25 mg/L is considered an appropriate threshold to prevent detriment effects on biota (Hayward *et al*., 2009; Stevenson *et al*., 2010) and is therefore used in this report.

Turbidity is a measure of the transmission of light through water. Suspended matter in the water column causes light to be scattered or absorbed as is travels through the water. As for TSS, turbidity decreases the clarity of the water and can negatively affect stream biota (Ryan, 1991). A guideline level for this parameter is not provided in the LWRP or the WRRP. ANZECC (2000) provides a guideline of 5.6 Nephelometric Turbidity Units (NTU) for lowland rivers, which is used in this report. This approach is consistent with current recommendations from ECan; however, this guideline will be reviewed in future reports, following publication of the proposed changes to the National Policy Statement for Freshwater Management (Michele Stevenson, ECan, personal communication, 19 June 2020).

Water clarity was used by the SLLT as a proxy for turbidity and TSS loads. ANZECC (2000) provides a guideline of 80 cm for lowland rivers.

DO is the concentration of oxygen dissolved or freely available in water and is commonly expressed as percent saturation. Adequate DO levels are essential for aquatic animals, such as fish and invertebrates, and can be influenced by many factors, including temperature, velocity, decomposition of organic material, and the photosynthesis and respiration of aquatic plants. The LWRP details a minimum DO level of 70% for 'spring-fed – plains' and 'spring-fed – plains – urban' waterways, and 90% for Banks Peninsula waterways (i.e. Cashmere Stream in this monitoring report). The WRRP details a minimum of 80% for the waterways relevant to this monitoring report (i.e. Ōtūkaikino River catchment).

High *water temperature* can affect aquatic biota, with some studies showing that the presence of sensitive macroinvertebrates decreases with increasing temperature (Wahl *et al*., 2013). The LWRP water quality standard for temperature is a maximum of 20°C for all waterway classifications; the WRRP details a maximum of 25°C for the waterways relevant to this monitoring report (i.e. Ōtūkaikino River catchment).

Biochemical Oxygen Demand (BOD_5) is an indicator of the amount of biodegradable organic material in the water and the amount of oxygen required by bacteria to break down this material. High BOD_5 values are due to plant matter, nitrogen and phosphorus, and indicate the potential for bacteria to deplete oxygen levels in the water. The LWRP does not have a guideline level for this parameter. The WRRP and the Ministry for the Environment (1992) guideline level is 2 mg/L, which is the value used in this report. However, the data presented in this report is conservative, as it relates to total BOD_5, instead of the guideline requirement of filtered.

Total ammonia (ammoniacal nitrogen) is typically a minor component of the nitrogen available for plant growth, but at high levels can have toxic effects on aquatic ecosystems. The toxicity of ammonia varies with pH (ANZECC, 2000). Therefore, the LWRP water quality standards also vary depending on pH, ranging from 2.57 mg/L at pH 6 to 0.18 mg/L at pH 9 (Environment Canterbury, 2019). For this report, the water quality standard (for both monthly and wet weather sampling) was adjusted based on the median pH levels from monthly sampling for the relevant catchments. The exception to this is for Banks Peninsula waterways (i.e. Cashmere Stream in this monitoring report), that have a set guideline value regardless of pH (0.32 mg/L). The WRRP does not have a guideline level.

Nitrate can be toxic to stream biota at high concentrations (Hickey, 2013). Guidelines are available for different species protection levels: 99% (pristine environment with high biodiversity and conservation values), 95% (environments which are subject to a range of disturbances from human activities, but with minor effects), 90% (environments which have naturally seasonally elevated concentrations for significant periods of the year (1-3 months)), 80% (environments which are measurably degraded and which have seasonally elevated concentrations for significant periods of the year (1-3 months)), and acute (environments which are significantly degraded; probable chronic effects on multiple species) (Hickey, 2013). Based on these descriptions and the predominantly urban nature of the waterways monitored, most of the waterways in this report would fall under the 80% to acute species description (i.e. Ōtākaro/ Avon, Ōpāwaho/ Heathcote and Huritini/ Halswell River catchments). However, the Pūharakekenui/ Styx and Ōtūkaikino River catchments (and Cashmere Stream) likely fall under the 90% species

protection; these catchments have much better water quality, but exceed some of the receiving water quality guidelines throughout the year. To be conservative, the 90% species protection was chosen as the guideline level for all waterways in this report. Within this 90% level of species protection there are two guideline values: the 'grading' guideline (3.8 mg N/L) that provides for ecosystem protection for average long-term exposure (measured against medians) and the 'surveillance' guideline (5.6 mg N/L) that assesses seasonal maximum concentrations (measured against annual 95th percentiles). Both guideline levels have been assessed in this report to investigate both long-term and short-term effects. It is also noted that Schedule 8 (region-wide water quality limits) of ECan's LWRP gives a nitrate toxicity limit for lowland streams of 3.8 mg N/L (measured against annual median).

Elevated concentrations of *Nitrate and Nitrite Nitrogen* (NNN) can lead to proliferation of algae and aquatic plants (i.e., eutrophication), because nitrate and nitrite are oxidised forms of nitrogen that are readily available to plants. Eutrophication occurs at much lower nitrate concentrations than toxicity. The LWRP and the WRRP do not have a guideline value for this parameter, but the ANZECC (2000) water quality guidelines provide a guideline value of 0.444 mg/L for lowland rivers to avoid excessive plant growth. Note that this guideline is based on the 80th percentile of measurements from three lowland reference sites, so it is not "effects-based". Rather, compliance with the guideline indicates the risk of eutrophication is relatively low. Compliance with NNN guidelines will also protect against nitrate toxicity.

DIN, which is the sum of ammonia, nitrite and nitrate, provides a similar measure of eutrophication risk to NNN. The LWRP details a DIN value of 1.5 mg/L for 'spring-fed – plains' and 'spring-fed – plains – urban' waterways, and 0.09 mg/L for Banks Peninsula waterways. The DIN guideline of 1.5 mg/L is based on the median of Canterbury Spring-fed plains streams, whereas the 0.09 mg/L guideline is derived from the New Zealand Periphyton Guideline, based on flow data from Canterbury streams (Biggs, 2000; Hayward *et al*., 2009). There is no DIN guideline value in the WRRP.

DRP is a soluble form of phosphorus that is readily available for use by plants. Phosphorus is an essential nutrient for plant growth and can limit primary production at low levels, but can cause eutrophication at high levels. The guideline levels in the LWRP for 'spring-fed - plains' and 'spring-fed – plains – urban' waterways are 0.016 mg/L, and 0.025 mg/L for Banks Peninsula waterways. There is no guideline value for this parameter in the WRRP.

Escherichia coli is a bacterium that is commonly used as an indicator of faecal contamination in freshwater and therefore health risk from contact recreation (Ministry for the Environment, 2003). The guideline level in the LWRP for 'spring-fed – plains', 'spring-fed – plains – urban' and Banks Peninsula waterways is 550 *E. coli* per 100ml (for 95% of samples). The WRRP does not have a guideline value for this parameter.

TPH is the term used to describe a wide variety of chemical compounds that are found in oil and petroleum-based products. Some of the hydrocarbons found in petroleum products are toxic to aquatic life. In addition, hydrocarbons are broken down by microbial activity that then reduces oxygen levels in the water, which can also be harmful to sensitive fish and invertebrate species (ANZECC 2000). There are no guidelines for TPH in New Zealand freshwaters.

2.4 Data Analysis

2.4.1 Summary Statistics and Graphs

Boxplots (for monthly data) were produced using the program RStudio (Version 1.2.5033). To allow statistical analyses of monthly samples, values less than the LOD were converted to half the detection limit. In some years, monthly *E.coli* levels exceeded the maximum laboratory limit for counting (24,000 MPN/100ml) and were analysed as 24,000, although levels may have been much higher than this. There were two such *E. coli* cases during the 2019 monitoring year.

The dark lines in the boxes of the boxplots represent the medians, and the bottom and top lines of the boxes represent the 25th and 75th percentiles (the interquartile range), respectively. The T-bars that extend from the boxes approximate the location of 90% of the data (i.e. the 5th and 95th percentiles, HAZEN methodology). Circles represent outliers. In some cases, boxplots do not show all components, such as the percentiles, due to a lack of variation in the data, with some showing only the medians. This usually occurred where a large proportion of the data were below the laboratory limit of detection.

In line with the respective guideline documents and ECan guidance (Dr Lesley Bolton-Ritchie, Environment Canterbury, 6th April 2016, personal communication), the monthly data were compared to guideline levels using median levels. The exceptions being for *E. coli*, toxicants (metals and ammonia) and the 'surveillance' nitrate level, which were compared to the 95th percentiles.

2.4.2 Temporal Trends Analysis

Temporal trends analysis was carried out on the monthly data from each of the sites, to determine whether water quality is declining, improving or staying the same over time. Some of the sites have been monitored for longer periods than others, as detailed in Appendix C, Table i. Dissolved metals have only been analysed since 2011, with total metals sampled prior to this. Dissolved metals are now considered to be more relevant because they constitute the bio-available proportion of metals that can have adverse effects on biota (ANZECC, 2000). The guidelines also essentially pertain to dissolved metal concentrations, not total metals. As NNN is predominantly comprised of nitrate, trends analysis was also only conducted on NNN and not nitrate as well.

Trends analysis was conducted using Time Trends V 6.3, build 14 (NIWA, 2014). The Seasonal Kendall trend test was used to test the significance, magnitude and direction of the trends, providing an average annual percentage change. A change was considered meaningful when there was a statistically significant positive or negative result of greater than 1% (NIWA, 2020). In previous reports, any statistically significant results between -0.99 and 0.99 were identified, but this is no longer considered appropriate, given the above information defining what is meaningful. Time Trends (V 6.3) accommodates for variable LODs, and the option for using censored values in Sen slope calculation was selected. This software requires three years of data and all CCC sites met this requirement. However, when a large proportion of data is below the LOD (e.g. dissolved copper and lead) or missing (e.g. missing SLLT data in some years) these analyses may be less accurate. SLLT monitoring included five new sites in 2018/2019: Kā Pūtahi at Blakes Rd, Styx Drain at Redbrook Rd, Smacks at Wilkinsons Rd, Rhodes Drain at Hawkins Rd and Horner's Drain at Hawkins Rd. Therefore, there was insufficient data to run trends analysis for these sites.

Concentrations of parameters may vary depending on flow rates at the time of sampling, due to variations in the level of dilution. Therefore, flow-adjusted data can be used in the Time Trends software to account for this potentially confounding factor. However, a flow recorder is only directly present at one of the sites (Heathcote at Ferniehurst St). It is considered that extrapolation of this flow data to other locations, as well as the use of other flow gauges in Christchurch not directly at the monitoring sites, may bias the results through differences in habitat and additional discharge inputs. This may lead to inaccurate trend conclusions. Given the long period of monitoring, it is considered that variations in flow rates between sampling events will not strongly influence the trends analysis, as most events will have been conducted during baseflow conditions. To ensure accurate comparisons between sites, the flow data for Heathcote River at Ferniehurst St was not used.

This monitoring year, an issue was encountered when analysing the BOD_5 data in Time Trends. At most sites the direction of change could be calculated, but not the magnitude (i.e. %). This was due to the programme being unable to deal with the high proportion of censored (below the LOD) data. It is unclear whether this will continue to be an issue in future reports, as it is dependent on the results of future testing. CCC is currently investigating lowering the LOD to mitigate these potential impacts.

2.4.1 Water Quality Index

A Water Quality Index (WQI) was developed for the CCC monthly monitoring sites, based on a Canadian WQI (CCME; Canadian Council of Ministers for the Environment, 2001). This index uses three factors to assess water quality: scope (the percentage of parameters not meeting the guideline on at least one occasion); frequency (the percentage of samples that did not meet the guideline); and amplitude (the amount by which the guideline was not met). The WQI ranges from 0 – 100, with 100 representing high water quality. The user can choose which parameters to include and what guideline levels are appropriate to their system.

The parameters used in the CCC WQI were copper, zinc, pH, TSS, DO, temperature, BOD_5, total ammonia, NNN, DRP and *E. coli*. WQI scores were used to categorise the CCC sites as being 'very poor' (0 – 39.99), 'poor' (40 – 69.99), 'fair' (70 – 79.99), 'good' (80 – 89.99) or 'very good (90 – 100). The categories were selected based on local knowledge of water quality compared to other waterways nationally. These categorise Christchurch City waterways as expected. The WQI index was calculated for every year from 2013, to allow comparisons over time. The update to the hardness modified guideline values for dissolved metals affected the calculation of the WQI. Therefore, WQI scores from 2013–2018 were recalculated using the new dissolved copper and zinc guideline values, to enable accurate temporal changes to be determined (Section 2.3; Appendix B). Auckland Council (Holland *et al*., 2016) and ECan (Robinson & Stevenson, 2016) have also adapted this CCME WQI index for their own purposes. However, because the parameters used to calculate these indices and/or their categories are different, these indices cannot be compared.

To test for significant relationships in WQI between catchments and years, statistical models were run in the program RStudio (Version 1.2.5033). Generalised Linear Mixed Effects Models with a binomial error structure and logit link function were used (Crawley, 2007), with the following combinations of fixed effects: (1) a null model with intercept

only; (2) a model that considered ‘year’; (3) a model that considered ‘catchment’; and (4) a model that considered the interaction between ‘year’ and ‘catchment’. ‘Year’ was also included in each model as a random effect to account for temporal autocorrelation (repeated measures). ‘Site’ was also included as an observational level random effect, due to the models exhibiting overdispersion (Harrison, 2014; Harrison, 2015). Boxplots of WQI across years were also graphed in R for each catchment (see the explanation of how to interpret boxplots in the Summary Statistics and Graphs section).

Temporal trends analysis was carried out on the WQI at each site, to determine whether overall water quality is declining, improving or staying the same over time. Analysis was undertaken on data collected from 2013- 2019 inclusive. Trends analysis was conducted using Time Trends (NIWA, 2020). The Seasonal Kendall trend test was used to test the significance, magnitude and direction of the trends, providing an average annual percentage change. This software requires three years of data and all sites met this requirement. A change was considered meaningful when there was a statistically significant positive or negative result of greater than 1% (NIWA, 2020).

3 Results: Monthly Monitoring

3.1 Rainfall

- Daily rainfall has been collected at the Christchurch Botanic Gardens by the CCC since the early 1960's.
- Over the last five years rainfall has been variable, including dry years (2015 and 2016), wet years (2017 and 2018) and intermediate years (2019) (Figure 2).
- For the 2019 monitoring year (for the CCC monthly data only) the Ōtūkaikino catchment recorded the most number of sampling days affected by rain (47%), followed by the Pūharakekenui/ Styx River catchment (44%), Ōtākaro/ Avon River catchment (29%), Linwood Canal catchment (25%), Ōpāwaho/ Heathcote River catchment (15%) and Huritini/ Halswell River catchment (8%). This was based on observations of the water quality samplers as to whether it had rained within the 24 hours prior to sampling.

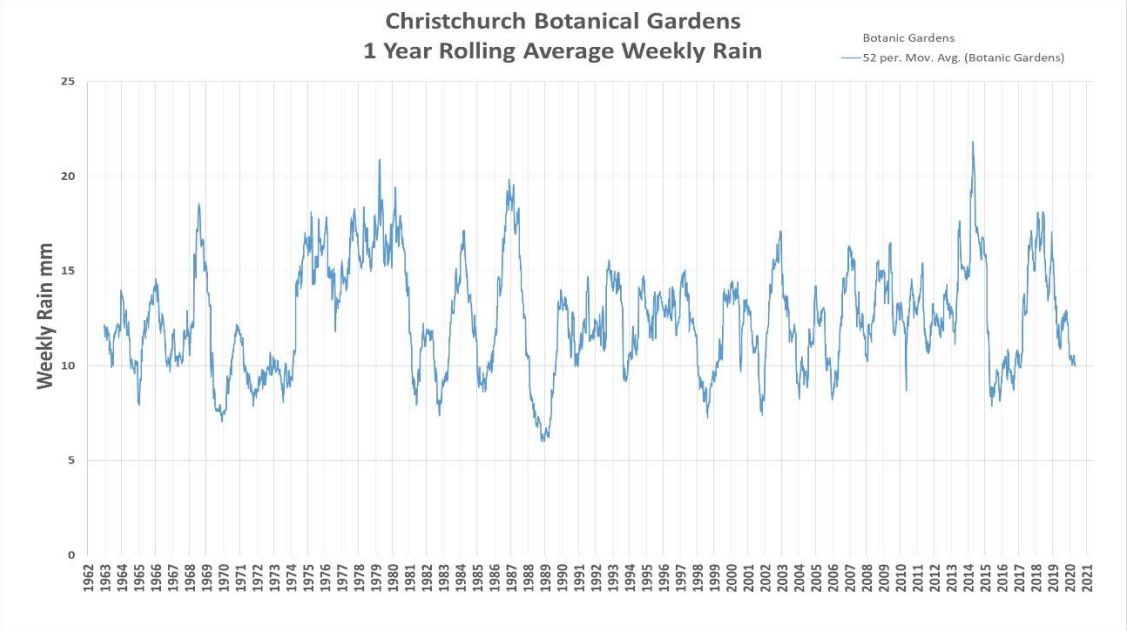

Figure 2. Average weekly rainfall at the Botanic Gardens in Hagley Park

3.2 Water Quality Parameters

3.2.1 Summary

- Over 11,000 tests were conducted during the monitoring year for the CCC monthly monitoring, with 7,440 of these allowing the assessment of each waterway site against relevant guideline levels (Table 3). Twenty percent of these samples did not meet the guideline level, with 41 sites (97.6%) not meeting the guideline for at least one parameter.

- The parameters that were exceeded at the most sites were *E. coli* (36 sites), NNN (32 sites), and DRP and dissolved copper (both 23 sites). The NNN guideline was exceeded most frequently (80% of samples), followed by DRP (54% samples) and DIN (41% of samples).
- Most parameters did not change in concentration since monitoring began, with 420 (64%) parameter-site combinations recording no significant upwards or downwards trends in concentrations (Appendix D, Tables i–iv). However, 182 (28%) parameter-site combinations recorded a significant improvement in water quality, 50 (8%) recorded a significant decline in water quality, and 1 (0.2%) recorded a significant change that could represent either a decline or improvement in water quality (pH).
- The majority of sites across all catchments recorded a small decrease in BOD_5, DRP and NNN/DIN. Many sites in the Pūharakekenui/ Styx River recorded an increase in *E. coli* levels.
- The largest increases in parameter concentrations at individual sites were:
    - 18% for NNN and 16% for DIN at the Ōtūkaikino at Scout Camp site, due to some high peaks in concentrations in 2017–2019 (Figures 3 – 4)
    - 16% in dissolved zinc at Curletts at Motorway, due to a steady increase over time (Figure 5)
- The largest decreases in parameter concentrations at individual sites were:
    - 33% for total ammonia (driven by concentrations peaking in 2011 and lower concentrations since then), 28% for dissolved lead (due to peak levels in 2014-2016 and generally lower concentrations since then) and 19% for TSS at the Halswell Basin Outlet site (with concentrations generally decreasing over time) (Figures 6 – 7, 10)
    - 31% for NNN and 24% for DIN at the Curletts at Motorway site, due to lower levels since 2016 (Figures 8 – 9)
- Whilst not classified as one of the largest changes over time above, the following results are of interest:
    - 12% increase in copper at the Curletts at Motorway site, due to a large increase since early 2019
    - 12% increase in ammonia at the Wilsons Stm site, due to a steady increase over time; however, levels are still low overall. This is of note as this trend is unusual, and this parameter is extremely toxic to biota and is typically associated with industry.
    - 16% and 13% reduction in copper and lead, respectively, at Curletts U/S of Heathcote, due to steady decreases over time
    - 18% decrease in DRP at Cashmere Stream at Sutherlands Rd, due to reductions in large peaks since 2014
- Although there was no significant change in either TSS or turbidity at the Cashmere at Worsleys Rd site, there is potentially a steady increase in these parameters occurring, and this should be assessed carefully in next year's report to see if levels decrease or increase (Figures 11–12).

3.2.2 Dissolved Copper

- 95th percentiles for most sites in the Ōtākaro/ Avon and Ōpāwaho/ Heathcote catchments, as well as at the Ōtūkaikino at Groynes and Linwood Canal sites exceeded their respective guideline levels (Appendix E, Figure i (a) – (b)).
- Copper levels were generally higher in the Ōtākaro/ Avon and Ōpāwaho/ Heathcote catchments compared to the other catchments.

- Of the three highest values recorded (0.018 mg/L, 0.017 mg/L and 0.014 mg/L), all were from the Curletts at Motorway site and only the lowest of these values was associated with rain.
- The Halswell Basin sites recorded levels generally higher than the waterway sites, except for the Curletts at Motorway site. Levels were higher at the inlet compared to the outlet.
- Concentrations have remained stable (i.e. there were no significant trends) since regular monitoring of dissolved metals was instigated, except for the Curletts U/S of Heathcote (decrease of 16%), Halswell Basin Outlet (decrease of 7%) and Curletts at Motorway (increase of 12%) sites (Appendix D, Tables i–iv).

3.2.3 Dissolved Lead

- All 95th percentiles for each site complied with the respective guidelines (Appendix E, Figure ii (a) – (b)).
- Lead levels were generally higher in the Ōtākaro/ Avon and Ōpāwaho/ Heathcote catchments compared to the other catchments.
- The three highest values were all from the lower Heathcote River: Heathcote at Mackenzie Ave (0.0096 mg/L), Heathcote at Catherine St (0.0059 mg/L) and Heathcote at Tunnel Rd (0.0049 mg/L). Only the highest value was associated with rain; however, all three samples were taken during a period when upstream dredging was occurring (CCC, *unpublished data*).
- Levels with the Halswell Basin sites were generally higher compared to most waterway sites, and higher at the inlet than the outlet.
- Much higher lead levels were recorded at the Heathcote at Catherine St, Heathcote at Tunnel Rd and Heathcote at Ferrymead Bridge sites compared to 2018. These samples were all associated with upstream dredging.
- Concentrations remained stable over time at all sites except the Halswell Basin Outlet (Figure 7), Dudley Creek and Curletts U/S of Heathcote sites, which recorded 32%, 15%, and 13% reductions, respectively (Appendix D, Tables i–iv).

3.2.4 Dissolved Zinc

- 95th percentiles for most sites in the Ōtākaro/ Avon, approximately half of the sites in the Ōpāwaho/ Heathcote catchments, as well as the Kā Pūtahi at Blakes Rd and Nottingham at Candys Rd sites, all exceeded their respective guideline levels (Appendix E, Figure iii (a) – (b)).
- Zinc levels were generally higher in the Ōtākaro/ Avon and Ōpāwaho/ Heathcote catchments compared to the other catchments.
- The three highest values (0.77 mg/L, 0.60 mg/L and 0.52 mg/L) were from the Curletts at Motorway site and only the second highest was associated with rain.
- Levels in the Halswell Basin sites were generally higher than the waterway sites, t.
- Sites within areas with high industrial and commercial land use, such as Addington Brook, Curletts Stream and Haytons Stream, typically had higher concentrations than the rest of their respective catchments.
- Concentrations have generally remained stable since sampling was instigated (Appendix D, Tables i–iv). A few sites showed large decreases: Wairarapa Stm (13%), Heathcote at Templetons Rd (13%), Styx at Gardiners Rd (11%), Smacks at Gardiners Rd (16%) and Ōtūkaikino at Groynes (17%). However, large increases were recorded at Curletts at Motorway (16%; Figure 5), with a particularly large peak recorded in April of the monitoring year, and Heathcote at Ferrymead Bridge (14%).

3.2.5 pH

- Medians of all CCC and SLLT waterway sites complied with the guideline levels (Appendix D, Figure iv (a) – (c)).
- The three highest values at the waterway sites were from Haytons Stm (9.5), Curletts at Motorway (8.6) and Avon at Pages Rd (8.2 on two occasions), and Avon at Bridge St (8.2), with none of these values recorded in association with rain. The lowest recorded pH of 6.5 was at the Heathcote at Templetons Rd site and was not associated with rain.
- The Halswell Basin sites recorded substantially higher pH than the waterway sites. Levels were slightly lower at the outlet than the inlet.
- Concentrations remained stable over time, except for small very increases at Ōtūkaikino at Scout Camp and most SLLT sites where trends analysis could be run (Appendix D, Tables i–v).

3.2.6 Conductivity

- No relevant guidelines exist for conductivity.
- The tidal sites had greater conductivity and variability in values than non-tidal sites, due to saline influence (Appendix D, Figure v (a) – (c)).
- Addington Brook and both Curletts Road Stream sites had more variability and higher concentrations compared to other non-tidal sites, indicating pollution sources.
- Both Halswell Basin sites had levels comparable to the waterway sites, and levels were slightly lower at the outlet.
- Conductivity at the SLLT sites were similar to the CCC waterway sites.
- Of particular note was a substantial increase at the three lower sites in the Heathcote catchment compared to 2018. At these sites, medians increased by 1.5–3.7 fold, minimums by 1–4 fold and maximums by 1.7–12.6 fold.
- Concentrations generally did not change over time by any large degree, with increases from 1–8% and decreases from 1–4% (Appendix D, Tables i–v).

3.2.7 TSS

- Medians of all waterway sites complied with the guideline level, except for Heathcote at Tunnel Rd and Heathcote at Ferrymead Bridge (Appendix D, Figure vi (a) – (b)).
- The three highest TSS values were recorded from the Ōpāwaho/ Heathcote catchment in association with dredging: Heathcote at Opawa Rd (310 mg/L, 210 mg/L) and Heathcote at Mackenzie Ave (140 mg/L), with no values recorded in association with rain.
- The Halswell Basin Inlet generally recorded levels higher than the waterway sites. Levels were lower at the outlet than the inlet.
- Typically, higher TSS was recorded in the lower, tidal sites of the Ōtākaro/ Avon and Ōpāwaho/ Heathcote catchments, potentially due to resuspension of the naturally softer substrate at these locations compared to non-tidal sites.
- Concentrations at the Heathcote at Mackenzie Ave site were much higher in 2019 compared to 2018.
- The Halswell Basin Outlet was the only site to record a substantial change in concentrations over time, with a 20% decrease recorded (Figure 10; Appendix D, Tables i–iv).

3.2.8 Turbidity

- The medians of the following sites exceeded the guideline: Addington Brook, Avon at Bridge St, Haytons Stm, Cashmere at Worsleys Rd, Heathcote at Ferniehurst St, Heathcote at Opawa Rd, Heathcote at Tunnel Rd, Heathcote at Ferrymead Bridge and Linwood Canal (Appendix D, Figure vii (a) – (b)).
- The three highest turbidity readings were recorded from the Ōpāwaho/ Heathcote catchment: Heathcote at Opawa Rd (110 NTU, 140 NTU) and Heathcote at Tunnel Rd (46 NTU). None of these recordings were associated with rain; however, they were all recorded in association with dredging (CCC, *unpublished data*).
- The Ōpāwaho/ Heathcote River catchment, followed by the Ōtākaro/ Avon River catchment, generally recorded higher turbidity levels compared to the other catchments. The lower three Ōpāwaho/ Heathcote River tidal sites typically recorded higher turbidity than the other sites in this catchment.
- The most substantial decrease over time (11%) was at the Ōtūkaikino at Groynes site and the most substantial increase (13%) was at the Wilsons Stm site (Appendix D, Tables i–iv).

3.2.1 Water Clarity (SLLT sites only)

- The medians of all sites did not comply with the guidelines, except for Smacks at Wilkinsons Rd and Styx Drain at Redbrook Rd (Appendix D, Figure viii).
- The three highest values were from Horner's Drain at Hawkins Rd (32 cm, 35 cm and 45 cm).
- Except for Horner's Drain at Hawkins Rd and Rhodes Drain at Hawkins Rd, water clarity was similar across sites, and between the mainstem and tributaries.
- No substantial changes in levels were recorded over time (Appendix D, Table v).

3.2.2 DO

- Medians of the following sites did not meet the guideline: Horseshoe Lake, Heathcote at Templetons Rd, both Curletts Road Stream sites, both Cashmere Stream sites, Styx at Gardiners Rd, Smacks at Gardiners Rd and Linwood Canal (Appendix D, Figure ix (a) – (b)).
- The three lowest readings were 13% and 20% (Curletts U/S of Heathcote), and 23% (Curletts at Motorway). None of these records were associated with rain.
- DO levels were generally higher at the Halswell Basin Outlet than the Inlet, and both sites were fairly comparable to the waterway sites.
- Dissolved oxygen levels were lower in the Ōpāwaho/ Heathcote catchment, particularly at the upstream sites.
- Levels did not change over time by any large degree at any of the sites (Appendix D, Tables i–iv).

3.2.3 Water Temperature

- Medians of all CCC and SLLT sites complied with their respective guidelines (Appendix D, Figure x (a) – (c)).
- The three highest readings from the waterway sites were from Linwood Canal (22.8 °C, 22.4 °C), Heathcote at Tunnel Rd (22.4 °C) and Heathcote at Ferrymead Bridge (22.2 °C).

- The inlet and the outlet of the Halswell Retention Basin recorded similar levels to each other, and. These two sites typically recorded higher and more variable temperatures than the waterway sites.
- The SLLT sites recorded generally similar temperatures to the CCC sites.
- Levels did not change over time by any large degree (Appendix D, Tables i–v).

3.2.4 BOD_5

- Medians of all waterway sites complied with the guideline (Appendix D, Figure xi (a) – (b)).
- The highest values recorded at the waterway sites were from Kā Pūtahi at Blakes Rd (5.9 mg/L), Curletts U/S of Heathcote (4.2 mg/L) and Haytons Stm (3.6 mg/L). None of these values were recorded in association with rain.
- Levels in the Halswell Basin sites were generally higher than the waterway sites and levels were lower at the outlet.
- Levels were typically higher in the Ōtākaro/ Avon River and Ōpāwaho/ Heathcote River catchments.
- Compared to 2018, concentrations were markedly lower at the Curletts at Motorway and Heathcote at Ferrymead Bridge sites.
- Most sites across all catchments recorded decreases in BOD_5 since sampling began (Appendix D, Tables i–iv).

3.2.5 Total Ammonia

- 95th percentiles of all sites complied with their respective guidelines (Appendix D, Figure xii (a) – (b)).
- The three highest levels within the waterway sites were from the Linwood Canal (0.57 mg/L, 0.56 mg/L) and Haytons Stm (0.55 mg/L) sites, with only the Haytons Stm sample associated with rain
- The Halswell Basin Inlet generally recorded values higher than the waterway sites, and levels were substantially lower at the outlet.
- Ammonia was generally higher in the tributaries compared to mainstems.
- Over half of sites remained stable over time (Appendix D, Tables i–iv). The following sites recorded large decreases in concentrations: Halswell Basin Outlet (33%), Halswell Basin Inlet (25%; Figure 6) and Heathcote at Ferrymead Bridge (13%). Wilsons Stm recorded a significant increase of 12%.

3.2.6 Nitrate, NNN and DIN

- All waterway sites complied with the nitrate guidelines, except for Heathcote at Templetons Rd and Knights at Sabys Rd where the median exceeded the grading guideline (Appendix D, Figure xiii (a) – (b)). Medians of most sites did not comply with the NNN guideline (Appendix D, Figure xiv (a) – (b)). The medians of over half of the sites complied with their respective DIN guideline, but the majority sites in the Ōpāwaho/ Heathcote did not (Appendix D, Figure xv (a) – (b)).
- Heathcote at Templetons Rd and Knights at Sabys Rd recorded much higher levels of nitrogen than the other sites, with the three highest exceedances of nitrate, NNN and DIN from these sites: Heathcote at Templetons Rd (DIN: 4.4 mg/L and 4.3 mg/L (three samples)), Knights at Sabys Rd (DIN: 4.4 mg/L (two samples), 4.3 mg/L (two

samples) and 4.2mg/L). Only one record was associated with rain (4.3 mg/L at the Heathcote at Templetons Rd site).

- Both Halswell Basin sites recorded levels comparable to the waterway sites. Levels at the outlet and inlet were generally comparable.
- All three parameters typically decreased downstream in the mainstem, and were lower in the Pūharakekenui/ Styx, Ōtūkaikino and Linwood Canal catchments.
- NNN and DIN concentrations generally remained stable or decreased over time, with over 50% of sites recording a decrease in at least one parameter (Appendix D, Tables i–iv). Comparatively large decreases were recorded at Curletts at Motorway (NNN = 30%, DIN = 24%; Figures 8 and 9), Halswell Basin Outlet (DIN = 18%), Halswell Basin Inlet (DIN = 15%), and Haytons Stm (NNN = 11%, DIN = 14%). An increase in NNN (18%) and DIN (16%) was recorded at Ōtūkaikino at Scout Camp, due to some high peaks in concentrations in 2017–2019 (Figures 3–4).

3.2.7 DRP

- The medians of over half of the sites did not comply with their respective guidelines, with the majority of sites in the Ōpāwaho/ Heathcote exceeding this value (Appendix D, Figure xvi (a) – (b)).
- Particularly high levels were recorded in Haytons Stm, with the three highest values (0.43 mg/L, 0.35 mg/L and 0.27 mg/L) from this site. Only the highest value was associated with rain.
- The Halswell Basin sites were within the higher range of the waterway sites, and concentrations were slightly lower at the outlet.
- DRP generally increased downstream in the catchments.
- Most sites recorded a decrease in DRP concentrations since monitoring began (Appendix D, Tables i–iv). The largest decreases were from Cashmere at Sutherlands Rd (18%), Ōtūkaikino at Groynes (14%), Heathcote at Ferrymead Bridge (14%), Heathcote at Templetons Rd (12%), Haytons Stm (11%), and Halswell Basin Outlet (11%). No site increased in concentration.

3.2.8 *E. coli*

- The 95th percentiles for Heathcote at Templetons Rd, Haytons Stm, Curletts U/S of Heathcote, Cashmere at Sutherlands Rd, Ōtūkaikino at Scout Camp and Ōtūkaikino at Groynes all complied with the guideline level (Appendix D, Figure xvii (a) – (b)). Levels were exceeded at all other sites. In 2018, Cashmere at Sutherlands Rd was the only site to comply with the guideline level.
- The highest value (>24,000 MPN/100ml) was recorded on one occasion each at the Riccarton Main Drain and Nottingham at Candys Rd sites. The next highest record of 16,000 MPN/100ml was from Dudley Creek, while the third highest (12,000 MPN/100ml) was from Kā Pūtahi at Belfast Rd. Only the Kā Pūtahi at Belfast Rd record was associated with rain. No *E. coli* samples were associated with a recorded CCC wastewater overflow event.
- The Halswell Basin sites were within the range of that recorded at the waterway sites, and the outlet concentrations were generally lower than the inlet.
- Concentrations generally remained stable over time (Appendix D, Tables i–iv). The largest changes were recorded at Curletts U/S of Heathcote (13% decrease) and Wilsons Stm (13% increase).

Table 3. Number of waterway sites monitored for each parameter (where guideline levels are available), the number of samples analysed and the number of samples and sites (based on medians/95th percentiles, depending on the parameter) not meeting the guideline levels, during the monitoring period of January to December 2019.

Parameter	Guideline	Number of Sites Monitored	Number of Samples Analysed	Number of Samples Not Meeting Guideline	Number of Sites Not Meeting Guidelines
Escherichia coli	95%the percentile <550/100ml	42	500	147 (29.4%)	36
Nitrate Nitrite Nitrogen	Median <0.444 mg/L	42	500	399 (79.8%)	32
Dissolved Reactive Phosphorus	Varies depending on catchment, from median <0.016 mg/L to <0.025 mg/L	42	500	269 (53.8%)	23
Dissolved copper	Varies depending on catchment, from 95th percentile <0.001 mg/L to <0.0018 mg/L	42	500	47 (9.4%)	23
Dissolved zinc	Varies depending on catchment, from 95th percentile <0.00634 mg/L to <0.12691 mg/L	42	500	51 (10.2%)	18
Dissolved Inorganic Nitrogen	Varies depending on catchment, from median <0.09 mg/L to <1.5 mg/L	42	500	204 (40.8%)	17
Turbidity	Median <5.6 NTU	37	440	120 (27.3%)	9
Dissolved oxygen	Varies depending on catchment, from median >70% to >90%	42	500	125 (25.0%)	9
Total Suspended Solids	Median <25 mg/L	42	500	48 (9.6%)	2 (Heathcote at Tunnel Rd, Heathcote at Ferrymead Bridge)
Nitrate	Median <3.8 mg/L and/or 95%ile <5.6 mg/L	42	500	21 (4.2%)	2 (Heathcote at Templetons Rd, Knights Stream)
Biochemical Oxygen Demand	Median <2 mg/L	42	500	16 (3.2%)	0
Water temperature	Varies depending on catchment, from median <20°C to <25°C	42	500	13 (2.6%)	0
pH	Median 6.5 to 8.5	42	500	3 (0.6%)	0
Dissolved lead	Varies depending on catchment, from 95th percentile <0.00427 mg/L to <0.13610 mg/L	42	500	0 (0%)	0
Total ammonia	Varies depending on catchment, from 95th percentile <0.32 mg/L to <1.99 mg/L	42	500	0 (0%)	0
Total	-	42	7,440	1,463 (19.7%)	41 of 42 (97.6%) (for at least one parameter)

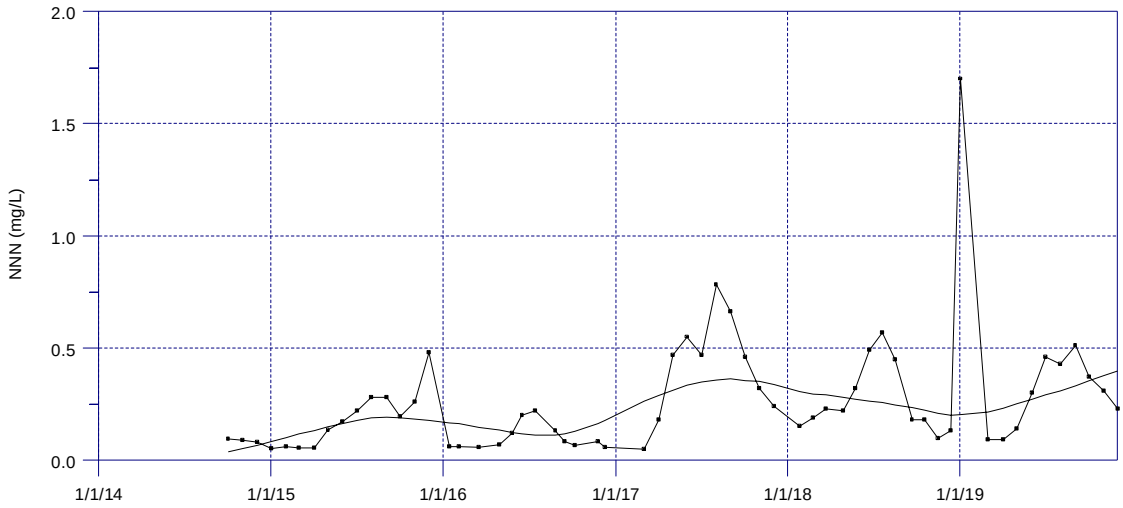

Figure 3. NNN levels at the Ōtūkaikino at Scout Camp site for the monitoring period October 2014 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A positive (i.e. increasing) trend of 18% was recorded over the sampling period.

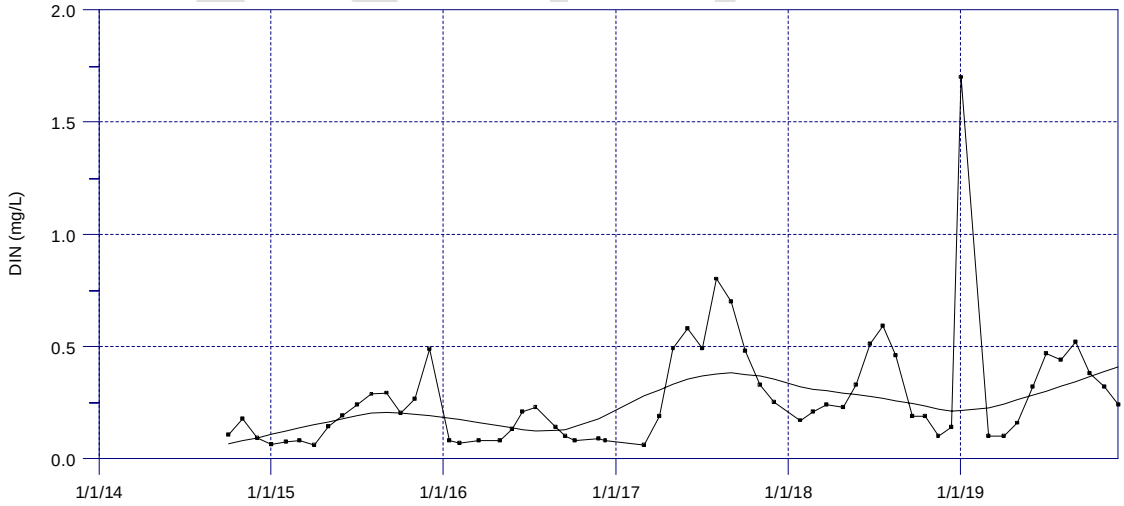

Figure 4. DIN levels at the Ōtūkaikino at Scout Camp site for the monitoring period October 2014 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A positive (i.e. increasing) trend of 16% was recorded over the sampling period.

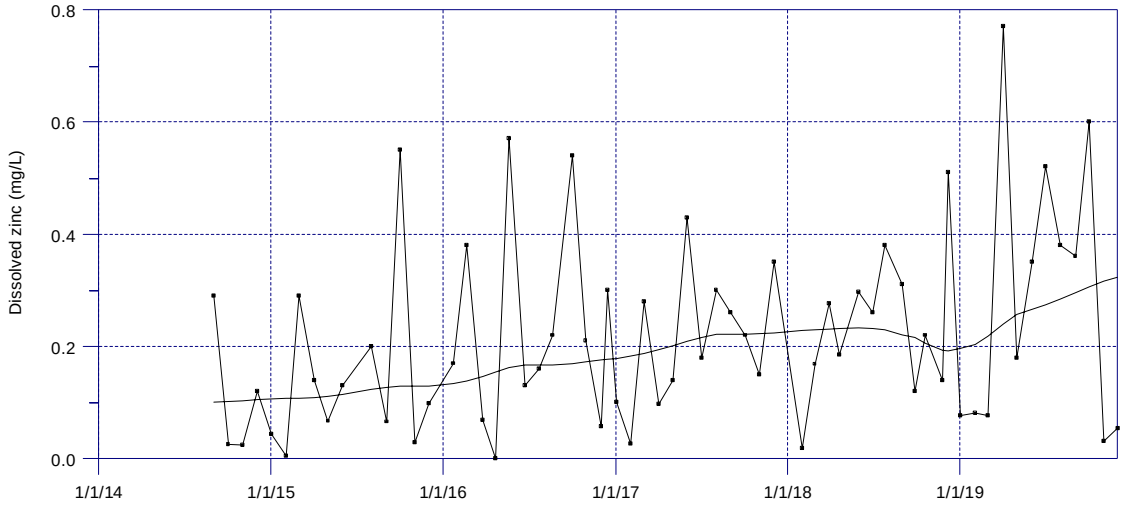

Figure 5. Dissolved zinc levels at the Curletts at Motorway site for the monitoring period September 2014 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A positive (i.e. increasing) trend of 16% was recorded over the sampling period.

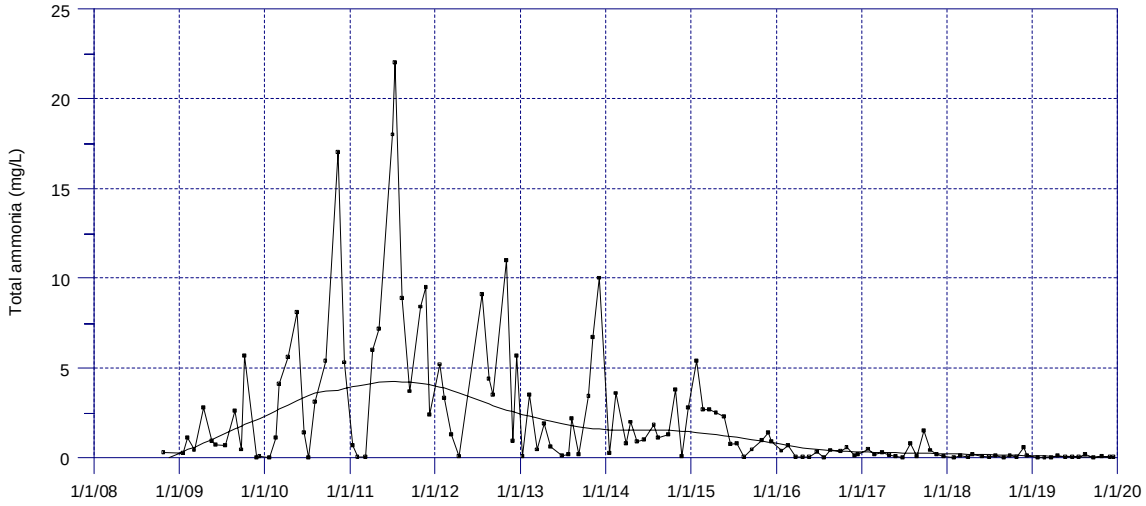

Figure 6. Total ammonia levels at the Halswell Basin Outlet site for the monitoring period October 2008 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A negative (i.e. decreasing) trend of 33% was recorded over the sampling period.

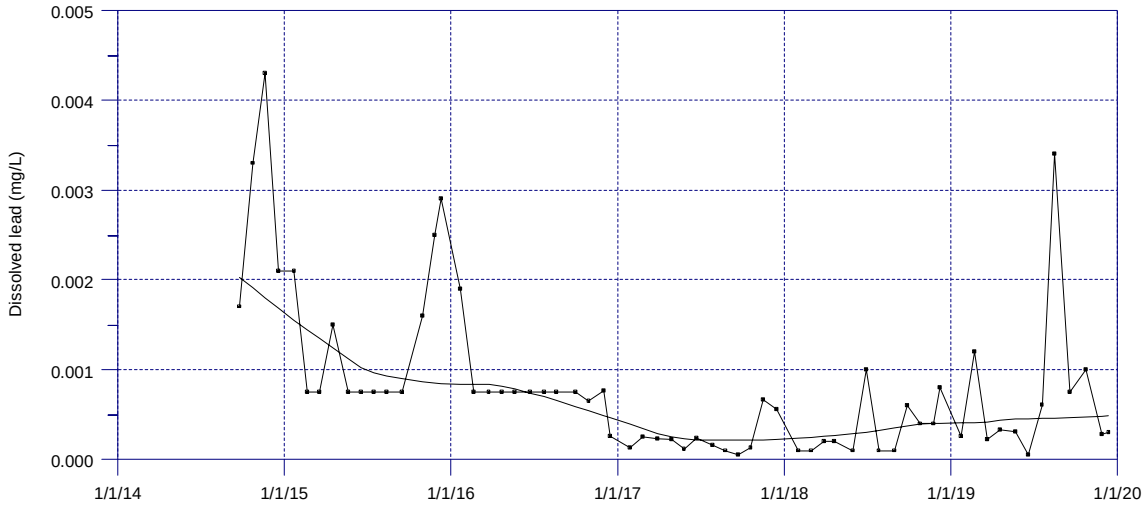

Figure 7. Dissolved lead levels at the Halswell Basin Outlet site for the monitoring period September 2014 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A negative (i.e. decreasing) trend of 28% was recorded over the sampling period.

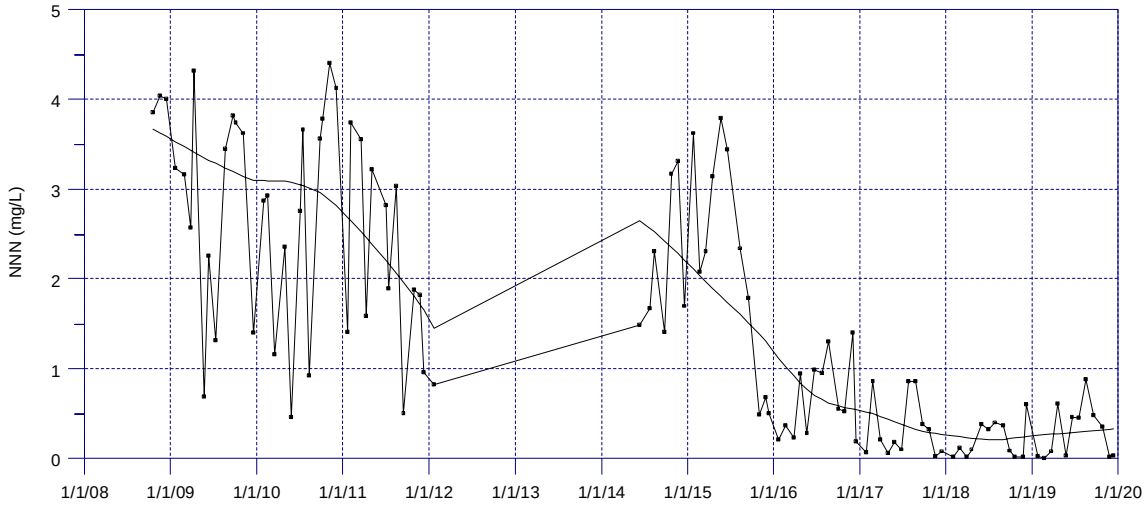

Figure 8. NNN levels at the Curletts at Motorway site for the monitoring period October 2008 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A negative (i.e. decreasing) trend of 31% was recorded over the sampling period. This site was unable to be sampled from February 2012 – May 2014, due to motorway construction.

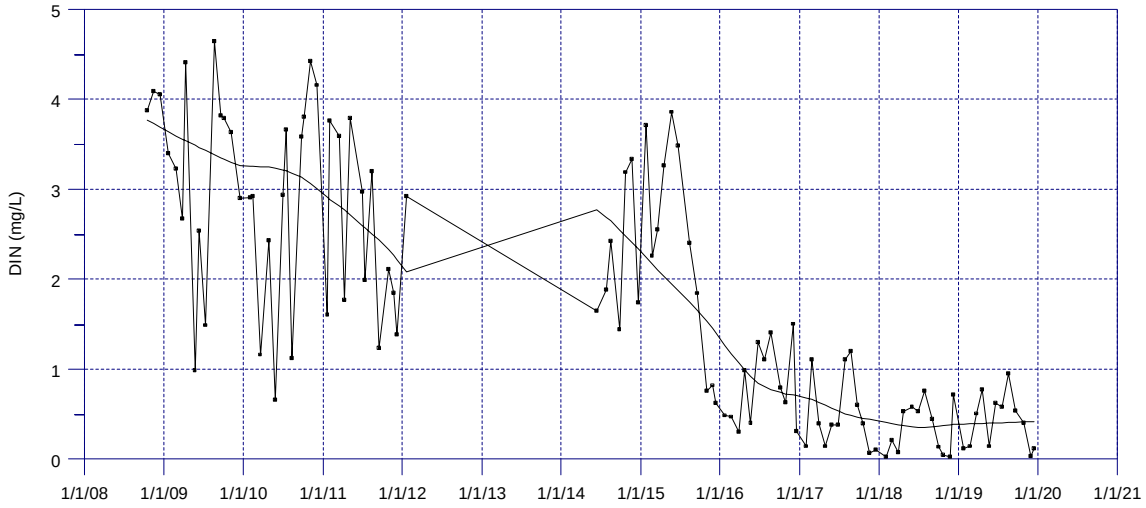

Figure 9. DIN levels at the Curletts at Motorway site for the monitoring period October 2008 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A negative (i.e. decreasing) trend of 24% was recorded over the sampling period. This site was unable to be sampled from February 2012– May 2014, due to motorway construction.

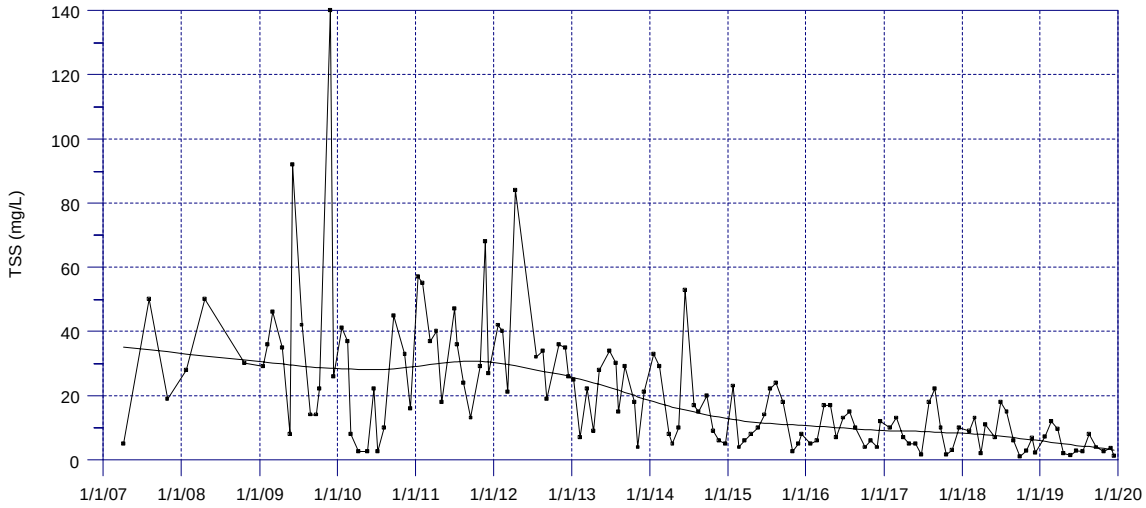

Figure 10. TSS levels at the Halswell Basin Outlet site for the monitoring period April 2007 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. A negative (i.e. decreasing) trend of 20% was recorded over the sampling period.

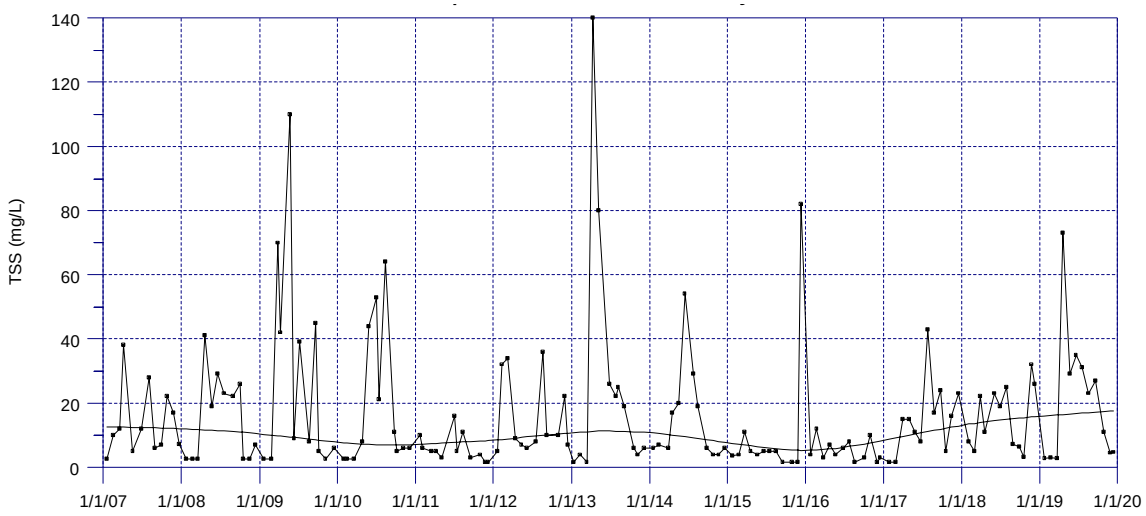

Figure 11. TSS levels at the Cashmere at Worsleys Rd site for the monitoring period January 2007 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. No significant trend was recorded over the sampling period.

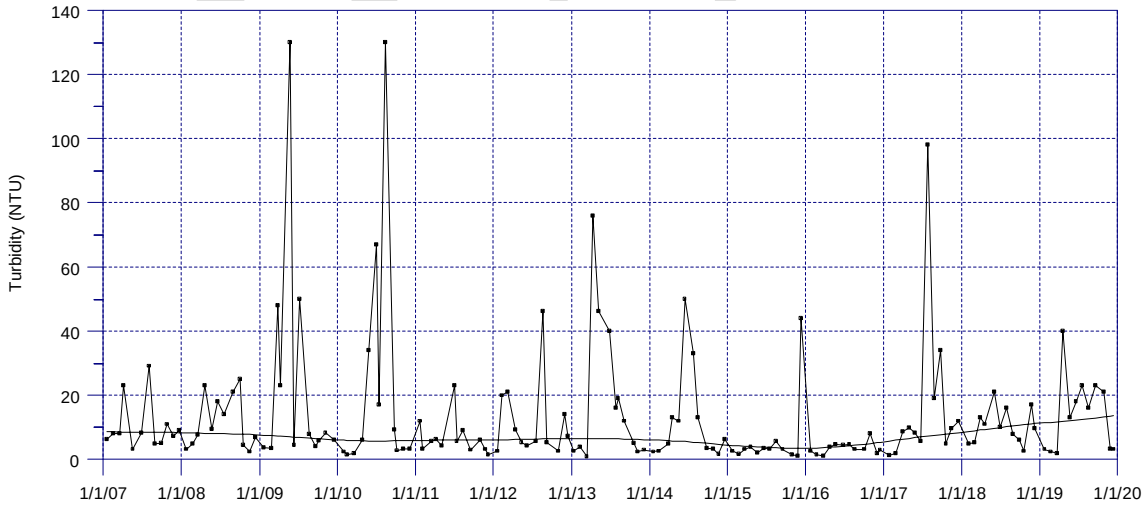

Figure 12. Turbidity levels at the Cashmere at Worsleys Rd site for the monitoring period January 2007 to December 2019. Squares indicate individual sampling events. The trendline was fitted using the Locally Weighted Scatterplot Smoothing (LOWESS) method in the Time Trends software. No significant trend was recorded over the sampling period.

3.3 Water Quality Index

- 59.5%, 23.8% and 16.7% of sites were recorded as having 'poor', 'fair' and 'good' water quality, respectively (Table 4; Figure 13). No site had 'very poor' or 'very good' water quality, the latter being because the guidelines were exceeded on at least one occasion at all sites.
- All catchments generally recorded 'poor' or 'fair' water quality, except the Ōtūkaikino River and the upper Pūharakekenui/ Styx, which recorded 'good' water quality (Table 4; Figure 14).
- The Ōtūkaikino River recorded the best water quality out of all the catchments and Ōpāwaho/ Heathcote catchment recorded the worst water quality (Table 5).
- The best sites for water quality was jointly Styx at Main North Rd and Ōtūkaikino at Scout Camp, followed by Ōtūkaikino at Groynes, and then Smacks at Gardiners Rd (Table 5).
- The worst site for water quality was Curletts at Motorway, followed by Heathcote at Tunnel Rd, and then Haytons Stm and Heathcote at Ferrymead Bridge (Table 5).
- The best fitting statistical model was the 'catchment' and 'year' interaction model, meaning that some catchments, but not all, varied in WQI depending on the year of survey (x^2 = 253.99, d.f.= 35, p<0.0001; Figure 14):
    - Ōtākaro/ Avon: initially showed an improvement in WQI over time, peaking in 2016 with the median WQI in the 'good' category. However, the median has since declined and now falls in the 'poor' category, where it was in 2013.
    - Ōpāwaho/ Heathcote: no improvement in WQI over time, with the median WQI always within the 'poor' category.
    - Huritini/ Halswell: some improvement in WQI over time; however, median WQI has remained in the 'poor' category for all years. The catchment consists of only three sites which may not be a thorough representation of the catchment.
    - Pūharakekenui/ Styx: has recorded an improvement in WQI over time, improving from the 'poor' category in 2013 to 'good' in 2019. However, water quality regressed to the 'poor' category in 2018.
    - Ōtūkaikino: very variable WQI scores over the years, with the median WQI moving between the 'poor' and 'very good' categories. However, this catchment consists of only three sites which may not be a thorough representation of the catchment.
    - Linwood Canal: has recorded no overall improvement in WQI over time, with the median WQI always in the 'poor' category. As this data is from only one site, extrapolation to the entire catchment may not be appropriate.
- Time Trends analysis showed that three sites recorded a significant improvement in WQI over time (Nottingham at Candys Rd, Heathcote at Bowenvale Ave and Cashmere at Sutherlands Rd) and one site recorded a significant decline (Curletts at Motorway) (Table 4).

Table 4. Water Quality Index (WQI) scores at each site for the monitoring period of January to December 2019 and direction of significant trends (p≤0.05) since 2013. Additional water quality categories not represented by sites in 2019 are 'very poor' (0–39.99) and 'very good' (≥90).

Catchment	Site	WQI	Water Quality Category	Change over time
Ōpāwaho/ Heathcote	Curletts at Motorway	41.8	Poor	↓ 5%
Ōpāwaho/ Heathcote	Heathcote at Tunnel Rd	48.4	Poor	
Ōpāwaho/ Heathcote	Haytons Stm	52.6	Poor	
Ōpāwaho/ Heathcote	Heathcote at Ferrymead Bridge	53.3	Poor	
Ōpāwaho/ Heathcote	Curletts U/S of Heathcote	54.3	Poor	
Ōtākaro/ Avon	Addington Brook	55.4	Poor	
Ōpāwaho/ Heathcote	Heathcote at MacKenzie Ave	55.8	Poor	
Ōtākaro/ Avon	Dudley Creek	59.2	Poor	
Ōtākaro/ Avon	Avon at Pages Rd	59.4	Poor	
Ōtākaro/ Avon	Riccarton Main Drain	59.9	Poor	
Linwood Canal	Linwood Canal	61.1	Poor	
Ōpāwaho/ Heathcote	Heathcote at Rose St	61.9	Poor	
Ōpāwaho/ Heathcote	Heathcote at Catherine St	61.9	Poor	
Pūharakekenui/ Styx	Kā Pūtahi at Blakes Rd	63.0	Poor	
Huritini/ Halswell	Halswell at Tai Tapu Rd	64.4	Poor	
Ōtākaro/ Avon	Avon at Bridge St	64.8	Poor	
Ōtākaro/ Avon	Avon at Dallington Tce	64.8	Poor	
Ōtākaro/ Avon	Avon at Carlton Mill	64.9	Poor	
Ōpāwaho/ Heathcote	Heathcote at Opawa Rd	65.0	Poor	
Ōtākaro/ Avon	Avon at Manchester St	66.1	Poor	
Pūharakekenui/ Styx	Kā Pūtahi at Belfast Rd	67.0	Poor	
Ōtākaro/ Avon	Avon at Mona Vale	67.6	Poor	
Ōpāwaho/ Heathcote	Cashmere at Worsleys Rd	68.8	Poor	
Ōtākaro/ Avon	Horseshoe Lake	69.0	Poor	
Huritini/ Halswell	Knights at Sabys Rd	69.1	Poor	
Ōtākaro/ Avon	Avon at Avondale Rd	70.0	Fair	
Huritini/ Halswell	Nottingham at Candys Rd	70.5	Fair	↑ 3%
Ōpāwaho/ Heathcote	Heathcote at Templetons Rd	70.6	Fair	
Ōtūkaikino	Wilsons Stm	73.0	Fair	
Ōpāwaho/ Heathcote	Heathcote at Bowenvale Ave	73.1	Fair	↑ 7%
Ōpāwaho/ Heathcote	Heathcote at Ferniehurst St	75.4	Fair	
Pūharakekenui/ Styx	Styx at Richards Bridge	75.6	Fair	
Ōtākaro/ Avon	Wairarapa Stm	76.9	Fair	
Ōpāwaho/ Heathcote	Cashmere at Sutherlands Rd	77.8	Fair	↑ 3%
Pūharakekenui/ Styx	Styx at Marshland Rd	79.9	Fair	
Pūharakekenui/ Styx	Styx at Harbour Rd	80.3	Good	
Ōtākaro/ Avon	Waimairi StmStream	82.0	Good	

Catchment	Site	WQI	Water Quality Category	Change over time
Pūharakekenui/ Styx	Styx at Gardiners Rd	82.4	Good	
Pūharakekenui/ Styx	Smacks at Gardiners Rd	82.5	Good	
Ōtūkaikino	Ōtūkaikino at Groynes	84.0	Good	
Ōtūkaikino	Ōtūkaikino at Scout Camp	89.0	Good	
Pūharakekenui/ Styx	Styx at Main North Rd	89.3	Good	

Table 5. Best and worst catchments and sites for the monitoring period January to December 2019, based on the Water Quality Index (WQI). Red = Ōtākaro/ Avon River catchment, orange = Ōpāwaho/ Heathcote River catchment, blue = Pūharakekenui/ Styx River catchment, green = Ōtūkaikino River catchment, and purple = Huritini/ Halswell River catchment. Linwood Canal (WQI = 61) is not included as a catchment, as only one site is monitored.

Placing	Best Sites		Worst Sites	
	Catchment Scale	Site Scale	Catchment Scale	Site Scale
	Ōtūkaikino River (median WQI = 84)	Styx at Main North Rd Ōtūkaikino at Scout Camp (WQI = 89)	Ōpāwaho/ Heathcote River (median WQI = 62)	Curletts at Motorway (WQI = 42)
	Pūharakekenui/ Styx River (median WQI = 80)	Ōtūkaikino at Groynes (WQI = 84)	Ōtākaro/ Avon River (median WQI = 65)	Heathcote at Tunnel Rd (WQI = 48)
	Huritini/ Halswell River (median WQI = 69)	Smacks at Gardiners Rd (WQI = 83)	Huritini/ Halswell River (median WQI = 69)	Haytons Stm Heathcote at Ferrymead Bridge (WQI = 53)

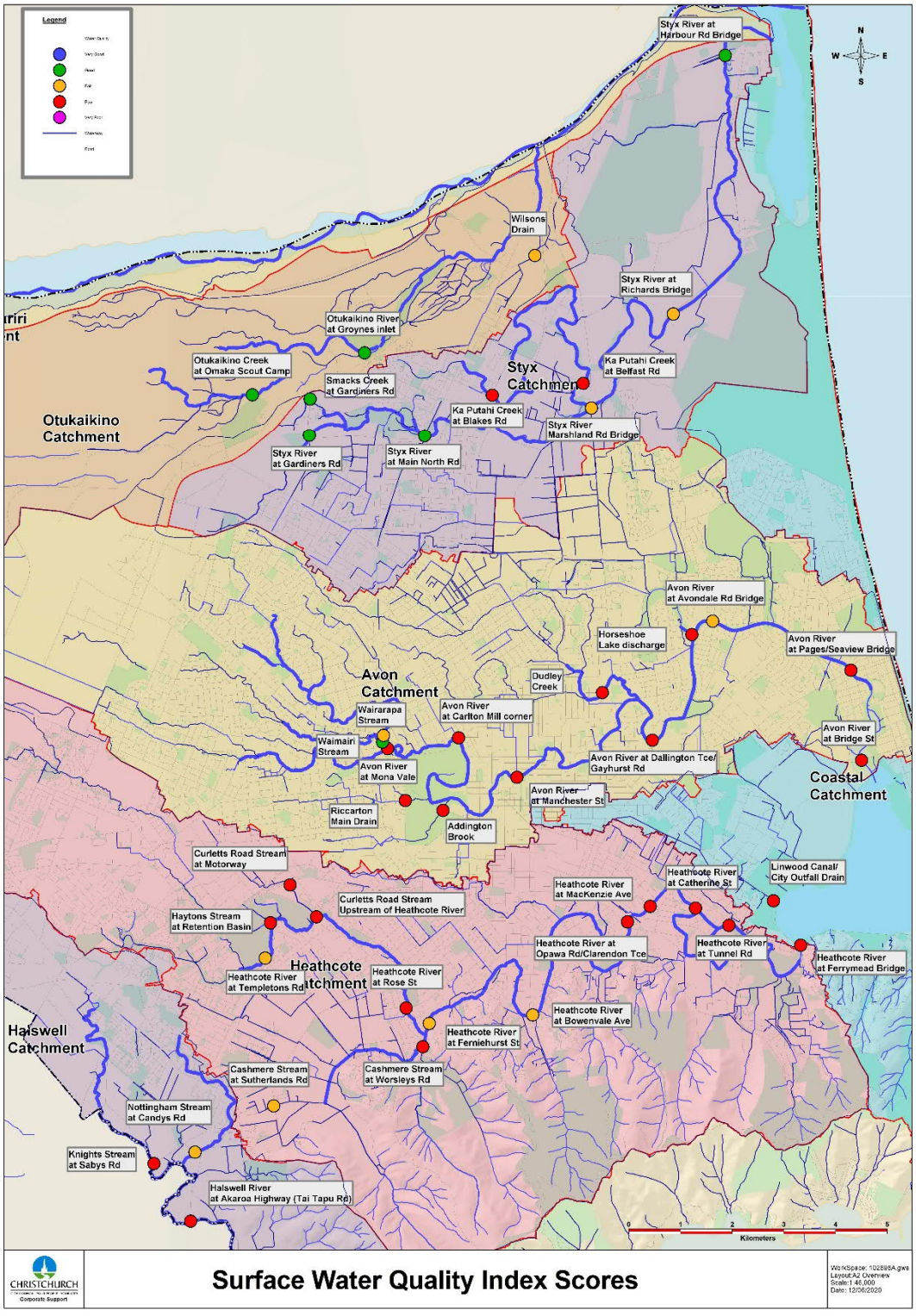

Figure 13. Water Quality Index (WQI) categories for 2019 at the Christchurch City Council water quality monitoring sites. No sites were in the Very Poor or Very Good categories.

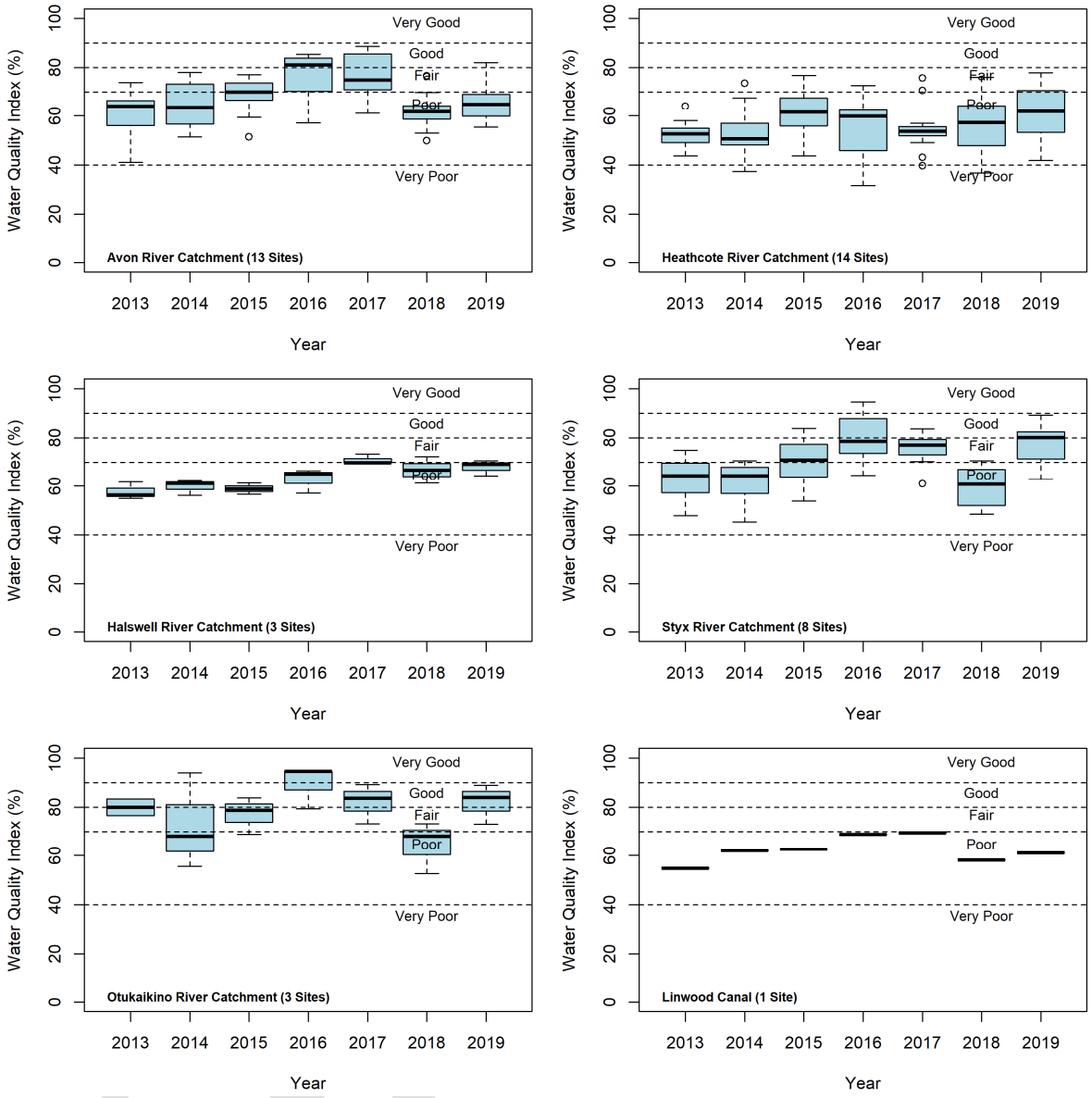

Figure 14. Boxplots of Water Quality Index for each catchment for the 2013 to 2019 monitoring years

4 Results: Wet Weather Monitoring

4.1 Styx River

4.1.1 Rainfall

- The amount of rainfall that had fallen for the first and second wet weather event before samples were taken was 8 mm and 3 mm, respectively (Figure 15).
- Both sampling events therefore occurred during the First Flush (up 25 mm). Both rain events occurred after three dry days (where daily rainfall totals were less than 1 mm). However, the second event did not meet the criteria of a minimum of 5 mm total rainfall depth prior to sampling.
- The levels of parameters for the second event may therefore be lower than what typically occurs in waterways during wet weather.

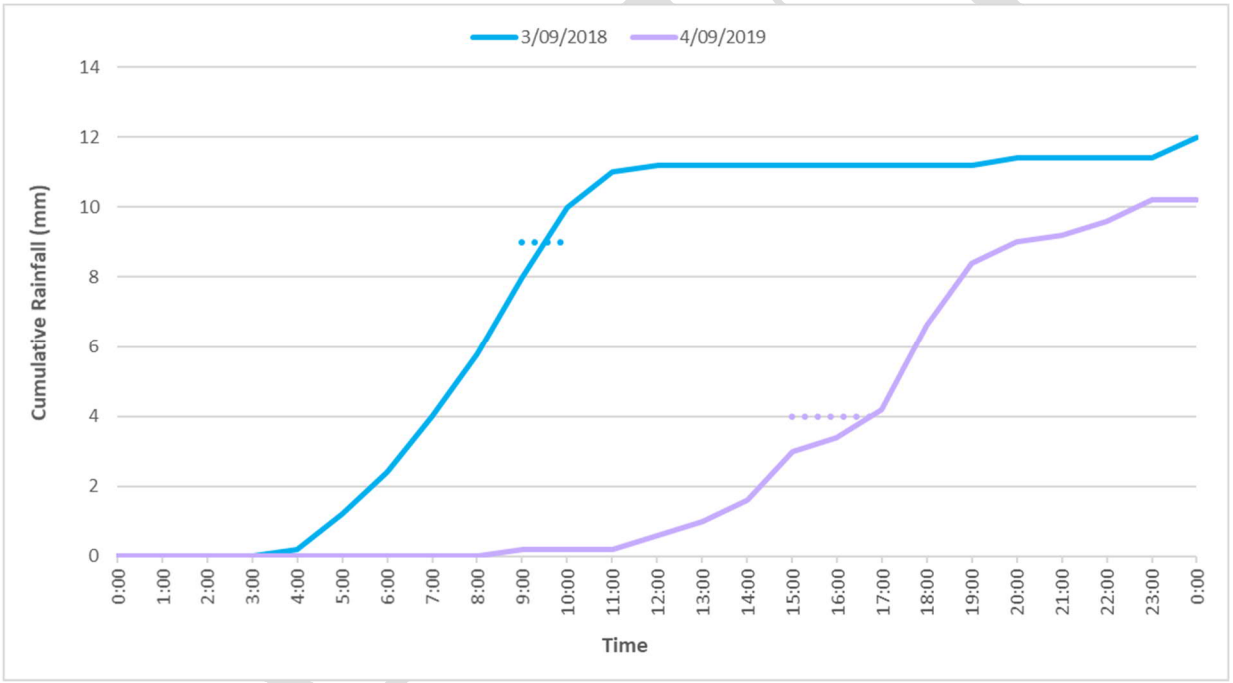

Figure 15. Rainfall during the wet weather events of 3/09/2018 (blue line) and 4/09/2019 (purple line), with approximate sampling times indicated by dotted lines.

4.1.2 Water Quality Parameters

- Parameter concentrations were generally similar between monitoring events (Figures 16–20).
- The guidelines were not met for:
  - TSS at the Styx at Main North Rd and Styx at Marshlands Rd sites during the first event (recording a high value of 190 mg/L – eight times higher than the guideline level)
  - Turbidity at all sites during the first event; levels were particularly high at the Styx at Marshlands Rd site, where a value of 57 NTU was recorded – 10 times higher than the guideline level
  - Dissolved oxygen at Styx at Marshlands Rd during the first event

  - BOD_5 at the Styx at Marshlands Rd site during the first event
  - NNN generally at all sites during both events
  - DRP generally at all sites during both events
  - *E. coli* all sites during the first event and at Kā Pūtahi at Belfast Rd site during the second event. No *E. coli* samples were associated with a recorded wastewater overflow event
- Levels were generally comparable to the monthly monitoring, with the following notable exceptions:
  - TSS levels during the first event at the Styx at Marshlands Rd site were much higher
  - Turbidity at the Styx at Marshlands Rd site during the first event was much higher
  - DO levels were higher at the Smacks at Gardiners Rd site during both events
  - BOD_5 was generally higher at all sites during the first event
  - DRP at the Smacks at Gardiners Rd and Styx at Main North Rd sites were higher during the first event
  - *E. coli* at Styx at Main North Rd during the first event

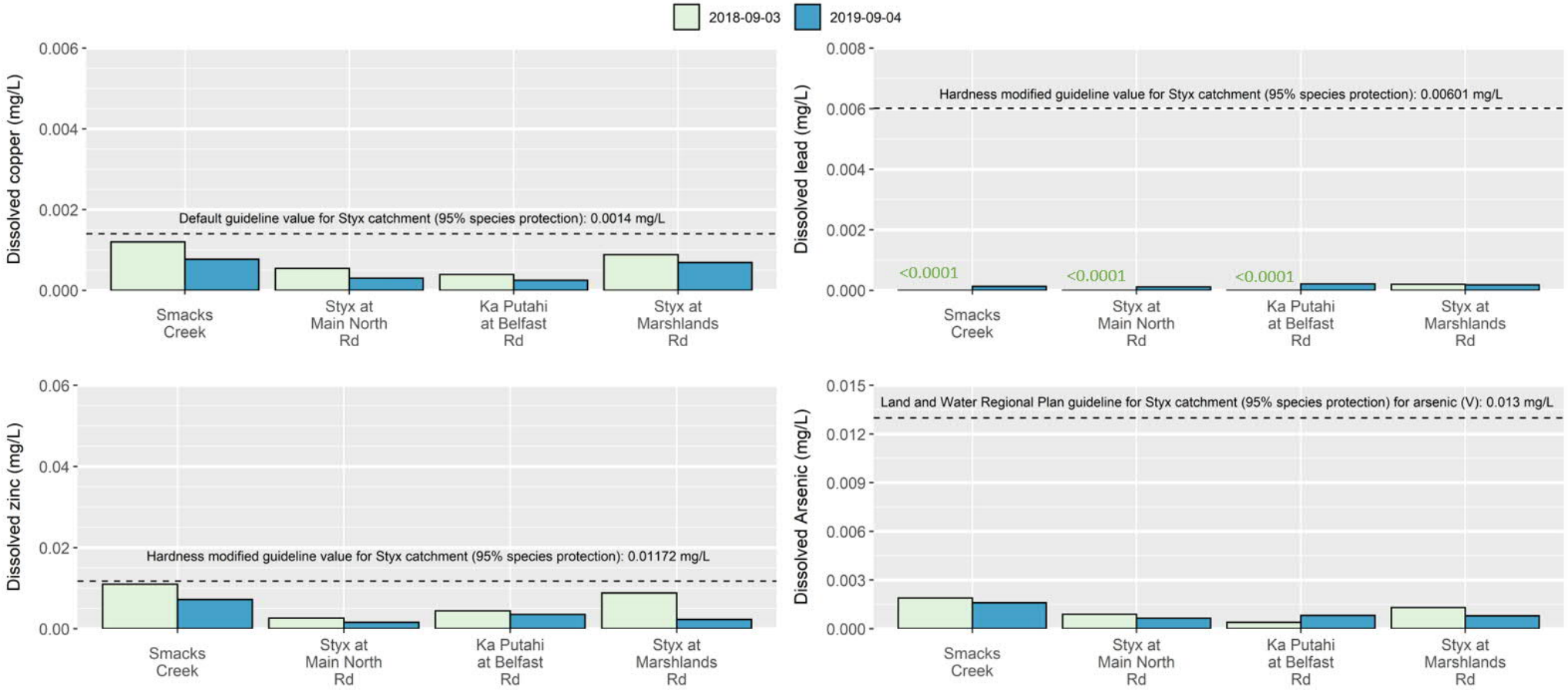

Figure 16. Dissolved copper (top left), lead (top right), zinc (bottom left) and arsenic (bottom right) levels in water samples taken from the Pūharakekenui/ Styx River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent either the 95% default (copper, arsenic) or hardness modified (lead, zinc) guideline values as per the Land and Water Regional Plan (Environment Canterbury, 2019) and Warne *et al.*, (2018).

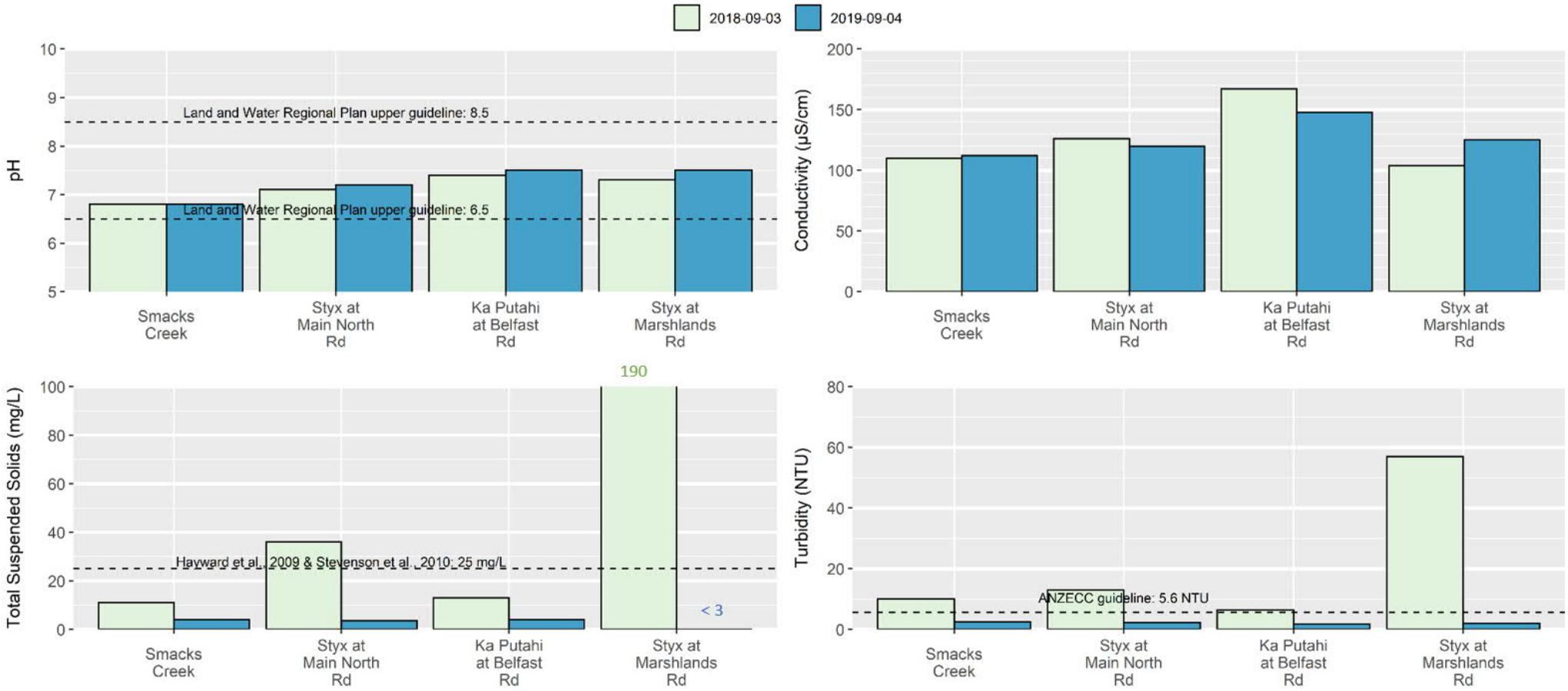

Figure 17. pH (top left), conductivity (top right), Total Suspended Solids (TSS; bottom left) and turbidity (bottom right) levels in water samples taken from the Pūharakekenui/ Styx River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the respective guidelines (pH: Environment Canterbury (2017); TSS: Hayward *et al.* (2009) & Stevenson *et al*. (2010); Turbidity: ANZECC (2000)).

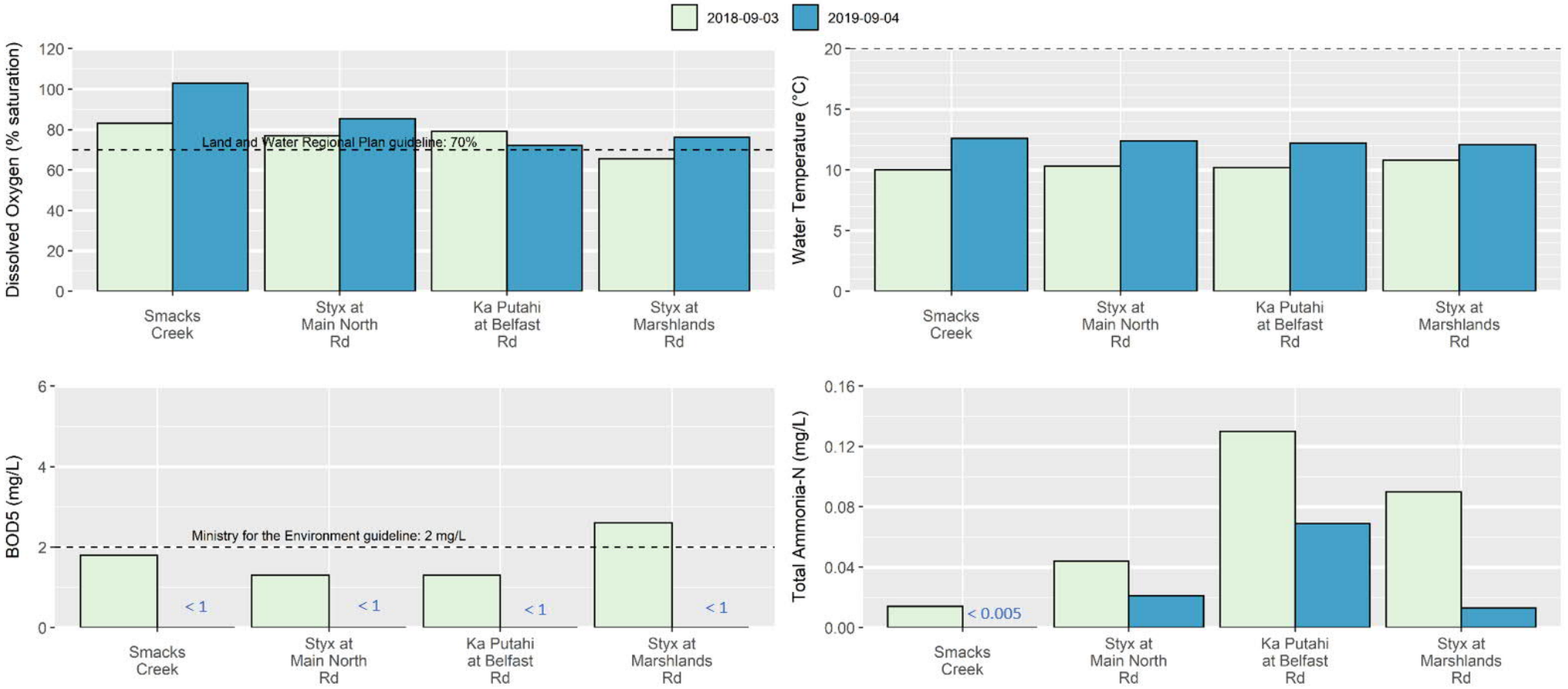

Figure 18. Dissolved oxygen (DO; top left), water temperature (top right), BOD_5 (bottom left) and total ammonia-N (bottom right) levels in water samples taken from the Pūharakekenui/ Styx River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the respective guidelines (DO, water temperature: Environment Canterbury, 2019; BOD_5: Ministry for the Environment, 1992). The guideline value for total ammonia-N, adjusted in accordance with median 2019 pH (7.2; Environment Canterbury, 2019), is not visible as it is off the scale (1.99 mg/L).

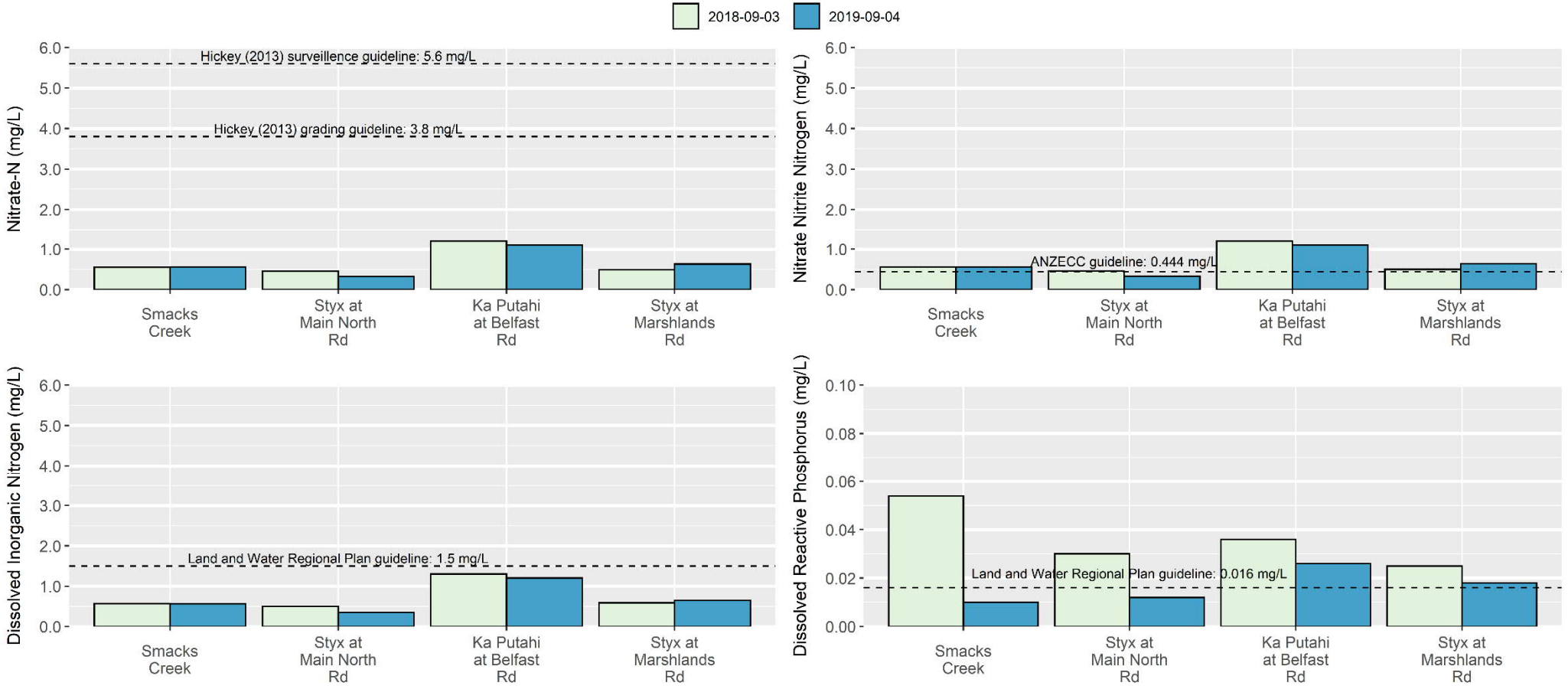

Figure 19. Nitrate-N (top left), Nitrate Nitrite Nitrogen (NNN; top right), Dissolved Inorganic Nitrogen (DIN; bottom left) and Dissolved Reactive Phosphorus (DRP) levels in water samples taken from the Pūharakekenui/ Styx River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the respective guidelines (Nitrate-N: Hickey, 2013; NNN: ANZECC, 2000; DIN, DRP: Environment Canterbury, 2019).

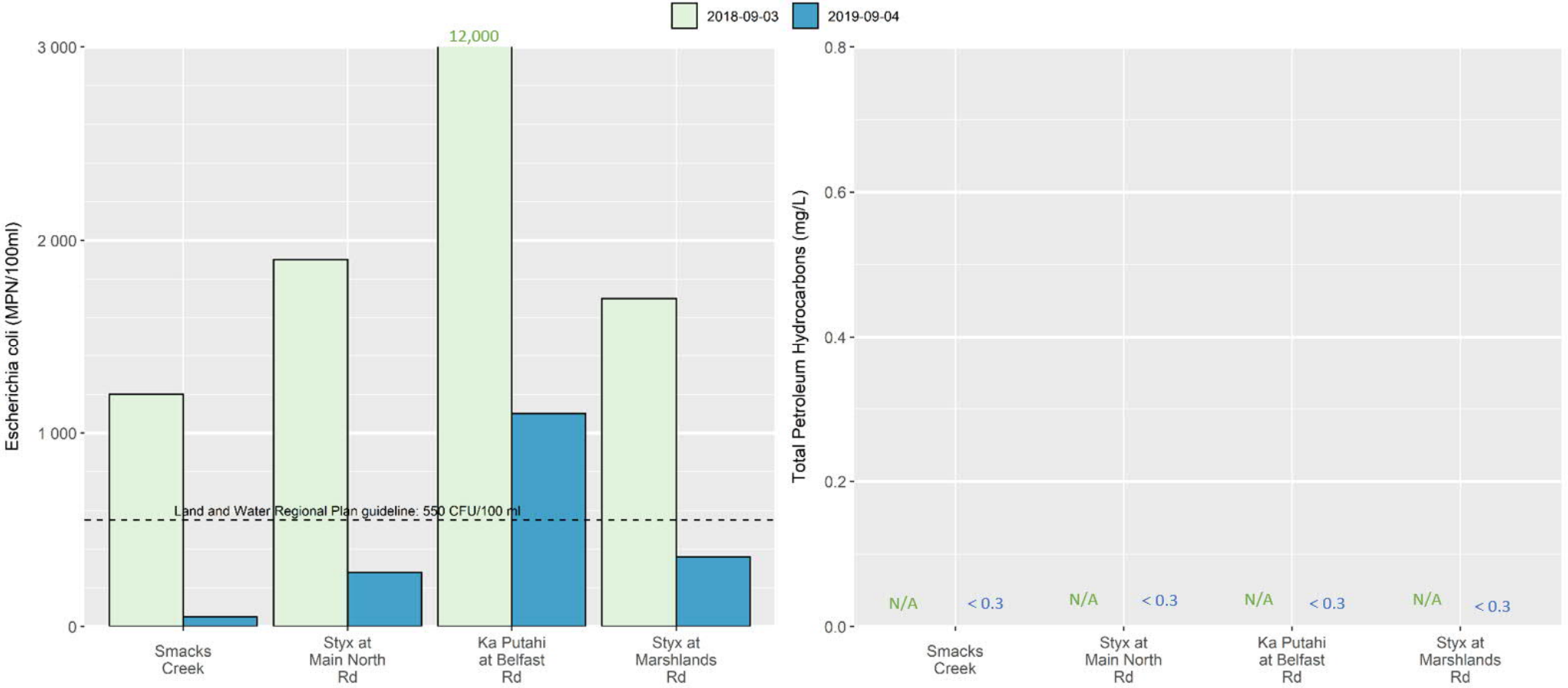

Figure 20. *Escherichia coli* (left) and Total Petroleum Hydrocarbons (TPH; right) levels in water samples taken from the Pūharakekenui/ Styx River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed line represents the Land and Water Regional Plan guideline value of 550 MPN/100ml for 95% of samples for 'spring-fed – plains' waterways (Environment Canterbury, 2019).

4.2 Avon River

4.2.1 Rainfall

- The amount of rainfall that had fallen for the first and second wet weather event before samples were taken was 11 mm and 8 mm, respectively (Figure 21).
- Both sampling events therefore occurred during the First Flush (up 25 mm).
- Prior to sampling the first event, approximately 2 mm of rain was recorded each day for the three days preceding sampling. The second rain event occurred after three dry days (where daily rainfall totals were less than 1 mm).
- Due to the first event not meeting the minimum antecedent dry period, levels may be lower than what typically occurs in waterways during wet weather.

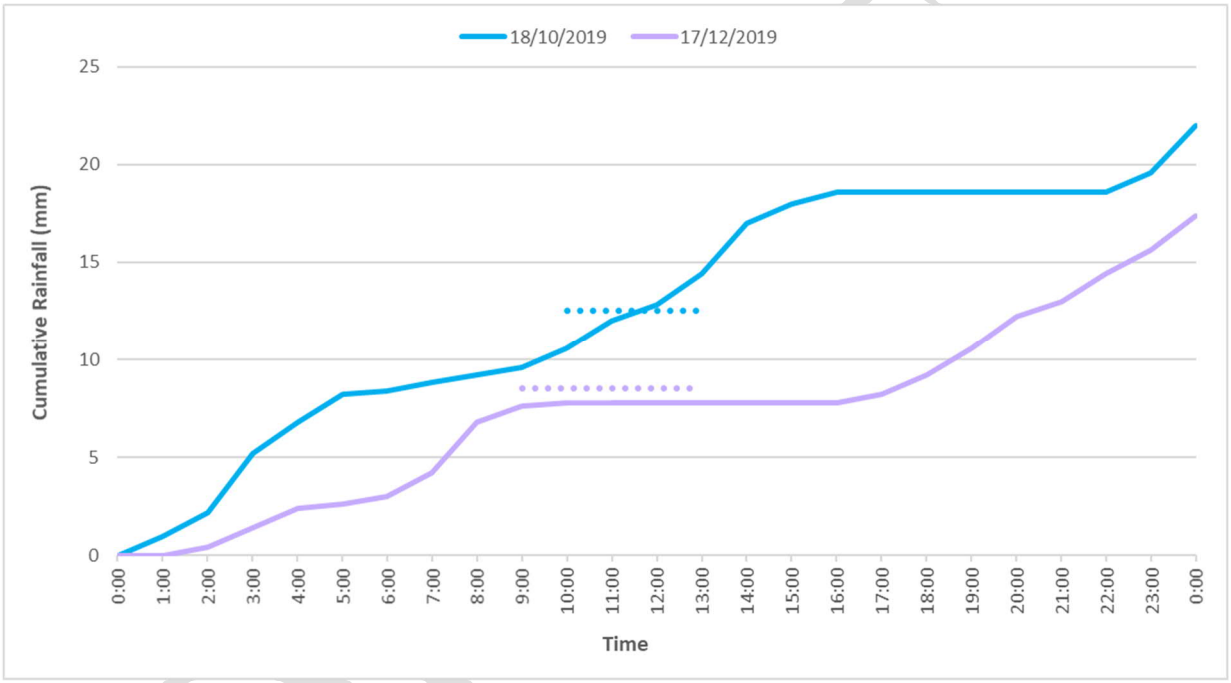

Figure 21. Rainfall during the wet weather events of 18/10/2019 (blue line) and 17/12/2019 (purple line), with approximate sampling times indicated by dotted lines.

4.2.2 Water Quality Parameters

- Parameter concentrations were usually similar between monitoring events, or higher during the second event, depending on the parameter (Figures 22–26).
- No one site typically recorded much higher levels compared to the other sites.
- The guidelines were not met for:
  - Dissolved copper and zinc generally at all sites during both events
  - TSS at the Avon at Carlton Mill and Avon at Manchester St sites during the second event
  - Turbidity generally at all sites during both events
  - Dissolved oxygen at Dudley Creek during the second event
  - BOD_5 generally at all sites during both events
  - NNN generally at all sites during both events
  - DIN at the Avon at Mona Vale site during the second event
  - DRP generally at all sites during both events
  - *E. coli* generally at all sites. No *E. coli* samples were associated with a recorded wastewater overflow event

- Levels were generally comparable to that recorded during the monthly monitoring, with the following exceptions:
  - Dissolved copper was generally higher during both events at all sites
  - Dissolved lead was higher during the first event at the Avon at Mona Vale, Avon at Manchester St and Dudley Creek sites
  - TSS and turbidity levels were higher during both events at Avon at Manchester St
  - BOD_5 was generally higher at all sites during both events
  - Total ammonia levels were higher during the second event at the Avon at Mona Vale, Riccarton Main Drain, Addington Brook and Dudley Creek sites
  - DRP levels were higher during the second event at the Avon at Mona Vale, Riccarton Main Drain and Addington Brook sites
  - *E. coli* levels were higher predominantly during the second event at the Avon at Mona Vale, Addington Brook, Avon at Manchester St, and Dudley Creek sites

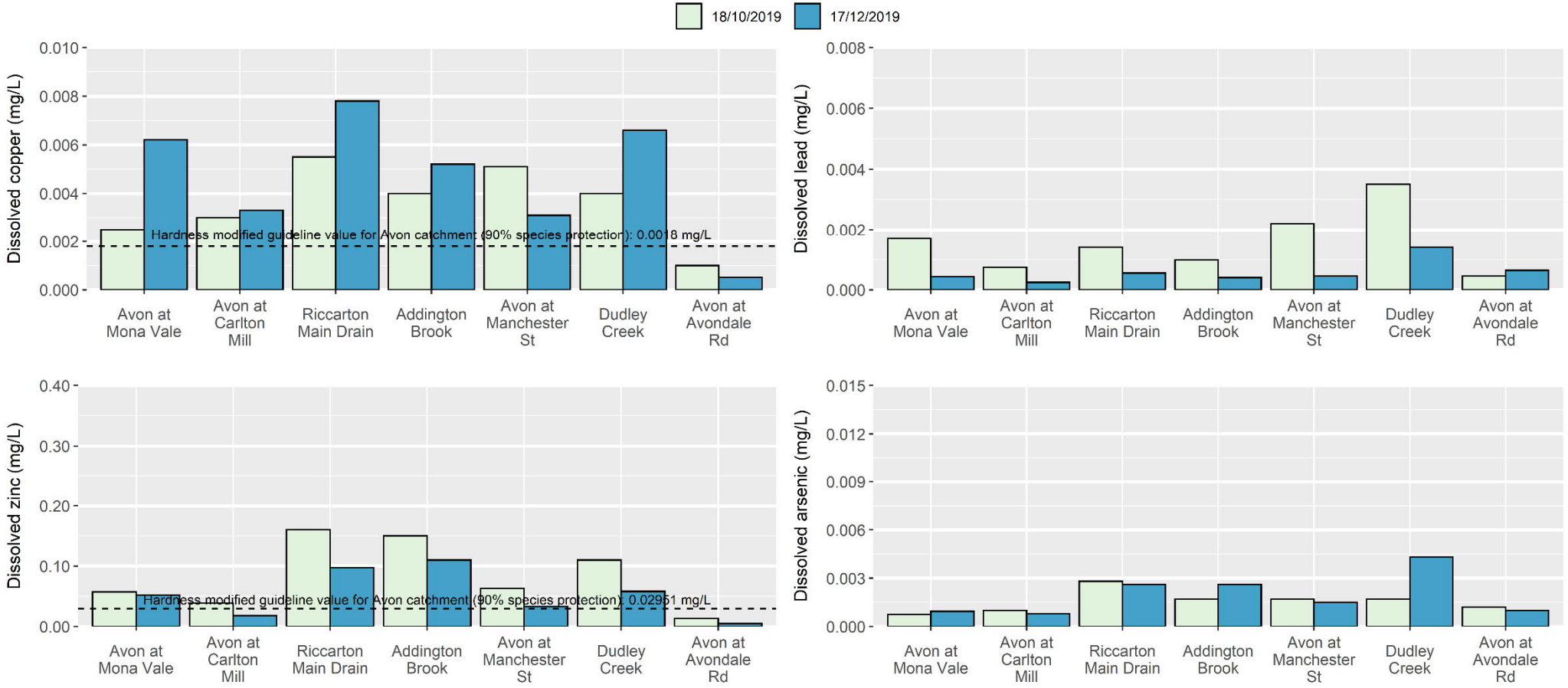

Figure 22. Dissolved copper (top left), lead (top right), zinc (bottom left) and arsenic (bottom right) levels in water samples taken from the Ōtākaro/ Avon River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent either the 90% default (copper) or hardness modified (zinc) guideline values as per the Land and Water Regional Plan (Environment Canterbury, 2019) and Warne *et al.* (2018). The lead (hardness modified: 0.01539 mg/L) and arsenic (V) (default: 0.042 mg/L) guidelines are not visible as they are off the scale.

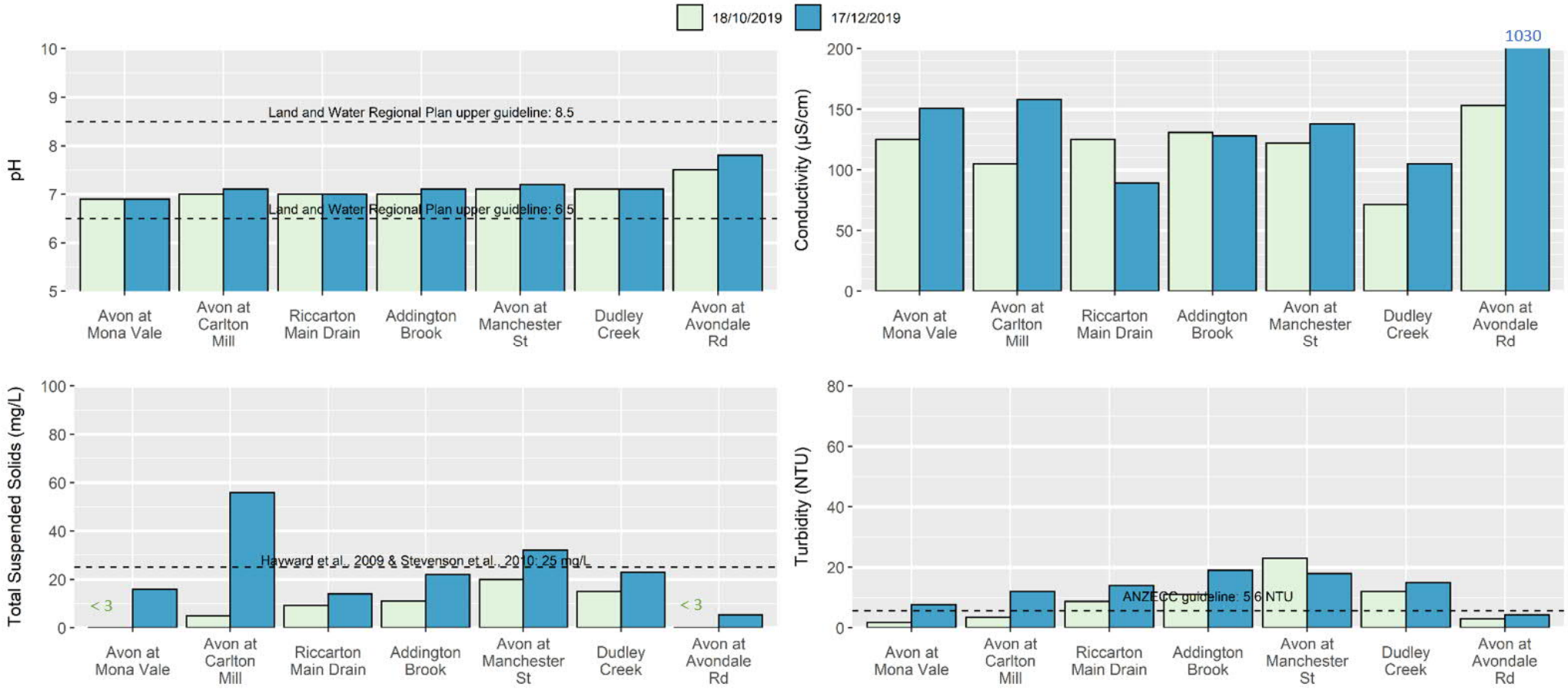

Figure 23. pH (top left), conductivity (top right), Total Suspended Solids (TSS; bottom left) and turbidity (bottom right) levels in water samples taken from the Ōtākaro/ Avon River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the respective guidelines (pH: Environment Canterbury (2017); TSS: Hayward *et al.* (2009) & Stevenson *et al*. (2010); Turbidity: ANZECC (2000)).

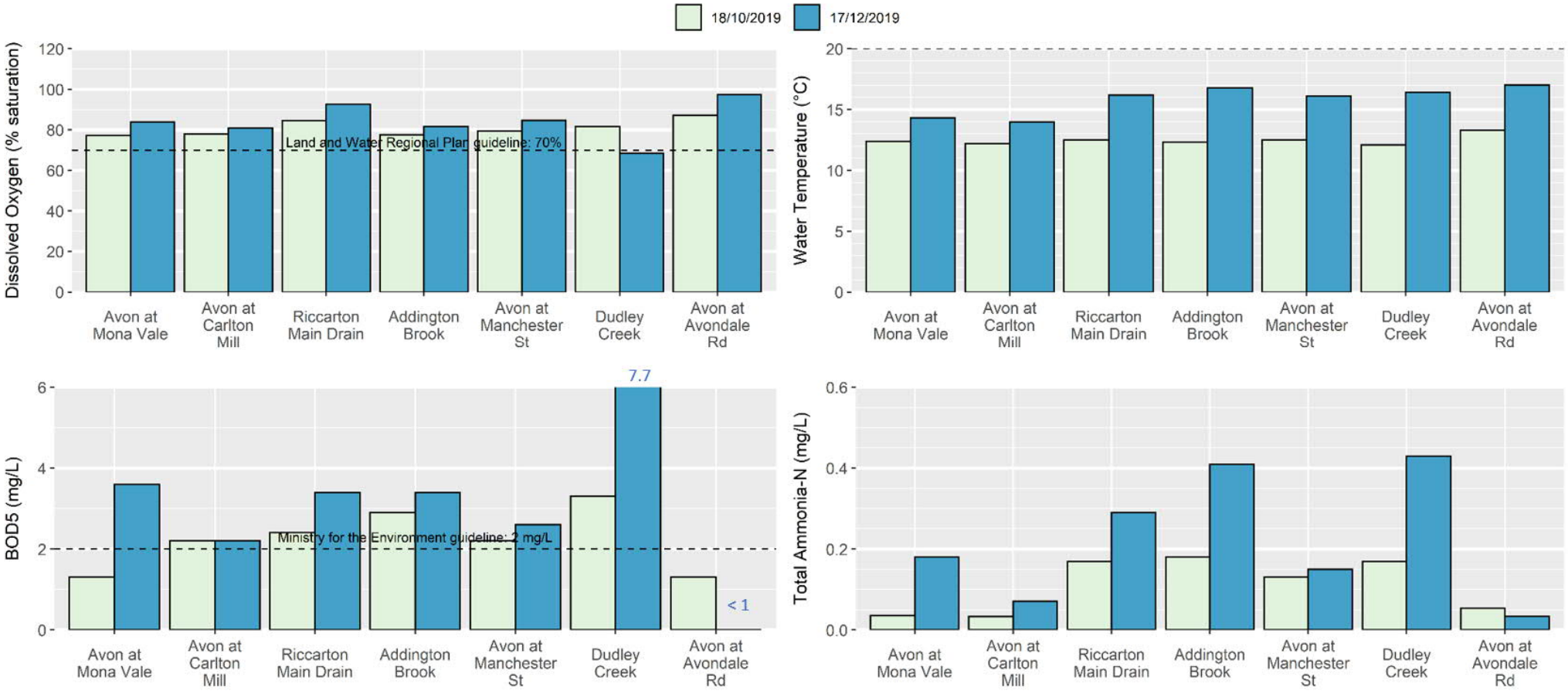

Figure 24. Dissolved oxygen (DO; top left), water temperature (top right), BOD_5 (bottom left) and total ammonia-N (bottom right) levels in water samples taken from the Ōtākaro/ Avon River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the respective guidelines (DO, water temperature: Environment Canterbury, 2019; BOD_5: Ministry for the Environment, 1992). The guideline value for total ammonia-N, adjusted in accordance with median 2019 pH (7.3; Environment Canterbury, 2019) is not visible as it is off the scale (1.88 mg/L).

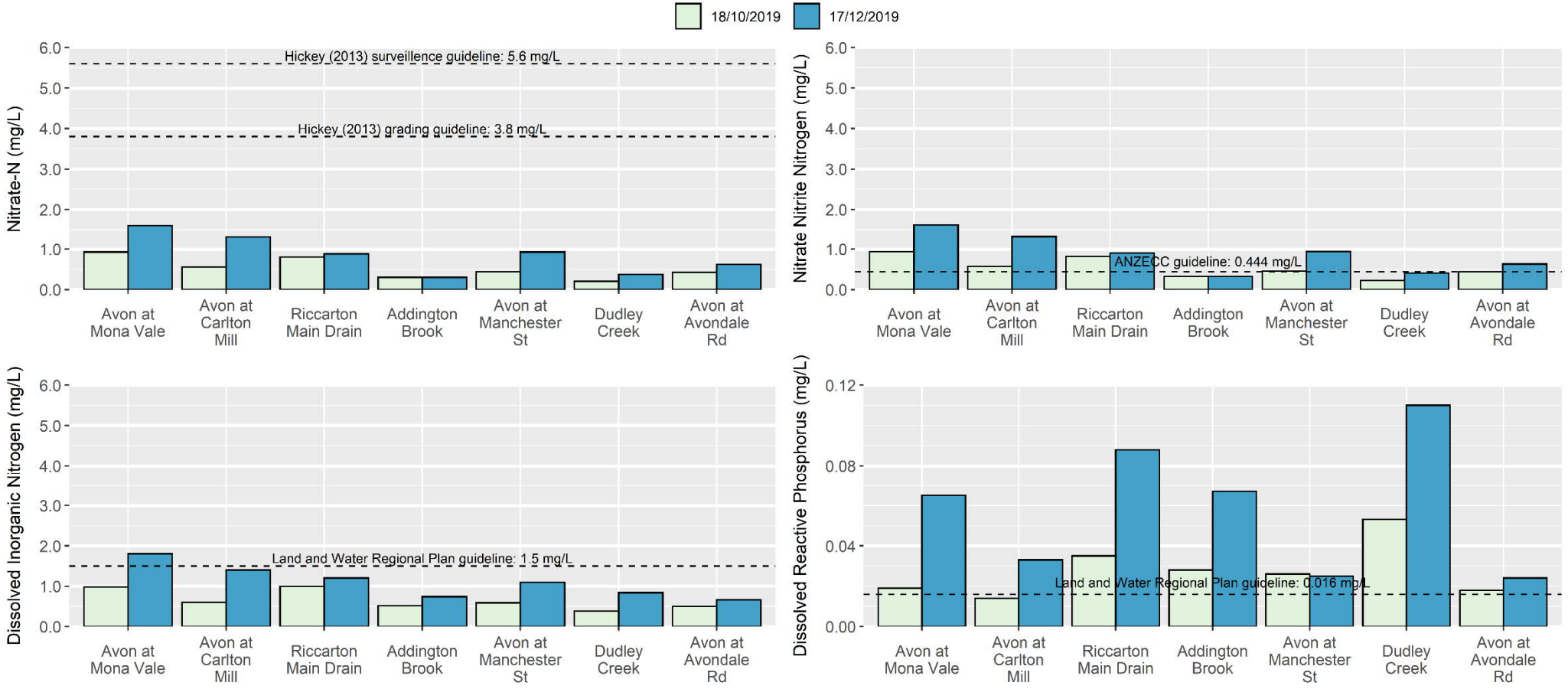

Figure 25. Nitrate-N (top left), Nitrate Nitrite Nitrogen (NNN; top right), Dissolved Inorganic Nitrogen (DIN; bottom left) and Dissolved Reactive Phosphorus (DRP) levels in water samples taken from the Ōtākaro/ Avon River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the respective guidelines (Nitrate-N: Hickey, 2013; NNN: ANZECC, 2000; DIN, DRP: Environment Canterbury, 2019).

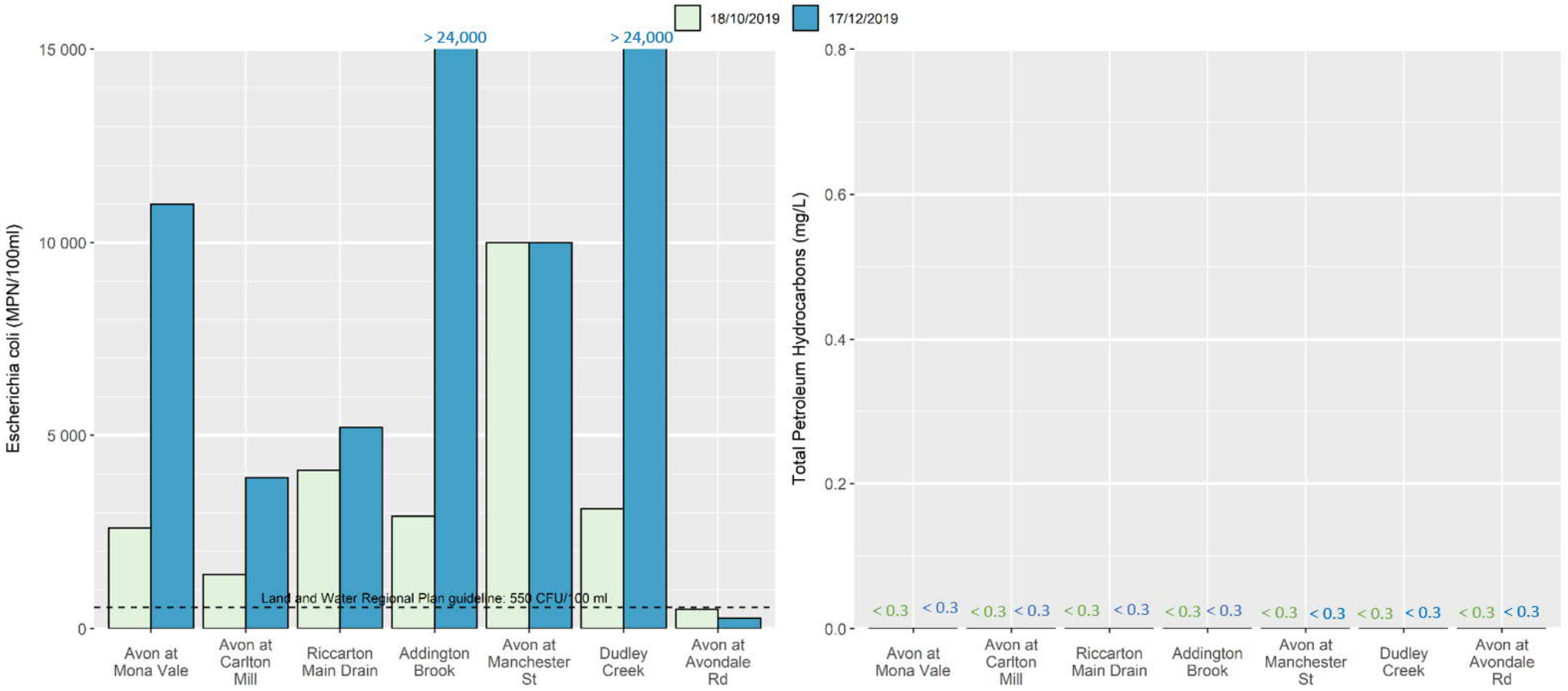

Figure 26. *Escherichia coli* (left) and Total Petroleum Hydrocarbons (TPH; right) levels in water samples taken from the Ōtākaro/ Avon River catchment during two rain events. Sites are ordered from upstream to downstream (left to right). The dashed line represents the Land and Water Regional Plan guideline value of 550 MPN/100ml for 95% of samples for 'spring-fed – plains – urban' waterways (Environment Canterbury, 2019).

5 Discussion

There were several parameters within the waterways that were recorded at levels unlikely to cause adverse effects, including dissolved lead, pH, water temperature, BOD_5, and total ammonia. However, 20% of samples (1,463 of 7,440 samples) did not meet the guideline levels. The parameters that recorded values well outside the guidelines across most sites included dissolved copper, dissolved zinc, NNN, DIN, DRP, and *E. coli*. There were also some parameters that generally recorded levels within the guidelines, but on several occasions, or regularly at a small number of sites, levels exceeded the guidelines. These parameters were TSS, turbidity, dissolved oxygen, and nitrate. The parameters that did not meet guidelines at the most sites were *E. coli* (36 sites), NNN (32 sites), and DRP and dissolved copper (both 23 sites).

The concentrations of parameters at the sites have mostly remained steady over time (64%), but some improvements in water quality were recorded this year (28%) and some declines (8%). The following temporal trends of note were recorded:

- A small decrease in BOD_5, DRP and NNN/DIN, across all catchments.
- An increase in *E. coli* levels at many sites in the Pūharakekenui/ Styx River.
- An increase in nitrogen at the Ōtūkaikino at Scout Camp site. This indicates that there are still some nutrient sources entering the stream, likely due to agricultural land use in the catchment.
- An increase in dissolved copper and zinc at the Curletts at Motorway site and a decrease in nitrogen. An increase in copper and zinc over time is not unusual, especially in an industrial catchment like this, due to increases in traffic volumes (with copper coming from brake pads and zinc from tyres) and degradation of roofs with zinc over time. This is supported by the increase in zinc being due to a gradual change in concentrations over time, rather than sudden peaks in concentrations. This was the first year of monitoring that there was a significant increase in copper at this site. The reason for the decrease in nitrogen is unclear, but may be due to riparian planting that has been carried out by the CCC upstream of the Motorway (due to filtering of runoff from adjacent grassed areas), less input from nitrogen rich groundwater, or more stormwater inputs diluting groundwater.
- Reductions in copper and lead at the Curletts U/S of Heathcote site. The steady decrease in copper may be due to reductions in the source of this contaminant (predominantly brake pads), due to the building of the motorway with related stormwater treatment. However, monitoring began after the motorway construction, so there is no before data for comparison. The reduction in lead may be due to a decrease over time due to the phasing out of leaded petrol.
- A steady increase in ammonia over time within Wilsons Drain, with more peaks in later years. This catchment drains the industrial area of Belfast, so this indicates that ammonia has been reaching the stormwater system from some businesses for some time, with overall concentrations slowly increasing.
- A decrease in DRP at the Cashmere Stream at Sutherlands Rd site, due to a reduction in large peaks since 2014. This is likely due to the gradual urbanisation for this traditionally agricultural catchment (i.e reducing runoff and erosion).
- Reductions in the concentrations of a number of parameters at the Halswell Basin outlet, including dissolved copper, dissolved lead, TSS, ammonia, BOD_5, DIN and DRP. There was a small reduction in TSS recorded over time at the inlet also, so the large reduction of TSS at the outlet may be a combination of less inputs into the basin and increased treatment efficiency over time for the basin. No alterations have been made to the basin since its construction; however, increased efficiency may

have occurred through the maturation of vegetation around the basin. The reduction in copper and lead at the outlet may be due to the increased TSS removal efficiency, as a proportion of metals adsorb to sediment and there were no significant reductions in these contaminants at the inlet. As there was a large decrease in ammonia at the inlet, and the basin is a wet pond not likely to treat these contaminants, it may be that inputs into the catchment of this parameter have reduced overall. As ammonia makes up a proportion of DIN, it is likely the reduction in DIN at both the inlet and outlet is due to the reduction in ammonia, with trends between the two parameters also similar over time. In contrast, the reductions in ammonia and DIN may be related to less waterfowl inputs over time, again due to the maturing of vegetation preventing access to the pond. This would also explain the reduction in BOD_5 (at both the inlet and outlet), DRP (at both the inlet and outlet), *E. coli* at the inlet and ammonia at the inlet as well as the outlet. Even though it was expected that lead inputs would have reduced over time since the phasing out of leaded petrol, this parameter still occurs within the basin, with the highest level recorded this monitoring year since monitoring began in 2014. This may indicate an industrial source within the catchment.

The results of the temporal trends do not indicate that there have been any lasting effects on sediment levels in the water at these monitoring sites due to (1) the 2010 Christchurch earthquake sequence, or (2) the 2017 Port Hills fires and subsequent erosion. However, TSS and turbidity may be trending towards a significant increase over time at Cashmere at Worsleys Rd, and this should be assessed in next year's report. In addition, sediment cover and depth of the streambed may have increased due to these two events, and this is not covered by this water quality monitoring programme but addressed by other aquatic ecology monitoring undertaken by the CCC.

In 2019, major instream projects such as dredging and bank stabilisation occurred in the Ōpāwaho/ Heathcote River. Separate monitoring for these projects showed that high TSS and turbidity levels occurred due to the dredging works. In this monitoring, much higher conductivities were recorded at the three lower Ōpāwaho/ Heathcote River sites this year, compared to last year, and this is likely to be due to the dredging. Atypically high dissolved lead levels were also recorded at these sites during the latter part of the year, with sample collection coinciding with periods of dredging. However, these increases did not result in any significant change in parameters since monitoring began, with the exception of conductivity at the Heathcote at Catherine St site.

Based on the WQI, the Ōtūkaikino and Pūharakekenui/ Styx River catchments generally had 'good' water quality; however, all other catchments generally had 'poor' water quality. The Ōtūkaikino River recorded the best overall water quality out of all the catchments, but the best site was shared between the Ōtūkaikino at Scout Camp and Styx at Main North Rd sites, followed by the Ōtūkaikino River at Groynes site, and then the Smacks at Gardiners Rd site. The catchment recording the worst water quality was Ōpāwaho/ Heathcote River. The worst sites were in this catchment, at the Curletts at Motorway, then Heathcote at Tunnel Rd, followed jointly by Haytons Stm and Heathcote at Ferrymead Bridge sites. There were a number of contaminants of particular concern at the Curletts at Motorway (copper, zinc, DO, DRP, *E. coli*), Heathcote at Tunnel Rd (TSS, turbidity, NNN, DRP), Haytons Stm (copper, zinc, turbidity, DRP) and Heathcote at Ferrymead Bridge (TSS, turbidity, NNN, DRP) sites.

Most catchments showed improvement in the WQI compared to 2018, with seven sites in the 'good' category, up from zero in 2018. Improvement of these seven sites is largely due to a decrease in the number of parameters exceeding the guideline, particularly for

pH and DRP, but also copper, zinc, TSS, DO, temperature, BOD_5, and *E. coli*. Differences in rainfall alone cannot explain the reduced number of exceedances observed this year. Compared to 2018, the number of rainfall events varied by only ± 1. Significant increases in WQI scores over time were recorded at Nottingham at Candys Rd, Heathcote at Bowenvale Ave and Cashmere at Sutherlands Rd. However, the Curletts at Motorway site WQI significantly declined over time.

The six waterway sites located in proximity to main stormwater outfalls did not appear to record differing results compared to the other waterway sites. This could be due to (a) many of the other sites also being located near other outfalls, (b) the monthly monitoring not often being carried out during the early stages of a wet weather event (when the 'first flush' of contaminants typically occurs), or (c) stormwater not having any noticeable effects in these locations. The exception to this was Curletts at Motorway, which generally recorded worse levels of contaminants than other waterway sites (for copper, zinc, pH, dissolved oxygen, BOD_5 and DRP). Haytons Stm also recorded higher levels of copper, zinc, pH, BOD_5, and DRP compared to the other waterway sites, as Avon at Mona Vale did occasionally for TSS.

The two Halswell Basin sites (inlet and outlet) generally recorded higher concentrations of parameters than the waterway sites. In particular, the basin recorded higher levels of copper, zinc, pH, TSS, BOD_5, and total ammonia. This is to be expected given the predominantly industrial stormwater input into the basins and that the waterways are subjected to dilution from baseflow. The outlet generally recorded lower levels than the inlet. Lower levels at the outlet might be due to the treatment ability of the basin, but as these samples were taken at the same time, it may be a reflection that peak contaminant levels had not reached the outlet yet. Of note, pH levels were very high at both the inlet and outlet. Previously only the outlet levels were elevated, and it was thought that basin processes were causing basic conditions. This years' results indicate that there may be processes higher in the catchment creating the basic conditions. Overall, these monitoring results for the basin are similar to those recorded in previous years (e.g. Margetts & Marshall, 2015; Margetts & Marshall, 2016; Margetts & Marshall, 2018; Marshall & Burrell, 2017; Marshall & Noakes, 2019).

Wet weather monitoring in the Ōtākaro/ Avon and Pūharakekenui/ Styx River catchments was generally similar to the monthly monitoring. However, there were a number of exceptions for many parameters across many sites. The most widespread exceptions were higher levels in the wet weather monitoring for BOD_5 in both catchments and higher copper levels in the Ōtākaro/ Avon River catchment. As the main source of copper is from brake pads, these higher concentrations than the monthly monitoring are likely due to stormwater input from roads and carparks.

The results of this year's monitoring are largely consistent with those recorded in previous years (Dewson, 2012; Dewson, 2013; Whyte, 2013a; Whyte, 2013b; Whyte, 2014a; Whyte, 2014b; Margetts, 2014a; Margetts & Marshall, 2015; Margetts & Marshall, 2016, Marshall & Burrell, 2017; Margetts & Marshall, 2018, Marshall & Noakes, 2019). This indicates that many of Christchurch's waterways are both historically and currently subjected to contamination, from stormwater, wastewater and other inputs (e.g. agriculture, waterfowl faeces and industrial discharges). These parameters may be having short-term and long-term adverse effects on biota (i.e. DIN, copper, zinc, TSS/turbidity, dissolved oxygen and BOD_5), may encourage the proliferation of aquatic plants and/or algae (i.e. NNN and DRP), may indicate human health risks from contact recreation (i.e. *E. coli*) and may affect water clarity/aesthetics (TSS/turbidity). These results support the international Urban Stream Syndrome (Walsh *et al*., 2005), whereby

lower water quality is recorded internationally in urban (particularly industrial) areas (e.g. Ōtākaro/ Avon and Ōpāwaho/ Heathcote River catchments) and generally better water quality is recorded in rural areas (e.g. Ōtūkaikino River catchment).

The sites and parameters of concern in this report should be the focus of improved catchment management practices by CCC, ECan and landowners themselves. The CCC has recently been granted a new stormwater consent for the City and Banks Peninsula, the Comprehensive Stormwater Network Discharge Consent (CSNDC). This consent will give the Council better focus and directive to tackle surface water quality issues within its jurisdiction. Past, current and future practices to improve stormwater quality include source control (e.g., erosion and sediment control measures, redirection of stormwater to trade waste), more effective stormwater treatment devices and community education. For example, CCC are constructing a number of stormwater basins for the purpose of flood mitigation and stormwater treatment. CCC also work with ECan to audit business in key catchments, helping reduce the amount of contaminants entering the stormwater system. Implementation of new regional and national policy will also support these measures. Due to all this, surface water quality improvements are anticipated across the City, but may only occur over long time scales, due to the size of the issue and the lag in benefits. Further monitoring and targeted management is still required to address the water quality issues detailed in this report.

6 Recommendations

- Haytons Stream and Curletts Road Stream should remain as the top priority areas for improved contaminant source control and stormwater treatment, followed by the middle tributaries of the Ōtākaro/ Avon River (Riccarton Main Drain, Addington Brook and Dudley Creek):
  - CCC and ECan should continue working with landowners to reduce contaminants entering stormwater systems or waterways directly. Industrial site audits are proving a good avenue for targeting key contaminant sources and increasing education around stormwater.
  - CCC should undertake detailed effectiveness monitoring of the two stormwater treatment facilities recently upgraded in Haytons and Curletts Streams (Haytons Retention Basin and Wigram Basin). Monitoring of Wigram basin is currently proposed within the stormwater device efficiency monitoring project of the CSNDC, in conjunction with ECan and the University of Canterbury.
  - Haytons and Curletts Road Streams should remain the priority for the targeted wet weather monitoring project under the CSNDC, which aims to pin point hotspots of contaminants within these catchments, to inform catchment management practices. With time and if resources allow, the project should extend to the Ōtākaro/ Avon River tributaries.
  - The recommendations within the ECan catchment management plan for Addington Brook and the Haytons Stream Action Plan should be undertaken.
  - Stormwater treatment by the large CCC facilities proposed for Addington Brook and Riccarton Stream should be prioritised.
- Investigations into the sources of particularly poor water quality in non-priority catchments should be carried out for the following waterways, based on this and previous year's results:
  - Linwood Canal (DO, total ammonia, DRP, and *E. coli*).
  - Wilsons Stream (ammonia, nitrogen, and *E. coli*)
  - Cashmere at Worsleys Rd (TSS/turbidity). This is particularly important given the high concentration of threatened kākahi/freshwater mussels located in

Cashmere Stream (Instream Consulting Ltd, 2020; Marshall 2019, *unpublished data*).
    - Heathcote at Templetons Road and Knights Stream (nitrogen)
    - Kā Pūtahi Creek and other sites within the Pūharakekenui/ Styx River catchment, and Nottingham Stream (*E. coli*)
    - Ōtūkaikino River at Scout Camp (NNN), although this may be due to the short monitoring period (approximately five years), compared to the other sites, with the significant annual increase decreasing each year (46% in 2017, 25% in 2018, and 18% in 2019).
- Investigations into the sources of phosphorus in the catchments should be carried out to identify the major source that is increasing downstream (e.g. fertilisers or faecal input).
- A long-term monitoring program is established to investigate changes in conductivity and salinity in the lower Ōpāwaho/ Heathcote River in response to dredging, and any resultant changes in biota and riparian vegetation.
- Investigations should be carried out to identify how best to reduce faecal contamination within the waterways, particularly with the public interest in swimmable rivers. Faecal source tracking has indicated that waterfowl are a major source of faecal contamination during dry and wet weather (Moriarty & Gilpin, 2015), but waterfowl control within the city may be unpopular with some people.
- Monitoring of Halswell Retention Basin is retained under the CSNDC stormwater device efficiency monitoring project, as it is no longer to be monitored under this surface water quality programme. This monitoring should include investigations into the high pH typically recorded in the basin.
- A Waterways Action Plan should be developed that considers collectively what we want to achieve for our waterways (this may vary between different people) and what is required to get there. For example, an improvement in stormwater quality may not result in an increase in biodiversity, due to other habitat limitations.

7 Conclusions

Christchurch City waterways generally recorded a WQI of ‘poor’ this monitoring year. The Ōpāwaho/ Heathcote River catchment recorded the poorest water quality, and the worst site was Curletts at Motorway, followed by Heathcote at Tunnel Rd, Haytons Stm and Heathcote at Ferrymead Bridge. The Ōtūkaikino River catchment recorded the best water quality and the best site was shared between the Ōtūkaikino at Scout Camp and Styx at Main North Rd sites. WQI largely did not change over time. The contaminants that exceeded guidelines at the most sites were *E. coli*, nitrogen, phosphorus and dissolved copper. The concentrations of all parameters have mostly remained steady over time, with some improvements and declines in water quality. The results of this year’s monitoring are largely consistent with previous years.

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Appendix A: Laboratory Methods and Limits of Detection

Table i. Laboratory methods used over time to calculate parameter concentrations. N/A = Not Applicable.

Group	Parameter	Limit of Detection	Date	Analysis Method
Metals	Total copper	<0.001 mg/L	1 July 2018 - current day	APHA 3125 B modified, (Varian7900 ICP- MS). Digestion APHA 3030 E
		Varies between <0.001- <0.005 mg/L	5 May 2016 - 30 June 2018	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters. Digestion APHA 3030 E
		Varies between <0.001- <0.005 mg/L	Sampling instigation – 4 May 2016	
	Dissolved copper	<0.0001 mg/L	October 2016 - current day	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters
		<0.002 mg/L	December 2008 – September 2016	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters
		<0.004 mg/L	2007 - November 2008)	Graphite furnace (GFAA - graphite furnace atomic absorption, Varian) using acid washed GF/F filters
	Total lead	<0.001 mg/L	1 July 2018 - current day	APHA 3125 B modified (Varian7900 ICP- MS). Digestion APHA 3030 E
		Varies between <0.004 - <0.0015 mg/L	Sampling instigation - 30 June 2018	APHA 3125 B modified (Varian7900 ICP- MS). Digestion APHA 3030 E
	Dissolved lead	<0.0001 mg/L	October 2016 - current day	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters
		<0.0015 mg/L	December 2008 - September 2016	APHA 3125 B modified (Varian7900 ICP- MS), using nylon 0.45um filters. Digestion APHA 3030 E
		<0.006 mg/L	2007 - November 2008	APHA 3125 B modified (Varian7900 ICP- MS), using nylon 0.45um filters. Digestion APHA 3030 E
	Total zinc	<0.005 mg/L	1 July 2018 - current day	APHA 3125 B modified, (Varian7900 ICP- MS). Digestion APHA 3030 E
		<0.001 mg/L	5 May 2016 – 30 June 2018	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters
		<0.001 mg/L	March 2009 – 4 May 2016	ICPOES (Inductively coupled optical emission spectrometer, Perkin Elmer) using acid washed GF/F filters
		<0.006 mg/L	Sampling instigation - February 2009	ICPOES (Inductively coupled optical emission spectrometer, Perkin Elmer) using acid washed GF/F filters
	Dissolved zinc	<0.0001 mg/L	October 2016 - current day	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters
		<0.001 mg/L	5 May 2016 – September 2016	APHA 3125 B modified, (Varian7900 ICP- MS) using nylon 0.45um filters

Group	Parameter	Limit of Detection	Date	Analysis Method
		<0.001 mg/L	March 2009 – 4 May 2016	ICPOES (Inductively coupled optical emission spectrometer, Perkin Elmer) using acid washed GF/F filters
		<0.006 mg/L	Sampling instigation - February 2009	ICPOES (Inductively coupled optical emission spectrometer, Perkin Elmer) using acid washed GF/F filters
	Total arsenic	<0.001 mg/L	1 July 2018 - current day	APHA 3125 B modified, (Varian7900 ICP- MS). Digestion APHA 3030 E
		<0.001 mg/L	October 2015 - 30 June 2018	ICPMS APHA 3125B
		<0.002 mg/L	Sampling instigation - September 2015	GFAA APHA 3120B
Nutrients	Total nitrogen	<0.010mg/L	1 July 2018 - current day	APHA 4500-N C (persulphate digestion and continuous flow analyser)
		<0.01 mg/L	10 July 2014 - 30 June 2018	APHA 4500-N C 22nd Ed. 2012 (persulphate digestion and continuous flow analyser)
		<0.05 mg/L	4 March 2009 - 9 July 2014	
		<1.0 mg/L	Sampling instigation - 3 March 2009	
	Nitrate nitrogen	0.002 mg/L	1 July 2018 - current day	4500-NO3 F, Automated Cadmium Reduction Method
		<0.003 mg/L	9 September 2014 - 30 June 2018	APHA 4500-NO3 F (Continuous Flow Autoanalyser)
		<0.05 mg/L	Sampling instigation - 8 September 2014	APHA 4500-NO3 H (Hydrazine Reduction Discrete Analyser)
	Nitrite nitrogen	<0.001 mg/L	1 July 2018 - current day	APHA 4500-NO3 F (continuous flow analyser)
		<0.001 mg/L	9 September 2014 - 30 June 2018	APHA 4500-NO3 F 22nd Ed. 2012 (cadmium reduction and continuous flow analyser)
		<0.005 mg/L	Sampling instigation - 8 September 2014	APHA 4500-NO2 B (Discrete Analyser)
	Nitrate Nitrite Nitrogen (NNN)	<0.002mg/L	1 July 2018 - current day	APHA 4500-NO3 E (Continuous Flow Autoanalyser)
		<0.01 mg/L	27 July 2011 - 30 June 2018	APHA 4500-NO3 E (Continuous Flow Autoanalyser)
		<0.05 mg/L	3 April 2009 - 26 July 2011	APHA 4500-NO3 E (Continuous Flow Autoanalyser)
		<0.05 mg/L	Sampling instigation – 2 April 2009	Nitrate + Nitrite
	Dissolved Inorganic Nitrogen (DIN)	<0.007 mg/L	1 July 2018 - current day	Total ammonia + Nitrite-Nitrate-Nitrogen
		<0.02 mg/L	Sampling instigation - 30 June 2018	Total ammonia + Nitrite-Nitrate-Nitrogen
	Total ammonia	<0.005 mg/L	4 September 2014 - current day	APHA 4500-NH3 G (Continuous Flow Autoanalyser)

Group	Parameter	Limit of Detection	Date	Analysis Method
	(ammoniacal nitrogen)	<0.01 mg/L	sampling instigation - 3 September 2014	4500-NH3 F (Discrete Analyser)
	Total phosphorus	<0.001 mg/L	1 July 2018 - current day	APHA 4500-P J (persulphate digestion and continuous flow analyser)
		<0.003 mg/L	10 July 2014 - 30 June 2018	APHA 4500-P J 22nd Ed. 2012 (persulphate digestion and continuous flow analyser)
		<0.02 mg/L	17 November 2009 - 09 July 2014	APHA 4500-P J (Discrete Analyser)
		<0.06 mg/L	Sampling instigation - 16 November 2009	APHA 4500-P J (Discrete Analyser)
	Dissolved Reactive Phosphorus (DRP)	<0.001 mg/L	1 July 2018 - current day	APHA 4500-P F (Continuous Flow Autoanalyser)
		<0.003 mg/L	22 December 2010 - 30 June 2018	APHA 4500-P F (Continuous Flow Autoanalyser)
		<0.02 mg/L	1 December 2010 - 21 December 2010	4500-P E (Discrete Analyser)
		<0.003 mg/L	17 November 2009 - 30 November 2010	4500-P E (Discrete Analyser)
		<0.01 mg/L	Sampling instigation - 16 November 2009	4500-P E (Discrete Analyser)
Bacteria	*Escherichia coli*	<1 and >24,000 MPN/100ml	1 July 2018 - current day	Colilert APHA 4500 9223 B
		Varies depending on required dilution	Sampling instigation - 30 June 2018	Colilert APHA 4500 9223 B
	Enterococci	<10 and >24,000 MPN/100ml	sampling instigation - current day	Enterolert APHA 9230 D
Clarity	Total Suspended Solids (TSS)	<1 mg/L	1 July 2018 - current day	APHA 2540 D
		<3 mg/L	September 2010 - 30 June 2018	APHA 2540 D
		<5 mg/L	Sampling instigation - August 2010	APHA 2540 D
	Turbidity	<0.1 NTU	28 August 2018 – current day	TL230 ISO 7027 (concurrent testing)
		<0.1 NTU	Sampling instigation - current day	APHA 2130 B, (turbidity meter Hach 2100AN) (concurrent testing)
Other	Dissolved Oxygen (DO)	N/A	1 July 2018 - current day	APHA 4500-O G, YSI Pro ODO meter

Group	Parameter	Limit of Detection	Date	Analysis Method
		N/A	Sampling instigation - 30 June 2018	APHA 4500-O G
	Biochemical Oxygen Demand (BOD_5)	<1.0 mg/L	Sampling instigation- current day	APHA 5210 B
	Total water hardness	N/A	Sampling instigation- current day	APHA 2340 B calculation from calcium and magnesium measured by APHA 3125 B modified (Varian7900 ICP- MS,) using nylon 0.45um filters
	Conductivity	N/A	Sampling instigation- current day	APHA 2510 B
	pH	N/A	Sampling instigation- current day	APHA 4500-H+ B
	Water temperature	N/A	Sampling instigation- current day	APHA 2550 B.YSI Pro ODO meter
	TPH[12]	<0.3 mg/L	Sampling instigation- current day	Extraction DCM (GC-FID)

[12] Analysed by Watercare Laboratory (IANZ accredited)

Appendix B: Metal Hardness Modified Guideline Values

Hardness Modified Guideline Values for Metals in Christchurch City Waterways

1. Introduction

The Australian and New Zealand guidelines for fresh and marine water quality provide a set of default guideline values for dissolved metals (ANZG, 2018). If measured concentrations of toxicants are below the default guideline values, then there is a low risk of adverse environmental effects.

The guidelines also provide a process of modifying the default guideline values for local environmental conditions, namely hardness, which can affect the toxicity of metals (excluding copper) and therefore increase the risk of adverse biological effects (Warne et al., 2018). The default guideline values for metals assume that water is soft (hardness 0–59 mg/L as $CaCO_3$). However, as water hardness increases, the toxicity of some metals decreases and therefore the guideline value may increase, without increasing the risk of adverse biological effects.

Hardness Modified Guideline Values (HMGV), formerly known as Hardness Modified Trigger Values (HMTV), have been previously calculated by Christchurch City Council (Dewson, 2012; Margetts & Marshall, 2015). It is considered that hardness values are unlikely to change over the years, so these values can be reassessed approximately every five years. This memorandum constitutes the five-yearly update of these values, as required under the Comprehensive Stormwater Network Discharge Consent (CRC190445), and reflects the recommendation that copper is no longer modified by hardness (Warne *et al.*, 2018).

2. Methods

In 2019, water samples were collected monthly from 36 non-tidal sites across the five main river catchments within Christchurch City (Avon, Heathcote, Styx, Ōtūkaikino and Halswell Rivers), as well as a tidal site within Linwood Canal, giving a total of 12 samples for each of the 37 sites (Appendix A, Tables i and ii). These samples were collected as part of the wider Christchurch City Council surface water quality monitoring programme. Tidal sites within this wider monitoring programme for the five main river catchments[1] were excluded from the analyses, as tidal sites typically have high hardness levels, which would skew the results for each catchment, resulting in inappropriately higher guideline levels. As there was only one site for Linwood Canal, it did not matter that this site was tidal.

Boxplots of the water hardness data were created in RStudio (version 1.2.5033), to show the median and interquartile range. The dark line in the boxplots represents the median, and the bottom and top lines of the box represent the 25th and 75th percentiles (the interquartile range), respectively. The T-bars that extend from the box approximate the location of the 5th and 95th percentiles (using HAZEN methodology).

To calculate the HMGV, the following species protection levels were chosen, as per ECan (2018).

- Avon River, Heathcote River, and Linwood Canal catchments: 90% (Spring-fed – plains – urban)
- Styx, Ōtūkaikino, and Halswell River catchments: 95% (Spring-fed – plains)
- Cashmere Stream: 99% (Banks Peninsula)

[1] Avon River at Pages/Seaview Bridge, Avon River at Bridge Street, Heathcote River at Catherine Street, Heathcote River at Tunnel Road and Heathcote River at Ferrymead Bridge.

These default guideline values were then modified by the median catchment hardness, as per the below formula (Warne *et al.*, 2018).

$$Lead\ HMGV = Default\ Guideline\ Value\ x \left(\frac{hardness}{30}\right)^{1.27}$$

$$Zinc\ HMGV = Default\ Guideline\ Value\ x \left(\frac{hardness}{30}\right)^{0.85}$$

3. Results

Median water hardness in the five main river catchments in Christchurch (Avon, Heathcote, Styx, Ōtūkaikino and Halswell) ranged from 'soft' to 'moderate'; however, Linwood Canal fell between the 'very hard' and 'extremely hard' categories (Table 1; Figures 1–2). HMGV are greater than default guideline values in each of the rivers in Christchurch, as the default values assume water is 'soft' and thus conservatively protects aquatic ecosystems (Table 1).

Table 1. Default and HMGV for dissolved zinc and lead in Christchurch waterways.

Catchment	Median hardness (mg/L)	Species protection level (ECan, 2018)	Zinc guideline		Lead guideline	
			Default (mg/L)	HMGV (mg/L)	Default (mg/L)	HMGV (mg/L)
Heathcote River – Cashmere Stream	94.0	99%	0.0024	0.00634	0.0010	0.00427
Halswell River	75.0	95%	0.0080	0.01743	0.0034	0.01089
Styx River	47.0	95%	0.0080	0.01172	0.0034	0.00601
Ōtūkaikino River	35.0	95%	0.0080	0.00912	0.0034	0.00414
Avon River	66.5	90%	0.0150	0.02951	0.0056	0.01539
Heathcote River – remainder	94.0	90%	0.0150	0.03960	0.0056	0.02388
Linwood Canal	370.0	90%	0.0150	0.12691	0.0056	0.13610

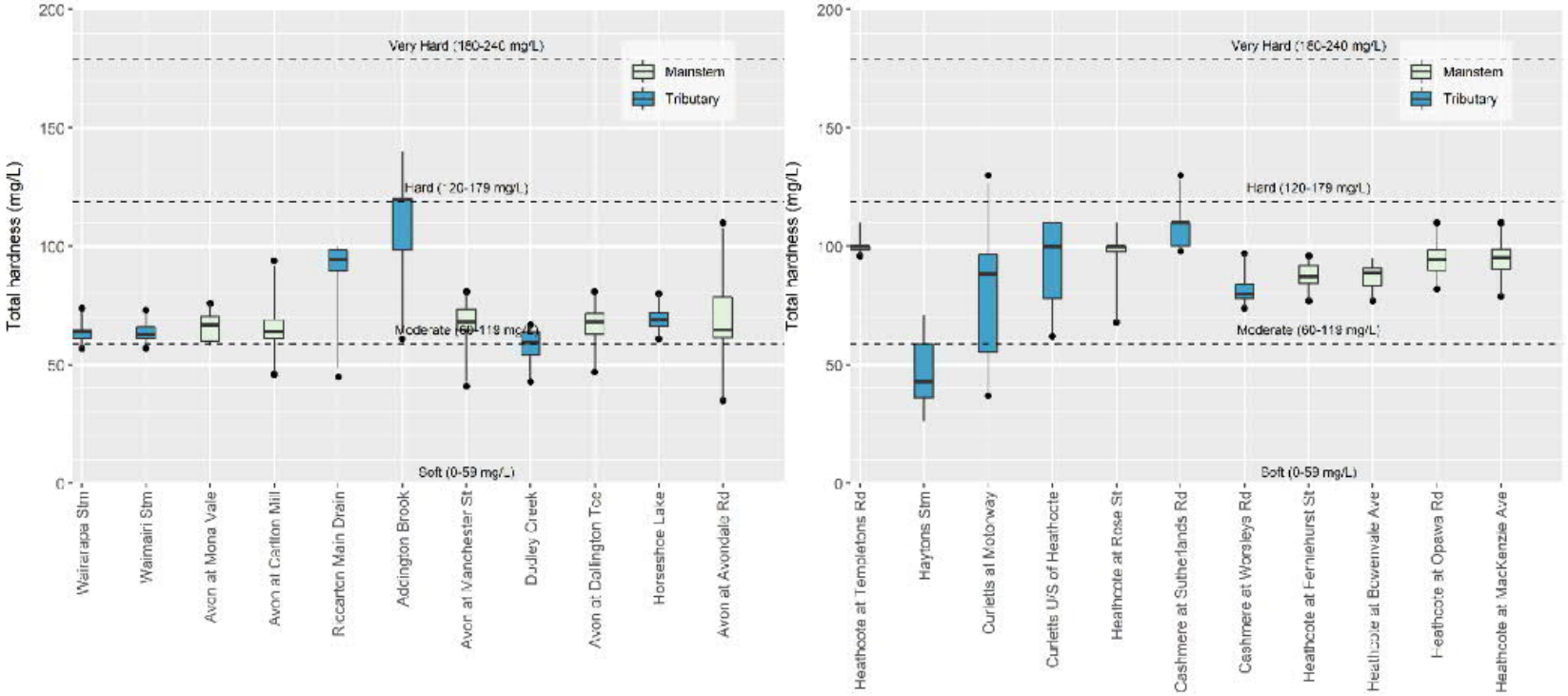

Figure 1. Total hardness (as $CaCO_3$) levels in water samples taken monthly from non-tidal sites within the Ōtākaro/Avon (left graph) and Ōpāwaho/Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June, as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the ANZECC (2000) delineations between water hardness categories.

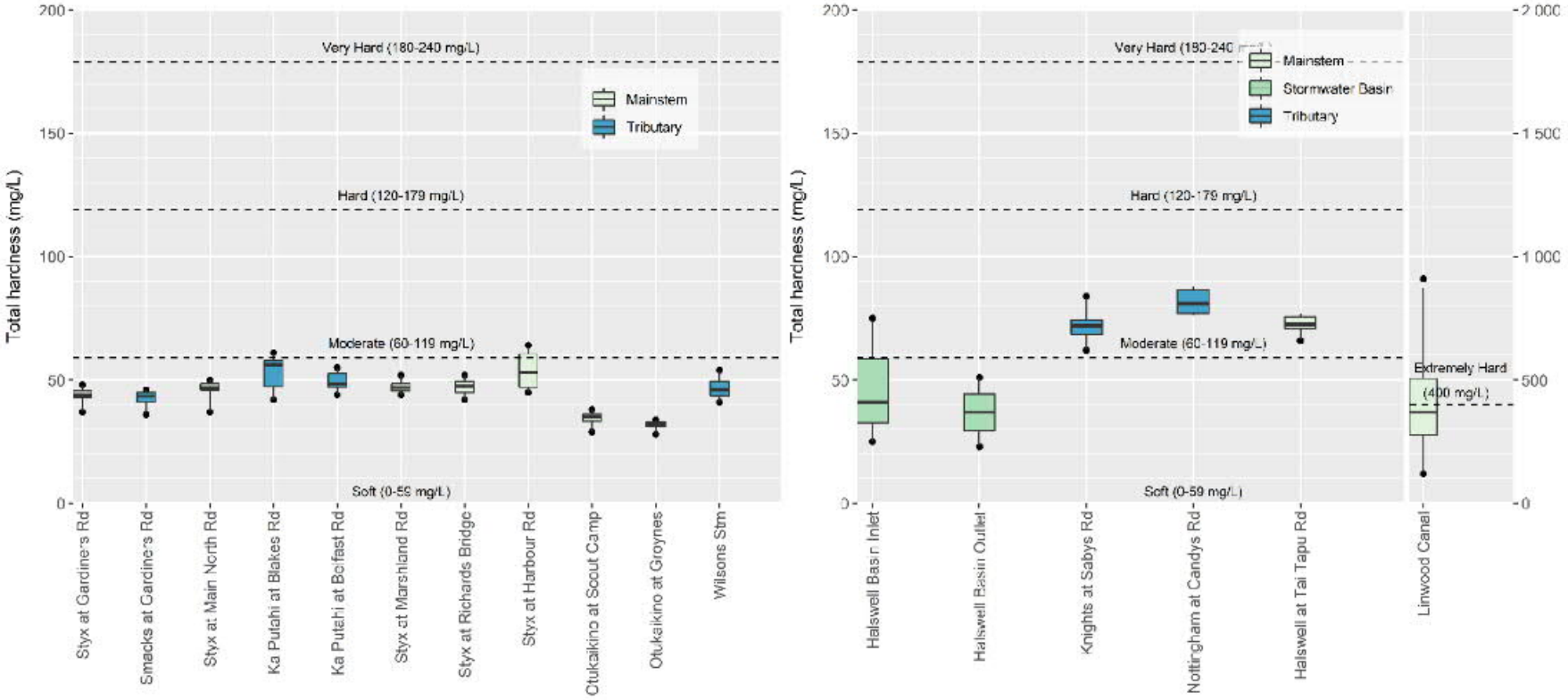

Figure 2. Total hardness (as $CaCO_3$) levels in water samples taken monthly from not-tidal sites within the Pūharakekenui/Styx and Ōtūkaikino Rivers (left graph), and the Huritini/Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the ANZECC (2000) delineations between water hardness categories.

4. References

ANZECC (Australian and New Zealand Environment and Conservation Council, ANZECC, and Agriculture and Resource Management Council of Australia and New Zealand, ARMCANZ), 2000. Australian and New Zealand guidelines for fresh and marine water quality. Volume 1: The guidelines. ANZECC & ARMCANZ, Artarmon, New South Wales.

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17th June 2020

5. Appendix A: Site locations

Table i. Water quality monitoring sites for the water hardness investigations in the Avon and Heathcote River catchments.

Catchment	Site	Easting (NZTM)	Northing (NZTM)
Ōtākaro/ Avon	Avon River at Dallington Terrace/Gayhurst Road	1573560	5181210
	Avon River at Manchester Street	1570890	5180481
	Wairarapa Stream	1568250	5181303
	Waimairi Stream	1568233	5181172
	Avon River at Mona Vale	1568334	5181046
	Riccarton Main Drain	1568683	5180019
	Addington Brook	1569427	5179826
	Dudley Creek	1572574	5182150
	Horseshoe Lake Discharge	1574342	5183294
	Avon River at Carlton Mill Corner	1569737	5181259
	Avon River at Avondale Road	1574752	5183557
Ōpāwaho/ Heathcote	Heathcote River at Opawa Road/Clarendon Terrace[4]	1573071	5177615
	Heathcote River at Bowenvale Avenue	1571198	5175780
	Cashmere Stream at Worsleys Road	1569030	5175155
	Heathcote River at Rose Street	1568701	5175918
	Heathcote River at Ferniehurst Street	1569157	5175612
	Heathcote River at Templetons Road	1565915	5176897
	Haytons Stream at Retention Basin	1566020	5177596
	Curletts Road Stream Upstream of Heathcote River Confluence	1566928	5177711
	Heathcote River at Mackenzie Avenue Footbridge	1573520	5177917
	Curletts Road Stream at Southern Motorway	1566405	5178358
	Cashmere Stream at Sutherlands Road	1566086	5173988

Table ii. Water quality monitoring sites for the water hardness investigations in the Styx River, Halswell River, Ōtūkaikino River and Linwood Canal catchments.

Catchment	Site	Easting (NZTM)	Northing (NZTM)
Pūharakekenui/ Styx	Smacks Creek at Gardiners Road near Styx Mill Road	1566804	5187956
	Styx River at Gardiners Road	1566790	5187226
	Styx River at Main North Road	1569066	5187219
	Kā Pūtahi[2] Creek at Blakes Road	1570401	5188030
	Kā Pūtahi[2] Creek at Belfast Road	1572194	5188267
	Styx River at Marshland Road Bridge	1572358	5187778
	Styx River at Richards Bridge	1573975	5189640
	Styx River at Harbour Road Bridge	1574998	5194749
Huritini/ Halswell	Halswell Retention Basin Inlet	1561701	5177022
	Halswell Retention Basin Outlet	1561796	5176914
	Nottingham Stream at Candys Road	1564532	5173080
	Halswell River at Akaroa Highway (Tai Tapu Road)	1564446	5171721
	Knights Stream at Sabys Road	1563723	5172852
Ōtūkaikino	Ōtūkaikino River at Groynes Inlet	1567878	5188869
	Wilsons Drain at Main North Road	1571241	5190793
	Ōtūkaikino Creek at Omaka Scout Camp	1565664	5188038
Linwood	Linwood Canal/City Outfall Drain	1575952	5178026

[2] While officially shown on maps as Kaputone Creek, CCC has recently endorsed the use of the original Māori name for the area, Kā Pūtahi Creek.

Appendix C: Sampling Instigation at Each Site

Table i. Summary of the date of first monthly sampling at the 44 water quality monitoring sites. Dissolved metals were monitored from 2011, unless otherwise specified.

Catchment	Site Description	Monitoring Instigated
Ōtākaro/ Avon	Wairarapa Stream	January 2007[13]
	Waimairi Stream	January 2007[13]
	Avon River at Mona Vale	January 2007[13]
	Avon River at Carlton Mill Corner	October 2008[14]
	Riccarton Main Drain	October 2008
	Addington Brook	October 2008
	Avon River at Manchester Street	July 2008[15]
	Dudley Creek	October 2008
	Avon River at Dallington Terrace/Gayhurst Road[8]	January 2007
	Horseshoe Lake Discharge	October 2008
	Avon River at Avondale Road	October 2008[14]
	Avon River at Pages/Seaview Bridge	January 2007
	Avon River at Bridge Street	January 2007[13]
Ōpāwaho/ Heathcote	Heathcote River at Templetons Road	January 2007[16]
	Haytons Stream at Retention Basin	April 2007[17]
	Curletts Road Stream Upstream of Heathcote River	October 2008
	Curletts Road Stream at Motorway	October 2008[14]
	Heathcote River at Rose Street	June 2008[18]
	Cashmere Stream at Sutherlands Road	December 2010
	Cashmere Stream at Worsleys Road	January 2007
	Heathcote River at Ferniehurst Street	July 2008[17,19]
	Heathcote River at Bowenvale Avenue	January 2007
	Heathcote River at Opawa Road/Clarendon Terrace	January 2007
	Heathcote River at Mackenzie Avenue	October 2008[14]
	Heathcote River at Catherine Street	October 2008[14]
	Heathcote River at Tunnel Road	January 2007
	Heathcote River at Ferrymead Bridge	January 2007
Pūharakekenui/ Styx	Smacks Creek at Gardiners Road	January 2007[16]
	Styx River at Gardiners Road	January 2007[16]
	Styx River at Main North Road	January 2007[16]
	Kā Pūtahi at Blakes Road	January 2007[16]
	Kā Pūtahi at Belfast Road	January 2007[16]
	Styx River at Marshland Road Bridge	January 2007[16]
	Styx River at Richards Bridge	October 2008
	Styx River at Harbour Road Bridge	January 2008
Huritini/ Halswell	Halswell Retention Basin Inlet	April 2007[14,17]
	Halswell Retention Basin Outlet	April 2007[14,17,20]
	Knights Stream at Sabys Road	May 2012
	Nottingham Stream at Candys Road	October 2008
	Halswell River at Akaroa Highway	October 2008
Ōtūkaikino	Ōtūkaikino Creek at Omaka Scout Camp	October 2014
	Ōtūkaikino River at Groynes Inlet	October 2008
	Wilsons Drain at Main North Road	November 2013
Linwood	Linwood Canal	January 2007[13]

[13] Dissolved oxygen monitored from June 2007
[14] Dissolved metals monitored from September 2014
[15] Dissolved oxygen monitored from October 2008
[16] Dissolved oxygen monitored from March 2007
[17] Dissolved oxygen, total ammonia, conductivity, *E. coli*, nitrogen parameters, pH, DRP and water temperature monitored from October 2008
[18] Dissolved oxygen, BOD_5, conductivity, nitrate, pH, TSS and water temperature monitored from August 2008. Total ammonia, *E. coli*, nitrogen parameters (excluding nitrate) and DRP monitored from October 2008
[19] BOD_5 and TSS monitored from October 2008
[20] BOD_5 monitored from April 2008

Christchurch City Council

Appendix D: Time Trends analysis

Table i. Direction of significant trends (p≤0.05) for parameters monitored monthly at each of the sites in the Ōtākaro/ Avon River catchment (refer to Appendix C, Table i for sample periods). Parameter changes represented by an arrow with no number are where a statistically significant change was recorded, but due to a high proportion of censored data, only the direction of change could be calculated.

Site	Dissolved copper	Dissolved lead	Dissolved Zinc	DRP	pH	EC	TSS	Turbidity	DO	Temp	BOD_5	Total Ammonia	NNN	DIN	*E. coli*
Wairarapa Stm			↓ 13%	↓ 8%							↓				
Waimairi Stm				↓ 7%				↓ 2%					↓ 2%	↓ 2%	
Avon at Mona Vale				↓ 7%							↓		↓ 1%	↓ 2%	
Avon at Carlton Mill				↓ 9%				Not Sampled			↓	↑ 4%	↓ 3%	↓ 3%	
Riccarton Main Drain				↓ 7%		↑ 3%					↓		↑ 4%	↑ 4%	
Addington Brook				↓ 3%							↓ 7%				↑ 5%
Avon at Manchester St				↓ 7%							↓		↓ 3%	↓ 3%	↓ 2%
Dudley Creek		↓ 15%				↓ 1%				↑ 1%	↓ 9%	↓ 3%	↓ 4%	↓ 4%	
Avon at Dallington Tce							↓ 4%	↓ 6%		↑ 1%	↓	↓ 6%	↓ 1%	↓ 2%	
Horseshoe Lake								↓ 3%		↑ 1%	↓ 3%	↓ 3%	↓ 3%	↓ 3%	
Avon at Avondale Rd				↓ 3%				Not Sampled			↓		↓ 4%	↓ 4%	
Avon at Pages Rd			↓ 9%	↓ 1%		↑ 4%		↓ 3%			↓	↓ 3%	↓ 2%	↓ 3%	↑ 4%
Avon at Bridge St				↓ 5%		↑ 5%			↑ 1%	↑ 1%	↓	↓ 7%	↓ 2%	↓ 3%	↑ 6%

Notes: EC = Electrical Conductivity, TSS = Total Suspended Solids, DO = Dissolved Oxygen, Temp = Temperature; BOD_5 = Biochemical Oxygen Demand, NNN = Nitrate Nitrite Nitrogen and DIN = Dissolved Inorganic Nitrogen. Blank cells indicate no significant upwards or downwards trends.

Table ii. Direction of significant trends (p≤0.05) for parameters monitored monthly at each of the sites in the Ōpāwaho/ Heathcote River catchment (refer to Appendix C, Table i for sample periods). Parameter changes represented by an arrow with no number are where a statistically significant change was recorded, but due to a high proportion of censored data, only the direction of change could be calculated.

Site	Dissolved copper	Dissolved lead	Dissolved Zinc	DRP	pH	EC	TSS	Turbidity	DO	Temp	BOD_5	Total Ammonia	NNN	DIN	*E. coli*
Heathcote at Templetons Rd			↓13%	↓ 12%					↓ 2%		↓		↑ 2%	↑ 2%	↓ 4%
Haytons Stm			↑ 9%	↓ 11%			↑ 6%	↑ 4%			↓ 5%	↓ 7%	↓ 11%	↓ 14%	
Curletts at Motorway	↑ 12%		↑ 16%			↑ 2%	↑ 6%	Not Sampled					↓ 31%	↓24%	
Curletts U/S of Heathcote	↓16%	↓13%					↓ 5%	↓ 9%			↓ 2%	↓ 5%			↓ 13%
Heathcote at Rose St				↓ 8%							↓ 5%				
Cashmere at Sutherlands Rd				↓ 18%					↓ 2%		↓		↓ 3%	↓ 3%	
Cashmere at Worsleys Rd				↓ 6%							↓				↓ 3%
Heathcote at Ferniehurst St				↓ 6%							↓				
Heathcote at Bowenvale Ave				↓ 6%							↓				
Heathcote at Opawa Road				↓ 6%				↓ 3%			↓	↓ 2%			
Heathcote at Mackenzie Ave				↓ 8%				Not Sampled			↓				
Heathcote at Catherine St				↓ 7%		↑ 2%		Not Sampled			↓ 5%	↓ 3%		↓ 1%	
Heathcote at Tunnel Rd				↓ 9%			↓ 2%	↓ 5%				↓ 9%			
Heathcote at Ferrymead Bridge			↑ 14%	↓ 14%							↓ 4%	↓ 13%			

Notes: EC = Electrical Conductivity, TSS = Total Suspended Solids, DO = Dissolved Oxygen, Temp = Temperature; BOD_5 = Biochemical Oxygen Demand, NNN = Nitrate Nitrite Nitrogen and DIN = Dissolved Inorganic Nitrogen. Blank cells indicate no significant upwards or downwards trends. No monitoring was undertaken at the Heathcote River at Templeton's Road site from February – June 2015, November 2015 – January 2016, March – December 2016 and January- July 2017, as the site was dry.

Table iii. Direction of significant trends (p≤0.05) for parameters monitored monthly at each of the sites in the Huritini/ Halswell River catchment and Linwood Canal (refer to Appendix C, Table i for sample periods). Parameter changes represented by an arrow with no number are where a statistically significant change was recorded, but due to a high proportion of censored data, only the direction of change could be calculated.

Site	Dissolved copper	Dissolved lead	Dissolved Zinc	DRP	pH	EC	TSS	Turbidity	DO	Temp	BOD_5	Total Ammonia	NNN	DIN	*E. coli*
Halswell Basin Inlet				↓ 5%			↓ 4%	Not Sampled			↓ 8%	↓ 25%		↓ 15%	↓ 4%
Halswell Basin Outlet	↓6%	↓28%		↓ 11%		↓ 4%	↓ 19%	Not Sampled	↑ 3%		↓ 19%	↓ 33%		↓ 18%	
Knights at Sabys Rd			↓ 7%	↓ 8%							↓	↓ 7%			
Nottingham at Candy's Rd			↑ 7%			↓ 3%		↓ 4%			↓		↓ 5%	↓ 5%	
Halswell River at Tai Tapu Rd			↓ 8%	↓ 3%					↑ 1%		↓		↓ 3%	↓ 3%	↑ 8%
Linwood Canal				↓ 4%		↑ 8%		↓ 3%		↑ 1%	↓ 8%	↓ 3%	↓ 7%	↓ 5%	

Notes: EC = Electrical Conductivity, TSS = Total Suspended Solids, DO = Dissolved Oxygen, Temp = Temperature; BOD_5 = Biochemical Oxygen Demand, NNN = Nitrate Nitrite Nitrogen and DIN = Dissolved Inorganic Nitrogen. Blank cells indicate no significant upwards or downwards trends.

Table iv. Direction of significant trends (p≤0.05) for parameters monitored monthly at each of the sites in the Pūharakekenui/ Styx and Ōtūkaikino River catchments (refer to Appendix C, Table i for sample periods). Parameter changes represented by an arrow with no number are where a statistically significant change was recorded, but due to a high proportion of censored data, only the direction of change could be calculated.

Site	Dissolved copper	Dissolved lead	Dissolved Zinc	DRP	pH	EC	TSS	Turbidity	DO	Temp	BOD_5	Total Ammonia	NNN	DIN	*E. coli*
Styx at Gardiners Rd			↓ 10%	↓ 5%		↓ 1%					↓		↓ 6%	↓ 6%	↑ 8%
Smacks at Gardiners Rd			↓ 16%	↓ 4%		↓ 1%		↓ 8%			↓		↓ 3%	↓ 3%	
Styx at Main North Rd				↓ 3%				↓ 4%			↓		↓ 5%	↓ 5%	↑ 4%
Kā Pūtahi at Blakes Rd						↑ 2%	↑ 2%	↑ 4%			↓				
Kā Pūtahi at Belfast Rd				↓ 3%				↓ 4%	↑ 1%		↓ 5%	↓ 3%	↑ 2%	↑ 1%	
Styx at Marshland Rd				↓ 2%							↓				↑ 3%
Styx at Richards Bridge				↓ 3%							↓				↑ 5%
Styx at Harbour Rd				↓ 2%							↓		↓ 2%	↓ 2%	↑ 5%
Ōtūkaikino at Groynes			↓ 16%	↓ 14%				↓ 11%			↓	↓ 2%	↓ 6%	↓ 6%	
Ōtūkaikino at Scout Camp				↓ 7%	↓ 1%	↑ 4%			↓ 1%				↑ 18%	↑ 16%	
Wilsons Stm						↑ 1%		↑ 13%				↑ 12%	↑ 4%	↑ 4%	↑ 13%

Notes: EC = Electrical Conductivity, TSS = Total Suspended Solids, DO = Dissolved Oxygen, Temp = Temperature; BOD5 = Biochemical Oxygen Demand, NNN = Nitrate Nitrite Nitrogen and DIN = Dissolved Inorganic Nitrogen. Blank cells indicate no significant upwards or downwards trends.

Table v. Direction of significant trends (p≤0.05) for parameters monitored by the Styx Living Laboratory Trust, with sufficient data to run Time Trends analysis.

Site	Clarity	pH	EC	Temp
Styx at Brooklands		↑ 2%		↑ 1%
Kā Pūtahi at Everglades		↑ 1%		
Kā Pūtahi at Ouruhia Domain		↑ 1%		
Styx at Radcliffe Rd		↑ 2%		↑ 1%
Styx at Conservation Reserve			↑ 1%	
Styx at Willowbank	↓ 2%			↑ 1%

Notes: EC = Electrical Conductivity. Blank cells indicate no significant upwards or downwards trends.

Appendix E: Monthly Monitoring Graphs

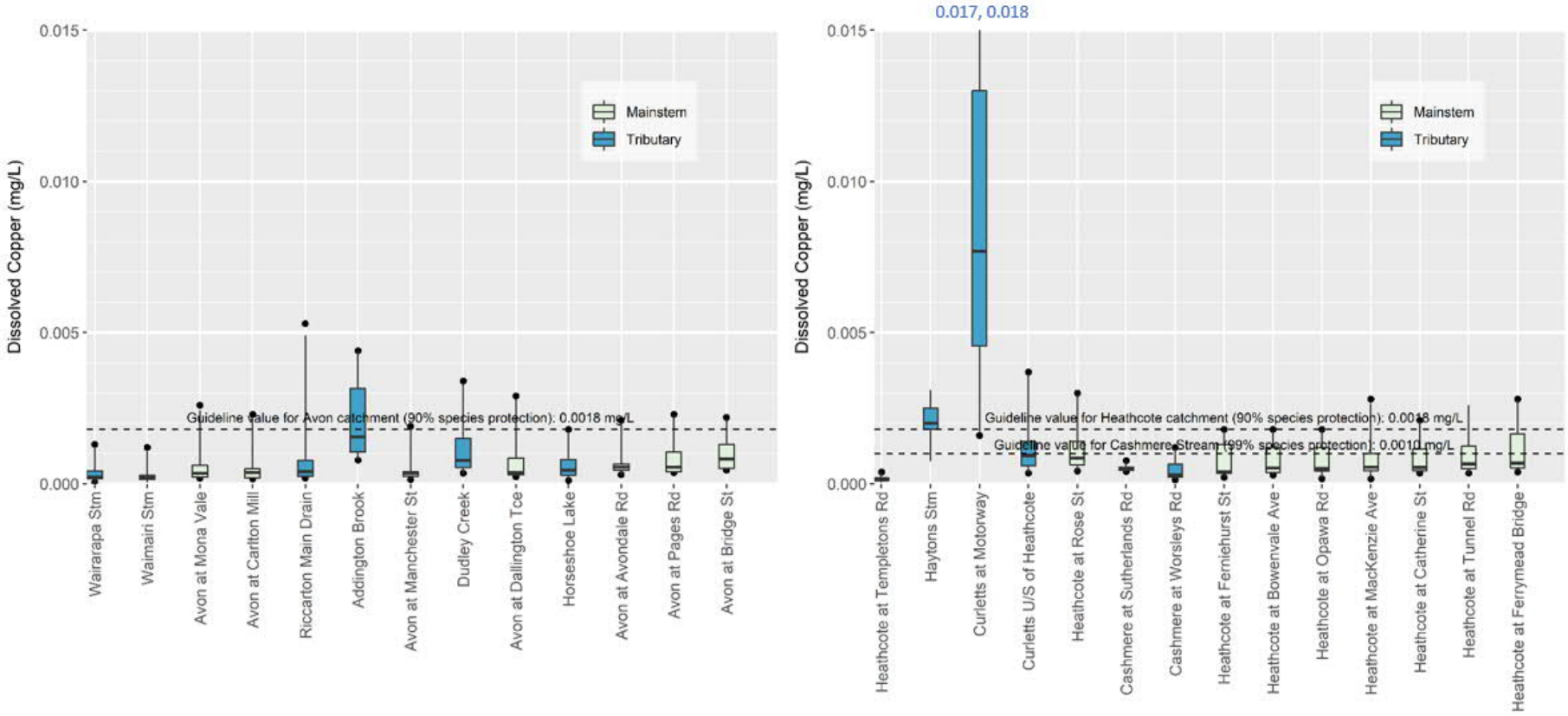


Figure i (a). Dissolved copper levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan

guideline values (Environment Canterbury, 2019). The Laboratory Limit of Detection for these two catchments was 0.0001 mg/L – analysed as half this value (0.00005 mg/L) to allow statistics to be undertaken.

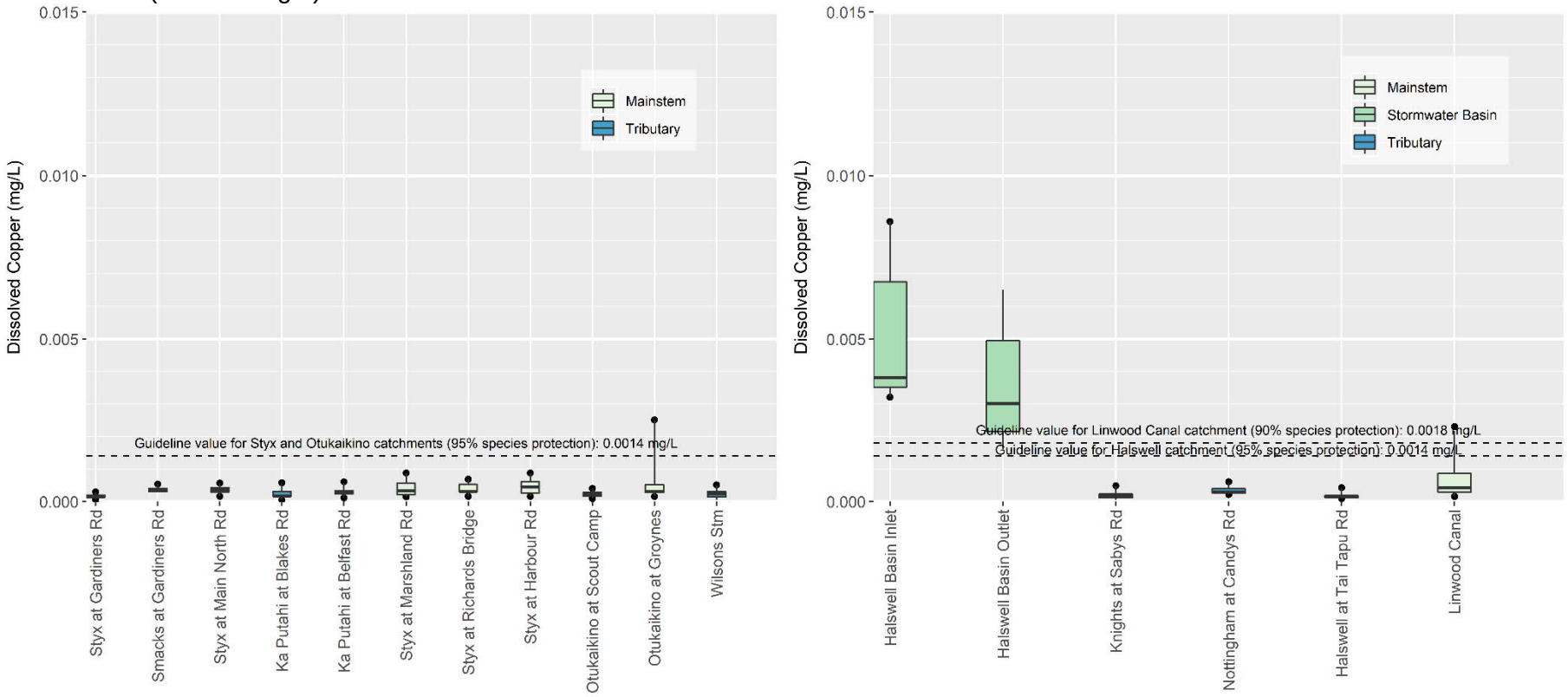


Figure i (b). Dissolved copper levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline values (Environment Canterbury, 2019). The 90% species protection HMGV for Linwood Canal (0.167 mg/L) is not visible because it is off the scale. The Laboratory Limit of Detection was 0.0001 mg/L (analysed as half this value (0.00005 mg/L) to allow statistics to be undertaken).

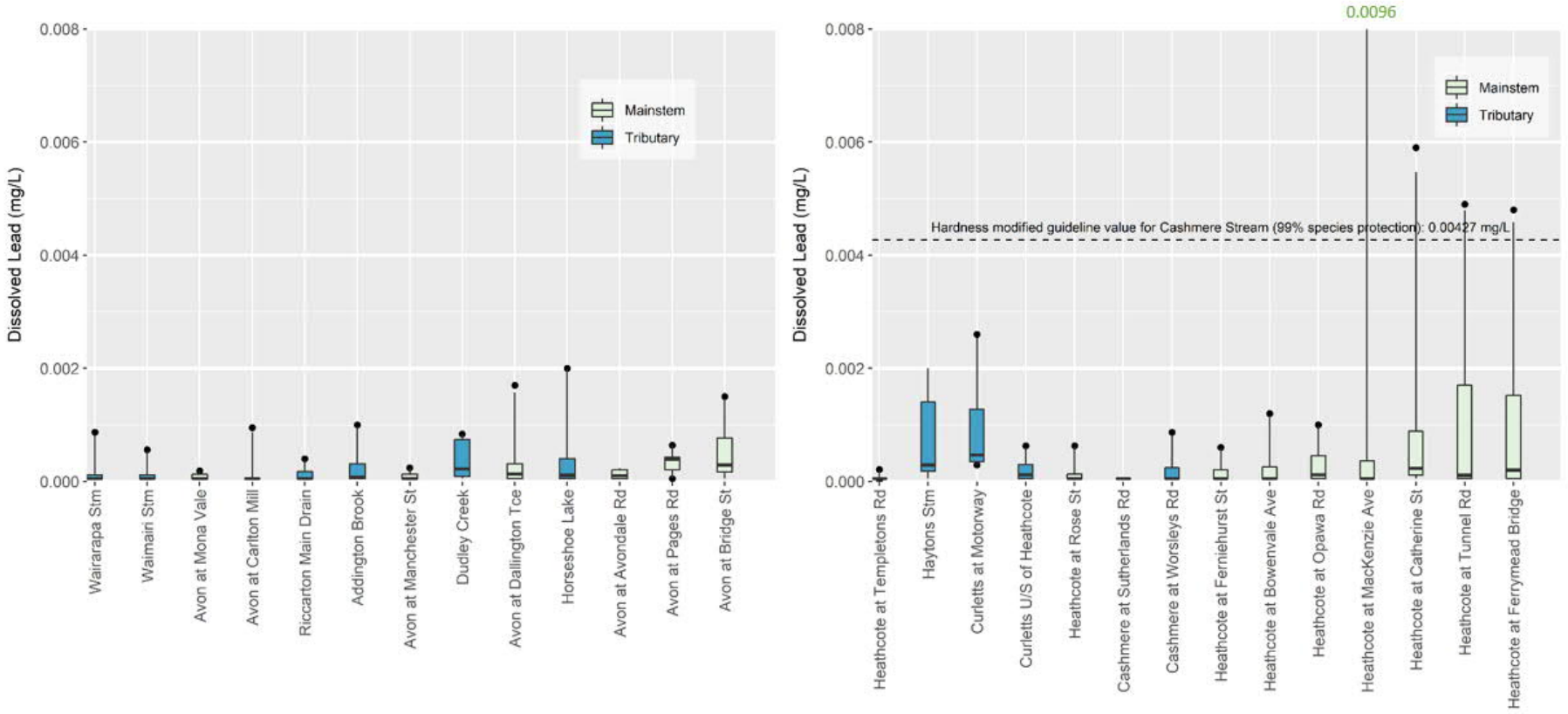


Figure ii (a). Dissolved lead levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed line represents the Land and Water Regional Plan guideline value (Environment Canterbury, 2019), which has been modified to account for water hardness (Hardness Modified Guideline Value = HMGV), as per the Warne *et al.* (2018) guidelines methodology. The 90% protection HMGV for the Ōtākaro/ Avon River (0.01539 mg/L) and the Ōpāwaho/ Heathcote River (0.02388 mg/L) are not shown as they are off the scale. The Laboratory Limit of Detection was 0.0001 mg/L – analysed as half this value (0.00005 mg/L) to allow statistics to be undertaken.

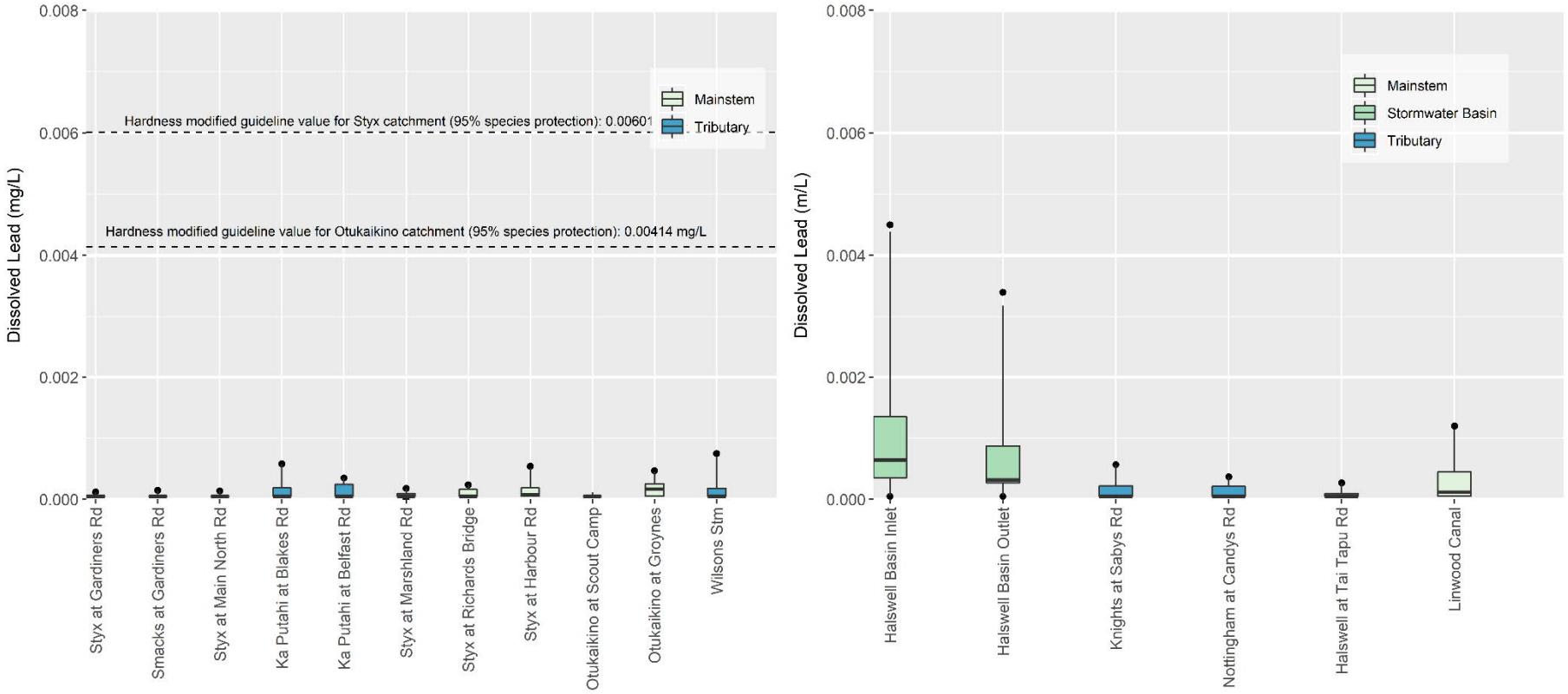


Figure ii (b). Dissolved lead levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value (Environment Canterbury, 2019), which has been modified to account for water hardness (Hardness Modified Guideline Value = HMGV), as per the Warne *et al.* (2018) guidelines methodology. The 95% protection HMGV for Huritini/ Halswell River (0.01089 mg/L) and 90% protection HMGV for Linwood Canal (0.13610 mg/L) are not visible because they are off the scale. The Laboratory Limit of Detection was 0.0001 mg/L – analysed as half this value (0.00005 mg/L) to allow statistics to be undertaken.

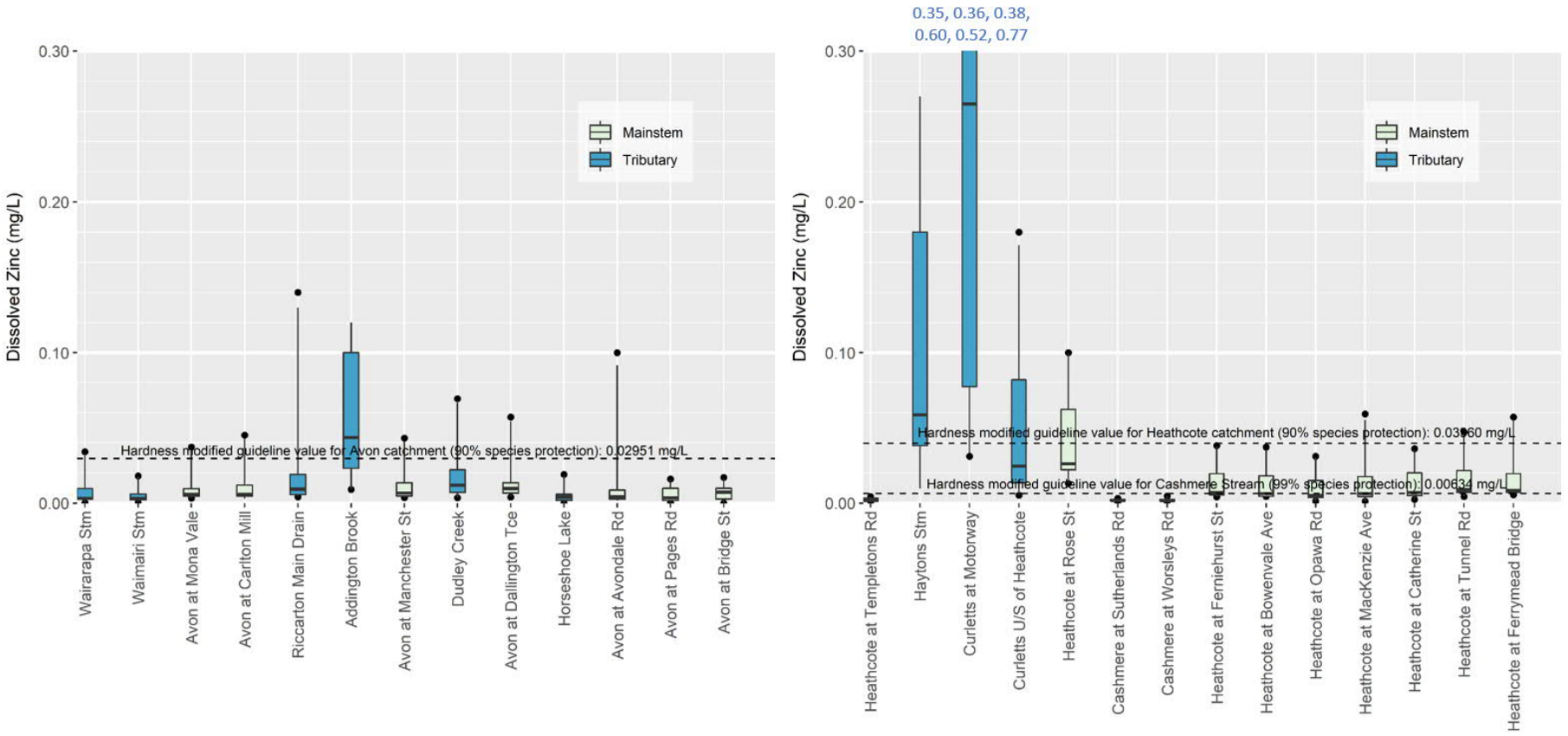


Figure iii (a). Dissolved zinc levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline values (Environment Canterbury, 2019), which have been modified to account for water hardness (Hardness Modified Guideline Value = HMGV), as per the Warne *et al.* (2018) guidelines methodology. The Laboratory Limit of Detection was 0.0001 mg/L – analysed as half this value (0.00005 mg/L) to allow statistics to be undertaken.

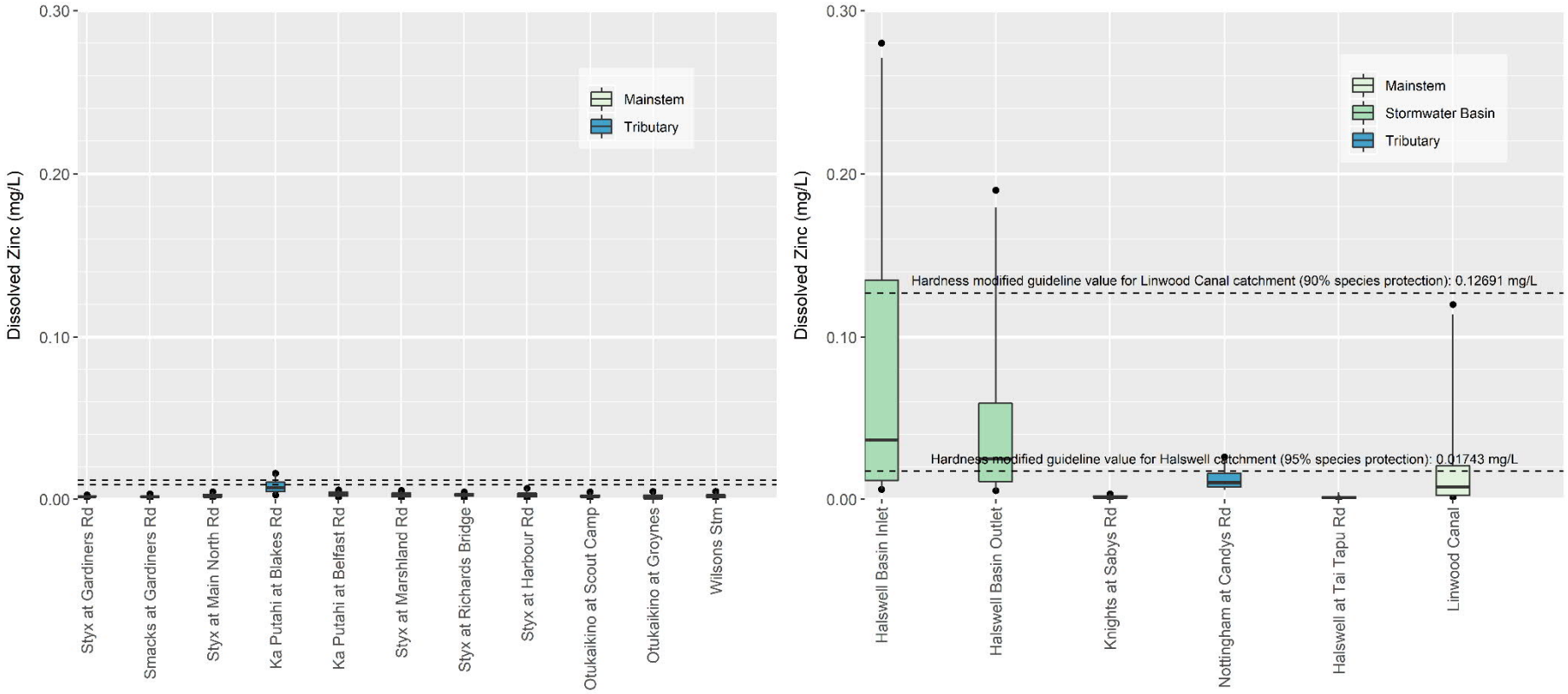


Figure iii (b). Dissolved zinc levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline values (Environment Canterbury, 2019), which have been modified to account for water hardness (Hardness Modified Guideline Value = HMGV), as per the Warne *et al.* (2018) guidelines methodology. On the left graph, the upper dashed line represents the 95% species protection for Pūharakekenui/ Styx River catchment (0.01172 mg/L), while the lower represents the 95% species protection for Ōtūkaikino River catchment (0.00912 mg/L). The 90% protection HMGV for Linwood Canal (0.12691 mg/L) is not visible because it is off the scale. The Laboratory Limit of Detection was 0.0001 mg/L – analysed as half this value (0.00005 mg/L) to allow statistics to be undertaken.

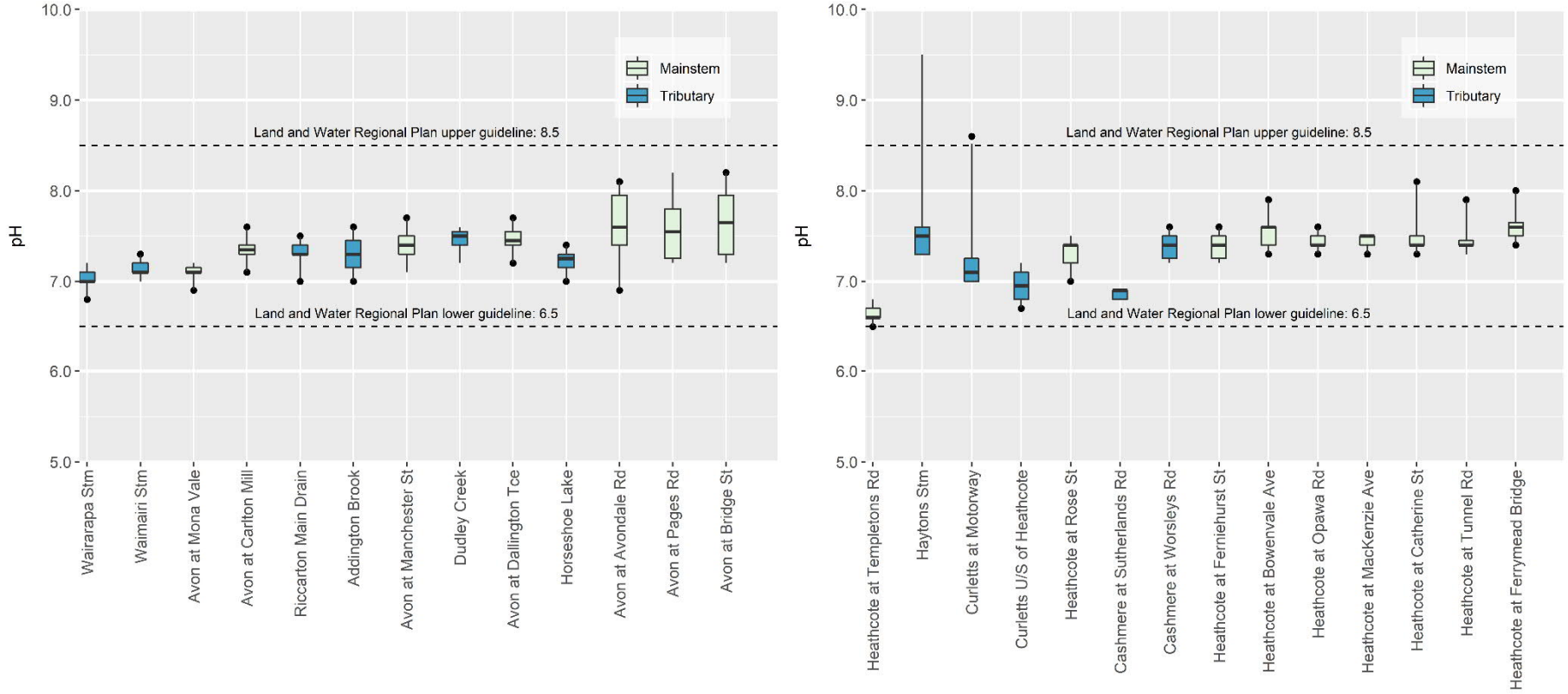


Figure iv (a). pH levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019.No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan lower (6.5) and upper (8.5) limits (Environment Canterbury, 2019).

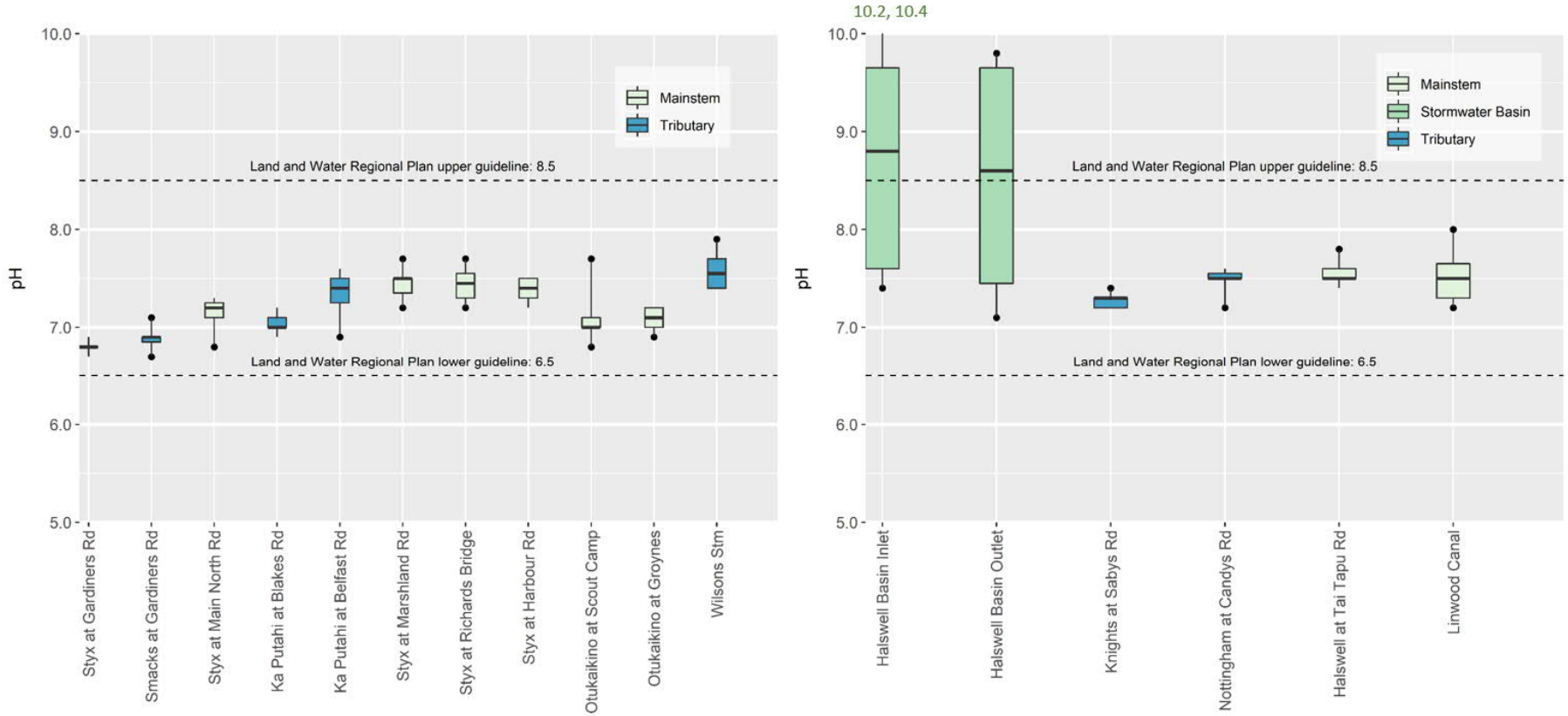


Figure iv (b). pH levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan lower (6.5) and upper (8.5) limits (Environment Canterbury, 2019).

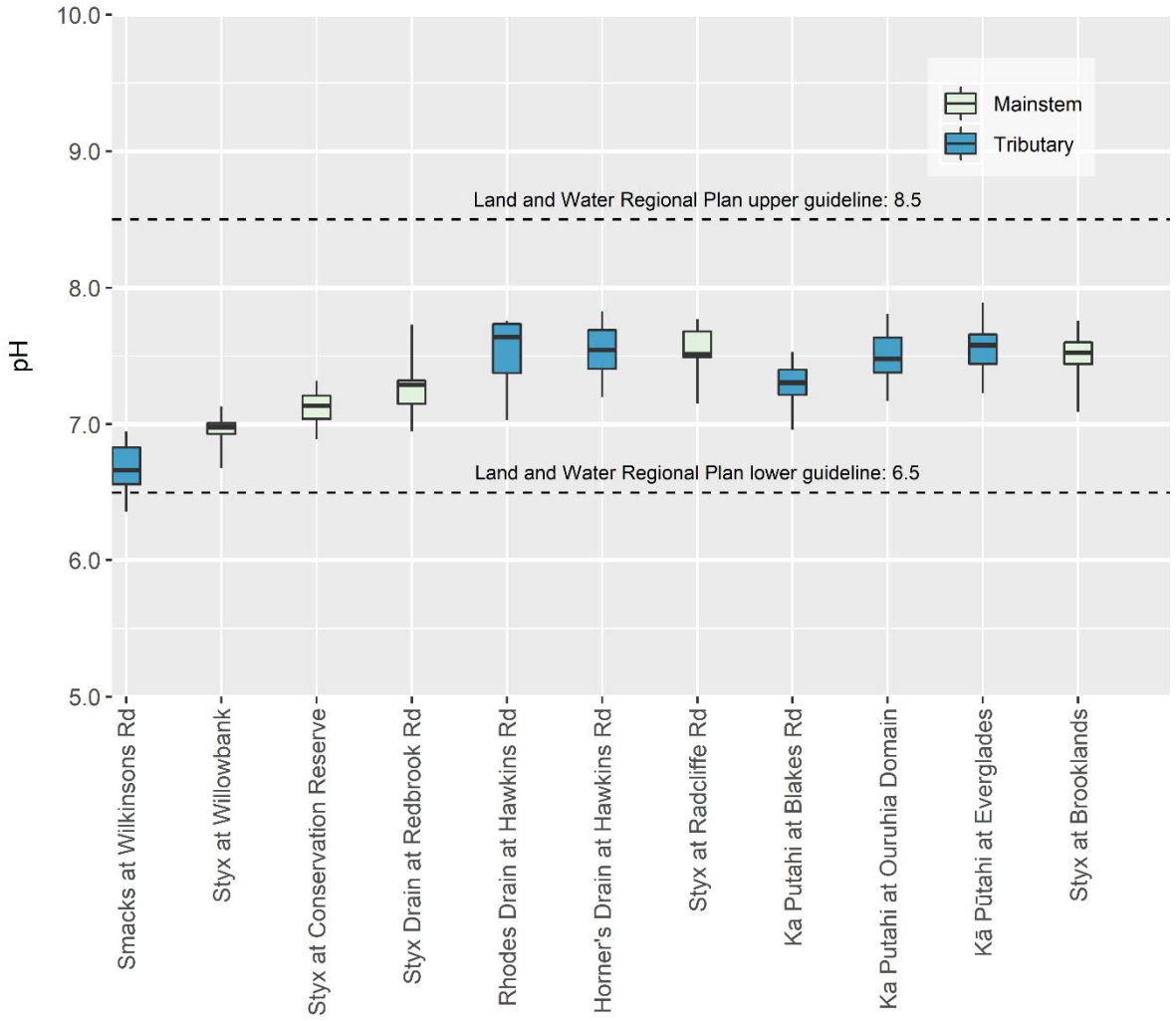


Figure iv (c). pH levels in water samples taken from the Pūharakekenui/ Styx River catchment by the Styx Living Laboratory Trust volunteers for the monitoring period January to December 2019 (n = 6–10 samples per site). Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan lower (6.5) and upper (8.5) limits (Environment Canterbury, 2019).

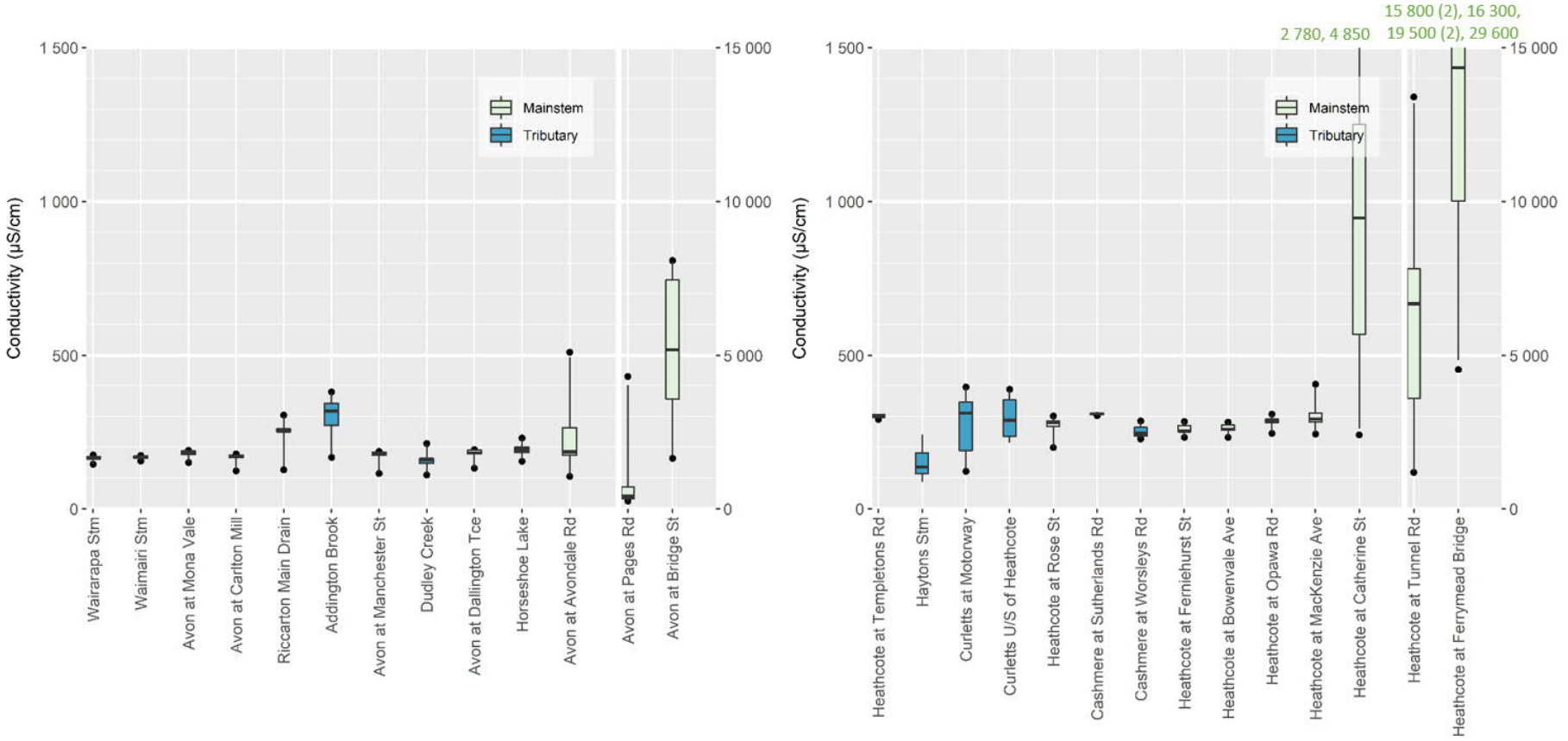


Figure v (a). Conductivity levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019.No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). All conductivity graphs have the same scale presented on the primary (left) axis. Given the large differences in values within the catchments, some sites are presented with an alternate scale on the secondary (right) axis. Scale change is marked with a vertical, thick white line.

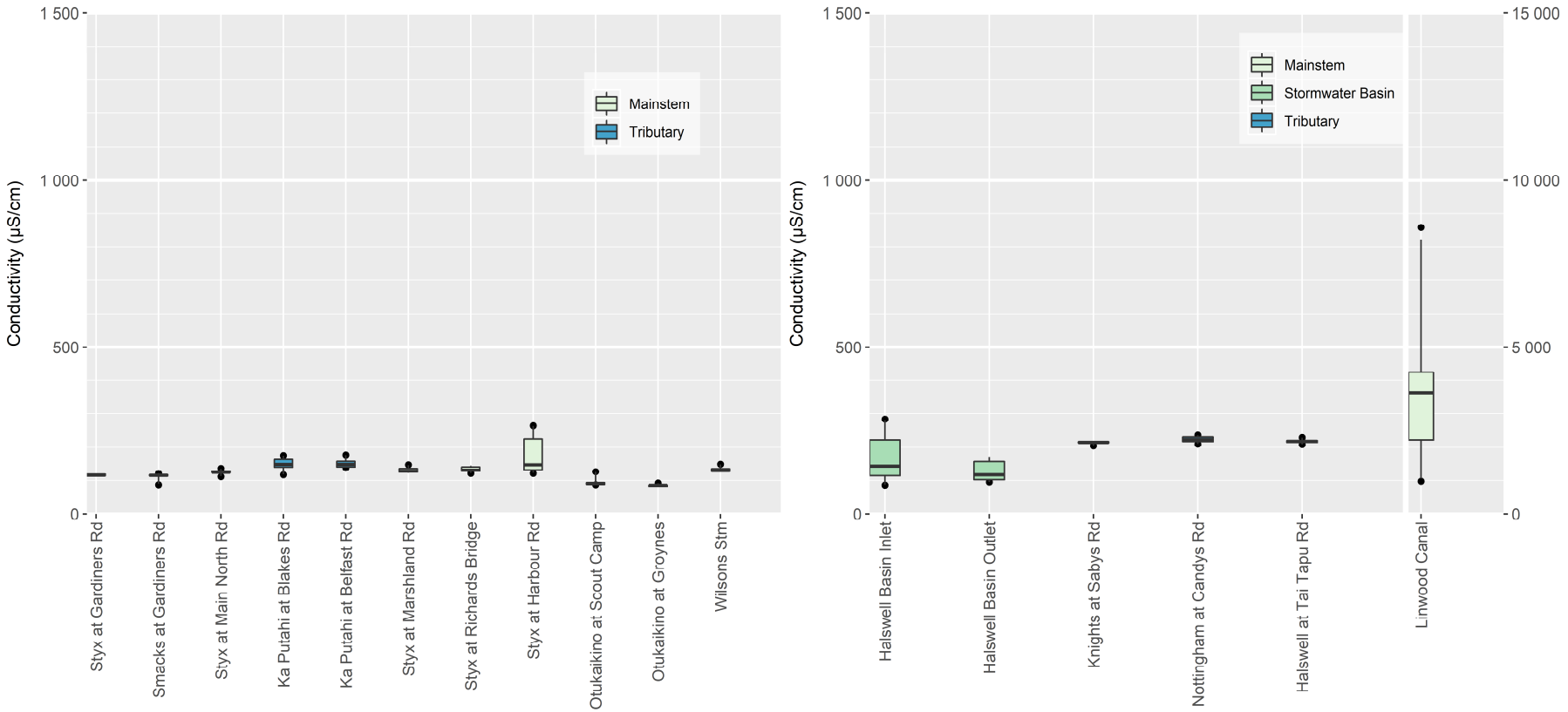


Figure v (b). Conductivity levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). All conductivity graphs have the same scale presented on the primary (left) axis. Given the large differences in values within the catchments, some sites are presented with an alternate scale on the secondary (right) axis. Scale change is marked with a vertical, thick white line.

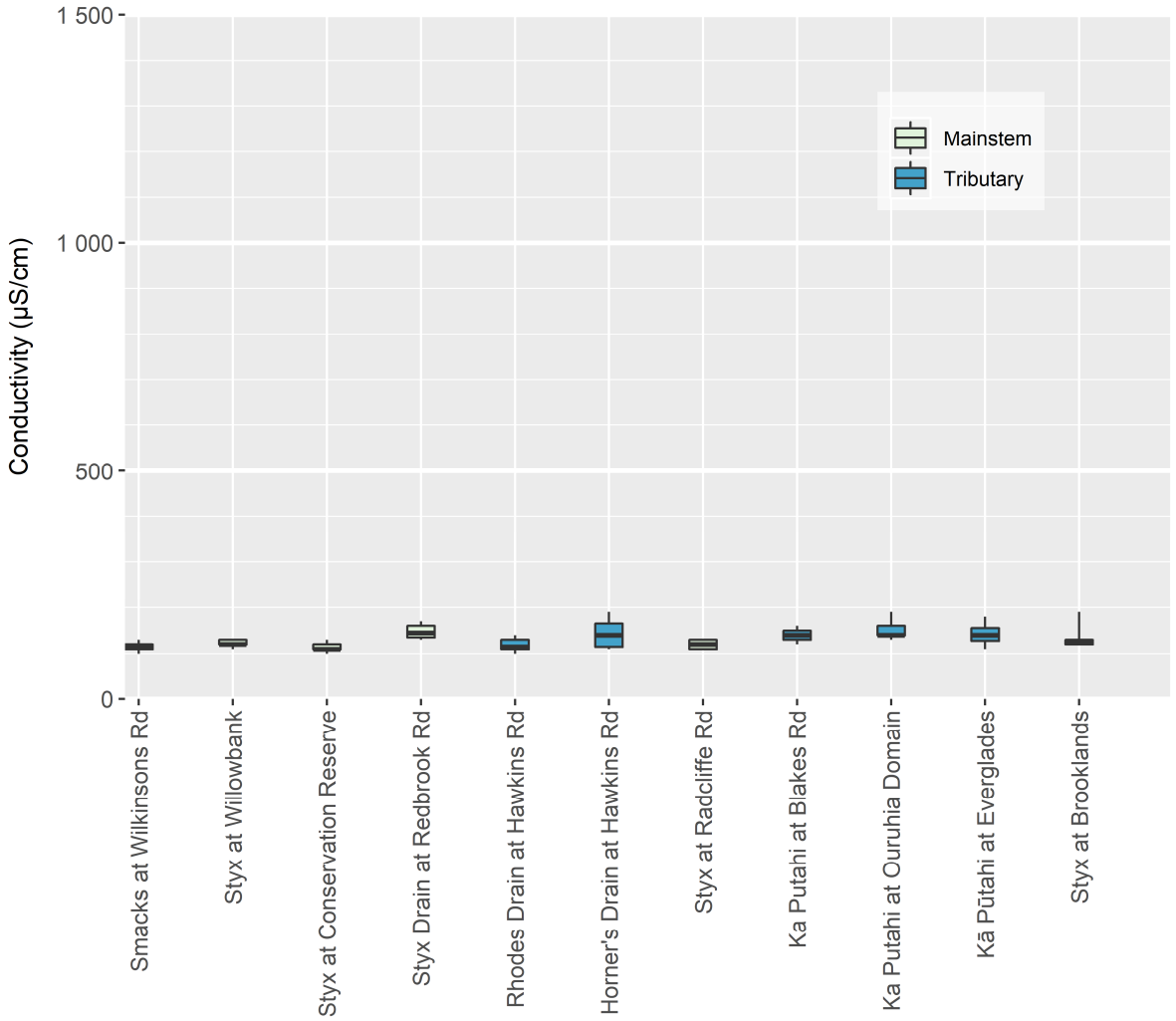


Figure v (c). Conductivity levels in water samples taken from the Pūharakekenui/ Styx River catchment by the Styx Living Laboratory Trust volunteers for the monitoring period January to December 2019 (n = 6–10 samples per site). Sites are ordered from upstream to downstream (left to right).

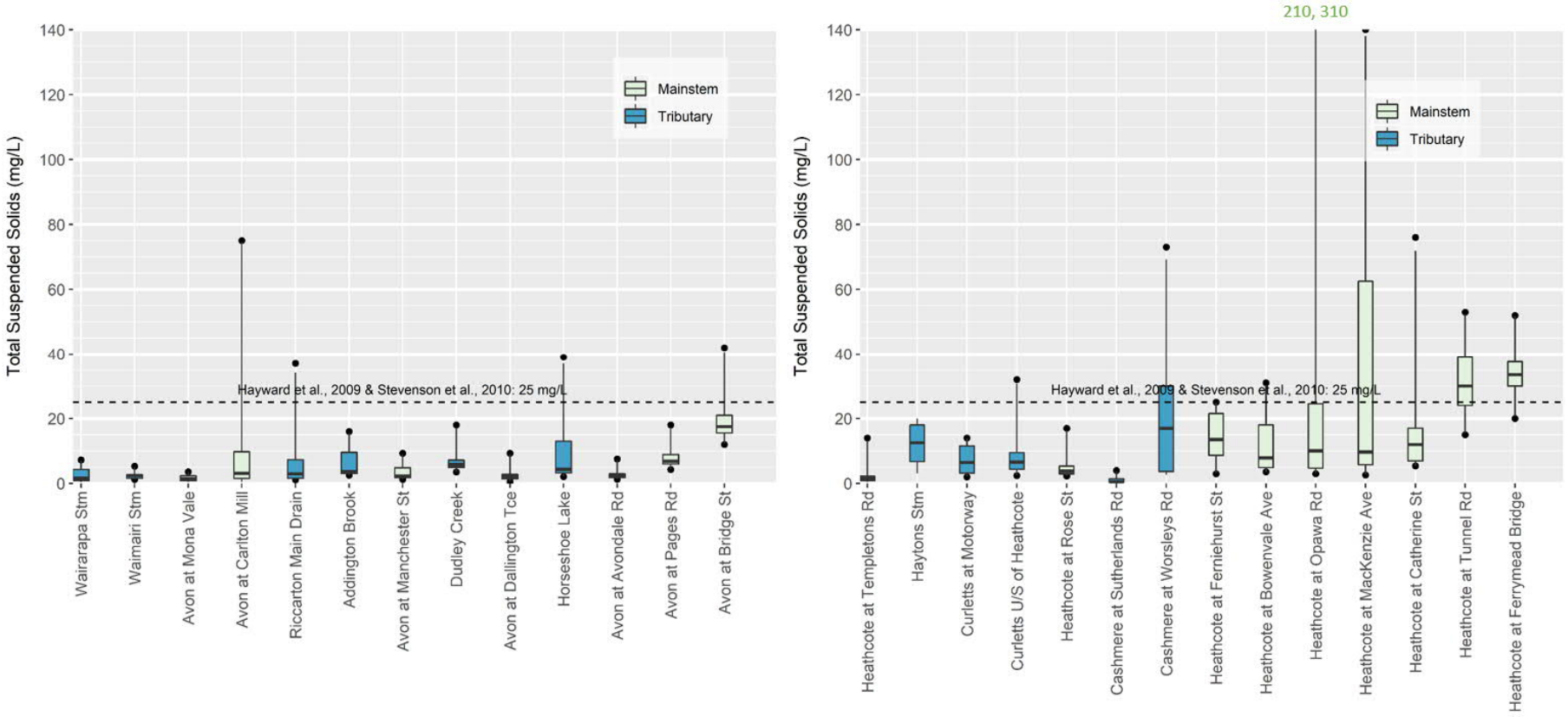


Figure vi (a). Total Suspended Solid (TSS) levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the guideline value of 25 mg/L. The Laboratory Limit of Detection was 1.0 mg/L – analysed as half this value (0.5 mg/L) to allow statistics to be undertaken.

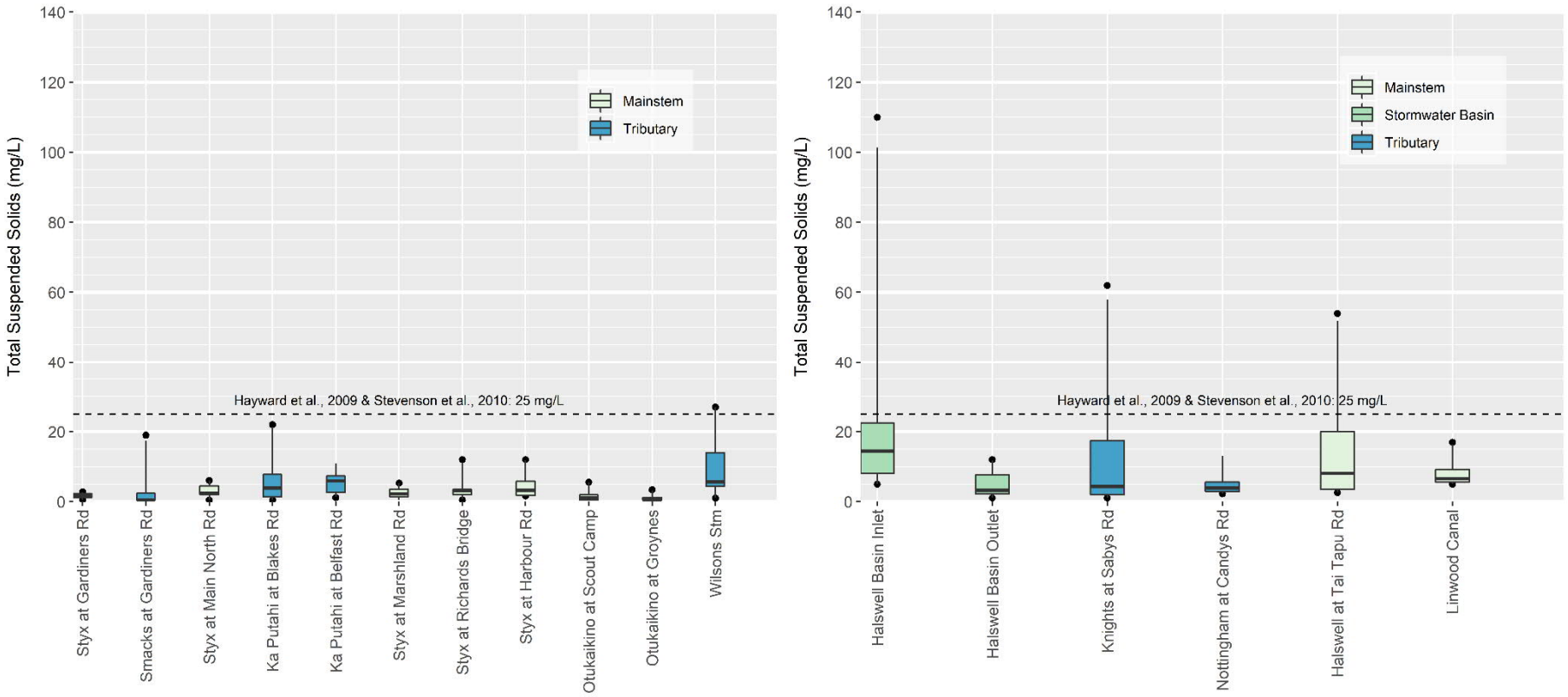


Figure vi (b). Total Suspended Solid (TSS) levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the guideline value of 25 mg/L. The Laboratory Limit of Detection was 1.0 mg/L – analysed as half this value (0.5 mg/L) to allow statistics to be undertaken.

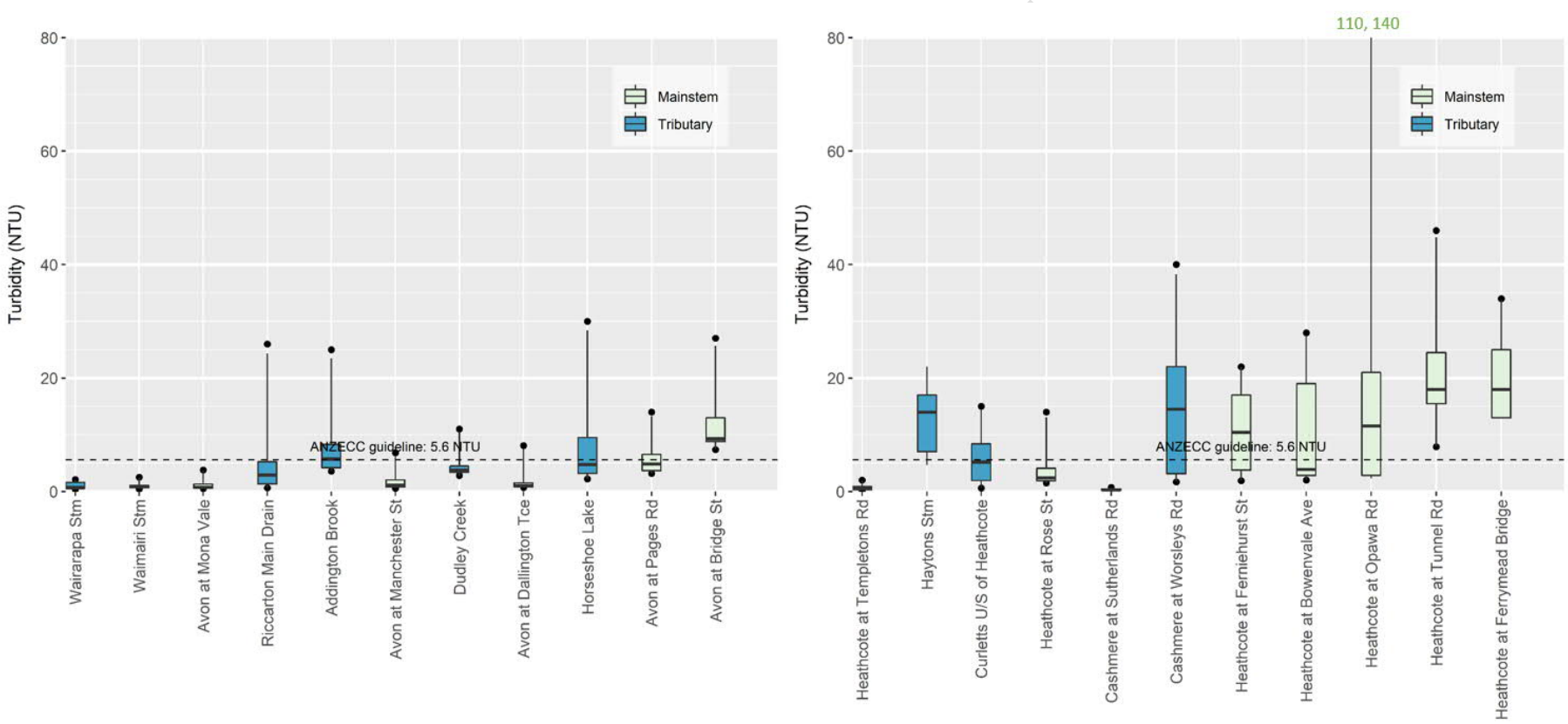


Figure vii (a) .Turbidity levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. The following sites were not measured for this parameter: Avon River at Carlton Mill Corner, Avon River at Avondale Road Bridge, Curletts Road Stream at Motorway, Heathcote River at Catherine Street and Heathcote River at Mackenzie Avenue. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the ANZECC (2000) guideline value of 5.6 Nephelometric Turbidity Units (NTU).

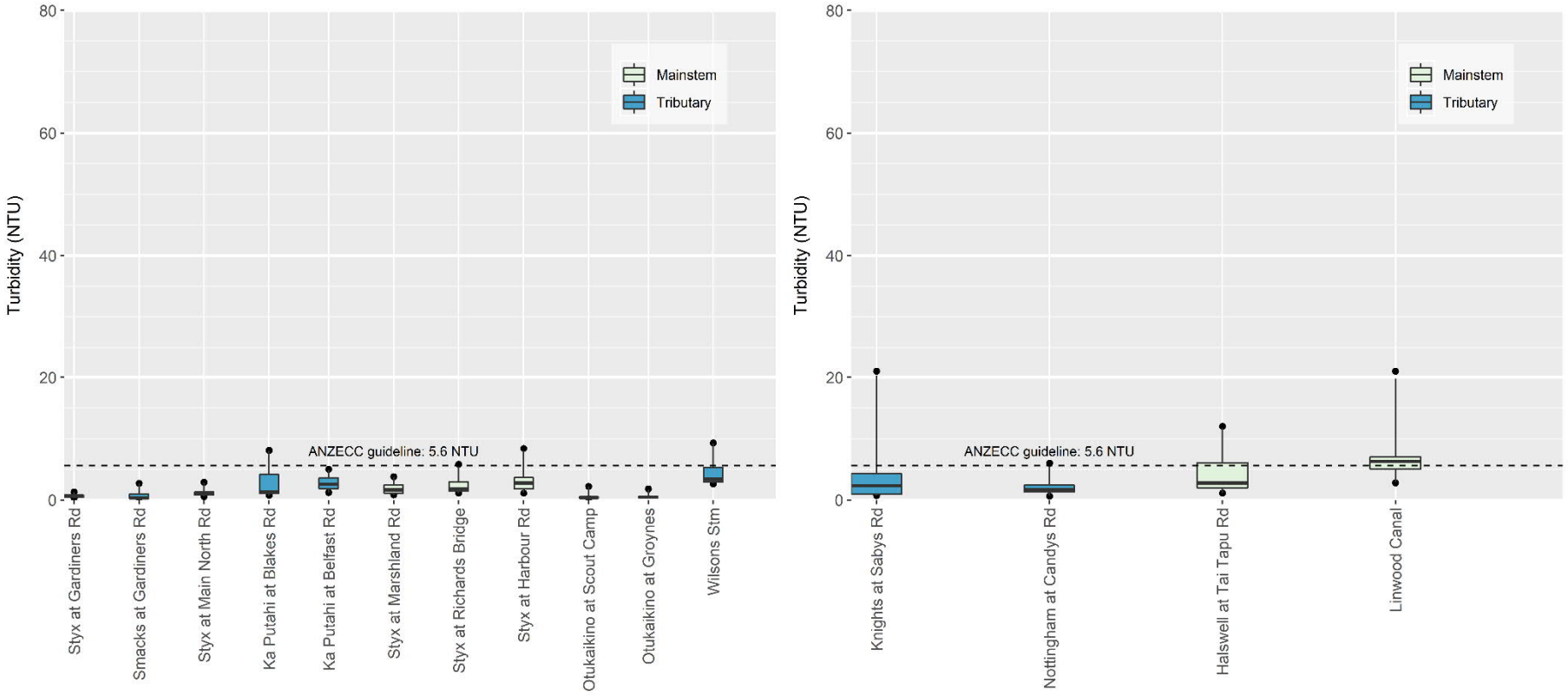


Figure vii (b). Turbidity levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. The following sites were not measured for this parameter: Halswell Retention Basin Inlet and Halswell Retention Basin Outlet. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the ANZECC (2000) guideline value of 5.6 Nephelometric Turbidity Units (NTU).

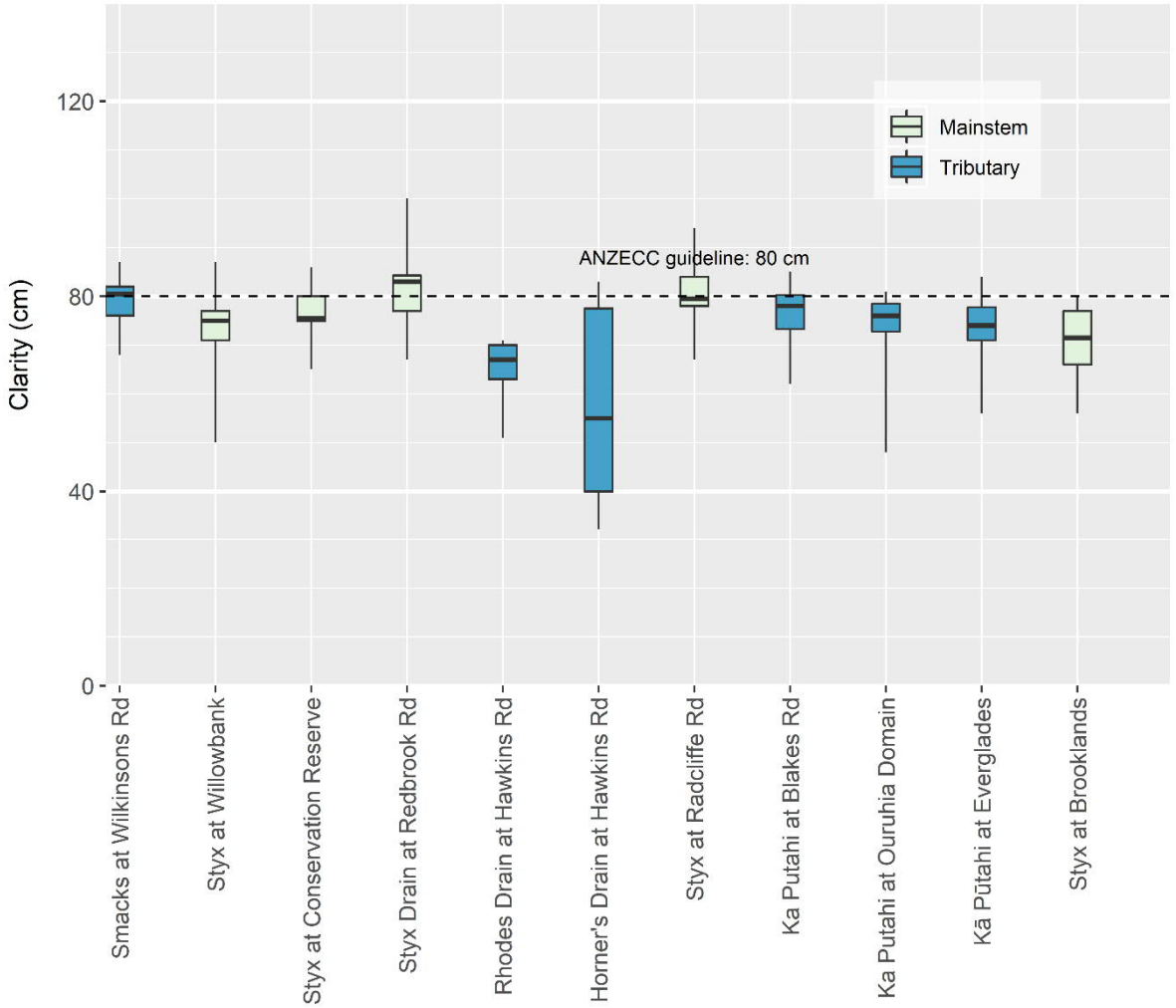


Figure viii. Water clarity levels in water samples taken from the Pūharakekenui/ Styx River catchment by the Styx Living Laboratory Trust volunteers for the monitoring period January to December 2019 (n = 6–10 samples per site). Sites are ordered from upstream to downstream (left to right). The dashed line represents the ANZECC (2000) guideline value of 80 cm.

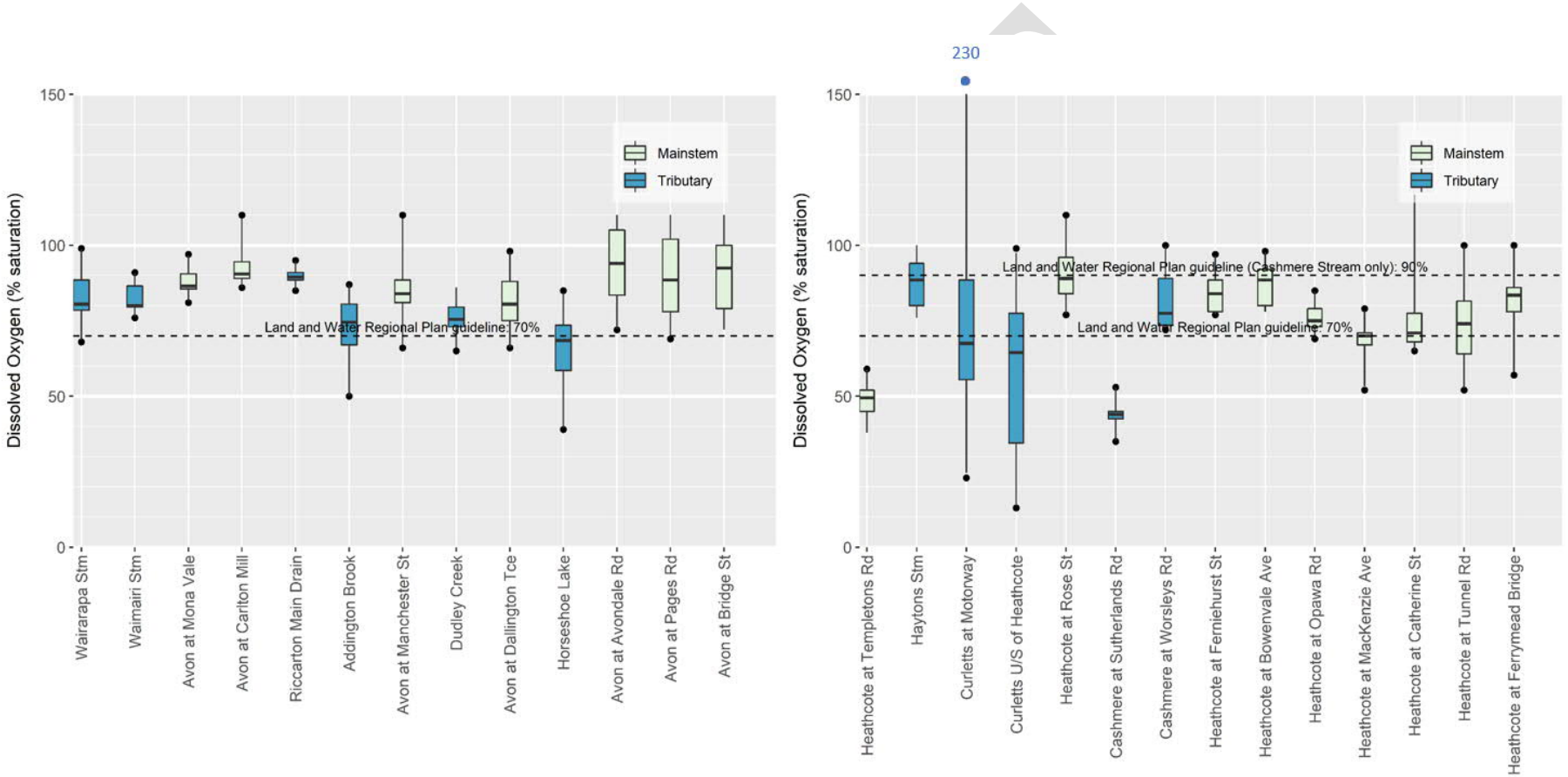


Figure ix (a). Dissolved oxygen levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The lower and upper dashed lines represent the Land and Water Regional Plan minimum guideline value for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways (70%), and Banks Peninsula waterways (90%; Cashmere Stream only), respectively (Environment Canterbury, 2019).

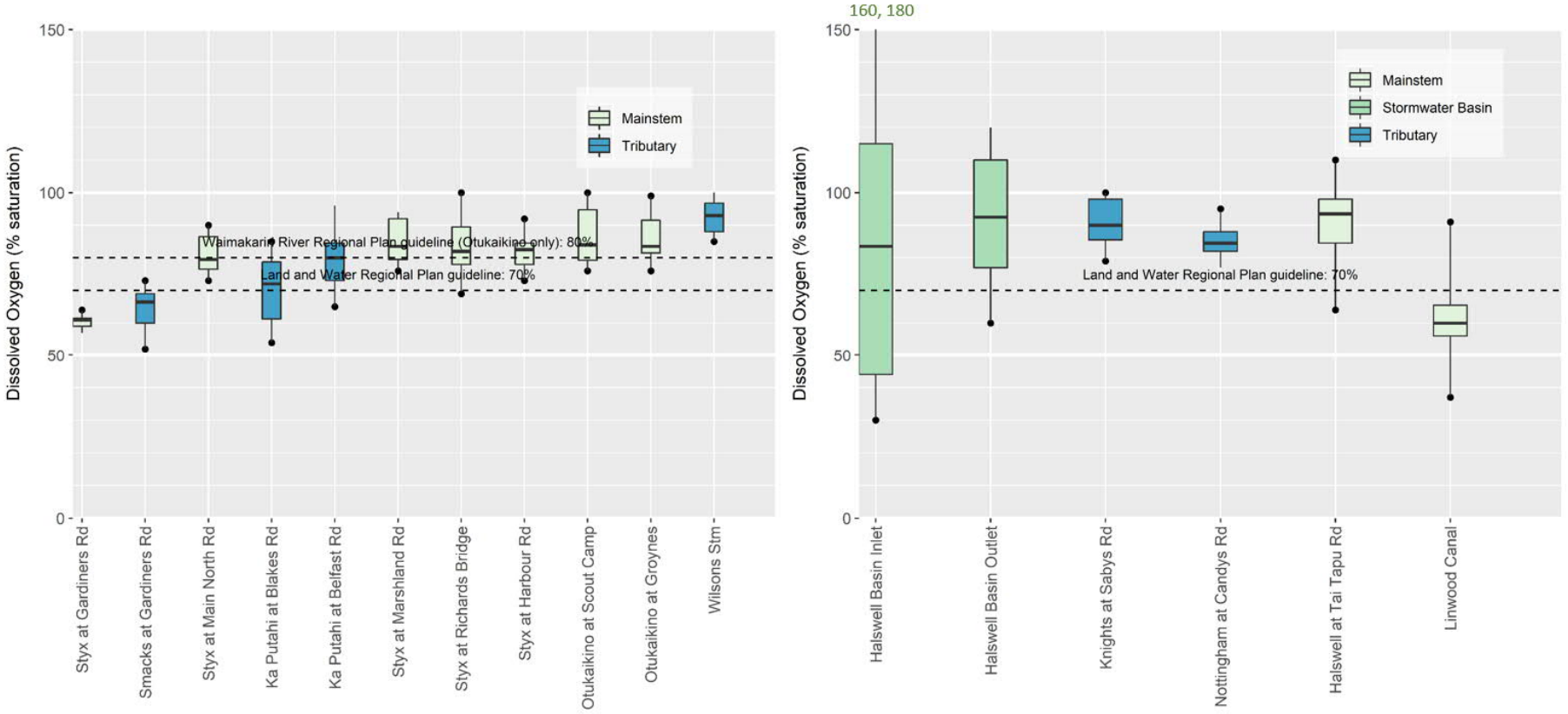


Figure ix (b). Dissolved oxygen levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The lower dashed line represents the Land and Water Regional Plan minimum guideline value for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways (70%, Environment Canterbury, 2019). The upper dotted line represents the Waimakariri River Regional Plan minimum guideline value for all Ōtūkaikino sites (80%, Environment Canterbury, 2011).

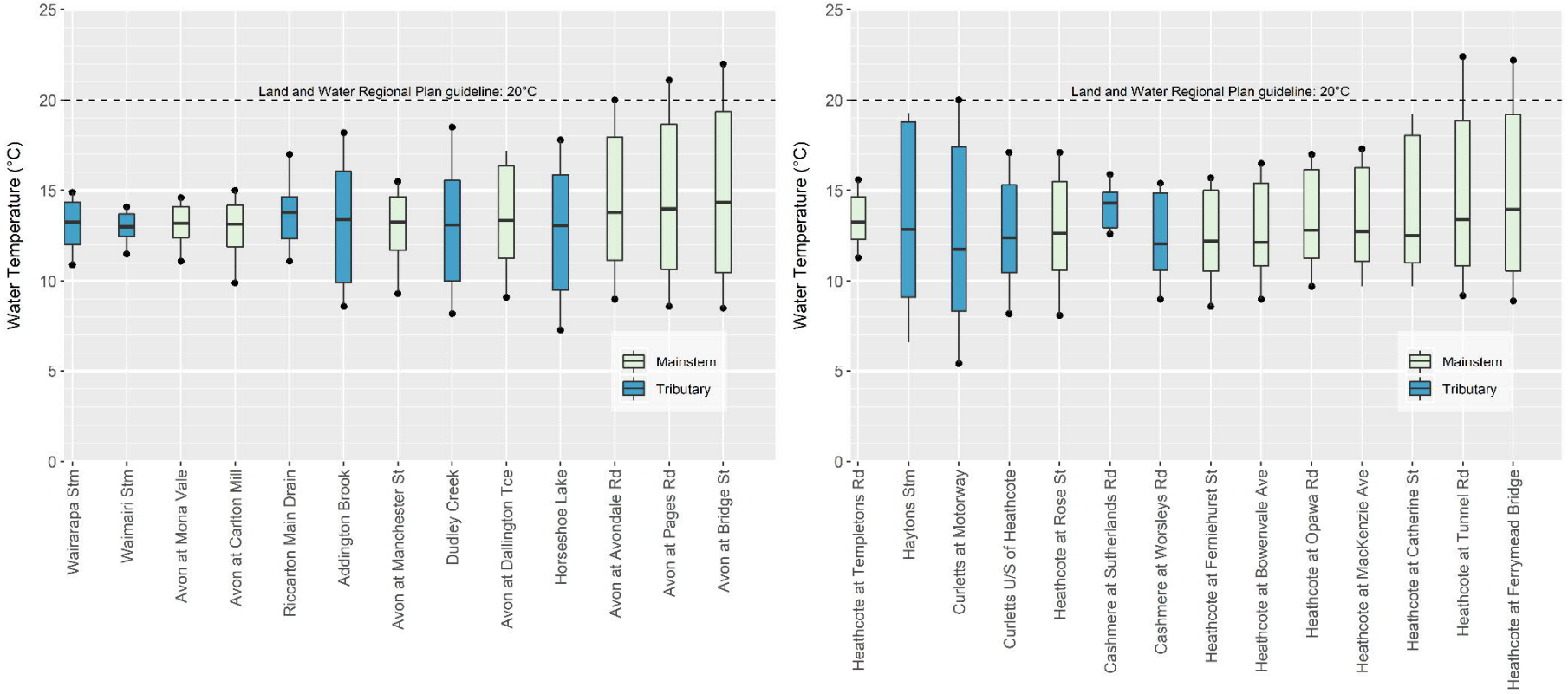


Figure x (a). Temperature of the water at the time of sampling at the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed line represents the Land and Water Regional Plan maximum guideline value (20ºC, Environment Canterbury, 2019).

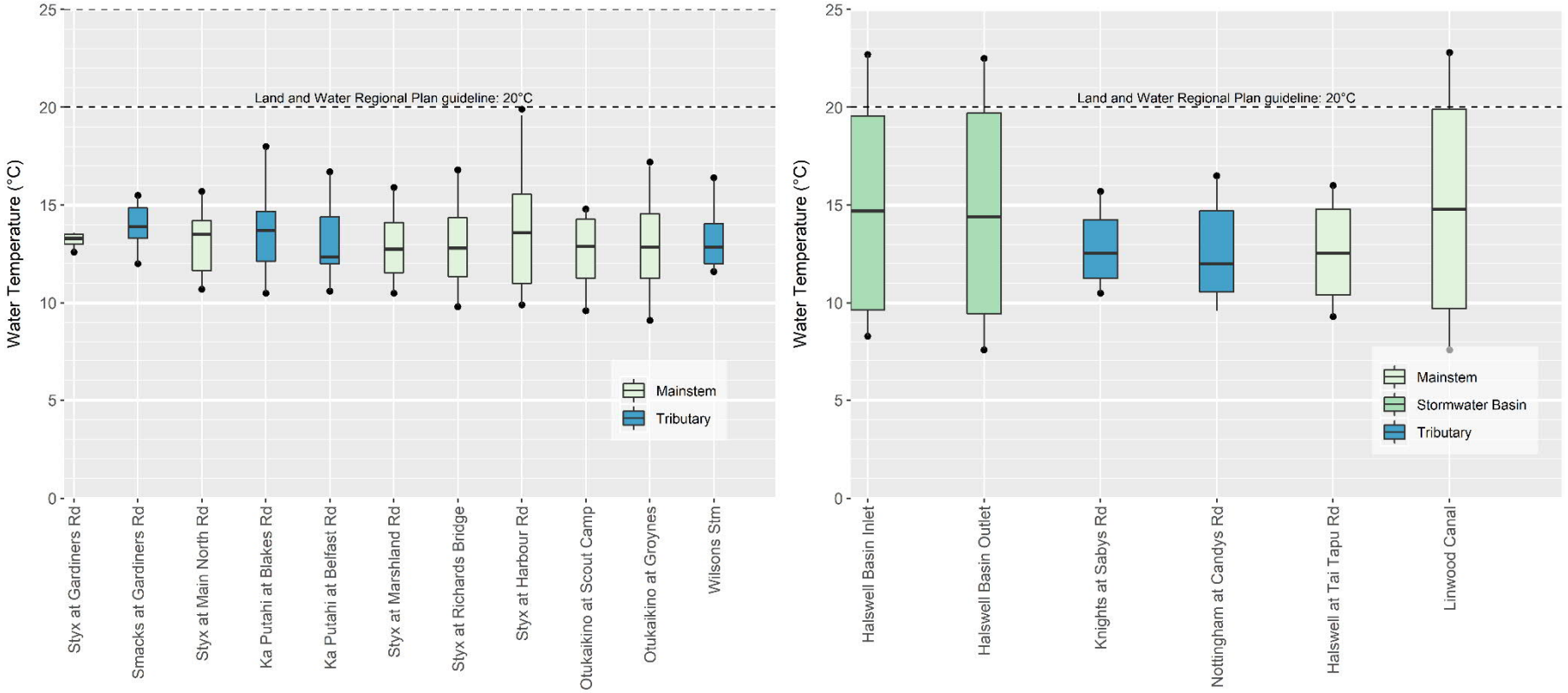


Figure x (b). Temperature of the water at the time of sampling at the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan maximum guideline value (20ºC, Environment Canterbury, 2019). The Waimakariri River Regional Plan maximum guideline value for all Ōtūkaikino sites is 25ºC (Environment Canterbury, 2011).

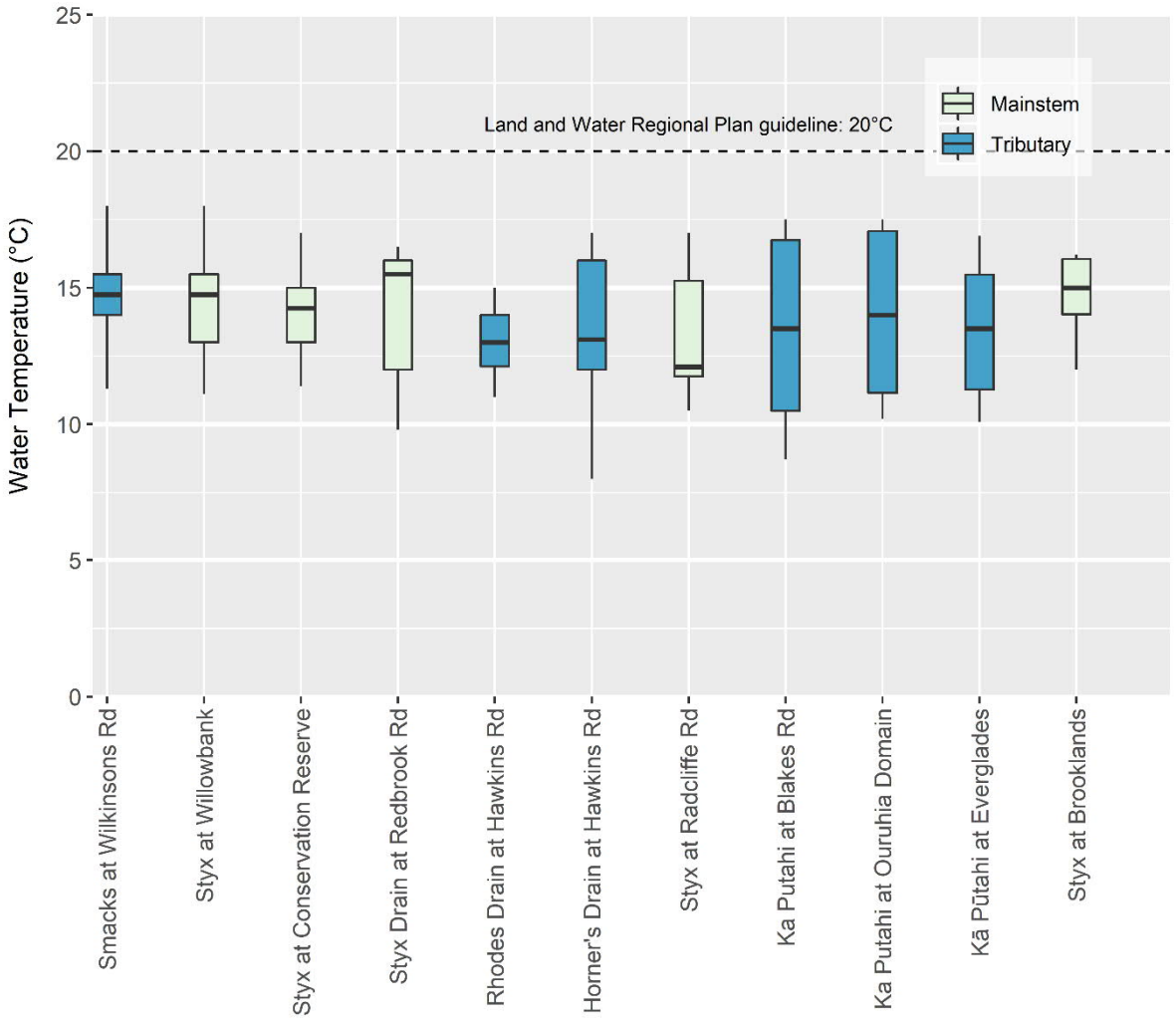


Figure x (c). Temperature of the water at the time of sampling by the Styx Living Laboratory Trust volunteers for the monitoring period January to December 2019 (n = 6–10 samples per site). Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan maximum guideline value (20 ºC, Environment Canterbury, 2019).

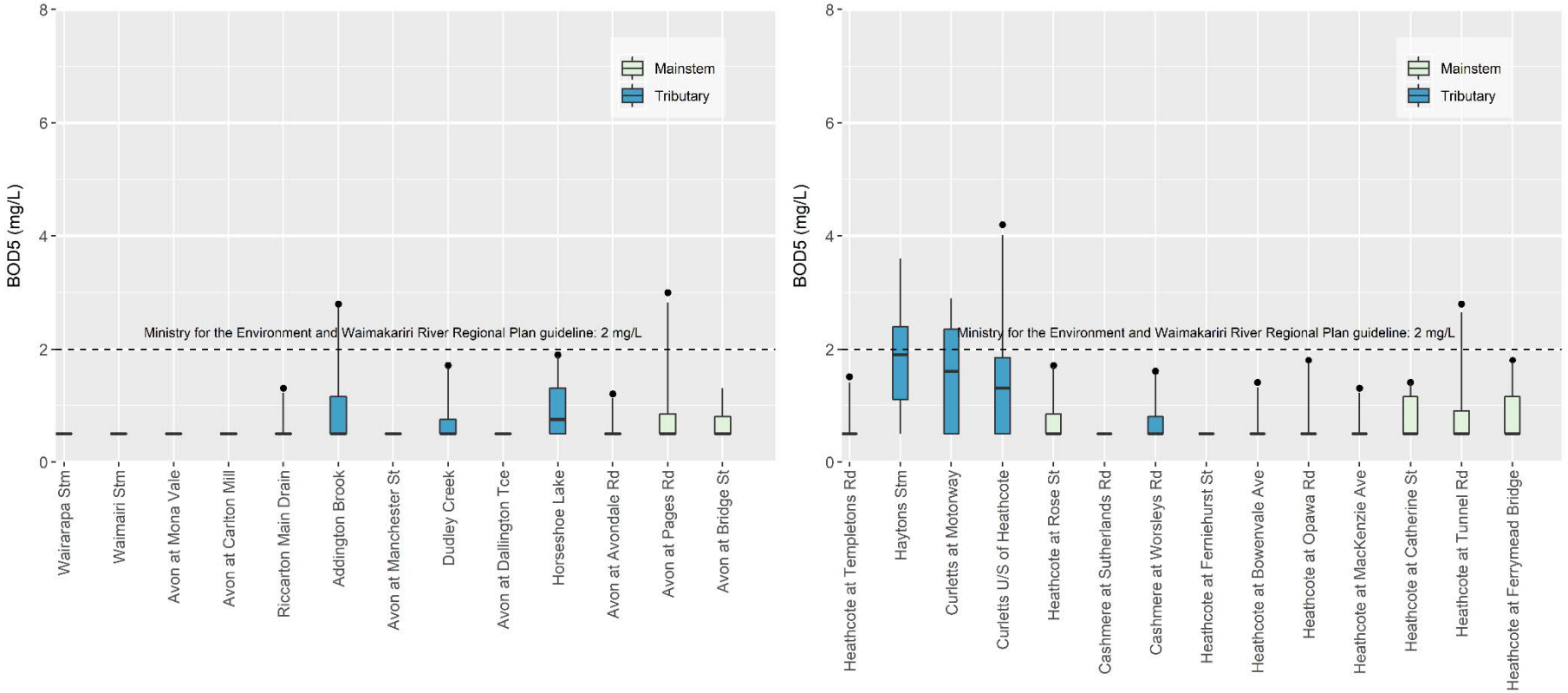


Figure xi (a). Biochemical Oxygen Demand (BOD_5) levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent both the Ministry for the Environment and Waimakariri River Regional Plan guideline value (2 mg/L; Ministry for the Environment, 1992; Environment Canterbury, 2011). The Laboratory Limit of Detection was 1.0 mg/L, analysed as half this value (0.5 mg/L) to allow statistics to be undertaken.

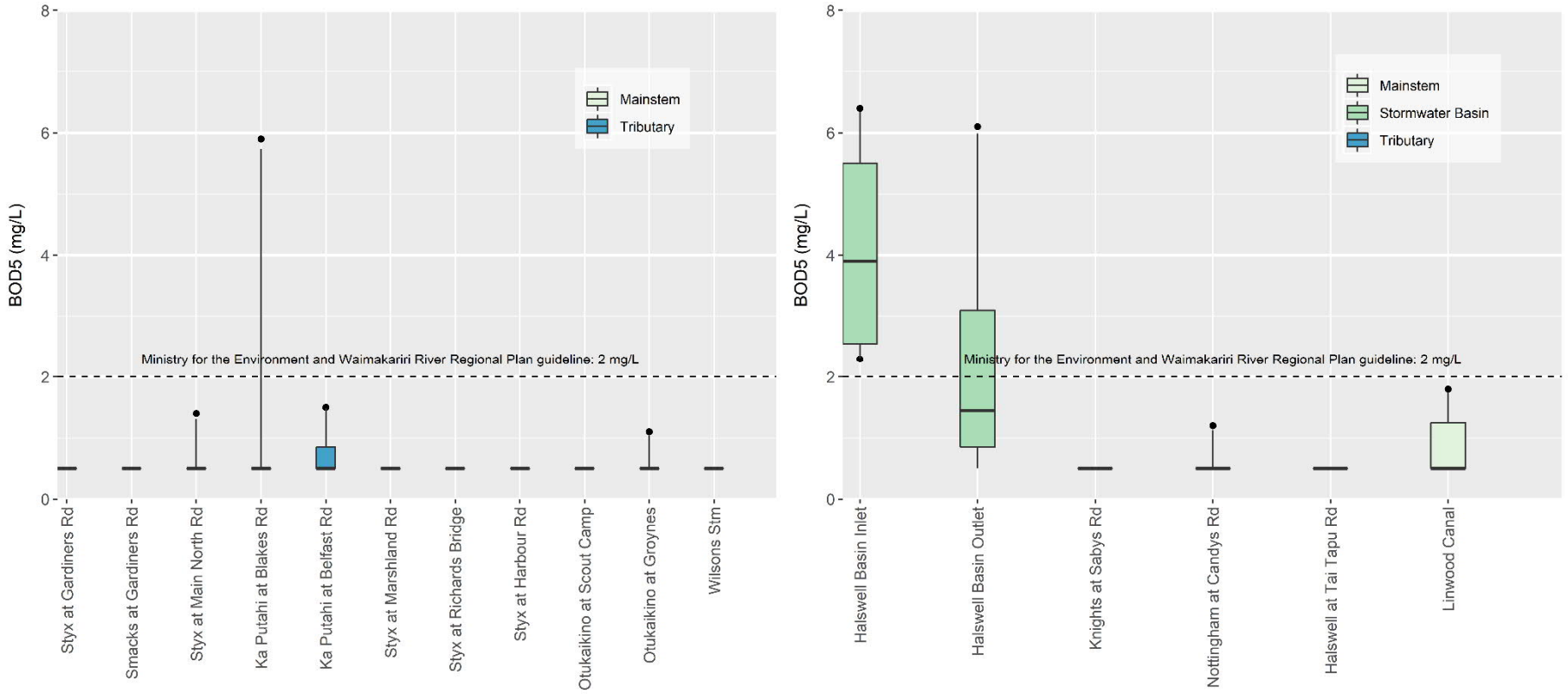


Figure xi (b). Biochemical Oxygen Demand (BOD_5) levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent both the Waimakariri River Regional Plan and Ministry for the Environment guideline value (2 mg/L; Ministry for the Environment, 1992; Environment Canterbury, 2011). The Laboratory Limit of Detection was 1.0 mg/L, analysed as half this value (0.5 mg/L) to allow statistics to be undertaken.

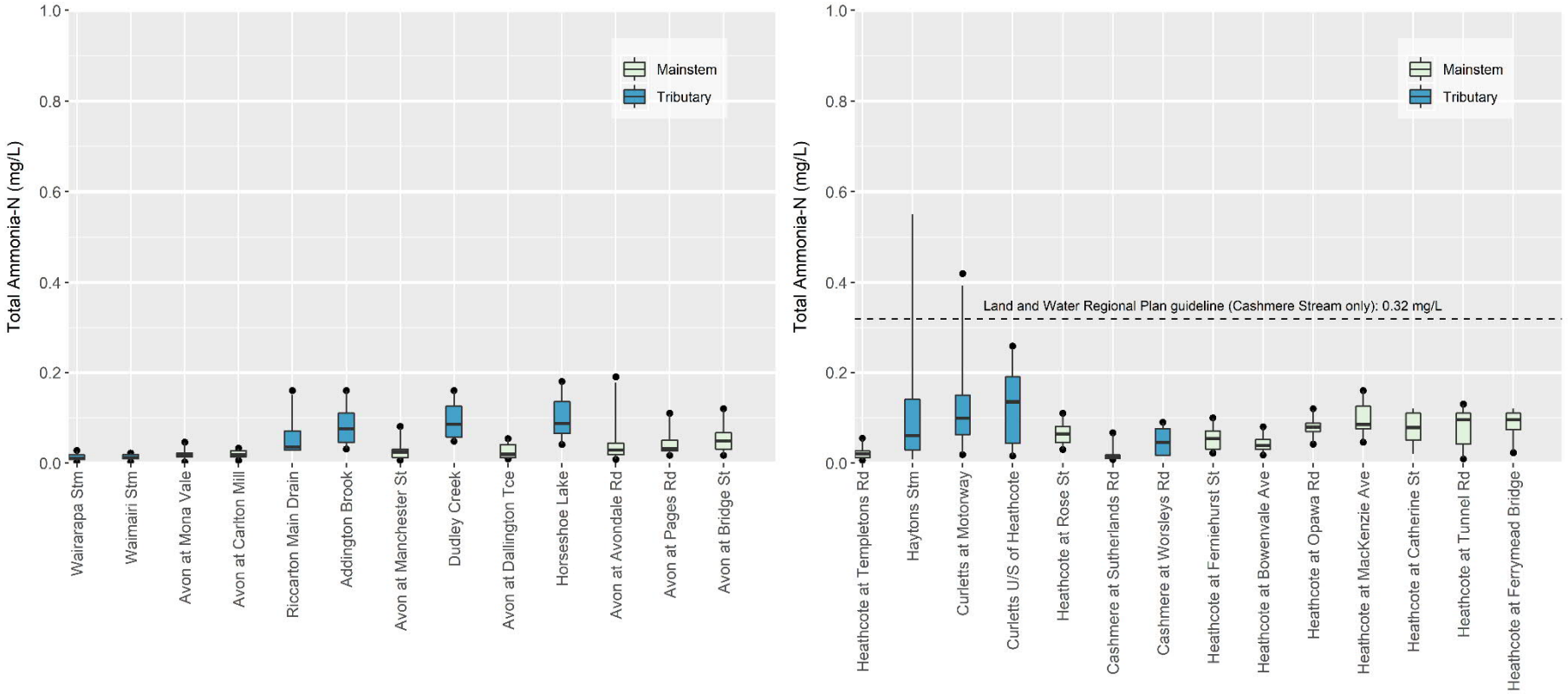


Figure xii (a). Total ammonia levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The Land and Water Regional Plan guideline value (Ōtākaro/ Avon catchment: 1.88 mg/L, Ōpāwaho/ Heathcote: 1.75 mg/L,; Environment Canterbury, 2019), which has been adjusted in accordance with median pH levels for the monitoring period (Ōtākaro/ Avon catchment: 7.3, Ōpāwaho/ Heathcote catchment: 7.4), are not presented on the graph as they are off the scale. The dashed line represents the Land and Water Regional Plan maximum guideline value for Banks Peninsula waterways (0.32 mg/L, Cashmere Stream only; Environment Canterbury, 2019). The Laboratory Limit of Detection was 0.005 mg/L – analysed as half this value (0.0025 mg/L) to allow statistics to be undertaken.

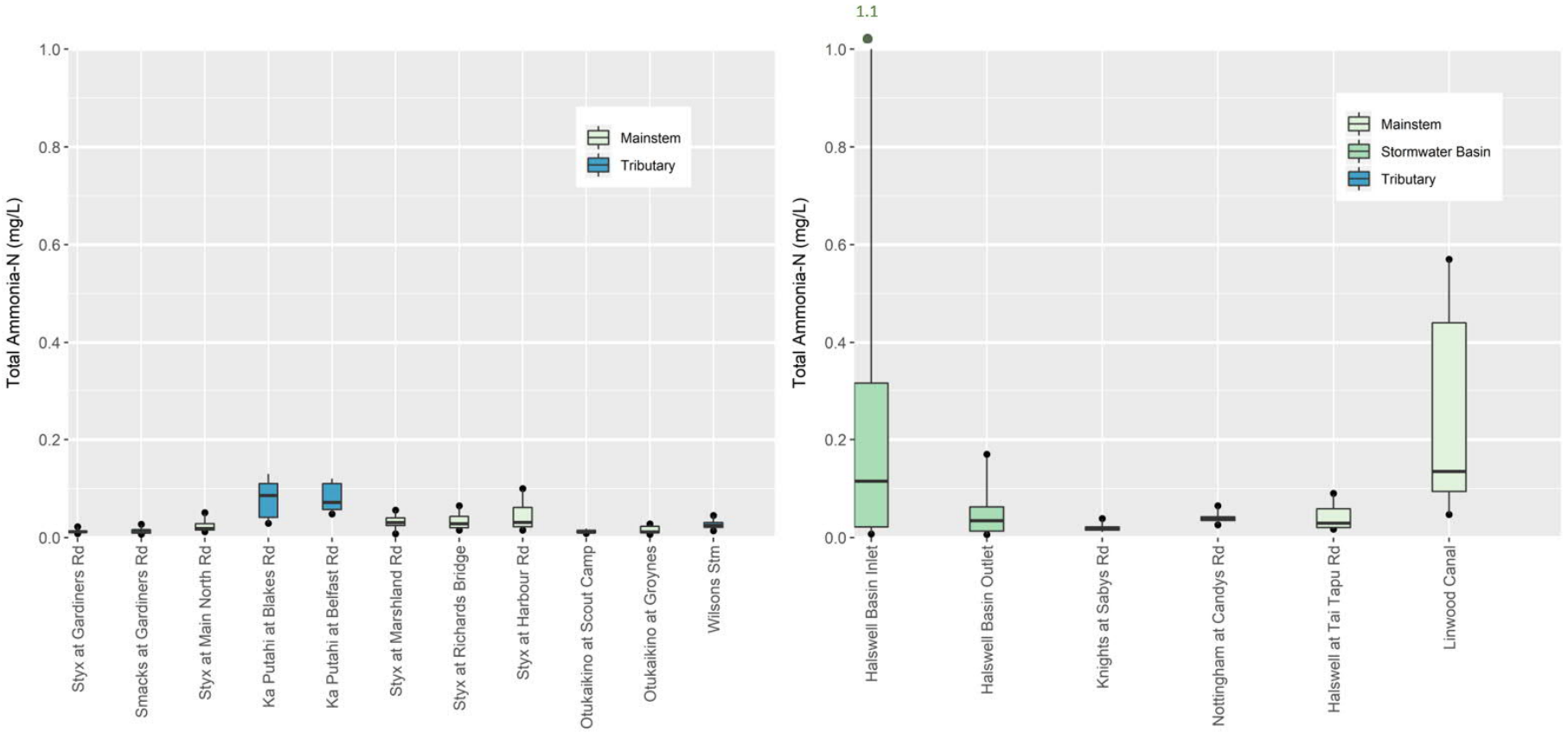


Figure xii (b). Total ammonia levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The Land and Water Regional Plan guideline values (Pūharakekenui/ Styx catchment: 1.99 mg/L, Ōtūkaikino catchment: 1.99 mg/L, Huritini/ Halswell catchment: 1.61 mg/L, Linwood Canal: 1.61 mg/L,; Environment Canterbury, 2019), adjusted in accordance with median pH levels for the monitoring period (Pūharakekenui/ Styx catchment: 7.2, Ōtūkaikino catchment: 7.2, Huritini/ Halswell catchment: 7.5, Linwood Canal: 7.5), are not presented on the graph as they are off the scale. The Laboratory Limit of Detection was 0.005 mg/L – analysed as half this value (0.0025 mg/L) to allow statistics to be undertaken.

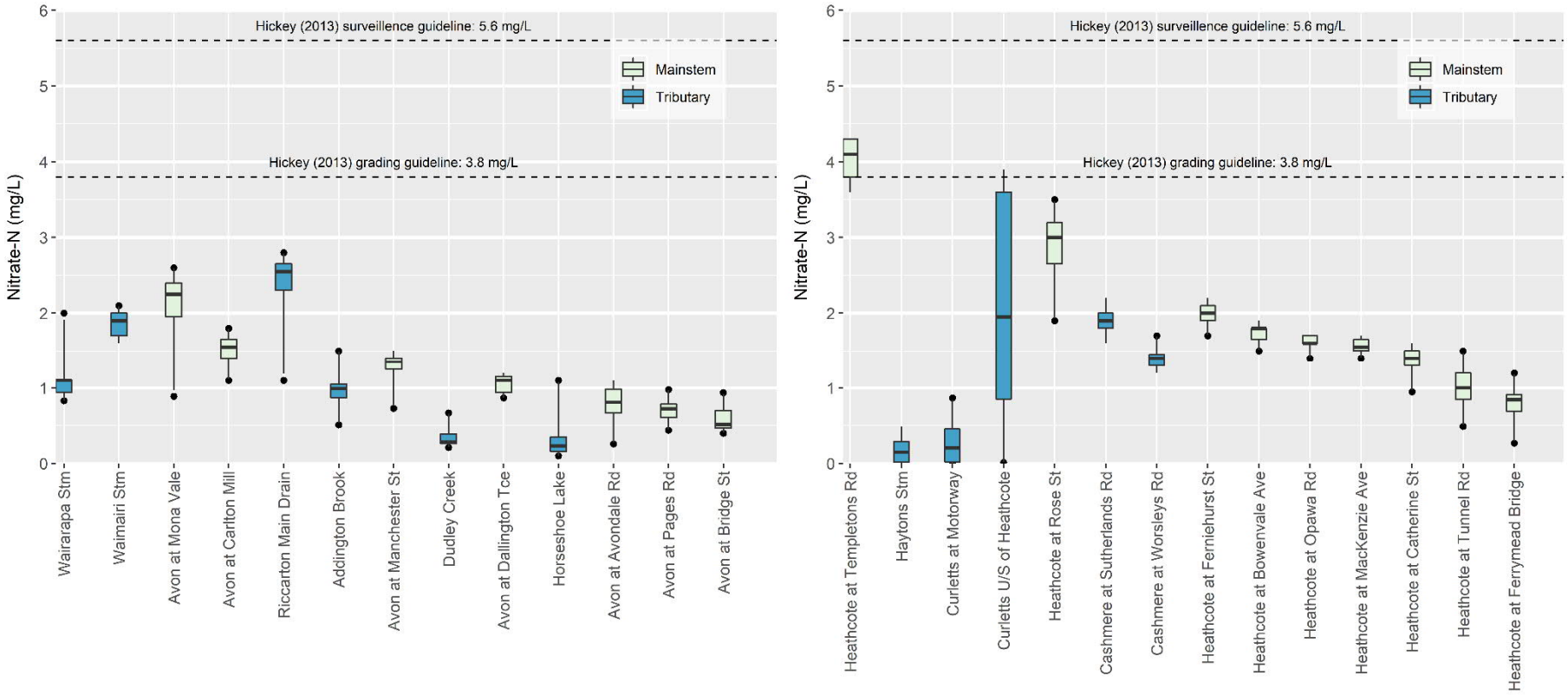


Figure xiii (a). Nitrate-nitrogen levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed and solid lines represent the Hickey (2013) grading (3.8 mg/L) and surveillance (5.6 mg/L) guideline levels, respectively. The Laboratory Limit of Detection was 0.002 mg/L – analysed as half this value (0.001 mg/L) to allow statistics to be undertaken.

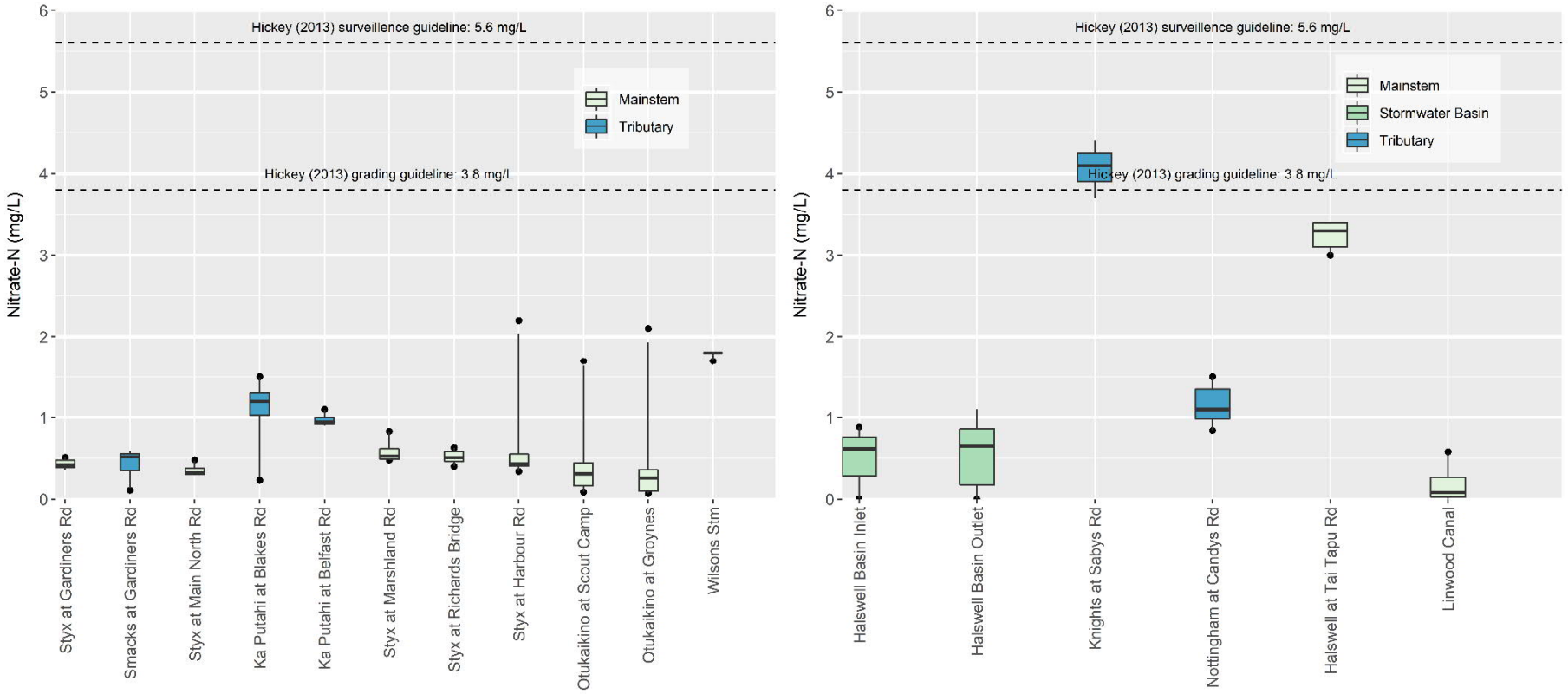


Figure xiii (b). Nitrate levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino Rivers (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed and solid lines represent the Hickey (2013) grading (3.8 mg/L) and surveillance (5.6 mg/L) guideline levels, respectively. The Laboratory Limit of Detection was 0.002 mg/L – analysed as half this value (0.001 mg/L) to allow statistics to be undertaken.

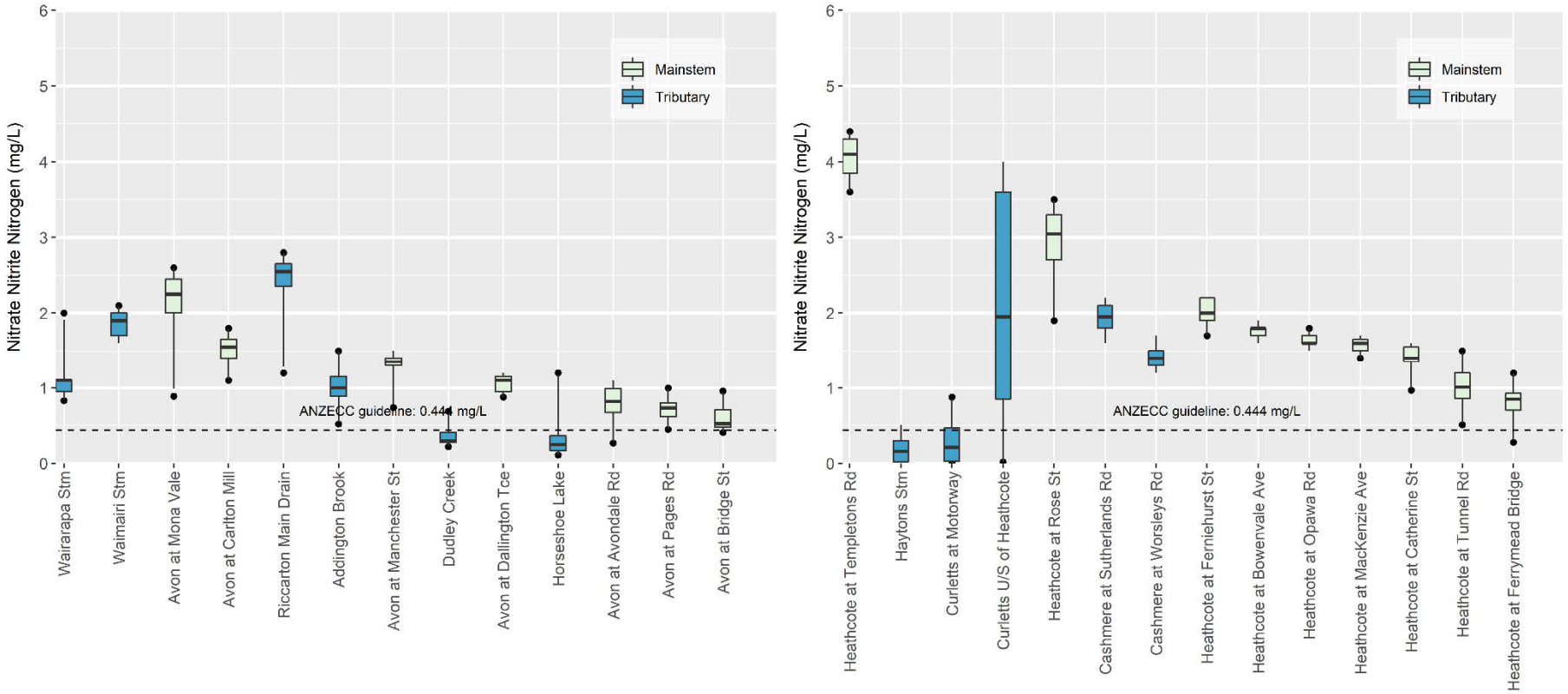


Figure xiv (a). Nitrate Nitrite Nitrogen (NNN) in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the ANZECC water quality guideline (0.444 mg/L; ANZECC, 2000). The Laboratory Limit of Detection was 0.002 mg/L – analysed as half this value (0.001 mg/L) to allow statistics to be undertaken.

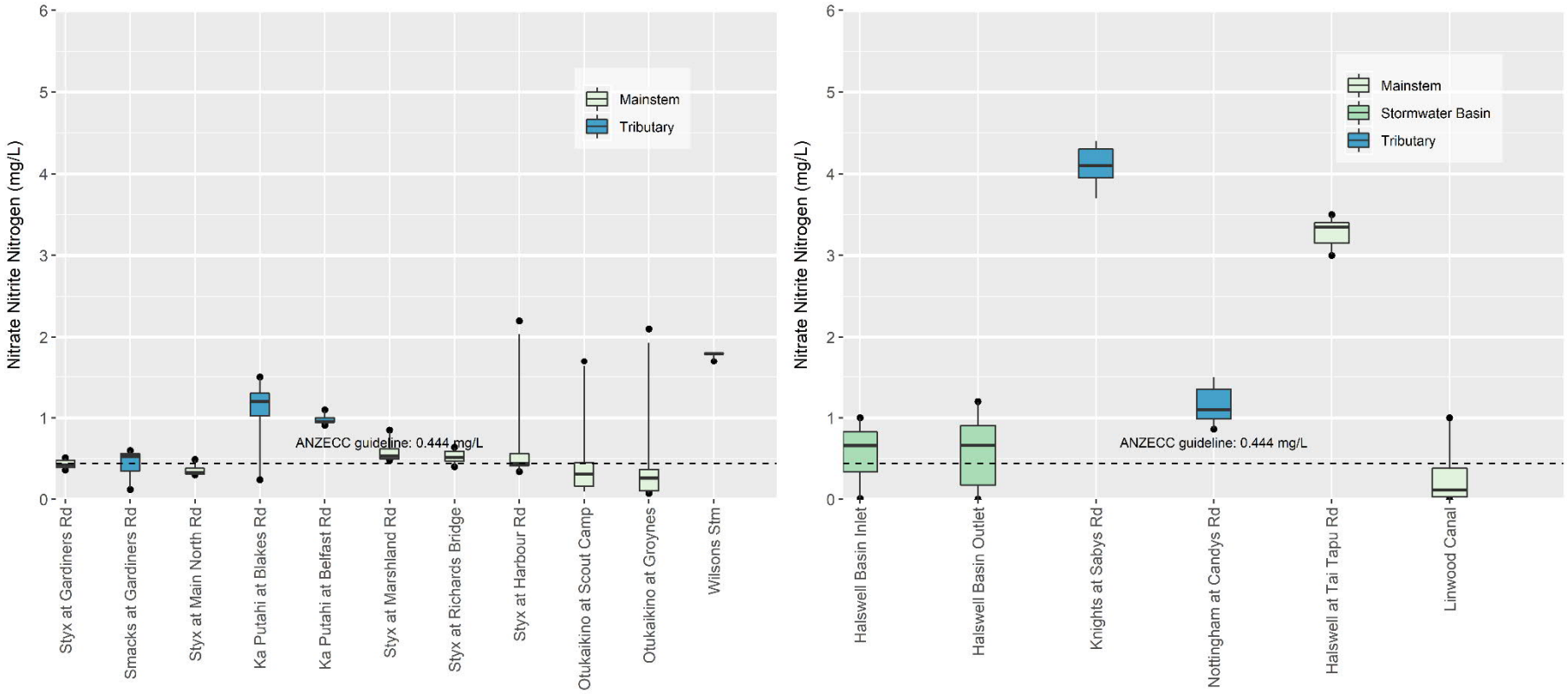


Figure xiv (b). Nitrate Nitrite Nitrogen (NNN) levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the ANZECC water quality guideline (0.444 mg/L; ANZECC, 2000). The Laboratory Limit of Detection was 0.002 mg/L – analysed as half this value (0.001 mg/L) to allow statistics to be undertaken.

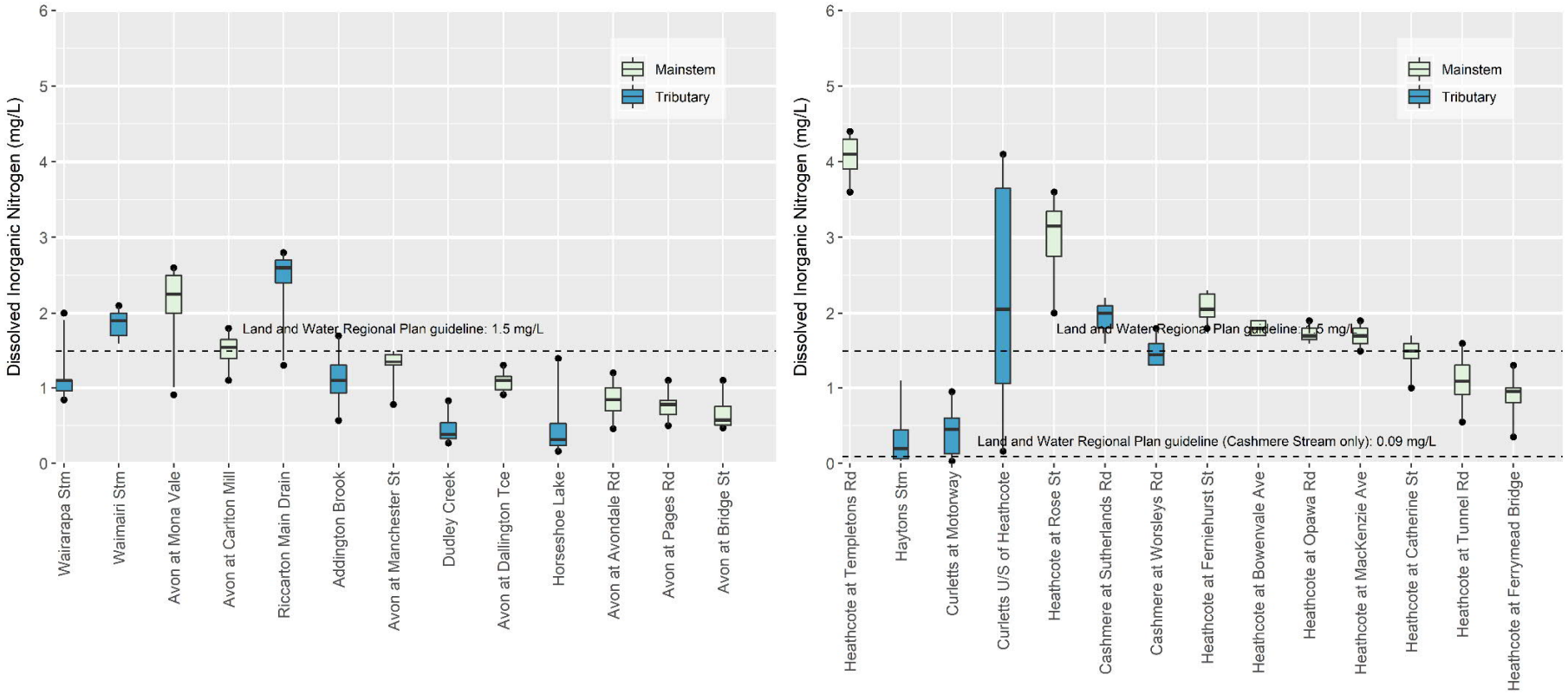


Figure xv (a). Dissolved Inorganic Nitrogen (DIN) levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value of 1.5 mg/L for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways, and 0.09 mg/L for Banks Peninsula waterways (Cashmere Stream only), respectively (Environment Canterbury, 2019).

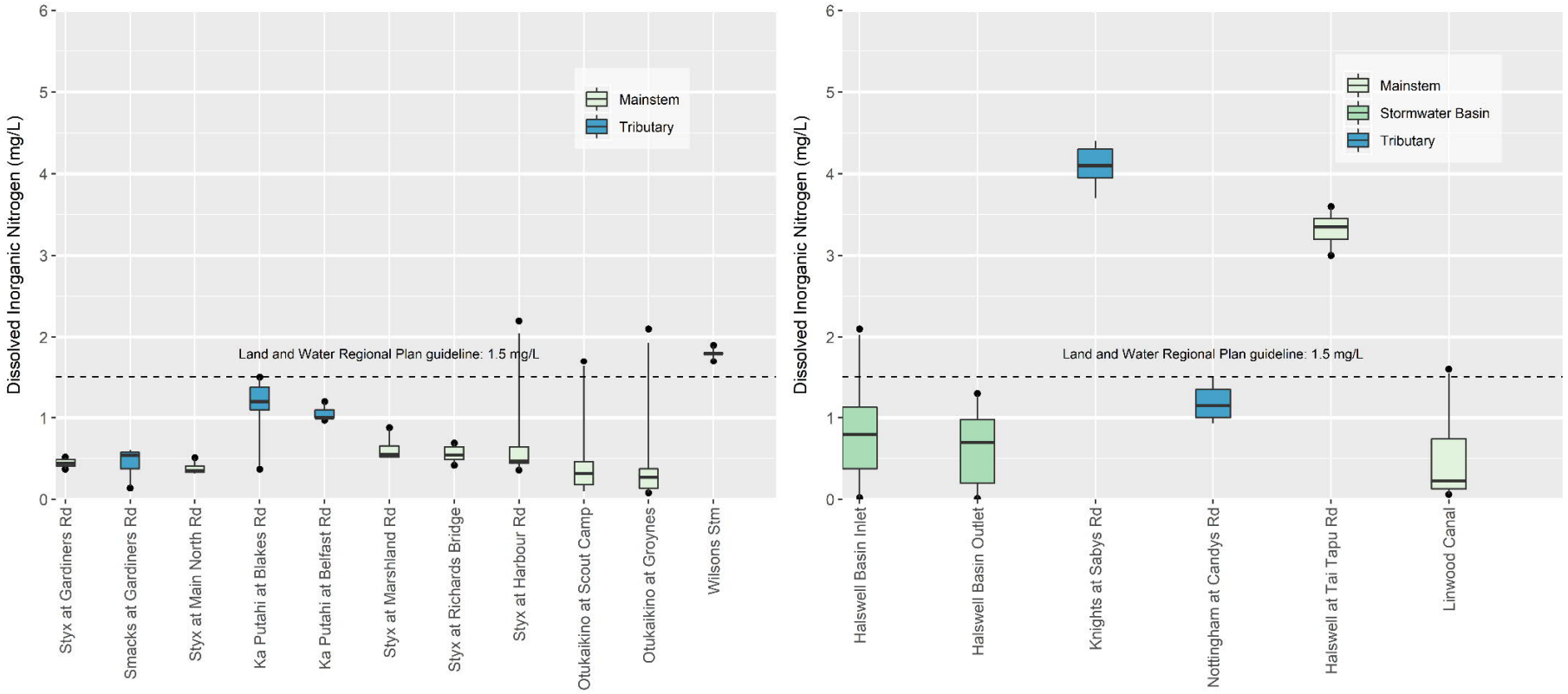


Figure xv (b). Dissolved Inorganic Nitrogen (DIN) levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways of 1.5 mg/L (Environment Canterbury, 2019).

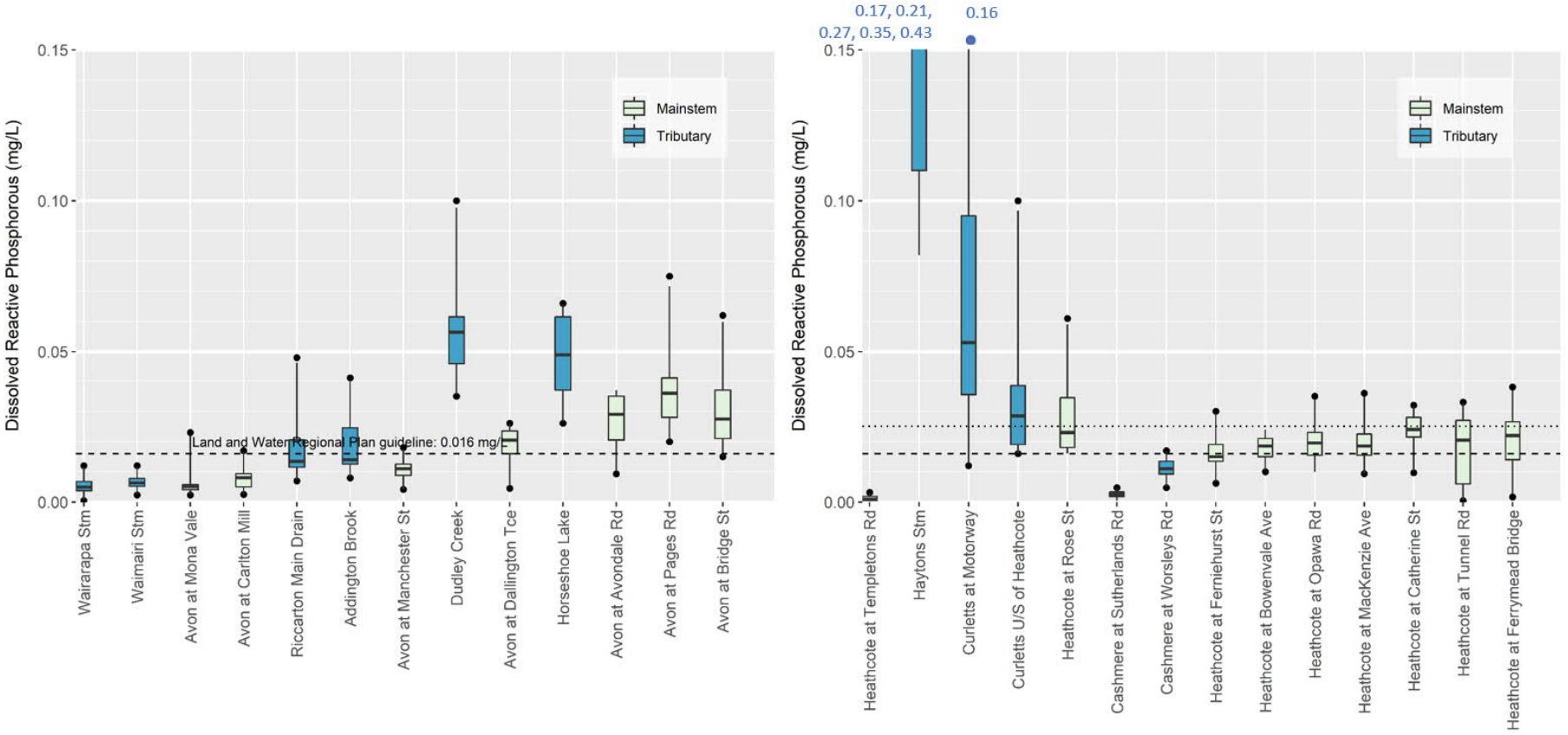


Figure xvi (a). Dissolved Reactive Phosphorus (DRP) levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019. No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value of 0.016 mg/L for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways, and the dotted line (right graph only), represents the Land and Water Regional Plan guideline value of 0.025 mg/L for Banks Peninsula waterways (Cashmere Stream only), (Environment Canterbury, 2019). The Laboratory Limit of Detection was 0.001 mg/L, analysed as half this value (0.0005 mg/L) to allow statistics to be undertaken.

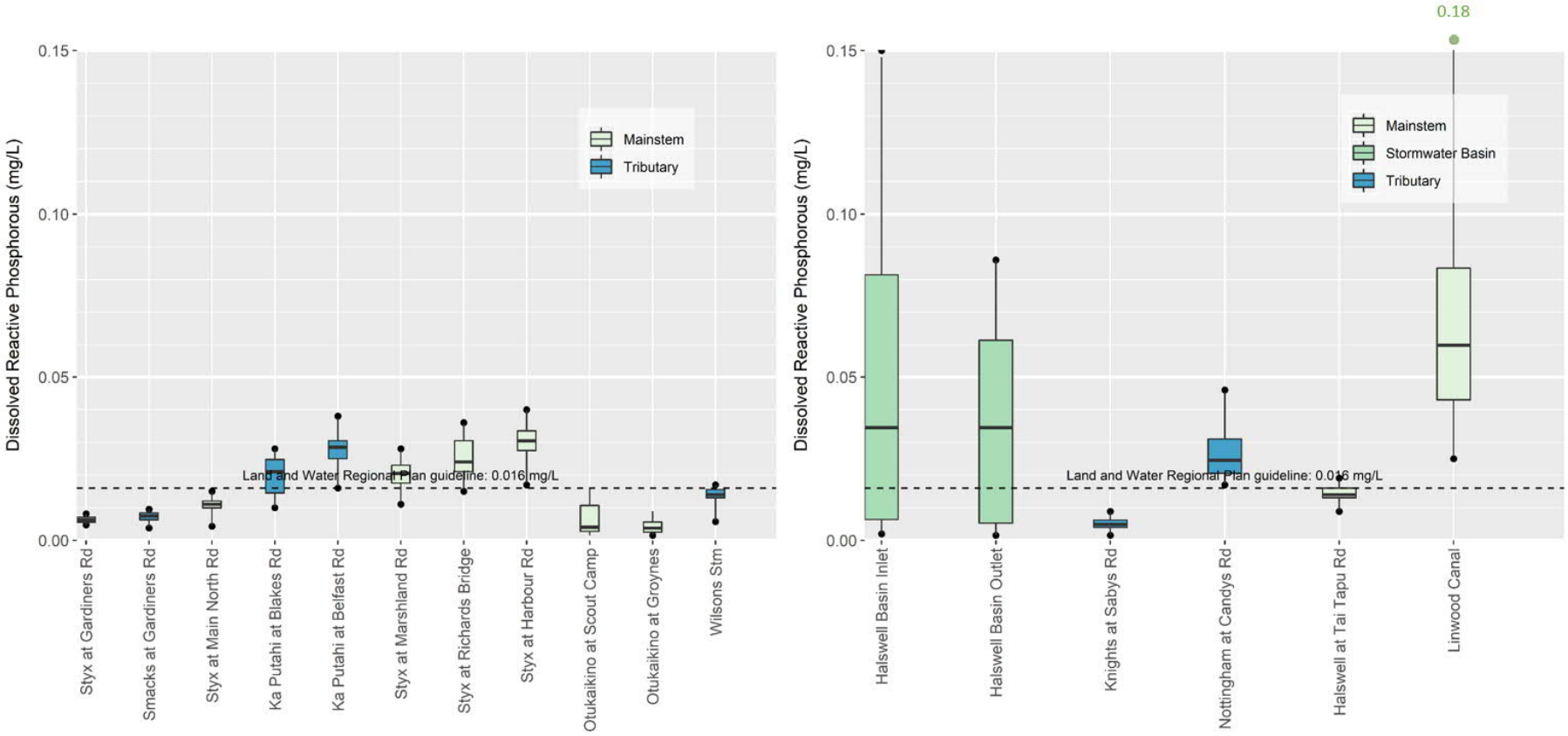


Figure xvi (b). Dissolved Reactive Phosphorus (DRP) levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value of 0.016 mg/L for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways (Environment Canterbury, 2019). The Laboratory Limit of Detection was 0.001 mg/L, analysed as half this value (0.0005 mg/L) to allow statistics to be undertaken.

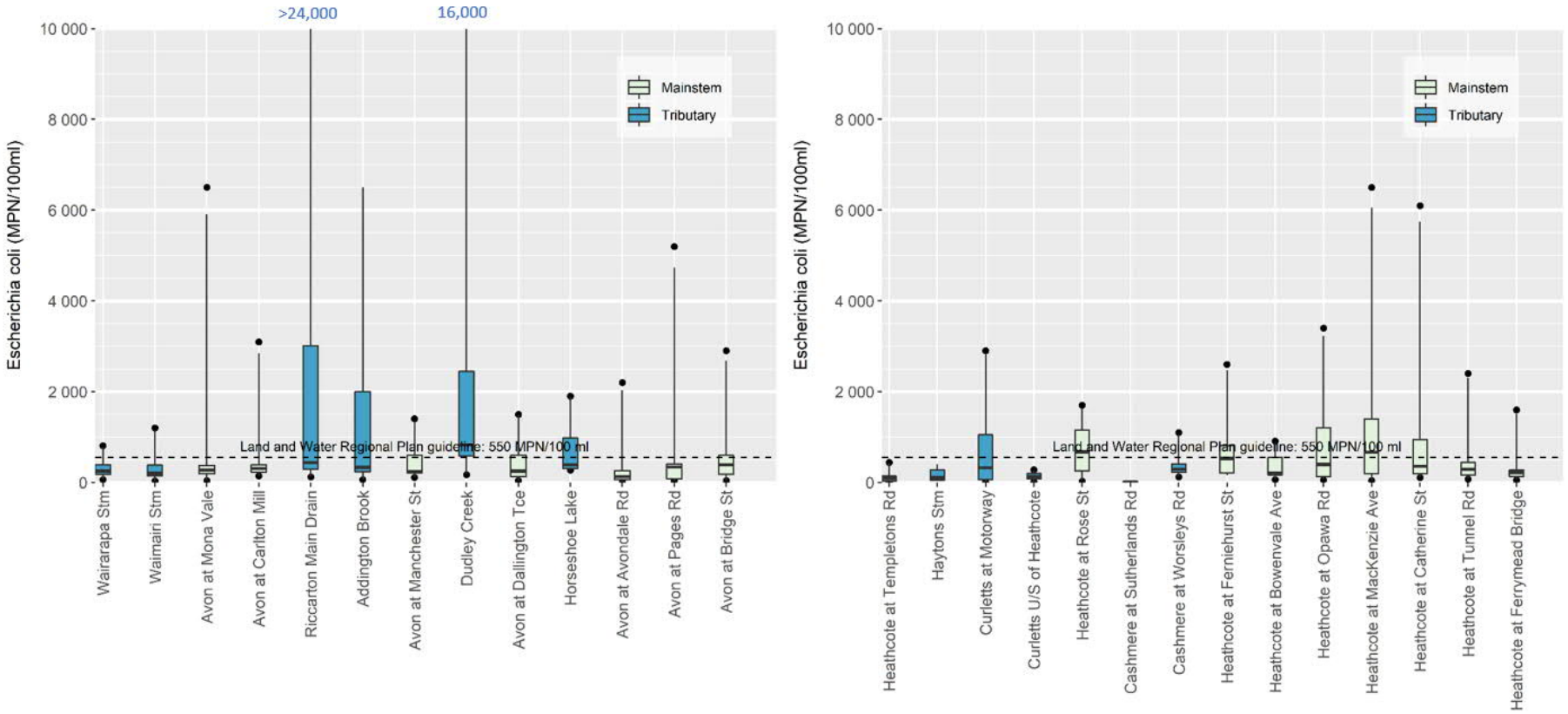


Figure xvii (a). *Escherichia coli* levels in water samples taken from the Ōtākaro/ Avon (left graph) and Ōpāwaho/ Heathcote (right graph) River sites, for the monitoring period January to December 2019.No monitoring was undertaken at the Haytons Stream site in March and June as the site was dry. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value of 550 MPN/100ml for 95% of samples for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways (Environment Canterbury, 2019). The Laboratory Limit of Detection varied depending on the necessary dilution of the sample, but all were analysed as half this value to allow statistics to be undertaken.

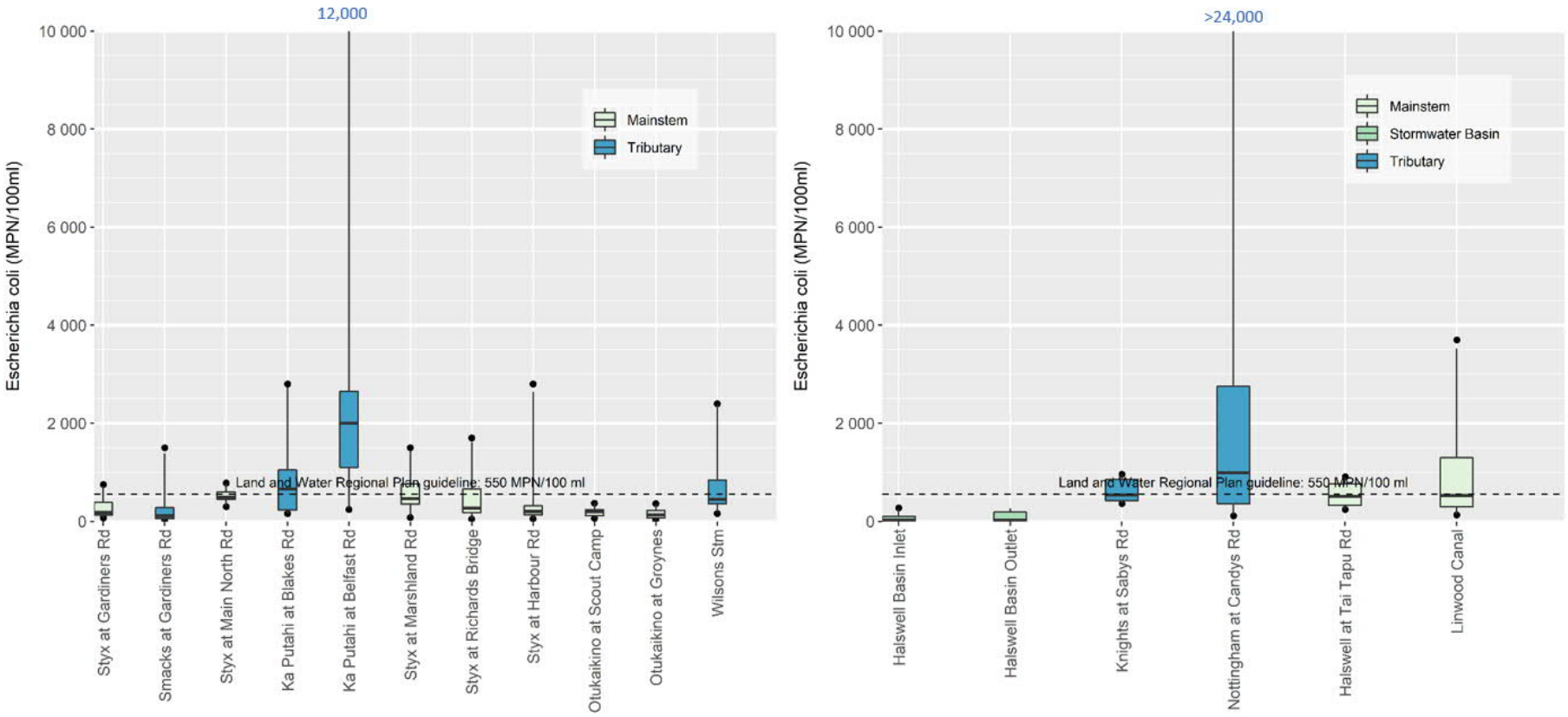


Figure xvii (b). *Escherichia coli* levels in water samples taken from the Pūharakekenui/ Styx and Ōtūkaikino River (left graph), and the Huritini/ Halswell River and Linwood Canal sites (right graph) for the monitoring period January to December 2019. No monitoring was undertaken at the Kā Pūtahi Creek at Blakes Road site in August and the Ōtūkaikino Creek at Omaka Scout Camp site in February, as these sites could not be accessed. Sites are ordered from upstream to downstream (left to right). The dashed lines represent the Land and Water Regional Plan guideline value of 550 MPN/100ml for 95% of samples for 'spring-fed – plains – urban' and 'spring-fed – plains' waterways (Environment Canterbury, 2019). The Laboratory Limit of Detection varied depending on the necessary dilution of the sample, but all were analysed as half this value to allow statistics to be undertaken.

Timetables for stormwater mitigation projects within the Ōpāwaho/Heathcote Stormwater Management Plan Area

Paragon IQ

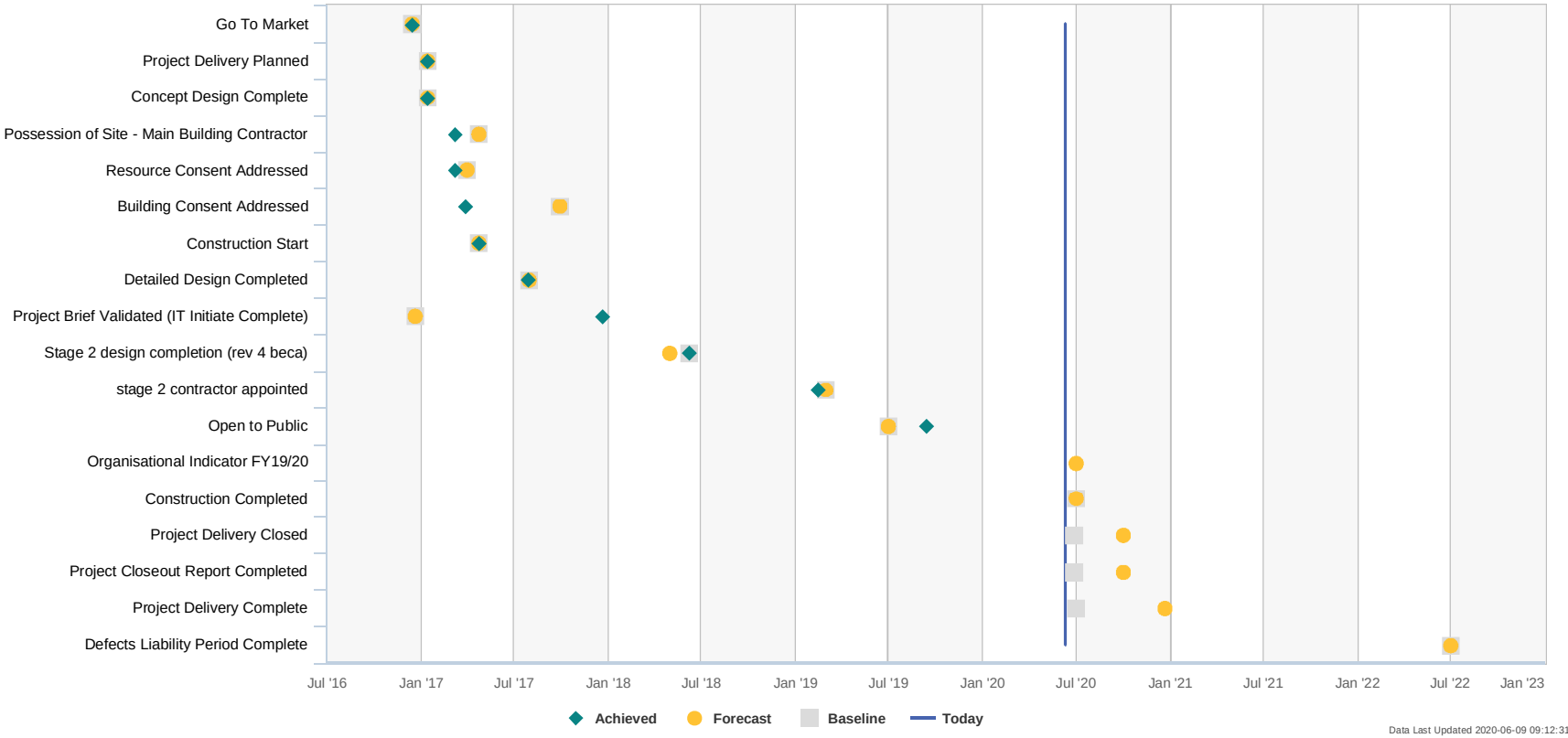
PROJECT EXPLORER

Select A Project: 40237 - LDRP 520 Wigram East Retention Basin

LDRP 520 Wigram East Retention Basin

Project CPMS ID # 40237

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: All works other than planting and final landscaping will be delivered within financial year.

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Christchurch City Council

Paragon IQ

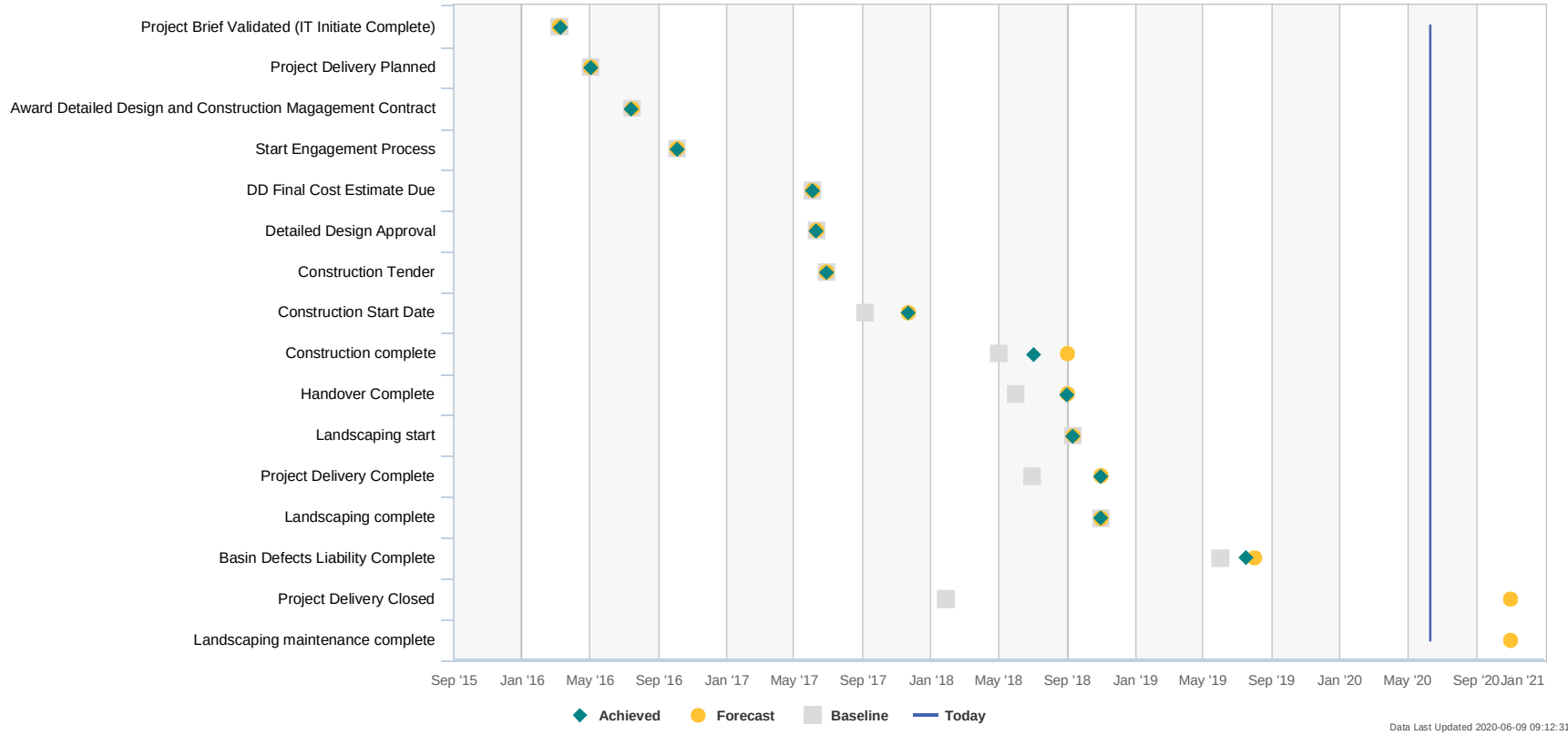
PROJECT EXPLORER

Select A Project: 31593 - LDRP 516 Knights Drain - Wainoni Park

LDRP 516 Knights Drain - Wainoni Park

Project CPMS ID # 31593

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Landscaping complete.

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Christchurch City Council

Paragon IQ

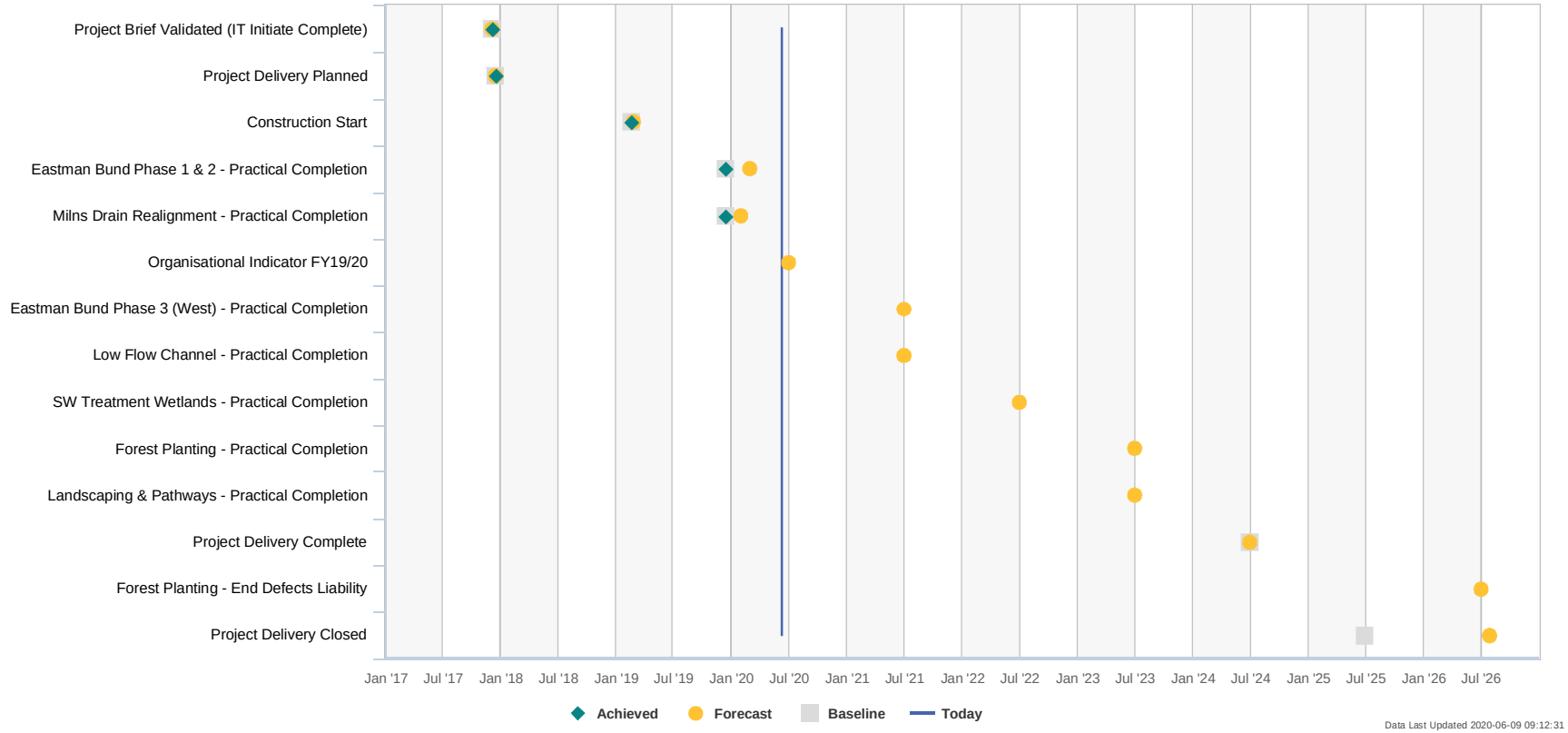
PROJECT EXPLORER

Select A Project: 46474 - LDRP 528 Eastman Wetlands

LDRP 528 Eastman Wetlands

Project CPMS ID # 46474

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

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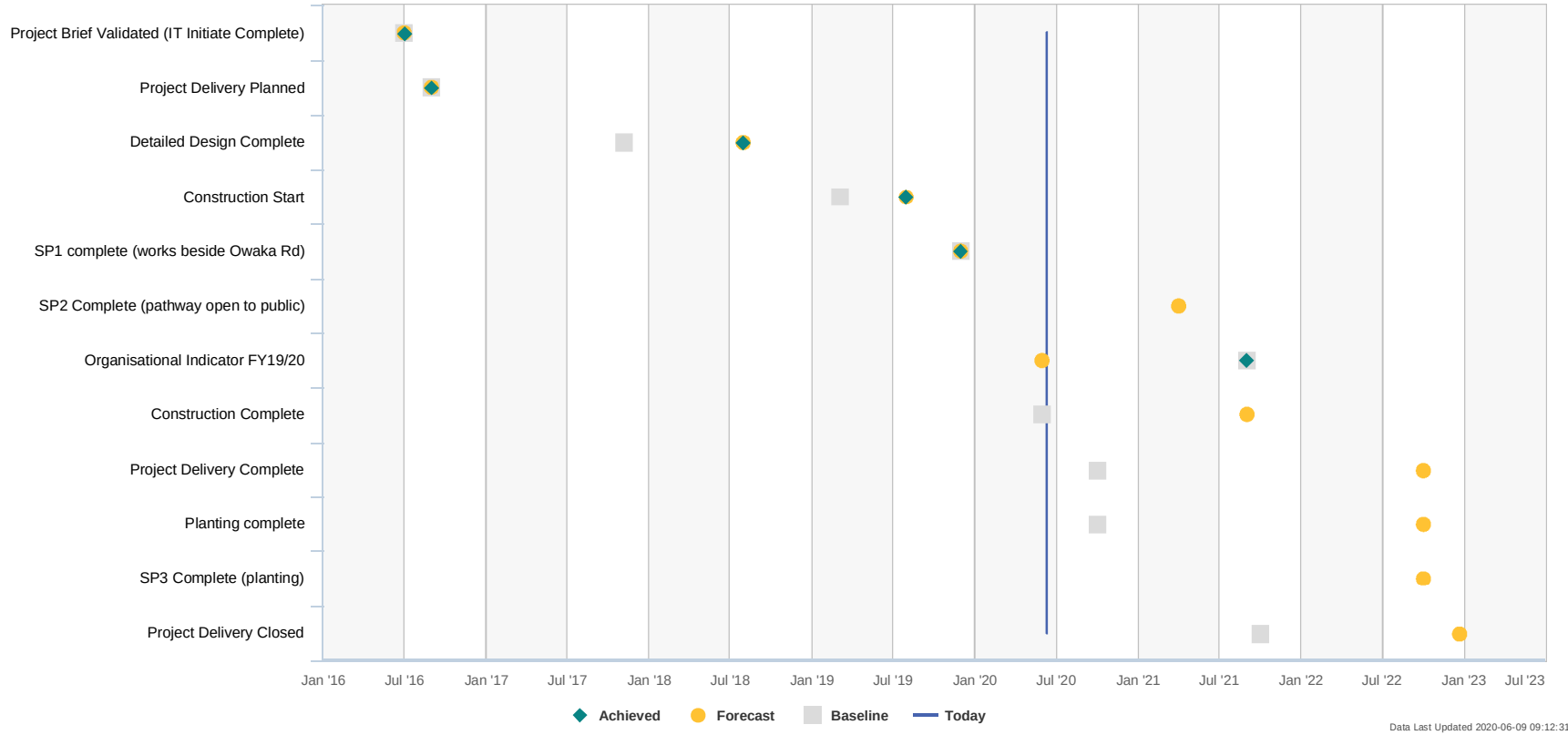
PROJECT EXPLORER

Select A Project: 33979 - SW Owaka Corridor

SW Owaka Corridor

Project CPMS ID # 33979

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Changes to programme due to finding protected skinks on site.

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Christchurch City Council

Paragon IQ

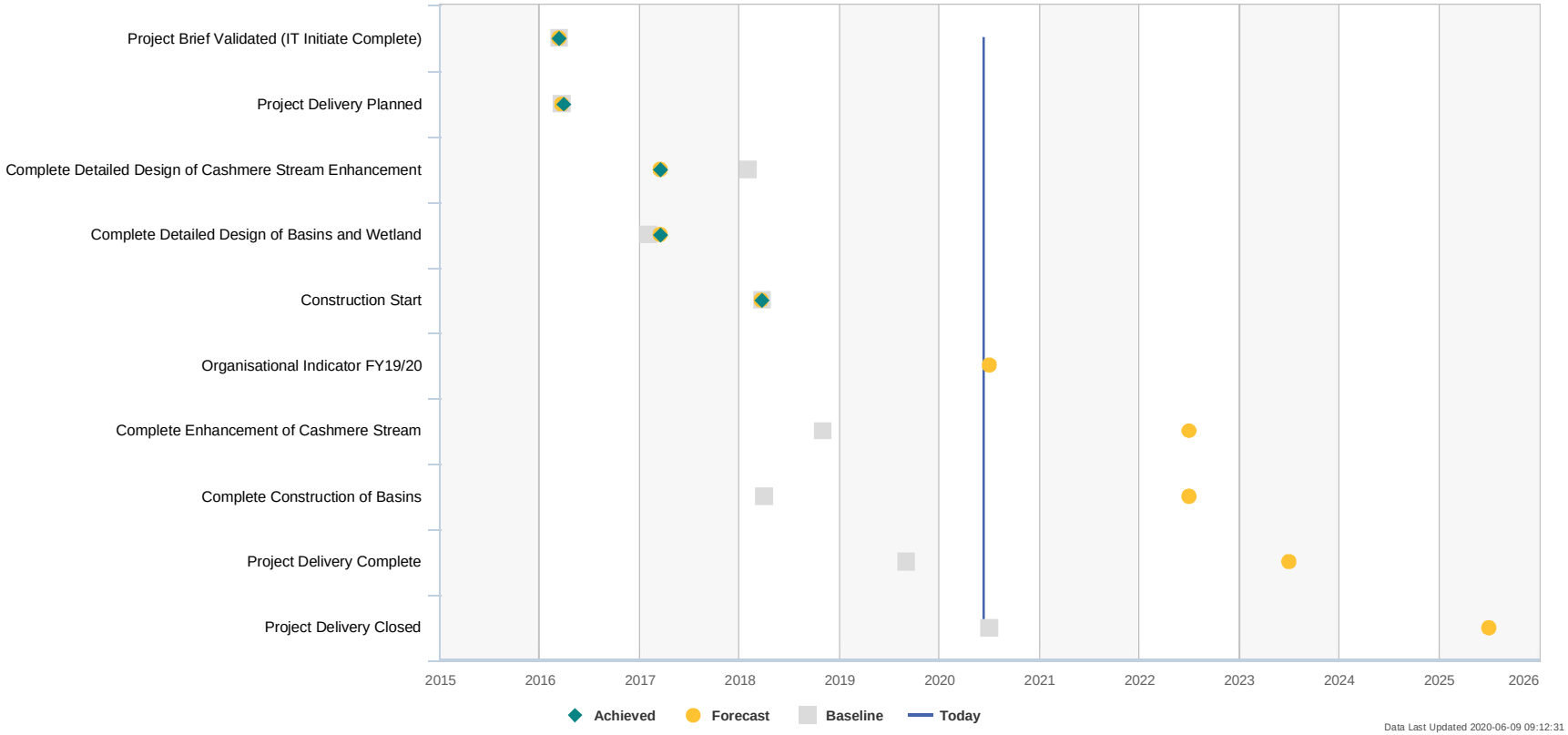
PROJECT EXPLORER

Select A Project: 32243 - SW Sutherlands Basin (Welsh) Stormwater Treatment

SW Sutherlands Basin (Welsh) Stormwater Treatment

Project CPMS ID # 32243

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

Paragon IQ

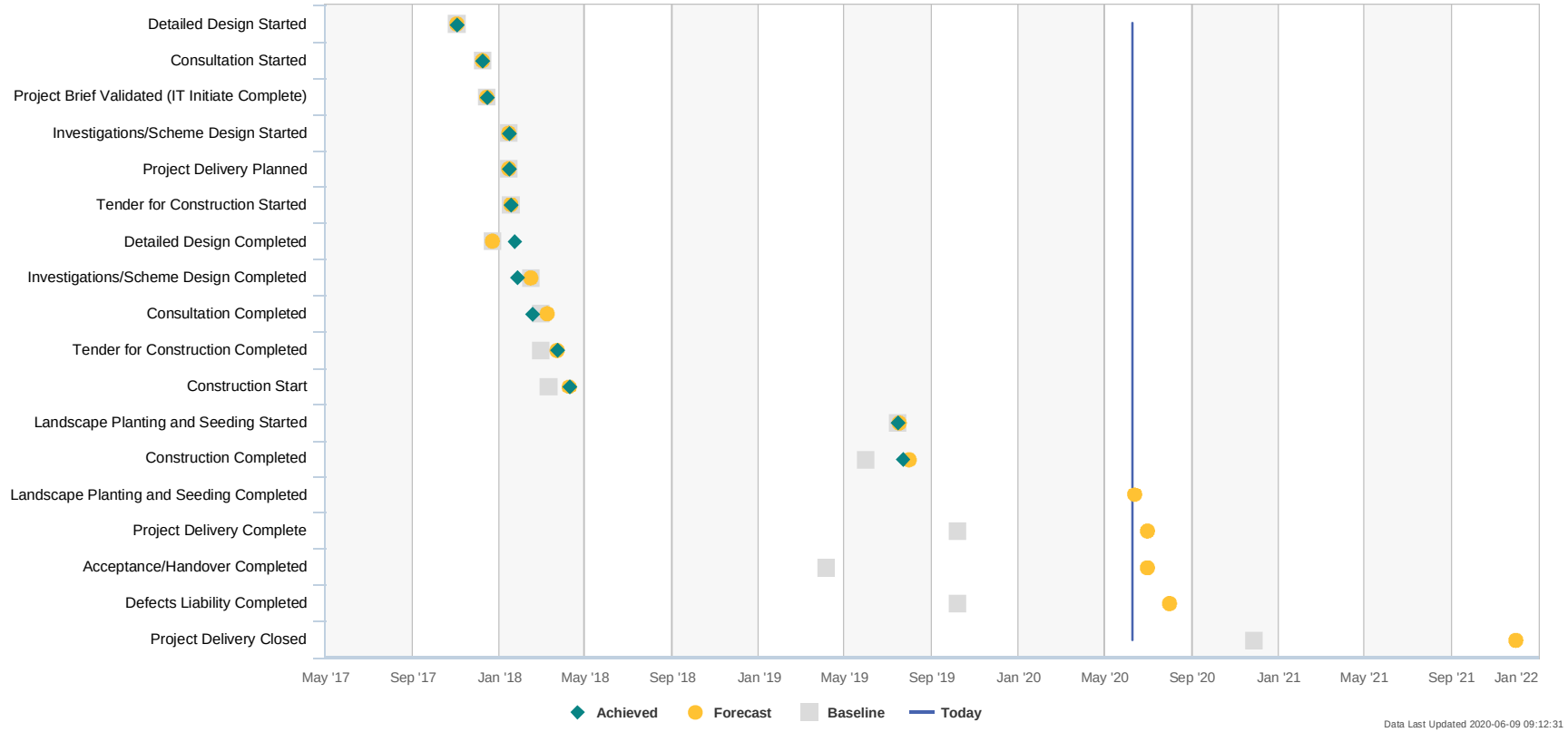
PROJECT EXPLORER

Select A Project: 45455 - LDRP 526 Curletts Flood Storage

LDRP 526 Curletts Flood Storage

Project CPMS ID # 45455

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

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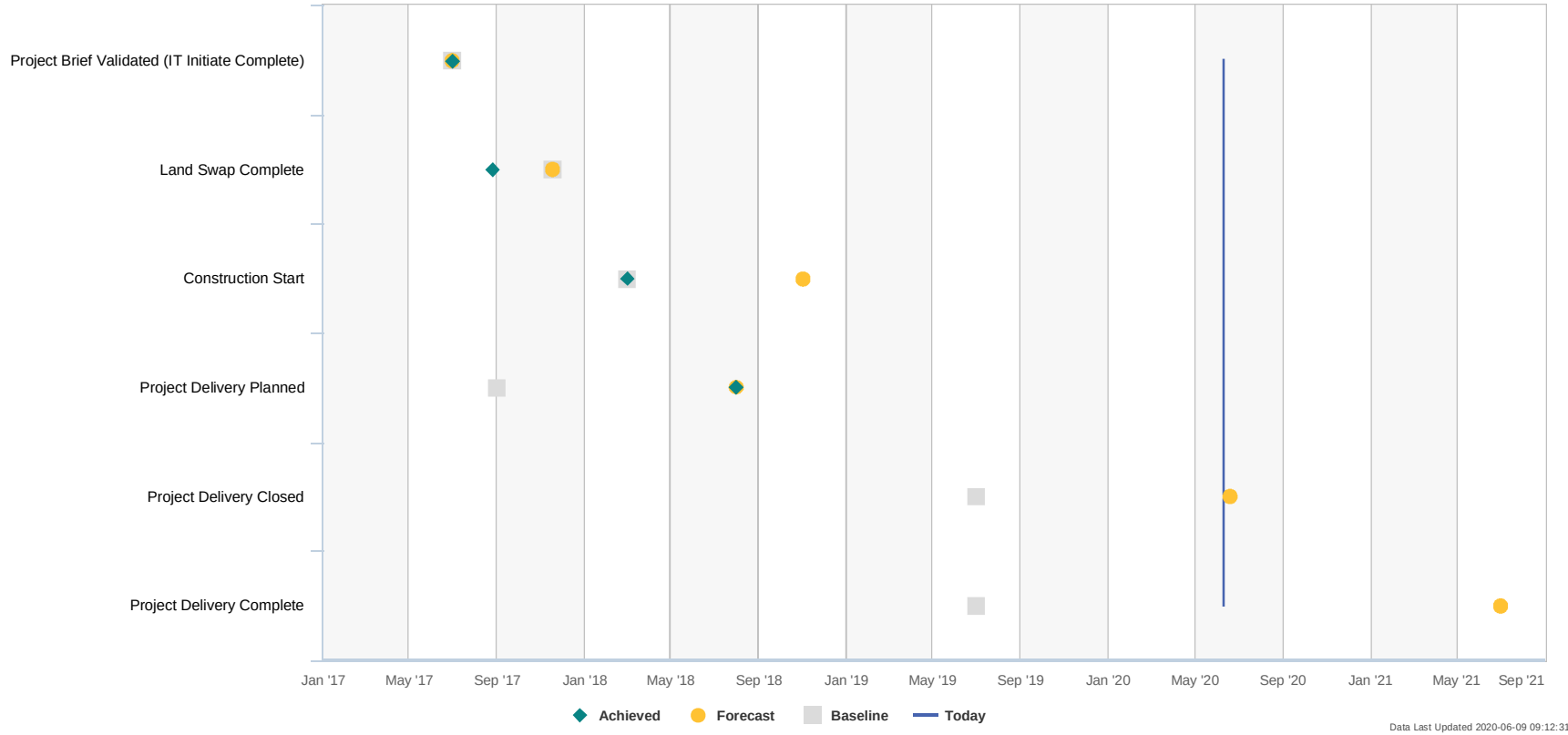
PROJECT EXPLORER

Select A Project 33980 - SW Owaka Basin

SW Owaka Basin

Project CPMS ID # 33980

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

Paragon IQ

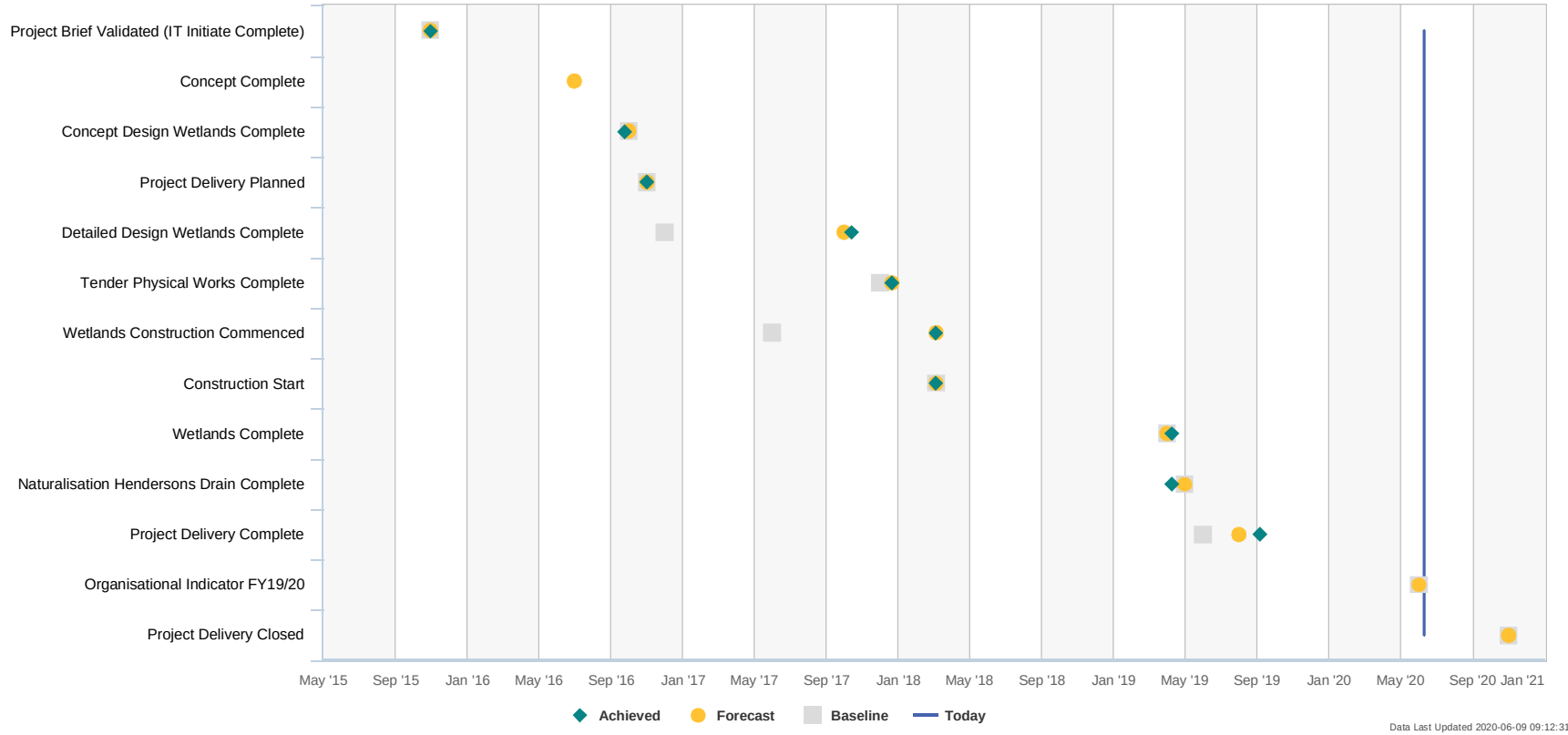
PROJECT EXPLORER

Select A Project: 15751 - SW Sparks road development drainage works

SW Sparks road development drainage works

Project CPMS ID # 15751

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Wetland and Naturalisation of Hendersons Drain is complete

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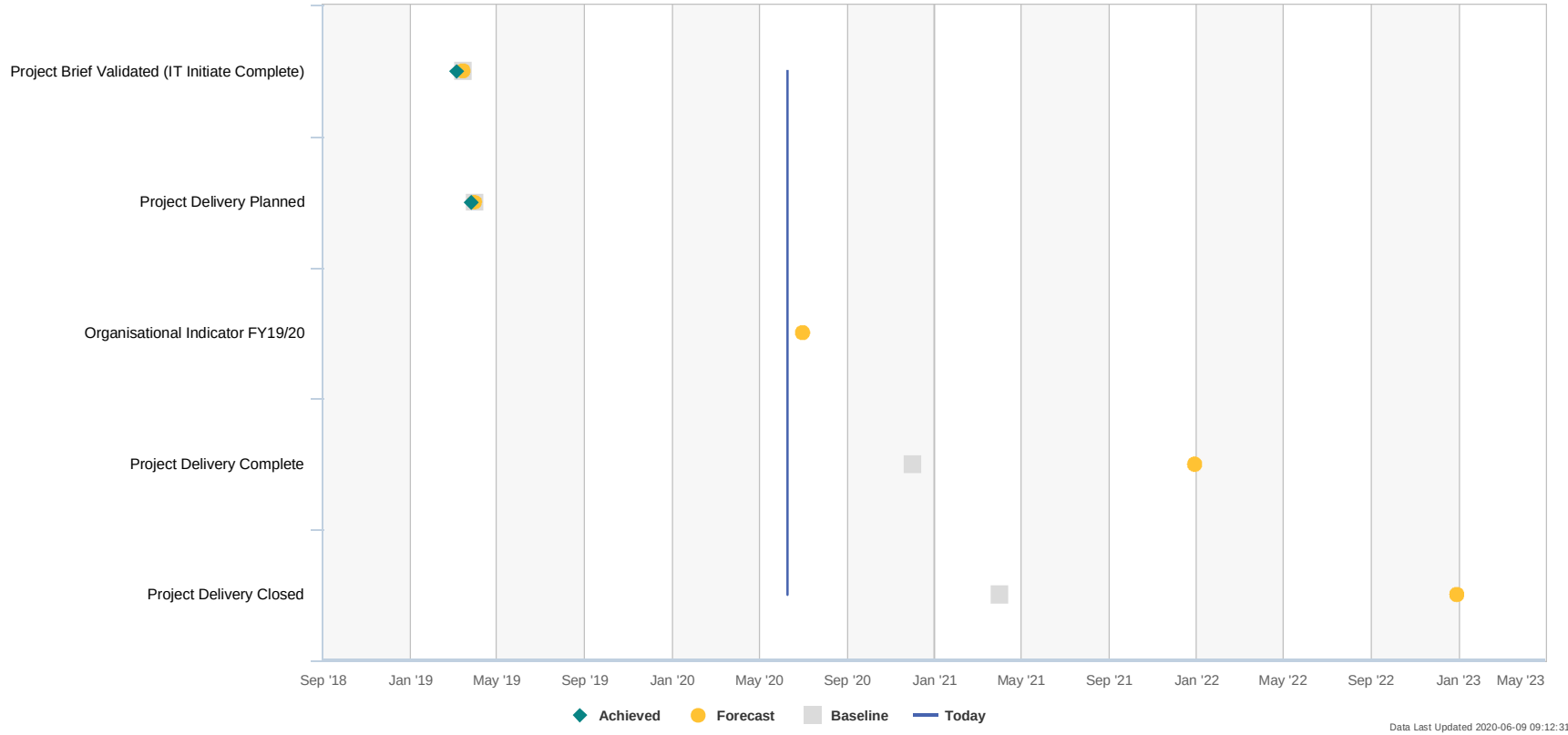
PROJECT EXPLORER

Select A Project 48918 - LDRP 530 Upper Heathcote Storage Optimisation

LDRP 530 Upper Heathcote Storage Optimisation

Project CPMS ID # 48918

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments The control logic development and controls + instrumentation detailed design is progressing however, has been delayed causing a delay to construction start.

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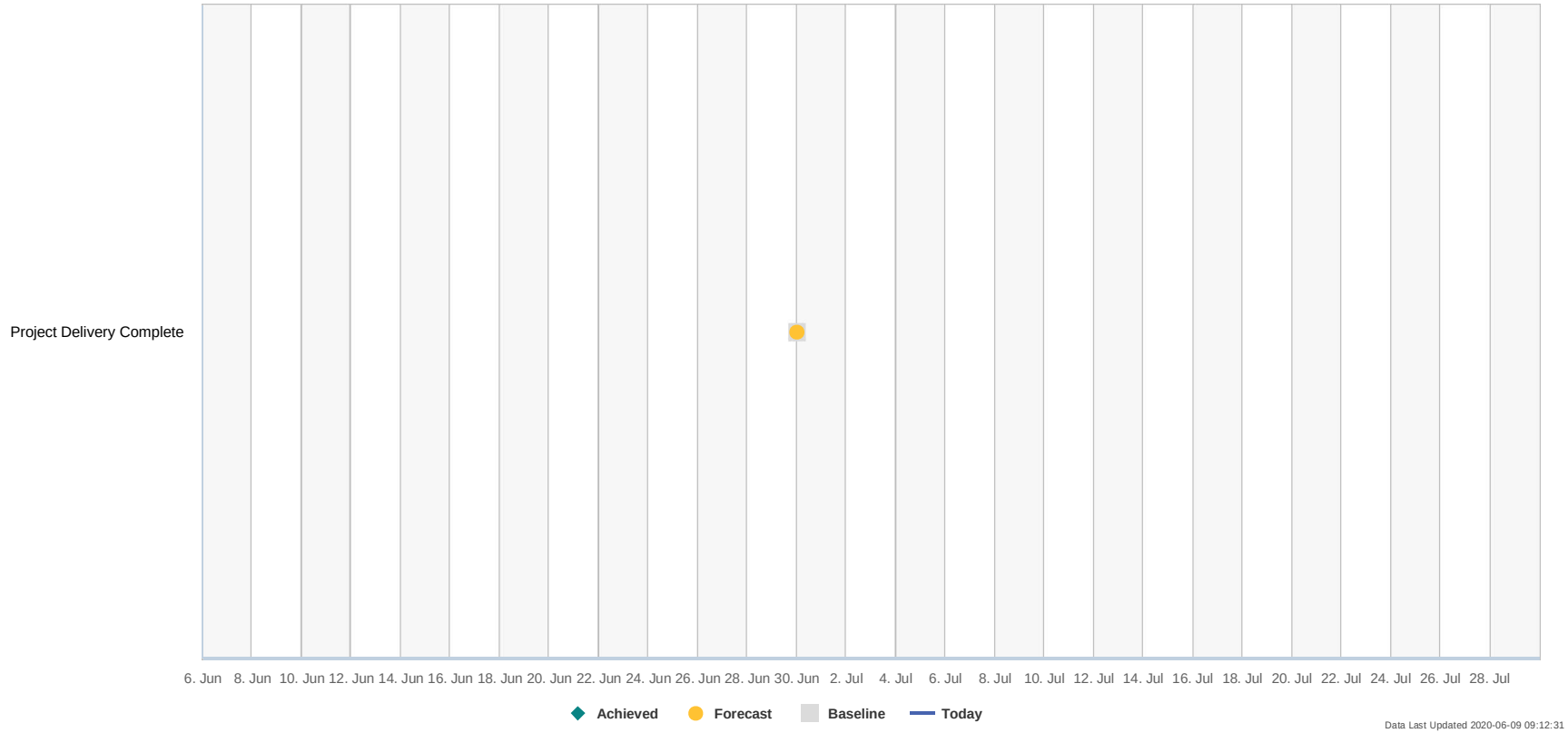
PROJECT EXPLORER

Select A Project: 54802 - SW Carrs Corridor - Stage 1 (IPA)

SW Carrs Corridor - Stage 1 (IPA)

Project CPMS ID # 54802

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: None

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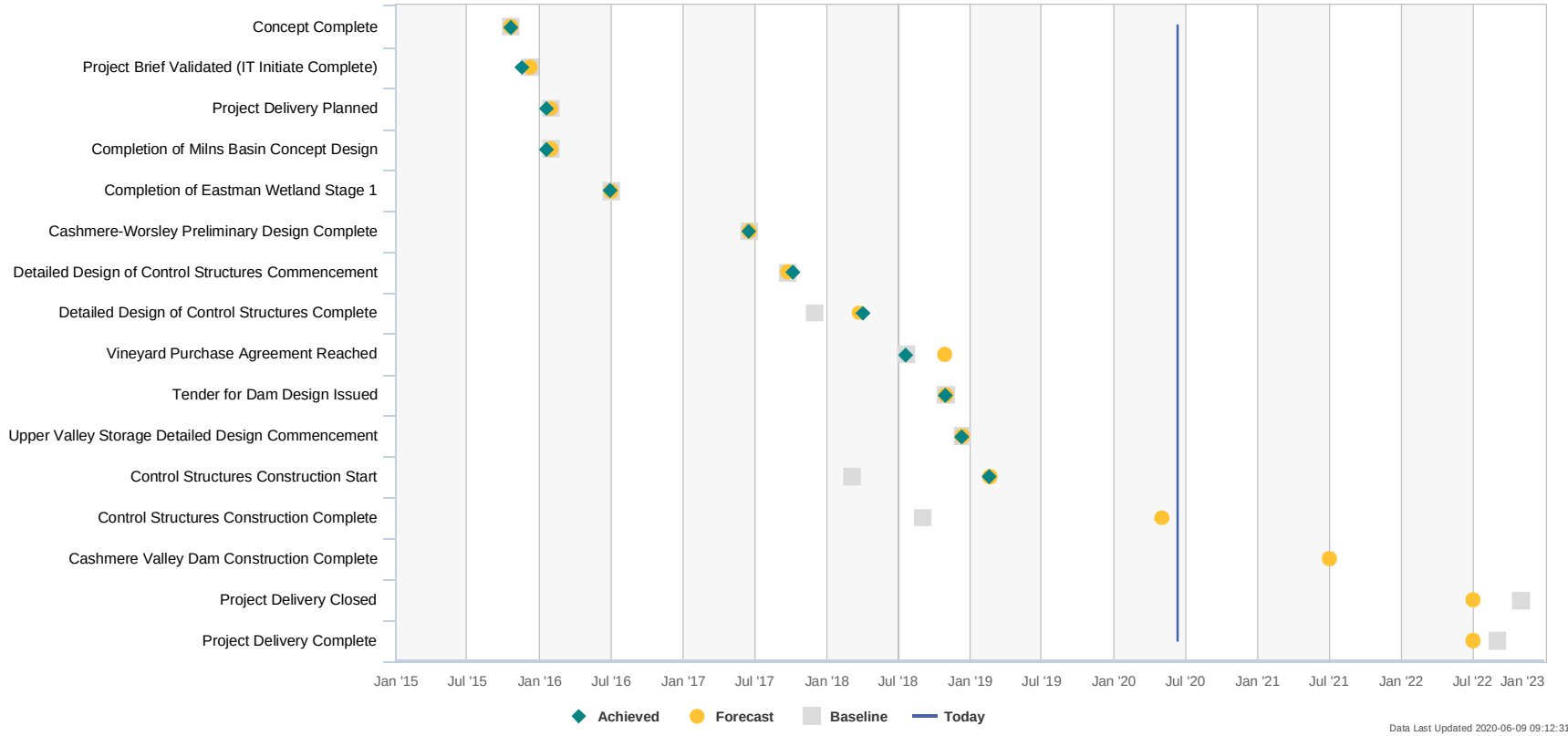
PROJECT EXPLORER

Select A Project: 26599 - LDRP 500 Cashmere Worsleys Flood Storage

LDRP 500 Cashmere Worsleys Flood Storage

Project CPMS ID # 26599

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: None

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Christchurch City Council

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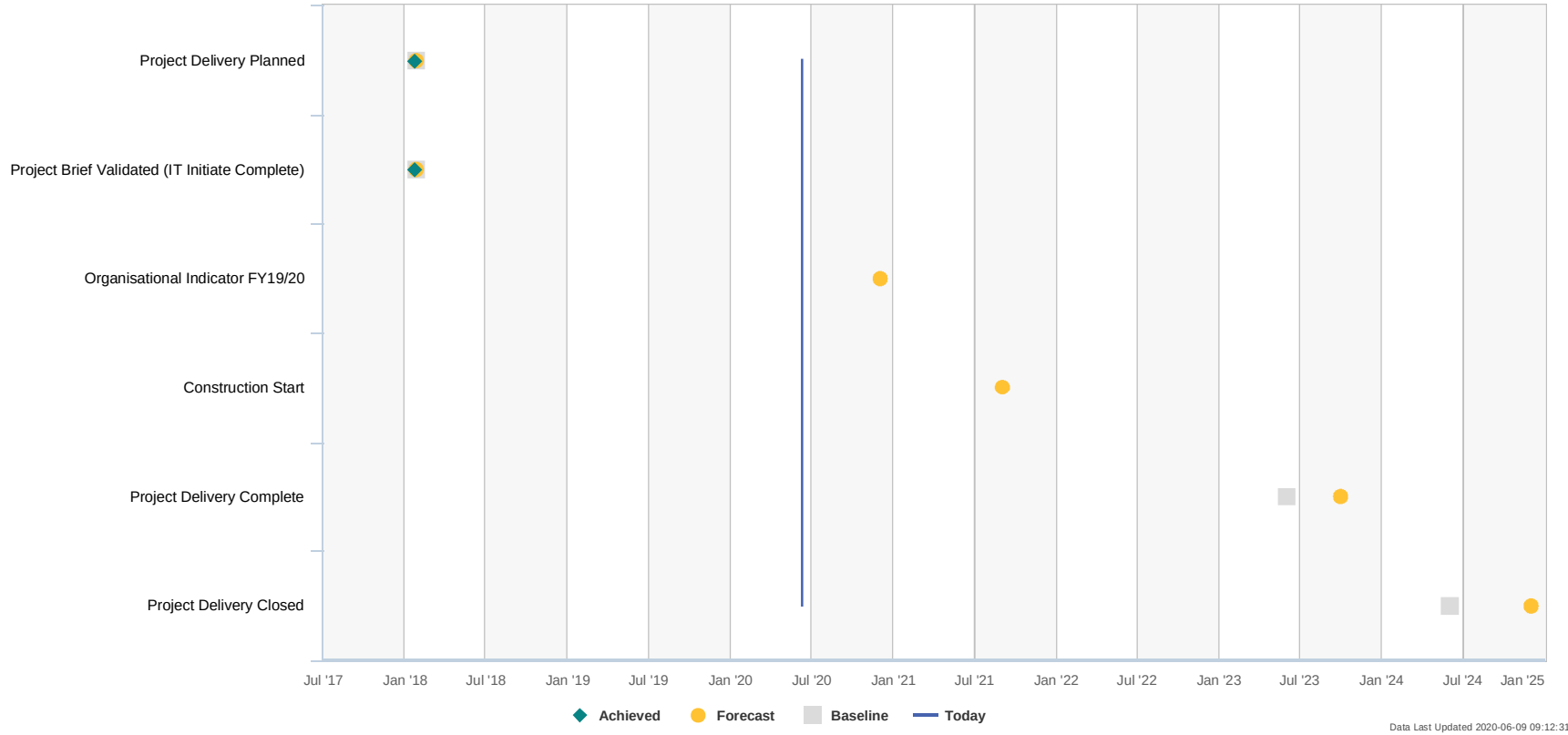
PROJECT EXPLORER

Select A Project: 46688 - LDRP 529 Heathcote Low Stopbanks

LDRP 529 Heathcote Low Stopbanks

Project CPMS ID # 46688

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Commence detailed design (subject to Council approval to proceed). Unlikely to be achieved due to report to 3 Waters Infrastructure and Environment Committee being delayed.

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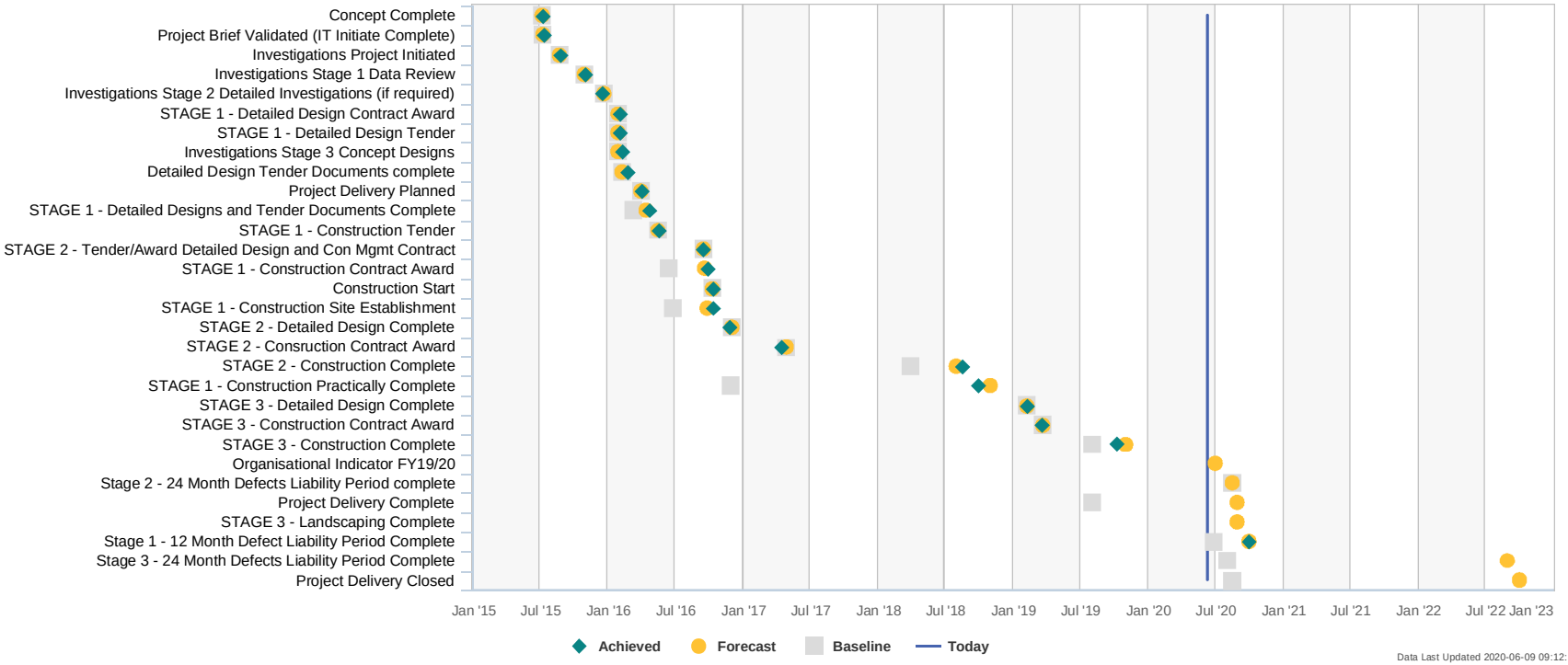
PROJECT EXPLORER

Select A Project 26597 - LDRP 502 Matuku Waterway

LDRP 502 Matuku Waterway

Project CPMS ID # 26597

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments Works now likely complete next FY21

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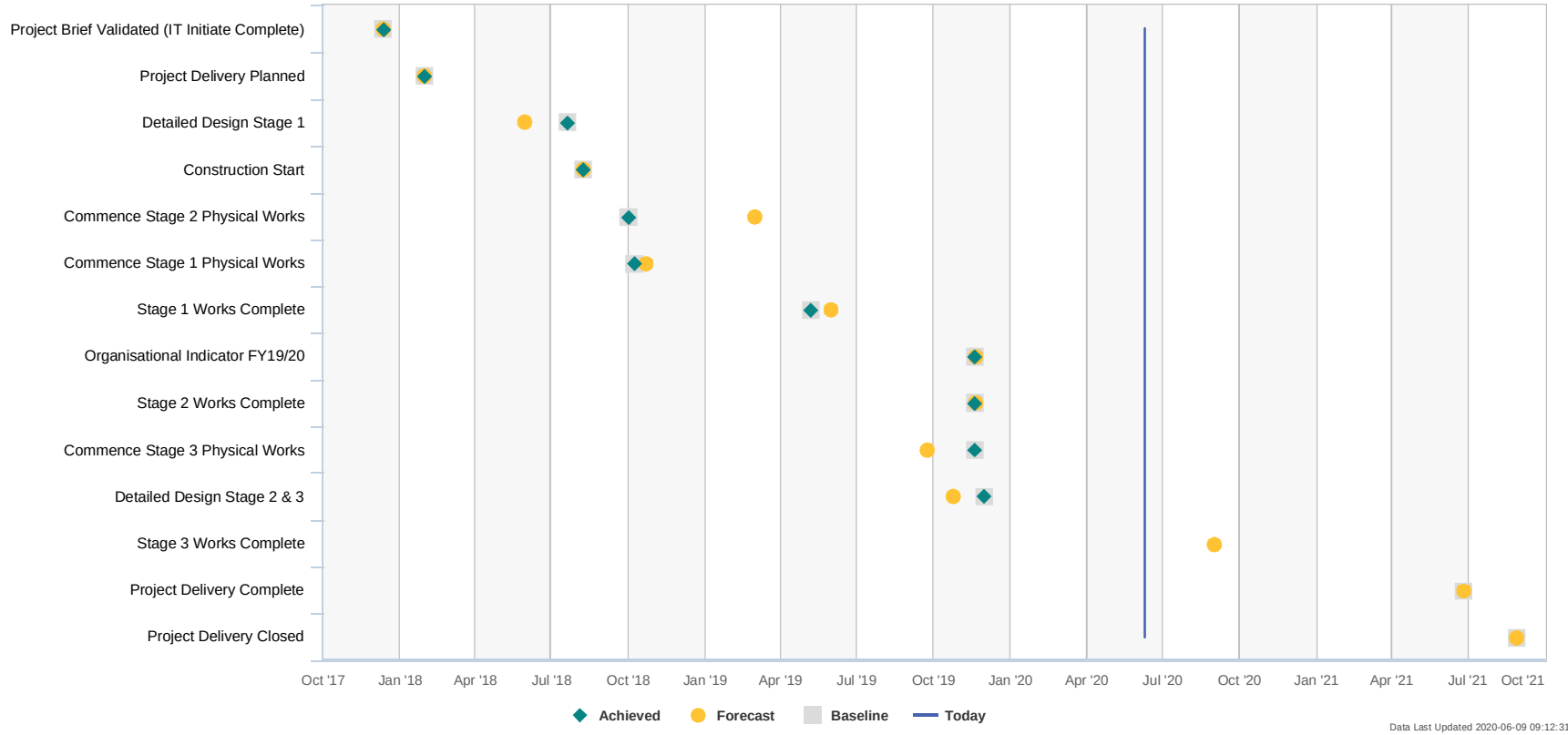
PROJECT EXPLORER

Select A Project: 46181 - LDRP 527 Heathcote Dredging

LDRP 527 Heathcote Dredging

Project CPMS ID # 46181

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Dredging up to Opawa Rd expected to be complete by end of November. Landscaping along Stage 2 Richardson and Clarendon will be done at completion of dredging.

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Christchurch City Council

Paragon IQ

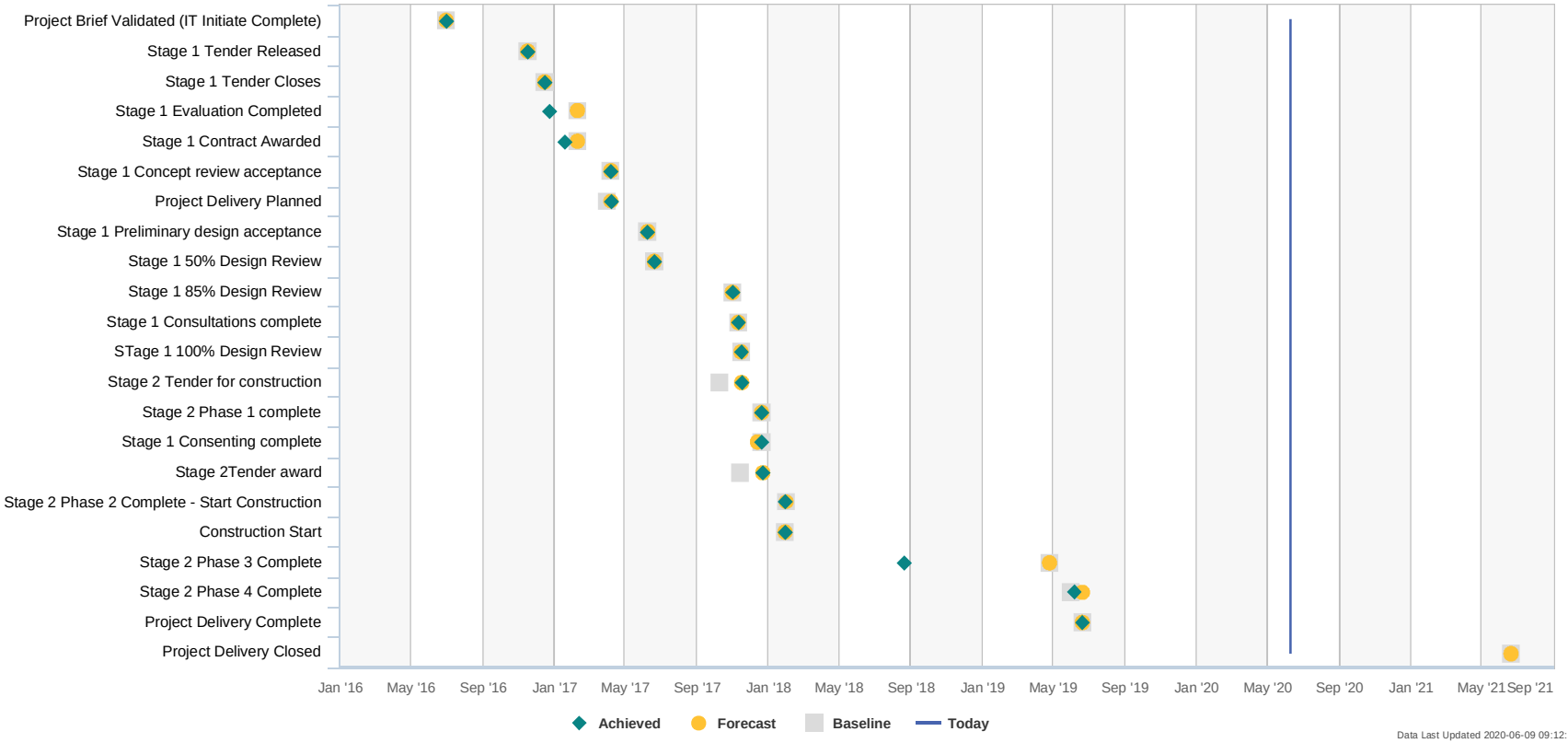
PROJECT EXPLORER

Select A Project 35140 - LDRP 518 Mid Heathcote Bank Stabilisation

LDRP 518 Mid Heathcote Bank Stabilisation

Project CPMS ID # 35140

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Main construction complete, landscape infill/replacement only outstanding works.

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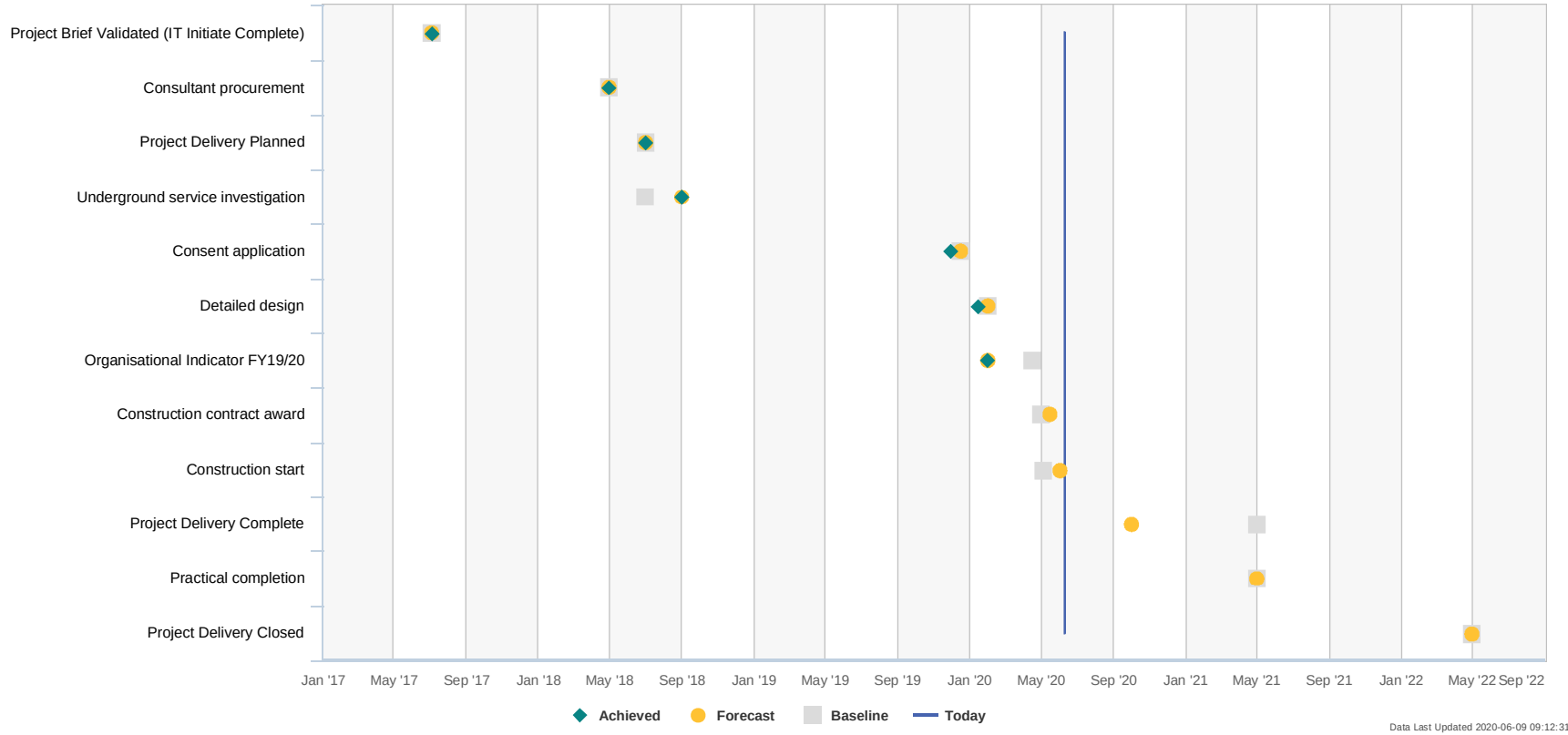
PROJECT EXPLORER

Select A Project: 37306 - SW Jacksons Creek Brick Barrel Renewal near Selwyn St - Brougham St Intersection

SW Jacksons Creek Brick Barrel Renewal near Selwyn St - Brougham St Intersection

Project CPMS ID # 37306

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

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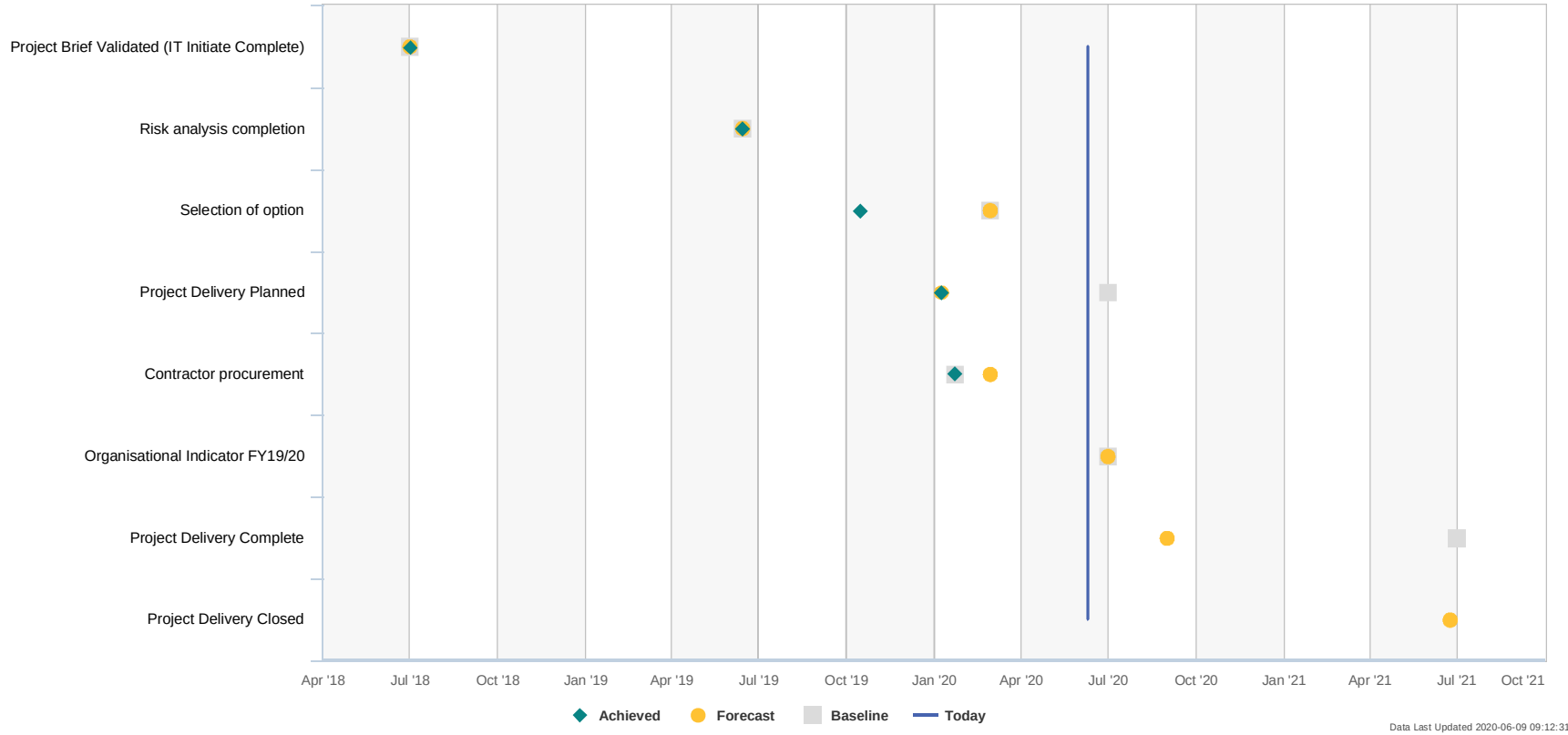
PROJECT EXPLORER

Select A Project: 49030 - SW 80m Brick Barrel Renewal, Jacksons Creek Upper at 16 to 32 Ward St

SW 80m Brick Barrel Renewal, Jacksons Creek Upper at 16 to 32 Ward St

Project CPMS ID # 49030

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: On track to meet the FY20 milestone of delivery planned.

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Christchurch City Council

Paragon IQ

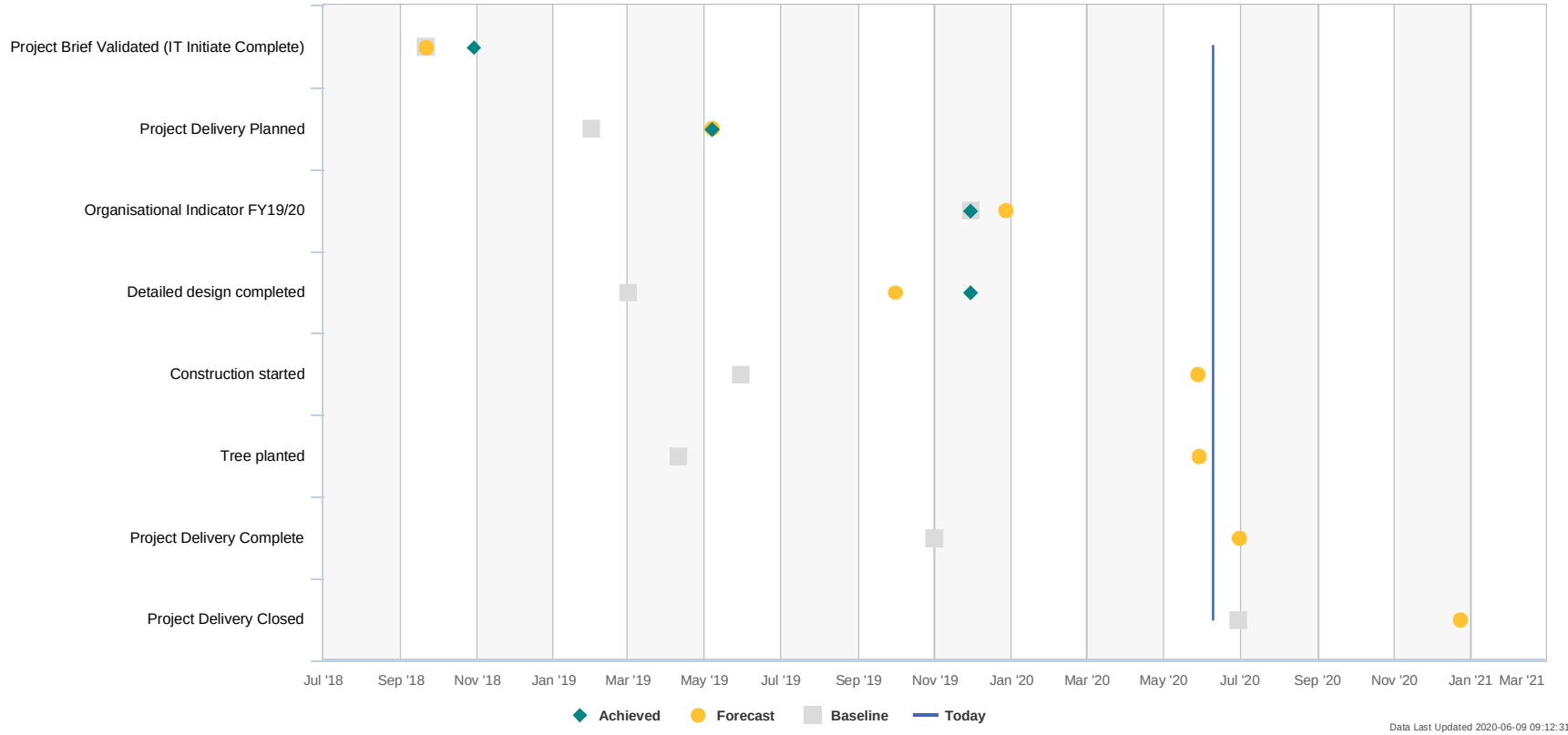
PROJECT EXPLORER

Select A Project: 50358 - SW Remuera Ave Drain Improvements & Flood Relief

SW Remuera Ave Drain Improvements & Flood Relief

Project CPMS ID # 50358

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Construction May FY2020.

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Christchurch City Council

Timetables for stormwater mitigation projects within the Pūharakekenui/Styx Stormwater Management Plan Area

Paragon IQ

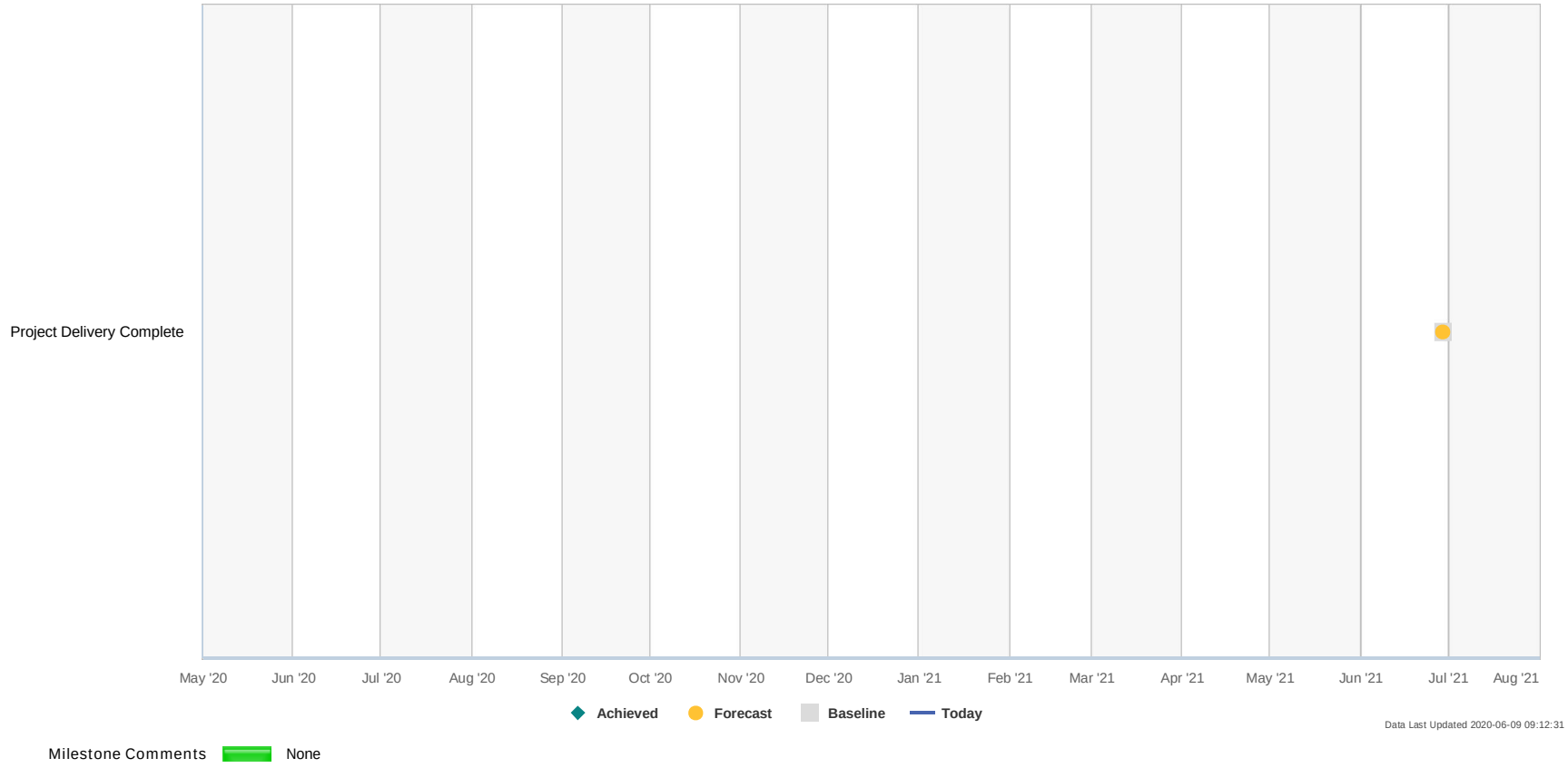
PROJECT EXPLORER

Select A Project: 37904 - SW Summerset at Highsted - Infrastructure Provision Agreement (IPA)

SW Summerset at Highsted - Infrastructure Provision Agreement (IPA)

Project CPMS ID # 37904

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

Paragon IQ

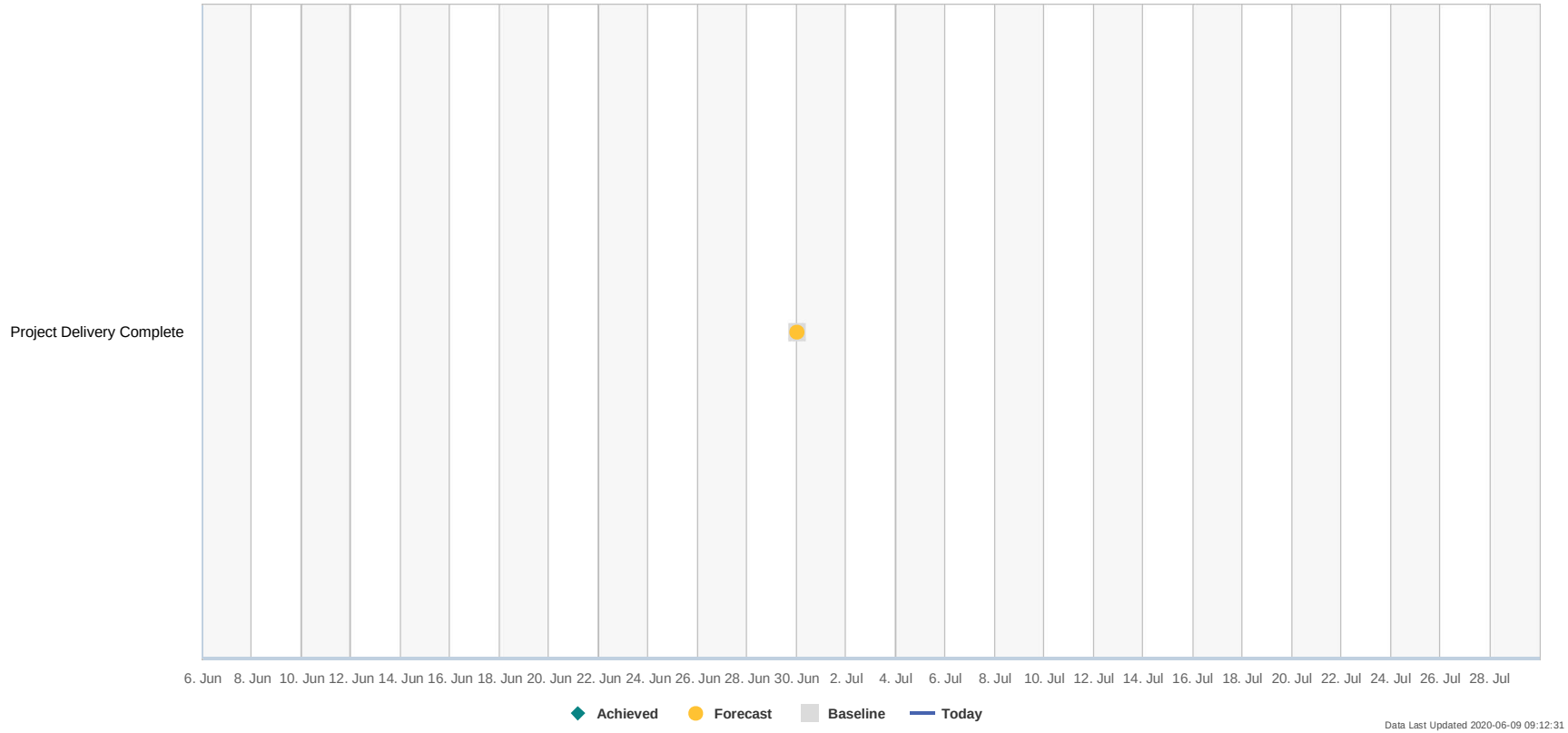
PROJECT EXPLORER

Select A Project: 51269 - SW Highfield Northwest Basins - Infrastructure Provision Agreement (IPA)

SW Highfield Northwest Basins - Infrastructure Provision Agreement (IPA)

Project CPMS ID # 51269

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: None

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Christchurch City Council

Paragon IQ

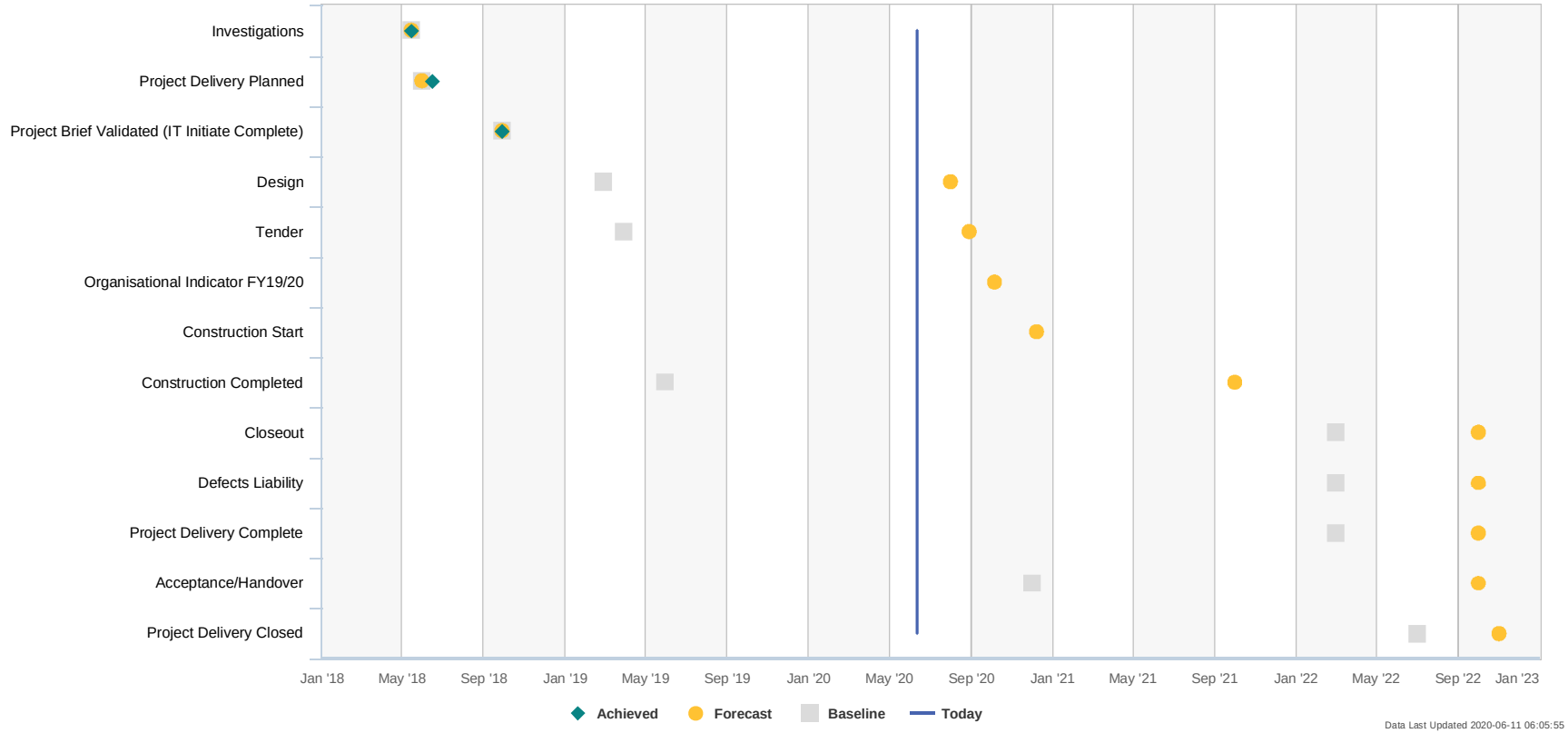
PROJECT EXPLORER

Select A Project 38022 - SW Works 1 Stormwater Facility

SW Works 1 Stormwater Facility

Project CPMS ID # 38022

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments None

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Christchurch City Council

Paragon IQ

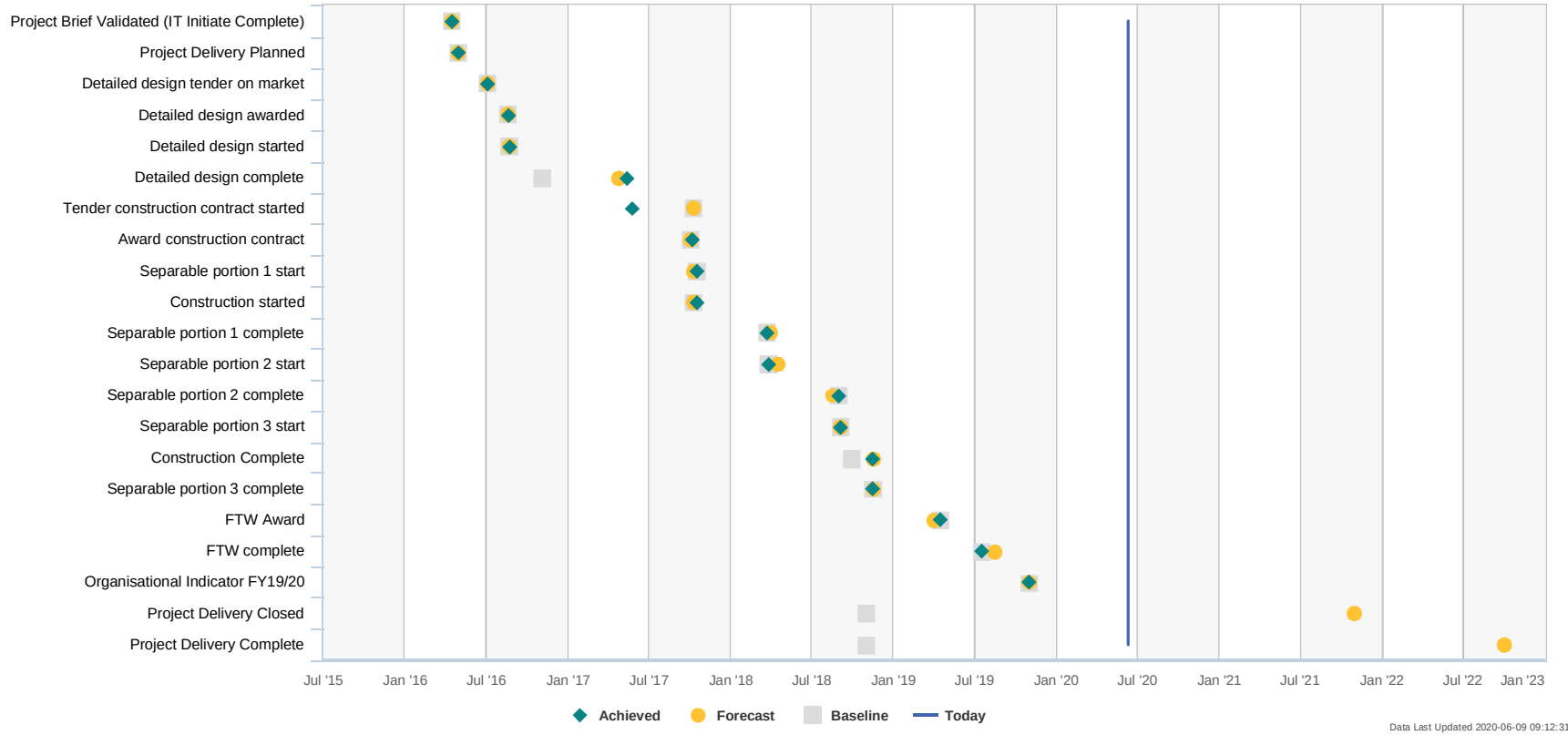
PROJECT EXPLORER

Select A Project 33258 - LDRP 512 No 1 Drain

LDRP 512 No 1 Drain

Project CPMS ID # 33258

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments Project complete. Maintenance and remedials being worked through

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Christchurch City Council

Paragon IQ

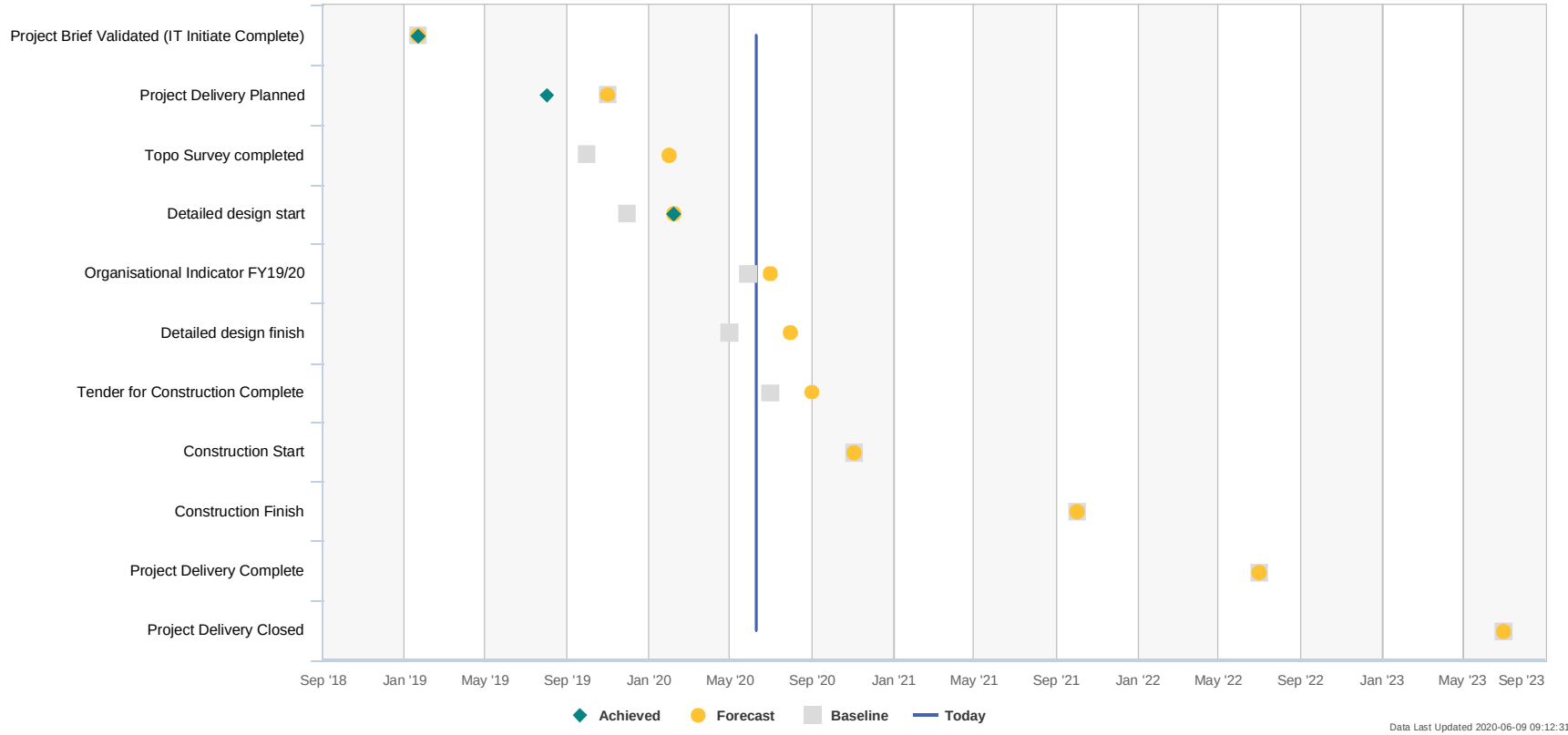
PROJECT EXPLORER

Select A Project: 38088 - SW Gardiners Stormwater Facility

SW Gardiners Stormwater Facility

Project CPMS ID # 38088

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: There is urgency to start construction as soon as possible. Failing this would breach the CCCC Styx river discharge consent.

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Paragon IQ

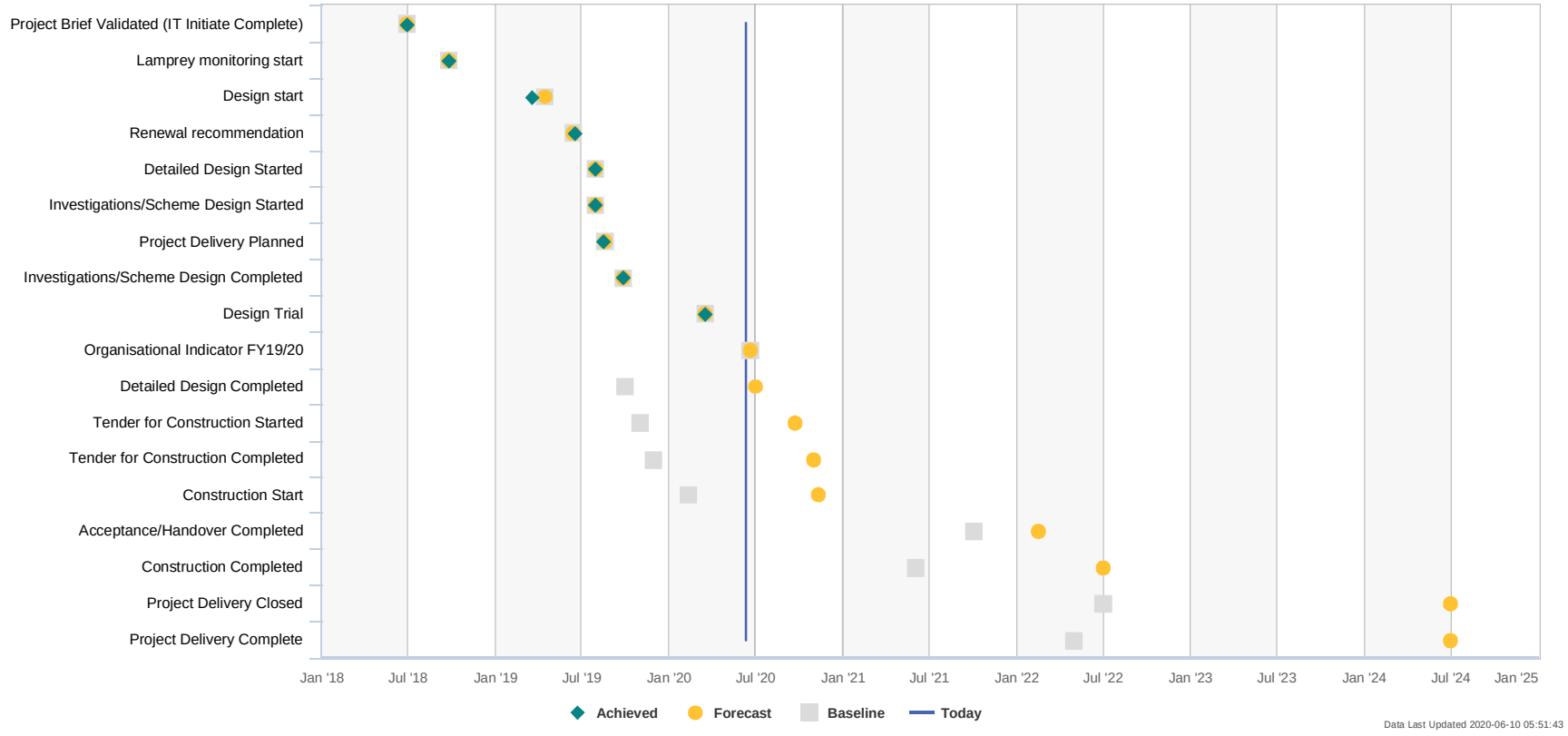
PROJECT EXPLORER

Select A Project: 33828 - SW Canal Reserve Drain, Marshland Rd - Timber Lining Renewal Ph1

SW Canal Reserve Drain, Marshland Rd - Timber Lining Renewal Ph1

Project CPMS ID # 33828

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Organisational milestone of Lamprey understanding

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Paragon IQ

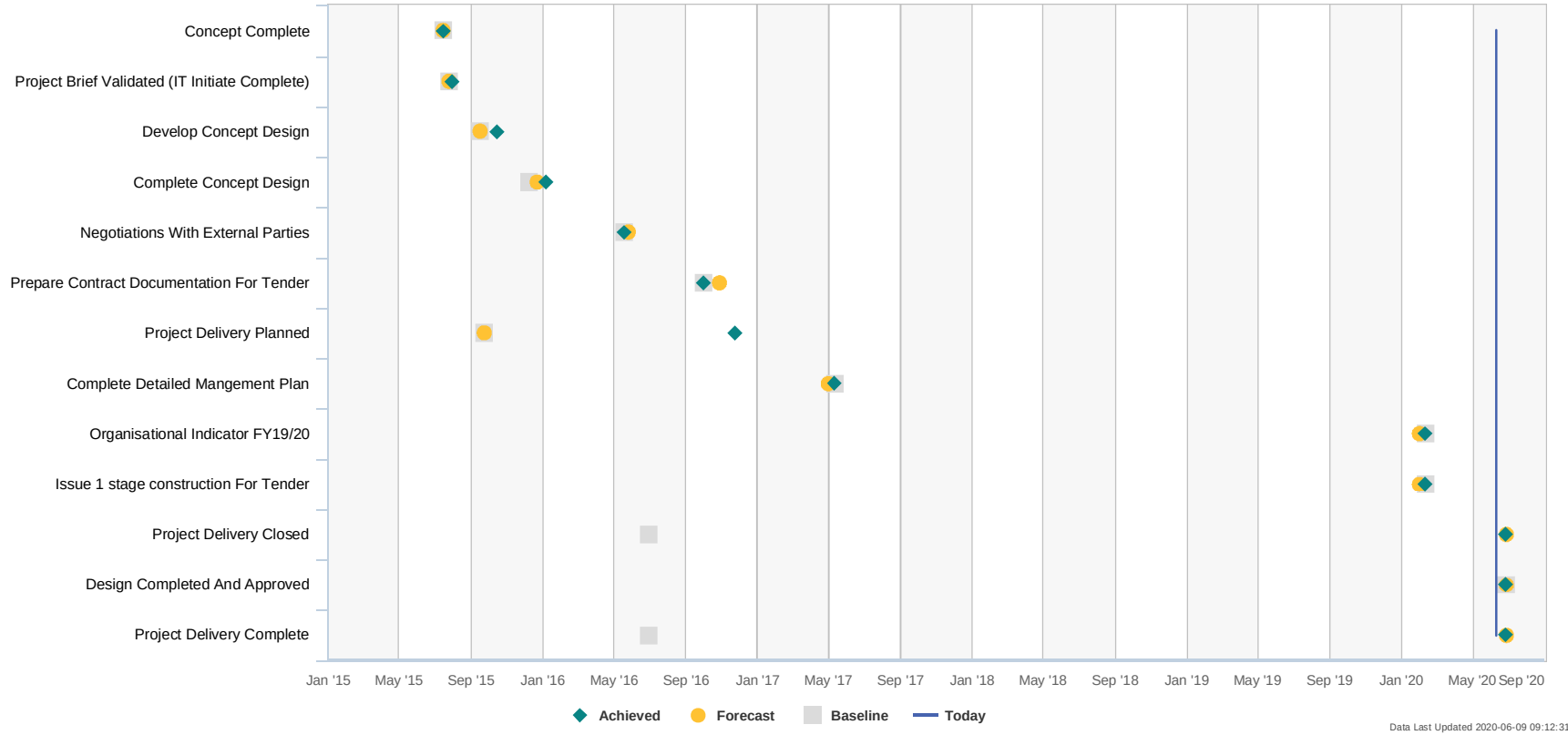
PROJECT EXPLORER

Select A Project: 26103 - SW Highsted Cavendish stormwater management system

SW Highsted Cavendish stormwater management system

Project CPMS ID # 26103

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Paragon IQ

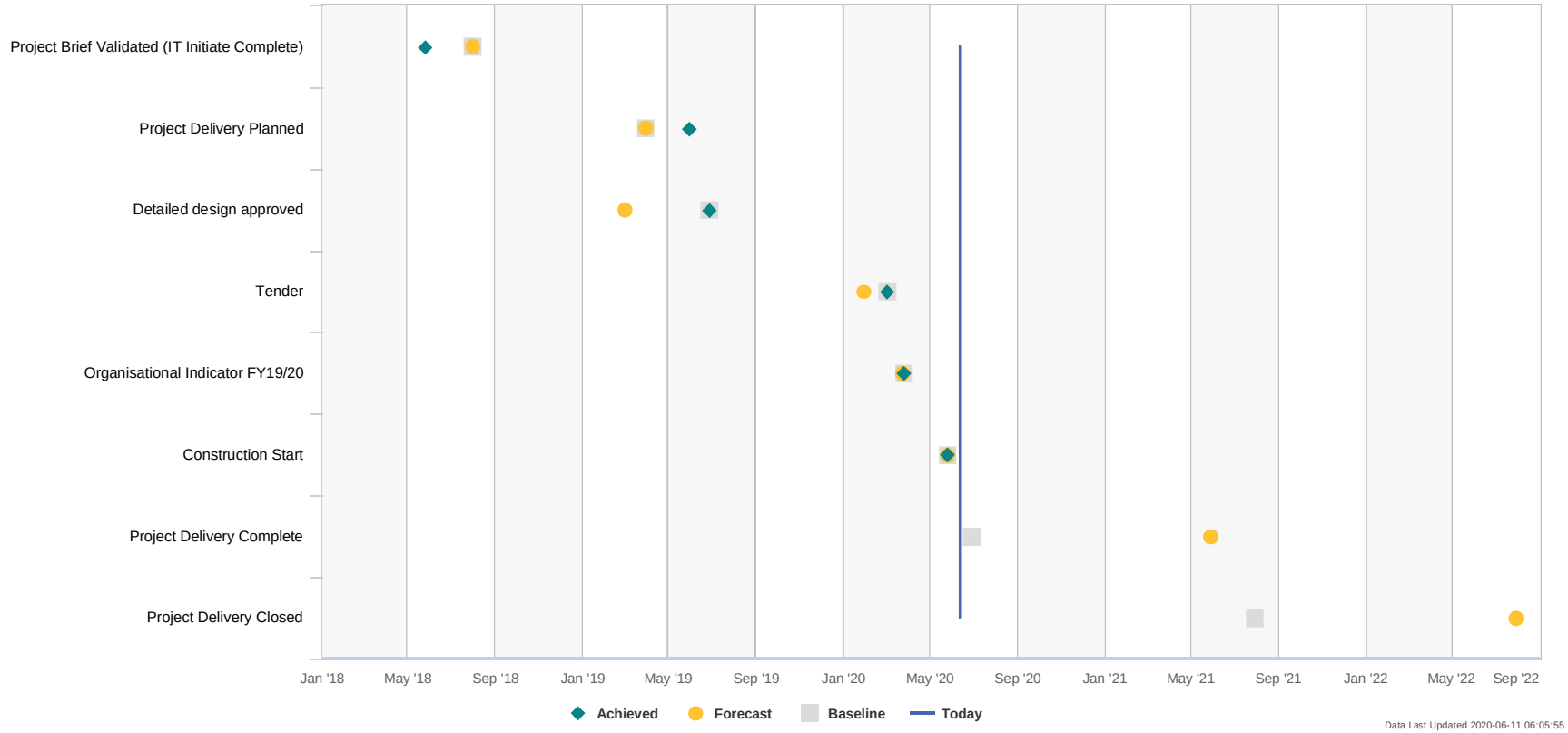
PROJECT EXPLORER

Select A Project: 37343 - SW Highsted Land Purchase & Construction of Waterways, Basins & Wetlands

SW Highsted Land Purchase & Construction of Waterways, Basins & Wetlands

Project CPMS ID # 37343

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments: Construction Start/finish Delay.

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Paragon IQ

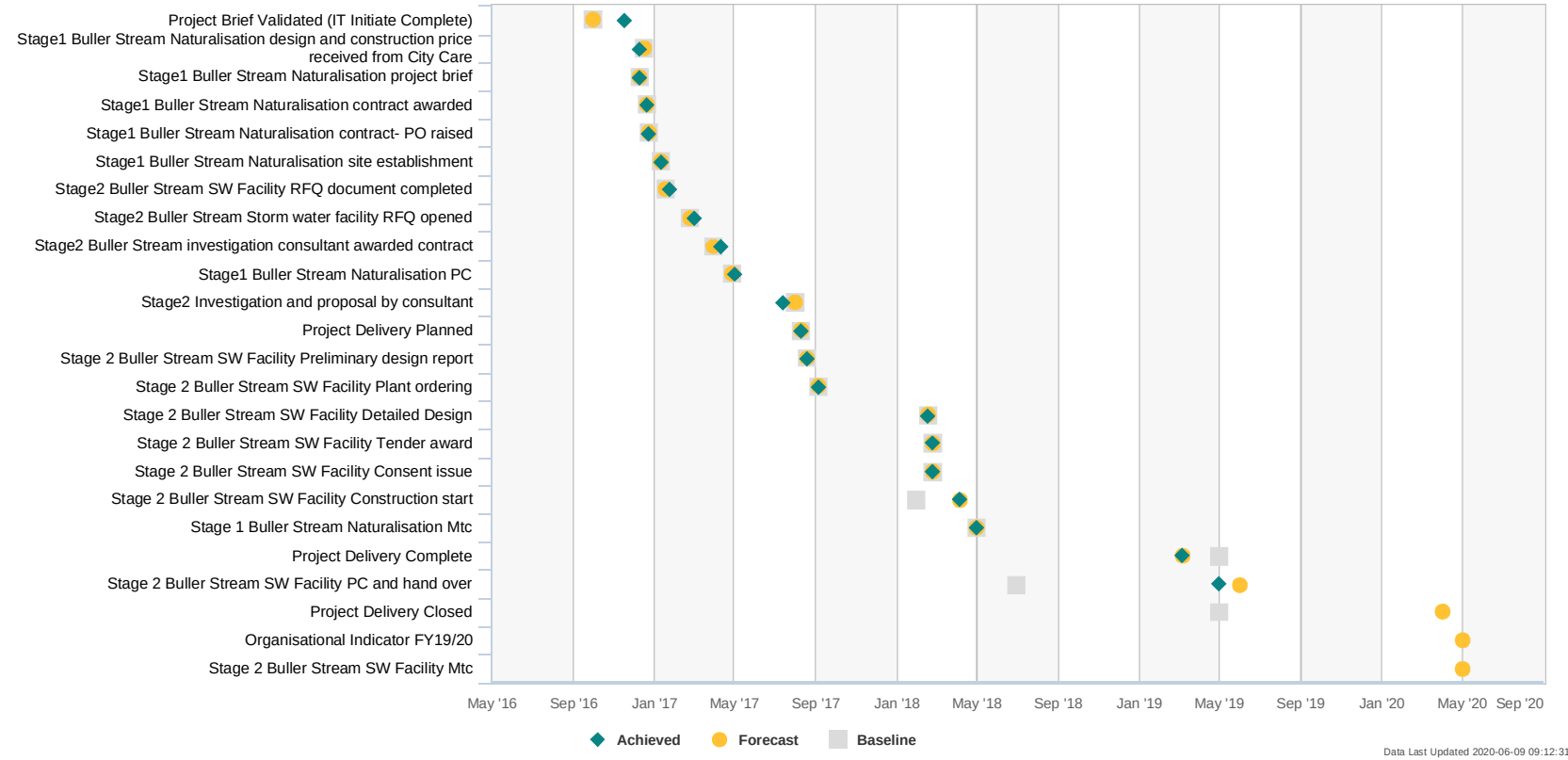
PROJECT EXPLORER

Select A Project: 36062 - SW Bullers Stream Naturalisation and Facility

SW Bullers Stream Naturalisation and Facility

Project CPMS ID # 36062

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: End of April for handover - still on track.

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Christchurch City Council

Timetables for stormwater mitigation projects within the Te Pātaka o Rākaihautū/Banks Peninsula Stormwater Management Plan Area

Paragon IQ

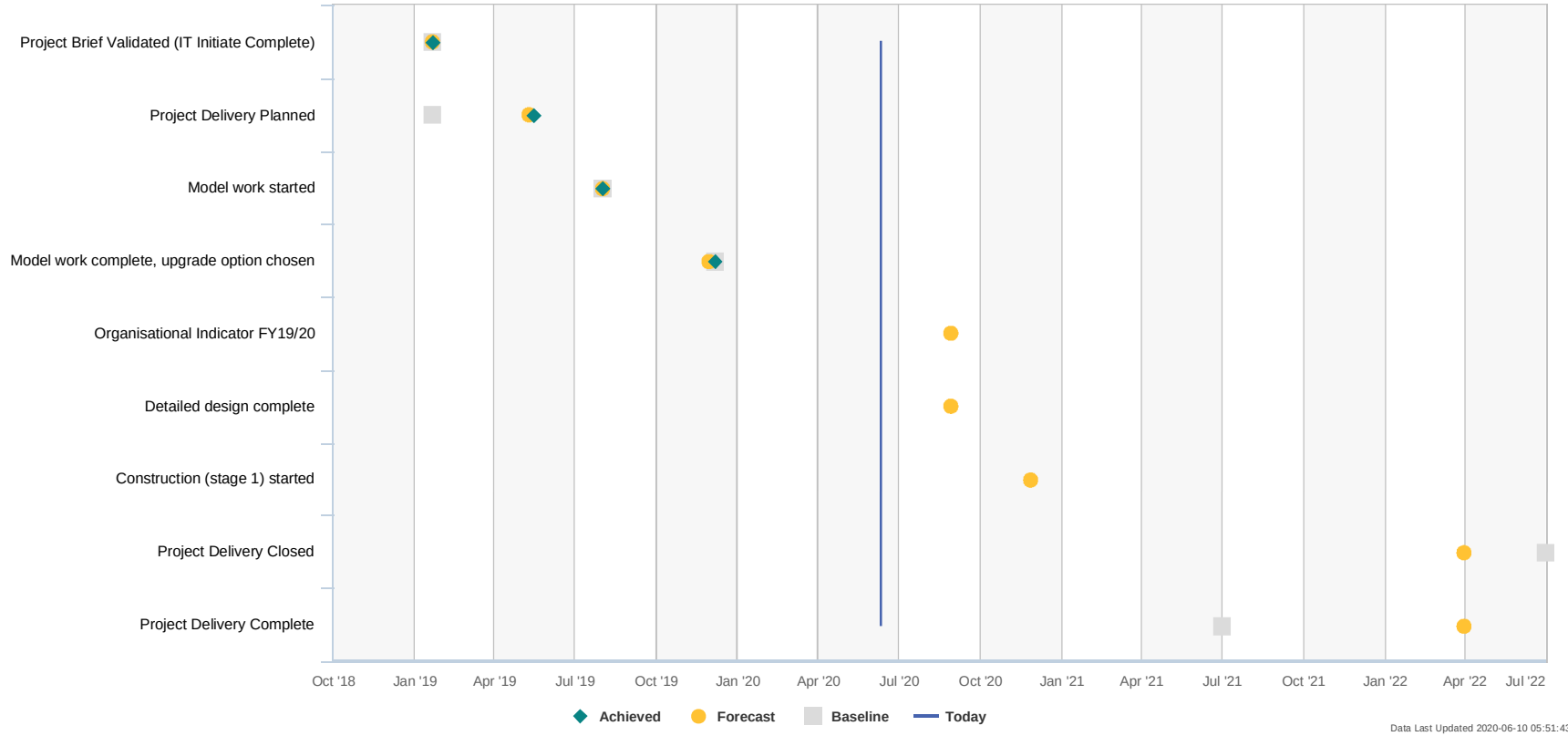
PROJECT EXPLORER

Select A Project: 49028 - SW Little River SW System Renewals

SW Little River SW System Renewals

Project CPMS ID # 49028

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Due to CCC technical (engineering and CAD) resources are limited, TSD advised in March this project to go to external consultancy designer. This will delay detailed design therefore the construction start and finish.

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Paragon IQ

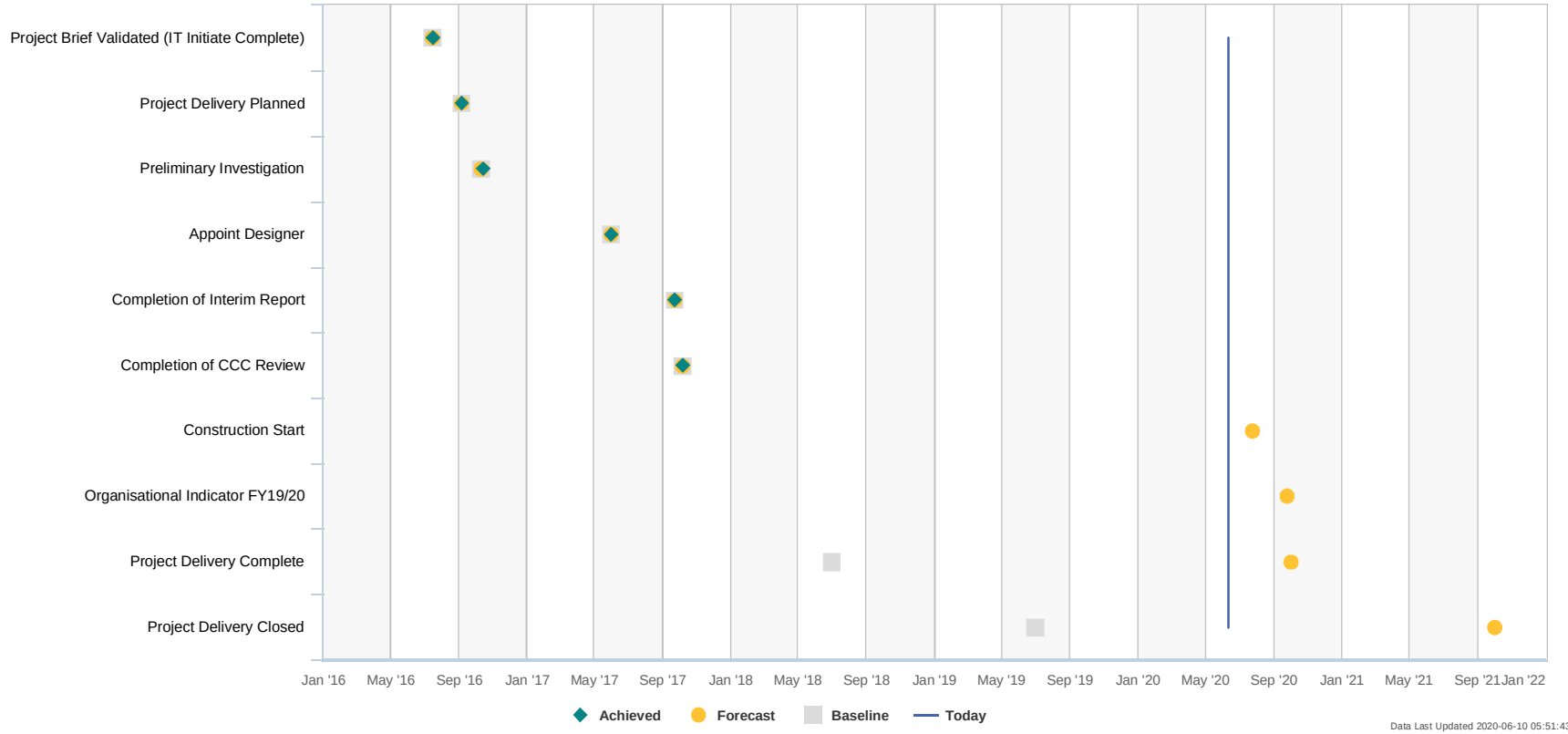
PROJECT EXPLORER

Select A Project: 34025 - SW Pump Station 601 Drain, 28 Cressy Terrace - Inlet Arrangement Improvement and pipe renewal

SW Pump Station 601 Drain, 28 Cressy Terrace - Inlet Arrangement Improvement and pipe renewal

Project CPMS ID # 34025

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Following Seipp quote ($247K) HDM requested to extend tender to another three contractors. This delays construction start.

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Christchurch City Council

Paragon IQ

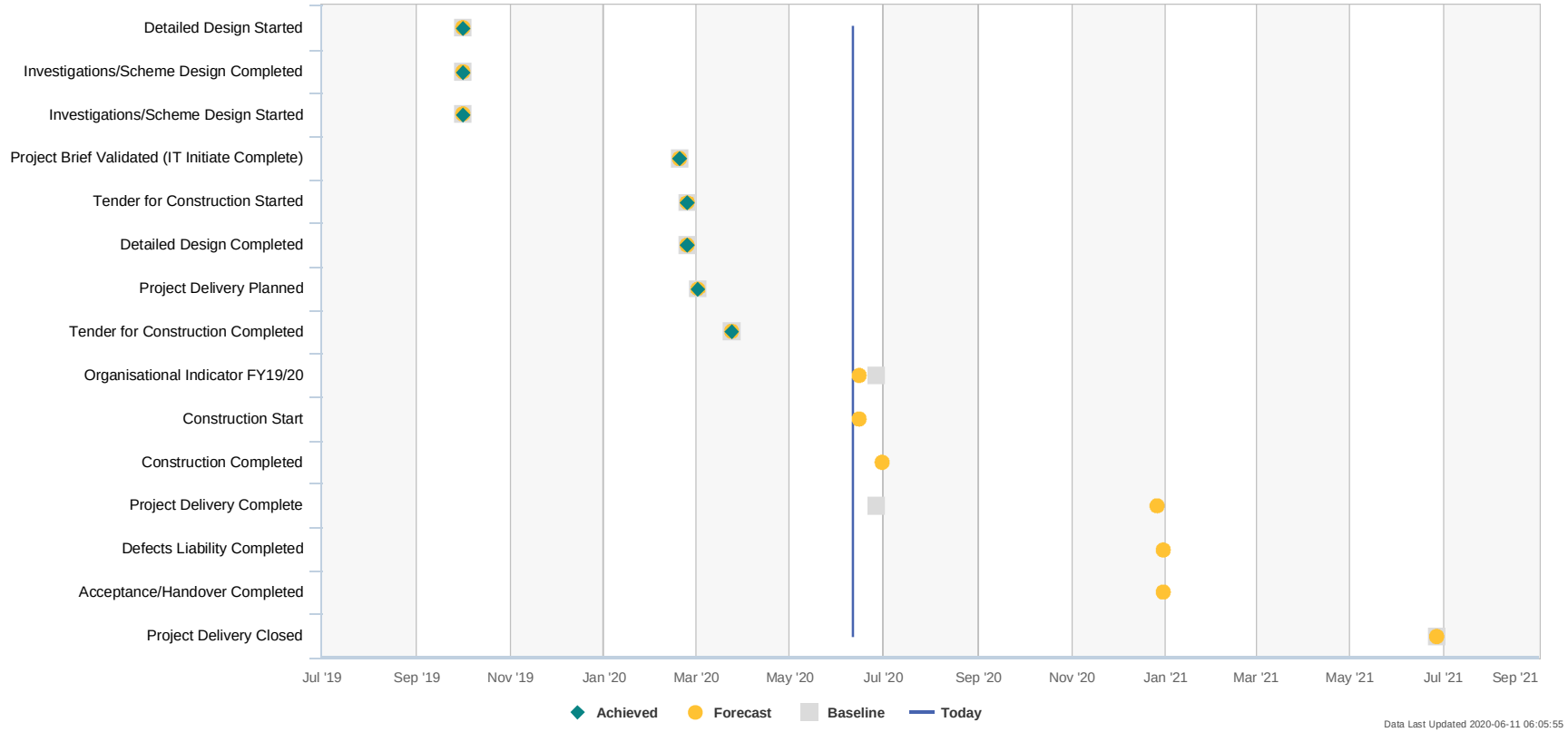
PROJECT EXPLORER

Select A Project 58848 - SW Taimana Lane Renewal

SW Taimana Lane Renewal

Project CPMS ID # 58848

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments On track

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Christchurch City Council

Paragon IQ

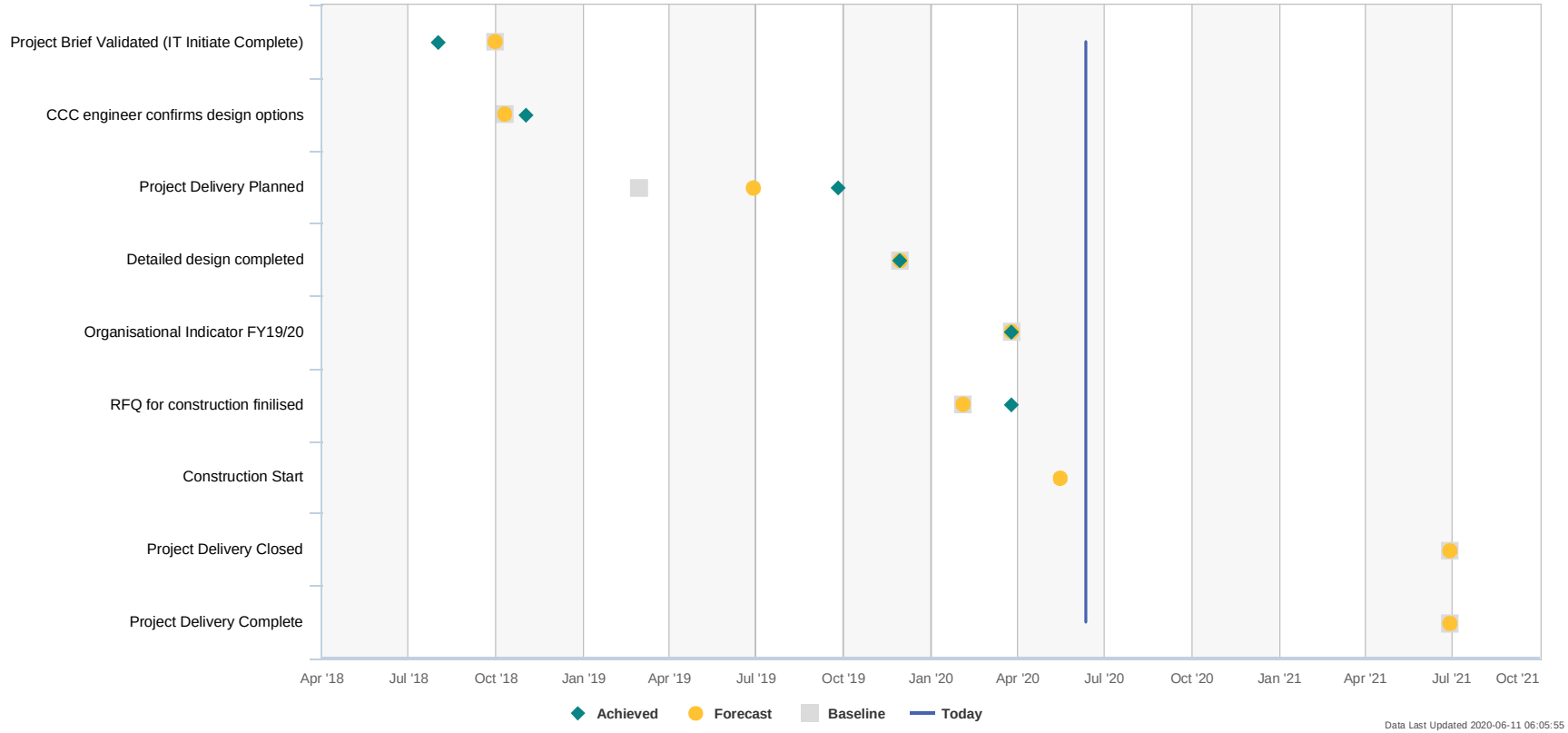
PROJECT EXPLORER

Select A Project: 49283 - SW Cass Bay Drain - 30m concrete lining renewal nr 35 Harbour View Terrace

SW Cass Bay Drain - 30m concrete lining renewal nr 35 Harbour View Terrace

Project CPMS ID # 49283

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments: Consents process and detailed design approvals delay construction. No concern to the project.

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Christchurch City Council

Paragon IQ

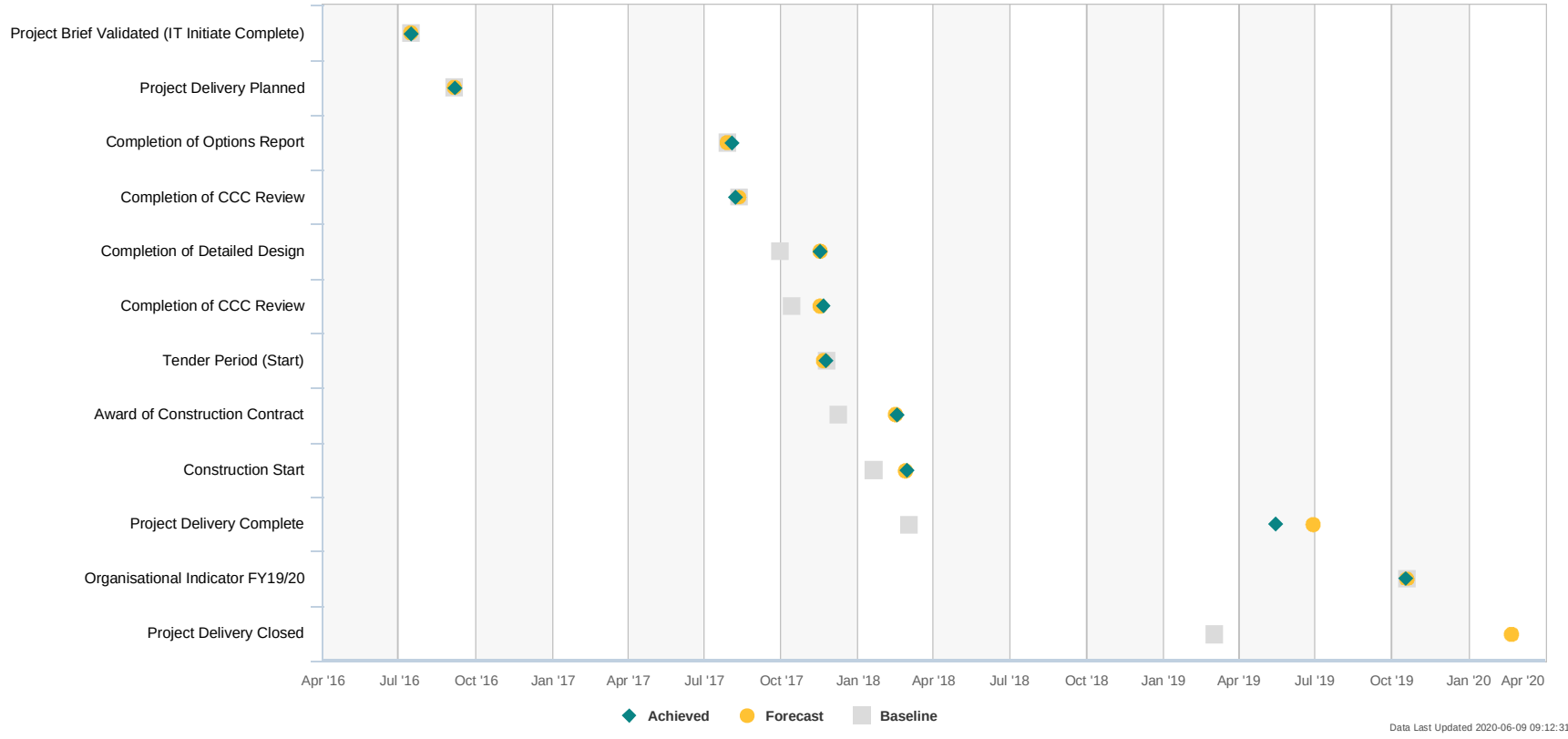
PROJECT EXPLORER

Select A Project: 34001 - SW Cass Bay Drain, nr 94 Governors Bay Rd - Inlet arrangement improvement (construction)

SW Cass Bay Drain, nr 94 Governors Bay Rd - Inlet arrangement improvement (construction)

Project CPMS ID # 34001

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

Paragon IQ

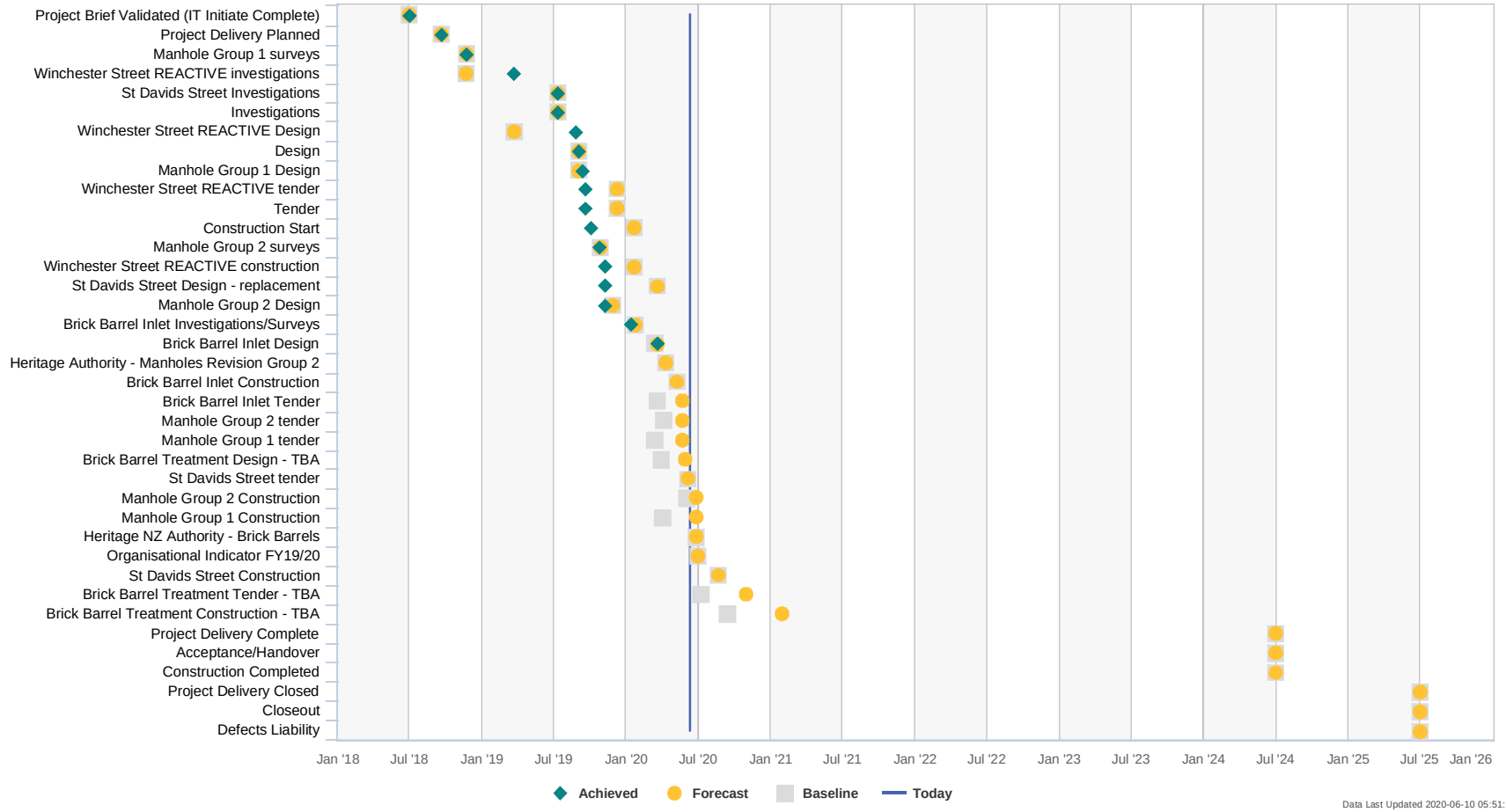
PROJECT EXPLORER

Select A Project: 37305 - SW Lyttelton Brick Barrels Renewals Work Package

SW Lyttelton Brick Barrels Renewals Work Package

Project CPMS ID # 37305

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Programme experiencing significant delays due to challenges around obtaining archaeological authority to carry out the works on brick barrels

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Christchurch City Council

Timetables for stormwater mitigation projects within the Ōtākaro/Avon River Stormwater Management Plan Area

Paragon IQ

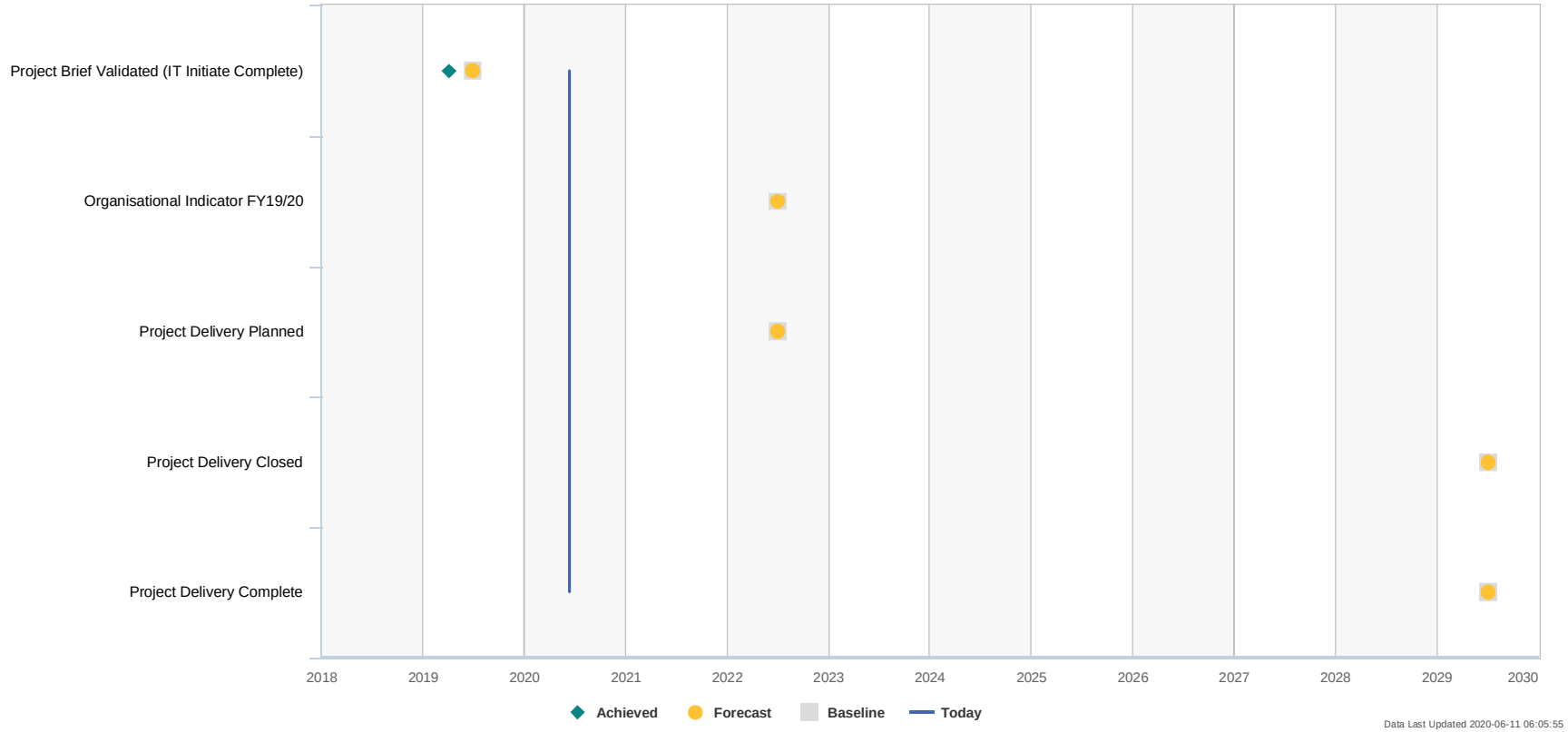
PROJECT EXPLORER

Select A Project: 41987 - SW Addington Brook and Riccarton Drain Filtration Devices

SW Addington Brook and Riccarton Drain Filtration Devices

Project CPMS ID # 41987

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments: Concept design to be in progress at end of FY

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Christchurch City Council

Paragon IQ

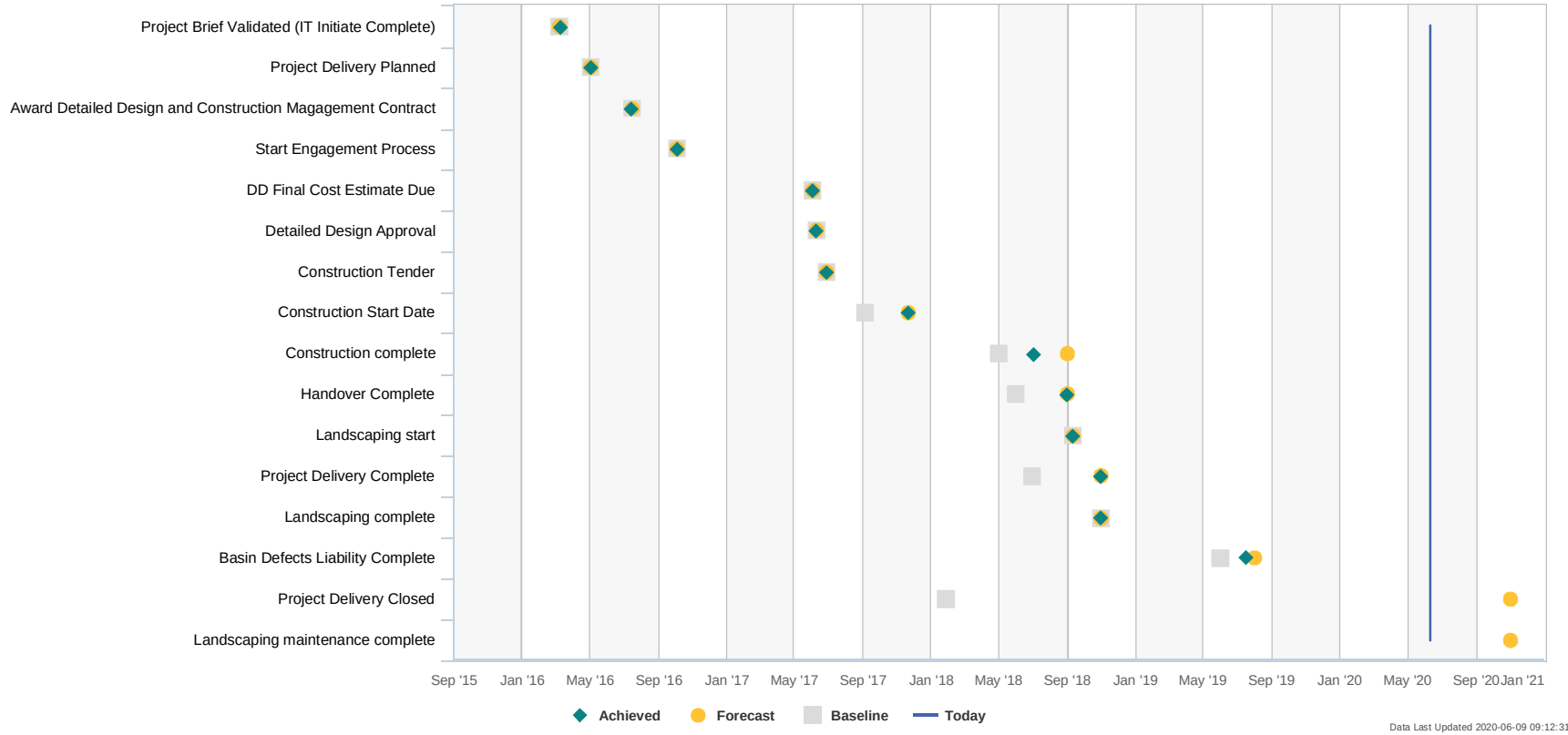
PROJECT EXPLORER

Select A Project: 31593 - LDRP 516 Knights Drain - Wainoni Park

LDRP 516 Knights Drain - Wainoni Park

Project CPMS ID # 31593

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Landscaping complete.

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Christchurch City Council

Paragon IQ

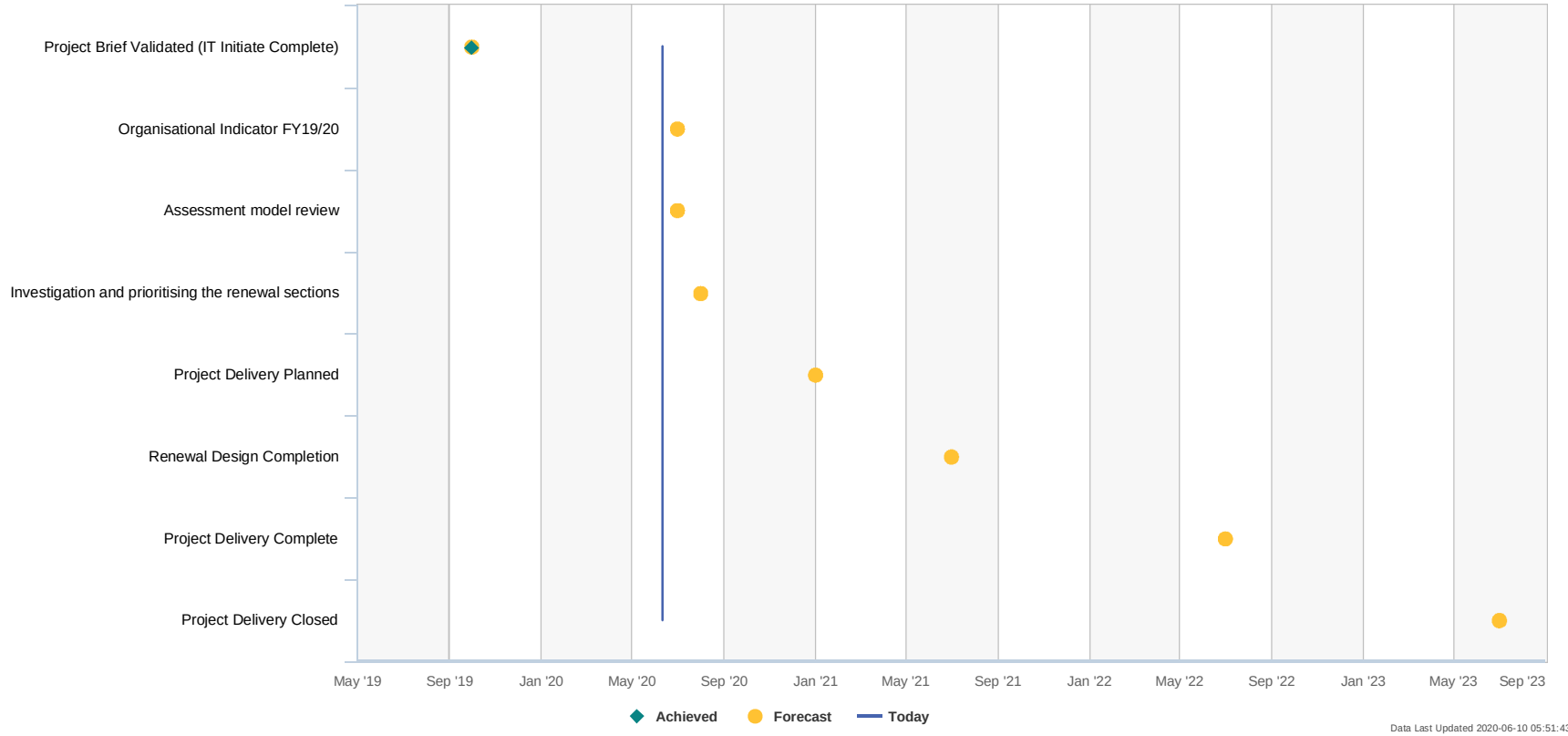
PROJECT EXPLORER

Select A Project: 55073 - SW Tennyson Street Brick Barrel Renewal

SW Tennyson Street Brick Barrel Renewal

Project CPMS ID # 55073

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Complete investigation in FY20

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Christchurch City Council

Paragon IQ

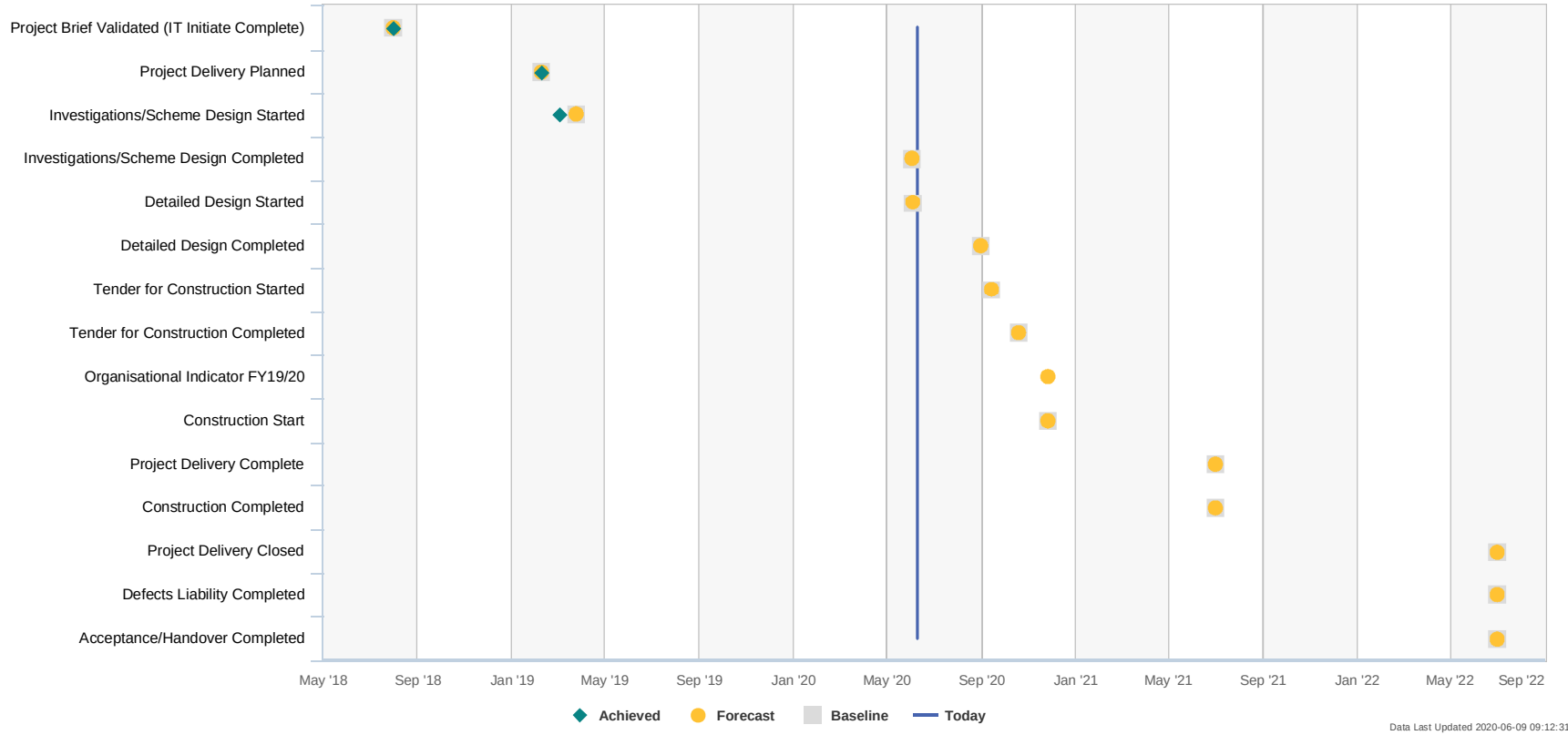
PROJECT EXPLORER

Select A Project: 48551 - SW Manchester St Drain DN750BB Renewal - Purchas St to Bealey Ave

SW Manchester St Drain DN750BB Renewal - Purchas St to Bealey Ave

Project CPMS ID # 48551

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Milestones on track, more milestones to be added post planning

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Christchurch City Council

Paragon IQ

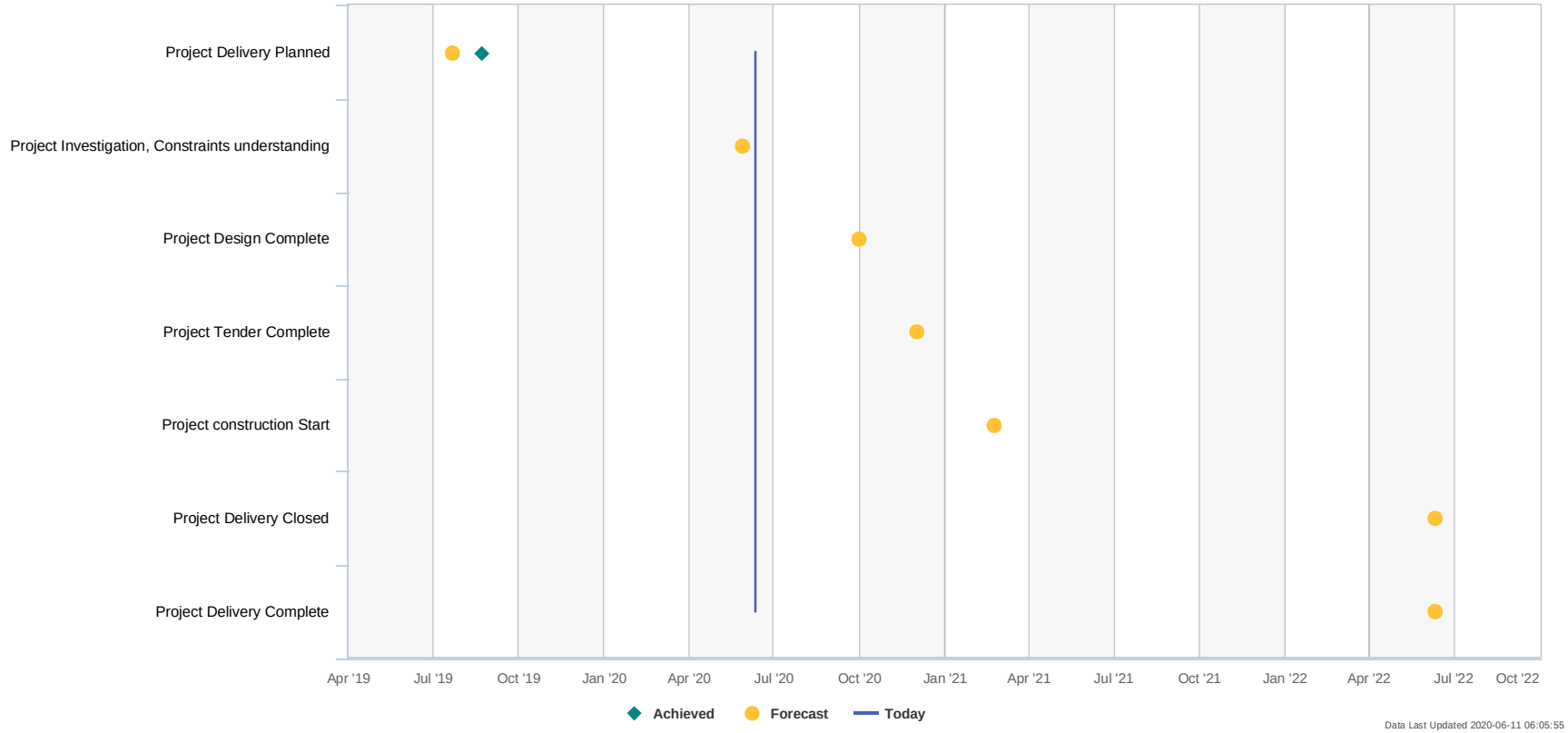
PROJECT EXPLORER

Select A Project: 55105 - SW Papanui Creek, Paparoa Street Waterway Lining Upgrade

SW Papanui Creek, Paparoa Street Waterway Lining Upgrade

Project CPMS ID # 55105

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments: Design & Investigation in FY21

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Christchurch City Council

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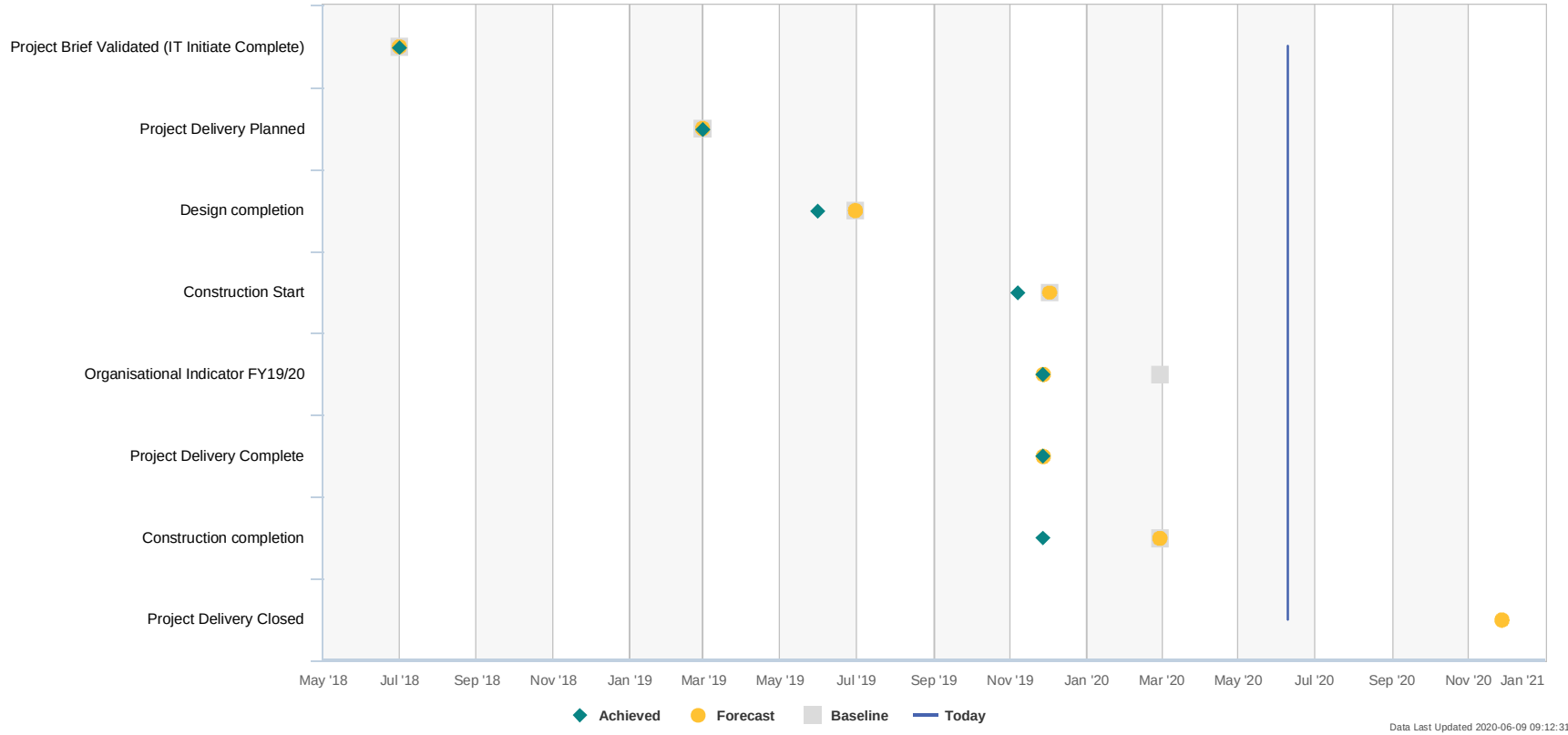
PROJECT EXPLORER

Select A Project: 33761 - SW Frees Creek, 62/66 Sherborne St - Lined Drain Renewal

SW Frees Creek, 62/66 Sherborne St - Lined Drain Renewal

Project CPMS ID # 33761

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Detailed design is completed. Construction works are started and planned to complete by the end of November 2019.

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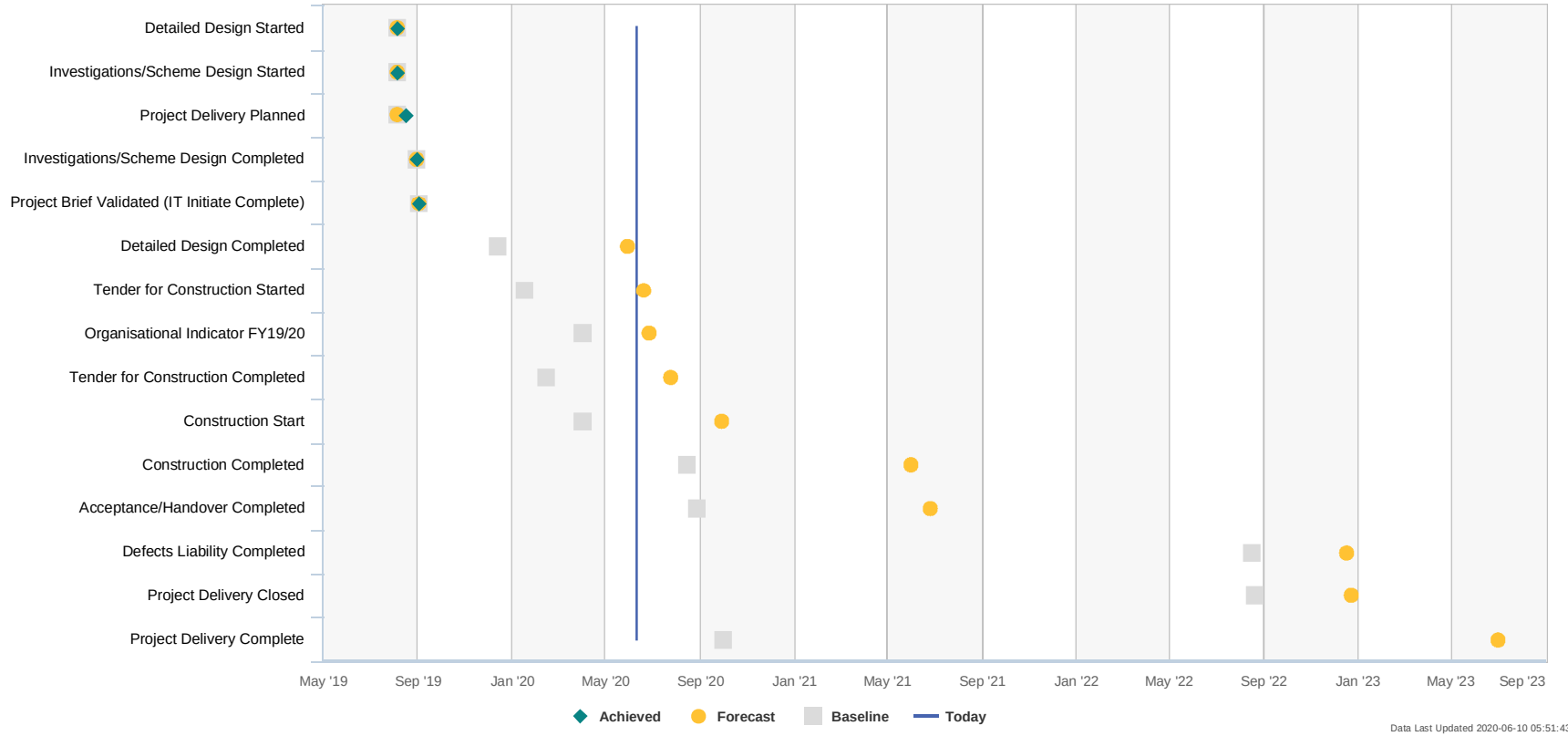
PROJECT EXPLORER

Select A Project: 57329 - LDRP 534 St Albans Creek Slater to Hills

LDRP 534 St Albans Creek Slater to Hills

Project CPMS ID # 57329

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Construction start

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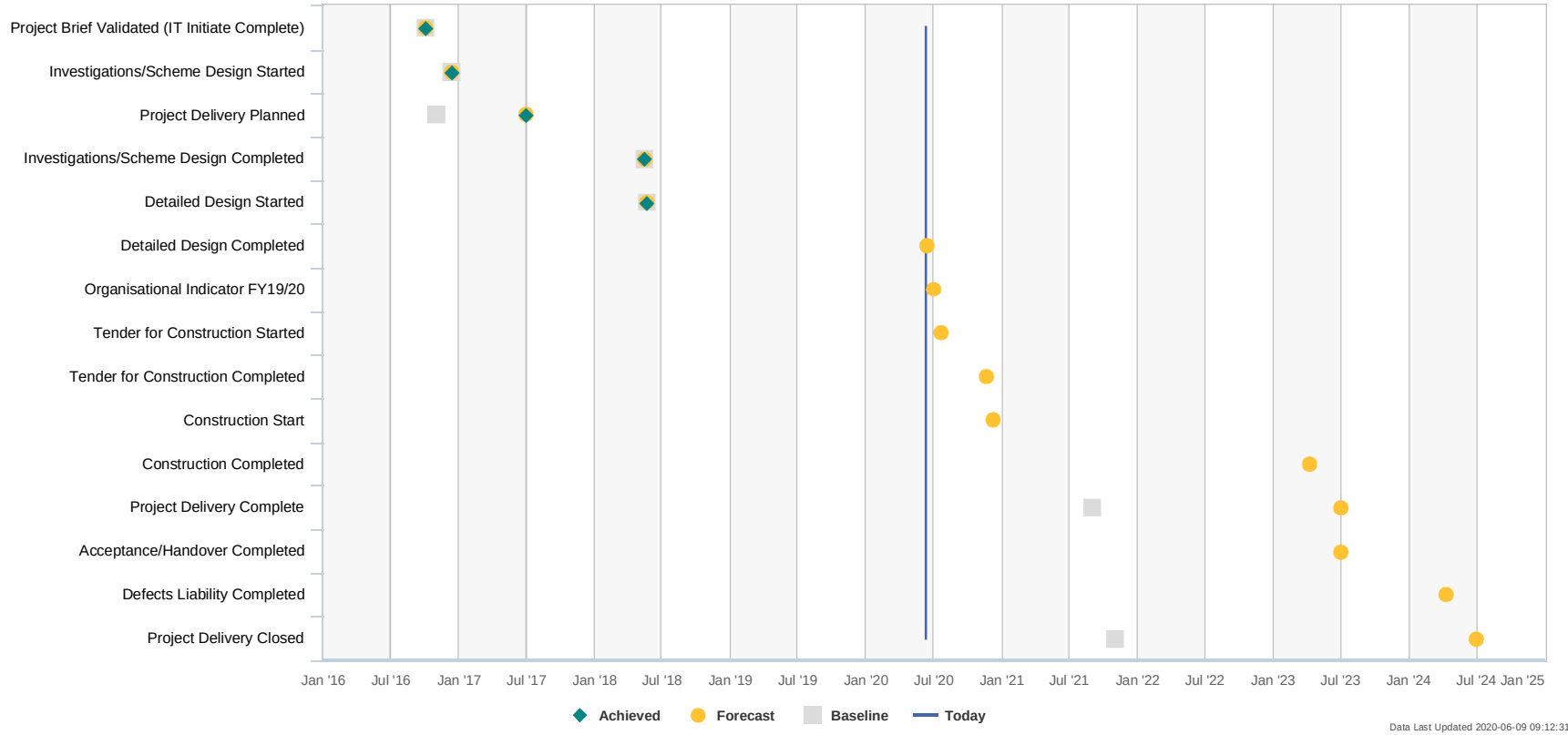
PROJECT EXPLORER

Select A Project 35900 - LDRP 513 PS205

LDRP 513 PS205 *i*

Project CPMS ID # 35900

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments Pump station upgrade construction underway.

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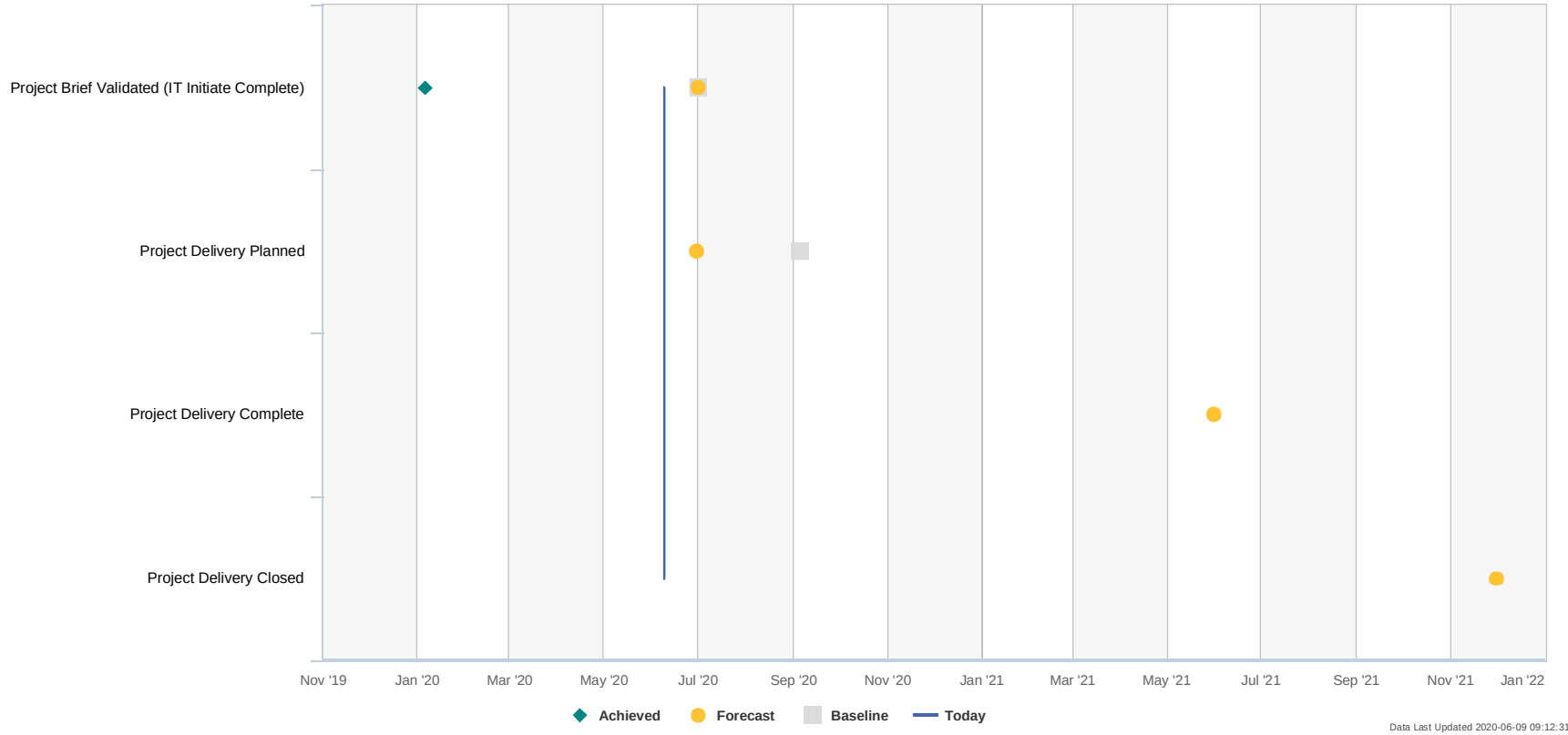
PROJECT EXPLORER

Select A Project 49031 - 95m SwPipe-26936 Renewal Roche Ave

95m SwPipe-26936 Renewal Roche Ave

Project CPMS ID # 49031

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

Paragon IQ

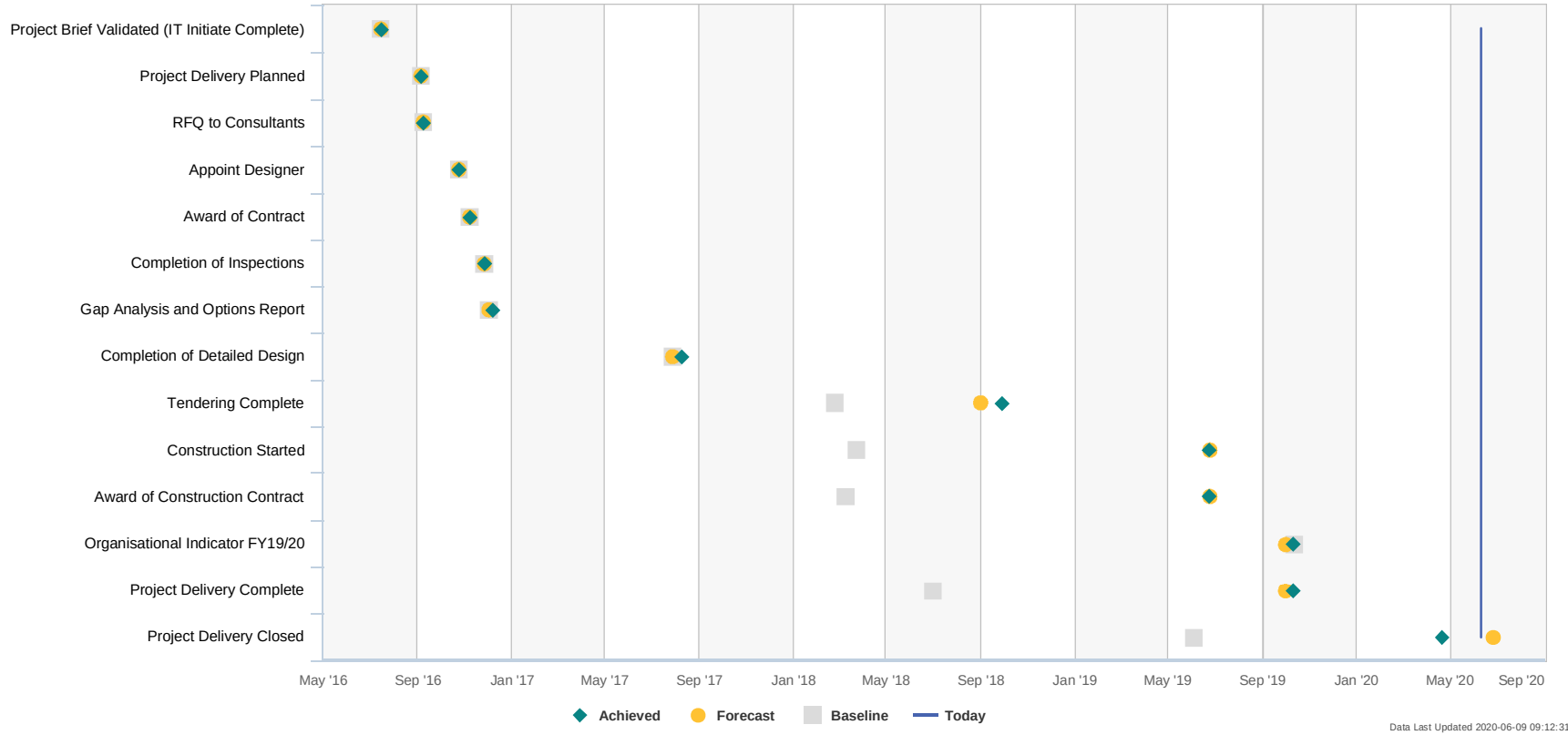
PROJECT EXPLORER

Select A Project: 33803 - SW Buckleys Road Drain - 76 to 58 Buckleys Rd - piping 135m of drain

SW Buckleys Road Drain - 76 to 58 Buckleys Rd - piping 135m of drain

Project CPMS ID # 33803

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: None

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Paragon IQ

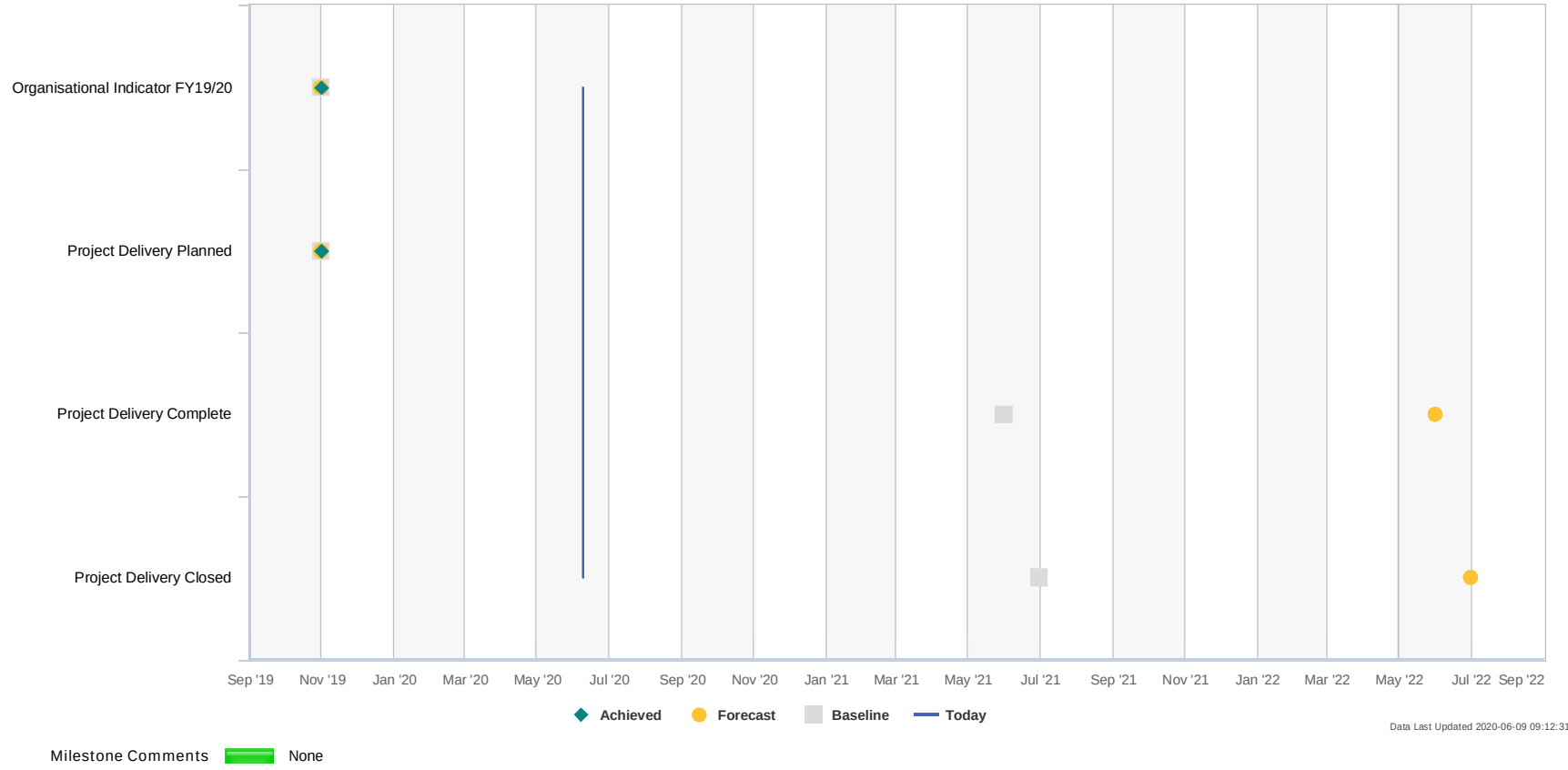
PROJECT EXPLORER

Select A Project: 55103 - SW Dudley Creek, Scotston Avenue Waterway Lining Upgrade

SW Dudley Creek, Scotston Avenue Waterway Lining Upgrade

Project CPMS ID # 55103

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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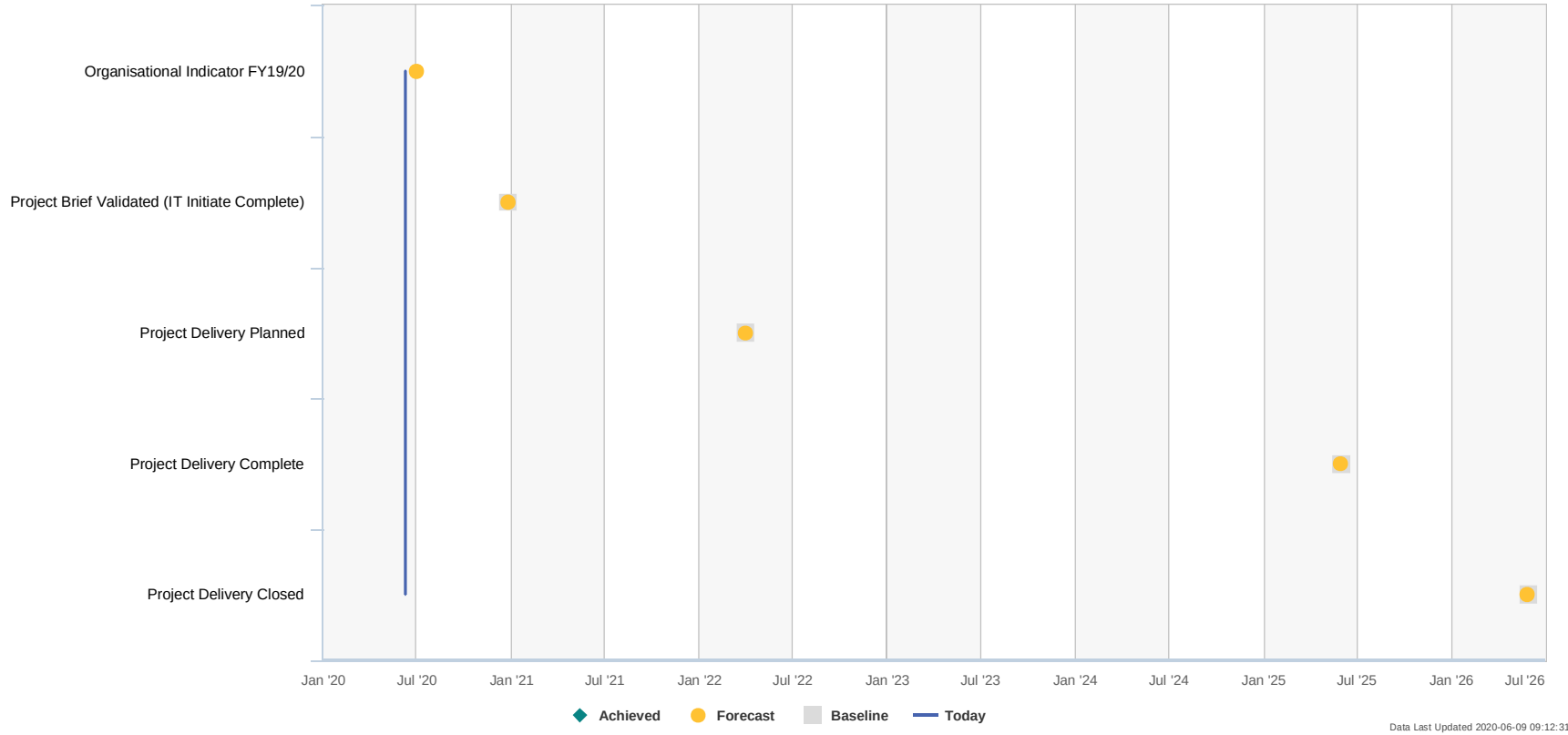
PROJECT EXPLORER

Select A Project: 28741 - LDRP 506 Dudley Creek tributaries

LDRP 506 Dudley Creek tributaries

Project CPMS ID # 28741

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Agree brief at risk due to internal resourcing and programme priorities

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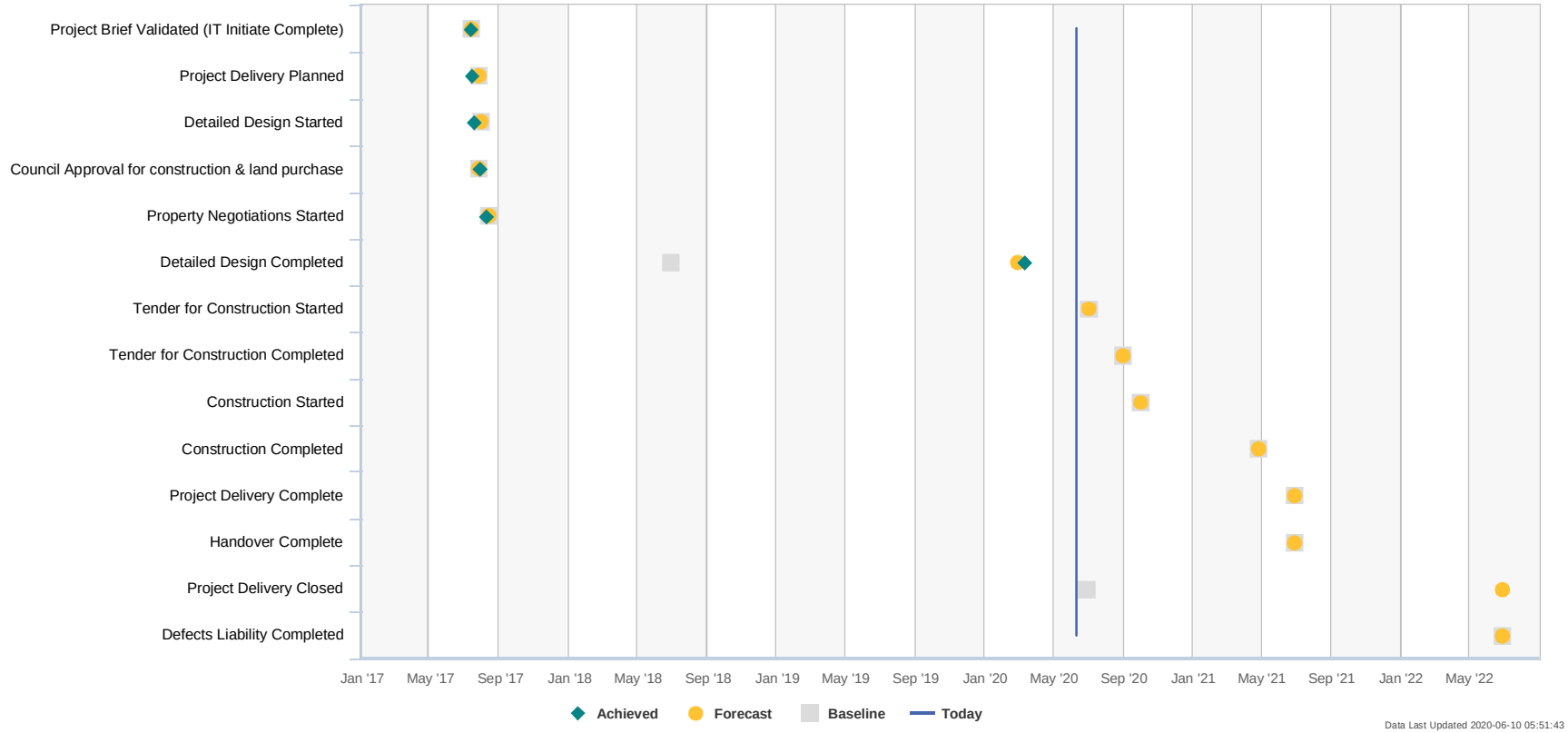
PROJECT EXPLORER

Select A Project: 44056 - LDRP 509 Knights Drain Ponds

LDRP 509 Knights Drain Ponds

Project CPMS ID # 44056

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Detailed design completion delayed discussions. No impact on construction programme.

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Christchurch City Council

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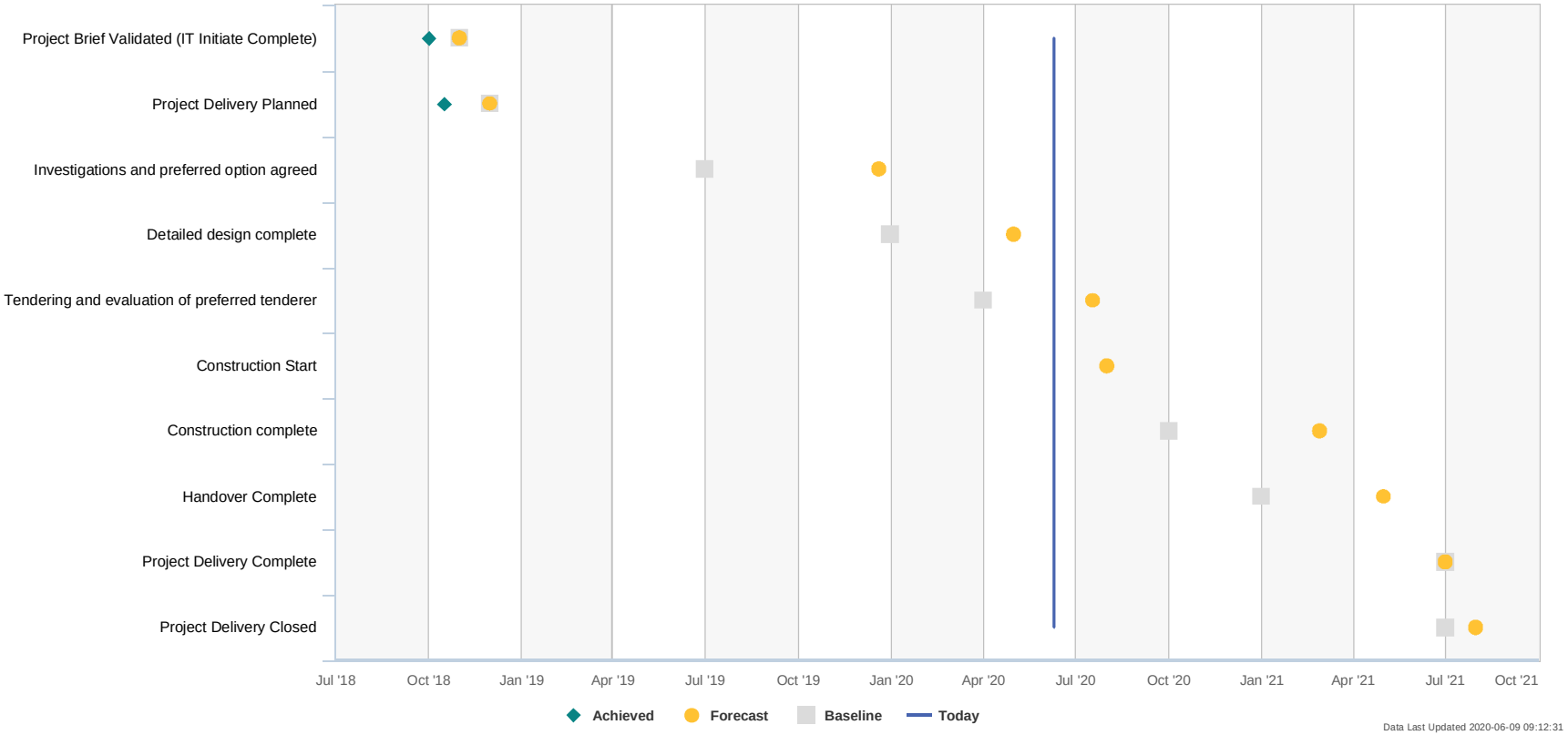
PROJECT EXPLORER

Select A Project: 49964 - SW Sissons Drain, Hoani St to Langdons Rd - 105m Timber Lining Renewal

SW Sissons Drain, Hoani St to Langdons Rd - 105m Timber Lining Renewal

Project CPMS ID # 49964

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Award construction contract may not be achievable due to resource issue.

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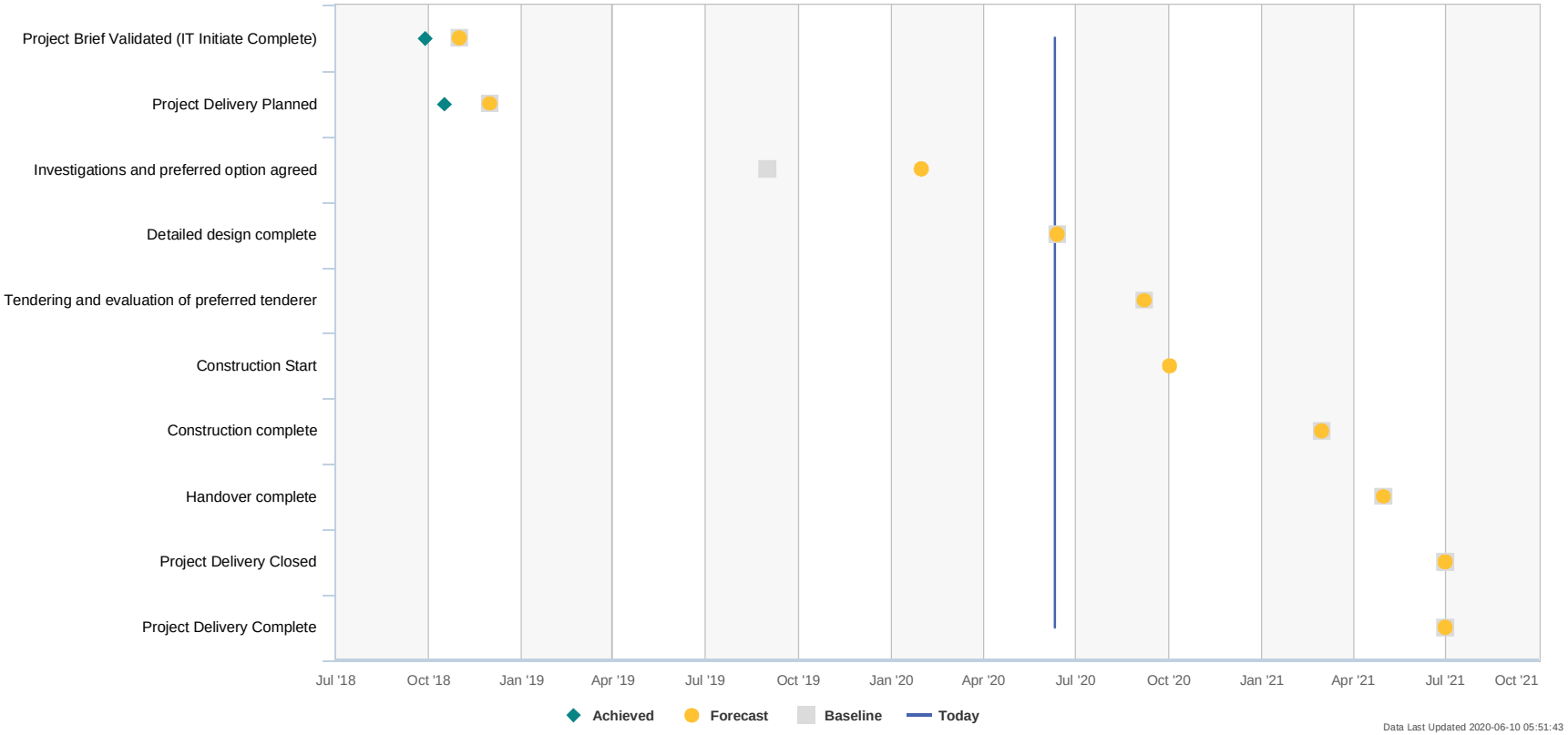
PROJECT EXPLORER

Select A Project: 49716 - SW Mairehau Dr, Westminster to Crosby - 430m timber lining renewal

SW Mairehau Dr, Westminster to Crosby - 430m timber lining renewal

Project CPMS ID # 49716

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Commenced detailed design.

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Paragon IQ

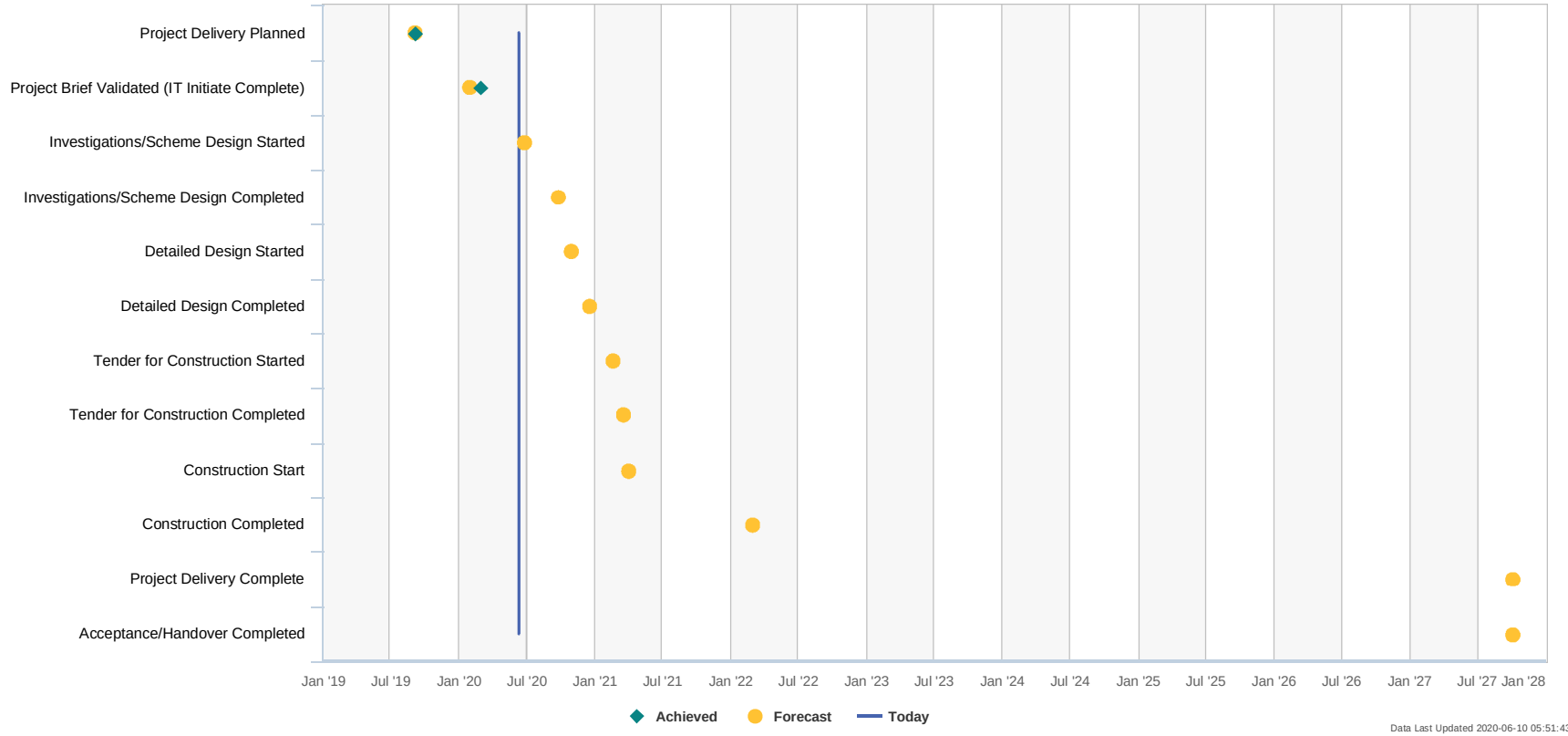
PROJECT EXPLORER

Select A Project: 56166 - SW Waikākāriki - Horseshoe Lake Stormwater Treatment Facility - Stage 1

SW Waikākāriki - Horseshoe Lake Stormwater Treatment Facility - Stage 1

Project CPMS ID # 56166

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Project charter still to be finalised by Project Sponsor. Awaiting update on Project definition, inclusion and boundaries. Project has a budget of $51K in FY20

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Christchurch City Council

Paragon IQ

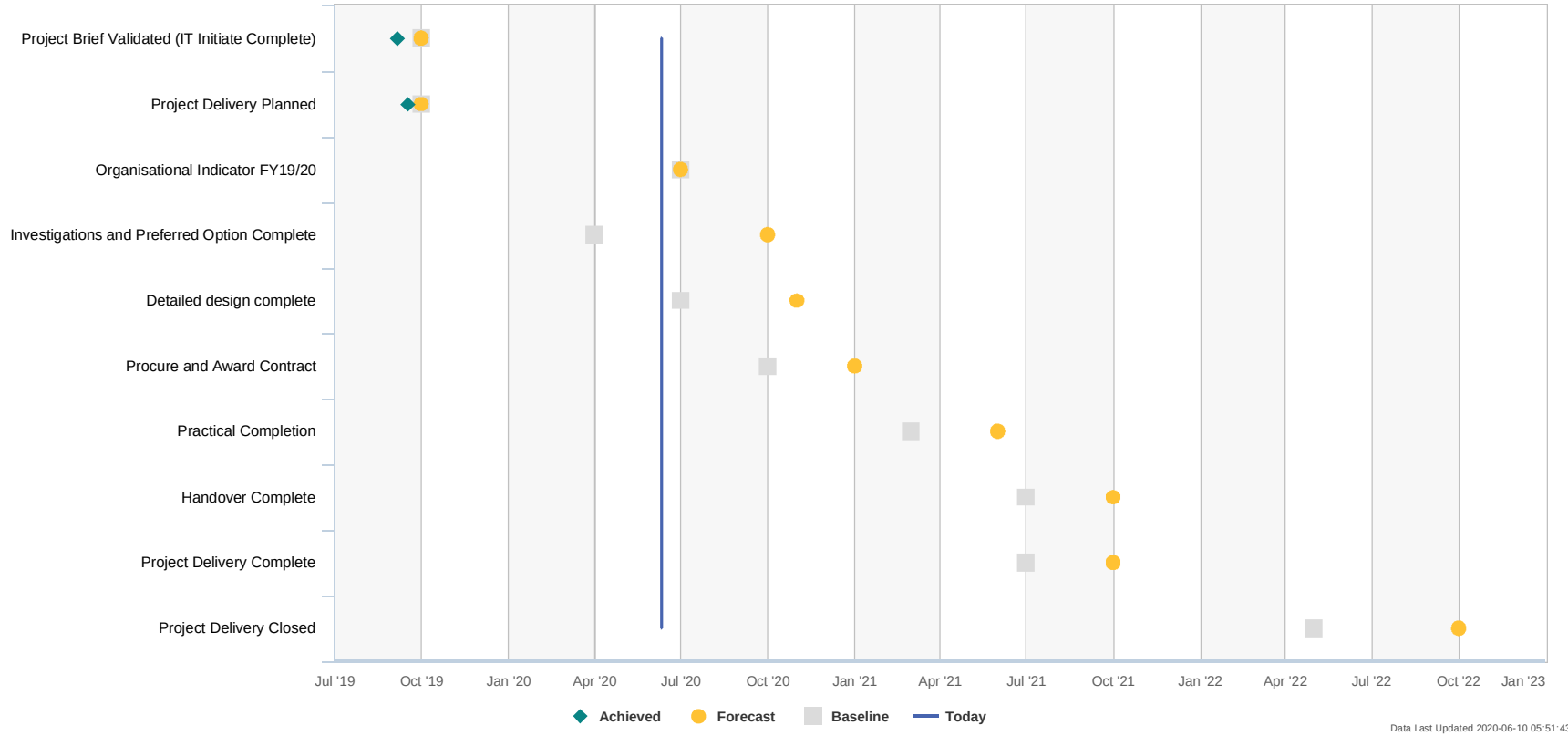
PROJECT EXPLORER

Select A Project 49282 - Wilkins Drain@Holmwood Road- 80m concrete lining renewal

Wilkins Drain@Holmwood Road- 80m concrete lining renewal

Project CPMS ID # 49282

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments Detailed design complete

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Paragon IQ

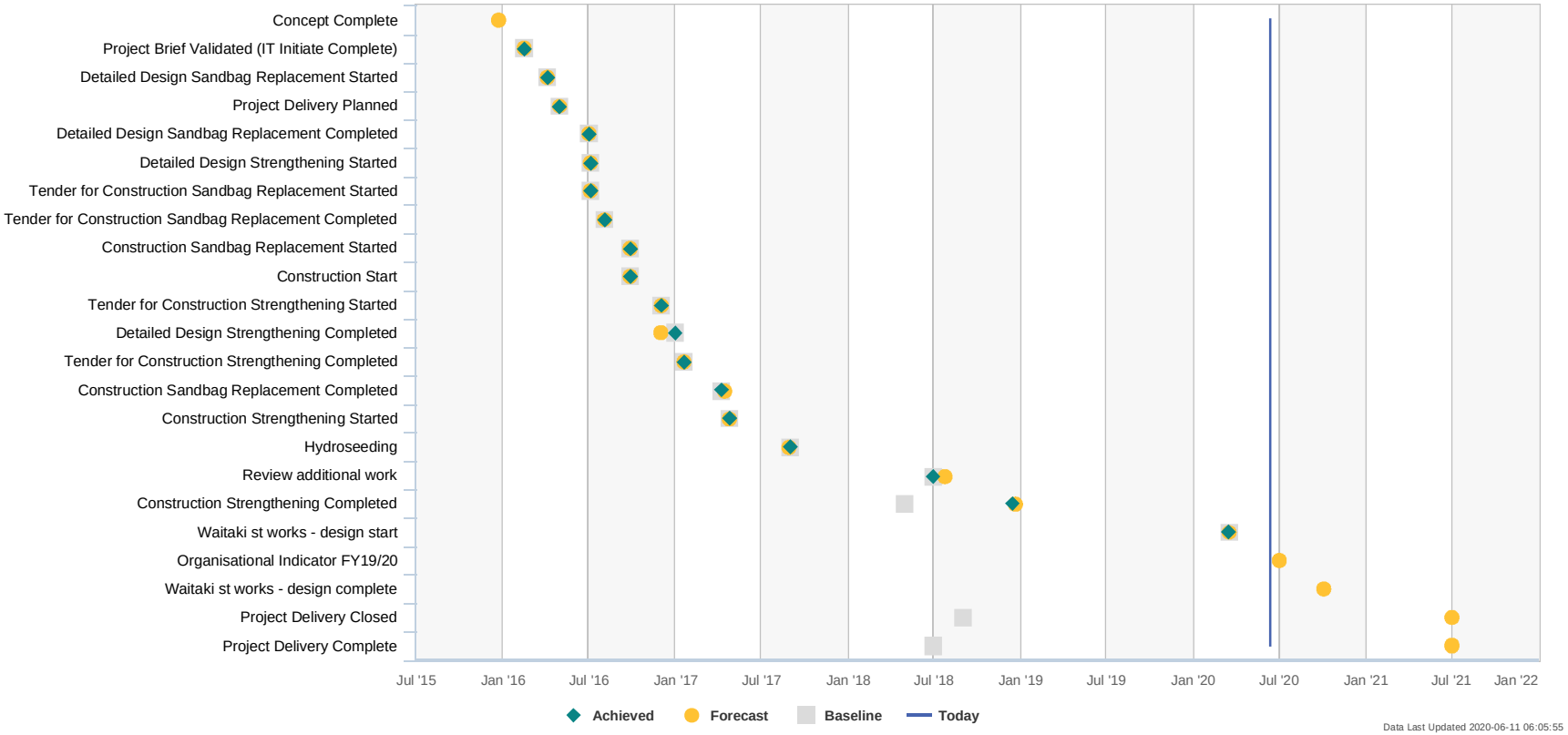
PROJECT EXPLORER

Select A Project: 28742 - LDRP 507 Temporary stop bank management

LDRP 507 Temporary stop bank management

Project CPMS ID # 28742

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments: Bund stability - Owles tce and Waitaki ontrack.

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Christchurch City Council

Timetables for stormwater mitigation projects within the Estuary and Coastal Stormwater Management Plan Area

Paragon IQ

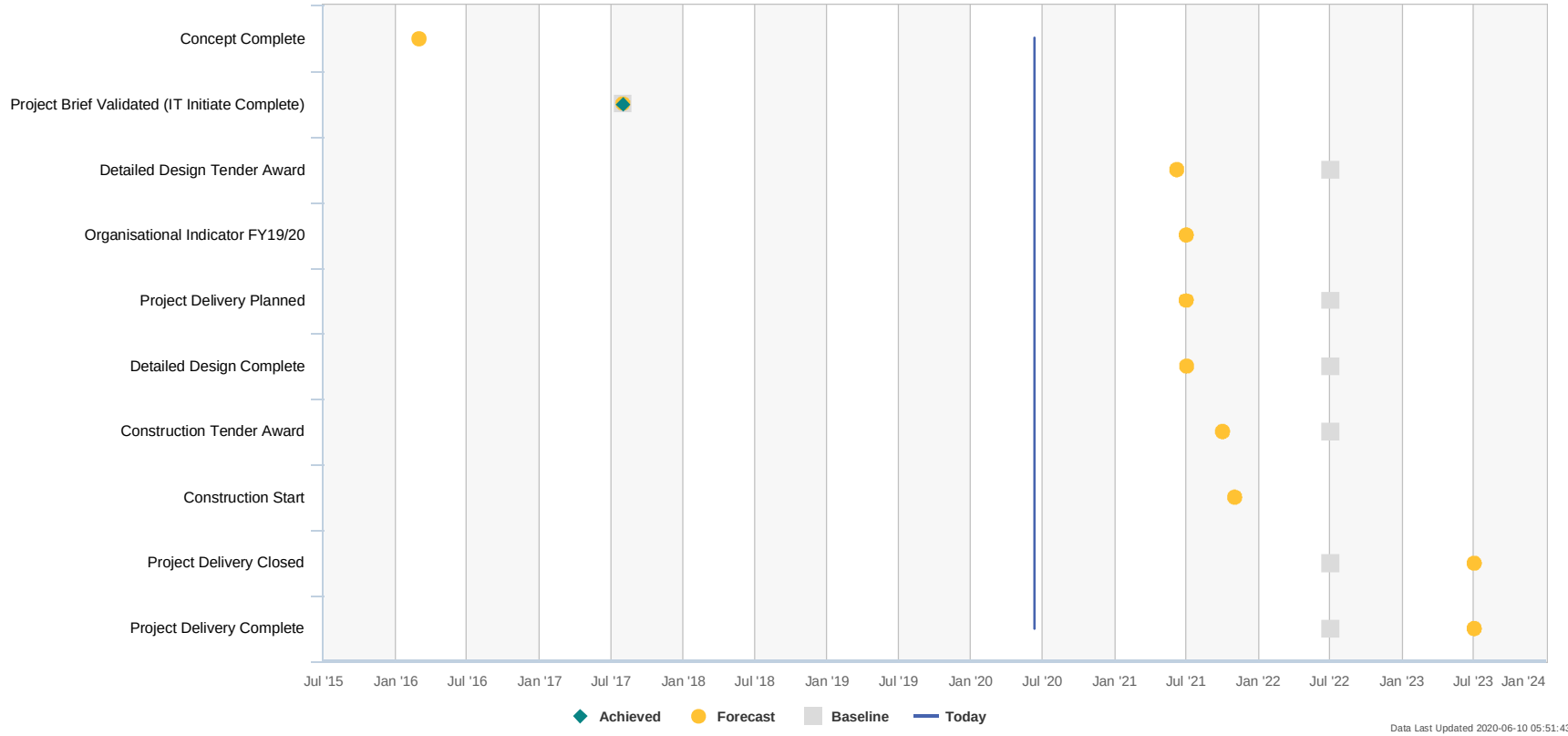
PROJECT EXPLORER

Select A Project: 28744 - LDRP 505 Sumner Stream and Richmond Hill Waterway

LDRP 505 Sumner Stream and Richmond Hill Waterway

Project CPMS ID # 28744

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments: Capital Delivery not planned to start until FY22 but due to recent flooding events in the catchment this has been brought back to FY20 for site investigation and scoping

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Paragon IQ

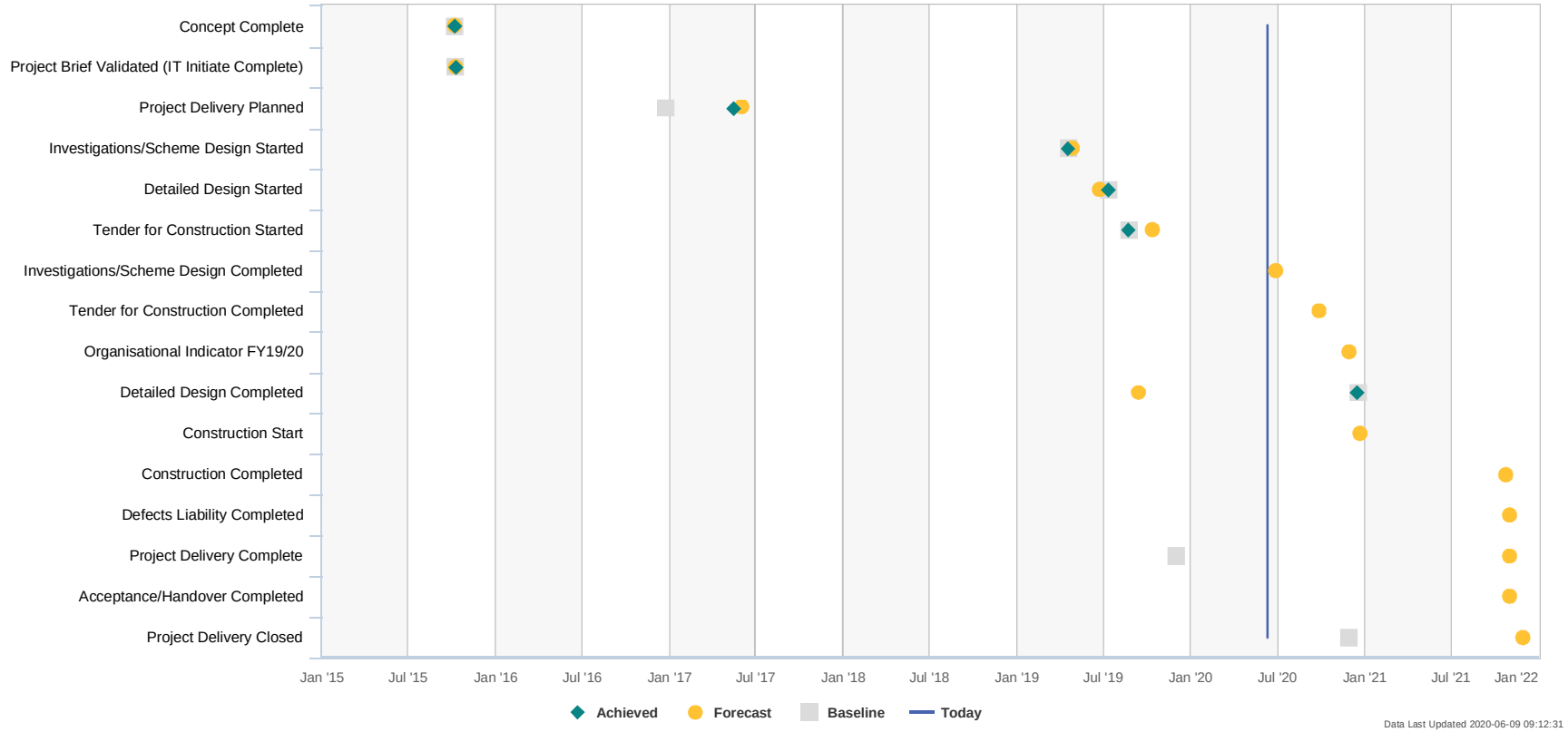
PROJECT EXPLORER

Select A Project: 29076 - LDRP 531 Charlesworth Drain

LDRP 531 Charlesworth Drain

Project CPMS ID # 29076

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Milestones in delay - causes - Land owner access issues, design delivery late

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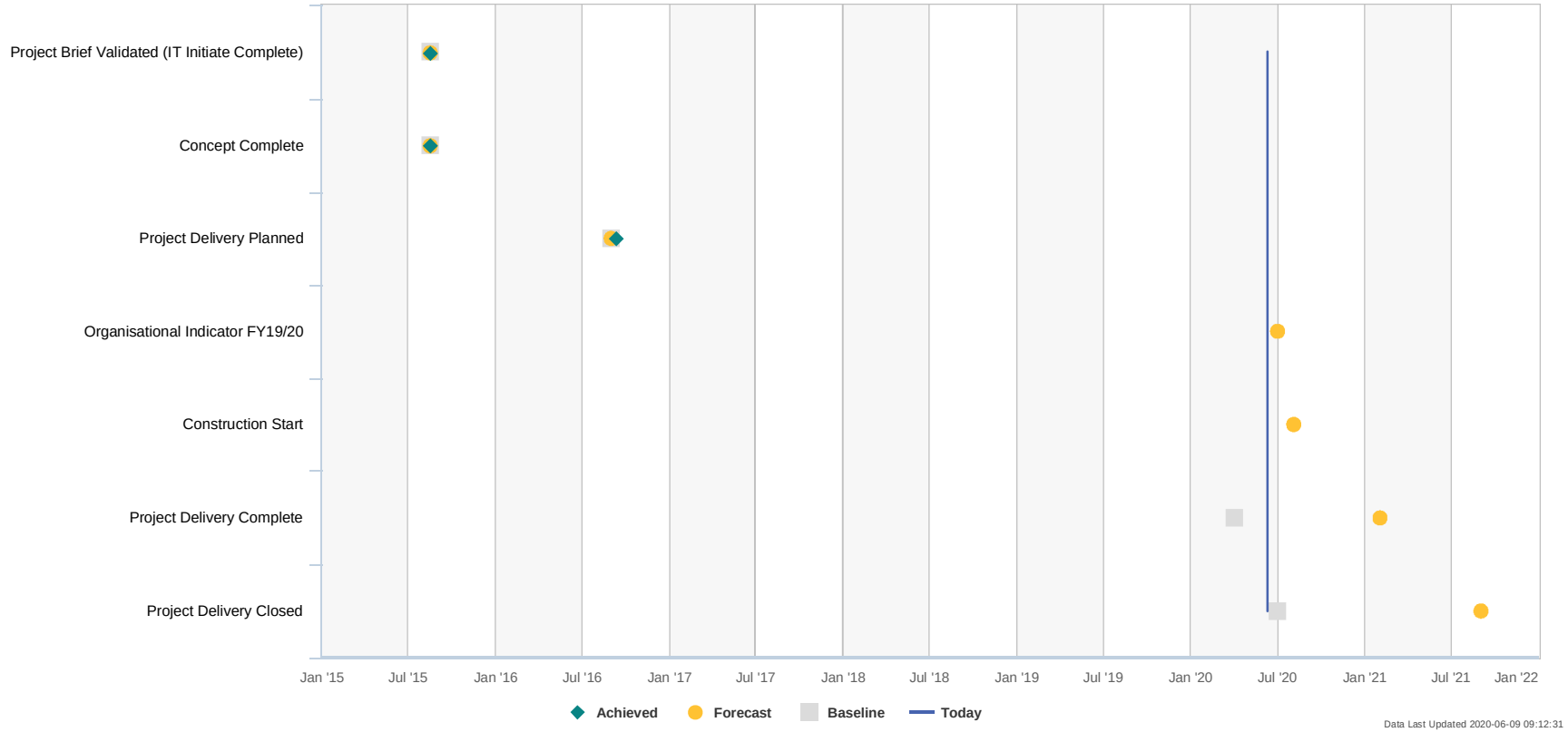
PROJECT EXPLORER

Select A Project: 26891 - LDRP 515 Estuary Drain

LDRP 515 Estuary Drain

Project CPMS ID # 26891

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Construction completion in FY20 will not occur due to delays in detailed design.

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Paragon IQ

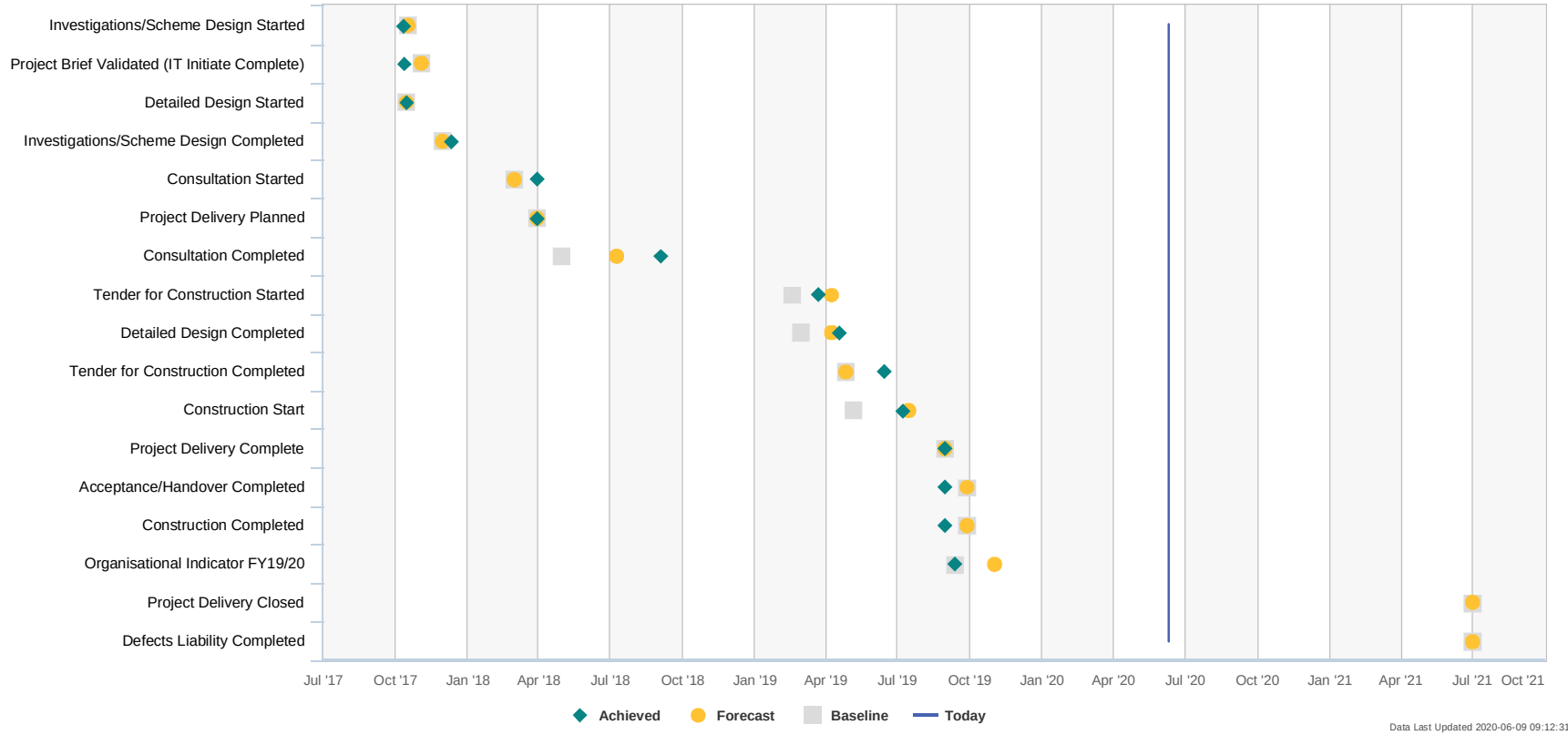
PROJECT EXPLORER

Select A Project: 45166 - LDRP 525 Southshore Emergency Bund

LDRP 525 Southshore Emergency Bund

Project CPMS ID # 45166

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments: Milestone will be met and construction completed in FY 20.

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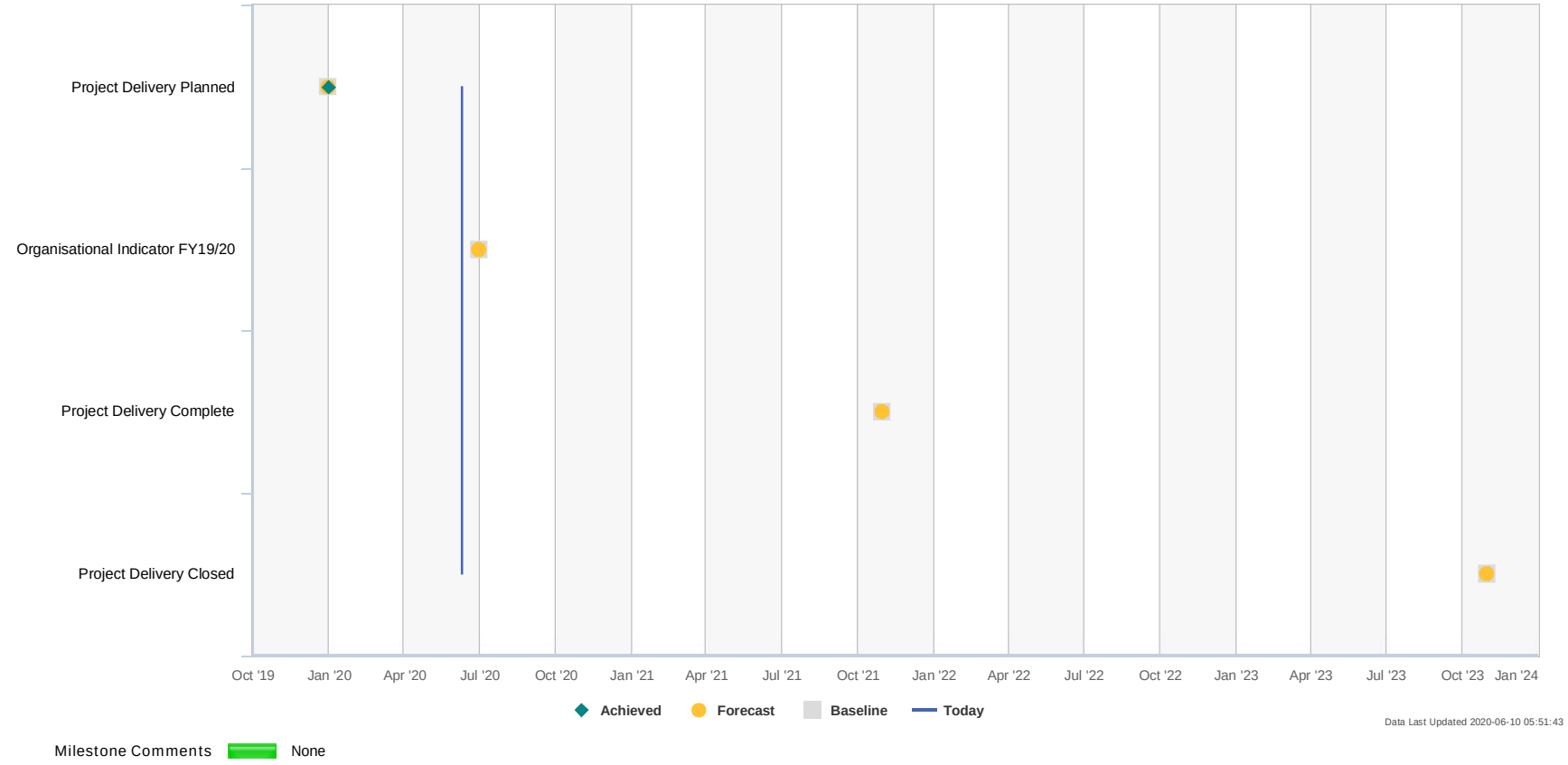
PROJECT EXPLORER

Select A Project 56950 - South New Brighton Set-back Bund – Bridge St to Jetty

South New Brighton Set-back Bund – Bridge St to Jetty

Project CPMS ID # 56950

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments None

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Christchurch City Council

Timetables for stormwater mitigation projects within the Outer Christchurch Stormwater Management Plan Area

Paragon IQ

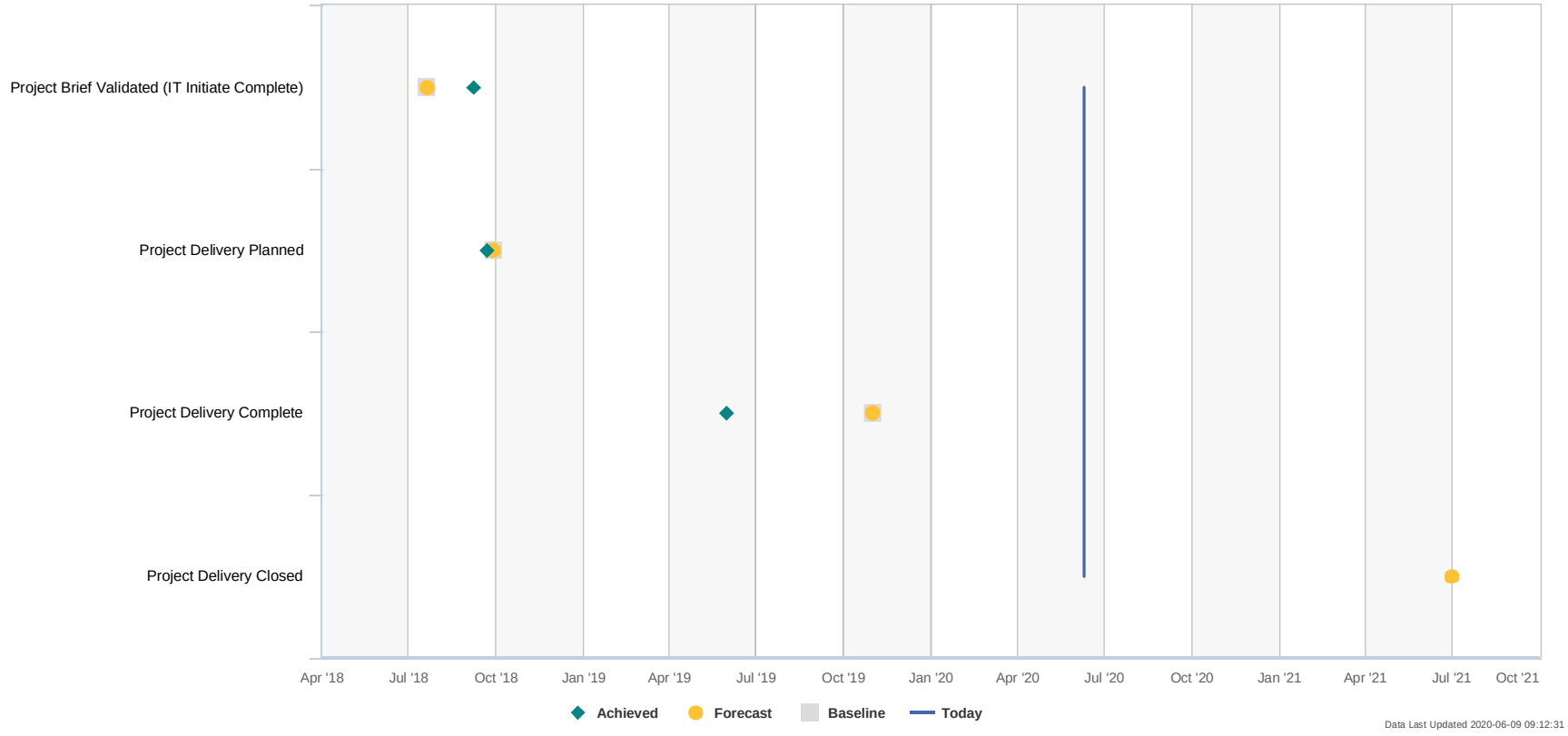
PROJECT EXPLORER

Select A Project 50367 - SW Otukaikino Creek Riparian Margin Restoration

SW Otukaikino Creek Riparian Margin Restoration

Project CPMS ID # 50367

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-09 09:12:31

Milestone Comments None

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Christchurch City Council

Timetables for stormwater mitigation projects within the Huritini/Halswell River Stormwater Management Plan Area

Paragon IQ

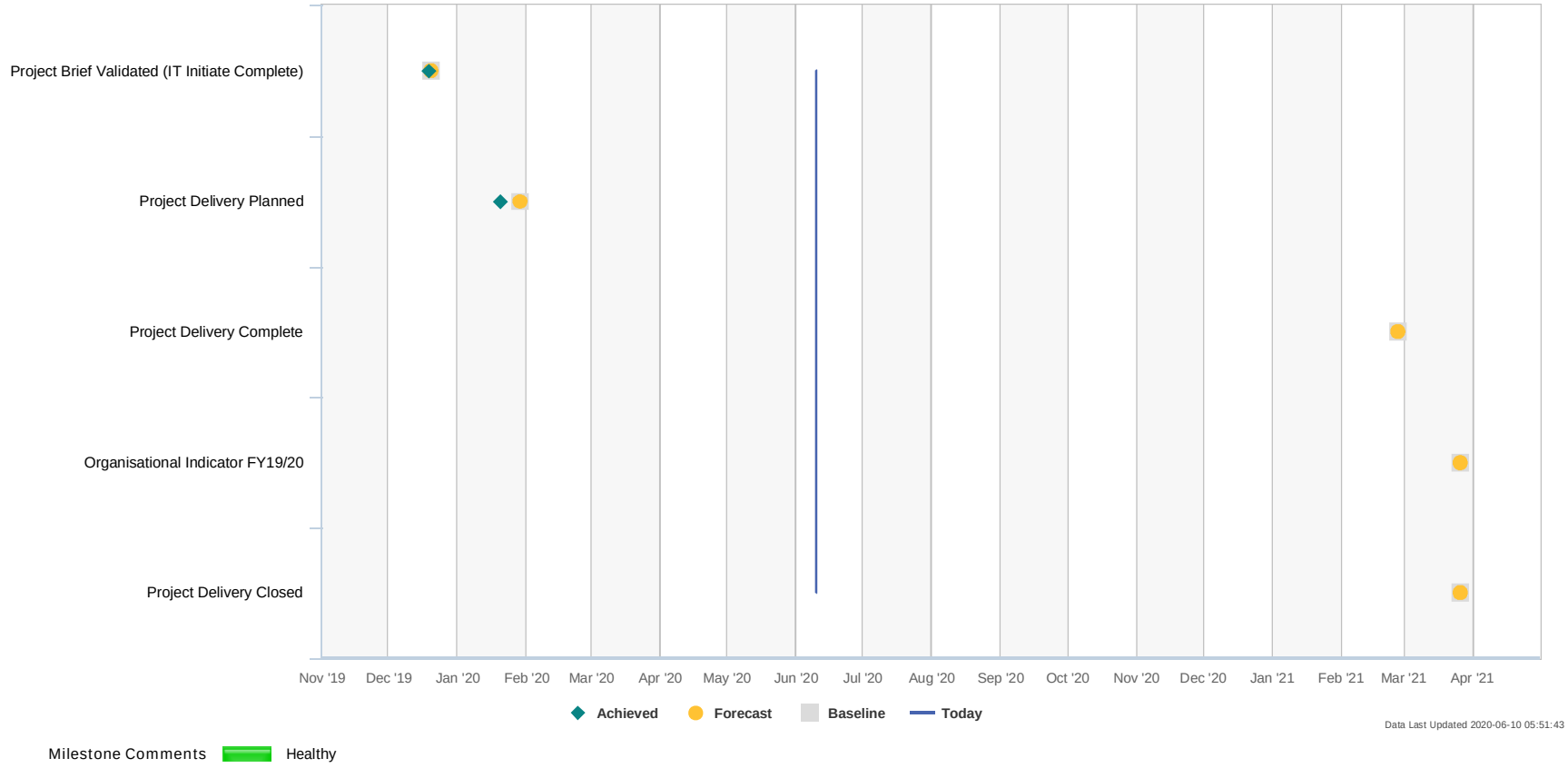
PROJECT EXPLORER

Select A Project 55592 - LDRP 533 Halswell Modelling

LDRP 533 Halswell Modelling

Project CPMS ID # 55592

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments Healthy

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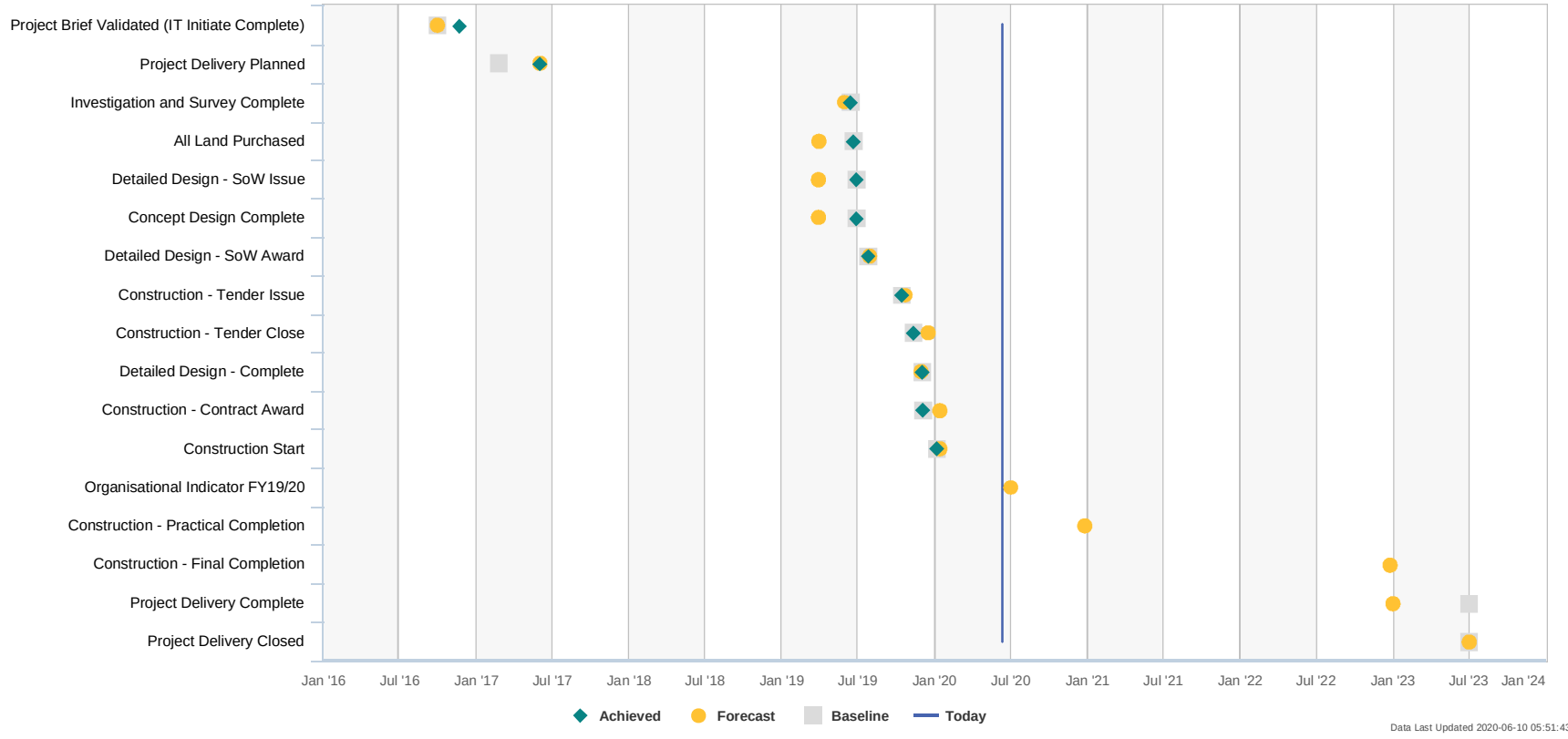
PROJECT EXPLORER

Select A Project: 36063 - SW Coxs - Quaifes Facility

SW Coxs - Quaifes Facility

Project CPMS ID # 36063

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Data Last Updated 2020-06-10 05:51:43

Milestone Comments None

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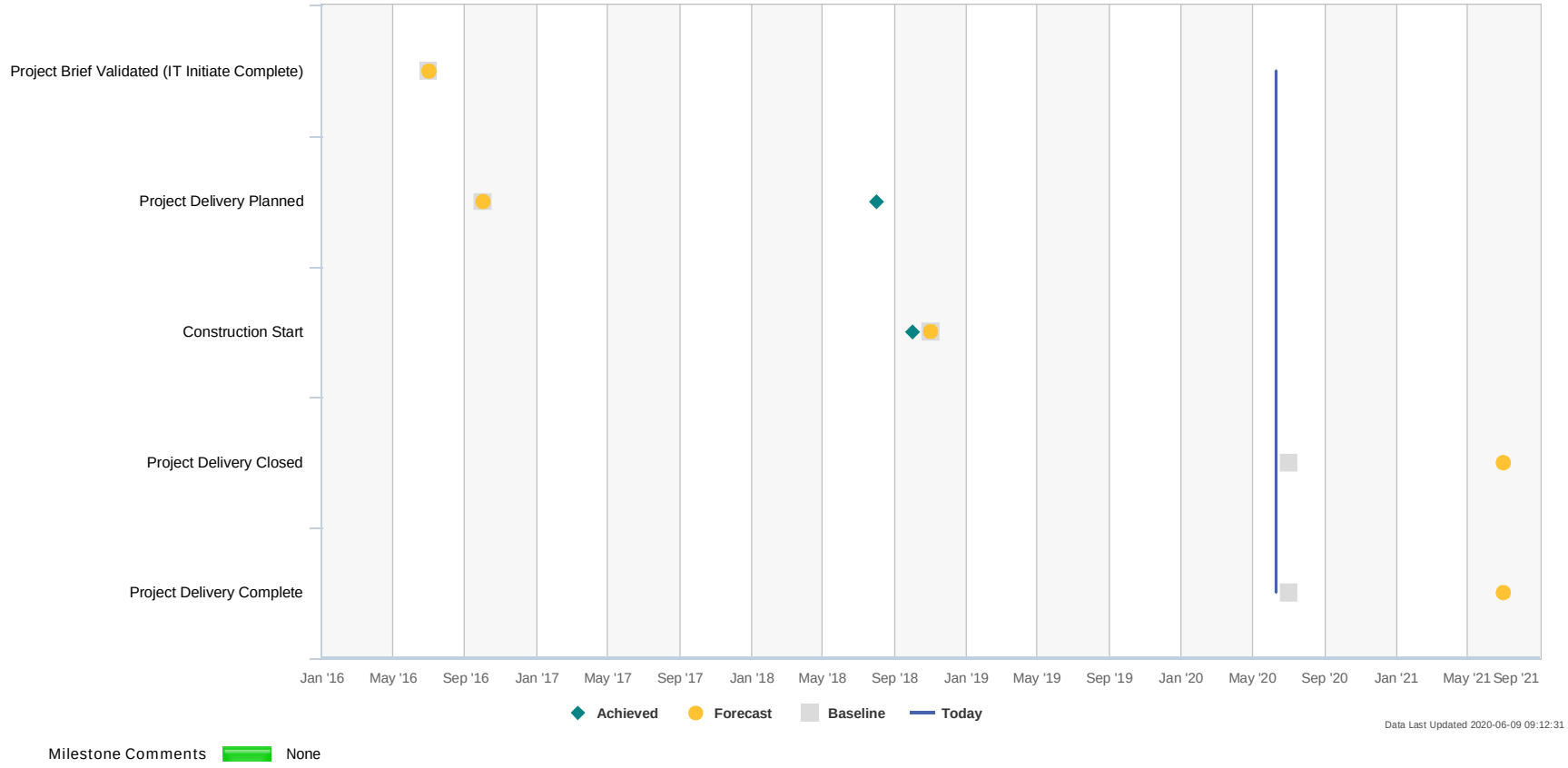
PROJECT EXPLORER

Select A Project: 33976 - SW Rossendale - Infrastructure Provision Agreement (IPA)

SW Rossendale - Infrastructure Provision Agreement (IPA)

Project CPMS ID # 33976

Summary | Finances | Milestones | Phase Progress History | Status Reports | Contracts | Related Projects | Comments



Milestone Comments None

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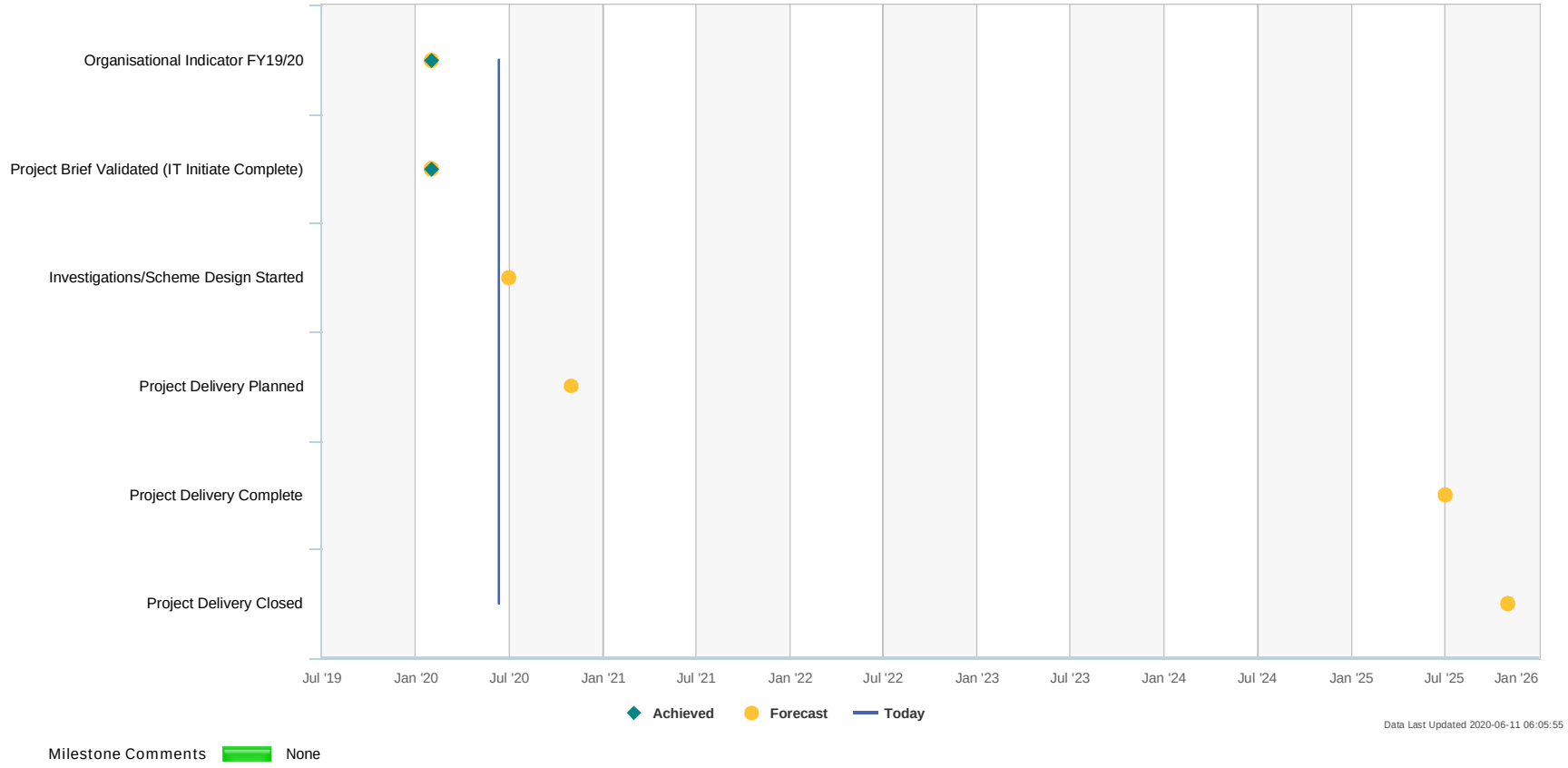
PROJECT EXPLORER

Select A Project 38090 - SW Greens Stormwater Facility

SW Greens Stormwater Facility

Project CPMS ID # 38090

Summary Finances Milestones Phase Progress History Status Reports Contracts Related Projects Comments



Data Last Updated 2020-06-11 06:05:55

Milestone Comments None

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Christchurch City Council

Schedule 1: Sites Excluded from the Comprehensive Stormwater Network Discharge Consent CRC190445

Sites excluded from the Heathcote and Halswell SMP Areas

Street Address	Street Number	Legal Description	CCC Prupi
Alloy Street	2	Lot 2 DP 64248	704537
Ballarat Way	2	Lot 1 DP 466471	618251
Ballarat Way	10	Lot 2 DP 466471	618252
Blenheim Road	412	Part Lot 3 DP 15178	466207
Blenheim Road	4/455	Lot 1 DP 489573	923053
Branston Street	96	Lot 2 DP 352288	587825
Canterbury Street	7	Lot 10 DP 2899, Lot 9 DP 2899, Lot 11 DP 2899, Lot 12 DP 2899, Lot 1 DP 21916	716119
Carmen Road	106G	Lot 3 DP 338441	582584
Chapmans Road	62	Lot 1 DP 81080, Lot 1 DP 81318	856662
Chappie Place	17	Lot 1 DP 443257	908779
Gerald Connolly Place	4	Lot 2 DP 76880	825361
Gerald Connolly Place	4a	Lot 3 DP 76880	825362
Halswell Junction Road	515	Lot 2 DP 358423, Lot 3 DP 358423	587860, 587861
Hayton Road	115	Lot 3 DP 353897	585855
Hayton Road	137	Lot 2 DP 343321	584430
Hayton Road	79 & 79A	Lot 1 DP 481286, Lot 2 DP 481286	924341, 924342
Main South Road	222	Lot 1 DP 14716, Lot 1 DP 51993	750576
Main South Road	243 & 245	Pt Lot 2 DP 6604, RS 39034, Lot 1 DP 78344, Lot 2 DP 78344	516213, 520964, 408547, 510731
McAlpine Street	18	Lot 8 DP 36831	429004
McAlpine Street	67	Lot 9 DP 30936	428578
Parkhouse Road	59	Lot 1 DP 25818	485608
Springs Road	254	Lot 1 DP 358423	587859
Waterloo Road	60	Lot 1 DP 80063	407540
Wigram Close	15	Lot 1 DP 51889, Lot 2 DP 324467	504628, 579847
Wigram Road	120	Lot 2 DP 493335	625647
Wigram Road	122	Lot 4 DP 475888	621028
Wigram Road	120A	Lot 1 DP 493335	625646
Wilmers Road	10	Lot 4 DP 20669	817675
Wilmers Road	50	Lot 5 DP 447519	615860
Partial Site Exclusions			
Street Address	Street Number	Legal Description	CCC Prupi
Carmen Road	112	Section 27 SO 459717	629404
Halswell Junction Road	600	Lot 7 DP 404845	609872
Harvard Avenue	45	Lot 1 DP 81480	565026
Main South Road	282	Lot 10 DP 1391	750597

Sites excluded from the Pūharakekenui/Styx SMP Area

Street Address	Street Number	Legal Description	CCC Prupi
Barnes Road	79-87	Lot 1 DP 346683	586324
Belfast Road	30	Lot 2 DP 37063	425217
Broughs Road	6	LOT 15 DP 36871	814749
Broughs Road	7	LOT 2 DP 36871	714473
Broughs Road	15	LOT 3 DP 36871	804901
Broughs Road	23	LOT 4 DP 36871	874832
Cavendish Road	150	Lot 2 DP 401108	609557
Cavendish Road	158	Lot 1 DP 360822	587685
Cranford Street	514	Lot 2 DP 16135	722133
Dickeys Road	13	Pt Lot 1 DP 23890, Lot 1 DP 25116	437651, 438723
Export Avenue	1	LOT 6 DP 83863	861839
Export Avenue	2	LOT 2 DP 304904	861835
Export Avenue	3	LOT 5 DP 83863	861838
Export Avenue	6	LOT 3 DP 83863	861836
Export Avenue	8	LOT 4 DP 83863	861837
Johns Road	480	Sec 62 SO 460822	620075
Johns Road	530	PT LOT 1 DP 51000	870081
Johns Road	544	PT LOT 1 DP 23615	857821
Johns Road	550	Sec 8 SO 494743, Sec 21 SO 494743	628638, 628647
Johns Road	568	LOT 2 DP 51000	832492
Johns Road	600	PT RS 40862	870083
Logistic Drive	10	LOT 10 DP 375764	891559
Logistic Drive	11	LOT 9 DP 375764	891558
Logistic Drive	12	LOT 1 DP 412022	900821
Logistic Drive	14	LOT 12 DP 375764, LOT 2	900822
Logistic Drive	15	LOT 8 DP 375764	891557
Logistic Drive	16	LOT 13 DP 375764	891562
Logistic Drive	17	LOT 7 DP 375764	891556
Logistic Drive	18	LOT 100 DP 412877	900774
Logistic Drive	19	LOT 6 DP 375764	891555
Logistic Drive	20	LOT 101 DP 412877	900775
Logistic Drive	21	LOT 5 DP 375764	891554
Logistic Drive	23	LOT 4 DP 375764	891553
Logistic Drive	24	LOT 102 DP 412877	900776
Logistic Drive	25	LOT 3 DP 375764	891552
Logistic Drive	26	LOT 103 DP 412877	900777
Logistic Drive	27	LOT 2 DP 375764	891551
Logistic Drive	28	LOT 104 DP 412877	900778
Logistic Drive	29	LOT 1 DP 375764	891550
Logistic Drive	31	LOT 17 DP 375764	891566
Logistic Drive	15L	LOT 19 DP 375764	891573
Logistic Drive	29L	LOT 20 DP 375764	891574
Lower Styx Road	361	Lot 1 DP 508689	629529
Mcleans Island Road	2	LOT 16 DP 375764	891565
Mcleans Island Road	12	LOT 15 DP 375764	891564
Mcleans Island Road	14	LOT 1 DP 304904	865337
Mcleans Island Road	16	LOT 2 DP 79639	754142
Nathan Place	1	PT LOT 2 DP 55072	870082
Nathan Place	7	LOT 3 DP 55072	864585
Nathan Place	11	LOT 1 DP 70619	864584

Radcliffe Road	301	Lot 4 DP 313448	584569
Sawyers Arms Road	527	LOT 1 DP 55072	836526
Sawyers Arms Road	530	PT LOT 1 DP 51000	870081
Sawyers Arms Road	533	LOT 1 DP 45800	858525
Sawyers Arms Road	540	LOT 1 DP 36870	817420
Sawyers Arms Road	565	LOT 2 DP 64781	771301
Sawyers Arms Road	575	LOT 1 DP 64781	771302
Spencerville Road	25	Lot 2 DP 53987	419068
Turners Road	50	Lot 3 DP 83312	568085
Wairakei Road	656	Lot 1 DP 6411	414964

Sites excluded from the Outer Christchurch SMP Area

Sites excluded from the Avon River SMP Area

Sites excluded from the Estuary and Coastal SMP Area

Francella Street	77	Lot 2 DP 313378	866732
Wickham Street	48	Lot 2 DP 82490	857062
Maces Road	42	Lot 1 DP 43149	833399, 833400, 833401, 833402

Sites excluded from the Banks Peninsula SMP Area

Appendix 5 - Industrial Site Audits 2019

_status	business_name	site_address	initial_audit_date	industry_category	waterways_impacted
Completed	PharmaZen Ltd	320 Port Hills Road, Hillsborough, Christchurch 8022	16/07/2019	Food and Beverage Manufacturers	Jardens Drain
Completed & Excluded	Hornby Auto Parts Limited	514 Cranford Street, Redwood, Christchurch 8051	17/04/2019	Automobile Salvage Yards	Dudley Creek
Completed	Southern Insulation	5 Atom Lane, Woolston, Christchurch 8023	15/05/2019	Building, Construction, Landscaping, and Earthworks Related Activities	Heathcote River
Completed & Excluded	A Class Coaches Ltd	4 Gerald Connolly Place, Sockburn, Christchurch 8042 PO Box 910, Christchurch 8140	5/07/2019	Motor Vehicle and Equipment Associated Facilities	Haytons Stream
Reviewed	Annex Metals	257 Annex Rd, Middleton, Christchurch 8024 259 Annex Rd, Middleton, Christchurch 8024	5/08/2019	Scrap and Waste Recycling Facilities	Curletts Stream
Completed (x2) & Excluded	Sims Pacific Metals Ltd	48 Wickham St, Bromley, Christchurch 8062	29/05/2019	Scrap and Waste Recycling Facilities	Charlesworth Drain
Reviewed	Taha Auto Limited	115A Main South Road, Sockburn, Christchurch 8042	30/10/2019	Automobile Salvage Yards	Curletts Stream
Completed	Gordon Milne Collision Repair	38 Hands Road, Middleton, Christchurch 8024	5/07/2019	Motor Vehicle and Equipment Associated Facilities	Hands Road Drain
Reviewed	Hornby Auto Parts Limited	141 Maces Rd, Bromley, Christchurch 8062 143 Maces Rd, Bromley, Christchurch 8062	4/10/2019	Automobile Salvage Yards	Linwood Canal
Completed (x2)	Tegel Foods Ltd - ECan Consented	112 Carmen Road, Hei Hei, Christchurch 8042	12/09/2019	Food and Beverage Manufacturers	Haytons Stream
Completed	Jasol New Zealand - Rutherford Street	105 Rutherford Street, Woolston, Christchurch 8023 107 Rutherford Street, Woolston, Christchurch 8023 109 Rutherford Street, Woolston, Christchurch 8023 111 Rutherford Street, Woolston, Christchurch 8023 117 Rutherford Street, Woolston, Christchurch 8023	10/04/2019	Chemical and Pharmaceutical Product Manufacturers	Heathcote River
Completed	Jasol New Zealand - Atom Lane	9 Atom Lane, Woolston, Christchurch 8023	10/04/2019	Chemical and Pharmaceutical Product Manufacturers	Heathcote River
Completed	Winstone Wallboards Limited - 215-217 & 219-235 Opawa Rd	215 Opawa Rd, Hillsborough, Christchurch 8022 217 Opawa Rd, Hillsborough, Christchurch 8022 219 Opawa Rd, Hillsborough, Christchurch 8022 227 Opawa Rd, Hillsborough, Christchurch 8022 229 Opawa Rd, Hillsborough, Christchurch 8022 231 Opawa Rd, Hillsborough, Christchurch 8022 233 Opawa Rd, Hillsborough, Christchurch 8022 235 Opawa Rd, Hillsborough, Christchurch 8022	2/05/2019	Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturers	Heathcote River