



Carrington Water Race Natural and artificial water race segments' assessment

10 October 2023

Report Prepared for

Greater Wellington Regional Council

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CARRINGTON WATER RACE NATURAL AND ARTIFICIAL WATER RACE SEGMENTS' ASSESSMENT

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EXECUTIVE SUMMARY

The Carrington Water Race is located in the Carterton District and sources water from the Mangatāre Stream. It was established more than a hundred years ago, to provide freshwater for livestock, domestic and irrigation use.

Currently, it is unclear what kind of watercourse water races are under the definitions in Greater Wellington Regional Council's (GWRC) natural resources plan (NRP). Watercourse definition has implications for which rules are applicable, including stock exclusion and watercourse clearance and maintenance (i.e., in the bed of a watercourse).

The purpose of this investigation was to classify the various sections¹ of the Carrington Water Race network against the Resource Management Act (RMA) and GWRC's NRP classifications for watercourses (i.e., whether an individual Carrington Race section is "water race that is or used to be a stream" or "artificial water race"). To assess whether a section of a water race is or was a stream or artificial watercourse we developed assessment criteria based on the definitions of "River" in the RMA and those set out in a GWRC guidance document. The assessment comprised a desktop component that drafted a classification of all sections of the water race, and a field verification component.

The combined findings of the desktop and field assessments with regard to the status of the water race sections (artificial or sections that are or used to be streams) are depicted in Figure A. Some key findings were:

- The water race sections from the intake until around Fensham Reserve do not intercept any natural sources of water. The westernmost section of the water race is a completely artificial channel dug on the side of the hill. Much of the run-off this section would intercept from gullies on the side of the hill is channelled through pipes towards the plain, bypassing the race. These water race sections are unlikely to have conveyed water in the absence of the water race intake. They should be considered artificial.
- On the western edge of Fensham Reserve, a natural stream creates a wetland, but inflow is insufficient to maintain outflow. Water is pumped from the race into a fire-fighting hole and then to the wetland, in order to maintain the wetland's outflow.
- The water race sections downstream from the Fensham Reserve are mostly artificial, but potentially conveying water from natural sources, such as the wetland's outflow and an ephemeral stream that is intercepted by the water race on the south-western border of the reserve.
- The only exceptions to the artificial water race category (i.e. segments that are or used to be streams) are the outflow channel of the wetland, a channel with natural form further downstream that is being used as part of the water race, and two sections of the water race that discharge into the Mangatāre Stream, at the eastern-most and the southern-most end of the water race.

¹ A section of the water race network is defined as a watercourse flowing between two network nodes (i.e., points where a watercourse splits or two or more watercourses merge).

Carrington Water Race

Artificial Water Race

Water Race that is or used to be a stream



Figure A: Classification of sections of the Carrington Water Race as water races that are or used to be streams (marked with blue), or artificial water races (marked with yellow), based on the desktop and field assessments that took place in 2023.

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1 Introduction

1.1 Context

A water race is a constructed (i.e., artificial) water channel designed to convey water from a natural stream/river to be used for farming purposes. Multiple connected water races (i.e., a water race with multiple branches) conveying water from a natural source is referred to as a water race network. The primary function of the Wairarapa water race networks is to provide water for domestic needs and livestock, although they do also currently permit a few specified takes for other uses (e.g., irrigation, frost protection and other industrial purposes). The overall allocation of water from a water race network is managed through a consenting process; in particular, this is needed for any “other uses” of water race water. Water race networks can also provide an important stormwater management service, helping to manage the flood risk to low lying areas. Moreover, they can support thriving and valuable instream biological communities. Across the Wellington Region water races have been found to support native populations of longfin eels, giant kokopu and brown mudfish, which are all nationally threatened.

The Carterton District Council (CDC) provides and manages two water race networks, the Carrington Water Race network north of Carterton and the Taratahi Water Race network between Masterton and Carterton. The Carrington Race was established more than a hundred years ago and provides drinking water for livestock, domestic and irrigation use. It takes up to 250 litres of water a second from the upper reaches of the Mangatāre Stream, depending on the latter’s flow levels, and has a total length (i.e., all segments combined) of 36 km (Carterton District Council, 2022).

Over the last decade water race networks have come under increased scrutiny regarding whether they contain sections of ‘rivers’ that are not actually ‘artificial’ watercourses under section 13 of the Resource Management Act (RMA). Watercourse delineation is important as it has implications for how the water contained in the race can be used (i.e., allocation and minimum flow) and the activities that can occur in the water race (i.e., activities in the bed of a stream) under the provisions of the RMA. While water races have generally been considered ‘artificial’ water courses, sections of water races may join and/or follow natural stream channels, while others may receive inputs from natural streams. In these two cases, the water race may be considered a ‘River’ under the RMA. Delineating water race networks that contain sections of ‘Rivers’ can be a difficult undertaking, especially in water races that have existed for a long period of time such as the Carrington Race.

1.2 Aim & Scope

The purpose of this investigation was to classify the various sections² of the Carrington Water Race network against the RMA and Greater Wellington Regional Council’s (GWRC) Natural Resources Plan (NRP) classifications for watercourses as water races that are or used to be streams, and as artificial water races. No such classification exercise has been previously undertaken for the Carrington water race.

Mapping of the Carrington Water Race took place in February 2023 (desktop assessment) and April 2023 (field assessment), to distinguish “artificial” sections of the water race from “River” sections, i.e. sections that are or used to be streams. The purpose of the field assessment was to ground-truth the results of the initial desktop assessment.

² A section of the water race network is defined as a watercourse flowing between two network nodes (i.e., points where a watercourse splits or two or more watercourses merge).

2 Watercourse determination

In 2020 GWRC had guidance developed by Aquanet Consulting Ltd for determining whether a watercourse is a river, a highly modified river or stream, an ephemeral watercourse or an artificial watercourse, as each of these classifications are subject to different rules under the NRP (Greer, 2021).

The following definitions from the RMA and GWRC's NRP need to be considered when classifying watercourses:

RMA

- **river** means a permanently or intermittently flowing body of fresh water, which is subject to RMA section 13, and includes streams and modified watercourses, but does not include artificial watercourses (e.g., irrigation canals, water supply races, canals for the supply of water for electricity power generation, and farm drainage canals).

Natural Resources Plan

- **highly modified river or stream** means a river or stream that has been modified and channelled for the purpose of land drainage of surface or sub-surface water and has the following characteristics:
 - It has been channelled into a single flow.
 - The channel has been straightened.
 - The channel is mechanically formed with straight or steeply angled banks.And
 - It exhibits these characteristics for at least its entire length through the property in which the activity is being carried out.
 - It is not managed as part of a stormwater network and is not a water race.
- **ephemeral flow path** means a river that:
 - has a bed that is predominantly vegetated.
 - only conveys or temporarily retains water during or immediately following heavy rainfall events.
 - does not convey or retain water at other times.

The classification process, then, needs to consider whether:

- the watercourse is a flowing body of freshwater under the RMA.
- the watercourse has a "natural" or "constructed/modified" form.
- flow permanence in the watercourse is ephemeral or permanent/intermittent.
- the watercourse has a natural or artificial source of flow, i.e., whether the watercourse
 - has a natural form (which is a reliable indicator of natural source of flow).
 - has a modified form in the place of a pre-existing water body (e.g., river, lake, wetland).
 - receives its water via a constructed system and would otherwise not be a watercourse.

These definitions and this process set the criteria that we addressed in order to classify the sections of the Carrington Water Race as 'water races that are or used to be streams' or "artificial water races'.

3 Water Race assessment criteria

To classify a section of the Carrington Water Race as a 'water race that is or used to be a stream' or 'artificial water race' under the RMA and NRP we undertook an initial desktop assessment and subsequent field investigation.

The desktop component assessed whether the watercourse:

- has a natural source of flow; this was done through the use of aerial photographs to determine whether:
 - o the watercourse intercepts or merges with natural freshwater bodies, or
 - o the watercourse intercepts known groundwater sources, such as springs (determined through discussion with GWRC).
- has a natural or constructed/modified form, i.e.:
 - o whether the watercourse has been channelled into a single flow.
 - o whether the watercourse has been straightened, lacking any meandering/sinuuous natural form that would be expected in a stream or river.

The field component assessed whether the watercourse:

- is a flowing body of freshwater under the RMA.
- has a natural source of flow, e.g.:
 - o whether the watercourse intercepts or merges with natural watercourses, or
 - o whether the watercourse intercepts other freshwater bodies, e.g., lakes, wetlands, or groundwater sources, such as springs.
- has a natural or constructed/modified form, i.e.:
 - o whether the watercourse has been channelled into a single flow.
 - o whether the watercourse has been straightened, lacking any meandering/sinuuous natural form that would be expected in a stream or river.
 - o whether the channel is mechanically formed with straight or steeply angled banks.
- has permanent/intermittent or ephemeral flow, as indicated by:
 - o the level of vegetation covering its bed,
 - o the retention/conveyance of water at the time of assessment.

The two assessments lead to the classification of the water race sections as:

- water races that are or used to be streams, or
- artificial water races, which were further distinguished into
 - o artificial water races potentially conveying water from a natural stream, or
 - o artificial water races with no natural inputs.

4 Water Race assessment

4.1 Desktop assessment

The desktop assessment was undertaken on the 8 February 2023 by Traverse Environmental (formerly Aquanet Consulting) and GWRC staff. The classification of the various sections of the Carrington Water Race is presented in Figure 1. Water race sections that required further assessment to identify the type of watercourse were also identified.

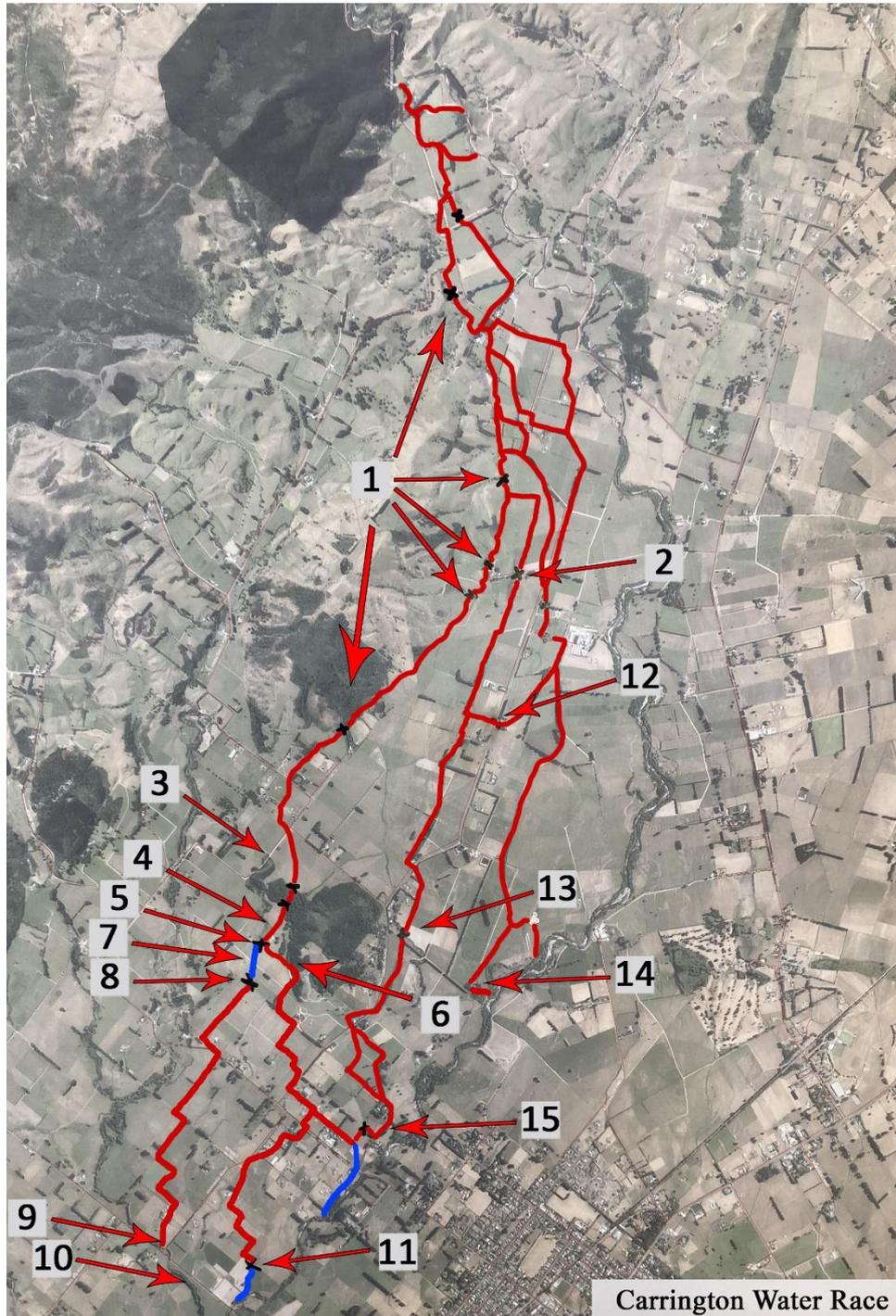


Figure 1: Classification of sections of the Carrington Water Race as water races that are or used to be streams (marked with blue) or artificial water races (marked with red) through the desktop assessment. Sites that required field assessment are numbered and marked with a black cross.

4.2 Field assessment

The field assessment survey was undertaken on 28 March 2023, by Traverse Environmental, GWRC, and CDC staff. Table 1 lists the sites that were selected during the desktop assessment to be verified on-site.

Table 1: Sites along the Carrington Water Race that were assessed on the ground.

Site #	Description	Latitude (NZTM)	Longitude (NZTM)
1	Run-off gully crossing (multiple)	5461959.407	1812171.076
2	Ford crossing	5461235.319	1812277.203
3	Unnamed tributary of Enaki Stream (Fensham Stream)	5459181.808	1810379.167
4	Water race split #1	5458652.824	1810452.877
5	Water race split #2	5458506.591	1810342.752
6	Natural stream confluence	5458334.221	1810509.221
7	Wetland discharge confluence	5458506.683	1810307.21
8	Water race split #3	5458194.069	1810229.975
9	Water race discharge to Enaki Stream #1	5456286.679	1809557.72
10	Water race discharge to Enaki Stream #2	5456060.117	1809763.278
11	Water race discharge to Mangatāre Stream #1	5455889.636	1810122.842
12	Piped water race section #1	5460125.106	1811955.555
13	Piped water race section #2	5458919.813	1811623.298
14	Water race discharge to Mangatāre Stream #2	5458602.941	1812185.945
15	Belvedere Road crossing	5456843.807	1810989.959

4.2.1 Site 1 – Run-off gully crossing (multiple)

The western-most and longest uninterrupted channel of the water race, from the intake from the Mangatāre Stream until upstream of Fensham Reserve, comprises a completely artificial channel, dug on the side of the Tararua foothills, a few metres higher than the actual bottom of the hills. Along this watercourse’s length, there are multiple points where it crosses with gullies that channel surface run-off from the foothills of the Tararua range towards Carter’s Stream. These watercourses are piped at the points where they cross the water race, and thus do not come in contact with the water race itself, except for during heavy rainfall, when they might overflow into the water race channel. Consequently, the entire western-most section of the water race until Fensham Reserve should be considered an **artificial water race**.

4.2.2 Site 2 – Ford crossing

The western section of the water race described in Section 4.2.1 supplies water to the eastern parts of the water race at three points. On the section conveying water from the third point, the water race crosses a driving track via a ford (Figure 2). It flows in a straight, narrow, shallow, hard-bottomed channel, vegetated mainly with grasses, and a line of trees on its True Right Bank (TRB). Because of the form of the channel and the absence of any apparent sources of natural flow upstream from this section, the section from the split of the western watercourse of the water race until Site 11 (Section 4.2.9) should be considered an **artificial water race**.

4.2.3 Site 3 – Unnamed tributary of Enaki Stream (Fensham Stream)

This site does not belong to the water race network but facilitates understanding of the water race’s function and assessment of nearby water race sections.

The unnamed tributary of Enaki Stream that flows through the edge of Fensham Reserve (to facilitate reporting, the stream will hereafter be called Fensham Stream), upstream from the reserve flows in its natural channel through a paddock and discharges into a wetland at the edge of the reserve (Figure 3). Evidently, the wetland is a **natural waterbody**. However, the stream's normal flow is insufficient to allow outflow from the wetland into a downstream channel (communication with CDC). Therefore, water from the water race is supplied to the wetland at two points, to support the continuous flow of freshwater through the wetland (see Section 4.2.4).

4.2.4 Site 4 – Water race split #1

The water race flows through the north-eastern edge of Fensham Reserve. Shortly after exiting the reserve, the water race is practically split into two watercourses:

- The True Left Watercourse (TLW) is the continuation of the main channel of the watercourse, which flows in a straight, steep-banked channel (Figure 4). As there are no natural inputs of freshwater into this section of the water race, it should be considered an **artificial water race**.
The end of this section comes when it splits again into two channels (see Section 4.2.5).
- The True Right Watercourse (TRW) comprises water that is pumped from the main channel of the water race into a fire-fighting hole (**artificial water race**) (Figure 4). The overflow from the hole is discharged into the wetland described in Section 4.2.3, facilitating the continuous flow of water through and out of the wetland (**natural watercourse supported by the water race**).

4.2.5 Site 5 – Water race split #2

Downstream from the first water race split (section 4.2.4), on its TLW, the water race splits again:

- The TLW flows away from the wetland, to the east, in a similarly structured channel, with no inputs from a natural source. Consequently, it should be considered an **artificial water race**.
- The TRW flows through a short, piped section and merges with the wetland outflow. It should be considered an **artificial water race**.

4.2.6 Site 6 – Natural stream confluence

This site was not detected during the desktop exercise and was consequently not marked for a visit during the field investigation. Classification is based on communication with CDC.

The TLW from the second split of the water race (section 4.2.5) merges with an ephemeral stream that starts within Fensham Reserve, and then flows through a series of short, straight sections. There does not appear to be a natural channel that was straightened in order to be used by the water race, but rather the sections downstream from the confluence appear to be artificial. Because of the short distance from the start of the stream (up to approximately 500 m), it could be assumed that, in the absence of the water race, the water of the natural stream would dissipate in the ground or follow another flow path around the reserve. Consequently, the section downstream from the confluence should be considered an **artificial water race, potentially conveying water from a natural stream**.

4.2.7 Site 7 – Wetland discharge confluence

After the TRW from the split at Site 5 (section 4.2.5) merges with the wetland outflow, it then flows through a short, very weakly meandering channel. The general form of this channel resembles more a natural channel than an artificial one and is likely, in times with more water flowing into the wetland by the Fensham Stream, to have been the natural outflow channel of the wetland. As such, this section should be considered a **water race that is or used to be a stream**.



Figure 2: Site 2, ford crossing upstream (left) and downstream (right), March 2023.



Figure 3: Site 3 – Unnamed tributary of Enaki Stream flowing into Fensham Reserve and discharging into the wetland: a) upstream from the road, outside the reserve, and b) downstream from the road in the reserve, with the wetland in the background, March 2023.



Figure 4: Site 4 – Water race split #1, upstream from the split and the split towards the piped True Right Watercourse (left), downstream from the split on the True Left Watercourse (middle), and the fire-fighting hole supplied with water from the split as the True Right Watercourse (right), March 2023.

4.2.8 Site 8 – Water race split #3, Site 9 – Water race discharge to Enaki Stream #1 and Site 10 – Water race discharge to Enaki Stream #2

The water race splits into two watercourses approximately 300 m downstream from the merge of the water race and the wetland outflow:

- The TRW comprises a series of straight, artificial channels, which eventually lead to the discharge into the Enaki Stream (Site 9 – Figure 5). As they convey water from the wetland outflow, they should be considered **artificial water races, potentially conveying water from a natural stream**.
- The TLW starts similarly to the TRW, with its first section flowing through a straight, artificial channel, and should be considered an **artificial water race, potentially conveying water from a natural stream**. However, the form of the channel then changes radically, becoming strongly sinuous while continuing to flow through a flat area, until it also discharges into Enaki Stream after crossing Brooklyn Road (Site 10 – Figure 5). There is no incoming stream, or intercepted spring. Consequently, this channel should be considered a **water race that is or used to be a stream**.

4.2.9 Site 11 – Water race discharge to Mangatāre Stream #1

This site was marked during the desktop exercise, but could not be accessed during the field assessment.

After the merge with the ephemeral stream at section 4.2.6, the race conveys water through an artificial section, which comprises multiple short and straight segments. Just before discharging into the Mangatāre Stream, the channel takes a much more natural form. According to aerial photographs, the water race merges at that point into a natural channel. That channel is not registered as a stream in NIWA's NZRiverMaps database, so it was assumed to be an ephemeral stream. Consequently, the water race section from the merge of the water race with the channel of the ephemeral stream, should be considered as **water race that is or used to be a stream**.

4.2.10 Site 12 – Piped water race section #1 and Site 13 – Piped water race section #2

These areas were marked during the desktop assessment, as there are signs of multiple potential channels on the ground at Site 12 and no channels at all at Site 13, as seen in aerial photos. As advised by CDC, the water race at these sections is piped, so they should be considered **artificial water races**.

4.2.11 Site 14 – Water race discharge to Mangatāre Stream #2

This site was not marked during the desktop assessment, and thus was not visited during the field assessment. Its classification relies on communication with CDC.

The eastern-most section of the water race splits at this point into two watercourses:

- The TRW flows through an underground pipe (**artificial water race**) and discharges into the wetland when needed. The outflow from the wetland leads to an artificial channel that discharges water into Mangatāre Stream. However, a natural stream also discharges into the wetland. Consequently, the section downstream of the outflow of the wetland into the artificial channel should be considered an **artificial water race, potentially conveying water from a natural stream**.
- The TLW flows through an artificial channel (**artificial water race**), which merges with what appears to be an ephemeral stream, and then flows through the stream's channel and discharges into Mangatāre Stream. Consequently, the section downstream of the confluence of the water race and the ephemeral stream should be considered a **water race that is or used to be a stream**.

4.2.12 Site 15 – Belvedere Road crossing

The water race at this point follows a channel parallel to that of Mangatāre Stream. Upstream from Belvedere Road the channel appears to have been artificially opened (Figure 6). It is an ephemeral watercourse, heavily vegetated with emerged and submerged macrophytes, holds small amounts of water during dry weather, and has little to no flow. It crosses the road via a culvert. Downstream from the culvert it forms a pool, also with little to no flow, with lots of submerged macrophytes and algae (Figure 6). Both upstream and downstream of the road, the water race channels are straight and with no signs of natural form. The water conveyed through that section could potentially be partly traced back to the merge of the water race and the ephemeral stream at Site 6 (Section 4.2.6), and consequently should be considered an **artificial water race, potentially conveying water from a natural stream**.



Figure 5: Site 9 – Water race discharge to Enaki Stream #1 (left) and Site 10 – Water race discharge to Enaki Stream #2, upstream from Brooklyn Road (right), March 2023.



Figure 6: Site 15 – Belvedere Road crossing, upstream (left) and downstream (right), March 2023.

5 Key conclusions

The combined findings of the desktop and field assessments with regard to the status of the Carrington water race sections as artificial or water races that are or used to be streams, are depicted in Table 2 and Figure 7 and Figure 8. Key findings were:

- The water race sections from the intake until around Fensham Reserve do not intercept any natural sources of water. The westernmost section of the water race is a completely artificial channel dug on the side of the hill. Much of the run-off this section would intercept from gullies on the side of the hill is channelled through pipes towards the plain, bypassing the race. These water race sections are unlikely to have conveyed water in the absence of the water race intake. They should be considered artificial.
- On the western edge of Fensham Reserve, a natural stream creates a wetland, but with not enough inflow to maintain an outflow from the wetland. Water is pumped from the race into a fire-fighting hole and then to the wetland, in order to maintain the wetland's outflow.
- The water race sections downstream from the Fensham Reserve are mostly artificial, potentially conveying water from natural sources, such as the wetland's outflow and an ephemeral stream that is intercepted by the water race on the south-western border of the reserve.
- The only exceptions to the artificial water race category (i.e., sections that are or used to be streams) are the outflow channel of the wetland, a channel with natural form further downstream that is being used as part of the water race, and two sections of the water race that discharge into the Mangatāre Stream, at the eastern-most and the southern-most end of the water race.

Table 2: Classification of sections of interest along the Carrington Water Race, as assessed on the ground, March 2023.

Site #	Description	Assessment	
1	Run-off gully crossing (multiple)	Artificial water race	
2	Ford crossing	Artificial water race	
3	Unnamed tributary of Enaki Stream (Fensham Stream)	N/A	
4	Water race split #1 a. True right watercourse b. True left watercourse	Artificial water race Artificial water race	
5	Water race split #2 a. True right watercourse b. True left watercourse	Artificial water race Artificial water race	
6	Natural stream confluence	Artificial water race	potentially conveying water from a natural stream
7	Wetland discharge confluence	Water race that is or used to be a stream	
8	Water race split #3 a. True right watercourse b. True left watercourse	Artificial water race • Artificial water race (first two reaches of the section) • Water race that is or used to be a stream	potentially conveying water from a natural stream potentially conveying water from a natural stream
9	Water race discharge to Enaki Stream #1	Artificial water race	potentially conveying water from a natural stream
10	Water race discharge to Enaki Stream #2	Water race that is or used to be a stream	
11	Water race discharge to Mangatāre Stream #1	Water race that is or used to be a stream	
12	Piped water race section #1	Artificial water race	

Site #	Description	Assessment	
13	Piped water race section #2	Artificial water race	
14	Water race discharge to Mangatāre Stream #2 a. True right watercourse b. True left watercourse	<ul style="list-style-type: none"> • Artificial water race (upstream of the wetland) • Artificial water race • Artificial water race (upstream of the confluence with the ephemeral stream) • Water race that is or used to be a stream 	potentially conveying water from a natural stream
15	Belvedere Road crossing	Artificial water race	potentially conveying water from a natural stream

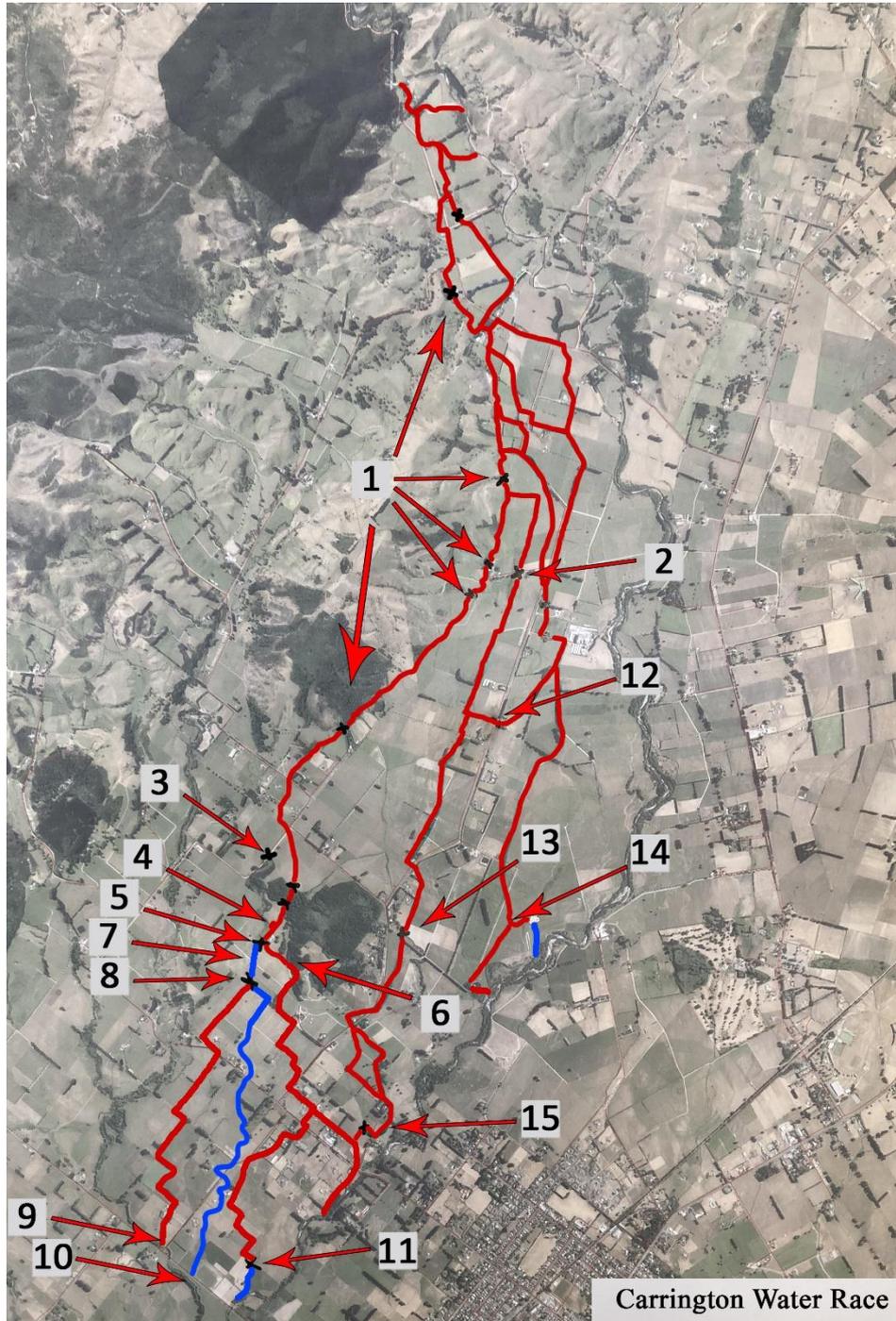


Figure 7: Classification of sections of the Carrington Water Race as water races that are or used to be streams (marked with blue) and artificial water races (marked with red), based on the desktop and field assessments that took place in 2023. Sites that required ground assessment are numbered and marked with a black cross.

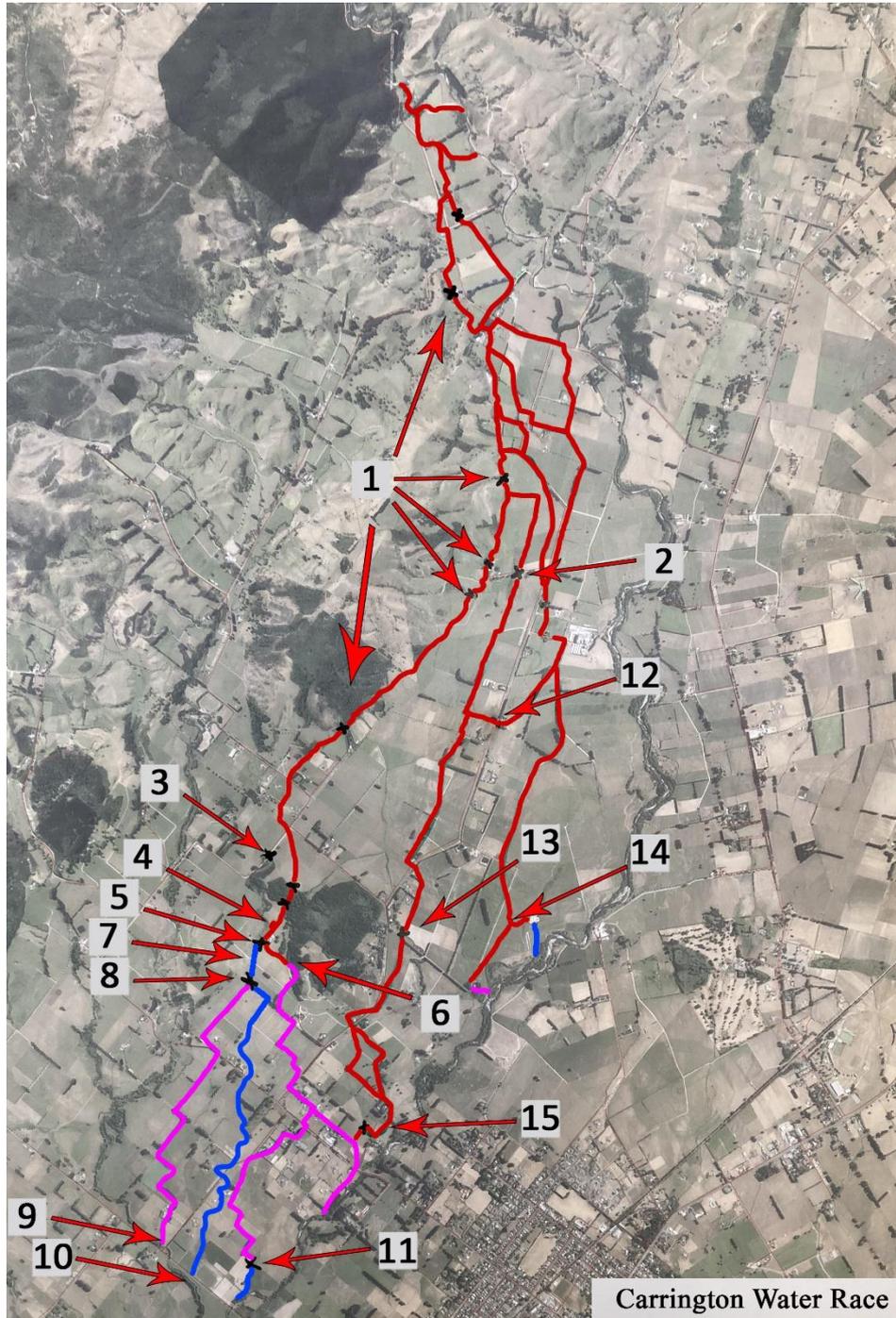


Figure 8: Classification of sections of the Carrington Water Race as water races that are or used to be streams (marked with blue), artificial water races with no inputs from natural streams (marked with red), and artificial water races, potentially conveying water from natural streams (marked with purple), based on the desktop and field assessments that took place in 2023. Sites that required ground assessment are numbered and marked with a black cross.

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