NSW Public Works

Ground Water Investigation

Hay Water Supply System

Summary report

Report Number: P-FY20242939-PWO-WTA-RP-001-01

March 2025

Prepared for:

Template Rev 1 July 2024

Report Number: P- FY20242939-PWO-WTA-RP-001-01

Document Control

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Cover photo: Hay WTP

Source: Hay Shire Council.

Executive Summary

Two areas within the Lower Murrumbidgee Deep Aquifer, situated near Hay WTP, have been identified as potential groundwater sources for the Hay water supply system. This report summarises the findings of studies conducted by Hay Shire Council (HSC) to evaluate the suitability and feasibility of the groundwater source as an alternative water supply during emergencies or droughts.

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1. Introduction

Hay Shire Council operates the Hay town water scheme, providing Raw and Filtered water to the town.

The town water scheme draws its raw water from the Murrumbidgee River, with the Hay Water Treatment Plant (WTP) treating the river water before distributing it to the town. However, the water supply scheme is vulnerable to contamination—such as blue-green algae in the Murrumbidgee River—and supply disruptions during droughts, as it lacks an alternative backup source.

Two areas within the Lower Murrumbidgee Deep Aquifer, located within 3 km of the WTP, have been identified as potential groundwater source. To explore the feasibility of using groundwater as an emergency or drought supply, Hay Shire Council (HSC) initiated a study to assess its suitability. As part of this effort, a hydrogeologist was engaged to conduct a groundwater investigation.

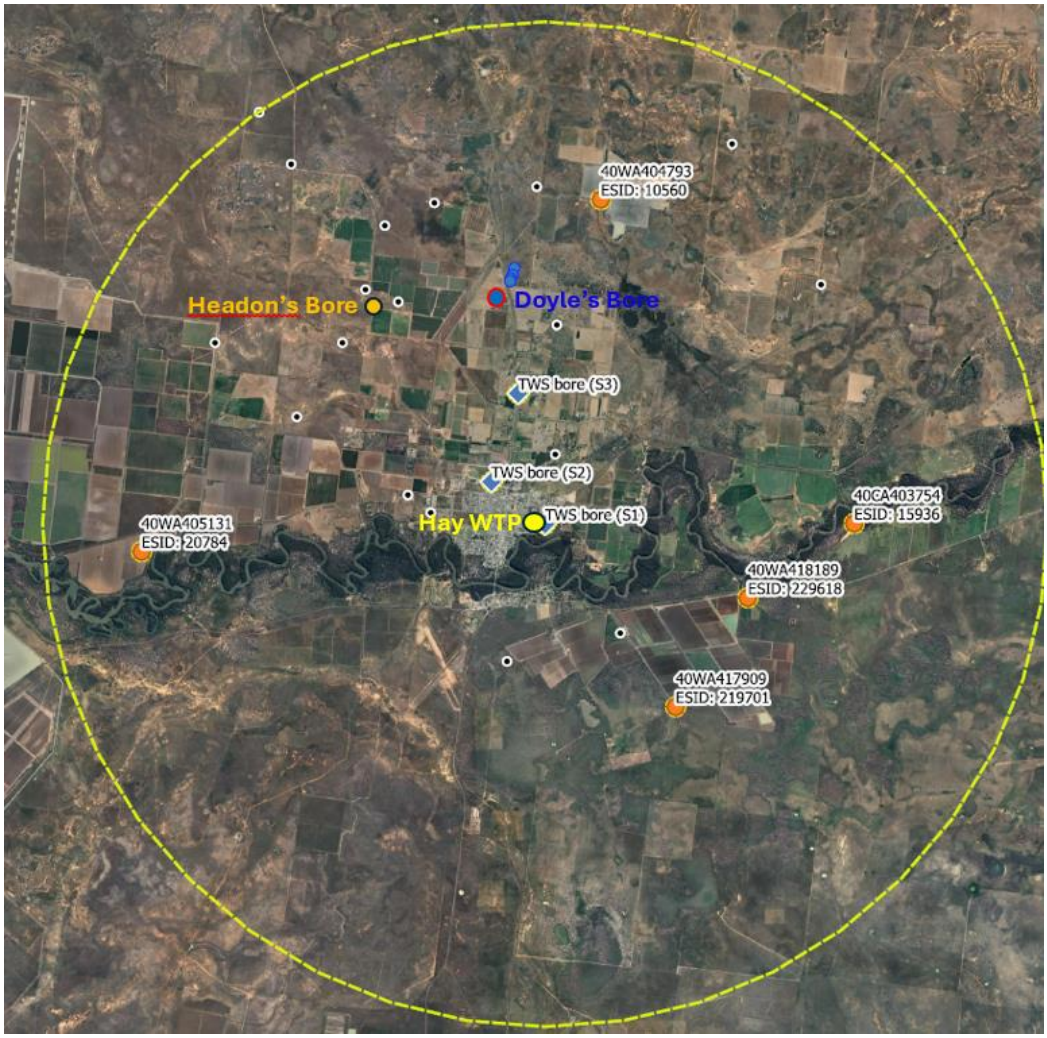
Since water quality data from existing bores near the identified groundwater source were considered representative, samples were collected and tested. Additionally, an assessment was carried out to determine whether Hay WTP could effectively treat water from the new groundwater source, should treatment be necessary.

2. Hydrogeological Study

A hydrogeological study for the identified potential groundwater source was completed in October 2024, and a separate report was prepared (High-Level Groundwater Assessment report by WSP Australia Pty Ltd).

3. Bore water testing area map

Two existing bores: Doyle's Bore and Headon's Bore located in the area were selected to sample the water for testing. The locations of these two bores are shown below.


40WA404793
ESID: 10560
Headon's Bore
Doyle's Bore
TWS bore (S3)
TWS bore (S2)
Hay WTP
TWS bore (S1)
40CA403754
ESID: 15936
40WA405131
ESID: 20784
40WA418189
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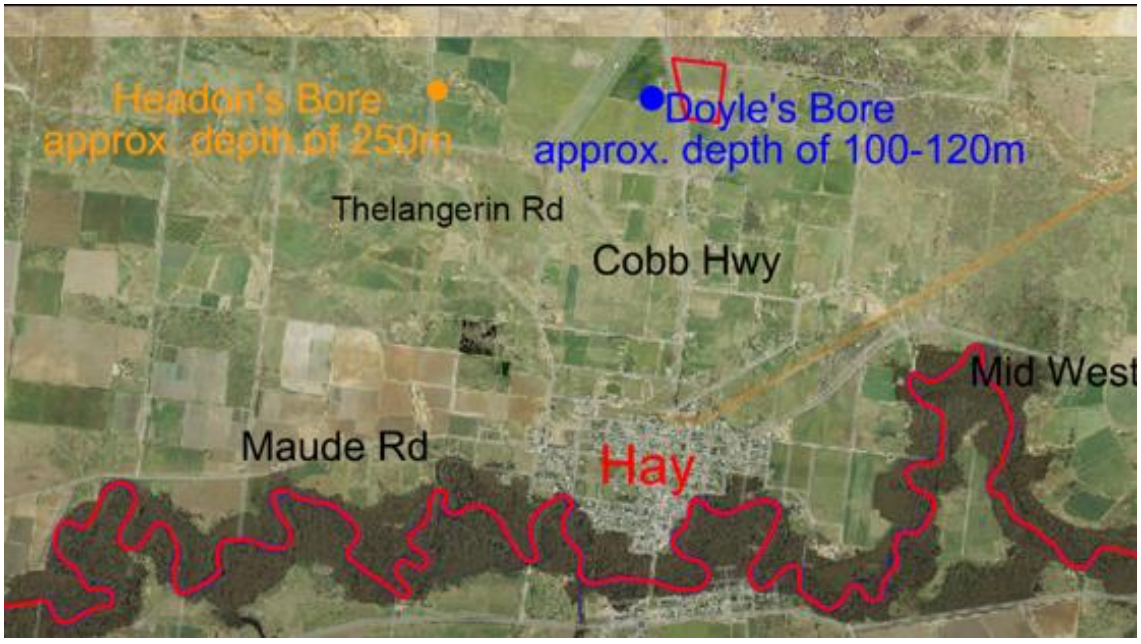
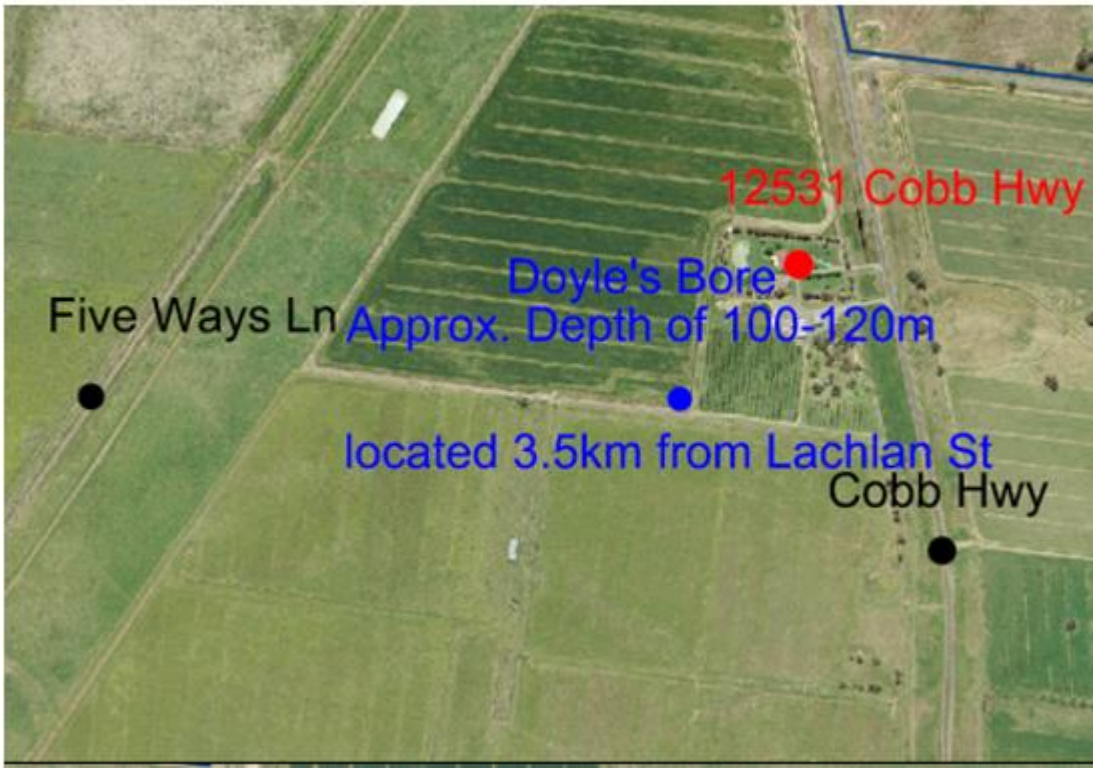
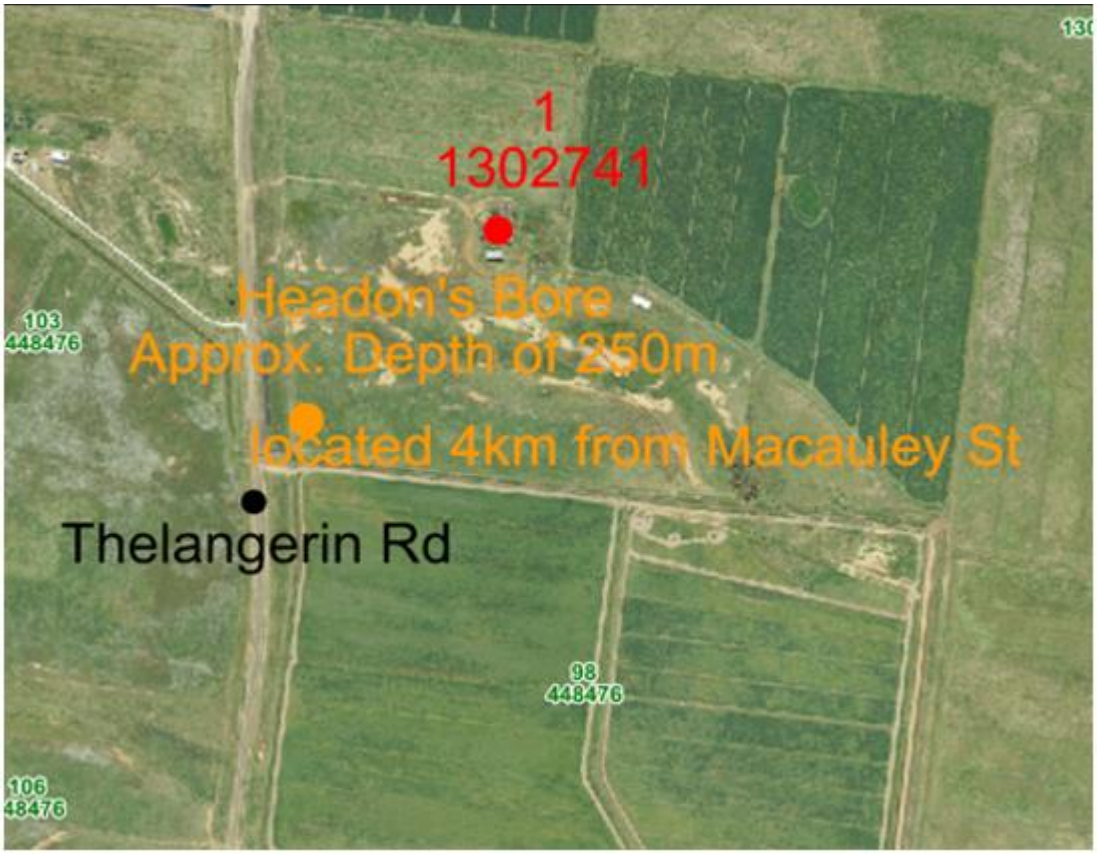
ESID: 219701


Headon's Bore
approx. depth of 250m
Doyle's Bore
approx. depth of 100-120m
Thelangerin Rd
Cobb Hwy
Mid West
Maude Rd
Hay


12531 Cobb Hwy
Doyle's Bore
Approx. Depth of 100-120m
Five Ways Ln
located 3.5km from Lachlan St
Cobb Hwy


1
1302741
Headon's Bore
Approx. Depth of 250m
103
448476
located 4km from Macauley St
Thelangerin Rd
98
448476
106
48476

4. Water quality test results

The results of the water samples tested from the Doyle's Bore and Headon's Bore are provided below.

Table 1: Chemical and Physical parameters

	Doyle Bore Test Date: Analysis Commenced: 31/10/2024		
	Test Results	ADWG Aesthetic Level (mg/L unless otherwise specified)	ADWG Health Level (mg/L unless otherwise specified)
Alkalinity (as CaCO3)	223		
Aluminium	<0.01	0.2	c
Ammonia	0.32	0.5	C
Antimony	<0.0001		0.003
Apparent Colour	57		
Arsenic	0.003		0.01
Barium	0.1178		2
Boron	0.1042		4
Bromide	2.5		
Cadmium	<0.0001		0.002
Calcium	30.7		
Calcium Hardness as CaCo3	77.0		
Chloride	664	250	c
Chromium	<0.001		0.05 (as Cr(VI))
Copper	<0.001	1	2
Dissolved Iron	0.06		
Dissolved Manganese	0.1152		

Dissolve Organic Carbon	0.0		
Dissolved Reactive Phosphorous	<0.02		
Electrical Conductivity	3080		
Fluoride	0.37		1.5
Iodine	0.37		c
Iron	0.77	0.3	c
Lead	<0.0002		0.01
Magnesium	50.98		
Manganese	0.1208	0.1	0.5
Mercury	<0.0008		0.001
Molybdenum	0.0002		0.05
Nickel	0.0004		0.02
Nitrate	<1		50
Nitrite	<0.1		3
pH	7.5	pH 6.5-8.5	c
Phosphate	0.2		
Potassium	7.70		
Selenium	<0.007		0.01
Silica as SiO2	40.39	80 (as all silica)	
Silver	<0.0002		0.1
Sodium	458	180	“Not necessary”
Strontium	0.57		
Sulfate	180	250	c
TDS	1540	600	“Not necessary”
TOC	<0.01		

Total Hardness as CaCO3	286.8	“Not necessary”	200
Total Phosphorous	<50		
True Colour	5HU	15HU	
Turbidity	5.0NTU	5 NTU	c
Uranium	<0.0001		0.02
Zinc	0.02	3	c

c = “Insufficient data set a guideline value based on health consideration”

	Headon Bore Test Date: Analysis Commenced: 31/10/2024		
	Test Results	ADWG Aesthetic Level (mg/L unless otherwise specified)	ADWG Health Level (mg/L unless otherwise specified)
Alkalinity (as CaCO3)	199		
Aluminium	<0.01	0.2	c
Ammonia	1.08	0.5	C
Antimony	<0.0001		0.003
Apparent Colour	236		
Arsenic	0.00		0.01
Barium	0.2298		2
Boron	0.0476		4
Bromide	1.2		
Cadmium	<0.0001		0.002
Calcium	30.8		
Calcium Hardness as CaCo3	26.3		
Chloride	279	250	c
Chromium	<0.001		0.05 (as Cr(VI))

Copper	<0.001	1	2
Dissolved Iron	1.26		
Dissolved Manganese	0.0455		
Dissolve Organic Carbon	0.0		
Dissolved Reactive Phosphorous	<0.2		
Electrical Conductivity	1294		
Fluoride	0.30		1.5
Iodine	0.19		c
Iron	3.23	0.3	c
Lead	<0.0002		0.01
Magnesium	12.64		
Manganese	0.0472	0.1	0.5
Mercury	<0.0008		0.001
Molybdenum	<0.0001		0.05
Nickel	<0.0004		0.02
Nitrate	<1		50
Nitrite	<0.1		3
pH	7.3	pH 6.5-8.5	c
Phosphate	0.2		
Potassium	15.83		
Selenium	<0.007		0.01
Silica as SiO2	14.60	80 (as all silica)	
Silver	<0.0002		0.1
Sodium	183	180	“Not necessary”
Strontium	0.28		

Sulfate	<0.2	250	c
TDS	647	600	“Not necessary”
TOC	<0.1		
Total Hardness as CaCO3	78.3	“Not necessary”	200
Total Phosphorous	<0.5		
True Colour	5HU	15HU	
Turbidity	24.3NTU	5 NTU	c
Uranium	<0.0001		0.02
Zinc	0.01	3	c

c = “Insufficient data set a guideline value based on health consideration”

4.1 Microbiological Test Results

Table 2: Microbiology results

Doyle Bore Test Date: tested on 31/10/2024 but re-booked on 05/11/2024 due to "Sample Type" wrongly used				
Test	Method Code	Sample ID		ADWG Health Level
		2024012479	20224012480	
Total Coliforms (MPN/100mL)	MW18	<1	<1	
E.coli (MPN/100mL)	MW18	<1	<1	0
Heterotrophic Colony Count 22C℃ (CFU/ml)	MW10a	<10	<10	
Headon Bore Test Date: tested on 31/10/2024 but re-booked on 05/11/2024 due to "Sample Type" wrongly used				
Test	Method Code	Sample ID		ADWG Health Level
		2024012481	20224012482	
Total Coliforms (MPN/100mL)	MW18	83	100	

E.coli (MPN/100mL)	MW18	<1	<1	0
Heterotrophic Colony Count 22C℃ (CFU/ml)	MW10a	93	78	

5. Hay Water Treatment Plant

The 2.2 ML/d (28 L/s) Hay WTP was commissioned in 1988 and has been in operation for approximately 37 years without a major upgrade.

The Murrumbidgee River is the raw water source. The treatment process follows a conventional approach, including coagulation, flocculation, sedimentation, and media filtration.

The main components of the WTP consist of the following:

- a concrete ”Pulsator” type clarifier
- two concrete gravity sand filter cells
- concrete clear water tank underneath the building
- brick control building
- chemical dosing facilities
- machinery room for backwash pumps, compressor etc.
- two clear water pumps
- electrical switchboard
- sludge disposal facilities including two sludge lagoons
- a point-to-point contact type telemetry system.

The upflow pulse sludge blanket clarifier has been designed to operate at 1.5m3/hr/m2 loading rate.

Two open gravity sand filters are designed to operate at 5 m3/ hr/ m2 loading rate.

Alum is used as a coagulant, with powdered activated carbon dosing to address algal toxins, taste, and odour issues. Soda ash is added for pH correction, and gas chlorination is used for disinfection. Fluoridation is also carried out for dental health.

5.1 Review of WTP's suitability to treat bore water

Tables 1 and 2 present the water quality test results for Doyle's and Headon's Bores, with parameters exceeding ADWG highlighted. A brief discussion on these results, along with the suitability of the Hay WTP to treat this water, is provided below.

Doyle's Bore

The main concern is the very high sodium level, recorded at 458 mg/L, which exceeds the ADWG limit of 180 mg/L.

Total dissolved solids (TDS) are 1,540 mg/L, significantly higher than the ADWG limit of 600 mg/L.

Slightly elevated levels of iron, manganese, and chloride were also reported.

Headon's Bore

A **very high iron level** was recorded.

Sodium and total dissolved solids **slightly exceed** ADWG limits.

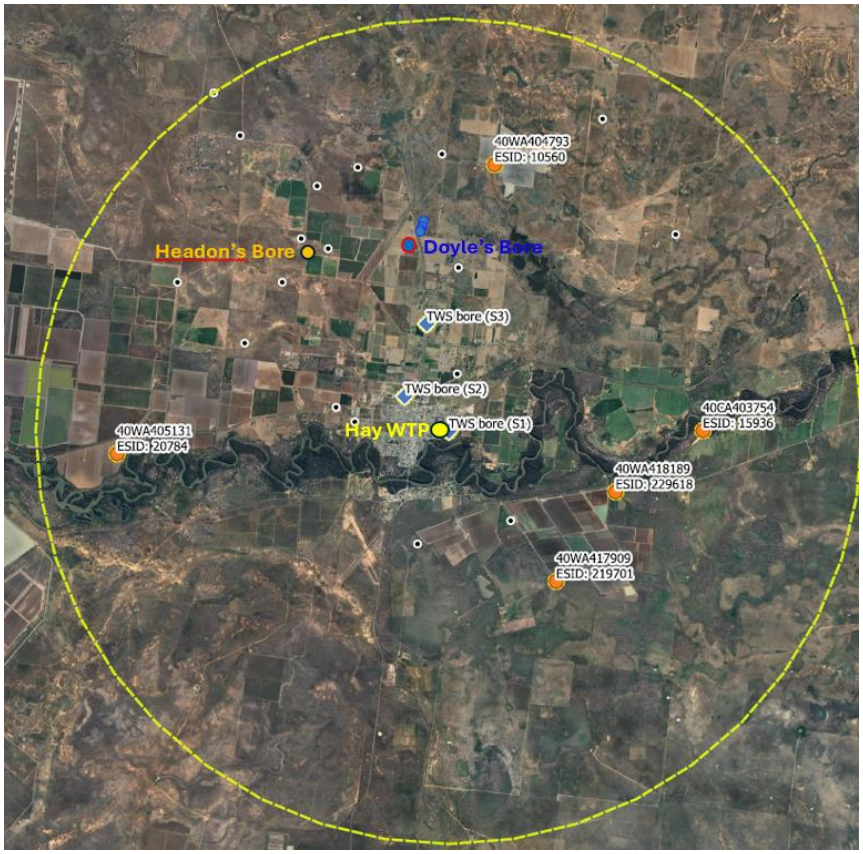
Based on the test results, the water from Doyle's and Headon's bores is not considered to be of good quality, primarily due to excessive levels of sodium, dissolved solids, and iron. The Hay WTP is not equipped to manage these water quality exceedances. Upgrading the WTP and implementing new treatment processes—particularly to reduce high sodium levels—could be complex and costly.

6. Drilling new bores

The existing bores, including Doyle's Bore (100–120 m deep) and Headon's Bore (approximately 250 m deep), which were used for testing, are considered relatively shallow. According to the hydrogeologist's report, the bores need to be drilled deeper to reach the next aquifer, which may yield better-quality water. Details on test bore drilling are provided in the hydrogeological report.

7. Recommendation

It is recommended drilling a new test bore into the next layer aquifer at an appropriate location within the identified area shown with the dotted line on the below map.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ESID: 10560
Headon's Bore
Doyle's Bore
TWS bore (S3)
TWS bore (S2)
Hay WTP
TWS bore (S1)
40WA405131
ESID: 20784
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