MINING MANAGEMENT PLAN

Nobles Nob Gold Project

Operator:

Tennant Consolidated Mining Group Pty Ltd.

ABN 72 645 263 547 / ACN 645 263 547

Authorization Number: 1123-01

July 2022

Copies to:

- Department of Industry, Tourism and Trade (Mines Division)
- Tennant Consolidated Mining Group Pty Ltd.

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Date			
Name			
Signature			

I, Marty Costello – Executive Director declare that to the best of my knowledge the information contained in this Mining Management Plan is true and correct and commit to undertake the works detailed in this plan in accordance with all the relevant Local, Northern Territory and Commonwealth Government legislation.

SIGNATURE: .....

DATE: 29/07/2022

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1 INTRODUCTION

This Mining Management Plan (MMP) has been developed on behalf of Tennant Consolidated Mining Group (TCMG) for the Nobles Nob Gold Project (the Project) that encompasses extractive mining and reprocessing of the old rock waste dump (Southern Waste Rock Dump (WRD)), a small 'goodbye cut' at the existing Nobles Nob pit, and exploration activities. This will require the establishment of a new processing plant and a new tailings facility as well as new water management infrastructure. Associated mine site infrastructure, including processing plant and tailings storage facility, will be established in previously cleared and disturbed areas. A hybrid power supply solution is also proposed, which includes a solar field which would represent the only area of new disturbance on site. Further details of the proposed activities are provided in Section 4 and 5 of this MMP.

1.1 Operational Details

Operator Name:	Tennant Consolidated Mining Group Pty Ltd.
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1.1.1 Organisational Structure and Responsibility

Overall responsibility for environmental management and compliance at the Nobles Nob Site lies with the Executive Director (Marty Costello), which includes implementing, resourcing and maintaining environmental management as documented in this MMP. This includes the maintenance of this MMP. The Executive Director and relevant onsite personnel are responsible for defining and communicating relevant environmental responsibilities and accountabilities to employees, consultants and contractors, during the stages of operations and closure.

The organisational structure for the Project is detailed in Figure 1-1.

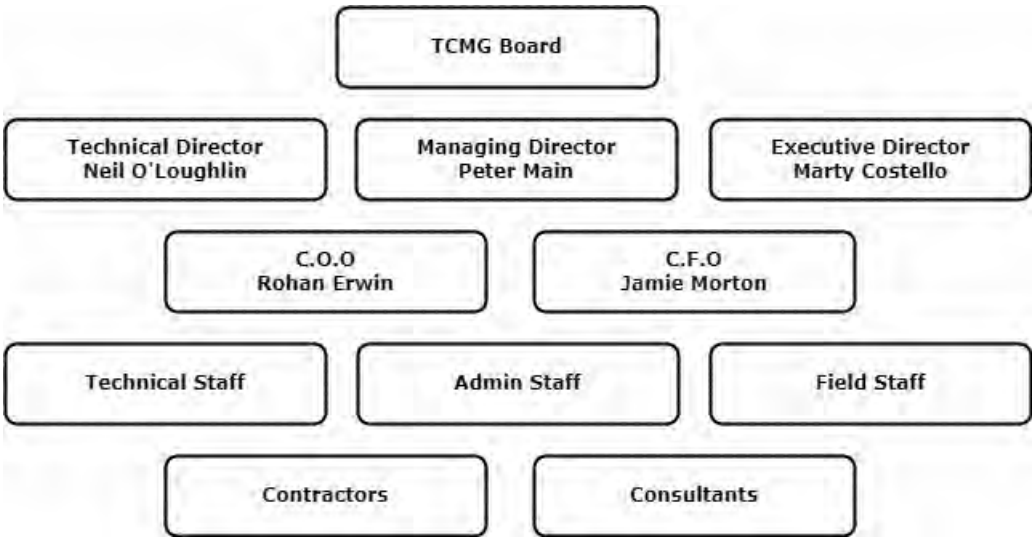

Figure 1-1. Organisational structure

1.2 Title Details

TCMG are the tenement holders for the Nobles Nob tenements. These are: MLC512, MLC513, MLC514, MLC515, MLC516, MLC517, MLC521, MLC525, MLC526, MLC531, MLC532, MLC533, MLC534, MLC537, MLC538, MLC539, MLC540, MLC541, MLC542, MLC543, MLC544, MLC545, MLC548, MLC549, MLC550, MLC556, MLC589, MLC590, MLC688, MLC689, MLC690, MLC691.

TCMG are the approved operator of the Juno tenements. These are: MCC284, MLC154, MLC155, MLC45, MLC46, MLC47, MLC578, MLC579, MLC652, MLC68. The nomination of operator form is attached in Appendix A. TCMG have an access agreement with Tennant Gold for use of the Juno tenements, for all required activities excluding active mining. A confirmation letter is also included in Appendix A.

All tenements relating to the Project are detailed in Table 1-1.

Table 1-1. Mining tenements related to the Project

Title number	Title holder	Grant date	Expiry date
MLC517	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC534	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC690	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC521	Tennant Consolidated Mining Group Pty Ltd	3/07/1953	31/12/2029
MLC525	Tennant Consolidated Mining Group Pty Ltd	23/12/1954	31/12/2030
MLC549	Tennant Consolidated Mining Group Pty Ltd	29/01/1959	31/12/2036
MLC545	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC540	Tennant Consolidated Mining Group Pty Ltd	3/06/1957	31/12/2033
MLC548	Tennant Consolidated Mining Group Pty Ltd	29/01/1959	31/12/2036
MLC537	Tennant Consolidated Mining Group Pty Ltd	9/04/1957	31/12/2033
MLC515	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC516	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC589	Tennant Consolidated Mining Group Pty Ltd	6/05/1975	31/12/2030
MLC556	Tennant Consolidated Mining Group Pty Ltd	19/03/1962	31/12/2032
MLC689	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC531	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC541	Tennant Consolidated Mining Group Pty Ltd	3/06/1957	31/12/2033
MLC526	Tennant Consolidated Mining Group Pty Ltd	7/03/1955	31/12/2026

Title number	Title holder	Grant date	Expiry date
MLC538	Tennant Consolidated Mining Group Pty Ltd	9/04/1957	31/12/2033
MLC514	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC688	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC542	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC513	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC532	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC691	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC539	Tennant Consolidated Mining Group Pty Ltd	23/05/1957	31/12/2033
MLC590	Tennant Consolidated Mining Group Pty Ltd	6/05/1975	31/12/2030
MLC512	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC550	Tennant Consolidated Mining Group Pty Ltd	29/01/1959	31/12/2036
MLC543	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC544	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC533	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC68	Tennant Gold Pty Ltd	18/06/1968	31/12/2033
MLC154	Tennant Gold Pty Ltd	17/02/1973	31/12/2024
MLC46	Tennant Gold Pty Ltd	5/01/1965	31/12/2035
MLC47	Tennant Gold Pty Ltd	5/01/1965	31/12/2035
MLC578	Tennant Gold Pty Ltd	28/05/1968	31/12/2033
MLC652	Tennant Gold Pty Ltd	19/06/1987	31/12/2033
MLC45	Tennant Gold Pty Ltd	5/01/1965	31/12/2035
MLC579	Tennant Gold Pty Ltd	28/05/1968	31/12/2033
MLC155	Tennant Gold Pty Ltd	17/02/1973	31/12/2024
MCC284	Tennant Gold Pty Ltd	8/07/1989	7/07/2024

1.3 Project Description

1.3.1 Location

Project Name: Nobles Nob

Mineral Titles: MLC512, MLC513, MLC514, MLC515, MLC516, MLC517, MLC521, MLC525, MLC526, MLC531, MLC532, MLC533, MLC534, MLC537, MLC538, MLC539, MLC540, MLC541, MLC542, MLC543, MLC544, MLC545, MLC548, MLC549, MLC550, MLC556, MLC589,

MLC590, MLC688, MLC689, MLC690, MLC691

As well as operation of Juno Mine Site (excluding active mining activities) on MCC284, MLC154, MLC155, MLC45, MLC46, MLC47, MLC578, MLC579, MLC652, MLC68.

Location: 13 kilometres south-east of Tennant Creek NT.

Site Access: The Project is accessible via Peko road from Tennant Creek.

1.3.2 Project Summary and Improvements

The Project area encompasses a total of 355 ha, with 253 ha within Nobles Nob mining tenements and 102 ha within Juno tenements. Figure 1-2 shows the general location of the Project and Figure 1-3 shows the location of Nobles Nob tenements, where the majority of the activities occur.

Nobles Nob was historically mined over a period of over 50 years from the late 1930's to the 1980's. Mining commenced in 1939 with underground operations. The collapse of the crown pillar in 1968 led to the construction of a new plant and open cut operations commenced in 1969. Some of the material from the collapsed crown pillar was recovered, however most of the material stockpiled in the existing mineralised southern waste rock dump (Southern WRD) to the south of the Nobles Nob pit.

Open cut mining continued at Nobles Nob from 1969 through to 1985 with a total production of 1.6Mt of ore at a grade of ~7g/t gold yielding 342,000 ounces of gold. In total since the 1930's the Nobles Nob mine produced 2.1Mt of ore at a grade of at 17.0 g/t with a total yield of 1.17M ounces of gold and was considered Australia's richest gold mine for many of those years.

Juno was an underground polymetallic mine that was operated from 1967 to 1977 and was processed along with ore from other sites at the neighbouring Peko Mine processing plant. Ore was contained in two major lodes which produced ~0.5Mt of ore at a grade of ~52-60g/t gold. With a total yield of 838,236 ounces of gold; 2,293,422 kilograms of bismuth; 88,480 ounces of silver; and 1,418 tonnes of copper.

In 2011, 5 RC holes were conducted at Nobles Nob. In 2012, 5 holes were drilled as well as a full scale structural geological mapping program and a ground based gravity survey were undertaken.

Work carried out during 2013 consisted of non-invasive ground-based activities using existing tracks. Walking gravity surveys and mapping were also carried out.

In 2018 the total number of RC holes in the Nobles Tenements was 269 RC holes, 63 of which were in the pit and 10 of these holes were in the Southern WRD.

Proposed activities include mining of the existing Southern WRD from historic Nobles Nob pit operations. This is the key ore reserve proposed to be mined within the current stage of activities. Also proposed is a small Goodbye Cut at the base of the existing Nobles Nob pit. No additional waste rock will be produced from either activity. With the establishment of a proposed 700 kt CIL ore processing plant, Geotubes tailings treatment facility (see section 5.2), and associated site infrastructure. All infrastructure except the solar field will be placed within the disturbance footprint of previous mining operations and will not require clearing of any undisturbed areas. The proposed solar field will be placed on the western section of the site and will require clearing of a 4 ha area of vegetation. This is the only new area of disturbance proposed.

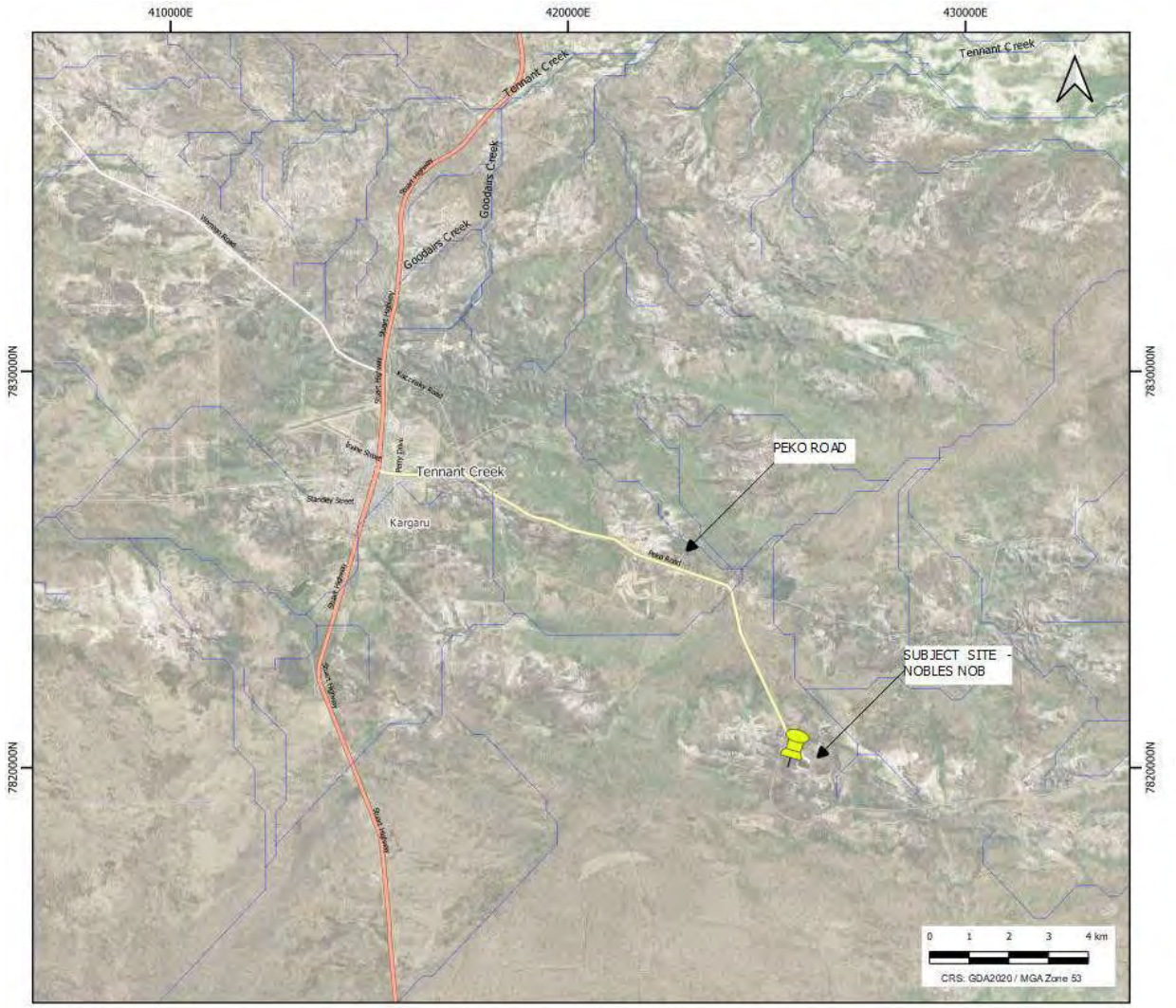

Figure 1-2. Project location

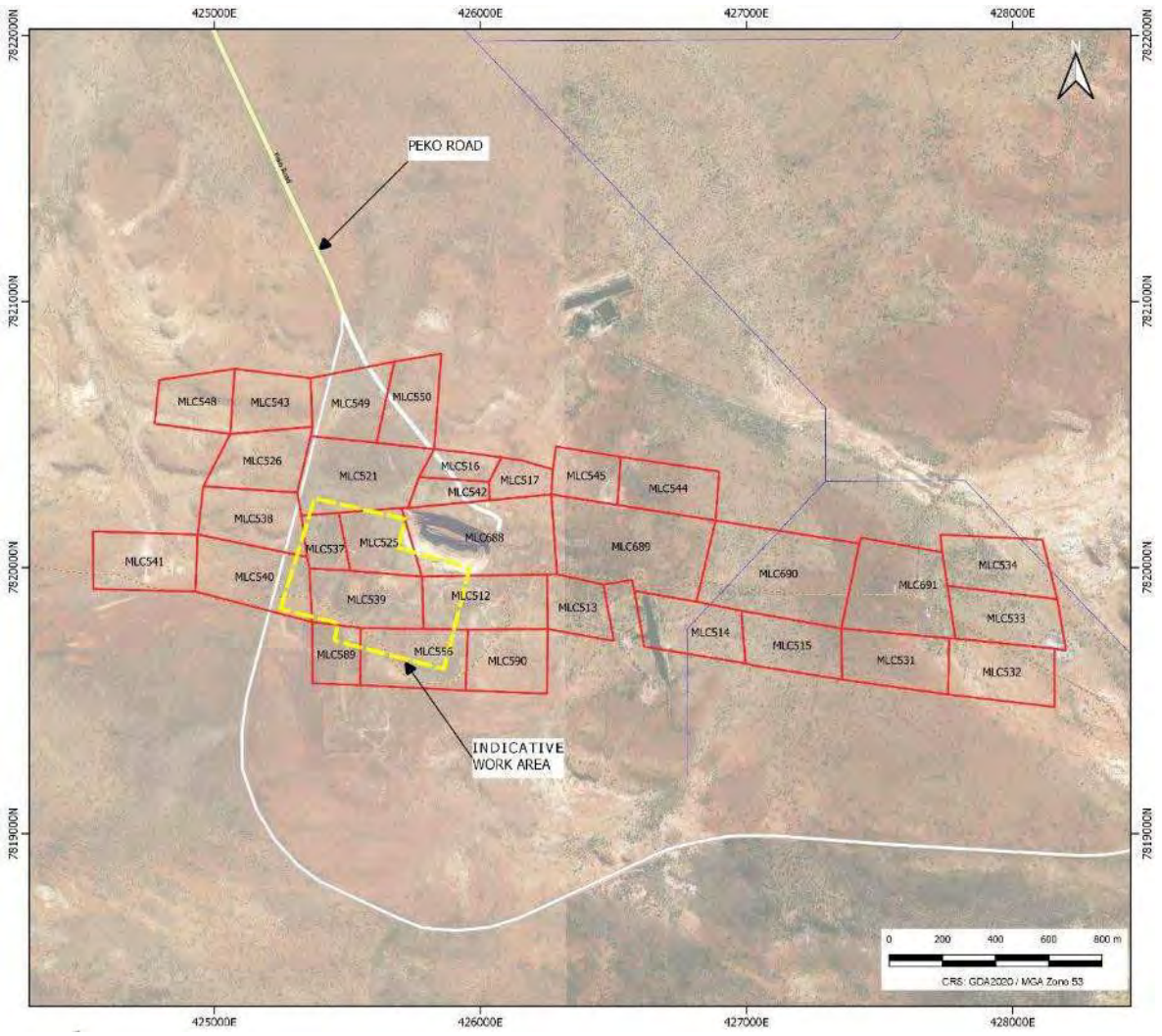

Figure 1-3. Nobles Nob Mine Tenements

NORTH WASTE DUMP

300m BLAST RADIUS

NOBLES NOB TAILINGS

NOBLES NOB MINE

PROPOSED 4ha SOLAR FIELD

RAW WATER POND

SUMP

PROCESS WATER POND

NOBLES NOB TAILINGS PLATFORM

8m CLEARANCE BOUNARY

FUEL STATION

POWER STATION

SOUTH WASTE DUMP

SOUTH TAILINGS

WHITE DEVIL TAILINGS

1:2500

50m 0 50m 100m 150m 200m 250m

PRELIMINARY FOR INFORMATION ONLY

DRAWING NUMBER	DESCRIPTION
DRAWING REFERENCE	

REV	DATE	REVISION DESCRIPTION	DRAWN	CHECKED	ENGINEER	APPROVED
A	02.02.2022	ISSUED FOR REVIEW	J.G	D.P	S.W	

IN THE ABSENCE OF THE APPROVED SIGNATURE, THIS DRAWING SHALL BE TREATED AS PRELIMINARY

		DATE
DRAWN	J.GREEFF	02.02.2022
DESIGNED		02.02.2022
CHECKED	D.P ENAAR	02.02.2022
ENGINEER	S.WOLMERANS	02.02.2022
APPROVED		

wave international
DETERMINE • DESIGN • DELIVER

CLIENT	TENNANT CREEK GOLD MINE
PROJECT	NOBLES NOB MINE
TITLE	GENERAL ARRANGEMENT PLAN
DRAWING STATUS	ISSUED FOR INFORMATION
CLIENT DWG NO	AS1100-1992 ALL DIMENSIONS IN mm
SCALE	1:2500
GRID	MGA94 Z 53
DATUM	GDA94
SIZE	A1
DWG NO	5449-40-DWG-CI-00001
REV	A

Figure 1-4. Site Layout Nobles Nob

2 SITE CONDITIONS

2.1 Physical Environment

2.1.1 Climate

The Project area experiences a warm desert climate (BWh, according to the Köppen-Geiger Classificaiton). The highest mean temperature is 37.2 ºC recorded in December, whereas July records the lowest at 12.3 ºC. Median annual rainfall is 425.8 mm, concentrated between October and March as a result of low pressure systems associated with monsoonal troughs, cyclones and ex-cyclones. (Figure 2-1).

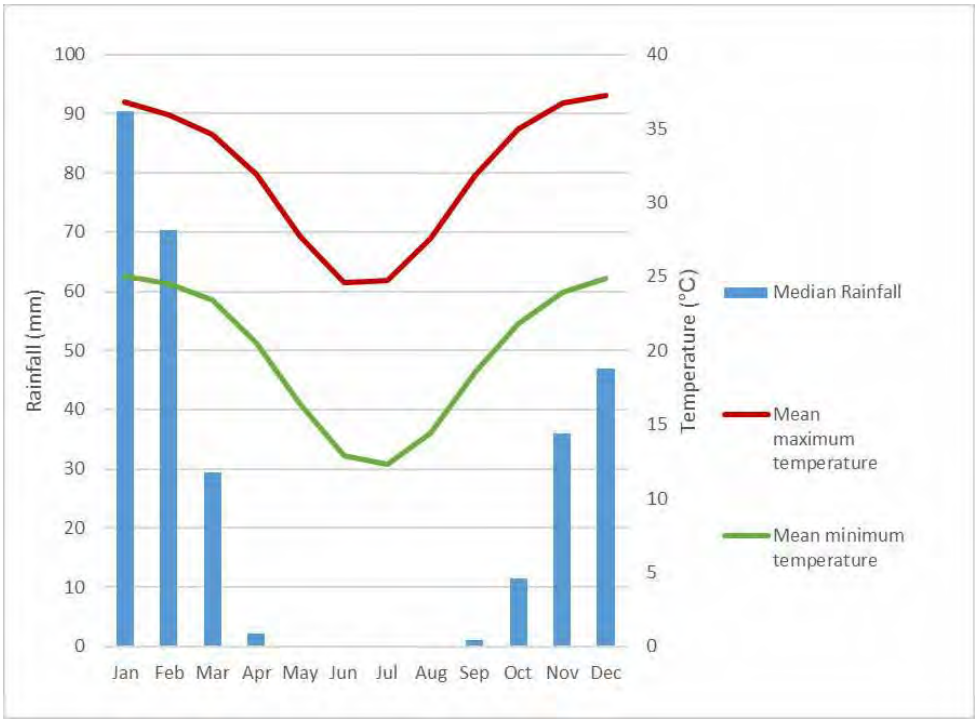

Figure 2-1. Average climate data for Tennant Creek Airport from 1969 to 2021.

2.1.2 Land Systems and Geology

The Project is situated within the Tennant Creek Land System, being dominated by sandstones plains and rises characteristic of the Ashburton Range subregion. It is part of the greater Davenport Murchison Ranges bioregion, characterised by plateaux, plains and rises on sandstone, claystone and limestone, and outcrops with shallow stony soils. It is located at the intersection of three soil types: AB31, BA13, and My80.

The Project area is located within the Proterozoic Tennant Creek Inlier, which is comprised of a turbiditic flysch sedimentary sequence abutting various volcanic rocks. In the Tennant Creek region, these rocks are typified by the Warramunga Group, which commonly strikes east-west with variable dip. These rocks have been intrused by various granites and deformed by the Tennant Event of 1850 Ma.

Gold-copper-bismuth mineralisation has been found to be hosted by fine grained haematitic mudstones and shaley siltstones. The mineralisation is poddy in nature and is typically located within steep dipping hinge zones of regionally minor folds with localised shearing and accompanying chlorite and silica with or without dolomite alteration. These dilation zones of rich gold mineralisation are also typified by strong magnetite alteration below the base of oxidation. Above the base of oxidation the magnetite is chemically weathered to haematite.

The distribution of the metals is variable, with no direct correlation between bismuth, gold and copper though some of the better known deposits display zonation. For example, it is common to find an outer

magnetite/dolomite altered copper zone, a mixed magnetite-silica bismuth zone and magnetite plus gold zone in the core. The mineralisation style at Tennant Creek is generally small tonnage but high grade pods of iron rich mineralisation. Gold is also generally very fine grained in fresh deposits, but very coarse and nuggety in the oxidised deposits, such as Nobles Nob (Excalibur 2012).

2.1.3 Flora and Fauna

There are three Sites of Botanical Significance (SoBS) within a 50 km radius of the Project area. The Gosse River and Edinburgh Creek SoBS, included within the Davenport and Murchison Ranges Site of Conservation significance (SoCS), is located approximately 38 km to the south. The Short Range Waterholes SoBS is located 46 km to the north. The Little lake Surprise (Ngwrratiji) SoBS is located 35 km to the east-southeast. Given their distance from the Project area it is unlikely that they will be affected by the proposed development.

Flora

Previous surveys identified the vegetation to be predominantly eucalypt low open woodland and acacia-sparse shrubland over hummock grassland. Rises host a community of open woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*) over gummy spinifex (*Triodia pungens*) grassland. Plains and drainage communities are composed by a mosaic of *E. pruinosa* and *E. aparrerinja* woodlands (Tennant Gold, 2018). No vegetation communities or ecological communities of listed conservation significance have been recorded within 50 km of the Project area. A search of the NT Flora Atlas identified 22 records of 13 species of listed conservation significance, three of which are considered Near Threatened under the *TPWC Act*: *Lythrum wilsonii*, *Trianthema glossostigmum*, and *Trianthema. oxycalyptra* var. *oxycalyptra*. These species are considered unlikely to occur within the project area due to the disturbed and unsuitable habitat (Table 2-1).

Table 2-1. Likelihood of occurrence of threatened flora within 50 km of the Project area.

Species	Status		Likelihood of occurrence
	TPWC Act	EPBC Act	
Lythrum wilsonii	NT	-	Unlikely – disturbed and unsuitable habitat
Trianthema glossostigmum	NT	-	Unlikely– disturbed and unsuitable habitat
Trianthema. oxycalyptra var. oxycalyptra	NT	-	Unlikely– disturbed and unsuitable habitat

Lythrum wilsonii is an erect herb with lilac flowers found in seasonal swamps, under Eucalyptus vitrix, clay soil.

Trianthema glossostigmum is a groundcover with lilac flowers found on gravelly red soil to red sandplain associated with Triodia pungens-Acacia lysiphloia community.

Trianthema. oxycalyptra* var. *oxycalyptra is a purple flowered herb found on one small flat with red sandy soil between open rocky hills with granite boulders and triodia.

The vegetation within the 4 ha area proposed to be cleared for the solar field is representative of the surrounding vegetation type. Consisting of low open eucalypt woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*). This area was inspected, and no vegetation or ecological communities of conservation significance were identified.

Fauna

A search of the NT Fauna Atlas identified 1070 records of 59 species of conservation significance within a 50 km radius of the Project area. Of these, 93 records corresponded to 15 threatened species under the *TPWC Act*. The EPBC Protected Matters Search added four threatened bird species to the list of species

with the potential to occur within the Project area (see Table 2-2). Of these 19 species, five have a medium likelihood of occurrence and one high likelihood of occurence.

Table 2-2. Likelihood of occurrence of threatened fauna within 50 km of the Project area.

Species	Status		Likelihood of occurrence
	TPWC Act	EPBC Act	
Gastropods			
Spencer's Tapered Snail *Bothriembryon spenceri*	VU	-	**LOW.** This land snail is found in leaf litter under fig trees and/or rocky areas, largely restricted to the Krichauff and Chewings Ranges west of Alice Springs. There is only one observation of his species 13 km northeast of the Project area.
Reptiles			
Great Desert Skink *Liopholis kintorei*	VU	VU	**LOW.** Great Desert Skink hasn't been observed for over 100 years within a 50 km radius of the Project area. NT populations are now restricted to the Tanami Desert, Uluru-Kata Tjuta National Park and Yulara.
Birds			
Curlew Sandpiper *Calidris ferruginea*	VU	CE	**LOW.** Curlew Sandpipers mostly occur around the coast. Inland they are found in smaller numbers near waterbodies. Considering there are no wetlands in its vicity, they are unlikely to occur in the Project area.
Great Sandplover *Charadrius leschenaultii*	VU	VU	**LOW.** Great Sadplovers are mostly restricted to the Australian coast. Counting only with occasional observations inlad.
Australian Painted-snipe *Rostratula australis*	-	EN	**LOW.** Australian Painted Snipe mostly occur in the eastern coast. Inland they are less common and inhabiting wetlands. Considering there are no wetlands in its vicity, they are unlikely to occur in the Project area.
Red Goshawk *Erythrotriorchis radiatus*	VU	VU	**LOW.** There is only a limited extent of riparian habitat in the ML's, making the area only marginally-suitable. Important habitat for this species is primarily tall trees in riparian zones that are suitable for nesting within.
Grey Falcon *Falco hypoleucos*	VU	VU	**MEDIUM.** Grey Falcons are distributed sparsely over Australia's arid and semi-arid zones. It favours lightly timbered and untimbered lowland plains that are crossed by tree-lined watercourses.
Painted Honeyeater *Grantiella picta*	VU	VU	**MEDIUM.** Painted Honeyeater core range is inland south-eastern Australia, reaching eastern parts of Northern Territory over winter, where they are found predominantly in *Eucalyptus* and *Acacia* woodlands and forests. Their movement is connected to the presence of mistletoe and the role of that plant as a food source.
Night Parrot *Pezoporus occidentalis*	CE	EN	**LOW.** Night Parrot is a highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia. It could occur in the vicinity of the Project area although it have never been recorded within 50 km radius from it.
Princess Parrot *Polytelis alexandrae*	VU	VU	**LOW.** Princess Parrot is confined to arid regions of Australia. Although suitable habitat occurs in the vicity of the Project area, this species has never been recorded within a 50 km radius.
Great Painted-snipe *Rostratula benghalensis*		EN	**NONE.** Great painted Snipe is a migratory species restricted to coastal areas in Australia, occasionaly found inland in and around wetlands. It has never been observed within a 50 km radius of the Project area.
Mammals			
Pale Field-rat *Rattus tunneyi*	VU	-	**MEDIUM.** There is suitable habitat (especially closer to the creek), but few recent records for the region. However, the ML's does not represent important habitat for this species, and the poor vegetation quality within the disturbance area reduces the likelihood of this species occurring there.
Brush-tailed mulgara *Dasycercus blythi*	VU	VU	**MEDIUM.** The presence of hummock grassland (*T. pungens*) habitat could support this species. However, the occurrence of brush-tailed

Species	Status		Likelihood of occurrence
	TPWC Act	EPBC Act	
			mulgara in the Project area appears highly unlikely due to absence of records in the 50 km radius search area for over a century.
Western quoll *Dasyurus geoffroii*	EX	VU	**LOW.** Western Quoll previously occurred throughout arid and semi arid Australia, but is now restricted to south-west Western Australia. It was last observed in the vicinity of the Project area over 50 years ago.
Golden bandicoot *Isoodon auratus*	EN	VU	**LOW.** It previously occurred throughout central Australia, but is now restricted to Barrow Island, the Kimberley, and Marchinbar Island.
Mala *Lagorchestes hirsutus*	EW	EN	**LOW.** Last observations of Malas in the vicity of the Project area occurred over 50 years ago. This species used to be present across most of Australia. It has been recorded in hummock grassland on sandplains, spinifex on gravelly plains, tussock grassland and shrubland. It now only occurs on island in Shark Bay and feral-free areas near Alice Springs.
Greater Bilby *Macrotis lagotis*	VU	VU	**MEDIUM.** Greater bilbies occupy predominantly sandy landscapes that may also include rocky outcrops, laterite rises and low-lying drainage systems. These haitat characteristcs are present in the vicity of the Project area and may represent connectivity to the Great Bilby population of the Tanami.
Central Australian Rock-wallaby *Petrogale lateralis centralis*	NT	VU	**HIGH.** Central Australian Rock-wallaby habitat extends as far north as the Davenport and Murchison Ranges. Some suitable rock shelters within 50 km of the Project area contain recent signs (scats) attributable to this species. Therefore it is likely that this spcies occurs through the Project area.
Red-tailed Phascogale *Phascogale calura*	EX	VU	**NONE.** Declared Extinct in the NT. Last observations near the Project area occurred more than hundred years ago.

Weeds and Pests

The Project footprint lies within the Tennant Creek Regional Weeds Strategy 2021-2026 (DEPWS 2021). This strategy focusses on weeds that are most important to the region, categorising them as either:

- *Category 1 – Priority weeds* (present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions)
- *Category 2 – Priority weeds or strategic control – including the eradication of outliers* (species warranting strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values)
- *Category 3 – Weeds of concern* (assessed by the weed risk management system as a medium to high risk, or have not been assessed, but have been identified by stakeholders as posing a threat to the values of the Region)
- *Category 4 – Hygiene and biosecurity* weeds (it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises)
- *Category 5 – Alert weeds* (have the potential to have a high level of impact to the region should it become established, the likelihood of the species naturalising and spreading in the region is perceived to be high).

All such weeds are listed in Table 2-3.

Table 2-3. Weed species relevant to the Project footprint

Common name	Botanical name	Class	WoNS	Status in management plan
Bellyache Bush	*Jatropha gossypiifolia*	A	Yes	Category 1, very high
Gamba grass	*Andropogon gayanus*	A	Yes	Category 1, very high
Mesquite	*Prosopis spp.*	A	Yes	Category 1, very high
Prickly acacia	*Vachellia nilotica*	A	Yes	Category 1, very high
Prickly Pears	*Opuntia spp.*	A		Category 1, very high
Rope Cactus	*Cylindropuntia spp.*	A		Category 1, very high
Rubber vine	*Cryptostegia grandiflora*	A		Category 1, very high
Athel Pine	*Tamarix aphylla*	A/B	Yes	Category 2, very high
Neem	*Azadirachta indica*	B		Category 2, very high
Parkinsonia	*Parkinsonia aculeata*	B	Yes	Category 2, very high
Rubber bush	*Calotropis procera*	B		Category 2, high
Mimosa bush	*Vachellia farnesiana*	Not declared (native)		Category 3, N/A
Asbestos grass	*Cenchrus basedowii*	Not declared (native)		Category 3, N/A
Buffel Grass	*Cenchrus ciliaris*	Not declared		Category 3, very high
Mossman River Grass	*Cenchrus echinatus*	B		Category 3, medium
Noogoora burr	*Xanthium strumarium*	B		Category 3, high
Caltrop	*Tribulus terrestris*	B		Category 4, low
Coffee senna	*Senna occidentalis*	B		Category 4, medium
Kapok	*Aerva javanica*	Not declared		Category 4, N/A
Mexican Poppy	*Argemone ochroleuca*	B		Category 4, medium
Mission grass - annual	*Cenchrus pedicellatus*	Not declared		Category 4, very high
Sicklepod	*Senna obtusifolia*	B		Category 4, very high
Giant rats tail grass	*Sporobolus natensis and S. pyramidalis*	Not declared		Category 5
Grader grass	*Themeda quadrivalvis*	B		Category 5
Parthenium weed	*Parthenium hysterophorus*	A	Yes	Category 5
Siam weed	*Chromolaena odorata*	A		Category 5

N/A = Not Assessed
WoNS = Weeds of National Security

A search in the NR Maps database within a 50 km radius from the Project area revealed the occurrence of twelve declared weeds (Table 2-4), three of which, the Bellyache Bush (*Jatropha gossypiifolia*), Parthenium (*Parthenium hysterophorus*), and Athel Tree (*Tamarix aphylla*) are listed as Class A and should be eradicated from the Project area. The other weed species listed below are considered Class B and should also have their growth and spread controlled. One introduced weed species was recorded during the 2018 dry season survey conducted by EcoScience NT – the prickly shrub Parkinsonia (*Parkinsonia aculeata*). During the wet season survey, a total of nine introduced species were recorded, including three Class B declared species: Rubber Bush (*Calotropis procera*), *Parkinsonia aculeata* and Flannel weed (*Sida cordifolia*). Overall, despite the long history of disturbance due to a range of different factors, the Project area had a relatively low incidence of weeds.

Table 2-4. Declared weeds within 50km radius of Project area

Common name	Botanical name	Class	WoNS
Goats head	*Acanthospermum hispidum*	B	
Khaki weed	*Alternanthera pungens*	B	
Neem	*Azadirachta indica*	B	
Rubber bush	*Calotropis procera*	B	
Mossman River Grass	*Cenchrus echinatus*	B	
Tree Cholla	*Cylindropuntia imbricata*	B	
Bellyache Bush	*Jatropha gossypiifolia*	A/B	Yes
Parkinsonia	*Parkinsonia aculeata*	B	Yes
Parthenium weed	*Parthenium hysterophorus*	A	Yes
Coffee senna	*Senna occidentalis*	B	
Spinyhead Sida	*Sida acuta*	B	
Athel Pine	*Tamarix aphylla*	A/B	Yes

The search also revealed the occurrence of nine introduced fauna species (Table 2-5).

Table 2-5. Introduced fauna within 50km of Project area

Common name	Scientific name
Asian House Gecko	*Hemidactylus frenatus*
Barbary Dove	*Barbary Dove*
Cat	*Felis catus*
Cattle	*Bos taurus*
Fox	*Vulpes vulpes*
Horse	*Equus caballus*
House Mouse	*Mus musculus*
House Sparrow	*Passer domesticus*
Rock Dove	*Columba livia*

2.1.4 Hydrology

The following information has been summarised from the in depth studies undertaken by Umwelt. For further detailed information see the full report in Appendix C.

TCMG installed 10 monitoring bores in May/June 2021 to monitor the water quality of groundwater at Nobles Nob. Based on the analysis of aquifer yields, bore logs and lithology, the following hydrogeological units have been identified at Nobles Nob:

- Shallow weathered horizon
- Deep fractured sandstone/siltstone

Groundwater can also occur associated with faults; however, no fault structures have been mapped within 2 km of Nobles Nob - (Umwelt, 2021).

Shallow weathered horizon

The CSIRO regolith depth mapping indicates regolith depth up to 3 m around the pit (0 to 1 m close to the pit, and 2-3 m for slightly away from the pit). This is consistent with the drilling logs of bore NNMW001, NNMW004 and NNMW005 that recorded 0-3 m of regolith. As per the CSIRO regolith depth mapping, higher regolith depth is mapped for the area where bore NNMW018 is located (approximately 10-20 m).

However, the drill logs of bore NNMW018 suggests approximately 3 m of laterite, followed by 3 m of clay, before reaching the siltstone at 6 m below ground. Observations on the extent of the weathering at 6 m below are not provided. Overall, the drill logs and regolith depth mapping suggest that the area's regolith depth is not very deep.

Previous studies (e.g. Rockwater, 1989; Verhoeven & Knott, 1980) have indicated that groundwater might occur in the shallow weathered horizon of the Warramunga Formation. However, the drilling records from the monitoring and registered bores generally suggest that no groundwater was encountered at shallow depths. Registered bores drilled at shallow depths (<32 m) also did not encounter any groundwater - (Umwelt, 2021).

Deep Fractured Sandstone/Siltstone Aquifer

The groundwater monitoring bores and registered bores within 2.5 km of Nobles Nob suggest that the primary groundwater bearing unit on site is within the local scale fractured sandstone/siltstone of Warramunga Group.

Groundwater in this aquifer is generally first encountered between approximately 70 to 80 m below ground level. The bottom of Nobles Nob open pit, which is approximately 80 m below the surface, has a permanent pool of water (Tennant Gold Resource, 2018), possibly indicating the water table in the region. The review suggests that the water level in all bores, except NNMW002 and NNMW011, was recorded higher than the depth at which groundwater was encountered, suggesting the confined nature of the aquifer - (Umwelt, 2021).

2.1.5 Groundwater flow and direction

There is minimal information regarding groundwater flow directions in the fractured rock aquifers of the Warramunga Group. However, regionally it has been reported that groundwater flows from the southeast to the northwest, in line with surface topography (McPherson et al., 2021). The groundwater levels at Nobles Nob, retrieved from the monitoring data in October 2021, also suggest that the overall flow is from the east towards the west-northwest, mirroring the regional groundwater flow direction and overall surface topography (Umwelt, 2021).

2.2 Socio-Economic Environment

The nearest town to the Project area is Tennant Creek, administered by the Barkly Regional Council and has approximately 3,000 inhabitants according to the 2016 census. The Project area is located approximately 13 km south-east of Tennant Creek, along the Peko Road.

2.2.1 Current Land Use

Due to the history of mining, grazing and other land use within the Project area, disturbance to vegetation is particularly evident. The Nobles Nob open cut mine was previously one of the largest mines of this type in Australia and the pit and surrounding area remains a significant feature of the local landscape. Although areas of reasonably healthy remnant vegetation remain, the majority of the Project area is moderately disturbed with some areas significantly impacted by previous mining activities.

The Nobles Nob pit has been fenced-off for safety and environmental reasons. The Project area sits on Warumungu Aboriginal Trust land. There is currently no mining in the Project area and only intermittent exploration drilling programs occurring in recent years. Excalibur Mining had been exploring the area for gold

since October 2007. The expected post-closure land use is for the continuation of the pre-mining land use. The open pit will be a legacy feature and will be left in a safe state with public access restricted for safety reasons. The Project is not situated on an operational pastoral station.

2.2.2 Identified Stakeholders and Consultation

TCMG have engaged Ernst and Young to carry out a comprehensive stakeholder engagement strategy and develop a Territory Benefit Policy and Plan. This includes an Aboriginal Development Plan and a Buy Local Procurement Policy. This was kicked off in January 2022.

Ernst and Young and TCMG have identified six key stakeholder groups for the Project, which are listed in Figure 2-2 below.

Category	Groups		
Aboriginal Community	1. Central Land Council 2. Traditional Owners 3. Prescribed Body Corporate 4. Aboriginal Community members		
Town of Tennant Creek	1. Local Businesses 2. Community Residents 3. Community Activist Groups 4. Community Service Providers 5. Schools and Clontarf		
Commercial	1. Future Contractors 2. Emmerson Resources Ltd 3. Resource companies in the region 4. Common users of infrastructure 5. Third party ore suppliers		
Education and Training	1. Charles Darwin University 2. RTO's 3. RN Employment Services 4. Juno Centre 5. Myuma Group		
Government	1. Local Gov (Barkly Shire) 2a. Commonwealth 2b. Barkly Regional Deal 3. NTG Barkly Region Network 4. NTG Investment Territory	5. NT DCMC 6. NT Buy Local 7. NT IBN 8. Ministers and MLAs 9. NT Business Council	10. EPA 11. DEPWS 12. Treasury and Finance 13. AAPRA
Pastoralists	1. Pastoralist 1 2. Pastoralist 2 3. Julalikari		

Figure 2-2. Key stakeholder groups identified for the Project

2.3 Conceptual site model

The Nobles Nob Conceptual Site Model (CSM) had been developed to describe the key Project risks and assesses the adequacy of the management system (Table 2-6). The potentially impacted receptors from the potential contaminants and impacts of concern are surface water, groundwater, vegetation, fauna, and soils. The overarching objectives of these receptors are:

Terrestrial ecosystems: *Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.*

Terrestrial environmental quality: *Protect the quality and integrity of land and soils so that environmental values are supported and maintained.*

Hydrological processes: *Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

Inland water environmental quality: *Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

Site-specific objectives and environmental management to achieve these objectives are discussed in section 8.3.

Table 2-6. Nobles Nob Conceptual site model (CSM)

Disturbance	Potential contaminants and impacts of concern	Source	Pathway	Receptor
Mining of Southern WRD and Nobles Nob Pit	• Turbidity (TSS) • Hydrocarbons (TRH/TPH) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Electrical Conductivity (EC) • Hydrocarbons (TRH/TPH)	• Southern WRD material • Mining fleet / pumps – hydrocarbon sources	Water – seepage and runoff Pumps	Surface water Groundwater
Geotubes TSF	• Possible cyanide • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn)	• Runoff from the geotubes	Water – seepage and runoff	Surface water Groundwater
Southern WRD	• Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu), zinc (Zn) and selenium (Se) • Electrical Conductivity (EC)	• Southern WRD material	Water – seepage and runoff	Surface water Groundwater
ROM and Ore storage	• Turbidity (TSS) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Electrical Conductivity (EC)	• ROM and Ore stockpiles	Water – seepage and runoff	Surface water Groundwater
Process water dam	• Possible cyanide • Electrical Conductivity (EC) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Hydrocarbons (TRH/TPH) • Turbidity (TSS).	• Process water • Dewatering of the Pit • Runoff from the Geotubes storage area • Mining fleet / pumps – hydrocarbon sources	Water – failure of equipment, seepage and runoff	Surface water Groundwater Soils Vegetation
Solar field	• Ground disturbance • Clearing vegetation – reduced vegetation cover and habitat availability	• Construction and operation of solar field	Water – seepage and runoff	Vegetation Soils Fauna

3 STATUTORY AND NON-STATUTORY REQUIREMENTS

3.1 Statutory Requirements

Applicable legislation, permits and licences that may be required for the Project area listed in Table 3-1.

Table 3-1. Relevance of legislation to the Project

Legislation	Regulation/ approval	Project relevance
Mining Activities		
Environmental Assessment Act (EA Act)	Not applicable	The NT EPA is responsible for administering the EA Act, the key legislation used to perform the EIA of proposed actions in the NT. The primary purpose of the EIA process is to provide for appropriate examination of proposed Projects that may cause significant environmental impact.
Mineral Titles Act (MT Act)	Mineral Licence	The Department of Industry, Tourism and Trade (DITT) oversees the approval and regulation of mining activities. Under the *MT Act*, TCMG has been granted MCC284, MLC154-MLC155, MLC45-MLC47, MLC512-MLC517, MLC521, MLC525-MLC526, MLC531-MLC534, MLC537-MLC545, MLC548-MLC550, MLC556, MLC578-MLC579 MLC589-MLC590, MLC652, MLC68, MLC688-MLC691 that encompasses the proposed mine site. The Project also has an Access Authority to utilise neighbouring land for the use of water extraction and roads under Section 84. An application will be made to DITT prior to any mining activities taking place within the Project area.
Mining Management Act (MM Act)	Mining Authorisation	The mining authorisation is the key regulatory instrument used by the NT Government for approval and compliance monitoring of mining operations in the NT. This MMP will form the basis for the application for mining authorisation.
Flora and Fauna		
Planning Act	Land Clearing Permit	Vegetation clearing on mining interests is controlled by application of the *MM Act* and MMP's. No permit is required.
Territory Parks and Wildlife Conservation Act (TPWC Act)	Permit to take or interfere with wildlife that is threatened	Pursuant to Section 56, the taking or interfering with wildlife that is listed as threatened, requires approval at the Ministerial level. No threatened species' populations are expected to occur within the extraction area. No permit is required.
Environmental Protection and Biodiversity Conservation Act (EPBC Act)	Not applicable	Provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – matters of national environmental significance (MNES). There are no MNES which will be impacted by the Project and the Project will not be referred under the *EPBC Act*.
Weed Management Act (WM Act)	Not applicable	Occupiers of land (including mine sites) have an obligation to ensure listed weeds are not introduced or spread. Weed management is addressed in Section 8.3.10 of this MMP.
Land and Soils		
Soil Conservation and Land Utilisation Act	Not applicable	This Act provides for the prevention of soil erosion, and for the conservation and reclamation of soil, and requires Erosion and Sediment Control Plans (ESCPs) to be devised for development Projects. Erosion control is addressed in Section 8.3.1 of this MMP.
Water Quality and Hydrological Processes		
Water Act	Waste Discharge Licence (WDL)	Any off-site discharge from operational areas to a watercourse would require a Waste Discharge Licence (WDL). The licencing system is managed by the NT EPA. Water is to be recycled through ore processing activities and no discharges will take place from mine water.

Legislation	Regulation/ approval	Project relevance
	Permit to construct or alter works Licence to take or use surface water or groundwater	A recent amendment to the *Water Act* now requires mining activities to hold both permits where they are applicable. An application will be submitted to SEWPaC Water Resources Division when required.
Public and Environmental Health Act	Wastewater works design approval	A septic tank that complies with the Department of Health's (DOH) definitions of a 'standard conventional septic systems' will be installed. An Approval Application form will be submitted to the DOHs Environmental Health Division.
Social, Economic and Cultural Aspects		
Native Title Act 1993	Sacred Sites Clearance Certificate	TCMG has applied for a Sacred Sites Clearance Certificate through the Central Land Council (CLC). Field consultations have occurred with Traditional Owners and Custodians, and the report is currently being prepared.
Aboriginal Sacred Sites Act	Authority Certificate	TCMG has been granted an Aboriginal Areas Protection Authority (AAPA) Certificate for the two tenements on which there are known sacred sites. This contains a number of conditions and designates a restricted works area to protect Aboriginal sacred sites. TCMG will uphold these, and implement management controls to ensure that no unauthorised access or damage will occur to these sites. An application for a second AAPA Certificate has also been made to cover the broader works area. Anthropological fieldwork has been undertaken and a report is currently being prepared.
Heritage Act	Work Approval	There are no sites on the NT Heritage Register within the Project area.
Other		
Work Health and Safety (National Uniform Legislation) Act	Risk Management Plan (RMP)	Mine sites in the NT must not permit any mining activity or a related mining activity to be carried out unless the mine operator has given to the regulator an RMP for the mine site that has been certified in accordance with regulation 614.
Dangerous Goods Act & Regulations	Explosive Permits	The storage and transport of explosives requires an approval to be obtained from Worksafe NT.
Waste Management and Pollution Control Act (*WMPC Act*)	Environmental Protection Approval or Licence (EPA and EPL)	EPA and EPL are required for construction and operation of facilities that store and handle listed wastes. General and hazardous wastes will be removed from site by a licenced contractor. There is no onsite landfill proposed. No approval or licence is required.
National Greenhouse and Energy Reporting Act (*NGER Act*)	GHG reporting	Corporations must register and report if they emit greenhouse gases (GHG), produce energy, or consume energy at or above specified quantities in a given financial year. The Project will not trigger the reporting thresholds for reporting.

3.2 Non-Statutory Obligations

Mine planning and design have considered the following standards, guidelines and codes of practice relevant to avoiding or minimising environmental impacts.

Mining best-practice guidelines

- *A Guide to Leading Practice Sustainable Development in Mining* (Australian Centre for Sustainable Mining Practices, 2011)

Waste characterisation/Acid Mine Drainage

- *Global Acid Rock Drainage Guide* (International Network for Acid Prevention, 2014)
- *Materials Characterisation Baseline Data Requirements for Mining Proposals* (Department of Mines and Petroleum, 2016)

- *Environmental Assessment Guidelines on Acid and Metalliferous Drainage* (NT EPA, 2013)
- *Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade 2016a)

Storm-water management, erosion and sediment control

- *Best Practice Erosion and Sediment Control* (International Erosion Control Association, 2008)

Noise and dust

- *Airborne Contaminants, Noise and Vibration – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade, 2009)

Tailings management

- *Tailings Management – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade 2016b)
- *Australian National Committee on Large Dams (ANCOLD) "Guidelines on Tailings Dams"* (ANCOLD, 2012)

Water management

- *Water Stewardship – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade 2016c)
- *Water Accounting Framework for the Australian Minerals Industry* (Minerals Council of Australia, 2014).

Storage and handling of hazardous substances and dangerous goods

- National Standard for the Storage and Handling of Workplace Dangerous Goods
- Australian Code for the Transport of Dangerous Goods by Road & Rail (7.7-2020)
- Storage and Handling of Workplace Dangerous Goods National Code of Practice [NOHSC:2017(2001)]
- AS1940:2017 The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2017)
- AS 1962:2006 Tanks for flammable combustible liquids
- AS 3780:2008 The storage and handling of corrosive substances
- AS/NZS 4452:1997 The storage and handling of toxic substances

Mine closure planning

- *WA Guidelines for Preparing Mine Closure Plans* (Department of Mines and Petroleum and Environment Protection Authority, 2015).
- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade 2016d)
- *Mine Closure – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade 2016)

3.3 Sacred, Archaeological and Heritage Sites

3.3.1 Sacred Sites

The Project area sits on Warumungu Aboriginal Land Trust land. The Aboriginal Areas Protection Authority (AAPA) has advised that there are two recorded sacred sites within the Project area, one on MLC514, the other on MLC549. TCMG has been granted an Aboriginal Areas Protection Authority (AAPA) Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989* for works on MLC514 and MLC549, which designates a restricted works area around the two known sacred sites. See Appendix B. TCMG has also applied for a second AAPA Certificate for all other mining tenements at Juno and Nobles Nob, as listed in Table 1-1, to ensure that all works areas are included, and any other unknown significant Aboriginal heritage

areas are recorded and managed appropriately. Anthropological fieldwork has been undertaken and a report is currently being prepared.

TCMG have also applied for a Sacred Sites Clearance Certificate through the Central Land Council (CLC). Being located on Aboriginal Land Trust land, this in required in addition to the AAPA Certificate under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Australian Government). This application was submitted in April 2022 and includes all proposed mining activities within the Juno and Nobles Nob tenements. Field consultations have occurred with Traditional Owners and Custodians, and the report is currently being prepared, with approvals expected to be received in July 2022.

TCMG are developing a Cultural Heritage Management Plan, and will implement management controls on site to ensure that no unauthorised access or damage will occur to known sacred sites. All conditions outlined within the AAPA and CLC Certificates will be upheld. Site layout places infrastructure away from the location of sacred sites, and all planned works including exploration activities will be outside of the designated restricted works areas.

The Project area occurs on Mining Leases granted prior to Native Title allocation. However, TCMG will continue to work in conjunction with the AAPA and the CLC throughout the Project to ensure that all necessary approvals and precautions are taken to protect sacred sites. If any suspected artefacts are discovered during operations the appropriate authority will be immediately notified.

Figure 3-1. Location of the Sacred Sites

3.3.2 Heritage and Archaeological Sites

A search in the NT Heritage Register did not return any heritage or archaeological site within the Project area. The high level of historic activities indicates the likelihood of disturbance of such site is extremely low.

4 MINING ACTIVITIES

4.1 Proposed mining of the Southern WRD

The Southern WRD is located to the south of the Nobles Nob pit. This covers approximately 9.24 ha of land which was used for waste rock and mineralised waste disposal when the historic Nobles Nob pit was in operation and when the crown pillar collapsed. Mineralised portions of approximately 8.9 ha of mineralised material at the southern end of the Southern WRD is planned to be recovered and processed on site (generally the upper layer of material). This is referred to as the South Waste Dump in the site layout shown in Figure 1-4. This material will be processed entirely and removed, no additional waste rock will be produced. Sections of the Southern WRD that are lower grade will not be processed (generally the lower layer of material), and will be progressively used as capping for rehabilitation instead. Further detail of the staged processing approach is included in the attached operating plan for the processing of the Southern WRD (Appendix I). Further detail of the use of material for capping and its suitability for rehabilitation purposes is included in the attached letter at Appendix K.

Mining of the Southern WRD will be undertaken by conventional excavator / front end loader and truck method:

1. Clear and grub of regrowth of the mineable section of Southern WRD;
2. Mining of material in nominally 3-meter benches;
3. Ore processed on site;
4. Rehabilitate newly created faces in the Southern WRD and;
5. Unmined lower section of Southern WRD will be progressively used for capping of the tailings storage facility.

Equipment:

- Front End Loader
- Excavator
- Off Highway Haul Trucks

4.1.1 Waste Rock Characterisation

Umwelt was engaged by TCMG to characterise the samples from the historical Southern WRD of the Nobles Nob Project in the Northern Territory, Australia. TCMG collected a total of 25 composite samples from drill holes drilled on the Southern WRD and one within the historical ROM pad. These samples were sent to a NATA accredited laboratory for analysis. The results were assessed to observe the potential of acidic, metalliferous, or saline drainage from these samples.

The results suggest that the aged pH of the samples ranged from a 5.9 to 8.6 pH unit, with the mean aged pH being 7, whereas the median aged pH being 6.9. Only one sample out of the total 26 samples recorded aged pH <6 pH units. The classification of the samples suggests that all 25 samples from the Southern WRD and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely.

The geochemical abundance index (GAI) assessment of the 25 samples collected from the Southern WRD and one sample from the ROM pad at Nobles Nob suggest that the samples are significantly enriched (GAI >= 3) with the following metals:

• Molybdenum (Mo) – 5 out of 26 samples recorded GAI value equal to or greater than 3.

• Mercury (Hg) – only the sample from the ROM pad recorded GAI value equal to 3.

The Australian Standard Leachate Procedure (ASLP) tests for all 26 samples from the Southern WRD at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) DGV for 90% species protection. The results indicate that leachate from the samples recorded 80th percentile

concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection. Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment.

The combined assessment of GAI and ASLP results suggests a potential of metalliferous drainage from a few samples enriched in aluminium, zinc, and mercury (possibility of mercury enriched drainage is only from 1 sample 143512). It is recommended that drainage from these samples be restrained, and the receiving environment should be monitored for these analytes.

Electrical conductivity (EC) has been used as a proxy for salinity in this assessment. All 26 samples underwent aged EC (1:2) and ASLP EC measurement. The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded aged EC between 150 and 450 µS/cm, whereas 100% samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely.

Umwelt's report can be found at Appendix C.

4.2 Proposed mining within the existing Nobles Nob pit

This will include a Goodbye Cut to the extent that is safely recoverable. Ore will be excavated to a depth of approximately 7 m at the base of the pit where possible. No waste rock will be created. The pit will be accessed using the existing pit ramp, which was repaired recently for the approved drilling activities carried out.

Mining of the base of the Nobles Nob pit will include:

1. Dewatering the Nobles Nob Pit for access;
2. Re-establishment of safe access via existing pit ramp;
3. Excavation of winnable ore from pit floor;
4. Processing of ore on site; and
5. Any works required to leave the pit in a safe state for possible future mining activities.

Equipment:

- Excavator
- Off Highway Haul Trucks

4.3 Mining Reserves and Geology

The prospects lie within the Proterozoic Warramunga Group, which comprises sediments, volcanic lavas and volcaniclastic sediments. The mineralisation occurs within lenticular bodies rich in hematite. These are replacement bodies which cut across sedimentary structures and have been referred to as "ironstones" by previous workers. The hematite bodies are favourably situated in second order anticlinal folds, especially in domal positions or within faults or shear zones.

Tennant Creek-type ironstone bodies grade upwards from chloritic alteration into stringer zones of chlorite-magnetite, coalescing higher into massive ore bearing magnetite +/- hematite, topped with talc-dolomite.

Table 4-1. Statement of Mineral Resource Estimates

	JORC 2012 MRE*			
Prospect	**Classification**	**Tonnes**	**Grade**	**Ounces**
Nobles SWD	**Indicated**	1,320,000	1.12	47,500
Nobles Nob	**Indicated**	173,000	2.20	12,300

*Note: work is currently underway to classify Nobles Nob using JORC 2012. This resource is currently classified using JORC 2004

4.4 Mining Performance against Previous MMP

This is the first MMP for this operator and no mining activities have yet taken place.

5 PROCESSING ACTIVITIES

5.1 Treatment and ore processing

It is proposed for an existing gold processing plant to be transported to, and re-established and commissioned onsite. Once relocated, the process equipment is subject to a detailed plant condition and refurbishment report. The plant will be placed within the area previously used as a processing plant during historic mining operations. Required site infrastructure will be placed within the historic disturbance footprint, with the only exception being the solar field. This includes ore treatment plant, power generation plant, sewerage treatment plant, tailings treatment pad, process water dam, and site buildings and office.

Ore processing will use a conventional Carbon in Leach (CIL) process, utilising Cyanide (CN) in solution to dissolve contained gold. Once the processing plant is operational, it is proposed to initially process the material from the Southern WRD and 'Goodbye cut' as outlined in the Mining Activities section above. Ore processing consists of a series of physical and chemical separation processes to separate out the gold, as outlined below. With the final product of gold doré bars for export.

Ore crushing is a three-stage process involving a primary jaw crusher, secondary crushing, and tertiary cone crushers to reduce the 'Run of Mine' (ROM) ore feed material to a P80 (80% of material passing) sizing of 10 mm. This 10 mm ore is then fed into a ball mill together with water. The ball mill produces a smaller P80 material sizing of 106 microns in slurry. This slurry is then fed into a gravity separation circuit together with Quicklime. Quicklime is added to the mill feed for mixing and to maintain pH levels in the subsequent leach tanks that are sufficiently alkaline to hold CN in solution.

The gravity separation circuit consists of hydrocyclones which physically separate the heavy (gold) and coarse fractions of material, thus removing 'free gold' from the slurry feed. The heavier gold-bearing fraction is directed to a centrifugal concentrator; whereas the lighter and finer fractions report directly to the leach tanks.

The centrifugal concentrator further physically separates the gold-bearing fraction. This gold-bearing concentrate is then directed to an Acacia reactor; and the balance of the material is directed to the leach tanks.

The Acacia reactor uses an intense cyanidation process in conjunction with sodium hydroxide, to dissolve contained gold. This pregnant solution is directed to a dedicated electro-winning circuit, which forms a gold solid on steel wool electrodes. This solid is then smelted to form gold doré bars.

The bulk of the ore feed is contained in the 'lighter and finer' fractions which are split at the gravity circuit. This, together with the balance of material from the centrifugal concentrator, report to the leach circuit. The leach circuit consists of a standard CIL circuit, involving 8 tanks (each 8.3 m diameter and 8.5m height) which are mechanically agitated.

Liquid cyanide is dosed into the first tank, and the first two tanks (the leach tanks) have compressed air injected at the base providing oxygenation, to enhance gold leaching. The remaining 6 tanks (the adsorption tanks) have granular (+2 mm) activated carbon added, which captures the gold in solution. The quantum and collective volume of the tanks provides the necessary 'residence time' required for gold leaching, and for gold to carbon attachment to take place. Slurry is moved progressively from tank to tank via launders from one to the next. Slurry from the last tank is pumped through a screen separating the 'loaded carbon' from the leached material. The loaded carbon is sent to an Elution circuit; and the remaining leached material is sent to tailings.

Tailings have a flocculant added and are directed to Geotubes within the tailings storage facility, where rapid dewatering occurs. Solids are settled and contained within the Geotubes; and nominally 80% of contained water is recovered and returned to the processing circuit. See Section 5.2 below for further details.

Loaded carbon from the leach tanks reports to the Elution circuit, where it is washed. Wash water is returned to the leach tank circuit. Cleaned loaded carbon is then acid washed to remove impurities and transferred to

a pressure elution circuit where gold is stripped from the carbon under pressure and heat, using sodium hydroxide. The stripped pregnant gold-bearing solution is directed to an electro-winning cell to form a gold solid on steel wool electrodes as previously described, and then smelted into gold doré bars. The stripped solutions are reused in closed circuit and introduced to the front of the leach tank circuit. The stripped carbon is "regenerated" using heat, at circa 750 degrees centigrade in a regeneration kiln, refreshing and reactivating its surfaces for adsorption performance and reuse.

The chemical processing reagents used are:

- Quicklime in bulk dry powder form for mill feed addition;
- Sodium Cyanide in solid form for mixing and leach tank addition;
- Sodium cyanide in solution for intense leach reactor use;
- Sodium Hydroxide in 1,000 litre pods; and
- Hydrochloric acid in 1,000 litre pods.

5.2 Tailings Treatment and Storage Facility

As part of the proposed processing operations, it is proposed that Geotubes will be implemented as the main dewatering system for slurry tailings material outputted from the processing plant. Geotubes are an effective dewatering technology fabricated from an engineered textile. By adding a flocculant to the slurry, the tubes provide containment of fine solids inside the tubes while allowing water to permeate through the engineered textile.

ATC Williams Geotubes Platform Concept Design Report (Appendix D) was developed to assess possible scenarios of Geotubes stacking to contain a total in-situ volume slurry of 642,850 m^3 over 1.5 years (18 months) within the Nobles Nob mine lease boundaries. The conceptual options for Geotubes positioning and the required quantities were studied by considering water management options and geotechnical considerations.

It is proposed to use Geotubes Dewatering Technology to treat and store the tailings from the proposed operations. This will involve construction of Geotube treatment pads of approximately 7.5 ha, which will be placed adjacent to the processing plant, within the existing disturbance footprint. Pad areas shall be lined with an impermeable barrier. As the Geotubes dewater they will drain into the process water dam. Water will then be reclaimed and reused for processing. This approach will materially reduce the environmental impacts and long-term stability issues of traditional open tailings dams, and significantly reduces water and cyanide requirements during processing. It is estimated that 70% of process water can be reclaimed for use.

As shown in Figure 5-1 it is proposed to stack Geotubes in five horizontal layers with a total length of 11,704 m (311.1 m in length and 184.2 m in width). The proposed configuration shall occupy an area of the prepared platform around 57,305 m^2 (5.73 ha) to accommodate the required tailings deposition volume per the plant production rate. The total Geotubes platform area proposed is approximately 7.5 ha, for the flat area of the geopad platform and approximatley 9 ha including the earthworks batters and the wider disturbance footprint.

A typical cross section for a five stacked Geotubes configuration is shown in Figure 5-1 and Figure 5-2.

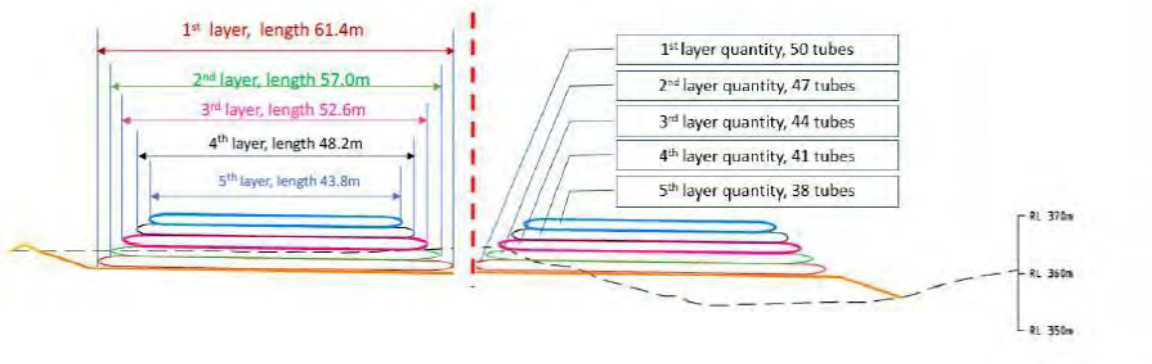

Figure 5-1. Plan view and cross-sections of the proposed geotubes

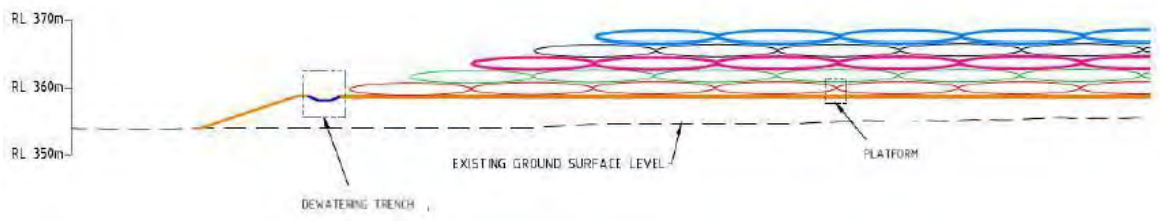

Figure 5-2. Example of stacked geotubes

The geotube platform will be prepared horizontally on a level surface. The drainage aggregate may vary in depth to allow a flat platform beneath the Geotubes.

The foundation and platform preparation will require general earthworks; and any borrow materials are expected to be excavated from the existing tailings embankment in close proximity to the works area, as directed by TCMG. Excavated materials would most likely be suitable for use within an inner zone of the platform foundation and bounds, assuming the material is not dispersive and contains some granular structures. Construction of the platform requires excavation of a significant portion of the existing TSF embankment and landform. Additional borrow material may be needed for the proposed operations and should be sought from areas within the general extent of works wherever possible.

The platform base will include a lining and drainage system to support the placement of the Geotubes and collection of water and return to the process plant. A typical cross section of prepared platform for the Geotubes includes the following (from top of surface to subgrade):

- Drainage Gravel; nominal 300 mm (depth to vary to provide a level platform directly below Geotubes);
- Geomembrane Liner (HDPE or BGM) and protective geotextile; and
- Compacted earth fill; 400 mm.

The surface of the gravelly layer immediately underneath the stacked Geotubes shall be level to avoid any instability issues. Bleed water from the Geotubes will flow through the drainage gravel to the perimeter drains.

Effluent from the Geotubes is likely to contain pollutants that should not be discharged directly to the downstream waterways. It is therefore proposed that the Geotubes platform captures process water expressed from the Geotubes within a sump and bunding around the low side of the platform. Water captured within the sump will be pumped to the Process Pond, where it will be re-used as process water within the processing plant. In extreme rainfall events, runoff can overtop the sump and discharge to the Pit for containment. All surface water runoff from the Geotubes operational and processing areas are proposed to be captured within site conveyance systems and directed to the Pit (in extreme events) to prevent contact water discharges to downstream watercourse(s).

Figure 5-3 indicates the overall surface flow diversion strategy. Refer to ATC Williams Water Management Report (Appendix E) for further details regarding the water management system proposed for the Geotubes operations.

A bund is also proposed along the eastern boundary of the platform to provide a containment volume if a tube failed. The volume is sized for the largest tube (approximately 2 ML). If a failure occurred during heavy rainfall, the flow from a failure could overtop the proposed bund and discharge NE to the Pit for additional containment. Under an extreme rainfall event, another possible but unlikely failure scenario is a tube failing and discharging to Peko Road from the western or southern side of the platform. A Consequence Category Assessment (CCA) in accordance with ANCOLD is presented in ATC Williams Water Management Report (Appendix E) and concludes the proposed storage structures fall under ‘a Minor’ consequence category.

Further details are included within the ATC Williams Geotubes Platform Concept Design report (Appendix D).

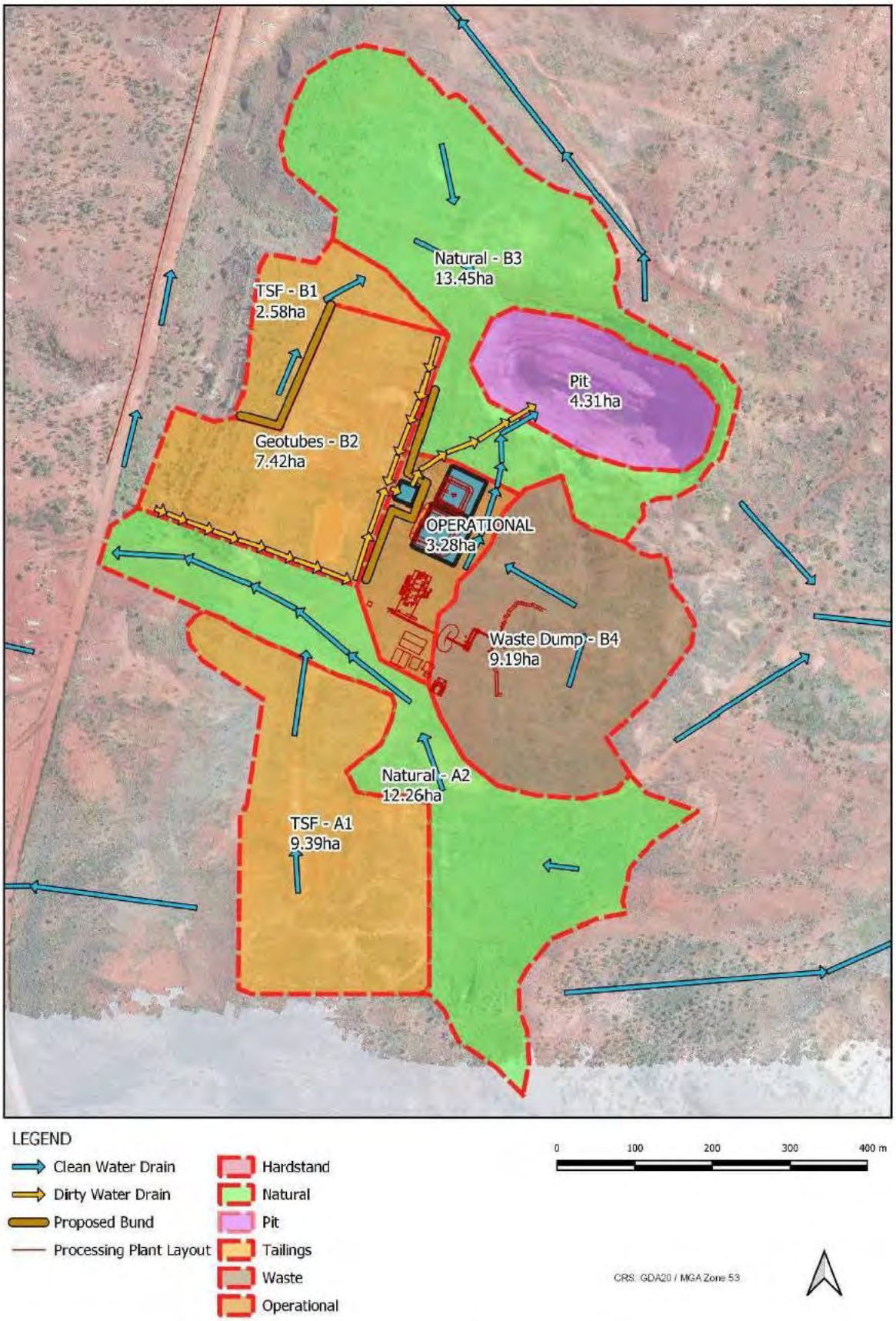

Figure 5-3. Proposed surface water diversion system

5.3 Process/Mine Water Dams

The process water dam will be constructed adjacent to the Geotube platform. Further detail of this is included in the Geotubes concept design and water balance model report (Appendix D).

Process water will be sourced from two locations. The first and primary supply from the adjacent Juno mine site; and the second from the town water supply as a potential top up and back up supply source. Town water will also provide a source of potable water for use on site. Approvals for water extraction and access are currently underway.

Transport of water from the Juno mine site will be via a pipeline from Juno to Nobles Nob. Construction of a pipeline will be undertaken as part of this MMP. The pipeline corridor is located on Warumungu Aboriginal Land Trust freehold land, which has previously been approved and cleared and land access has previously been granted for this purpose. TCMG are currently in communication with the CLC to seek permission to re-establish the pipeline. The town water supply will also require a pipeline extension from existing infrastructure of approximately 3 km. It is planned to r0un this pipeline along the existing road verge of Peko Road to avoid the need to clear any new area. Permission will be sought from the Department of Infrastructure, Planning and Logistics (DIPL) prior to carrying out any works.

5.4 Power and water supply

5.4.1 Power supply

The expected power demands of the Project are estimated to be 3.0 MW on an annual average load basis. It is planned to supply this demand by generation on site with a total installed operational capacity of 4MW, which will easily meet demand. With a hybrid solar and diesel power station which consists of: Diesel + Battery + Solar (hi penetration). Including 4 x 1250 kW peak rated diesel generators coupled with a 2 MW/0.5 hr battery and a ~4 MW solar array. A staged approach is planned to test and add solar, with the goal being to run day operations on solar power when feasible. The solar array will be placed within a 4 ha area to the west of the processing plant (on MLC540), as indicated in the site layout shown in Figure 1-4.

Diesel fuel tanks will be stored on site to supply the diesel generators and their day tanks, with up to 4 x 110 kL tanks planned. This will cover two week's supply of fuel, and longer when solar is being used. These tanks will be placed in an appropriately designed and bunded fuel facility, and or self- bunded containerized tanks shall be used.

5.4.2 Water supply

The expected water demands of the Project are estimated to be 12 L/s for initial operations and a total of 15 L/s once satellite mining operations for mill feed commence. This includes processing operations, dust suppression and other site water demands. It is planned to access water supply from two key points. The first is by accessing groundwater from the existing Juno mine shaft, located on MLC579. A groundwater extraction licence application has been submitted to the Department of Environment, Parks and Water Security concurrently with this MMP. It is planned to initially dewater the Juno mine workings from within the Juno mine shaft, and to extract water from the underlying aquifer following that. Water will be pumped into a pipeline, which will transport the water over to the processing plant located at Nobles Nob (MLC539), with a total pipeline length of approximately 5 km. A Sacred Sites Clearance certificate has previously been granted by the CLC for this purpose, and TCMG have made a new application for the proposed operations and to ensure that land access for this purpose is agreed. Juno is expected to supply approximately 7 L/s of Project water demands on a long-term basis. It can supply materially more than this for periods of time if required while initially dewatering the old Juno workings. Water quality is deemed appropriate for use as process water and for dust suppression activities.

The balance of the water requirement is planned to be accessed from the Tennant Creek town water supply via the existing Peko water Pipeline located approximately 4 km north of the Nobles Nob mine site. This pipeline is owned by the Peko mine site tenement holders and connects to town water supply at One Tank

Hill. An access agreement is currently being negotiated between TCMG and the Peko mine site tenement holders to access their infrastructure and arrangement with the Power and Water Corporation. This will supply the balance of water requirements of the Project being 5 L/s Initially and up to 8 L/s as satellite deposit operations are commenced. Town water will also provide a source of potable water for use on site.

Stored capacity in both the Juno and town water systems provide short term redundant capacity for each other, and surety of water supply for maintaining operations in the event of failure within either system.

5.5 Wastewater treatment system

Wastewater from amenities will be directed to a septic system designed and constructed in accordance with the Code of Practice for Onsite Wastewater Management (July, 2014).

6 EXPLORATION ACTIVITIES

To date, there are 2,249 historic drill holes in the Nobles Nob deposit assay database. These drill holes include 774 diamond drill core (DDH), 702 reverse circulation holes (RC), 100 aircore (AC), 23 rotary air blast (RAB), nine open hole percussion (PERC) and seven underground diamond drill core (UGDDH). Most of the DDH and RC holes were inclined 60° to the north. Samples were collected at one-metre intervals as per standard drilling procedures. DDH holes included HQ, NQ and BQ core diameters.

Exploration activities are planned to continue to assess the viability of further extensions of the Nobles Nob pit; the potential to mine existing historic tailings dams located on site; as well as the nearby Rising Sun and any other viable deposits on site. If assessed to be viable, mining of these deposits may be included within a future amendment application to the current MMP.

TCMG propose to drill 11 holes (each within a 20m x 20m drill pad area) at Juno mine site as shown below in Table 6-1 and Figure 6-1. The total area of drill pads to be cleared is 0.4 ha, with some overlapping between drill pads, as shown below in Figure 6-2. This is the total area of disturbance from drilling activities. No costeons, bulk sample pits, line/track clearing, water bores, or camp areas will be required. Drilling is considered unlikely to encounter groundwater.

Table 6-1. Proposed drilling at Juno

Hole ID	Easting	Northing	RL	Max depth	Hole type
phase_1001	420,340	7,821,284	349	197	RC
phase_1002	420,350	7,821,288	350	192	RC
phase_1003	420,330	7,821,298	350	209	RC
phase_2001	420,370	7,821,317	350	196	RC
phase_2002	420,380	7,821,308	349	193	RC
phase_3001	420,430	7,821,297	349	193	RC
phase_3002	420,430	7,821,267	349	163	RC
phase_3003	420,420	7,821,271	349	180	RC
phase_3004	420,440	7,821,320	348	204	RC
phase_4001	420,470	7,821,317	347	198	RC
phase_4002	420,480	7,821,357	347	221	RC

Figure 6-1. Location of proposed drill holes at Juno

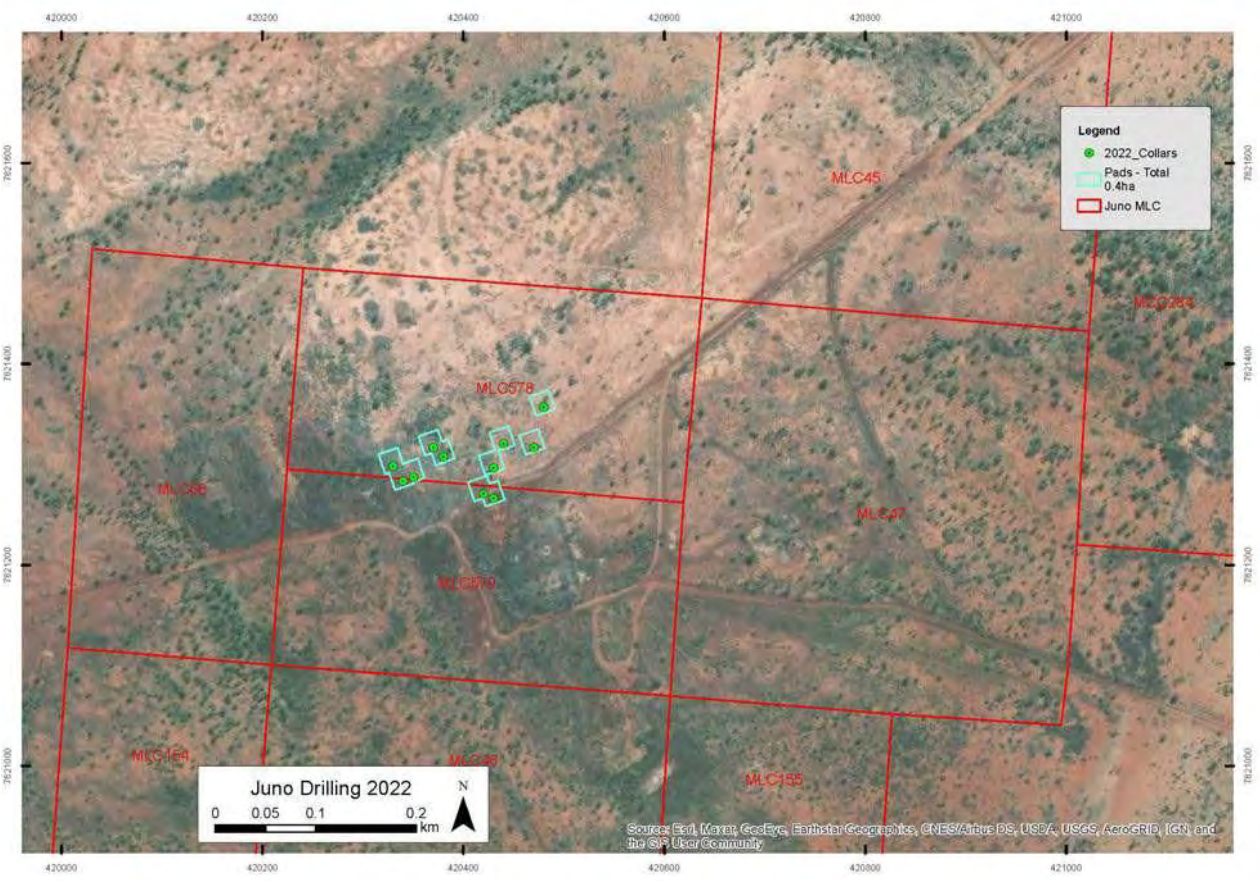

Figure 6-2. Location of proposed drill pads at Juno

TCMG propose to drill 54 holes (each within a 20m x 20m drill pad area) at Nobles Nob mine site. Information on the proposed drill holes are provided in Table 6-2 and location in Figure 6-3, with closer detail of each drill area shown in Figure 6-5 (Nobles Nob West), Figure 6-6 (around Nobles Nob pit) and Figure 6-7 (Weabers find, east of the pit). The total area of drill pads to be cleared is 1.6 ha, with some overlapping between drill pads, as shown below in Figure 6-4. This is the total area of disturbance from drilling activities. No costeons, bulk sample pits, line/track clearing, water bores, or camp areas will be required. Drilling is considered unlikely to encounter groundwater.

Table 6-2. Proposed drilling at Nobles Nob

Hole ID	Easting	Northing	RL	Max depth	Hole type
46	424,610	7,820,032	213	162	RC
45	424,621	7,820,009	213	163	RC
44	424,629	7,820,025	207	170	RC
43	424,634	7,819,993	203	175	RC
35	425,830	7,820,112	209	167	RC
34	425,820	7,820,099	197	171	RC
24	425,840	7,820,066	199	173	RC
18	425,799	7,820,086	205	174	RC
29	425,709	7,820,168	199	184	RC
23	425,870	7,820,054	185	186	RC
31	425,700	7,820,154	191	192	RC
22	425,880	7,820,048	181	193	RC
32	425,720	7,820,150	188	195	RC
26	425,830	7,820,091	176	200	RC
20	425,860	7,820,079	152	230	DDH
30	425,650	7,820,169	147	245	DDH
21	425,860	7,820,055	88	285	DDH
36	425,890	7,820,065	140	290	DDH
16	425,749	7,820,125	96	299	DDH
27	425,789	7,820,138	84	313	DDH
19	425,849	7,820,126	61	335	DDH
17	425,799	7,820,104	37	339	DDH
28	425,769	7,820,168	58	343	DDH
25	425,840	7,820,122	43	366	DDH
33	425,780	7,820,139	29	378	DDH
38	425,960	7,820,142	299	91	RC
37	425,950	7,820,133	294	103	RC
39	425,970	7,820,108	260	137	RC

Hole ID	Easting	Northing	RL	Max depth	Hole type
15	426,012	7,820,027	264	144	RC
40	426,040	7,820,054	112	288	DDH
41	426,050	7,820,052	109	292	DDH
42	426,060	7,820,049	104	297	DDH
11	425,879	7,820,274	336	41	RC
14	425,894	7,820,246	335	43	RC
10	425,874	7,820,247	333	46	RC
12	425,884	7,820,278	330	47	RC
13	425,889	7,820,246	331	49	RC
4	425,870	7,820,263	330	51	RC
5	425,870	7,820,237	375	55	RC
9	425,859	7,820,259	319	59	RC
7	425,864	7,820,257	316	62	RC
8	425,854	7,820,259	316	62	RC
56	426,830	7,819,942	309	49	RC
54	426,860	7,819,936	307	50	RC
52	426,840	7,819,935	306	52	RC
48	426,820	7,819,942	303	56	RC
47	426,820	7,819,936	303	56	RC
57	426,810	7,819,940	302	57	RC
49	426,820	7,819,932	299	61	RC
50	426,800	7,819,938	298	62	RC
51	426,800	7,819,932	297	63	RC
55	426,860	7,819,930	291	69	RC
58	426,810	7,819,936	289	72	RC
53	426,840	7,819,927	281	81	RC

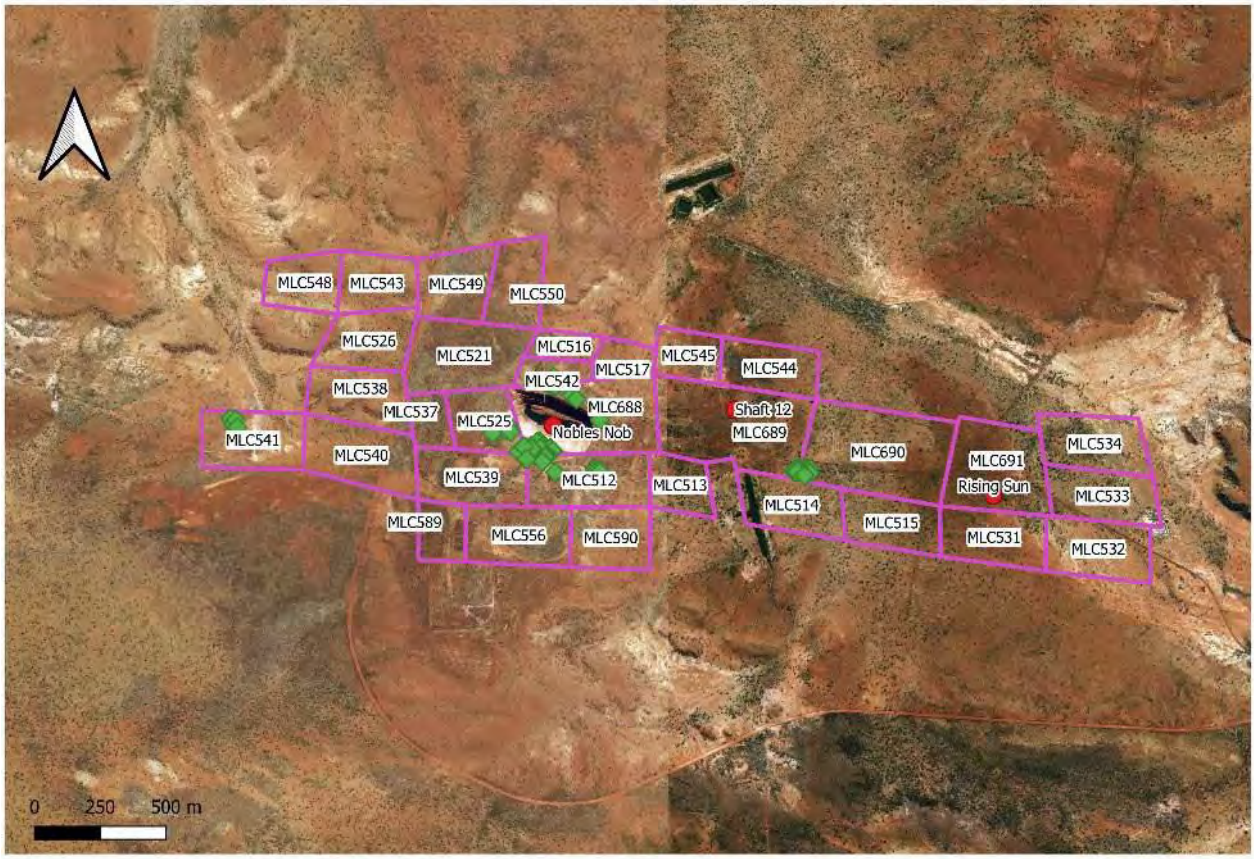

Figure 6-3. Location of proposed drill holes at Nobles Nob

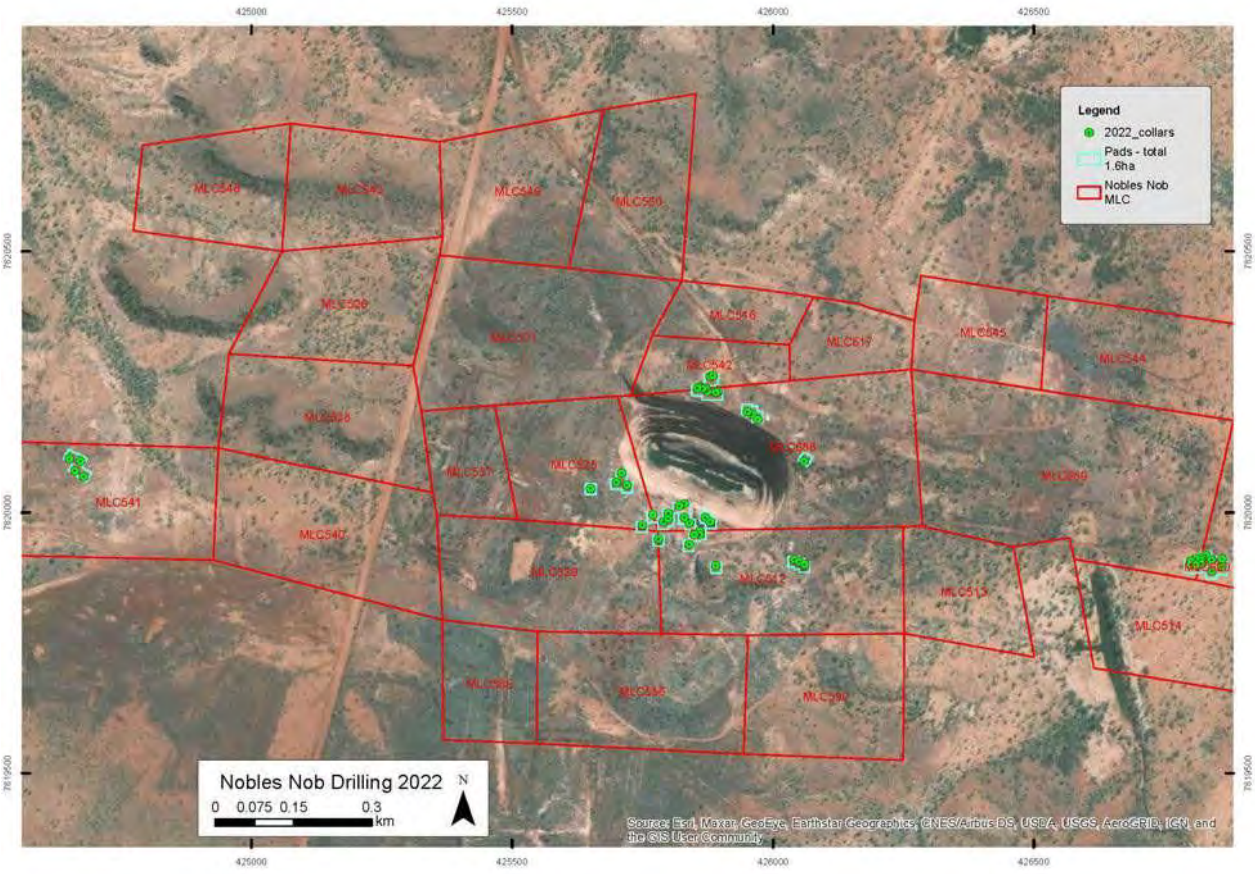

Figure 6-4. Location of proposed drill pads at Nobles Nob

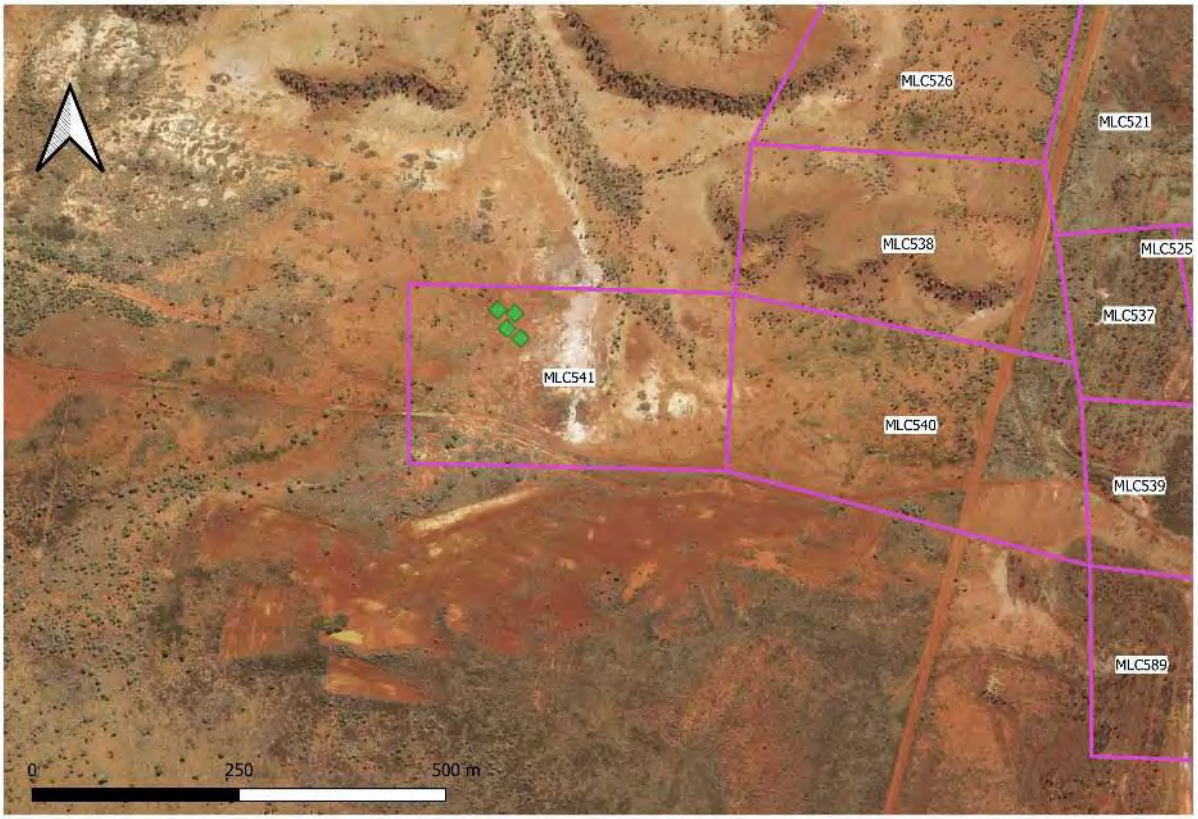

Figure 6-5. Location of proposed drill holes at Nobles Nob West

Figure 6-6. Location of proposed drill holes at Nobles Nob pit

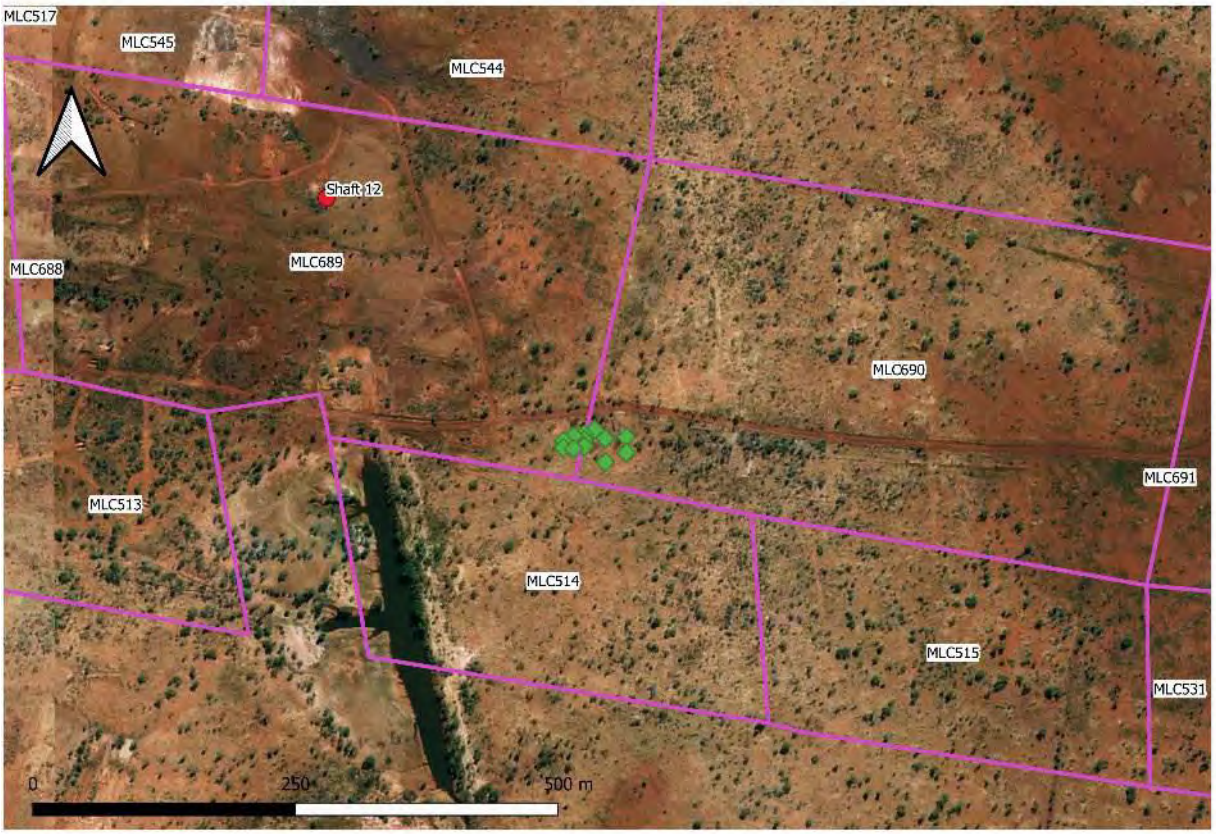

Figure 6-7. Location of proposed drill holes at Weabers Find

7 ENVIRONMENTAL MANAGEMENT SYSTEMS

TCMG activities will be carried out so as to protect the health of management, staff, employees, contractors, key stakeholders and community while paying proper regard to the protection and management of the environment. The primary goal of TCMG's operations is to maintain the highest environmental standards.

7.1 Environmental Policy

Refer to Appendix G for TCMG's Environmental Policy.

7.2 Environmental Management Structure

TCMG will maintain over-arching responsibility for complying with this MMP and the conditions of all approvals, permits and licences issued for the Project. The Mine Manager will be responsible for environmental compliance for all staff and contractors.

7.3 Environmental Commitments

There are no environmental commitments to be reported upon under this section. The Project has not required any formal assessment and therefore there are no commitments arising out of this process.

7.3.1 Commitments Contained in the MMP

Section 8.3 below is the Environmental Management Plan (EMP) identifying planned activities.

TCMG will continue to commit to environmental management over subsequent MMP submissions. The following commitments will form part of the ongoing Project:

- All of the proposed mining activities and processing will be within the mineral lease boundaries.
- An application to extract groundwater has beeen submitted to Department of Environment, Parks and Water Security (DEPWS). Approval will be sought prior to commencement of extraction.
- An Approval Application form for Wastewater works will be submitted to the DOHs Environmental Health Division.
- The access road will be maintained throughout the Project via grading and dust suppression activities.
- During the first weeks of Project operations samples of runoff water from the TSF will be taken for basic testing so as to ensure that management procedures are adequate.
- Water quality samples will be collected of the water being reused in the plant so as to ensure that it hasn't unexpectedly accumulated or concentrated toxins or pollutants.
- Development and implementation of an Erosion and Sediment Control Plan (ESCP).
- The Water Quality Management Plan (WQMP) included in Appendix J will be implemented.
- All relevant Project personnel, contractors and visitors will undertake a site induction detailing the essential environmental management information for the Project. This will include an explanation of the environmental management structure, environmental policy and requirements of this MMP.
- Emergency and incident response procedures will be presented during inductions and include spill response, equipment failure, storms and fire, and information on reporting requirements.

- Scheduled toolbox meetings with Project workers will keep employees informed of safety and environmental issues, and will ensure continued awareness of environmental management activities.
- All incidents which cause or have the potential to cause material or serious environmental harm will be reported to The Northern Territory Department of Industry, Tourism and Trade (DITT) as required under Section 29 of the Mining Management Act.
- TCMG will progressively rehabilitate Project areas as the Project progresses.
- Weed management will be undertaken for the duration of the Project. All plant, equipment and vehicles will be cleaned prior to arriving at the Project area to ensure that they are free of organic materials that may contain seeds. The presence of existing weeds across the Project will be assessed prior to the commencement of works. Any areas of significant weed infestation will be the target of weed management efforts such as spraying, and/or delineated and identified as no-go areas for vehicles and equipment.
- A register of incidents will be maintained during operations for the Project which will include details about the incident, how it occurred, where and when it occurred, physical actions taken to rectify, remediate or rehabilitate, and operational actions to address the future management of incidents of this type. Where required, accidents and incidents will be reported to DITT via a Notification of an Environmental Incident form.
- The agreed end land use is for the site to be safe and stable.
- The site will be assessed after the first substantial rain event post closure, so as to remedy any potential rehabilitation issues and ensure that the stability of the tailings storage facility has not been impacted. Corrective actions will be taken if required.
- When appropriate TCMG will provide a report on rehabilitation success so as to start the process towards relinquishment of the site and return of the bond.
- A care and maintenance program would be developed within one week of temporary suspension of operations.

7.3.2 Recommendations Resulting from Formal Environmental Assessment

No formal environmental assessment under the *Environmental Assessment Act* (*EA Act*) has occurred within the last ten years for the Project, as no mining or proposed mining activities have been undertaken.

The proposed Project underwent a risk assessment during a workshop between the proponent and EcOz Environmental Consultants. During that workshop, the Environmental Assessment Guidelines were examined to determine whether the Project needs to be referred to the NTEPA or not. The risk assessment also compared Project information to the self-assessment tool of the EPBC Act.

The Project and planned actions were assessed as to whether they are likely to have a significant effect on the environment. The significant effect – matters considered by the NT EPA identified in the NT EPA document “Referring a Proposal to the NT EPA” were utilised in this consideration.

It was determined through this process that the Project did not require referral to either the NT EPA for assessment under the EA Act, nor the EPBC Act.

7.4 Environmental Training and Education

All relevant Project personnel, contractors and visitors will be presented with a site induction detailing the essential environmental management information for the Project. This will include an explanation of the environmental management structure, environmental policy and requirements of this MMP.

Emergency and incident response procedures will be presented during inductions and include spill response, equipment failure, storms and fire, and include information on reporting requirements.

Scheduled toolbox meetings with Project workers will keep employees informed of safety and environmental issues, and will ensure continued awareness of environmental management activities.

7.5 Environmental Emergency Preparedness and Response

The Mine Manager is the contact person for all emergencies and environmental incidents. All incidents which cause or have the potential to cause material or serious environmental harm will be reported to DITT as required under Section 29 of the *Mining Management Act*.

The details of the designated contact persons for emergencies and environmental incidents are included in Table 7-1. This includes contacts for reporting environmental incidents (including non-urgent problems such as dust/noise), heritage and Aboriginal cultural heritage incidents, and contacts for provision of advice.

Table 7-1. Emergency contact details

Contact	Contact Details
Mine Manager	Matt Golovanoff 0414 867 084 matt@tennantmining.com.au
DITT Mining Operations	GPO Box 4550, Darwin NT 0801 08 8999 6528 mineral.info@nt.gov.au
Aboriginal Areas Protection Authority (AAPA)	AAPA 08 8999 5511 Enquiries.aapa@nt.gov.au
Heritage Branch	Level 1 Arnhemica House, 16 Parap Road, Parap NT 0820 08 8999 5039 Heritage@nt.gov.au
NT Police/Fire/Ambulance	000
NT Fire Rescue Service	08 8999 3473
Tennant Creek Fire Station	08 8962 0903

Spill Response Procedure

In the event of any spill, the following procedure is to be implemented:

- Locate the source of the spill, identify the volume and type of spill;
- Assess the risk to workers and the environment from the spill to ensure appropriate PPE and containment measures are implemented;
- Control and contain the spill by isolating and/or removing the source;
- Clean the spill using spill kit absorbent material if practical, or installing bunds;
- Collect all contaminated material and dispose of contaminated spill control material, and/or contaminated materials to an appropriately licenced waste facility; and
- Report significant spills, or spills that entered a waterway to DITT via a Notification of an Environmental Incident form.

Appropriately stocked spill containment equipment kits will be available in all works areas. All personnel on site will be trained in the use of spill kits.

7.6 Reporting

Table 7-2 below indicates the statutory reporting requirements for the Project.

Table 7-2. Statutory Reporting Requirements

Statutory Reporting	Required By	Frequency	Responsible Person
Mining Management Plan	Department of Industry, Tourism and Trade	Annually	Project Manager
Employment, Injury and Safety Statistics	NT Worksafe	Annually	Project Manager
Tenement Annual Reports	Department of Industry, Tourism and Trade	Annually	Tenement Administrator
National Pollutant Inventory Reporting	Department of Industry, Tourism and Trade	Annually	Project Manager
Production Statistics	Department of Industry, Tourism and Trade	Annually	Project Manager
Water Sampling Raw Results	Department of Industry, Tourism and Trade	Quarterly	Project Manager
Water Quality Report	Department of Industry, Tourism and Trade	Annually	Project Manager

7.6.1 Environmental reporting

In the event of a serious accident or incident the DITT Chief Executive Officer will be notified of the occurrence as soon as practicable as required by section 29 of the Mining Management Act.

8 IMPLEMENTATION, MONITORING AND REVIEW

8.1.1 Identification of Environmental Aspects and Impacts

Environmental aspects are the elements of TCMG and/or its contractor's activities within the Project area that interact or can interact with the environment (e.g. excavations, processing, hauling, fuel storage, vehicle and machinery movements, etc.).

TCMG will identify and assess any activity which may cause an impact (either positive or negative) to the environment. This includes aspects from mining, operations, screening, processing and storage areas. When identifying aspects, consideration will be given to potential emergency situations, normal and abnormal operating conditions.

Environmental impacts are any change to the environment, whether adverse or beneficial, wholly or partially resulting from TCMG and/or its contractor's activities.

A risk assessment of the potential and actual impacts for each of the identified environmental aspects is presented in Appendix H using the likelihood and consequence categories in Table 8-2, Table 8-3 and the risk matrix and key presented in Table 8-1.

Table 8-1. Risk matrix and key

		Consequence				
Likelihood		1	2	3	4	5
	A	1	3	6	10	15
	B	2	5	9	14	19
	C	4	8	13	18	22
	D	7	12	17	21	24
	E	11	16	20	23	25

Red	Extreme risk	Intolerable
Orange	High risk	Intolerable or tolerable
Yellow	Moderate risk	Tolerable or acceptable
Green	Low risk	Acceptable

Table 8-2. Likelihood categories

Qualitative measures of likelihood categories		
A	Rare	Highly unlikely, will only occur in exceptional circumstances. Has never occurred in association with an development in the region.
B	Unlikely	Could occur at some time but unlikely. Has only occasionally occurred in association with an development in the region.
C	Moderate	Might occur at some time. Has previously occurred in similar developments.
D	Likely	Known to occur or will probably occur. Has occurred several times in association with recent developments.
E	Almost certain	Common or repeating occurrence. Is expected to occur several times over the duration of an development in the region.

Table 8-3. Consequence categories

Consequence categories		
1	Insignificant	No measurable impact on the environment or social values
2	Minor	Some, minor, temporary environmental and/or social impact
3	Moderate	Contained temporary, or permanent minor, localised environmental damage or social impact
4	Major	Severe environmental and/or social impacts
5	Catastrophic	Environmental disaster

8.2 Risk assessment

Appendix H shows the risk assessment of the potential and actual impacts for each of the identified environmental aspects.

8.3 Environmental Management Plan (EMP)

The following section provides information regarding the implementation of environmental management measures to ensure the potential risks to the receiving environment are mitigated. The tables below provide a summary of how this EMP will be implemented to address the potential impacts associated with the Project operations. This includes the management actions, targets / performance indicators, monitoring, corrective actions and contingencies, and reporting and record keeping mechanisms.

8.3.1 Soil erosion and sediment management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC). • Erosion and sediment control measures will be maintained regularly and after rainfall events. • Erosion and sediment control measures will not be removed until disturbed areas have been stabilised.	• No detection of erosion within the Project area • No sedimentation of surrounding environments	• Visual monitoring for erosion within the Project area • Water quality performance will be monitored through the Water Quality Monitoring Plan (WQMP).	• Fix erosion issues and review ESCP and amend where necessary	• Incident reporting records • Water quality database

8.3.2 Water quality and quantity

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• An ESCP will be implemented to prevent sediment entering watercourses. • Fuel, oils and chemicals will be appropriately stored and bunded according to the National Standard for the Storage and Handling of Workplace Dangerous Goods and any other relevant Australian standards. Including the Australian Standards for *The storage and handling of flammable and combustible liquids* (AS 1940); *Tanks for flammable*	• No detection of erosion within the Project area • No sedimentation of surrounding environments • No indication of spills of chemicals	• Visual monitoring for erosion within the Project area • Regular inspections of chemical and hazardous substance storage areas through operational	• Fix erosion issues and review ESCP and amend where necessary • Review storage and handling practices for chemicals and hazardous	• Incident reporting records • Water quality database

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
combustible liquids (AS 1962); *The storage and handling of corrosive substances* (AS 3780); and *The storage and handling of toxic substances* (AS/NZS 4452). • Fit for purpose spill kits to be positioned at refuelling and storage areas. • All personnel on site will be trained in use of spill kits, in the event of a spill. • The Water Quality Management Plan (WQMP) included in Appendix J will be implemented.	or hazardous substances. • Any spill of stored product is contained and remediated through the spill response procedure. • No leaks from equipment. • No contamination of groundwater. • No leaching from tailings storage facility.	activities. • Water quality performance will be monitored through the WQMP.	substances. • Increase the amount of bunding and containment for chemical and hazardous substance storage areas. • Increase the number, capacity or type of spill kit materials.	

8.3.3 Air quality

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Dust generated during site activities will be managed through dust suppression activities. • Community notification will be undertaken, where work is likely to cause impact on the public and nearby residents. • No burning of vegetation or other materials will be permitted on site. • Exhaust emissions from plant and equipment will be minimised by maintaining equipment in accordance with manufacturer's specifications and undertaking periodic visual checks of exhaust systems. • Any vehicle transporting waste or other materials that may produce odours or dust will be covered during transportation.	• No complaints regarding dust and air quality	• Visual monitoring for dust within the Project area • Regular inspections of plant and equipment.	• Implement more dust suppression activities where required • Plant and equipment maintenance where required	• Incident reporting records • Complaints database

8.3.4 Noise and vibration

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• All reasonable practical steps will be undertaken to reduce Project activity noise and vibration from the site.	• No complaints regarding noise and vibration	• Regular inspections of plant and equipment.	• Implement noise monitoring if required due to complaints • Plant and equipment maintenance where required	• Incident reporting records • Complaints database

8.3.5 Flora and fauna

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Clearing of vegetation for the solar field will be kept to the minimum area required for infrastructure construction and maintenance • Minimal ground disturbance other than removal of vegetation • • Construction of solar field and underlying drainage to avoid erosion and sedimentation resulting from the cleared area • Enforce speed limits on site access roads.	• Top soil remains *in situ* below solar field • No detection of erosion within the solar field area • No sedimentation of surrounding environments • No incidents of fauna strike	• Daily inspections during clearance works • Regular inspections of solar field and surrounds for erosion and sedimentation • Regular inspections of working areas for fauna strike	• Review equipment used for clearing and construction of solar field • Review solar field drainage • Review speed limits across site • Review induction/staff training	• Incident reporting records • Incident report to be completed for all fauna injuries or death.

8.3.6 Cultural and historical heritage

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping

• Copies of AAPA and CLC Certificates and access Permits will be kept on site at all times
• Conditions attached to any AAPA Certificate will be complied with, such as:
  • All works are to be confined to the 'subject' land identified on the Certificate.
  • All activities conducted by the Company are covered in the 'Purpose of Use' on the certificate.
  • All conditions on the Certificate are adhered to.
  • The Company, its employees and all subcontractors are aware of the conditions of the Certificate.
• A stop works will be implemented if artefacts are located during activities on site. The PM will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.
	• No damage to cultural or historical artefacts or sites	• Regular inspections of working areas	• Review staff inductions and training	• Incident reporting records
				• Report/liaise with NT Heritage Branch

8.3.7 Waste management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Waste generated from site activities will be sorted and amounts estimated and recorded. • Remove from the site and dispose of all waste materials, including green waste, food scraps and other putrescible wastes, Project waste, chemicals and effluent in an appropriate manner, in approved legal waste disposal sites or facilities. • Where available, waste suitable for reuse or recycling will be reused or recycled. • Materials and products with recycled content will be proposed for the works wherever these are cost and	• No waste issues on site	• Regular inspections of working areas	• Review staff inductions and training • Review waste management actions	• Waste records

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
performance competitive and they are environmentally preferable to the non-recycled alternative. • Waste oil will be sent to approved recyclers, or a licenced disposal facility. • Waste and containers not able to be recycled will be disposed of at a licensed landfill facility.				

8.3.8 Wastewater management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Wastewater from amenities will be directed to a septic system designed and constructed in accordance with the Code of Practice for Onsite Wastewater Management • Sewage treatment plant operated in accordance with relevant standards and maintained to manufacturers recommendations • Management of sewage wastewater in accordance with approved standards and Department of Health code of practice and guidelines • A registered certified plumber will conduct any upgrades required to the wastewater management system (septic) • Development of irrigation management plan for management of grey water	• Design specifications and installation meets requirements • Maintenance and monitoring of Sewage treatment plant in accordance with manufactures recommendations • Plumber registered and certified is upgrades undertaken • No significant impacts on water quality (bacteriological) based on assessment using criteria in Water	• Wastewater effluent quality testing prior to irrigation of grey water to ensure sewage treatment plant is functioning appropriately	• Review sewage treatment plant procedures • Registered certified plumber to undertake an inspection and maintenance as required to sewage treatment plant • Review irrigation procedures	• Maintenance records of sewage treatment plant • Incident register • Water quality database • Report to regulators in accordance with approval and licence conditions.

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
	Quality Monitoring Plan			

8.3.9 Hazardous materials and dangerous goods

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• The handling, storage and transport of hazardous materials and dangerous goods will be in accordance with all relevant legislation, manufacturer's instructions and relevant Safety Data Sheets (SDSs). • Fuel, oils and chemicals will be appropriately stored and bunded according to the National Standard for the Storage and Handling of Workplace Dangerous Goods and any other relevant Australian standards. Including the Australian Standards for *The storage and handling of flammable and combustible liquids* (AS 1940); *Tanks for flammable combustible liquids* (AS 1962); *The storage and handling of corrosive substances* (AS 3780); and *The storage and handling of toxic substances* (AS/NZS 4452). • Employ transporting, handling, storage and application methods that will prevent chemical, fuel and lubricant spillage on the site and adjoining areas. • Spill clean-up equipment and materials, appropriate for the type and quantities of chemicals used on site, must be kept on site at all times during the works and in a readily accessible location. • Clean up spills in accordance with the spill response as follows: • Locate the source of the spill, identify the volume and	• No contamination from spills/use on site	• Regular inspections of working areas	• Review staff inductions and training • Review transport, use and storage of chemicals onsite and amend where neccessary	• Incident reporting records • Report significant spills, or spills that entered a waterway to the NT EPA Pollution Hotline.

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
type of spill; • Assess the risk to workers and the environment from the spill to ensure appropriate PPE and containment measures are implemented; • Control and contain the spill by isolating and/or removing the source; • Clean the spill using spill kit absorbent material if practical, or installing bunds; and • Collect all contaminated material and dispose of contaminated spill control material, and/or contaminated materials to an appropriately licence waste facility. • Report significant spills, or spills that entered a waterway to the NT EPA Pollution Hotline. • Report spills and all environmental incidents to DITT under S29 of the Mining Management Act 2001.				

8.3.10 Weeds and pest management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• All declared weeds will be managed in accordance with the *Weeds Management Act.* • Identification of any declared weed will be reported to the Weeds Branch in accordance with the NT Weeds Management Act. • Weed treatment will be in accordance with the *NT Weed Management Handbook*. • Weed hygiene will be implemented to control movement of machinery, vehicles and personnel in a manner which avoids movement of weed plants, seeds or contaminated soil from	• No new weed occurrences at site • No pests hanging around waste at site	• Regular inspections of working areas for weeds • Regular inspections for pests, especially around waste storage areas	• Review staff inductions and training • Review waste management actions • Review weed management actions	• Weed records

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
infested areas into un-infested areas. • Machinery and equipment will arrive at and depart from the site in a clean condition, free of seed or mud, and pests (i.e. cane toads), with inspection records. • Wastes will be contained and managed on site, including domestic wastes to prevent the introduction of pest species to the Project area. This will include the use of lidded waste containers, regular removal of wastes from site, and inspections of waste containment areas to monitor for pest species.				

8.3.11 Fire management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• No fires will be lit on site. • Water cart on standby during periods of high fire danger. • A water storage tank will be kept on site with water available for use as emergency fire control. • Where fires are accidentally started, they will be extinguished immediately, if appropriate and safe to do so. • Hot works such as welding not to be undertaken on days of total fire ban or high winds. • Smokers appropriate disposal of cigarettes • Vehicles will be maintained.	• No fires started on site	• Regular inspections of working areas to ensure smokers are disposing of butts appropriately, and to ensure no hot works occur during total fire bans or high winds	• Review staff inductions and training • Review management actions	• Incident reporting records

8.3.12 Environmental induction and training

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• All site staff and contractors will be made aware of this MMP,	• No environmental	• Regular inspections	• Review staff inductions	• Incident reporting

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
any environmentally sensitive areas, any culturally significant areas, and their environmental responsibilities.	incidents on site	of working areas	and training • Review management actions	records

8.3.13 Community liaison

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping

• Members of the affected community will be notified of the proposed works prior to their commencement.
• Complaints received will be recorded and attended to promptly. On receiving a complaint, works will be reviewed to determine whether issues relating to the complaint could be avoided or minimised, and works methods will be amended accordingly.
• A register of complaints will be kept by the Company that records:
  • Date and time of complaint
  • Method by which complaint was made (i.e. telephone, letter, meeting, etc.)
  • Name, address, contact telephone number of complainant
  • Details of complaint
  • Action taken in response to the complaint, including follow up contract with the complainant
  • Any monitoring to confirm the complaint has been satisfactorily resolved
  • If no action was taken, the reason for no action being taken.
	• No complaints received	• Regular inspections of working areas	• Review staff inductions and training
			• Review management actions
				• Incident reporting records

8.4 Decision framework

TCMG EMS decision framework is shown in Figure 8-1. This decision framework outlines how the EMS and EMPs are used to inform decisions and management and identifies who is responsible throughout the process.

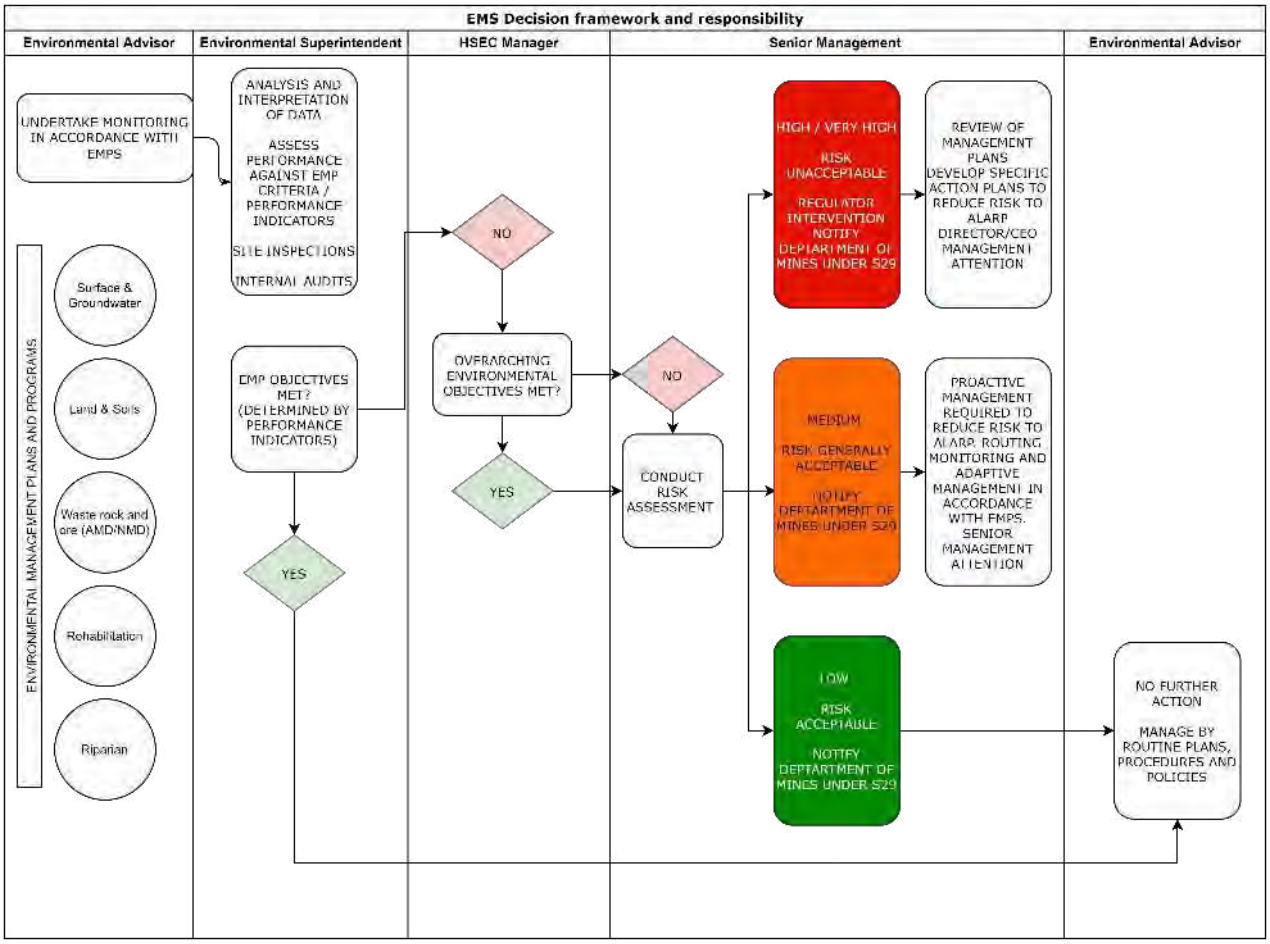

Figure 8-1. Decision framework

9 INCIDENT REPORTING

TCMG is yet to commence operational activities for the Project, and this is their first MMP for the Project. A register of incidents will be maintained during operations which will include details about the incident, how it occurred, where and when it occurred, physical actions taken to rectify, remediate or rehabilitate, and operational actions to address the future management of incidents of this type. Where required, environmental accidents and incidents will be reported to DITT via a Notification of an Environmental Incident form as required under S29 of the Mining Management Act 2001. Any significant pollution events will also be reported to the NT EPA Pollution Hotline.

10 CLOSURE PLANNING

The Project is set to recover ores from the existing Southern WRD and the existing Nobles Nob Pit as a 'good-bye' cut. The majority of the Project site has been previously cleared of native vegetation and topsoil prior to the commencement of the historical mining and ore processing operations. With the exception of a 4 ha area proposed to be cleared for a solar field. The main aim for rehabilitation, is to rehabilitate the site to a safe, stable and sustainable state upon completion of the Project.

Given the history of disturbance of the site, mining of the existing wasterock, and the innovative tailings solutions proposed to be used, rehabilitation will likely improve the overall habitat value of the site compared to its current state.

10.1 Planned closure strategy

10.1.1 Expected disturbance areas

The Project site layout involves the following major infrastructure components:

- Nobles Nob Pit
- Southern WRD
- Processing plant area (including fuel storage and power station)
- Sump, process water pond and raw water pond
- Geotubes TSF
- Solar field
- Workshop/laydown area
- Office/ablutions area

As shown on Figure 1-4, the Project area is very compact and restricted, and other than the solar field, has previously been disturbed. The total disturbance area of the project is approximately 33 ha.

10.1.2 Completion criteria

Completion criteria are important to ensure that a clear definition of successful rehabilitation is established for each rehabilitation area.

The completion criteria for TCMG is to leave the Project site as a safe and structurally sound facility, that fits in with the surrounding environment. Closure and relinquishment of the site by TCMG will be based on the following activities having occurred:

- Removal of all remaining infrastructure and rehabilitation of disturbed areas;
- Ensuring that the Geotubes TSF is structurally sound and rehabilitated appropriately as detailed in ATC Williams Geotubes Platform Concept Design report (Appendix D);
- Groundwater monitoring around the Geotubes TSF and the Nobles Nob pit indicates no new or ongoing contamination concerns;
- Rehabilitation of all drill pads and holes; and
- Rehabilitation of disturbed areas.

Rehabilitation will be deemed successful when post rehabilitation monitoring has been undertaken and there is no evidence of any erosion issues, groundwater monitoring results show no issues with the Geotubes TSF or Nobles Nob pit, and the re-vegetated areas are showing successful growth with a similar percentage cover to that of the surrounding environment.

10.1.3 Post mining land use

Post mining land use from the perspective of TCMG is that it will be returned to a safe and stable environment, available for the use of others.

10.1.4 Rehabilitation implementation

Geotubes will be used as an environmentally stable and clean tailings solution. These will be rehabilitated by covering with material and revegetating. This will be done in stages throughout the operational development of the Geotube TSF and completed at the conclusion of the Project. Further details are included within the ATC Williams Geotubes Concept Design and Water Management Plan Reports (Appendix D and Appendix E).

Disturbed areas, including the solar field, will be revegetated to be self-sustaining and provide good habitat value for native flora and fauna species. There is no known topsoil stored from historic mining activities, however existing waste rock material is appropriate for revegetation of local vegetation types which includes hardy flora such as *Triodia* species adapted to these conditions. Topsoil in the solar field will remain *in situ*, hence aiding revegetation upon completion.

All cleared and disturbed areas will be ripped to a depth of 300 mm and seeded, to create micro environments for the collection of seed, and improved germination rates.

The rehabilitation of the Southern WRD will involve earthworks to ensure a safe landform that matches the surrounding environment and ripping and seeding.

The Nobles Nob Mine pit area will be returned to a safe and stable environment as was existing prior to undertaking the Project. Areas will be ripped and seeded with a mix similar to that of the surrounding environment as needed.

All drill pads and holes will be rehabilitated including capping, ripping and seeding as required.

All remaining ore, rock, stockpiles etc will be utilised around the TSF, returned to the pit or simply levelled and stabilised, allowing establishment of revegetation and blending into the surrounding terrain.

10.2 Unplanned closure strategy

If for some reason the site was to go into an unplanned closure, operations will cease and all equipment and infrastructure will be removed from site.

In the event the site is placed in care and maintenance, environmental monitoring of surface and groundwater will continue to take place, as will the routine inspections of erosion and sediment controls. The site will be inspected monthly to ensure that there are no risks of ongoing environmental harm. Should the site be nominated for closure, the planned closure strategy will be implemented.

If an unforeseen closure occurs TCMG will notify DITT of the closure before any action is taken. When notifying DITT, the following information will be provided:

- The reason for the closure or suspension
- The current status of operations and all landforms within the Project
- The closure activities to be undertaken and the status of those activities
- Progress on development of the relevant plans.

10.3 Rehabilitation monitoring

Rehabilitation monitoring will focus on erosion, groundwater monitoring and the structural stability of the Geotubes TSF and Nobles Nob Pit.

Visual inspections of rehabilitation areas will take place six months after rehabilitation has taken place, as well as after the first large rainfall event following rehabilitation and closure of the Project.

Before site disturbance and after rehabilitation photographs will be taken and included as appendices in the MMP each year to demonstrate that rehabilitation activities have been carried out. Photographs will:

- be labelled with location identification name/number;
- include the date when the photograph was taken;
- be taken from the same point and be consistent in orientation (ie from the north east corner of the drill pas facing south west); and
- include an identifying feature or reference point for comparison (ie a tree in the foreground or a hill in the background).

10.4 Previous Rehabilitation prior to TCMG

Some rehabilitation of the Project area has been undertaken by previous holders of the tenements such as the removal of old buildings, rehabilitation of drill holes and surface disturbance areas. Previous disturbance and the rehabilitation status of historical mine activities are outlined in Table 10-1. TCMG assume responsibility for the management and rehabilitation of the Nobles Nob mining tenements it holds.

Table 10-1: Previous Disturbance and Rehabilitation Status of Historical Mine Activities

Site	Disturbance	Rehabilitation Status	Further Rehabilitation Activities Required
Juno	Buildings	Buildings dismantled and removed from site	Concrete foundations to be removed or buried
	Headframe	Headframe removed from site.	Headframe concrete footings remain and are to be removed or buried
	Surface disturbance	Rehabilitation has been conducted	Monitor regrowth, seeding and weed management if required
Nobles Nob	Open pit	No rehabilitation conducted	Maintain fence and bunding around the open pit
	Tailings dams	Rehabilitation has been conducted	Monitor regrowth, seeding and weed management if required
	Surface disturbance	Ripping and rehabilitation of some areas has been conducted	Monitor regrowth, seeding and weed management if required
			Finalise rehabilitation of drill pads, collars, sumps and tracks.

10.5 Costing of closure

Section 43A of the Mining Management Act specifies that the Minister will calculate the required amount of security to be provided to the Northern Territory Government. Once the security bond is set, the amount will be reviewed in conjunction with the Government to ensure it remains consistent with the level of disturbance caused by the project at any specific time.

Appendix F details the security calculation for the Project.

10.6 Rehabilitation register

A Rehabilitation Register summarising the rehabilitation status of all disturbances will be provided as an appendix in future annual MMP. This is the first MMP for TCMG for this Project.

10.7 Background for Costing of Closure Activities

Table 10-2 presents the disturbance area inventory for the Project.

Table 10-2. Disturbance area inventory

Disturbance Area Inventory	
Whole of site summary	**Total Area (ha)**
Lease surface area (total)	355
Lease surface area (Noble Nob)	253
Lease surface area (Juno)	102
Disturbed operational area	36.36
Above grade landforms	**Total Area (ha)**
Tailings Dam #1 (geotubes)	9
Mining area #1 (existing Southern WRD)	8.9
Mining area #2 (base of pit for goodbye cut)	0.5
Haul roads	N/A
Access roads (Nobles Nob)	2.5
Access roads (Juno)	1.3
Water ponds/dams/drains	2
Area of infrastructure (total)	8.16
Process Plant Area	0.95
Crushing Plant Area	0.45
Mining Infrastructure Area	4.5
Water extraction	0.3
Camp area	N/A
Area of drill pads and sumps	N/A
Costeans/pits	N/A
Tracks/roads	N/A
Other (water pipeline)	1.96
Solar field	4

10.8 Security Estimate

The DITT Security Calculation Tool has been used to determine the security calculation for the Project. Security calculations have been based on the total disturbance footprint for the Project as outlined in Table 10-2 above. [redacted] The calculation spreadsheets along with any assumptions are provided in Appendix F, and is summarised in **Table 10-3** below.

Table 10-3. Summary of security calculation

Security Calculation	
Domains	**Calculated Cost**
1: Site Infrastructure	[redacted]
2: Extractive Workings - Sand, Clay & Gravel	
3: Hard Rock Pits & Quarries	
4: Underground Workings	
5: Tailings Storage Facilities and Dams	
6: Stockpiles & Waste Rock Dumps	
7: Exploration	
8: Access and Haul Roads	
9: River Diversions	
Decommissioning & Post Closure Management	
Sub-Total - All Domains	
CONTINGENCY @ 15%	
TOTAL COST	
10% Discount	
Amended amount	
1% levy	

The security amount will be provided in 5 stages, according to the sequencing of planned stages of site works. With the amount for each stage paid in advance of that stage of works commencing, to account for any planned disturbance in advance. Site works will not commence until the security bond amount for that stage has been paid. The amounts included in each stage of works are outlined in Table 10-4 below. See Appendix F for further details.

Table 10-4. Staged security deposit according to site disturbance

Stage of planned works	Domain	Management area	Description	Amount	Total Amount for Stage	With contingency	With discount
1: Exploration	7: Exploration	All	All	[redacted]			
2: Earthworks Initial earthworks to clear and level, preparation of ground	3: Hard Rock Pits & Quarries	All	All				
	5: Tailings Storage Facilities and Dams	Water Dams, Ponds	shaping or levelling				
			source cart and spread topsoil				
			final trim, deep rip				
			revegetation by direct seeding				
			fertiliser application				
	8: Access and Haul Roads	All	1/2 of amount				
	Decommissioning & Post Closure Management	Decomissioning and Closure	All				
3: Construction Construction of plant, infrastructure & dams	1: Site Infrastructure	All except Other	All except Solar Array				
	5: Tailings Storage Facilities and Dams	Water Dams, Ponds	backfill to natural surface				
			structural works for drainage				
	8: Access and Haul Roads	All	1/2 of amount				
4: Operations First stage of plant operations, with first area of TSF use	5: Tailings Storage Facilities and Dams	Tailings Dams	1/2 of amount				
	Decommissioning & Post Closure Management	Post Closure	All				
5: TSF extension & PV construction Construction of solar array and second area of TSF use	1: Site Infrastructure	Revegetation Activities	4 ha for Solar Array				
		Other	Solar Array				
	5: Tailings Storage Facilities and Dams	Tailings Dams	1/2 of amount				

11 REFERENCES

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Umwelt (2021). Waste Rock Characterisation Nobles Nob Mine.

APPENDIX A TENNANT GOLD - JUNO AGREEMENT

Department of Environment, Parks and Water Security
4th Floor Goyder Building
25 Chung Wah Terrace
Palmerston NT 0830

Dear Sir/Madam,

RE: Ground water extraction licence Juno mine site tenements MCC284; MLC154; MLC155; MLC45; MLC46; MLC47; MLC578; MLC579; MLC652; and MLC68.

As the tenement holder of the Juno mine site tenements, Tennant Gold Pty Ltd gives full permission to Tennant Consolidated Mining Group (TCMG) to access and perform all activities required on the tenements listed above, other than active mining.

This is as per the existing option agreement between Tennant Gold and TCMG.

Yours Sincerely,

Alex Bajada
Director

Nomination of an operator of a mine site

This form is to be completed by a Title Holder appointing an Operator in accordance with section 10 of the *Mining Management Act 2001.*

Title Holder				
Title Holders Name	Tennant Gold Pty Ltd			
ACN	108 557 339		**ABN**	
Postal Address	PO Box 1779, West Perth WA			
Contact Person	Alex Bajada			
Phone (business) Include area code	(08) 9429 2900	**Phone (mobile)**	041 · 990 9999.	
Email	abajada@cabbel.co			
Mining Interest/s (i.e. Title numbers)	MLC's 45, 46, 47, 68, 154, 155, 578, 579, 652 & MCC284			
Operator				
Name of Operator Use ASIC-ABR registered name if a company	Tennant Consolidated Mining Group Pty Ltd		**ACN/ABN**	645 263 547

Confirmation of Title Holders Nomination of Operator

We, the authorised officers of the Title Holder confirm the Title Holder has, by written agreement(s) with the Operator

- Appointed the Operator in accordance with section 10 of the Mining Management Act; and
- Conferred on the Operator the right of the Title Holder to take and use water in accordance with section 81 of the Mineral Titles Act.

Title Holder Signature /Director Signature			
Name (please print)	Alex Bajada - Director	**Date**	02/03/2022
Director / Company Secretary Signature			
Name (please print)	Roland Berzins – Company Sectary	**Date**	02/03/2022

NORTHERN TERRITORY GOVERNMENT

Confirmation of Operators Acceptance of Appointment	
We, the authorised officers of the Operator, confirm the Operator has: • Accepted the appointment and complied with section 10 of *Mining Management Act 2001*; and • Accepted the Title Holders rights to take and use water pursuant to section 81 of the *Mineral Titles Act* and in accordance with the *Mining Management Act 2001* accepts responsibility for meeting the environmental obligations.	
Operators Signature / Director Signature	
Name (please print)	Peter Main
Director / Company Secretary Signature	
Name (please print)	Marty Costello
Date	2/3/2022

Email your completed form to mineralinfo.ITT@nt.gov.au

APPENDIX B ABORIGINAL AREAS PROTECTION AUTHORITY CERTIFICATE

Our File: **RA2022/6**
In Reply Please Quote: **202201029**

Aboriginal Areas
Protection Authority
protecting sacred sites across the territory

Tennant Mining
PO BOX 37
WEST PERTH WA 6872

ATTENTION: PETER MAIN

RE: ISSUE OF AUTHORITY CERTIFICATE FOR NOBLES NOB MINING PROJECT - 202201029

I refer to your application for an Authority Certificate received on the 24th January 2022 for the above location.

Accordingly, under the powers delegated to me under Section 19 of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) I am pleased to issue the attached Authority Certificate.

Please read the conditions outlined in the Certificate carefully. In particular, you should note that it has been issued for an indefinite period of time, providing that the works covered by the Certificate start within the period stipulated in condition 3.

Please note that the cost of this Authority Certificate will be $22,852 inclusive of GST and an invoice will be issued to you by the Department of Corporate and Digital Development. The terms and conditions of the invoice will require you to make payment within 30 days of receipt.

I have issued you with a map which should be retained with your original Certificate. This should also be supplied for use by contractors to avoid unnecessary photocopying of a colour coded document.

If you have any further queries regarding this Authority Certificate please email enquiries.aapa@nt.gov.au or contact Janelle White on (08) 89515034.

Yours faithfully

DR. BEN SCAMBARY
Chief Executive Officer
23 June 2022

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ABORIGINAL AREAS PROTECTION AUTHORITY

AUTHORITY CERTIFICATE

Issued in accordance with Section 22 of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT)

REFERENCE: **RA2022/6** **(Doc: 202201029)** **C2022/026**

Tennant Mining
PO BOX 37
WEST PERTH WA 6872

SUBJECT LAND: MLC514 and MLC549, as shown on the map which is Annexure 'A' hereto.

PROPOSED WORK OR USE: Activities authorised by the Mining Management Act for mining and mineral exploration inclusive of ground disturbance and land and vegetation clearing requisite for: extraction and removal of minerals; evaluation, processing or refining of minerals; treatment and storage of tailings, waste and other materials; construction of camps and associated infrastructure; and all works ancillary to the above mentioned works including routine and ongoing maintenance of any infrastructure and or services.

PREAMBLE: To the extent of any inconsistency between the terms of the Authority Certificate herein, and the terms of any previous Authority Certificate issued over the same area to the applicant for the proposed works, the terms of this Authority Certificate shall prevail.

CONDITIONS:

1. The applicant shall ensure that the conditions of this Certificate are included in any subsequent contract or tender documents for the works or use described herein.
2. The applicant shall ensure any agent, contractor or employee is aware of the conditions of this Certificate and the obligations of all persons (who enter on, or carry out works or use land on which there is a sacred site) under Part IV of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT).
3. This Certificate shall lapse and be null and void if the works in question or the proposed use is not commenced within 24 months of this Certificate.
4. The applicant shall ensure any agent, contractor or employee is aware of the content of section 40(1) of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) which provides that this Certificate does not negate the need for consent, approval or permission for the subject works or use of the land which may be required under another statute.
5. Within the area marked Restricted Works Area 1 (RWA 1) on Annexure 'A', associated with sacred site 5758-150, no works shall take place or no damage shall occur.

   The features of sacred site 5758-150 include: Boulders and Rock Outcrop.
6. Within the area marked Restricted Works Area 2 (RWA 2) on Annexure 'A', associated with sacred site 5758-152, no works shall take place or no damage shall occur.

   The features of sacred site 5758-152 include: A small, long billabong also known as Lake Alice.

The COMMON SEAL of the
ABORIGINAL AREAS PROTECTION AUTHORITY
was hereto affixed on the 23 day
of June 2022

DR. BEN SCAMBARY
Chief Executive Officer

Nobles Nob Mining Project - 202201029

ANNEXURE "A" MAP FORMING PART OF

AUTHORITY CERTIFICATE C2022/026

ISSUED TO:
Tennant Mining

CHECKED BY:.....DATE 21/06/2022

XLI - SENIOR LAND INFORMATION OFFICER

J2022-0045

0 400

metres

Scale 1:6,500

Coordinate system: GDA94

KEY

- Subject Land
- Extent of Recorded Sacred Site
- Restricted Works Area
- Recorded Sacred Site

** The Sacred Site point is not indicative of the specific site location and does not represent the location of any features of the site.*

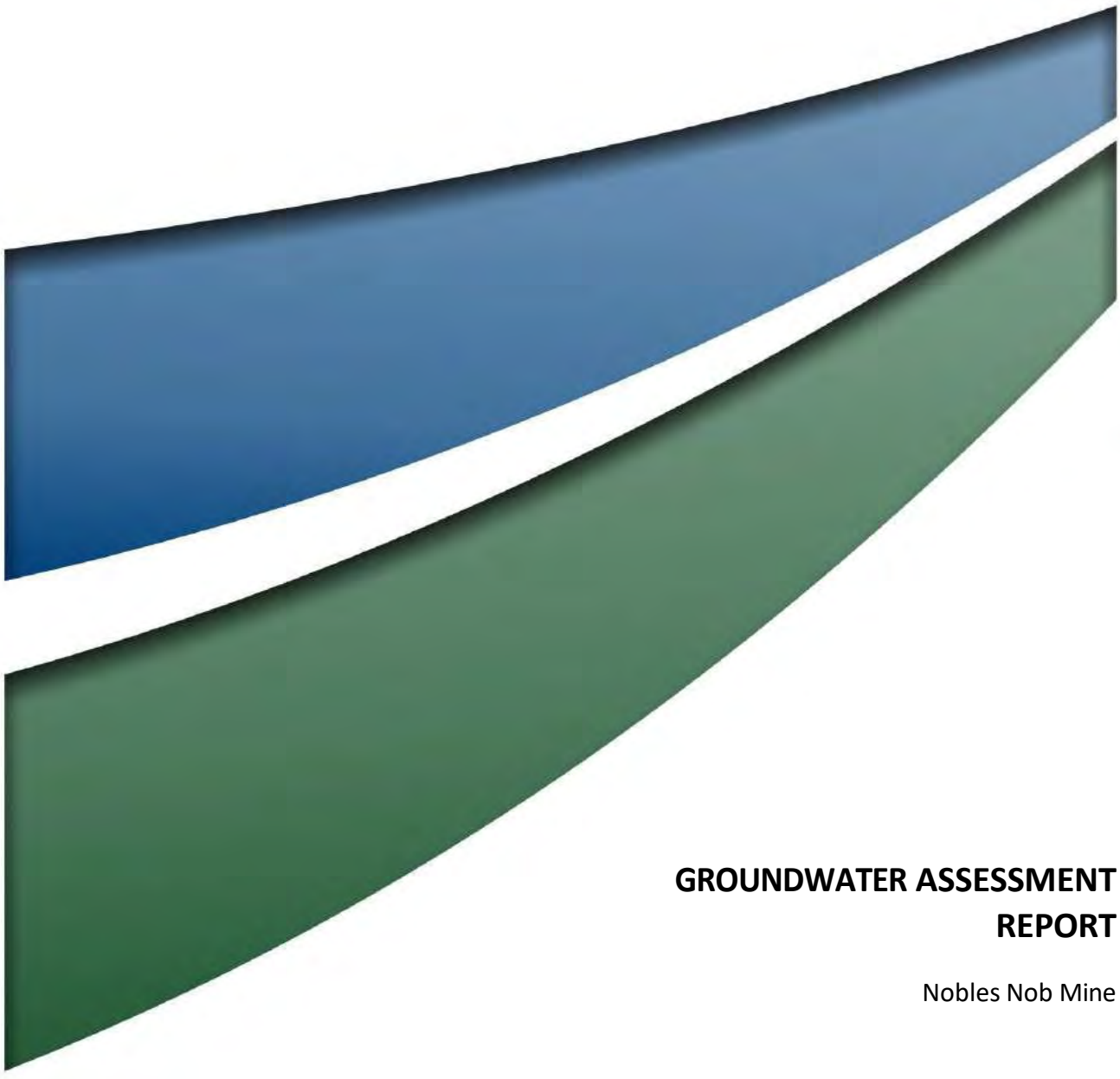
Aboriginal Areas Protection Authority
protecting and caring for country

Prepared and produced by Aboriginal Areas Protection Authority (AAPA), Darwin, Northern Territory of Australia
© Northern Territory of Australia

This map forms part of a Certificate issued by the Authority under section 22 of the *Northern Territory Aboriginal Sacred Sites Act 1989*. No reliance should be put on the accuracy of the information on the map except as it relates to the land the subject of the Certificate and the fact that sites are not shown in other areas shall not be taken as a definitive indication of the existence or lack of existence of sites.

APPENDIX C UMWELT - GROUNDWATER ASSESSMENT REPORT AND WASTEROCK CHARACTERISATION REPORT

umwelt
Environmental & Social Consultants



GROUNDWATER ASSESSMENT REPORT

Nobles Nob Mine

FINAL

December 2021

GROUNDWATER ASSESSMENT REPORT

Nobles Nob Mine

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tennant Consolidated Mining Group

Project Director: Claire Stephenson
Project Manager: Ashish Mishra
Technical Director: Claire Stephenson
Technical Manager: Ashish Mishra
Report No. 21728 R02
Date: December 2021

umwelt
Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Claire Stephenson	30/11/2021	Claire Stephenson	01/11/2021
Final-V2	Claire Stephenson	13/12/2021	Claire Stephenson	13/12/2021

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Appendices

Appendix A	Nobles Nob WRC Report
Appendix B	Statement of Bore
Appendix C	Laboratory Results
Appendix D	Nobles Nob Slug Test Report

1.0 Introduction

Tennant Creek Project is a mining interest owned by Tennant Consolidated Mining Group (TCMG). The Tennant Creek Project includes the historical Nobles Nob Gold Mine in Northern Territory, located approximately 13 kilometres (km) southeast of Tennant Creek township. Gold was initially extracted at Nobles Nob from underground operations commencing in the early 1930's and then via open-cut methods from the 1960's. Open-cut mining at Nobles Nob concluded in 1985, although gold production continued until 1992.

TCMG are proposing to recommence operations at Nobles Nob. To obtain approvals, TCMG is required to submit a Mining Management Plan (MMP) under the NT *Mining Management Act 2005*. The primary purpose of the MMP is to formalise the actions to be taken and strategies to be implemented to manage potential impacts to the environment, including groundwater.

Umwelt Australia Pty Ltd (Umwelt) were engaged by TCMG to prepare a groundwater assessment to support the MMP. This report presents the hydrogeological understanding of the Nobles Nob Mine based on available information, and outlines potential impacts that may occur to groundwater as a result of the proposed mining activities and proposed management and mitigation measures.

1.1 Data Availability

The groundwater assessment was conducted based on available site data and additional field data collected for the purpose of the study.

The available information for the site included the following:

- Site geological mapping and model
- Baseline Fauna Survey Final Report (Excalibur, 2010)
- Process Description Report (COMO, 2021)
- Geological logs of the groundwater bores

The additional site work and field data collection conducted for the site included:

- Waste rock sampling and analysis – TCMG collected 26 samples, which included 25 samples from existing waste rock material and one sample from historical run-of-mine pad material. The samples were submitted to SGS laboratory for analysis. Umwelt conducted a review of the laboratory results to characterise the geochemical properties of the waste and host rock material and potential for acid rock drainage. The analysis report and laboratory results are presented in **Appendix A**.
- Bore installation – Installation of 10 groundwater monitoring bores across the site in May/June 2021 by May Drilling and overseen by TCMG, informed by a bore design plan prepared by AGE Consultants. Bore installation details are included in **Appendix B**.
- Bore development and water quality sampling – Airlifting and development of the newly installed groundwater monitoring network conducted by TCMG in early October 2021. Groundwater quality samples were collected from the developed bores by Umwelt on 12 and 13 October 2021, with field parameters recorded and samples submitted to SGS for laboratory analysis. Water quality results are summarised in **Appendix C**, along with the complete laboratory reports.

- Hydraulic testing – slug testing conducted by Umwelt for the recently installed monitoring bores. This included rising and falling head tests, undertaken in October 2021. Results were analysed using Waterloo HGA Plus (AquiferTest v10.0) software to estimate horizontal hydraulic conductivity for the target geology at each bore. The report and analysis results are presented in **Appendix D**.

All available data was reviewed and utilised to inform this assessment of potential groundwater impacts.

1.2 Site Details

1.2.1 Location and Land Use

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 13 km southeast of Tennant Creek in Northern Territory, Australia. Tennant Creek is approximately 504 km north of Alice Springs and 978 km south of Darwin (**Figure 1.1**).

Due to the history of mining and grazing within the area, the vegetation within the Nobles Nob tenements is disturbed (Tennant Gold Resource, 2018). The majority of the area around the Nobles Nob open-cut mine is moderately disturbed and significantly impacted by previous mining activities (Tennant Gold Resource, 2018). As the site is not located in any agricultural station, the land use after the closure of the mine is expected to be suitable for grazing and other pre-mining uses, with the open-pit left in a safe state (Tennant Gold Resource, 2018).

1.2.2 Previous Mining Activities

Gold mining at Nobles Nob commenced in the 1930's, with several small underground gold mines operated in the area. These small operations included Rising Sun, Shaft 12, Kimberly Kids, and Weaber's Find (Tennant Gold Resource, 2018). In 1934, the first shaft was sunk to the depth of 50 feet (~15 meters) to start large-scale mining. In 1968, following the collapse of the crown pillar, the mine was modified into an open pit with a new mill on site, with site site in operation until September 1992. Over this time, 2,140,000 tonnes of ore were processed at Nobles Nob, producing approximately 1,169,775 ounces of gold.

1.3 Proposed Activities

The Project includes excavation of existing waste rock from the Mineralised Waste Rock Dump (refer to **Figure 1.1**) for reprocessing. The historical tailings dams (refer **Figure 1.1**) may also be utilised for reprocessing. No new mining/extraction of ore at Nobles Nob Pit or underground is proposed as part of the current Project activities reviewed as part of this assessment.

The excavated waste rock material and tailings will then be reprocessed within the Proposed Processing Area (refer **Figure 1.1**). The design and layout of the Proposed Processing Area is being finalised by ATC Williams but is understood to comprise:

- Processing Plant - designed based on an estimated throughput of 0.7 million tonnes per annum (COMO, 2021). The processing will include crushing and milling of the ore before processing and discharge of tailings.

- Tailings Storage Area – tailings slurry from the processing plant will be pumped to a tailings storage area, where it will be filtered using Geotube dewatering tubes. These Geotubes will retain the solid particles, while allowing the liquid to discharge (COMO, 2021). The discharged liquid will be captured by a recovery pump located at the base of the Geotube stacking area.

- Process Water Ponds - the recovery pump will return the discharged water to the process water ponds for re-use (COMO, 2021).

The operations at Nobles Nob will be supplied with raw water from Juno mine, located approximately 4 km northwest. The raw water will be used to top up the process water and for dust suppression and wash down purposes across the Nobles Nob site (COMO, 2021).

1.4 Relevant Legislation

Exploration and mining operations in NT must be authorised under the *Mining Management Act 2001* (MMA). Under the MMA, a Mining Management Plan (MMP) must be submitted to the Department of Tourism, Industry and Trade (DITT) for authorisation. This groundwater assessment has been prepared to support the MMP for Nobles Nob proposed activities as specified in **Section 1.3**.

Environmental Protection Act 2019 (NT) (EP Act) came into force as of 29 June 2020 and aims to protect the environment of the Territory, promote ecologically sustainable development by establishing a framework for assessing potential environmental impacts of development projects. As outlined in Part 4 of the EP Act, an environmental impact assessment is required where a proposed action has the potential to have a significant impact on the environment or meets referral criteria. It is understood the Project has not been referred. However, findings from this preliminary assessment may be used in future to inform a referral process.

The *Waste Management and Pollution Control Act 1998* (NT) provides for the protection of the environment through the encouragement of effective waste management, pollution prevention and control practices. An Environmental Protection approvals and licenses are issued by the NT Environmental Protection Agency (EPA). It is understood that the proposed activities may relate to activities that require an environmental protection approval under Part 1, Schedule 2 of the *Waste Management and Pollution Control Act 1998.*

The Water Act provides the legislative framework for water planning and entitlements for most water resources in the NT. The Water Act also provides for the investigation, allocation, use, control, protection, management and administration of surface water and groundwater resources. The Nobles Nob tenement is within the Tennant Creek Water Control District, which is a designated water management area under the *Water Act 1992*. As a water control district, a license is required to extract or intercept surface water or groundwater water. There is currently no water allocation plan in place for the Tennant Creek Water Control District.

Environment Protection and Biodiversity Conversation Act 1999 (Cth) (EPBC Act) provides a framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and other matters, defined in the EPBC Act as matters of national environmental significance (MNES). It is understood that there are no MNES identified in the vicinity of the Project area.

Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Nobles Nob Pit Area
- Proposed Processing Area
- Historical Tailings to be Mined
- Roads
- Watercourse

FIGURE 1.1

Site Layout and Proposed Activities

Image Source: ESRI Basemap (2021) Data source: Department of Environment, Parks and Water Security (2020)

2.0 Site Characteristics

2.1 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), presented in **Table 2.1**. Mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.2°C in the summer (December). The maximum temperature recorded at this station was 45.6°C in January 2014, with a minimum of 8°C recorded during June 2007 (BoM, 2021).

Table 2.1 Mean Monthly Temperature 1969 to 2021

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.6	31.9	27.7	24.6	24.8	27.6	31.8	35	36.7	37.2
Mean minimum temperature (˚C)	25	24.5	23.4	20.5	16.4	13	12.4	14.4	18.5	21.8	23.9	24.9

Mean has been calculated using monthly data from 1969 to 2021

Rainfall data has been retrieved from the publicly available Scientific Information for Landowners (SILO) database. The monthly average rainfall and evapotranspiration data has been retrieved from the nearest SILO station Tennant Creek Airport (Latitude -19.64, Longitude 134.18), from 01/01/1900 to 01/10/2021.

The SILO database generally provides a complete long-term dataset and is therefore helpful in assessing long term rainfall trends in the vicinity of the site. This dataset is interpolated from quality checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall is 383 mm, with evaporation exceeding rainfall during each month of the year (**Table 2.2** and **Figure 2.1**).

Table 2.2 Monthly Average of Rainfall and Evapotranspiration at Tennant Creek Airport

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SILO Rainfall	96.74	91.08	50.18	11.81	10 36	6.56	5.03	2.00	5 36	14.95	30.23	58.14	382.45
SILO ET	350.17	291.84	321.21	287.54	232.83	186.81	198.92	250.05	307.12	358.69	371.79	371.63	3528.60
SILO fao56 ET	213.65	182.77	191.34	167.69	138.37	115.27	126.32	156.08	185.14	215.50	220.75	224.11	2136.98

Note: ET – Evapotranspiration. All values are in mm.

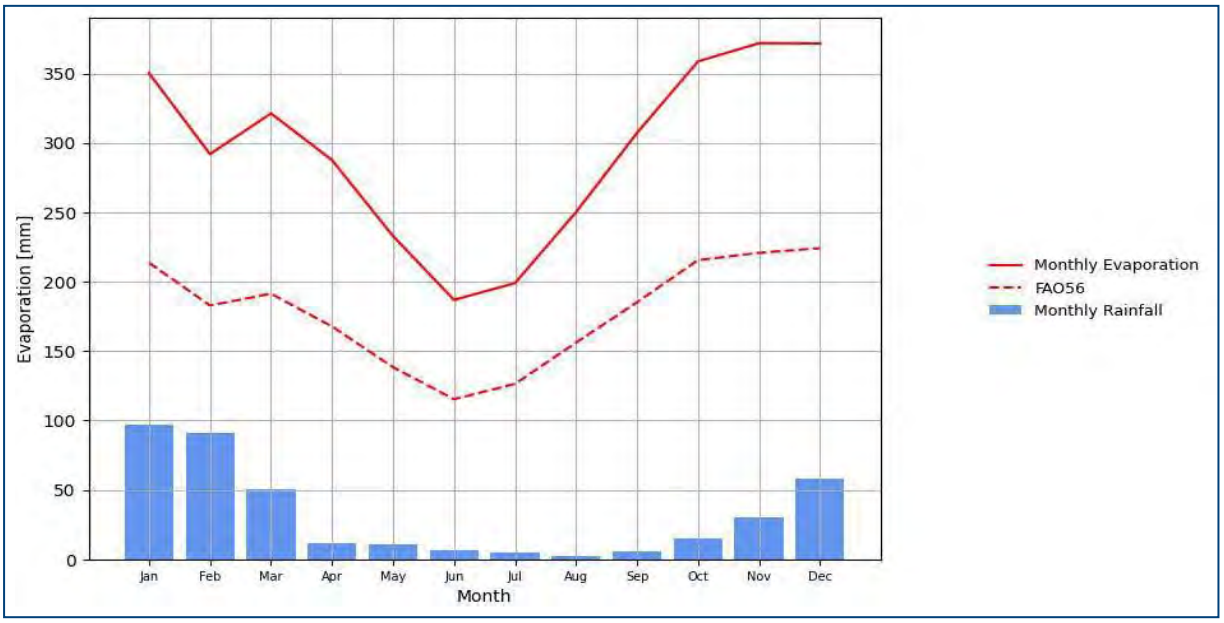


Figure 2.1 Graph Showing Monthly Average rainfall and Evaporation

The SILO dataset was used to calculate the cumulative rainfall deviation (CRD). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall. A rising trend in slope in the CRD plot indicates periods of above-average rainfall, whilst a declining slope indicates periods when rainfall is below average.

The CRD in **Figure 2.2** has been calculated based on the long-term average monthly rainfall from 1900 to 2021. The CRD indicates that the area has experienced a period of generally above-average rainfall from 2000 to 2016, and generally below-average rainfall since 2016. There exists a strong seasonality in rainfall, with the majority of rainfall occurring over the wet season, between November and March.

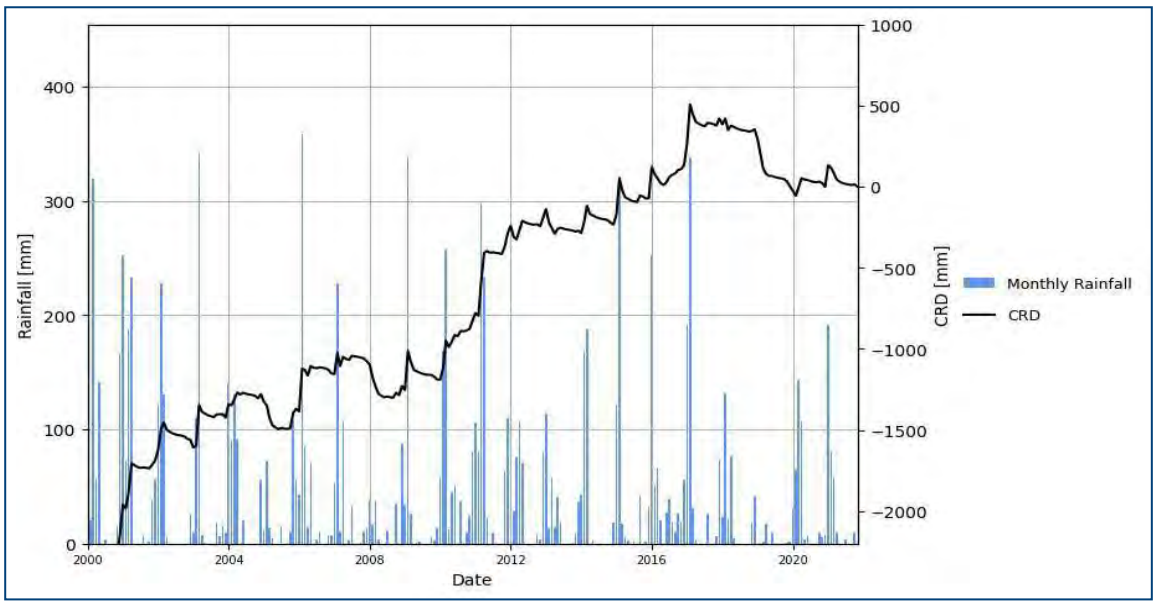


Figure 2.2 Monthly Rainfall (2000-2021) and CRD

2.2 Topography and Drainage

Land surface elevation, informed from LiDAR data, shows that the area around Nobles Nob comprises plains, rises, and low hills, which are associated with the McDougall Ranges. Elevation throughout the site ranges from approximately 295 mAHD to 380 mAHD. The rest of the region towards the west of Nobles Nob appears to be dominated by level to undulating plains, associated mainly with dune fields and sand plains of the Tanami Desert (**Figure 2.3**).

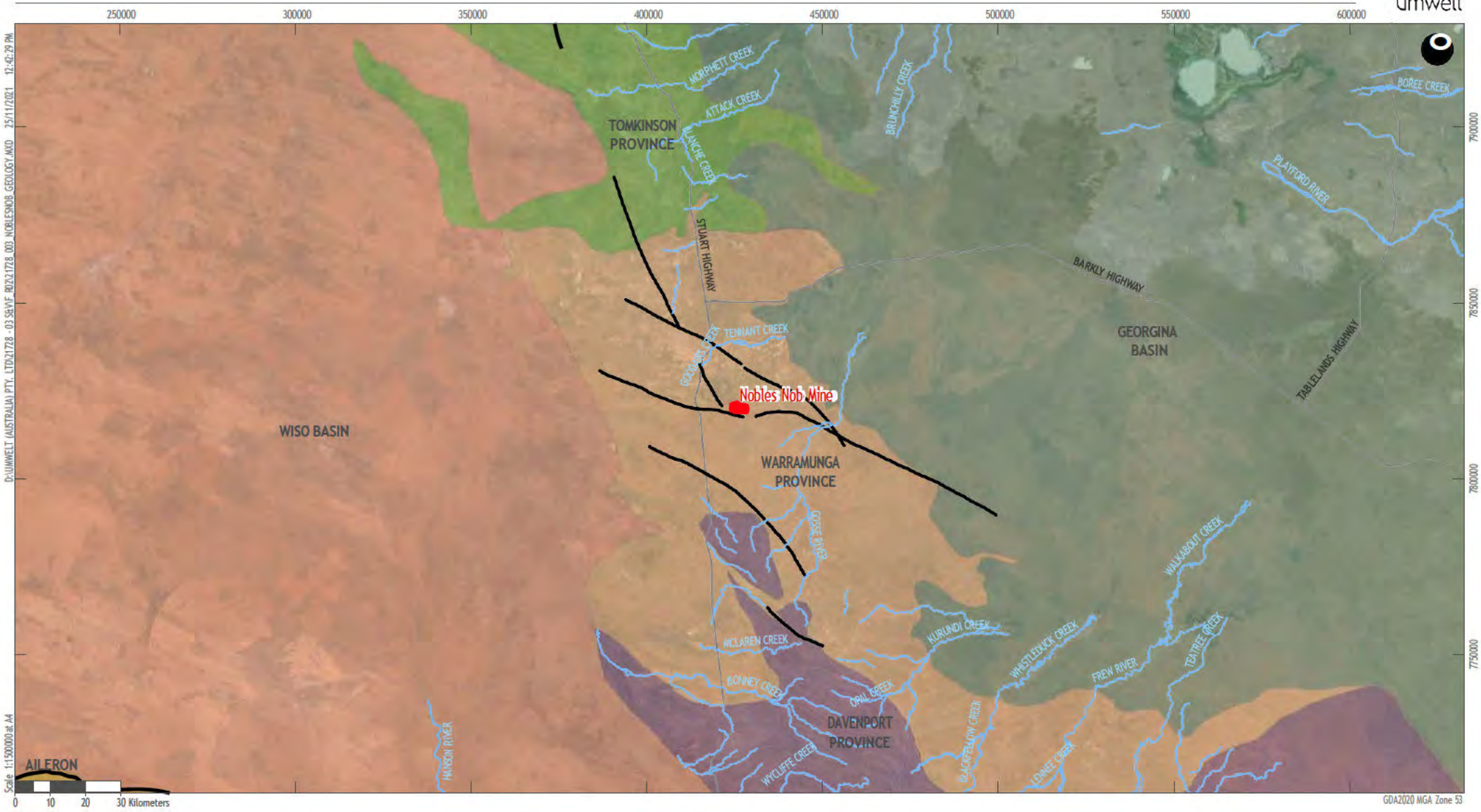
Several watercourses and surface drainages are mapped in the area (**Figure 2.3**); however, these watercourse and drainages are poorly defined. There is no natural permanent surface water around Nobles Nob (Tennant Gold Resource, 2018). Some surface drainage occurs briefly during the wet season.

2.3 Geology

The Tennant Creek region is within the Proterozoic Tennant Creek Inlier and is comprised of orogenic rocks of the Warramunga, Tomkinson, and Davenport provinces (McPherson et al., 2020; Ahmad & Dunster, 2013). The Wiso Basin is located to the west of the Warramunga Province, whereas the Georgina basin is located to the east (**Figure 2.3**).

The rocks of the Warramunga Province are divided into the Warramunga Formation, and the correlative Junalki Formation and Woodenjerrie Beds. The lithological units in the Warramunga Formation are tuffaceous/volcanilithic sandstone metagreywacke and siltstone, along with banded argillaceous ironstone (haematite shale), slate, and minor schist (Donellan , 2013). The Warramunga Formation commonly strikes east-west with variable dip (McPherson et al., 2020; Ahmad & Dunster, 2013). These rocks have been intruded by various granites and deformed by the Tennant Event of 1850 millions years ago (Ma) (ADL, 1970).

Gold-copper-bismuth mineralisation in the area has been found to be hosted by fine-grained haematitic mudstones and shaley siltstones. The Nobles Nob ore body lies within the Warramunga Group, comprising sediments, volcanic lavas and volcaniclastic sediments. The mineralisation at Tennant Creek is generally small but of high grade and is hosted by fine-grained haematitic mudstones and shaley siltstones (Excalibur 2012). The mineralisation occurs within lenticular, ellipsoidal or pipelike bodies rich in magnetite and/or hematite. These are replacement bodies that cut across sedimentary structures and have been referred to as "ironstones". These zones of rich gold mineralisation are characterised by strong magnetite alteration below the base of oxidation. Above the base of oxidation, the magnetite is chemically weathered to haematite. Gold is generally very fine-grained in fresh deposits but very coarse and nuggety in the oxidised deposits (Excalibur 2012).



Legend

- Faults
- Roads
- Watercourse

Geological Regions

- Aileron Province
- Davenport Province
- Georgina Basin
- Tomkinson Province
- Warramunga Province
- Wiso Basin

FIGURE 2.3
Site Geology

Image Source: ESRI Basemap (2021) Data source: NTGS (2018)

2.4 Hydrogeological Understanding

2.4.1 Previous Investigations and Available Data

Publicly available reports indicated several groundwater investigations were carried out in the 1970s and 1980s to understand the water supply for Tennant Creek township (Rockwater, 1989; Rose, 1973; Rose & Willis, 1973; Verhoeven, 1976; Verhoeven & Knott, 1980). A hydrogeological investigation by McPherson et al. (2020) was also undertaken in the Tennant Creek region as part of the Exploring for The Future (EFTF) program, focused on understanding groundwater resources across Australia. However, this study focused on the borefields (Cabbage Gum and Kelly Well) that supplies water to Tennant Creek town and did not include data from Nobles Nob area. The Cabbage Gum and Kelly Well bore fields are located approximately 25 kilometres south of Tennant Creek.

The publicly available reports provided indicative information on the hydrogeology of the region. However, no records of any previous groundwater supply studies or impact assessments for Nobles Nob were available as part of this assessment.

2.4.2 Groundwater Monitoring

TCMG installed 10 monitoring bores in May/June 2021 to monitor the water quality of groundwater at Nobles Nob. The details of the bores are presented in **Table 2.3**, and locations are shown in **Figure 2.4**.

A review of registered bores within 2.5 km of the Nobles Nob pit was also undertaken using the NR Maps desktop tool (https://nrmaps.nt.gov.au/nrmaps.html). Details of the registered bores are also presented in **Table 2.3.** The review of registered bores identified 16 registered bores within 2.5 km of Nobles Nob. Of these 16 bores, two are historical angular exploration holes (RN007139 and RN007140), three are historical Stope holes (RN003774, RN003775, and RN003776). The remaining bores are noted as being installed as historical mine water production bores; however, most note that no water was encountered. As per the NR Maps, none of the 16 registered bores are noted as potentially being used for stock water supply.

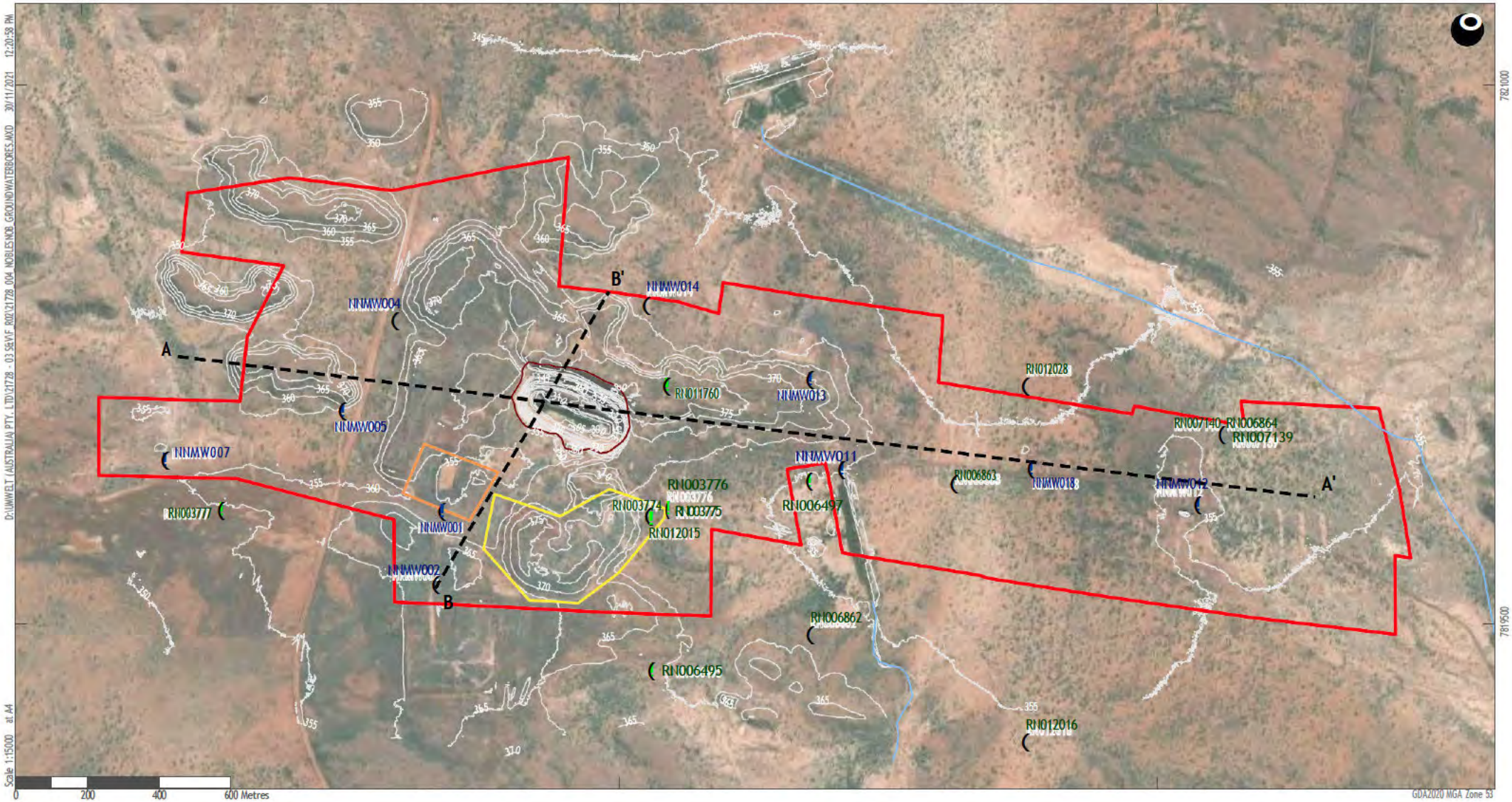
Table 2.3 Groundwater Monitoring Bores and Registered Bores at Nobles Nob

Bore ID	Date completed	Easting*	Northing*	Depth	Screen Interval	Water Bearing Unit	Yield (L/s)	Depth of water Strike (m)
Monitoring Bores								
NNMW001	6/06/2021	425505	7819803	102	90 - 102	Sandstone	0.01	90 (also at 76m, 0.001 L/s yield)
NNMW002	9/6/2021	425488	7819596	77.9	65.9 - 77.9	Sandstone	0.05	72
NNMW004	4/6/2021	425374.9	7820346	75	63 - 75	Sandstone	0.11	69.4 (damp at 63m)
NNMW005	3/6/2021	425228.6	7820086	70	58 - 70	Sandstone	0.53	62.6
NNMW007	2/6/2021	424730.8	7819950	95.8	83.8 - 95.8	Sandstone	0.13	90 (also at 18m with 0.001 L/s and at 66m with 0.0001 L/s yield)
NNMW011	29/5/2021	426621.8	7819922	66	54 - 66	Sandstone	1	59
NNMW012	31/5/2021	427616.9	7819830	76.6	64.4 - 76.4	Sandstone	0.2	68
NNMW013	7/6/2021	426527.3	7820174	78	66 - 78	Sandstone/ Siltstone	0.2	72
NNMW014	30/5/2021	426075.9	7820387	69.6	57.6 - 69.6	Hematite Shale	0.2	63.6

Bore ID	Date completed	Easting*	Northing*	Depth	Screen Interval	Water Bearing Unit	Yield (L/s)	Depth of water Strike (m)
NNMW018	1/6/2021	427151.5	7819926	78	66 - 78	Sandstone	1.9	70
Registered Bores within 2.5 km								
RN006863	26/11/69	426927	7819869	100.6	NA	Slate	1	74.06
RN006864	28/11/69	427677	7820019	152.4	NA	Siltstone	0.1	74.37
RN007139	11/5/70	427677	7820019	131.1	NA	No Water Encountered	0	-
RN007140	19/5/70	427677	7820019	112.8	NA	No Water Encountered	0	-
RN006496	5/5/69	424127	7819169	91.4	NA	No Water Encountered	0	-
RN006862	24/11/69	426527	7819469	123.4	NA	Siltstone	0.9	80.77
RN006495	6/5/69	426127	7819369	99.1	NA	No Water Encountered	0	-
RN003777	11/6/63	424877	7819819	112.8	NA	Greywacke (sandstone)	0.5	73.15
RN012016#	6/10/78	427127	7819169	106.8	NA	Greywacke (sandstone)	0.1	85.7
RN003776†	14/05/63	426127	7819819	32	NA	No Water Encountered	0	-
RN012015#	5/02/90	426076	7819792	97.6	NA	Siltstone	2	75.7
RN003775†	16/6/63	426127	7819819	25.9	NA	No Water Encountered	0	-
RN006497	7/5/69	426527	7819869	100.6	NA	Siltstone	1	60.96
RN011760#	18/11/77	426127	7820169	110	NA	Siltstone	3.2	72
RN003774†	10/3/63	426127	7819819	23.2	NA	No Water Encountered	0	-
RN012028#	25/11/78	427127	7820169	91	NA	Siltstone	2	82 (also at 76

*Coordinates in GDA2020 MGA Zone 53.

abandoned/backfilled. † Stope holes located at the same location. NA- Not Available



Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Nobles Nob Pit Area
- Proposed Processing Area
- Monitoring Bore
- Registered Bore
- Cross Section
- Contours

Image Source: ESRI Basemap (2021) Data source: NTGS (2018)

FIGURE 2.4

Groundwater Bores at Nobles Nob

2.4.3 Hydrogeological Units

Based on the analysis of aquifer yields, bore logs and lithology, the following hydrogeological units have been identified at Nobles Nob:

- Shallow weathered horizon
- Deep fractured sandstone/siltstone

Groundwater can also occur associated with faults; however, no-fault structures have been mapped within 2 km of Nobles Nob.

The groundwater bearing units are discussed further in **Sections 2.4.3.1** and **2.4.3.2**.

2.4.3.1 Shallow Weathered Horizon (Regolith)

The CSIRO regolith depth mapping indicates regolith depth up to 3 metres around the pit (0 to 1 m close to the pit, and 2-3 m for slightly away from the pit). This is consistent with the drilling logs of bore NNMW001, NNMW004 and NNMW005 that recorded 0-3 metres of regolith. As per the CSIRO regolith depth mapping, higher regolith depth is mapped for the area where bore NNMW018 is located (approximately 10-20m). However, the drill logs of bore NNMW018 suggests approximately 3 metres of laterite, followed by 3 metres of clay, before reaching the siltstone at 6 metres below ground. Observations on the extent of the weathering at 6 metres below are not provided. Overall, the drill logs and regolith depth mapping suggest that the area's regolith depth is not very deep.

Previous studies (e.g. Rockwater, 1989; Verhoeven & Knott, 1980) have indicated that groundwater might occur in the shallow weathered horizon of the Warramunga Formation. However, the drilling records from the monitoring and registered bores generally suggest that no groundwater was encountered at shallow depths. Registered bores drilled at shallow depths (<32m) also did not encounter any groundwater.

An exception to this was bore NNMW007, which was noting as having encountered water at 18 meters below ground level (mbgl) during drilling (**Table 2.3**). The yield was 0.001 L/sec, which is extremely low. Groundwater was also encountered at this bore at 66 mbgl (0.0001 L/sec) and 90 mbgl (0.13 L/sec). Nearby bore bore NNMW005, which is located around 500 m east of NNMW007, did not encounter water until 62.6 meters below ground (**Table 2.3**). Similarly, registered bore RN003777 located around 200 m south of NNMW005 also recorded groundwater intersection at 73.15 m depth.

The presence of water may relate to the local geology, with the bore log for NNMW007 recording a weathered quartz vein from 12 - 15 m depth, which was logged as comprising fine sand overlying sandstone and siltstone. The bore was constructed with the screen from 83.8 to 95.8 m depth. The groundwater level after the installation was 61.14 m, and subsequent monitoring in October 2021 indicates that water in bore NNMW007 was measured at 61.04 m depth (refer to **Section 2.4.5**). This indicates that if a shallow water table is present at this location, it is likely hydraulically separate from the deeper fractured rock aquifer.

2.4.3.2 Deep Fractured Sandstone/Siltstone Aquifer

The groundwater monitoring bores and registered bores within 2.5 km of Nobles Nob suggest that the primary groundwater bearing unit on site is within the local scale fractured sandstone/siltstone of Warramunga Group. This is consistent with the findings of previous studies around the Tennant Creek area that found that groundwater occurred within Warramunga Group siltstones, schists and granites, and Gum Ridge Formation limestone and chert (Verhoeven, 1976; Verhoeven & Knott, 1980). These studies also found that the permeability of these aquifers is low, and the quality is unsuitable for human consumption (Rockwater, 1989; Verhoeven & Knott, 1980). Measurements of airlift yields recorded during drilling of monitoring bores and registered bores are generally less than 1 L/s (only 2 out of 10 bores recorded yield of > 1 L/s), which agrees with the findings of previous studies that groundwater permeability in the area is low.

The information provided in the drilling records and water level readings post-installation were also reviewed. Groundwater in this aquifer is generally first encountered between approximately 70 to 80 meters below ground level (refer **Table 2.3**). The bottom of Nobles Nob open pit, which is approximately 80 m below the surface, has a permanent pool of water (Tennant Gold Resource, 2018), possibly indicating the water table in the region. The review suggests that the water level in all bores, except NNMW002 and NNMW011, was recorded higher than the depth at which groundwater was encountered, suggesting the confined nature of the aquifer.

2.4.4 Hydraulic Parameters

To estimate the hydraulic parameters of the groundwater system, slug tests were undertaken at 10 monitoring bores at Nobles Nob. Slug tests estimate the hydraulic conductivity of the aquifers, which is the measure of the permeability of the aquifers. It presents how easily water can pass through the aquifer, i.e., high hydraulic conductivity denotes a highly permeable aquifer. The slug tests were undertaken between 13 and 17 October 2021 (refer **Appendix D**). The slug tests were processed using Aquifer Test (HydroGeoAnalysis Plus) software and results analysed using Bouwer-Rice (1976) and Hvorslev (1951) methods. The results of the slug tests are also presented in **Table 2.4**.

The values of hydraulic conductivity range from 0.0105 m/day at bore NNMW002 to 0.681 m/day at Bore NNMW018 (refer **Table 2.4**). Bores NNMW011 and NNMW012, located towards the east of the Nobles Nob Pit, recorded hydraulic conductivity values of 0.387 m/day and 0.355 m/day, respectively. This range is consistent with previous studies into the Warramunga Formation (e.g., Rockwater, 1989; Verhoeven & Knott, 1980).

Table 2.4 Results of the Slug Tests

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW001	0.0162	Hvorslev	12	0.194
NNMW002	0.0105	Bouwer & Rice	12	0.126
NNMW004	0.321	Hvorslev	12	3.852
NNMW005	0.559	Hvorslev	12	6.708
NNMW007	0.0591	Hvorslev	12	0.709
NNMW011	0.387	Bouwer & Rice	12	4.644
NNMW012	0.355	Hvorslev	12	4.260
NNMW013	0.411	Hvorslev	12	4.932

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW014	0.11	Hvorslev	12	1.320
NNMW018	0.681	Hvorslev	12	8.172
Average (Confined)	0.314			3.768
Average (Unconfined)	0.199			2.385
Average (All)	0.291			3.492

2.4.5 Groundwater Levels and Flow Direction

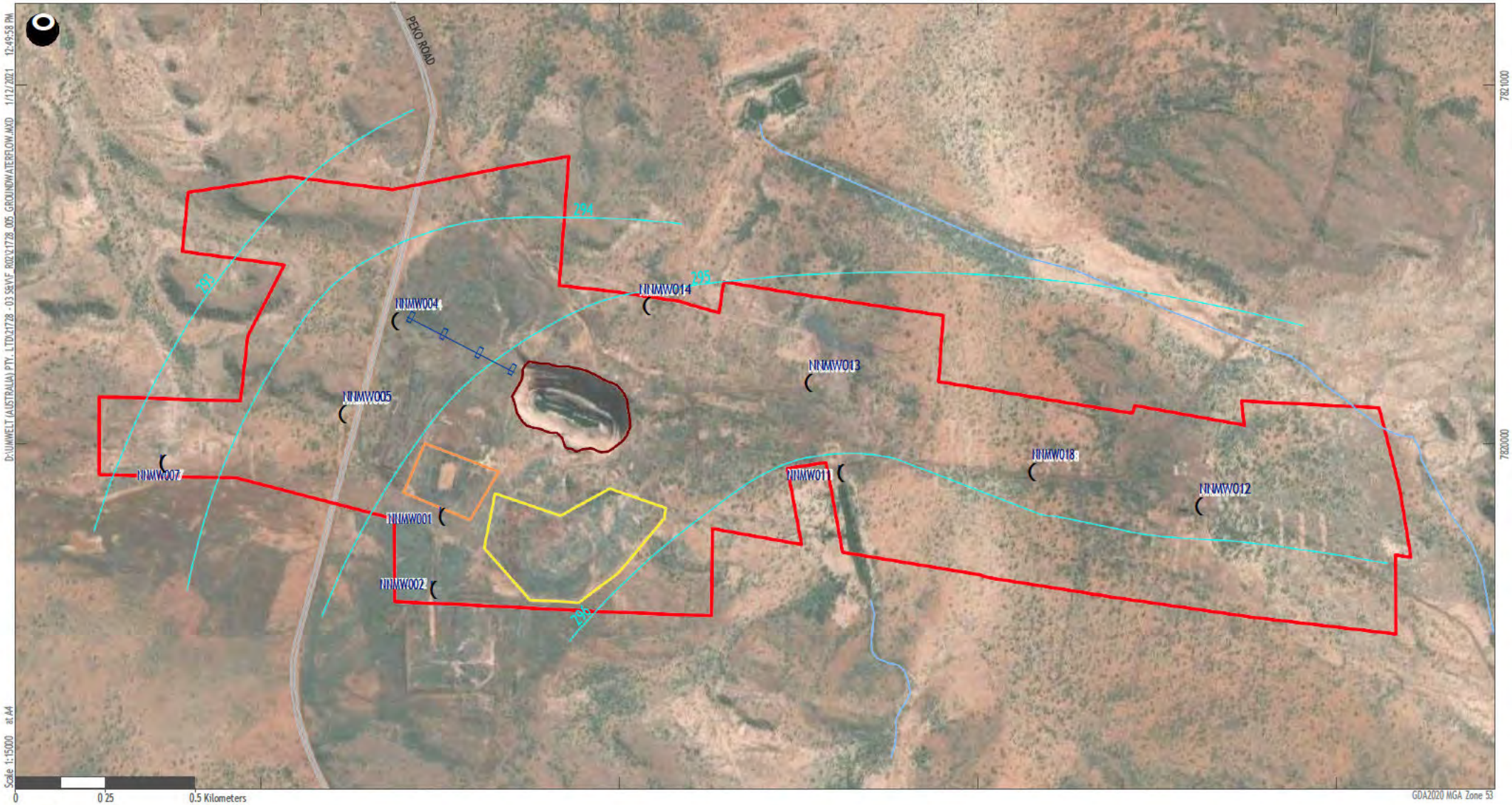
The groundwater level was measured after the installation of the groundwater bores and during the October 2021 monitoring event. The results of the groundwater level are presented in **Table 2.5**. The elevation of groundwater in October 2021 ranges from approximately 293 mAHD at NNMW007 to approximately 296 mAHD at NNMW011. There is no water level reading available for the Nobles Nob pit in October to compare. A recent LiDAR reading, from May 2021 following the wet season, indicated a level at around 296 mAHD. There is no seasonal data available for the groundwater bores as yet; however, the available level indicates a relatively flat groundwater gradient in the area.

There is minimal information regarding groundwater flow directions in the fractured rock aquifers of the Warramunga Group. However, regionally it has been reported that groundwater flows from the southeast to the northwest, in line with surface topography (McPherson et al., 2021). The groundwater levels at Nobles Nob, retrieved from the monitoring data in October 2021, also suggest that the overall flow is from the east towards the west-northwest, mirroring the regional groundwater flow direction and overall surface topography (**Figure 2.5**).

Table 2.5 Groundwater Levels at Nobles Nob

Bore _ID	Easting*	Northing*	Casing Top RL (mAHD)	SWL after Drilling (mbtoc#)	RL after Drilling (mAHD^)	SWL Oct 21 (mbtoc#)	RL Oct 21 (mAHD^)
NNMW001	425505.04	7819803.37	357.09	68.18	288.91	61.8	295.29
NNMW002	425488	7819596.41	363.924	68.99	294.934	68.775	295.149
NNMW004	425374.93	7820346.45	351.62	57	294.62	56.69	294.93
NNMW005	425228.61	7820085.77	354.08	59.8	294.28	59.87	294.21
NNMW007	424730.83	7819950.05	354.51	61.14	293.37	61.04	293.47
NNMW011	426621.8	7819921.77	355.91	59.71	296.2	59.885	296.025
NNMW012	427616.88	7819829.56	359.13	63.2	295.93	63.22	295.91
NNMW013	426527.28	7820174.17	366.01	70.06	295.95	70.18	295.83
NNMW014	426075.85	7820387.3	354.14	58.64	295.5	58.7	295.44
NNMW018	427151.54	7819925.64	351.22	55.17	296.05	55.22	296

*Coordinates in GDA2020 MGA Zone 53. # mbtoc- meters below top of casing. ^ mAHD – meters Australian Height Datum.



Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Nobles Nob Pit Area
- Proposed Processing Area
- Roads
- Watercourse

FIGURE 2.5

Groundwater Flow Contours

Image Source: ESRI Basemap (2021) Data source: Department of Environment, Parks and Water Security (2020)

2.4.6 Groundwater Quality

The information on groundwater quality around Nobles Nob is limited. Post-installation of the groundwater bores at Nobles Nob, only one round of sampling was undertaken in October 2021. The results of the groundwater quality from the October 2021 sampling event are discussed below. One round of water quality samples from Nobles Nob pit was also collected in 2018, and the results are also discussed in the sections below.

2.4.6.1 Physicochemical

The pH values observed in the groundwater bores ranged from 6.53 at NNMW011 to 7.12 pH units at NNMW007 (**Table 2.6**). The field EC values ranged from 4,537 µS/cm at NNMW002 to 14,980 µS/cm at NNMW005 (**Table 2.6**) with an average of 10,455 µS/cm. The total dissolved solids (TDS) concentrations were also high in the groundwater bores, ranging from 3,200 mg/L to 8,700 mg/L. This is consistent with the previous studies that also found that water quality in the Warramunga Group is highly saline and is unsuitable for human consumption (Rockwater, 1989; Verhoeven & Knott, 1980).

Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the water from Lake Alice in October 2021 recorded very low EC (99 µS/cm at Lake Alice and 140 µS/cm) and TDS (60 mg/L at Lake Alice and 84 mg/L at Nobles Nob Pit). This might be due to the fact that the samples were collected from near-surface, and higher EC/TDS values could be expected further down the water profile as saline water often sinks to the bottom. It could also be possible that water in the pit and Lake Alice could represent rainfall runoff. It is recommended that gradient sampling of pit water using a hydrasleeve be undertaken to understand further the water composition and recharge source within the pit and Lake Alice.

2.4.6.2 Major Ions

Major ion concentrations were also laboratory analysed for all 10 groundwater bores. Amongst the cations, the sodium concentration was recorded the highest at all bores, ranging from 560 mg/L at NNMW002 to 2,100 mg/L at NNMW004 and NNMW005. Amongst the anions, the chloride concentration was the highest ranging from 1,300 mg/L at NNMW002 to 3,700 mg/L at NNMW005, followed by sulfate ranging from 240 mg/L at NNMW002 to 1,100 mg/L at NNMW011. Carbonate concentrations were below the limit of reporting at all bores.

The major ion data suggests that the water type of all groundwater bores is sodium chloride type (**Figure 2.6**)**.** Sodium chloride (Na-Cl) dominated water in the groundwater bores reflect low recharge and influence of evaporative processes.

Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the surface water from Lake Alice (SWLA) in October 2021 record a different proportion of major ions. The dominant cation in Nobles Nob pit is potassium (13 mg/L) followed by calcium (7.3 mg/L). The dominant anion in Nobles Nob pit water is bicarbonate (52 mg/L). The stiff diagram of Nobles Nob suggest the water type is Ca-HCO_3+CO_3 (**Figure 2.7**). This likely reflects the influence of rainfall recharge to the open pit.

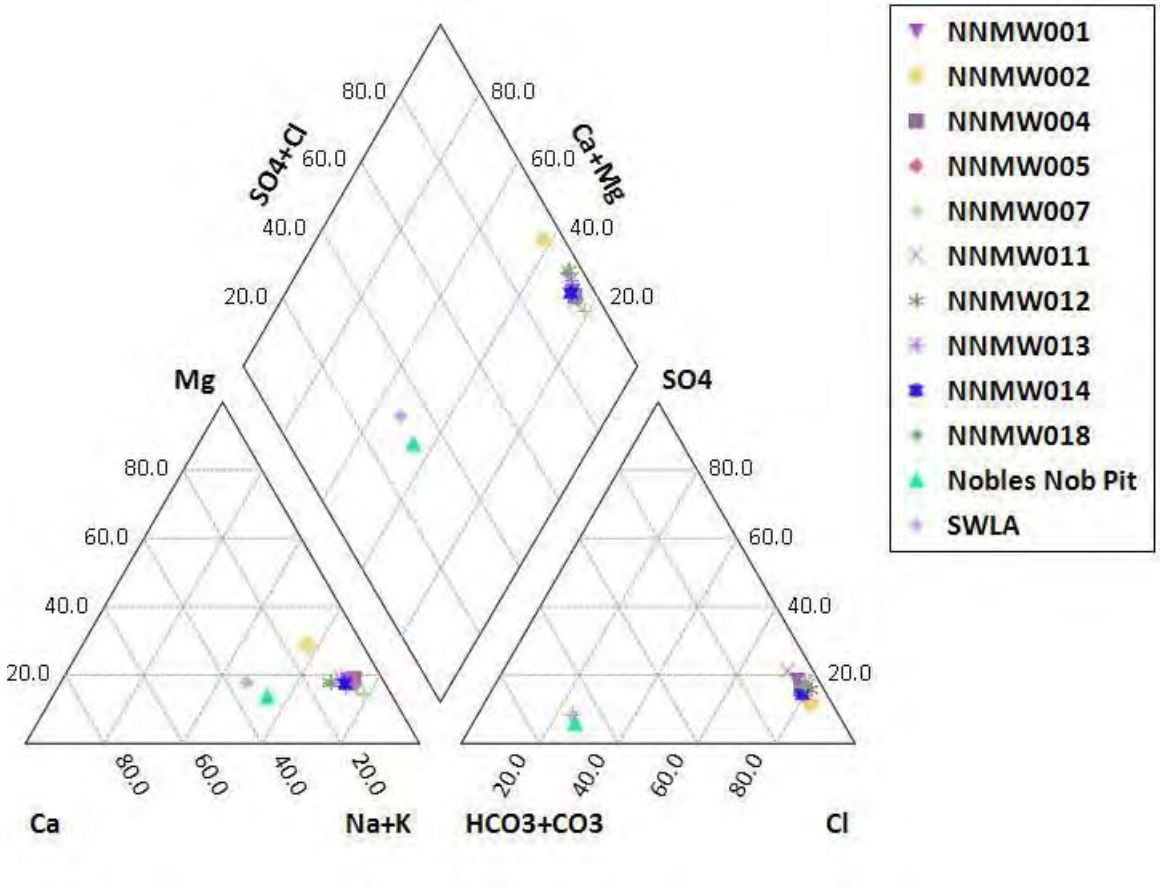


Figure 2.6 Piper Diagram of Groundwater Bores at Nobles Nob

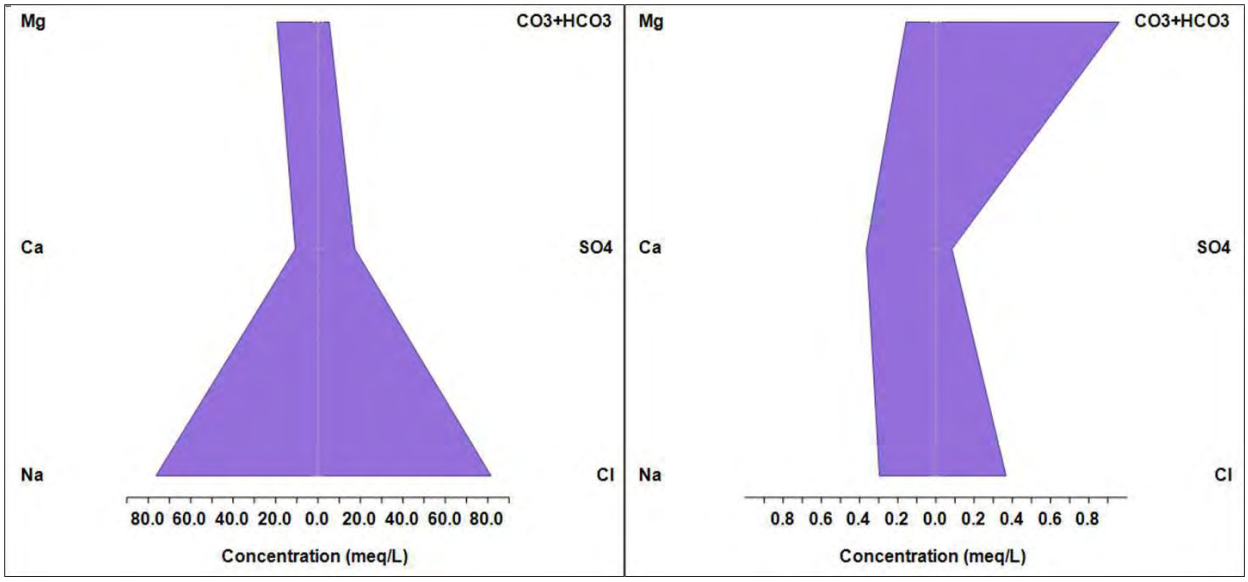


Figure 2.7 Stiff Diagram of Groundwater Bores (Left) and Nobles Nob Pit (Right)

2.4.6.3 Metals and Metalloids

Results for dissolved and total metals from samples collected in October 2021 are presented in **Table 2.6** and summarised as follows.

The concentration of many metals was recorded below the limit of reporting (LOR) in all bores. These include dissolved and total concentrations of arsenic, mercury, and silver (**Table 2.6**). It is recommended that monitoring at Nobles Nob be continued to understand site-specific occurrence and variation in concentrations of metals in groundwater. The median concentrations of most metals were recorded higher than the Nobles Nob pit, which was sampled in 2018. This reflects the influence of rainfall capture to the pit, with groundwater contribution likely to below.

All bores recorded free cyanide concentrations below the LOR (**Table 2.6**), whereas the total cyanide concentration was below LOR in 7 out of 10 bores. Bores NNMW001, NNMW004, and NNMW005 recorded the concentration of total cyanide above LOR. The presence of cyanide at these bores might be attributed to the fact that these bores are located very close to the historical tailings deposits. Cyanide concentrations were not available for the Nobles Nob pit.

Table 2.6 Summary of the Groundwater Quality at Nobles Nob

Parameters	Unit	Groundwater Bores at Nobles Nob				Nobles Nob Pit**
		Non-detect (%)	Min	Median	Max	
Field EC	µS/cm	0	4537	10360	14890	-
Field pH	pH unit	0	6.53	6.865	7.12	-
Lab EC	µS/cm	0	4700	11000	14000	140
Lab pH	pH unit	0	7.4	7.8	7.9	6.9
Sulfur as Sulfate SO_4	mg/L	0	240	885	1100	4
Total Dissolved Solids	mg/L	0	3200	6600	8700	84
Aluminium	mg/L	0	0.012	0.02	0.043	<0.01
Arsenic*	mg/L	100	5.00E-04	0.0045	0.0045	<0.001
Cadmium	mg/L	30	0.00015	0.00035	5.00E-04	<0.0001
Chromium	mg/L	80	0.001	0.0015	0.0034	<0.001
Cobalt	mg/L	10	0.0015	0.014	0.18	<0.001
Copper	mg/L	60	0.0015	0.0015	0.01	0.001
Iron	mg/L	90	0.01	0.01	0.02	0.003
Lead	mg/L	80	5.00E-04	0.0015	0.006	<0.001
Manganese	mg/L	0	0.016	0.665	4.3	<0.005
Mercury	mg/L	100	2.50E-05	2.50E-05	2.50E-05	-
Nickel	mg/L	40	0.0015	0.0035	0.012	<0.001
Selenium	mg/L	0	0.01	0.018	0.037	<0.001
Silver	mg/L	100	5.00E-05	7.50E-05	0.000125	-
Vanadium	mg/L	80	0.001	0.0015	0.005	-
Zinc	mg/L	30	0.0025	0.0075	0.024	<0.01
Total Aluminium	mg/L	0	0.094	0.93	3.3	4.6
Total Arsenic*	mg/L	100	5.00E-04	0.0045	0.0045	0.002
Total Cadmium	mg/L	30	0.00015	4.00E-04	5.00E-04	<0.0001

Parameters	Unit	Groundwater Bores at Nobles Nob				Nobles Nob Pit**
		Non-detect (%)	Min	Median	Max	
Total Chromium	mg/L	50	0.0015	0.00225	0.005	0.009
Total Cobalt	mg/L	10	0.0015	0.017	0.18	0.004
Total Copper	mg/L	20	0.0015	0.0045	0.025	0.011
Total Iron	mg/L	0	0.13	1.03	2.5	13
Total Lead	mg/L	20	0.0015	0.004	0.006	0.011
Total Manganese	mg/L	0	0.024	0.7	4.4	0.23
Total Mercury	mg/L	100	2.50E-05	2.50E-05	2.50E-05	-
Total Nickel	mg/L	30	0.0015	0.004	0.014	0.003
Total Selenium	mg/L	0	0.011	0.0195	0.038	<0.001
Total Silver	mg/L	100	5.00E-05	7.50E-05	0.000125	-
Total Vanadium	mg/L	30	0.0015	0.0045	0.008	-
Total Zinc	mg/L	0	0.006	0.013	0.029	0.017
Free Cyanide	mg/L	100	0.002	0.002	0.002	-
Total Cyanide	mg/L	70	0.002	0.002	0.039	-

Note: *the LOR for arsenic in the analysis was variable. ** Nobles Nob Pit was sampled in 2018. < denotes below Limit of Reporting.

2.5 Recharge

Recharge to the aquifers around Nobles Nob is primarily from rainfall infiltration through the ground surface. However, it is challenging to assess water level responses in groundwater bores to rainfall events due to the lack of water level readings. The Nobles Nob pit also potentially acts as a point of recharge for the area.

It is also likely that recharge occurs to the aquifers through direct infiltration from creek beds further away from the site. This is also consistent with the strong correlation between sodium and chloride, which indicates that recharge water is also Na-Cl rich. Usually, indirect recharges are common in arid areas (Harrington et al., 2002). As rainfall in the Tennant Creek area is episodic and low, and as the evapotranspiration rates are high throughout the year, recharge from rainfall will be during high-intensity rainfall periods.

2.6 Discharge

A recent study (McPherson et al., 2020) conducted approximately 25 kilometres south of Tennant Creek found that the groundwater discharge across all the bore fields in the study area occurred in the following ways:

- Underflow to the Wiso Basin (southeast to northwest trend).
- Evapotranspiration and diffuse discharge where groundwater is close to the surface.
- Groundwater pumping from the Cabbage Gum and Kelly Well bore fields.

In the Nobles Nob area, the discharge is mainly through evapotranspiration. Diffuse discharge occurs where groundwater is shallow (e.g., less than 10 m below ground surface), which is not the case at Nobles Nob. The average water level is approximately 60 to 70 metres below ground. The Nobles Nob pit might also act as a source of discharge, given the rate of evaporation in the area is high.

Pumping at the Cabbage Gum and Kelly Well bore fields is the other source of groundwater discharge from the system, across Tennant Creek region. However, the low permeability and saline nature of the groundwater around Nobles Nob indicates that the groundwater system at Nobles Nob is not connected to the bore fields that are being pumped.

2.7 Groundwater-Surface Water Interaction

The points at which the groundwater system and the surface water systems come in contact with each other is often referred to as groundwater-surface water interactions. This can be either groundwater expressed at the surface in the form of springs, permanent pools etc.; or where groundwater is recharged by the surface water, such as rivers recharging the aquifers through bedrock or outcrop etc.

The assessment of springs through the Atlas of Groundwater Dependent Ecosystems (BOM, 2012) and the NR Maps tool indicated no known springs or permanent water bodies within 10 km of the Nobles Nob pit.

2.8 Environmental Values and Use of Groundwater

Historical mining and grazing have been the primary use of the land, and therefore the use of groundwater around Nobles Nob is restricted to these activities.

As per the findings of previous studies (e.g., Rockwater, 1989; Rose, 1973; Rose & Willis, 1973; Verhoeven, 1976; Verhoeven & Knott, 1980), the quality and low permeability of groundwater from the Warramunga Group limits its usage. That is why the water for Tennant Creek Township is pumped from the Cabbage Gum, and Kelly Well bore fields, which are approximately 25 kilometres south of Tennant Creek. As mentioned in **Section 2.4.2**, all the registered bores within 2.5 km of Nobles Nob pit are mine related bores, and there are no declared groundwater users in the area.

Assessment of groundwater-dependent ecosystems (GDEs) around Nobles Nob suggests that there are no GDEs within a 10 km of the Nobles Nob Pit. The GDEs refer to ecosystems that rely on groundwater, either permanently or intermittently. This includes surface expressions of groundwater in the forms of springs and wetlands and below ground systems, such as caves.

2.9 Conceptual Hydrogeological Model

A conceptual hydrological model for the site was developed based on the available background information and groundwater data presented in **Section 2.0**, which includes climate trends, topography, drainage, geology, and hydrogeological characteristics.

The topography at the Nobles Nob site varies from approximately 285 mAHD to approximately 380 mAHD, reducing in elevation away from the Nobles Nob pit. There are no surface water features in the area, except the Nobles Nob pit and Lake Alice located close to bore NNMW011.

From the background information, the main groundwater bearing unit on site is associated with local scale fractured and weathered rock aquifer that occurs in sandstone/siltstone of the Warramunga Formation. Drilling records of the monitoring bores on site, installed in May/June 2021 suggests that groundwater in this aquifer is generally first encountered between approximately 70 to 80 meters below ground level.

Cross sectional models illustrating inferred groundwater levels and flow directions, interpolated geology, groundwater conditions and interaction with the pit are shown in **Figure 2.8** and **Figure 2.9**. The alignment of the conceptual models is shown in **Figure 2.4**. The cross-sections show a relatively flat groundwater gradient at site, and mapping in **Figure 2.5** indicates a general gradient towards the northwest consistent with the regional flow direction.

Figure 2.8 and **Figure 2.9** illustrate that the Nobles Nob pit is recharged by rainfall, with levels likely controlled by evaporation. The available water quality data from the Nobles Nob pit is very different compared to the groundwater quality recorded at the monitoring bores, indicating potentially low groundwater contributions. However, additional temporal spread of groundwater and surface water data should also be collected to confirm this interaction.

Available information indicates that the proposed processing plant (proposed near bore NNMW001) will be in an area that has a thick layer (> 30 m) of clay. This clay layer will act as a natural aquitard and restrict recharge and seepage from surface to the fractured rock aquifer. However the extent and condition of this clay layer should be verified.

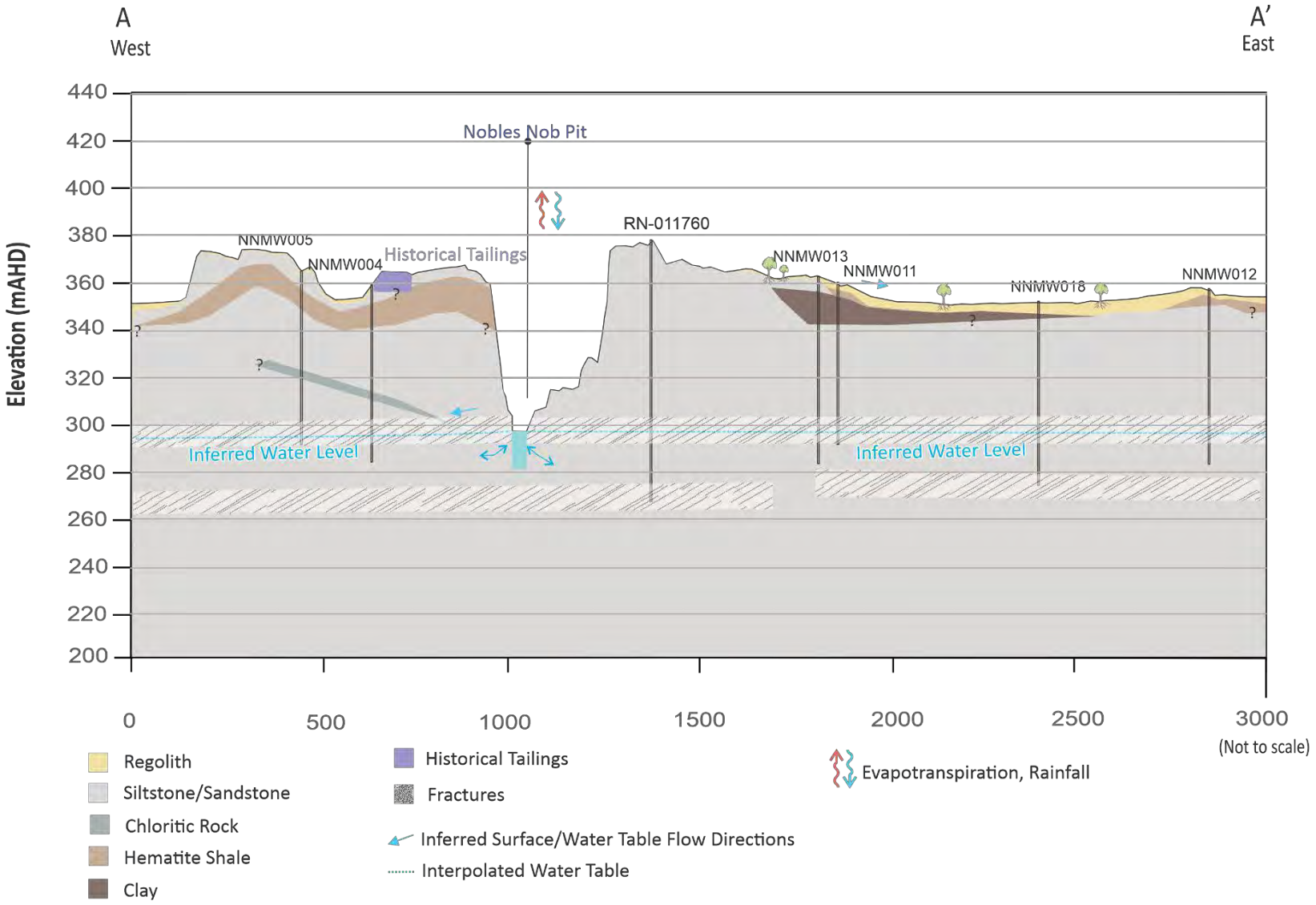


Figure 2.8 Conceptual Model A-A' – West to East

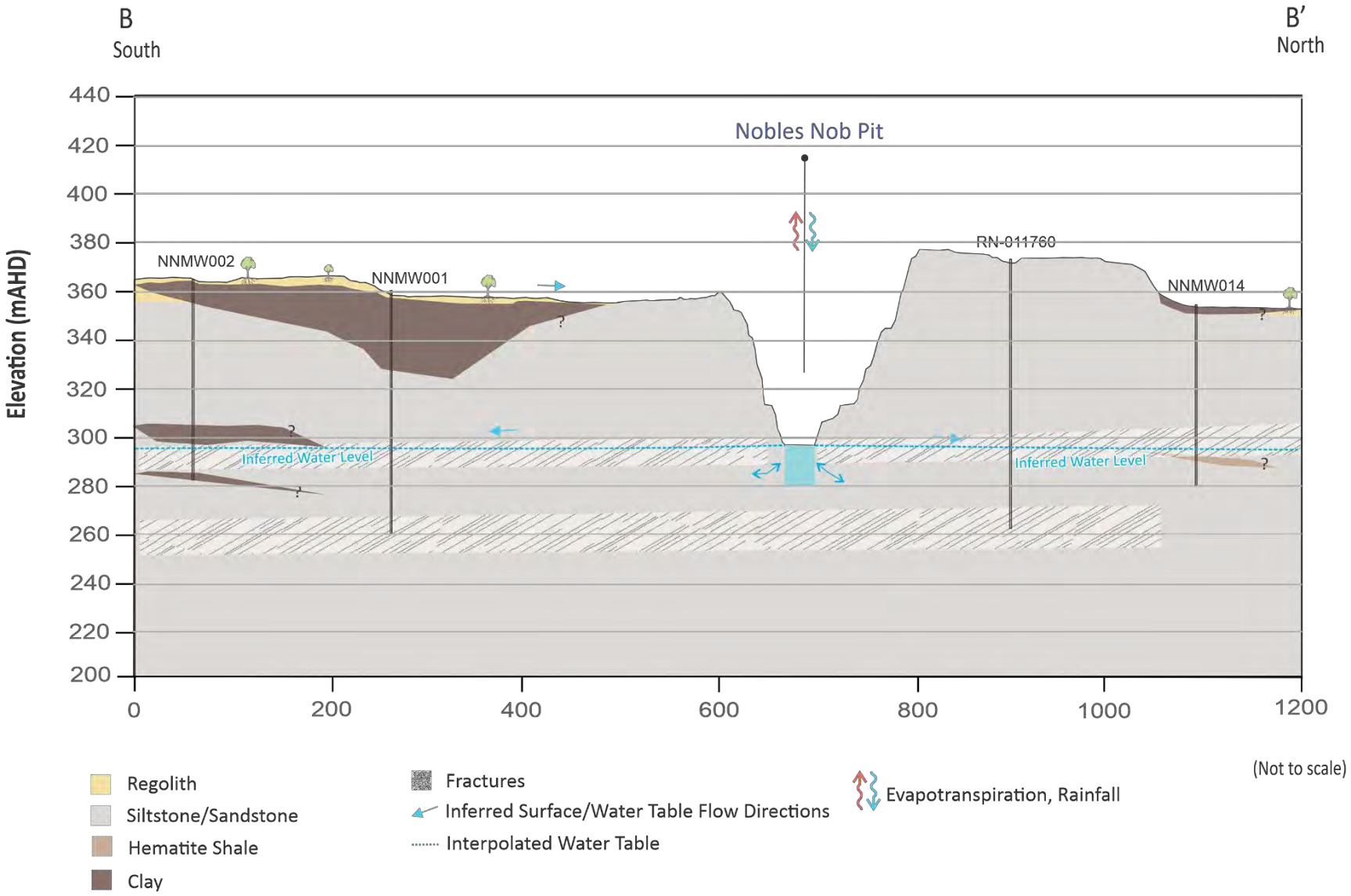


Figure 2.9 Conceptual Model B-B' – South to North

3.0 Predicted Impacts of Proposed Activities on Groundwater

3.1 Groundwater Affecting Activities and Potential Impacts

3.1.1 Processing Plant and Tailings Storage

TCMG is planning to process existing waste and tailings material at Nobles Nob by setting up a processing plant within the Proposed Processing Area (**Figure 1.1**). The processing will include crushing and milling of the existing waste rocks, before processing and discharge of tailings. As per the plan, the tailings will be pumped to the tailings storage area, where they will be filtered using Geotube dewatering tubes. These Geotubes will retain the solid particles while allowing the liquid to discharge (COMO, 2021). The discharged liquid will be captured by a recovery pump located at the base of the Geotube stacking area. The recovery pump will return the discharged water to the process water ponds for re-use (COMO, 2021).

As the processing plant uses cyanide, the discharged water from the Geotubes might contain high concentrations of cyanide and other metals (both dissolved and total). There is a potential of impact on groundwater quality from the discharged water from the Geotubes. Communications with TCMG have indicated that the Geotubes and the drainage ponds collecting discharged water will be designed with a high density polyethylene (HDPE) liner to inhibit seepage. In addition, as presented in **Figure 2.9,** the geological log for bore NNMW001 indicates the presence of a thick sequence of low permeability clays at the surface. The liner and clays (where present) will inhibit potential seepage to groundwater, which occurs around 61 m below the surface. However, management and mitigation measures are recommended to verify the performance of the liner and for ongoing monitoring.

3.1.2 Process Water Storage

The operations at Nobles Nob will also be storing process water on-site and will be distributed throughout the plant. As per the report by COMO (2021), the process water will be used for the following:

- Mill discharge
- Trommel Screen Spray water
- General hosing

The process water will be sourced from a raw water supply and from the tailings discharge water from the Geotubes. As the discharged tailing water might contain a high amount of cyanide and elevated metal concentrations, there is a potential for impact on groundwater quality. Umwelt understands that the bottom of the process water dams will be lined with HDPE liner, which should prevent leakage of dam water into the underlying water-bearing unit. In addition, as presented in **Figure 2.9** and discussed above, low permeability clays occur at the surface around the Proposed Processing Area. The liner and clays (where present) will inhibit potential seepage to groundwater, which occurs around 61 m below the surface. However, management and mitigation measures are recommended to verify the performance of the liner and for ongoing monitoring.

3.1.3 Storage of Ore/Run-Of-Mine Stockpile

The ores and run-of-mine (ROM) will be stored around the processing area and ROM pad in stockpiles before processing. Although the timeframe of this storage will be small, there is the potential of leachate running from these ores and waste rocks stockpiles during rainfall events. The assessment of the waste rock samples indicated that the likelihood of acidic drainage from these waste rocks is unlikely (Umwelt, 2021a). However, there is a potential for metalliferous drainage enriched in aluminium and zinc (Umwelt, 2021b).

Since the groundwater on site is over 50 m below the surface, it is unlikely to be impacted by these leachates. It is more likely that the leachate from the stockpiles will travel at the surface, and it is recommended that systems to intercept this surface flow (such as sumps and diversion drains etc.) should be installed. It is noteworthy that these waste rocks have already experienced weathering, minimising the potential for leachate and geochemical changes in these samples. Furthermore, as the Nobles Nob area does not experience much rainfall, the likelihood of this happening is fairly low, but cannot be completely ruled out.

4.0 Management and Mitigation Measures

As outlined in **Sections 2.9** and **3.0**, the main potential risks and impacts relevant to groundwater relate to changes in water quality. The proposed activities (refer to **Section 1.3**) do not include any interception or abstraction of groundwater; therefore, there are no predicted impacts on groundwater levels or availability. Due to this, the management and mitigation measures are focused on groundwater quality aspects. This section presents the proposed monitoring network, monitoring frequency and parameters, quality assurance and assessment and reporting protocols relevant to groundwater.

4.1 Proposed Groundwater Monitoring Program

4.1.1 Proposed Monitoring Network

The existing groundwater monitoring network at Nobles Nob comprises 10 monitoring bores installed in May/June 2021. The existing groundwater bore network consists of two monitoring bores, NNMW001 and NNMW002, around the proposed processing plant and tailings storage area. Both these monitoring bores are also designed to monitor groundwater at a depth of 90-102 metres (NNMW001) and 65.9-77.9 metres (NNMW002) below ground level. These bores were sampled only once in October 2021 since their installation. Details on the existing bores is included in **Table 4.1**, and locations are shown in **Figure 2.4**.

The total depth of the existing bores ranged from 66 m to 102 mbgl and targeted the regional groundwater table. There is potential for water to be present in the shallow weathered horizon in localised areas, as identified at NNMW007 and discussed in **Section 2.4.3.1**. Therefore, it is proposed that an additional four shallow bores be installed for early detection of potential seepage relevant to site activities in the proposed processing plant and tailings storage area. These shallow bores would also help confirm the degree of hydraulic connectivity to the regional groundwater table targeted by the deeper bores.

The tentative depth and screen intervals of the proposed shallow bores are proposed in **Table 4.1**. These details will be finalised once the design and location of the processing plant, process water ponds, tailings storage are finalised.

Table 4.1 also presents the proposed monitoring program, including water level montoring and water quality monitoring frequency. Further details on the monitoring program is included in **Section 4.1.2**.

Table 4.1 Proposed Monitoring Program

Bore ID	Easting*	Northing*	Depth (m)	Screen Interval	Stratigraphy	Purpose	SWL	WQ
Proposed 1	TBC	TBC	~ 10	~ 4 - 10	Weathered horizon – water table	Early detection of potential seepage from proposed Proposed Processing Area. Locations to be determined based on final plan designs.	Daily (logger) and Monthly (manual)	Monthly
Proposed 2	TBC	TBC	~ 10	~ 4 - 10				
Proposed 3	TBC	TBC	~ 20	~ 11 - 20				
Proposed 4	TBC	TBC	~ 20	~ 11 - 20				
NNMW001	425505	7819803	102	90 - 102	Sandstone	Located south of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Daily (logger) and Monthly (manual)	Monthly
NNMW002	425488	7819596	77.9	65.9 - 77.9	Sandstone			
NNMW004	425374.9	7820346	75	63 - 75	Sandstone	Located north-west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Daily (logger) and Monthly (manual)	Monthly
NNMW005	425228.6	7820086	70	58 - 70	Sandstone	Located west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly (manual)	Monthly
NNMW007	424730.8	7819950	95.8	83.8 - 95.8	Sandstone	Located west of the Proposed Processing Area. Monitoring groundwater levels and quality, for detection of potential changes in water quality due to site activities	Monthly (manual)	Monthly
NNMW014	426075.9	7820387	69.6	57.6 - 69.6	Hematite Shale	Located north of the existing open-cut. To monitor groundwater levels and quality trends in response to existing mine features and verify regional flow directions and influence from historical mining.	Monthly (manual)	Monthly
NNMW011	426621.8	7819922	66	54 - 66	Sandstone	Background reference bore. To monitor groundwater level and quality trends up-gradient of site.	Quarterly (manual)	Quarterly
NNMW012	427616.9	7819830	76.6	64.4 - 76.4	Sandstone			
NNMW013	426527.3	7820174	78	66 - 78	Sandstone/Siltstone			
NNMW018	427151.5	7819926	78	66 - 78	Sandstone			

Note: TBC – To be confirmed *mbgl – metres below ground level* *SWL – Standing water level monitoring program* *WQ – Water quality monitoring program*

4.1.2 Groundwater Monitoring Frequency and Parameters

The frequency of monitoring for the proposed network is shown in **Table 4.1**. A monthly frequency has been proposed for selected bores for the initial 12 months of monitoring, in order to collect sufficient baseline data. Following the 12 months of data collection, the monitoring frequency should be reviewed and refined.

Groundwater level monitoring will be conducted to capture natural groundwater level fluctuations (such as responses to rainfall) and detect any potential groundwater level impacts. It has also been proposed that the proposed shallow proposed bores and the two existing deeper bores near the Proposed Processing Area be equipped with dataloggers to collect daily timeseries water level data and can be downloaded on a monthly basis and verified against manual dipped levels. This will help to verify the water table response to rainfall events and degree of hydraulic connection between the shallow weathered horizon and deeper regional groundwater table.

Groundwater quality sampling should conducted to detect any changes in groundwater quality relevant to the proposed site activities. In order to better understand the groundwater quality characteristics on-site, it is recommended that the groundwater samples be analysed from the sampling suite outlined in **Table 4.2**.

As discussed in **Section 3.1** and the waste rock characterisation results (**Appendix A**), the main potential contaminants of concern include cyanide associated with the processing plant and aluminium and zinc associated with the waste rock material. These analytes have been included in **Table 4.2**, along with additional metals to provide a baseline dataset. It is recommended that the analyte suite be reviewed after the initial 12 months of data is collected to further refine based on relevant site water quality results.

Table 4.2 Groundwater Parameters for Monitoring

Parameters
Standing Water level (SWL)**
pH*
Electrical Conductivity*
Major Anions - Na, K, Ca, Mg, hardness
Major Cations - Cl, SO4, Alkalinity (CO3-, HCO3-, total alkalinity)
Total Dissolved Solids*
Total and Dissolved Metals
Aluminium
Arsenic
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium

Parameters
Vanadium
Zinc
Free and Total Cyanide

Note: *Both field and laboratory measurements are to be recorded. ** only field measurement in mbtoc.

4.1.3 Groundwater Monitoring

Groundwater monitoring and sampling should be conducted in accordance with *Australian and New Zealand Standard for Groundwater Sampling (AS/NZS 5667.11:1998)* and *Methodology for the Sampling of Groundwater* developed by Department of Primary Industry and Resources (DPIR) of the Northern Territory.

4.1.4 Monitoring Data Management

It is recommended that the data gathered from the groundwater monitoring be collated into a database which includes:

- A site plan showing sampling location.
- Periodic photos from sampling locations during the sampling event.
- Tabulated results of the monitoring compared with appropriate background levels (when available).
- All data collected during each monitoring round.
- A record of the chain of custody of the samples from sampling through to analysis.
- Laboratory analysis certificates.

In addition to the above-mentioned list, the following records should also be kept for each sampling event:

- Field sheets with all field observations for each bore sampled.

4.2 Quality Assurance and Quality Control

As a quality assurance and control measure, a blind duplicate sample should be collected every 10 samples for the groundwater monitoring at Nobles Nob. The date and time of the sample should not be disclosed to the laboratory. Interpretation of the results from the blind duplicate is based on the reproducibility assessment method, which provides a measure of precision. The analytical values from the original sample and its duplicate are compared by calculating the relative per cent difference (RPD) for each parameter as follows:

$$RPD\ (\%) = [\frac{Sample - Duplicate}{(Average\ of\ Sample\ and\ Duplicate)}] * 100$$

The RPD then uses the limit of reporting (LOR) to identify thresholds for valid reproducibility. These include:

- Mean of sample and duplicate <10 times LOR: There is no RPD limit (i.e., reproducibility is valid)
- 10 times LOR < Mean of sample and replicate < 20 times LOR: The RPD range limit is 0%-50% for a valid duplicate

- Mean of sample and replicate > 20 times LOR: The RPD range limit is 0% - 20% for a valid duplicate.

If the RPD exceeds the threshold percentage, the results are considered unreliable and require further investigation. Only one duplicate sample is needed to be collected per sampling event.

4.3 Groundwater Assessment Protocols

4.3.1 Assessment Criteria

The groundwater quality monitoring results should be assessed against criteria, which will provide an early warning for any potential impacts through changes in the groundwater quality. Due to the lack of available groundwater data at Nobles Nob, developing site-specific criteria is not possible. It is recommended that the criteria to assess groundwater quality be developed following sufficient observations, with a minimum of 12 months of groundwater data.

For the period until sufficient groundwater data is available, interim groundwater triggers levels have been proposed in accordance with ANZECC & ARMCANZ (2000) guideline values for livestock drinking water, and Australian drinking water guidelines (NHMRC, NRMMC, 2011)(**Table 4.3**).

Table 4.3 Proposed Interim Trigger Levels

Parameters	Trigger Level	Units
pH*	6 - 9	pH Units
EC**	5970	µS/cm
Total Dissolved Solids (TDS)**	4000	mg/L
Sulfate	1000	mg/L
Aluminium	5	mg/L
Arsenic	0.5	mg/L
Cadmium	0.01	mg/L
Chromium	1	mg/L
Cobalt	1	mg/L
Copper	1	mg/L
Iron*	0.2	mg/L
Lead	0.1	mg/L
Manganese*	0.2	mg/L
Mercury	0.002	mg/L
Nickel	1	mg/L
Selenium	0.02	mg/L
Zinc	20	mg/L
Free Cyanide^	0.007	mg/L
Total Cyanide#	0.08	mg/L

Note: * Trigger Level for pH, Iron, and Manganese has been derived from ANZECC Irrigation guideline values (ANZECC & ARMCANZ, 2000)
** Trigger level for TDS has been adapted from the levels specified for Beef cattle. Trigger Level for EC has been calculated using conversion from adapted TDS using equation 4.6 of ANZECC & ARMCANZ (2000)
^Trigger level for Free Cyanide has been derived from ANZG (2018) default guideline value for aquatic ecosystem (95% level of species protection).
#Trigger level for Total Cyanide has been adapted from Australian drinking water guidelines (NHMRC, NRMMC, 2011).

4.3.2 Investigation Criteria

In order to manage the groundwater on-site, the groundwater monitoring results should be assessed with criteria outlined in **Section 4.3.1 above**, which will provide an early warning for any potential changes in the groundwater quality.

Based on the available groundwater data, it is recommended that the criteria to trigger an investigation should be the following:

- If the groundwater quality results exceed the triggers mentioned in **Table 4.3** for three (3) consecutive monitoring events.
- If the groundwater quality results exhibit an increasing temporal trend in three (3) consecutive monitoring events.

4.3.3 Investigation Procedures

It is recommended that when an investigation criterion is triggered, the bore and the analyte should be investigated. An investigation should assess the potential for environmental harm and should include a written report outlining:

- Details of the investigations carried out, including source and cause of the criterion.
- Actions taken to prevent environmental harm.

4.4 Reporting and Review

It is recommended that yearly reporting summarising the monitoring network's water level and quality results should be undertaken. The existing monitoring program should be reviewed annually by an appropriately qualified person to determine if it continues to meet the requirements. The review may also include:

- A review of the adequacy of the monitoring locations, frequencies, and development of groundwater quality triggers.
- Recommendations for any required increase in monitoring bore locations to monitor quality/drawdown impacts adequately.
- Revision of monitoring parameters and/or frequency, if required.
- Expanding the existing groundwater monitoring network over time to enable ongoing groundwater impact evaluations.

As required, this monitoring program may be updated or revised based on the outcomes of the review process.

5.0 Conclusion and Recommendations

Based on the limited available groundwater data, a preliminary hydrogeological assessment for Nobles Nob has been undertaken in this report. The finding for the report suggests that groundwater level and quality at existing groundwater monitoring bores at Nobles Nob should be continued to be monitored monthly. It is recommended that the water level in the Nobles Nob pit should be surveyed during one of the monitoring rounds for better comparison of groundwater level in bores and water level in the pit.

Adequacy of the existing monitoring plan should be reviewed again once the design and location of the processing plants are finalised, and additional shallow bores should be installed where necessary. It is also recommended that the monitoring frequency, parameters, and groundwater assessment criteria should be reviewed annually by a suitably qualified person.

It is also recommended that sufficient baseline groundwater data should be collected, and appropriate quality triggers should be developed, which can provide early signs of any impact on groundwater quality from the proposed activities.

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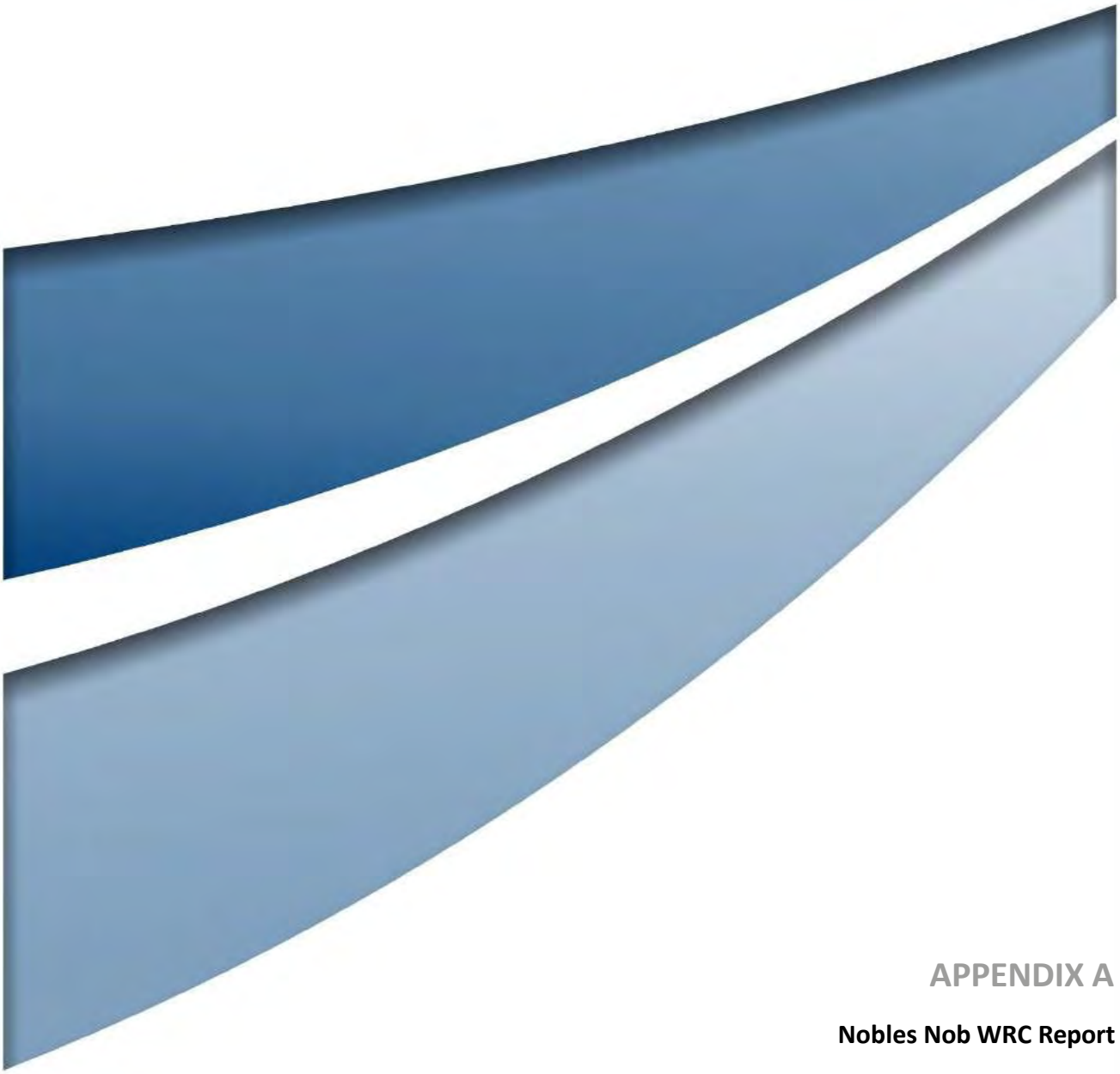

APPENDIX A

Nobles Nob WRC Report

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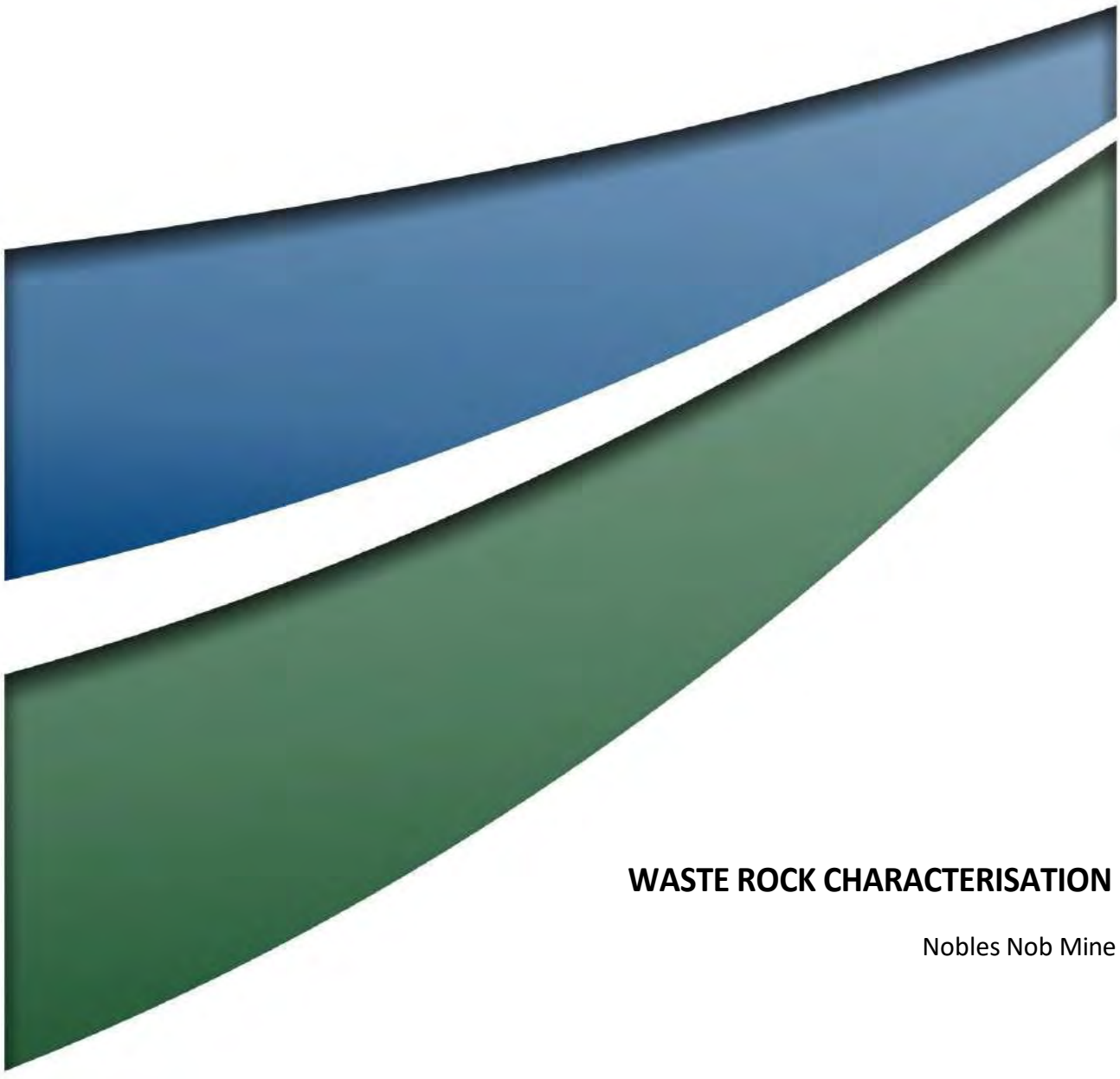
Environmental & Social
Consultants



WASTE ROCK CHARACTERISATION

Nobles Nob Mine

FINAL

October 2021

WASTE ROCK CHARACTERISATION

Nobles Nob Mine

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tennant Mining Consolidated Group

Project Director: Claire Stephenson
Project Manager: Ashish Mishra
Report No. 21728/R01
Date: October 2021

Environmental & Social Consultants

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Claire Stephenson	28/10/2021	Claire Stephenson	28/10/2021

Executive Summary

Umwelt Australia Pty Ltd (Umwelt) was engaged by Tennant Mining Consolidated Group (TCMG) to characterise the samples from the historical southern waste rock dump of the Nobles Nob Project in the Northern Territory, Australia. TCMG collected a total of 25 composite samples from drill holes drilled on the southern waste rock dump and one within the historical ROM pad. These samples were sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. The results were assessed to observe the potential of acidic, metalliferous, or saline drainage from these samples.

***Potential of Acidic* Drainage**

The results suggest that the aged pH of the samples ranged from a 5.9 to 8.6 pH unit, with the mean aged pH being 7, whereas the median aged pH being 6.9. Only one sample out of the total 26 samples recorded aged pH <6 pH units. The classification of the samples suggests that all 25 samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely.

Potential of Metalliferous Drainage

The geochemical abundance index (GAI) assessment of the 25 samples collected from the southern waste rock dump and one sample from the ROM pad at Nobles Nob suggest that the samples are significantly enriched (GAI >= 3) with the following metals:

- Molybdenum (Mo) – 5 out of 26 samples recorded GAI value equal to or greater than 3.
- Mercury (Hg) – only the sample from the ROM pad recorded GAI value equal to 3.

The Australian Standard Leachate Procedure (ASLP) tests for all 26 samples from the southern waste rock dump at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) DGV for 90% species protection. The results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection. Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment.

The combined assessment of GAI and ASLP results suggests a potential of metalliferous drainage from a few samples enriched in aluminium, zinc, and mercury (possibility of mercury enriched drainage is only from 1 sample 143512). It is recommended that drainage from these samples be restrained, and the receiving environment should be monitored for these analytes.

***Potential of Saline* Drainage**

Electrical conductivity (EC) has been used as a proxy for salinity in this assessment. All 26 samples underwent aged EC (1:2) and ASLP EC measurement. The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded aged EC between 150 and 450 µS/cm, whereas 100% samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely.

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1.0 Introduction

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 10 km southeast of Tennant Creek. Tennant Creek is approximately 500 km north of Alice Springs and 978 km south of Darwin.

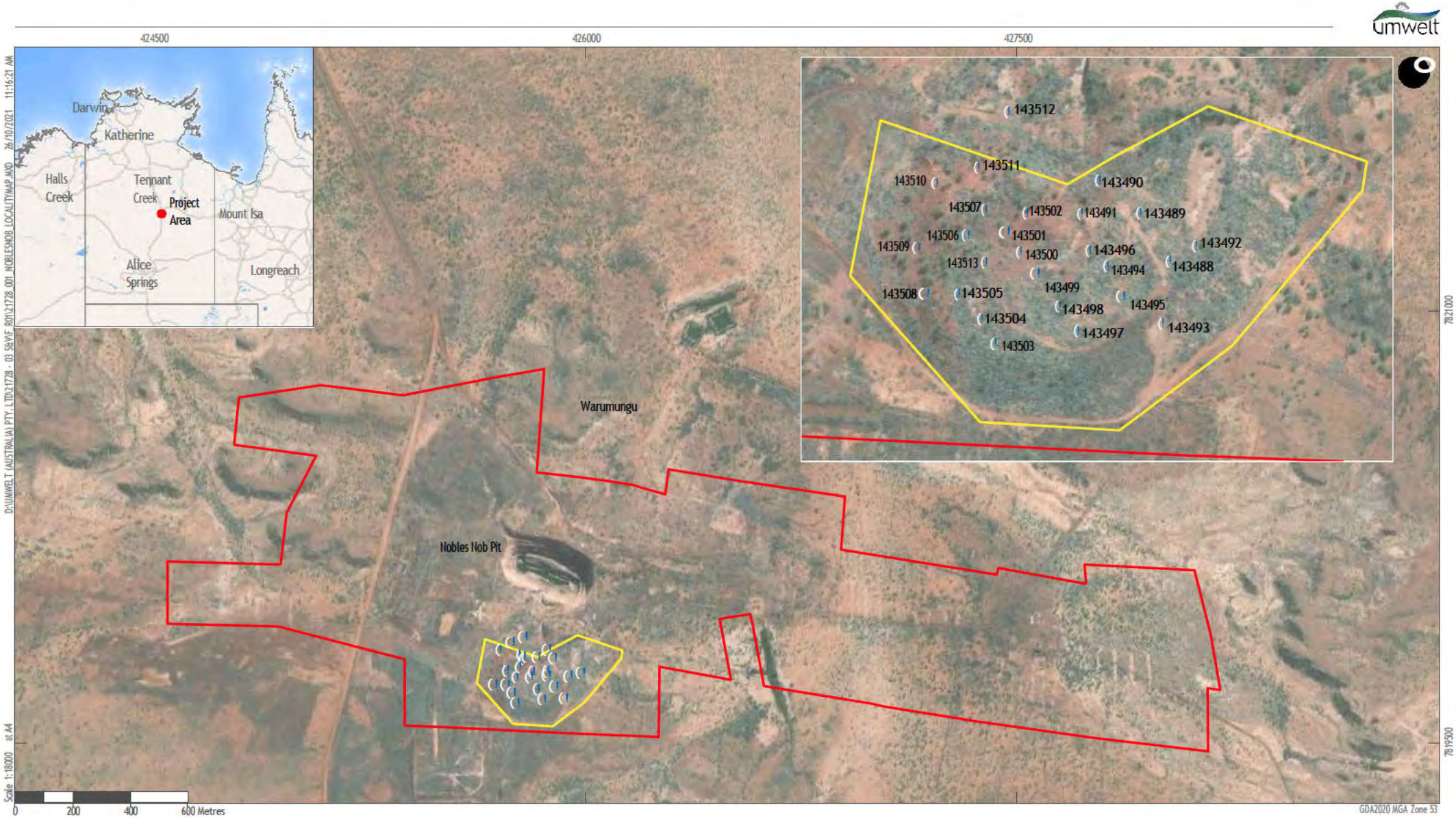
Nobles Nob Mine ranked amongst Australia's richest gold mine, yielding almost 1.1 million ounces (34 tonnes) of gold during its 45 years of operation. Gold mining at Nobles Nob commenced in 1934 when the first shaft was sunk to the depth of 50 feet (~15 meters). In 1968, following the collapse of the crown pillar, the mine was modified into an open pit with a new mill on site. Production at Nobles Nob continued until September 1992 when it was put into care and maintenance. The mine is now owned by Tennant Consolidated Mining Group (TCMG). TCMG are conducting field studies to support a mine management plan (MMP) to re-commence operations at the site. This included collection of 25 samples by TCMG from reverse circulation (RC) drill holes drilled on the southern waste rock dump at Nobles Nob and one sample from the historical Run-of-Mine (ROM) pad (refer **Figure 1.1)**. The samples were submitted to National Association of Testing Authorities (NATA) accredited laboratory SGS for analysis. It is understood from the information provided by TCMG, that materials from the historical waste rock dump and historical ROM pad will be processed at the proposed processing facilities at Nobles Nob.

Umwelt Australia Pty Ltd (Umwelt) was engaged by TCMG to review the laboratory results from the waste rock samples and assess the potential of acidic, metalliferous, or saline drainage from the samples. This report presents the findings from the geochemical assessment.

1.1 Geology

The Nobles Nob area is located within the Proterozoic Tennant Creek Inlier, which comprises a turbiditic flysch sedimentary sequence abutting various volcanic rocks. In the Tennant Creek region, these rocks are typified by the Warramunga Group, which commonly strikes east-west with variable dip. These rocks have been intruded by various granites and deformed by the Tennant Event of 1850 Ma.

The Nobles Nob ore body lies within the Warramunga Group, comprising sediments, volcanic lavas and volcaniclastic sediments. Gold-copper-bismuth mineralisation in the area has been found to be hosted by fine-grained haematitic mudstones and shaley siltstones. The mineralisation at Tennant Creek is generally small but of high grade and is hosted by fine-grained haematitic mudstones and shaley siltstones (Excalibur 2012). The mineralisation occurs within lenticular, ellipsoidal or pipelike bodies rich in magnetite and/or hematite. These are replacement bodies that cut across sedimentary structures and have been referred to as "ironstones" by previous workers on site. These zones of rich gold mineralisation are characterised by strong magnetite alteration below the base of oxidation. Above the base of oxidation, the magnetite is chemically weathered to haematite. Gold is generally very fine-grained in fresh deposits but very coarse and nuggety in the oxidised deposits (Excalibur 2012).



Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- ! Sample Locations

FIGURE 1.1

Site Layout and Sample Locations

Image Source: ESRI Basemap (2021) Data source: Umwelt 2021

1.2 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station Tennant Creek Airport (Station number 15135), presented in **Table 1.1**. Mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.2°C in the summer (December). The maximum temperature recorded at this station was 45.6°C in January 2014, and the minimum of 8°C was in June 2007 (BoM, 2021).

Table 1.1 Mean Monthly Temperature in Degree Celsius from 1969 to 2021

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature	36.8	35.9	34.6	31.9	27.7	24.6	24.8	27.6	31.8	35	36.7	37.2
Mean minimum temperature	25	24.5	23.4	20.5	16.4	13	12.4	14.4	18.5	21.8	23.9	24.9

All Values are in degree Celsius. Mean has been calculated using monthly data from 1969 to 2021

Rainfall data has been retrieved from the publicly available Scientific Information for Landowners (SILO) database. The monthly average rainfall and evapotranspiration data has been retrieved from the nearest SILO station Tennant Creek Airport (Latitude -19.64, Longitude 134.18), from 01/01/1900 to 01/10/2021.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long term rainfall trends in the vicinity of the site. This dataset is interpolated from quality checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall is 383 mm, which shows a rainfall deficit with evapotransiration (fao56) of 2137 mm/year (**Table 1.2** and **Figure 1.2**).

Table 1.2 Monthly Average of Rainfall and Evapotranspiration at Tennant Creek Airport

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SILO Rainfall	96.74	91.08	50.18	11.81	10 36	6.56	5.03	2.00	5 36	14.95	30.23	58.14	382.45
SILO ET	350.17	291.84	321.21	287.54	232.83	186.81	198.92	250.05	307.12	358.69	371.79	371.63	3528.60
SILO fao56 ET	213.65	182.77	191.34	167.69	138.37	115.27	126.32	156.08	185.14	215.50	220.75	224.11	2136.98

Note: ET – Evapotranspiration. All values are in mm.

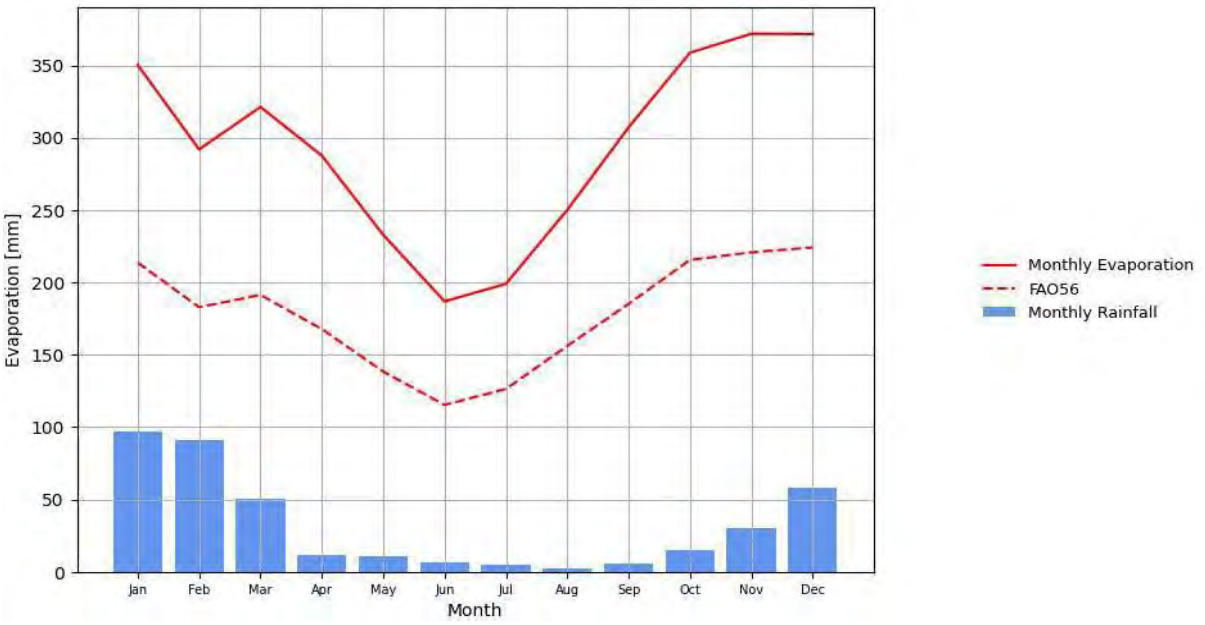


Figure 1.2 Graph showing Monthly Average Rainfall and Evaporation

The SILO dataset was used to calculate the cumulative rainfall deviation (CRD). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD plot indicates periods of above-average rainfall, whilst a declining slope indicates periods when rainfall is below average.

The CRD in **Figure 1.3** indicates that the area has experienced a period of above-average rainfall from around 2000 to 2016, and below-average rainfall since 2016. Due to the importance of large, episodic rainfall events for groundwater recharge, and in order to address temporal data gaps in the record, rainfall station data from across the area were combined. The figure also shows that there is strong seasonality in rainfall, with majority of rainfall occurring over the wet season, between November and March.

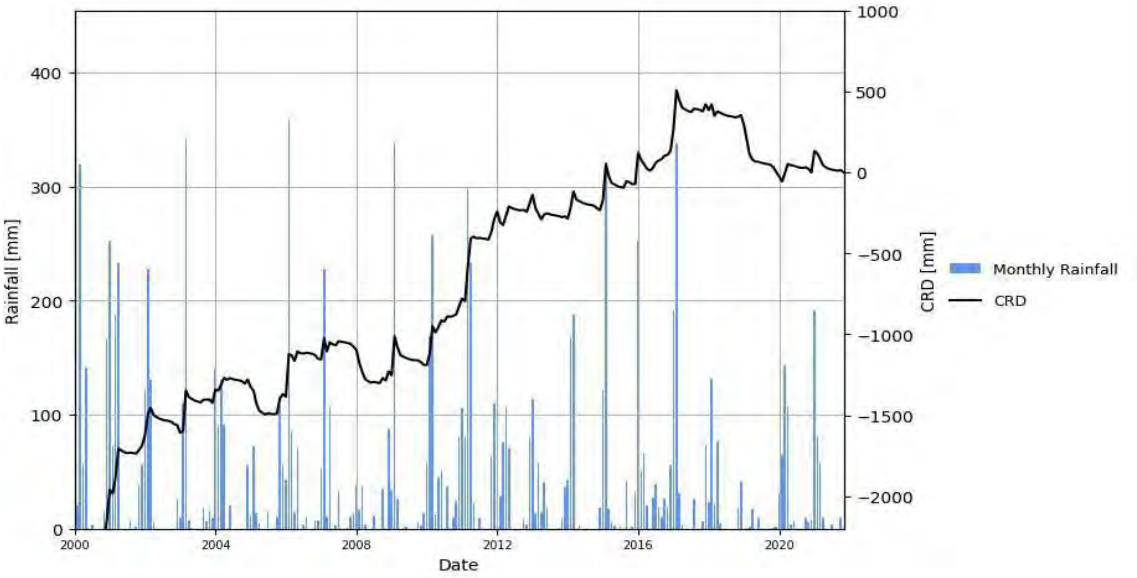


Figure 1.3 Monthly Rainfall and CRD (2000-2021)

2.0 Methodology

2.1 Sample Selection

A total of 25 composite samples were collected by TCMG from the reverse circulation (RC) drill holes drilled on the southern waste rock dump. Plus, one sample (143512) collected from the historical ROM pad.

Composite samples were collected by combining drill chips from various depth interval. The details of the samples including drill holes collected from, and the depth interval that were combined to form a composite sample is presented in **Table 2.1**. The sample locations are shown in **Figure 1.1.**

Table 2.1 Details and Locations of the Samples

Hole ID	Easting	Northing	Collar RL	Dip(◦)	Depth From (m)	Depth To (m)	Sample ID
TNNDU002	425935.43	7819721.5	375.73	-90	0	16	143488
TNNDU003	425890.25	7819684.7	374.13	-90	0	9	143495
TNNDU004	425845.46	7819653.3	373.36	-90	0	9	143497
TNNDU006	425874.54	7819709.5	371.77	-90	0	13	143494
TNNDU007	425827.35	7819677.2	371.68	-90	0	7	143498
TNNDU009	425906.34	7819760.6	373.15	-90	0	9	143489
TNNDU010	425857.27	7819732.8	370.97	-90	0	13	143496
TNNDU011	425804.55	7819700.3	370.77	-90	0	12	143499
TNNDU013	425866.06	7819790.2	370.01	-90	0	11	143490
TNNDU014	425849.03	7819764.5	369.72	-90	0	14	143491
TNNDU015	425788	7819730.7	371.31	-90	0	11	143500
TNNDU016	425771.48	7819754.3	374.93	-90	0	17	143501
TNNDU017	425756.13	7819772.6	376.72	-90	0	17	143507
TNNDU018	425764.11	7819641.4	374.54	-90	0	11	143503
TNNDU019	425751.04	7819665.4	374.91	-90	0	12	143504
TNNDU020	425728.42	7819691.3	375.6	-90	0	15	143505
TNNDU021	425736.5	7819747.6	376.54	-90	0	13	143506
TNNDU023	425795.18	7819766.7	374.54	-90	0	18	143502
TNNDU024	425755.16	7819720.2	374.8	-90	0	14	143513
TNNDU031	425783.31	7819868.2	363.35	-90	0	7	143512*
TNNDU036	425748.18	7819814.3	370.25	-90	0	13	143511
TNNDU041	425706.84	7819789.4	369.67	-90	0	15	143510
TNNDU042	425688.63	7819735.4	368.74	-90	0	11	143509
TNNDU043	425698.41	7819690.9	371.28	-90	0	10	143508
TNNDU044	425961.06	7819736.9	372.57	-90	0	13	143492
TNNDU045	425928.3	7819661.3	372.38	-90	0	14	143493

Coordinates are in GDA 2020. Collar RL is in mAHD.
*Sample 143512 from hole ID TNNDU031 is located on the historical ROM pad.

2.2 Laboratory Assessment

TCM sent the samples for analysis to SGS, which is a NATA accredited laboratory. Sub-sample preparation at the laboratory involved crushing, splitting and pulverising rock chip samples. All 26 samples were subjected to initial acid-base account (ABA) geochemical testing.

The characteristics that were assessed included:

- Aged pH (1:2) and Aged Electrical Conductivity (1:2) - The aged pH and aged electrical conductivity (EC) is the measured pH and EC of a mixture of sample and water at a ratio of 1:2, after leaving it overnight (~>16 hours).
- Total sulfur (wt%)
- Australian standard leaching procedure (ASLP)
- Acid neutralising capacity (ANC)
- Net acid producing potential (NAPP)
- Net acid generation (NAG)

In addition, a full metal suite analysed by inductively coupled plasma optical emission spectroscopy methods (ICP-OES) was conducted for the following metals:

- Arsenic (As)
- Aluminium (Al)
- Barium (Ba)
- Cadmium (Cd)
- Cobalt (Co)
- Chromium (Cr)
- Copper (Cu)
- Iron (Fe)
- Manganese (Mn)
- Mercury (Hg)
- Molybdenum (Mo)
- Nickel (Ni)
- Lead (Pb)
- Zinc (Zn)

2.3 Acidic Drainage Potential

In order to assess the acidic drainage potential of the samples, the combination of net acid production potential (NAPP) and net acid generation (NAG) classification scheme is commonly used in Australia, as per the AMIRA (2002) guideline. AMIRA (2002) is a guideline that outlines various tests and assessment methods to characterise acid forming potential of materials.

The NAPP is the difference between maximum potential acidity (MPA) and acid neutralising capacity (ANC) and represents the net acid producing capacity of the sample. In the NAG test, a sample is treated with hydrogen peroxide to rapidly oxidise any sulfide minerals contained within a sample (AMIRA, 2002). The result represents the net amount of acid generated by the sample, and is commonly referred to as the NAG capacity and is expressed in kg H_2SO_4/t.

NAG and NAPP help in classification of waste rocks into following categories (AMIRA, 2002):

- Non-acid Forming (NAF): suggests that the material cannot generate acid.
- Potentially acid forming (PAF): suggests that the material can potentially generate acid.
- Uncertain (UC): the test is not certain about the material's potential to generate acid.

2.4 Metalliferous Drainage Potential

Metal concentrations in the samples were analysed by inductively coupled plasma optical emission spectroscopy methods (ICP-OES). These results are important to characterise the overall metal concentrations in the samples and to identify enriched metals that can pose a risk of possible metalliferous drainage. Test of enrichment was undertaken using the geochemical abundance index (GAI).

2.4.1 Geochemical Abundance Index (GAI)

The geochemical abundance index (GAI) can be used to estimate the enrichment of metals in the samples relative to median crustal concentrations. The GAI is expressed on a log 2 scale. The GAI was developed by Förstner et al., (1993) and is defined as follows:

$$GAI = log_2 (\frac{C}{(1.5*B)})$$

Where,

C= measured concentration in sample,

B= median crustal abundance/concentration.

The enrichment ranges of a metal based on the GAI values are interpreted as follow:

- GAI=0 indicates <3 times median crustal abundance.
- GAI=1 indicates 3 to 6 times median crustal abundance.
- GAI=2 indicates 6 to 12 times median crustal abundance.
- GAI=3 indicates 12 to 24 times median crustal abundance.
- GAI=4 indicates 24 to 48 times median crustal abundance.
- GAI=5 indicates 48 to 96 times median crustal abundance.
- GAI=6 indicates more than 96 times median crustal abundance.

As a general guide, GAI value of 3 or above is considered significant concentration and might indicate potential of metalliferous drainage from that particular sample. The median crustal abundances used to compare results against the GAI are provided in **Table 2.2**.

Table 2.2 Median Crustal Abundance for Metals (Berkman and Ryall, 1976; Bowen, 1979)

Name	Symbol	Median Crustal Abundance (mg/kg)
Arsenic	As	6
Aluminium	Al	71000
Barium	B	500
Cadmium	Cd	0.35
Cobalt	Co	8
Chromium	Cr	70
Copper	Cu	30
Iron	Fe	40000
Manganese	Mn	1000
Molybdenum	Mo	2
Nickel	Ni	50
Lead	Pb	35
Zinc	Zn	90
Mercury	Hg	0.06

2.4.2 Australian Standards Leaching Procedure (ASLP)

The use of the GAI alone to understand the potential of metalliferous drainage may provide an over-conservative indicator (Jones et al., 2016). Therefore, other methods to assess the potential of metalliferous drainages, such as leaching procedures, is also undertaken. As such, the Australian Standards Leaching Procedure (ASLP) was undertaken on all 26 samples.

The ASLP is originally based on the Toxicity Characteristic Leaching Procedure (TCLP) developed by the United States Environmental Protection Agency (US EPA, 1992). The main objective of this procedure is to simulate the leaching of wastes from the waste rock into the receiving environment under acidic conditions. Deionised water is generally used as a leaching agent in test procedures that are utilised for assessing the leaching potential of waste rocks at mine sites.

Taking a conservative approach, the ASLP test results were compared to ANZG (2018) default guideline values (DGVs) for freshwater aquatic ecosystems, to understand impacts to receiving environment from drainage from these samples. The reason for selecting ANZG (2018) DGVs for comparison is because these DGVs are conservative, and lack of any site-specific trigger levels for metals and metalloids in water. As the site was operational until 1992, the site was considered highly disturbed, and the 90% species protection DGVs for aquatic ecosystem were used for comparison.

2.5 Saline Drainage Potential

There are no standard methods to assess saline drainage in the AMIRA (2002) guidelines. However, many technical guidelines (such as DME,1995 and Jones et al., 2016) outline an indicative criterion to assess the potential for saline drainage using electrical conductivity (EC). The potential for saline drainage has been assessed using aged EC of a 1:2 (sample:water) suspension. EC in the leachate test has also been measured for the samples and have been utilised to determine the potential for saline drainage.

3.0 Results

3.1 Acid Drainage Potential

3.1.1 Aged pH

The aged pH of the samples ranged from a 5.9 to 8.6 pH unit (**Figure 3.1**). The mean aged pH recorded by the samples is 7, whereas the median aged pH is recorded 6.9. The highest aged pH was recorded in sample ID 143512 collected from the drill hole TNNDU031 within the historical ROM pad (**Figure 1.1**). The lowest aged pH was recorded in sample 143489 collected from the drill hole TNNDU009 located on the eastern side of the mineralised waste rock dump. Only one sample (143489) out of the total 26 samples recorded aged pH <6 pH units, thereby suggesting that the potential for any acidic drainage from these samples is less likely.

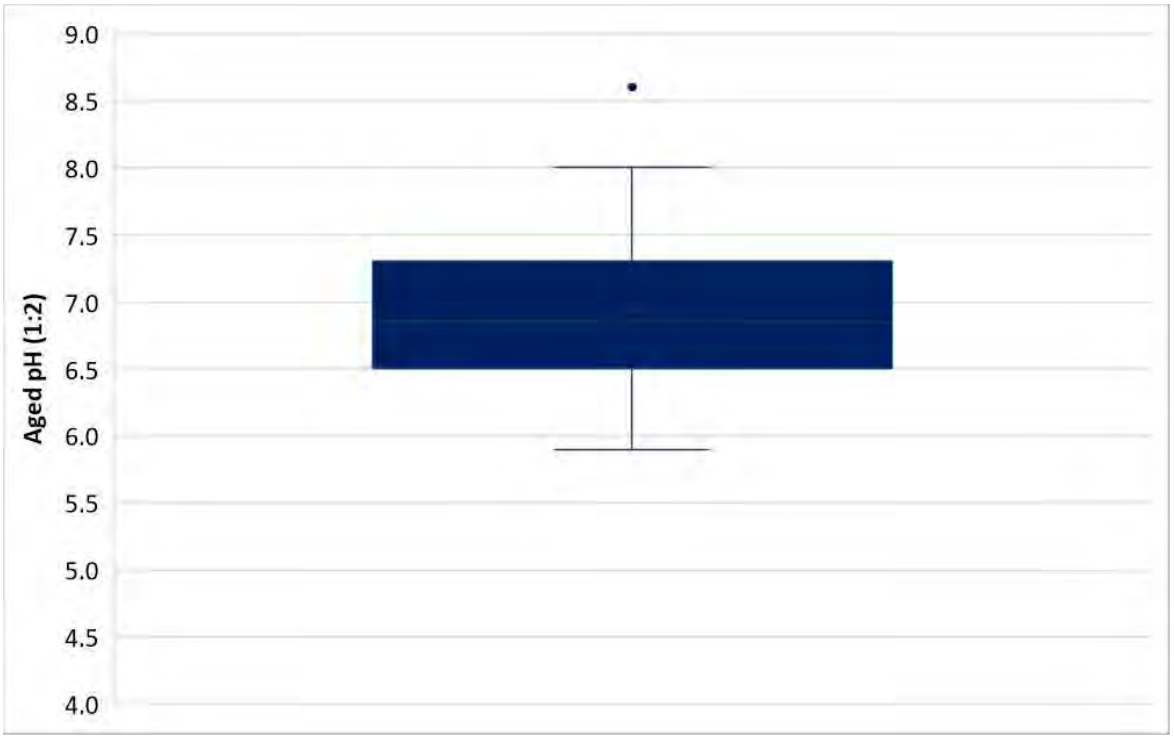


Figure 3.1 Boxplot showing range of aged pH (1:2) in samples

3.1.2 Acid-Base Classification

All 26 samples recorded negative NAPP, ranging from -35 kg H_2SO_4/t to -3 kg H_2SO_4/t. Classification of the samples using the NAG pH and NAPP suggests that all 25 samples from the mineralised waste rock dump and the sample from the ROM pad are non-acid forming (NAF). The classification plot for the samples is represented in **Figure 3.2**. Like aged pH, no correlation was found between NAPP and the spatial location of the sample.

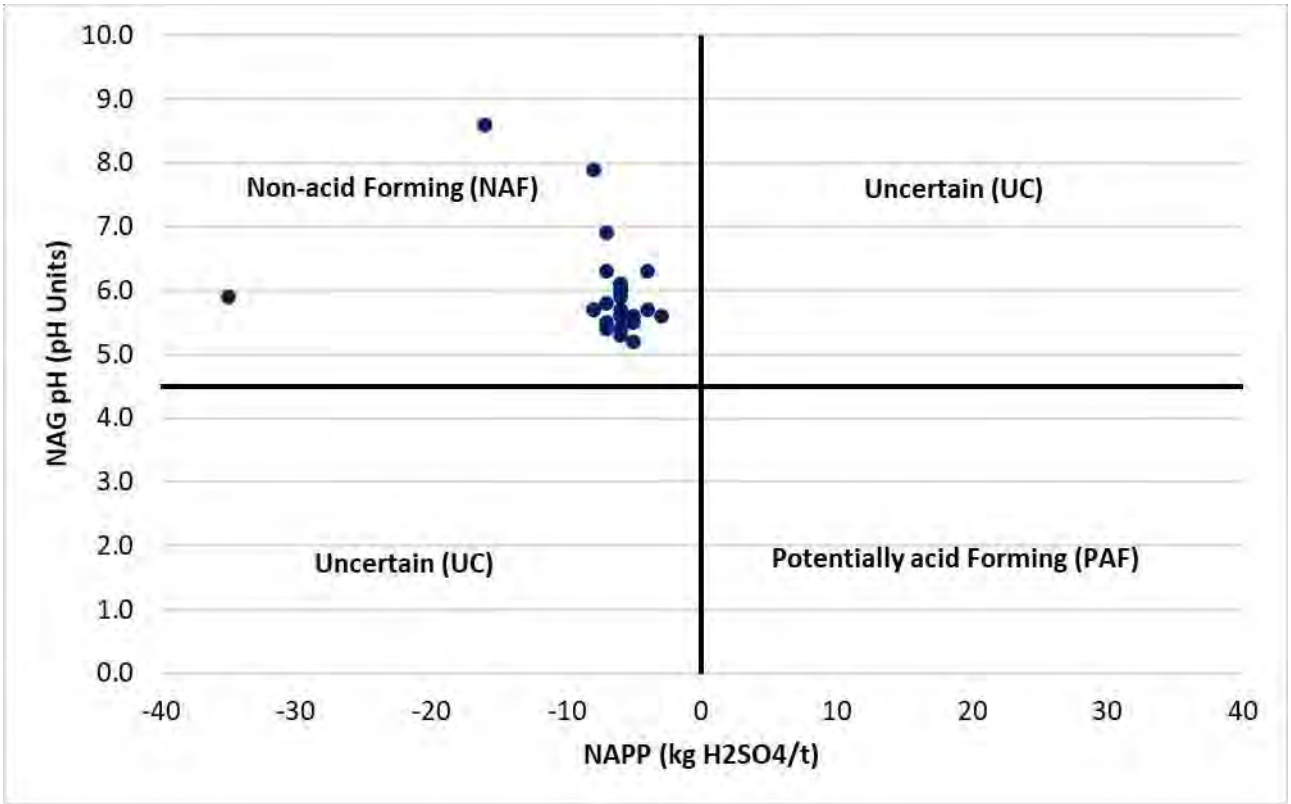


Figure 3.2 Geochemical Classification Plot

3.2 Metalliferous Drainage Potential

The mobilisation of metals from waste rock samples in drainage is called metalliferous drainage. Typically, pH controls the mobility of metals in aqueous systems (Smith, 1999), and the potential for metalliferous drainage is significantly reduced in non-acidic conditions. However, the mobility of metals also depends on geochemical changes and the characteristics of the metals themselves. Therefore, determining the abundances of specific metals via the geochemical abundance index (GAI) is a good indicator of the potential for metalliferous drainage potential in waste rocks.

3.2.1 Geochemical Abundance Index (GAI)

The GAI assessment of the 25 samples collected from the southern waste rock dump and one sample from the ROM pad at Nobles Nob suggests that some samples recorded GAI value of equal to or greater than 3 for the following metals:

- Molybdenum (Mo) – five out of 26 samples recorded GAI values equal to or greater than 3 (**Table 3.1**). Highest GAI recorded was 4, signifying 24 to 48 times median crustal concentrations. Among the remaining samples, 16 recorded GAI values greater than 1 but less than 3, and 5 samples recorded GAI values equal to 0.

- Mercury (Hg) – only the sample collected from the ROM pad (143512) recorded GAI value equal to 3 (**Table 3.1**). Out of the remaining 25 samples, one sample recorded GAI value of 1, while all the others recorded GAI values of 0 for mercury. In addition to the above, two samples for copper and 1 sample for cobalt recorded GAI value of 1 (**Table 3.1**).

Table 3.1 GAI values of Elements in the Samples

Sample	GAI (Al)	GAI (As)	GAI(Ba)	GAI (Cd)	GAI (Co)	GAI (Cr)	GAI (Cu)	GAI (Fe)	GAI (Mn)	GAI (Mo)	GAI (Ni)	GAI (pb)	GAI (Zn)	GAI (Hg)
143488	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143489	0	0	0	0	0	0	0	0	0	2	0	0	0	0
143490	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143491	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143492	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143493	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143494	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143495	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143496	0	0	0	0	0	0	0	0	0	3	0	0	0	0
143497	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143498	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143499	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143500	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143501	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143502	0	0	0	0	0	0	0	0	0	3	0	0	0	0
143503	0	0	0	0	0	0	0	0	0	3	0	0	0	0
143504	0	0	0	0	0	0	0	0	0	4	0	0	0	0
143505	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143506	0	0	0	0	1	0	0	0	0	3	0	0	0	0
143507	0	0	0	0	0	0	1	0	0	2	0	0	0	0
143508	0	0	0	0	0	0	0	0	0	2	0	0	0	0
143509	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143510	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143511	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143512	0	0	0	0	0	0	0	0	0	0	0	0	0	3
143513	0	0	0	0	0	0	1	0	0	2	0	0	0	1

Cells highlighted in pink denotes GAI value of 3 or above. Cells highlighted in orange denotes GAI value of >0 but <3.
Median crustal abundance for metals were retrieved from Berkman and Ryall (1976) and Bowen (1979).

3.2.2 Australian Standards Leaching Procedure (ASLP)

The results of the ASLP tests for all 25 samples from the southern waste rock dump and one sample from the ROM pad at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) default guideline values (DGVs). As the site was operational until 1992, the site was considered highly disturbed, and the 90% species protection DGVs were used for comparison. The comparison has been summarised in Table 3.2.

The ASLP results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection (**Table 3.2**). Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment. The GAI value of copper was recorded to be 1, signifying 3 to 6 times median crustal abundance in 2 samples (143507 and 143513); however, the ASLP results from both these samples recorded concentration of copper below the limit of reporting (LOR).

Table 3.2 Statistical Summary of ASLP Test Results in Samples

Analytes	Units	ANZG (2018) DGVs*	Number	non-detect (%)	Min	5th %ile	20th %ile	Median	80th %ile	95th %ile	Max
ASLP pH	pH units	-	26	0	5.2	5.325	5.6	6.1	6.9	7.825	8.5
ASLP EC	µS/cm	-	26	0	18	23.25	31	50.5	76	104.75	130
Aluminium	mg/L	0.08	26	7.7	0.01	0.02	0.09	0.585	13	18.5	26
Boron	mg/L	0.68	26	100	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Mercury	mg/L	0.0019	26	96.2	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0.0015
Arsenic	µg/L	42	26	100	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Barium	µg/L	-	26	0	1	3.25	8	28.5	90	167.5	200
Beryllium	µg/L	-	26	100	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	µg/L	0.4	26	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chromium	µg/L	1.8	26	53.8	0.5	0.5	0.5	0.5	2	2	3
Cobalt^	µg/L	14	26	73.1	0.5	0.5	0.5	0.5	2	2	5
Copper	µg/L	1.8	26	46.2	0.5	0.5	0.5	1	6	9.75	27
Manganese	µg/L	2500	26	7.7	0.5	0.625	3	12.5	27	50.5	54
Molybdenum**	µg/L	34	26	73.1	0.5	0.5	0.5	0.5	1	4.75	8
Nickel	µg/L	13	26	73.1	0.5	0.5	0.5	0.5	1	2	2
Lead	µg/L	5.6	26	84.6	0.5	0.5	0.5	0.5	0.5	9	12
Zinc	µg/L	15	26	3.8	0.5	1	2	11	36	68.5	87

*DGV used here is ANZG (2018) DGVs for 90% species protection for freshwater aquatic ecosystem. Cells highlighted in orange exceed ANZG (2018) DGVs for 90% species protection. **level of species protection for molybdenum's DGV is not specified in ANZG (2018).

^ level of species protection for cobalt in freshwater is not specified in ANZG (2018). Hence, DGV in marine water has been used in this assessment.

3.2.3 Potential of Metalliferous Drainage

The metals that have the potential to cause metalliferous drainage from these samples, based on the GAI assessment and ASLP results, are discussed below.

3.2.3.1 Aluminium

None of the samples were found to be significantly enriched with aluminium (i.e., GAI >=3). However, the ASLP results indicated that the leachate from 21 out of 26 samples recorded aluminium concentration higher than the ANZG (2018) DGV (0.08 mg/L).

Under most environmental conditions, the mobility of aluminium is low (Shiller and Frilot, 1996). However, aluminium mobility can increase if the pH drops below 5.5, or in the anionic form under strongly alkaline conditions at pH values above 8 (Shiller and Frilot, 1996).

In this case, the average aged pH of the samples is recorded to be 7, which is not acidic or alkaline enough to mobilise aluminium. In addition, none of the samples were found to be enriched with aluminium in GAI assessment. Some samples, such as 143493 and 143512, recorded high aged pH values of 8 and 8.6, respectively. Aluminium enriched drainage might occur from these two samples. Overall, it is less likely that aluminium enriched drainage will occur from all the other samples.

3.2.3.2 Chromium

None of the samples were found to be significantly enriched with chromium in the GAI assessment in **section 3.2.1** above. However, the ASLP results indicated that the leachate from six out of 26 samples recorded a chromium concentration above the ANZG (2018) DGV (1.8 µg/L). The 80th percentile concentration of chromium for all samples was recorded 2 µg/L, also higher than the ANZG (2018) DGV (1.8 µg/L) (**Table 3.2**).

Chromium is generally not very mobile, especially if the conditions are moderately oxidising or moderately reducing (Kabata-Pendias, 2001). At near-neutral pH values, the mobility of chromium is limited (Kabata-Pendias, 2001). The main dominant species in reducing environments between pH 5 and pH 9 are $CrOH^{2+}$ and $Cr(OH)_2^+$ (Kabata-Pendias, 2001). Chromium, especially the trivalent form, readily substitutes for iron (III) (Fe^{3+}) in minerals, and coprecipitates with Fe^{3+} as insoluble $Cr(OH)_3$, at high pH values (i.e., above pH 9). It is possible that chromium might get liberated along with iron at higher pH values. However, the average aged pH of the samples is 7, implying near-neutral pH value, where chromium is less mobile. Therefore, the likelihood of chromium enriched drainage is low from these samples.

3.2.3.3 Copper

None of the samples were found to be significantly enriched with copper (i.e., GAI >=3). The ASLP test results for the samples indicated that the 80th percentile concentration of copper was above the ANZG (2018) DGV (1.8 µg/L). Out of the 26 samples, 12 recorded concentrations of copper in ASLP test above the ANZG (2018) DGV.

Copper is mobile under oxidising, acidic conditions, especially at pH values in the range of 5 to 6 (Rashid, 1974; Rippey, 1982). This is because of the more oxidised Cu^{2+} species, that predominates in such conditions. Co-precipitation of Copper (and zinc) can occur in the presence of iron hydrous oxides (Lottermoser et al., 1999), which can be discharged in an acidic environment. None of the samples recorded aged pH <6, and the average aged pH of all the samples is 7, which is not acidic enough to cause

copper enriched drainage. Additionally, the GAI of copper for 24 samples was 0, implying no enrichment of copper in these samples. The two samples that recorded GAI values of 1 for copper – 143507 and 143513, recorded the concentration of copper in ASLP test below LOR, implying that copper enriched drainage from these samples is less likely.

3.2.3.4 Lead

None of the 26 samples were found to be significantly enriched with lead. However, the ASLP results indicated that leachate from samples recorded the 95th percentile concentration of lead higher than the ANZG (2018) DGV (5.6 µg/L). This was because two samples (143491 and 143512) out of 26 samples recorded a concentration of lead above the ANZG (2018) DGV in ASLP test. One of these sample locations (143512) was collected from the old ROM pad.

Lead can mobilise in acidic environments, as it is present in the aqueous environment as Pb^{2+} when the pH is below 6 (Nelson et al., 1995). None of the samples recorded aged pH <6, and the average aged pH recorded by the samples is 7. The two samples that recorded the concentration of lead above the DGV in the ASLP test, also recorded a high aged pH value of 7.9 (143491) and 8.6 (143512). Therefore, lead enriched drainage from these samples is unlikely.

3.2.3.5 Molybdenum

Five samples out of the 26 samples recorded GAI value of 3 and above for molybdenum. However, the ASLP test result stated that leachate from all the samples recorded a concentration of molybdenum below the ANZG (2018) DGV (0.0034 mg/L).

The most commonly occurring molybdenum-bearing mineral is the sulfide molybdenite. Molybdenite often occurs with other sulfide minerals, including pyrite and chalcopyrite (Frascoli and Hudson-Edwards, 2018). Minor chalcopyrite was associated with the gold ore at Nobles Nob (ADL, 1970). Oxidation of the molybdenum-bearing sulfides can result in the liberation of molybdenum and its oxidation to molybdate (Frascoli and Hudson-Edwards, 2018). Molybdate is stable over a wide range of pH conditions, from neutral down to pH value of 3-4 (Frascoli and Hudson-Edwards, 2018; Smedley and Kinniburgh, 2017). In an acidic environment (i.e., pH value below 3), the molybdate is protonated to form $HMoO_4^-$ or H_2MoO_4 (Smedley and Kinniburgh, 2017). Also, under moderately acidic pH conditions (pH 5-6), molybdate can be sorbed onto the secondary iron (III) minerals, such as jarosite, schwertmannite, ferrihydrite (Goldberg et al., 1996; Xu et al., 2006). These secondary iron (III) phases can decompose in acidic pH waters (e.g., from acidic drainage), releasing their sorbed molybdate (Frascoli and Hudson-Edwards, 2018; Smedley and Kinniburgh, 2017; Xu et al., 2006; Goldberg et al., 1996). In highly alkaline conditions (i.e., pH above 9), mobility of molybdenum also increases due to the reduced binding properties of the molybdate (Frascoli and Hudson-Edwards, 2018; Goldberg et al., 1996).

Thus, molybdenum enriched drainage might occur in extremely acidic or alkaline drainages. However, the average aged pH for the samples is 7 pH unit, which is neither acidic enough nor alkaline enough to mobilise molybdenum. Furthermore, none of the samples recorded aged pH <6 or greater than 9. Two samples that recorded aged pH equal to or above 8 are 143493 (aged pH 8) and 143512 from the ROM pad (aged pH 8.6), and both were not significantly enriched in molybdenum (i.e., recorded GAI<3). As such, enriched molybdenum drainage is less likely from these samples.

3.2.3.6 Mercury

Only one sample (143512) out of the 26 samples recorded GAI value of 3 for mercury (**Table 3.1**). This sample was collected from the ROM pad (143512) and is the only sample that recorded concentrations of mercury above the LOR. The concentration recorded at sample 143512 is 0.0015 mg/L, which is below ANZG (2018) DGV for 90% species protection (0.0019 mg/L) but is above the ANZG (2018) GDV for 95% species protection (0.0006 mg/L). To account for the bioaccumulating nature of mercury, the comparison has been made with the 95% species protection level DGV.

The behaviour of mercury is highly dependent on the presence of sorption materials such as organic complexes or clay. In acidic environments, mercury bound to organic matter may be leached (Kabata-Pendias 2001). At pH >5.5, sorption of mercury occurs to iron oxides (Barringer et al., 2013; Connor et al., 2019; Yang et al.,2007). In an acidic environment, sorbed mercury can mobilise with iron oxide particles (Barringer et al., 2013). The mobility of mercury decreases at pH<3 and at pH>12, due to the extremely high buffering capacity of humus in both acidic and alkaline environments (Kabata-Pendias 2001).

As the aged pH recorded at the enriched sample 143512 is 8.6, it is possible that mercury enriched drainage might occur for that sample from the ROM pad. And as the ASLP test results suggest, mercury enriched drainage from the waste rock is unlikely.

3.2.3.7 Zinc

None of the samples were found to be significantly enriched with zinc (i.e., GAI >=3). All samples recorded GAI value of 0. The ASLP test results for the samples indicated that the 80th percentile concentration of zinc is above the ANZG (2018) DGV (15 µg/L). The concentration of zinc in the ASLP test of 11 out of 26 samples exceeded the DGV.

The mobility of zinc is more dependent on adsorption on clay minerals, hydroxides of iron/manganese/aluminium, and organic matter than its solubility (Mihaljevic, 1999). The mobility of zinc in the environment is greatest under oxidising, acidic conditions and more restricted under reducing conditions. Below pH 7.5 - 8.0, zinc occurs predominantly in the Zn^{2+} form (Brookins, 1988). At higher pH values, it forms low solubility complexes with carbonate and hydroxyl ions (Brookins, 1988). Since the average aged pH of all samples is 7, which is below 7.5, it is likely that zinc enriched drainage might occur from these samples.

3.2.4 Limitations of ASLP

It is noteworthy that the ASLP test and the assessment of drainage potential have certain limitations. The ASLP test is not indicative of actual drainage quality, because ASLP tests only provide representative leaching data for the pH values under which the tests are carried out. The ASLP test also does not provide any information on the long-term leaching behaviour of the materials under a range of varied conditions (van der Sloot, 1996).

Additionally, the ASLP tests are slightly biased for acidic conditions, resulting in conservative values of leaching potential for these samples. Also, no consideration is given to the variation in concentration of enrichment of metals with changes in the water to rock ratio (van der Sloot, 1996).

The assessment of enriched drainage potential is mainly based on the pH of the runoff from these samples. However, none of the pH (e.g. aged pH, NAG pH, and ASLP pH) is an authoritative indicator of potential drainage pH. Additionally, the drainage due to rainfall usually dilutes the concentration of the metals much more compared to ASLP results.

3.3 Saline Drainage Potential

Electrical conductivity (EC) measures the capacity of a solution to conduct electricity. It is often used as a proxy for salinity and is expressed as µS/cm. All 26 samples underwent aged EC (1:2) measurement. In addition, the ASLP extracts were also measured for EC to assess saline drainage potential. The results are discussed in the subsections below.

3.3.1 Aged and ASLP EC

The aged EC recorded by the samples ranged from 90 µS/cm (at 143489) to 670 µS/cm (at 143493). The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded EC between 150 and 450 µS/cm, and 100% of samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely. The sample distribution is presented in **Table 3.3** and **Figure 3.3**.

Table 3.3 Sample Distribution based on classification of aged and ASLP EC

	Very Low <150µS/cm	Low 150-450µS/cm	Moderate 450-900µS/cm	High >900µS/cm	TOTAL
Aged EC	2	19	5	0	26
ASLP EC	26	0	0	0	26

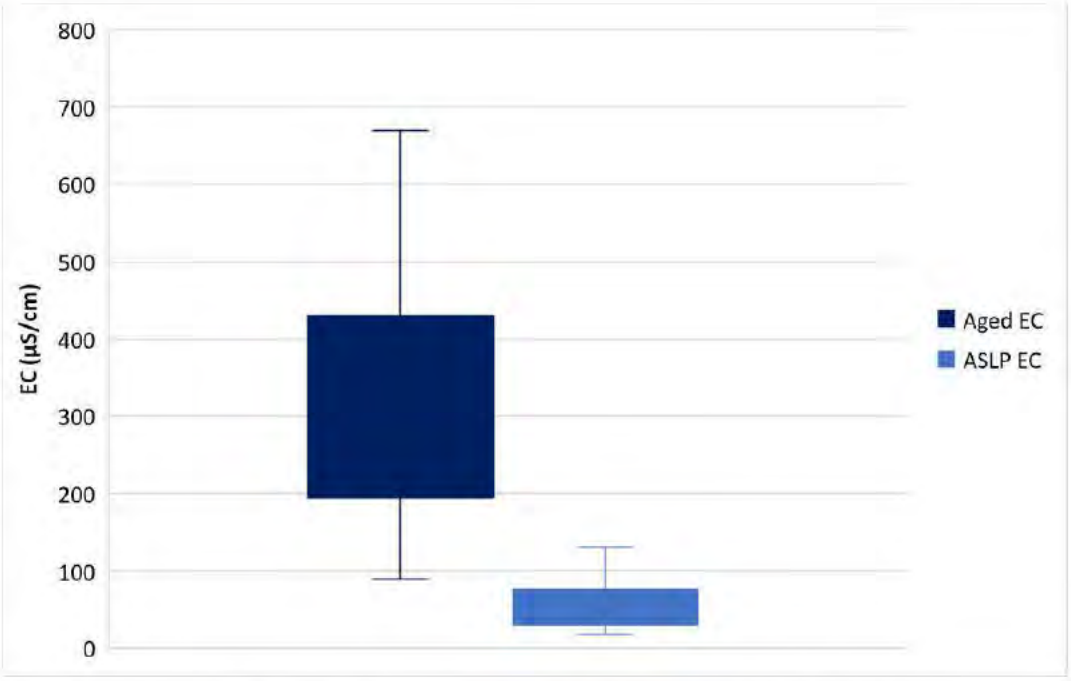


Figure 3.3 Boxplot showing range of Aged EC and ASLP EC (in µS/cm)

4.0 Conclusion and Recommendations

Umwelt was engaged by TCMG to characterise the samples from the historical southern waste rock dump of the Nobles Nob Project in the Northern Territory. One sample 143512 collected from the drill hole located on the historical ROM pad containing ore stockpiles, close to the mill.

TCMG collected a total of 26 composite samples from the RC drill holes drilled on the southern waste rock dump. Composite samples were collected by combining drill chips from various depth intervals. These samples were sent to a NATA accredited laboratory for analyses. The results were assessed to observe potential of acidic, metalliferous, or saline drainage from these samples.

The results suggest that the aged pH of the samples ranged from a 5.9 to 8.6 pH unit, with the mean aged pH being 7, whereas the median aged pH being 6.9. Only one sample out of the total 26 samples recorded aged pH <6 pH units. All 26 samples recorded negative NAPP, and the classification of the samples using the NAG pH and NAPP suggests that all 26 samples from the mineralised waste rock dump are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely.

The GAI assessment of the 26 samples collected from the southern waste rock dump at Nobles Nob suggests that the samples are significantly enriched (GAI >= 3) with the following metals:

- Molybdenum (Mo) – 5 out of 26 samples recorded GAI value equal to or greater than 3.
- Mercury (Hg) – only the sample from the ROM pad recorded GAI value equal to 3.

The results of the ASLP tests for all 25 samples from the southern waste rock dump and one sample from the ROM pad at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) DGV for 90% species protection. The results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection. Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment. The combined assessment of GAI and ASLP results of the samples from waste rock dump suggests a potential of metalliferous drainage from a few samples, enriched in aluminium, and zinc. Sample 143512, collected from the ROM pad, outside the historical waste rock dump, recorded highest aged pH value (pH 8.6). Additionally, it also recorded highest concentration of aluminium, chromium, copper, mercury, and zinc in ASLP test. The assessment also indicated that aluminium, molybdenum, and mercury enriched drainage might occur from this sample.

Electrical conductivity (EC) is used as a proxy for salinity in this assessment. All 26 samples underwent aged EC (1:2) and ASLP EC measurement. The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded aged EC between 150 and 450 µS/cm, whereas 100% samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely.

5.0 References

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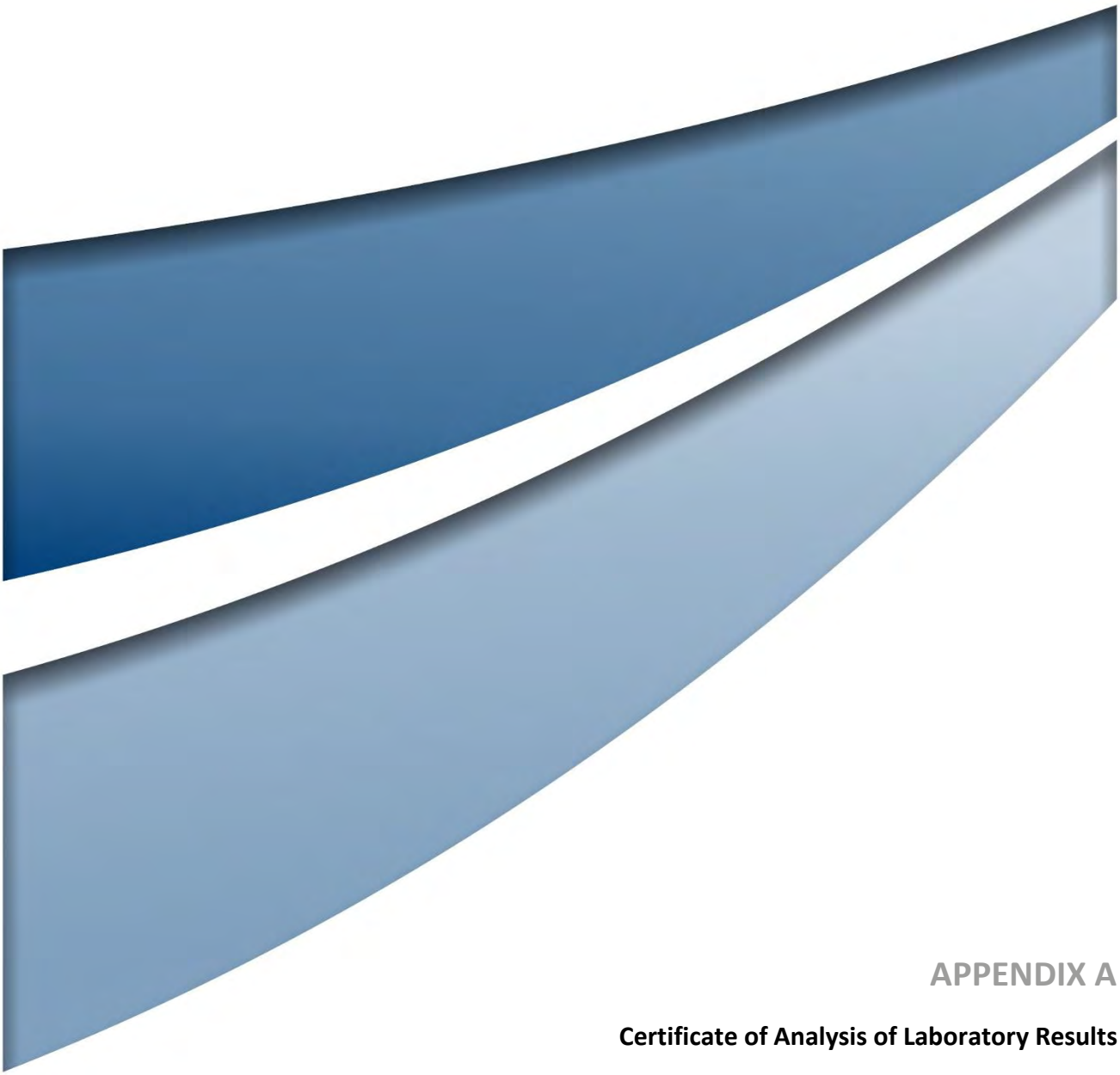

APPENDIX A

Certificate of Analysis of Laboratory Results

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Matt Golovanoff	Manager	Anthony Nilsson
Client	TENNANT MINING	Laboratory	SGS Cairns Environmental
Address	PO BOX 37 WEST PERTH WA 6005	Address	Unit 2, 58 Comport St Portsmith QLD 4870
Telephone	0414867084	Telephone	+61 07 4035 5111
Facsimile	(Not specified)	Facsimile	+61 07 4035 5122
Email	matt@tennantmining.com.au	Email	AU.Environmental.Cairns@sgs.com
Project	**Nobles Nob Southern Waste Dump**	SGS Reference	**CE154939A R0**
Order Number	(Not specified)	Date Received	07 Oct 2021
Samples	26	Date Reported	12 Oct 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

SIGNATORIES

Anthony NILSSON
Operations Manager

Jon DICKER
Manager Northern QLD

Mitsuko BALDWIN
Metals Team Leader

Parameter	Units	LOR	Sample Number: CE154939A.001 Sample Matrix: Soil Sample Name: 143488	CE154939A.002 Soil 143489	CE154939A.003 Soil 143490	CE154939A.004 Soil 143491
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**3600**	**3900**	**4100**	**2600**
Arsenic, As	mg/kg	0.5	**1.1**	**1.1**	**1.2**	**1.1**
Barium, Ba	mg/kg	0.5	**62**	**83**	**160**	**95**
Cadmium, Cd	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**1.6**	**3.2**	**2.6**	**1.1**
Chromium, Cr	mg/kg	0.5	**15**	**14**	**18**	**13**
Copper, Cu	mg/kg	0.5	**27**	**47**	**24**	**14**
Iron, Fe	mg/kg	50	**45000**	**70000**	**61000**	**39000**
Manganese, Mn	mg/kg	2	**90**	**110**	**72**	**60**
Molybdenum, Mo	mg/kg	1	**4**	**12**	**7**	**6**
Nickel, Ni	mg/kg	0.5	**4.6**	**5.1**	**5.8**	**4.2**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	**0.5**	<0.5
Zinc, Zn	mg/kg	0.5	**20**	**31**	**32**	**53**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	<0.01	**0.06**	**0.04**	**0.05**

Parameter	Units	LOR	Sample Number: CE154939A.005 Sample Matrix: Soil Sample Name: 143492	CE154939A.006 Soil 143493	CE154939A.007 Soil 143494	CE154939A.008 Soil 143495
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**3800**	**3900**	**4200**	**3800**
Arsenic, As	mg/kg	0.5	**1.3**	**1.6**	**1.3**	**1.8**
Barium, Ba	mg/kg	0.5	**76**	**88**	**110**	**60**
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**4.7**	**4.5**	**3.8**	**2.8**
Chromium, Cr	mg/kg	0.5	**18**	**15**	**21**	**16**
Copper, Cu	mg/kg	0.5	**46**	**40**	**43**	**46**
Iron, Fe	mg/kg	50	**74000**	**40000**	**62000**	**62000**
Manganese, Mn	mg/kg	2	**170**	**130**	**150**	**120**
Molybdenum, Mo	mg/kg	1	**10**	**9**	**4**	**8**
Nickel, Ni	mg/kg	0.5	**5.2**	**6.6**	**5.2**	**4.6**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	**31**	**32**	**41**	**36**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	<0.01	<0.01	**0.01**	**0.02**

Parameter	Units	LOR	Sample Number: CE154939A.009 Sample Matrix: Soil Sample Name: 143496	CE154939A.010 Soil 143497	CE154939A.011 Soil 143498	CE154939A.012 Soil 143499
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**2500**	**4300**	**4500**	**4300**
Arsenic, As	mg/kg	0.5	**1.4**	**1.4**	**3.0**	**1.3**
Barium, Ba	mg/kg	0.5	**73**	**440**	**62**	**69**
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**1.1**	**4.0**	**5.2**	**1.6**
Chromium, Cr	mg/kg	0.5	**19**	**20**	**22**	**20**
Copper, Cu	mg/kg	0.5	**26**	**41**	**70**	**33**
Iron, Fe	mg/kg	50	**77000**	**68000**	**85000**	**52000**
Manganese, Mn	mg/kg	2	**77**	**140**	**270**	**82**
Molybdenum, Mo	mg/kg	1	**30**	**9**	**10**	**4**
Nickel, Ni	mg/kg	0.5	**2.8**	**5.0**	**5.0**	**4.3**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	**17**	**29**	**25**	**22**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	<0.01	**0.04**	<0.01	<0.01

Parameter	Units	LOR	Sample Number: CE154939A.013 Sample Matrix: Soil Sample Name: 143500	CE154939A.014 Soil 143501	CE154939A.015 Soil 143502	CE154939A.016 Soil 143503
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**3500**	**3900**	**4100**	**4400**
Arsenic, As	mg/kg	0.5	**0.9**	**1.9**	**1.3**	**1.3**
Barium, Ba	mg/kg	0.5	**77**	**160**	**110**	**150**
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**1.8**	**5.9**	**3.0**	**8.0**
Chromium, Cr	mg/kg	0.5	**18**	**20**	**18**	**16**
Copper, Cu	mg/kg	0.5	**30**	**69**	**26**	**47**
Iron, Fe	mg/kg	50	**64000**	**76000**	**80000**	**60000**
Manganese, Mn	mg/kg	2	**100**	**160**	**87**	**140**
Molybdenum, Mo	mg/kg	1	**7**	**5**	**31**	**37**
Nickel, Ni	mg/kg	0.5	**4.3**	**5.8**	**5.3**	**6.2**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	**1.0**	<0.5
Zinc, Zn	mg/kg	0.5	**32**	**41**	**43**	**47**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	<0.01	**0.05**	**0.08**	**0.01**

Parameter	Units	LOR	Sample Number: CE154939A.017 Sample Matrix: Soil Sample Name: 143504	CE154939A.018 Soil 143505	CE154939A.019 Soil 143506	CE154939A.020 Soil 143507
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**3600**	**4400**	**4400**	**4500**
Arsenic, As	mg/kg	0.5	**1.2**	**1.2**	**1.3**	**2.0**
Barium, Ba	mg/kg	0.5	**180**	**130**	**76**	**47**
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**3.3**	**6.3**	**38**	**7.6**
Chromium, Cr	mg/kg	0.5	**16**	**20**	**20**	**19**
Copper, Cu	mg/kg	0.5	**35**	**53**	**86**	**100**
Iron, Fe	mg/kg	50	**69000**	**68000**	**92000**	**72000**
Manganese, Mn	mg/kg	2	**85**	**200**	**710**	**230**
Molybdenum, Mo	mg/kg	1	**51**	**10**	**24**	**12**
Nickel, Ni	mg/kg	0.5	**3.9**	**5.6**	**11**	**9.0**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	**41**	**22**	**41**	**110**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	**0.01**	<0.01	**0.01**	**0.03**

Parameter	Units	LOR	Sample Number: CE154939A.021 Sample Matrix: Soil Sample Name: 143508	CE154939A.022 Soil 143509	CE154939A.023 Soil 143510	CE154939A.024 Soil 143511
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**3800**	**3700**	**3400**	**3700**
Arsenic, As	mg/kg	0.5	**2.1**	**1.5**	**1.1**	**0.8**
Barium, Ba	mg/kg	0.5	**35**	**69**	**94**	**100**
Cadmium, Cd	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**3.0**	**5.6**	**1.7**	**1.5**
Chromium, Cr	mg/kg	0.5	**26**	**19**	**14**	**17**
Copper, Cu	mg/kg	0.5	**53**	**79**	**32**	**17**
Iron, Fe	mg/kg	50	**56000**	**79000**	**45000**	**63000**
Manganese, Mn	mg/kg	2	**100**	**170**	**69**	**88**
Molybdenum, Mo	mg/kg	1	**13**	**11**	**8**	**6**
Nickel, Ni	mg/kg	0.5	**4.8**	**6.2**	**4.5**	**4.0**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	**63**	**41**	**47**	**38**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	<0.01	<0.01	<0.01	**0.05**

Parameter	Units	LOR	Sample Number: CE154939A.025 Sample Matrix: Soil Sample Name: 143512	Sample Number: CE154939A.026 Sample Matrix: Soil Sample Name: 143513
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021				
Aluminium, Al	mg/kg	50	**3400**	**6000**
Arsenic, As	mg/kg	0.5	**1.1**	**1.8**
Barium, Ba	mg/kg	0.5	**130**	**89**
Cadmium, Cd	mg/kg	0.1	<0.1	**0.1**
Cobalt, Co	mg/kg	0.5	**1.7**	**14**
Chromium, Cr	mg/kg	0.5	**12**	**24**
Copper, Cu	mg/kg	0.5	**23**	**100**
Iron, Fe	mg/kg	50	**26000**	**99000**
Manganese, Mn	mg/kg	2	**36**	**280**
Molybdenum, Mo	mg/kg	1	**1**	**12**
Nickel, Ni	mg/kg	0.5	**4.8**	**12**
Lead, Pb	mg/kg	0.5	**4.1**	<0.5
Zinc, Zn	mg/kg	0.5	**53**	**160**
Mercury in Soil Method: AN312 Tested: 11/10/2021				
Mercury	mg/kg	0.01	**1.0**	**0.34**

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury in Soil Method ME-(AU)-[ENV]AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB094887	mg/kg	0.01	<0.01	0%	99 - 100%	104%

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method ME-(AU)-[ENV]AN040/AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Aluminium, Al	LB094889	mg/kg	50	<50	6 - 7%	109 - 114%	
Arsenic, As	LB094889	mg/kg	0.5	<0.5	9 - 10%	98 - 102%	
Barium, Ba	LB094889	mg/kg	0.5	<0.5	1 - 6%	96 - 101%	
Cadmium, Cd	LB094889	mg/kg	0.1	<0.1	0%	95 - 99%	92%
Cobalt, Co	LB094889	mg/kg	0.5	<0.5	6 - 23%	89 - 95%	84%
Chromium, Cr	LB094889	mg/kg	0.5	<0.5	4 - 6%	101 - 105%	97%
Copper, Cu	LB094889	mg/kg	0.5	<0.5	7 - 9%	105 - 109%	103%
Iron, Fe	LB094889	mg/kg	50	<50	3 - 5%	106 - 110%	
Manganese, Mn	LB094889	mg/kg	2	<2	4 - 6%	96 - 101%	93%
Molybdenum, Mo	LB094889	mg/kg	1	<1	9 - 19%	102 - 106%	
Nickel, Ni	LB094889	mg/kg	0.5	<0.5	9 - 10%	86 - 92%	82%
Lead, Pb	LB094889	mg/kg	0.5	<0.5	0%	101 - 105%	97%
Zinc, Zn	LB094889	mg/kg	0.5	<0.5	1 - 8%	85 - 90%	78%

METHOD	METHODOLOGY SUMMARY
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting wi h ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance wi h ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Matt Golovanoff	Manager	Anthony Nilsson
Client	TENNANT MINING	Laboratory	SGS Cairns Environmental
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Project	**Nobles Nob Southern Waste Dump**	SGS Reference	**CE154939 R0**
Order Number	(Not specified)	Date Received	17 Sep 2021
Samples	26	Date Reported	07 Oct 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

SIGNATORIES

Anthony NILSSON
Operations Manager

Jon DICKER
Manager Northern QLD

Maristela GANZAN
Quality Coordinator

Parameter	Units	LOR	Sample Number: CE154939.001 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143488	CE154939.002 Soil 01 Sep 2021 143489	CE154939.003 Soil 01 Sep 2021 143490	CE154939.004 Soil 01 Sep 2021 143491
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	**0.6**	**0.5**	**0.9**	**0.8**
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	**6.5**	**5.9**	**7.3**	**7.9**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	**120**	**90**	**380**	**330**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	**0.007**	**0.013**	**0.015**	**0.007**
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.006**	**0.006**	**0.010**	**0.006**
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	**0.6**	**0.5**	**0.5**	**1.6**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**6.3**	**5.0**	**5.0**	**16**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**6.1**	**4.9**	**4.9**	**16**

Parameter	Units	LOR	Sample Number: CE154939.001 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143488	CE154939.002 Soil 01 Sep 2021 143489	CE154939.003 Soil 01 Sep 2021 143490	CE154939.004 Soil 01 Sep 2021 143491
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021						
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-6**	**-5**	**-4**	**-16**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021						
ECox (NAG Conductivity)	µS/cm	1	**37**	**40**	**46**	**90**
pHox (NAG pH)	No unit	-	**5.3**	**5.2**	**6.3**	**8.6**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**1.3**	**1.2**	<0.5	<0.5
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	**1.3**	**1.2**	<1.0	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021						
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.7**	**5.3**	**6.9**	**7.9**
Conductivity @25C	µS/cm	1	**22**	**18**	**67**	**87**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021						
Aluminium, Al	mg/L	0.02	**0.11**	**0.05**	**0.41**	**0.44**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021						
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**1**	**4**	**77**	**43**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	<1	**1**	<1
Lead, Pb	µg/L	1	<1	<1	<1	**12**
Manganese, Mn	µg/L	1	<1	**3**	**2**	<1
Molybdenum, Mo	µg/L	1	<1	<1	**5**	**4**
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Zinc, Zn	µg/L	1	<1	**2**	**2**	**1**
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.005 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143492	CE154939.006 Soil 01 Sep 2021 143493	CE154939.007 Soil 01 Sep 2021 143494	CE154939.008 Soil 01 Sep 2021 143495
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	**0.7**	**0.8**	**0.8**	**0.8**
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	**7.1**	**8.0**	**7.3**	**7.1**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	**370**	**670**	**160**	**200**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	**0.008**	**0.012**	**0.005**	<0.005
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.006**	**0.010**	**0.006**	<0.005
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	**0.9**	**0.8**	**3.6**	**0.6**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**8.8**	**7.5**	**36**	**6.3**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**6.6**	**7.4**	**36**	**6.1**

Parameter	Units	LOR	Sample Number: CE154939.005 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143492	Sample Number: CE154939.006 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143493	Sample Number: CE154939.007 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143494	Sample Number: CE154939.008 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143495
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021						
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-8**	**-7**	**-35**	**-6**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021						
ECox (NAG Conductivity)	µS/cm	1	**43**	**54**	**41**	**39**
pHox (NAG pH)	No unit	-	**5.7**	**6.9**	**5.9**	**5.7**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**0.9**	<0.5	**0.6**	<0.5
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021						
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.7**	**7.6**	**6.2**	**6.4**
Conductivity @25C	µS/cm	1	**52**	**130**	**31**	**32**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021						
Aluminium, Al	mg/L	0.02	<0.02	**15**	**13**	**7.6**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021						
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**11**	**79**	**79**	**25**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	**2**	**2**	**1**
Cobalt, Co	µg/L	1	<1	**2**	**1**	<1
Copper, Cu	µg/L	1	<1	**8**	**8**	**5**
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**8**	**51**	**43**	**12**
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	**2**	**1**	<1
Zinc, Zn	µg/L	1	**5**	**25**	**39**	**10**
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.009 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143496	CE154939.010 Soil 01 Sep 2021 143497	CE154939.011 Soil 01 Sep 2021 143498	CE154939.012 Soil 01 Sep 2021 143499
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	**0.5**	**0.6**	**0.6**	<0.5
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	**6.3**	**6.3**	**6.2**	**6.9**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	**200**	**340**	**450**	**180**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	**0.008**	**0.016**	**0.012**	<0.005
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.006**	**0.016**	**0.013**	<0.005
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	**0.8**	**0.6**	**0.5**	**0.4**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**7.5**	**6.3**	**5.0**	**3.8**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**7.4**	**6.1**	**4.9**	**3.7**

Parameter	Units	LOR	Sample Number: CE154939.009 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143496	CE154939.010 Soil 01 Sep 2021 143497	CE154939.011 Soil 01 Sep 2021 143498	CE154939.012 Soil 01 Sep 2021 143499
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021						
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-7**	**-6**	**-5**	**-4**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021						
ECox (NAG Conductivity)	µS/cm	1	**42**	**48**	**49**	**39**
pHox (NAG pH)	No unit	-	**5.4**	**5.6**	**5.5**	**5.7**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**0.7**	**0.6**	**0.7**	**0.6**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021						
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.4**	**5.7**	**5.2**	**6.3**
Conductivity @25C	µS/cm	1	**31**	**61**	**76**	**27**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021						
Aluminium, Al	mg/L	0.02	**0.09**	**2.8**	**0.24**	**17**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021						
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**6**	**160**	**16**	**49**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	**1**	<1	**2**
Cobalt, Co	µg/L	1	<1	**2**	<1	<1
Copper, Cu	µg/L	1	<1	**3**	<1	**5**
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**1**	**54**	**49**	**10**
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	<1	<1	**1**
Zinc, Zn	µg/L	1	**1**	**10**	**4**	**14**
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.013 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143500	CE154939.014 Soil 01 Sep 2021 143501	CE154939.015 Soil 01 Sep 2021 143502	CE154939.016 Soil 01 Sep 2021 143503
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	<0.5	0.5	<0.5	<0.5
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	6.4	7.5	7.3	6.8
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	490	480	200	260
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	0.017	0.010	0.011	0.014
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.019	0.011	0.005	0.008
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	0.6	0.8	0.6	0.6
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	6.3	7.5	6.3	6.3
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	6.1	7.4	6.1	6.1

Parameter	Units	LOR	Sample Number: CE154939.013 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143500	CE154939.014 Soil 01 Sep 2021 143501	CE154939.015 Soil 01 Sep 2021 143502	CE154939.016 Soil 01 Sep 2021 143503
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021						
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-6**	**-7**	**-6**	**-6**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021						
ECox (NAG Conductivity)	µS/cm	1	**49**	**48**	**40**	**40**
pHox (NAG pH)	No unit	-	**5.4**	**6.3**	**5.6**	**6.1**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**0.7**	<0.5	**0.9**	**0.8**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021						
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.8**	**7.0**	**6.3**	**5.5**
Conductivity @25C	µS/cm	1	**75**	**89**	**32**	**41**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021						
Aluminium, Al	mg/L	0.02	**6.5**	**19**	**15**	**3.8**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021						
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**24**	**150**	**170**	**90**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	**1**	**2**	**2**	**1**
Cobalt, Co	µg/L	1	<1	**2**	**2**	<1
Copper, Cu	µg/L	1	**3**	**10**	**9**	**4**
Lead, Pb	µg/L	1	<1	**1**	**3**	<1
Manganese, Mn	µg/L	1	**20**	**26**	**27**	**39**
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	**2**	**2**	**1**
Zinc, Zn	µg/L	1	**17**	**36**	**76**	**46**
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.017 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143504	CE154939.018 Soil 01 Sep 2021 143505	CE154939.019 Soil 01 Sep 2021 143506	CE154939.020 Soil 01 Sep 2021 143507
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	<0.5	<0.5	<0.5	<0.5
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	**6.5**	**6.7**	**6.9**	**6.7**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	**280**	**430**	**210**	**370**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	**0.015**	**0.009**	<0.005	**0.006**
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.010**	**0.010**	<0.005	**0.006**
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	**0.6**	**0.9**	**0.5**	**0.8**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**6.3**	**8.8**	**5.0**	**7.5**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**6.1**	**8.6**	**4.9**	**7.4**

Parameter	Units	LOR	Sample Number: CE154939.017 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143504	CE154939.018 Soil 01 Sep 2021 143505	CE154939.019 Soil 01 Sep 2021 143506	CE154939.020 Soil 01 Sep 2021 143507
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021						
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-6**	**-8**	**-5**	**-7**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021						
ECox (NAG Conductivity)	µS/cm	1	**45**	**51**	**41**	**43**
pHox (NAG pH)	No unit	-	**5.9**	**5.7**	**5.6**	**5.8**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**1.2**	<0.5	**1.0**	**0.8**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	**1.2**	<1.0	**1.0**	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021						
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.6**	**6.0**	**6.3**	**6.0**
Conductivity @25C	µS/cm	1	**49**	**69**	**32**	**54**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021						
Aluminium, Al	mg/L	0.02	**0.70**	**0.26**	**0.15**	**0.06**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021						
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**120**	**22**	**6**	**8**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	**1**	<1	<1	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**23**	**11**	**11**	**13**
Molybdenum, Mo	µg/L	1	<1	<1	**1**	**2**
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Zinc, Zn	µg/L	1	**34**	**1**	**2**	**23**
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.021 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143508	CE154939.022 Soil 01 Sep 2021 143509	CE154939.023 Soil 01 Sep 2021 143510	CE154939.024 Soil 01 Sep 2021 143511
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	<0.5	<0.5	<0.5	<0.5
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	**6.6**	**6.9**	**6.6**	**6.8**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	**430**	**170**	**160**	**250**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	**0.008**	**0.007**	**0.007**	**0.011**
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.005**	<0.005	**0.006**	**0.008**
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	**0.4**	**0.6**	**0.8**	**0.6**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**3.6**	**6.3**	**7.5**	**6.3**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**3.7**	**6.1**	**7.4**	**6.1**

Parameter	Units	LOR	Sample Number: CE154939.021 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143508	CE154939.022 Soil 01 Sep 2021 143509	CE154939.023 Soil 01 Sep 2021 143510	CE154939.024 Soil 01 Sep 2021 143511
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021						
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-3**	**-6**	**-7**	**-6**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021						
ECox (NAG Conductivity)	µS/cm	1	**49**	**38**	**35**	**38**
pHox (NAG pH)	No unit	-	**5.6**	**6.0**	**5.5**	**6.0**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**1.1**	**0.6**	**1.1**	**0.6**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	**1.1**	<1.0	**1.1**	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021						
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.5**	**6.5**	**5.8**	**6.5**
Conductivity @25C	µS/cm	1	**64**	**28**	**30**	**42**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021						
Aluminium, Al	mg/L	0.02	<0.02	**4.5**	**6.6**	**0.47**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021						
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**3**	**29**	**52**	**28**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	**1**	**1**	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	**6**	**3**	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**18**	**17**	**8**	**2**
Molybdenum, Mo	µg/L	1	<1	**2**	<1	**1**
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Zinc, Zn	µg/L	1	**37**	**11**	**33**	**3**
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.025 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143512	Sample Number: CE154939.026 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143513
Moisture Content Method: AN002 Tested: 20/9/2021				
% Moisture	%w/w	0.5	<0.5	<0.5
pH in soil (1:2) Method: AN101 Tested: 22/9/2021				
pH (1:2) aged	pH Units	-	**8.6**	**7.7**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021				
Conductivity (1:2) aged @ 25C	µS/cm	1	**490**	**430**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021				
Total Sulfur	%w/w	0.005	**0.015**	**0.010**
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021				
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.012**	**0.009**
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021				
ANC as % $CaCO_3$	% CaCO3	0.1	**0.9**	**0.6**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**8.8**	**6.3**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**8.6**	**6.1**

Parameter	Units	LOR	Sample Number: CE154939.025 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143512	Sample Number: CE154939.026 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143513
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021				
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-8**	**-6**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021				
ECox (NAG Conductivity)	µS/cm	1	**74**	**47**
pHox (NAG pH)	No unit	-	**7.9**	**6.1**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	<0.5	**0.6**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021				
Mass of test sample for extraction	g	-	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**8.5**	**6.9**
Conductivity @25C	µS/cm	1	**110**	**83**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021				
Aluminium, Al	mg/L	0.02	**26**	**0.08**
Boron, B	mg/L	0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021				
Arsenic, As	µg/L	1	<1	<1
Barium, Ba	µg/L	1	**200**	**27**
Beryllium, Be	µg/L	1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	**3**	<1
Cobalt, Co	µg/L	1	**2**	**5**
Copper, Cu	µg/L	1	**27**	<1
Lead, Pb	µg/L	1	**11**	<1
Manganese, Mn	µg/L	1	**20**	**5**
Molybdenum, Mo	µg/L	1	<1	**8**
Nickel, Ni	µg/L	1	**2**	<1
Zinc, Zn	µg/L	1	**87**	**11**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	CE154939.025 Soil 01 Sep 2021 143512	CE154939.026 Soil 01 Sep 2021 143513
Mercury in ASLP DI Water Extract	**Method: AN311(Perth) /AN312**	**Tested: 27/9/2021**			
Mercury	mg/L	0.0001		**0.0015**	<0.0001

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method ME-(AU)-[ENV]AN212

Parameter	QC Reference	Units	LOR	DUP %RPD
Acid Neutralisation Capacity/Neutralisation Potential	LB094328	kg CaCO3/T	1	0 - 29%
Acid Neutralisation Capacity/Neutralisation Potential kg H_2SO_4/t	LB094328	kg H2SO4/T	1	0 - 29%

Conductivity (1 2) in soil Method ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	DUP %RPD
Conductivity (1:2) aged @ 25C	LB094536	µS/cm	1	1 - 3%

Mercury in ASLP DI Water Extract Method ME-(AU)-[ENV]AN311(Perth) /AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury	LB094475	mg/L	0.0001	<0.0001	0 - 8%	103 - 104%

Metals in ASLP DI Extract by ICPOES Method ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Aluminium, Al	LB094779	mg/L	0.02	<0.02	0 - 3%	98%
Boron, B	LB094779	mg/L	0.05	<0.05	0%	NA

pH in soil (1 2) Method ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	DUP %RPD
pH (1:2) aged	LB094327	pH Units	-	1 - 2%

Single Addition Net Acid Generation (NAG) Method ME-(AU)-[ENV]AN216

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
ECox (NAG Conductivity)	LB094377	µS/cm	1	40	0 - 7%	97%
pHox (NAG pH)	LB094377	No unit	-	5.1	0 - 3%	96%
NAG as kg H_2SO_4/tonne to pH 4.5	LB094377	kg H2SO4/T	0.5	<0.5	0%	105%
NAG as kg H_2SO_4/tonne to pH 7	LB094377	kg H2SO4/T	0.5	<0.5	0 - 27%	112%
NAG as kg CaCO3/tonne to pH 4.5	LB094377	kg CaCO3/T	1	<1.0	0%	105%
NAG as kg CaCO3/tonne to pH 7	LB094377	kg CaCO3/T	1	<1.0	0 - 27%	112%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Trace Metals in ASLP DI Extract by ICPMS Method ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Arsenic, As	LB094234	µg/L	1	<1	0%	NA
Barium, Ba	LB094234	µg/L	1	<1	4 - 8%	NA
Beryllium, Be	LB094234	µg/L	1	<1	0%	NA
Cadmium, Cd	LB094234	µg/L	0.1	<0.1	0%	NA
Chromium, Cr	LB094234	µg/L	1	<1	0%	NA
Cobalt, Co	LB094234	µg/L	1	<1	0%	NA
Copper, Cu	LB094234	µg/L	1	<1	0%	NA
Lead, Pb	LB094234	µg/L	1	<1	0%	NA
Manganese, Mn	LB094234	µg/L	1	<1	0 - 6%	NA
Molybdenum, Mo	LB094234	µg/L	1	<1	0%	NA
Nickel, Ni	LB094234	µg/L	1	<1	0%	NA
Zinc, Zn	LB094234	µg/L	1	<1	0 - 2%	NA

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN007/AS4439.3	Contaminants of interest in a waste material are leached out of the waste with a selected leaching solution under controlled conditions. The ratio of sample to extraction fluid is 100 g to 2 L (1 to 20 by mass). The concentration of each contaminant of interest is determined in the leachate by appropriate methods after separation from the sample by filtering. Based on AS4439.3.
AN012/AN320	Dried prepared soil is digested by oxidation with nitric acid and bromine followed by analysis of the digest by ICP OES.
AN014	This method is for the determination of soluble sulfate (SO4-S) by extraction with hydrochloric acid. Sulphides should not react and would normally be expelled. Sulfate as Sulfur is determined by ICP.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:2 and the pH determined and reported on the extract after 1 hour extraction (pH 1:2) or after 1 hour extraction and overnight aging (pH (1:2) aged). Reference APHA 4500-H+.
AN106	Conductivity : Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conduc ivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:2 and the EC determined and reported on the extract basis after the 1 hour extraction (EC(1:2)) or after he 1 hour extraction and overnight aging (EC(1:2) aged). Reference APHA 2510 B.
AN106	Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.
AN212	Samples are initially evaluated to determine the strength of reagents needed using a `'fizz' test. Samples are then subjected to an excess of hydrochloric acid followed by alkaline back titration to pH 7. Results are expressed in kg H2SO4/tonne or Kg CaCO3/tonne after correction for moisture content if applicable.
AN215	This is purely a calculation based on results obtained from Total Sulphur , Sulfate Method, and Acid Neutralisation Capacity Method (ME-AU-ENV-AN212). The negative value included as the LOR allows negative NAPP data to be reported in the LIMS, it is not the numerical LOR which would theoretically be 1kg H2SO4/tonne. The range of results is theoretically -980 to 1640kg H2SO4/ Tonne.
AN216	Pulverised sub-sample of a waste rock or an as received sample of filter cake, soil or sludge is subjected to an oxidising digest with 15% hydrogen peroxide adjusted to pH 4.5. The pH and EC of the NAG suspension is recorded at various stages in the digest. The acid produced (if any) is titrated using standardised NaOH to pH 7.0. NAG results are reported to 0.5 kg H2SO4/tonne.
AN311(Perth) /AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN318	Determination of elements at trace level in waters by ICP-MS technique, referenced to USEPA 6020B and USEPA 200.8 (5.4).

METHOD	METHODOLOGY SUMMARY
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transi ions through unique energy levels. The emitted light is focused onto a diffrac ion grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting wi h ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance wi h ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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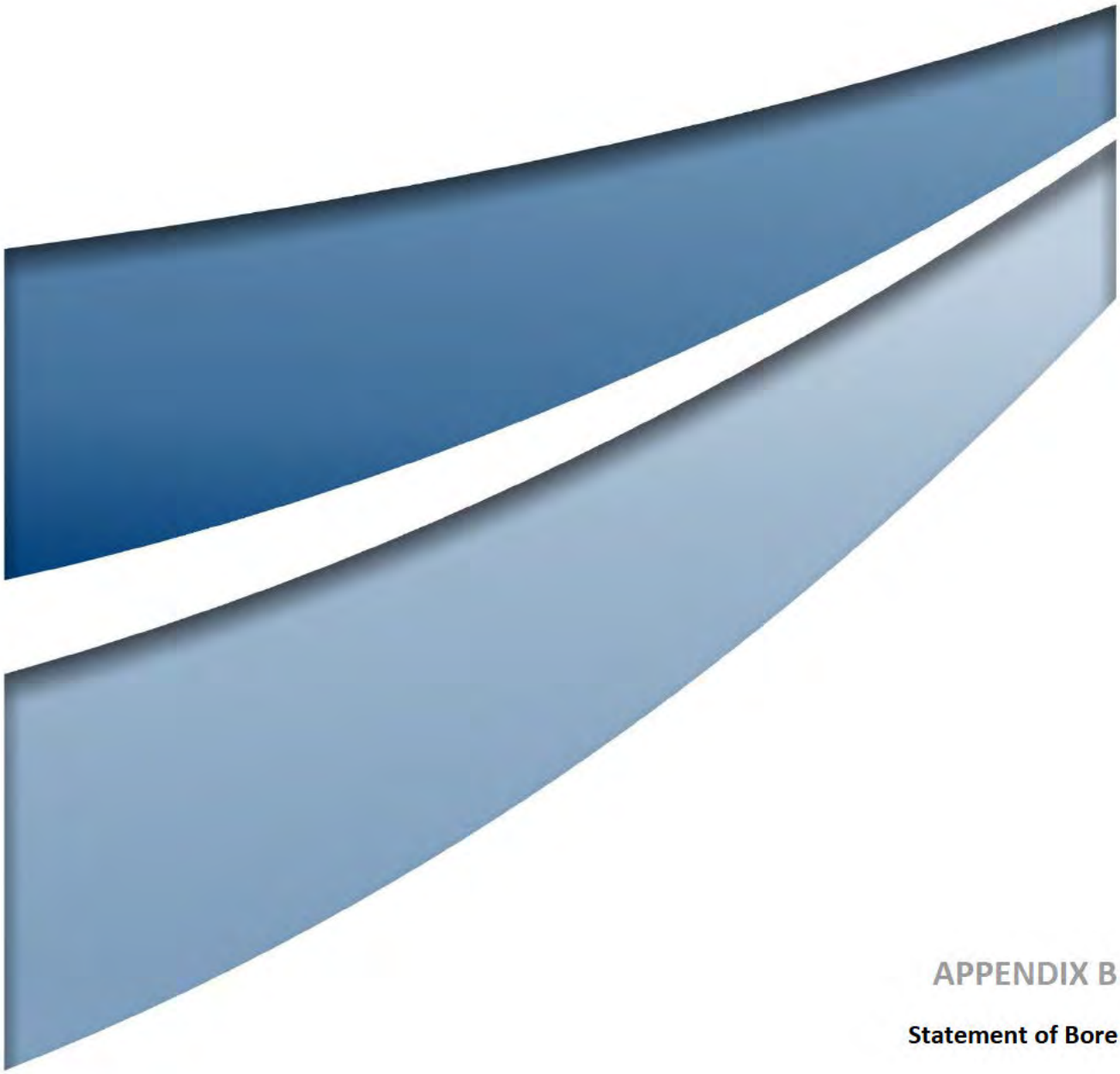


APPENDIX B

Statement of Bore

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd Tennant Creek 3735	Bore Name:	NWMW001
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting:	Northing:	Latitude(DMS):	Longitude(DMS):
	☐	☒	☐	☐ / ☒	425505.04	7819803.37		

From	To	Particulars of Strata
0	3	GRAVEL
3	33	CLAY
33	54	SANDSTONE
54	60	SANDSTONE /SILTSTONE
60	66	SANDSTONE
66	72	SANDSTONE/ SILTSTONE
72	102	SANDSTONE

Name of Drilling Company: ~~F. May~~ May Drilling

Name of Driller: Frederick May.

Name of supervising driller

Date Commenced: 4/6/2021

Date Completed: 6/6/2021

Depth Drilled: 102m (m)

Completion Depth: 102m (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☒	☐	☐	☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air.
12	102	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	110	4.8mm Steel
0	~~102~~ 102	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
90	102	101	2mm	Hand Slotted

Casing Suspended: Yes☐ No ☐

Method:

Height of Casing above GL: (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% B Grout.
~~87~~ 88	~~88~~ 89	Bentonit Seal
89	102	3-6mm Sand pack.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
	76	.001						
90	102	.01						

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐	Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐		GDA2020 ☐	
	MGA Zone:	Easting:		Latitude (DMS):
	Index Map Number:	Northing:		Longitude (DMS):

Date Registered:	Dept Officer:	Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Creek Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd Tennant Creek 3735	Bore Name:	NWMW002
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting:	Latitude(DMS):
	☐	☒	☐	☐ / ☒	425488	
					Northing: 7819596.4	Longitude(DMS):

From	To	Particulars of Strata
0	12	CLAY
12	27	SANDSTONE
27	33	SANDSTONE /SILTSTONE
33	39	SANDSTONE
39	42	SANDSTONE /SILTSTONE
42	45	SANDSTONE
45	48	SANDSTONE /SILTSTONE
48	57	SANDSTONE
57	60	SANDSTONE/SILTSTONE
60	72	CLAY
72	75	SANDSTONE
75	78	CLAY

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller

Date Commenced: 7/6/2021
Date Completed: 9/6/2021

Depth Drilled: 78 (m)
Completion Depth: 77.9 (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☑

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air SLF Foam
12	78	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	78	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
66	78	101	2mm	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: 0.7 (m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Bent Grout.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
72	78	.05						

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

Completion Yield: (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

Very Soft. Altered clays. ~72-78m Dark Brown clays "Very Different"

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐	Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐		GDA2020 ☐	
	MGA Zone:	Easting:		Latitude (DMS):
	Index Map Number:	Northing:		Longitude (DMS):
Date Registered:	Dept Officer:		Signature:	
Remarks:				

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining
Street address /NT Parcel:	935 Peko Rd Tennant Creek 3735
Bore Registration No :	RN
Bore Name:	NNMW 004
BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting:	Northing:	Latitude(DMS):	Longitude(DMS):
	☐	☒	☐	☐ / ☒	425375	7820086		

From	To	Particulars of Strata
0	3	SANDSTONE/SILTSTONE
3	12	SANDSTONE
12	21	HEMATITE SHALE
21	24	SANDSTONE/SILTSTONE
24	51	SANDSTONE
51	57	CHLORITE ROCK
57	75	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller

Date Commenced: 3/6/2021
Date Completed: 4/6/2021
Depth Drilled: 75 (m)
Completion Depth: 75 (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☐

Specify:

HOLE DIAMETER

From (m)	To (m)	Dia. (mm)	DRILLING FLUID Type
0	12m	310	Air
12	75	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	75	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
63	75	101	2mm	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Bento Grout
61	75	3-6mm Sand
59	61	Bentonite Seal

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
63	63.6	Damp						
	69.4	0.11		1/2				

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

Completion Yield: 0.11 (L/s) Method: Air lift. Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION RN:

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐		Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:	
	Portion No:	Lease No:		Hundred of:	
Coordinate Location Verified:	Datum: GDA94☐		GDA2020☐		
	MGA Zone:	Easting:		Latitude (DMS):	
	Index Map Number:	Northing:		Longitude (DMS):	
Date Registered:	Dept Officer:		Signature:		

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd 3735 Tennant Creek ~~3735~~	Bore Name:	NMW005
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone:		Easting:	Latitude(DMS):
	☐	☒	☐	52 ☐ 53 ☐		425229	
					Northing:	7820086	Longitude(DMS):

From	To	Particulars of Strata
0	3	CLAY
3	6	SANDSTONE
6	12	HEMATITE SHALE
12	36	SANDSTONE
36	39	CHLORITE ROCK
39	48	SANDSTONE
48	51	CHLORITE ROCK
51	54	SANDSTONE/ SILTSTONE
54	69	SANDSTONE
69	71	SILTSTONE

Name of Drilling Company:

Name of Driller:

Name of supervising driller

Date Commenced: 2/6/2021

Date Completed: 3/6/2021

Depth Drilled: (m)

Completion Depth: (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	70.2	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	70.1	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
58	70	101	2mm	Hand Slotted.

Casing Suspended: Yes☐ No ☑

Method: Seated on Bottom

Height of Casing above GL: .7m (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Bentonite grout
54	56	Bentonite Seal
56	70	3-6mm Sand pack

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
62.6	64	.53		5				

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: .53 (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐	Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐		GDA2020 ☐	
	MGA Zone:	Easting:		Latitude (DMS):
	Index Map Number:	Northing:		Longitude (DMS):

Date Registered:	Dept Officer:	Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735
Bore Registration No :	RN
Bore Name:	NTMW007
BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone:	Easting:	Latitude(DMS):
	☐	☒	☐	52 ☐ 53 ☒	Northing: 7819450	Longitude(DMS):

From	To	Particulars of Strata
0	12	CLAY
12	21	SILTSTONE / SANDSTONE
21	27	SANDSTONE
27	30	SILTSTONE
30	39	HEMATITE SHALE
39	42	SANDSTONE / SILTSTONE
42	87	SANDSTONE
87	90	CHLORITE ROCK
90	96	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller

Date Commenced: 1/6/2021
Date Completed: 2/6/2021

Depth Drilled: 96 (m)
Completion Depth: 95.8 TD,GL (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☐

Specify:

HOLE DIAMETER

From (m)	To (m)	Dia. (mm)	DRILLING FLUID Type
0	12	310	Air
12	96	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	95.8	101 mm	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
83.8	95.8	101	2mm	Hand Slotted.

Casing Suspended: Yes☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7 m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
82.8	95.8	3-6mm Gravel Pack
81	82.8	Bentonite

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
18	24	.001						
	66	.0001						
90	96	.13		1/2				
Cumulative Yield:								

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

Completion Yield: .13 (L/s) Method: air Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION RN:

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐	Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐		GDA2020 ☐	
	MGA Zone:	Easting:		Latitude (DMS):
	Index Map Number:	Northing:		Longitude (DMS):
Date Registered:	Dept Officer:		Signature:	
Remarks:				

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735
Bore Registration No :	RN
Bore Name:	NWMW011
BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53
	☐	☒	☐	☐ / ☒

Easting: 426622 Latitude(DMS):

Northing: 7819922 Longitude(DMS):

From	To	Particulars of Strata
0	3	CLAY
3	6	HEMATITE SHALE
6	21	CLAY
21	66	SANDSTONE

Name of Drilling Company: May Drilling

Name of Driller: Frederick May

Name of supervising driller

Date Commenced: 28/5/2021

Date Completed: 29/5/2021

Depth Drilled: (m)

Completion Depth: (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
0	66	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel.
0	66	101	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
54	66	101	2mm	Hand Slotted

Casing Suspended: Yes☐ No ☑

Method: Seated on Bottom

Height of Casing above GL: .7m (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
52	66	3-6mm Sand.
50	52	Bentonite.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
59	60	1			Salty.			

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: 1 (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐		Other ☐
Property Location:	Section No:		Lot No:	LTO Code:	Town of:
	Portion No:		Lease No:		Hundred of:
Coordinate Location Verified:	Datum:	GDA94☐		GDA2020☐	
	MGA Zone:		Easting:		Latitude (DMS):
	Index Map Number:		Northing:		Longitude (DMS):

Date Registered:	Dept Officer:	Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW012
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting: 427617	Latitude(DMS):
	☐	☒	☐	☐ / ☒	Northing: 7819829.6	Longitude(DMS):

From	To	Particulars of Strata
0	3	CLAY
3	9	HEMATITE SHALE
9	18	SILTSTONE
18	27	SANDSTONE
27	30	SILTSTONE
30	33	SANDSTONE
33	36	SILTSTONE
36	48	SANDSTONE
48	54	SILTSTONE
54	78	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May.
Name of supervising driller

Date Commenced: 30/5/2024
Date Completed: 31/5/2021

Depth Drilled: 76.6m (m)
Completion Depth: 76.4m (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER / DRILLING FLUID

From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	76.6	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	76.4	101mm	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
64.4	76.4	2mm	101	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
63.4	76.4	3-6mm Gravel pack
0	12m	Bentonite grout.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
68	70	.2			Salty.			
Cumulative Yield:		.2						

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

Completion Yield: .2 (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION	RN:

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☑ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐		Other ☐
Property Location:	Section No:		Lot No:	LTO Code:	Town of:
	Portion No:		Lease No:		Hundred of:
Coordinate Location Verified:	Datum:	GDA94☐		GDA2020☐	
	MGA Zone:		Easting:		Latitude (DMS):
	Index Map Number:		Northing:		Longitude (DMS):

Date Registered:	Dept Officer:	Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW13
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting:	Latitude(DMS):
	☐	☒	☐	☐ / ☒	426527	
					Northing: 7820174	Longitude(DMS):

From	To	Particulars of Strata
0	6	~~vovish Dow~~ SANDSTONE / SILTSTONE
6	18	CLAY
18	30	SANDSTONE
30	33	SILTSTONE / SANDSTONE
33	66	SANDSTONE / SILTSTONE
66	69	SILTSTONE / SANDSTONE
69	78	SANDSTONE / SILTSTONE

Name of Drilling Company: May Drilling

Name of Driller: Seamus May.

Name of supervising driller

Date Commenced: 7/6/2021

Date Completed: 8/6/2021

Depth Drilled: (m)

Completion Depth: (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☐

Specify:

HOLE DIAMETER / DRILLING FLUID

From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	78	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	78	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
66	78	101	2mm	Hand Slotted

Casing Suspended: Yes ☐ No ☐

Method:

Height of Casing above GL: (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Grout Bentonite
64	78	3-6mm Sand Pack
62	64	Bentonite Seal

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
72	78	.24						

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐		Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:	
	Portion No:	Lease No:		Hundred of:	
Coordinate Location Verified:	Datum: GDA94☐		GDA2020☐		
	MGA Zone:	Easting:		Latitude (DMS):	
	Index Map Number:	Northing:		Longitude (DMS):	

Date Registered:	Dept Officer:	Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko RD, Tennant Creek 3735	Bore Name:	NWMW 014
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting:	Latitude(DMS):
	☐	☒	☐	☐ / ☒	Northing: 7820387	Longitude(DMS):

From	To	Particulars of Strata
0	9	CLAY
9	15	SANDSTONE
15	18	VOLCANIC TUFF
18	24	SANDSTONE
24	27	SILTSTONE
27	60	SANDSTONE / SILTSTONE
60	66	HEMATITE SHALE
66	72	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May.
Name of supervising driller

Date Commenced: 29/5/2021
Date Completed: 30/5/2021

Depth Drilled: 69.6 (m)
Completion Depth: 69.4 (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER

From (m)	To (m)	Dia. (mm)
0	12	310
12	69.6	200

DRILLING FLUID

Type
Air
Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	69.6	101 mm	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
57.6	69.6	101	2 mm	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
69.6	52	3-6mm Sand.
52	50	Bentanite.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
63.6	66	.2			Salty.			

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

Completion Yield: .2 (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐	Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94☐		GDA2020☐	
	MGA Zone:	Easting:		Latitude (DMS):
	Index Map Number:	Northing:		Longitude (DMS):
Date Registered:	Dept Officer:		Signature:	

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW018
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020	GDA94	WGS84	Zone: 52 / 53	Easting:	Northing:	Latitude(DMS):	Longitude(DMS):
	☐	☒	☐	☐ / ☒	427152	7819926		

From	To	Particulars of Strata
0	3	LATERITE
3	6	CLAY
6	21	SILTSTONE
21	24	VOLCANIC TUFF
24	30	SANDSTONE
30	39	HEMATITE SHALE
39	75	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederich May
Name of supervising driller

Date Commenced: 31/5/2021
Date Completed: 1/6/2021

Depth Drilled: 78 (m)
Completion Depth: 78 (m)

METHOD OF DRILLING

Auger	Rotary Air	Rotary Mud	Sonic	Other
☐	☑	☐	☐	☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	78	200	

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	78	101	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
78	66	2mm	101	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: 0.7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
65	78	3-6mm Gravel Pack
63	65	Bentonite

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
70	74.6	~~1.9~~ 0.19			Fair			

Cumulative Yield: 1.9
Completion Yield: 1.9 (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☑ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☑	Industry	☐	Mning ☐ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

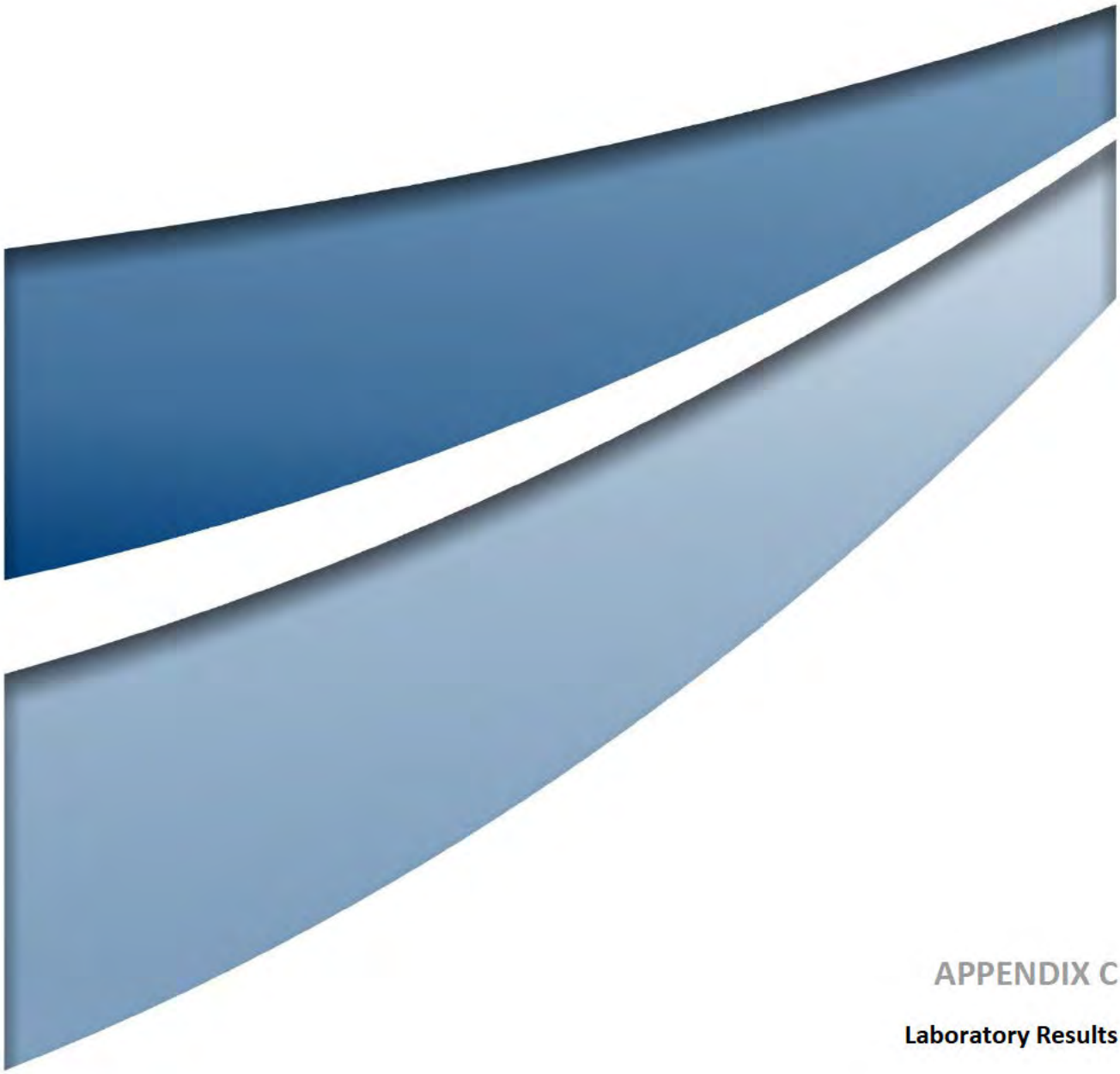
Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐		Survey ☐	Other ☐
Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐		GDA2020 ☐	
	MGA Zone:	Easting:		Latitude (DMS):
	Index Map Number:	Northing:		Longitude (DMS):
Date Registered:	Dept Officer:		Signature:	
Remarks:				



APPENDIX C

Laboratory Results

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Matt Golovanoff	Manager	Anthony Nilsson
Client	TENNANT MINING	Laboratory	SGS Cairns Environmental
Address	PO BOX 37 WEST PERTH WA 6005	Address	Unit 2, 58 Comport St Portsmith QLD 4870
Telephone	0414867084	Telephone	+61 07 4035 5111
Facsimile	(Not specified)	Facsimile	+61 07 4035 5122
Email	matt@tennantmining.com.au	Email	AU.Environmental.Cairns@sgs.com
Project	**Water Analysis - 12-13 October 2021**	SGS Reference	**CE155426 R0**
Order Number	(Not specified)	Date Received	18 Oct 2021
Samples	12	Date Reported	02 Nov 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

For determination of soluble metals, filtered sample was not received so samples were laboratory filtered on receipt. This may give soluble metals results that do not represent the concentrations present at the time of sampling.
Metals - The Limit of Reporting (LOR) has been raised due to interferences from the sample matrix.
Cyandie subcontracted to SGS Perth Environmental, 28 Reid Rd Perth Airport WA, NATA Accreditation Number 2562, Site Number 898, PE155587.

SIGNATORIES

Alyson BERGAMO
Senior Laboratory Technician

Anthony NILSSON
Operations Manager

Jon DICKER
Manager Northern QLD

Maristela GANZAN
Quality Coordinator

Mitsuko BALDWIN
Metals Team Leader

Parameter	Units	LOR	Sample Number: CE155426.001 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW001	CE155426.002 Water 12 Oct 2021 NNMW002	CE155426.003 Water 13 Oct 2021 NNMW004	CE155426.004 Water 13 Oct 2021 NNMW005
pH in water Method: AN101 Tested: 19/10/2021						
pH**	pH Units	0.1	**7.8**	**7.4**	**7.9**	**7.8**
Alkalinity Method: AN135 Tested: 19/10/2021						
Bicarbonate Alkalinity as HCO3	mg/L	5	**360**	**140**	**390**	**430**
Carbonate Alkalinity as CO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	**300**	**120**	**320**	**350**
Bicarbonate Alkalinity as CaCO3	mg/L	5	**300**	**120**	**320**	**350**
Carbonate Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Chloride by Discrete Analyser in Water Method: AN274 Tested: 20/10/2021						
Chloride, Cl	mg/L	1	**3000**	**1300**	**3200**	**3700**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 19/10/2021						
Conductivity @ 25 C	µS/cm	5	**11000**	**4700**	**11000**	**14000**
Total Dissolved Solids (by calculation)	mg/L	2	-	-	-	-
Acidity and Free CO2 Method: AN140 Tested: 19/10/2021						
Acidity to pH 8.3	mg CaCO3/L	5	**27**	**30**	**28**	**40**
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 25/10/2021						
Total Dissolved Solids Dried at 175-185°C	mg/L	10	**7300**	**3200**	**7100**	**8700**

Parameter	Units	LOR	Sample Number: CE155426.001 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW001	CE155426.002 Water 12 Oct 2021 NNMW002	CE155426.003 Water 13 Oct 2021 NNMW004	CE155426.004 Water 13 Oct 2021 NNMW005
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 25/10/2021						
Aluminium, Al	mg/L	0.005	**0.016**	**0.012**	**0.015**	**0.024**
Calcium, Ca	mg/L	0.1	**220**	**120**	**180**	**190**
Iron, Fe	mg/L	0.02	<0.02	<0.02	<0.02	-
Magnesium, Mg	mg/L	0.1	**270**	**150**	**290**	**260**
Manganese, Mn	mg/L	0.005	**3.6**	**1.1**	**0.70**	**0.39**
Potassium, K	mg/L	0.1	**84**	**21**	**96**	**79**
Sodium, Na	mg/L	0.5	**2000**	**560**	**2100**	**2100**
Sulfur asSulfate, SO4	mg/L	0.5	**980**	**240**	**870**	**990**
Zinc, Zn	mg/L	0.005	**0.008**	**0.006**	**0.007**	**0.012**
Total Hardness by Calculation	mg CaCO3/L	1	**1600**	**930**	**1600**	**1600**
Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 25/10/2021						
Total Aluminium	mg/L	0.005	**0.094**	**3.3**	**0.30**	**1.1**
Total Iron	mg/L	0.02	**0.13**	**2.5**	**0.37**	**1.7**
Total Manganese	mg/L	0.005	**3.9**	**1.9**	**0.74**	**0.49**
Total Zinc	mg/L	0.005	**0.014**	**0.010**	**0.009**	**0.023**
Metals in Water (Dissolved) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021						
Arsenic, As	mg/L	0.003	<0.009↑	<0.006↑	<0.009↑	-
Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0002**	<0.0003↑	-
Chromium, Cr	mg/L	0.001	<0.0030↑	<0.0020↑	<0.0030↑	-
Cobalt, Co	mg/L	0.001	**0.054**	**0.017**	**0.050**	-
Copper, Cu	mg/L	0.001	**0.003**	**0.003**	<0.003↑	-
Lead, Pb	mg/L	0.001	**0.003**	<0.002↑	<0.003↑	-
Nickel, Ni	mg/L	0.001	**0.006**	**0.012**	<0.003↑	-
Selenium, Se	mg/L	0.002	**0.037**	**0.010**	**0.025**	-
Vanadium, V	mg/L	0.001	<0.003↑	<0.002↑	<0.003↑	-
Metals in Water (Total) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021						
Total Arsenic, As	mg/L	0.003	<0.009↑	<0.006↑	<0.009↑	-
Total Cadmium, Cd	mg/L	0.0001	**0.0005**	**0.0003**	<0.0003↑	-
Total Chromium, Cr	mg/L	0.001	<0.003↑	**0.003**	<0.003↑	-
Total Cobalt, Co	mg/L	0.001	**0.055**	**0.019**	**0.051**	-
Total Copper, Cu	mg/L	0.001	**0.004**	**0.006**	<0.003↑	-
Total Lead, Pb	mg/L	0.001	**0.003**	**0.005**	<0.003↑	-
Total Nickel, Ni	mg/L	0.001	**0.007**	**0.014**	<0.003↑	-
Total Selenium, Se	mg/L	0.002	**0.038**	**0.012**	**0.025**	-
Total Vanadium, V	mg/L	0.001	<0.003↑	**0.007**	**0.003**	-
Trace Metals (soluble) in saline water by ICPMS Method: AN318 Tested: 29/10/2021						
Arsenic	mg/L	0.001	-	-	-	<0.001
Cadmium	mg/L	0.001	-	-	-	<0.001
Chromium	mg/L	0.001	-	-	-	**0.003**
Cobalt	mg/L	0.001	-	-	-	**0.18**
Copper	mg/L	0.001	-	-	-	**0.010**
Iron	mg/L	0.01	-	-	-	**0.02**
Lead	mg/L	0.001	-	-	-	<0.001
Nickel	mg/L	0.001	-	-	-	**0.004**
Selenium	mg/L	0.002	-	-	-	**0.013**
Vanadium	mg/L	0.001	-	-	-	**0.002**
Zinc	µg/L	5	-	-	-	-
Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021						
Total Arsenic	mg/L	0.001	-	-	-	<0.001
Total Cadmium	mg/L	0.001	-	-	-	<0.001
Total Chromium	mg/L	0.001	-	-	-	**0.005**
Total Cobalt	mg/L	0.001	-	-	-	**0.18**
Total Copper	mg/L	0.001	-	-	-	**0.025**

Parameter	Units	LOR	Sample Number: CE155426.001 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW001	CE155426.002 Water 12 Oct 2021 NNMW002	CE155426.003 Water 13 Oct 2021 NNMW004	CE155426.004 Water 13 Oct 2021 NNMW005
Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021 (continued)						
Total Iron	mg/L	0.01	-	-	-	-
Total Lead	mg/L	0.001	-	-	-	**0.005**
Total Nickel	mg/L	0.001	-	-	-	**0.004**
Total Selenium	mg/L	0.002	-	-	-	**0.014**
Total Vanadium	mg/L	0.001	-	-	-	**0.005**
Total Zinc	µg/L	5	-	-	-	-
Metals (dissolved) in Water by GF AAS Method: AN304 Tested: 25/10/2021						
Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0001	<0.0002↑	<0.0003↑
Metals (total-acid soluble) in Water by GF AAS Method: AN022/AN304 Tested: 25/10/2021						
Total (acid soluble) Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0001	<0.0002↑	<0.0003↑
Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 25/10/2021						
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury (total) in Water Method: AN311(Perth) /AN312 Tested: 25/10/2021						
Total Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calculation of Anion-Cation Balance (SAR Calc) Method: AN121 Tested: 29/10/2021						
Sum of Cation Milliequivalents*	meq/L	-	**124**	**44.3**	**128**	**127**
Sum of Anion Milliequivalents*	meq/L	-	**111**	**44.1**	**114**	**131**
Anion-Cation Balance	%	-100	**5.5**	**0.2**	**5.9**	**-1.8**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name CE155426.001 Water 12 Oct 2021 NNMW001	CE155426.002 Water 12 Oct 2021 NNMW002	CE155426.003 Water 13 Oct 2021 NNMW004	CE155426.004 Water 13 Oct 2021 NNMW005
Cyanide Forms in Water by CFA Method: AN296 Tested: 22/10/2021						
Free Cyanide (pH 6)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	**0.021**	<0.004	**0.025**	**0.039**

Parameter	Units	LOR	Sample Number: CE155426.005 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013
pH in water Method: AN101 Tested: 19/10/2021						
pH**	pH Units	0.1	**7.9**	**7.7**	**7.7**	**7.8**
Alkalinity Method: AN135 Tested: 19/10/2021						
Bicarbonate Alkalinity as HCO3	mg/L	5	**310**	**420**	**240**	**250**
Carbonate Alkalinity as CO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	**250**	**350**	**190**	**210**
Bicarbonate Alkalinity as CaCO3	mg/L	5	**250**	**350**	**190**	**210**
Carbonate Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Chloride by Discrete Analyser in Water Method: AN274 Tested: 20/10/2021						
Chloride, Cl	mg/L	1	**2700**	**2800**	**3500**	**2600**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 19/10/2021						
Conductivity @ 25 C	µS/cm	5	**9900**	**11000**	**12000**	**10000**
Total Dissolved Solids (by calculation)	mg/L	2	-	-	-	-
Acidity and Free CO2 Method: AN140 Tested: 19/10/2021						
Acidity to pH 8.3	mg CaCO3/L	5	**12**	**55**	**20**	**16**
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 25/10/2021						
Total Dissolved Solids Dried at 175-185°C	mg/L	10	**6100**	**6700**	**8100**	**6500**

Parameter	Units	LOR	Sample Number: CE155426.005 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 25/10/2021						
Aluminium, Al	mg/L	0.005	**0.020**	**0.021**	**0.024**	**0.018**
Calcium, Ca	mg/L	0.1	**140**	**200**	**350**	**210**
Iron, Fe	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Magnesium, Mg	mg/L	0.1	**180**	**220**	**280**	**230**
Manganese, Mn	mg/L	0.005	**0.18**	**0.016**	**4.3**	**1.1**
Potassium, K	mg/L	0.1	**83**	**83**	**80**	**76**
Sodium, Na	mg/L	0.5	**1800**	**1900**	**2000**	**1600**
Sulfur asSulfate, SO4	mg/L	0.5	**790**	**1100**	**920**	**830**
Zinc, Zn	mg/L	0.005	<0.005	**0.008**	**0.014**	<0.005
Total Hardness by Calculation	mg CaCO3/L	1	**1100**	**1400**	**2000**	**1500**
Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 25/10/2021						
Total Aluminium	mg/L	0.005	**0.76**	**0.15**	**1.9**	**2.0**
Total Iron	mg/L	0.02	**0.66**	**0.16**	**2.3**	**1.7**
Total Manganese	mg/L	0.005	**0.21**	**0.024**	**4.4**	**1.2**
Total Zinc	mg/L	0.005	**0.008**	**0.014**	**0.018**	**0.006**
Metals in Water (Dissolved) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021						
Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.009↑	<0.009↑
Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0003**	**0.0004**	<0.0003↑
Chromium, Cr	mg/L	0.001	**0.0034**	<0.0030↑	<0.0030↑	<0.0030↑
Cobalt, Co	mg/L	0.001	**0.006**	<0.003↑	**0.018**	**0.011**
Copper, Cu	mg/L	0.001	<0.003↑	<0.003↑	<0.003↑	**0.005**
Lead, Pb	mg/L	0.001	<0.003↑	<0.003↑	**0.006**	<0.003↑
Nickel, Ni	mg/L	0.001	<0.003↑	<0.003↑	**0.005**	**0.006**
Selenium, Se	mg/L	0.002	**0.017**	**0.019**	**0.014**	**0.030**
Vanadium, V	mg/L	0.001	<0.003↑	<0.003↑	<0.003↑	<0.003↑
Metals in Water (Total) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021						
Total Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.009↑	<0.009↑
Total Cadmium, Cd	mg/L	0.0001	**0.0005**	**0.0004**	**0.0004**	<0.0003↑
Total Chromium, Cr	mg/L	0.001	**0.004**	<0.003↑	**0.004**	**0.004**
Total Cobalt, Co	mg/L	0.001	**0.007**	<0.003↑	**0.022**	**0.015**
Total Copper, Cu	mg/L	0.001	<0.003↑	**0.004**	**0.005**	**0.017**
Total Lead, Pb	mg/L	0.001	<0.003↑	**0.004**	**0.006**	**0.004**
Total Nickel, Ni	mg/L	0.001	<0.003↑	**0.003**	**0.006**	**0.009**
Total Selenium, Se	mg/L	0.002	**0.019**	**0.020**	**0.014**	**0.034**
Total Vanadium, V	mg/L	0.001	**0.004**	<0.003↑	**0.008**	**0.005**
Trace Metals (soluble) in saline water by ICPMS Method: AN318 Tested: 29/10/2021						
Arsenic	mg/L	0.001	-	-	-	-
Cadmium	mg/L	0.001	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-
Cobalt	mg/L	0.001	-	-	-	-
Copper	mg/L	0.001	-	-	-	-
Iron	mg/L	0.01	-	-	-	-
Lead	mg/L	0.001	-	-	-	-
Nickel	mg/L	0.001	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-
Vanadium	mg/L	0.001	-	-	-	-
Zinc	µg/L	5	-	-	-	-
Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021						
Total Arsenic	mg/L	0.001	-	-	-	-
Total Cadmium	mg/L	0.001	-	-	-	-
Total Chromium	mg/L	0.001	-	-	-	-
Total Cobalt	mg/L	0.001	-	-	-	-
Total Copper	mg/L	0.001	-	-	-	-

Parameter	Units	LOR	Sample Number: CE155426.005 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013
Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021 (continued)						
Total Iron	mg/L	0.01	-	-	-	-
Total Lead	mg/L	0.001	-	-	-	-
Total Nickel	mg/L	0.001	-	-	-	-
Total Selenium	mg/L	0.002	-	-	-	-
Total Vanadium	mg/L	0.001	-	-	-	-
Total Zinc	µg/L	5	-	-	-	-
Metals (dissolved) in Water by GF AAS Method: AN304 Tested: 25/10/2021						
Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0003↑	<0.0002↑
Metals (total-acid soluble) in Water by GF AAS Method: AN022/AN304 Tested: 25/10/2021						
Total (acid soluble) Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0003↑	<0.0002↑
Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 25/10/2021						
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury (total) in Water Method: AN311(Perth) /AN312 Tested: 25/10/2021						
Total Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calculation of Anion-Cation Balance (SAR Calc) Method: AN121 Tested: 29/10/2021						
Sum of Cation Milliequivalents*	meq/L	-	**103**	**114**	**131**	**99.7**
Sum of Anion Milliequivalents*	meq/L	-	**97.8**	**107**	**122**	**102**
Anion-Cation Balance	%	-100	**2.5**	**3.3**	**3.4**	**-0.9**

Parameter	Units	LOR	Sample Number: CE155426.005 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013
Cyanide Forms in Water by CFA Method: AN296 Tested: 22/10/2021						
Free Cyanide (pH 6)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004

Parameter	Units	LOR	Sample Number: CE155426.009 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW014	Sample Number: CE155426.010 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW018	Sample Number: CE155426.011 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: SWLA	Sample Number: CE155426.012 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: Juno Shaft
pH in water Method: AN101 Tested: 19/10/2021						
pH**	pH Units	0.1	**7.9**	**7.9**	**7.1**	**7.2**
Alkalinity Method: AN135 Tested: 19/10/2021						
Bicarbonate Alkalinity as HCO3	mg/L	5	**360**	**280**	**38**	**49**
Carbonate Alkalinity as CO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	**300**	**230**	**31**	**40**
Bicarbonate Alkalinity as CaCO3	mg/L	5	**300**	**230**	**31**	**40**
Carbonate Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Chloride by Discrete Analyser in Water Method: AN274 Tested: 20/10/2021						
Chloride, Cl	mg/L	1	**2800**	**3100**	**9**	**4000**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 19/10/2021						
Conductivity @ 25 C	µS/cm	5	**9900**	**11000**	**99**	**14000**
Total Dissolved Solids (by calculation)	mg/L	2	-	**6500**	-	-
Acidity and Free CO2 Method: AN140 Tested: 19/10/2021						
Acidity to pH 8.3	mg CaCO3/L	5	**18**	**9**	**10**	<5
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 25/10/2021						
Total Dissolved Solids Dried at 175-185°C	mg/L	10	**6400**	IS	**60**	**11000**

Parameter	Units	LOR	Sample Number: CE155426.009 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW014	CE155426.010 Water 12 Oct 2021 NNMW018	CE155426.011 Water 13 Oct 2021 SWLA	CE155426.012 Water 13 Oct 2021 Juno Shaft
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 25/10/2021						
Aluminium, Al	mg/L	0.005	**0.043**	**0.020**	**0.20**	**0.042**
Calcium, Ca	mg/L	0.1	**210**	**320**	**5.8**	**760**
Iron, Fe	mg/L	0.02	<0.02	<0.02	**0.47**	<0.02
Magnesium, Mg	mg/L	0.1	**220**	**250**	**1.8**	**250**
Manganese, Mn	mg/L	0.005	**0.27**	**0.63**	<0.005	**0.29**
Potassium, K	mg/L	0.1	**79**	**73**	**5.7**	**140**
Sodium, Na	mg/L	0.5	**1700**	**1800**	**5.7**	**2200**
Sulfur asSulfate, SO4	mg/L	0.5	**680**	**900**	**4.2**	**1700**
Zinc, Zn	mg/L	0.005	<0.005	**0.024**	<0.005	-
Total Hardness by Calculation	mg CaCO3/L	1	**1400**	**1800**	**22**	**2900**
Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 25/10/2021						
Total Aluminium	mg/L	0.005	**1.2**	**0.16**	**0.21**	**0.045**
Total Iron	mg/L	0.02	**1.4**	**0.31**	**0.83**	**0.82**
Total Manganese	mg/L	0.005	**0.30**	**0.66**	**0.021**	**0.29**
Total Zinc	mg/L	0.005	**0.012**	**0.029**	<0.005	-
Metals in Water (Dissolved) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021						
Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.003	-
Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0003**	<0.0001	-
Chromium, Cr	mg/L	0.001	<0.0030↑	<0.0030↑	<0.0010	-
Cobalt, Co	mg/L	0.001	**0.005**	**0.008**	<0.001	-
Copper, Cu	mg/L	0.001	<0.003↑	<0.003↑	**0.001**	-
Lead, Pb	mg/L	0.001	<0.003↑	<0.003↑	<0.001	-
Nickel, Ni	mg/L	0.001	<0.003↑	**0.003**	<0.001	-
Selenium, Se	mg/L	0.002	**0.020**	**0.010**	<0.002	-
Vanadium, V	mg/L	0.001	**0.005**	<0.003↑	**0.001**	-
Metals in Water (Total) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021						
Total Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.003	-
Total Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0004**	<0.0001	-
Total Chromium, Cr	mg/L	0.001	<0.003↑	<0.003↑	<0.001	-
Total Cobalt, Co	mg/L	0.001	**0.006**	**0.009**	<0.001	-
Total Copper, Cu	mg/L	0.001	**0.005**	**0.004**	**0.001**	-
Total Lead, Pb	mg/L	0.001	**0.004**	**0.003**	**0.001**	-
Total Nickel, Ni	mg/L	0.001	<0.003↑	**0.004**	<0.001	-
Total Selenium, Se	mg/L	0.002	**0.027**	**0.011**	<0.002	-
Total Vanadium, V	mg/L	0.001	**0.006**	<0.003↑	**0.001**	-
Trace Metals (soluble) in saline water by ICPMS Method: AN318 Tested: 29/10/2021						
Arsenic	mg/L	0.001	-	-	-	**0.012**
Cadmium	mg/L	0.001	-	-	-	<0.001
Chromium	mg/L	0.001	-	-	-	**0.002**
Cobalt	mg/L	0.001	-	-	-	<0.001
Copper	mg/L	0.001	-	-	-	**0.006**
Iron	mg/L	0.01	-	-	-	-
Lead	mg/L	0.001	-	-	-	<0.001
Nickel	mg/L	0.001	-	-	-	**0.001**
Selenium	mg/L	0.002	-	-	-	**0.002**
Vanadium	mg/L	0.001	-	-	-	<0.001
Zinc	µg/L	5	-	-	-	<5
Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021						
Total Arsenic	mg/L	0.001	-	-	-	**0.021**
Total Cadmium	mg/L	0.001	-	-	-	<0.001
Total Chromium	mg/L	0.001	-	-	-	**0.003**
Total Cobalt	mg/L	0.001	-	-	-	<0.001
Total Copper	mg/L	0.001	-	-	-	**0.006**

Parameter	Units	LOR	Sample Number: CE155426.009 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW014	CE155426.010 Water 12 Oct 2021 NNMW018	CE155426.011 Water 13 Oct 2021 SWLA	CE155426.012 Water 13 Oct 2021 Juno Shaft
Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021 (continued)						
Total Iron	mg/L	0.01	-	-	-	-
Total Lead	mg/L	0.001	-	-	-	<0.001
Total Nickel	mg/L	0.001	-	-	-	**0.003**
Total Selenium	mg/L	0.002	-	-	-	<0.002
Total Vanadium	mg/L	0.001	-	-	-	<0.001
Total Zinc	µg/L	5	-	-	-	**11**
Metals (dissolved) in Water by GF AAS Method: AN304 Tested: 25/10/2021						
Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0001	<0.0003↑
Metals (total-acid soluble) in Water by GF AAS Method: AN022/AN304 Tested: 25/10/2021						
Total (acid soluble) Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0001	<0.0003↑
Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 25/10/2021						
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury (total) in Water Method: AN311(Perth) /AN312 Tested: 25/10/2021						
Total Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calculation of Anion-Cation Balance (SAR Calc) Method: AN121 Tested: 29/10/2021						
Sum of Cation Milliequivalents*	meq/L	-	**106**	**117**	**1.05**	**159**
Sum of Anion Milliequivalents*	meq/L	-	**98.7**	**111**	**0.979**	**149**
Anion-Cation Balance	%	-100	**3.6**	**2.6**	**3.4**	**3.3**

Parameter	Units	LOR	Sample Number: CE155426.009 Sample Matrix: Water Sample Date: 12 Oct 2021 Sample Name: NNMW014	CE155426.010 Water 12 Oct 2021 NNMW018	CE155426.011 Water 13 Oct 2021 SWLA	CE155426.012 Water 13 Oct 2021 Juno Shaft
Cyanide Forms in Water by CFA Method: AN296 Tested: 22/10/2021						
Free Cyanide (pH 6)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acidity and Free CO2 Method ME-(AU)-[ENV]AN140

Parameter	QC Reference	Units	LOR	MB
Acidity to pH 8.3	LB095161	mg CaCO3/L	5	<5

Alkalinity Method ME-(AU)-[ENV]AN135

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Bicarbonate Alkalinity as HCO3	LB095170	mg/L	5	5		
	LB095264	mg/L	5	<5 - 6		
Carbonate Alkalinity as CO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Hydroxide Alkalinity as OH	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Total Alkalinity as CaCO3	LB095170	mg/L	5	<5	1 - 8%	106 - 109%
	LB095264	mg/L	5	<5	0 - 8%	98 - 100%
Bicarbonate Alkalinity as CaCO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Carbonate Alkalinity as CaCO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Hydroxide Alkalinity as CaCO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		

Chloride by Discrete Analyser in Water Method ME-(AU)-[ENV]AN274

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chloride, Cl	LB095219	mg/L	1	<1	0 - 3%	110%

Conductivity and TDS by Calculation - Water Method ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB095170	µS/cm	5	<5	0 - 6%	99 - 103%
	LB095264	µS/cm	5	<5	0 - 5%	99 - 101%
Total Dissolved Solids (by calculation)	LB095170	mg/L	2	<10		NA
	LB095264	mg/L	2	<2		NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury (dissolved) in Water Method ME-(AU)-[ENV]AN311(Perth)/AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB095413	mg/L	0.00005	<0.00005	0 - 6%	99 - 100%	100 - 104%

Mercury (total) in Water Method ME-(AU)-[ENV]AN311(Perth) /AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Mercury	LB095412	mg/L	0.00005	<0.00005	0 - 6%	99 - 100%	99 - 103%

Metals (dissolved) in Water by GF AAS Method ME-(AU)-[ENV]AN304

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Silver, Ag	LB095391	mg/L	0.0001	<0.0001	0%	92%

Metals (total-acid soluble) in Water by GF AAS Method ME-(AU)-[ENV]AN022/AN304

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total (acid soluble) Silver, Ag	LB095392	mg/L	0.0001	<0.0001	0%	97 - 102%

Metals in Water (Total) by ICPOES Method ME-(AU)-[ENV]AN022/AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Aluminium	LB095355	mg/L	0.005	<0.005	1 - 14%	107%	
Total Iron	LB095355	mg/L	0.02	<0.02	3 - 4%	95%	97%
Total Manganese	LB095355	mg/L	0.005	<0.005	1 - 4%	104%	NA
Total Zinc	LB095355	mg/L	0.005	<0.005	1%	109%	100%

Metals in Water (Dissolved) by ICPOES Method ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Aluminium, Al	LB095354	mg/L	0.005	<0.005	2 - 3%	108%	
Calcium, Ca	LB095354	mg/L	0.1	<0.1	2 - 4%	109%	89%
Iron, Fe	LB095354	mg/L	0.02	<0.02	0%	95%	91%
Magnesium, Mg	LB095354	mg/L	0.1	<0.1	1 - 2%	109%	
Manganese, Mn	LB095354	mg/L	0.005	<0.005	1%	104%	85%
Potassium, K	LB095354	mg/L	0.1	<0.1	0 - 4%	104%	
Sodium, Na	LB095354	mg/L	0.5	<0.5	1 - 10%	104%	
Sulfur asSulfate, SO4	LB095354	mg/L	0.5	<0.5			
Zinc, Zn	LB095354	mg/L	0.005	<0.005	1%	109%	94%
Total Hardness by Calculation	LB095354	mg CaCO3/L	1	<1			

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Metals in Water (Dissolved) by ICPOES-USN Method ME-(AU)-[ENV]AN320/AN322

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Arsenic, As	LB095356	mg/L	0.003	<0.003	0%	100%
Cadmium, Cd	LB095356	mg/L	0.0001	<0.0001	5%	101%
Chromium, Cr	LB095356	mg/L	0.001	<0.0010	0%	100%
Cobalt, Co	LB095356	mg/L	0.001	<0.001	6%	101%
Copper, Cu	LB095356	mg/L	0.001	<0.001	0%	97%
Lead, Pb	LB095356	mg/L	0.001	<0.001	0%	111%
Nickel, Ni	LB095356	mg/L	0.001	<0.001	5%	98%
Selenium, Se	LB095356	mg/L	0.002	<0.002	1%	93%
Vanadium, V	LB095356	mg/L	0.001	<0.001	0%	101%

Metals in Water (Total) by ICPOES-USN Method ME-(AU)-[ENV]AN320/AN322

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Arsenic, As	LB095357	mg/L	0.003	<0.003	0%	101%
Total Cadmium, Cd	LB095357	mg/L	0.0001	<0.0001	14%	97%
Total Chromium, Cr	LB095357	mg/L	0.001	<0.001	0%	98%
Total Cobalt, Co	LB095357	mg/L	0.001	<0.001	5%	98%
Total Copper, Cu	LB095357	mg/L	0.001	<0.001	1%	104%
Total Lead, Pb	LB095357	mg/L	0.001	<0.001	3%	102%
Total Nickel, Ni	LB095357	mg/L	0.001	<0.001	3%	99%
Total Selenium, Se	LB095357	mg/L	0.002	<0.002	7%	108%
Total Vanadium, V	LB095357	mg/L	0.001	<0.001	0%	99%

pH in water Method ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH**	LB095170	pH Units	0.1	6.1 - 7.1	0 - 3%	NA
	LB095264	pH Units	0.1	5.8 - 8.4	0 - 6%	100 - 101%

Total Dissolved Solids (TDS) in water Method ME-(AU)-[ENV]AN113

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Dissolved Solids Dried at 175-185°C	LB095386	mg/L	10	<10	0 - 3%	105%	103 - 113%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Trace Metals (soluble) in saline water by ICPMS Method ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Arsenic	LB095490	mg/L	0.001	<0.001	99%
Cadmium	LB095490	mg/L	0.001	<0.001	104%
Chromium	LB095490	mg/L	0.001	<0.001	
Cobalt	LB095490	mg/L	0.001	<0.001	103%
Copper	LB095490	mg/L	0.001	0.001	99%
Iron	LB095490	mg/L	0.01	<0.01	98%
Lead	LB095490	mg/L	0.001	<0.001	114%
Nickel	LB095490	mg/L	0.001	<0.001	93%
Selenium	LB095490	mg/L	0.002	<0.002	108%
Vanadium	LB095490	mg/L	0.001	<0.001	100%
Zinc	LB095490	µg/L	5	<5	105%

Trace Metals (total) in saline water by ICPMS Method ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Total Arsenic	LB095491	mg/L	0.001	<0.001	99%
Total Cadmium	LB095491	mg/L	0.001	<0.001	104%
Total Chromium	LB095491	mg/L	0.001	<0.001	
Total Cobalt	LB095491	mg/L	0.001	<0.001	103%
Total Copper	LB095491	mg/L	0.001	0.001	99%
Total Lead	LB095491	mg/L	0.001	<0.001	114%
Total Nickel	LB095491	mg/L	0.001	<0.001	93%
Total Selenium	LB095491	mg/L	0.002	<0.002	108%
Total Vanadium	LB095491	mg/L	0.001	<0.001	100%
Total Zinc	LB095491	µg/L	5	<5	105%

METHOD	METHODOLOGY SUMMARY
AN022/AN304	Total (acid soluble) metals by GF AAS: Unfiltered sample is digested with nitric acid prior to analysis by Graphite Furnace AAS. Referenced to APHA3113B.
AN022/AN320	Total (acid soluble) Metals by ICP-OES: Samples are digested in nitric or nitric and hydrochloric acids prior to analysis for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter wi h temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.
AN106	Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.
AN113	Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.
AN113	The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.
AN121	This method is used to calculation the balance of major Anions and Cations in water samples and converts major ion concentration to milliequivalents and then summed. Anions sum and Cation sum is calculated as a difference and expressed as a percentage.
AN135	Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135
AN140	Acidity by Titration: The water sample is titrated wi h sodium hydroxide to designated pH end point. In a sample containing only carbon dioxide, bicarbonates and carbonates, titration to pH 8.3 at 25°C corresponds to stoichiometric neutralisation of carbonic acid to bicarbonate. Method reference APHA 2310 B.
AN274	Chloride by Discrete Analyse: Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN296	This method is applicable to the determination of free, total and weak acid dissociable cyanide in drinking water, soil and domestic and industrial waste of a variety of matrices by using San++ continuous flow analysis
AN304	Filtered acidified sample analysed by GFAAS, referenced to APHA3113B.

METHOD	METHODOLOGY SUMMARY
AN311(Perth) /AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions taken from unfiltered sample are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN311(Perth)/AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.
AN320/AN322	ICP-OES (Ultrasonic Nebuliser): After preservation with 10% nitric acid, a wide range of metals and some non-metals in solution can be measured by ICP- Ultrasonic nebulisation. Solutions are aspirated using an ultrasonic nebuliser into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.
AN320/AN322	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B
AN322	ICP-OES (Ultrasonic Nebuliser): After preservation with 10% nitric acid, a wide range of metals and some non-metals in solution can be measured by ICP- Ultrasonic nebulisation. Solutions are aspirated using an ultrasonic nebuliser into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.
AN322	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B
Calculation	Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported . APHA4500CO2 D.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Repor ing
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

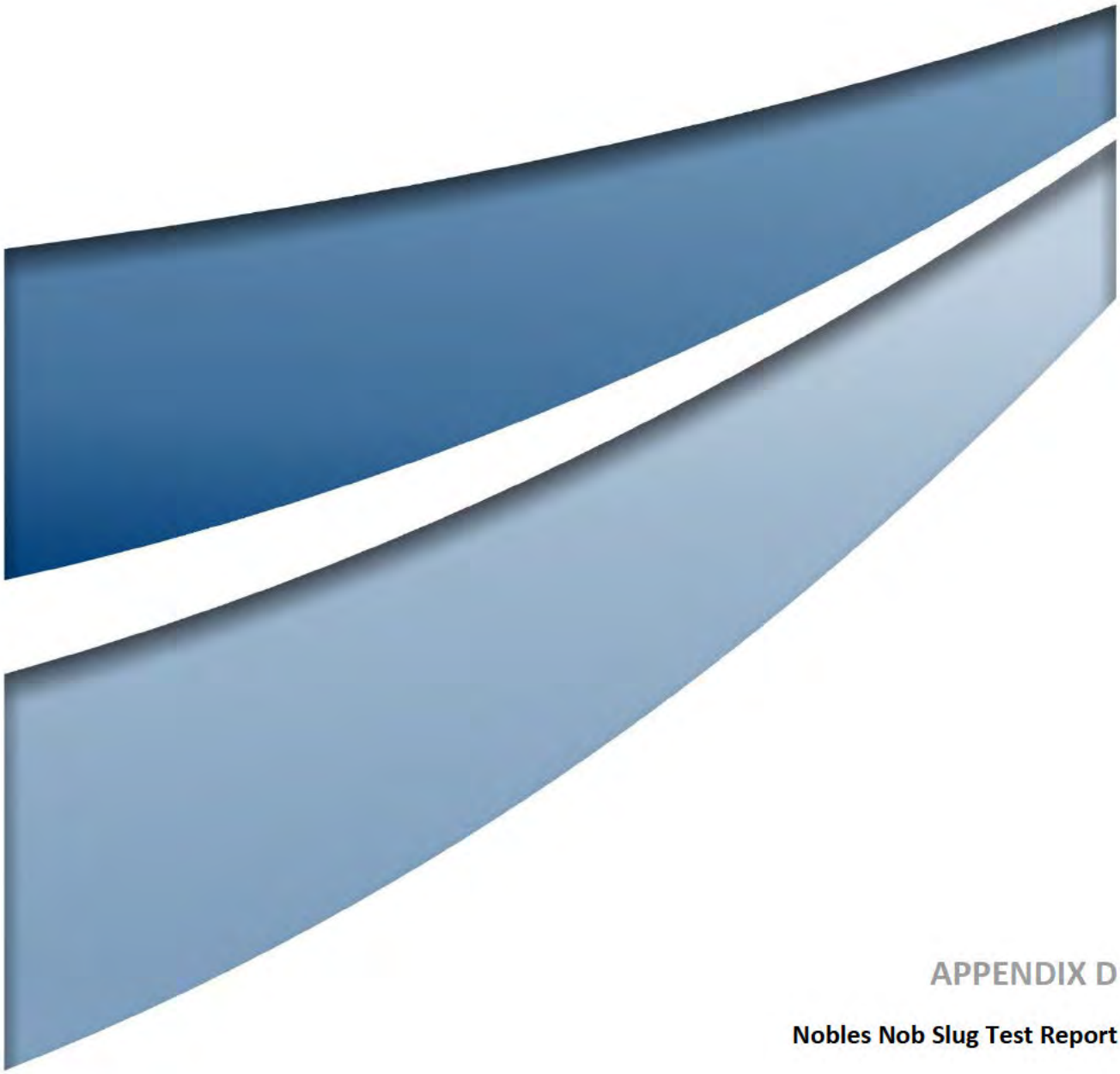
If reported, measurement uncertainty follow he ± sign after he analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.



APPENDIX D

Nobles Nob Slug Test Report

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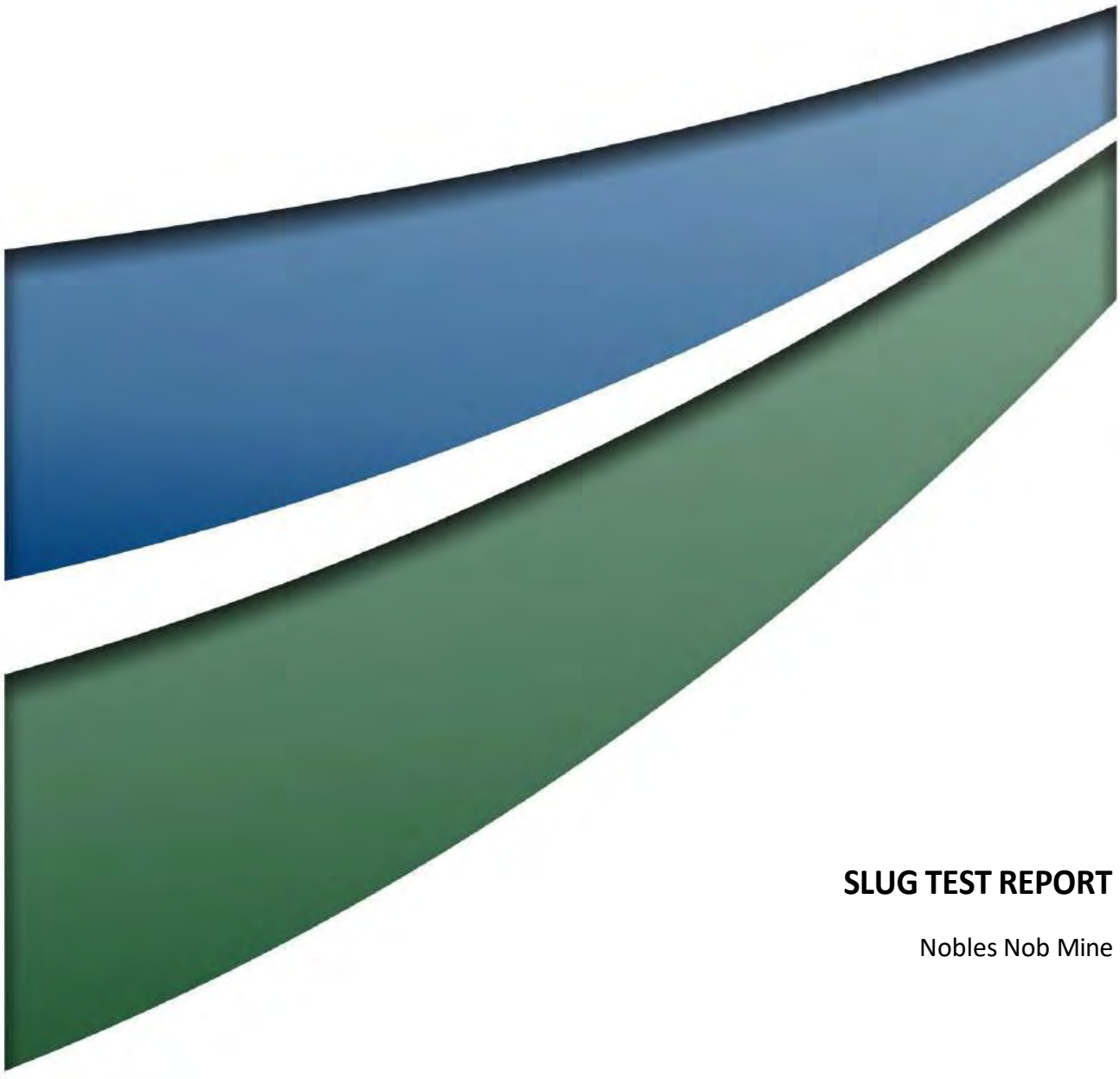

SLUG TEST REPORT

Nobles Nob Mine

FINAL

November 2021

SLUG TEST REPORT

Nobles Nob Mine

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tennant Consolidated Mining Group

Project Director: Claire Stephenson
Project Manager: Ashish Mishra
Technical Director: Craig Vincent
Technical Manager: Ashish Mishra
Report No. 21728 R03
Date: November 2021

umwelt
Environmental & Social Consultants

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	Craig Vincent	09-11-2021	Craig Vincent	09-11-2021

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Tables

Appendices

1.0 Introduction

Tennant Mining Consolidated Group (TCMG) own and operate the Nobles Nob Project (Nobles Nob) in the Northern Territory, Australia. Umwelt Australia Pty Ltd (Umwelt) was engaged by TCMG to estimate the hydraulic properties at ten groundwater monitoring locations by undertaking slug tests.

1.1 Bores Details

Slug tests were undertaken between 13 October 2021 and 17 October 2021. The details of the groundwater monitoring bores at Nobles Nob are presented in **Table 1.1**.

Table 1.1 Location and Details of Groundwater Bores at Nobles Nob

Bore _ID	Easting*	Northing*	Depth of hole (mbgl**)	Screen		Gravel		Water Level (mbtoc***)
				From	To	From	To	
NNMW001	425505	7819803	102	90	102	89	102	68.18
NNMW002	425488	7819596	77.9	65.9	77.9	65.9	77.9	68.99
NNMW004	425374.9	7820346	75	63	75	61	75	57
NNMW005	425228.6	7820086	70	58	70	56	70	59.8
NNMW007	424730.8	7819950	95.8	83.8	95.8	82.8	95.8	61.14
NNMW011	426621.8	7819922	66	54	66	52	66	59.71
NNMW012	427616.9	7819830	76.6	64.4	76.4	63.4	76.4	63.2
NNMW013	426527.3	7820174	78	66	78	64	78	70.06
NNMW014	426075.9	7820387	69.6	57.6	69.6	52	69.6	58.64
NNMW018	427151.5	7819926	78	66	78	65	78	55.17

*coordinates in WGS 84/UTM zone 53S.
** mbgl – metres below ground level
*** mbtoc – metres below top of casing

2.0 Methodology

2.1 Equipment

The following equipment was used to conduct the slug tests at Nobles Nob:

- Solinst Levelogger 5 Water Level Dataloggers suspended within the bore using wire rope.
- A field computer.
- Slugs (Waterra Well Slugs).
- Water level dipper.

2.2 Test Procedure

Slug tests are undertaken to estimate the hydraulic properties of water bearing horizons by inducing a rapid water level displacement (rise or fall) and measuring the subsequent water level response. A slug test can be performed by either causing a sudden rise of the water level by inserting a slug (known as a falling-head test) or a sudden fall of the water level by withdrawing the slug (known as a rising-head test). In all the groundwater bores at Nobles Nob, both falling-head tests and rising-head tests were performed by inserting a solid slug into the bore. Falling head tests in some bores were also undertaken by injecting a known volume of water into the bore. Water levels were measured at 1-second intervals using the water level datalogger.

2.2.1 Falling-Head Test

During falling-head tests, the water level datalogger was firstly lowered into the bore to record the pre-test water level. The water level dipper was also used to record the water level prior to lowering the slug into the bore. The slug was then rapidly lowered into the bore, causing a sudden rise in the water level. As the water level recovers, the datalogger measures the water level every second. When the water level falls back to the original level, the falling-head test is complete.

For bores with rapid recovery, the falling-head test was conducted by injecting potable water instead of using a solid slug to cause a sudden rise in the water level. An exact amount of water (20 L) was quickly poured into the bore to create a rise in water level. The datalogger measures the fall in water level, and when the water level returns to its original level, the test is completed.

2.2.2 Rising-Head Test

The rising-head test is similar to the falling-head test, but in this case, the slug is rapidly withdrawn from the bore, causing a sudden drop in the water level. As the water level recovers in the bore, the datalogger measures the water level every second. Once the water level returns to its original level, the datalogger is retrieved, and the data is checked and downloaded to the field computer.

2.3 Data Handling

Following the field program, the data from the datalogger was saved on a field computer, using the Solinst levelogger program (v 4.6.1). After each test, the saved datalogger files were exported to comma-separated (.csv) format.

2.4 Data Analyses

The computer program Aquifer Test (Version 10) was used for all the slug test analyses. The program allows for both automatic and manual fitting of a straight-line plot to the measured data. The program has the inbuilt function of using the Hvorslev method and the Bouwer & Rice method. Both these methods are designed to estimate the hydraulic conductivity of an aquifer. The methods assume a fully or partially penetrating bore in a confined or unconfined aquifer.

The program Aquifer Test (Version 10) recommends using Bouwer & Rice for unconfined or leaking confined aquifers and the Hvorslev method for confined aquifers. The analyses in this report have been undertaken using the Hvorslev method for confined conditions and the Bouwer & Rice method for unconfined conditions. Except for monitoring bore NNMW002 and NNMW011, which is screened across an unconfined aquifer, all monitoring bores are interpreted to be screened across confined aquifers and were analysed using the Bouwer & Rice method.

3.0 Results

3.1 Hydraulic Testing

The results of the slug tests are summarised in **Table 3.1** below. The average hydraulic conductivity derived from the rising-head and falling-head tests for each bore is presented in **Table 3.1.** The recovery of water levels in some bores due to the displacement caused by the slug was very quick, and hence, 20 L of tap water was injected into those bores. These includes bore NNMW005, NNMW11, and NNMW18. The hydraulic conductivity results from the slug test at bore NNMW018 were slightly unreliable since the water level recovered quickly and had a lot of noise. Hence the falling-head test data from injecting 20L of water was used in the analysis.

The values of hydraulic conductivity range from 0.0105 m/day at bore NNMW002 to 0.681 m/day at Bore NNMW018 (**Table 3.1**). Bores NNMW011 and NNMW012, located towards the east of the Nobles Nob Pit, recorded hydraulic conductivity values of 0.387 m/day and 0.355 m/day, respectively. This range is consistent with anecdotal evidence that historically, the water supply bore field for Nobles Nob was located in the same area.

Aquifer transmissivity was calculated by multiplying the hydraulic conductivity by the aquifer thickness. The aquifer thickness refers to the distance between groundwater level and bedrock in the unconfined case, and the distance between the bottom of the clay layer and bedrock in the confined case. The complete test analysis results are also presented in **Appendix A.**

Table 3.1 Results of the Hydraulic Testing

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW001	0.0162	Hvorslev	12	0.194
NNMW002	0.0105	Bouwer & Rice	12	0.126
NNMW004	0.321	Hvorslev	12	3.852
NNMW005	0.559	Hvorslev	12	6.708
NNMW007	0.0591	Hvorslev	12	0.709
NNMW011	0.387	Bouwer & Rice	12	4.644
NNMW012	0.355	Hvorslev	12	4.260
NNMW013	0.411	Hvorslev	12	4.932
NNMW014	0.11	Hvorslev	12	1.320
NNMW018	0.681	Hvorslev	12	8.172

4.0 Summary and Conclusion

The aquifer properties were evaluated according to the Hvorslev and the Bouwer & Rice methods. The computer program Aquifer Test (Version 10) was used for the analyses.

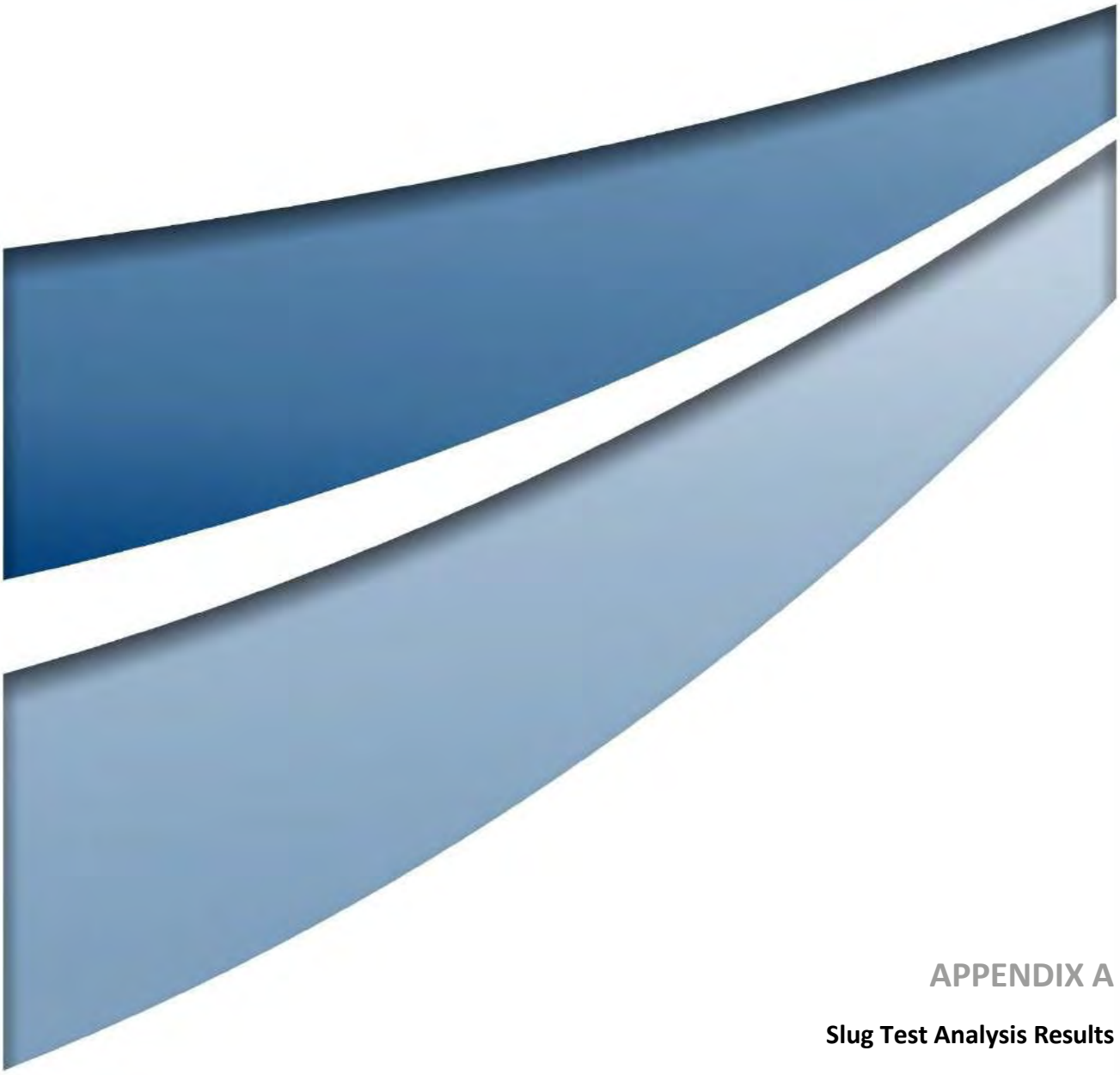
The lowest hydraulic conductivity was observed at bores NNMW001 and NNMW002, located south (south-east) of the Nobles Nob pit. The values ranged from 0.0105 m/day at bore NNMW002 to 0.604 m/day at Bore NNMW018.

5.0 References

Bouwer, H. and Rice, R.C. (1976), "A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells", Water Resources Research, Vol. 12, No. 3, pp. 423-428.

Hvorslev M.J., (1951), *"Time Lag and Soil Permeability in Ground Water Observations"*, U.S. Army Corps of Engineers Waterway Experimentation Station, Bulletin 36.

Röhrich T., Waterloo Hydrogeologic Inc, (2002). Aquifer Test v3.5. User's Manual- Advanced Pumping Test & Slug Test Analysis Software.

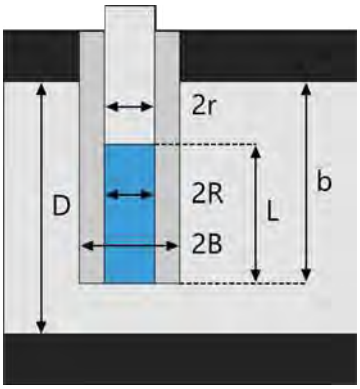


APPENDIX A

Slug Test Analysis Results

	Wells A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

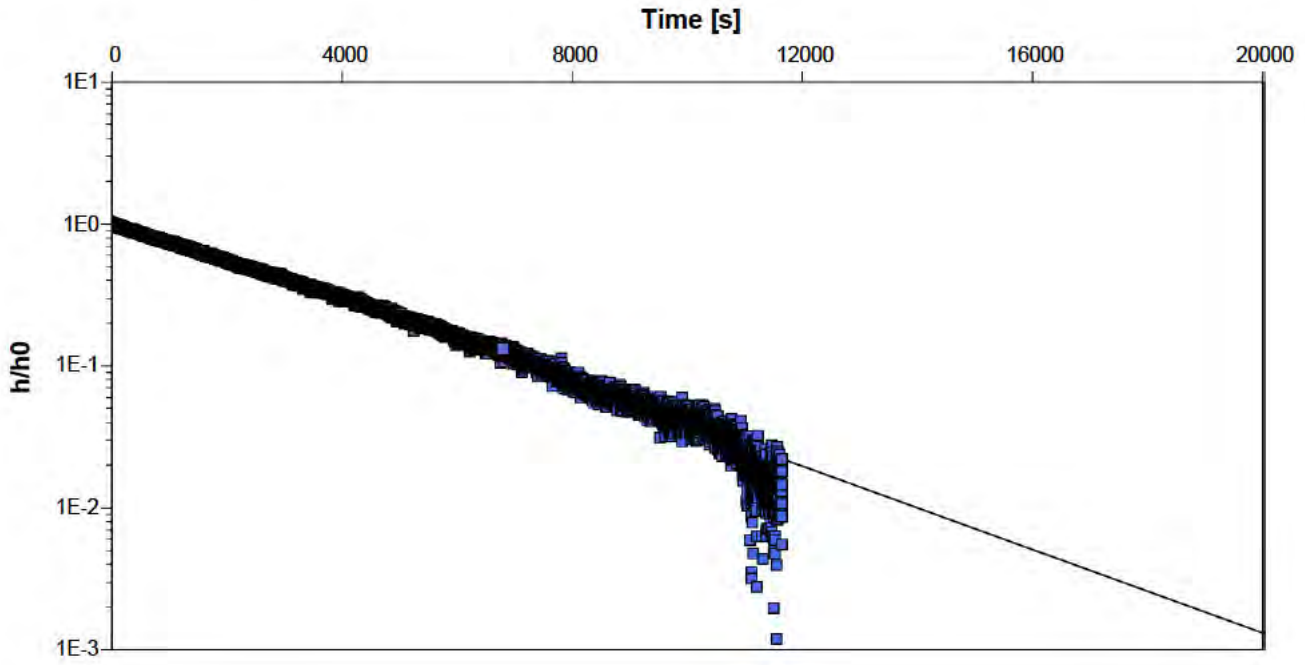
Location: Tennant Creek, NT



	Name	X [m]	Y [m]	Elevation (amsl)	Benchmark [m]	Penetration	L [m]	B [m]
1	NNMW001	425505.04	7819803.37	356.39		Fully	12	0.11
2	NNMW002	425488	7819596.41	363.21		Fully	12	0.11
3	NNMW004	425374.93	7820346.45	351.18		Fully	12	0.11
4	NNMW005	425228.61	7820085.77	353.47		Fully	12	0.11
5	NNMW007	424730.83	7819950.05	354.03		Fully	12	0.11
6	NNMW011	426621.8	7819921.77	355.32		Fully	12	0.11
7	NNMW012	427616.88	7819829.56	358.53		Fully	12	0.11
8	NNMW013	426527.28	7820174.17	365.51		Fully	12	0.11
9	NNMW014	426075.85	7820387.3	353.63		Fully	12	0.11
10	NNMW018	427151.54	7819925.64	350.67		Fully	12	0.11

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW001-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW001	1.71×10^{-2}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

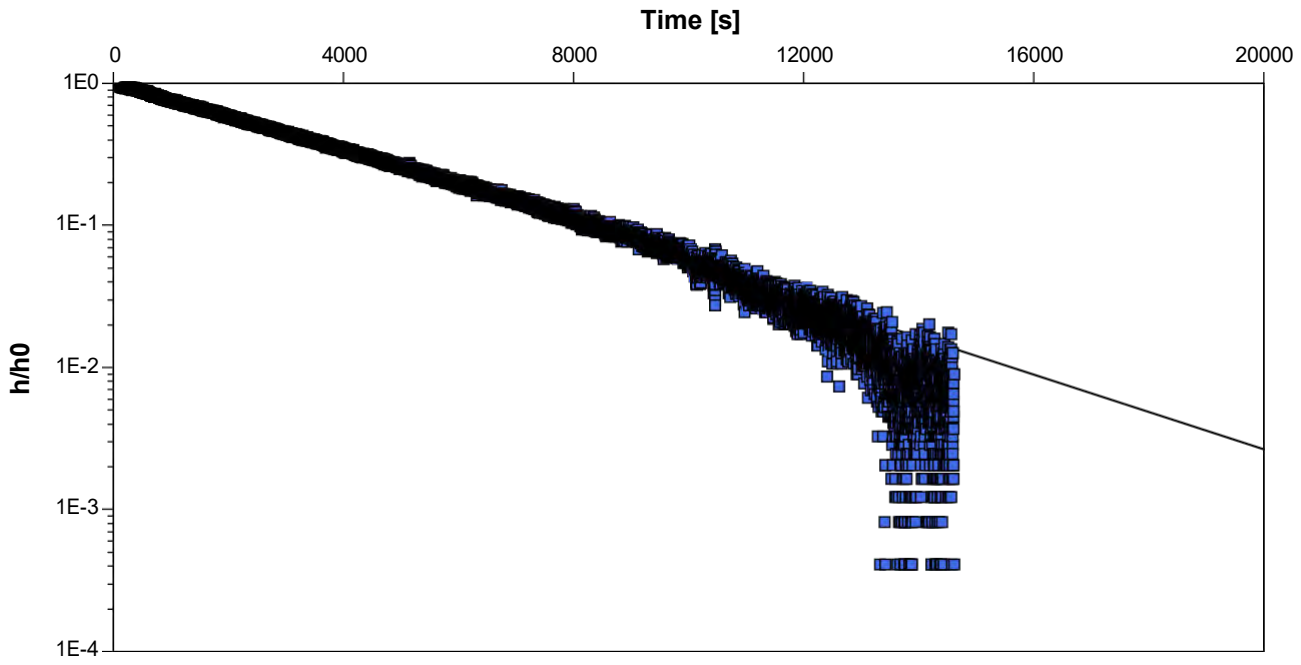
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW001-FH	AM	8/11/2021	Hvorslev	NNMW001		1.71×10^{-2}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW001-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW001	1.53×10^{-2}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

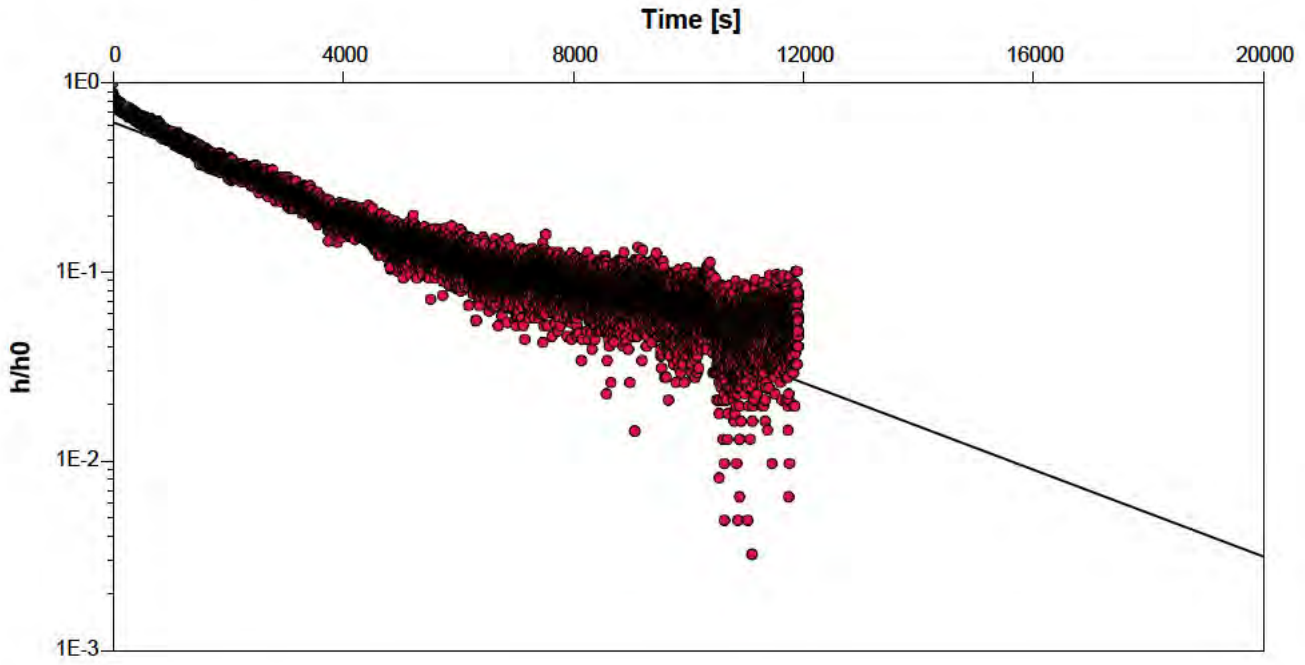
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW001-RH	AM	8/11/2021	Hvorslev	NNMW001		1.53×10^{-2}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW002-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW002	1.05×10^{-2}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

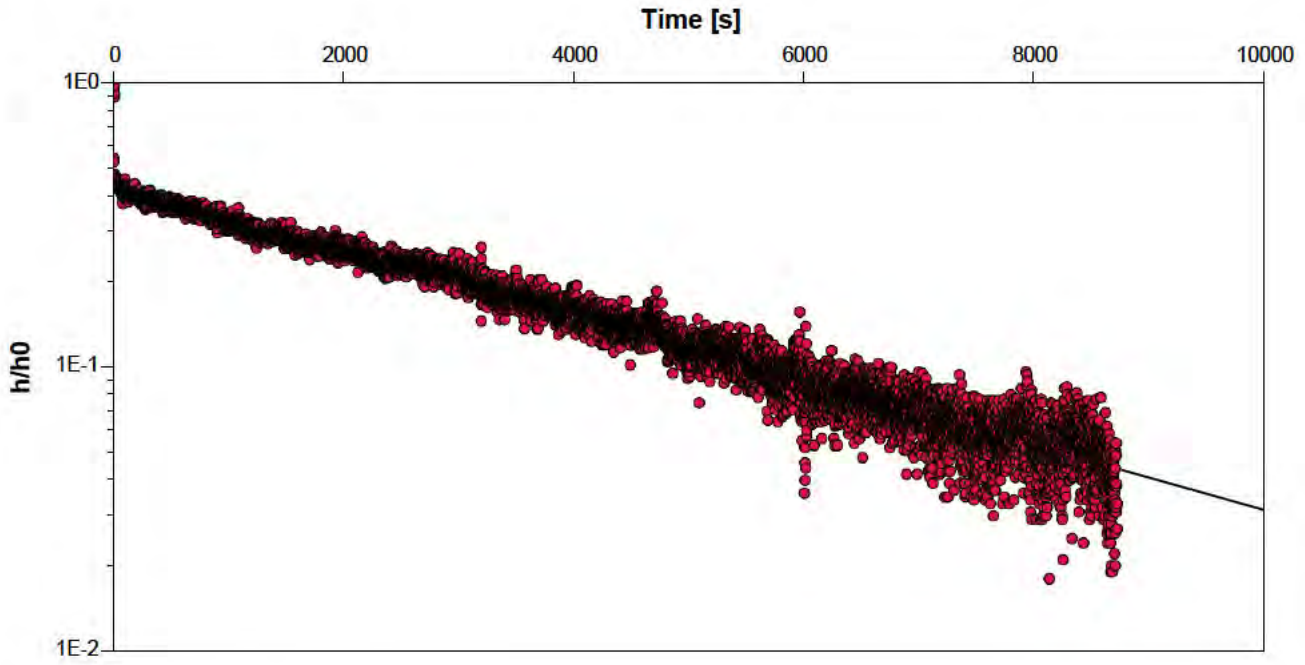
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW002-FH	AM	8/11/2021	Bouwer & Rice	NNMW002		1.05×10^{-2}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW002-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW002	1.04×10^{-2}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

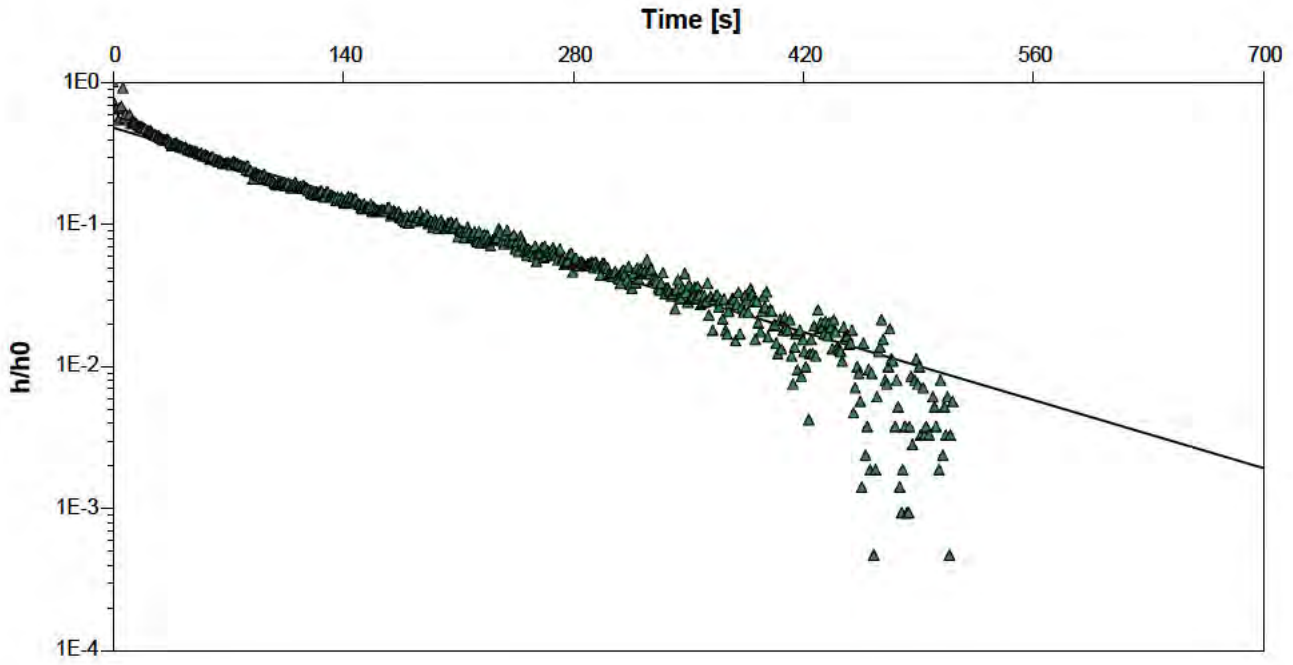
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW002-RH	AM	8/11/2021	Bouwer & Rice	NNMW002		1.04×10^{-2}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW004-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW004	3.99×10^{-1}	

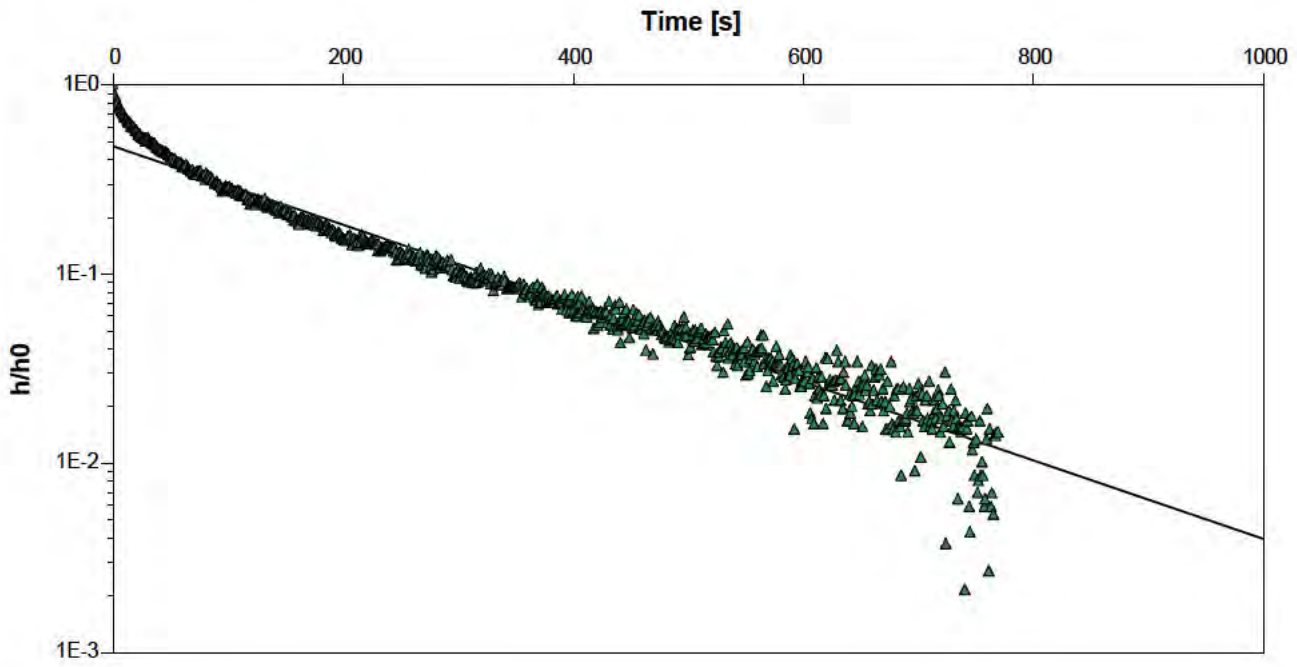
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW004-FH	AM	8/11/2021	Hvorslev	NNMW004		3.99×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW004-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW004	2.42×10^{-1}	

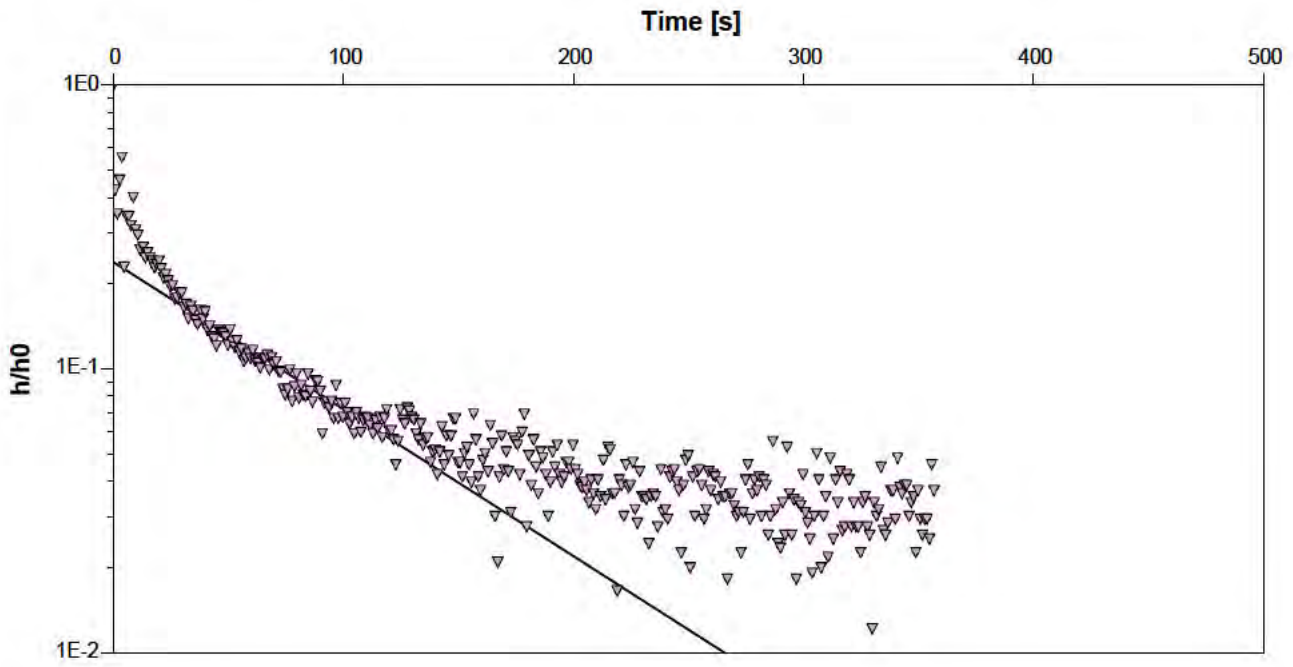
	Slug Test - Analyses Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW004-RH	AM	8/11/2021	Hvorslev	NNMW004		2.42×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW005-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW005	6.03×10^{-1}	

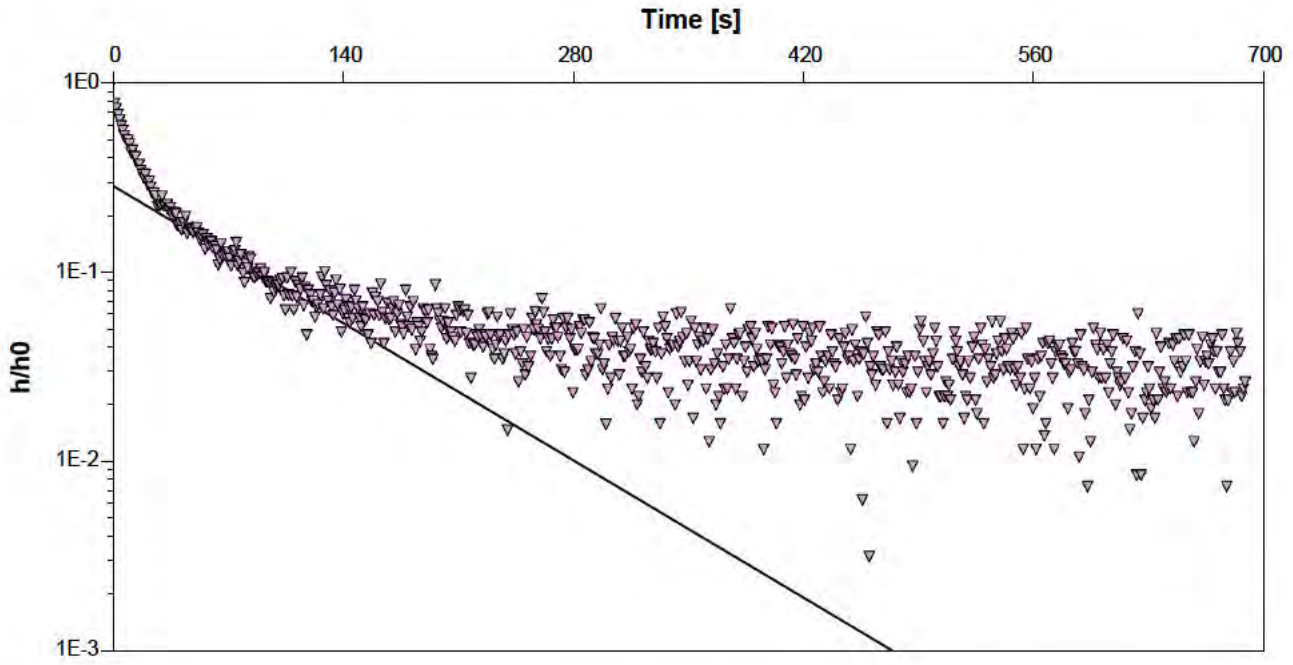
	Slug Test - Analyses Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW005-FH	AM	8/11/2021	Hvorslev	NNMW005		6.03×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW005-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW005	6.03×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

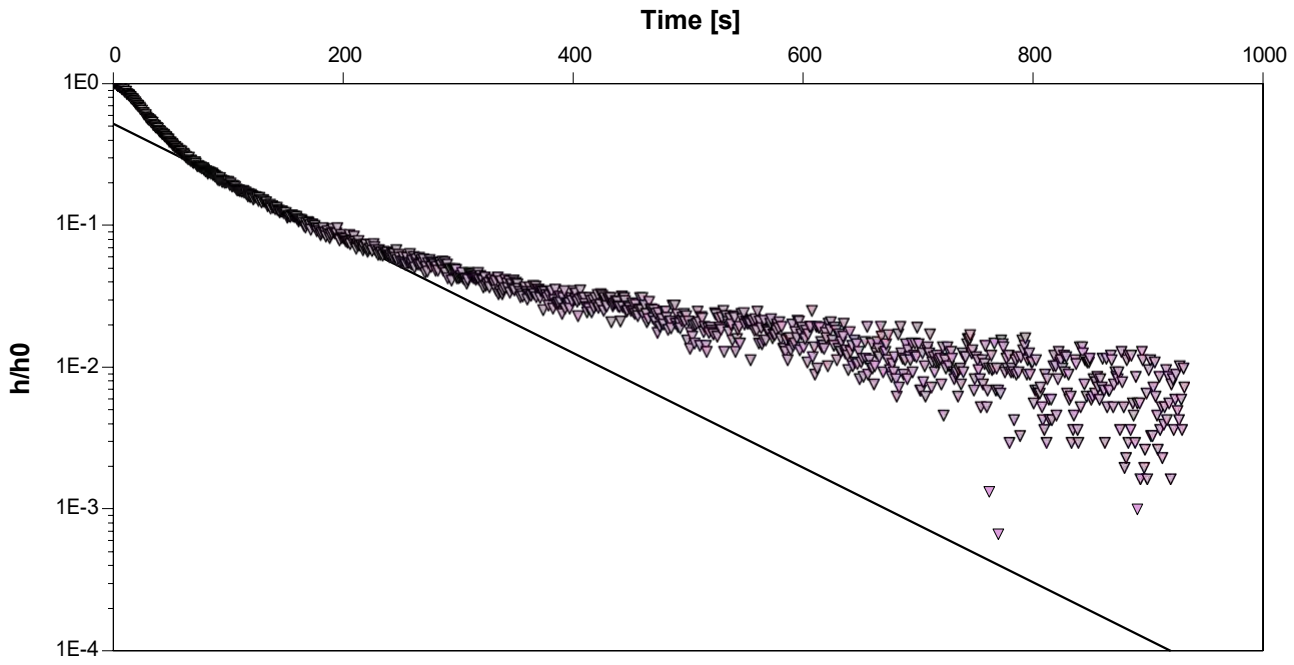
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW005-RH	AM	8/11/2021	Hvorslev	NNMW005		6.03×10^{-1}	

	Slug Test Analysis Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW005-WInj	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW005	4.70×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

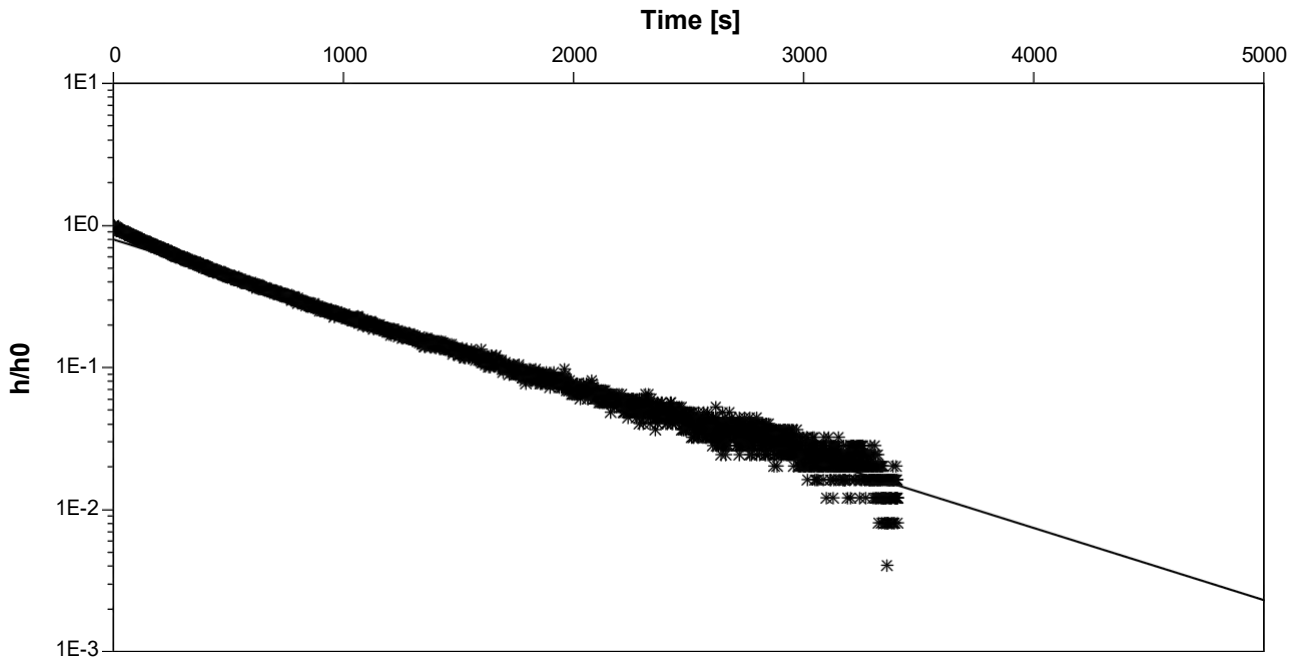
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW005-WInj	AM	8/11/2021	Hvorslev	NNMW005		4.70×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW007-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW007	5.90×10^{-2}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

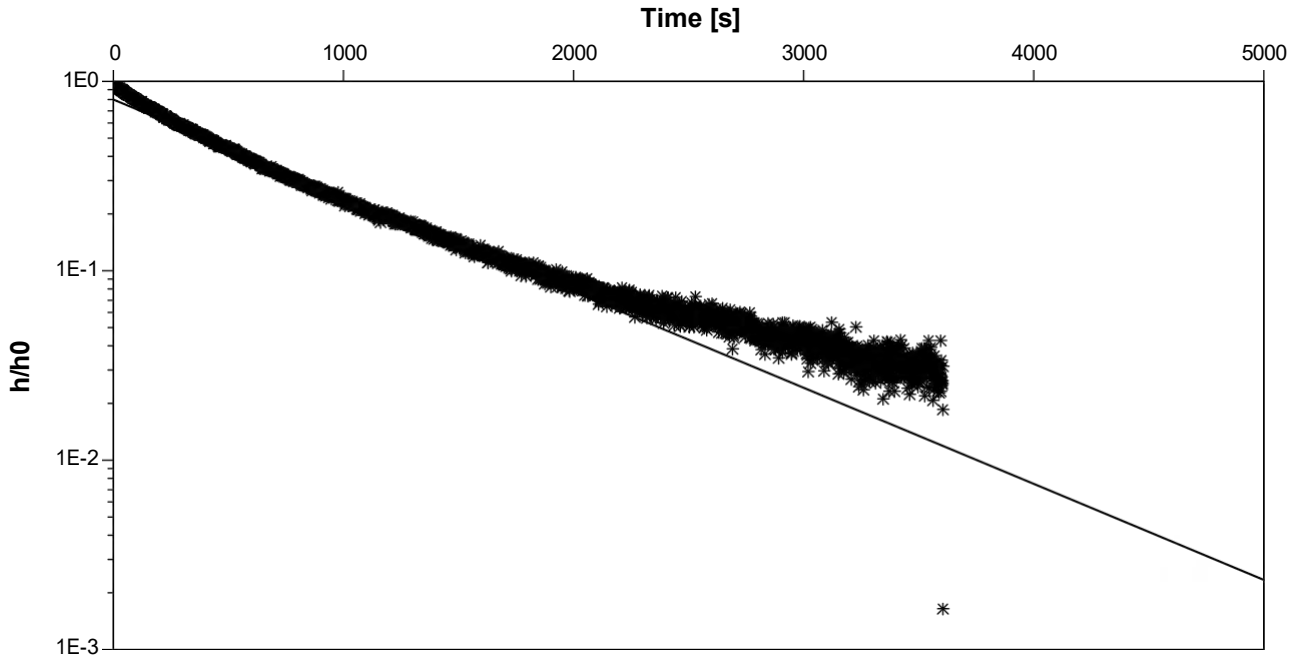
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW007-FH	AM	8/11/2021	Hvorslev	NNMW007		5.90×10^{-2}	

	Slug Test Analysis Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW007-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW007	5.91×10^{-2}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

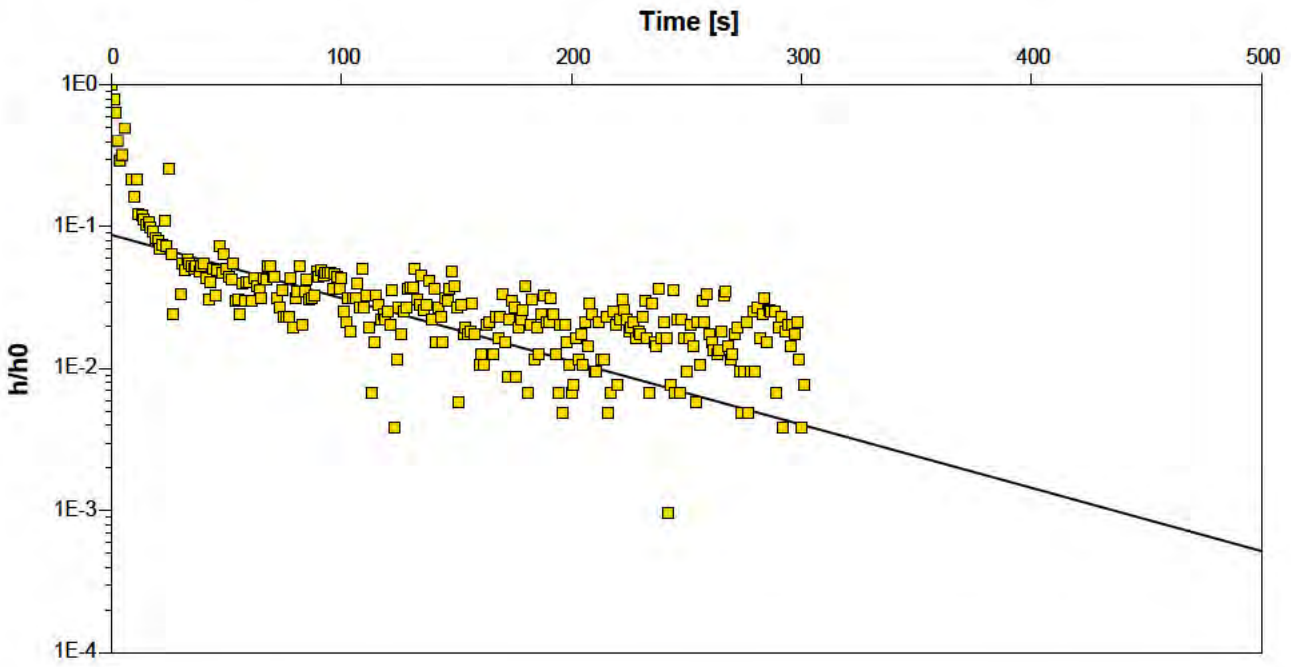
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW007-RH	AM	8/11/2021	Hvorslev	NNMW007		5.91×10^{-2}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW011-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW011	4.07×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

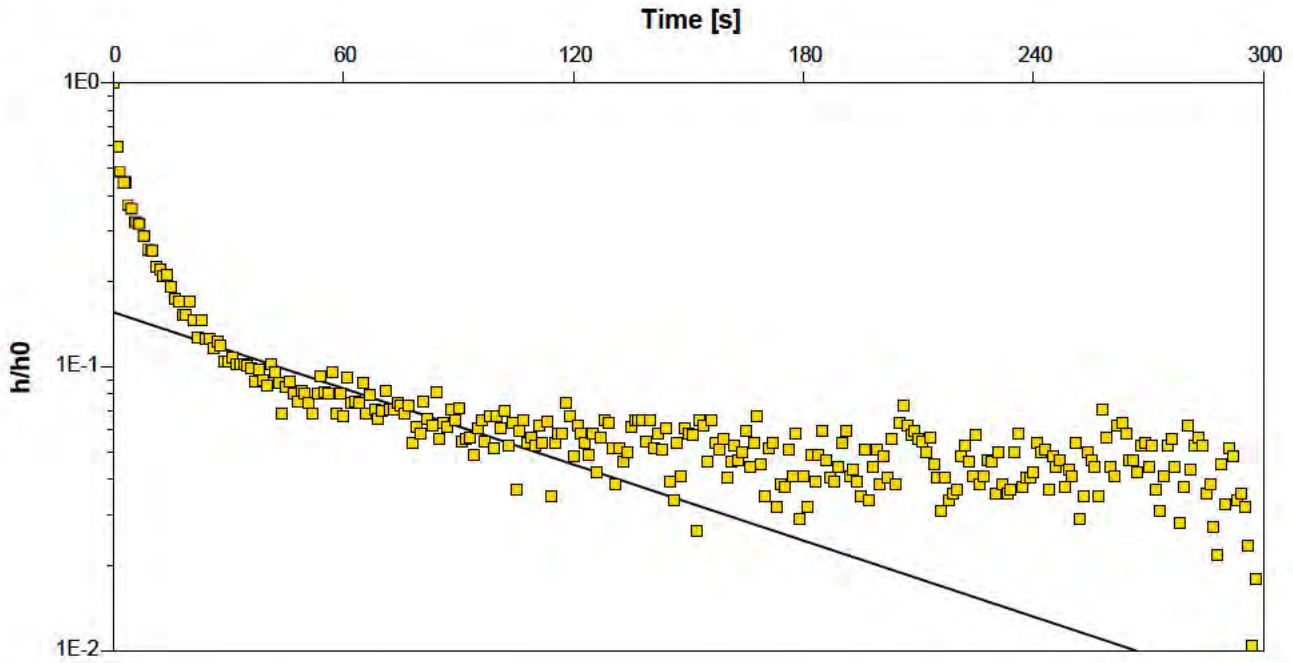
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW011-FH	AM	8/11/2021	Bouwer & Rice	NNMW011		4.07×10^{-1}	

	Slug Test Analysis Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW011-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW011	4.08×10^{-1}	

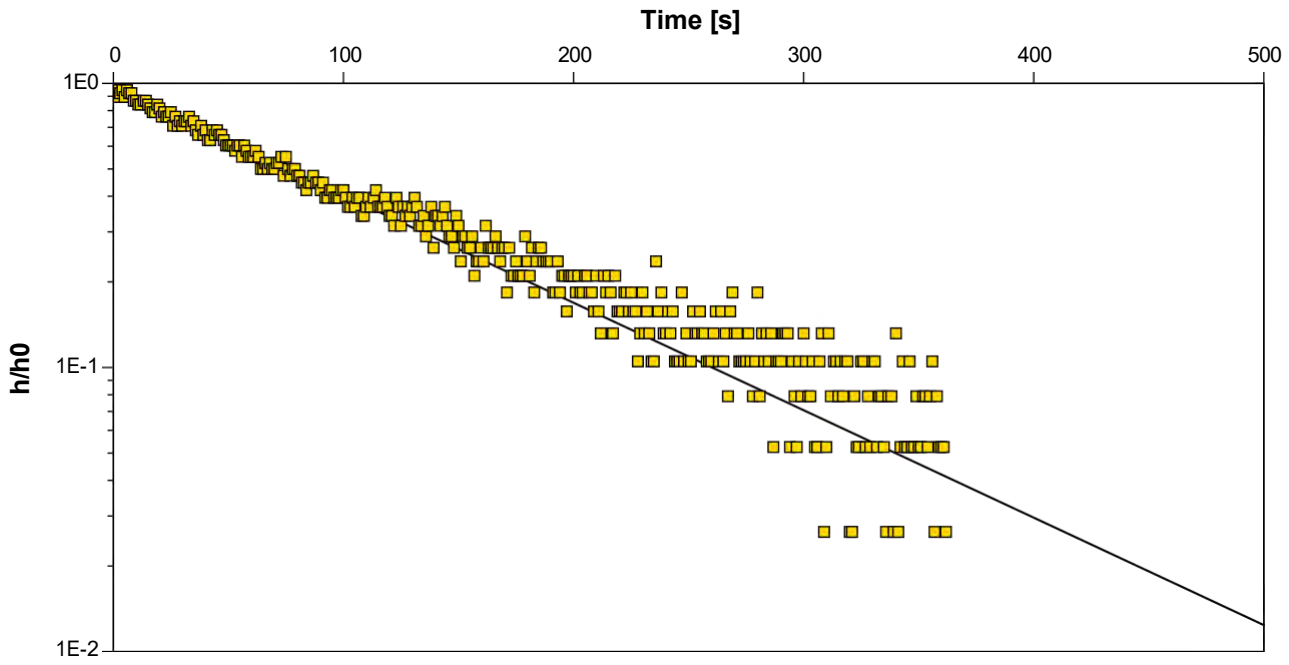
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW011-RH	AM	8/11/2021	Bouwer & Rice	NNMW011		4.08×10^{-1}	

	Slug Test Analysis Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW011-WInj	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW011	3.45×10^{-1}	

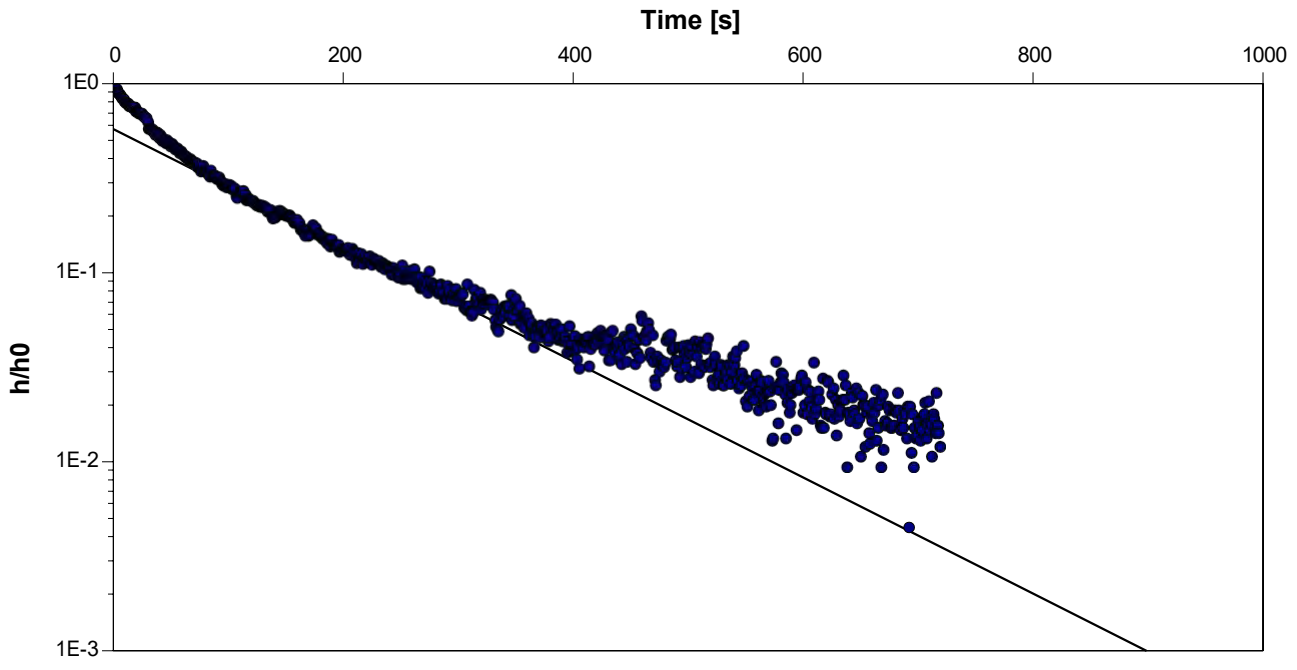
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW011-WInj	AM	8/11/2021	Bouwer & Rice	NNMW011		3.45×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW012-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW012	3.57×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

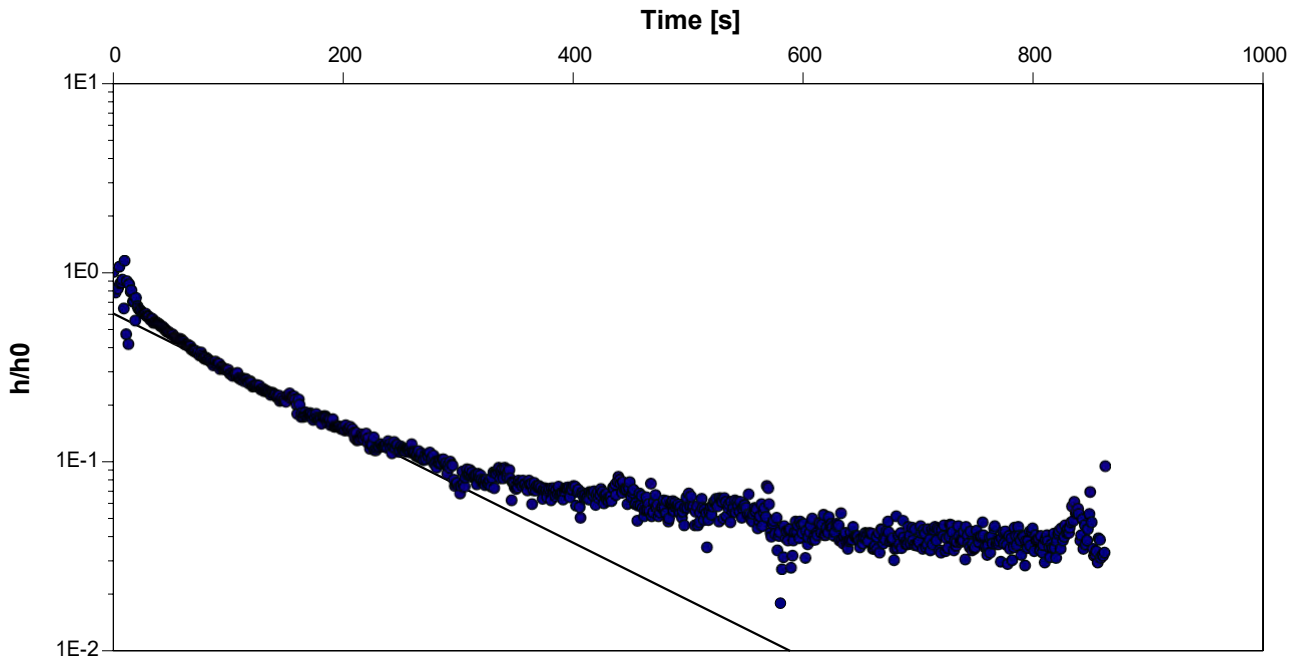
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW012-RH	AM	8/11/2021	Hvorslev	NNMW012		3.57×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW012-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW012	3.53×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

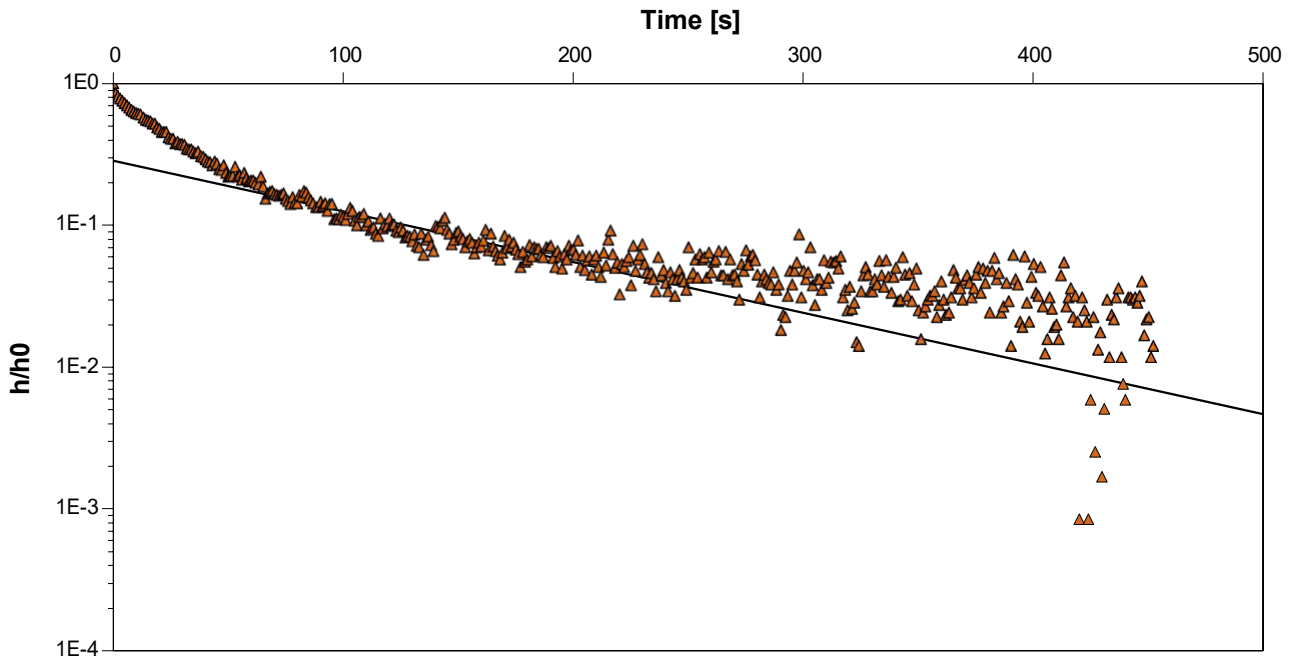
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW012-FH	AM	8/11/2021	Hvorslev	NNMW012		3.53×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW013-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW013	4.15×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

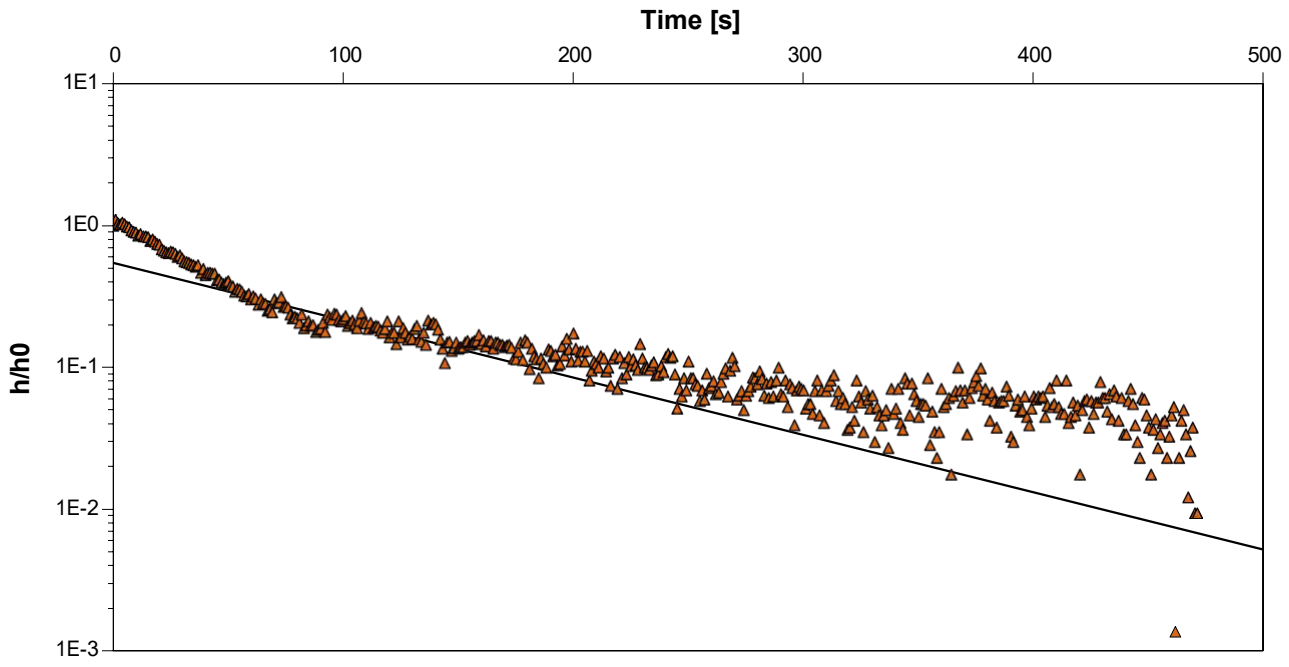
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW013-RH	AM	8/11/2021	Hvorslev	NNMW013		4.15×10^{-1}	

	Slug Test Analysis Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW013-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW013	4.70×10^{-1}	

Slug Test - Analyses Report A

Project: Nobles Nob Slug Test

Number: 21728-3

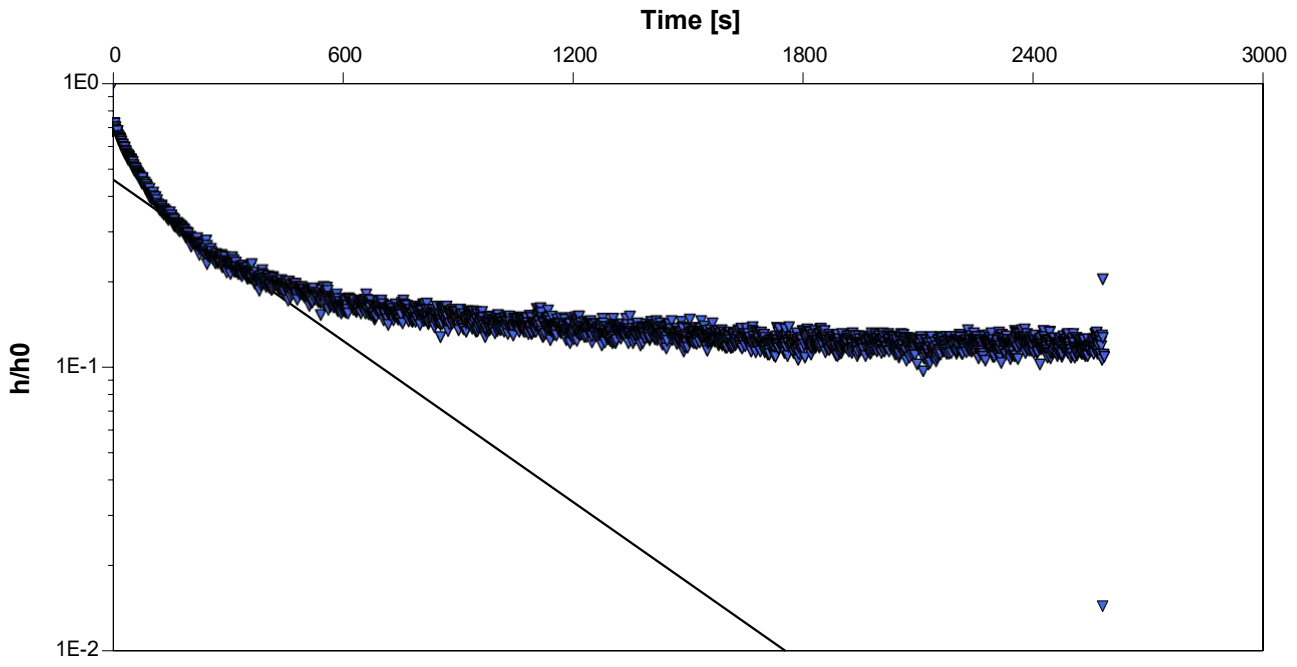
Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW013-FH	AM	8/11/2021	Hvorslev	NNMW013		4.70×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW014-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW014	1.10×10^{-1}	

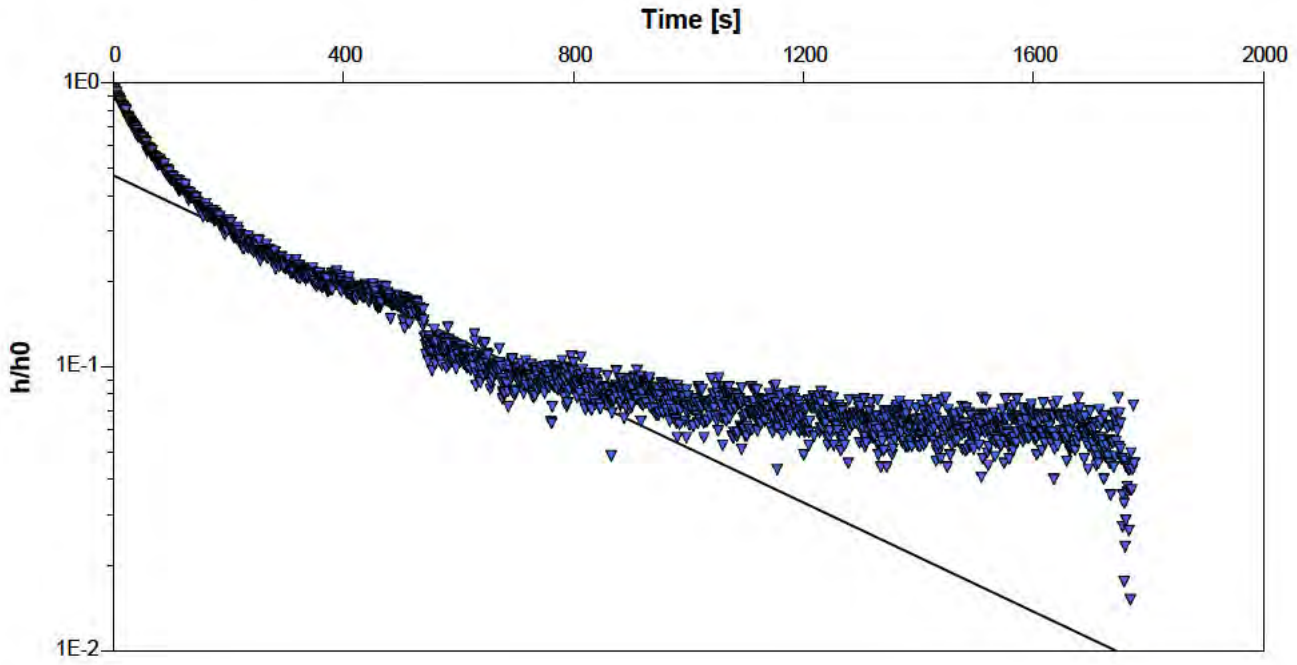
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW014-FH	AM	8/11/2021	Hvorslev	NNMW014		1.10×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW014-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW014	1.12×10^{-1}	

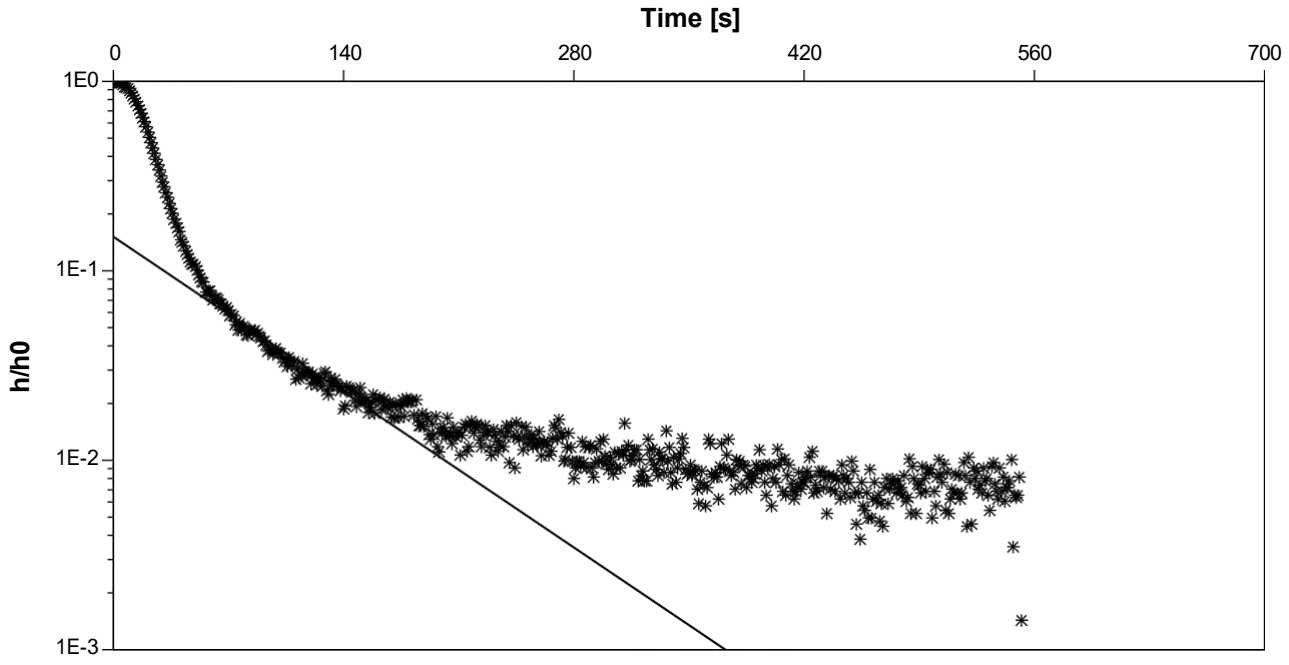
	Slug Test - Analyses Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW014-RH	AM	8/11/2021	Hvorslev	NNMW014		1.12×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW018
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW018-Winj	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW018	6.81×10^{-1}	

	Slug Test - Analyses Report	A
	Project: Nobles Nob Slug Test	
	Number: 21728-3	
	Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW018
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW018-Winj	AM	8/11/2021	Hvorslev	NNMW018		6.81×10^{-1}	

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APPENDIX D ATC WILLIAMS - GEOTUBES PLATFORM CONCEPT DESIGN

REPORT

TENNANT CONSOLIDATED MINING GROUP PTY LTD
ABN: 72 645 263 547

Nobles Nob
Geotubes Platform Concept Design

121089-01R001Rev0
February 2022

TAILINGS.WATER.WASTE.

Document Control

Project Name:	Nobles Nob
Document Title:	Geotubes Platform Concept Design
File Location:	\\atcscmvpfps01\Synergy\Projects\121\121089 Nobles Nob\01 Water Mgmt Assess & Deposition Modelling\Documents\R01\Text
Document Number:	121089-01R001rev0-ConceptDesign.docx

Revision History

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B	Draft Issue	18/02/2022	MJ	MG
0	Final Issue	21/02/2022	MJ	MG

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1 INTRODUCTION

1.1 Background

Gold was first produced at the Nobles Nob mine site through underground operations from 1933 until 1967 when the crown pillar collapsed. In this time the underground production totalled approximately 828 koz of gold from 528 kt of ore. Nobles Nob was then mined from an open Pit between 1969 to 1985 which approximately produced 218 koz of gold from 1.46 Mt of ore.

Tennant Consolidated Mining Group Pty Ltd (TCMG) have control of the Nobles Nob project among other mine titles in the Tennant Creek area and are planning 7 to 10 years of gold production. TCMG have estimated that there is 50,000 oz of gold below the existing Nobles Nob Pit floor and 80,000 oz of gold in the existing waste dumps and tailings.

1.2 Proposed Operations

The proposed initial stage of works is a planned 18-month timeframe involving processing the existing Mineralised Waste Dump material from historic extraction of the Noble Nob pit. This involves the establishment of an on-site processing plant and construction of a platform that will be used to stack Geotube dewatering tubes to store tailings. The processing plant includes on-site crushing and milling infrastructure and a Carbon in Leach (CIL) circuit where cyanide is added as part of the processing. The processing plant outputs a tailings slurry that is pumped to the Geotubes and dewatered.

The Geotubes are filled one tube at a time (via a pump) with the slurry tailings mixture from the processing plant where the slurry is dewatered through the geotextile lining of the Geotubes. The Geotubes dewatering process requires a polymer to be dosed to the tailings slurry to encourage flocculation of solids. The flocculation of solids allows maximum water expression, leaving a dry solid in the Geotubes. It is assumed the effluent from the Geotubes would be contaminated with cyanide and possibly other contaminates. The platform is therefore proposed to be lined with a Geomembrane liner and the effluent is proposed to be collected in a sump at the low point of the platform. The sump water is then pumped to the process pond before being re-used in the processing operations. It is proposed to stage the Geotubes platform construction into two main areas to reduce the initial extent of works.

The processing plant is proposed with a throughput of 0.7 million tonnes per annum using equipment relocated from the Great Australian Mine (GAM) **[7]**. The processing plant requires an external water supply, sourced from the Juno mine (approximately 4 km NW of Nobles Nob). This water is collected in a raw water pond for storage before being used in the processing operations.

The key equipment and infrastructure proposed as part of these operations are as follows:

- Geotubes and platform;
- Process Plant:
  - Primary Jaw crusher;
  - Secondary and Tertiary Cone Crushing;
  - Fine ore stockpile;
  - Reclaim Ore Feed bin;
  - Primary Ball Mill and Regrind ball mill;
  - Cyclone classification;
  - Gravity Circuit;
  - Leach and adsorption circuit totalling 24hrs residence time;
  - Zadra elution circuit and carbon regeneration;

  - Services and reagents
- Process Pond;
- Raw Water Pond;
- Clean Water and Dirty Water Drains;
- General infrastructure laydown areas.

1.3 Scope of Works

The proposed operations require a Mining Management Plan (MMP) to be approved under the NT Mining Management Act 2005. To support the MMP (by others), ATC Willilams (ATCW) have been engaged to provide a Concept Design Report for the initial eighteen (18) months of operations. This initial phase is referred to as Phase 1 of the project throughout this report. This report outlines the outcomes from the concept design of the Geotubes platform for Phase 1.

This report should be read in conjunction with ATCW's Water Management Report **[2]**.

1.4 Legal and Regulatory Requirements

The mine is currently operated under a **Mining Management Plan for the Tennant Creek Project – Nobles Nob and Juno [17],** approved under DPIR Authorisation Number 0925 (with the last amendment on 11/10/2018). Legislation and regulatory requirements applicable to the site and operations due to the environmental risks of mining activities. The following legal and regulatory guidelines have been used as a reference when developing this report:

- ANCOLD Guidelines on Consequence Categories of Dams (2012) **[3]**
- ANCOLD Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure (2019) **[4]**
- Waste Management and Pollution Control Act (NT) 1998 **[12]**
- The Water Act (NT) 1992 **[13]**
- Environmental Protection Act (NT) 2019 **[14]**
- Environment Protection and Biodiversity Conversation Act 1999 (EPBC Act) **[1]**

2 PROJECT SITE AND BACKGROUND INFORMATION

The Nobles Nob mine site is located approximately 13 km south-east of Tennant Creek in the Northern Territory (refer to **Diagram 1**). The site consists of the following significant features:

- Open Cut Pit;
- Existing Tailings Storage Facilities (TSFs);
- Mineralised Waste Dump;
- Associate mine infrastructure areas.

Refer to **Appendix A – Nobles Nob Site Features** that illustrates the general site features.

Nobles Nob forms part of the larger Tennant Creek Project that TCMG own, and includes several other sites in the local area. The following mine titles are applicable to Nobles Nob: MLC512-MLC517, MLC521, MLC525-MLC526, MLC537-MLC545, MLC548-MLC550, MLC556, MLC589-MLC590, MLC688-MLC691 (refer to **Diagram 2**).

DIAGRAM 1: SITE LOCATION

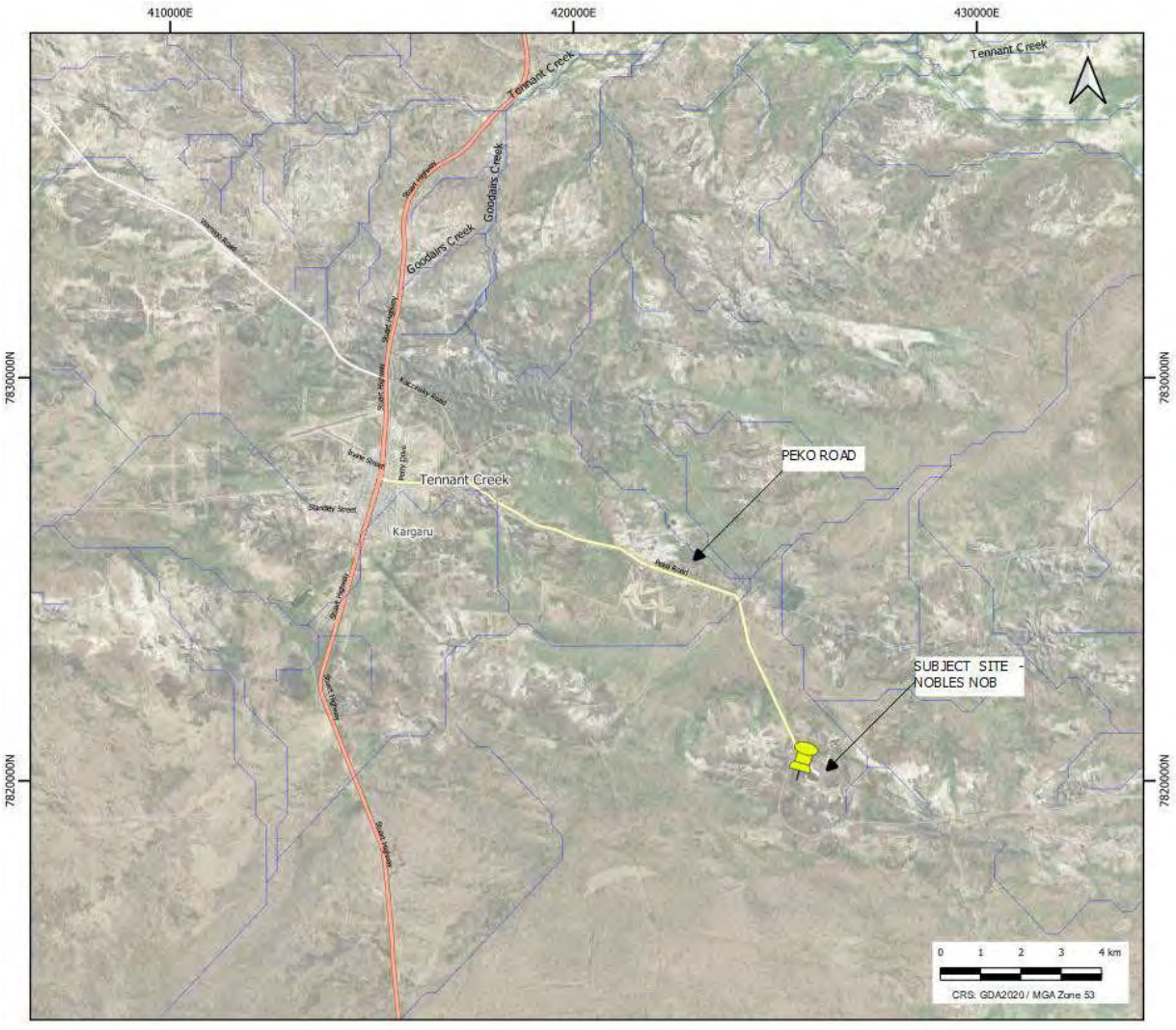
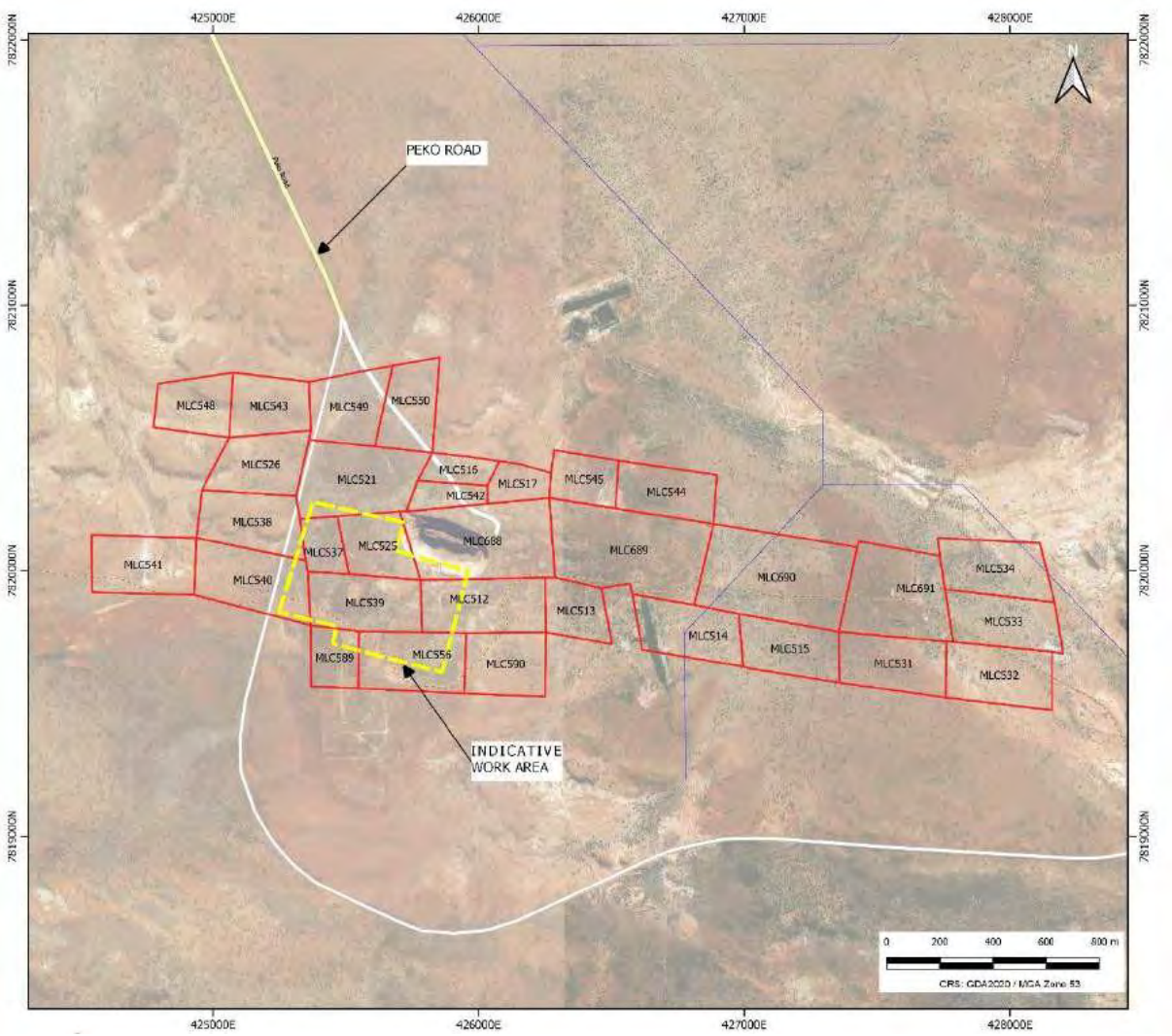


DIAGRAM 2: NOBLES NOB MINE TITLES

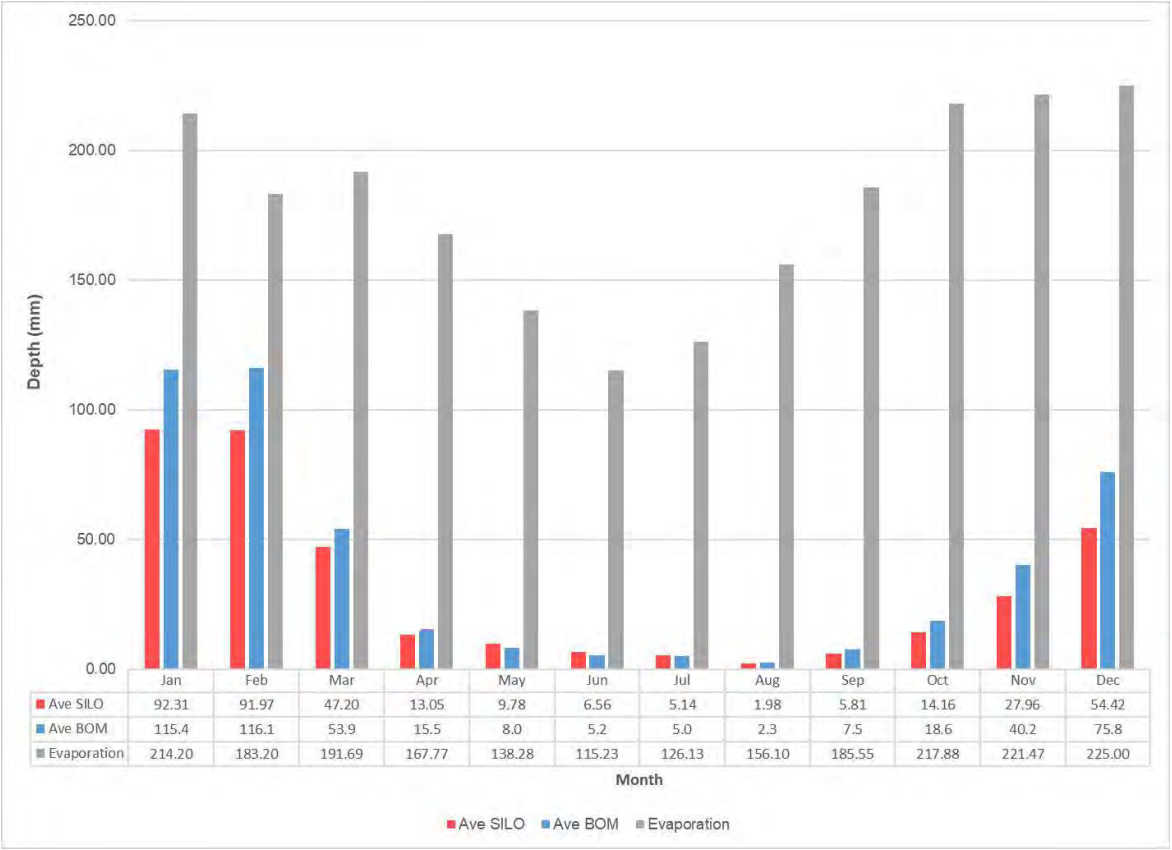


2.1 Climate

The Tennant Creek area is a subtropical climate with summers that are long, hot, and mostly cloudy and the winters are short, dry, windy, and mostly clear. The climate has defined wet season typically throughout the summer months (November to March). Monthly rainfall statistics were sourced from BOM's **[6]** available data at the Tennant Creek Airport station from 1970 to 2020. Point location SILO data **[16]** from 1889 to 2020 for rainfall and evaporation was also extracted for the site. **Graph 1** illustrates the BOM and SILO climate statistics.

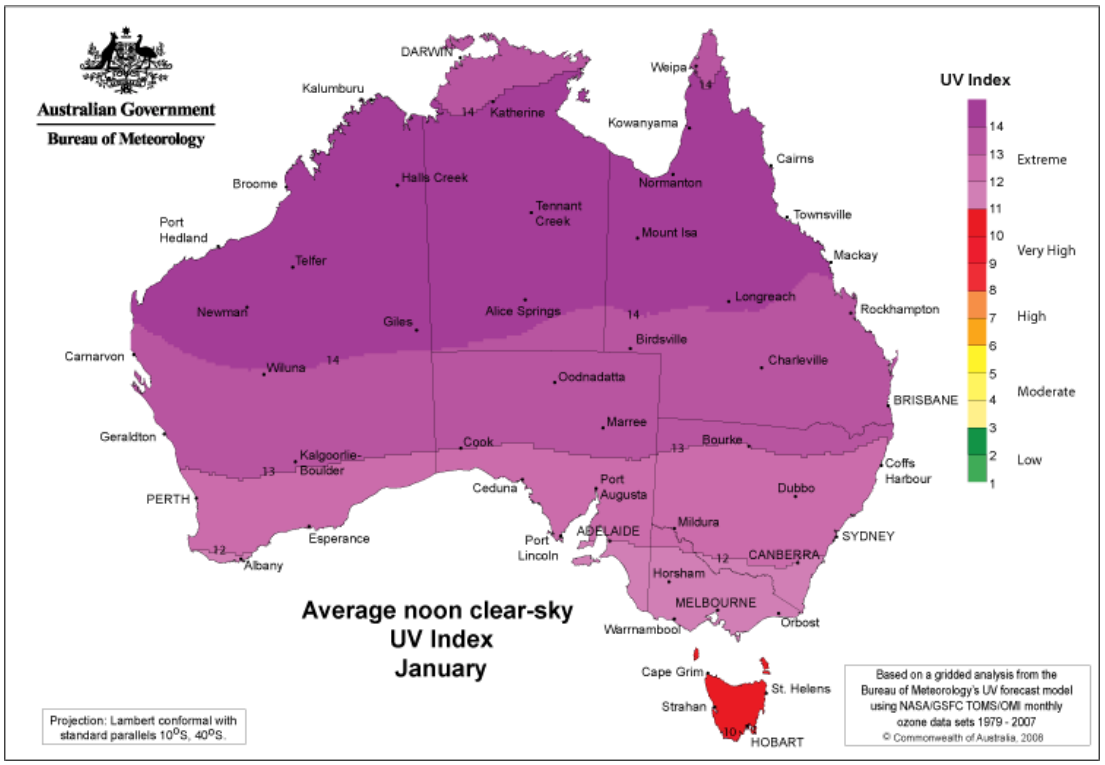
Climate and rainfall impacts are critical for the long-term performance of Geomembrane liners and geotextile Geotubes, as the values of retained strength for all geotextiles generally decreases with exposure time. According to a study regarding solar exposure and Geotextile mechanical properties **[5]**, the retained strength of Geotextiles can drop to 10 to 20% of the initial condition after an exposure time of 12 months. The anticipated exposure time should therefore be discussed with the supplier, to assess the expected damages to the tensile strength properties of the proposed Geotubes and liner proposed. A general UV index map is shown in **Diagram 3**, indicating that the site location is within an extreme UV range.

GRAPH 1: CLIMATE AVERAGES IN TENNANT CREEK



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave SILO	92.31	91.97	47.20	13.05	9.78	6.56	5.14	1.98	5.81	14.16	27.96	54.42
Ave BOM	115.4	116.1	53.9	15.5	8.0	5.2	5.0	2.3	7.5	18.6	40.2	75.8
Evaporation	214.20	183.20	191.69	167.77	138.28	115.23	126.13	156.10	185.55	217.88	221.47	225.00

DIAGRAM 3 – AUSTRALIAN UV INDEX RANGE



2.2 Site Observations

A site visit inspection was conducted from Monday, 11 October 2021 to Tuesday, 12 October 2021 by a Principal Engineer from ATC Williams. Observations from the site visit include the following:

- The site is located in a very large, flat, natural basin and has been used for mining activity previously.
- Some remnants of the old mining activities exist on the site such as waste rock dumps, tailings storage facility and open-pit.
- The terrain has some undulating hills, and the drainage pathways tend to run in a direction to the open pit, which stores excess rainfall.
- Slight erosion was observed, which is expected due to the flatness of the landscape, extreme variations of temperature, wind, and rainfall over time.
- Some gully formation was witnessed on the tailings surface due to runoff and potential seepage expression.

Geotechnically, features of the slopes looks stable for the pit, waste rock dumps and tailings. There was no evidence of historical failures at the time of the site visit. Seepage and associated salt crusting was observed at the toe of the tailings storage facility.

Photo 1 to **Photo 6** illustrate general site photographs of the Nobles Nob site.

PHOTO 1: NATURAL TERRAIN FROM OBSERVATION POST LOCATED NORTHEAST OF THE OPEN-PIT

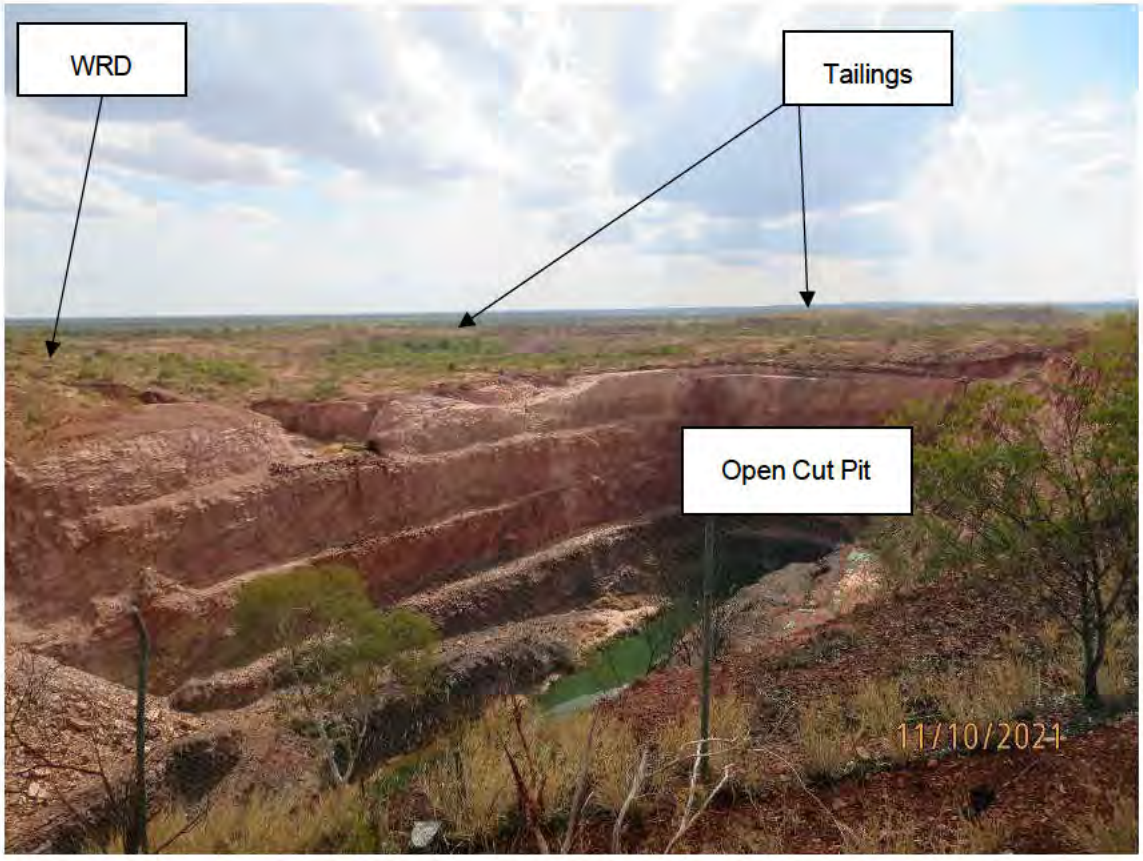


PHOTO 2: REMNANTS OF THE OLD PROCESSING PLANT

PHOTO 3: NATURAL DRAINAGE TYPICALLY RUNNING INTO OPEN PIT

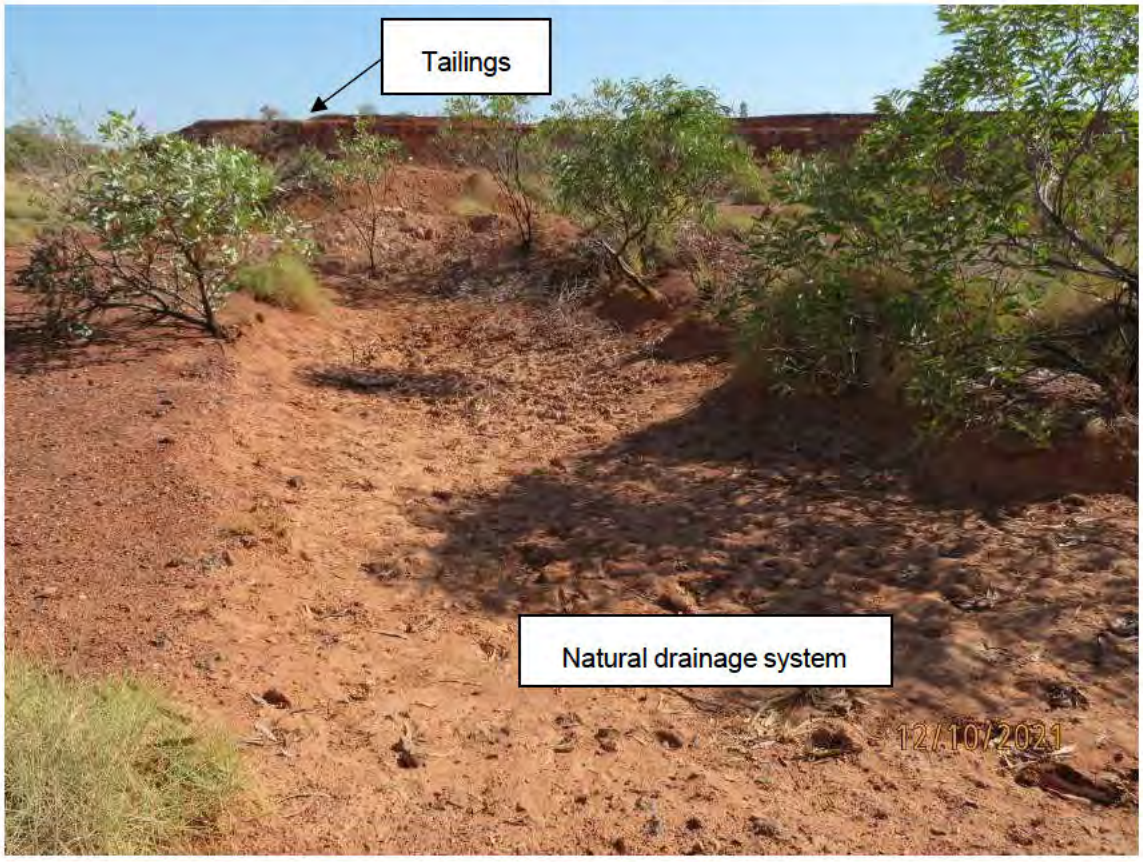
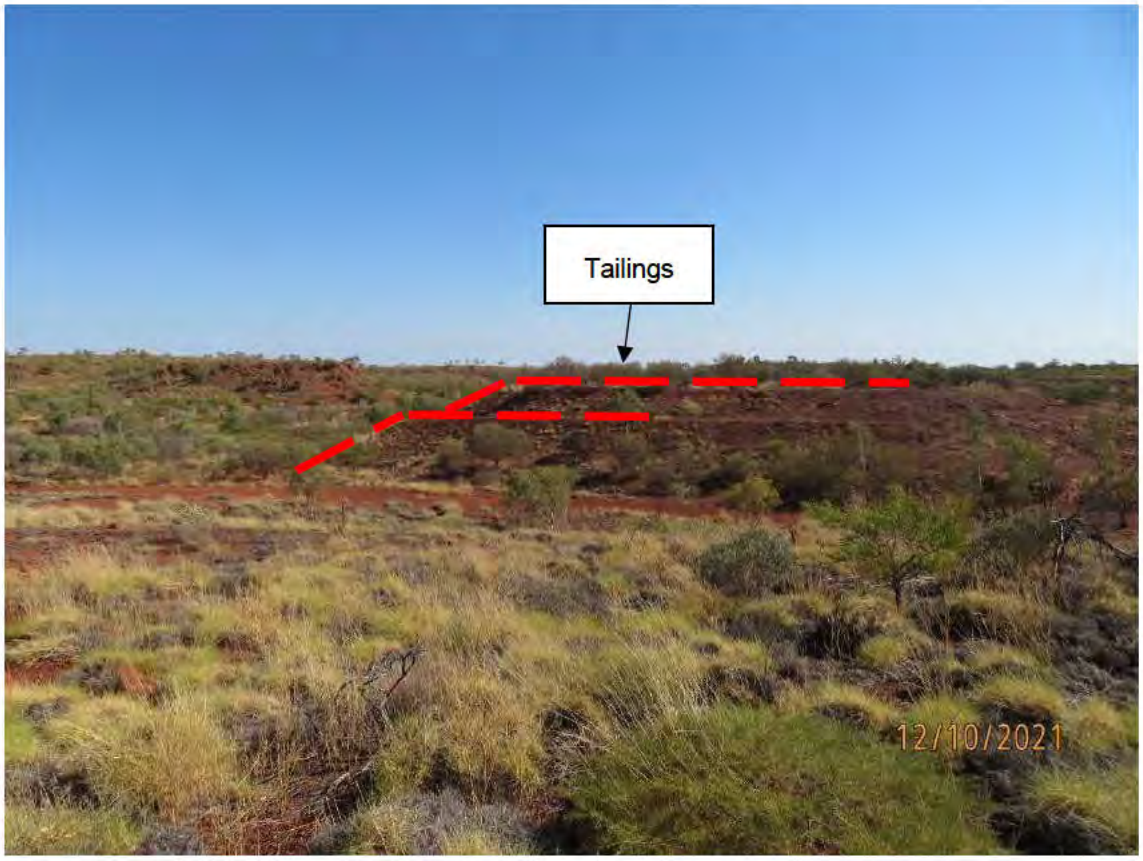


PHOTO 4: VIEW OF OLD TAILINGS STORAGES



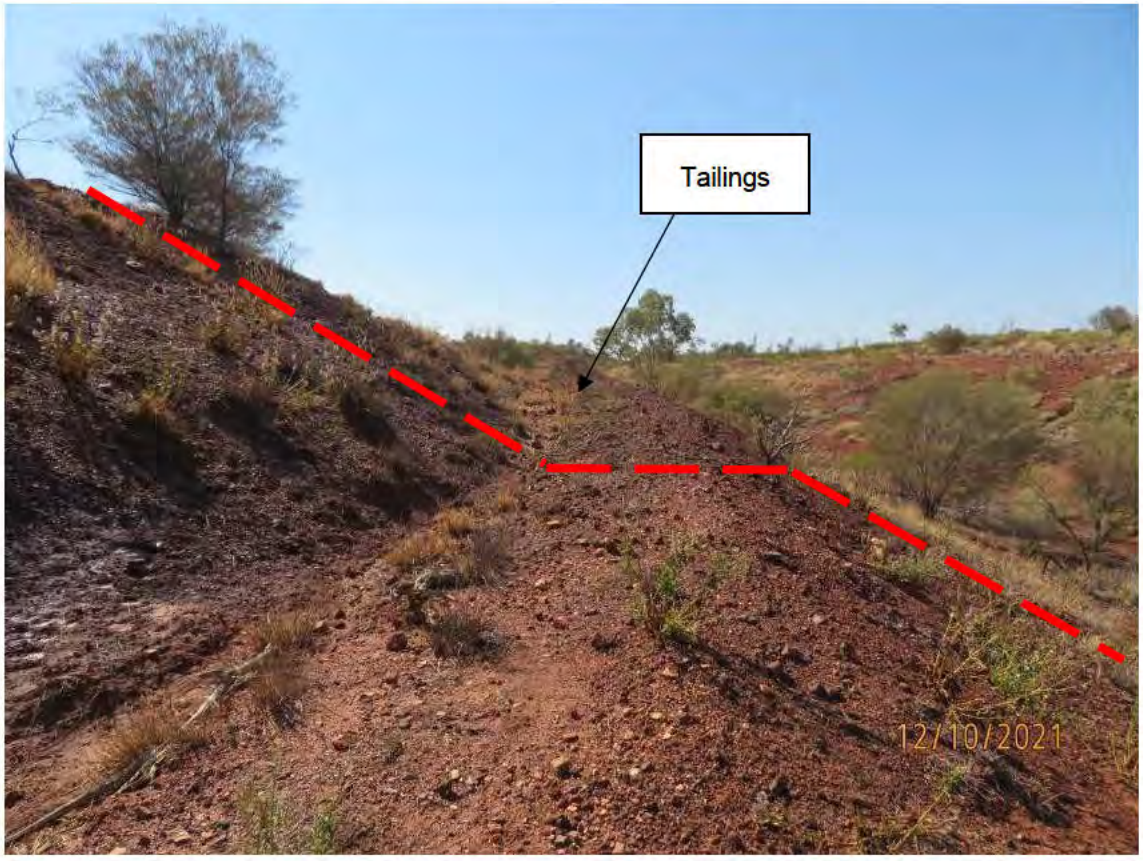


PHOTO 5: EROSION OBSERVED IN TAILINGS SLOPES, GULLY FORMATION AND VEGETATION DEBRIS.

PHOTO 6: POTENTIAL SEEPAGE FROM TAILINGS SLOPES

2.3 Topography and Hydrology

The site topography generally comprises rocky and undulating hills, with low lying grasses and sparse tree cover (refer to **Photo 7** for typical site conditions). Rehabilitation of some site surfaces has been undertaken in the past using a loose cover material (refer to **Photo 8**). These areas appear to have reduced vegetation cover and include areas over the TSFs and Mineralised Waste Dump.

PHOTO 7: TYPICAL SITE CONDITIONS

PHOTO 8: EXISTING TSF BATTER

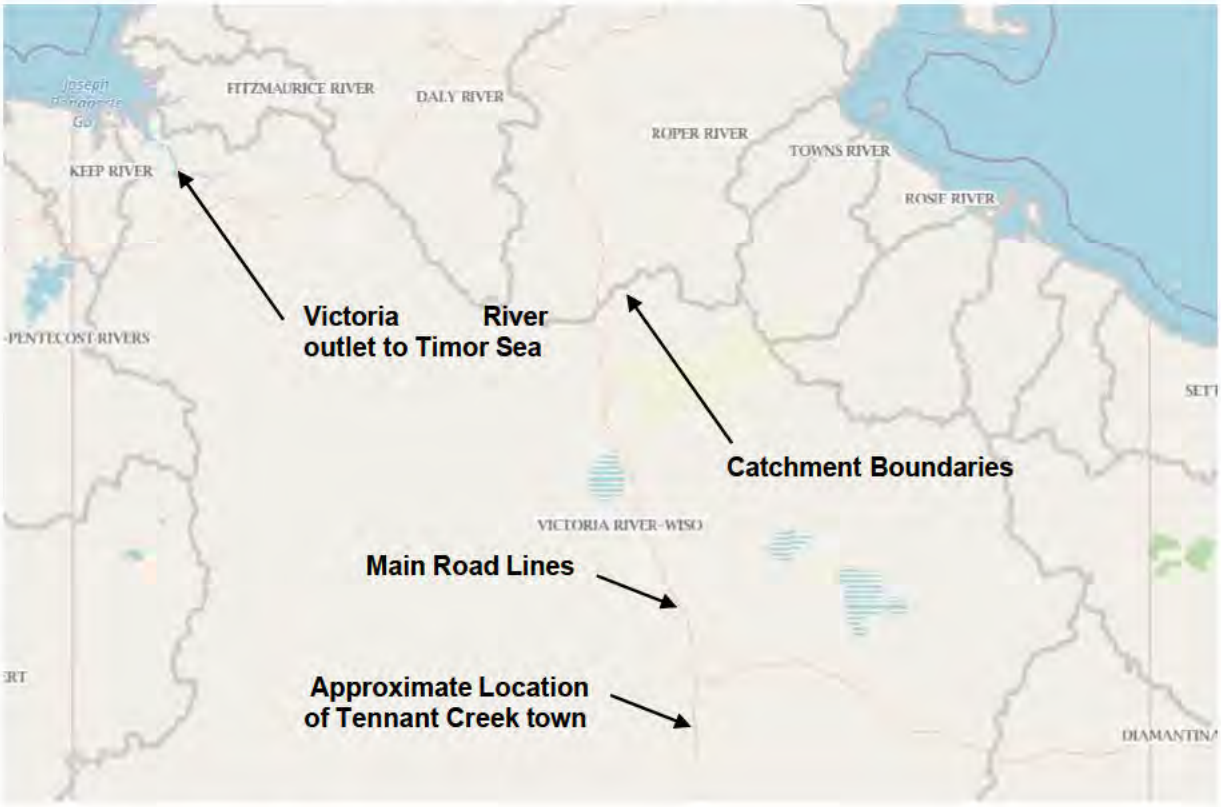
Mine site elevations range from approximately RL 355.0 m AHD at the Peko Road access to the site, to RL 376.0 m AHD at the crest of the Mineralised Waste Dump, and RL 296.0 m AHD at the base of the Pit. Surface flows across the mine site would predominately be conveyed as sheet flow over 50-100 m before channelising, forming local flow paths which convey flows to one of three main existing points of discharge. A large extent of site surface areas discharge to the Pit, where runoff is captured and eventually evaporates. The existing catchment to the Pit is approximately 36.9 ha.

Within the southern and western extents of the proposed works area, approximately 24.3 ha of catchment discharges to the north/northwest along Peko Road. A portion of the Mineralised Waste Dump catchment area discharges east to an existing pond. Refer to **Diagram 4** that illustrates the existing catchment boundaries.

DIAGRAM 4: EXISTING CATCHMENTS

Flow from the site area would contribute to flows in local tributaries that head north/northwest and eventually discharge to the Tennant Creek watercourse approximately 25 km downstream of the site. Tennant Creek is within the Western Plateau Drainage Division, contributing to the Victoria River catchment. This ultimately discharges to the Timor Sea some 800 km downstream, refer to **Diagram 5**.

DIAGRAM 5: VICTORIA RIVER CATCHMENT



2.4 Regional Geology

According to Johnstone **[11]**, the Nobles Nob site area took place by the metamorphic/igneous deposition of the Proterozoic Warramunga Province during the Tennant Orogeny (~1850 Ma). The geological bodies of the Tennant Creek Supersuite were introduced to the Warramunga Province by this event. Prior to orogenesis, the Tenant Creek Supersuite included greenschist metamorphosed and ironstone (hematite and magnetite) bodies that reacted with reduced gold-copper-bismuth rich hydrothermal fluids. Post-orogenesis of the Tennant group, I-type granitoids (via the Tennant Creek granite) of quartz feldspar porphyry and mafic composition were generated.

The lithological characteristics of the surrounding geology produced a spatial continuity of metamorphic and igneous facies, striking from the NW to SE. These facies were predominated by the I-type Granitoids and Basaltic/Mafic material with traces of Gabbro series. Surficial deposits and clastic sedimentary species overlayed the metamorphosed/igneous material as post-deformation sequences. Economic commodities produced include gold-copper-bismuth mineralisation.

2.5 Hydrogeology

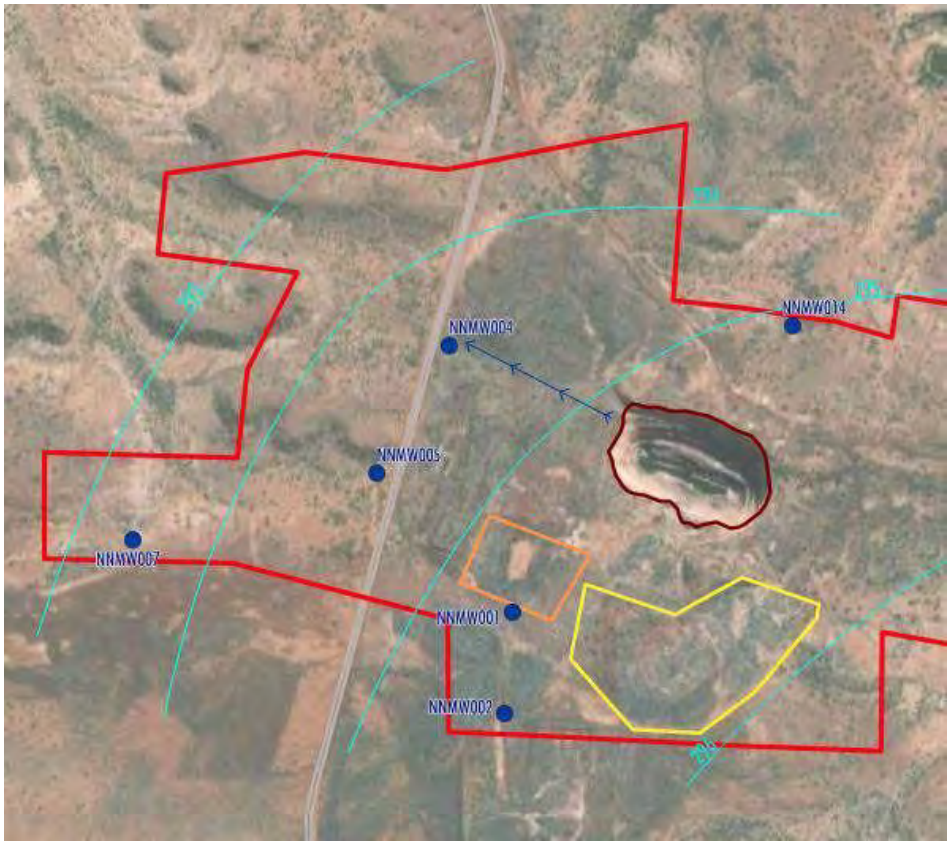
A Groundwater Assessment Report has been prepared by Umwelt **[20]** and the outcomes from this report are summarised below:

Several registered groundwater monitoring bores are present within 2.5 km of the site, most of which were found to be mine exploration bores with very little to no water encountered during drilling. Ten (10) monitoring bores were installed at the Nobles Nob site to estimate the hydraulic parameters of the groundwater system. Values of hydraulic conductivity ranged from 0.0105 m/day to 0.681 m/day across the site. Recorded groundwater elevations ranged from RL293 m AHD to RL296 m AHD across the

site, noting that this did not include possible seasonal fluctuations. The groundwater flow direction appears to be similar to the regional flow direction of northwest, as illustrated in **Diagram 6**.

No groundwater levels in the Pit were provided, however, the Pit appears to have a permanent water level of around RL296 m AHD. It is inferred that this permanent water level coincides with the regional water table level as it generally aligns with the groundwater levels recorded in the bores.

DIAGRAM 6: EXTRACT OF ASSUMED SITE GROUNDWATER CONTOURS



Extracted from Umwelt **[20]**

2.6 Assessment of Available Geotechnical Information

Limited geotechnical information and documents were available at this stage of design, and the only geological/surface soil information is briefly discussed in “Excalibur Tennant Ck Project Final Fauna Report_8-Sep-10” **[8]**. Available geological information and site observations were used to assess the current conditions of the area; however, further geotechnical investigation is required prior to the detailed design phase of the project.

Part of the current tailing embankment will be excavated and used for the platform construction; therefore, a tailing characteristics study is critical to determine the mechanical responses of the material (consolidation and settlement in the foundation) under the imposed surcharge loads from Geotubes stacking. A comprehensive geotechnical characteristic test for residual soils and tailings material will be undertaken prior to the detailed design stage.

3 GEOTUBES STACKING AND PLATFORM CONCEPT DESIGN

3.1 Objectives

As part of the proposed processing operations, it is understood that Geotubes will be implemented as the main dewatering system for slurry tailings material outputted from the processing plant. Geotubes are an effective dewatering technology fabricated from an engineered textile. By adding a flocculant to the slurry, the tubes provide containment of fine solids inside the tubes while allowing water to permeate through the engineered textile.

The objective of this concept design report was to assess possible scenarios of Geotubes stacking to contain a total in-situ volume slurry of 642,850 m^3 over 1.5 years (18 months) within the Nobles Nob mine lease boundaries. The conceptual options for Geotubes positioning and the required quantities were studied by considering water management options and geotechnical considerations. The following sections outline the major assumptions adopted and the outcomes from the concept design.

3.2 Key Assumptions of Options Design

The basis of the design is to consider stacking of Geotubes tubes at a nominated location to meet the required processing volumes. This requires a large platform to be constructed within the site area. The concept design is critically constrained by the target tailings volume and mine lease boundaries.

For the Geotubes platform foundation design, it is noted that three key design criteria must be satisfied:

- The foundation must be able to resist the loadings for the ultimate condition, such that the foundation will not collapse (ultimate load criterion)
- The foundation must not settle or deflect excessively under the normal design (serviceability) loadings (serviceability criterion).
- The foundation must be sufficiently durable so that it will endure the design life of the supported structure without excessive deterioration (durability criterion).

According to the site photos and general geology conditions of the area, it is expected that residual and tailings material are suitable to construct a platform for the placement of the Geotubes; however, details regarding bearing capacities, Geotubes full-stack stability, ground settlement and corresponding foundation parameters will be analysed in the detailed design phase of the project. The conceptual Geotubes stacking model presented in this report is adopted from similar dewatering projects and available published reports.

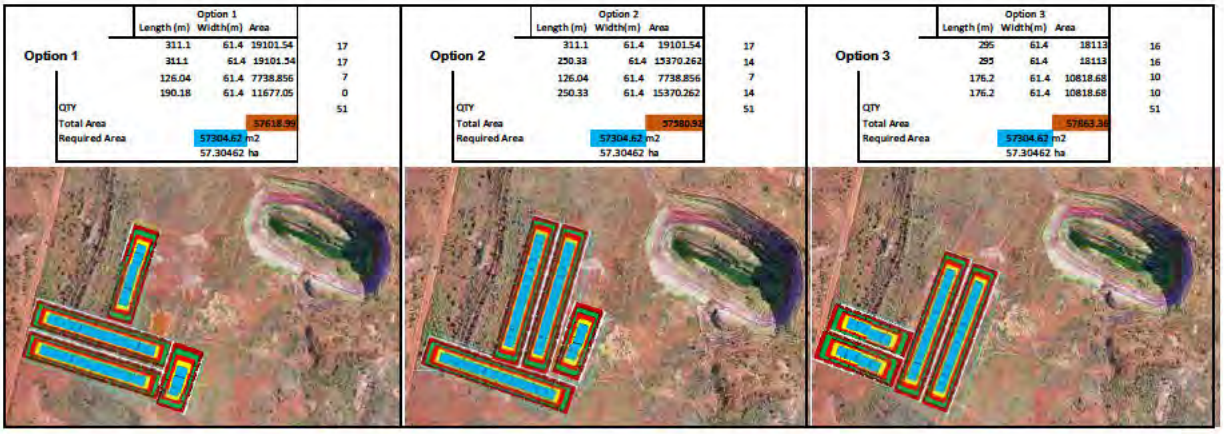
A site visit was carried out to identify any potential geotechnical risks (refer to **Section 2.2**). Based on the available information and completion of a site walkover, it was concluded that no major geotechnical constraints were identified (such as soft and problematic soil strata) other than the presence of a few eroded drainage channels on batter slopes and around the existing Pit. The eroded channels could be related to the granular matrix of the residual soils or uncontrolled surface waters, which generally impose a low risk to the platform design.

3.3 Platform Layout Options Assessment

An initial design of the Geotubes layout was proposed by Geofabrics (Geotubes supplier) for the proposed Nobles Nob operations **[10]**. The tailings slurry input rate to the Geotubes was originally assumed as 48.9 m^3/h, with a tailings specific gravity of 3.2 t/m^3, and an initial slurry wet density of 1.38 t/m^3, and an slurry rate of 67.5 t/h. Based on the design slurry volumes, several conceptual Geotubes layout configurations were assessed as discussed in the following sections. It should be noted that the process plant engineers (COMO) propose higher pump rates **[7]** to the Geotubes dewatering facility than those mentioned above (as per Geofabrics). The higher pump rates (123.7 m^3/hr slurry inflow to Geotubes) would reduce the overall lifetime of the project to meet the same design slurry volumes, which will significantly increase the labour/personnel required for the operations. This requires review with the Geotubes supplier as part of the detailed design phase to confirm any potential impacts to the construction methodology and platform design.

Based on the above and the assumptions outlined in **Section 3.2**, seven (7) scenarios were initially reviewed and assessed, and the final configurations were selected in three main groups as shown in **Diagram 7.**

DIAGRAM 7: INITIAL OPTIONS ASSESSMENT FOR GEOTUBES STACKING

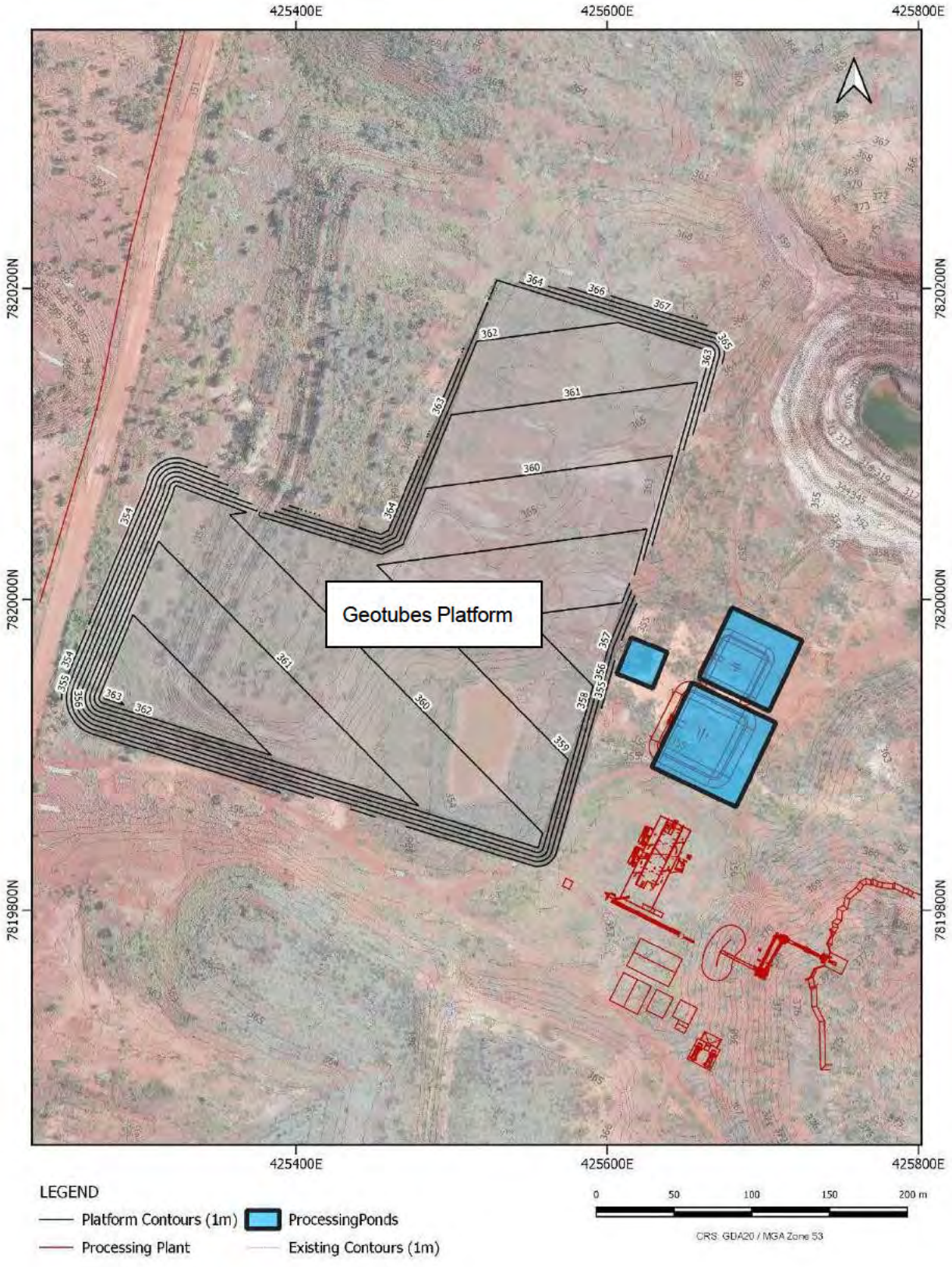


All selected options fulfil the tailings volume requirements and provide safe and stable conditions. **Option 3** illustrated above likely provides the best stability arrangement as the lateral movement of the Geotubes would allow further support to the whole stacking system and avoids horizontal instability towards any future infrastructure facilities. In addition, the Geotubes are positioned at an adequate offset from the current pit boundaries, preventing any imposed surcharges/deformations toward the pit area.

Option 3 was therefore assessed in greater detail to determine the required cut and fill volumes for the platform. The platform location was adjusted to suit surface water management constraints, enable the existing access road to be maintained, and obtain balanced earthworks volumes. Six (6) grading scenarios were then considered, with the following option (as illustrated in **Diagram 8**) deemed the best outcome in terms of the stability configuration, surface water management, and maintaining the existing access road.

The platform design illustrated in **Diagram 8** proposes to excavate a large portion of the existing tailings storage facility (TSF) to enable a level area for Geotubes stacking. This requires the removal of existing tailings material for use as fill material for the platform.

DIAGRAM 8: FINAL CONFIGURATION OF GEOTUBES PLATFORM



3.4 Site Preparation

It is recommended that all earthworks including site preparation, excavation, and filling are carried out generally in accordance with the relevant specifications (i.e. MRTS04 – General Earthworks). It would be expected that the platform area would be stripped of any deleterious, loose, soft, wet, highly compressible, and/or organic rich material such as topsoil prior to the placement of any fill material. Additionally, prior to commencement of filling it would also be expected that the works area is test rolled with a minimum 12-tonne static weight smooth drum roller or similar. Any areas identified as unsuitable, such as soils with poor bearing capacity, during a proof roll should be excavated, removed, and replaced with suitable materials.

3.5 Geotubes Platform Liner and Foundation

The geotechnical risk for the Geotubes platform area is considered low as no soft ground or existing slope stability issues were observed during the site inspection by ATCW. The presence of residual soils may result in low to medium shrink/swell potential and a low likelihood of dispersive soils is expected based on the site walkover and observational assessment of in-situ materials. The existing materials are estimated to provide a CBR value in the order of 3% to 5% for residual soils and up to 10% for areas underlain directly by XH-HW metamorphic/igneous depositions.

The foundation and platform preparation will require general earthworks; and any borrow materials are expected to be excavated from the existing tailings embankment in close proximity to the works area, as directed by TCMG. Excavated materials would most likely be suitable for use within an inner zone of the platform foundation and bounds, assuming the material is not dispersive and contains some granular structures. Construction of the platform requires excavation of a significant portion of the existing TSF embankment and landform. Additional borrow material may be needed for the proposed operations and should be sought from areas within the general extent of works wherever possible.

The platform base will include a lining and drainage system to support the placement of the Geotubes and collection of water and return to the process plant. A typical cross section of prepared platform for the Geotubes includes the following (from top of surface to subgrade):

- Drainage Gravel; nominal 300mm (depth to vary to provide a level platform directly below Geotubes);
- Geomembrane Liner (HDPE or BGM) and protective geotextile;
- Compacted earth fill; 400mm

The surface of the gravelly layer immediately underneath the stacked Geotubes shall be level to avoid any instability issues. Bleed water from the Geotubes will flow through the drainage gravel to the perimeter drains.

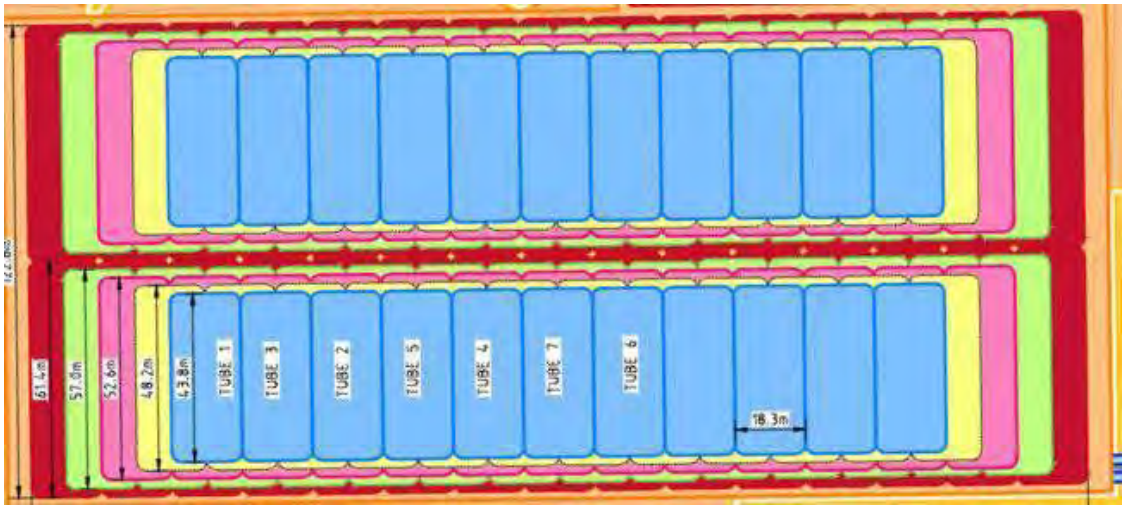
Further details of the platform are provided in the drawings (121089.01-001 and 121089.01-008 within **Appendix B**).

3.6 Geotubes Filling Methodology

A flocculant is mixed with the tailings slurry prior to it being pumped into the Geotubes. This is to increase the concentration of solids from the processed tailings and encourage dewatering. According to the initial estimate by Geofabrics **[10]**, a dose rate of 300 g/mtds would be expected. Therefore, the filling and stacking process of Geotubes must be carefully considered, to provide adequate time for dewatering and support new Geotubes being filled.

Diagram 9 outlines the recommended staging methodology when filling the Geotubes. Geotubes 1 and 2 are initially filled with one tube width left as an interval space between tube 1 and 2. This process is repeated for Geotubes 3 and 4 and subsequent tubes. When filling Geotubes 4 and 5, Geotubes 2 and 3 are assumed to gain the required densification. This approach will be continued for first layer of Geotubes stacking and subsequent stacking layers shall follow this same methodology. This process is recommended as it provides for a safe and adequate area to manage the dewatering process.

DIAGRAM 9: GEOTUBES STACKING MODEL AND FILLING ORDER



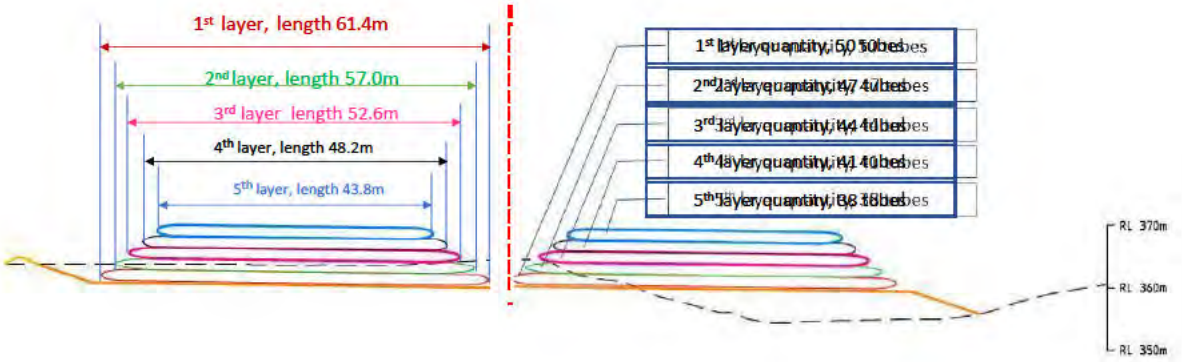
Unrolling and installing of the Geotubes is proposed to be deployed from temporary lay-down/platform areas to allow appropriate handling equipment such as a light-weight crane to facilitate placement of the tubes. This would also require temporary ramps over the drainage channels to allow access to the platform. Good quality fill material shall be set aside for use in constructing temporary ramps and lay-down areas. Geotubes shall be lifted by the crane and placed and positioned over the lined platform, and once aligned, the outer protective wrapper will be removed and unrolled over the designated location. Deployment and unrolling of the Geotubes would also require a tractor or excavator. The filling and dewatering process requires a team that will need to be skilled in polymer dosing and essential operating parameters such as monitoring maximum Geotubes fill height limits. Manpower will also be required to correctly deploy the tubes and set up feed pipes etc.

Further details regarding temporary ramp and lay-down locations should be considered as part of the detailed design and construction methodology. It should be noted that all Geotubes shall be labelled, shipped, stored, and handled in accordance with ASTM D 4873.

3.7 Geotubes Stacking Methodology

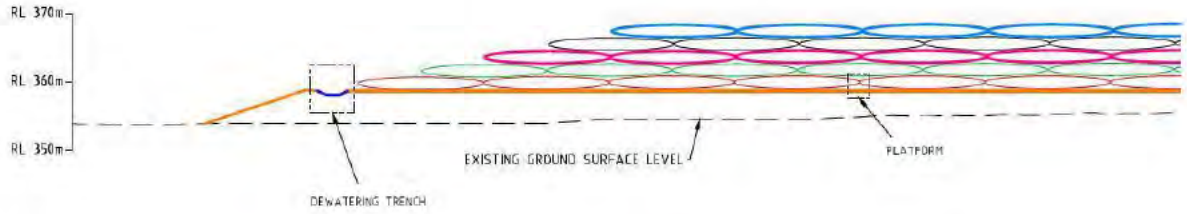
As shown in **Diagram 10,** it is proposed to stack Geotubes in five horizontal layers with a total length of 11,704 m (311.1 m in length and 184.2 m in width). The Geotubes shall occupy an area within the proposed platform of around 57,305 m^2 (5.73 ha) to accommodate the required tailings deposition volume as per the plant production rate. The total Geotubes platform area proposed is approximately 7.5 ha.

DIAGRAM 10: PLAN VIEW AND CROSS-SECTIONS OF THE INITIAL PROPOSED GEOTUBES STACKING



A typical cross section for a five (5) stacked Geotubes configuration is also illustrated in **Diagram 11**.

DIAGRAM 11: EXAMPLE OF GEOTUBES STACKED IN MULTIPLE LAYERS



As presented in **Diagram 11**, the Geotube platform shall be prepared horizontally on a level surface. The drainage aggregate may vary in depth to allow a flat platform beneath the Geotubes. The preparation of the platform utilises compacted engineering materials as discussed in **Section 3.5** to avoid any differential settlement.

3.8 Failure Risks and Interactions

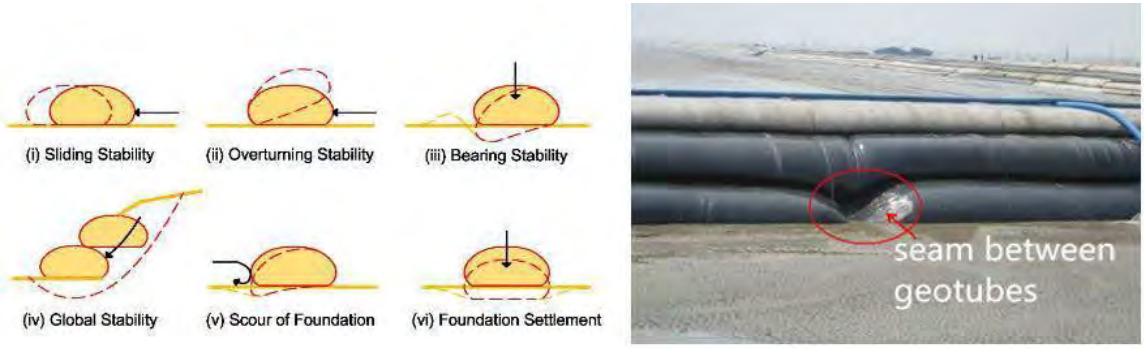
It is expected that the Geotubes would be constantly subjected to various static and dynamic forces throughout the operational period. Forces include lateral and overburden pressures due to the weight of stacked Geotubes, and superimposed surface loads. The main damage risk however, is related to flexible footing conditions.

There are two main types of failures and risks that could be associated with Geotubes stacking:

1. Global instability of stacked Geotubes due to the imposed hydrostatic, static, and dynamic loads **[18]**. This normally would occur when the underlying foundation is not stiff enough, or the Geotubes are filled unevenly, which causes non-uniform surcharge loads;
2. Local damage to Geotubes when the damage is formed and developed at the weakest joint sections of stacking adjacent Geotubes. Consequently, tailings in the Geotubes would flow out of the tube through the damaged lap seam. This would be typically expected when local and differential settlement has occurred **[10]**.

An example of these failure modes mentioned are illustrated in **Diagram 12**. **Section 3.9** discusses containment measures that have been implemented as part of the concept design.

DIAGRAM 12: GLOBAL INSTABILITY (LEFT) AND LOCAL DAMAGES (RIGHT)



The pumping system shall be high enough to achieve finished crest height (nominal height of 1.8m) but not excessive to cause damage or rupture of Geotubes. Geotubes shall be filled as evenly as possible, with the top of the tube at a uniform elevation, without any pronounced humps, bulges, or isolated low unfilled areas.

3.9 Drainage Channel Surrounding the Platform

Dewatered fluid from the tubes (effluent) is proposed to discharge to trapezoidal drains within the platform to a sump where the effluent is pumped to the Process Pond. A trench drain system from a past Geotubes project is shown in **Diagram 14** (photo resource from Tencate Geotubes **[10]**). Typically, this consists of trenches about 200-300 mm wide sized to direct effluent to the outlet sump. However, due to the large catchment of the proposed Geotubes platform, the dewatering drains will need to be significantly larger to cater for surface flows. The drainage channel proposed consists of a 2.0 m wide base, with 3:1 (H:V) batters, and 600-900 mm depth. It is also recommended to allocate a 5.0 m (min.) distance from the edge of the first Geotubes layer to the drain to accommodate HDPE piping and flexible hoses connections, as shown in **Diagram 14**.

A bund is also proposed along the eastern boundary of the platform to provide a containment volume if a tube failed. The volume is sized for the largest tube (approximately 2 ML). If a failure occurred during heavy rainfall, the flow from a failure could overtop the proposed bund and discharge NE to the Pit for additional containment. Under an extreme rainfall event, another possible but unlikely failure scenario is a tube failing and discharging to Peko Road from the western or southern side of the platform. A Consequence Category Assessment (CCA) in accordance with ANCOLD is presented in ATCW's Water Management Report **[2]**, and concludes the proposed storage structures fall under 'a Minor' consequence category.

DIAGRAM 13: GENERAL SURFACE CROSS SECTION, BUNDS AND DRAINAGE CHANNEL

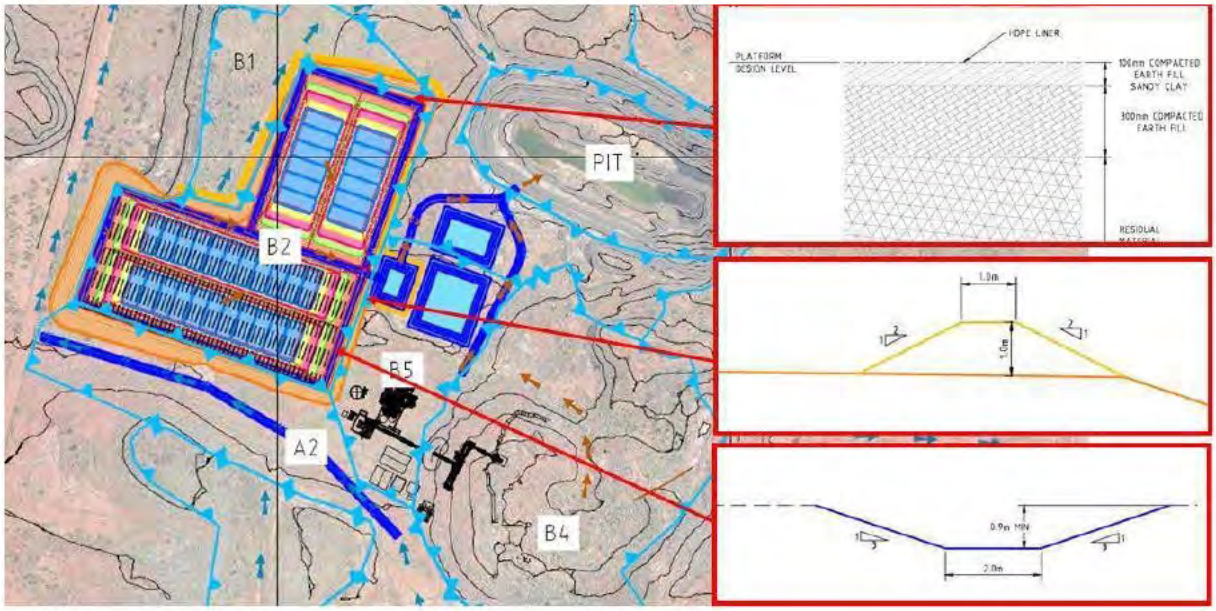
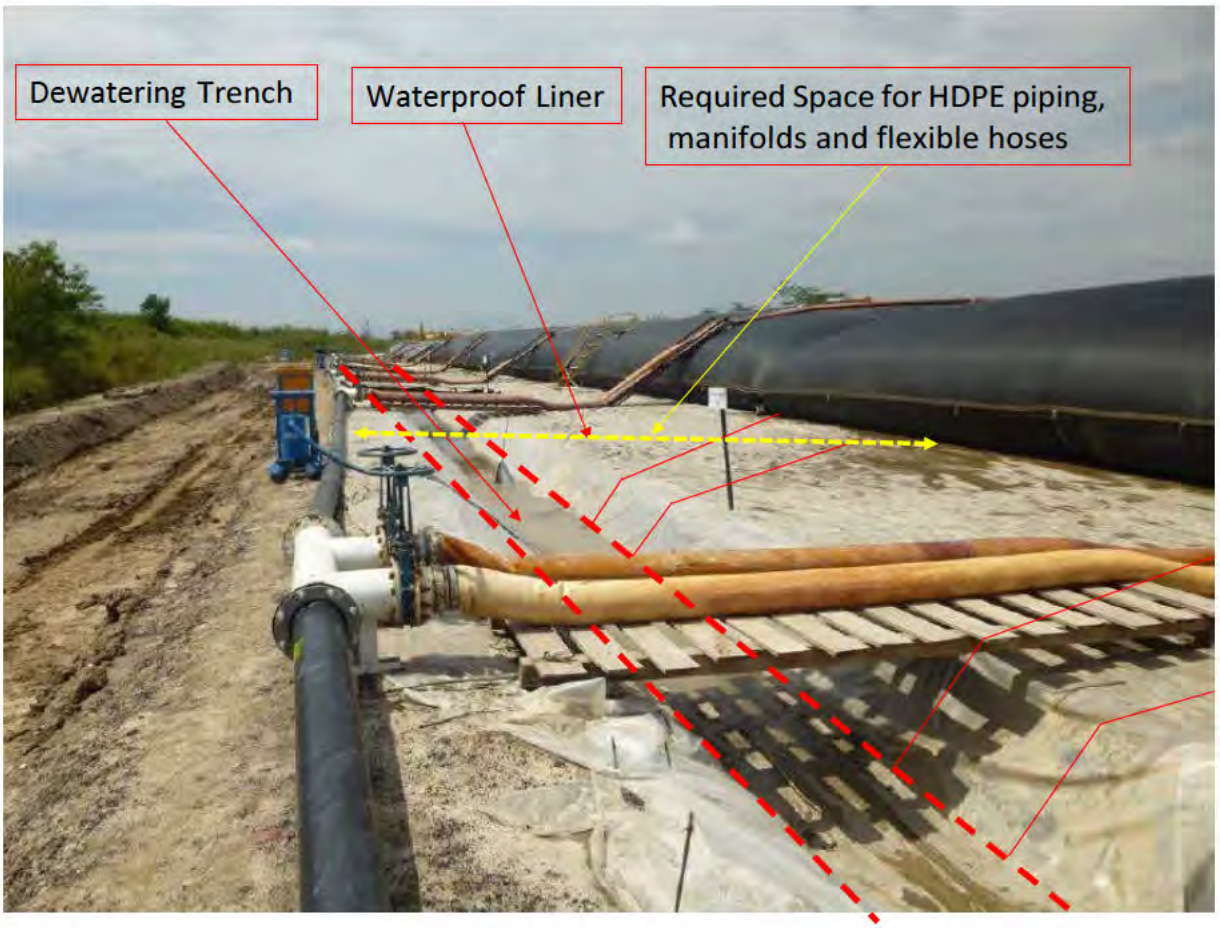


DIAGRAM 14: TYPICAL IMAGE OF DEWATERING TRENCH AND SUPPLEMENTARY EQUIPMENT SYSTEM



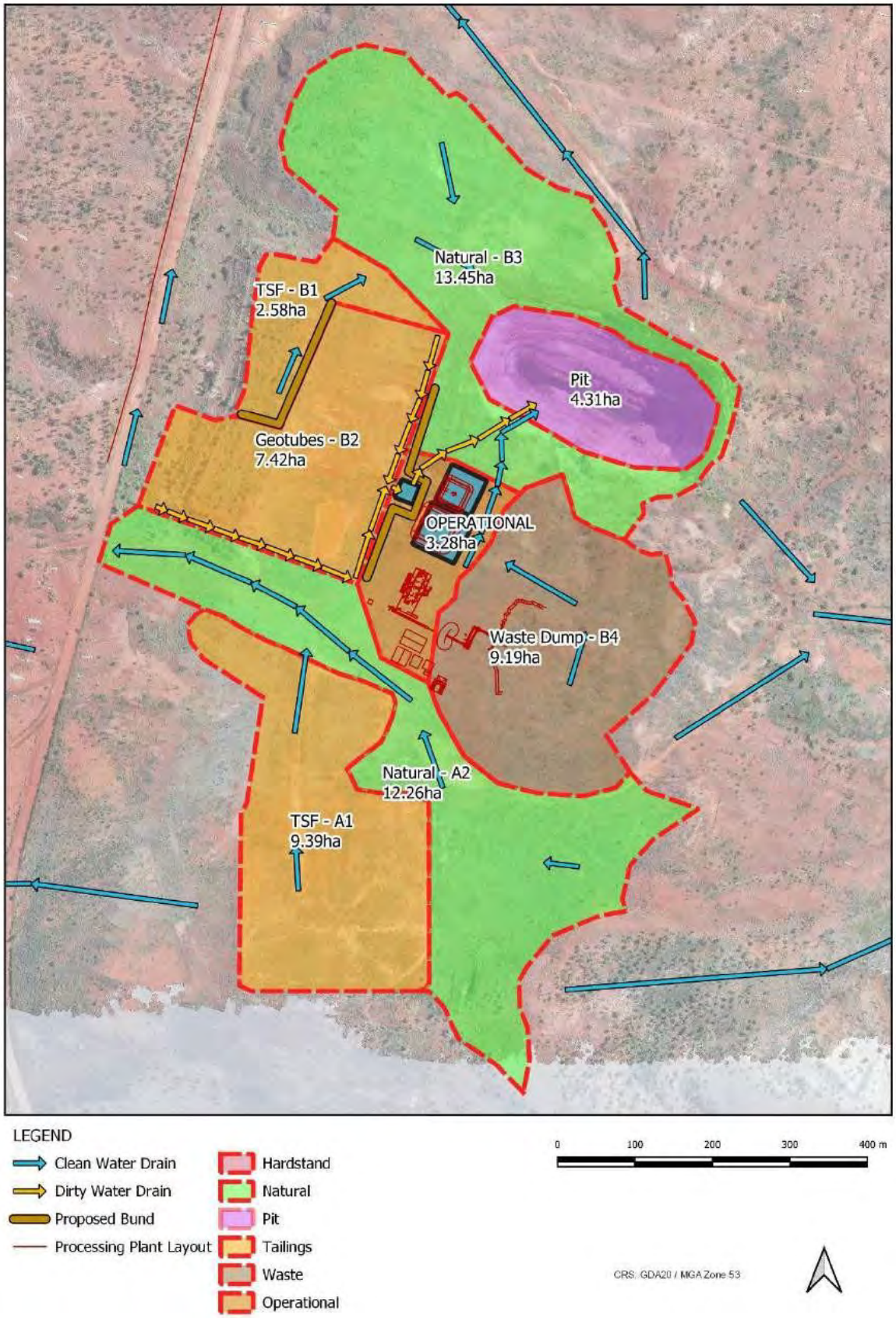
3.10 Surface Water Requirements

Effluent from the Geotubes is likely to contain pollutants that should not be discharged directly to the downstream waterways. It is therefore proposed that the Geotubes platform captures process water expressed from the Geotubes within a sump and bunding around the low side of the platform. Water captured within the sump will be pumped to the Process Pond, where it will be re-used as process water within the processing plant. In extreme rainfall events, runoff can overtop the sump and discharge to the Pit for containment. All surface water runoff from the Geotubes operational and processing areas are proposed to be captured within site conveyance systems and directed to the Pit (in extreme events) to prevent contact water discharges to downstream watercourse(s).

Diagram 15 indicates the overall surface flow diversion strategy. Refer to ATCW's Water Management Report **[2]** for further details regarding the water management system proposed for the Geotubes operations. The WMP report includes a Water Balance Model and discussion of the main storages involved in the operations:

- Process Pond
- Raw Water Pond
- Geotubes Sump
- Pit

DIAGRAM 15: SURFACE WATER DIVERSIONS



3.11 Staged Rehabilitation and Capping

The Geotubes platform is proposed to be constructed in two main stages to reduce the initial earthworks required. Progressive capping and rehabilitation of Stage 1 should therefore commence as soon as practical to reduce the catchment area discharging to the Geotubes sump and reduce potential overflows to the Pit. Capping of the Geotubes is required to prevent potential containments being discharged from the Geotubes landform. Capping can only occur once seepage from the Geotubes has ceased, and the full stack height has been achieved. Capping systems are discussed in ATCW's Water Management Report **[2]**, and include:

- Capillary Break (deep soil cover to prevent upward migration of moisture and contaminates through capillary action which can contaminate cover soils);
- BGM (bituminous geomembrane (BGM) acts as the hydraulic barrier preventing seepage though the cover soils into the tailings);
- Store and Release (store and release cover is to maximise plant available moisture within the cover system promoting infiltration into the cover system and minimising runoff);

The selection of the preferred cover system will be dependent upon review of tailings geochemical characterisation. In addition to this, in order to determine the suitability of the chosen cover system, vadose modelling of the preferred option should be undertaken to determine the cover system thickness required. Trial pads should be utilised during the operational phase of the project to determine if minor reshaping works with or without cover soil and the addition of topsoil can achieved the rehabilitation objectives for cover system cap. As part of the trail pad investigations analysis of runoff water quality must also be monitored.

Rehabilitation of disturbed surface areas should be undertaken progressively, and surface flow should be diverted away from the Pit wherever practical. Any subsequent operational phases should also aim to divert surface flows away from the Pit wherever practical. Ongoing testing of Geotubes effluent water quality and water captured in the Pit should be implemented and actively monitored throughout the operations.

4 CONCLUSIONS

A concept design for a multi-layered Geotubes dewatering facility has been developed to meet the Nobles Nob Phase 1 operation phase requirements. A large platform of approximately 7.5 ha is proposed to cater for the Geotubes stacking, dewatering drains and associated infrastructure. This requires extensive earthworks to enable a safe and stable platform. General platform configurations and stacking models were investigated as a part of the conceptual study, and an optimal Geotubes filling methodology was proposed based on the preliminary assessments. Further geotechnical investigation is required to assess the suitability of the foundation material and to allow stability modelling of the stacked configuration.

Rehabilitation of disturbed surface areas should be undertaken progressively, and surface flow should be diverted away from the Pit wherever practical. Any subsequent operational phases should also aim to divert flow away from the Pit wherever practical. Ongoing testing of water quality in the Pit should be implemented and actively monitored throughout the operations.

Further investigations and assessments should be conducted following this concept design and before the detailed design phase, such as:

- A detailed geotechnical and geochemical investigation of existing site materials and tailings material.
- A more detailed investigation into the likely effluent water quality from the Geotubes should be conducted.
- Detailed progressive rehabilitation and closure phase assessment.

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APPENDICES

APPENDIX A: SITE FEATURES

PEKO ROAD

TSF

Pit

#4

ACCESS ROAD

Waste Dump

TSF

TSF

#1

LEGEND

Existing Contours (5m)

Mine Lease Boundaries

Water Sample Locations

Existing Site Features

Pit

Tailings

Waste Dump

0 50 100 150 200 m

FIGURE 001
NOBLES NOB - EXISTING SITE FEATURES

ATC WILLIAMS

DATE: 2022-02-21
CRS: GDA20 / MGA Zone 53

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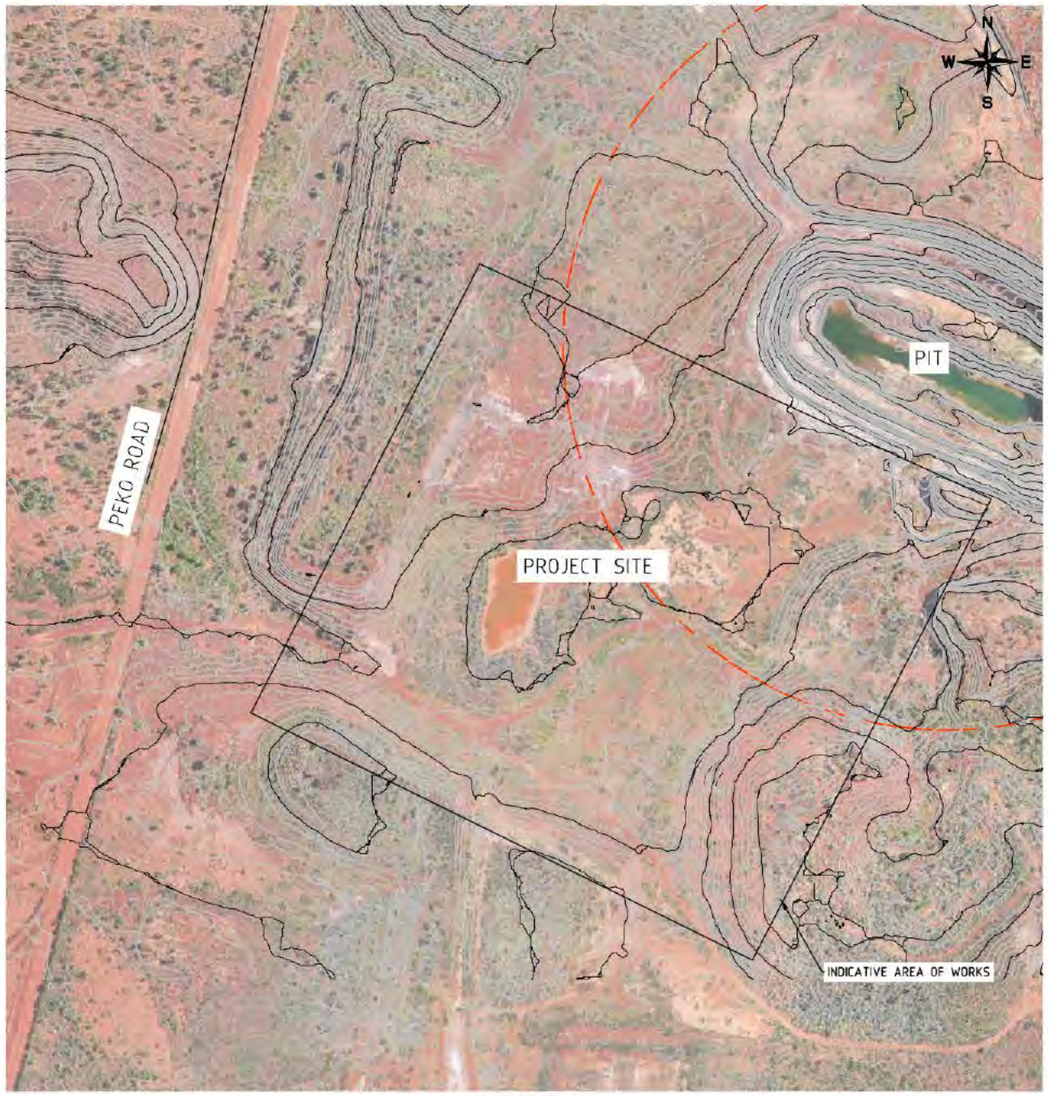
APPENDIX B: ATCW CONCEPT DESIGN DRAWINGS

TENNANT CONSOLIDATED MINING GROUP PTY LTD

NOBLES NOB GEOTUBES PLATFORM CONCEPT DESIGN



LOCALITY PLAN
SCALE NTS

DRAWING LIST

NUMBER	DESCRIPTION
121089.01-001	LOCALITY PLAN AND DRAWINGS LIST
121089.01-002	GENERAL ARRANGEMENT - SITE LAYOUT
121089.01-003	GEOTUBE PLATFORM - SECTIONS
121089.01-004	GEOTUBE PLATFORM - EARTHWORKS
121089.01-005	GEOTUBE PLATFORM - STAGING - STAGE ONE
121089.01-006	GEOTUBE PLATFORM - STAGING - STAGE TWO
121089.01-007	CLOSURE PLAN
121089.01-008	DETAILS
121089.01-009	CATCHMENT PLAN - OVERALL SITE (OPERATIONS)
121089.01-010	CATCHMENT PLAN - OVERALL SITE (CLOSURE)
121089.01-011	PONDS AND DRAINS - SECTIONS AND DETAILS

ISSUED FOR REPORTING
NOT FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
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SCALE: NTS
JOB No. 121089.01
DATE FEB. 2022
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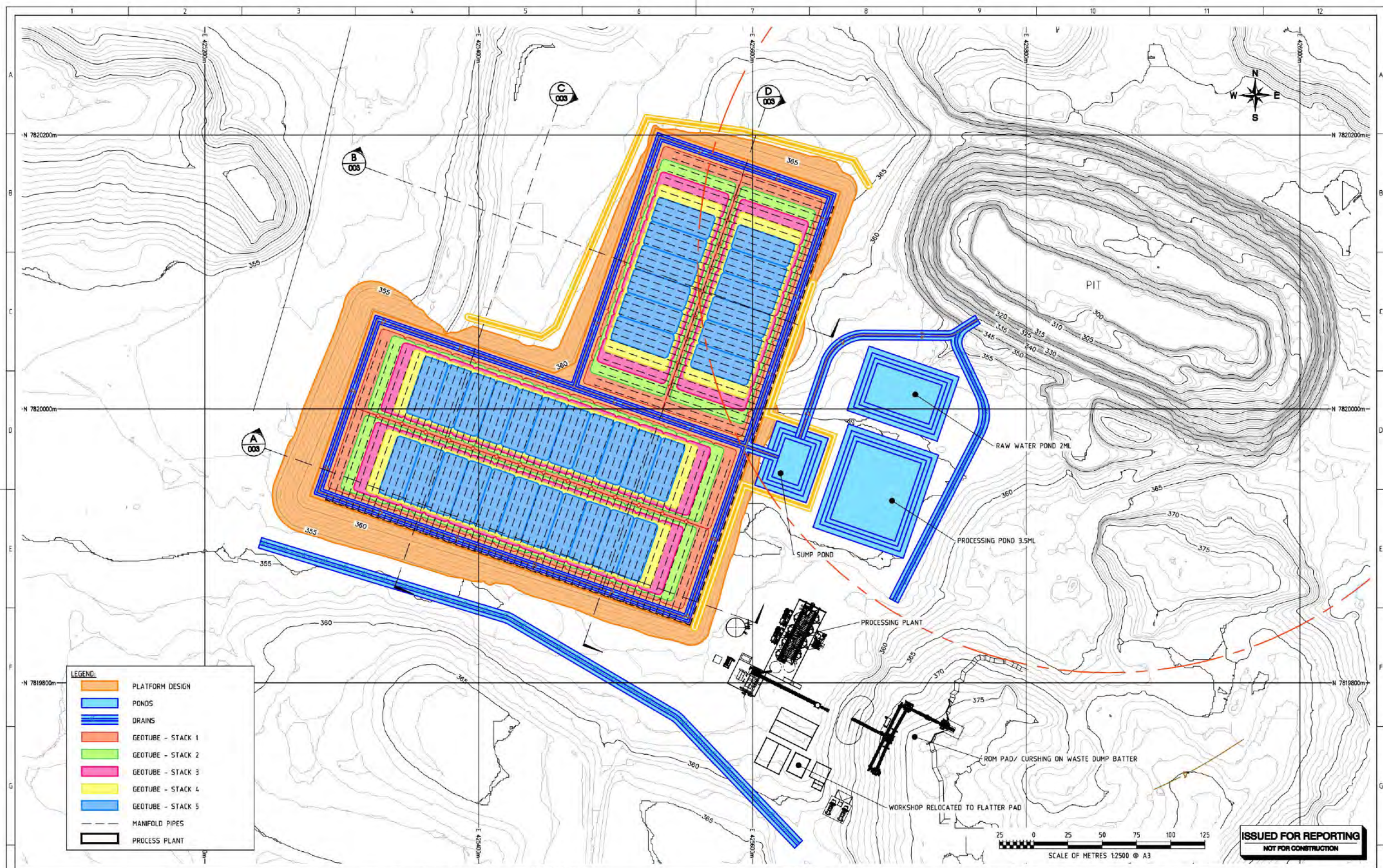
SHEET SIZE A3 Rev. A

SHEET 1 OF 1



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SCALE:	1:2,500
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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GENERAL ARRANGEMENT
SITE LAYOUT

DWG. No. 121089.01-002

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1

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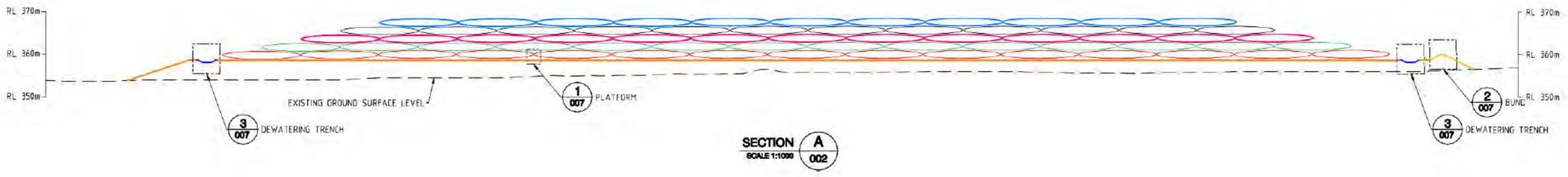

SECTION A 002
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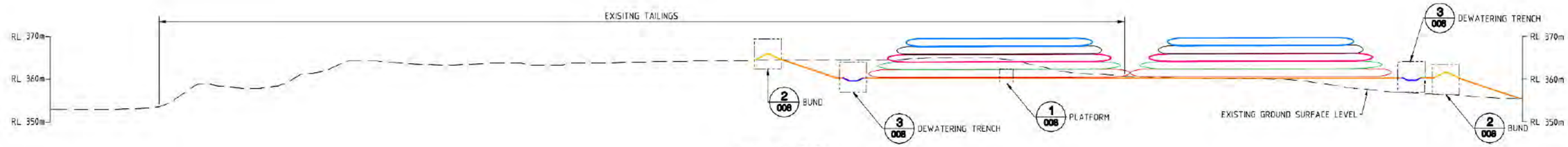

SECTION B 002
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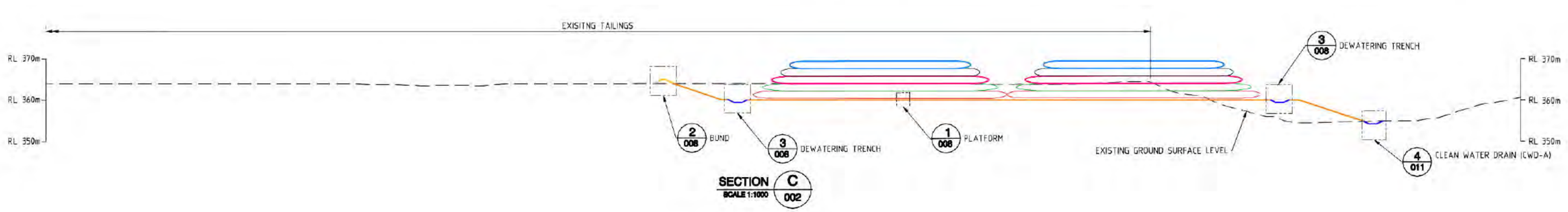

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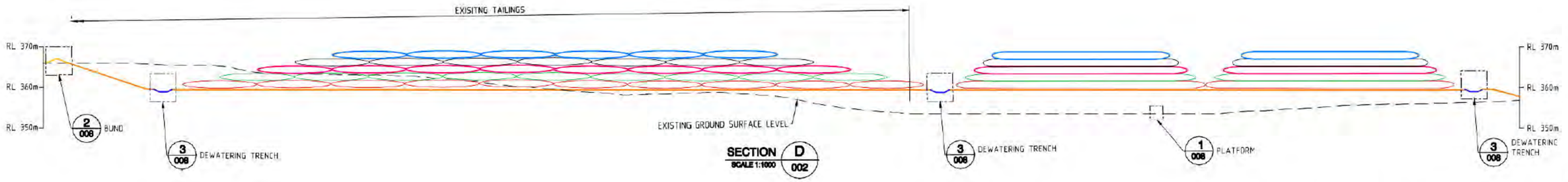

SECTION D 002
SCALE 1:1000

10 0 10 20 30 40 50
SCALE OF METRES 1:1000 @ A3

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SCALE: 1:1,000
JOB No. 121089.01
DATE FEB. 2022
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DRAWN ARL
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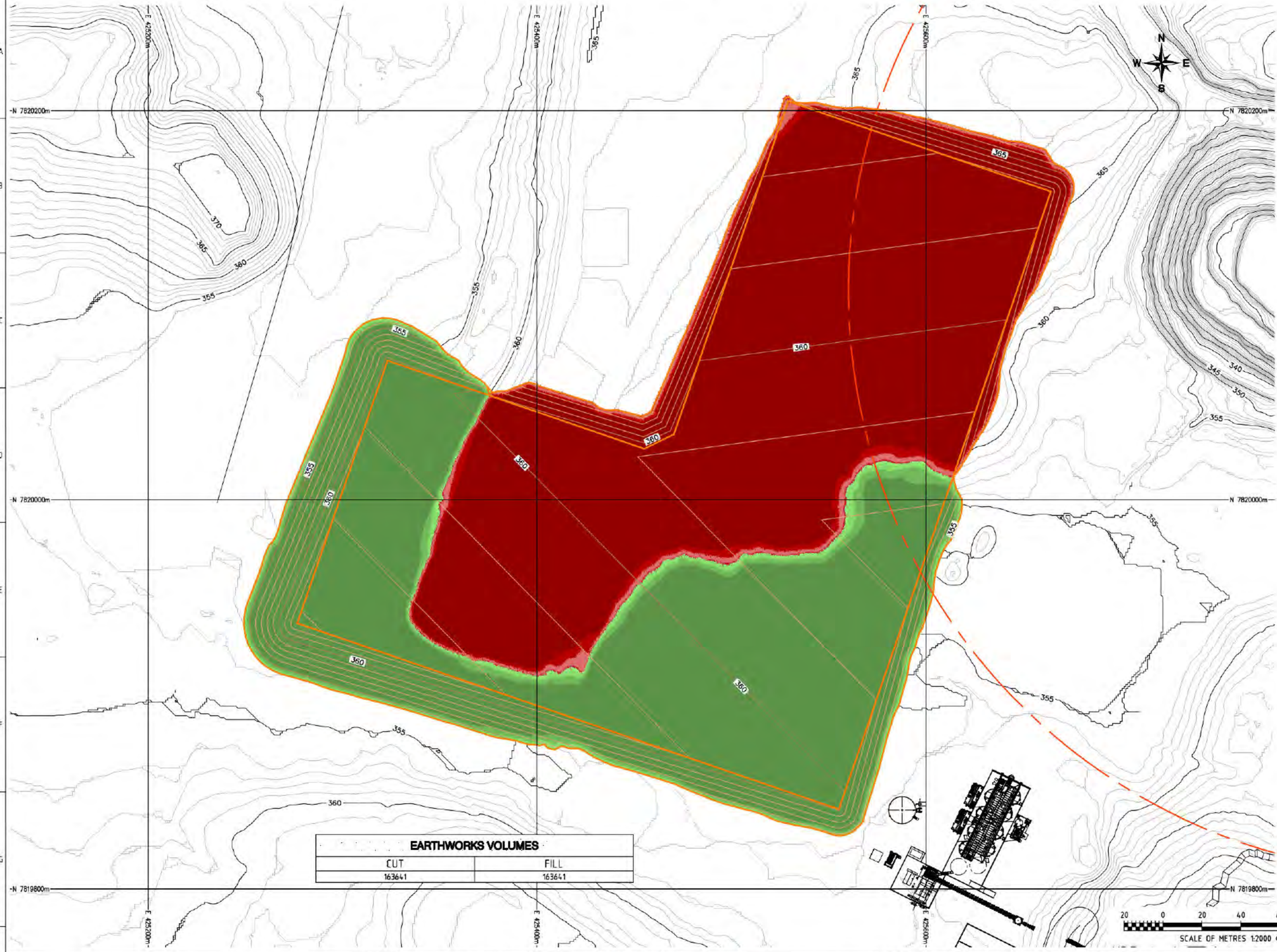
GEOTUBE PLATFORM SECTIONS

DWG. No. 121089.01-003
SHEET SIZE A3 Rev. A

SHEET 1 OF 1



DEPTH RANGE TABLE

Lower Value		Upper Value		Colour
-9999	to	-100	m	
-100	to	-10	m	
-10	to	-1	m	
-1	to	-.5	m	
-.5	to	-.1	m	
-.1	to	-.01	m	
-.01	to	0	m	
0	to	.1	m	
.1	to	.5	m	
.5	to	1	m	
1	to	10	m	
10	to	100	m	
100	to	9999	m	

EARTHWORKS VOLUMES

CUT	FILL
163641	163641

20 0 20 40 60 80 100
SCALE OF METRES 1:2000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
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SCALE: 1:2,000	
JOB No.	121089.01
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DESIGN	BH
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GEOTUBE PLATFORM
EARTHWORKS

DWG. No. 121089.01-004

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1

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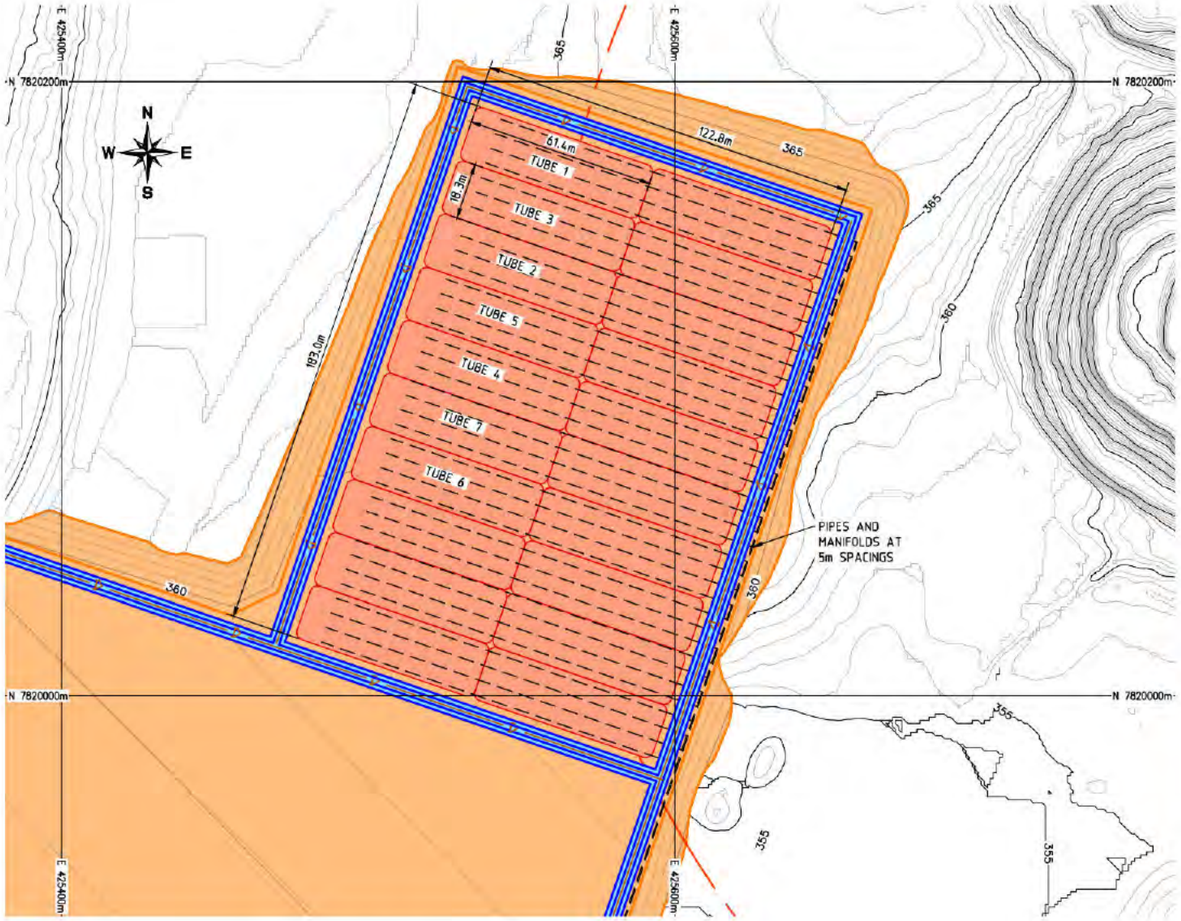
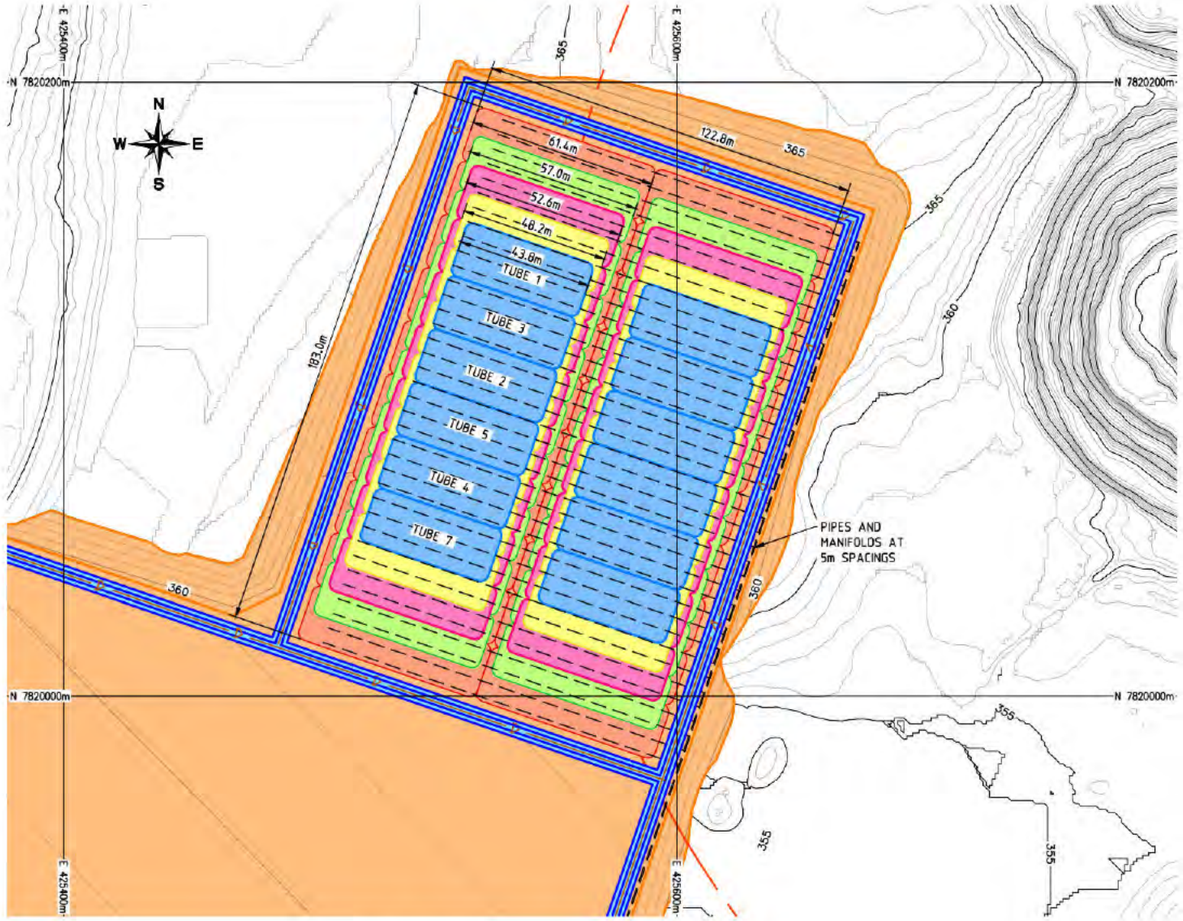


GEOTUBES STAGING - STAGE ONE (STACK ONE)
SCALE 1:2000



GEOTUBES STAGING - STAGE ONE (STACK FIVE)
SCALE 1:2000

20 0 20 40 60 80 100
SCALE OF METRES 1:2000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,000	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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GEOTUBE PLATFORM
STAGING
STAGE ONE

DWG. No. 121089.01-005
SHEET SIZE A3 Rev. A
SHEET 1 OF 1

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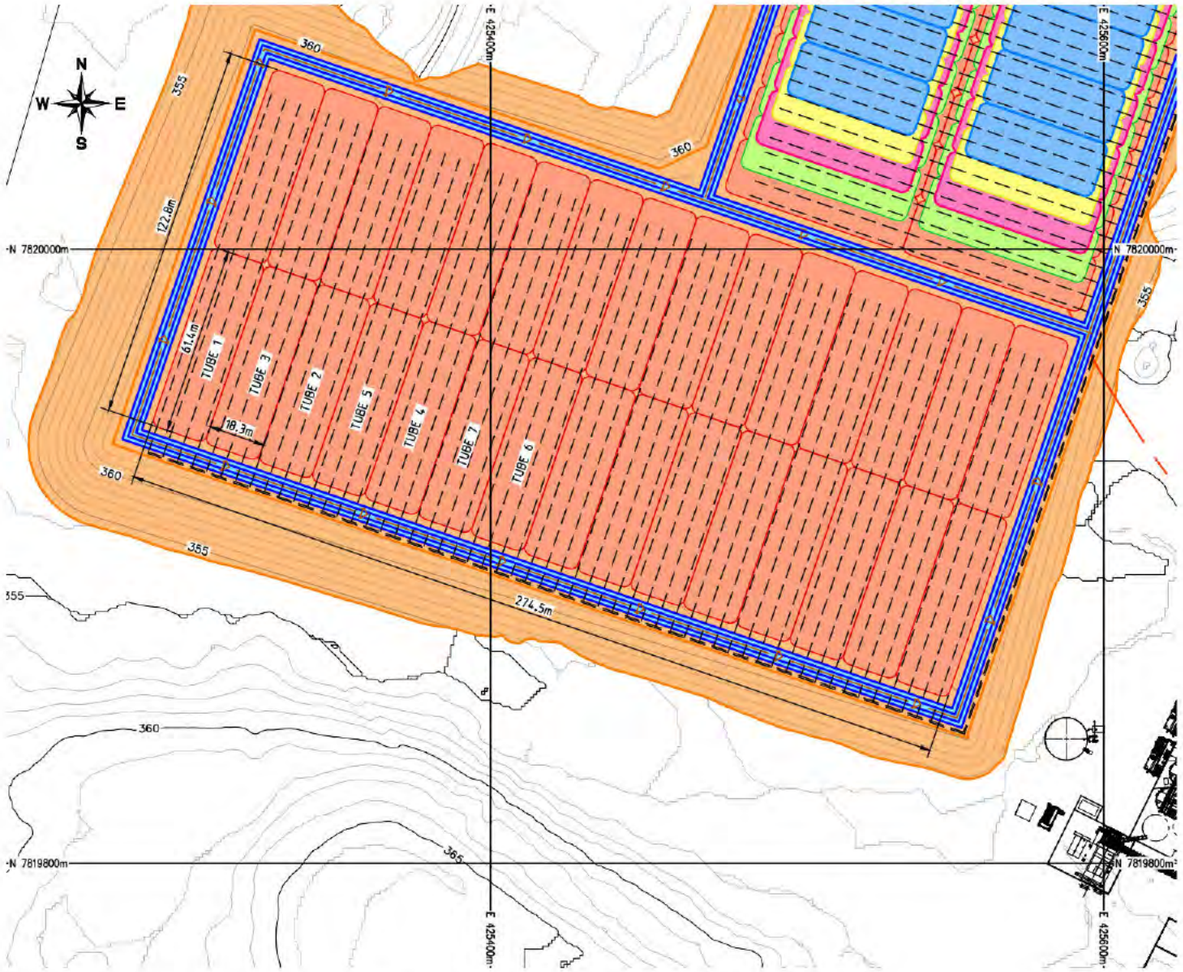
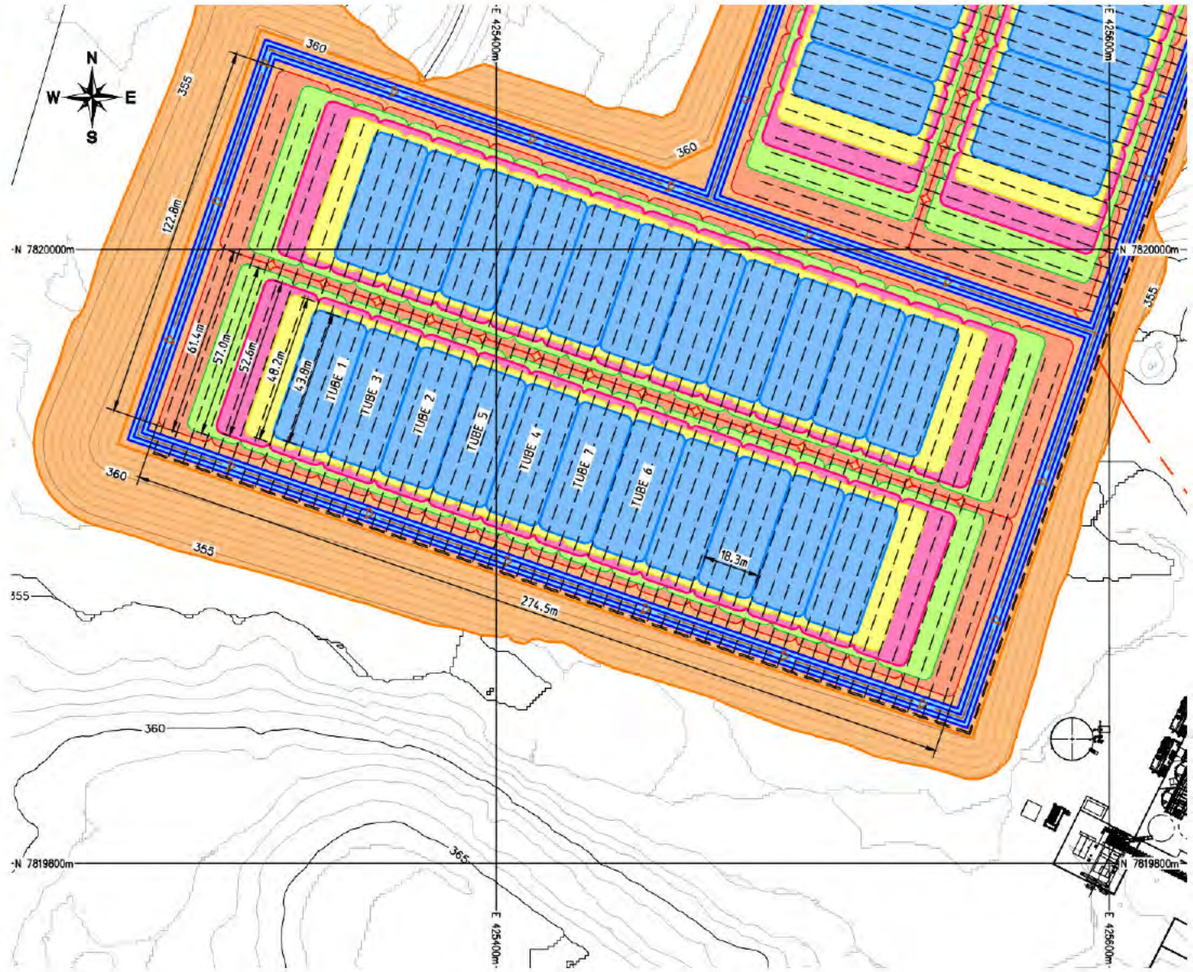
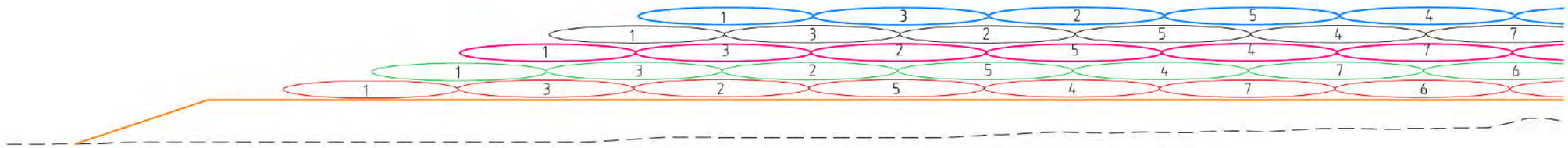


GEOTUBES STAGING - STAGE TWO (STACK ONE)
SCALE 1:2000



GEOTUBES STAGING - STAGE TWO (STACK FIVE)
SCALE 1:2000



TYPICAL GEOTUBES STAGING SECTION
SCALE 1:500

5 0 5 10 15 20 25
SCALE OF METRES 1:500 @ A3

20 0 20 40 60 80 100
SCALE OF METRES 1:2000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,000
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
CHECKED MWJ
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GEOTUBE PLATFORM
STAGING
STAGE TWO

DWG. No. 121089.01-006
SHEET SIZE A3 Rev. A

SHEET 1 OF 1

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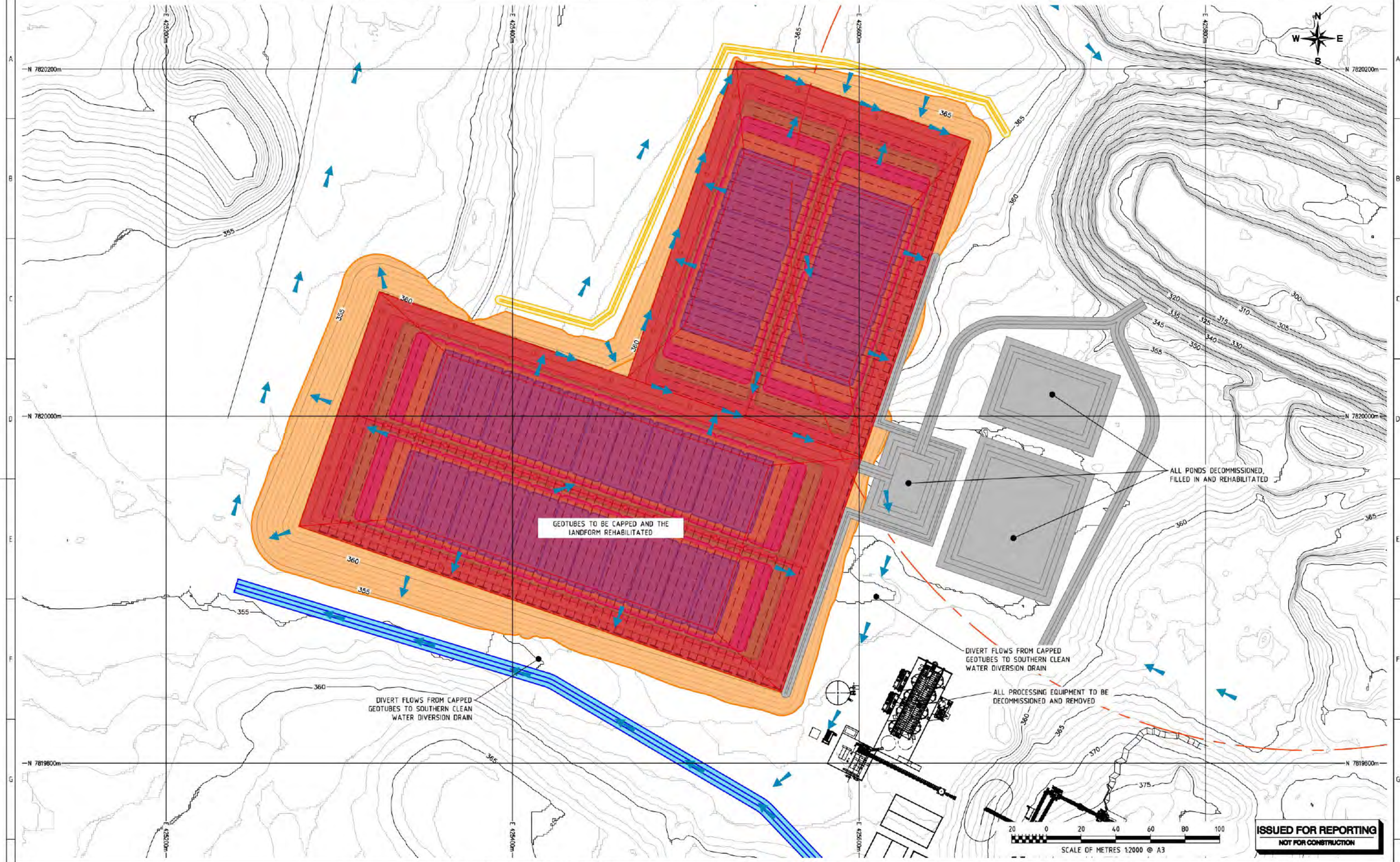

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SCALE: 1:2,000
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
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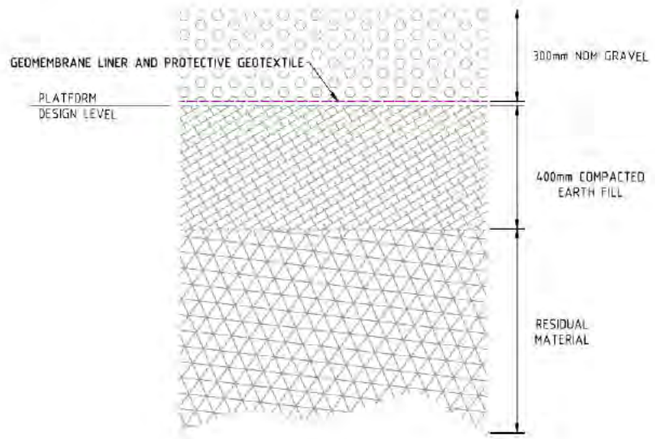
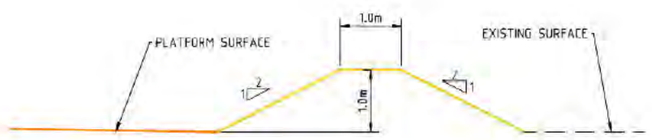
CLOSURE PLAN

DWG. No. 121089.01-007
SHEET SIZE A3 Rev. A

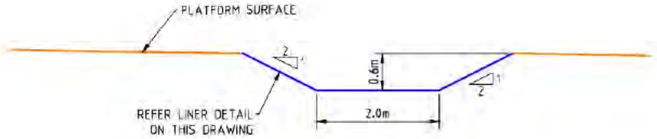
SHEET 1 OF 1



DETAIL 1 PLATFORM
SCALE: 1:20 — 003



DETAIL 2 BUND ADJACENT TO PLATFORM
SCALE 1:100 — 003



DETAIL 3 DEWATERING TRENCH
SCALE 1:100 — 003

1 0 1 2 3 4 5
SCALE OF METRES 1:100 @ A3

0.2 0 0.2 0.4 0.6 0.8 1.0
SCALE OF METRES 1:20 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
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SCALE: AS SHOWN	
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DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
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DETAILS

DWG. No. 121089.01-008

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1

S:\Projects\121\121089 Nobles Nob\01 Water Mgnt Assess & Deposition Modelling\CADD\CAD\121089.01-008.dwg

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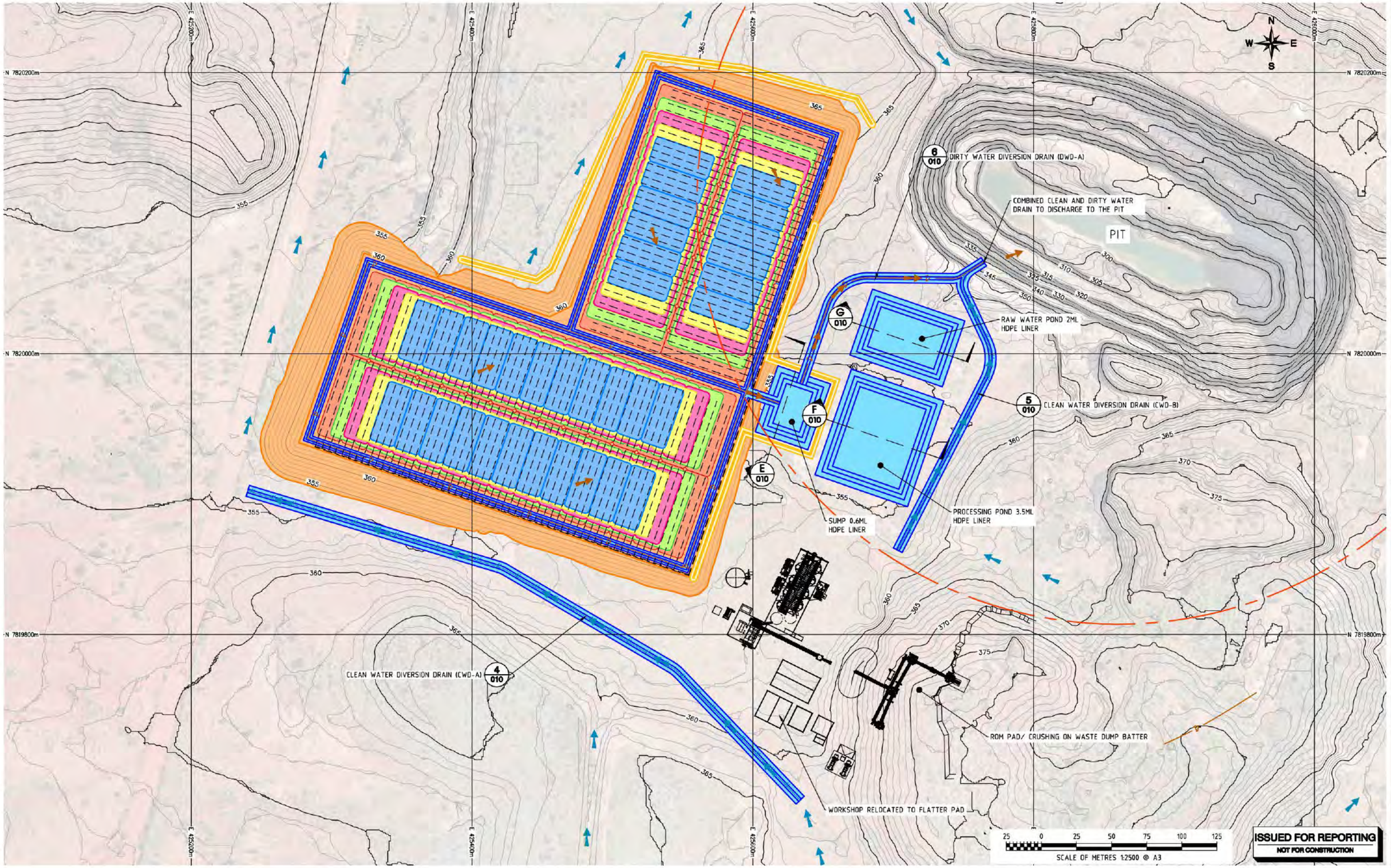

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JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
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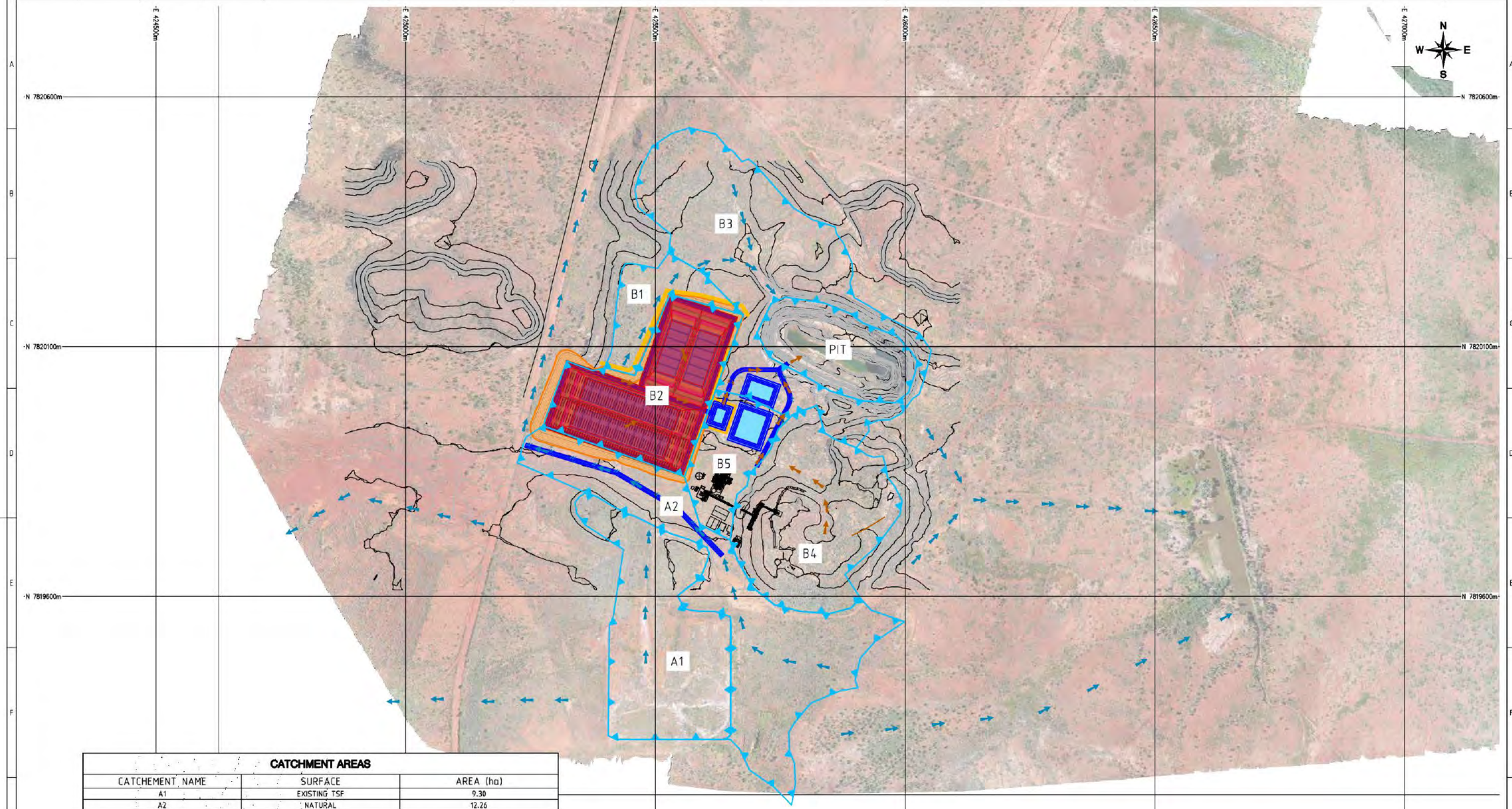
CATCHMENT PLAN
OVERALL SITE (OPERATIONS)

DWG. No. 121089.01-009

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1



CATCHMENT AREAS		
CATCHEMENT NAME	SURFACE	AREA (ha)
A1	EXISTING TSF	9.30
A2	NATURAL	12.26
B1	EXISTING TSF	2.58
B2	GEOTUBES	7.42
B3	NATURAL	13.45
B4	WASTE DUMP	9.19
B5	OPERATIONAL AREA	3.28
PIT	PIT	4.31

75 0 75 150 225 300 375
SCALE OF METRES 1:7500 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:7,500
JOB No. 121089.01
DATE FEB. 2022
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CATCHMENT PLAN
OVERALL SITE (CLOSURE)

DWG. No. 121089.01-010
SHEET SIZE A3 Rev. A

SHEET 1 OF 1

S:\Projects\121\121089 Nobles Nob\01 Water Mgmt Assess & Deposition Modelling\CADD\CAD\121089.01-010.dwg

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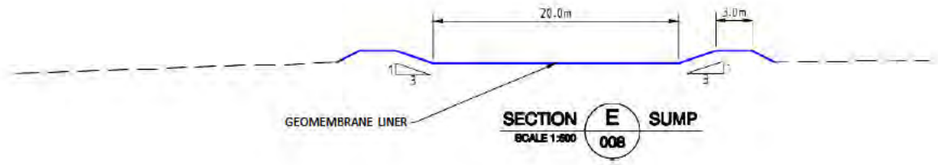
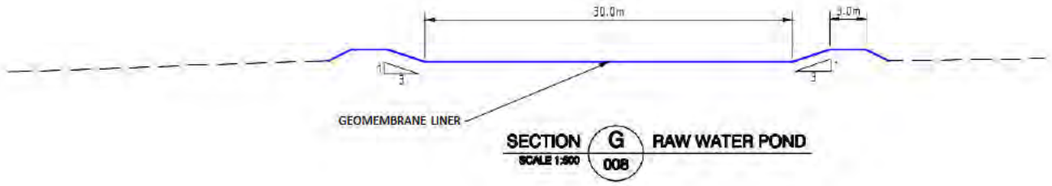
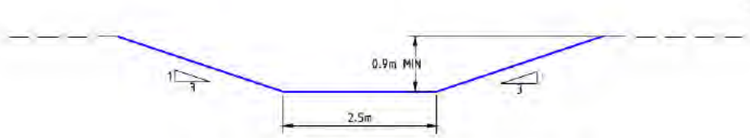


SECTION E SUMP
SCALE 1:500 — 008

SECTION F PROCESSING POND
SCALE 1:500 — 008

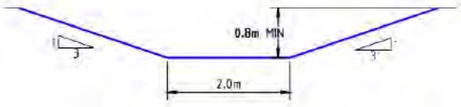


SECTION G RAW WATER POND
SCALE 1:500 — 008



DETAIL 4 CLEAN WATER DRAIN (CWD-A)
SCALE 1:100 — 003 008

DETAIL 5 CLEAN WATER DRAIN (CWD-B)
SCALE 1:100 — 008



DETAIL 6 DIRTY WATER DRAIN (DWD-A)
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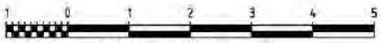

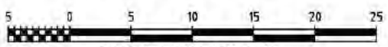

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
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SCALE: AS SHOWN	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
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PONDS AND DRAINS
SECTIONS AND DETAILS

DWG. No. 121089.01-011
SHEET SIZE A3 Rev. A

SHEET 1 OF 1

APPENDIX E ATC WILLIAMS - WATER MANAGEMENT PLAN

REPORT

TENNANT CONSOLIDATED MINING GROUP PTY LTD
ABN: 72 645 263 547

Nobles Nob
Water Management Plan

121089-01R002rev0-WMP
February 2022

TAILINGS.WATER.WASTE.

Document Control

Project Name:	Nobles Nob
Document Title:	Water Management Plan
File Location:	\\atcscmvpfps01\Synergy\Projects\121\121089 Nobles Nob\01 Water Mgmt Assess & Deposition Modelling\Documents\R02\Text
Document Number:	121089-01R002rev0-WMP.docx

Revision History

Revision	Issue	Issue Date	Prepared by	Reviewed by
A	Draft Issue	18/02/2022	MJ	NB
0	Final Issue	21/02/2022	MJ	MG

Issue Register

Distribution List	Format
Tennant Consolidated Mining Group	PDF

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CONTENTS

TABLES

PHOTOS

DIAGRAMS

GRAPHS

APPENDICES

1 INTRODUCTION

1.1 Background

Gold was first produced at the Nobles Nob mine site through underground operations from 1933 until 1967 when the crown pillar collapsed. In this time the underground production totalled approximately 828 koz of gold from 528 kt of ore. Nobles Nob was then mined from an open Pit between 1969 to 1985 which approximately produced 218 koz of gold from 1.46 Mt of ore.

Tennant Consolidated Mining Group Pty Ltd (TCMG) have control of the Nobles Nob project among other mine titles in the Tennant Creek area, and are planning 7 to 10 years of gold production. TCMG have estimated that there is 50,000 oz of gold below the existing Nobles Nob Pit floor and 80,000 oz of gold in the existing waste dumps and tailings.

1.2 Proposed Operations

The proposed initial stage of works is a planned 18-month timeframe involving processing the existing Mineralised Waste Dump material from historic extraction of the Noble Nob pit. This involves the establishment of an on-site processing plant and construction of a platform that will be used to stack Geotube dewatering tubes to store tailings. The processing plant includes on-site crushing and milling infrastructure and a Carbon in Leach (CIL) circuit where cyanide is added as part of the processing. The processing plant outputs a tailings slurry that is pumped to the Geotubes and dewatered.

The Geotubes are filled one tube at a time (via a pump) with the slurry tailings mixture from the processing plant where the slurry is dewatered through the geotextile lining of the Geotubes. The Geotubes dewatering process requires a polymer to be dosed to the tailings slurry to encourage flocculation of solids. The flocculation of solids allows maximum water expression, leaving a dry solid in the Geotubes. It is assumed the effluent from the Geotubes would be contaminated with cyanide and possibly other contaminates. The platform is therefore proposed to be lined with a Geomembrane liner (refer to the Concept Design report by ATCW **[2]**), and the effluent is proposed to be collected in a sump at the low point of the platform. The sump water is then pumped to the process pond before being re-used in the processing operations. It is proposed to stage the Geotubes platform construction into two main areas to reduce the initial extent of works.

The processing plant is proposed with a throughput of 0.7 million tonnes per annum using equipment relocated from the Great Australian Mine (GAM) **[7]**. The processing plant requires an external water supply, sourced from the Juno mine (approximately 4 km NW of Nobles Nob). This water is collected in a raw water pond for storage before being used in the processing operations.

The key equipment and infrastructure proposed as part of these operations are as follows:

- Geotubes and platform;
- Process Plant:
    - Primary Jaw crusher;
    - Secondary and Tertiary Cone Crushing;
    - Fine ore stockpile;
    - Reclaim Ore Feed bin;
    - Primary Ball Mill and Regrind ball mill;
    - Cyclone classification;
    - Gravity Circuit;
    - Leach and adsorption circuit totalling 24hrs residence time;
    - Zadra elution circuit and carbon regeneration;
    - Services and reagents
- Process Pond;
- Raw Water Pond;
- Clean Water and Dirty Water Drains;
- General infrastructure laydown areas.

1.3 Report Scope of Works

The proposed operations require a Mining Management Plan (MMP) to be approved under the NT Mining Management Act 2005. To support the MMP (by others), ATC Willilams (ATCW) have been engaged to provide a site water management plan for the initial eighteen (18) months of operations. This initial phase is referred to as Phase 1 of the project throughout this report. This report outlines the proposed water management measures to be implemented as part of the Geotubes operations and the outcomes from a Water Balance Model (WBM).

This report should be read in conjunction with ATCW's Concept Design Report **[2]**.

1.4 Legal and Regulatory Requirements

The mine has recently been operated under the **Mining Management Plan for the Tennant Creek Project – Nobles Nob and Juno [14],** approved under DPIR Authorisation Number 0925 (with the last amendment in 11/10/2018). However, a MMP must be developed for the proposed works and legislative and regulatory requirements apply to the site operations due to the environmental risks associated with mining activities. A MMP is required under the Mining Management Act 2001 **[11]**.

The Northern Territory government does not have any tailings dam specific guidelines, and therefore industry standards (ANCOLD), were used as the principal guideline when designing the water management aspects. The goal being to design solutions that provide a safe outcome and reduces the potential impacts to the surrounding environment. The following specific guidelines were used in the preparation of this report:

- ANCOLD Guidelines on Consequence Categories of Dams (2012) **[3]**
- ANCOLD Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure (2019) **[4]**

The proposed operations are subject to government legislation developed by the Northern Territory and the Australian government. The following legal and regulatory policies are relevant to the proposed works:

- Waste Management and Pollution Control Act (NT) 1998 **[8]**
- The Water Act (NT) 1992 **[10]**
- Environmental Protection Act (NT) 2019 **[12]**
- Environment Protection and Biodiversity Conversation Act 1999 (EPBC Act) **[1]**

The Waste Management and Pollution Control Act (NT) 1998, is in place for the "protection of the environment through encouragement of effective waste management and pollution prevention and control practices and for related purposes" **[8]**. This applies to the site as the proposed operations may need environmental protection approval under Schedule 2, Part 1.

The Water Act (NT) 1992 **[10]**, is in place to "provide for the investigation, allocation, use, control, protection, management and administration of water resources, and for related purposes" **[10]**. Nobles Nob is within the Tennant Creek Water Control District, and a licence is required to extract or intercept surface water or groundwater. It is understood that a Water Allocation Plan is being prepared (by others) for the operations.

Environmental Protection Act (NT) 2019 **[12]**, is in place to "provide for the protection of the environment and for related purposes" **[12]**. At this stage, it is not anticipated that an Environmental Impact Statement is required as no significant impacts to the environment are proposed as part of the operations.

Environment Protection and Biodiversity Conversation Act 1999 (EPBC Act) **[1]**, is the "Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as matters of national environmental significance" **[1]**. No significant or highly significant natural habitats or important ecological function areas within the project area were identified in the Fauna report 'Excalibur Mining Corporation Ltd. Tennant Creek Project Baseline Fauna Survey Final Report' by FaunAssess **[8]**.

1.5 Report Summary and Structure

Effluent from the Geotubes is likely to contain pollutants that should not be discharged directly to the downstream waterways. It is therefore proposed that the Geotubes platform captures process water expressed from the Geotubes within a sump and bunding around the low side of the platform. Water captured within the sump will be pumped to the Process Pond, where it will be re-used as process water within the processing plant. In extreme rainfall events, runoff can overtop the sump and discharge to the site Pit for containment. All surface water runoff from the Geotubes operational and processing areas are proposed to be captured within site conveyance systems and directed to the Pit to prevent contact water discharges to downstream watercourse(s). The Process Pond and Raw Water Pond have been designed to have a less than a 1% spill risk during the Phase 1 operational period. During extreme events, overtopping flows from the ponds can discharge to the Pit for containment.

The Geotubes platform design alters the mine lease area catchments and discharges a significantly larger area to the Pit when compared to the existing conditions. It is proposed to install clean water diversions wherever possible to divert flow away from the Geotubes and the Pit to reduce the contributing catchment area. The existing catchment to the Pit is approximately 36.9 ha, whereas the proposed catchment area to the Pit is 48.2 ha (assuming all storages are overtopping). The WBM conducted demonstrates that the Pit is unlikely to overtop (<1% spill risk) over the Phase 1 operational period. An ANCOLD Consequence Category Assessment of the Geotubes platform and Process Pond found that the storages fall under the 'Very Low' consequence category, and do not require a Design Storage Allowance or Extreme Storm Storage to be added to the pond volumes.

The Geotubes platform is proposed to be constructed in two main stages to reduce the initial earthworks required. Progressive capping and rehabilitation of Stage 1 should therefore commence as soon as practical to reduce the catchment area discharging to the Geotubes sump and reduce potential overflows to the Pit. Capping of the Geotubes is required to prevent potential containments being discharged from the Geotubes landform. Rehabilitation of disturbed surface areas should be undertaken progressively, and surface flow should be diverted away from the Pit wherever practical. Any subsequent operational phases should also aim to divert surface flows away from the Pit wherever practical. Ongoing testing of Geotubes effluent water quality and water captured in the Pit should be implemented and actively monitored throughout the operations.

The report structure is as follows:

Section 2: Project Site

Provides a brief description of the project site and the regional climate.

Section 3: Desktop Contaminant Source Study

Presents a desktop contaminant source study.

Section 4: Consequence Category Assessment (CCA)

Presents a basic Consequence Category Assessment.

Section 5: Hydraulics and Hydrology

Description of dirty water and clean water drain sizing as well as spillway sizing.

Section 6: Water Balance Model

Presents the site water balance model and results.

Section 7: Rehabilitation and Closure

Description of concept closure phase water management aspects.

Section 8: Conclusions

States the conclusions and recommendations.

2 PROJECT SITE

2.1 Background

The Nobles Nob site has an extensive history of both underground and open cut mining for gold. The last major operations ceased in 1985, with the site remaining predominantly inactive since that time. TCMG now have control over the Nobles Nob site, in addition to other sites in the Tennant Creek area. Operations are proposed at Nobles Nob to initially process Mineralised Waste Dump material using an on-site processing plant and Geotubes dewatering tubes to store tailings.

2.2 Site Location

The Nobles Nob mine site is located approximately 13 km south-east of Tennant Creek in the Northern Territory (refer to **Diagram 1**). The site consists of the following significant features:

- Open Cut Pit;
- Existing Tailings Storage Facilities (TSFs);
- Mineralised Waste Dump;
- Associate mine infrastructure areas.

Refer to **Appendix A – Nobles Nob Site Features** that illustrates the general site features.

Nobles Nob forms part of the larger Tennant Creek Project that TCMG own, and includes several other sites in the local area. The following mine titles are applicable to Nobles Nob: MLC512-MLC517, MLC521, MLC525-MLC526, MLC537-MLC545, MLC548-MLC550, MLC556, MLC589-MLC590, MLC688-MLC691 (refer to **Diagram 2**).

DIAGRAM 1 – SITE LOCATION

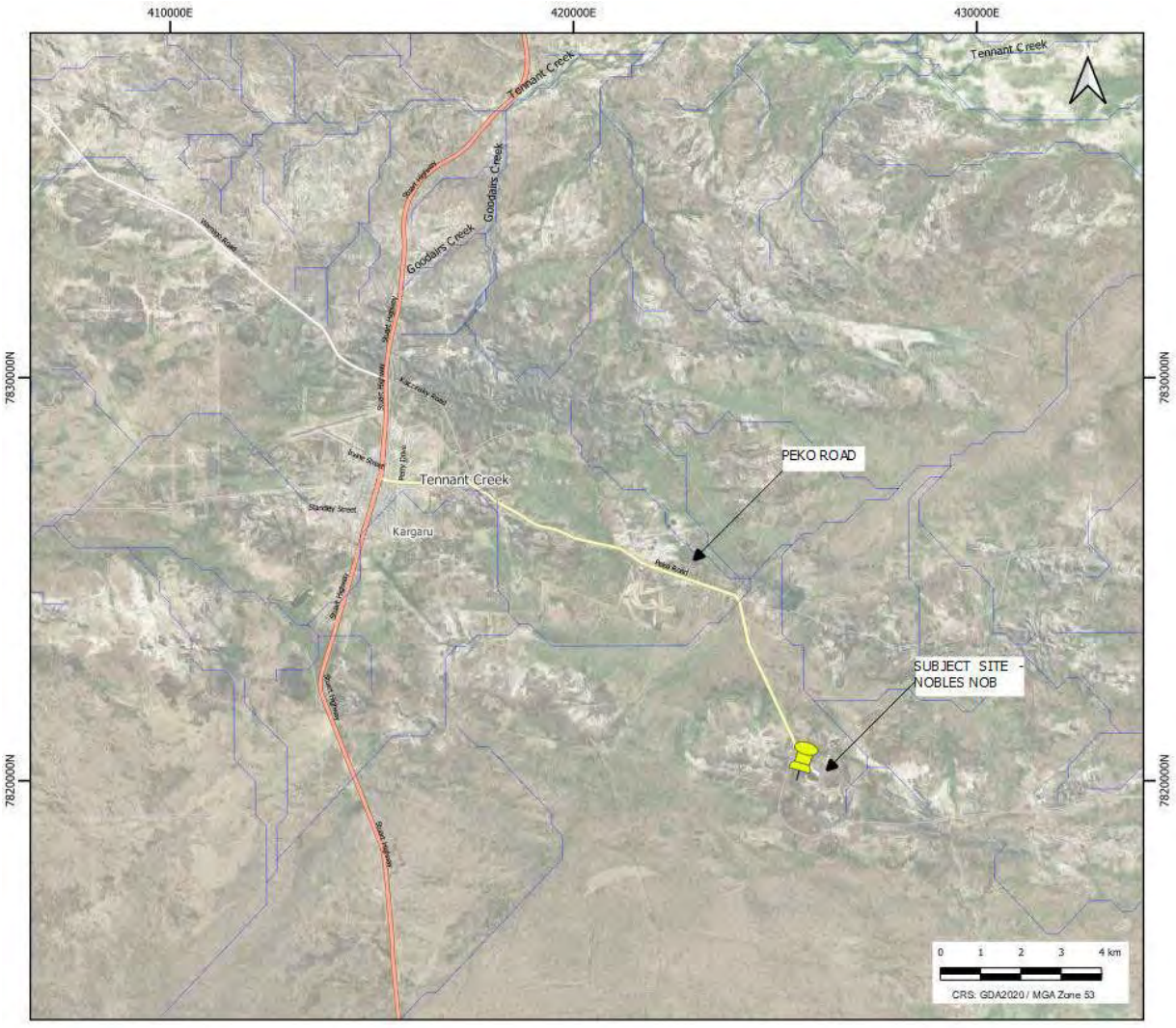
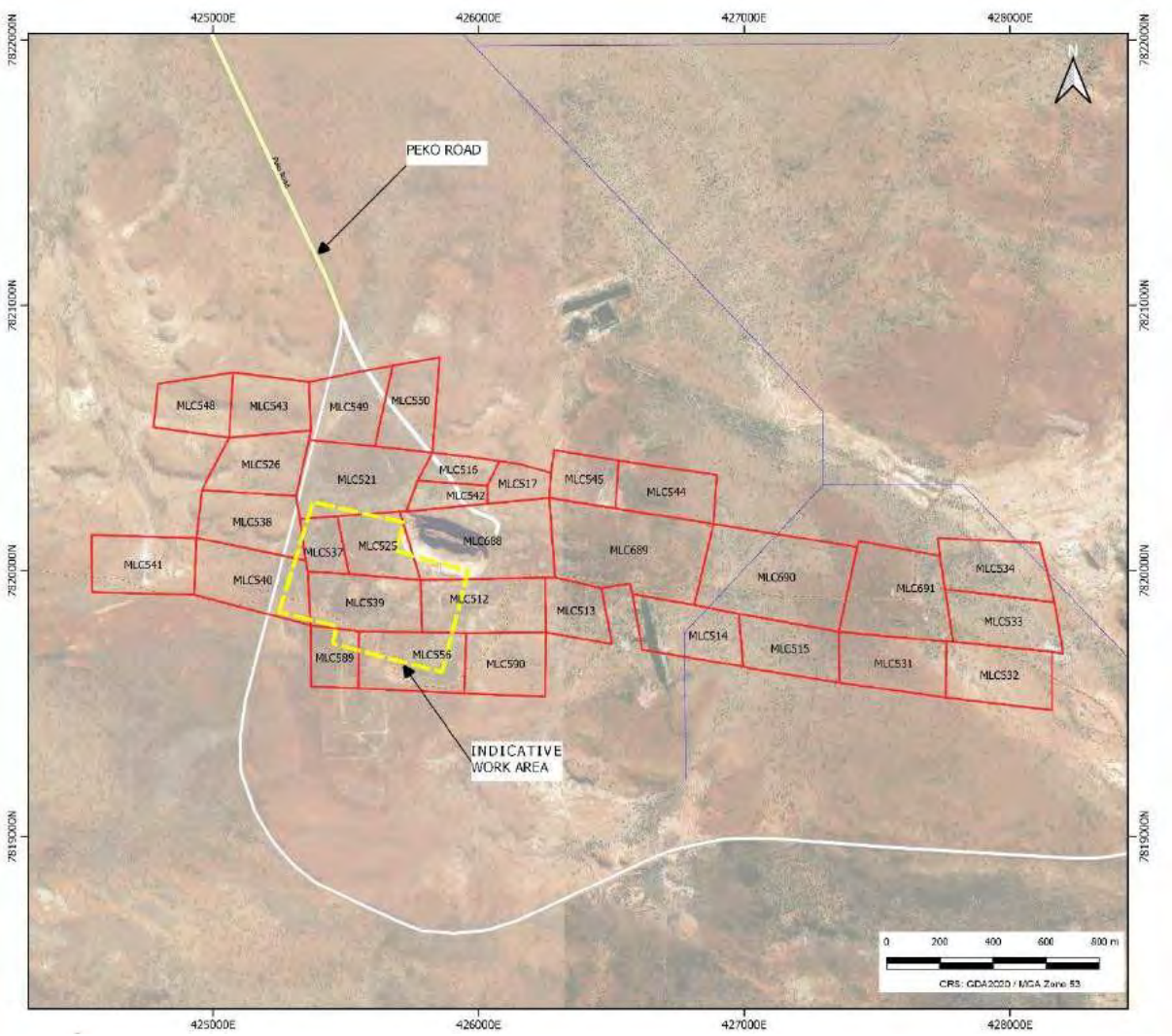


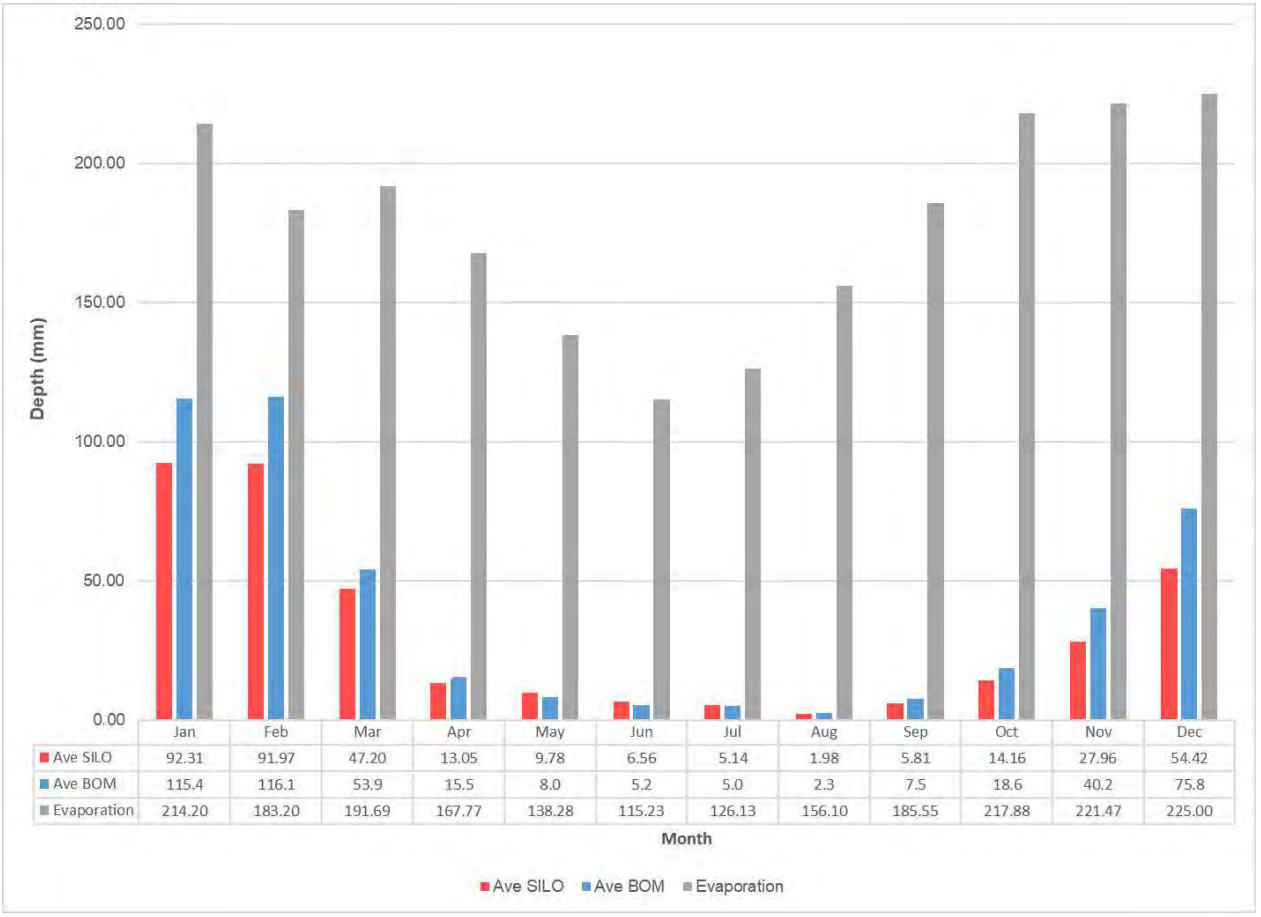
DIAGRAM 2 – NOBLES NOB MINE TITLES



2.3 Climate

The Tennant Creek area is a subtropical climate with summers that are long, hot, and mostly cloudy and the winters are short, dry, windy, and mostly clear. The climate has defined wet season typically throughout the summer months (November to March). Monthly rainfall statistics were sourced from BOM's **[6]** available data at the Tennant Creek Airport station from 1970 to 2020. Point location SILO data **[13]** from 1889 to 2020 for rainfall and evaporation was also extracted for the site. **Graph 1** illustrates the BOM and SILO climate statistics.

GRAPH 1 – CLIMATE AVERAGES IN TENNANT CREEK



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave SILO	92.31	91.97	47.20	13.05	9.78	6.56	5.14	1.98	5.81	14.16	27.96	54.42
Ave BOM	115.4	116.1	53.9	15.5	8.0	5.2	5.0	2.3	7.5	18.6	40.2	75.8
Evaporation	214.20	183.20	191.69	167.77	138.28	115.23	126.13	156.10	185.55	217.88	221.47	225.00

2.4 Topography and Hydrology

The site topography generally comprises rocky and undulating hills, with low lying grasses and sparse tree cover (refer to **Photo 1** for typical site conditions). Rehabilitation of some site surfaces has been undertaken in the past using a loose cover material (refer to **Photo 2**). These areas appear to have reduced vegetation cover and include areas over the TSFs and Mineralised Waste Dump.

PHOTO 1 – TYPICAL SITE CONDITIONS

PHOTO 2 – EXISTING TSF BATTER

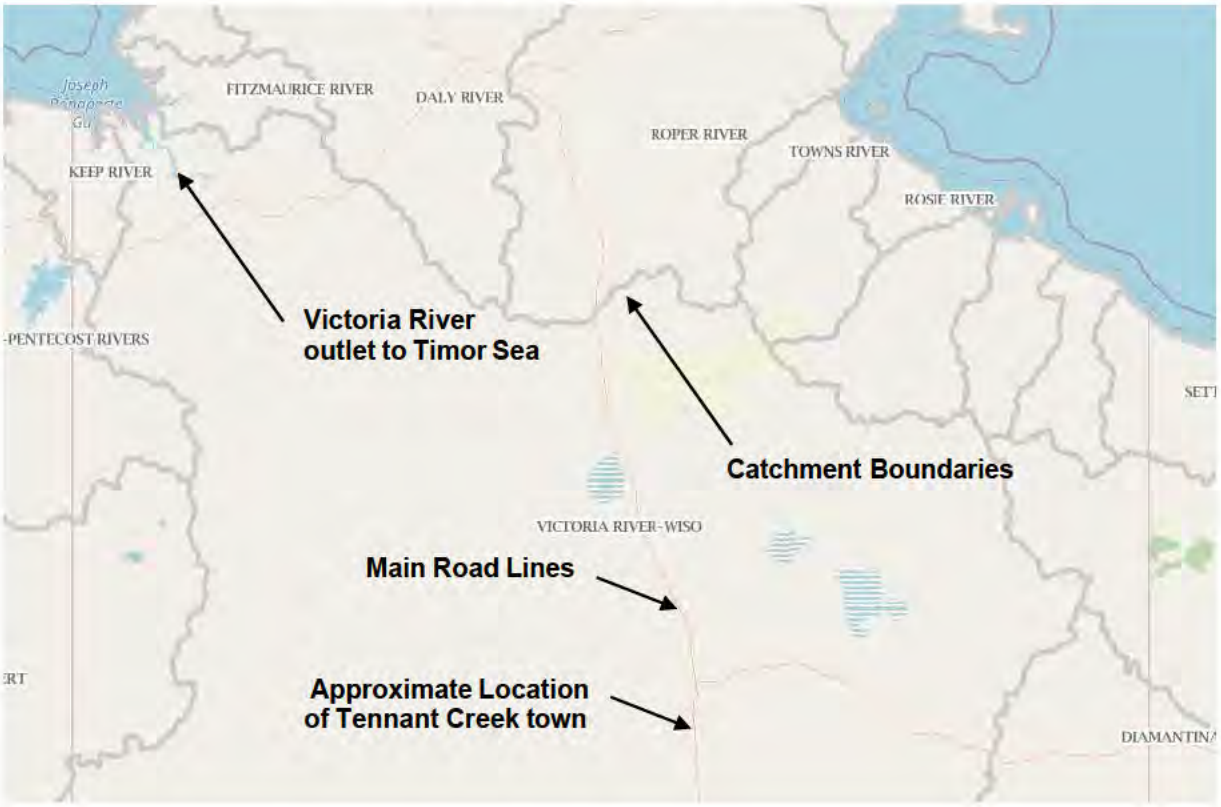
Mine site elevations range from approximately RL 355.0 m AHD at the Peko Road access to the site, to RL 376.0 m AHD at the crest of the Mineralised Waste Dump, and RL 296.0 m AHD at the base of the Pit. Surface flows across the mine site would predominately be conveyed as sheet flow over 50-100 m before channelising, forming local flow paths which convey flows to one of three main existing points of discharge. A large extent of site surface areas discharge to the Pit, where runoff is captured and eventually evaporates. The existing catchment to the Pit is approximately 36.9 ha.

Within the southern and western extents of the proposed works area, approximately 24.3 ha of catchment discharges to the north/northwest along Peko Road. A portion of the Mineralised Waste Dump catchment area discharges east to an existing pond. Refer to **Diagram 3** that illustrates the existing catchment boundaries.

DIAGRAM 3 – EXISTING CATCHMENTS

Flow from the site area would contribute to flows in local tributaries that head north/northwest and eventually discharge to the Tennant Creek watercourse approximately 25 km downstream of the site. Tennant Creek is within the Western Plateau Drainage Division, contributing to the Victoria River catchment. This ultimately discharges to the Timor Sea some 800 km downstream, refer to **Diagram 4**.

DIAGRAM 4 – VICTORIA RIVER CATCHMENT



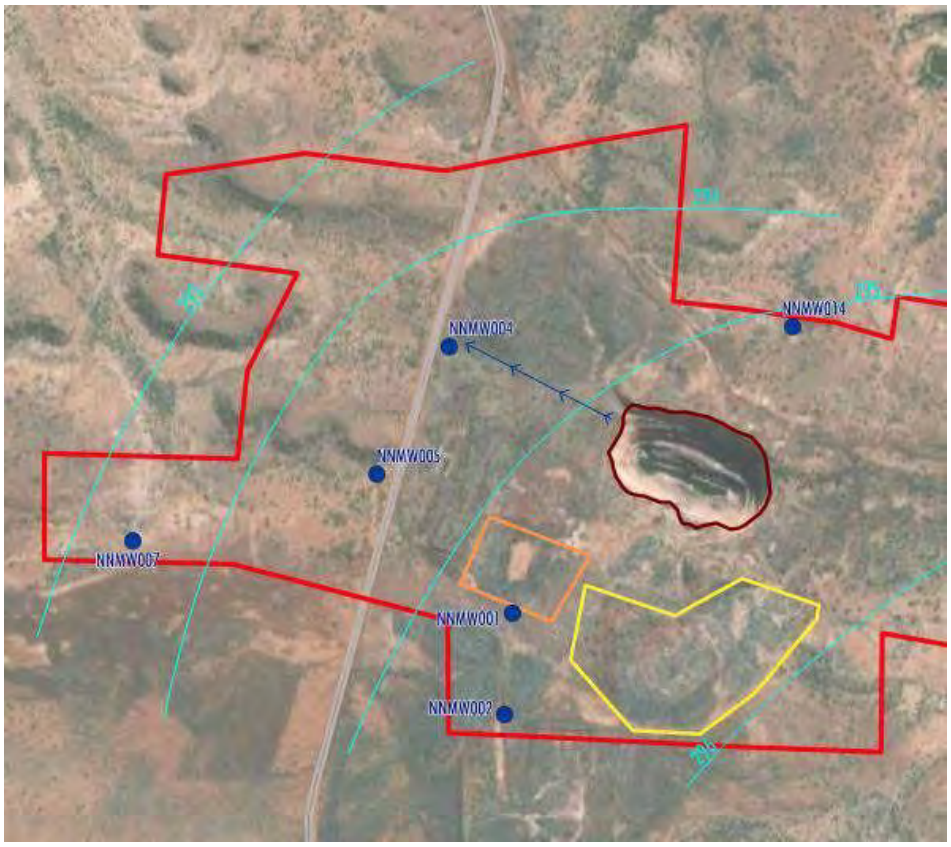
2.5 Hydrogeology

A Groundwater Assessment Report has been prepared by Umwelt **[15]** and the outcomes from this report are summarised below:

Several registered groundwater monitoring bores are present within 2.5 km of the site, most of which were found to be mine exploration bores with very little to no water encountered during drilling. Ten (10) monitoring bores were installed at the Nobles Nob site to estimate the hydraulic parameters of the groundwater system. Values of hydraulic conductivity ranged from 0.0105 m/day to 0.681 m/day across the site. Recorded groundwater elevations ranged from RL293 m AHD to RL296 m AHD across the site, noting that this did not include possible seasonal fluctuations. The groundwater flow direction appears to be similar to the regional flow direction of northwest, as illustrated in **Diagram 5**.

No groundwater levels in the Pit were provided, however, the Pit appears to have a permanent water level of around RL296 m AHD. It is inferred that this permanent water level coincides with the regional water table level as it generally aligns with the groundwater levels recorded in the bores.

DIAGRAM 5 – EXTRACT OF ASSUMED SITE GROUNDWATER CONTOURS



Extracted from Umwelt **[15]**

3 DESKTOP CONTAMINANT SOURCE STUDY

3.1 Objective

A desktop Contaminant Source Study (CSS) has been conducted for the site and is summarised in the following sections. The objective of the CSS is to identify potential sources of contaminants within the site that could be detrimental to the downstream environment if released.

This section should be updated following any updated or additional detailed geochemistry investigation/s.

3.2 Receiving Environment

3.2.1 Regulatory Context

Long-term monitoring locations in accordance with NT government and EPA requirements should be implemented on-site to enable both groundwater and surface water quality monitoring.

3.2.2 Environmental Values and Beneficial Users

The primary tool for managing and protecting the Territory's water resources is the Northern Territory (NT) Water Act 1992 **[10]**. The NT EPA also has a role in preventing pollution of waterways under the Environmental Protection Act 2019 **[12]** and the Waste Management and Pollution Control Act 1998 **[8]**, and supports the Northern Territory Government's role in preventing pollution under other legislation.

The principle objective being that anyone who holds a licence or approval must make sure that they do not do anything which adversely affects the beneficial uses, water quality standards, criteria or objectives that have been set. No site-specific water quality targets are specified in the Water Act and will therefore need to be set by the NT government for the proposed mining operations.

3.3 Water Quality Monitoring

Water quality monitoring of the stored water within the Nobles Nob Pit and surrounding ponds was conducted in August 2018. A selection of the results from this water sampling investigation is illustrated in **Table 1**, with the remaining results attached to **Appendix C**. Noting that the eastern pond collects some runoff from the Mineralised Waste Dump.

TABLE 1 – WATER QUALITY SAMPLE RESULTS

Quality Characteristic	Unit	Eastern Pond (Location #1)	Pit (Location #4)
pH	pH Units	8.5	6.9
Electrical Conductivity	µS/cm	4,100	140
Total Dissolved Solids	mg/L	2,400	84
Total Suspended Solids	mg/L	5	420
Turbidity	NTU	1	810
Sulphate, SO4	mg/L	360	1
Total Zinc	mg/L	2	17
Total Molybdenum	mg/L	<1	<1
Total Arsenic, As	mg/L	<1	1
Total Cadmium, Cd	mg/L	<0.1	<0.1
Total Copper, Cu	mg/L	9	11
Total Lead, Pb	mg/L	<1	<1
Total Selenium, Se	mg/L	16	<1
Total Manganese, Mn	mg/L	<5	230

3.4 Saline, Metalliferous and Acid Rock Drainage

A Waste Rock Characterisation report has been developed by Umwelt **[15]**, which concludes that the existing waste rock is likely Non-Acid Forming (NAF) and acidic drainage is unlikely. Some further points from the report indicated that:

- The waste rock samples were enriched with Molybdenum (Mo) and one sample from the ROM pad area was enriched with Mercury (Hg).
- The results indicate that samples from the waste rock dump also have the potential for metalliferous drainage enriched in Aluminium (Al), Chromium (Cr), Copper (Cu), and Zinc (Zn) however, were not found in significant abundance.
- Saline drainage from the waste rock dump was found to be less likely.

The ATCW site visit also found that some seepage from the existing TSF batters was evident at the surface as illustrated in **Photo 3**. Groundwater for the area is also known to be highly saline **[15]**.

PHOTO 3 – SALT OVER PART OF THE EXISTING TAILINGS SURFACE

3.5 Geotubes Effluent

The processing plant proposes to adopt a carbon in leach (CIL) circuit whereby cyanide would be added to the leach tanks as required. The Geotubes dewatering process subsequently has the potential to result in high cyanide concentrations within the effluent from the Geotubes. It is assumed that there may also be salt and pH exceedances within the effluent as well.

No detailed geochemical investigation has been conducted for the existing tailings or slurry material from the processing plant. The potential contaminants and water quality is therefore unconfirmed at this stage in the concept design phase. Further investigation through Geotube trials should be conducted prior to the detailed design phase to provide a better indication of the expected effluent water quality.

3.6 Potential Contaminant Sources

Based on the preceding information, the conceptual potential contaminant sources identified within the site are presented in **Table 2**.

TABLE 2 – POTENTIAL CONTAMINANT SOURCES

Potential Contaminant Source	Likely Contaminants	Comments
Mine infrastructure areas and ROM	Suspended solids, possible Mercury.	Discharge general disturbed operational areas to the Pit.
Mineralises Waste Dump	Suspended solids, Molybdenum, Total Dissolved Solids, Sulphate, Aluminium, Chromium, Copper and Zinc, Selenium.	Assumed from waste rock characterisation sampling. Majority of the landfom discharges to the Pit, some discharge east to an existing pond.
Tailings Material and Geotubes	Suspended solids, metals, Saline drainage, also likely to have cyanide concentrations.	Assumed from site photos, to be confirmed from site sampling and trial runs. Containment and conveyance structures are to be provided to prevent the release of contaminants from the site works area. Extreme weather event flows are to be directed to the Pit.
Pit	Suspended solids, Total Dissolved Solids.	Assumed from water sampling tests.

4 CONSEQUENCE CATEGORY ASSESSMENT (CCA)

4.1 Objectives

In accordance with the Australian National Committee on Large Dams (ANCOLD) **[3]**, a Consequence Category Assessment (CCA) is required for any fluid retaining structures to assess the potential severity of damage and loss, in conjunction with the risk to human life resulting from a dam failure. The ANCOLD guidelines comprise dam failure consequences and environmental spillway consequences.

4.2 Assessment

Both the Geotubes platform (including the sump) and the Process Pond have been identified as requiring a CCA to estimate the potential downstream impacts if either structure was to fail. This is due to the Geotubes Platform and Process Pond storing large volumes of contaminated slurry or water. The Raw Water Pond is not considered a significant structure due to the small volume and uncontaminated water that will be stored in the pond.

4.2.1 Failure Scenario

Two main failure scenarios are considered for the CCA:

A. The failure scenario for the Geotubes involves any single tube failing during the pumping of slurry or whilst the tube is dewatering (noting the largest tube contains approximately 2 ML). A tube failure will first flow to the middle of the eastern bunded extent of the platform towards the sump for containment. If this occurred during heavy rainfall, the flow from a failure could overtop the sump bund and discharge NE to the Pit. Under an extreme rainfall event, another possible but unlikely failure scenario is a tube failing and discharging to Peko Road from the western or southern side of the platform.
B. The failure scenario for the Process Pond (3.5 ML) is a loss of the stored water within the pond to the surrounding environment. The volume would be conveyed NE towards to the Pit under gravity flow conditions, within proposed conveyance structures.

4.2.2 Population at Risk

The Population at Risk (PAR) is a key indicator in characterising off-site impact. The possible location of public (off-site) impact is traffic along Peko Road to the north and west of the site (refer to **Diagram 1**). Peko Road is considered a rural road with low traffic volumes **[13]**, particularly along the section of road adjacent to Nobles Nob. It could also be possible that a person/s could be near the site in association with cattle management. However, the numbers and exposure time are considered insignificant for both of these impact areas due to the low volumes of traffic and the failure storages proposed (such as Geotubes platform bunding and the Pit).

It is therefore considered that there is a very low population at risk (i.e. PAR<1) immediately near the proposed locations of the operations, hence the potential loss of life PLL is neglected and highly improbable.

4.2.3 ANCOLD Tables of Assessment

The assessment criteria from ANCOLD **[3]** as illustrated in **Table 3** has been used to develop the CCA for the proposed Geotube operation.

TABLE 3 – SEVERITY LEVEL IMPACTS ASSESSMENT (ANCOLD [3])

Damage Type	Minor	Medium	Major	Catastrophic
Infrastructure (dam, houses, commerce, farms, community)	<$10M	$10M-$100M	$100M-$1B	>$1B
Business importance	Some restrictions	Significant impacts	Severe to crippling	Business dissolution, bankruptcy
Public health	<100 people affected	100-1000 people affected	<1000 people affected for more and one month	>10,000 person months or numerous business failures
Social dislocation	<100 person or <20 business months	100-1000 person or 20-200 business months	>1000 person or >200 business months	>10,000 person months or numerous business failures
Impact area	<1km²	<5km²	20km²	>20km²
Impact duration	<1 year	<5 years	<20 years	>20 years
Impact on natural environment	Damage limited to items of low conservation value (e.g. degraded or cleared land, ephemeral streams, non-endangered flora and fauna). Remediation possible.	Significant effects on rural land and local flora and fauna. Limited effects on: A. Items of local and state natural heritage B. Native flora and fauna within forestry, aquatic and conservation reserves, or recognised habitat corridors, wetlands or fish breeding areas.	Extensive rural effects. Significant effects on river system and areas A and B. C. Items of National or world natural heritage D. Native flora and fauna within national parks recognised wilderness areas, RAMSAR wetlands and nationally protected aquatic reserves Remediation difficult.	Extensive affects areas A and B. Significantly affects areas C and D. Remediation involves significantly altered ecosystems.

The above criteria has been adopted to conduct the CCA for the Geotubes and Process Pond, with the results summarised in **Table 4**.

TABLE 4 – CONSEQUENCE CATEGORY ASSESSMENT

DAMAGE TYPE	CATEGORY AND IMPACT	GEOTUBES PLATFORM COMMENTARY	PROCESS POND COMMENTARY
Infrastructure (dam, houses, commerce, farms, community)	**MINOR** <$10m	No significant infrastructure has been identified on the expected failure path. Therefore, impacts on external infrastructure are expected to cost less than $10 million to repair, rehabilitate or remediate.	No significant infrastructure has been identified on the expected failure path. Therefore, impacts on external infrastructure are expected to cost less than $10 million to repair, rehabilitate or remediate.
Business importance	**MINOR** Some restrictions	Site operations would require a temporary suspension, with staff evacuated, returning only once the site is made safe and operable.	Site operations would require a temporary suspension, with staff evacuated, returning only once the site is made safe and operable.
Public health	**MINOR** <100 People affected	No population at risk (PAR<1) has been identified. Additionally, it is likely that the majority of volume from a failure would discharge to the site Pit, where water would be captured. No significant river/channels were identified near to the area; the closest town is approx. 13 km away.	No population at risk (PAR<1) has been identified. Additionally, it is likely that the volume from a failure would discharge to the site Pit, where water would be captured. No significant river/channels were identified near to the area; the closest town is approx. 13 km away.
Social dislocation	**MINOR** <100 persons or <20 business months	Based on the impacts assessment undertaken, no dislocation of people would be expected or impacts to business downstream. Peko Road provides access to the Nobles Nob Mine; however, it is expected that repairs could be undertaken quickly.	Based on the impacts assessment undertaken, no dislocation of people would be expected or impacts to business downstream. Peko Road provides access to the Nobles Nob Mine; however, it is expected that repairs could be undertaken quickly.
Impact Area	**MINOR** <1km²	Impact area is not expected to exceed 1 km².	Impact area is not expected to exceed 1 km².
Impact Duration	**MINOR** <1 year	The time required to repair (or replace) a broken Geotubes tube and restore full site operations and remediate environment is expected to be less than 1 year.	The time required to repair (or replace) the pond and restore full site operations and remediate environment is expected to be less than 1 year.

DAMAGE TYPE	CATEGORY AND IMPACT	GEOTUBES PLATFORM COMMENTARY	PROCESS POND COMMENTARY
Impact on natural environment	**MINOR** Damage limited to items of low conservation value (e.g. degraded or cleared land, ephemeral streams, non-endangered flora and fauna). Remediation possible.	Tailings from the Geotubes could be high in contaminant concentrations, however, is likely to be contained within the platform/sump in the event of a failure. If during a heavy rainfall event, a tube failed the volume would discharge to the Pit or possibly to Peko Road. The areas that would be inundated are considered degraded and of low conservation value.	The storage would discharge to the site Pit, where it is unlikely to create a significant impact on the natural environment.
OVERALL	**MINOR**		

4.3 Results

As detailed in **Table 4** the CCA has an overall 'Minor' consequence category in accordance with ANCOLD **[3]**. As a result, with a PAR <1 (hence PLL is neglected), the resulting Severity of Damage and Loss has been categorized as 'Very Low' as per **Table 5**. Therefore, no Design Storage Allowance or Extreme Storm Storage Allowance is deemed required of the storages. However, additional controls have been adopted to the site operations as described in **Table 6**.

TABLE 5 – CONSEQUENCE CATEGORIES BASED ON PAR

Population at Risk (PAR)	Severity of Damage and Loss			
	Minor	Medium	Major	Catastrophic
<1	**Very Low**	Low	Significant	High C
≥1 to <10	Significant (Note 2)	Significant (Note 2)	High C	High B
≥10 to <100	(Note 1)	High C	High B	High A
≥100 to <1,000		High B	High A	Extreme
≥1,000		(Note 1)	Extreme	Extreme

Note 1: With a PAR in excess of 100, it is unlikely damage will be minor. Similarly with a PAR in excess of 1,000 it is unlikely damage will be classified as medium.

Note 2: Change to 'High C' where there is the potential of one or more lives being lost.

TABLE 6 – ANCOLD DESIGN CRITERIA ADOPTED

Parameter	'Very Low' Design Criteria	Adopted Design Criteria
Design Storage Allowance (DSA)	No DSA required	Geotubes platform to have a bunded containment volume over and above the sump volume for the largest single tube (2ML) if it failed. Process Pond volume designed to have a less than 1% chance of spilling during the operational period.
Extreme Storm Storage (ESS) Allowance	No storm storage required	Platform is bunded for additional storage containment in large events. Overtopping flows to discharge to the Pit in extreme rainfall events.
Wave Runup	N/A	N/A
Additional Freeboard	N/A	N/A
Spillway Design Flood	N/A	1:100 AEP

It is recommended that TCMG develop a detailed operational plan in the event of a failure to outline risks and the methodology that should be conducted by site personnel.

5 HYDRAULICS AND HYDROLOGY

5.1 Drain Sizing

Both clean water and dirty water drains are proposed as part of the water management strategy for the site. Clean water drains are proposed to discharge runoff from existing vegetated surfaces that are not part of the proposed operations. A dirty water drain is proposed to capture any overtopping flows from the Geotubes platform and to convey the effluent from the Geotubes.

Refer to Drawing 008 of **Appendix B** that illustrates the drain locations.

TABLE 7 – CONCEPT DRAIN SIZING

Parameter	Clean Water Drains	Dirty Water Drains
Hydrological Method	Rational Method	Rational Method
Coefficient of Runoff C_{10}	0.49	0.49
Catchment Area (ha)	CWD A = 22.62 CWD B = 9.24	DWD A = 7.5 Effluent DWD = 3.5
Time of Concentration (min)	CWD A = 49.0 CWD B = 19.0	DWD A = 10.0 Effluent DWD = 10.0
Depth (m)	CWD A = 0.90 CWD B = 0.90	DWD A = 0.80 Effluent DWD = 0.50
Drain Base Width (m)	CWD A = 2.0 CWD B = 1.5	DWD A = 2.0
Drain Side Slopes	4H:1V	DWD A = 3H:1V Effluent DWD = 2H:1V
1% AEP Peak Flow (m^3/s)	CWD A = 4.76 CWD B = 3.02	DWD A = 2.06 Effluent DWD = 1.0
Manning's 'n'	0.035 for a lightly vegetated channel	0.020 for excavated earth and/or lined drain

5.2 Spillway Sizing

Indicative spillway sizing for the storage structures are illustrated in **Table 8**.

TABLE 8 – CONCEPT SPILLWAY SIZING

Parameter	Process Pond	Raw Water Pond	Geotubes Sump
Hydrological Method	Rational Method	Rational Method	Rational Method
Coefficient of Runoff C_{10}	0.49	0.49	0.49
Catchment Area (ha)	0.45	0.25	7.50
Time of Concentration (min)	5	5	10
Depth (m)	0.5	0.5	0.6
Base Width (m)	3.0	3.0	8.0
Side Slopes	1:2	1:2	1:2
1% AEP Peak Flow (m^3/s)	0.23	0.13	2.06
Manning's 'n'	0.050 Rock lined	0.050 Rock lined	0.050 Rock lined

6 WATER BALANCE MODEL

6.1 Objectives

The principal objective of this Water Balance Model (WBM) is to estimate the water level and volumes of the site storages during the Phase 1 operational period. The following sections outline the methodology conducted to achieve this objective.

6.2 Operational Storages

Four significant on-site storages form part of the proposed Geotubes operations and have been included in the WBM. The storages are as follows:

- Site Pit (existing)
- Process Pond
- Raw Water Pond
- Geotubes Sump

Primary water balance inputs for site storages are outlined in **Table 9**, estimated from the available elevation data.

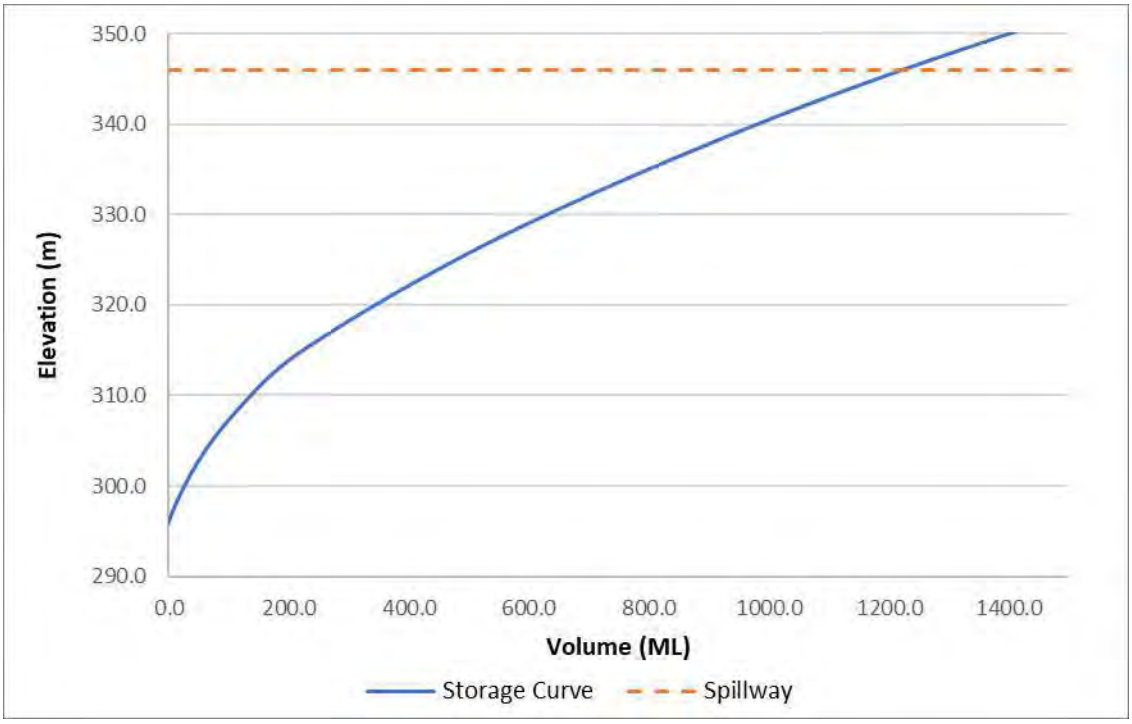
TABLE 9 – SITE STORAGE CAPACITIES

Storage	Spillway Elevation (m AHD)	Max Storage Capacity	Initial Water Level	Assumed Maximum Groundwater Level
Pit	RL 346.0	1223 ML	RL 296.2 (base of survey*)	RL 296.0 m
Raw Water Pond	RL 356.0	2.0 ML	RL 355.0 (assuming pond starts with 1.0 m of stored water)	RL 295.5 m
Process Pond	RL 356.0	3.5 ML	RL 354.0 (empty)	RL 295.5 m
Geotubes Sump and Platform	RL 358.50	3.8 ML	RL 354.5 (empty)	RL 295.5 m

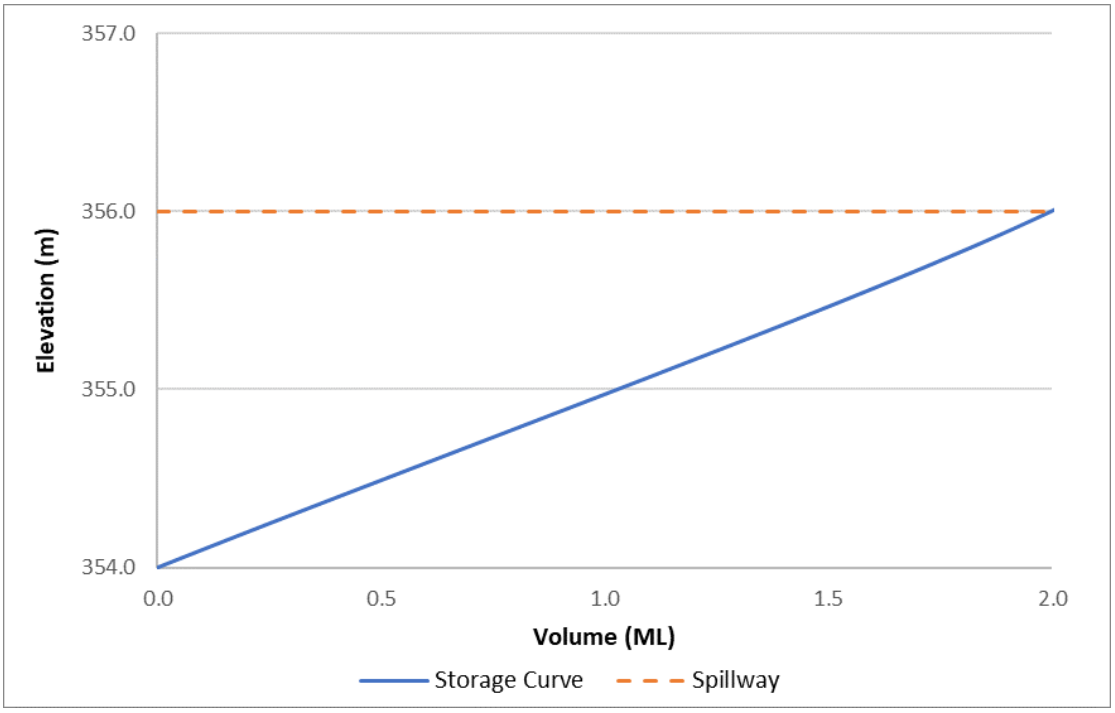
*Note that the Pit storage curve is not a bathometric survey and therefore the base of the storage curve has been taken as the permeant water level in the Pit.

Initial water levels were based off aerial imagery, design levels, and groundwater contours for the site. Storage curves are illustrated in **Graph 2** to **Graph 5**, and were generated using the elevation data described in **Section 6.3.2.**

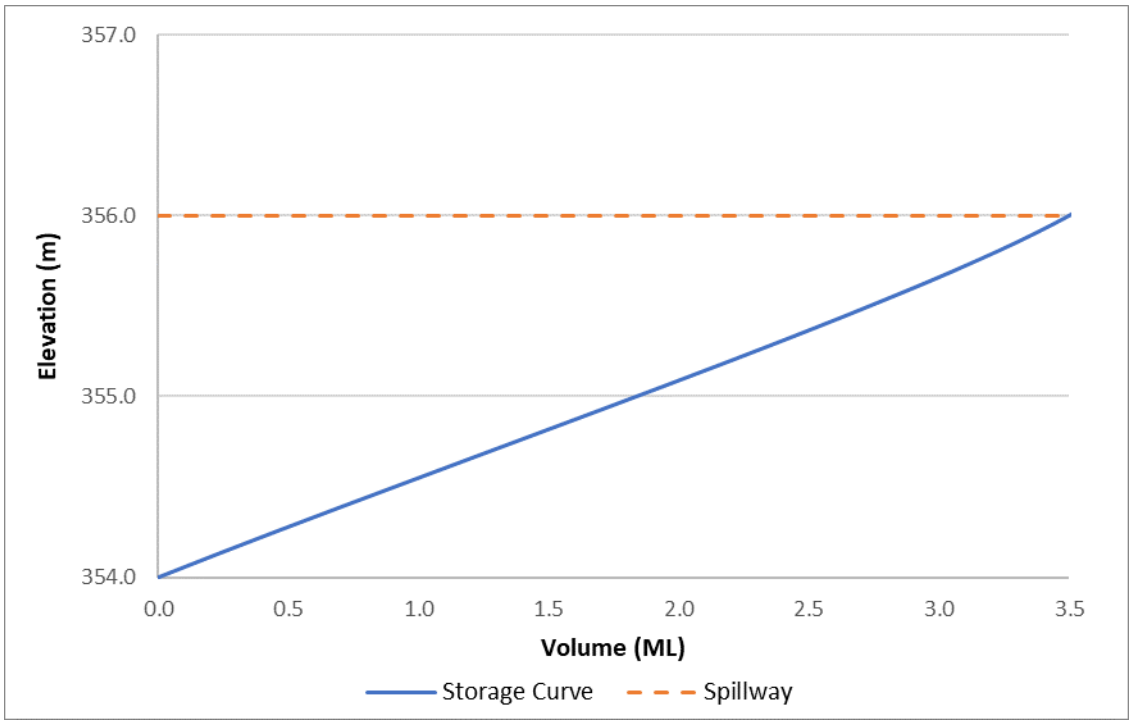
GRAPH 2 – PIT STORAGE CURVE



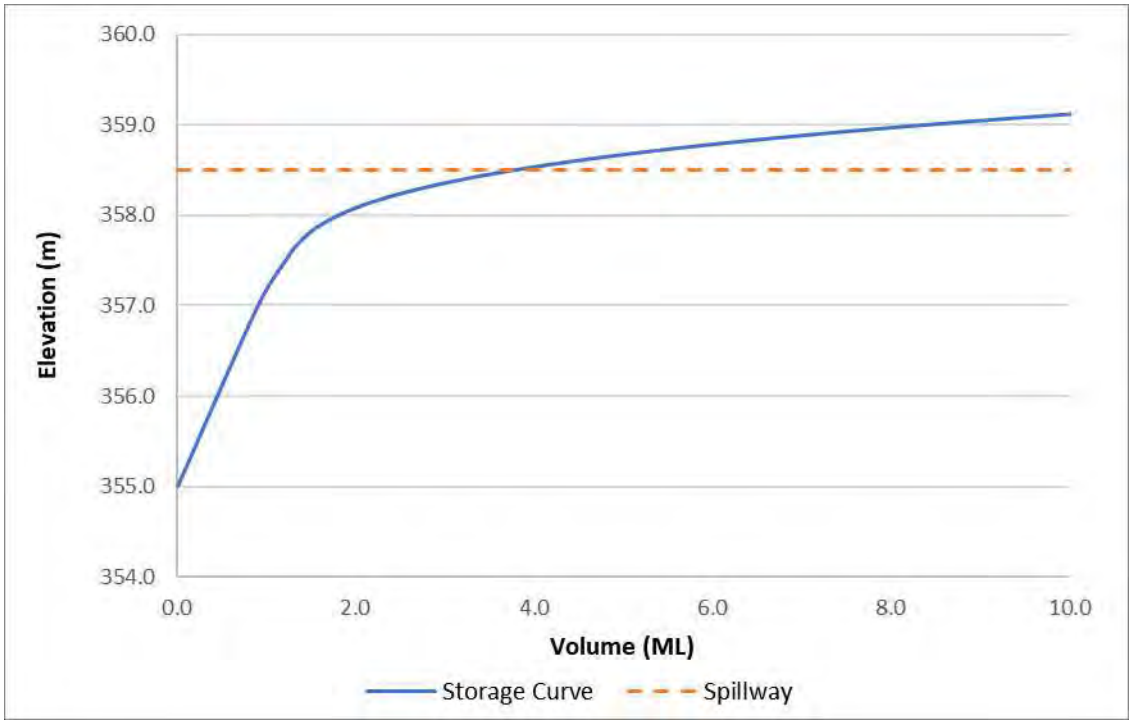
GRAPH 3 – RAW WATER POND STORAGE CURVE



GRAPH 4 – PROCESS POND STORAGE CURVE



GRAPH 5 – GEOTUBES SUMP AND PLATFORM STORAGE CURVE



6.3 Data and Assumptions

6.3.1 Climate Data

The rainfall data adopted for the model was sourced from SILO **[13]** which is an enhanced database for Australian climate data and has available data dating back to 1889. It is hosted by the Science Delivery Division of the Department of Science, Information Technology, Innovation and the Arts (DSITIA) which also provides other daily meteorological datasets such as evaporation and evapotranspiration data suitable for modelling purposes. Rainfall for the period from 1889 to 2020 was downloaded for use in the model.

6.3.2 Site Survey

Elevation data for the site was provided by the client in 1.0 m gridded resolution. A finer 0.1 m gridded resolution was provided over the Pit extents. The provided elevation data for the site was used to determine the operational catchment delineation and the Pit storage curve.

6.3.3 Catchment Delineation

The Geotubes platform will change the catchment delineation and increase the contributing catchment to the Pit. The operational catchment delineation is illustrated in **Diagram 7**. It is proposed to include a sump for pumping to the process pond, and bunding to the lower ends of the Geotubes platform to enable capture of a tube failure, if one occured. An overtopping weir would divert dirty water to an excavated drain to allow larger rainfall events to be diverted to the Pit. This dirty water drain will require excavation of a gravity fed drainage channel to the Pit.

The Raw Water Pond and the Process Pond will be protected by bunding and all external catchments to the ponds will be diverted away from the storages. The catchment for both ponds is therefore only the pond surface area.

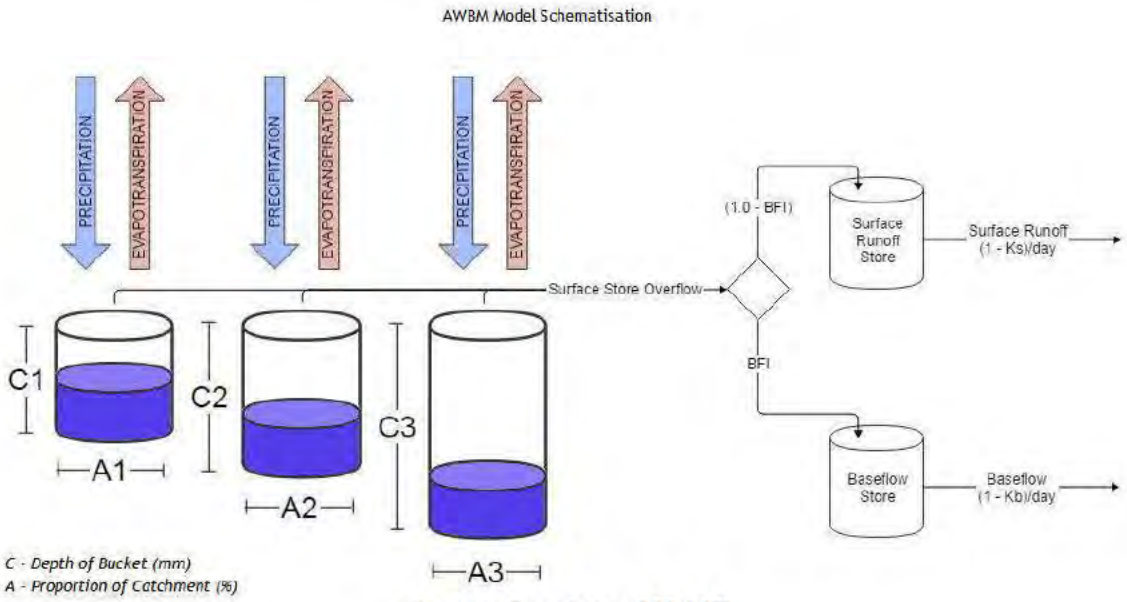
6.4 Model Development

The WBM was developed in GoldSim 12.1.5 as it is a powerful and commonly adopted software package for water balance assessments in the engineering industry. ATCW has developed a robust and efficient method to undertake water balance models in GoldSim, and have successfully adopted similar models on many mine sites throughout Australian and abroad.

6.4.1 Adopted Runoff Model

Stormwater runoff estimations in the WBM were undertaken using the Australian Water Balance Model (AWBM). The AWBM is a surface runoff model that routes rainfall through a series of surface stores with defined depths, subtracting daily evapotranspiration rates to represent soil and surface conditions in site catchments **[5]**. The AWBM is an antecedent rainfall model, which considers the wetting and drying process that occurs over time. The model can represent a range of runoff conditions, based upon seasonal and climatic differences over the calendar year. A schematic of the AWBM model structure is depicted in **Diagram 6** and the site catchments are illustrated in **Diagram 7**.

DIAGRAM 6 – AWBM SCHEMATIC



Source: Boughton, 2004 **[5]**

Where:

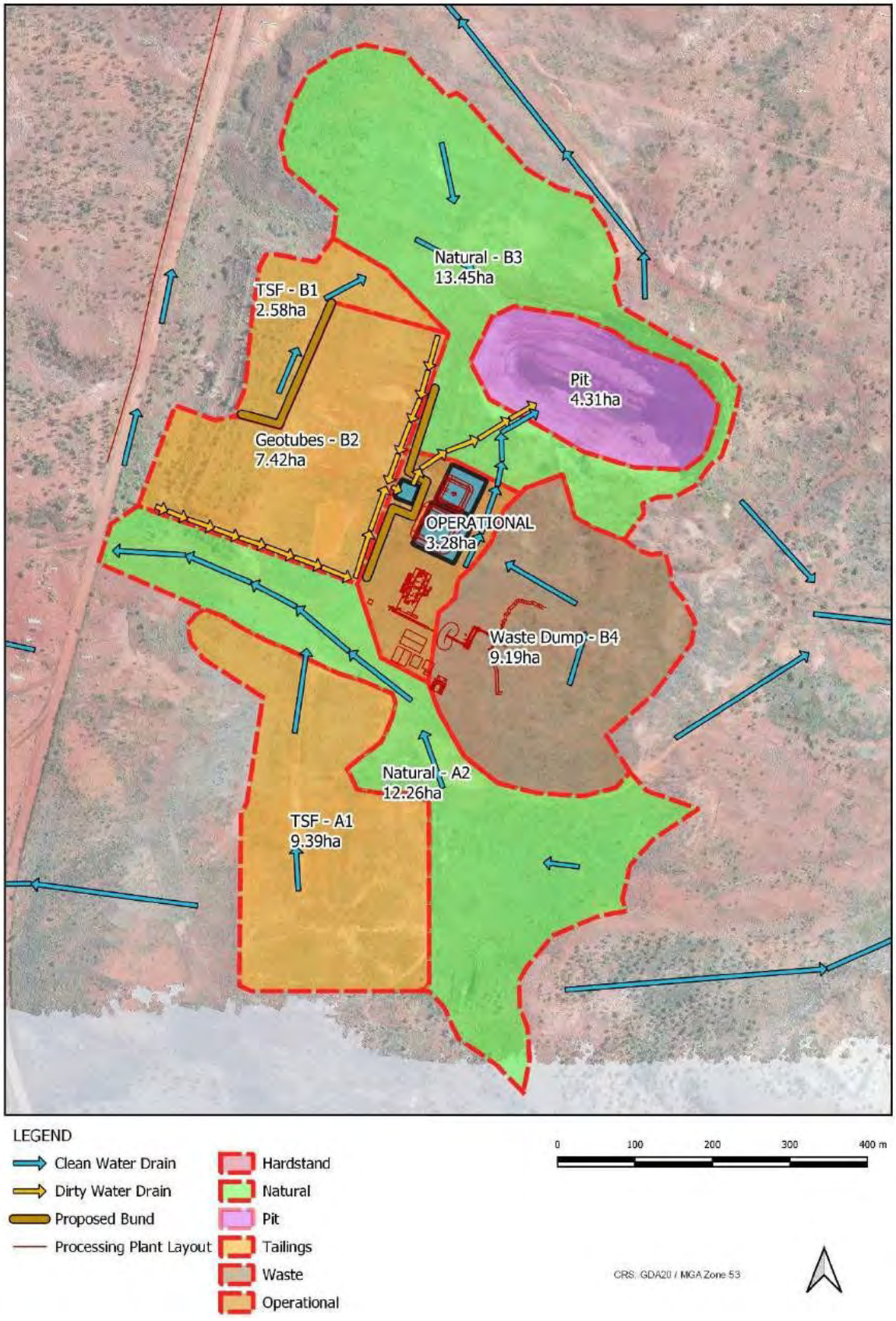
C1 – C3	= Surface Storage Capacities
A1 – A3	= Partial Areas Represented by Surface Storages
BFI	= Baseflow Index
K_b	= Daily Baseflow Recession Constant
BS	= Current Volume in Baseflow Store
K_S	= Daily Surface Flow Recession Constant
S	= Current Volume in Surface Store Routing

The catchment types and AWBM model parameters adopted are summarised in **Table 10.** Model parameters have been selected based on experience with similar water balance model studies and AWBM recommendations. No site data was available for calibration of catchment parameters.

TABLE 10 – AWBM MODEL PARAMETERS

AWBM Parameters	Split Areas (sum=1.0)			Storage Capacities (mm)			Ks (day-1)	BFI	Kb (day-1)
	A1	A2	A3	C1	C2	C3			
Natural	0.3	0.35	0.35	12	120	250	0	0	1
Hardstand	1.0	0	0	10	10	10	0	0	1
Waste	0.2	0.8	0	10	50	0	0	0	1
Open Cut	0.1	0.9	0	5	20	0	0	0	1
Tailings	0.2	0.8	0	5	50	0	0	0	1

DIAGRAM 7 – SITE CATCHMENTS



Runoff calculated from the AWBM formed the natural inflow to the storages as groundwater is assumed to be at or below the Pit base, and well below any of the other storages.

6.4.2 Natural Outflows

Evaporation was modelled as the only natural outflow from the storages. Seepage is unlikely from the processing storages as an impermeable liner is proposed over existing in-situ clayey materials. The base of the Pit storage curve is taken from the approximate permanent water level (fed by the groundwater recharge) and therefore no seepage was included in the model as a conservative approach.

6.4.3 Processing Plant Operations

The processing plant proposes several pumping and transfers as part of the processing operations. The processing details are summarised in **Section 1.2** based on the Process Description by COMO **[7]**, and follow the general water transfer steps below:

- Raw Water Pond storage is pumped to the process plant for use in the following areas:
  - Process water top up
  - Screen water sprays
  - Dust suppression
  - Wash down;
- Process Water Pond is pumped to the process plant for use in the following areas:
  - Mill discharge
  - Trommel screen spray water
  - General hosing
- Geotubes effluent is collected in a Sump at the low point of the Geotubes platform before being pumped to the Process Water pond for re-use;

Based on the information provided by TCMG, the in-situ volume of slurry required to be dewatered is approximately 642,850 m^3 over 1.5 years (18 months). The tailings slurry input rate to the Geotubes was originally assumed as 48.9 m^3/h, assuming a tailings specific gravity of 3.2 t/m^3, an initial slurry wet density of 1.38 t/m^3, and an slurry rate of 67.5 t/h. However, COMO **[7]** have proposed much higher pump rates and tailings slurry inflows to the Geotubes as illustrated in **Table 11**. Confirmation of these flow rates should be discussed with the Geotubes supplier, COMO, and TCMG prior to the detailed design phase to confirm any potential impacts to the construction methodology. The rates proposed by COMO **[7]** have been adopted in the WBM to account for the maximum flow rates expected.

TABLE 11 – MODELLED TRANSFERS

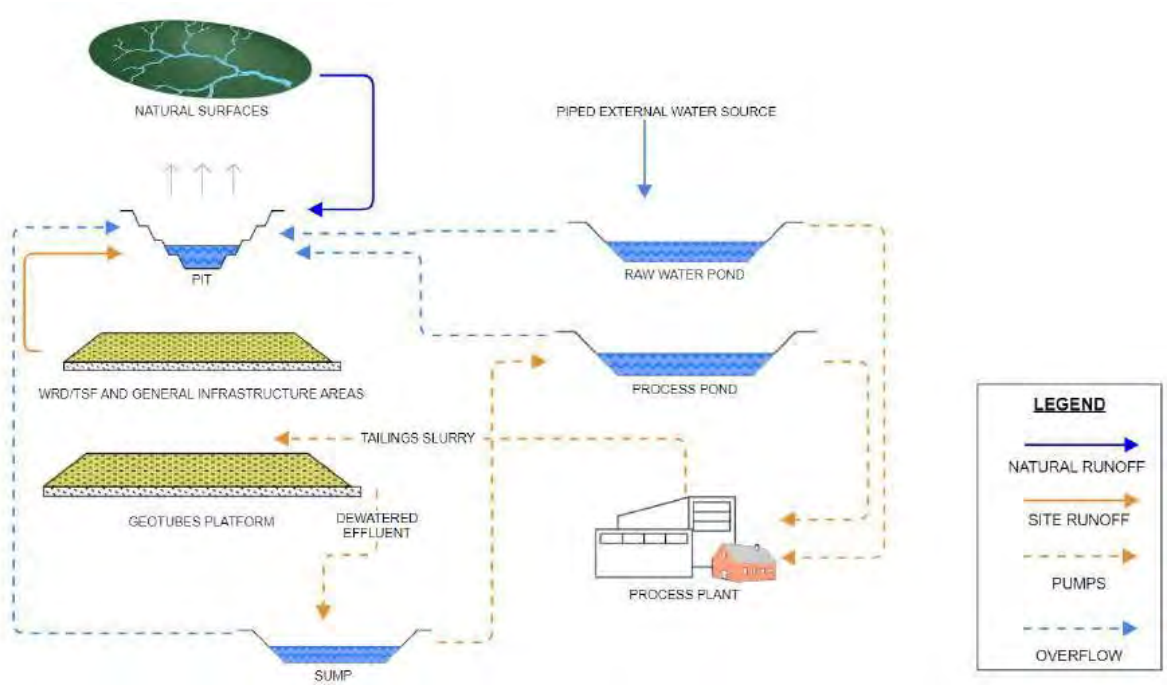
Storage	Inflow	Outflow
Pit	N/A	N/A
Raw Water Pond	9 L/s (0.78 ML/d)	9 L/s (0.78 ML/d), split as 4.95 L/s to plant 4.1 L/s to process pond plus a maximum 3.5 L/s (0.3 ML/d) dust suppression
Process Pond	28 L/s (2.42 ML/d) (24 L/s from Geotubes and 4.1 L/s from Raw Water)	28 L/s (2.42 ML/d) to plant
Geotubes Sump and Platform	24 L/s (2.07 ML/d)	24 L/s (2.07 ML/d)

A potable water supply is also required for the site as the Raw Water Pond's water supply is likely to be highly saline and not suitable for potable use. The potable water transfer system has not been modelled as part of this water balance assessment.

6.4.4 Model Schematic

A model schematic is illustrated in **Diagram 8**, and represents the developed model that was assessed for the site.

DIAGRAM 8 – GOLDSIM MODEL SCHEMATIC



6.4.5 Staging

It is likely that the Geotubes platform will be staged into two main areas to reduce the extent of earthworks initially required, however, this WBM assessment has adopted the combined Stage 1 and Stage 2 total platform case without any rehabilitation occurring, as the worst case scenario. This represents the maximum catchment area that could possibly discharge to the storages. For further details regarding rehabilitation and staging refer to **Section 7**.

6.4.6 Model Duration and Realisations

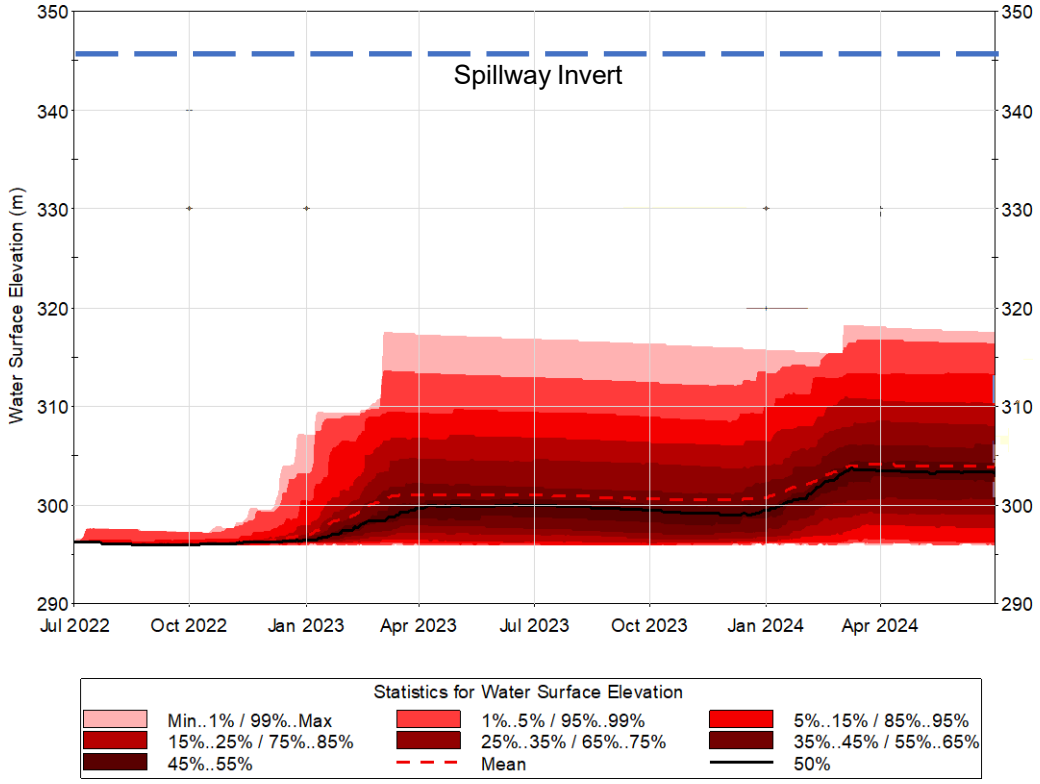
The model was run for 2 years to cover the anticipated 18 month operational period. This allowed for 130 realisations to be modelled as a monte carlo simulation in GoldSim.

6.5 Water Balance Results

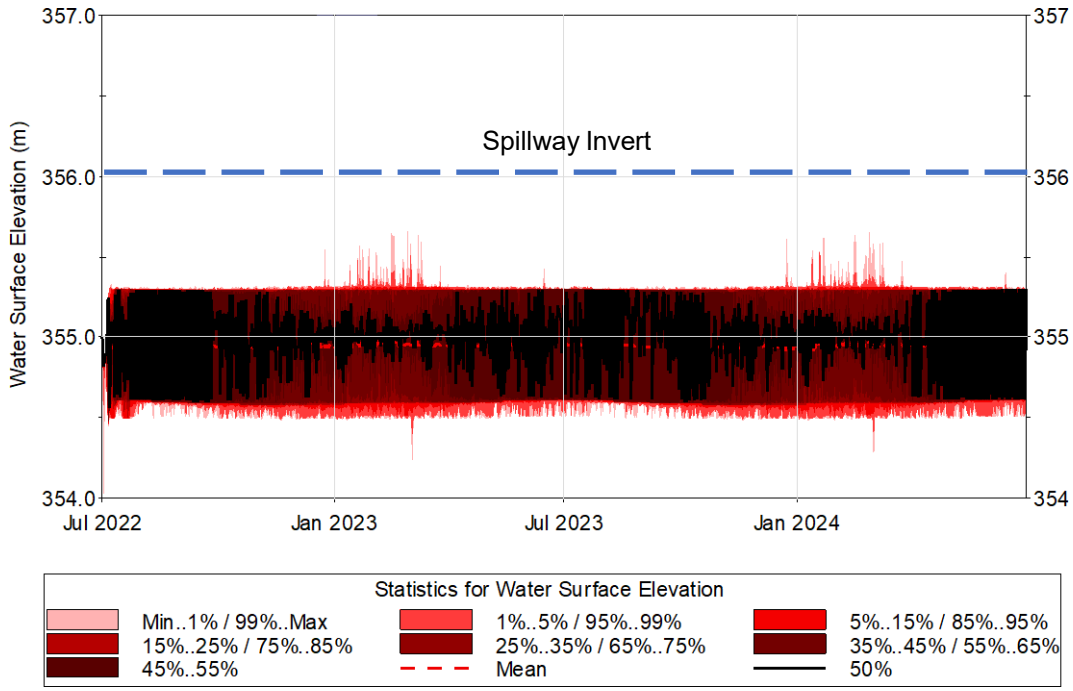
Outputs from the water balance modelling for the modelled storages is presented in **Graph 6 to Graph 9.** The graph provides a plot of maximum water elevation versus the model duration, including:

- Mean and median;
- Upper and lower bounds; and
- 5%, 25%, 75% and 95% (percentiles).

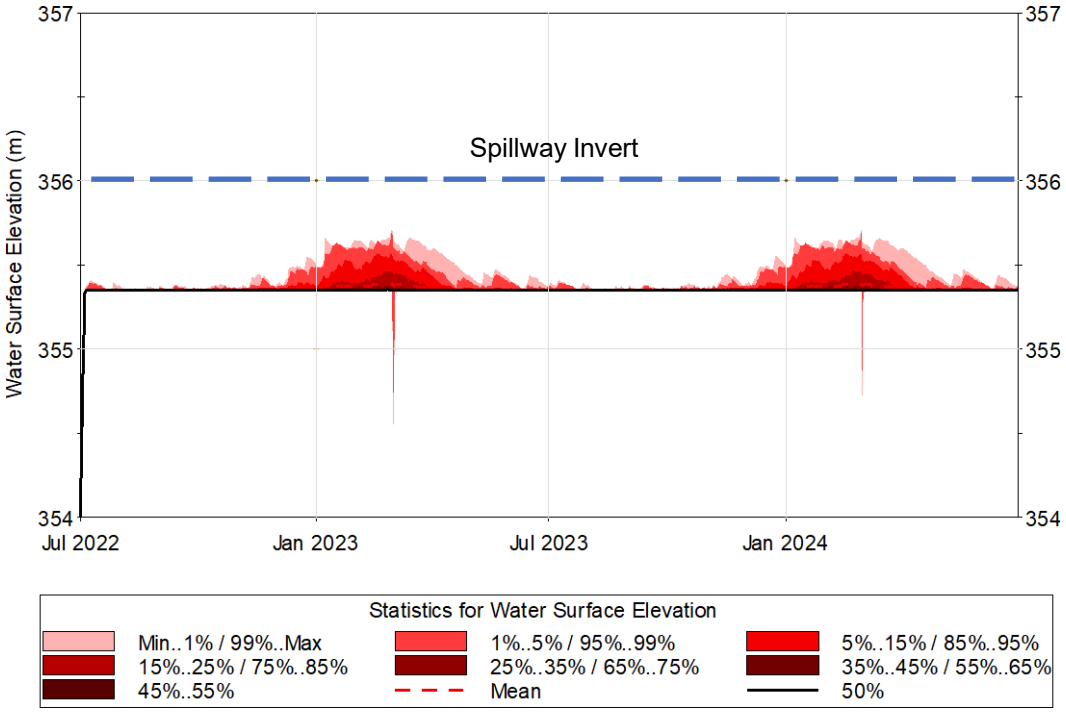
GRAPH 6 – PIT MODELLED MAXIMUM WATER SURFACE ELEVATION



GRAPH 7 – RAW WATER POND MODELLED MAXIMUM WATER SURFACE ELEVATION



GRAPH 8 – PROCESS POND MODELLED MAXIMUM WATER SURFACE ELEVATION



GRAPH 9 – GEOTUBES AND SUMP MODELLED MAXIMUM WATER SURFACE ELEVATION

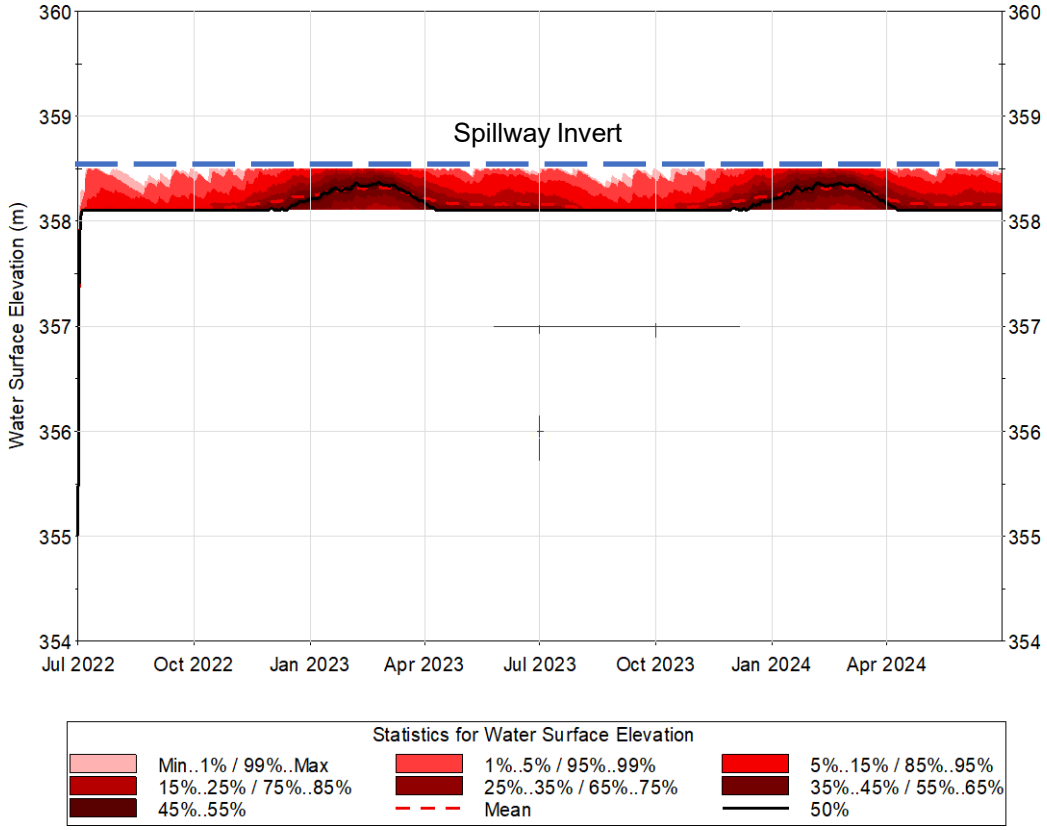


TABLE 12 – SPILL PROBABILITY

Storage	Spill Probability (to 2024)
Site Pit	<1%
Process Pond	<1%
Raw Water Pond	<1%
Geotubes Platform	<25% (all overflows are transferred to the Pit)

Sensitivity testing of the catchment surface storage capacities were also conducted to analyse how sensitive the model was due to changes of the critical input parameters. A 20% reduction to the surface storage capacities (i.e. more runoff potential), it was found that the Pit is very unlikely (<1%) to spill within the operational period.

6.6 Performance Implications

The site Pit gradually increases in stored water over the modelled period. There is a very low (less than 1%) chance of the Pit spilling within the operational period. The Process Pond and Raw Water Pond are also both designed to have a spill risk of less than 1%. Due to the large catchment from the Geotubes platform the sump would overtop in large rainfall events (<25% spill risk). A dirty water drain is therefore proposed to divert any potential overtopping flows to the Pit for containment. The risks of environmental damage due to the release of water from the operations is therefore considered very low.

Following completion of the Geotubes operation, it is anticipated that the Geotubes platform will be diverted away from the Pit wherever possible and the catchment contributing to the Pit would be reduced to replicate similar site conditions before the Phase 1 operations began. The reduction of catchment would allow the Pit water level to slowly reduce back to the permanent water level that is fed by groundwater. Ongoing and additional groundwater and Pit water testing should be conducted to monitor the water quality over the operational period.

7 REHABILITATION AND CLOSURE

7.1 Objective

The rehabilitation and closure phase of the project must be considered as part of the concept design to provide positive environmental outcomes for the site and surrounding land.

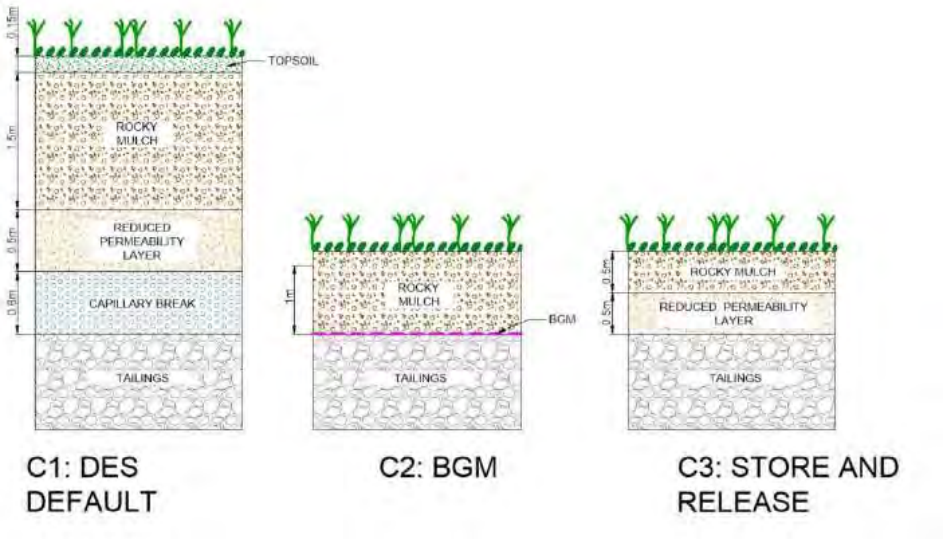
7.2 Capping

In order to reduce the risks associated with contaminanted runoff from the Geotubes, a capping system must be provided as part of the rehabilitation works.

Three potential cover systems are presented below that should be reviewed as part of a future options assessment. This is to determine the most cost-effective means to prevent contaminant transport and provide a growing medium for vegetation establishment. Typical cross sections are illustrated in **Diagram 9**.

It is noted that the proposed material depths are conceptual only and were based on cover systems developed for similar projects. The required material depths for each cover system would need to be assessed individually.

DIAGRAM 9: COVER OPTIONS



A description of cover systems identified is summarised as follows:

Cover 1 (Capillary Break):	Based on the default cover system for high risk facilities, based on Queensland Government's Estimated Rehabilitation Cost Calculator. The capillary break prevents upward migration of moisture and contaminates through capillary action which can contaminate cover soils.
Cover 2 (BGM):	The BGM cover system is comprised of a vegetation growth layer (rocky mulch) and a bituminous geomembrane (BGM) as the hydraulic barrier preventing seepage though the cover soils into the tailings.

Cover 3 (Store and Release): The objective of the store and release cover is to maximise plant available moisture within the cover system promoting infiltration into the cover system and minimising runoff. Functionally, storage of moisture should be confined to the infiltration storage layer (rocky mulch). A clay layer (reduced permeability layer) provides the hydraulic barrier to minimise seepage though the cover soils into the tailings.

The selection of the preferred cover system will be dependent upon review of geochemical characterisation. In addition to this, to determine the suitability of the chosen cover system, vadose modelling of the preferred option shall be undertaken to determine the cover system thickness required. Trial pads should be utilised during the operational phase of the project to determine if minor reshaping works with or without cover soil and the addition of topsoil can achieve the rehabilitation objectives for cover system cap. As part of the trail pad investigations analysis of runoff water quality must also be monitored.

7.3 Water Management

The Geotubes are proposed to be left in place and capped following the completion of the processing operations. The capped Geotubes will therefore form a large landform to be rehabilitated within the site. An interim erosion and sediment control plan is likely required until such time the landform is appropriately rehabilitated. Once vegetation is established, it is proposed to divert the landform's clean water away from the Pit wherever practical in form of diversion drains and bunding along the landform batters. Progressive capping and rehabilitation of the Geotubes landform should be conducted to reduce the maximum disturbed areas on-site.

Refer to Drawing 009 of **Appendix B** that illustrates the indicative closure phase plan.

7.4 Staging

It is proposed to construct the Geotubes platform in two main stages to reduce the initial earthworks required. Progressive rehabilitation of Stage 1 should therefore commence as soon as practical to reduce the catchment area discharging to the Geotubes sump and reduce potential overflows to the Pit. This would additionally reduce the Pit water that has to be treated and disposed of at the end of Phase 1.

Refer to Drawing 004 and 005 of **Appendix B** that illustrates the indicative staging of the Geotubes.

8 CONCLUSIONS

A water management plan for a Geotubes dewatering facility has been developed to for the Phase 1 Nobles Nob operational requirements. An on-site process plant is proposed, that requires a Raw Water Pond and Process Pond as critical water storages for the plant. The process plant outputs a tailings slurry that is pumped to the proposed Geotubes for dewatering. A large platform is proposed to stack the Geotubes, requiring extensive earthworks to enable a safe and stable platform. The effluent expressed from the Geotubes is captured within a containment storage volume in the form of a sump at the base of the platform. It is proposed to bund the lower eastern boundary of the platform to provide a containment volume if a Geotube fails during slurry filling or the dewatering process. The effluent from the Geotubes is pumped from the sump to the Process Pond for storage, and then re-used in the processing plant. During larger rainfall events, runoff from the Geotubes platform can overtop and discharge to the Pit via an excavated dirty water drain.

A Consequence Category Assessment in accordance with ANCOLD, concluded the storages to be a 'Very Low' CCA, and therefore require no Design Storage Allowance or Extreme Storm Storage volume to be included. The Water Balance Model demonstrated that there is low risk (<1%) of the Pit, Raw Water Pond, and Process Pond spilling within the Phase 1 Geotubes operation. The Geotubes platform is likely to overtop in large rainfall events and therefore a dirty water drain is proposed to divert overtopping flows to the Pit. Clean water diversion drains are proposed to divert clean surface runoff around the operations wherever practical. It is proposed that the operational and process areas of the site discharge to the Pit.

Rehabilitation of disturbed surface areas should be undertaken progressively, and surface flow should be diverted away from the Pit wherever practical. Any subsequent operational phases should also aim to divert flow away from the Pit wherever practical. Ongoing testing of water quality in the Pit should be implemented and actively monitored throughout the operations.

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[15] Umwelt (2021), 'Groundwater Assessment Report', December, Final Issue

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APPENDICES

APPENDIX A: SITE FEATURES

PEKO ROAD

TSF

Pit

#4

ACCESS ROAD

Waste Dump

TSF

TSF

#1

LEGEND

Existing Contours (5m)

Mine Lease Boundaries

Water Sample Locations

Existing Site Features

Pit

Tailings

Waste Dump

0 50 100 150 200 m

FIGURE 001
NOBLES NOB - EXISTING SITE FEATURES

ATC WILLIAMS

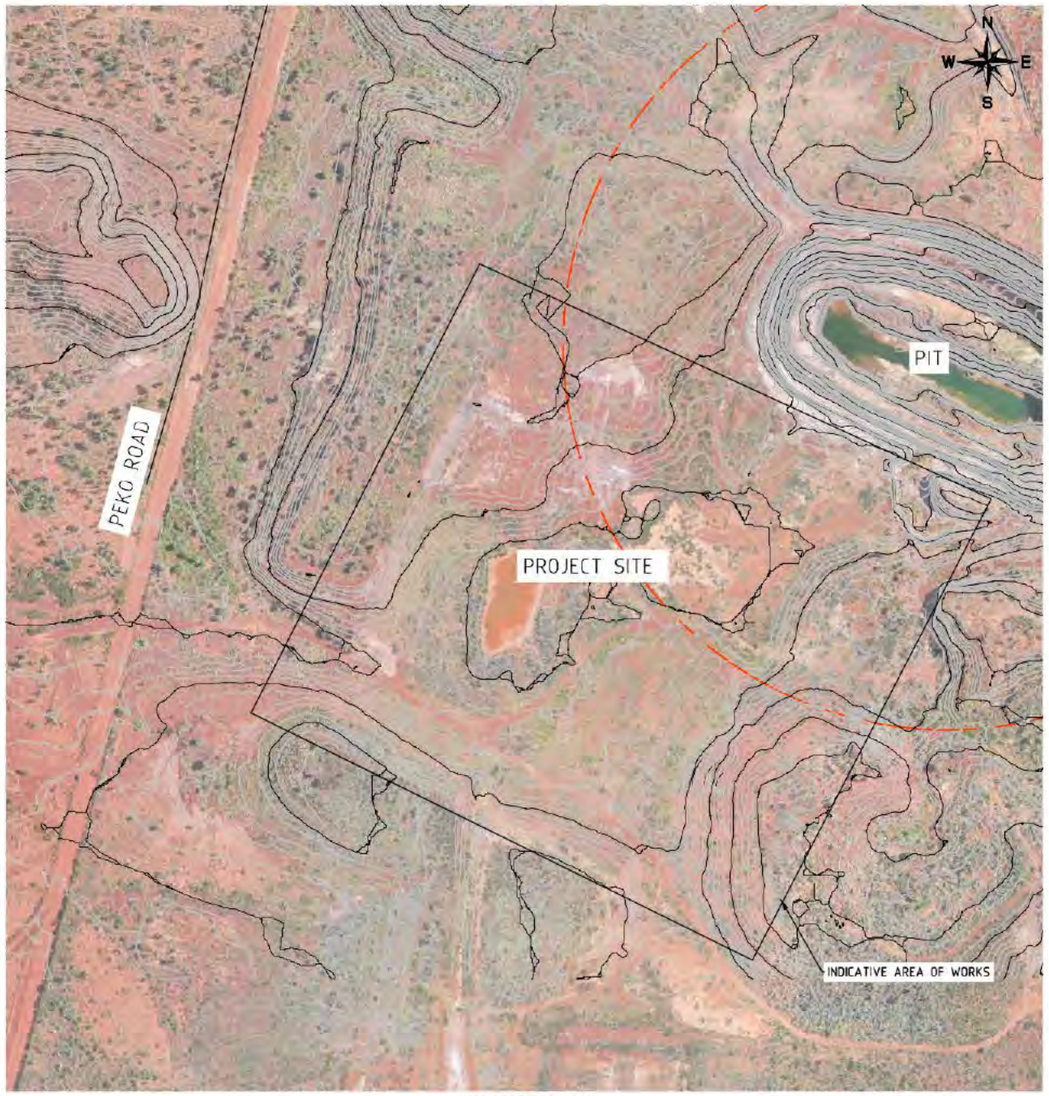
DATE: 2022-02-21
CRS: GDA20 / MGA Zone 53

N

APPENDIX B: ATCW CONCEPT DESIGN DRAWINGS

TENNANT CONSOLIDATED MINING GROUP PTY LTD

NOBLES NOB GEOTUBES PLATFORM CONCEPT DESIGN



LOCALITY PLAN
SCALE NTS

DRAWING LIST

NUMBER	DESCRIPTION
121089.01-001	LOCALITY PLAN AND DRAWINGS LIST
121089.01-002	GENERAL ARRANGEMENT - SITE LAYOUT
121089.01-003	GEOTUBE PLATFORM - SECTIONS
121089.01-004	GEOTUBE PLATFORM - EARTHWORKS
121089.01-005	GEOTUBE PLATFORM - STAGING - STAGE ONE
121089.01-006	GEOTUBE PLATFORM - STAGING - STAGE TWO
121089.01-007	CLOSURE PLAN
121089.01-008	DETAILS
121089.01-009	CATCHMENT PLAN - OVERALL SITE (OPERATIONS)
121089.01-010	CATCHMENT PLAN - OVERALL SITE (CLOSURE)
121089.01-011	PONDS AND DRAINS - SECTIONS AND DETAILS

ISSUED FOR REPORTING
NOT FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: NTS
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
CHECKED MWJ
APPROVED EJB

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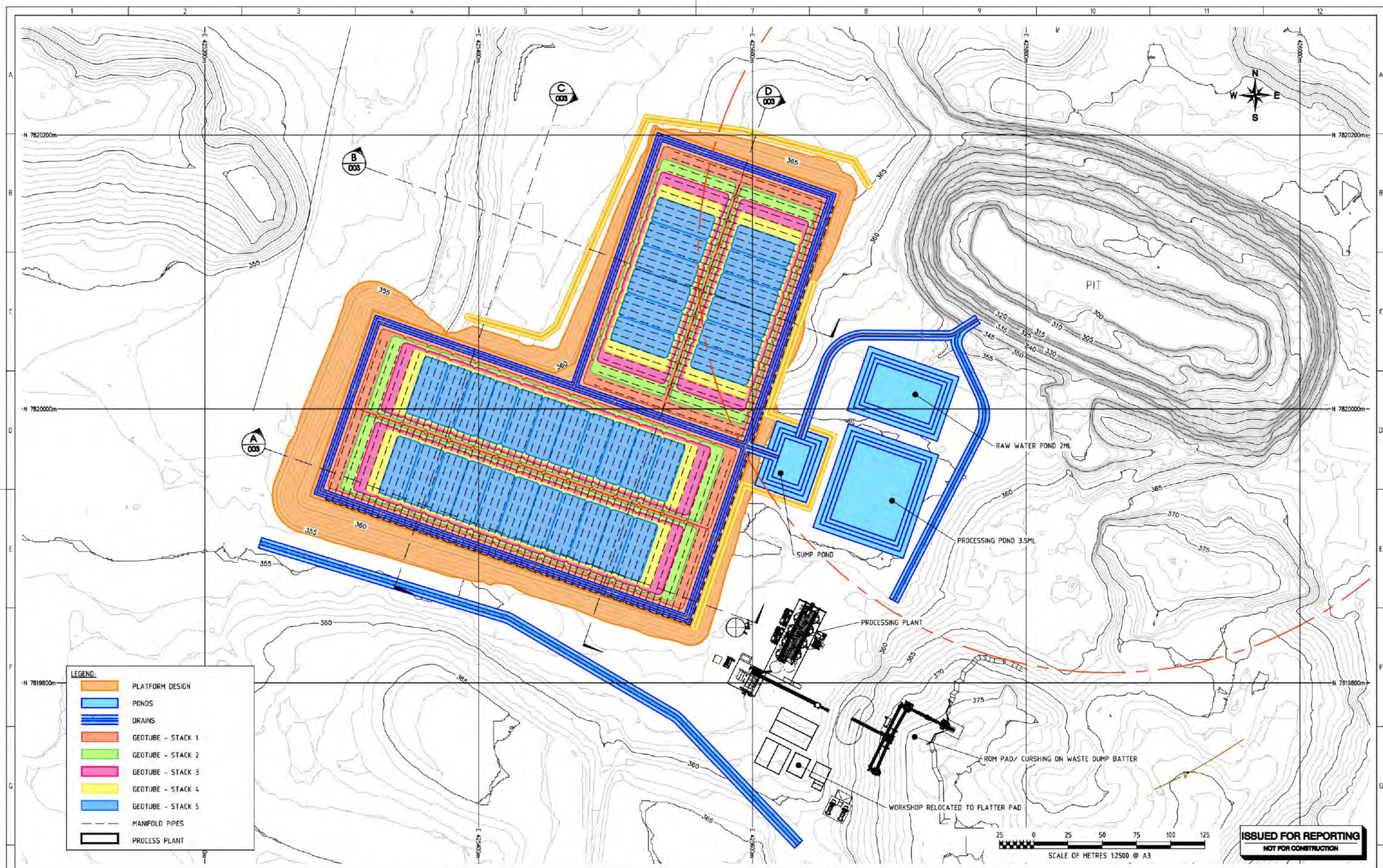
SHEET SIZE A3 Rev. A

SHEET 1 OF 1



No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE:	1:2,500
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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GENERAL ARRANGEMENT
SITE LAYOUT

DWG. No. 121089.01-002

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1

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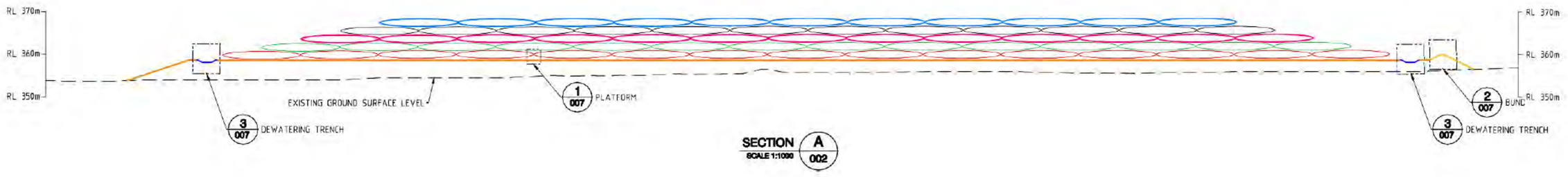
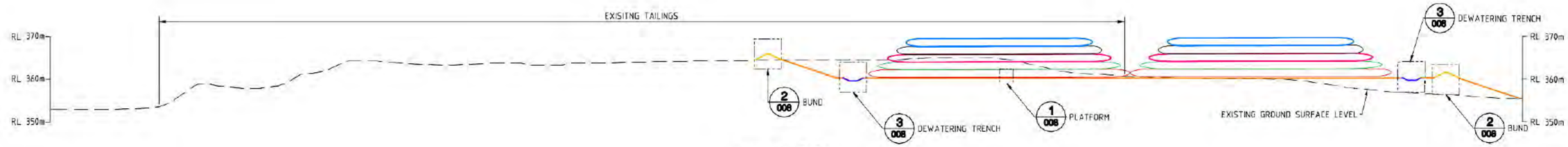
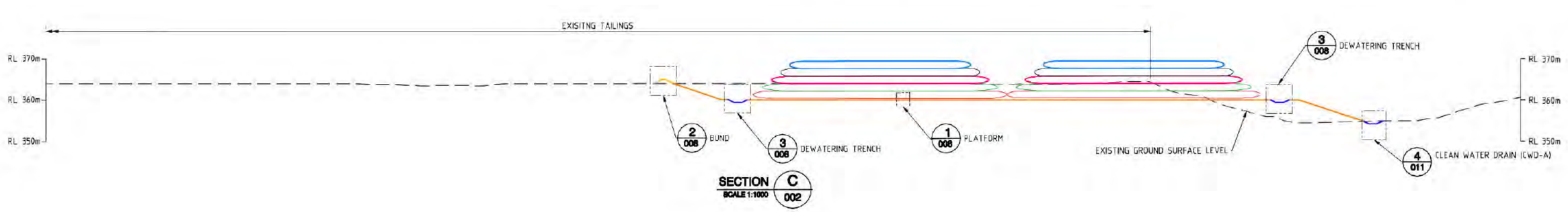


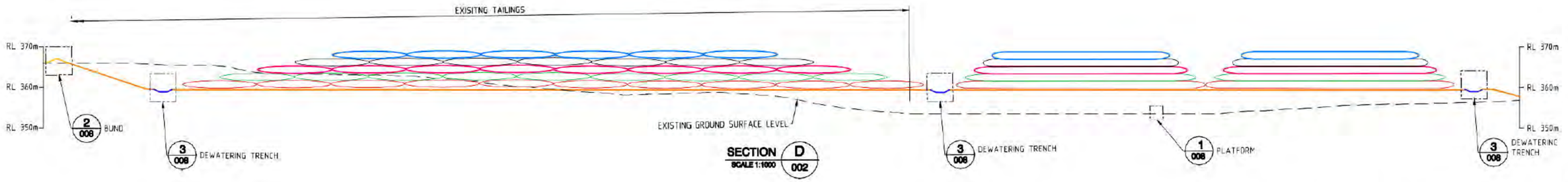
SECTION A 002
SCALE 1:1000



SECTION B 002
SCALE 1:1000



SECTION C 002
SCALE 1:1000



SECTION D 002
SCALE 1:1000

10 0 10 20 30 40 50
SCALE OF METRES 1:1000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REVISED REFERENCE PLANE	18/02/22	ARL	MWJ	EJB

SCALE: 1:1,000
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
CHECKED MWJ
APPROVED EJB

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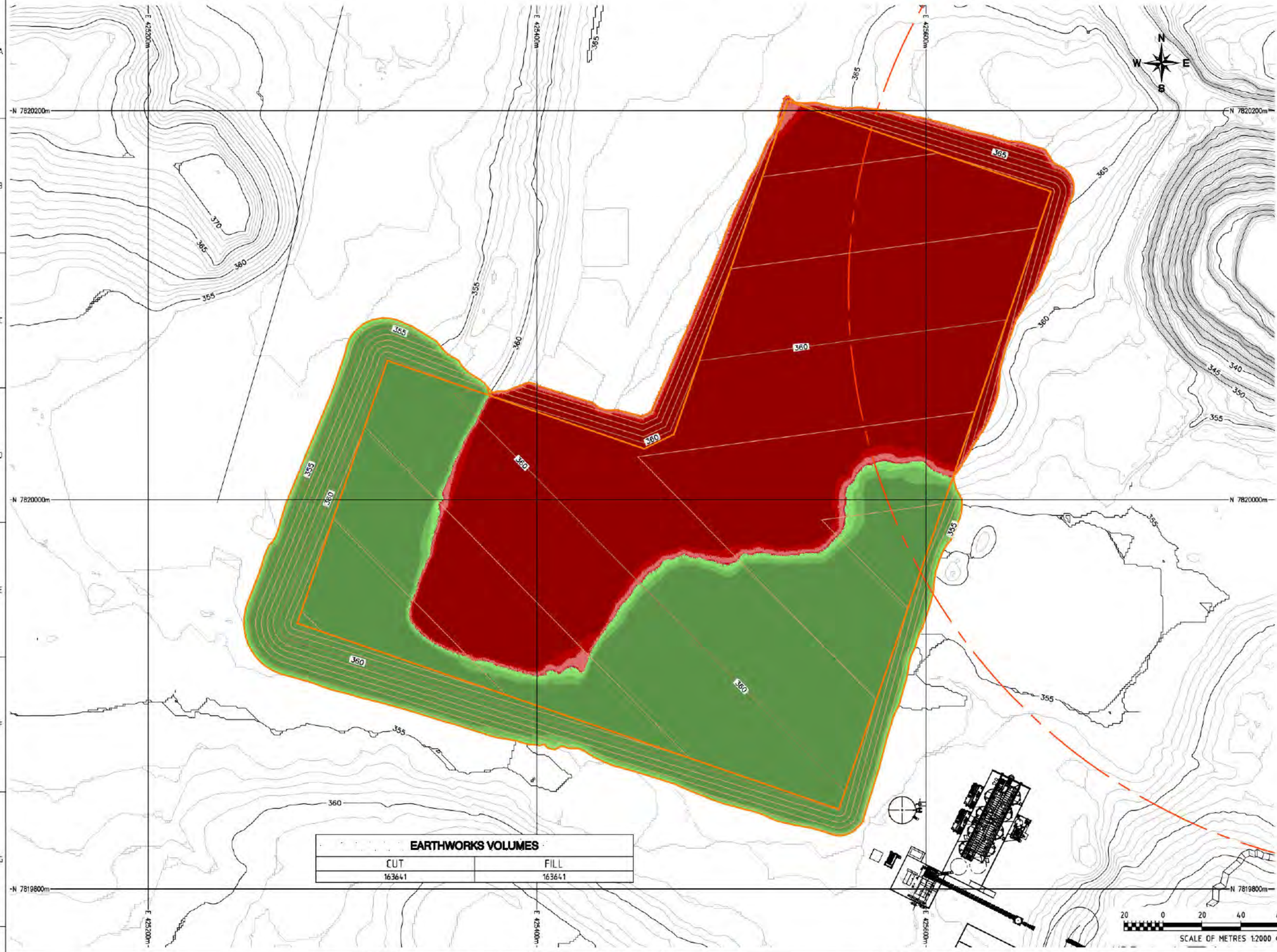
GEOTUBE PLATFORM SECTIONS

DWG. No. 121089.01-003
SHEET SIZE A3 Rev. A

SHEET 1 OF 1



DEPTH RANGE TABLE

Lower Value		Upper Value		Colour
-9999	to	-100	m	
-100	to	-10	m	
-10	to	-1	m	
-1	to	-.5	m	
-.5	to	-.1	m	
-.1	to	-.01	m	
-.01	to	0	m	
0	to	.1	m	
.1	to	.5	m	
.5	to	1	m	
1	to	10	m	
10	to	100	m	
100	to	9999	m	

EARTHWORKS VOLUMES

CUT	FILL
163641	163641

20 0 20 40 60 80 100
SCALE OF METRES 1:2000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,000	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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GEOTUBE PLATFORM
EARTHWORKS

DWG. No. 121089.01-004

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1

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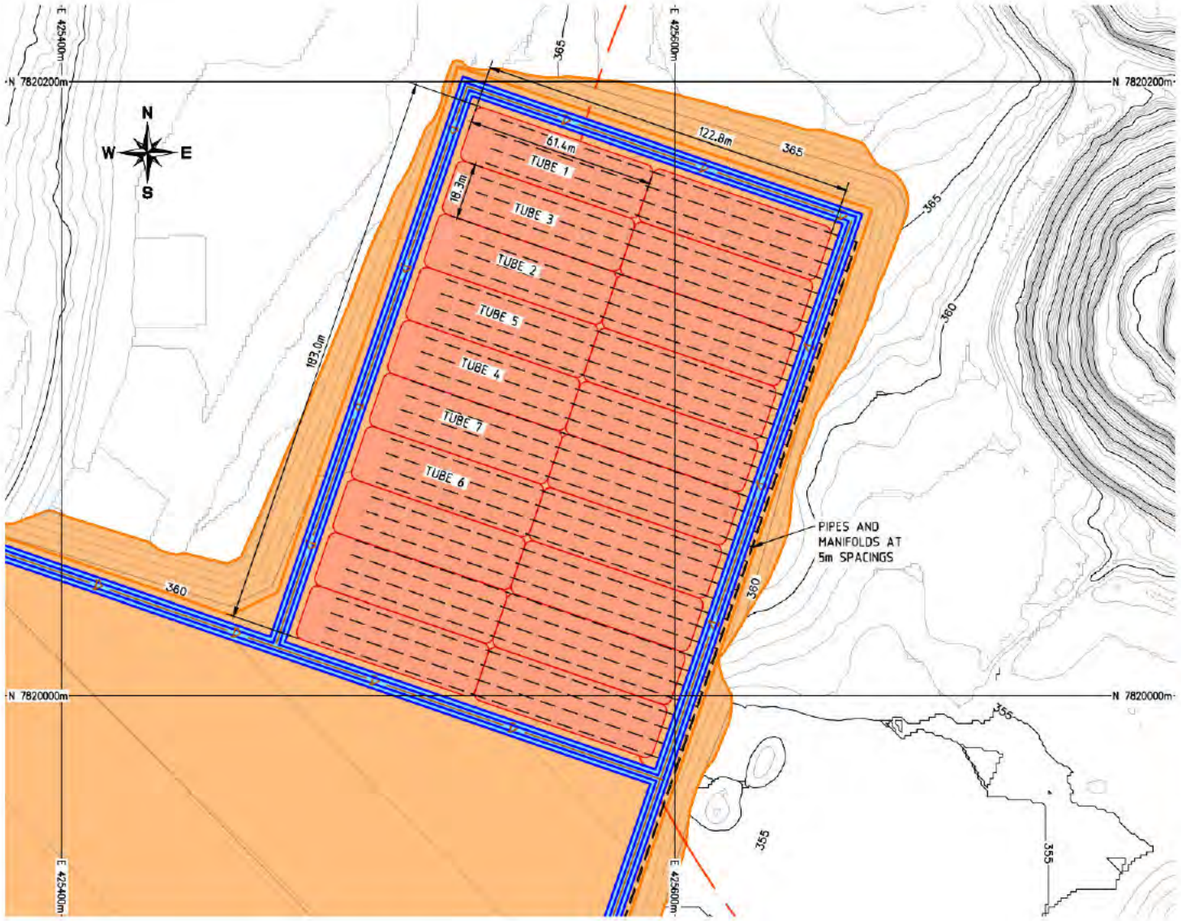
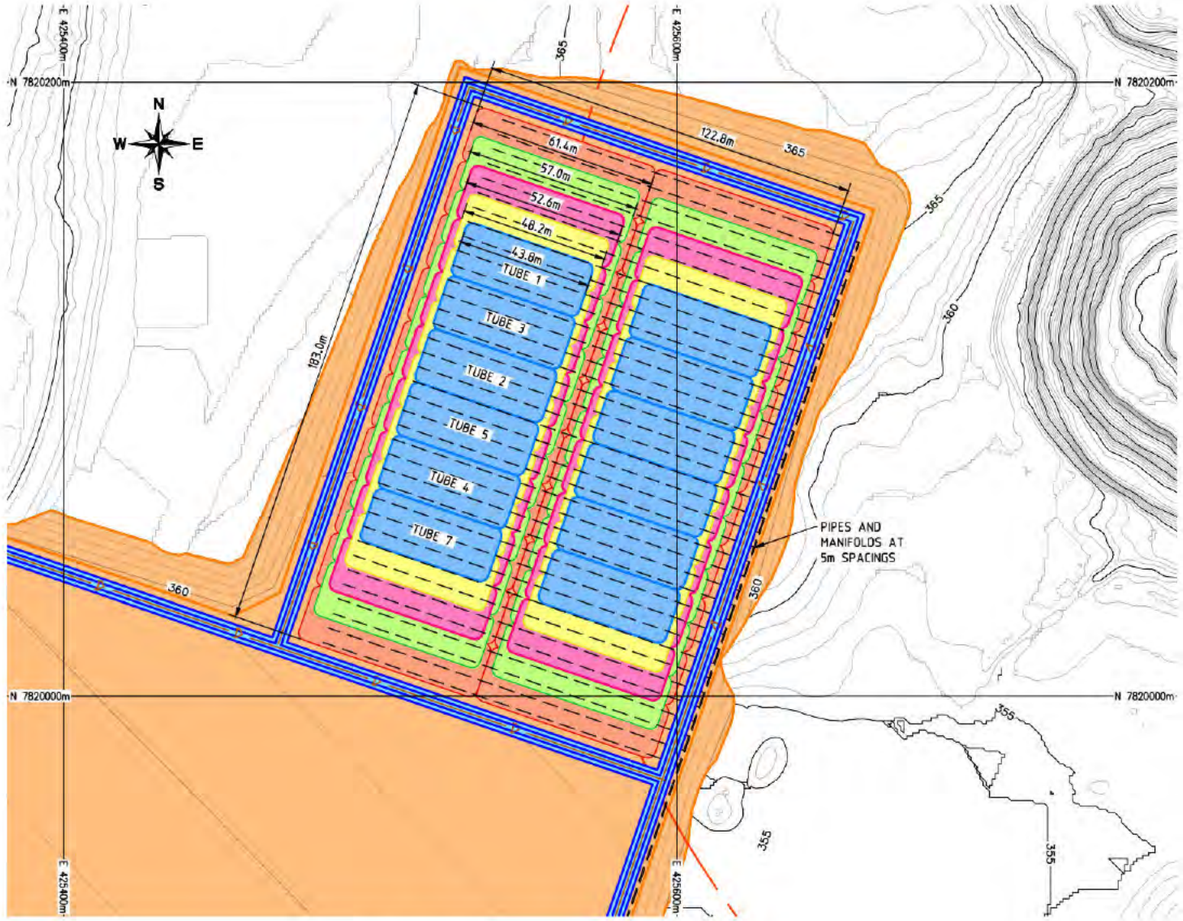


GEOTUBES STAGING - STAGE ONE (STACK ONE)
SCALE 1:2000



GEOTUBES STAGING - STAGE ONE (STACK FIVE)
SCALE 1:2000

20 0 20 40 60 80 100
SCALE OF METRES 1:2000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,000	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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GEOTUBE PLATFORM
STAGING
STAGE ONE

DWG. No. 121089.01-005
SHEET SIZE A3 Rev. A
SHEET 1 OF 1

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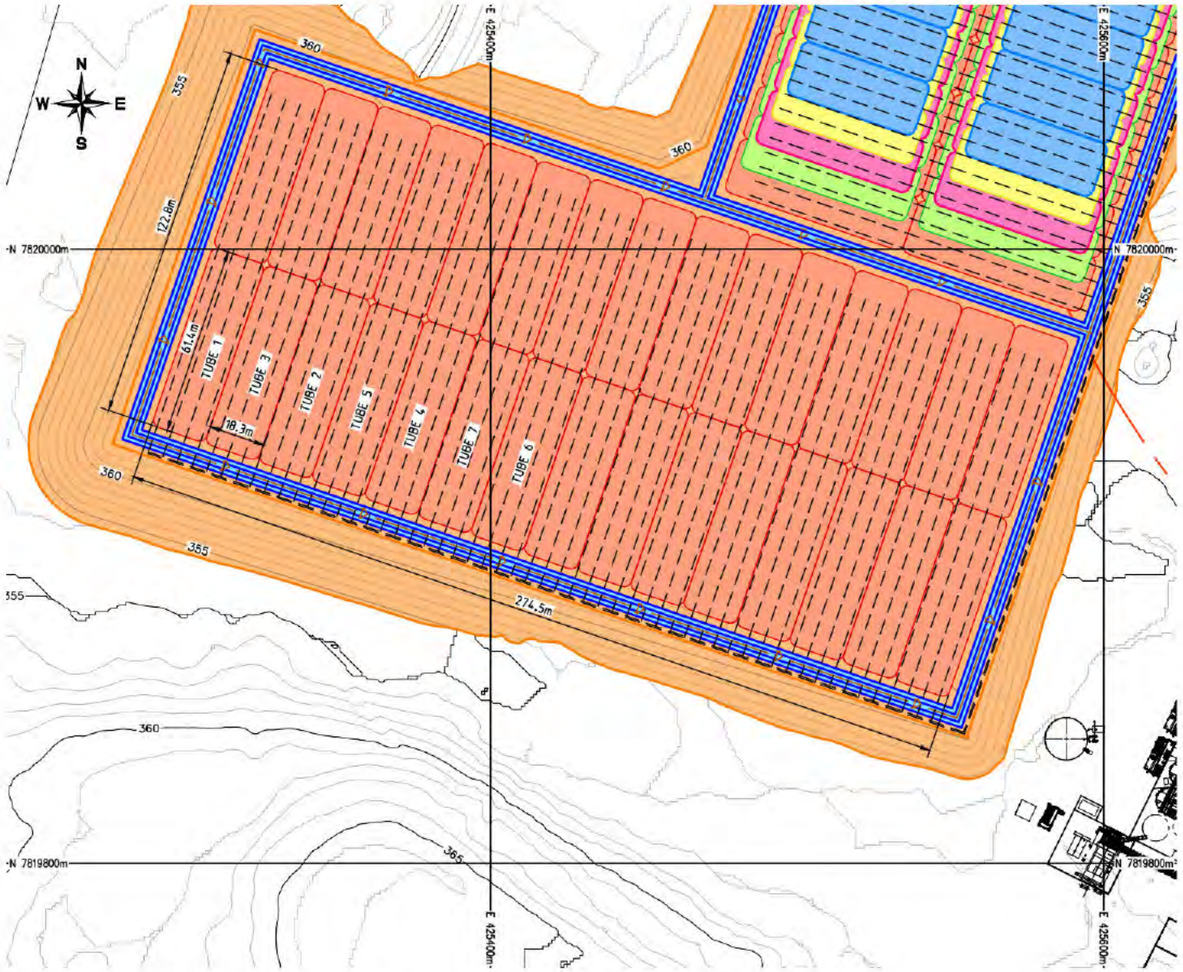
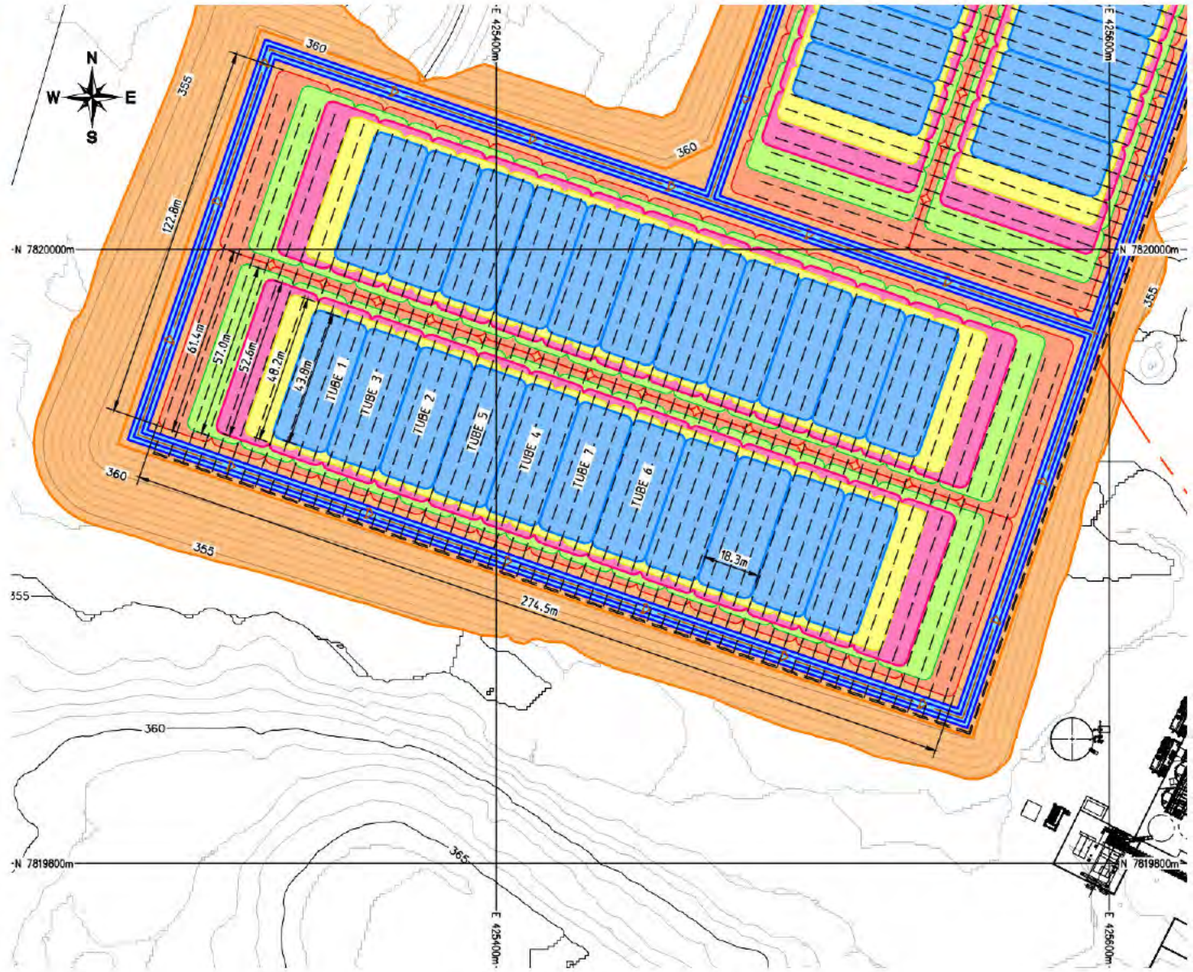
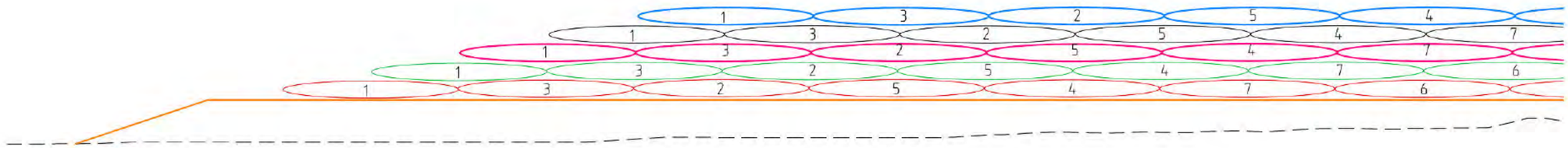


GEOTUBES STAGING - STAGE TWO (STACK ONE)
SCALE 1:2000



GEOTUBES STAGING - STAGE TWO (STACK FIVE)
SCALE 1:2000



TYPICAL GEOTUBES STAGING SECTION
SCALE 1:500

5 0 5 10 15 20 25
SCALE OF METRES 1:500 @ A3

20 0 20 40 60 80 100
SCALE OF METRES 1:2000 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,000
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
CHECKED MWJ
APPROVED EJB

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GEOTUBE PLATFORM
STAGING
STAGE TWO

DWG. No. 121089.01-006
SHEET SIZE A3 Rev. A

SHEET 1 OF 1

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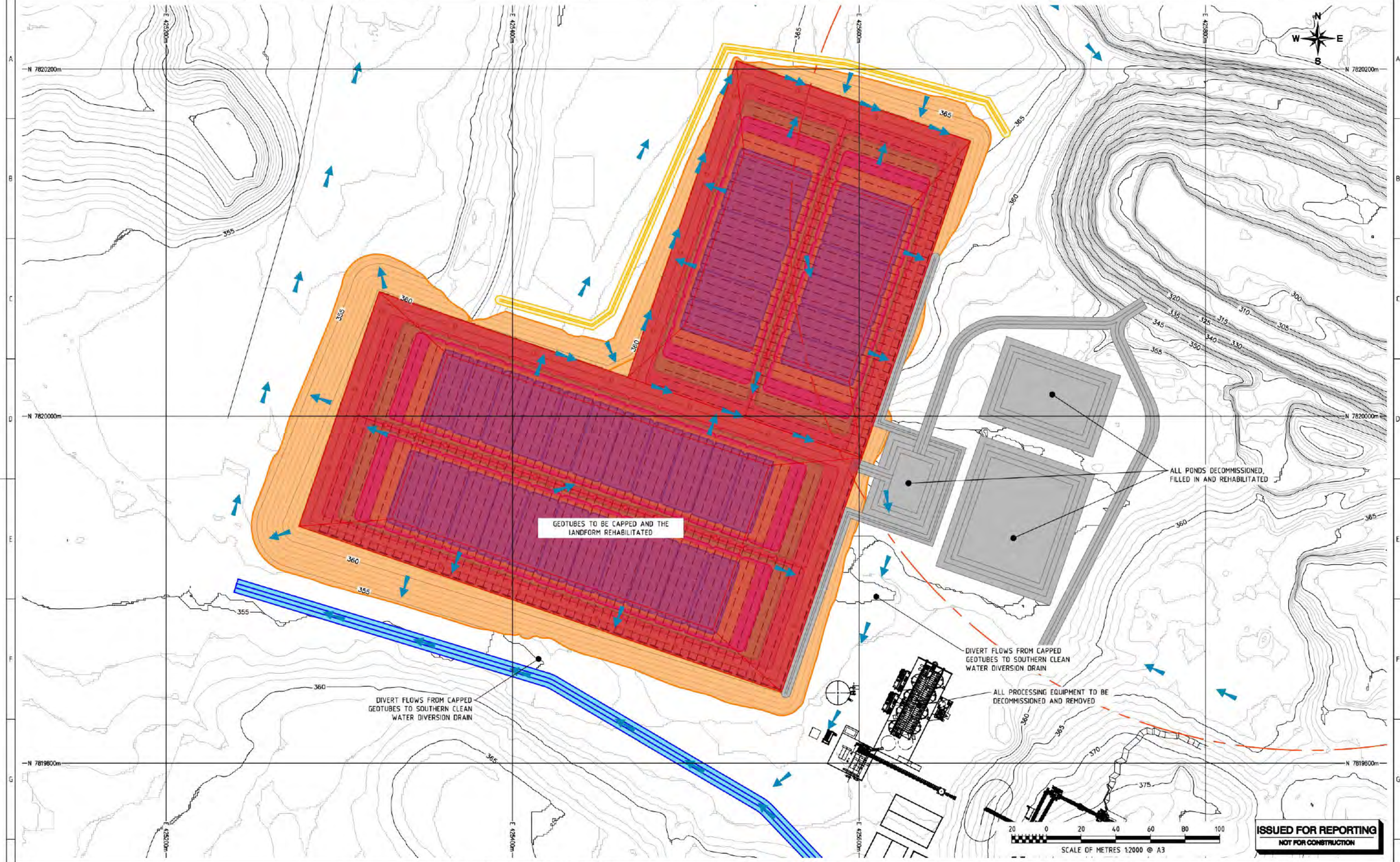

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,000
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
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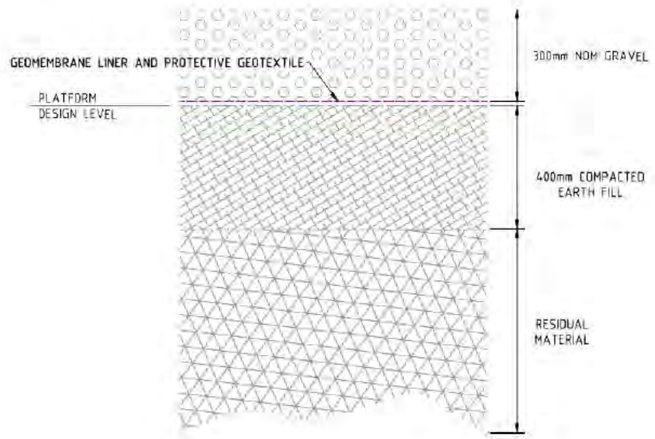
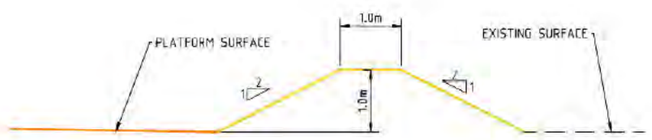
CLOSURE PLAN

DWG. No. 121089.01-007
SHEET SIZE A3 Rev. A

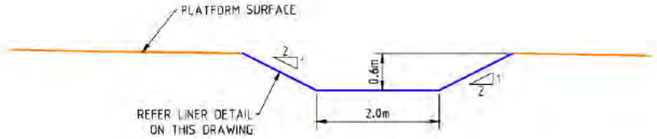
SHEET 1 OF 1



DETAIL 1 PLATFORM
SCALE: 1:20 — 003



DETAIL 2 BUND ADJACENT TO PLATFORM
SCALE 1:100 — 003



DETAIL 3 DEWATERING TRENCH
SCALE 1:100 — 003

1 0 1 2 3 4 5
SCALE OF METRES 1:100 @ A3

0.2 0 0.2 0.4 0.6 0.8 1.0
SCALE OF METRES 1:20 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REPORT REFERENCE PLAN	18/02/22	ARL	MWJ	EJB

SCALE: AS SHOWN	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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DETAILS

DWG. No. 121089.01-008

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1

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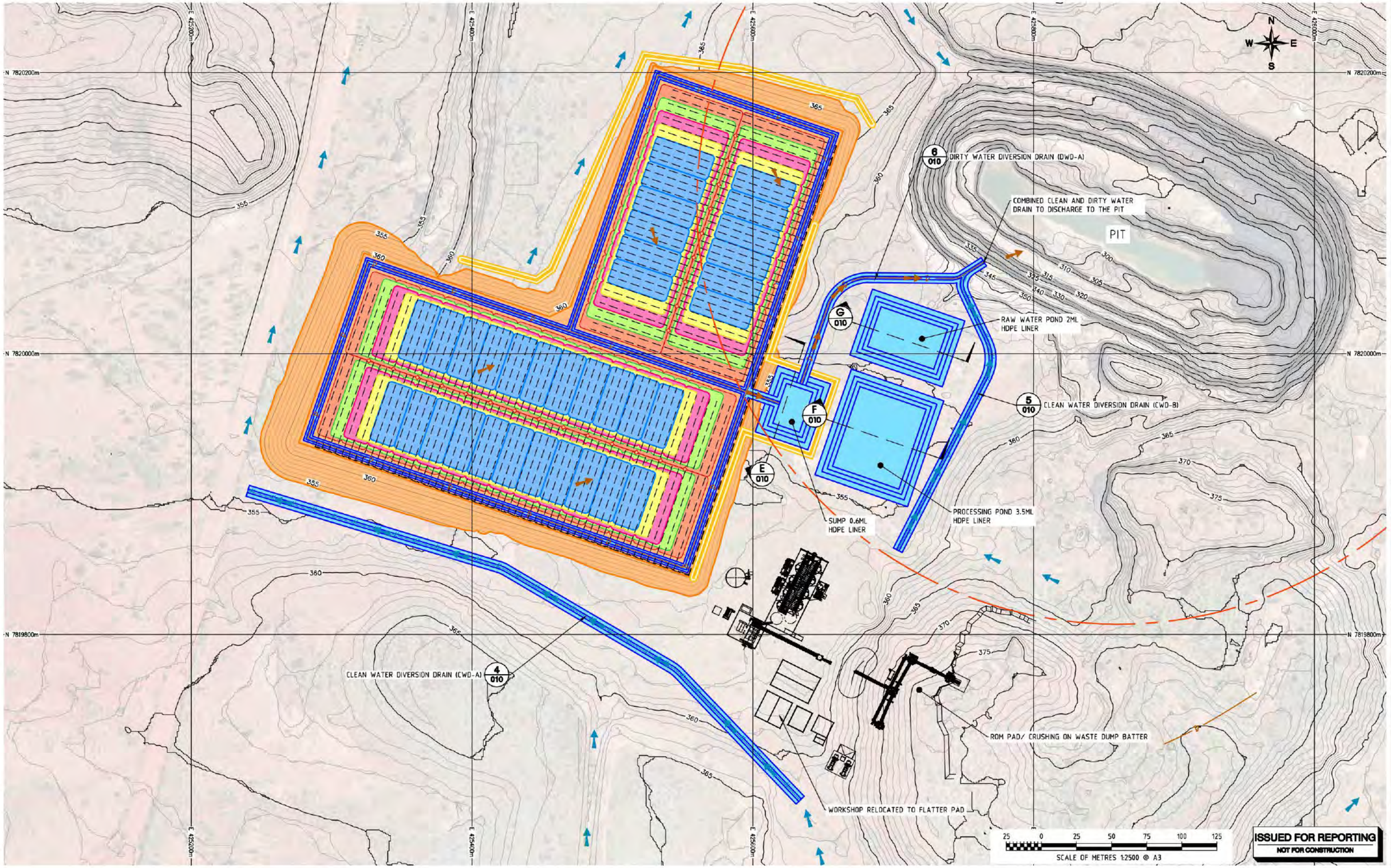

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:2,500	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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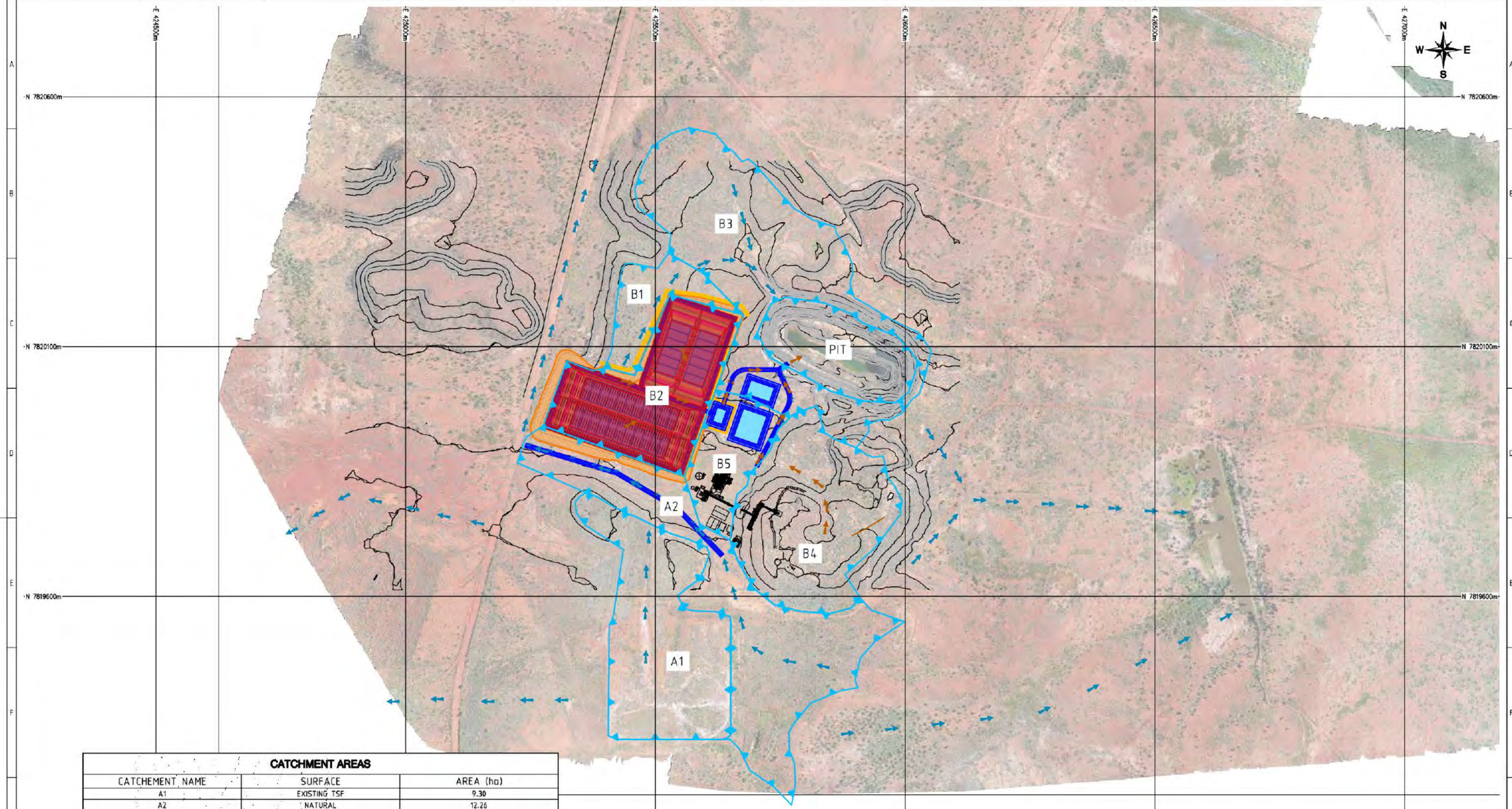
CATCHMENT PLAN
OVERALL SITE (OPERATIONS)

DWG. No. 121089.01-009

SHEET SIZE A3 | Rev. A

SHEET 1 OF 1



CATCHMENT AREAS		
CATCHEMENT NAME	SURFACE	AREA (ha)
A1	EXISTING TSF	9.30
A2	NATURAL	12.26
B1	EXISTING TSF	2.58
B2	GEOTUBES	7.42
B3	NATURAL	13.45
B4	WASTE DUMP	9.19
B5	OPERATIONAL AREA	3.28
PIT	PIT	4.31

75 0 75 150 225 300 375
SCALE OF METRES 1:7500 @ A3

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No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:7,500
JOB No. 121089.01
DATE FEB. 2022
DESIGN BH
DRAWN ARL
CHECKED MWJ
APPROVED EJB

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CATCHMENT PLAN
OVERALL SITE (CLOSURE)

DWG. No. 121089.01-010
SHEET SIZE A3 Rev. A

SHEET 1 OF 1

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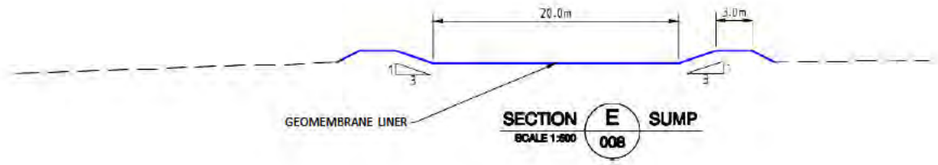
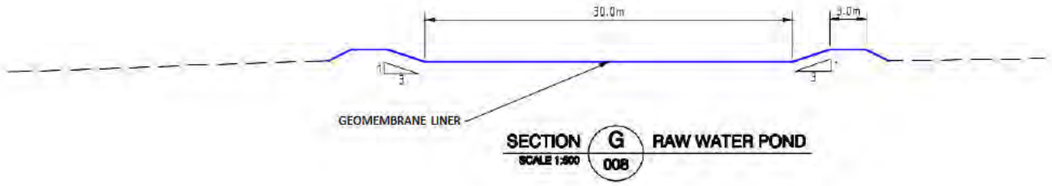
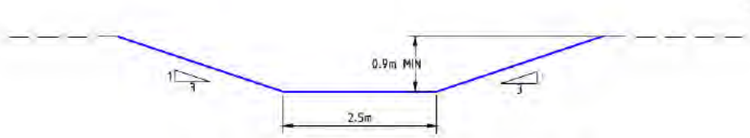


SECTION E SUMP
SCALE 1:500 — 008

SECTION F PROCESSING POND
SCALE 1:500 — 008

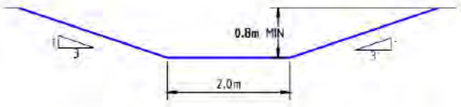


SECTION G RAW WATER POND
SCALE 1:500 — 008

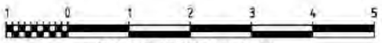


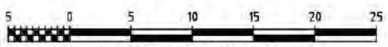
DETAIL 4 CLEAN WATER DRAIN (CWD-A)
SCALE 1:100 — 003 008

DETAIL 5 CLEAN WATER DRAIN (CWD-B)
SCALE 1:100 — 008



DETAIL 6 DIRTY WATER DRAIN (DWD-A)
SCALE 1:100 — 008





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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
A	REMOVE REFERENCE PLANE	18/02/22	ARL	MWJ	EJB

SCALE: AS SHOWN	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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PONDS AND DRAINS
SECTIONS AND DETAILS

DWG. No. 121089.01-011
SHEET SIZE A3 Rev. A

SHEET 1 OF 1

APPENDIX B: WATER SAMPLING RESULTS

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 199230

Client Details

Client	Territory Resources
Attention	Administration Email, A Koerber, John Milsom
Address	PO Box 109, Pine Creek, NT, 0847

Sample Details

Your Reference	**Frances Creek Operations**
Number of Samples	4 Water
Date samples received	24/08/2018
Date completed instructions received	24/08/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	31/08/2018
Date of Issue	31/08/2018

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Results Approved By
Jaimie Loa-Kum-Cheung, Senior Chemist
Nick Sarlamis, Inorganics Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

Miscellaneous Inorganics					
Our Reference	UNITS	199230-1	199230-2	199230-3	199230-4
Your Reference		SWNOB001	SWNOB002	SWNOB003	SWNOB004
Date Sampled		19/08/2018	19/08/2018	19/08/2018	19/08/2018
Type of sample		Water	Water	Water	Water
Date prepared	-	24/08/2018	24/08/2018	24/08/2018	24/08/2018
Date analysed	-	24/08/2018	24/08/2018	24/08/2018	24/08/2018
pH	pH Units	8.5	7.3	9.8	6.9
Electrical Conductivity	µS/cm	4,100	140	190	140
Total Dissolved Solids (by calc)	mg/L	2,400	82	110	84
Total Suspended Solids	mg/L	5	45	14	420
Turbidity	NTU	1.0	71	14	810

Metals in Waters - Acid extractable					
Our Reference		199230-1	199230-2	199230-3	199230-4
Your Reference	UNITS	SWNOB001	SWNOB002	SWNOB003	SWNOB004
Date Sampled		19/08/2018	19/08/2018	19/08/2018	19/08/2018
Type of sample		Water	Water	Water	Water
Date prepared	-	29/08/2018	29/08/2018	29/08/2018	29/08/2018
Date analysed	-	29/08/2018	29/08/2018	29/08/2018	29/08/2018
Phosphorus - Total	mg/L	<0.05	<0.05	<0.05	0.1

All metals in water-dissolved					
Our Reference	UNITS	199230-1	199230-2	199230-3	199230-4
Your Reference		SWNOB001	SWNOB002	SWNOB003	SWNOB004
Date Sampled		19/08/2018	19/08/2018	19/08/2018	19/08/2018
Type of sample		Water	Water	Water	Water
Date prepared	-	28/08/2018	28/08/2018	28/08/2018	28/08/2018
Date analysed	-	28/08/2018	28/08/2018	28/08/2018	28/08/2018
Arsenic-Dissolved	µg/L	<1	<1	1	<1
Aluminium-Dissolved	µg/L	<10	70	20	<10
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1
Copper-Dissolved	µg/L	8	1	2	1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Iron-Dissolved	µg/L	2	380	85	3
Manganese-Dissolved	µg/L	<5	<5	<5	<5
Molybdenum-Dissolved	µg/L	54	<1	<1	<1
Nickel-Dissolved	µg/L	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Tin-Dissolved	µg/L	<1	<1	<1	<1
Selenium-Dissolved	µg/L	15	<1	<1	<1
Thallium-Dissolved	µg/L	<1	<1	<1	<1
Uranium-Dissolved	µg/L	3.9	<0.5	<0.5	<0.5
Zinc-Dissolved	µg/L	1	<1	<1	<1

All metals in water - total					
Our Reference	UNITS	199230-1	199230-2	199230-3	199230-4
Your Reference		SWNOB001	SWNOB002	SWNOB003	SWNOB004
Date Sampled		19/08/2018	19/08/2018	19/08/2018	19/08/2018
Type of sample		Water	Water	Water	Water
Date prepared	-	27/08/2018	27/08/2018	27/08/2018	27/08/2018
Date analysed	-	27/08/2018	27/08/2018	27/08/2018	27/08/2018
Arsenic-Total	µg/L	<1	<1	1	2
Aluminium-Total	µg/L	<10	2,100	130	4,600
Beryllium-Total	µg/L	<0.5	<0.5	<0.5	0.7
Cadmium-Total	µg/L	<0.1	<0.1	<0.1	<0.1
Copper-Total	µg/L	9	4	2	11
Cobalt-Total	µg/L	<1	<1	<1	4
Chromium-Total	µg/L	<1	3	<1	9
Iron-Total	µg/L	12	4,700	820	13,000
Manganese-Total	µg/L	<5	26	35	230
Molybdenum-Total	µg/L	58	<1	<1	<1
Nickel-Total	µg/L	<1	1	<1	3
Lead-Total	µg/L	<1	3	<1	11
Tin-Total	µg/L	<1	<1	<1	<1
Selenium-Total	µg/L	16	<1	<1	<1
Thallium-Total	µg/L	<1	<1	<1	<1
Uranium-Total	µg/L	4.3	<0.5	<0.5	1
Zinc-Total	µg/L	2	4	2	17

Ion Balance					
Our Reference	UNITS	199230-1	199230-2	199230-3	199230-4
Your Reference		SWNOB001	SWNOB002	SWNOB003	SWNOB004
Date Sampled		19/08/2018	19/08/2018	19/08/2018	19/08/2018
Type of sample		Water	Water	Water	Water
Date prepared	-	24/08/2018	24/08/2018	24/08/2018	24/08/2018
Date analysed	-	24/08/2018	24/08/2018	24/08/2018	24/08/2018
Calcium - Dissolved	mg/L	64	6.2	12	7.3
Potassium - Dissolved	mg/L	27	9.3	13	13
Sodium - Dissolved	mg/L	760	9.8	12	6.8
Magnesium - Dissolved	mg/L	80	3.2	2.6	1.9
Hardness	mgCaCO 3 /L	490	29	41	26
Hydroxide A kalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	98	36	16	43
Carbonate Alkalinity as $CaCO_3$	mg/L	10	<5	26	<5
Total A kalinity as $CaCO_3$	mg/L	110	36	42	43
Sulphate, SO4	mg/L	360	4	8	4
Chloride, Cl	mg/L	1,100	25	26	13
Ionic Balance	%	4.0	-10	-3.0	-7.0

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-022	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA latest edition, 2130-B.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Alternatively determined by colourimetry/turbidity using Discrete Analyer.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			24/08/2018					24/08/2018	
Date analysed	-			24/08/2018					24/08/2018	
pH	pH Units		Inorg-001						102	
Electrical Conductivity	µS/cm	1	Inorg-002	<1					105	
Total Dissolved Solids (by calc)	mg/L	5	Inorg-002	<5						
Total Suspended Solids	mg/L	5	Inorg-019	<5					100	
Turbidity	NTU	0.1	Inorg-022	<0.1					98	

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			29/08/2018	[NT]	[NT]	[NT]	[NT]	29/08/2018	[NT]
Date analysed	-			29/08/2018	[NT]	[NT]	[NT]	[NT]	29/08/2018	[NT]
Phosphorus - Total	mg/L	0 05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	105	[NT]

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	199230-2
Date prepared	-			28/08/2018	1	28/08/2018	28/08/2018		28/08/2018	28/08/2018
Date analysed	-			28/08/2018	1	28/08/2018	28/08/2018		28/08/2018	28/08/2018
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	106	98
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	<10	<10	0	112	108
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0 5	1	<0.5	<0.5	0	108	117
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	104	97
Copper-Dissolved	µg/L	1	Metals-022	<1	1	8	8	0	110	100
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	109	99
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	109	103
Iron-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	112	97
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	<5	<5	0	106	98
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	54	53	2	101	92
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	104	96
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	105	96
Tin-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	119	100
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	15	15	0	108	100
Thallium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	104	97
Uranium-Dissolved	µg/L	0.5	Metals-022	<0 5	1	3 9	4.0	3	106	99
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	1	2	67	105	97

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			27/08/2018					27/08/2018	
Date analysed	-			27/08/2018					27/08/2018	
Arsenic-Total	µg/L	1	Metals-022	<1					99	
Aluminium-Total	µg/L	10	Metals-022	<10					103	
Beryllium-Total	µg/L	0.5	Metals-022	<0 5					95	
Cadmium-Total	µg/L	0.1	Metals-022	<0.1					99	
Copper-Total	µg/L	1	Metals-022	<1					101	
Cobalt-Total	µg/L	1	Metals-022	<1					100	
Chromium-Total	µg/L	1	Metals-022	<1					98	
Iron-Total	µg/L	1	Metals-022	<1					108	
Manganese-Total	µg/L	5	Metals-022	<5					101	
Molybdenum-Total	µg/L	1	Metals-022	<1					96	
Nickel-Total	µg/L	1	Metals-022	<1					98	
Lead-Total	µg/L	1	Metals-022	<1					97	
Tin-Total	µg/L	1	Metals-022	<1					107	
Selenium-Total	µg/L	1	Metals-022	<1					97	
Thallium-Total	µg/L	1	Metals-022	<1					96	
Uranium-Total	µg/L	0.5	Metals-022	<0 5					99	
Zinc-Total	µg/L	1	Metals-022	<1					100	

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			24/08/2018					24/08/2018	
Date analysed	-			24/08/2018					24/08/2018	
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5					102	
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5					108	
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5					105	
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5					104	
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5						
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5						
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5						
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5					99	
Sulphate, SO4	mg/L	1	Inorg-081	<1					102	
Chloride, Cl	mg/L	1	Inorg-081	<1					92	

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Total metals: no preserved sample was received, therefore
analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

Dissolved Metals: no preserved sample was received, therefore
the unpreserved sample was filtered through 0.45 µm filter at the lab.
Note: there is a possibility some elements may be underestimated.

APPENDIX F SECURITY CALCULATION

Tennant Consolidated Mining Group

Security Calculation

Security Summary

Details			
Contact Name	Marty Costello	**Authorisation #**	
Project	Nobles Nob Gold Project	**Date**	24/02/2022
MMP	Tennant Consolidated Mining Group - Nobles Nob and Juno		

NOTE: Operators may use DPIR Cost per Unit Of Measure as a guide or insert their own cost and UOM - adjust form as necessary. Justification of changes to UOM and cost should be provided if DPIR units area not used

New Authorisation	MMP Renewal/amendment	Audit Finding	Client Request
X	X	X	X

Domains	Calculated Cost
1: Site Infrastructure	[redacted]
2: Extractive Workings - Sand, Clay & Gravel	
3: Hard Rock Pits & Quarries	
4: Underground Workings	
5: Tailings Storage Facilities and Dams	
6: Stockpiles & Waste Rock Dumps	
7: Exploration	
8: Access and Haul Roads	
9: River Diversions	
Decommissioning & Post Closure Management	
Sub-Total - All Domains	
CONTINGENCY @15%	
TOTAL COST	
10% Discount	

NORTHERN TERRITORY GOVERNMENT

DISTURBANCE AREA INVENTORY			
Whole of site summary	**Total Area (ha)**	**Progressively rehabilitated area**	**Remaining area**
Lease surface area	355		
Disturbed operational area	36.36		
Above grade landforms			
Waste rock dump #1			
Waste rock dump #2			
Waste rock dump #3			
Waste rock dump #4			
Waste rock dump #5			
Tailings Dam #1	9		
Tailings Dam #2			
Tailings Dam #3			
Tailings Dam #4			
Mining area #1	8.9		
Mining area #2	0.5		
Mining area #3			
Mining area #4			
Mining area #5			
Solar array	4		
Extractive areas			
haul roads			
access roads	3.8		
water ponds/dams	2		
Area of infrastructure	6.2		
camp area			
area of drill pads and sumps			
costeans/pits			
tracks/roads			
other	1.96		
TOTAL	**36.36**		

NORTHERN TERRITORY GOVERNMENT

Domain 1: Infrastructure

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DPIR)
Process Plant, Mill, Crusher area	disconnect and terminate services	@	10000-27500	[redacted]			This item includes disconnecting all services such as power, water and sewer. This is a 'one off' cost for the area.	
	demolish and remove small buildings	m^2	70-90				enter the total area of small buildings and offices in the area, including demountables. It does not include workshops.	
	demolish and remove industrial workshops and sheds	m^2	160-210				enter the total area of workshop facilities in the area.	
	demolish remove conveyor system	m	100-250				Enter the total length of conveyors	
	demolish/remove crusher, process plant and mills	m^2	160-210				enter the total surface area of process plant and mills etc. If multi-story the area should be the sum of the surface area of all floors.	
	remove concrete pads and footings	m^2	10-30				enter the total area of buildings, workshops etc. Cost dependent on thickness. Assume $10/m2 for <300mm thick, $30/m2 for >300mm thick. (default $15 if unknown)	
	remove mobile plant	hr	140-300				consider distance to remove all mobile plant to the nearest centre or to Darwin.	
	remove contaminated material	m^3	3.00-5.00				enter volume of spillage and other contamination for removal to pit or WRD.	
	deconstruct and remove large tanks - eg leach	@	35000-165000				enter the number of tanks	
	deconstruct and remove small tanks	@	10000-30000				enter the number of tanks	
Main Workshop and Stores area	disconnect and terminate services	@	5000-5500				This item includes disconnecting all services such as power, water and sewer. This is a 'one off' cost for the area.	Same area as the above Process Plant, Mill, Crusher area - only one disconnection of services required
	demolish and remove small buildings	m^2	70-90				enter the total area of small buildings and offices in the area, including demountables. It does not include workshops.	
	demolish and remove industrial workshops and sheds	m^2	160-210				enter the total area of workshop facilities in the area. Are there any remote or field based workshops to include	
	remove concrete pads and footings	m^2	10-30				enter the total area of workshops and buildings. Include any areas of carpark and washdown pads, bulk fuel bunding and refuelling areas.	
	remove contaminated material	m^3	3.00-5.00				enter volume of spillage and other contamination for removal to pit or WRD.	
	underground tank removal - large hydrocarbon (>5000L)	@	48000-82500				removal of underground tank and all pipework, bunds and any contamination	
	underground tank removal - small hydrocarbon (up to 5000L)	@	20000-21000				removal of underground tank and all pipework, bunds and any contamination	
	above ground tank removal - hydrocarbon	@	200.00				enter number of tanks	
	remove hydrocarbon contamination	m^3	3.00-5.00				enter the volume to be removed to pit void for appropriate rehabilitation. If the volume is not known assume a volume of 3000m3 per fuel storage facility.	
	remediation on site of hydrocarbon contamination	m^3	30-55				enter the volume of material requiring onsite remediation. If the volume is not known assume a volume of 3000m3 per fuel storage facility.	
Administration	disconnect and terminate services	item	5000-5500				This item includes disconnecting all services such as power, water and sewer. This is a 'one off' cost for the area.	Same area as the above Process Plant, Mill, Crusher area - only one disconnection of services required
	demolish and remove small buildings	m^2	70-90				enter the total area of small buildings and offices in the area, including demountables. It does not include workshops.	
	demolish and remove industrial workshops and sheds	m^2	160-210				enter the total area of workshop facilities in the area.	
	remove bitumen from sealed carparks etc	m^2	12.00-17.00				enter total area of carparks. Includes removal offsite to appropriate facility	
	remove concrete pads, footings	m^2	10-30				enter the total area of workshops and buildings. (concrete <300mm @ $10/m2, concrete >300mm @ $30/m2)	
	waste disposal offsite	@	650				assumes removal offsite to a waste disposal facility. Adjust if disposing at onsite facility	
Sewerage/Water treatment plant	disconnect and terminate services	item	2500-5000				This item includes disconnecting all services such as power, water and sewer. This is a 'one off' cost for the area.	Same area as the above Process Plant, Mill, Crusher area - only one disconnection of services required
	demolish and remove small buildings	m^2	70-90				enter the total area of small buildings and tanks.	
	remove contaminated soil	m^3	3.00-5.00				removal to pit void for appropriate rehabilitation	
Accommodation Camp	disconnect and terminate services	item	5000-5500				This item includes disconnecting all services such as power, water and sewer. This is a 'one off' cost for the area.	
	demolish and remove small buildings	m^2	70-90				enter the total area of small buildings and tanks.	
Airstrip, borefields, other	remove concrete pads footings and bitumen	m^2	10-30				enter total area (concrete <300mm @ $10/m2, concrete >300mm @ $30/m2)	
	demolish and remove sheds and storage tanks	m^2	70-90				enter area of sheds and tanks	
	production/dewatering bore closure	@	2000-3300				sealing and rehabilitation	
	observation bore closure	@	500				includes sealing and rehabilitation to make safe.	
Revegetation Activities - all infrastructure areas	Deep rip	ha	550-1100				Enter all areas disturbed by infrasturcture from above, including laydown areas Assume highly disturbed and compacted areas - see assumptions.	
	source cart and spread topsoil	m^3	2.50-5.50				assume minimum of 10cm depth	
	revegetation by tubestock	ha	6000/ha (or 5/ea)				enter total area for revegetation by tubestock. (or enter quantity of tubestock required (<15cm), and density/ha)	
	revegetation by direct seeding	ha	1200-2000				this rate includes acquiring a mix of native tree and shrub species appropriate for the area, mixing and treating the seed and applying by hand at a rate of 4-10kg/ha	
	feriliser application	ha	140-744				includes a single application of fertiliser during the initial seeding program - see assumptions	
Other	remove powerlines	km	9800-15000				include dismantling and removal of lines and poles from the site	
	remove pipelines	km	1400-1800				remove polypipe >300mm diameter. Assumes removal by 3 persons via truck to nearest location.	
	solary array	@	30000					
DOMAIN 1 TOTAL								

NORTHERN TERRITORY GOVERNMENT

Domain 2: Extractive Workings - Sand, Clay & Gravel

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DPIR)
Pits	Scaling, battering for stabilisation	m^2	1.21-3.00				this includes the area requiring reshaping for stabilisation and preparation for revegetation	
	backfilling of pits	m^3	4.00-5.00				enter volume of material to be backfilled into pit	
	abandonment bund and pit access closed	m	20.00-63.25				required where final pit includes steep faces. Includes bund around pit and closure of ramp. Bund assumed to be 2m high and 5m wide at base	
	structural works for drainage	ha	700-1500				earthworks for banks and drains to manage surface water .	
	source cart and spread topsoil or growth medium	m^3	2.50-5.50				required if it has not been demonstrated that pit material is suitable as a growth medium	
	final trim, deep rip	ha	550-1600				to enhance vegetation program as required, dependent on material to be ripped eg sand, gravel, clay. Assume low to medium level disturbance - see assumtpions	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser application	ha	140-744				includes a single application of fertiliser during the initial seeding program - see assumptions	
	signage	@	50				enter number of warning signs as approriate	
Sediment Management	sediment traps/dams	m^3	2.50-2.90				enter volume of dam required for sediment traps	
	Rocks or coarse material lined sediment trap	m^3	1.00-5.00				condsider distance to cart material	
Other								
DOMAIN 2 TOTAL								

NORTHERN TERRITORY GOVERNMENT

Domain 3: Hard Rock Pits and Quarries

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DPIR)
Stabilisation of Pits	Drill and blast faces to make safe OR	m^3	1.20-1.60				Volume is worked out be multiplying length of bench by width and height to reduce angle to make it safe.	
	scaling, battering, pushing walls	m^3	1.21-3.00				volume requiring reshaping	
	abandonment bund and pit access closed	m	19.00-63.25				required where final pit includes steep faces (>18o). Includes bund (2m high , 5m base) around pit and closure of ramp	
	final trim, deep rip	ha	550-1600				to enhance vegetation program around pit and pit floors as required	
	structural works for drainage	ha	700-1540				earthworks for banks and drains to manage surface water .	
	source cart and spread topsoil if appropriate	m^3	2.50-5.50				includes min of 10cm of topsoil to assist revegetation program.	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the initial seeding program	
	fencing	m	10.0-30.0				construct a standard stock fence around the site	
	signage	@	50				enter number of warning signs as appropriate	
Infill of pits	infill with tailings or waste rock	m^3	2.00-4.00				haul and dump of waste rock or tailings. Distance needs to be considered.	
	shaping or levelling	ha	550-1100				area requiring minor reshaping prior to deep ripping	
	source cart and spread suitable material for growth medium	m^3	2.00-5.00				required if it has not been demonstrated that infill material is suitable as a growth medium and only if does not require egineered capping design for ARD/metals mitigation. Assume min thickness of 0.5m	
	source cart and spread topsoil if appropriate	m^3	2.50-5.50				includes min of 10cm of topsoil to assist revegetation program.	
	final trim, deep rip	ha	550-1600				to enhance vegetation program over infilled pit as required	
	structural works for drainage	ha	700-1540				earthworks for banks and drains to manage surface water on top of capped pit area if required.	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the initial seeding program - see assumptions	
Sediment Management	sediment traps/dams	m^3	2.5-2 9				enter volume of dam required for sediment traps	
	Rocks or coarse material lined sediment trap	m^3	1.00-5.00				condsider distance to cart material	
Other								
DOMAIN 3 TOTAL								

NORTHERN TERRITORY GOVERNMENT

Domain 4: Underground Workings

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DPIR)
Portals, Declines and Shafts	barricading portal/declines/adits	@	1500-2500				barricading of portal with steel grill to make safe and ensure access cnnot be gained but will allow movement of bats	
	sealing portal/decline	@	15000-25000				OR sealing portal with concrete and backfill to make safe and ensure access cannot be gained	
	capping/sealing shafts	@	10000-25000				cap shafts using reinforced concrete slab. Dependent on size	
	shaft infilling	m^3	8.00-20.0				filling of shafts using onsite material	
	seal ventilation fans	@	27500				seal and rehab ventilation fans to make safe.	
	final trim, deep rip	ha	550-1600				to enhance vegetation program in area as required	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the initial seeding program - see assumptions	
DOMAIN 4 TOTAL								

Domain 5: Tailings Storage Facilities and Dams

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DPIR)	
Water Dams, Ponds	clean water dams - stabilise and make safe	@	2000-2200	[redacted]			minor earthworks		Stage 1
	or backfill to natural surface	m²	2.00-5.00				backfill and with original material. Haul distances sliding scale from $2/m3 for up to 1km, up to $5/m3 for up to 5km or greater.		Stage 2
	dirty water dams - drain and remove sediment	m²	5.00-7.50				includes draining the dam to the pit or other appropriate place, removing 500mm of potentially contaminated sediments to be buried in the pit or other disposal area. Must consider the distance from dam to disposal area.		Stage 3
	shaping or levelling	ha	950-1100				area requiring minor reshaping prior to deep ripping		Stage 4
	source cart and spread suitable material for capping/growth medium	m²	2.00-5.00				required if it has not been demonstrated that infill material is suitable as a growth medium. Assume min thickness of 0.5m		
	source cart and spread topsoil if approp ia e	m²	2.50-5.50				includes min of 10cm of topsoil to assist revegetation program.		
	final trim, deep rip	ha	550-1800				to enhance vegetation program over infilled pit as required		
	structural works for drainage	ha	700-15 0				earthworks for banks and drains to manage surface water on top of capped dam area if required.		
	revegetation by tubestock	ha	6000/ha (or Site)				includes acquisition of tubestock, fertiliser and guarding as necessary		
	revegetation be direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of ~10kg/ha.		
	fertiliser application	ha	1 0 7				includes a single application of fertiliser during the initial seeding program		
Tailings Dams	source cart and spread suitable material for capping	m²	2.00-5.00				volume of suitable material for capping the TSF. Must have appropriate chemical and physical properties. Required whether for engineered design or growth medium.		
	apply capping design treatment as required eg stone and gravel	ha	25000- 9500				required to manage AMD or metals leaching from TSF. Capping layer assumed to be no less than 2m thick.	Lower range per UOM selected - due to the stable nature of the Geotubes tailings storage being used. This will reduce the costs of rehabilitation, as the Geotubes will rapidly dewater and represent a solidified stable structure. To more readily and economically cover and revegetate compared with conventional unconsolidated TSF Dams.	
	source cart and spread topsoil if approp ia e	m²	2.50-5.50				includes min of 10cm of topsoil to assist revegetation program.		
	reshape walls and surrounds	ha	1 00-5500				area requiring stabilisation and reshaping works around the walls of the emplacement		
	final trim, deep rip	ha	550-1800				to enhance vegetation program over infilled pit as required		
	structural works for drainage	ha	700-15 0				earthworks for banks and drains to manage surface water on top of capped dam area if required.		
	revegetation by tubestock	ha	6000/ha (or Site)				includes acquisition of tubestock, fertiliser and guarding as necessary		
	revegetation be direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of ~10kg/ha.		
	fertiliser application	ha	1 0 7				includes a single application of fertiliser during the initial seeding program - see assumptions		
	seepage management - recovery and treatment	@	20000-200000				where seepage is at unacceptable levels and no wetland filter is in place and company has committed to recovery and treatment of seepage. Depends on size.		
	seepage management - wetland filter	ha	5500				assumes wetland filter is in place and functioning		
Other									
DOMAIN 5 TOTAL									

NORTHERN TERRITORY GOVERNMENT

Domain 6: Stockpiles & Waste Rock Dumps

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Es imated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DPIR)
Oxide waste rock dumps and extractive product stockpiles	Recontouring/battering for stabilisa ion	m^2	2.00-3.60				this includes he area requiring reshaping for stabilisation and preparation for revegetation	
	unshaped requiring minor earthworks, trim and deep rip	ha	550-1600				enter the area requiring minor reshaping to 12-18° slopes and deep ripping to enhance revegetation	
	unshaped requiring major earthworks, trim and deep rip	m^3	1.21-4 00				include volume of material requiring major reshaping to achieve approriate grades (<18° Or as specified in MMP) and deep ripping	
	structural works for drainage	ha	700-1540				ear hworks for banks and drains to manage surface water on top of WRD.	
	source cart and spread topsoil or growth medium	m^3	2.50-5 50				required if it has not been demonstrated that WRD material is suitable as a growth medium	
	or removal of stockpiles	m3/bcm	3.00-5.00				carting of stockpiles offsite or WRD to pit. Consider carting distance	
	trim, deep rip if required	ha	550-1600				ripping stockpiles or surrounds if required.Assume ripping of waste rock dumps undertaken during reshaping.	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the ini ial seeding program - see assumptions	
Waste rock dumps with AMD or metals	unshaped requiring major earthworks, trim and deep rip	m^3	4.00-6 00				include volume of material requiring major reshaping to achieve approriate grades (<18° or as specified in MMP) and deep ripping	
	unshaped requiring minor earthworks, trim and deep rip	ha	550-1600				enter the are requiring minor reshaping and deep ripping to enhance revegetation	
	source cart and spread suitable material for capping	m^3	2.00-5.00				volume of suitable material for capping the WRD. Must have appropriate chemical and physical properites.	
	apply capping design treatment eg 'store and release'	ha	25000-49500				required to manage AMD or metals leachate from WRD. Capping layer assumed to be no less than 2m thick.	
	or removal of stockpiles	m3/bcm	3.00-5.00				removal to pit. Haulage distance needs to be considered at an additonal $1/km	
	source cart and spread topsoil if appropriate	m^3	2.50-5 50				required if it has not been demonstrated that capping material is suitable as a grow h medium	
	final trim, deep rip	ha	550-1600				to enhance vegetation program over infilled pit as required	
	structural works for drainage	ha	700-1540				ear hworks for banks and drains to manage surface water on top of WRD area if required.	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the ini ial seeding program - see assumptions	
Leachate and sediment management	Active recovery treatment of problem leachate	item	20000-200000				where seepage is at unacceptable levels and no wetland filter is in place and company has committed to recovery and treatment of seepage. Depends on size.	
	Wetland filter	ha	5500				assumes wetland filter is in place and functioning	
	dams for sediment control	m^3	2.50-2.90				enter volume of dam required for sediment traps	
	Rocks or coarse material lined sediment trap	m^3	1.00-5.00				condsider distance to cart material	
Other								
DOMAIN 6 TOTAL								

NORTHERN TERRITORY GOVERNMENT

Domain 7: Exploration

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DME)
Drillholes, Pads, sumps, costeans	capping drillholes 30cm below ground	@	80-275				Cut collar, insert plug and backfill. Assume using, concrete or plastic cone plugs or bridge (no 'occy' plugs) Depends on number of holes	
	grout with concrete	@	1250				Assume total grouting of drillhole	
	empty and remove plastic sample bags	hole	25-235				return cuttings to hole and remove plastic bags to a waste disposal facility. Bags cannot be disposed of on site.	
	ripping/scarifying pads	ha	440-2500				Minor ripping/scarifying of pads to depth of 0.3m to assist vegetation in areas of flat/gentle terrain, includes sump infilling. Sumps should not remain open for extended periods of time.	
	reshape drill pads	@	320				Required in steep terrain where earthworks required with excavator/dozer to return pad to slope and establish erosion control, includes sump infilling. Using PC650 excavator or equivalent assumes one pad per hour @$320/hr.	
	infilling costeans	m^3	2.00-3.00				Backfilling of all costeans/trenches. Assumes material does not have to be carted.	
	bulk sample pits	m^3	2.00-8.00				dependent on depth of pit and if battering of walls required to form to 18° slope	
	contouring for erosion control	ha	700-1540				minor pushing to construct water management structures such as contour banks and diversion drains as required.	
	topsoil replacement if applicable	m^3	2.50-5.50				includes min of 10cm of topsoil to assist revegetation program. **this may be carried out when reshaping pads	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha if required. Required where area of disturbance is significant.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the initial seeding program	
Tracks and Gridlines	ripping/scarifying minor tracks and gridlines	km	120-500				assume using grader or equivalent to rip to 0.3m and no windrows, establishing erosion control measures (eg bunds) as required	
	ripping major tracks and roads	km	550-1000				pushing in windrows and ripping track and establishing erosion control measures (ie bunds) across tracks as required	
	removal of gridpegs	item	1500				includes removal offsite of all grid pegs in exploration area	
	topsoil replacement if applicable	m^3	2.50-5.50				includes min of 10cm of topsoil to assist revegetation program if required	
	revegetation by tube stock	ha	6000/ha (or 5/ea)				includes acquisition of tubestock, fertiliser and guarding as necessary	
	revegetation by direct seeding	ha	1200-2000				includes acquiring and spreading a range of native seed by direct broadcast at a rate of 4-10kg/ha.	
	fertiliser applicataion	ha	140-744				includes a single application of fertiliser during the initial seeding program	
DOMAIN 7 TOTAL								

NORTHERN TERRITORY GOVERNMENT

Domain 8: Access and Haul Roads

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DME)
Haul Roads	remove ARD material from road	m3/bcm	2.50-5.50				where haul road has been constructed with waste rock material that is leaching ARD removal and disposal in pit or similar will be required	
	reshape and deep rip	ha	2000-5000				windrows are pulled back and edges battered, area is deep ripped (road 12mwide)	
	structural works for drainage	ha	700-1540				pushing to construct water management structures such as contour banks and diversion drains as required.	
Access Roads	breaking and removal of bitumen	m3	12.00-17.00				Includes area of bitument in roads car parks etc which needs to be removed and disposed of appropriately	
	reshape and deep rip	ha	2000-5000				windrows are pulled back and edges battered, area is deep ripped	
	structural works for drainage	ha	700-1540				pushing to construct water management structures such as contour banks and diversion drains as required.	
Revegetation activities - all roads	source cart and spread topsoil	m^3	2.50-5.50				assume minimum of 10cm depth	
	revegetation by tubestock	ha	6000/ha (or 5/ea)				enter total area for revegetation by tubestock. (or enter quantity of tubestock required (<15cm), and density/ha)	
	revegetation by direct seeding	ha	1200-2000				this rate includes acquiring a mix of native tree and shrub species appropriate for the area, mixing and treating the seed and applying by hand at a rate of 4-10kg/ha	
	feriliser application	ha	140-744				includes a single application of fertiliser during the initial seeding program - see assumptions	
DOMAIN 8 TOTAL								

Domain 9: River Diversions

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DME)
Creek/River	channel maintenance	m	165.00				Includes earthwork repairs and stabilisation following flow events.	
	vegetation by tubestock	ha	6000/ha (or 5/ea)				enter total area for revegetation by tubestock. (or enter quantity of tubestock required (<15cm), and density/ha)	
	vegetation by direct seeding	ha	1200-2000				this rate includes acquiring a mix of native tree and shrub species appropriate for the area, mixing and treating the seed and applying by hand at a rate of 4-10kg/ha	
	vegetation maintenance	ha	140-744				includes a single application of fertiliser during the initial seeding program	
DOMAIN 9 TOTAL								

NORTHERN TERRITORY GOVERNMENT

Decommissioning & Post Closure Management

Management Area	Technique	Unit of Measure (UOM)	Range per UOM ($)	Cost per UOM ($)	Estimated Quantity	Sub Total ($)	Technique Notes	Comment (eg when $/UOM differs from DME)
Decommissioning and Closure	mobilisation/demobilisation	km	10.00-15.00				determined based on distance to the mine and machinery used ($/km) Assume mob/demob from largest centre unless otherwise stipulated & supported by the operator. Calculation assumes 5 pieces of machinery required per site. Adjust formula if necessary.	
	Contaminated site assessment	@	35000				has a contaminated site assessment been undertaken? If not this should be included for large metalliferous mines.	
	Pest and weed management, monitoring & assessment	ha	200 - 250				Include total disturbed area , consider for minimum of 2 years during closure for larger sites only. Entry automated form 'Key Information' tab.	
	Contractor accommodation, messing and travel costs	man day	210-320				Assume 5-9 people required for 2-10 weeks (or more) depending on size of site *quantity = number of days X number of people (eg 9 persons for 50 days = 450 man days)	
	Closure management	yr	110,000 - 300,000				This includes project manaement team assuming 1 - 3 persons based on the magnitude of the process salaries, oncosts, tender preparation and closure report and coordination of works. Consider part of year only for small sites.	
Post Closure	mobilisation/demobilisation	km	10.00-15.00				Determined based on distance to the mine and machinery used ($/km) Assume mob/demob from largest centre unless otherwise stipulated & supported by the operator. Calculation assumes 1 piece of machinery required per site.	
	Post closure water monitoring	yr	adjust post closure entry rec				Monitoring and measurement requirements that may be needed following the closure of the project - use the 'post closure worksheet' Estimated quanity refers to number of years required post closure	
	Pest and weed management, monitoring & assessment	ha	200 - 250				Include total rehabilitated area , assumed for minimum of 3 years post closure Entry automated form 'Key Information' tab.	
	Earthwork maintenance	ha	1,100				Assume 20% failure rate for the total areas of contructed landforms (eg WRDS, TSF etc) for a period of 2 years (if not stipulated otherwise) Entry automated form 'Key Information' tab.	
	Revegetation maintenance, monitoring & assessment	ha	1,250 - 2,500				Assume a 20% failure rate for all disturbed areas for a period of 2 years. (if not stipulated otherwise) Entry automated form 'Key Information' tab.	
	Project management	yr	20,000				This includes tender preparation, financial reporting procurement, contractor management etc. Time frame assumed is 1-10 years depending upon the site & the complexity of the issues present	
	fire break maintenance	km	50-75				Grading of firebreaks during and after closure for a period of 1-10 years depending on site size *quantity = number km x number years	
POST CLOSURE TOTAL								

NORTHERN TERRITORY GOVERNMENT

POST CLOSURE WATER QUALITY MONITORING WORKSHEET

SUMMARY

NOTE:
Operators must enter numbers in the blue boxes, to the appropriate timeframes and reflecting the structures present on individual sites.

Item	Component		Cost ($)
1	Groundwater monitoring - Analytical		
2	Surface water monitoring - Analytical		
3	Field sampling and Expenses		
4	Water quality interpretation & reporting		
		TOTAL	

1 GROUNDWATER MONITORING - ANALYTICAL

Analytical & consumables
Assumptions: ICPMS, fields & laboratory consumables @ $250/sample

Mine site structures	Size (ha)	Enter the number of structures	Sampling points	Sampling per year	Enter the number of years 0-10	Subtotal cost ($)
Whole of site	All					
Extraction bores for use after closure						
Discrete infrastructure areas						
Underground fuel storage areas						
Pit voids/declines	All					
Waste rock dump - oxide	<5					
	5 - 20					
	>20					
Waste rock dump - mixed or sulfide	<5					
	5 - 20					
	>20					
Tailings dam / residue disposal ponds	0 -20					
	21 - 100					
	100 - 150					
	>150					
Heap leach pad	<10					
	>10					
Water containment/retention ponds (water not suitable for passive release)	<10					
	10 - 20					
	>20					
Waste disposal areas						
Other						
Other						
Other						

Denotes sampling of bores adjacent to structures

2 SURFACE WATER MONITORING - ANALYTICAL

Analytical & consumables
Assumptions: ICPMS, fields & laboratory consumables @ $250/sample

Mine site features	Number of features	Sampling points	Sampling per year	Enter No. of years 1-10	Subtotal cost ($)
Water retaining structures with no discharge					
Water retaining structures with possible discharge					
Bioremediation structures					

PLUS

Mine site features
Perenial streams discharging from site
Ephemeral streams discharging from site

OR Please note: Fill out either the streams or the site operat

Site operation complexity & size and climate
Arid zone site - small to medium
Arid zone site - large
Wet/dry tropics site - small size, simple issues
Wet/dry tropics site - small size, moderate -complex issues
Wet/dry tropics site - medium size, simple issues
Wet/dry tropics site - medium size, moderate -complex issues
Wet/dry topics site - large size, moderate -simple issues
Wet/dry topics site - large size, moderate -complex issues

3 FIELD SAMPLING & EXPENSES

Assumptions:
Road travel <200km = day trip , 2 people, no accommodation, fuel (300km return) & expenses
Road travel 200 - 500km = minimum of 1 nights accom , 1 day travel + 1 night for each additional sampling day, 2 people , fuel (av 800km return)
Road travel >500km = minimum of 2 nights accom, 2 days travel + 1 night for each additional sampling day, 2 people, fuel (av 1600km return)
Fuel = $1.20/L @ 6km/L Accommodation & meals = $130 per person /per night Personnel = $800 per person per day Air travel = $2000 per person return Expenses (e.g. vehicle/consumables etc) $100/day

Travel and expenses	Enter No. of years 0-10	Distance from nearest centre eg Darwin	Quantity	Enter est. days each sampling trip	Subtotal cost ($)
Field trips - Road travel					
Field trip - Air travel (Proof of availability & suitability required)					

4 WATER QUALITY INTERPRETATION AND REPORTING

Item	Site size& water mgmt challenges	Quantity	Enter No. of yrs 0-10	Unit cost ($)	Subtotal cost ($)
Quaterly data collation & interpretation	small				
	medium				
	large				
Annual data collation & interpretation	small				
	medium				
	large				
Other reporting					

NORTHERN TERRITORY GOVERNMENT

Assumptions

Ripping
deep rip low level disturbance - 14G grader or equivalent with multishank ripper to 3m width. At $180/hr and at 3km/hr with 0.83 efficiency will cover 7500m2/hr = $240/ha
Deep rip medium level disturbance- Cat D6 with triple shank rippers ripping to a depth of 0.3m and 3m width covered per pass. At $220/hr and 2km/hr with 0.83 efficiency will cover 4980m2/hr = $441/ha
deep rip high level of disturbance and compaction - using a Cat D9 with multishank
ripper to a width of 2.64m. At $300/hr and 1.6km/hr with 0.83 efficiency will cover 3320m2/hr = $900/ha

tracks
Assume D9 used to rip to depth of 0.3m, which can do 1.36km/hr. Assume $300/hr. Requires 2 passes on track ~5m wide = $440/km.
Windrows - 14G grader will grade in windrows at 3km/hr (2nd gear) and require two passes each side of road = 1500m of road/hr @ $180/hr =$120/km
two passes with grader to rip track <4m wide at 3km/hr =$120/km

grading firebreaks with 14G equivalent grader @$180/hr. Blade width of 14', travelling at ~5km/hr. Two passes required = 24minutes/km=$72/km

drillpads - major reshaping

using a Komatsu PC650 excavator or similar at $320/hr, can move 300bcm/hr assume one pad per hour

haul roads
haulroads assumed to be an average of 12m wide with an additional buffer of 5m each side of the road which has been cleared or significantly disturbed. Surfaces are heavily compacted and constructed of imported fill.
Road fill which may be ARD producing is removed using an excavator ($320/hr) and 3x50t dump truck ($750/hr), watercart @ $140/hr, dozer@$250/hr. Excavator will produce 300bcm/hr = $4.86/bcm

Stockpile/WRD removal/pit infill
Assume load and haul to pit using excavator and 3 dump trucks. Excavator ($320/hr) and 3 trucks ($840/hr total) as above = $3.87/bcm

bund - assume excavator and 3 dump trucks, with minimal haul distance (no greater than 1km.)
As per road fill above using and excavator and 3 trucks = $3.87/bcm. If bund is 5m wide and 2m high = 5m3/m then bund ~$19/m to construct

fertiliser - current (09/01/09) Landmark price per tonne for NPK fertiliser = $1487.50
fertiliser applied at 500kg/ha (best practice) = $743.75/ha
If applied at only 100kg/ha = $148.75/ha
application dependent on growth medium

RC drillpads assume average 10mx10m, DDH pads 10mx20m

post closure cost for pest, fire and weed management comes from contrators estimate for Woodcutters site

contractor costs for meals, accommodation, travel and supervision:
meals & accom @ $150/head/day
travel @$60/head/hr
supervision@$1000/day
so for 10.5hr day daily costs = $1845/hr/300bcm/hr of production = $6.15/bcm
This tool has assumed cost of $210-$320/man/day

APPENDIX G ENVIRONMENTAL POLICY

Tennant Consolidated Mining Group Environmental Policy

1. Introduction

Tennant Mining is committed to sustainable development. We recognize that the long-term sustainability of our business is dependent upon good stewardship in both the protection of the environment and our communities. We will ensure that all employees, directors, officers, contractors, agents, consultants and any other party representing Tennant Mining are aware of this policy and the responsibilities which it sets out.

2. Policy objectives

Tennant Mining's Environmental objectives include:

- To comply with all applicable environmental laws, regulations and requirements;
- To undertaking proactive environmental management practices; and
- To implement effective environmental risk management.

3. Scope

This policy applies to all employees, directors, officers, contractors, agents, consultants and any other party representing Tennant Mining wherever it operates across the world.

4. Policy statements

- We recognise that sustainability is an integral and multi-disciplinary part of our business that must be considered in all decisions;
- We will comply at all times with environmental laws and regulations with the objective to go beyond compliance to undertake proactive environmental management practices;
- We continuously review our operations to identify, assess and control environmental impact and actively promote the reduction of waste within our operation;
- We will set company-wide environmental targets and performance against these targets will be monitored, measured and reported on to the Board;
- We will report any actual or potential environmental incidents or spills irrespective of the severity and report on our environmental performance;
- We recognize the increasing awareness within our industry of climate change and the need to participate in solutions that address the long-term impact of climate change, including where feasible, the reduction of greenhouse gas emissions;
- We recognize the sensitivity around water management and water scarcity, where we will aim to constantly improve water management systems and their efficiency, and to monitor our usage of water resources in our areas of operation; and
- We are committed to transparent communication and stakeholder engagement with interested and affected parties on environmental aspects of our activities.

5. To achieve the objectives we will:

- Develop a culture that recognises the importance of demonstrating environmental leadership behaviour by embedding this as an expectation in all our planning, systems and procedures;
- Work to continually improve our environmental performance over time, including with regard to increasing our energy efficiency and reducing emissions and waste, and to promote sustainable development in the areas in which we operate;
- Undertake all necessary environmental assessments for our operations and use the best available evidence to identify how we can prevent, minimise, mitigate or remediate any harmful effects of our operation on the environment;
- Monitor, maintain and improve, where required, environment risks through the use of robust systems, governance and assurance processes;

- Work to ensure that we have technically sound plant and equipment; and work that is well designed, planned, executed, supervised and approved by trained and competent people;
- Provide appropriate levels of training, development and mentoring to ensure our employees and contractors are aware of the requirements of this policy and how it is implemented;
- Encourage our people to collaborate and share learnings to proactively prevent environmental incidents;
- Learn from incidents and strive to continually improve our environmental performance;
- Strive to be transparent in our public disclosure on environmental matters, particularly those relating to risk management systems in place and mitigation of environmental risk; and
- Conduct effective, meaningful, and comprehensive stakeholder engagement processes throughout the life of operations.

6. Policy Review

This policy will periodically be reviewed by the Board to ensure it continues to meet both regulatory and contemporary industry standards and practices.

APPENDIX H RISK ASSESSMENT

Theme	Environmental Factor/Value	Hazard/Aspect	Incident/event	Possible impact	L*	C*	IR*	Mitigation measures	L*	C*	RR*
LAND	Terrestrial Environmental Quality	Erosion	Exposed soils	Soil erosion due to increased runoff from cleared areas.	C	3	High Risk (13)	Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the *International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC)* .	B	3	Moderate Risk (9)
LAND	Terrestrial Environmental Quality	Clearing vegetation / ground disturbance	Clearing vegetation for solar field	Reduction of vegetation type. Reduction of habitat availability for fauna.	D	3	High Risk (17)	Retain topsoil in situ. Revegetation at end of project with local seed stock to restore vegetation cover and habitat value.	D	2	Moderate Risk (12)
LAND	Terrestrial Environmental Quality	Traffic	Fauna strike	Native fauna death or injury due to vehicle interaction	C	2	Moderate Risk (8)	Enforce speed limits on site access roads. Incident report to be completed for all fauna injuries or death. Little or no habitat on site	B	2	Low Risk (5)
LAND	Terrestrial Environmental Quality	Contaminated soil	Unexpected find of contaminated material	Contamination is spread from disturbance during activities	C	3	High Risk (13)	In the event that any unexpected material that has the potential of being a contaminant (e.g. dumped waste, stained soil, asbestos), is identified or uncovered during operations the following procedure will be implemented: •Stop work in the area where potential contaminated material is identified • Specialists will be engaged as necessary to advise and/or oversee the removal of the unexpected find. • The removal of the material will be conducted in accordance with relevant legislation (depending on what material is identified e.g. a licenced asbestos removal contractor) •If the material is identified as a listed waste, the waste will be removed and transported by a licenced waste contractor and disposed of at a licenced waste facility specific to the contaminated material. **If Asbestos is identified** - In the event that asbestos is found, an Asbestos Management Plan will be developed and implemented. Removal, transportation, disposal and remediation will be in accordance with the *Work Health and Safety (National Uniform Legislation) Regulations 2011, the Public and Environmental Health Act, the Waste Management and Pollution Control Act* and *Regulations 1998* , and other relevant guidelines/industry standards.	B	3	Moderate Risk (9)
LAND	Terrestrial Environmental Quality	Storage and handling of hazardous materials	Leaks and spills from fuel storage areas entering surface or groundwater	Contamination of soil from hazardous materials	D	2	Moderate Risk (12)	Storage and handling of hazardous materials will be developed as part of the site EMP. Fuel and flammable chemicals will be stored and handled in accordance with *AS 1940-2004* . Fit for purpose spill kits to be positioned at refuelling and storage areas. All personnel on site will be trained in use of spill kits, in the event of an spill.	B	2	Low Risk (5)
LAND	Terrestrial Ecosystems	Weeds	Weed introduction and spread	Reduced habitat quality on and off-site due to competition with native plant species	E	3	High Risk (20)	Weed mitigation measures will be incorporated in the sites EMP. Mitigation measures will include the following: o All machinery and equipment to be certified weed free by a suitably qualified person prior to arrival at site. o Control of declared weeds on-site as per the NT *Weeds Management Act.* o All weeds removed will be and disposed of appropriately to ensure no further spread of weeds. o Identification of any declared weed will be reported to the Weeds Branch in accordance with the NT *Weeds Management Act* .	B	3	Moderate Risk (9)
LAND	Terrestrial Ecosystems	Pests	Introduction of pest animals (i.e. fire ants) by machinery and equipment	Reduced habitat quality and competition with native species	D	2	Moderate Risk (12)	Visual inspection of machinery and equipment will be undertaken prior to arrival and departure from site.	B	2	Low Risk (5)
LAND	Terrestrial Ecosystems	Pests	Increase of pest species such as rats, cats and dogs at site during operations	Reduced habitat quality and competition with native species	D	2	Moderate Risk (12)	Putrescible waste will be correctly managed under the EMP and stored onsite in skip bins between each removal during construction and once the proposal area is used for residential purposes.	B	2	Low Risk (5)

LAND	Terrestrial Ecosystems	Noise	Noise emissions from machinery and equipment	Reduced habitat quality for fauna due to noise disturbance.	B	2	Low Risk (5)	No sensitive habitats in proximity to site (i.e. wetlands, roost sites), no mitigation required.	B	2	Low Risk (5)
LAND	Terrestrial Ecosystems	Dust	Dust emissions caused by operation of machinery and equipment	Reduced habitat quality due to smothering of plants	B	2	Low Risk (5)	No sensitive habitats in proximity to site (i.e. wetlands, roost sites), no mitigation required.	B	2	Low Risk (5)
LAND	Terrestrial Ecosystems	Bushfire	Uncontrolled bushfire caused by operation of equipment, lighting fires, discarded cigarette.	Change of vegetation community due to changes in fire frequency.	C	3	High Risk (13)	No fires allowed on site. Hot works such as welding not to be undertaken on days of total fire ban or high winds. Smokers appropriate disposal of cigarettes, vehicles maintained.	B	3	Moderate Risk (9)
LAND	Terrestrial Environmental Quality	Contaminated soil	AMD/NMD from ROM/Ore stockpiles	Stockpiles left in-situ leach contaminants to surrounding land/soils	C	3	High Risk (13)	Ore stockpiled on ROM short-term Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	B	3	Moderate Risk (9)
LAND	Terrestrial Environmental Quality	Contaminated soil	AMD/NMD from WRD	Contamination to surrounding environment	C	3	High Risk (13)	Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	B	3	Moderate Risk (9)
LAND	Terrestrial Environmental Quality	Contaminated soil	Failure of Geotubes TSF system	Contamination to surrounding environment	C	3	High Risk (13)	Studies have been undertaken by ATC Williams for the best location, and strucutural layout of the Geotubes system. The recommendations within that report will be implemented to ensure the most effective and safe use of Geotubes system occurs.	B	3	Moderate Risk (9)
WATER	Hydrological processes	Hydrology	Extraction of groundwater	Decreased quantity of groundwater in underlying aquifer system	B	2	Low Risk (5)	Groundwater is proposed to be used if necessary, however, the Project will rely heavily on recycling of the in-process water stream.	B	2	Low Risk (5)
WATER	Hydrological processes	Hydrology	Extraction of surface water	Decreased quantity of surface water in nearby surface water systems	B	2	Low Risk (5)	There is no intended use of any surface water for any Project activities.	B	2	Low Risk (5)
WATER	Inland Water Environmental Quality	Storage and handling of hazardous materials	Leaks and spills from fuel storage areas entering surface or groundwater	Hydrocarbon contamination of downstream surface waterways or groundwater.	B	3	Moderate Risk (9)	Storage and use of fuel will be included in the site specific EMP. Fuel storage and handling in designated areas and accordance with AS1940 and WHS Regulations Fit for purpose spill kits located on site in re fuelling areas and areas where hazardous substances are stored. All workers to be trained in use of spill kits.	A	2	Low Risk (3)
WATER	Inland Water Environmental Quality	Erosion	Erosion of site due to disturbance and exposure of ground surface.	Increased turbidity and sediment loads in ephemeral watercourses	B	3	Moderate Risk (9)	Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the *International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC)*.	A	3	Low Risk (6)
WATER	Aquatic ecosystems	Contaminated water (surface and groundwater)	Increased nutrients in surface water and groundwater from sedimentation discharge from site	Decrease in aquatic ecosystems health downstream of site	B	3	Moderate Risk (9)	Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the *International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC)*.	A	3	Low Risk (6)
WATER	Inland water environmental quality	Contaminated water (surface and groundwater)	Leaks from septic system into groundwater or surface water	Bacterial contamination of groundwater or surface water affects environmental values and/or other users	B	2	Low Risk (5)	Spill response procedures in EMP Waste water system to be installed and maintained as per manufacturers specifications. On-site waste water system will be installed by a licensed plumber in accordance with NT Code of Practice for onsite wastewater management. Approval for wastewater treatment system under the Building Act prior to installation	B	2	Low Risk (5)

WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	AMD/NMD from ROM/Ore stockpiles	Stockpiles left in-situ leach contaminants to surrounding environment	**C**	**3**	**High Risk (13)**	Ore stockpiled on ROM short-term Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	**B**	**3**	**Moderate Risk (9)**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	AMD/NMD from WRD	Contamination to surrounding environment	**C**	**3**	**High Risk (13)**	Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	**B**	**3**	**Moderate Risk (9)**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	Failure of Geotubes TSF system	Contamination to surrounding environment	**C**	**3**	**High Risk (13)**	Studies have been undertaken by ATC Williams for the best location, and strucutural layout of the Geotubes system. The recommendations within that report will be implemented to ensure the most effective and safe use of Geotubes system occurs.	**B**	**3**	**Moderate Risk (9)**
AIR	**Air Quality**	Dust	Dust emissions from cleared/disturbed ground and movement of vehicles and material	Increase in air particulates exceeding guidelines values for environmental values	**C**	**2**	**Moderate Risk (8)**	Dust levels will be visually monitored on site during operations, if dust becomes an issue, water carts will be used to wet down the areas of concern.	**B**	**2**	**Low Risk (5)**
AIR	**Air Quality**	Bushfire	Smoke emissions from uncontrolled bushfire caused from operation of equipment, lighting fires or discarding cigarette	Increase in air particulates exceeding guidelines values for environmental values (Potential implications include - suffocation of sensitive vegetation - increased fire potential)	**C**	**2**	**Moderate Risk (8)**	The bushfires will be managed in accordance with the *Bushfires Management Act 2016* and will be incorporated into the EMP. The EMP will include: No fires allowed on site. Hot works such as welding not to be undertaken on days of total fire ban or high winds. Smokers appropriate disposal of cigarettes, vehicles maintained. Cleared material will not be burnt on site, it will be mulched and use for erosion control or removed from site. Water cart on standby during periods of high fire danger.	**B**	**2**	**Low Risk (5)**
AIR	**Atmospheric processes**	Greenhouse Gas emissions	GHG emissions from use of diesel powered vehicles and generators	Increase in GHG	**B**	**2**	**Low Risk (5)**	Greenhouse gas emission from that activity will be on par with any small, short-term construction project. Vehicles and machinery will be kept in good running order i.e. not producing plumes of black smoke and not operating efficently.	**B**	**2**	**Low Risk (5)**
PEOPLE	**Communities and economy**	Noise	Noise emissions	Noise nuisance to surrounding land users	**C**	**2**	**Moderate Risk (8)**	Machinery maintained to manufacturers specifications . All vehicles and machinery will be fitted with noise attenuating reverse alarms. Noise complaint register to be established pre-construction. Records of noise complaints to be kept and investigation actions undertaken after a complaint is made.	**B**	**2**	**Low Risk (5)**
PEOPLE	**Communities and economy**	Dust	Dust emissions result in exceedance of air quality (particulates) guidelines	Dust nuisance on people accessing areas around proposal area.	**D**	**2**	**Moderate Risk (12)**	Dust will be managed through the Site EMP. Mitigaiton measures include: Dust suppression using water carts where necessary. Stockpiles will be covered and kept to heights <3m. Maintain a complaints register. A Erosion and Sediment Control Plan (ESCP) will be developed in accordance with the International Erosion Control Association Australasia (2008) - *Best Practice Erosion and Sediment Control (BPESC).*	**B**	**2**	**Low Risk (5)**
PEOPLE	**Culture and Heritage**	Clearing vegetation / ground disturbance	Disturbance of ground	Damage, desecration or destruction of Aboriginal sacred sites	**C**	**3**	**High Risk (13)**	A stop works will be implemented if artefacts are located during activities on site. The **PM** will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.	**A**	**3**	**Low Risk (6)**
PEOPLE	**Culture and Heritage**	Clearing vegetation / ground disturbance	Clearing of vegetation for solar field	Damage, desecration or destruction of Aboriginal sacred sites	**C**	**3**	**High Risk (13)**	A stop works will be implemented if artefacts are located during activities on site. The **PM** will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.	**A**	**3**	**Low Risk (6)**

Qualitative measures of likelihood categories		
A	Rare	Highly unlikely, will only occur in exceptional circumstances. Has never occurred in association with an development in the region.
B	Unlikely	Could occur at some time but unlikely. Has only occasionally occurred in association with an development in the region.
C	Moderate	Might occur at some time. Has previously occurred in similar developments.
D	Likely	Known to occur or will probably occur. Has occurred several times in association with recent developments.
E	Almost certain	Common or repeating occurrence. Is expected to occur several times over the duration of an development in the region.

Consequence categories		
1	Insignificant	No measurable impact on the environment or social values
2	Minor	Some, minor, temporary environmental and/or social impact
3	Moderate	Contained temporary, or permanent minor, localised environmental damage or social impact
4	Major	Severe environmental and/or social impacts
5	Catastrophic	Environmental disaster

Risk Matrix

		Consequence				
		1	2	3	4	5
Likelihood	A	1	3	6	10	15
	B	2	5	9	14	19
	C	4	8	13	18	22
	D	7	12	17	21	24
	E	11	16	20	23	25

Red	Extreme risk	Intolerable
Orange	High risk	Intolerable or tolerable
Yellow	Moderate risk	Tolerable or acceptable
Green	Low risk	Acceptable

Risk Assessment Criteria & Descriptions

Consequence	Score		Terrestrial Flora and Fauna	Terrestrial Environmental Quality	Inland Water Environmental Quality	Hydrological processes	Social, Economic and Cultural Surrounds	Community Health and Safety
Severe **Permanent** = Impact is felt during operations and indefinitely post-closure **Regional** = Impact occurs over a large area beyond the proposal area **Irreversible**	5		Impacts to terrestrial flora and fauna that permanently alter biodiversity and/or ecological integrity over a large area beyond the proposal area.	Soil disturbance, erosion or contamination that is irreversible and extends over a larger area beyond the proposal area.	Permanent major exceedance of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses downstream of the proposal area.	Significant reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges leading to permanent irreversible impact to ecological health, land-uses and/or amenity downstream of the proposal area.	Irreversible detrimental impact to stakeholder and/or community values. Long-term disruption to way of life that is felt by the majority of the regional population. Unauthorised destruction of Aboriginal Sacred Site and/or sites of heritage signficance. Damage is irreversible.	One or more fatalities. More than 1 people injured with permanent disbilities.
Major **Long-term** = Impact that is felt during construction and for some years post-construction **Regional** = Impact occurs over a larger area than the proposal area **Reversible** in the medium-long term with significant remedial works	4		Impacts to terrestrial flora and fauna that lead to long-term alteration of biodiversity and/or ecological integrity and/or extend over a large area beyond the proposal area.	Soil disturbance, erosion or contamination that oocurs over a long period of time and/or extends over a larger area than the proposal area. Significant remedial works required to reverse damage.	Long-term and/or major exceedance of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses downstream of the proposal area. Significant remedial works required over an extended period to return to acceptable water quality.	Reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges leading to long-term impact to ecological health, land-uses and/or amenity downstream of the proposal area. Significant remedial works required over an extended period to re-instate hydrological regimes.	Long-term detrimental impact to stakeholder and/or community values. Long-term disruption to way of life that is felt by some of the regional population. Unauthorised damage to Aboriginal Sacred Sites and/or sites of heritage signficance that can be remediated.	No fatalities. One injury with permanent disab lity. More than 10 injuries requiring hospitalisation.
Moderate **Medium to long-term** = Impact that is felt during operations and for some months to years post-closure **Localised** = Impact occurs within the disturbance footprint or immediate surrounds within the proposal area or in the ephemeral watercourse downstream of dams **Reversible** with a moderate level of remedial works	3		Medium-long term impacts to flora and fauna that are confined to the disturbance footprint and immediate surrounds with no measurable impact to biodiversity and/or ecological integrity	Localised soil disturbance, erosion or contamination that continues for months to years post-closure. Damage is reversible with a moderate level of remedial works.	On-going minor exceedances of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses. Exceedances will cease within months to a few years following site rehabilitation works.	Medium to long-term reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges that impacts ecological health, land-uses and/or amenity within the disturbance footprint and immediate surrounds.	Medium to long-term detrimental impact to stakeholder and/or community value. Medium-long term disruption to way of life that is felt by a small number of people. Unauthorised damage to Aboriginal Sacred Sites and/or sites of heritage signficance that can be remediated.	No fatalities. No permanent disability. 5-10 injuries requiring hospitalisation.
Minor **Short-term** = Impact that is felt during the construction phase only **Localised** = Impact occurs within the proposal area. **Reversible** without significant remedial works	2		Short-term impact to flora and fauna with no measurable impact to biodiversity and/or ecological integrity outside of the disturbance footprint.	Short-term and/or localised soil disturbance, erosion or contamination that is reversible without significant remedial works.	Minor temporary exceedances of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses. Exceedances will cease following mine closure without significant remedial	Short-term reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges that impacts ecological health, land-uses and/or amenity only within the disturbance footprint and immediate surrounds. Natural hydrological regimes will return in a short period of time post-closure without significant remedial works	Short-term detrimental impact to stakeholder and/or community values. Short-term disruption/ nuisance that is felt by a small number of people. Minor damage to Aboriginal Sacred Sites and/or heritage sites that does not require remedial works	No fatalities. No permanent disability. Less than 5 injuries requiring hospitalisation.
Insignificant No measurable impact outside of the immediate proposal area.	1		No measureable impact to terrestrial flora and fauna outside of the immediate disturbance footprint.	No measurable soil disturbance, erosion or contamination outside of the immediate disturbance footprint.	No measurable exceedance of pre-development water quality conditions attributable to project activities.	No measurable change to hydrological regimes outside of the immediate disturbance footprint.	No noticeable impact to stakeholder and/or community values. No impact to Aboriginal Sacred Sites and/or heritage sites.	No fatalities. No permanent disability. No injuries requiring hospitalisation.

Theme	NT EPA Factors	Indicative environmental values and sensitivities
Land	**Landforms**	Distinctive features in the landscape, either geological or anthropogenic Subterranean karstic terrain and faults Craters, gorges, ranges, saves, massifs, escarpments, plateaus Monuments Culturally important features Tourism related landforms
	Terrestrial Environmental Quality	Characteristics of soils, including chemical, physical, biological and aesthetic qualities
	Terrestrial Ecosystems	Sensitive or significant' vegetation Vegetation that provides an important ecological function Listed threatened species and their habitat (NT and Commonwealth) Listed migratory species and their habitat (Commonwealth) Locally endemic species or species with restricted habitat 'iconic' or culturally important animals, plants and vegetation
Water	**Hydrological processes**	The supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines. The supply and quality of water in groundwater features including aquifers, aquitards and water tables declared beneficial uses present and future uses and users of water current or potential water supplies, including regional scale aquifers culturally important water features
	Inland water environmental quality	The quality of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines. The quality of water in groundwater features including aquifers and water tables declared beneficial uses present and future uses and users of water current or potential water supplies, including regional scale aquifers culturally important water features RAMSAR wetlands
	Aquatic ecosystems	The health of the biota in inland waterways the habitats that support the lifecycle of aquatic biota Groundwater dependent ecosystems
Sea	**Coastal processes**	Processes that support coastal benthic communities and habitats such as coral reefs, mangroves, salt marshes, seagrass meadows and sponge gardens. Conservation significant low lying areas including tidal creeks, deltas and river mouths Unique coastal landforms Significant cultural and aesthetic values Active or passive recreation
	Marine environmental quality	Quality of the water, sediment and biota Ecosystem health condition Fishing and aquaculture Recreation and aesthetics Industrial water supply Cultural and spiritual value
	Marine ecosystems	Conservation significant marine and coastal fauna and critical habitat such as nesting, breeding or foraging habitat Conservation significant marine and coastal flora and vegetation Groups of species (species richness and assemblages of species) Ecological functions and processes Species of social, cultural and/or economic significance. Integrity of marine ecosystems and the ecological services they supply Biological diversity Functional diversity Provision of refuge Food supply
Air	**Air Quality**	The chemical, physical and biological characteristics of air The biological processes that depend on the air quality
	Atmospheric Processes	A contribution to the NT's greenhouse gas emissions Adaptation to a changing climate

People	**Society and economy**	Communities, towns, private properties and dwellings where people reside Aesthetics and recreation Resources including water supply and food sources Jobs and businesses Agriculture, fisheries and industry
	Culture and heritage	Bush foods Totemic flora and fauna Important or significant country
	Human health	Drinking water Recreational water Air quality Bush tucker Radiological limits

	Hazard/Aspect
1	Clearing vegetation / ground disturbance
2	Erosion
3	Weeds
4	Pests
5	Noise
6	Dust
7	Greenhouse Gas emissions
8	Bushfire
9	Contaminated soil
10	Traffic
11	Contaminated water (surface and groundwater)
12	Biting insects
13	Power and water supply
14	Storage and handling of hazardous materials
15	Waste
16	Visual
17	Dredging
18	Hydrology

APPENDIX I OPERATING PLAN

Operating Plan for Reclaim of the Nobles Nob Southwest Waste Dump

The current situation is shown in Figure 1.

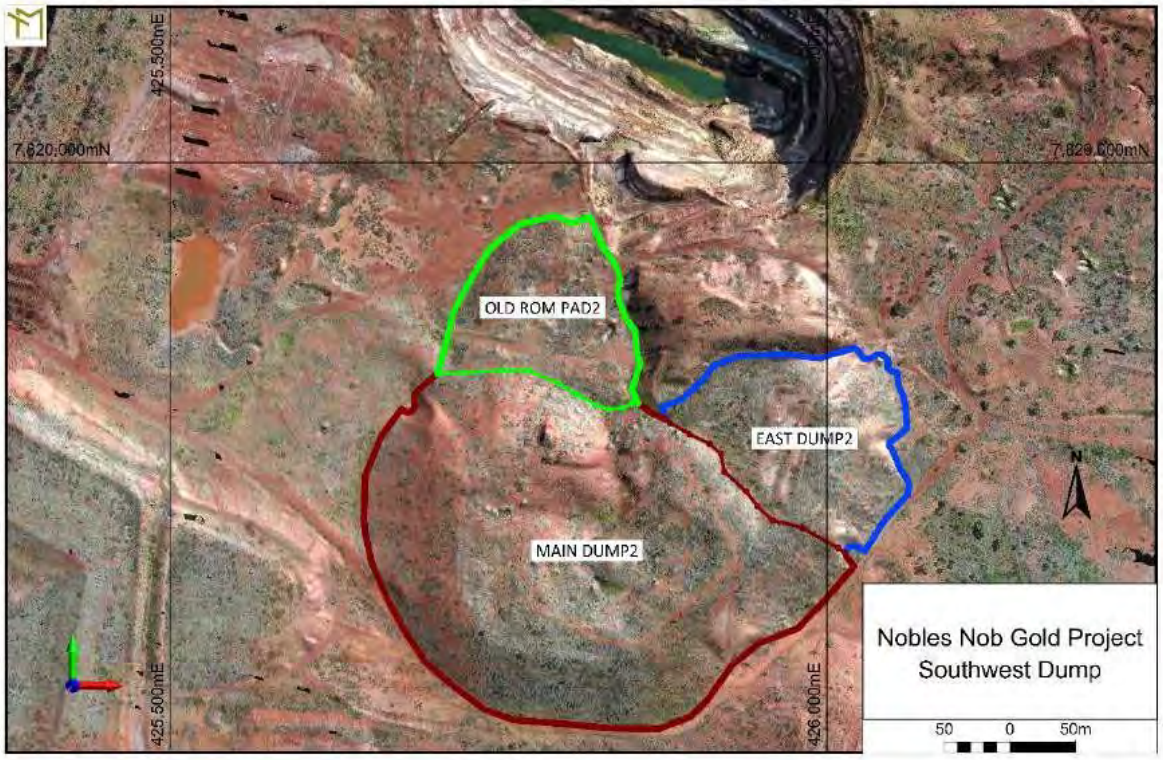

Figure 1: Plan view showing current situation at Noble Nob, with the Southwest Waste Dump (SWD) outlined; the historic Nobles Nob pit is shown in the north of the image

Figure 2 Shows the planned plant site in relation to the dump.

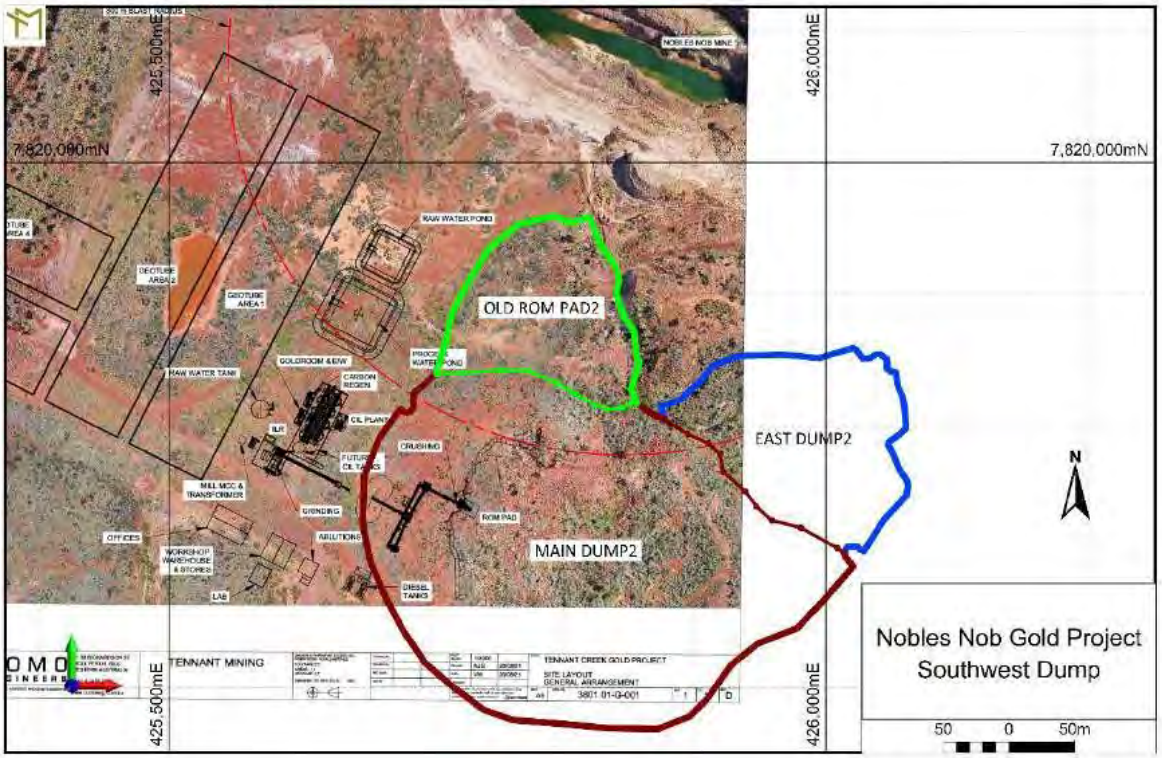

Figure 2: Plan view showing planned plant layout in relation to the SWD

Stage 1 of the dump reclaim will be to move the western slope of the dump in order to create the room for crusher hopper and crushed stockpile (Figure 3). This material will be moved using a temporary ramp up onto the existing dump to the east of the area shown as Stage 1. A loader and a dump truck will be used for this work.

During the dump move, dust will be controlled using a water truck carrying out daily runs at the beginning and end of shift to damp down dust. Further runs will be carried out if this is required. Water will come from the historic Nobles Nob pit.

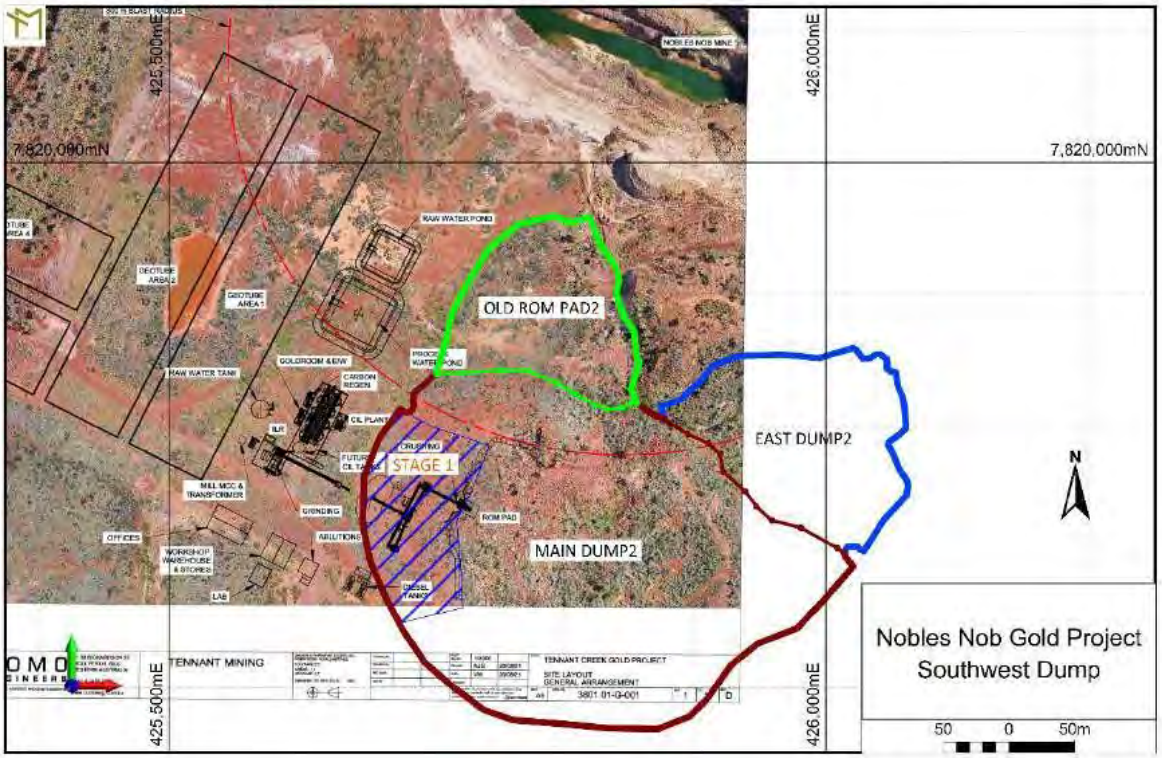

Figure 3: Plan view showing planned plant layout in relation to the SWD and Stage 1 of dump reclamation

Once the crushing circuit is ready for commissioning, reclaim of the dump will progress using a dozer and loader. The dozer will push the dump down to a safe working height (determined by the height of the loader bucket at full lift). The loader will move the dump material and tip into the crusher hopper. The dump reclaim will progress through Stage 2 and then Stage 3 and so on through to Stage 6 (Figure 4).

Dust will be controlled using a water truck carrying out daily runs at the beginning and end of shift to damp down dust. Further runs will be carried out if this is required. Water will come from the historic Nobles Nob pit or from dewatering of the historic Juno mine 3 km to the west.

Once areas of the reclaimed SWD are determined to be complete, then progressive rehabilitation is planned.

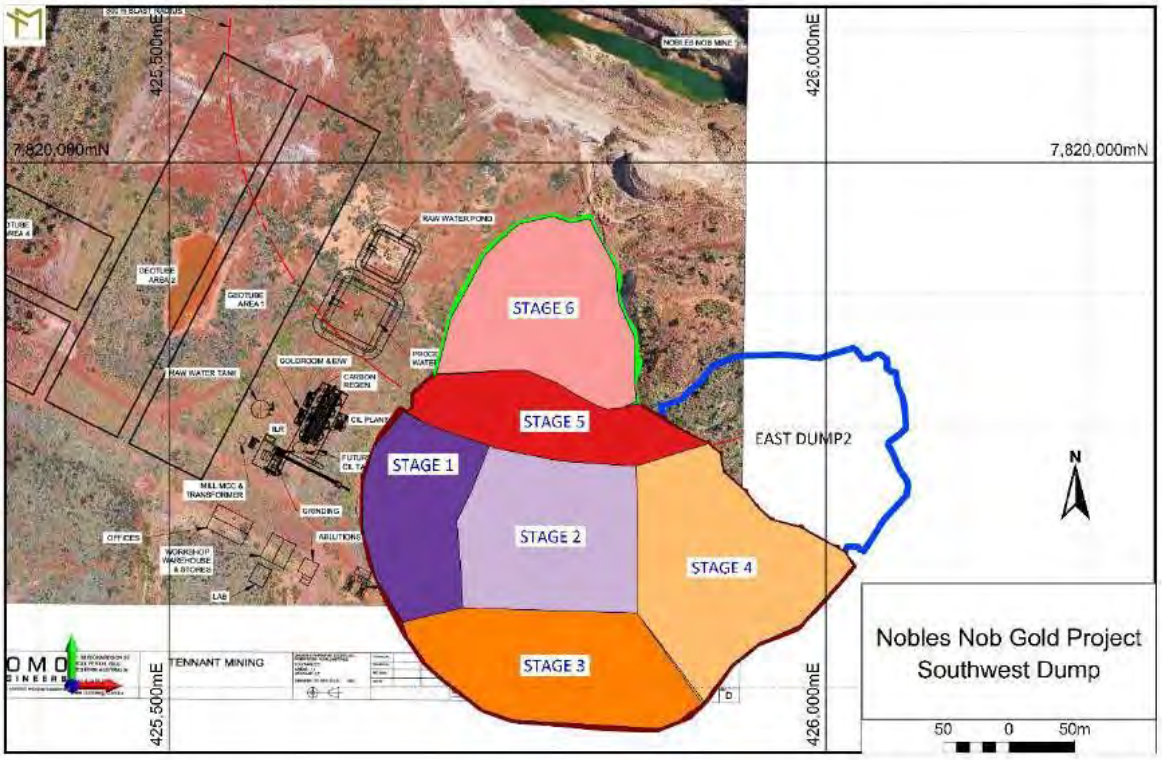

Figure 4: Plan view showing planned plant layout in relation to the SWD and Stages of dump reclamation

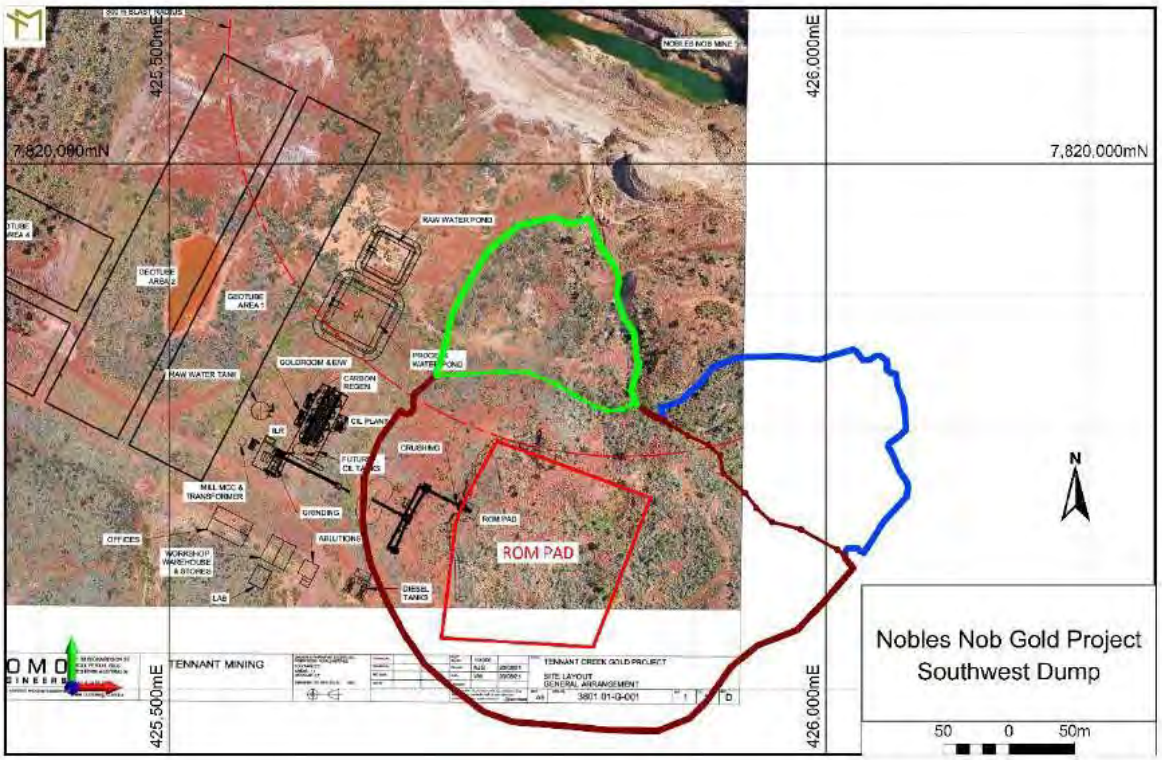

Figure 5: Plan view showing planned plant layout with ROM pad that will be established in the footprint of the reclaimed SWD

APPENDIX J WATER QUALITY MANAGEMENT PLAN

Water Quality Management Plan

Nobles Nob Gold Project

Tennant Consolidated Mining Group Pty Ltd

ER012/Version 0.2

JUNE 2022

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Custodians of the lands on which we work and operate. We pay our respects to elders, past, present and emerging.

Disclaimer

Document Control

Version	Prepared by	Date	Approved by	Date
Draft Version 0.1	Dr Ashish Mishra	08 July 2022	Reviewed by Yemaya Smythe McGuinness	08 July 2022
Final Version 0.2	Dr Ashish Mishra	08 July 2022	Marty Costello	08 July 2022

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1.0 Introduction

1.1 Background

This water quality management plan (WQMP) has been developed for the Nobles Nob Gold Project (Nobles Nob), located approximately 13 kilometres (km) southeast of Tennant Creek township, in the Northern Territory. The Nobles Nob mining tenements are held by Tennant Consolidated Mining Group (TCMG), on who's behalf this document has been prepared. Gold was initially extracted at Nobles Nob from underground operations commencing in the early 1930s and then via open-cut methods from the 1960s. Open-cut mining at Nobles Nob concluded in 1985, although gold production continued until 1992.

TCMG is proposing to recommence operations at Nobles Nob. To obtain approvals, TCMG submitted a Mining Management Plan (MMP) under the Northern Territory Mining Management Act 2005. The primary purpose of the MMP is to formalise the actions to be taken and strategies to be implemented to manage potential environmental impacts, if any. This WQMP is required as part of the environmental management plan (EMP), which will be sufficient to identify and manage critical environmental risks associated with the proposed disturbance.

1.2 Plan Development

This WQMP has been prepared by a suitably qualified person, Dr Ashish Mishra. Dr Ashish Mishra is a hydrogeologist/geochemist, with expertise in management and monitoring program design, water quality assessments, and geochemical assessments. Dr Ashish has experience in conducting impact assessments, water quality assessments and trigger derivation/amendments, aquifer testing, groundwater monitoring program design, groundwater production and monitoring well program management and construction, waste rock/overburden characterisation, geochemical assessment, and acid/metalliferous drainage. Dr Ashish has also undertaken several specialised contaminant source, cause and extent identification investigations for groundwater and surface water resources, and assessment of potential environmental impacts on water resources. Dr Ashish has more than four years of experience working as a hydrogeologist and geochemist, and has a PhD in Environmental Geochemistry, Master of Science in Sustainable Resource Management and Bachelor of Technology in Biotechnology (Engineering). Dr Ashish Mishra has been engaged as an independent contractor to prepare this WQMP on behalf of TCMG.

1.3 Document Scope and Organisation

This WQMP forms part of the MMP and will sit under the site-specific EMP, and has been designed to meet required statutory and regulatory requirements by providing:

- Pre-operational and operational aims and objectives to be adopted in relation to water quality.
- Management strategies to be followed to manage and reduce impacts on water quality from proposed operations.
- A monitoring program to determine whether significant changes in water quality occur due to proposed operations.

This document has been organised as follows:

- General background (Section 1);

- Roles and Responsibilities (Section 1);
- Objectives and Targets (Section 2);
- Potential risks and impacts (Section 3);
- Review of the available water quality data (Section 4);
- Level of protection required for the site based on the National Water Quality Management Framework (ANZG, 2018) (Section 6);
- WQMP development (Section 6), including the monitoring and management plans to be implemented;
- Sampling methodology and quality assurance/quality control (QA/QC) assessment (Section 6);
- Reporting requirements of this WQMP (Section 6); and
- Review of this WQMP (Section 7).

1.4 Roles and Responsibilities

TCMG is ultimately responsible for control and management of its site facilities. TCMG's management and the Work, Health, Safety Environment (WHSE) team are ultimately responsible for the environmental performance of TCMG sites including Nobles Nob.

The WHSE team is responsible for overseeing and monitoring environmental performance including:

- overseeing all aspects of the Environmental Management System;
- providing environmental technical advice and information;
- facilitating environmental risk assessments;
- contributing to, assessing and commenting on environmental aspects of proposed developments;
- facilitating regular environmental inspections and audits; and
- maintaining the Incident Register.

TCMG management and contractors with employees are responsible for:

- providing appropriate information about the WQMP;
- providing education and training with regards to water quality management on site;
- ensuring safe work environment is developed and maintained; and
- reporting environmental incidents to the Site Manager.

The general employees of TCMG and contractors (working as employees) are responsible for:

- compliance with the health and safety instructions and policies;
- correct use of equipment;
- following procedures safely and as instructed; and
- reporting environmental incidents to the Site Manager.

All TCMG employees and contractors working at site are responsible for promptly and accurately reporting any non-compliance and environmental incidents to the Site Manager. The Site Manager will be responsible for:

- ensuring that sites are supported after any environmental incident;
- ensure all incidents are reported to authorities and investigated in accordance with legislative and regulatory requirements;

- ensure that existing procedures are reviewed to ensure they are current and relevant to the works being carried out;
- ensure that corrective actions are agreed and implemented in a timely manner post any incidents or near miss situations; and
- updating and communication of the procedures on site and any relating procedures internally with the TCMG management, TCMG WHSE team, TCMG operations, including contractors and visitors, or third-party operators.

2.0 Objectives and Targets

The overall aim of this WQMP is to ensure that water quality at the site does not deteriorate due to proposed site activities. To achieve this, objectives, targets and key performance indicators have been set. These are presented in **Table 1** below. The objectives and targets are set in accordance with the approval requirements and the environmental values (EVs) identified at Nobles Nob.

Table 1 Objectives and Targets of the WQMP

Objectives	Targets	Key Performance Indicator
1. Undertake and complete works in compliance with statutory environmental requirements.	-No breaches of license/approval conditions. -No infringements.	-Number of breaches recorded. -Number of infringements.
2. Protection and maintenance of the environmental, cultural and spiritual values of water, including ecosystems and biota. **3. Protection of groundwater and surface water users.** **4. Maintenance of suitable water supply quality for the mining operations.**	***General***: -No complaints. -No exceedances of finalised adopted guideline values/limits. ***During Construction:*** -Management strategies implemented to prevent/contain any runoff during construction. ***During Operation:*** -Water quality monitoring results comply with the finalised guideline values. -Where exceedances of guideline values occur, the changes in water quality results are within the historical ranges observed during baseline monitoring (pre-operational). -characterise the water quality of any water supplied for operations.	-Number of environmental incidents or breaches. -Number of complaints. -Number of exceedances of finalised water quality guideline values. -Number of events when exceedances are above the historical concentration range observed at that site.
5. Collect sufficient data to characterise site water quality.	-Minimum 12 months of baseline data. -Suitable coverage of seasonal variation in baseline data.	-Length and number of baseline sampling events. -Number of wet/dry seasons covered while collecting baseline data.

6. Establish clear and safe sampling methodology, in accordance with the relevant standards and guidelines.	-Monitoring carried out on a regular basis as per this WQMP -Field QA/QC practices implemented. -QA/QC assessments to validate the data collected are implemented. -No workplace incidents or injury during monitoring.	-Number of QAA/QC samples collected. -Relative Percent Difference (RPD) between field duplicate and original samples. -Number of incidents/injury during monitoring.
7. Establish clear corrective actions and trigger levels for corrective actions	-Develop triggers for corrective actions. -Establish clear corrective actions to be taken, when triggered. -Establish corrective actions in the case of an environmental incident or emergency.	-Number of times requirement for corrective actions were triggered. -Number of environmental incidents or emergency.
8. Outline reporting requirements	-Establish reporting requirements, including the frequency and timing of reports, and the data and analysis that will be included in reports.	-Number and regular timing of reports produced.

3.0 Potential Risks and Impacts

Information about the existing site conditions and potential risks are provided in the technical reports (e.g., Umwelt, 2021a; Umwelt, 2021b; ATCW, 2022) and in the MMP. Based on the information provided, the key potential water quality related risks that will be managed through this WQMP are summarised below.

3.1 During Construction

During construction on site, the potential impacts to water quality will be related to sediment loss from the site, which might lead to an increased amount of nutrients in surface water and groundwater, thereby impacting the aquatic ecosystem. In addition to that, construction earthworks have the potential to increase the risk of erosion due to clearing activities and exposure of ground surfaces. Another potential risk to water quality is from spills or leaks of fuel from vehicles and from chemicals stored on site. All these risks are characterised as moderate in the initial risk assessment (See Appendix H – Risk Assessment of the MMP). With mitigation measures such as the development and implementation of an erosion and sediment control plan (ESCP), fuel storage and handling in designated areas and in accordance with standards and guidelines, and fit-for-purpose spill management kits, these risks were characterised to be low-risk (see Appendix H – Risk Assessment of the MMP).

3.2 During Operation

During the operational phase, the potential impact to water quality is runoff from the waste rock dump and the run-of-mine (ROM) or ore stockpiles, which could introduce water with elevated concentrations of metals. Additional potential impacts identified include failure of the tailings storage facility (TSF); and overflow of contaminated process water during high rainfall events. These were characterised high risk in the initial risk assessment (See Appendix H – Risk Assessment of the MMP). Studies have been undertaken to characterise the waste rock dump, and the ROM pad, which suggested that the samples are non-acid forming and release of drainage enriched with metals is less likely. Studies have also been undertaken to determine the most appropriate location and structural

layout for the TSF. This WQMP will be implemented to monitor water quality to capture any early signs of impacts and outline the appropriate corrective actions that will be taken if any contamination concerns are identified.

4.0 Baseline Water Quality Review

4.1 Overview

The information on water quality at Nobles Nob is limited, and hence new groundwater bores were installed in May/June 2021. After installation of the groundwater bores at Nobles Nob, sampling has been undertaken monthly since October 2021 (and quarterly for the upgradient sites since January 2022). Water quality samples have been collected monthly from Lake Alice (SWLA). One round of water quality samples from Nobles Nob pit was collected in 2018, and the results are discussed in the sections below. Nobles Nob pit has not been sampled since, due to issues with safe access. As part of this WQMP, more baseline samples will be collected from the Nobles Nob pit in a safe manner to capture any changes in pit water quality due to seasonal variations.

The baseline sampling effort has covered one wet season (between November 2021 to March 2022) and is currently collecting data from the dry season (March 2022 to November 2022). Compared to the longer-term climatic averages, the Tennant Creek region has experienced below-average rainfall since 2016 (Umwelt, 2021b). However, the rainfall data from Tennant Creek Airport, located approximately 14 km from Nobles Nob, suggests that the area received above-average rainfall in October and November 2021, and in January 2022 (**Figure 1**). The same data also indicates that the monthly rainfall was below-average in December 2021, and February and March 2022 (**Figure 1**).

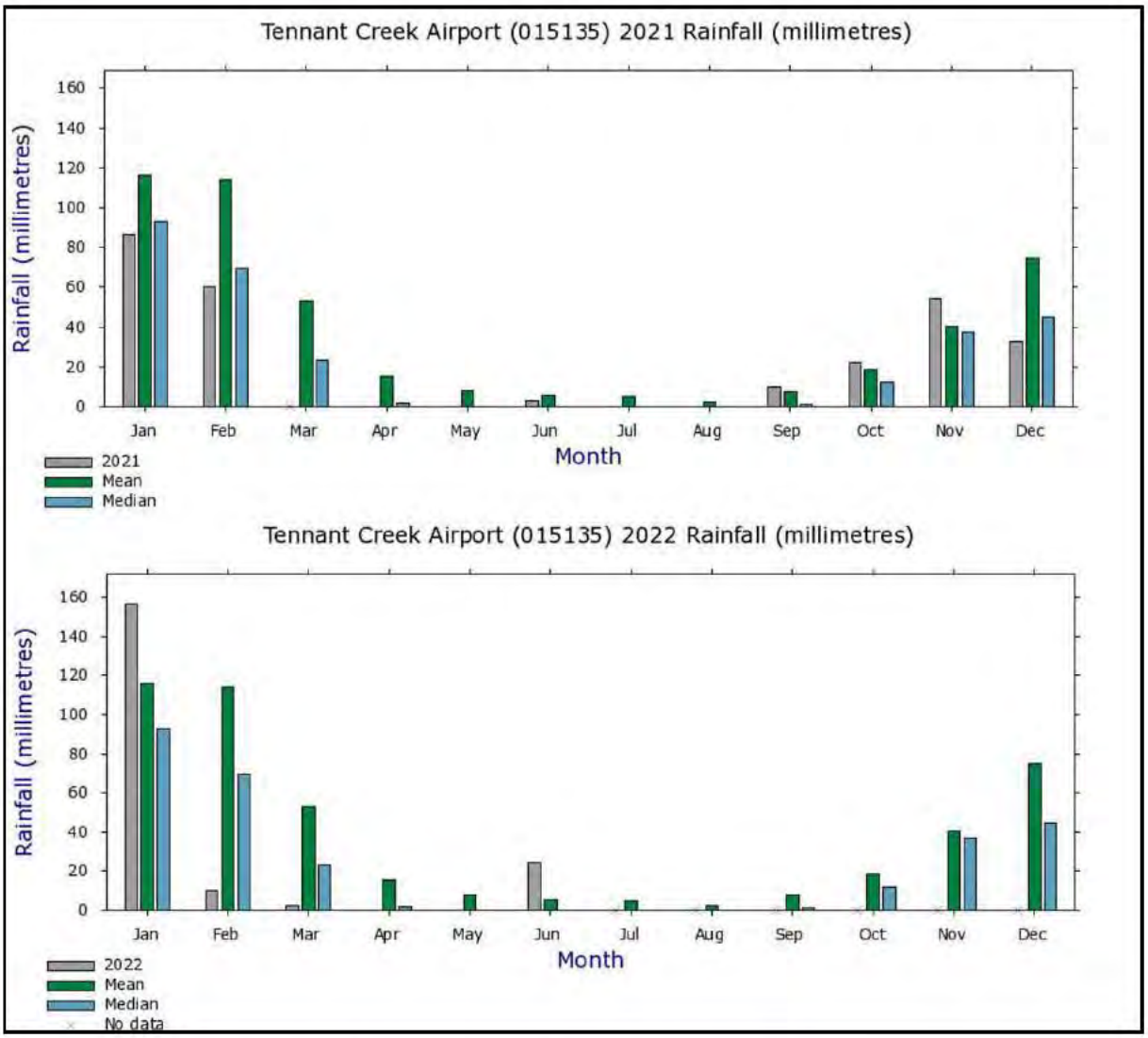

Figure 1 Monthly Rainfall at Tennant Creek Airport (Source: BoM)

The available water quality data for Nobles Nob is summarised in the sections below. The statistical summary for all parameters and all monitoring locations at Nobles Nob are presented in **Appendix A.** It summarises available water quality data using the following statistics:

- number of observations
- percentage of non-detect (i.e., below LOR)
- minimum, median, and maximum values
- percentile values (5th, 20th, 80th and 95th).

The time-series plots of the available water quality data were plotted, and the non-parametric Mann-Kendall statistical trend test was performed. These are presented in **Appendix B.** A significance level of 5% was used to determine statistically significant trends. Temporal trends were identified using Mann-Kendall statistics (tau and p-value), and the trend was considered statistically significant if the p-value was <0.05. Some locations exhibited positive or negative temporal trends in assessing available water quality data. However, these trends could be attributed to seasonality, and is difficult to evaluate unless at least 12 months of baseline data is available. These trends will be assessed, once sufficient baseline data is available (i.e., at least 12 months).

4.2 Physicochemical and Major Ions

The pH values observed at site ranged from 5.64 to 7.7, whereas the electrical conductivity (EC) values ranged from 4,500 µS/cm to 15,000 µS/cm in the groundwater bores (**Table 2**). The total dissolved solids (TDS) concentrations were also high in the groundwater bores, ranging from 3,100 mg/L to 11,000 mg/L. The median EC and TDS were recorded slightly higher in the upgradient reference bores, compared to the other groundwater bores. The median EC and TDS at upgradient bores (i.e., NNMW011, NNMW012, NNMW013, and NNMW18) were 10,000 µS/cm and 6,700 mg/L, whereas the median value of EC and TDS recorded at other groundwaters bores were 9,800 µS/cm and 6,650 mg/L. This EC and TDS recorded in the groundwater bores reflects similar results recorded in previous studies that also found that water quality in the area is highly saline and unsuitable for consumption (Umwelt, 2021b). Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the water from Lake Alice recorded very low EC (maximum of 99 µS/cm at Lake Alice and 140 µS/cm at Nobles Nob pit) and TDS (120 mg/L at Lake Alice and 84 mg/L at Nobles Nob pit) (**Figure 2** and **Figure 3**). The lower EC/TDS values in the pit and Lake Alice could represent rainfall recharge.

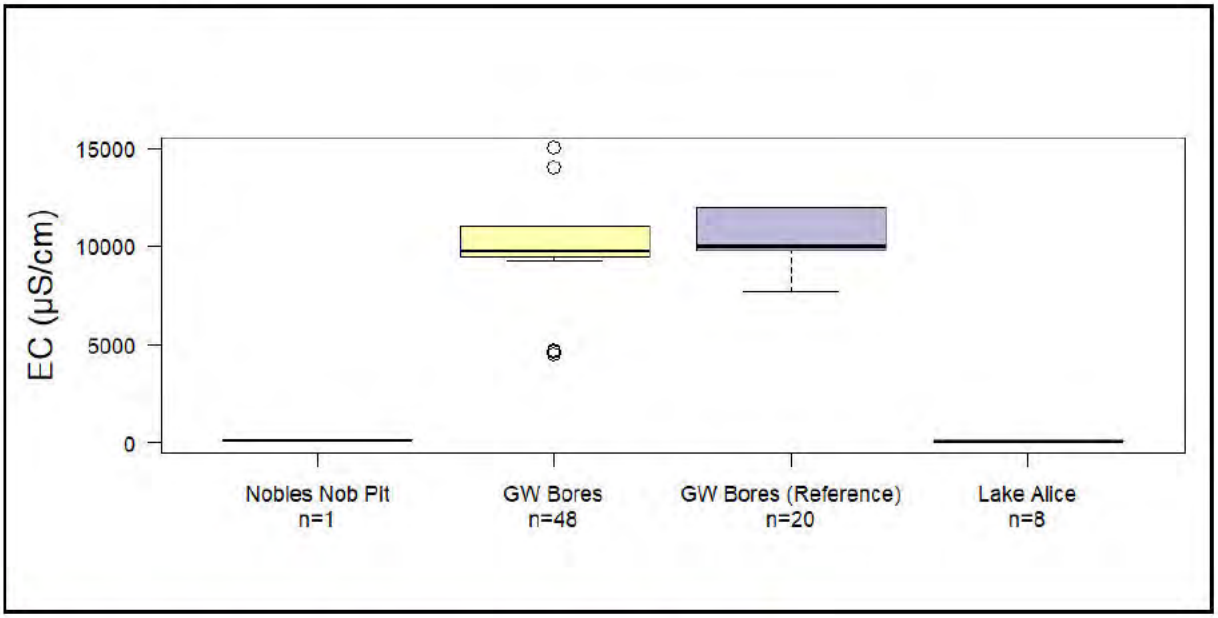

Figure 2 Boxplot Showing Electrical Conductivity at Nobles Nob

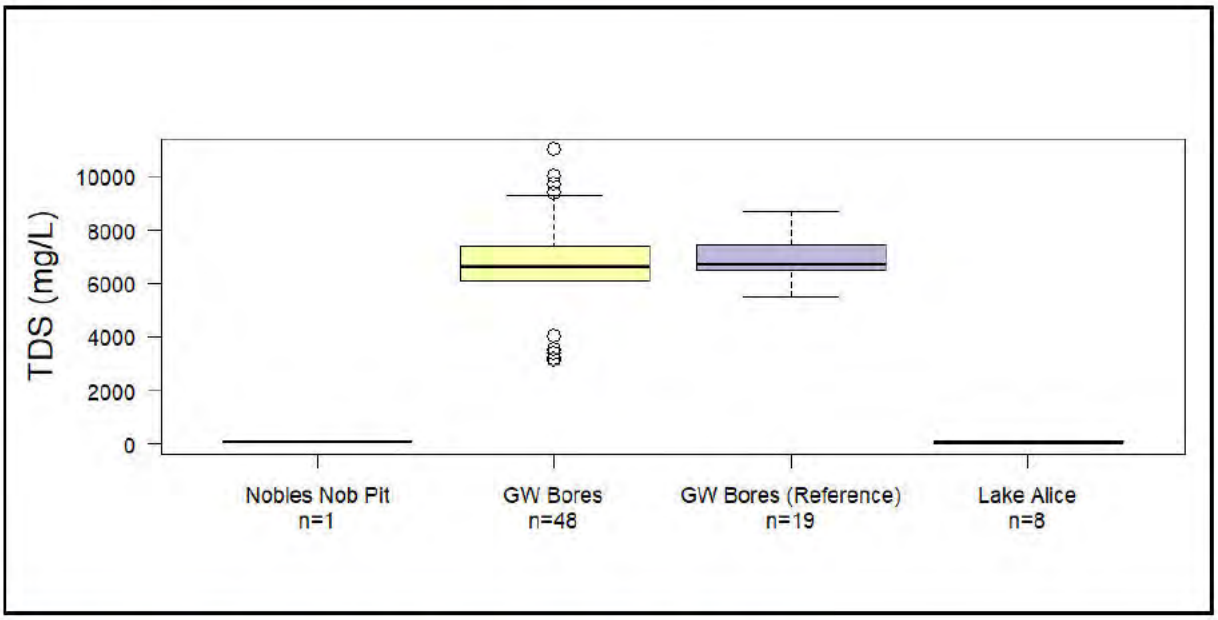

Figure 3 Boxplot Showing Total Dissolved Solids at Nobles Nob

Major ion concentrations from the water quality data suggest that the groundwater at Nobles Nob is dominated by sodium for cations (median 1,600 mg/L), and chloride for anions (median 2,800 mg/L). The major ion data suggests that the water type of all groundwater bores is sodium chloride type (**Figure 4**), further implying low recharge and influence of evaporative processes. The dominant cation in Nobles Nob pit is potassium (13 mg/L), and in Lake Alice is calcium (median 4.75 mg/L), whereas the dominant anion in Nobles Nob pit water and Lake Alice water is bicarbonate (52 mg/L at Nobles Nob pit, and median of 36.5 mg/L at Lake Alice). The Ca-HCO3+CO3 water type at Lake Alice and Nobles Nob pit indicates the influence of rainfall recharge on the open pit and Lake Alice water (**Figure 4**).

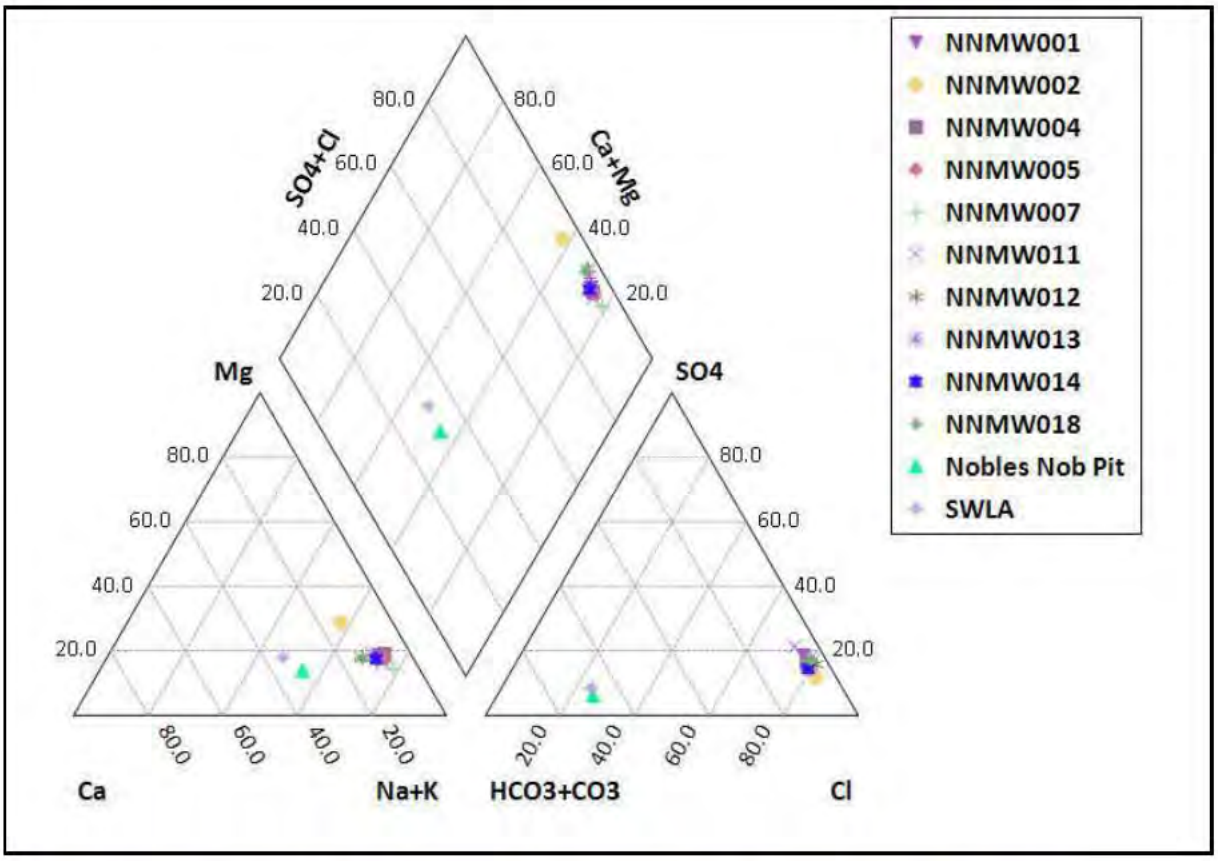

Figure 4 Piper Diagram of Water Quality at Nobles Nob (Source: Umwelt, 2021b)

4.4 Metals and Metalloids

Results for dissolved and total metals from water quality samples are presented in **Table 2** below. The concentration of many metals was recorded below the limit of reporting (LOR) at most locations. The median concentrations of most metals in groundwater bores were recorded higher than the Lake Alice samples, and Nobles Nob pit (sampled in 2018) (**Figure 5**). This reflects the influence of rainfall on the pit water is higher than on the groundwater.

To understand impacts of historical mining on water quality, cyanide concentrations were assessed. All upgradient bores (NNMW011, NNMW012, NNMW013, and NNMW018) recorded free cyanide concentrations below the LOR, whereas 90 per cent of the samples collected at upgradient bores recorded the total cyanide concentration below LOR. Free and total cyanide were recorded above LOR at bores NNMW001, NNMW004, and NNMW005 (**Figure 6**). Highest concentration of free cyanide and total cyanide was recorded at NNMW005 (0.024 mg/L free cyanide, and 0.15mg/L total cyanide). The presence of cyanide at these bores might be attributed to the fact that these bores are located very close to the historical tailings deposits, and are impacted by historical mining activities. Cyanide concentrations were not available for the Nobles Nob pit.

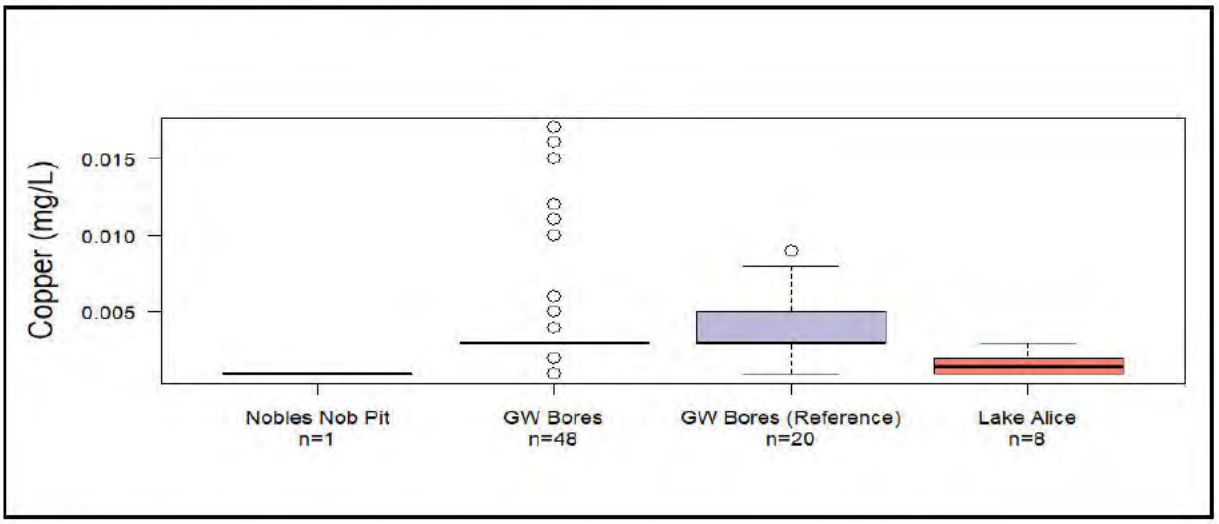

Figure 5 Boxplot Showing Dissolved Copper Concentration at Nobles Nob

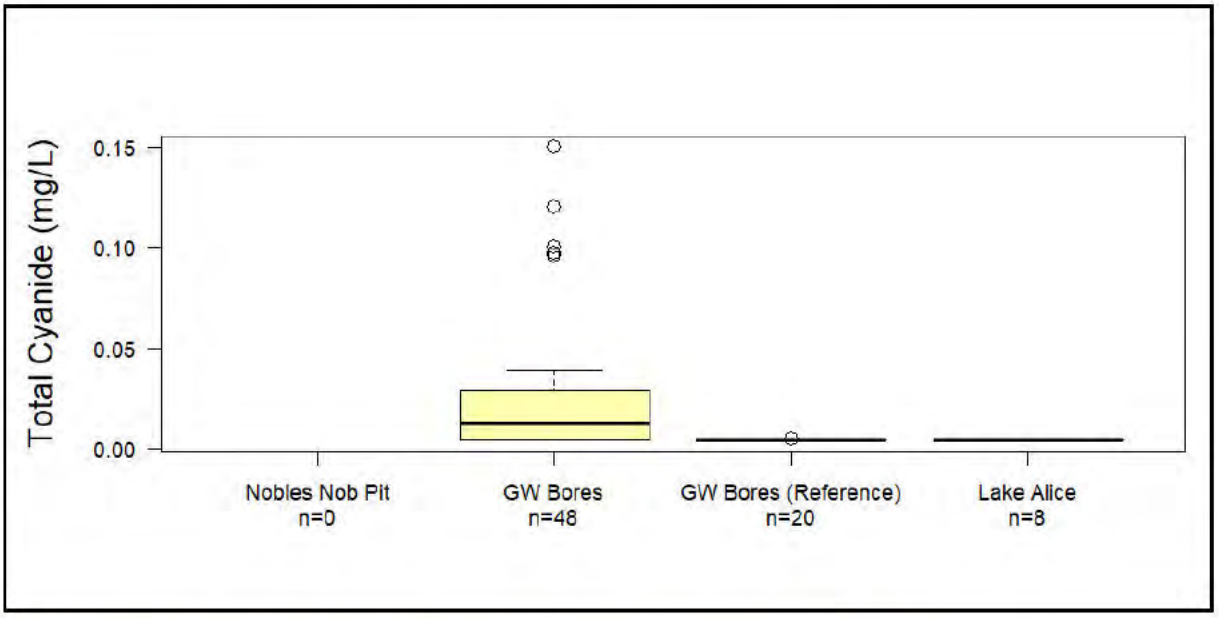

Figure 6 Boxplot Showing Total Cyanide Concentrations at Nobles Nob

Table 2 Summary of Existing Water Quality Data

Analytes	Groundwater									Lake Alice								Nobles Nob Pit	
	Number	Non-detect (%)	Min	5th %ile	20th %ile	Median	80th %ile	95th %ile	Max	Number	Non-detect (%)	Min	5th %ile	20th %ile	Median	80th %ile	95th %ile	Max	Number	Value
Field pH	58	0	5.64	5.897	6.19	6.35	6.788	7.0165	7.7	7	0	6.49	6.646	7.024	7.1	7.738	8.542	8.83	0	-
pH	68	0	6.6	6.935	7.2	7.4	7.7	7.9	8	8	0	6.8	6.8	6.8	6.95	7.06	7.1	7.1	1	6.9
EC	68	0	4500	4600	9440	9950	11600	14000	15000	8	0	42	43.4	51.2	67.5	83.4	94.1	99	1	140
Sulfate	68	0	220	240	690	845	1000	1500	1600	8	0	1.1	1.1	1.18	1.85	2.94	3.815	4.2	1	4
Total Dissolved Solids	67	0	3100	3400	6120	6700	8000	9610	11000	8	0	30	35.25	47	55.5	112	120	120	1	84
Calcium	68	0	100	120	150	210	246	339.5	360	8	0	3.4	3.47	3.96	4.75	5.32	5.73	5.8	1	7.3
Sodium	68	0	450	523.5	1400	1600	2000	2430	3100	8	0	2.2	2.2	2.32	3.55	5.42	6.025	6.2	1	6.8
Potassium	68	0	19	19.35	68	77	82	93.3	98	8	0	2.9	3.04	3.54	4.4	5.82	5.965	6	1	13
Magnesium	68	0	140	150	180	230	270	356.5	390	8	0	1.1	1.135	1.28	1.45	1.72	1.8	1.8	1	1.9
Bicarbonate Alkalinity as HCO3	68	0	120	133.5	300	355	436	470	520	8	0	22	24.8	30.8	36.5	40	41.3	42	1	52.46
Carbonate Alkalinity as CO3	68	100	5	5	5	5	5	5	5	8	100	5	5	5	5	5	5	5	1	3
Chloride	68	0	1200	1300	2540	2800	3360	4065	4600	8	0	4	4	4	7	9	9.65	10	1	13
Aluminium	68	0	0.012	0.01535	0.019	0.0245	0.0296	0.04265	0.049	8	0	0.12	0.148	0.208	0.42	1.88	2.52	2.8	1	<0.01
Arsenic	68	97.06	0.001	0.001	0.001	0.009	0.009	0.009	0.009	8	100	0.001	0.0017	0.003	0.003	0.003	0.003	0.003	1	<0.001
Barium	48	0	0.024	0.03165	0.061	0.071	0.0886	0.09465	0.11	6	0	0.051	0.05275	0.058	0.105	0.13	0.2275	0.26	0	-
Beryllium	48	89.58	2.00E-04	2.00E-04	3.00E-04	3.00E-04	0.001	0.001	0.001	6	66.67	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	0.000775	0.001	0	-
Boron	48	0	0.2	0.22	0.64	0.8	1.1	1.2	1.3	6	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	-
Cadmium	68	57.35	1.00E-04	1.00E-04	2.00E-04	3.00E-04	6.00E-04	0.001	0.001	8	87.5	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1	<0.0001
Chromium	68	83.82	0.001	0.001	0.002	0.003	0.003	0.003	0.007	8	62.5	0.001	0.001	0.001	0.001	0.00106	0.001165	0.0012	1	<0.001
Cobalt	68	4.41	0.001	0.003	0.006	0.0145	0.0408	0.2465	0.29	8	75	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	<0.001
Copper	68	57.35	0.001	0.001	0.003	0.003	0.005	0.01165	0.017	8	12.5	0.001	0.001	0.001	0.0015	0.002	0.00265	0.003	1	0.001
Iron	20	80	0.02	0.02	0.02	0.02	0.02	0.353	0.79	2	0	0.47	0.495	0.57	0.72	0.87	0.945	0.97	1	0.003
Lead	68	73.53	0.001	0.001	0.001	0.003	0.003	0.005	0.006	8	75	0.001	0.001	0.001	0.001	0.001	0.00165	0.002	1	<0.001
Manganese	68	1.47	0.005	0.0108	0.13	0.43	1.9	5.63	6.5	8	62.5	0.005	0.005	0.005	0.005	0.0224	0.0359	0.038	1	<0.005
Mercury	68	95.59	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0.00014	8	100	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0	-
Molybdenum	48	75	0.001	0.001	0.001	0.003	0.003	0.003	0.004	6	100	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	-
Nickel	68	35.29	0.001	0.00135	0.003	0.003	0.0056	0.01	0.013	8	62.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	<0.001
Selenium	20	0	0.002	0.0096	0.0126	0.0195	0.0234	0.03605	0.037	2	100	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1	<0.001

Silver	**67**	89.55	5.00E-05	5.00E-05	0.00015	0.00025	0.003	0.0037	0.005	**8**	100	5.00E-05	6.75E-05	1.00E-04	0.00055	0.001	0.001	0.001	0	-
Vanadium	**20**	90	0.001	0.001	0.002	0.003	0.003	0.0031	0.005	**2**	0	0.001	0.0011	0.0014	0.002	0.0026	0.0029	0.003	1	0
Zinc	**69**	10.14	0.005	0.005	0.006	0.01	0.0204	0.0338	0.063	**8**	100	0.005	0.005	0.005	0.005	0.005	0.005	0.005	1	<0.01
Total Aluminium	**68**	0	0.03	0.0592	0.094	0.16	0.532	1.76	3.3	**8**	0	0.13	0.158	0.21	1.055	3.14	4.355	4.6	1	4.6
Total Arsenic	**68**	94.12	0.001	0.001	0.001	0.009	0.009	0.009	0.009	**8**	100	0.001	0.0017	0.003	0.003	0.003	0.003	0.003	1	0.002
Total Barium	**48**	0	0.025	0.0336	0.0646	0.0795	0.11	0.143	0.22	**6**	0	0.056	0.05625	0.057	0.115	0.18	0.27	0.3	0	-
Total Beryllium	**48**	85.42	2.00E-04	2.00E-04	3.00E-04	3.00E-04	0.001	0.001	0.002	**6**	83.33	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	0.000775	0.001	0	-
Total Boron	**48**	0	0.22	0.2235	0.654	0.805	1.06	1.2	1.3	**6**	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	-
Total Cadmium	**68**	51.47	1.00E-04	1.00E-04	3.00E-04	4.00E-04	8.00E-04	0.001	0.0017	**8**	100	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1	<0.0001
Total Chromium	**68**	75	0.001	0.001	0.002	0.003	0.003	0.004	0.008	**8**	62.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	0.009
Total Cobalt	**68**	2.94	0.001	0.00335	0.008	0.016	0.0454	0.2695	0.32	**8**	50	0.001	0.001	0.001	0.001	0.001	0.0023	0.003	1	0.004
Total Copper	**68**	27.94	0.001	0.001	0.003	0.004	0.0066	0.01665	0.025	**8**	12.5	0.001	0.001	0.001	0.0015	0.003	0.003	0.003	1	0.011
Total Lead	**68**	38.24	0.001	0.001	0.001	0.003	0.0046	0.00665	0.008	**8**	37.5	0.001	0.001	0.001	0.001	0.002	0.002	0.002	1	0.011
Total Manganese	**68**	0	0.006	0.0162	0.164	0.48	2.02	6.095	6.6	**8**	0	0.018	0.01905	0.0226	0.0325	0.0578	0.14115	0.18	1	0.23
Total Mercury	**68**	92.65	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	8.25E-05	0.00016	**8**	100	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0	-
Total Molybdenum	**48**	64.58	0.001	0.001	0.002	0.003	0.003	0.007	0.012	**6**	100	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	-
Total Nickel	**68**	25	0.001	0.00135	0.003	0.004	0.006	0.012	0.014	**8**	62.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	0.003
Total Selenium	**20**	0	0.008	0.01085	0.014	0.021	0.0274	0.03855	0.049	**2**	100	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1	<0.001
Total Silver	**67**	85.07	5.00E-05	6.00E-05	0.00015	0.00025	0.003	0.003	0.005	**8**	100	5.00E-05	6.75E-05	1.00E-04	0.00055	0.001	0.001	0.001	0	-
Total Vanadium	**20**	45	0.001	0.0029	0.003	0.003	0.005	0.00705	0.008	**2**	0	0.001	0.0011	0.0014	0.002	0.0026	0.0029	0.003	0	-
Total Zinc	**69**	1.45	0.005	0.006	0.008	0.013	0.025	0.042	0.07	**8**	87.5	0.005	0.005	0.005	0.005	0.005	0.00695	0.008	1	0.017
Free Cyanide pH 6	**68**	85.29	0.004	0.004	0.004	0.004	0.004	0.0083	0.024	**8**	100	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0	-
Total Cyanide	**68**	61.76	0.004	0.004	0.004	0.004	0.0266	0.1	0.15	**8**	100	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0	-

5.0 Level of Protection

In order to define management goals and water quality guideline values, the level of protection needs to be determined. As per the water quality guideline (ANZG, 2018), a corresponding level of protection can be specified by using the site-specific ecosystem conditions. These can be:

- high conservation or ecological value systems
- slightly to moderately disturbed systems
- highly disturbed systems.

Due to the area's history of mining and grazing, the majority of the area around the Nobles Nob open-cut mine is moderately to highly disturbed and significantly impacted by previous mining activities. All the registered bores within 2.5 km of Nobles Nob pit are mine-related bores, and there are no declared water users in the area. Assessment of groundwater-dependent ecosystems (GDEs) around Nobles Nob suggests that there are no GDEs within a 10 km radius of the Nobles Nob Pit. As such, the area around Nobles Nob can be characterised as a highly disturbed system. The suitable guideline values for assessing water quality have been discussed in **Section 6.7**.

6.0 Water Quality Monitoring and Management

This WQMP has been prepared to provide an early warning of emerging potential impacts on the water quality due to operations at site. This program also outlines triggers to initiate corrective site actions to mitigate water quality impacts on receiving waters, if needed. This WQMP has been designed in line with the National Water Quality Management Strategy (NWQMS) (ANZG, 2018). This WQMP also outlines the monitoring sites that are to be sampled, frequency, and parameters to be tested, sampling methodology, and assessment criteria and interim guideline values. This WQMP incorporates the recommendations made in the Groundwater Assessment Report (Umwelt, 2021b) and the Water Management Plan (ATCW, 2022).

6.1 Water Quality Monitoring Locations

The existing water quality monitoring network at Nobles Nob comprises ten monitoring bores installed in May/June 2021, and one surface water site (Lake Alice). Amongst the 10 existing groundwater bore network, two monitoring bores, NNMW001 and NNMW002, are located around the proposed processing plant and tailings storage area. These monitoring bores are designed to monitor groundwater at a depth of 90-102 metres (NNMW001) and 65.9-77.9 metres (NNMW002) below ground level to monitor for any potential seepage into the groundwater table. Bores NNMW004 and NNMW005 are located towards the west and down-gradient of the proposed processing area and tailings storage area. These bores will be monitored to verify hydraulic connectivity to the weathered horizon and early detection of potential changes in water quality due to site activities. On the other hand, bores NNMW011, NNMW012, NNMW013, and NNMW018 are background reference bores, located upstream from the proposed activities at Nobles Nob and will monitor the groundwater quality up-gradient of the site.

Lake Alice has been identified by the Aboriginal Areas Protection Authority as a sacred site. If granted permission, water quality samples will continue to be collected from Lake Alice. Water quality samples will also be collected from the Nobles Nob pit to characterise the water quality in the pit and detect any changes in the water quality of the pit. A method for safe access to the pit for sampling will be established. Stability of a pit track is being assessed; and if deemed unsafe, a method for drone sampling will be established and implemented. Details of the existing monitoring

locations and their intended purpose are included in **Table 3** below. **Table 3** also presents the proposed water quality monitoring frequency.

6.1.1 Additional Monitoring Locations

The existing groundwater bores target the regional groundwater tables, and the depth of these bores ranges from 66 m to 102 mbgl. There is potential for water to be present in the shallow weathered horizon in localised areas (Umwelt, 2021b). Therefore, in accordance with the recommendations made in the groundwater assessment for Nobles Nob (Umwelt, 2021b), an additional four shallow bores will be installed for early detection of potential seepage relevant to site activities in the proposed processing plant and tailings storage area. The proposed depth and screen intervals of these shallow bores are presented in **Table 3**. These details will be finalised once the design and construction of the processing plant, process water pond, and tailings storage are completed. In addition to these four groundwater bores, the process water pond will also be included in the monitoring network and will be monitored regularly.

Table 3 Water Quality Monitoring Locations

Bore ID	Easting*	Northing*	Depth (m)	Screen Interval	Purpose	WQ	SWL
NNMW001	425505	7819803	102	90 - 102	Located south of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly	Daily (logger) and Monthly (manual)
NNMW002	425488	7819596	77.9	65.9 - 77.9			
NNMW004	425374.9	7820346	75	63 - 75	Located north-west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly	Daily (logger) and Monthly (manual)
NNMW005	425228.6	7820086	70	58 - 70	Located west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly	Monthly (manual)
NNMW007	424730.8	7819950	95.8	83.8 - 95.8	Located west of the Proposed Processing Area. Monitoring groundwater levels and quality, for detection of potential changes in water quality due to site activities	Monthly	Monthly (manual)
NNMW014	426075.9	7820387	69.6	57.6 - 69.6	Located north of the existing open-cut. To monitor groundwater levels and quality trends in response to existing mine features and verify regional flow directions and influence from historical mining.	Monthly	Monthly (manual)
NNMW011	426621.8	7819922	66	54 - 66	Background reference bore. To monitor groundwater level and quality trends up-gradient of site.	Quarterly	Quarterly (manual)
NNMW012	427616.9	7819830	76.6	64.4 - 76.4			
NNMW013	426527.3	7820174	78	66 - 78			
NNMW018	427151.5	7819926	78	66 - 78			
Proposed 1	TBC	TBC	~ 10	~ 4 - 10	Shallow bores for early detection of potential seepage from proposed processing area. Locations to be determined based on final plan designs.	Monthly	Daily (logger) and Monthly (manual)
Proposed 2	TBC	TBC	~ 10	~ 4 - 10			
Proposed 3	TBC	TBC	~ 20	~ 11 - 20			

Proposed 4	TBC	TBC	~ 20	~ 11 - 20			
Nobles Nob Pit	425938	7820052	-	-	To characterise the water quality at Pit, and early detection of potential changes in water quality due to site activities	Monthly	-
Lake Alice (SWLA)	426633	7819751	-	-	To characterise surface water quality on site, and early detection of any changes due to runoff from the waste rock dump.	Monthly	-
Process Water Storage Pond	TBC	TBC	-	-	To characterise the water stored on site, and to enable comparison with water quality on site	Monthly	-

*Coordinates in GDA2020 MGA Zone 53.

TBC – To be confirmed.

WQ – Water quality monitoring.

SWL – Standing Water Level (for groundwater sites only).

6.2 Water Quality Monitoring Frequency and Parameters

The frequency of monitoring for the proposed locations is shown in **Table 3** above. Based on the assessment of the available information, baseline monitoring data is to be collected from some of the sites for the initial 12 months, to collect sufficient baseline data. Following the 12 months of data collection, the monitoring frequency will be reviewed and refined.

The water quality parameters suite for this WQMP has been designed based on the key potential water quality related risks and relevant site activities. These parameters have been included in **Table 4** below, along with other metals to characterise the baseline water quality. The parameter suite will be reviewed after the initial 12 months of data collection.

6.2.1 Field Parameters

Based on the required analytes and holding times, some analytes will be recorded in the field for higher accuracy. They are as follows:

- Water temperature (in degrees Celsius)
- pH (in pH units)
- Electrical Conductivity (EC) (in µS/cm).

In addition to the above, the following parameters will also be noted in the field for interpretation only:

- Dissolved oxygen (DO) - a measure of the quantity of oxygen present in water. Water samples will indicate a lower DO value, signifying a lack of direct contact with air or that the existing oxygen is utilised in chemical and microbiological processes. Depletion of DO can encourage microbial reduction of nitrate to nitrite, sulfate to sulfide, and can increase the amount of ferrous iron in the solution. DO is usually measured in % as well as mg/L.
- Oxidation redox potential (ORP) - a measure of the oxidising/reducing conditions of the system, and a measure of a substance's ability to either oxidise or reduce another substance. This information can be useful in interpreting metal species in solutions and the possible corrosive effects of water. Characteristically, the fresh recharge waters will exhibit high and positive redox potentials, further implying oxidising conditions. ORP is usually measured in mV.

6.2.2 Laboratory Parameters

The samples for laboratory analysis will be submitted to a National Association of Testing Authorities (NATA) accredited laboratory. Laboratory analysis of the water samples will be undertaken as per the NATA accredited methods. The required laboratory parameters are outlined in **Table 4** below.

Table 4 Water Quality Monitoring Parameters

Field Parameters	Laboratory Parameters
pH	pH
Electrical Conductivity	Electrical Conductivity
Temperature	Major Anions - Na, K, Ca, Mg, hardness
Total Dissolved Solids	Major Cations - Cl, SO4, Alkalinity (CO3-, HCO3-, total alkalinity)
Dissolved Oxygen	Total Dissolved Solids
Oxidation redox potential (ORP)	Total and Dissolved Metals:

Standing Water level (SWL)*	*Aluminium* *Arsenic* *Boron* *Cadmium* *Chromium* *Cobalt* *Copper* *Iron* *Lead* *Manganese* *Molybdenum* *Mercury* *Nickel* *Selenium* *Vanadium* *Zinc*
	Free and Total Cyanide

*SWL will be measured only for groundwater monitoring locations.

The chemical processing reagents that will be used during processing activities are listed below. The water quality monitoring parameters above will capture any potential contamination from each of these:

- Quicklime in bulk dry powder form;
- Sodium Cyanide in solid form;
- Sodium Cyanide in solution;
- Sodium Hydroxide; and
- Hydrochloric acid.

6.3 Water Quality Monitoring Methodology

6.3.1 Groundwater Quality Monitoring Procedure

Groundwater quality monitoring at the monitoring locations will be conducted by a suitably qualified and experienced professional, in accordance with the *Methodology for the Sampling of Groundwater* (DPIR, 2016), the Geoscience Australia *Groundwater Sampling and Analysis – A Field Guide* (Sundaram et al., 2009), and the *Australian/New Zealand Standard (AS/NZS) 5667.11:1998 for water quality – sampling Part 11 guidance on sampling groundwater*.

6.3.1.1 Water Level Measurement

The water level in the groundwater bore is also called depth to groundwater or the standing water level (SWL). Depth to water will be measured with a water level meter and recorded before every sampling event.

The procedure to measure the depth to water level is:

- Switch on the water level meter. Check the sound button to check the light, and the sound device is working correctly.
- Lower the probe end of the water level meter slowly.
- When the sound device is activated (beep sound) and the light is lit, note the reading on the tape from top of the casing of the bore.
- Record the reading from the tape on the field sheet.

A mark will be made on the top of bore casing, so that the same point of reference for the water level reading is the same every time. The water level meter will be decontaminated before and after use at each bore. The water level meter will be maintained as per manufacturer recommendations to ensure accurate water level readings. This includes checking the tape for any stretching or tears.

Over time, the base of the monitoring bores can have sediment or silt build-up. Hence, comparing the measured total depth reading with the depth documented at the time of construction is useful to determine the status of the bore. This will be done at every sampling event.

The total depth of the bore can be measured using a weight attached to a tape measure. Use a tape measure that is at least as long as the deepest bore to be measured. The procedure is as follows:

- Lower the weight and the tape into the casing until it reaches the bottom of the bore, as this happens, the tape will become slack.
- Lift and drop the tape several times to 'feel' the bottom of the bore.
- Record the result as total depth in metres from the top of casing of the bore on the field sheets.
- Clean the tape before using it again.

6.3.1.2 Water Quality Measurement

The main methods recommended in the monitoring guidelines for groundwater sampling are:

- Low flow method.
- Bore purging method.

6.3.1.2.1 Low Flow Method

The low flow method is undertaken by specifically designed sample pumps, which usually incorporate a piston or bladder that is operated by compressed air or gas. The principle behind this method is to extract formation water through the bore screen (or slotted interval) at approximately the same rate it flows out of the pump, without disturbing the stagnant water column (Sundaram et al., 2009). This is achieved by pumping at a rate that results in a minimal drawdown of the water level within the bore. Typical flow rates for low flow sampling are in the order of 1 to 2 L/min; however, this might need to be adjusted depending on the rate of recharge of the bore.

The procedure to conduct groundwater sampling using the low flow method is as follows:

- Lower pump to the middle of the bore screen/slotted interval.
- Set pumping rate to a level that will result in a minimum drawdown of the water level. Check the water level before and during pumping and adjust the flow rate accordingly.
- Monitor field parameters to ensure stabilisation before taking the sample. Sterile gloves will be worn before collecting samples.
- When sampling for dissolved metals, make sure that the laboratory-supplied sample bottle for dissolved metals is appropriately labelled and is field filtered using a 0.45-micron filter.
- Label the sample bottles appropriately with sample location, date and time.
- Complete the field sheet.
- Preserve and pack the sample as outlined in **Section 6.5** below.

Based on the USEPA (1996) standard operating procedure, the stabilisation criteria for parameters before sampling is presented in **Table 5** below.

Table 5 Stabilisation Criteria

Analyte	Stabilisation Criteria
Temperature (°C)	± 0.2 °C
pH	± 0.1 pH Units
Electrical conductivity (EC)	± 3 % or ± 5 %

6.3.1.2.2 Bore Purging Method

To obtain a representative sample of the formation, it is necessary to remove the stagnant water from the bore casing before a sample is taken. This is called purging. It is recommended within the guidelines that at least three casing volumes of water will be removed before sampling. Usually, pumping of the bore is continued even after three casing volumes have been removed until the pH, EC, and temperature of the discharge water are stabilised (Sundaram et al., 2009).

The volume of the water to be removed is calculated using the following formula:

$V = 3 \times \{\pi \times r^2 \times (TD-SWL) \times 1000\}$

Where:

- V = total volume of water to be removed in litres
- r = radius of the casing in metres (radius is half of the diameter)
- TD = total depth of the bore in metres
- SWL = standing water level in the bore in metres
- π = the constant (3.14)

The procedure to collect groundwater samples using the bore purging method is as follows:

- Lower the pump to about 1 m above the screen (if screen interval is known), or to about 1 to 2 m from the bottom of the bore (if the screen interval is not known).
- After starting the pump, establish the highest flow rate possible without causing the bore to stop yielding. For low-yielding bores that are pumped dry, let the bore recover prior to sampling and review if low flow sampling or a change in monitoring requirements is needed for the bore.
- Calculate the flow rate i.e., rate of flow per unit time (L/sec or L/min).
- Pump until the three casing volumes of water is removed and until pH, EC and temperature measurements stabilise.
- Once parameters have stabilised and three bore volumes have been purged, samples can be collected. Sterile gloves will be worn before collecting samples.
- When sampling for dissolved and total metals, make sure that the sample bottle for dissolved metals is properly labelled and is field filtered using a 0.45-micron filter.
- Label the sample bottles appropriately with sample location, date and time.
- Complete the field sheet.
- Preserve and pack the sample as outlined in **Section 6.5** below.

The stabilisation criteria presented in **Table 5** above are recommended for this method as well.

Currently, the groundwater quality at Nobles is monitored using Hydrasleeves. The method of sampling using Hydrasleeves is a no-purge, passive sampling method, which is used as an alternative to low-flow pumped sampling. The concept behind the no-purge method is that the natural flow of groundwater through the well screen results in chemical concentrations in the screen that are equal

to concentrations in the surrounding formation (Freeze and Cherry, 1979; Reilly and LeBlanc, 1998). Moving forward, groundwater sampling will be collected using the low-flow method where possible. In bores where low-flow sampling is found unsuitable (i.e., causing drawdown), the bore purging method will be used.

6.3.2 Surface Water Quality Monitoring procedure

The information in this plan has been developed from *Australian/New Zealand Standards for Water Quality – Sampling parts 1, 4, and 6 (numbers 5667.1:1998; 5667.4:1998; and 5667.6:1998)* and the *Methodology for the Sampling of Surface Water* (DME, 2016). Appropriate safety precautions must be observed when collecting surface water samples.

The procedure for surface water sampling is as follows:

- The surface water sampling will be undertaken at the same location outlined in the WQMP for each round of monitoring.
- The sample will be taken from flowing, not stagnant water, where possible. Where there is no flow, such as in dams and isolated pools, samples can be collected from stagnant water. The "flow status" (for example, flowing, no flow, or pool) at the sampling point will be recorded on the field sheets at each location and during every sampling event.
- Surface water samples will be collected either by directly filling the laboratory-supplied containers from the surface water body, or by decanting the water from a collection device, which will be decontaminated before and after use (refer to the procedure presented in **Section 6.4**). Sterile gloves will be worn while collecting samples.
- Rinse the containers, where required. Fill the sample containers with the one-third of water to be sampled, rinse, and empty. Make sure that the water is emptied downstream or at a sufficient distance from the sample site to prevent mixing of rinse water with the water to be sampled and repeat the process a further two (2) times (a total of three (3) rinses). Make sure that the water used to rinse dissolved metal containers is filtered through the 0.45-micron filter. Sample containers with preservatives will not be rinsed.
- For sample collection, the bottle will be carefully plunged into the water mouth down and filled from 3 to 5 centimetres below the surface of the water, without disturbing the substrate.
- When the sampling bottle is uncapped for sampling, it is essential that the cap is protected from contamination.
- When sampling for dissolved metals, ensure that the sample bottle for dissolved metals is properly labelled and is field filtered using a 0.45-micron filter.
- Label the sample bottles appropriately with sample location, date and time.
- Complete the field sheets.
- Preserve and pack the sample as outlined in **Section 6.5**.

6.4 Decontamination of Sampling Equipment

To ensure the quality of samples collected, decontamination of monitoring equipment must be conducted consistently. All equipment that will contact the surface water (e.g., sampling pole) and groundwater (e.g., pumps and bailers) will be decontaminated prior to use at another sampling site to avoid cross-contamination. Disposable equipment intended for one-time use does not require decontamination but will be packaged for appropriate disposal.

The following procedure is required to be carried out in sequence for the decontamination of monitoring equipment:

- Use a non-phosphate and PFAS free detergent and tap or potable water wash, using a brush if necessary.
- Rinse with tap or potable water three times.
- Rinse three times with deionised water.

Sterile gloves will be worn by anyone handling the monitoring equipment.

6.5 Sample Handling, Preservation, Storage and Transport

6.5.1 Sample Handling

Samples shall be handled in a way to ensure their integrity is maintained and that they continue to represent the groundwater and surface water source conditions from which they were sampled, until the time of their analysis. Prior to the commencement of a sampling event, an assessment of the analytical holding times shall be made, and the sampling will be planned accordingly to ensure that holding times are minimised and are not exceeded wherever possible.

All samples will be placed in laboratory-provided containers using single-use disposable nitrile gloves. Duplicates will be collected in the field. Sample bottles shall be filled to the top of the sample container, minimising air gaps, and securely sealed.

All samples will be clearly labelled with unique sample identification numbers, sample date and time, sample location, and sampler's initials. In the case of field duplicates, sample containers will be labelled so as not to reveal the sample identification number, sample data and time, or sample location to the laboratory. An indelible pen shall be used for labelling to ensure that the lettering is not erased during transit to the laboratory.

6.5.2 Sample Preservation

Information on the appropriate sample container, preservation technique, and holding times, based on the parameters analysed under this WQMP is presented in **Table 6** below. The maximum holding times outlined are based on information stated in AS/NZS 5667.1:1998, however due to the remote location of Nobles Nob and distance to an accredited laboratory, the 24 hour holding time is not currently achievable. The holding time and preservation will therefore be confirmed with the contracted laboratory undertaking the analysis to inform the relevant interpretation of results.

After sampling is completed at each site, the sample containers will be checked to ensure details on the containers and labels are correct. The samples will then be kept and transported in an esky or a cooler box with ice or ice bricks to preserve the samples. Sample preservation will limit degradation and dispatch to the laboratory for analysis will occur as soon as practically possible.

Table 6 Water Quality Sample Storage and Preservation Procedure

Determinant	Type of Container	Preservation Procedure	Maximum Holding Time
Acidity and alkalinity	Plastic or glass	Fill container completely to exclude air and refrigerate (below 4 °C).	14 days
Metals	Acid washed plastic or glass	Acidify with nitric acid to pH 1 - 2 and refrigerate. Filtration of the sample must be performed prior to acidification*.	1 month

Major Cations	Plastic	Acidification is not required, though the addition of nitric acid sufficient to lower pH to 1 - 2 will enable determination of concentration with metals analysis.	1 week to
Chloride	Plastic or glass	None required.	1 month
Total Dissolved Solids/Total Suspended Solids	Plastic or glass	Filter on site and freeze.	24 hours
Iron	Plastic or glass	Freeze	24 hours
Sulfate	Plastic or glass	Refrigerate	1 week

6.5.3 Sample Storage and Transportation

All samples will be kept chilled in an esky with ice or ice bricks or dedicated site refrigerator prior to dispatch to the NATA registered laboratory under chain of custody procedures. Samples will be transported directly to the primary laboratory to ensure that the required holdings times are minimised. Since some parameters have very short recommended holding times (for example, the holding time for pH is six hours), in-situ or field measurement is important for these parameters.

6.5.4 Chain of Custody Forms

Chain of Custody (CoC) forms shall be completed, documenting the sample name (Sample ID) and parameters that are to be analysed. The CoC documents the chain of events from sample collection to delivery at the laboratory and provides a traceable account of sample handling. The CoC form shall be signed by both the sample collector/dispatcher and the receiving laboratory. Date and time of sample relinquishment and receipt at the laboratory will be documented. The CoC for each sampling event will be recorded.

6.6 Quality Assurance and Quality Control

Quality Assurance (QA) is the collection of policies, procedures, and actions established to provide and maintain data integrity and accuracy (Sundaram et al., 2009). In order to meet the objective of the WQMP, it is essential that a rigorous and thorough program of checks, comparisons and communication is implemented in the form of a QA system. Quality Control (QC) is a sample or procedure intended to verify the performance characteristics of a system (Sundaram et al., 2009). QC samples ensure that if there is any significant change in the sample results, due to contamination during sampling, handling and transportation, it will be picked up by QC sample.

The field QA/QC plan adopted for water quality monitoring has been designed to achieve precision, accuracy, representativeness, completeness and comparability of the data set, and that the data set is of acceptable quality to meet the objectives of this WQMP.

6.6.1 Field QA/QC

The field QA/QC procedures to be adopted during water quality monitoring and the corresponding acceptable control limits are presented in **Table 7** below.

Table 7 Field QA/QC

Data type	Comments and Acceptable Control Limits
Sampling Team	Sampling personnel will be comprised of personnel trained in conducting groundwater and surface water sampling.
Record Keeping	All field activities are to be recorded and maintained in field documents and field sheets.
Sampling Locations	Prior to any sampling undertaken, sampling locations will be confirmed.
Sample Collection	Groundwater and surface water samples will be collected into appropriate laboratory sampling bottles, using a fresh pair of disposable nitrile gloves.
Calibration of Field Equipment	The field water quality meter will be calibrated as per the manufacturer's recommendation before each sampling event. Calibration records will be kept for each sampling event.
Sample Nomenclature	Samples will be named as outlined in the WQMP. The same name is to be used for each sampling event for consistency.
Decontamination	Phosphate-free detergent and deionised water is to be used to decontaminate sampling instrumentation between samples, with consumable sampling equipment not to be reused between sample locations (for example, gloves). Deionised water will be used for rinses.
QA/QC	All fieldwork will be conducted in accordance with this WQMP.
Chain of Custody Forms	CoC procedures are required for all sample transfers. Laboratory CoC sheets list sample numbers, date of collection, and requested analyses. The analytical suite required will be in accordance with the WQMP and is to be reviewed by a SQP prior to submission to the laboratory.
Preservation	All samples will be sent to the laboratory in appropriately preserved containers, with sample preservation including packing samples with ice in eskies / cooler boxes.
Blind Samples	A blind sample is a duplicate of the primary field sample, which are both sent to the same laboratory for analysis to determine any differences in results within the same laboratory.
	Blind samples will be prepared in accordance with the procedures included in *Section 8 of Australian Standard AS4482.1-1997*. The frequency of replicate testing will be at least one (1) for each sampling event.
Field Blank Samples	A field blank sample contains laboratory-prepared water (usually DI water), that is sampled in the appropriate containers following the same process of groundwater and surface water sampling. The field blank is then placed in the esky that contains the samples.
	The field blank sample will not detect any metals above the limit of reporting (LOR). The field blank samples are used to determine any cross-contamination between samples during sampling or when placed in the esky during transit.
Logging and Location Marking	A visual assessment will be made of any markers (for example, odour, colour, or sheen on water) and GPS readings taken at each sample location.

6.6.2 Data Management

The data gathered from water quality monitoring will be collated into a database which will include:

- A site plan showing monitoring location.
- Periodic photos from monitoring locations during each sampling event.
- Enter the field results in a spreadsheet along with other details such as:
  - Sample location
  - Date sample was collected (day, month and year)
  - Time sample was collected in a 24-hour format
  - Field parameters recorded
  - Units of field parameters
  - Comments (for example, dry or insufficient water to sample, murky water etc.)
- A record of the chain of custody of the samples from sampling through to analysis.
- Compare the field result with appropriate background levels and previous results to ensure that none of the entries is off by a significant order.

In addition to the above-mentioned list, the following records will also be kept for each sampling event:

- Field sheets with all field observations for each monitoring location sampled.

The laboratory data gathered from the laboratory water quality monitoring will be collated into a database which will include:

- Laboratory analysis certificates.
- Spreadsheets with laboratory results for each sampling event.

It is important that a consolidated database for field and laboratory results be maintained for water quality monitoring at Nobles Nob. To facilitate adequate maintenance of the monitoring database, the following will be implemented:

- Ensure that there is no variability in the naming conventions of the sampling points for monitoring locations. Site names will be updated as per this WQMP to ensure that the field and laboratory data also have the same name.
- Make sure that the field results are monitored consistently in the same units. It will be helpful to prepare a template of field sample sheets or tabular spreadsheet and provide that to the sampling team to populate. This way, uniformity in results, units, and values can be attained.
- Make sure that the laboratory results are issued in consistent units and with consistent detection limits or LOR. This can be achieved by communicating to the contracted laboratory.
- Ask the contracted laboratory to issue the laboratory results in the same template for every sampling round. This will minimise variability in the data and will make compiling the monitoring database easier. This can be achieved by communicating with the contracted laboratory.
- Review and quality check of laboratory results will be undertaken for each monitoring round, before adding the results to the database. This includes checks of the results against historical results for each sample location. Data validation will be undertaken before adding the results to the database.

- A database management system such as MonitorPro or ESDAT will be considered for maintenance of environmental monitoring data. These database management systems are effective in maintaining large environmental databases.

6.6.3 Data Review, Validation, and Verification

The data collected will be reviewed, validated and verified for each sampling event. The specific requirements which will be checked during data validation are:

- Duplicate sample data: assess for the precision and reliability of the analysis by comparing the results between the sample and duplicate.
- Blank sample data: assess for accuracy and if any contamination occurred during sampling by reviewing the results of field blank results
- Overall data assessment: consistency of units and limit of reporting.

Field duplicate samples will be submitted to the laboratory as blind or mask samples. Relative percent differences (%RPD) will be calculated for each pair of original and duplicate results. The formula to derive RPD is as follows:

$$RRRRRR\ (\%) = \left(\frac{SSSSSSSSSSS\ \ CCCCCCCC.\ —RRDDSSSSWCCSSDDSS\ \ CCCCCCCC.}{MMSSSSCC\ CCoo\ SSSSSSSSSSS\ SSCCaa\ RRDDSSSSSDDCCSSDDSS\ CCCCCCCC.} \right) \times 100$$

The RPD then uses the limit of reporting (LOR) to identify thresholds for valid reproducibility. These include:

- Mean of sample and duplicate < 10 times LOR: there is no RPD limit (reproducibility is valid)
- 10 times LOR < mean of sample and replicate < 20 times LOR: the RPD range limit is 0% to 50% for a valid duplicate
- Mean of sample and replicate > 20 times LOR: the RPD range limit is 0% to 20% for a valid duplicate.

If the RPD exceeds the threshold percentage, the results are considered unreliable and require further investigation. Only one duplicate sample needs to be collected per sampling event.

6.7 Water Quality Assessment Protocols

6.7.1 Assessment Criteria and Guideline Values (Interim)

The water quality monitoring results will be assessed against criteria, which will provide an early warning for any potential impacts due to activities on site. The Nobles Nob area does not have any defined Water Quality Objectives (WQOs). Due to the lack of sufficient available baseline water quality data at Nobles Nob, developing site-specific criteria is not possible at this time. The site-specific criteria to assess water quality will therefore be developed following sufficient observations, once a minimum of 12 months of baseline water quality data has been recorded.

For the period until sufficient water quality data is available, interim guideline values have been developed in accordance with ANZECC & ARMCANZ (2000) guideline values for livestock drinking water, and Australian drinking water guidelines (NHMRC, NRMMC, 2011) (**Table 8**).

To determine their suitability, the data from the existing baseline program was compared to the interim guideline values. This involved comparing the computed criteria (i.e., 80th percentiles of the baseline data) with the interim guideline values. The comparison suggested that the proposed interim guideline values of the following parameters are unsuitable:

- Electrical Conductivity

- Sulfate
- Total Dissolved Solids
- Iron
- Manganese
- Selenium
- Free and total cyanide (unsuitable only for NNMW005)

Where the interim guideline values for livestock drinking water and Australian drinking water were found unsuitable, the second level of interim guideline values (called Interim Limits) were established (**Table 8**). These Interim Limits were derived using the 80th percentile of the baseline data. It is possible that the Interim Limits might not be suitable for all monitoring locations, and for those locations, individual site-specific guideline values will be derived, once sufficient data is available. These interim guideline values and limits will be revised as soon as we have a minimum of 12 months baseline water quality data from Nobles Nob.

Table 8 Proposed Interim Guideline Values to Assess Water Quality

Parameters	Interim Guideline Values	Interim Limit^^	Units
pH*	6-9	-	pH Units
EC**	5970	11600	µS/cm
Total Dissolved Solids (TDS)**	4000	8000, 10000 for NNMW005	mg/L
Sulfate	1000	1060 for NNMW001, 1560 for NNMW005, and 1100 for NNMW011	mg/L
Aluminium	5	-	mg/L
Arsenic	0.5	-	mg/L
Boron	5	-	
Cadmium	0.01	-	mg/L
Chromium	1	-	mg/L
Cobalt	1	-	mg/L
Copper	1	-	mg/L
Iron*	0.2	0.268 for NNMW004, 0.636 for NNMW018, and 0.87 for SWLA01	mg/L
Lead	0.1	-	mg/L
Manganese*	0.2	1.9; 6.34 for NNMW001, 4.86 for NNMW012, for total manganese – 6.56 for NNMW001 and	mg/L

		5.36 for NNMW012	
Molybdenum	0.15	-	mg/L
Mercury	0.002	-	mg/L
Nickel	1	-	mg/L
Selenium	0.02	0.034	mg/L
Zinc	20	-	mg/L
Free Cyanide^	0.007	0.0178 for NNMW005	mg/L
Total Cyanide#	0.08	0.112 for NNMW005	mg/L

Note: * Interim guideline values for pH, Iron, and Manganese has been derived from ANZECC Irrigation guideline values (ANZECC & ARMCANZ, 2000).
** Interim guideline values for TDS have been adapted from the levels specified for Beef cattle. Interim guideline values for EC has been calculated using conversion from adapted TDS using equation 4.6 of ANZECC & ARMCANZ (2000)
^Interim guideline values for Free Cyanide has been derived from ANZG (2018) default guideline value for aquatic ecosystem (95% level of species protection).
#Interim guideline value for Total Cyanide has been adapted from Australian drinking water guidelines (NHMRC, NRMMC, 2011).
^^ Interim limits have been derived using 80th percentile of all groundwater sites combined. Specific interim limits (such as 10000 mg/L TDS for NNMW005) has been derived using site-specific 80th percentiles.

6.7.2 Trigger for Corrective Actions

In order to manage the water quality on site, the monitoring results will be assessed against the guideline values outlined in **Section 6.7.1** above, which will provide an early warning for any potential changes in the water quality at Nobles Nob. Based on the available water quality data the below criteria have been established to trigger corrective actions:

- If the water quality results exceed the guideline values in **Table 8**, compare them with the interim limits (if available). If the water quality results exceed the interim guideline values and interim limits (if provided) mentioned in **Table 8**, and the concentrations are higher than that recorded in the upstream sites (e.g., NNMW011, NNMW012, NNMW013, and NNMW018), this will trigger corrective action.
- If the water quality results exhibit an increasing temporal trend in three (3) consecutive monitoring events (after baseline data collection is over), and the concentrations are outside the historical concentration range recorded during baseline data collection, this will trigger corrective action.

In addition to the above, any water quality impacts observed from construction activities, such as excessive erosion, acidic runoff, etc. will trigger corrective actions. Any environmental incident or emergency will also trigger corrective actions.

6.7.3 Corrective Actions

When a corrective action criterion is triggered, the following corrective actions will be implemented:

- Implement appropriate controls and contingency responses identified in the risk assessment and the EMP.
- In the event of exceedances, verify the water quality results, and ensure that the results are representative, and free of any errors occurred at the laboratory or during sampling.
- If required, re-test the sample in the laboratory, if the laboratory has sufficient samples to retest. Otherwise, resample and re-test the location with exceedances.

- In the event of genuine exceedances (i.e., exceedance is not an error), compare the exceedances with historical data. If an exceedance is within the historical range, continue monitoring the concentration.
- If an exceedance is outside the historical range, investigate potential sources of exceedances and undertake mitigation works. Including identification of contamination source; and prevention, capture, diversion, or prevention of any discharges from operations, as necessary.
- If required, install a system to prevent ongoing impact (e.g., installation of a seepage interception system, pump back bores etc.).

An investigation will assess the potential for environmental harm and will include a written report outlining:

- Details of the investigations carried out, including source and cause of the exceedances and criterion.
- Actions taken to prevent environmental harm.

In the case of an environmental incident or emergency, incident response shall be initiated immediately, if safe to do so. The Site Manager will be notified as soon as practicable to allocate resources onsite if available. In the case of environmental incident involving release of contaminated water, the cause of the release will be remedied immediately, if safe or possible to do so. Protection to the clean water drains and surface water bodies will be ensured, where possible, during the initial response. The general plan of action will include, but will not be limited to, the following:

- Identify environmental incident or emergency
- Cease or contain the cause of the incident. Notify the Site Manager or TCMG management.
- Initiate immediate site level response, where safe to do so
- Notify the relevant regulator, and emergency services if required
- Remediate, if possible. Consult Environmental professional, if needed
- Investigate the cause of incident, and submit a report outlining impacts from the incident, and ways to avoid such incidents in future.

6.8 Reporting

As part of this WQMP, an annual monitoring summary report will be prepared summarising the preceding 12 months of monitoring.

Additionally, a quarterly internal monitoring summary technical note will be prepared (after baseline data has been collected), summarising:

- All monitoring data, exceedances, and temporal trends, if any.
- All mitigation measures implemented, or changes to the monitoring program.

Any non-compliance or incident will be recorded in an incident reporting form and entered into the incident - complaint register. Any action(s) undertaken as corrective action to mitigate environmental harm from the non-compliance or incident will also be recorded.

A copy of relevant reports, management plans, procedures, approvals and licences will be maintained at the site, along with all relevant records showing compliance and non-compliance events. These can be provided to the regulators on request.

Any significant environmental accidents and incidents will be reported to the Department of Industry, Tourism and Trade (DITT) via a Notification of an Environmental Incident form as required under S29 of the Mining Management Act 2001. Any significant pollution events will also be reported to the NT EPA Pollution Hotline.

6.9 Summary of Water Quality Monitoring Program

The summary of this WQMP is presented in **Table 9** below.

Table 9 Summary of the WQMP

Item	Description
Aim	Ensure that the water quality at the site is maintained and does not deteriorate.
Objectives and Targets	Objectives and Targets from **Section 1**
Responsible Person	TCMG management, TCMG WHSE team, Site Manager, TCMG employees and contractors.
Actions / Mitigation Measures	-Implement the relevant plans, such as Erosion and Sediment Control Plan, Fuel storage and handling procedures etc. -Revise the interim guideline values once sufficient baseline data is collected. -Review and revise this WQMP as necessary, after sufficient baseline data is collected.
Monitoring	Implement a monitoring program as outlined in **Section 6** of this WQMP.
Reporting	-An annual monitoring summary report will be prepared summarising the preceding 12 months of monitoring. -A quarterly internal monitoring summary technical note will be prepared (after baseline data has been collected). -Any non-compliance or incident will be recorded on the incident reporting form (or similar) and entered into the incident-complaint register. -Any action(s) undertaken as corrective action to mitigate environmental harm from the non-compliance or incident will also be recorded. -Any significant environmental incidents will be reported to DITT and any other relevant authorities.
Trigger for Corrective Actions	-If the water quality results exceed the guideline values in Table 8, compare them with the interim limits (if available). If the water quality results exceed the interim guideline values and interim limits (if provided) mentioned in Table 8, and the concentrations are higher than that recorded in the upstream sites (e.g., NNMW011, NNMW012, NNMW013, and NNMW018), corrective actions will be triggered. -If the water quality results exhibit an increasing temporal trend in three (3) consecutive monitoring events (after baseline data collection is over), and the concentrations are outside the historical concentration range recorded during baseline data collection, corrective actions will be triggered.

Corrective Actions	-Implement appropriate controls and contingency responses identified in the risk assessment and the EMP. -In the event of exceedances, verify the water quality results, and ensure that the results are representative, and free of any errors occurred at the laboratory or during sampling. -If required, re-test the sample in the laboratory, if the laboratory has sufficient samples to retest. Otherwise, resample and re-test the location with exceedances. -In the event of genuine exceedances (i.e., exceedance is not an error), compare the exceedances with historical data. If an exceedance is within the historical range, continue monitoring the concentration. -If an exceedance is outside the historical range, investigate potential sources of exceedances and undertake mitigation works as necessary. -If required, install a system to prevent potential impact (e.g., installation of a seepage interception system, pump back bores etc.).
Review of this WQMP	This WQMP will be reviewed annually by an appropriately qualified person to determine if the WQMP continues to meet the requirements.

7.0 Review of this WQMP

This WQMP will be reviewed annually by an appropriately qualified person to determine if the WQMP continues to meet the requirements. The review will include:

- An assessment of the outcome of the WQMP against the objectives and targets.
- A review of the adequacy of the monitoring locations, frequencies, and development of water quality triggers.
- Any required increase in monitoring locations to monitor impacts on water quality adequately.
- Additional quality assurance and quality control measures, if required.
- Revision of monitoring parameters and/or frequency, if required.
- Expanding the existing monitoring network over time to enable ongoing impact evaluations.

As required, this WQMP may be updated or revised based on the outcomes of the review process. The WQMP will also be reviewed if:

- A review of the QA/QC results is non-acceptable. The monitoring procedures outlined in this WQMP will be reviewed and revised as necessary.
- Any relevant changes in legislation, approvals or other factors, that requires a review of this WQMP. The site activities alter the level of risk with respect to the objectives and targets of this WQMP, resulting in a review of the risk assessment.

8.0 References

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Appendix A. Statistical Summary

sites	statistic	Field pH	pH	EC	Sulfate	Total Diss	Aluminiun
NNMW001	Number	7	8	8	8	8	8
NNMW001	non-detect(%)	0	0	0	0	0	0
NNMW001	Min	6.19	7.2	11000	970	7100	0.016
NNMW001	5th %ile	6.211	7.2	11000	970	7100	0.01705
NNMW001	20th %ile	6.278	7.24	11000	974	7140	0.0206
NNMW001	Median	6.46	7.5	11000	980	7300	0.025
NNMW001	80th %ile	6.496	7.76	11000	1060	7520	0.0276
NNMW001	95th %ile	6.815	7.8	11000	1100	8055	0.0332
NNMW001	Max	6.95	7.8	11000	1100	8300	0.036
NNMW002	Number	7	8	8	8	8	8
NNMW002	non-detect(%)	0	0	0	0	0	0
NNMW002	Min	5.64	6.6	4500	220	3100	0.012
NNMW002	5th %ile	5.7	6.635	4500	223.5	3135	0.01235
NNMW002	20th %ile	5.848	6.74	4500	230	3200	0.0134
NNMW002	Median	5.9	7	4600	240	3400	0.016
NNMW002	80th %ile	6.518	7.26	4700	250	3500	0.0182
NNMW002	95th %ile	6.869	7.365	4700	269.5	3825	0.01965
NNMW002	Max	6.98	7.4	4700	280	4000	0.02
NNMW004	Number	7	8	8	8	8	8
NNMW004	non-detect(%)	0	0	0	0	0	0
NNMW004	Min	6.18	7.1	9300	680	6100	0.015
NNMW004	5th %ile	6.18	7.17	9475	683.5	6275	0.01605
NNMW004	20th %ile	6.196	7.3	9800	734	6600	0.0184
NNMW004	Median	6.31	7.55	10000	810	6950	0.0225
NNMW004	80th %ile	6.506	7.7	10600	840	7160	0.025
NNMW004	95th %ile	6.862	7.83	11000	859.5	7460	0.025
NNMW004	Max	7	7.9	11000	870	7600	0.025
NNMW005	Number	7	8	8	8	8	8
NNMW005	non-detect(%)	0	0	0	0	0	0
NNMW005	Min	6.08	7.1	14000	990	8700	0.024
NNMW005	5th %ile	6.086	7.135	14000	1063.5	8910	0.02575
NNMW005	20th %ile	6.106	7.2	14000	1240	9340	0.0306
NNMW005	Median	6.19	7.45	14000	1500	9550	0.0415
NNMW005	80th %ile	6.332	7.66	14600	1560	10000	0.0458
NNMW005	95th %ile	6.679	7.765	15000	1600	10650	0.0483
NNMW005	Max	6.82	7.8	15000	1600	11000	0.049
NNMW007	Number	7	8	8	8	8	8
NNMW007	non-detect(%)	0	0	0	0	0	0
NNMW007	Min	6.25	7.1	9500	780	6100	0.017
NNMW007	5th %ile	6.259	7.135	9500	783.5	6100	0.0177
NNMW007	20th %ile	6.288	7.28	9500	794	6100	0.0194
NNMW007	Median	6.42	7.5	9650	800	6150	0.0225
NNMW007	80th %ile	6.592	7.82	9800	852	6320	0.0242
NNMW007	95th %ile	6.964	7.965	9865	873	6725	0.0263
NNMW007	Max	7.12	8	9900	880	6900	0.027
NNMW011	Number	4	5	5	5	5	5

NNMW011	non-detect(%)	0	0	0	0	0	0
NNMW011	Min	6.09	7.2	10000	1000	6500	0.021
NNMW011	5th %ile	6.1125	7.24	10000	1000	6520	0.0224
NNMW011	20th %ile	6.18	7.36	10000	1000	6580	0.0266
NNMW011	Median	6.265	7.4	10000	1100	6700	0.028
NNMW011	80th %ile	6.386	7.7	10200	1100	6720	0.0284
NNMW011	95th %ile	6.494	7.7	10800	1100	6780	0.0296
NNMW011	Max	6.53	7.7	11000	1100	6800	0.03
NNMW012	Number	4	5	5	5	5	5
NNMW012	non-detect(%)	0	0	0	0	0	0
NNMW012	Min	6.2	7	12000	900	8100	0.024
NNMW012	5th %ile	6.2075	7.04	12000	904	8120	0.0242
NNMW012	20th %ile	6.23	7.16	12000	916	8180	0.0248
NNMW012	Median	6.26	7.3	12000	920	8200	0.029
NNMW012	80th %ile	6.482	7.72	12000	960	8460	0.032
NNMW012	95th %ile	6.7205	7.78	12000	990	8640	0.035
NNMW012	Max	6.8	7.8	12000	1000	8700	0.036
NNMW013	Number	4	5	5	5	5	5
NNMW013	non-detect(%)	0	0	0	0	0	0
NNMW013	Min	6.24	7.1	9700	810	6500	0.018
NNMW013	5th %ile	6.2595	7.14	9720	814	6500	0.019
NNMW013	20th %ile	6.318	7.26	9780	826	6500	0.022
NNMW013	Median	6.41	7.4	9800	830	6600	0.024
NNMW013	80th %ile	6.614	7.72	9920	868	6720	0.0264
NNMW013	95th %ile	6.7985	7.78	9980	892	6780	0.0276
NNMW013	Max	6.86	7.8	10000	900	6800	0.028
NNMW014	Number	7	8	8	8	8	8
NNMW014	non-detect(%)	0	0	0	0	0	0
NNMW014	Min	6.33	7.2	9400	670	6200	0.022
NNMW014	5th %ile	6.345	7.2	9400	673.5	6235	0.0227
NNMW014	20th %ile	6.396	7.28	9400	684	6340	0.026
NNMW014	Median	6.77	7.5	9550	795	6400	0.031
NNMW014	80th %ile	7.068	7.76	9660	846	6620	0.034
NNMW014	95th %ile	7.523	7.865	9830	856.5	7155	0.03985
NNMW014	Max	7.7	7.9	9900	860	7400	0.043
NNMW018	Number	4	5	5	5	4	5
NNMW018	non-detect(%)	0	0	0	0	0	0
NNMW018	Min	6.23	7.1	7700	660	5500	0.02
NNMW018	5th %ile	6.266	7.12	7940	662	5605	0.0204
NNMW018	20th %ile	6.374	7.18	8660	668	5920	0.0216
NNMW018	Median	6.67	7.5	9800	710	6300	0.023
NNMW018	80th %ile	6.898	7.74	11200	828	6520	0.0264
NNMW018	95th %ile	6.9295	7.86	11800	882	6655	0.0276
NNMW018	Max	6.94	7.9	12000	900	6700	0.028
SWLA01	Number	7	8	8	8	8	8
SWLA01	non-detect(%)	0	0	0	0	0	0
SWLA01	Min	6.49	6.8	42	1.1	30	0.12

SWLA01	5th %ile	6.646	6.8	43.4	1.1	35.25	0.148
SWLA01	20th %ile	7.024	6.8	51.2	1.18	47	0.208
SWLA01	Median	7.1	6.95	67.5	1.85	55.5	0.42
SWLA01	80th %ile	7.738	7.06	83.4	2.94	112	1.88
SWLA01	95th %ile	8.542	7.1	94.1	3.815	120	2.52
SWLA01	Max	8.83	7.1	99	4.2	120	2.8

Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	50	100	0	62.5	100	37.5
0.001	0.087	3.00E-04	0.6	1.00E-04	0.001	0.026	0.001	0.02	0.001
0.0038	0.0875	3.00E-04	0.61	0.00017	0.0017	0.02635	0.0017	0.02	0.0017
0.009	0.089	3.00E-04	0.64	3.00E-04	0.003	0.0286	0.003	0.02	0.003
0.009	0.091	3.00E-04	0.675	0.00035	0.003	0.0345	0.003	0.02	0.003
0.009	0.093	3.00E-04	0.7	4.00E-04	0.003	0.0492	0.003	0.02	0.004
0.009	0.10575	0.000825	0.7075	0.000465	0.003	0.0618	0.0043	0.02	0.0053
0.009	0.11	0.001	0.71	5.00E-04	0.003	0.066	0.005	0.02	0.006
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	50	100	0	75	100	75
0.001	0.066	2.00E-04	0.2	1.00E-04	0.001	0.002	0.001	0.02	0.001
0.00275	0.06625	2.00E-04	0.205	0.000135	0.00135	0.0034	0.00135	0.02	0.00135
0.006	0.067	2.00E-04	0.22	2.00E-04	0.002	0.006	0.002	0.02	0.002
0.006	0.072	2.00E-04	0.22	2.00E-04	0.002	0.008	0.002	0.02	0.002
0.006	0.075	2.00E-04	0.23	2.00E-04	0.002	0.0148	0.0026	0.02	0.002
0.006	0.07575	8.00E-04	0.2375	0.000265	0.002	0.01665	0.003	0.02	0.0033
0.006	0.076	0.001	0.24	3.00E-04	0.002	0.017	0.003	0.02	0.004
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	50	100	0	87.5	50	87.5
0.001	0.073	3.00E-04	0.88	1.00E-04	0.001	0.026	0.001	0.02	0.001
0.0038	0.07325	3.00E-04	0.8975	0.00017	0.0017	0.02635	0.0017	0.0355	0.0017
0.009	0.074	3.00E-04	0.95	3.00E-04	0.003	0.0278	0.003	0.082	0.003
0.009	0.087	3.00E-04	0.99	3.00E-04	0.003	0.0365	0.003	0.175	0.003
0.009	0.093	3.00E-04	0.99	0.00036	0.003	0.0518	0.003	0.268	0.003
0.009	0.0945	0.000825	0.9975	0.000465	0.003	0.0647	0.00365	0.3145	0.00365
0.009	0.095	0.001	1	5.00E-04	0.003	0.071	0.004	0.33	0.004
8	6	6	6	8	8	8	8	2	8
87.5	0	100	0	100	0	0	0	50	100
0.001	0.058	0.001	1	0.001	0.001	0.1	0.01	0.02	0.001
0.001	0.05975	0.001	1.025	0.001	0.001	0.128	0.01	0.02	0.001
0.001	0.065	0.001	1.1	0.001	0.001	0.2	0.0104	0.02	0.001
0.001	0.067	0.001	1.1	0.001	0.002	0.245	0.0115	0.02	0.001
0.001	0.068	0.001	1.1	0.001	0.003	0.286	0.0156	0.02	0.001
0.00165	0.07025	0.001	1.1	0.001	0.0056	0.29	0.01665	0.02	0.001
0.002	0.071	0.001	1.1	0.001	0.007	0.29	0.017	0.02	0.001
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	37.5	75	0	87.5	100	87.5
0.001	0.054	3.00E-04	1.1	1.00E-04	0.002	0.006	0.001	0.02	0.001
0.0038	0.05475	3.00E-04	1.125	0.00017	0.00235	0.006	0.0017	0.02	0.0017
0.009	0.057	3.00E-04	1.2	3.00E-04	0.003	0.0068	0.003	0.02	0.003
0.009	0.065	3.00E-04	1.2	0.00035	0.003	0.012	0.003	0.02	0.003
0.009	0.066	3.00E-04	1.2	0.00046	0.003	0.0168	0.003	0.02	0.003
0.009	0.069	0.000825	1.275	0.000565	0.00326	0.0245	0.003	0.02	0.0043
0.009	0.07	0.001	1.3	6.00E-04	0.0034	0.028	0.003	0.02	0.005
5	3	3	3	5	5	5	5	2	5

100	0	100	0	40	100	60	60	100	80
0.001	0.024	3.00E-04	0.76	1.00E-04	0.001	0.001	0.001	0.02	0.001
0.0026	0.0241	3.00E-04	0.764	0.00014	0.0014	0.0014	0.0014	0.02	0.0014
0.0074	0.0244	3.00E-04	0.776	0.00026	0.0026	0.0026	0.0026	0.02	0.0026
0.009	0.025	3.00E-04	0.8	3.00E-04	0.003	0.003	0.003	0.02	0.003
0.009	0.025	0.00072	0.812	0.00044	0.003	0.0044	0.0042	0.02	0.0032
0.009	0.025	0.00093	0.818	0.00056	0.003	0.0056	0.0078	0.02	0.0038
0.009	0.025	0.001	0.82	6.00E-04	0.003	0.006	0.009	0.02	0.004
5	3	3	3	5	5	5	5	2	5
100	0	100	0	80	80	0	20	50	80
0.001	0.082	0.001	0.62	4.00E-04	0.001	0.01	0.003	0.02	0.001
0.001	0.0831	0.001	0.622	0.00052	0.001	0.0102	0.003	0.0225	0.001
0.001	0.0864	0.001	0.628	0.00088	0.001	0.0108	0.003	0.03	0.001
0.001	0.093	0.001	0.64	0.001	0.001	0.015	0.004	0.045	0.001
0.0026	0.096	0.001	0.67	0.001	0.0038	0.0156	0.0062	0.06	0.002
0.0074	0.0975	0.001	0.685	0.001	0.0062	0.0174	0.0068	0.0675	0.005
0.009	0.098	0.001	0.69	0.001	0.007	0.018	0.007	0.07	0.006
5	3	3	3	5	5	5	5	2	5
100	0	100	0	60	100	0	20	100	40
0.001	0.044	3.00E-04	0.76	1.00E-04	0.001	0.008	0.003	0.02	0.001
0.0026	0.0451	3.00E-04	0.762	0.00014	0.0014	0.0084	0.003	0.02	0.0014
0.0074	0.0484	3.00E-04	0.768	0.00026	0.0026	0.0096	0.003	0.02	0.0026
0.009	0.055	3.00E-04	0.78	3.00E-04	0.003	0.011	0.005	0.02	0.003
0.009	0.07	0.00072	0.792	0.00034	0.003	0.0122	0.0056	0.02	0.0036
0.009	0.0775	0.00093	0.798	0.00046	0.003	0.0158	0.0074	0.02	0.0054
0.009	0.08	0.001	0.8	5.00E-04	0.003	0.017	0.008	0.02	0.006
8	6	6	6	8	8	8	8	2	8
87.5	0	83.33333	0	50	100	0	62.5	100	62.5
0.002	0.056	3.00E-04	0.74	1.00E-04	0.001	0.005	0.001	0.02	0.001
0.00445	0.05675	3.00E-04	0.7525	0.00017	0.0017	0.00535	0.0017	0.02	0.0017
0.009	0.059	3.00E-04	0.79	3.00E-04	0.003	0.0064	0.003	0.02	0.003
0.009	0.0665	3.00E-04	0.82	3.00E-04	0.003	0.0075	0.003	0.02	0.003
0.009	0.071	3.00E-04	0.83	0.00036	0.003	0.01	0.003	0.02	0.0036
0.009	0.074	0.000825	0.83	4.00E-04	0.003	0.01325	0.00495	0.02	0.00465
0.009	0.075	0.001	0.83	4.00E-04	0.003	0.015	0.006	0.02	0.005
5	3	3	3	5	5	5	5	2	5
100	0	100	0	60	100	0	80	50	80
0.001	0.07	2.00E-04	0.63	1.00E-04	0.001	0.003	0.001	0.02	0.001
0.002	0.0708	0.00021	0.633	0.00012	0.0012	0.0032	0.0012	0.0585	0.0014
0.005	0.0732	0.00024	0.642	0.00018	0.0018	0.0038	0.0018	0.174	0.0026
0.009	0.078	3.00E-04	0.66	3.00E-04	0.003	0.006	0.003	0.405	0.003
0.009	0.0876	0.00072	0.672	0.00038	0.003	0.0086	0.0032	0.636	0.0032
0.009	0.0924	0.00093	0.678	0.00062	0.003	0.0104	0.0038	0.7515	0.0038
0.009	0.094	0.001	0.68	7.00E-04	0.003	0.011	0.004	0.79	0.004
8	6	6	6	8	8	8	8	2	8
100	0	66.66667	100	87.5	62.5	75	12.5	0	75
0.001	0.051	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.47	0.001

0.0017	0.05275	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.495	0.001
0.003	0.058	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.57	0.001
0.003	0.105	1.00E-04	0.05	1.00E-04	0.001	0.001	0.0015	0.72	0.001
0.003	0.13	1.00E-04	0.05	1.00E-04	0.00106	0.001	0.002	0.87	0.001
0.003	0.2275	0.000775	0.05	1.00E-04	0.001165	0.001	0.00265	0.945	0.00165
0.003	0.26	0.001	0.05	1.00E-04	0.0012	0.001	0.003	0.97	0.002

Manganes	Mercury	Molybden	Nickel	Selenium	Silver	Vanadium	Zinc	Total Alum	Total Arse
8	8	6	8	2	8	2	8	8	8
0	100	100	0	0	87.5	100	12.5	0	100
3.6	5.00E-05	0.001	0.003	0.022	5.00E-05	0.003	0.005	0.094	0.001
3.775	5.00E-05	0.0015	0.00335	0.02275	8.50E-05	0.003	0.005	0.0996	0.0038
4.34	5.00E-05	0.003	0.004	0.025	0.00015	0.003	0.0054	0.114	0.009
5.55	5.00E-05	0.003	0.004	0.0295	0.001575	0.003	0.0085	0.13	0.009
6.34	5.00E-05	0.003	0.0052	0.034	0.003	0.003	0.012	0.334	0.009
6.5	5.00E-05	0.003	0.00665	0.03625	0.00365	0.003	0.0257	0.669	0.009
6.5	5.00E-05	0.003	0.007	0.037	0.004	0.003	0.032	0.83	0.009
8	8	6	8	2	8	2	8	8	8
0	100	100	0	0	100	100	0	0	100
0.021	5.00E-05	0.001	0.004	0.01	5.00E-05	0.002	0.005	0.11	0.001
0.02975	5.00E-05	0.00125	0.004	0.01005	6.75E-05	0.002	0.005	0.215	0.00275
0.064	5.00E-05	0.002	0.0044	0.0102	1.00E-04	0.002	0.0054	0.426	0.006
0.255	5.00E-05	0.002	0.0075	0.0105	0.00105	0.002	0.0065	0.88	0.006
1.1	5.00E-05	0.002	0.0112	0.0108	0.002	0.002	0.0098	1.96	0.006
1.23	5.00E-05	0.002	0.01265	0.01095	0.002	0.002	0.01165	2.985	0.006
1.3	5.00E-05	0.002	0.013	0.011	0.002	0.002	0.012	3.3	0.006
8	8	6	8	2	8	2	8	8	8
0	100	100	87.5	0	100	100	25	0	100
0.33	5.00E-05	0.001	0.001	0.02	5.00E-05	0.003	0.005	0.081	0.001
0.33	5.00E-05	0.0015	0.0017	0.02025	8.50E-05	0.003	0.005	0.08695	0.0038
0.342	5.00E-05	0.003	0.003	0.021	0.00015	0.003	0.0058	0.0988	0.009
0.425	5.00E-05	0.003	0.003	0.0225	0.001575	0.003	0.007	0.155	0.009
0.648	5.00E-05	0.003	0.003	0.024	0.003	0.003	0.0112	0.342	0.009
0.817	5.00E-05	0.003	0.003	0.02475	0.003	0.003	0.0146	0.539	0.009
0.88	5.00E-05	0.003	0.003	0.025	0.003	0.003	0.016	0.63	0.009
8	8	6	8	2	7	2	9	8	8
0	62.5	50	0	0	85.71429	50	0	0	87.5
0.39	5.00E-05	0.001	0.002	0.013	0.00025	0.001	0.012	0.13	0.001
0.3935	5.00E-05	0.001	0.00235	0.0135	0.00025	0.00105	0.0148	0.158	0.001
0.404	5.00E-05	0.001	0.003	0.015	0.00025	0.0012	0.019	0.21	0.001
0.54	5.00E-05	0.001	0.004	0.018	0.00036	0.0015	0.025	0.27	0.001
0.744	1.00E-04	0.001	0.0046	0.021	0.005	0.0018	0.0352	0.556	0.001
0.8985	0.000126	0.00325	0.00825	0.0225	0.005	0.00195	0.0538	0.925	0.0023
0.93	0.00014	0.004	0.01	0.023	0.005	0.002	0.063	1.1	0.003
8	8	6	8	2	8	2	8	8	8
0	100	66.66667	100	0	87.5	100	12.5	0	100
0.085	5.00E-05	0.002	0.001	0.017	6.00E-05	0.003	0.005	0.084	0.001
0.08955	5.00E-05	0.00225	0.0017	0.01715	9.15E-05	0.003	0.0057	0.08715	0.0038
0.1108	5.00E-05	0.003	0.003	0.0176	0.00015	0.003	0.007	0.1038	0.009
0.175	5.00E-05	0.003	0.003	0.0185	0.001575	0.003	0.009	0.145	0.009
0.186	5.00E-05	0.003	0.003	0.0194	0.003	0.003	0.0174	0.206	0.009
0.203	5.00E-05	0.003	0.003	0.01985	0.003	0.003	0.02165	0.5745	0.009
0.21	5.00E-05	0.003	0.003	0.02	0.003	0.003	0.022	0.76	0.009
5	5	3	5	2	5	2	5	5	5

20	100	100	60	0	80	100	0	0	100
0.005	5.00E-05	0.001	0.001	0.018	6.00E-05	0.003	0.008	0.094	0.001
0.005	5.00E-05	0.0012	0.0014	0.01805	7.80E-05	0.003	0.008	0.0946	0.0026
0.005	5.00E-05	0.0018	0.0026	0.0182	0.000132	0.003	0.008	0.0964	0.0074
0.005	5.00E-05	0.003	0.003	0.0185	0.00015	0.003	0.008	0.15	0.009
0.0096	5.00E-05	0.003	0.0046	0.0188	0.00072	0.003	0.0174	0.206	0.009
0.0144	5.00E-05	0.003	0.0064	0.01895	0.00243	0.003	0.0306	0.254	0.009
0.016	5.00E-05	0.003	0.007	0.019	0.003	0.003	0.035	0.27	0.009
5	5	3	5	2	5	2	5	5	5
0	100	100	0	0	100	100	0	0	60
2.7	5.00E-05	0.001	0.005	0.002	5.00E-05	0.001	0.007	0.15	0.001
3	5.00E-05	0.001	0.005	0.0026	9.00E-05	0.0011	0.008	0.152	0.001
3.9	5.00E-05	0.001	0.005	0.0044	0.00021	0.0014	0.011	0.158	0.001
4.3	5.00E-05	0.001	0.006	0.008	0.00025	0.002	0.014	0.29	0.001
4.86	5.00E-05	0.001	0.0078	0.0116	0.0008	0.0026	0.0152	1.58	0.0026
5.34	5.00E-05	0.001	0.0102	0.0134	0.00245	0.0029	0.0158	1.82	0.0074
5.5	5.00E-05	0.001	0.011	0.014	0.003	0.003	0.016	1.9	0.009
5	5	3	5	2	5	2	5	5	5
0	100	0	0	0	80	100	20	0	100
0.17	5.00E-05	0.002	0.002	0.02	1.00E-04	0.003	0.005	0.073	0.001
0.226	5.00E-05	0.0021	0.0024	0.0205	0.00011	0.003	0.0054	0.0752	0.0026
0.394	5.00E-05	0.0024	0.0036	0.022	0.00014	0.003	0.0066	0.0818	0.0074
0.69	5.00E-05	0.003	0.005	0.025	0.00015	0.003	0.01	0.16	0.009
0.932	5.00E-05	0.003	0.0062	0.028	0.00072	0.003	0.0162	0.672	0.009
1.058	5.00E-05	0.003	0.0068	0.0295	0.00243	0.003	0.0228	1.668	0.009
1.1	5.00E-05	0.003	0.007	0.03	0.003	0.003	0.025	2	0.009
8	8	6	8	2	8	2	8	8	8
0	100	33.33333	75	0	87.5	50	25	0	87.5
0.089	5.00E-05	0.002	0.001	0.02	6.00E-05	0.003	0.005	0.03	0.002
0.09215	5.00E-05	0.00225	0.0017	0.0208	9.15E-05	0.0031	0.005	0.04295	0.00445
0.1068	5.00E-05	0.003	0.003	0.0232	0.00015	0.0034	0.0054	0.0746	0.009
0.14	5.00E-05	0.003	0.003	0.028	0.001575	0.004	0.006	0.0945	0.009
0.166	5.00E-05	0.003	0.003	0.0328	0.003	0.0046	0.0086	0.156	0.009
0.235	5.00E-05	0.003	0.00365	0.0352	0.003	0.0049	0.0298	0.836	0.009
0.27	5.00E-05	0.003	0.004	0.036	0.003	0.005	0.041	1.2	0.009
5	5	3	5	2	5	2	5	5	5
0	100	100	0	0	80	100	0	0	100
0.56	5.00E-05	0.001	0.002	0.01	5.00E-05	0.003	0.01	0.048	0.001
0.574	5.00E-05	0.0011	0.0022	0.0104	6.00E-05	0.003	0.0104	0.0482	0.002
0.616	5.00E-05	0.0014	0.0028	0.0116	9.00E-05	0.003	0.0116	0.0488	0.005
0.92	5.00E-05	0.002	0.003	0.014	0.00015	0.003	0.02	0.055	0.009
1.7	5.00E-05	0.0026	0.0032	0.0164	0.00072	0.003	0.0256	0.1064	0.009
2	5.00E-05	0.0029	0.0038	0.0176	0.00243	0.003	0.0304	0.1466	0.009
2.1	5.00E-05	0.003	0.004	0.018	0.003	0.003	0.032	0.16	0.009
8	8	6	8	2	8	2	8	8	8
62.5	100	100	62.5	100	100	0	100	0	100
0.005	5.00E-05	0.001	0.001	0.002	5.00E-05	0.001	0.005	0.13	0.001

0.005	5.00E-05	0.001	0.001	0.002	6.75E-05	0.0011	0.005	0.158	0.0017
0.005	5.00E-05	0.001	0.001	0.002	1.00E-04	0.0014	0.005	0.21	0.003
0.005	5.00E-05	0.001	0.001	0.002	0.00055	0.002	0.005	1.055	0.003
0.0224	5.00E-05	0.001	0.001	0.002	0.001	0.0026	0.005	3.14	0.003
0.0359	5.00E-05	0.001	0.001	0.002	0.001	0.0029	0.005	4.355	0.003
0.038	5.00E-05	0.001	0.001	0.002	0.001	0.003	0.005	4.6	0.003

Total Bariu	Total Bery	Total Boro	Total Cadm	Total Chro	Total Coba	Total Copp	Total Lead	Total Man	Total Mere
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	50	100	0	50	25	0	100
0.097	3.00E-04	0.65	1.00E-04	0.001	0.029	0.001	0.001	3.9	5.00E-05
0.09775	3.00E-04	0.6525	0.00017	0.0017	0.0311	0.0017	0.0017	4.285	5.00E-05
0.1	3.00E-04	0.66	3.00E-04	0.003	0.0354	0.003	0.003	5.08	5.00E-05
0.115	3.00E-04	0.705	0.00035	0.003	0.04	0.003	0.0035	6.05	5.00E-05
0.13	4.00E-04	0.71	0.00046	0.003	0.0518	0.0046	0.0056	6.56	5.00E-05
0.13	0.00085	0.71	0.000565	0.003	0.0654	0.0063	0.00665	6.6	5.00E-05
0.13	0.001	0.71	6.00E-04	0.003	0.071	0.007	0.007	6.6	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	50	75	0	37.5	12.5	0	100
0.096	2.00E-04	0.22	1.00E-04	0.001	0.003	0.001	0.001	0.099	5.00E-05
0.0995	2.00E-04	0.22	0.000135	0.00135	0.00405	0.00135	0.00135	0.13085	5.00E-05
0.11	2.00E-04	0.22	2.00E-04	0.002	0.006	0.002	0.0024	0.19	5.00E-05
0.13	2.00E-04	0.225	2.00E-04	0.002	0.0085	0.002	0.003	0.305	5.00E-05
0.17	2.00E-04	0.24	0.00026	0.002	0.0166	0.0042	0.0036	1.66	5.00E-05
0.2075	8.00E-04	0.24	0.000365	0.00265	0.01965	0.00565	0.00465	1.83	5.00E-05
0.22	0.001	0.24	4.00E-04	0.003	0.02	0.006	0.005	1.9	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	50	100	0	62.5	50	0	87.5
0.075	3.00E-04	0.92	1.00E-04	0.001	0.031	0.001	0.001	0.34	5.00E-05
0.076	3.00E-04	0.93	0.00017	0.0017	0.031	0.0017	0.0017	0.3435	5.00E-05
0.079	3.00E-04	0.96	3.00E-04	0.003	0.0326	0.003	0.003	0.354	5.00E-05
0.095	3.00E-04	0.99	3.00E-04	0.003	0.039	0.003	0.003	0.445	5.00E-05
0.1	3.00E-04	1	0.00046	0.003	0.0546	0.0036	0.0046	0.676	5.00E-05
0.115	0.000825	1	0.000695	0.003	0.07	0.00465	0.005	0.8505	5.00E-05
0.12	0.001	1	8.00E-04	0.003	0.077	0.005	0.005	0.91	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	100	0	100	0	0	0	50	0	50
0.063	0.001	1	0.001	0.002	0.12	0.014	0.001	0.42	5.00E-05
0.06625	0.001	1	0.001	0.002	0.141	0.0147	0.001	0.427	5.00E-05
0.076	0.001	1	0.001	0.002	0.2	0.016	0.001	0.46	5.00E-05
0.0775	0.001	1.1	0.001	0.002	0.265	0.016	0.001	0.565	7.50E-05
0.08	0.001	1.1	0.001	0.0046	0.302	0.0216	0.0016	0.758	0.000138
0.083	0.001	1.175	0.001	0.00695	0.3165	0.02395	0.00395	0.8955	0.000157
0.084	0.001	1.2	0.001	0.008	0.32	0.025	0.005	0.92	0.00016
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	37.5	75	0	50	50	0	100
0.057	3.00E-04	1.2	1.00E-04	0.002	0.007	0.003	0.001	0.11	5.00E-05
0.0585	3.00E-04	1.2	0.00017	0.00235	0.00805	0.003	0.0017	0.1135	5.00E-05
0.063	3.00E-04	1.2	3.00E-04	0.003	0.0124	0.003	0.003	0.136	5.00E-05
0.0755	3.00E-04	1.2	4.00E-04	0.003	0.016	0.003	0.003	0.185	5.00E-05
0.076	3.00E-04	1.2	5.00E-04	0.003	0.0182	0.003	0.004	0.206	5.00E-05
0.07825	0.000825	1.275	0.000695	0.00365	0.02485	0.00365	0.0053	0.2165	5.00E-05
0.079	0.001	1.3	8.00E-04	0.004	0.028	0.004	0.006	0.22	5.00E-05
3	3	3	5	5	5	5	5	5	5

0	100	0	20	100	40	20	60	0	100
0.025	3.00E-04	0.76	1.00E-04	0.001	0.001	0.001	0.001	0.006	5.00E-05
0.0251	3.00E-04	0.764	0.00014	0.0014	0.0014	0.0016	0.0014	0.0062	5.00E-05
0.0254	3.00E-04	0.776	0.00026	0.0026	0.0026	0.0034	0.0026	0.0068	5.00E-05
0.026	3.00E-04	0.8	4.00E-04	0.003	0.005	0.004	0.003	0.01	5.00E-05
0.0272	0.00072	0.818	0.00056	0.003	0.0088	0.0054	0.0046	0.0144	5.00E-05
0.0278	0.00093	0.827	0.00074	0.003	0.0142	0.0096	0.0064	0.0216	5.00E-05
0.028	0.001	0.83	8.00E-04	0.003	0.016	0.011	0.007	0.024	5.00E-05
3	3	3	5	5	5	5	5	5	5
0	66.66667	0	80	40	0	0	60	0	100
0.089	0.001	0.63	4.00E-04	0.001	0.01	0.002	0.001	2.8	5.00E-05
0.0901	0.001	0.631	0.00052	0.001	0.0104	0.0024	0.001	3.08	5.00E-05
0.0934	0.001	0.634	0.00088	0.001	0.0116	0.0036	0.001	3.92	5.00E-05
0.1	0.001	0.64	0.001	0.002	0.015	0.005	0.001	4.4	5.00E-05
0.112	0.001	0.664	0.001	0.0048	0.0164	0.0074	0.0028	5.36	5.00E-05
0.118	0.001	0.676	0.001	0.0072	0.0206	0.0116	0.0052	5.54	5.00E-05
0.12	0.001	0.68	0.001	0.008	0.022	0.013	0.006	5.6	5.00E-05
3	3	3	5	5	5	5	5	5	5
0	66.66667	0	40	60	0	0	0	0	100
0.044	3.00E-04	0.76	3.00E-04	0.003	0.008	0.003	0.001	0.18	5.00E-05
0.0454	3.00E-04	0.764	3.00E-04	0.003	0.009	0.0036	0.0014	0.238	5.00E-05
0.0496	3.00E-04	0.776	3.00E-04	0.003	0.012	0.0054	0.0026	0.412	5.00E-05
0.058	3.00E-04	0.8	5.00E-04	0.003	0.013	0.006	0.004	0.7	5.00E-05
0.0754	0.00132	0.812	0.00074	0.0032	0.0156	0.0106	0.0044	0.96	5.00E-05
0.0841	0.00183	0.818	0.00146	0.0038	0.0174	0.0154	0.0056	1.14	5.00E-05
0.087	0.002	0.82	0.0017	0.004	0.018	0.017	0.006	1.2	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	37.5	100	0	25	37.5	0	100
0.057	3.00E-04	0.78	1.00E-04	0.001	0.006	0.002	0.001	0.094	5.00E-05
0.0585	3.00E-04	0.7825	0.00017	0.0017	0.006	0.00235	0.0017	0.0996	5.00E-05
0.063	3.00E-04	0.79	3.00E-04	0.003	0.0064	0.003	0.003	0.118	5.00E-05
0.0685	3.00E-04	0.82	4.00E-04	0.003	0.009	0.0035	0.003	0.14	5.00E-05
0.072	3.00E-04	0.84	4.00E-04	0.003	0.01	0.0046	0.0046	0.17	5.00E-05
0.07575	0.000825	0.8625	0.00053	0.003	0.0139	0.0063	0.0063	0.2545	5.00E-05
0.077	0.001	0.87	6.00E-04	0.003	0.016	0.007	0.007	0.3	5.00E-05
3	3	3	5	5	5	5	5	5	5
0	100	0	40	100	0	0	40	0	100
0.071	2.00E-04	0.63	1.00E-04	0.001	0.003	0.001	0.001	0.56	5.00E-05
0.072	0.00021	0.633	0.00014	0.0012	0.0032	0.0016	0.0014	0.58	5.00E-05
0.075	0.00024	0.642	0.00026	0.0018	0.0038	0.0034	0.0026	0.64	5.00E-05
0.081	3.00E-04	0.66	4.00E-04	0.003	0.009	0.004	0.003	0.95	5.00E-05
0.0894	0.00072	0.684	0.00048	0.003	0.0094	0.0052	0.0048	1.78	5.00E-05
0.0936	0.00093	0.696	0.00072	0.003	0.0106	0.0058	0.0072	2.02	5.00E-05
0.095	0.001	0.7	8.00E-04	0.003	0.011	0.006	0.008	2.1	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	100	100	62.5	50	12.5	37.5	0	100
0.056	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.001	0.018	5.00E-05

0.05625	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.001	0.01905	5.00E-05
0.057	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.001	0.0226	5.00E-05
0.115	1.00E-04	0.05	1.00E-04	0.001	0.001	0.0015	0.001	0.0325	5.00E-05
0.18	1.00E-04	0.05	1.00E-04	0.001	0.001	0.003	0.002	0.0578	5.00E-05
0.27	0.000775	0.05	1.00E-04	0.001	0.0023	0.003	0.002	0.14115	5.00E-05
0.3	0.001	0.05	1.00E-04	0.001	0.003	0.003	0.002	0.18	5.00E-05

Total Moly	Total Nick	Total Sele	Total Silve	Total Vana	Total Zinc	Free Cyan	Total Cyan	Calcium	Sodium
6	8	2	8	2	8	8	8	8	8
83.33333	0	0	87.5	100	0	87.5	0	0	0
0.001	0.003	0.027	6.00E-05	0.003	0.007	0.004	0.021	200	1500
0.0015	0.00335	0.02755	9.15E-05	0.003	0.007	0.004	0.02135	203.5	1535
0.003	0.004	0.0292	0.00015	0.003	0.0074	0.004	0.022	210	1600
0.003	0.005	0.0325	0.001575	0.003	0.011	0.004	0.026	215	1750
0.003	0.0062	0.0358	0.003	0.003	0.0146	0.004	0.0288	220	1920
0.003	0.00765	0.03745	0.003	0.003	0.03255	0.00465	0.03455	233	2065
0.003	0.008	0.038	0.003	0.003	0.042	0.005	0.037	240	2100
6	8	2	8	2	8	8	8	8	8
83.33333	0	0	100	0	0	100	100	0	0
0.001	0.004	0.012	5.00E-05	0.005	0.006	0.004	0.004	100	450
0.00125	0.004	0.0121	6.75E-05	0.0051	0.00635	0.004	0.004	103.5	457
0.002	0.0044	0.0124	1.00E-04	0.0054	0.0074	0.004	0.004	110	486
0.002	0.0075	0.013	0.00105	0.006	0.01	0.004	0.004	120	525
0.002	0.0128	0.0136	0.002	0.0066	0.014	0.004	0.004	120	556
0.002	0.014	0.0139	0.002	0.0069	0.0166	0.004	0.004	120	605.5
0.002	0.014	0.014	0.002	0.007	0.018	0.004	0.004	120	630
6	8	2	8	2	8	8	8	8	8
100	75	0	87.5	50	12.5	62.5	0	0	0
0.001	0.001	0.022	6.00E-05	0.003	0.005	0.004	0.023	160	1400
0.0015	0.0017	0.02215	9.15E-05	0.003	0.00535	0.004	0.0237	160	1435
0.003	0.003	0.0226	0.00015	0.003	0.0064	0.004	0.0254	160	1540
0.003	0.003	0.0235	0.001575	0.003	0.0085	0.004	0.026	165	1600
0.003	0.003	0.0244	0.003	0.003	0.0136	0.0056	0.0292	180	1940
0.003	0.0043	0.02485	0.003	0.003	0.0205	0.00665	0.03585	180	2100
0.003	0.005	0.025	0.003	0.003	0.024	0.007	0.039	180	2100
6	8	2	7	2	9	8	8	8	8
33.33333	0	0	71.42857	0	0	25	0	0	0
0.001	0.003	0.014	0.00025	0.001	0.021	0.004	0.039	190	2100
0.001	0.003	0.01455	0.00025	0.0012	0.0218	0.004	0.05895	207.5	2100
0.001	0.0034	0.0162	0.00026	0.0018	0.0242	0.0044	0.0964	244	2100
0.007	0.004	0.0195	0.00039	0.003	0.026	0.0075	0.1	255	2400
0.01	0.0046	0.0228	0.005	0.0042	0.038	0.0178	0.112	272	2500
0.0115	0.0102	0.02445	0.005	0.0048	0.0584	0.02295	0.1395	286.5	2890
0.012	0.013	0.025	0.005	0.005	0.07	0.024	0.15	290	3100
6	8	2	8	2	8	8	8	8	8
66.66667	62.5	0	75	50	0	100	100	0	0
0.002	0.001	0.019	7.00E-05	0.003	0.008	0.004	0.004	120	1400
0.00225	0.0017	0.01905	9.80E-05	0.00305	0.008	0.004	0.004	127	1435
0.003	0.003	0.0192	0.00015	0.0032	0.0084	0.004	0.004	140	1540
0.003	0.003	0.0195	0.0016	0.0035	0.011	0.004	0.004	140	1600
0.003	0.003	0.0198	0.003	0.0038	0.0184	0.004	0.004	150	1800
0.003	0.003	0.01995	0.003	0.00395	0.02395	0.004	0.004	150	1865
0.003	0.003	0.02	0.003	0.004	0.025	0.004	0.004	150	1900
3	5	2	5	2	5	5	5	5	5

100	40	0	80	100	0	100	100	0	0
0.001	0.001	0.02	7.00E-05	0.003	0.008	0.004	0.004	190	1400
0.0012	0.0014	0.02045	8.60E-05	0.003	0.0084	0.004	0.004	192	1440
0.0018	0.0026	0.0218	0.000134	0.003	0.0096	0.004	0.004	198	1560
0.003	0.003	0.0245	0.00015	0.003	0.014	0.004	0.004	210	1700
0.003	0.0048	0.0272	0.00072	0.003	0.0442	0.004	0.004	220	1920
0.003	0.0072	0.02855	0.00243	0.003	0.0598	0.004	0.004	220	1980
0.003	0.008	0.029	0.003	0.003	0.065	0.004	0.004	220	2000
3	5	2	5	2	5	5	5	5	5
66.66667	0	0	100	0	0	100	100	0	0
0.001	0.005	0.008	5.00E-05	0.004	0.011	0.004	0.004	260	1500
0.001	0.0052	0.0083	9.00E-05	0.0042	0.012	0.004	0.004	278	1540
0.001	0.0058	0.0092	0.00021	0.0048	0.015	0.004	0.004	332	1660
0.001	0.007	0.011	0.00025	0.006	0.018	0.004	0.004	350	1800
0.0022	0.012	0.0128	0.0008	0.0072	0.0258	0.004	0.004	360	2040
0.0028	0.012	0.0137	0.00245	0.0078	0.0462	0.004	0.004	360	2160
0.003	0.012	0.014	0.003	0.008	0.053	0.004	0.004	360	2200
3	5	2	5	2	5	5	5	5	5
0	0	0	80	50	0	100	60	0	0
0.002	0.004	0.024	0.00015	0.003	0.006	0.004	0.004	200	1300
0.0021	0.0042	0.0245	0.00015	0.0031	0.0062	0.004	0.004	202	1320
0.0024	0.0048	0.026	0.00015	0.0034	0.0068	0.004	0.004	208	1380
0.003	0.006	0.029	0.00025	0.004	0.011	0.004	0.004	210	1500
0.0036	0.0074	0.032	0.0018	0.0046	0.0186	0.004	0.0042	222	1640
0.0039	0.0086	0.0335	0.0027	0.0049	0.0264	0.004	0.0048	228	1760
0.004	0.009	0.034	0.003	0.005	0.029	0.004	0.005	230	1800
6	8	2	8	2	8	8	8	8	8
16.66667	50	0	87.5	50	0	100	100	0	0
0.002	0.001	0.027	6.00E-05	0.003	0.006	0.004	0.004	190	1300
0.00225	0.0017	0.0281	9.15E-05	0.00315	0.00635	0.004	0.004	197	1335
0.003	0.003	0.0314	0.00015	0.0036	0.0074	0.004	0.004	210	1400
0.003	0.003	0.038	0.001575	0.0045	0.008	0.004	0.004	210	1450
0.003	0.0036	0.0446	0.003	0.0054	0.0108	0.004	0.004	220	1620
0.00375	0.00465	0.0479	0.003	0.00585	0.0315	0.004	0.004	226.5	1765
0.004	0.005	0.049	0.003	0.006	0.042	0.004	0.004	230	1800
3	5	2	5	2	5	5	5	5	5
100	0	0	80	50	0	100	100	0	0
0.001	0.002	0.011	8.00E-05	0.003	0.013	0.004	0.004	220	1000
0.0011	0.0022	0.01135	8.40E-05	0.00305	0.013	0.004	0.004	222	1040
0.0014	0.0028	0.0124	9.60E-05	0.0032	0.013	0.004	0.004	228	1160
0.002	0.004	0.0145	0.00015	0.0035	0.022	0.004	0.004	280	1500
0.0026	0.005	0.0166	0.00072	0.0038	0.0302	0.004	0.004	296	1640
0.0029	0.005	0.01765	0.00243	0.00395	0.0338	0.004	0.004	314	1760
0.003	0.005	0.018	0.003	0.004	0.035	0.004	0.004	320	1800
6	8	2	8	2	8	8	8	8	8
100	62.5	100	100	0	87.5	100	100	0	0
0.001	0.001	0.002	5.00E-05	0.001	0.005	0.004	0.004	3.4	2.2

0.001	0.001	0.002	6.75E-05	0.0011	0.005	0.004	0.004	3.47	2.2
0.001	0.001	0.002	1.00E-04	0.0014	0.005	0.004	0.004	3.96	2.32
0.001	0.001	0.002	0.00055	0.002	0.005	0.004	0.004	4.75	3.55
0.001	0.001	0.002	0.001	0.0026	0.005	0.004	0.004	5.32	5.42
0.001	0.001	0.002	0.001	0.0029	0.00695	0.004	0.004	5.73	6.025
0.001	0.001	0.002	0.001	0.003	0.008	0.004	0.004	5.8	6.2

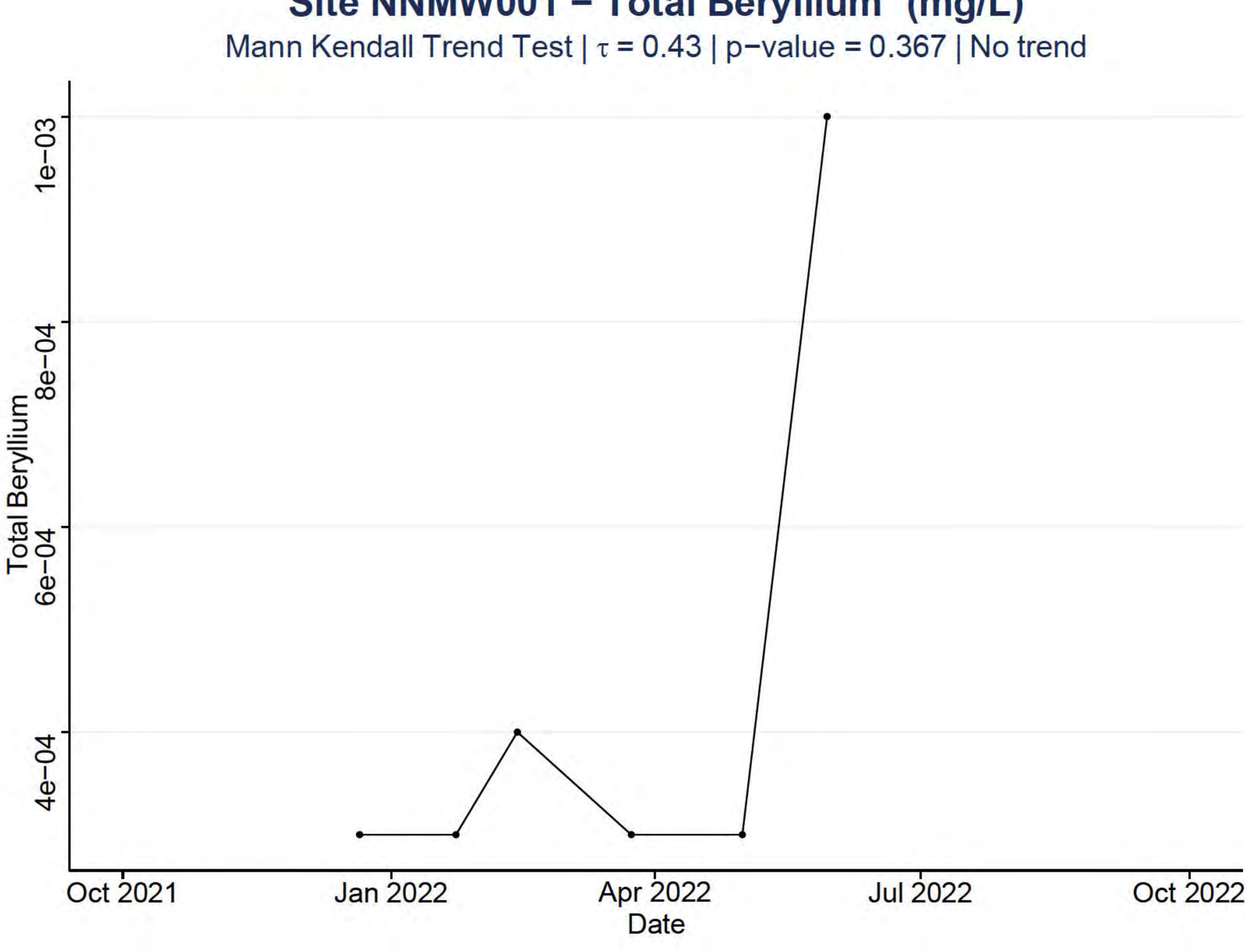
Potassium	Magnesiu	Bicarbona	Bicarbona	Carbonate	Carbonate	Chloride
8	8	8	8	8	8	8
0	0	0	0	100	100	0
73	210	280	340	5	5	2700
73.35	224	280	343.5	5	5	2770
74	250	284	350	5	5	2940
77	260	290	355	5	5	3000
78.6	266	300	366	5	5	3120
82.25	270	306.5	370	5	5	3265
84	270	310	370	5	5	3300
8	8	8	8	8	8	8
0	0	0	0	100	100	0
19	140	100	120	5	5	1200
19	143.5	100	123.5	5	5	1235
19	150	104	130	5	5	1300
19.5	150	115	135	5	5	1300
20	160	126	152	5	5	1300
20.65	160	130	160	5	5	1365
21	160	130	160	5	5	1400
8	8	8	8	8	8	8
0	0	0	0	100	100	0
76	210	320	390	5	5	2600
76.35	217	327	397	5	5	2635
77.4	234	340	414	5	5	2700
80.5	250	350	420	5	5	2850
85	270	356	436	5	5	3100
92.85	283	366.5	446.5	5	5	3165
96	290	370	450	5	5	3200
8	8	8	8	8	8	8
0	0	0	0	100	100	0
79	260	350	430	5	5	3400
82.15	281	357	437	5	5	3505
88.8	332	370	454	5	5	3820
91.5	355	380	465	5	5	4050
95.2	378	396	476	5	5	4100
97.3	390	400	486.5	5	5	4425
98	390	400	490	5	5	4600
8	8	8	8	8	8	8
0	0	0	0	100	100	0
77	160	250	300	5	5	2300
77.35	163.5	250	303.5	5	5	2335
78	174	250	310	5	5	2480
80	180	265	325	5	5	2700
82.2	186	276	336	5	5	2800
83	190	371	457	5	5	2865
83	190	420	520	5	5	2900
5	5	5	5	5	5	5

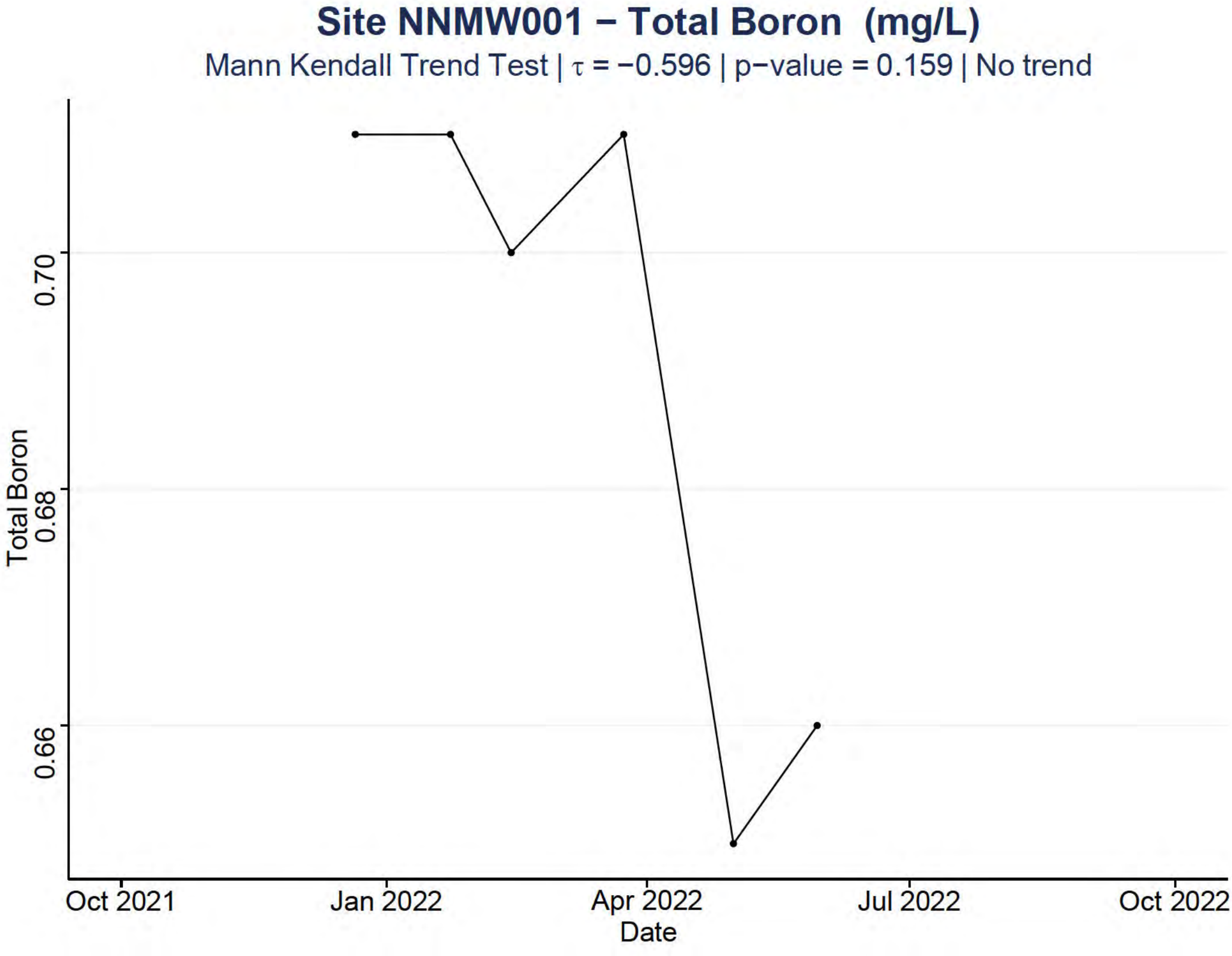
0	0	0	0	100	100	0
77	180	350	420	5	5	2600
77	186	354	426	5	5	2620
77	204	366	444	5	5	2680
78	220	370	450	5	5	2700
80.6	222	382	462	5	5	2720
82.4	228	388	468	5	5	2780
83	230	390	470	5	5	2800
5	5	5	5	5	5	5
0	0	0	0	100	100	0
72	230	190	240	5	5	3500
72.4	238	194	242	5	5	3500
73.6	262	206	248	5	5	3500
75	280	220	270	5	5	3500
76.8	282	252	310	5	5	3520
79.2	288	258	310	5	5	3580
80	290	260	310	5	5	3600
5	5	5	5	5	5	5
0	0	0	0	100	100	0
68	200	210	250	5	5	2700
68.4	206	216	260	5	5	2700
69.6	224	234	290	5	5	2700
71	230	250	310	5	5	2800
73.6	240	262	312	5	5	2980
75.4	240	268	318	5	5	3520
76	240	270	320	5	5	3700
8	8	8	8	8	8	8
0	0	0	0	100	100	0
67	190	300	360	5	5	2400
67.35	197	303.5	363.5	5	5	2470
68.4	214	314	378	5	5	2600
70	220	330	400	5	5	2650
73.8	230	336	410	5	5	2800
77.6	230	346.5	416.5	5	5	2865
79	230	350	420	5	5	2900
5	5	5	5	5	5	5
0	0	0	0	100	100	0
59	180	230	280	5	5	2100
59.2	180	234	286	5	5	2180
59.8	180	246	304	5	5	2420
61	210	250	310	5	5	2500
64.2	226	272	332	5	5	2860
70.8	244	278	338	5	5	3040
73	250	280	340	5	5	3100
8	8	8	8	8	8	8
0	0	0	0	100	100	0
2.9	1.1	18	22	5	5	4

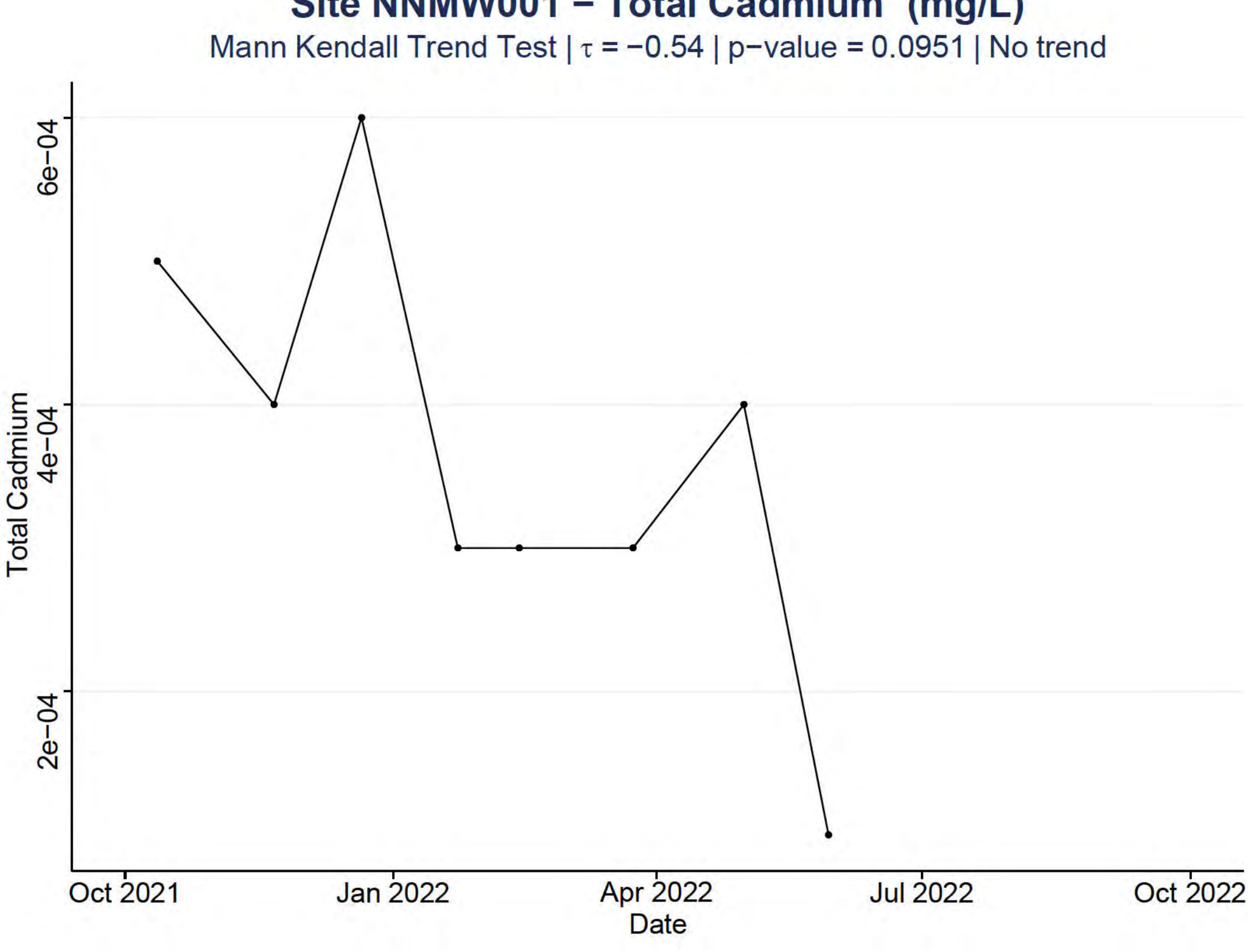
3.04	1.135	20.1	24.8	5	5	4
3.54	1.28	25.2	30.8	5	5	4
4.4	1.45	29.5	36.5	5	5	7
5.82	1.72	33	40	5	5	9
5.965	1.8	33.65	41.3	5	5	9.65
6	1.8	34	42	5	5	10

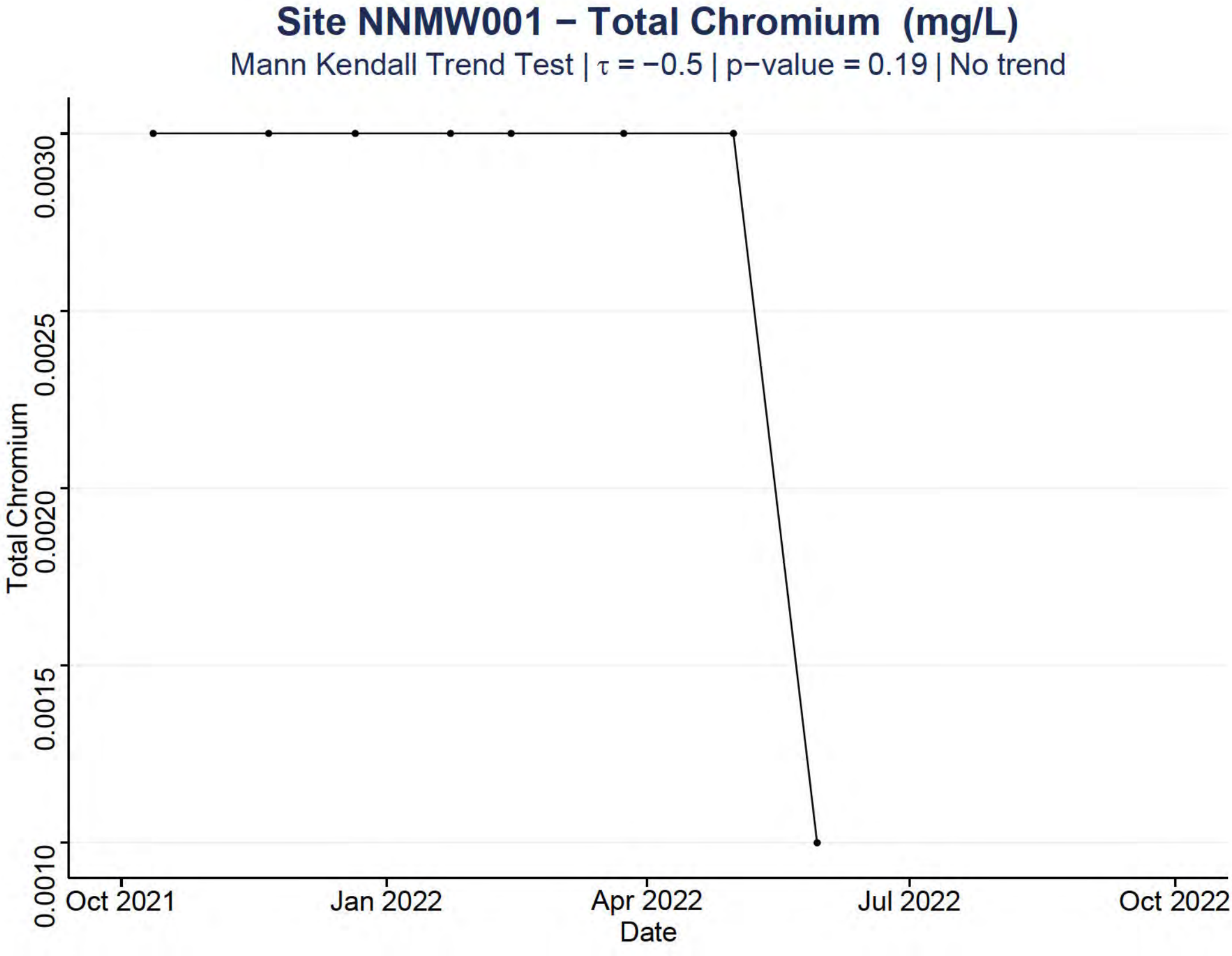
Appendix B. Time-series Plots

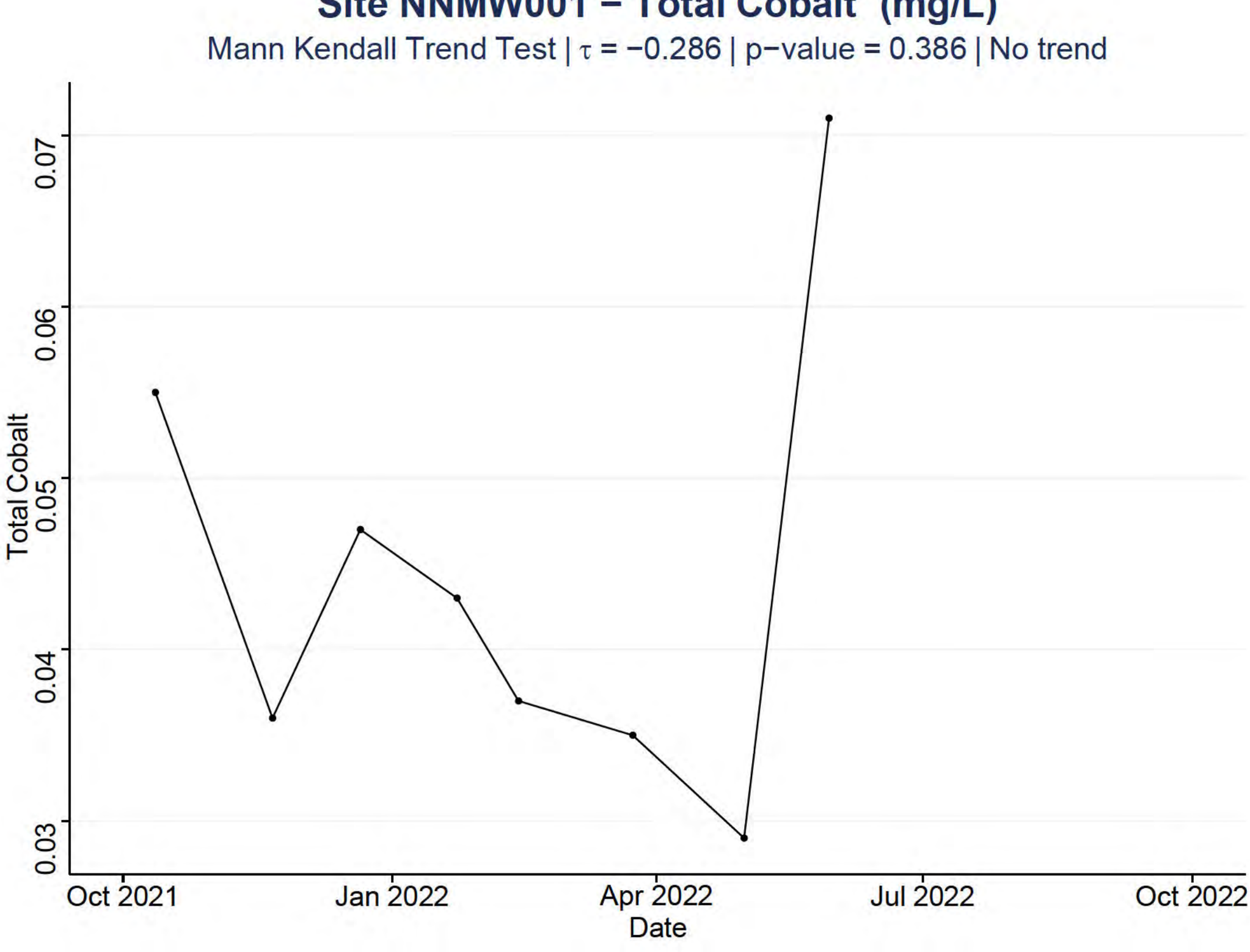
See attached.

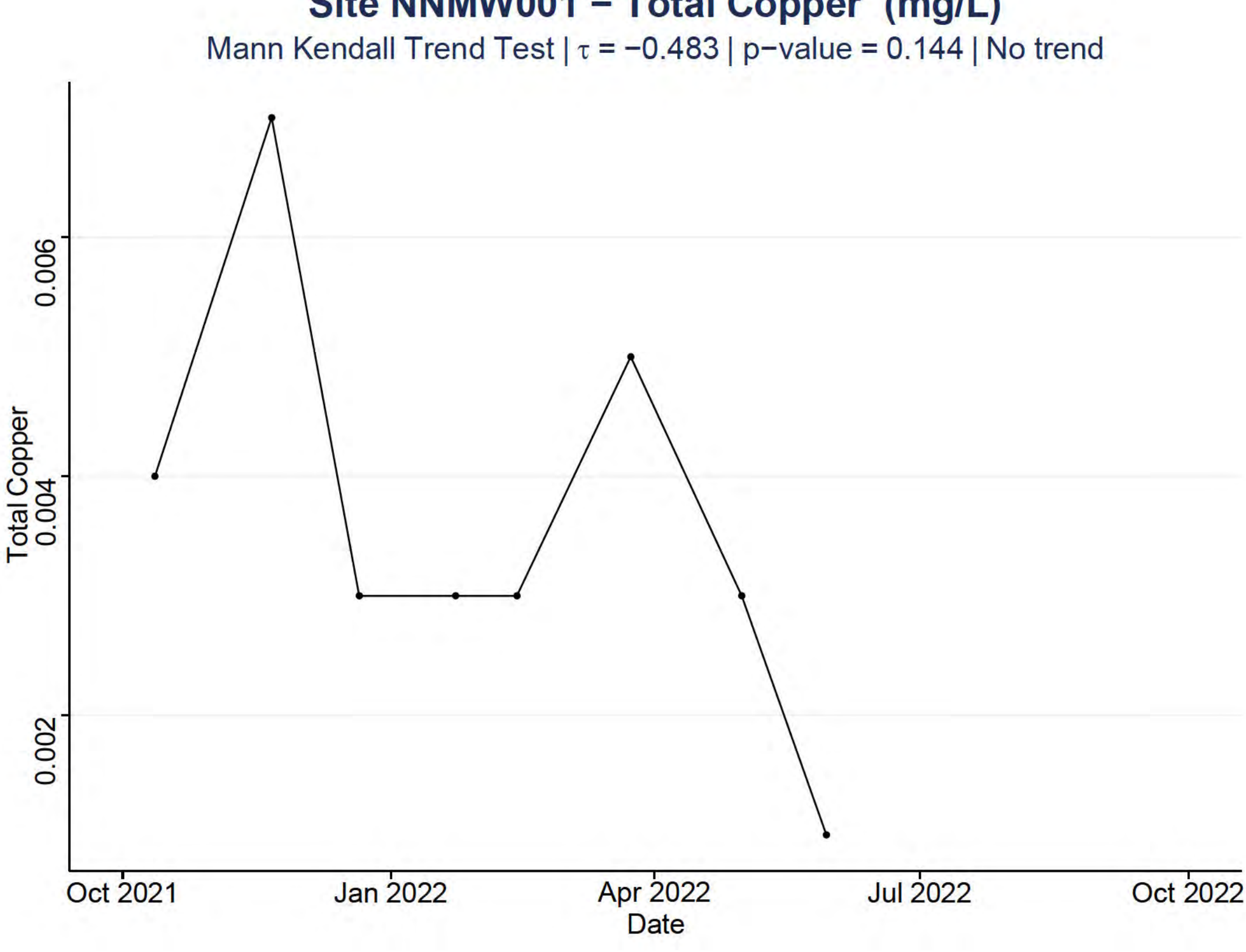

Site NNMW001 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.43 | p−value = 0.367 | No trend
Total Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

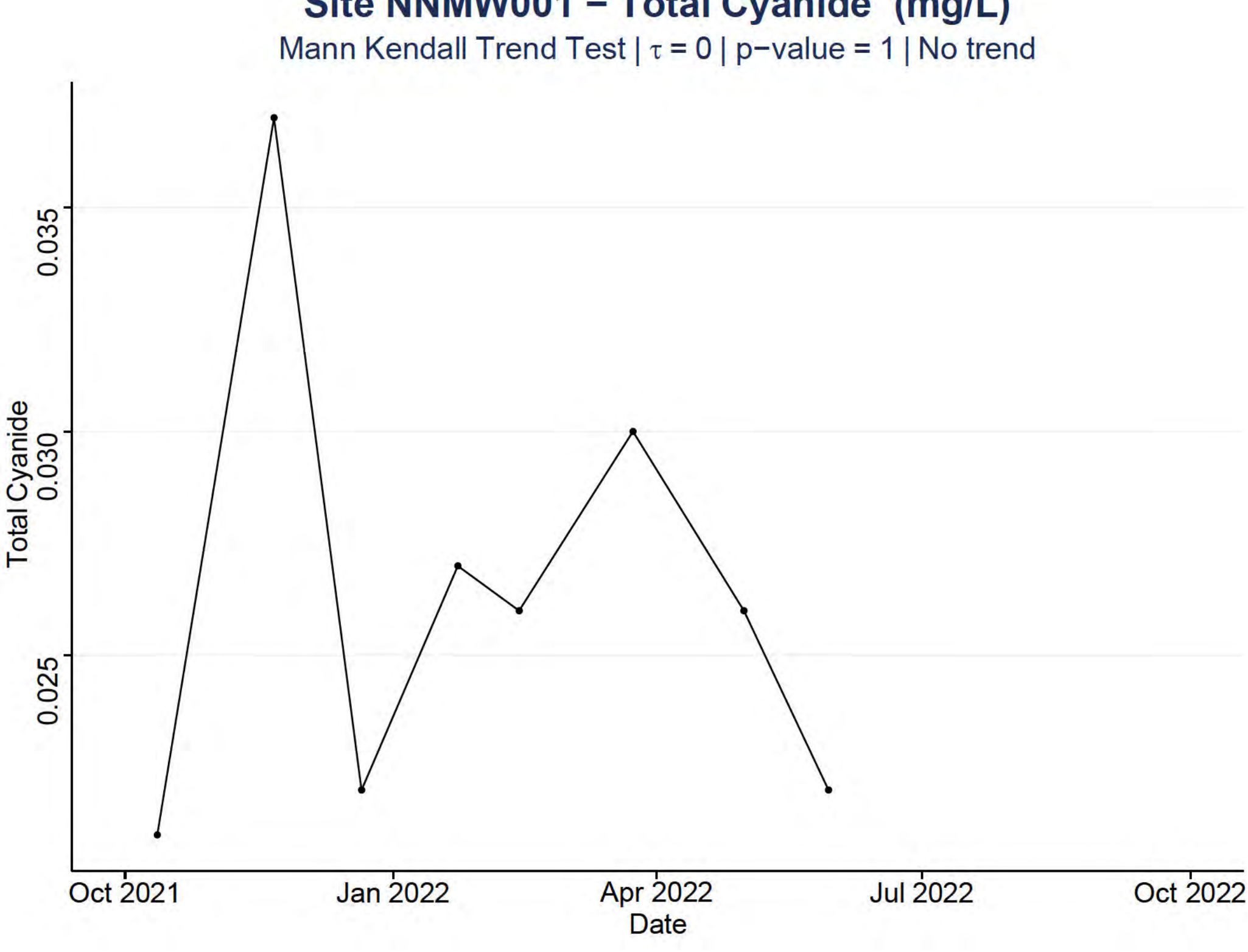

Site NNMW001 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = −0.596 | p−value = 0.159 | No trend
Total Boron
0.70
0.68
0.66
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

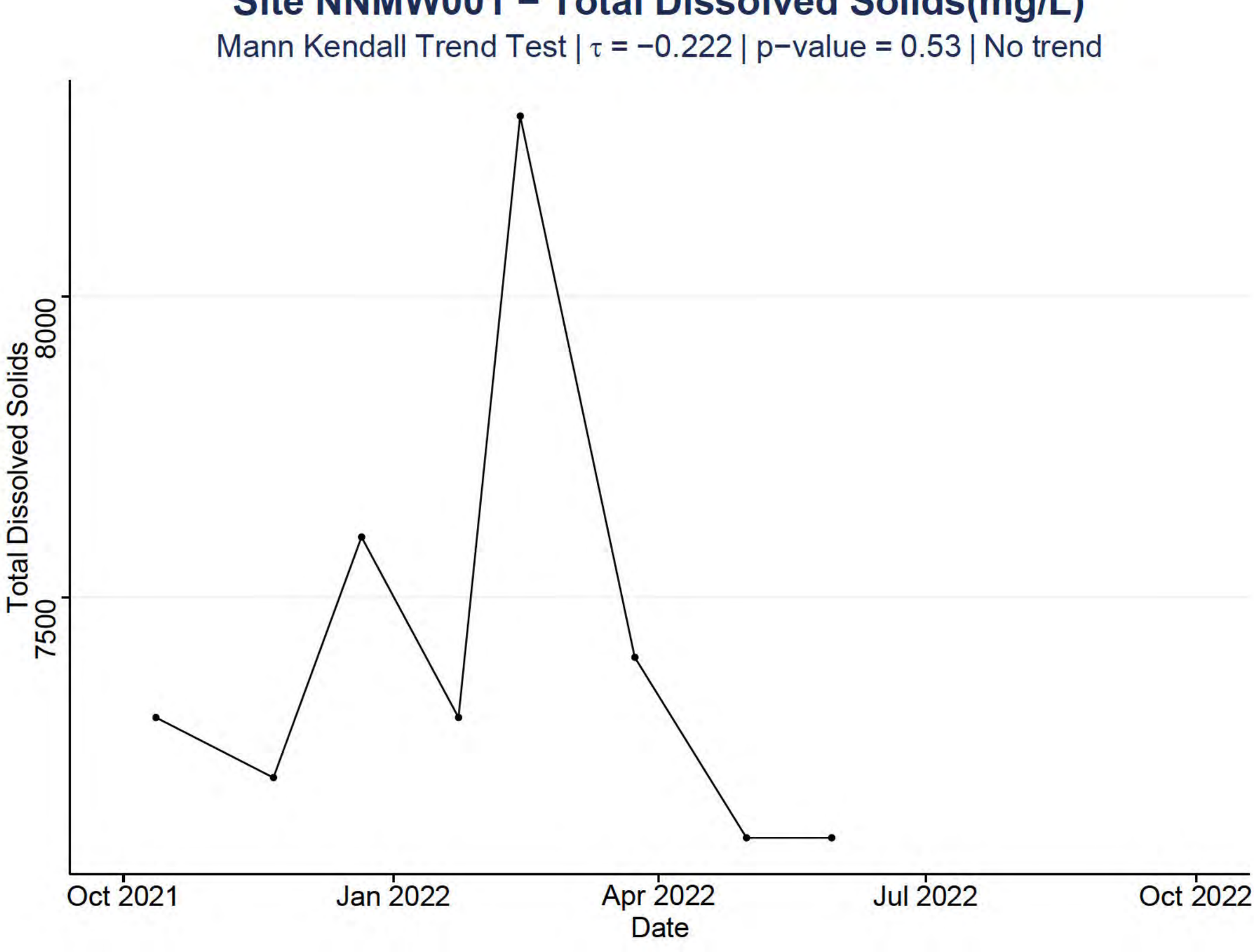

Site NNMW001 − Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.54 | p−value = 0.0951 | No trend
Total Cadmium
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

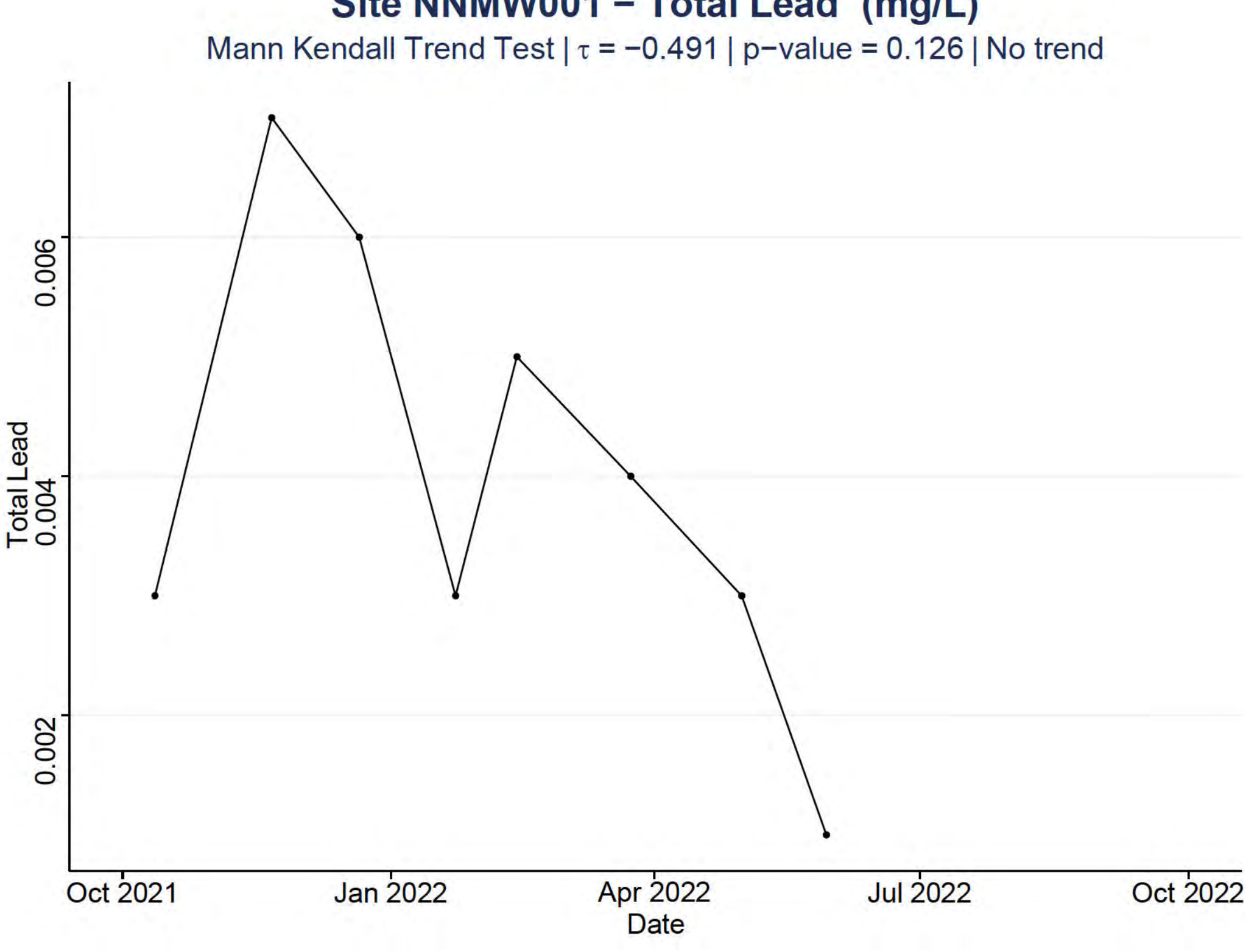

Site NNMW001 – Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

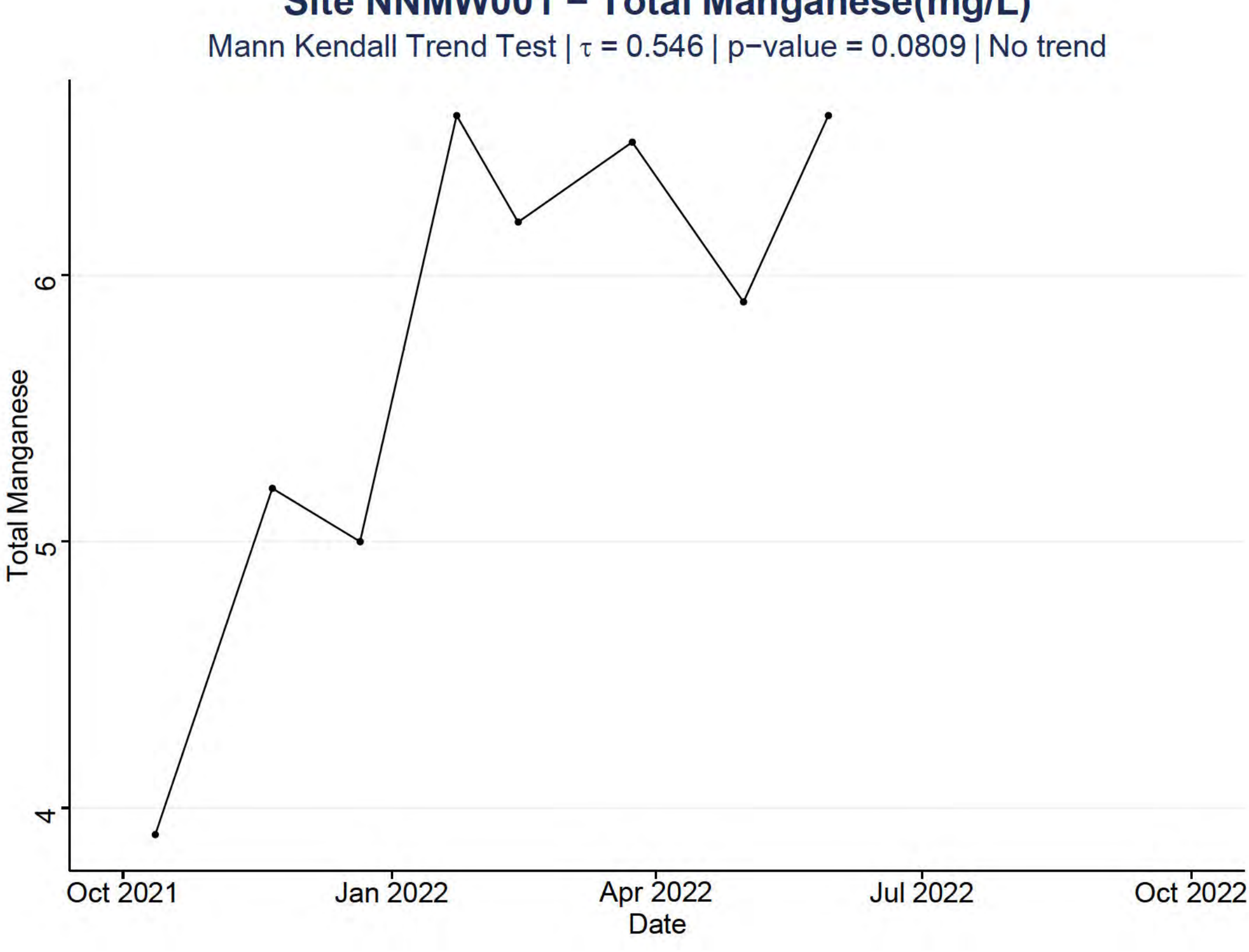

Site NNMW001 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.286 | p−value = 0.386 | No trend
Total Cobalt
0.03
0.04
0.05
0.06
0.07
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

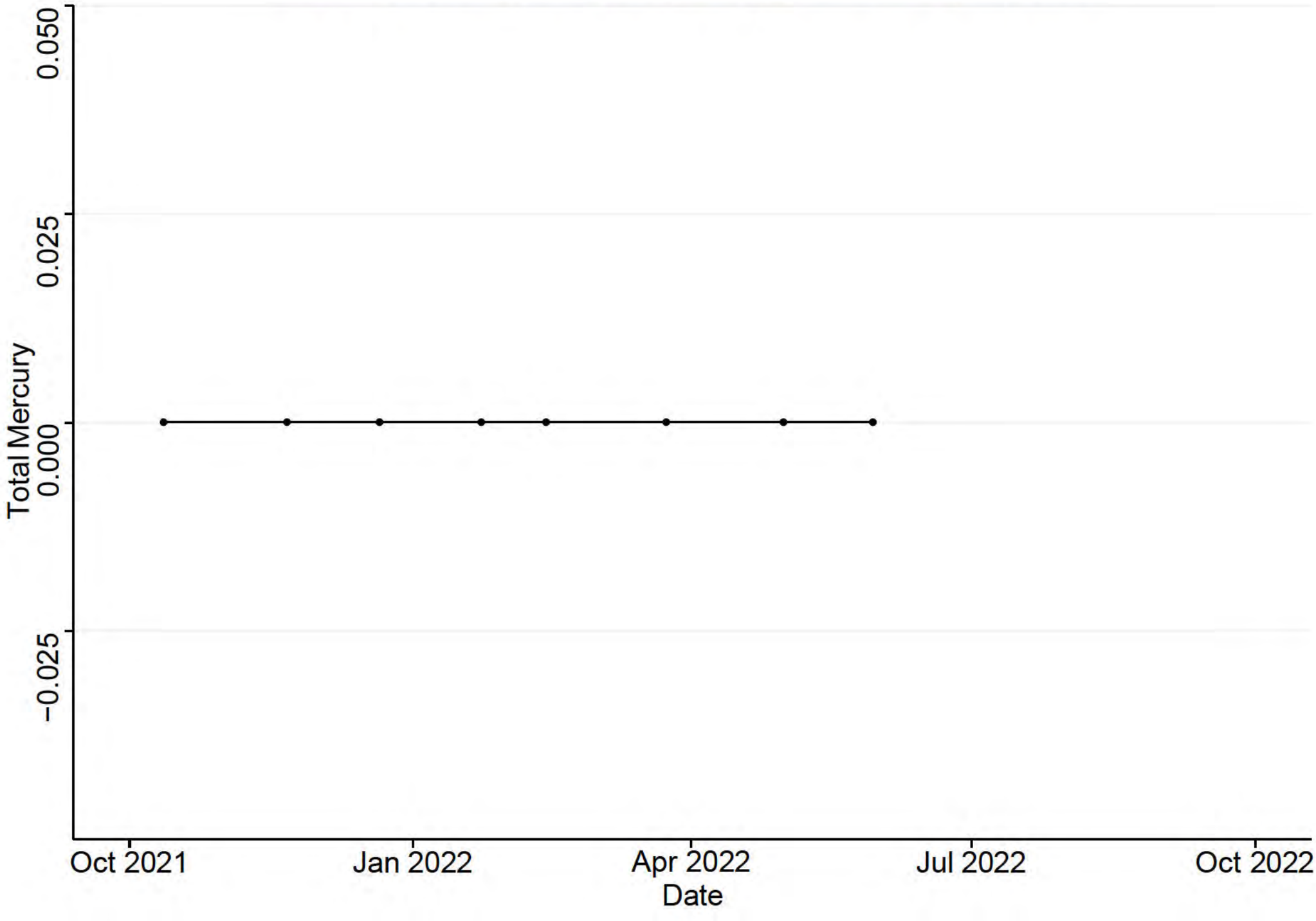

Site NNMW001 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.483 | p−value = 0.144 | No trend
Total Copper
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

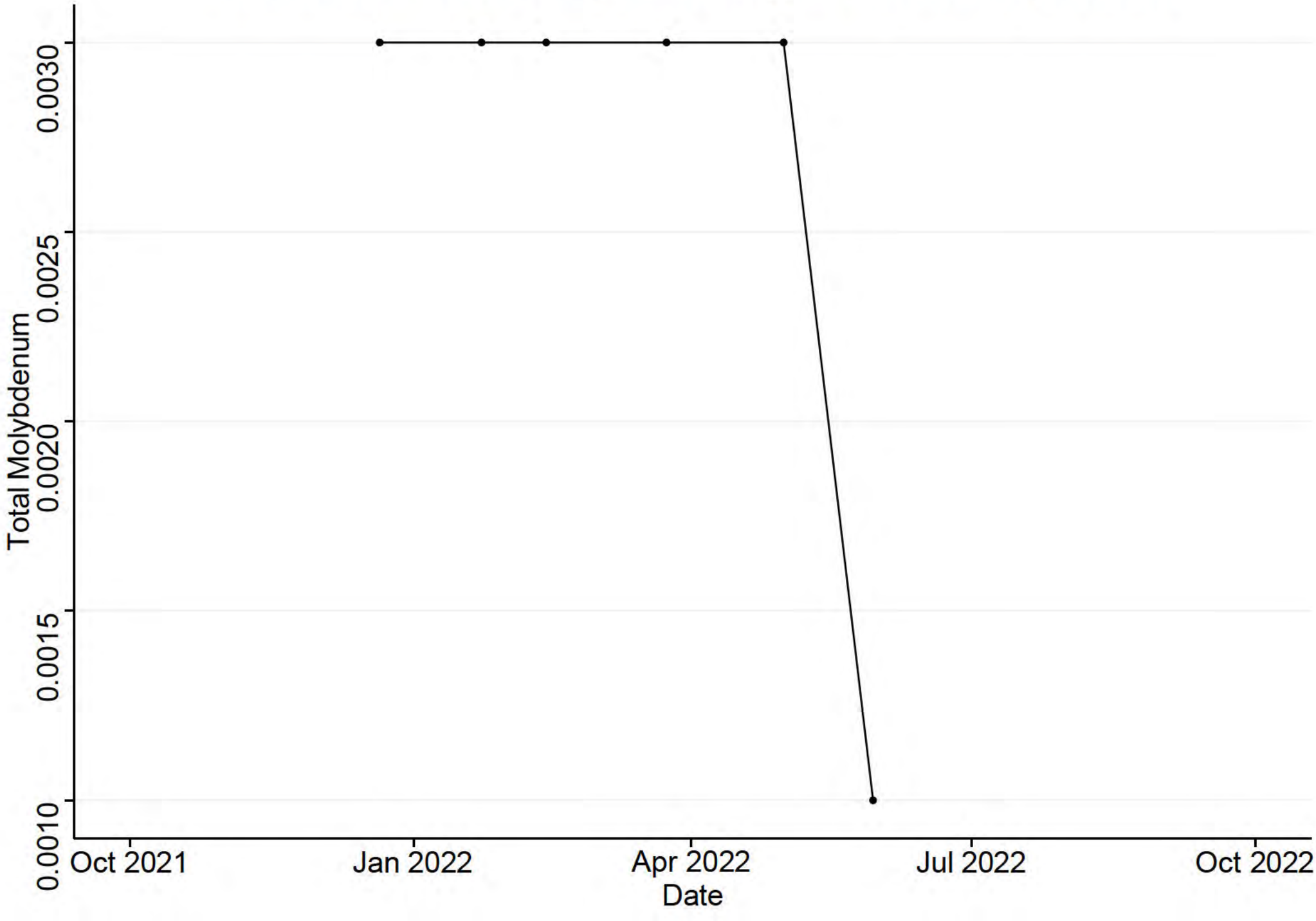

Site NNMW001 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Total Cyanide
0.035
0.030
0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

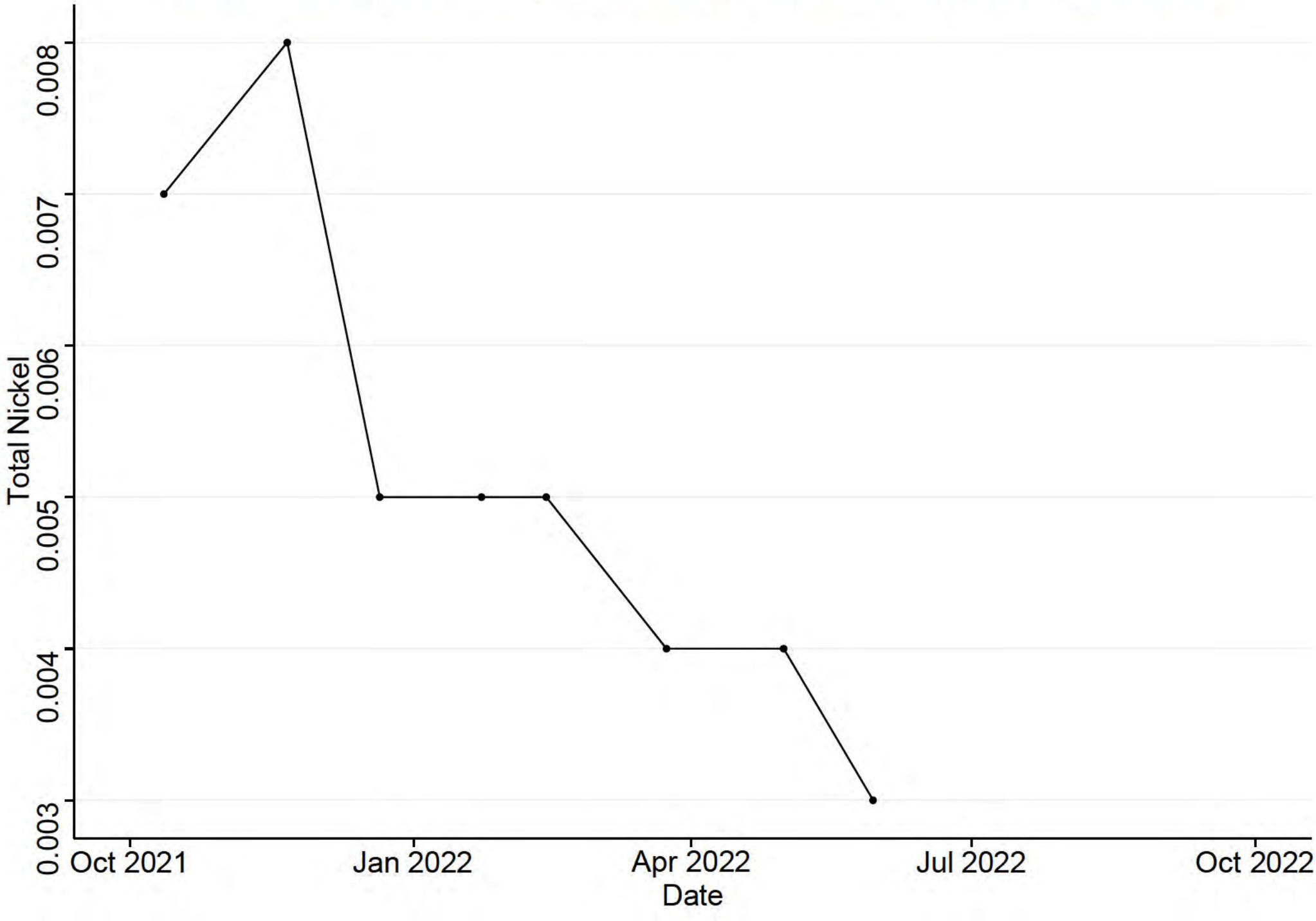

Site NNMW001 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.222 | p−value = 0.53 | No trend
Total Dissolved Solids
8000
7500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

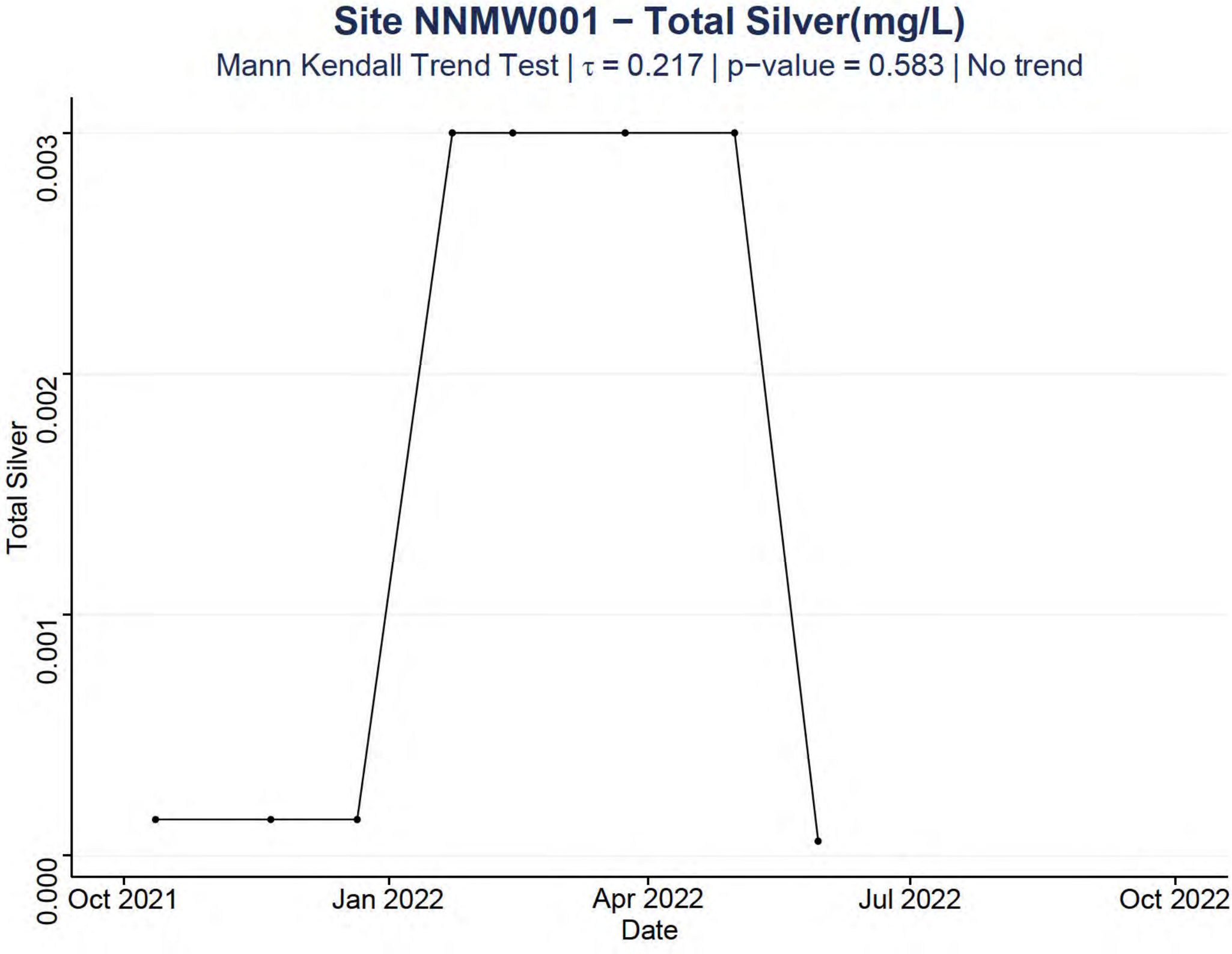

Site NNMW001 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.491 | p−value = 0.126 | No trend
Total Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

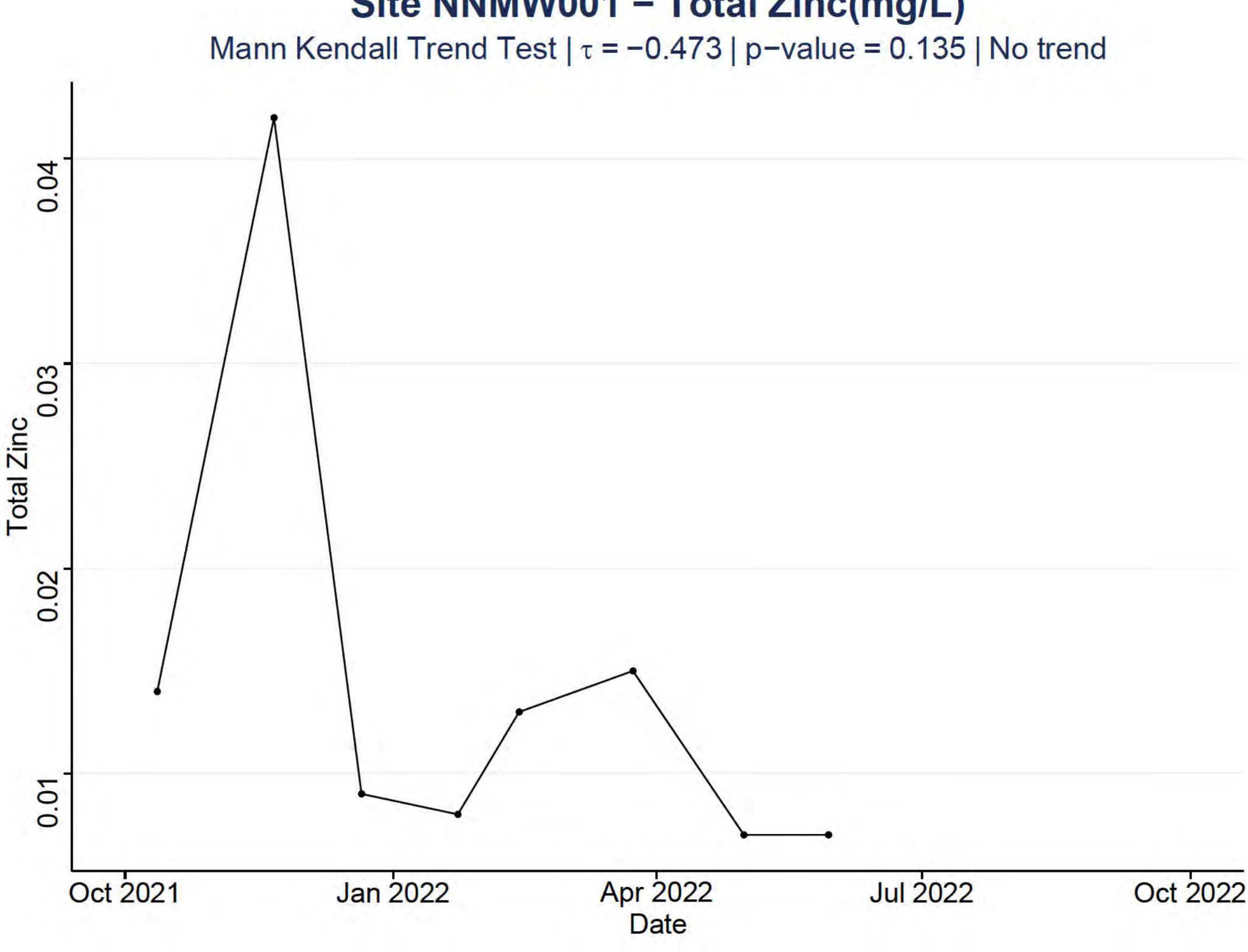

Site NNMW001 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = 0.546 | p−value = 0.0809 | No trend
Total Manganese
6
5
4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

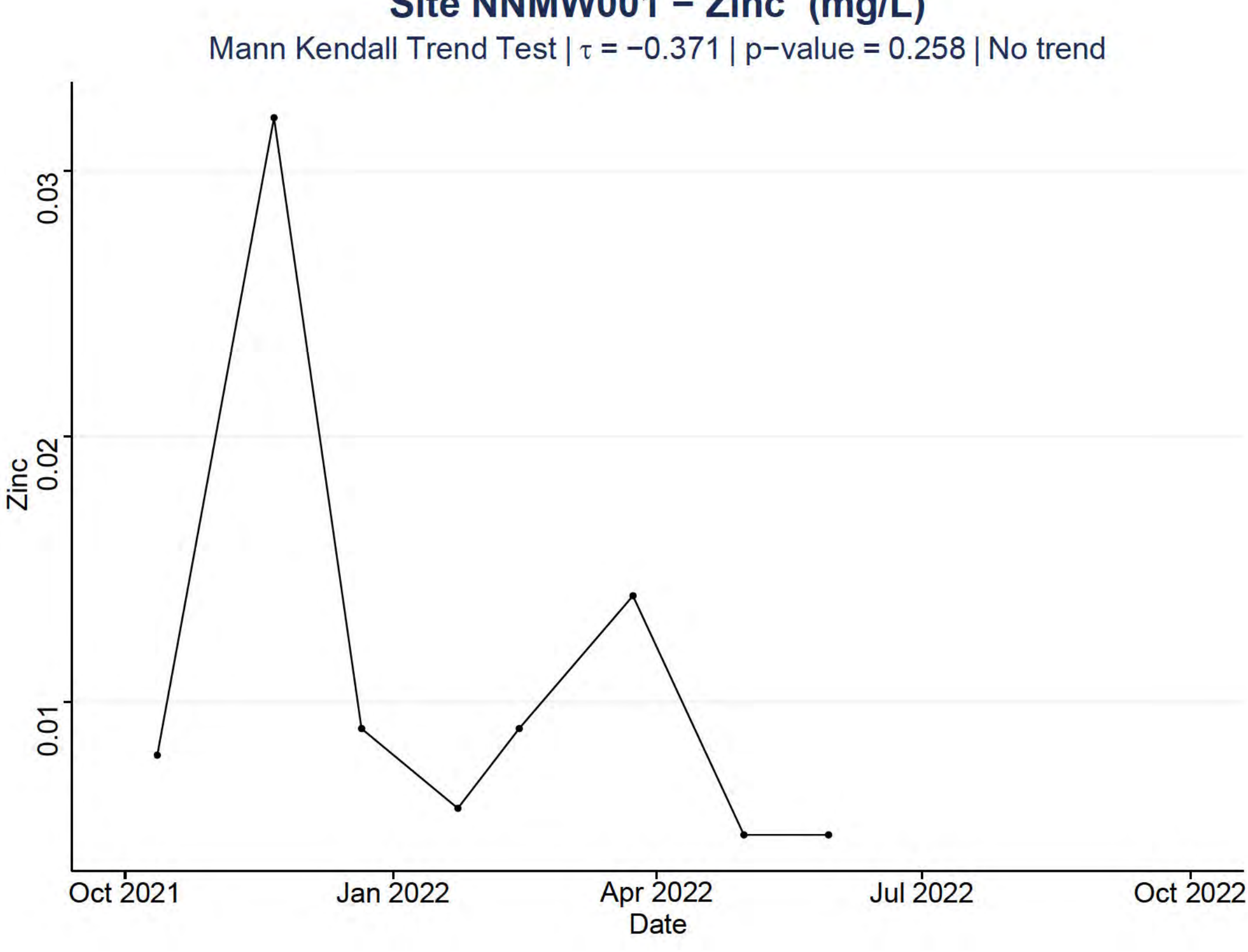

Site NNMW001 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

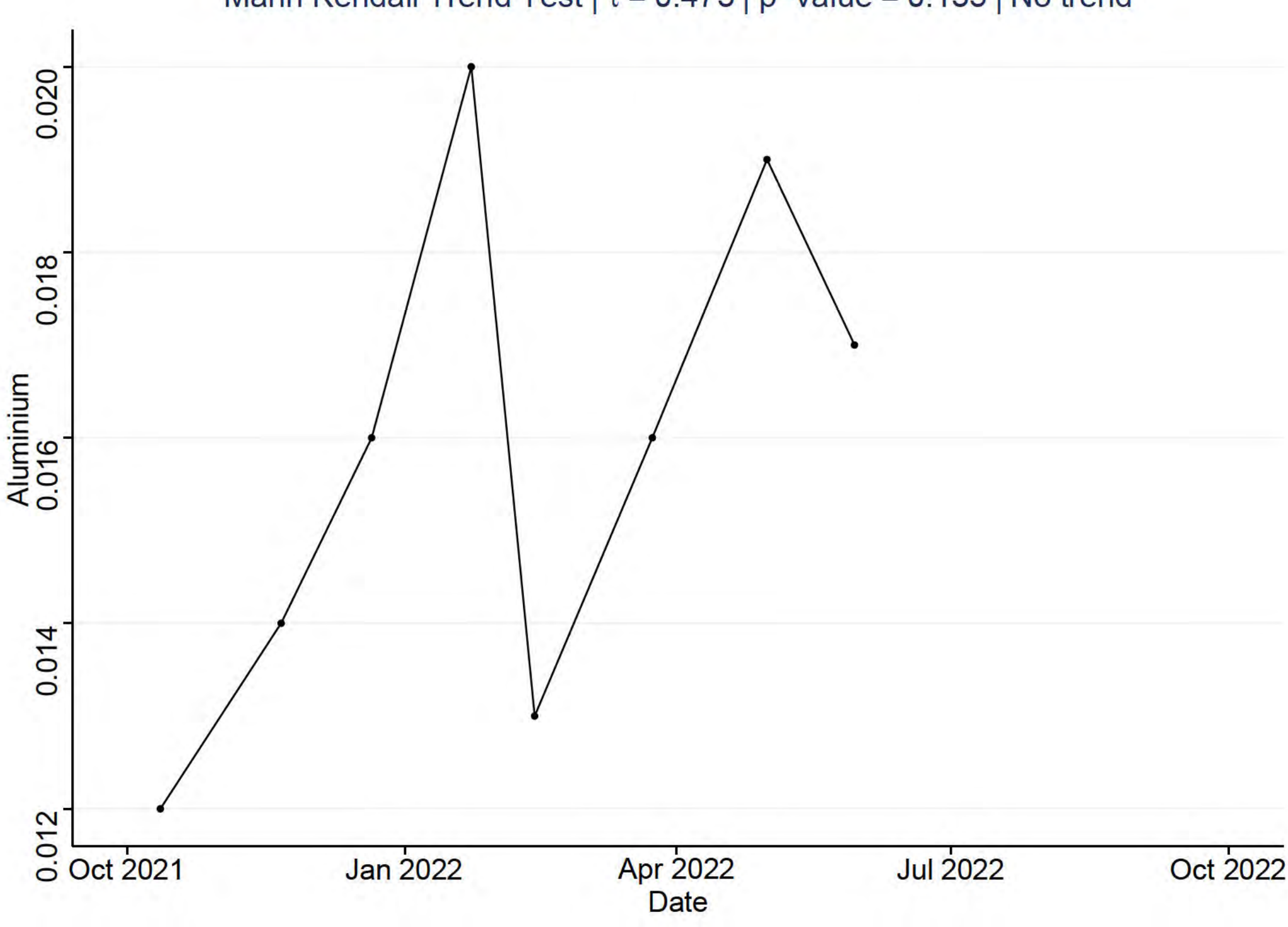

Site NNMW001 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Total Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

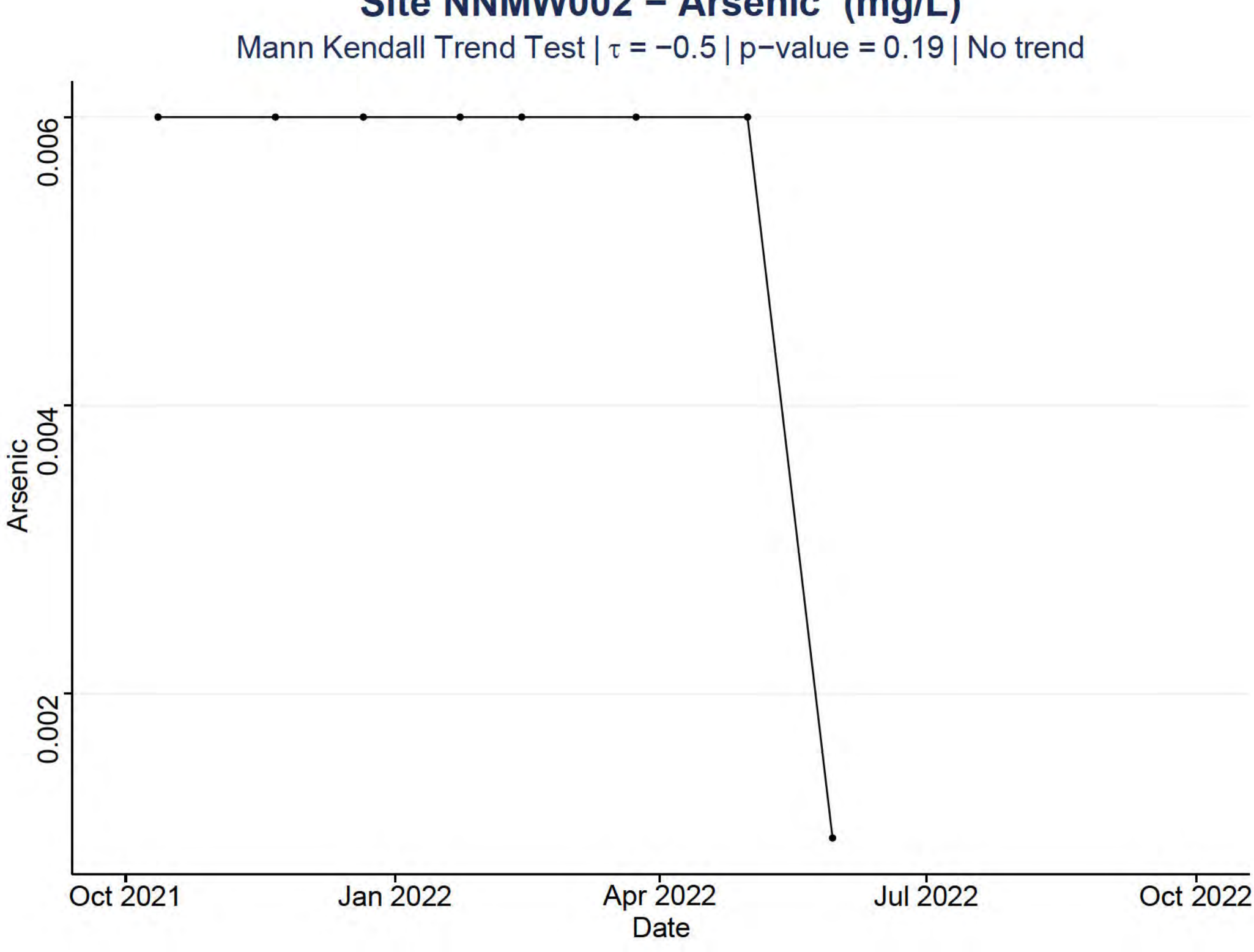

Site NNMW001 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.849 | p−value = 0.00701 | Negative trend
Total Nickel
0.003
0.004
0.005
0.006
0.007
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

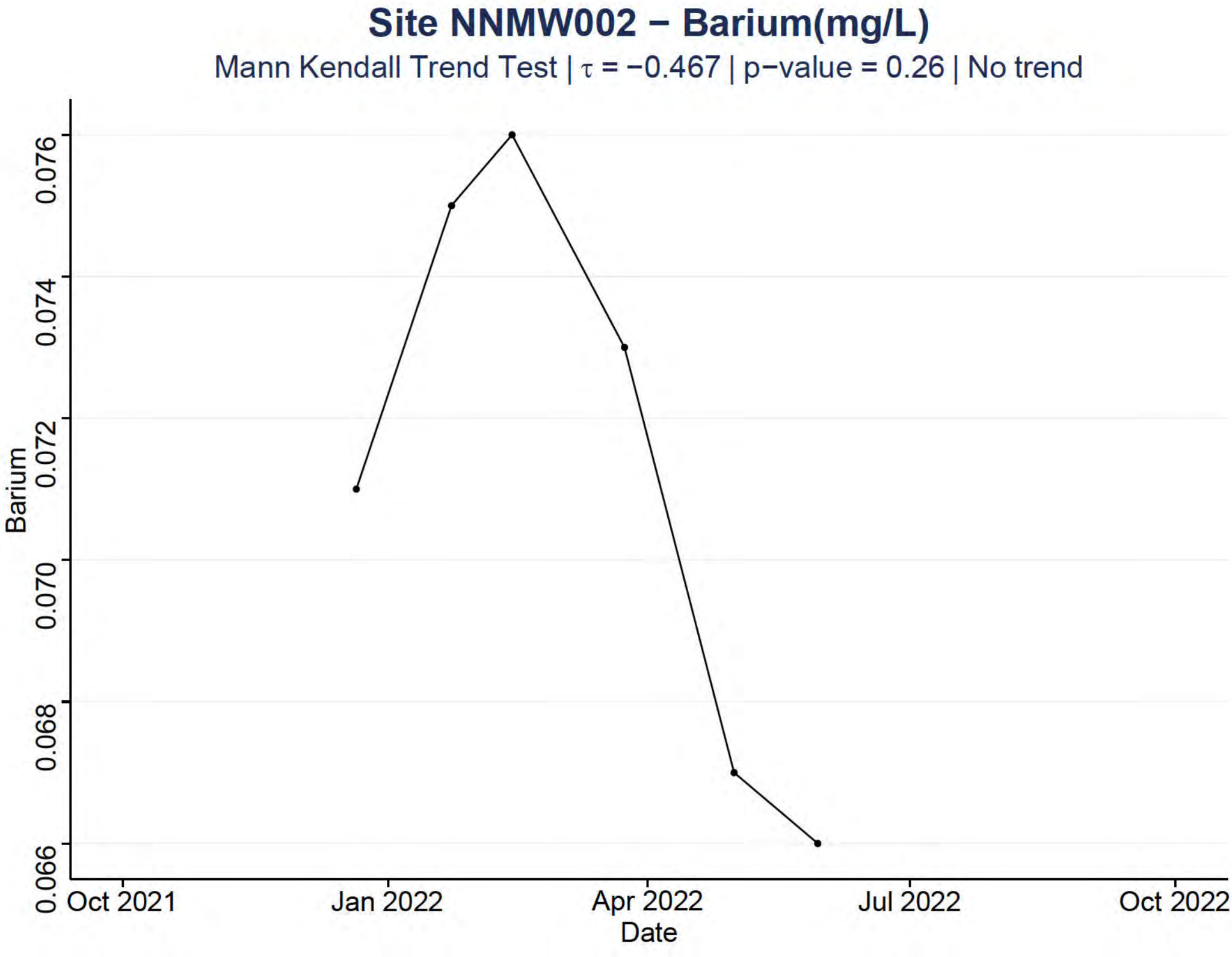

Site NNMW001 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Total Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

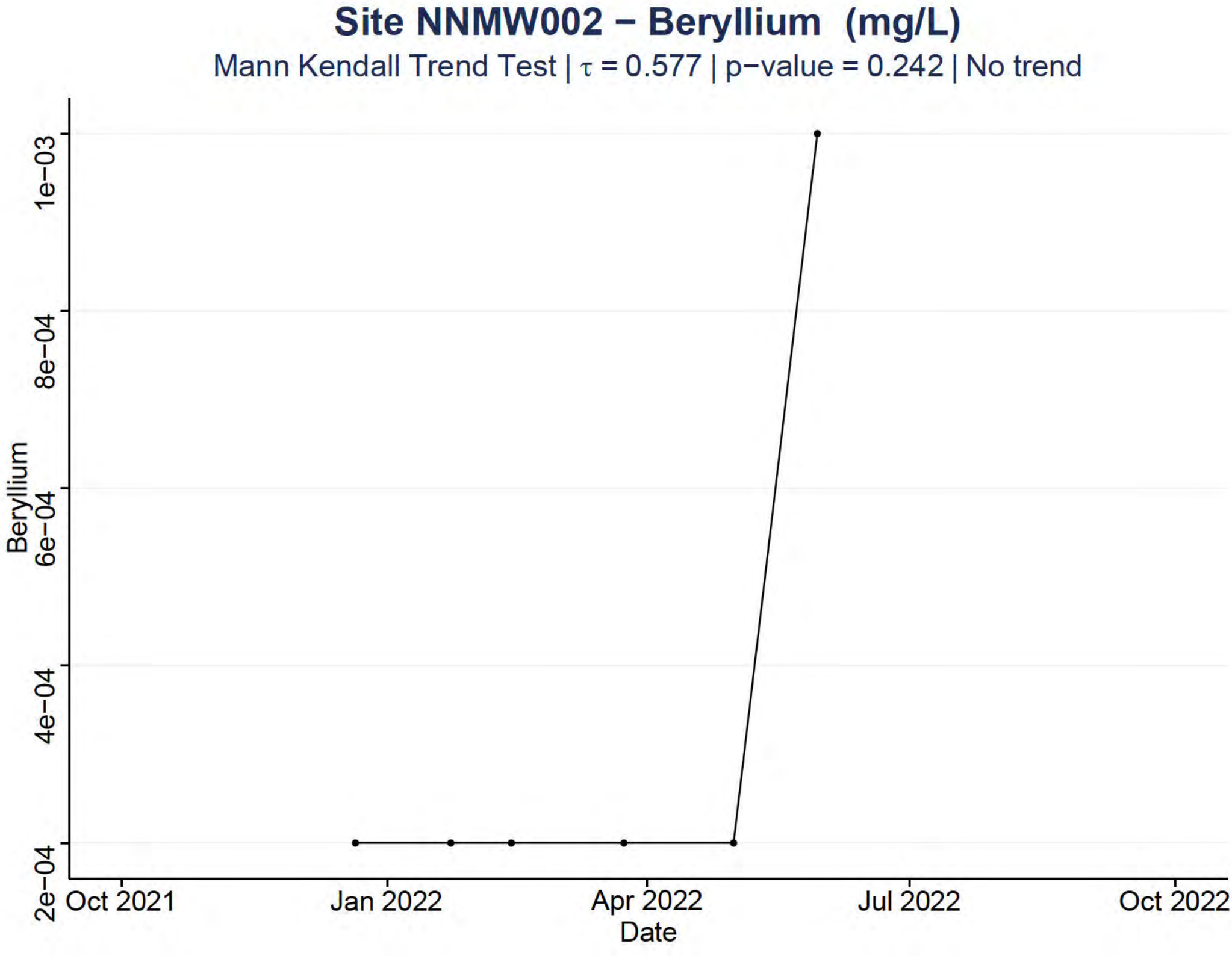

Site NNMW001 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.473 | p−value = 0.135 | No trend
Total Zinc
0.04
0.03
0.02
0.01
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

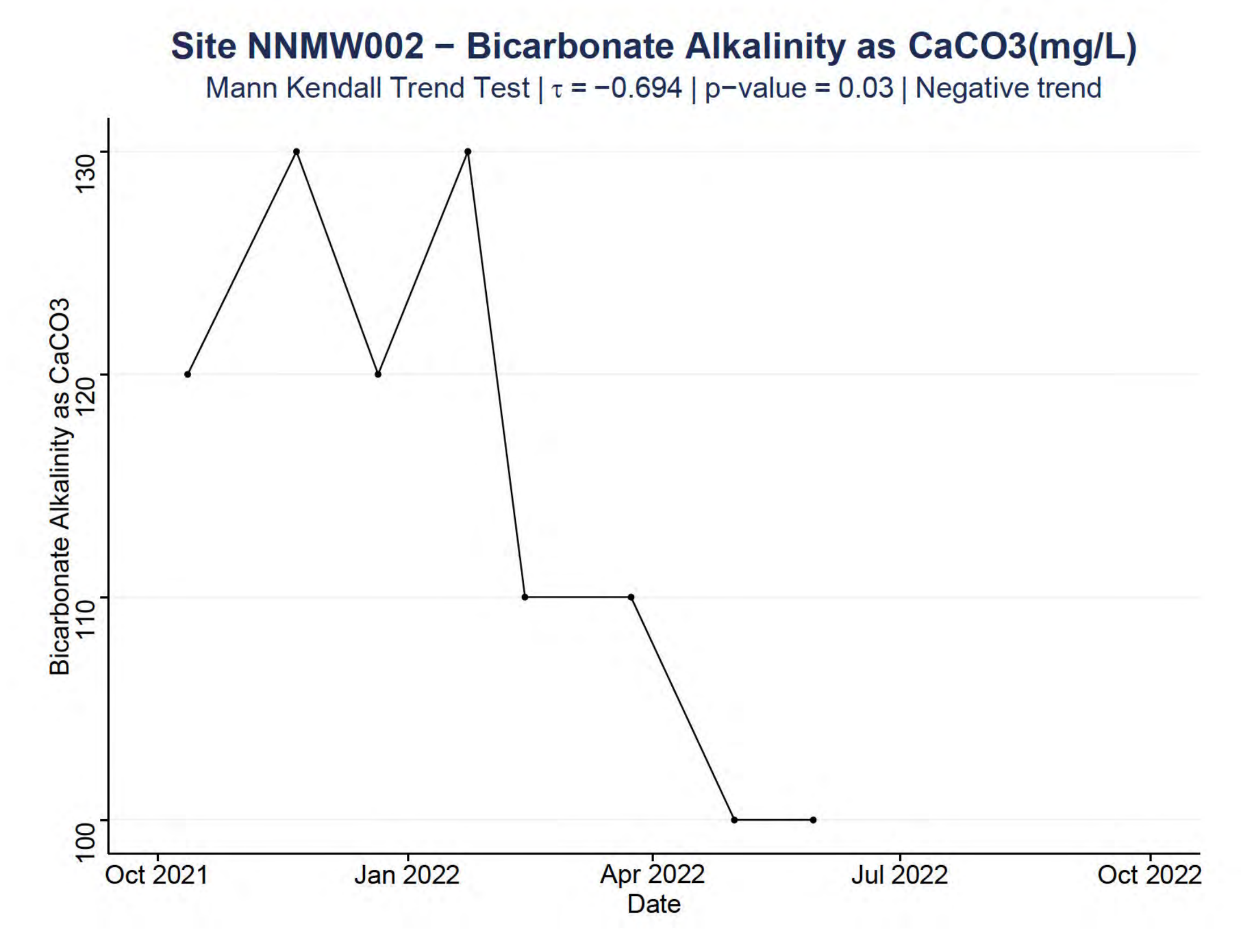

Site NNMW001 – Zinc (mg/L)
Mann Kendall Trend Test | τ = −0.371 | p−value = 0.258 | No trend
Zinc
0.03
0.02
0.01
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

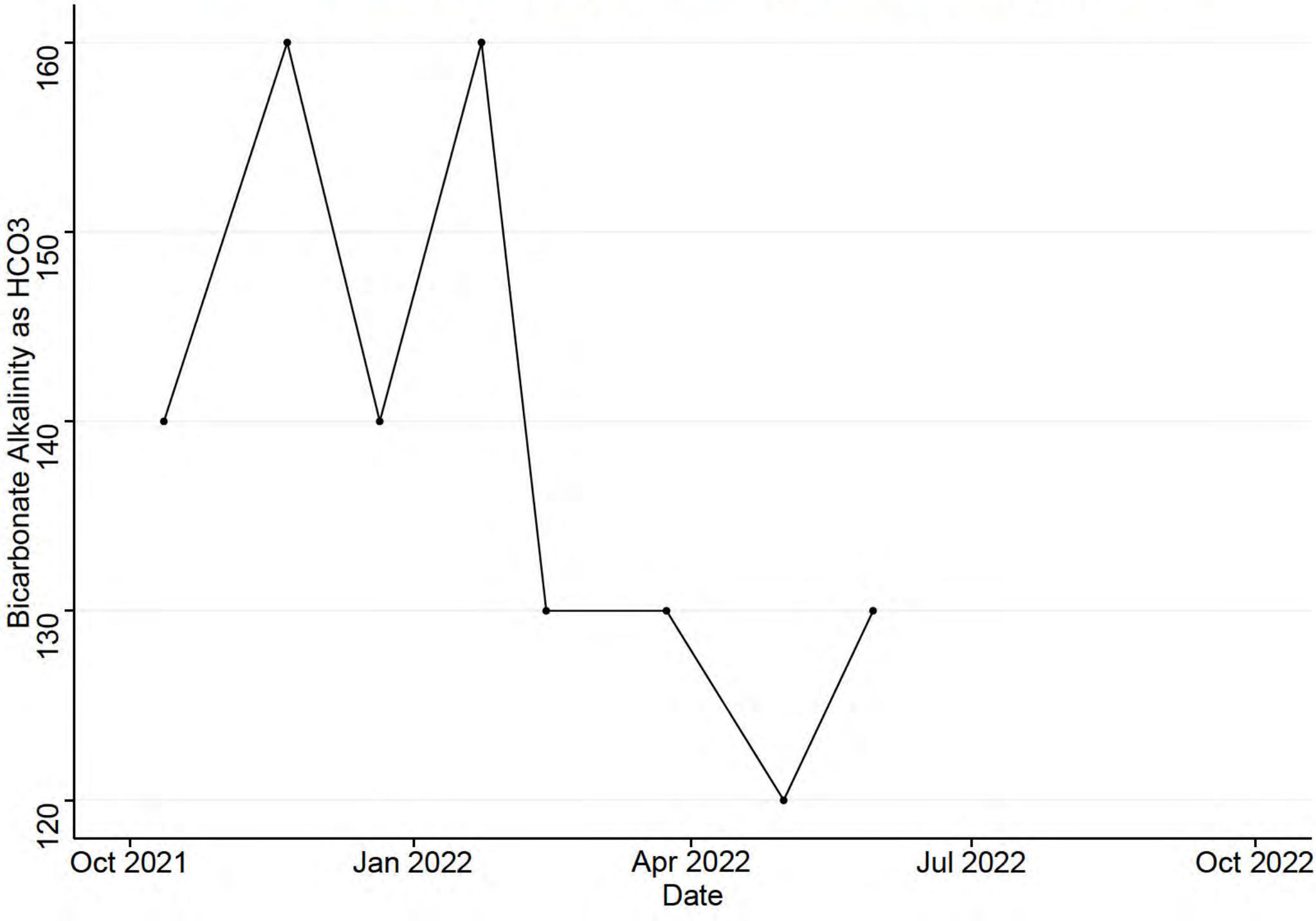

Site NNMW002 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.473 | p−value = 0.135 | No trend
Aluminium
0.020
0.018
0.016
0.014
0.012
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

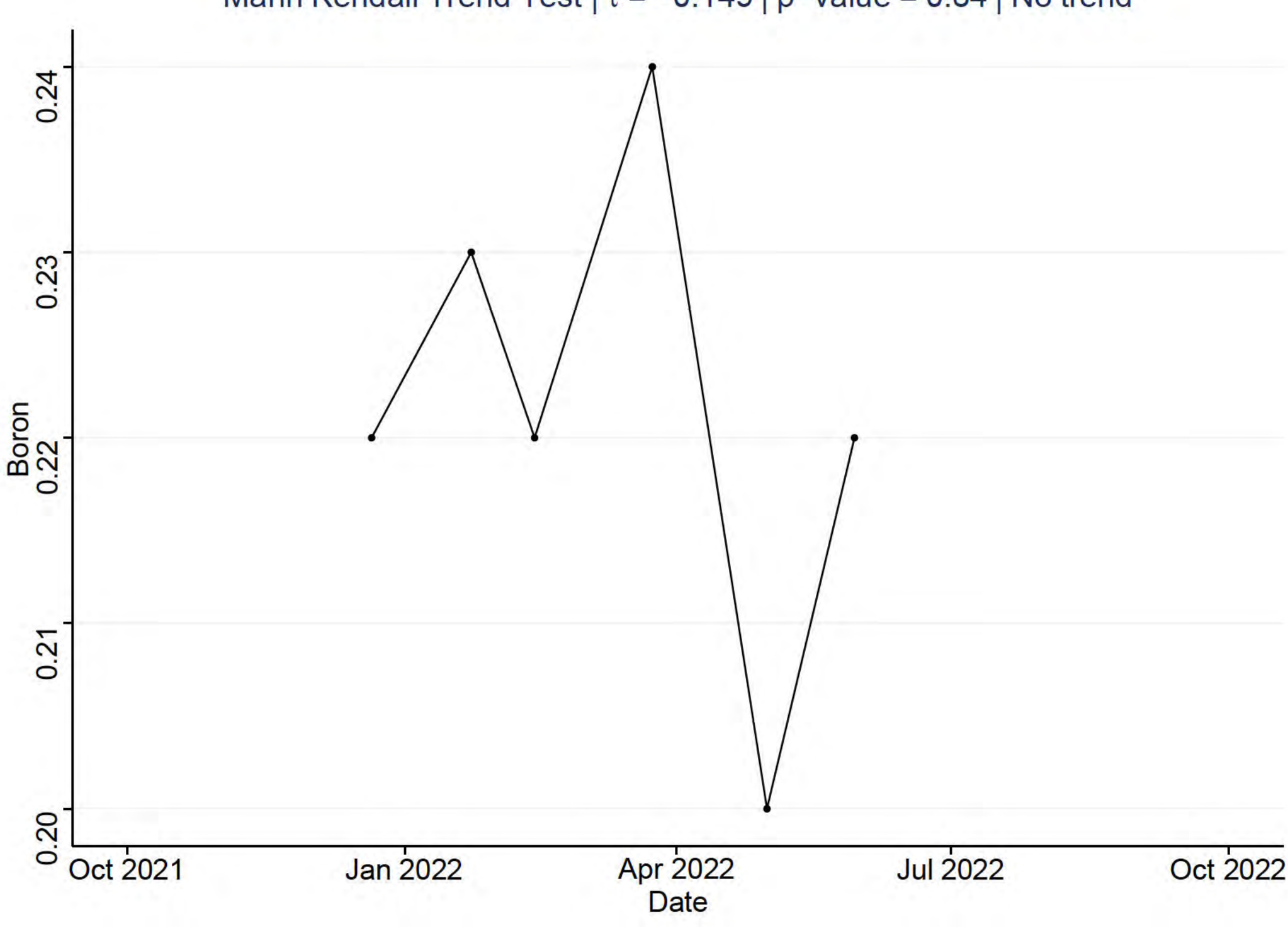

Site NNMW002 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Arsenic
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

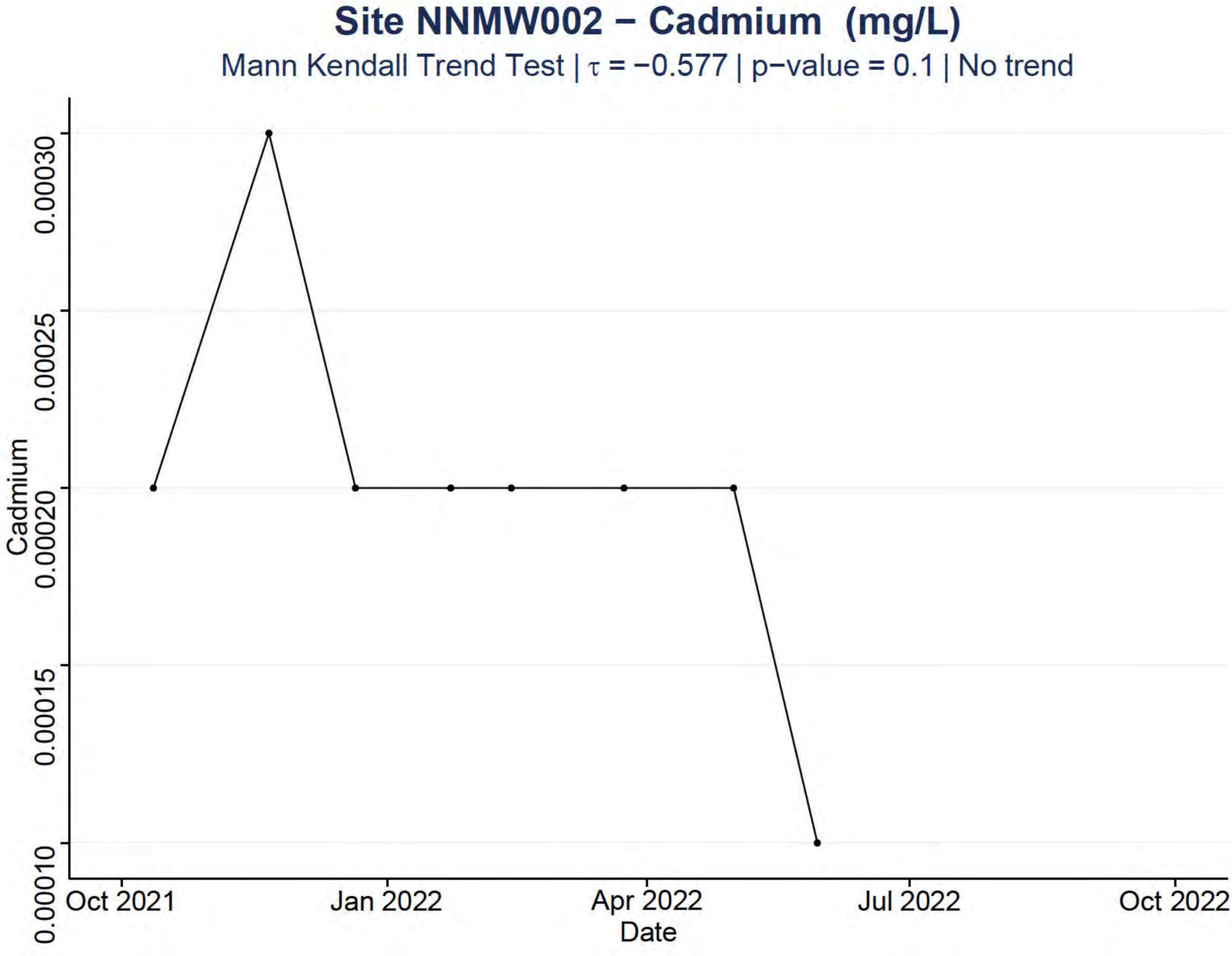

Site NNMW002 − Barium(mg/L)
Mann Kendall Trend Test | τ = −0.467 | p−value = 0.26 | No trend
Barium
0.076
0.074
0.072
0.070
0.068
0.066
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

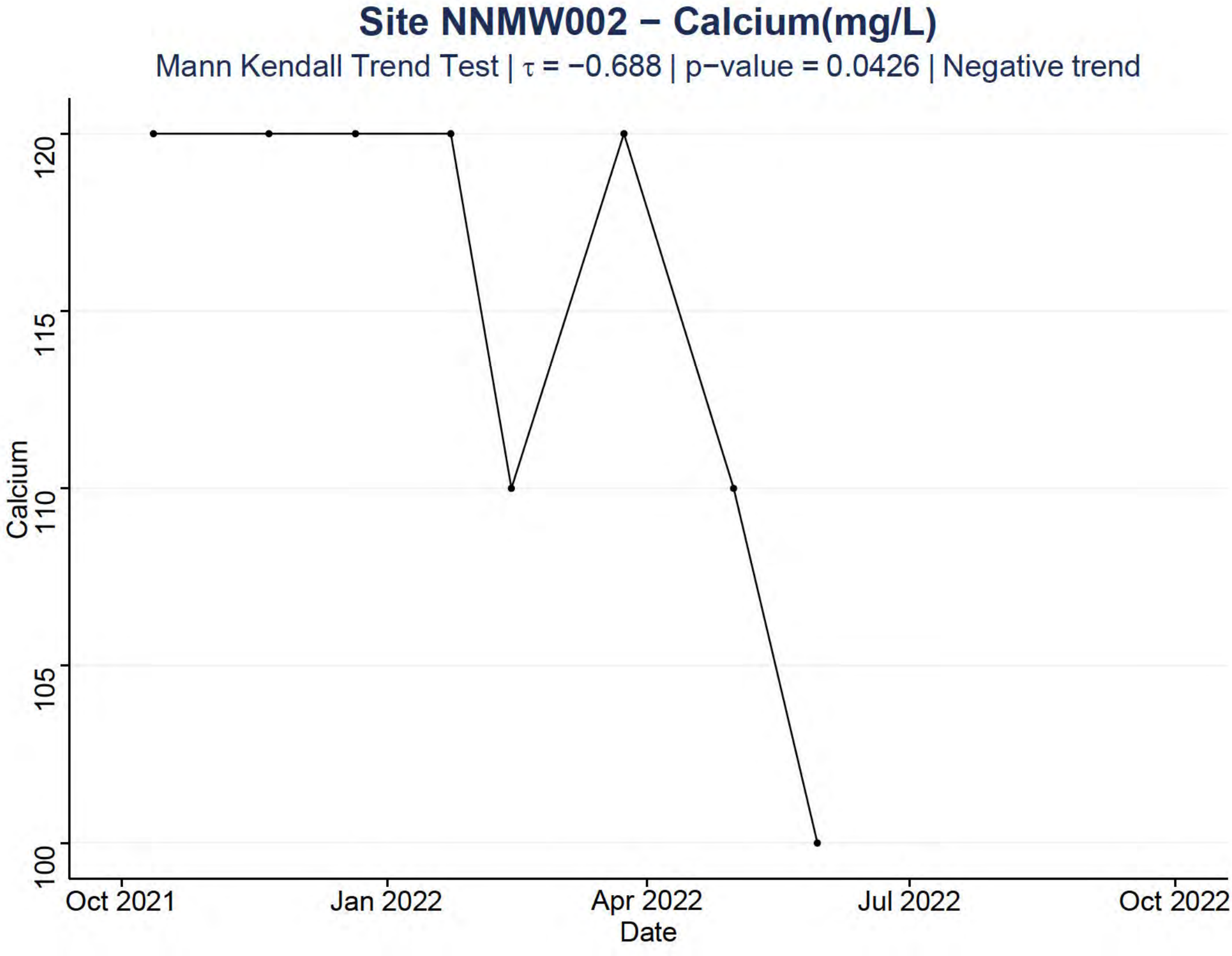

Site NNMW002 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Beryllium
2e−04
4e−04
6e−04
8e−04
1e−03
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

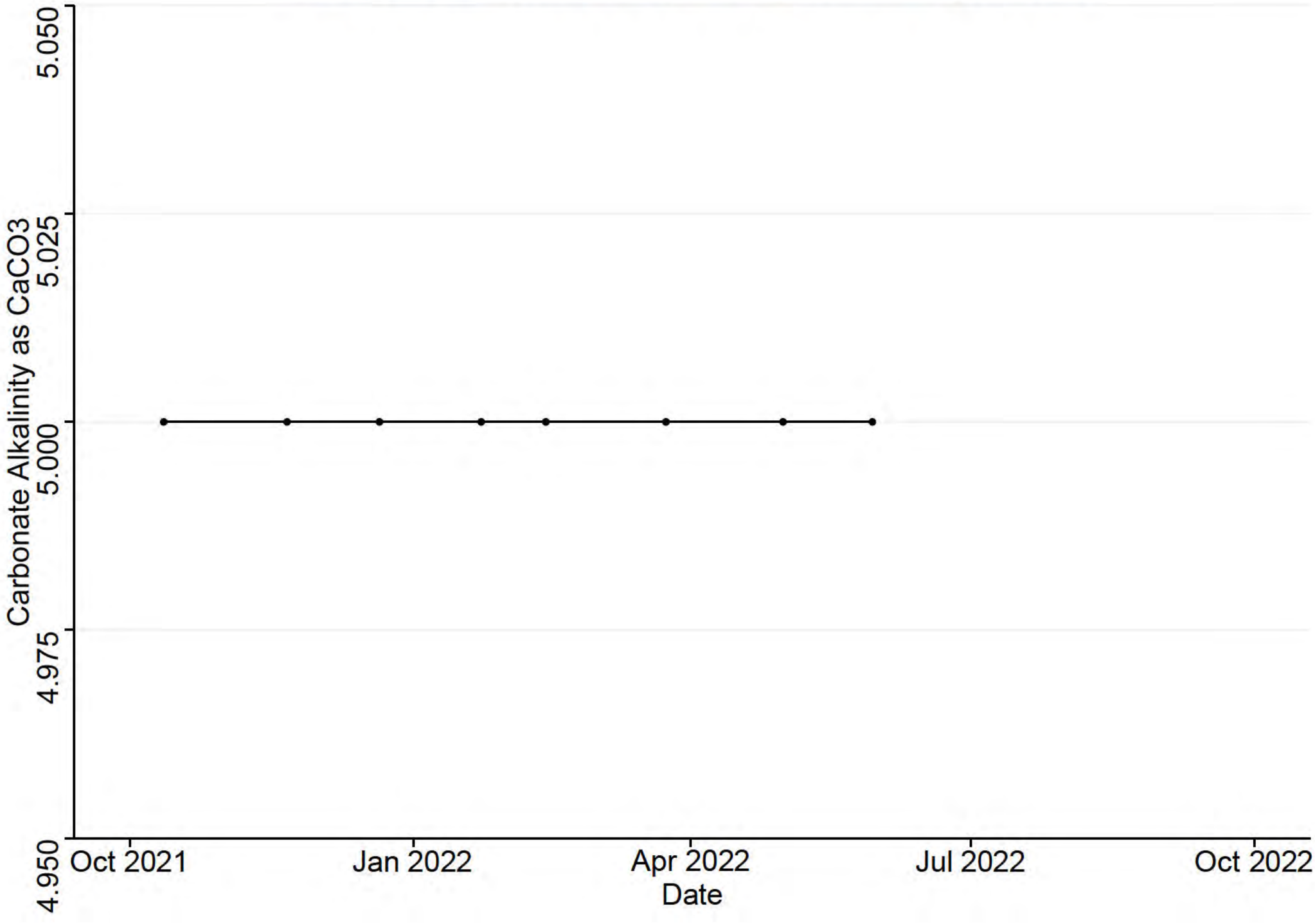

Site NNMW002 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = −0.694 | p−value = 0.03 | Negative trend
Bicarbonate Alkalinity as CaCO3
130
120
110
100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

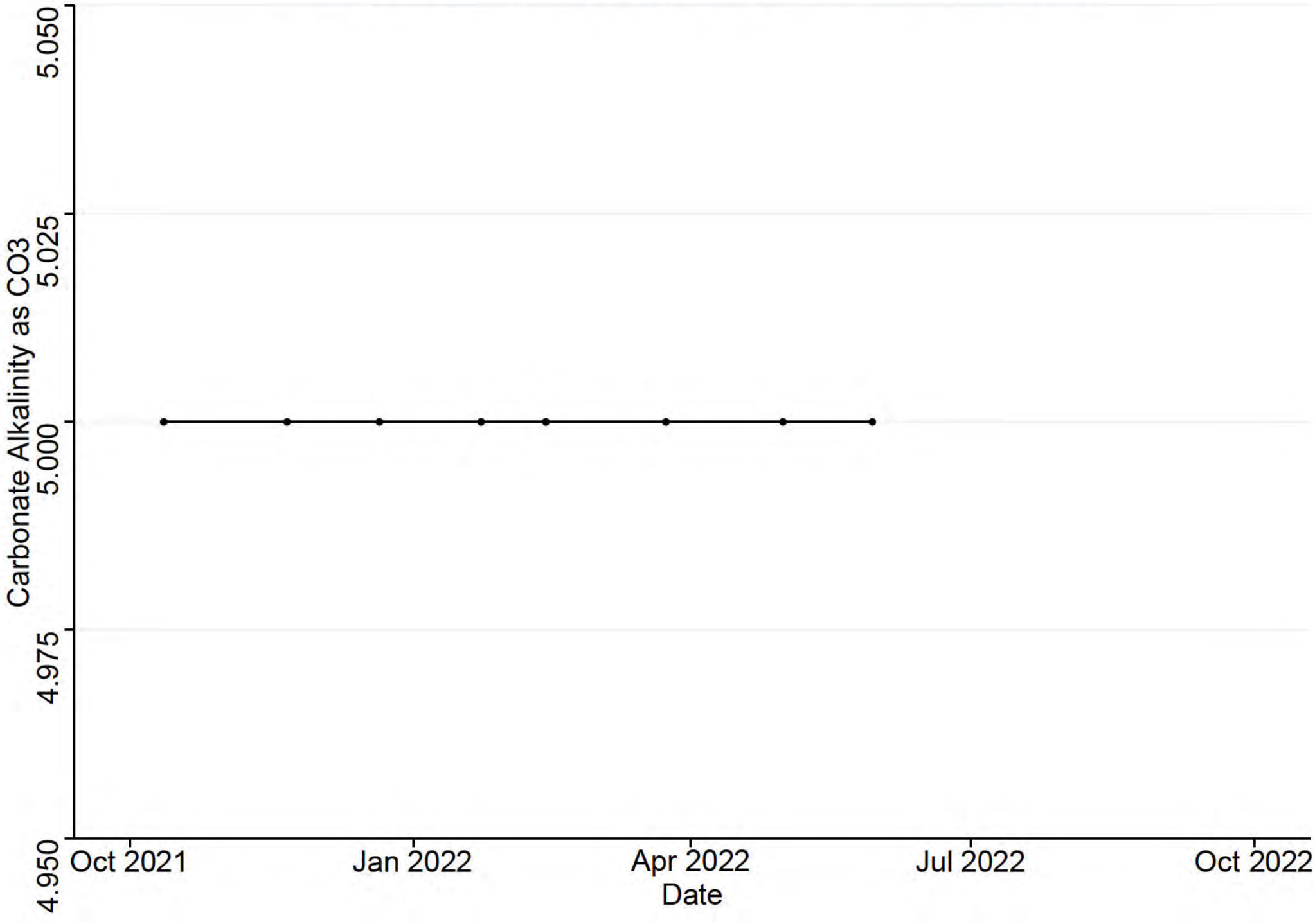

Site NNMW002 − Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = −0.591 | p−value = 0.0699 | No trend
Bicarbonate Alkalinity as HCO3
160
150
140
130
120
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

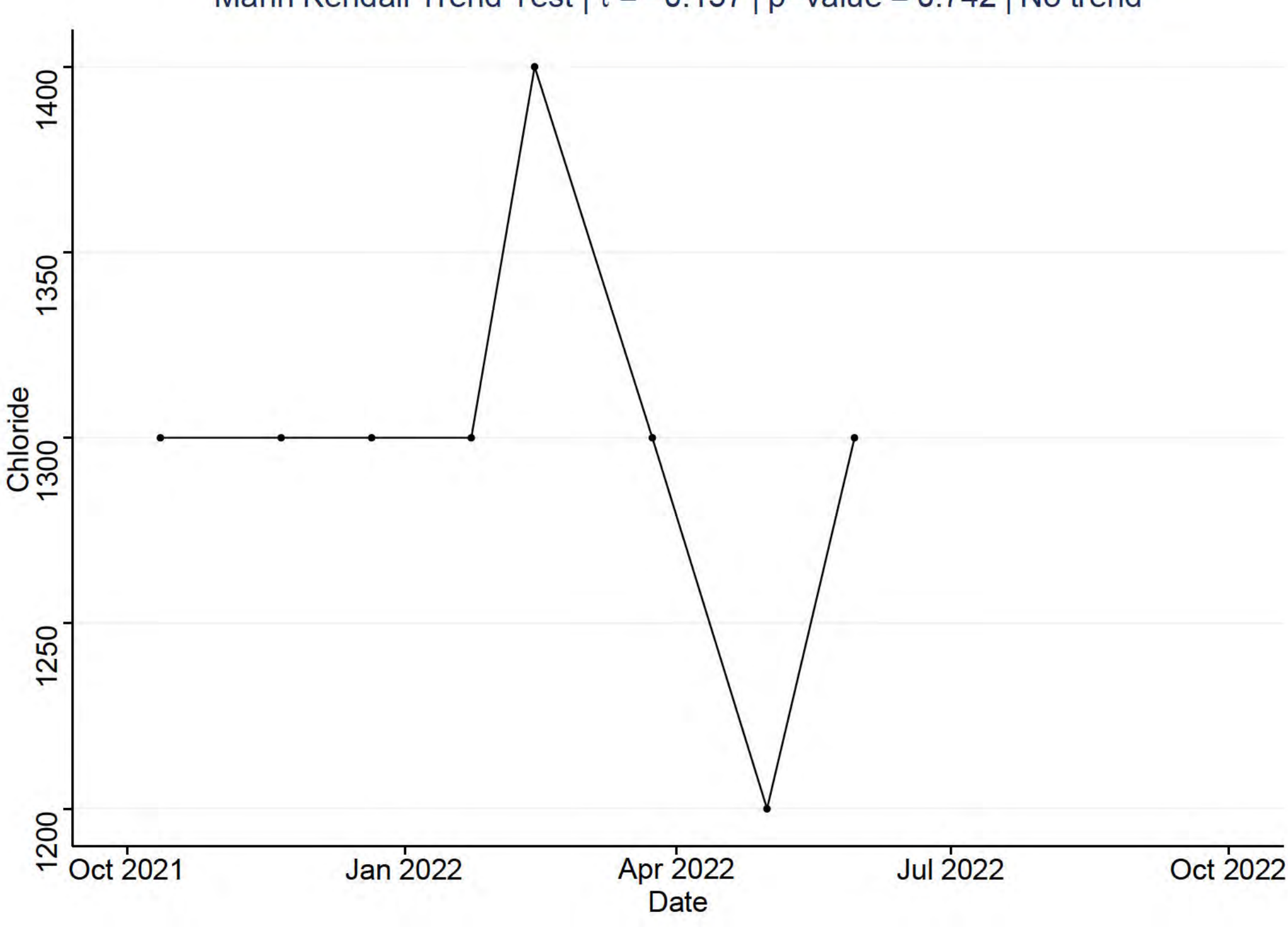

Site NNMW002 − Boron(mg/L)
Mann Kendall Trend Test | τ = −0.149 | p−value = 0.84 | No trend
Boron
0.24
0.23
0.22
0.21
0.20
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

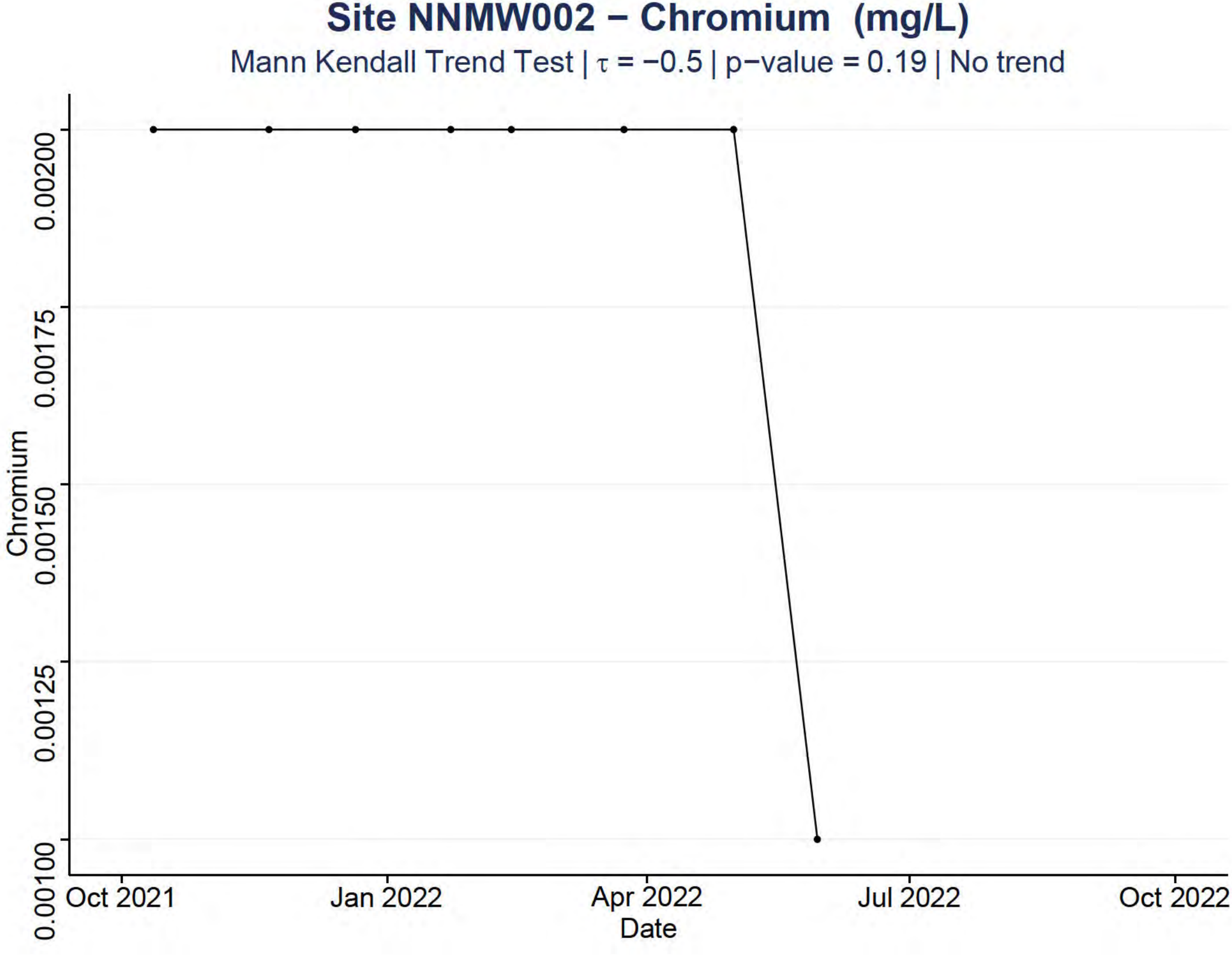

Site NNMW002 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.1 | No trend
Cadmium
0.00030
0.00025
0.00020
0.00015
0.00010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

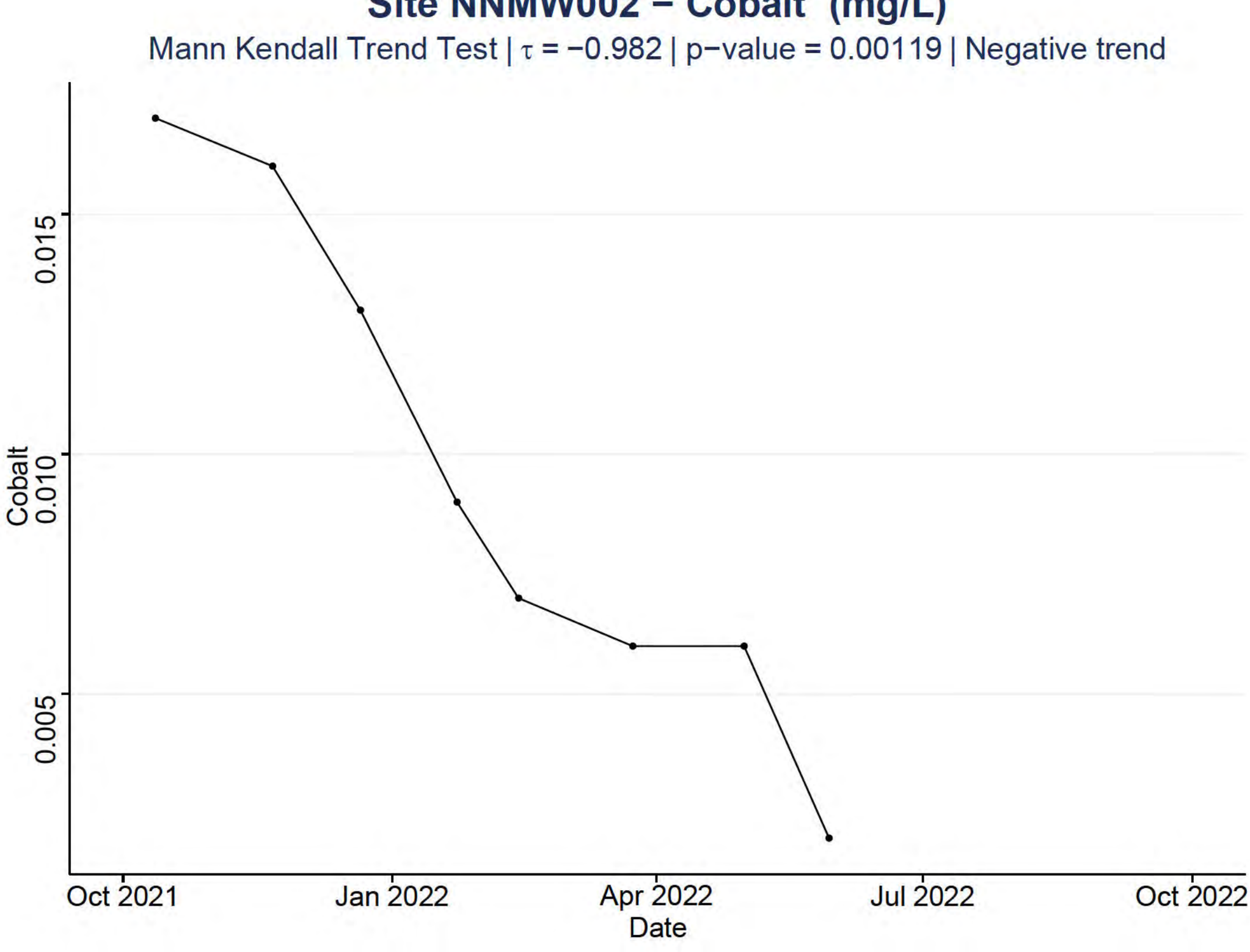

Site NNMW002 − Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.688 | p−value = 0.0426 | Negative trend
Calcium
120
115
110
105
100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

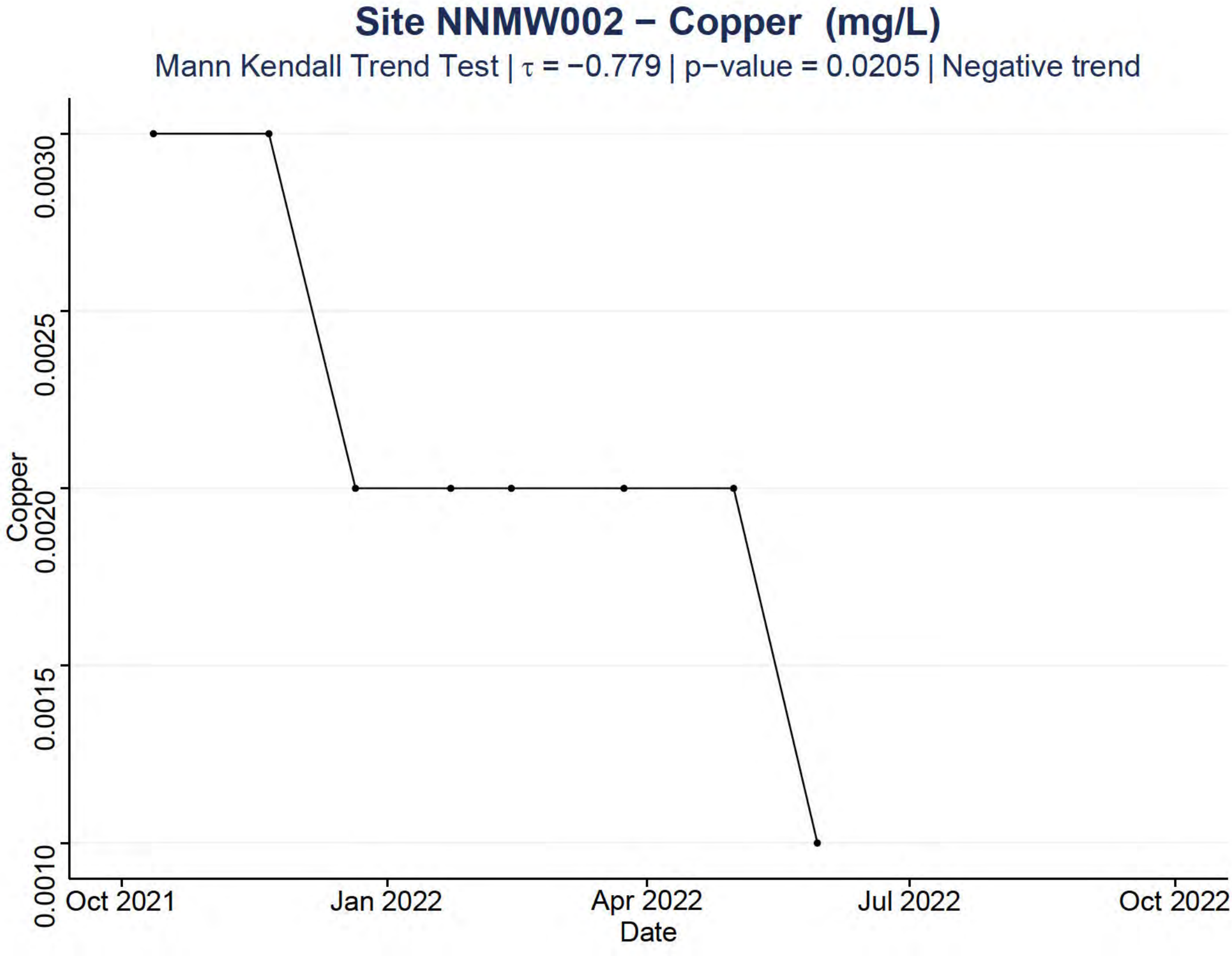

Site NNMW002 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

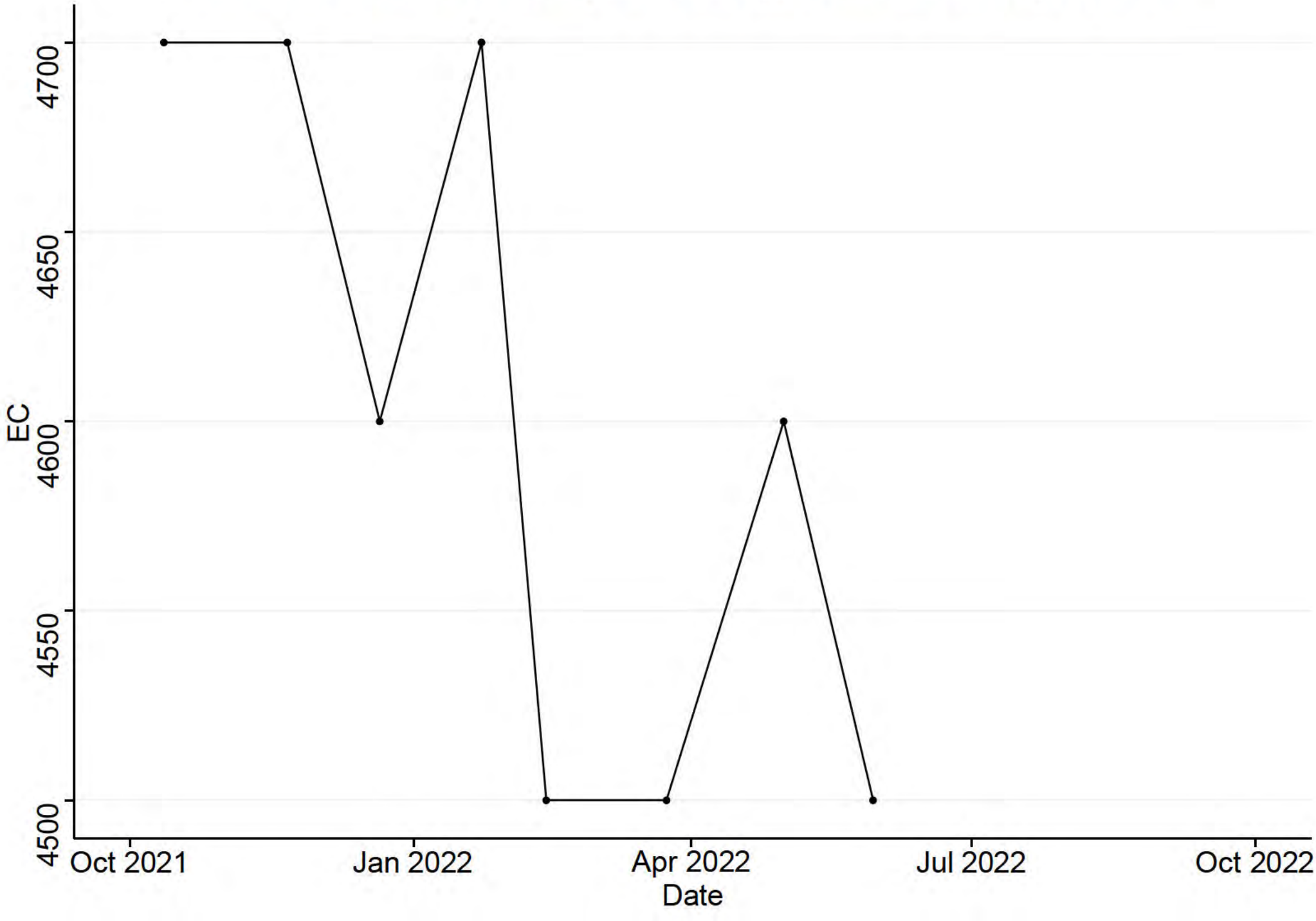

Site NNMW002 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

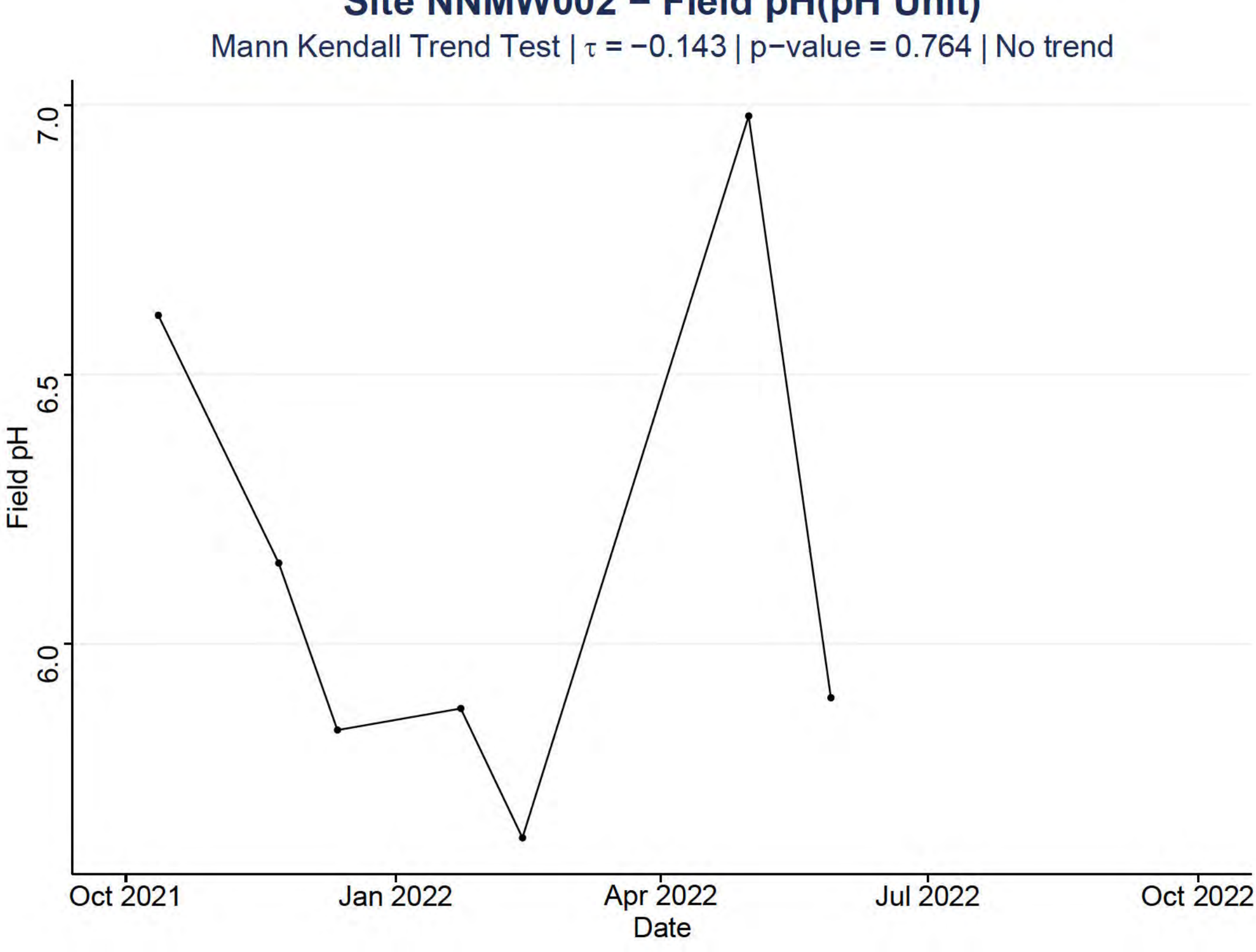

Site NNMW002 – Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.157 | p−value = 0.742 | No trend
Chloride
1400
1350
1300
1250
1200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW002 − Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Chromium
0.00200
0.00175
0.00150
0.00125
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW002 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.982 | p−value = 0.00119 | Negative trend
Cobalt
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

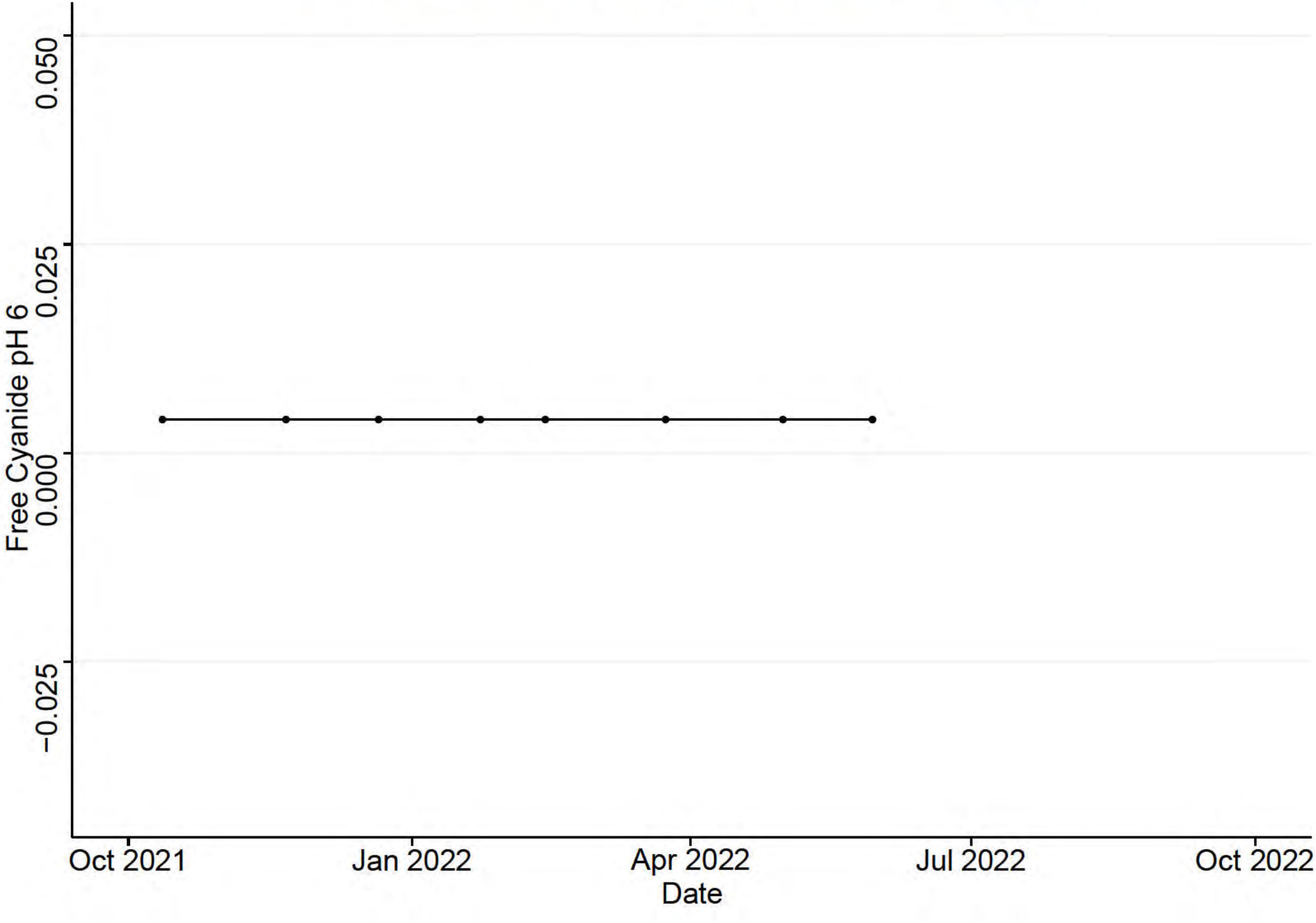

Site NNMW002 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.779 | p−value = 0.0205 | Negative trend
Copper
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

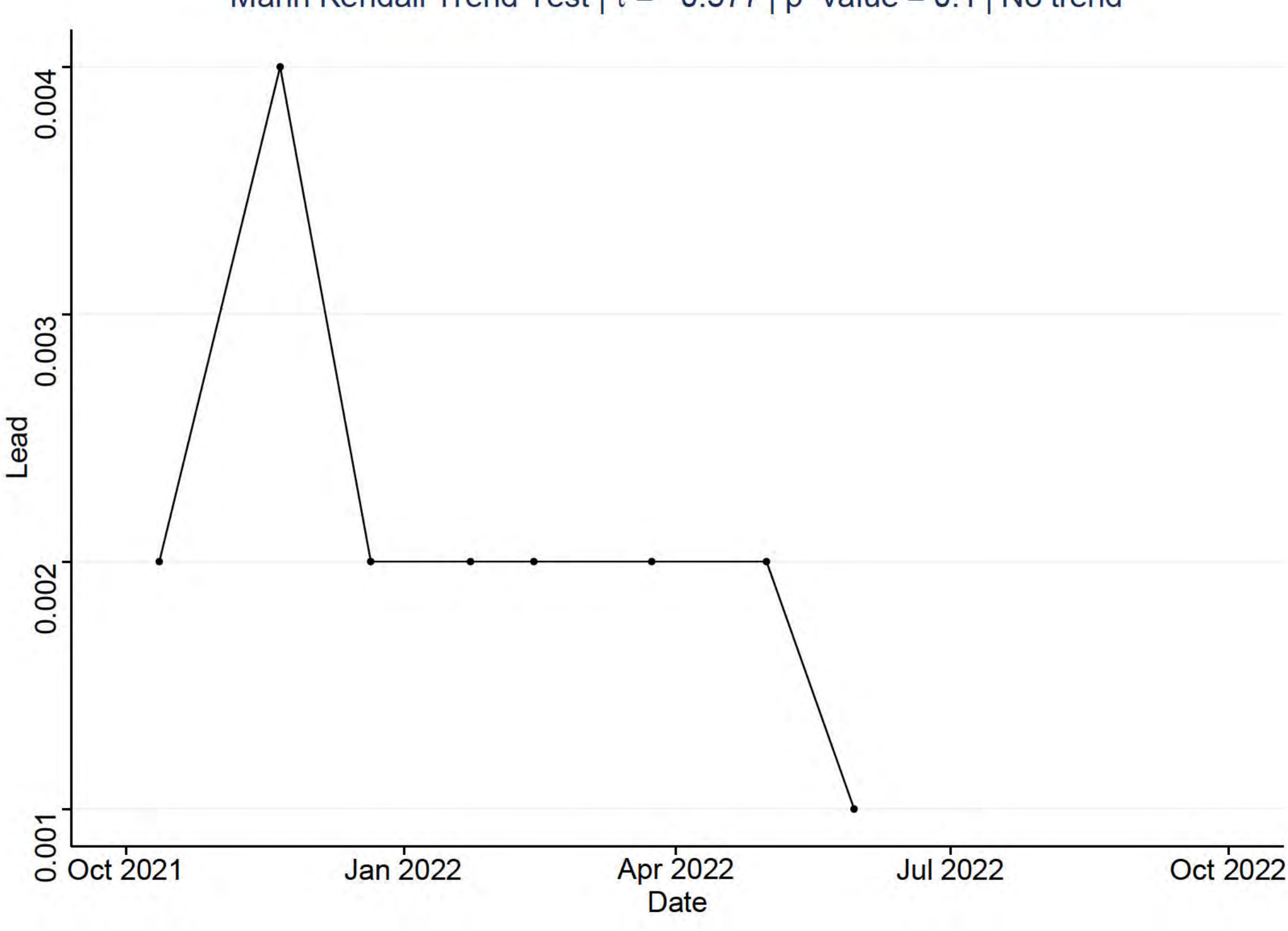

Site NNMW002 − EC(µS/cm)
Mann Kendall Trend Test | τ = −0.619 | p−value = 0.0637 | No trend
EC
4700
4650
4600
4550
4500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

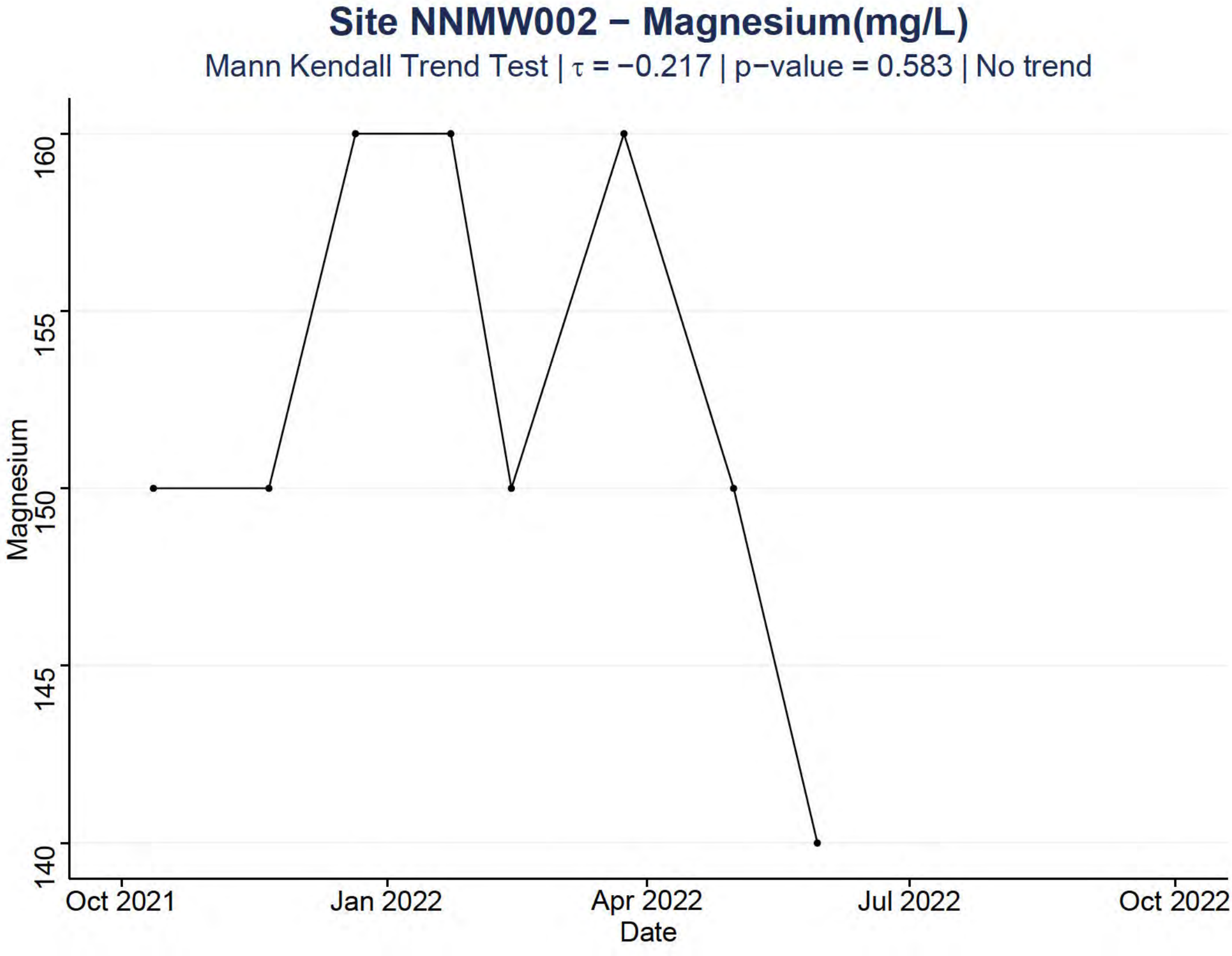

Site NNMW002 − Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.143 | p−value = 0.764 | No trend
Field pH
7.0
6.5
6.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

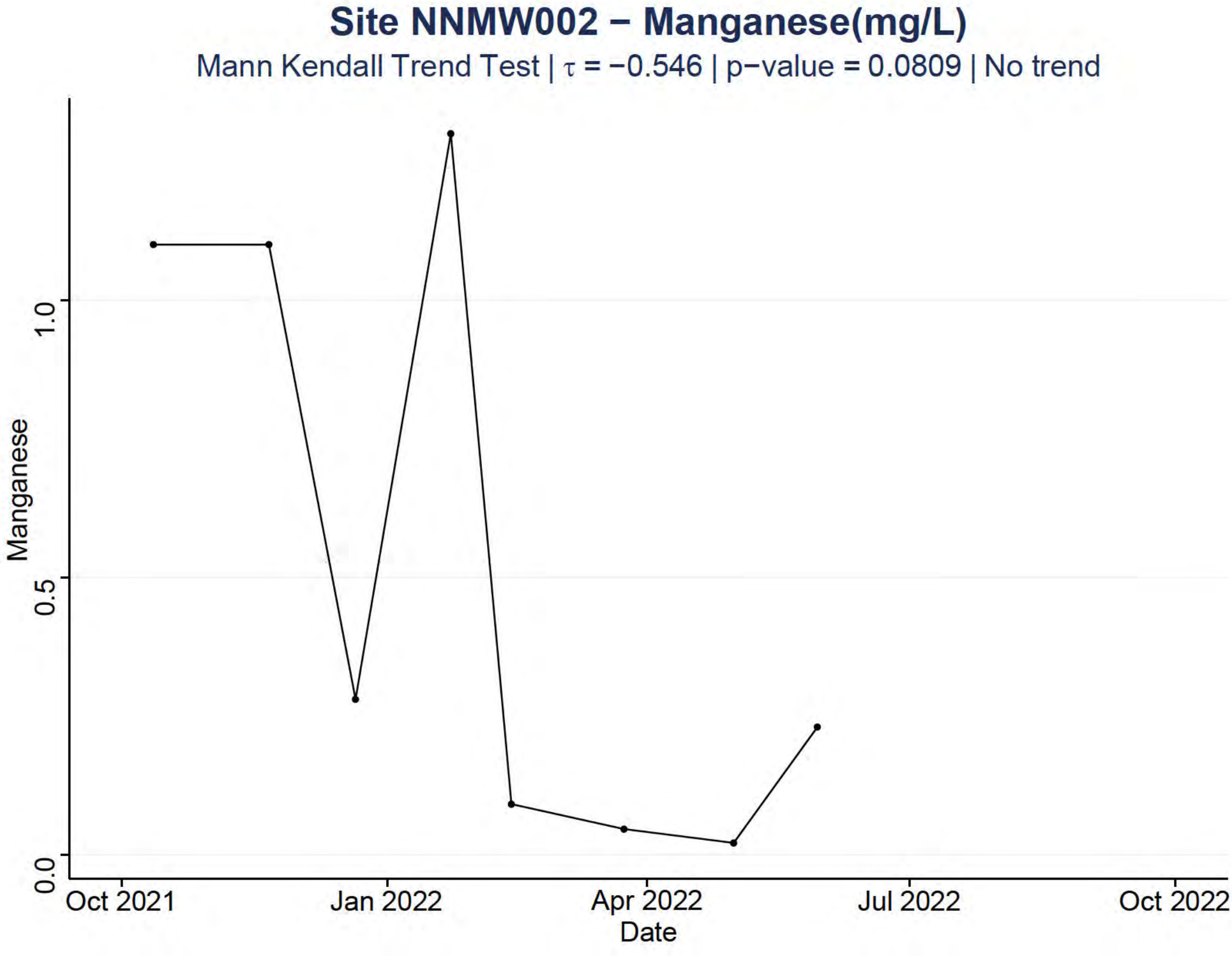
Site NNMW002 – Free Cyanide pH 6 (mg/L)

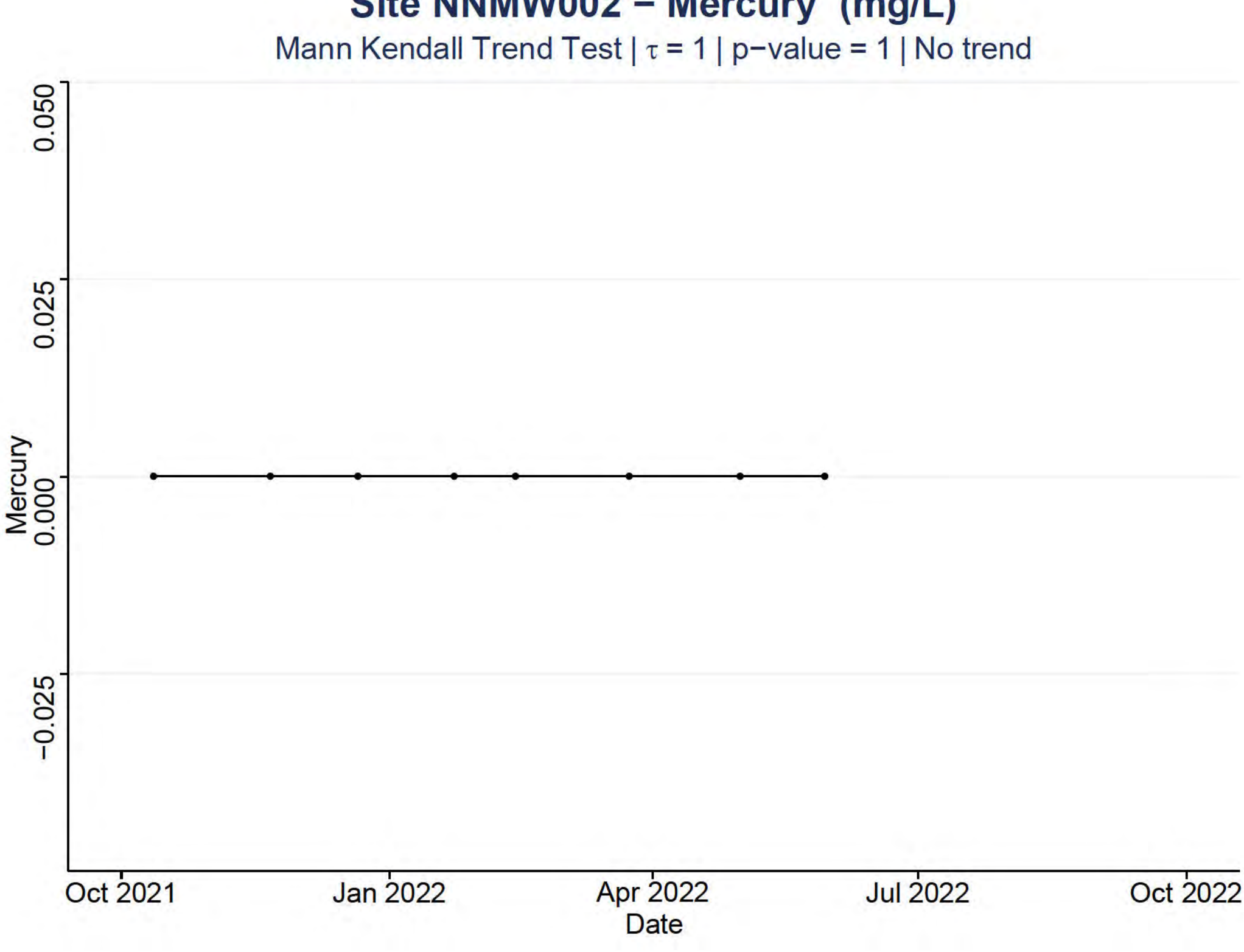
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend

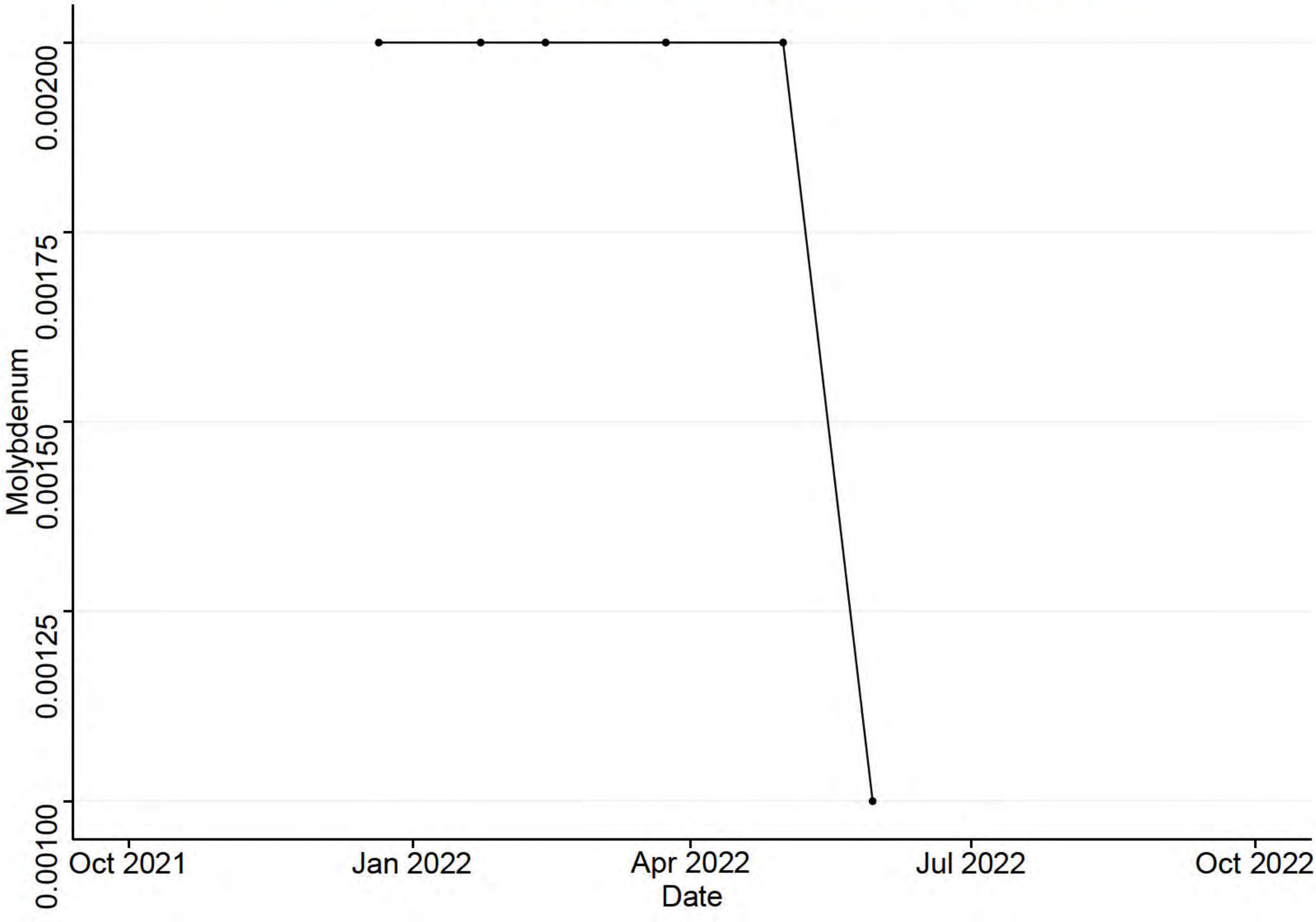


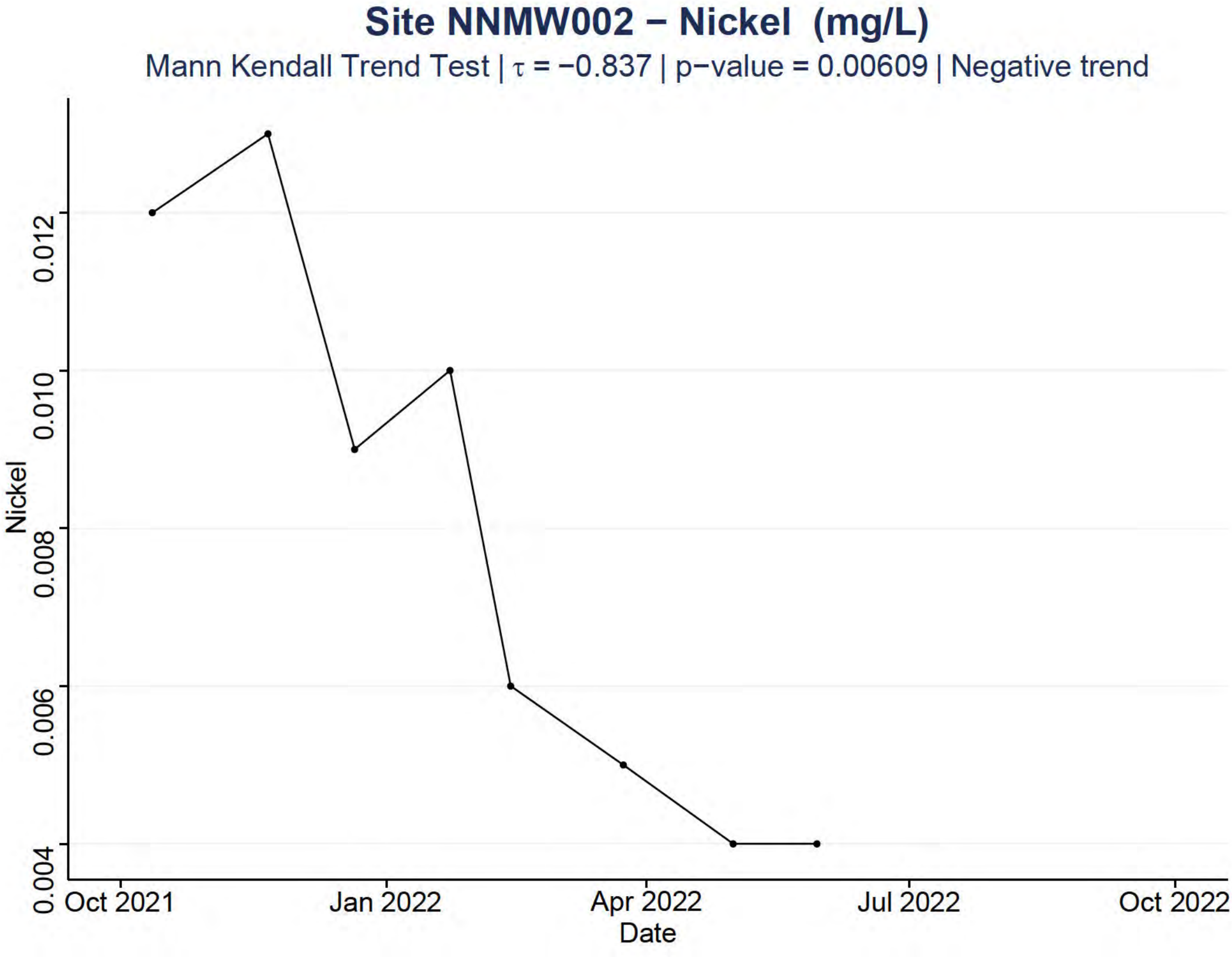

Site NNMW002 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.1 | No trend
Lead
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

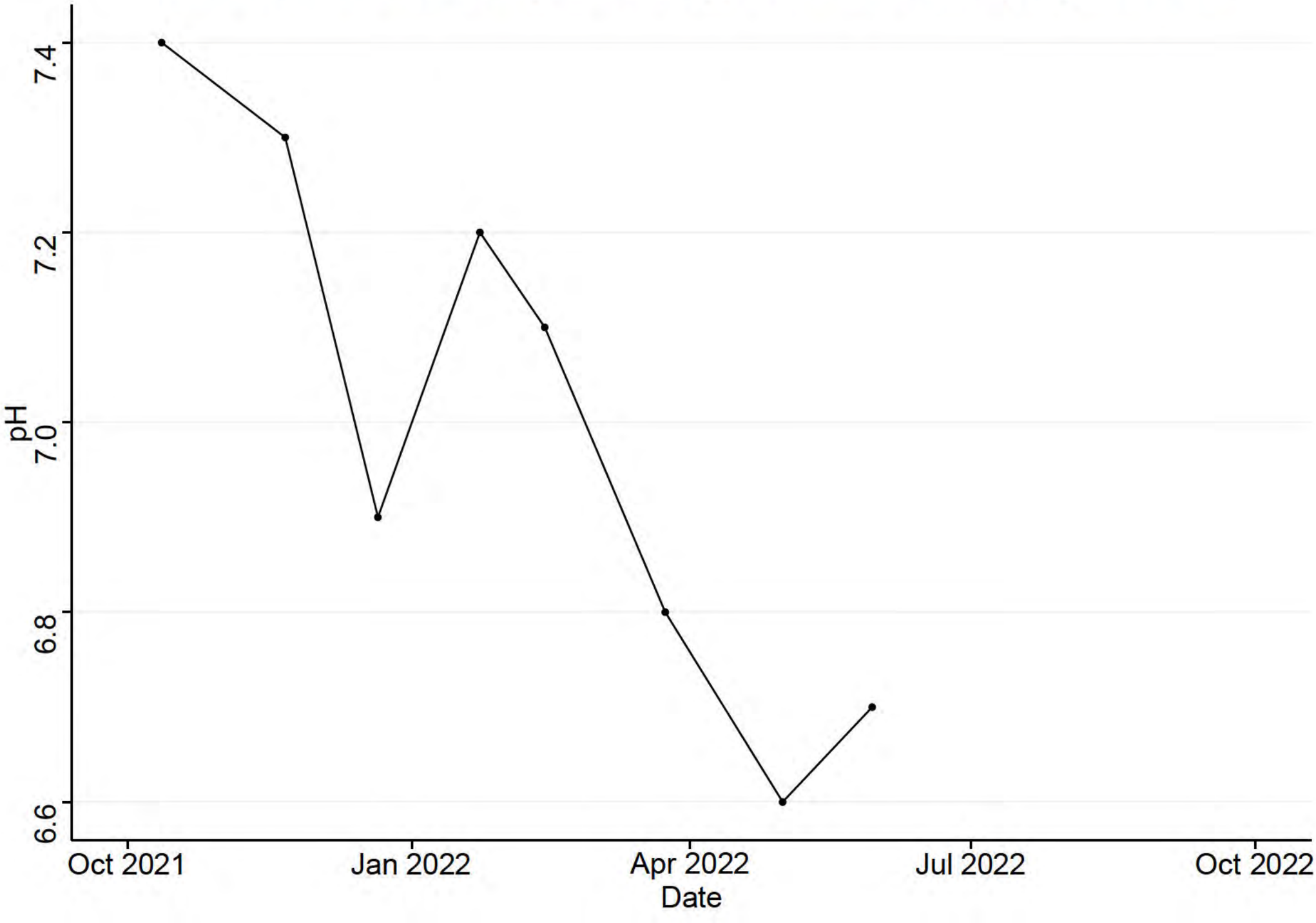

Site NNMW002 − Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.217 | p−value = 0.583 | No trend
Magnesium
160
155
150
145
140
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

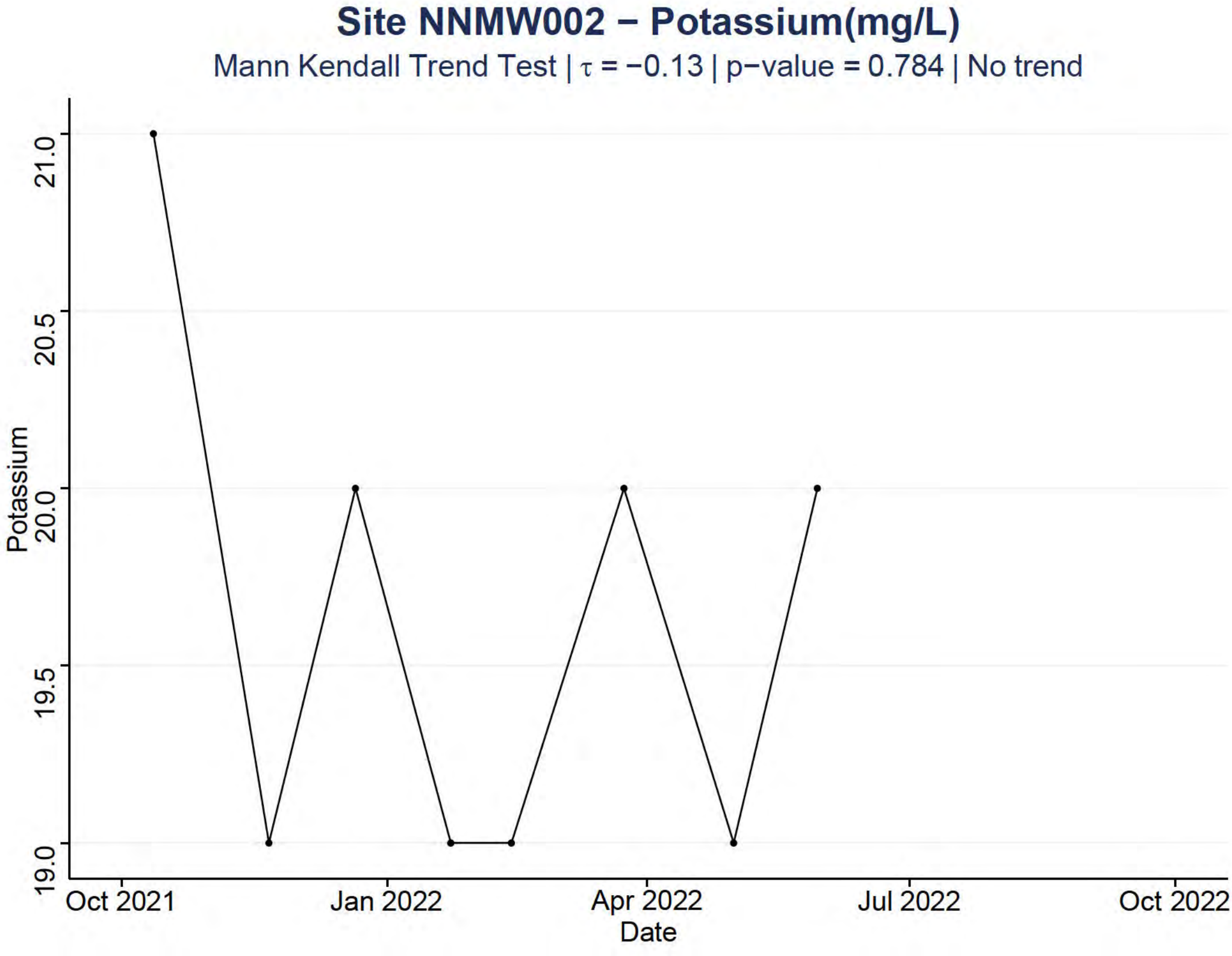

Site NNMW002 − Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.546 | p−value = 0.0809 | No trend
Manganese
0.0
0.5
1.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

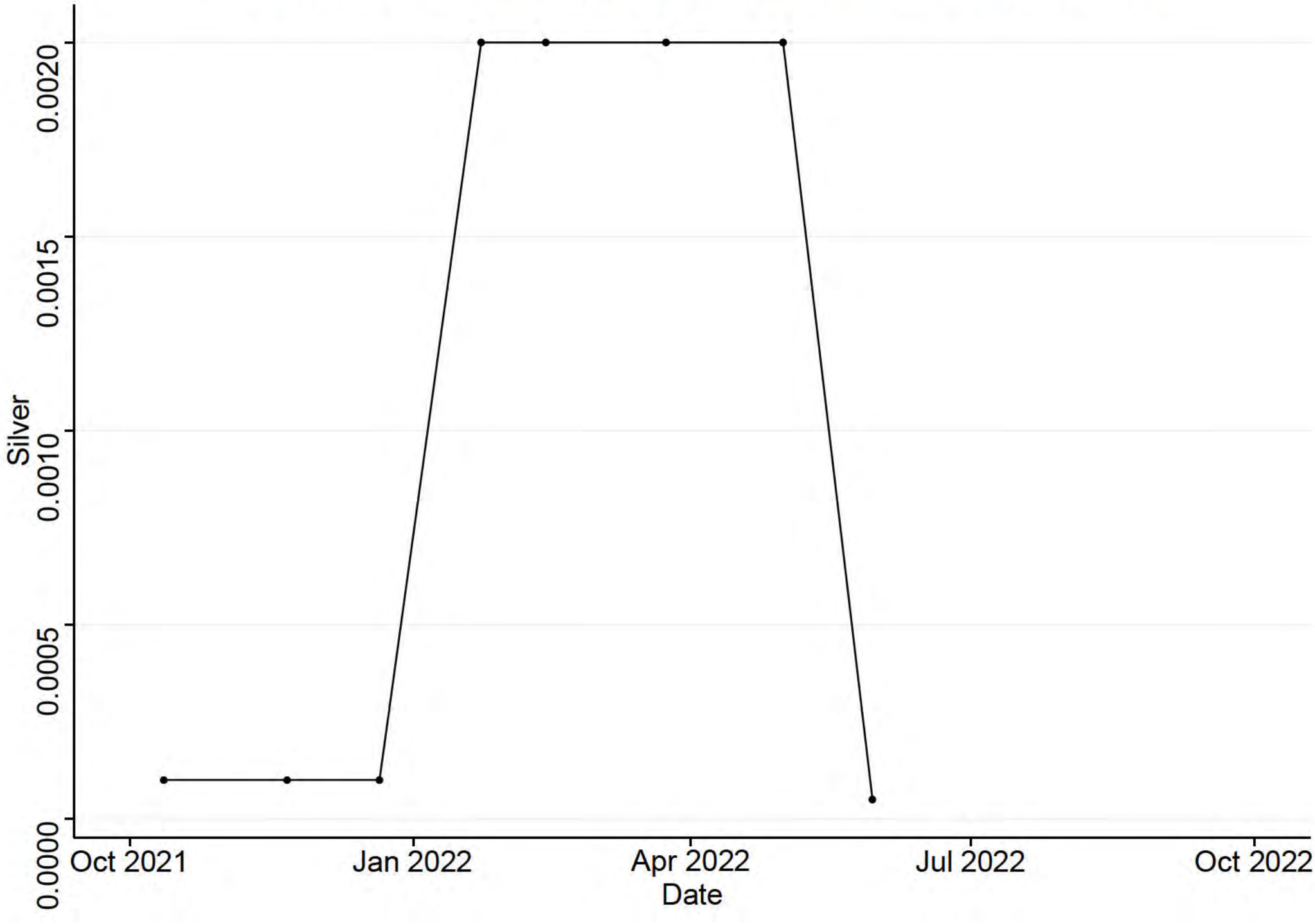

Site NNMW002 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

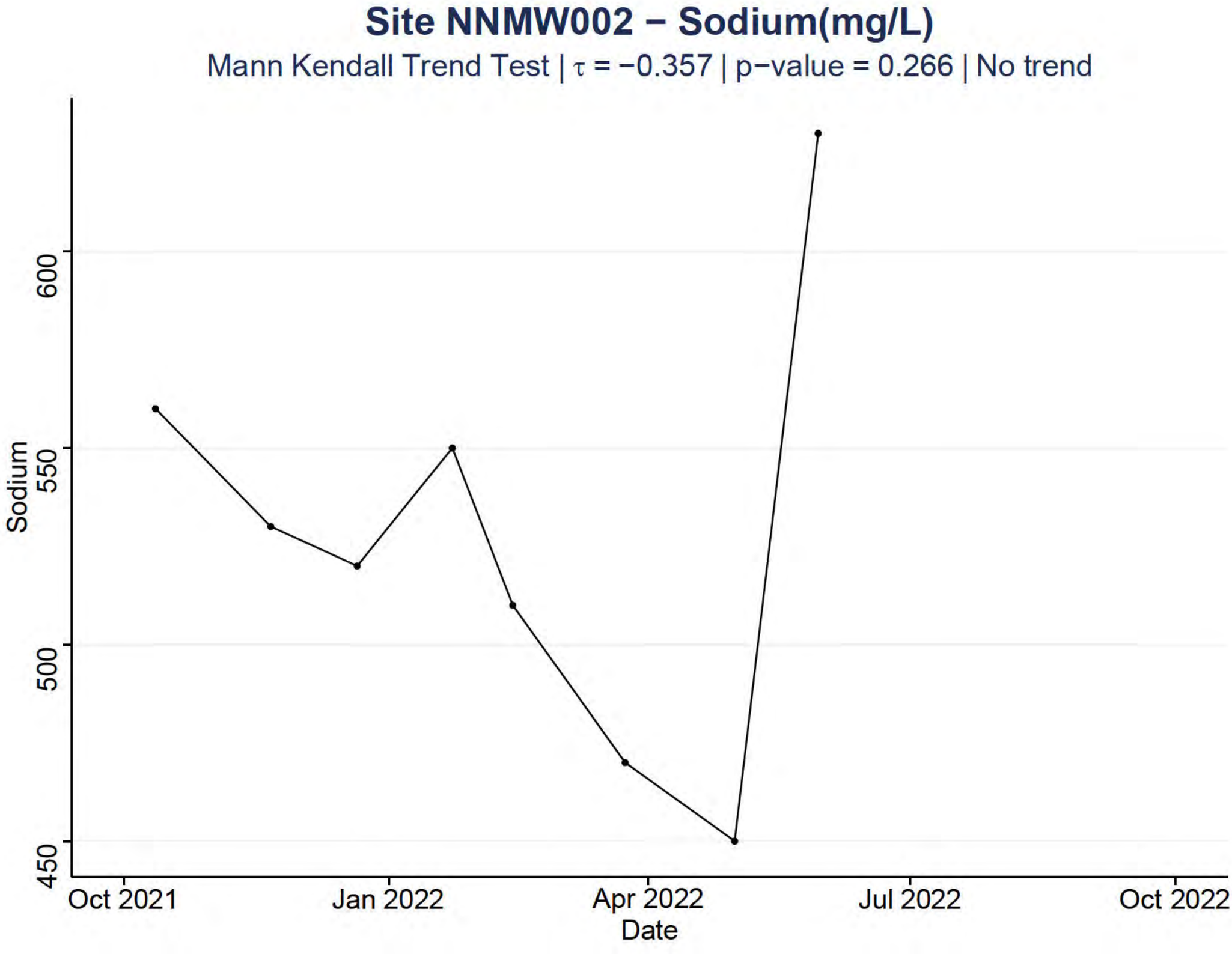

Site NNMW002 − Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Molybdenum
0.00200
0.00175
0.00150
0.00125
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

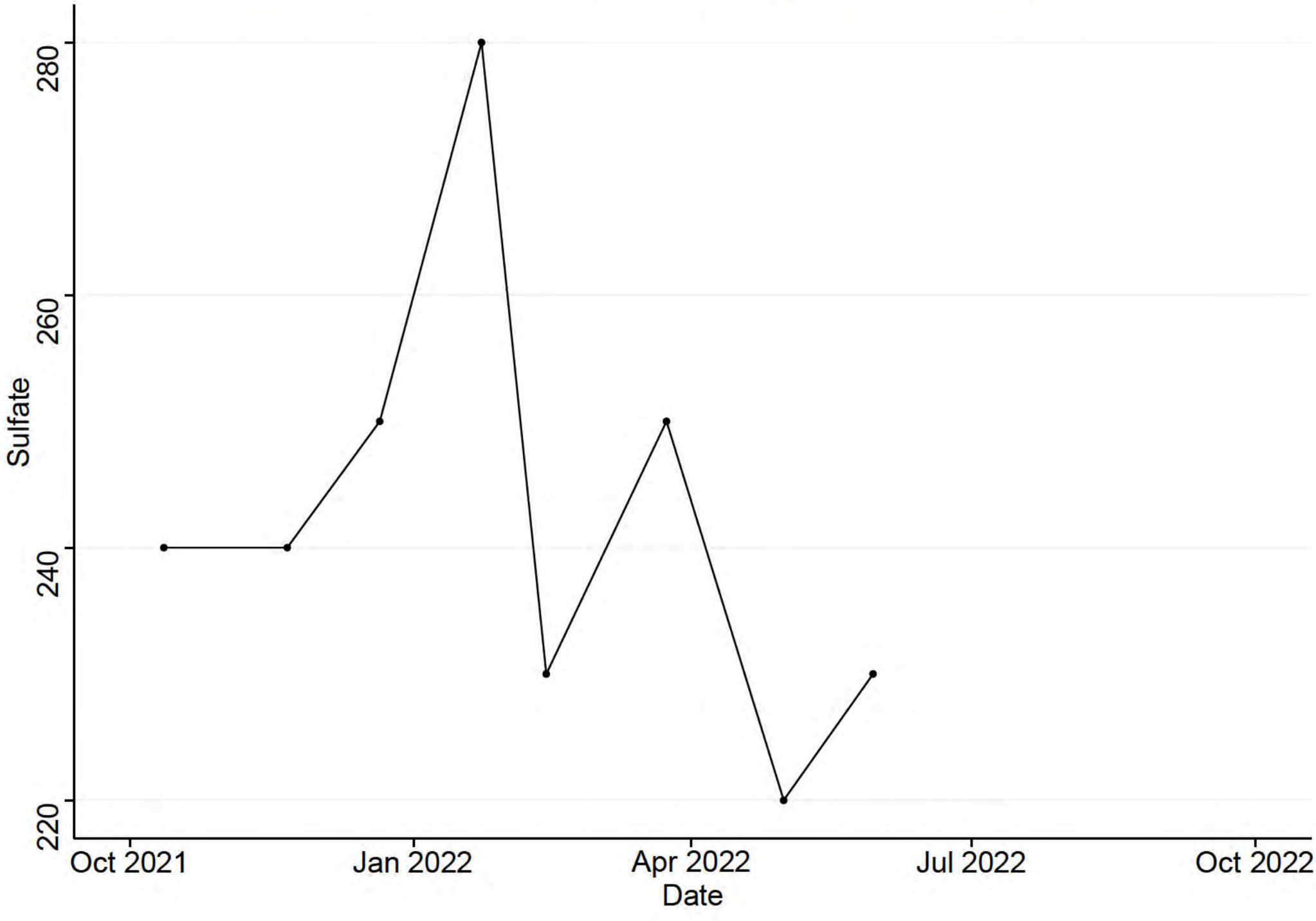

Site NNMW002 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.837 | p−value = 0.00609 | Negative trend
Nickel
0.004
0.006
0.008
0.010
0.012
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

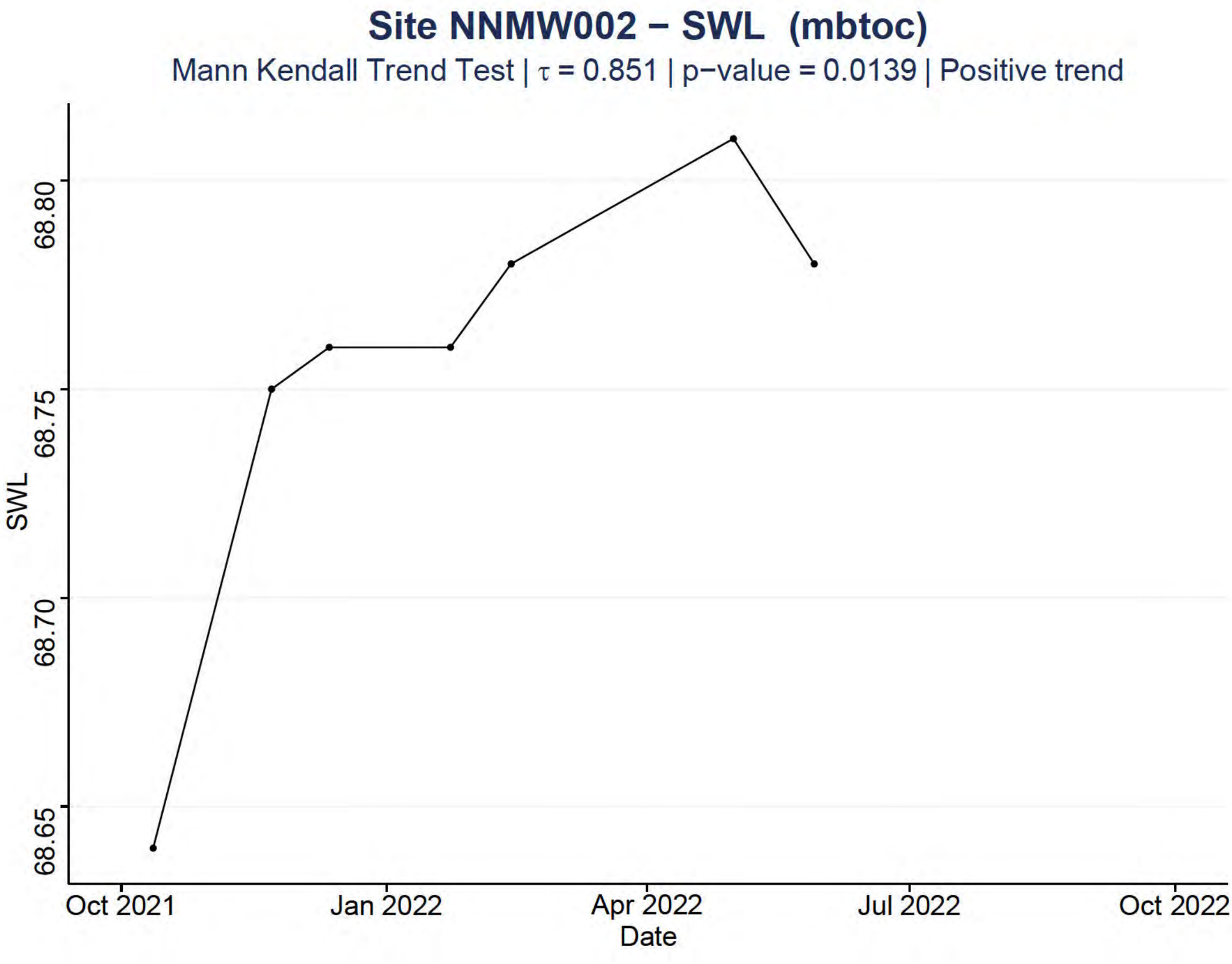

Site NNMW002 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.786 | p−value = 0.00937 | Negative trend
pH
7.4
7.2
7.0
6.8
6.6
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

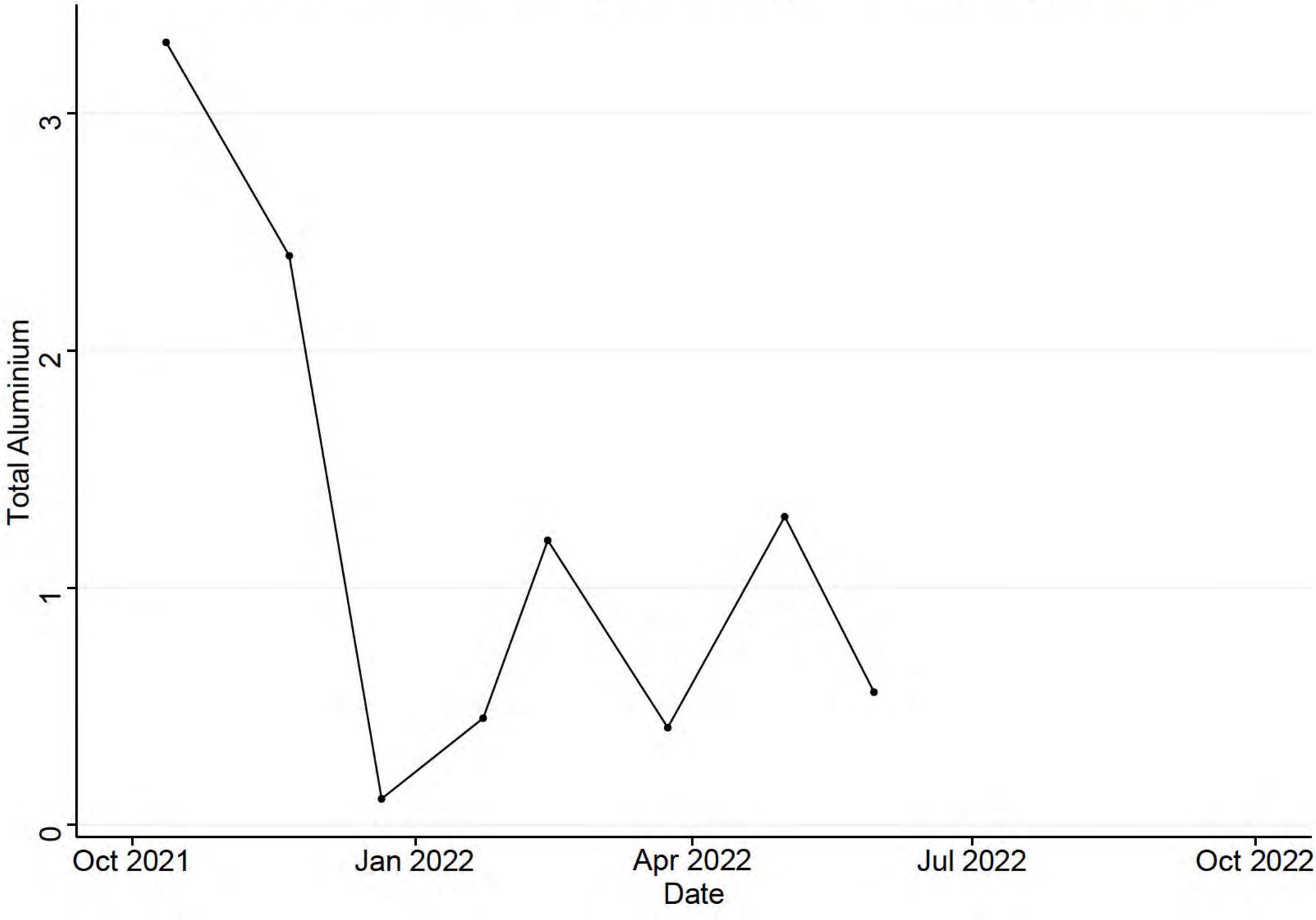

Site NNMW002 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.13 | p−value = 0.784 | No trend
Potassium
21.0
20.5
20.0
19.5
19.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

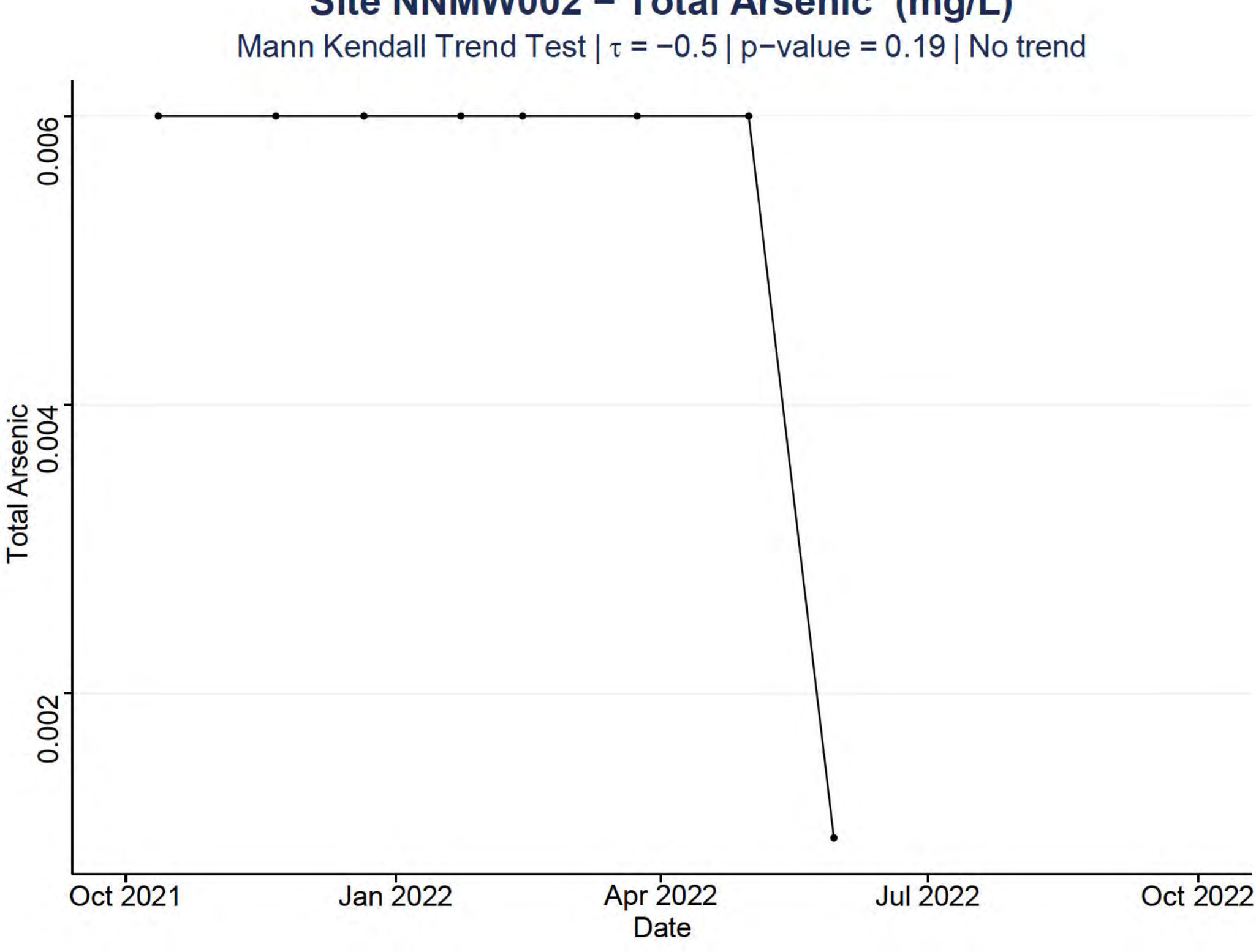

Site NNMW002 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Silver
0.0000
0.0005
0.0010
0.0015
0.0020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

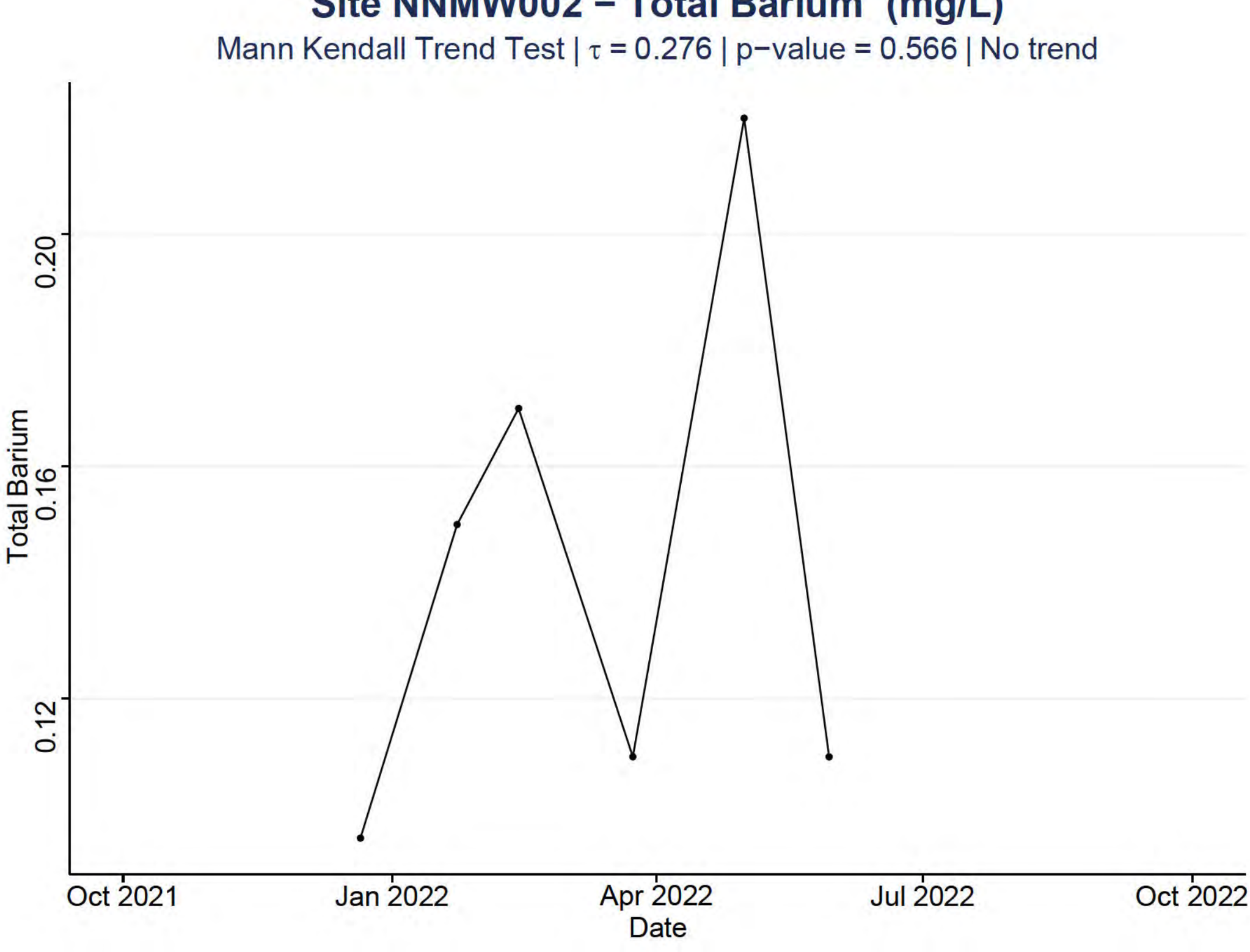

Site NNMW002 – Sodium(mg/L)
Mann Kendall Trend Test | τ = −0.357 | p−value = 0.266 | No trend
Sodium
600
550
500
450
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

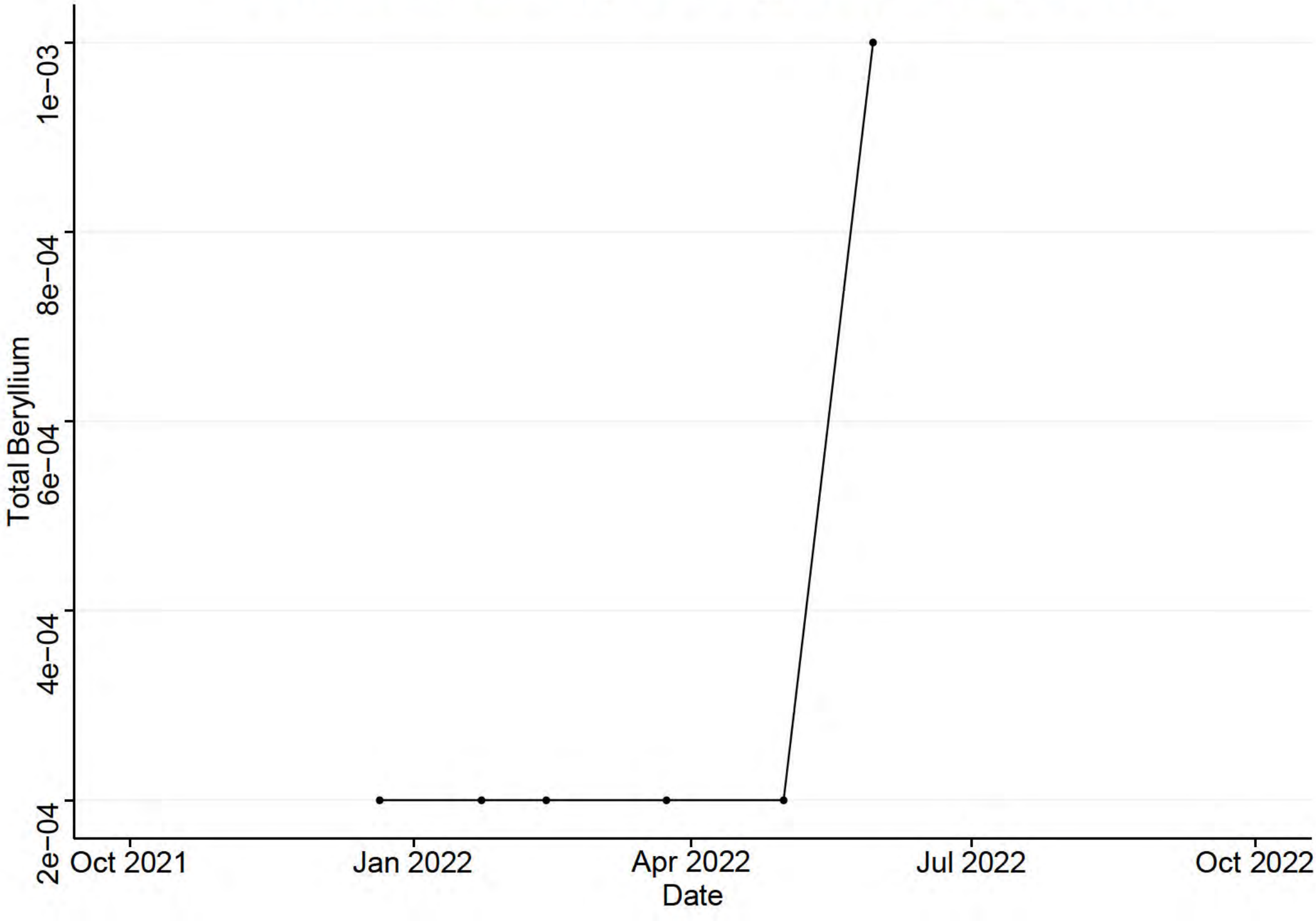

Site NNMW002 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = −0.265 | p−value = 0.447 | No trend
Sulfate
280
260
240
220
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

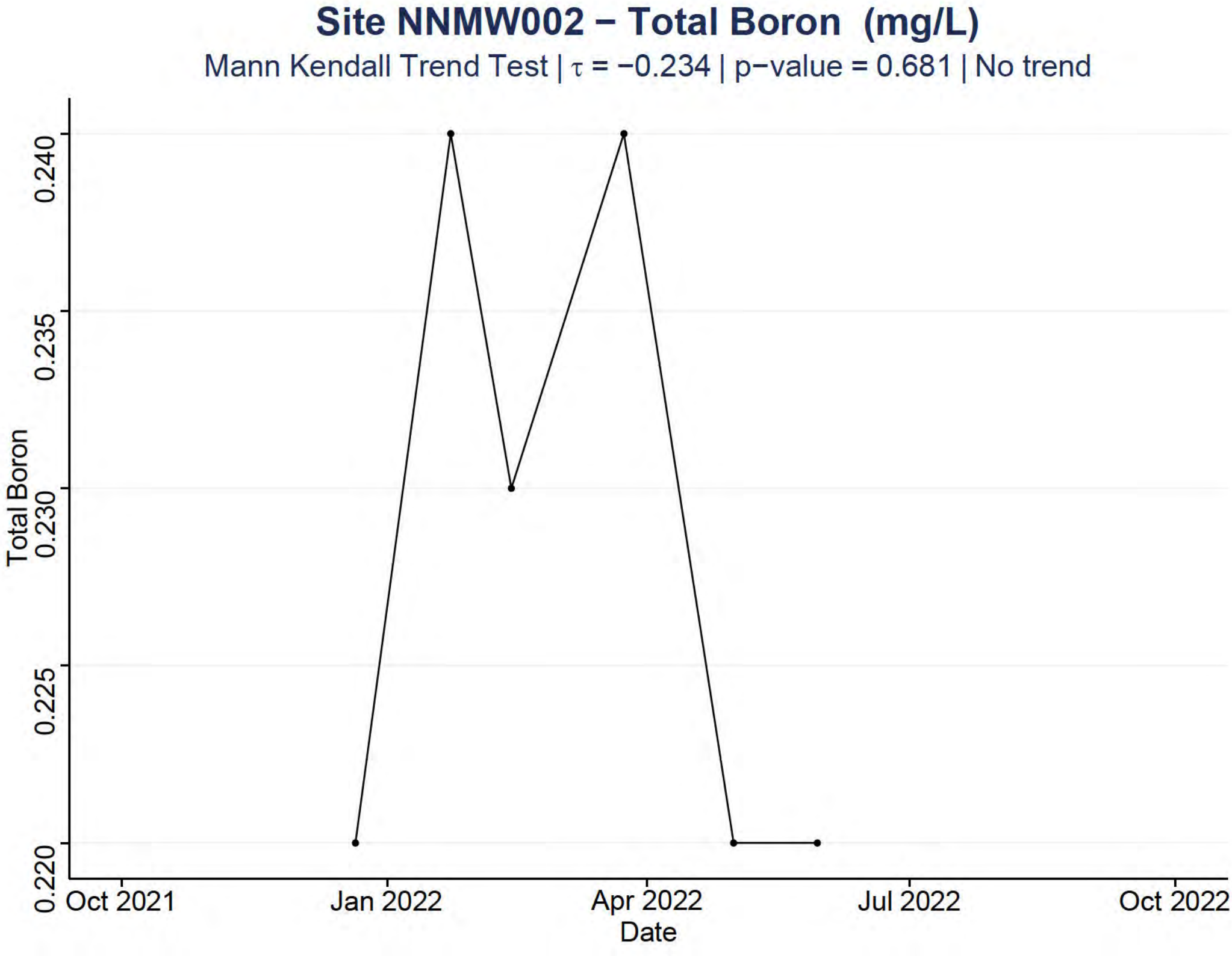

Site NNMW002 – SWL (mbtoc)
Mann Kendall Trend Test | τ = 0.851 | p−value = 0.0139 | Positive trend
SWL
68.80
68.75
68.70
68.65
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

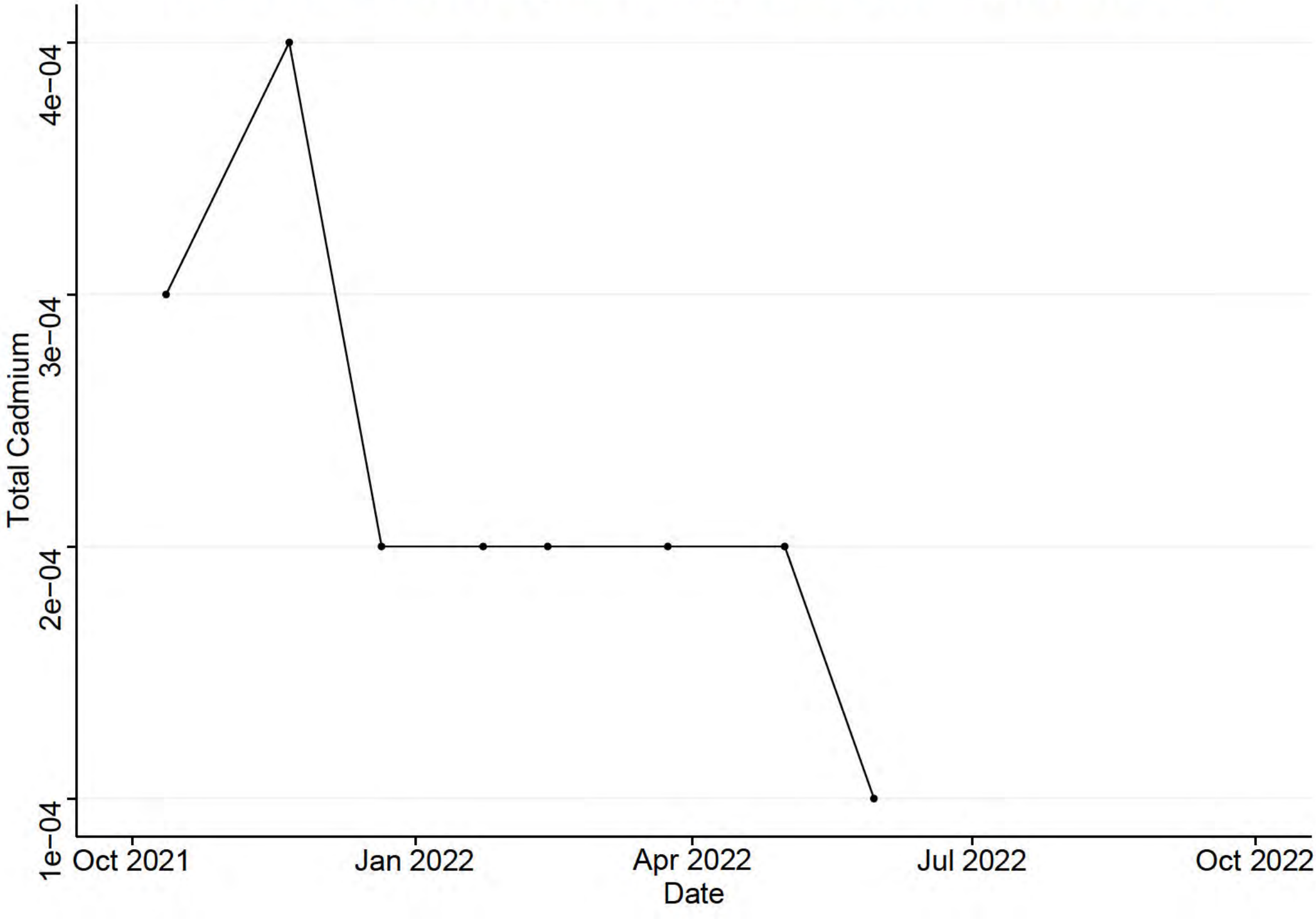

Site NNMW002 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.214 | p−value = 0.536 | No trend
Total Aluminium
0
1
2
3
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

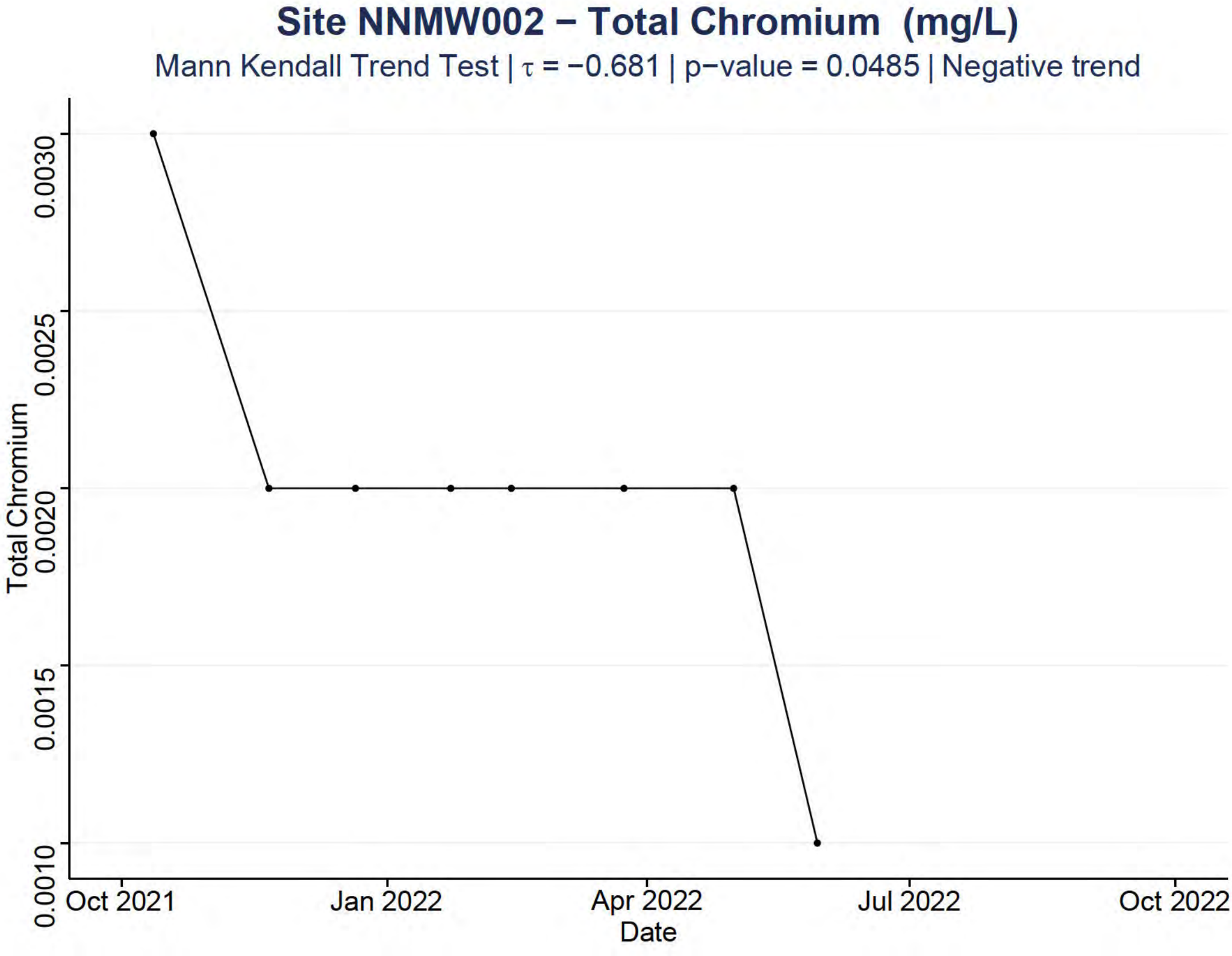

Site NNMW002 – Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Arsenic
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

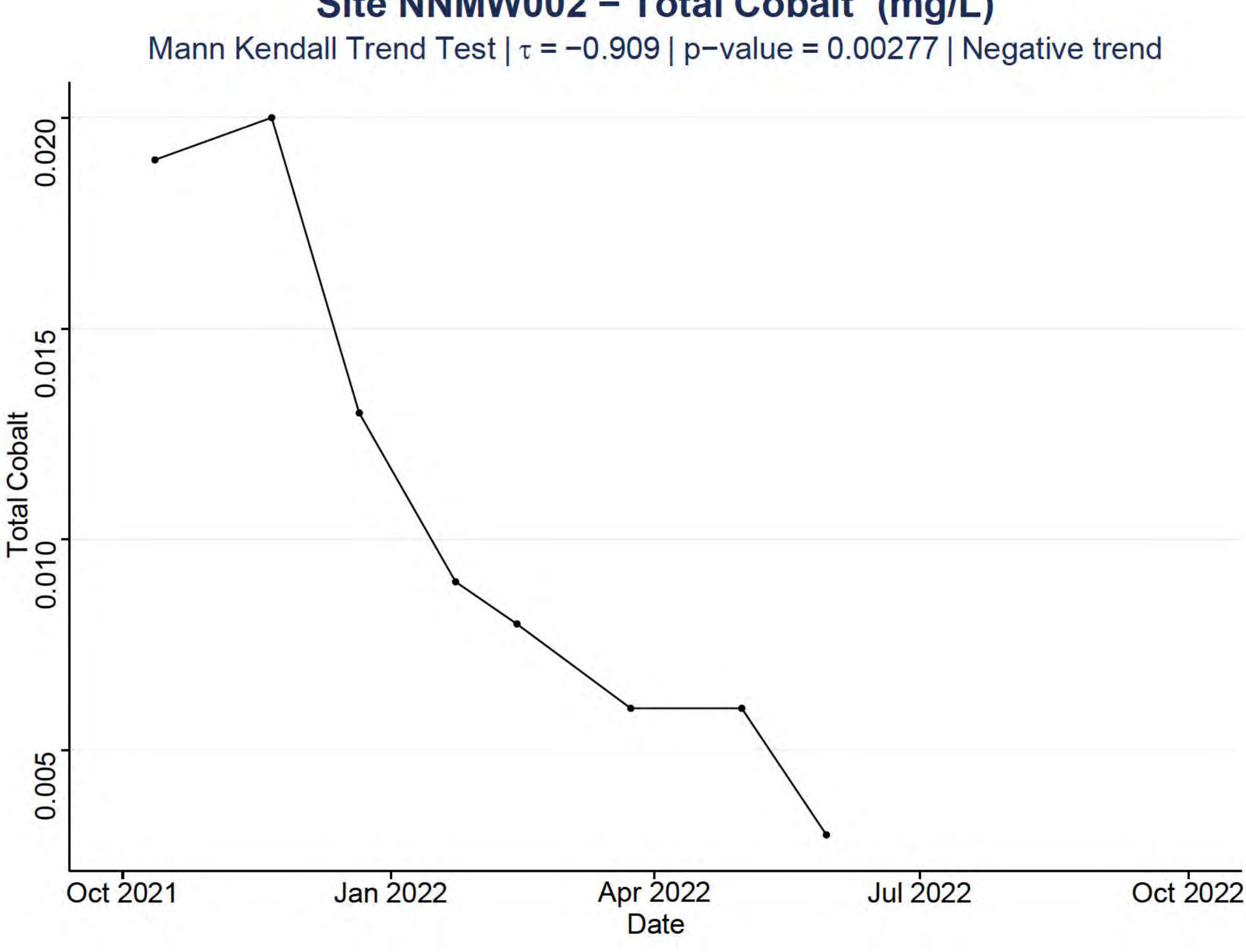

Site NNMW002 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = 0.276 | p−value = 0.566 | No trend
Total Barium
0.20
0.16
0.12
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

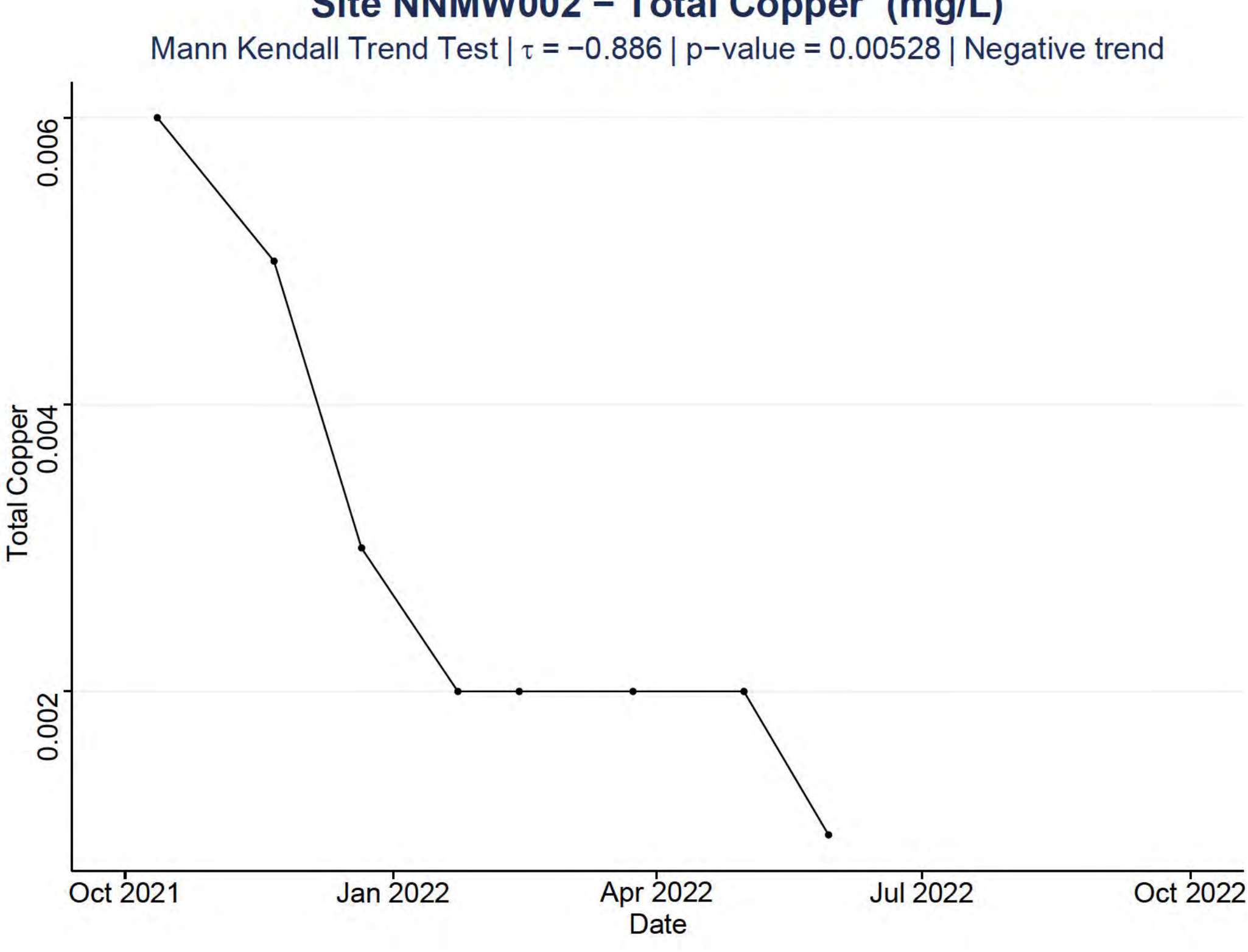

Site NNMW002 − Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Total Beryllium
1e−03
8e−04
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

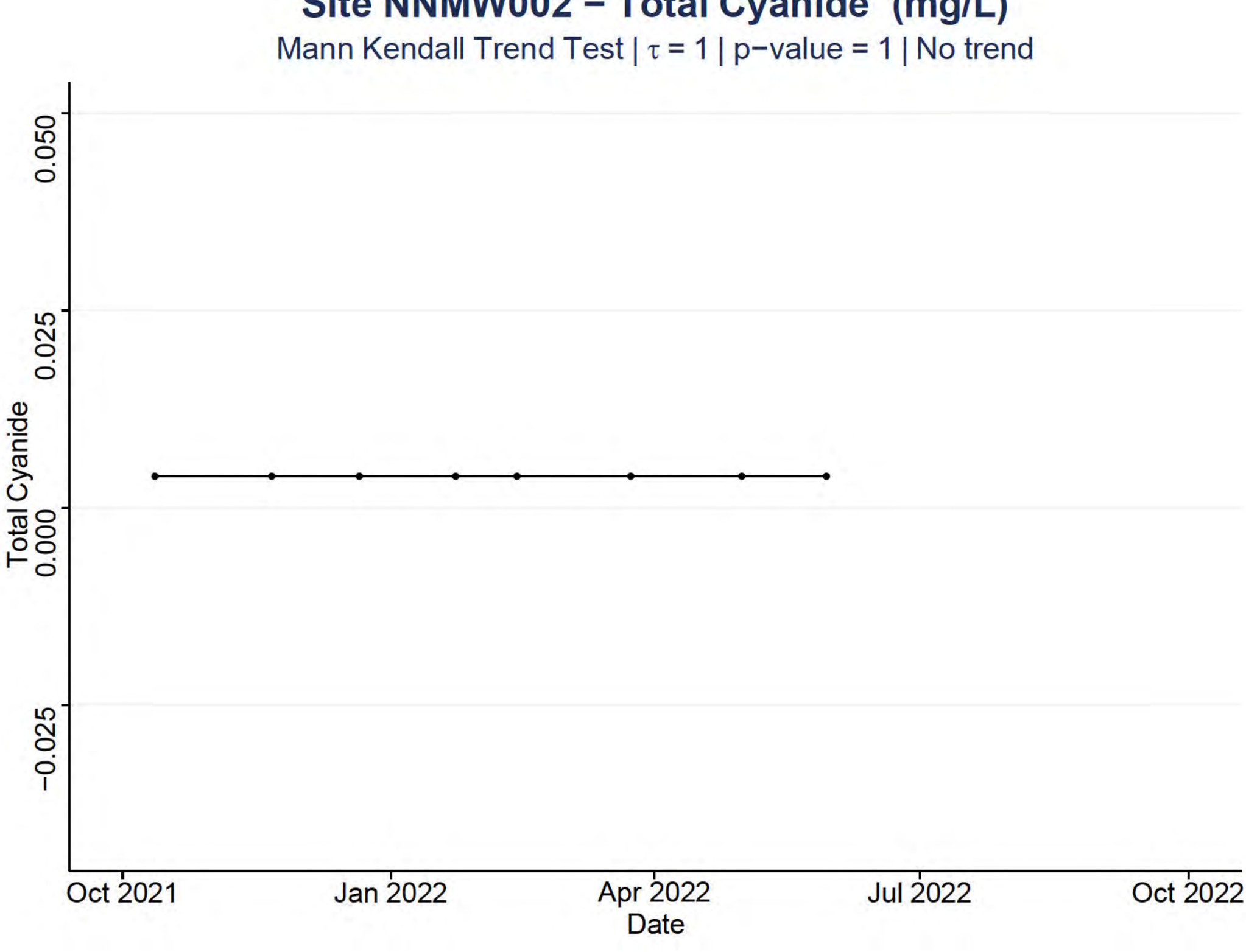

Site NNMW002 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = −0.234 | p−value = 0.681 | No trend
Total Boron
0.240
0.235
0.230
0.225
0.220
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

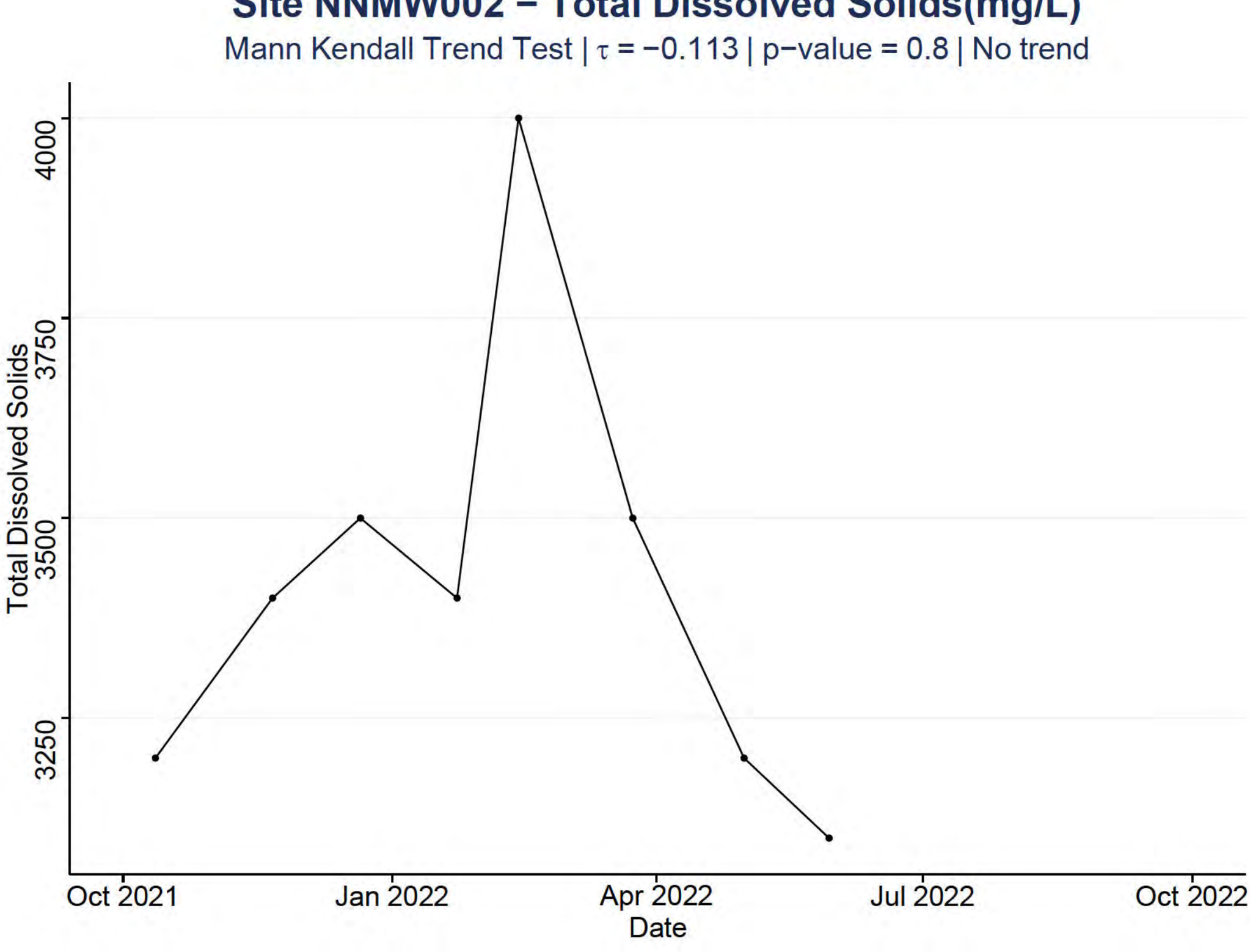

Site NNMW002 − Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.713 | p−value = 0.0315 | Negative trend
Total Cadmium
4e−04
3e−04
2e−04
1e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

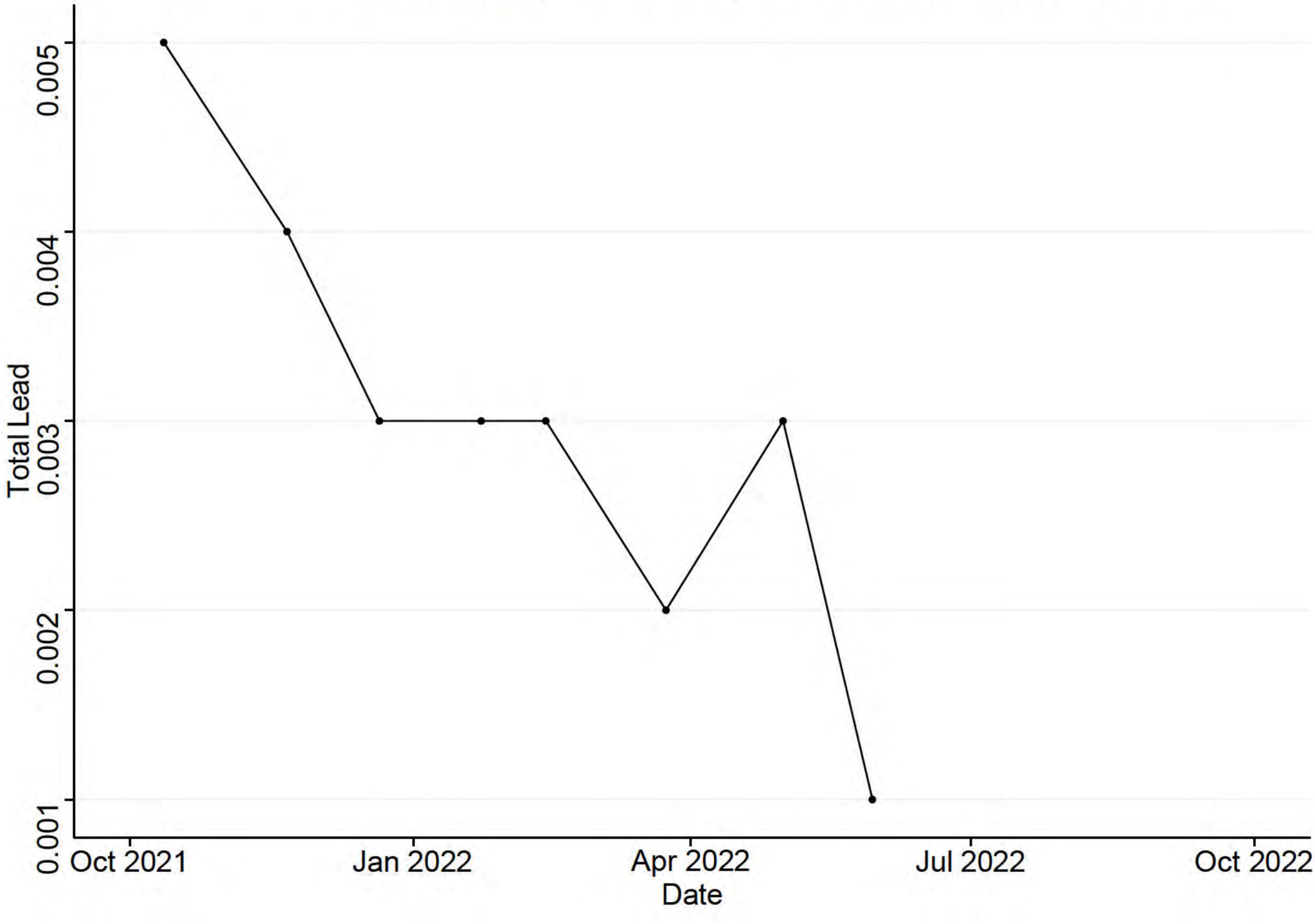

Site NNMW002 − Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.681 | p−value = 0.0485 | Negative trend
Total Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

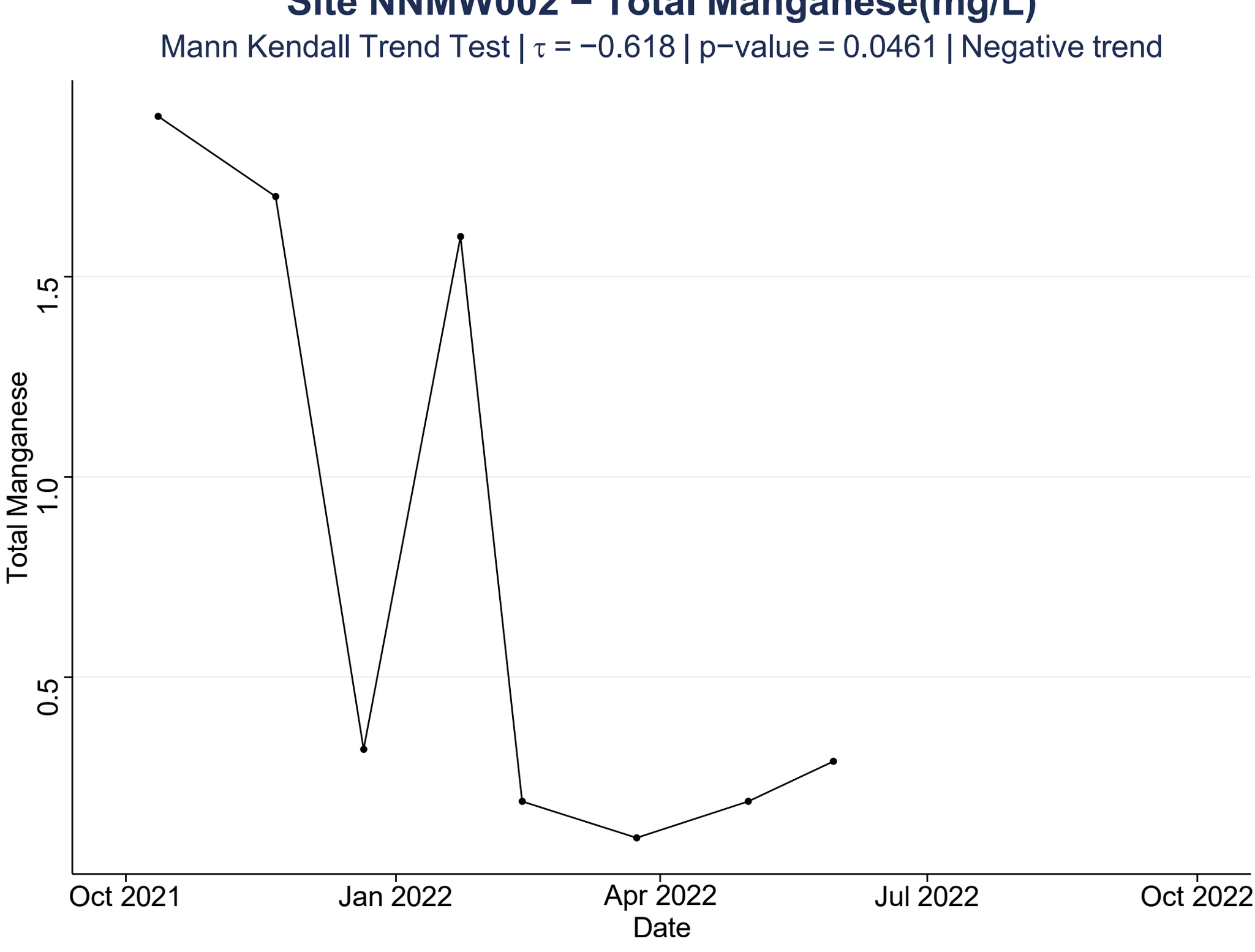

Site NNMW002 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.909 | p−value = 0.00277 | Negative trend
Total Cobalt
0.020
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

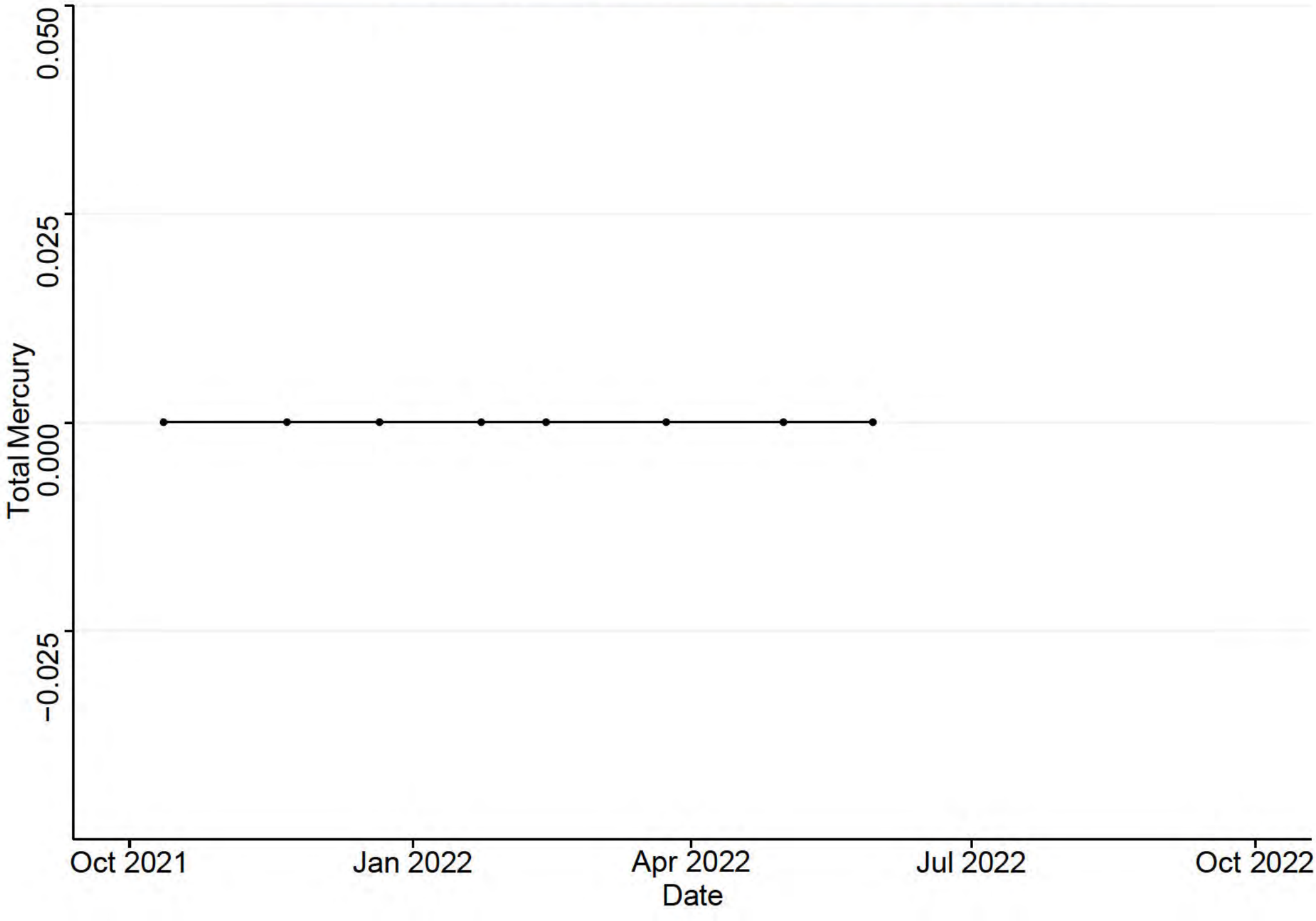

Site NNMW002 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.886 | p−value = 0.00528 | Negative trend
Total Copper
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

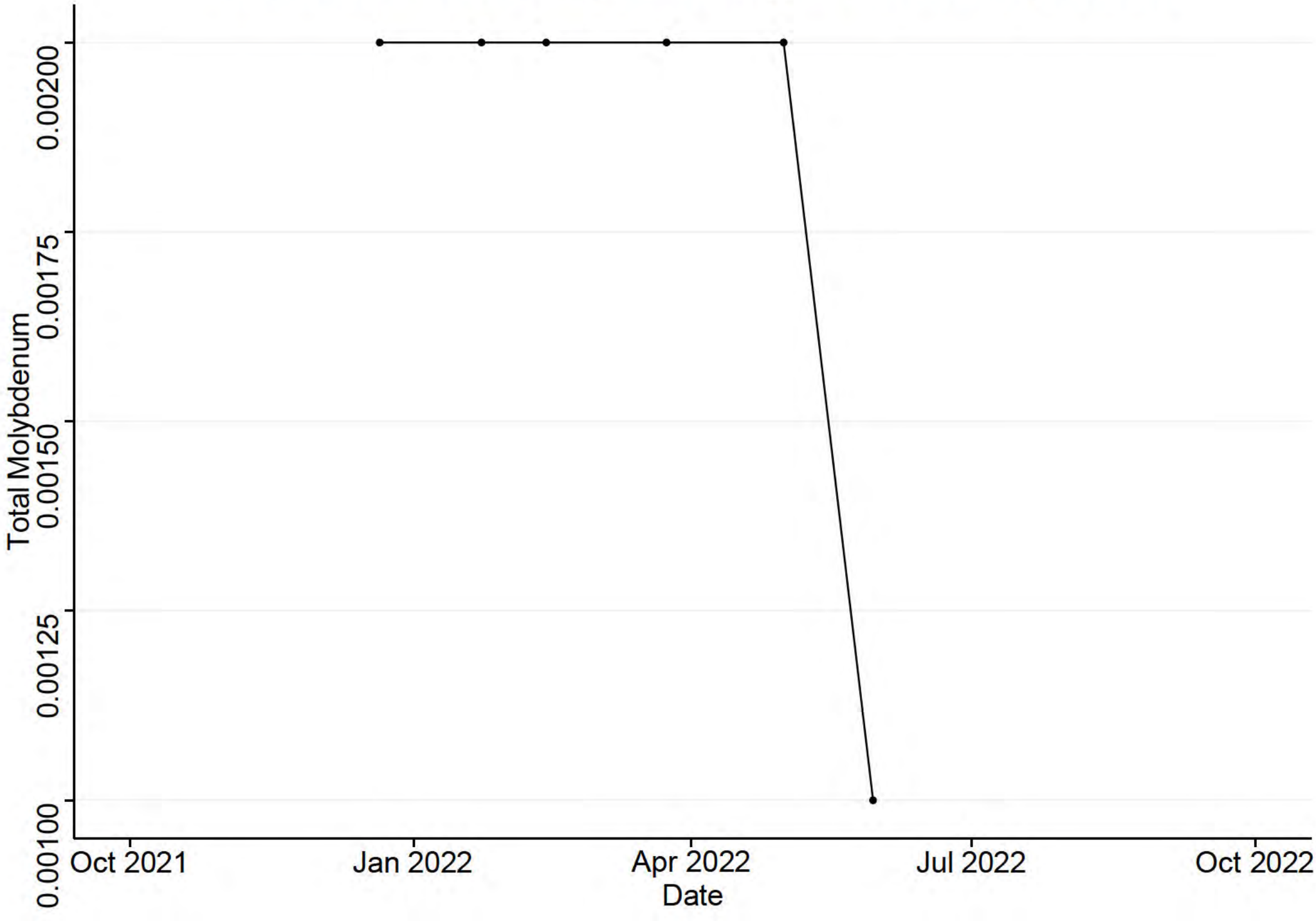

Site NNMW002 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

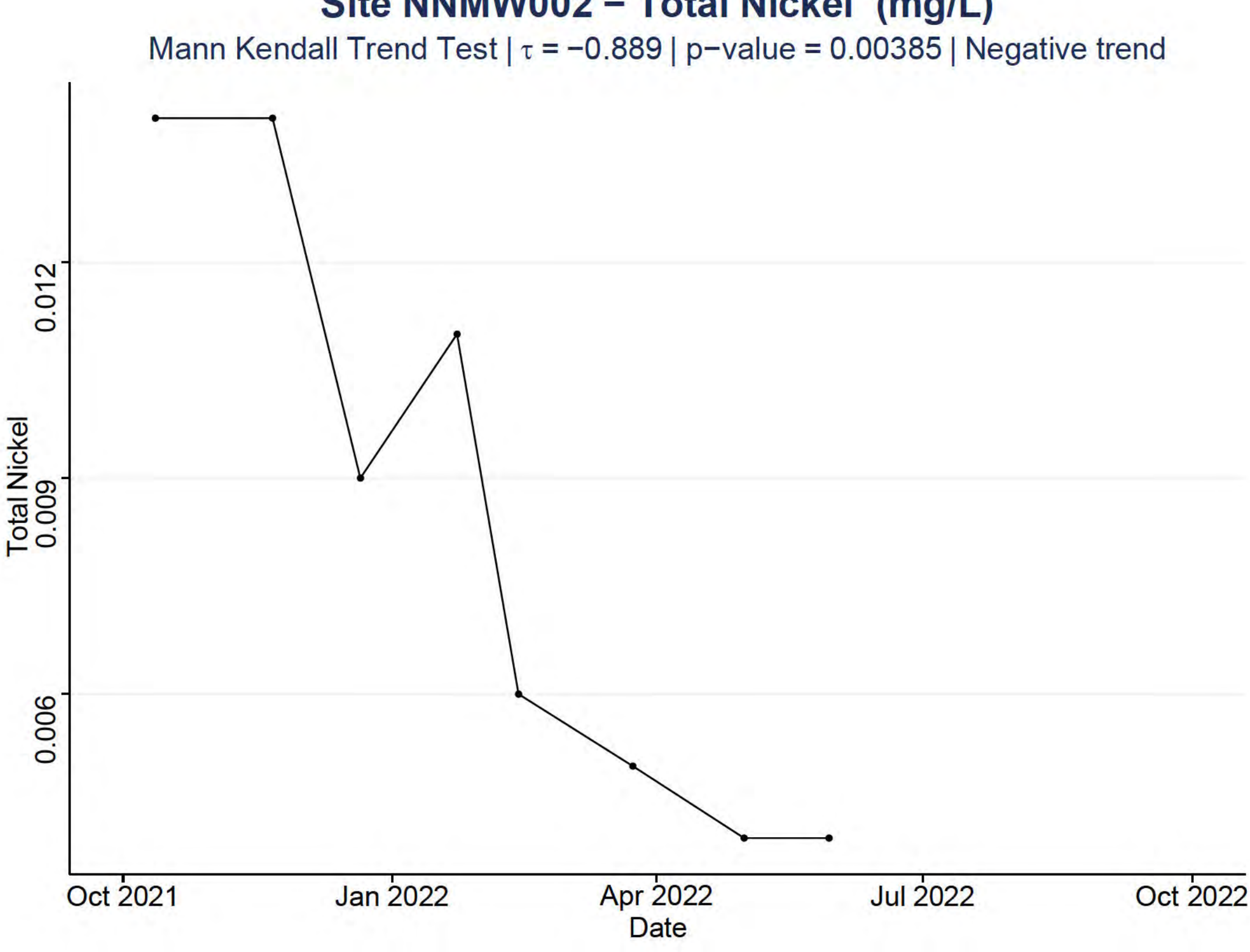

Site NNMW002 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.113 | p−value = 0.8 | No trend
Total Dissolved Solids
4000
3750
3500
3250
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

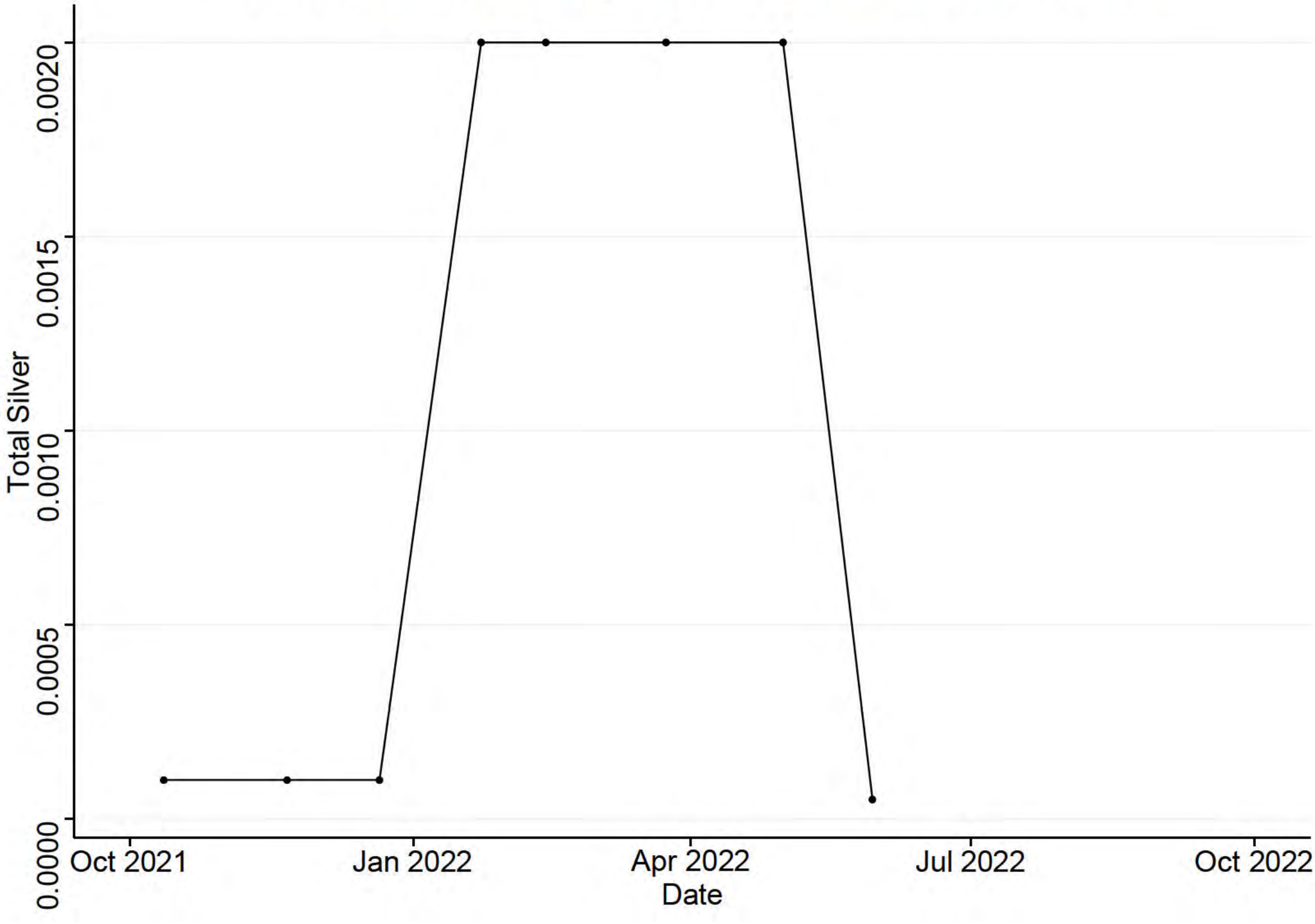

Site NNMW002 − Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.806 | p−value = 0.0116 | Negative trend
Total Lead
0.005
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

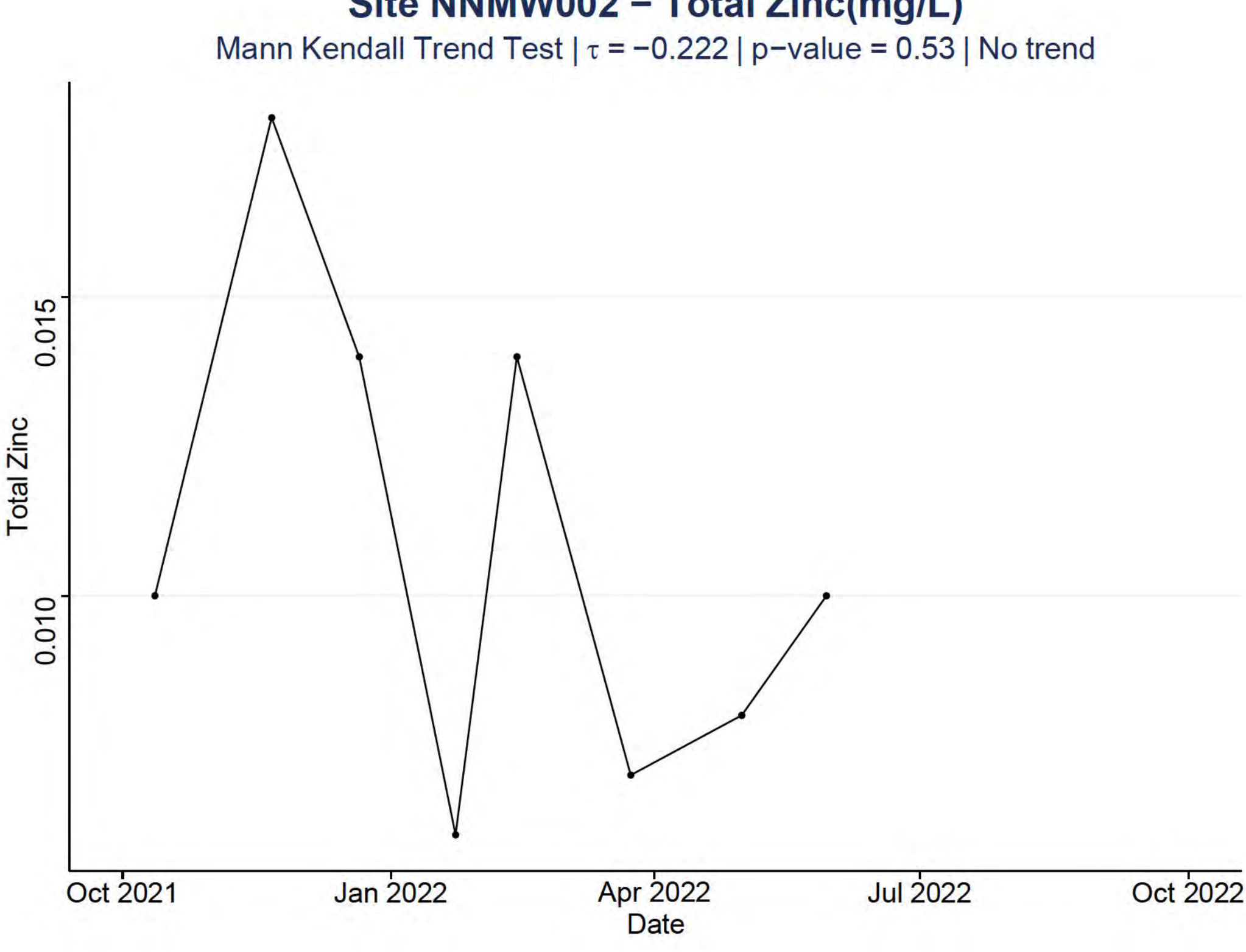

Site NNMW002 − Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.618 | p−value = 0.0461 | Negative trend
Total Manganese
0.5
1.0
1.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

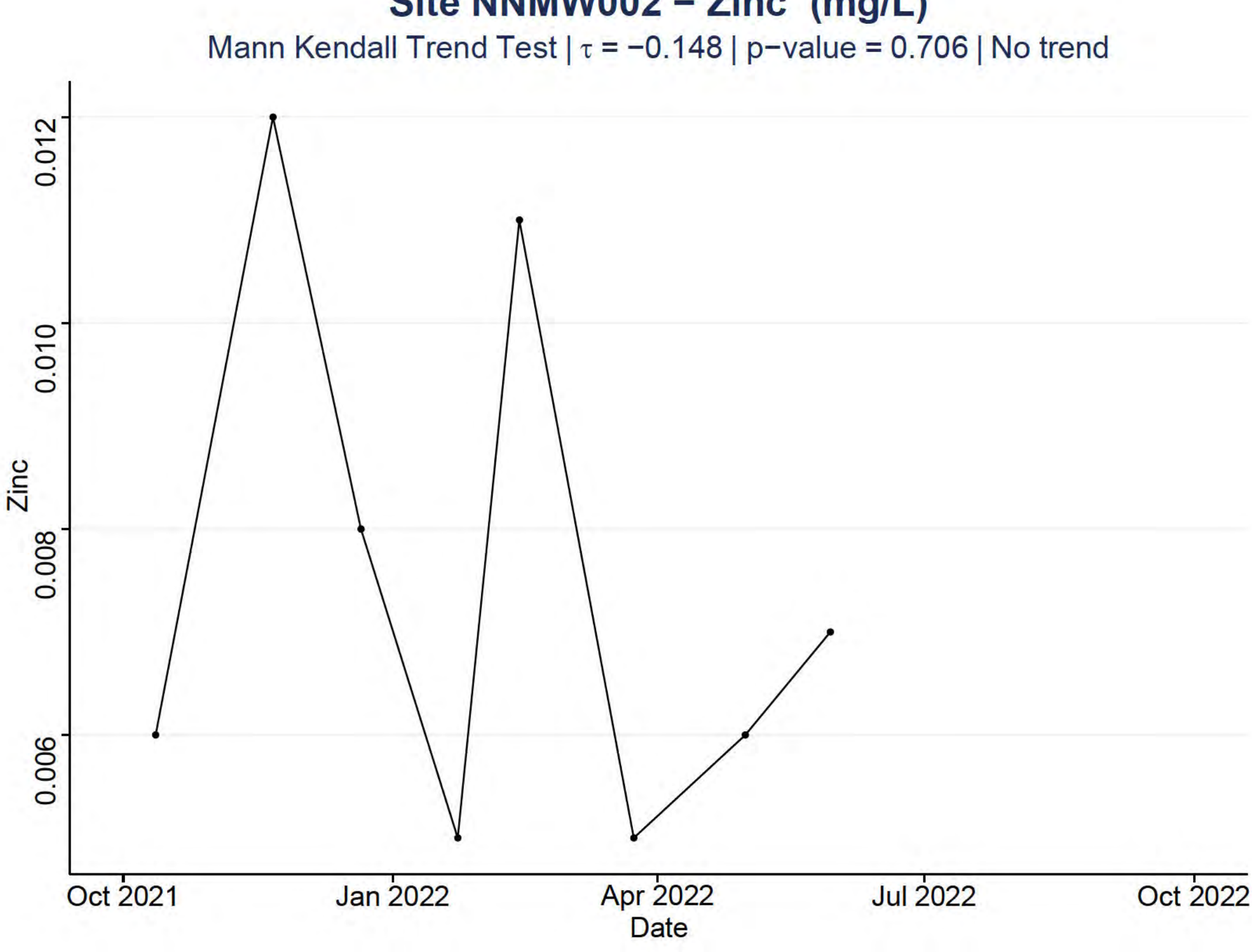

Site NNMW002 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

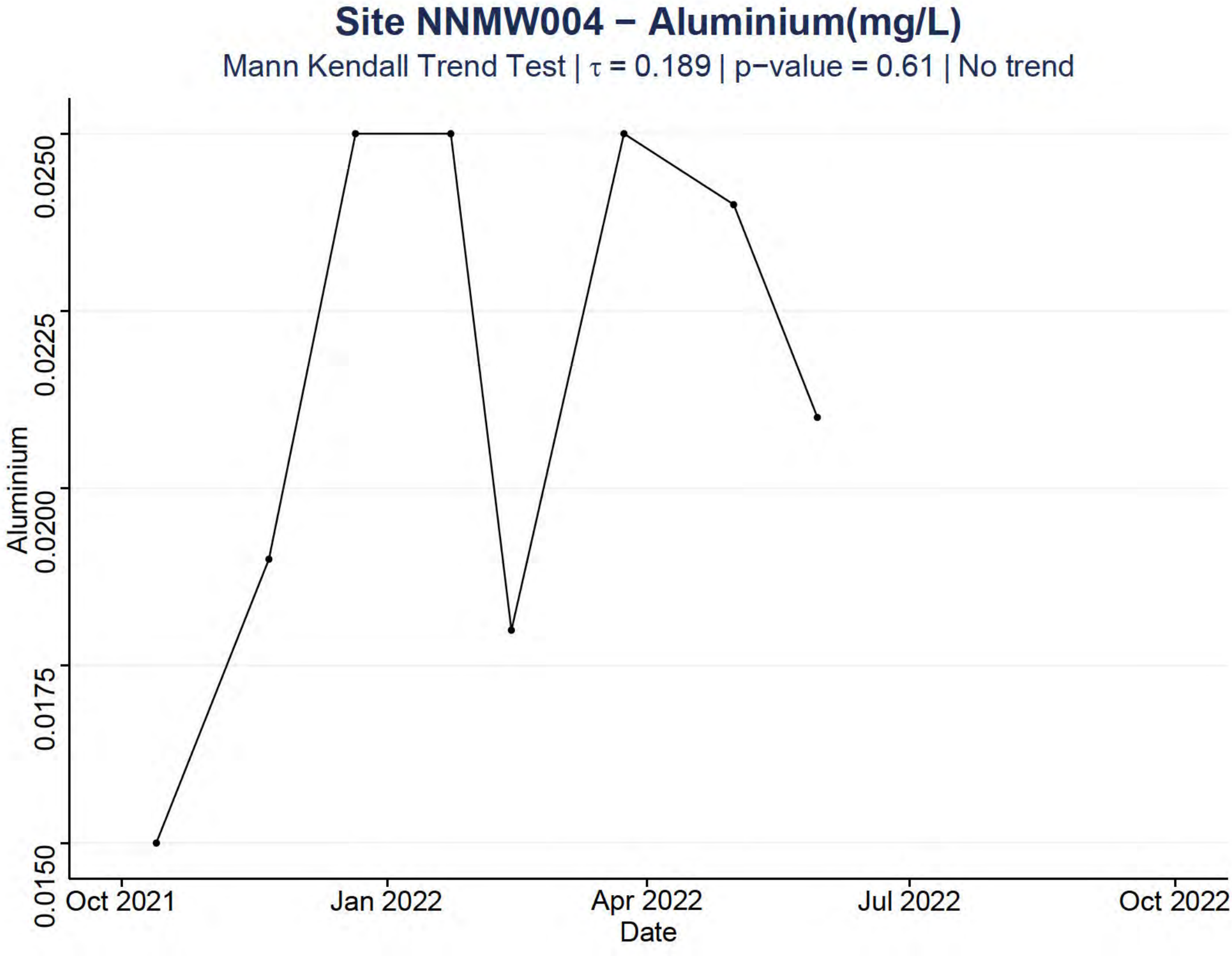

Site NNMW002 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Total Molybdenum
0.00200
0.00175
0.00150
0.00125
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

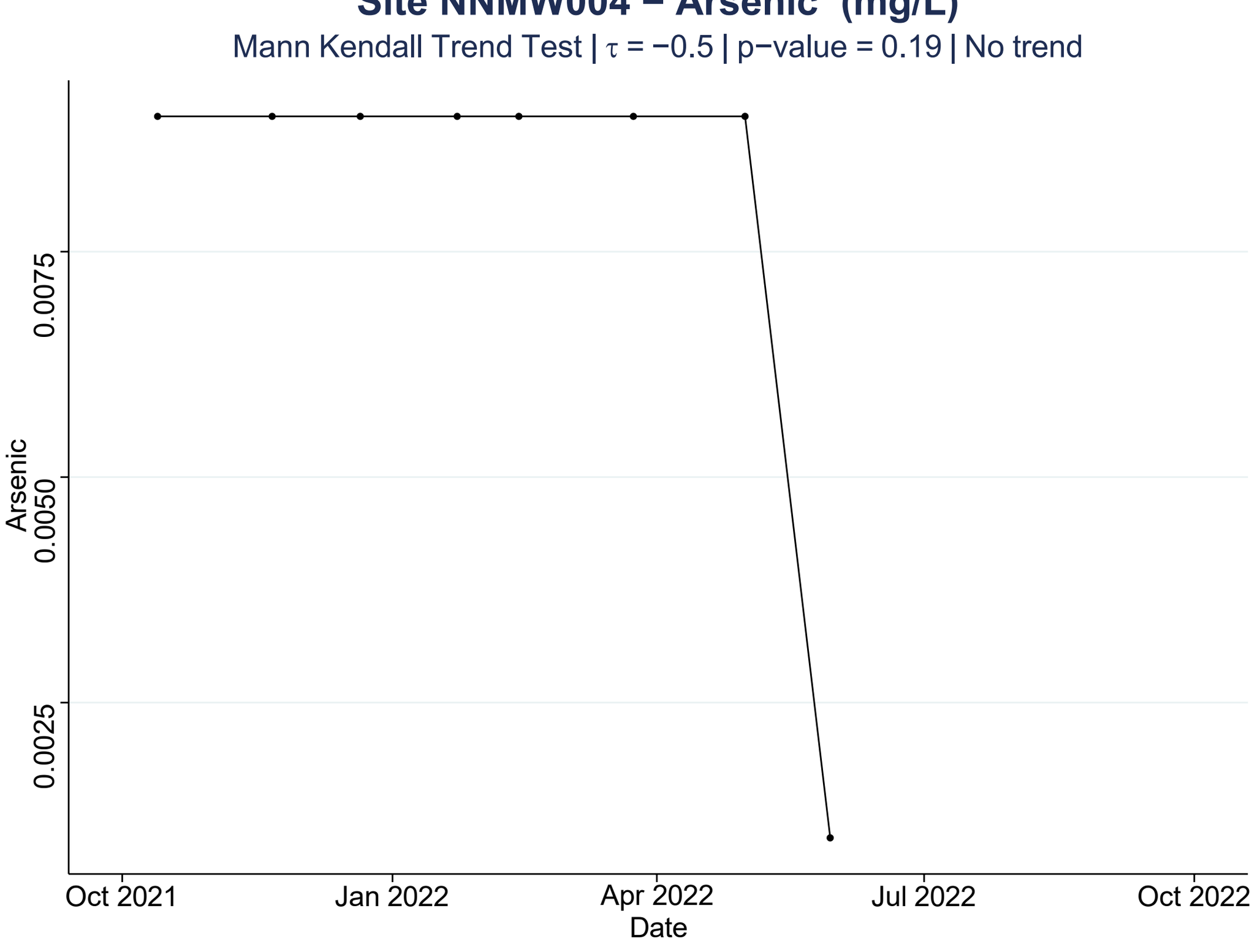

Site NNMW002 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.889 | p−value = 0.00385 | Negative trend
Total Nickel
0.012
0.009
0.006
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

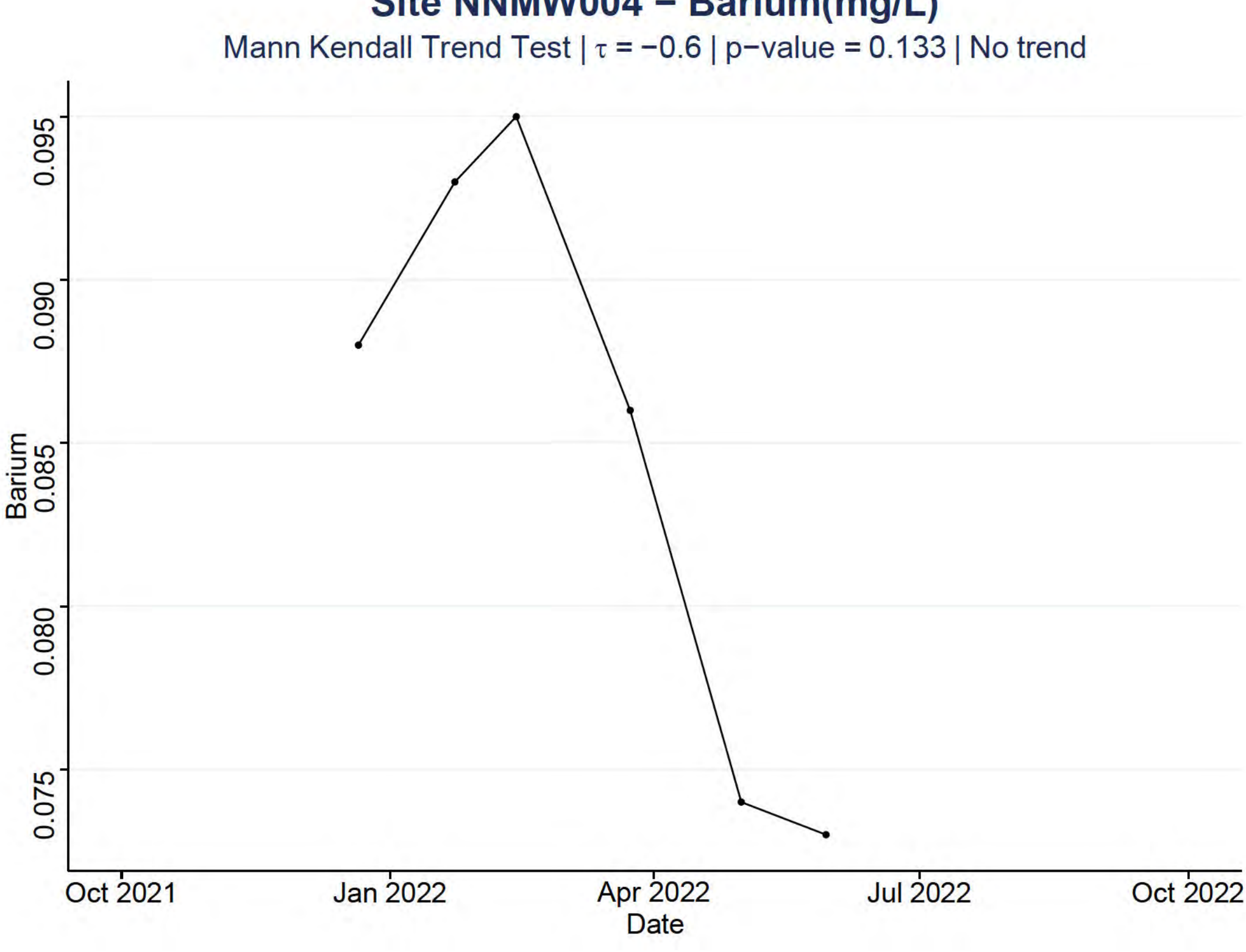

Site NNMW002 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Total Silver
0.0000
0.0005
0.0010
0.0015
0.0020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

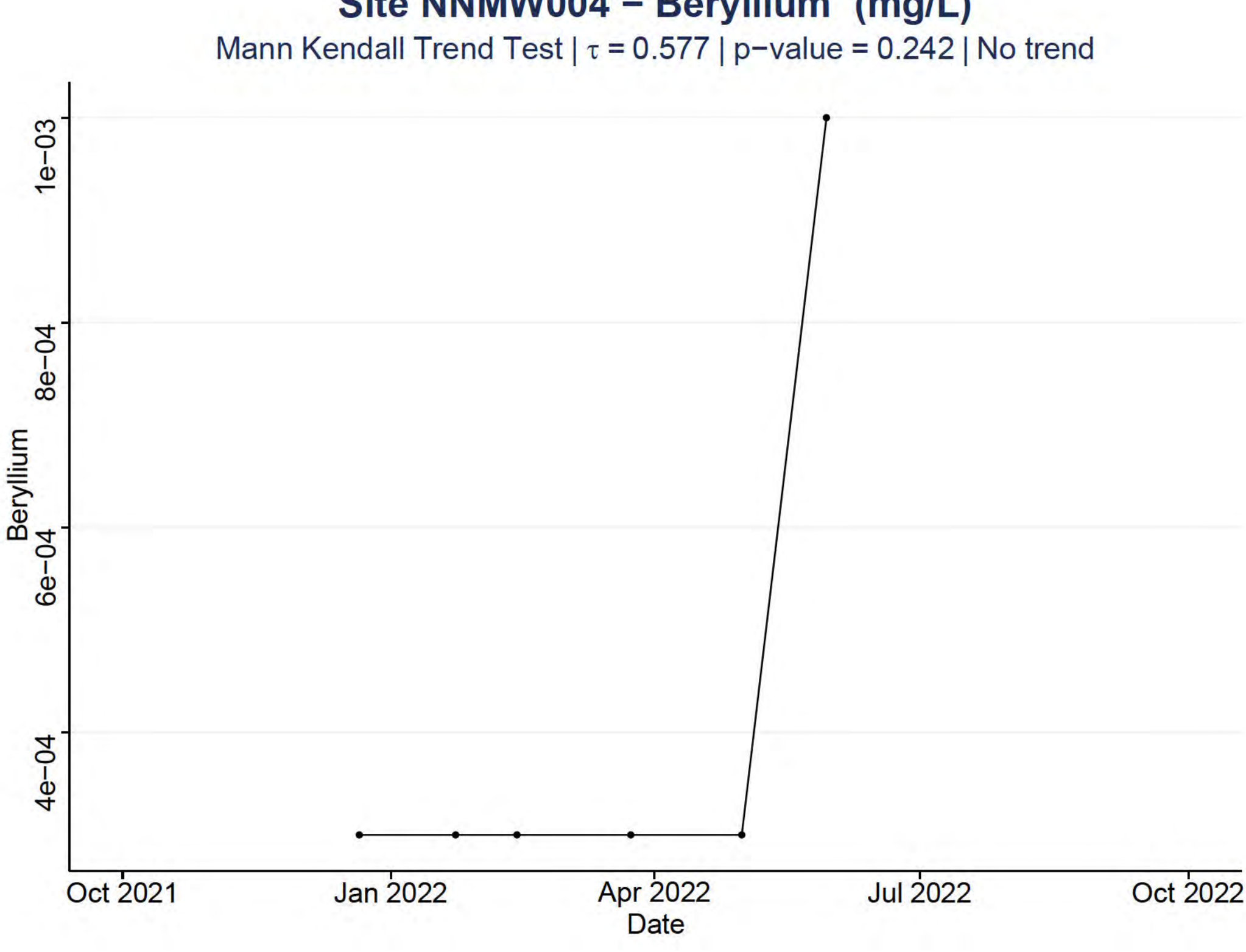

Site NNMW002 − Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.222 | p−value = 0.53 | No trend
Total Zinc
0.015
0.010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

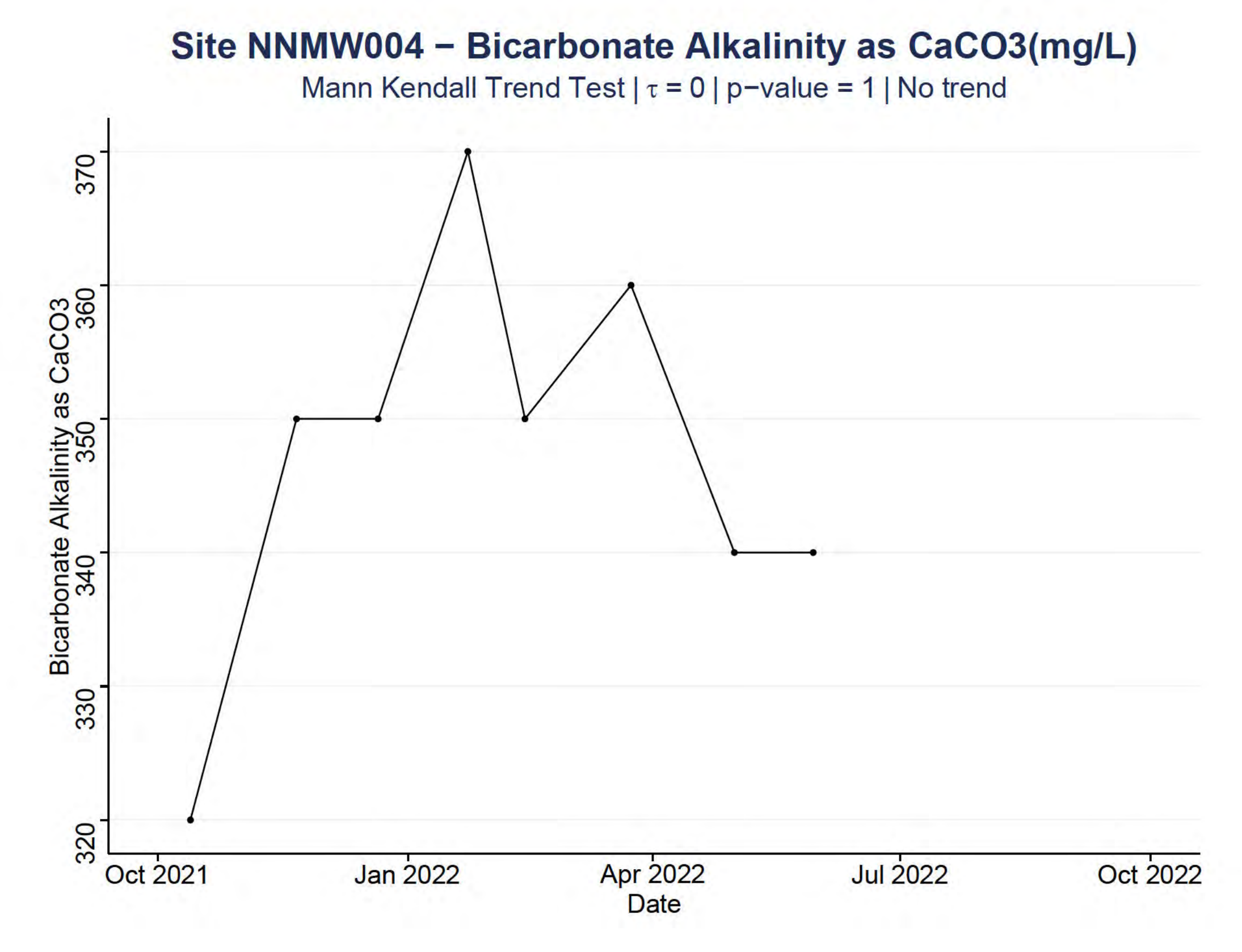

Site NNMW002 – Zinc (mg/L)
Mann Kendall Trend Test | τ = −0.148 | p−value = 0.706 | No trend
Zinc
0.012
0.010
0.008
0.006
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

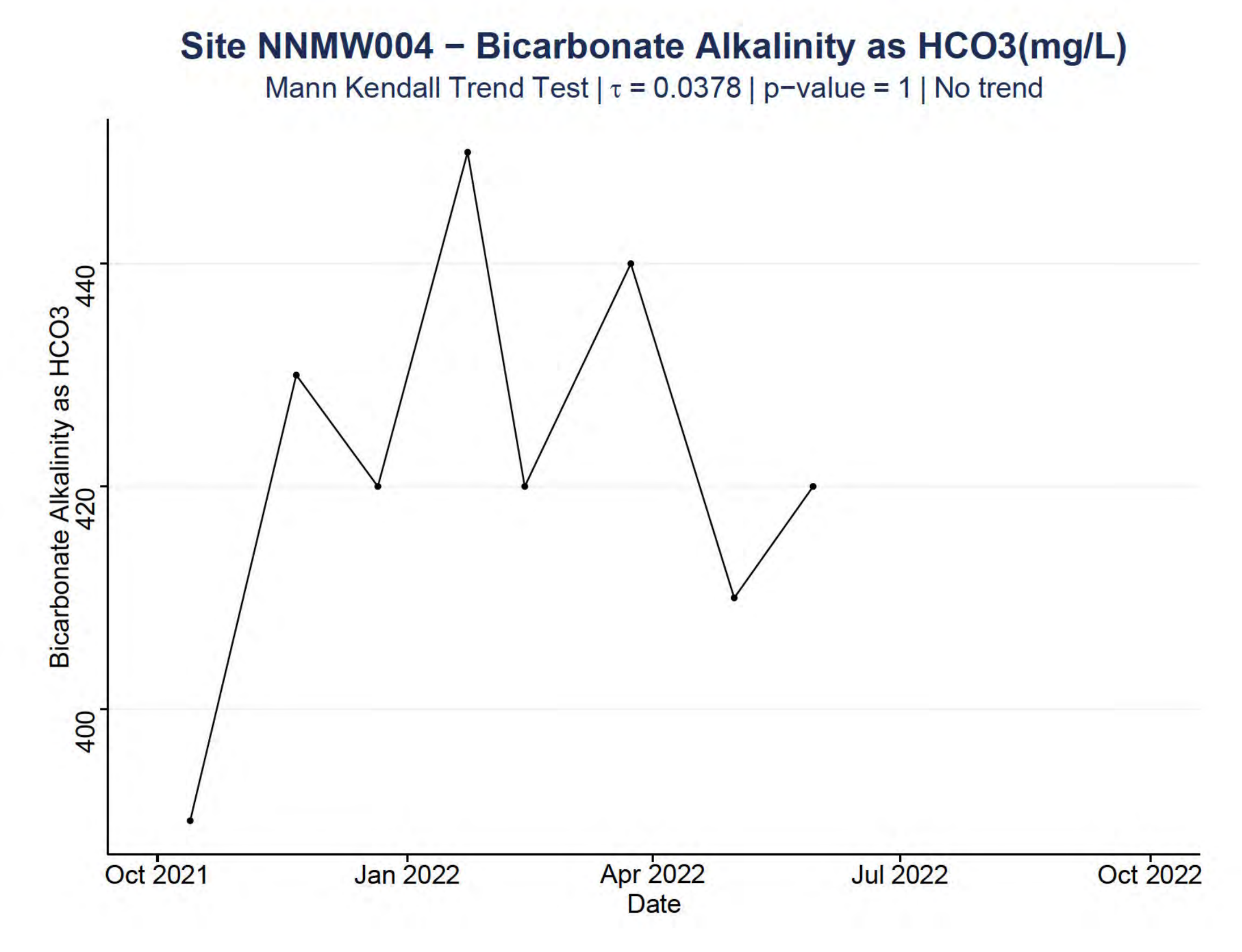

Site NNMW004 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.189 | p−value = 0.61 | No trend
Aluminium
0.0250
0.0225
0.0200
0.0175
0.0150
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

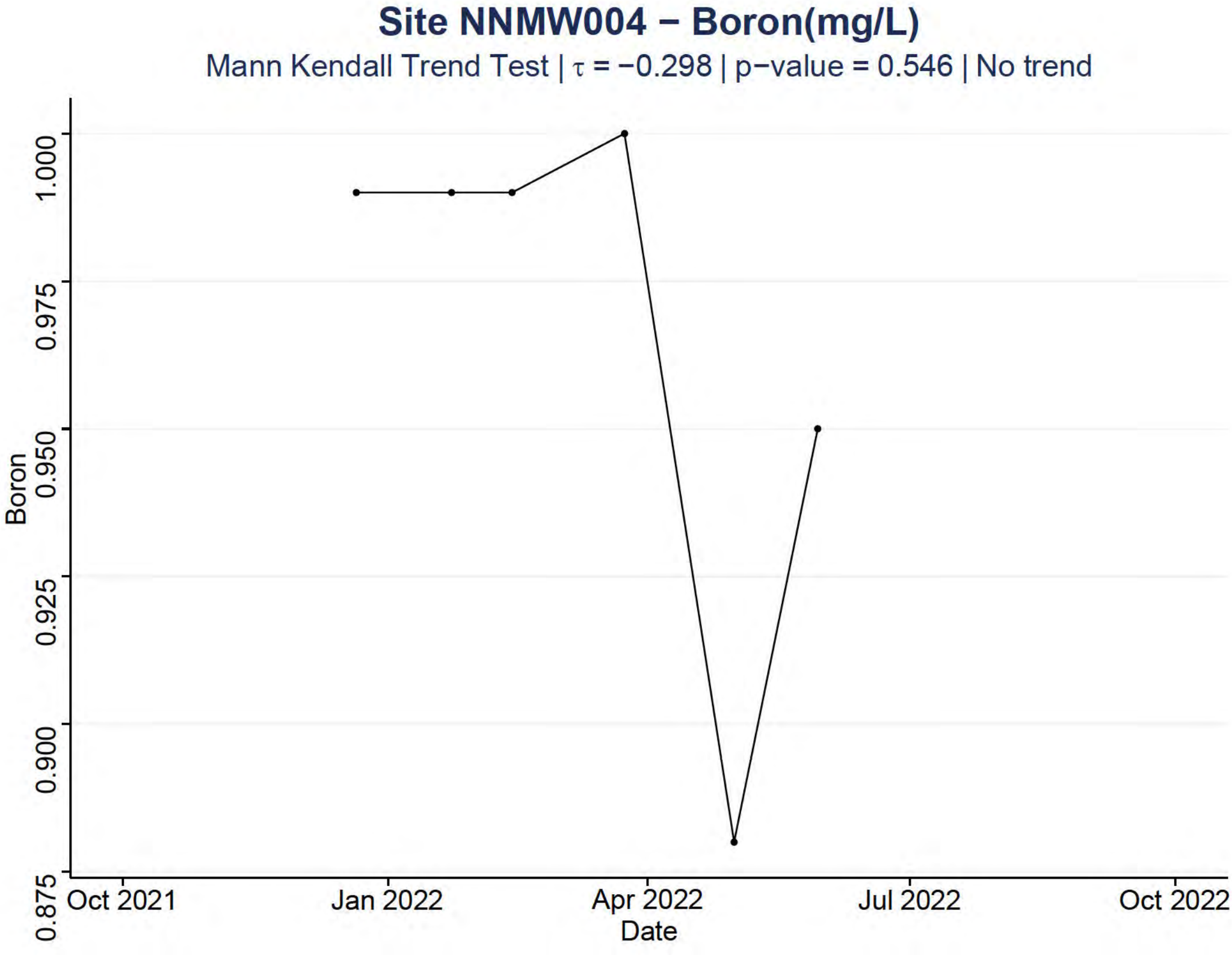

Site NNMW004 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

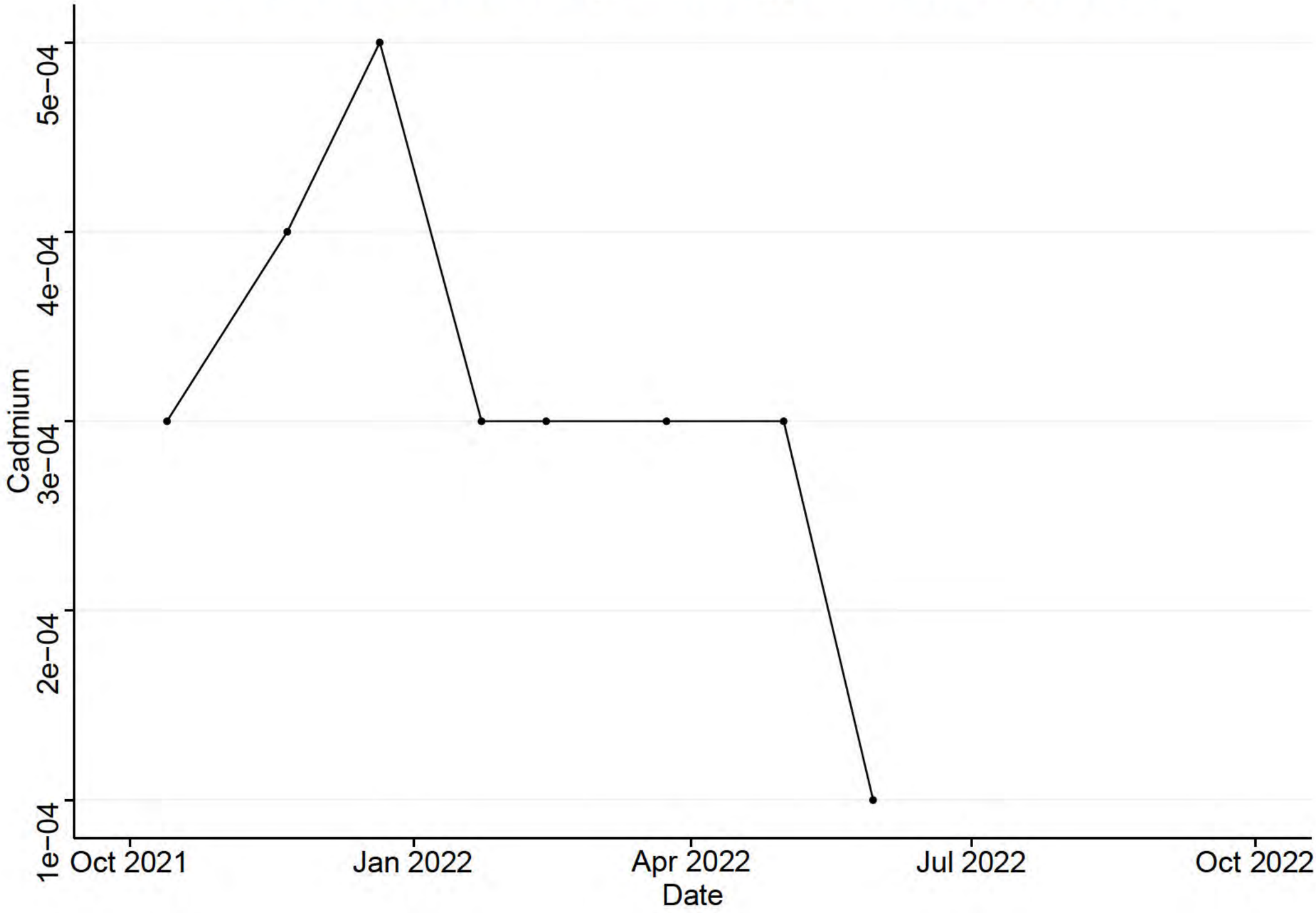

Site NNMW004 − Barium(mg/L)
Mann Kendall Trend Test | τ = −0.6 | p−value = 0.133 | No trend
Barium
0.095
0.090
0.085
0.080
0.075
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

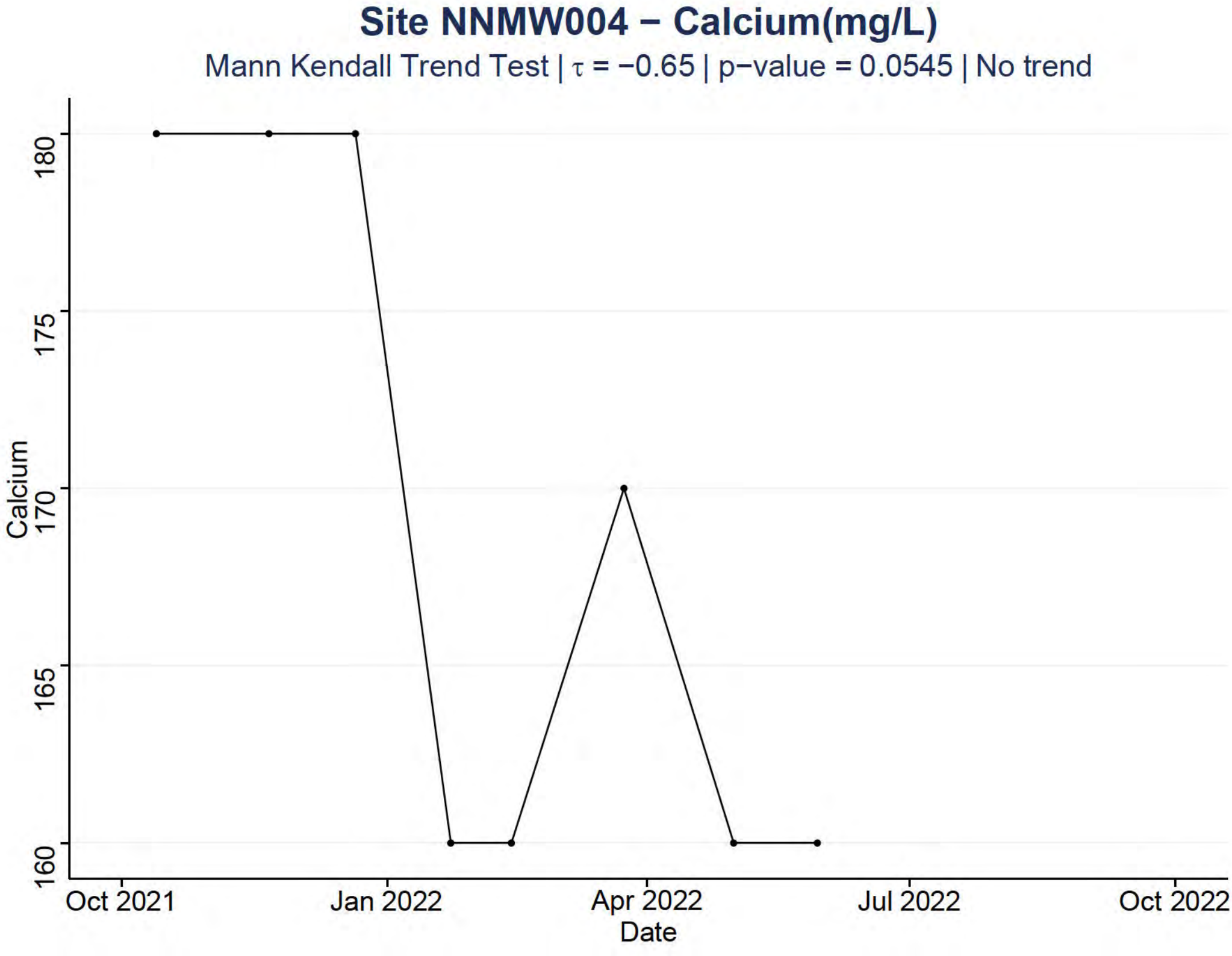

Site NNMW004 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

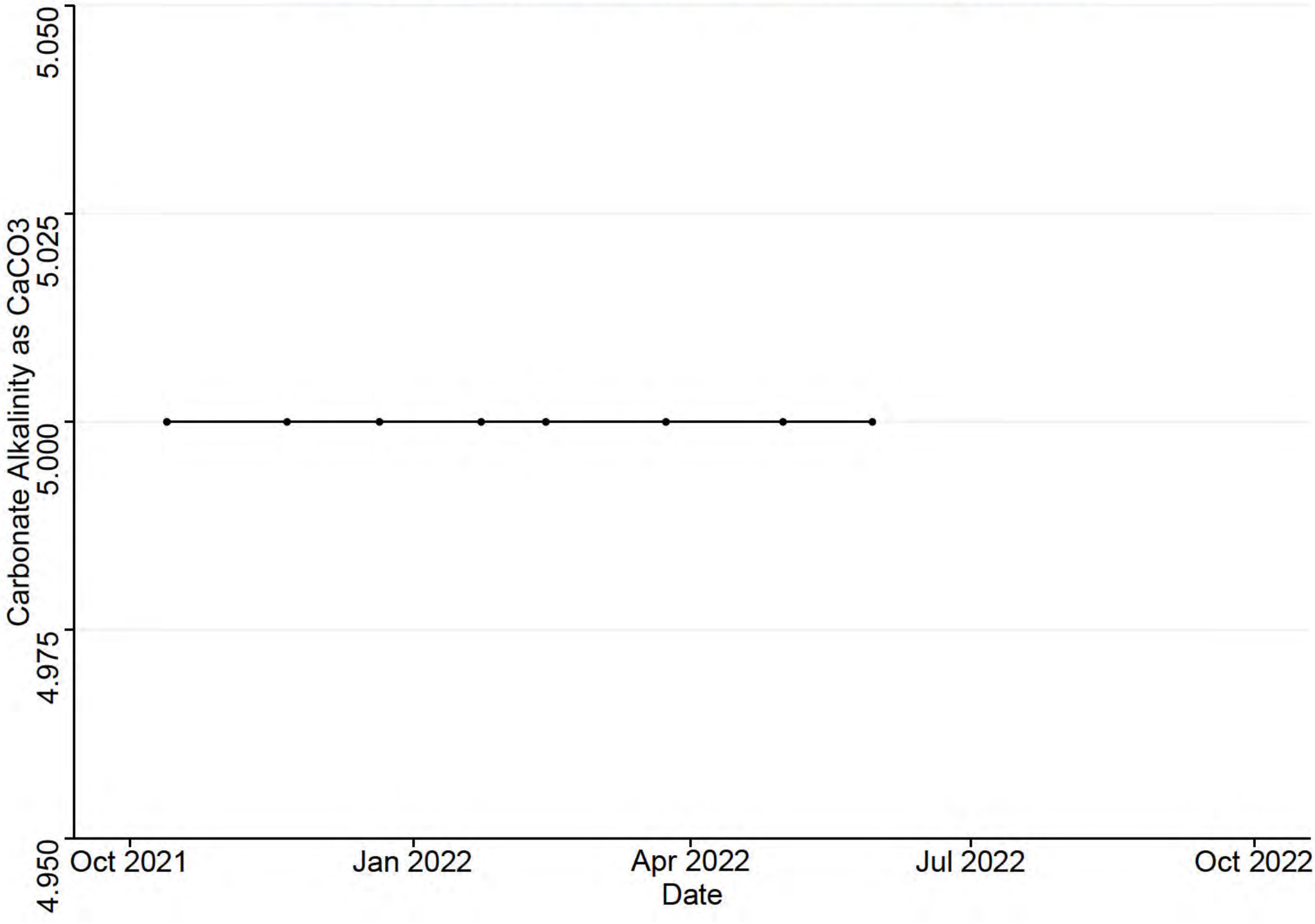

Site NNMW004 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Bicarbonate Alkalinity as CaCO3
320
330
340
350
360
370
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

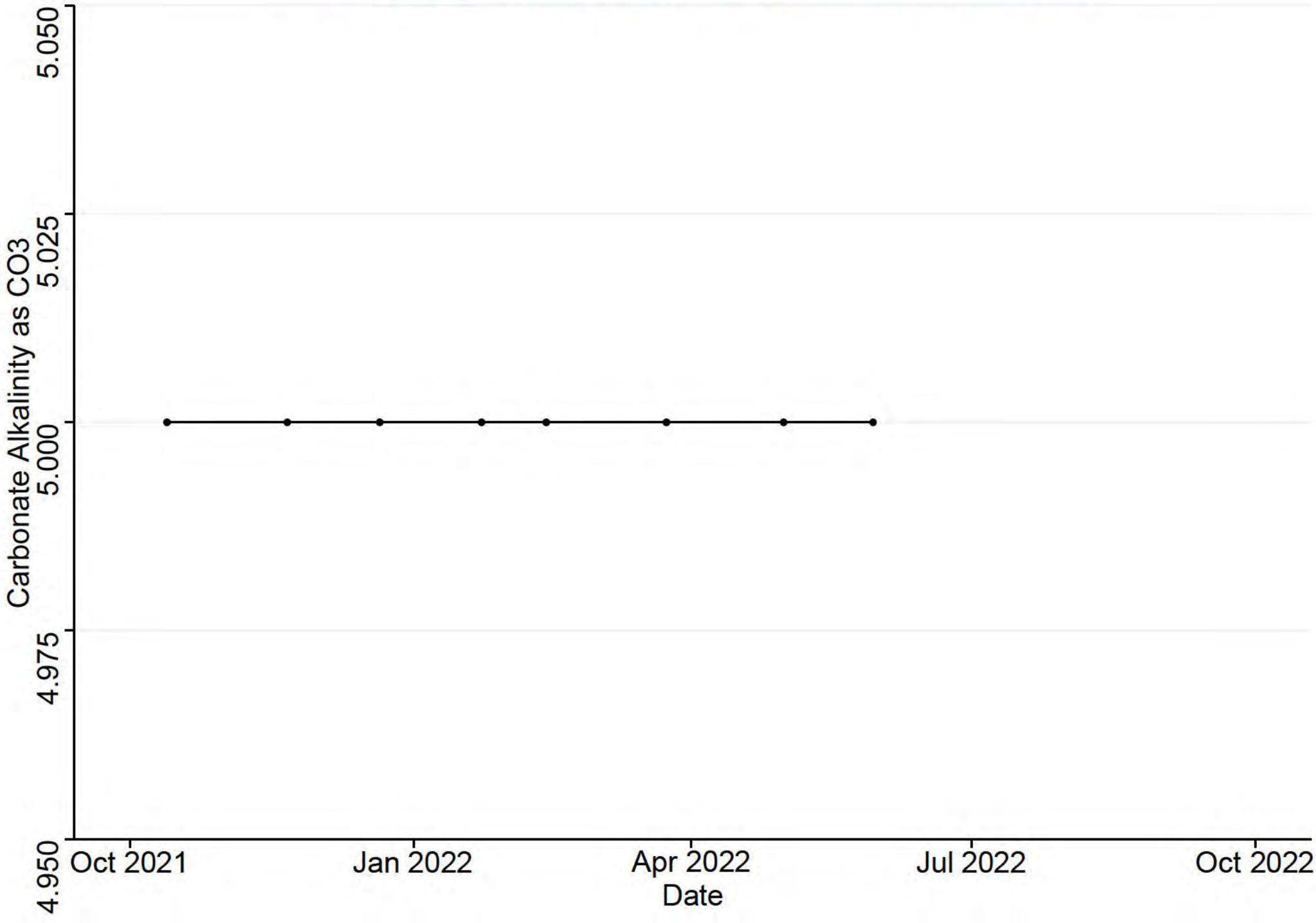

Site NNMW004 – Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.0378 | p−value = 1 | No trend
Bicarbonate Alkalinity as HCO3
400
420
440
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

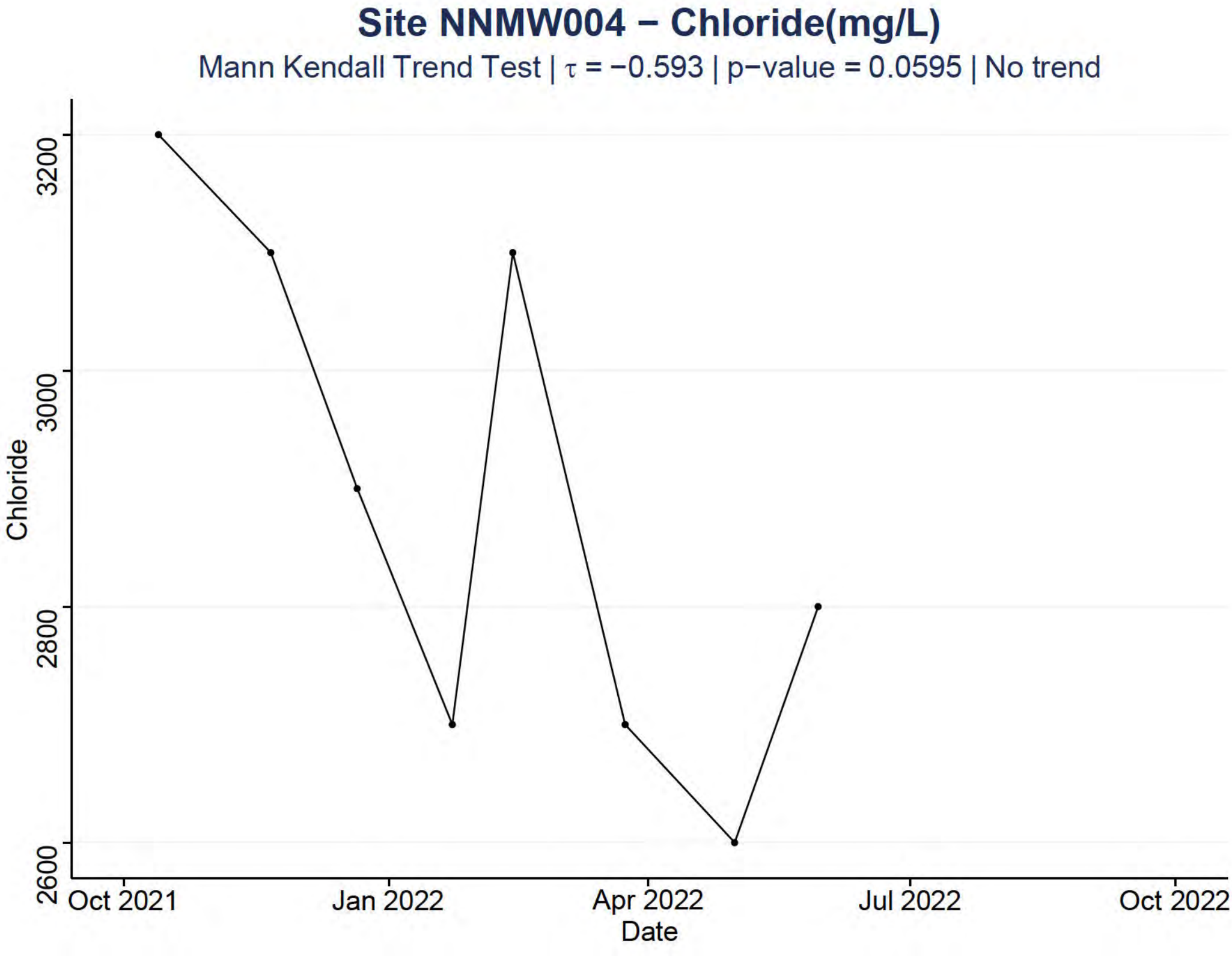

Site NNMW004 – Boron(mg/L)
Mann Kendall Trend Test | τ = −0.298 | p−value = 0.546 | No trend
Boron
1.000
0.975
0.950
0.925
0.900
0.875
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

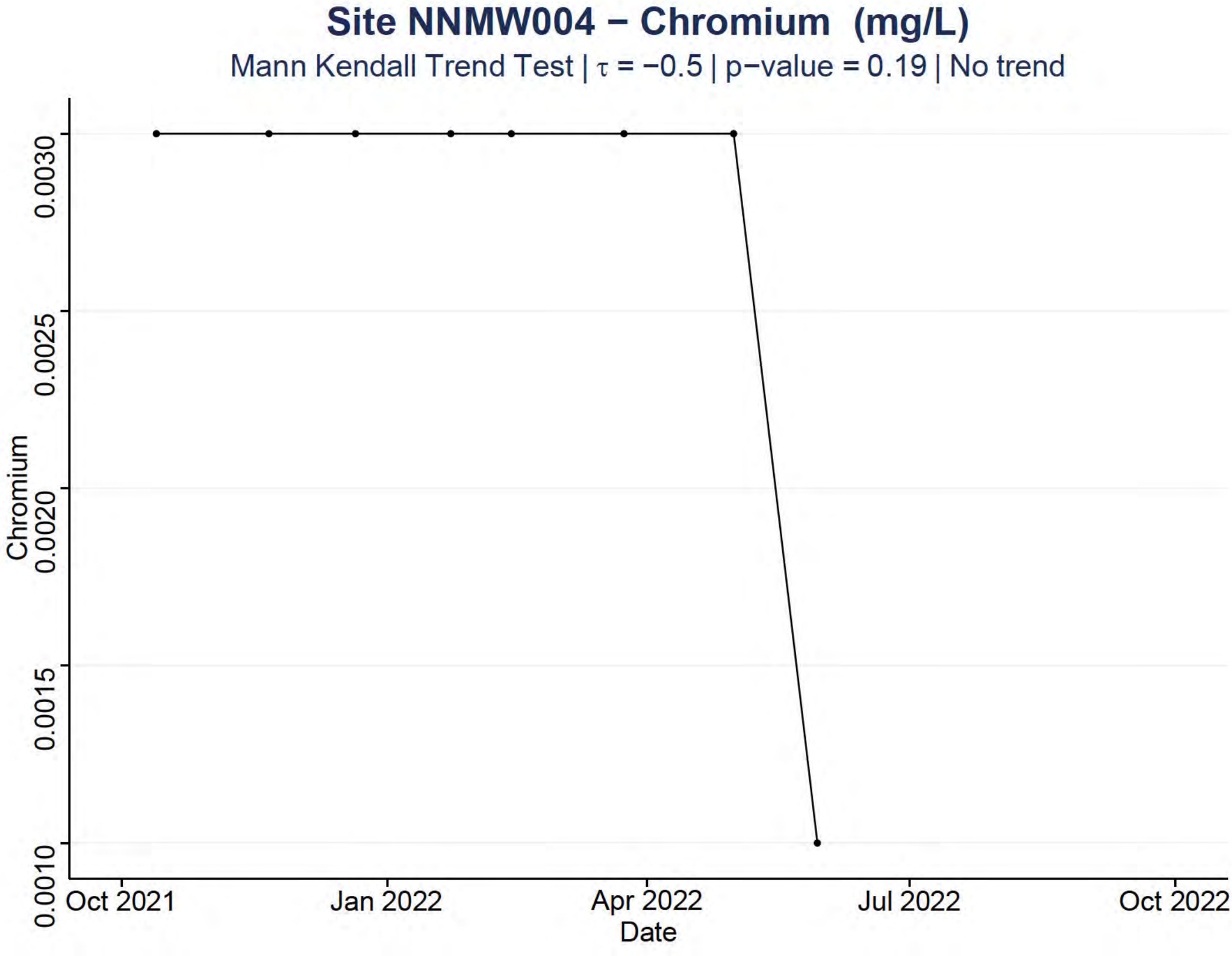

Site NNMW004 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.535 | p−value = 0.115 | No trend
Cadmium
5e−04
4e−04
3e−04
2e−04
1e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

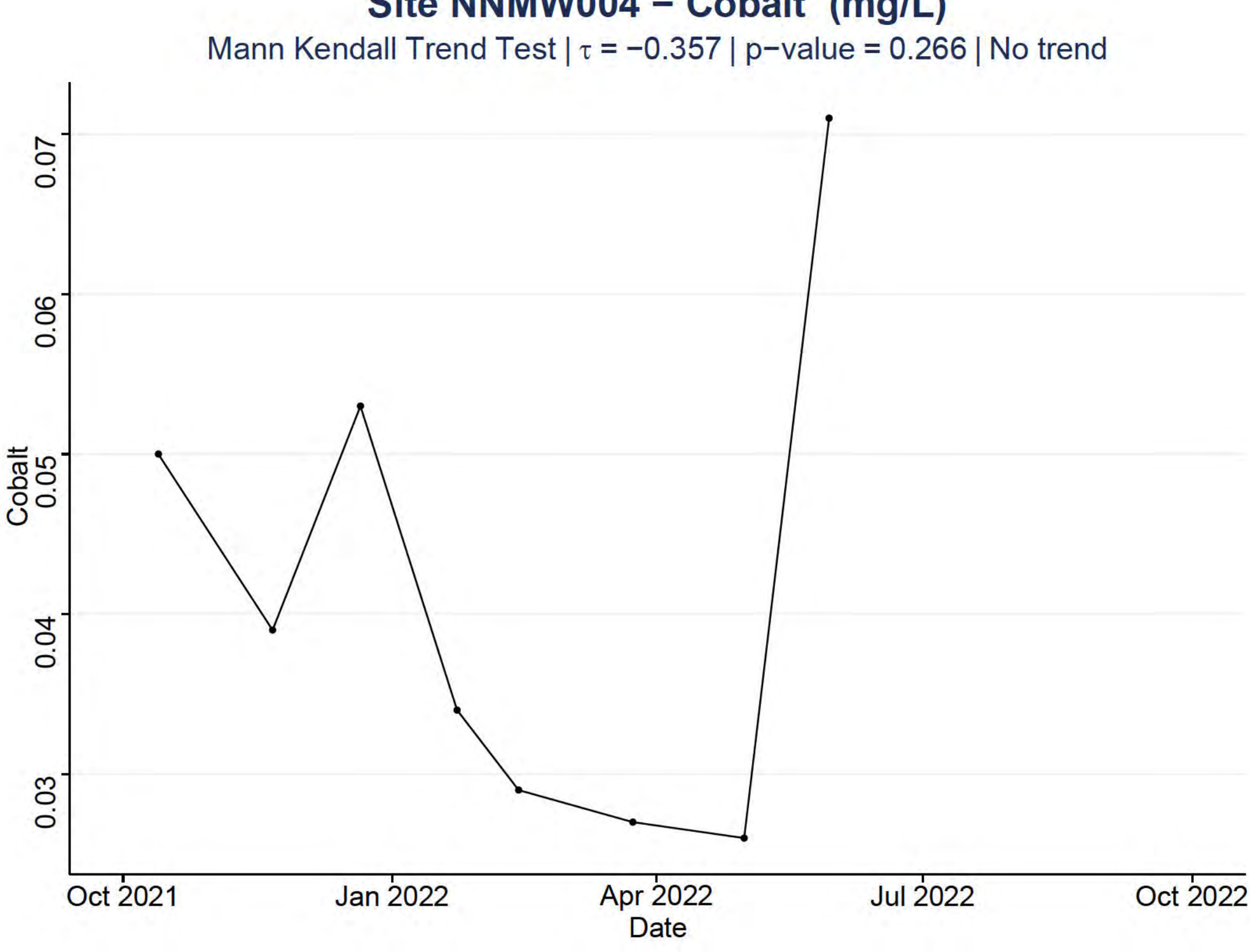

Site NNMW004 – Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.65 | p−value = 0.0545 | No trend
Calcium
180
175
170
165
160
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

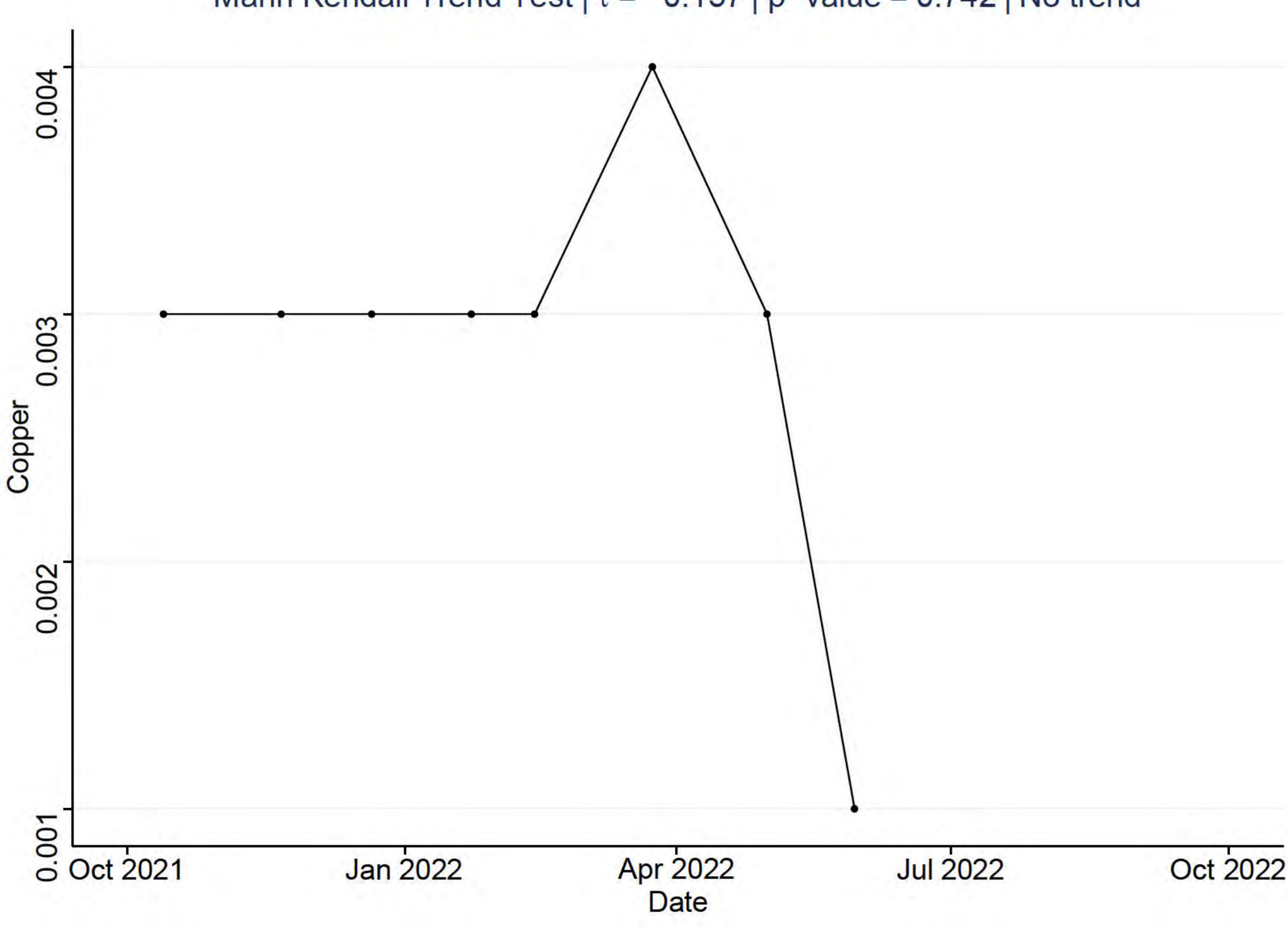

Site NNMW004 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

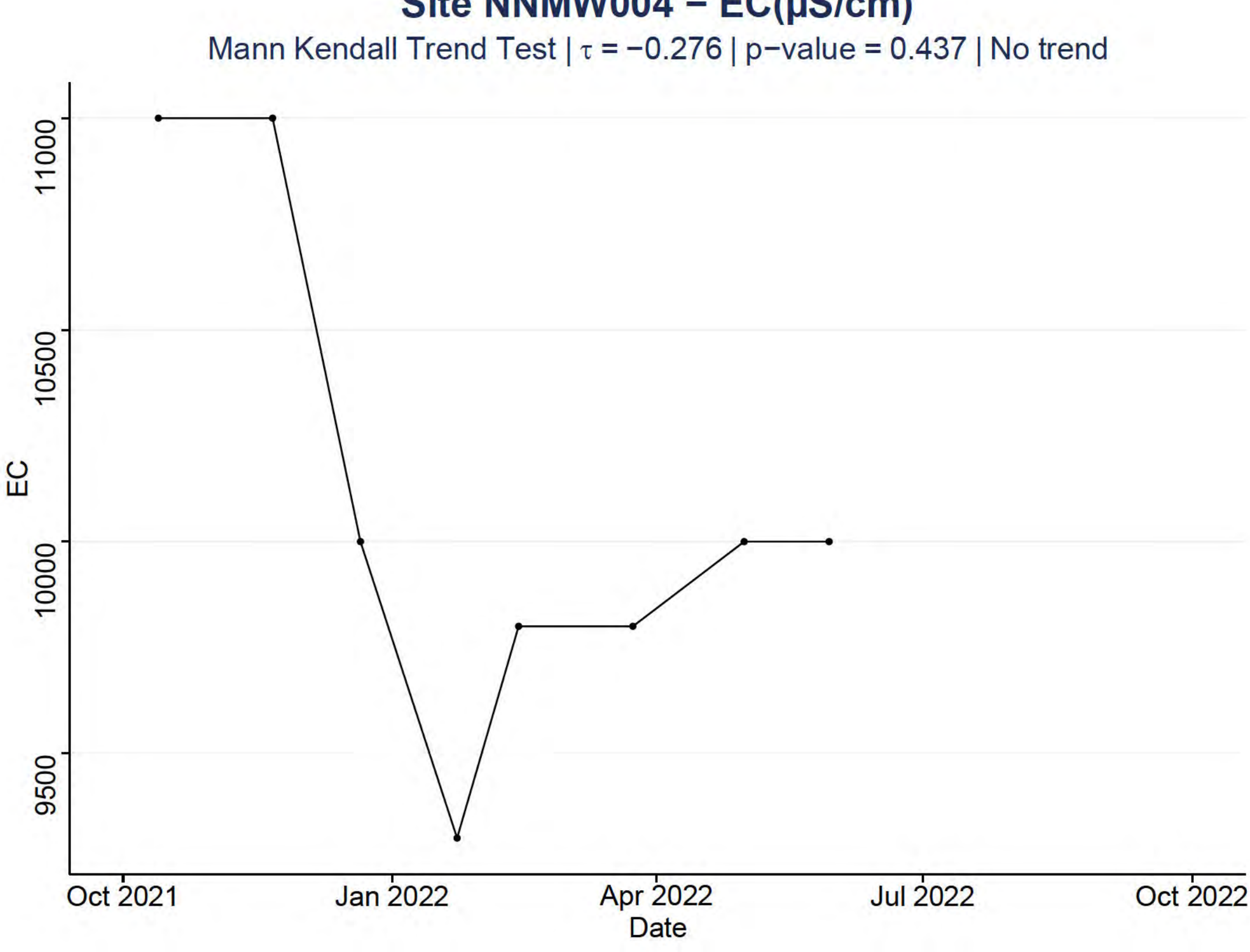

Site NNMW004 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

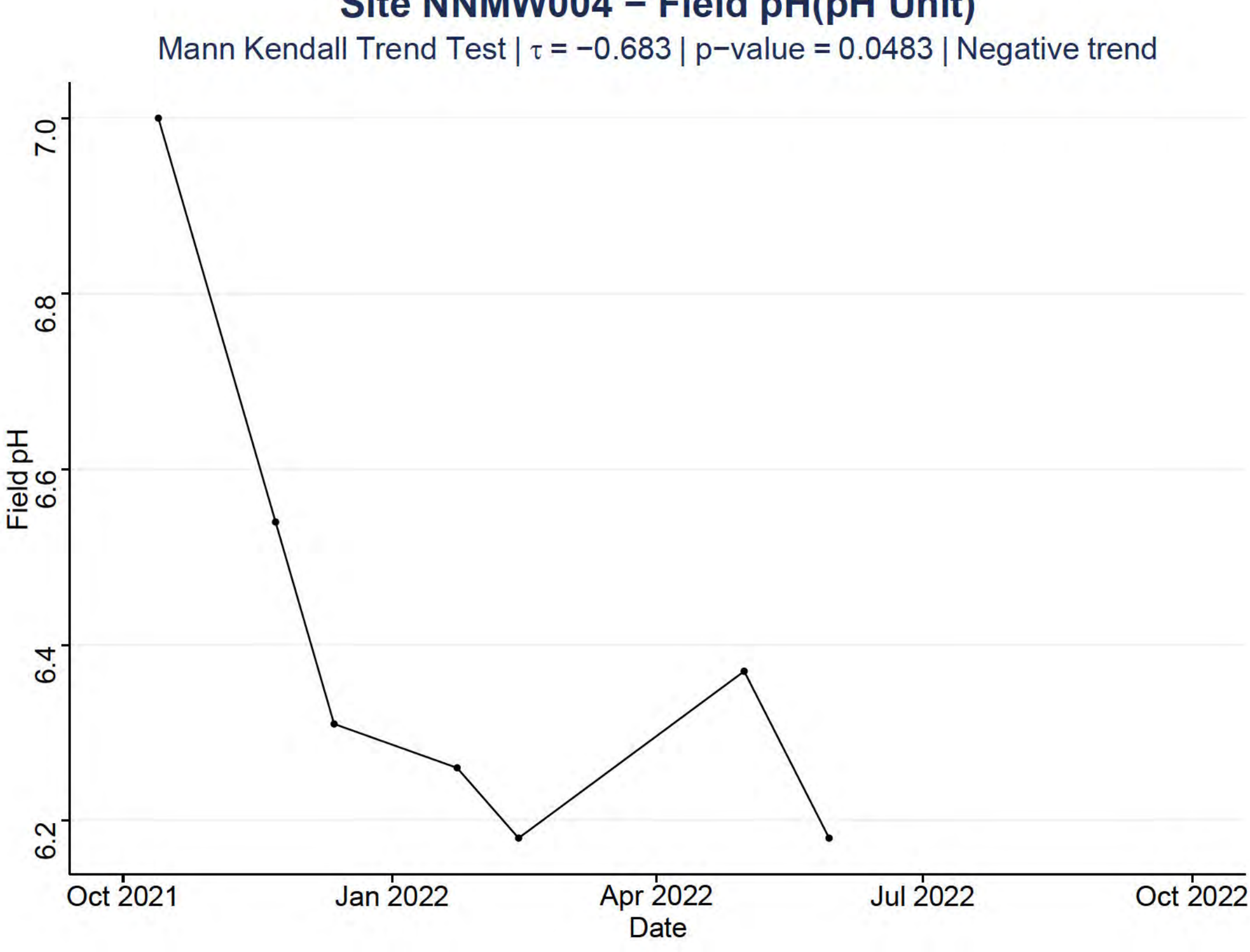

Site NNMW004 – Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.593 | p−value = 0.0595 | No trend
Chloride
3200
3000
2800
2600
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

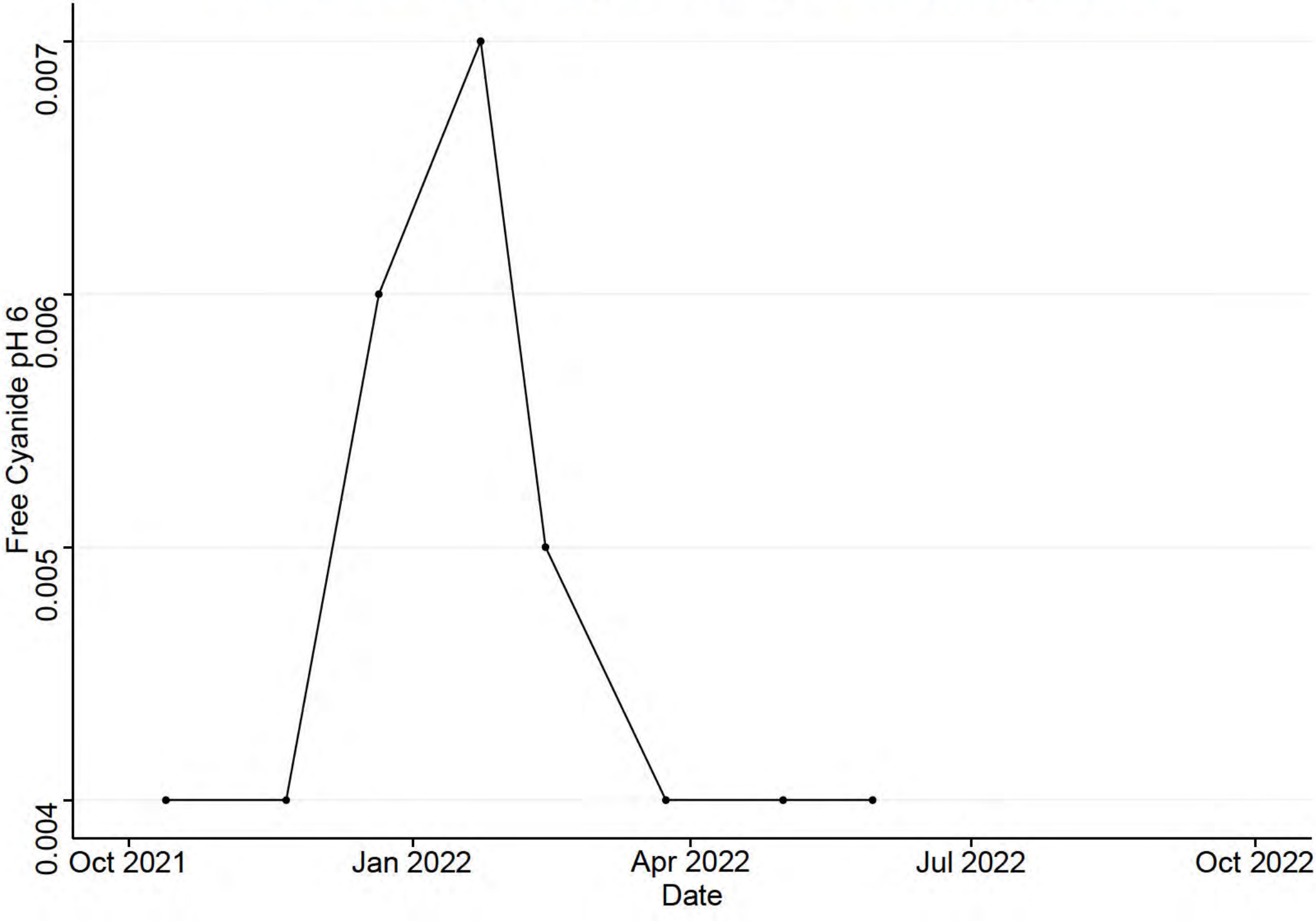

Site NNMW004 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

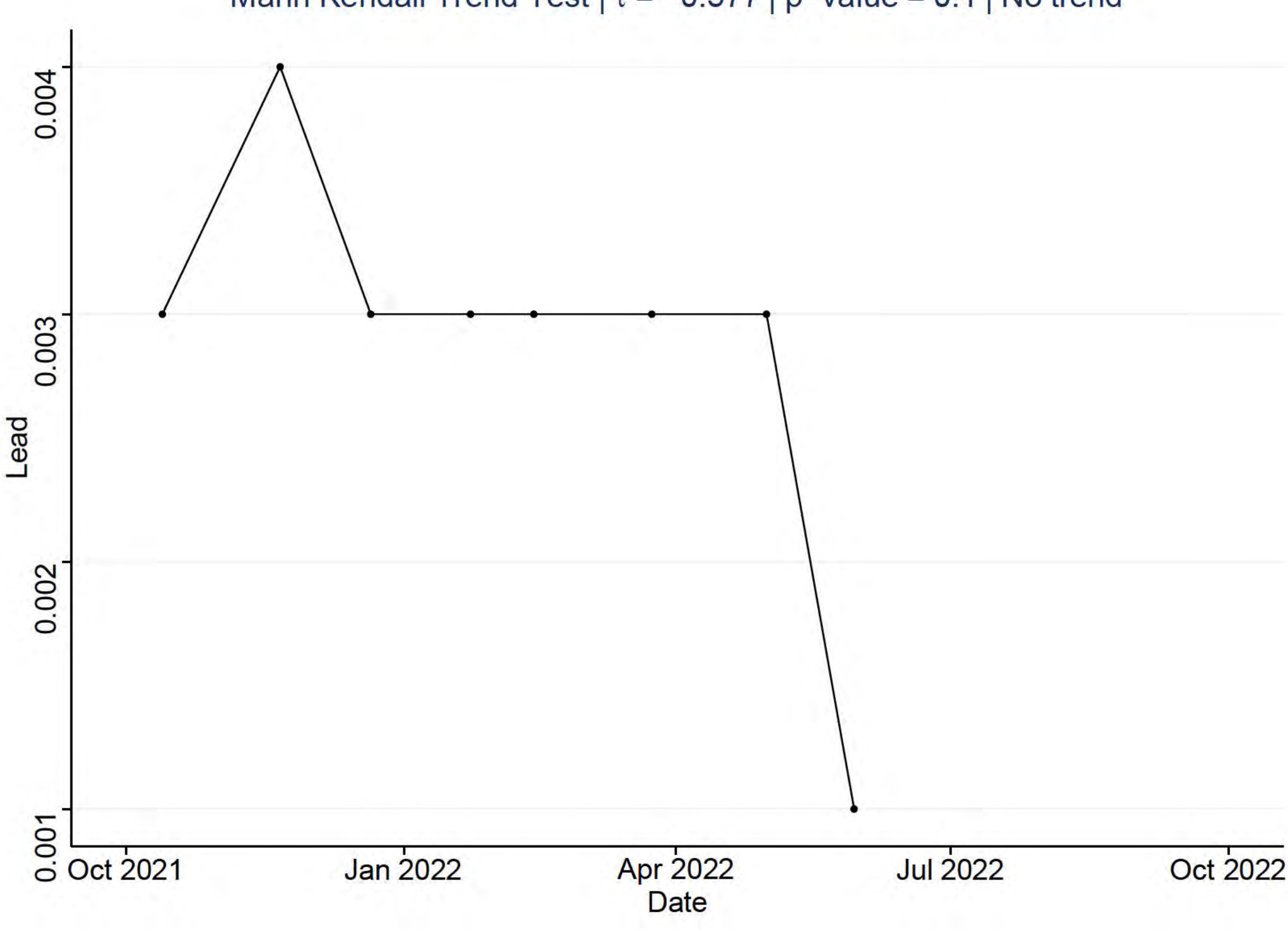

Site NNMW004 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.357 | p−value = 0.266 | No trend
Cobalt
0.07
0.06
0.05
0.04
0.03
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

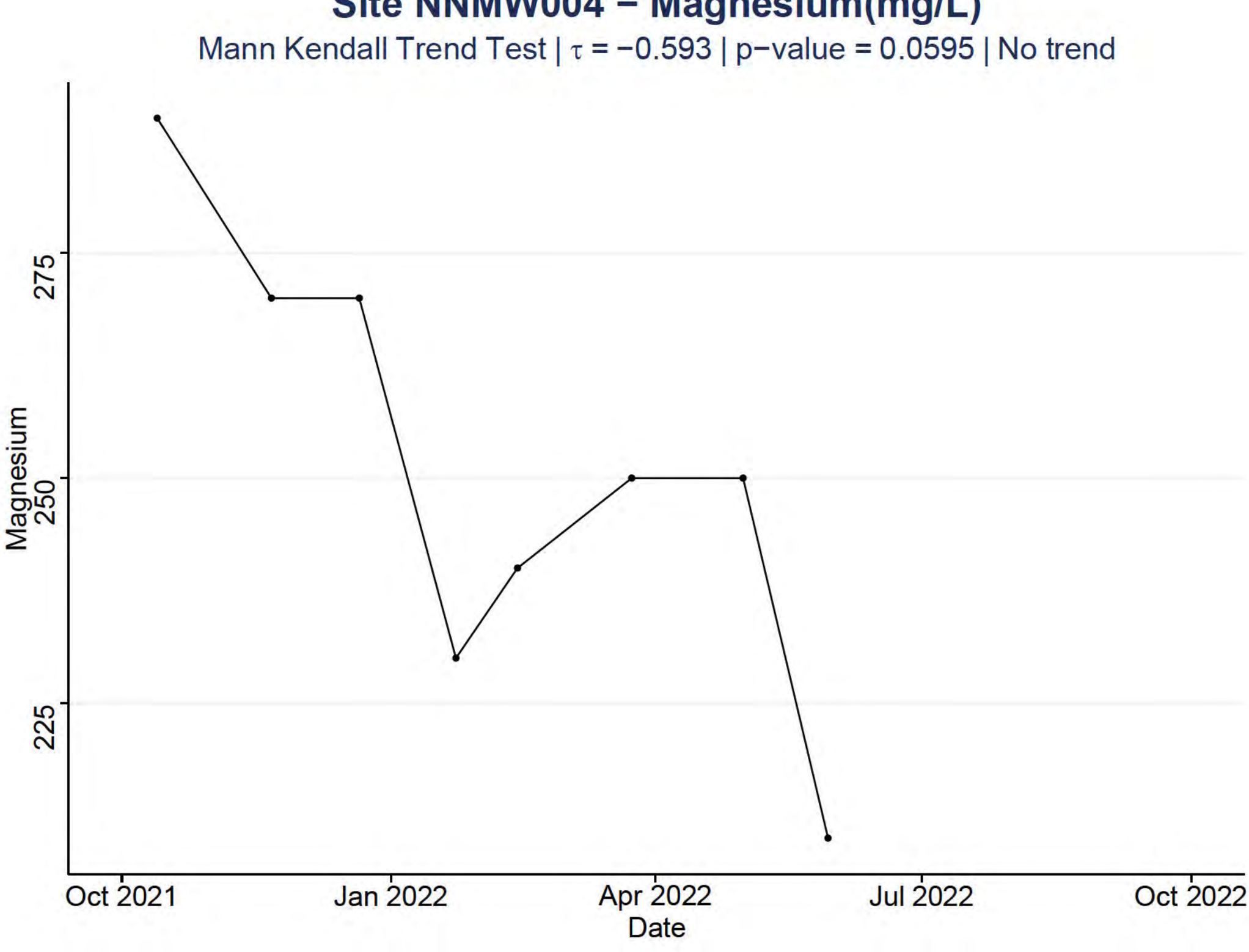

Site NNMW004 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.157 | p−value = 0.742 | No trend
Copper
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

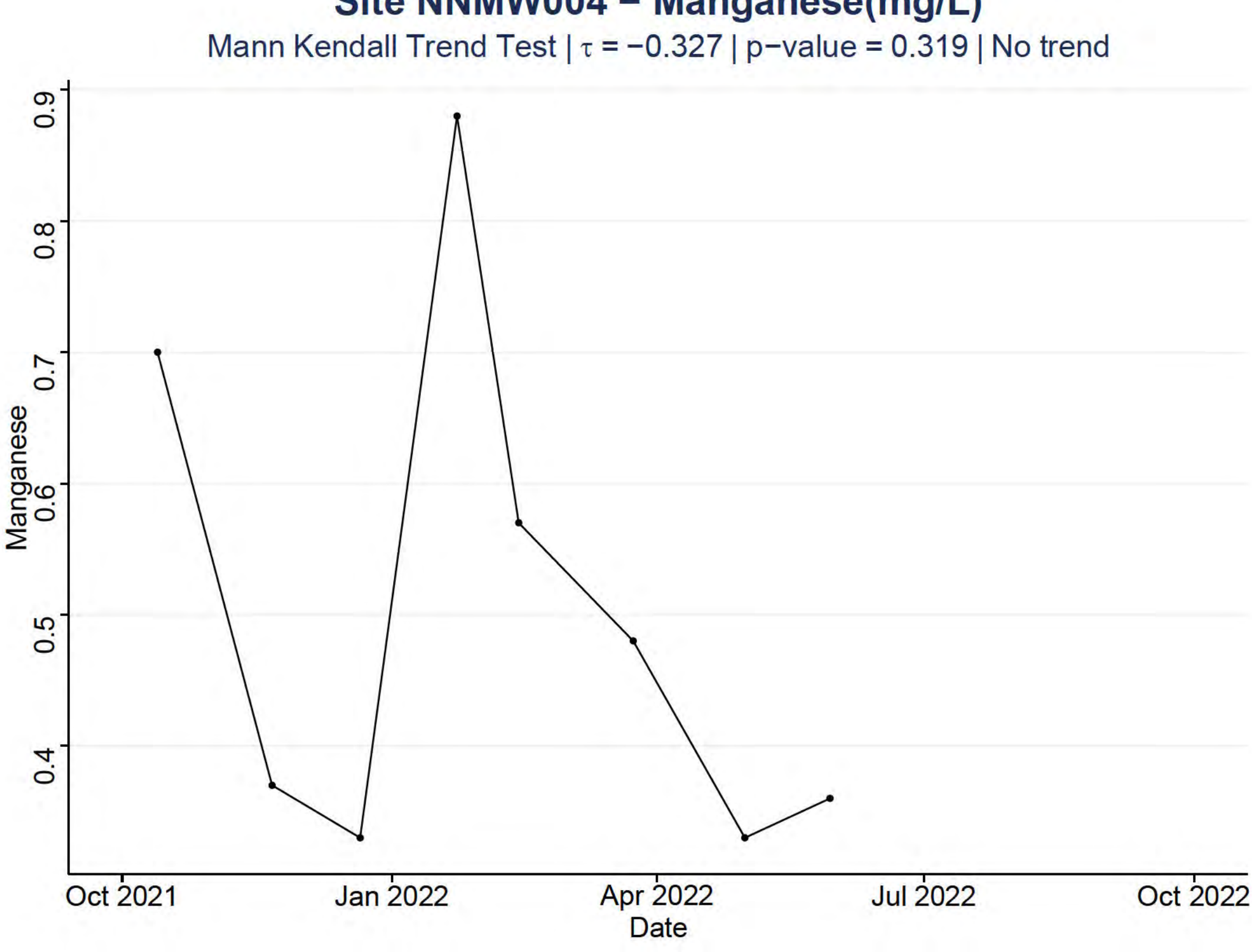

Site NNMW004 – EC(µS/cm)
Mann Kendall Trend Test | τ = −0.276 | p−value = 0.437 | No trend
EC
11000
10500
10000
9500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

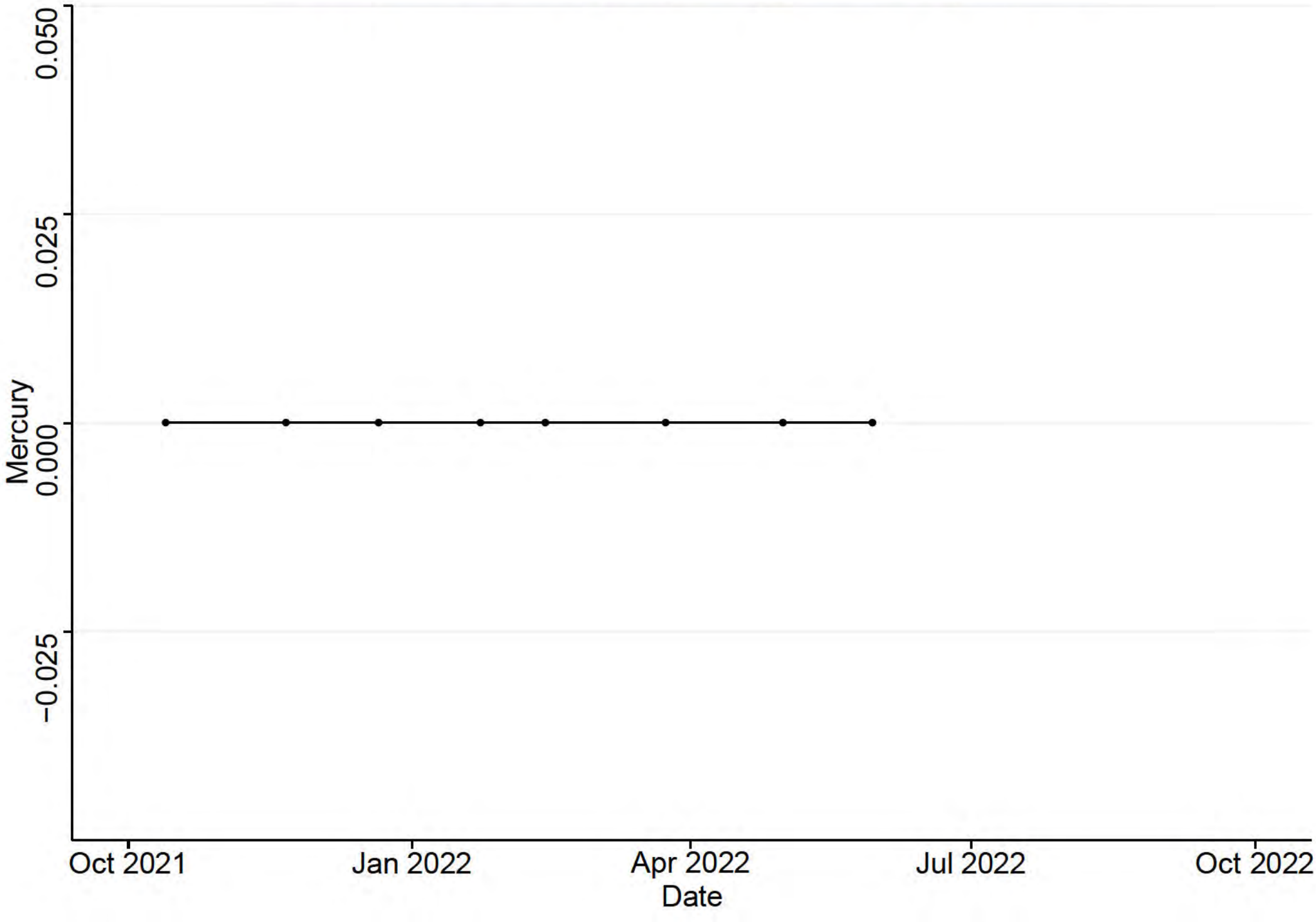

Site NNMW004 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.683 | p−value = 0.0483 | Negative trend
Field pH
7.0
6.8
6.6
6.4
6.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

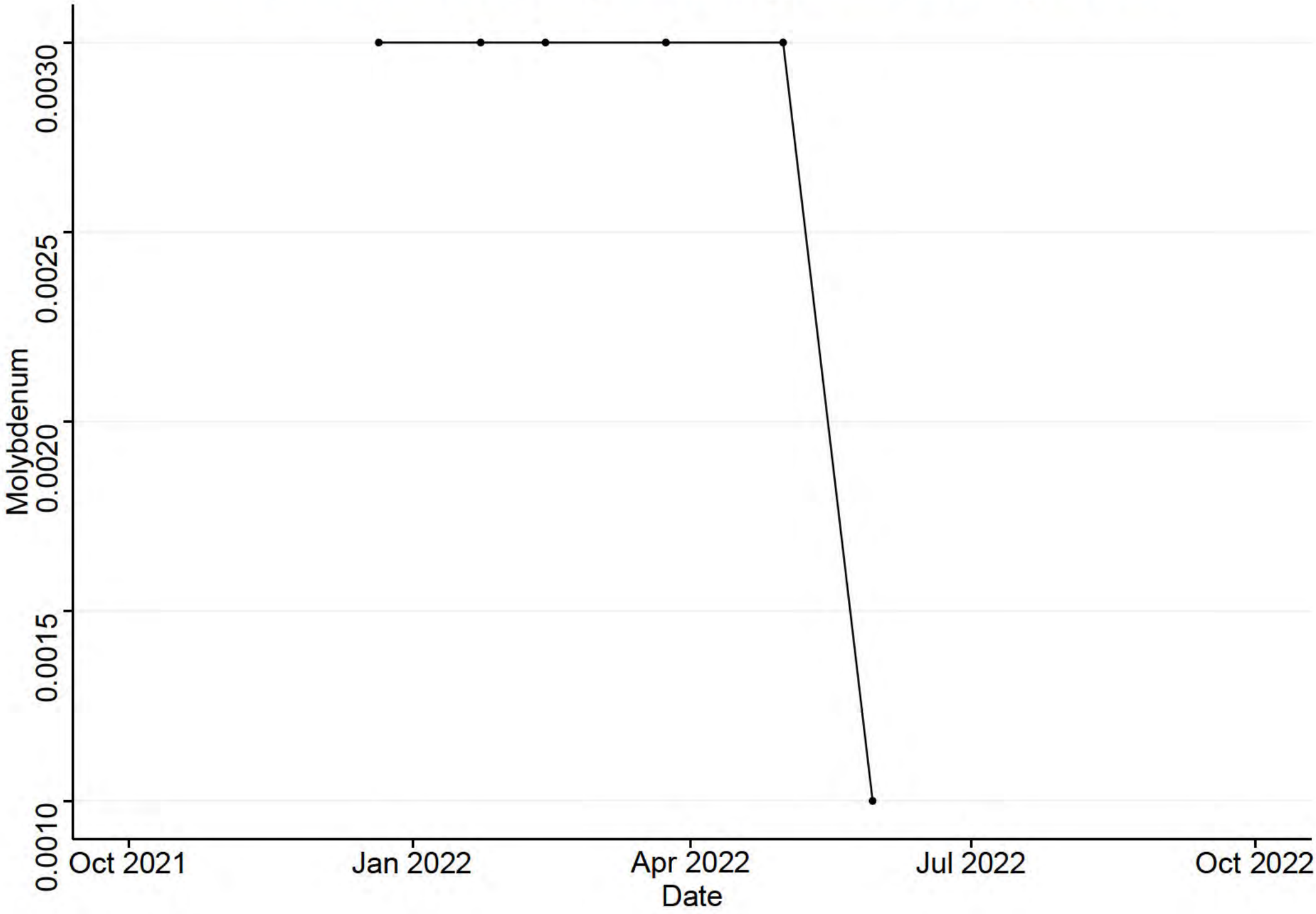

Site NNMW004 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = −0.178 | p−value = 0.667 | No trend
Free Cyanide pH 6
0.007
0.006
0.005
0.004
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

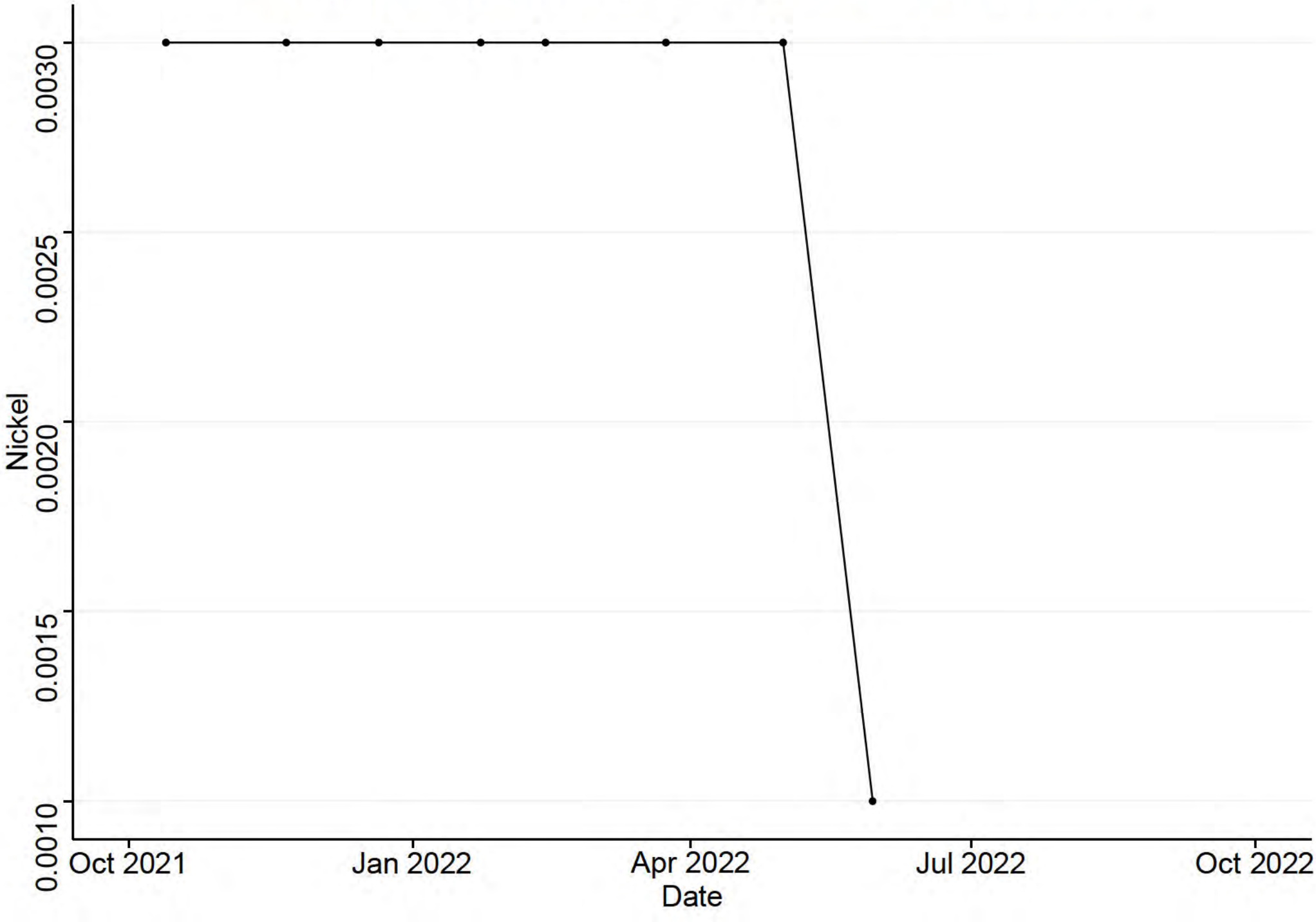

Site NNMW004 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.1 | No trend
Lead
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

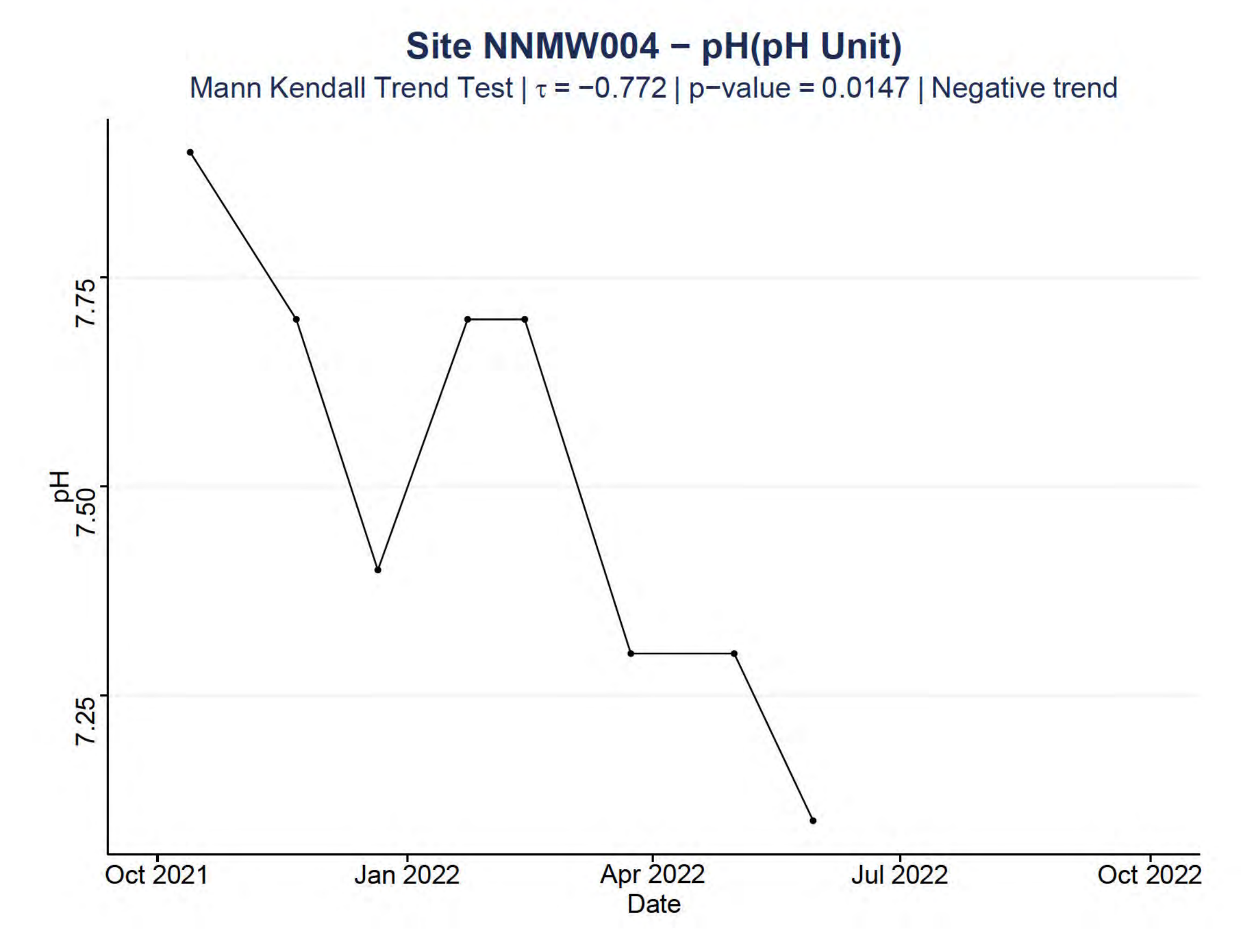

Site NNMW004 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.593 | p−value = 0.0595 | No trend
Magnesium
275
250
225
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

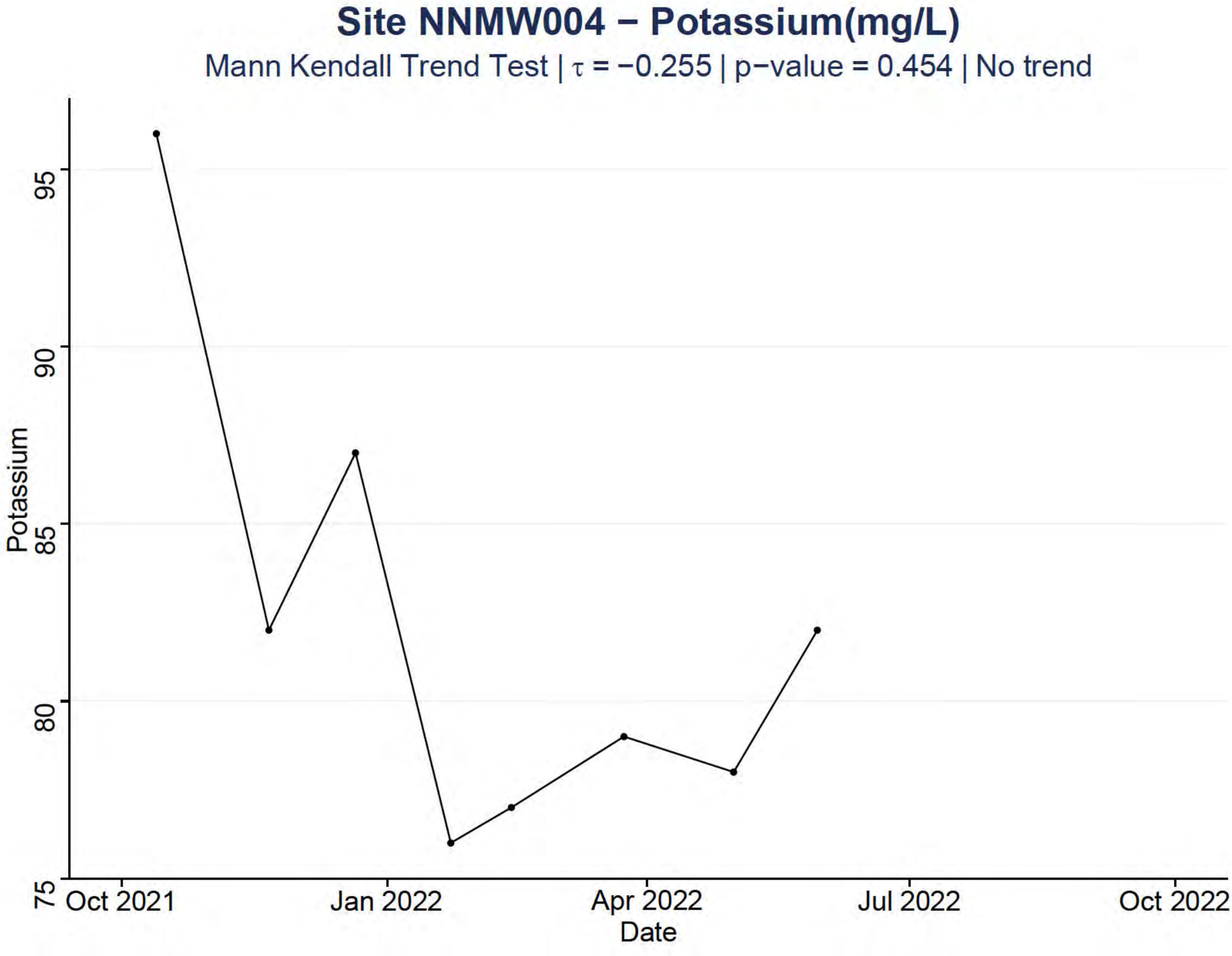

Site NNMW004 – Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.327 | p−value = 0.319 | No trend
Manganese
0.9
0.8
0.7
0.6
0.5
0.4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

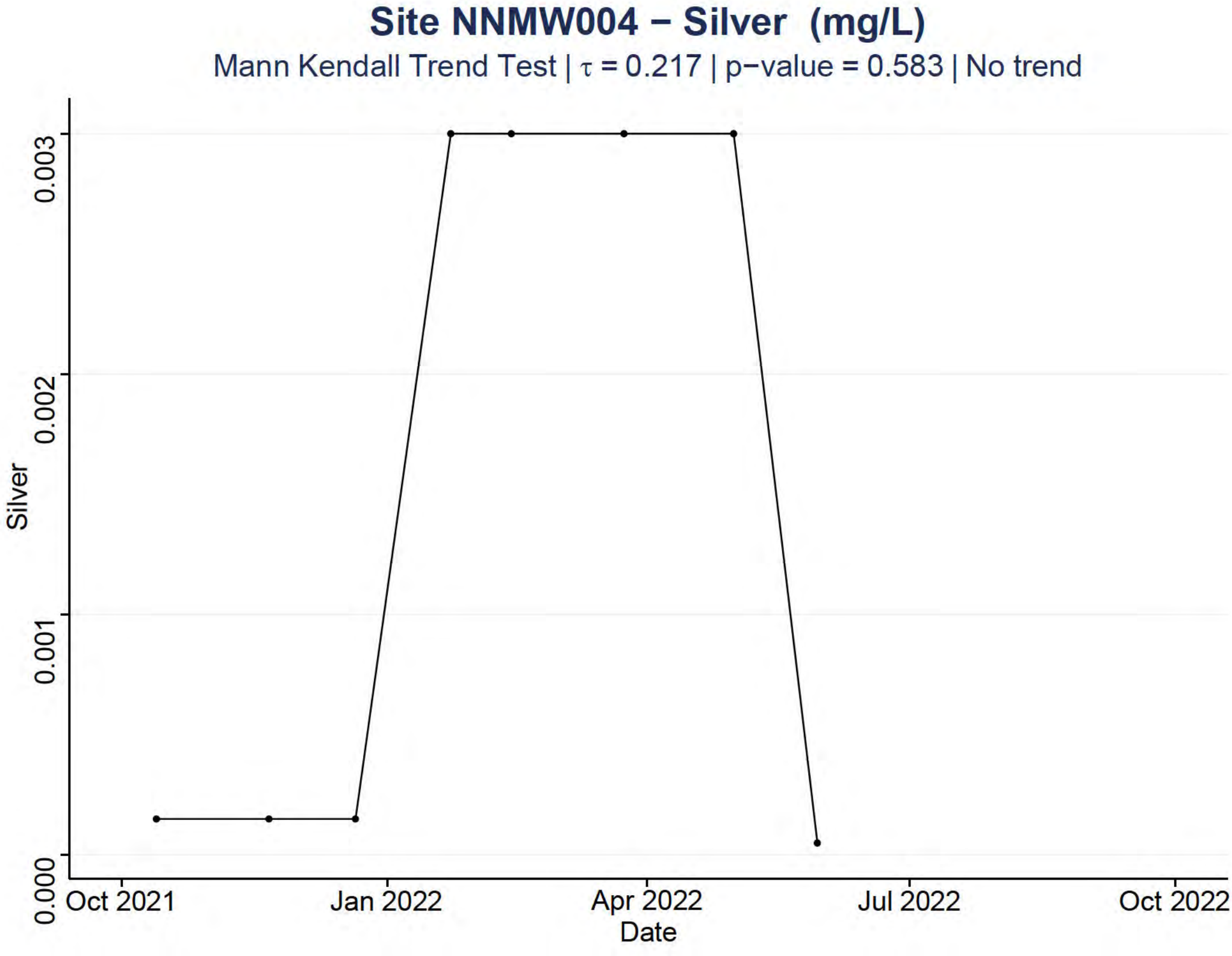

Site NNMW004 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

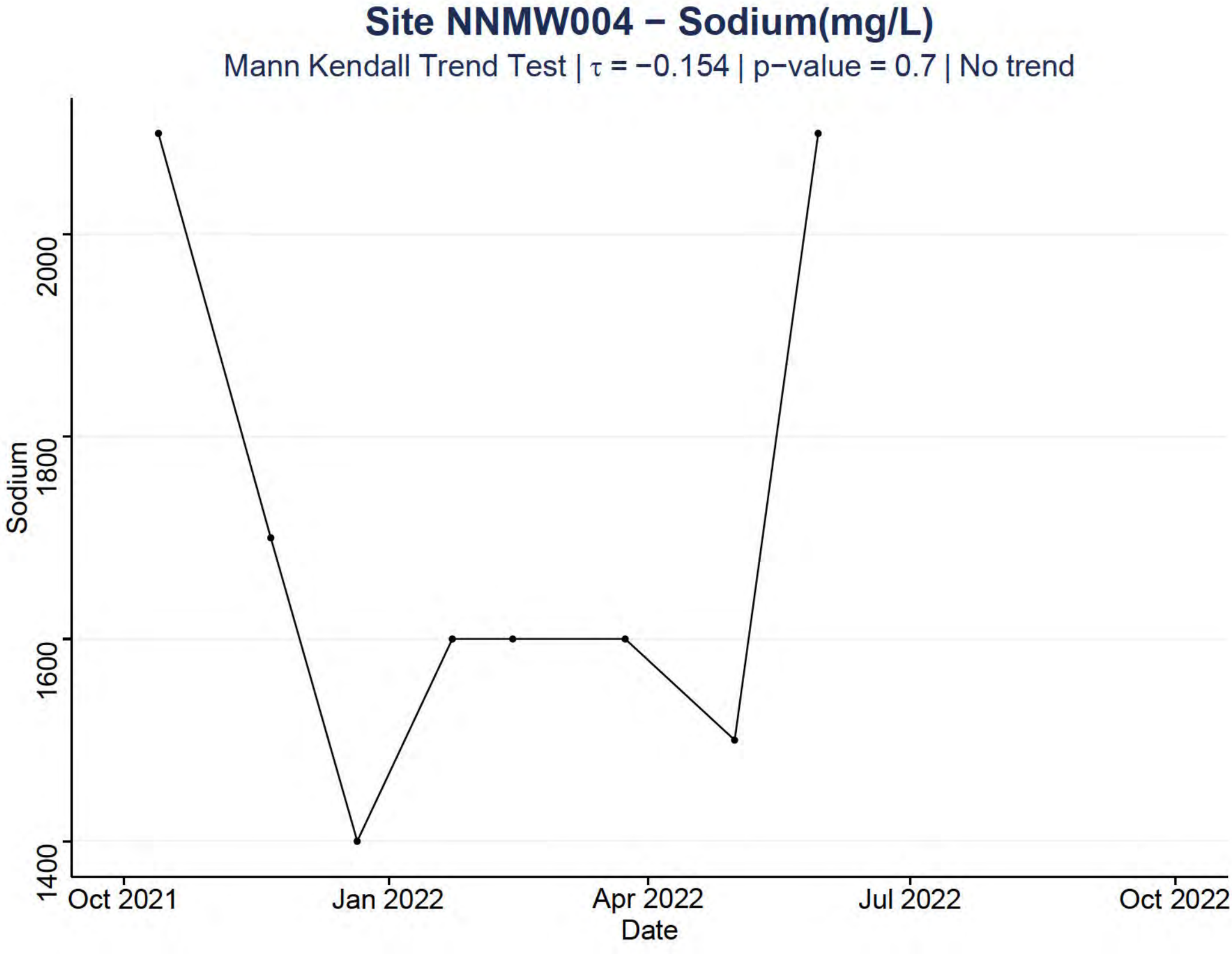

Site NNMW004 – Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

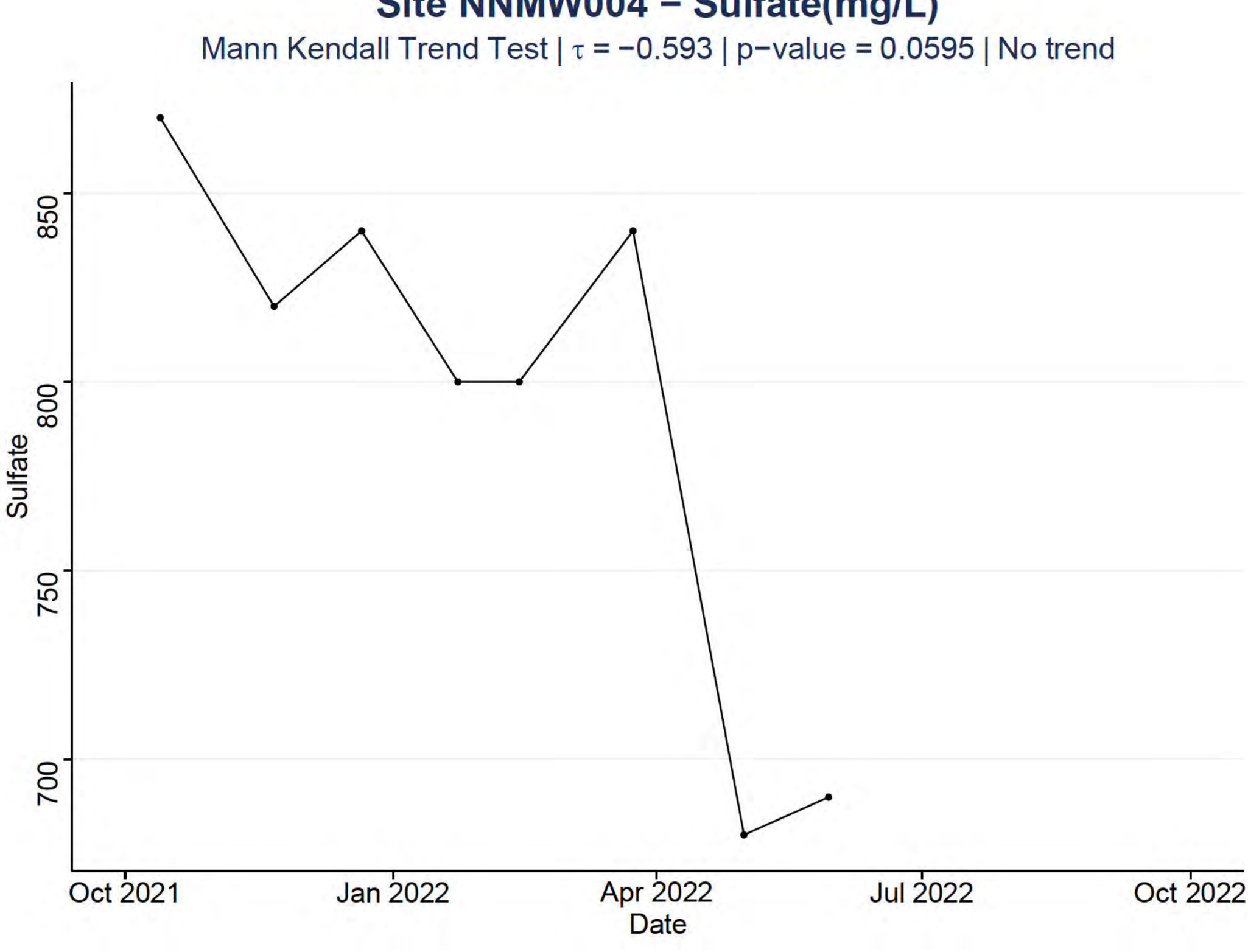

Site NNMW004 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Nickel
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

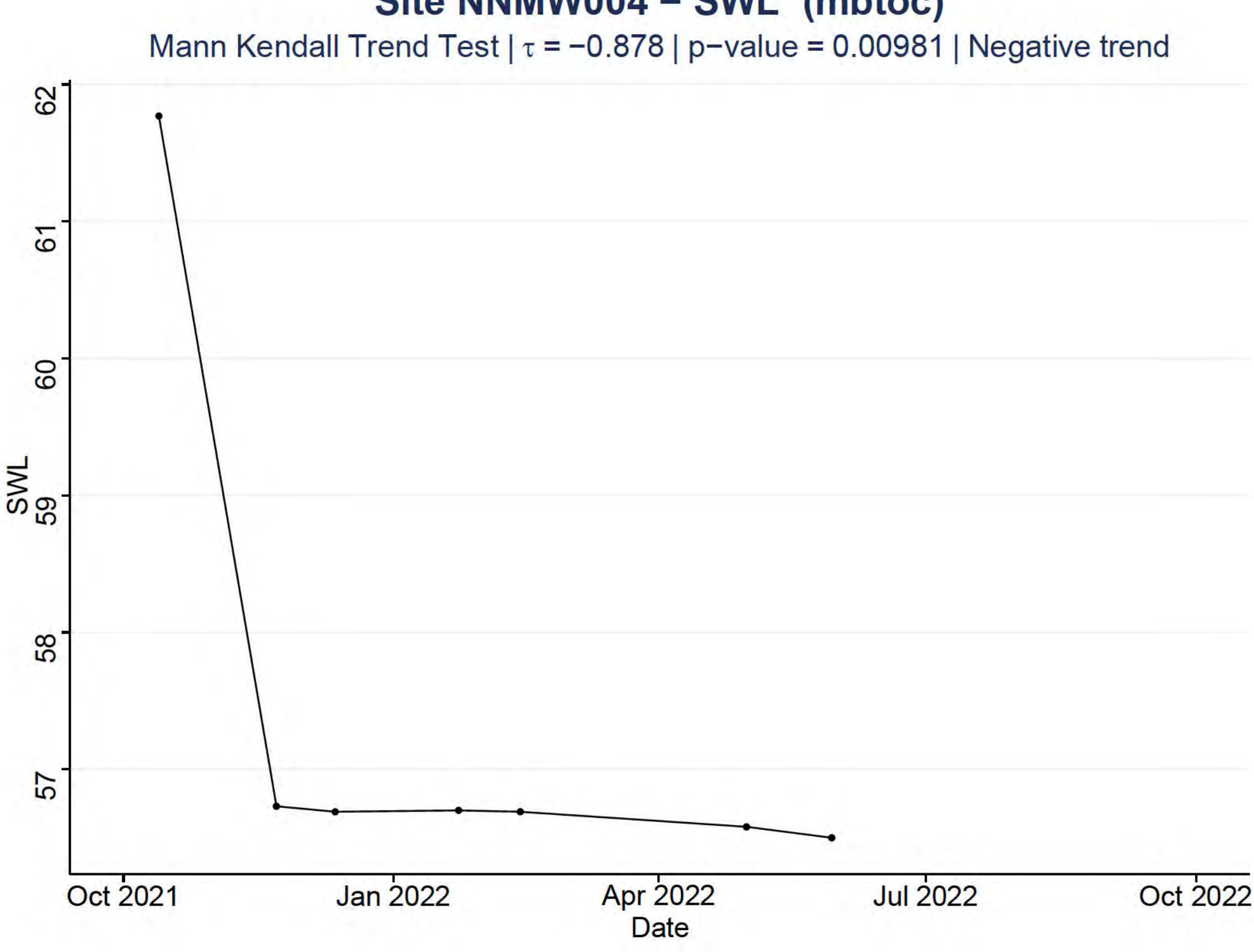

Site NNMW004 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.772 | p−value = 0.0147 | Negative trend
pH
7.75
7.50
7.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

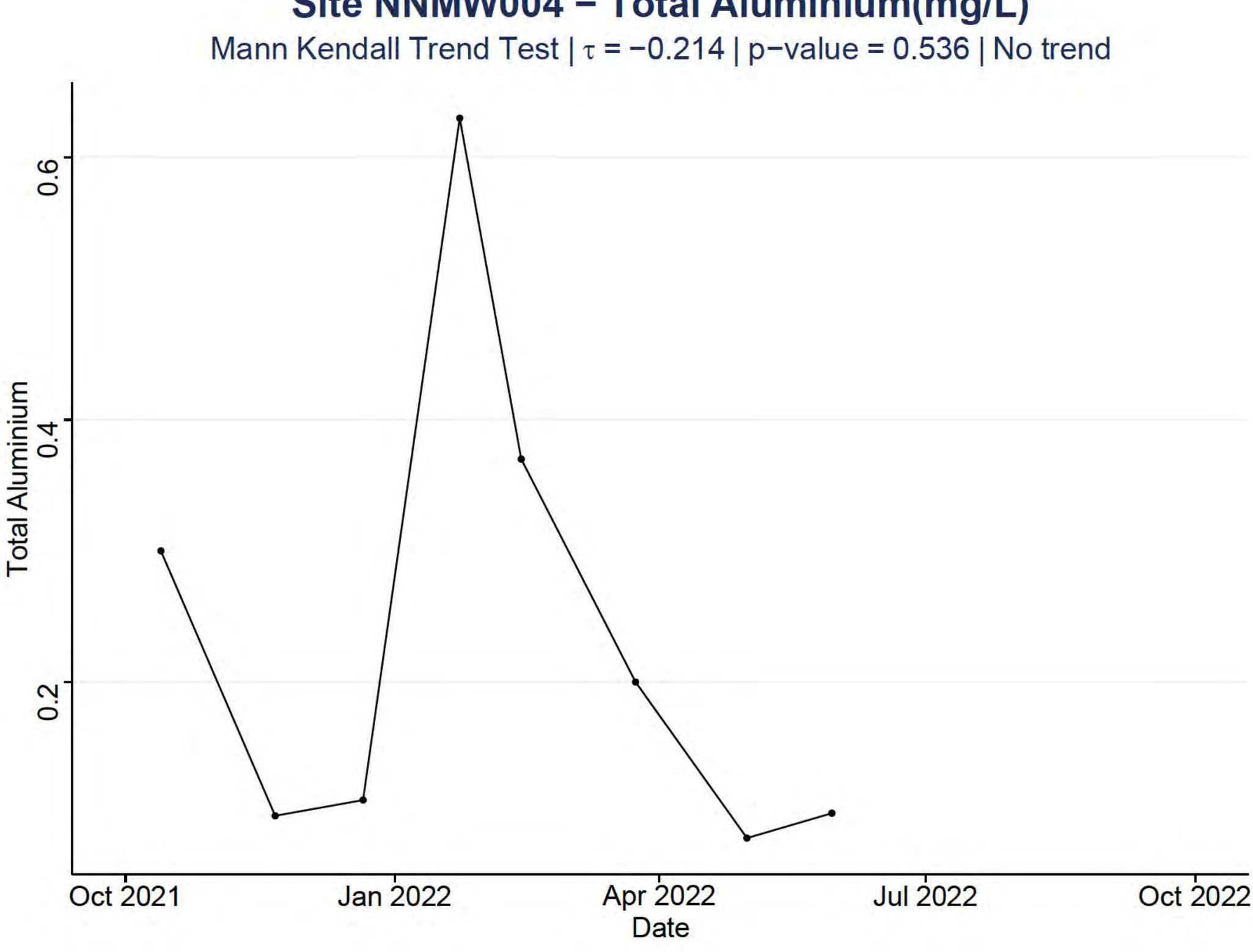

Site NNMW004 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.255 | p−value = 0.454 | No trend
Potassium
95
90
85
80
75
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

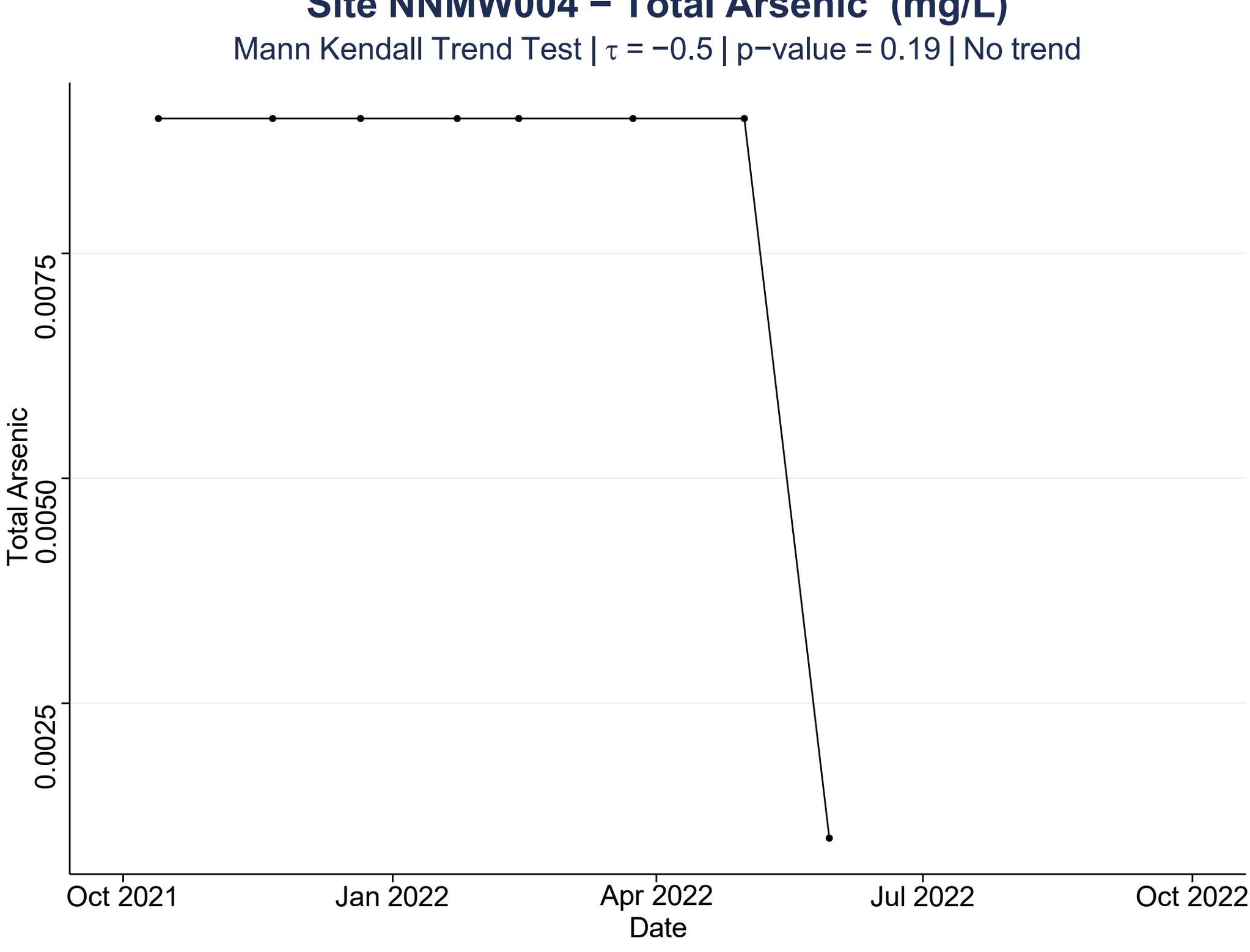

Site NNMW004 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

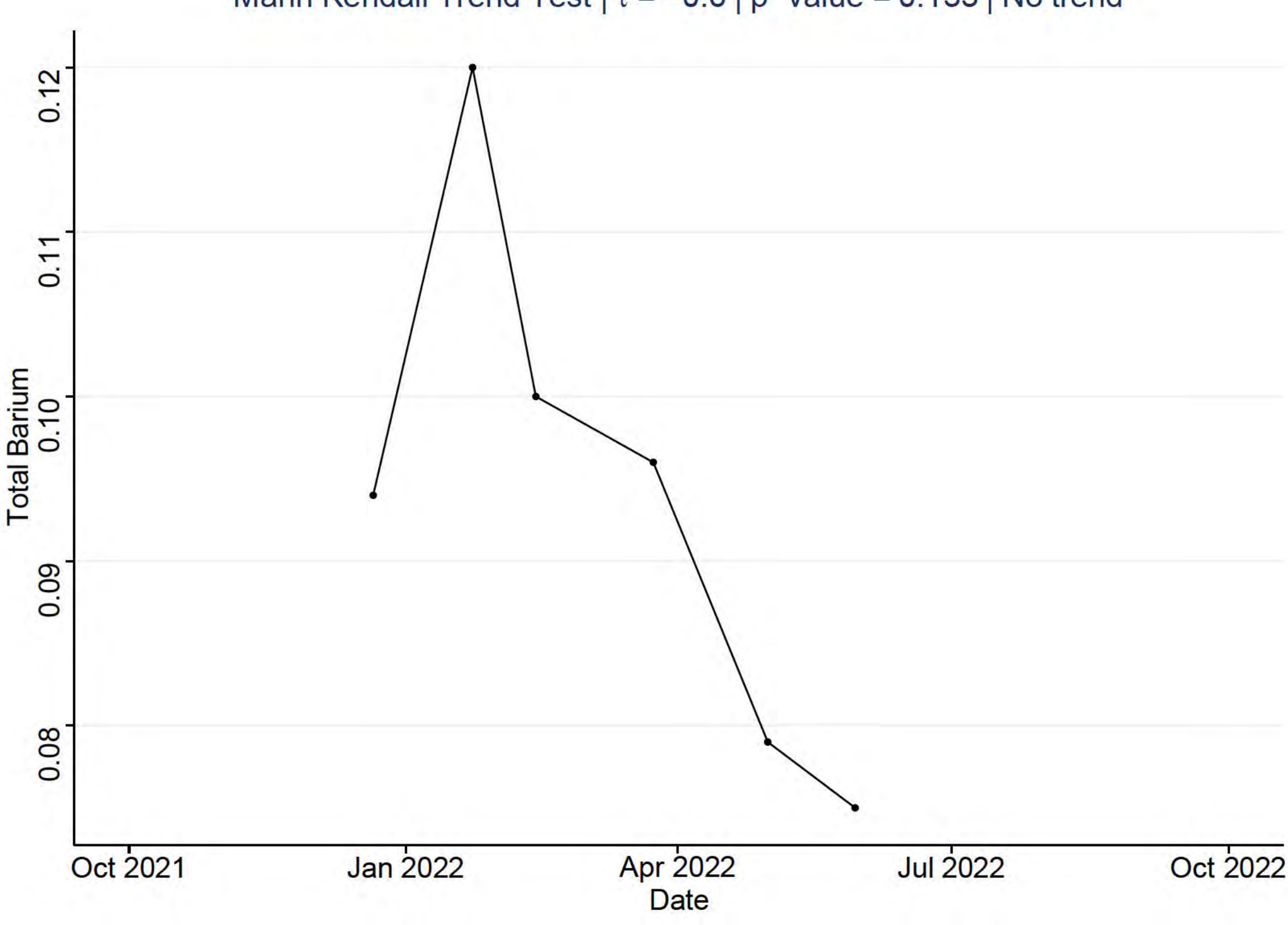

Site NNMW004 − Sodium(mg/L)
Mann Kendall Trend Test | τ = −0.154 | p−value = 0.7 | No trend
Sodium
2000
1800
1600
1400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

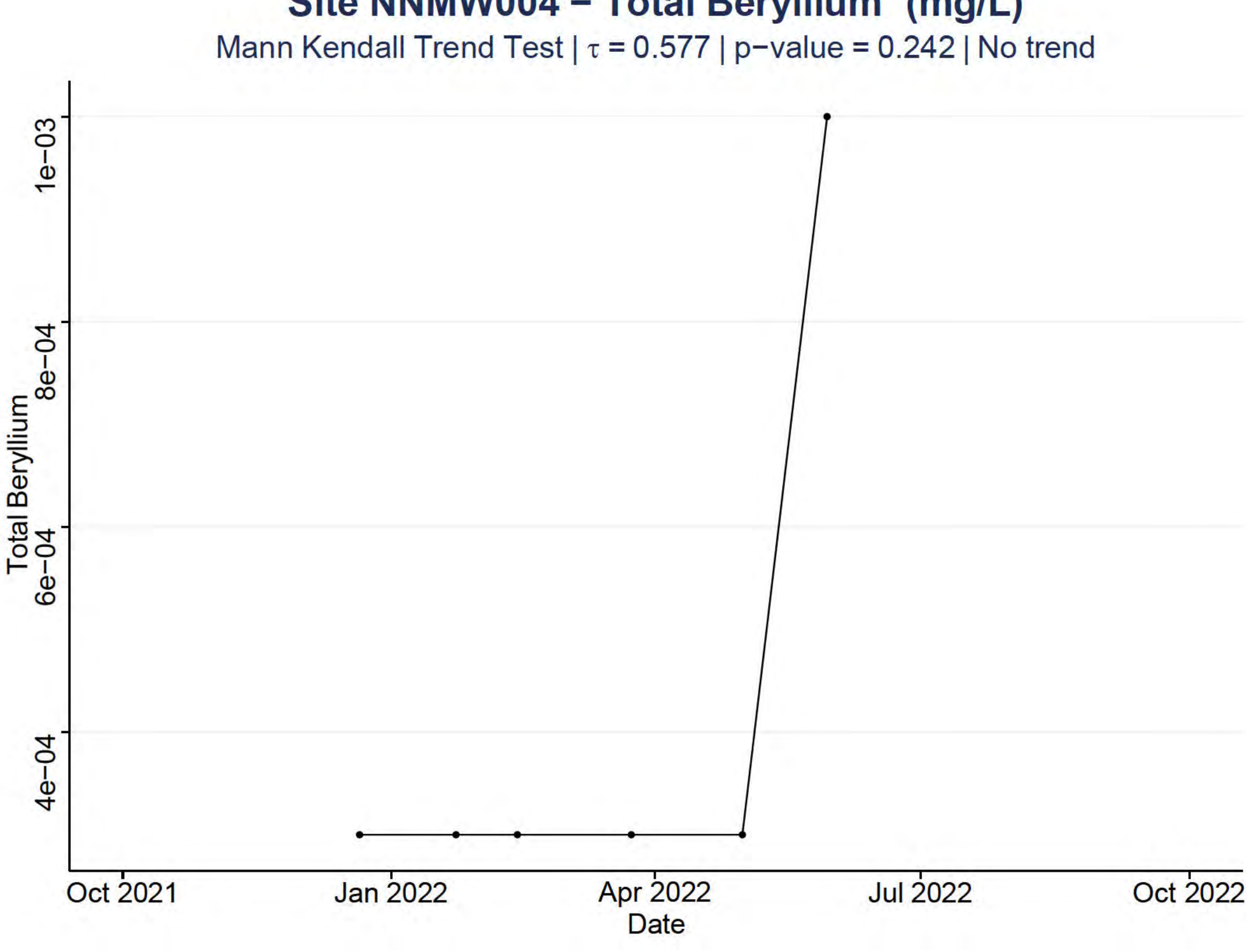

Site NNMW004 – Sulfate(mg/L)
Mann Kendall Trend Test | τ = −0.593 | p−value = 0.0595 | No trend
Sulfate
850
800
750
700
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

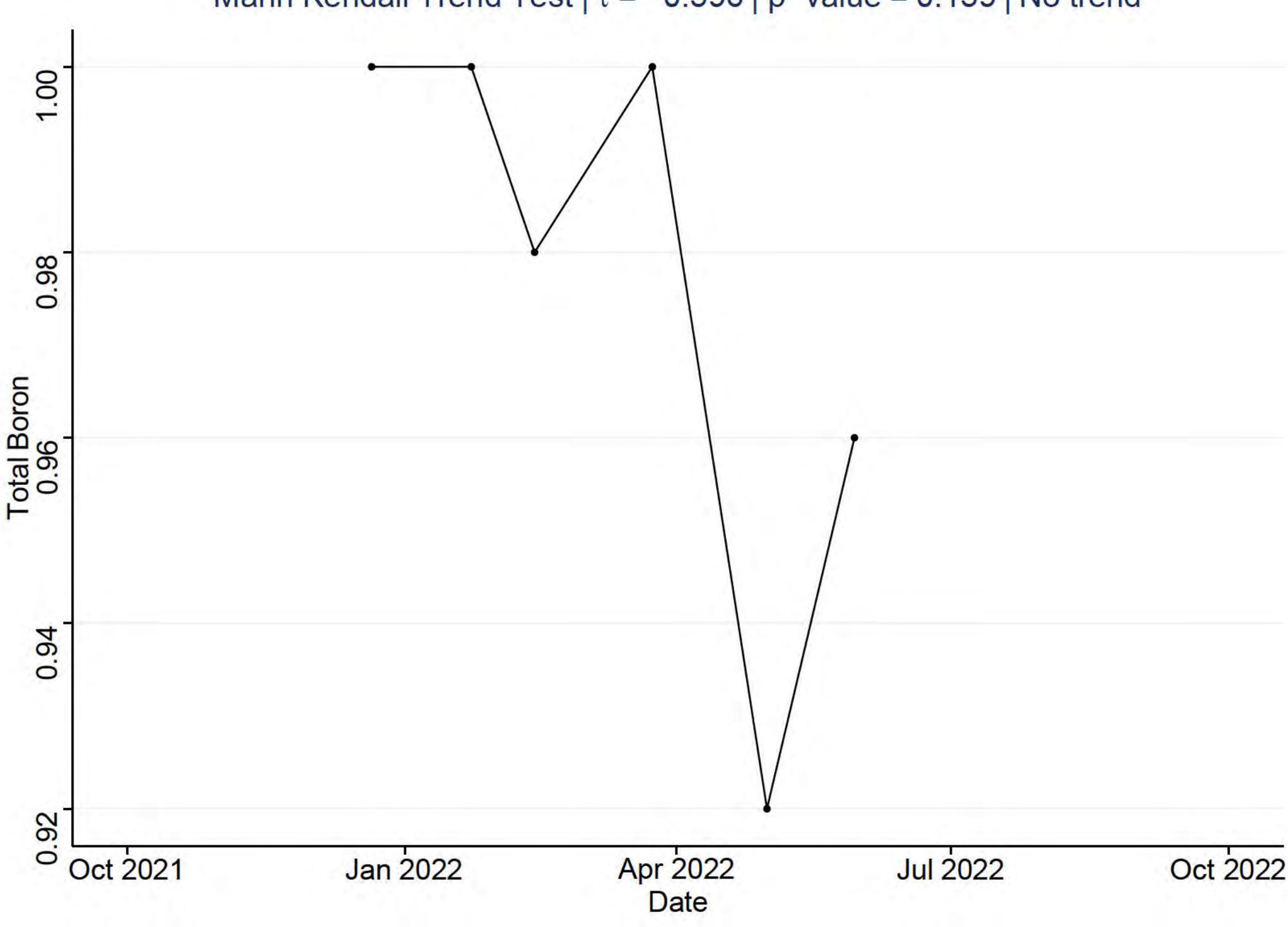

Site NNMW004 – SWL (mbtoc)
Mann Kendall Trend Test | τ = −0.878 | p−value = 0.00981 | Negative trend
SWL
62
61
60
59
58
57
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

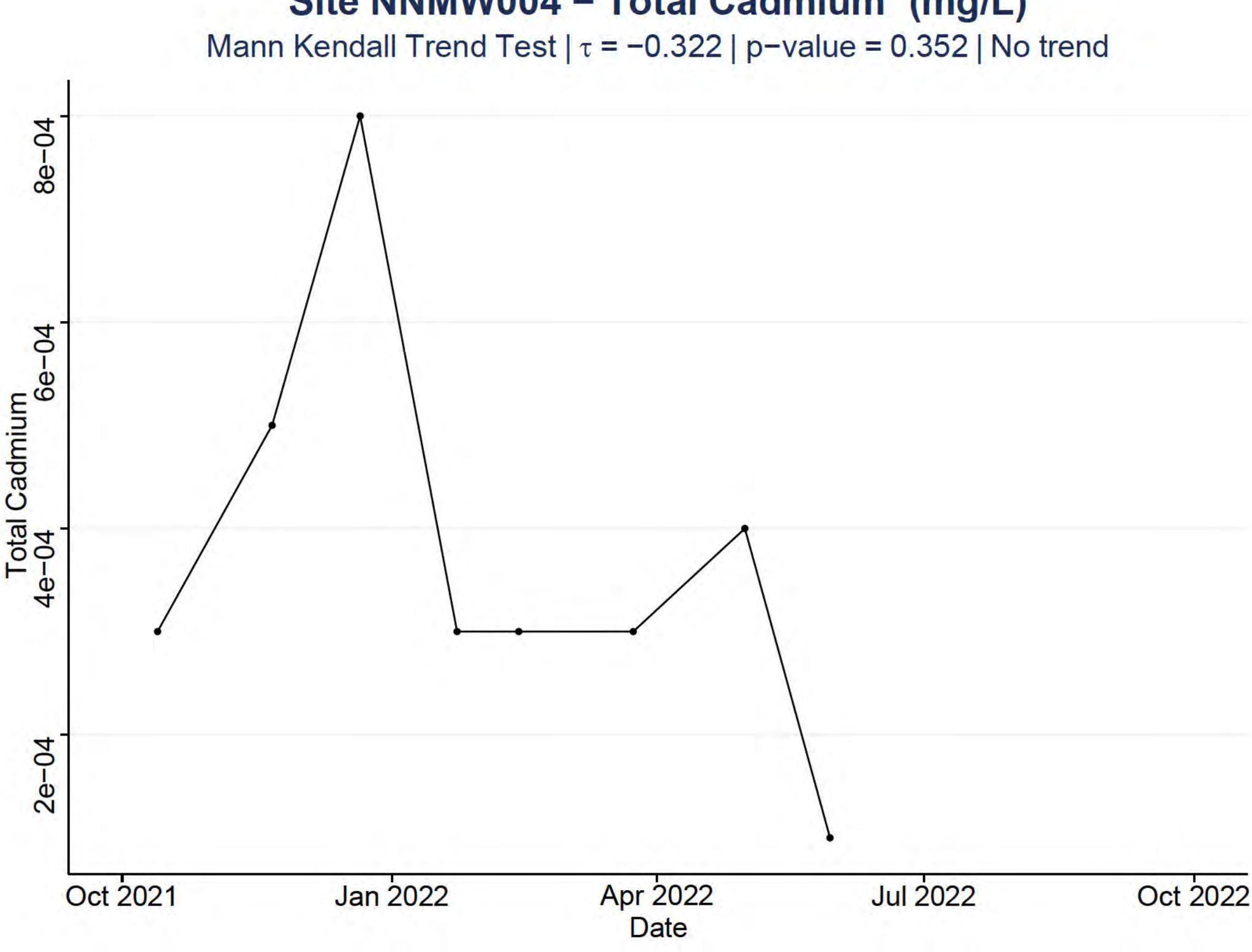

Site NNMW004 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.214 | p−value = 0.536 | No trend
Total Aluminium
0.6
0.4
0.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

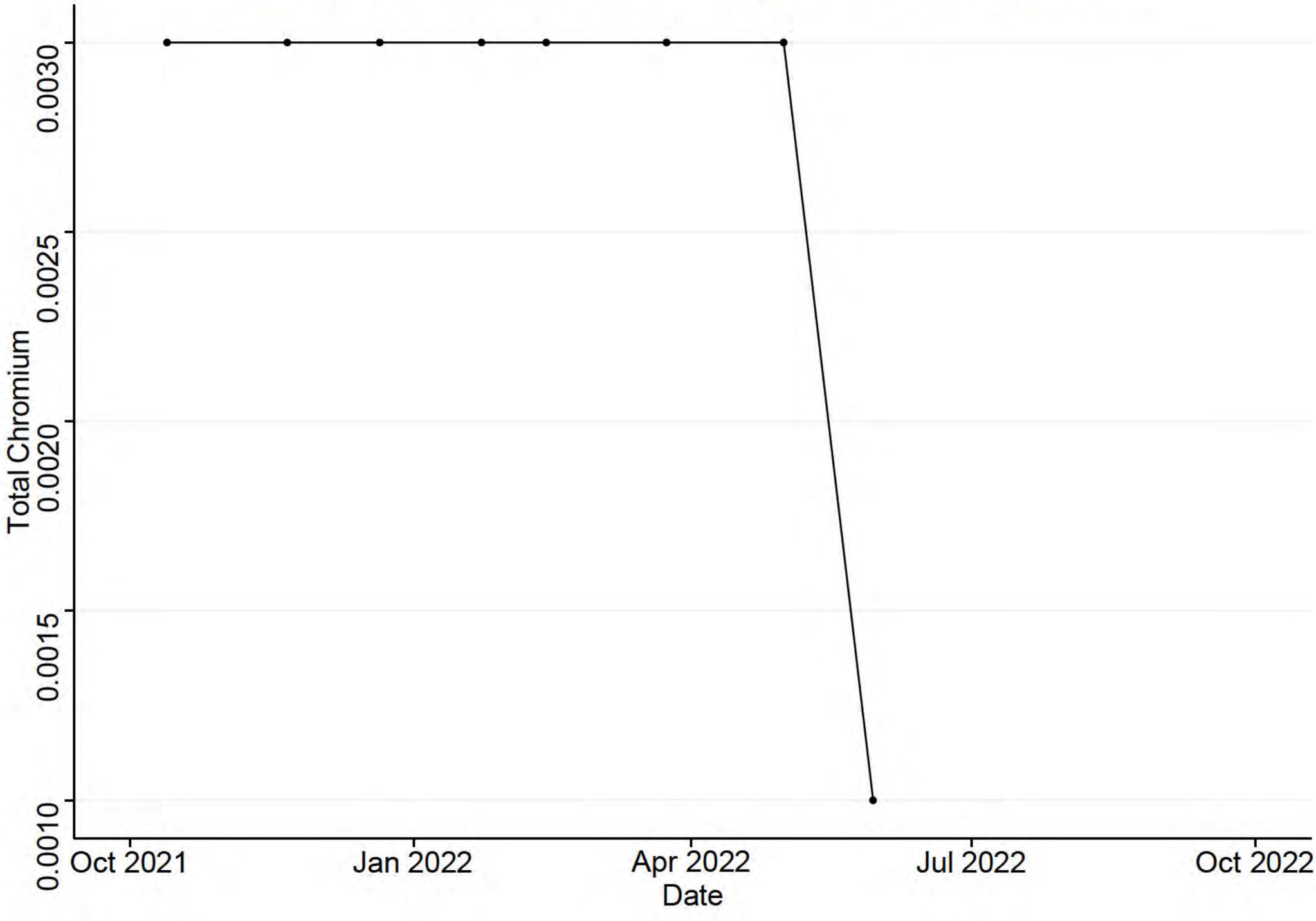

Site NNMW004 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

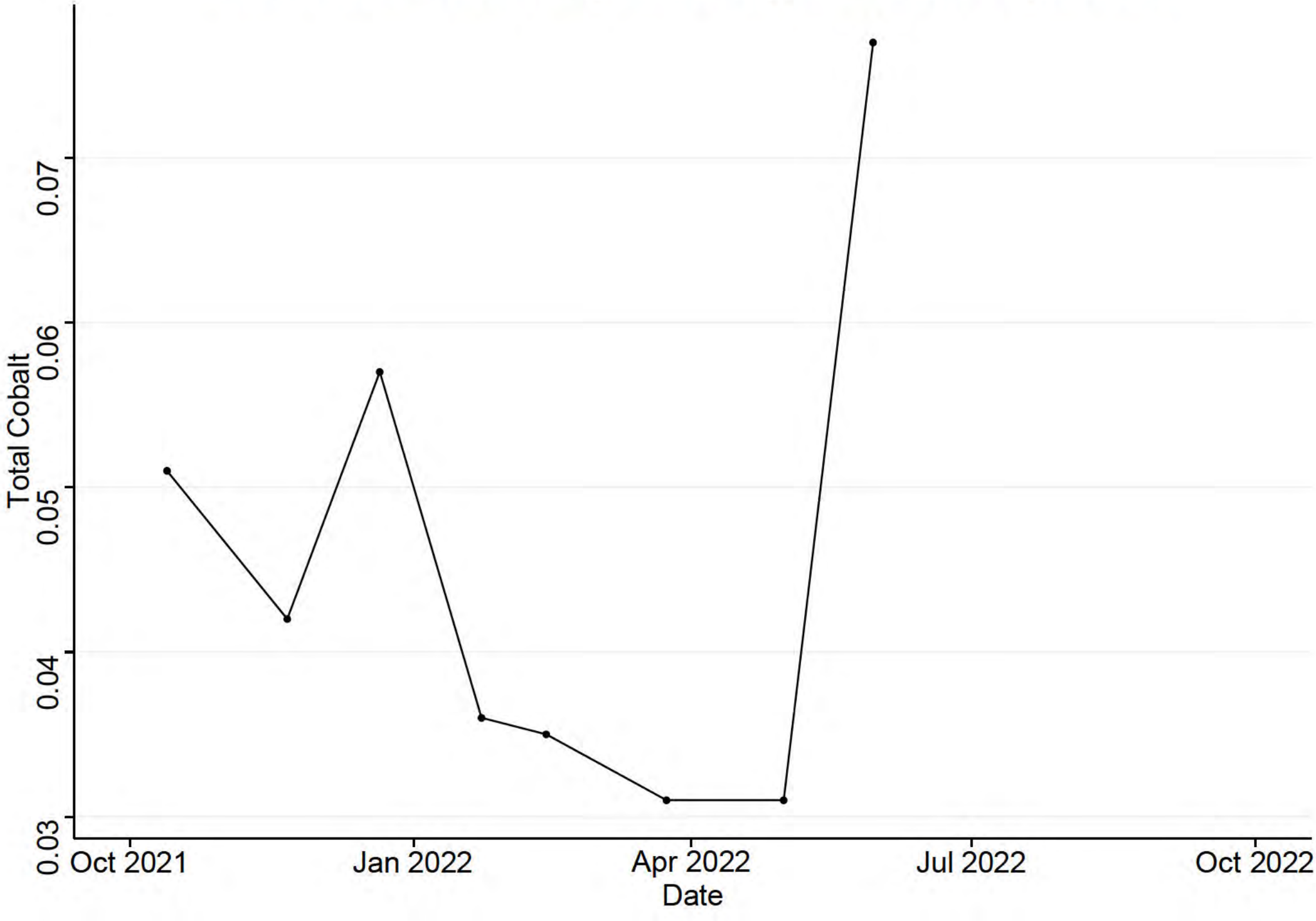

Site NNMW004 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = −0.6 | p−value = 0.133 | No trend
Total Barium
0.12
0.11
0.10
0.09
0.08
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

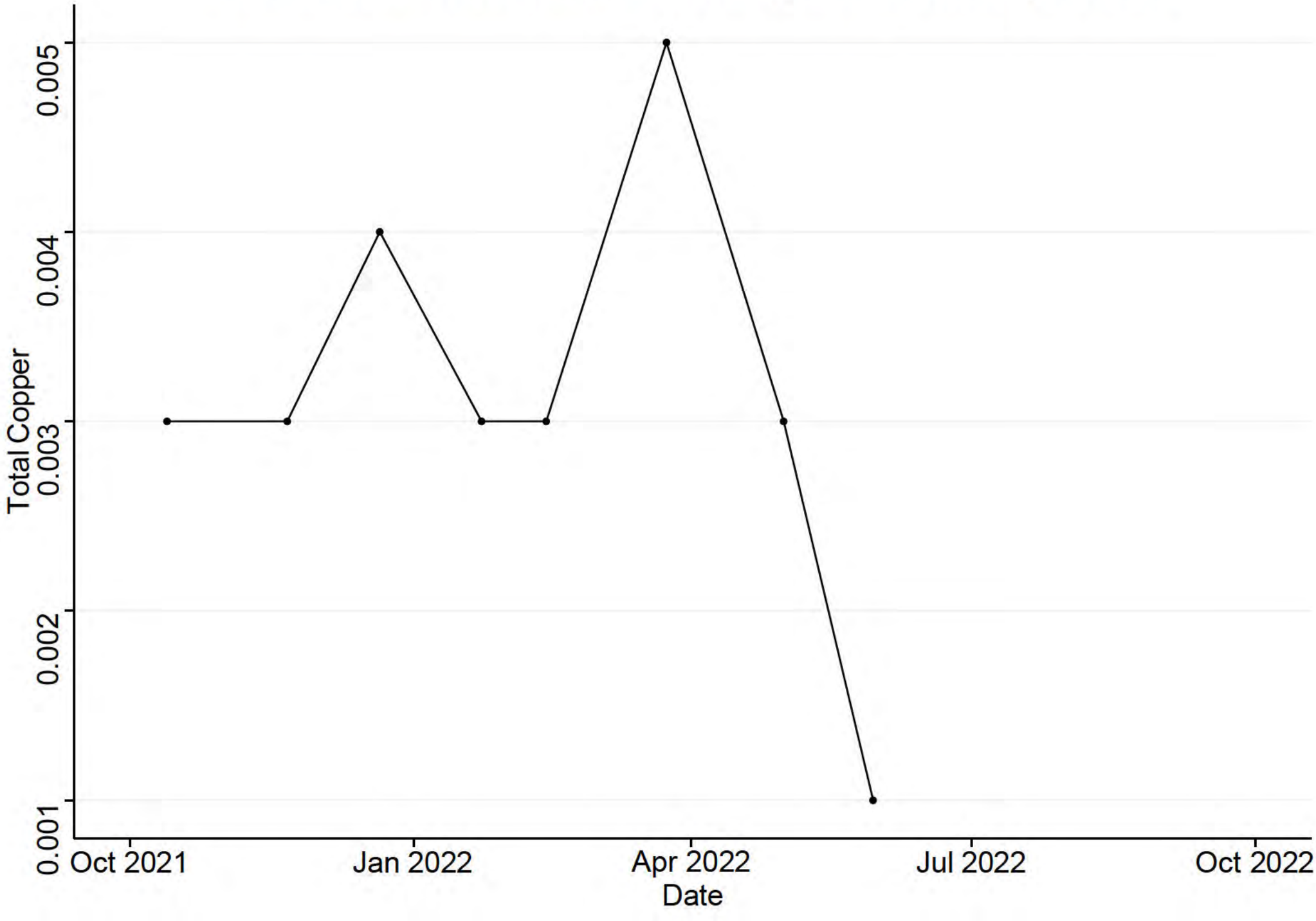

Site NNMW004 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Total Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

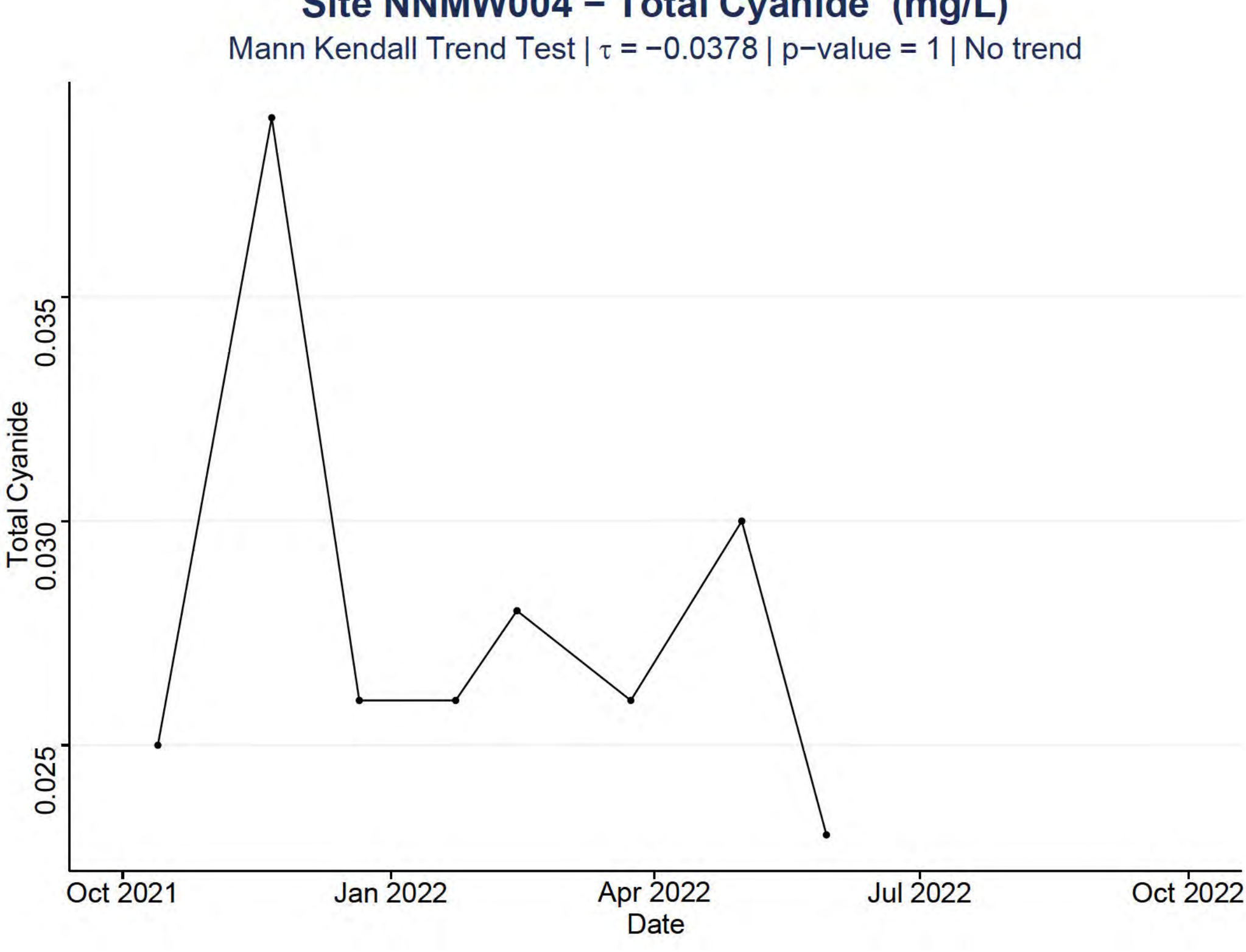

Site NNMW004 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = −0.596 | p−value = 0.159 | No trend
Total Boron
1.00
0.98
0.96
0.94
0.92
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

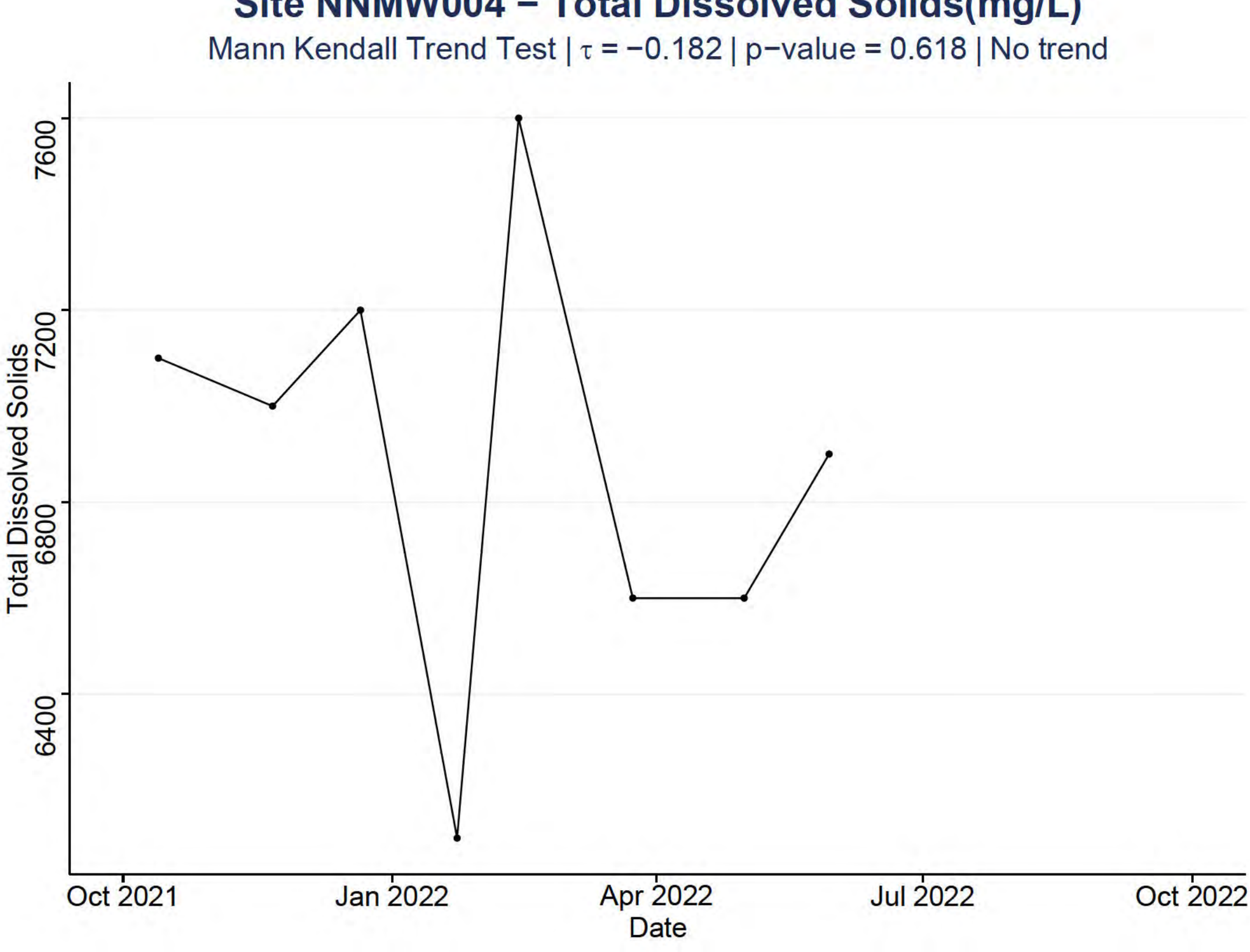

Site NNMW004 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.322 | p−value = 0.352 | No trend
Total Cadmium
8e−04
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

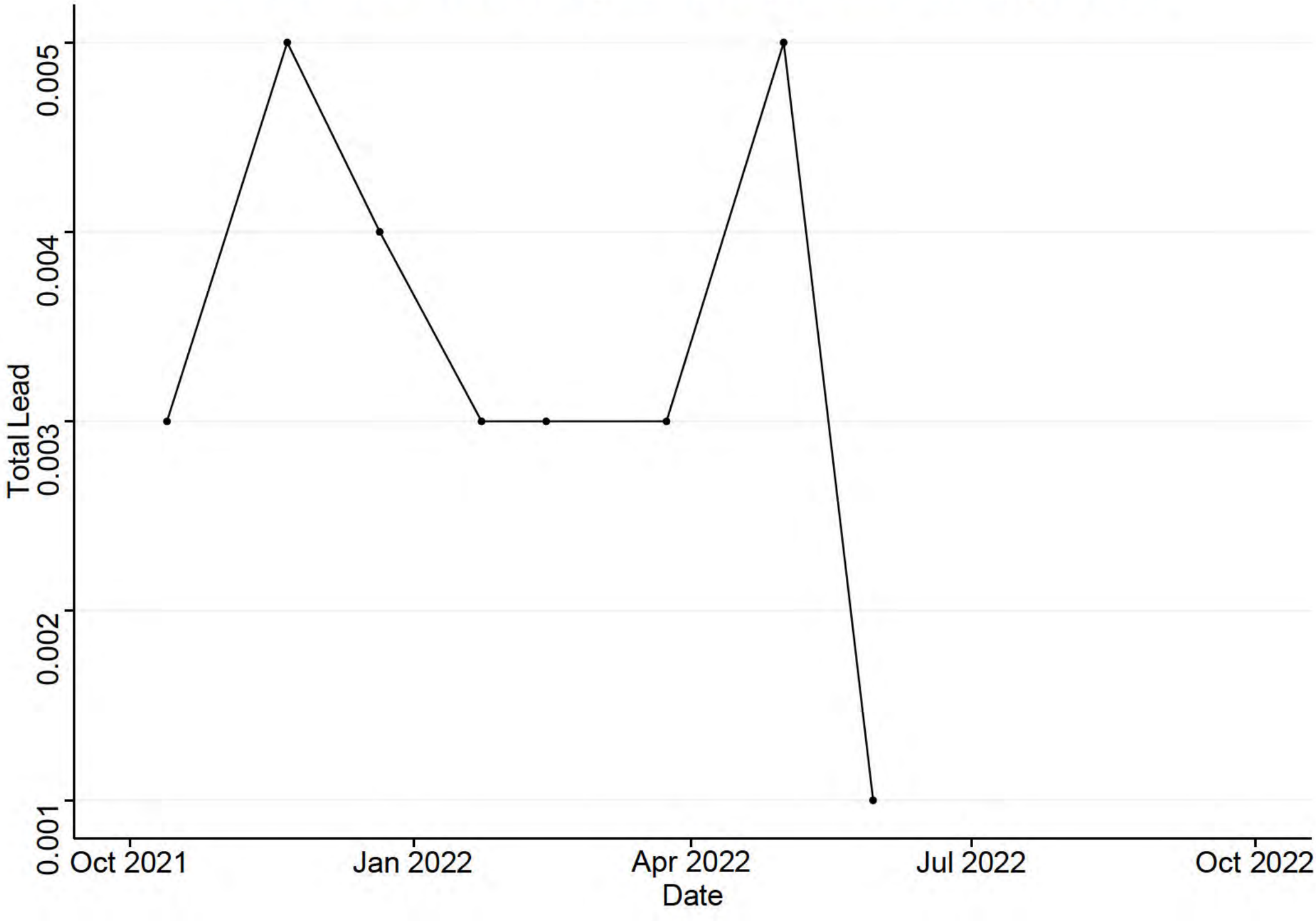

Site NNMW004 – Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

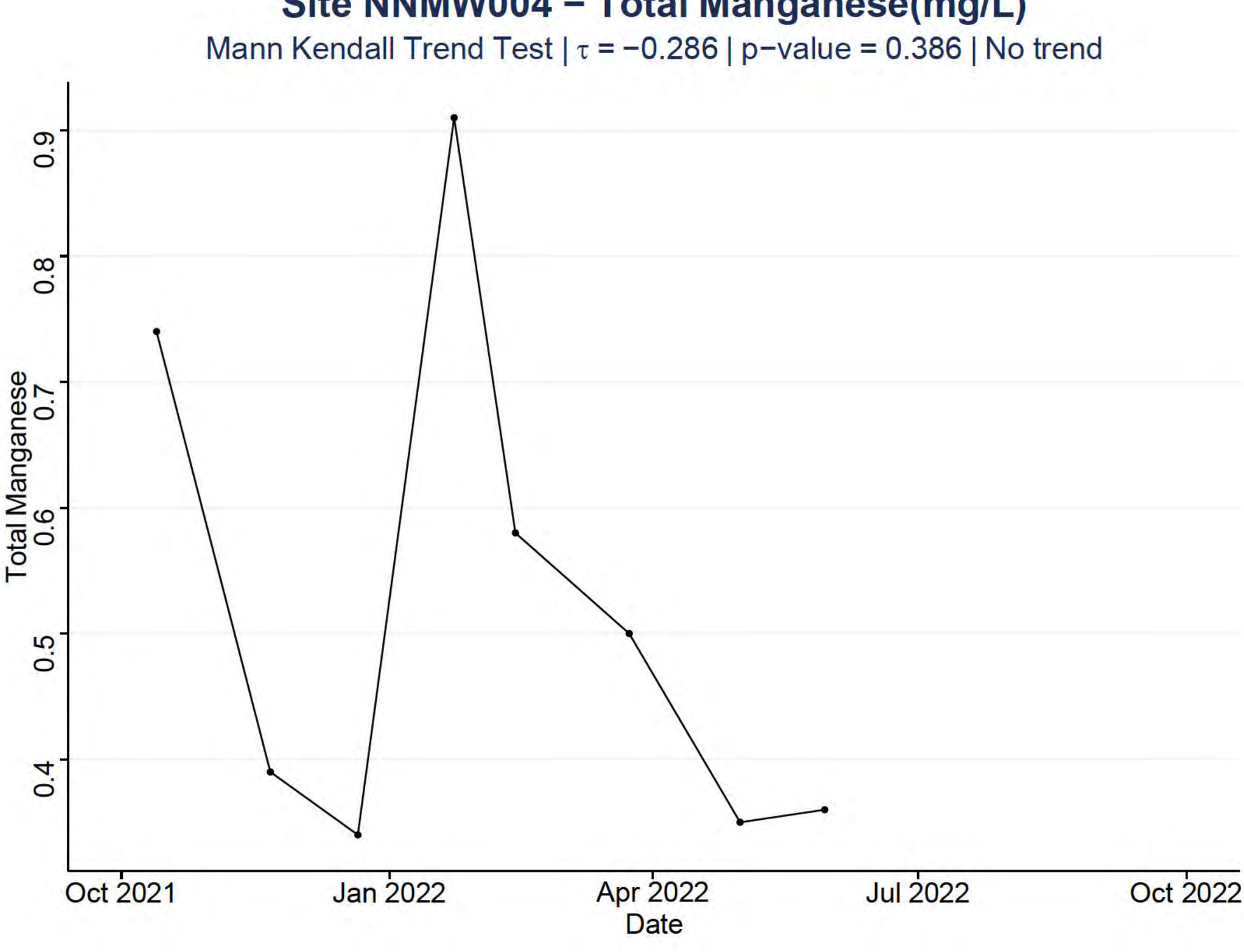

Site NNMW004 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.327 | p−value = 0.319 | No trend
Total Cobalt
0.03
0.04
0.05
0.06
0.07
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

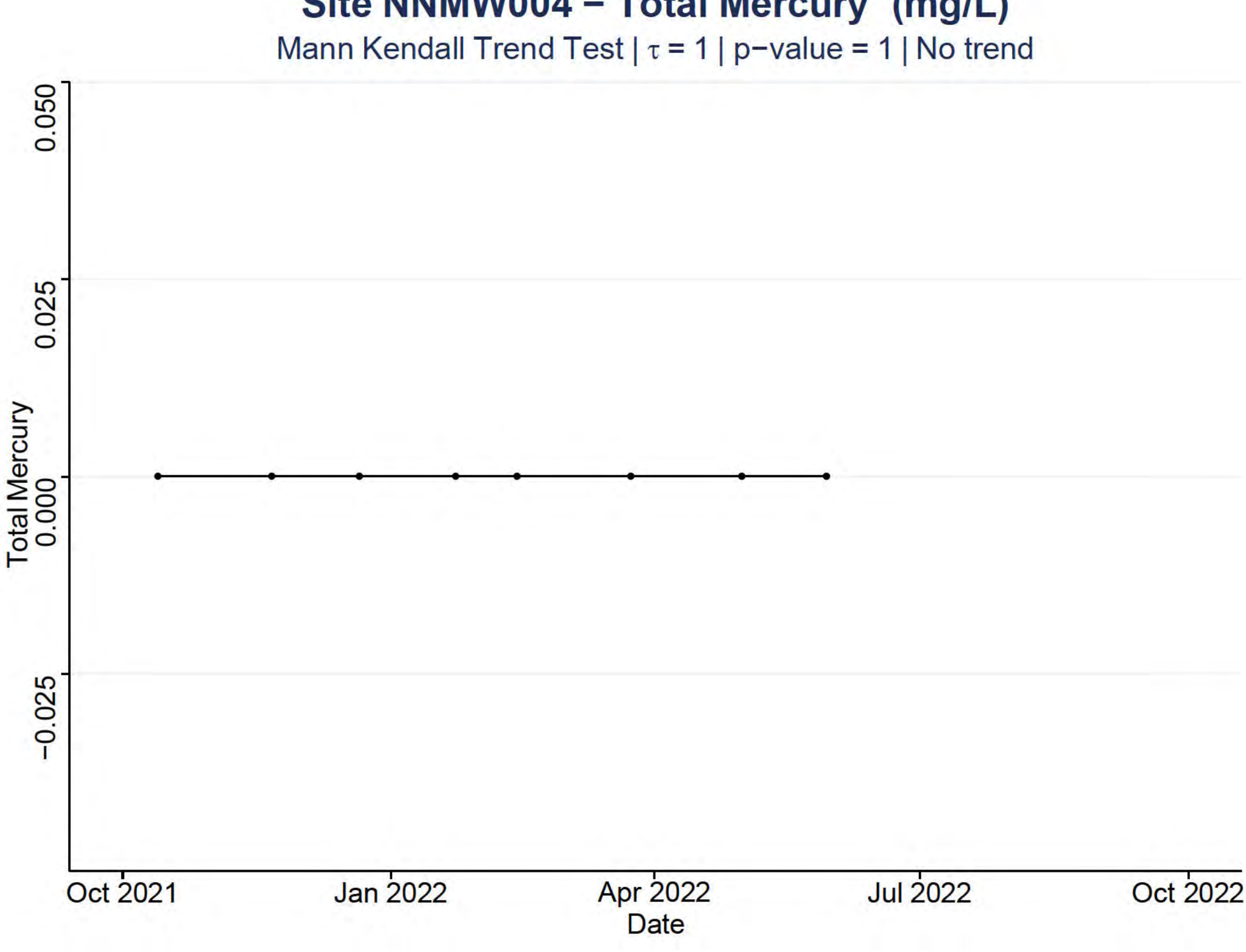

Site NNMW004 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.178 | p−value = 0.667 | No trend
Total Copper
0.005
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

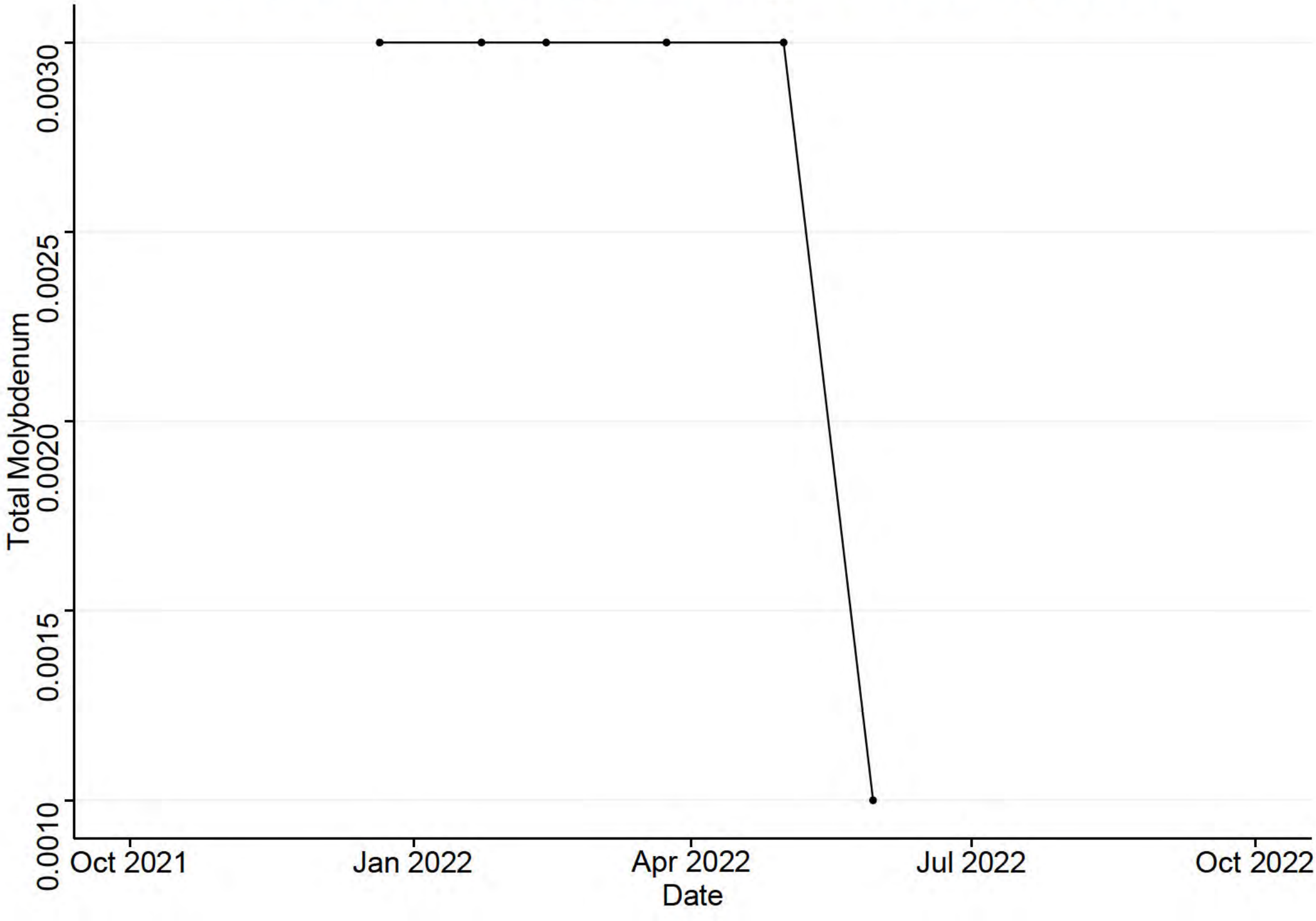

Site NNMW004 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = −0.0378 | p−value = 1 | No trend
Total Cyanide
0.035
0.030
0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

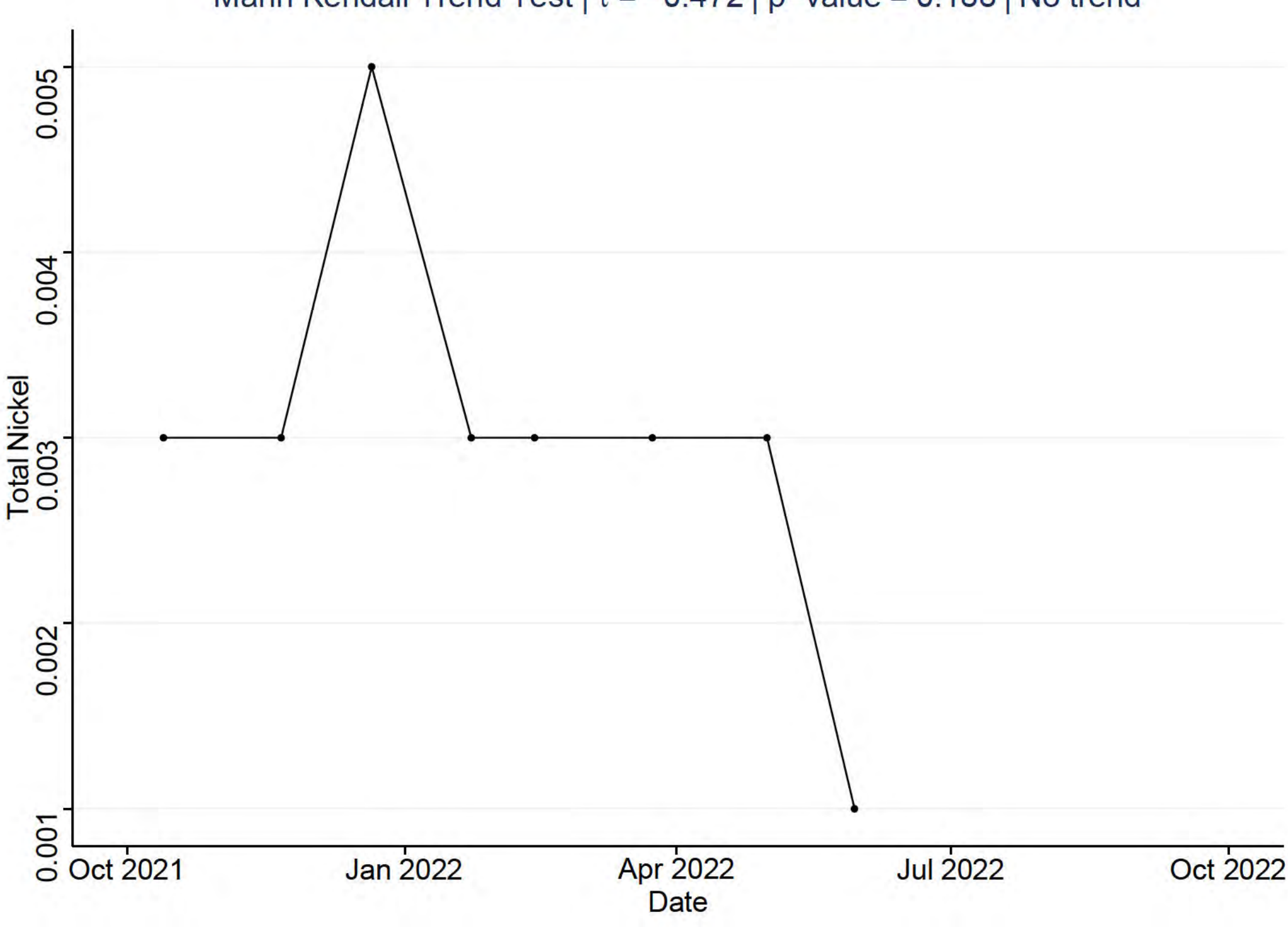

Site NNMW004 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.182 | p−value = 0.618 | No trend
Total Dissolved Solids
7600
7200
6800
6400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

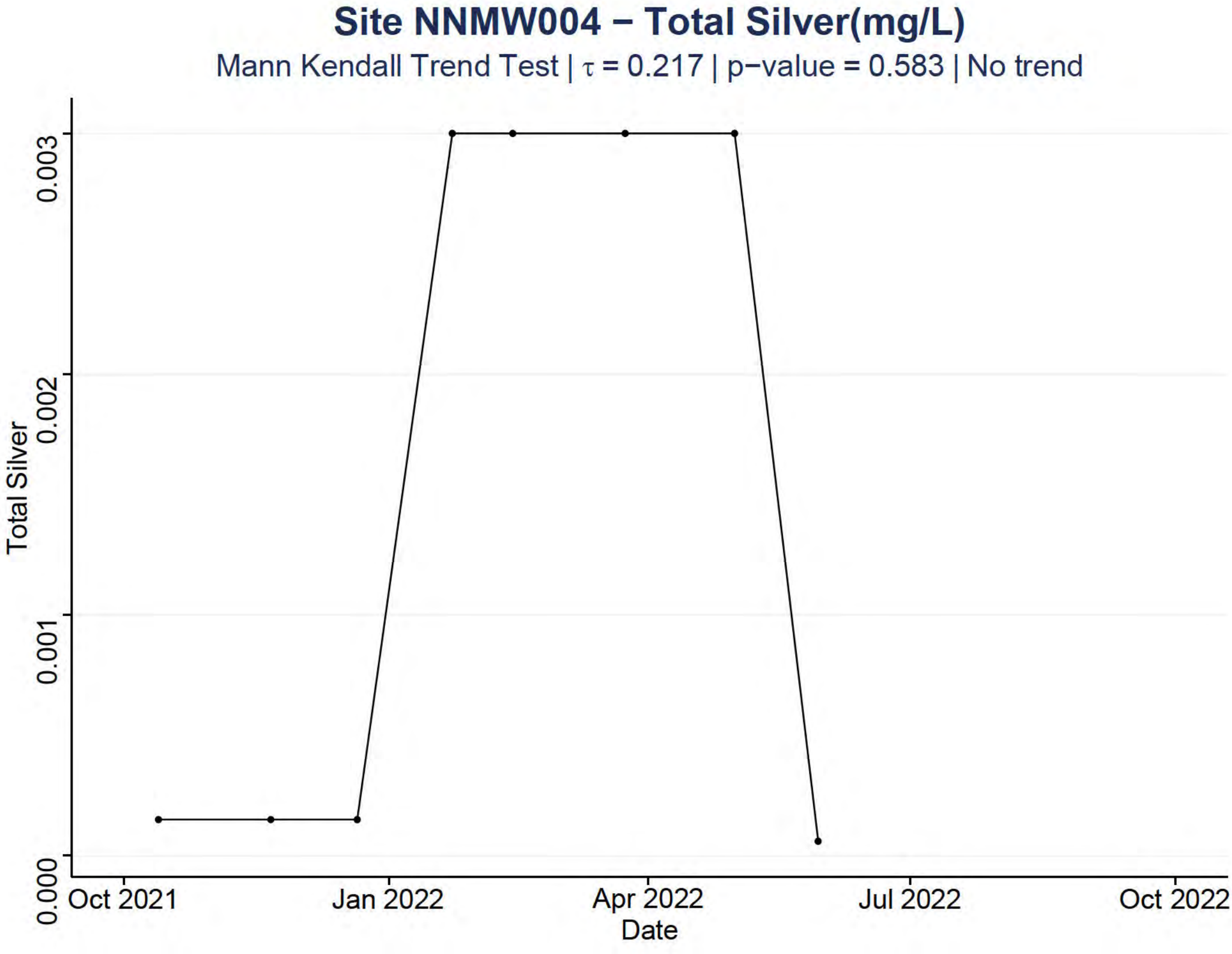

Site NNMW004 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.289 | p−value = 0.421 | No trend
Total Lead
0.001
0.002
0.003
0.004
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

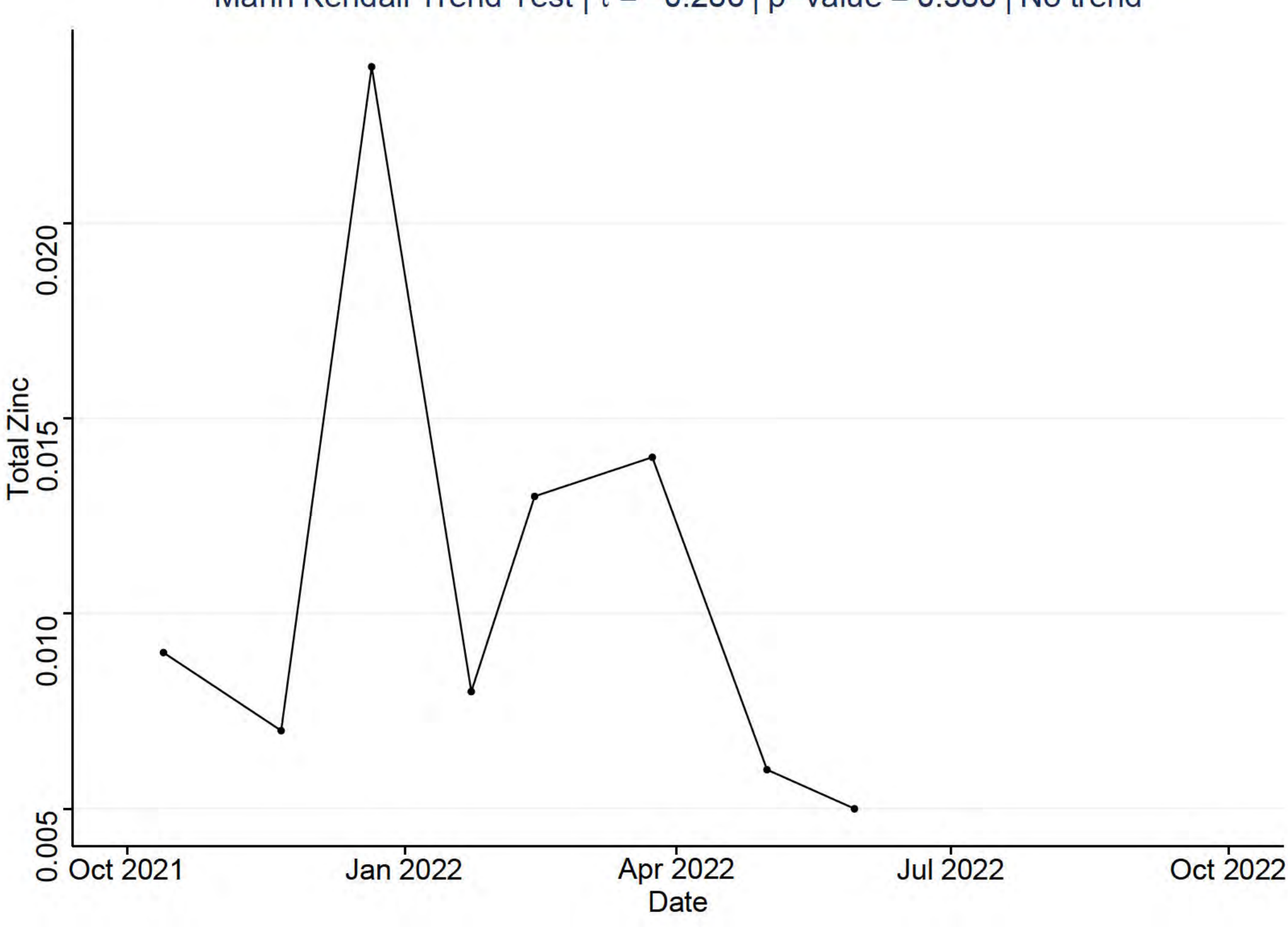

Site NNMW004 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.286 | p−value = 0.386 | No trend
Total Manganese
0.4
0.5
0.6
0.7
0.8
0.9
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

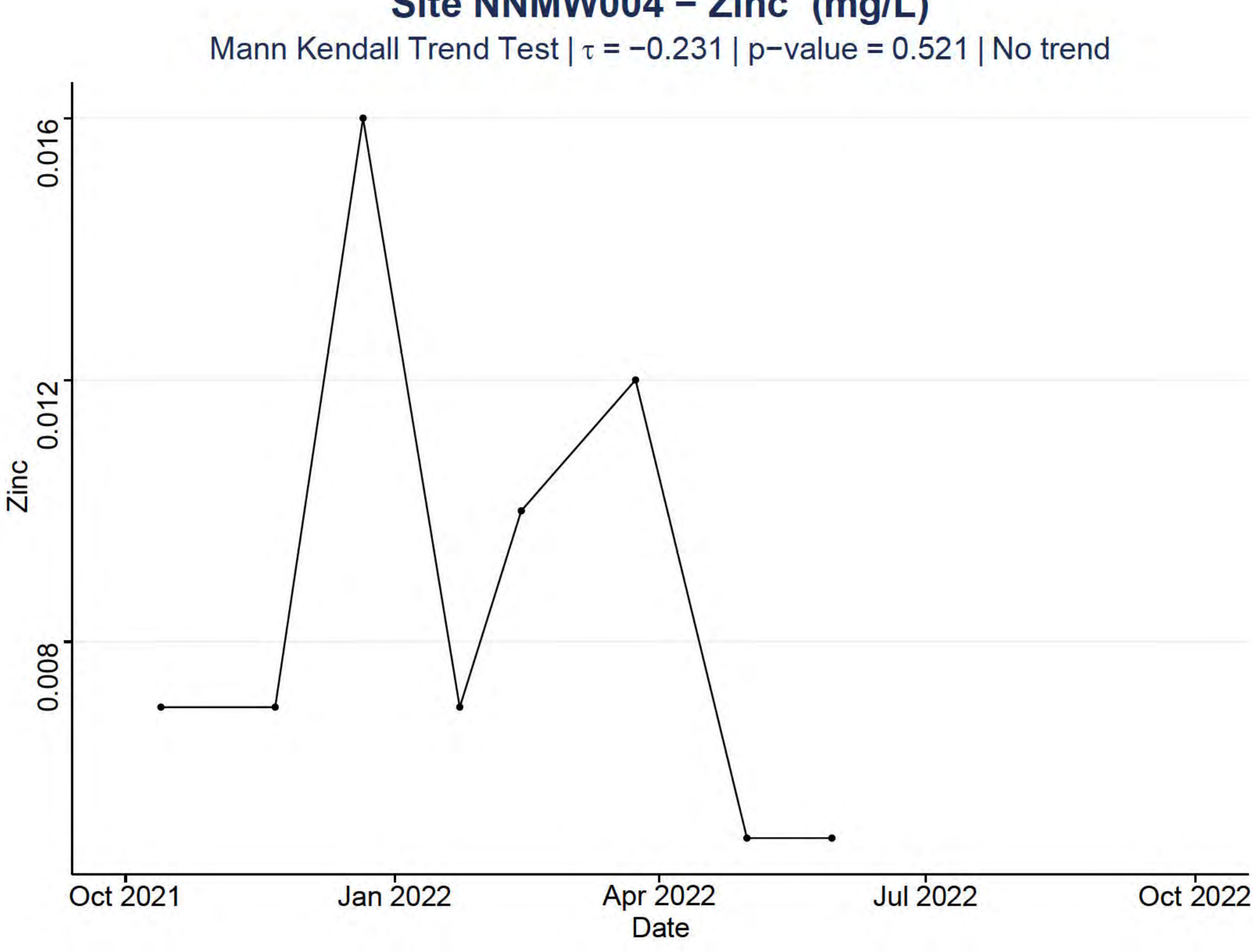

Site NNMW004 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

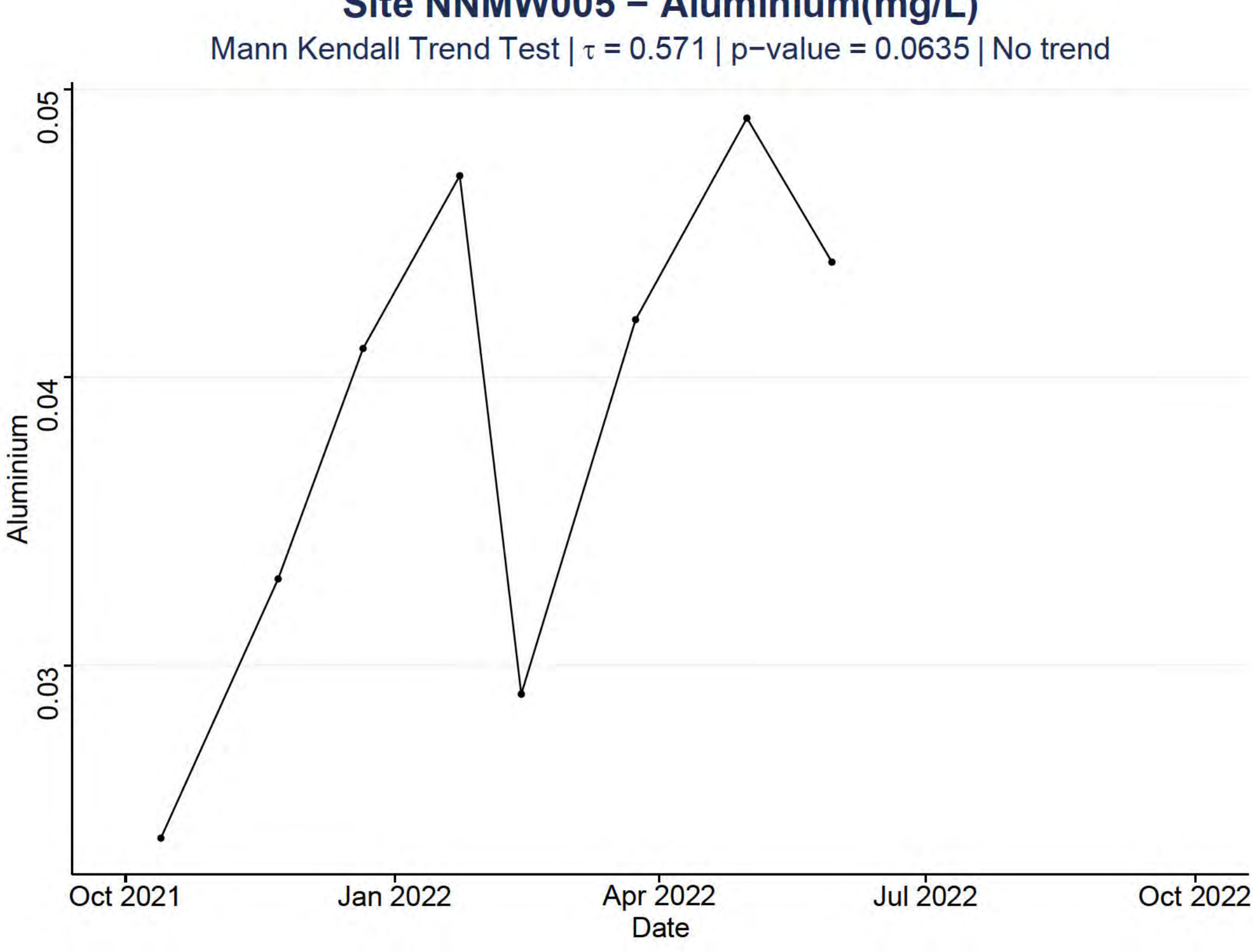

Site NNMW004 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Total Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

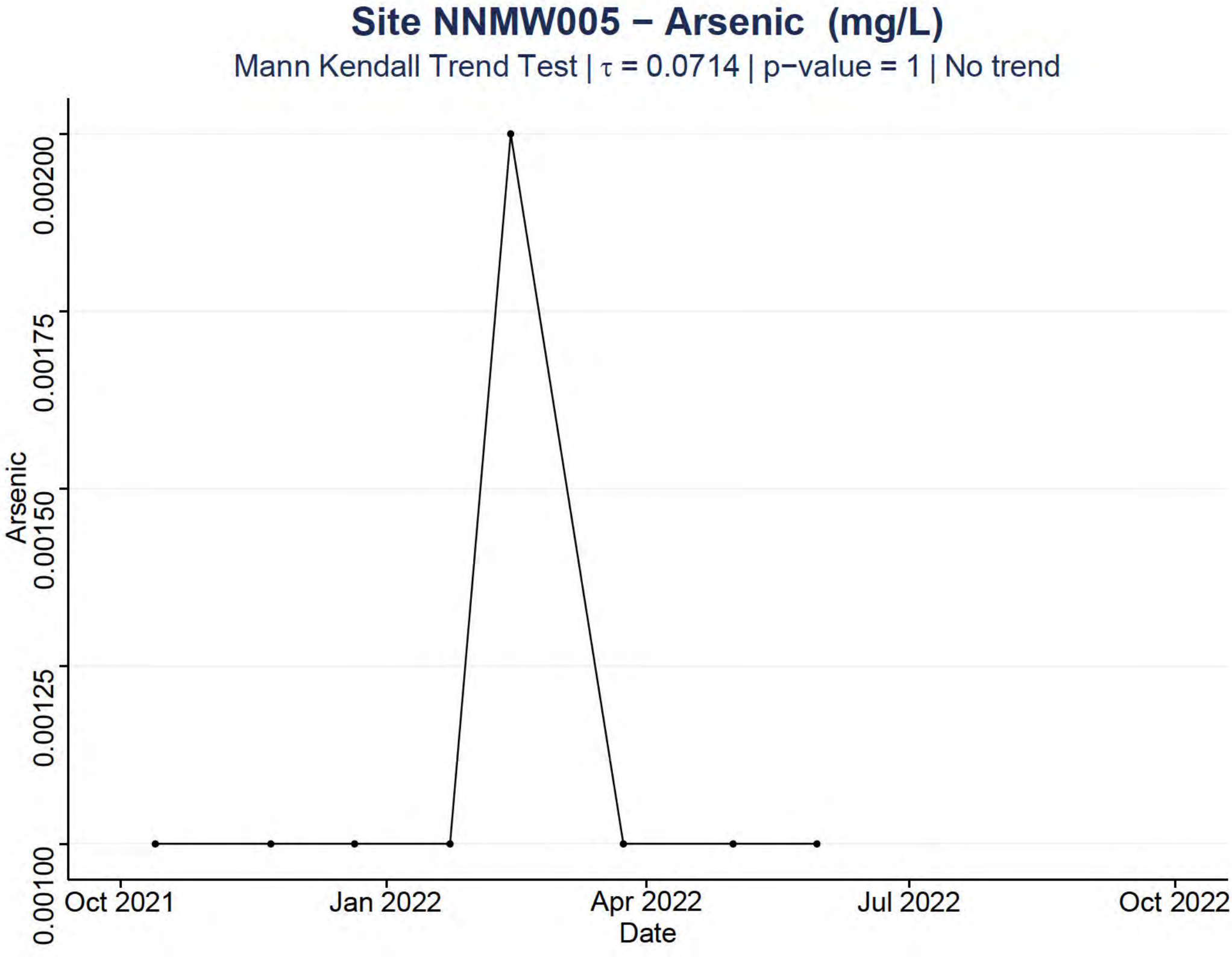

Site NNMW004 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.472 | p−value = 0.188 | No trend
Total Nickel
0.001
0.002
0.003
0.004
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

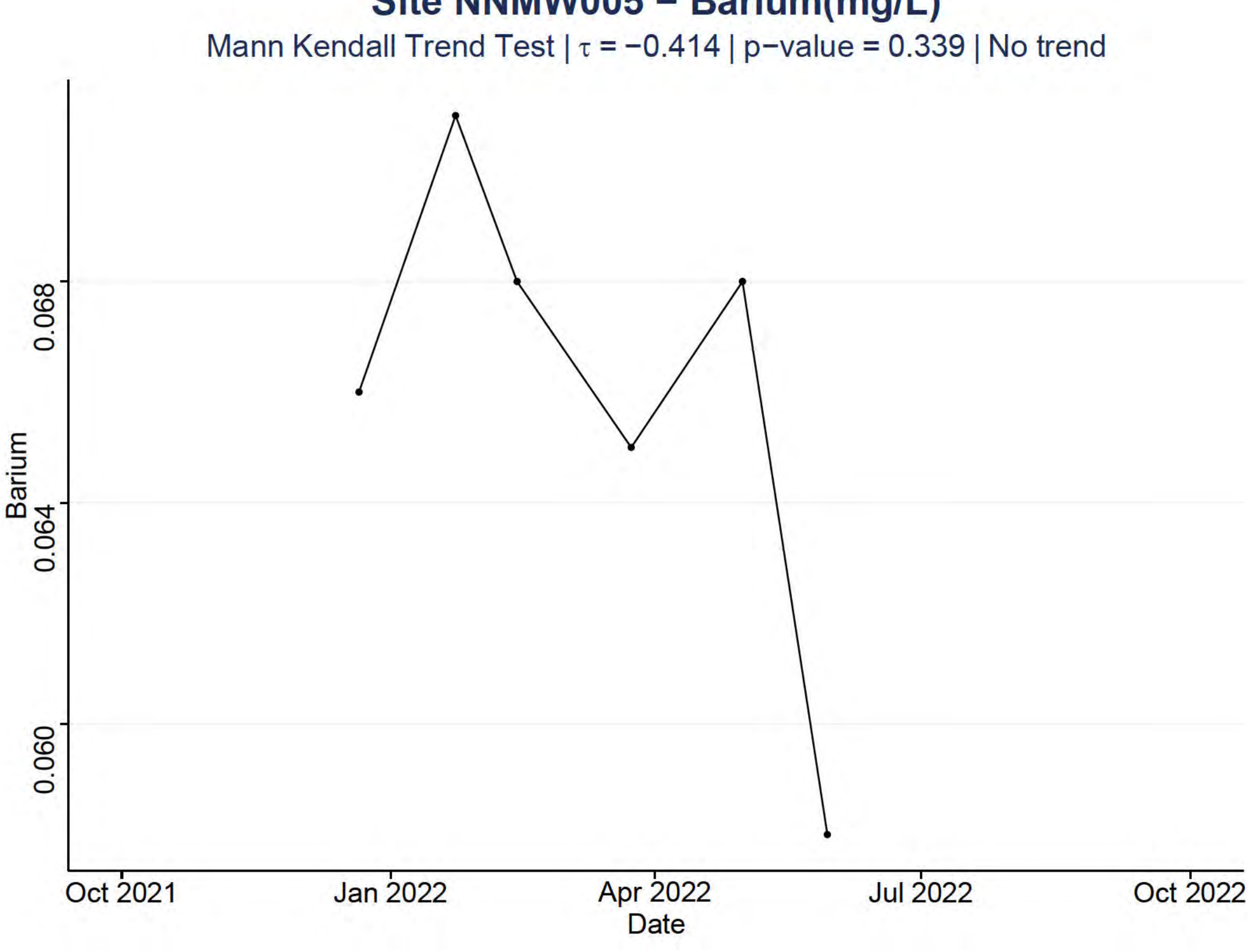

Site NNMW004 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Total Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

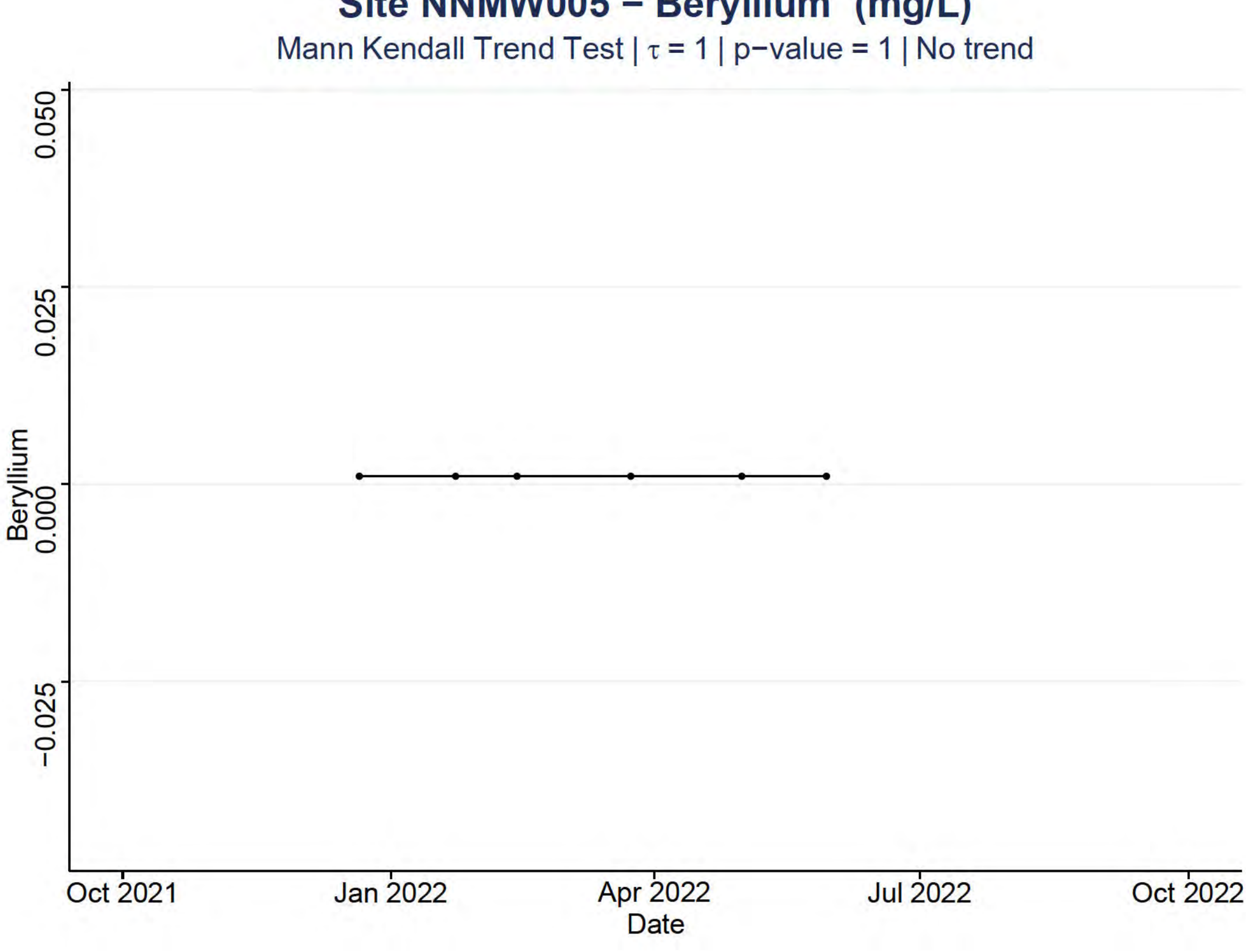

Site NNMW004 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.286 | p−value = 0.386 | No trend
Total Zinc
0.020
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

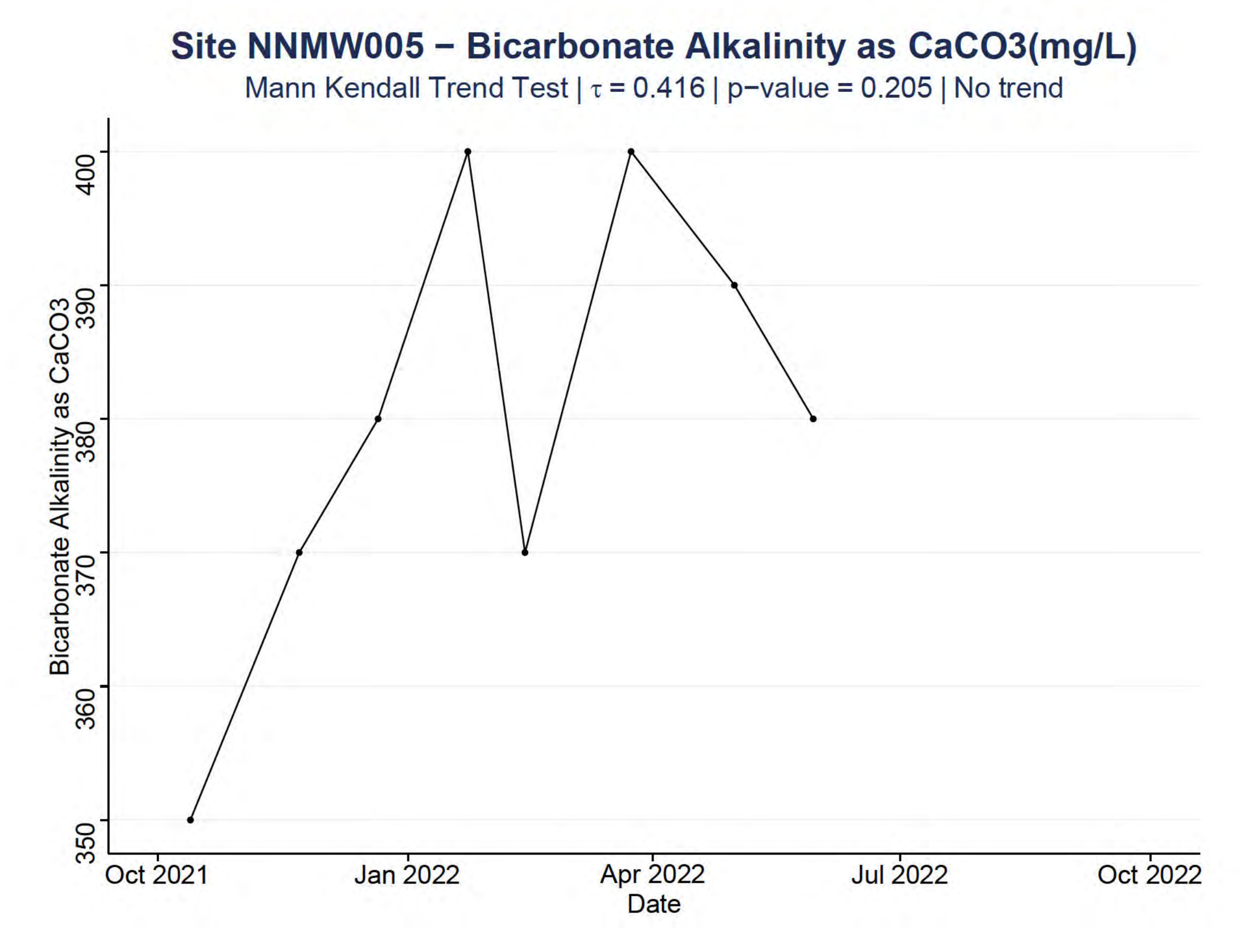

Site NNMW004 – Zinc (mg/L)
Mann Kendall Trend Test | τ = −0.231 | p−value = 0.521 | No trend
Zinc
0.016
0.012
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

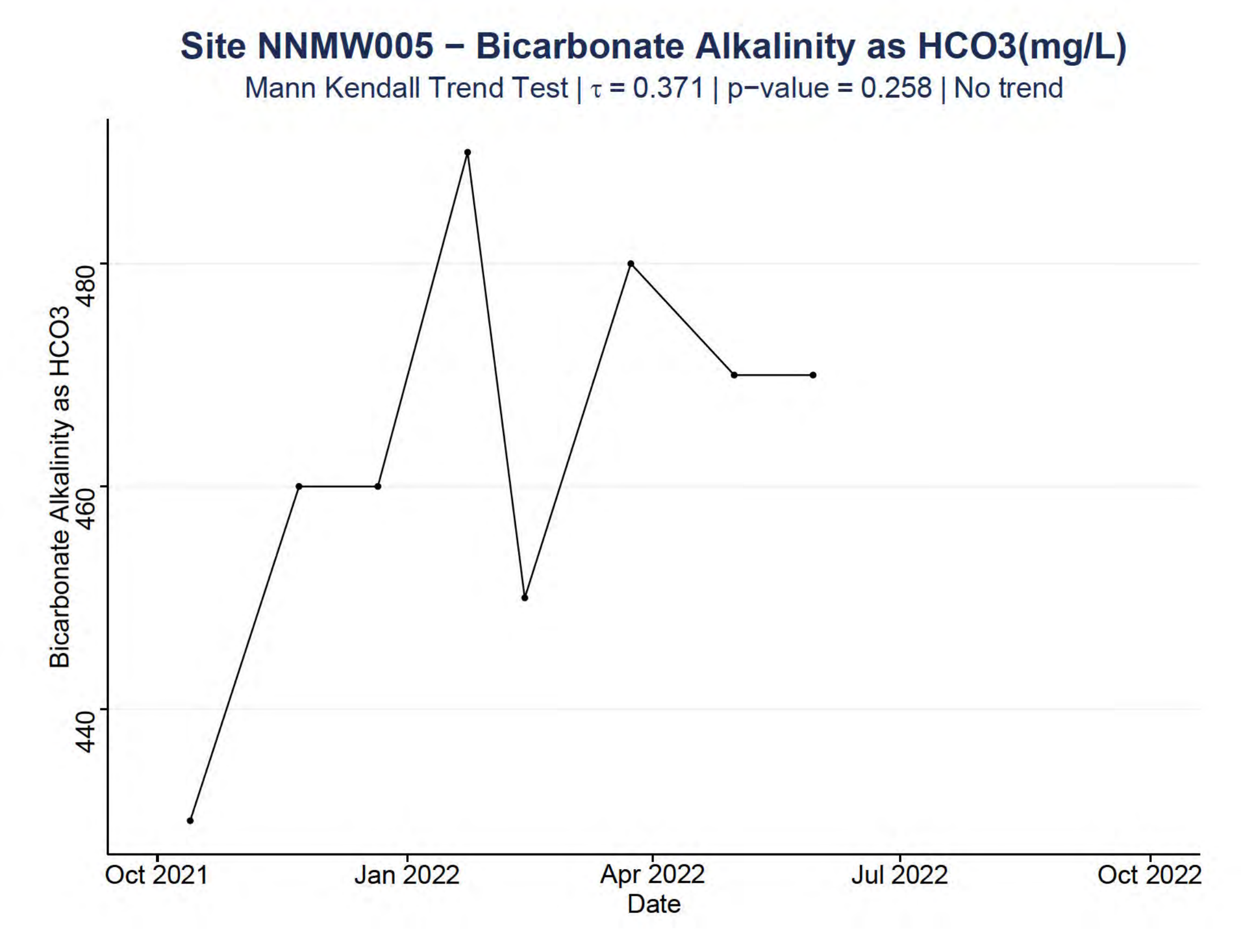

Site NNMW005 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.571 | p−value = 0.0635 | No trend
Aluminium
0.05
0.04
0.03
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

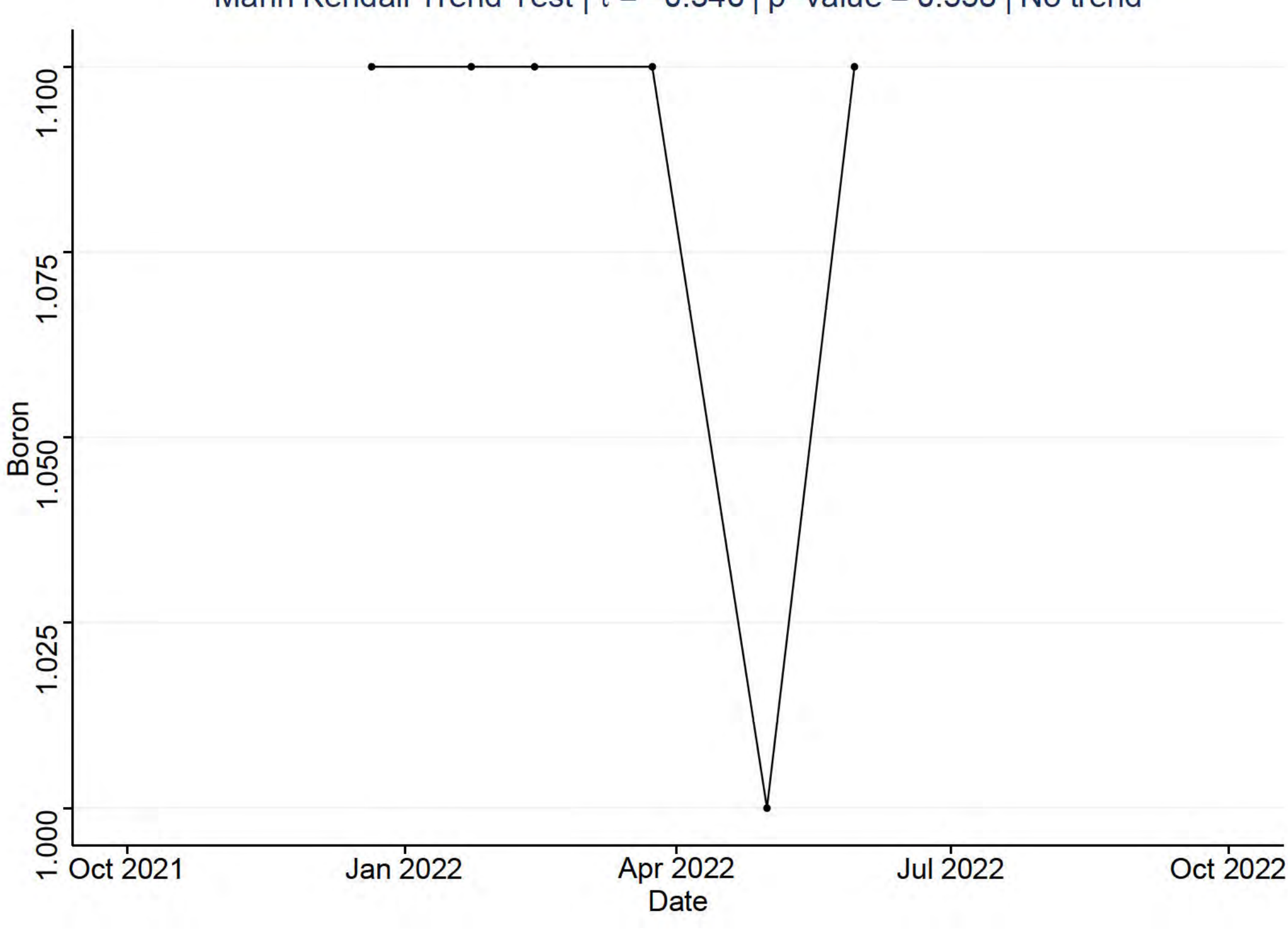

Site NNMW005 – Arsenic (mg/L)
Mann Kendall Trend Test | τ = 0.0714 | p−value = 1 | No trend
Arsenic
0.00200
0.00175
0.00150
0.00125
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

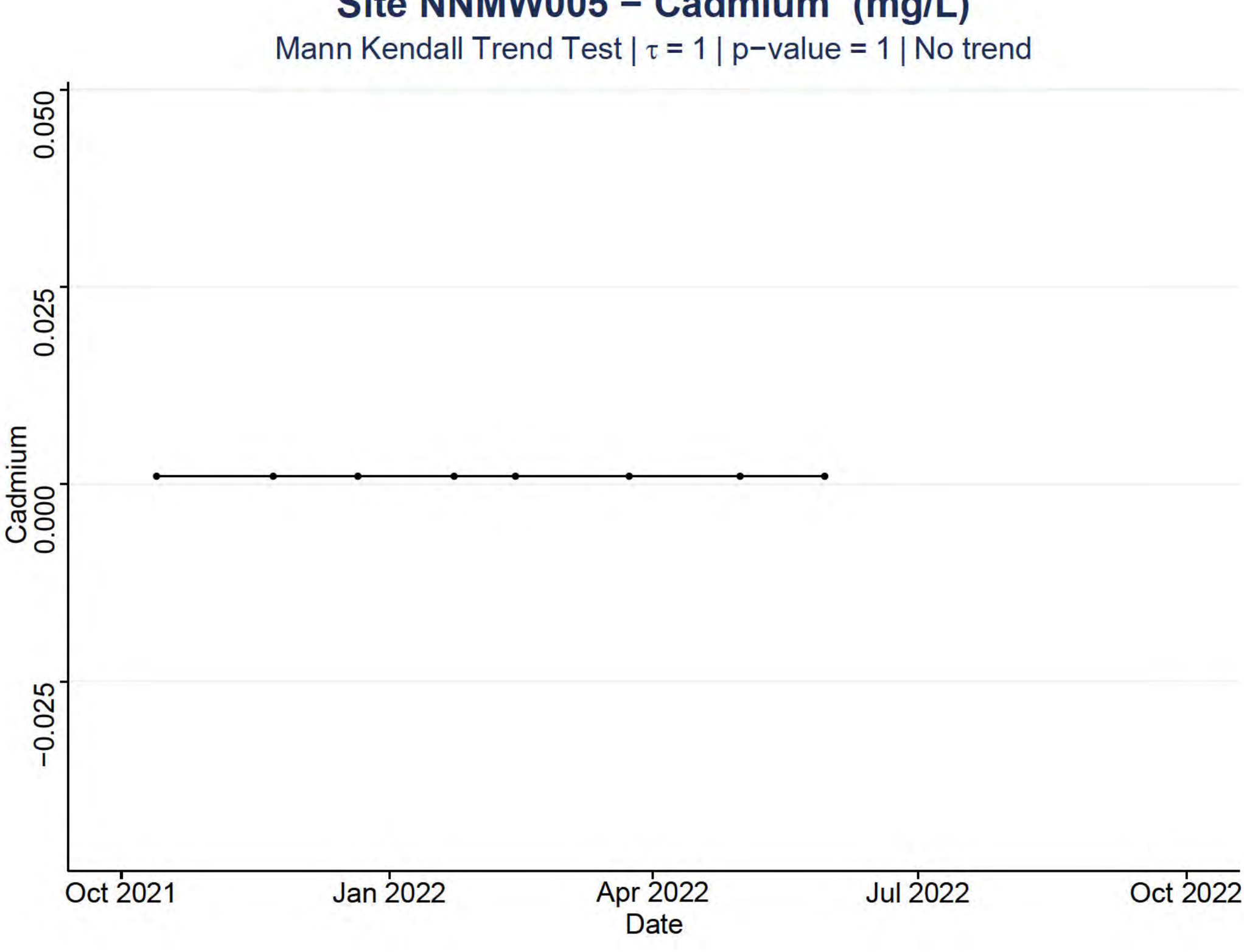

Site NNMW005 − Barium(mg/L)
Mann Kendall Trend Test | τ = −0.414 | p−value = 0.339 | No trend
Barium
0.068
0.064
0.060
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

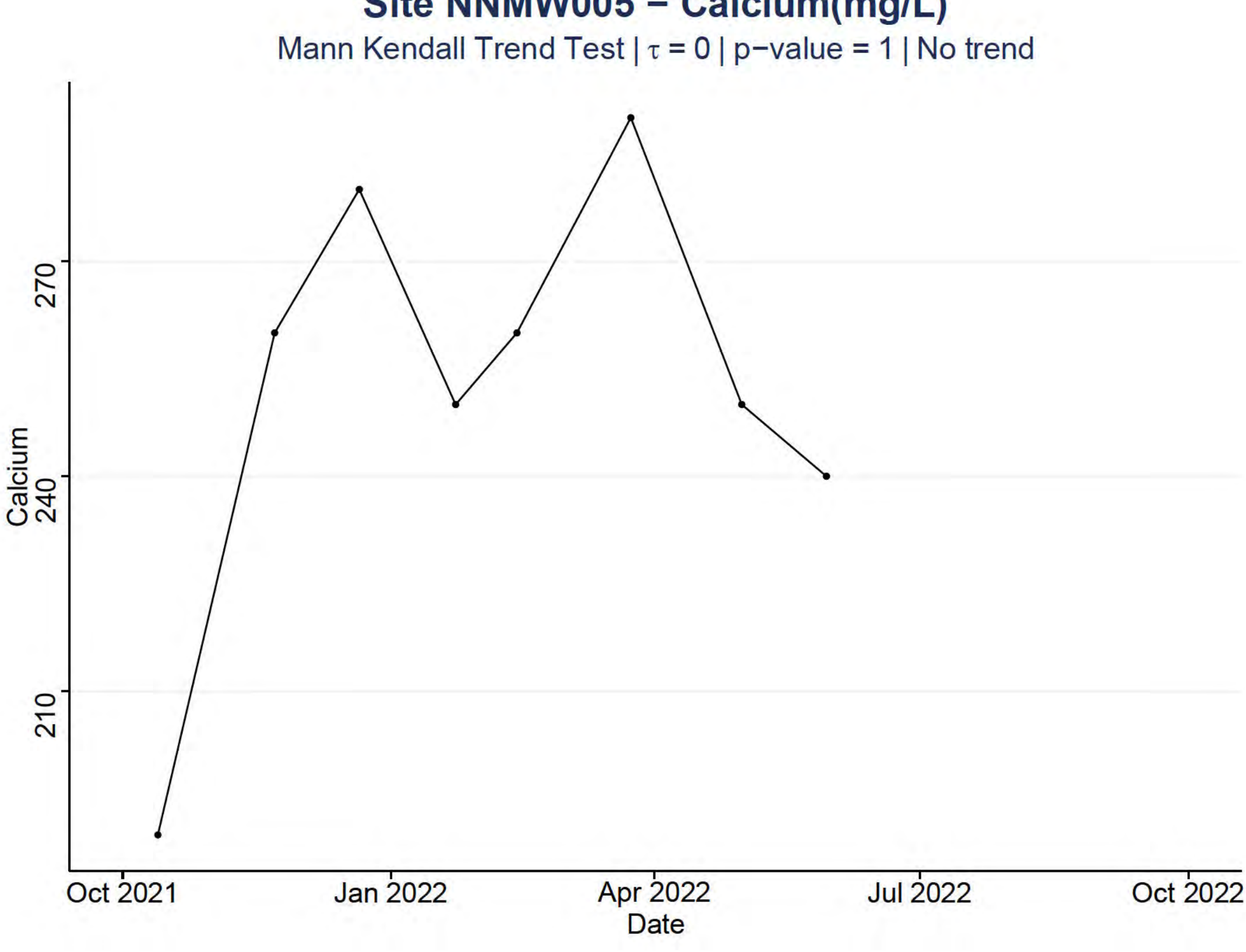

Site NNMW005 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Beryllium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

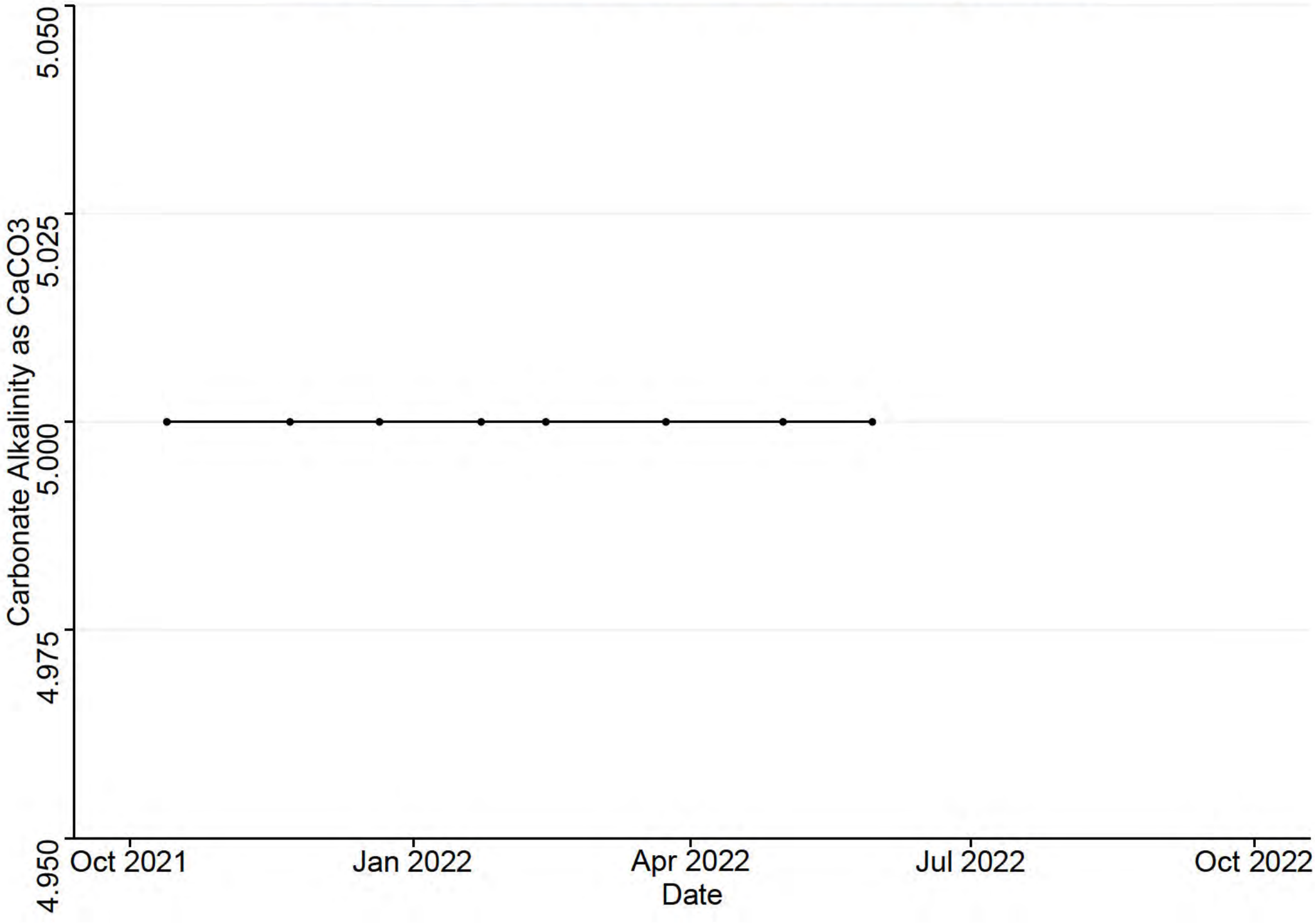

Site NNMW005 – Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.416 | p−value = 0.205 | No trend
Bicarbonate Alkalinity as CaCO3
350
360
370
380
390
400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

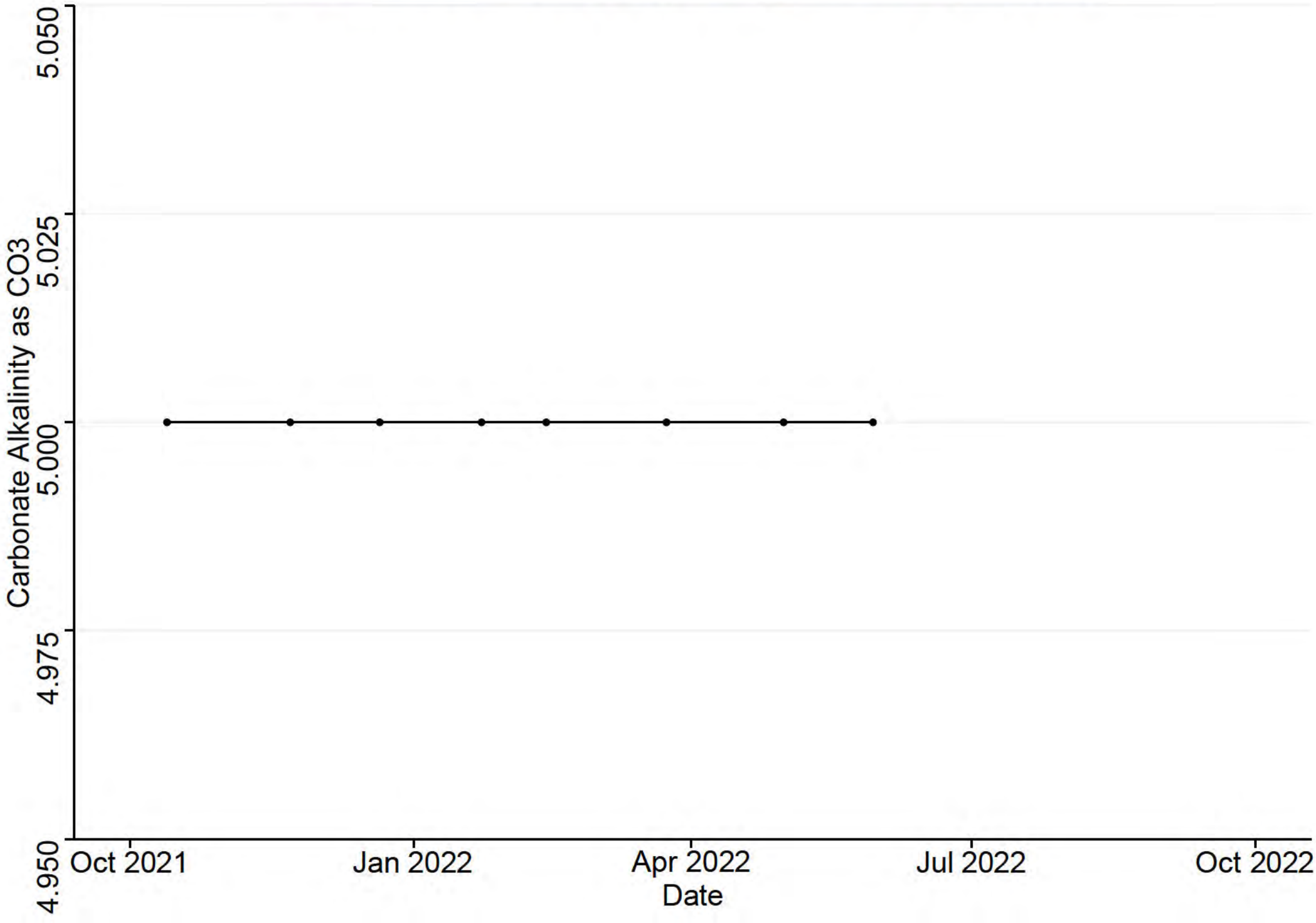

Site NNMW005 – Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.371 | p−value = 0.258 | No trend
Bicarbonate Alkalinity as HCO3
480
460
440
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

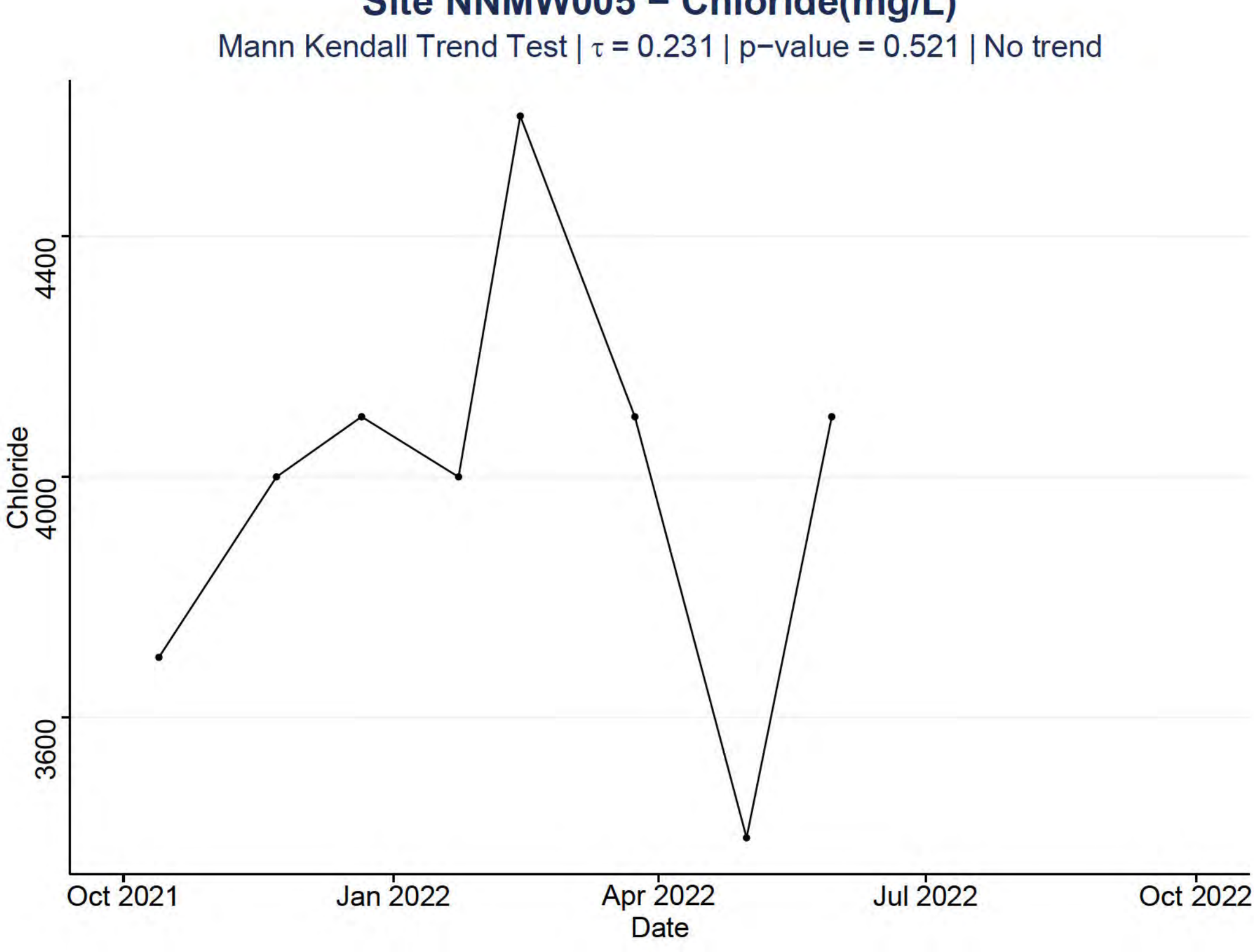

Site NNMW005 – Boron(mg/L)
Mann Kendall Trend Test | τ = −0.346 | p−value = 0.558 | No trend
Boron
1.100
1.075
1.050
1.025
1.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

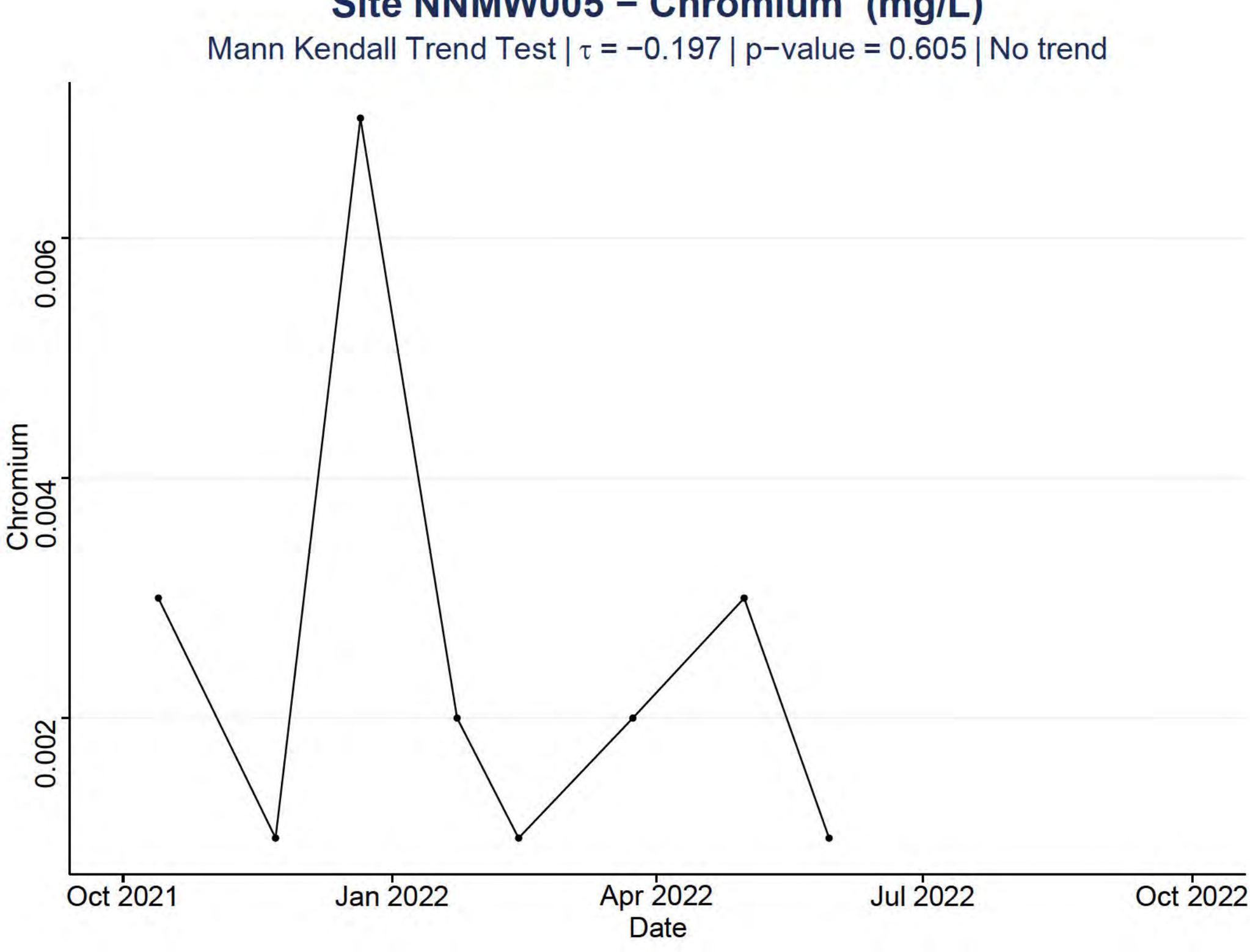

Site NNMW005 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Cadmium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

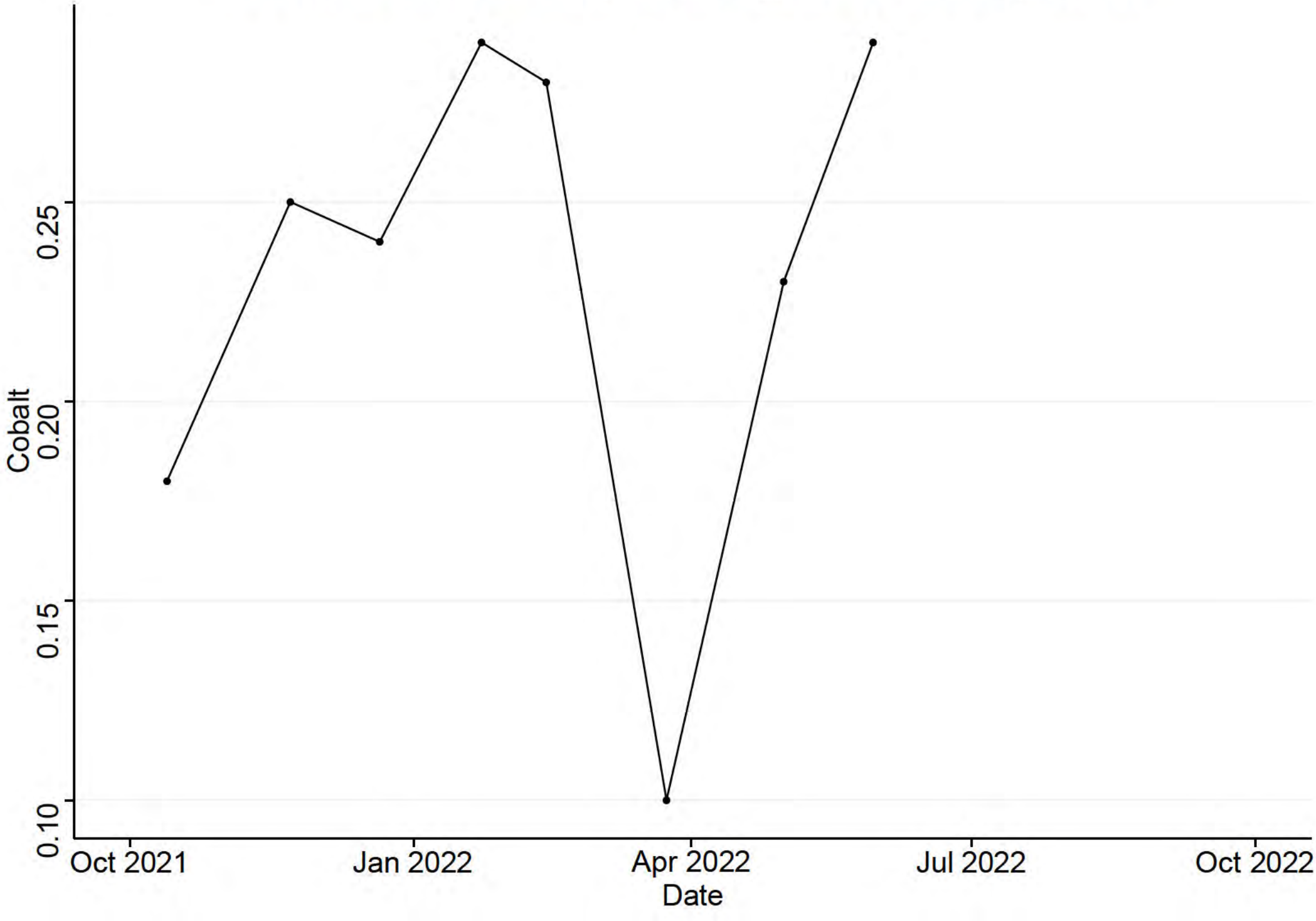

Site NNMW005 – Calcium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Calcium
270
240
210
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

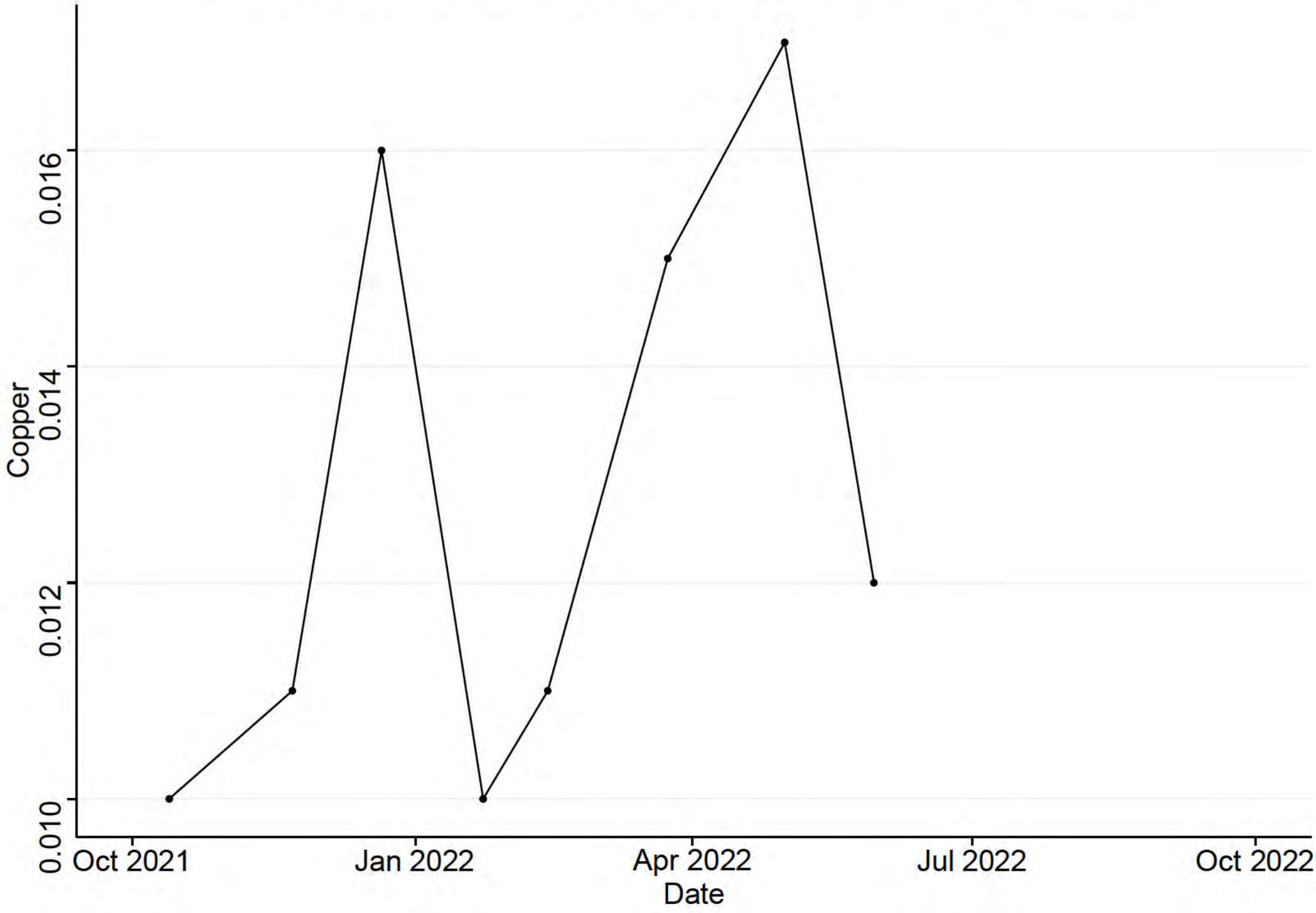

Site NNMW005 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

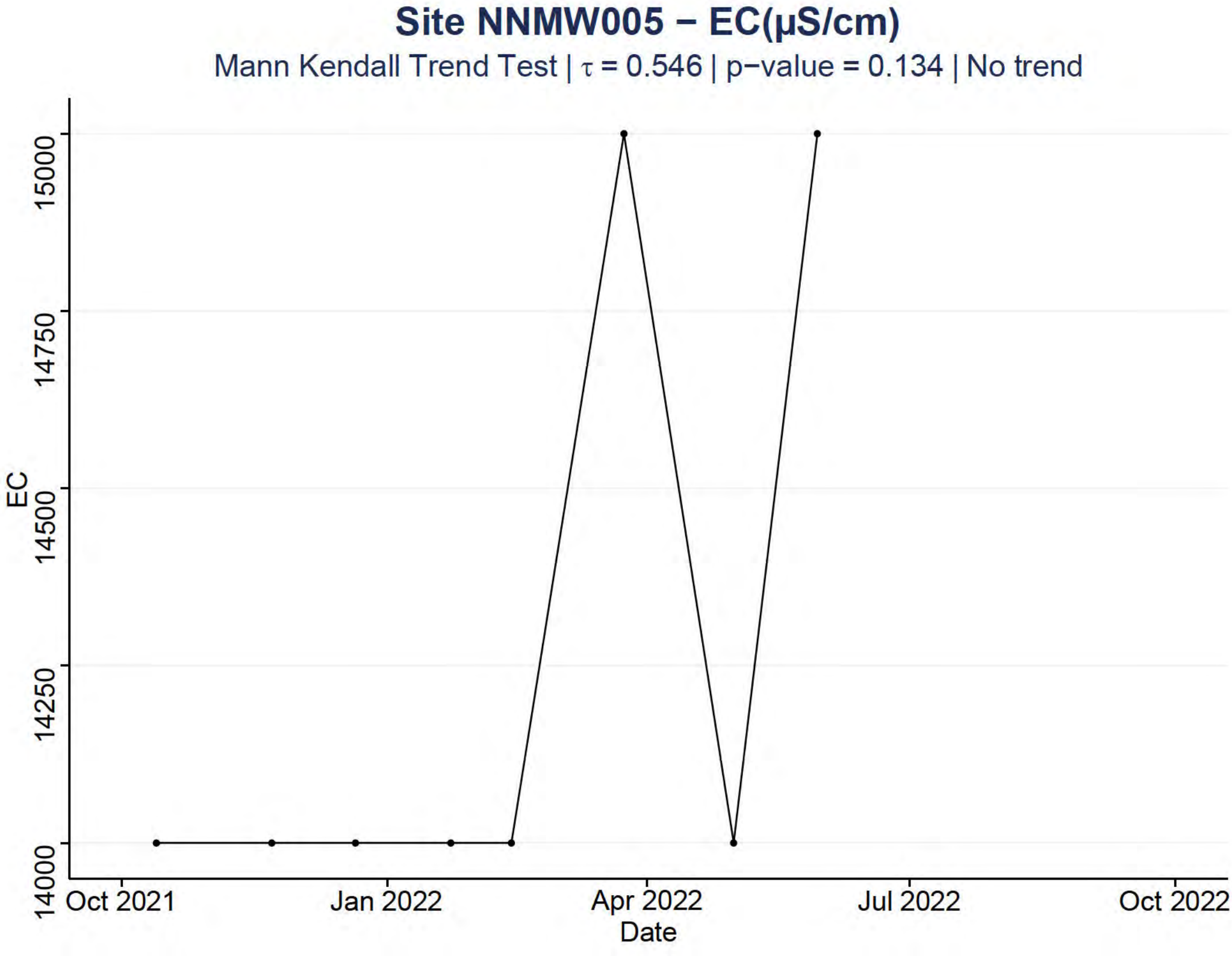

Site NNMW005 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

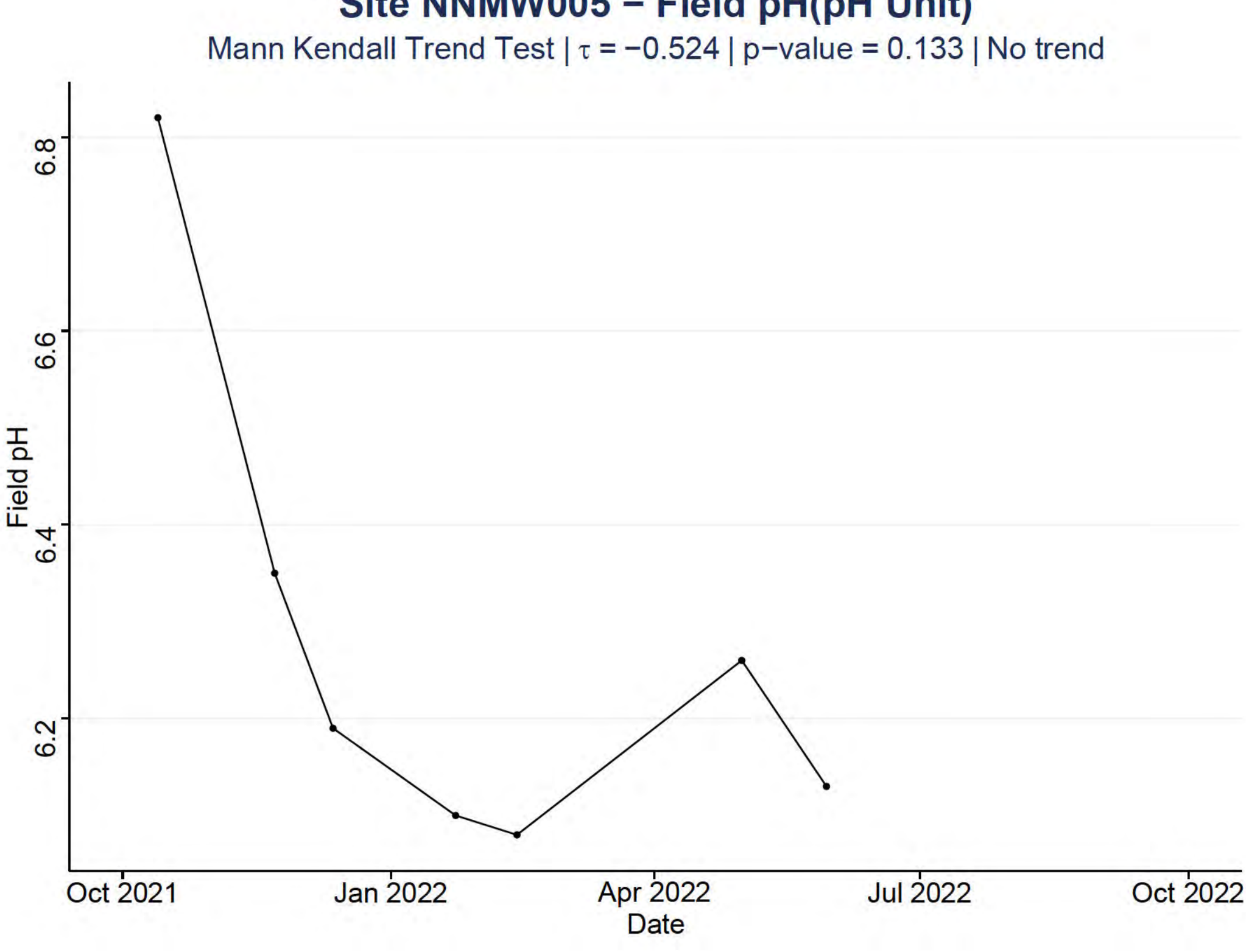

Site NNMW005 – Chloride(mg/L)
Mann Kendall Trend Test | τ = 0.231 | p−value = 0.521 | No trend
Chloride
4400
4000
3600
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

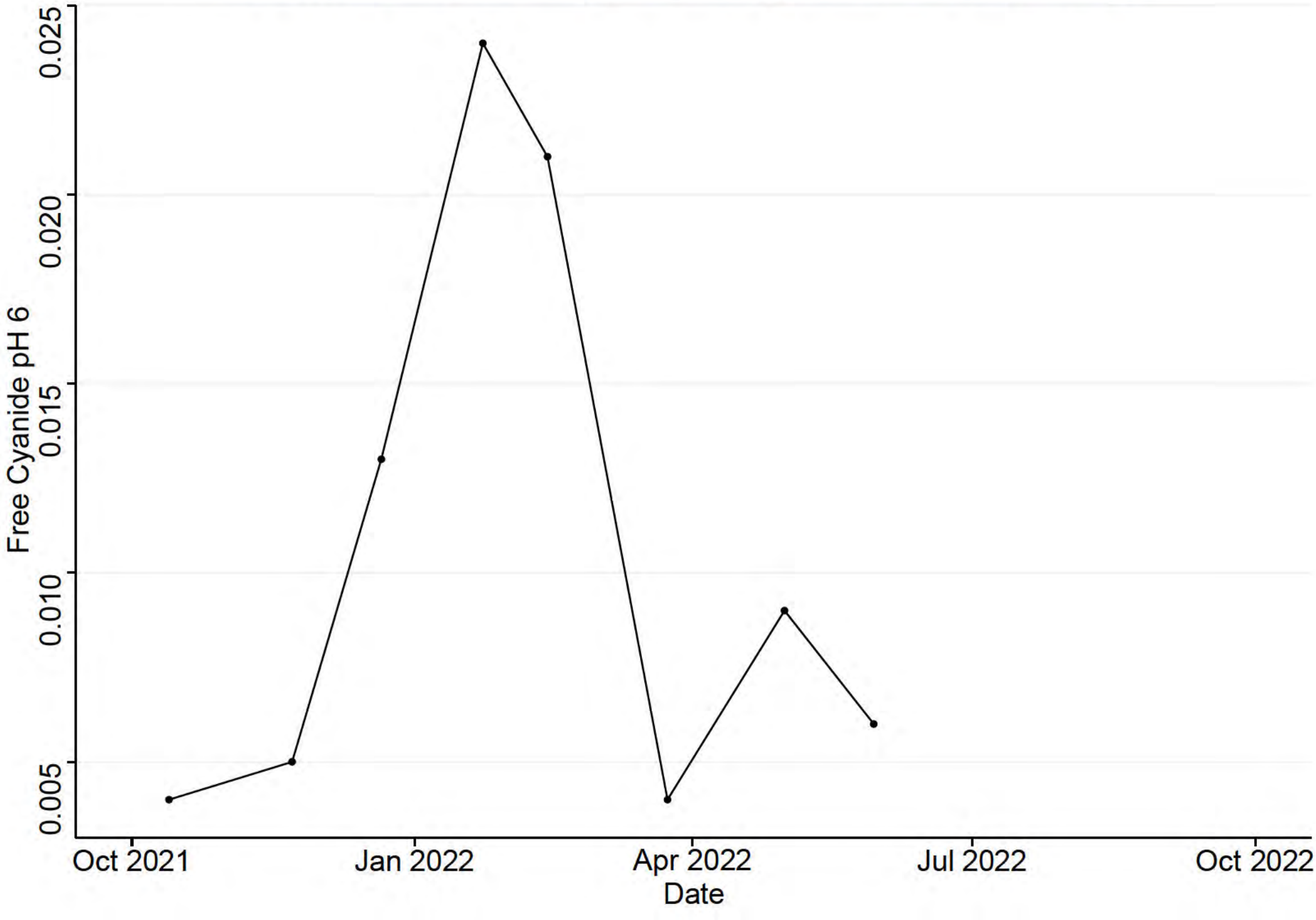

Site NNMW005 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.197 | p−value = 0.605 | No trend
Chromium
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

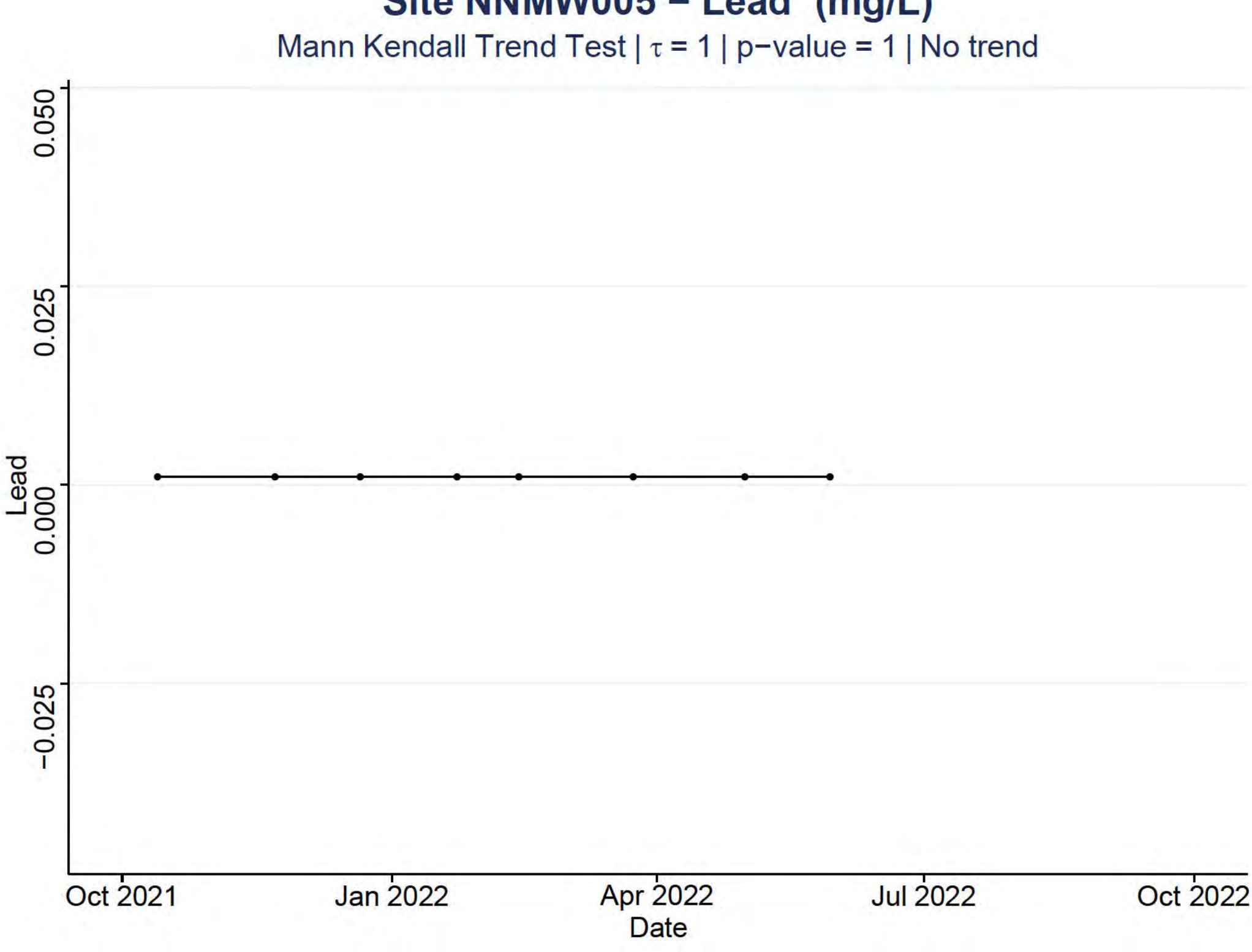

Site NNMW005 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = 0.182 | p−value = 0.618 | No trend
Cobalt
0.10
0.15
0.20
0.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

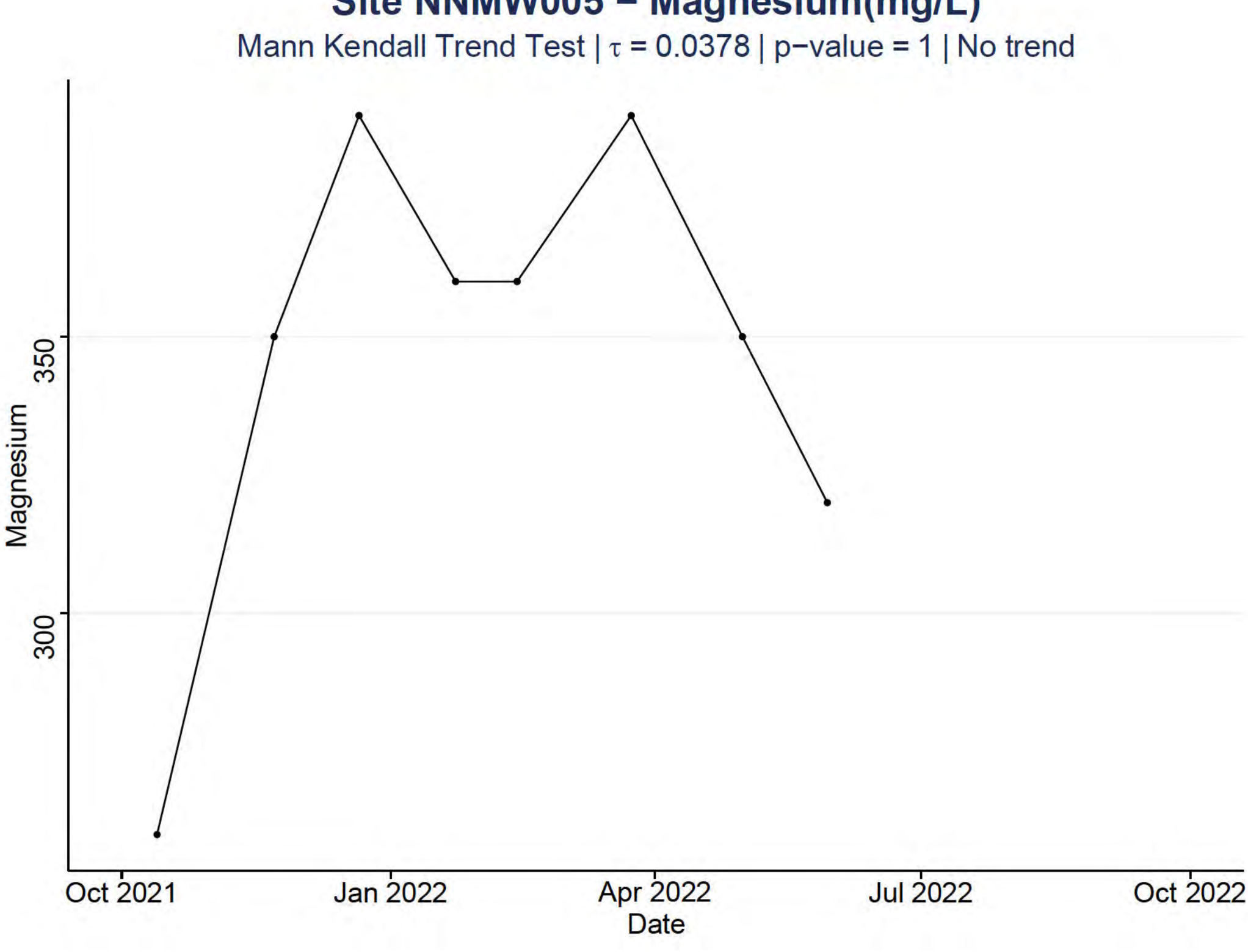

Site NNMW005 – Copper (mg/L)
Mann Kendall Trend Test | τ = 0.445 | p−value = 0.167 | No trend
Copper
0.010
0.012
0.014
0.016
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

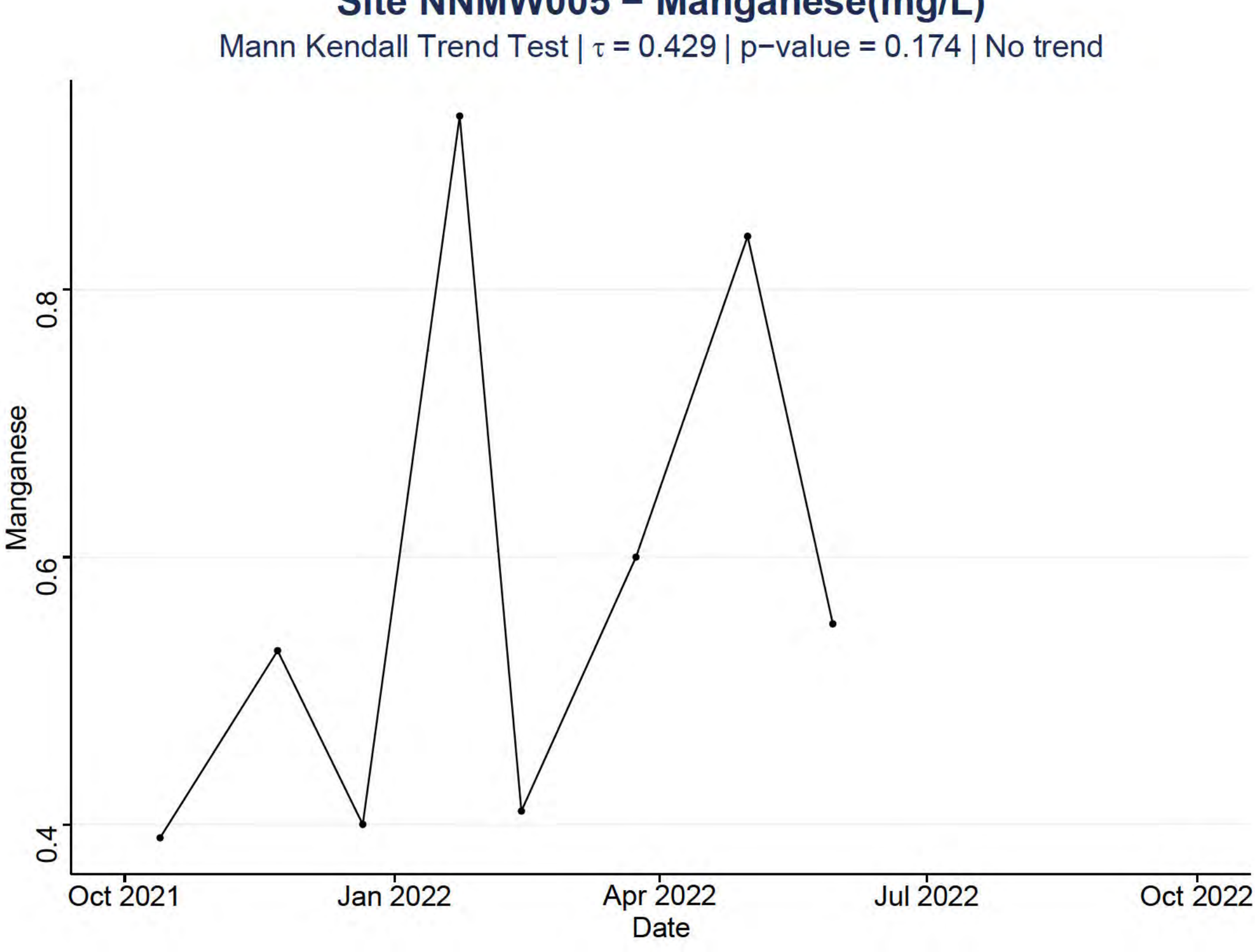

Site NNMW005 – EC(µS/cm)
Mann Kendall Trend Test | τ = 0.546 | p−value = 0.134 | No trend
EC
15000
14750
14500
14250
14000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

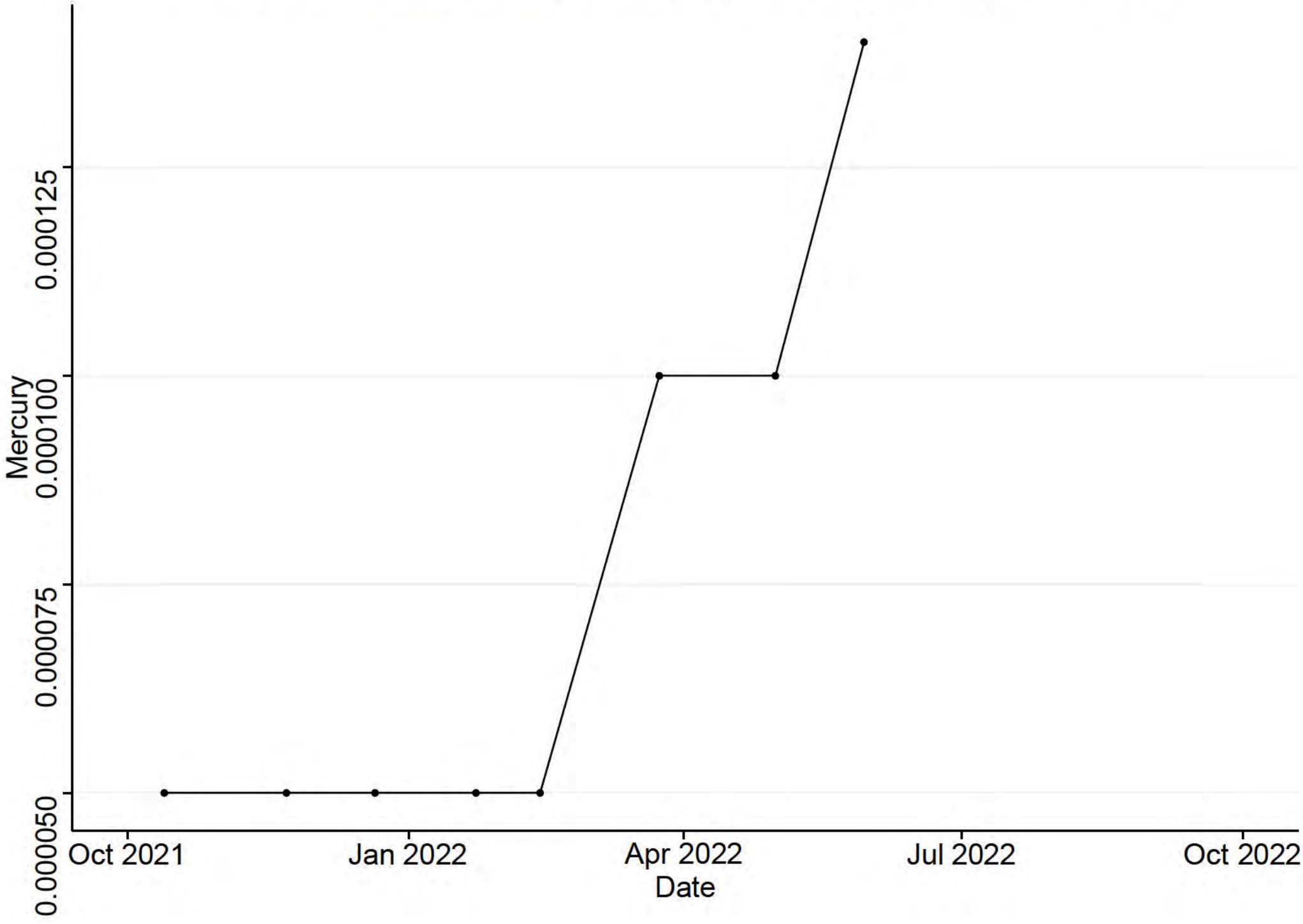

Site NNMW005 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.524 | p−value = 0.133 | No trend
Field pH
6.8
6.6
6.4
6.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

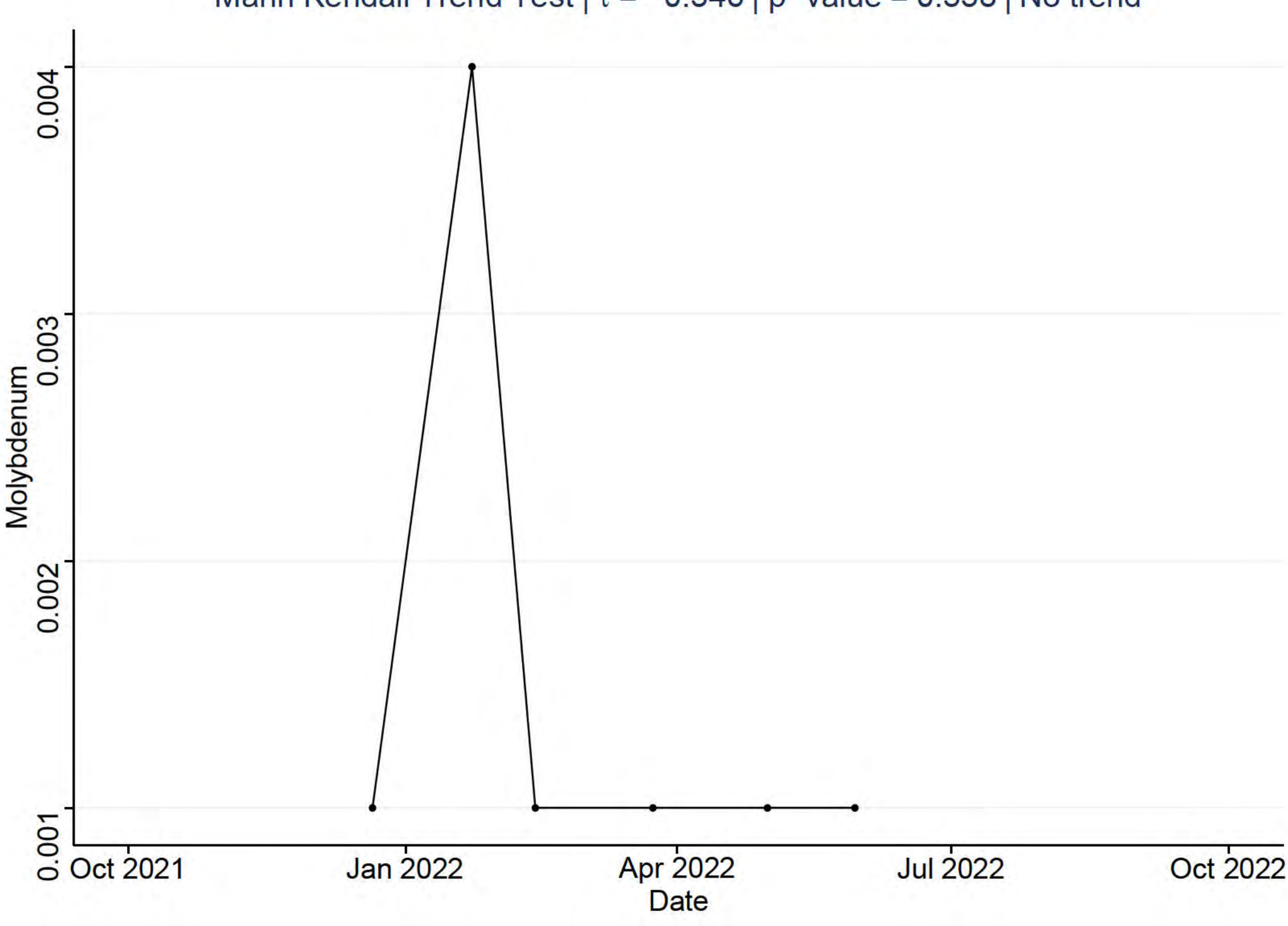

Site NNMW005 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = 0.109 | p−value = 0.803 | No trend
Free Cyanide pH 6
0.025
0.020
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

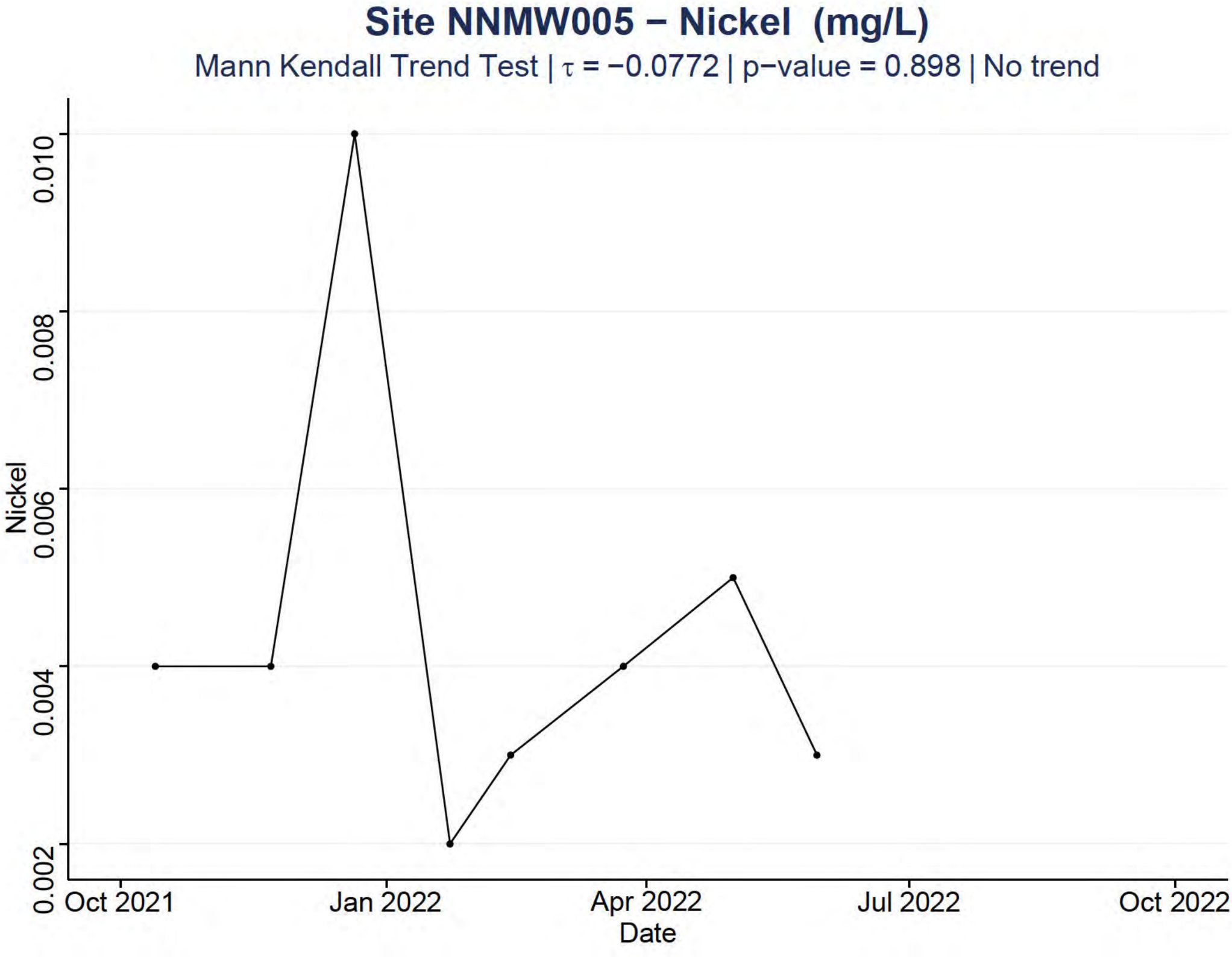

Site NNMW005 − Lead (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Lead
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

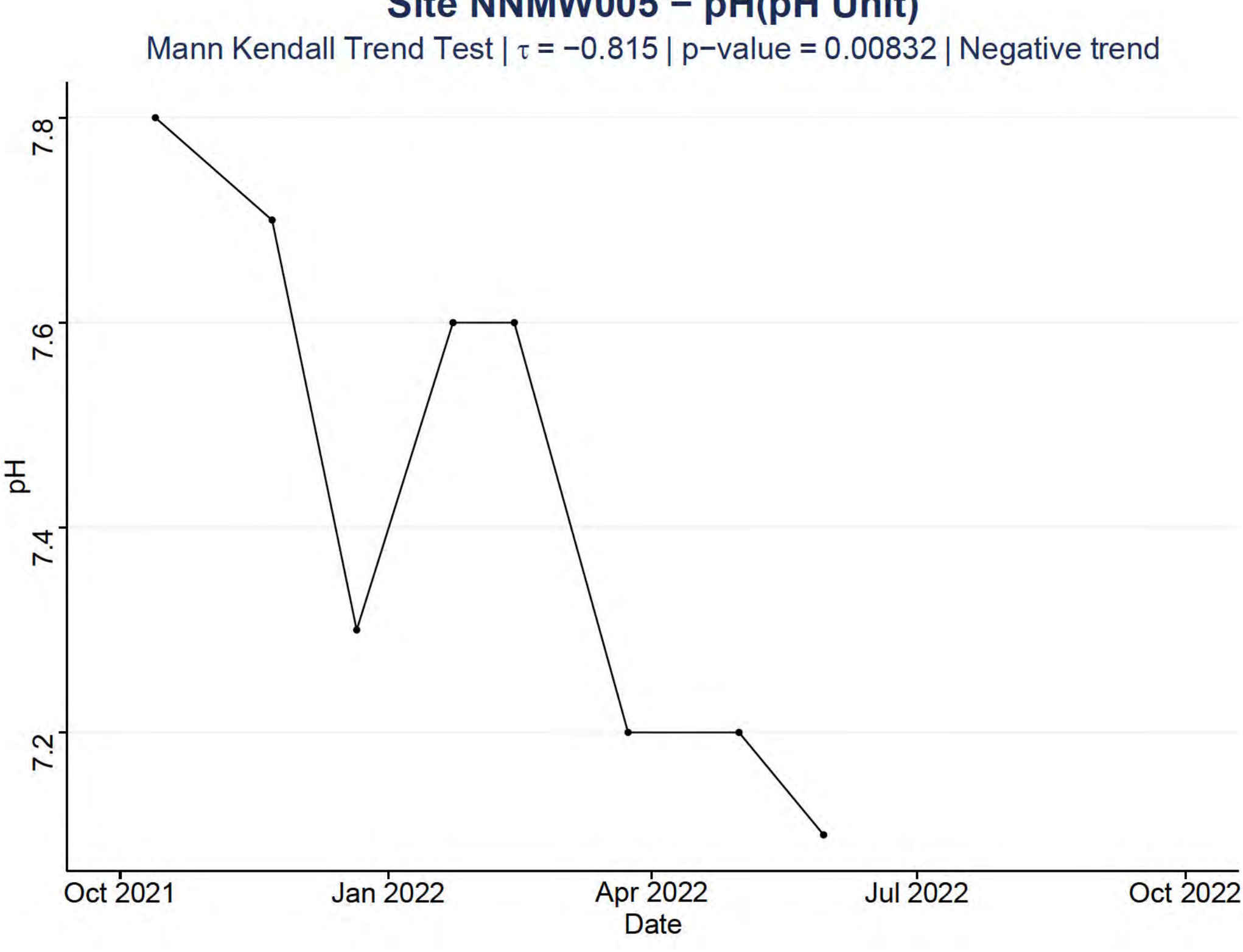

Site NNMW005 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = 0.0378 | p−value = 1 | No trend
Magnesium
350
300
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

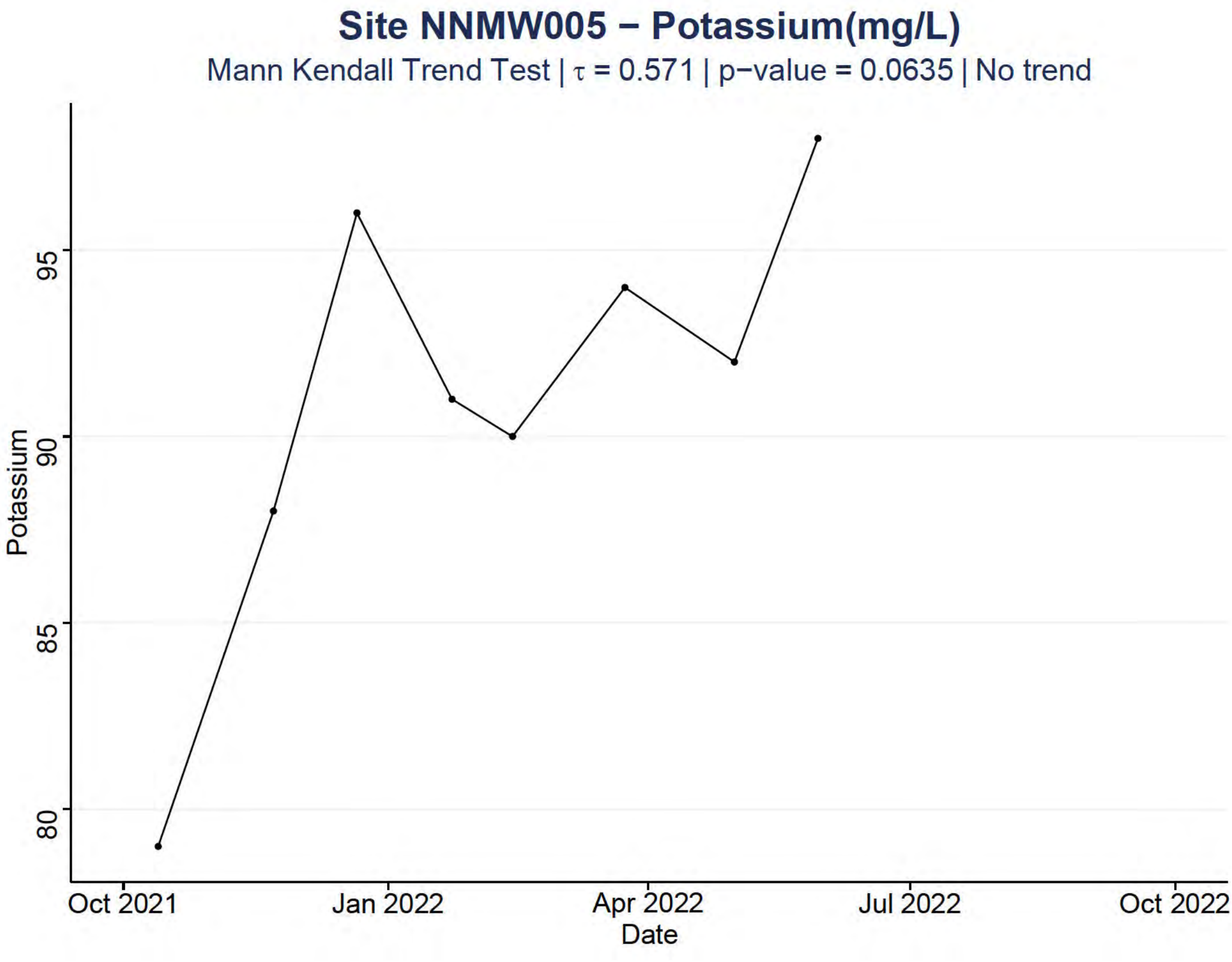

Site NNMW005 – Manganese(mg/L)
Mann Kendall Trend Test | τ = 0.429 | p−value = 0.174 | No trend
Manganese
0.4
0.6
0.8
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

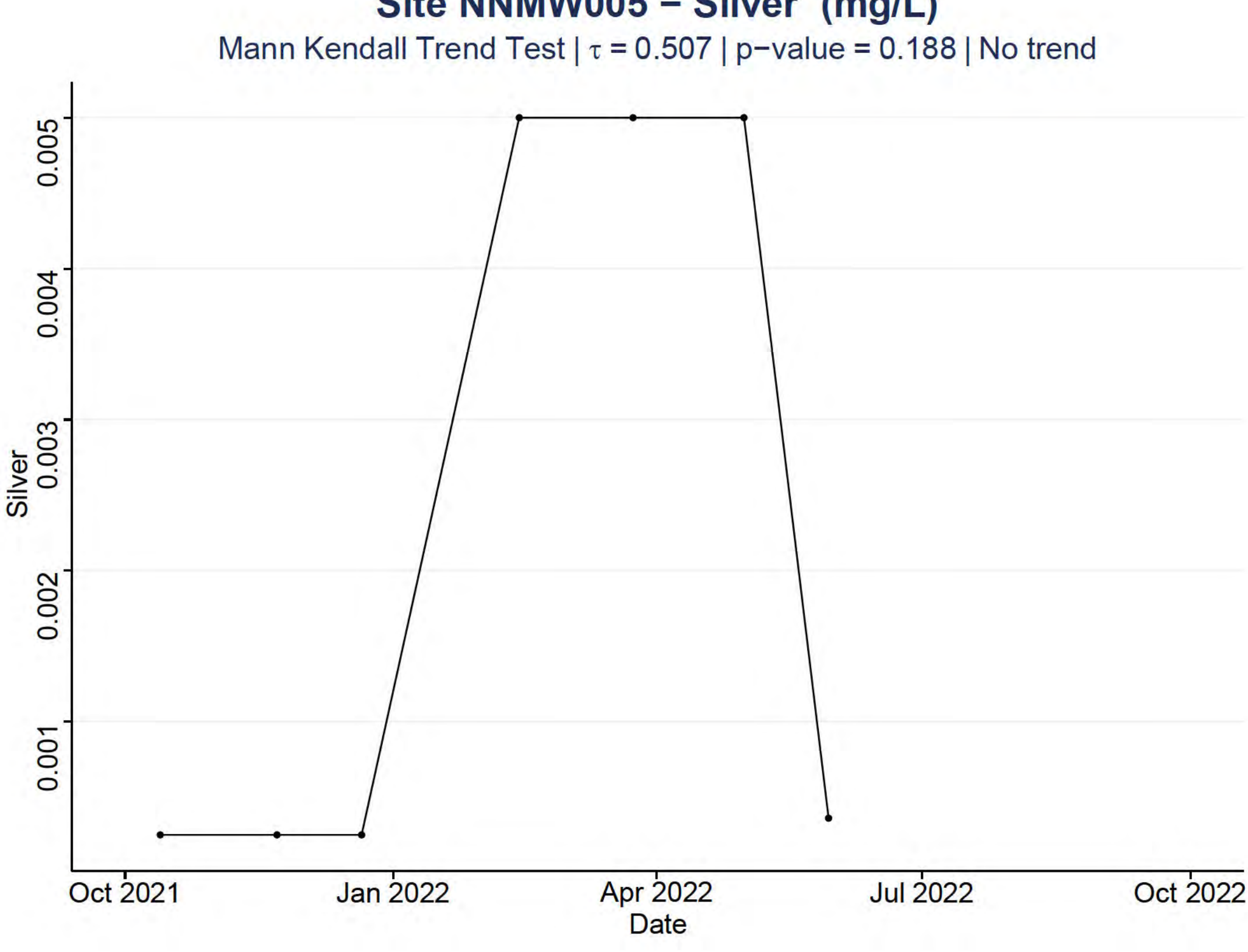

Site NNMW005 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 0.779 | p−value = 0.0205 | Positive trend
Mercury
0.000050
0.000075
0.000100
0.000125
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

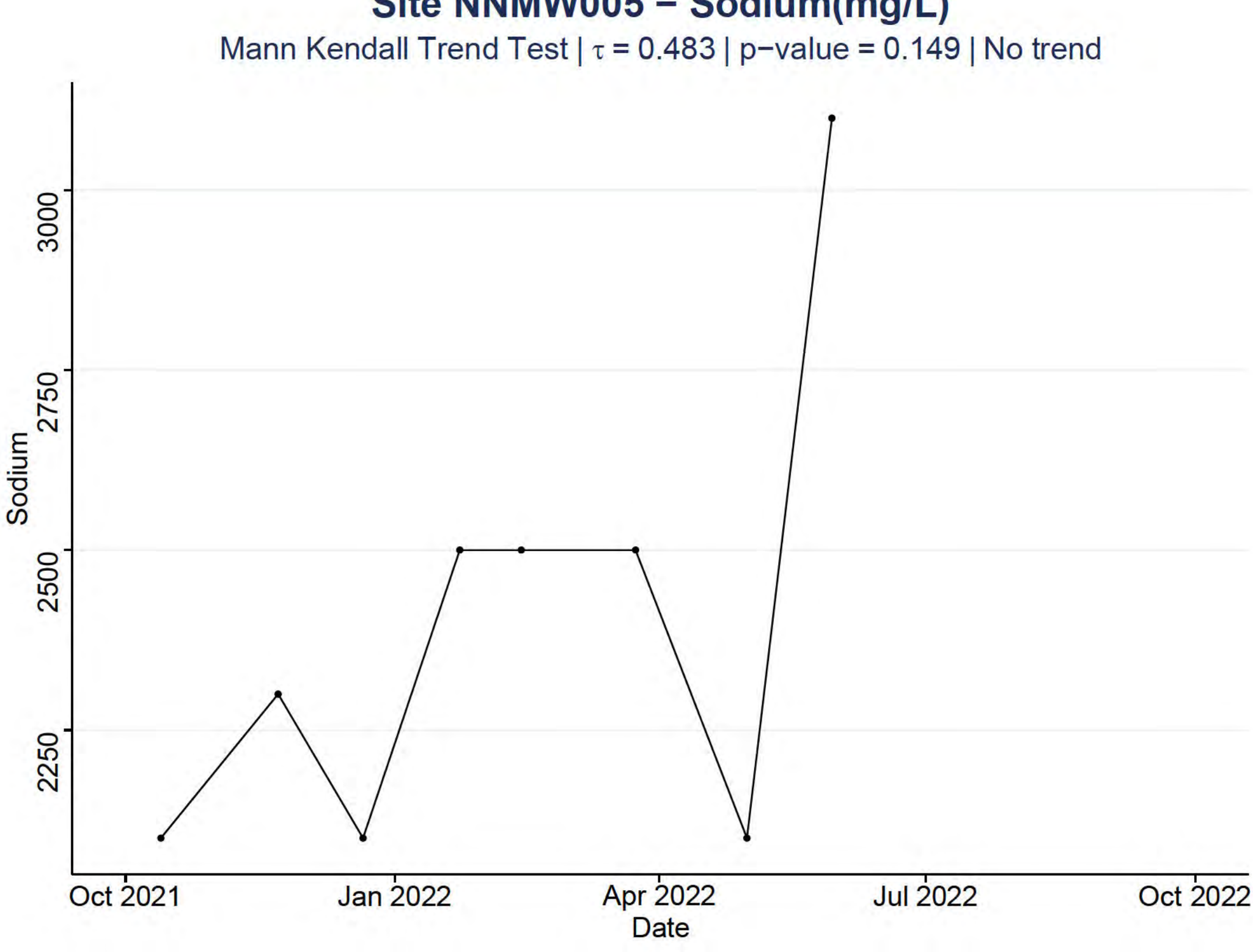

Site NNMW005 – Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.346 | p−value = 0.558 | No trend
Molybdenum
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

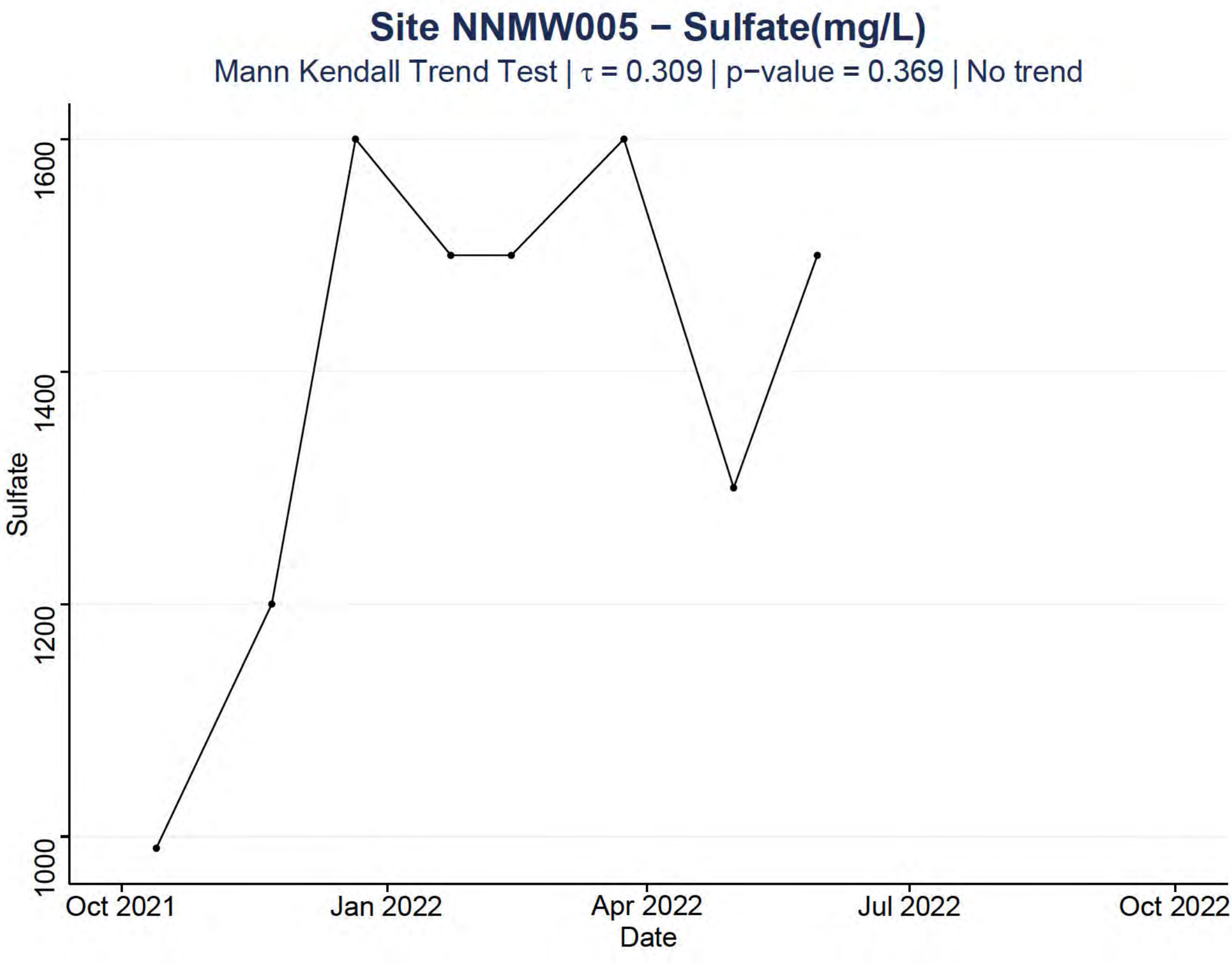

Site NNMW005 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.0772 | p−value = 0.898 | No trend
Nickel
0.010
0.008
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

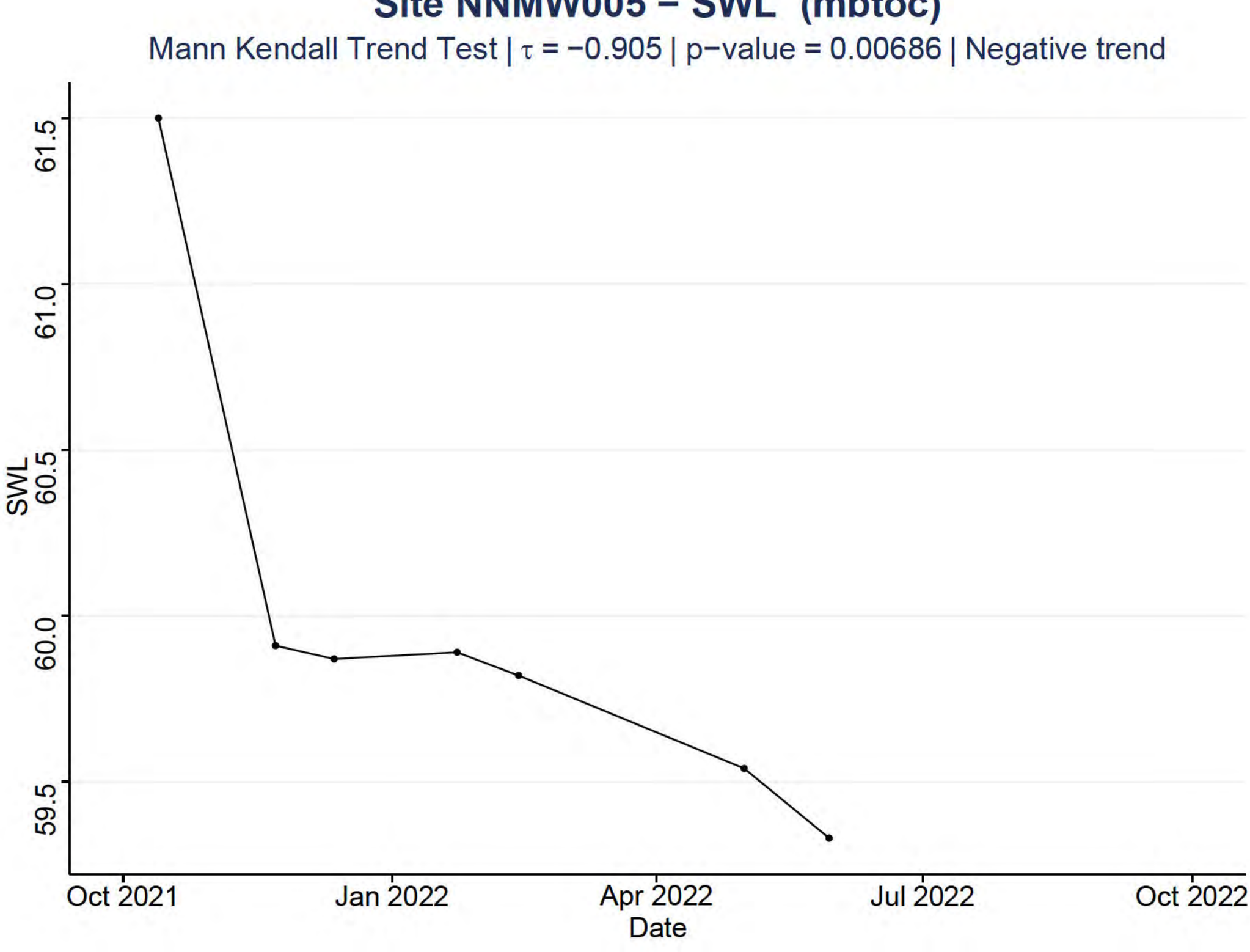

Site NNMW005 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.815 | p−value = 0.00832 | Negative trend
pH
7.8
7.6
7.4
7.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

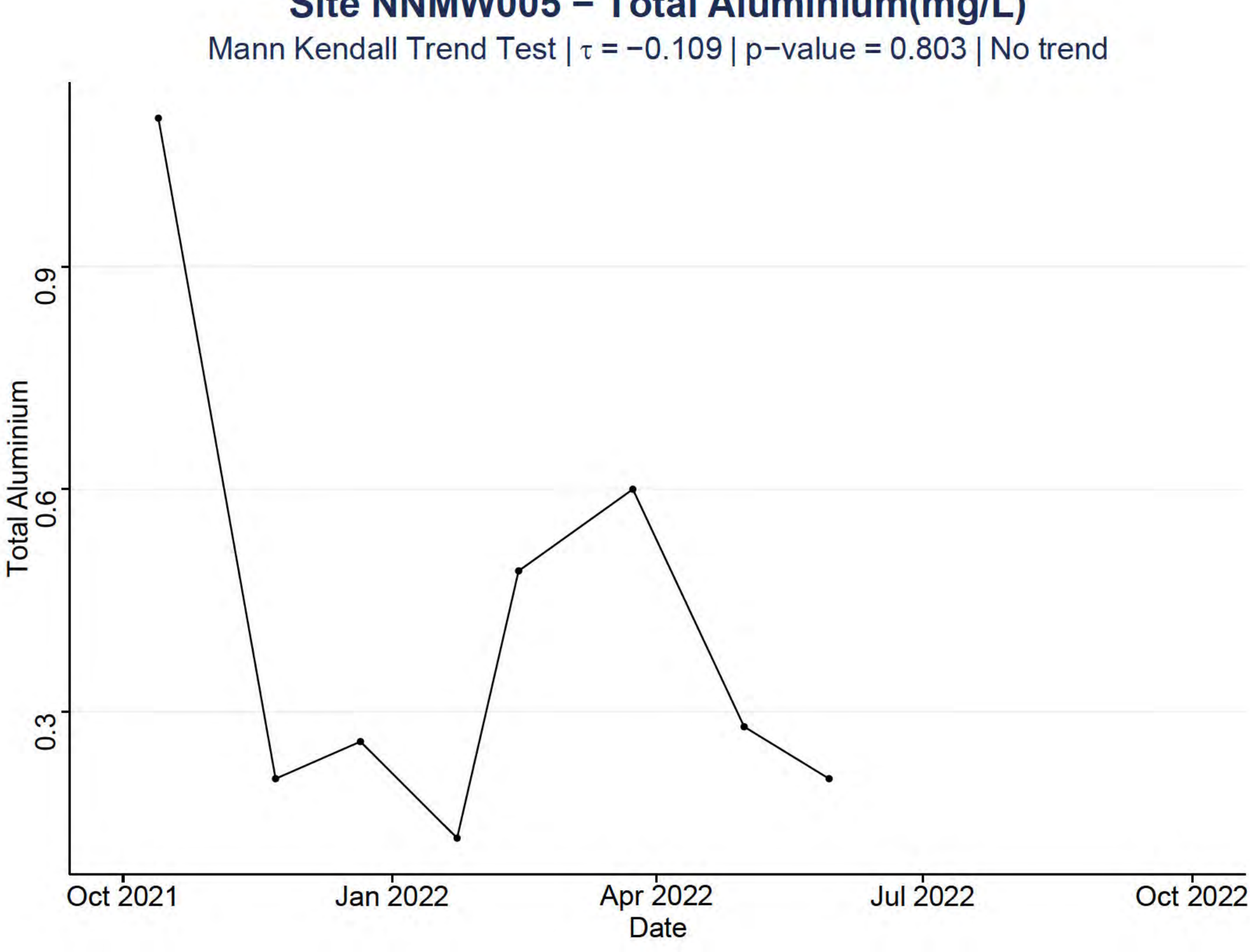

Site NNMW005 – Potassium(mg/L)
Mann Kendall Trend Test | τ = 0.571 | p−value = 0.0635 | No trend
Potassium
95
90
85
80
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

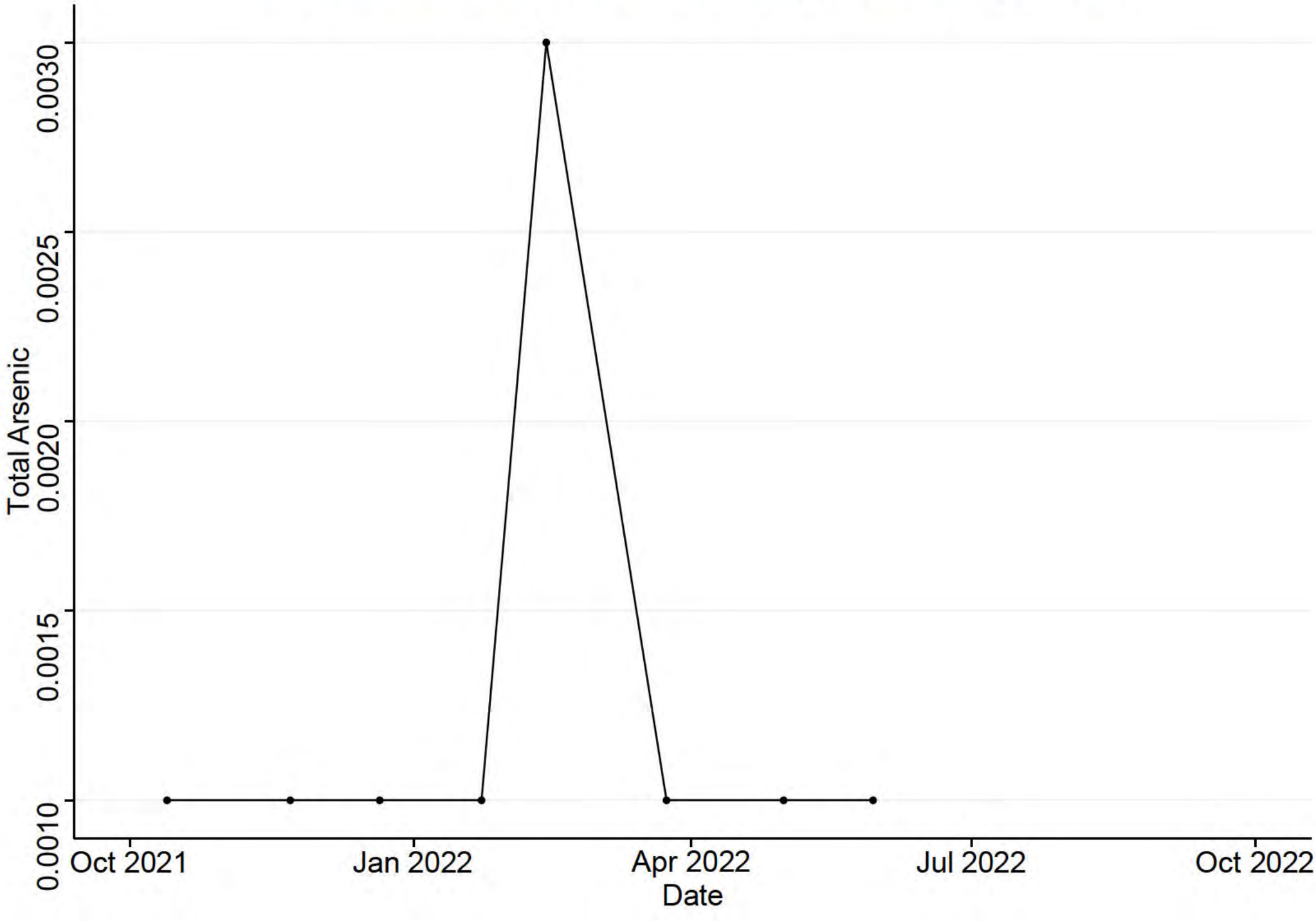

Site NNMW005 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.507 | p−value = 0.188 | No trend
Silver
0.001
0.002
0.003
0.004
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

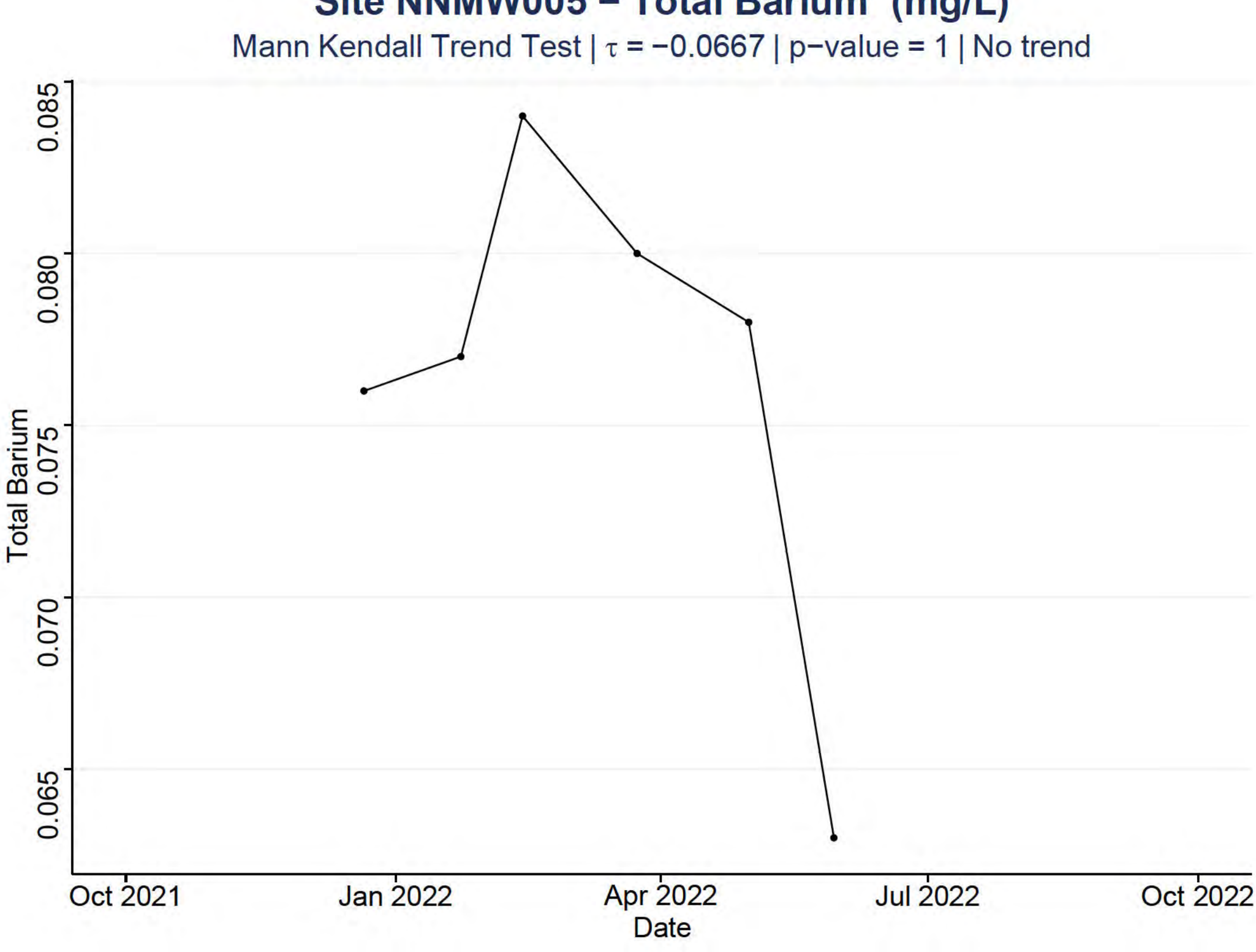

Site NNMW005 – Sodium(mg/L)
Mann Kendall Trend Test | τ = 0.483 | p−value = 0.149 | No trend
Sodium
3000
2750
2500
2250
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

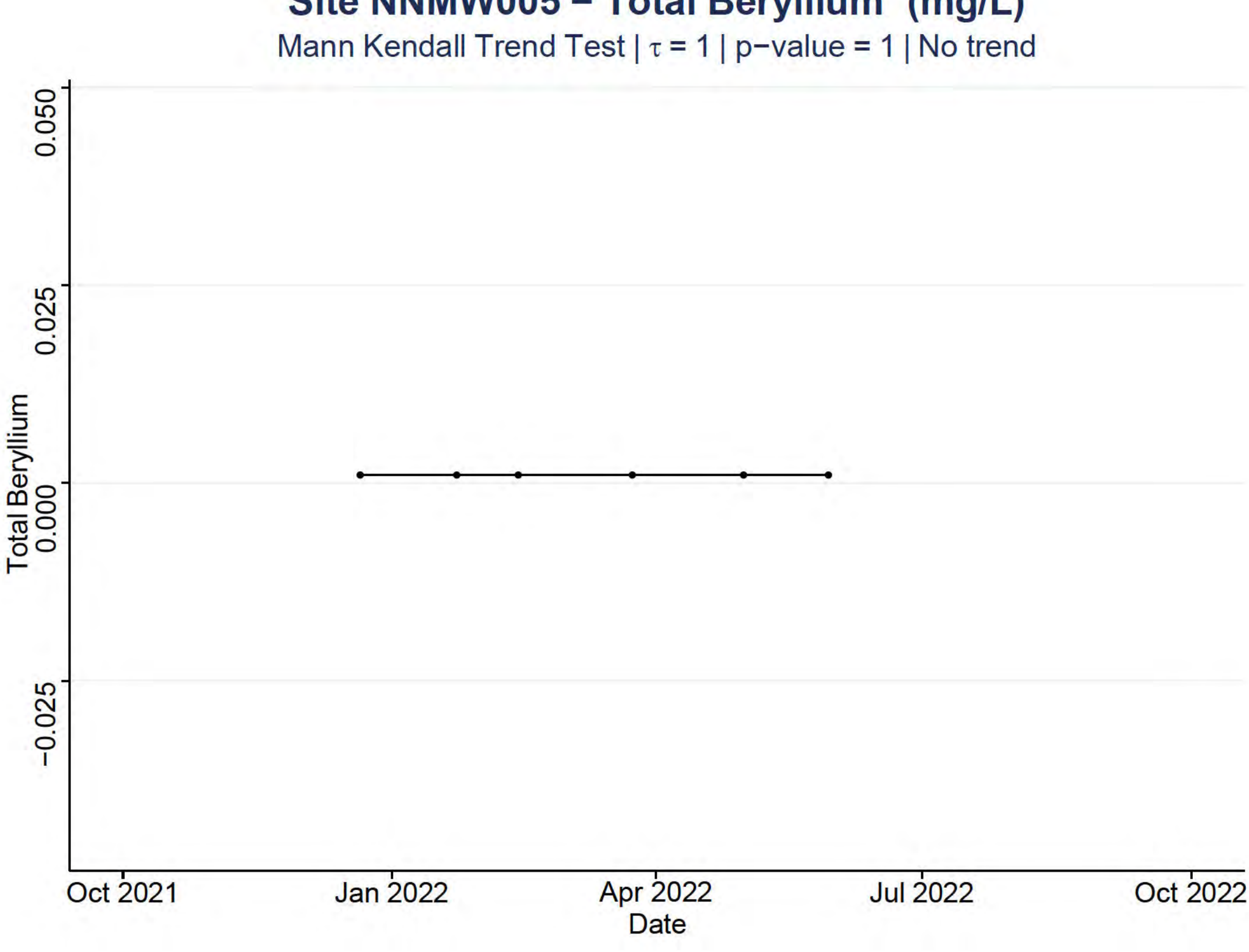

Site NNMW005 – Sulfate(mg/L)
Mann Kendall Trend Test | τ = 0.309 | p−value = 0.369 | No trend
Sulfate
1000
1200
1400
1600
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

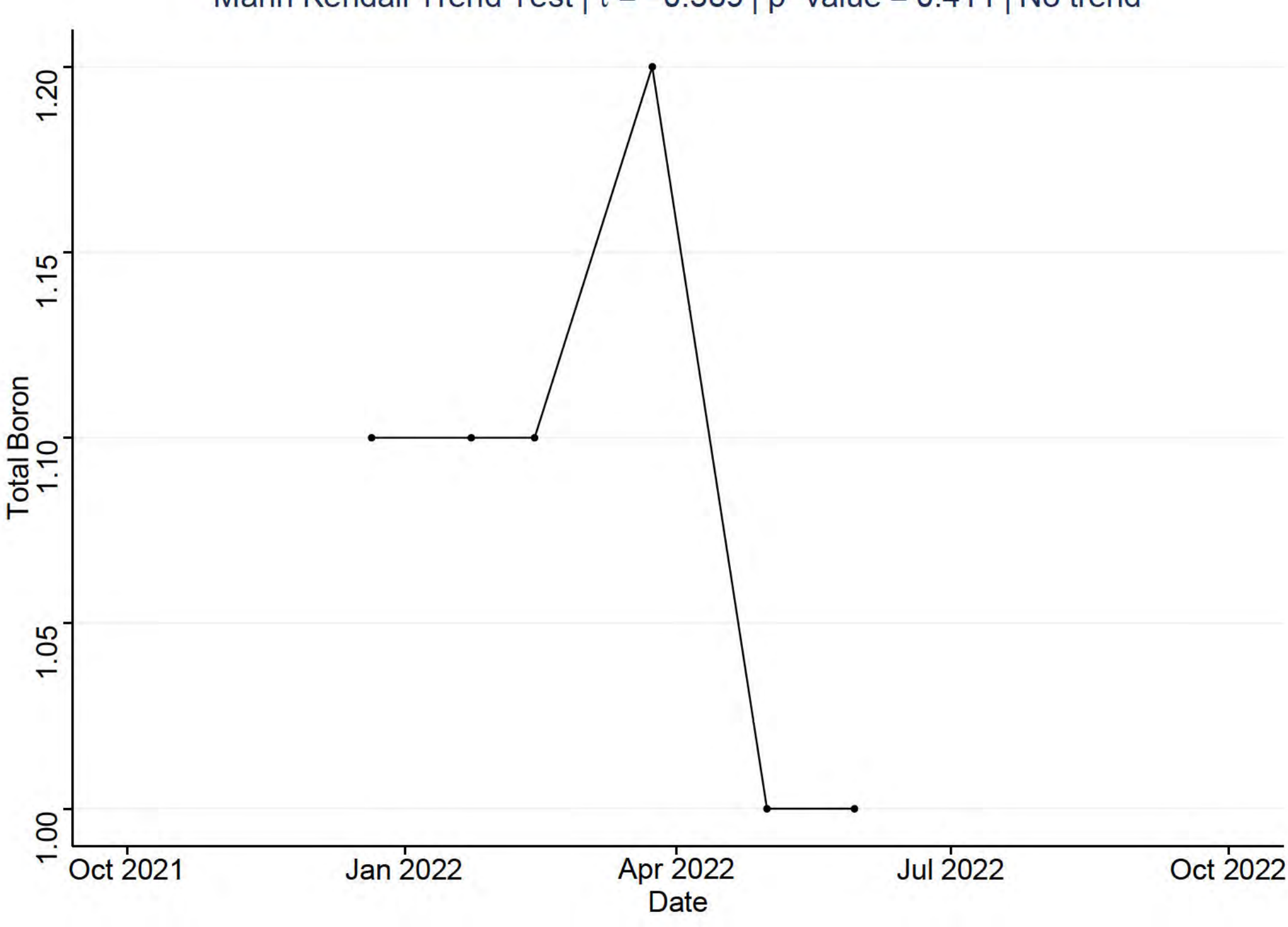

Site NNMW005 – SWL (mbtoc)
Mann Kendall Trend Test | τ = −0.905 | p−value = 0.00686 | Negative trend
SWL
61.5
61.0
60.5
60.0
59.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

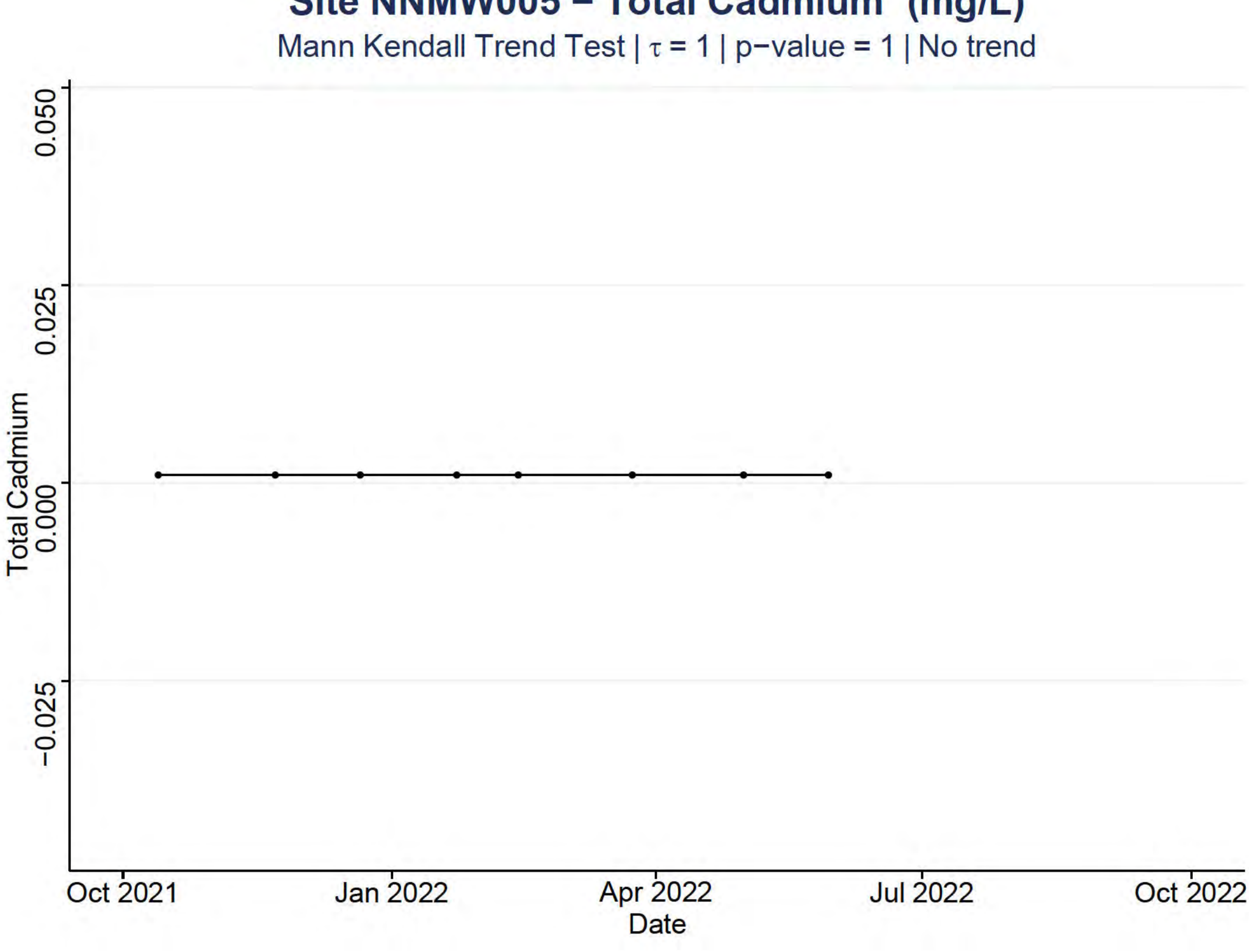

Site NNMW005 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.109 | p−value = 0.803 | No trend
Total Aluminium
0.3
0.6
0.9
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

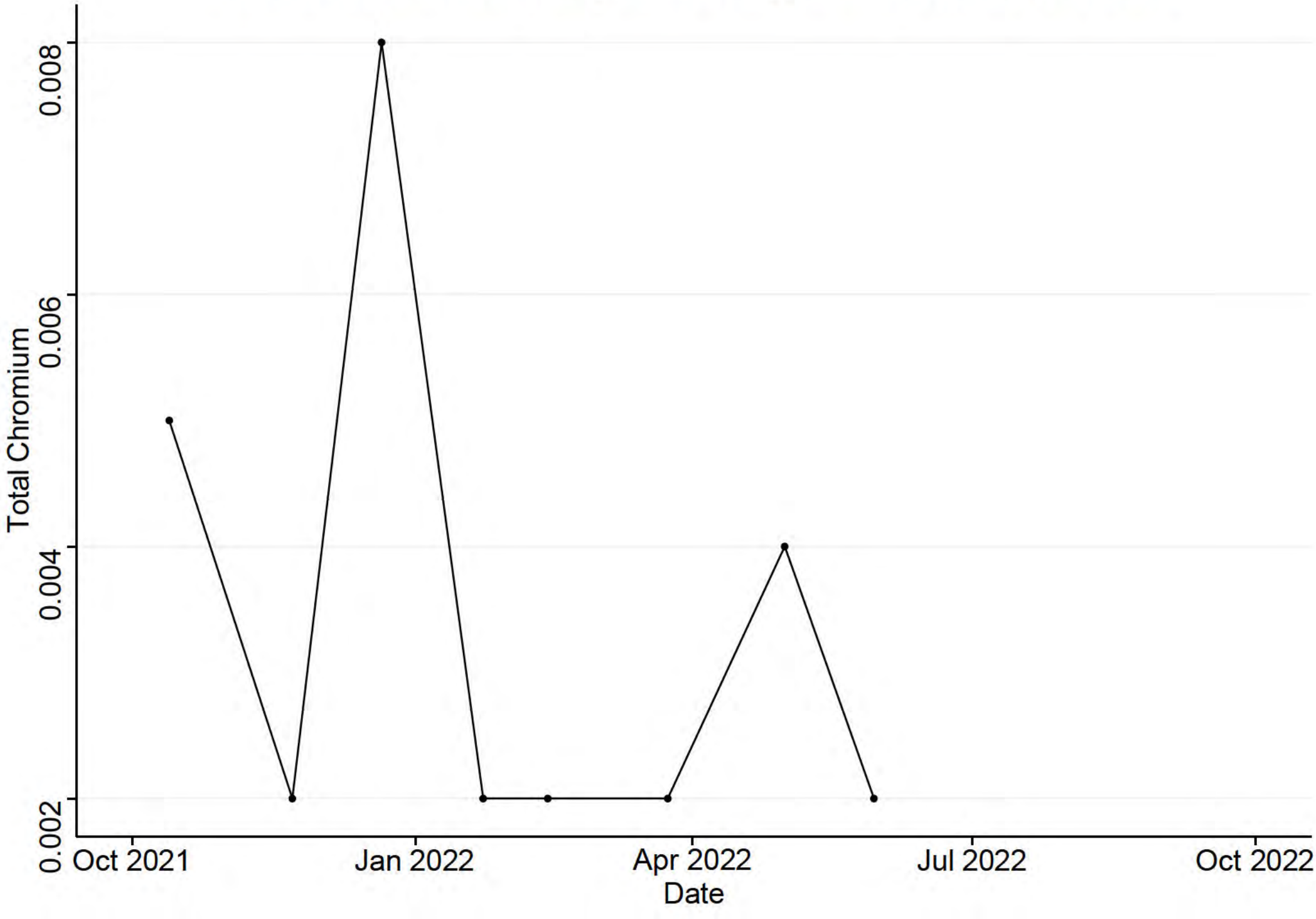

Site NNMW005 – Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = 0.0714 | p−value = 1 | No trend
Total Arsenic
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

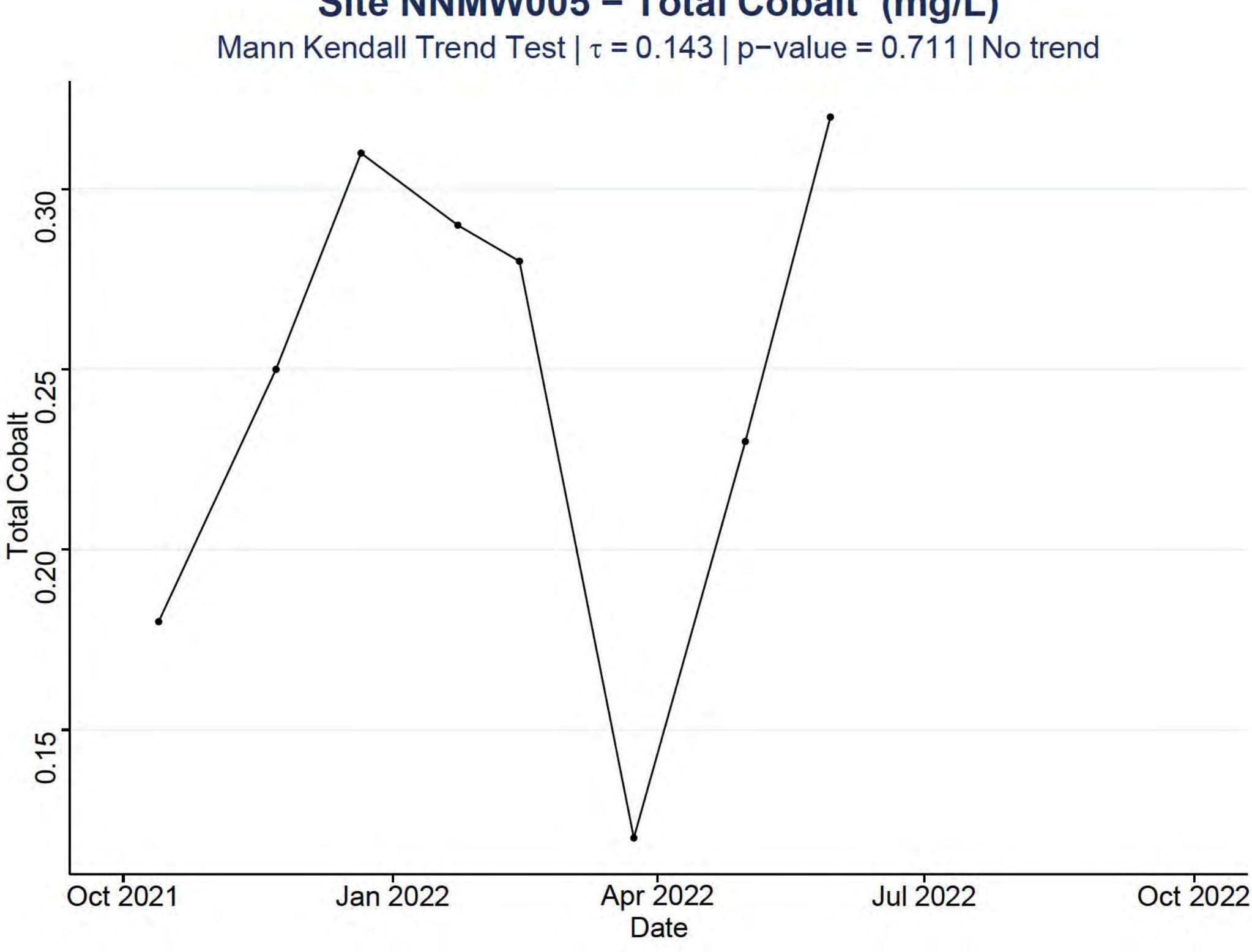

Site NNMW005 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = −0.0667 | p−value = 1 | No trend
Total Barium
0.085
0.080
0.075
0.070
0.065
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

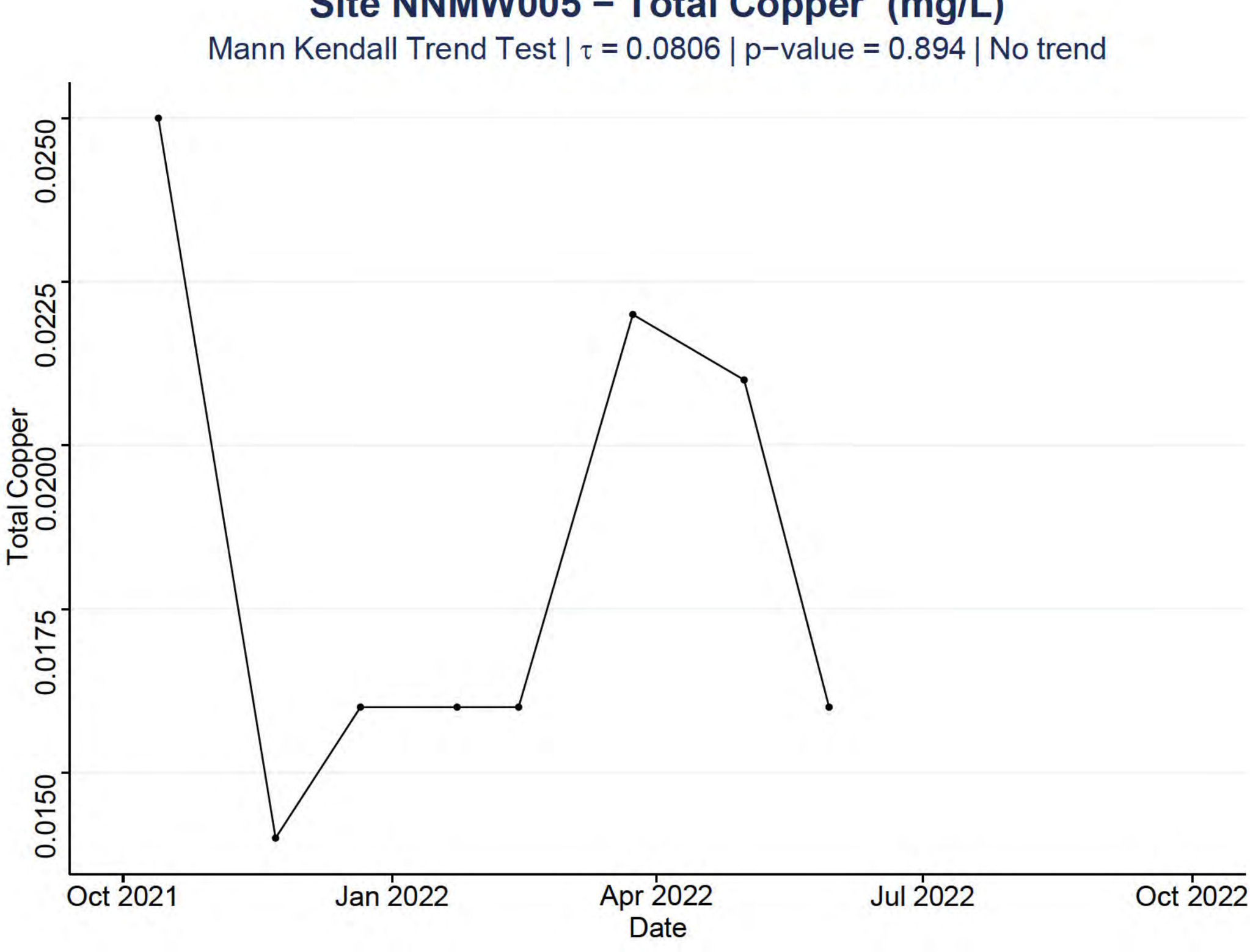

Site NNMW005 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Beryllium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

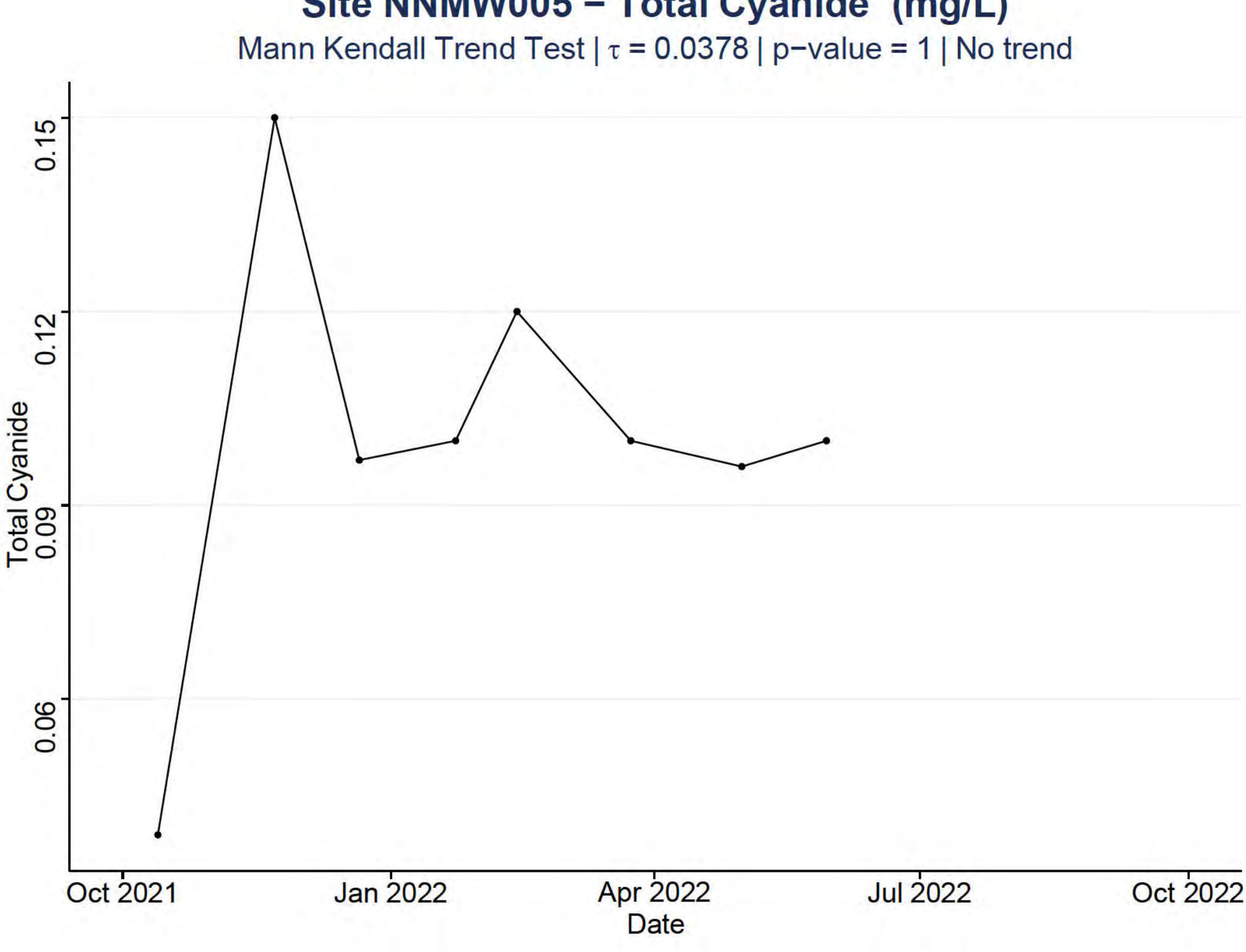

Site NNMW005 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = −0.389 | p−value = 0.411 | No trend
Total Boron
1.00
1.05
1.10
1.15
1.20
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

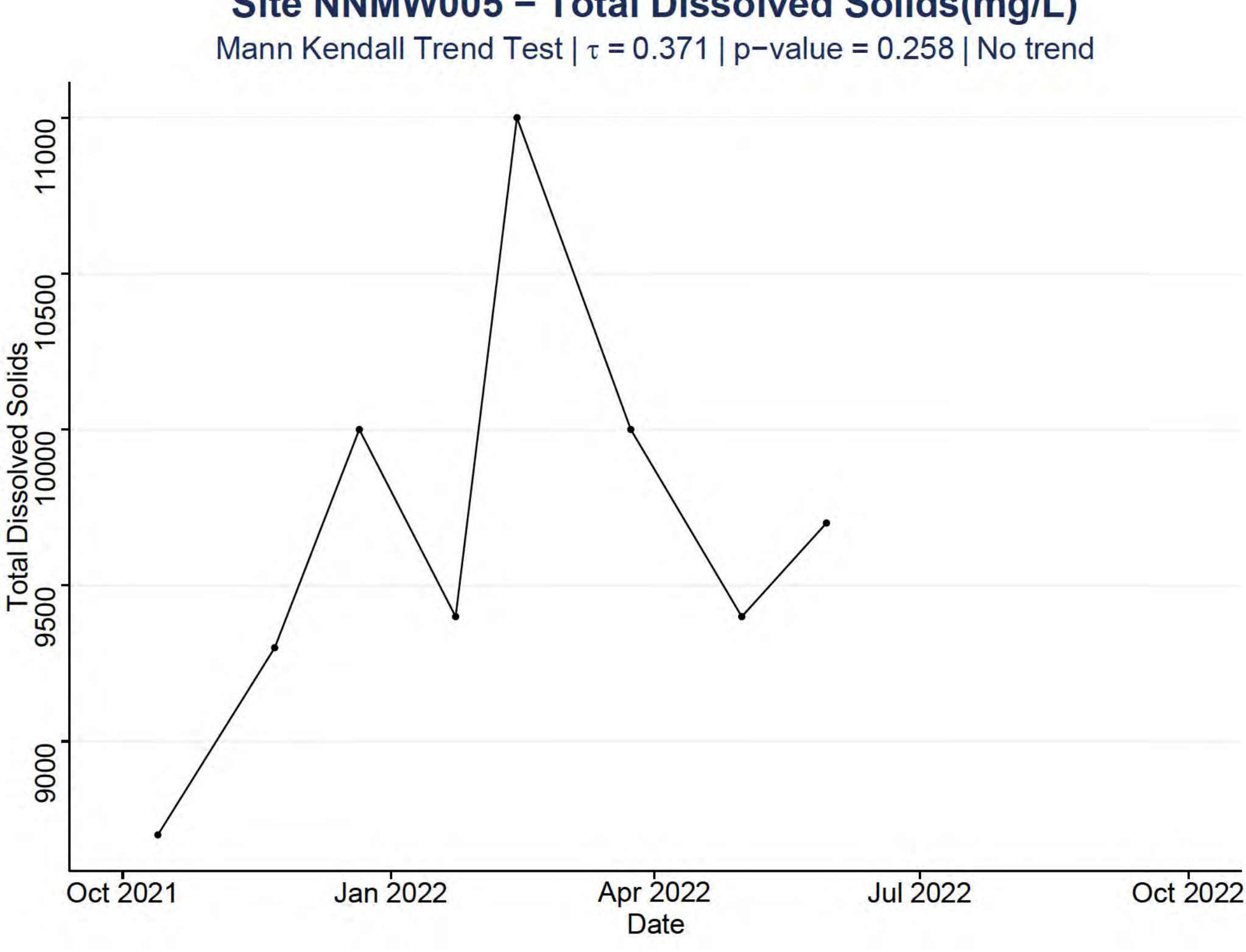

Site NNMW005 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cadmium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

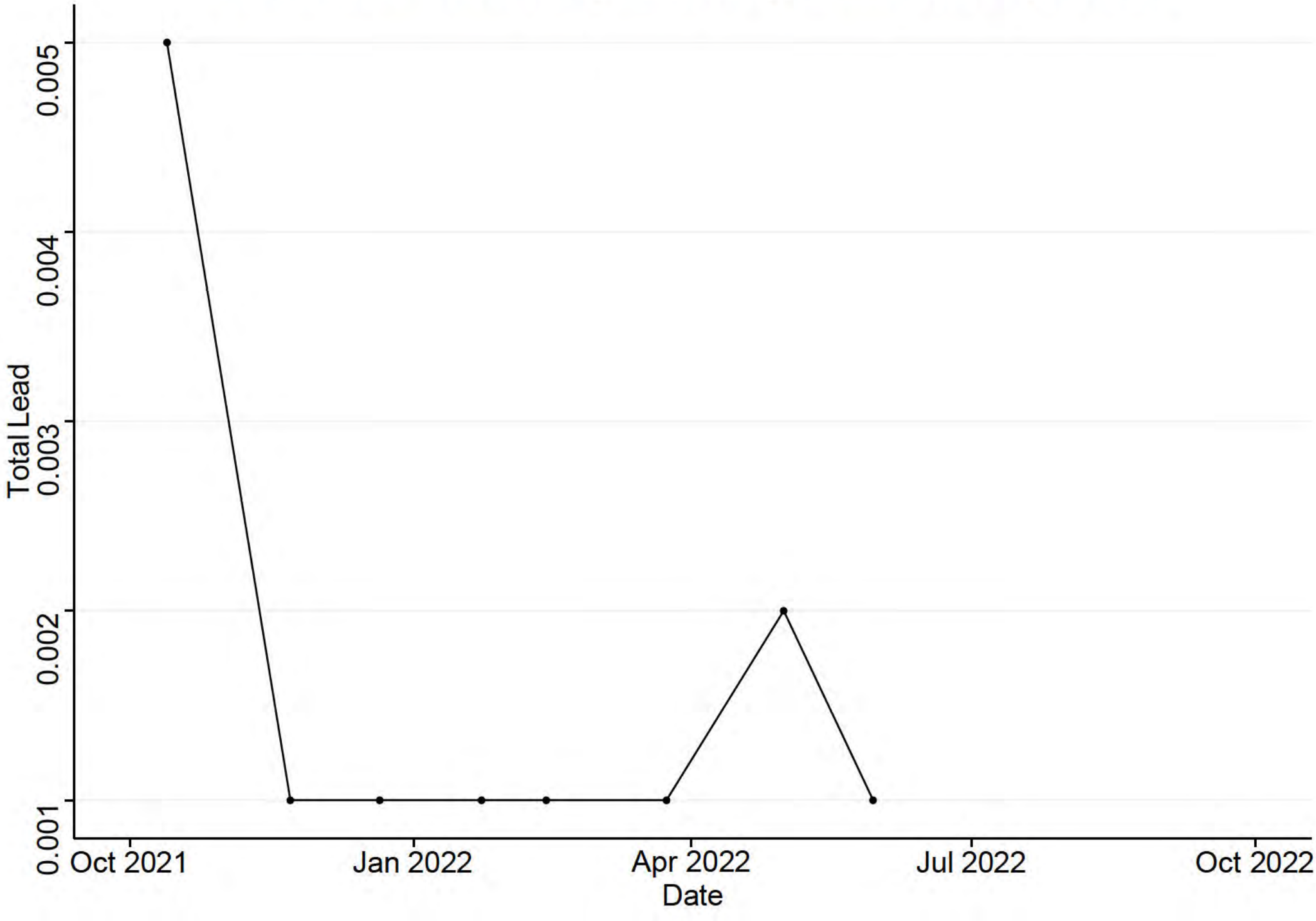

Site NNMW005 − Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.267 | p−value = 0.474 | No trend
Total Chromium
0.002
0.004
0.006
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

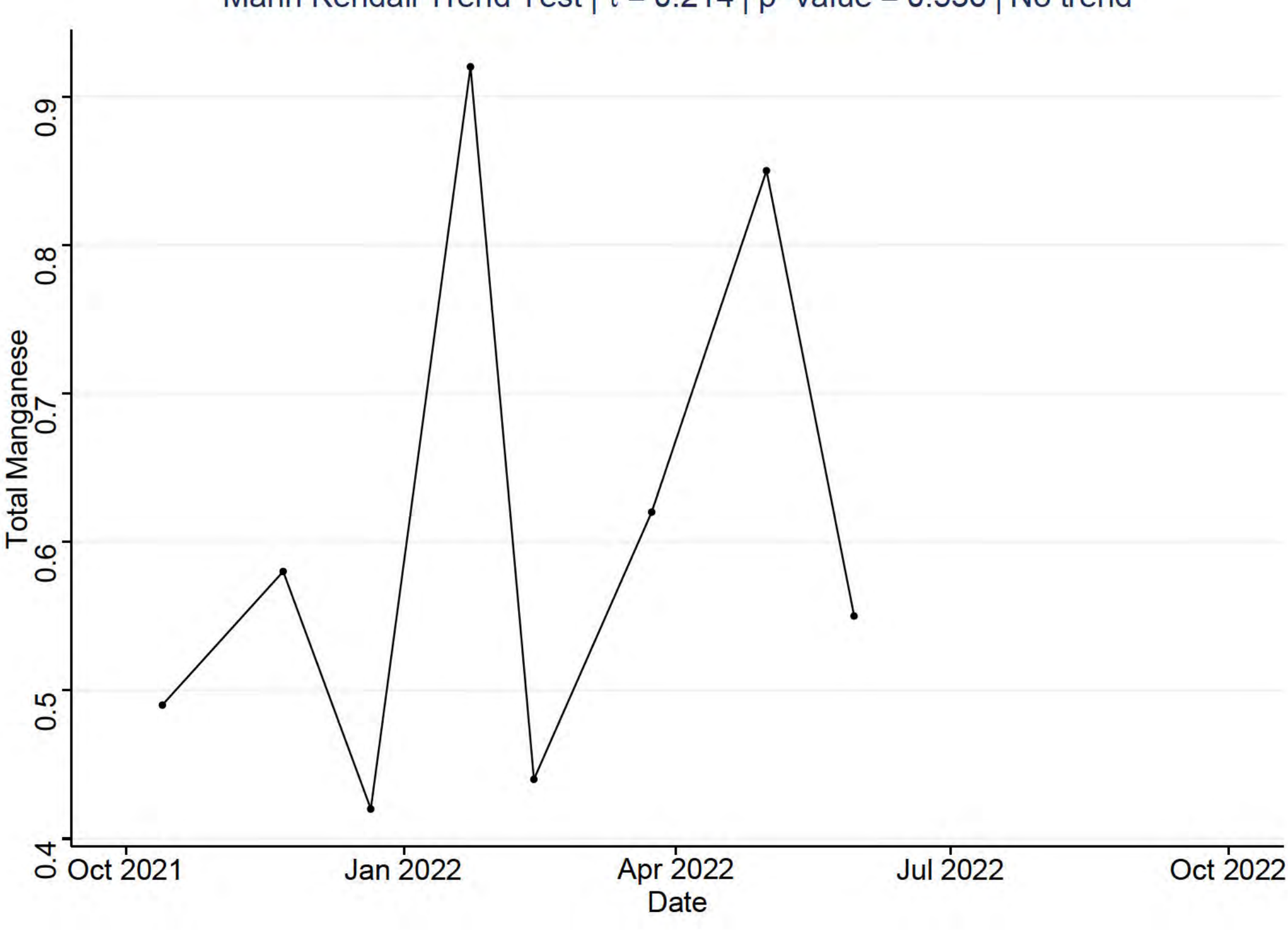

Site NNMW005 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = 0.143 | p−value = 0.711 | No trend
Total Cobalt
0.15
0.20
0.25
0.30
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

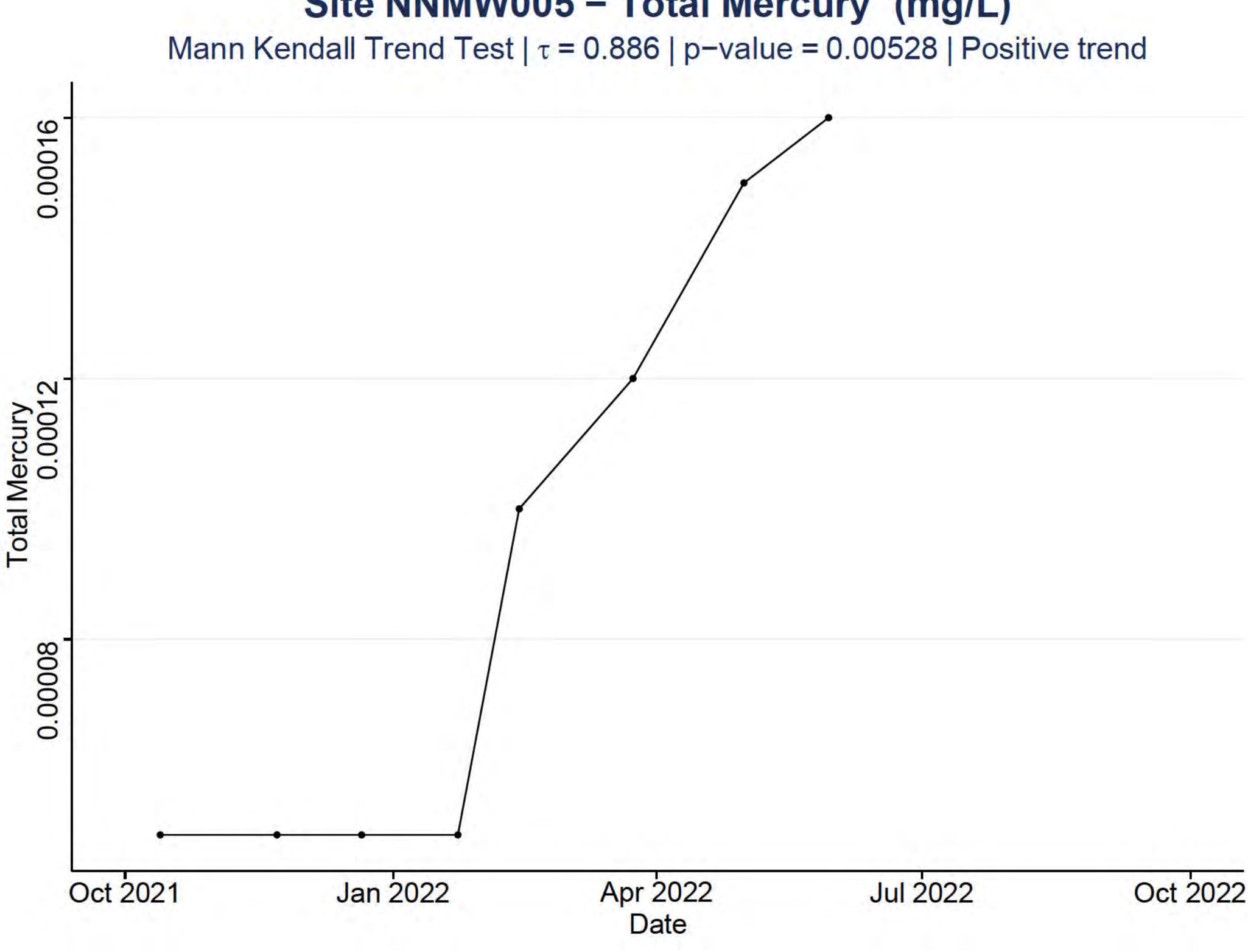

Site NNMW005 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = 0.0806 | p−value = 0.894 | No trend
Total Copper
0.0250
0.0225
0.0200
0.0175
0.0150
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

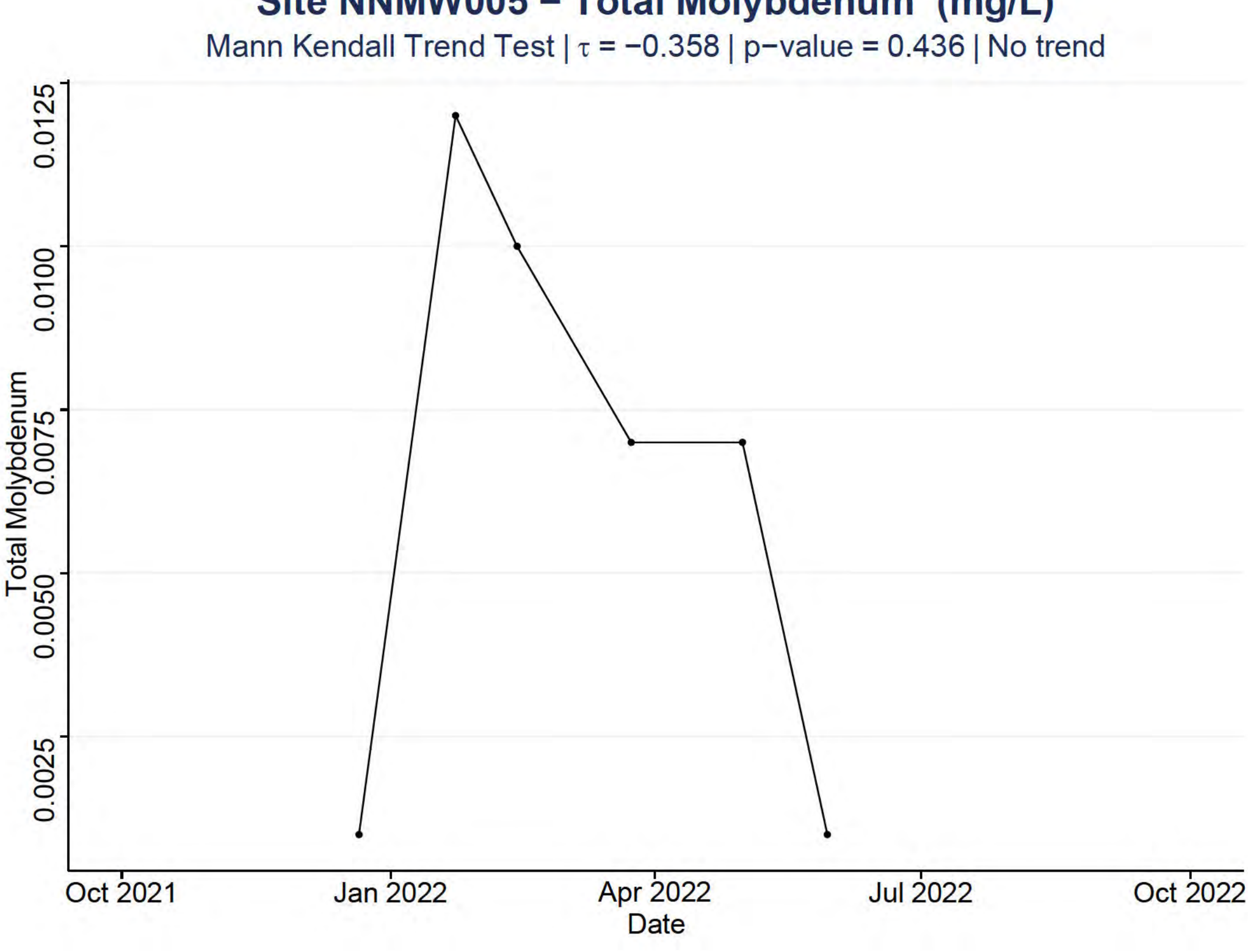

Site NNMW005 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 0.0378 | p−value = 1 | No trend
Total Cyanide
0.15
0.12
0.09
0.06
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

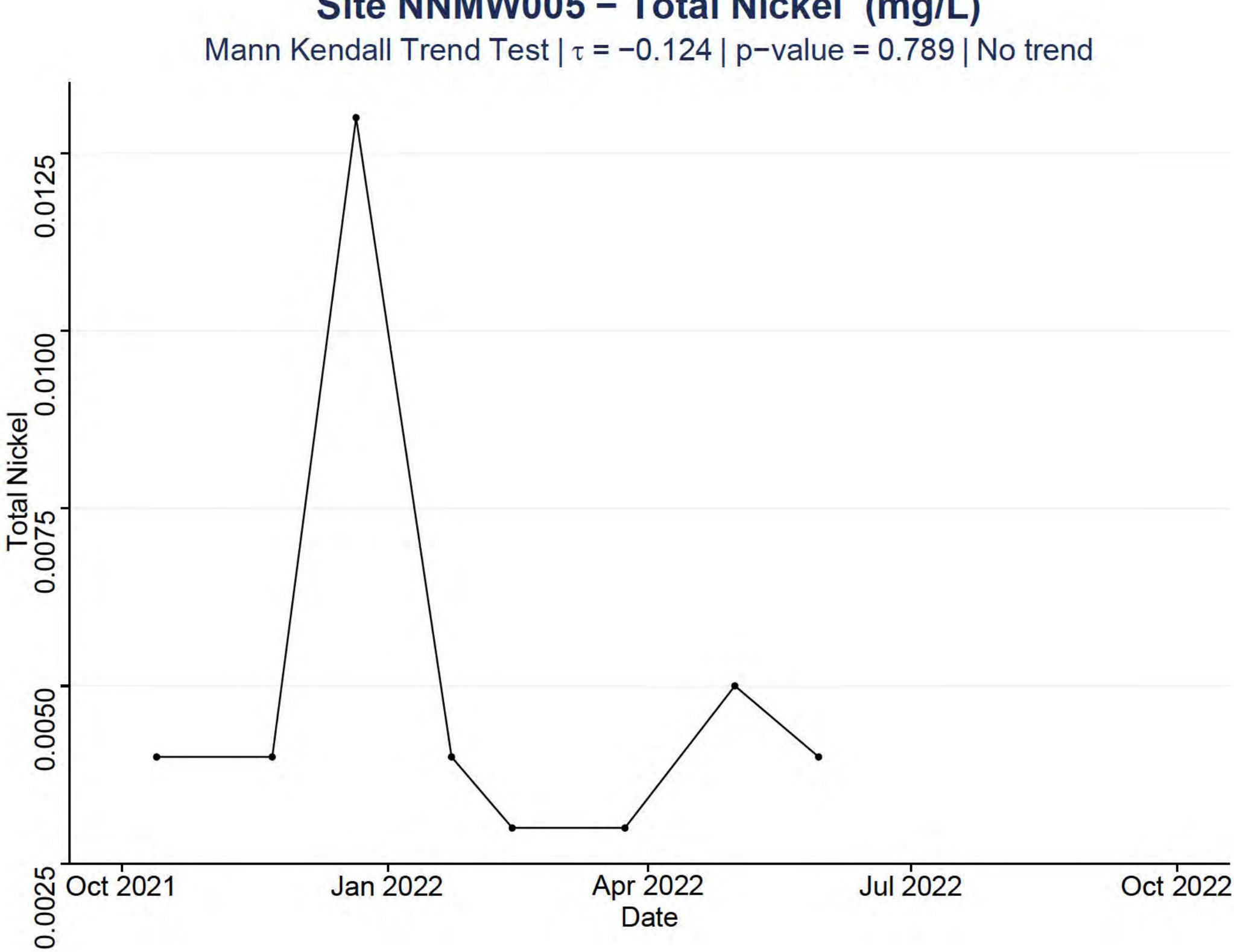

Site NNMW005 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = 0.371 | p−value = 0.258 | No trend
Total Dissolved Solids
11000
10500
10000
9500
9000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

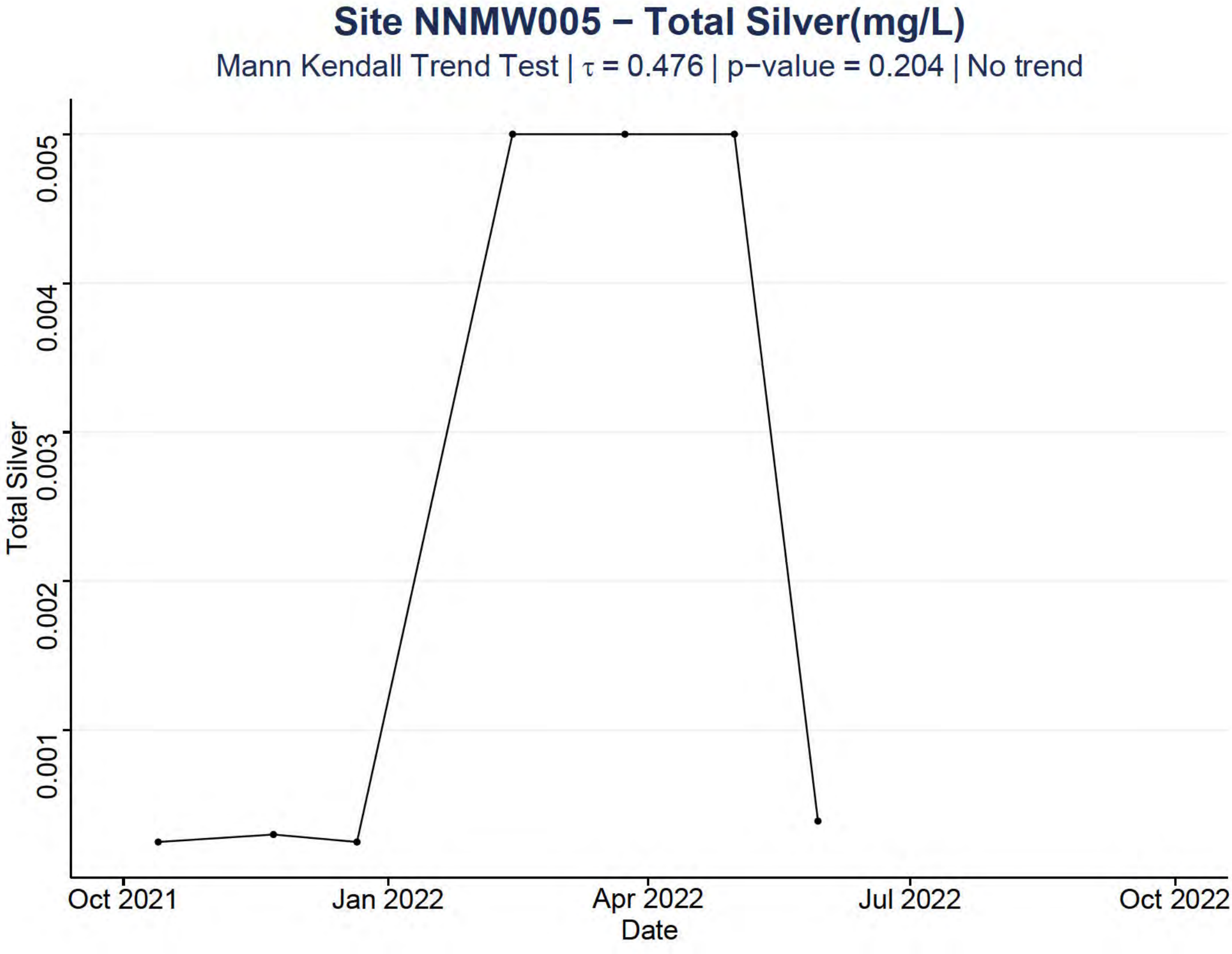

Site NNMW005 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.157 | p−value = 0.742 | No trend
Total Lead
0.005
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

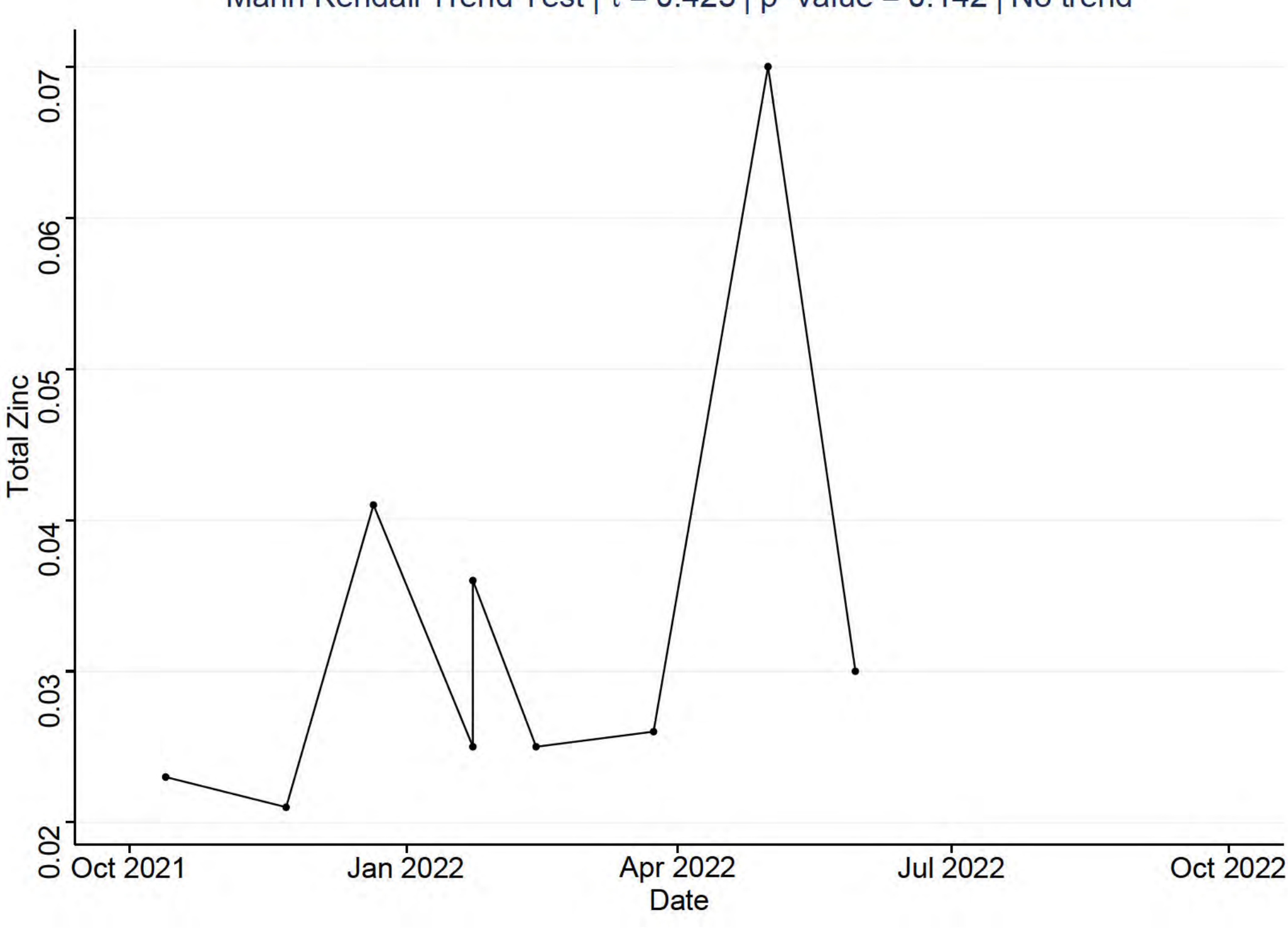

Site NNMW005 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = 0.214 | p−value = 0.536 | No trend
Total Manganese
0.4
0.5
0.6
0.7
0.8
0.9
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

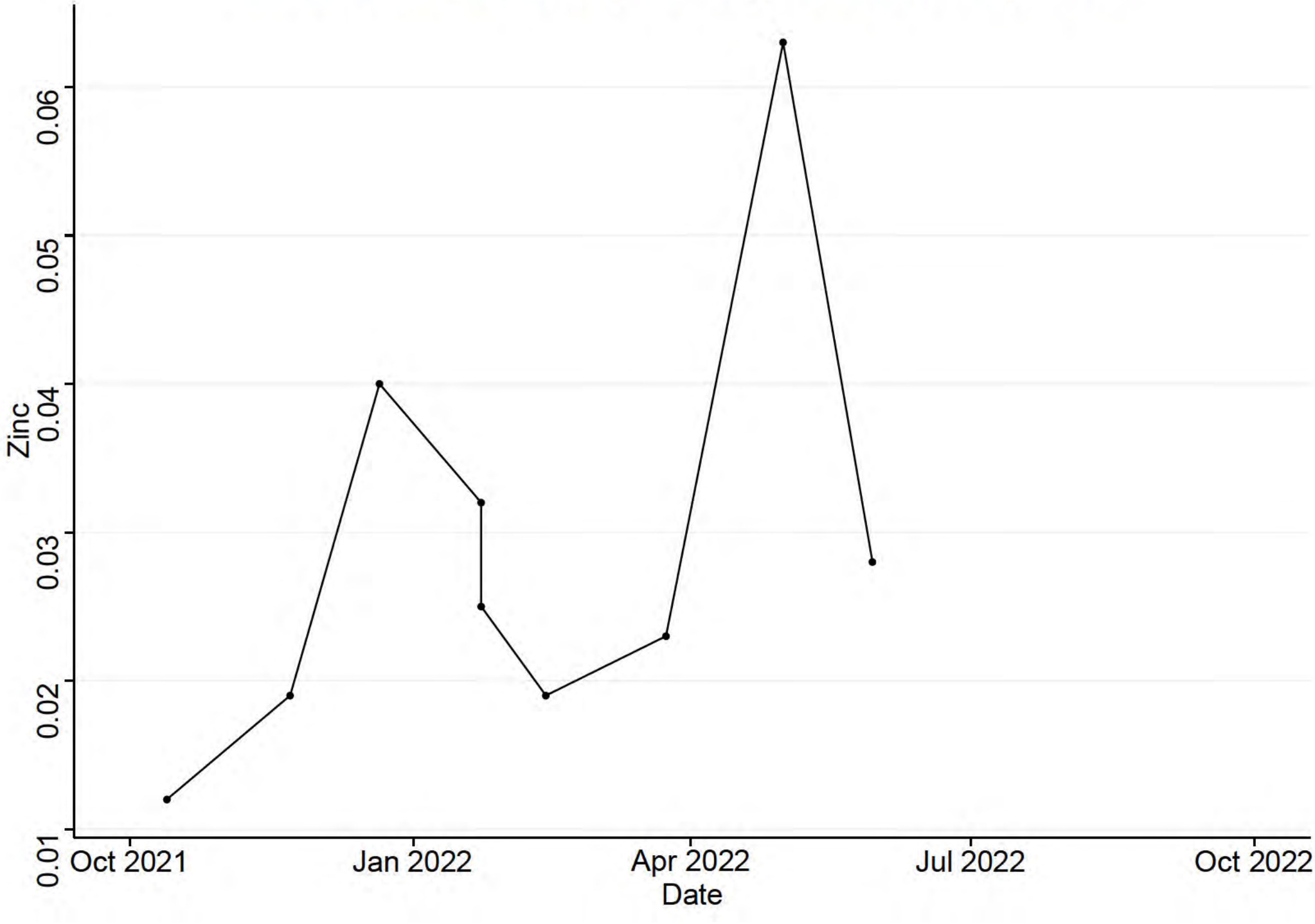

Site NNMW005 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 0.886 | p−value = 0.00528 | Positive trend
Total Mercury
0.00016
0.00012
0.00008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

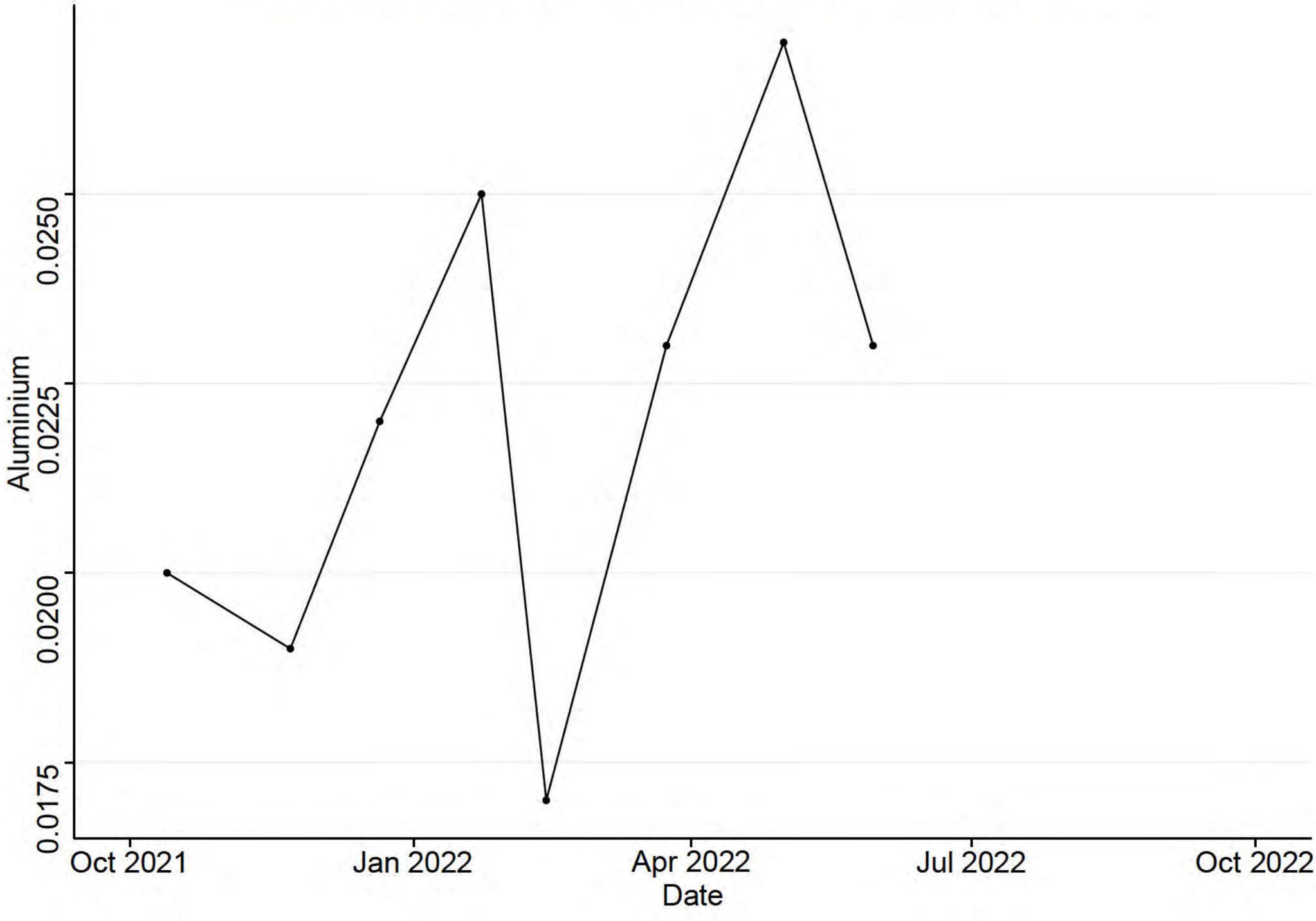

Site NNMW005 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.358 | p−value = 0.436 | No trend
Total Molybdenum
0.0125
0.0100
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

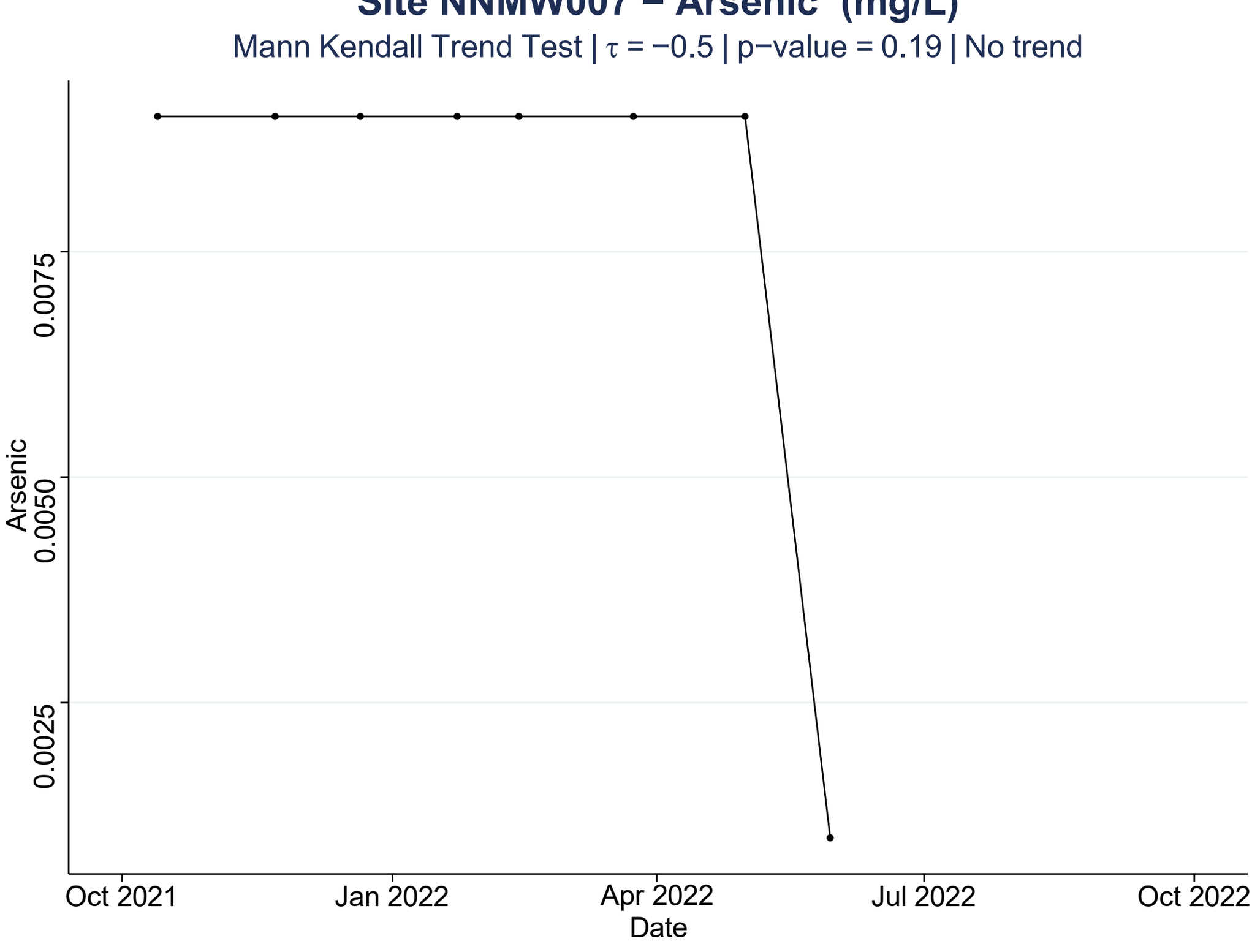

Site NNMW005 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.124 | p−value = 0.789 | No trend
Total Nickel
0.0125
0.0100
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

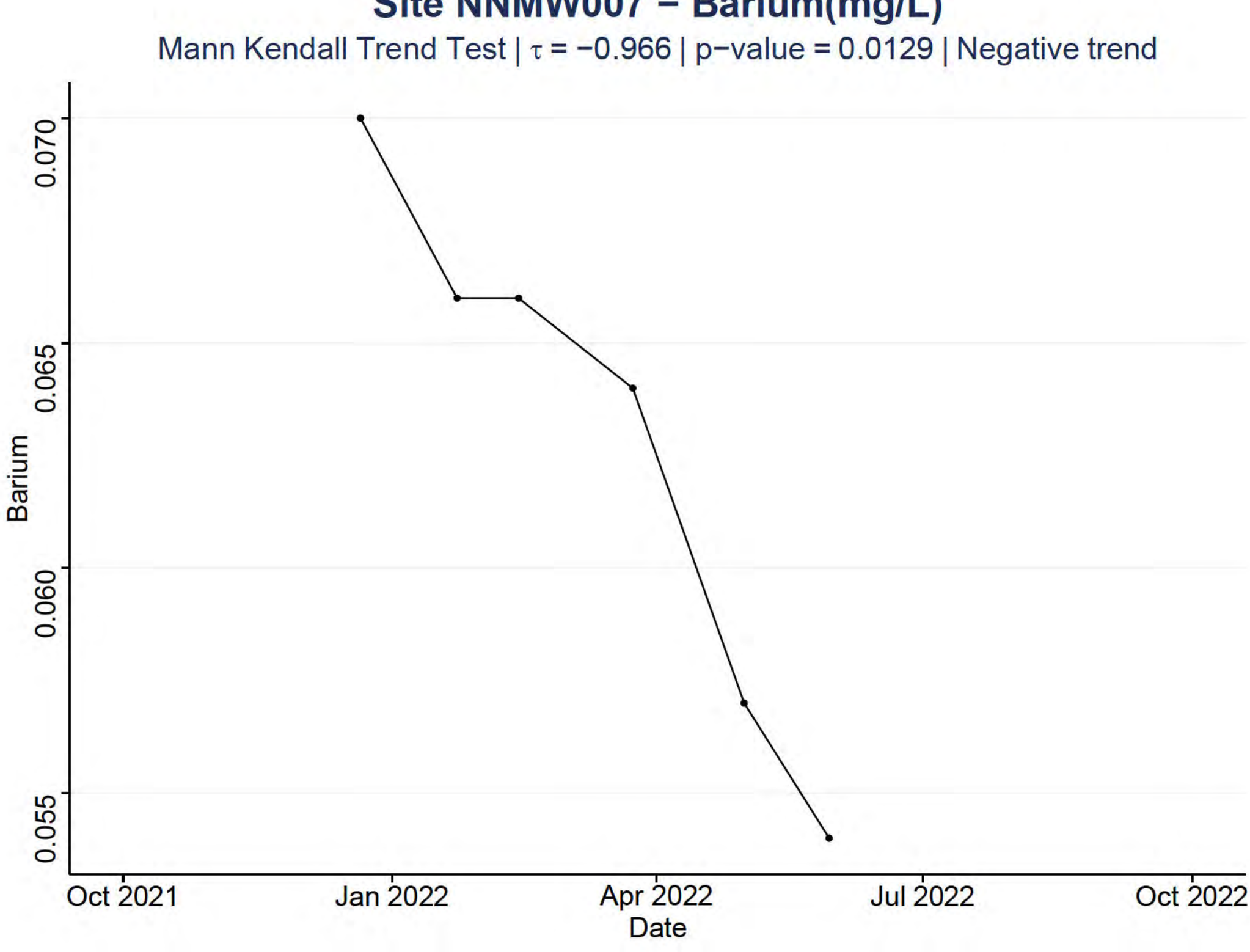

Site NNMW005 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.476 | p−value = 0.204 | No trend
Total Silver
0.001
0.002
0.003
0.004
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

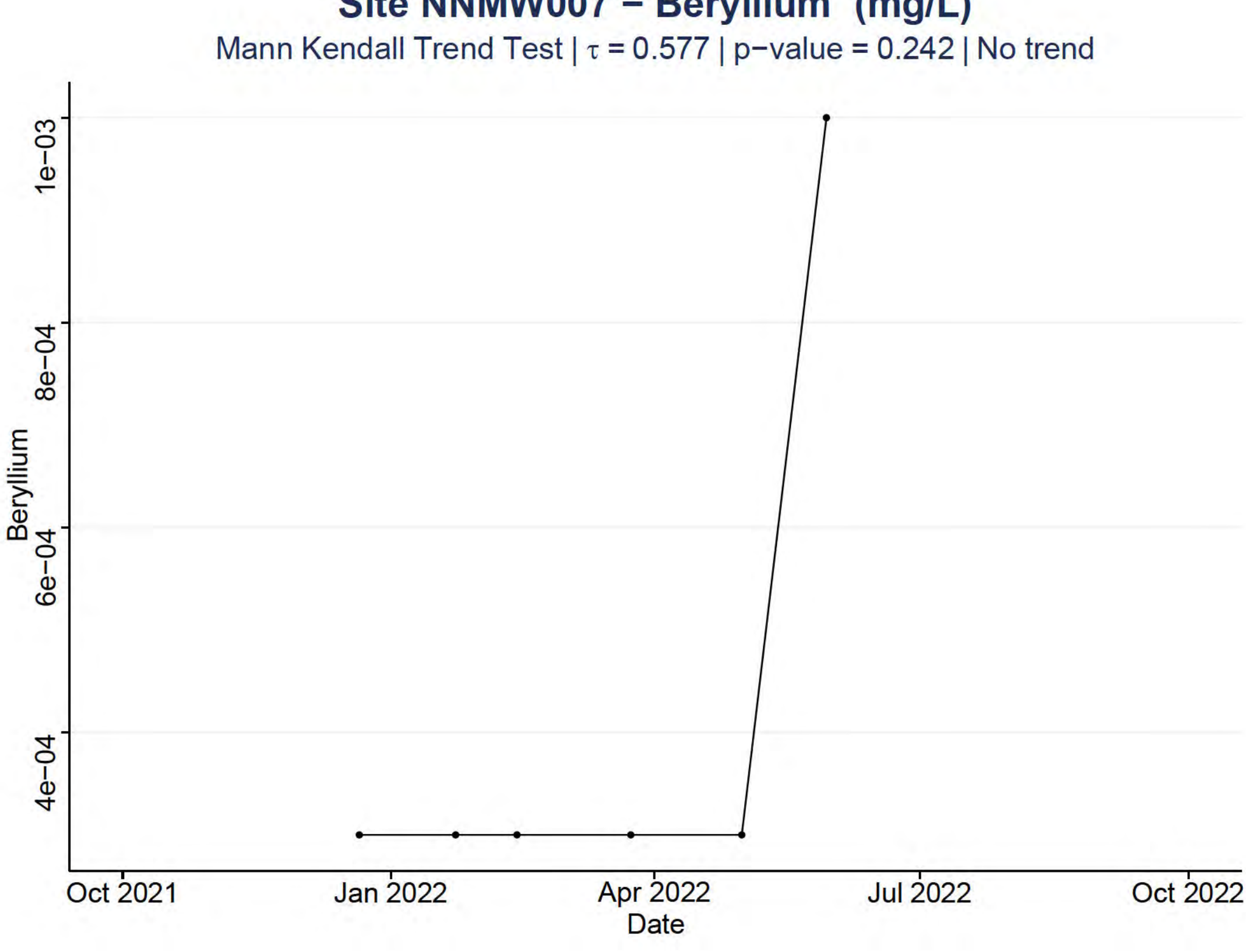

Site NNMW005 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = 0.423 | p−value = 0.142 | No trend
Total Zinc
0.02
0.03
0.04
0.05
0.06
0.07
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

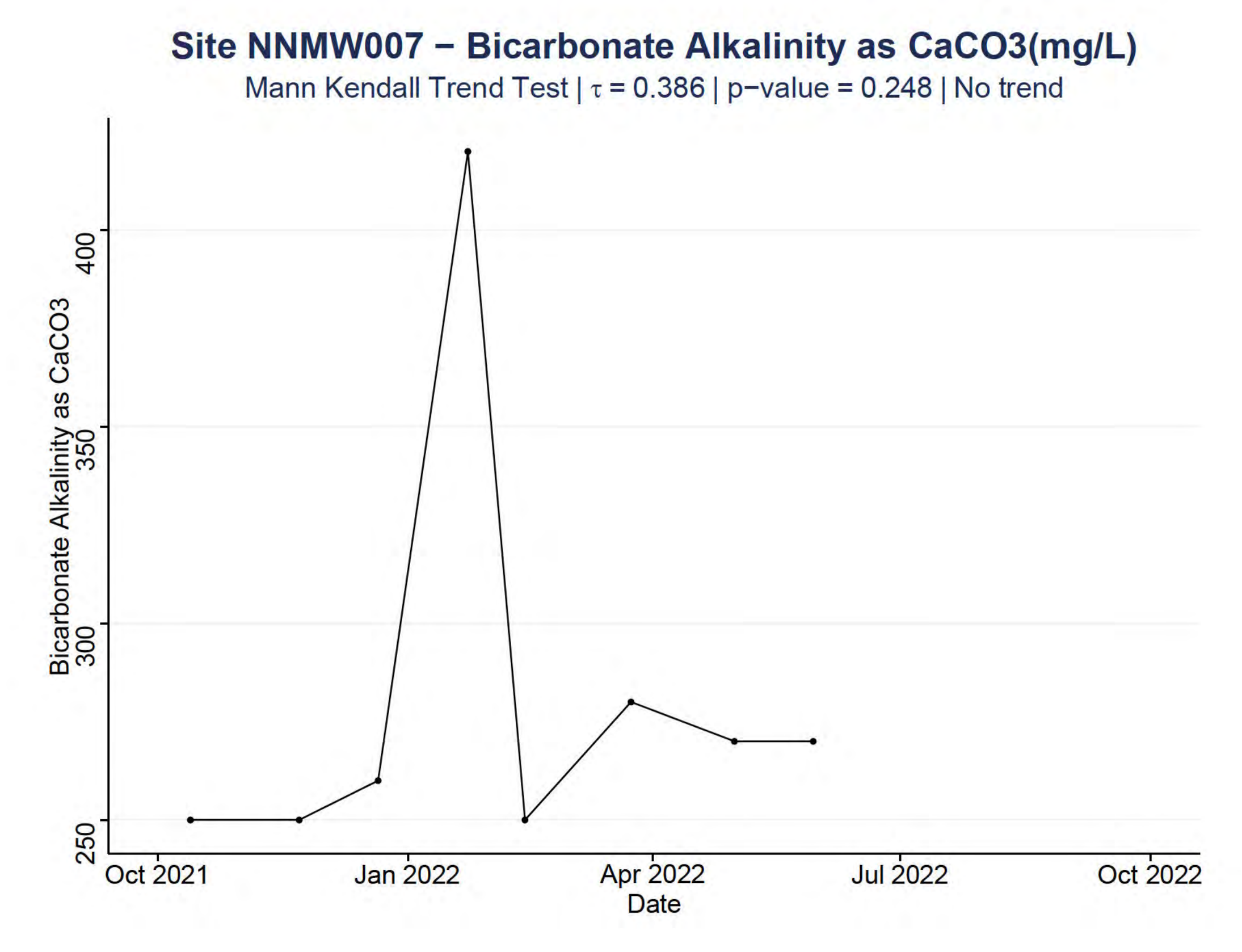

Site NNMW005 – Zinc (mg/L)
Mann Kendall Trend Test | τ = 0.31 | p−value = 0.295 | No trend
Zinc
0.01
0.02
0.03
0.04
0.05
0.06
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

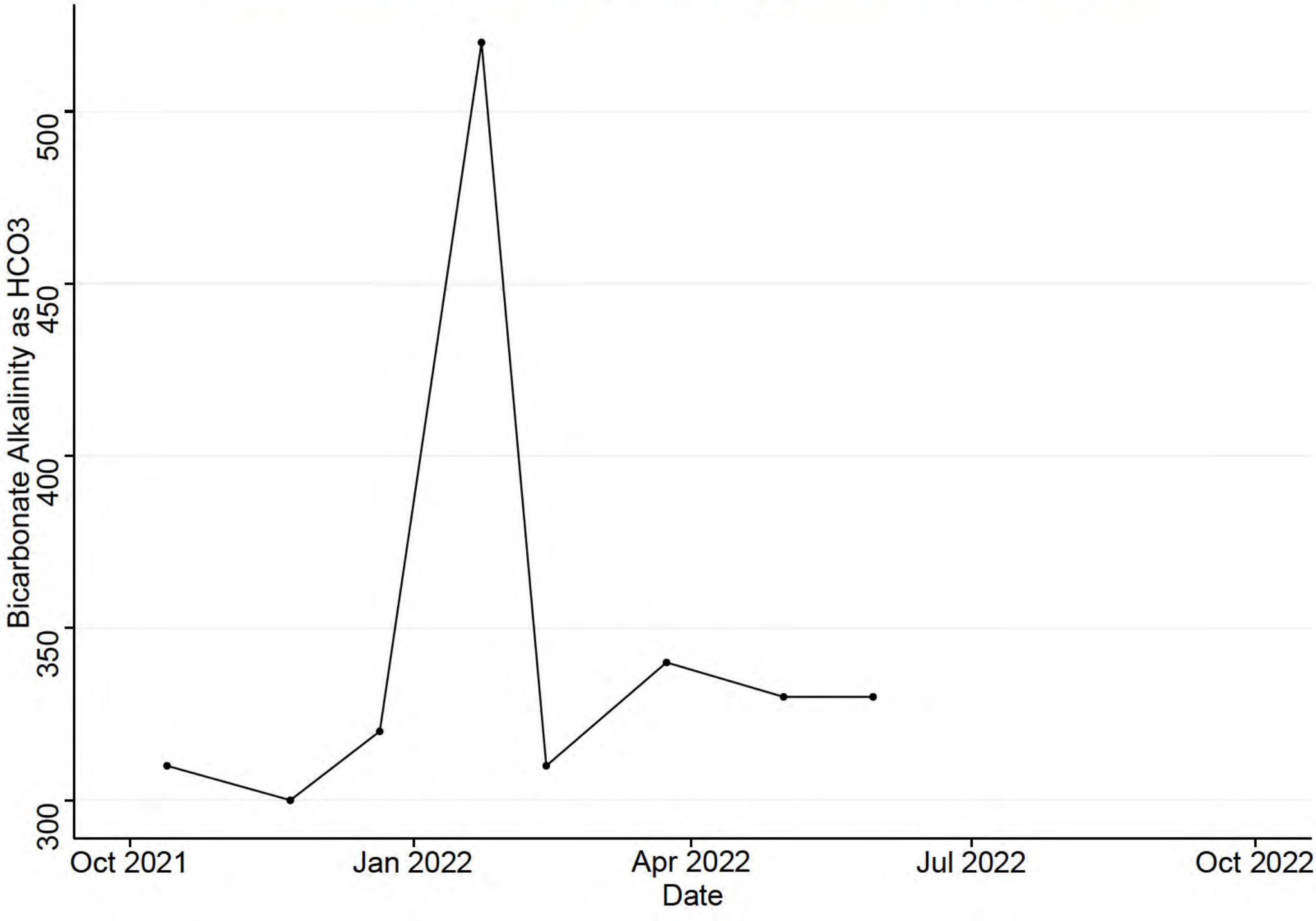

Site NNMW007 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.4 | p−value = 0.212 | No trend
Aluminium
0.0250
0.0225
0.0200
0.0175
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

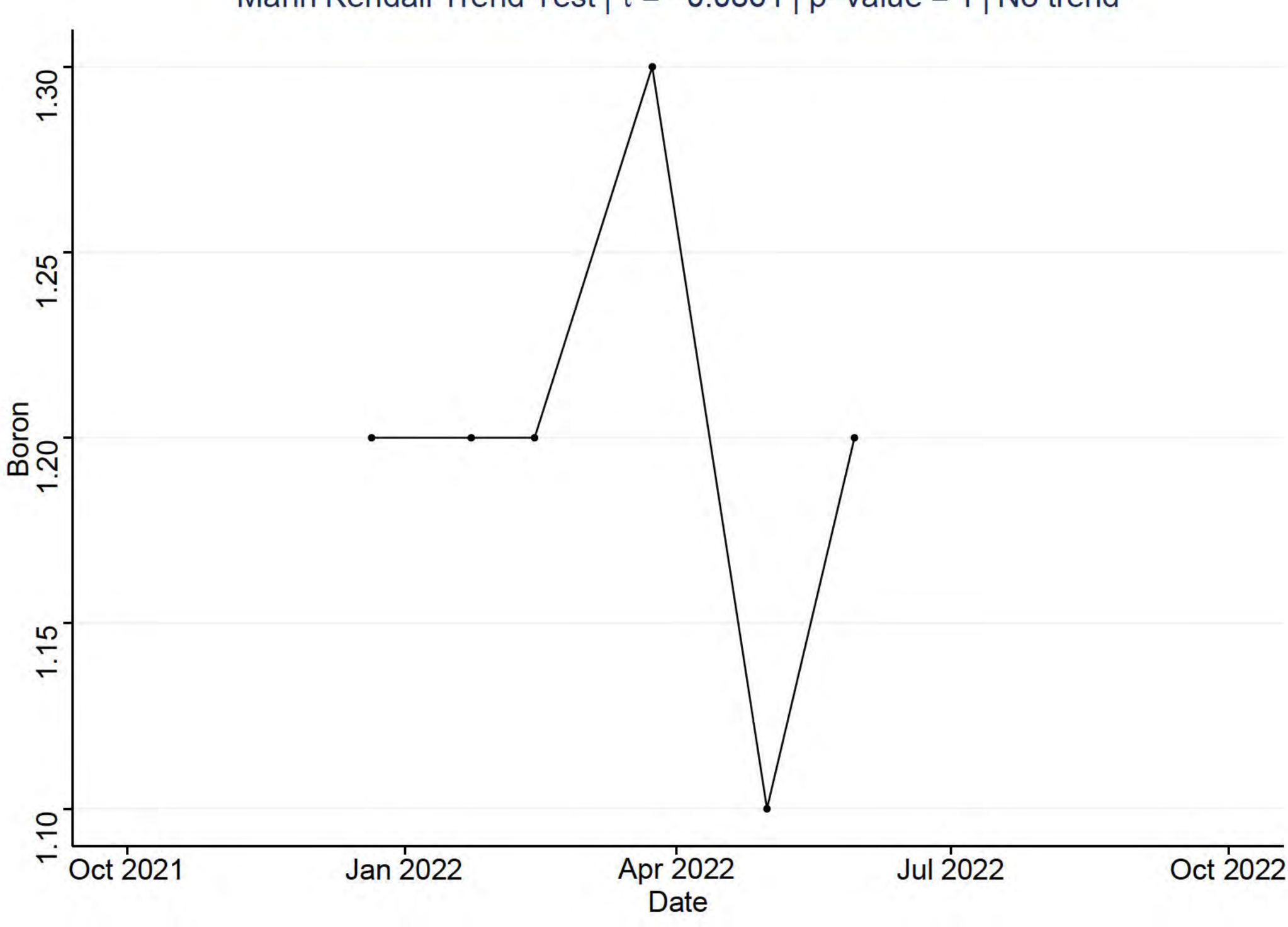

Site NNMW007 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

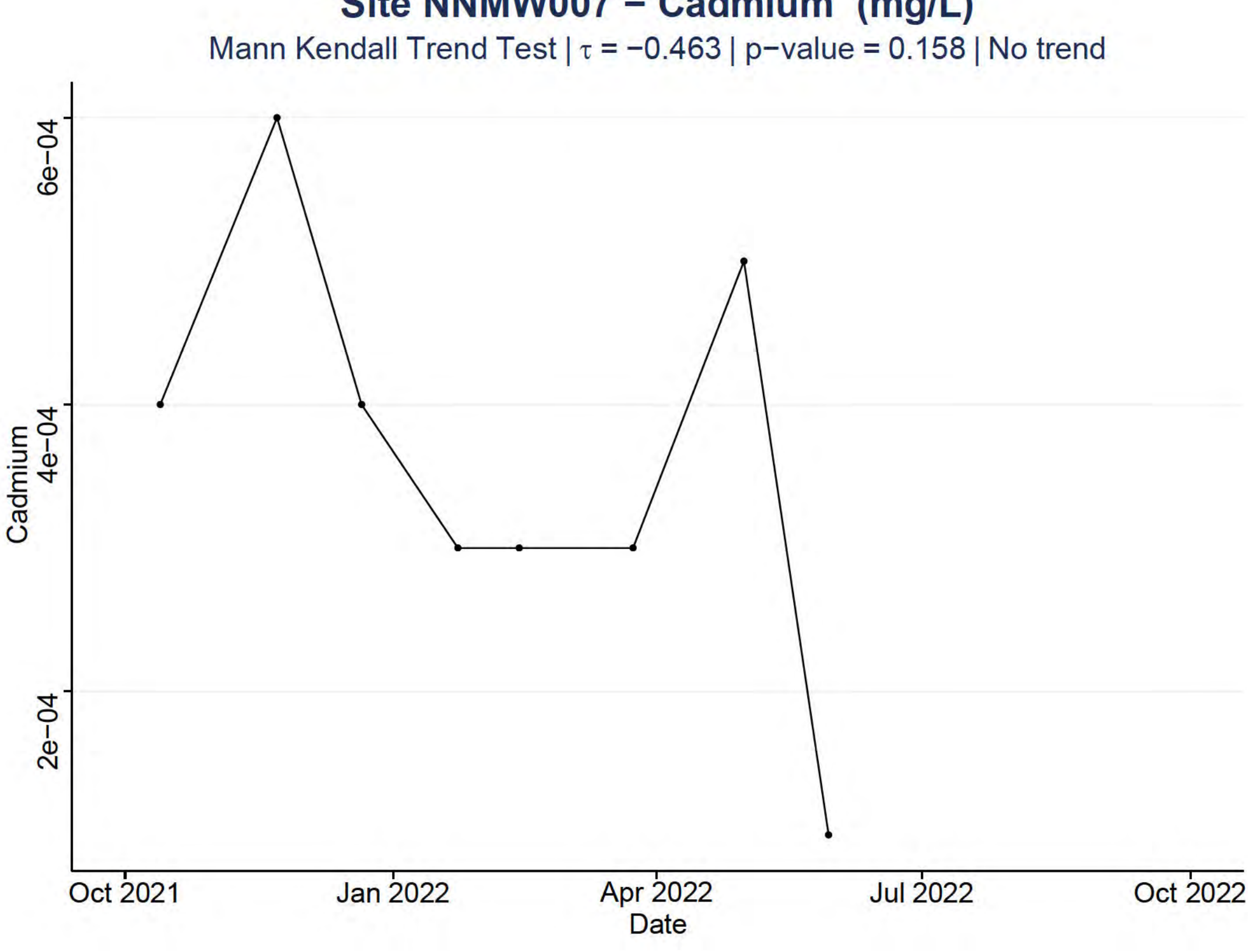

Site NNMW007 − Barium(mg/L)
Mann Kendall Trend Test | τ = −0.966 | p−value = 0.0129 | Negative trend
Barium
0.070
0.065
0.060
0.055
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

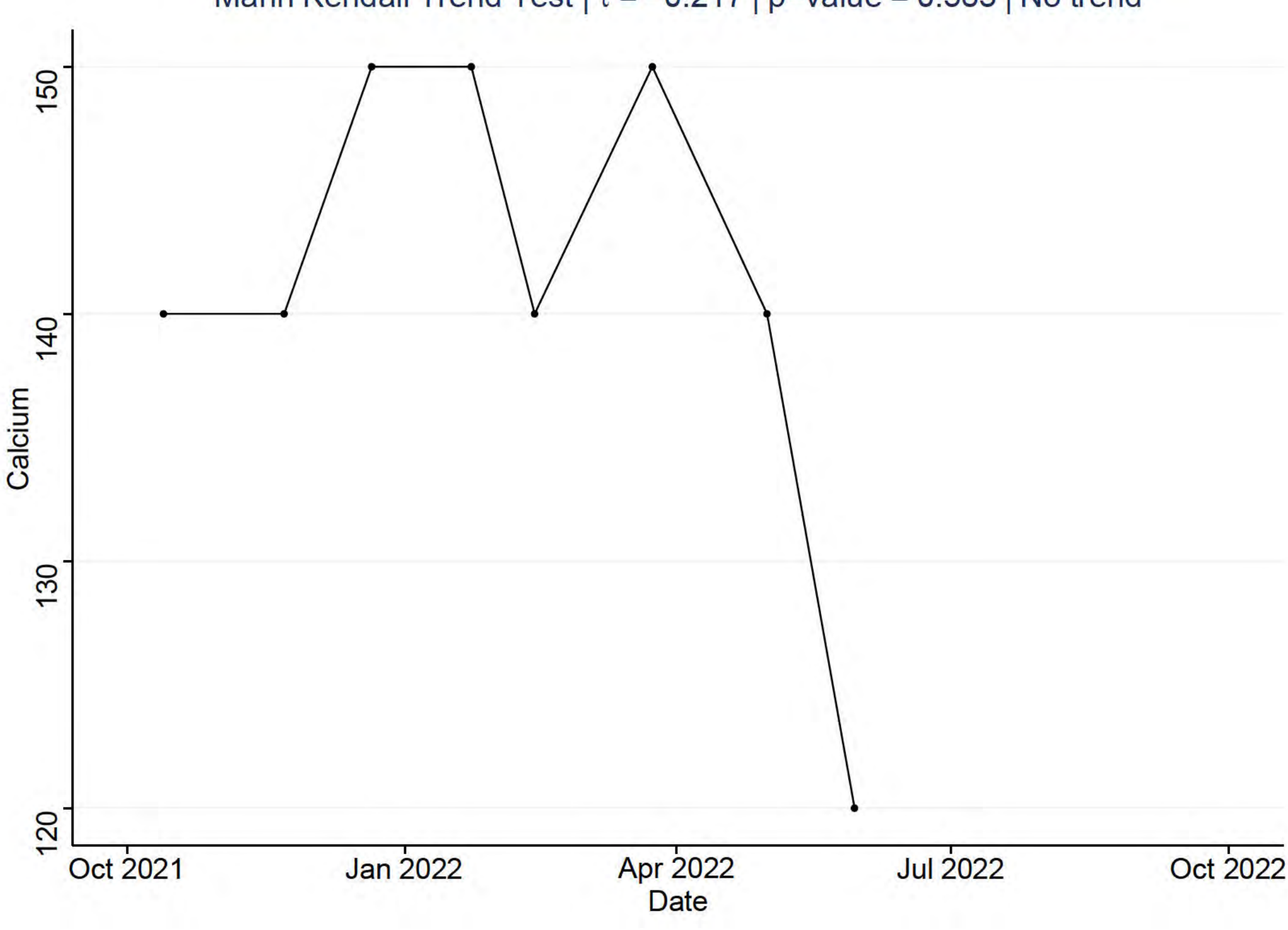

Site NNMW007 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

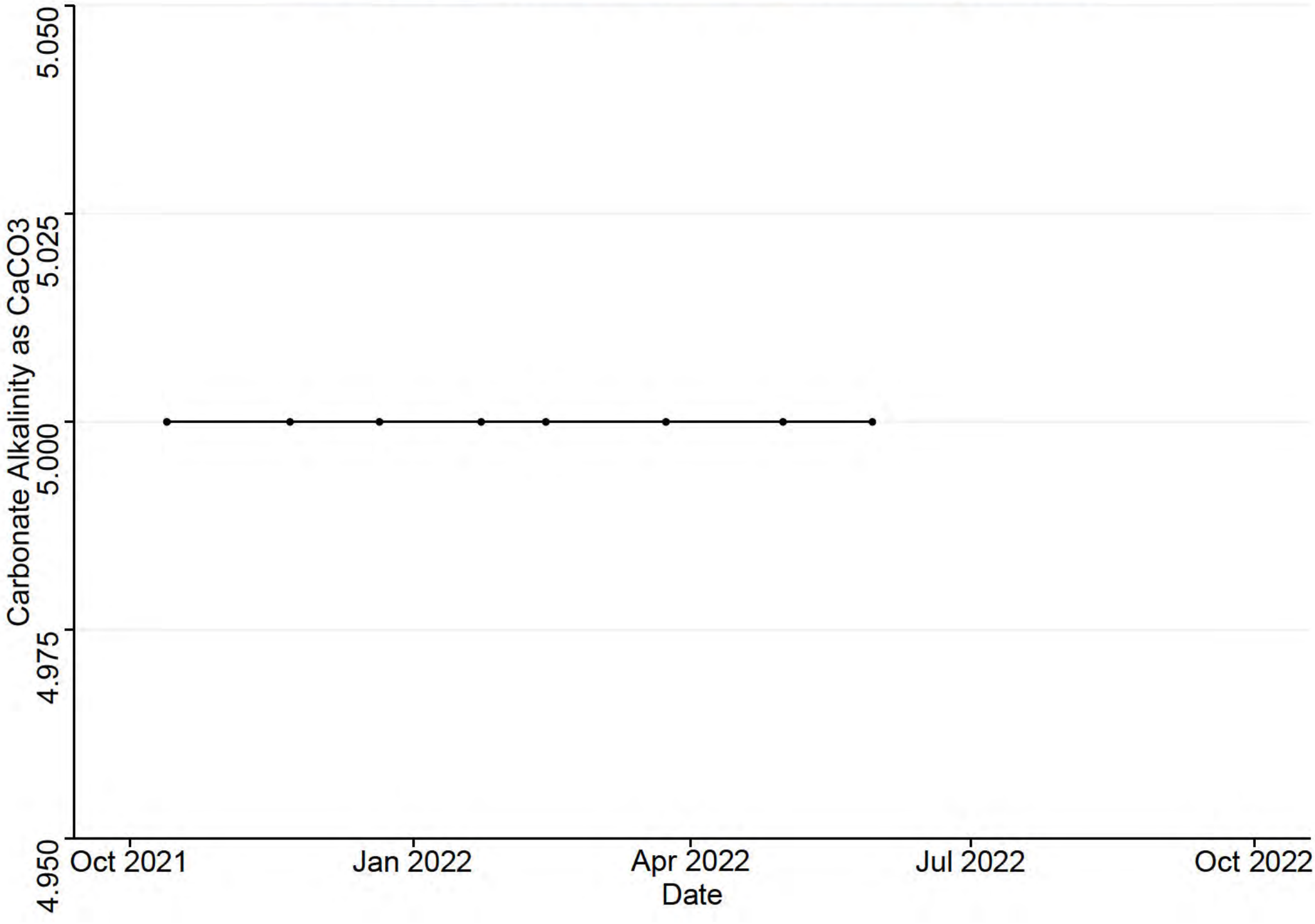

Site NNMW007 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.386 | p−value = 0.248 | No trend
Bicarbonate Alkalinity as CaCO3
250
300
350
400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

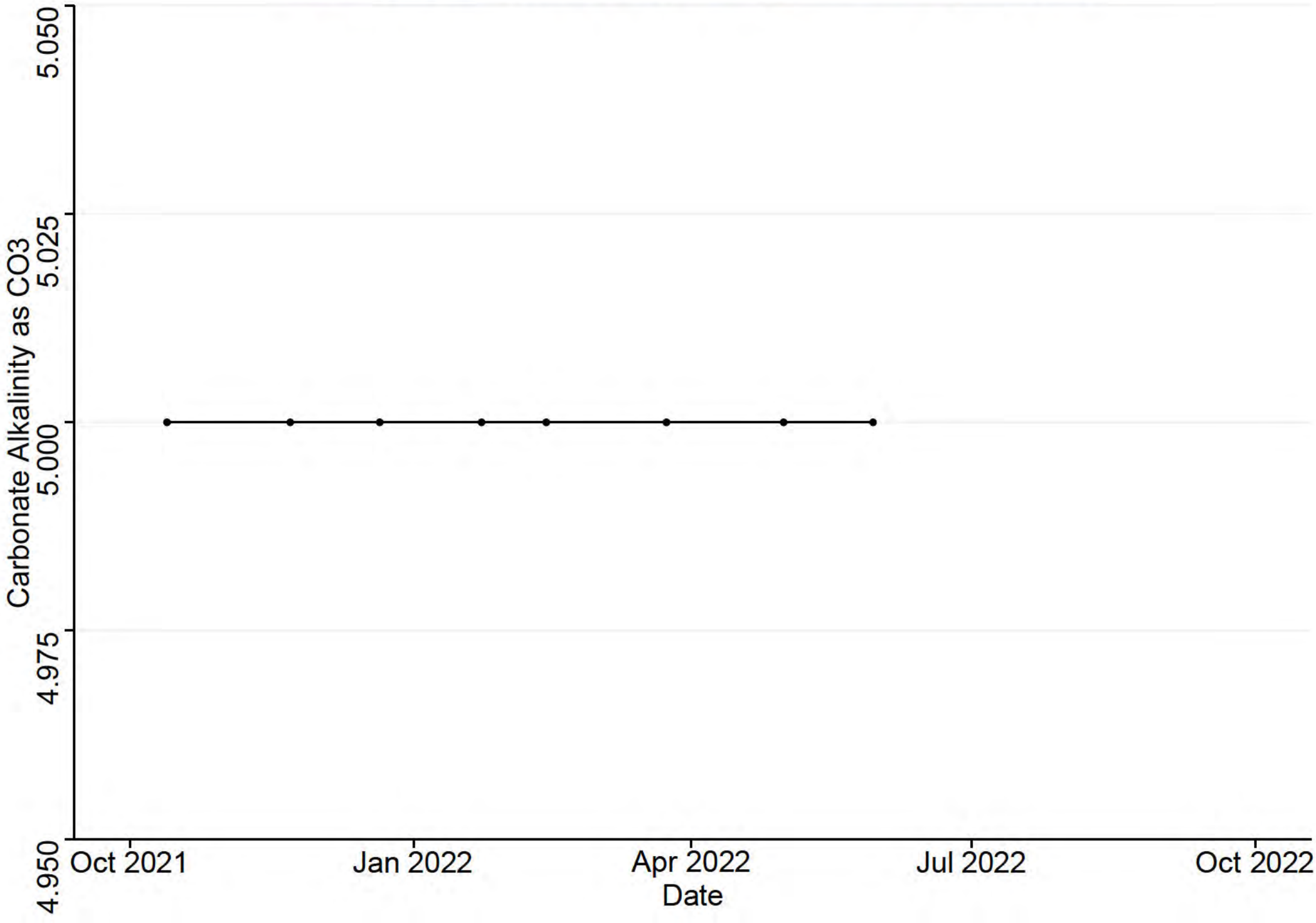

Site NNMW007 − Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.371 | p−value = 0.258 | No trend
Bicarbonate Alkalinity as HCO3
300
350
400
450
500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

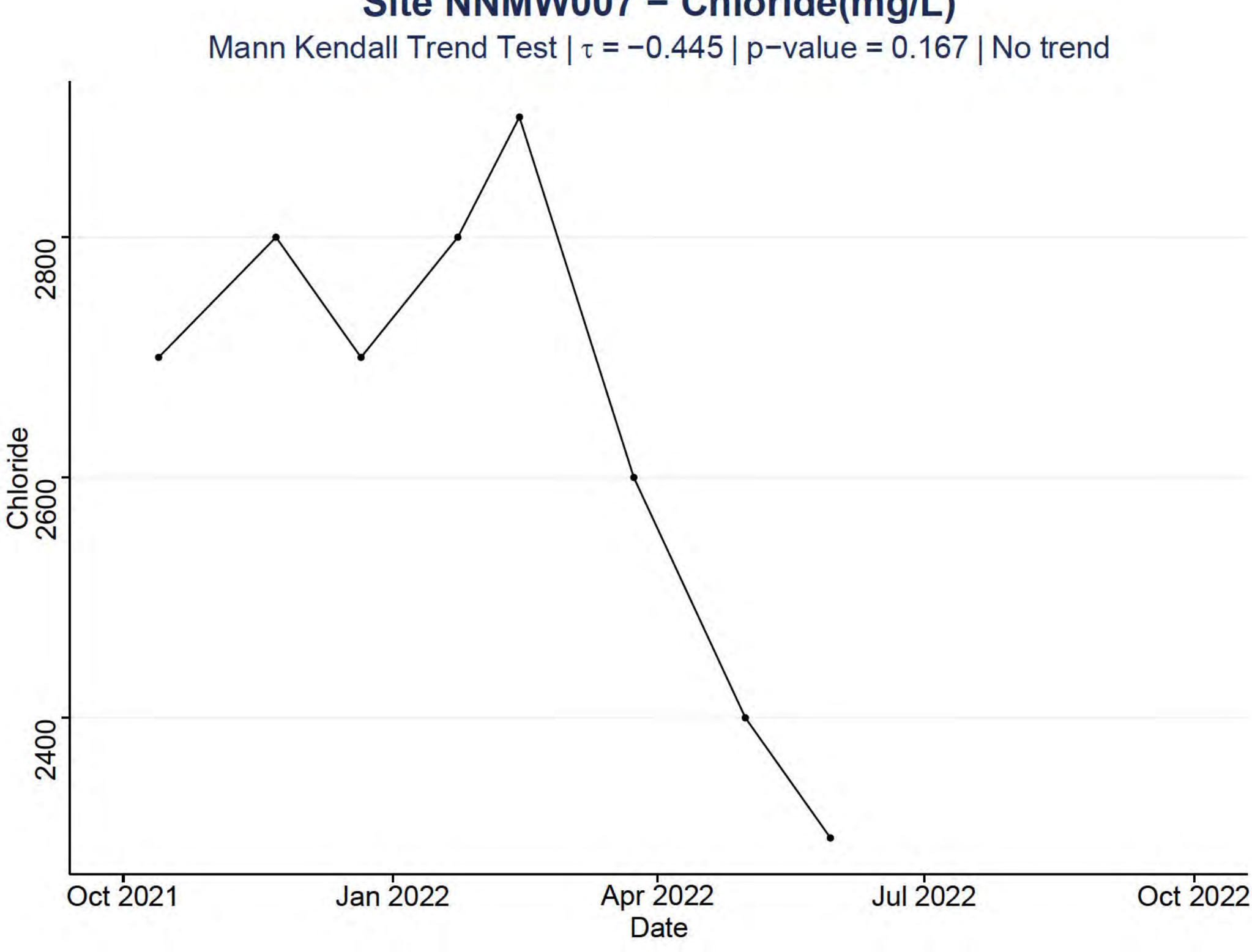

Site NNMW007 − Boron(mg/L)
Mann Kendall Trend Test | τ = −0.0861 | p−value = 1 | No trend
Boron
1.30
1.25
1.20
1.15
1.10
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

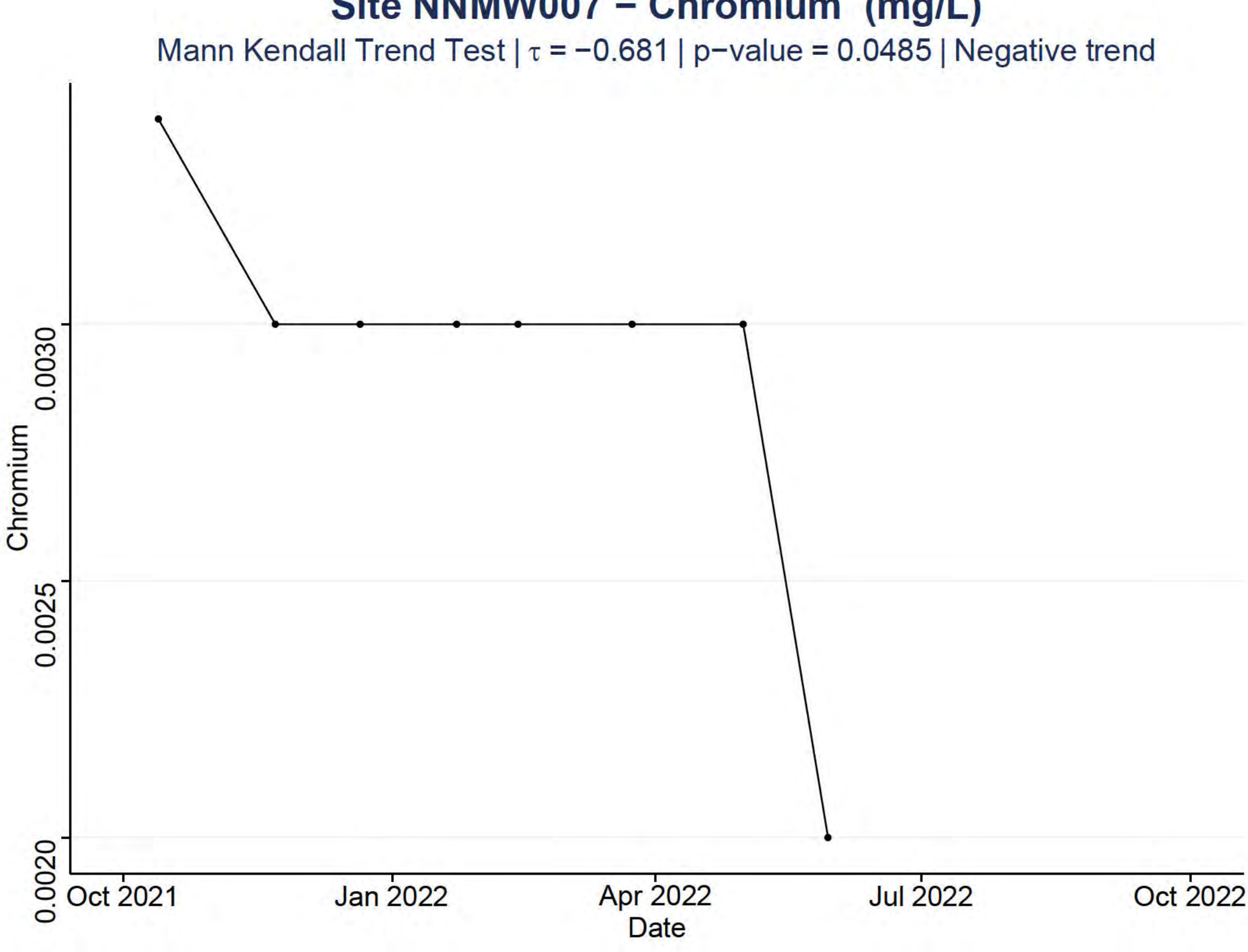

Site NNMW007 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.463 | p−value = 0.158 | No trend
Cadmium
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

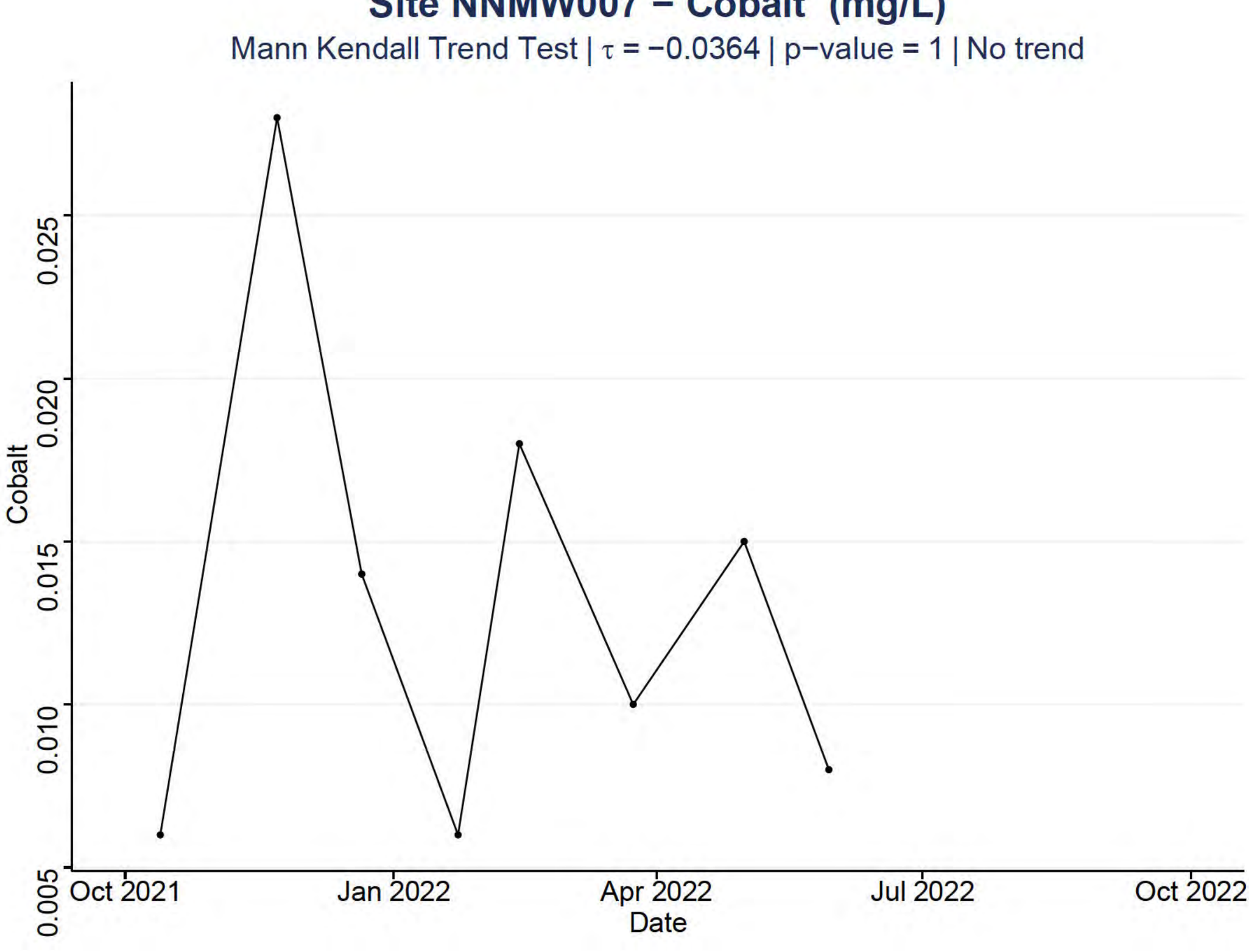

Site NNMW007 – Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.217 | p−value = 0.583 | No trend
Calcium
150
140
130
120
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

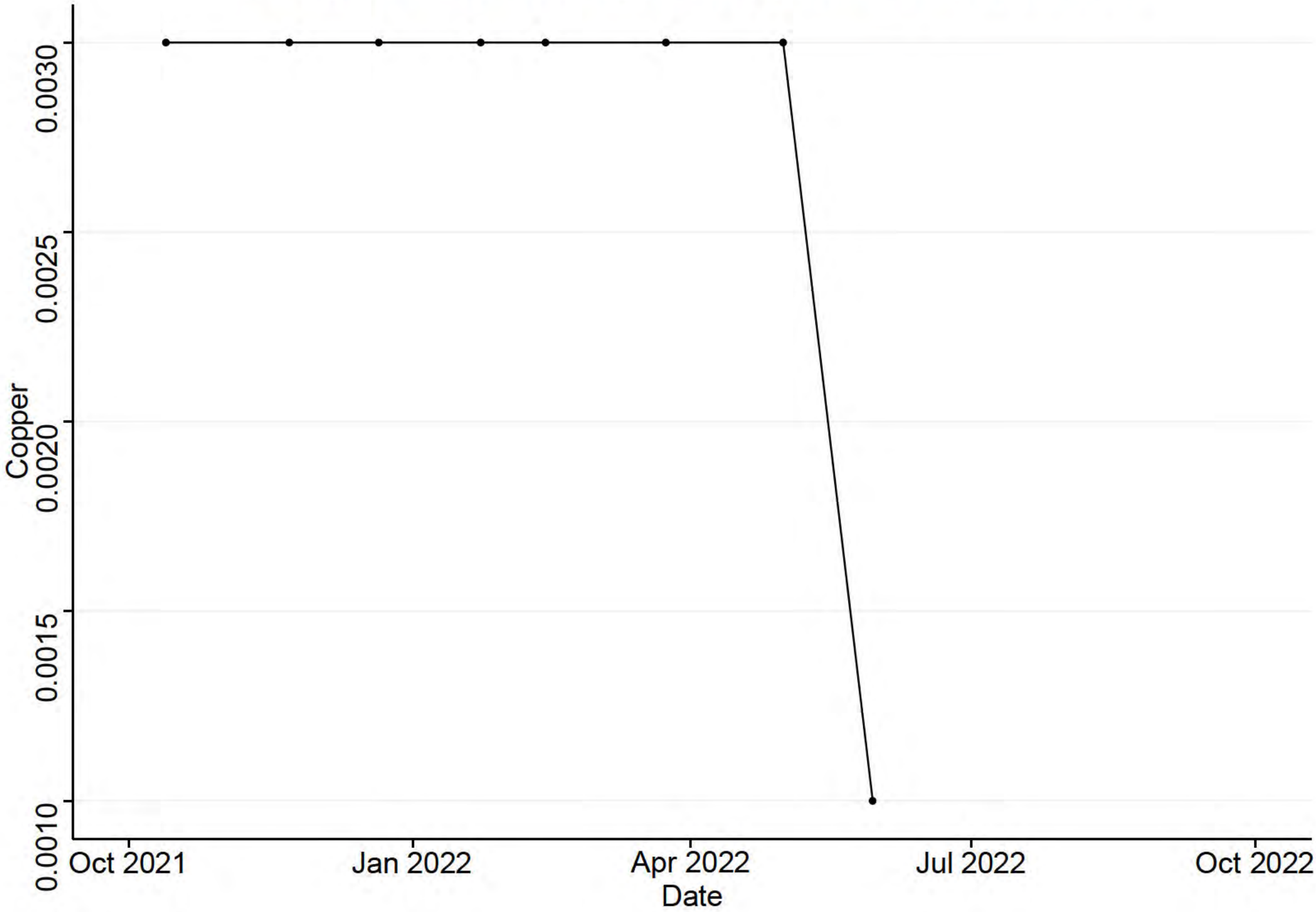

Site NNMW007 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

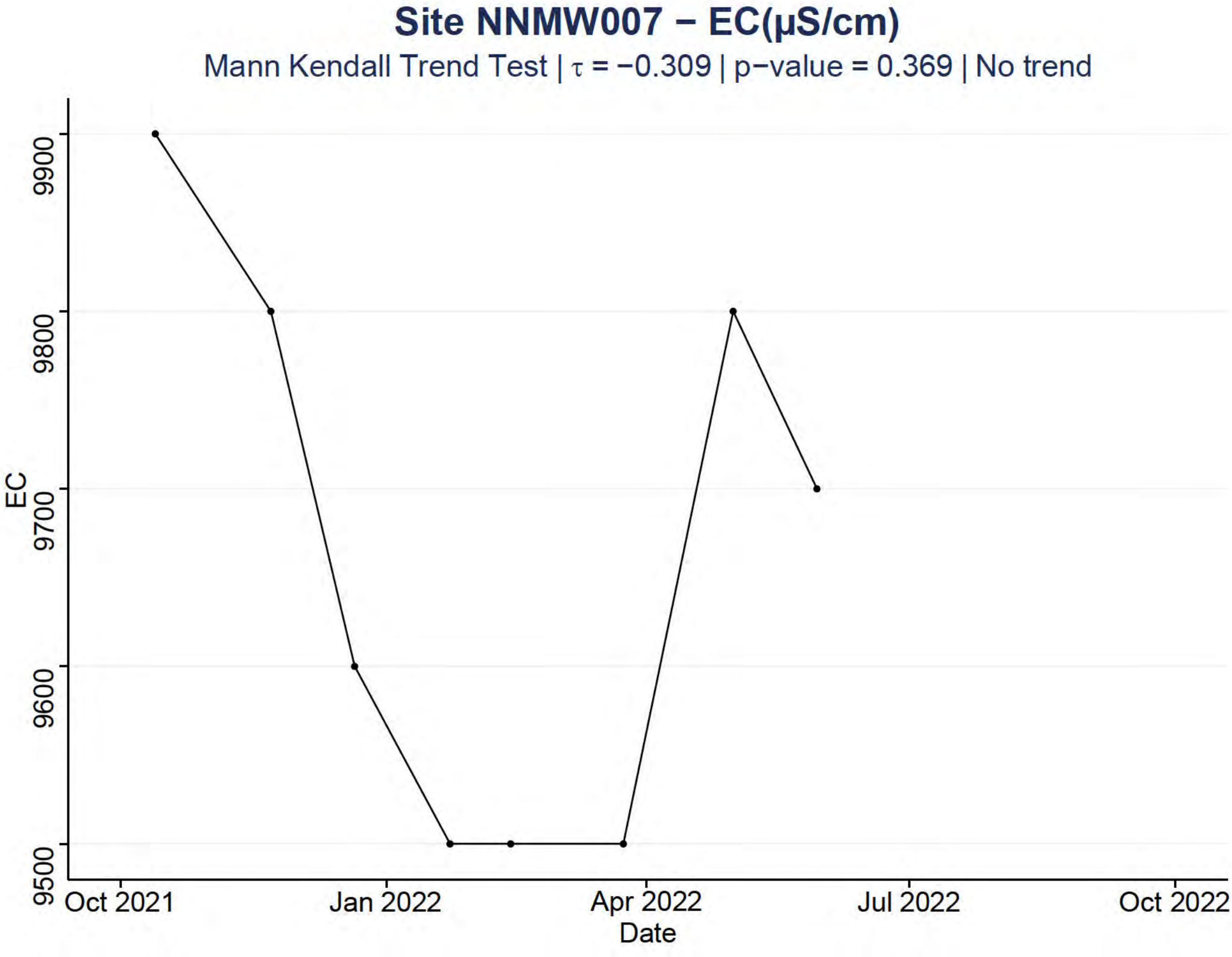

Site NNMW007 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

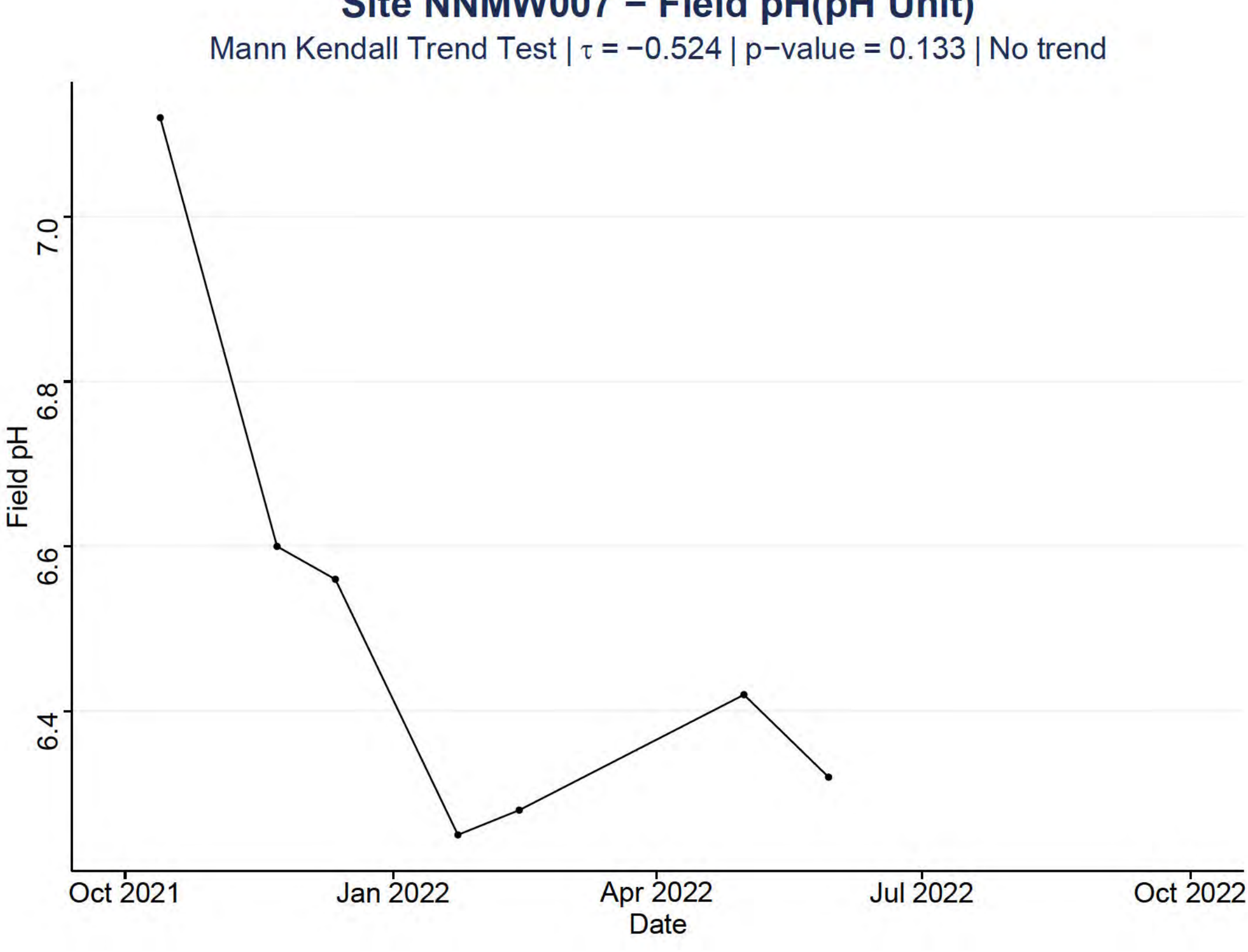

Site NNMW007 – Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.445 | p−value = 0.167 | No trend
Chloride
2800
2600
2400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW007 − Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.681 | p−value = 0.0485 | Negative trend
Chromium
0.0030
0.0025
0.0020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW007 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.0364 | p−value = 1 | No trend
Cobalt
0.005
0.010
0.015
0.020
0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

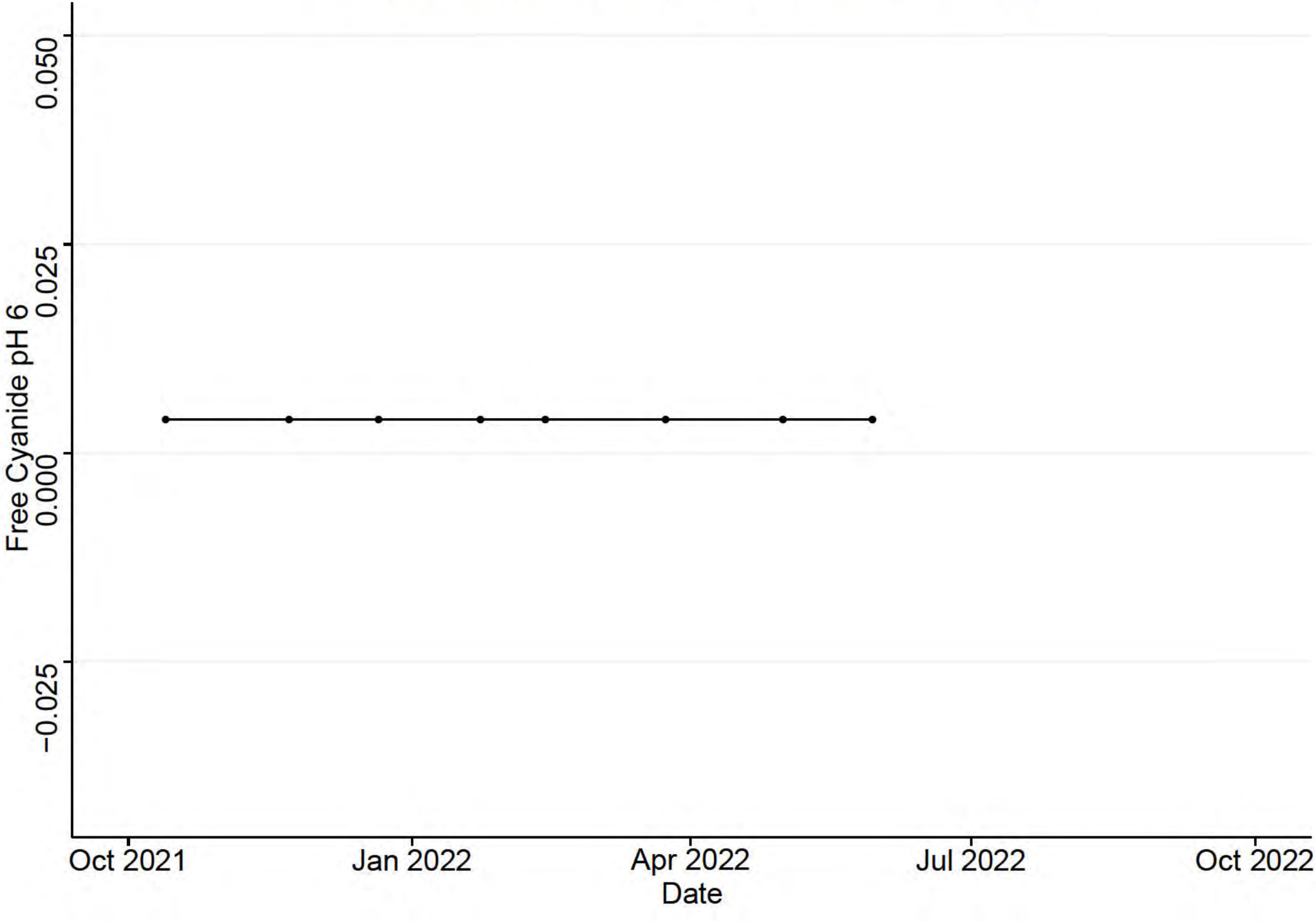

Site NNMW007 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Copper
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

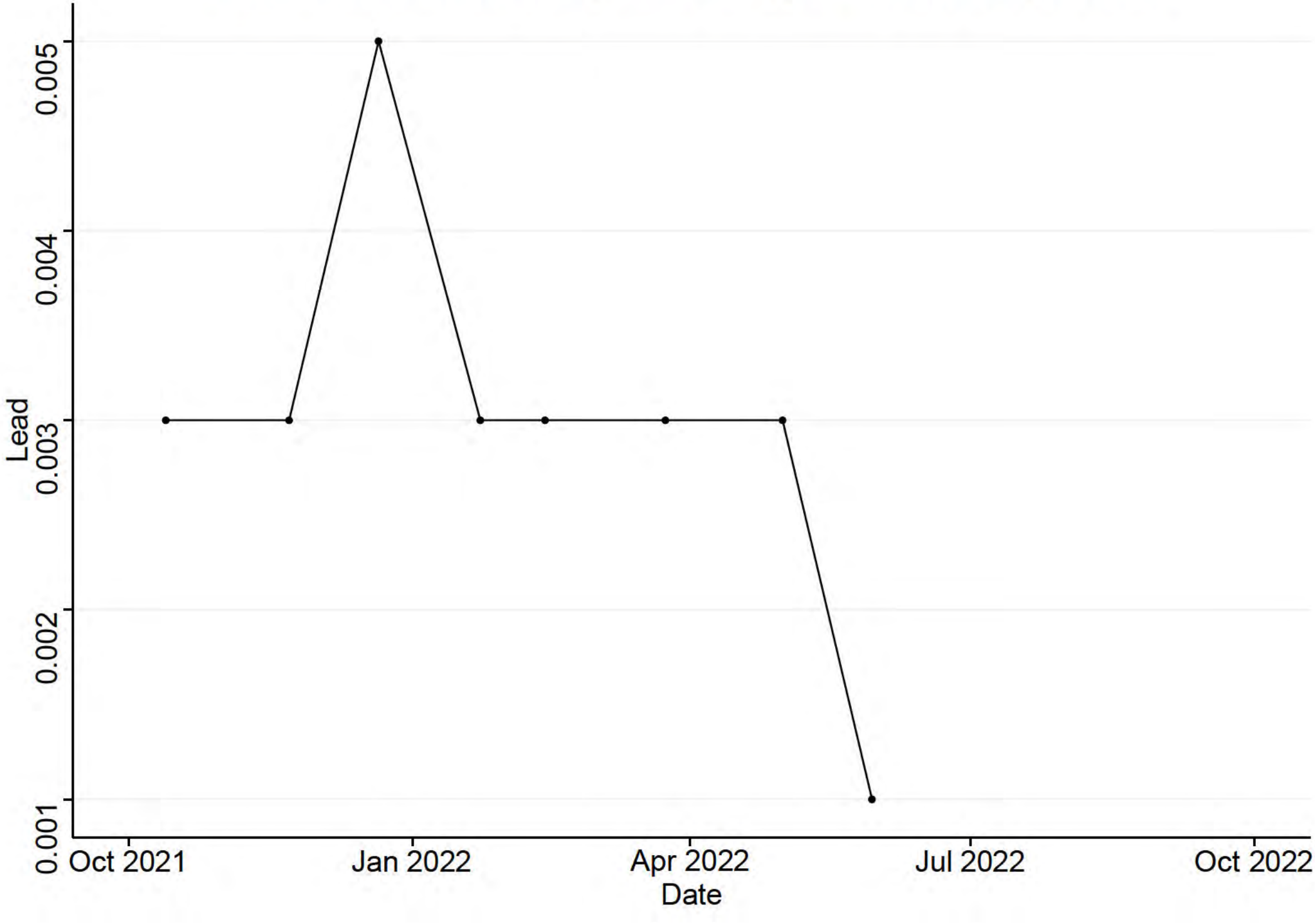

Site NNMW007 − EC(µS/cm)
Mann Kendall Trend Test | τ = −0.309 | p−value = 0.369 | No trend
EC
9900
9800
9700
9600
9500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

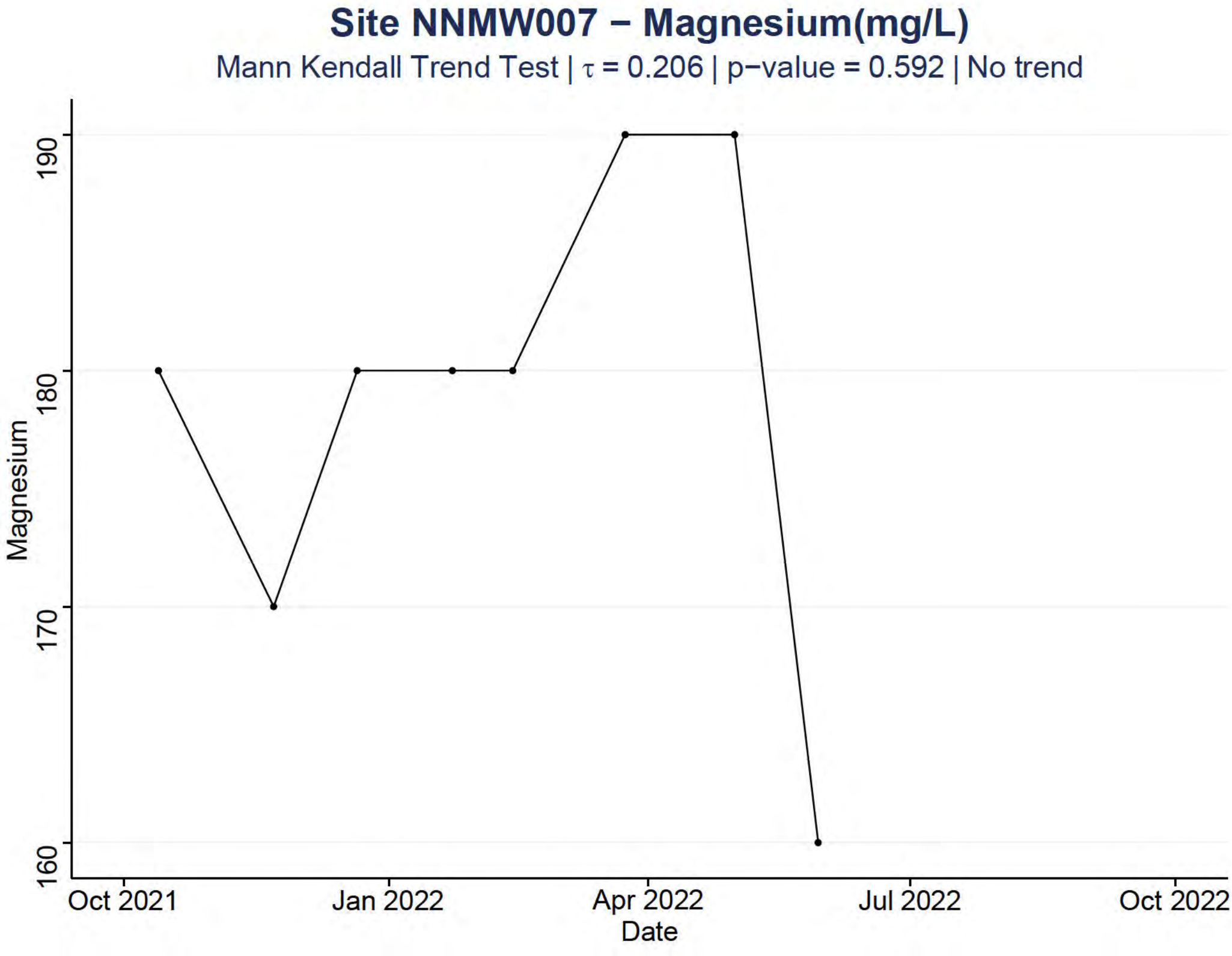

Site NNMW007 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.524 | p−value = 0.133 | No trend
Field pH
7.0
6.8
6.6
6.4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

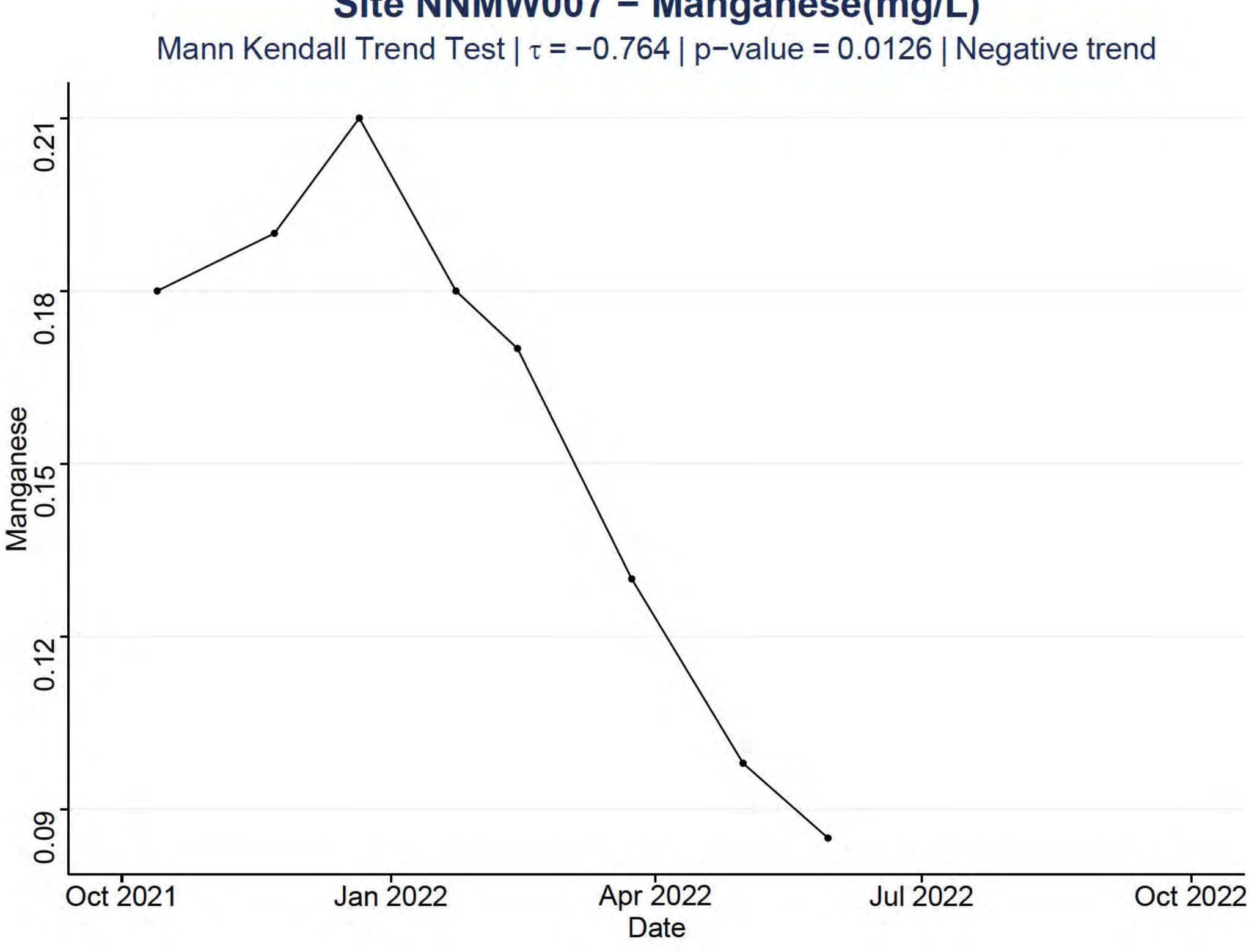
Site NNMW007 – Free Cyanide pH 6 (mg/L)

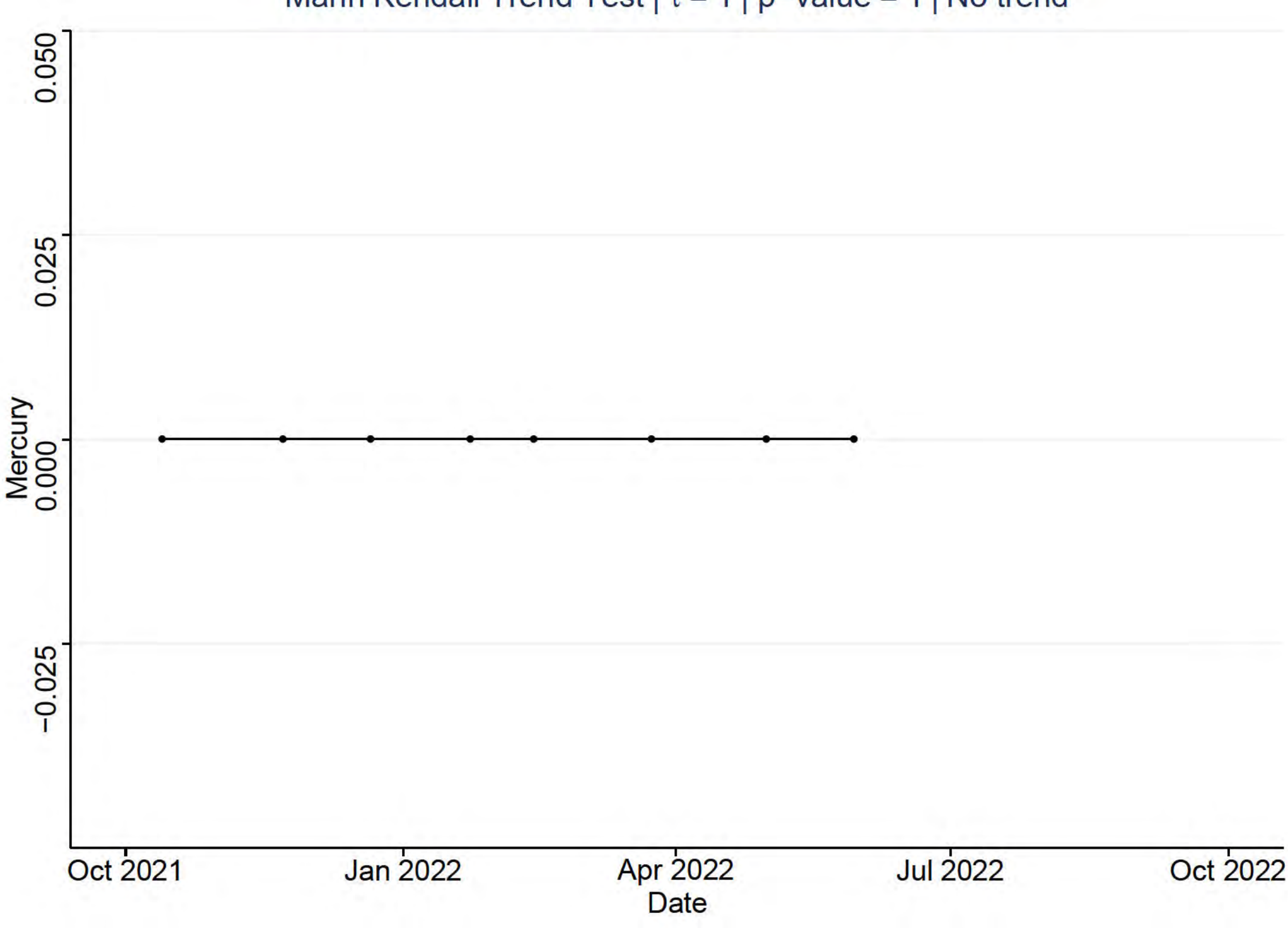
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend

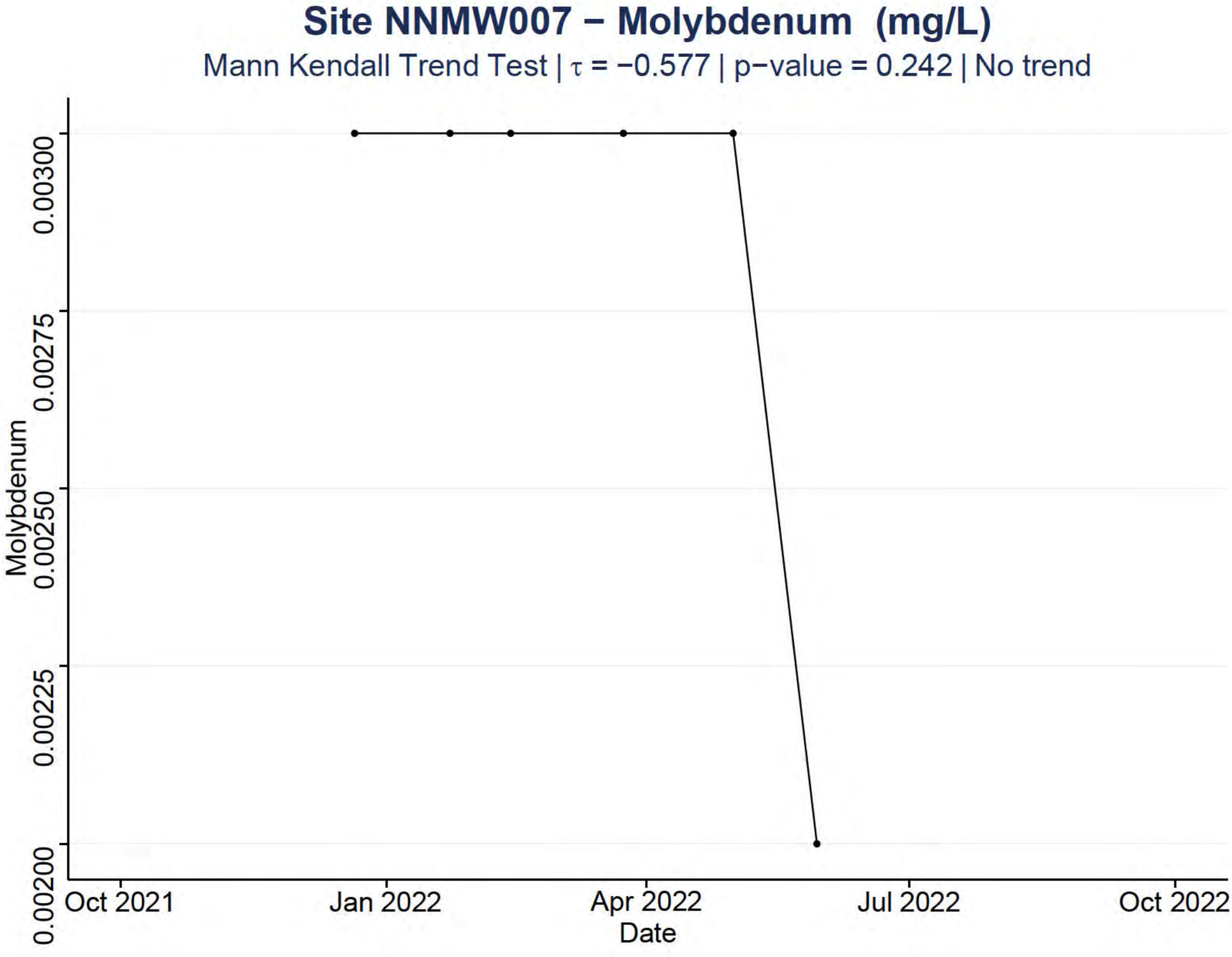


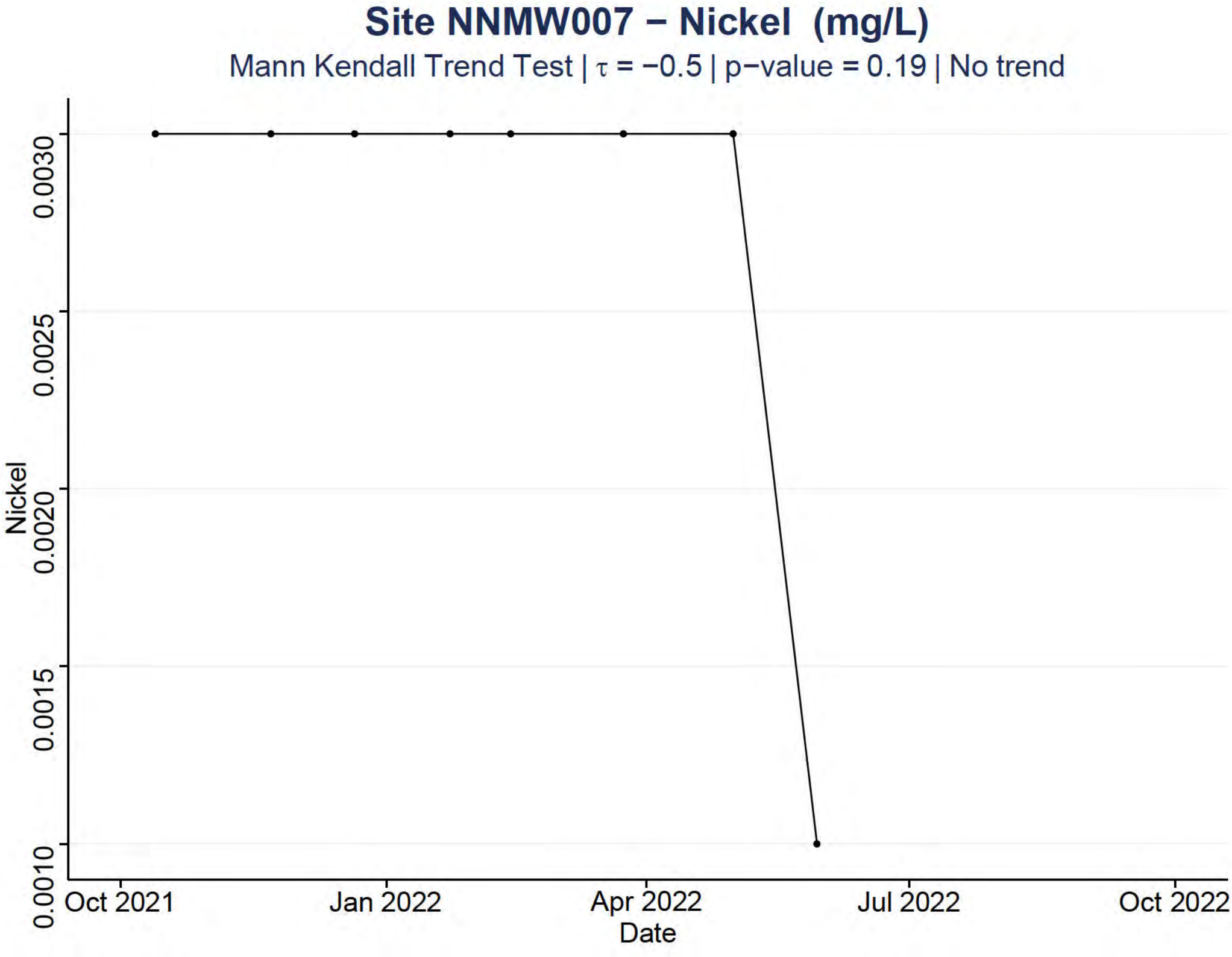

Site NNMW007 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.472 | p−value = 0.188 | No trend
Lead
0.005
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

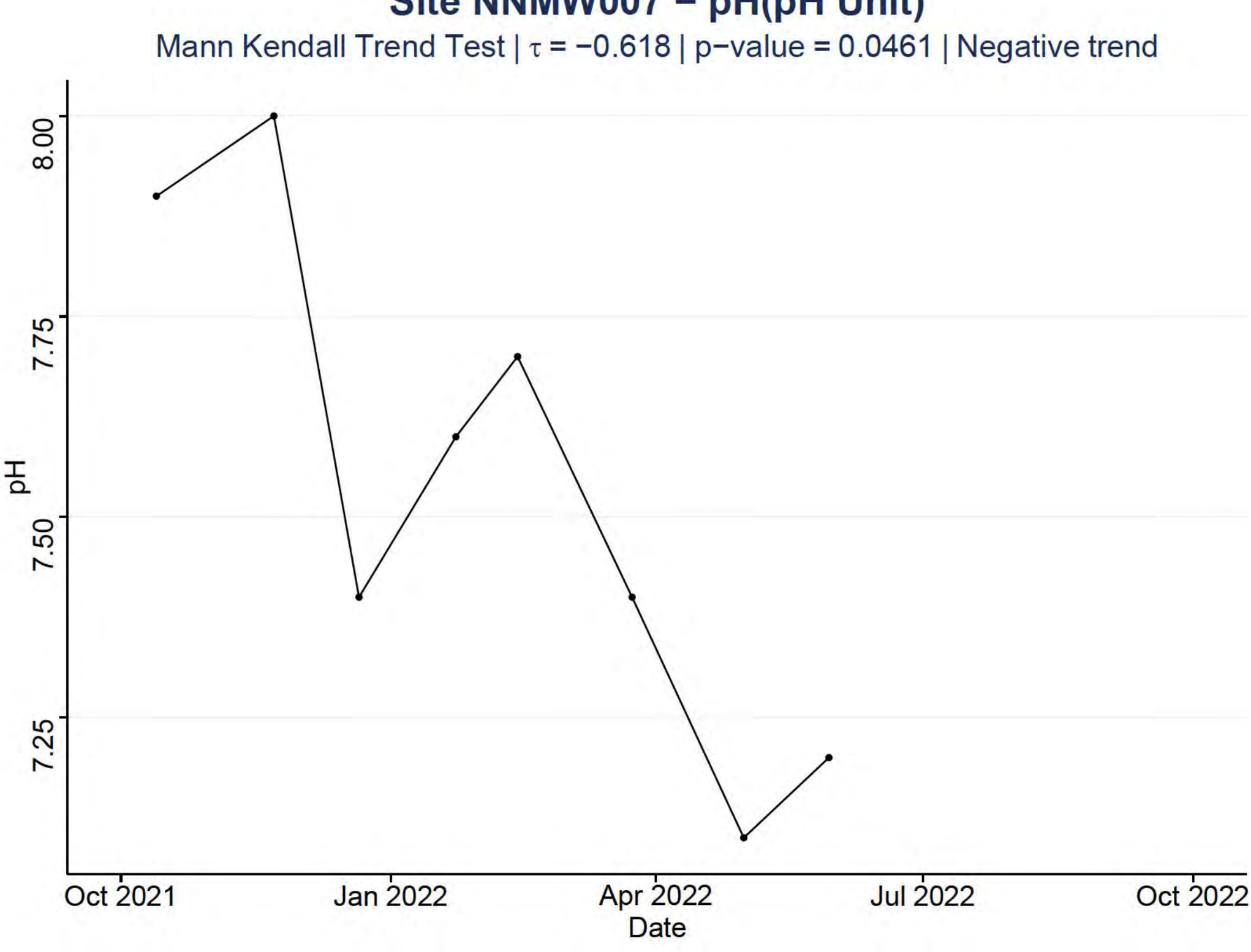

Site NNMW007 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = 0.206 | p−value = 0.592 | No trend
Magnesium
190
180
170
160
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

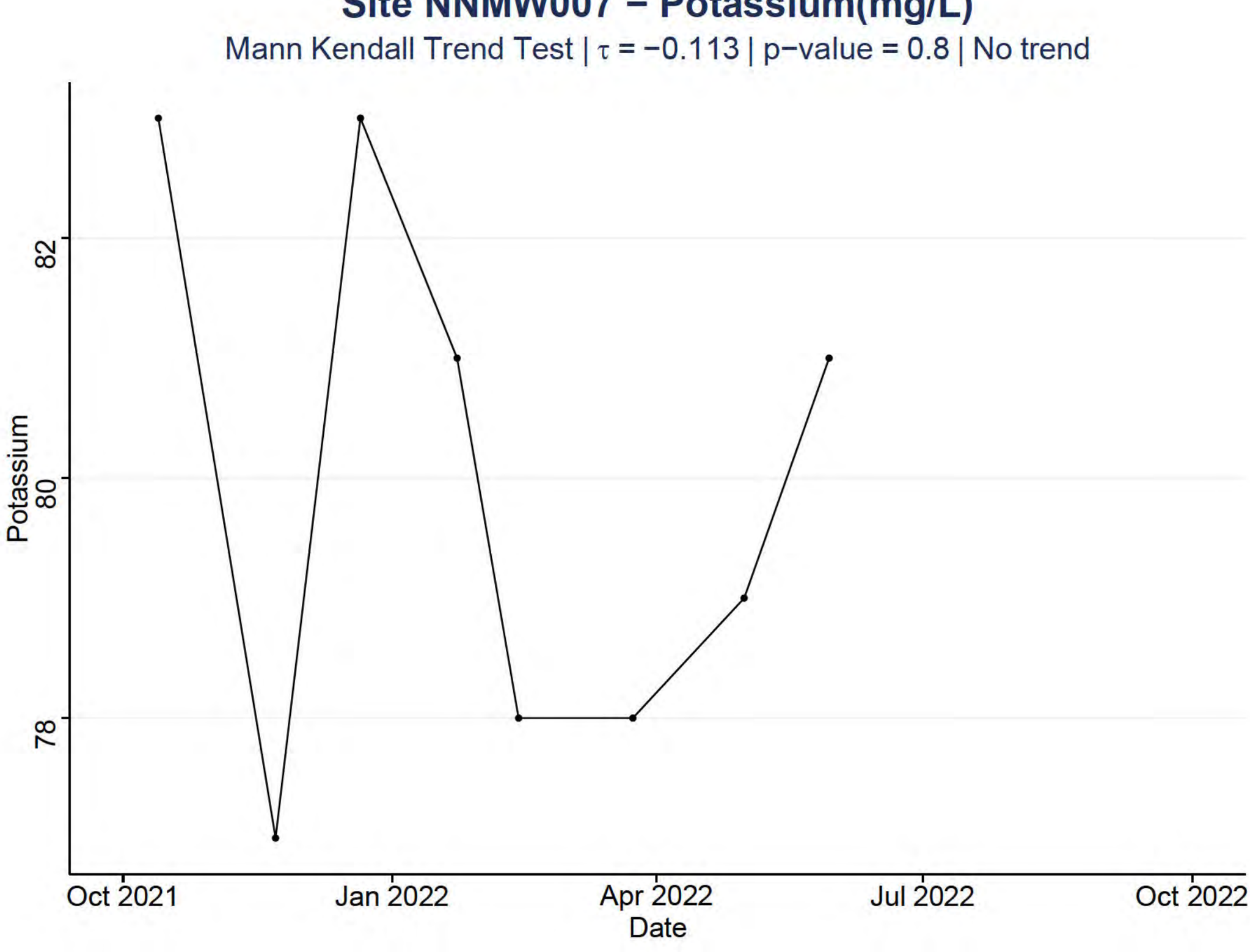

Site NNMW007 − Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.764 | p−value = 0.0126 | Negative trend
Manganese
0.21
0.18
0.15
0.12
0.09
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

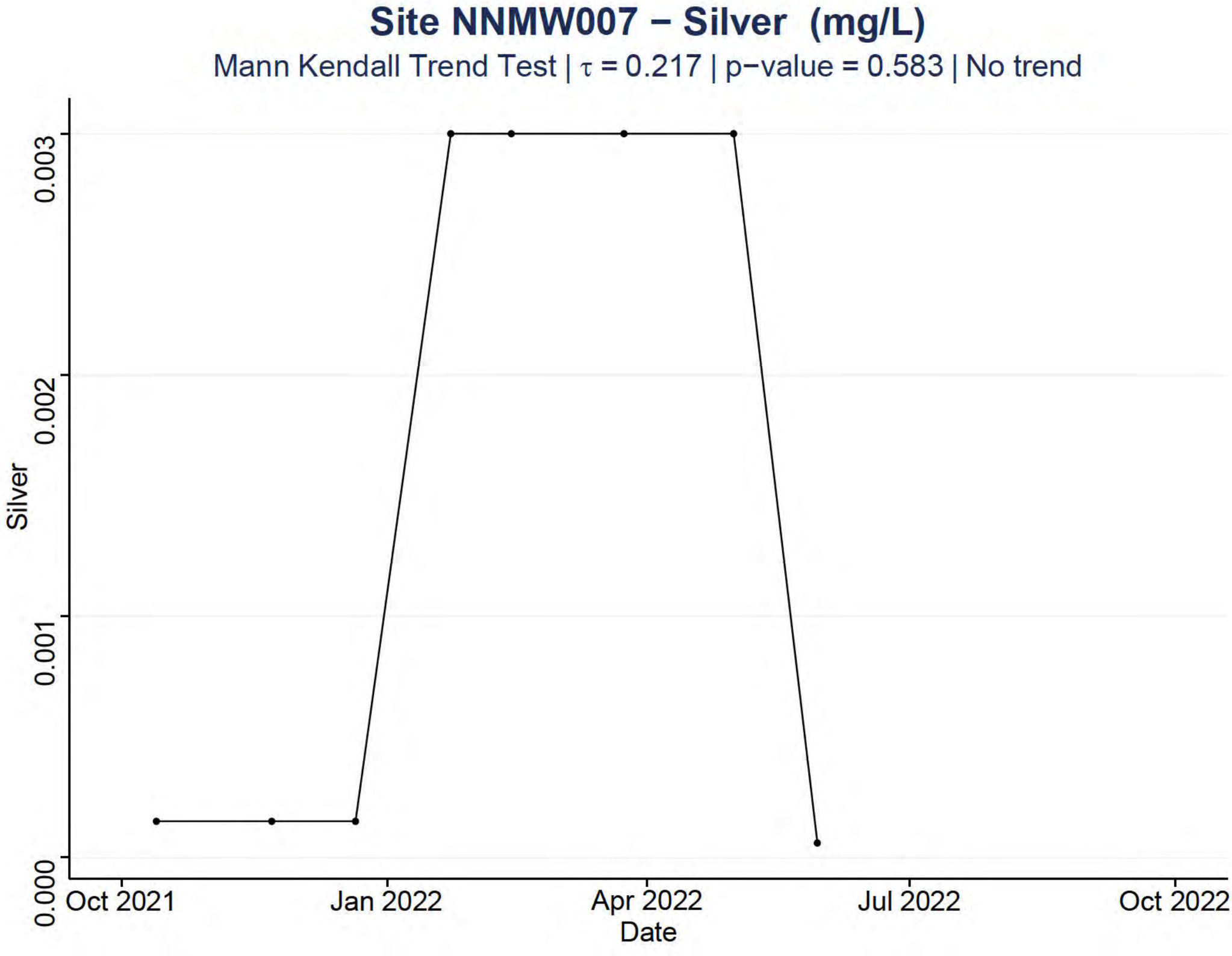

Site NNMW007 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

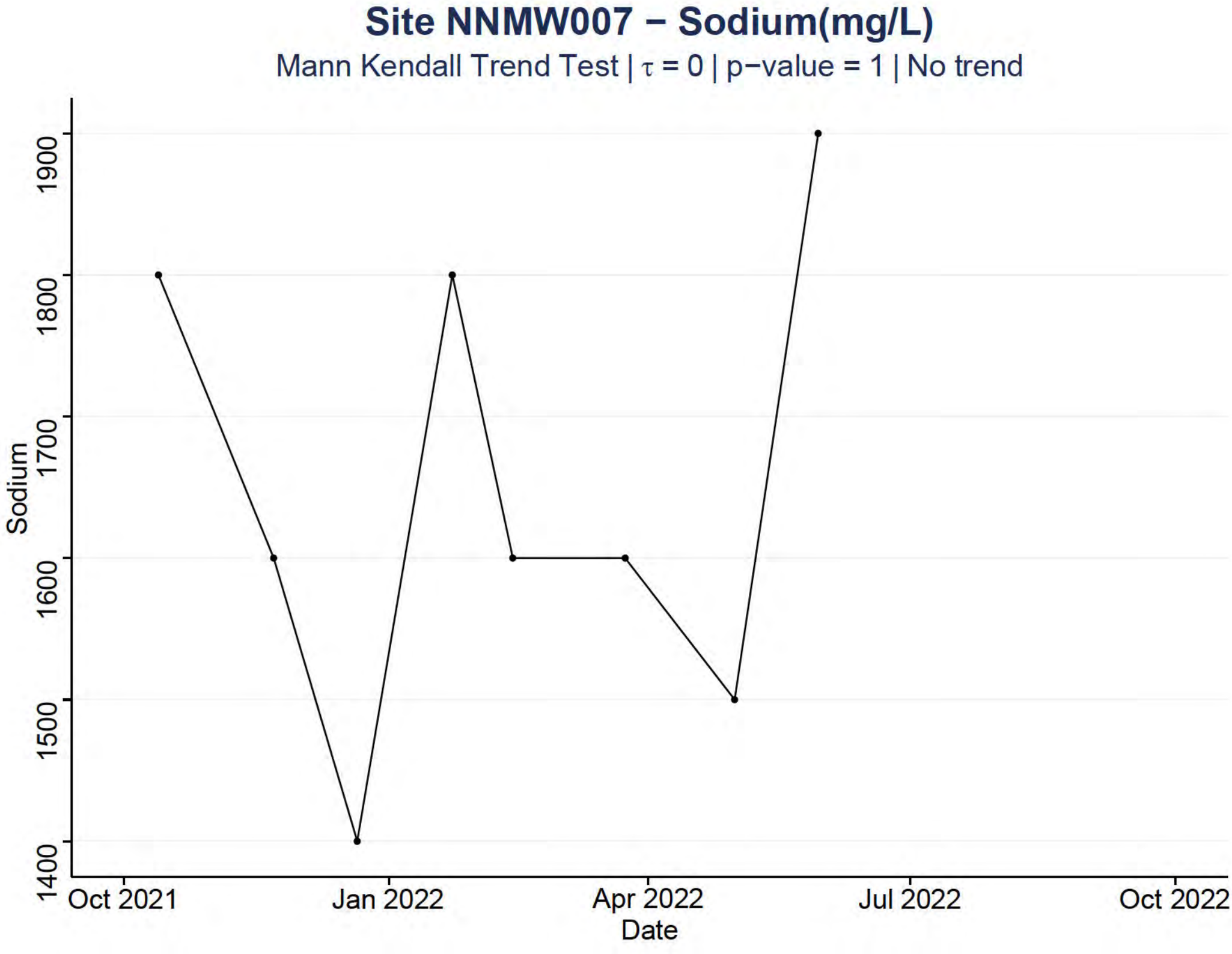

Site NNMW007 − Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Molybdenum
0.00300
0.00275
0.00250
0.00225
0.00200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

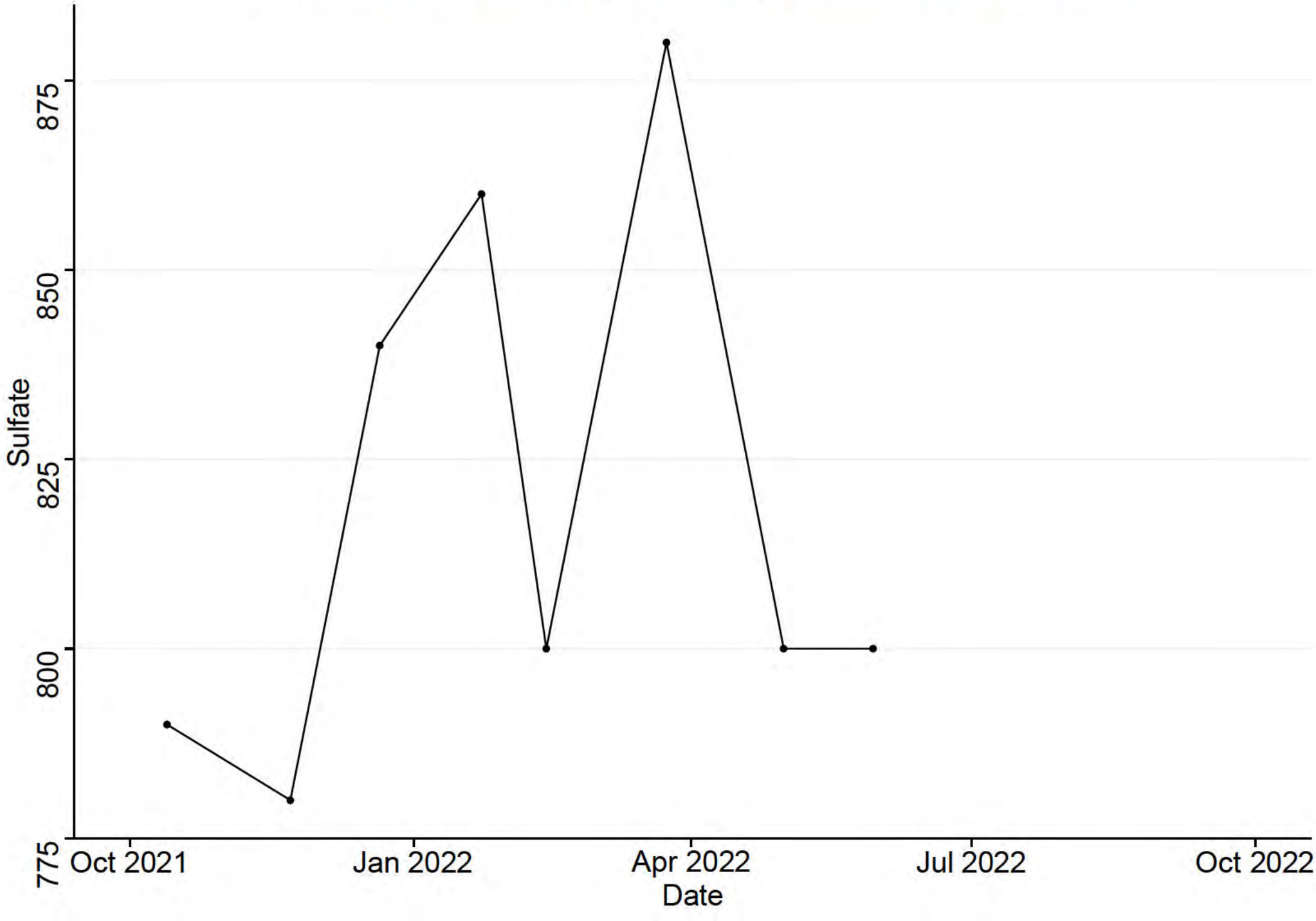

Site NNMW007 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Nickel
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

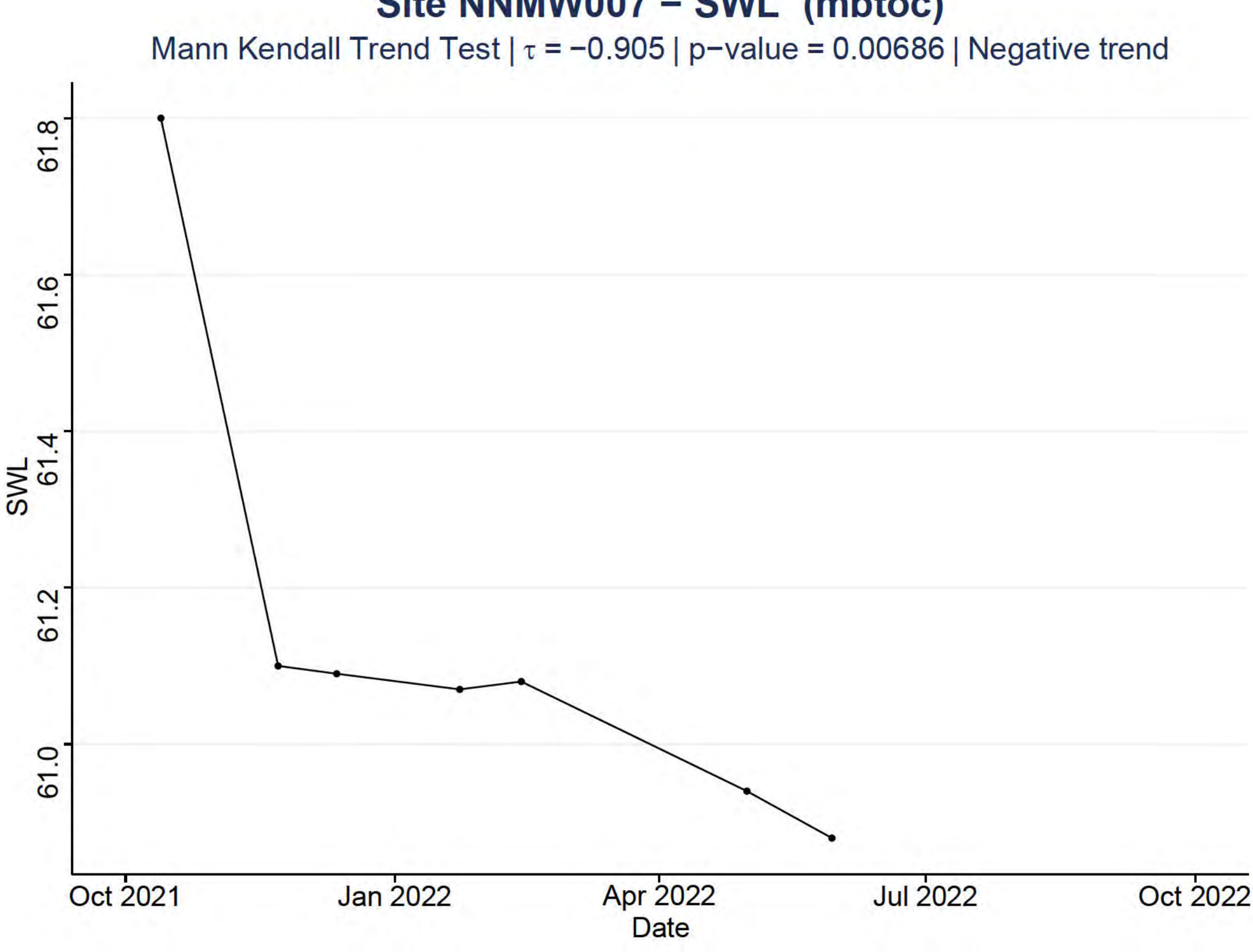

Site NNMW007 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.618 | p−value = 0.0461 | Negative trend
8.00
7.75
7.50
7.25
pH
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

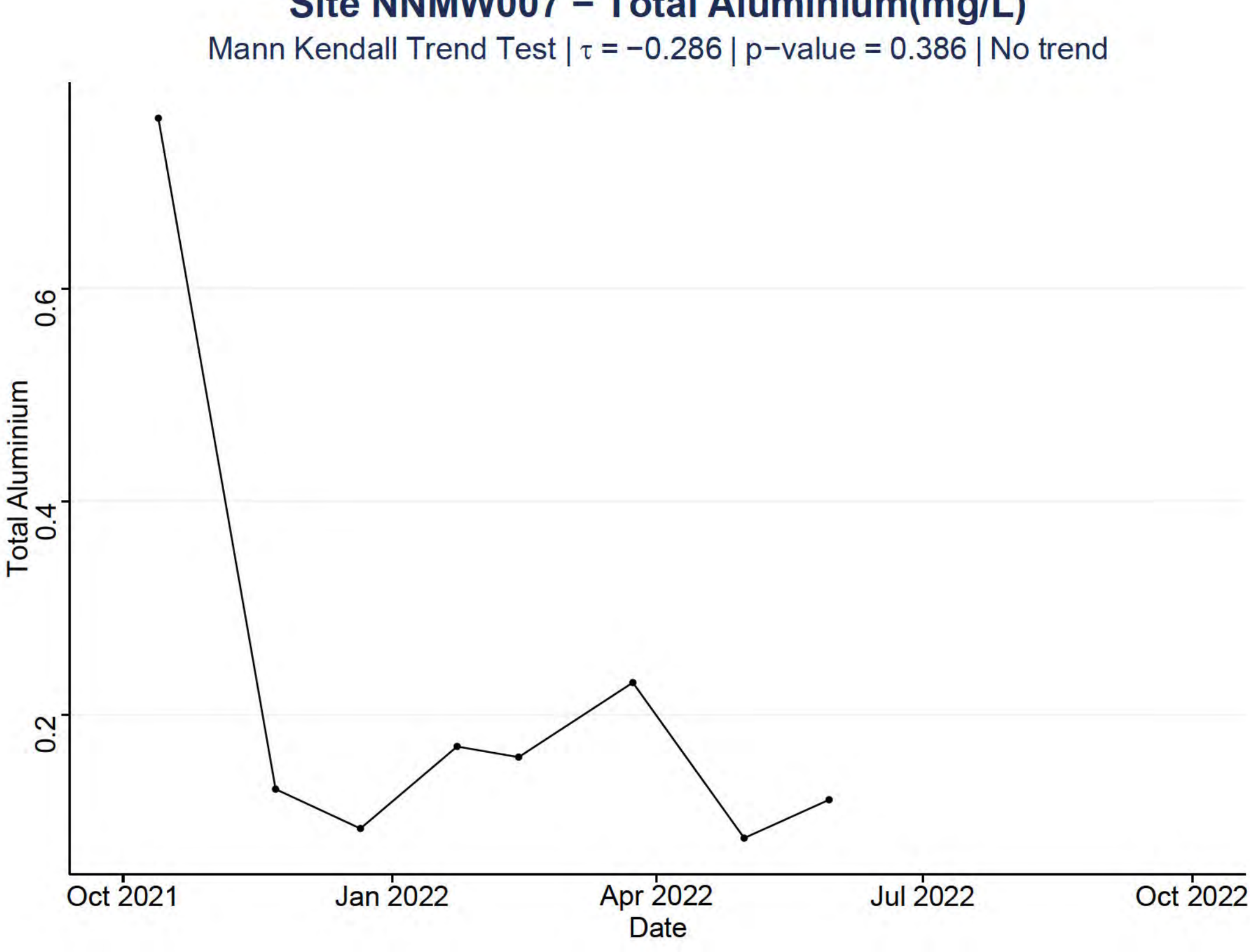

Site NNMW007 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.113 | p−value = 0.8 | No trend
Potassium
82
80
78
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

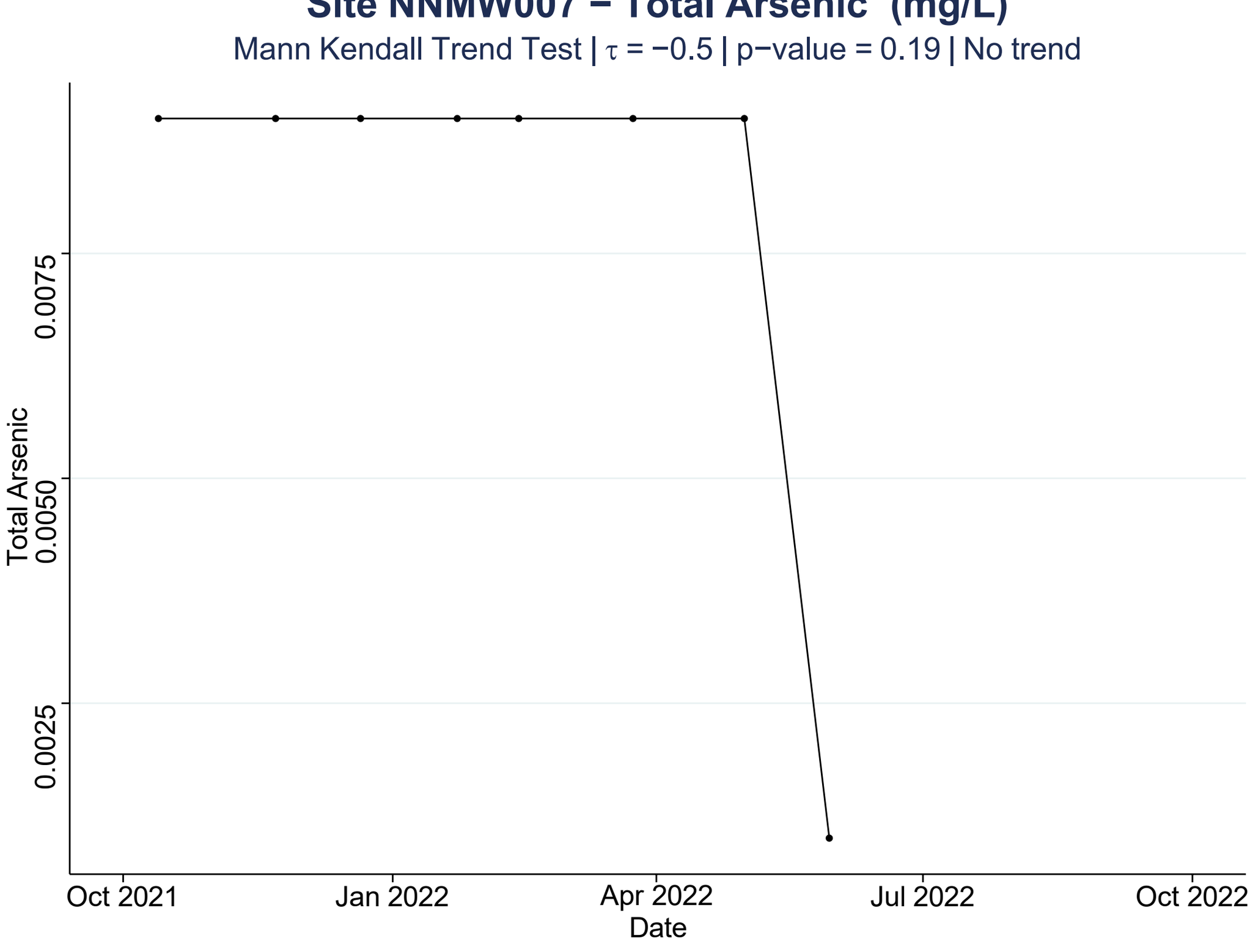

Site NNMW007 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

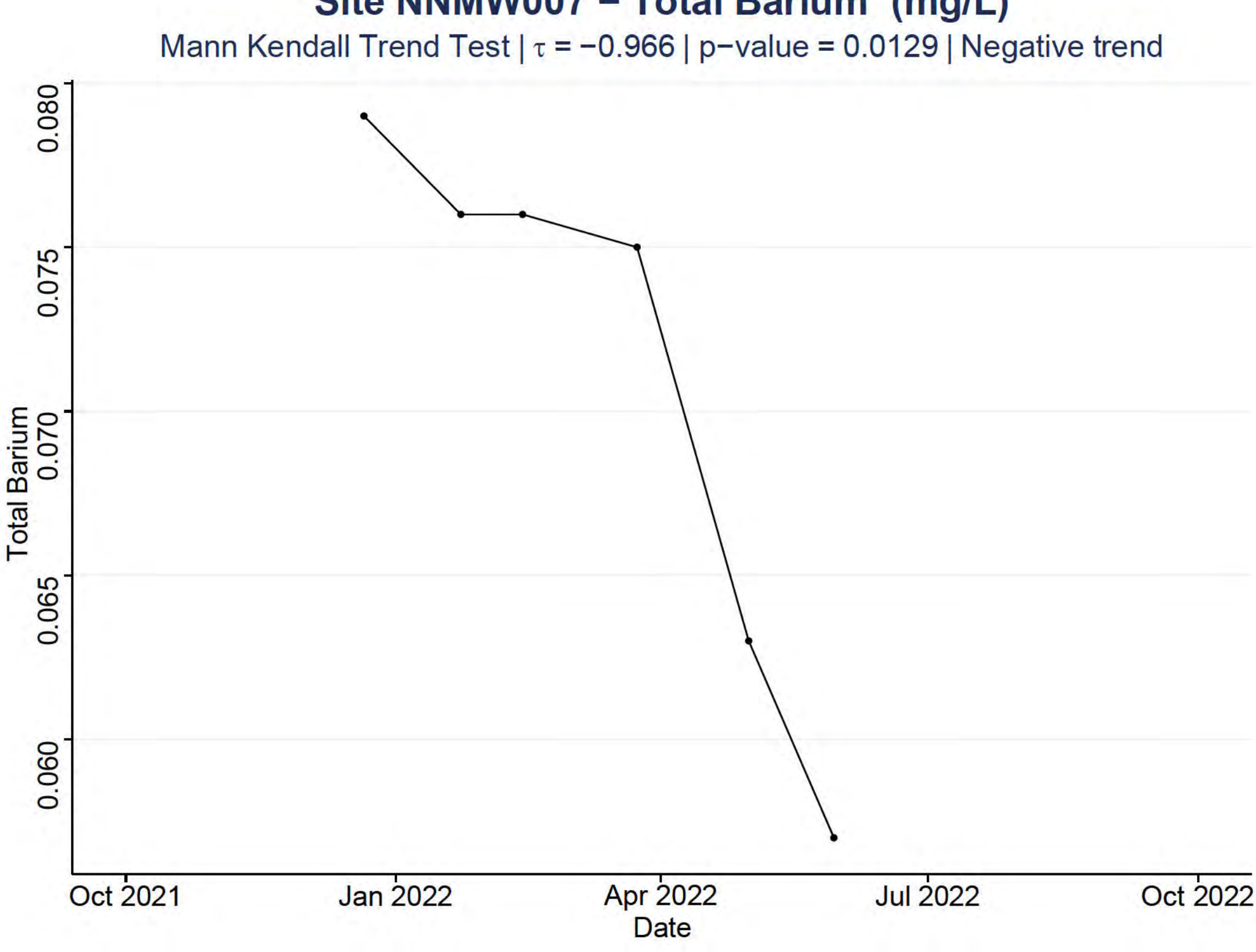

Site NNMW007 – Sodium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Sodium
1400
1500
1600
1700
1800
1900
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

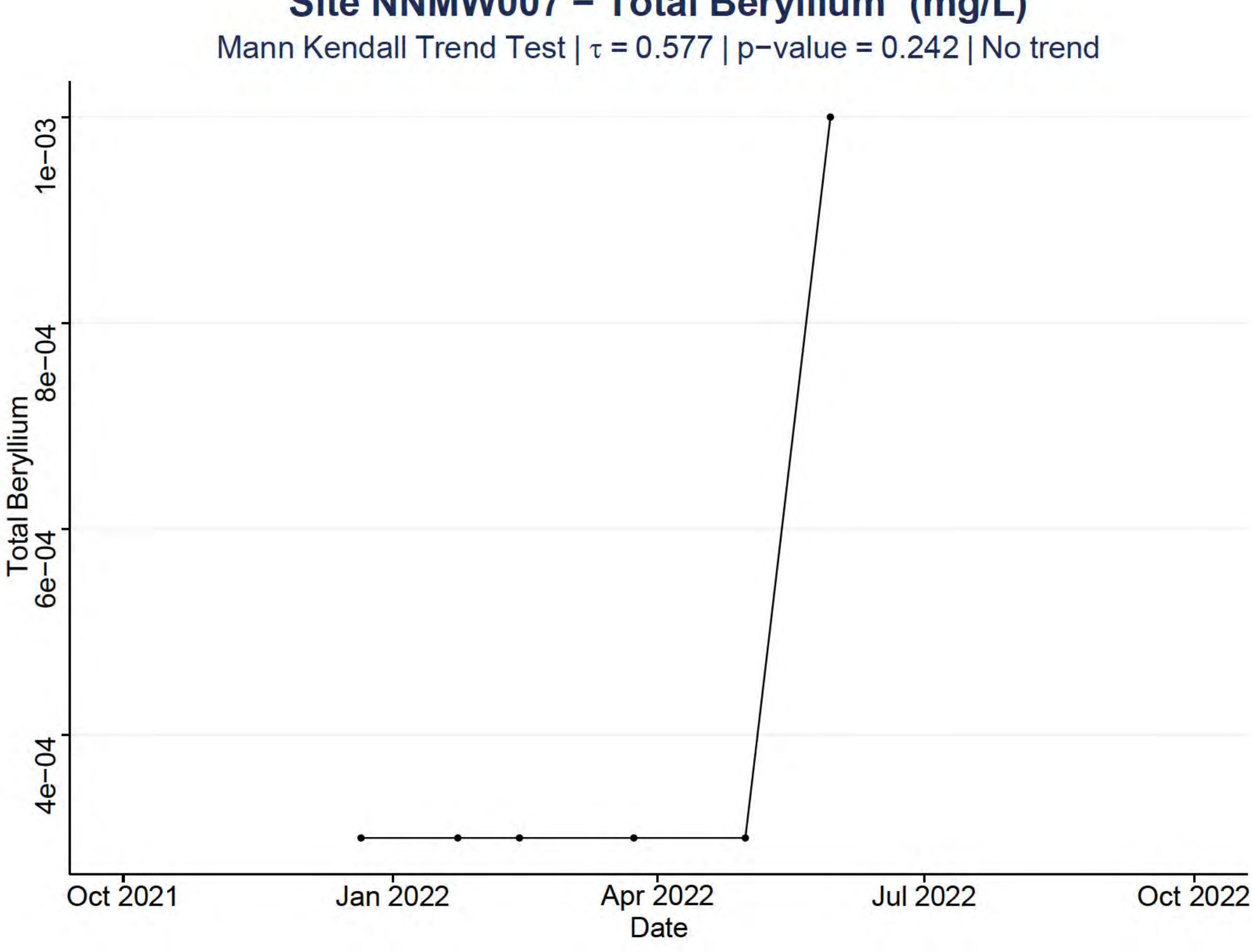

Site NNMW007 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = 0.265 | p−value = 0.445 | No trend
Sulfate
775
800
825
850
875
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

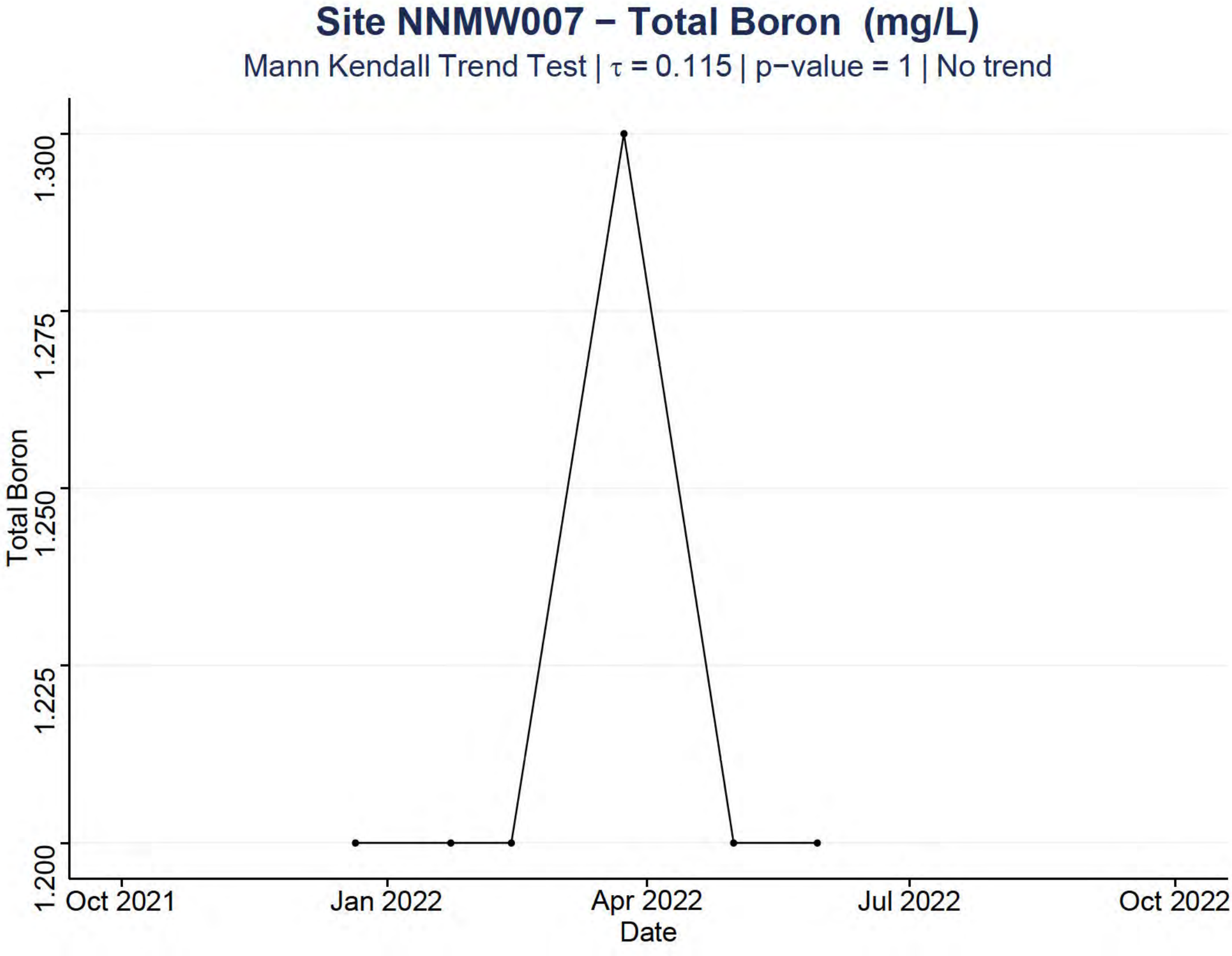

Site NNMW007 – SWL (mbtoc)
Mann Kendall Trend Test | τ = −0.905 | p−value = 0.00686 | Negative trend
SWL
61.8
61.6
61.4
61.2
61.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

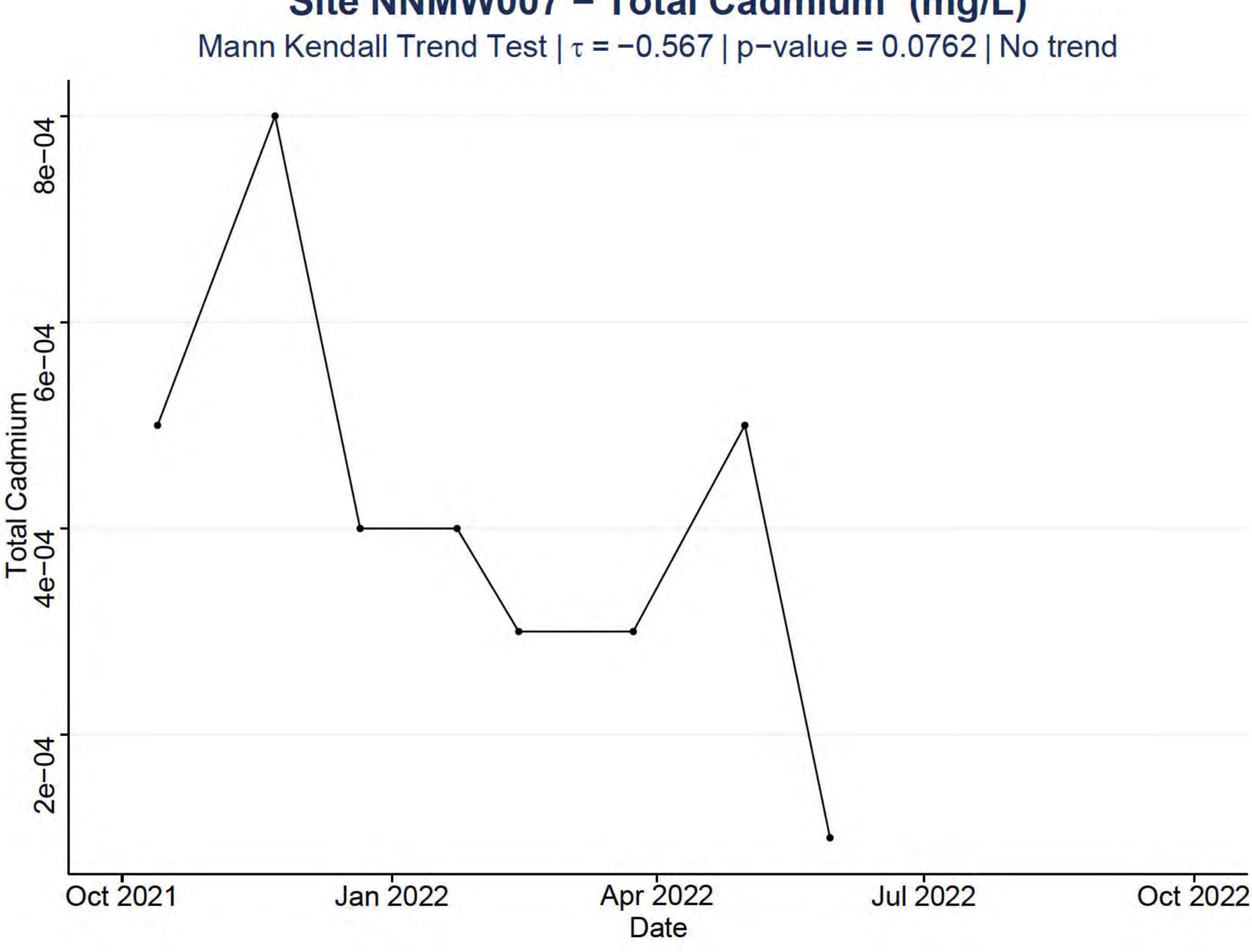

Site NNMW007 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.286 | p−value = 0.386 | No trend
Total Aluminium
0.2
0.4
0.6
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

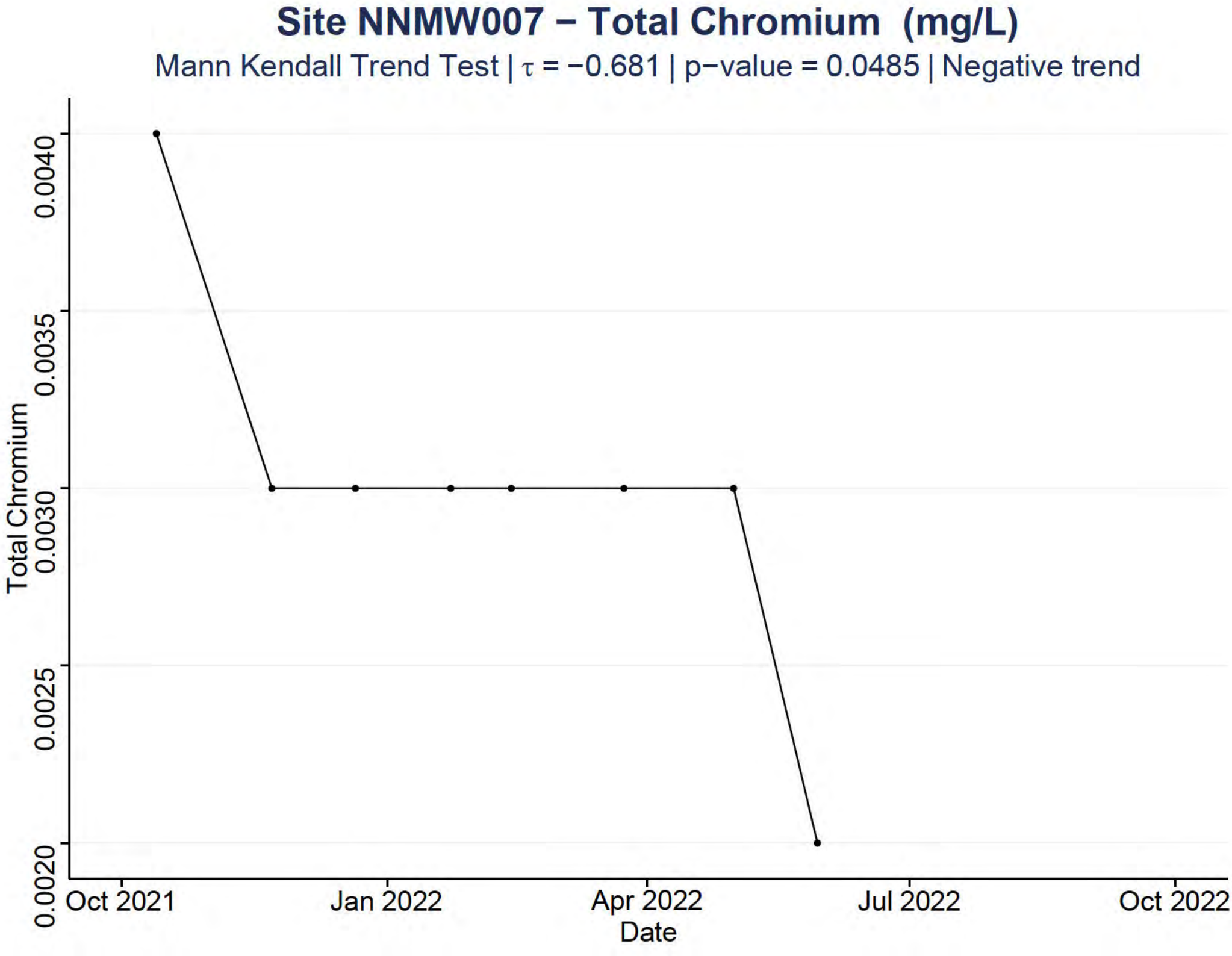

Site NNMW007 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

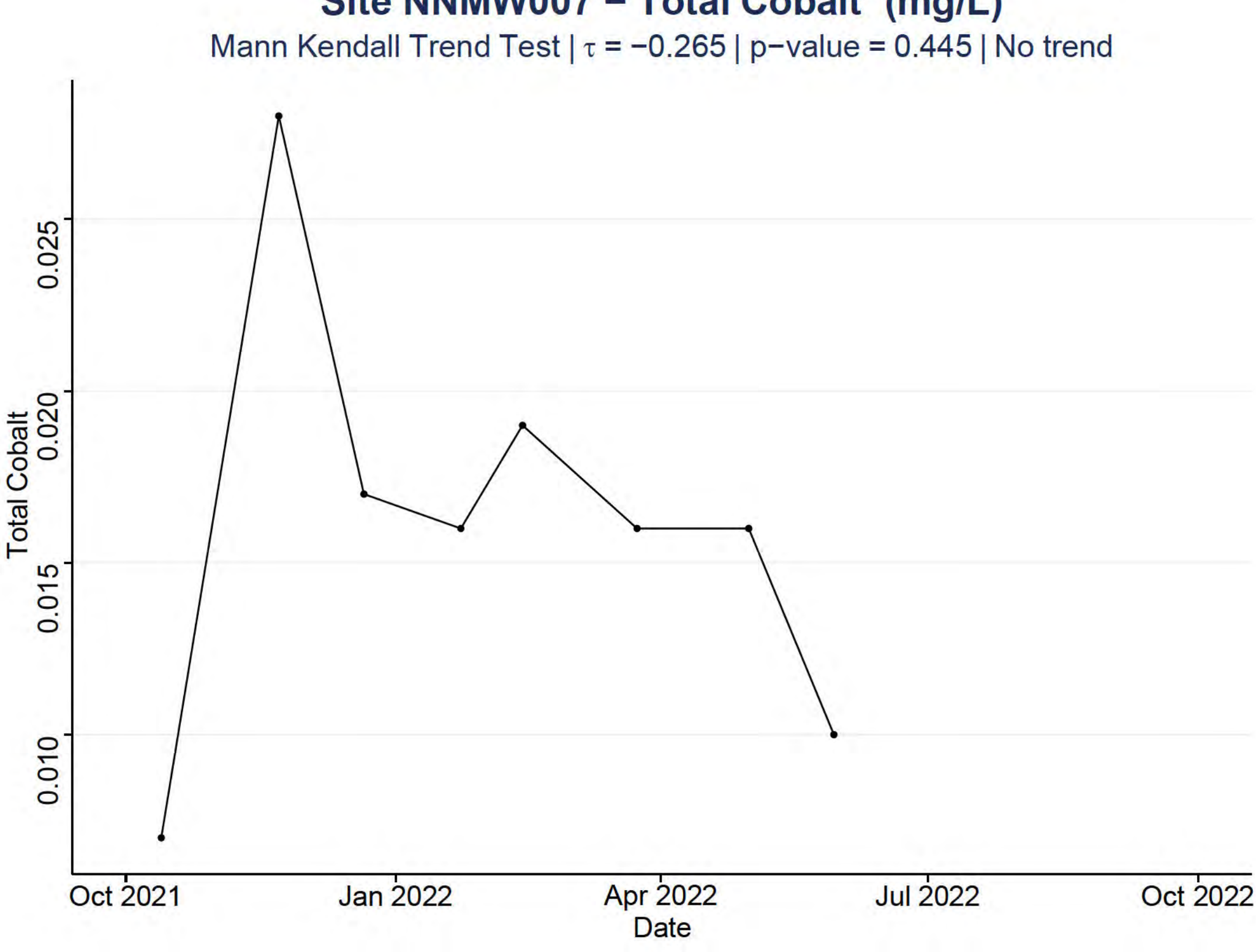

Site NNMW007 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = −0.966 | p−value = 0.0129 | Negative trend
Total Barium
0.080
0.075
0.070
0.065
0.060
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

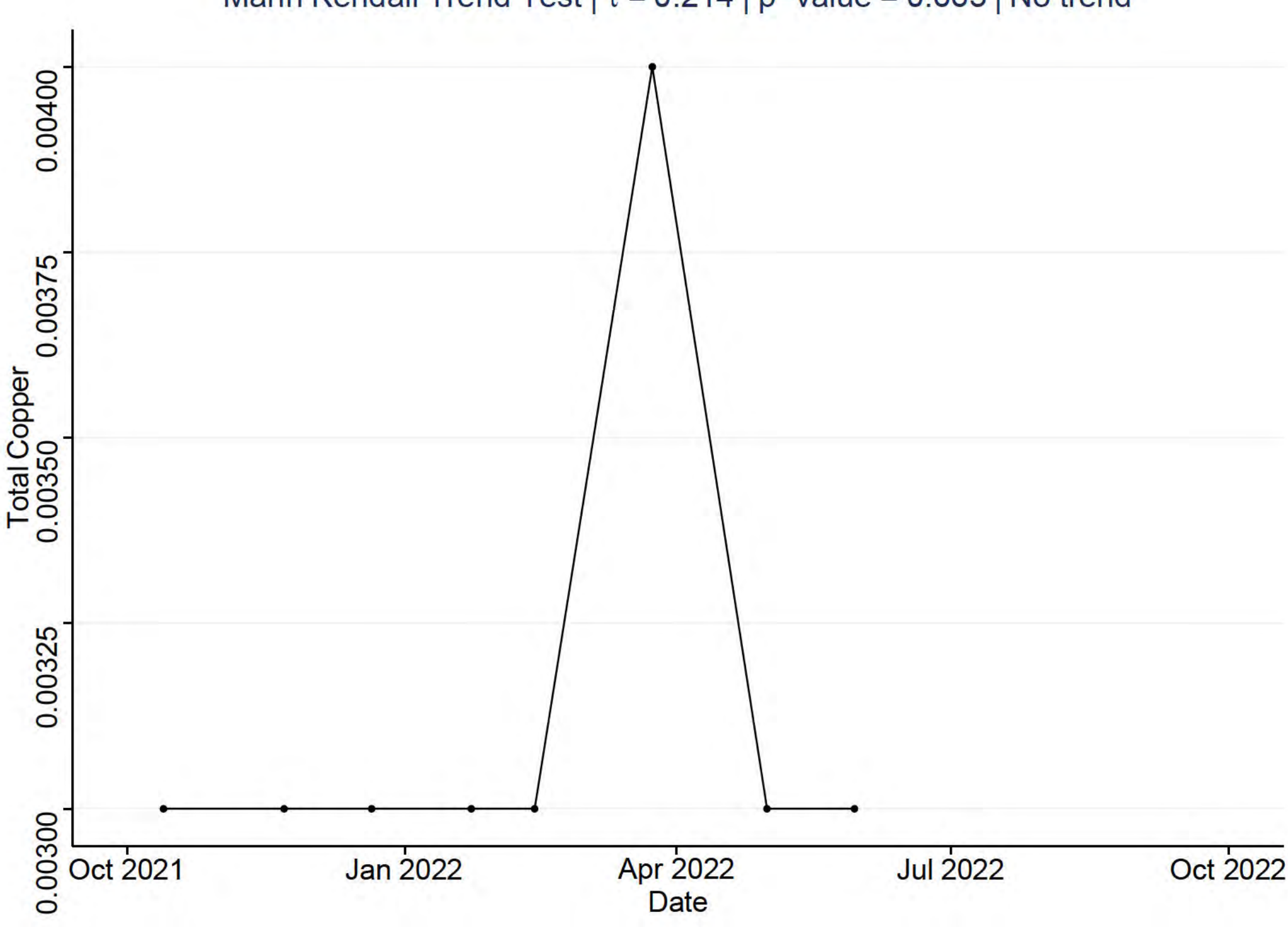

Site NNMW007 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Total Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

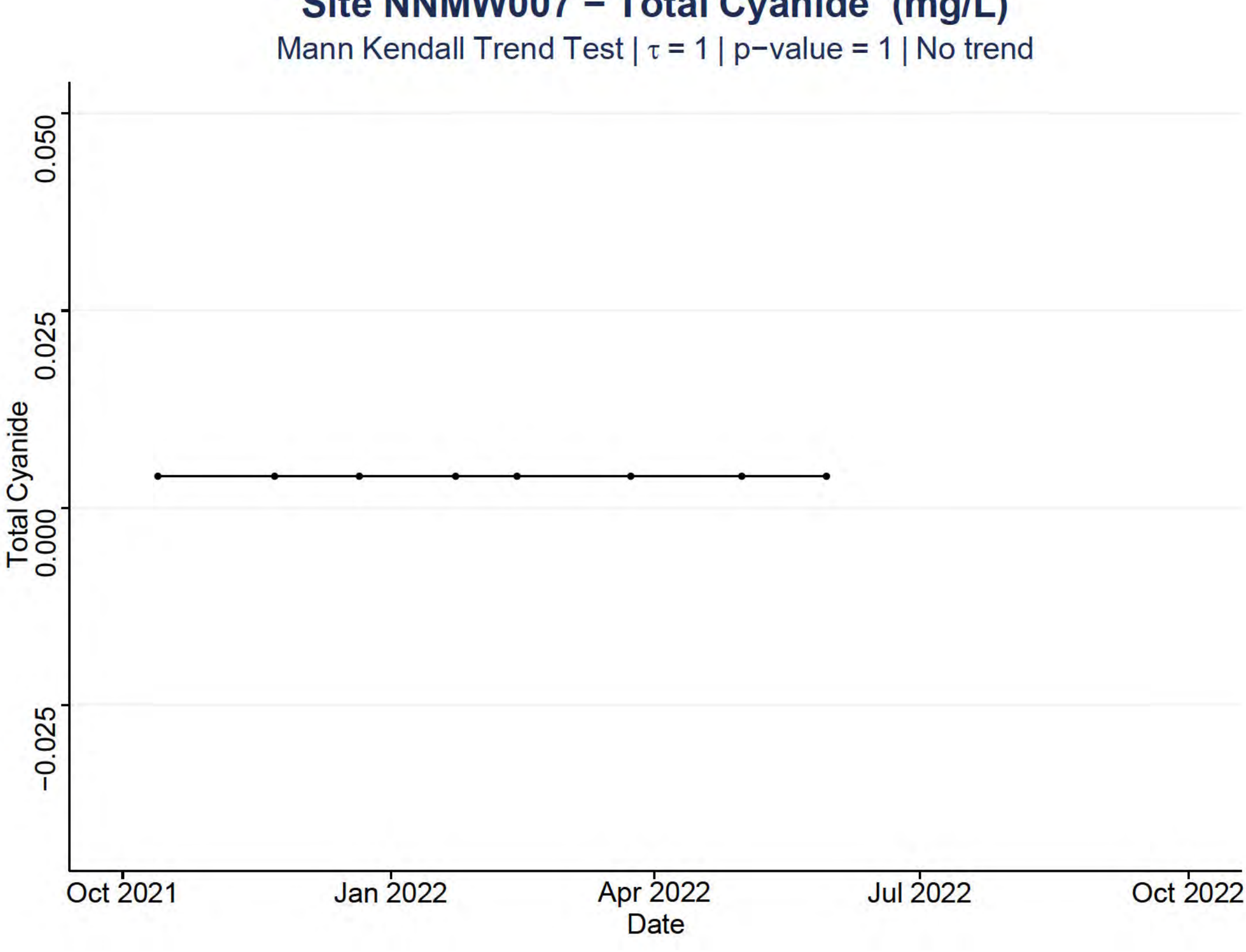

Site NNMW007 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = 0.115 | p−value = 1 | No trend
Total Boron
1.300
1.275
1.250
1.225
1.200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

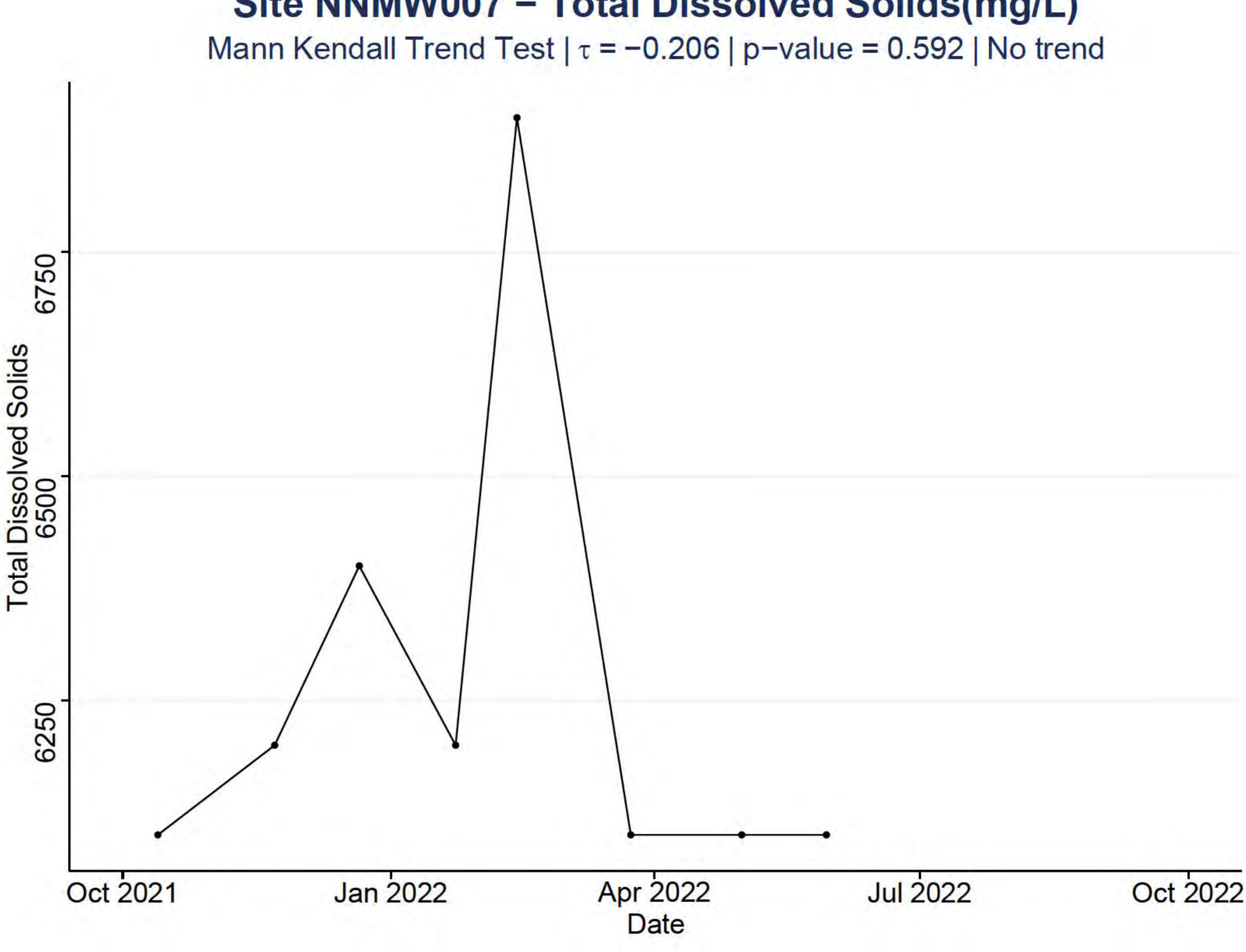

Site NNMW007 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.567 | p−value = 0.0762 | No trend
Total Cadmium
8e−04
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

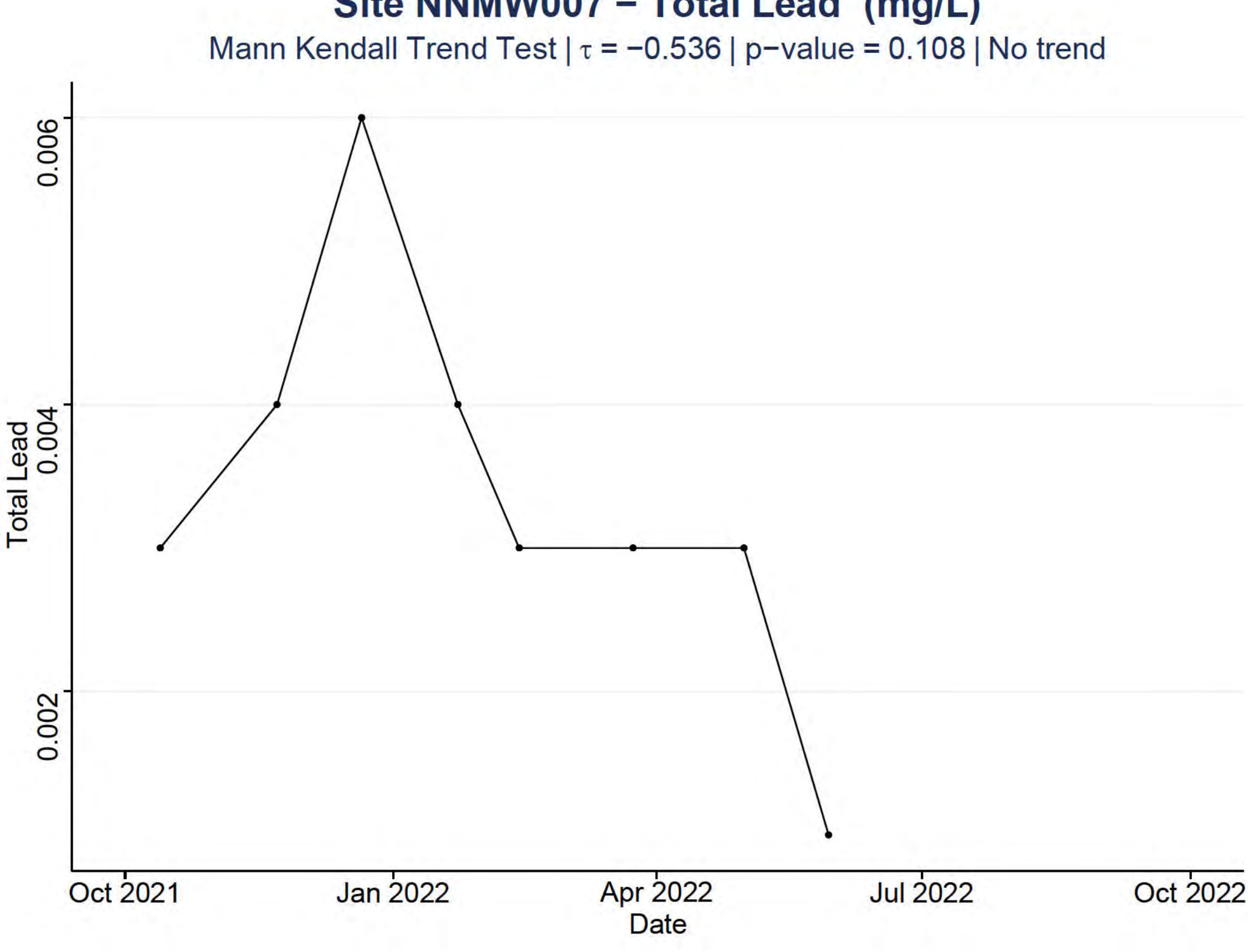

Site NNMW007 − Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.681 | p−value = 0.0485 | Negative trend
Total Chromium
0.0040
0.0035
0.0030
0.0025
0.0020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

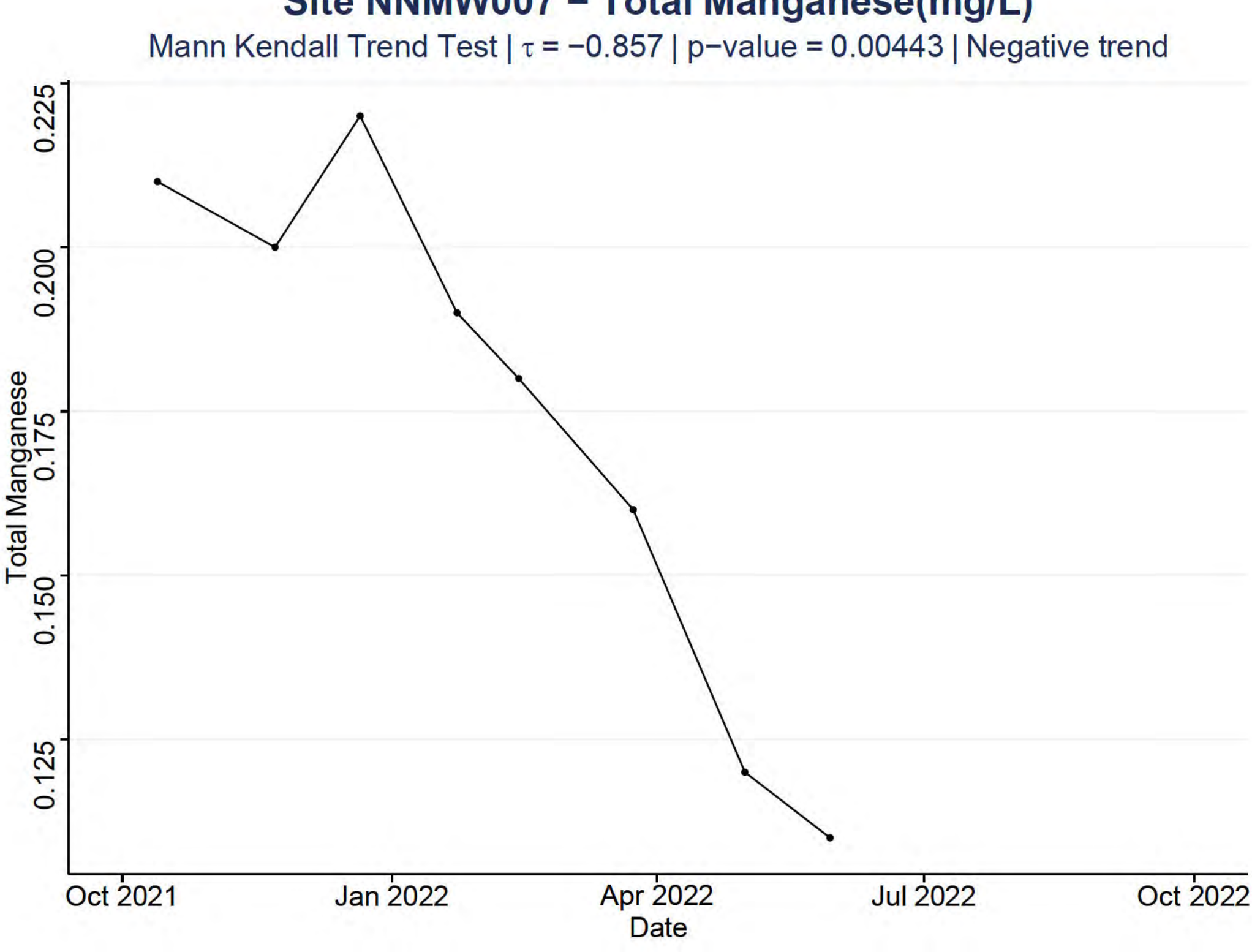

Site NNMW007 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.265 | p−value = 0.445 | No trend
Total Cobalt
0.025
0.020
0.015
0.010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

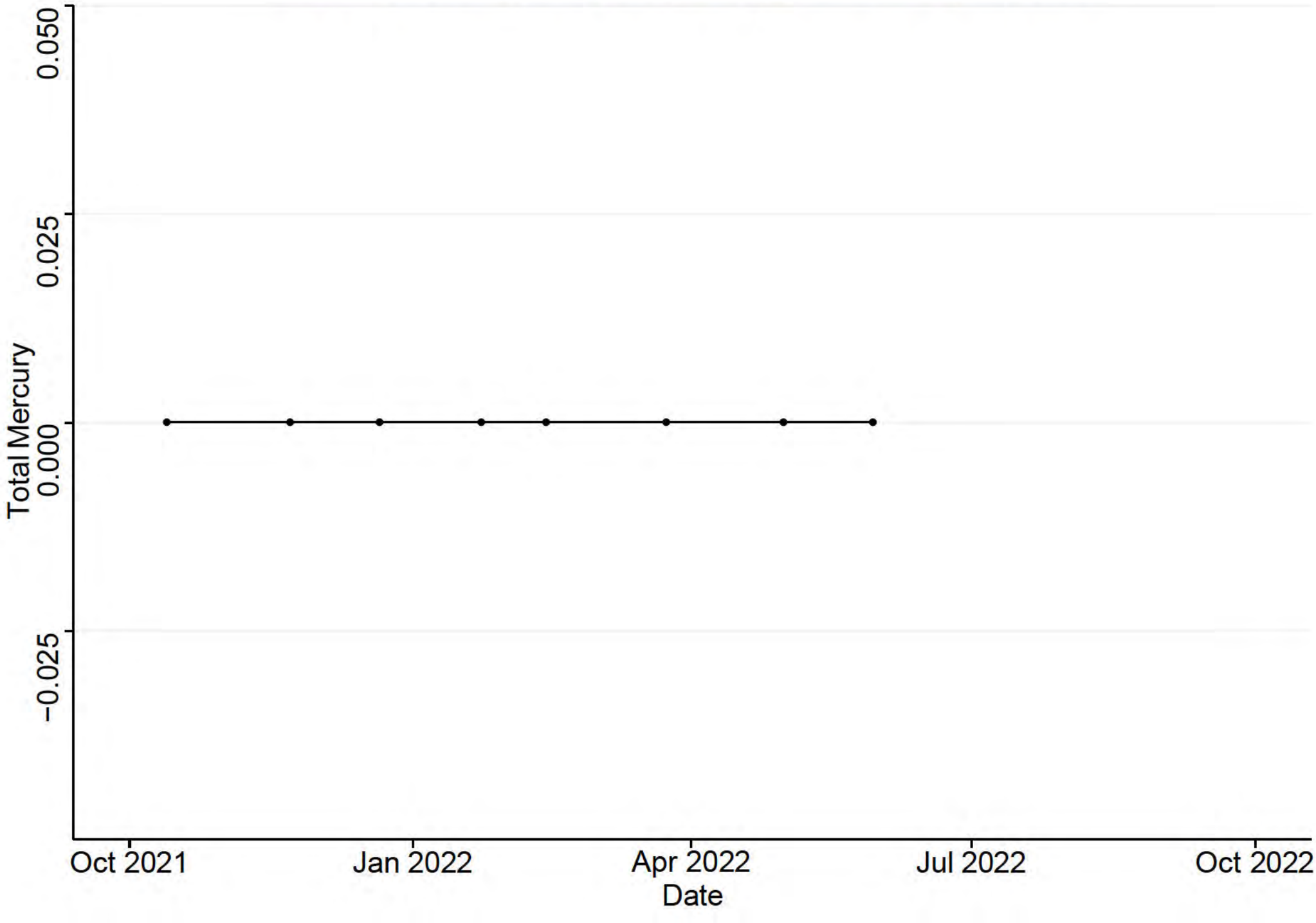

Site NNMW007 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = 0.214 | p−value = 0.663 | No trend
Total Copper
0.00400
0.00375
0.00350
0.00325
0.00300
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

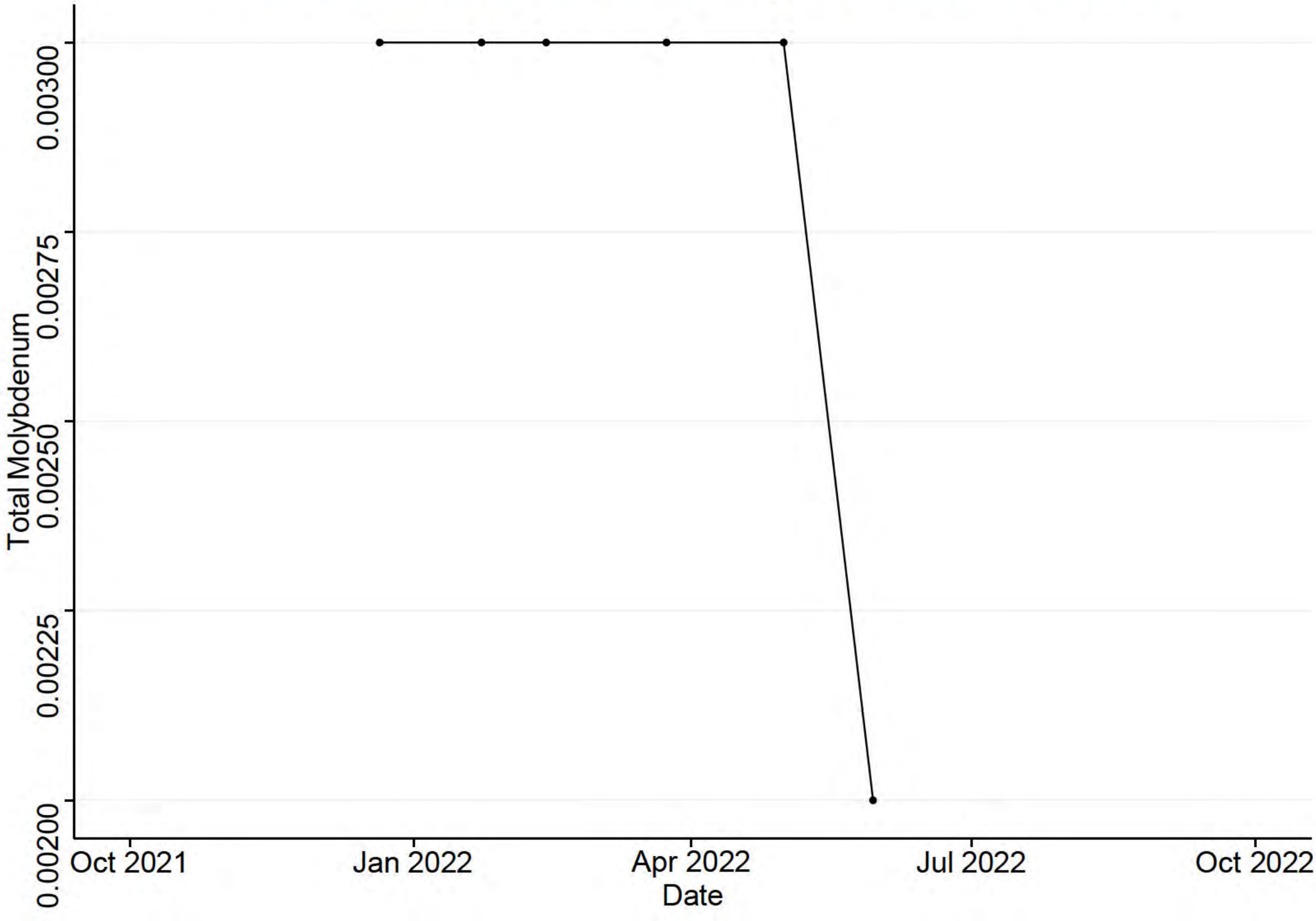

Site NNMW007 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

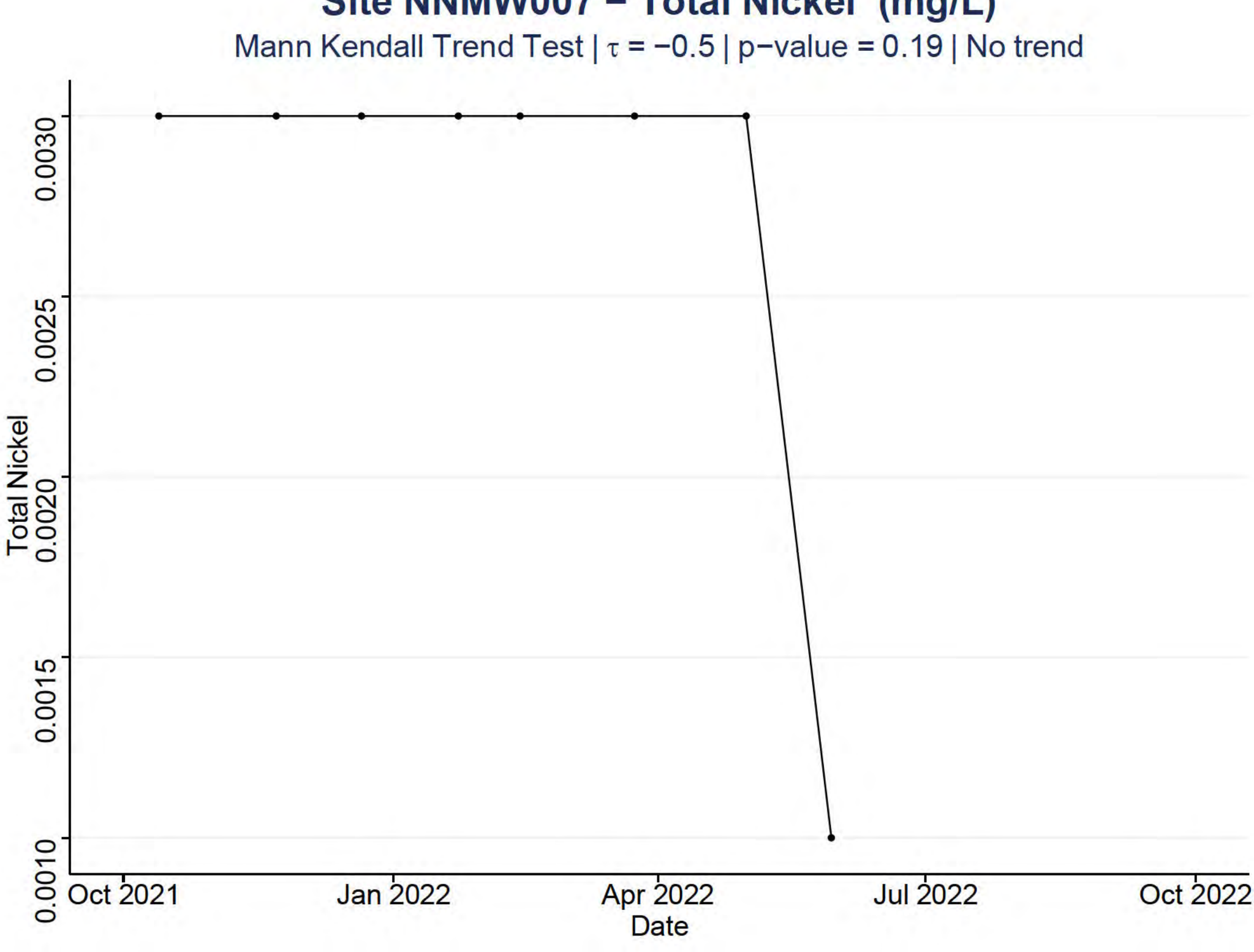

Site NNMW007 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.206 | p−value = 0.592 | No trend
Total Dissolved Solids
6750
6500
6250
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

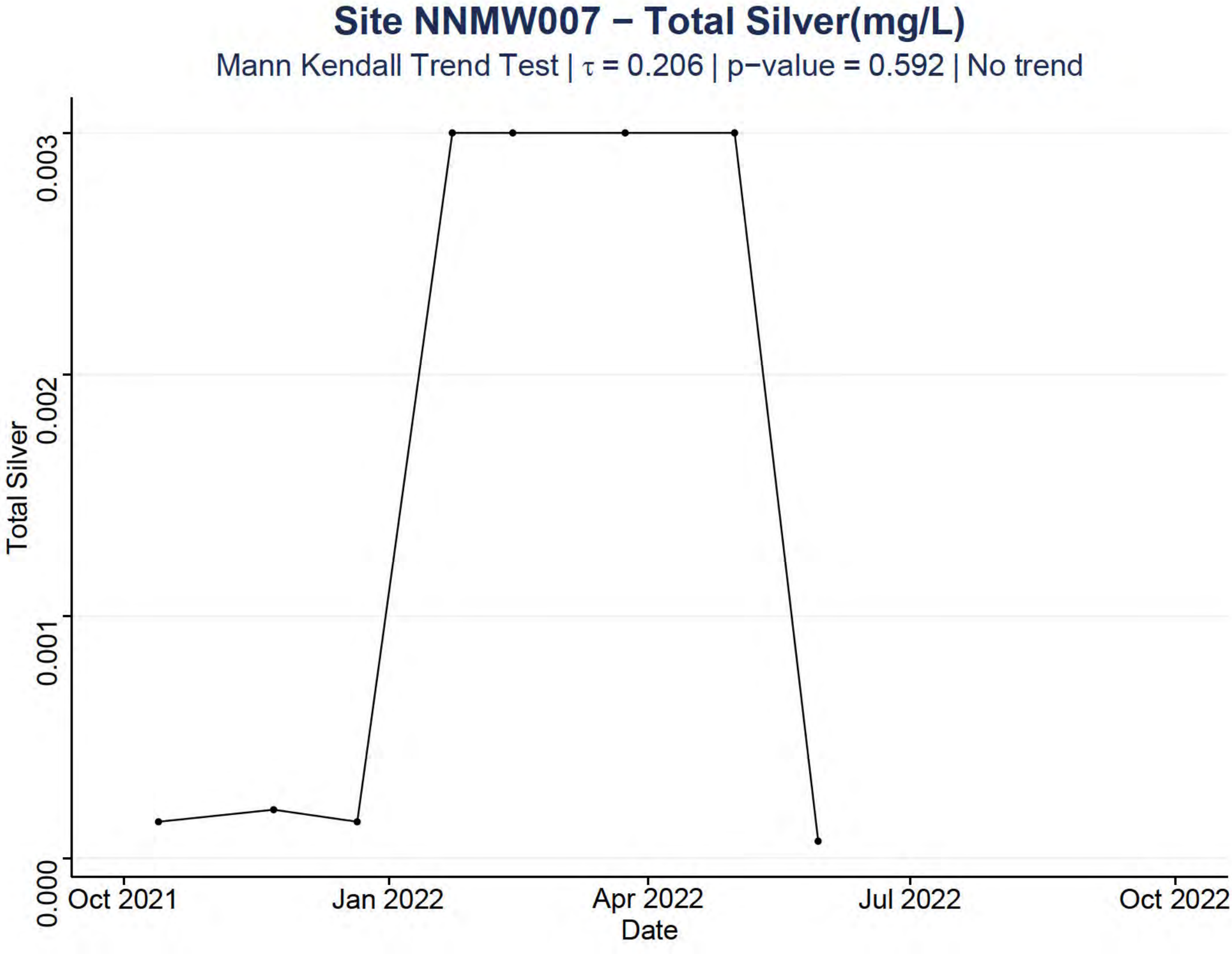

Site NNMW007 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.536 | p−value = 0.108 | No trend
Total Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

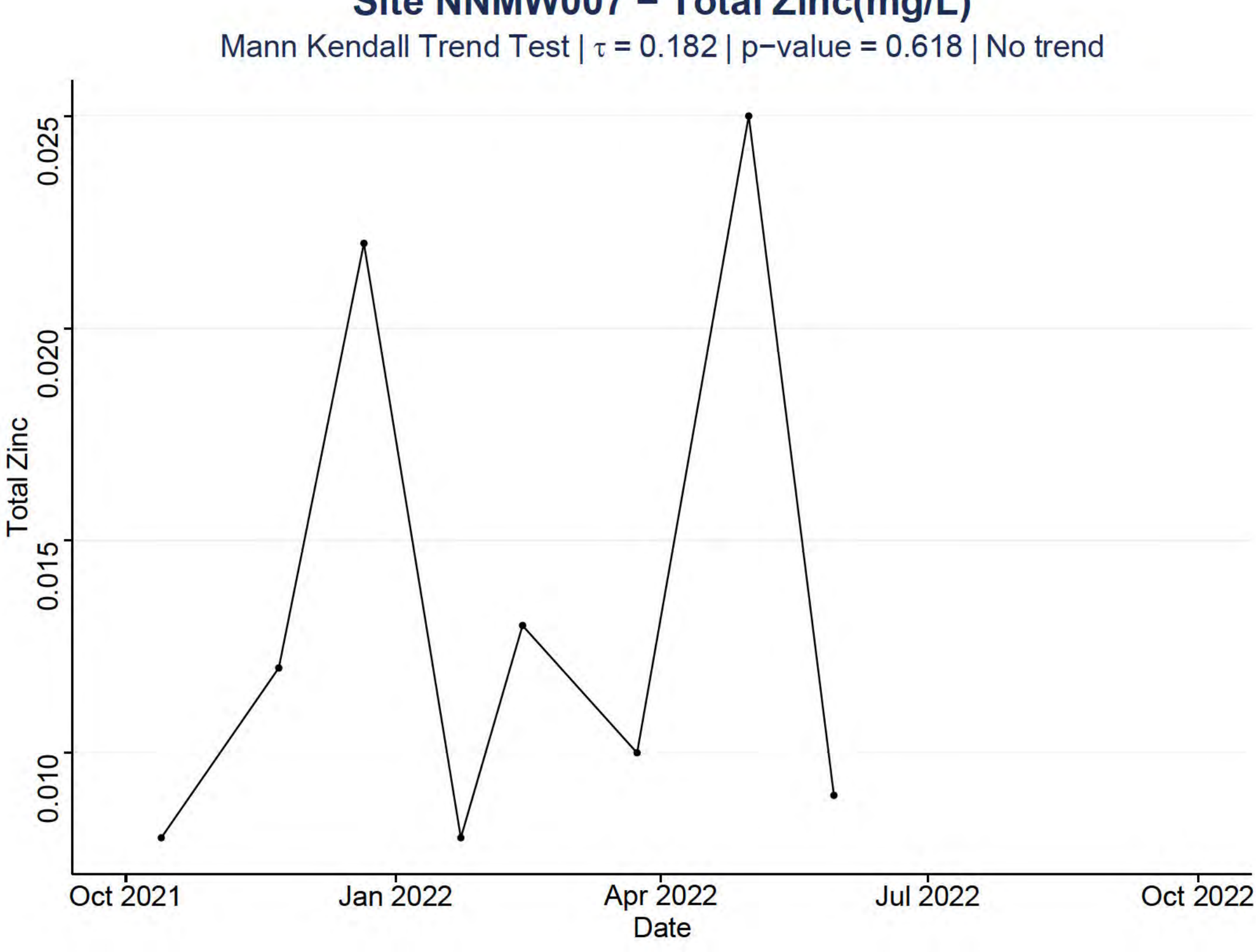

Site NNMW007 − Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.857 | p−value = 0.00443 | Negative trend
Total Manganese
0.225
0.200
0.175
0.150
0.125
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

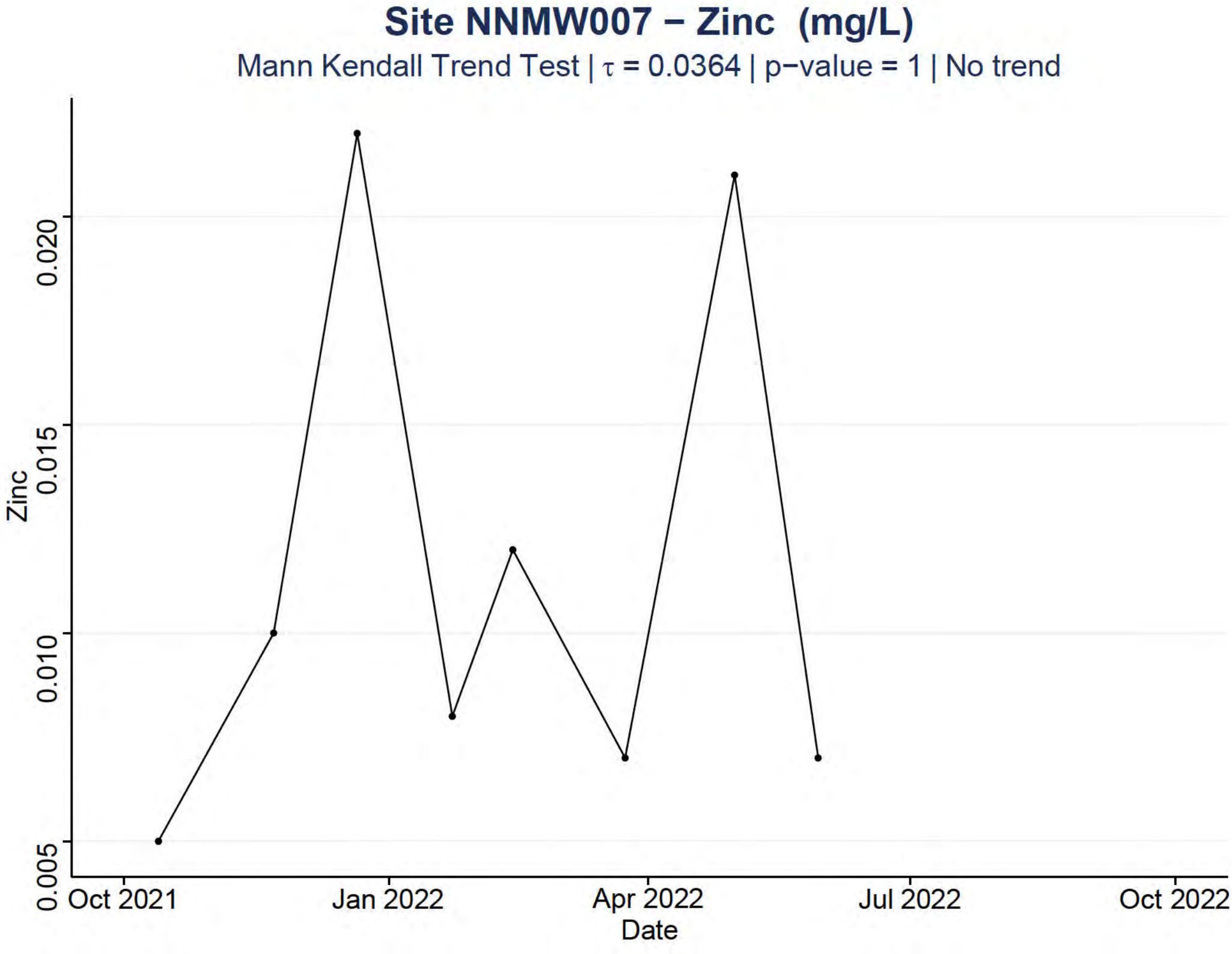

Site NNMW007 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

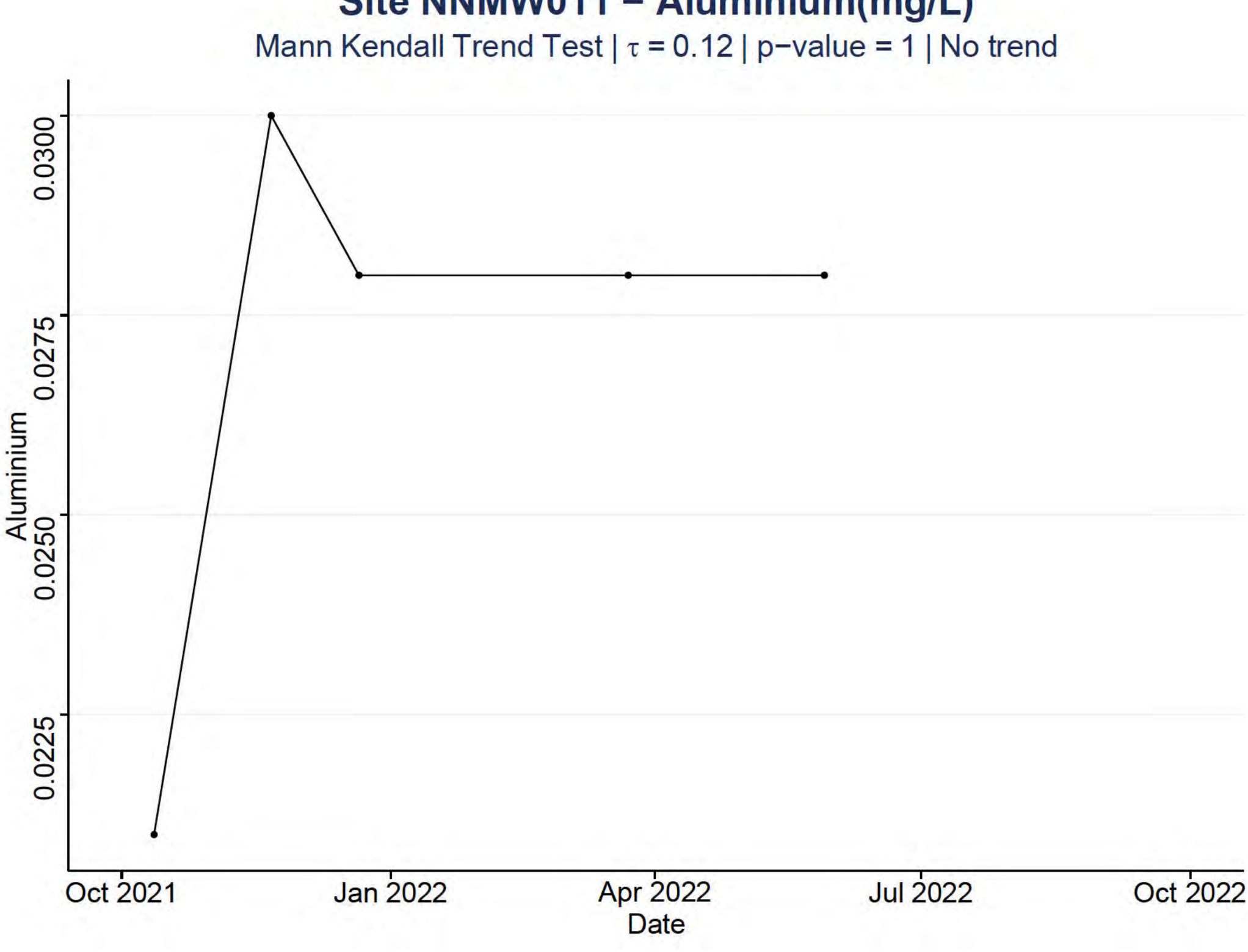

Site NNMW007 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Total Molybdenum
0.00300
0.00275
0.00250
0.00225
0.00200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

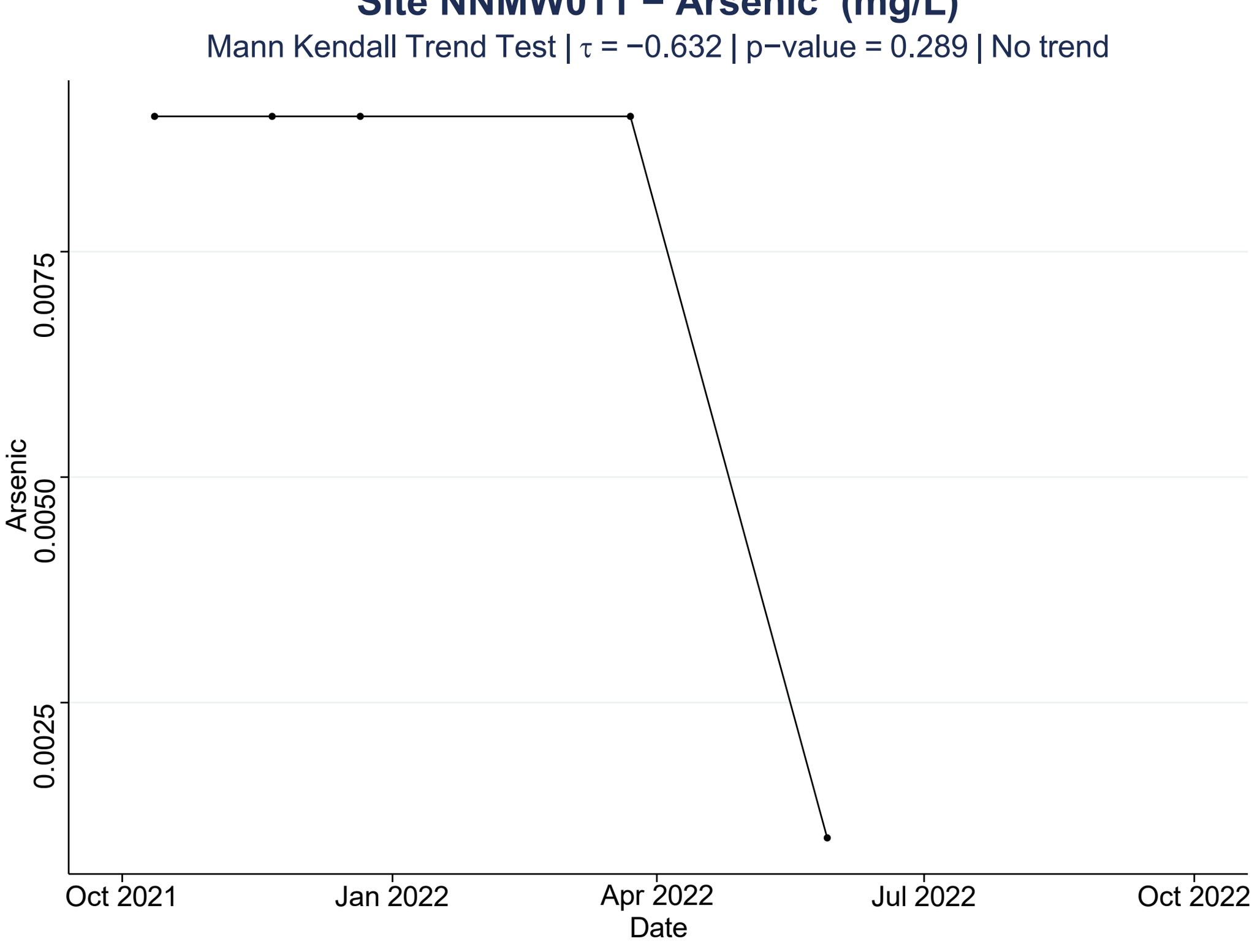

Site NNMW007 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Nickel
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

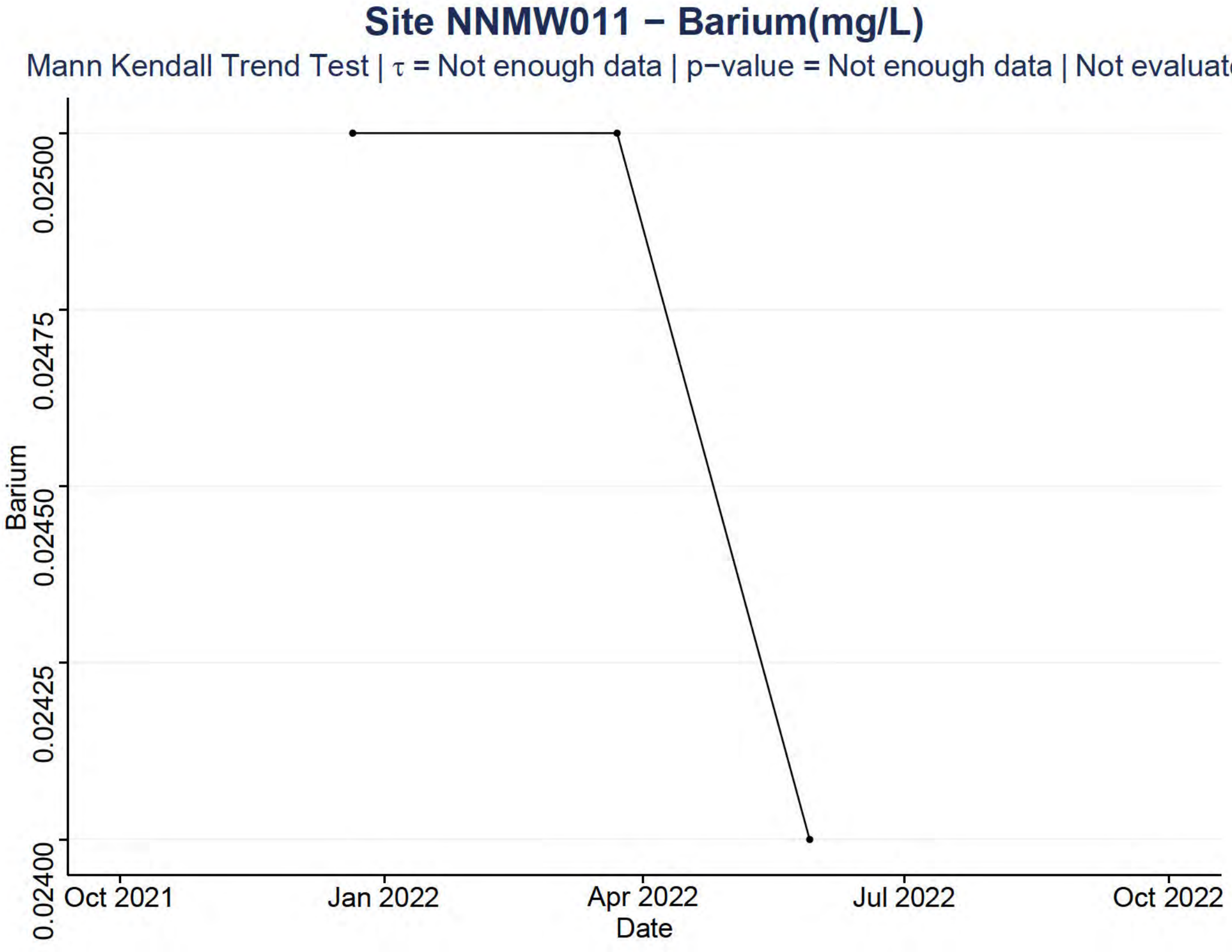

Site NNMW007 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.206 | p−value = 0.592 | No trend
Total Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW007 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = 0.182 | p−value = 0.618 | No trend
Total Zinc
0.025
0.020
0.015
0.010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW007 – Zinc (mg/L)
Mann Kendall Trend Test | τ = 0.0364 | p−value = 1 | No trend
Zinc
0.005
0.010
0.015
0.020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

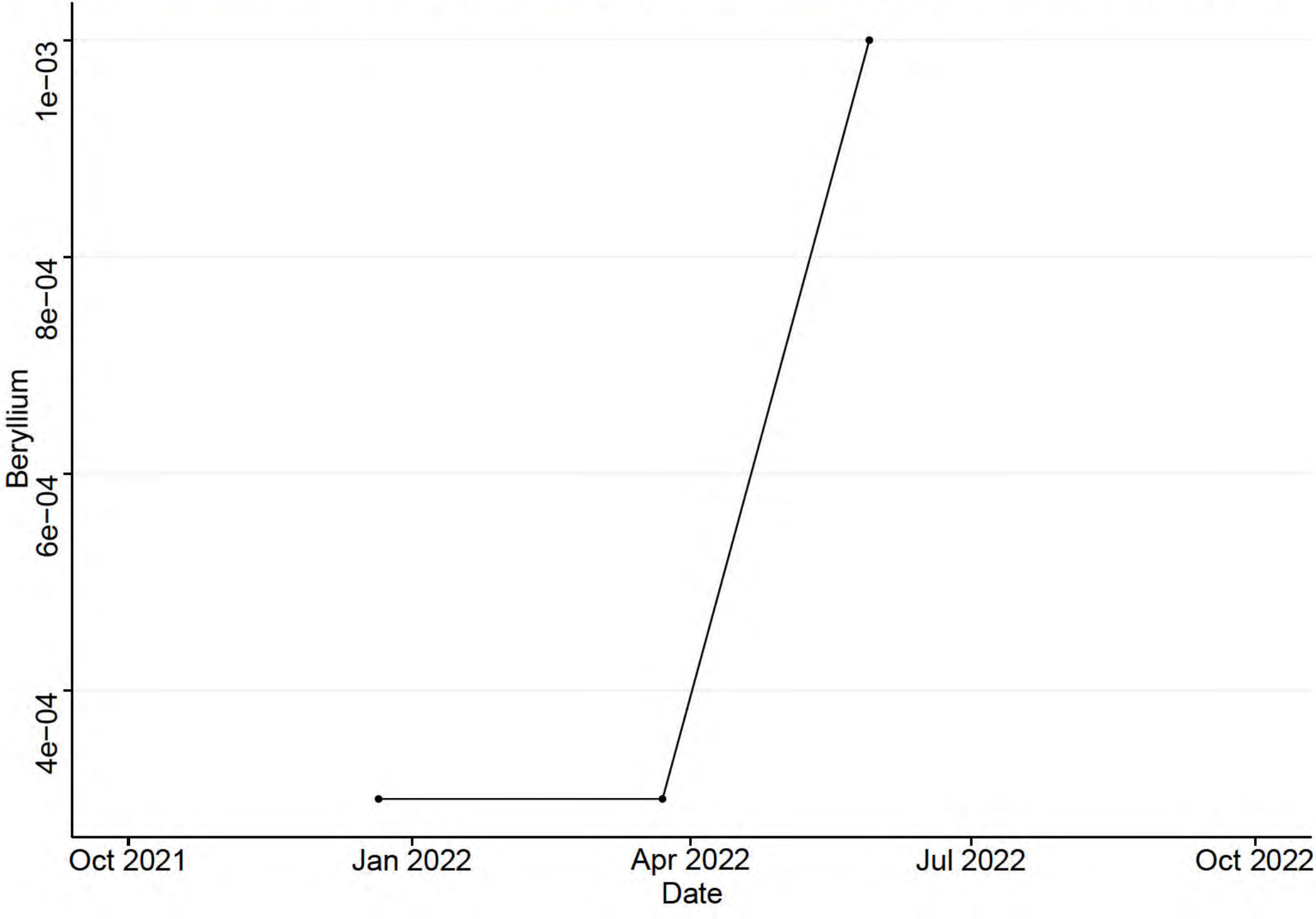

Site NNMW011 − Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.12 | p−value = 1 | No trend
Aluminium
0.0300
0.0275
0.0250
0.0225
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

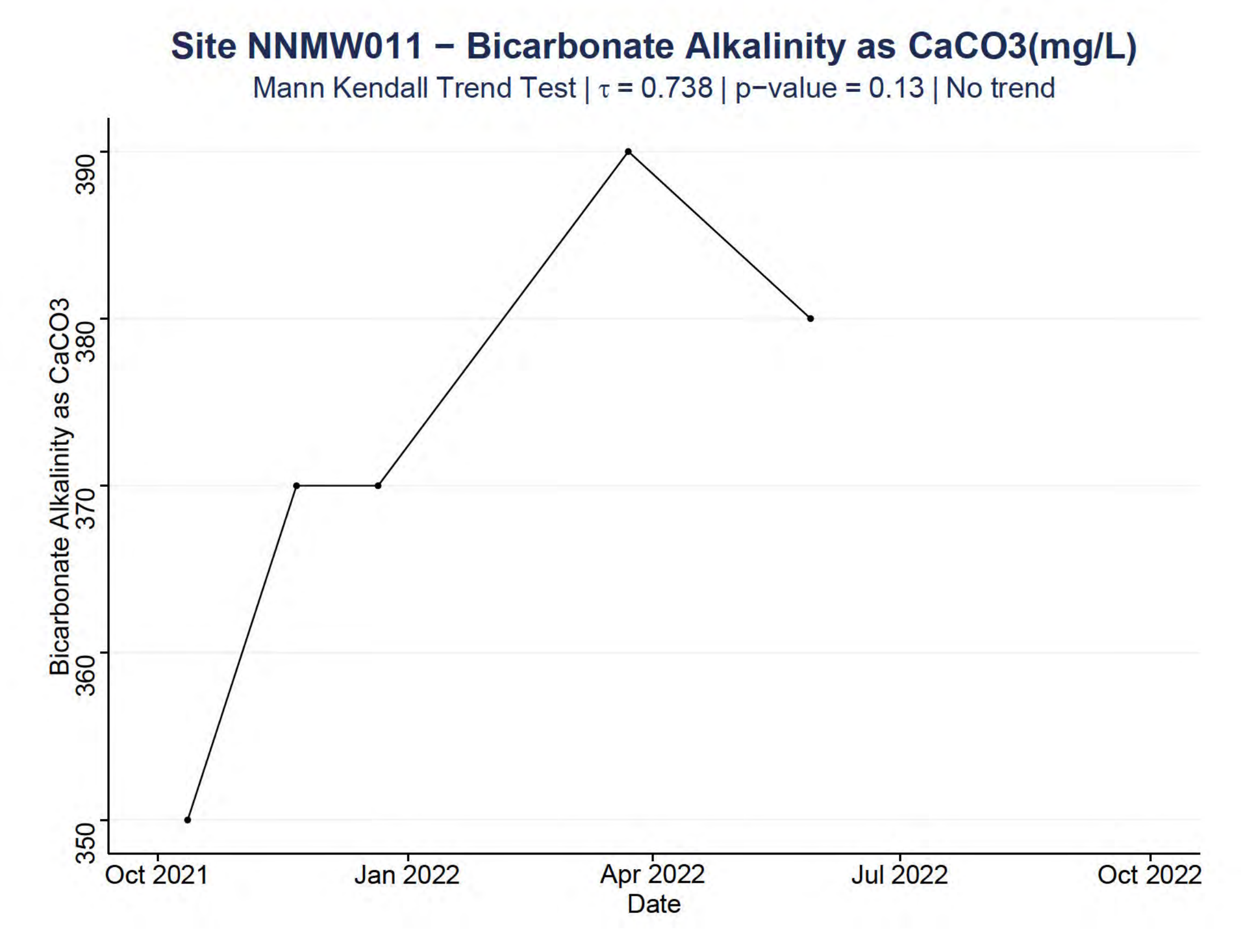

Site NNMW011 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

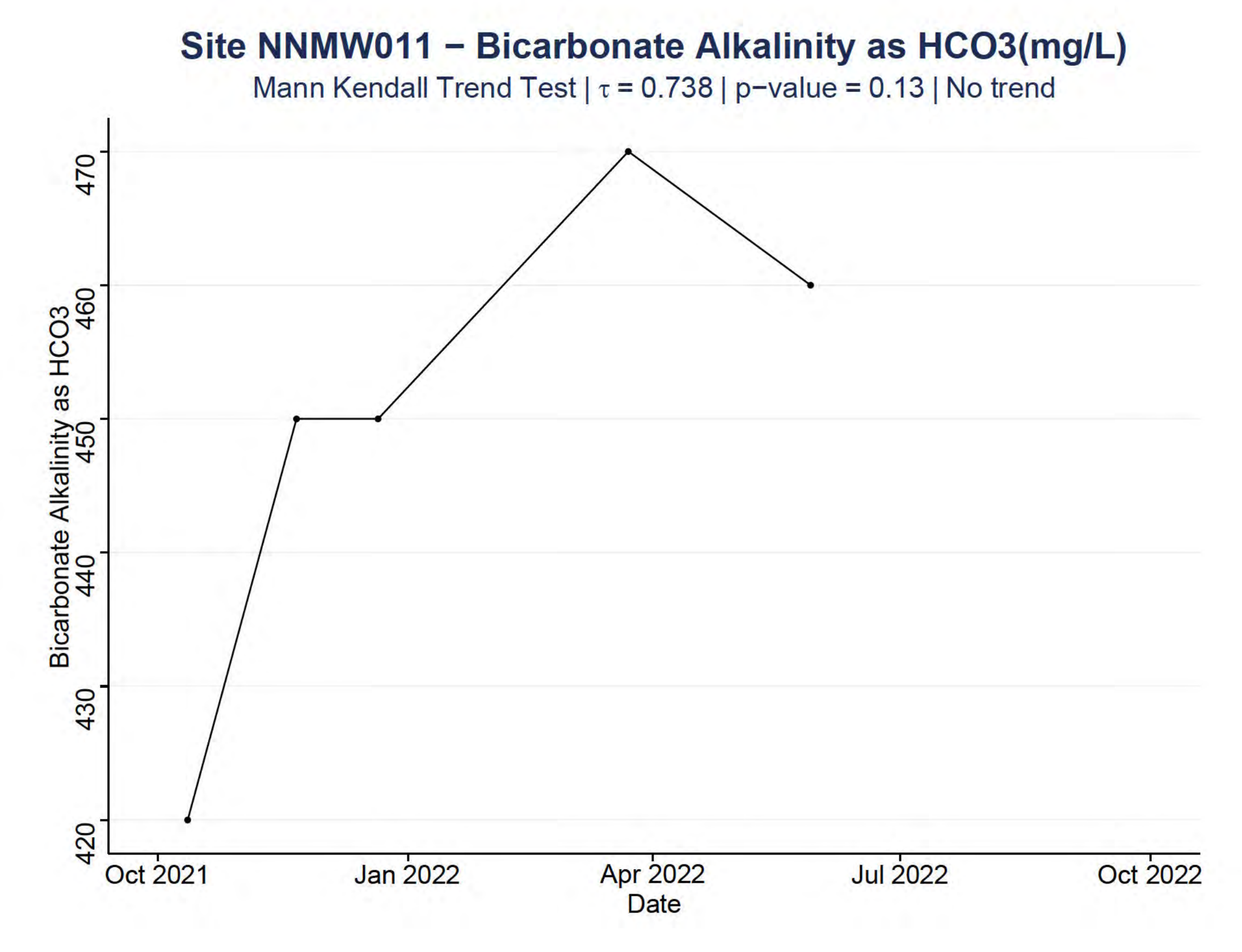

Site NNMW011 − Barium(mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Barium
0.02500
0.02475
0.02450
0.02425
0.02400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

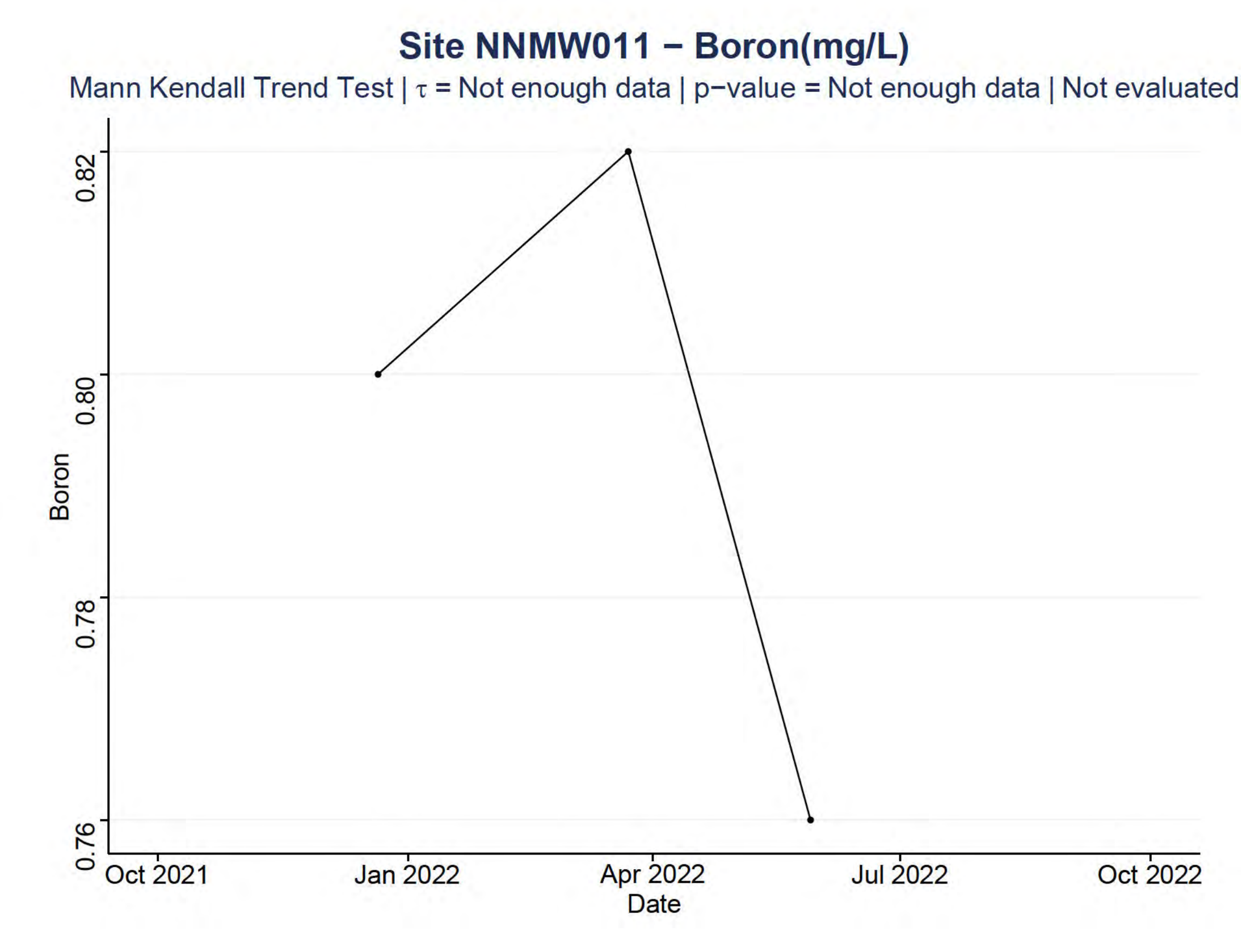
Site NNMW011 – Beryllium (mg/L)

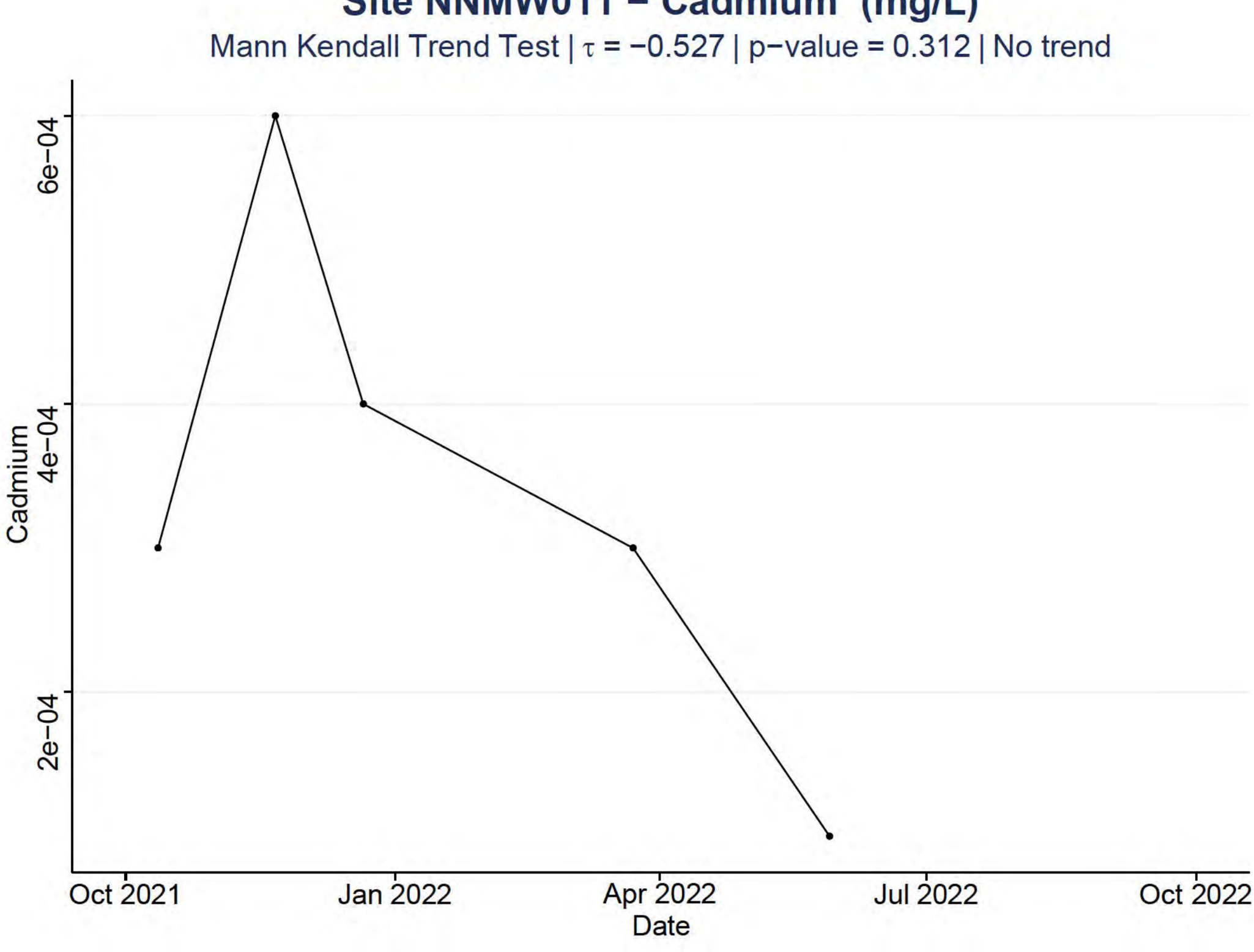
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

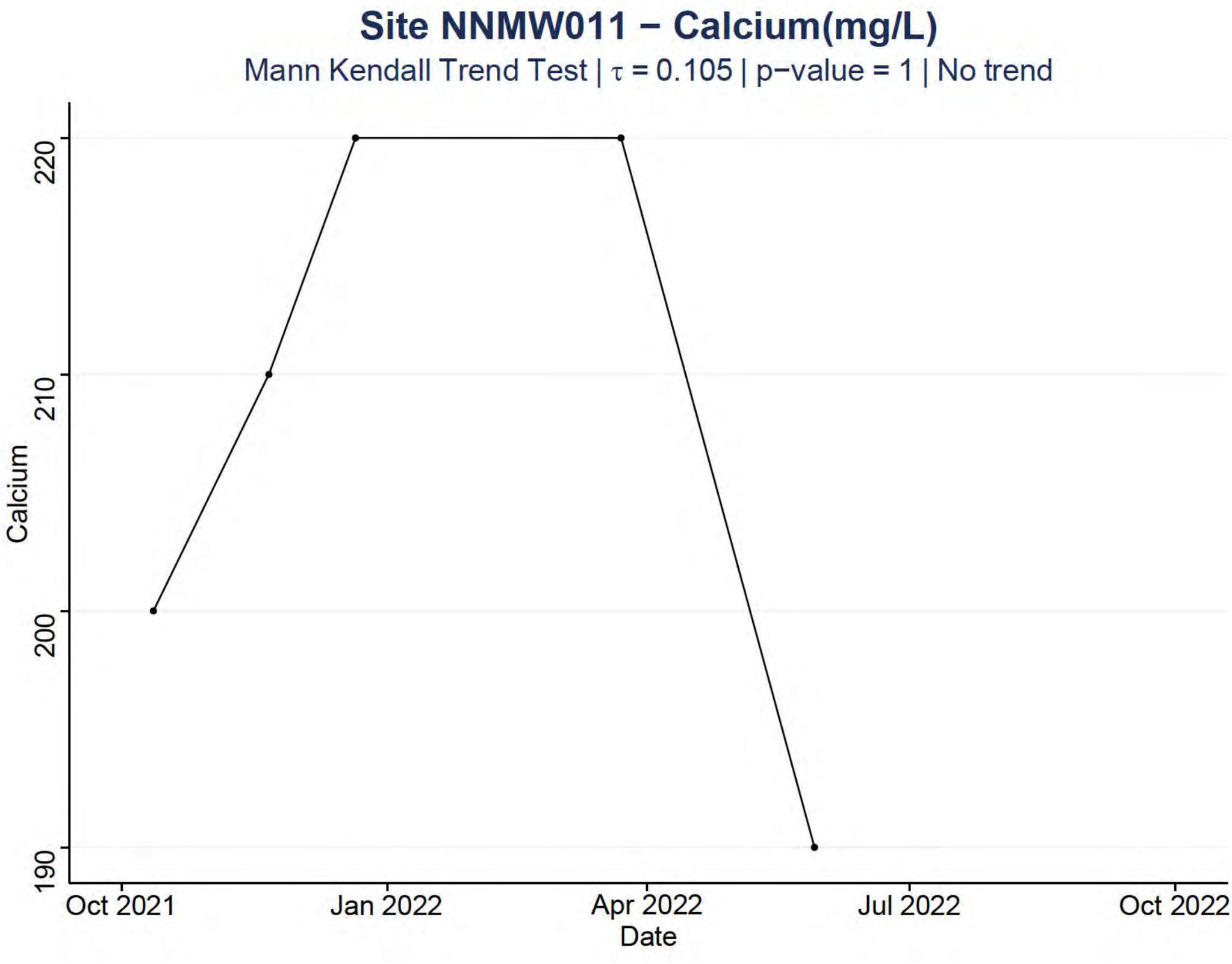


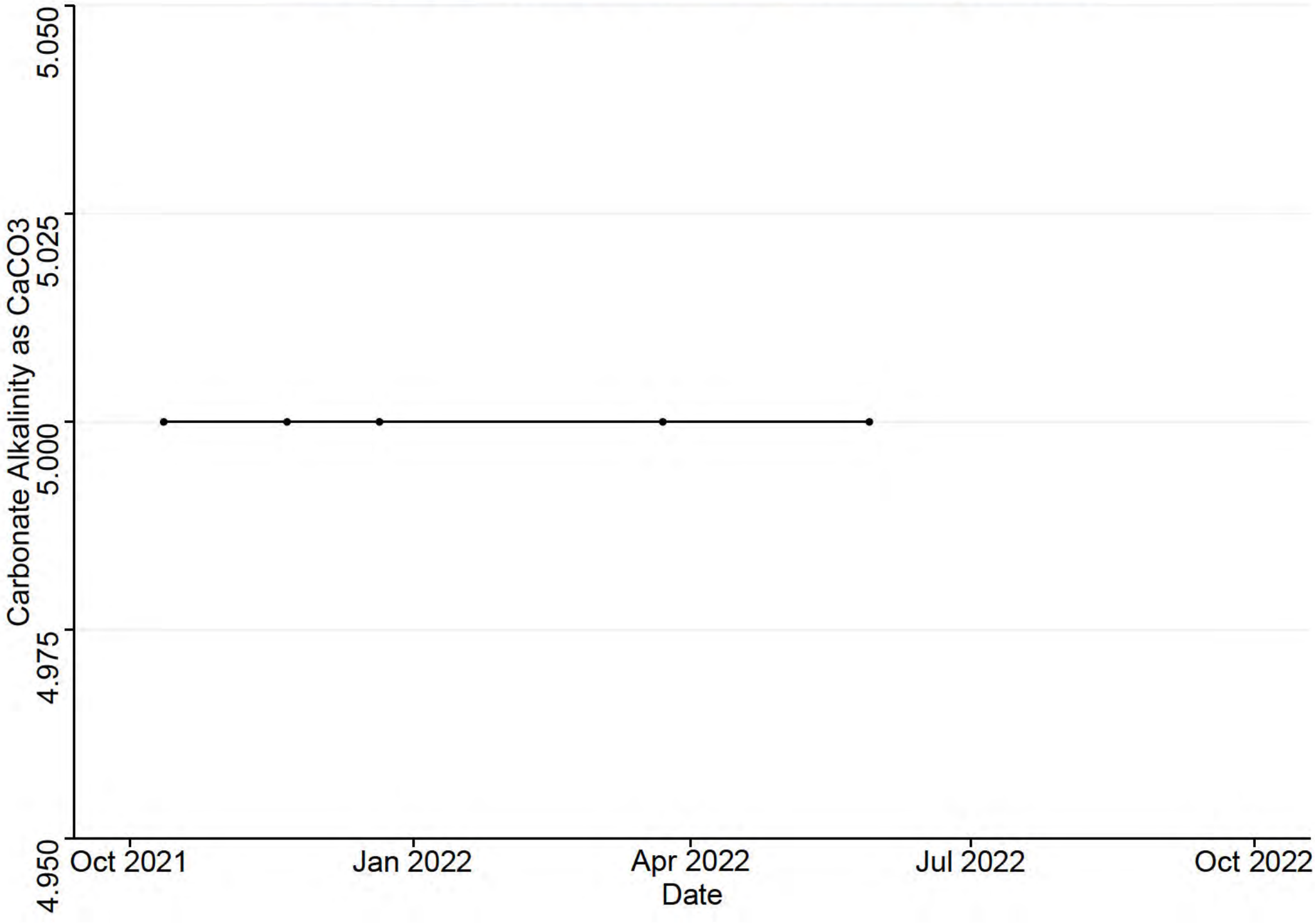

Site NNMW011 – Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.738 | p−value = 0.13 | No trend
Bicarbonate Alkalinity as CaCO3
350
360
370
380
390
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

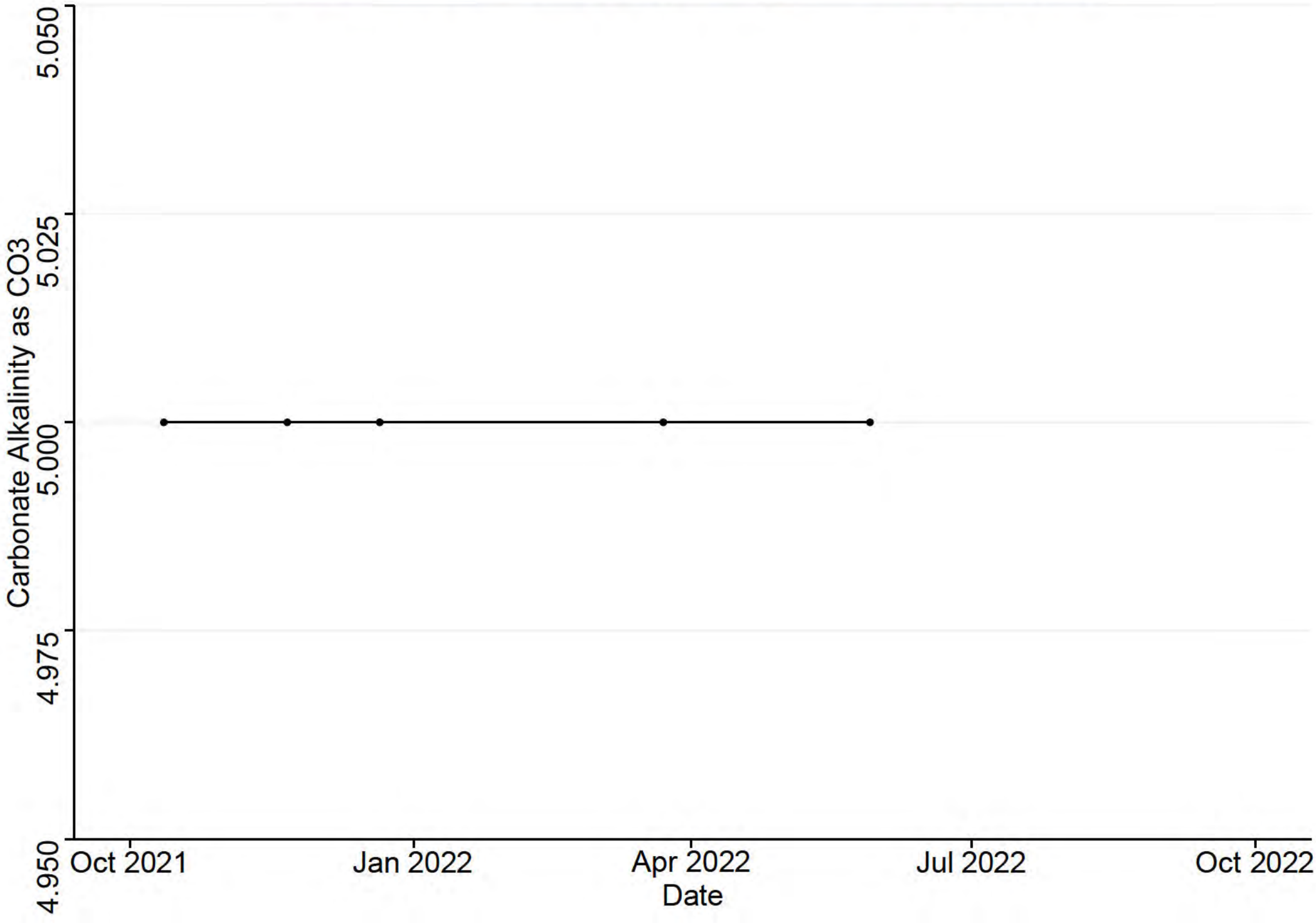

Site NNMW011 − Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.738 | p−value = 0.13 | No trend
Bicarbonate Alkalinity as HCO3
420
430
440
450
460
470
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

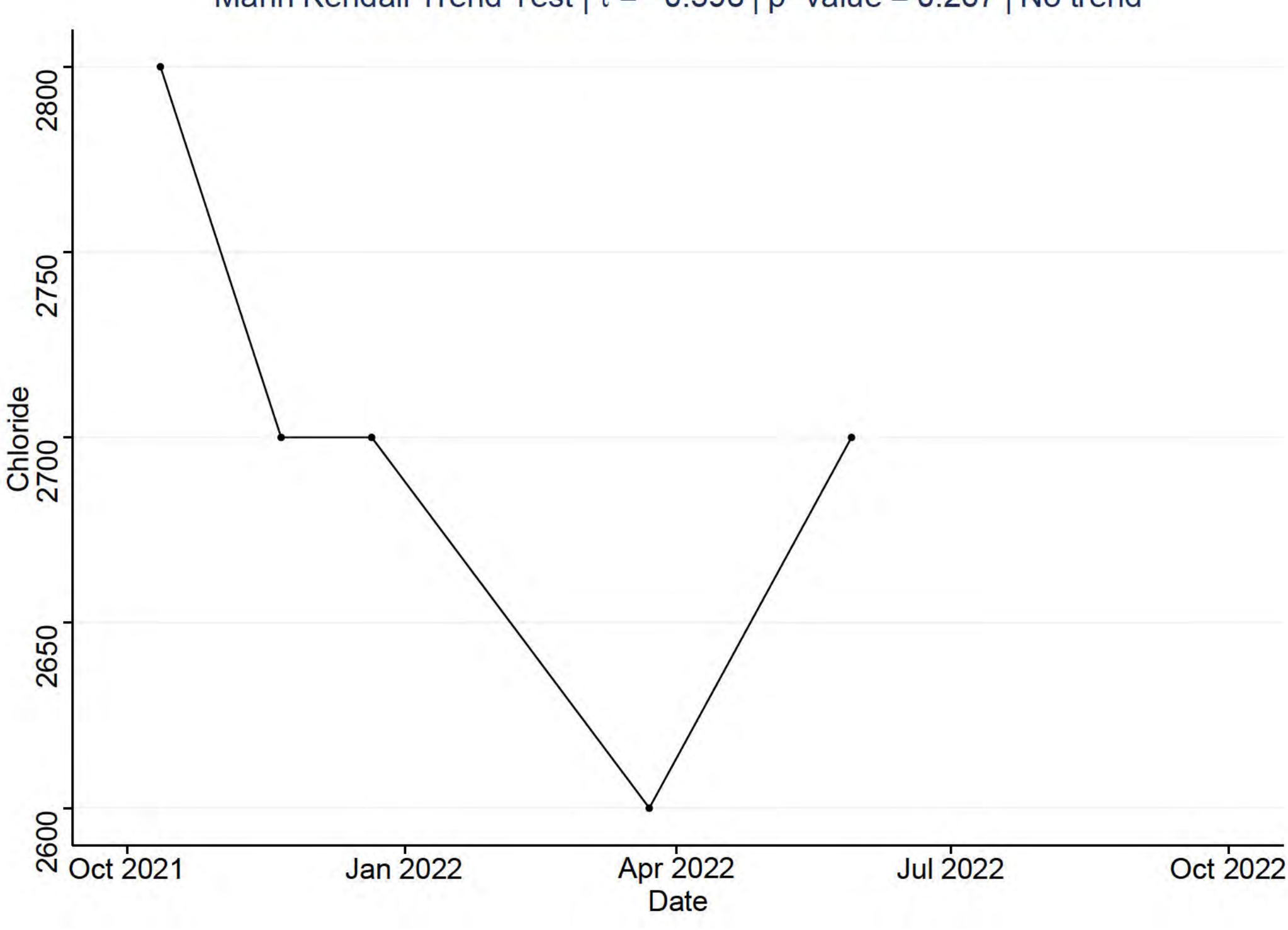

Site NNMW011 – Boron(mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Boron
0.82
0.80
0.78
0.76
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

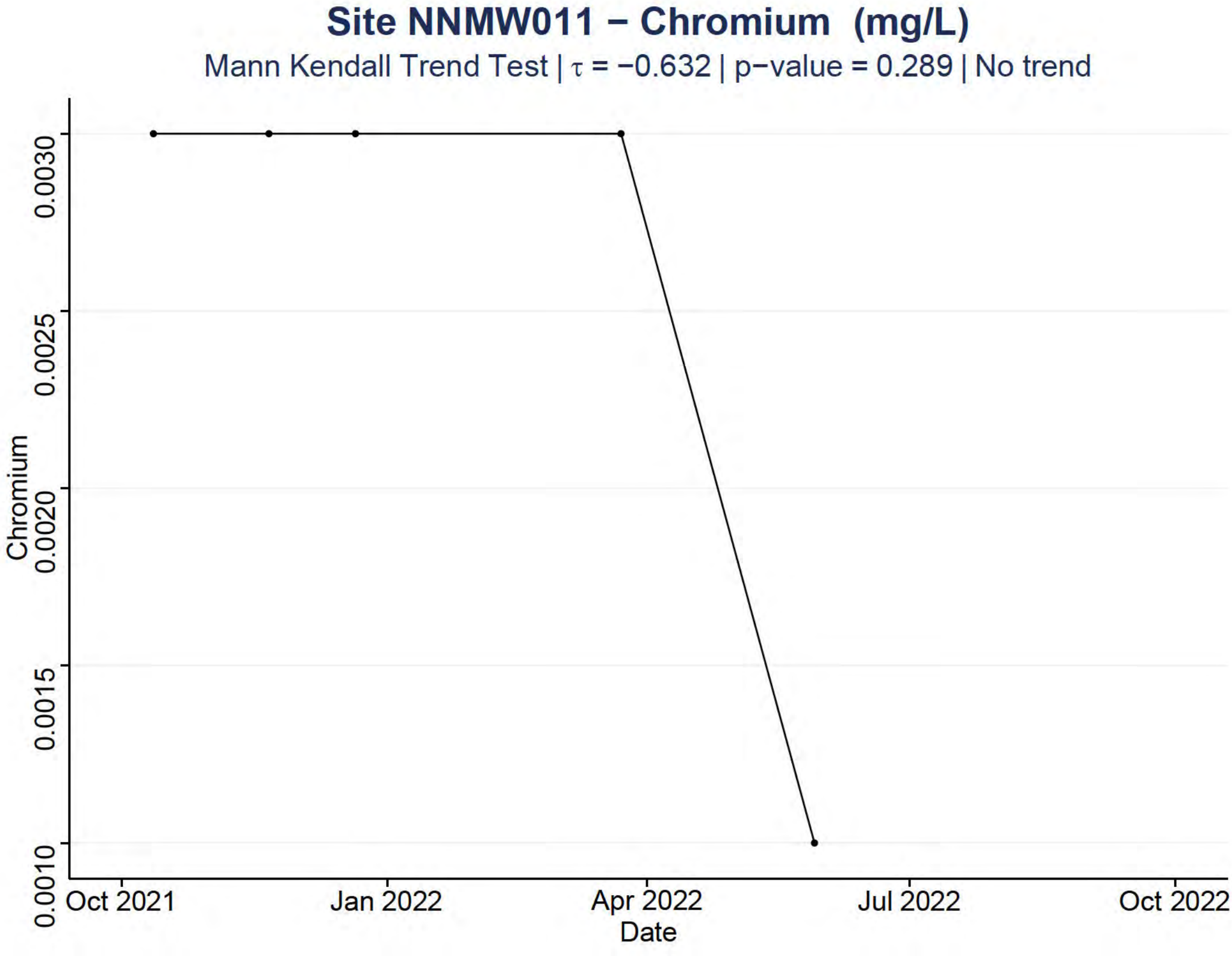

Site NNMW011 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Cadmium
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

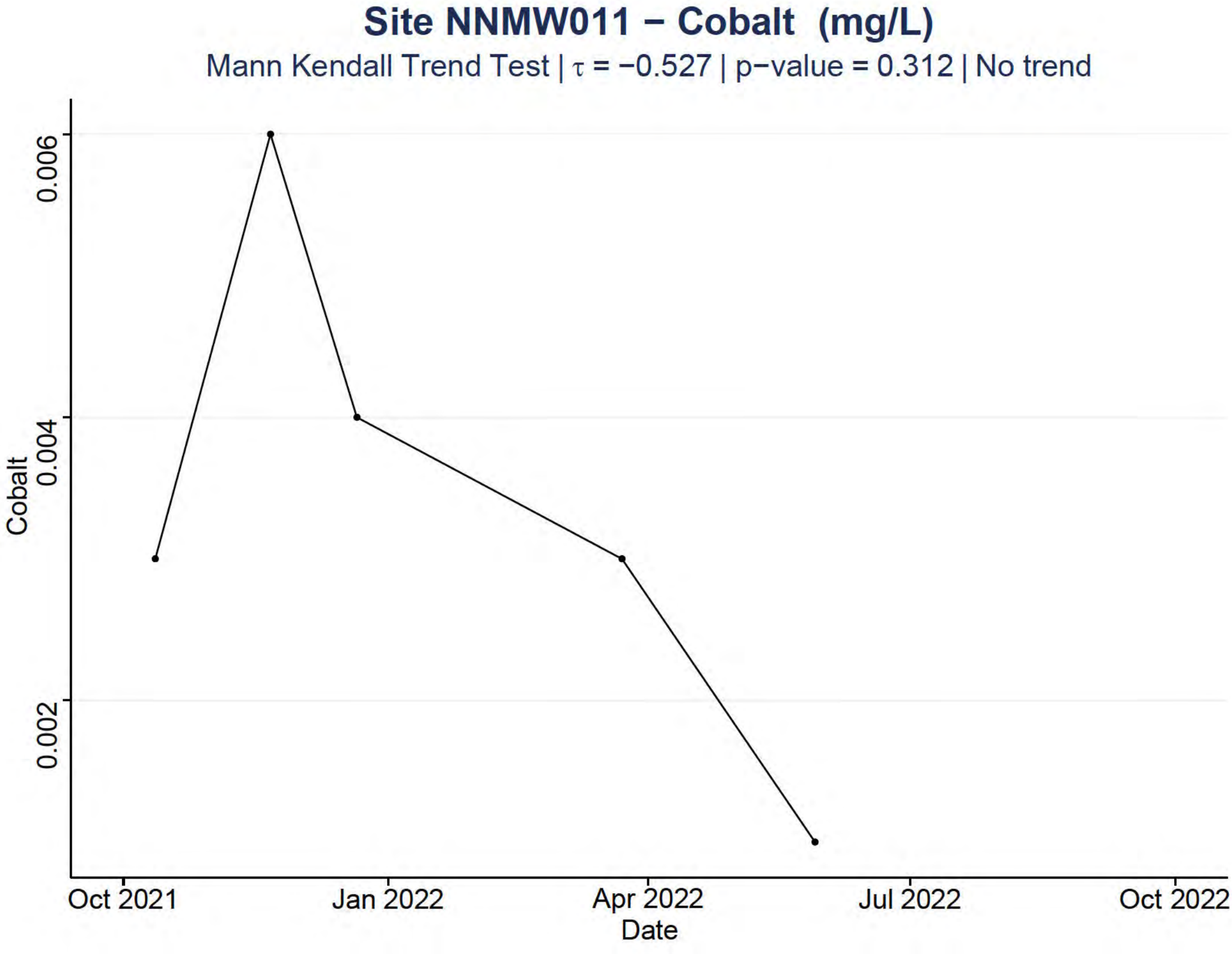

Site NNMW011 – Calcium(mg/L)
Mann Kendall Trend Test | τ = 0.105 | p−value = 1 | No trend
Calcium
220
210
200
190
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

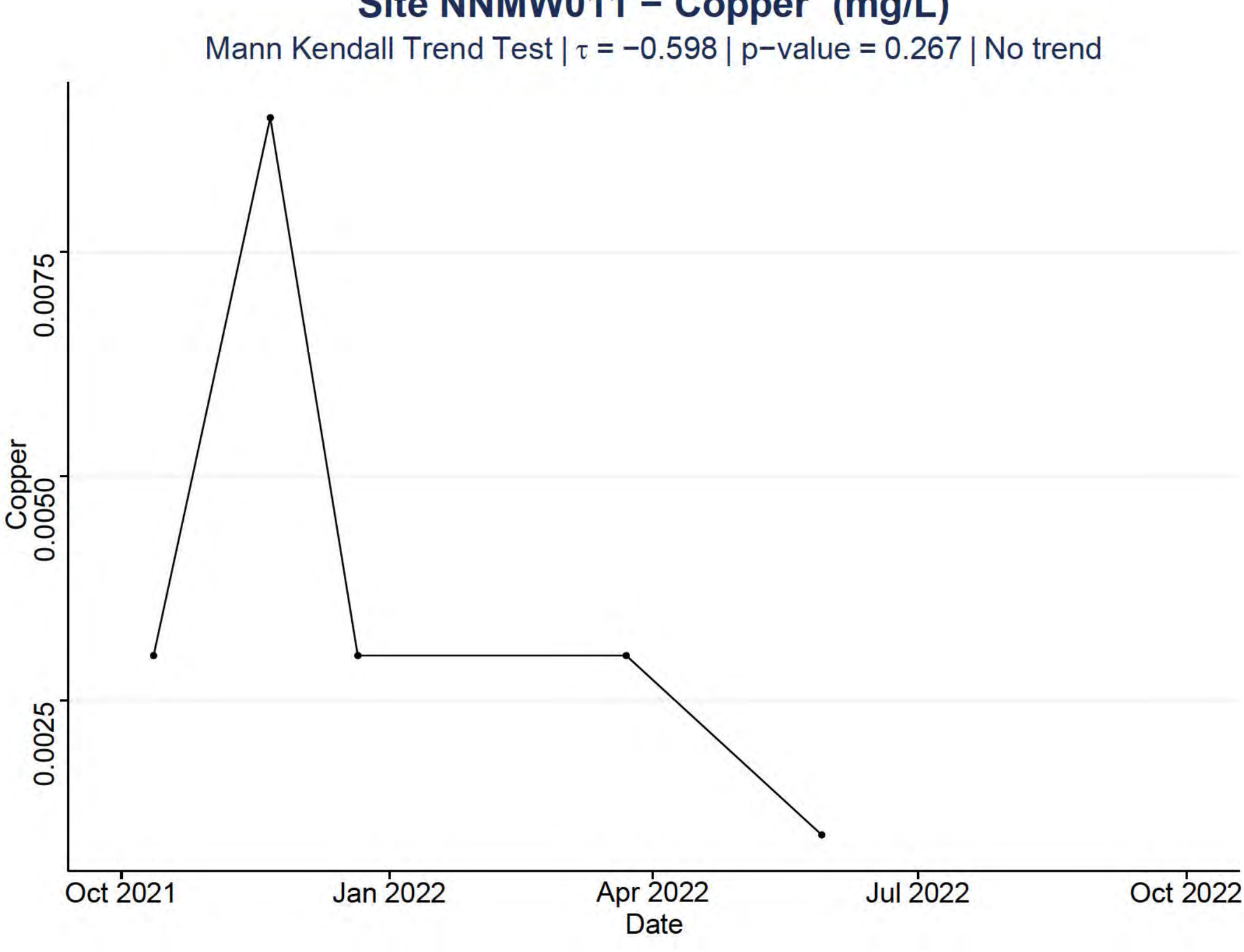

Site NNMW011 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

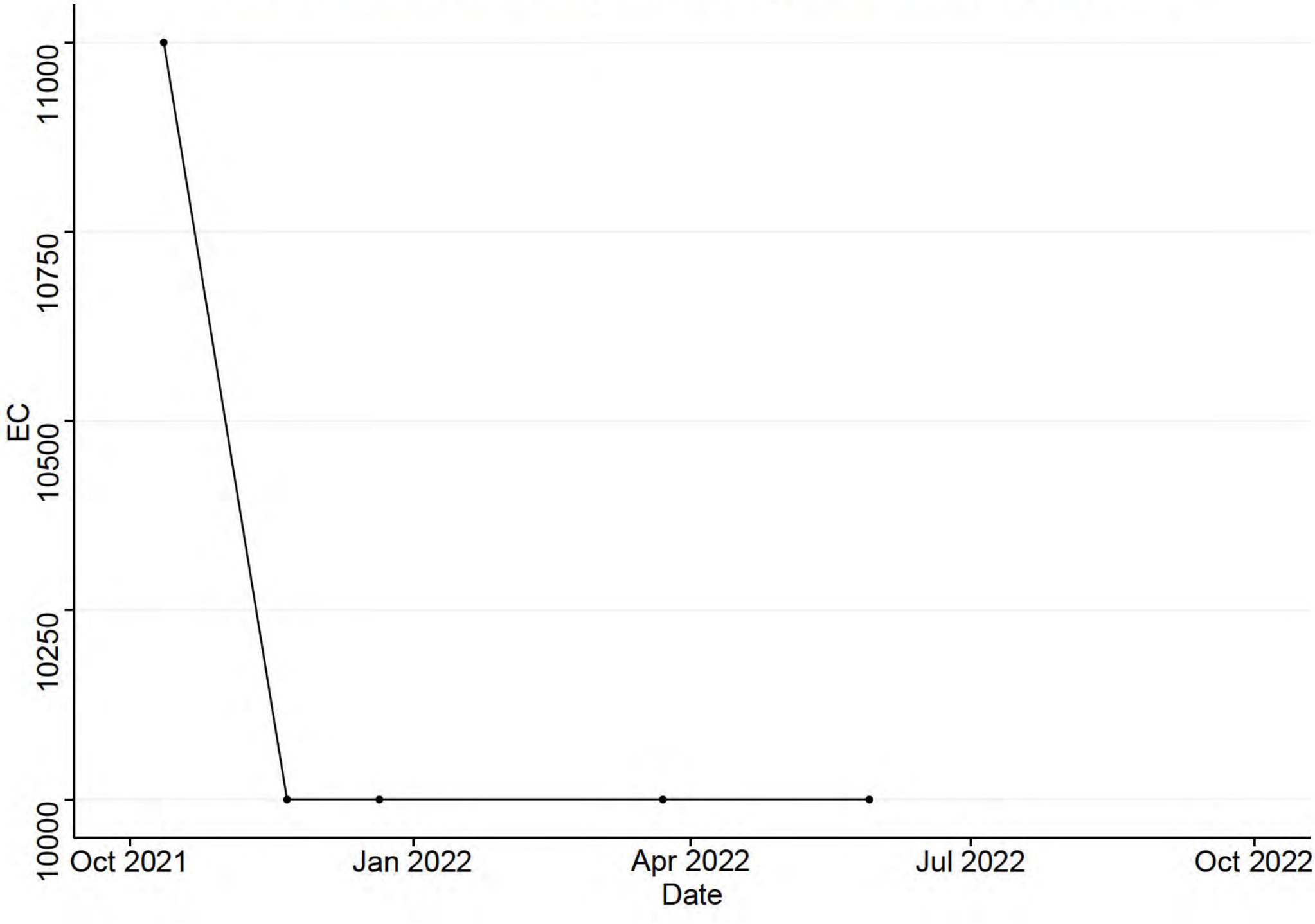

Site NNMW011 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

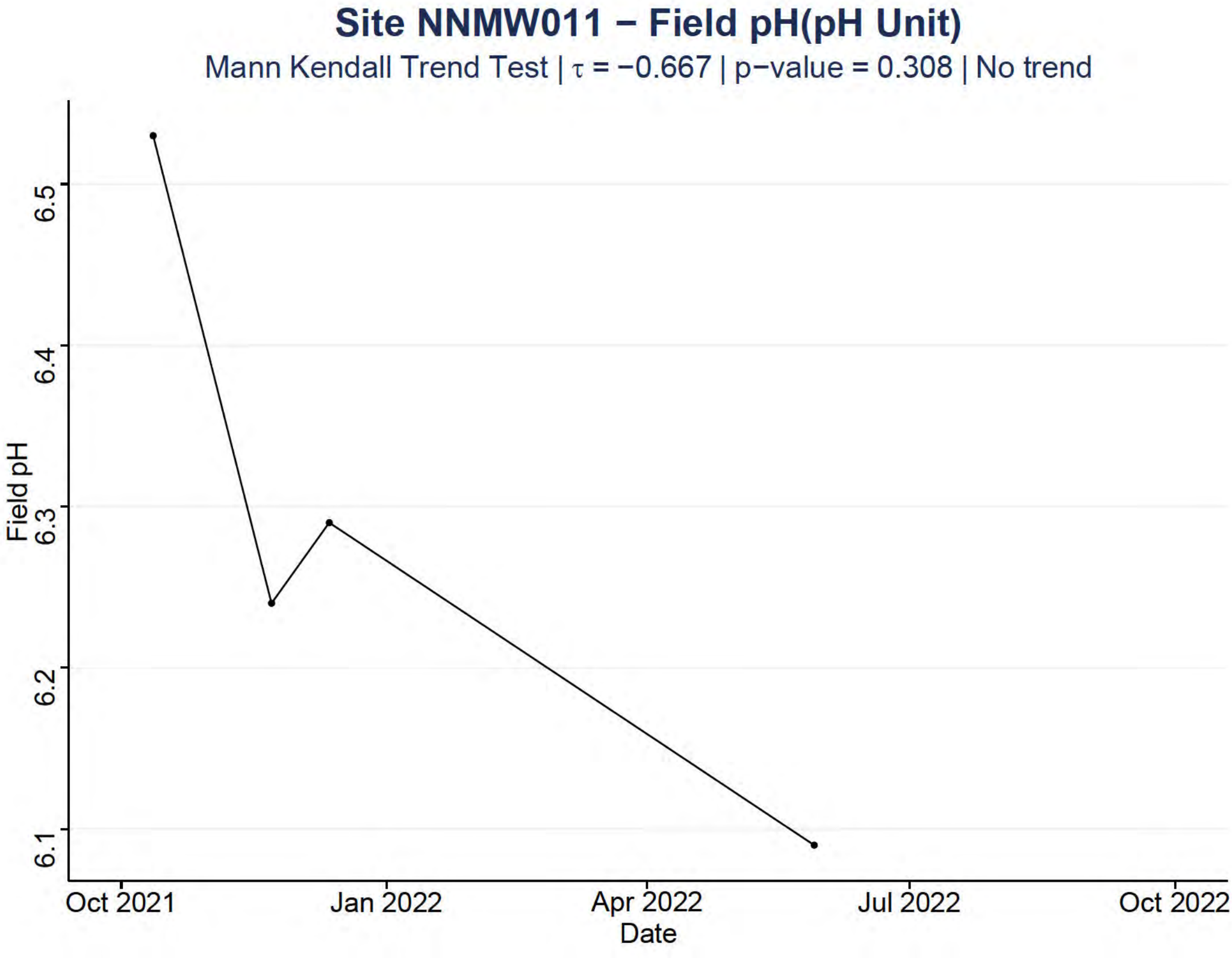

Site NNMW011 – Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Chloride
2800
2750
2700
2650
2600
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

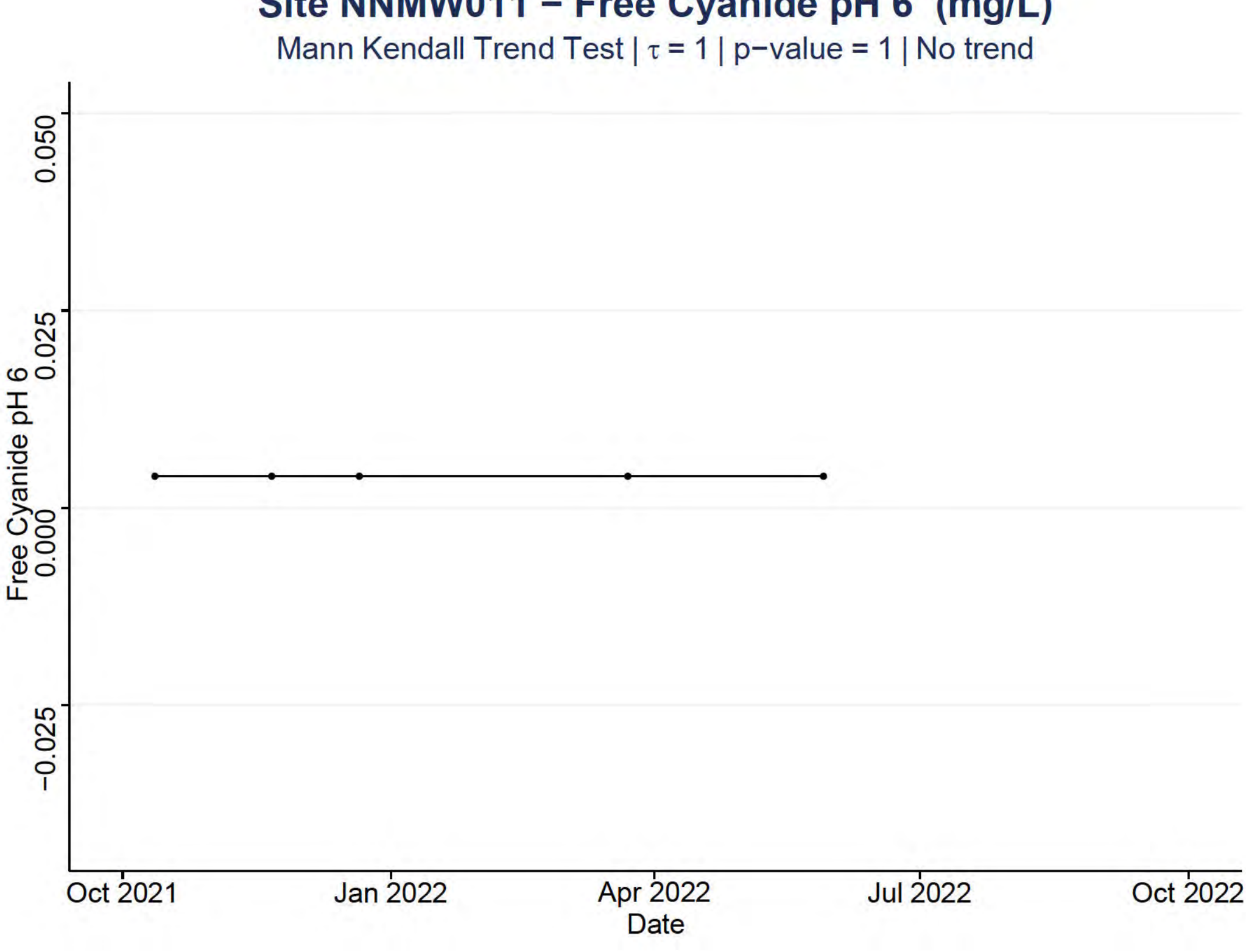

Site NNMW011 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

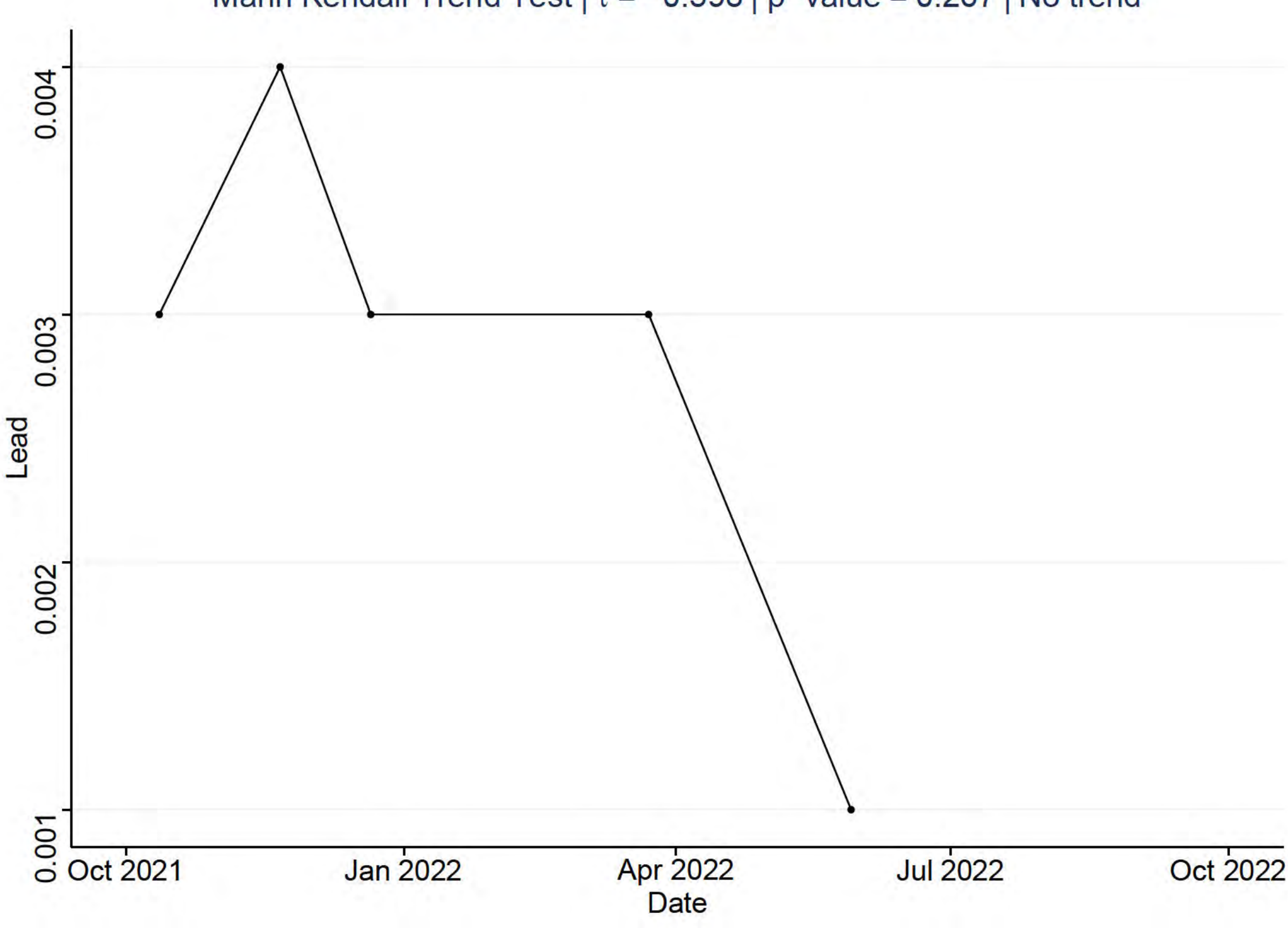

Site NNMW011 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Cobalt
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

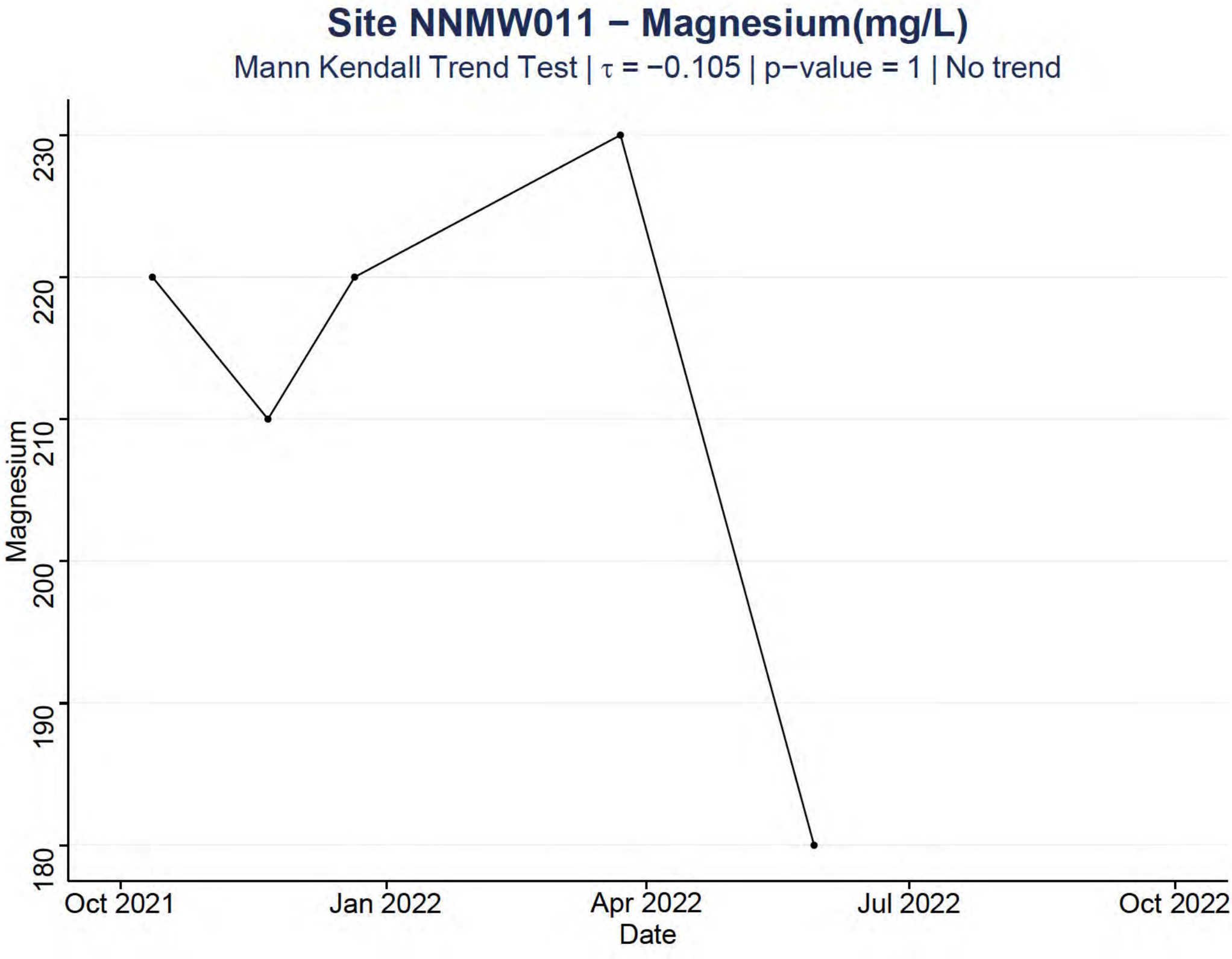

Site NNMW011 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Copper
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

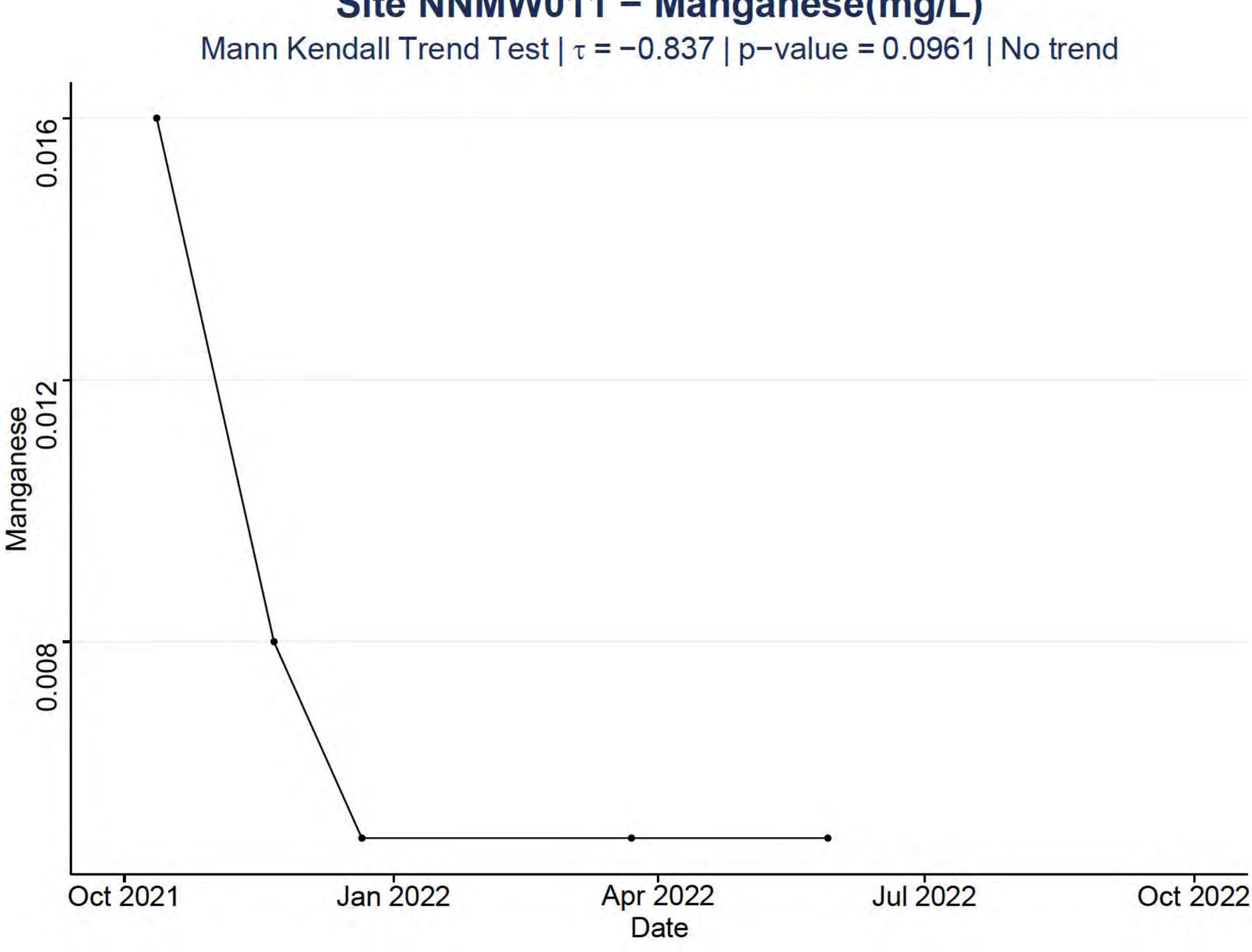

Site NNMW011 − EC(µS/cm)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
EC
11000
10750
10500
10250
10000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

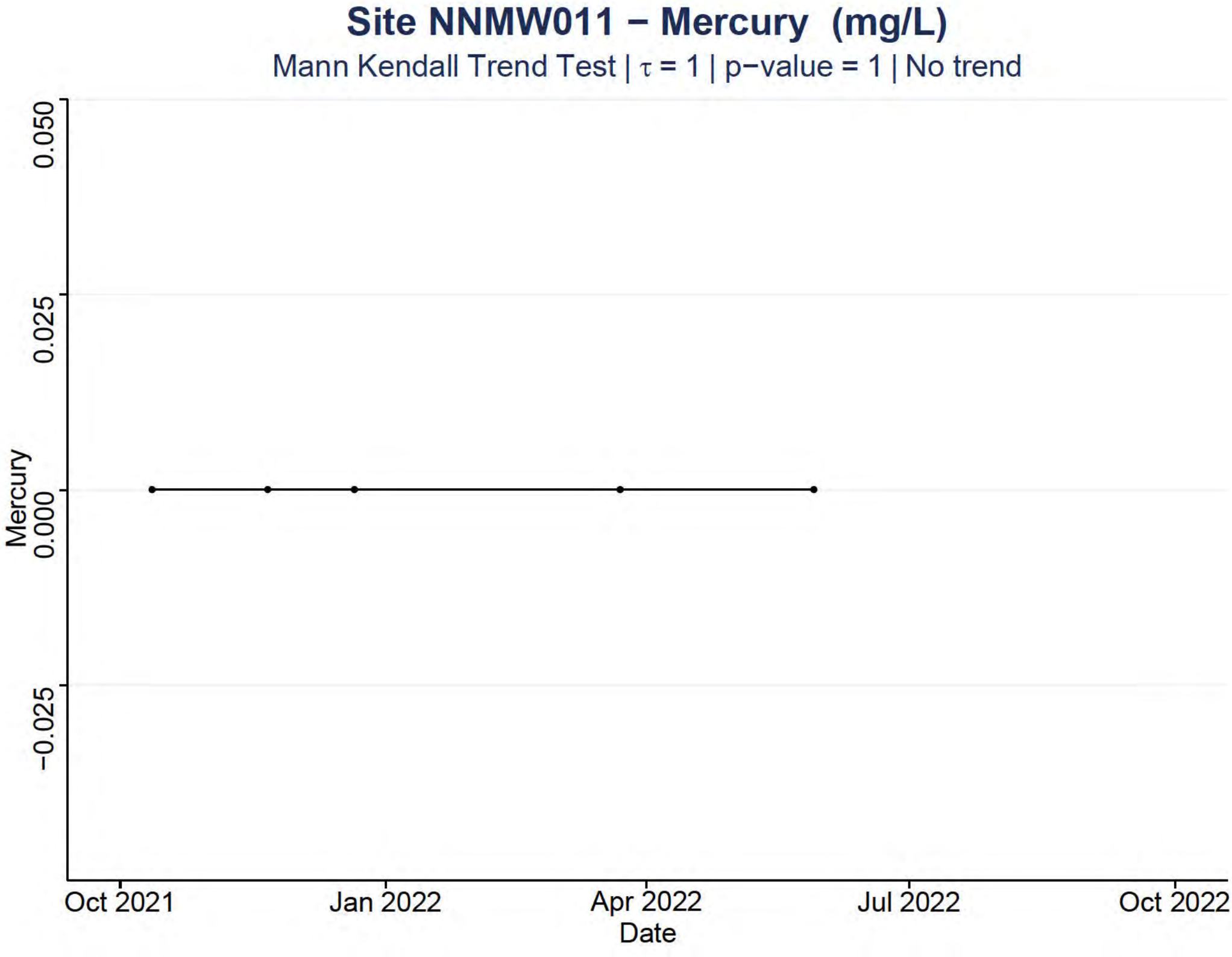

Site NNMW011 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.667 | p−value = 0.308 | No trend
Field pH
6.5
6.4
6.3
6.2
6.1
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

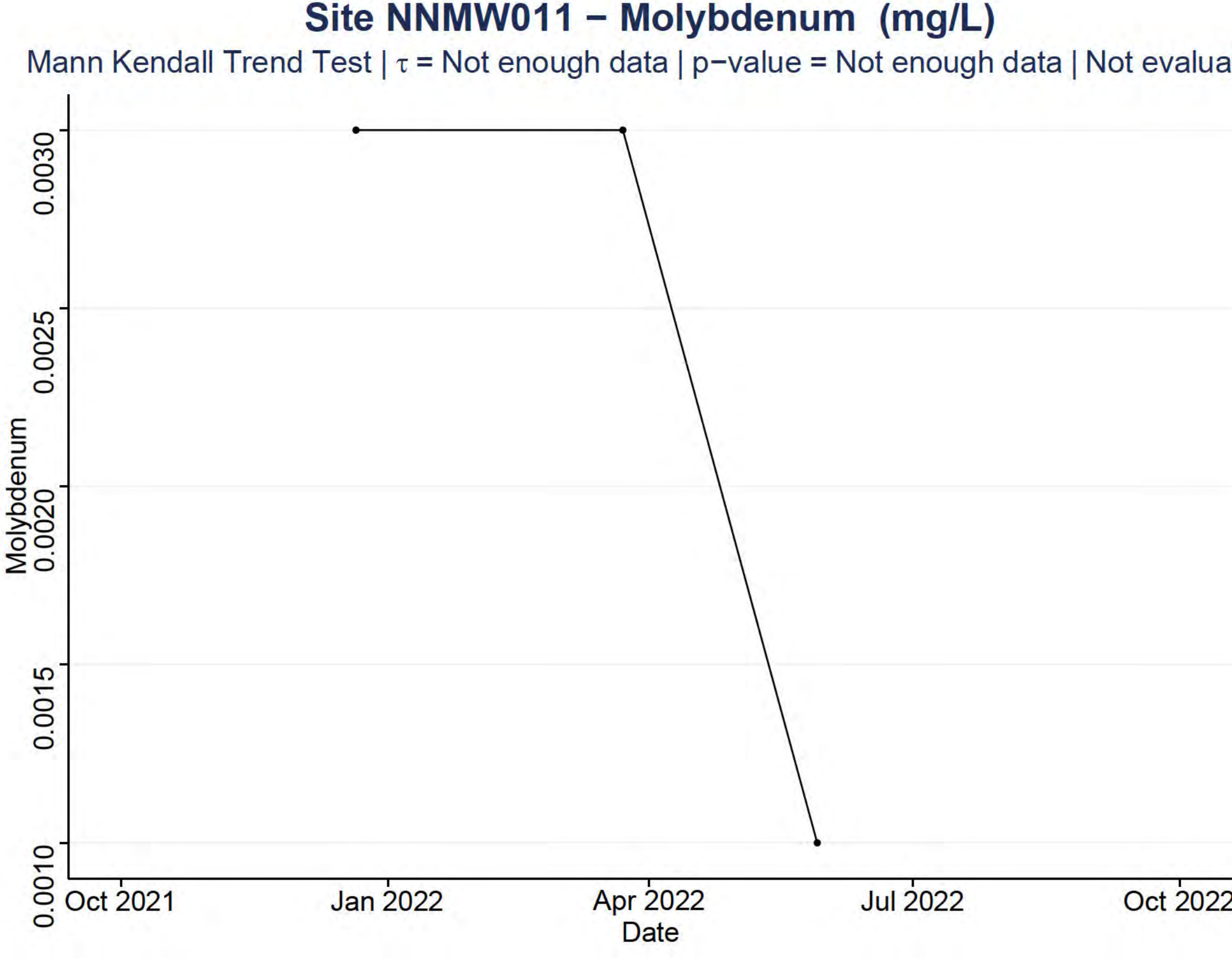

Site NNMW011 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Free Cyanide pH 6
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

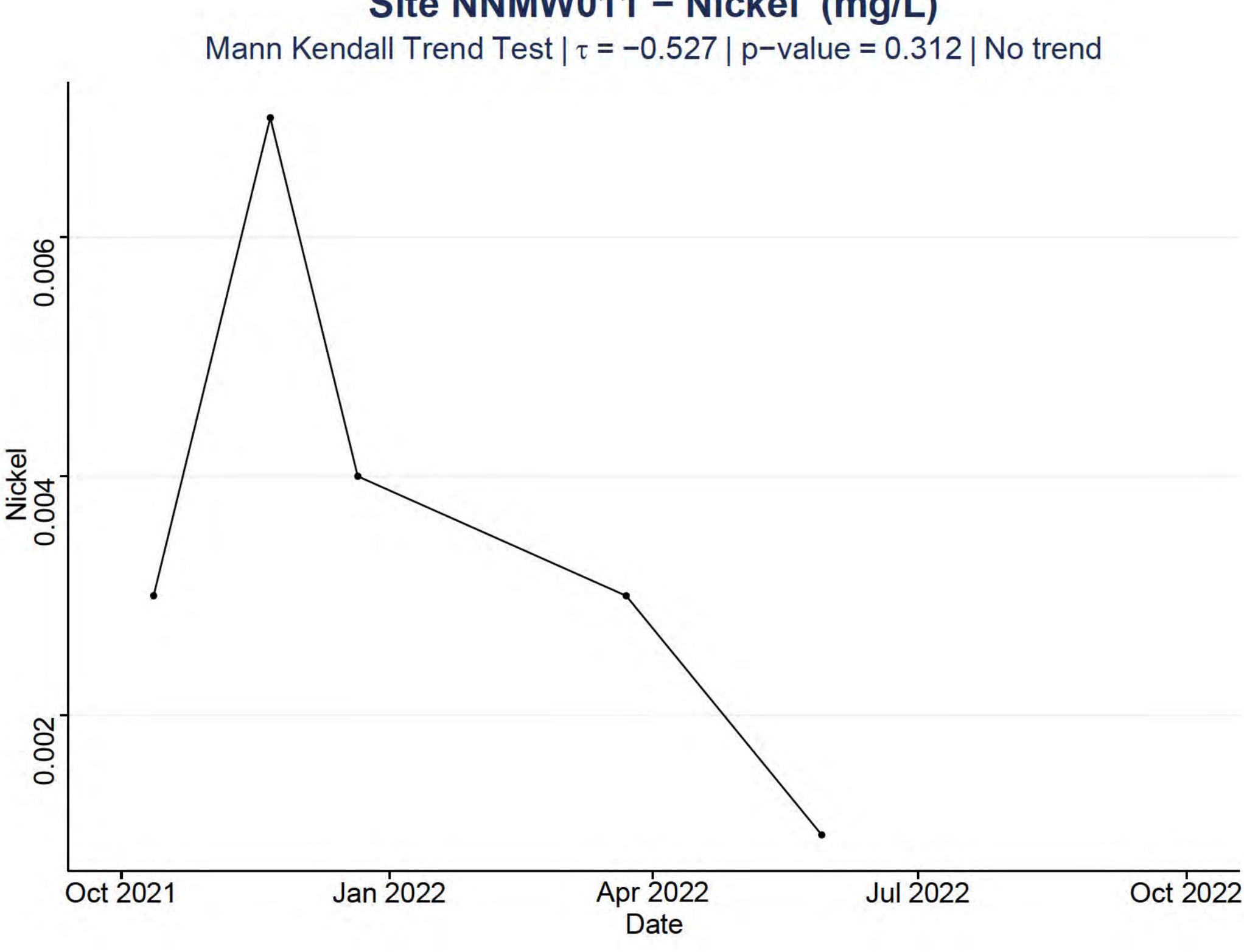

Site NNMW011 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Lead
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

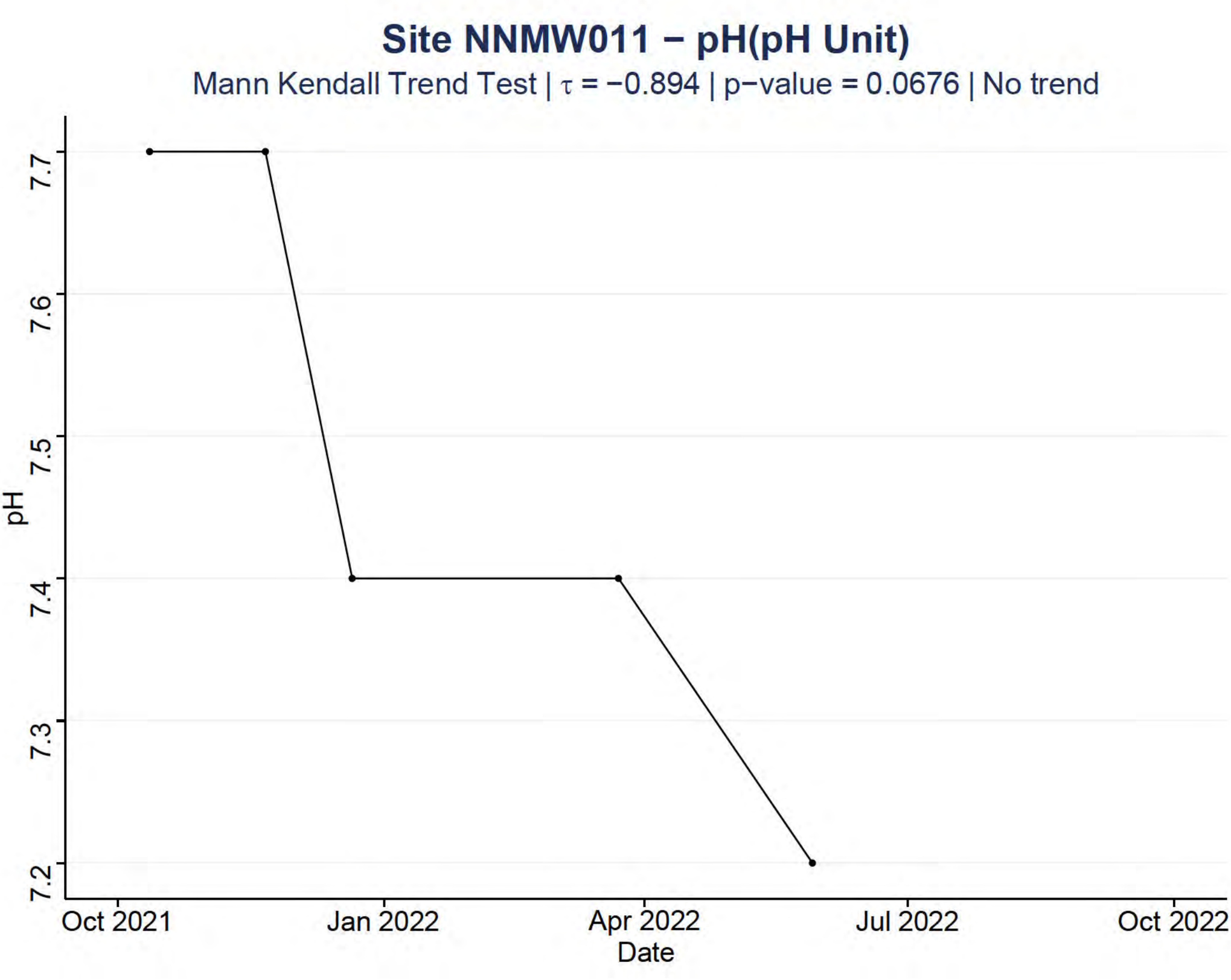

Site NNMW011 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.105 | p−value = 1 | No trend
Magnesium
230
220
210
200
190
180
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

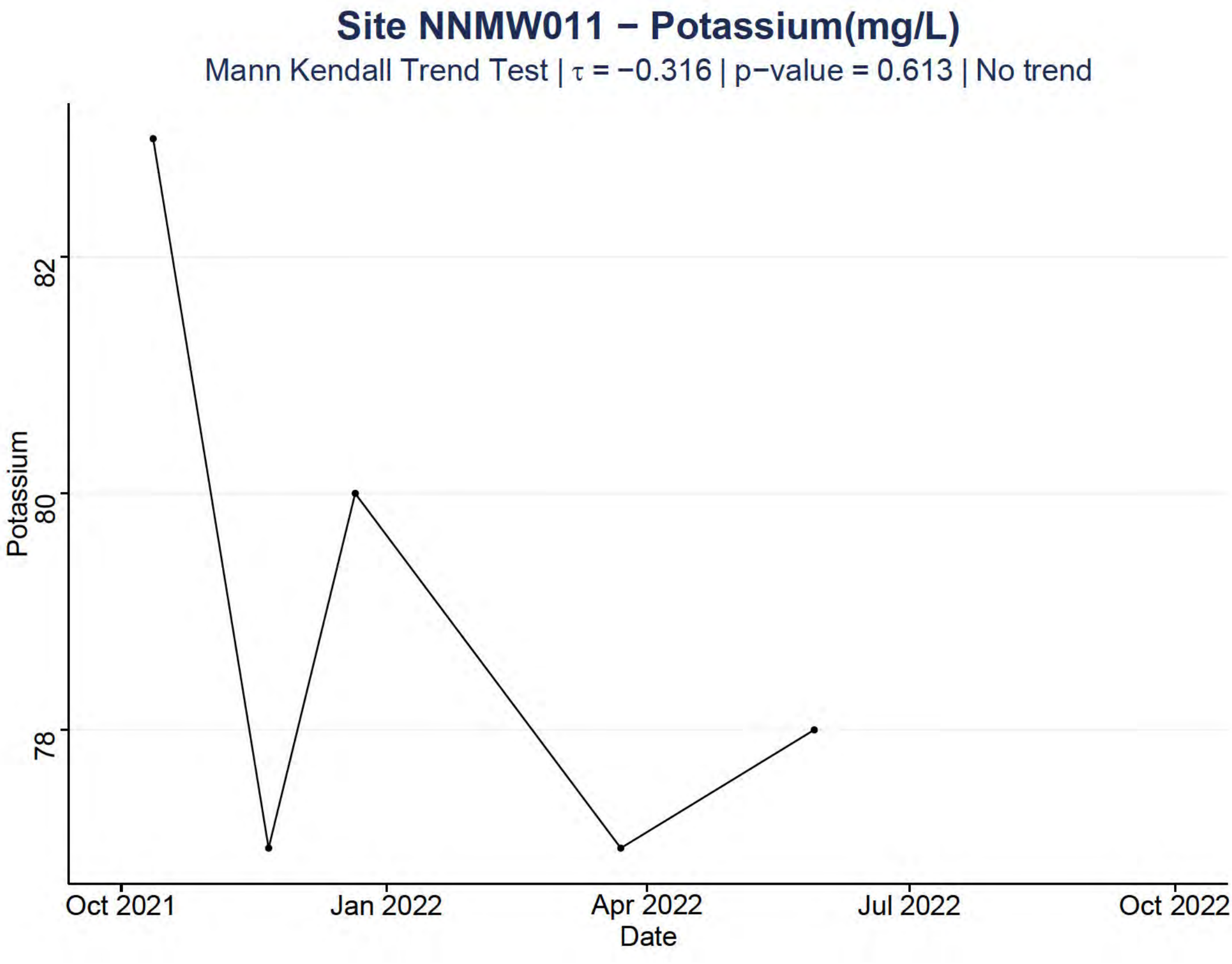

Site NNMW011 – Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.837 | p−value = 0.0961 | No trend
Manganese
0.016
0.012
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

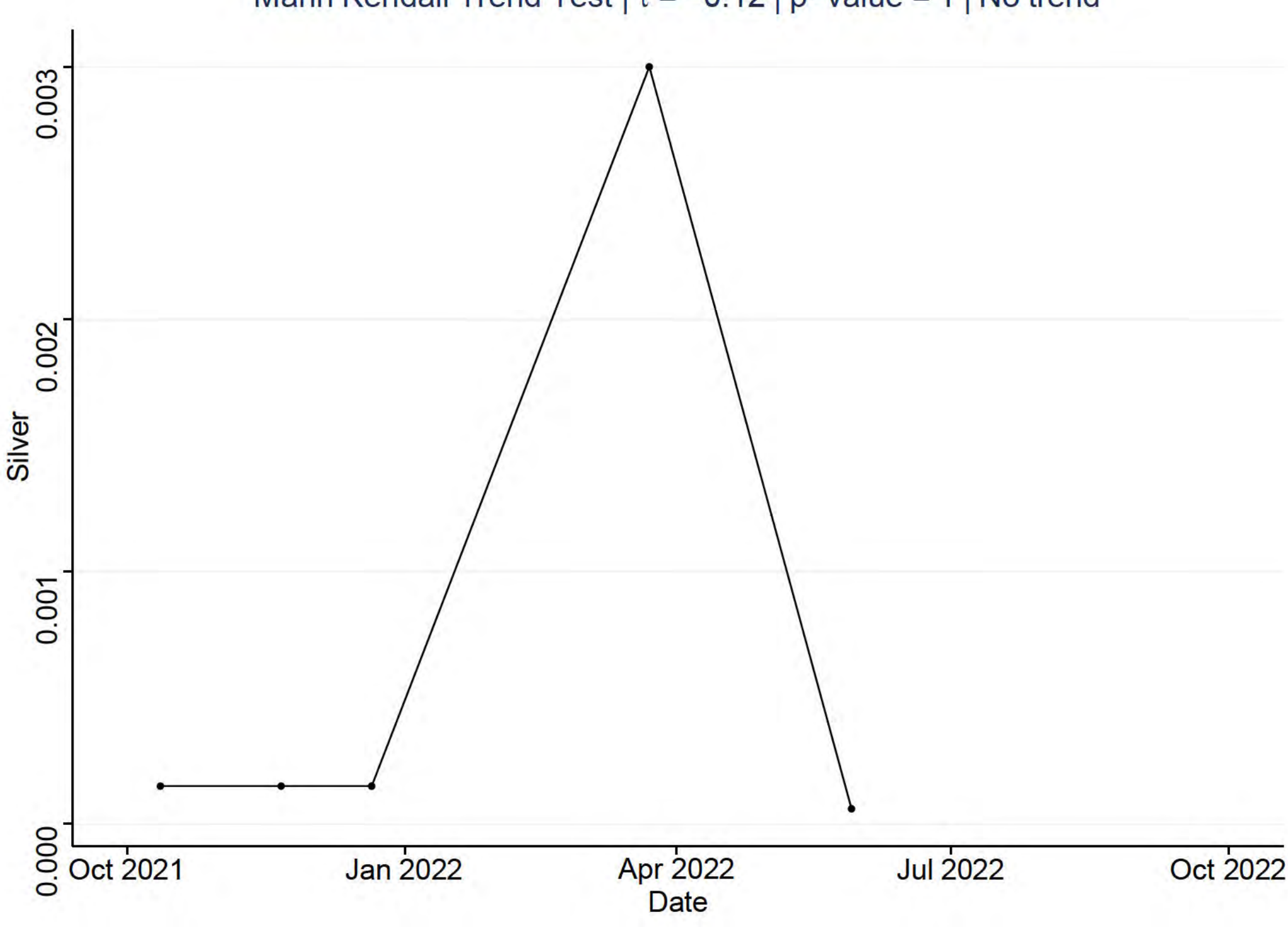

Site NNMW011 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
0.050
0.025
0.000
−0.025
Mercury
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

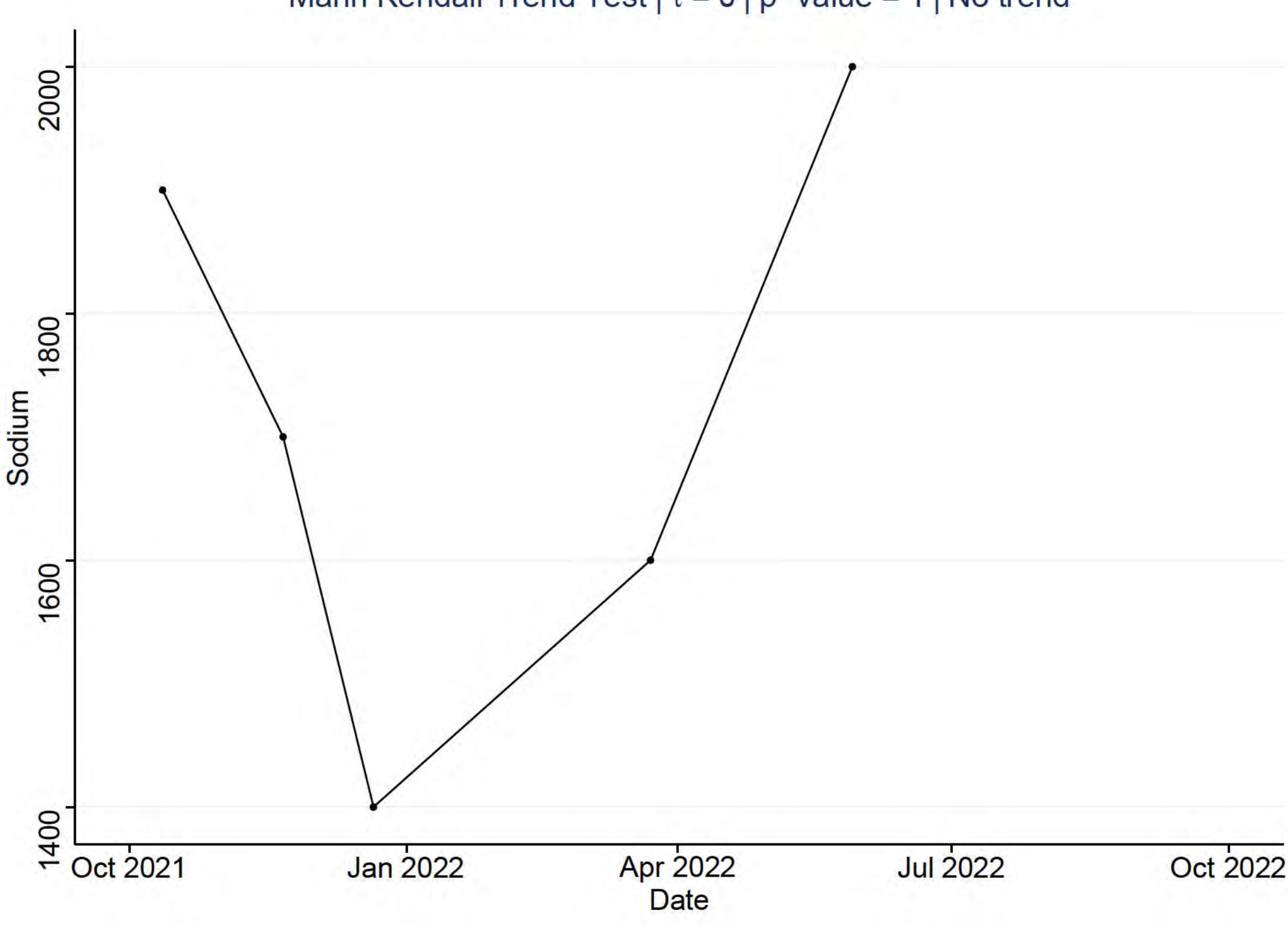

Site NNMW011 – Molybdenum (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

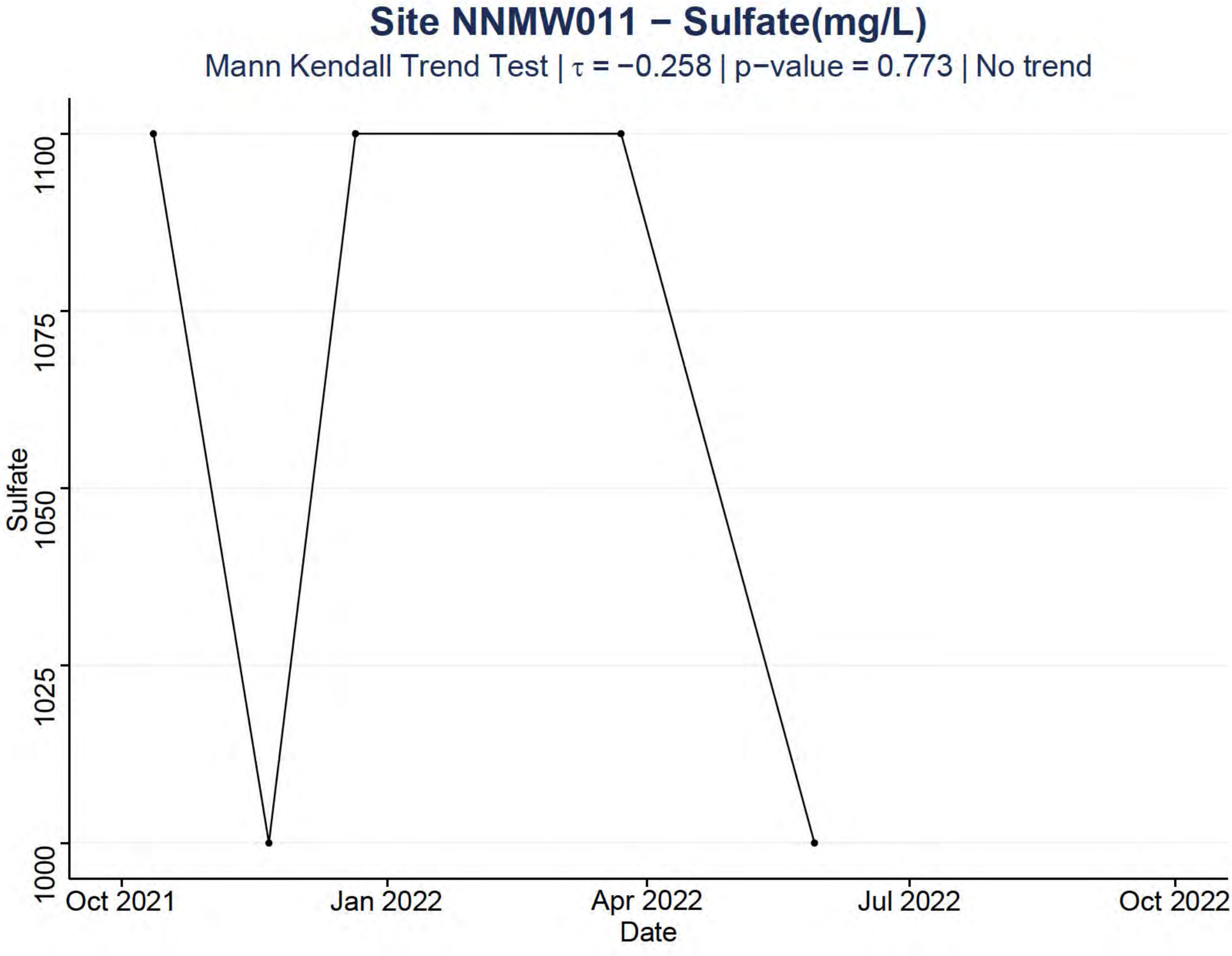

Site NNMW011 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Nickel
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

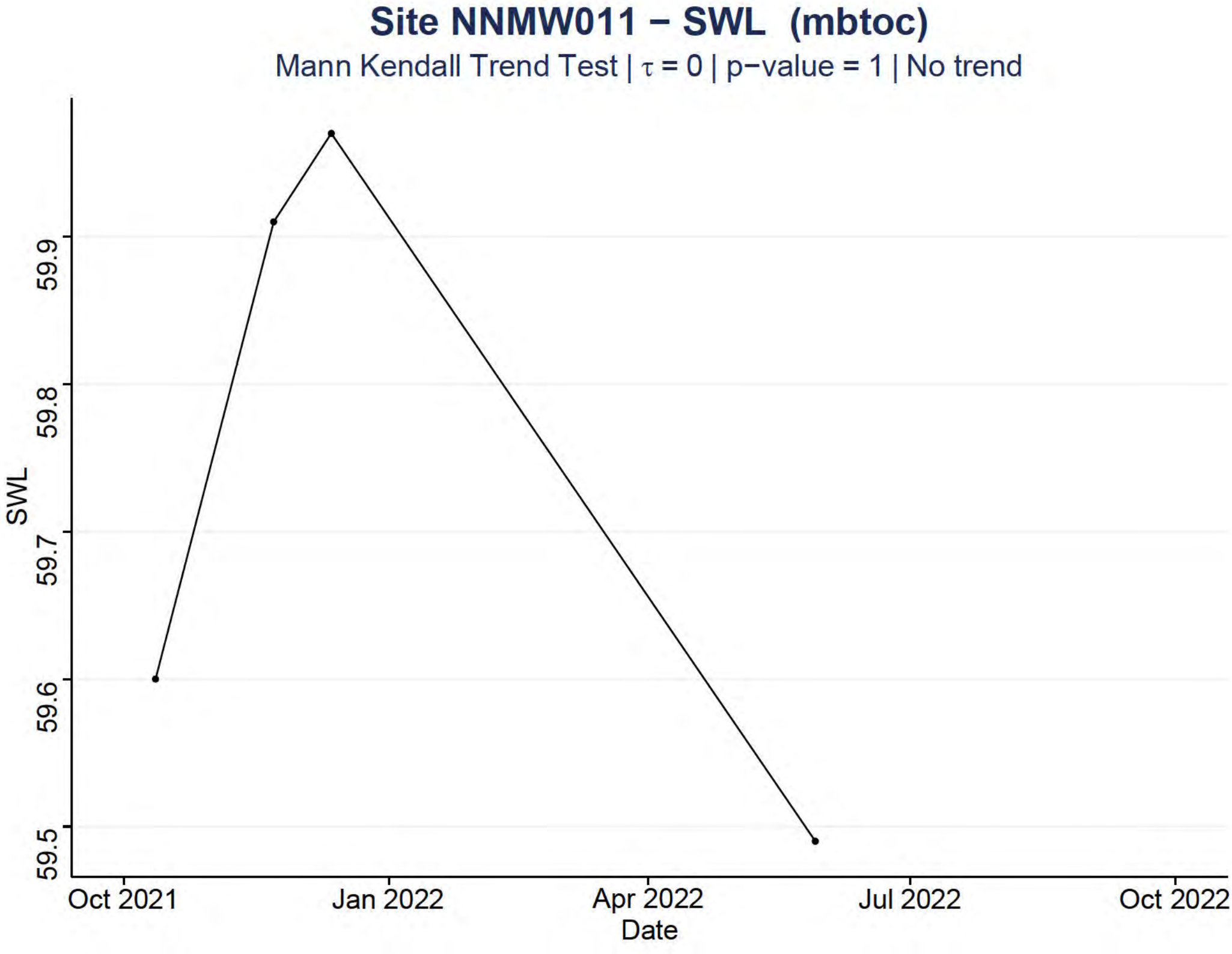

Site NNMW011 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.894 | p−value = 0.0676 | No trend
pH
7.7
7.6
7.5
7.4
7.3
7.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

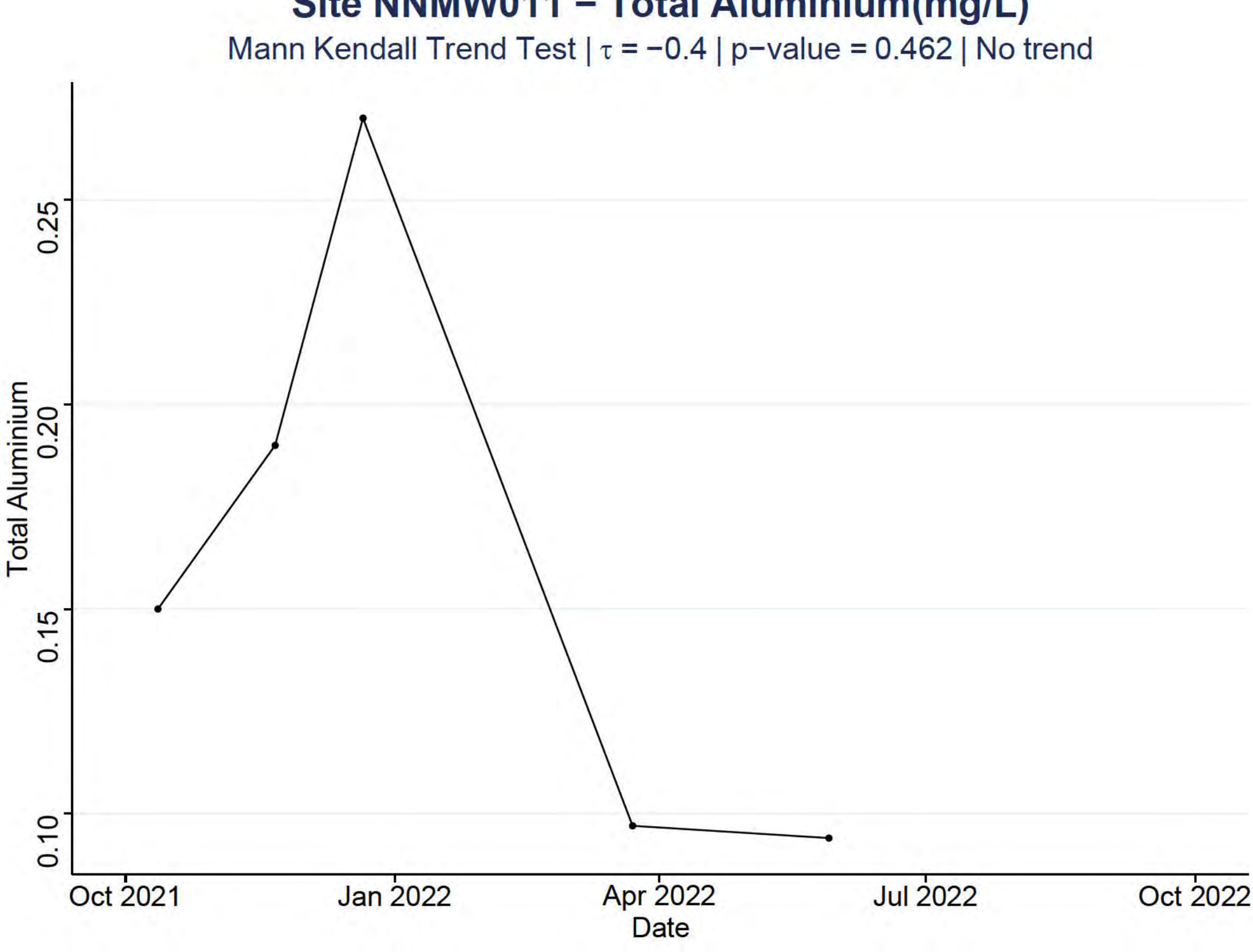

Site NNMW011 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Potassium
82
80
78
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

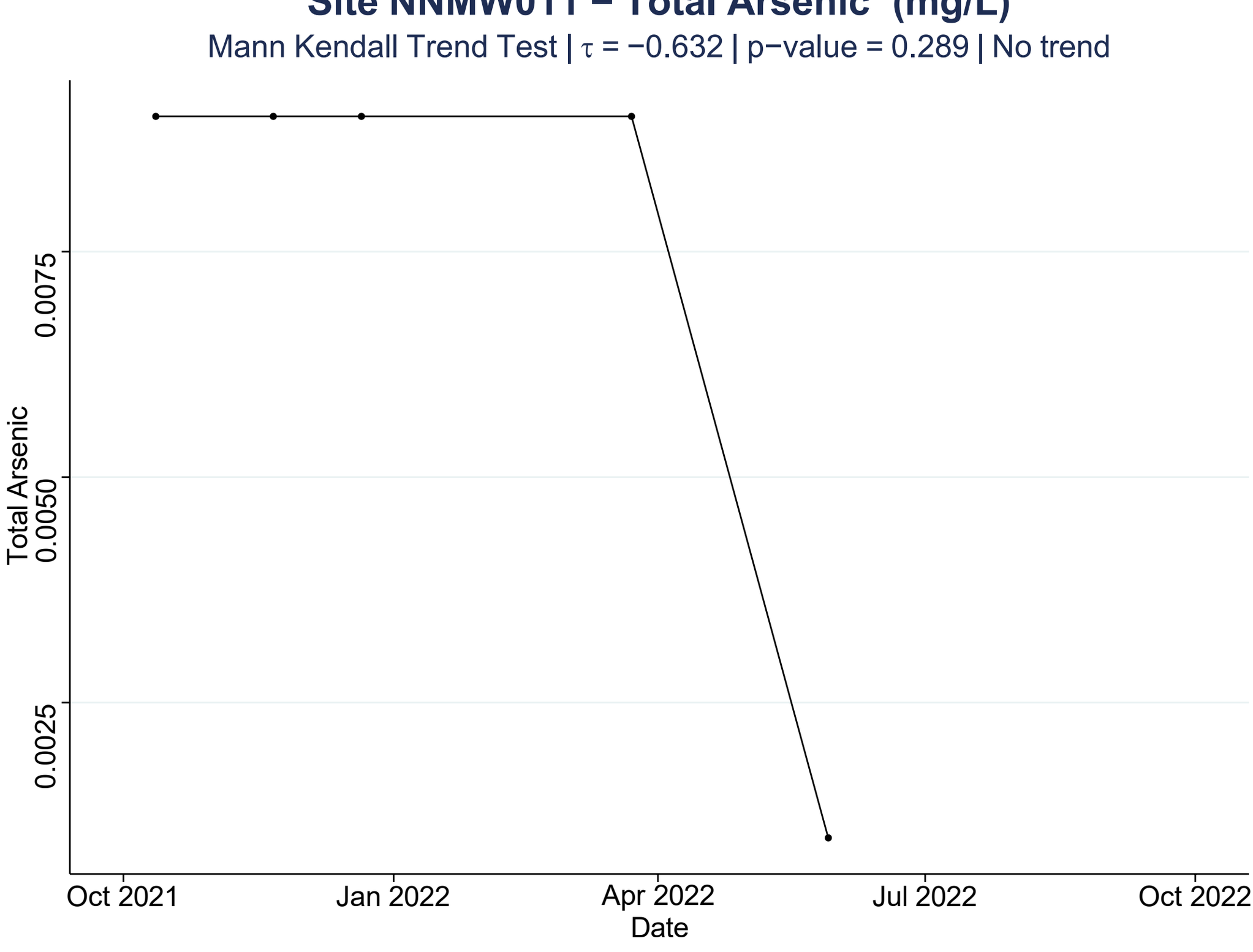

Site NNMW011 – Silver (mg/L)
Mann Kendall Trend Test | τ = −0.12 | p−value = 1 | No trend
Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

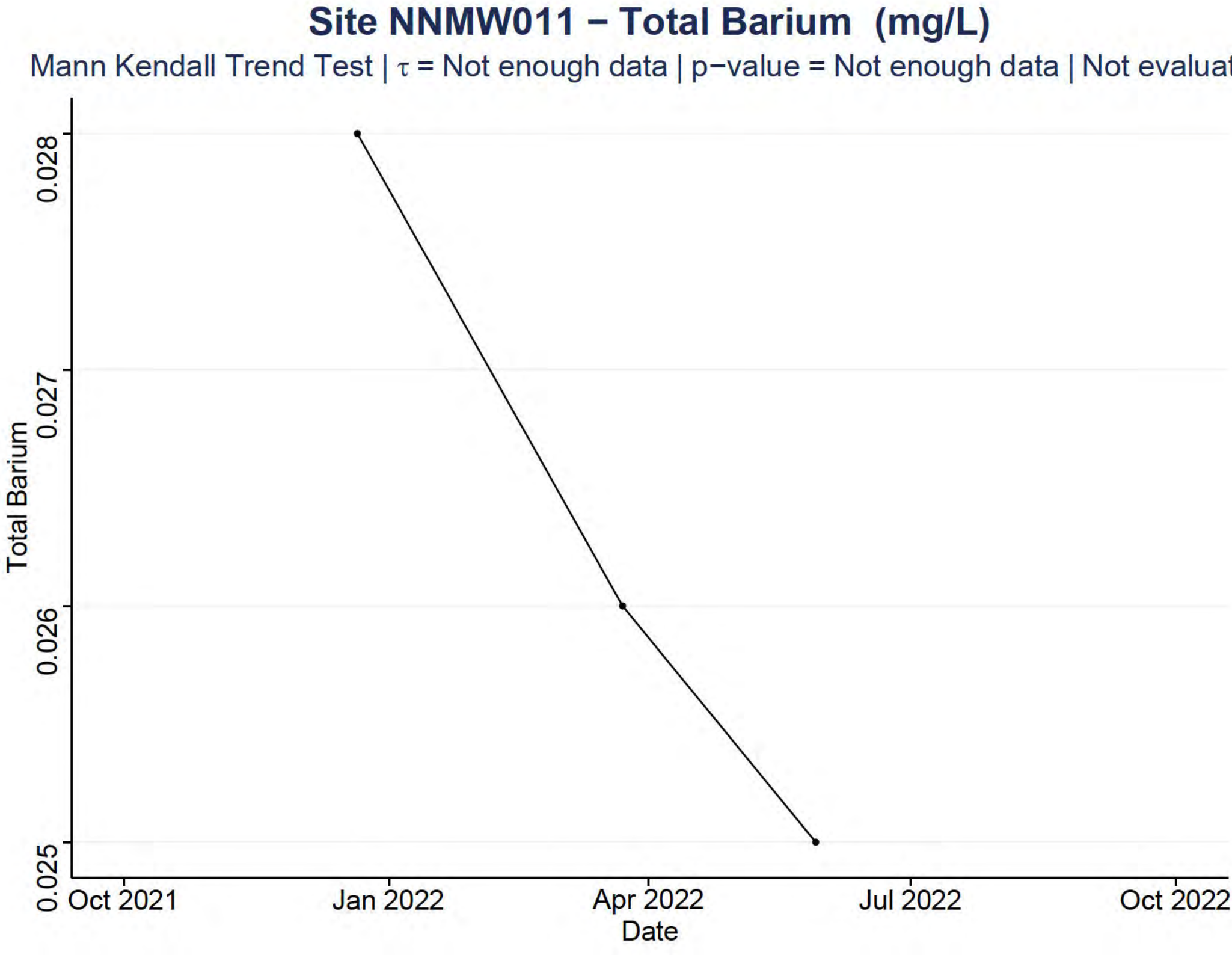

Site NNMW011 – Sodium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Sodium
2000
1800
1600
1400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

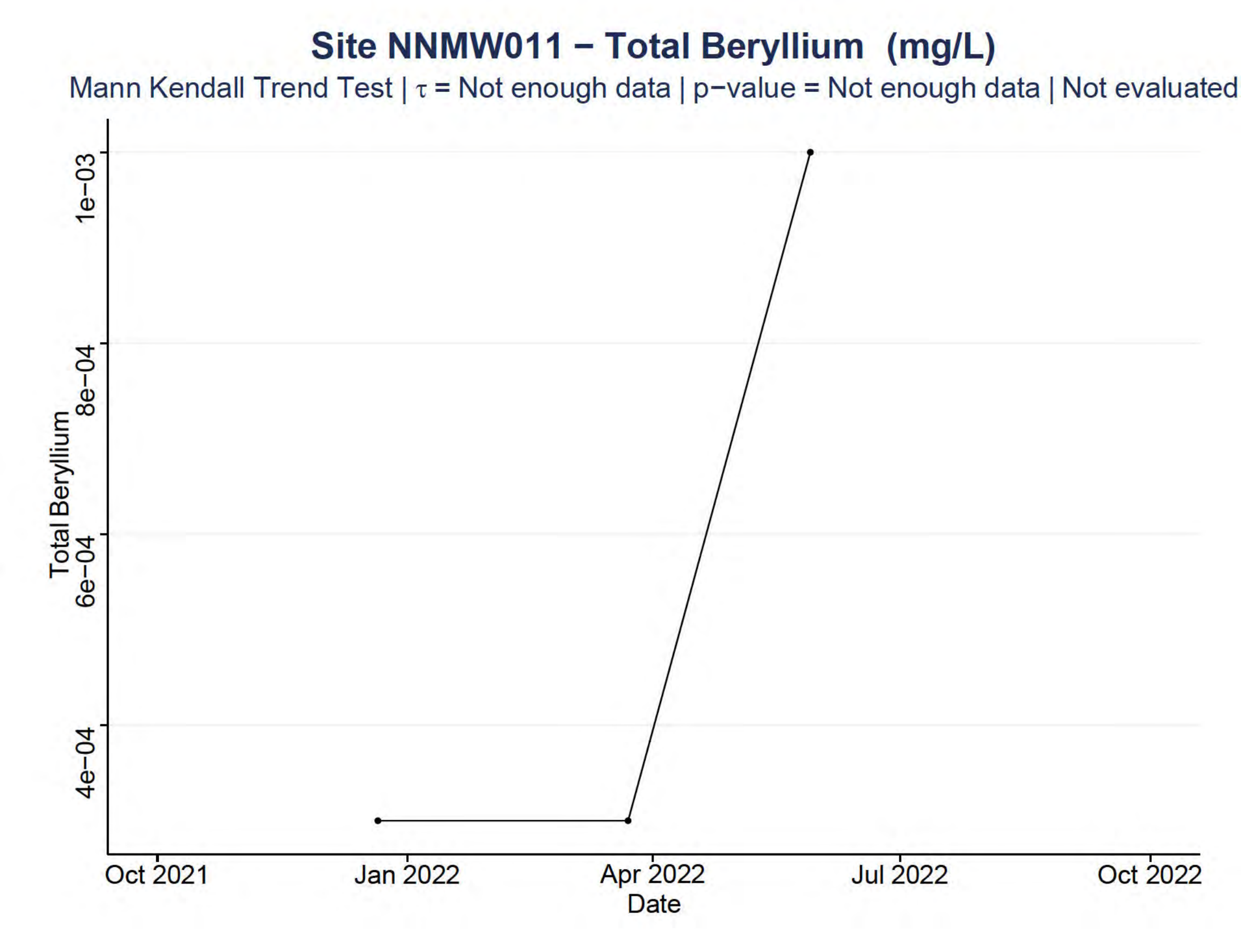

Site NNMW011 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = −0.258 | p−value = 0.773 | No trend
Sulfate
1100
1075
1050
1025
1000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

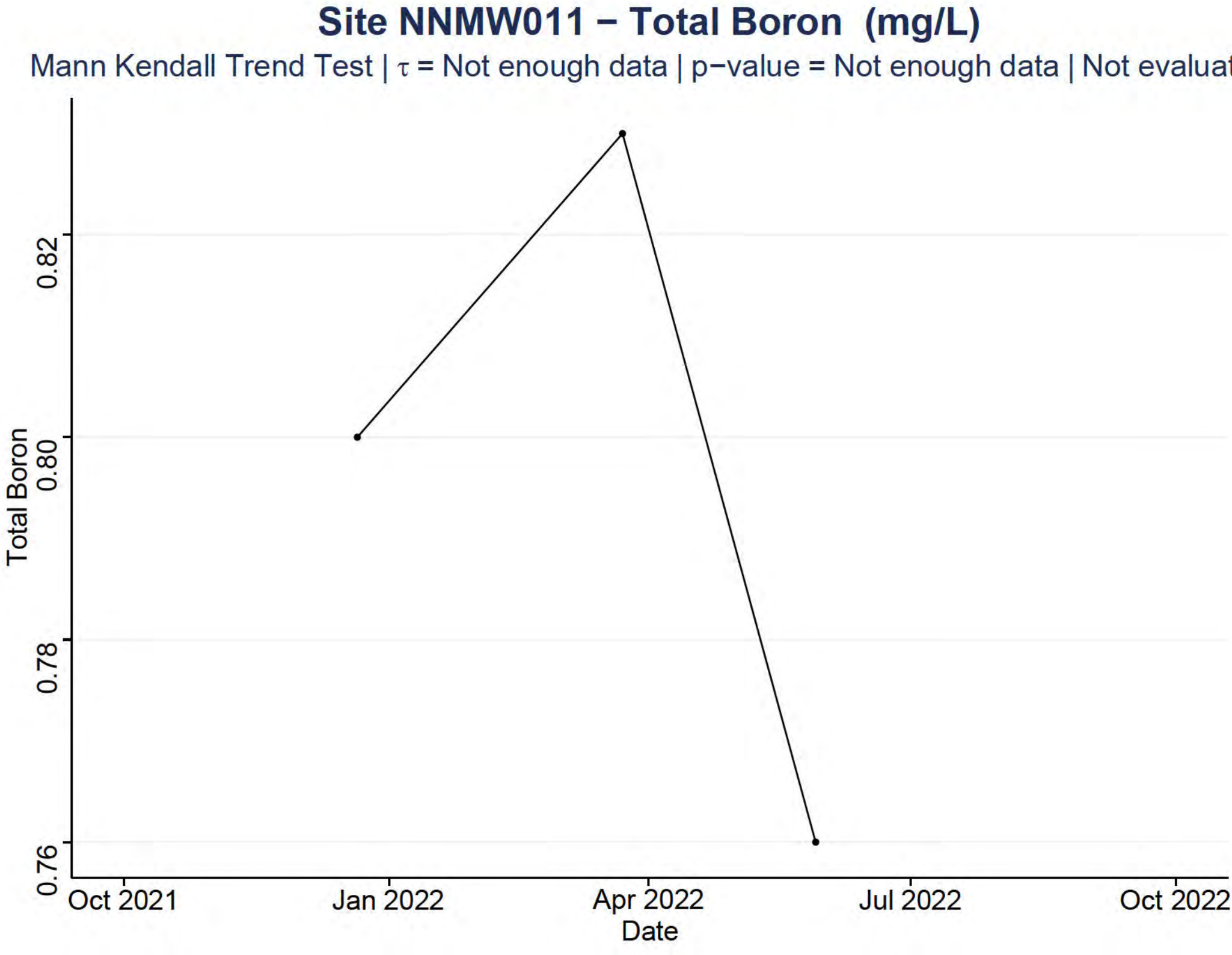

Site NNMW011 – SWL (mbtoc)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
SWL
59.5
59.6
59.7
59.8
59.9
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

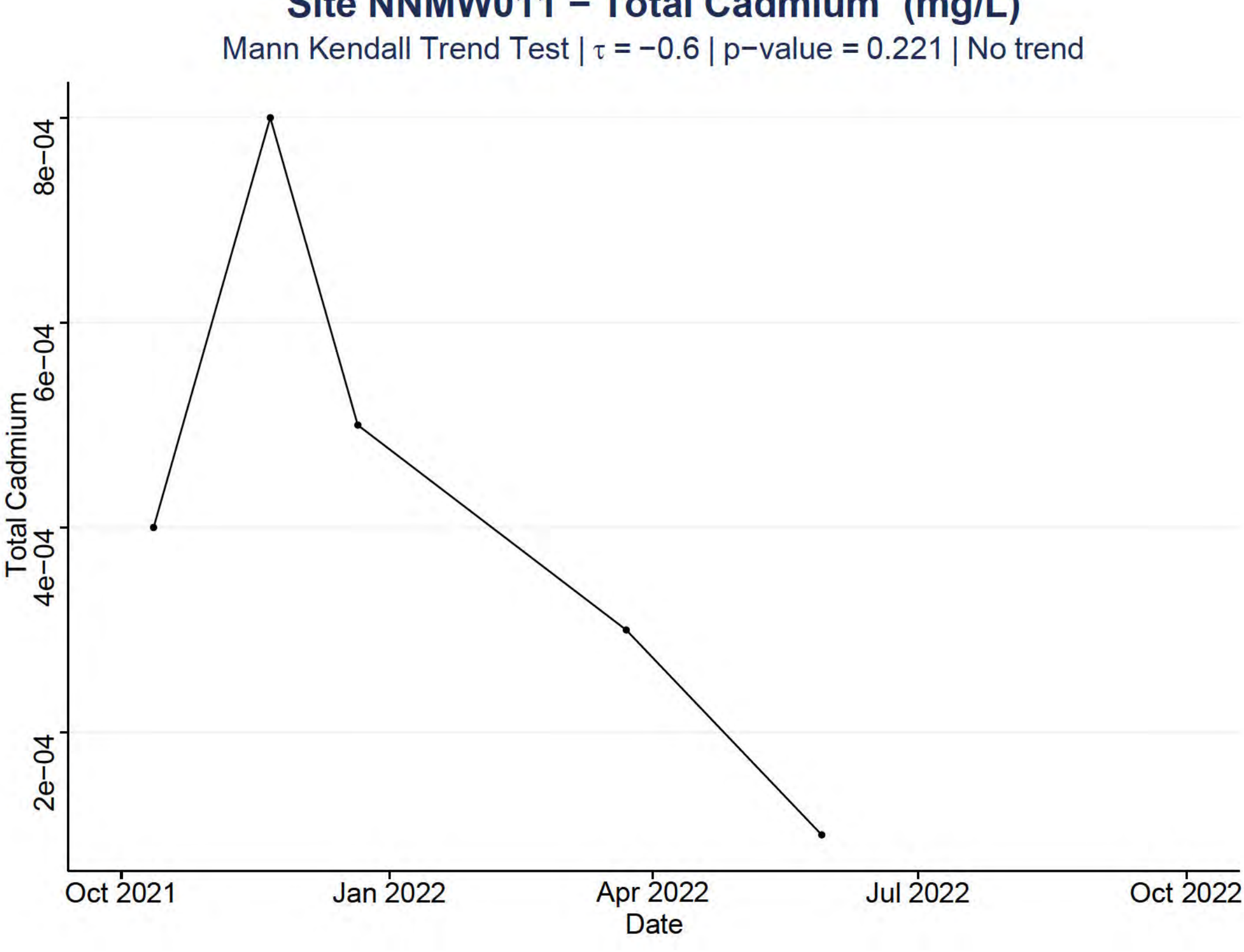

Site NNMW011 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.4 | p−value = 0.462 | No trend
Total Aluminium
0.10
0.15
0.20
0.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

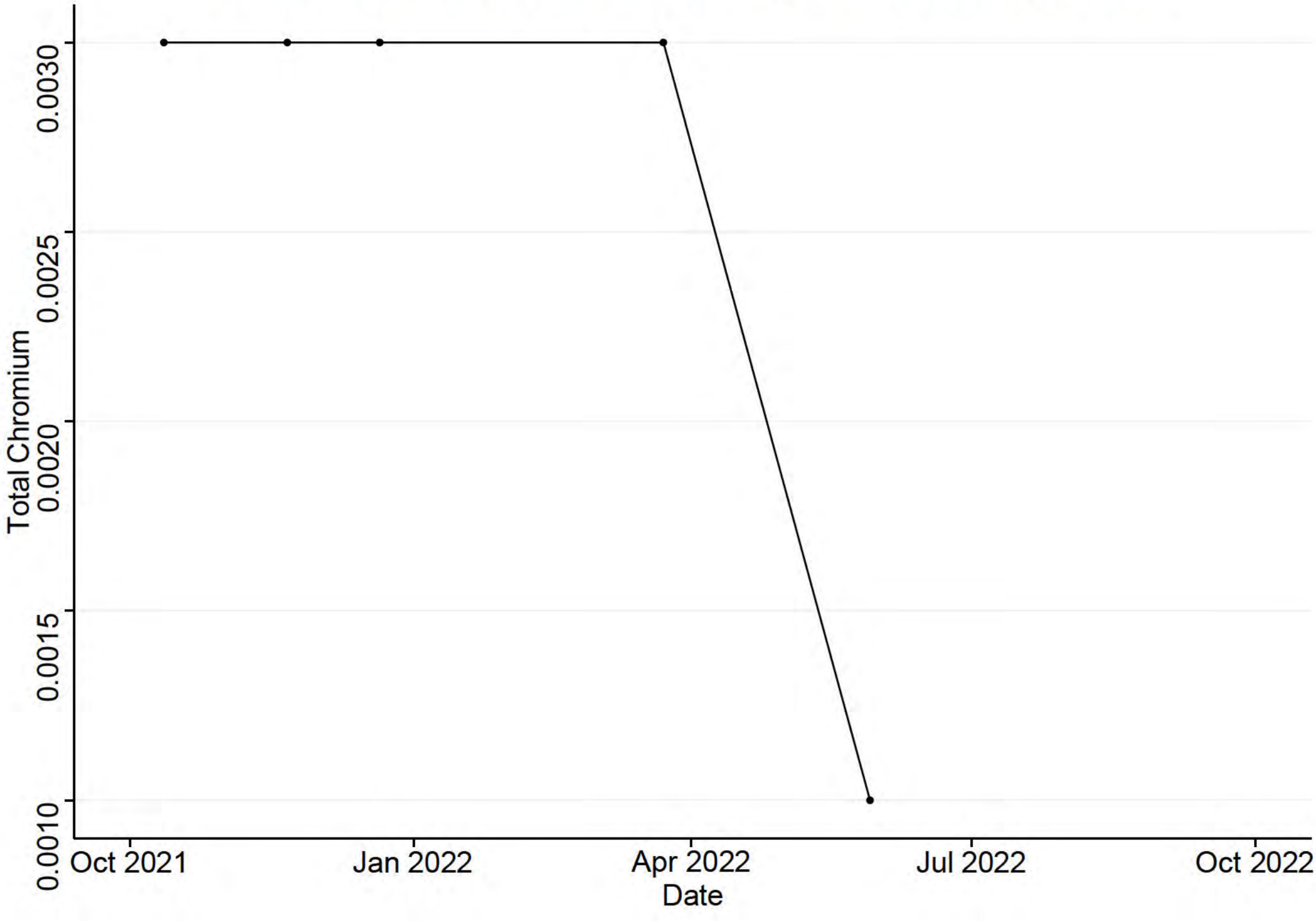

Site NNMW011 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

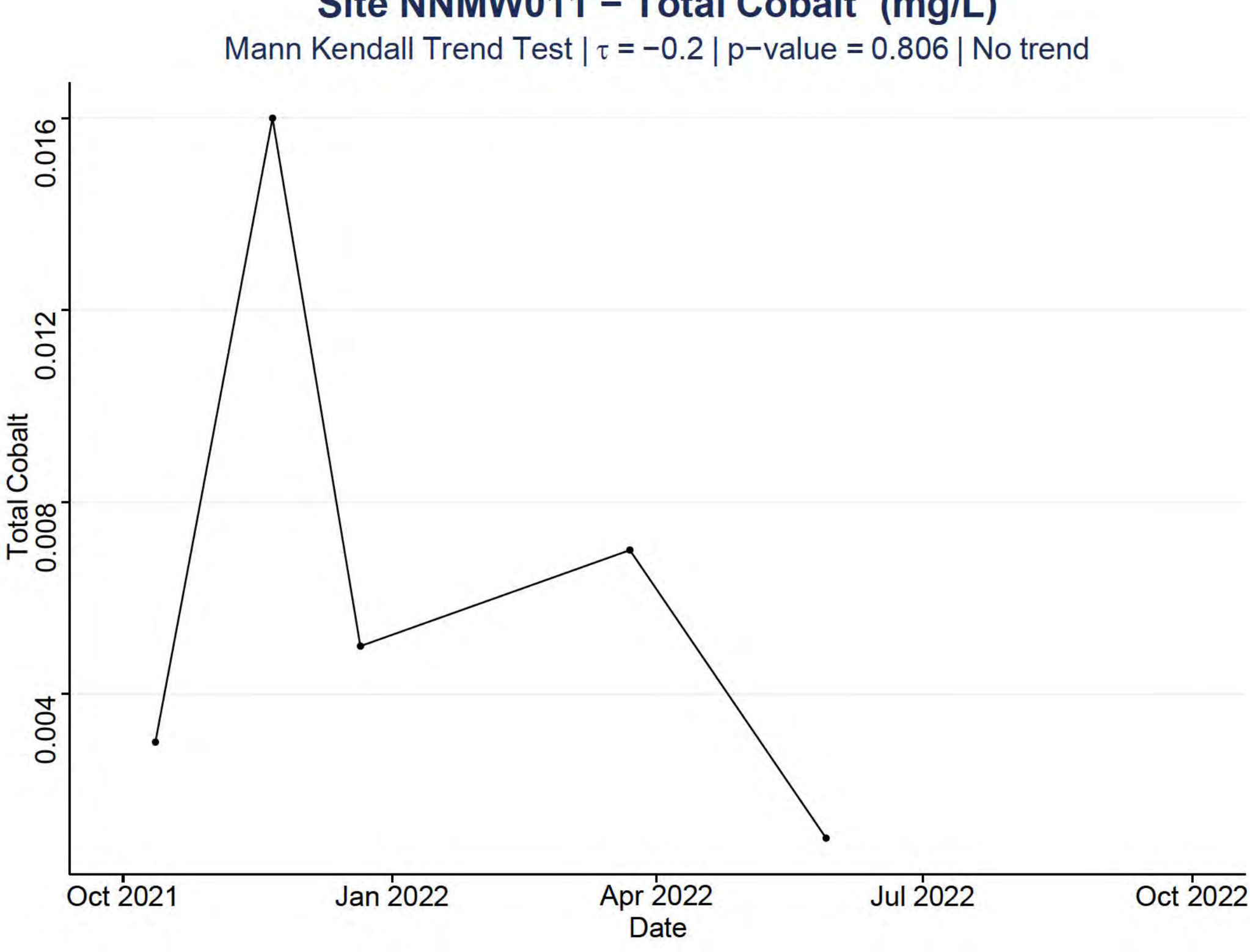

Site NNMW011 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Barium
0.028
0.027
0.026
0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

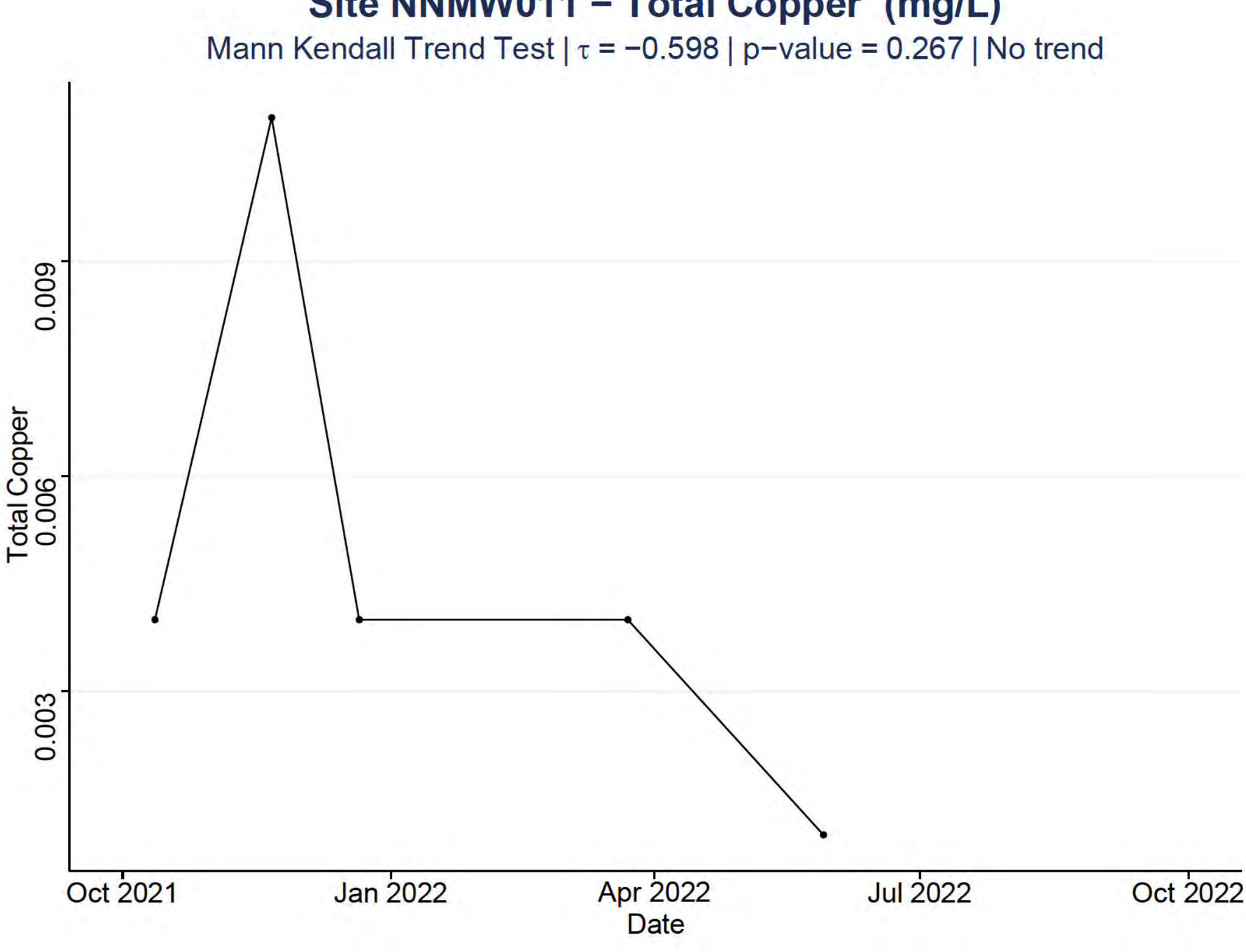

Site NNMW011 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

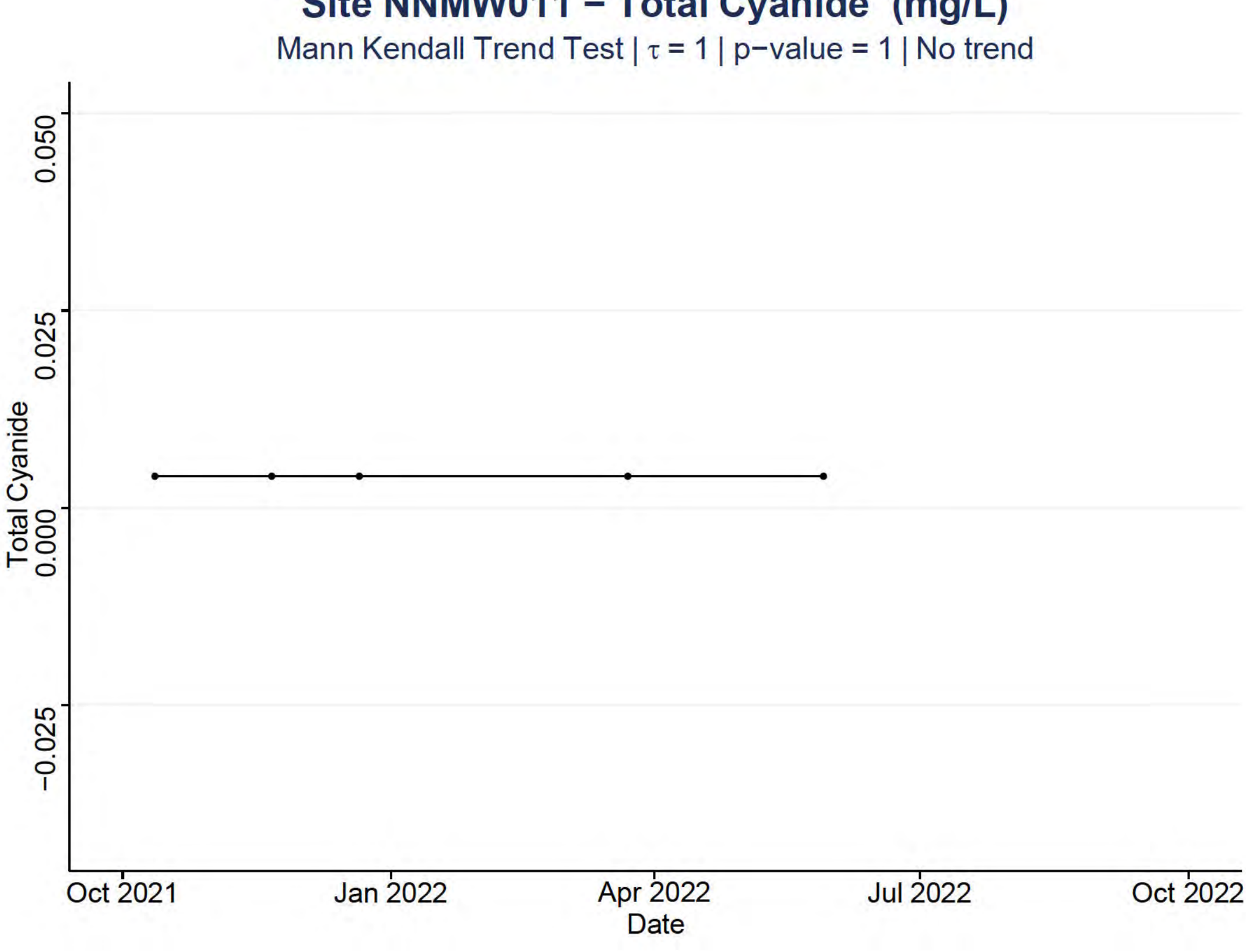

Site NNMW011 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Boron
0.82
0.80
0.78
0.76
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

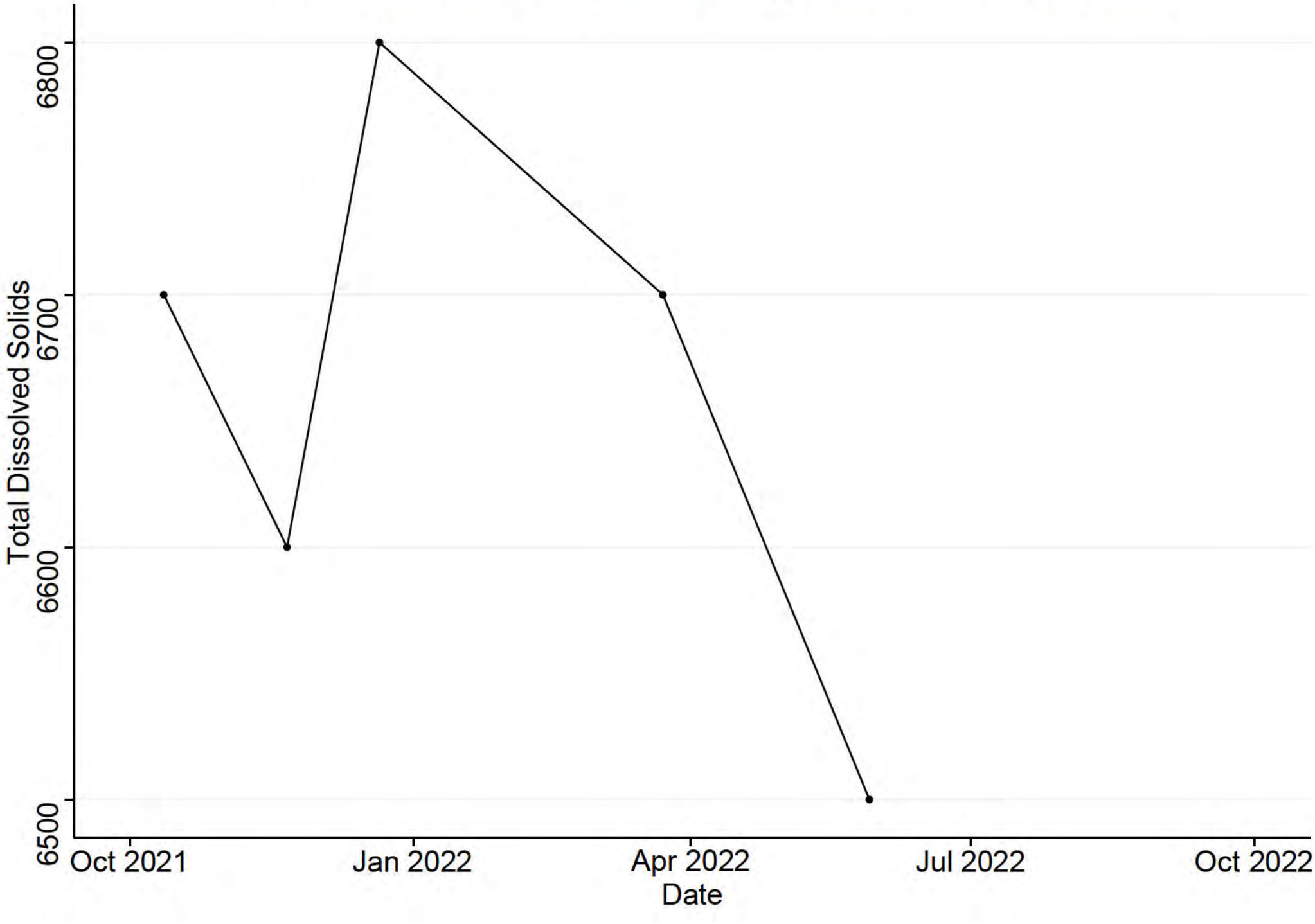

Site NNMW011 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.6 | p−value = 0.221 | No trend
Total Cadmium
8e−04
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

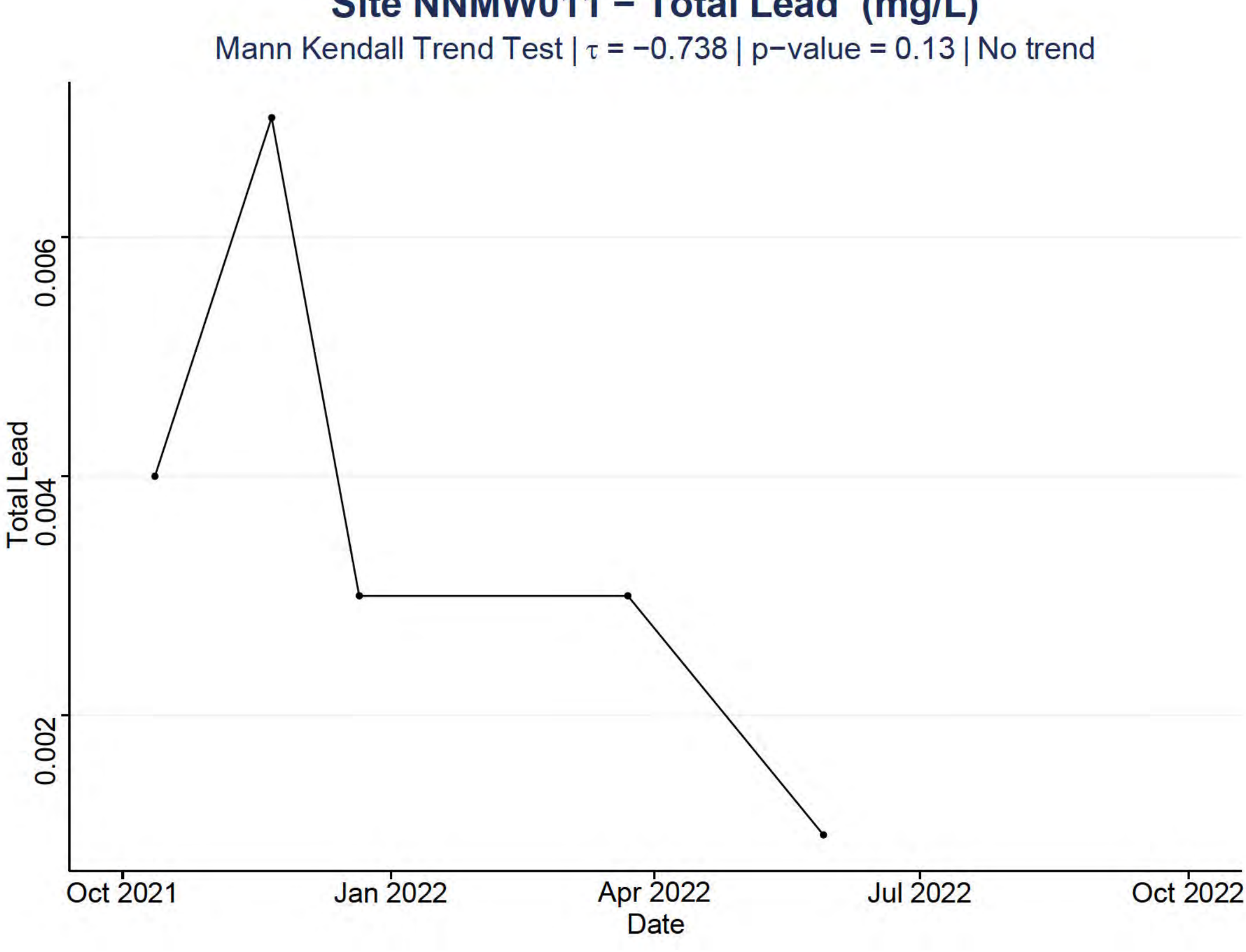

Site NNMW011 − Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Total Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

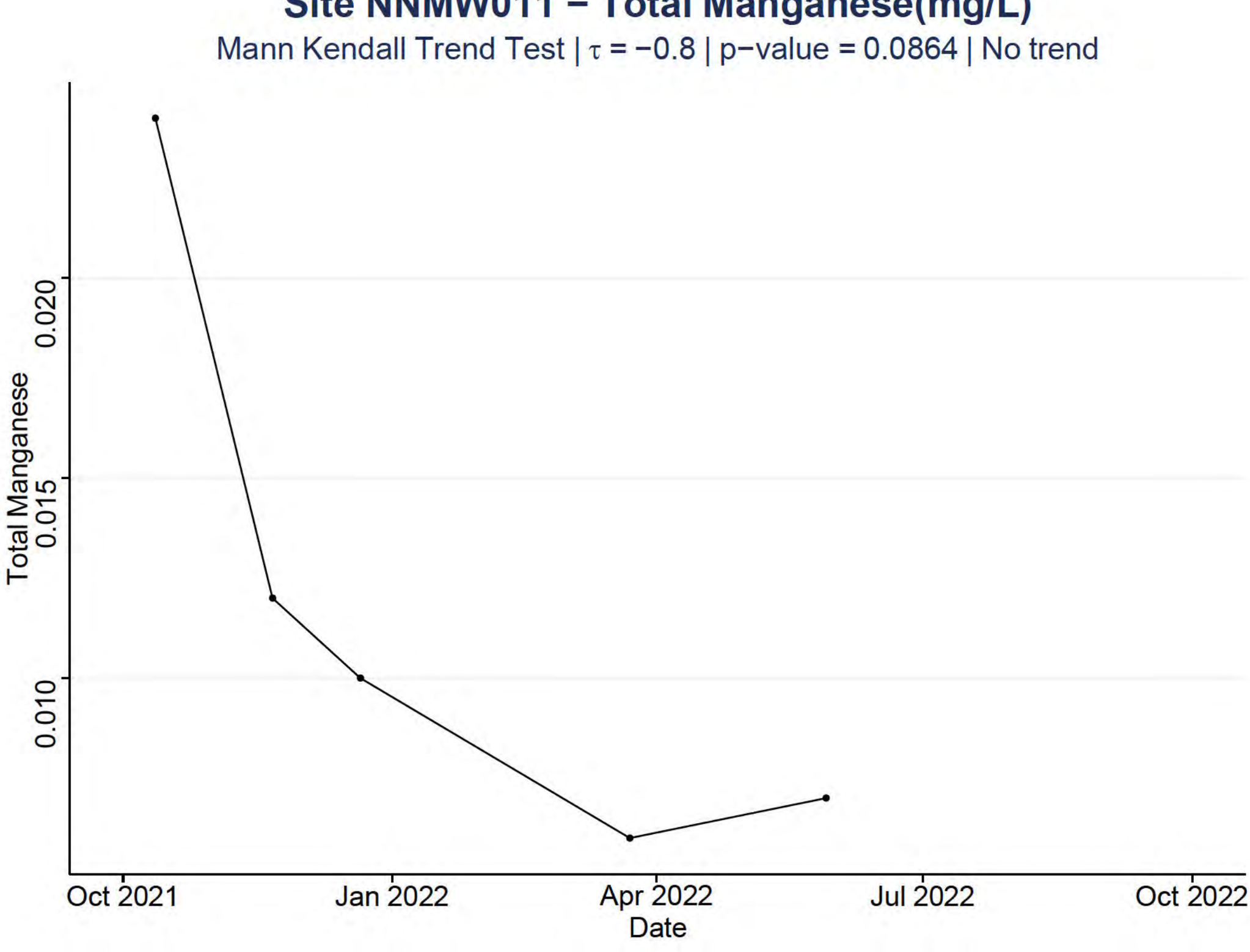

Site NNMW011 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Total Cobalt
0.016
0.012
0.008
0.004
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

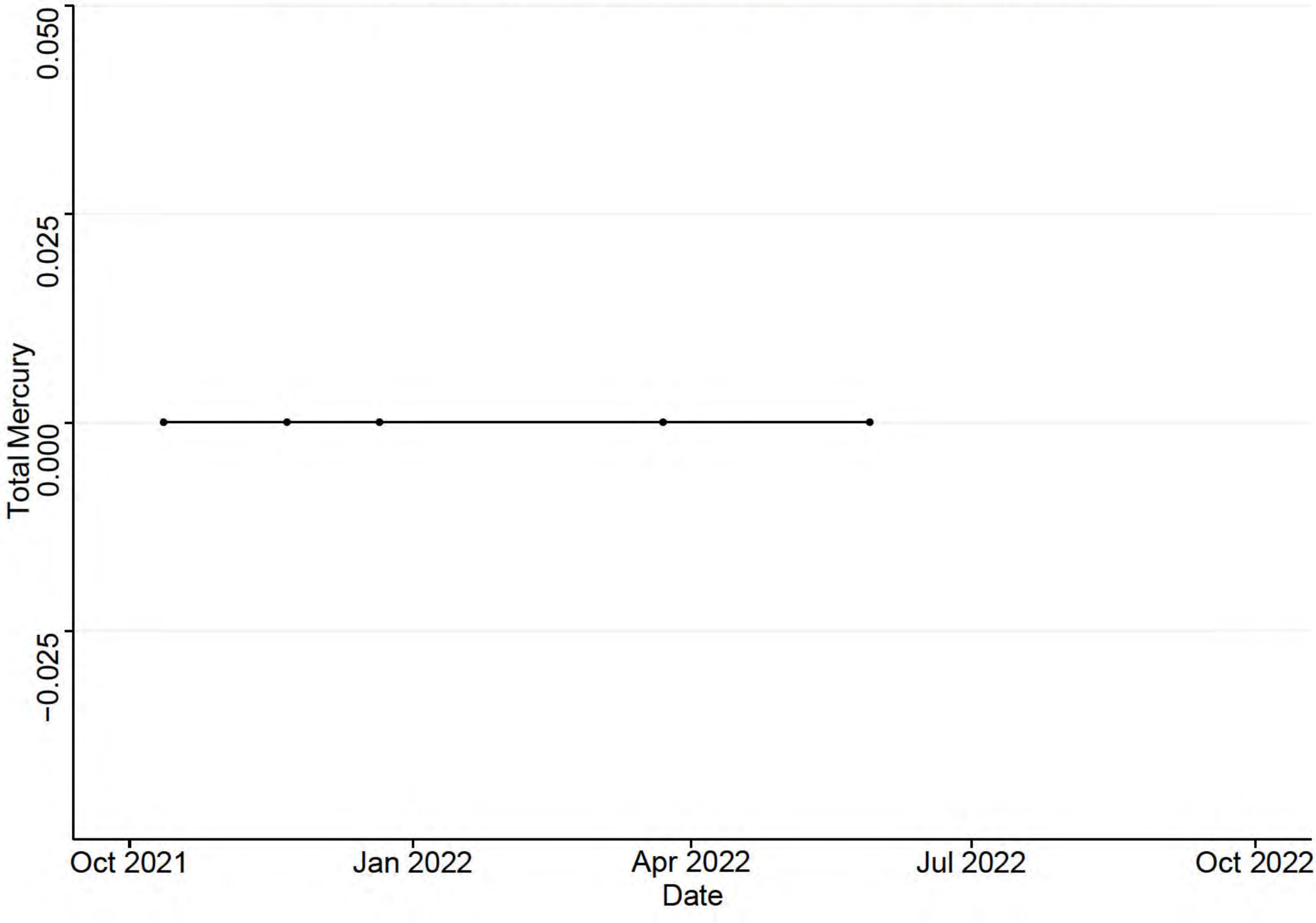

Site NNMW011 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Total Copper
0.009
0.006
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

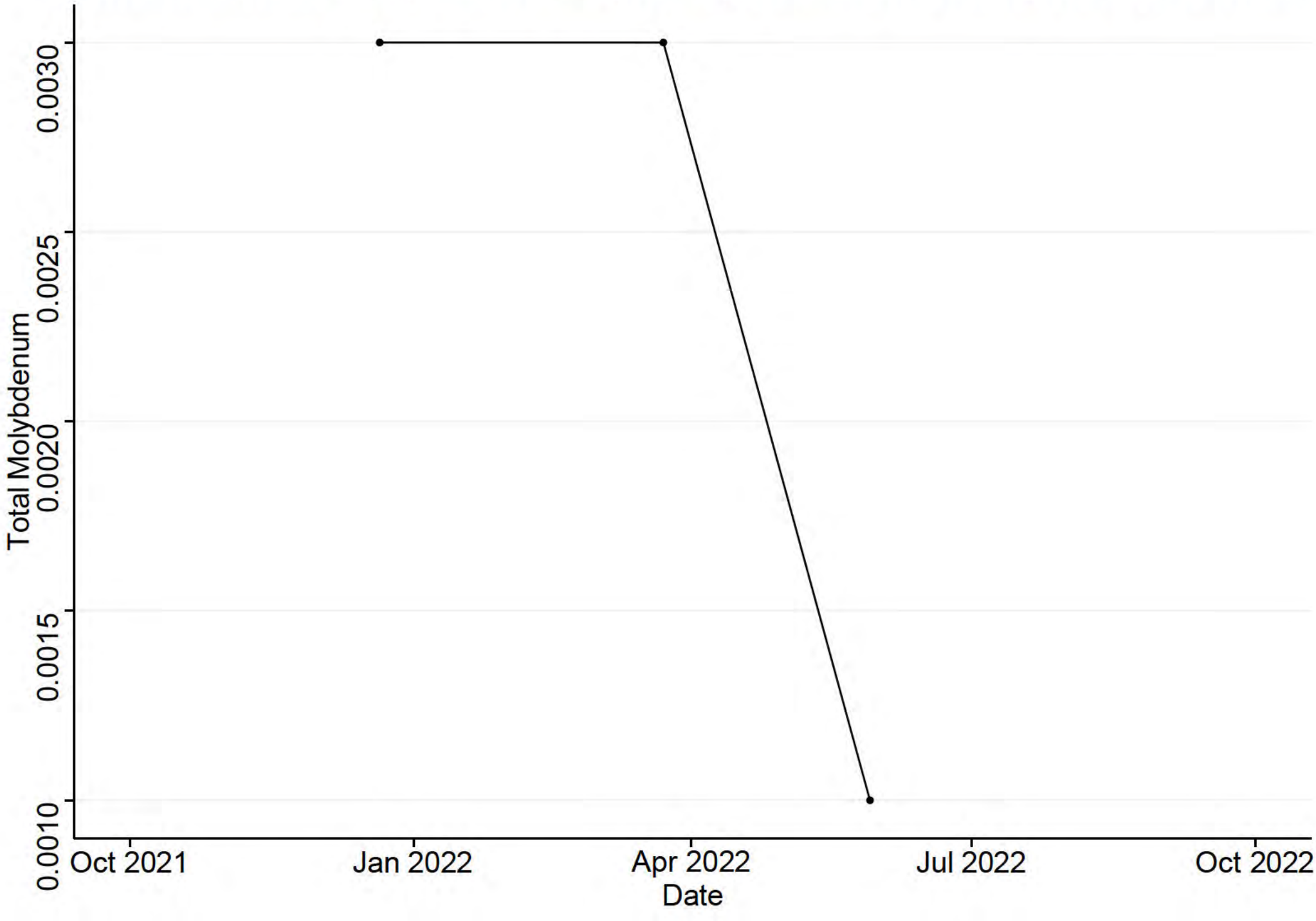

Site NNMW011 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

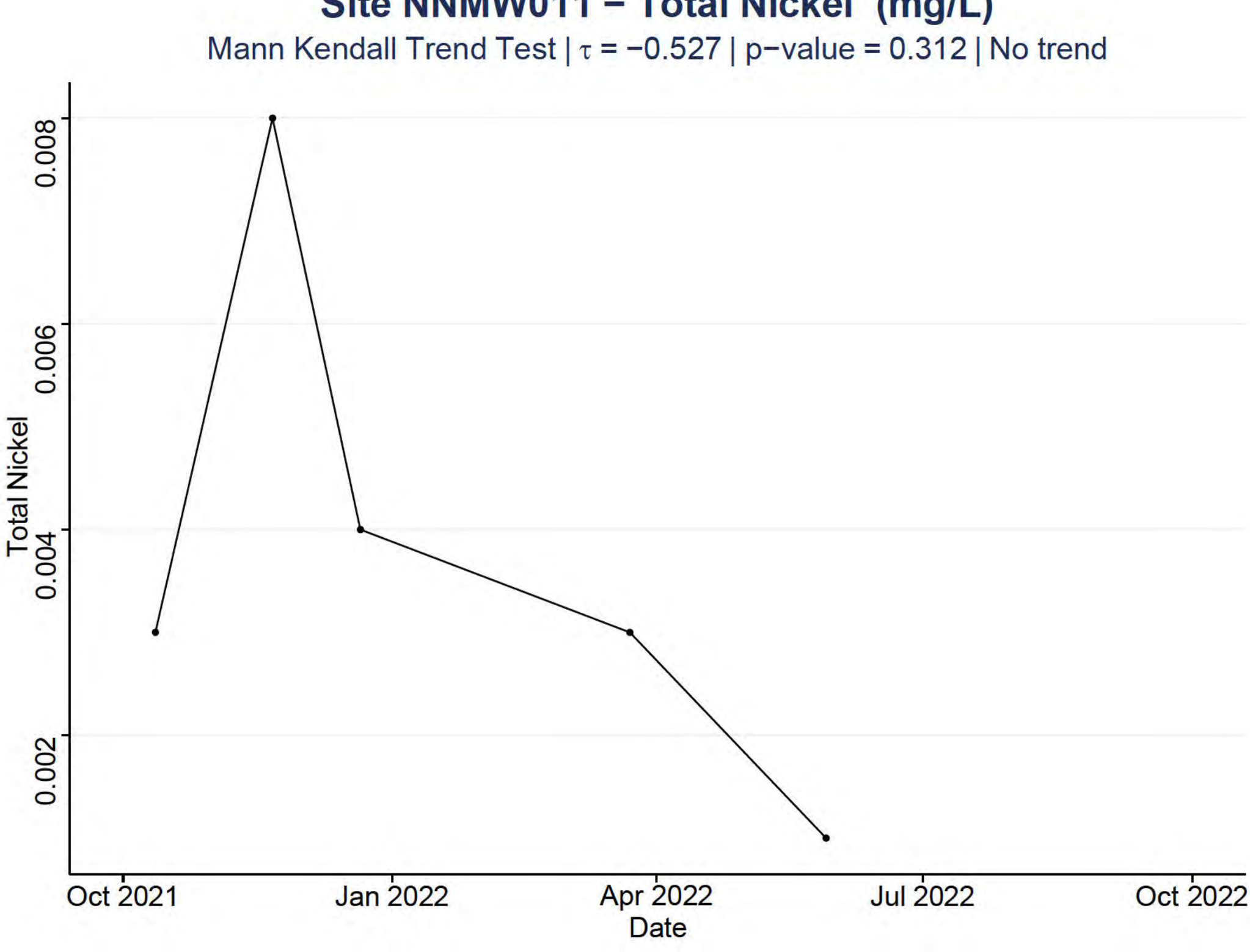

Site NNMW011 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Total Dissolved Solids
6800
6700
6600
6500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

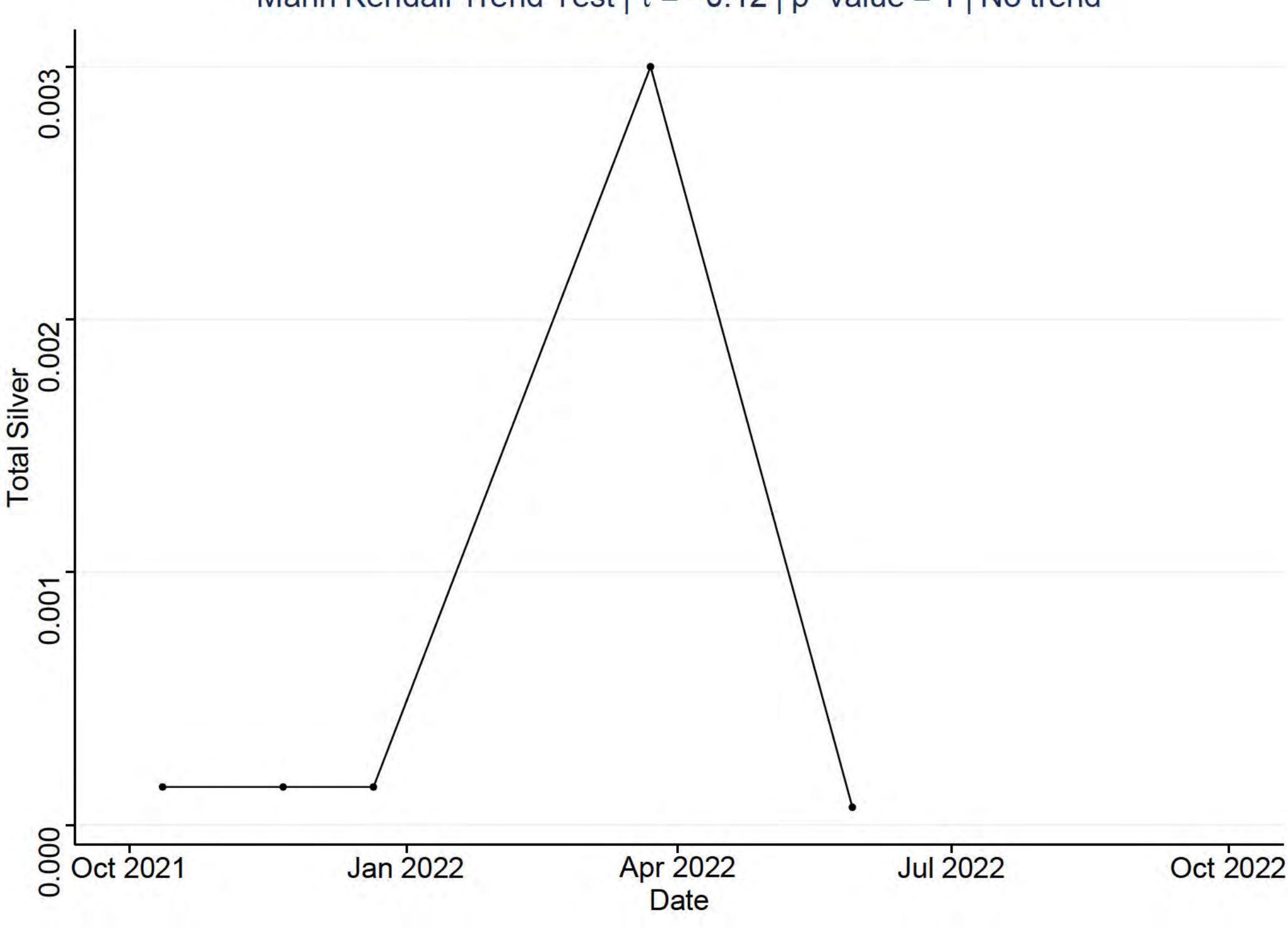

Site NNMW011 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.738 | p−value = 0.13 | No trend
Total Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

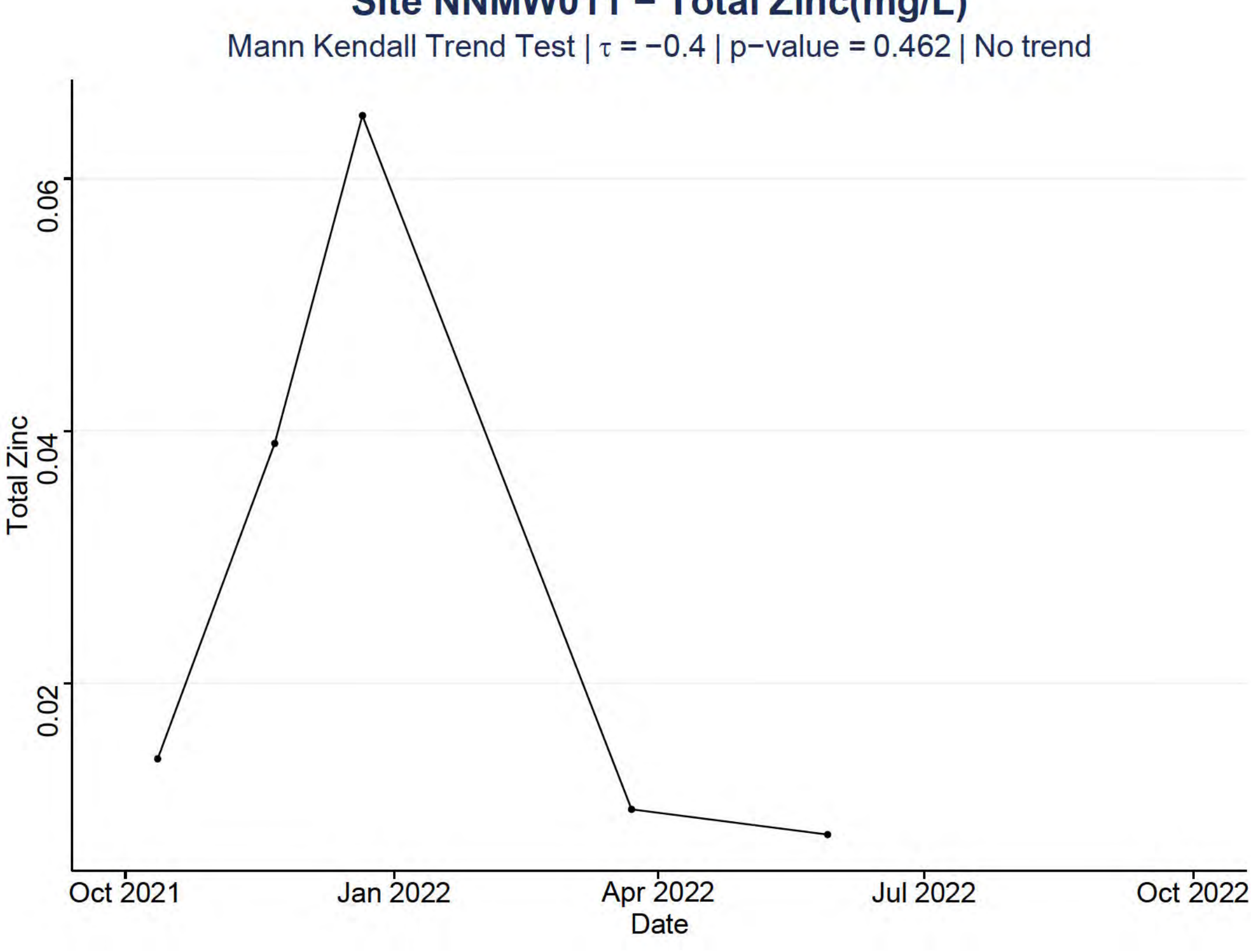

Site NNMW011 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.8 | p−value = 0.0864 | No trend
Total Manganese
0.020
0.015
0.010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

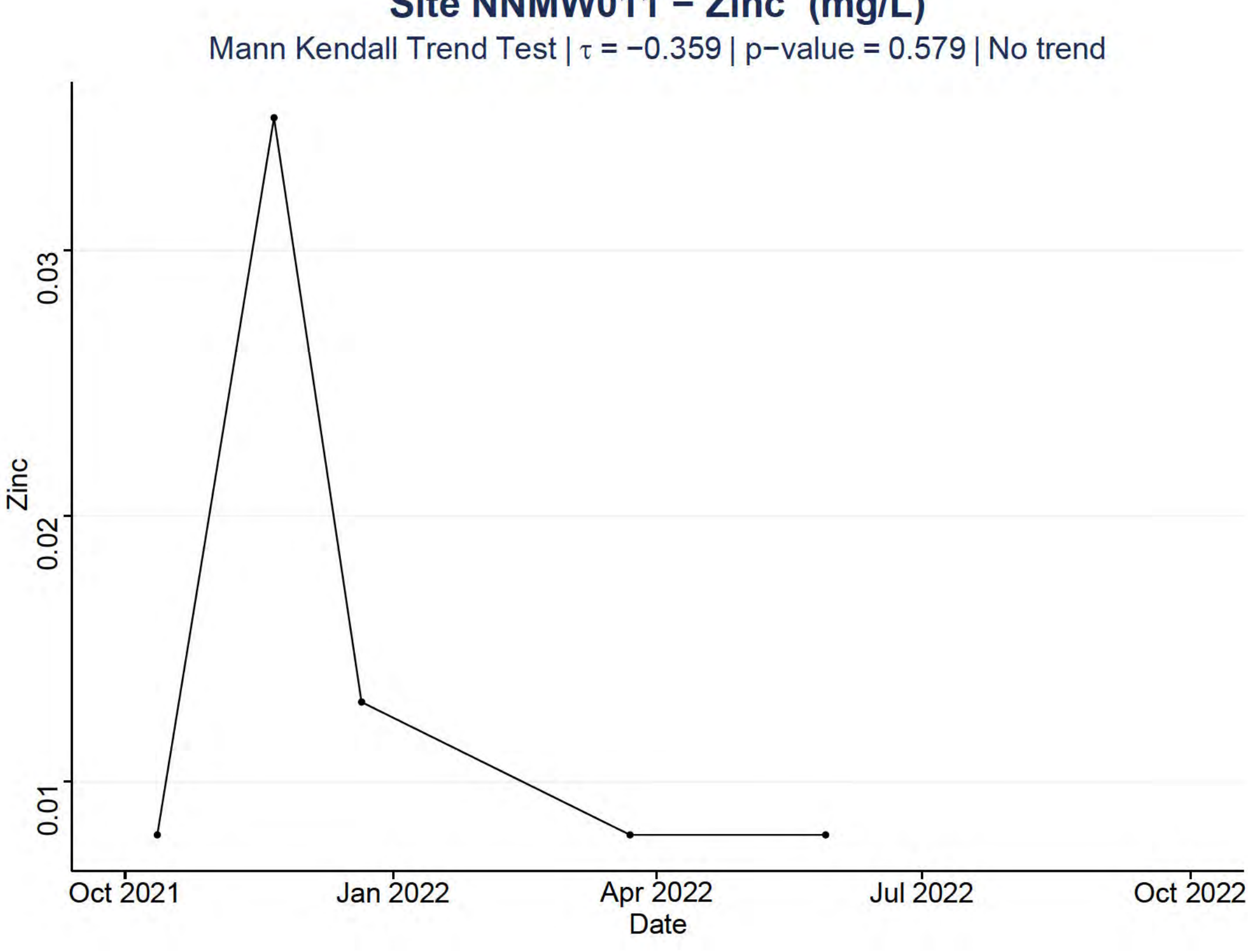

Site NNMW011 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

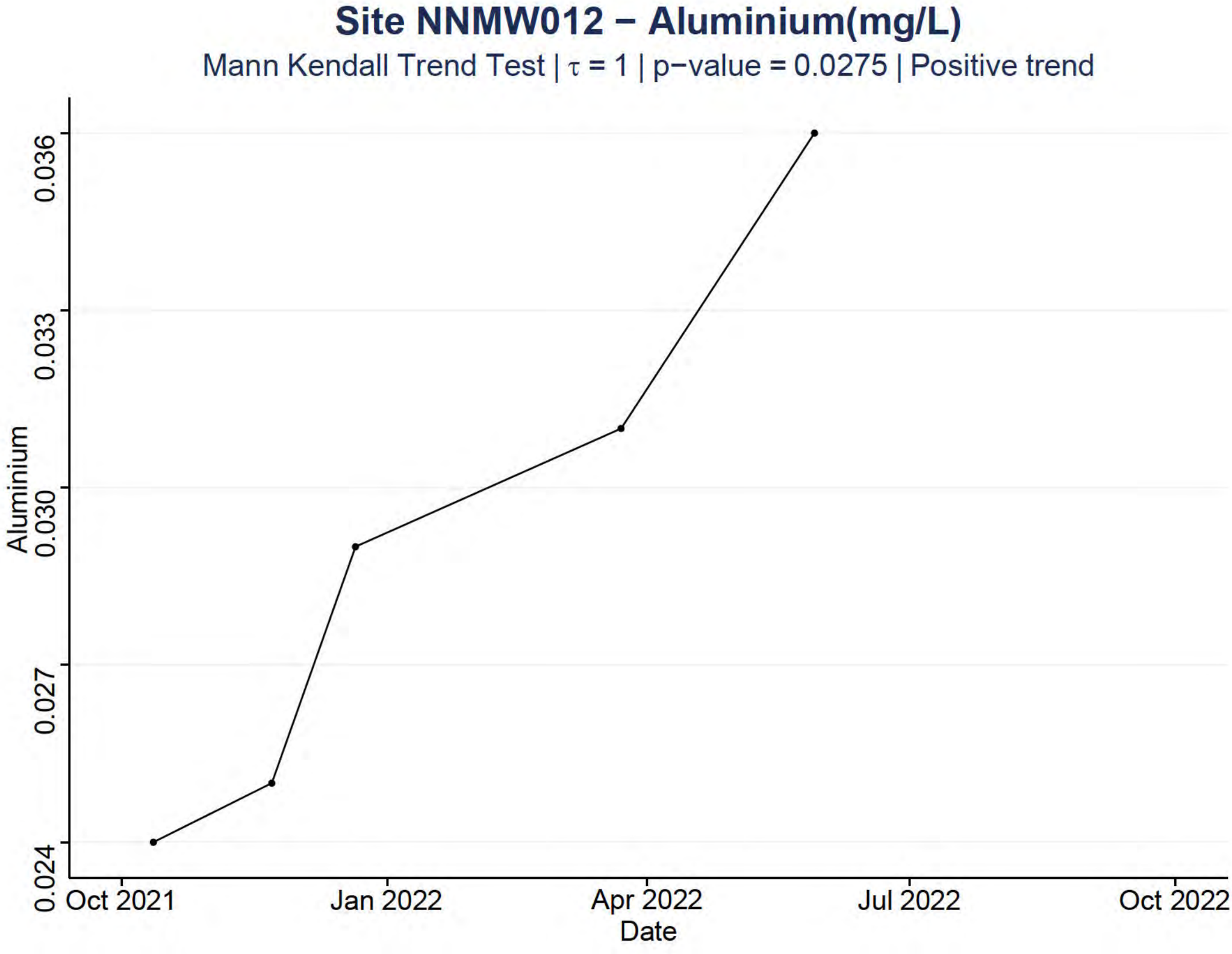

Site NNMW011 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

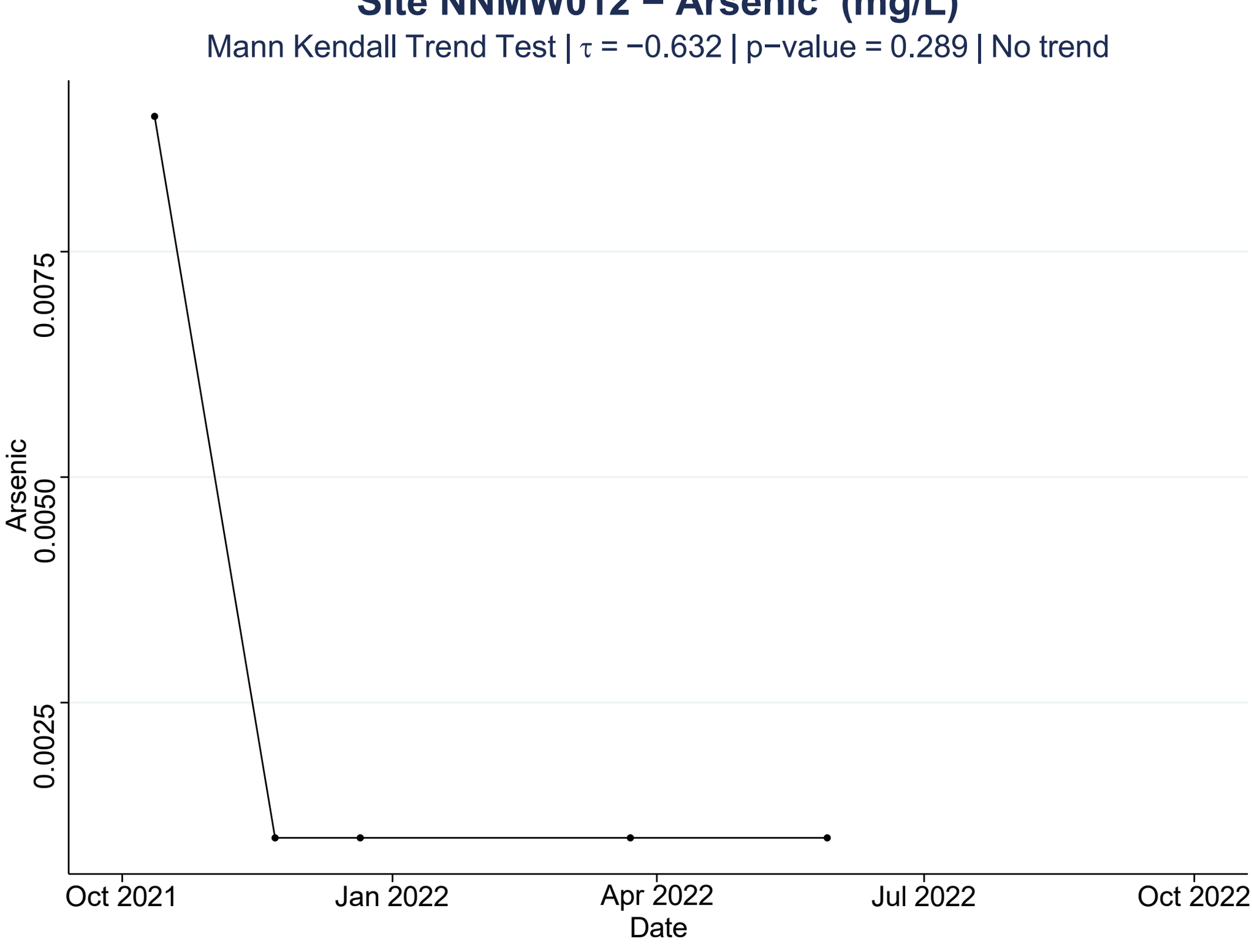

Site NNMW011 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Total Nickel
0.002
0.004
0.006
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW011 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = −0.12 | p−value = 1 | No trend
Total Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW011 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.4 | p−value = 0.462 | No trend
Total Zinc
0.06
0.04
0.02
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

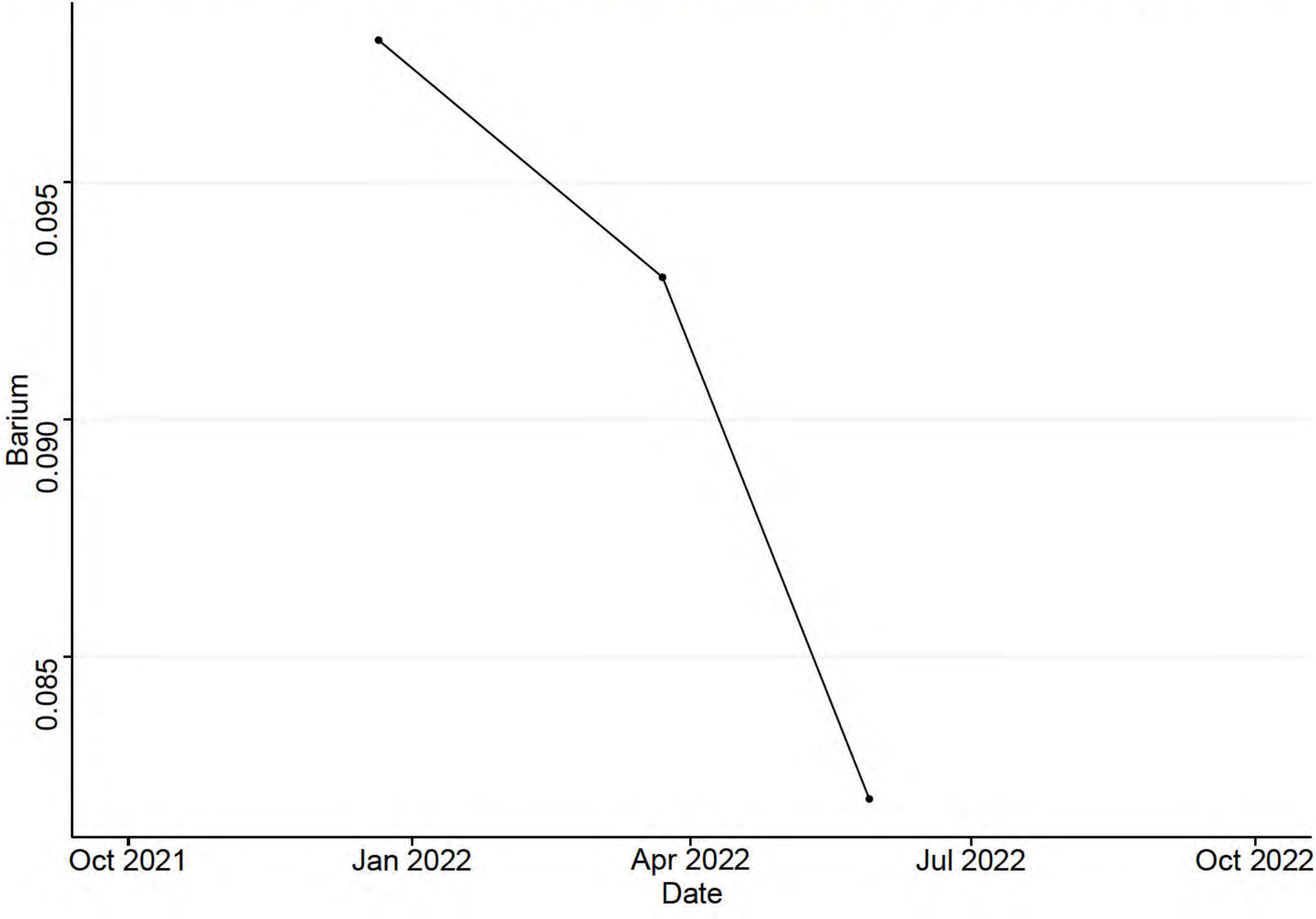

Site NNMW011 – Zinc (mg/L)
Mann Kendall Trend Test | τ = −0.359 | p−value = 0.579 | No trend
Zinc
0.03
0.02
0.01
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

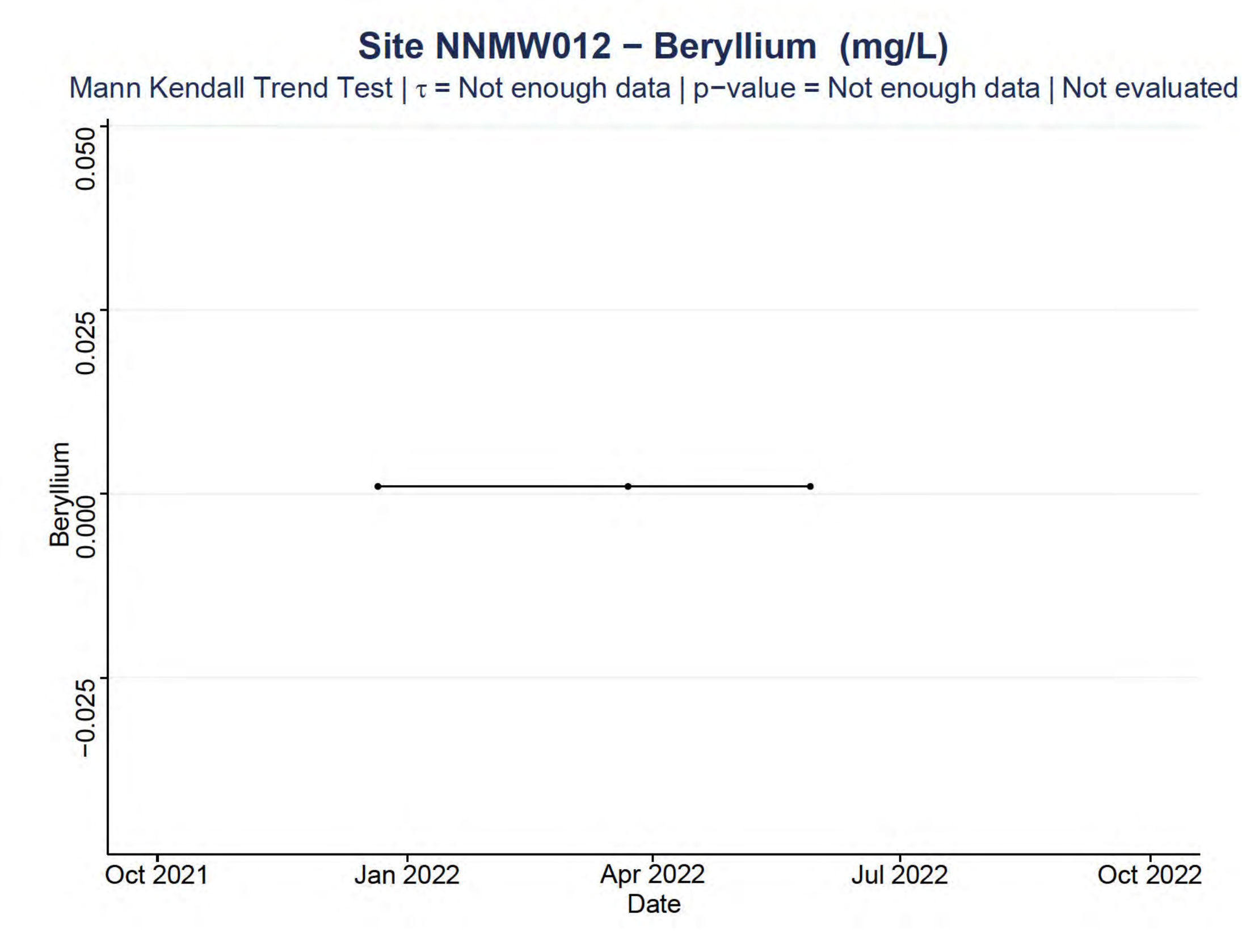

Site NNMW012 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 0.0275 | Positive trend
Aluminium
0.024
0.027
0.030
0.033
0.036
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

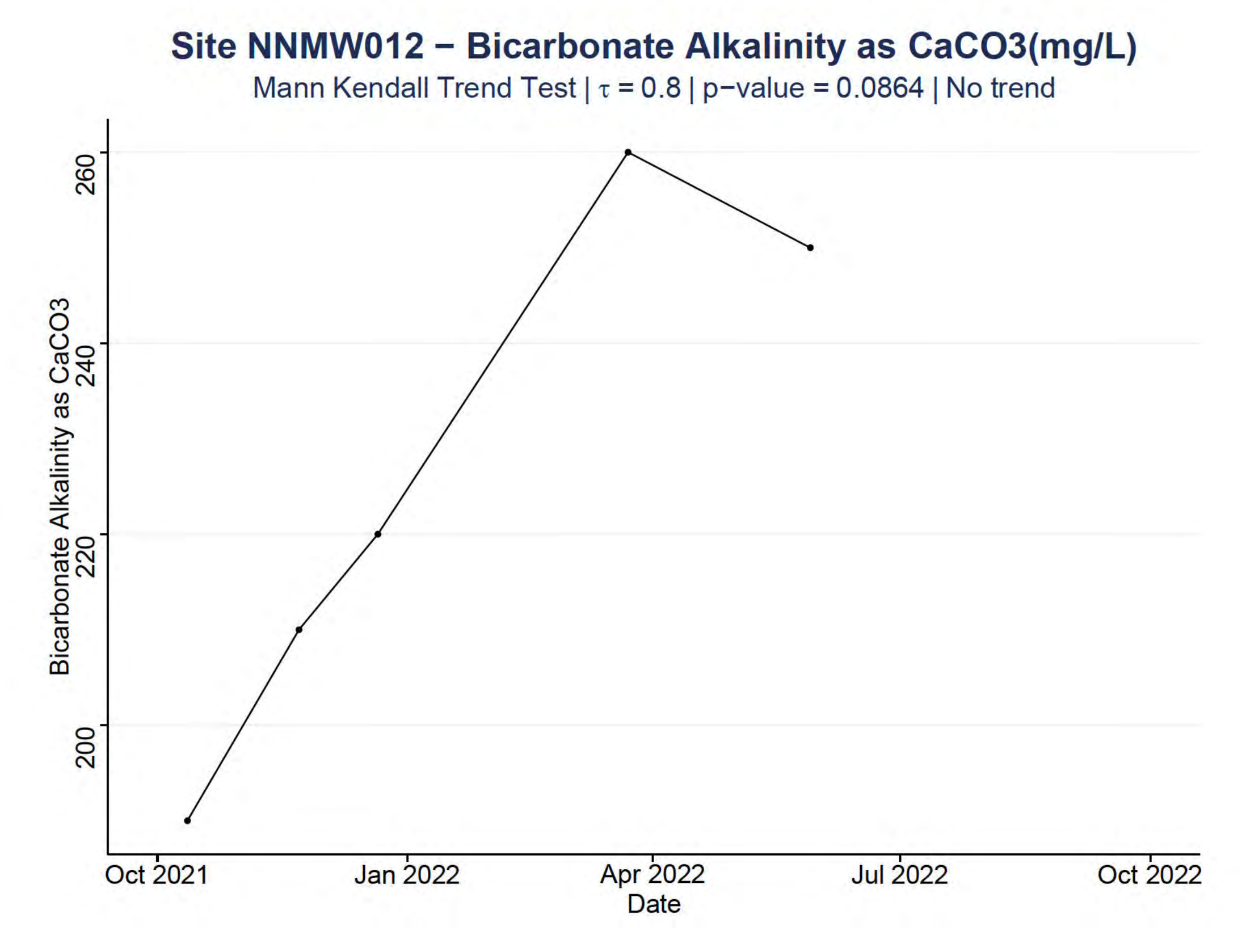

Site NNMW012 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

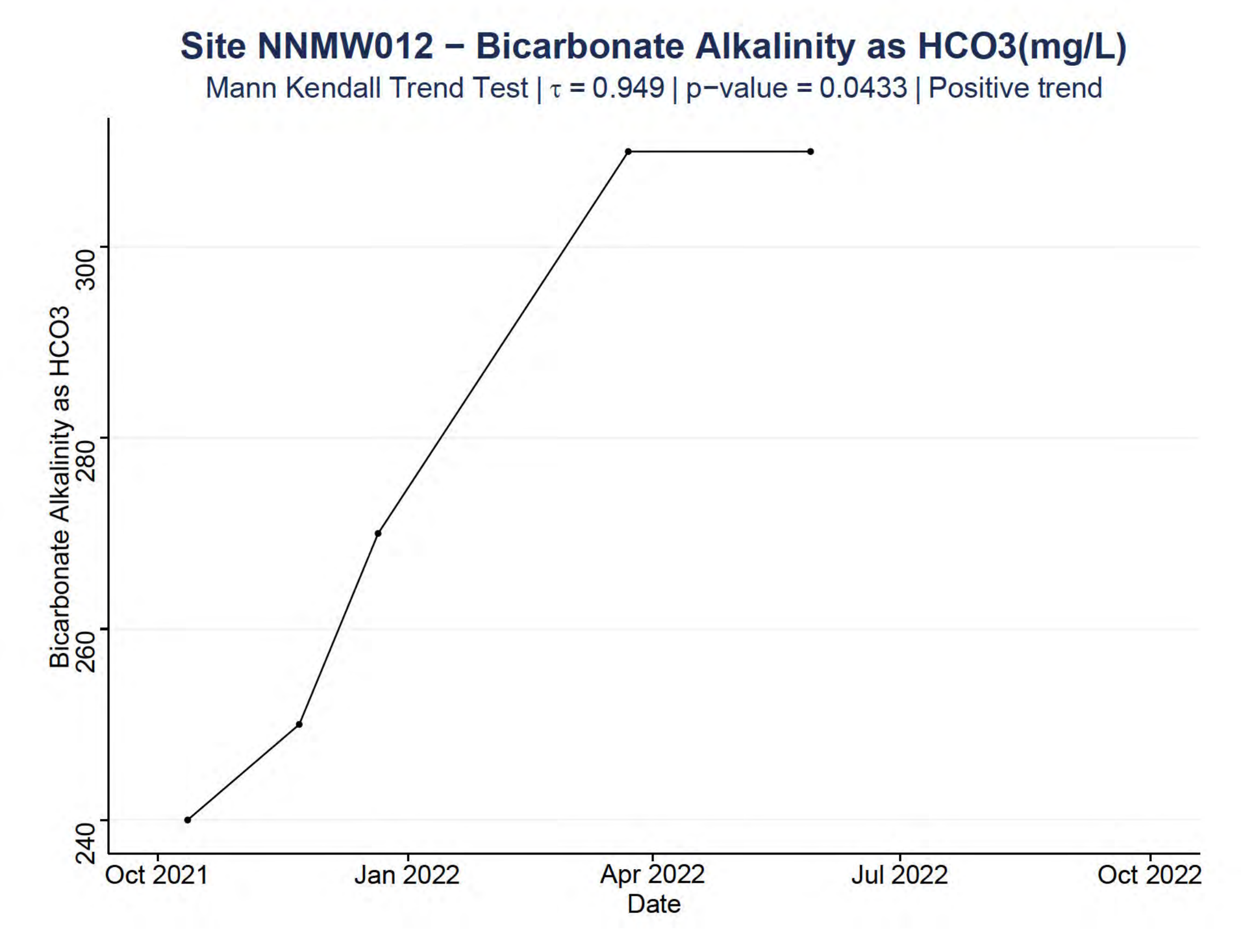
Site NNMW012 − Barium(mg/L)

Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated



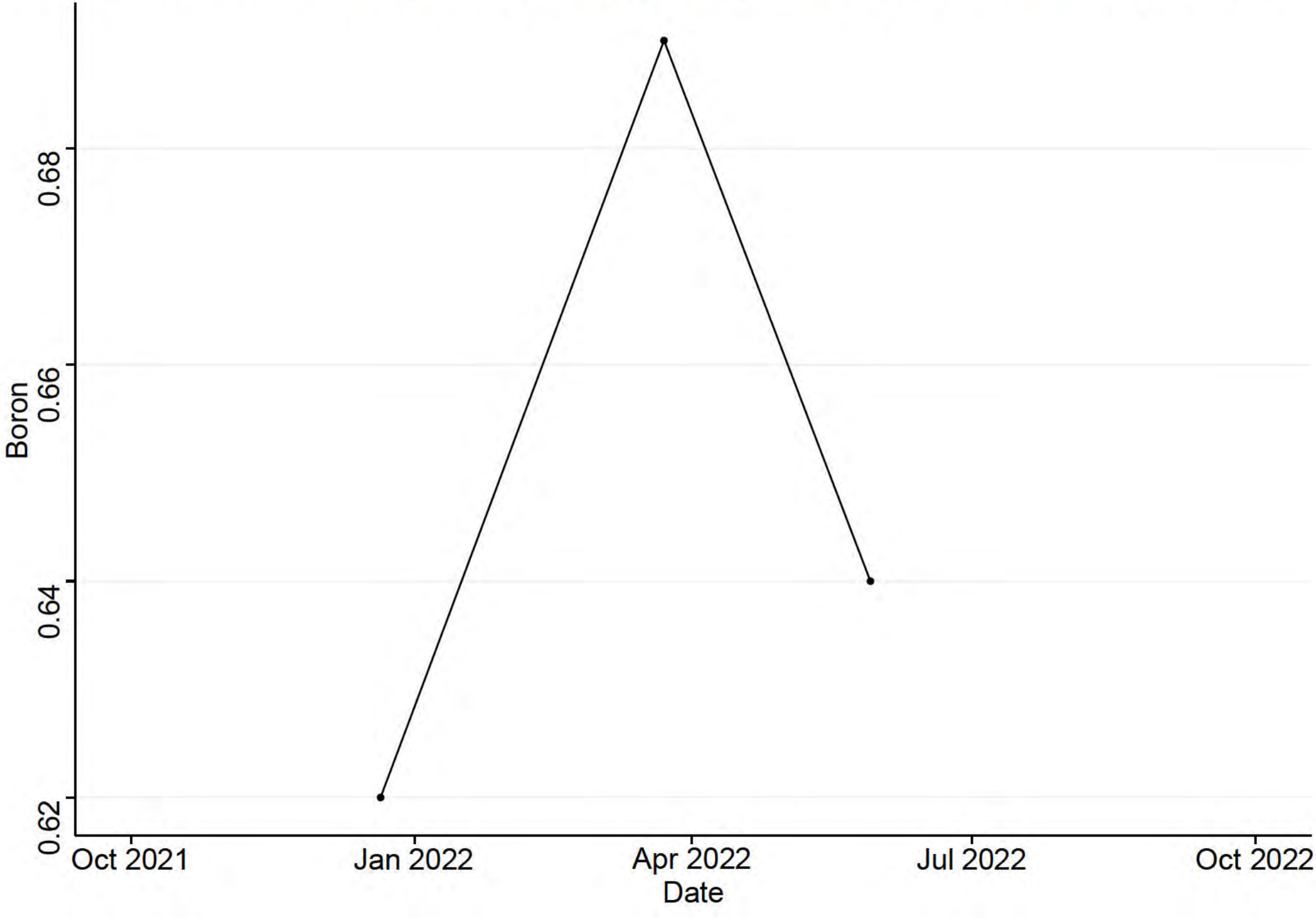

Site NNMW012 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Beryllium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

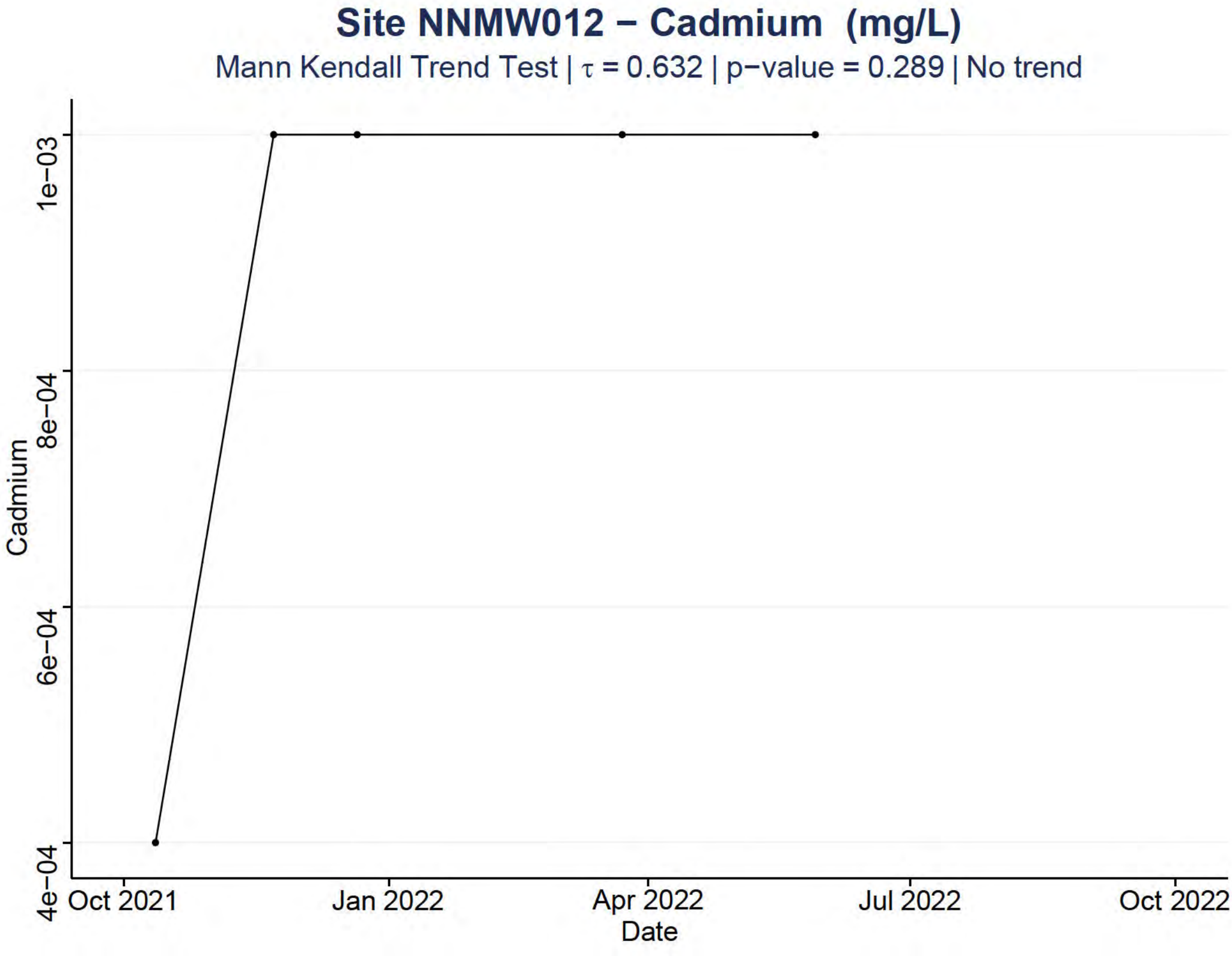

Site NNMW012 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.8 | p−value = 0.0864 | No trend
Bicarbonate Alkalinity as CaCO3
200
220
240
260
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

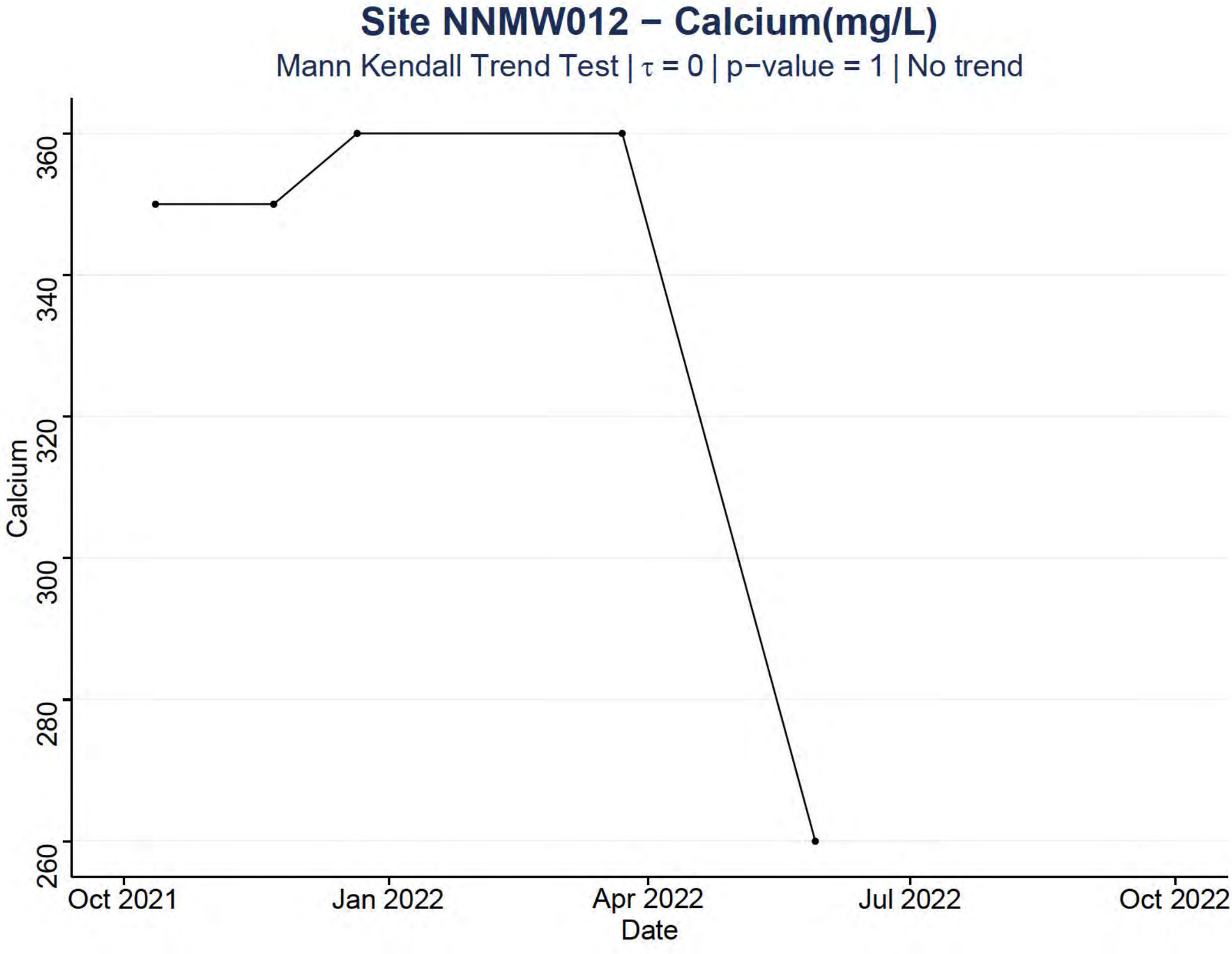

Site NNMW012 – Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.949 | p−value = 0.0433 | Positive trend
Bicarbonate Alkalinity as HCO3
240
260
280
300
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

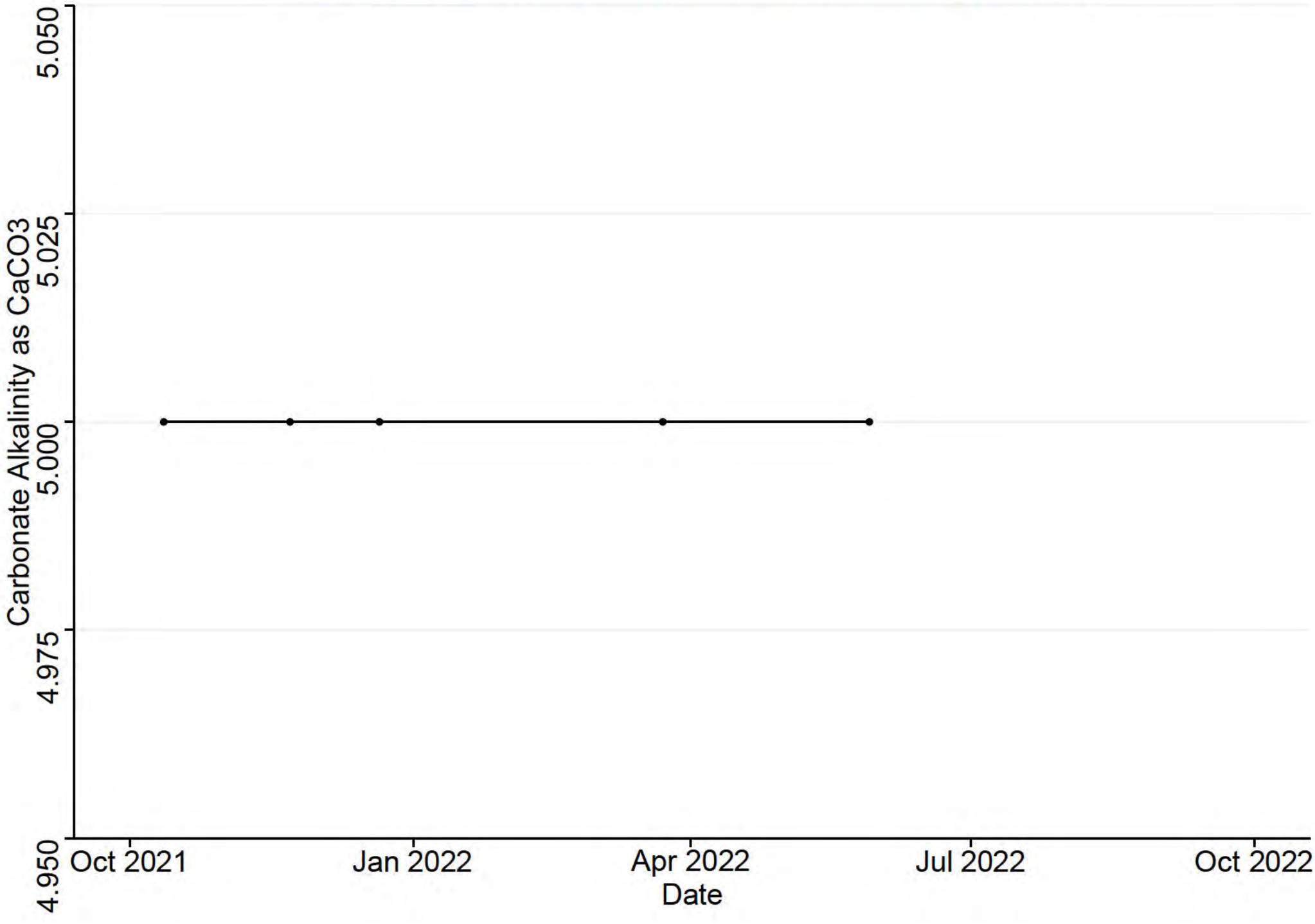
Site NNMW012 – Boron(mg/L)

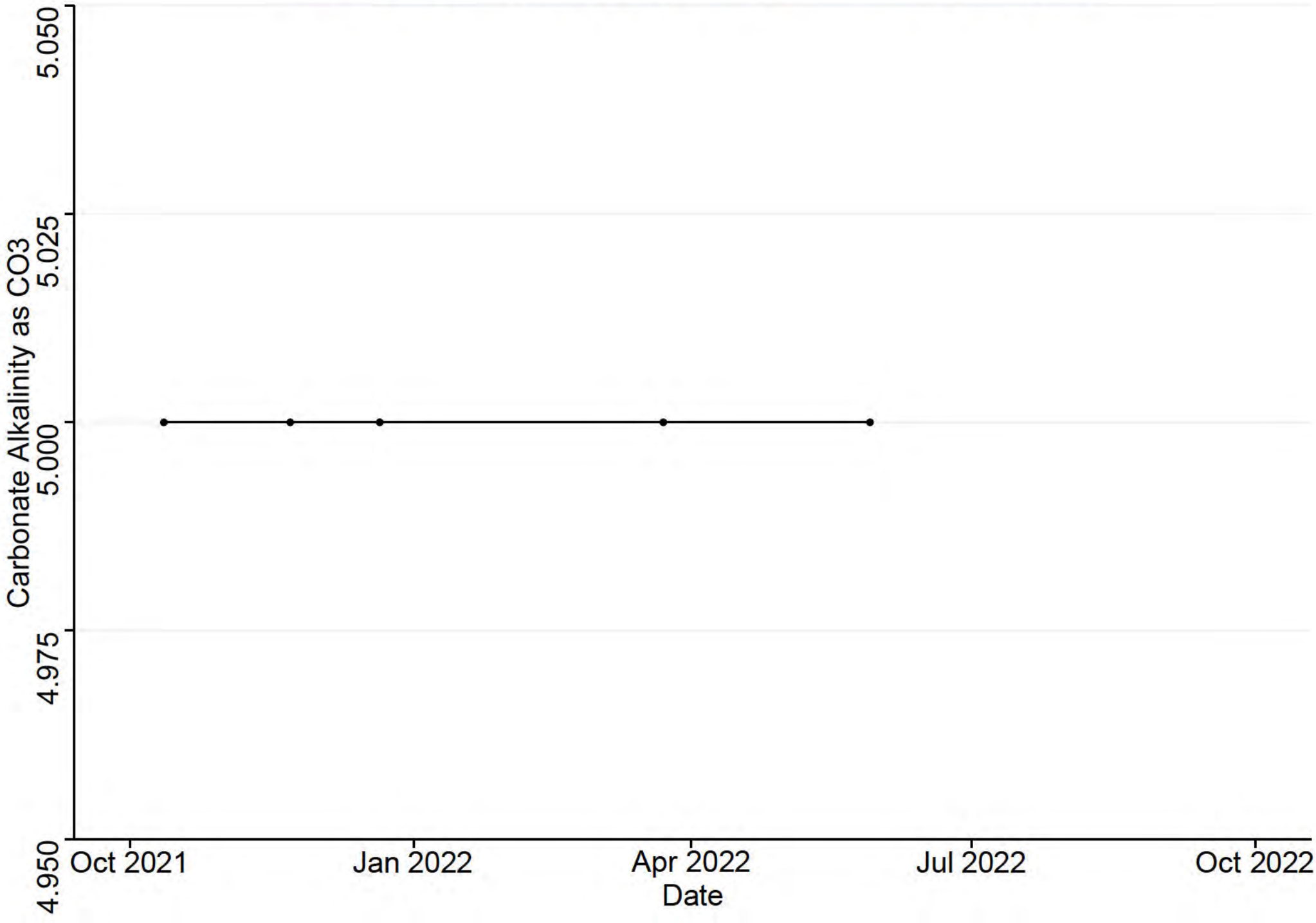
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

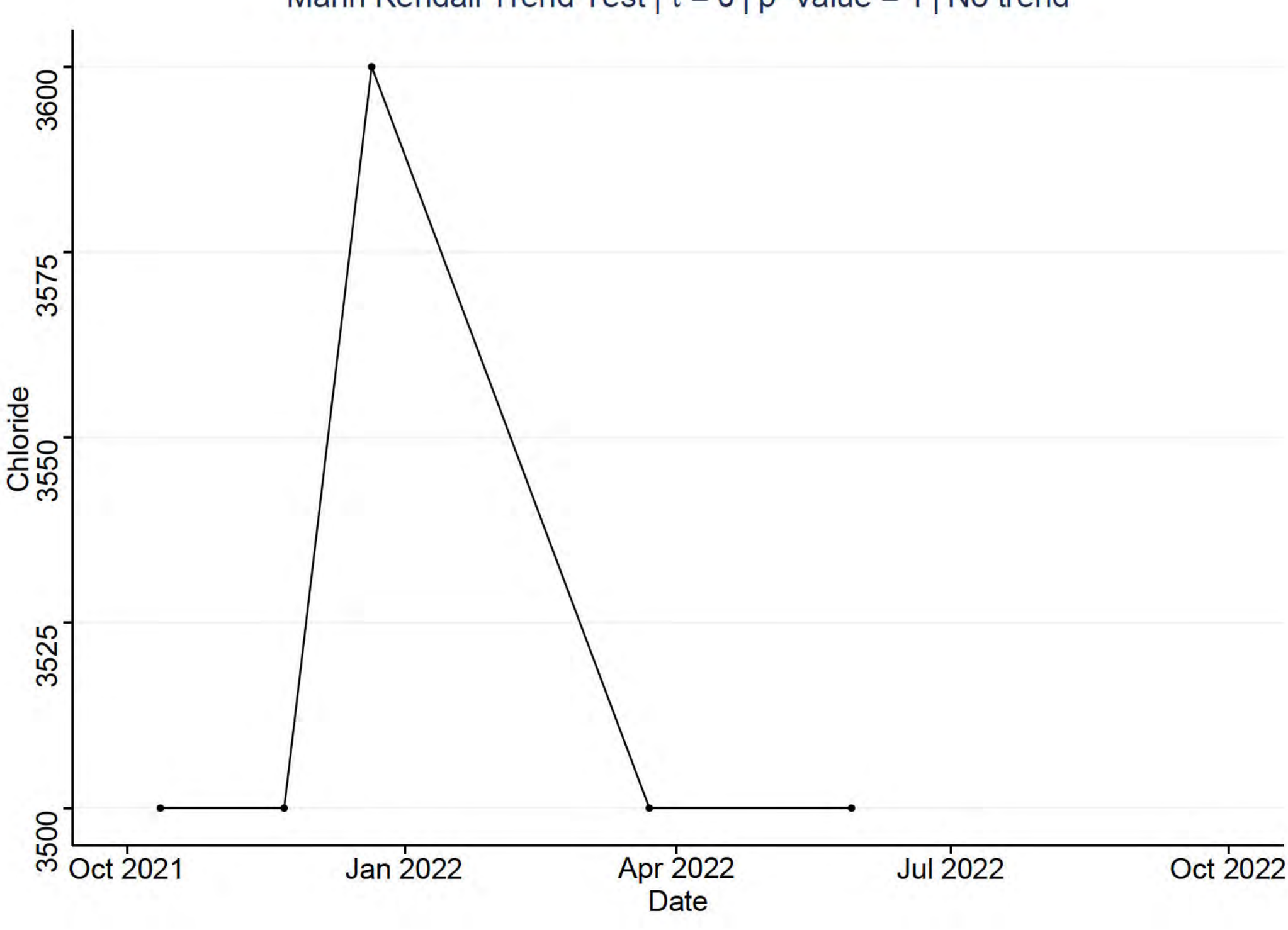


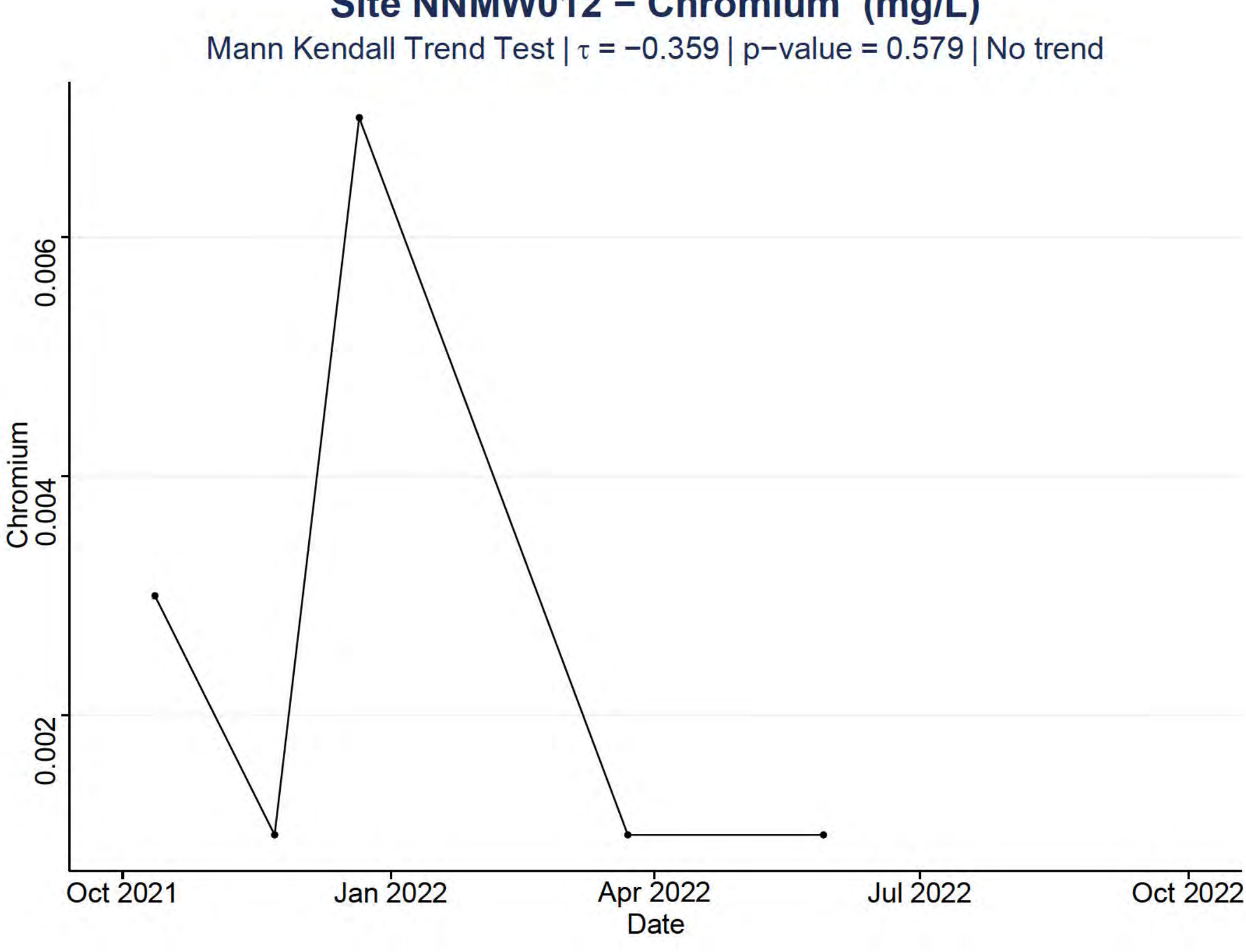

Site NNMW012 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = 0.632 | p−value = 0.289 | No trend
Cadmium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

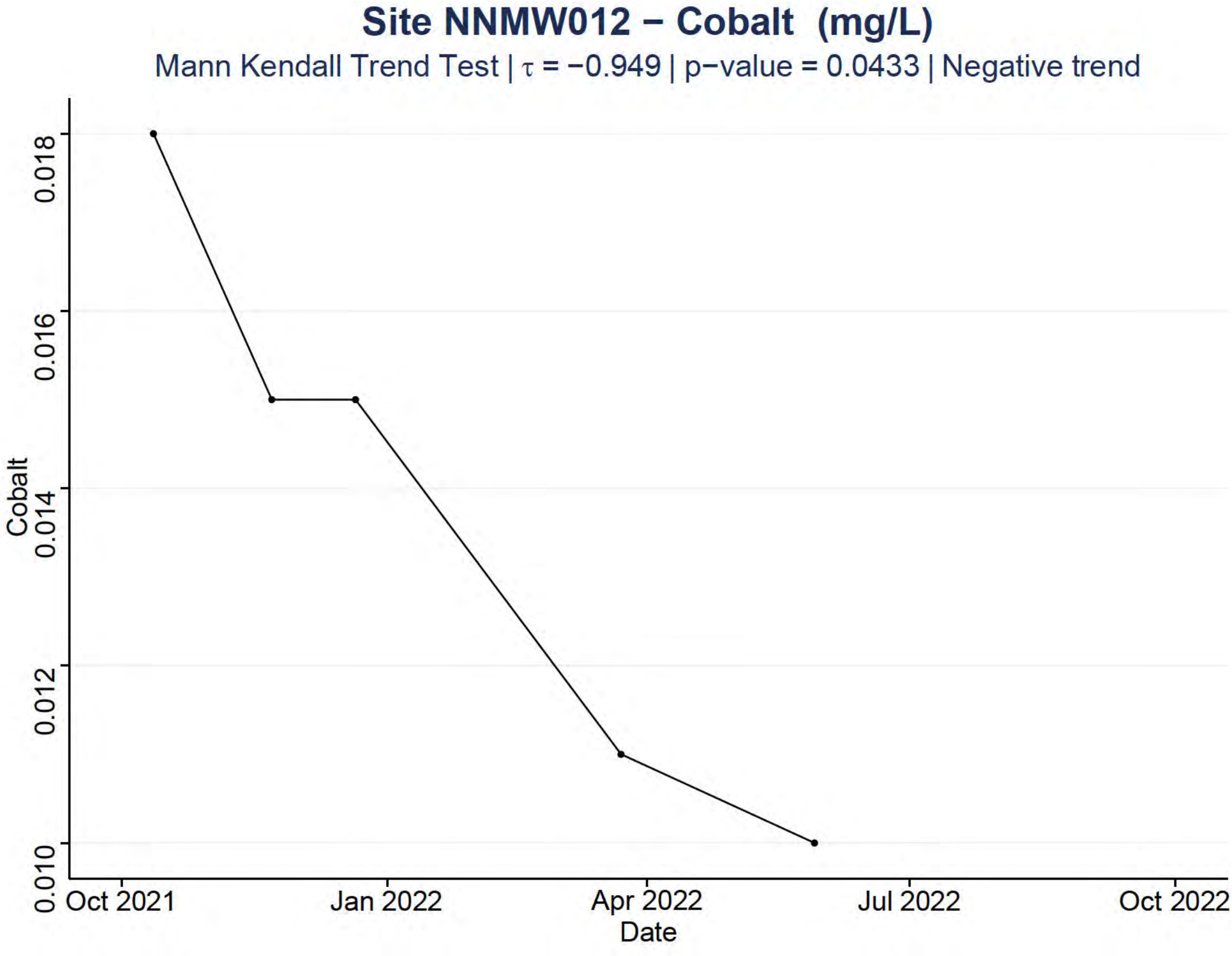

Site NNMW012 – Calcium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Calcium
360
340
320
300
280
260
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

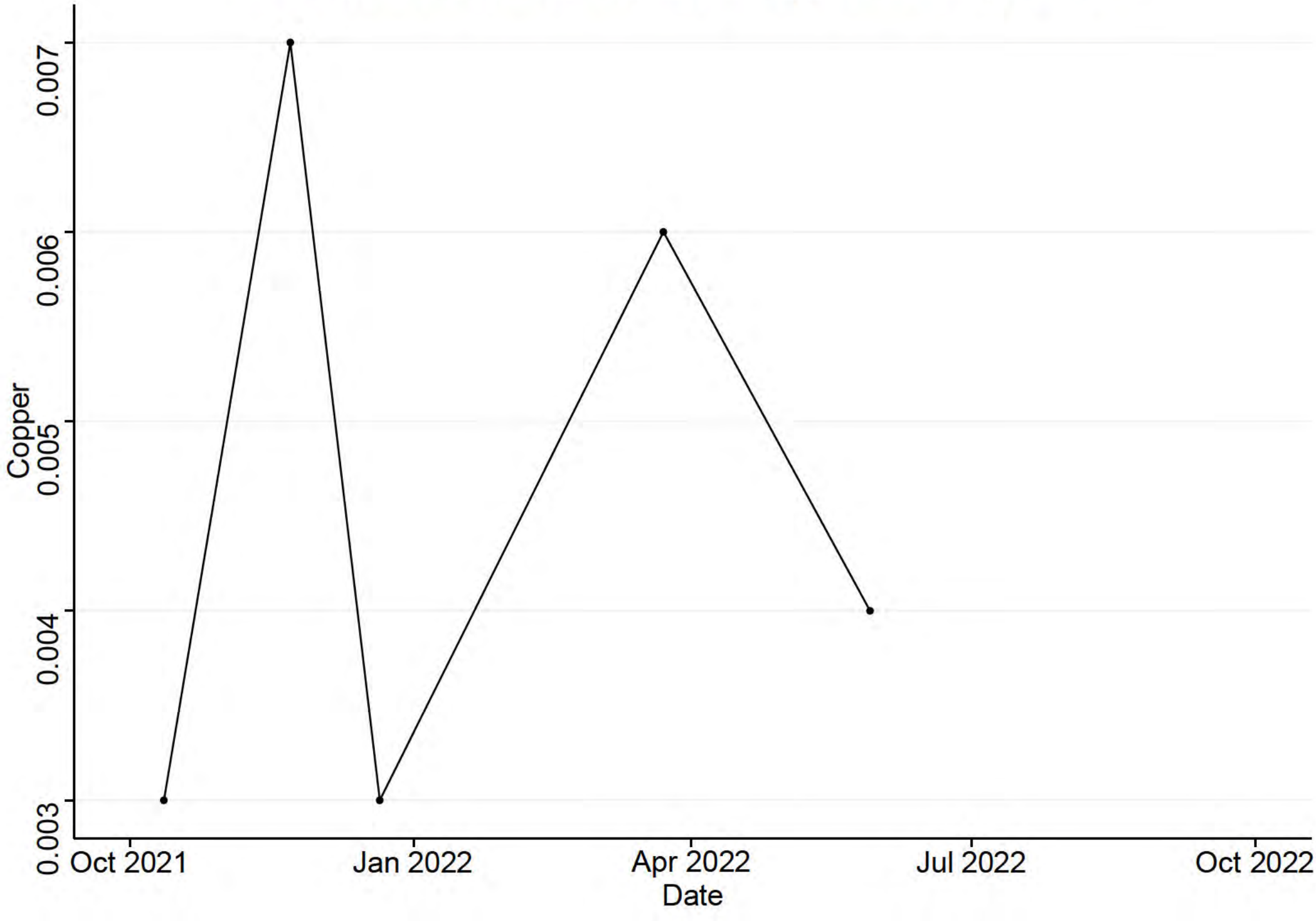

Site NNMW012 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

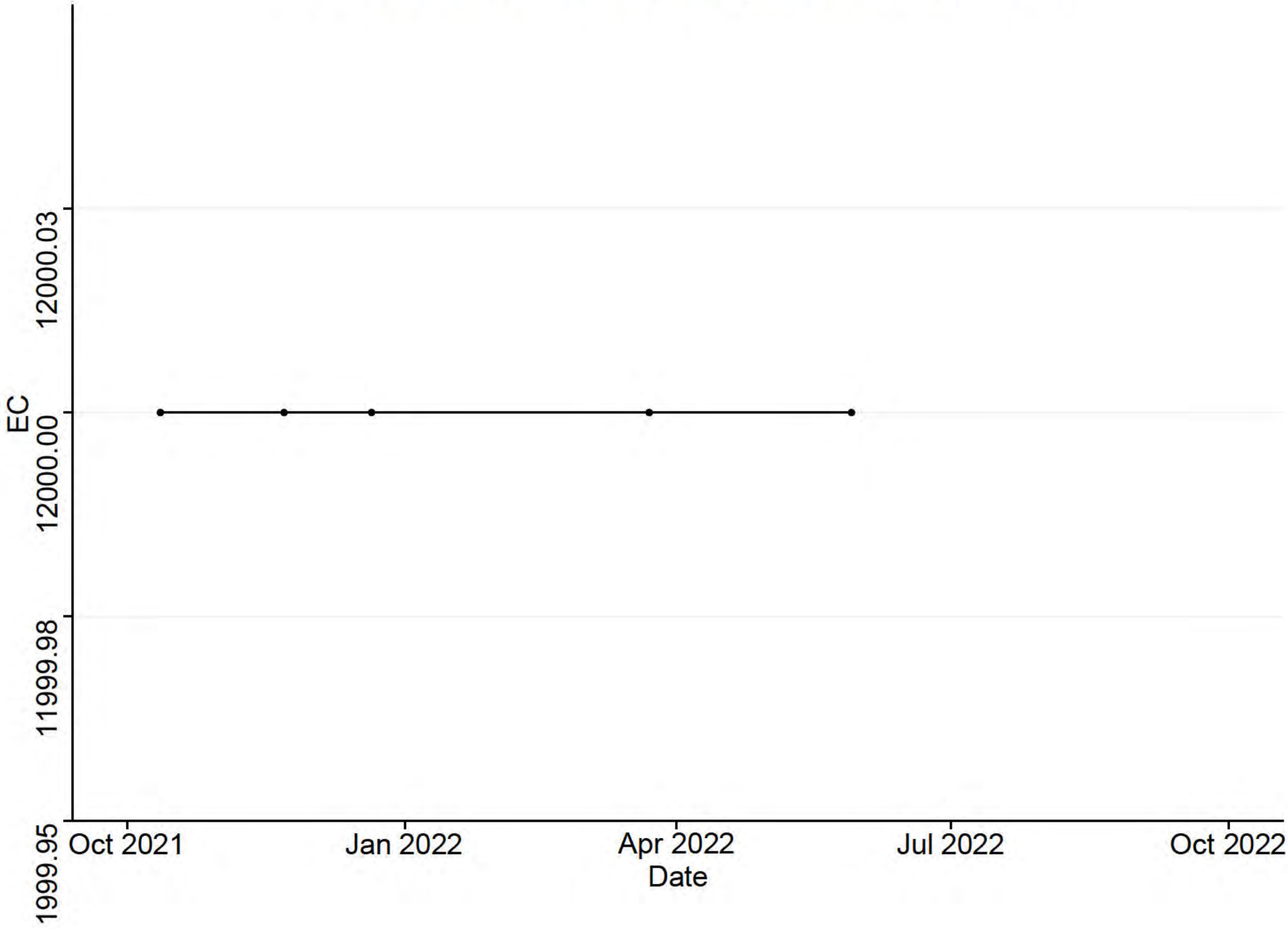

Site NNMW012 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

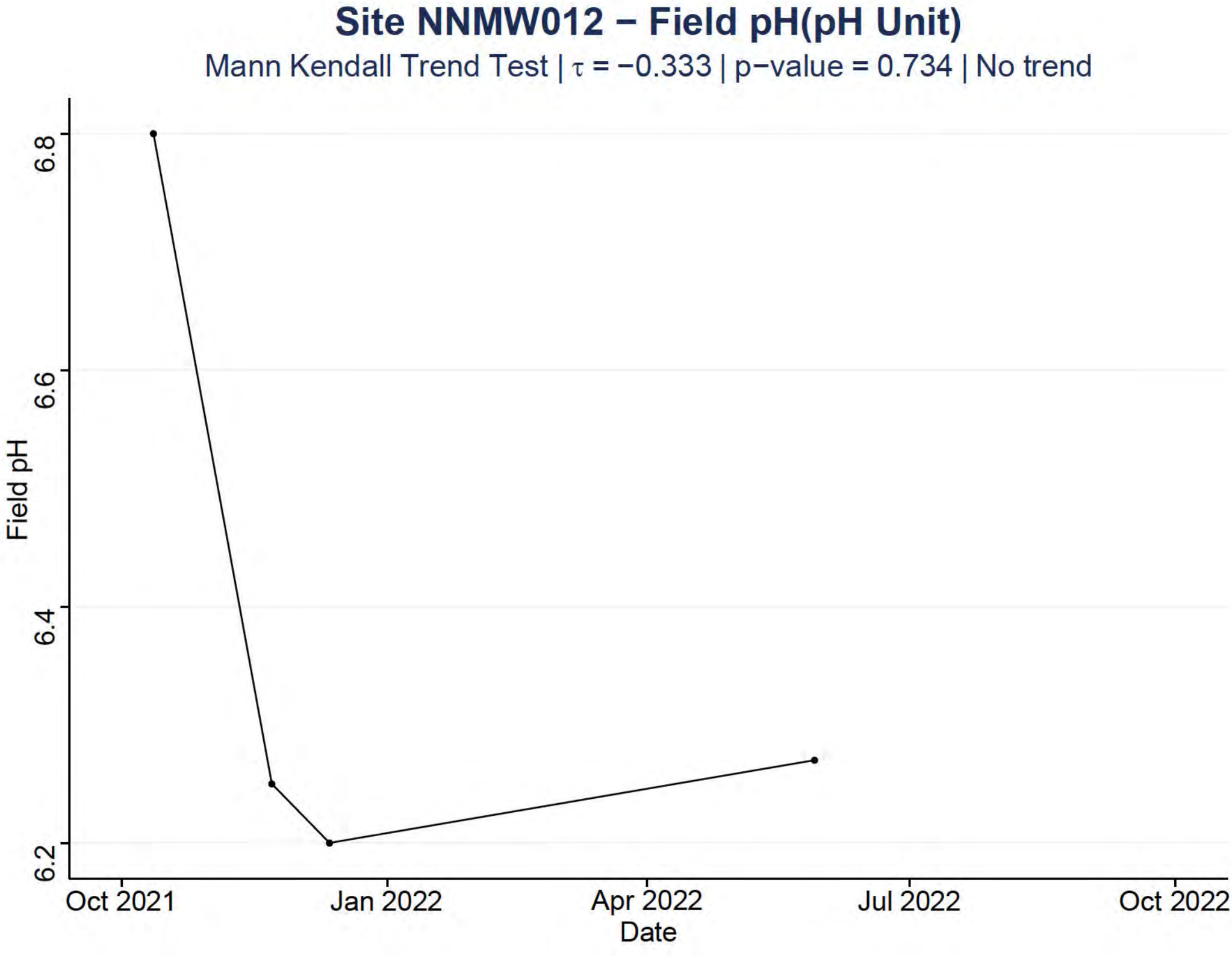

Site NNMW012 – Chloride(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Chloride
3600
3575
3550
3525
3500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 − Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.359 | p−value = 0.579 | No trend
Chromium
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.949 | p−value = 0.0433 | Negative trend
Cobalt
0.018
0.016
0.014
0.012
0.010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

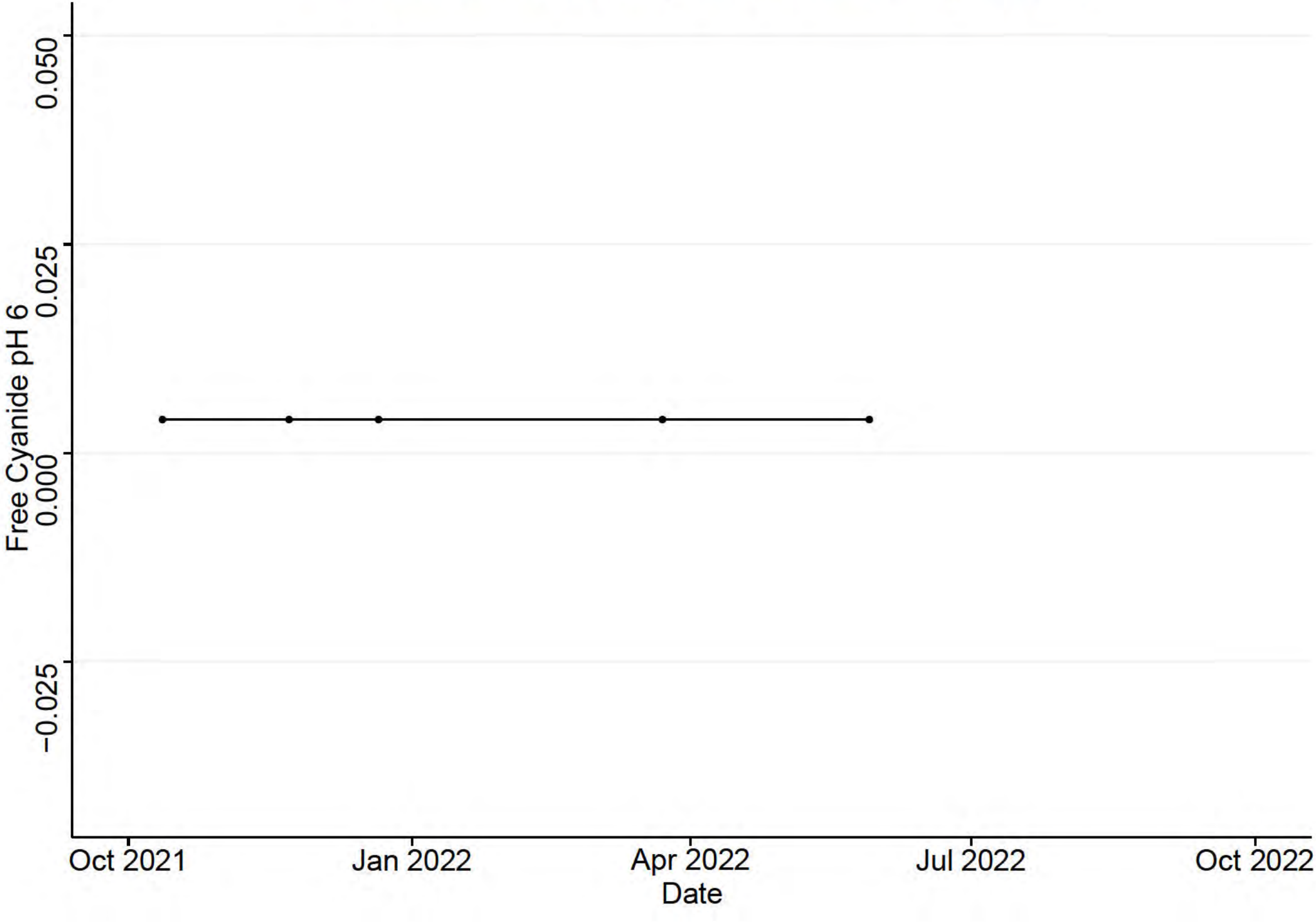

Site NNMW012 – Copper (mg/L)
Mann Kendall Trend Test | τ = 0.105 | p−value = 1 | No trend
Copper
0.003
0.004
0.005
0.006
0.007
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

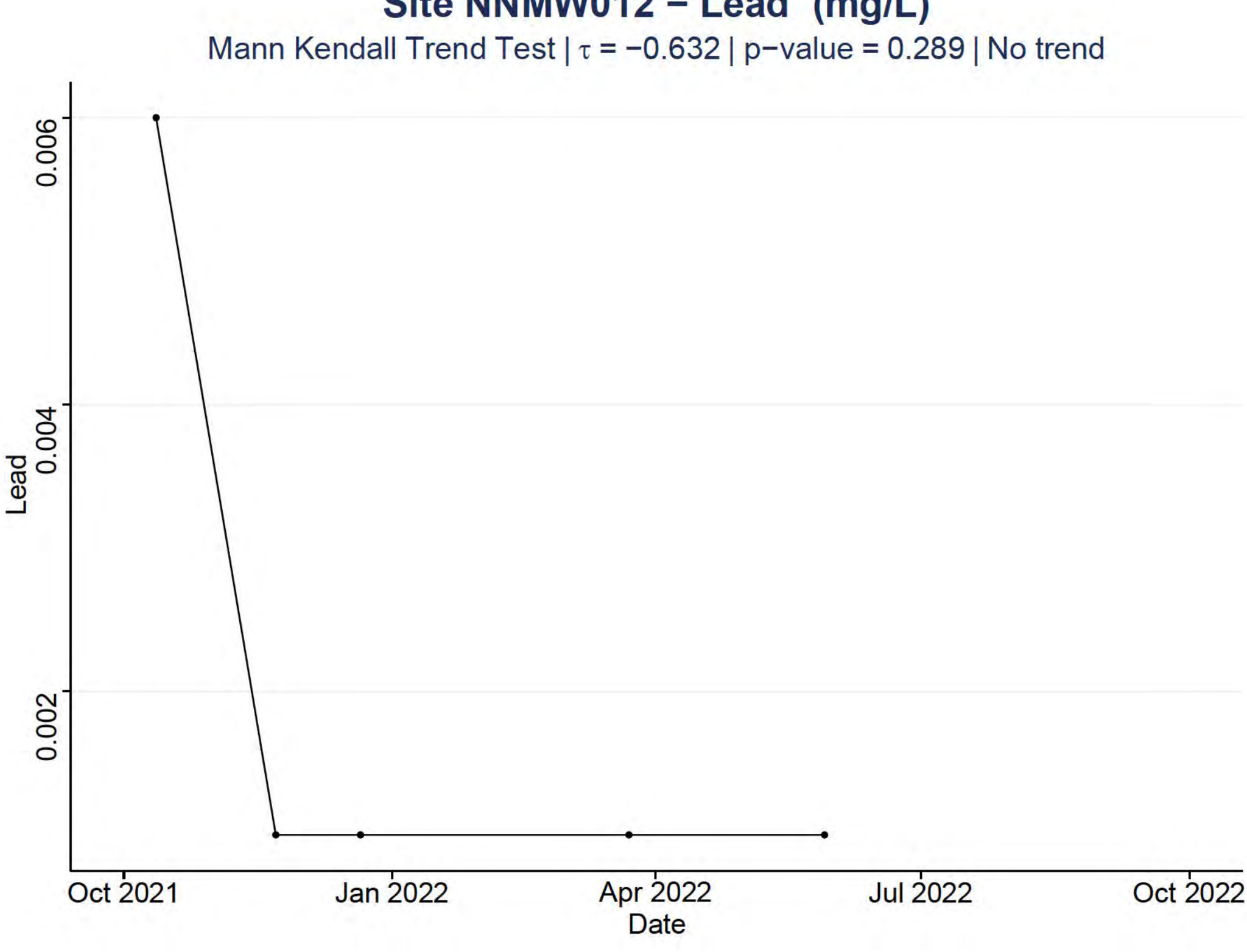

Site NNMW012 – EC(µS/cm)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
EC
12000.03
12000.00
11999.98
1999.95
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

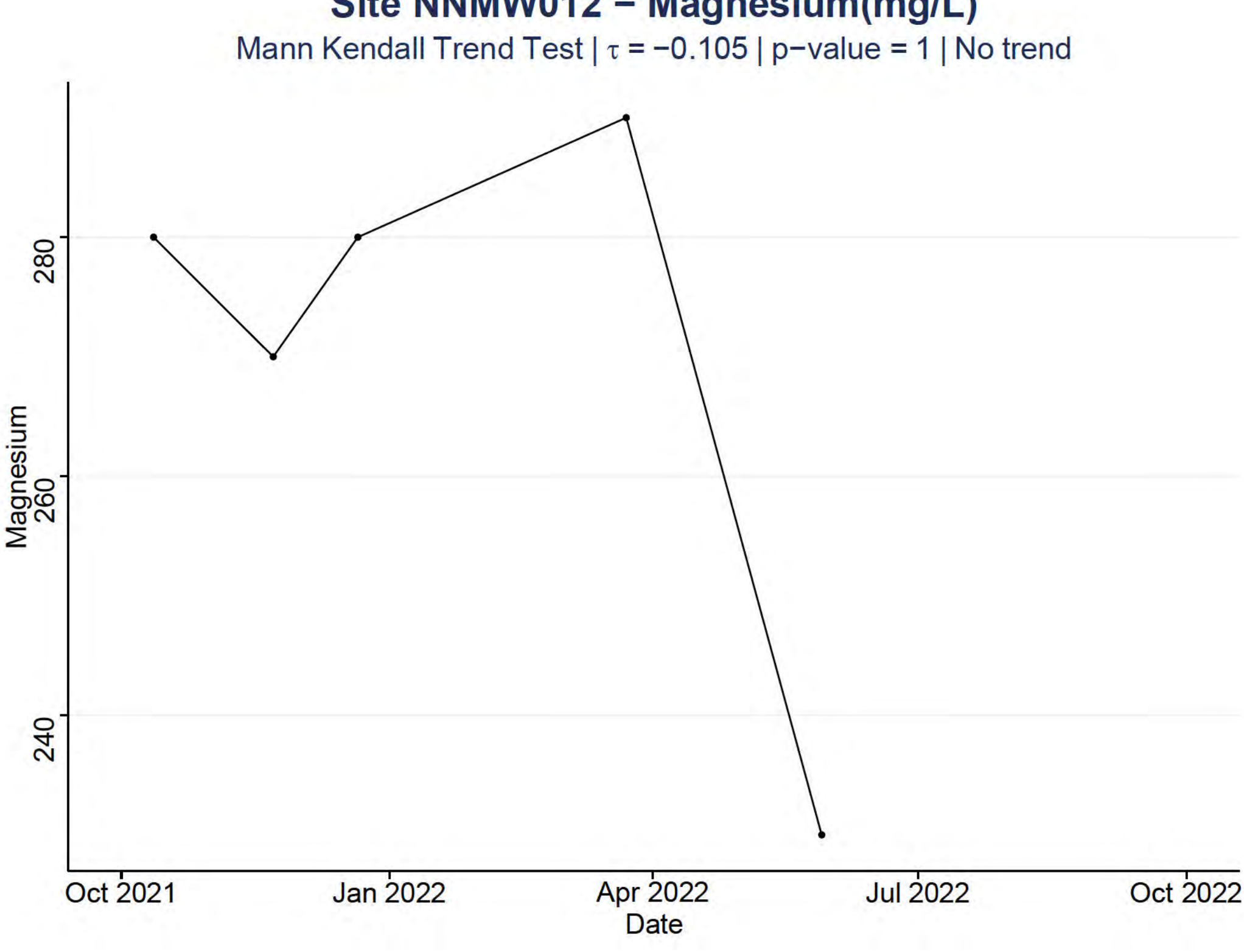

Site NNMW012 − Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.333 | p−value = 0.734 | No trend
Field pH
6.8
6.6
6.4
6.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

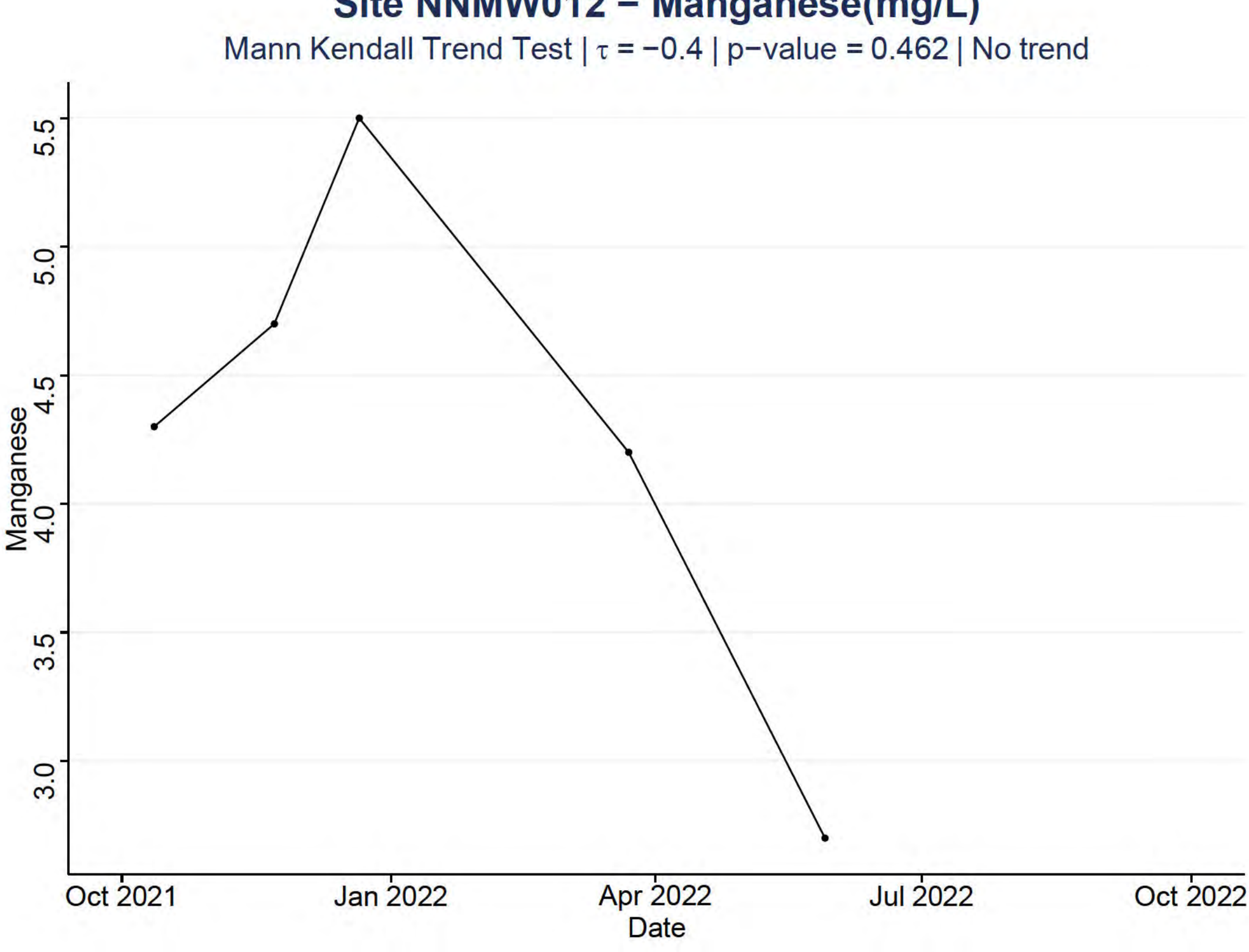
Site NNMW012 – Free Cyanide pH 6 (mg/L)

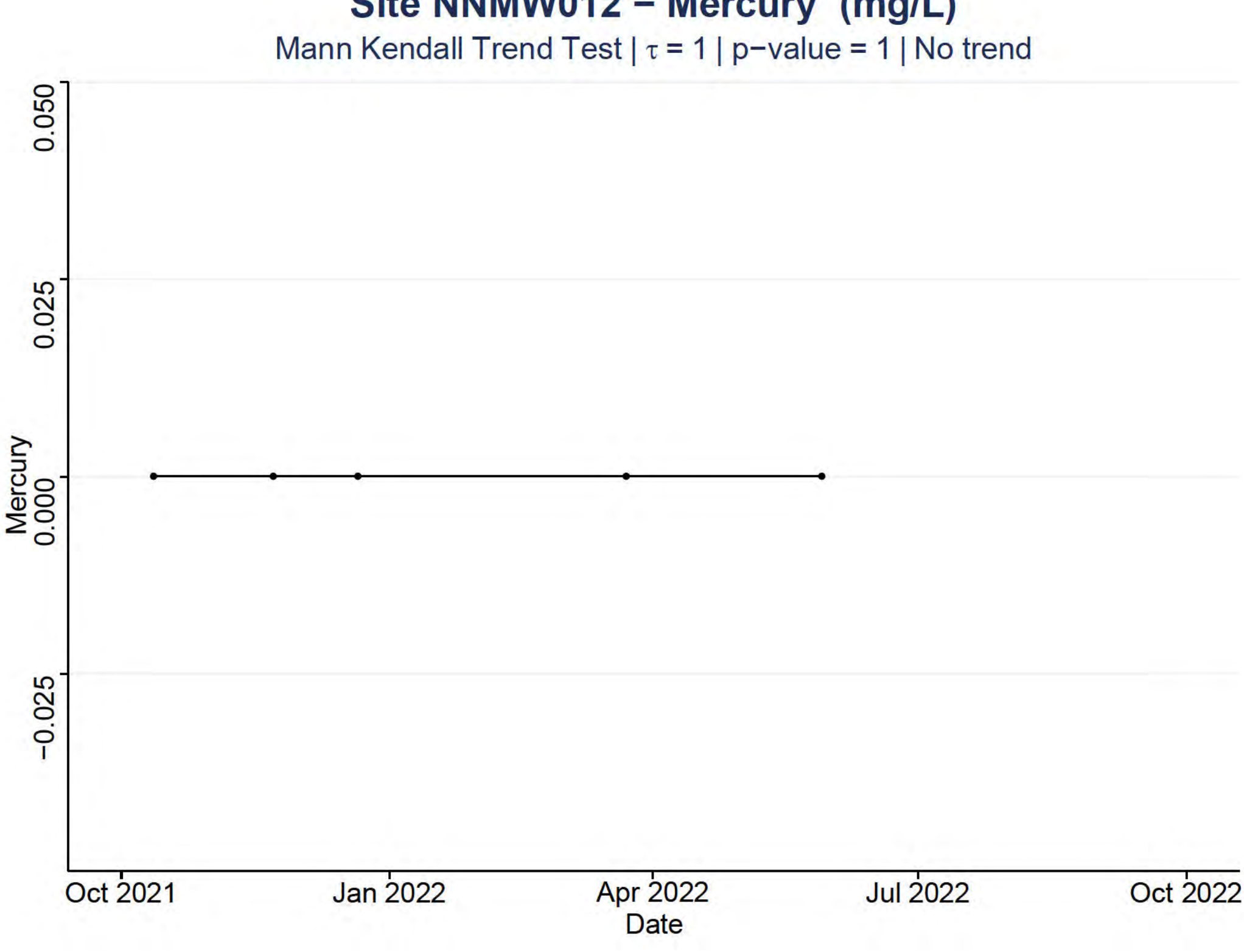
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend




Site NNMW012 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

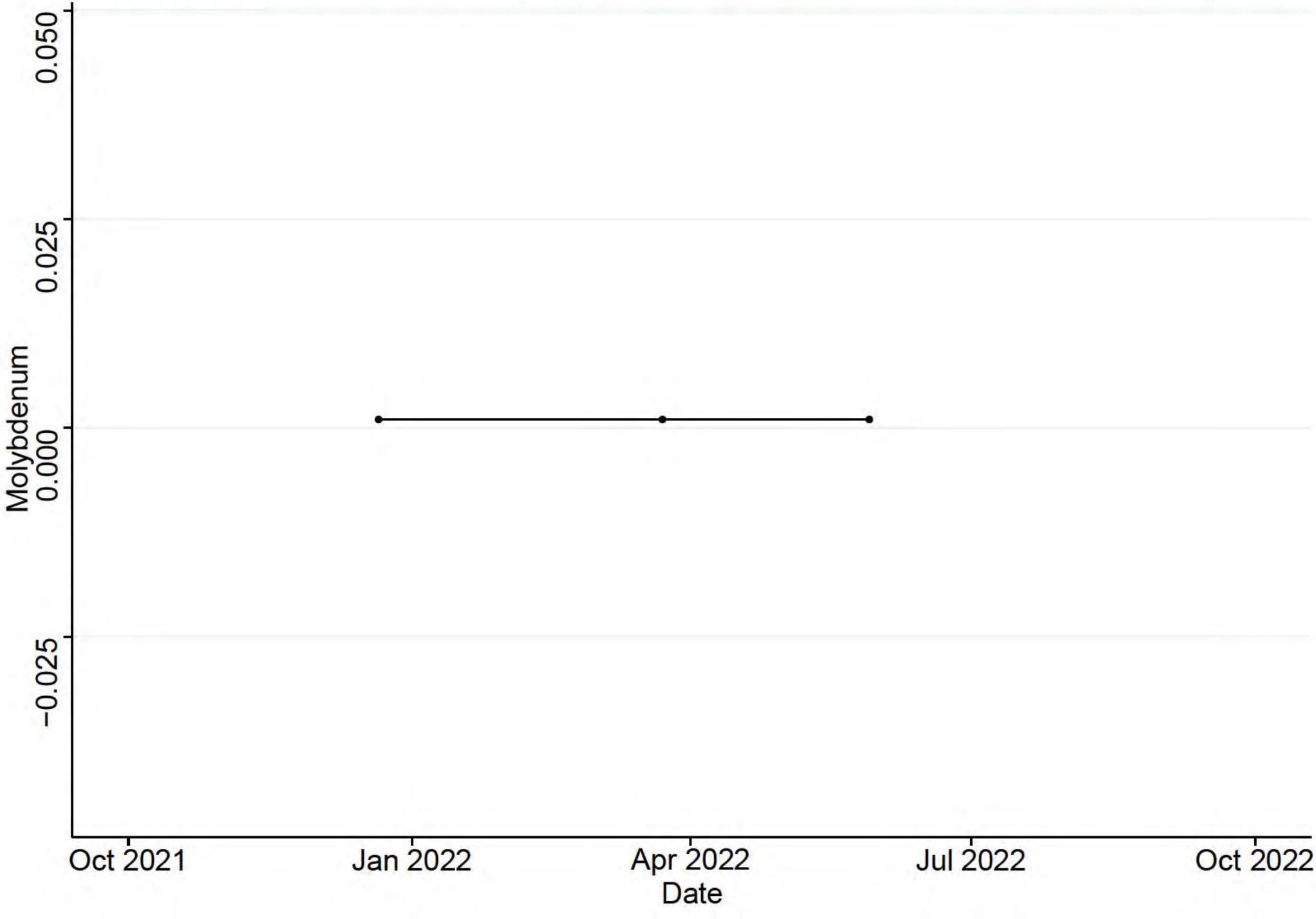

Site NNMW012 − Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.105 | p−value = 1 | No trend
Magnesium
280
260
240
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

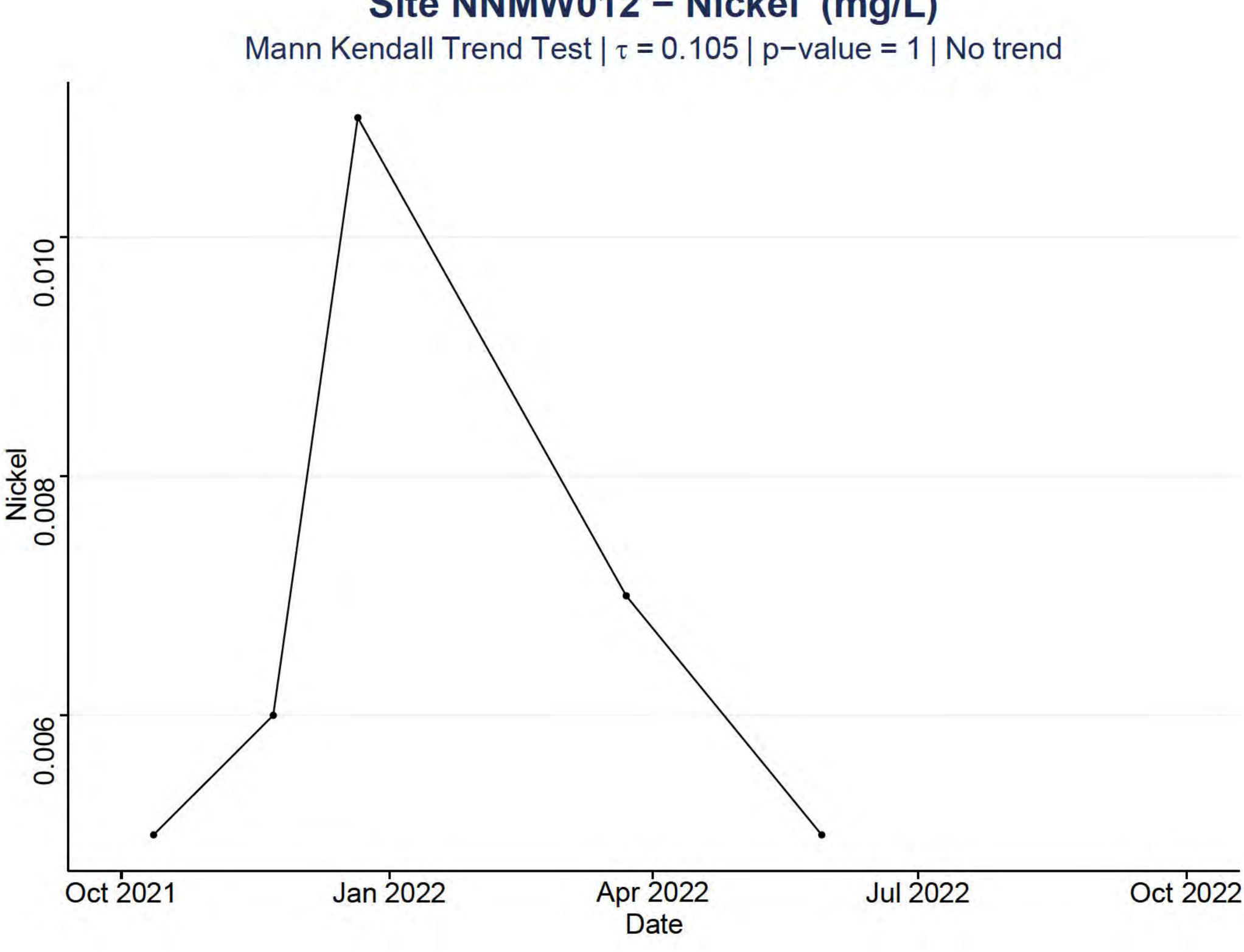

Site NNMW012 − Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.4 | p−value = 0.462 | No trend
Manganese
5.5
5.0
4.5
4.0
3.5
3.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

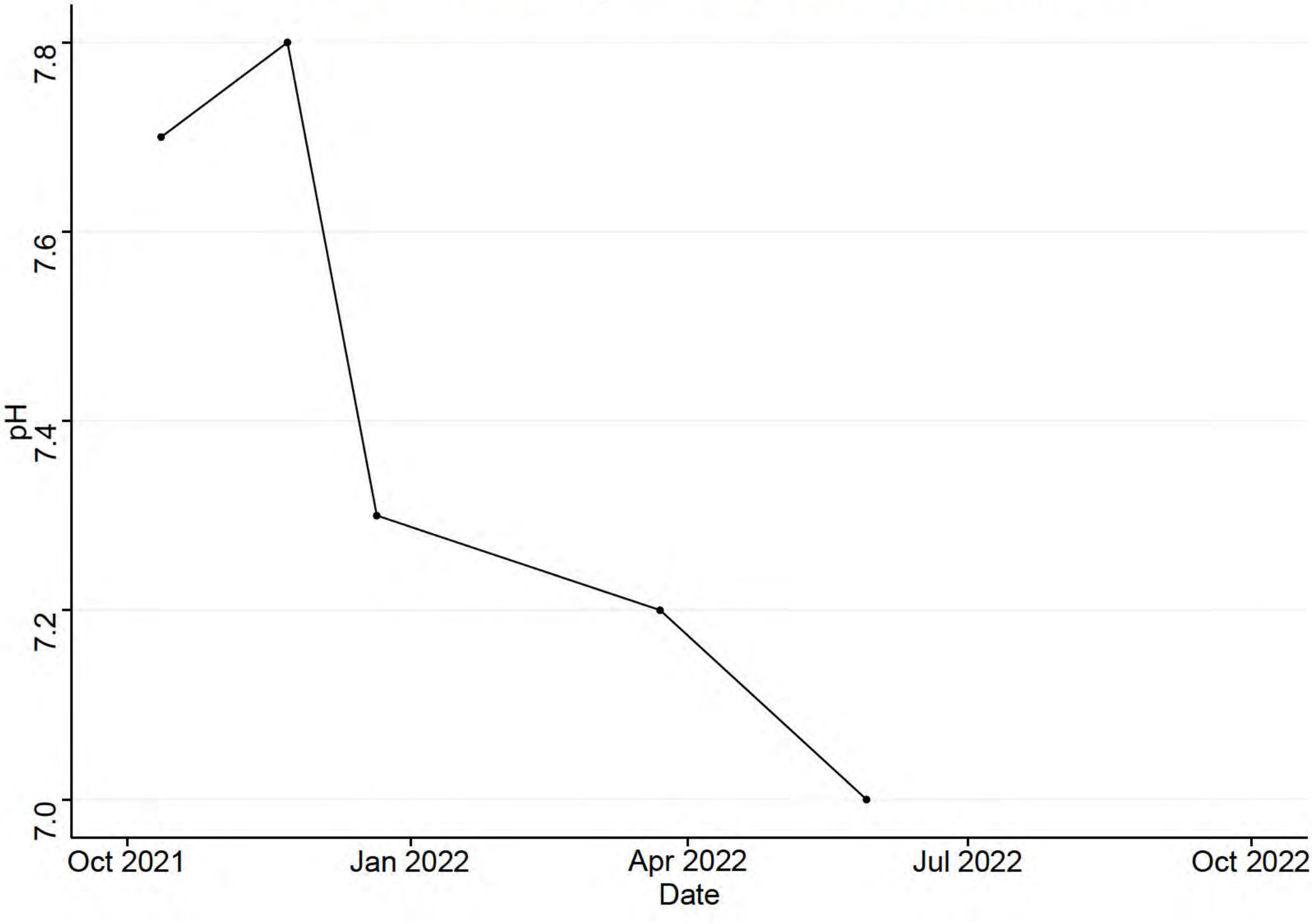

Site NNMW012 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

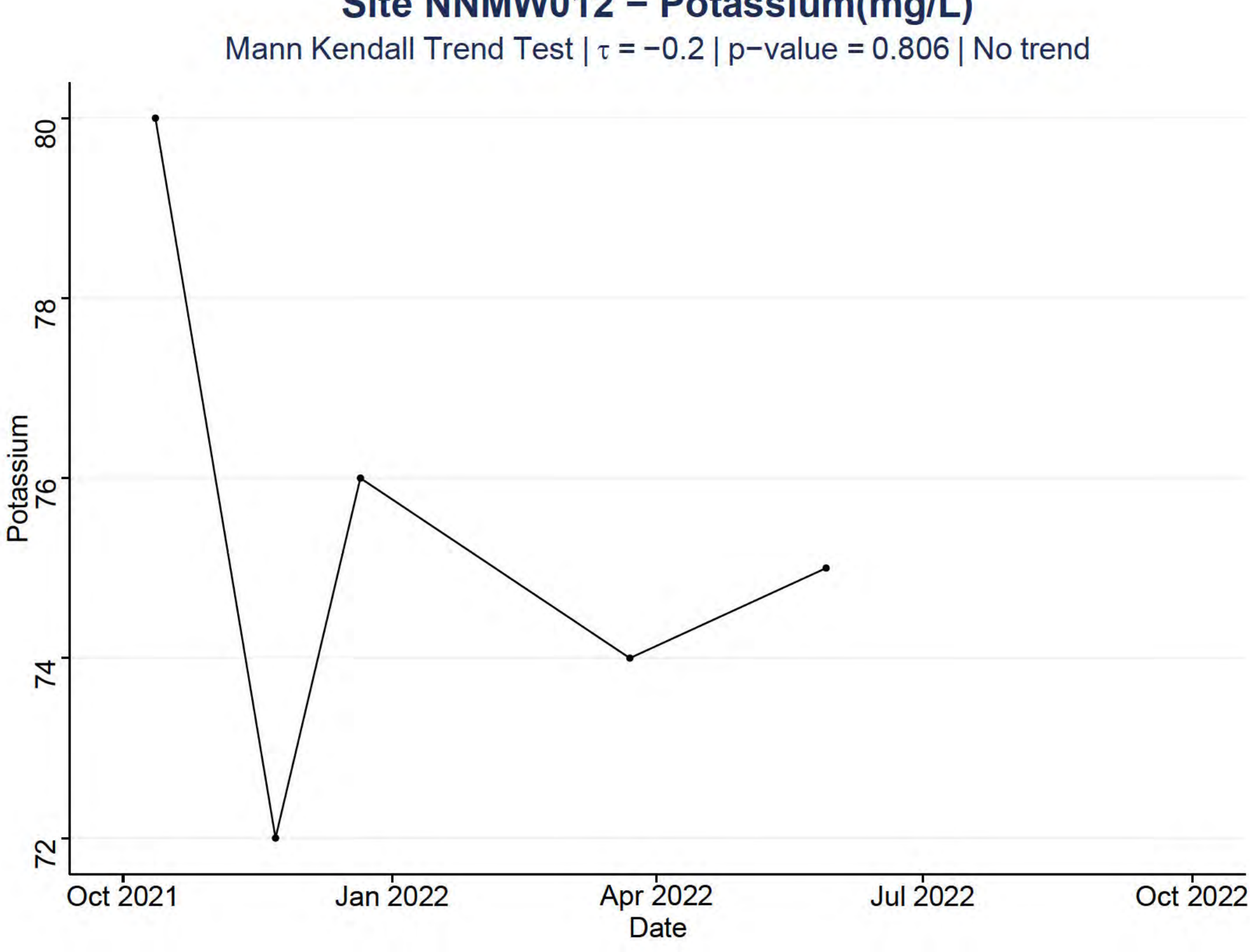
Site NNMW012 − Molybdenum (mg/L)

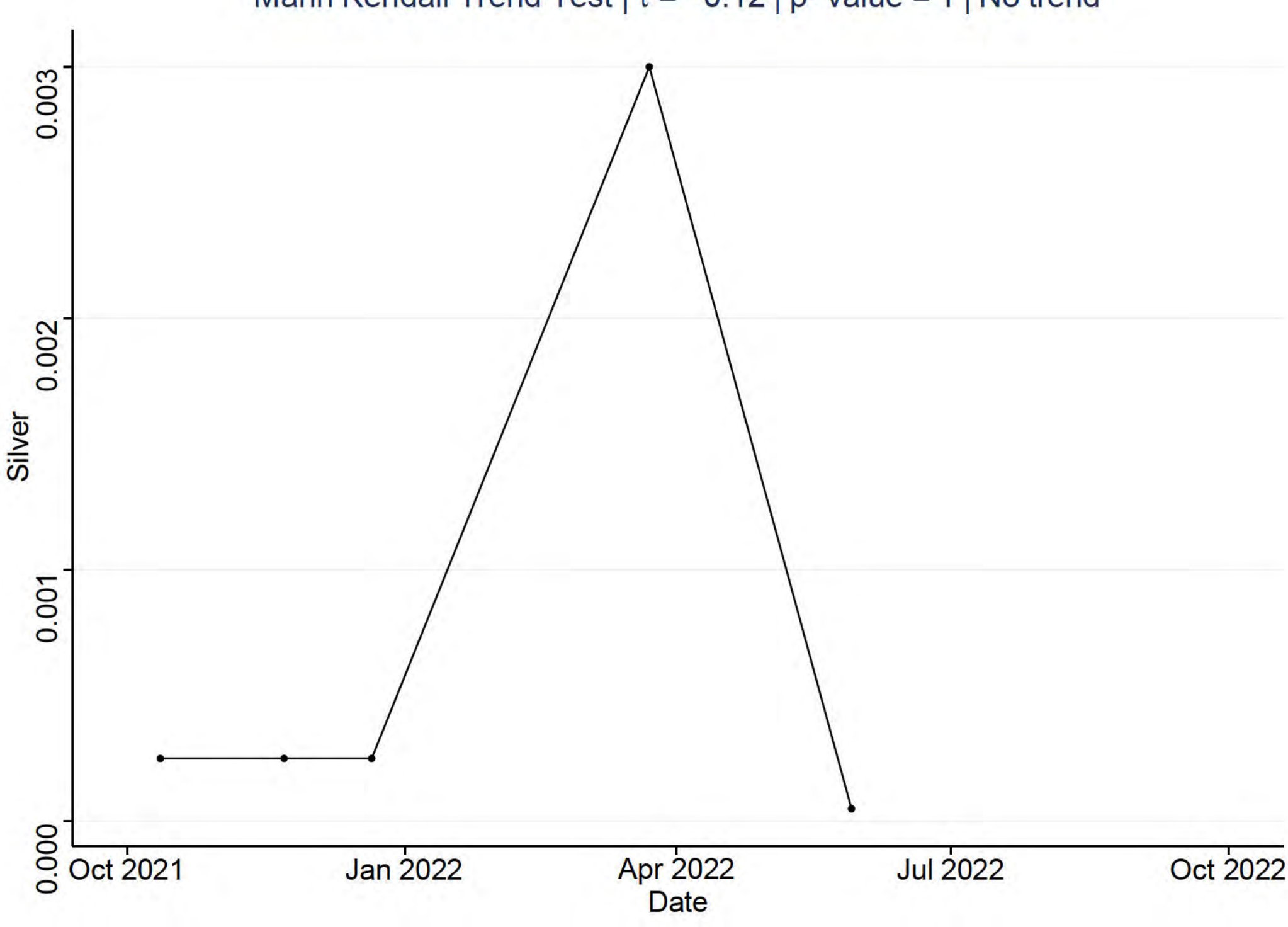
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

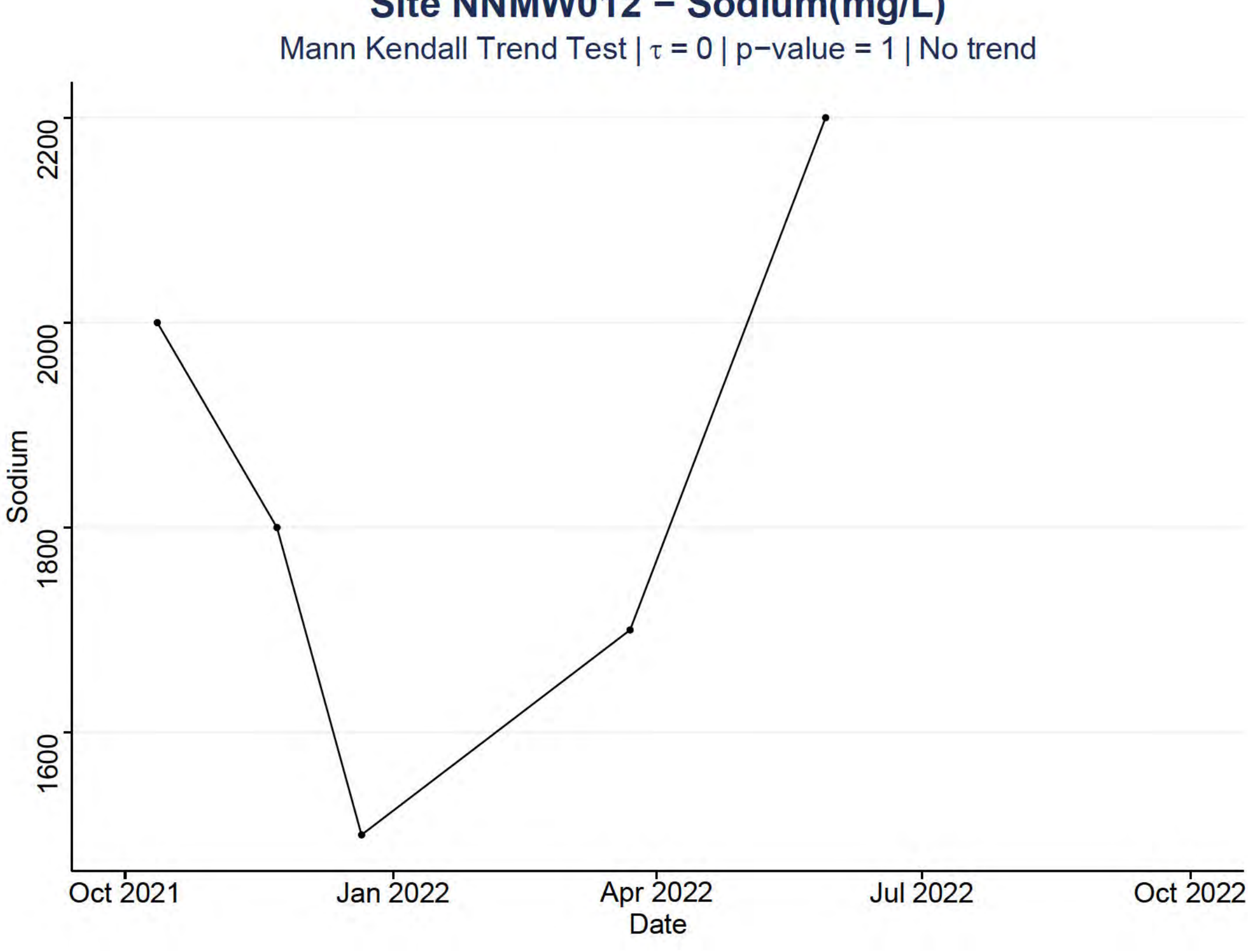


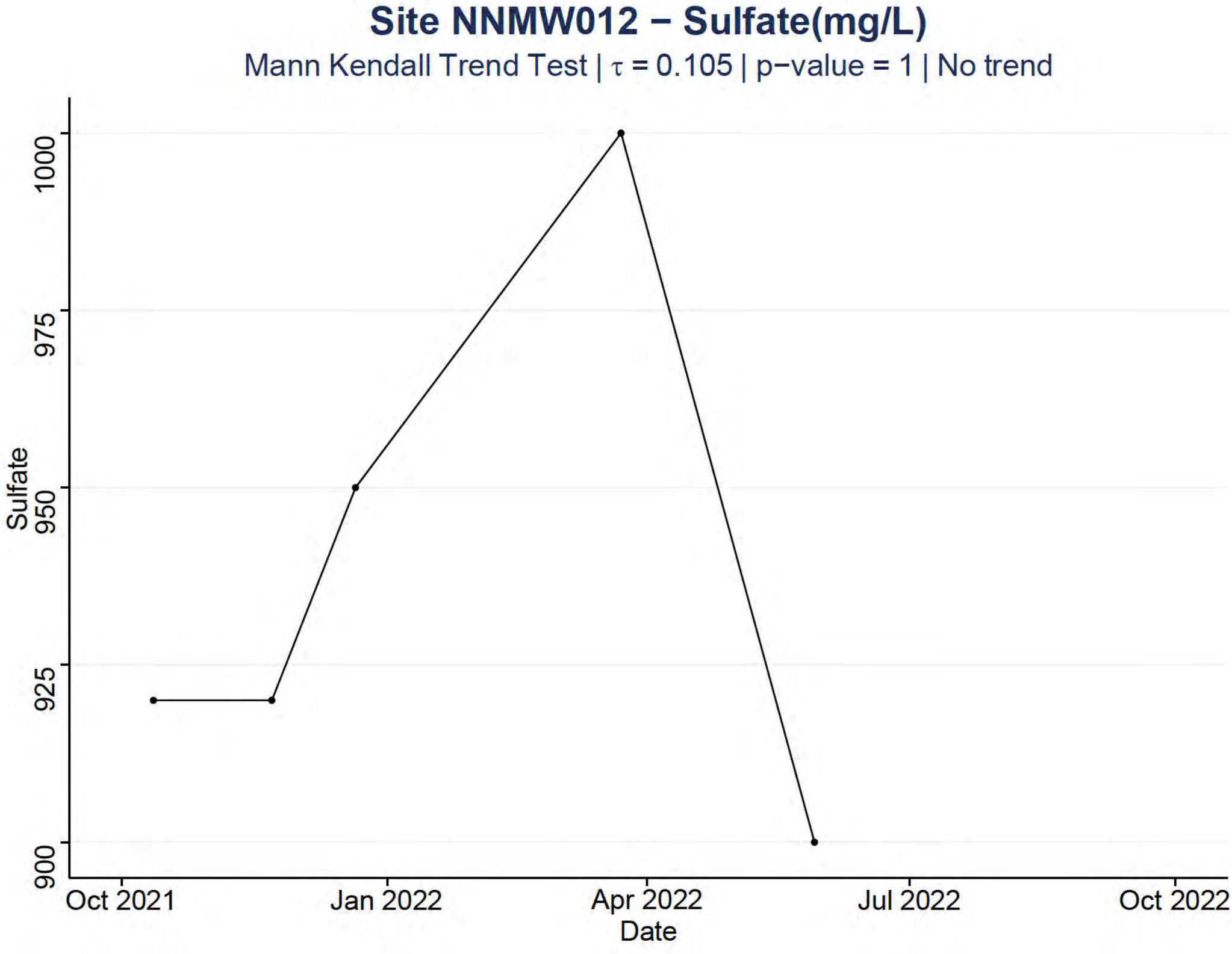

Site NNMW012 – Nickel (mg/L)
Mann Kendall Trend Test | τ = 0.105 | p−value = 1 | No trend
Nickel
0.010
0.008
0.006
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

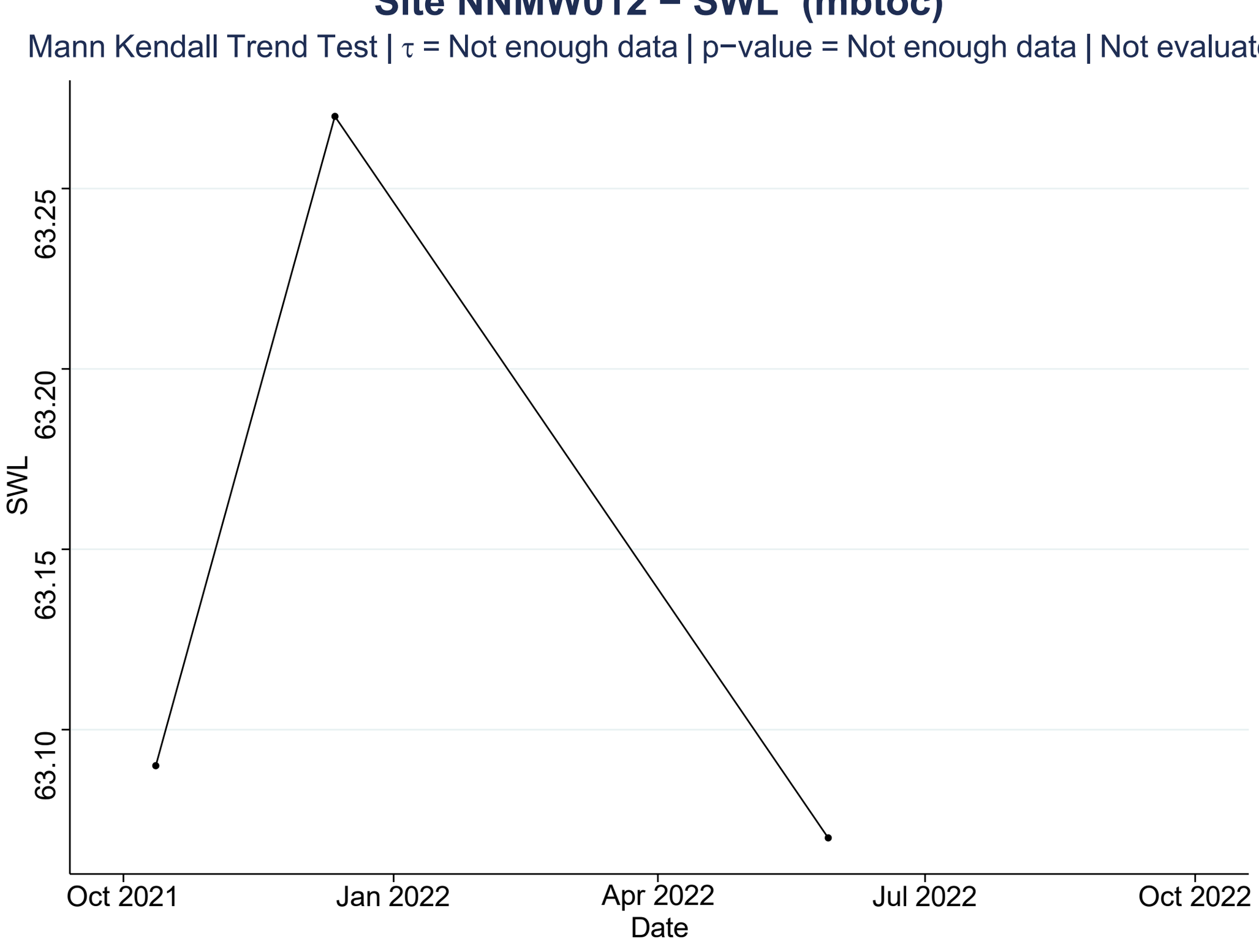

Site NNMW012 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.8 | p−value = 0.0864 | No trend
pH
7.8
7.6
7.4
7.2
7.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

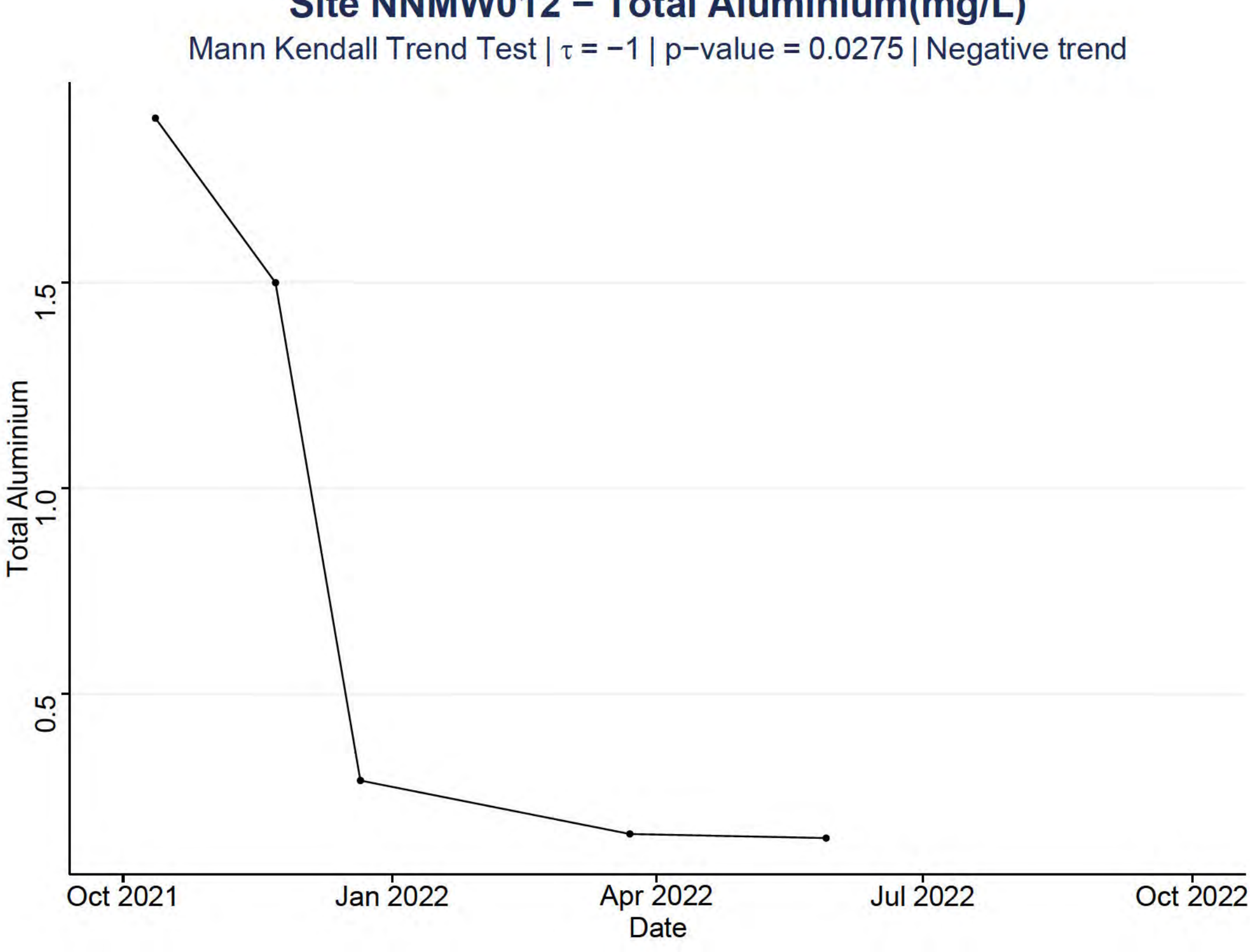

Site NNMW012 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Potassium
80
78
76
74
72
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

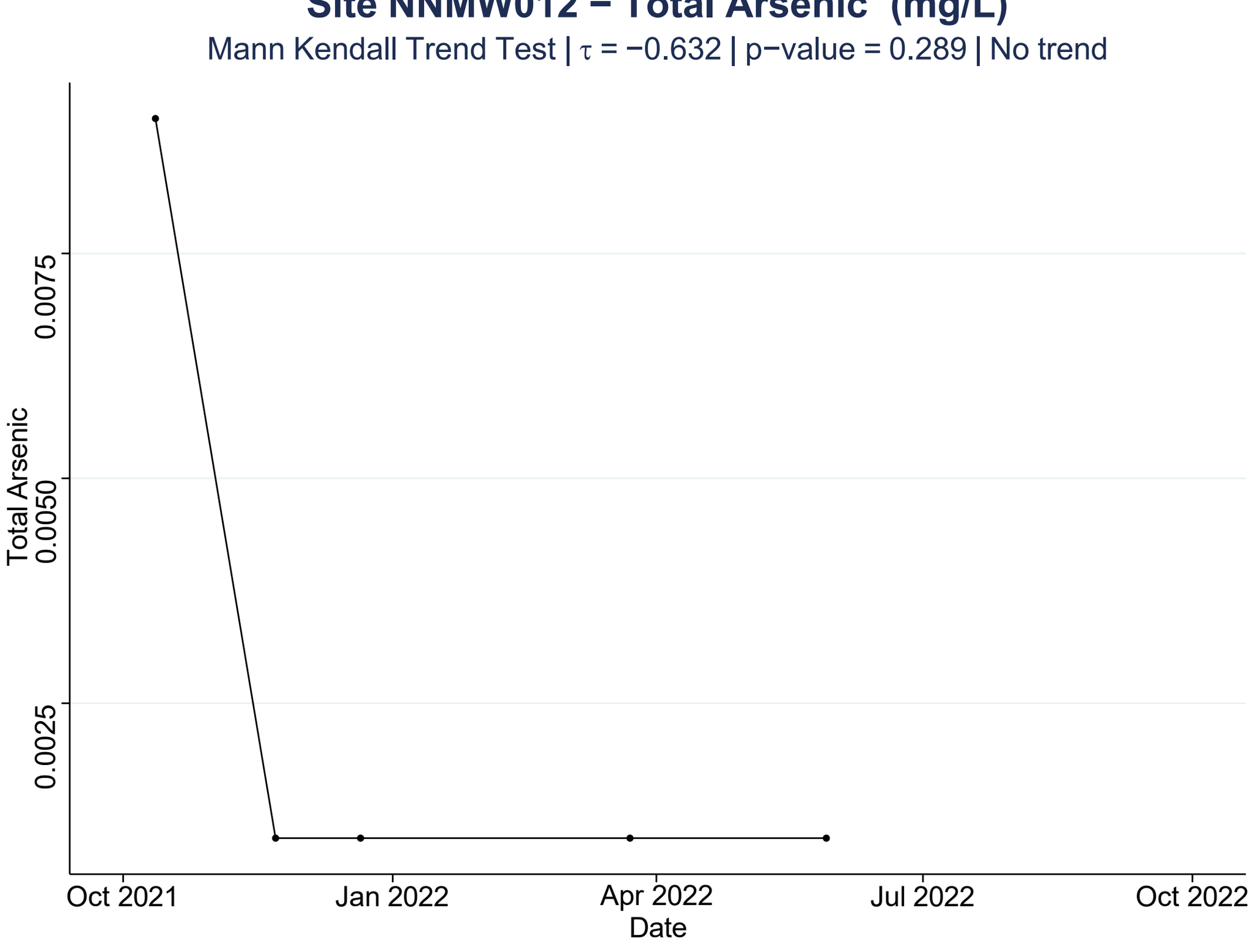

Site NNMW012 − Silver (mg/L)
Mann Kendall Trend Test | τ = −0.12 | p−value = 1 | No trend
Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

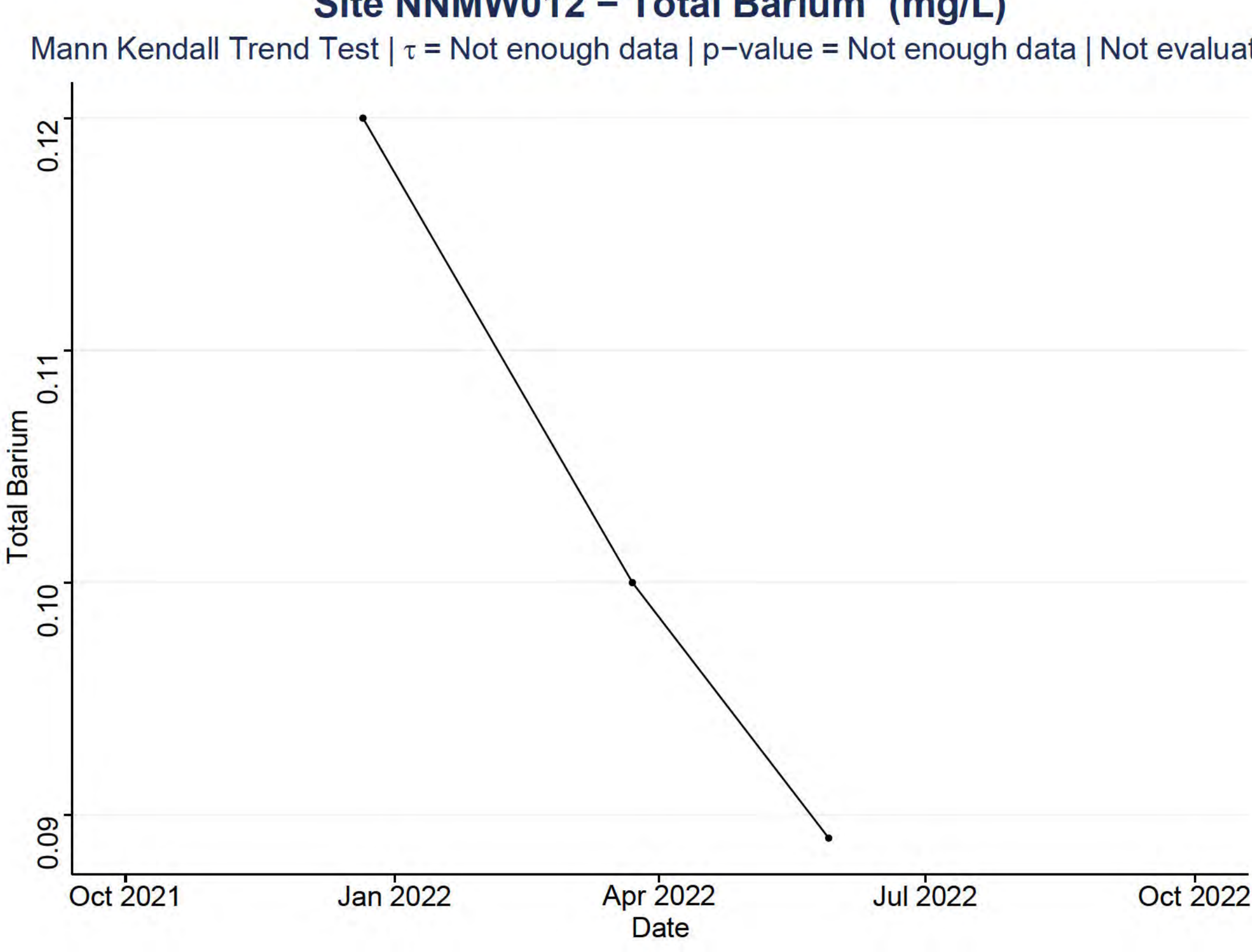

Site NNMW012 – Sodium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Sodium
2200
2000
1800
1600
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = 0.105 | p−value = 1 | No trend
Sulfate
1000
975
950
925
900
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 – SWL (mbtoc)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
SWL
63.10
63.15
63.20
63.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

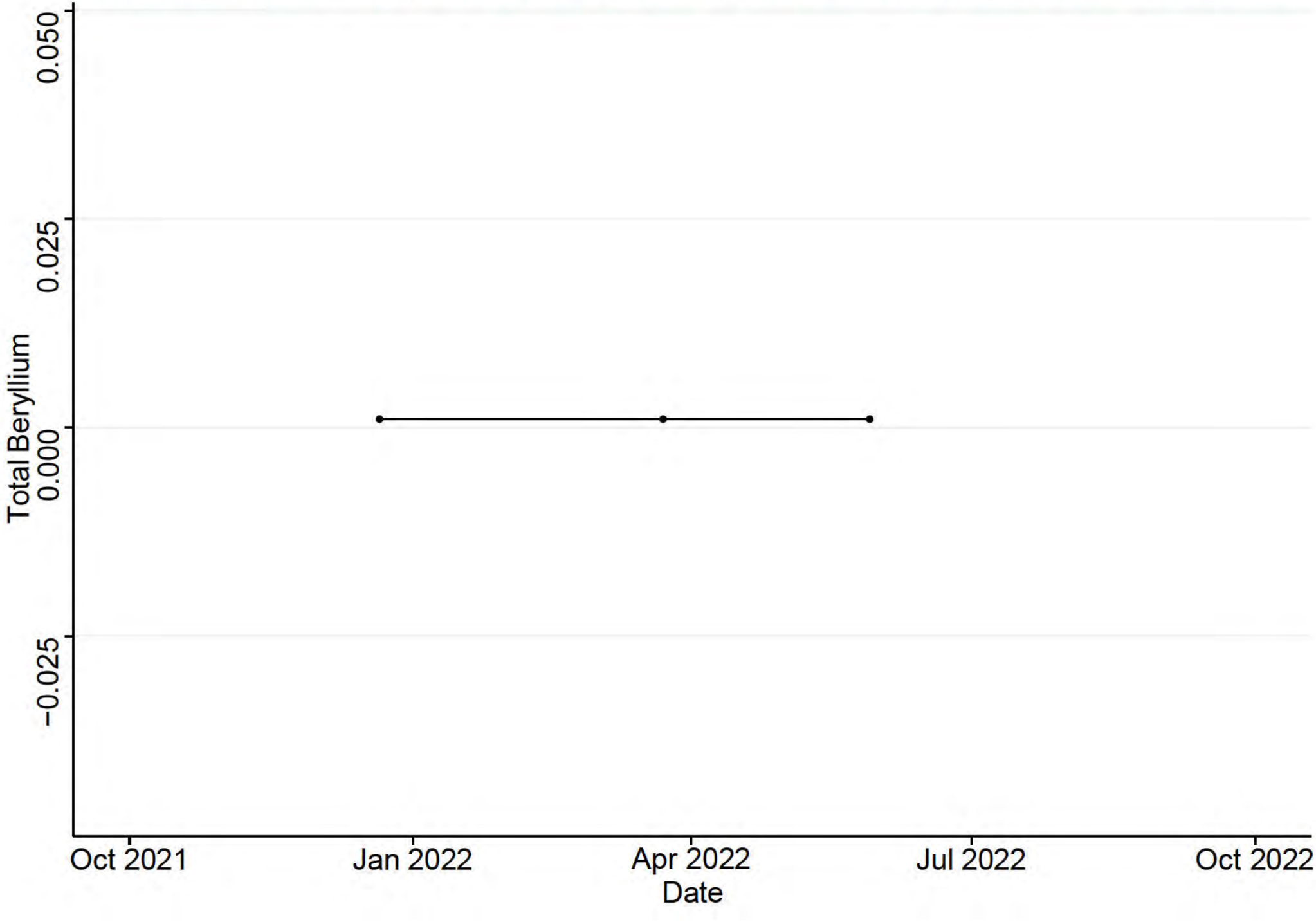

Site NNMW012 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −1 | p−value = 0.0275 | Negative trend
Total Aluminium
0.5
1.0
1.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Barium
0.12
0.11
0.10
0.09
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

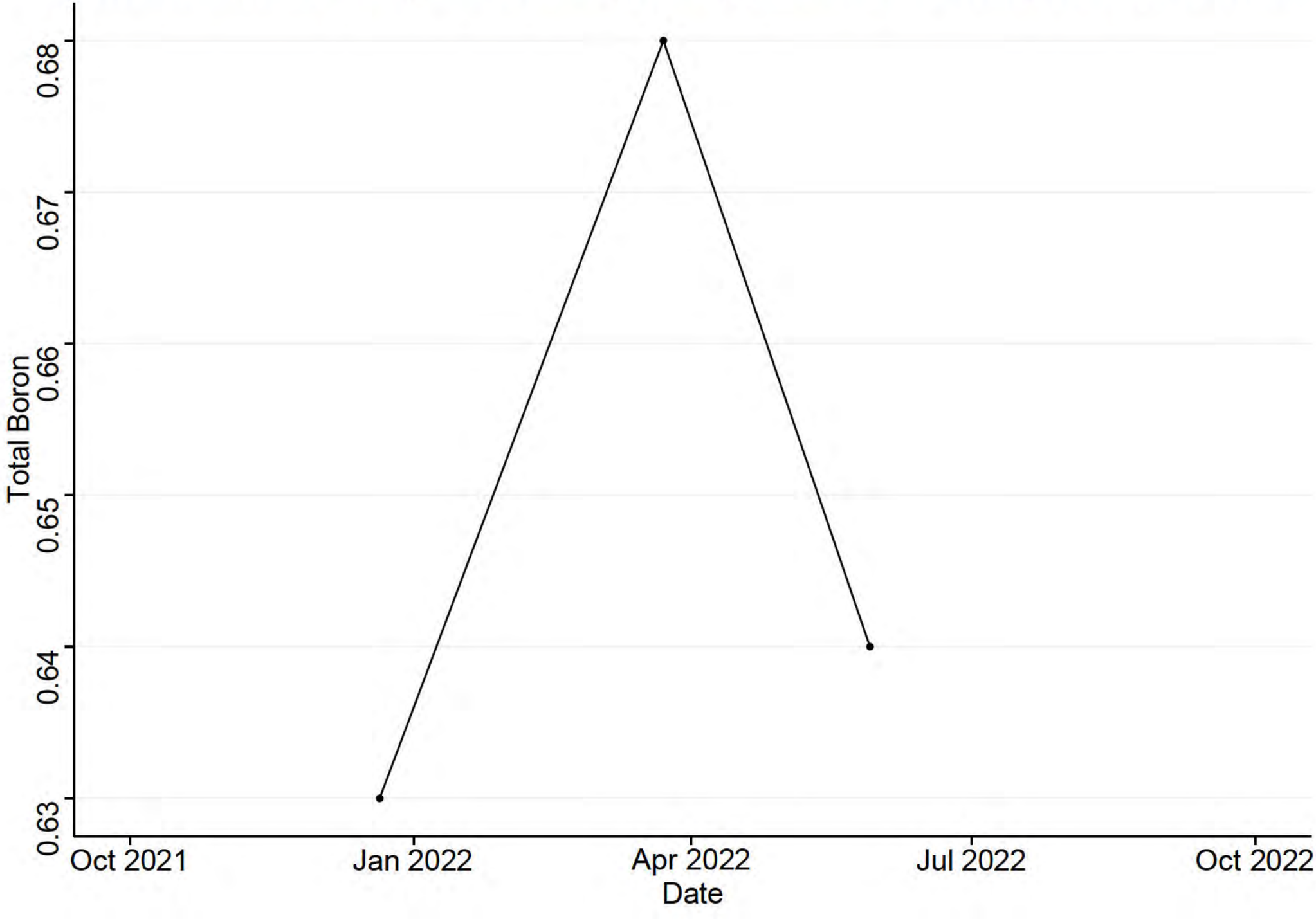
Site NNMW012 − Total Beryllium (mg/L)

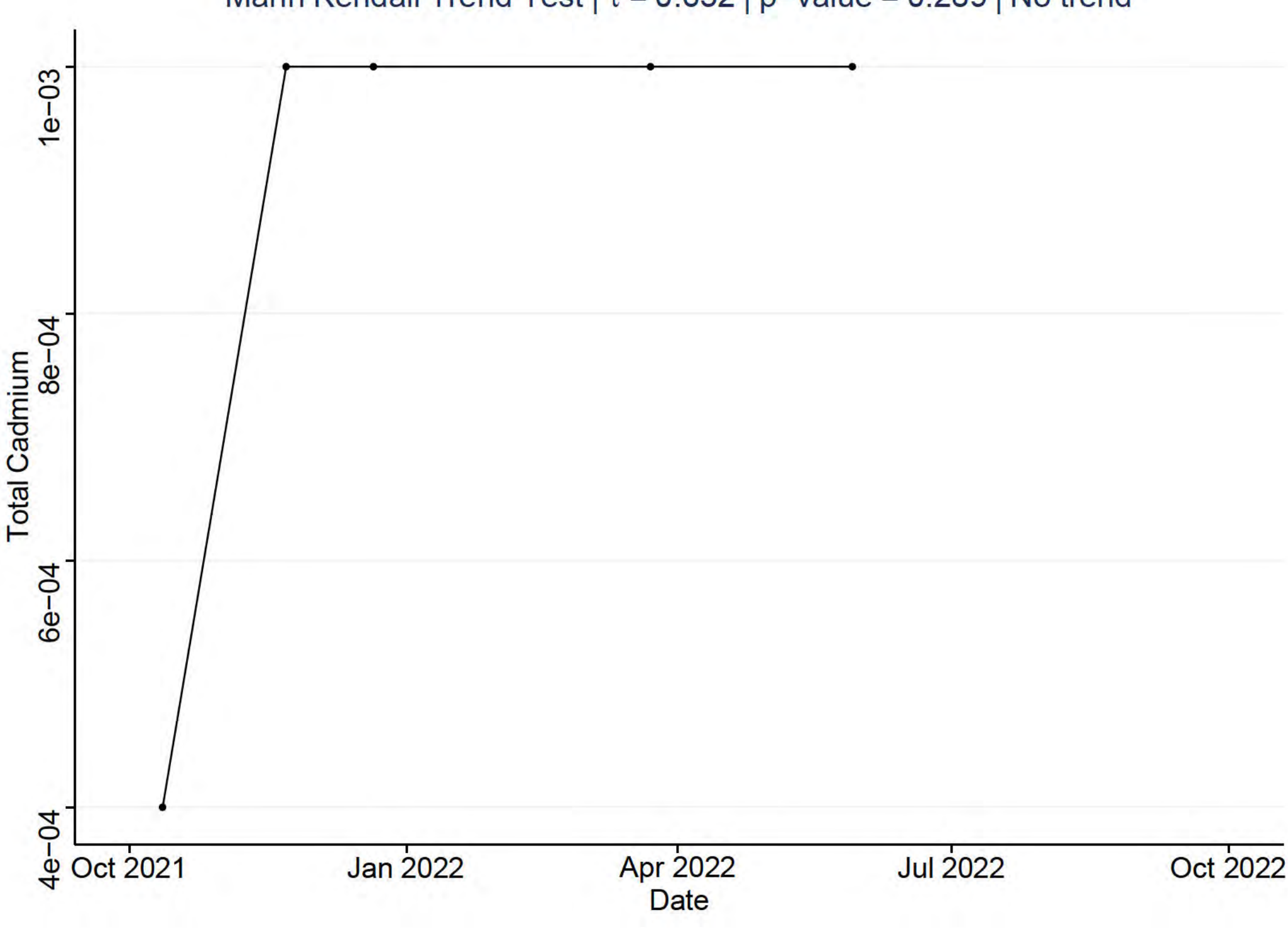
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

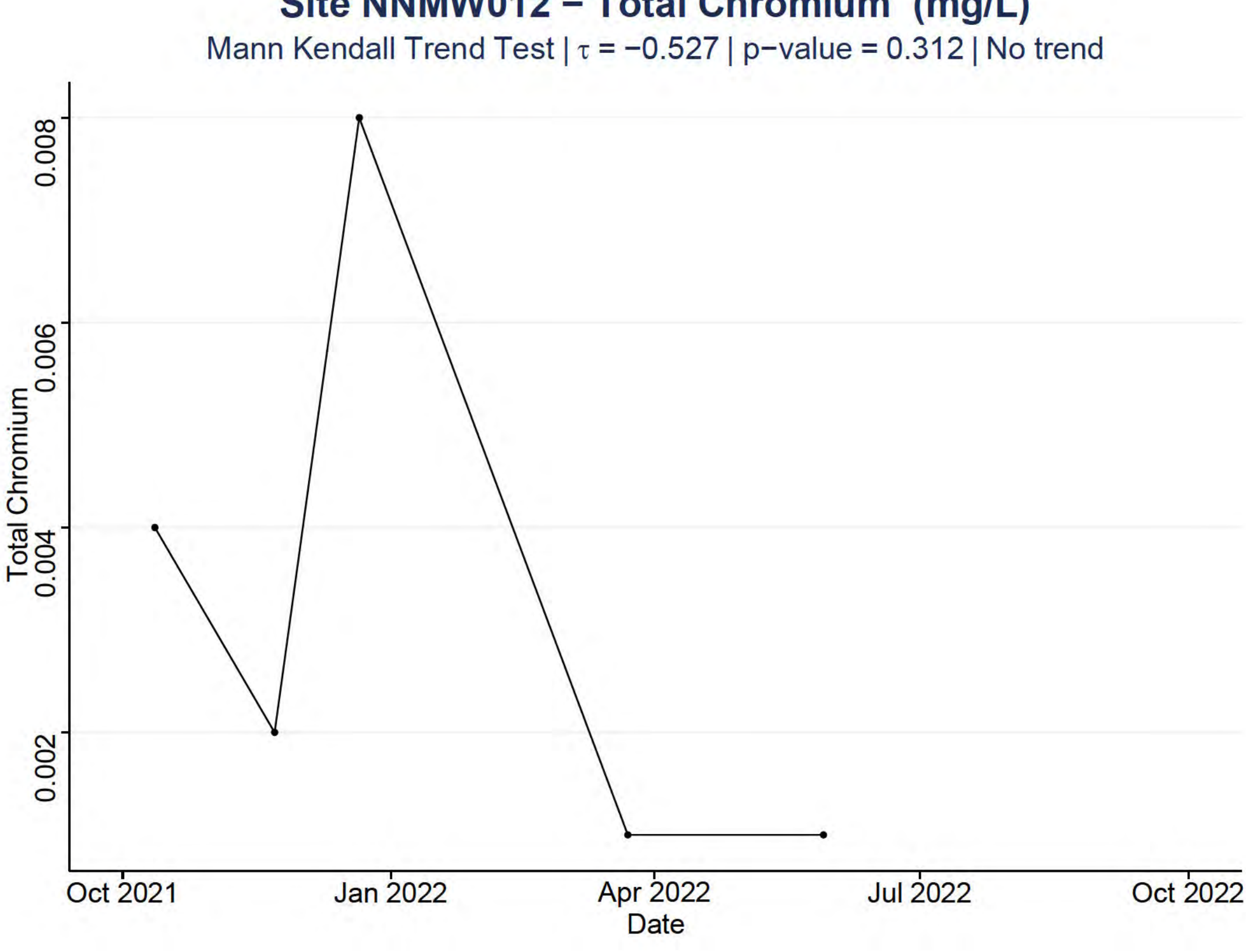


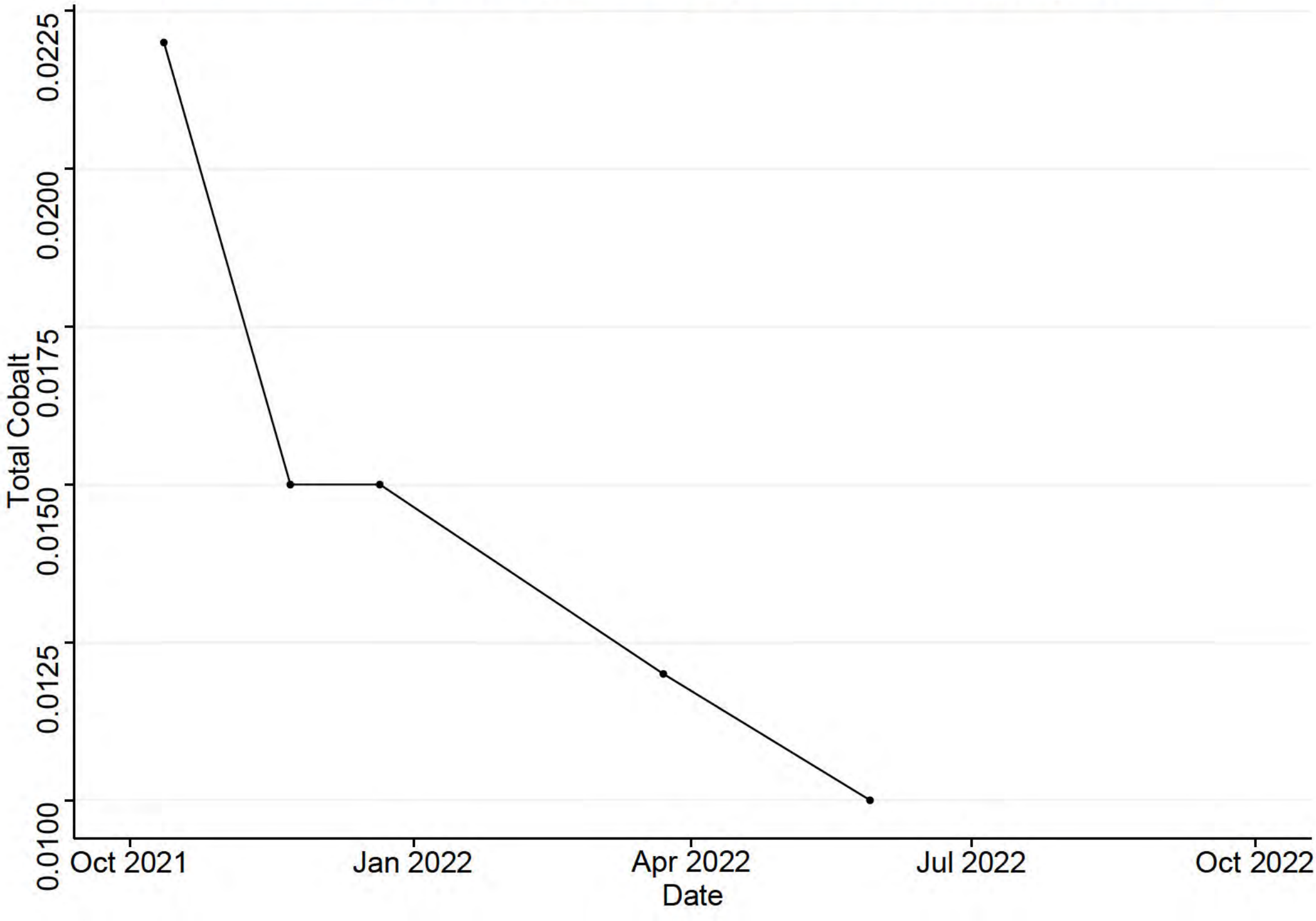
Site NNMW012 – Total Boron (mg/L)

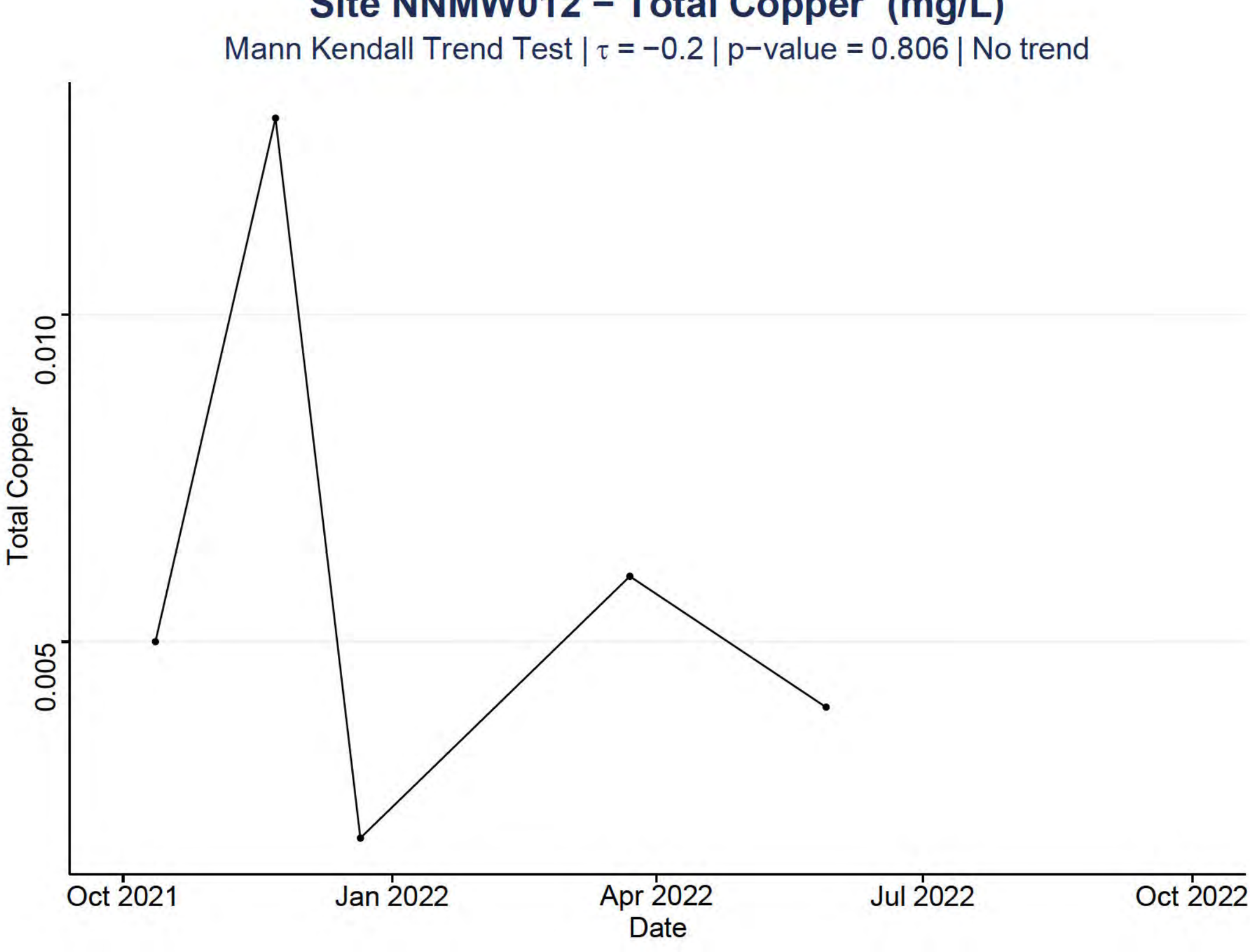
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

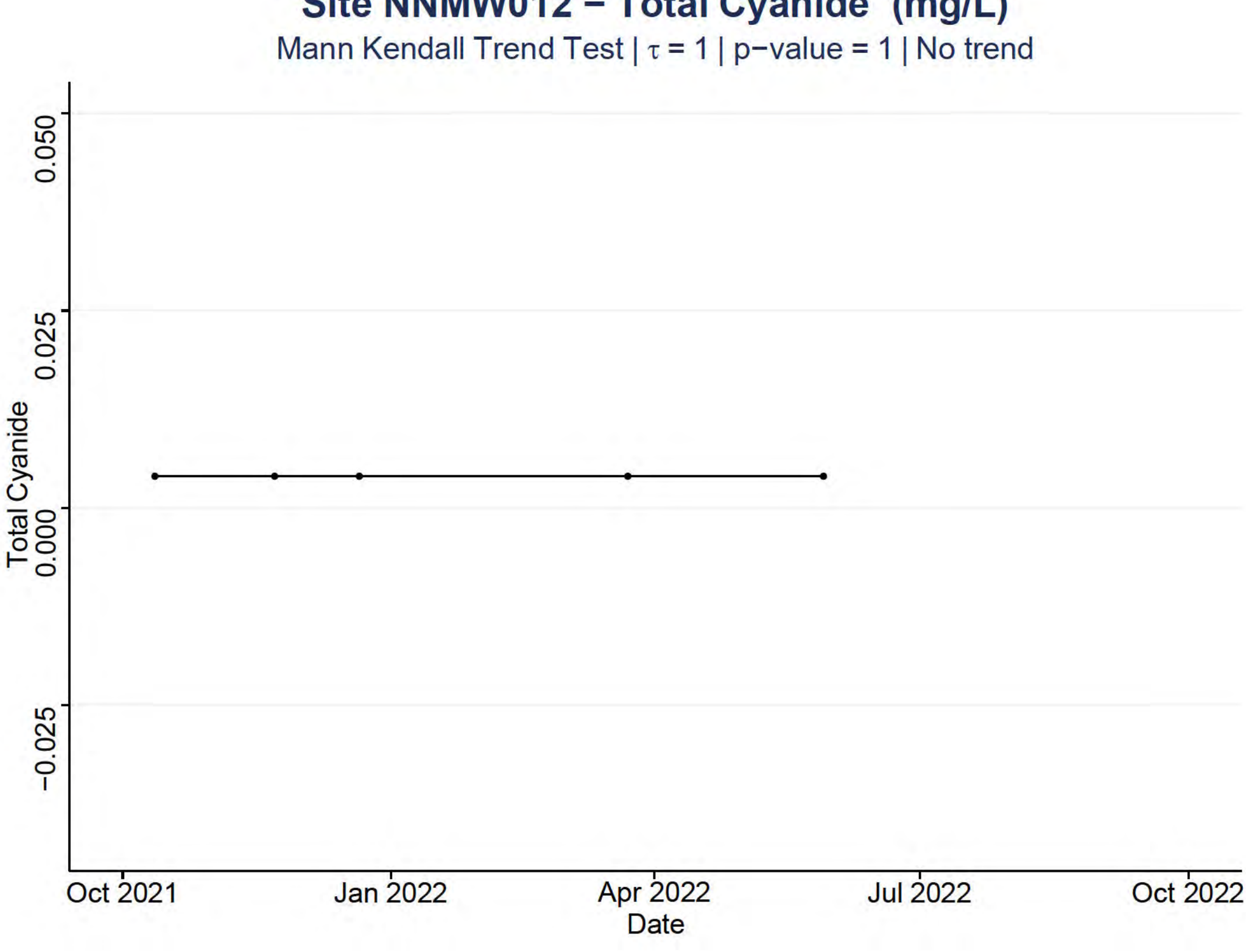


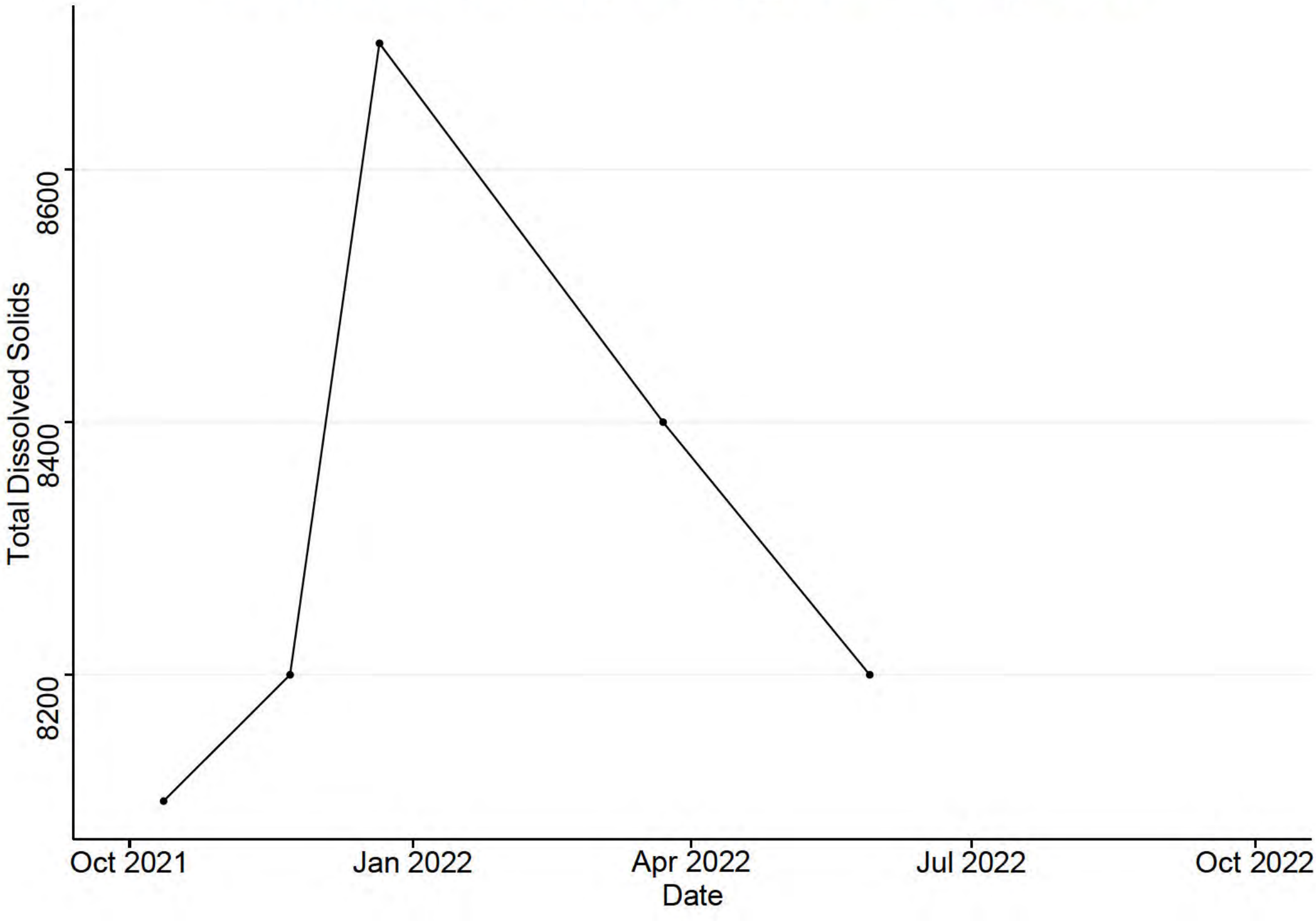

Site NNMW012 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = 0.632 | p−value = 0.289 | No trend
Total Cadmium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

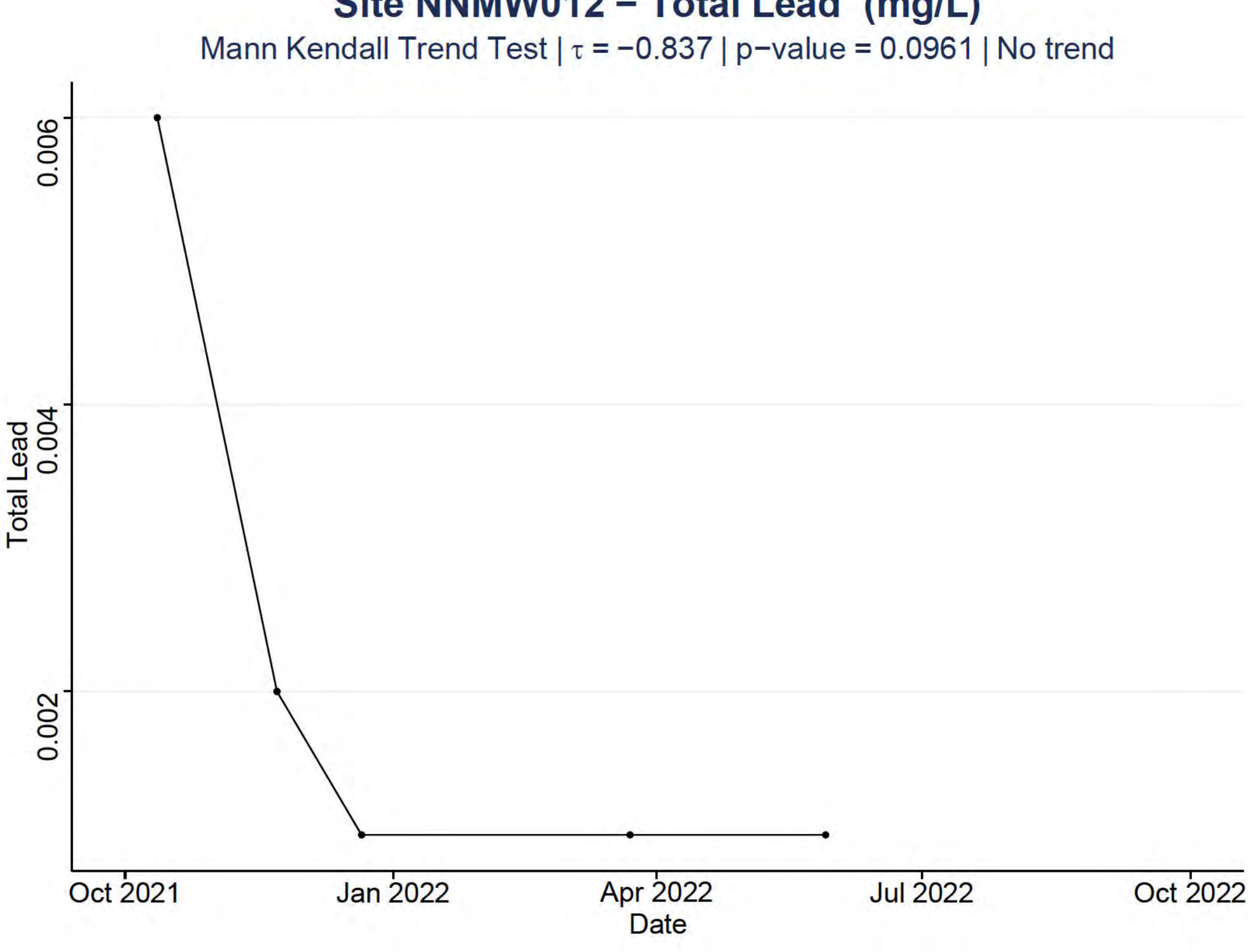

Site NNMW012 − Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Total Chromium
0.002
0.004
0.006
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

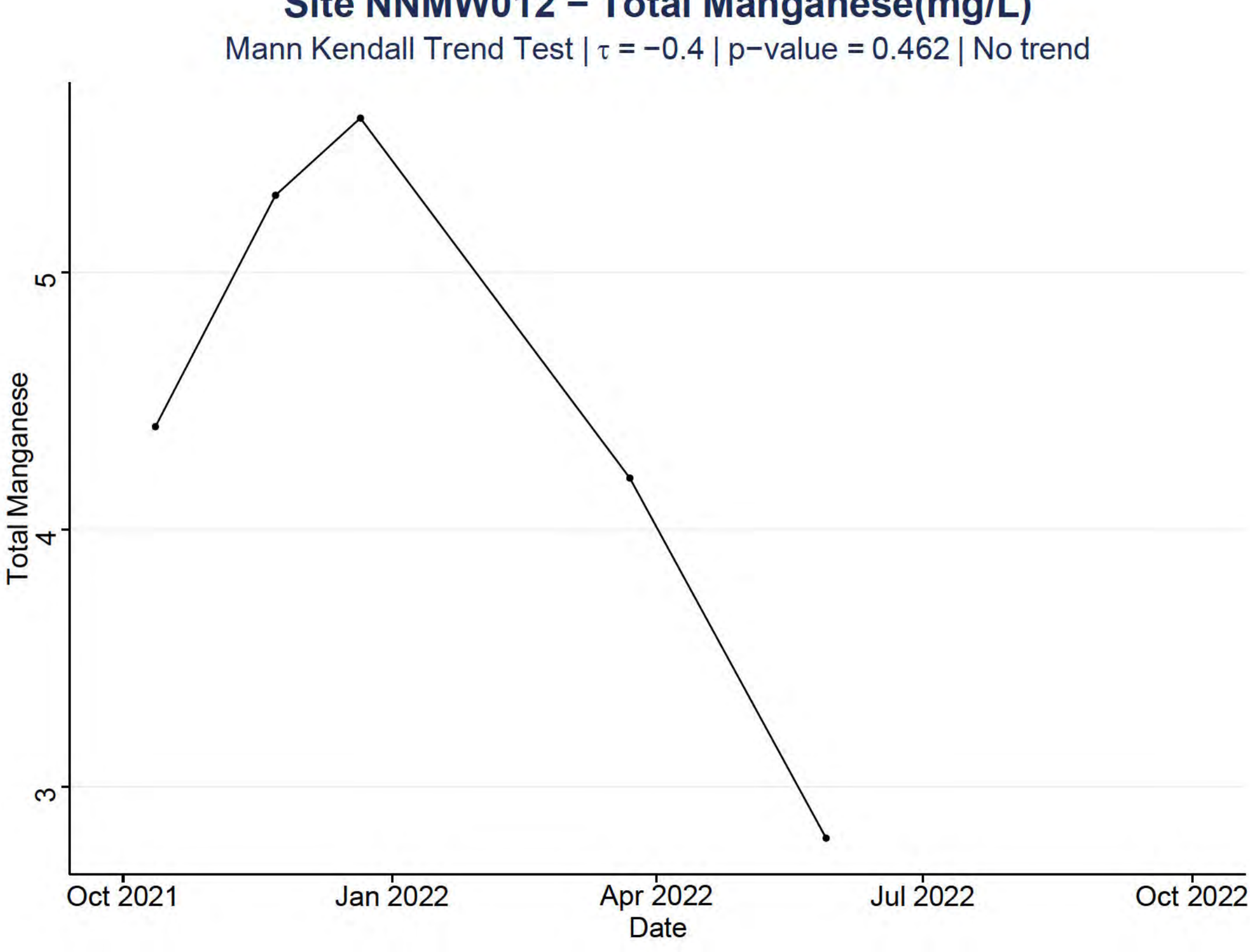

Site NNMW012 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.949 | p−value = 0.0433 | Negative trend
Total Cobalt
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

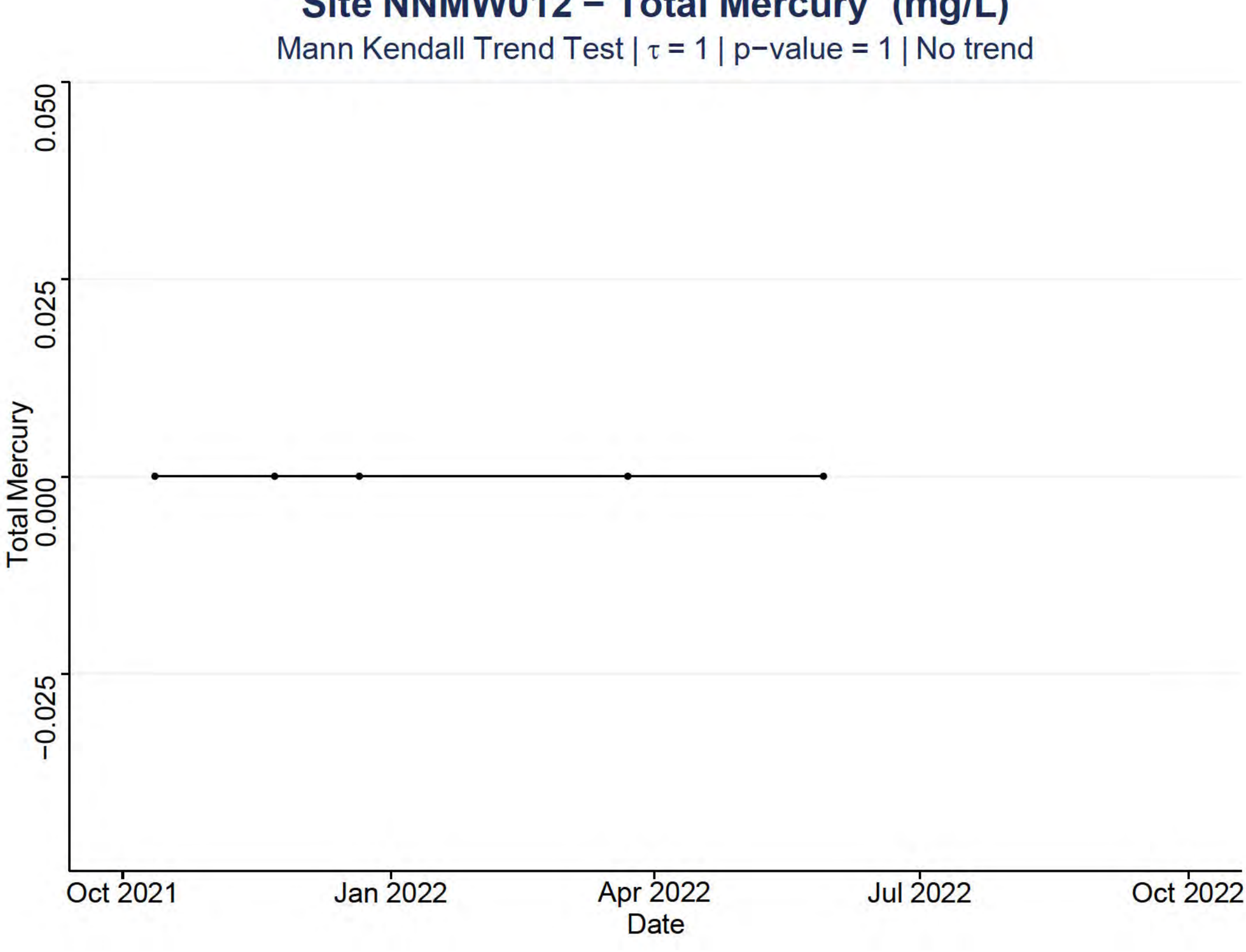

Site NNMW012 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Total Copper
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = 0.316 | p−value = 0.613 | No trend
Total Dissolved Solids
8600
8400
8200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

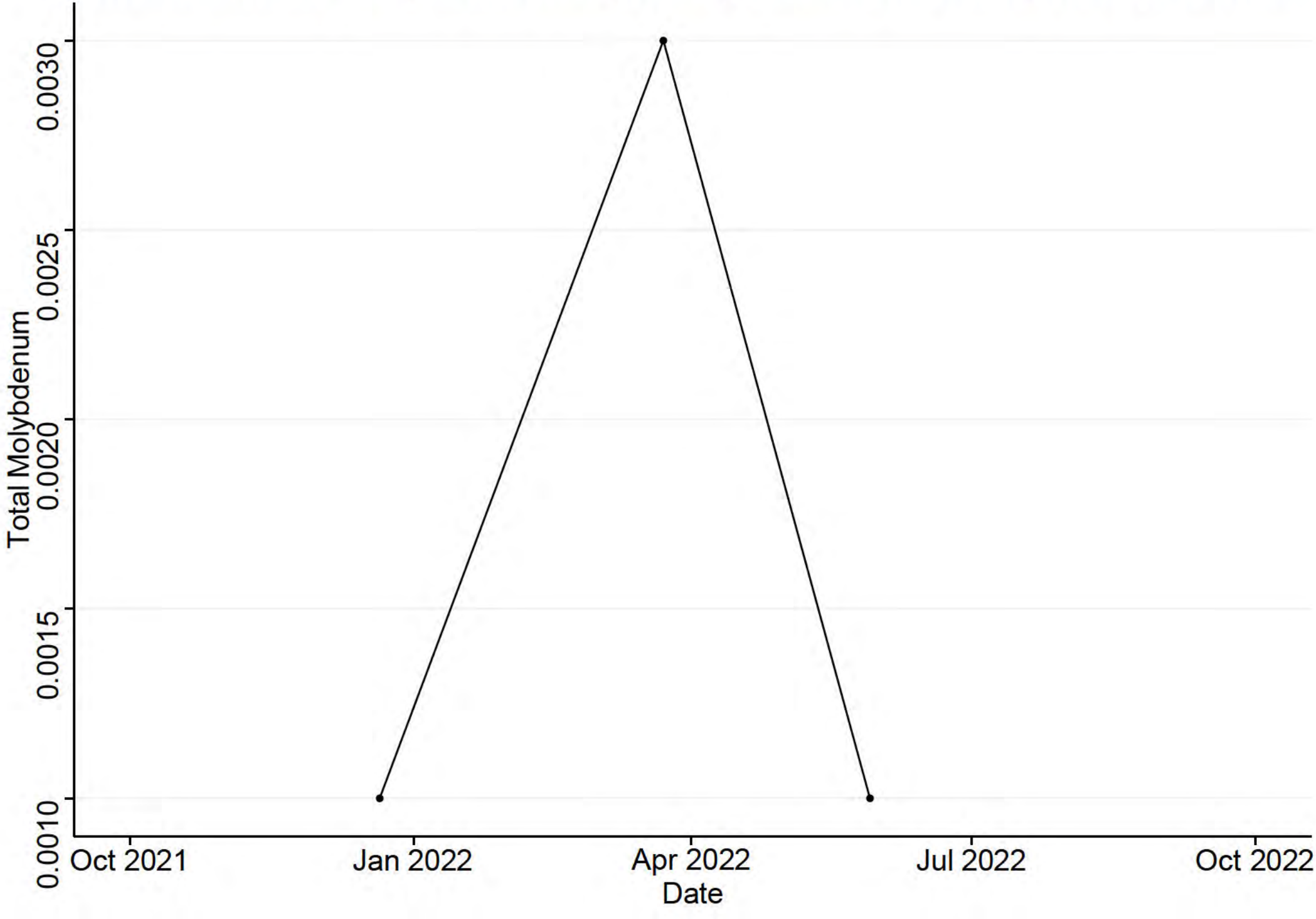

Site NNMW012 − Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.837 | p−value = 0.0961 | No trend
Total Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

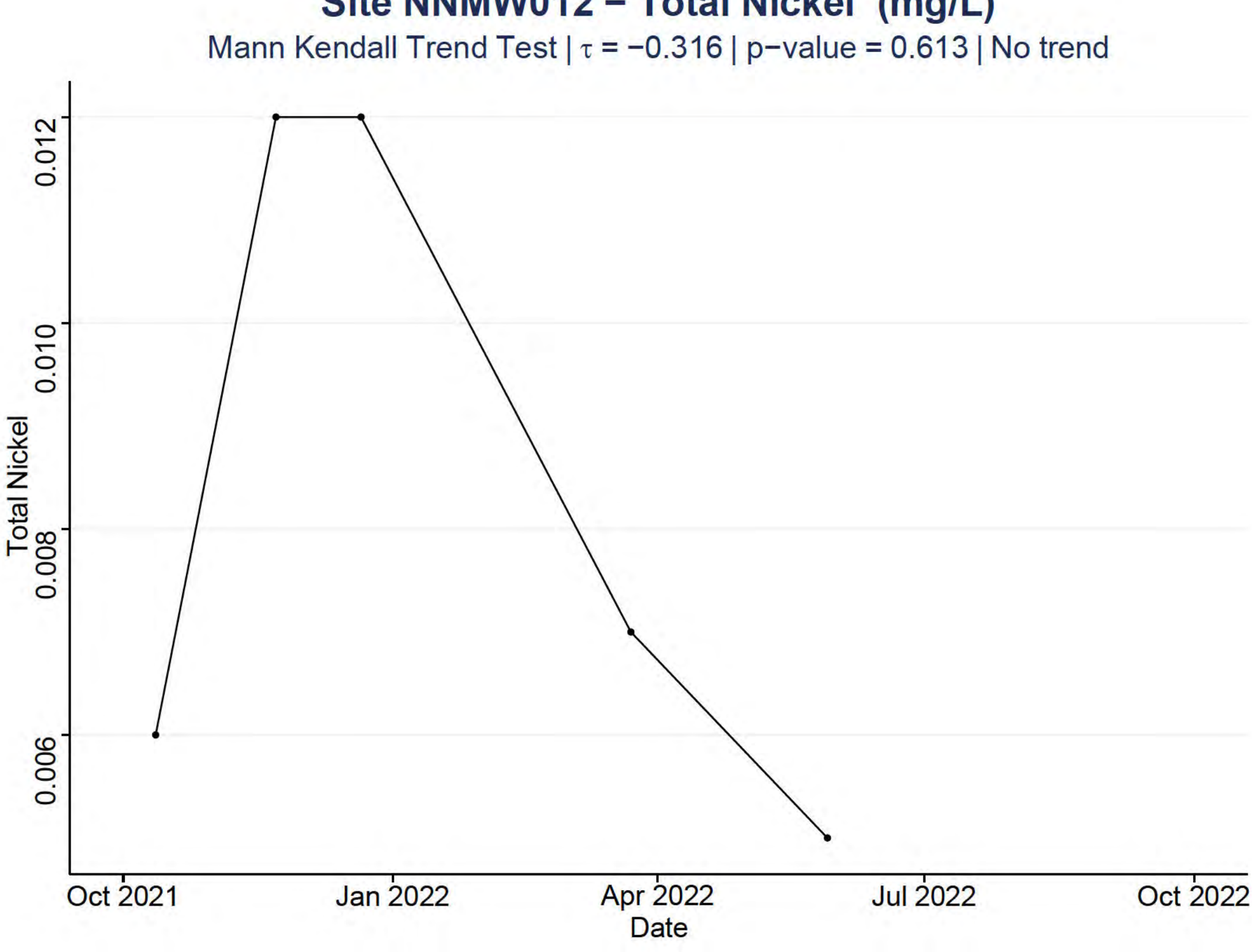

Site NNMW012 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.4 | p−value = 0.462 | No trend
Total Manganese
5
4
3
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

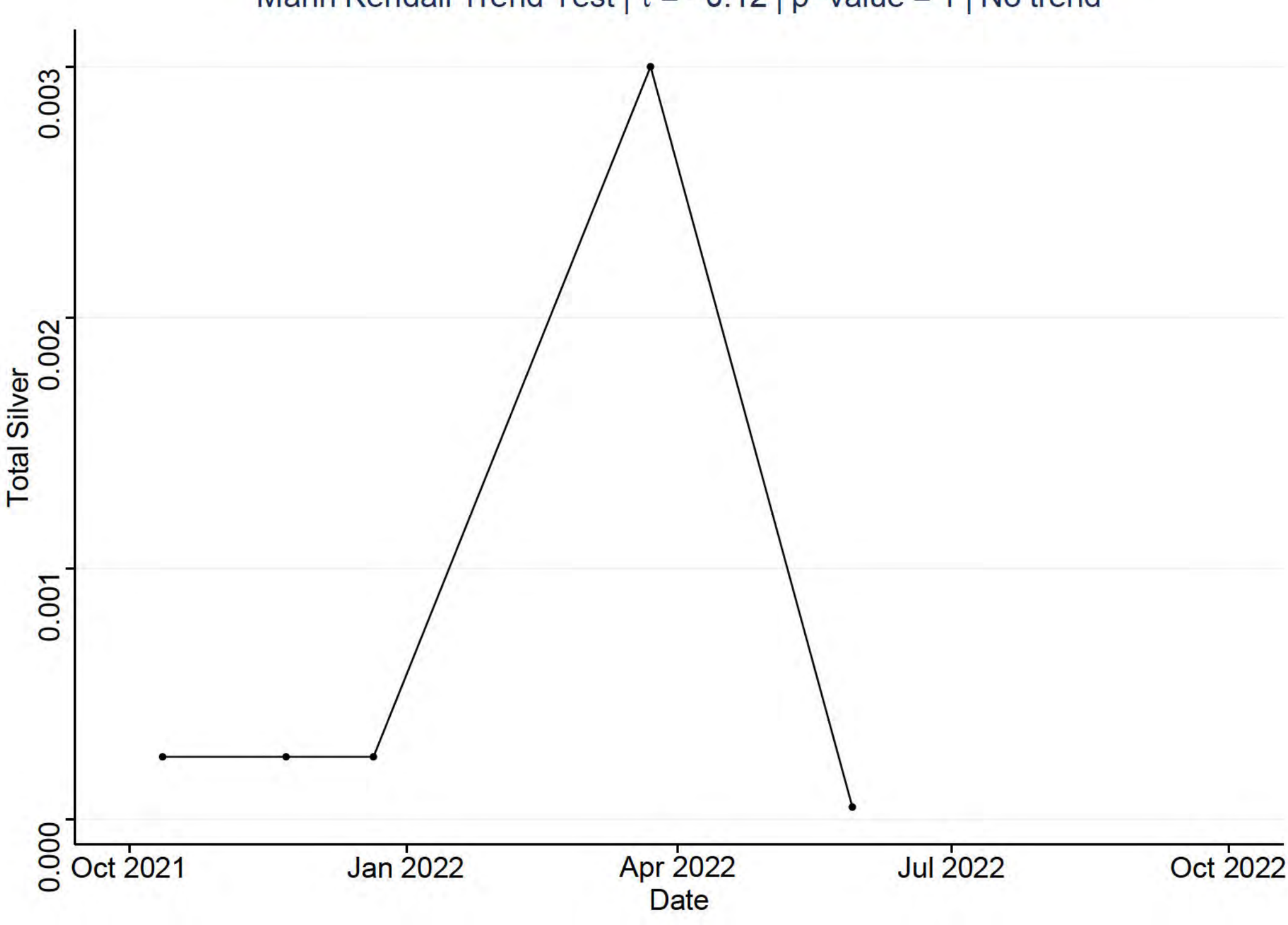

Site NNMW012 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

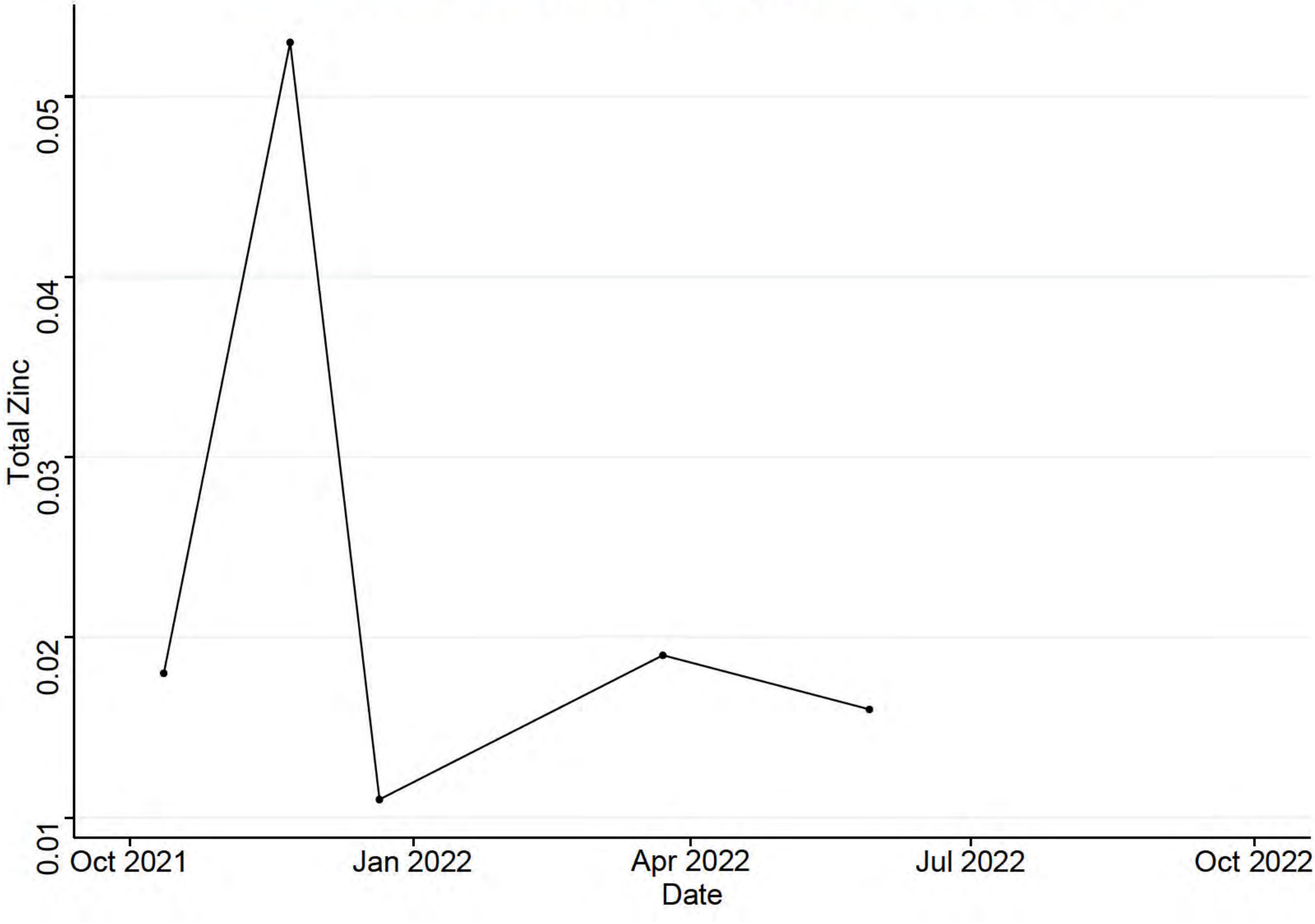
Site NNMW012 – Total Molybdenum (mg/L)

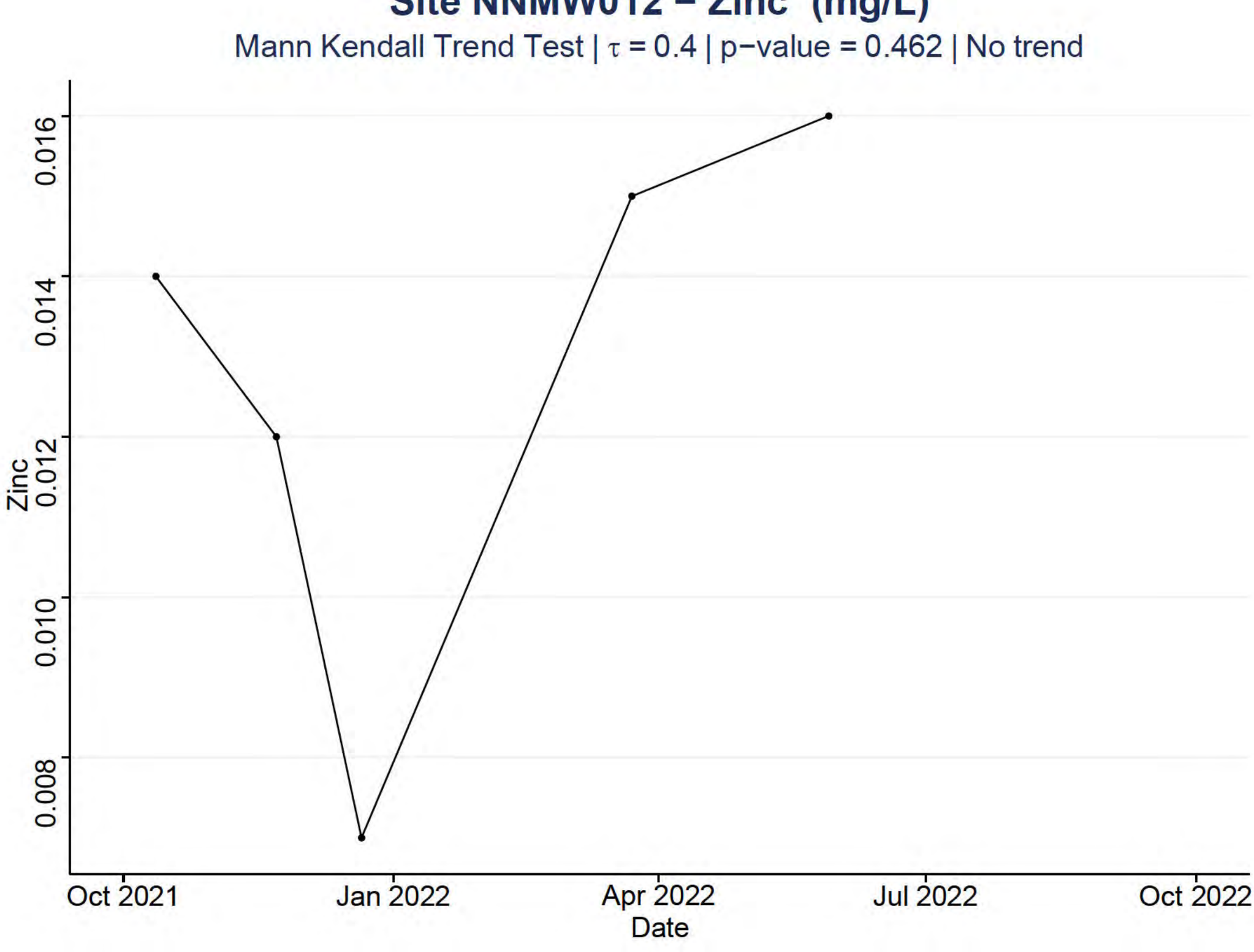
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

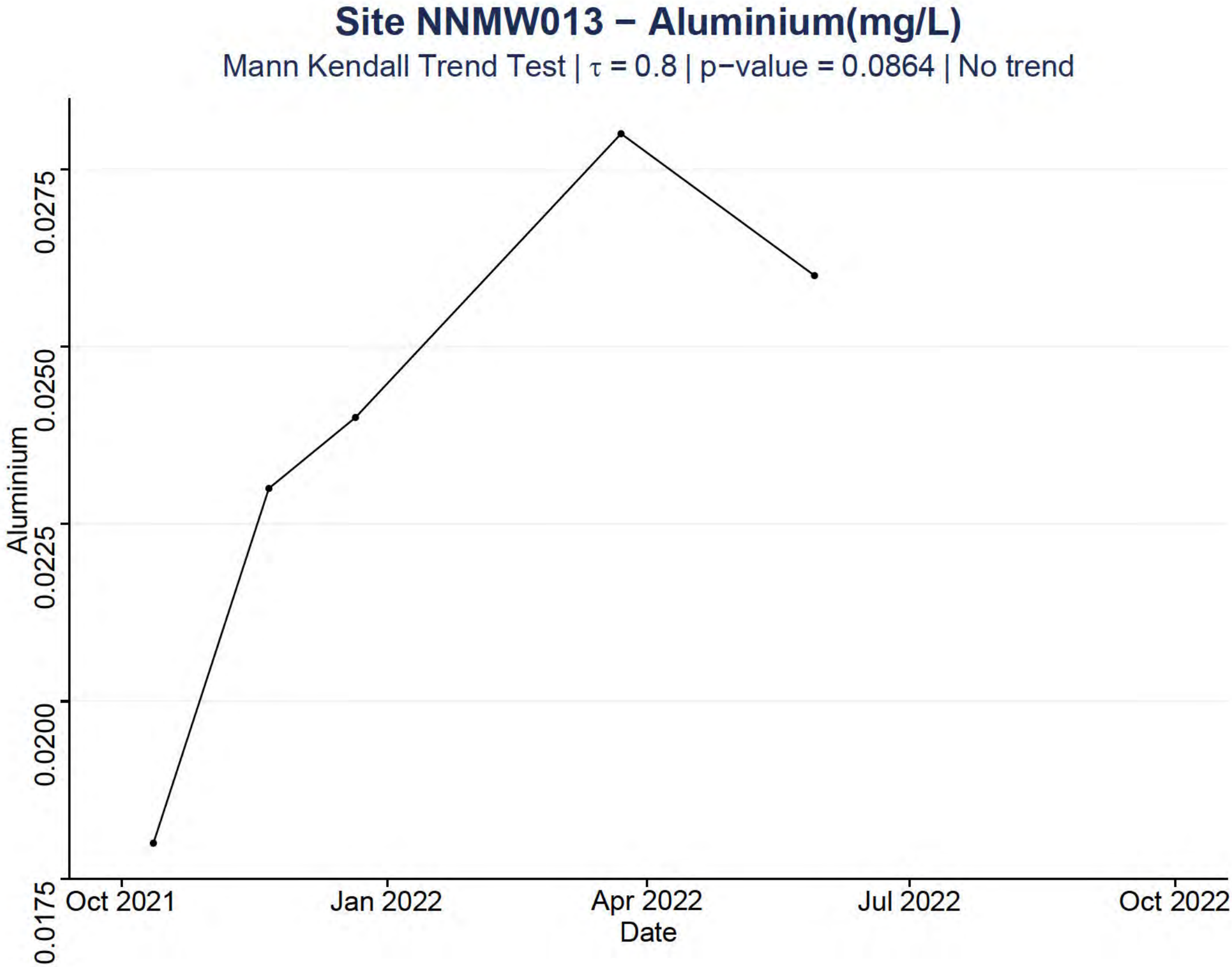


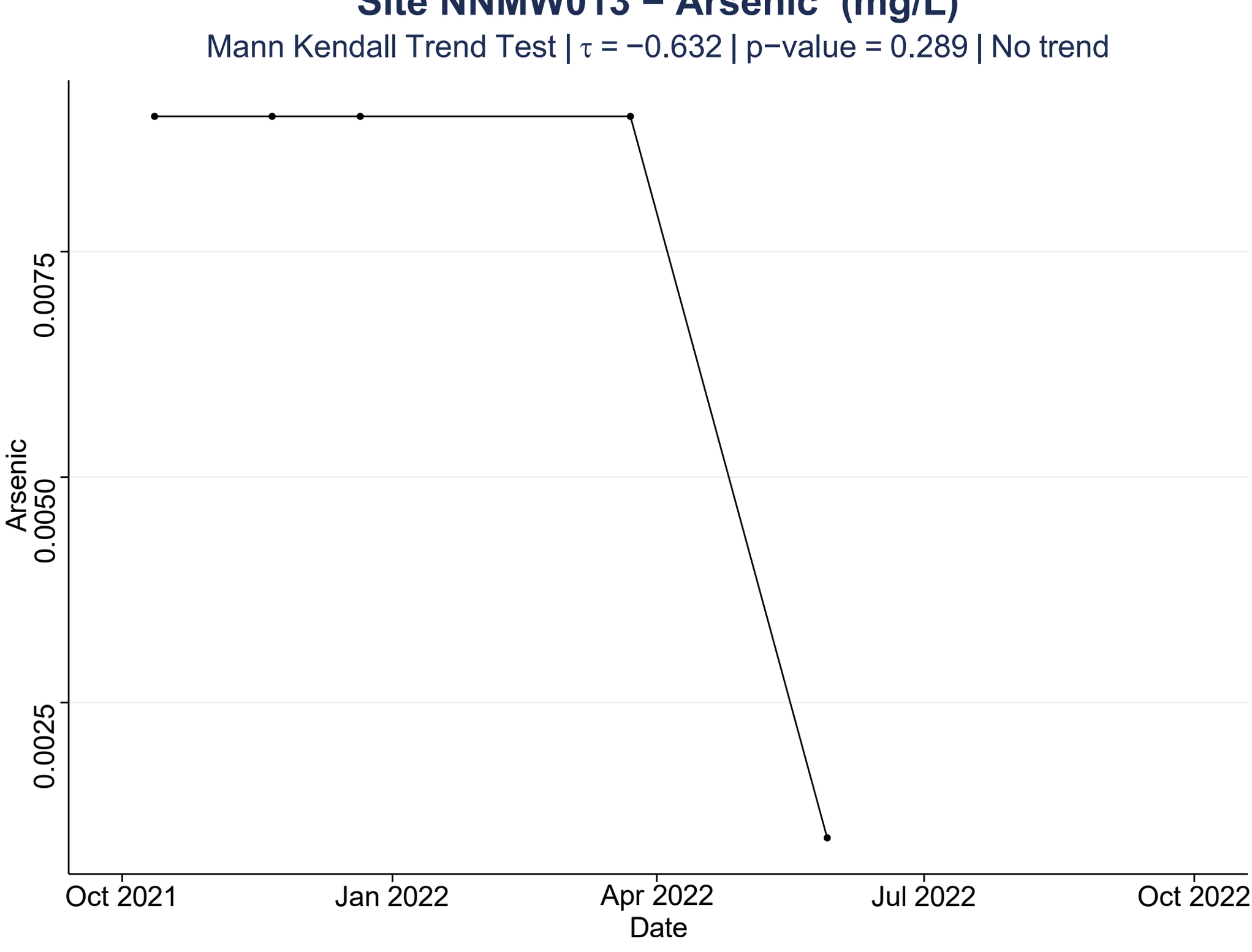

Site NNMW012 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Total Nickel
0.012
0.010
0.008
0.006
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = −0.12 | p−value = 1 | No trend
Total Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW012 − Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Total Zinc
0.01
0.02
0.03
0.04
0.05
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

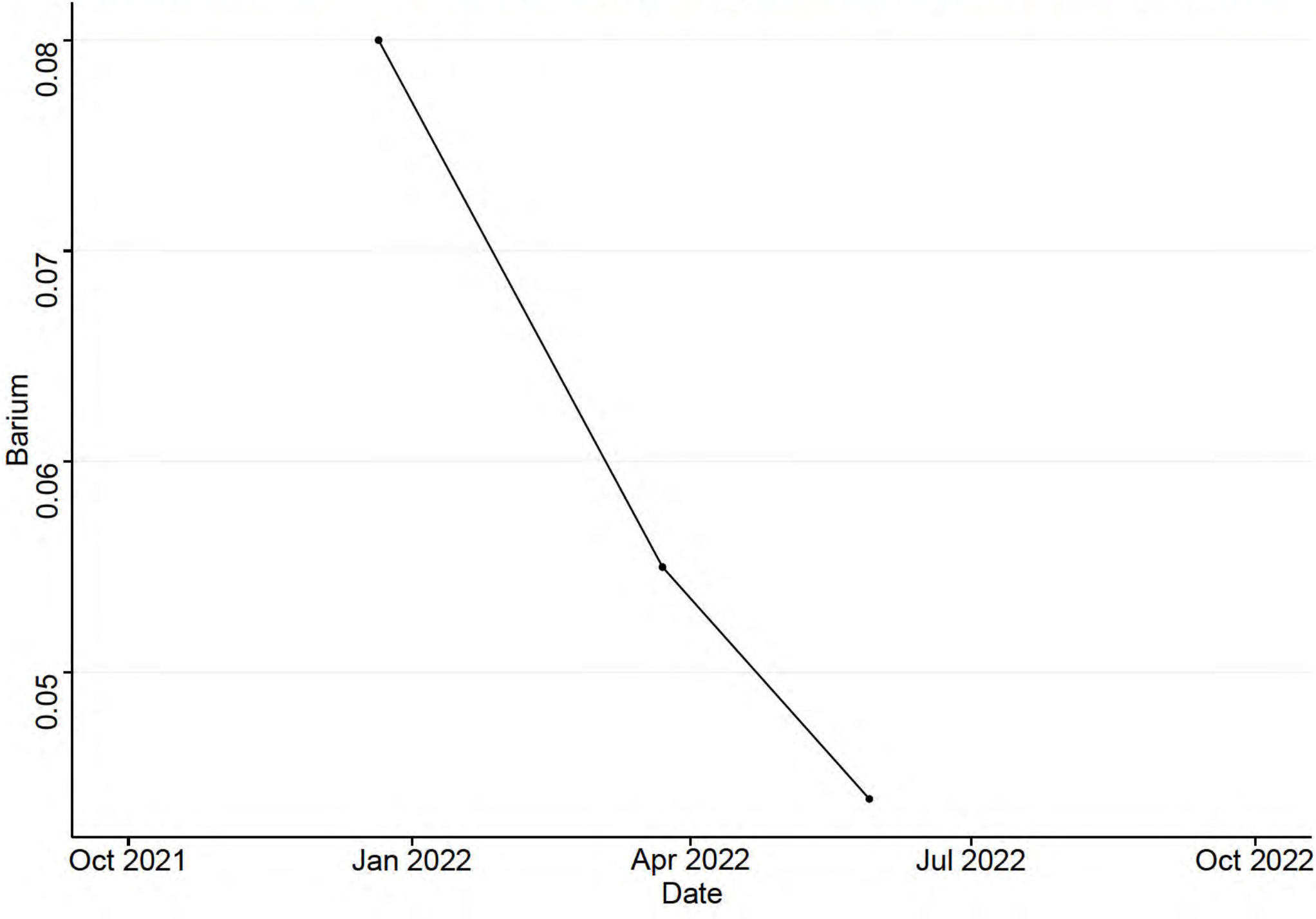

Site NNMW012 – Zinc (mg/L)
Mann Kendall Trend Test | τ = 0.4 | p−value = 0.462 | No trend
Zinc
0.016
0.014
0.012
0.010
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.8 | p−value = 0.0864 | No trend
Aluminium
0.0275
0.0250
0.0225
0.0200
0.0175
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

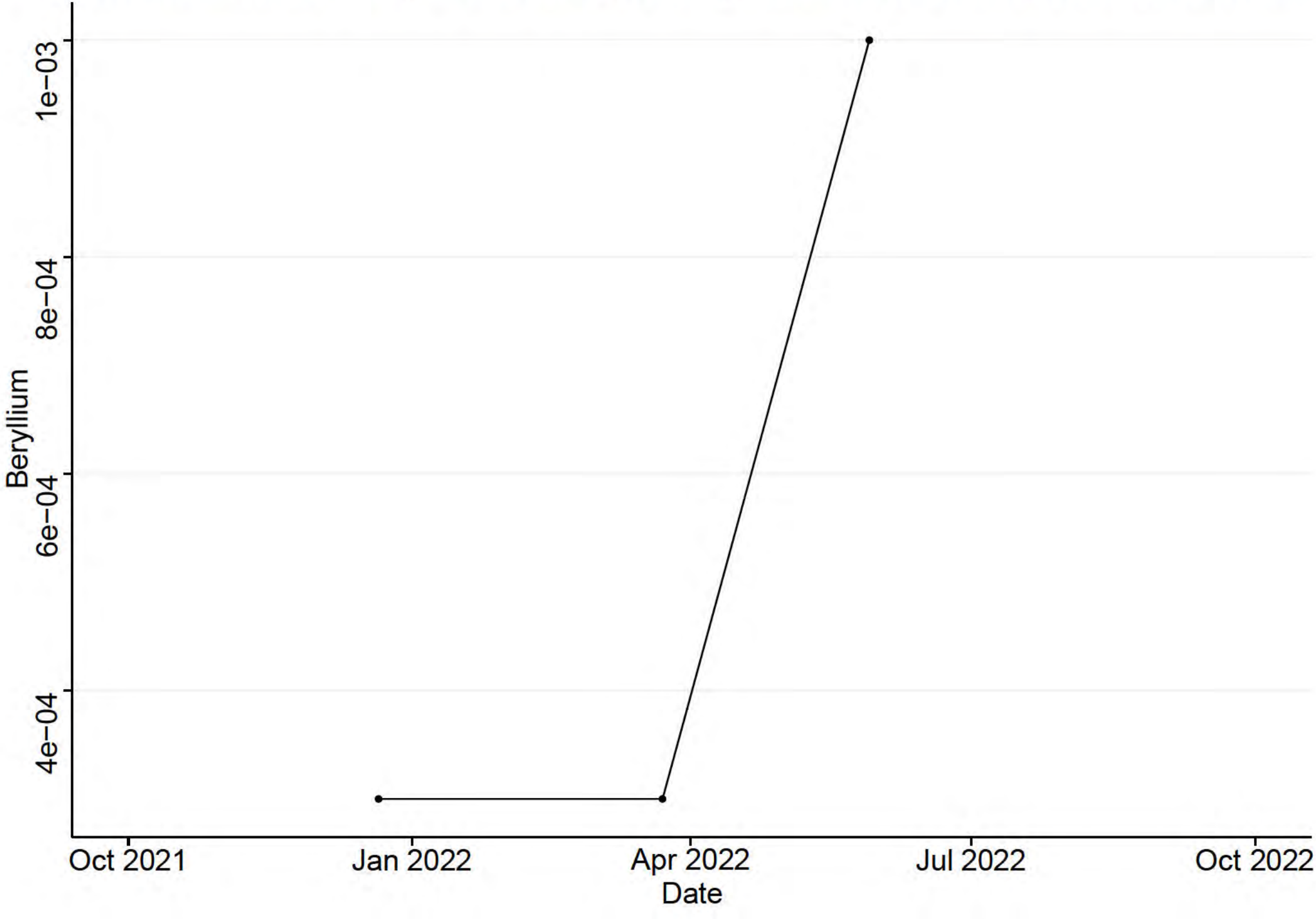
Site NNMW013 − Barium(mg/L)

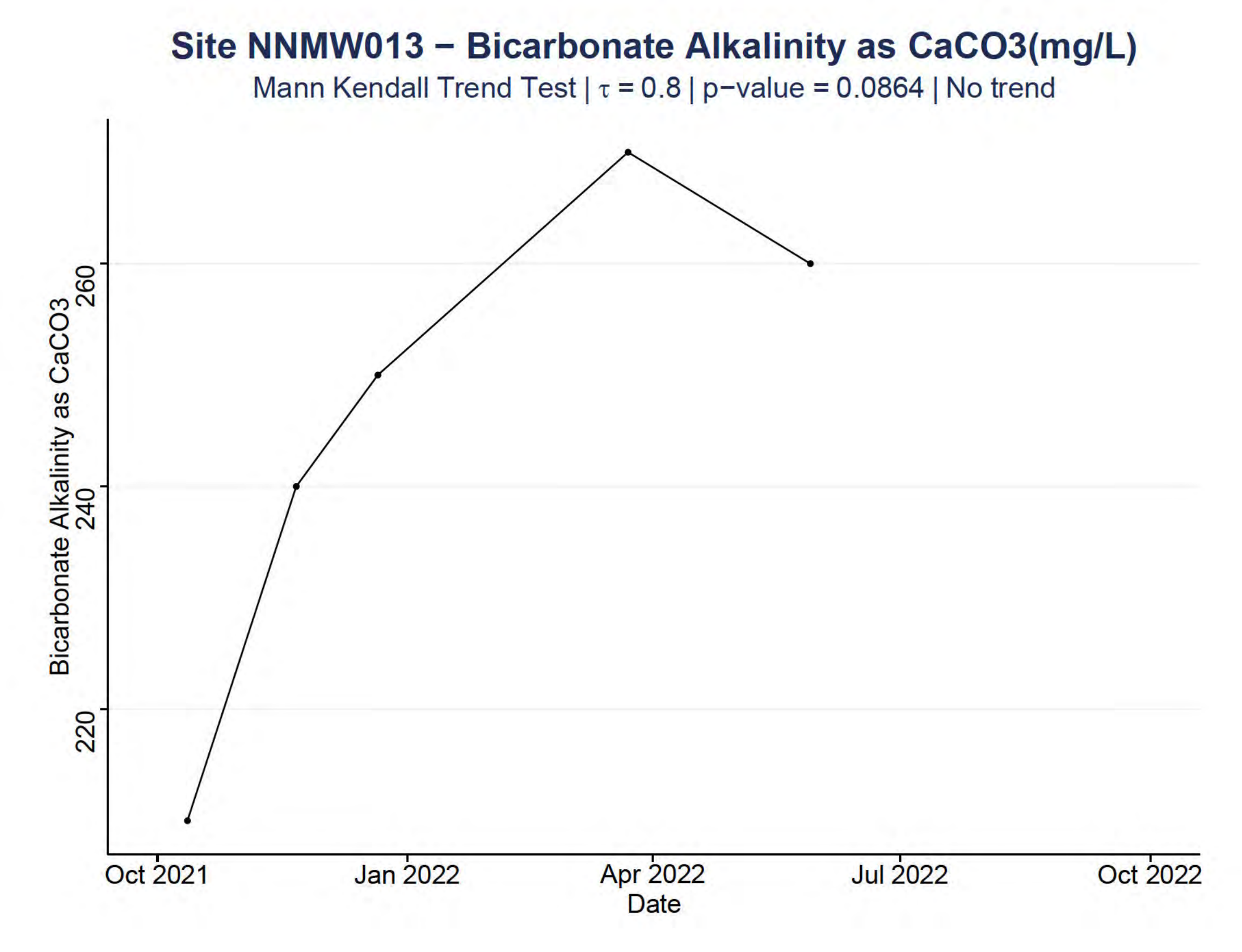
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

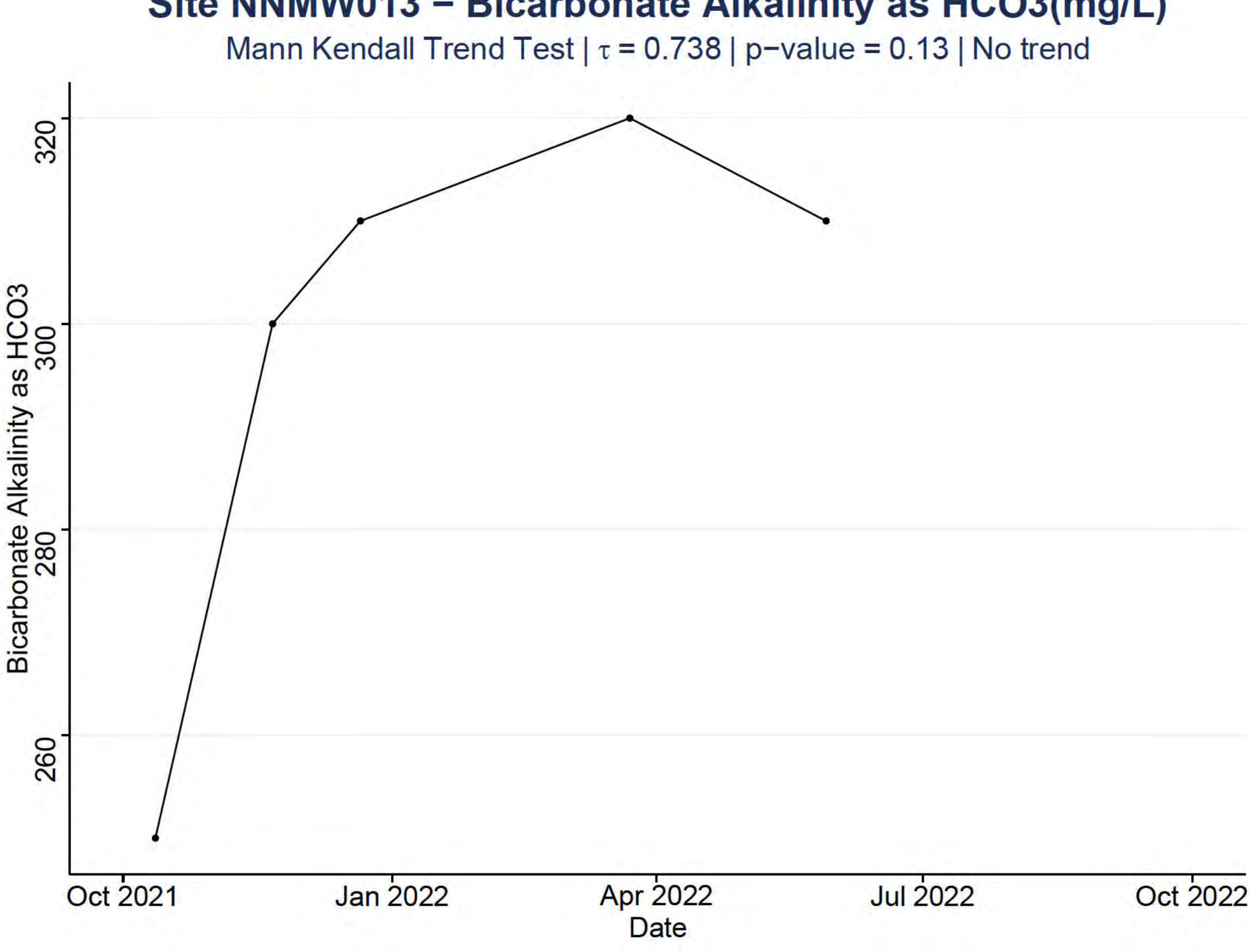


Site NNMW013 – Beryllium (mg/L)

Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

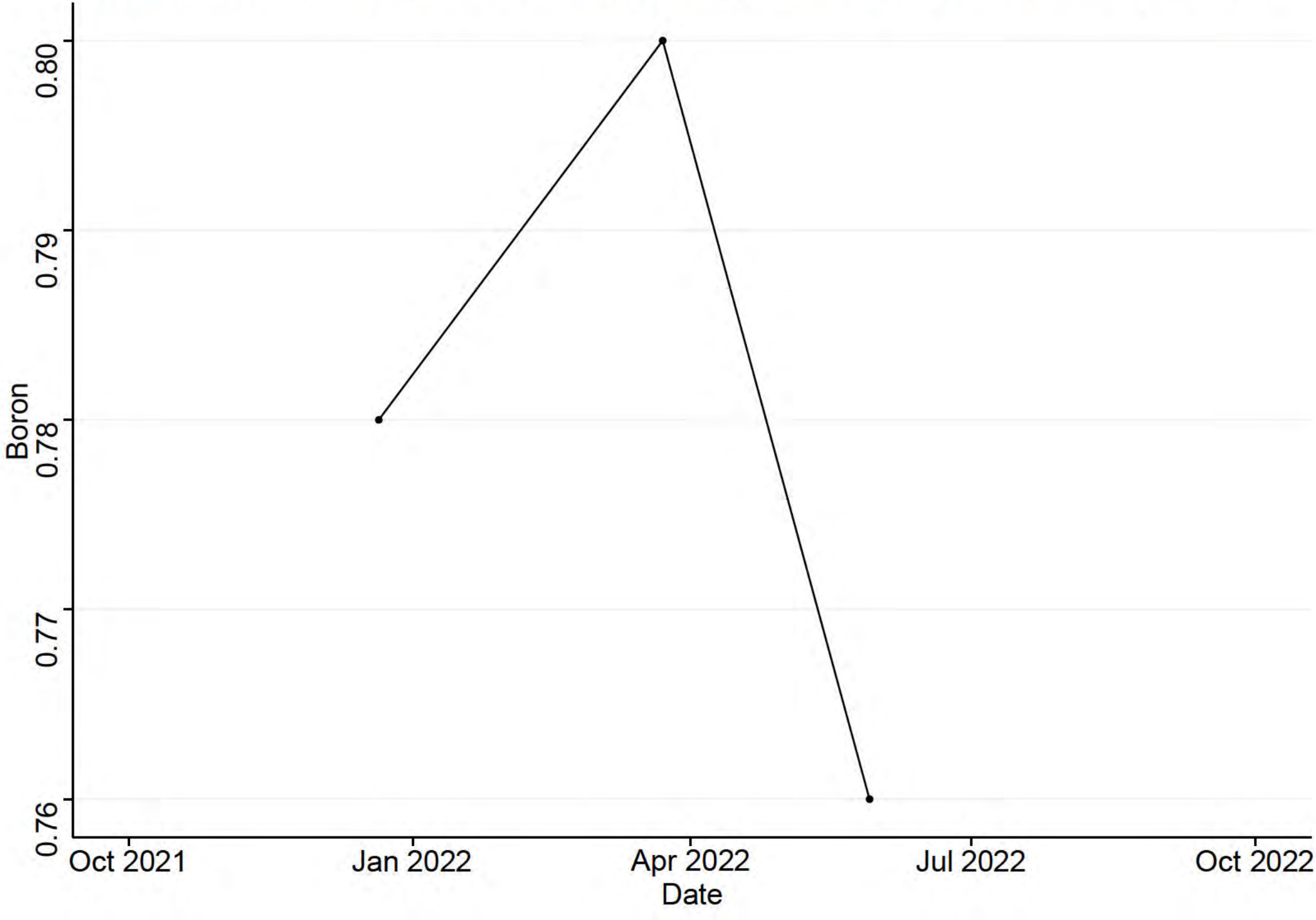


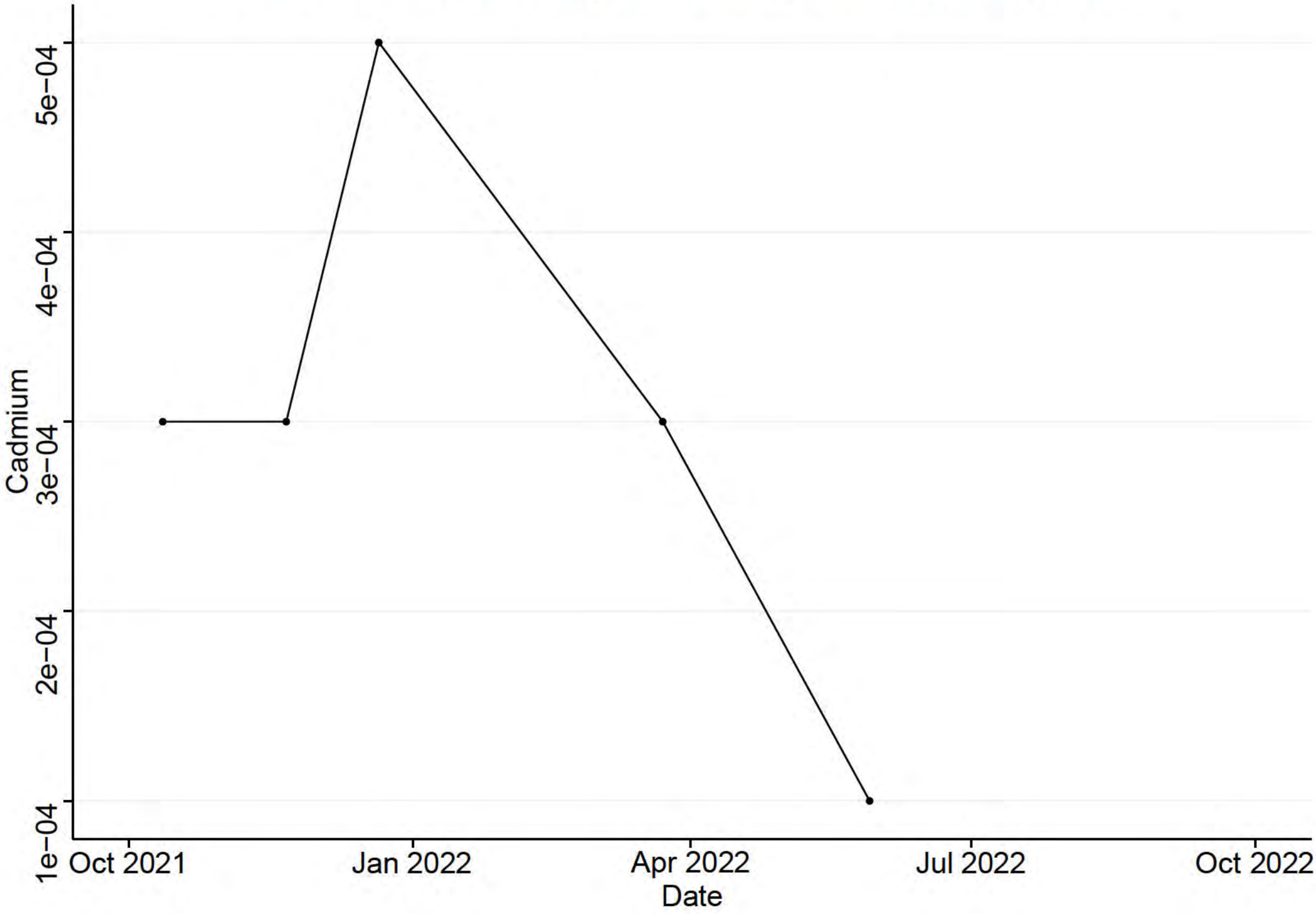

Site NNMW013 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.8 | p−value = 0.0864 | No trend
Bicarbonate Alkalinity as CaCO3
260
240
220
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

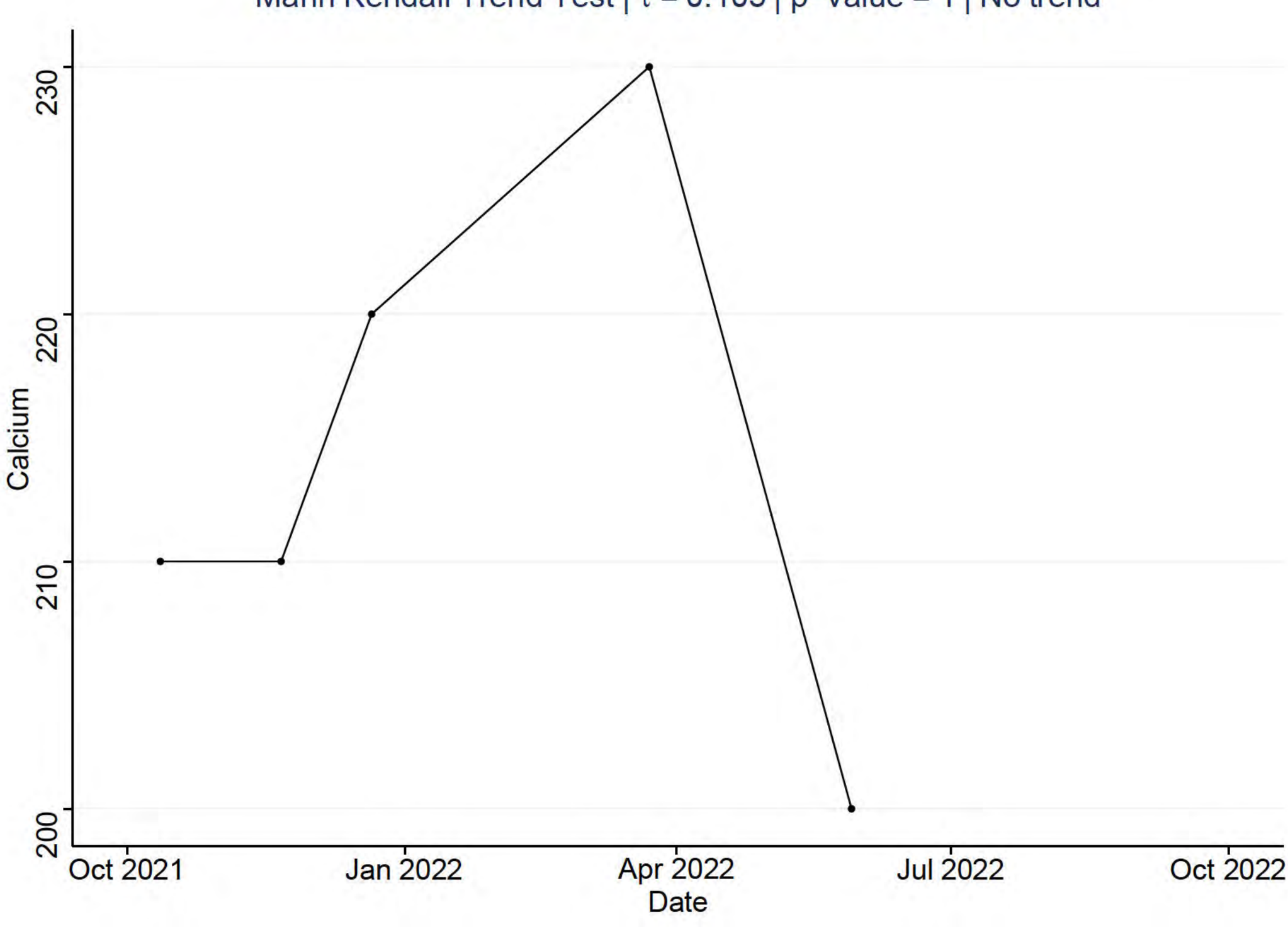

Site NNMW013 − Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.738 | p−value = 0.13 | No trend
Bicarbonate Alkalinity as HCO3
320
300
280
260
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

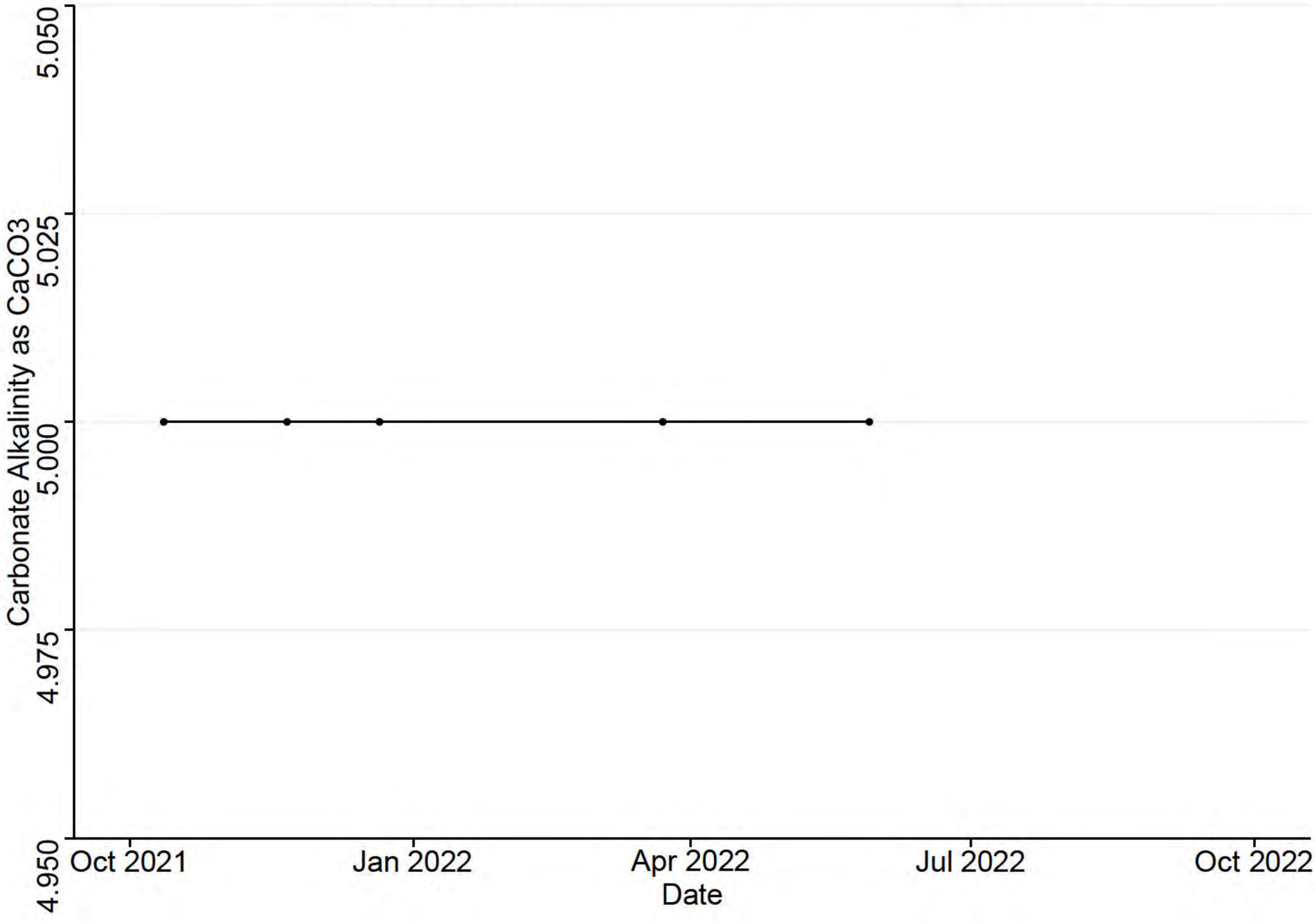
Site NNMW013 – Boron(mg/L)

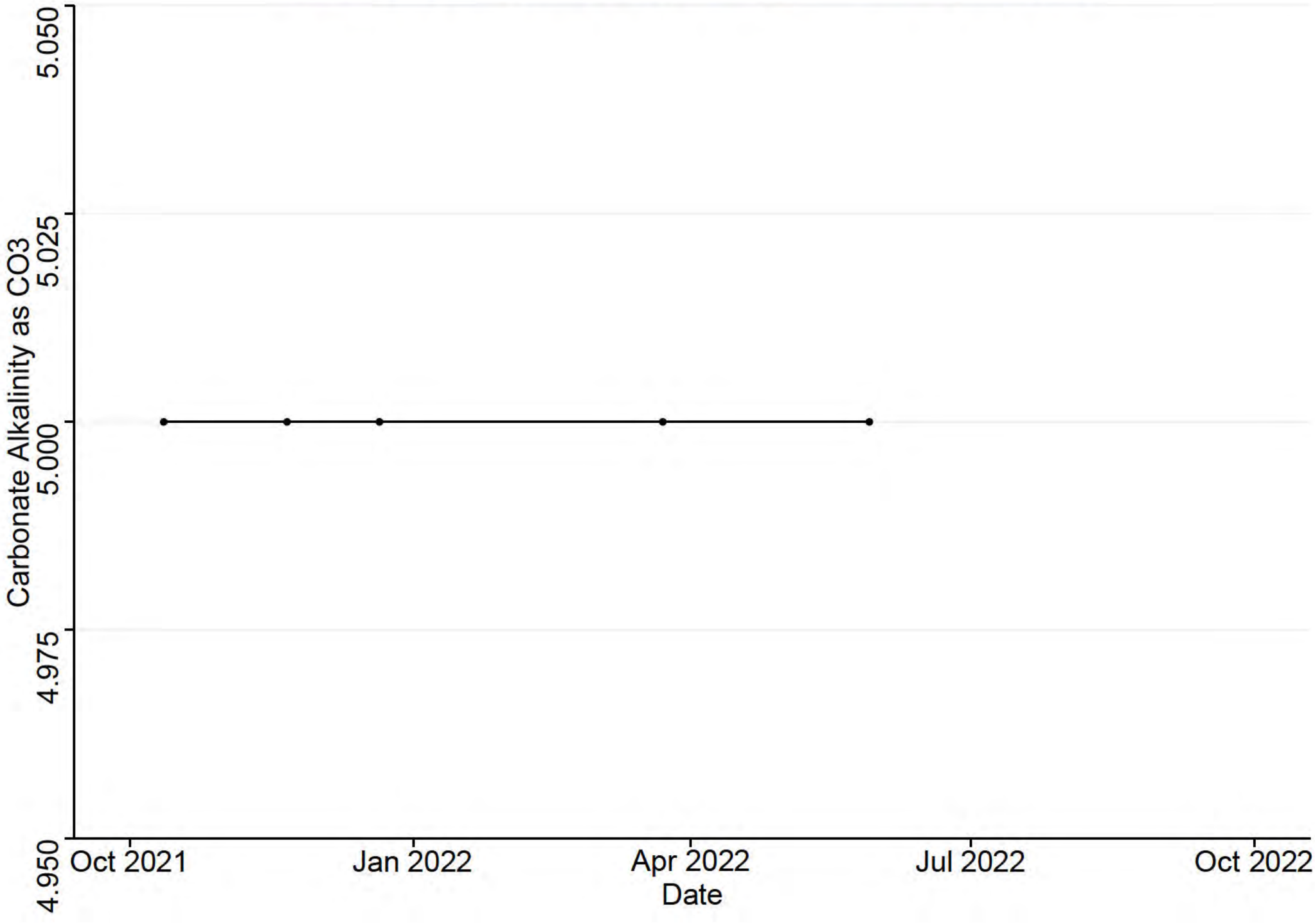
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

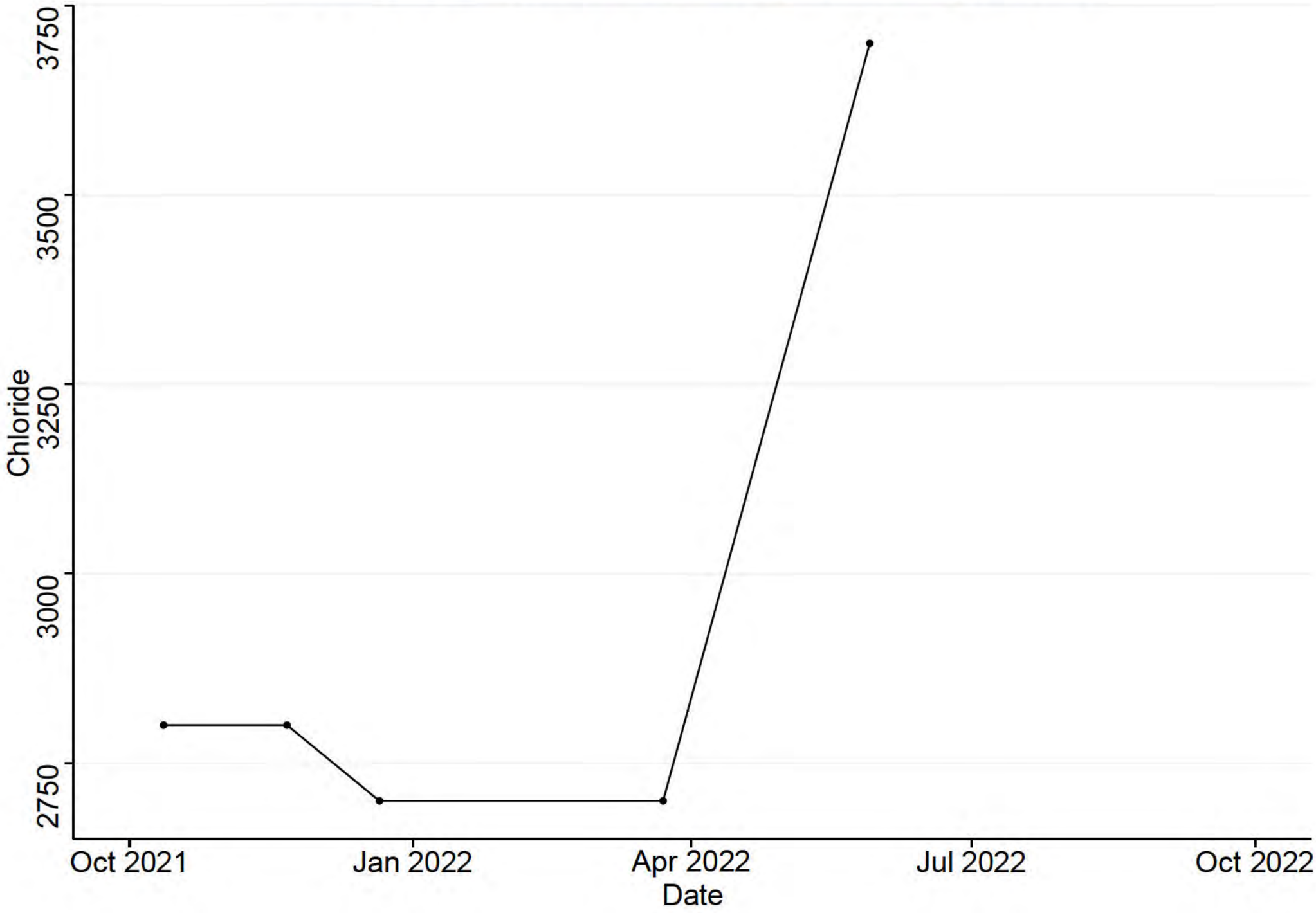


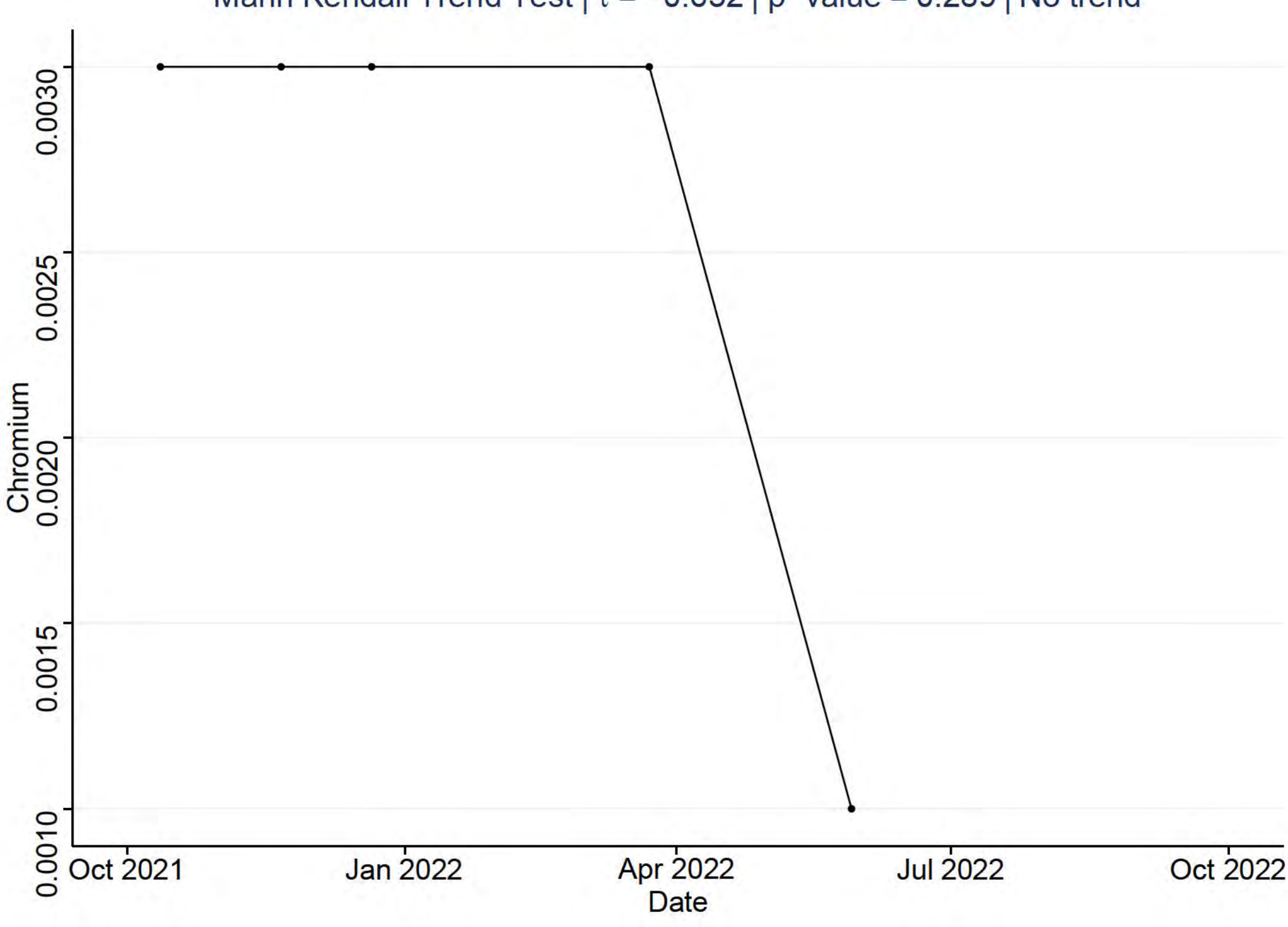

Site NNMW013 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.359 | p−value = 0.579 | No trend
Cadmium
5e−04
4e−04
3e−04
2e−04
1e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

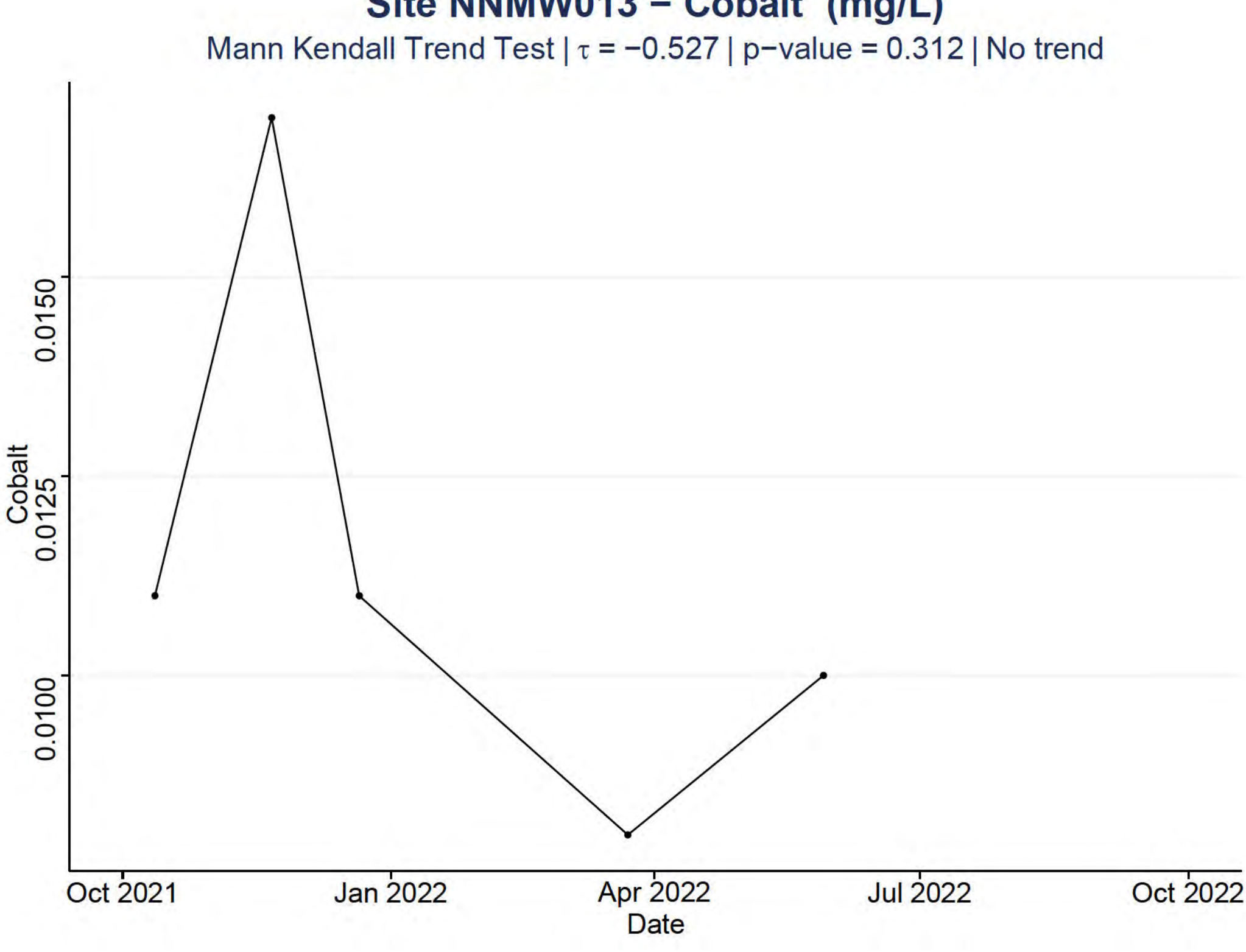

Site NNMW013 – Calcium(mg/L)
Mann Kendall Trend Test | τ = 0.105 | p−value = 1 | No trend
Calcium
230
220
210
200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

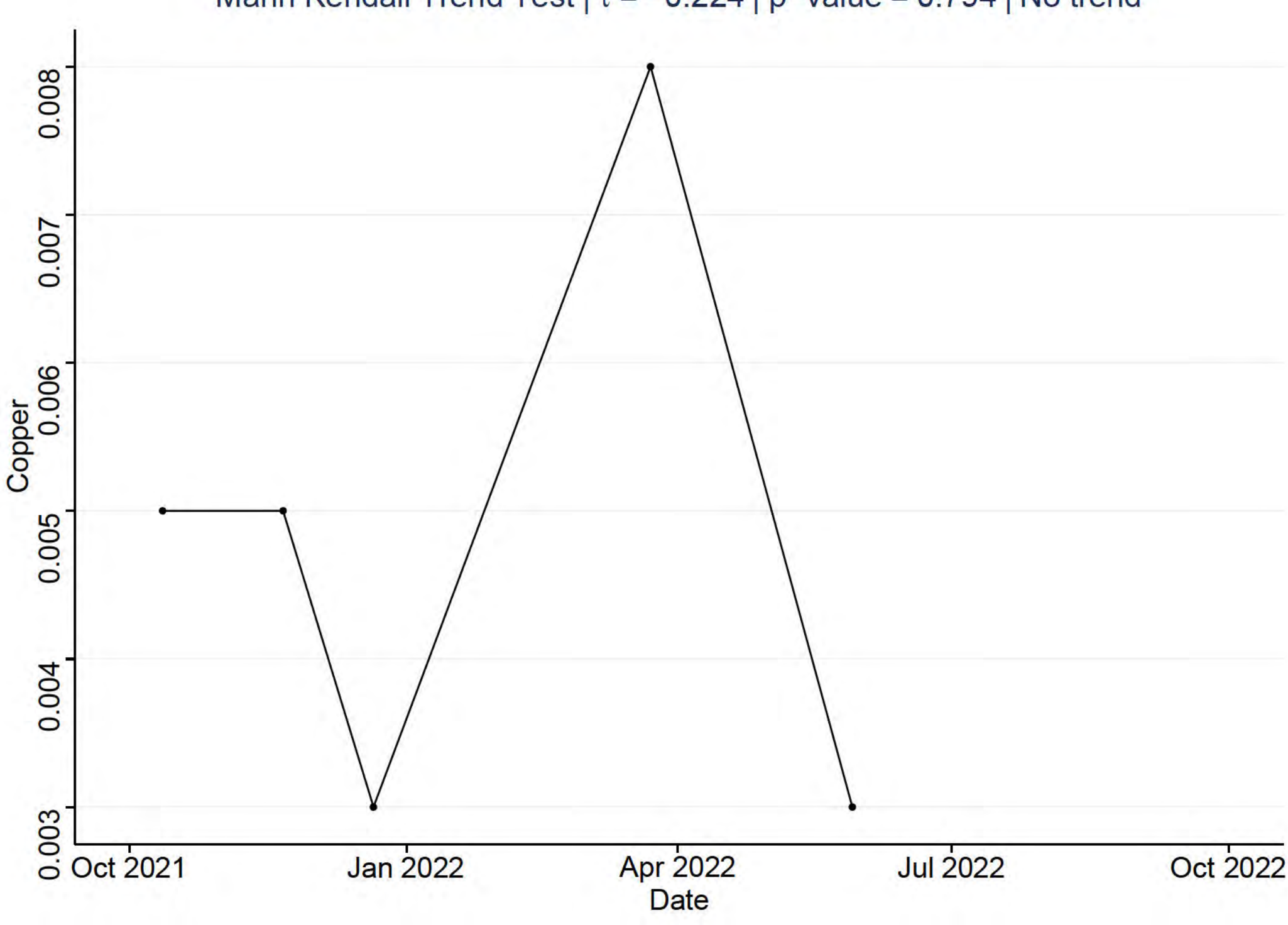

Site NNMW013 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

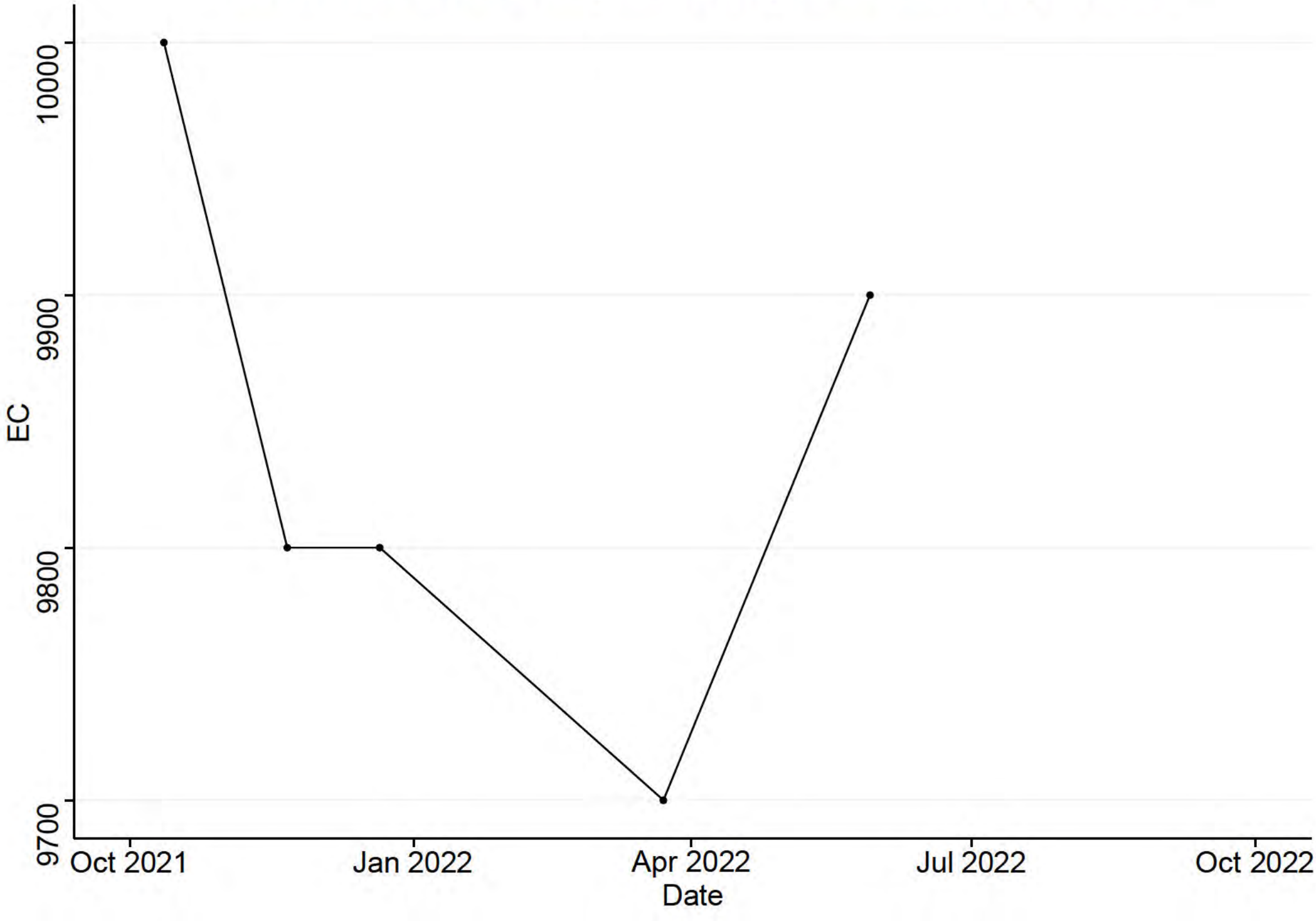

Site NNMW013 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

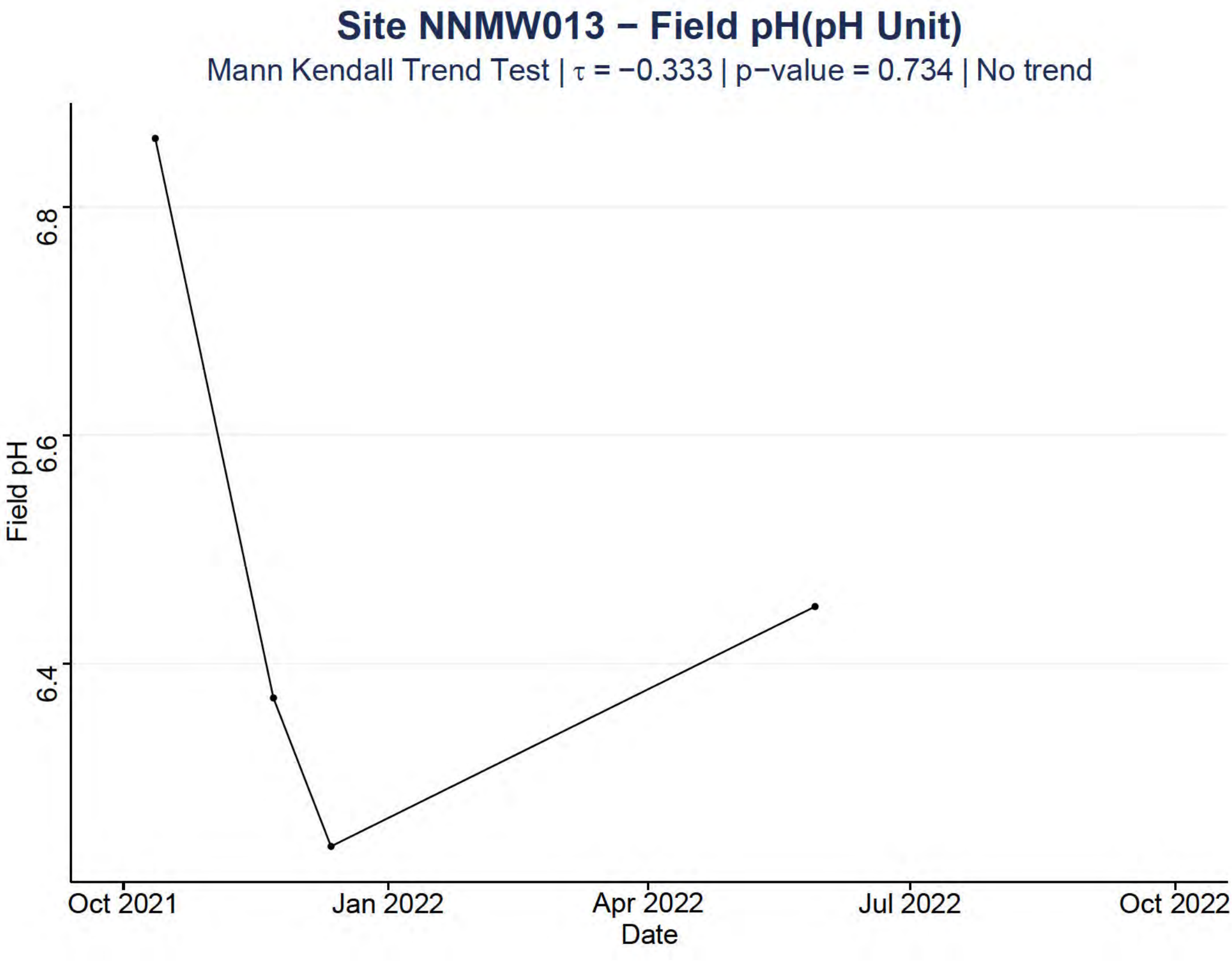

Site NNMW013 – Chloride(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Chloride
3750
3500
3250
3000
2750
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

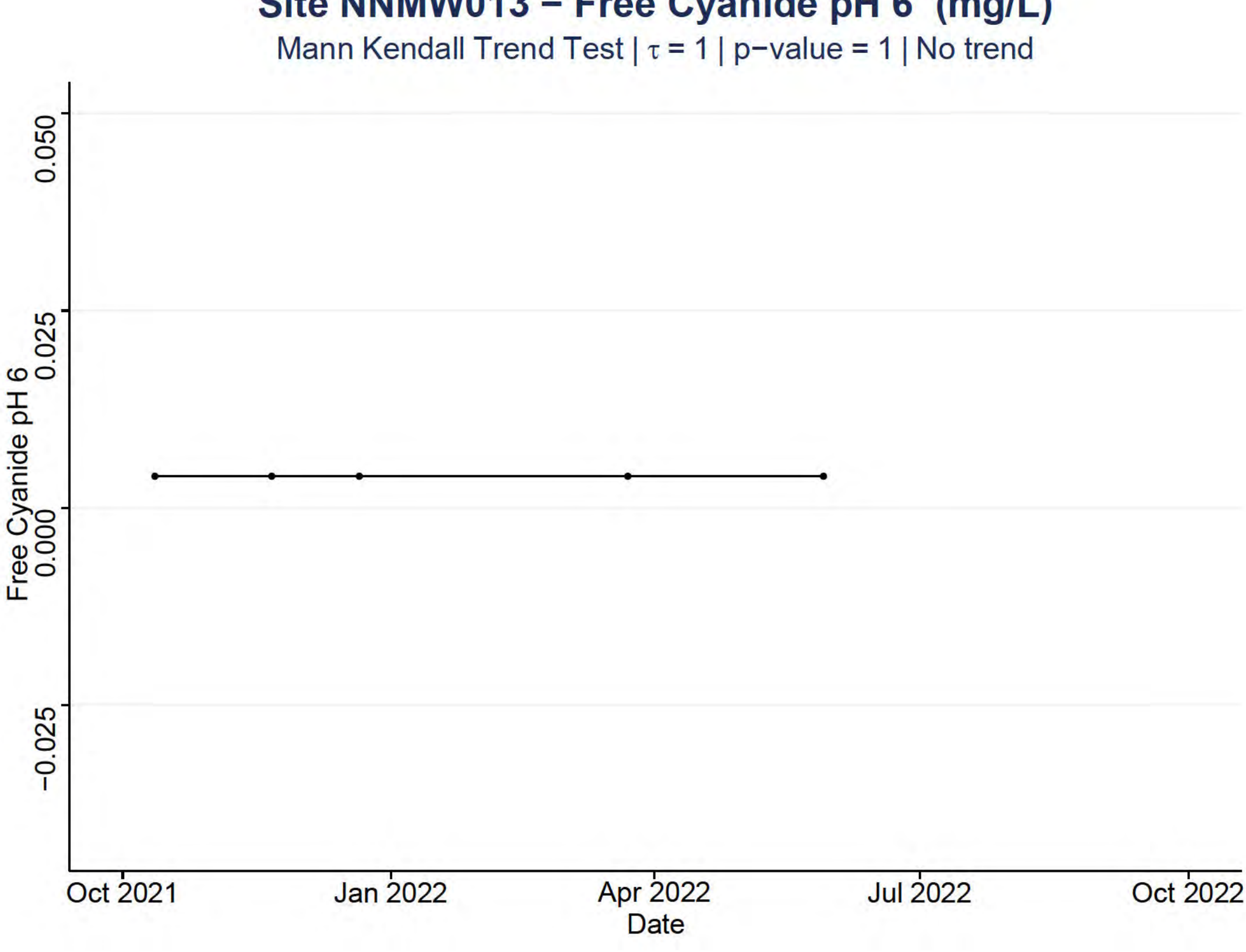

Site NNMW013 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

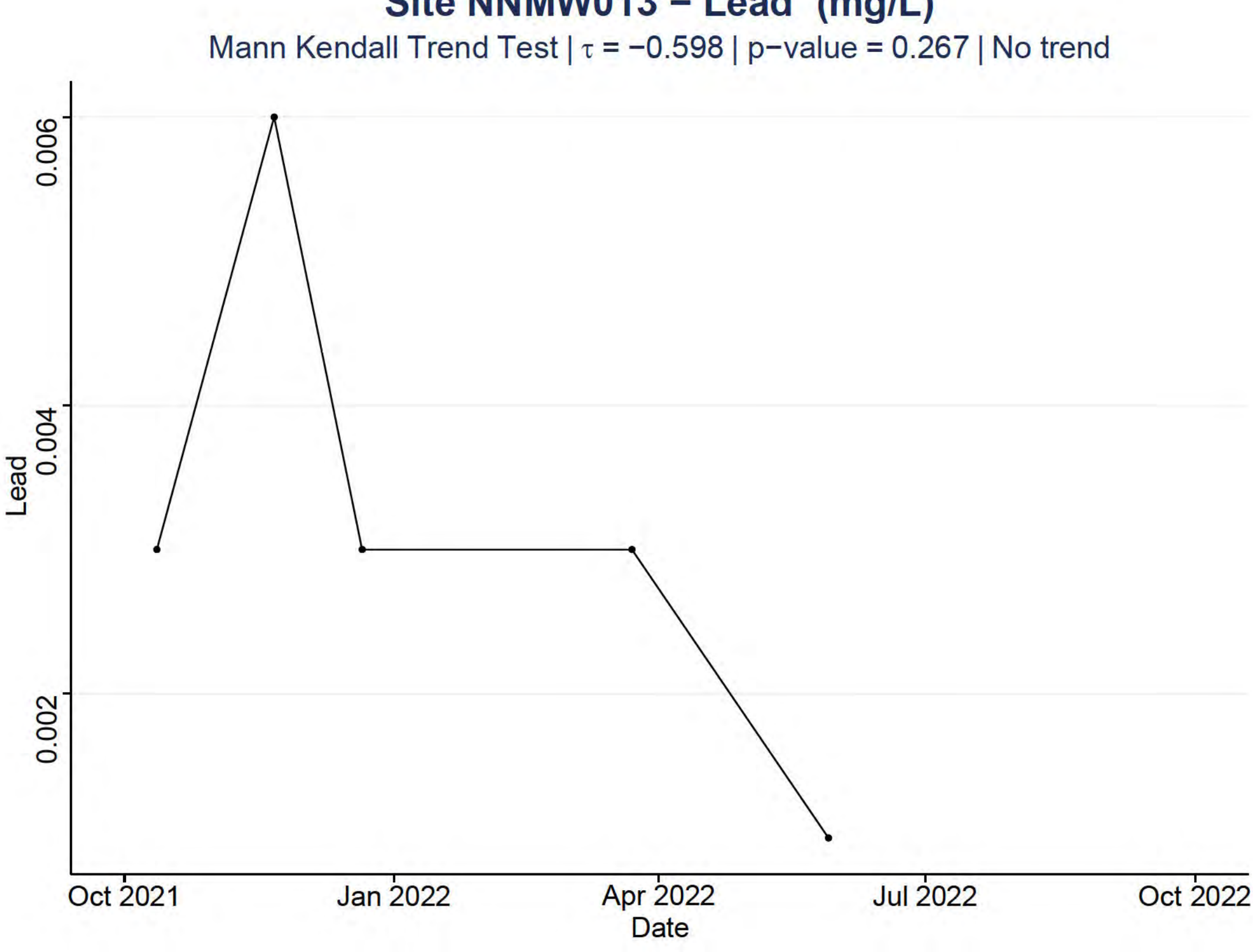

Site NNMW013 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Cobalt
0.0150
0.0125
0.0100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

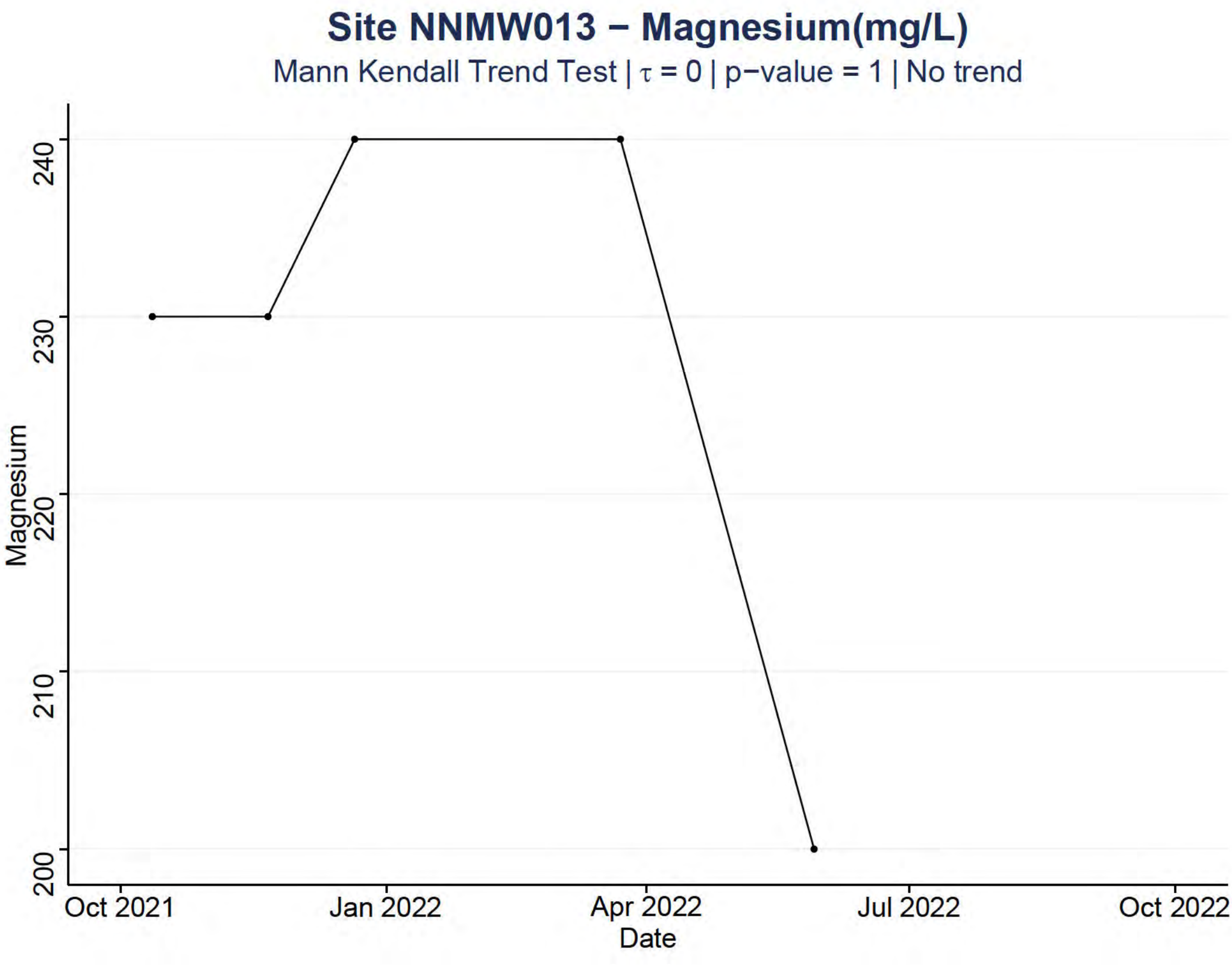

Site NNMW013 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.224 | p−value = 0.794 | No trend
Copper
0.003
0.004
0.005
0.006
0.007
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

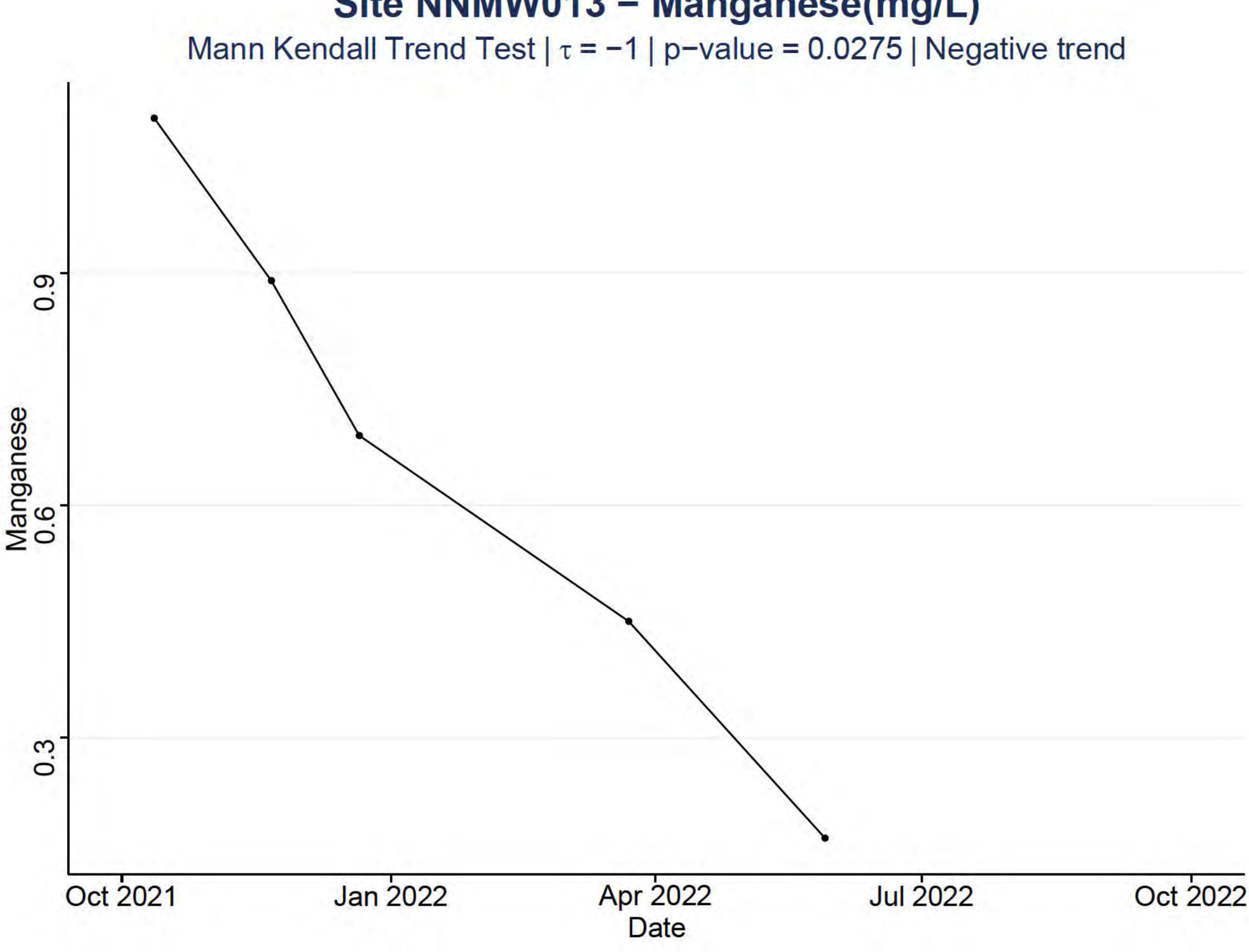

Site NNMW013 − EC(µS/cm)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
EC
10000
9900
9800
9700
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

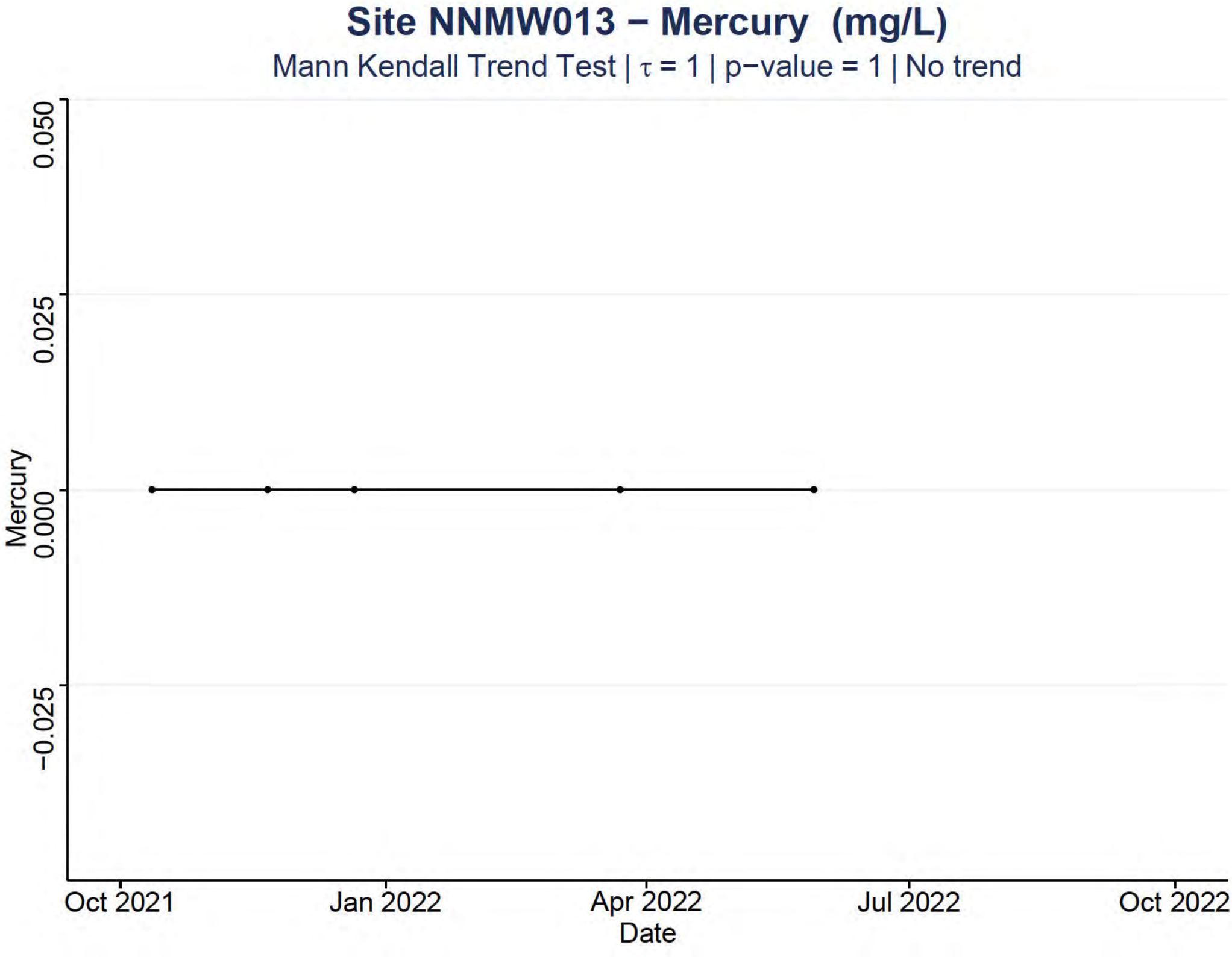

Site NNMW013 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.333 | p−value = 0.734 | No trend
Field pH
6.8
6.6
6.4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Free Cyanide pH 6
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

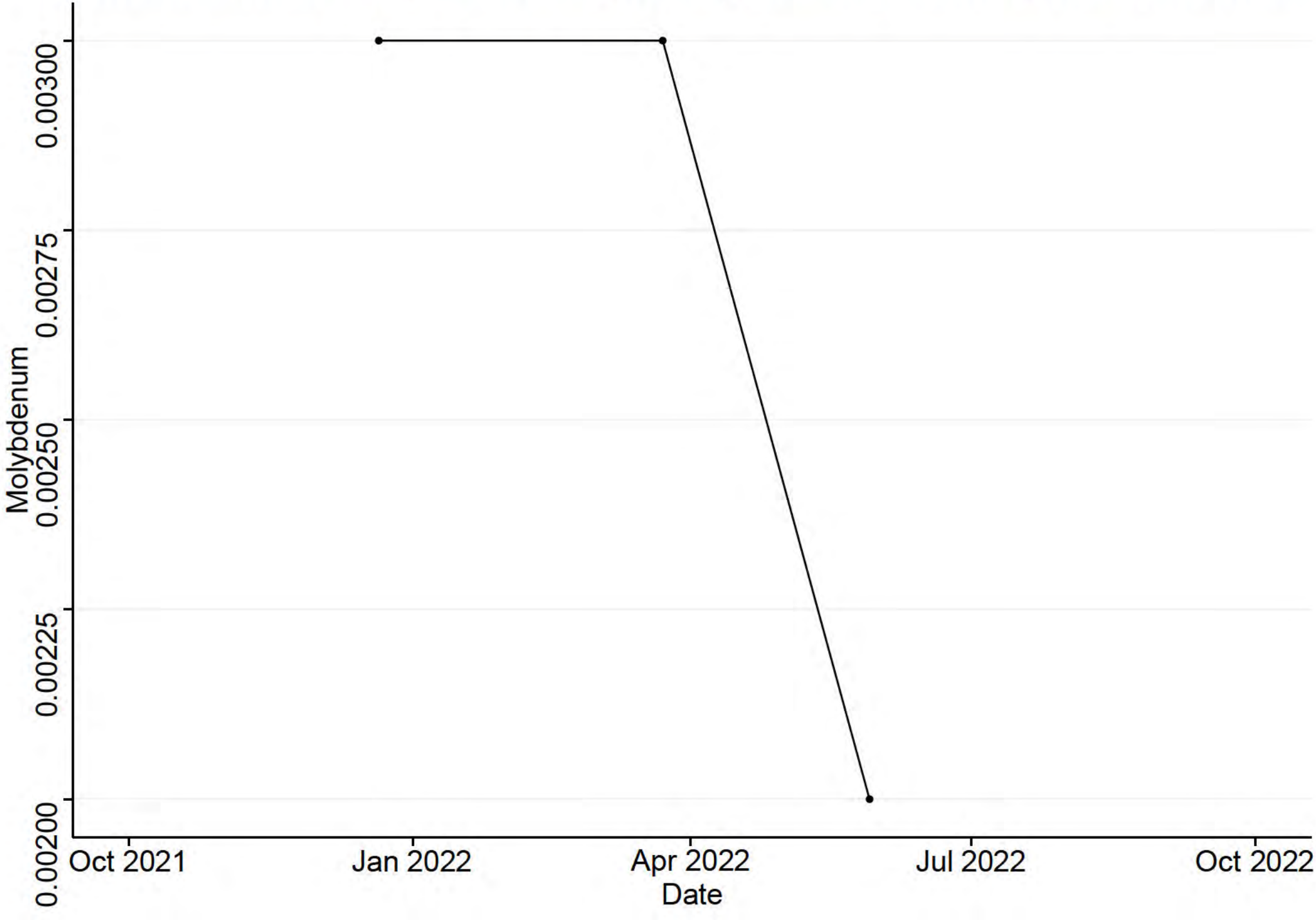

Site NNMW013 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Magnesium
240
230
220
210
200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

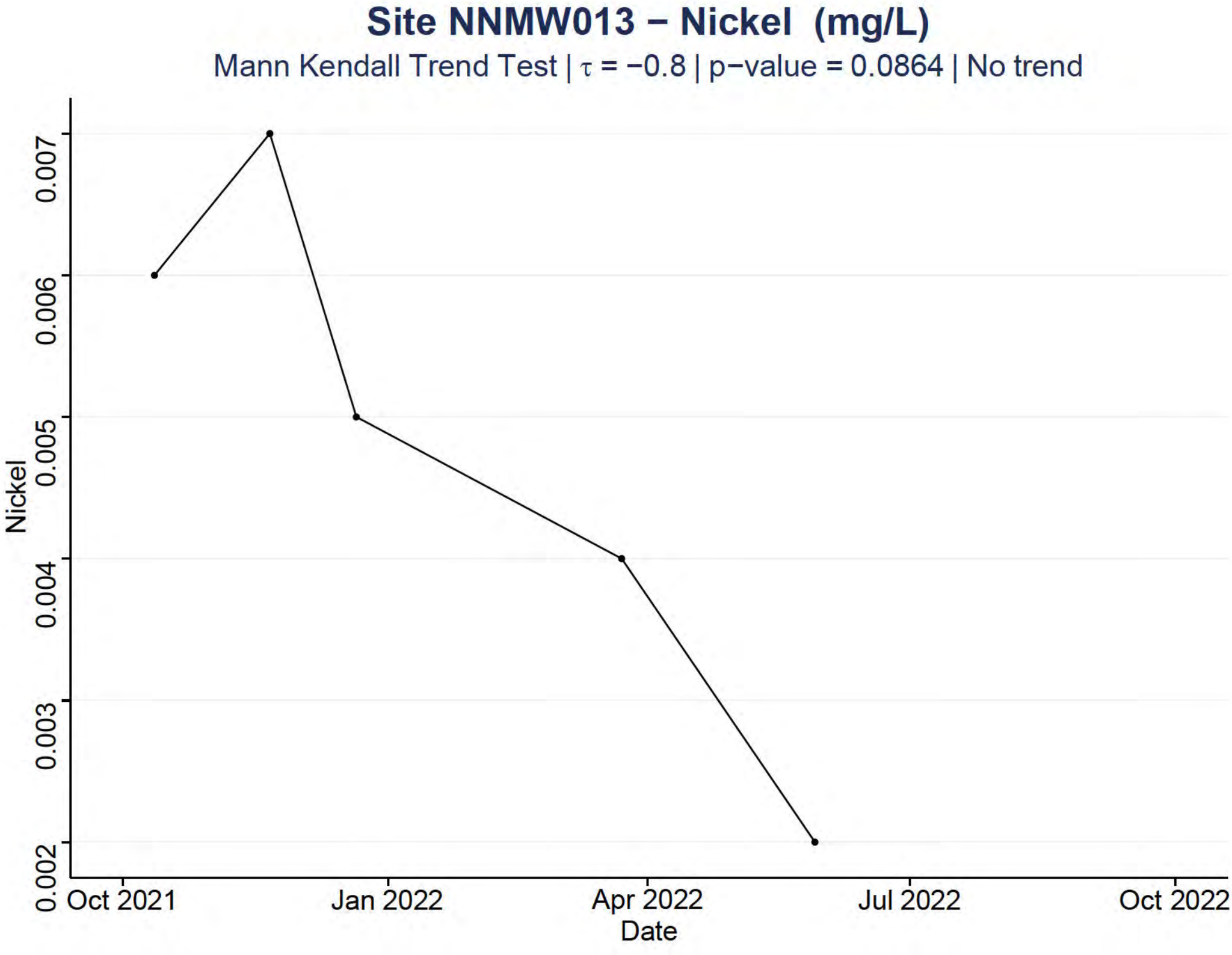

Site NNMW013 – Manganese(mg/L)
Mann Kendall Trend Test | τ = −1 | p−value = 0.0275 | Negative trend
Manganese
0.9
0.6
0.3
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

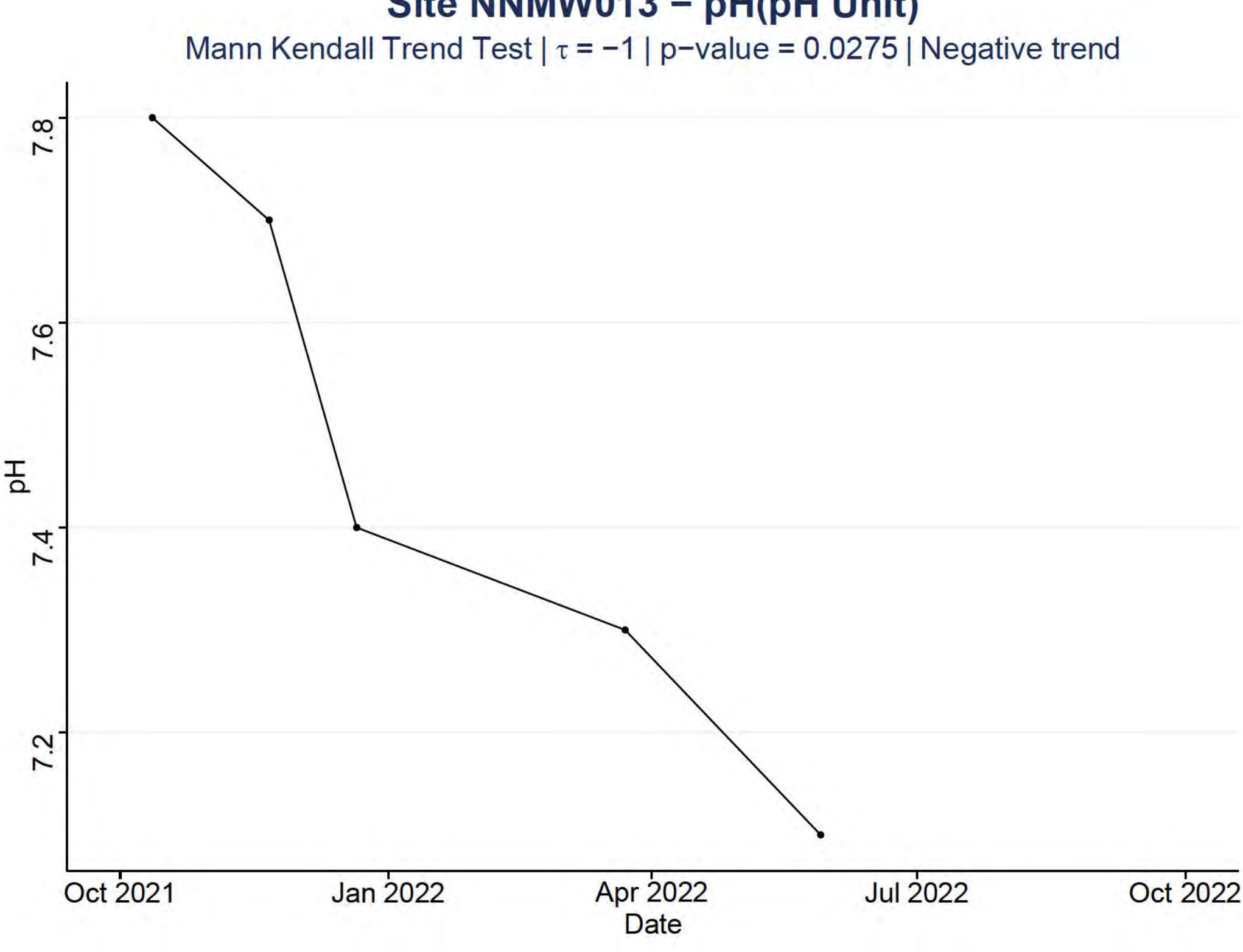

Site NNMW013 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

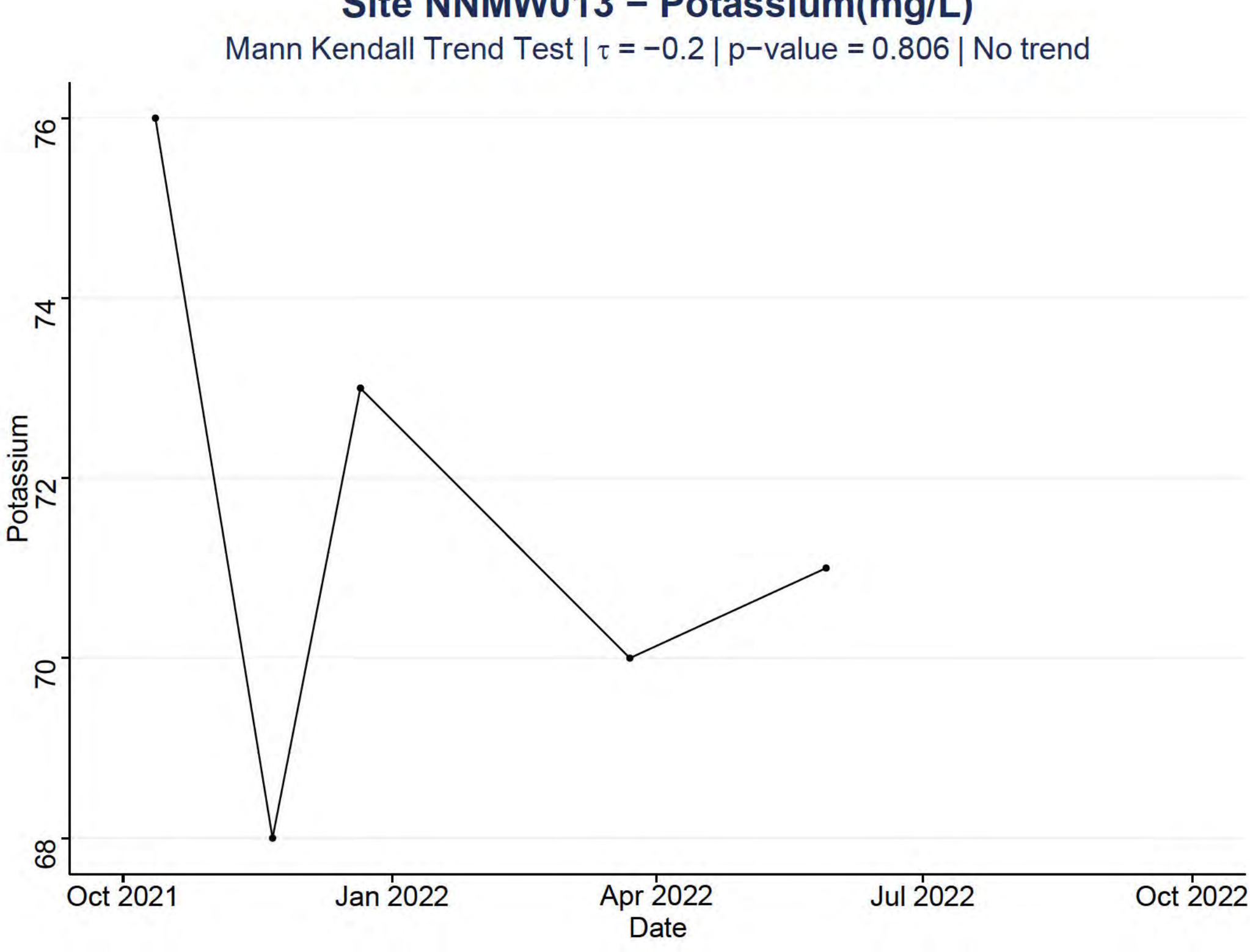
Site NNMW013 – Molybdenum (mg/L)

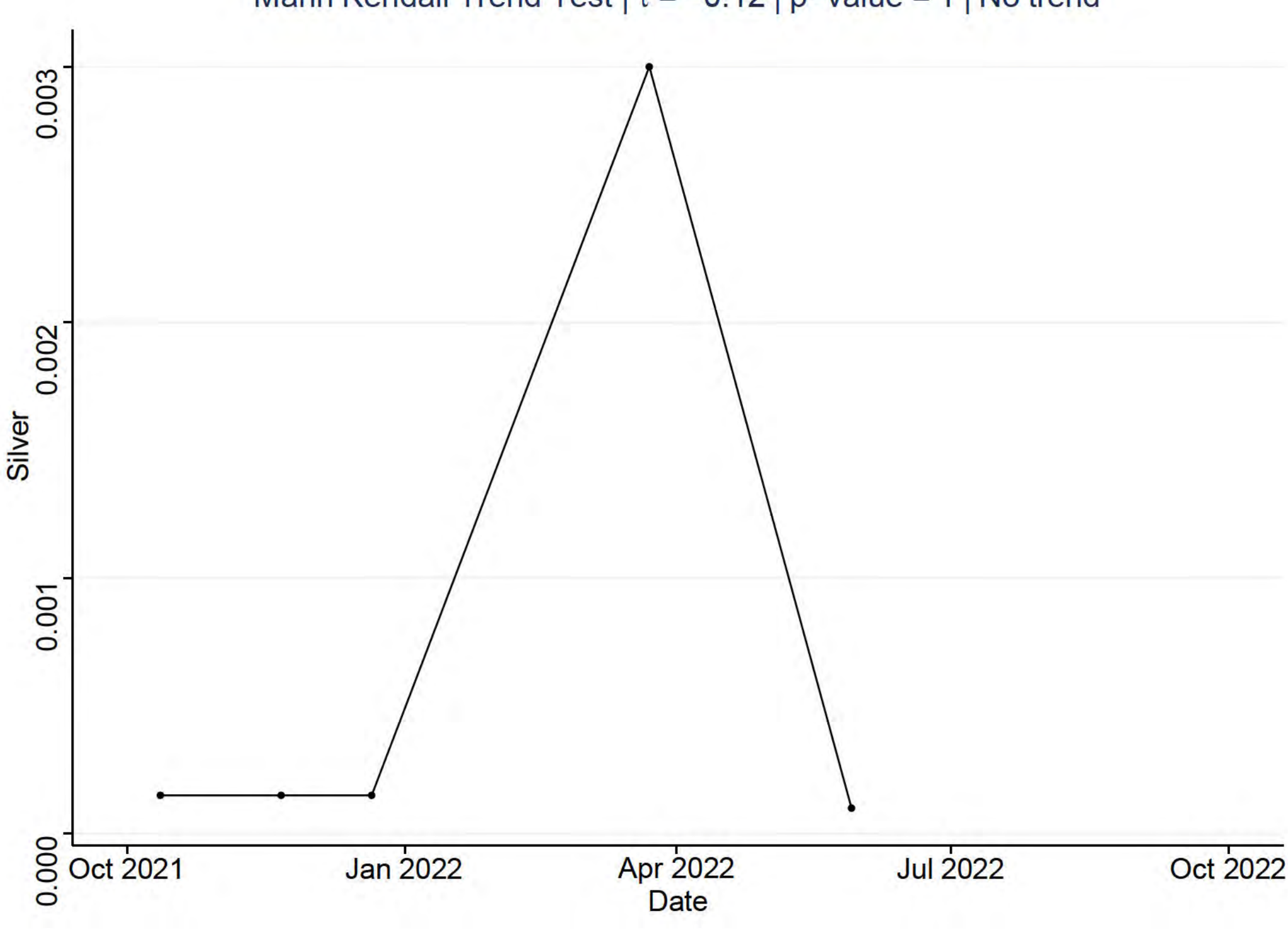
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

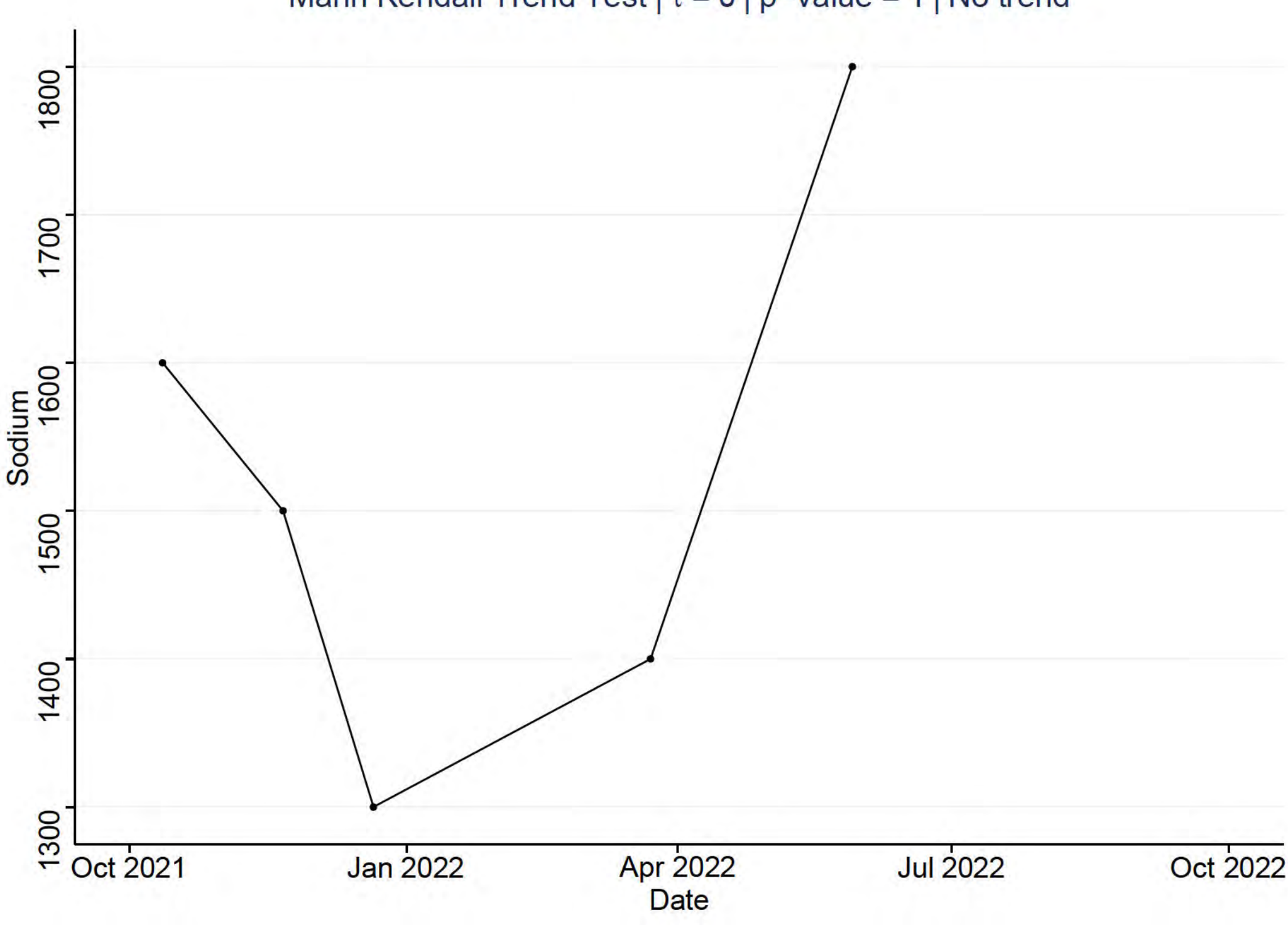


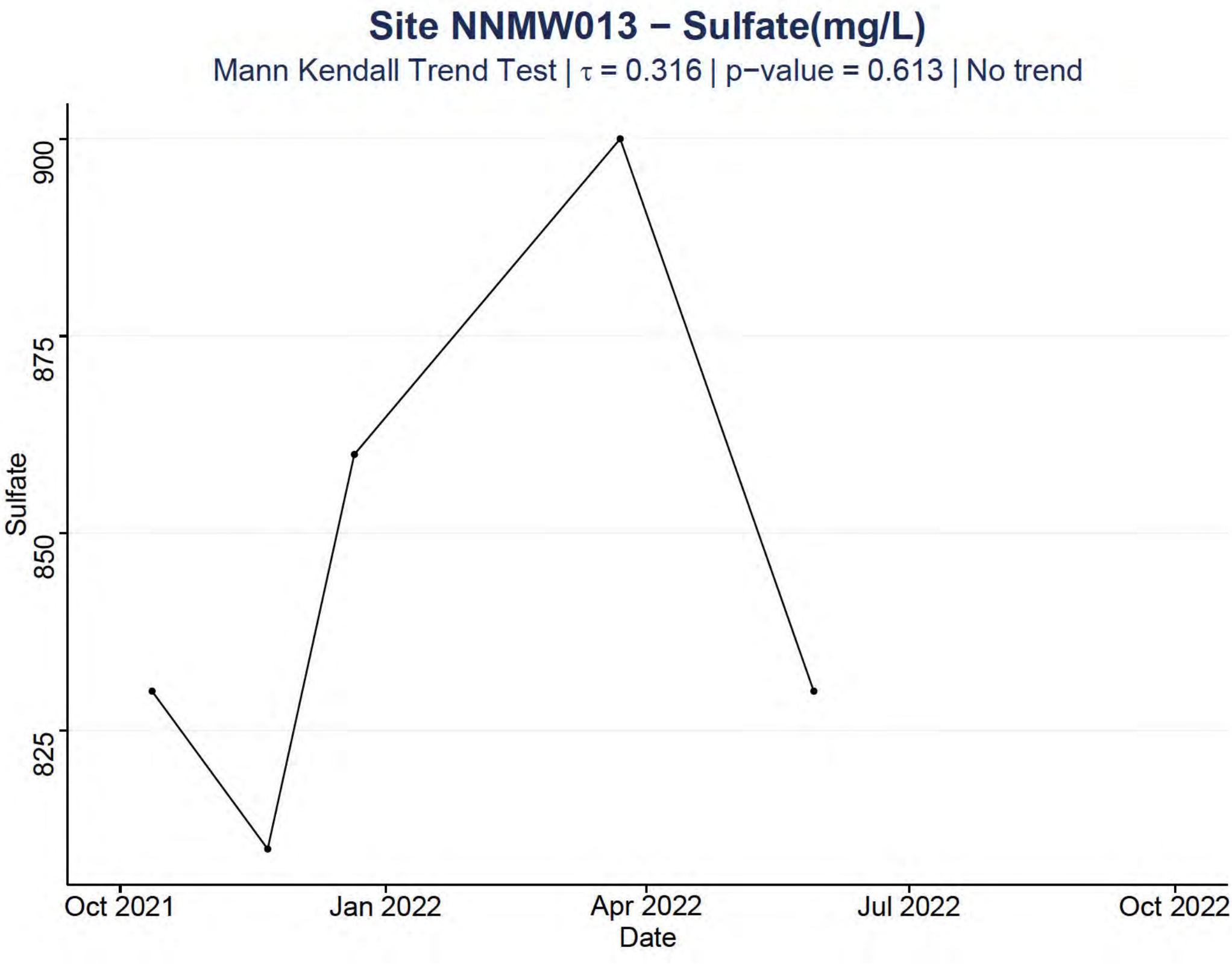

Site NNMW013 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.8 | p−value = 0.0864 | No trend
Nickel
0.002
0.003
0.004
0.005
0.006
0.007
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

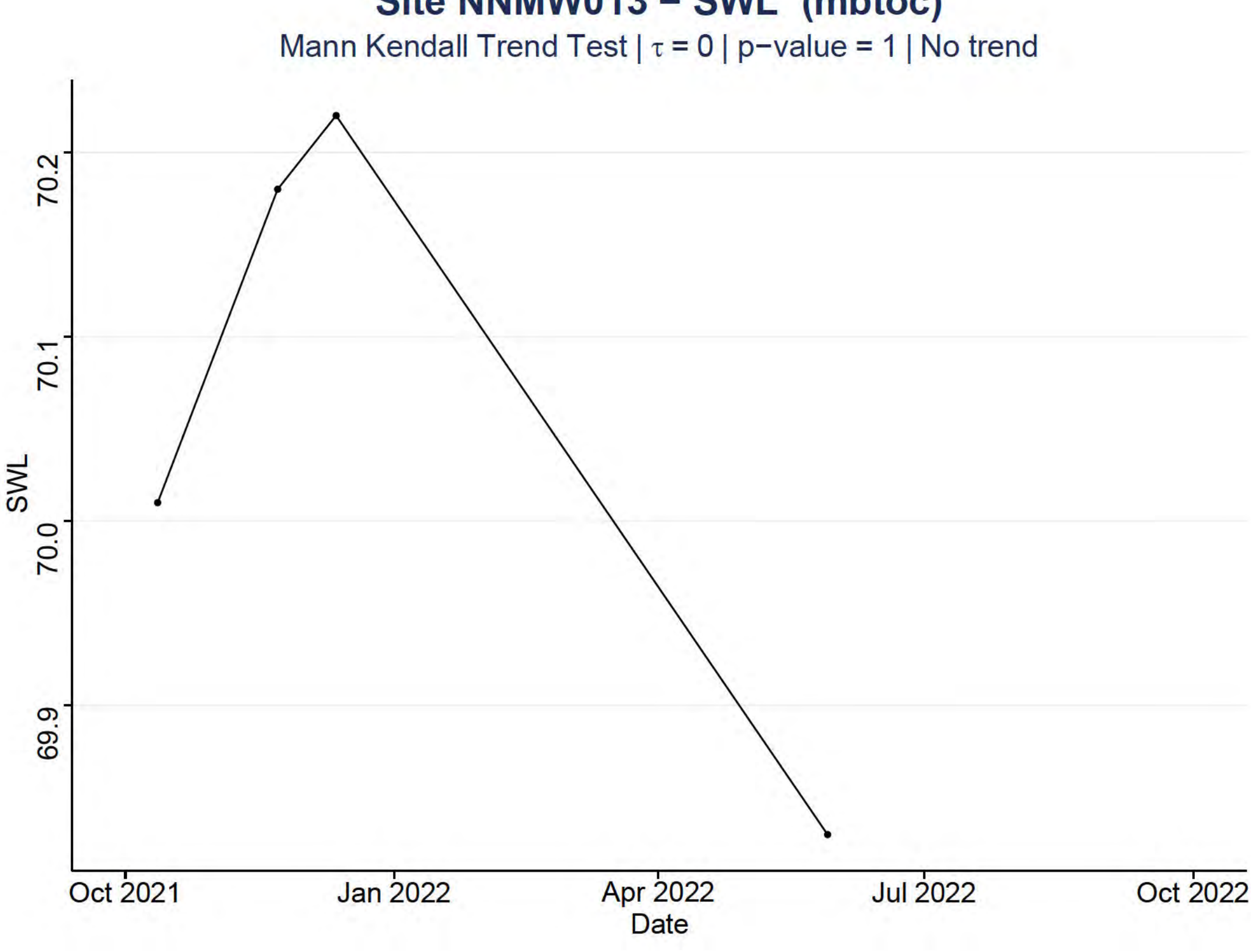

Site NNMW013 – pH(pH Unit)
Mann Kendall Trend Test | τ = −1 | p−value = 0.0275 | Negative trend
7.8
7.6
7.4
7.2
pH
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

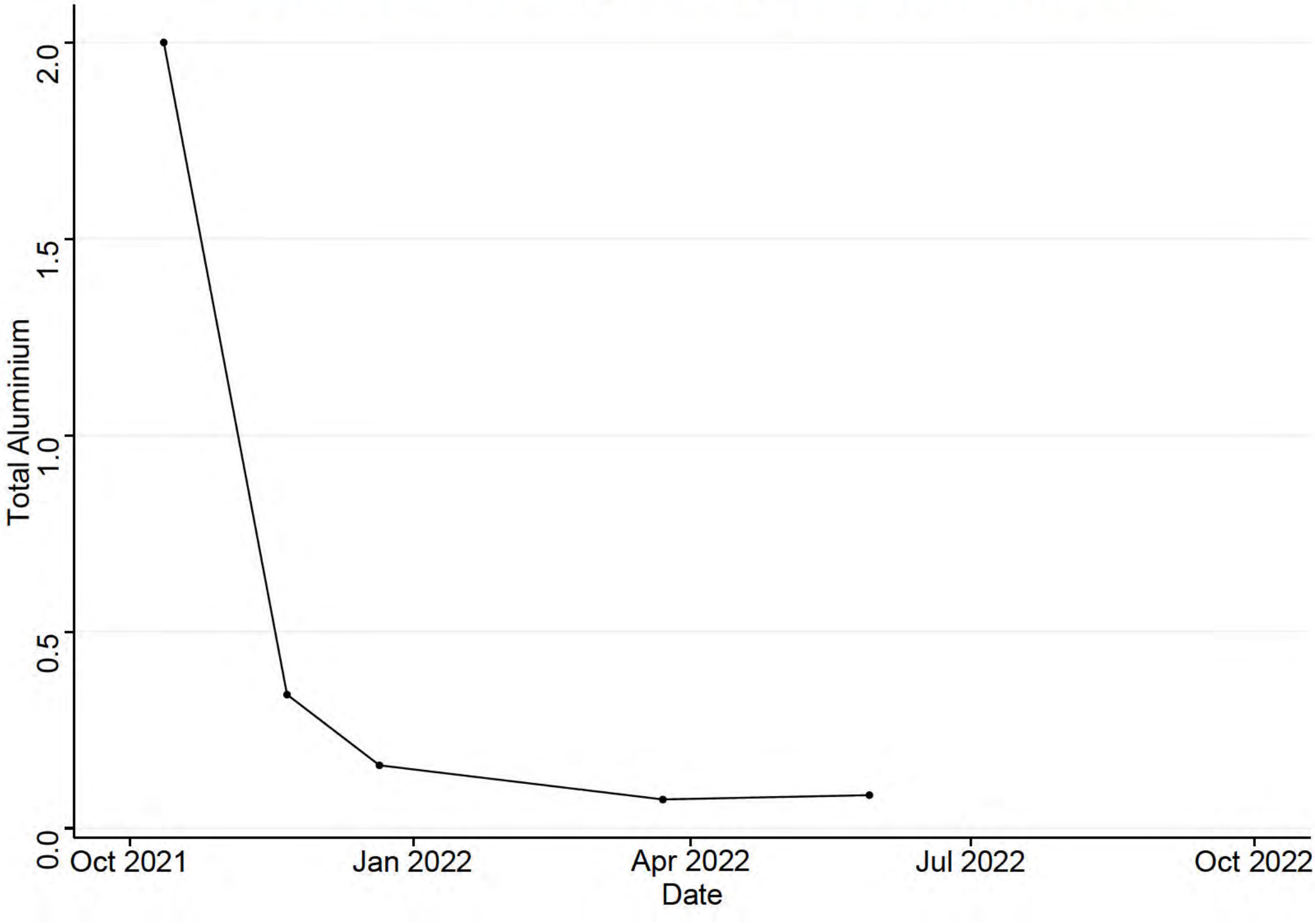

Site NNMW013 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Potassium
76
74
72
70
68
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

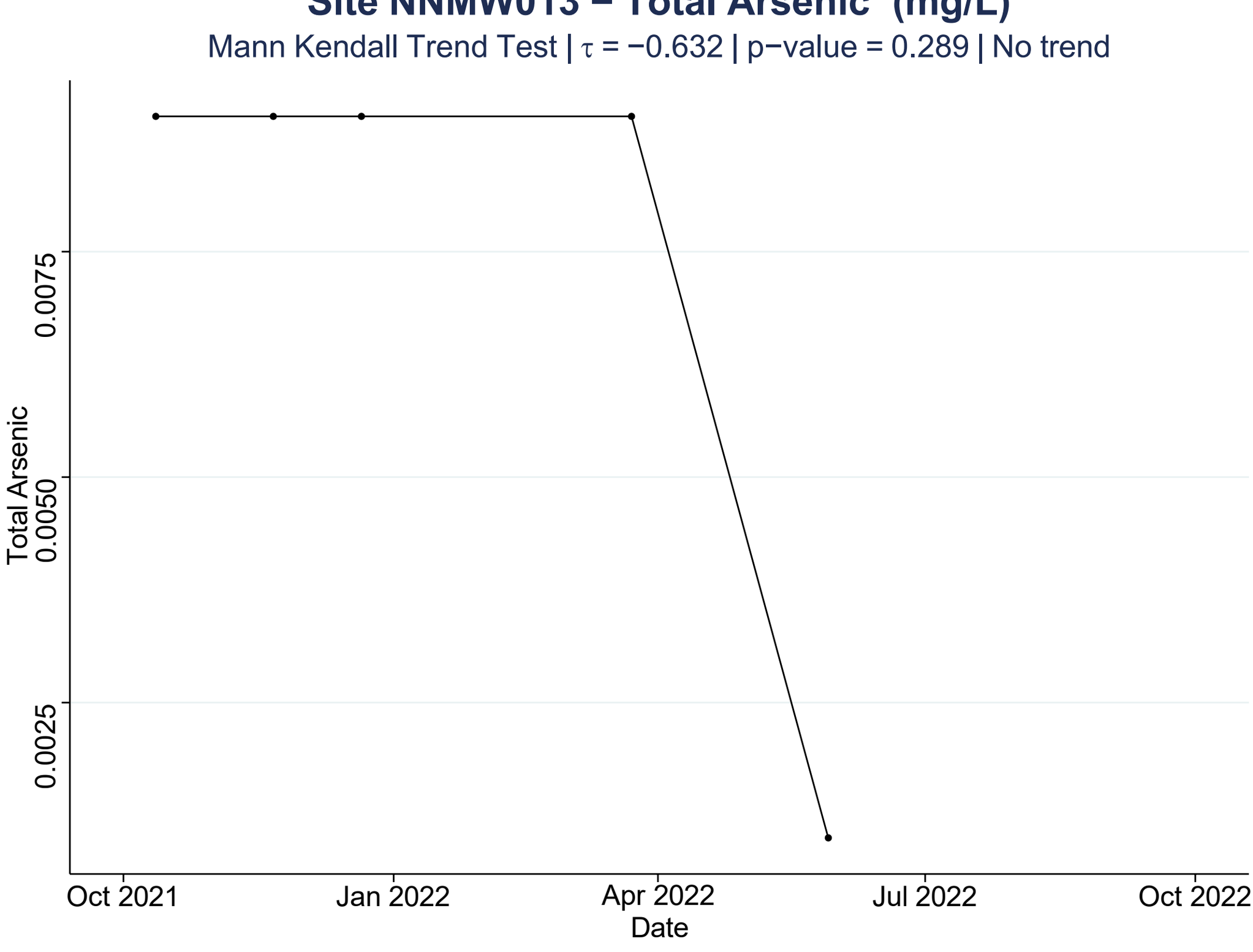

Site NNMW013 – Silver (mg/L)
Mann Kendall Trend Test | τ = −0.12 | p−value = 1 | No trend
Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 – Sodium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Sodium
1800
1700
1600
1500
1400
1300
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = 0.316 | p−value = 0.613 | No trend
Sulfate
900
875
850
825
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

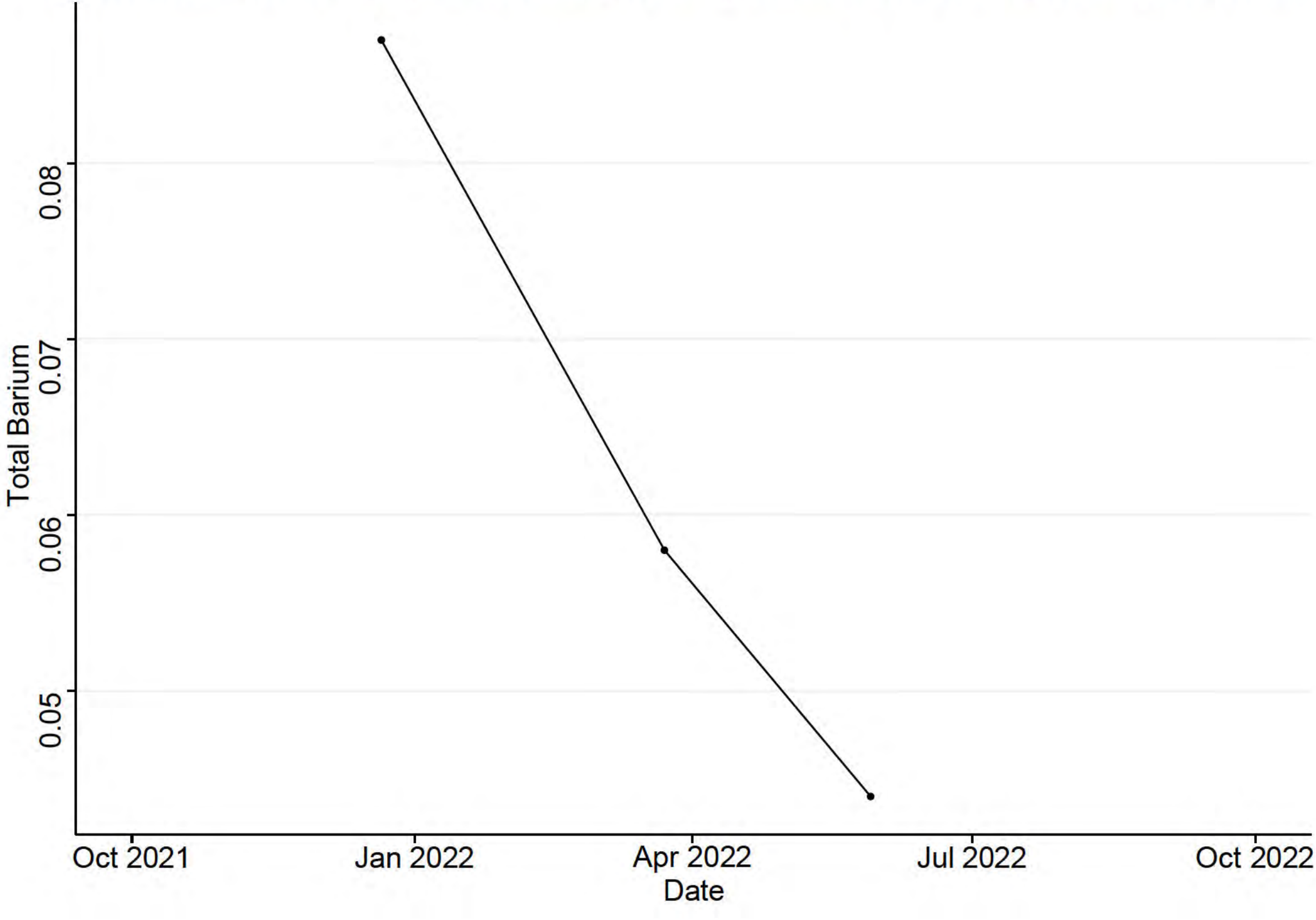

Site NNMW013 – SWL (mbtoc)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
SWL
70.2
70.1
70.0
69.9
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

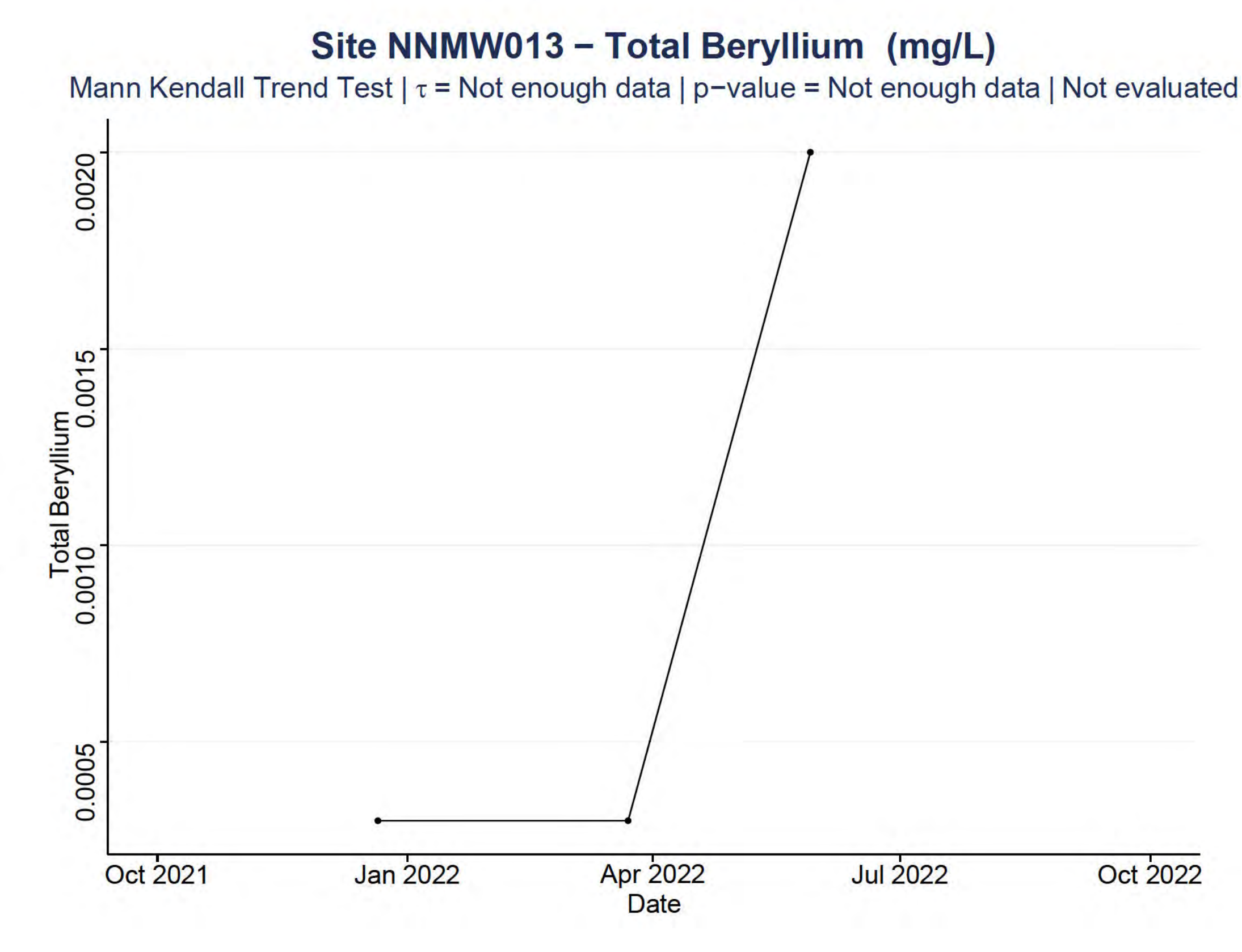

Site NNMW013 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.8 | p−value = 0.0864 | No trend
Total Aluminium
0.0
0.5
1.0
1.5
2.0
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

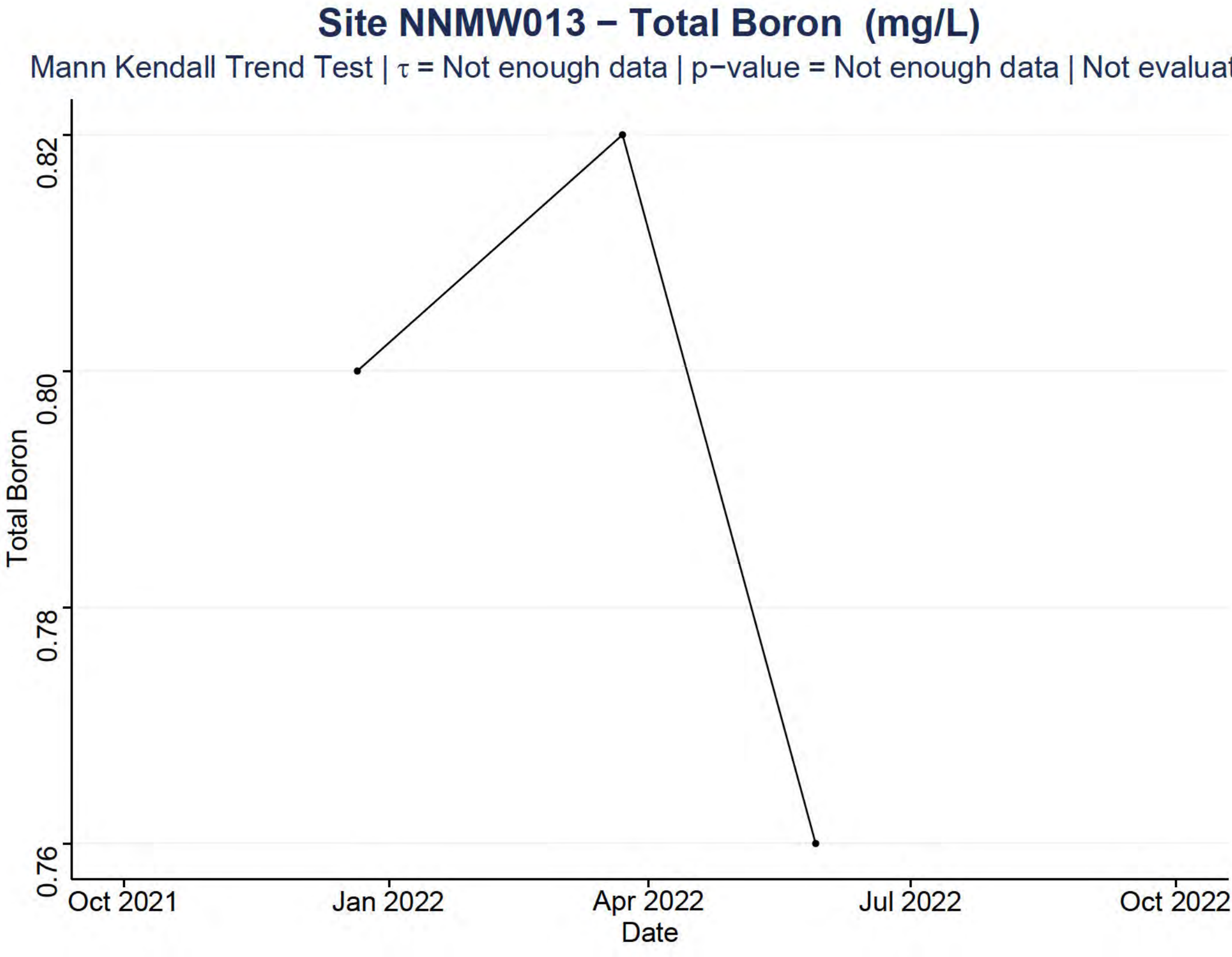

Site NNMW013 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

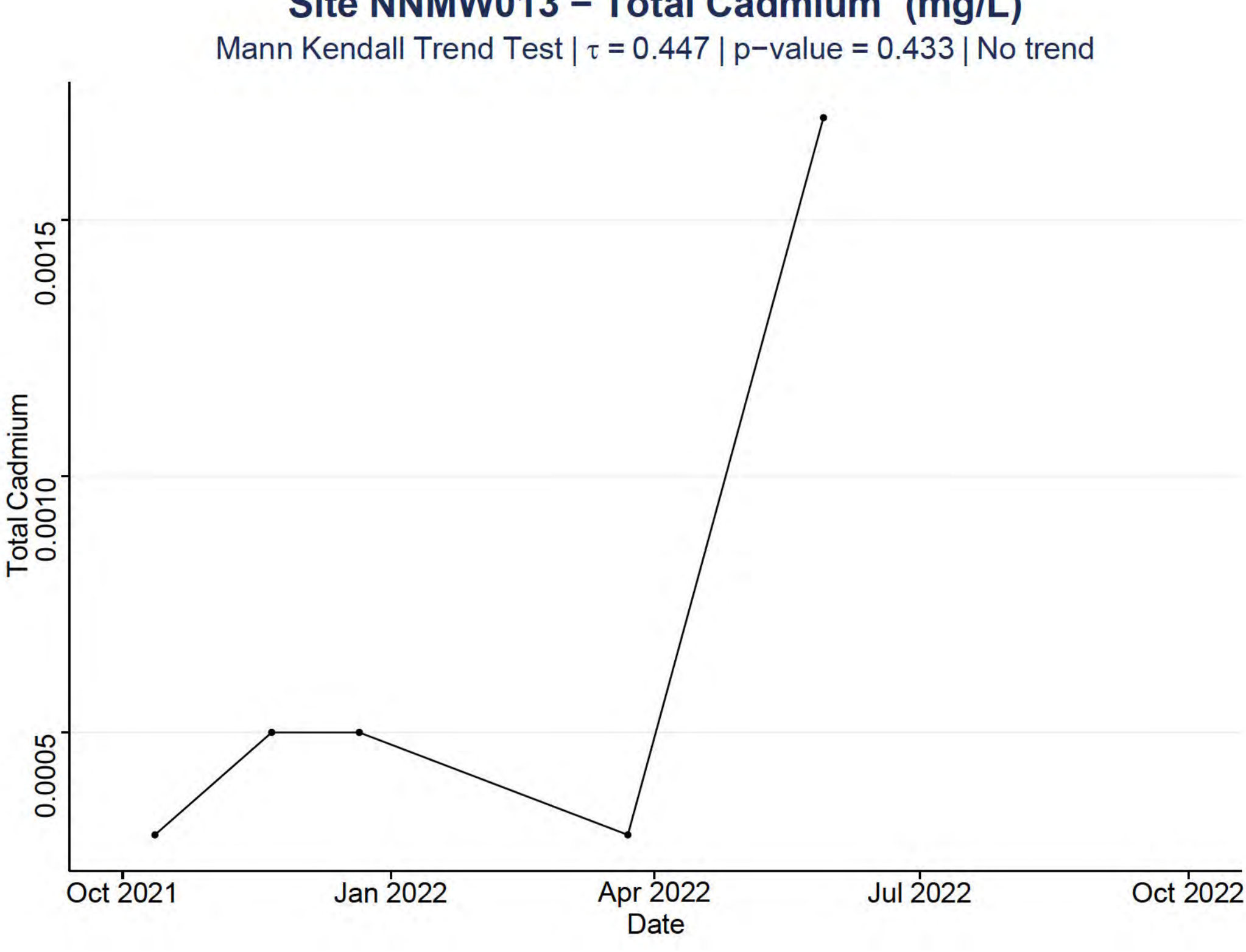
Site NNMW013 – Total Barium (mg/L)

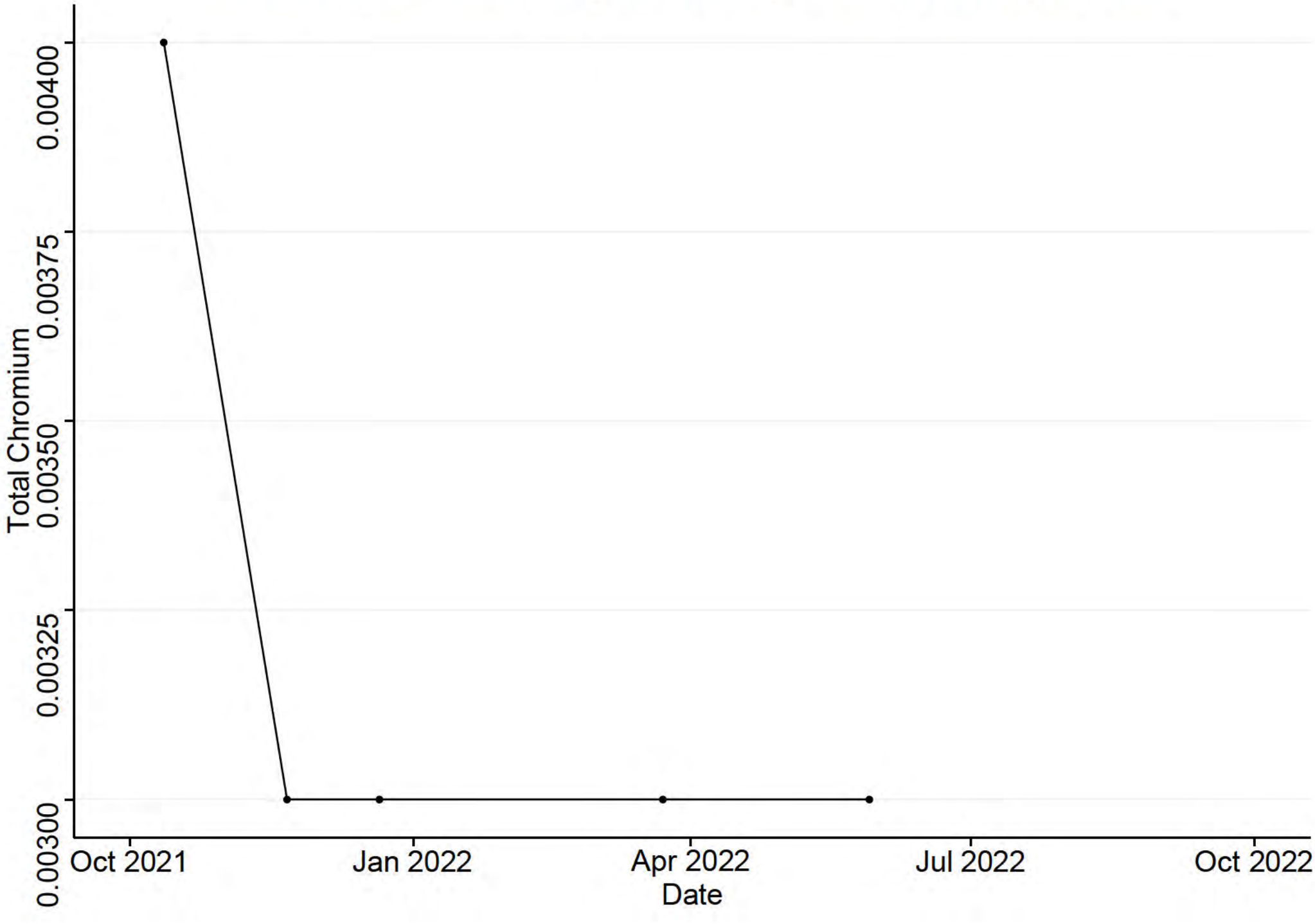
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

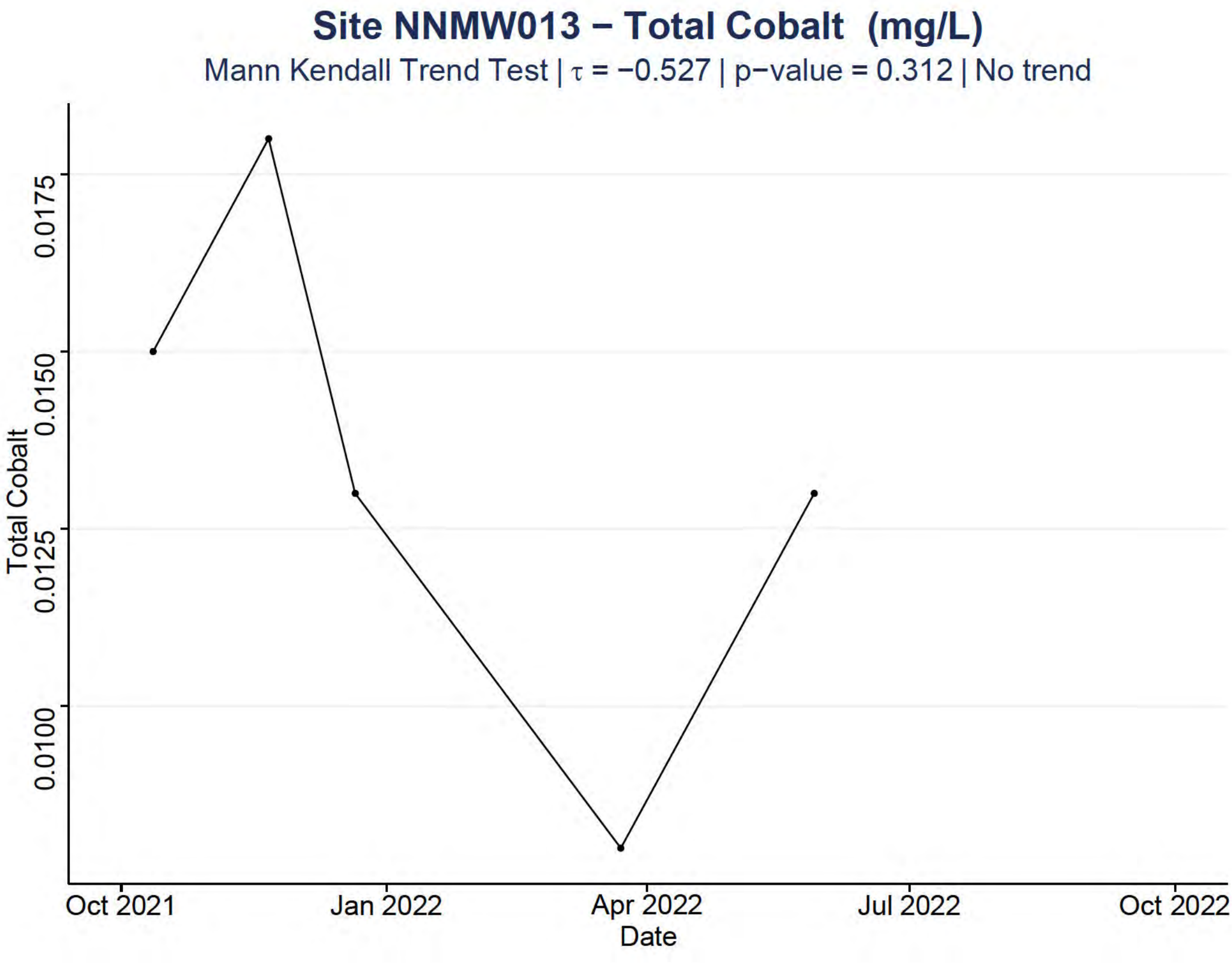


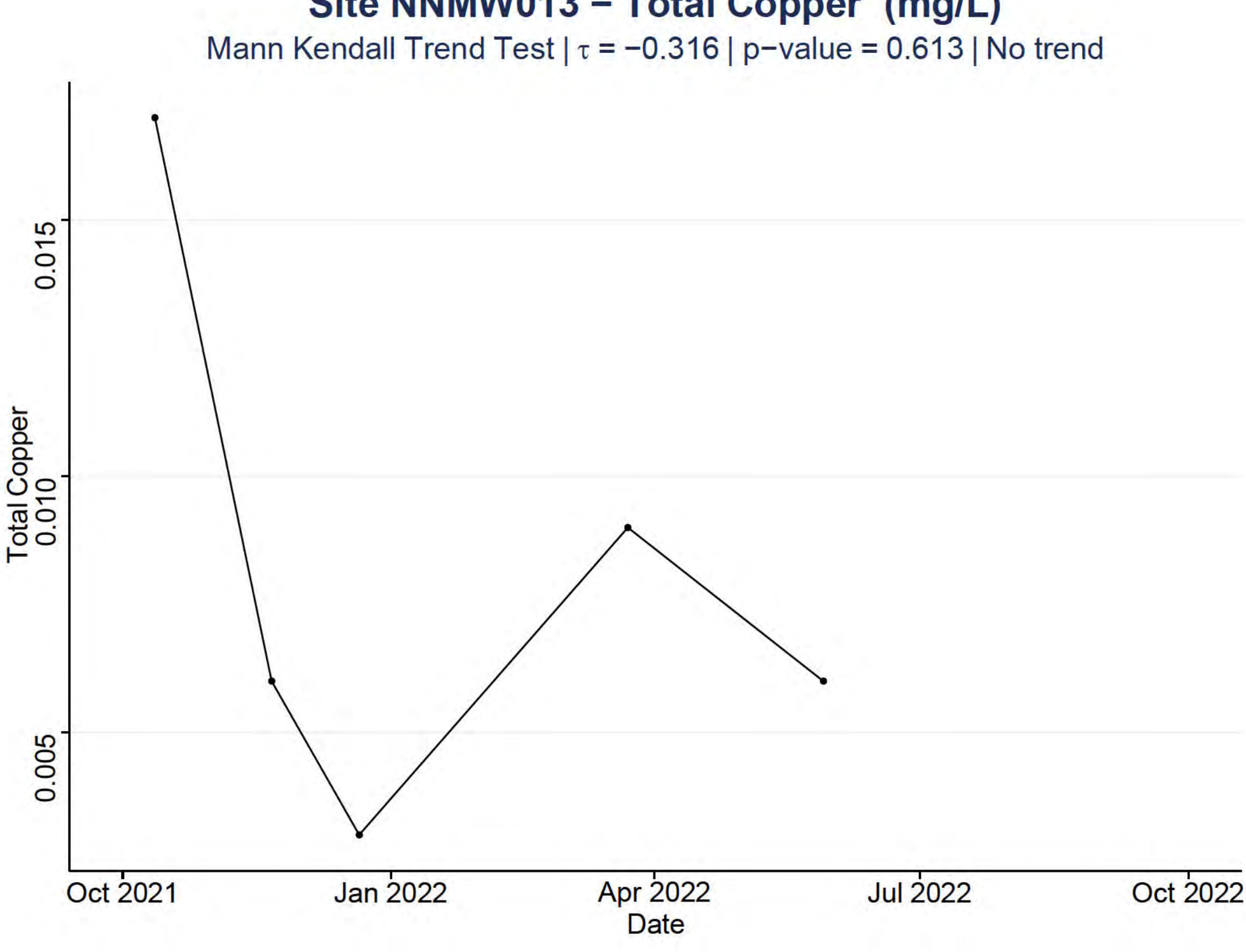

Site NNMW013 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Beryllium
0.0020
0.0015
0.0010
0.0005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

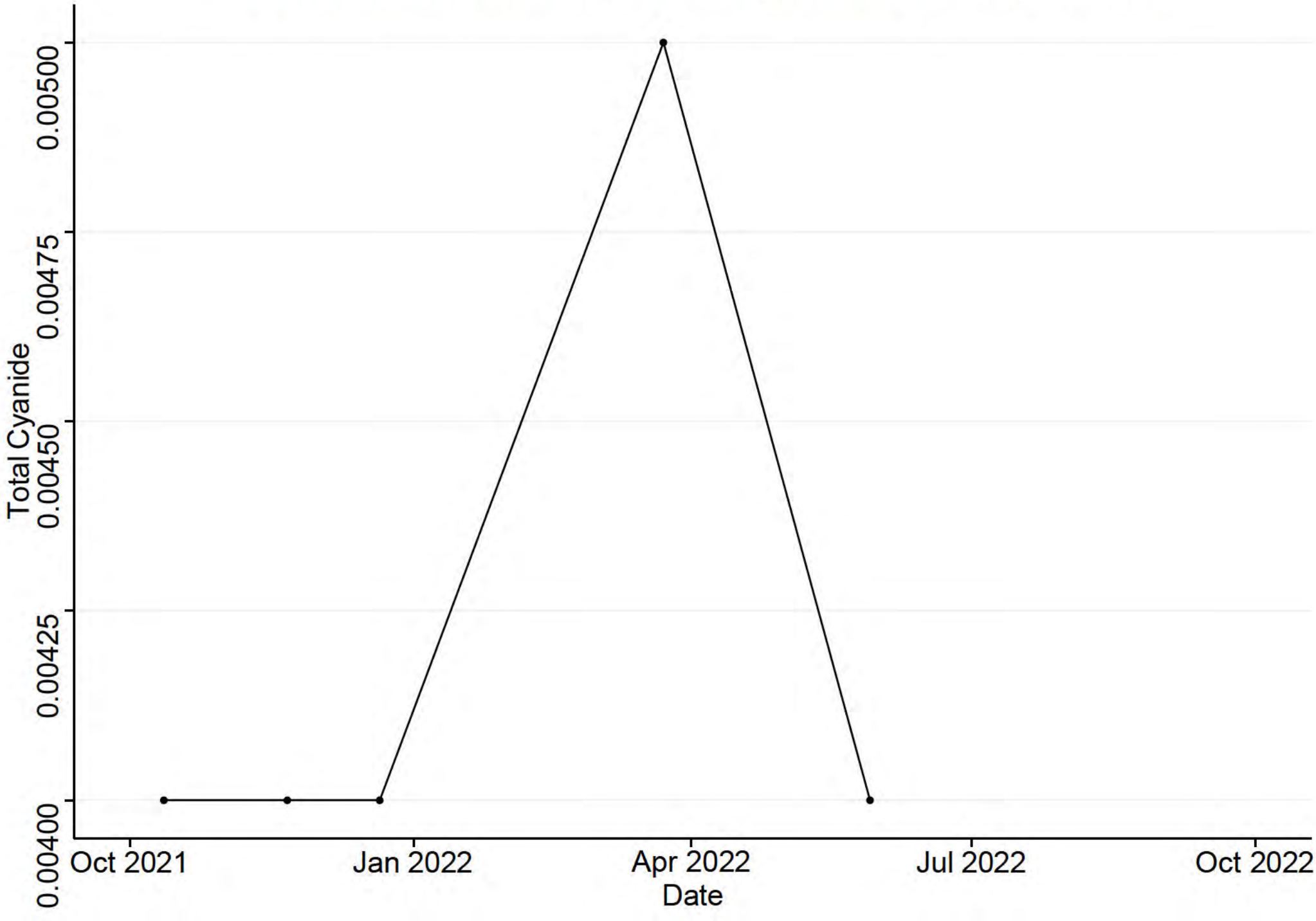

Site NNMW013 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Boron
0.82
0.80
0.78
0.76
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

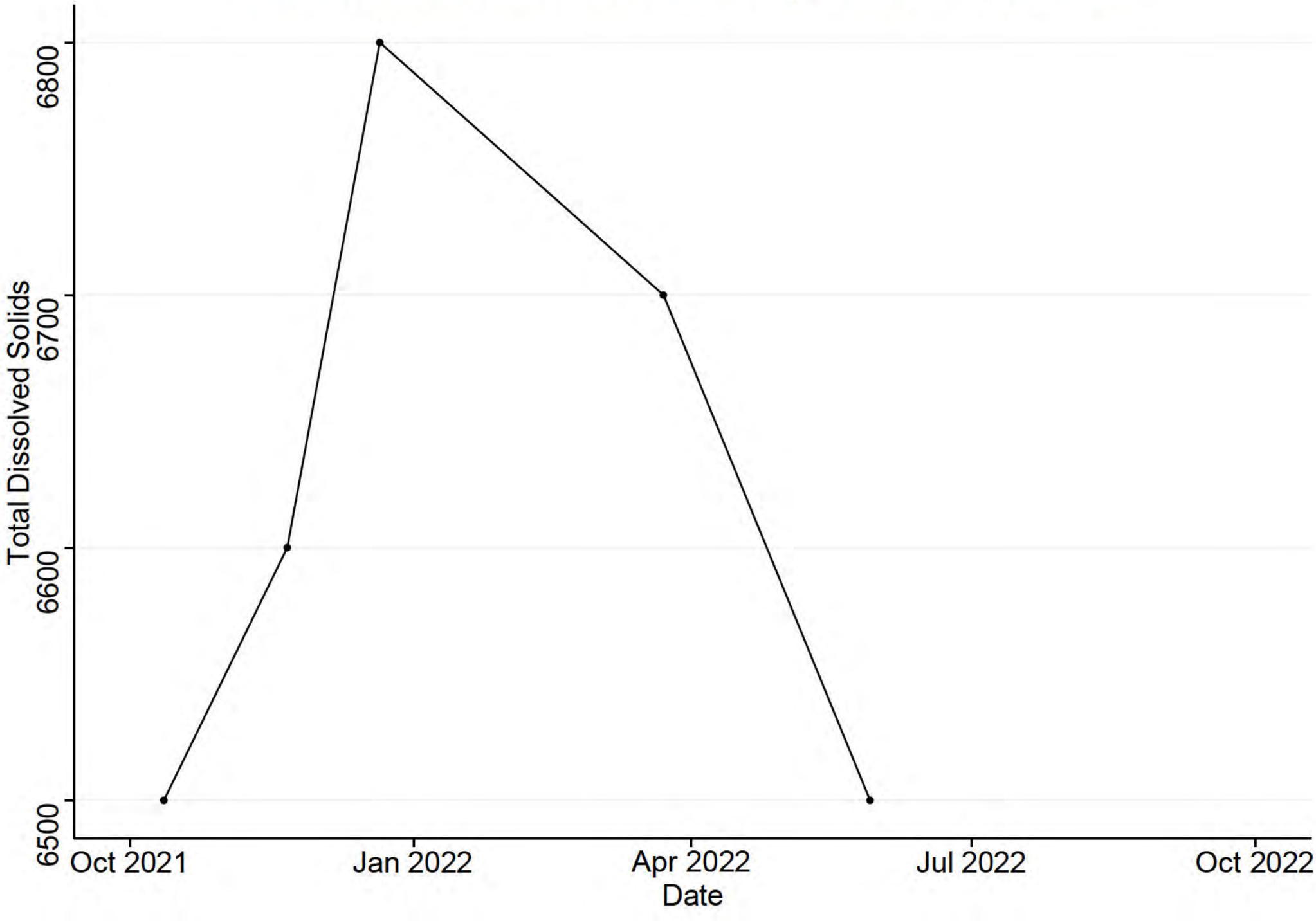

Site NNMW013 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = 0.447 | p−value = 0.433 | No trend
Total Cadmium
0.0015
0.0010
0.0005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

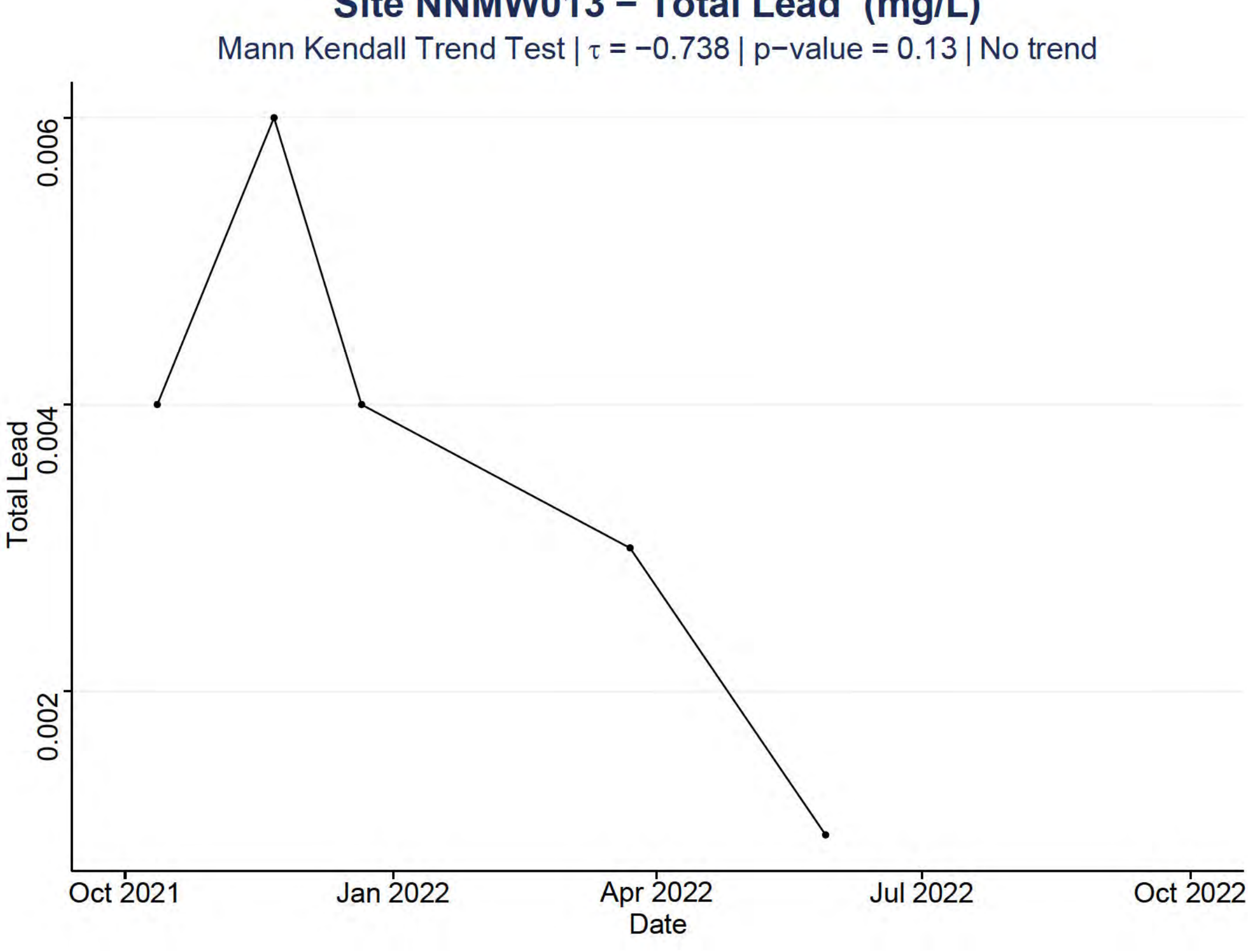

Site NNMW013 – Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.632 | p−value = 0.289 | No trend
Total Chromium
0.00400
0.00375
0.00350
0.00325
0.00300
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

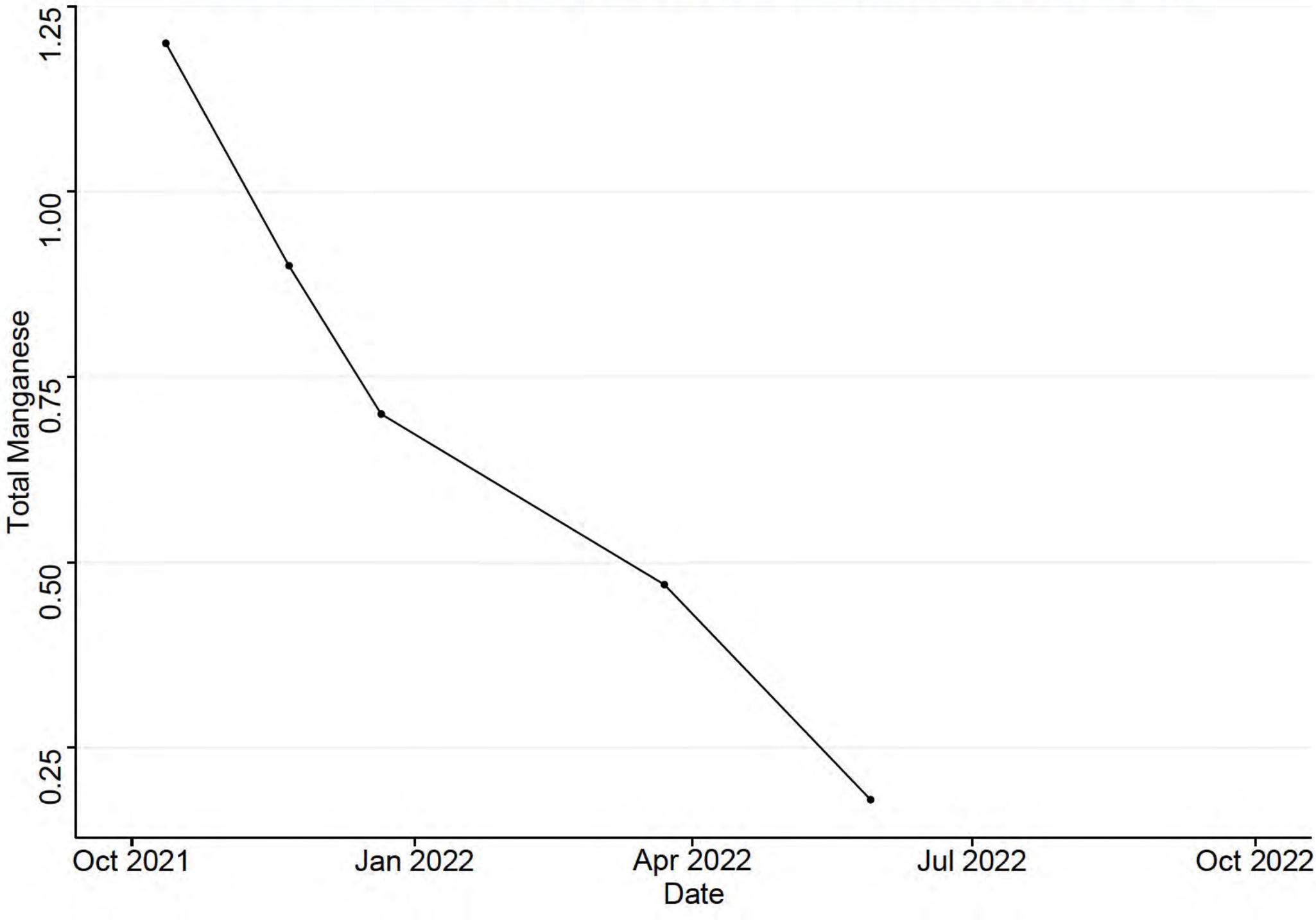

Site NNMW013 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Total Cobalt
0.0175
0.0150
0.0125
0.0100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

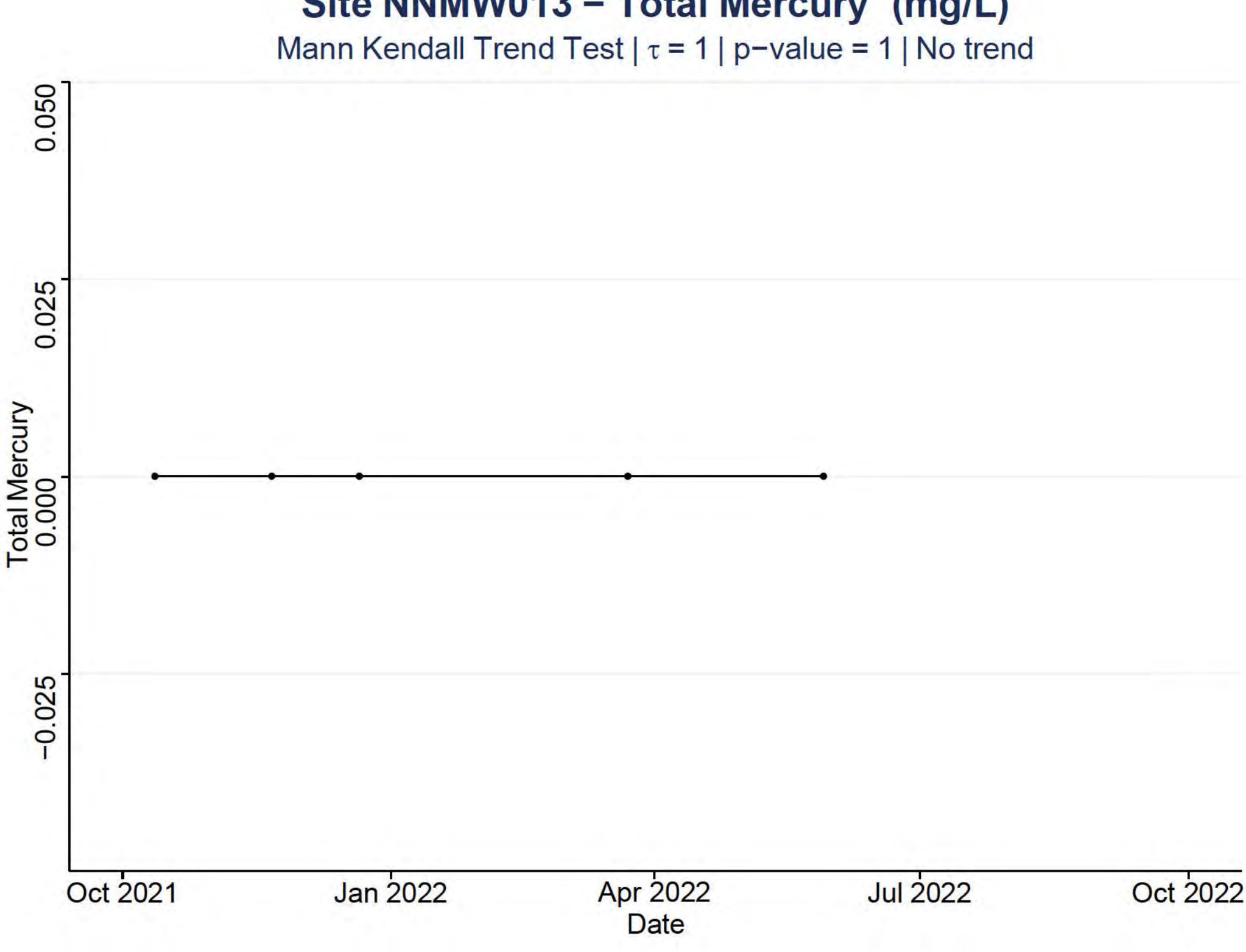

Site NNMW013 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Total Copper
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 0.316 | p−value = 0.724 | No trend
Total Cyanide
0.00500
0.00475
0.00450
0.00425
0.00400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW013 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = 0.105 | p−value = 1 | No trend
Total Dissolved Solids
6800
6700
6600
6500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

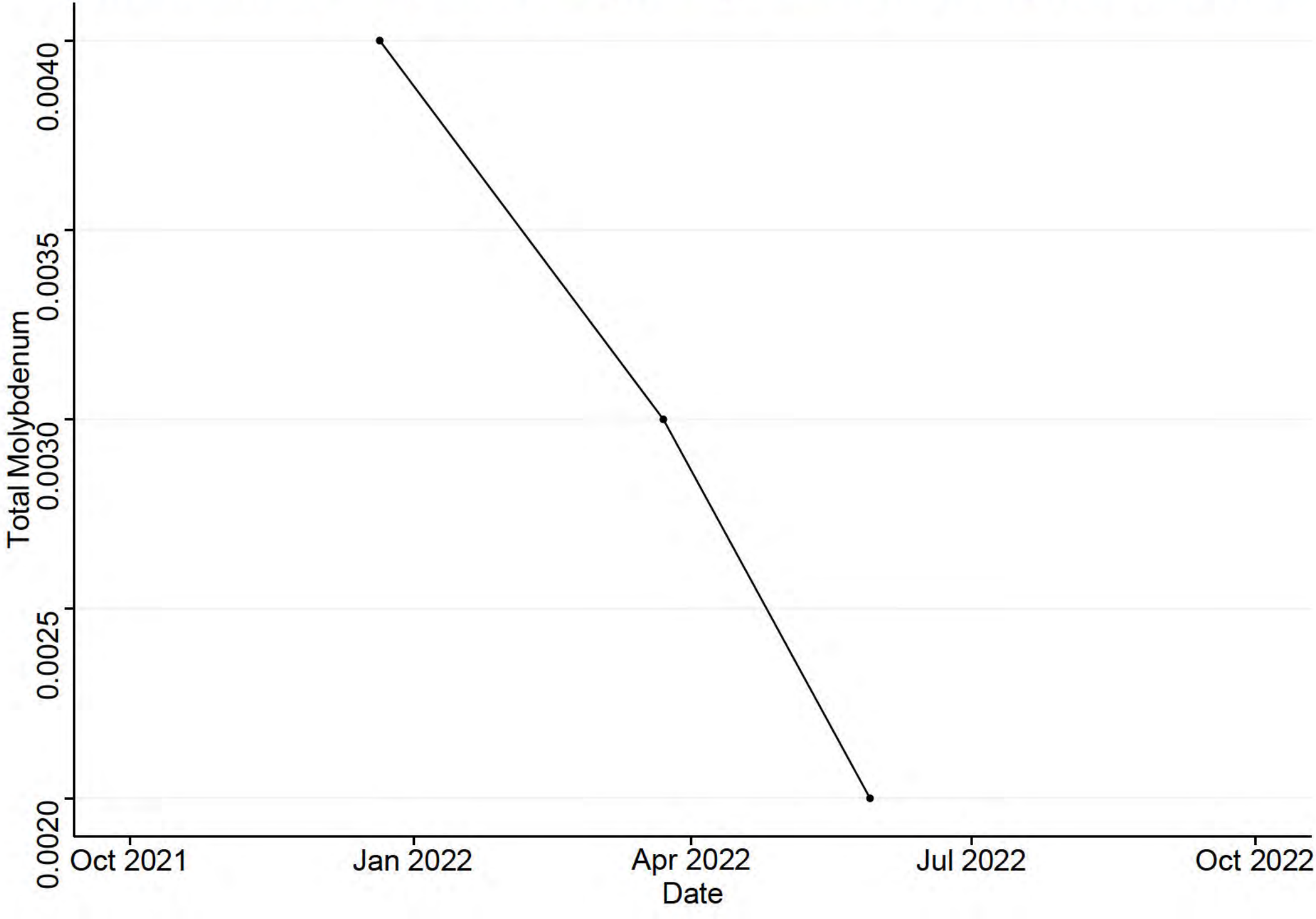

Site NNMW013 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.738 | p−value = 0.13 | No trend
Total Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

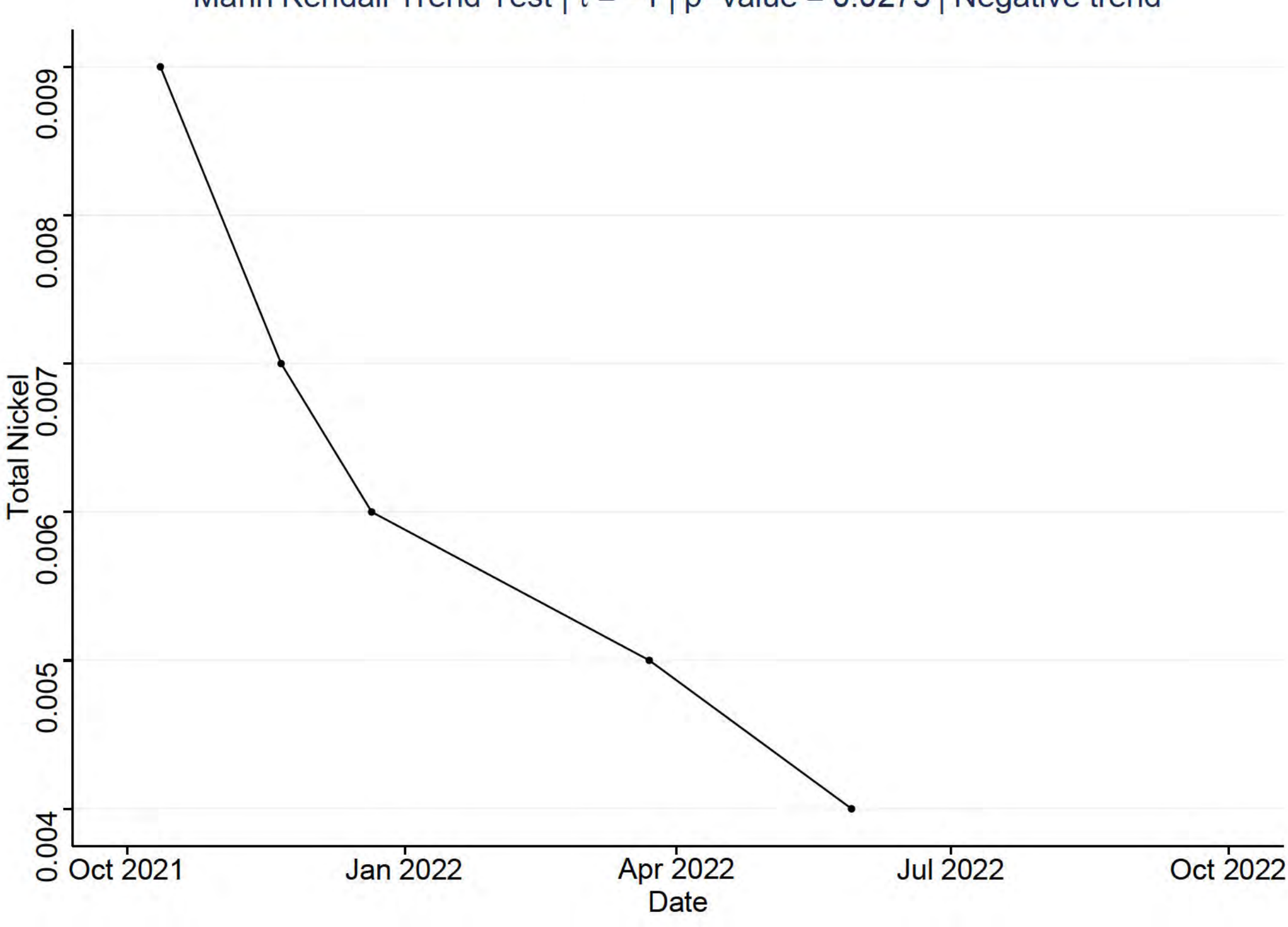

Site NNMW013 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −1 | p−value = 0.0275 | Negative trend
Total Manganese
1.25
1.00
0.75
0.50
0.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

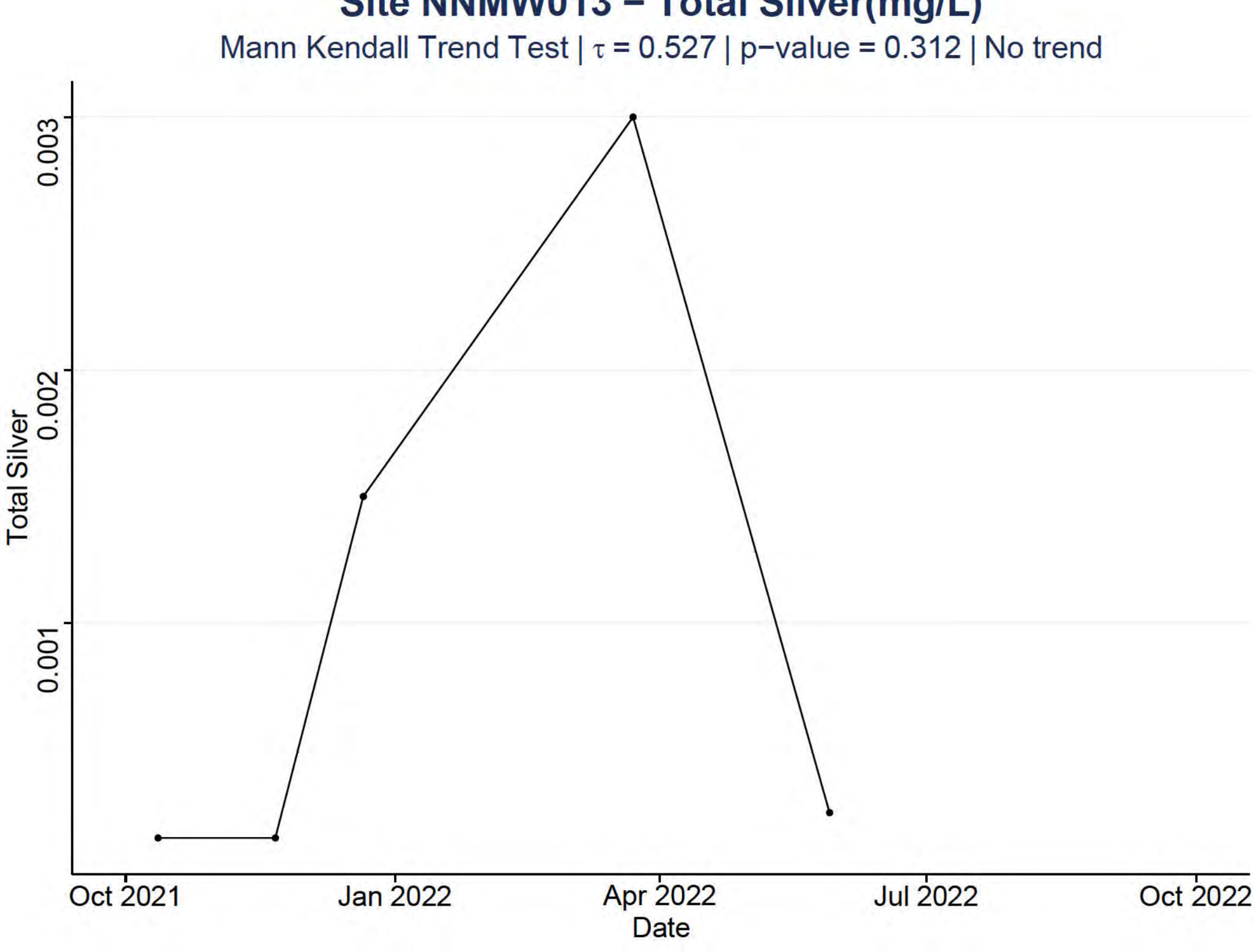

Site NNMW013 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

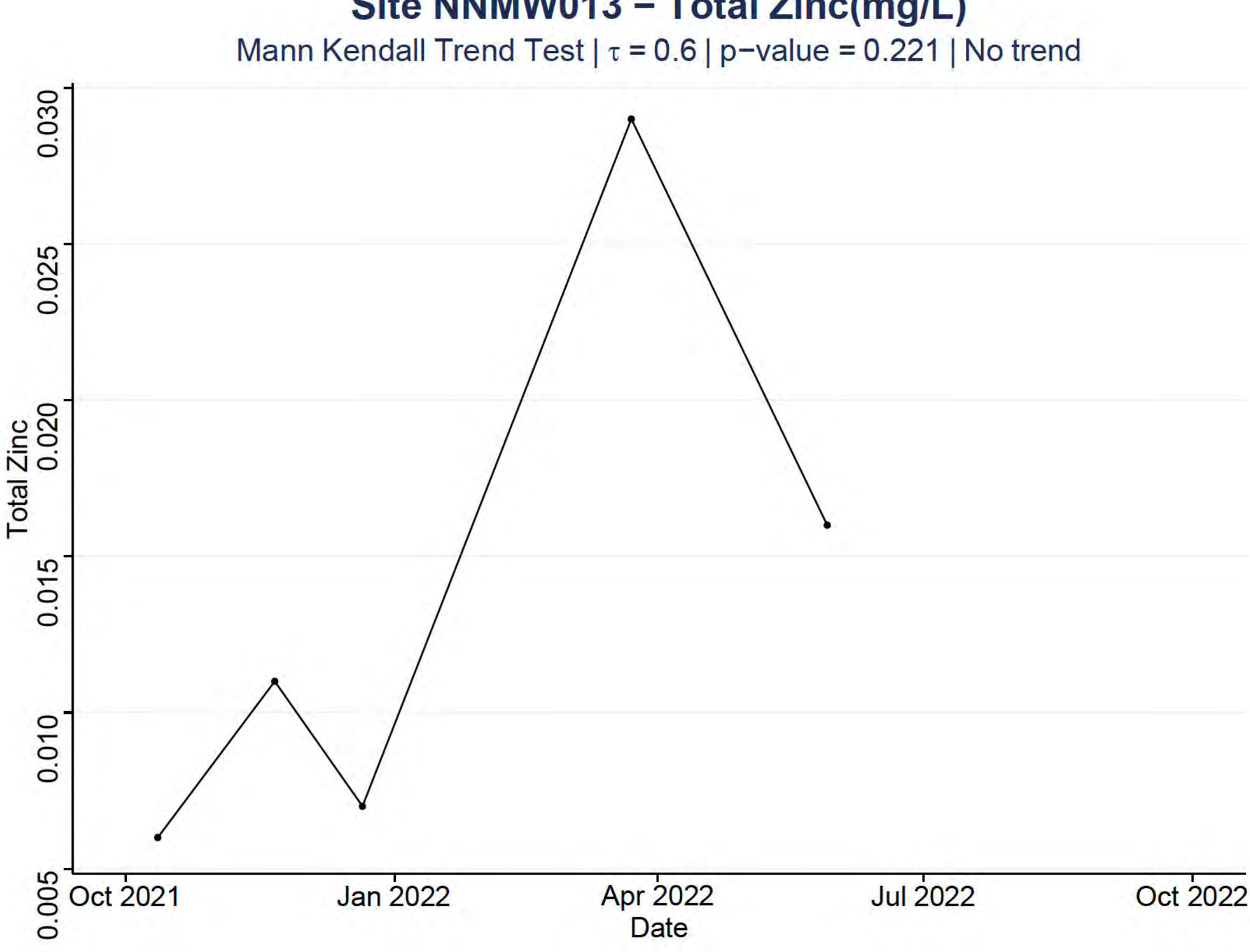
Site NNMW013 – Total Molybdenum (mg/L)

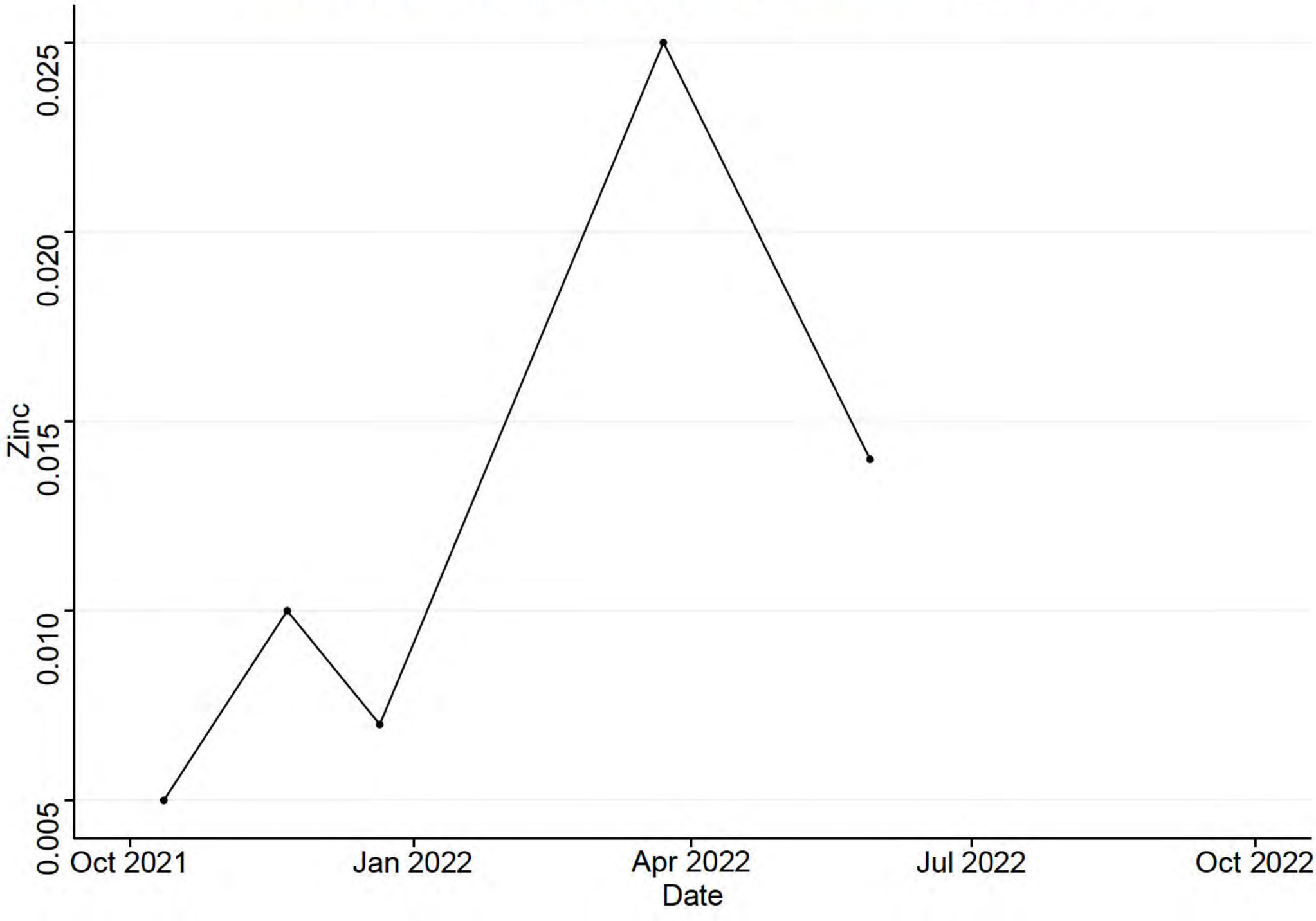
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

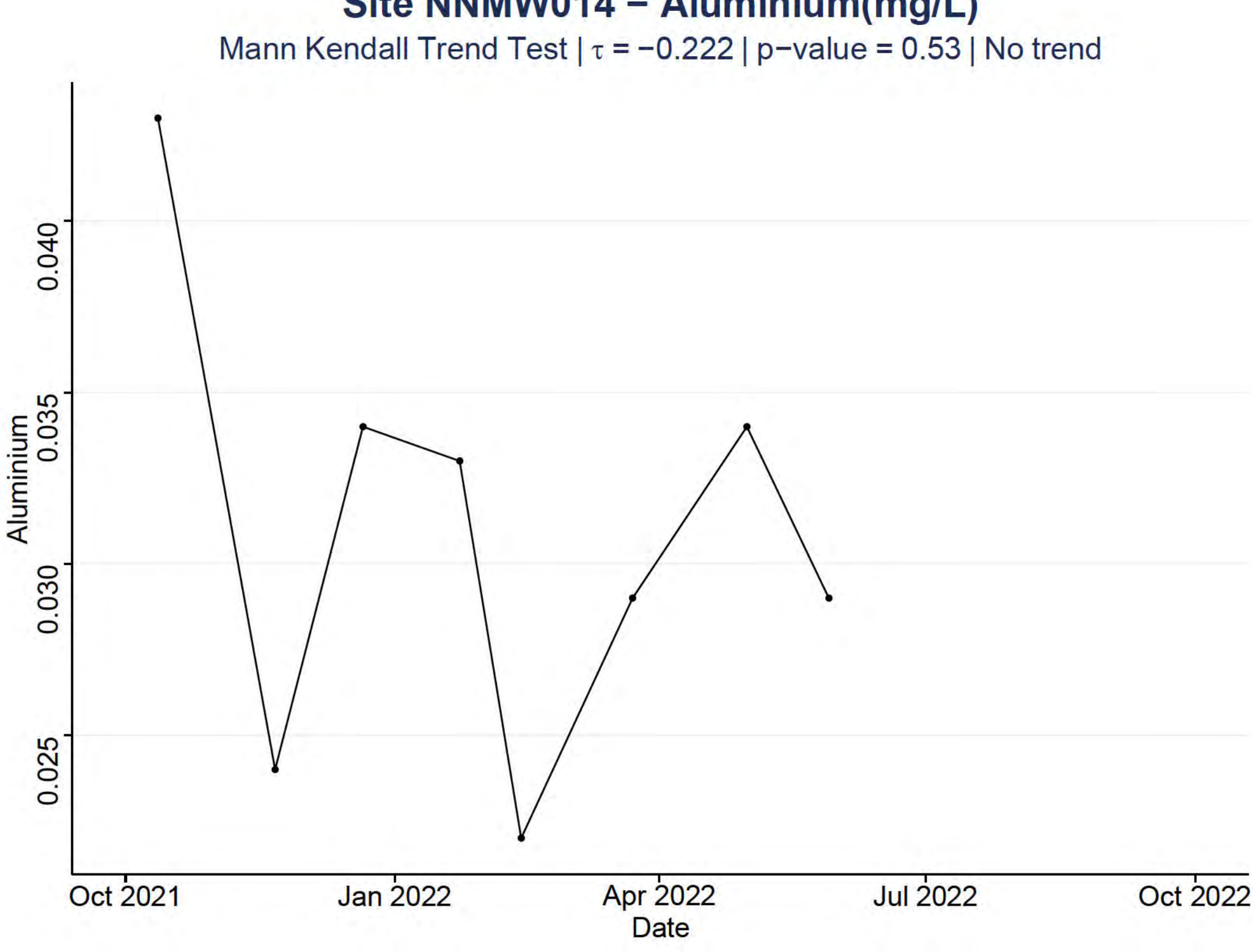


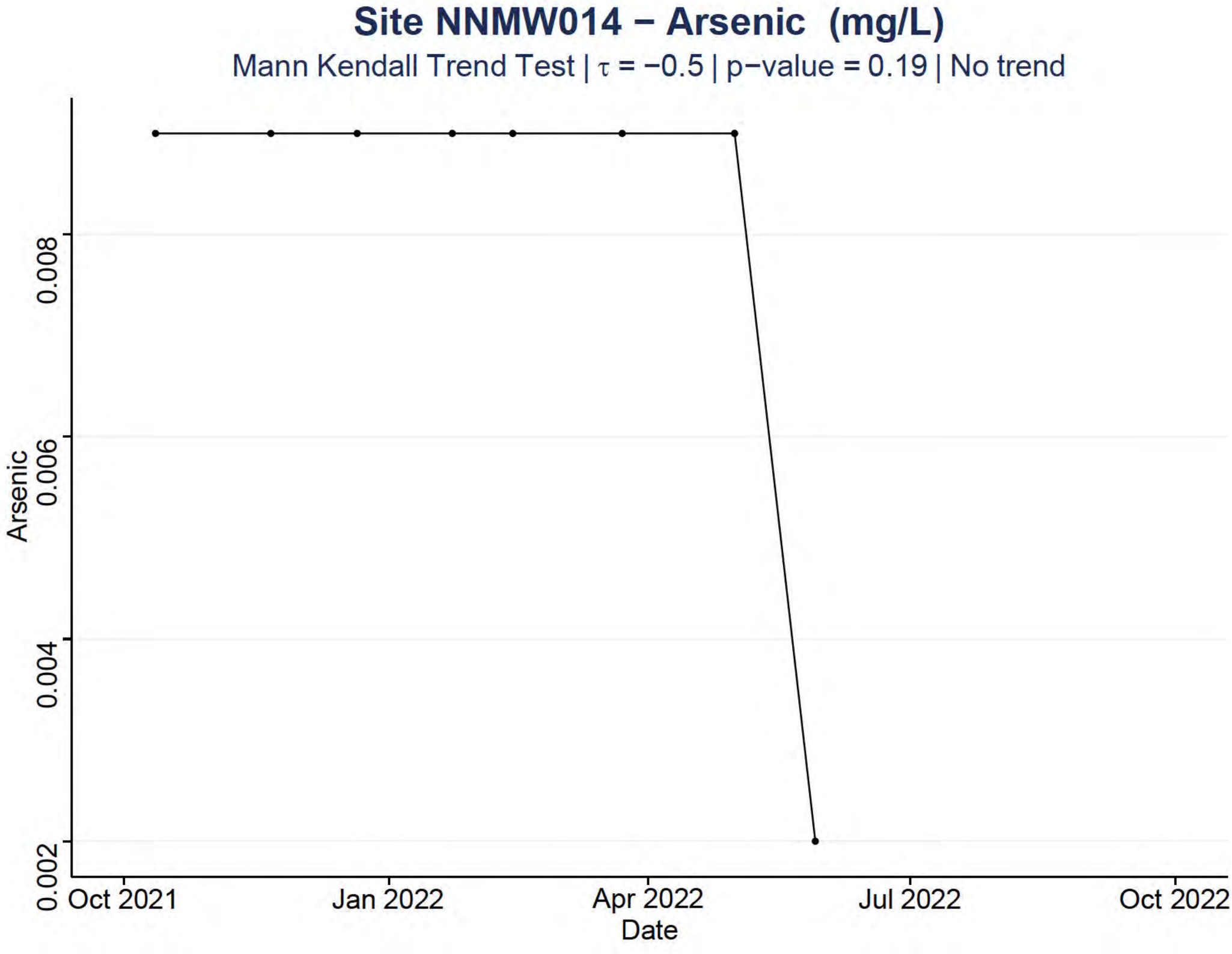

Site NNMW013 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −1 | p−value = 0.0275 | Negative trend
Total Nickel
0.004
0.005
0.006
0.007
0.008
0.009
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

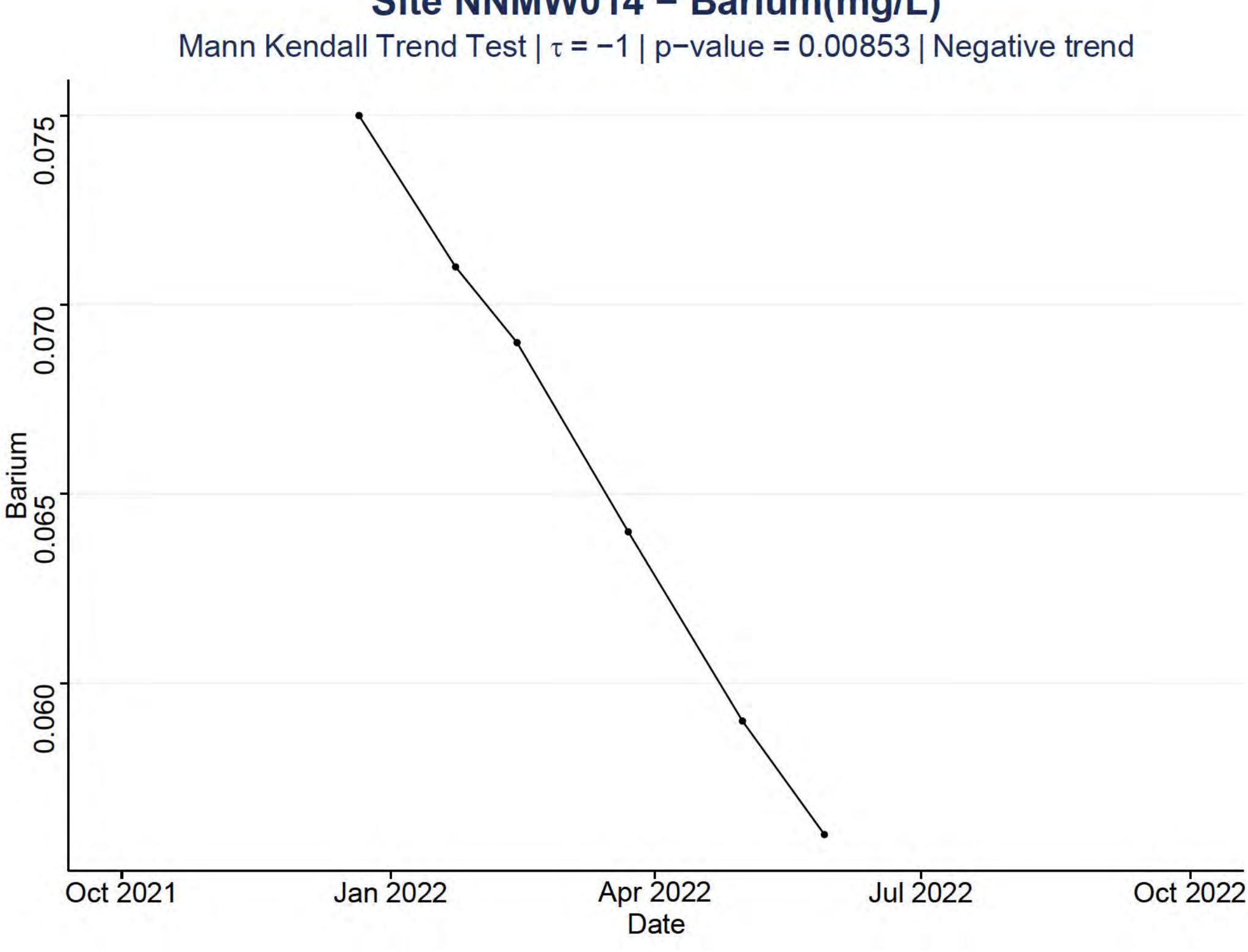

Site NNMW013 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.527 | p−value = 0.312 | No trend
Total Silver
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

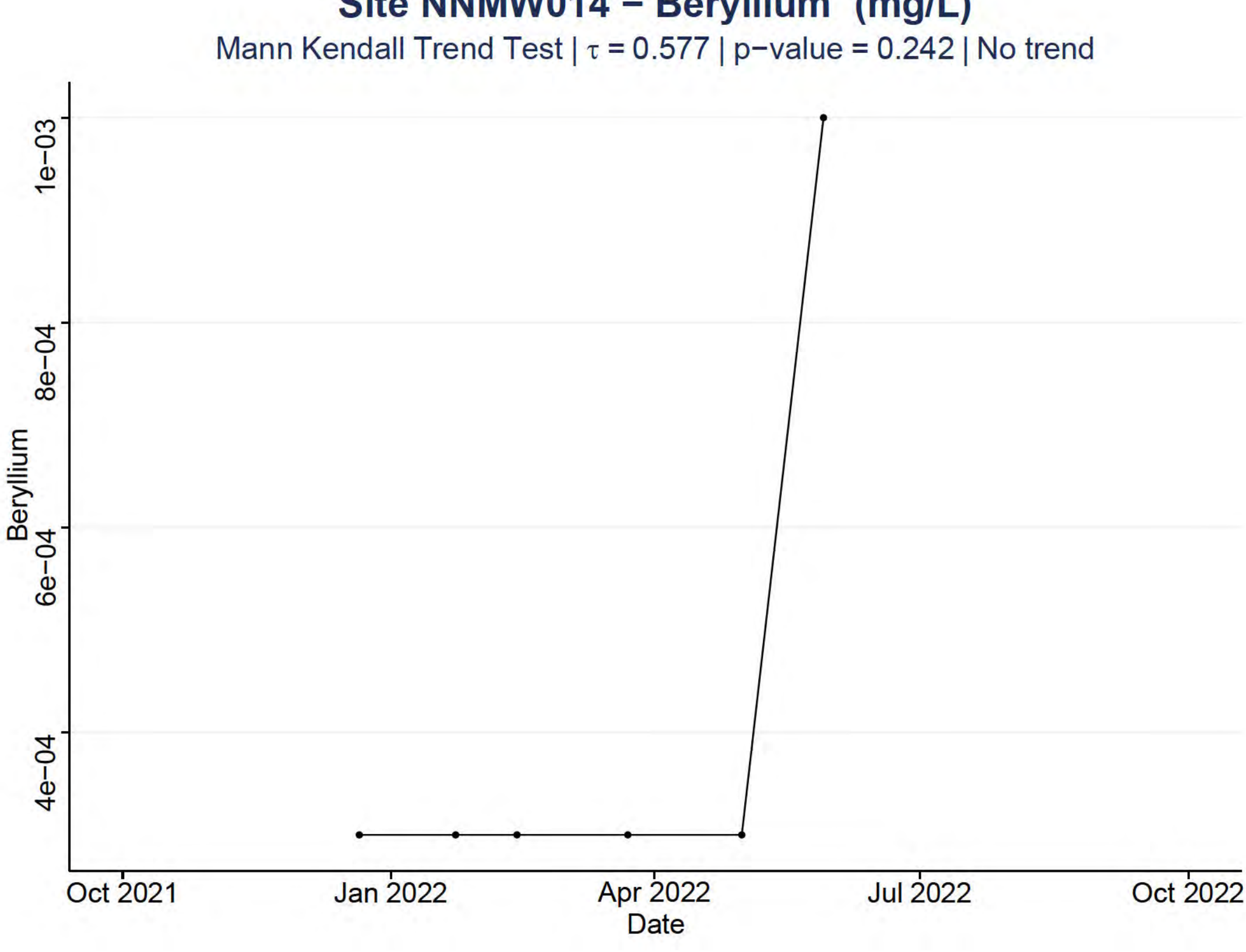

Site NNMW013 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = 0.6 | p−value = 0.221 | No trend
Total Zinc
0.030
0.025
0.020
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

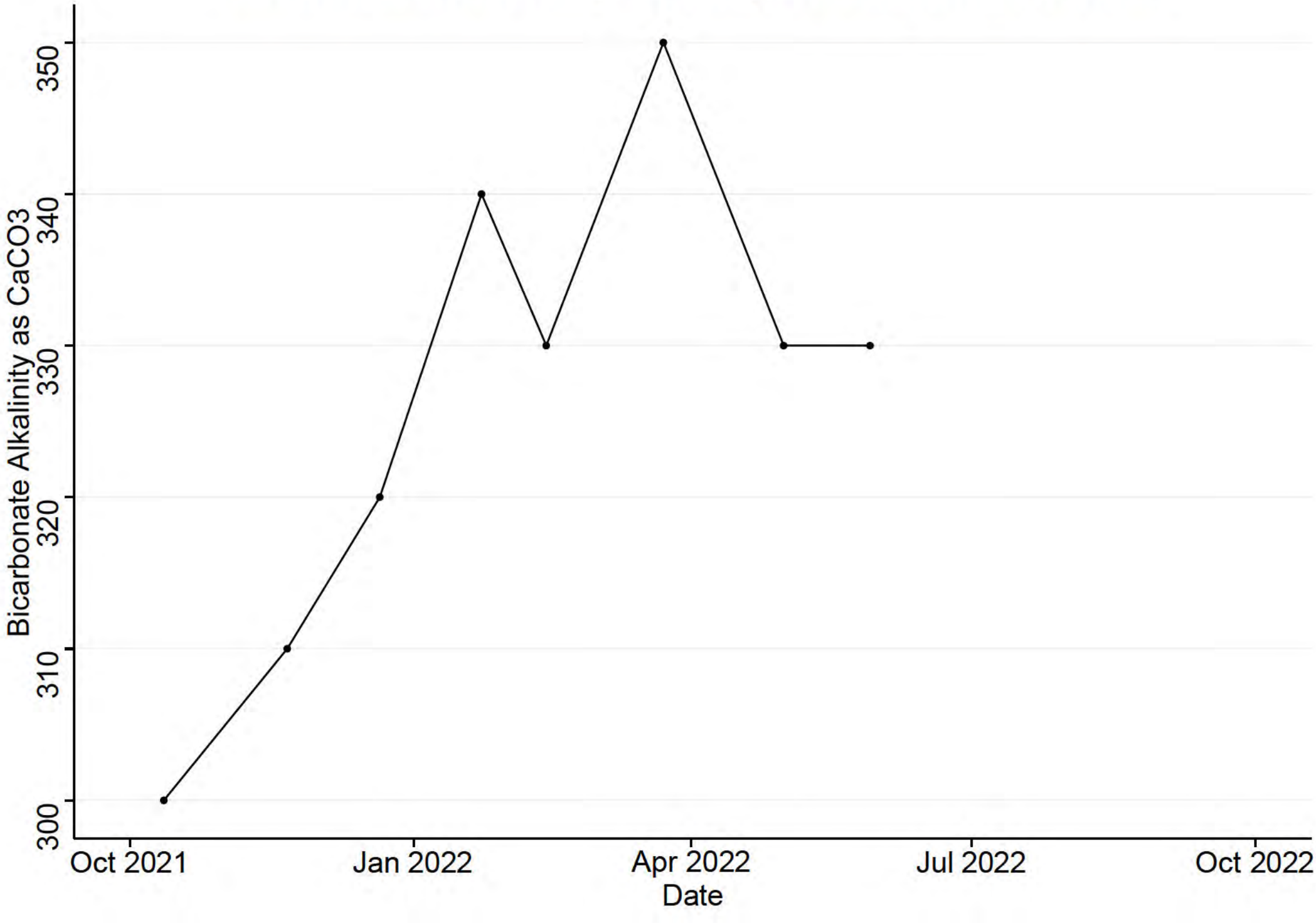

Site NNMW013 – Zinc (mg/L)
Mann Kendall Trend Test | τ = 0.6 | p−value = 0.221 | No trend
Zinc
0.025
0.020
0.015
0.010
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

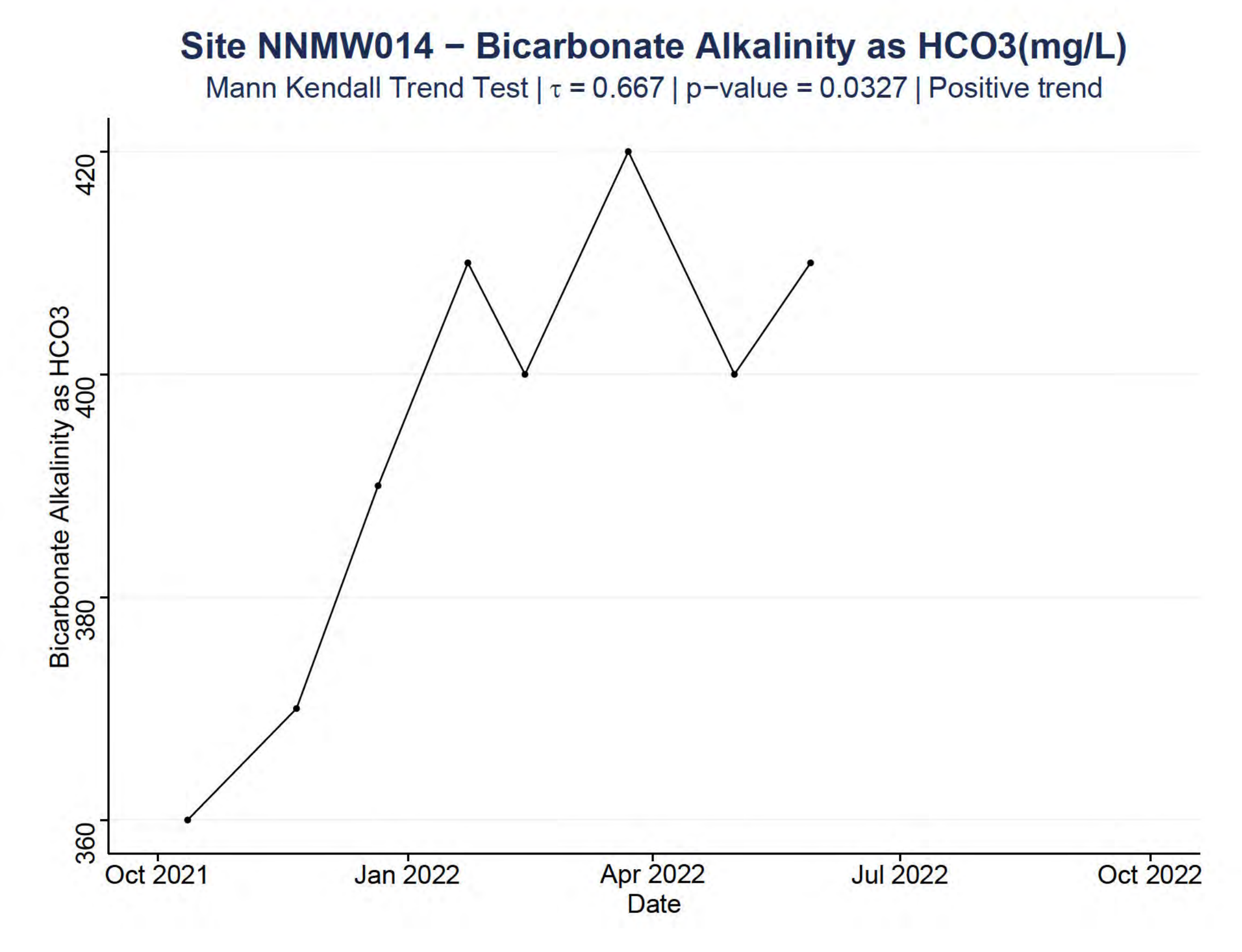

Site NNMW014 − Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.222 | p−value = 0.53 | No trend
Aluminium
0.040
0.035
0.030
0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

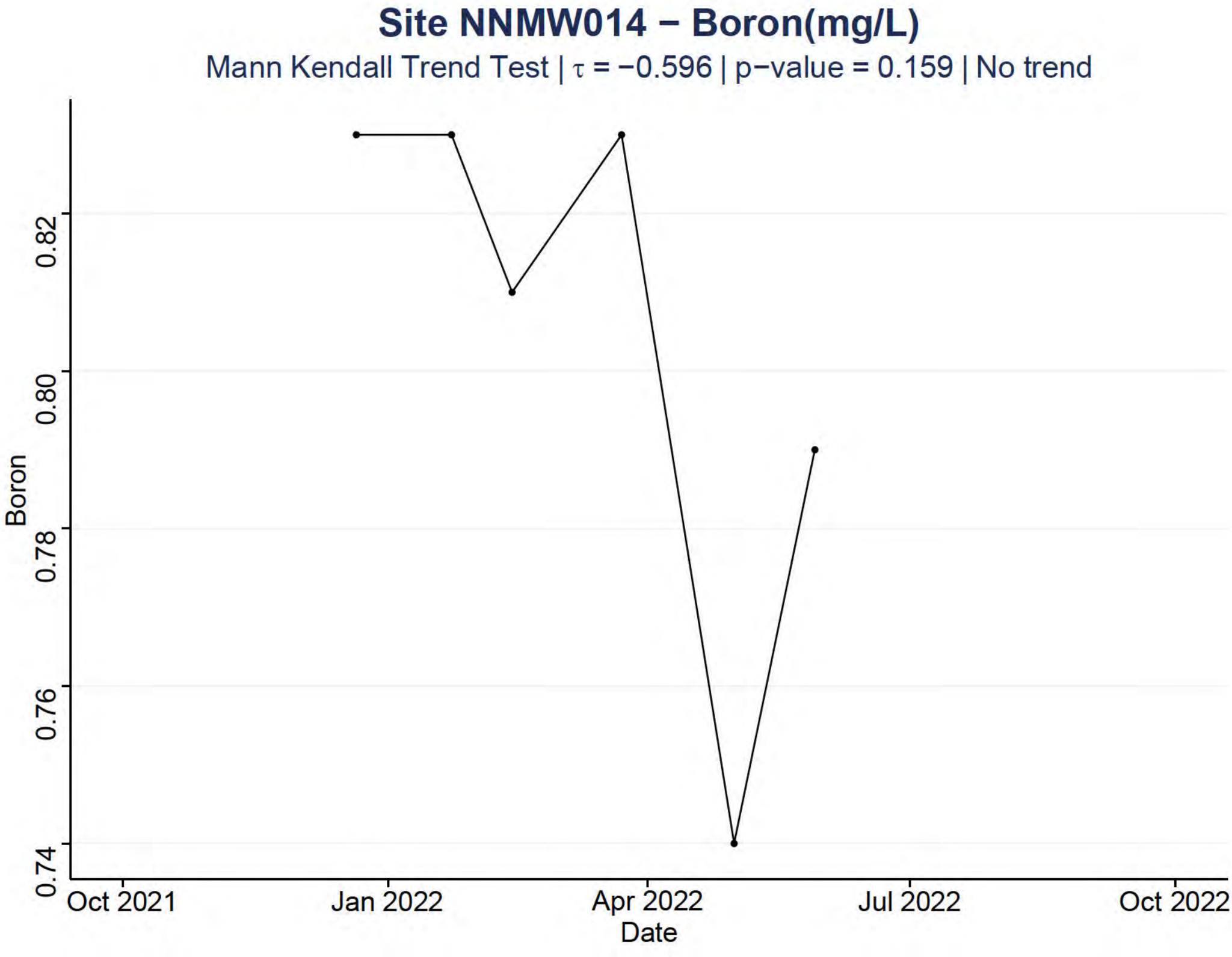

Site NNMW014 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Arsenic
0.002
0.004
0.006
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

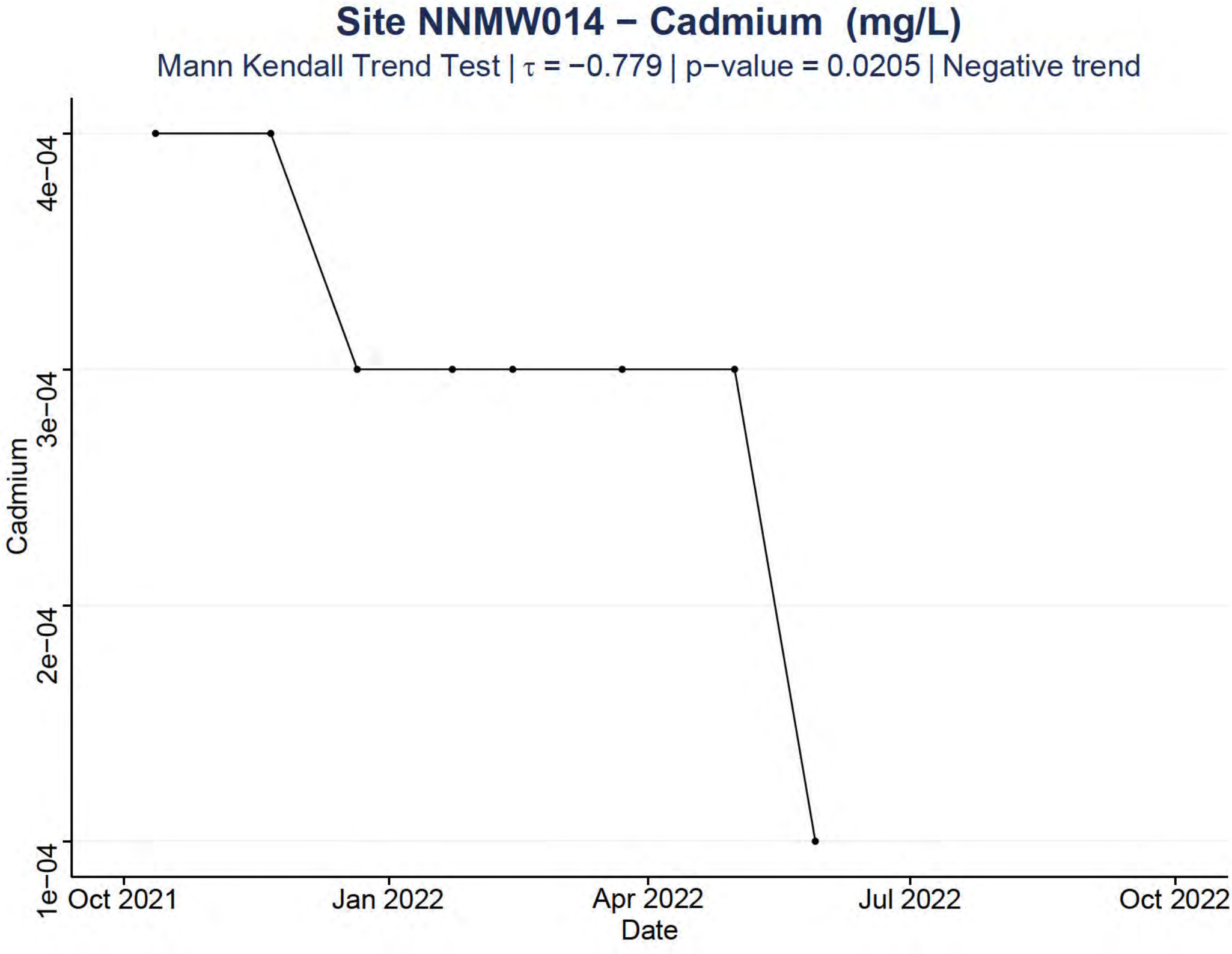

Site NNMW014 − Barium(mg/L)
Mann Kendall Trend Test | τ = −1 | p−value = 0.00853 | Negative trend
Barium
0.075
0.070
0.065
0.060
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

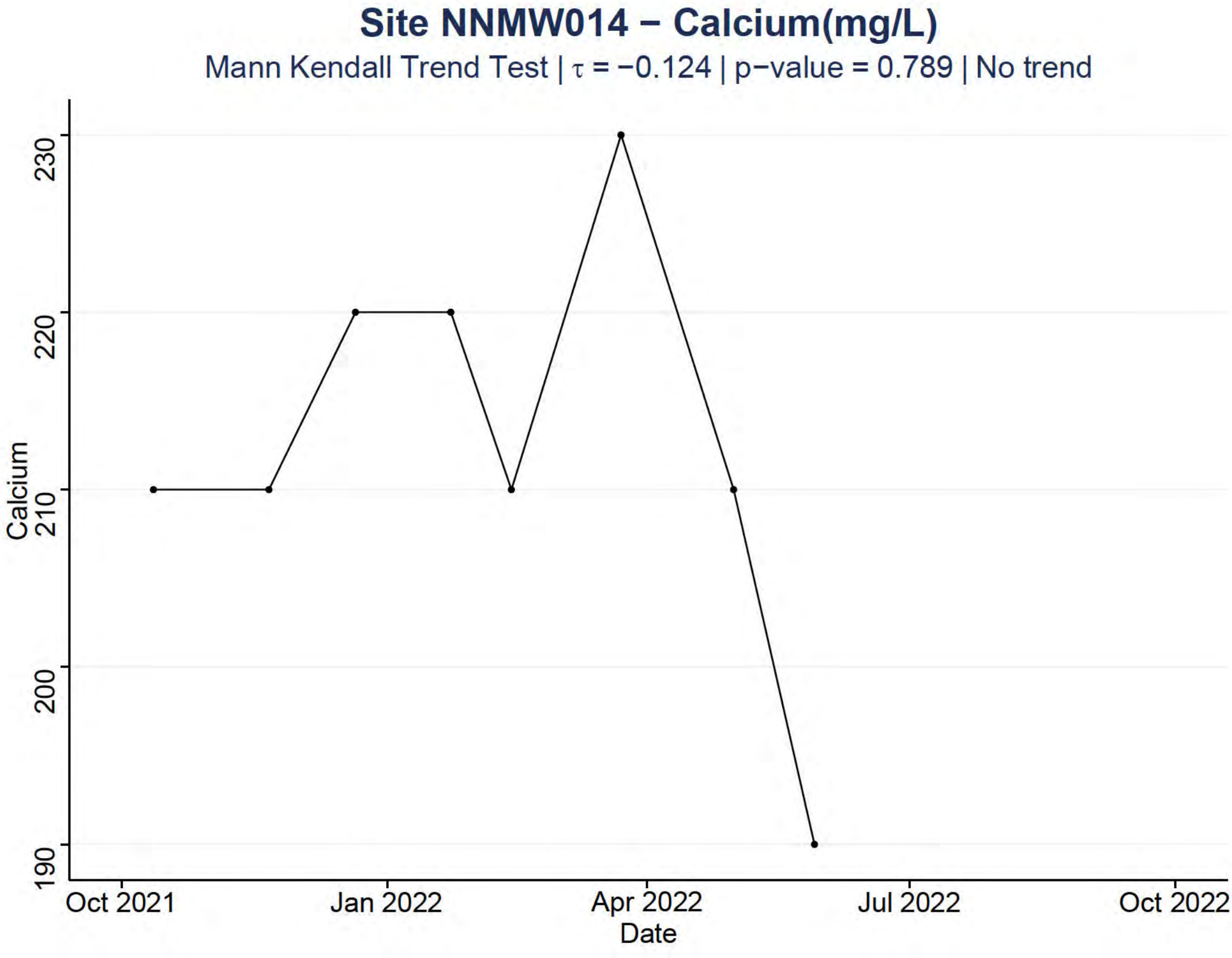

Site NNMW014 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

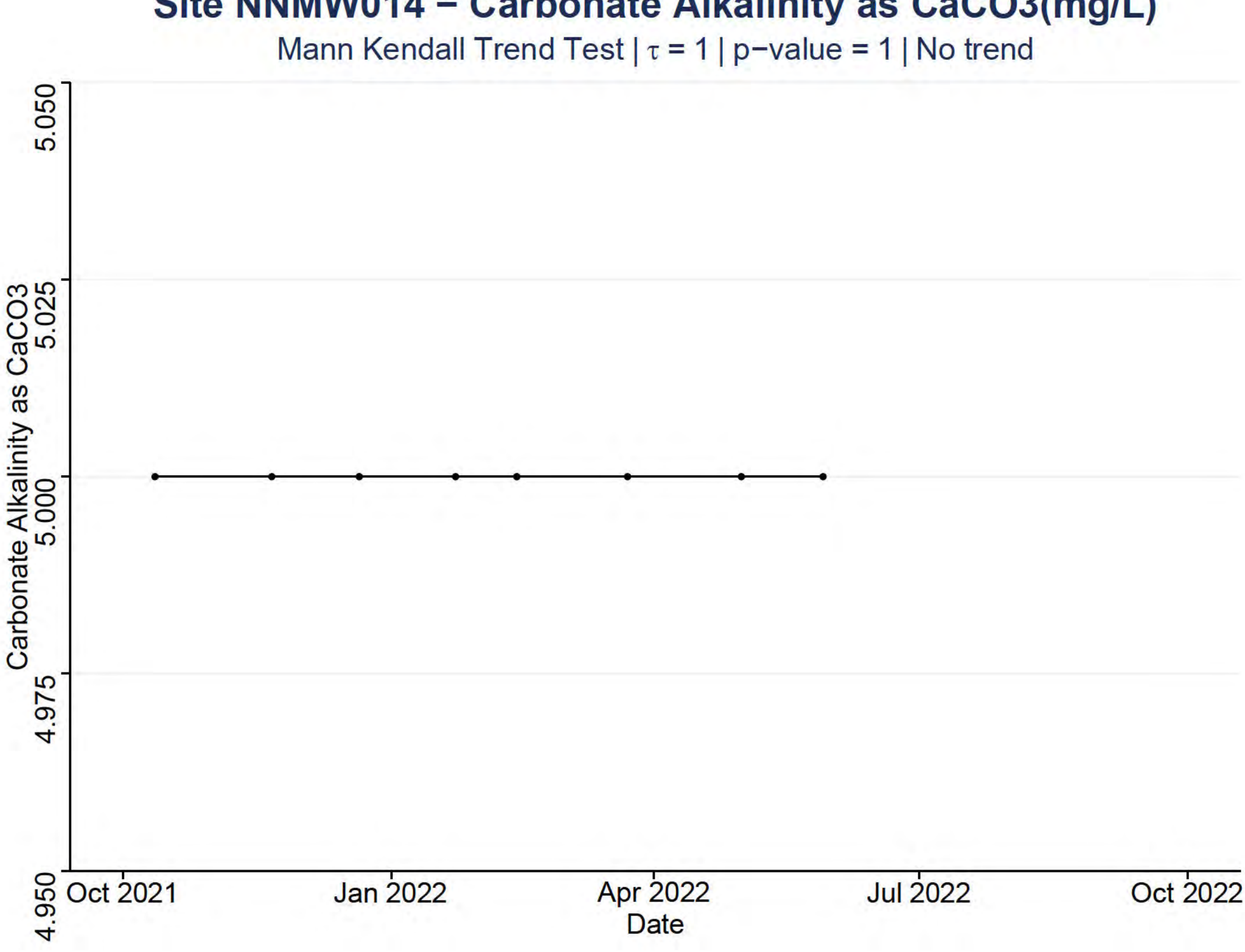

Site NNMW014 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.567 | p−value = 0.0746 | No trend
Bicarbonate Alkalinity as CaCO3
300
310
320
330
340
350
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

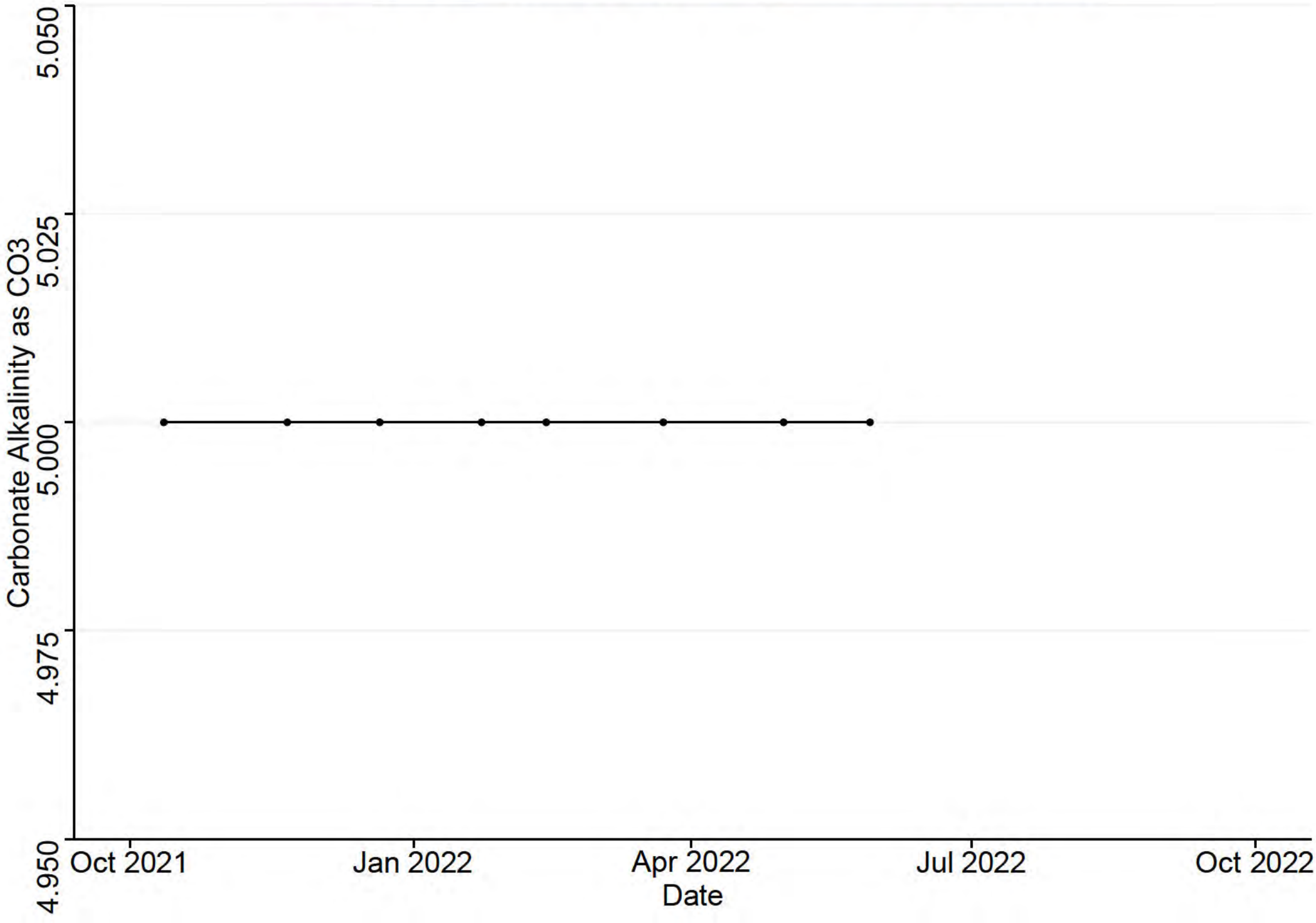

Site NNMW014 – Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.667 | p−value = 0.0327 | Positive trend
Bicarbonate Alkalinity as HCO3
420
400
380
360
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

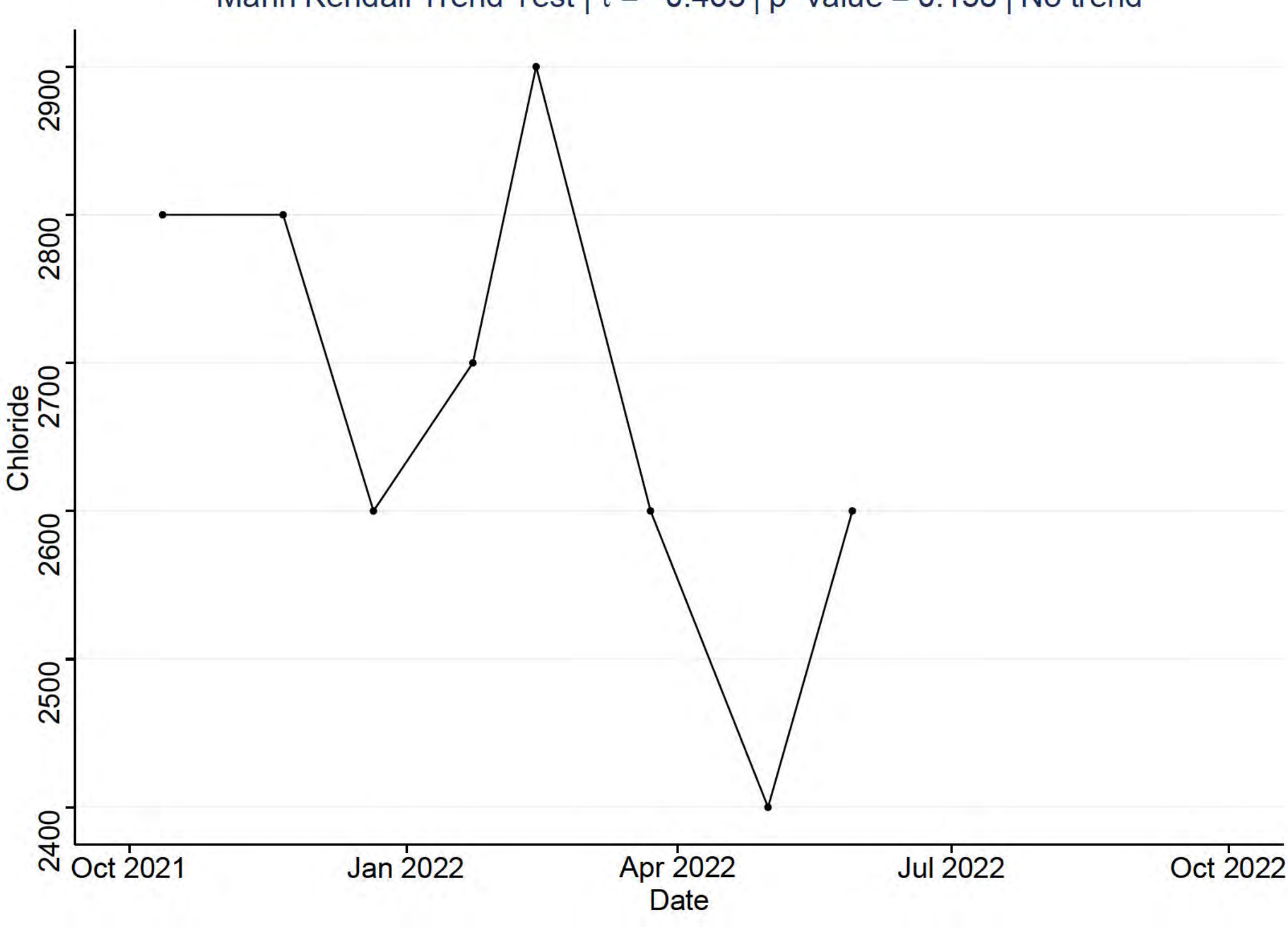

Site NNMW014 – Boron(mg/L)
Mann Kendall Trend Test | τ = −0.596 | p−value = 0.159 | No trend
Boron
0.74
0.76
0.78
0.80
0.82
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

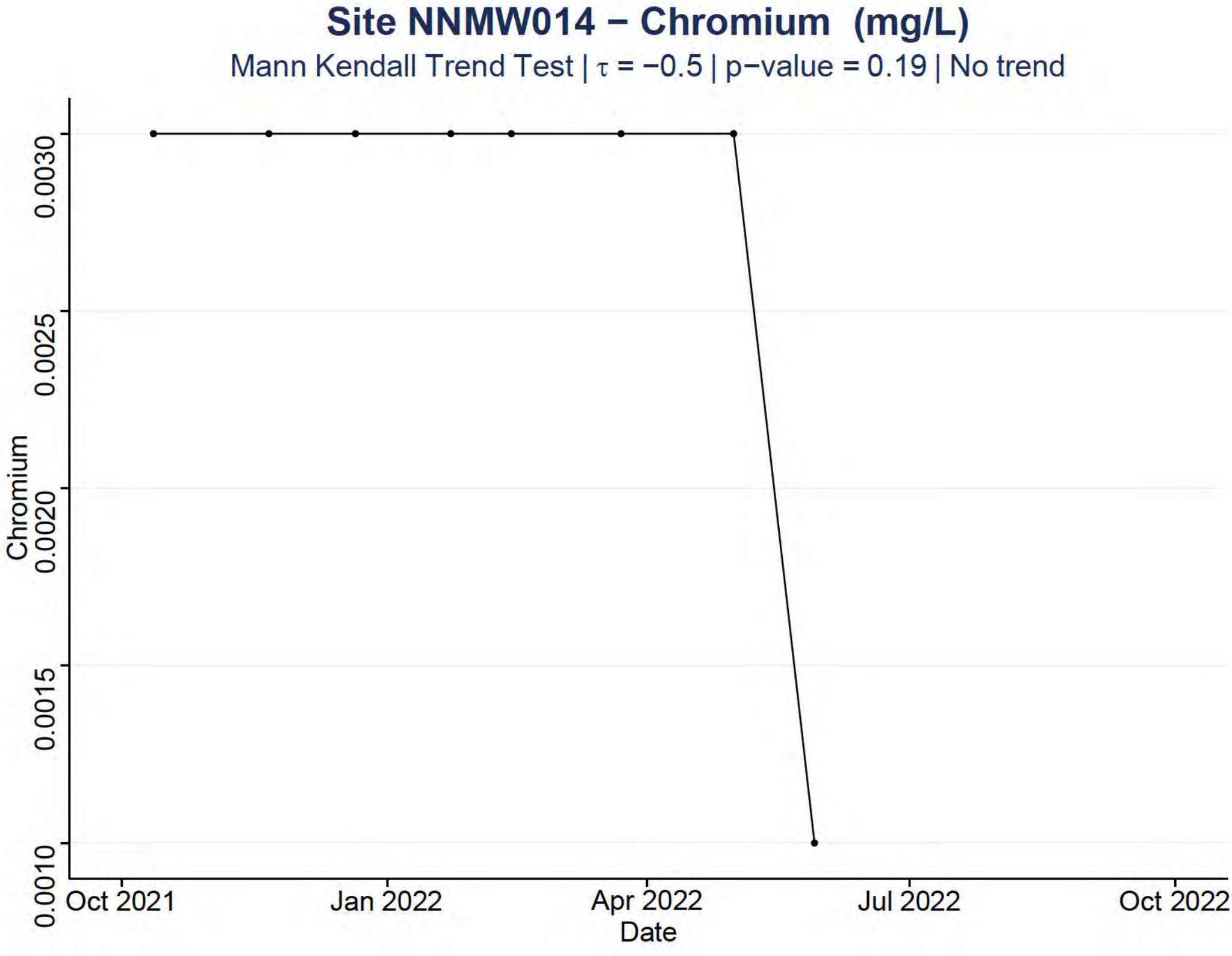

Site NNMW014 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.779 | p−value = 0.0205 | Negative trend
Cadmium
4e−04
3e−04
2e−04
1e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

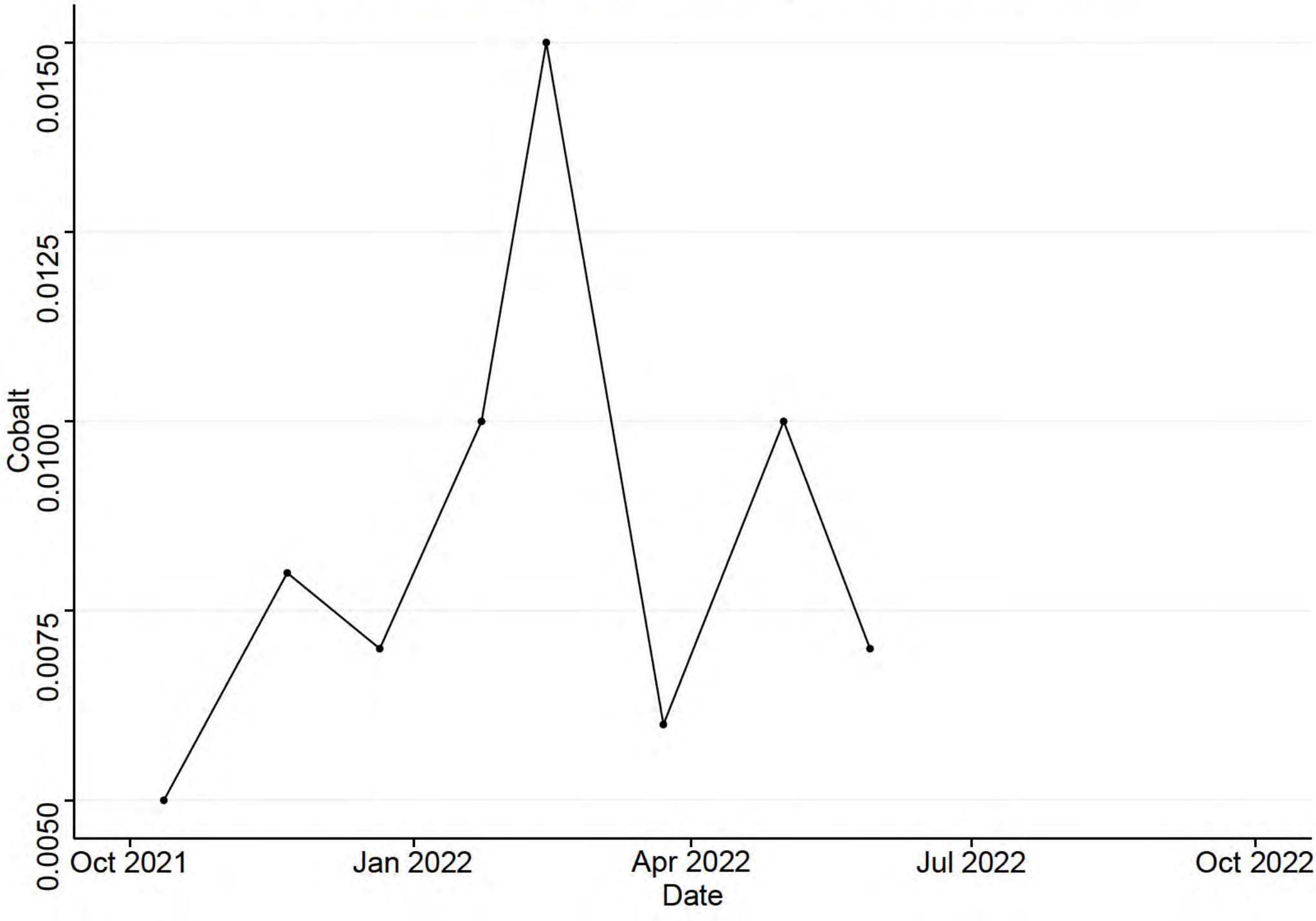

Site NNMW014 – Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.124 | p−value = 0.789 | No trend
Calcium
230
220
210
200
190
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

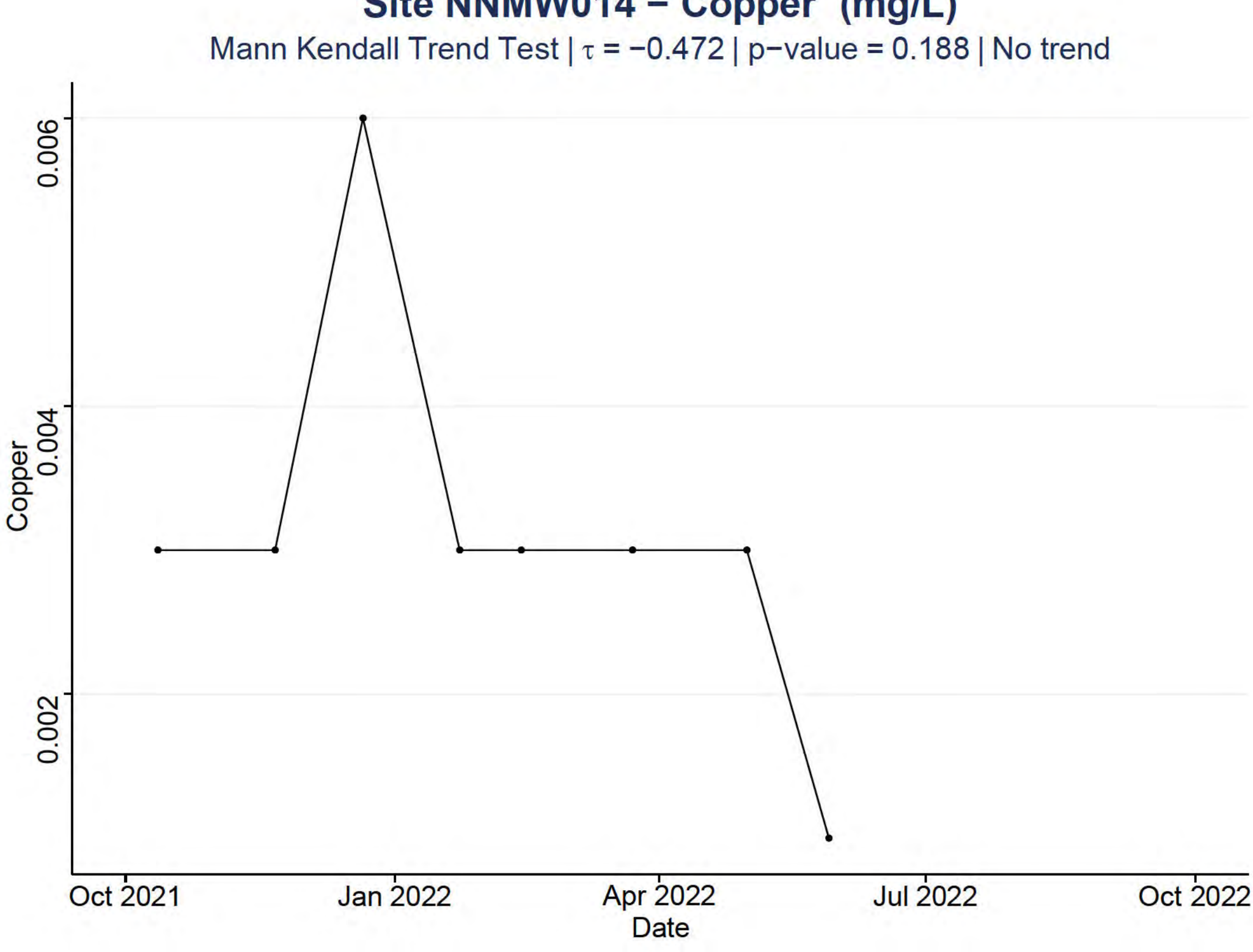

Site NNMW014 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

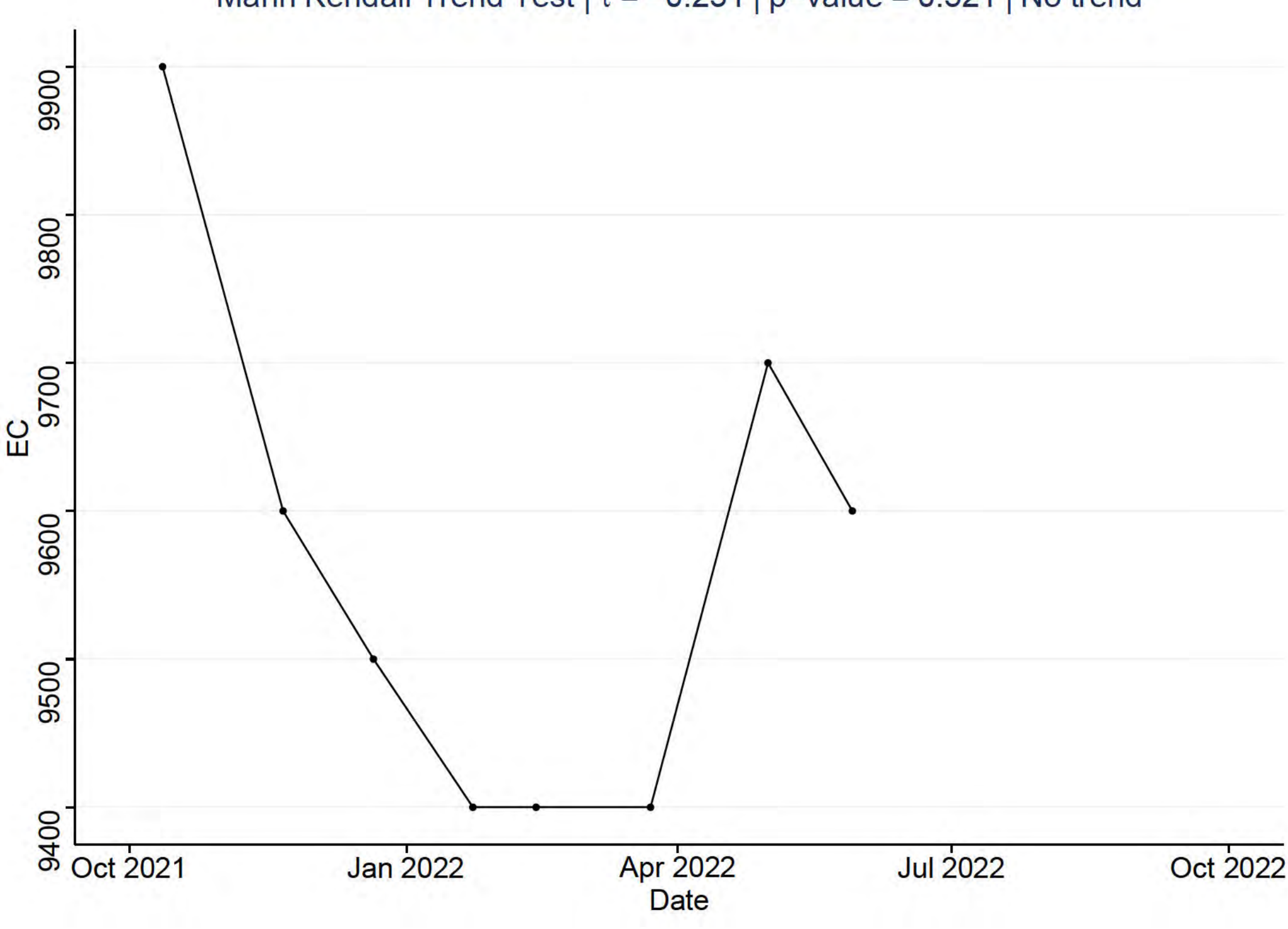

Site NNMW014 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

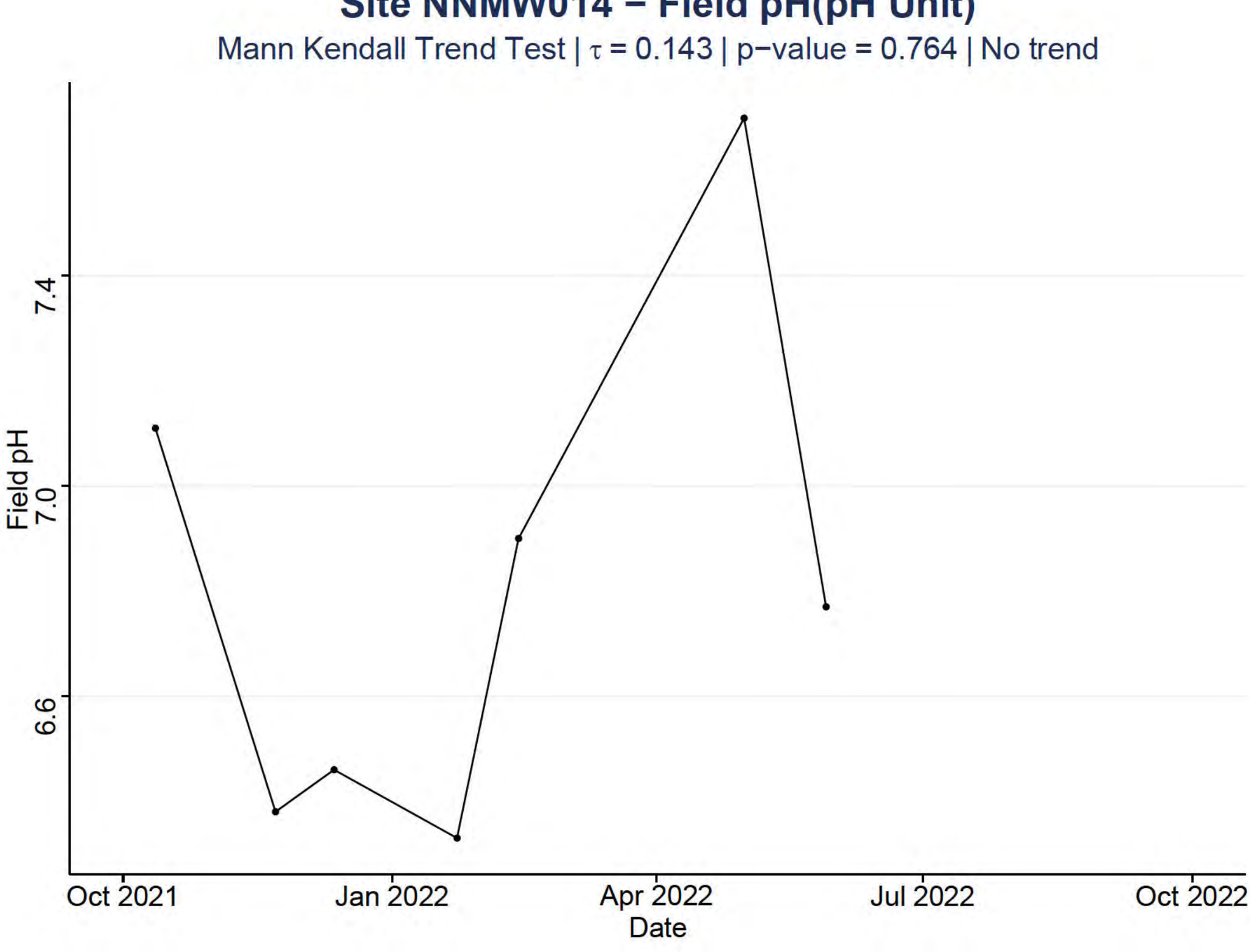

Site NNMW014 – Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.463 | p−value = 0.158 | No trend
Chloride
2400
2500
2600
2700
2800
2900
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

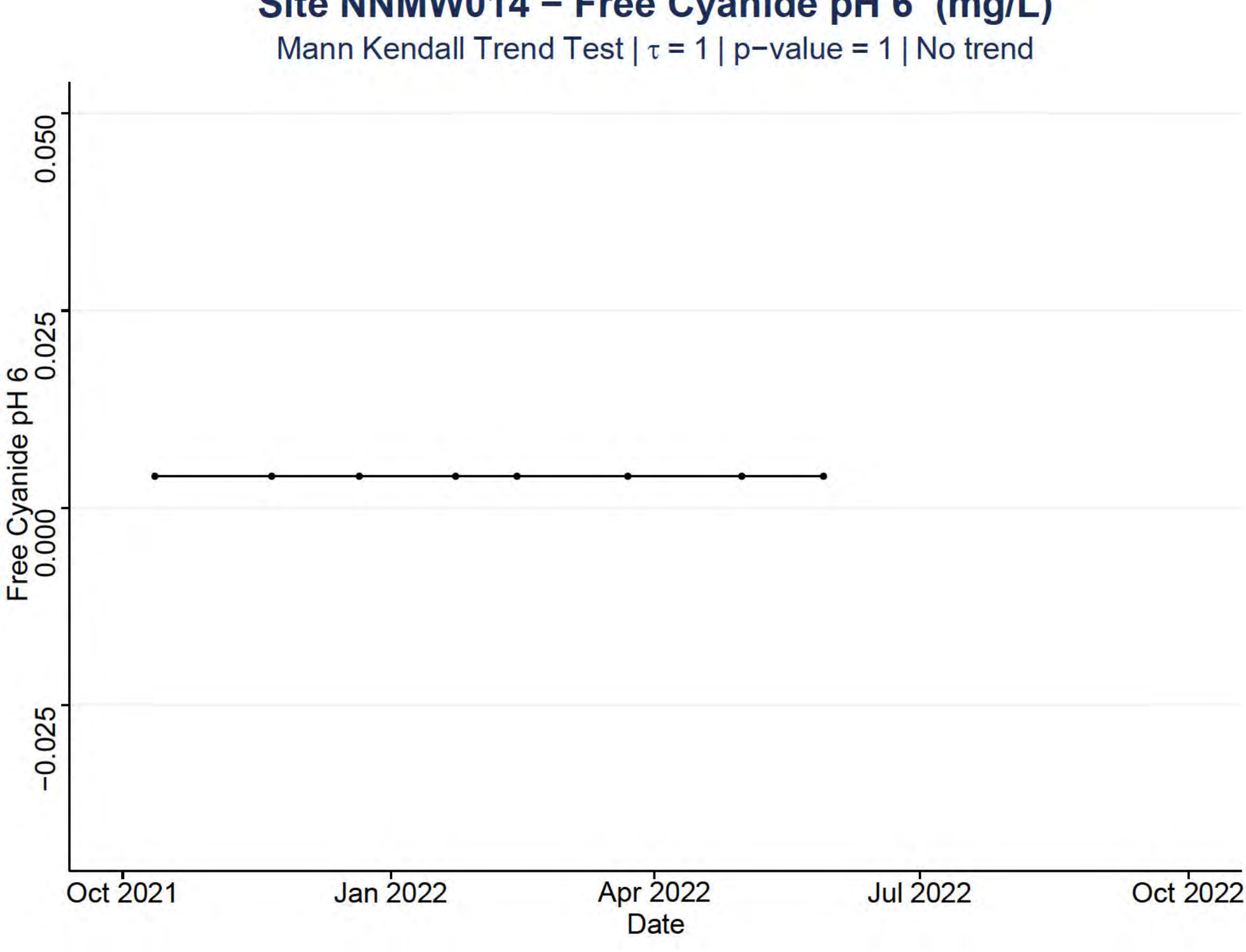

Site NNMW014 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

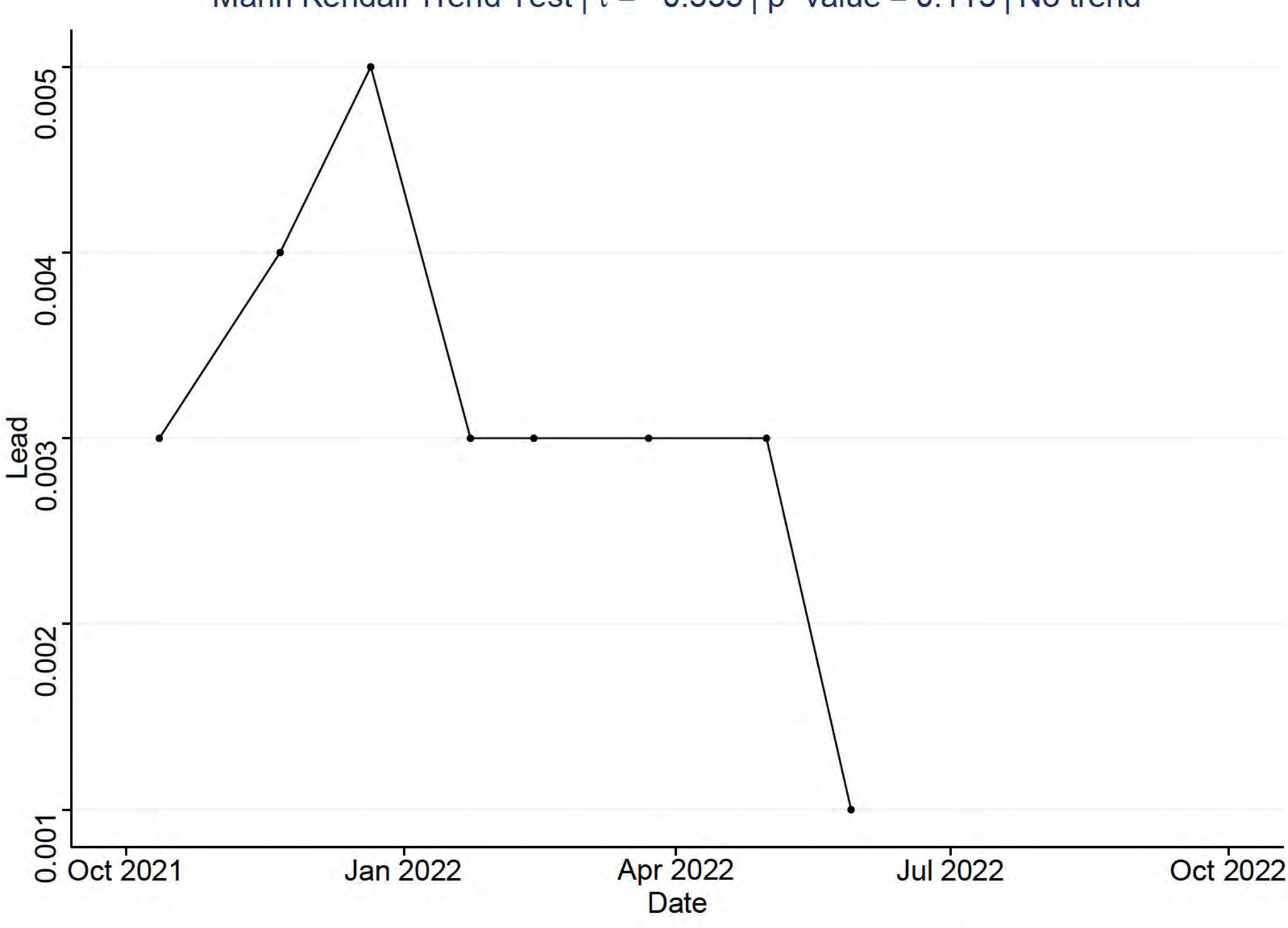

Site NNMW014 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = 0.222 | p−value = 0.53 | No trend
Cobalt
0.0150
0.0125
0.0100
0.0075
0.0050
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

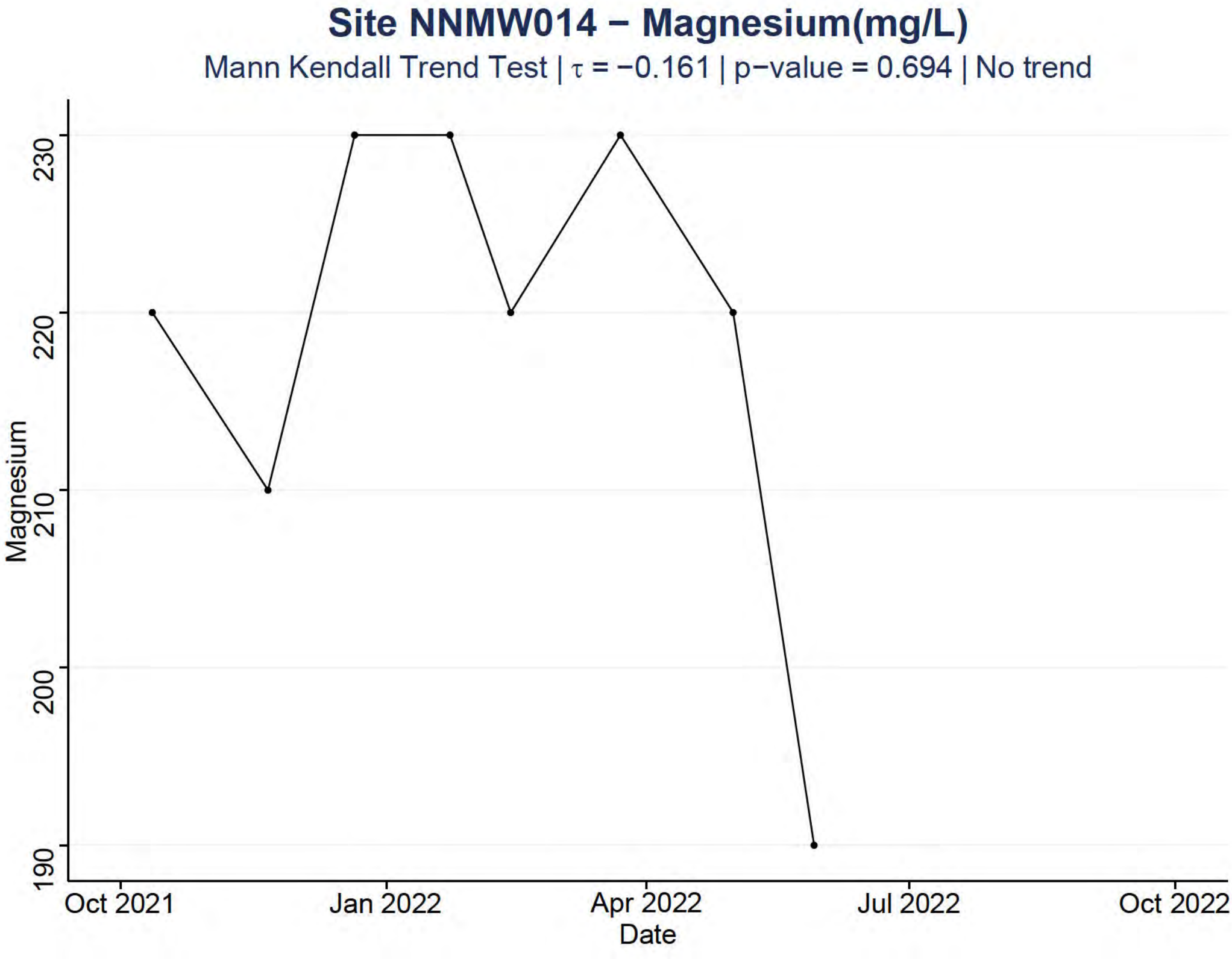

Site NNMW014 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.472 | p−value = 0.188 | No trend
Copper
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

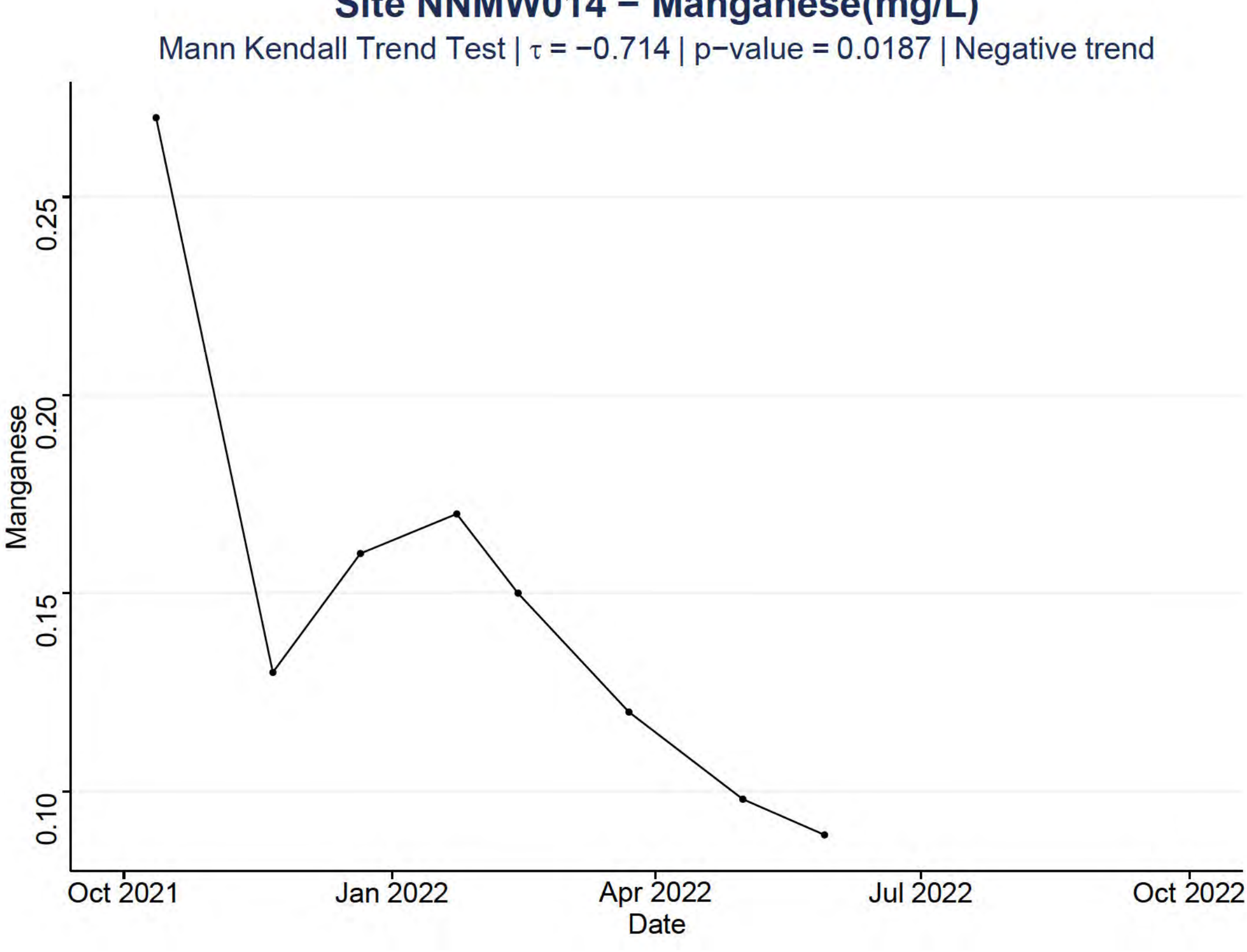

Site NNMW014 − EC(µS/cm)
Mann Kendall Trend Test | τ = −0.231 | p−value = 0.521 | No trend
EC
9900
9800
9700
9600
9500
9400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

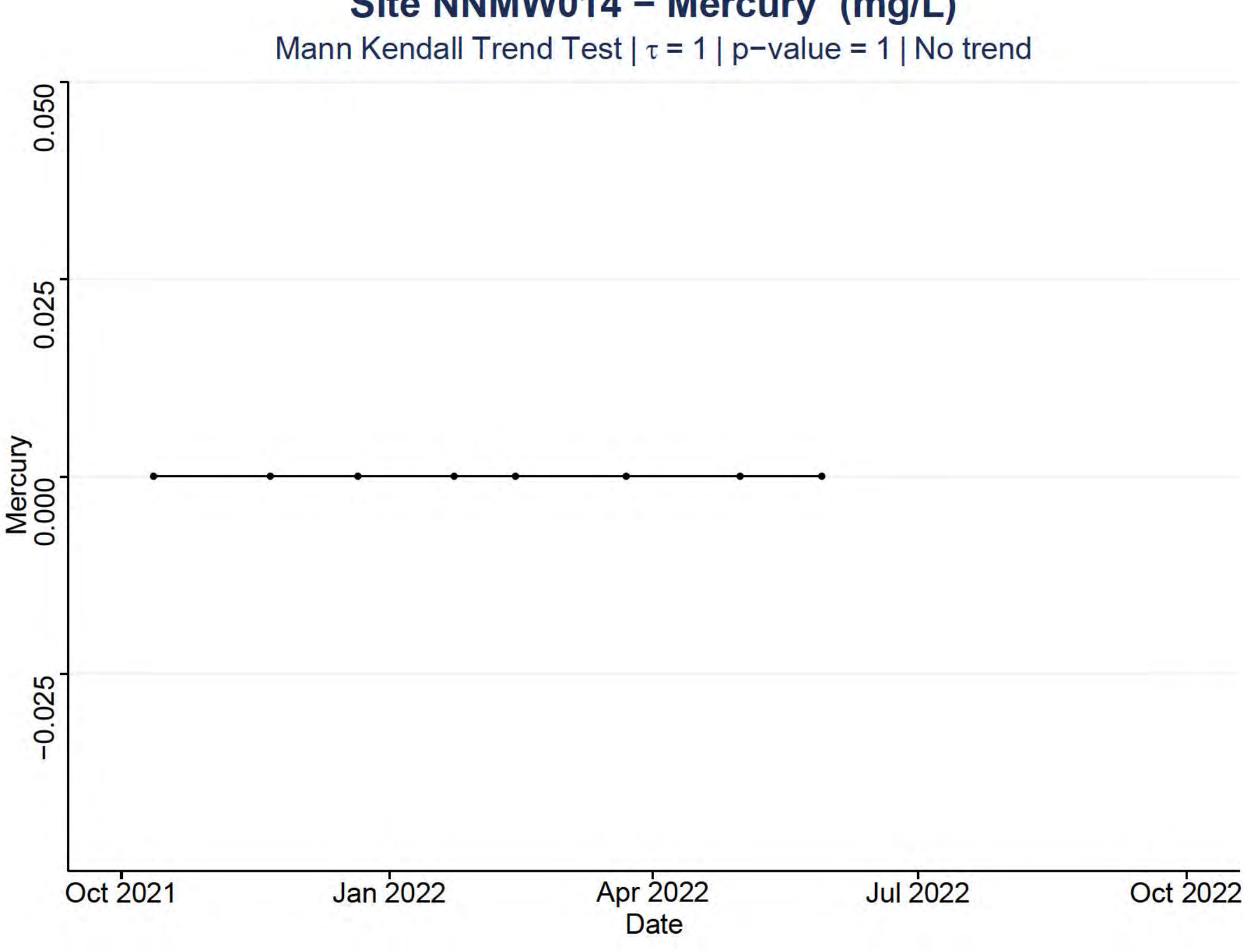

Site NNMW014 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = 0.143 | p−value = 0.764 | No trend
Field pH
7.4
7.0
6.6
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

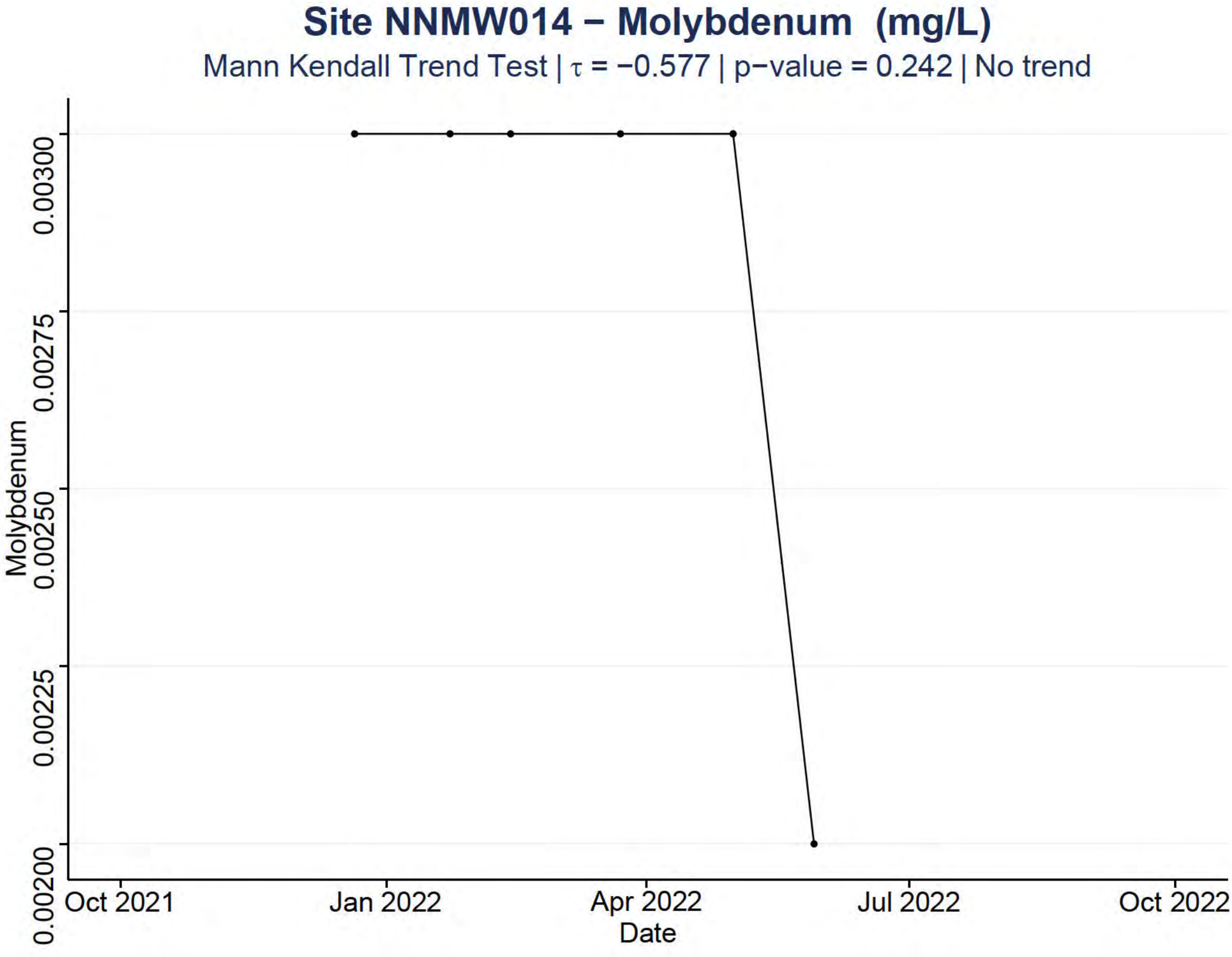

Site NNMW014 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Free Cyanide pH 6
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

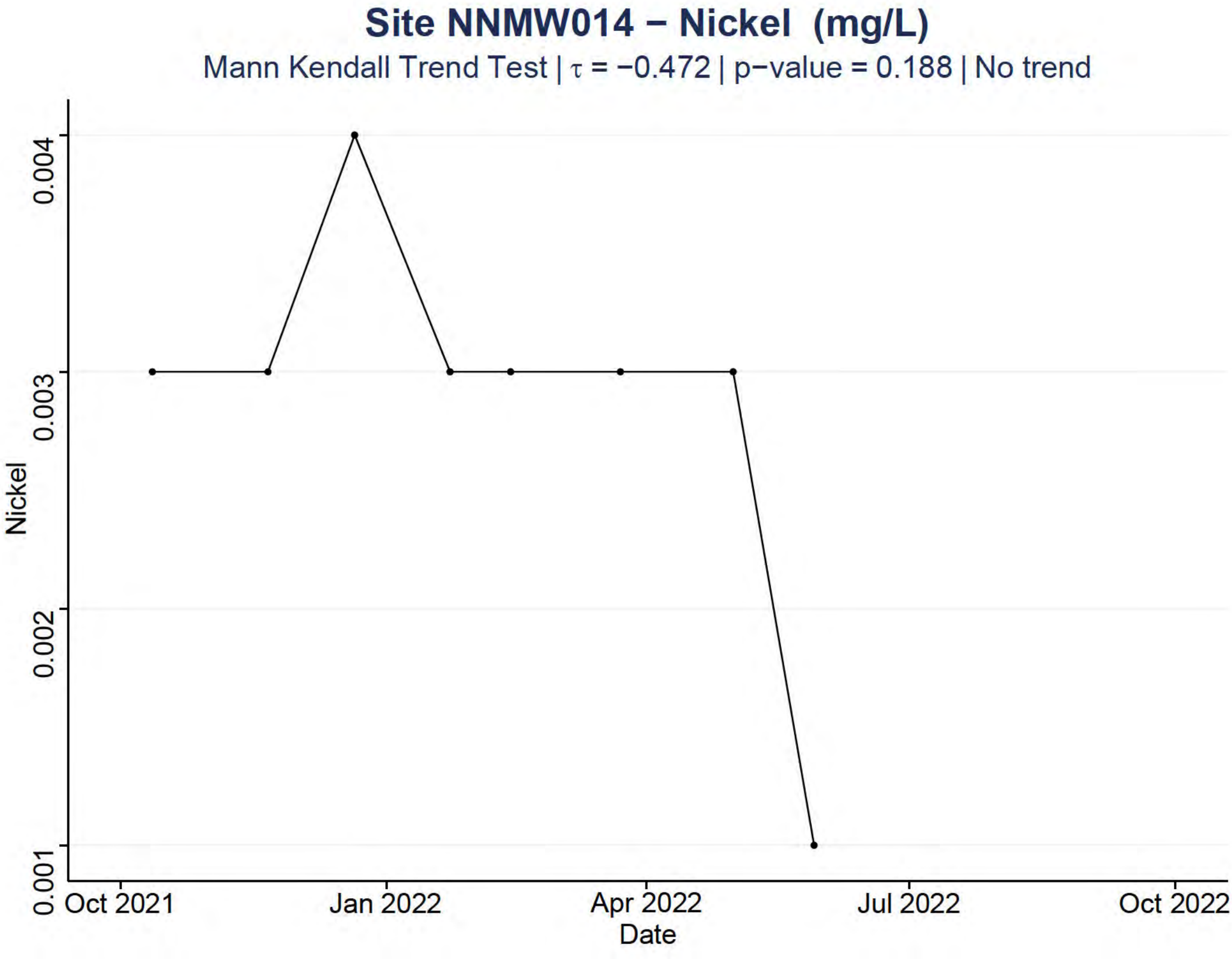

Site NNMW014 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.535 | p−value = 0.115 | No trend
Lead
0.001
0.002
0.003
0.004
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

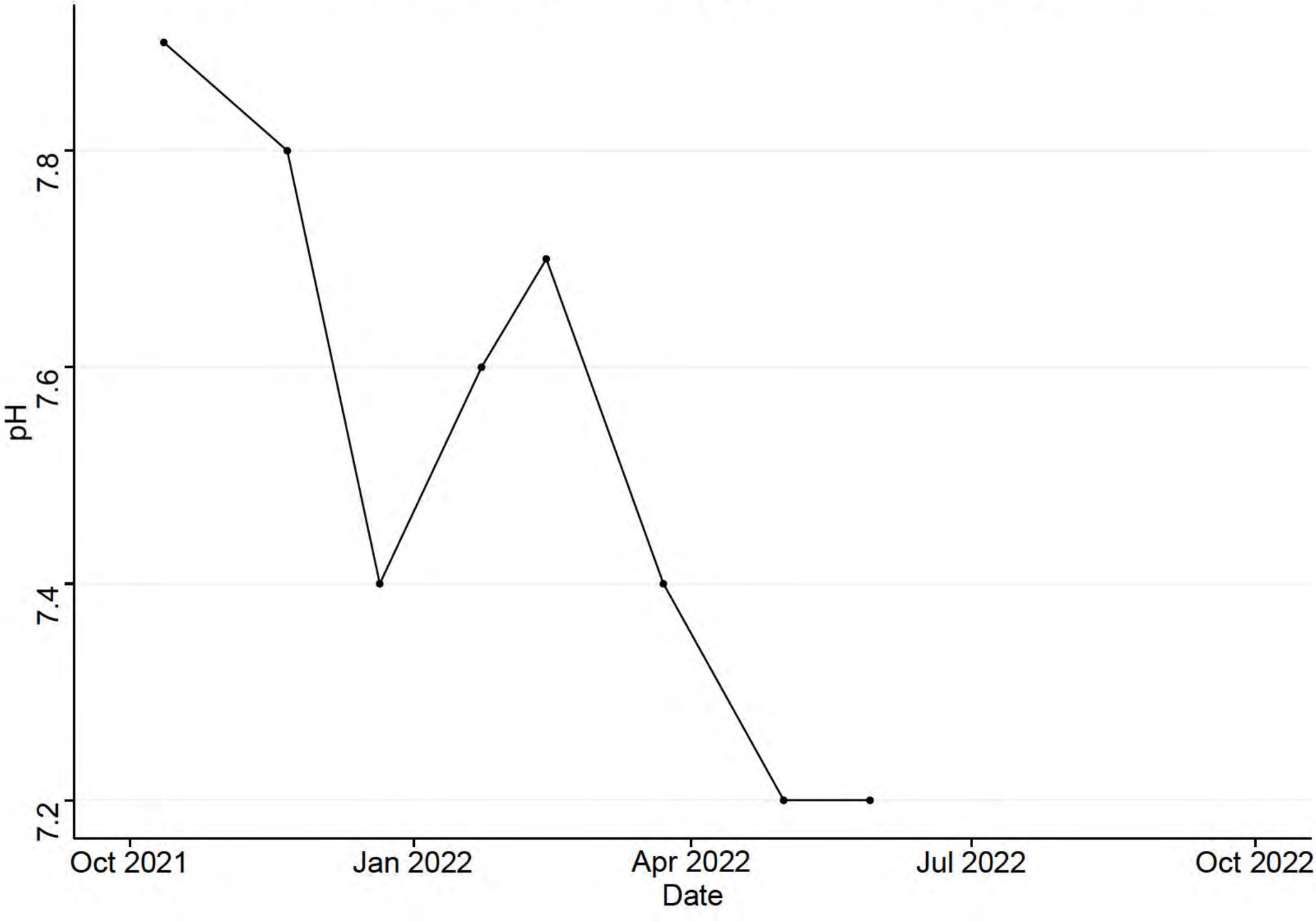

Site NNMW014 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.161 | p−value = 0.694 | No trend
Magnesium
230
220
210
200
190
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

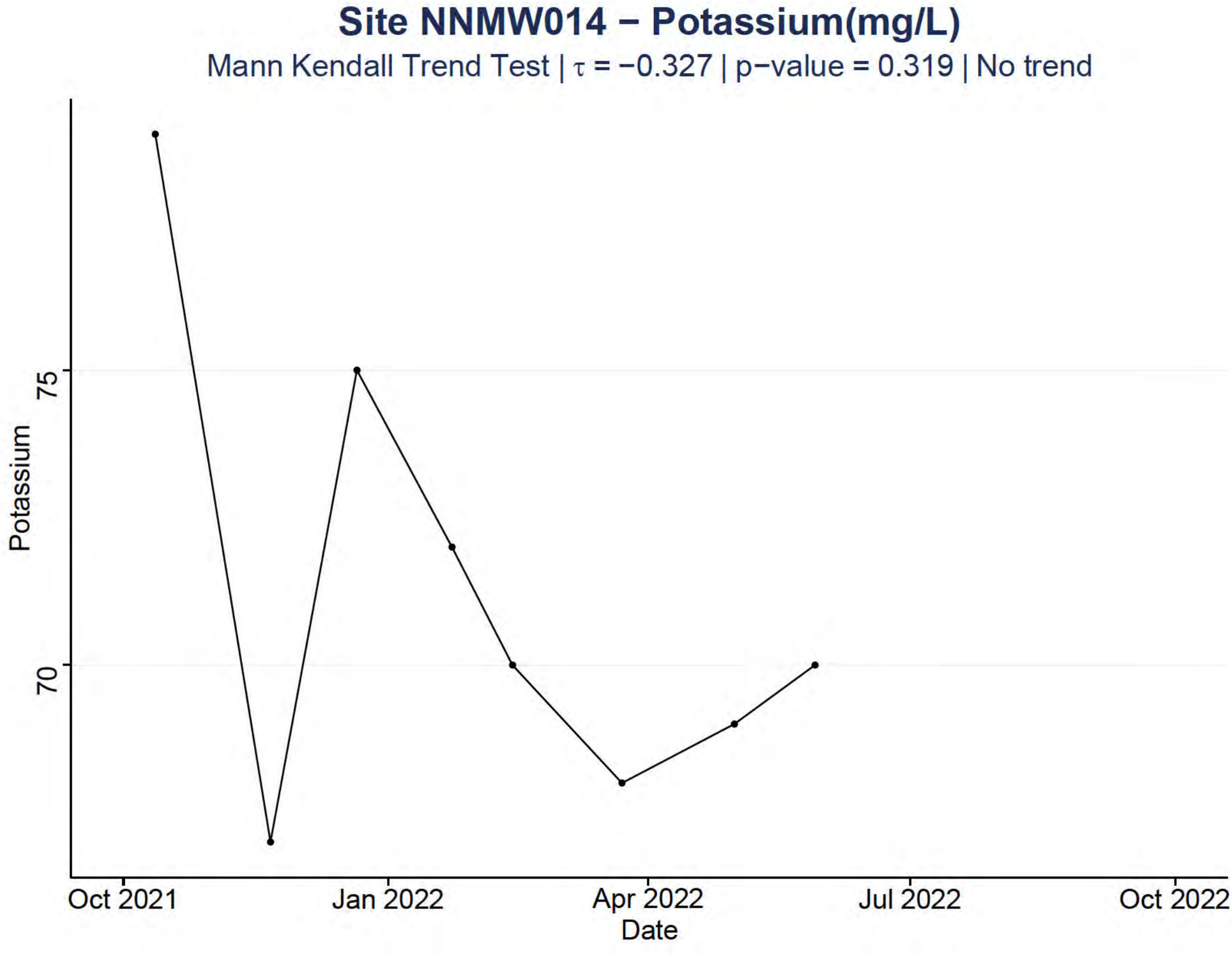

Site NNMW014 – Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.714 | p−value = 0.0187 | Negative trend
Manganese
0.25
0.20
0.15
0.10
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

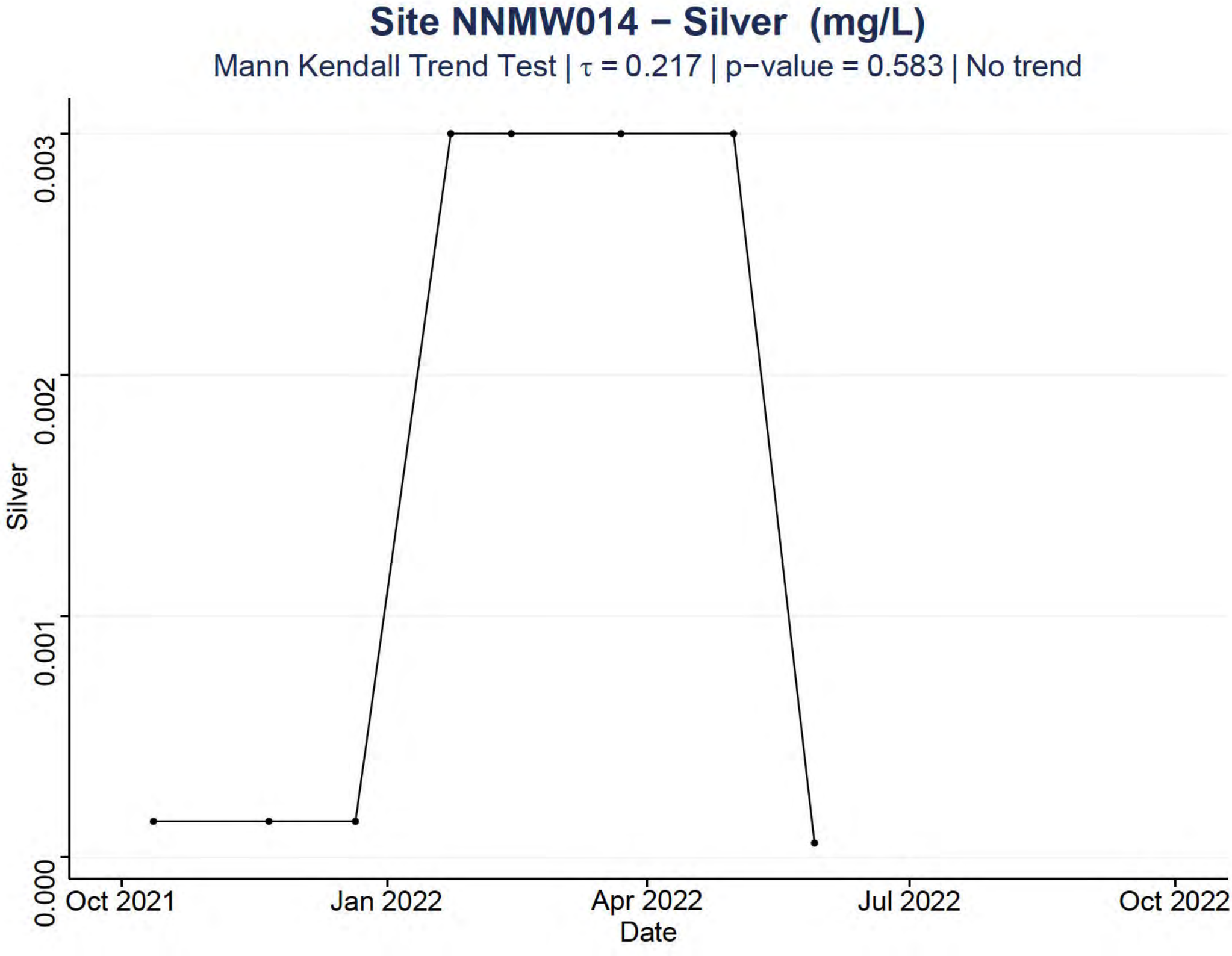

Site NNMW014 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

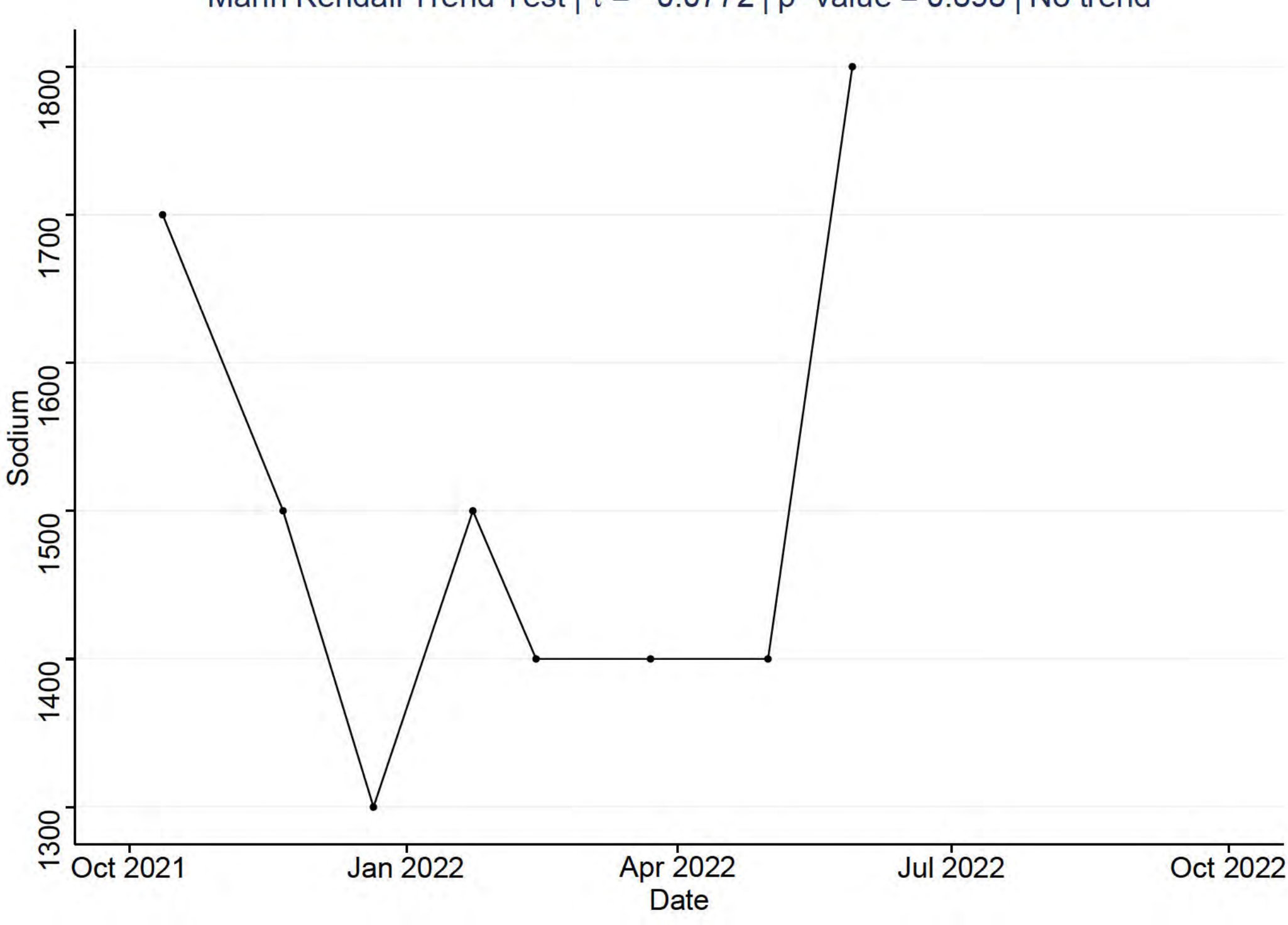

Site NNMW014 − Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Molybdenum
0.00300
0.00275
0.00250
0.00225
0.00200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

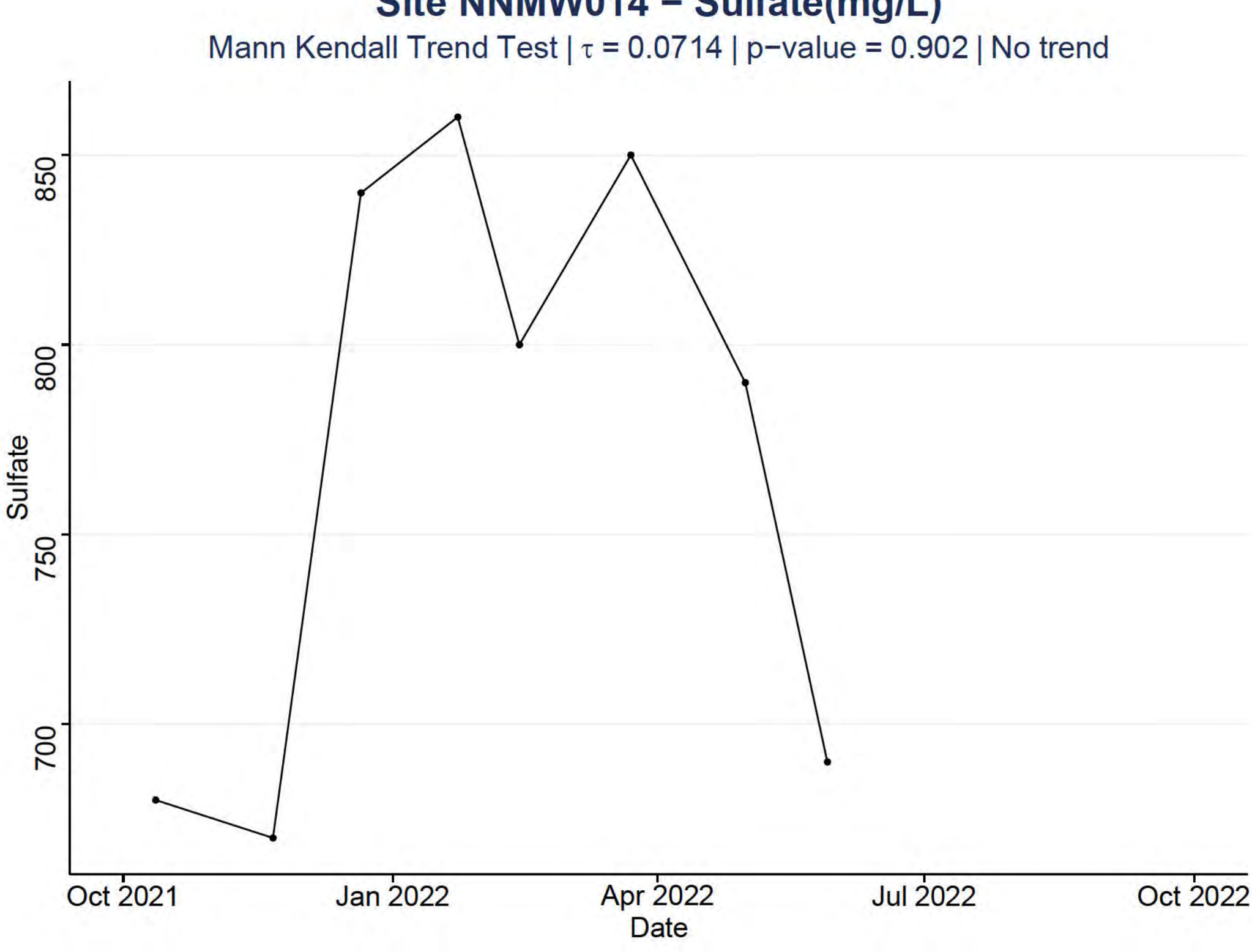

Site NNMW014 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.472 | p−value = 0.188 | No trend
Nickel
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

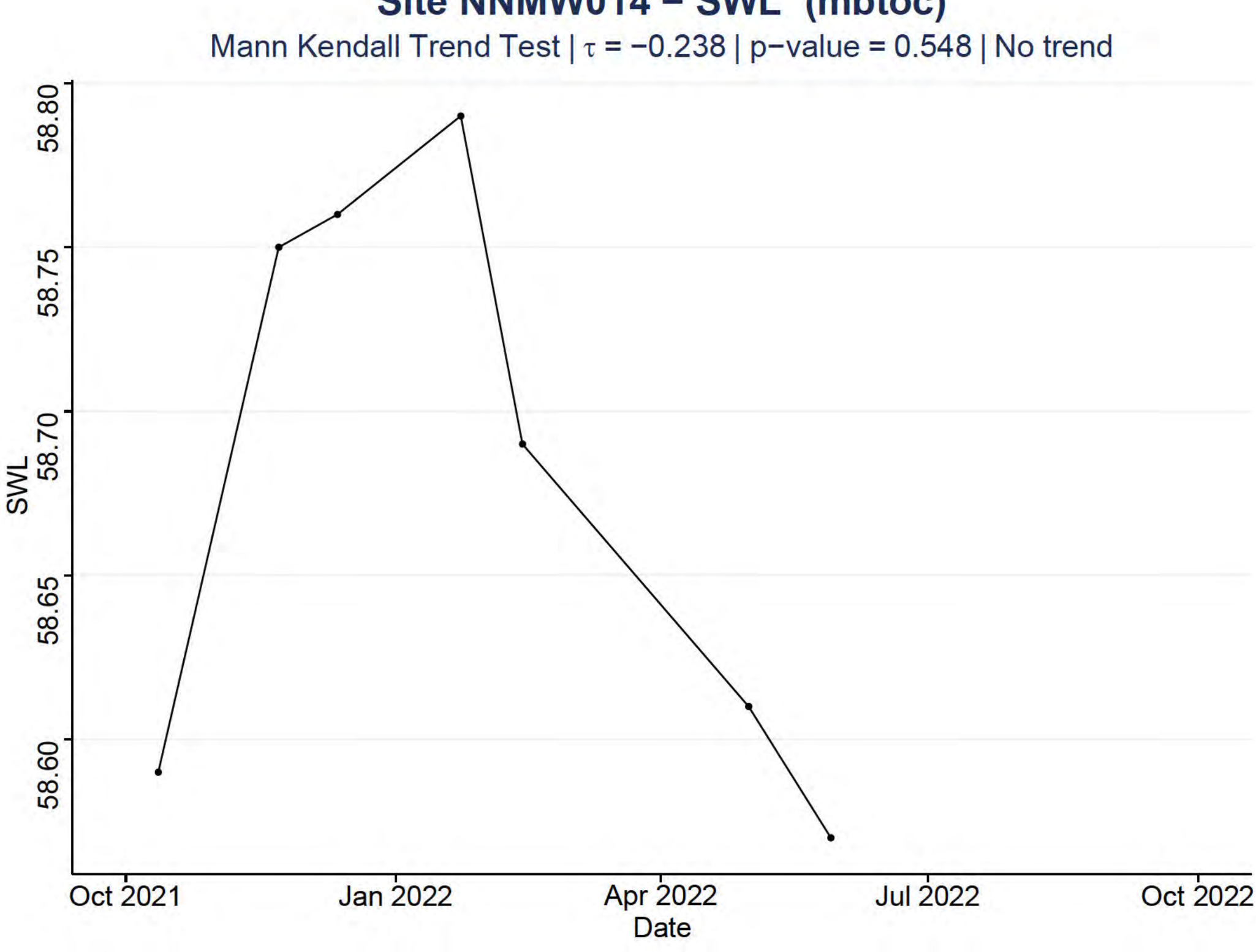

Site NNMW014 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.741 | p−value = 0.017 | Negative trend
pH
7.8
7.6
7.4
7.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

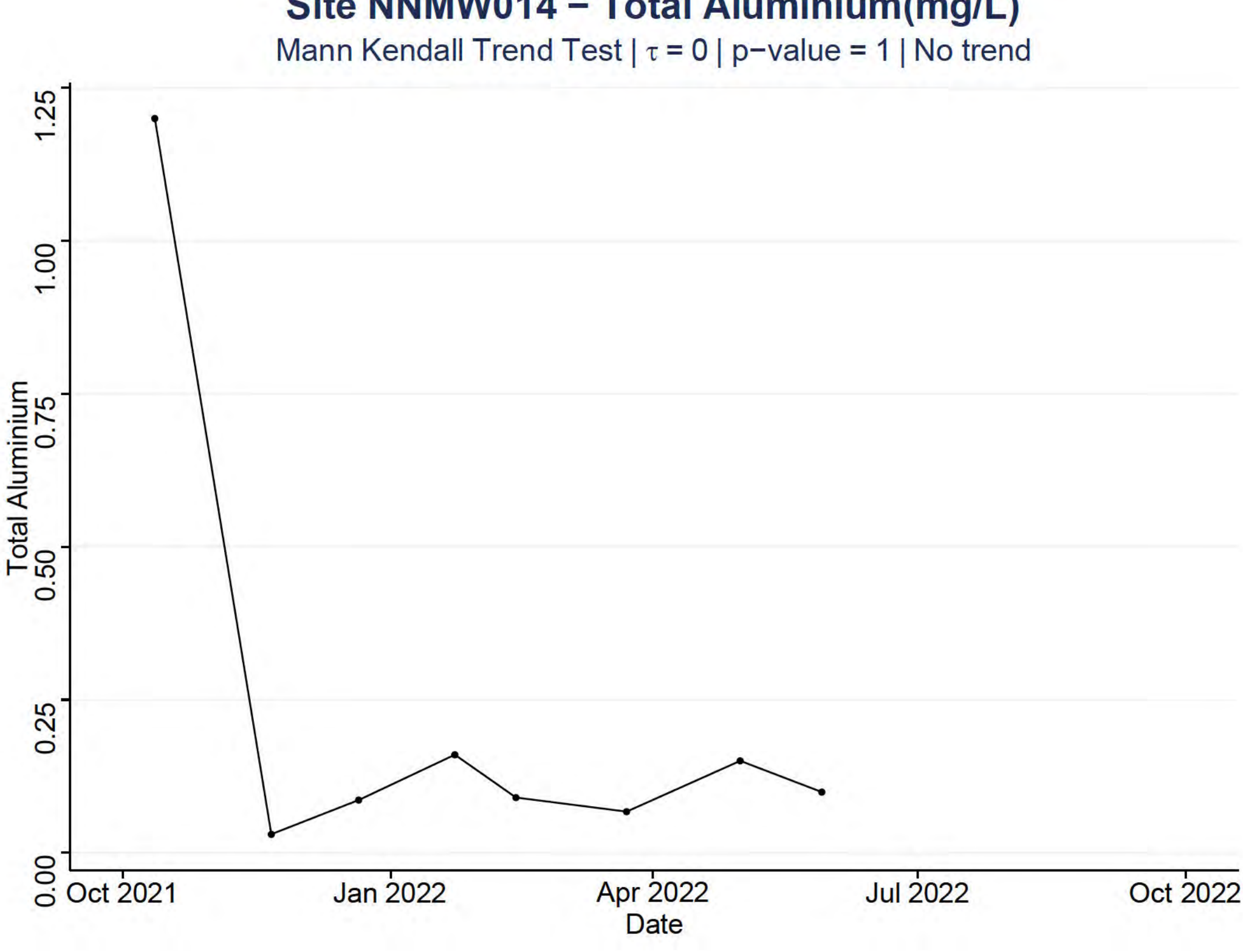

Site NNMW014 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.327 | p−value = 0.319 | No trend
Potassium
75
70
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

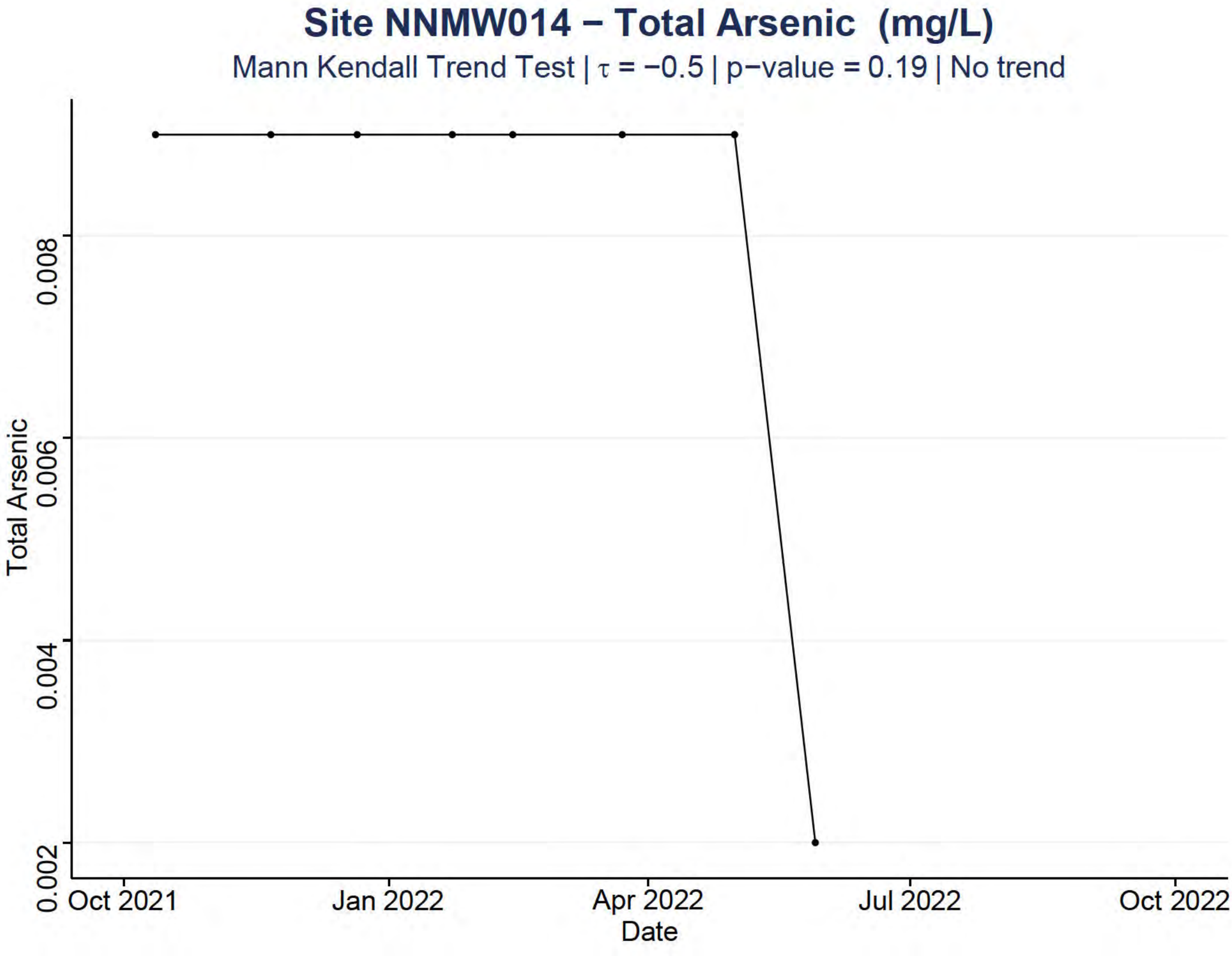

Site NNMW014 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

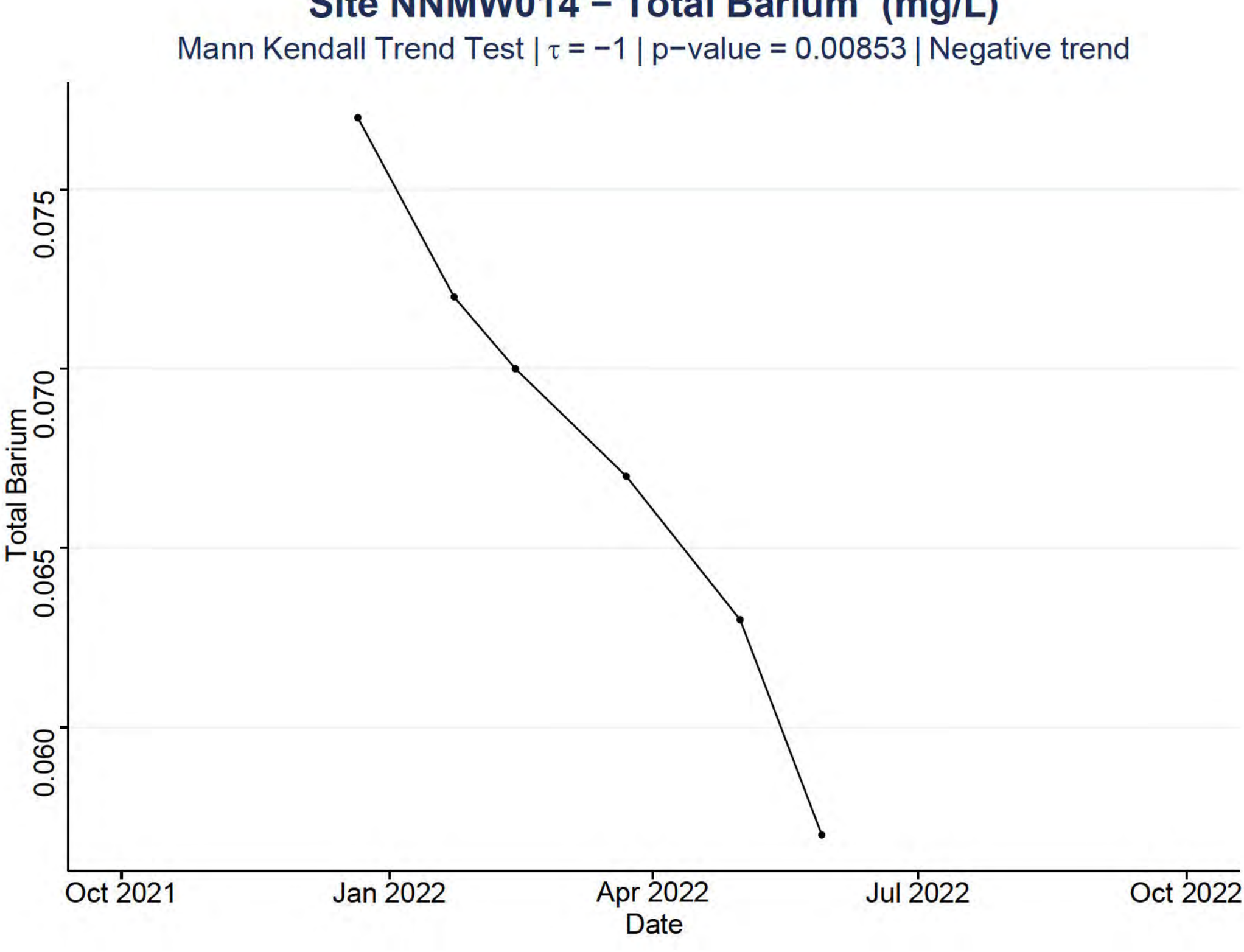

Site NNMW014 – Sodium(mg/L)
Mann Kendall Trend Test | τ = −0.0772 | p−value = 0.898 | No trend
Sodium
1300
1400
1500
1600
1700
1800
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

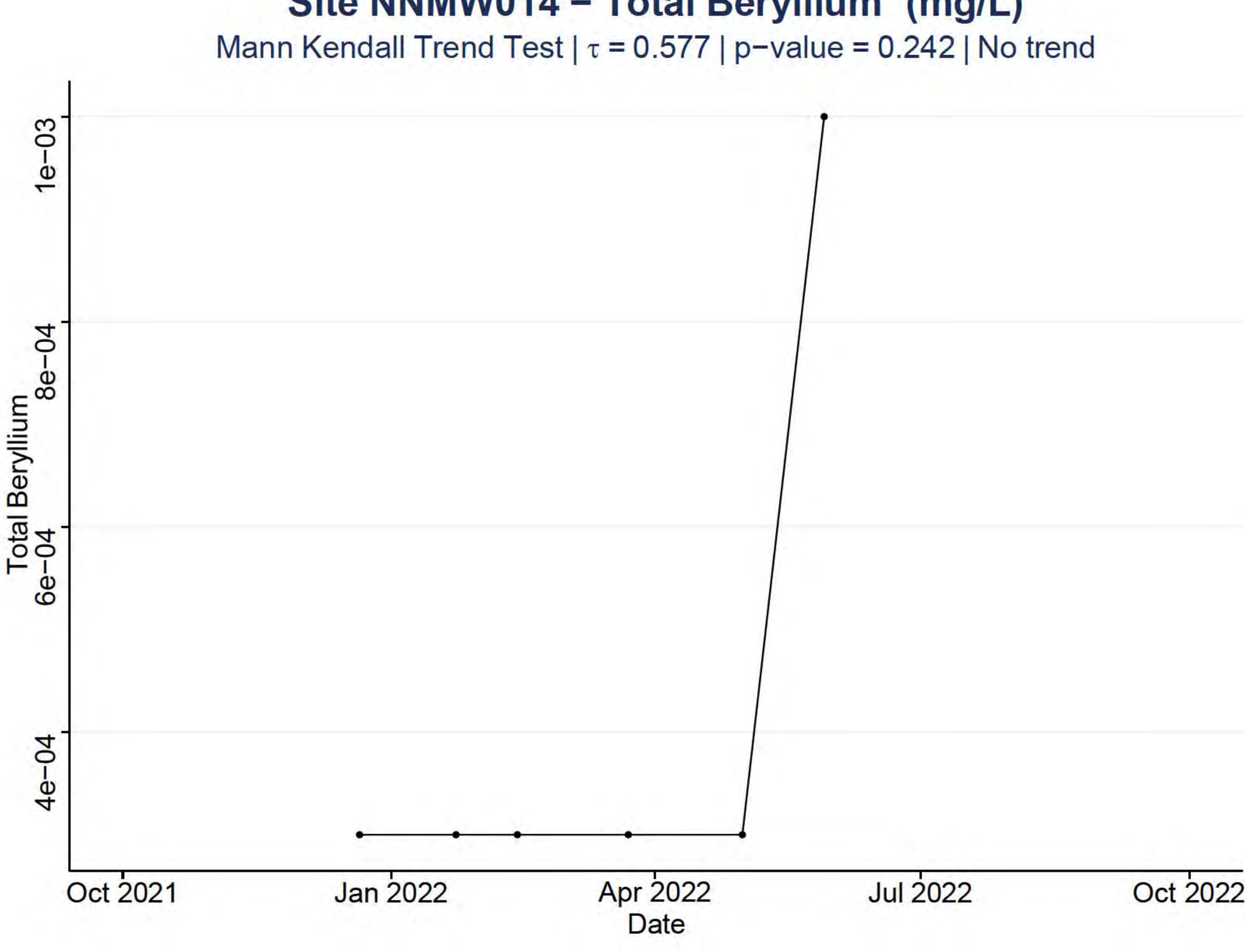

Site NNMW014 – Sulfate(mg/L)
Mann Kendall Trend Test | τ = 0.0714 | p−value = 0.902 | No trend
Sulfate
850
800
750
700
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

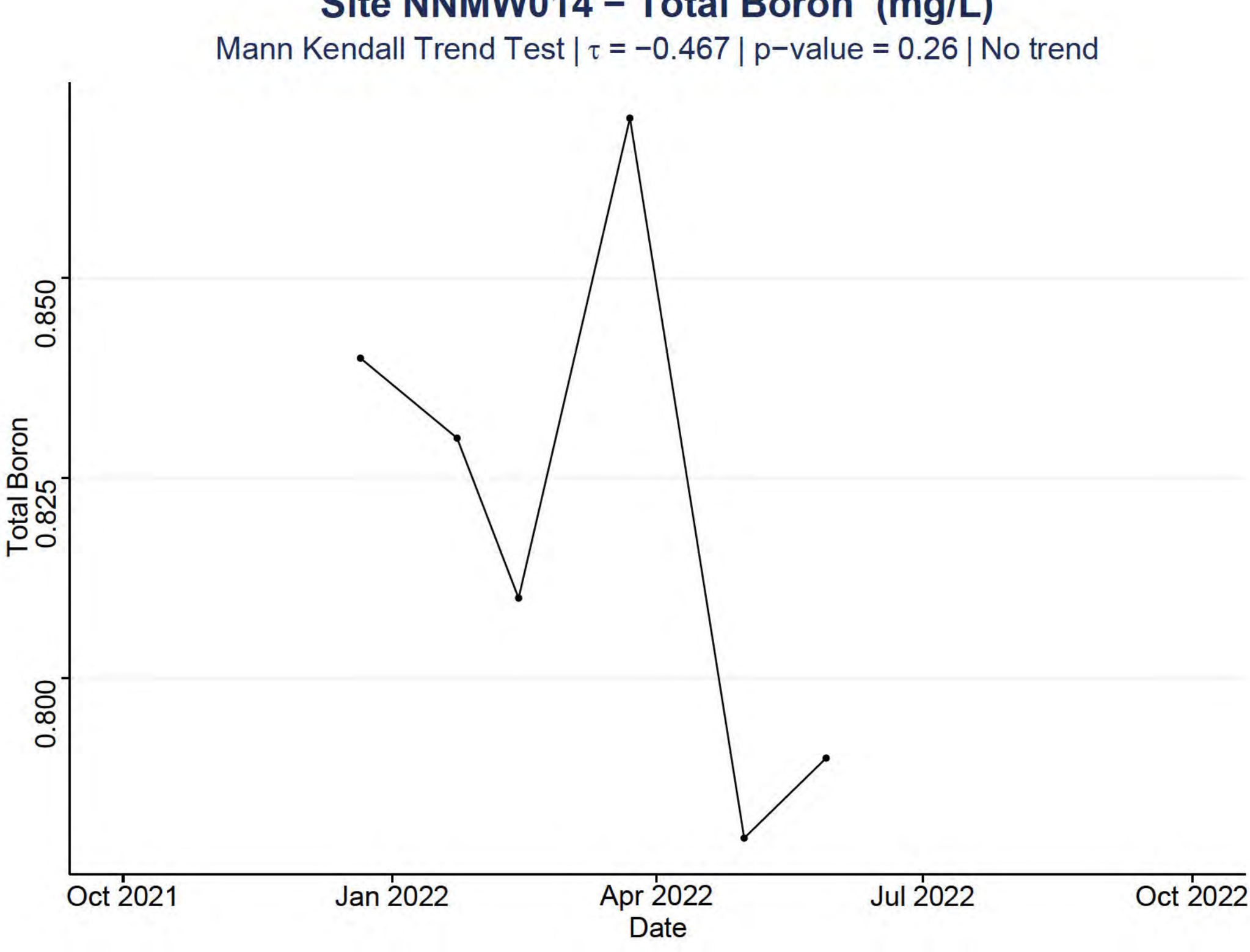

Site NNMW014 – SWL (mbtoc)
Mann Kendall Trend Test | τ = −0.238 | p−value = 0.548 | No trend
SWL
58.80
58.75
58.70
58.65
58.60
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

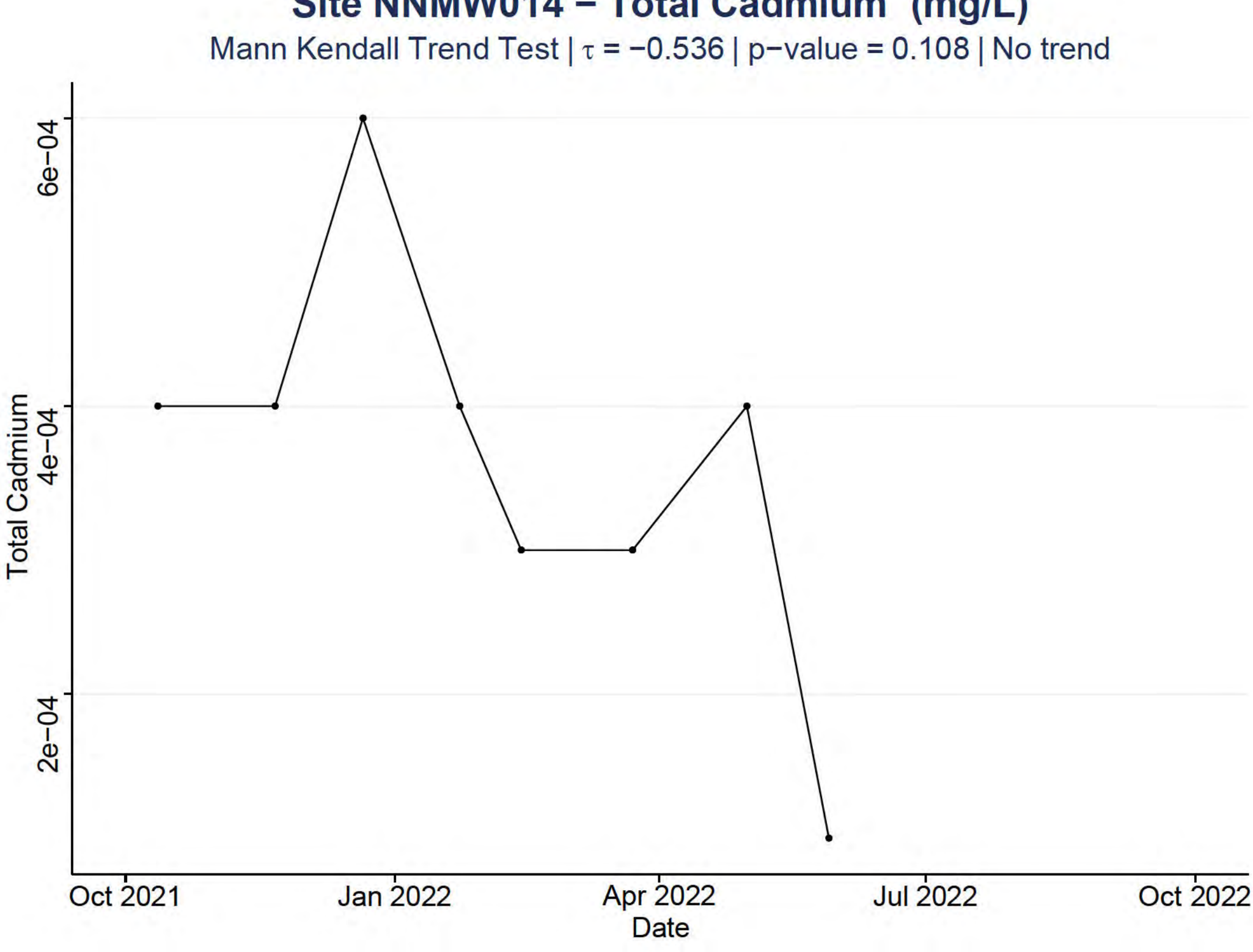

Site NNMW014 – Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Total Aluminium
0.00
0.25
0.50
0.75
1.00
1.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

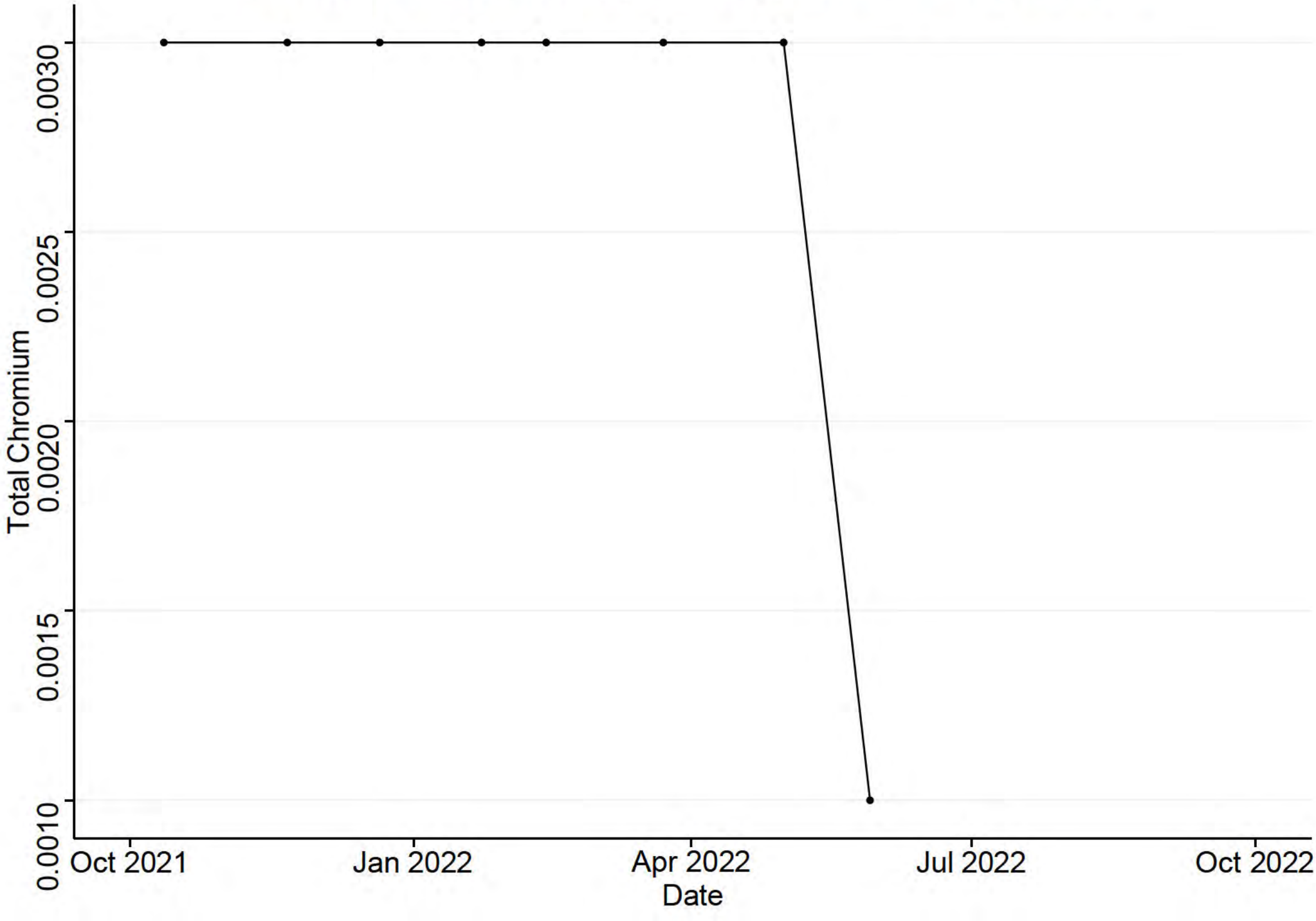

Site NNMW014 – Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Arsenic
0.002
0.004
0.006
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

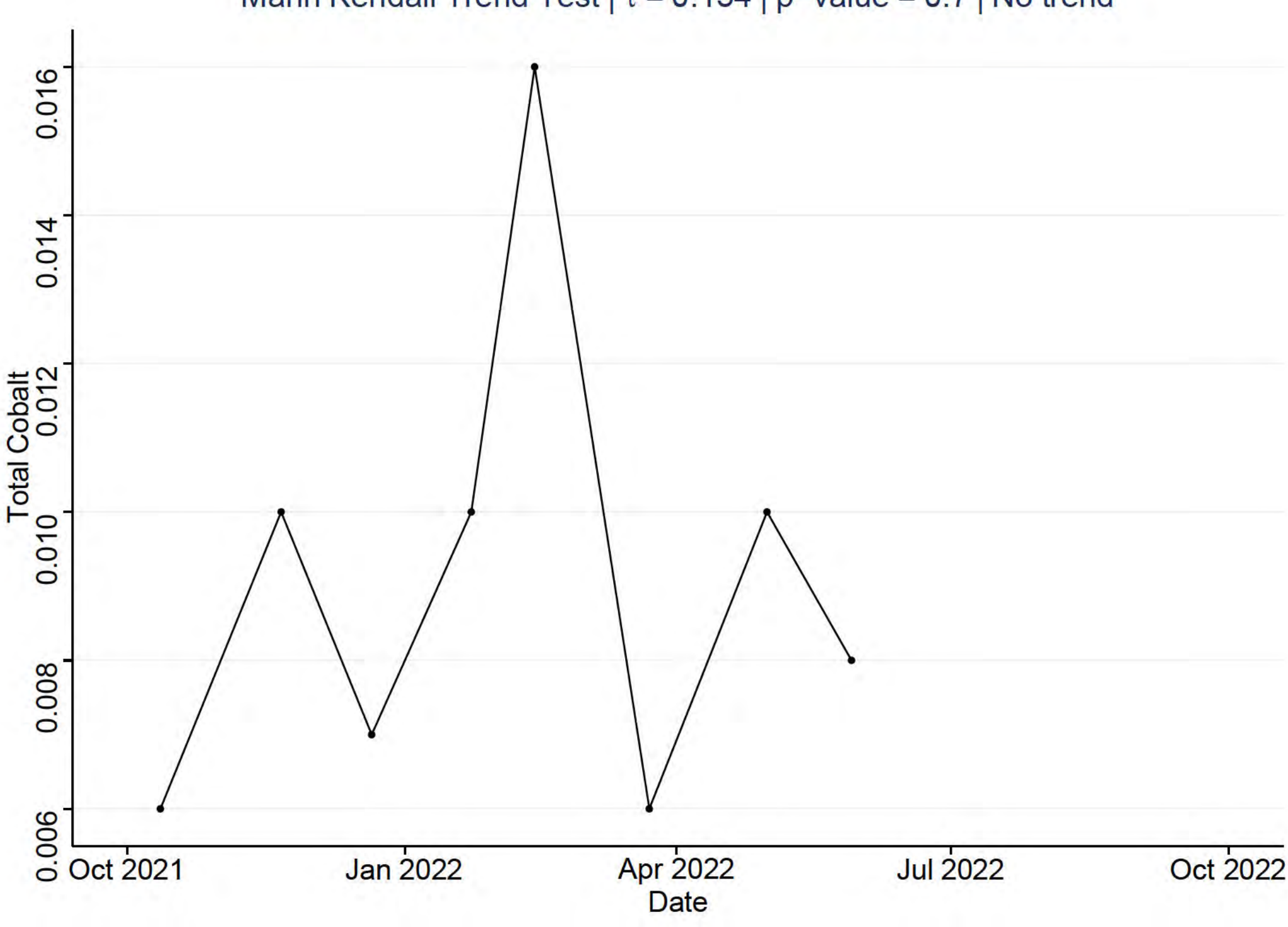

Site NNMW014 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = −1 | p−value = 0.00853 | Negative trend
Total Barium
0.075
0.070
0.065
0.060
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

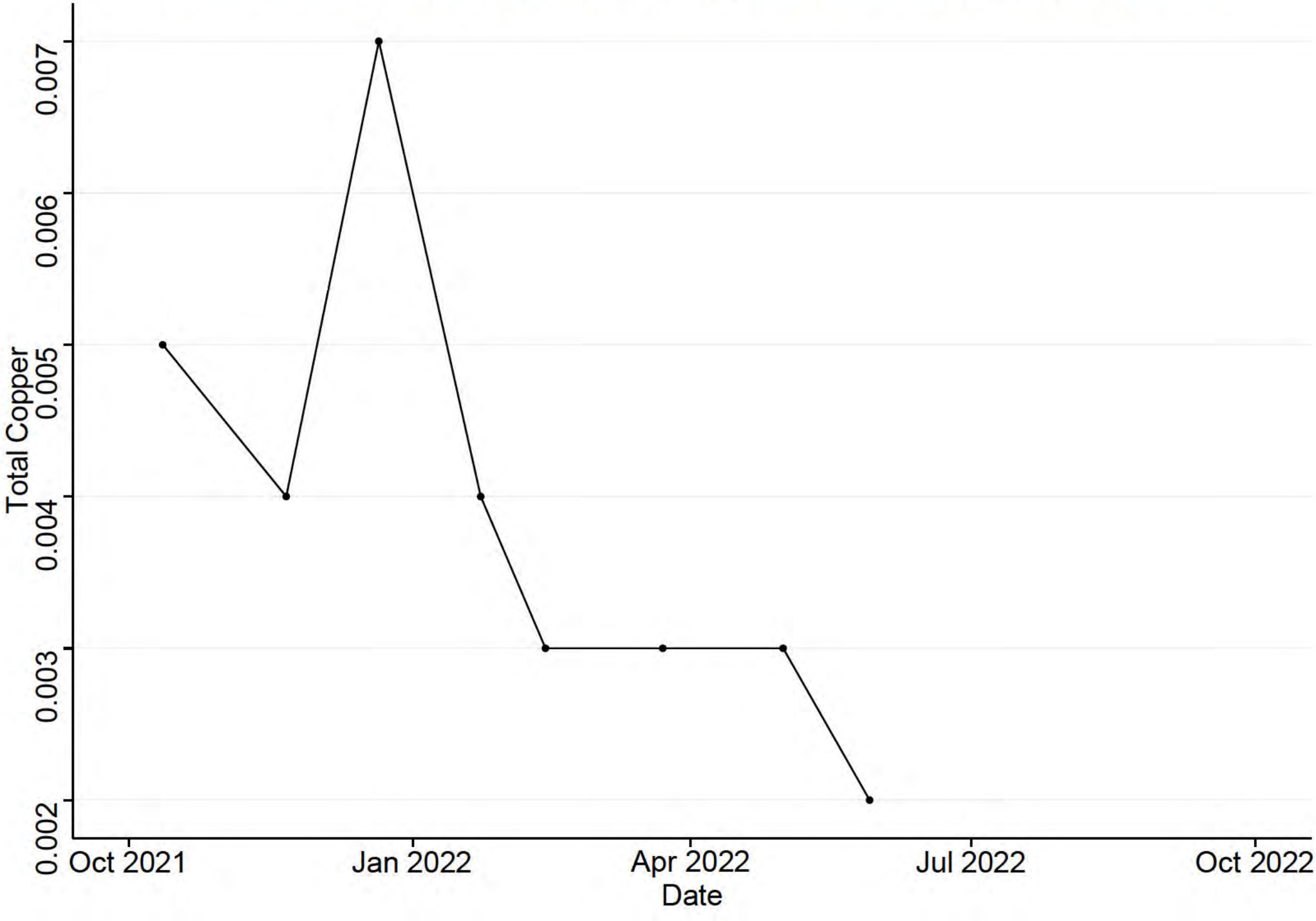

Site NNMW014 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Total Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

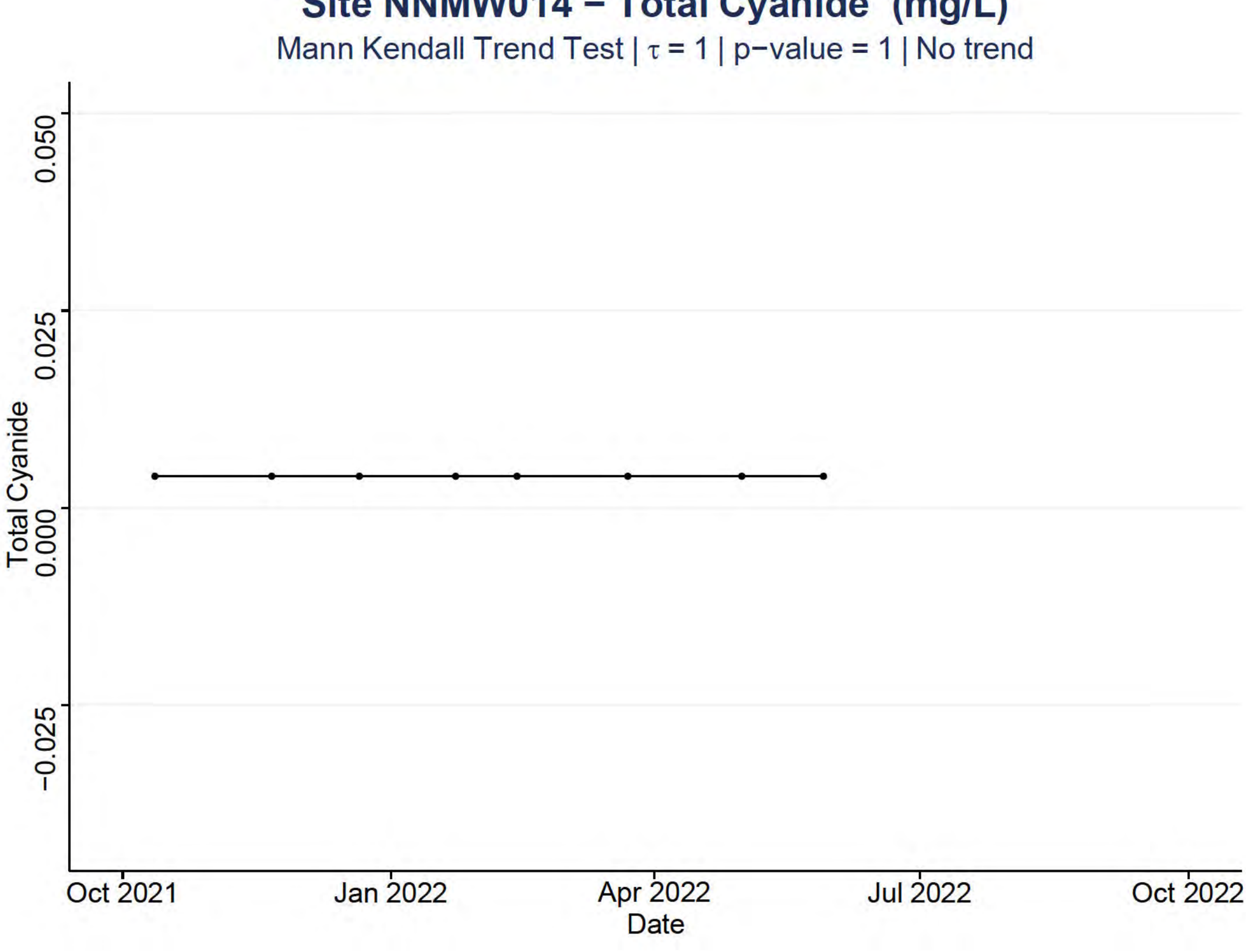

Site NNMW014 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = −0.467 | p−value = 0.26 | No trend
Total Boron
0.850
0.825
0.800
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

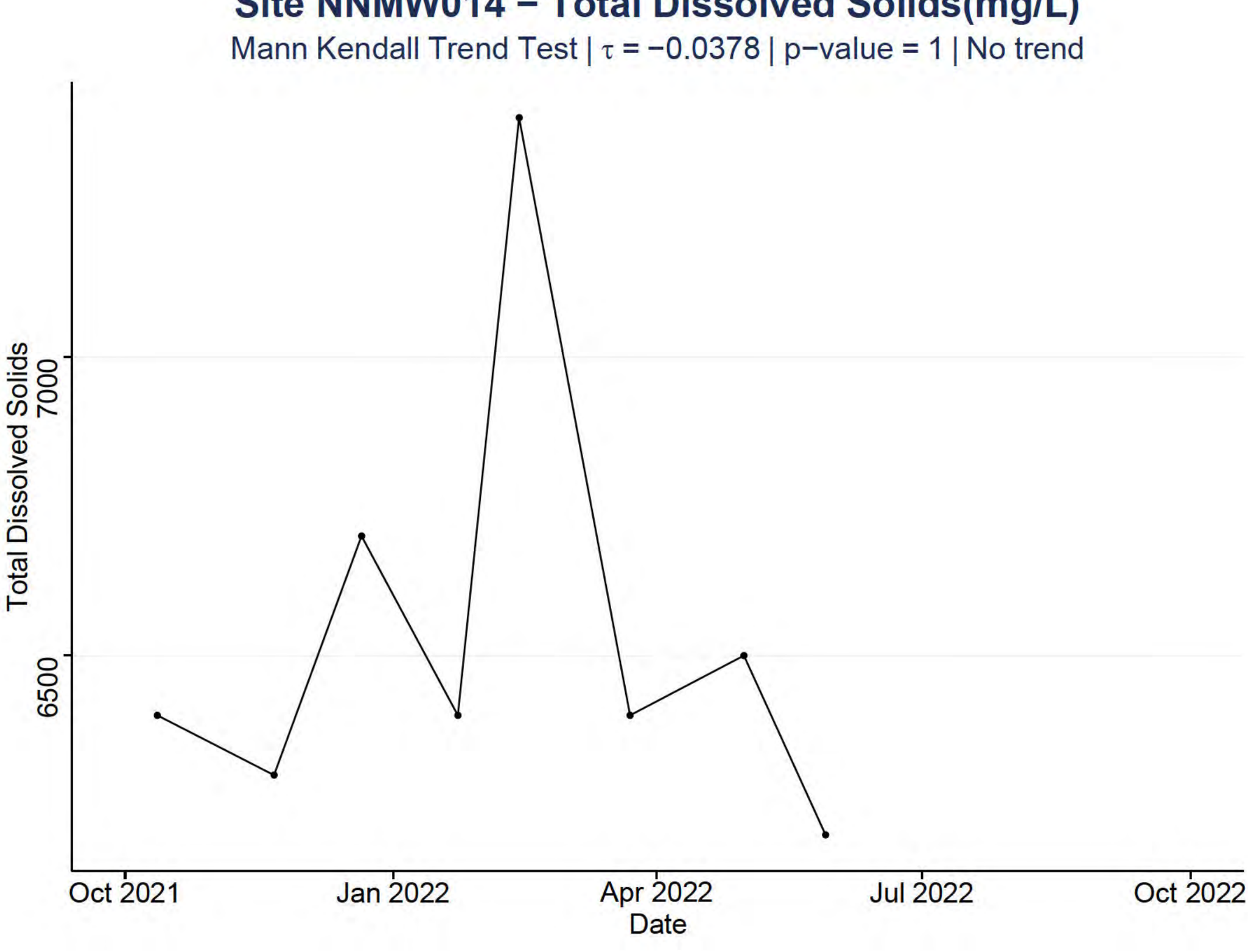

Site NNMW014 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.536 | p−value = 0.108 | No trend
Total Cadmium
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

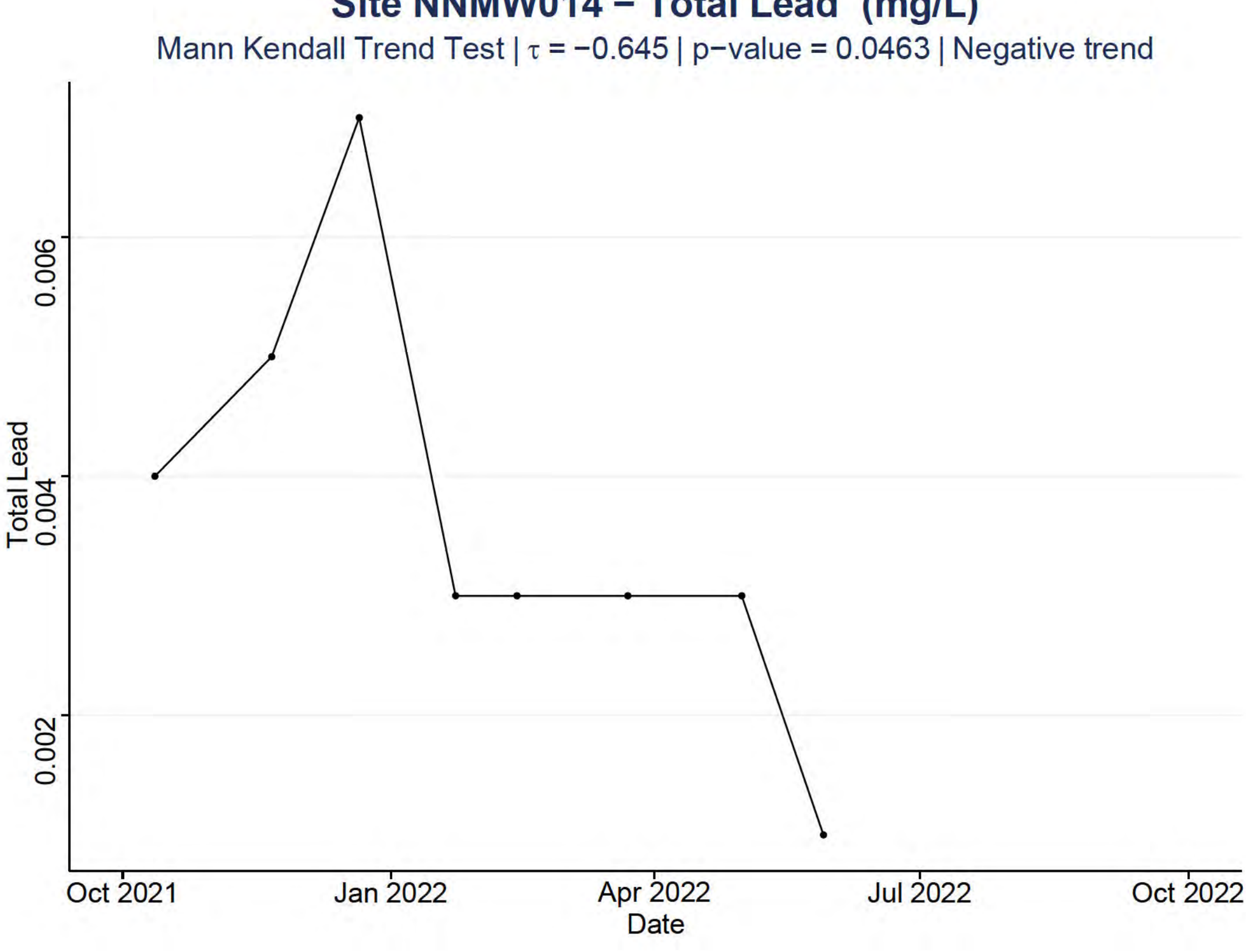

Site NNMW014 – Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

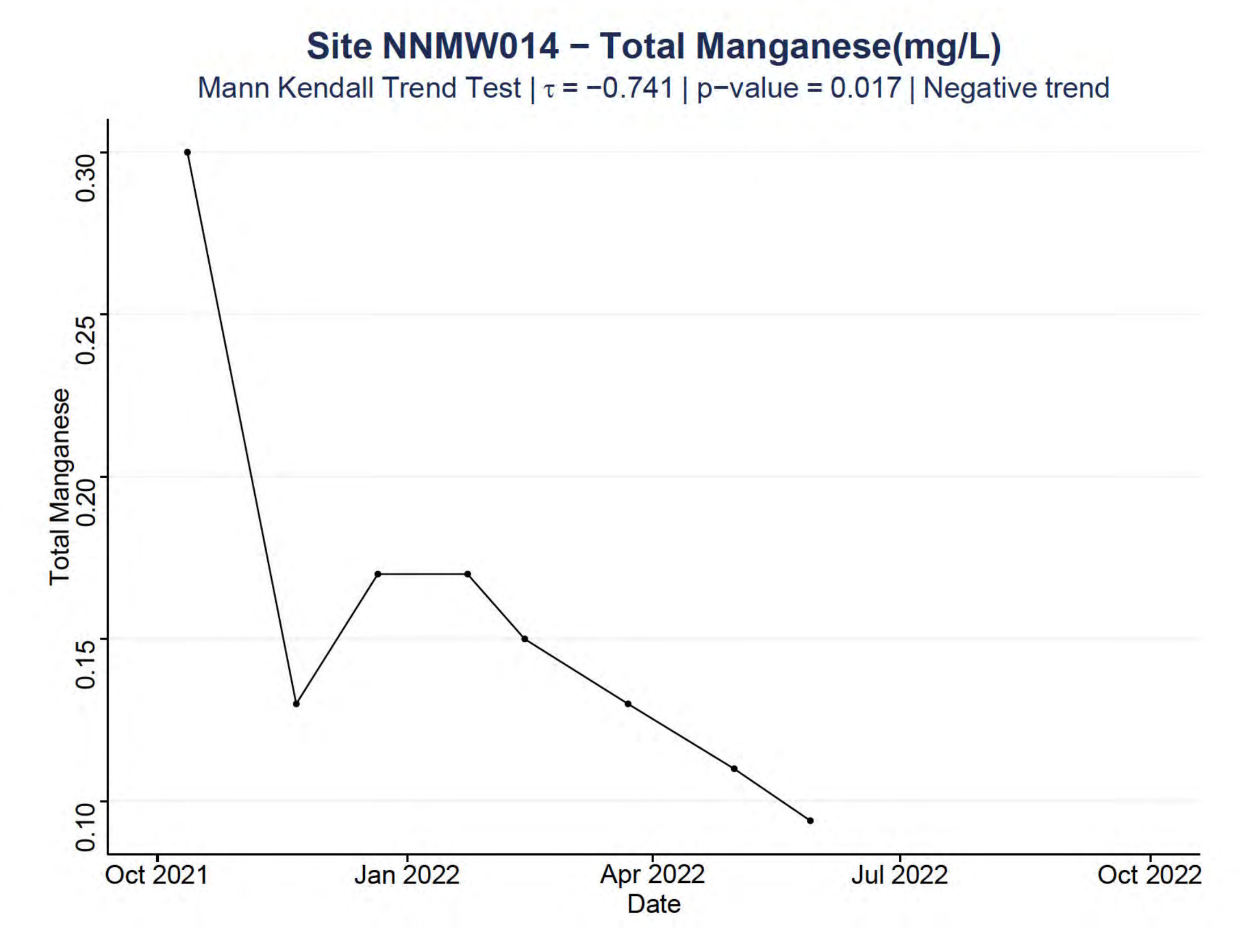

Site NNMW014 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = 0.154 | p−value = 0.7 | No trend
Total Cobalt
0.006
0.008
0.010
0.012
0.014
0.016
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

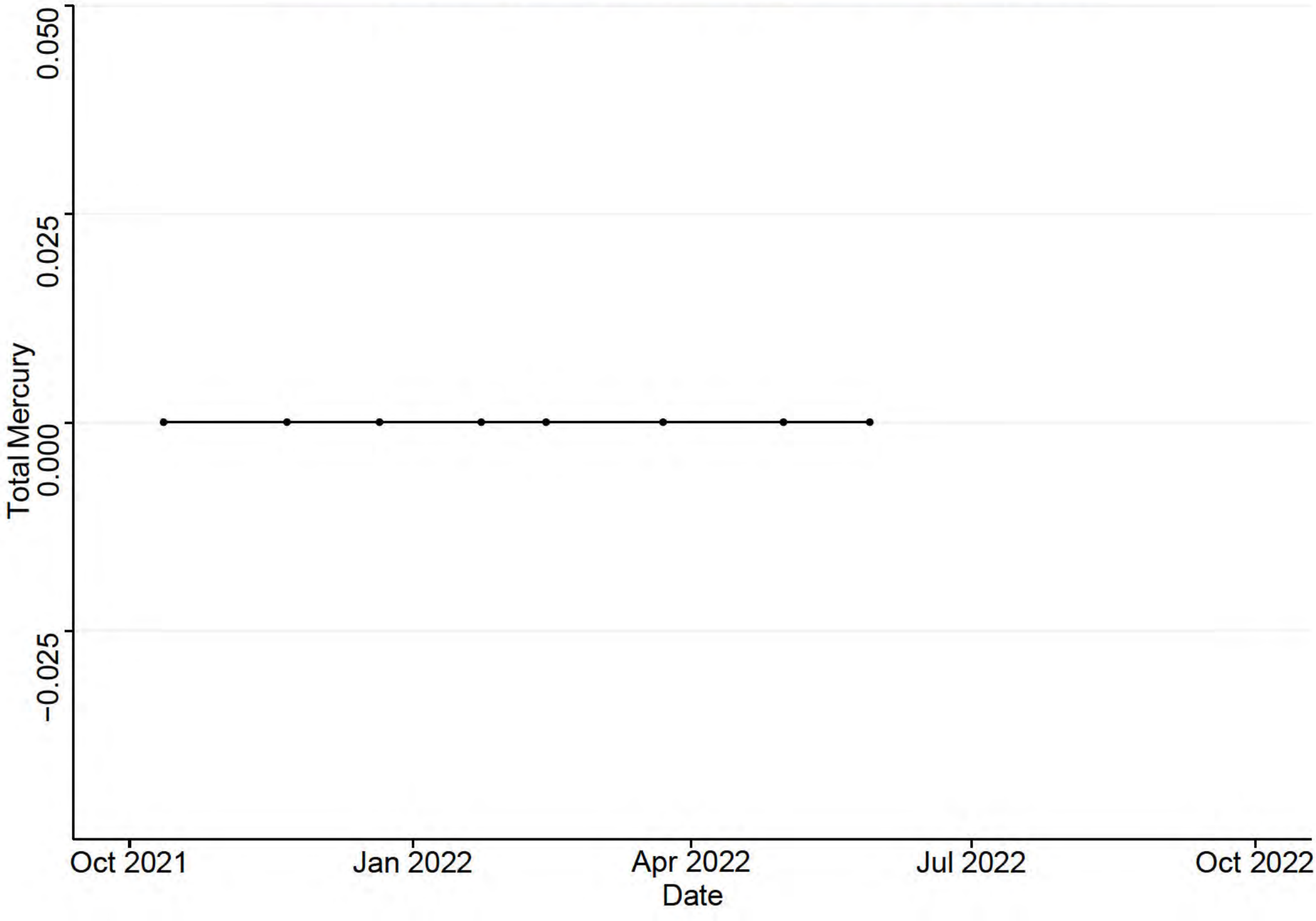

Site NNMW014 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.772 | p−value = 0.0147 | Negative trend
Total Copper
0.002
0.003
0.004
0.005
0.006
0.007
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

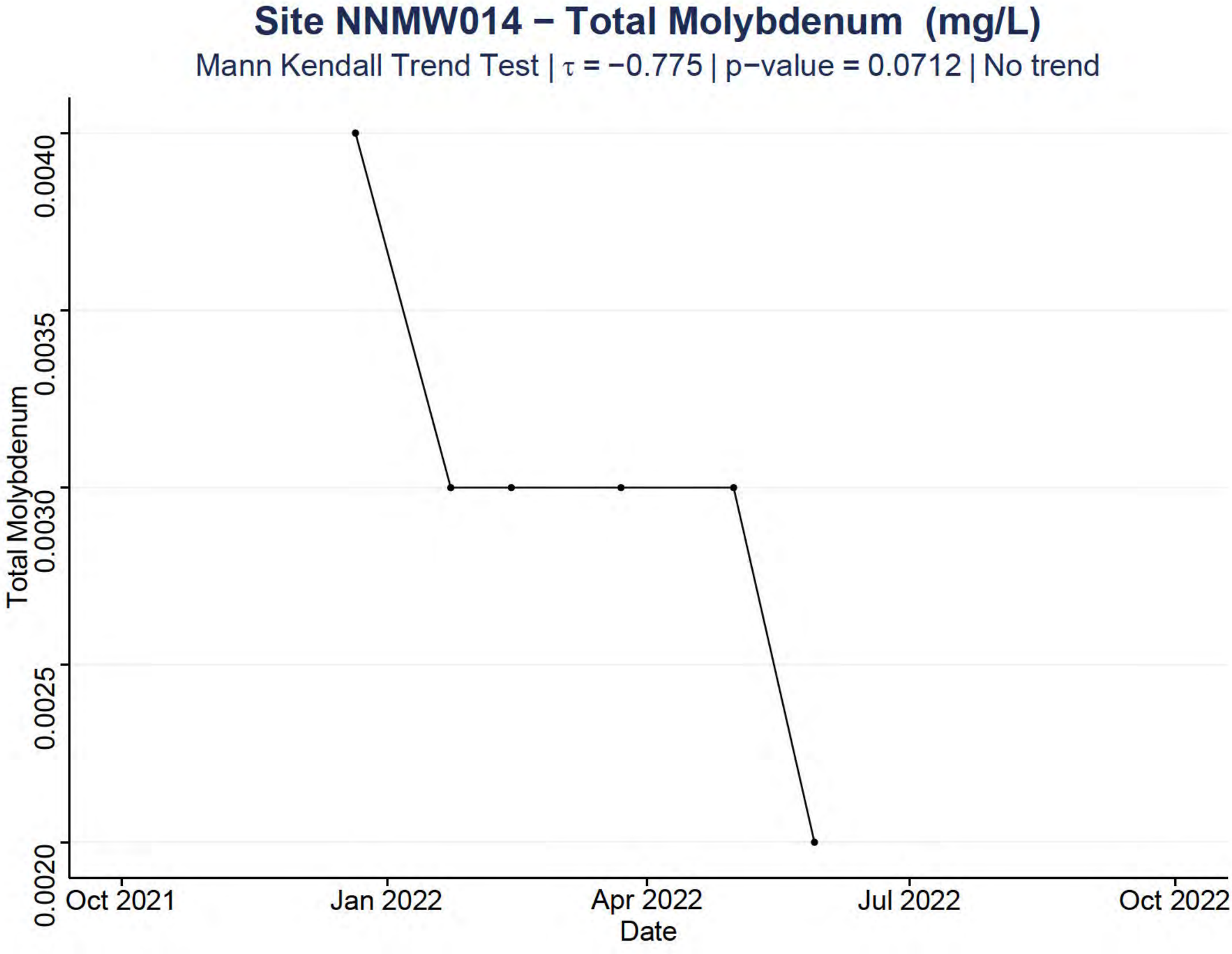

Site NNMW014 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

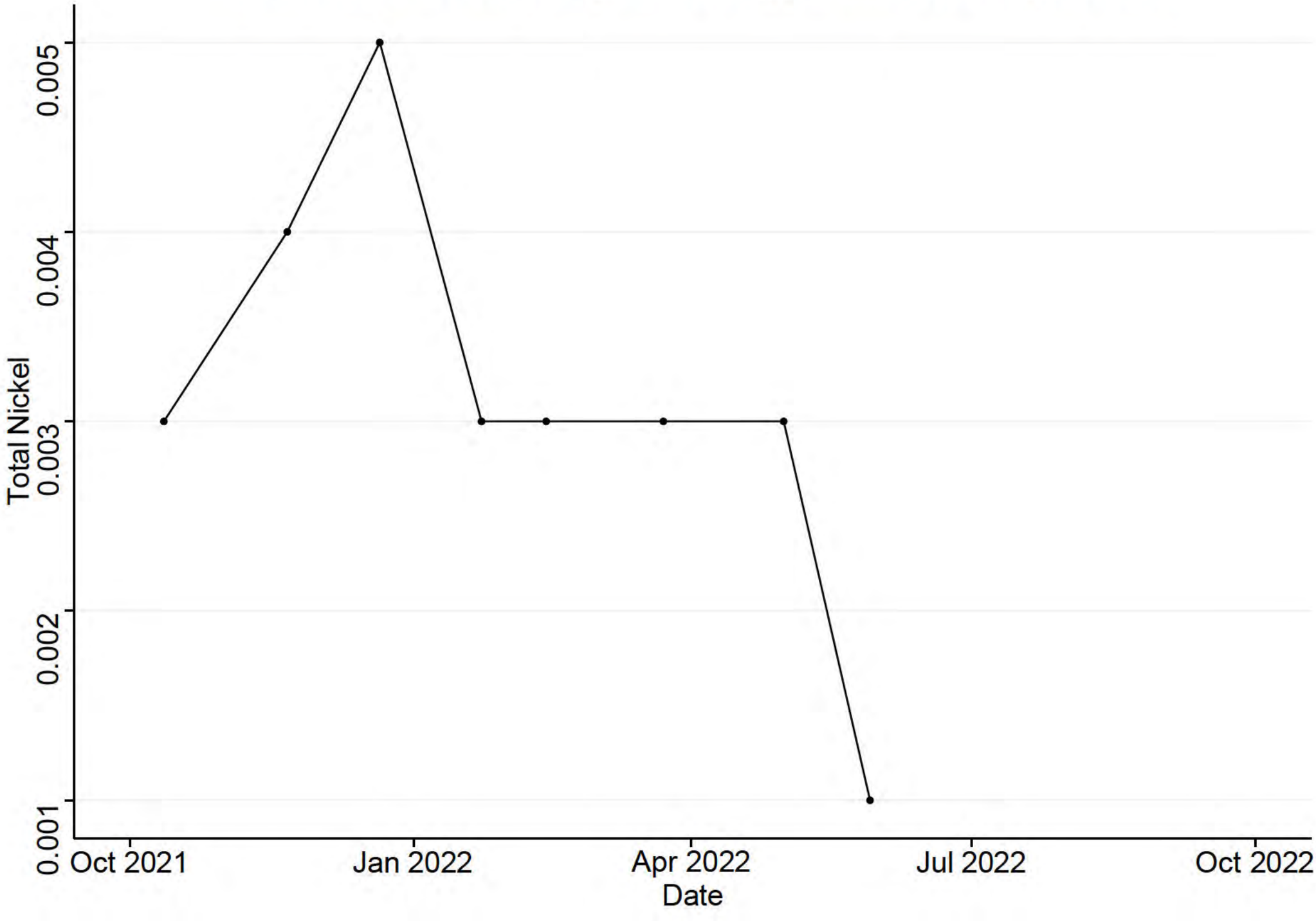

Site NNMW014 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.0378 | p−value = 1 | No trend
Total Dissolved Solids
7000
6500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

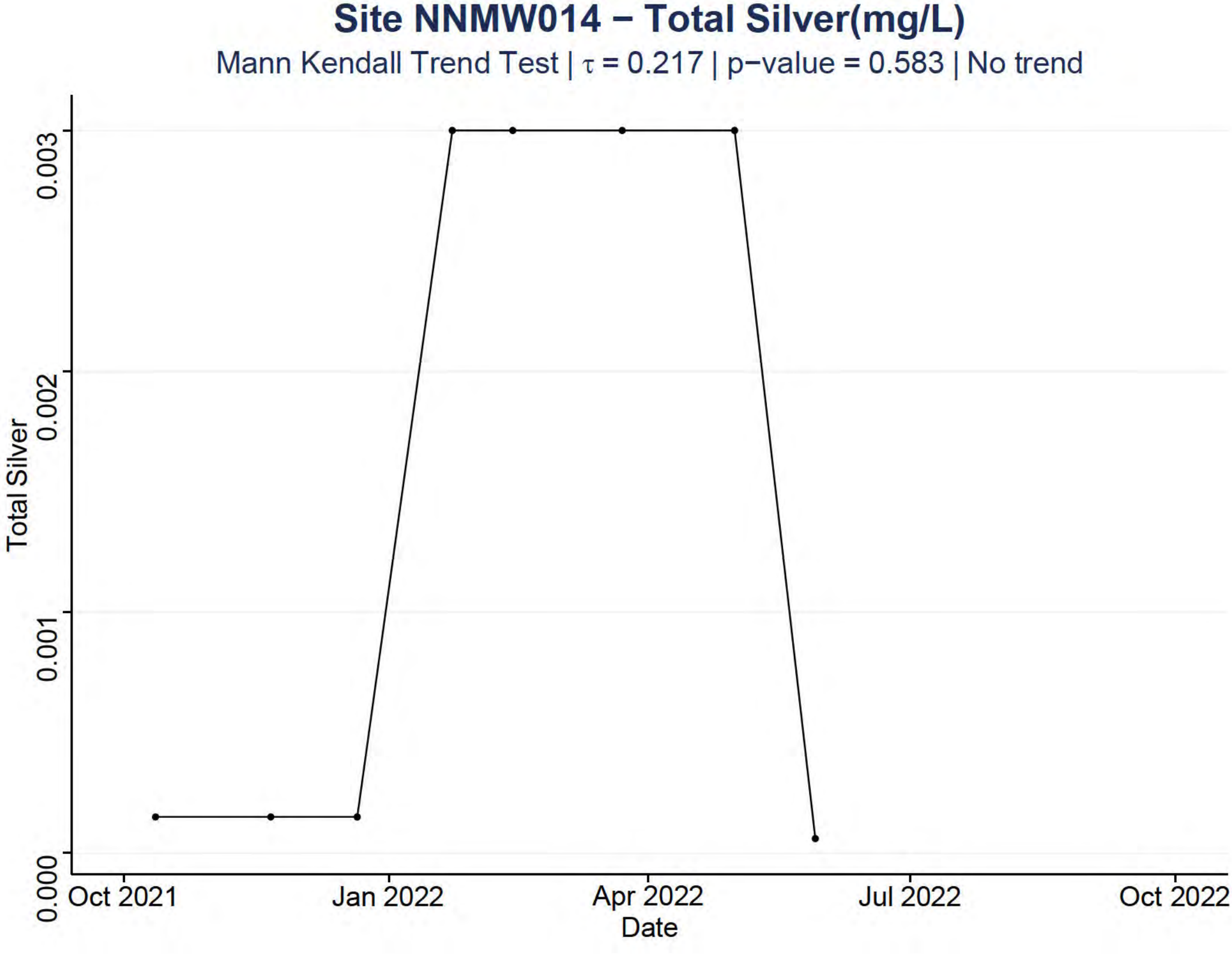

Site NNMW014 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.645 | p−value = 0.0463 | Negative trend
Total Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

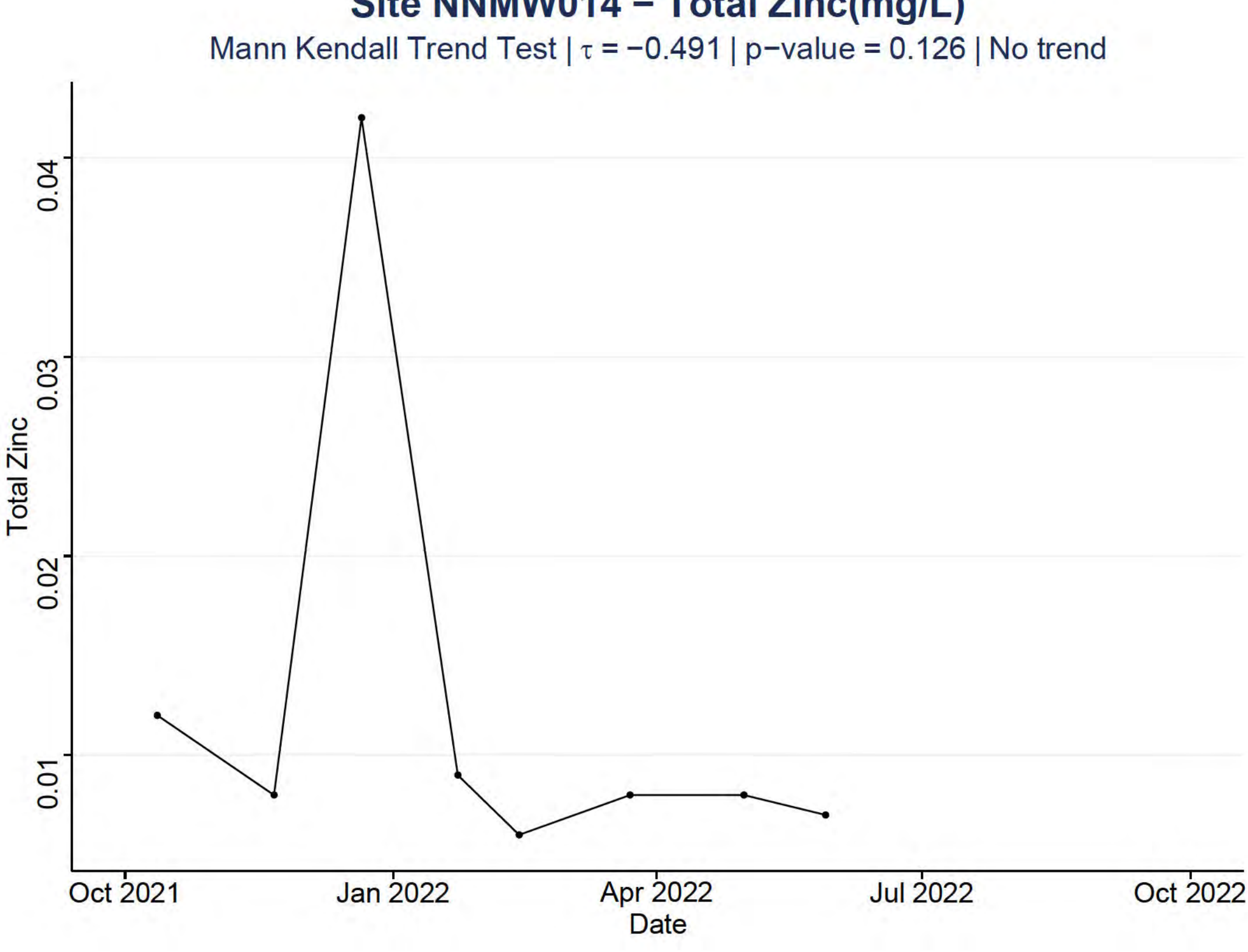

Site NNMW014 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.741 | p−value = 0.017 | Negative trend
Total Manganese
0.10
0.15
0.20
0.25
0.30
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

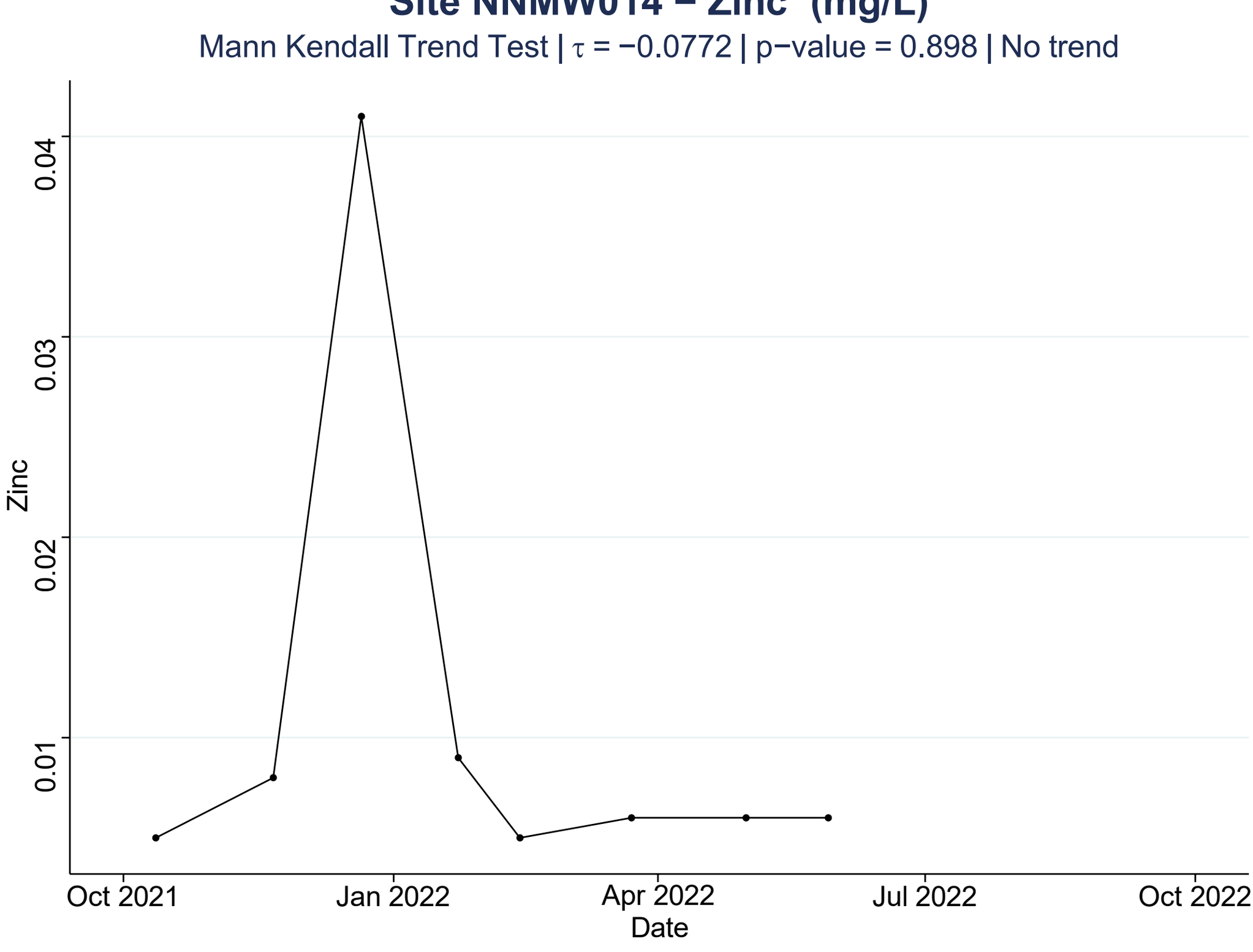

Site NNMW014 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

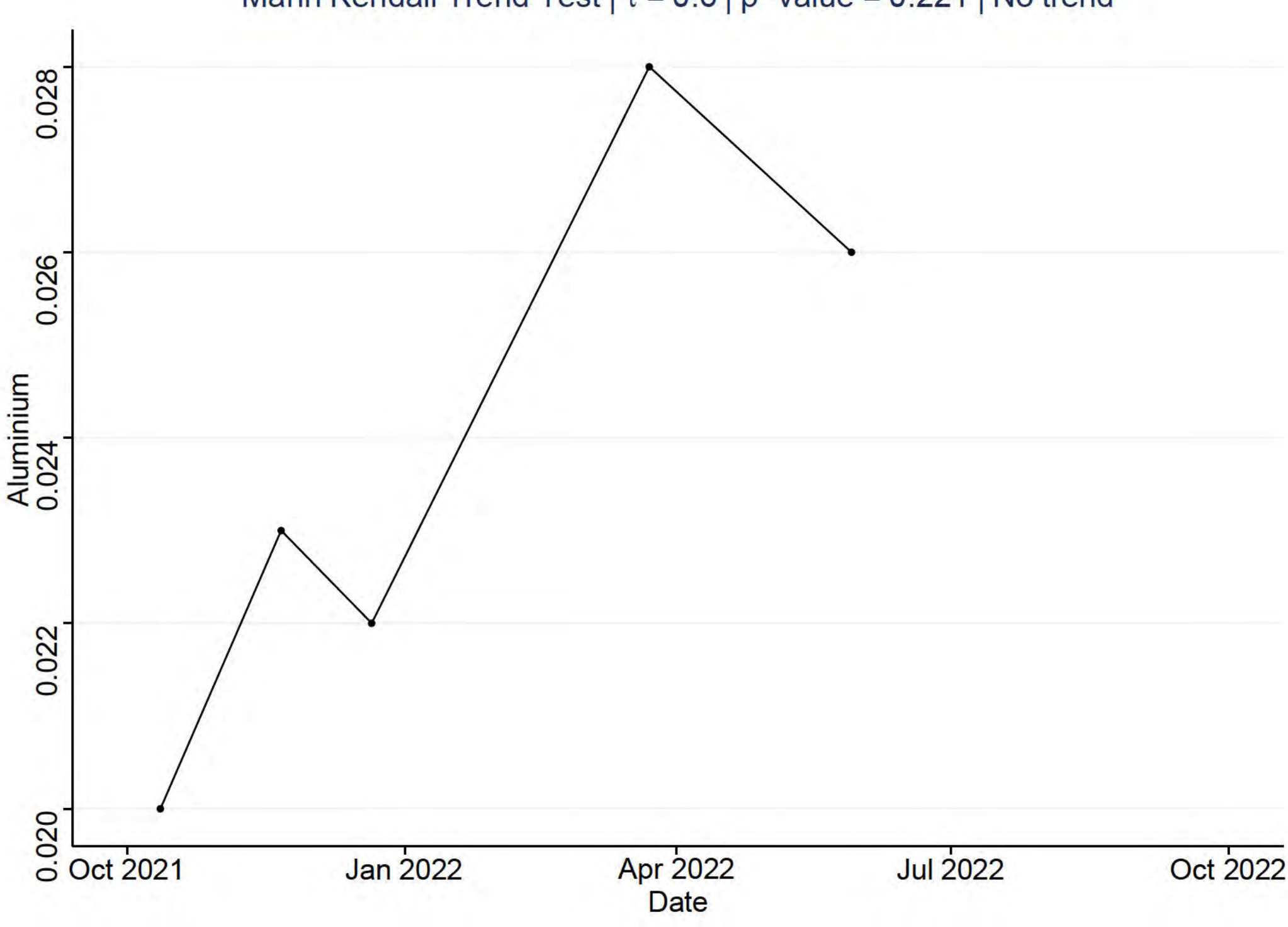

Site NNMW014 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.775 | p−value = 0.0712 | No trend
Total Molybdenum
0.0040
0.0035
0.0030
0.0025
0.0020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

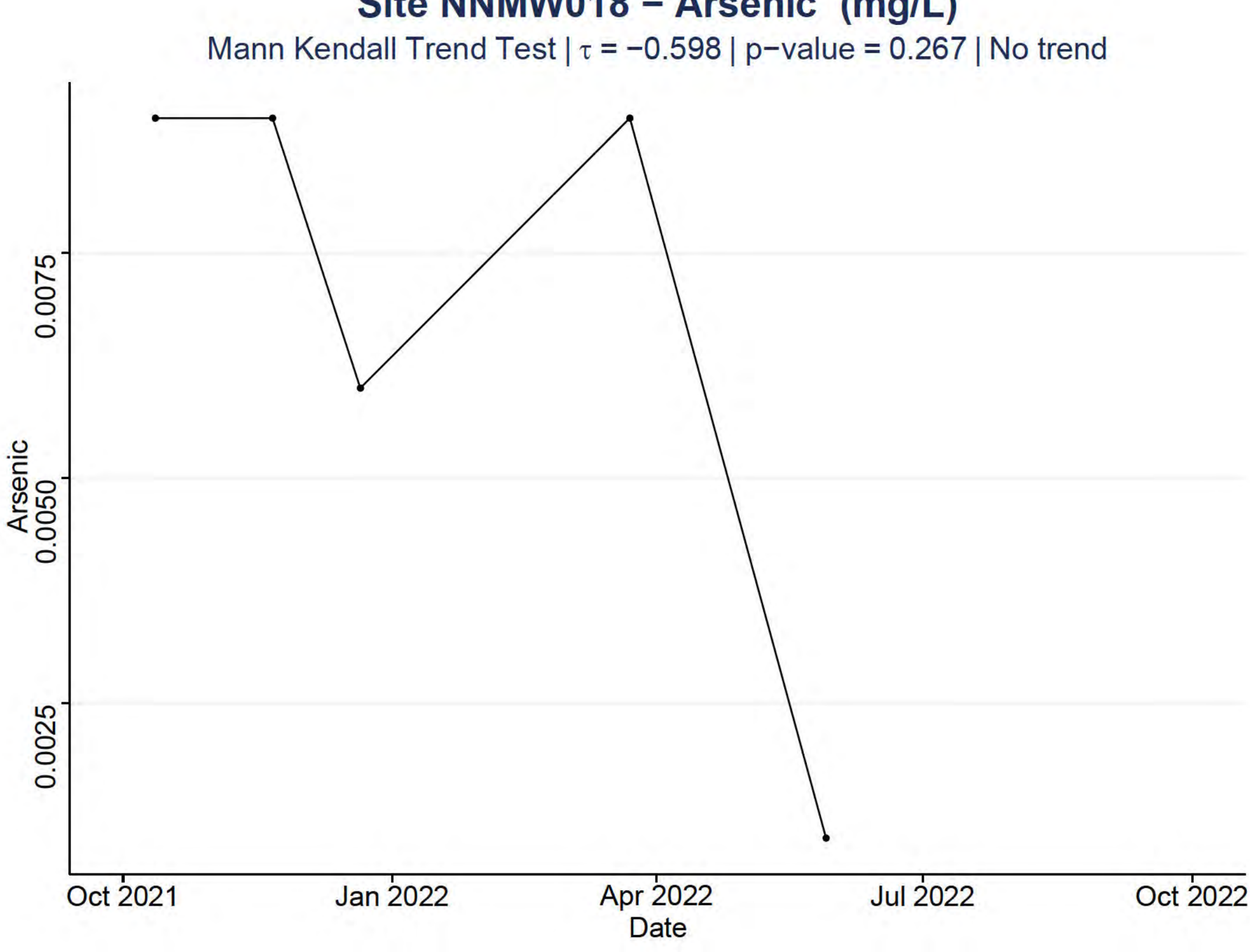

Site NNMW014 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.535 | p−value = 0.115 | No trend
Total Nickel
0.001
0.002
0.003
0.004
0.005
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

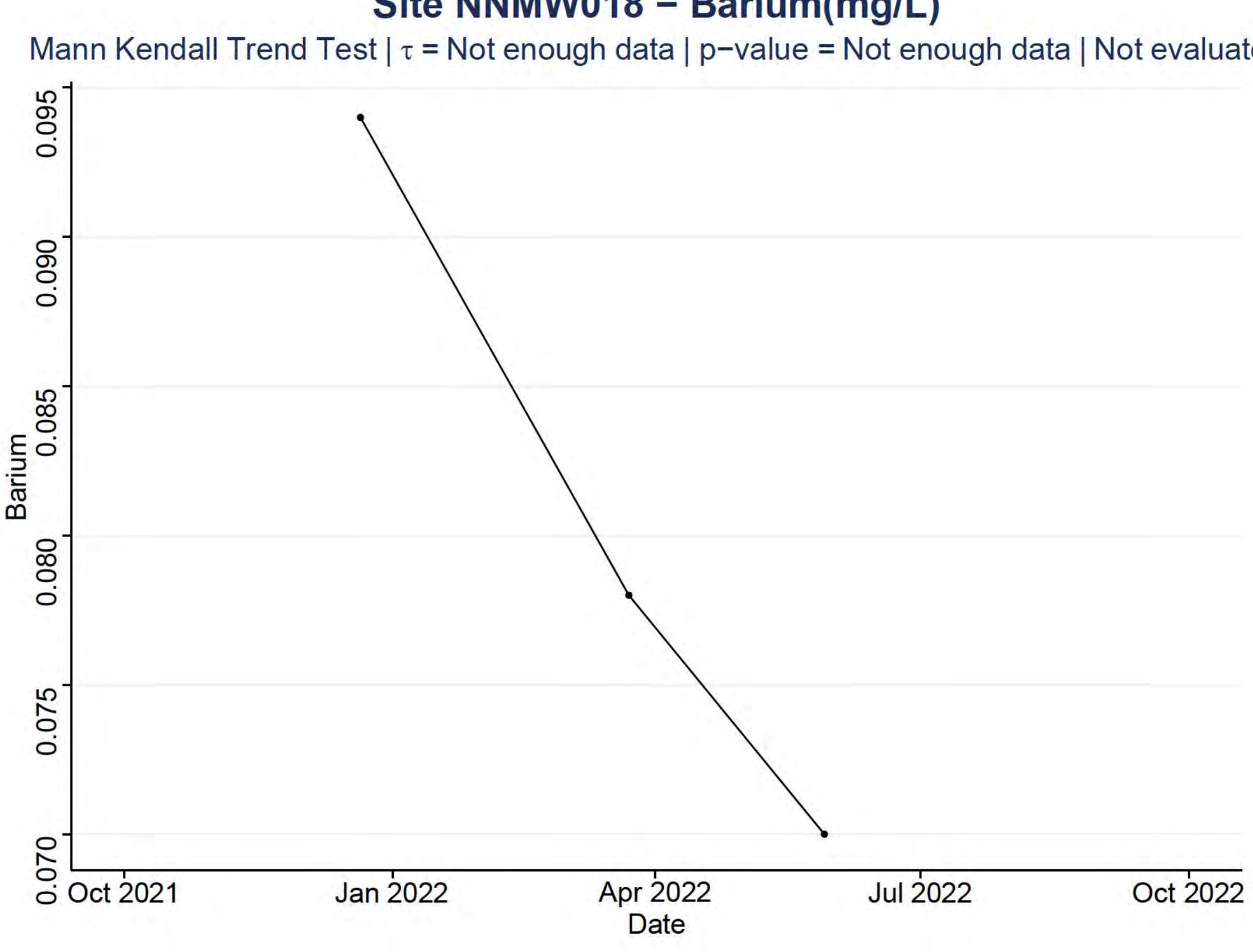

Site NNMW014 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Total Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW014 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.491 | p−value = 0.126 | No trend
Total Zinc
0.04
0.03
0.02
0.01
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW014 – Zinc (mg/L)
Mann Kendall Trend Test | τ = −0.0772 | p−value = 0.898 | No trend
Zinc
0.04
0.03
0.02
0.01
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

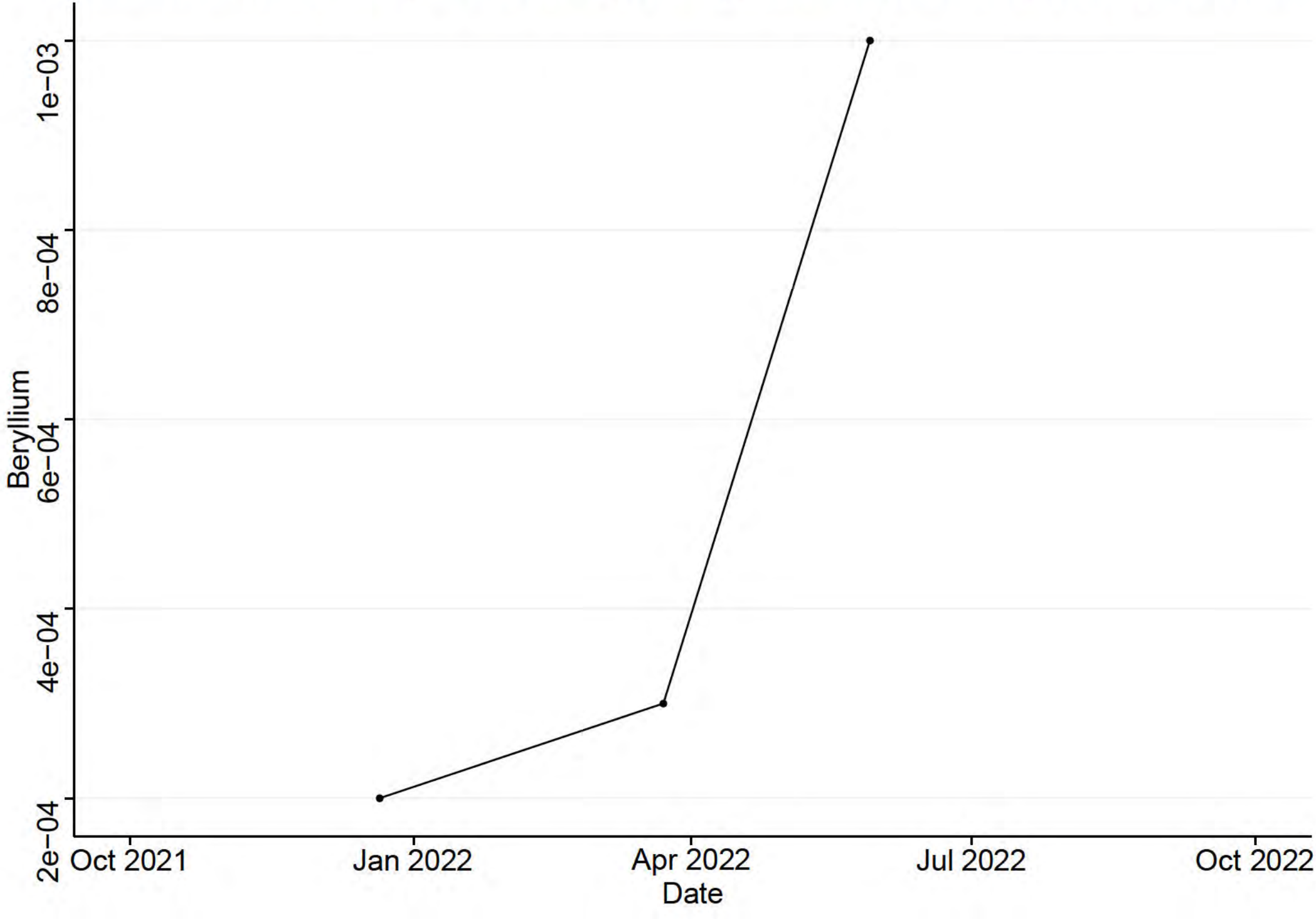

Site NNMW018 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.6 | p−value = 0.221 | No trend
Aluminium
0.020
0.022
0.024
0.026
0.028
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

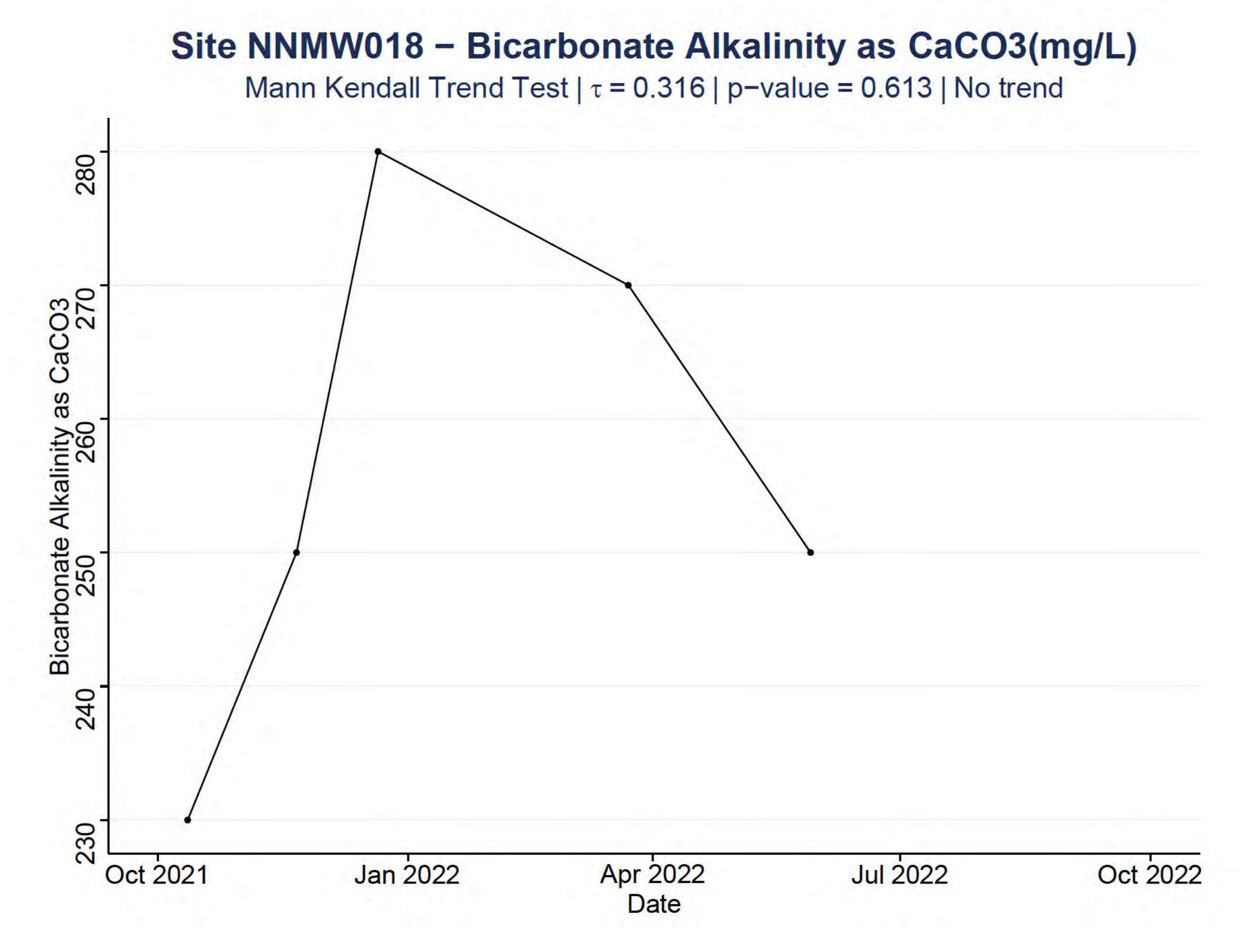

Site NNMW018 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

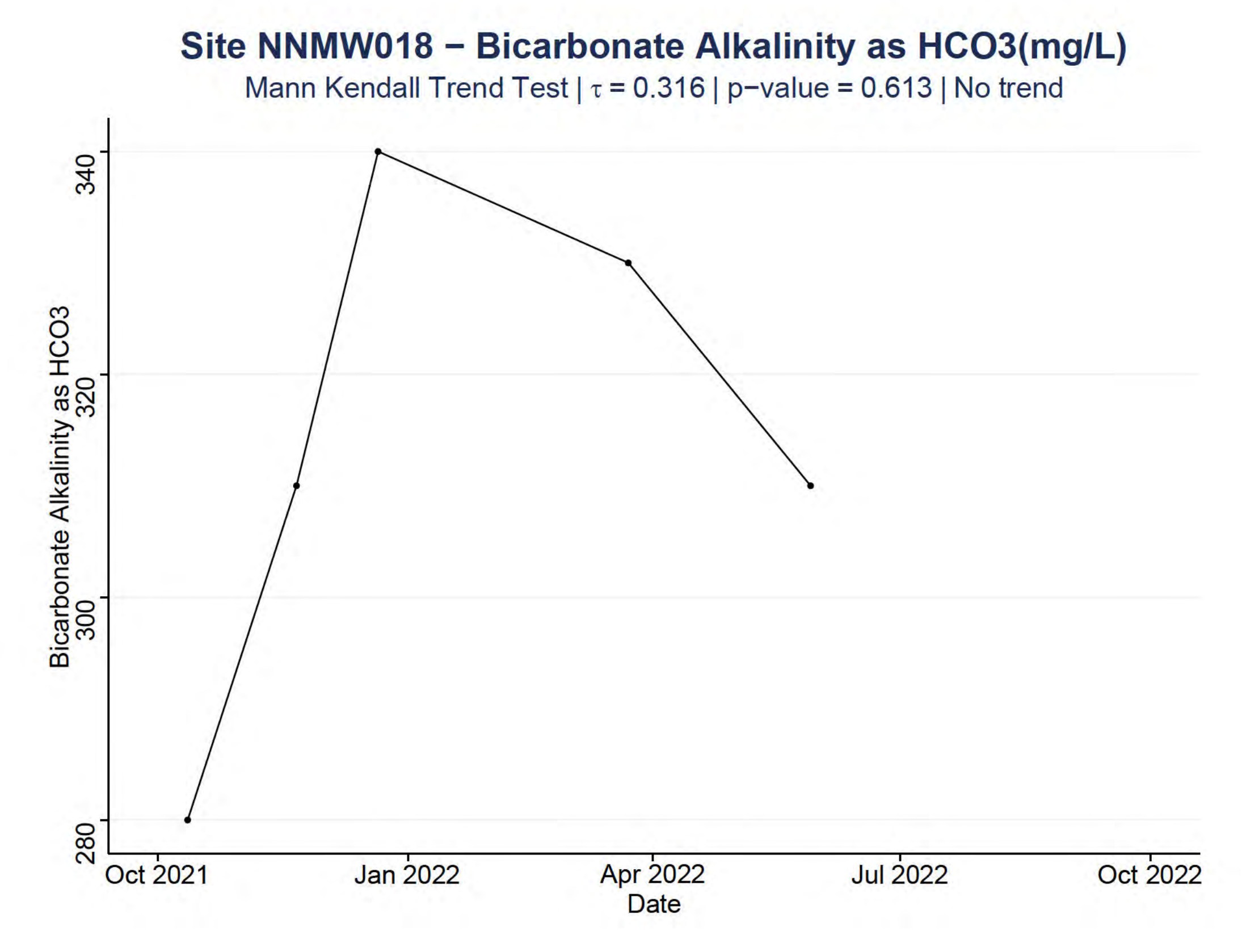

Site NNMW018 – Barium(mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Barium
0.095
0.090
0.085
0.080
0.075
0.070
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

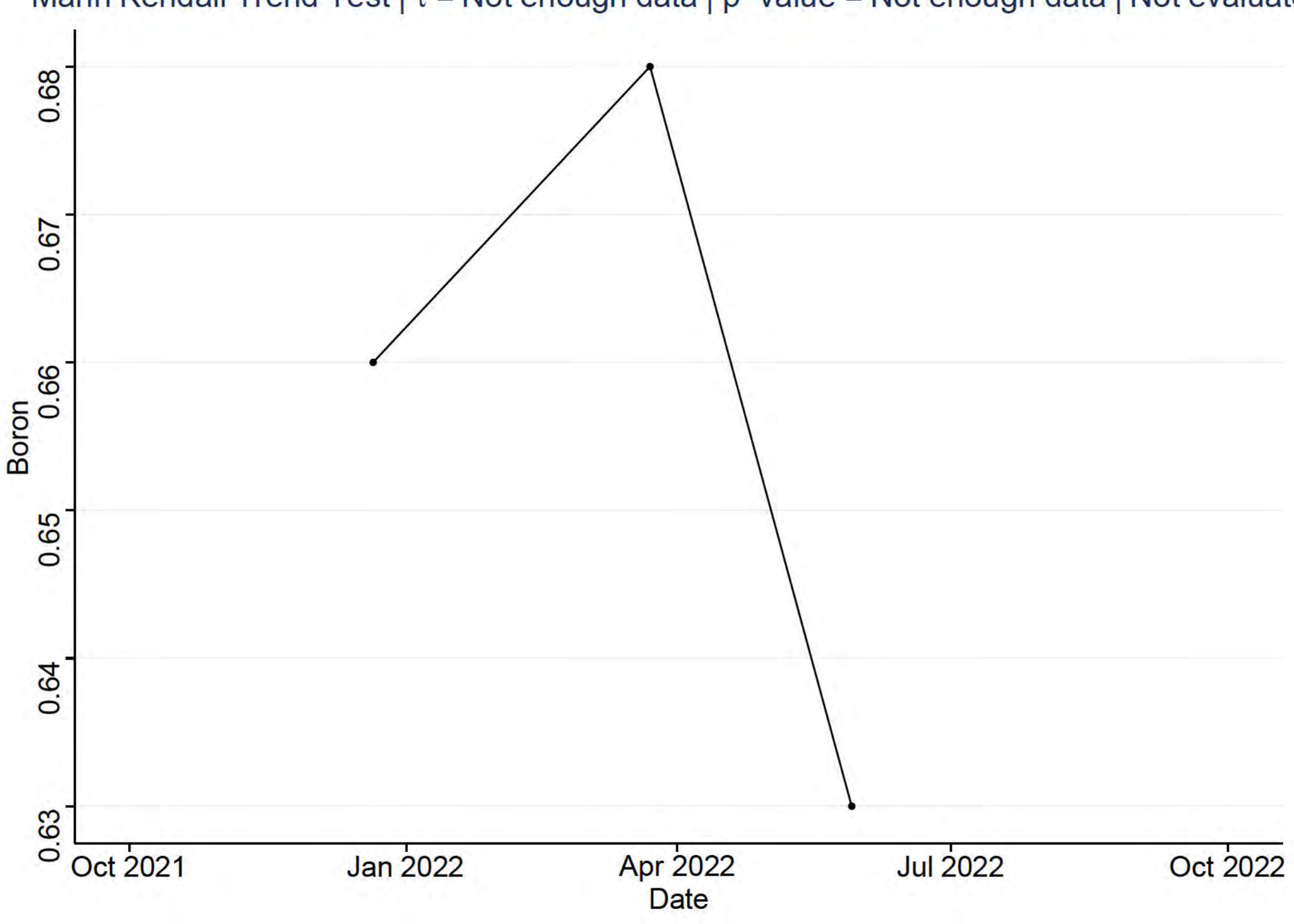
Site NNMW018 – Beryllium (mg/L)

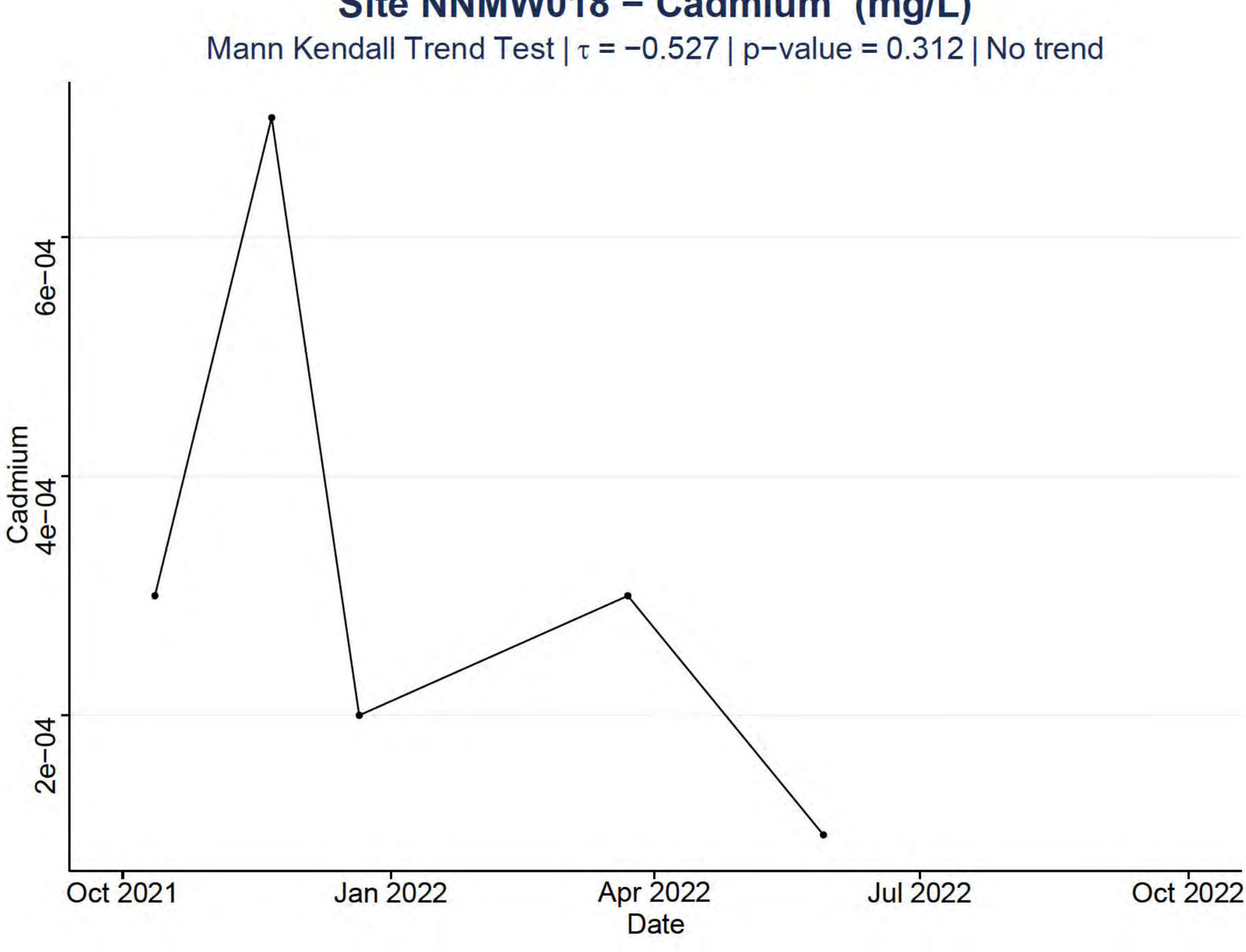
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

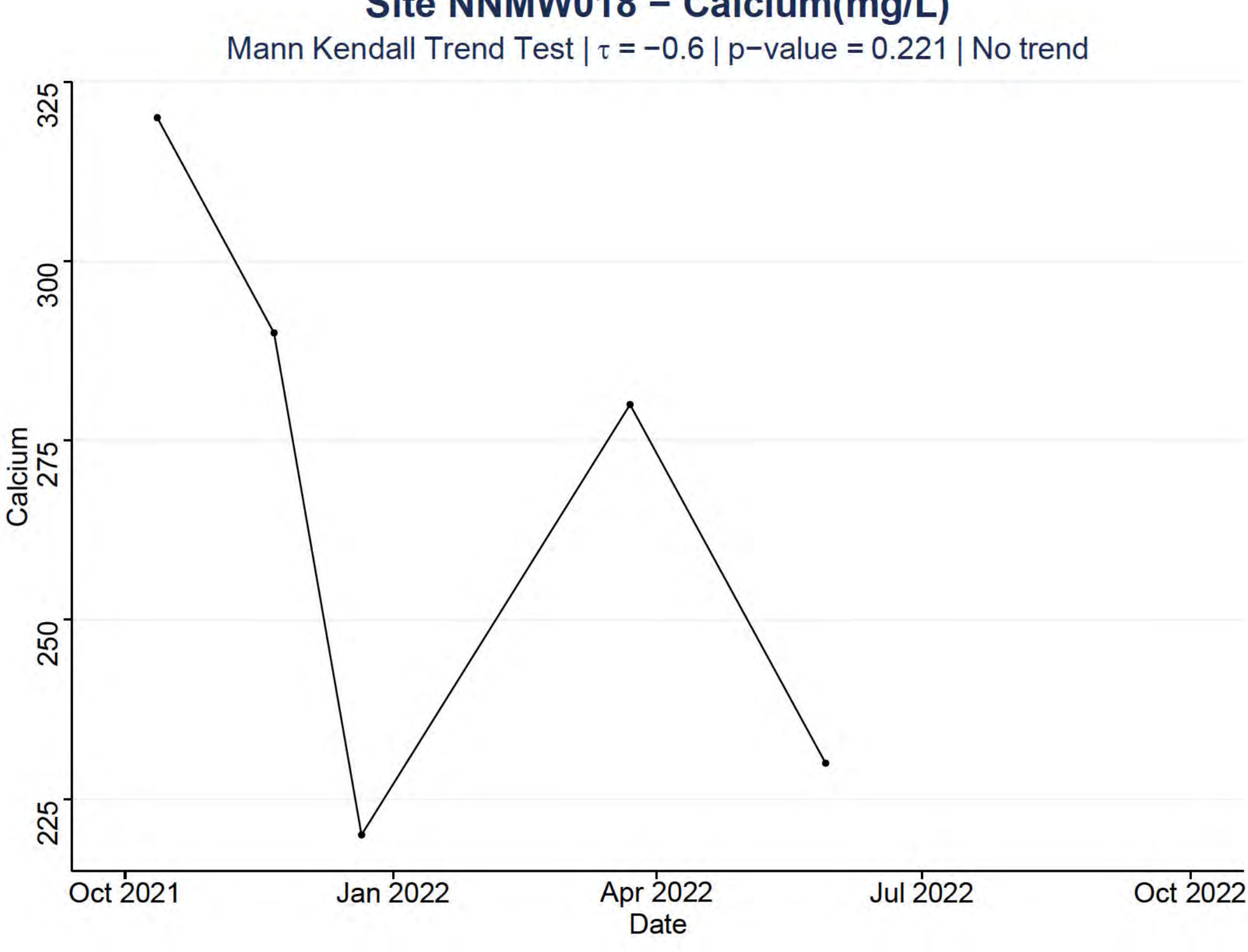


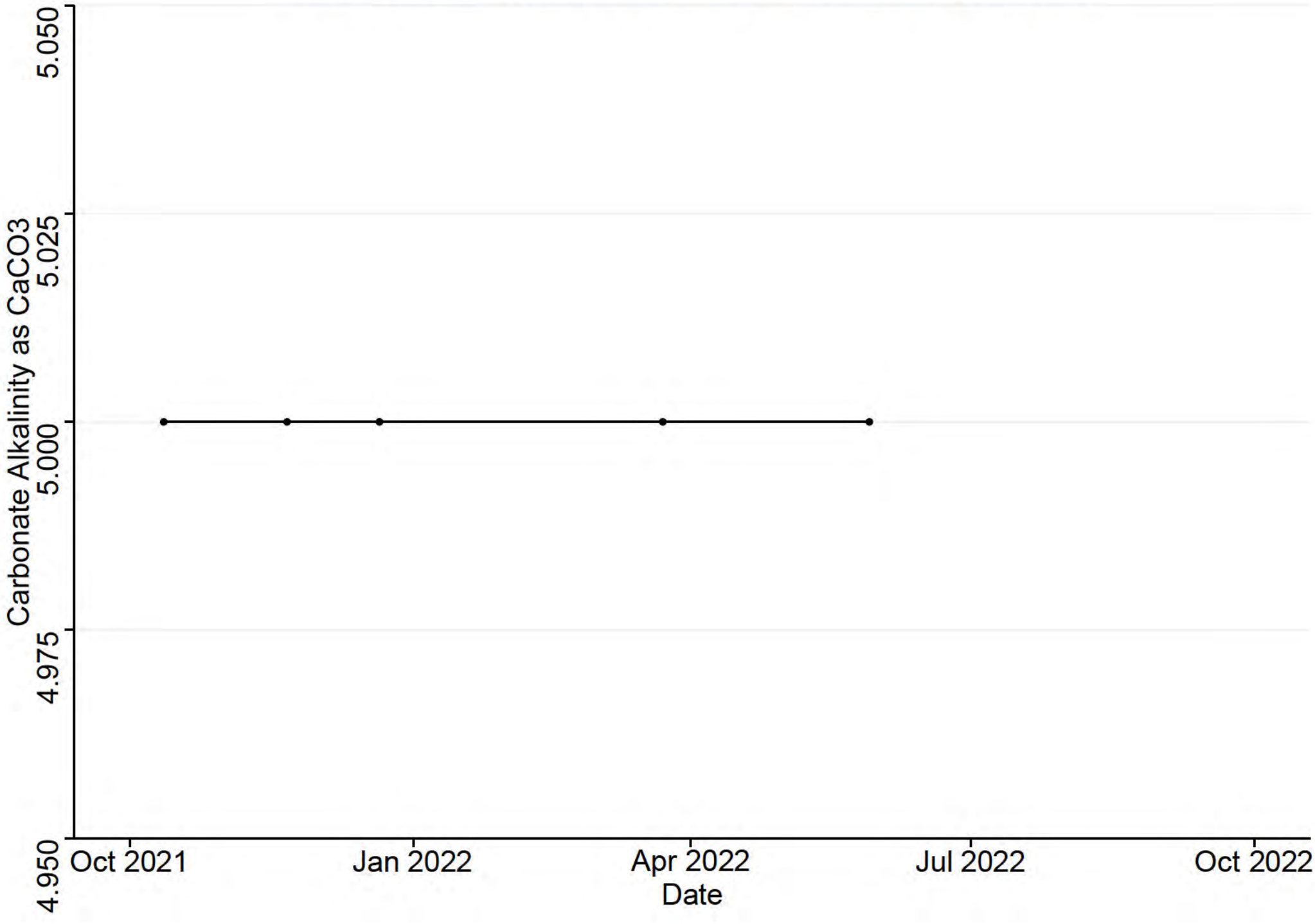

Site NNMW018 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.316 | p−value = 0.613 | No trend
Bicarbonate Alkalinity as CaCO3
230
240
250
260
270
280
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

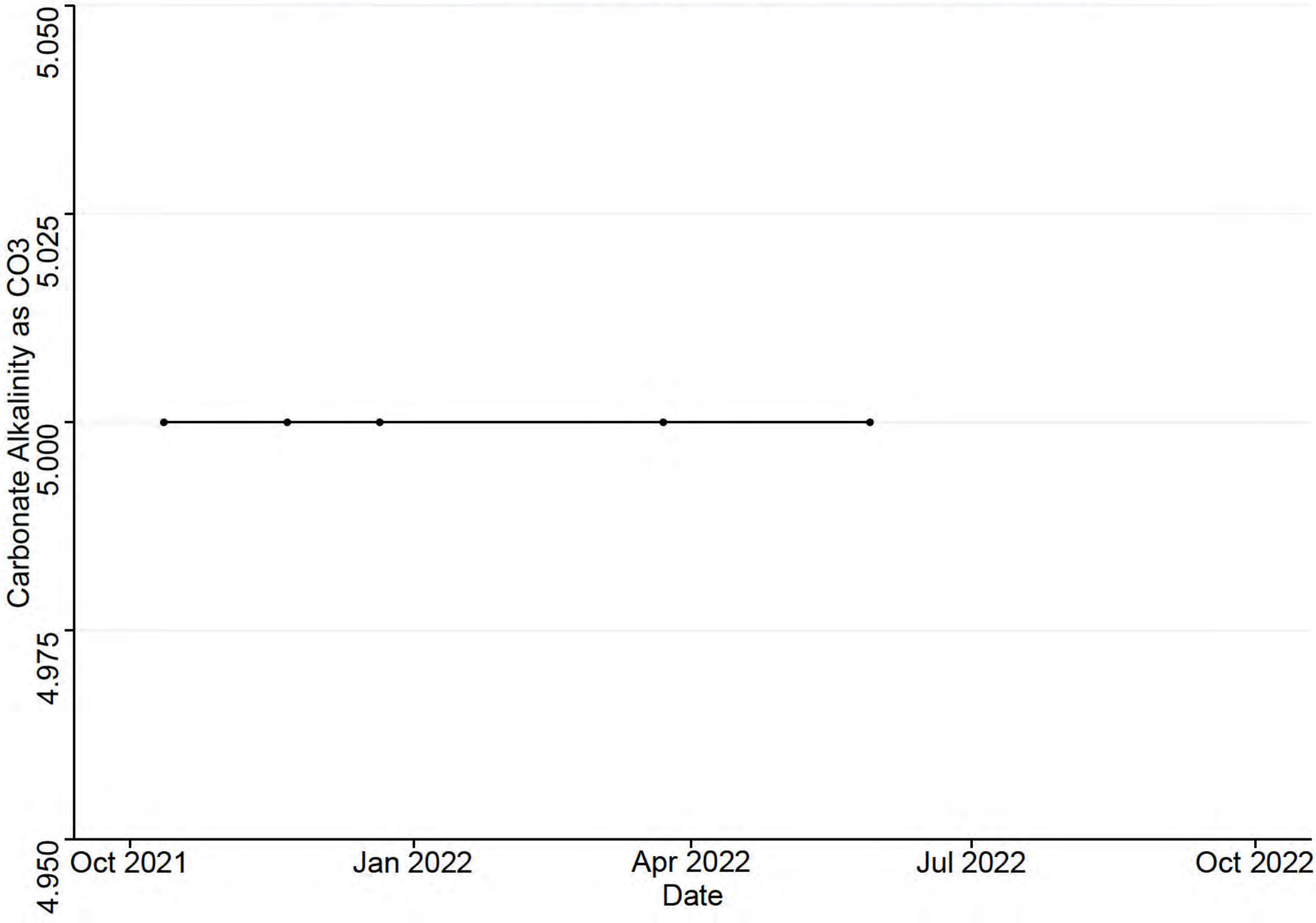

Site NNMW018 – Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.316 | p−value = 0.613 | No trend
Bicarbonate Alkalinity as HCO3
340
320
300
280
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

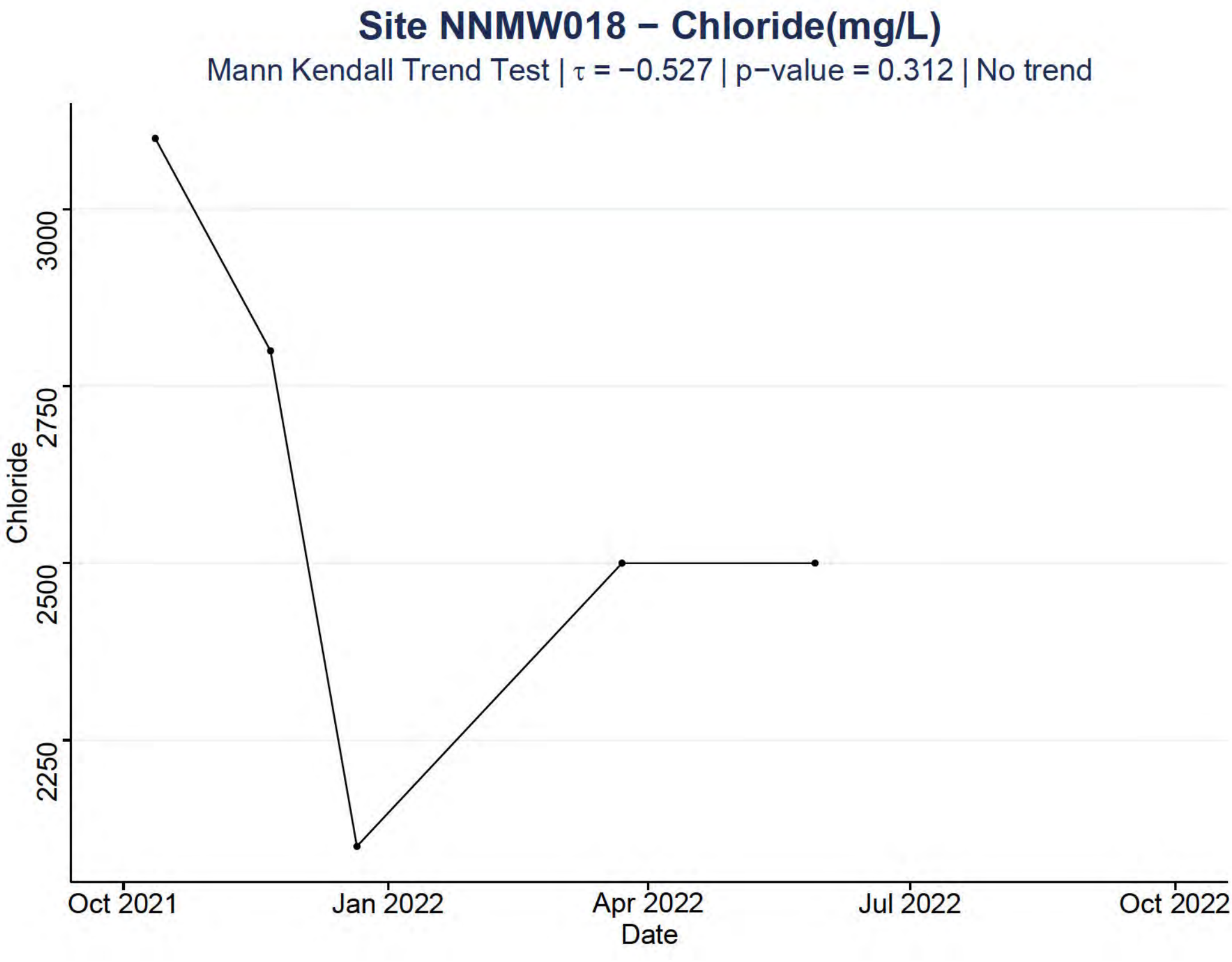

Site NNMW018 – Boron(mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Boron
0.68
0.67
0.66
0.65
0.64
0.63
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

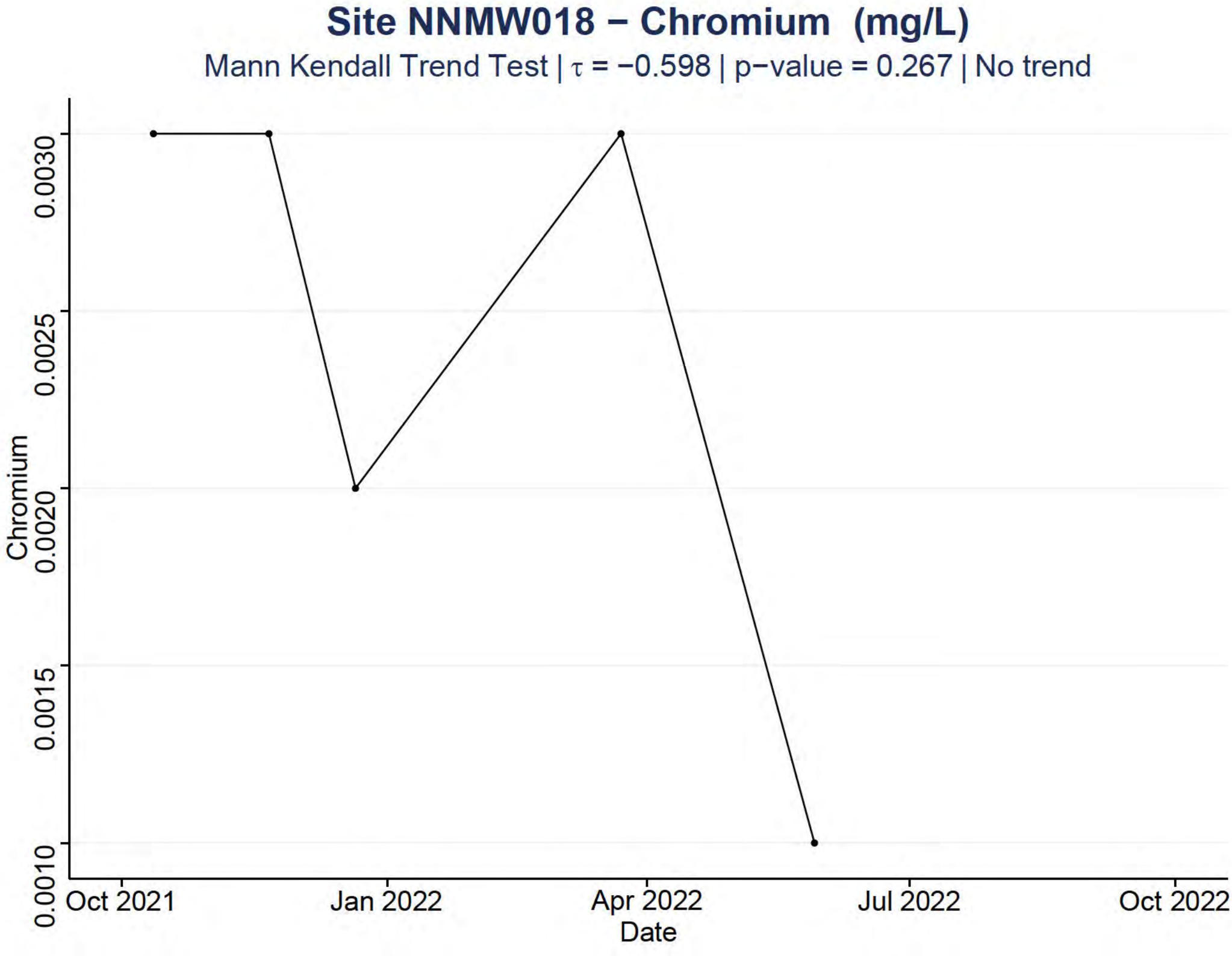

Site NNMW018 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Cadmium
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

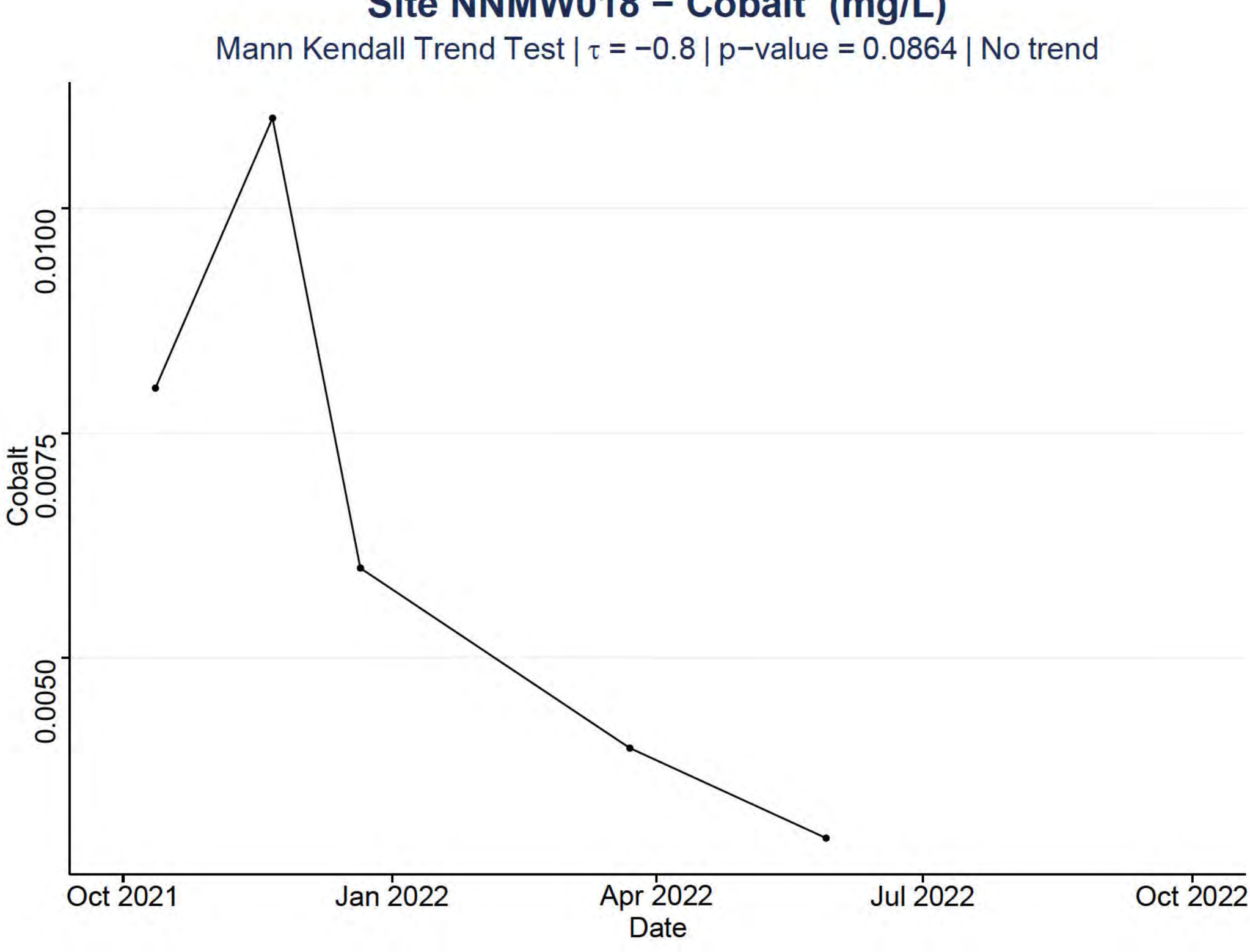

Site NNMW018 – Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.6 | p−value = 0.221 | No trend
Calcium
325
300
275
250
225
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

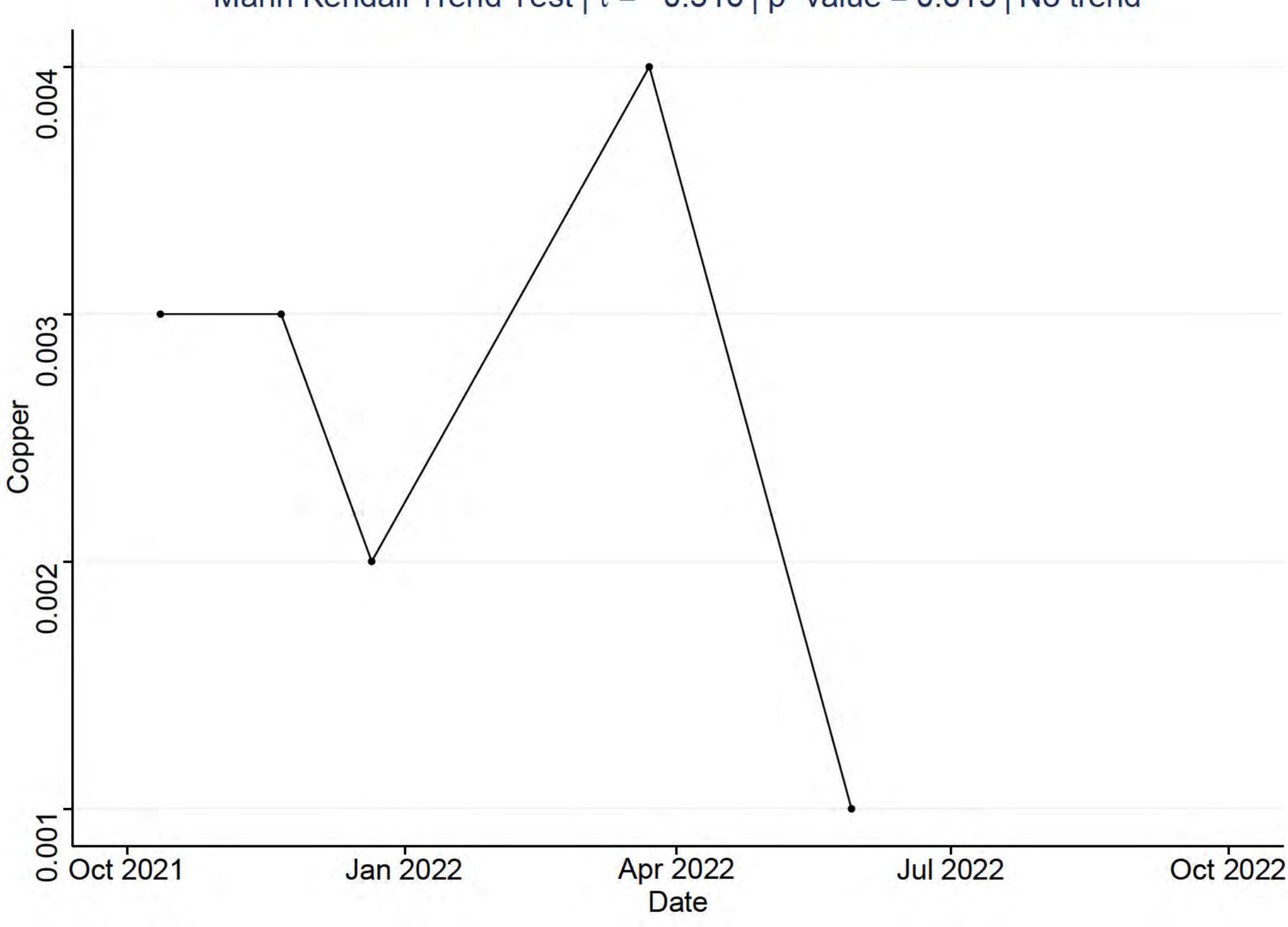

Site NNMW018 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

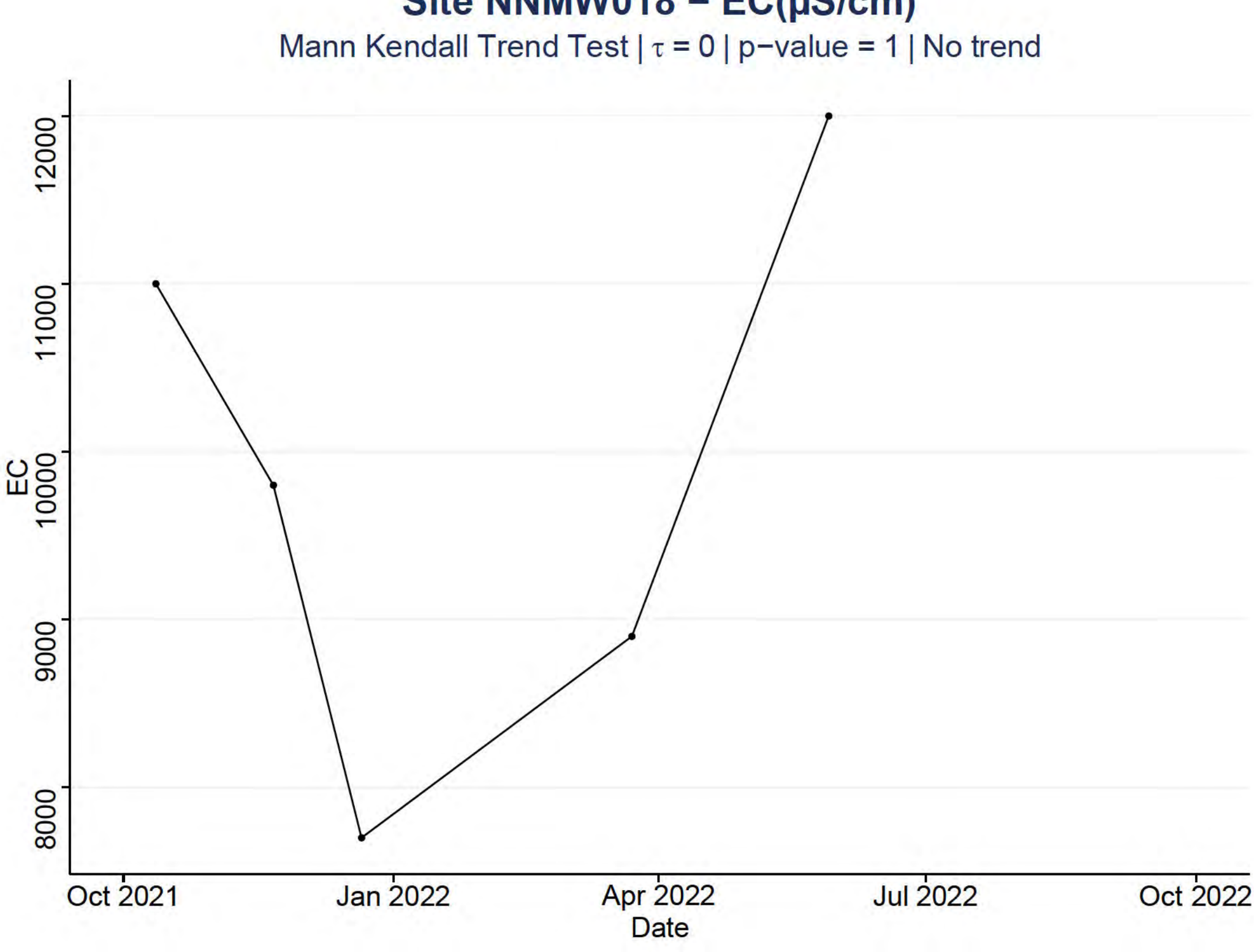

Site NNMW018 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

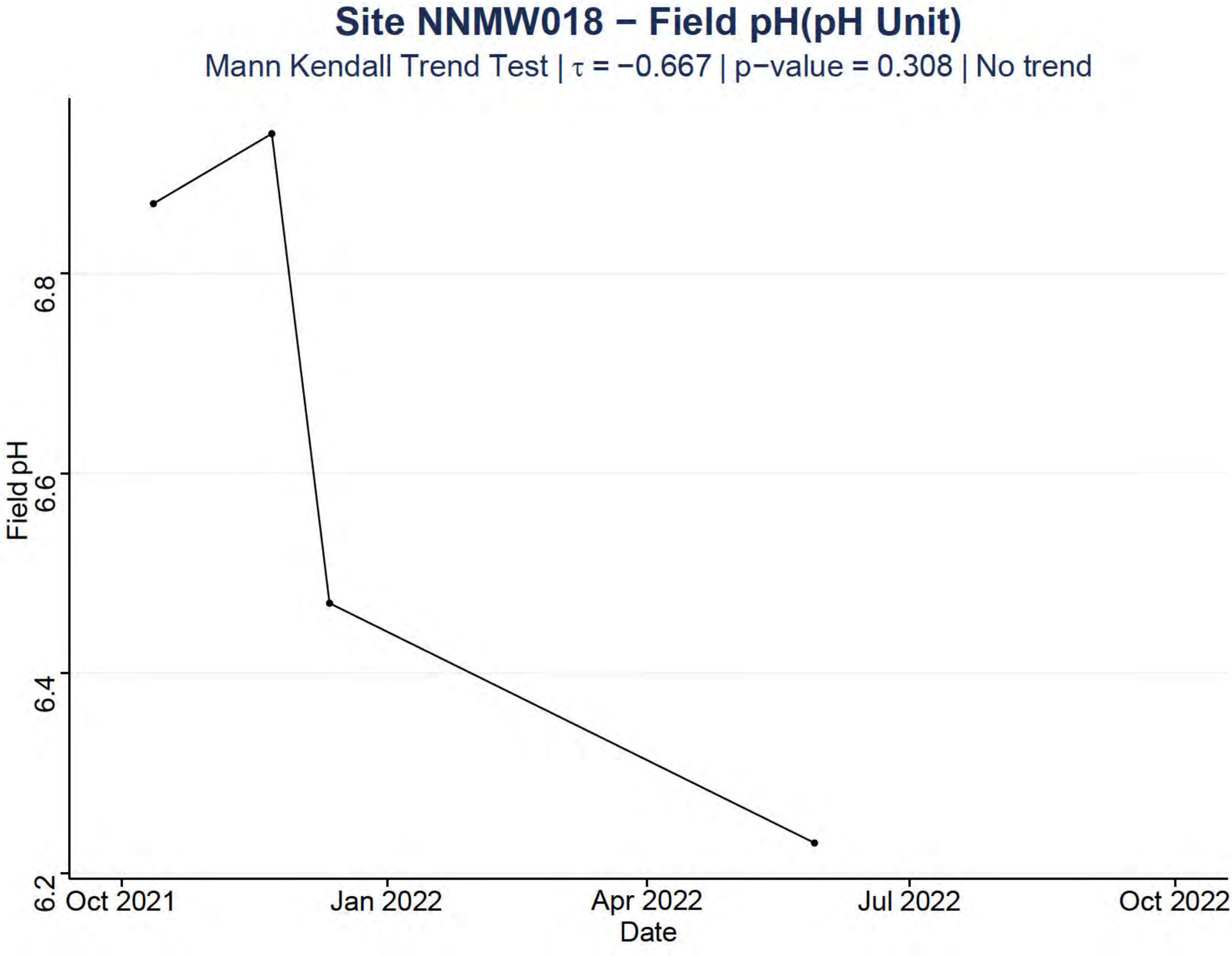

Site NNMW018 – Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Chloride
3000
2750
2500
2250
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

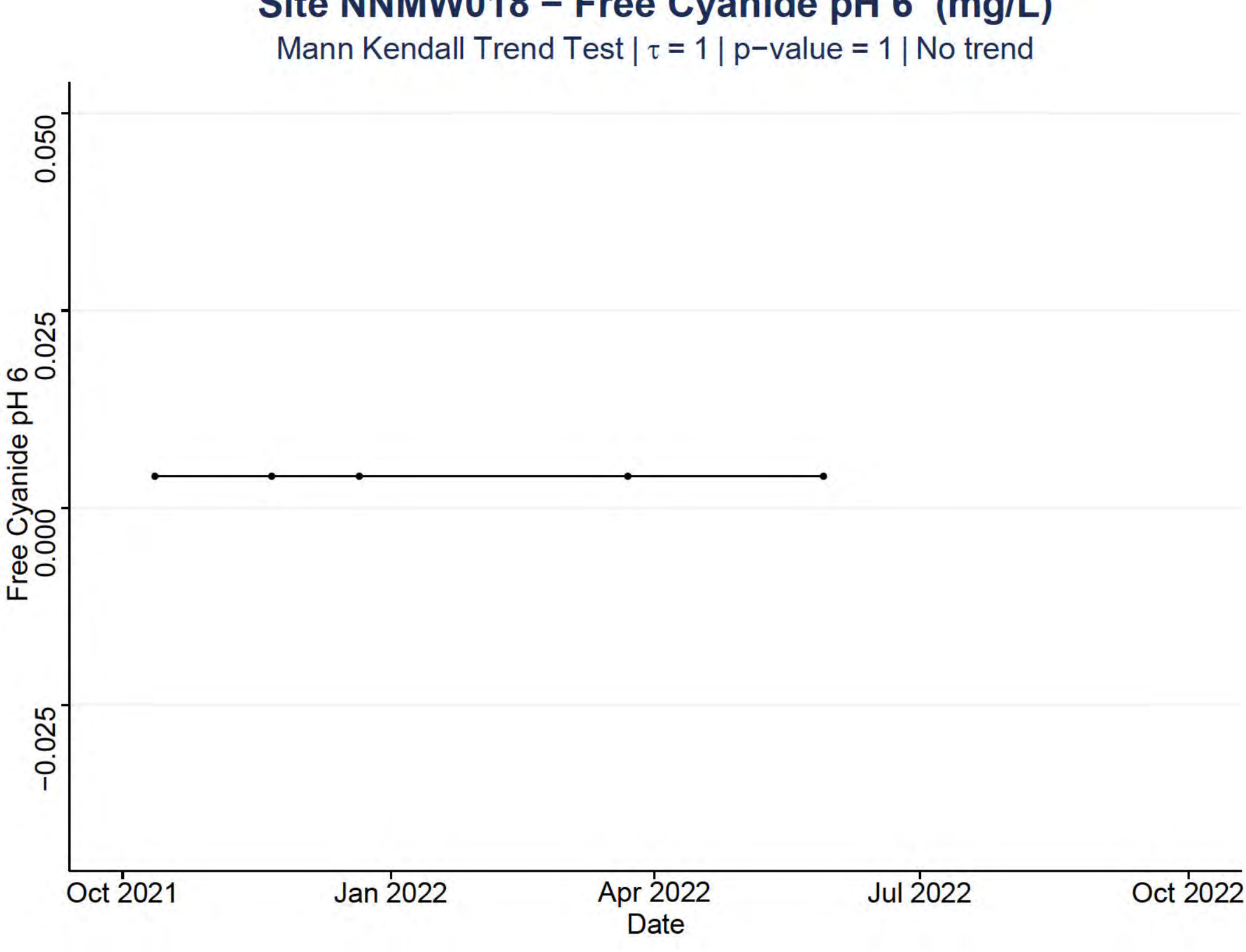

Site NNMW018 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

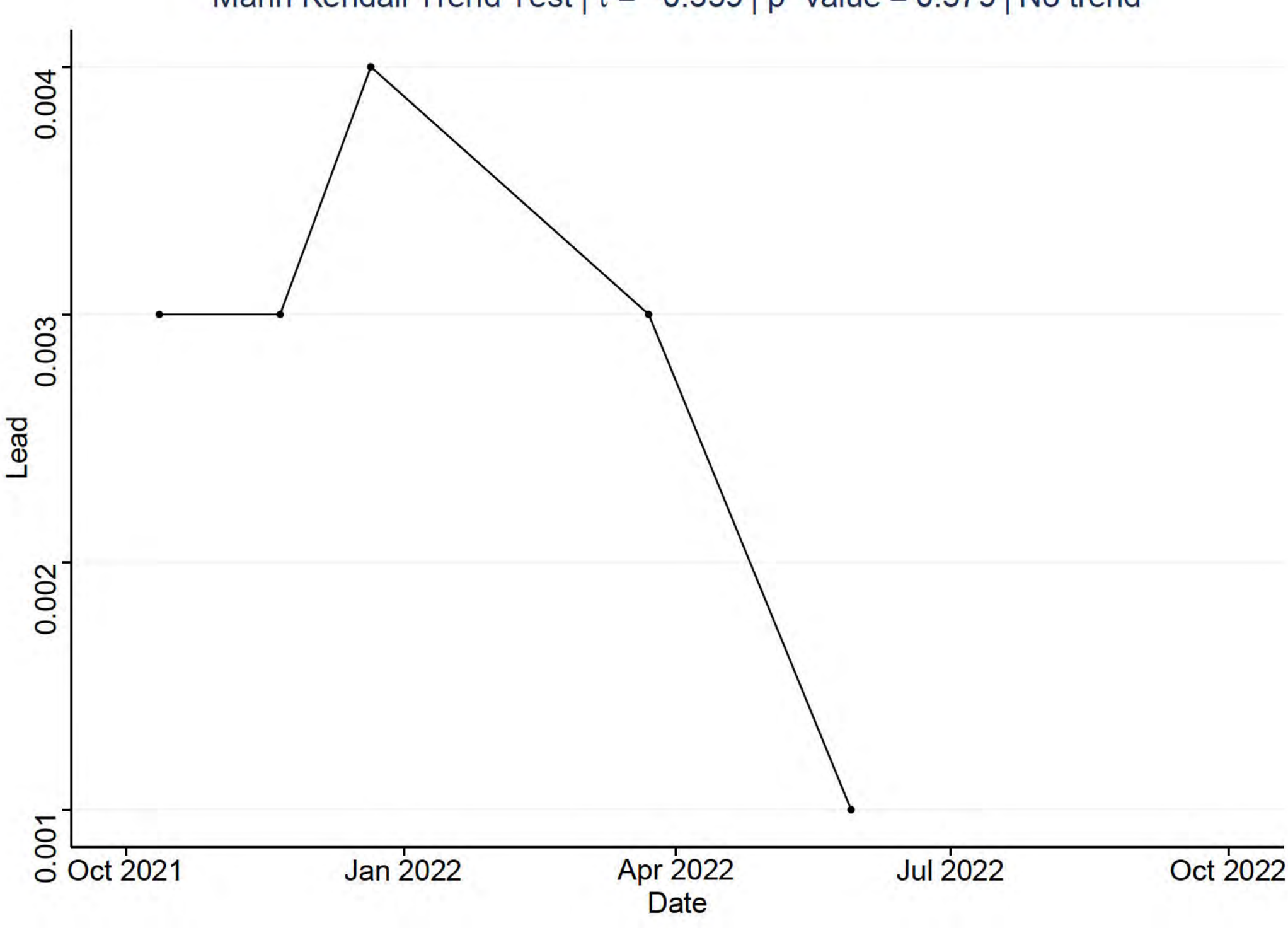

Site NNMW018 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.8 | p−value = 0.0864 | No trend
Cobalt
0.0100
0.0075
0.0050
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

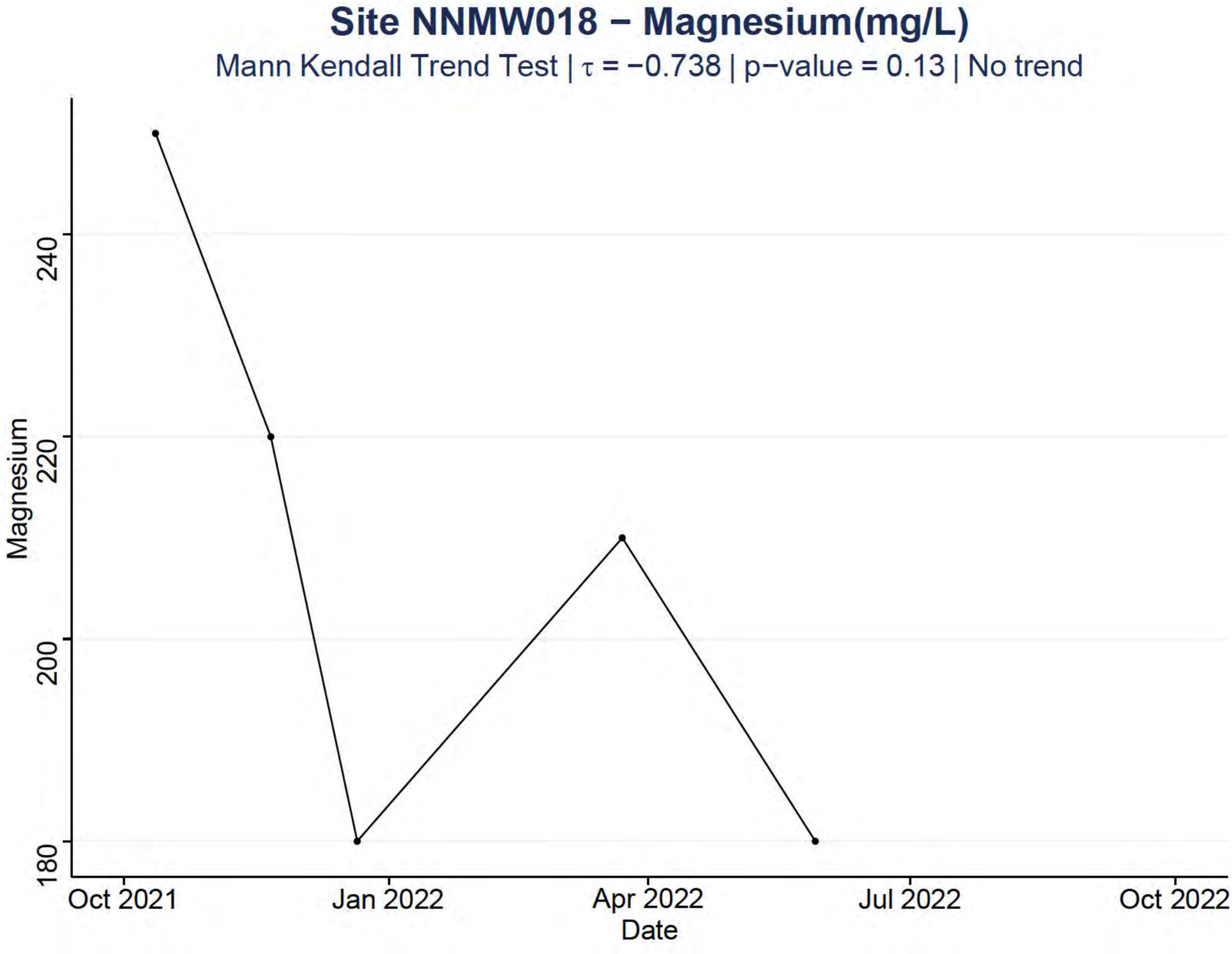

Site NNMW018 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Copper
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

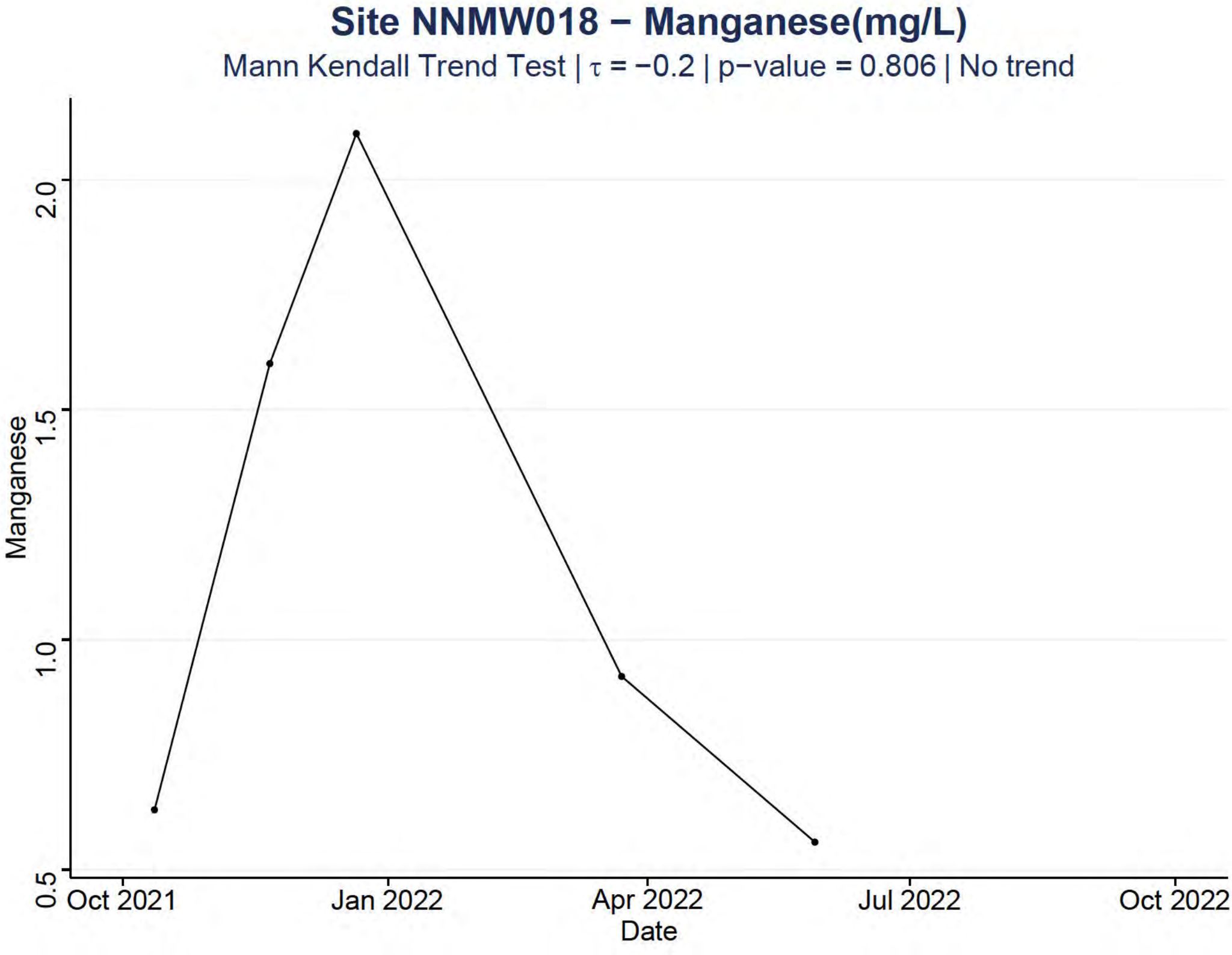

Site NNMW018 – EC(µS/cm)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
EC
12000
11000
10000
9000
8000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

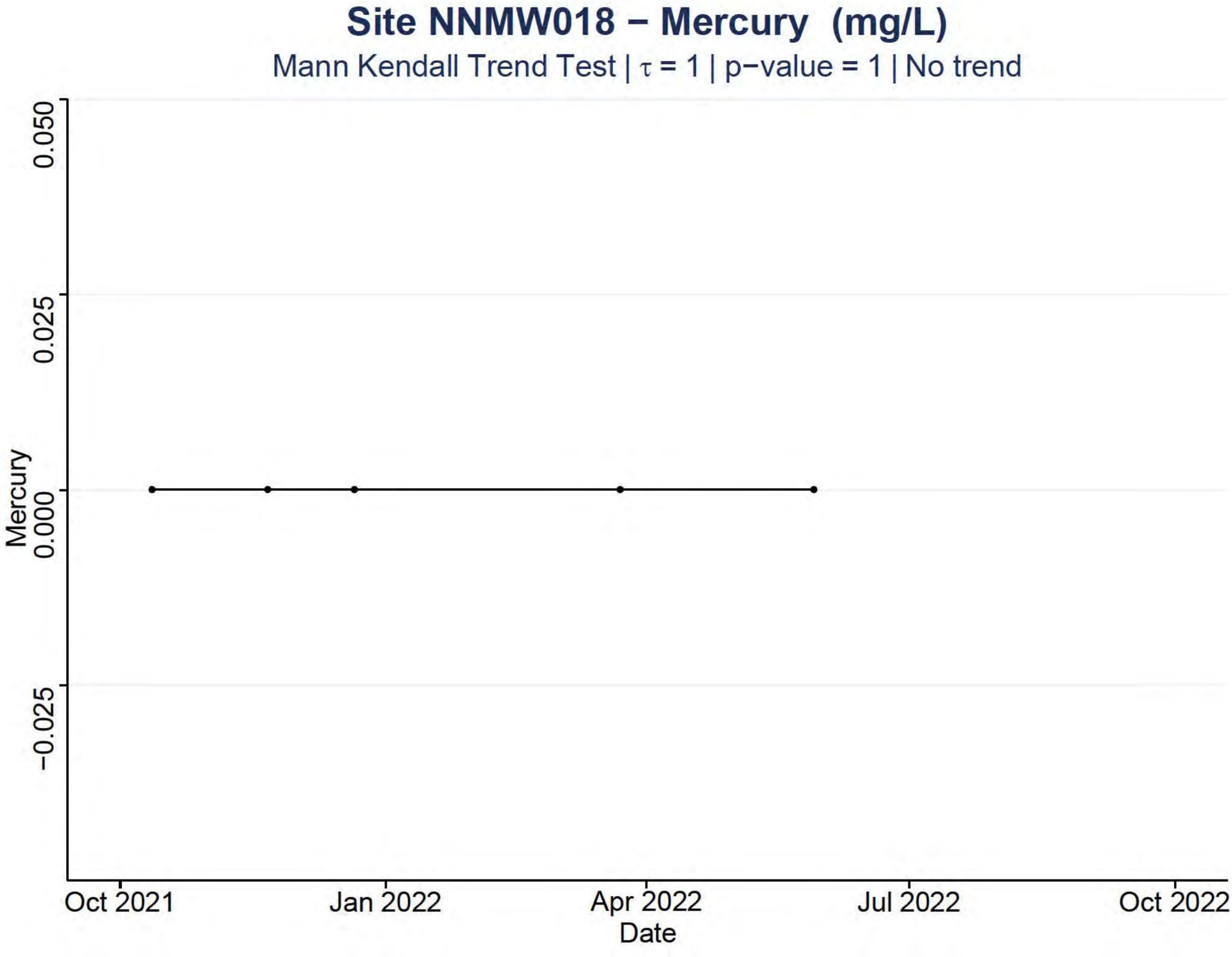

Site NNMW018 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.667 | p−value = 0.308 | No trend
Field pH
6.8
6.6
6.4
6.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW018 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Free Cyanide pH 6
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW018 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.359 | p−value = 0.579 | No trend
Lead
0.001
0.002
0.003
0.004
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

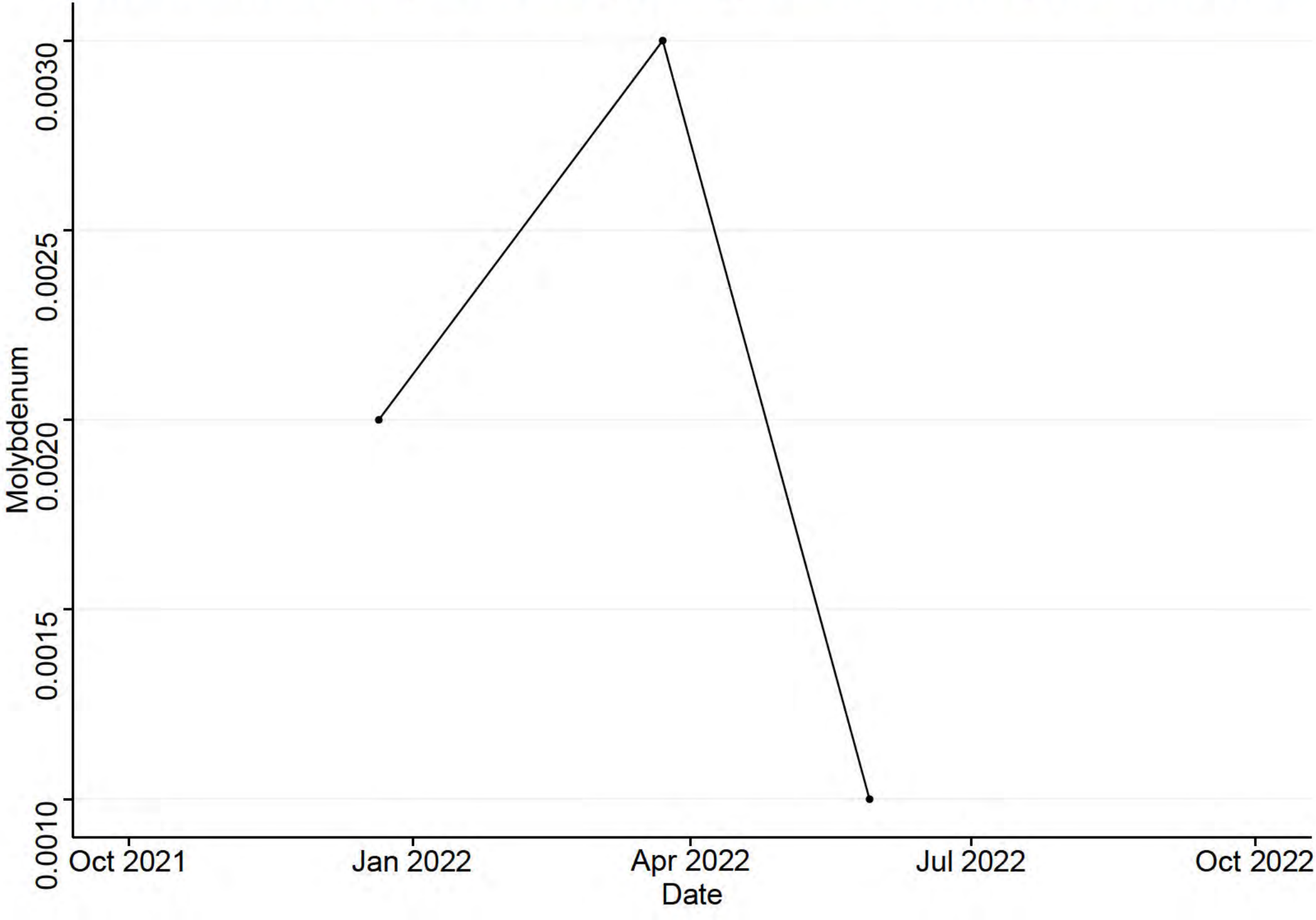

Site NNMW018 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.738 | p−value = 0.13 | No trend
Magnesium
240
220
200
180
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

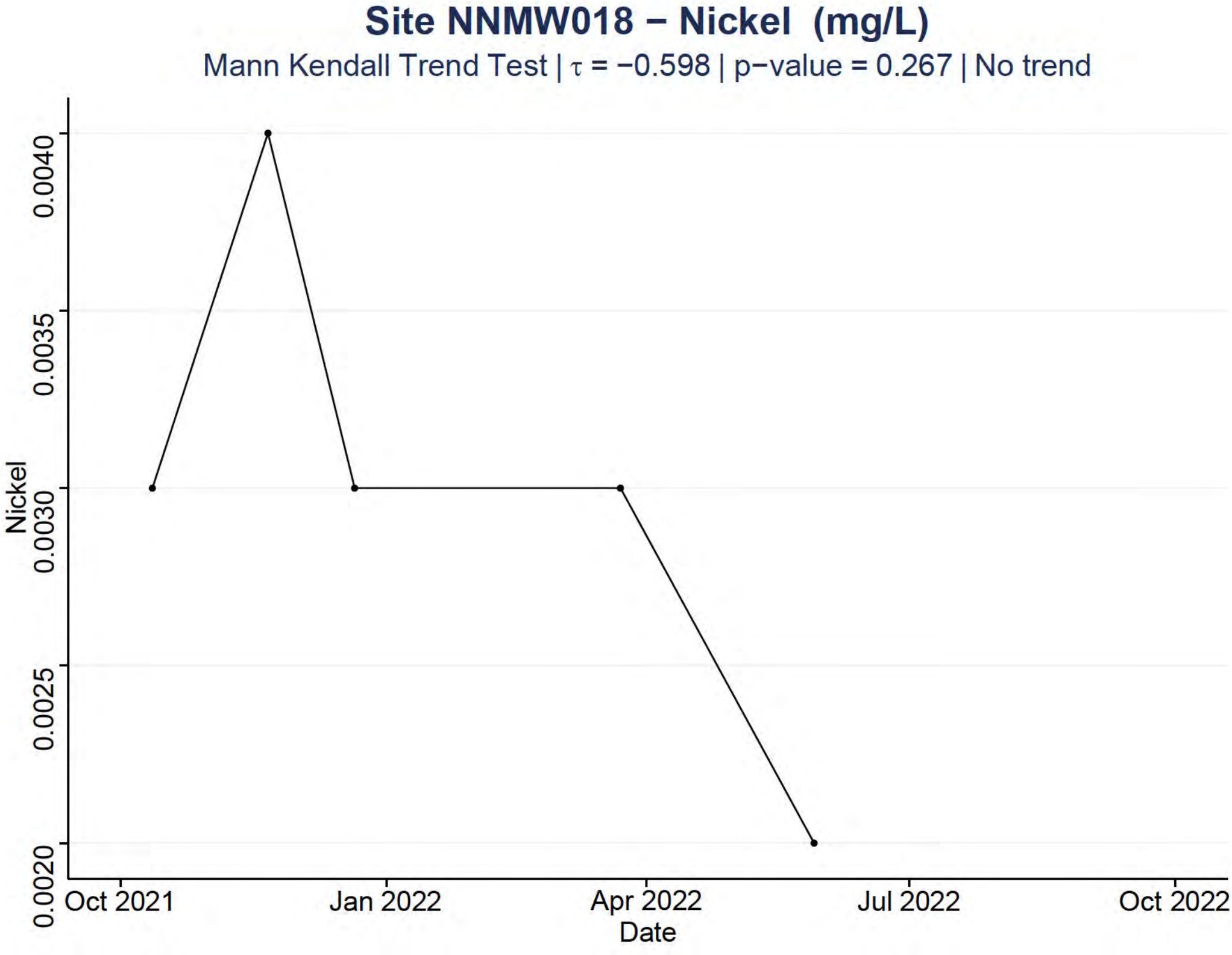

Site NNMW018 – Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Manganese
2.0
1.5
1.0
0.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

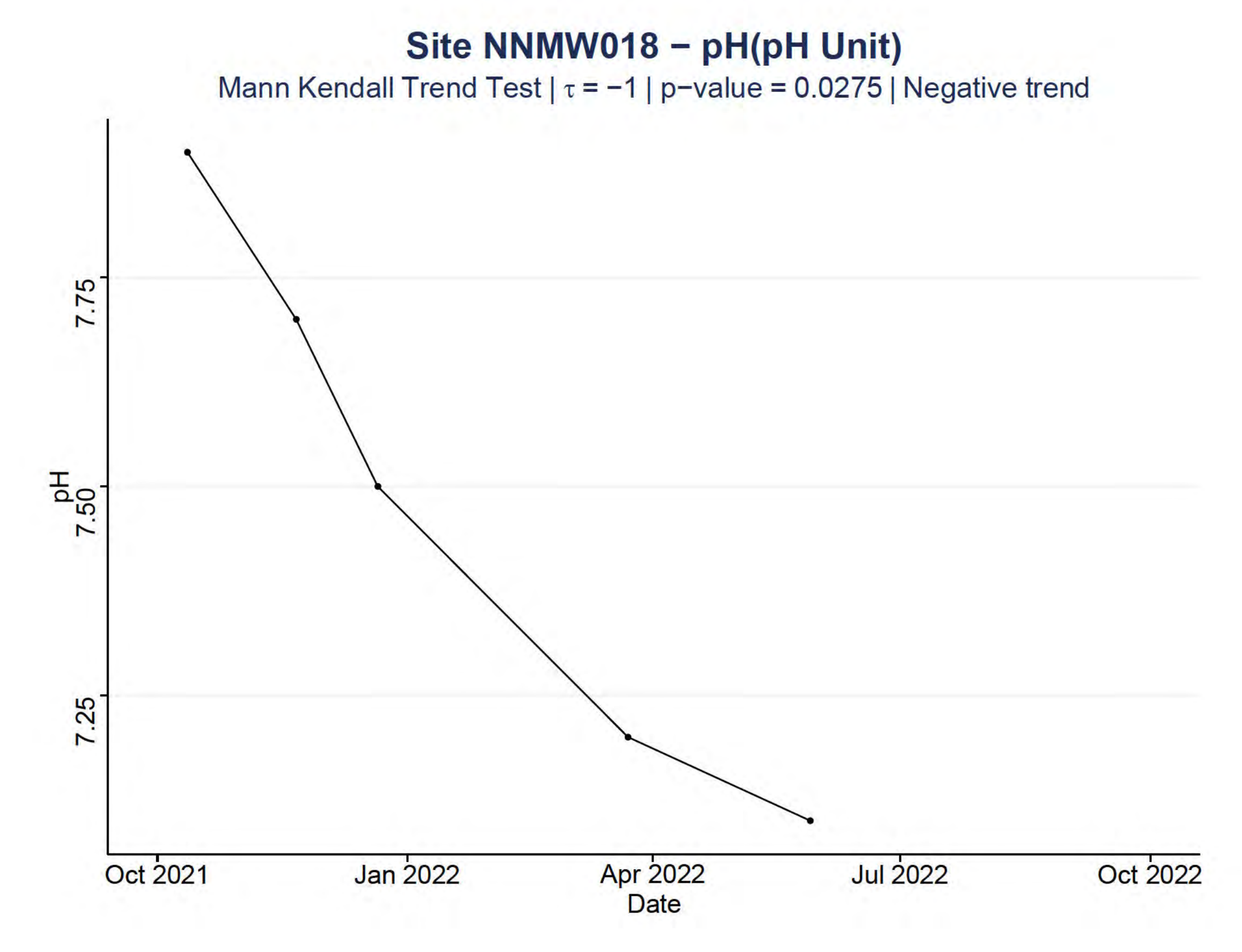

Site NNMW018 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

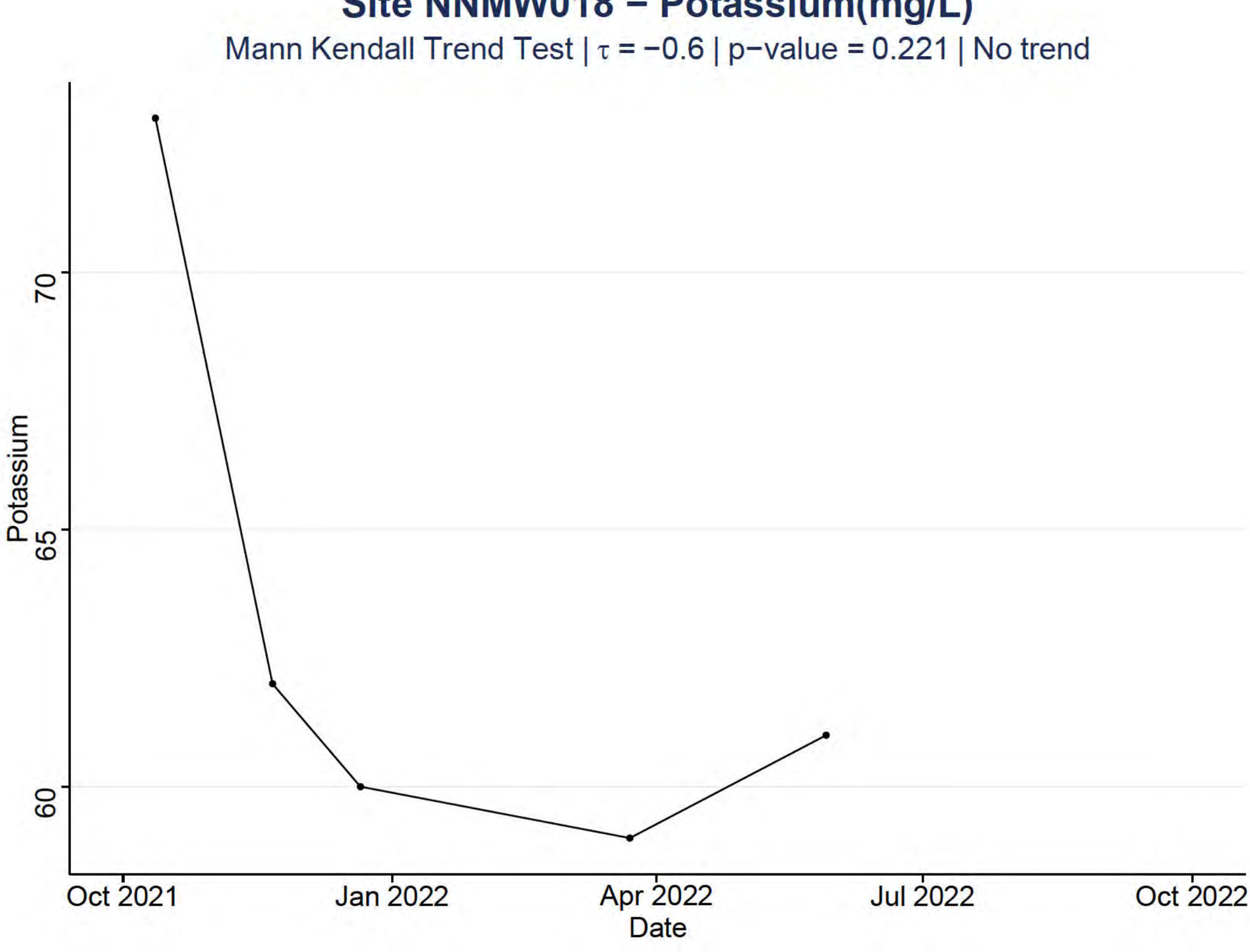
Site NNMW018 – Molybdenum (mg/L)

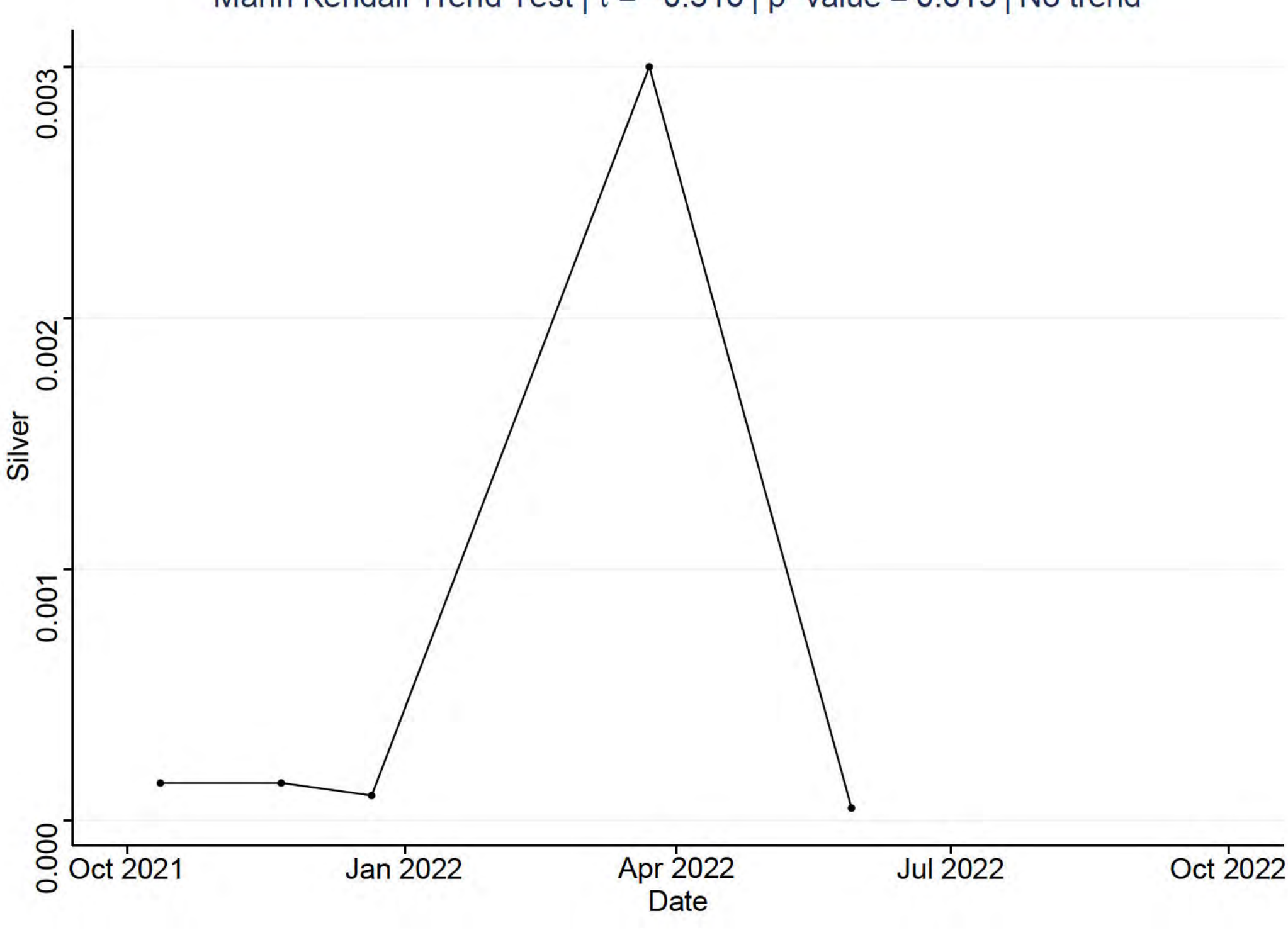
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated

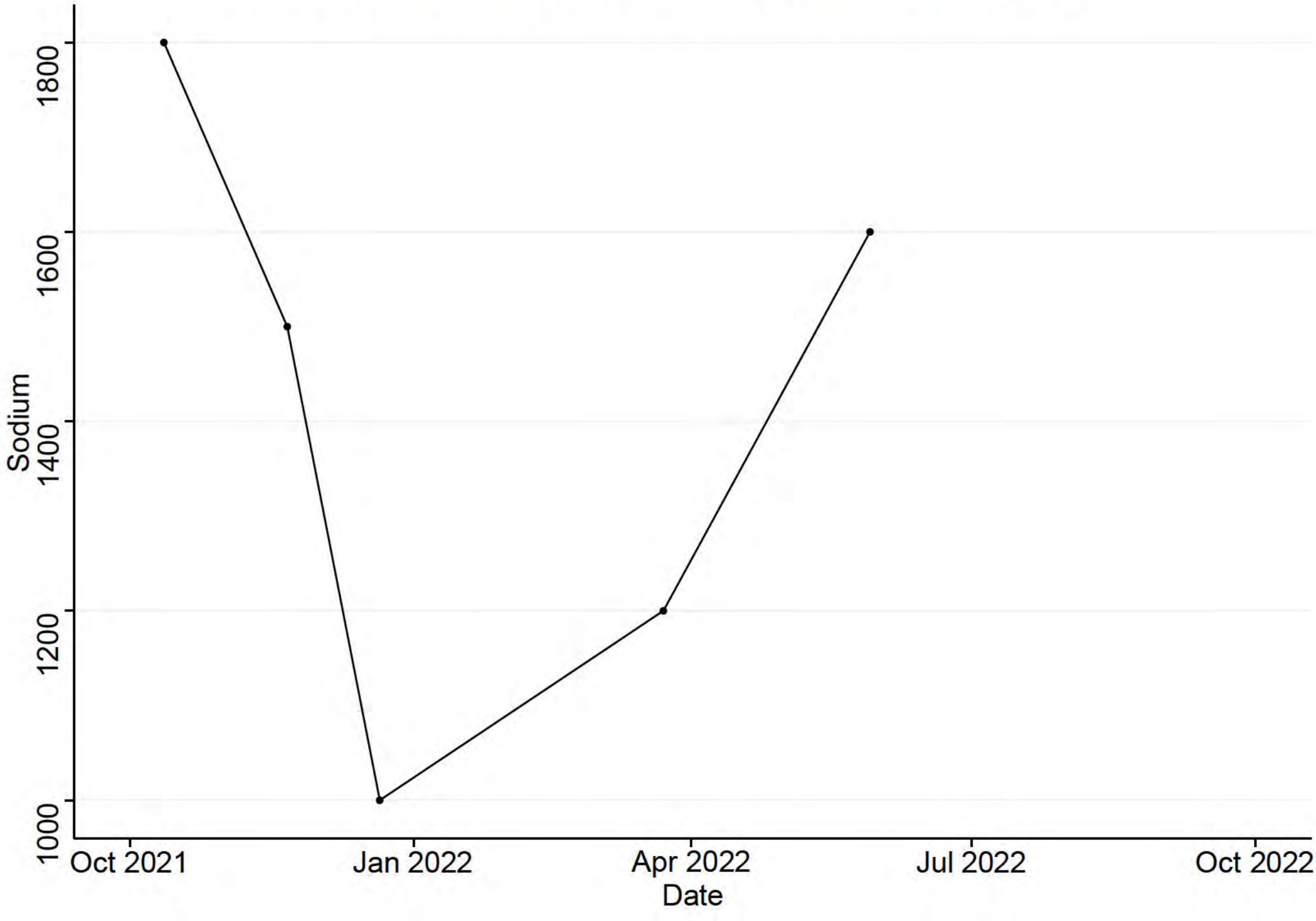


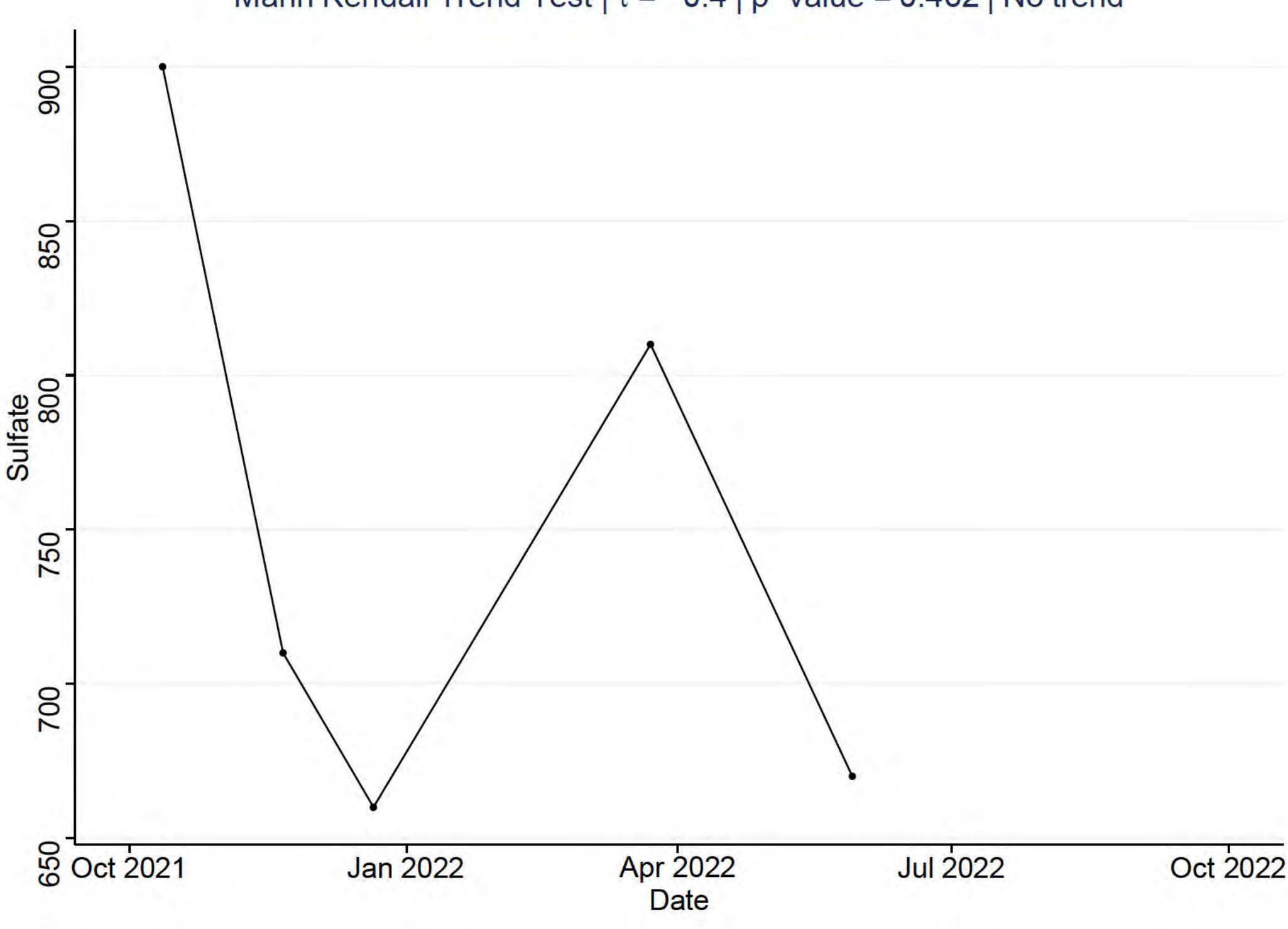

Site NNMW018 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Nickel
0.0040
0.0035
0.0030
0.0025
0.0020
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

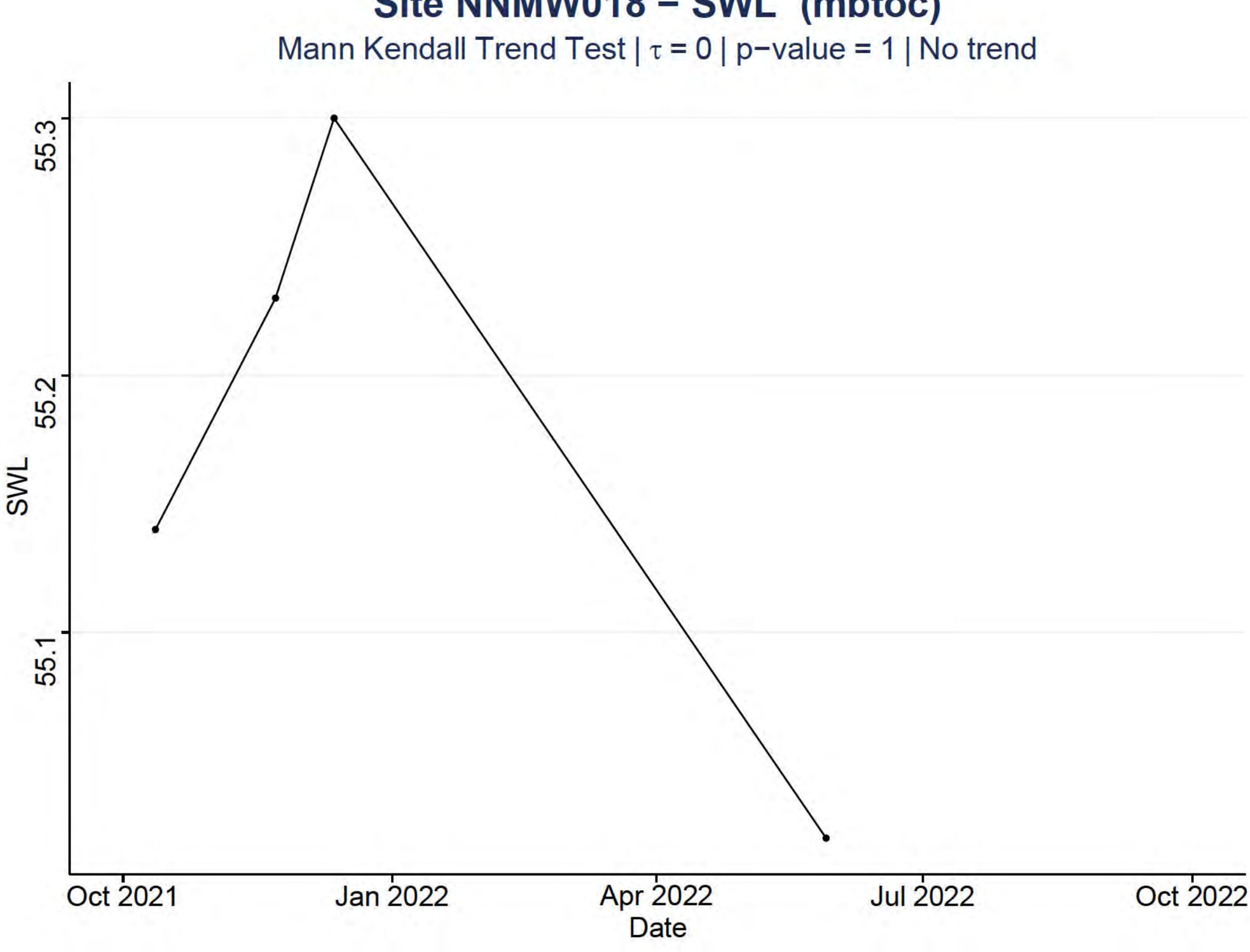

Site NNMW018 – pH(pH Unit)
Mann Kendall Trend Test | τ = −1 | p−value = 0.0275 | Negative trend
pH
7.75
7.50
7.25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

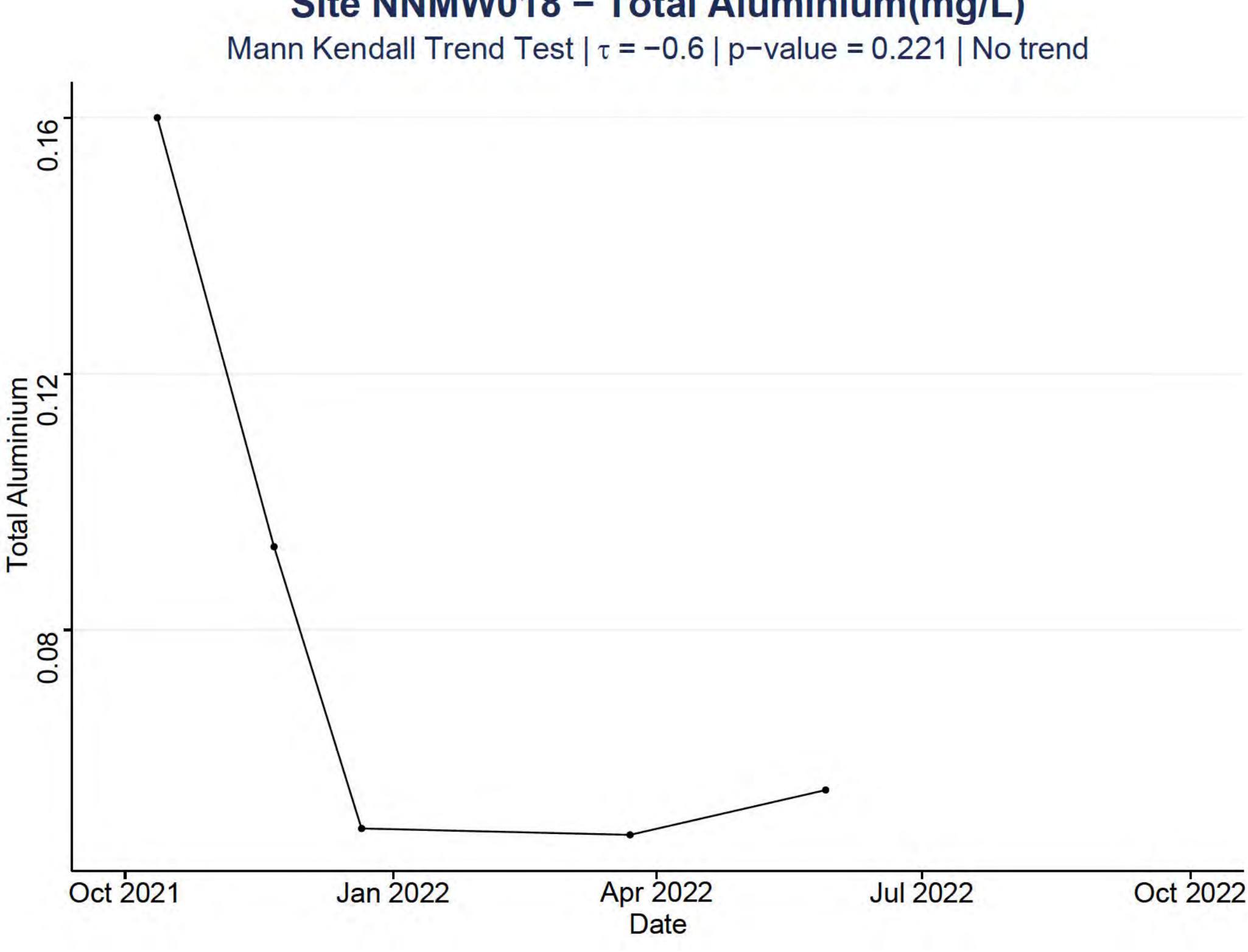

Site NNMW018 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.6 | p−value = 0.221 | No trend
Potassium
70
65
60
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

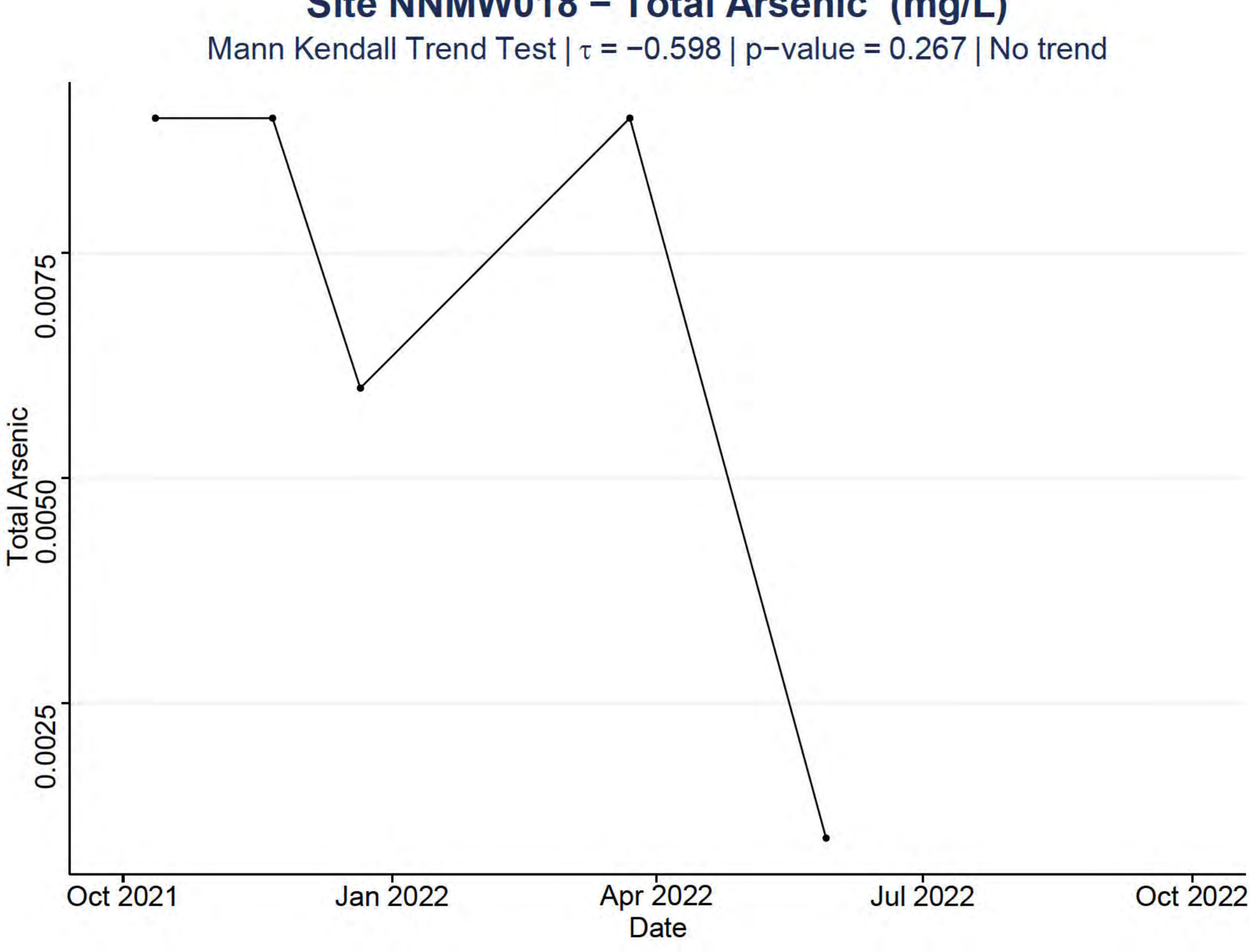

Site NNMW018 – Silver (mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Silver
0.000
0.001
0.002
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

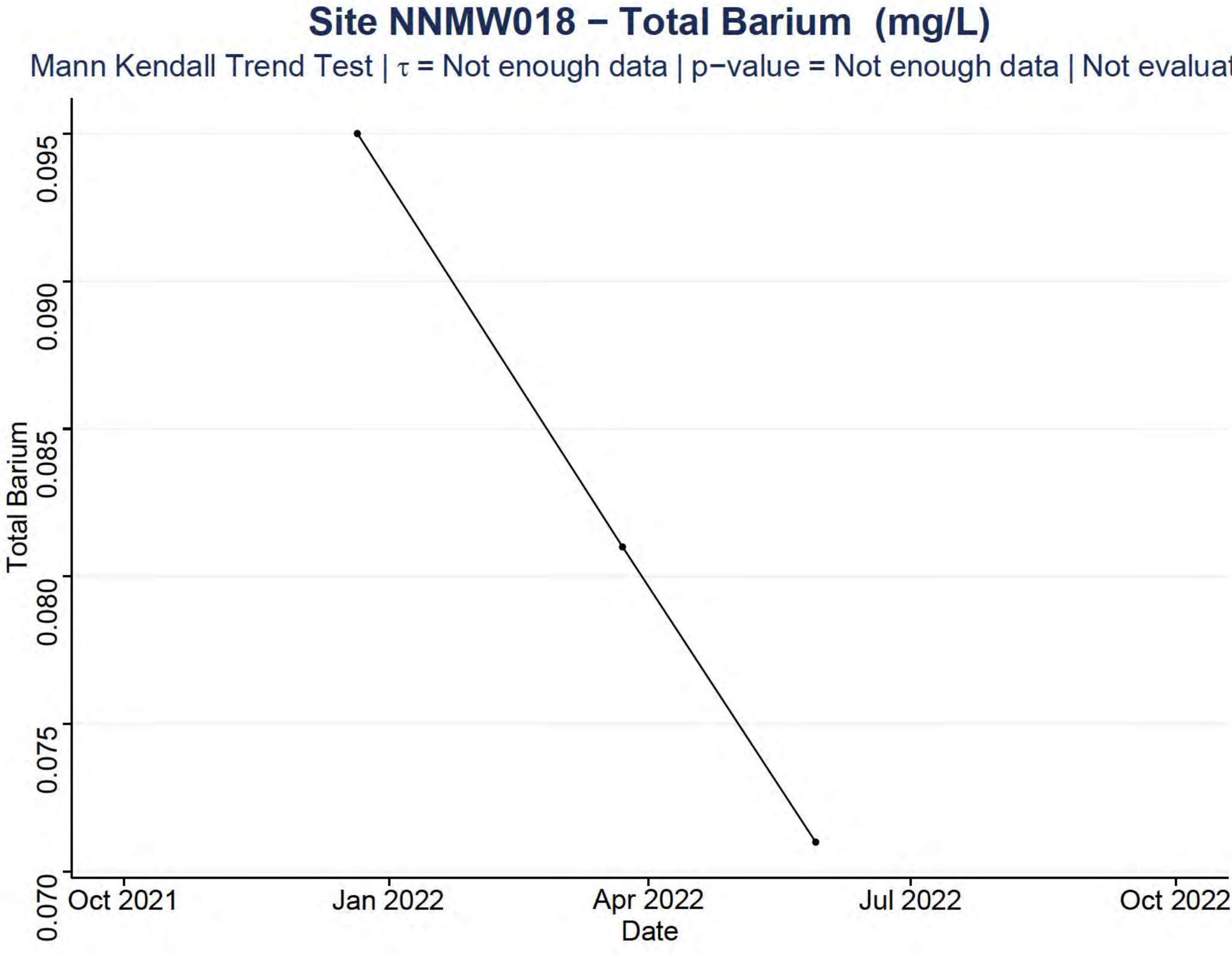

Site NNMW018 – Sodium(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Sodium
1800
1600
1400
1200
1000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

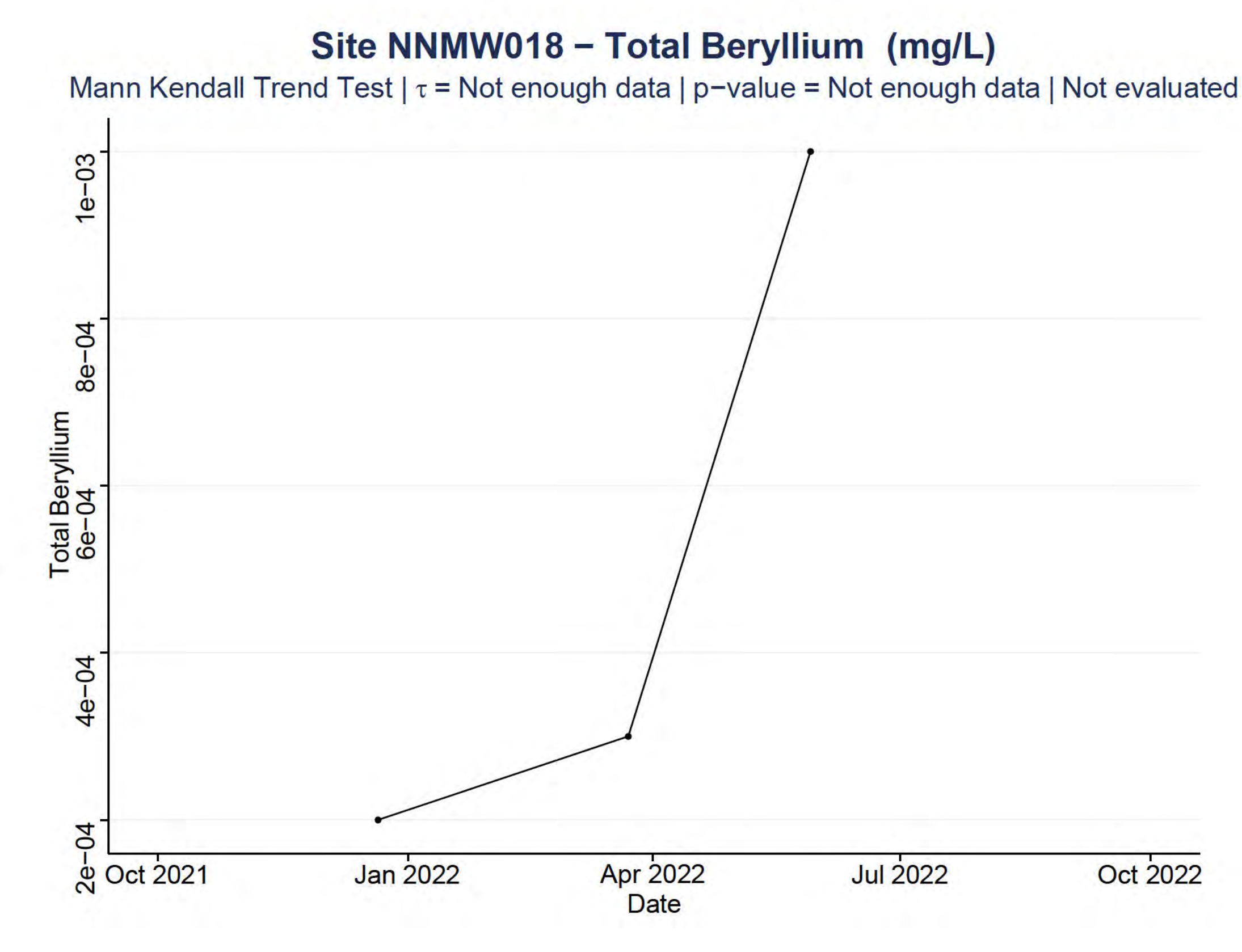

Site NNMW018 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = −0.4 | p−value = 0.462 | No trend
Sulfate
900
850
800
750
700
650
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

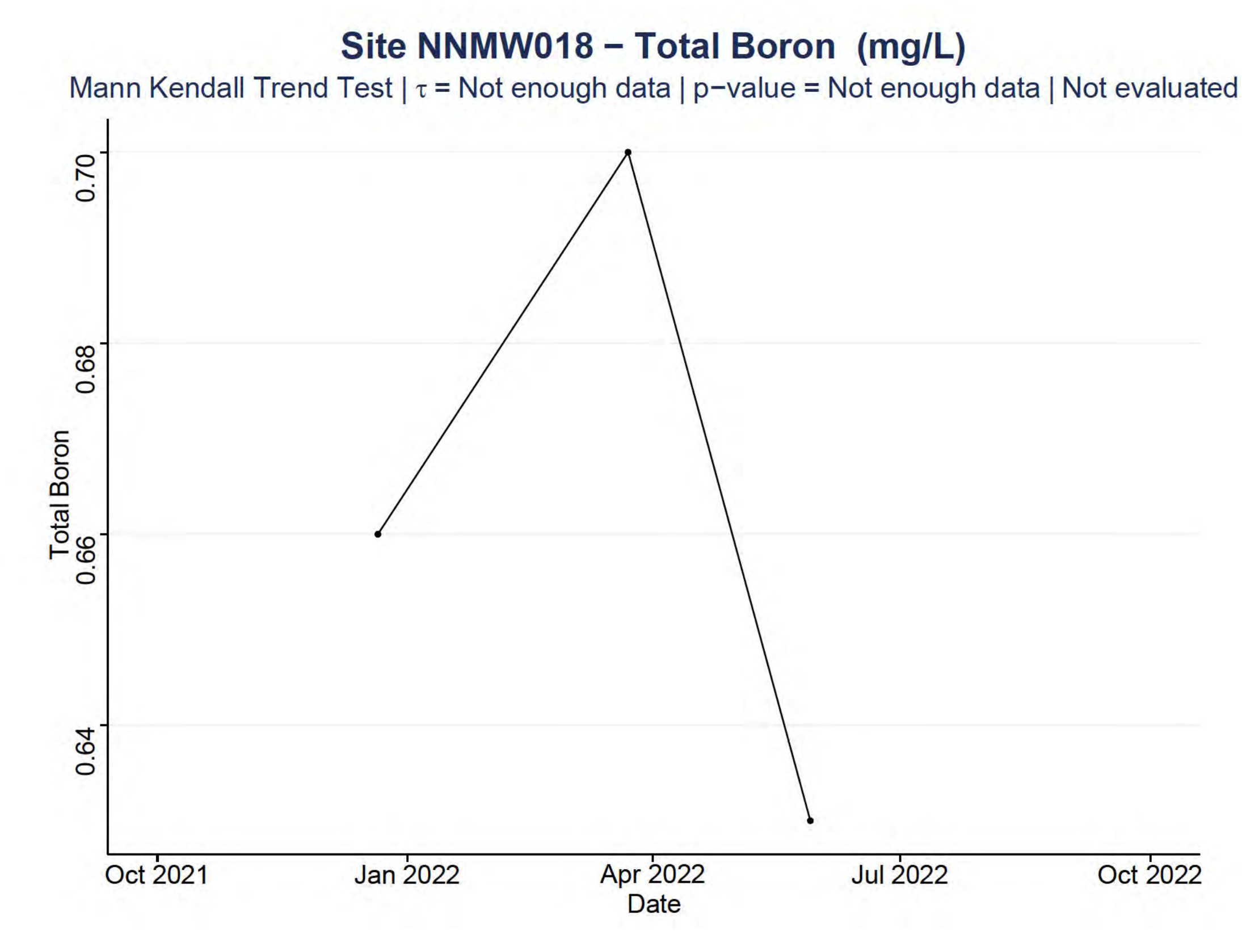

Site NNMW018 – SWL (mbtoc)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
SWL
55.3
55.2
55.1
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

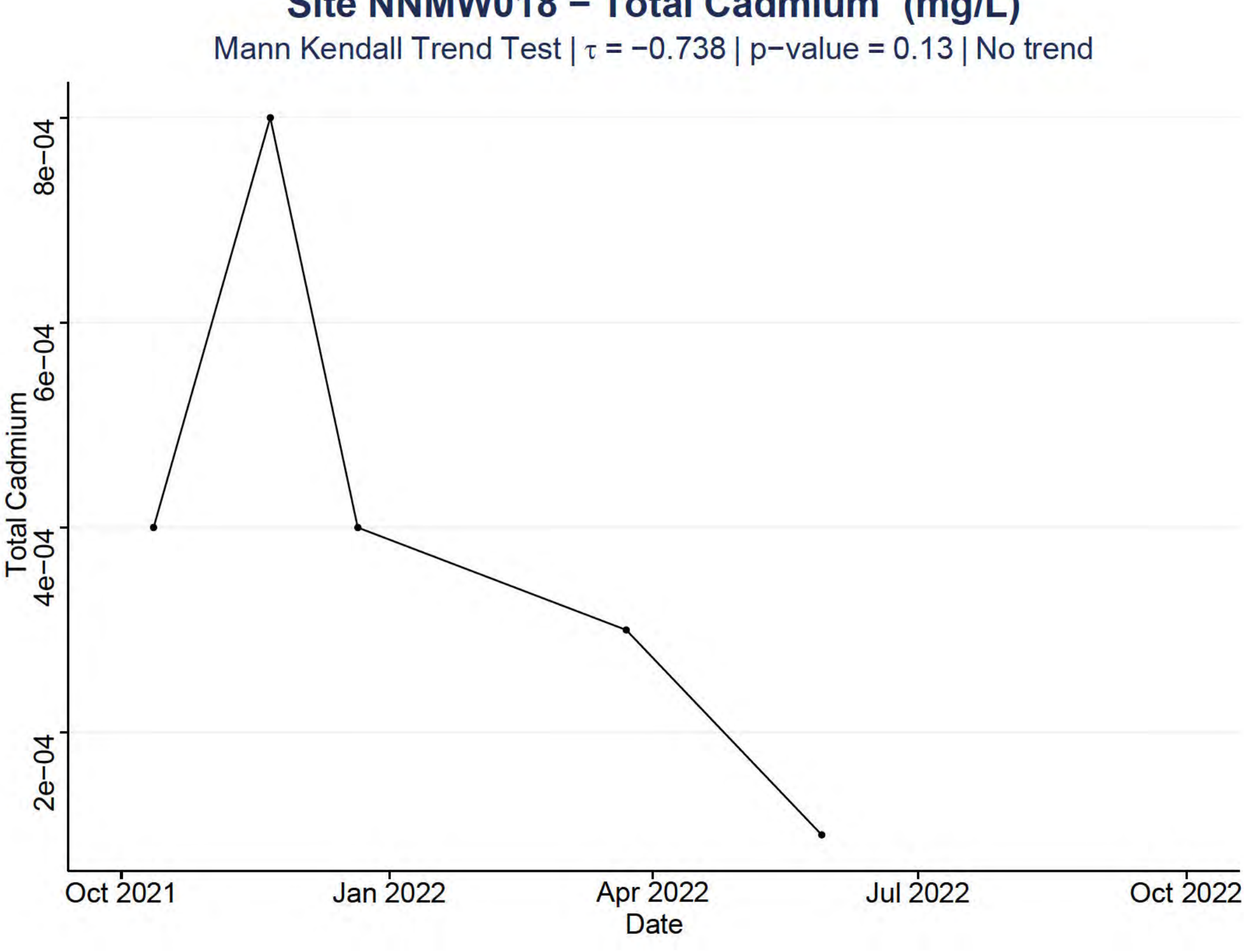

Site NNMW018 − Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.6 | p−value = 0.221 | No trend
Total Aluminium
0.16
0.12
0.08
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

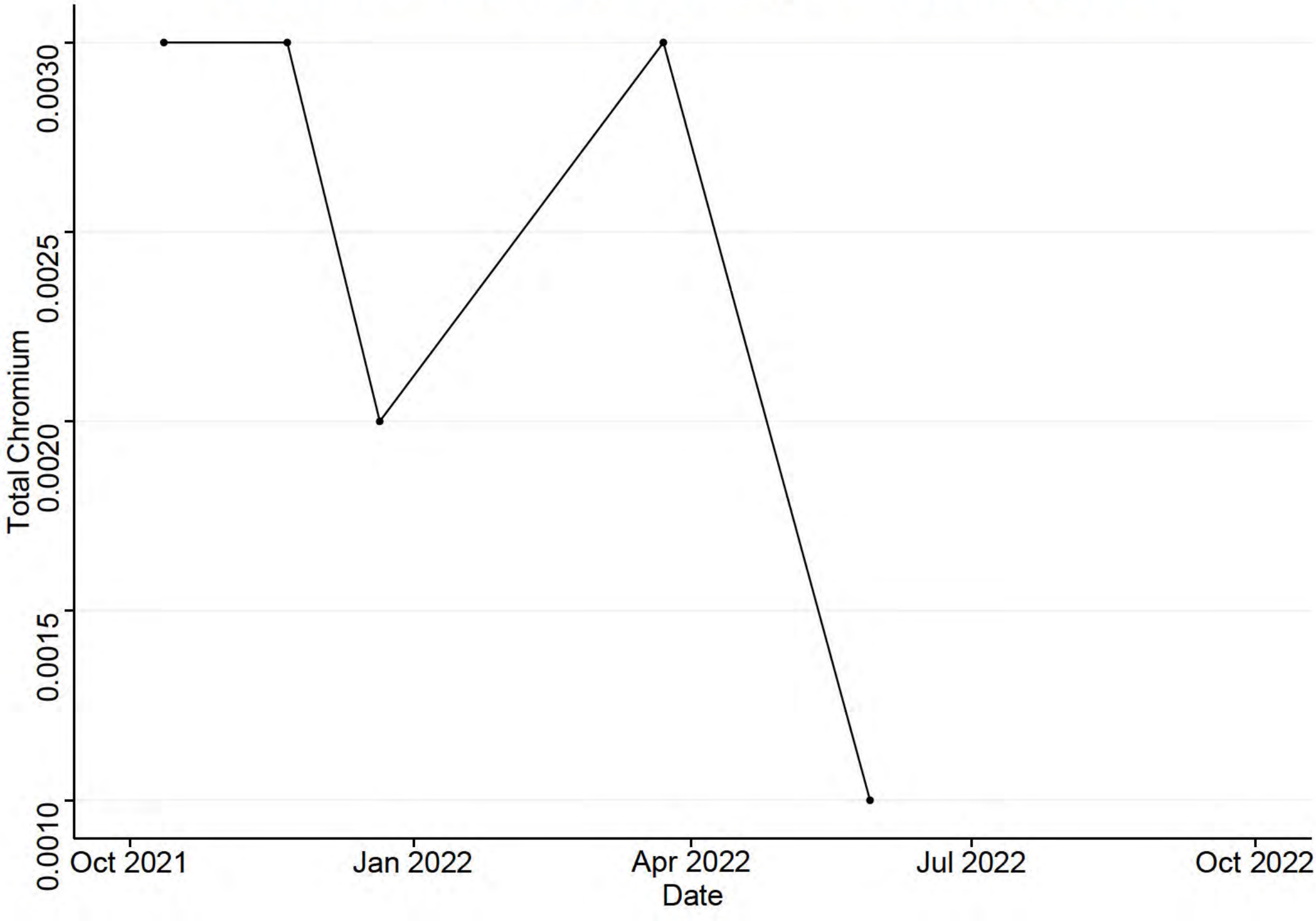

Site NNMW018 – Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

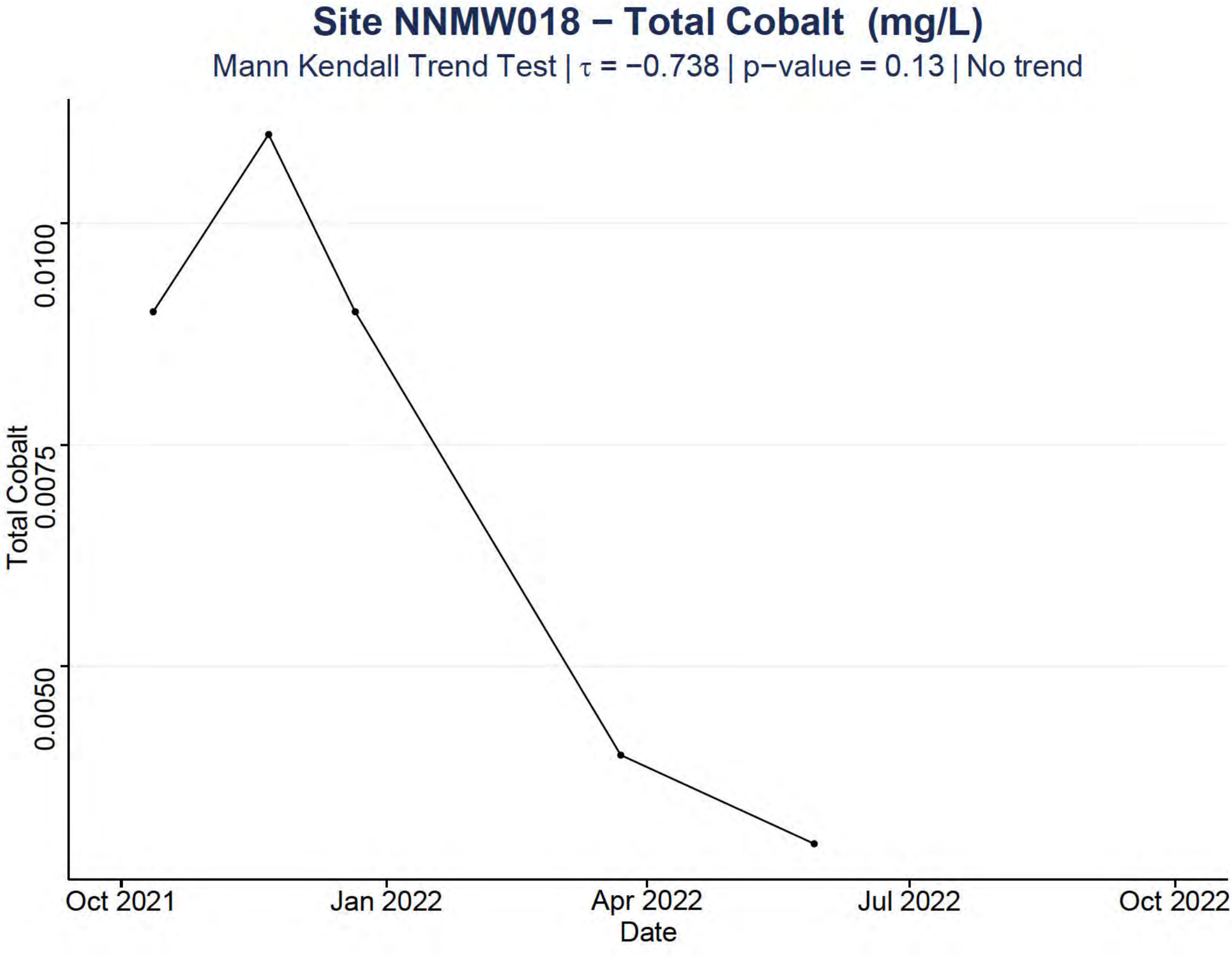

Site NNMW018 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Barium
0.095
0.090
0.085
0.080
0.075
0.070
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

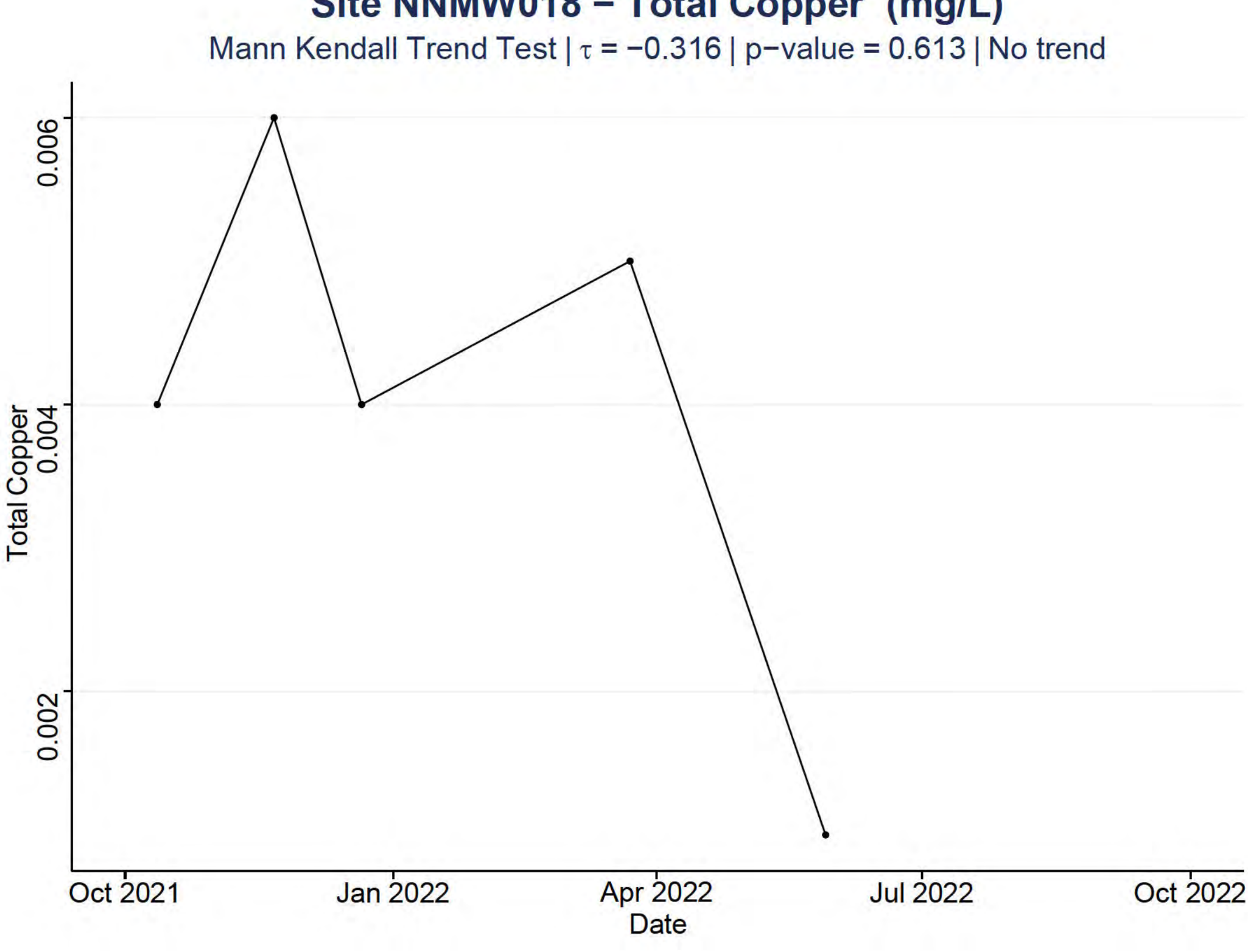

Site NNMW018 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Beryllium
1e−03
8e−04
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

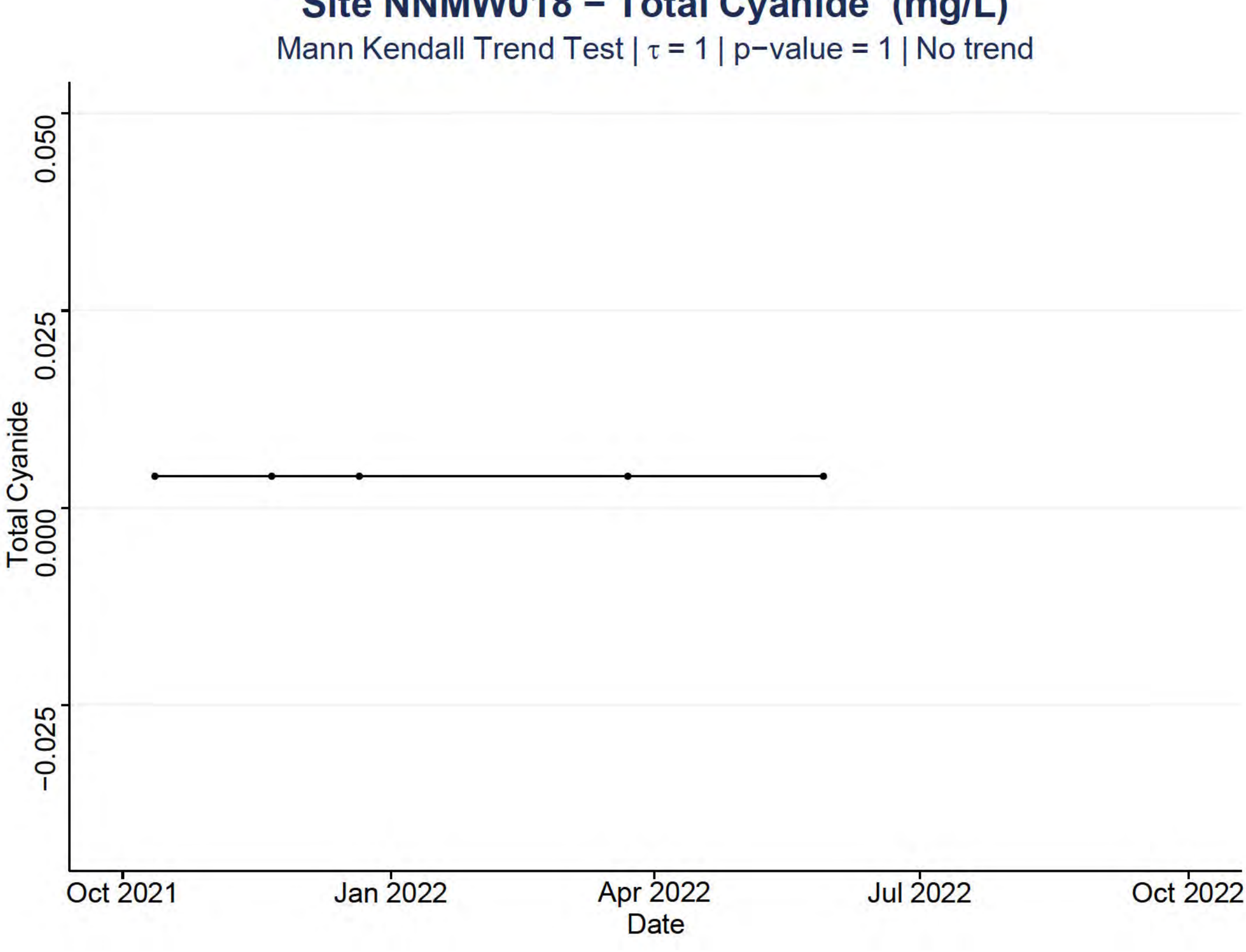

Site NNMW018 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Boron
0.70
0.68
0.66
0.64
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

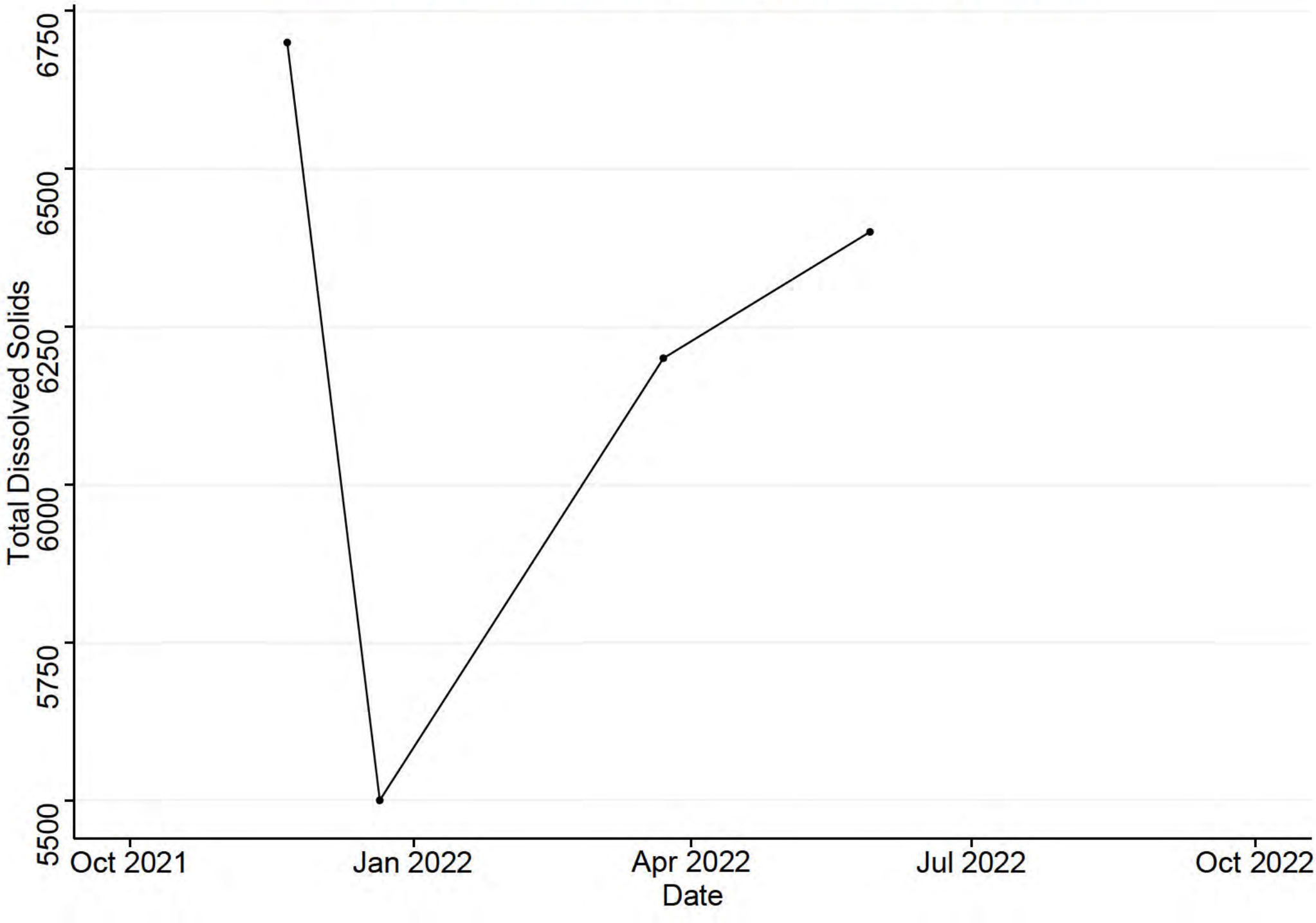

Site NNMW018 − Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.738 | p−value = 0.13 | No trend
Total Cadmium
8e−04
6e−04
4e−04
2e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

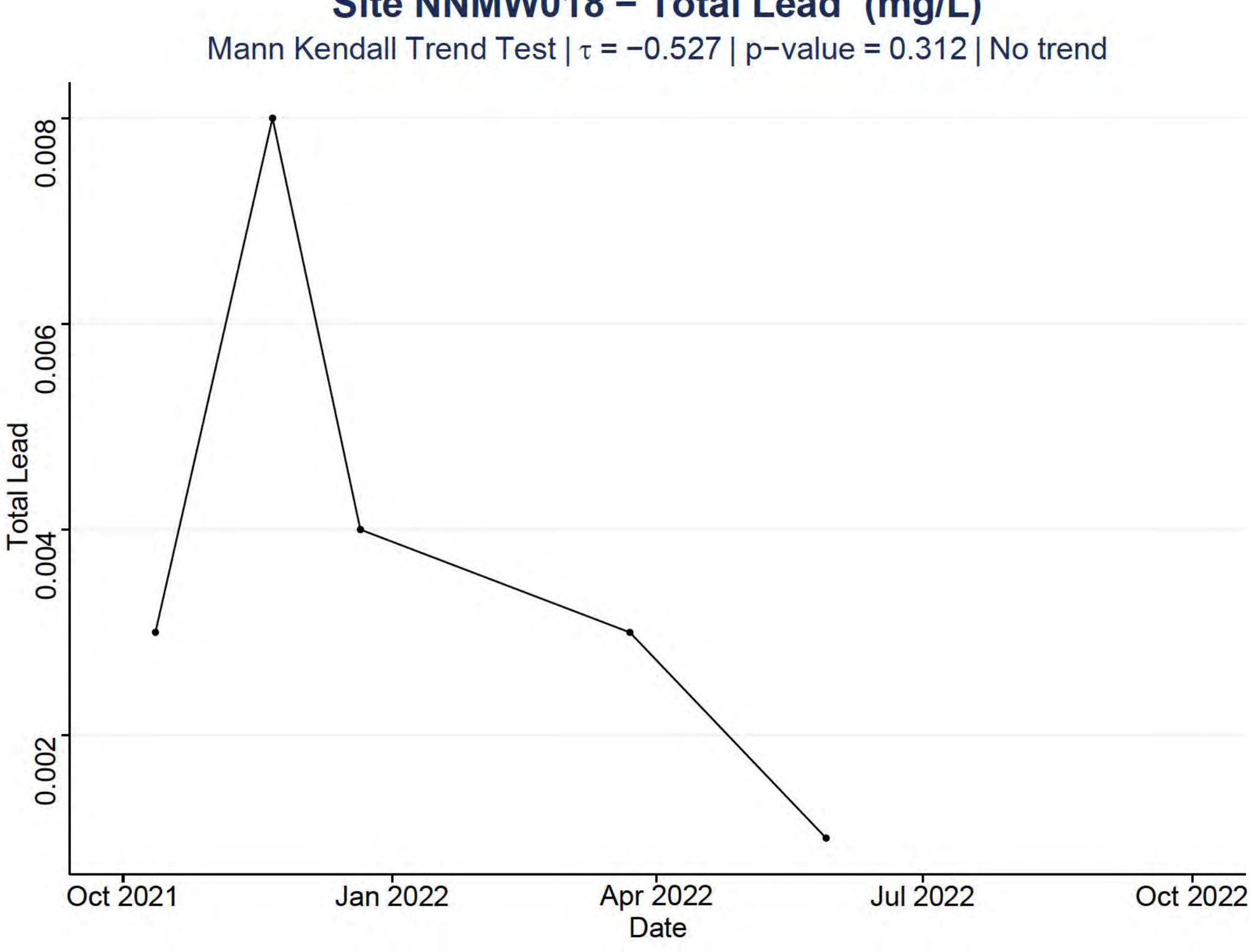

Site NNMW018 − Total Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.598 | p−value = 0.267 | No trend
Total Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

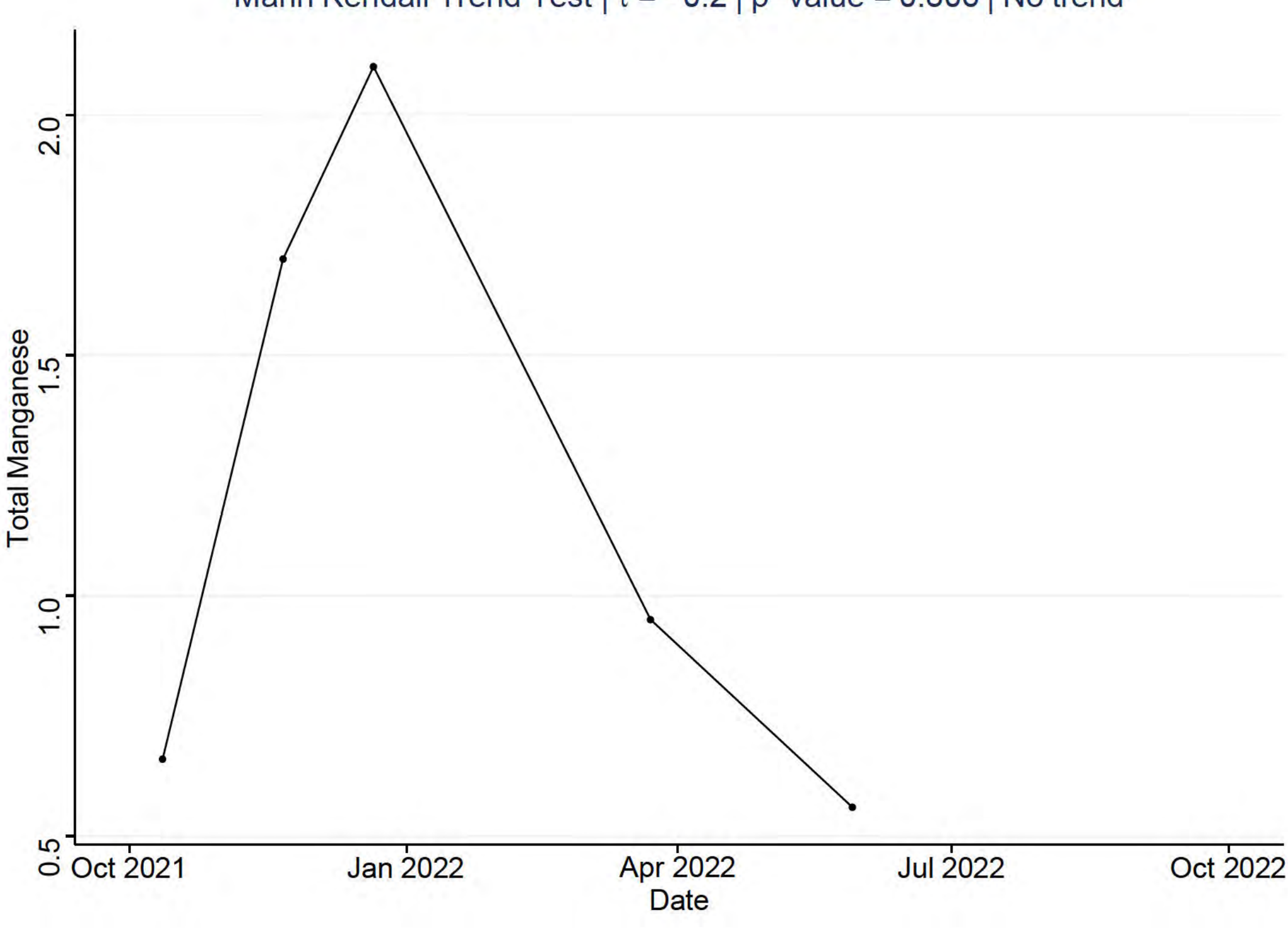

Site NNMW018 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.738 | p−value = 0.13 | No trend
Total Cobalt
0.0100
0.0075
0.0050
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

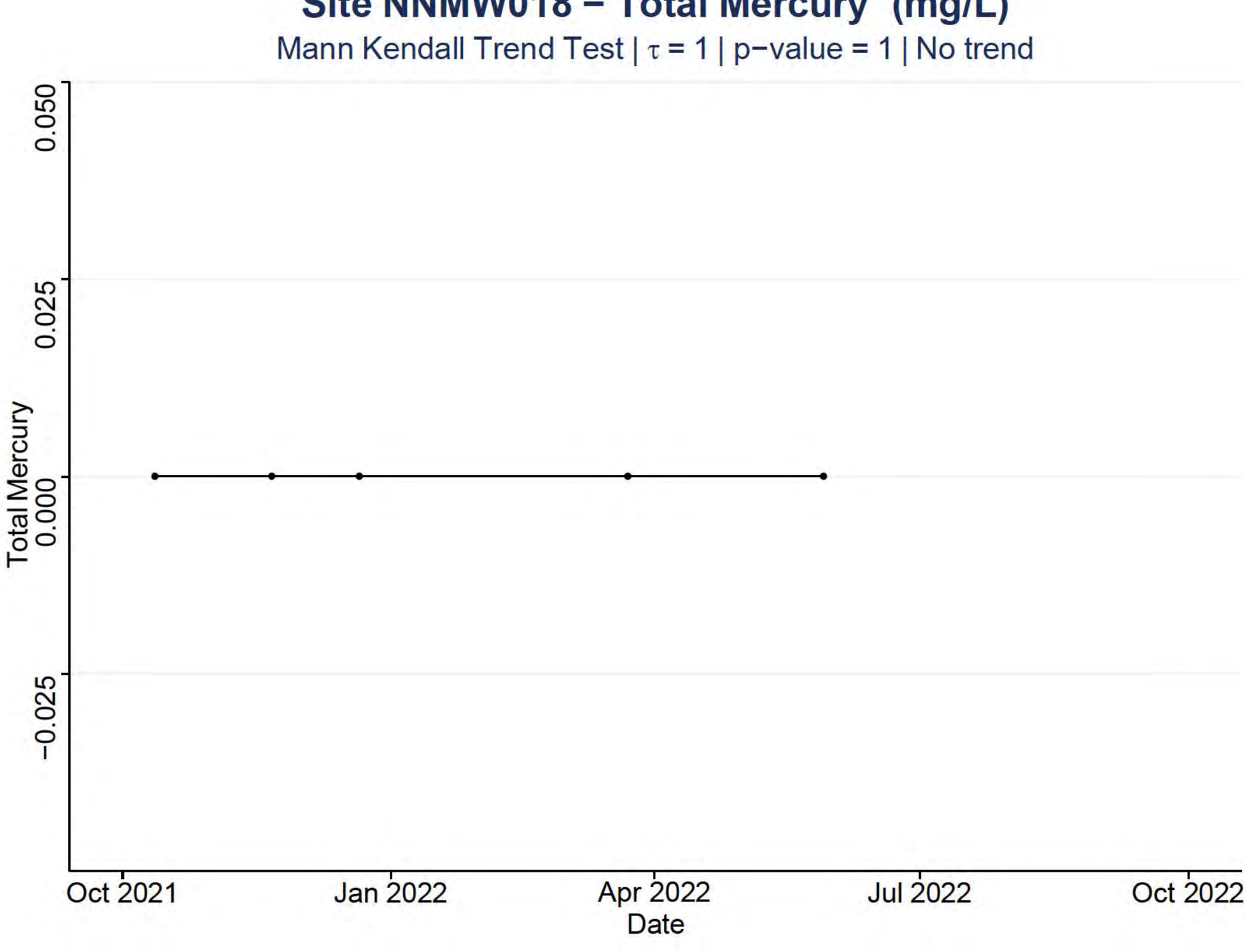

Site NNMW018 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Total Copper
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

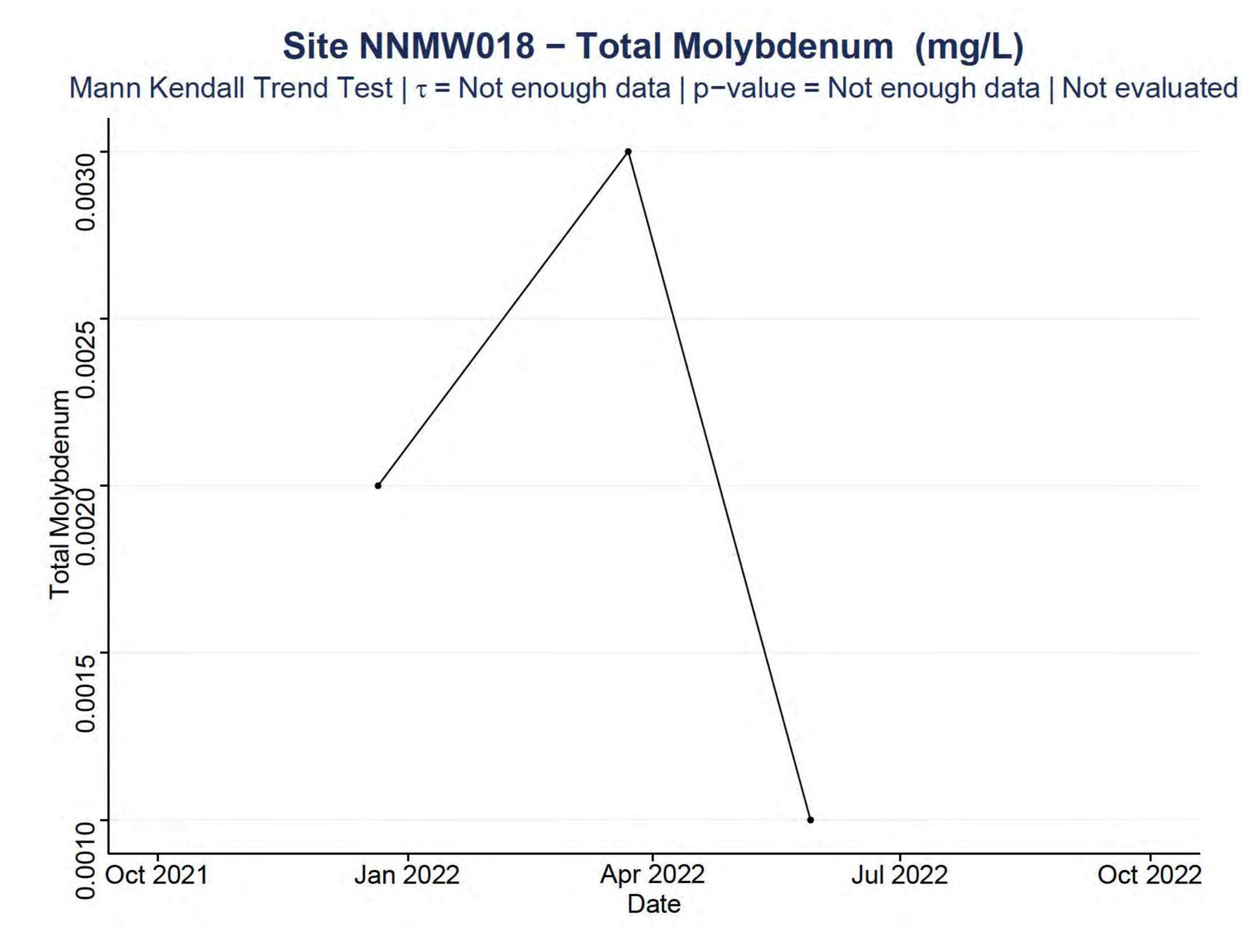

Site NNMW018 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

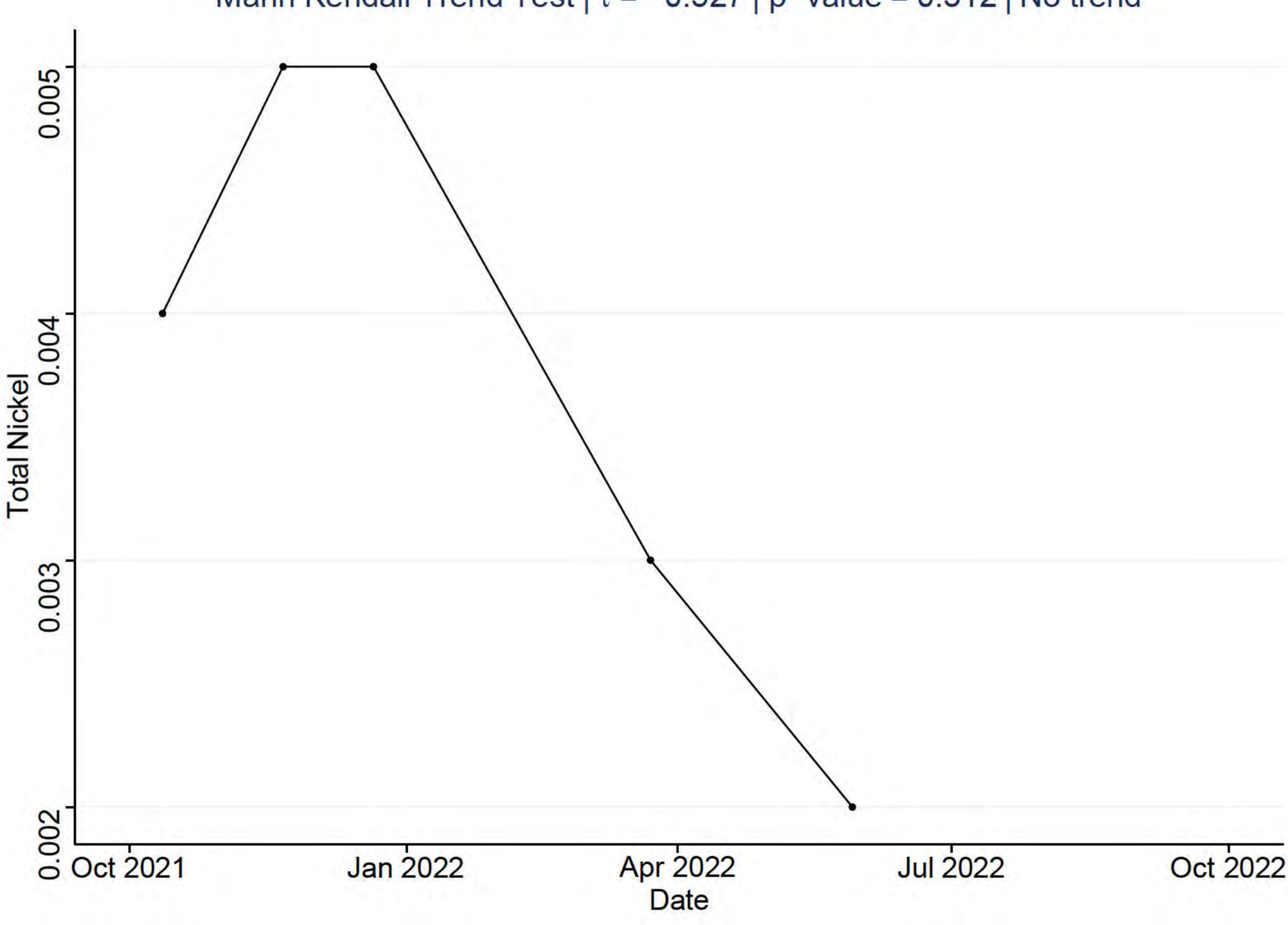

Site NNMW018 – Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Total Dissolved Solids
6750
6500
6250
6000
5750
5500
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

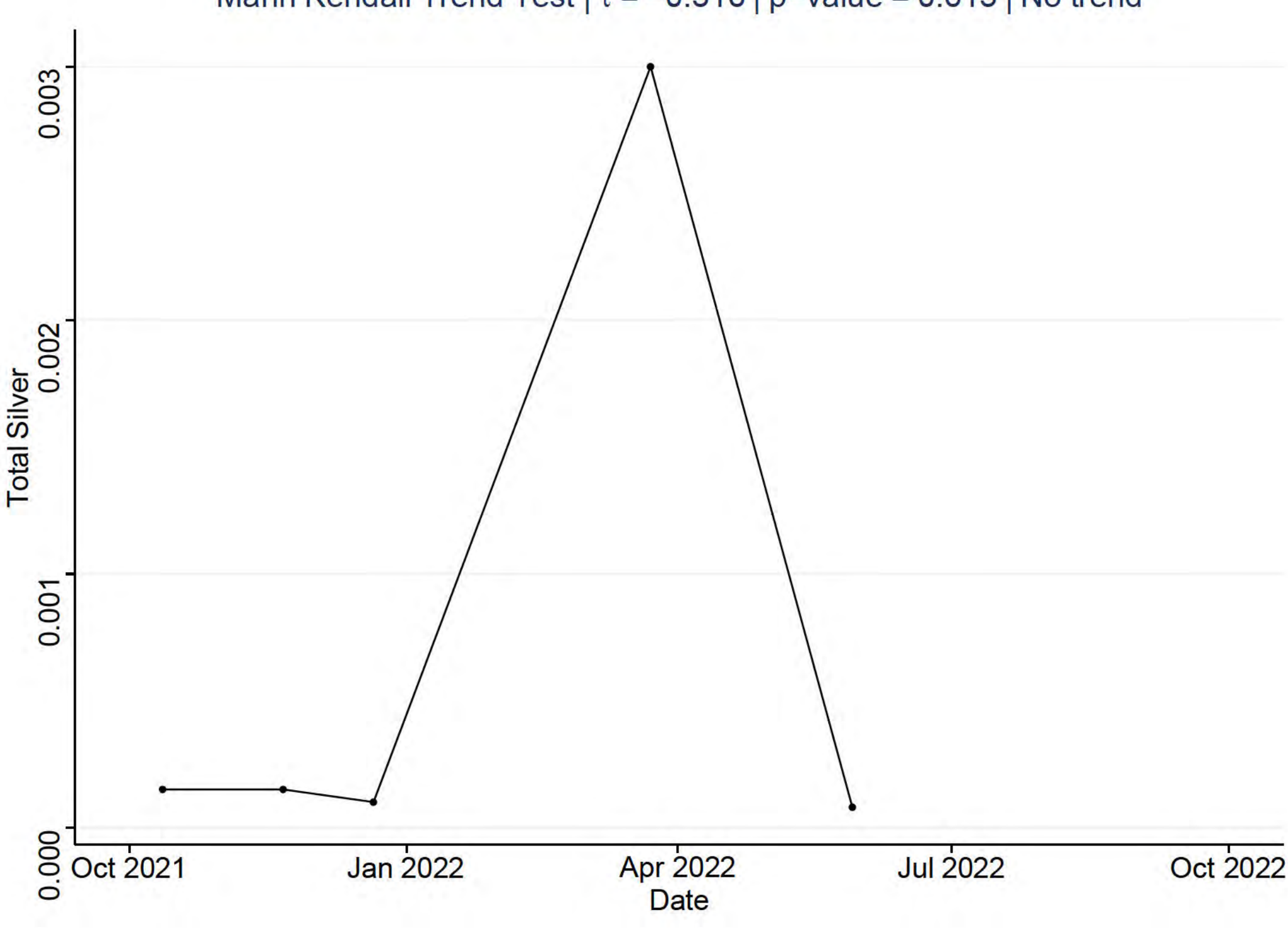

Site NNMW018 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Total Lead
0.002
0.004
0.006
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

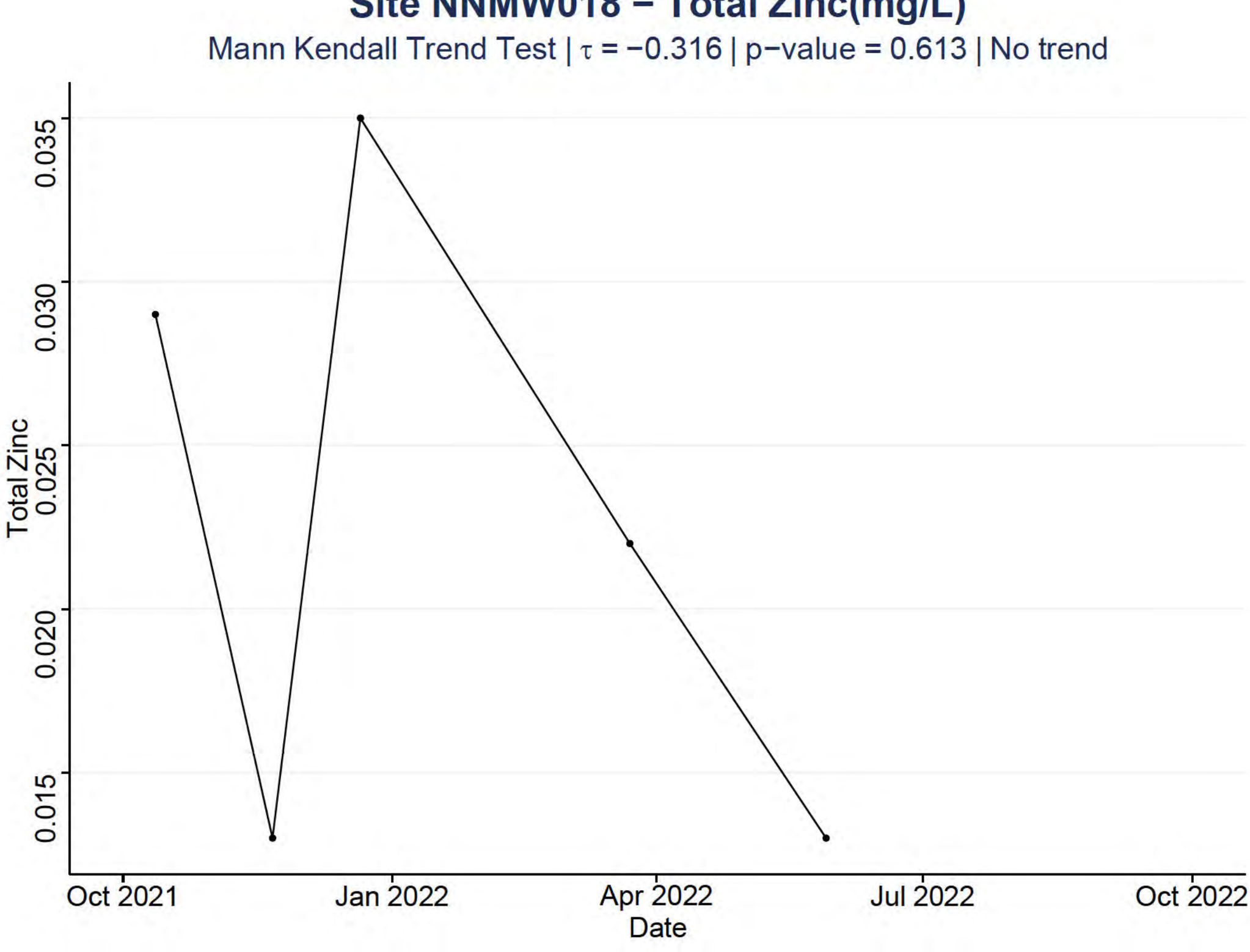

Site NNMW018 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Total Manganese
2.0
1.5
1.0
0.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

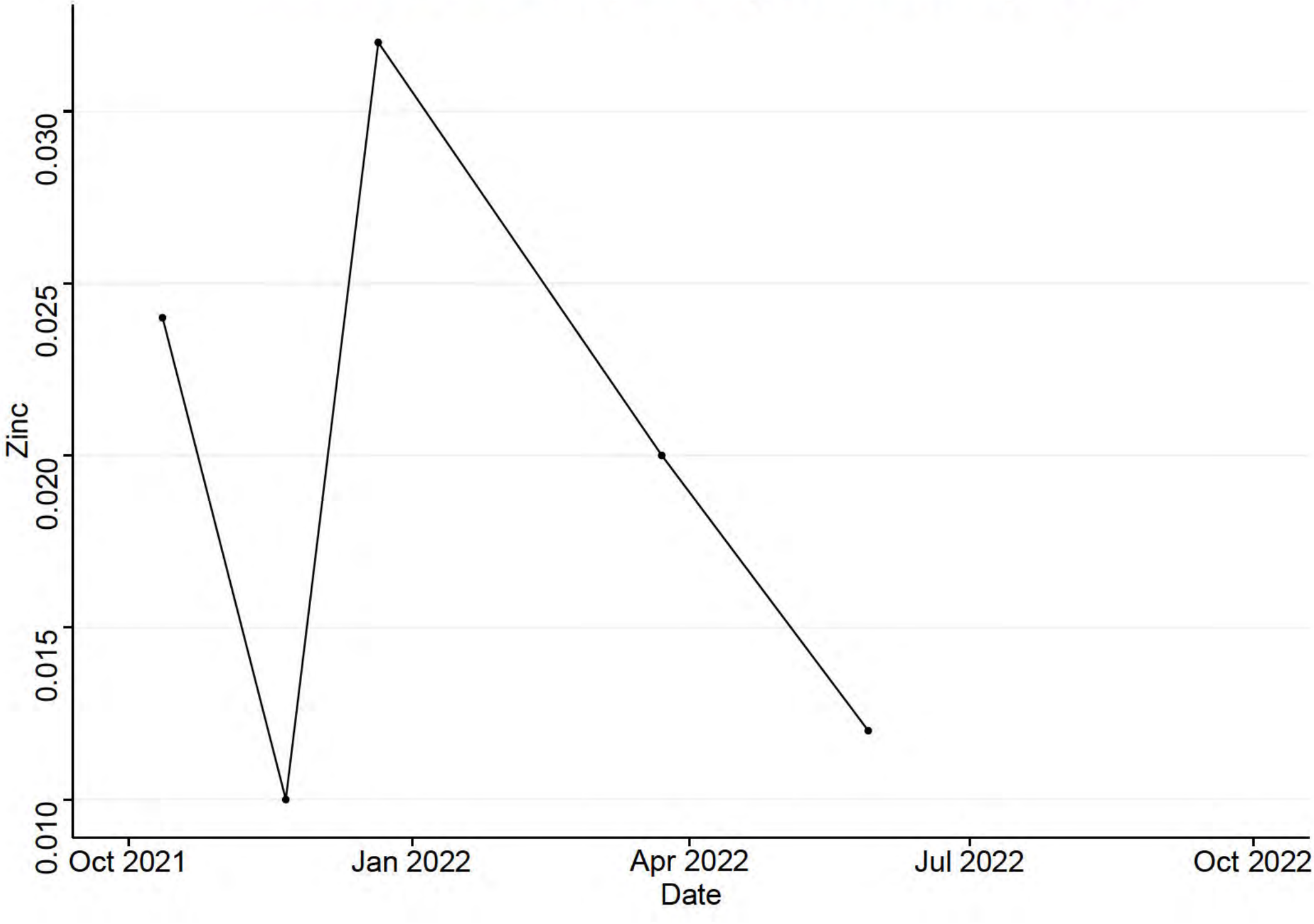

Site NNMW018 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

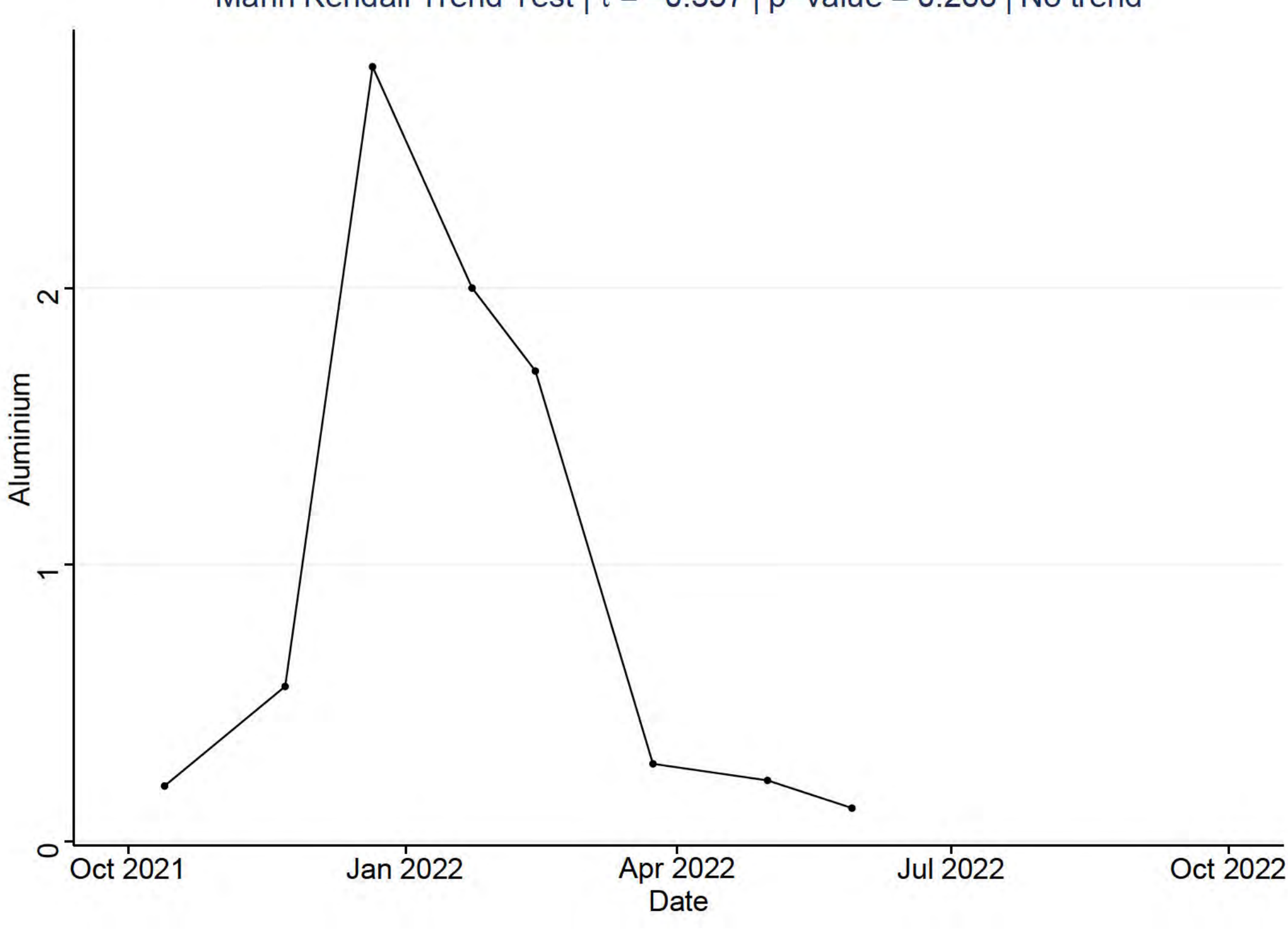

Site NNMW018 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = Not enough data | p−value = Not enough data | Not evaluated
Total Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

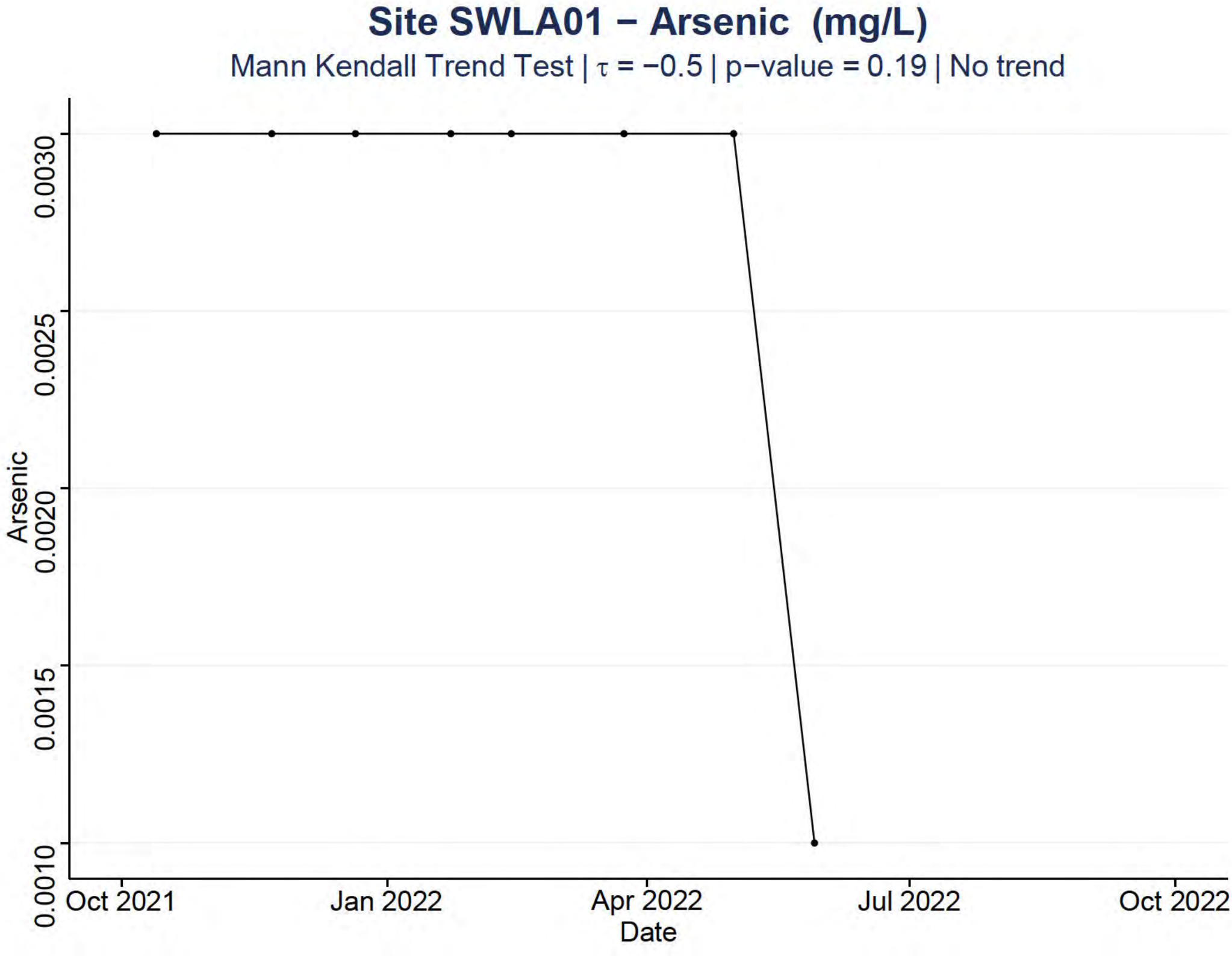

Site NNMW018 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.527 | p−value = 0.312 | No trend
Total Nickel
0.005
0.004
0.003
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

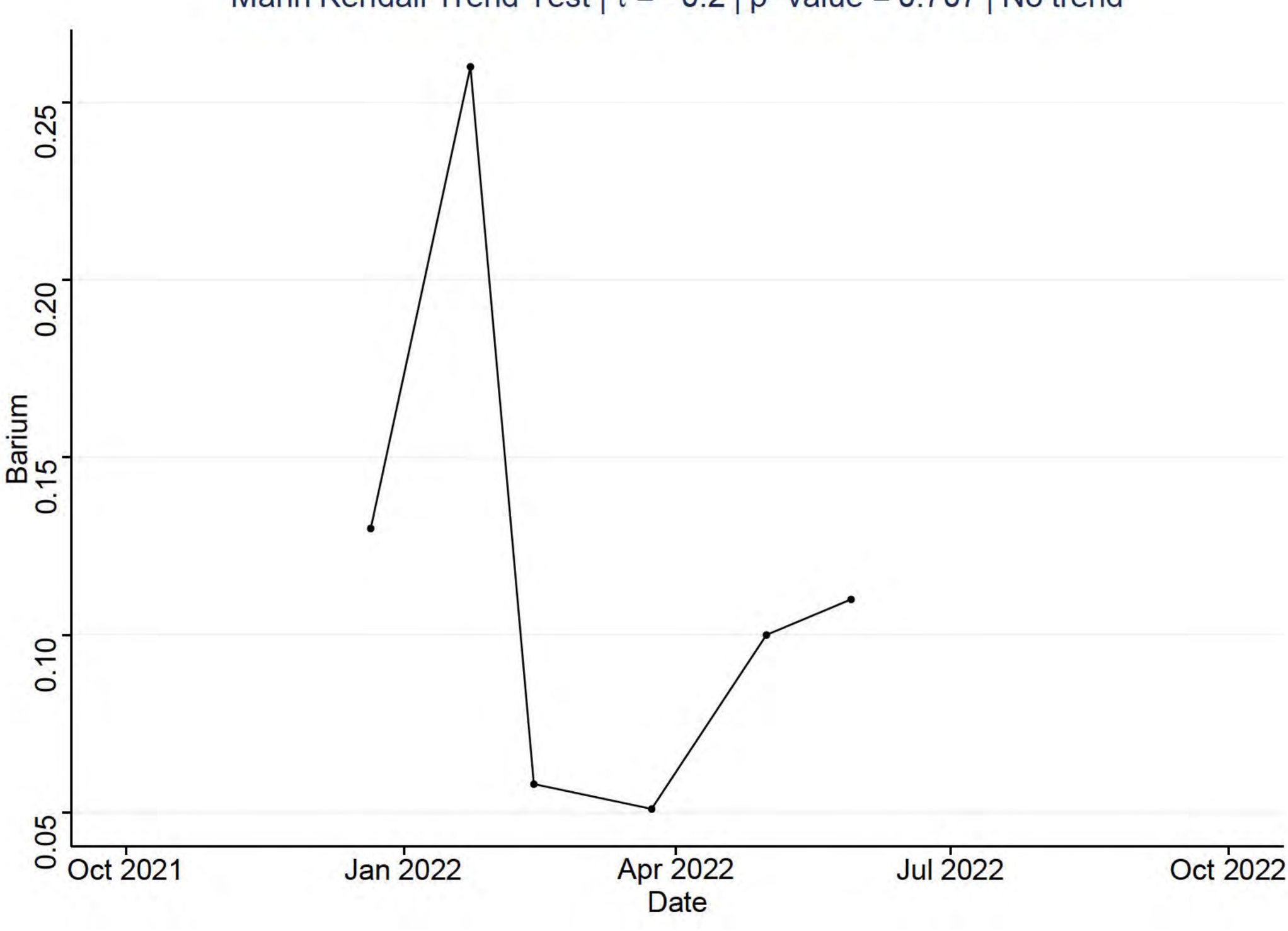

Site NNMW018 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Total Silver
0.003
0.002
0.001
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

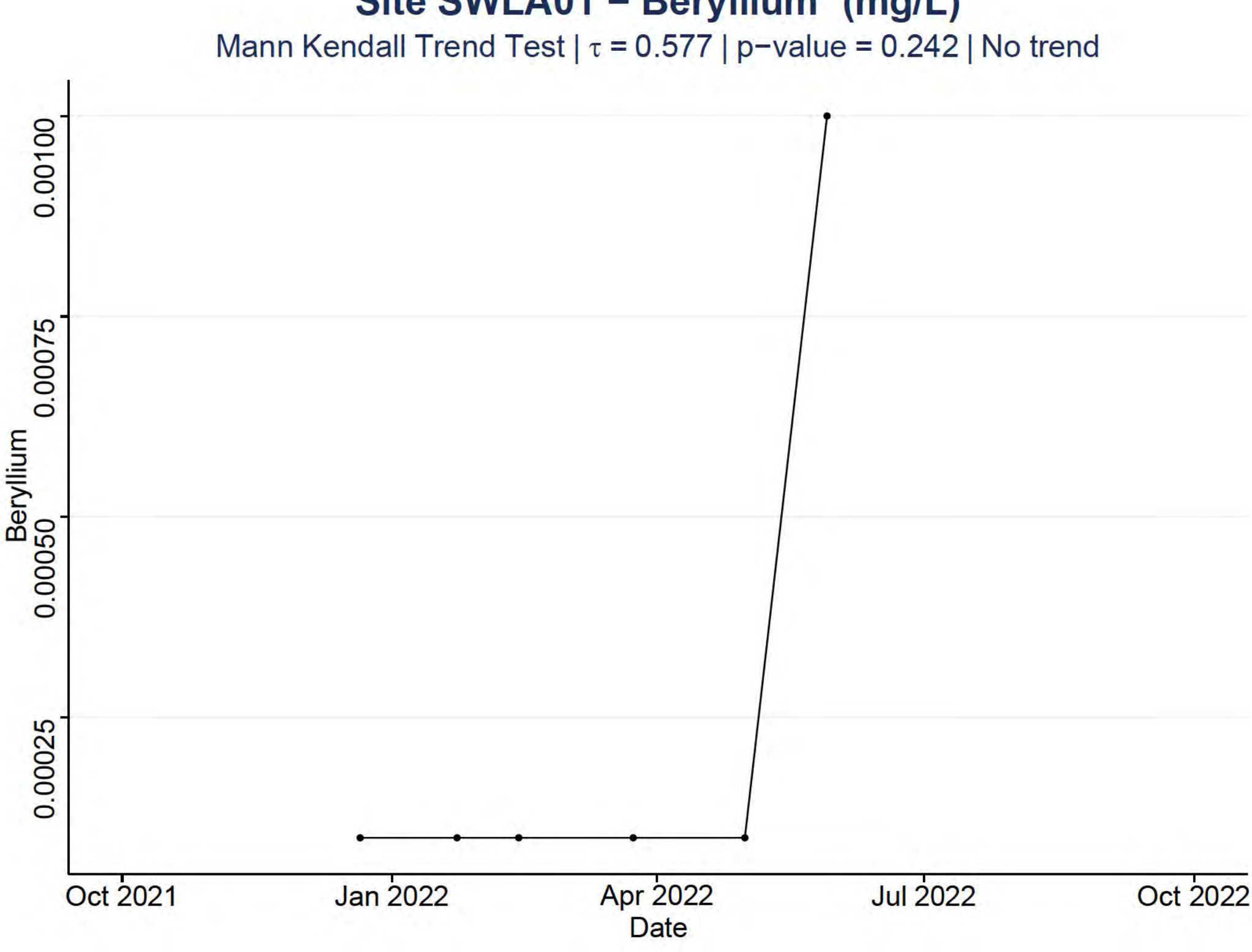

Site NNMW018 – Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.316 | p−value = 0.613 | No trend
Total Zinc
0.035
0.030
0.025
0.020
0.015
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

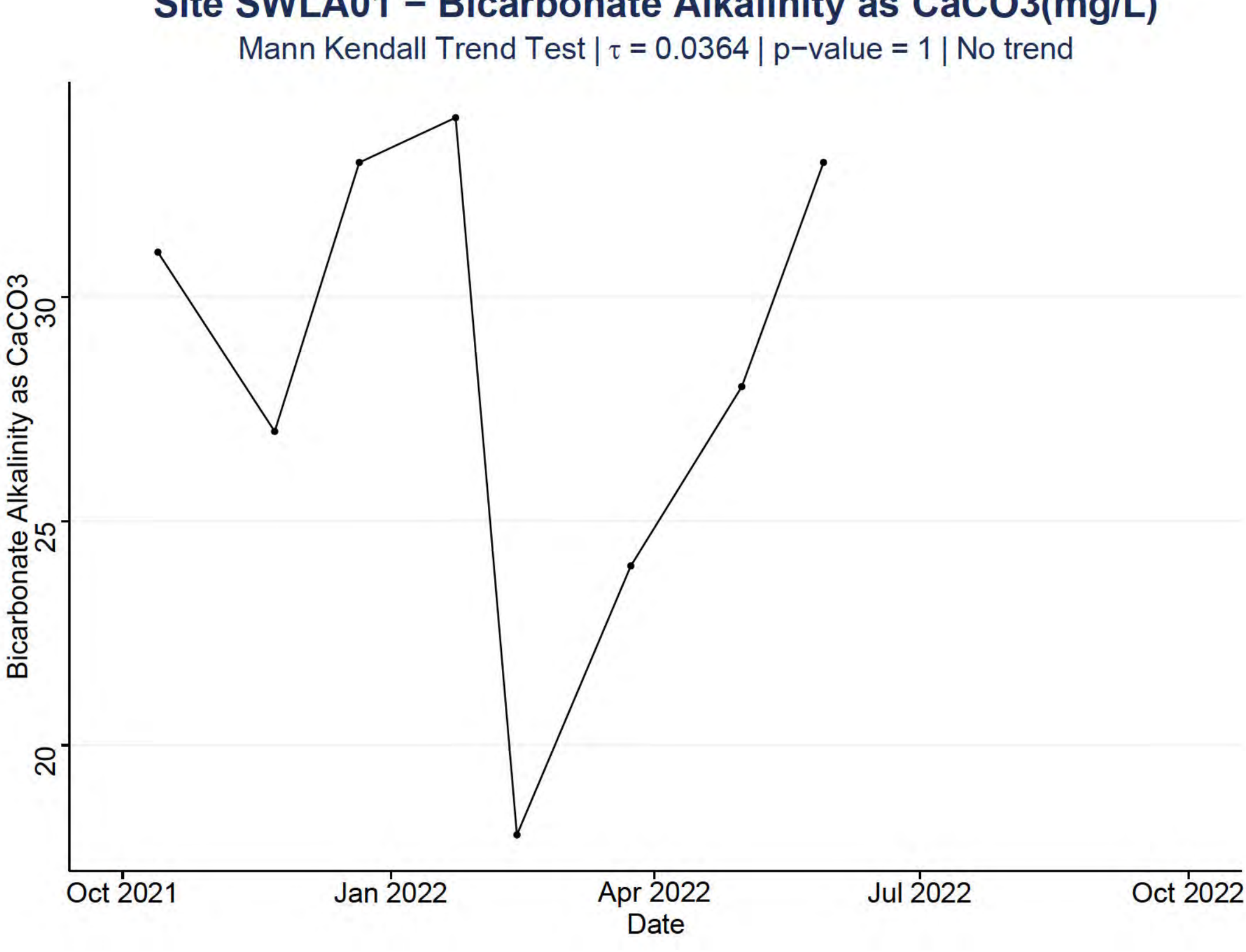

Site NNMW018 – Zinc (mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.806 | No trend
Zinc
0.010
0.015
0.020
0.025
0.030
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

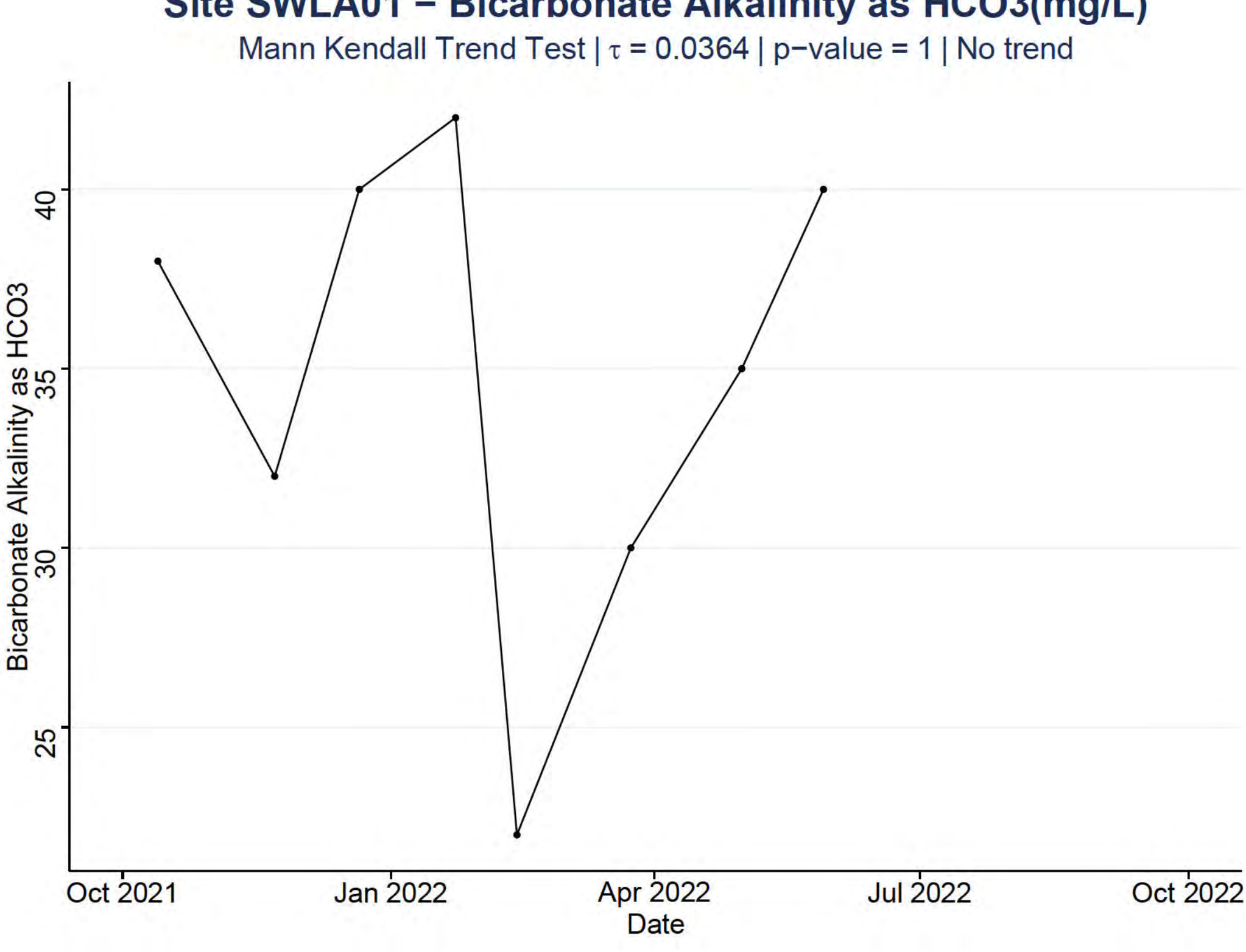

Site SWLA01 − Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.357 | p−value = 0.266 | No trend
Aluminium
0
1
2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

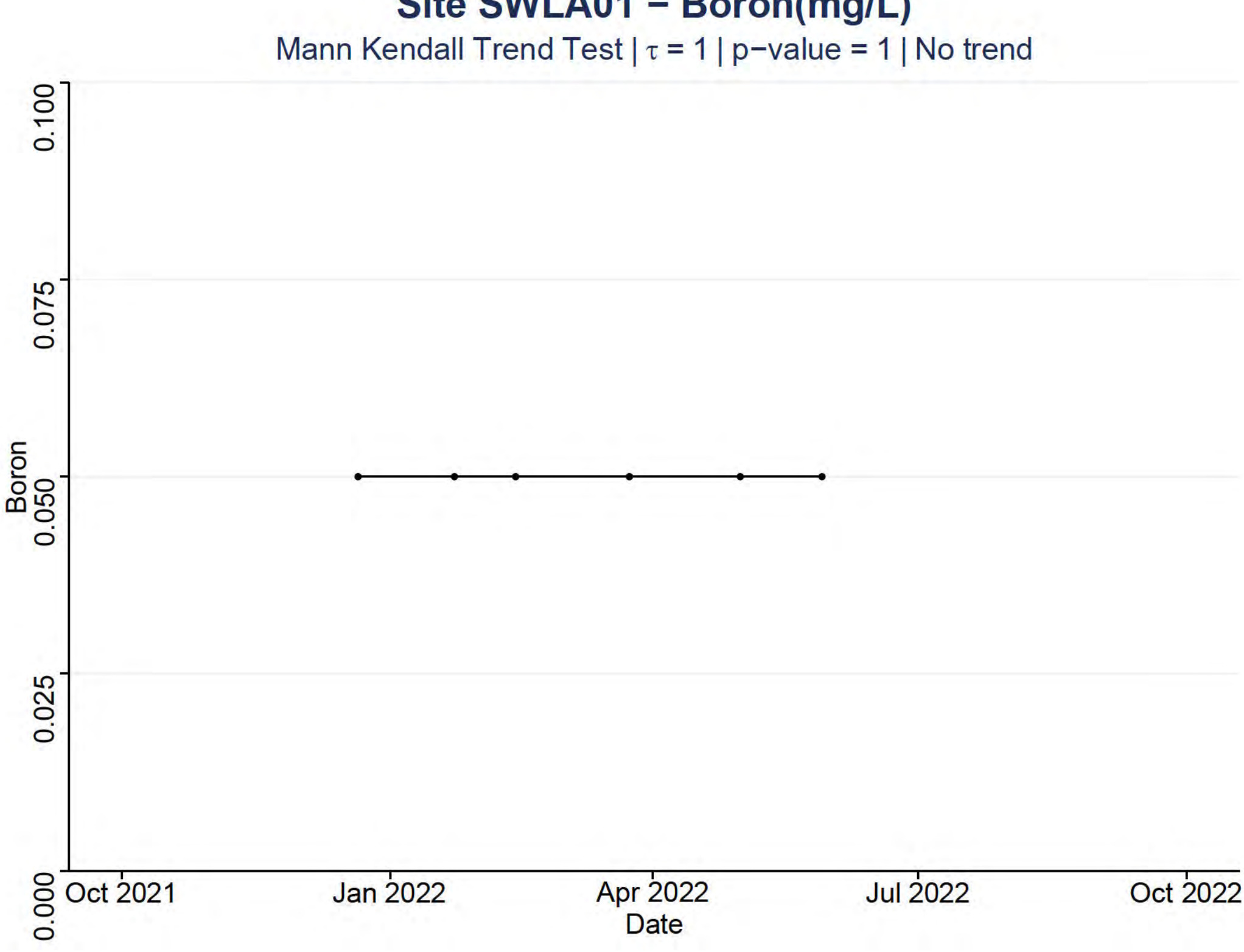

Site SWLA01 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Arsenic
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

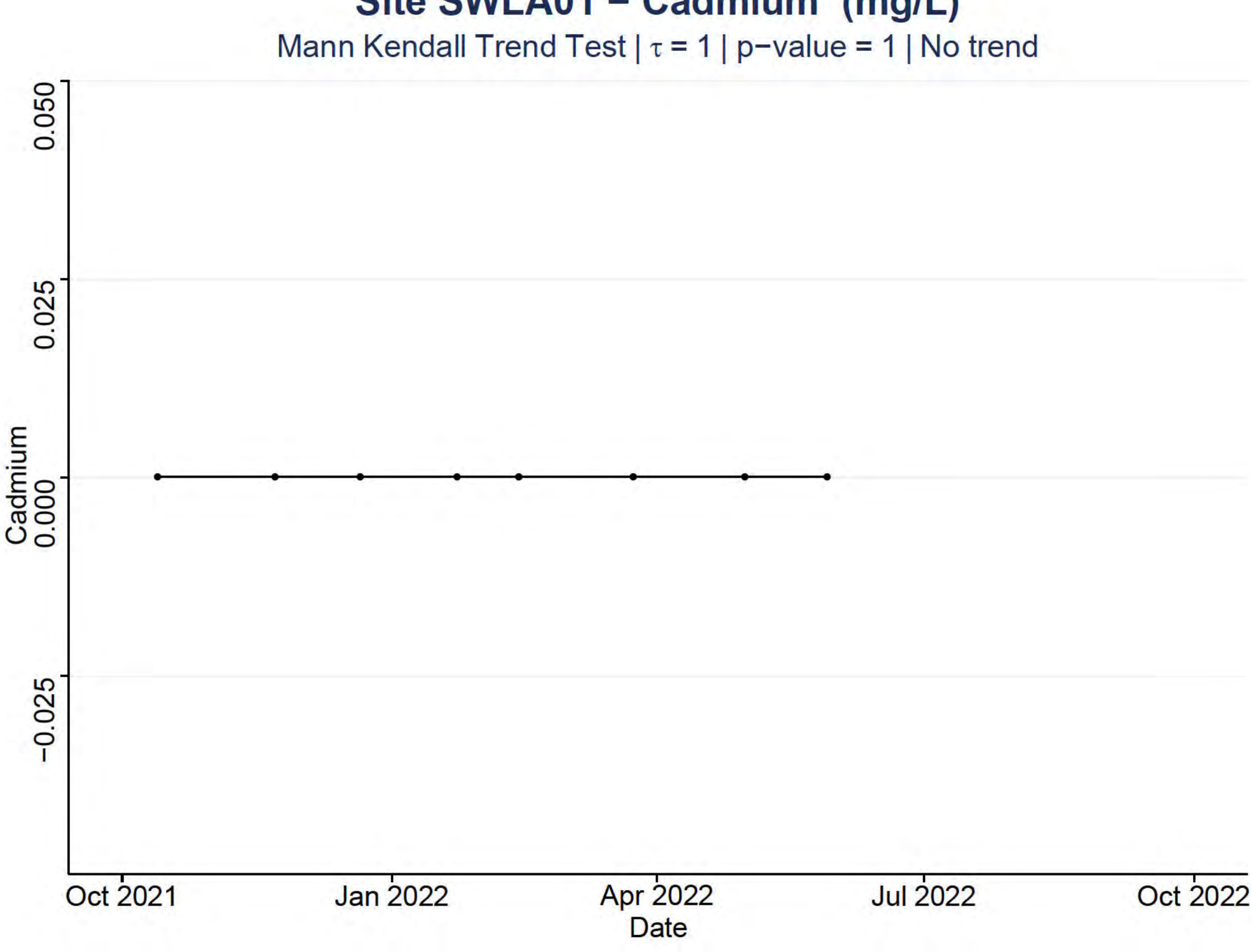

Site SWLA01 − Barium(mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.707 | No trend
Barium
0.25
0.20
0.15
0.10
0.05
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

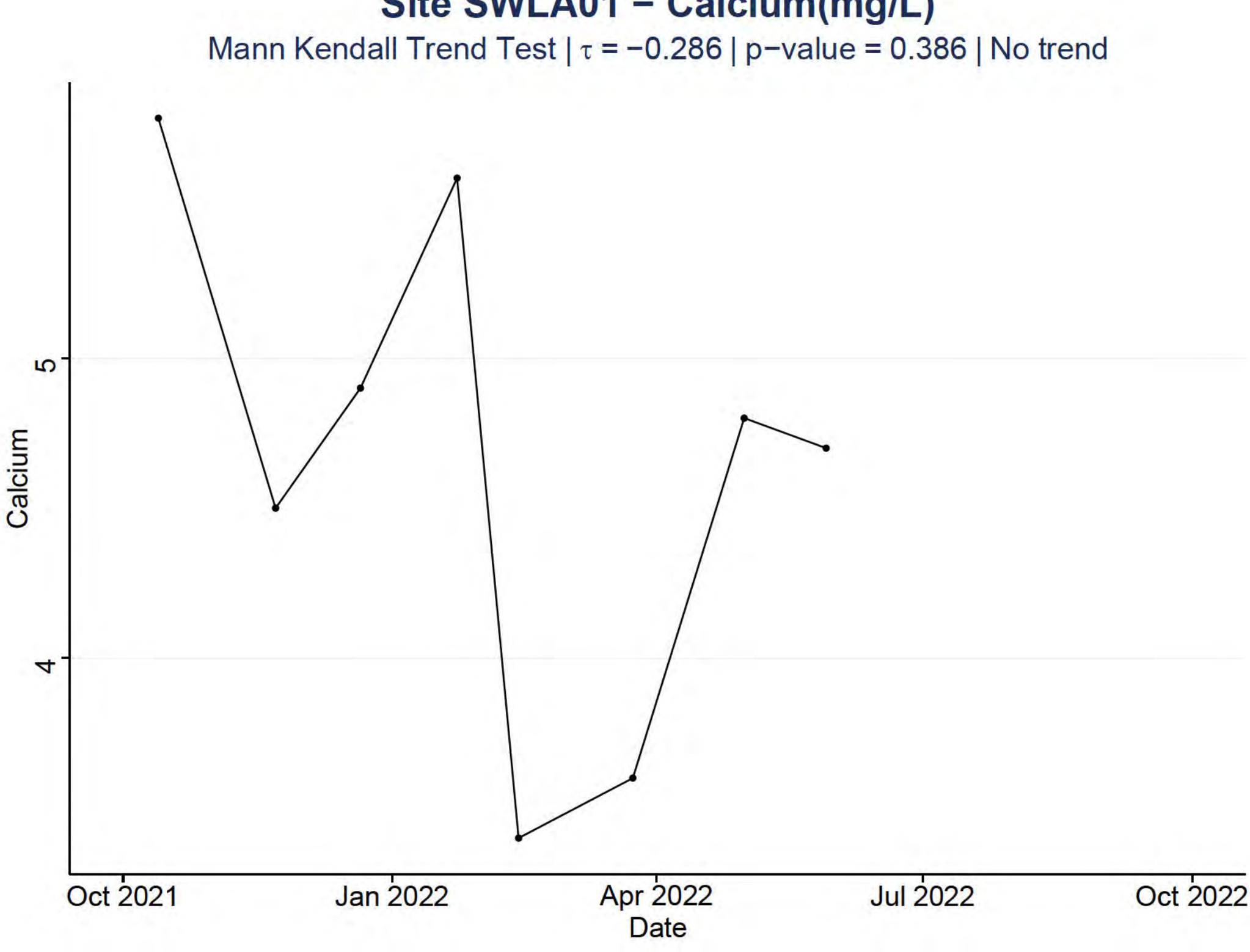

Site SWLA01 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Beryllium
0.00100
0.00075
0.00050
0.00025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

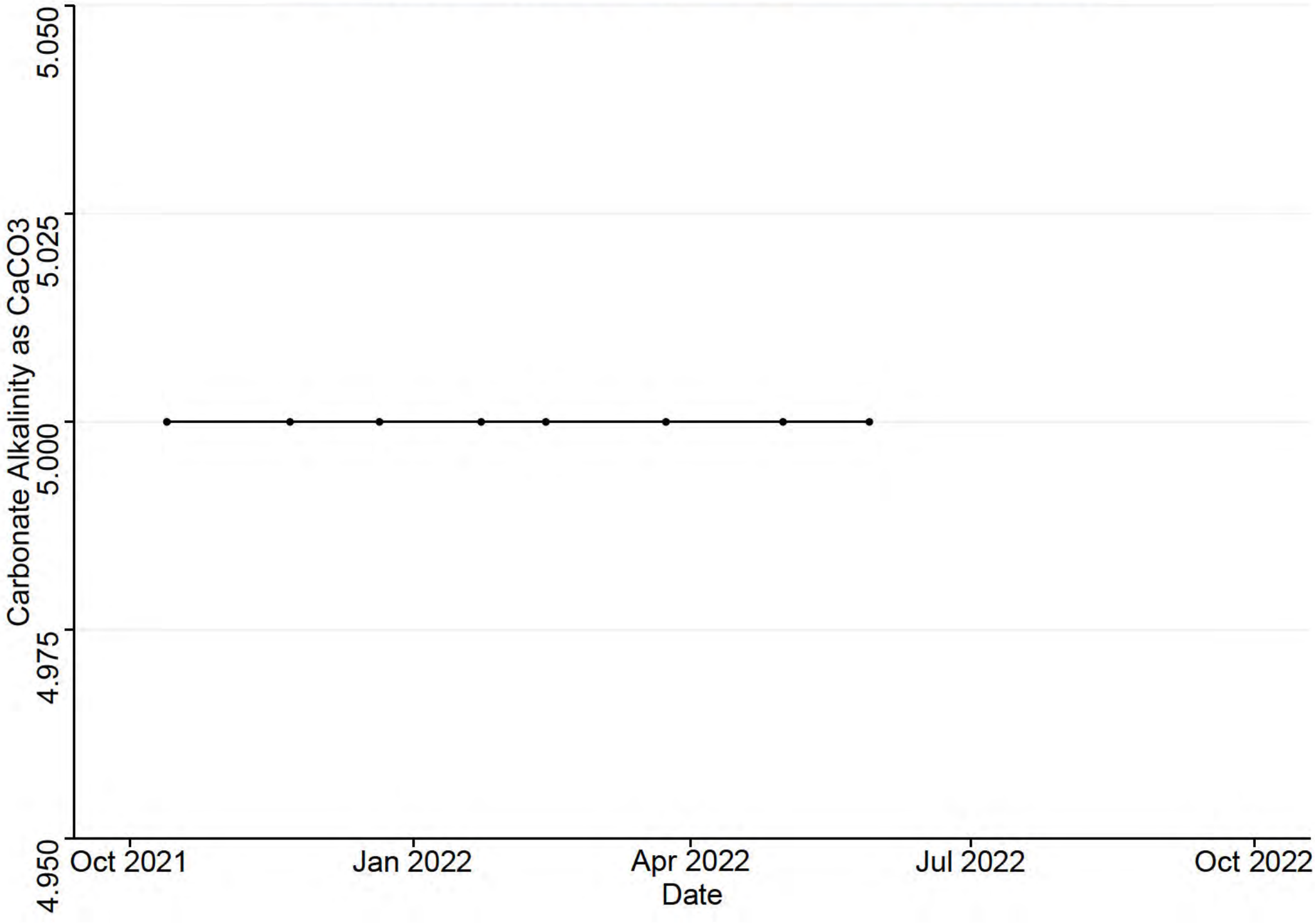

Site SWLA01 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.0364 | p−value = 1 | No trend
Bicarbonate Alkalinity as CaCO3
30
25
20
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

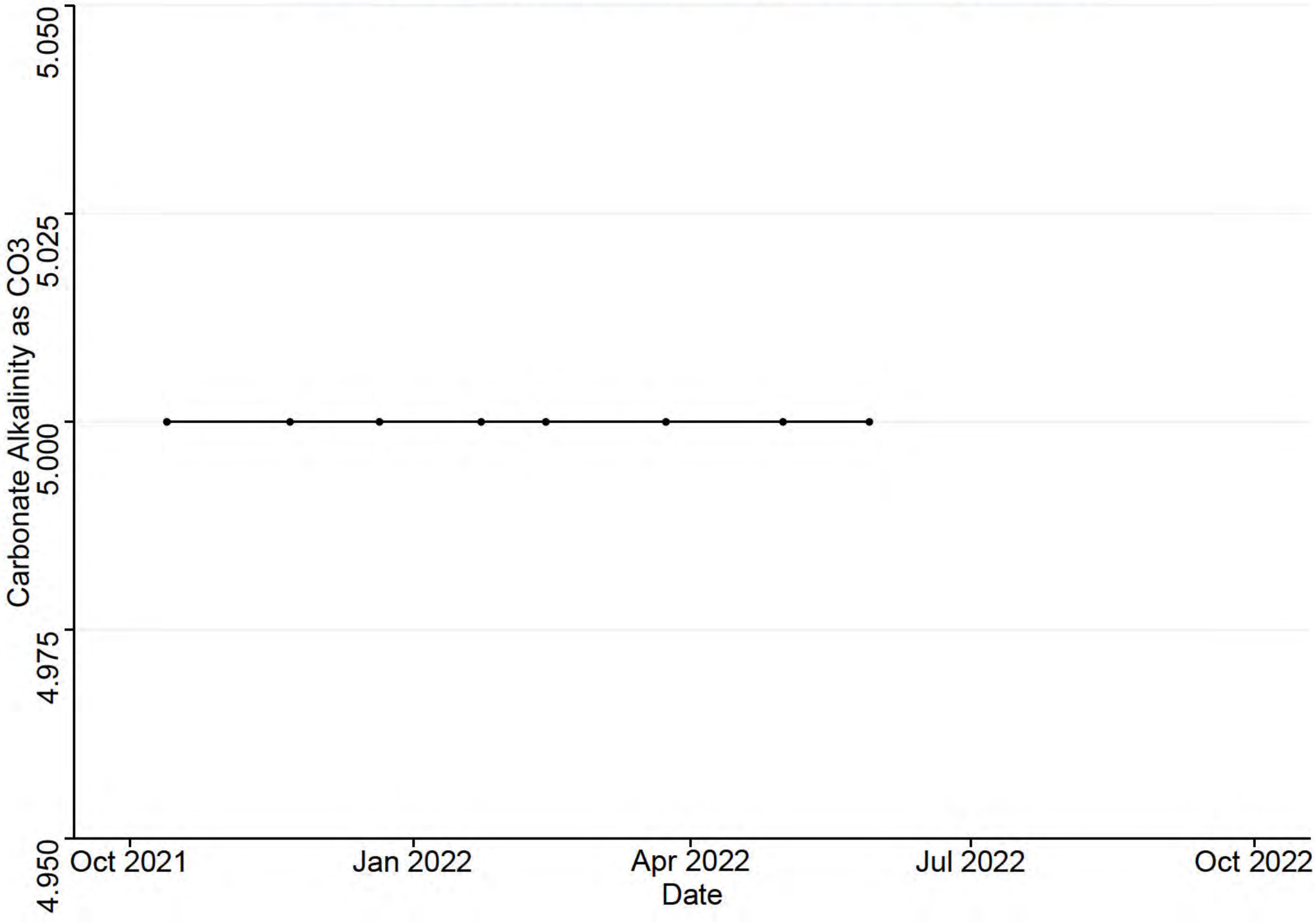

Site SWLA01 − Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.0364 | p−value = 1 | No trend
Bicarbonate Alkalinity as HCO3
40
35
30
25
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

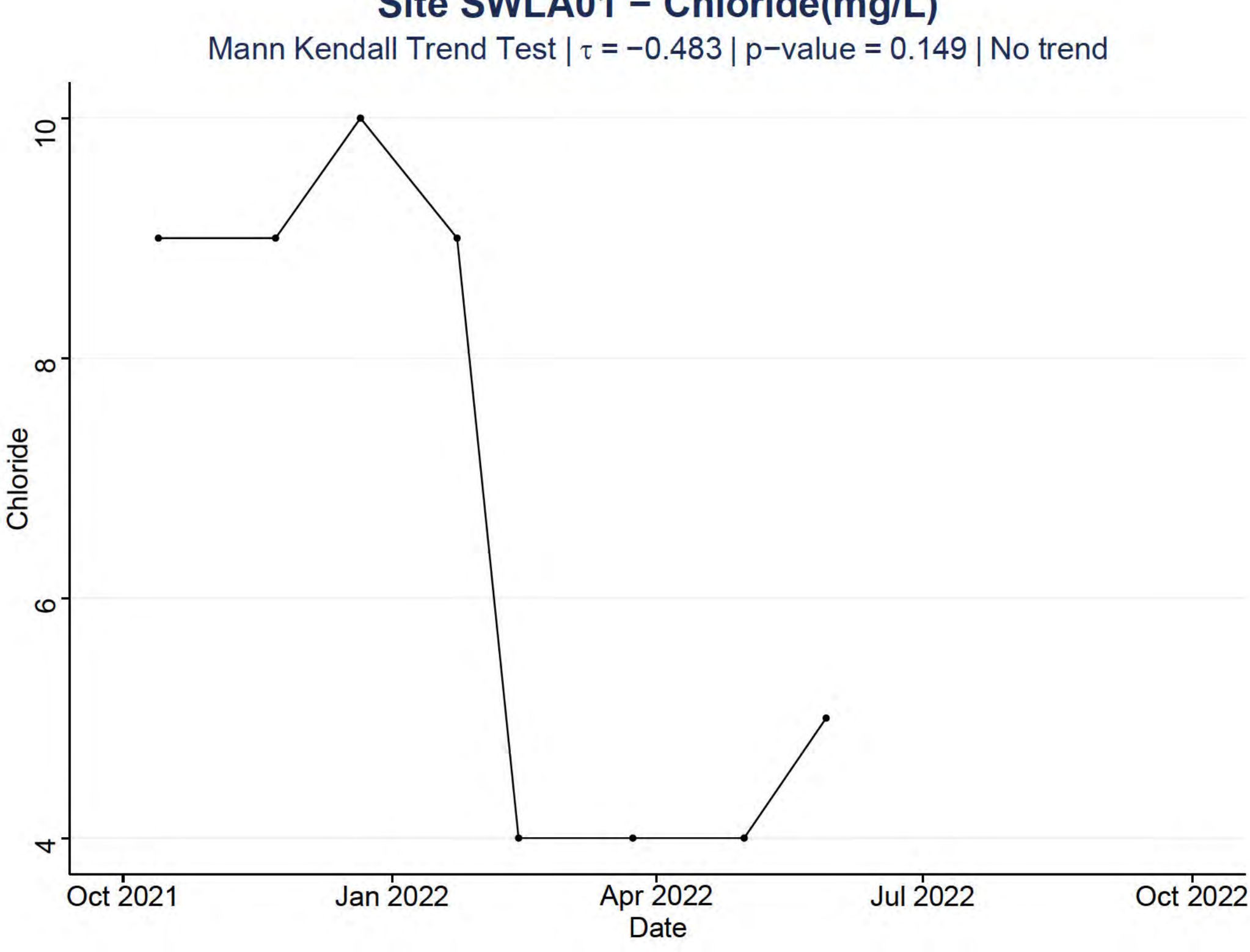

Site SWLA01 − Boron(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Boron
0.100
0.075
0.050
0.025
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

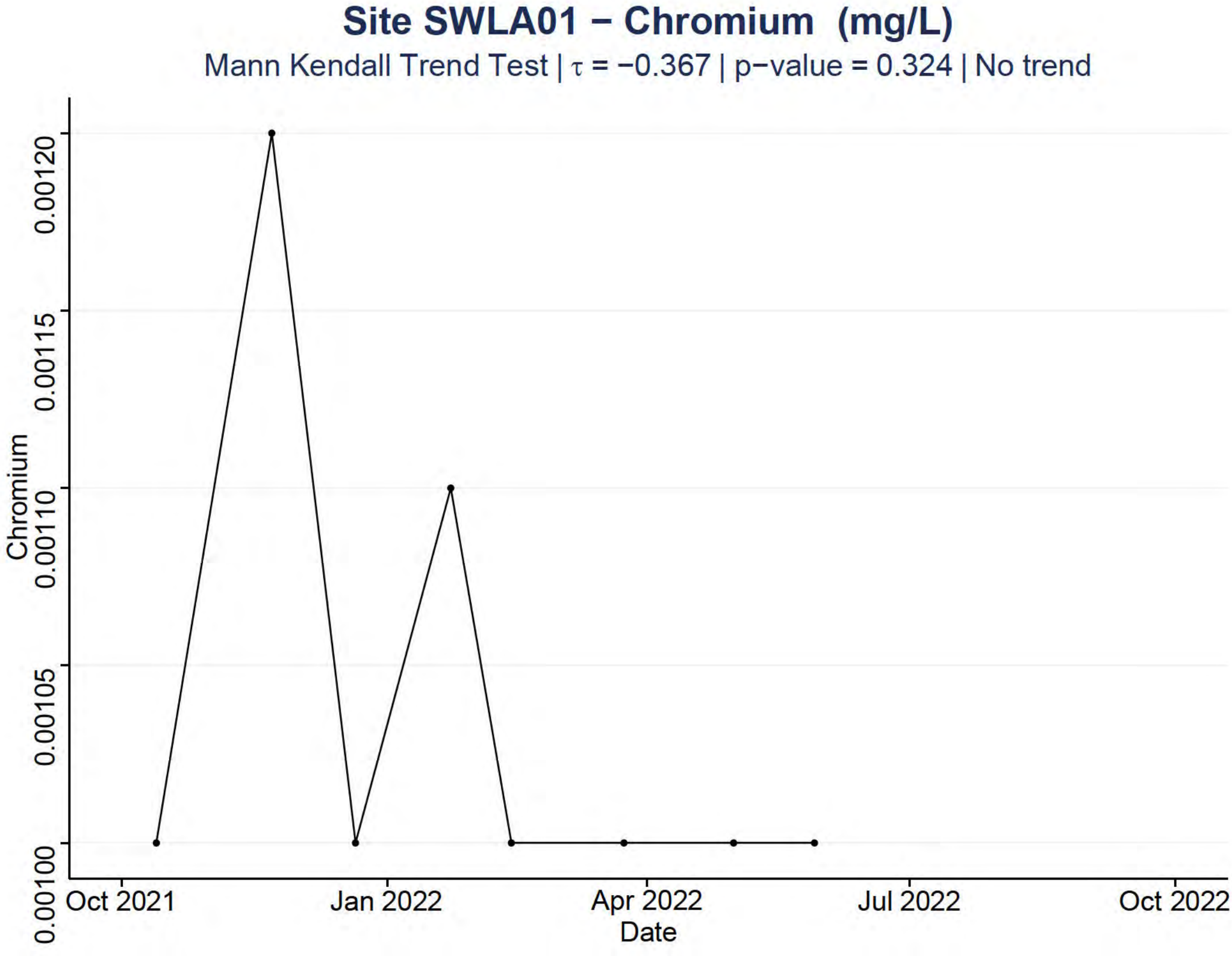

Site SWLA01 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Cadmium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

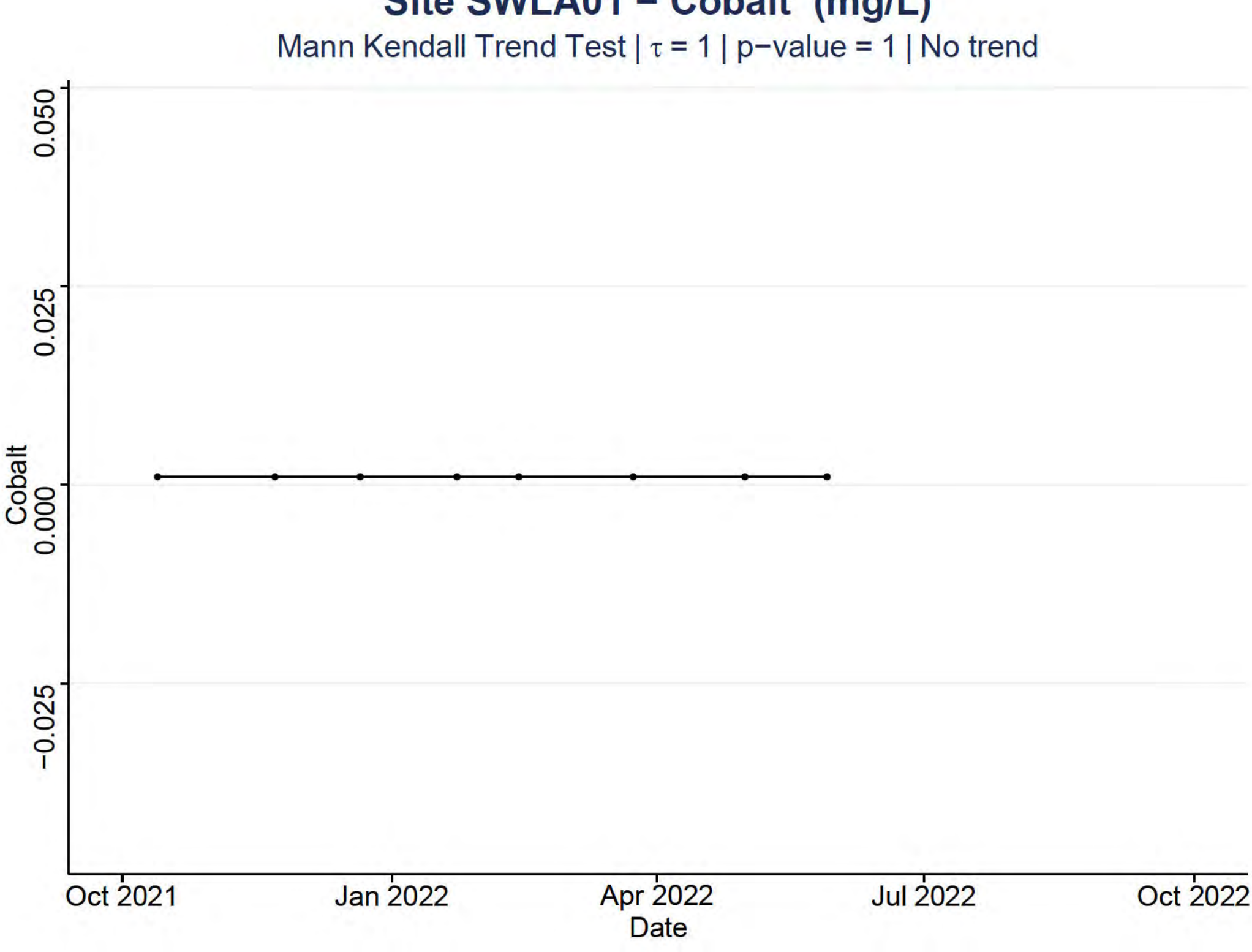

Site SWLA01 – Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.286 | p−value = 0.386 | No trend
Calcium
5
4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

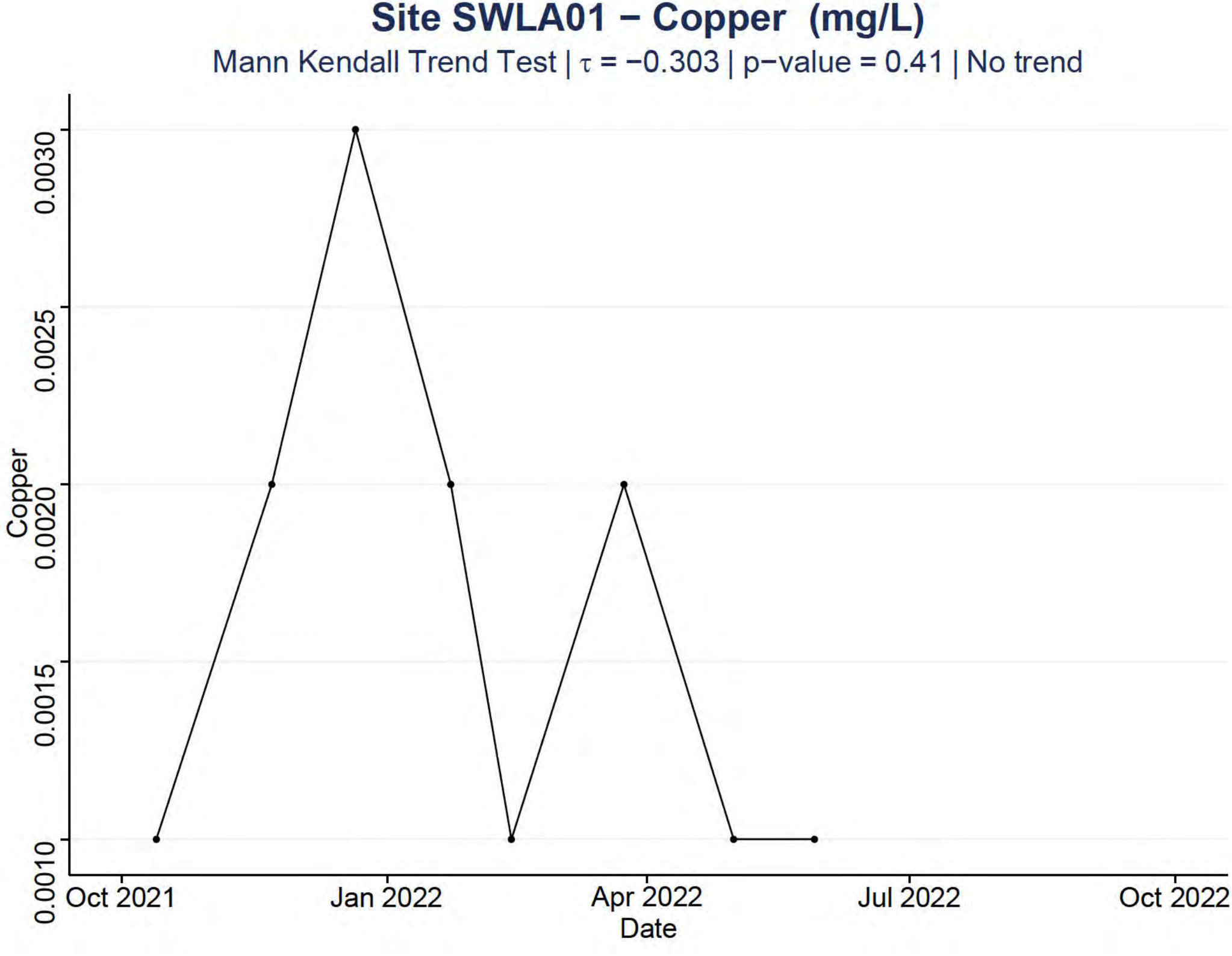

Site SWLA01 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

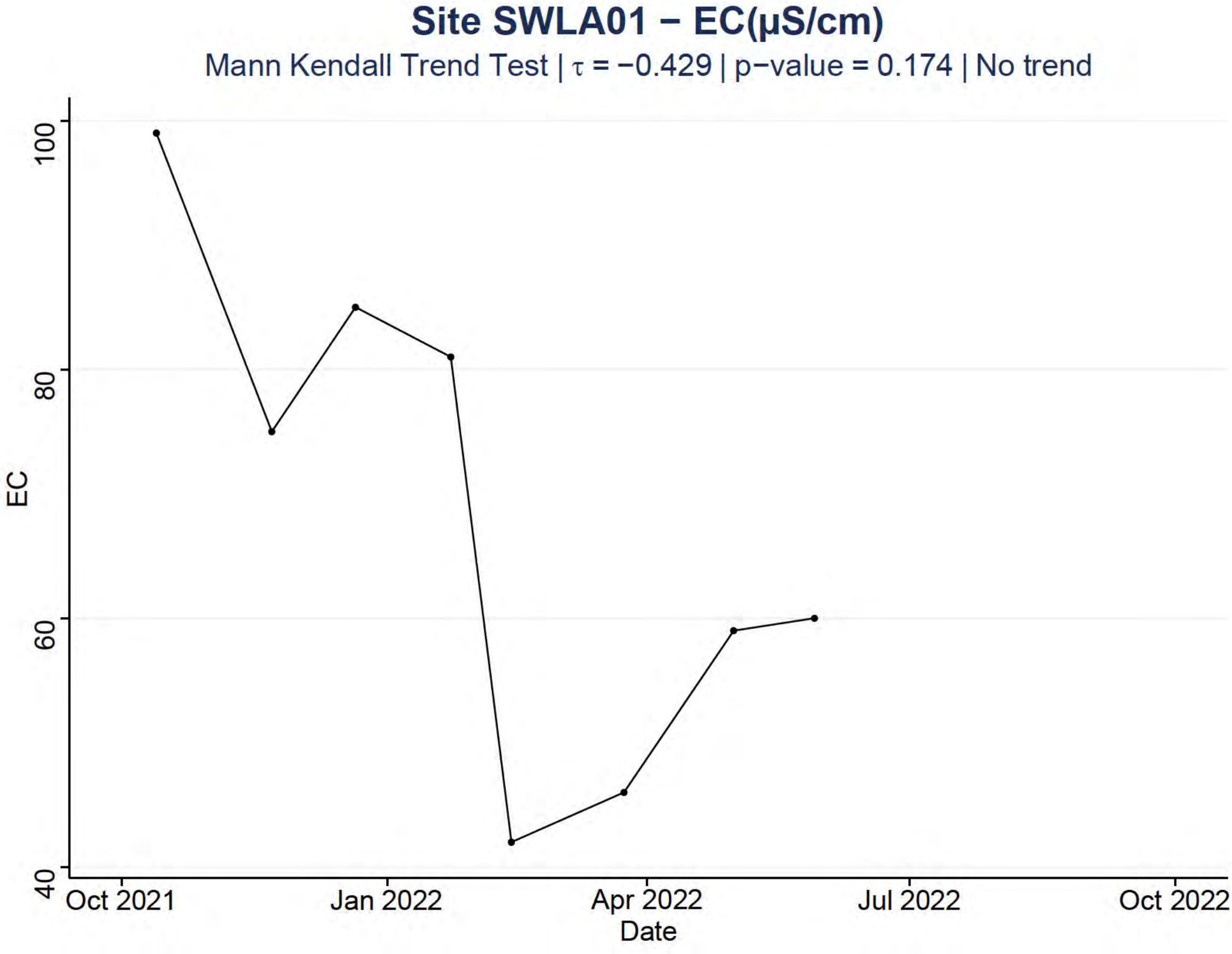

Site SWLA01 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

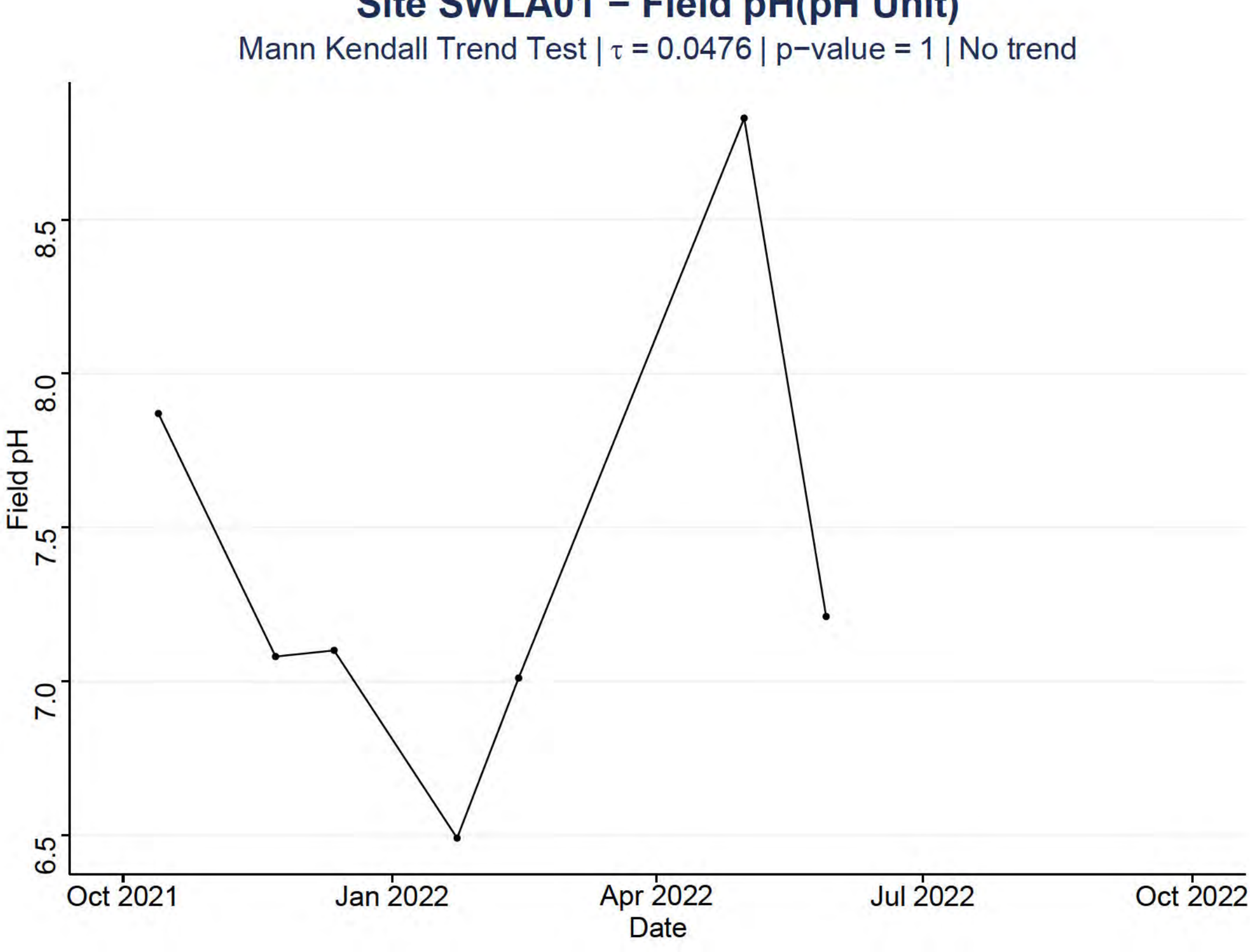

Site SWLA01 − Chloride(mg/L)
Mann Kendall Trend Test | τ = −0.483 | p−value = 0.149 | No trend
Chloride
10
8
6
4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

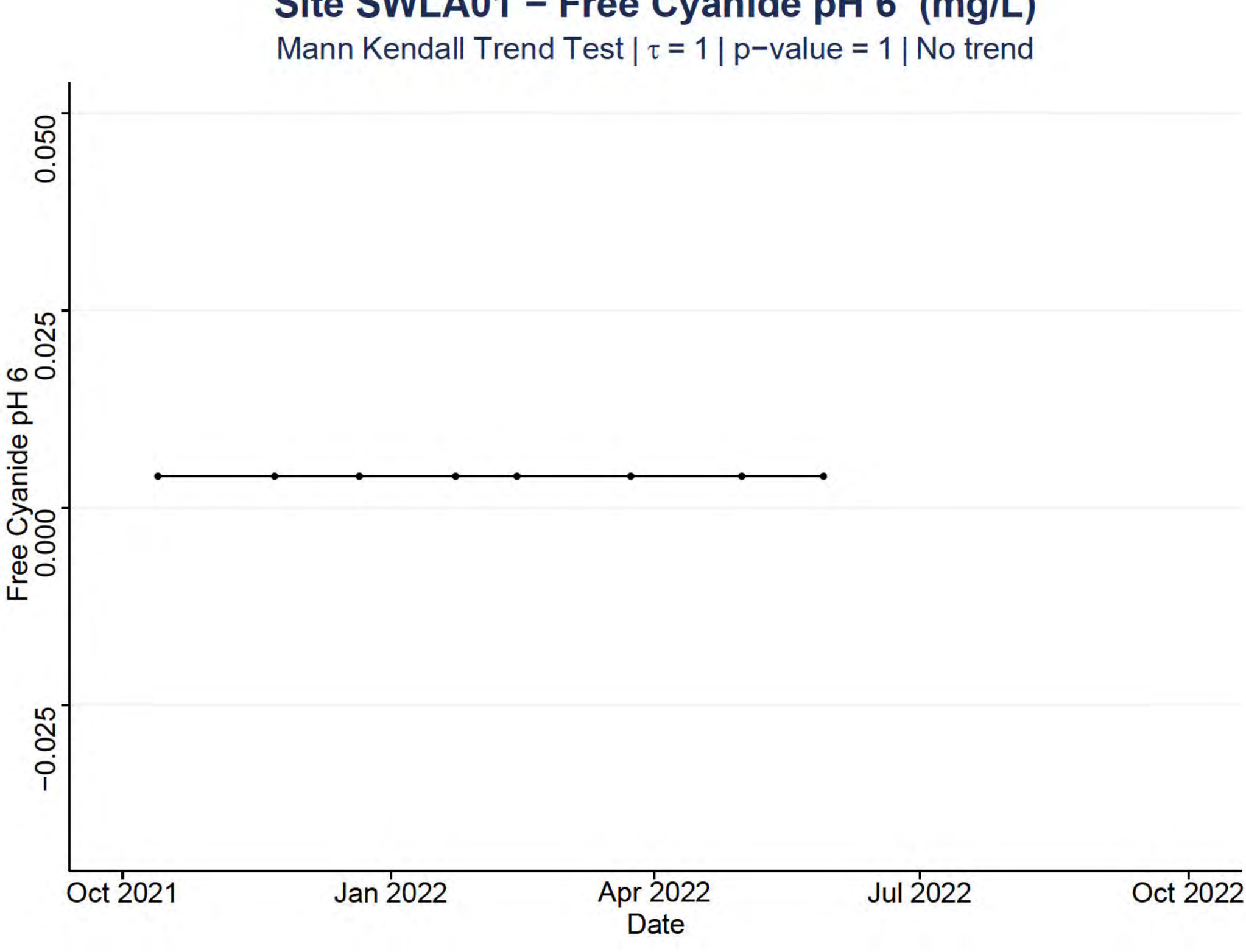

Site SWLA01 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.367 | p−value = 0.324 | No trend
Chromium
0.00120
0.00115
0.00110
0.00105
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

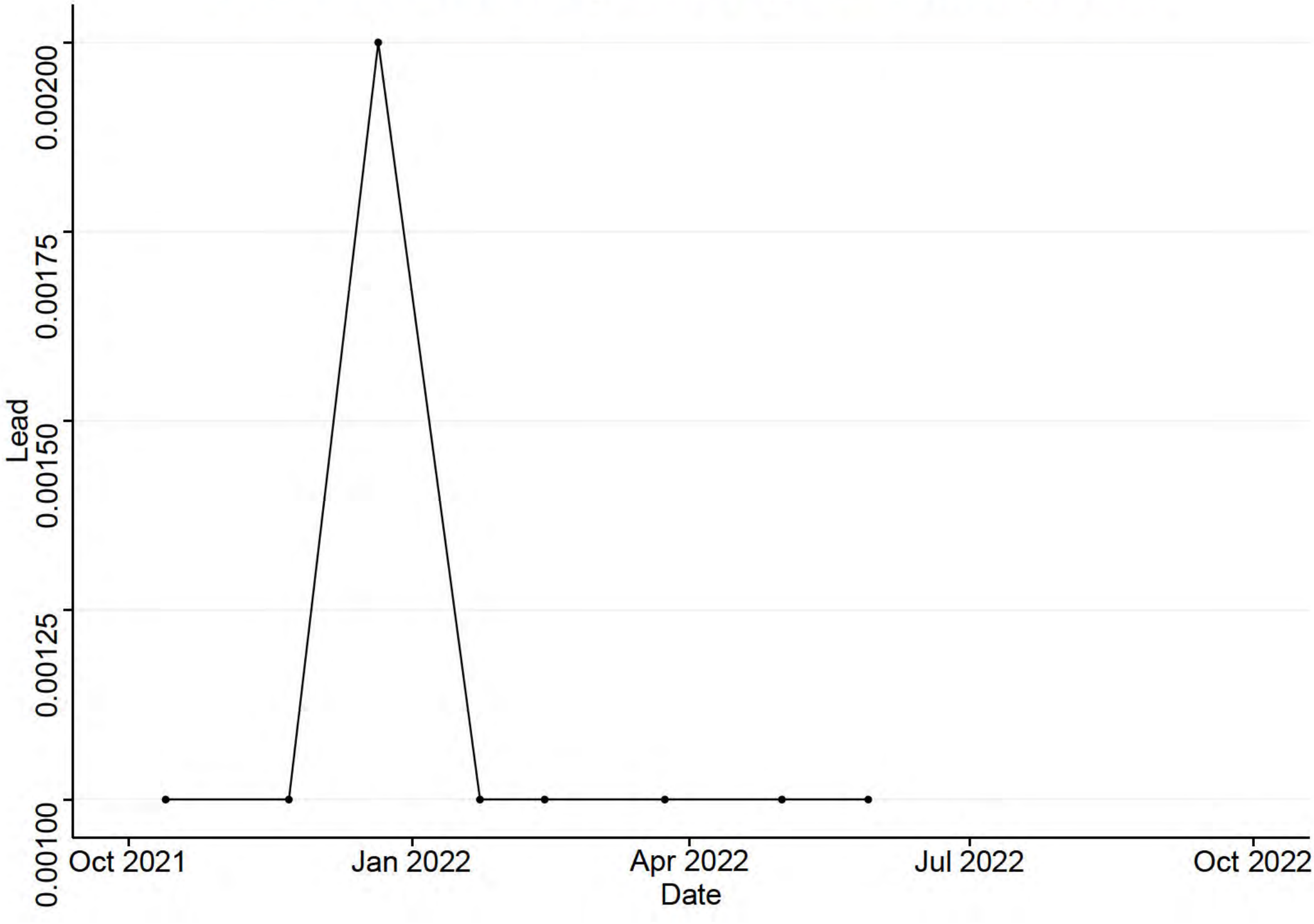

Site SWLA01 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
0.050
0.025
0.000
−0.025
Cobalt
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

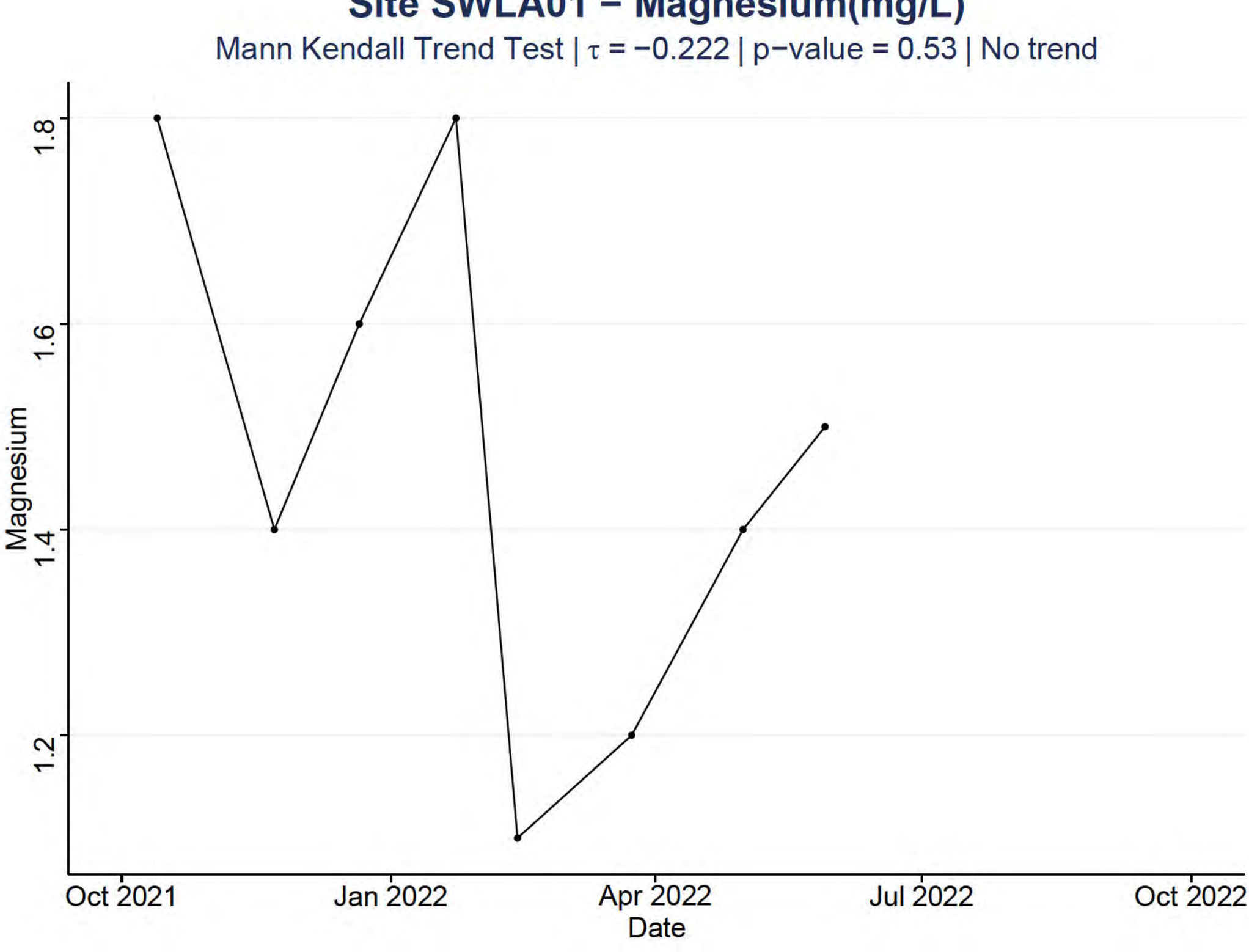

Site SWLA01 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.303 | p−value = 0.41 | No trend
Copper
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

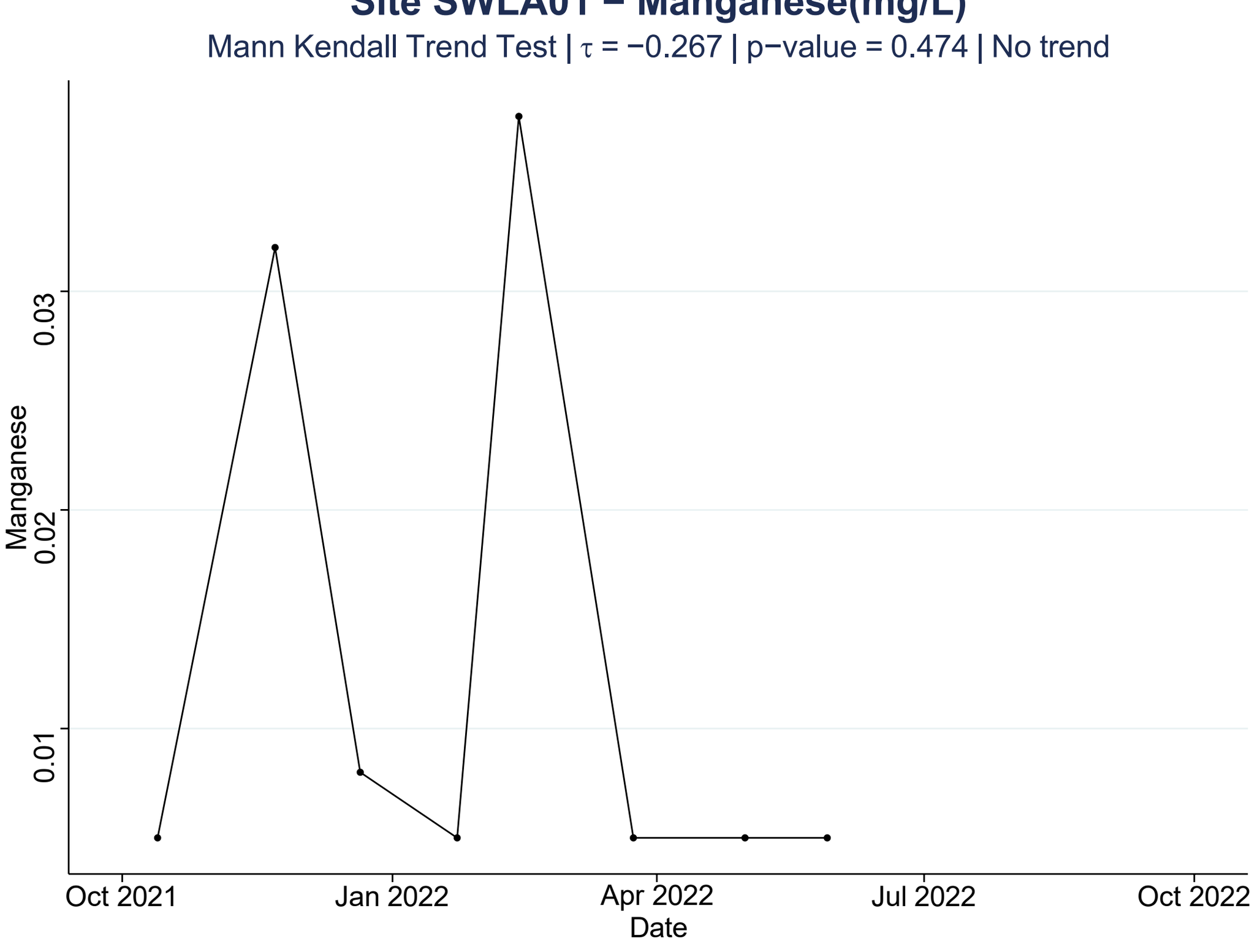

Site SWLA01 − EC(µS/cm)
Mann Kendall Trend Test | τ = −0.429 | p−value = 0.174 | No trend
EC
100
80
60
40
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

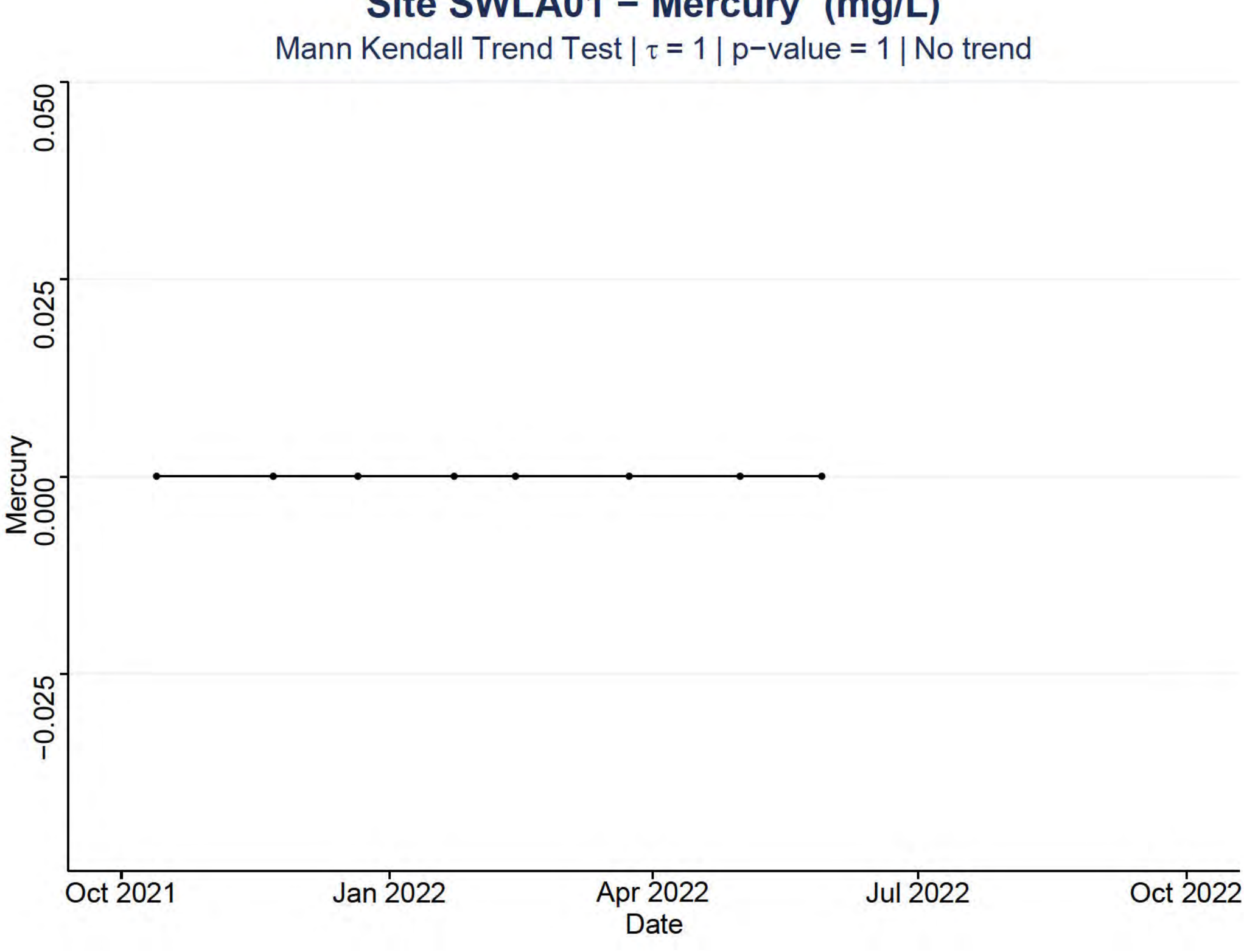

Site SWLA01 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = 0.0476 | p−value = 1 | No trend
Field pH
8.5
8.0
7.5
7.0
6.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

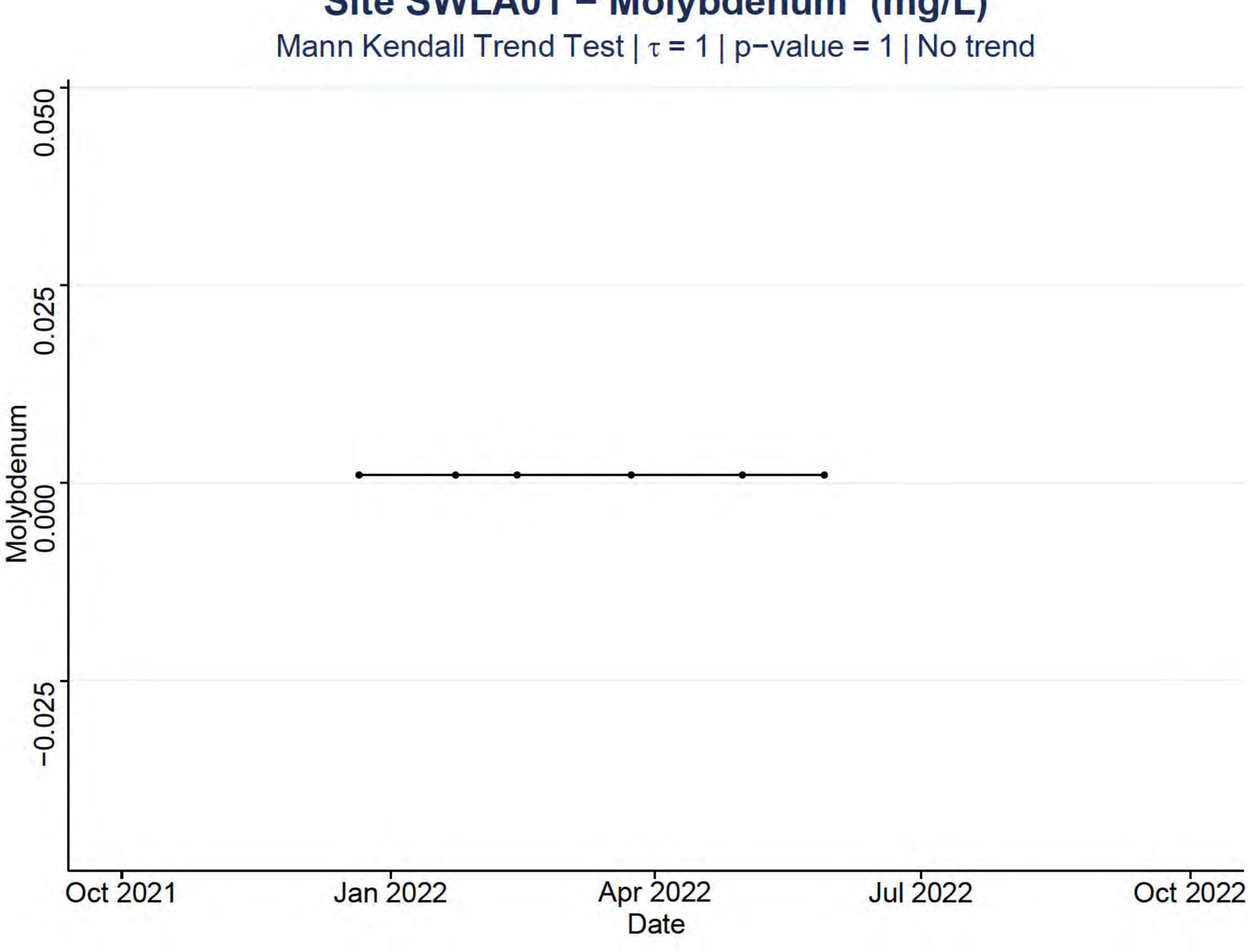

Site SWLA01 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Free Cyanide pH 6
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

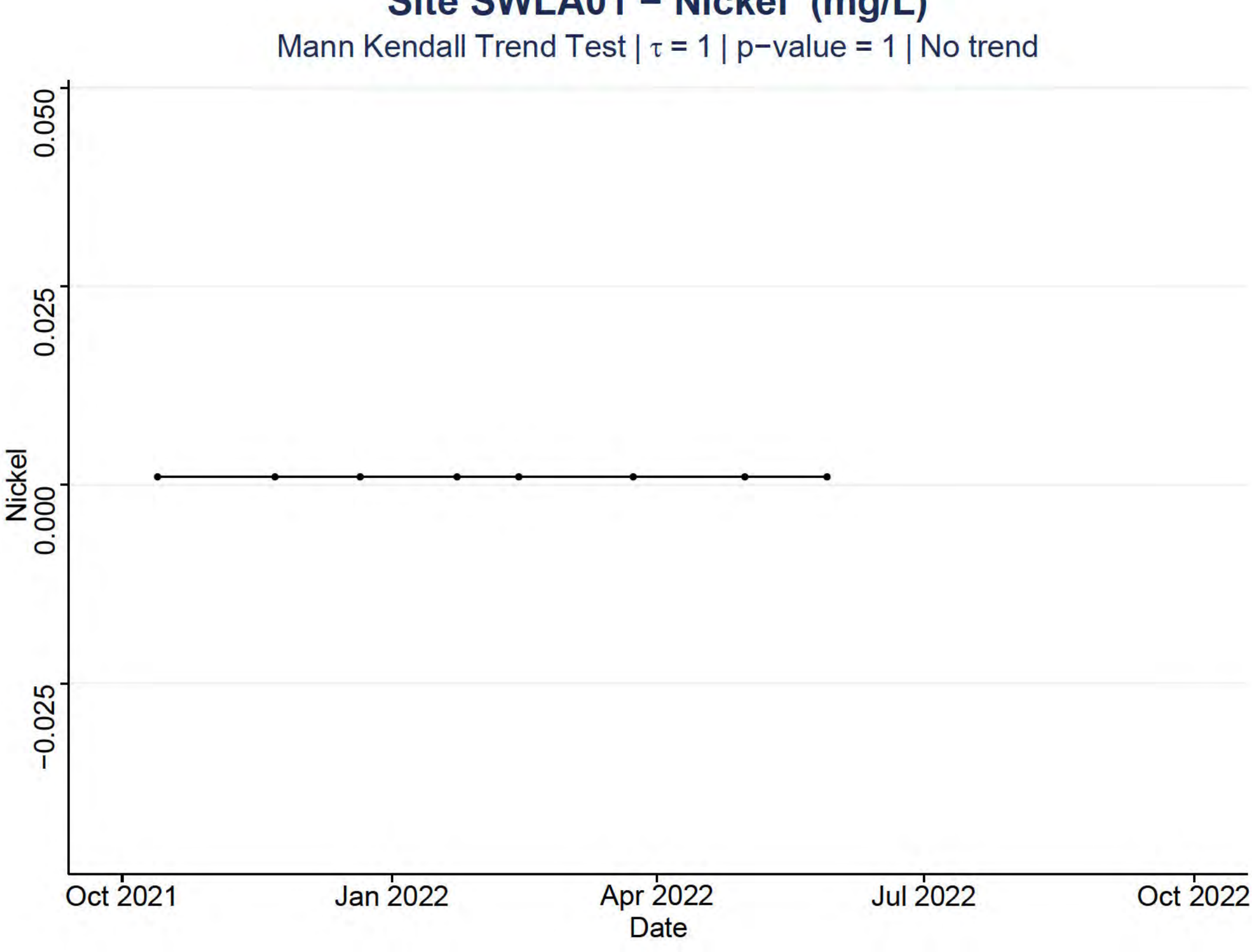

Site SWLA01 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.214 | p−value = 0.663 | No trend
Lead
0.00200
0.00175
0.00150
0.00125
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

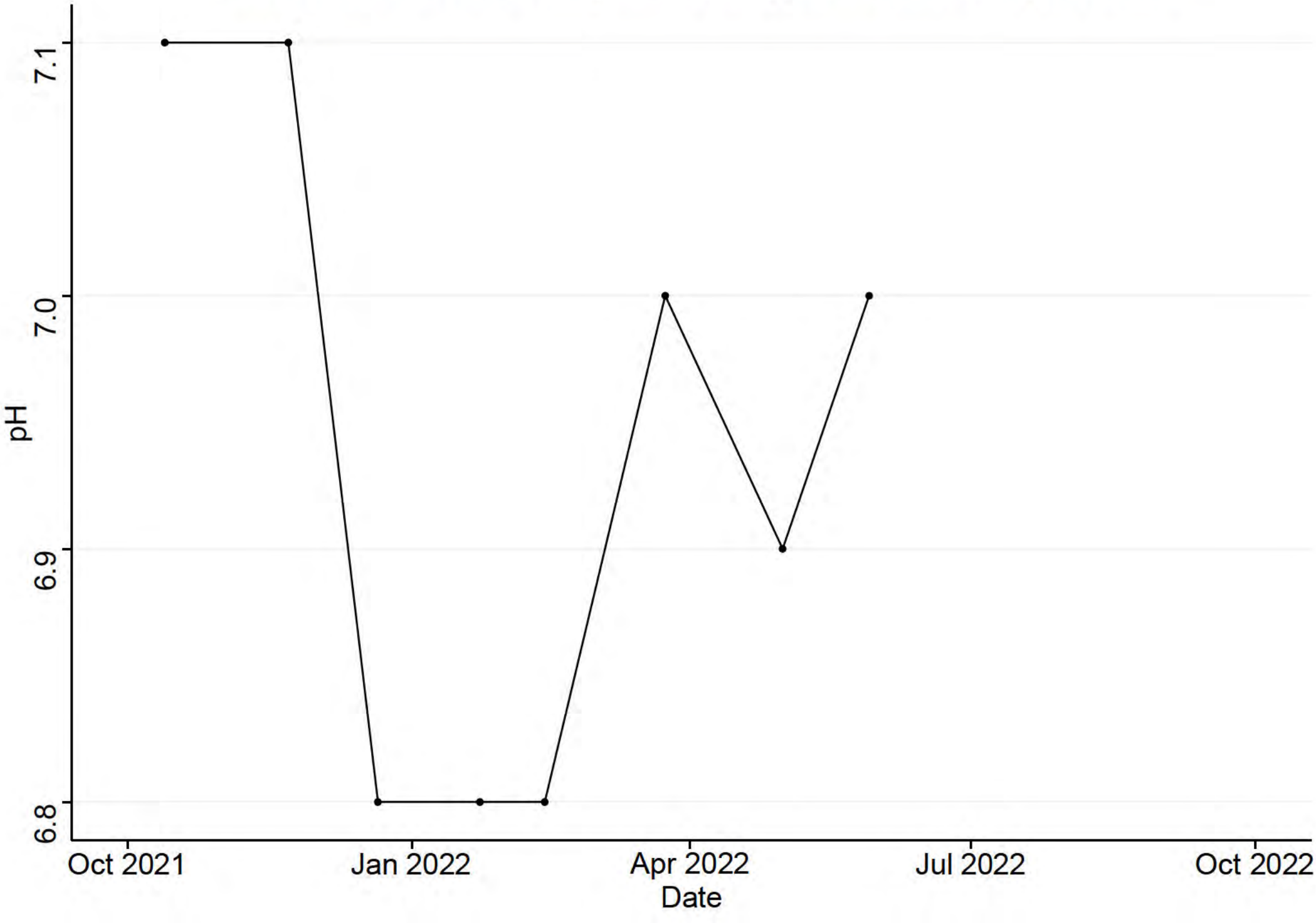

Site SWLA01 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.222 | p−value = 0.53 | No trend
Magnesium
1.8
1.6
1.4
1.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

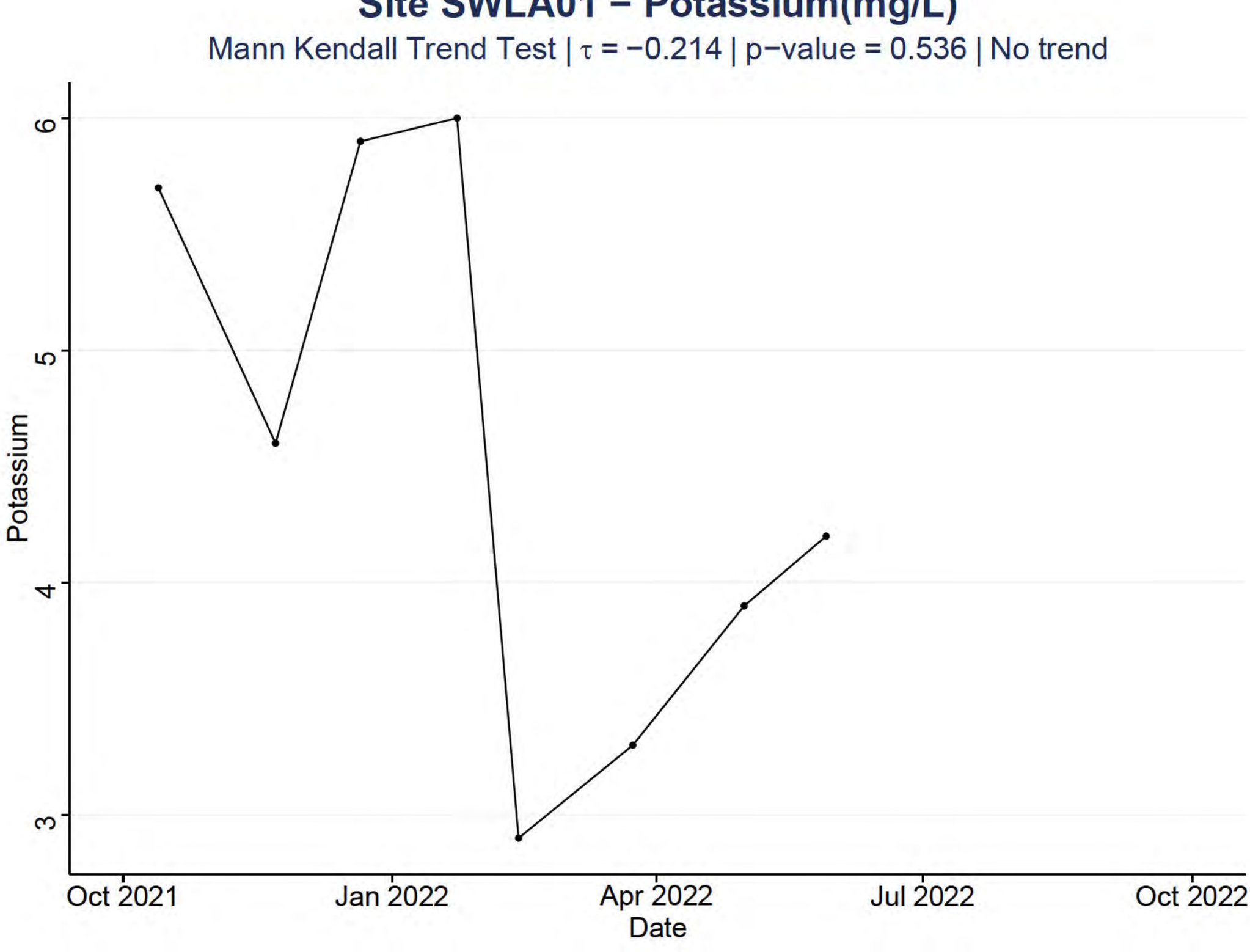

Site SWLA01 − Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.267 | p−value = 0.474 | No trend
Manganese
0.03
0.02
0.01
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

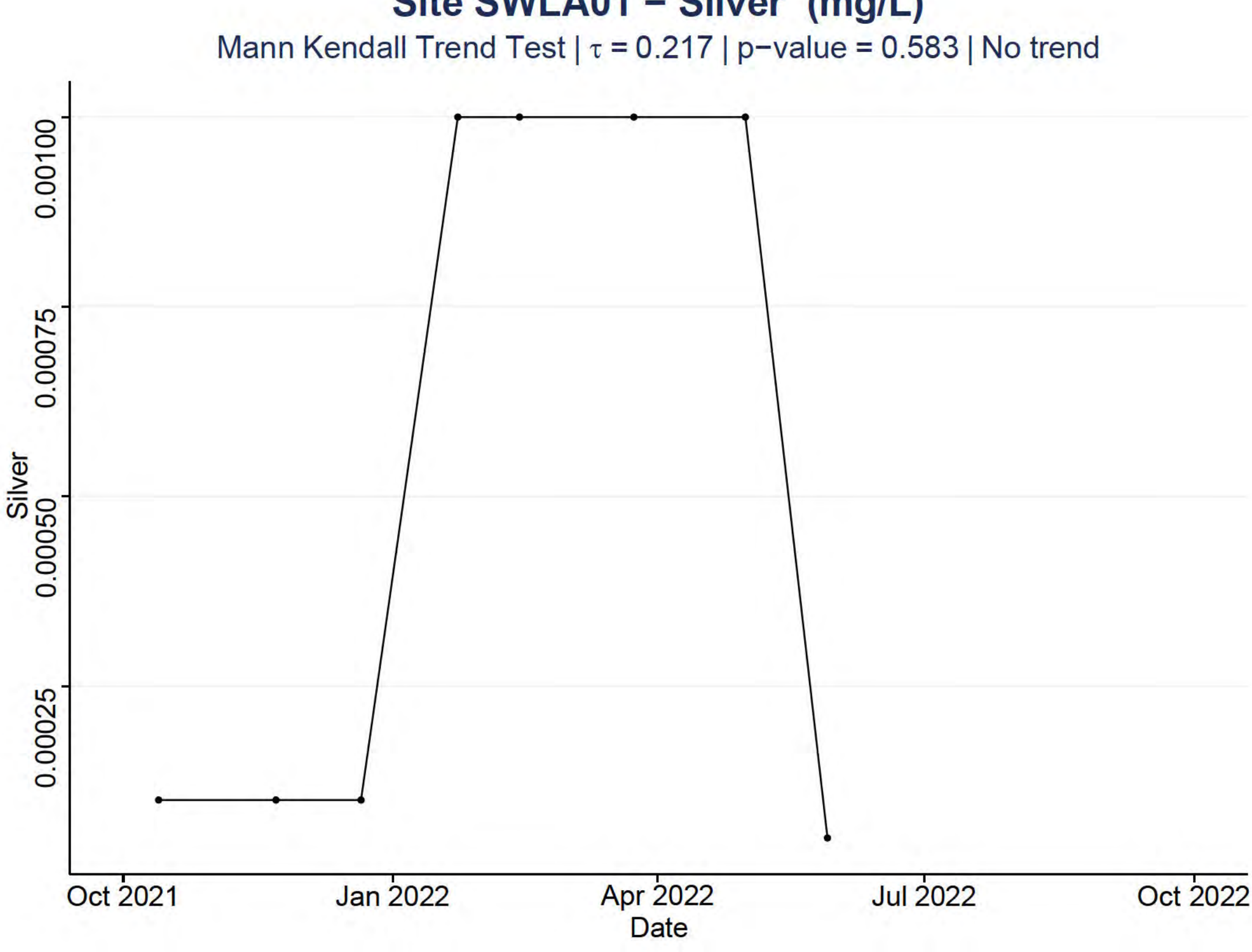

Site SWLA01 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

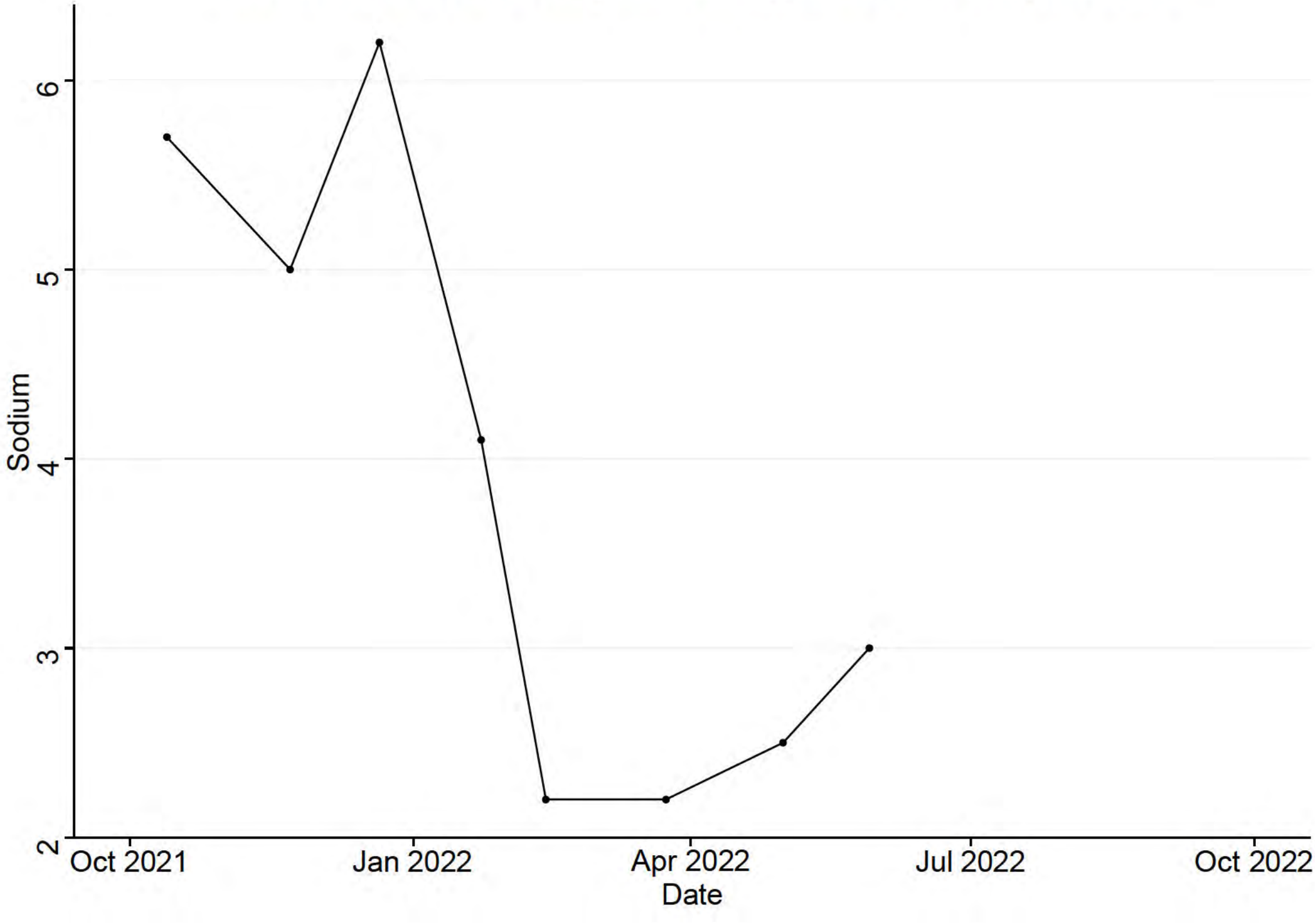

Site SWLA01 – Molybdenum (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Molybdenum
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

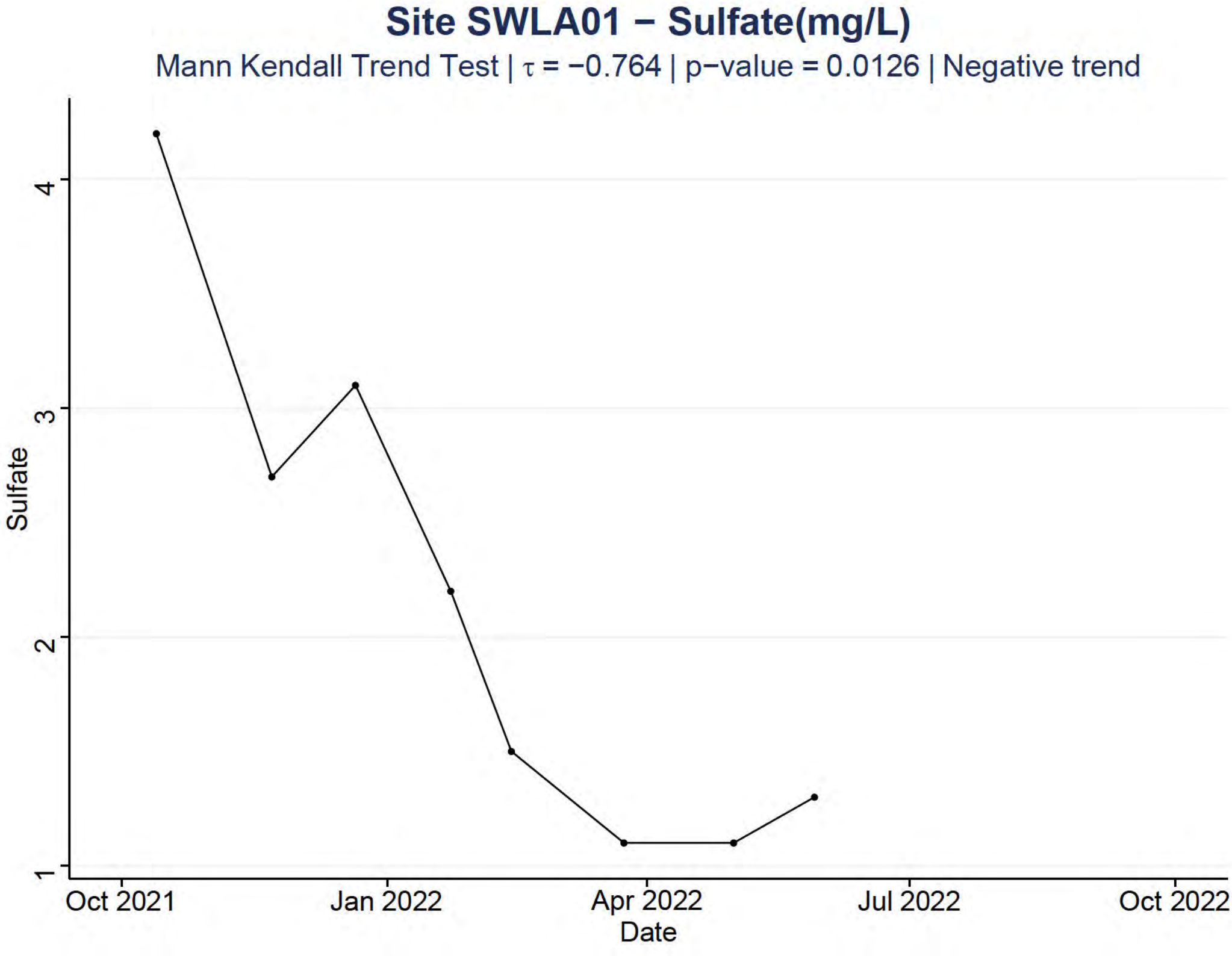

Site SWLA01 − Nickel (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
0.050
0.025
0.000
−0.025
Nickel
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

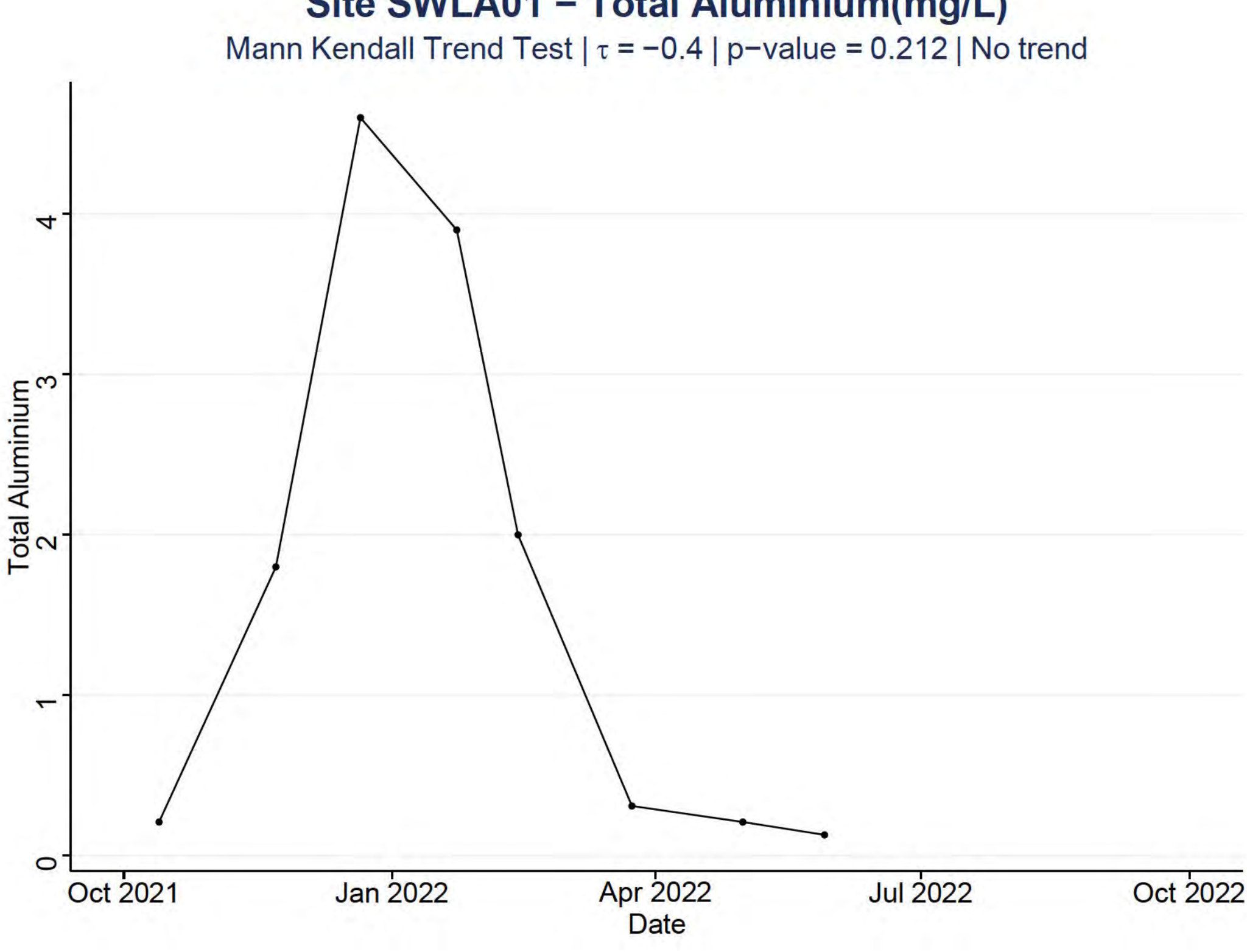

Site SWLA01 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.118 | p−value = 0.796 | No trend
pH
7.1
7.0
6.9
6.8
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

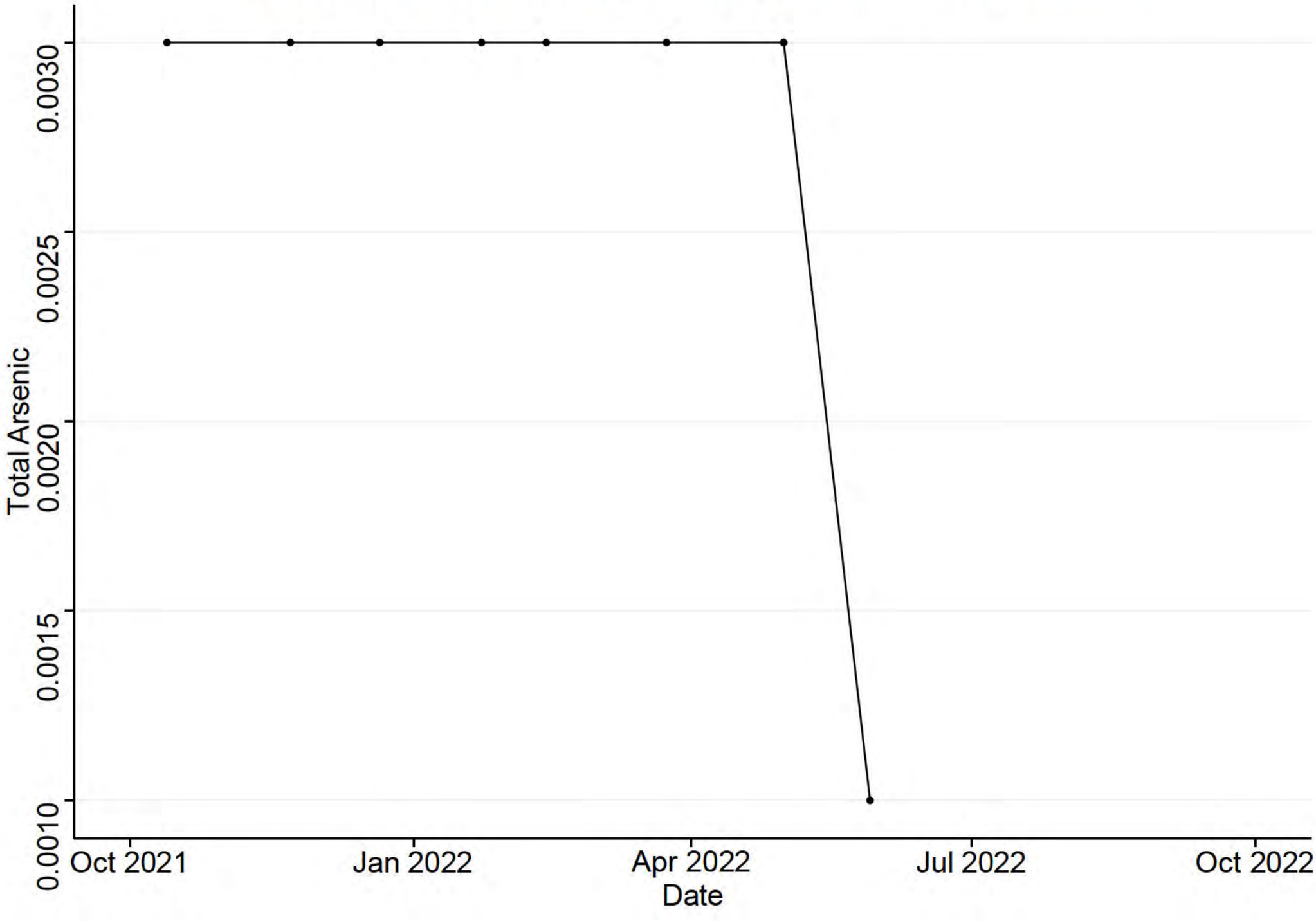

Site SWLA01 − Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.214 | p−value = 0.536 | No trend
Potassium
6
5
4
3
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

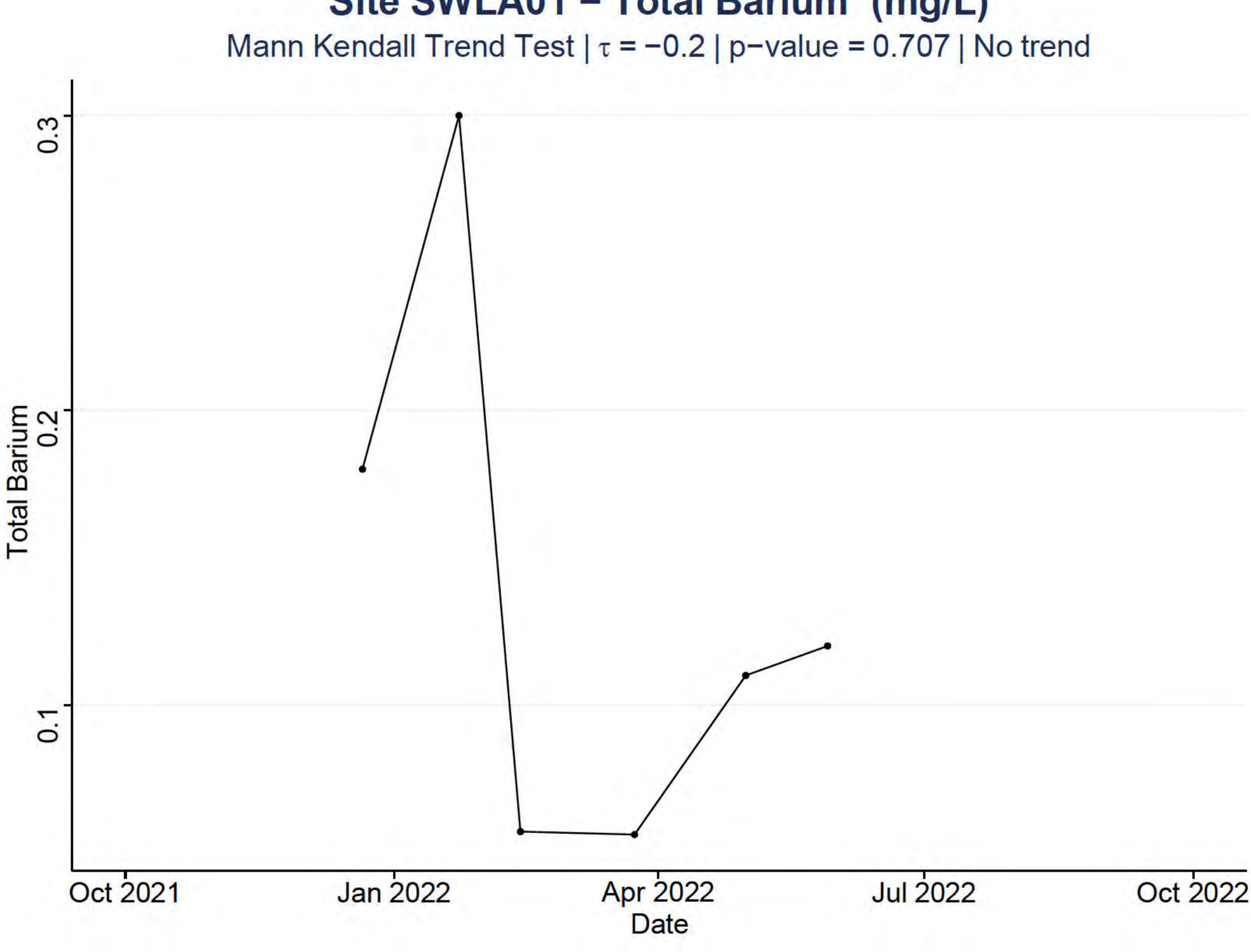

Site SWLA01 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Silver
0.00100
0.00075
0.00050
0.00025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

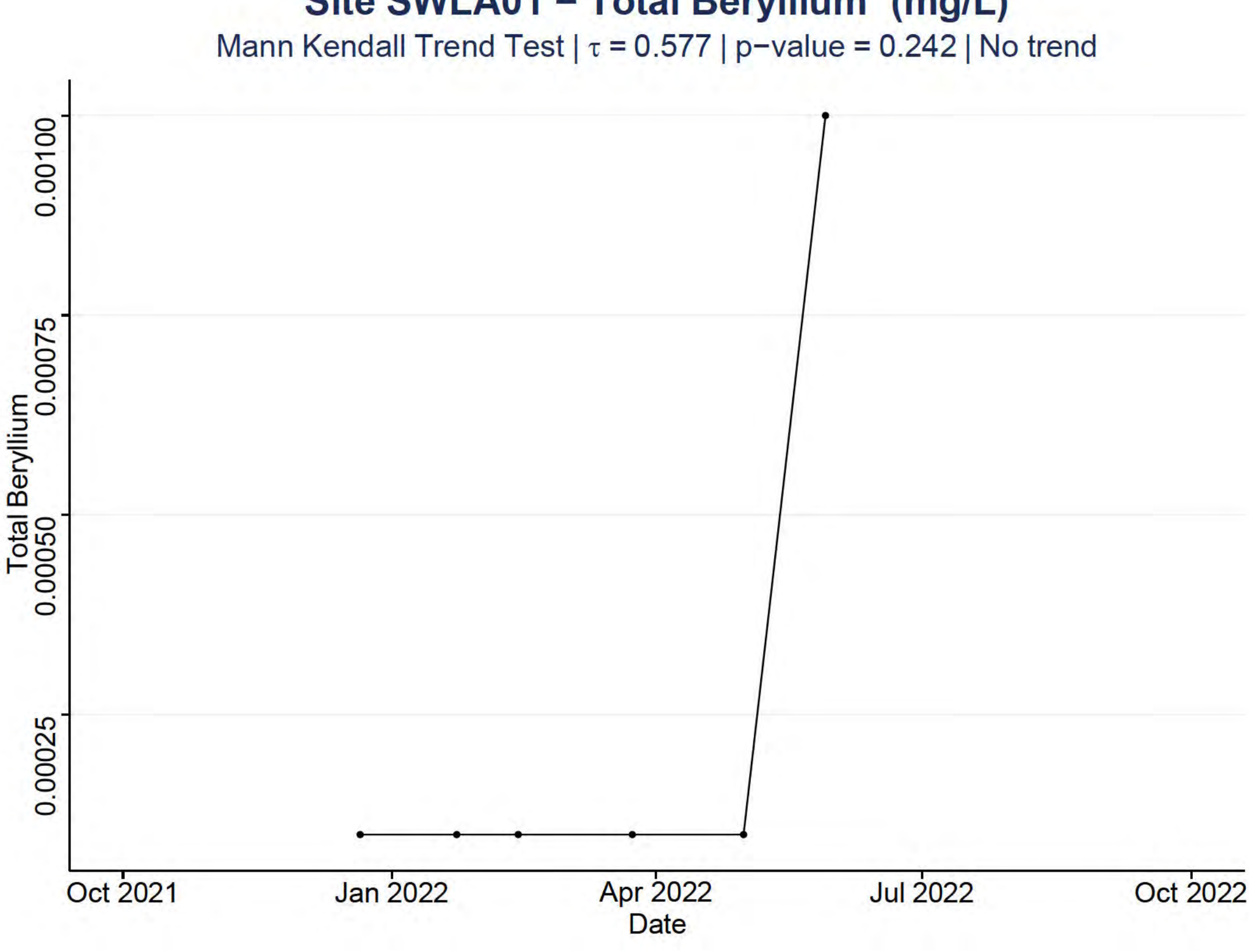

Site SWLA01 − Sodium(mg/L)
Mann Kendall Trend Test | τ = −0.473 | p−value = 0.135 | No trend
Sodium
2
3
4
5
6
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

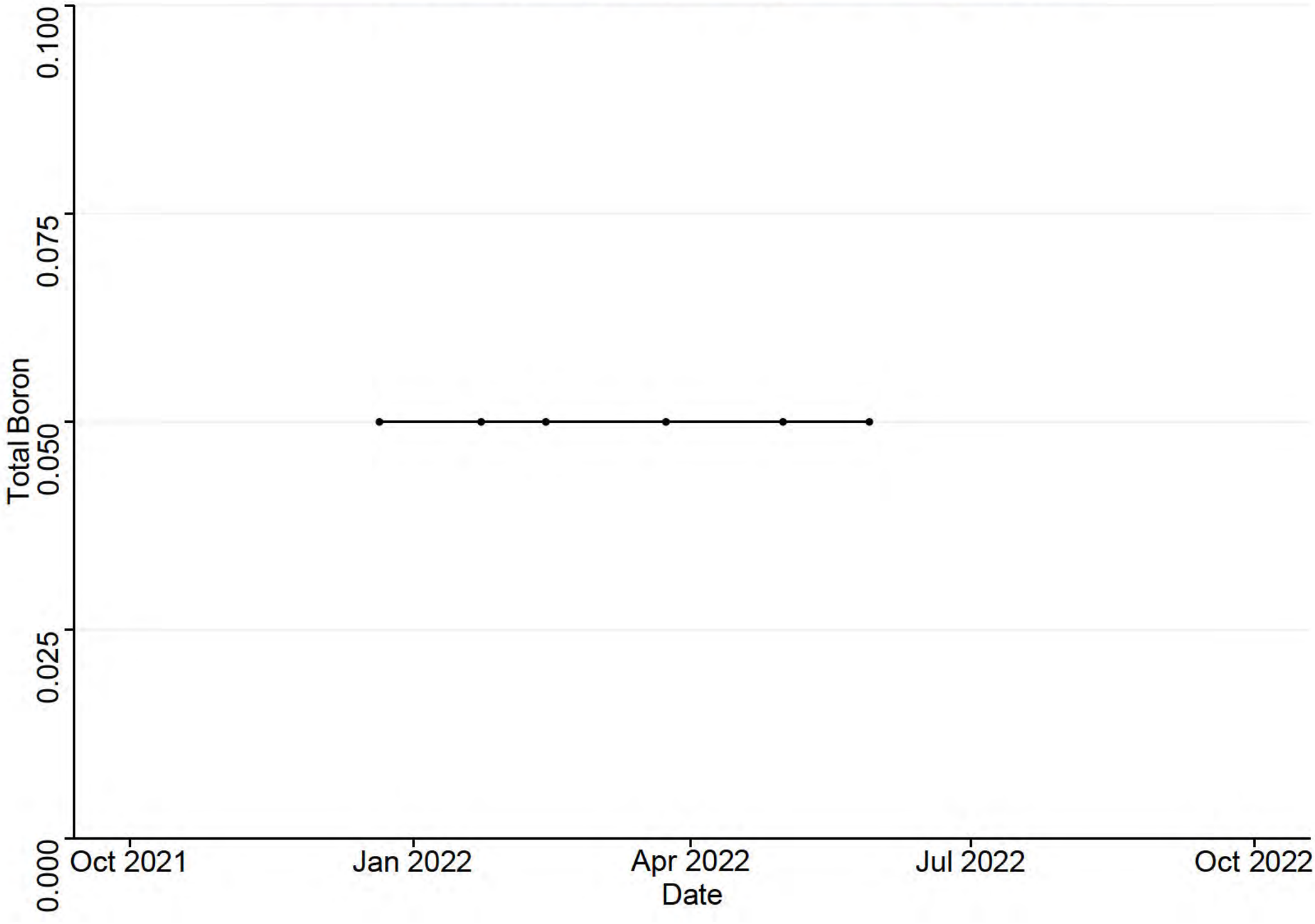

Site SWLA01 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = −0.764 | p−value = 0.0126 | Negative trend
Sulfate
4
3
2
1
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

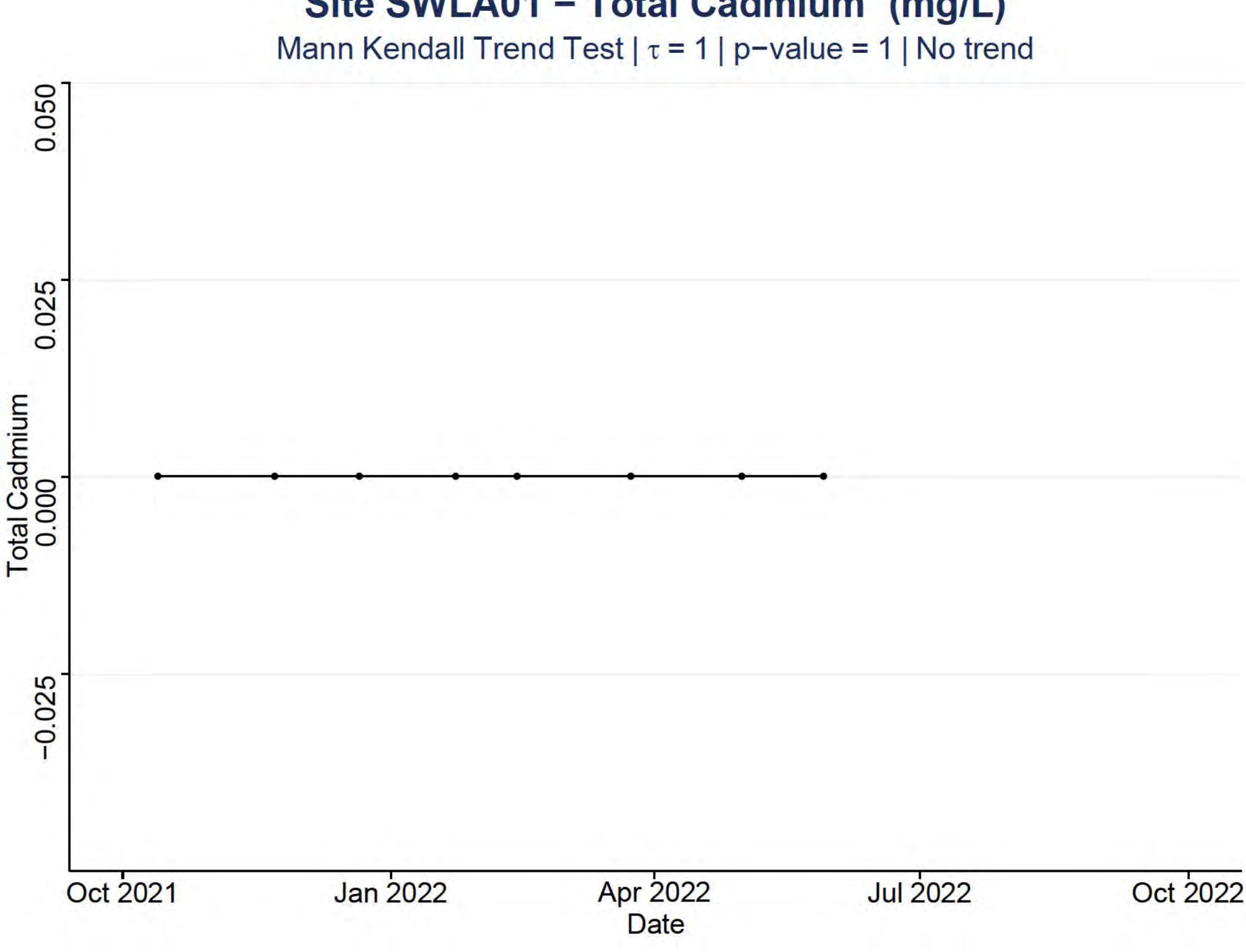

Site SWLA01 – Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = −0.4 | p−value = 0.212 | No trend
Total Aluminium
0
1
2
3
4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

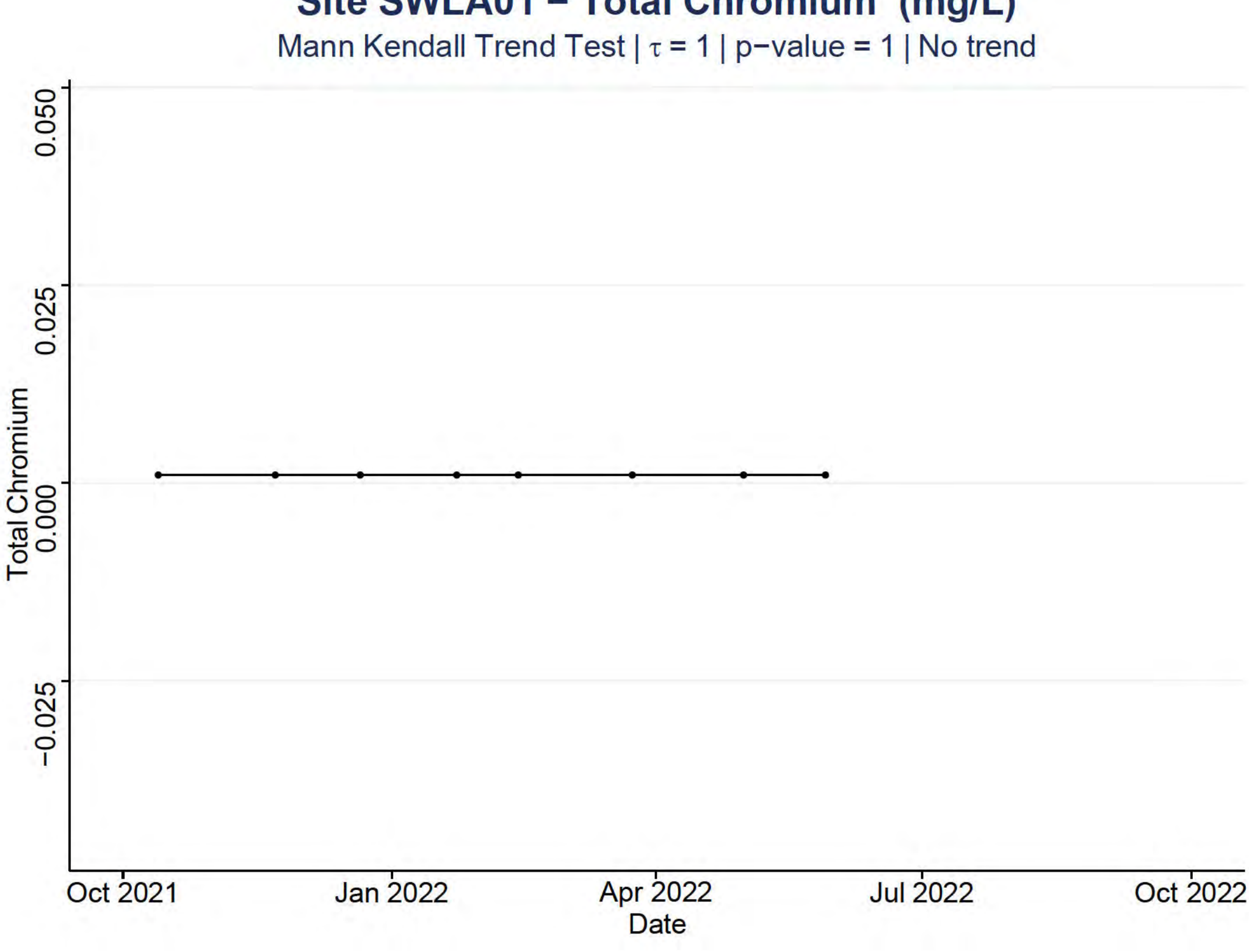

Site SWLA01 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Arsenic
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

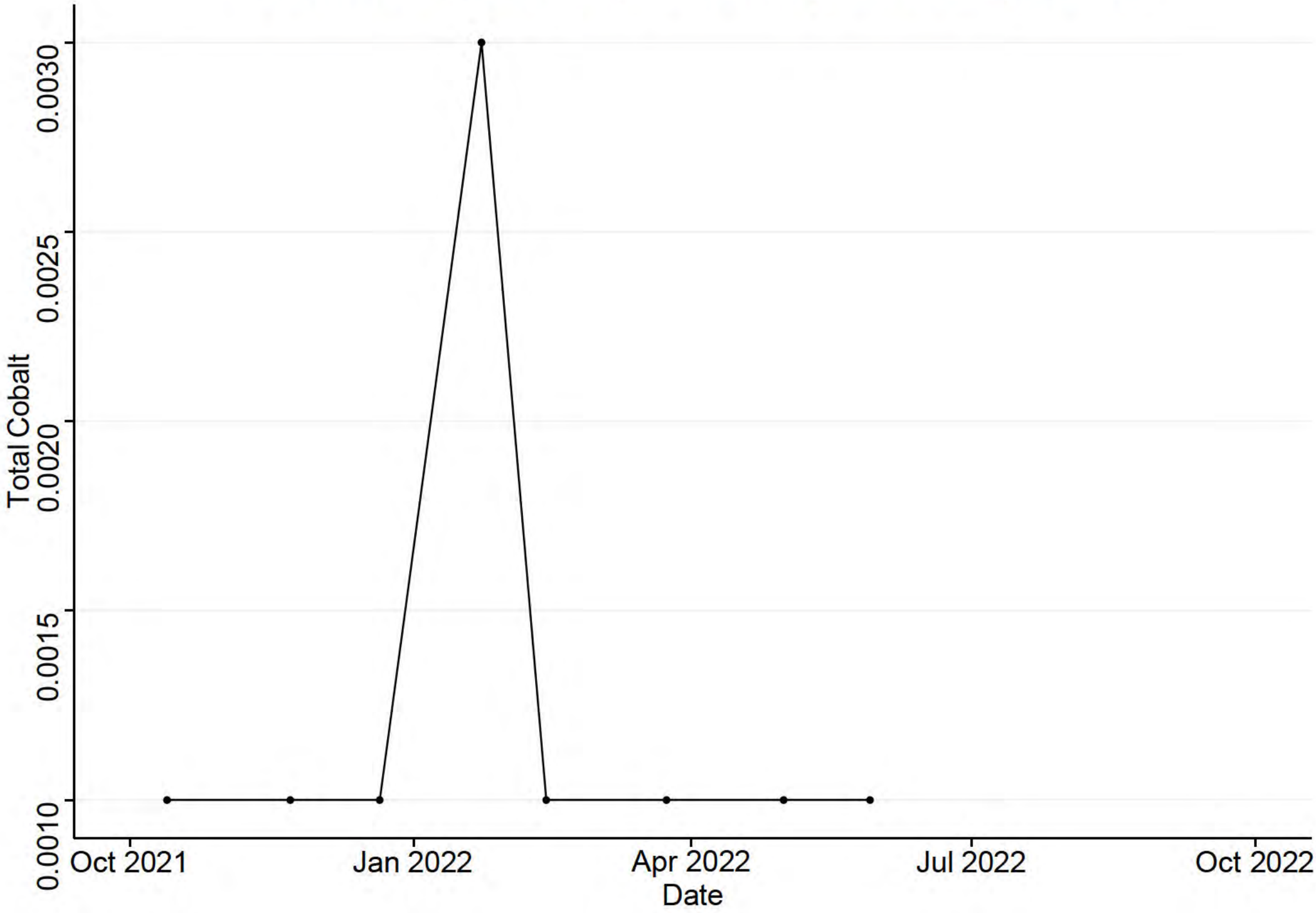

Site SWLA01 − Total Barium (mg/L)
Mann Kendall Trend Test | τ = −0.2 | p−value = 0.707 | No trend
Total Barium
0.3
0.2
0.1
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

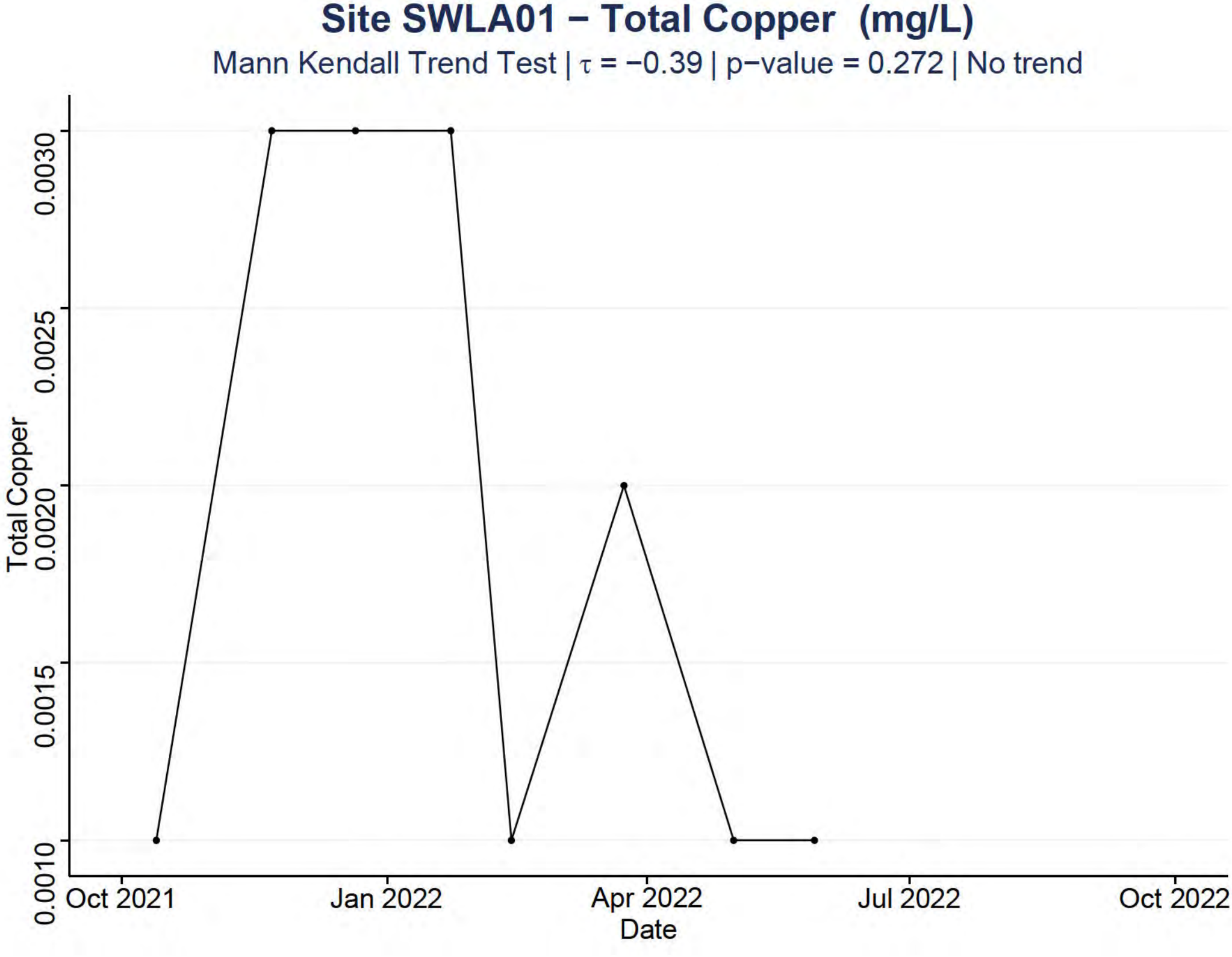

Site SWLA01 – Total Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Total Beryllium
0.00100
0.00075
0.00050
0.00025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

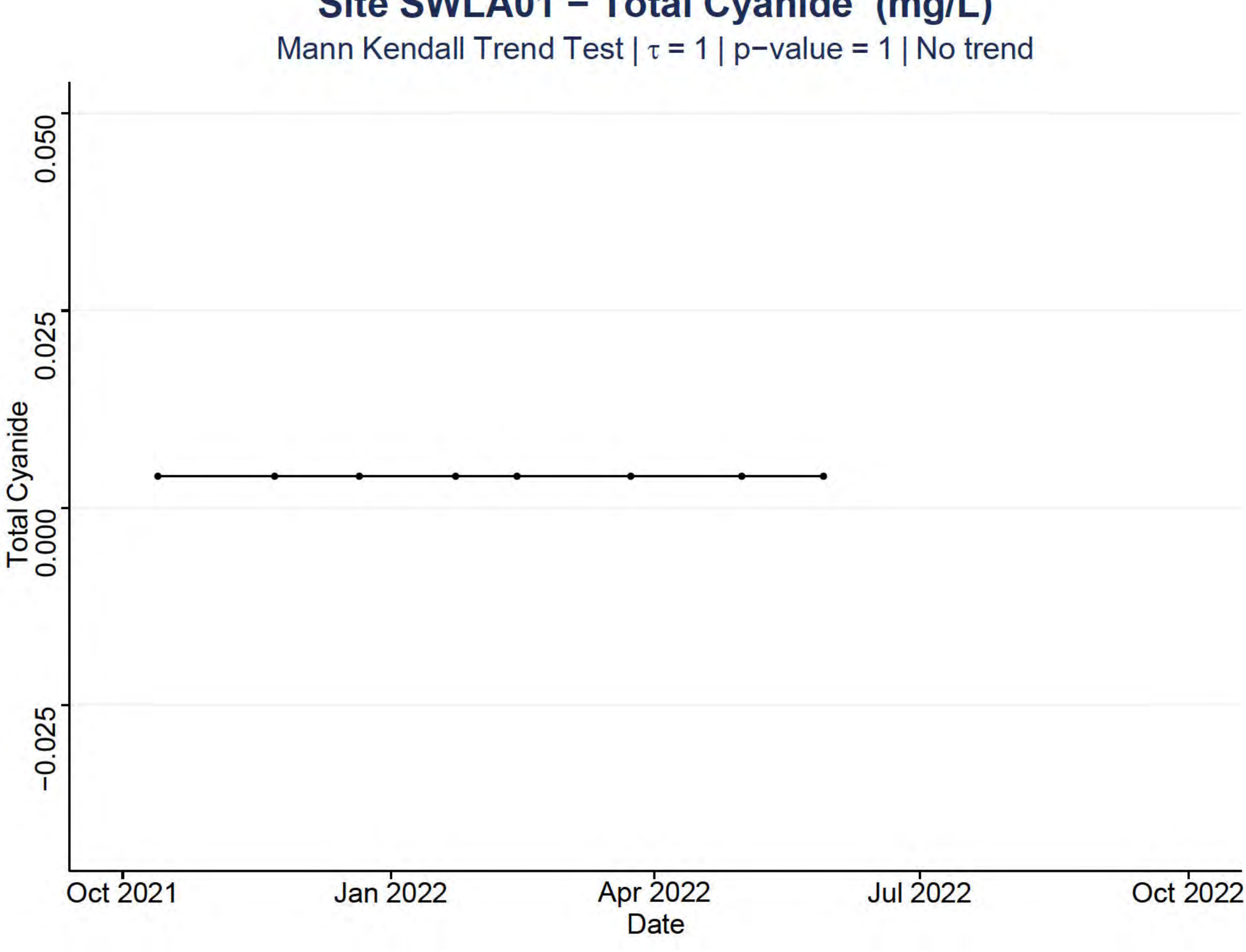

Site SWLA01 – Total Boron (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Boron
0.100
0.075
0.050
0.025
0.000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

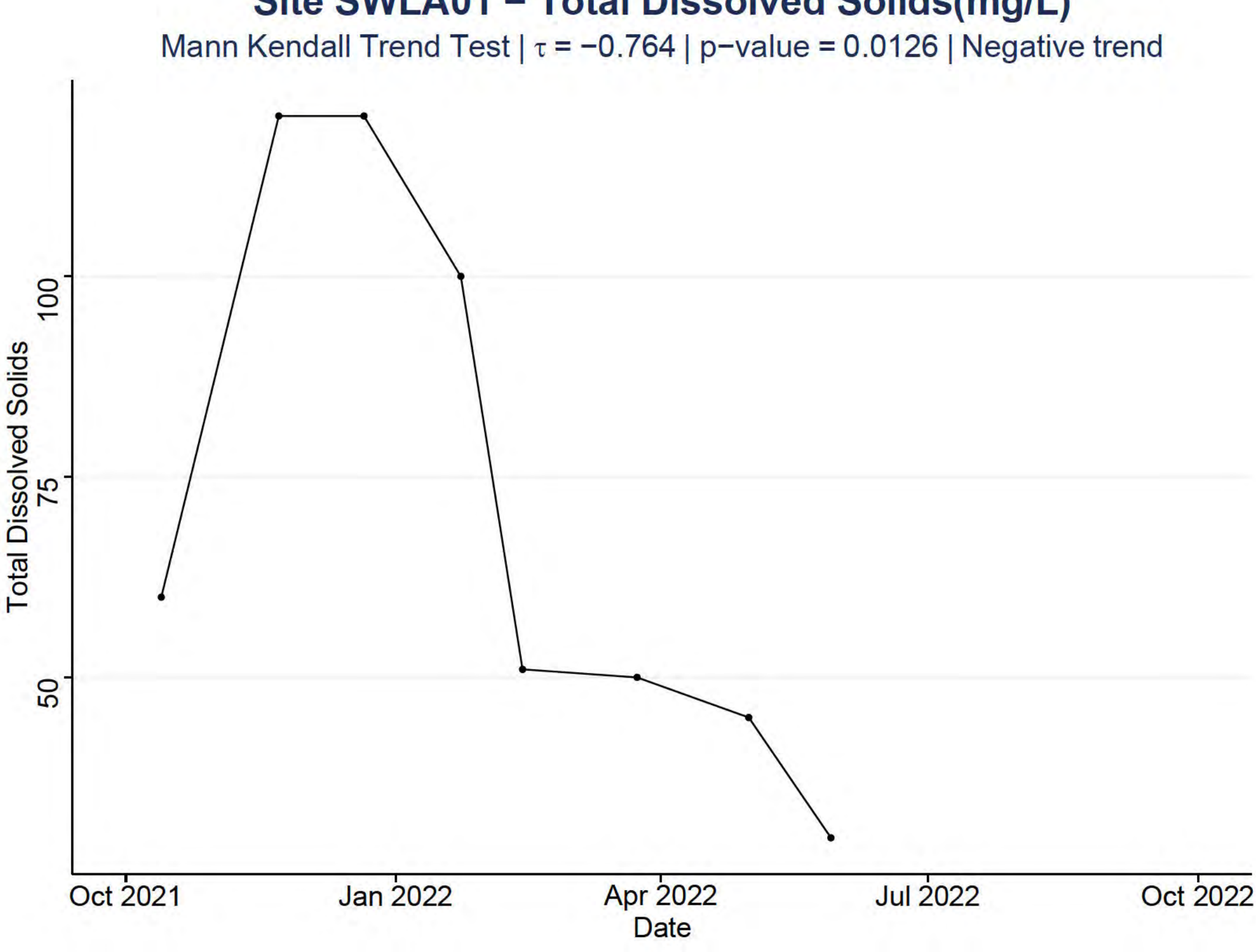

Site SWLA01 – Total Cadmium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cadmium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

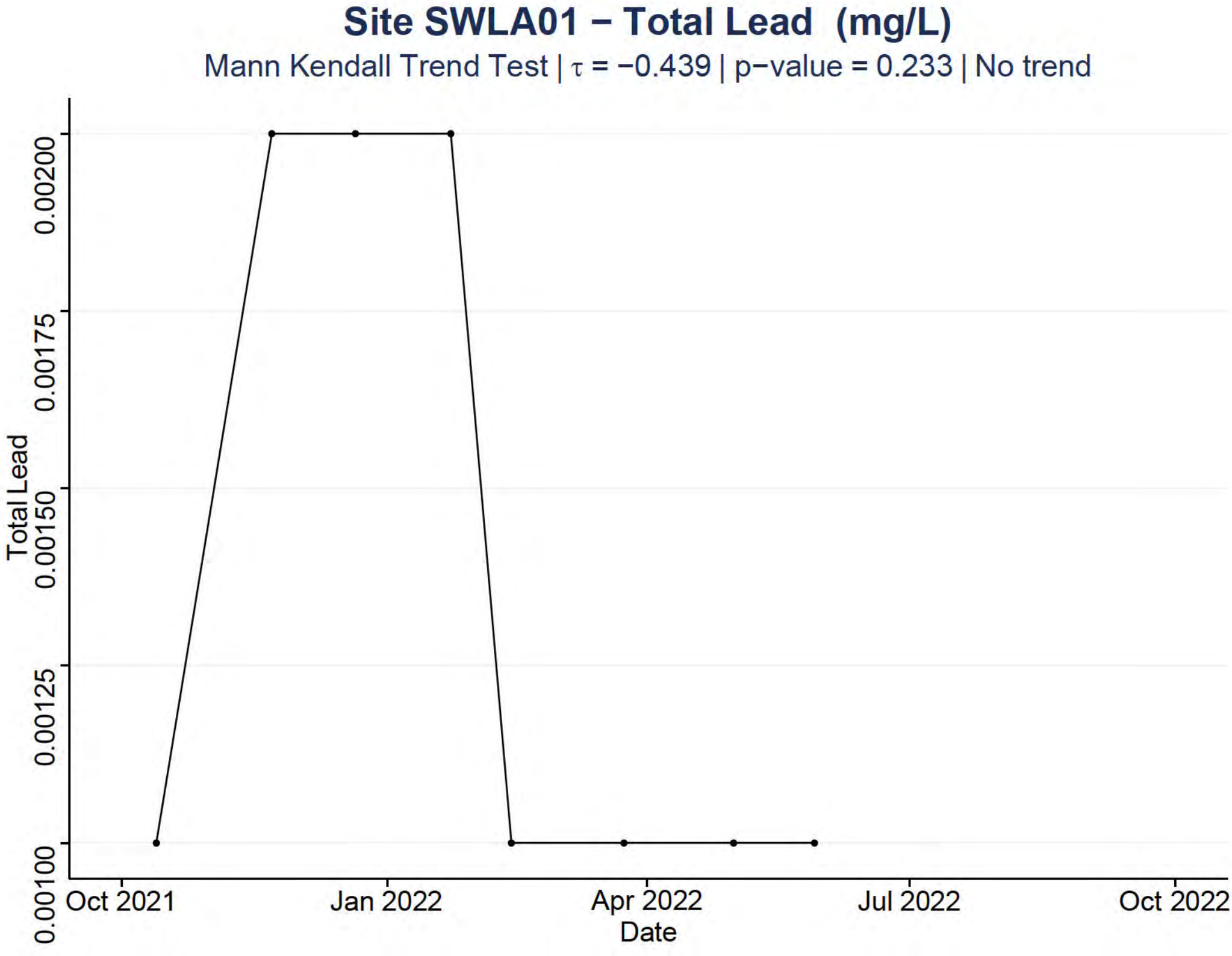

Site SWLA01 – Total Chromium (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Chromium
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

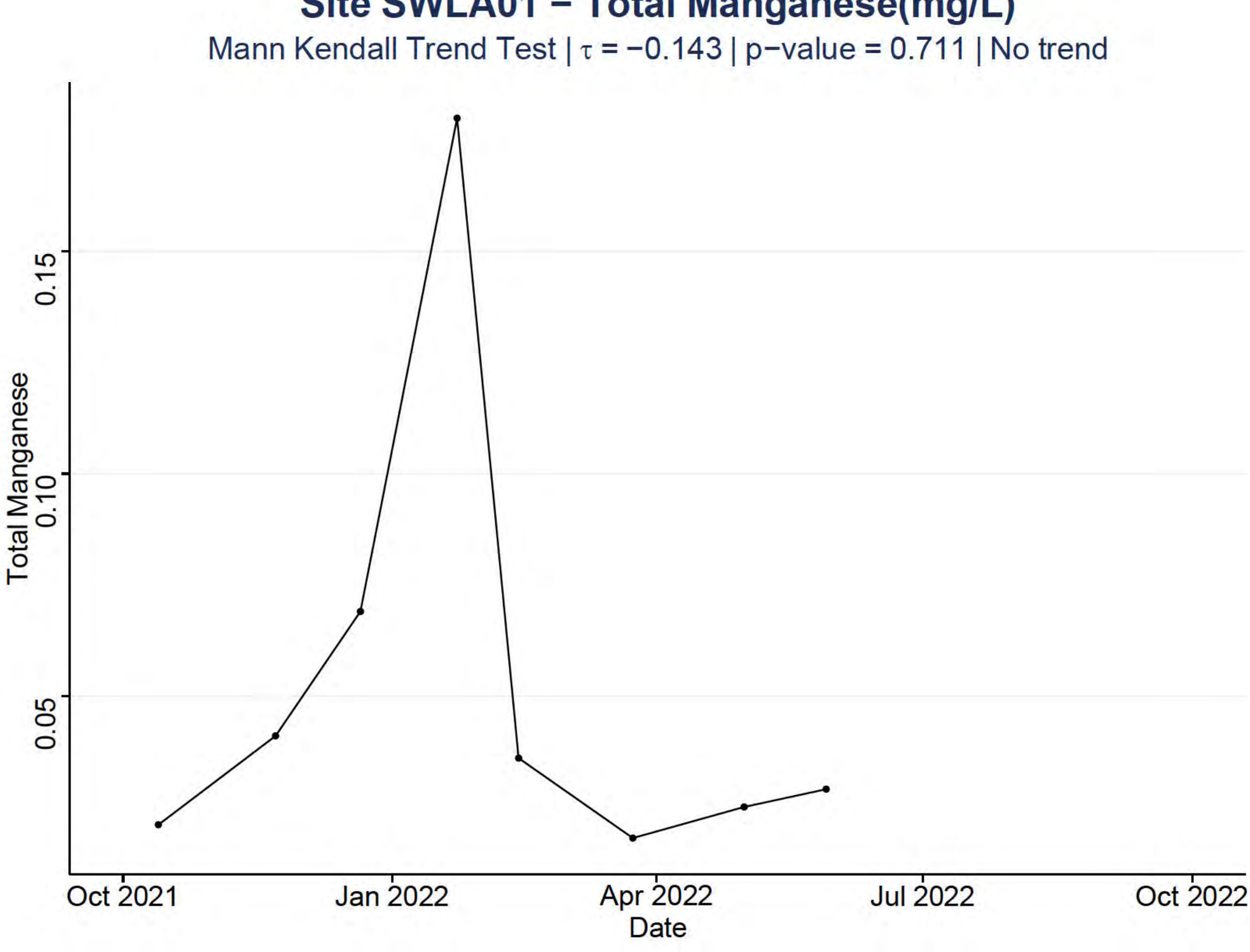

Site SWLA01 – Total Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.0714 | p−value = 1 | No trend
Total Cobalt
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

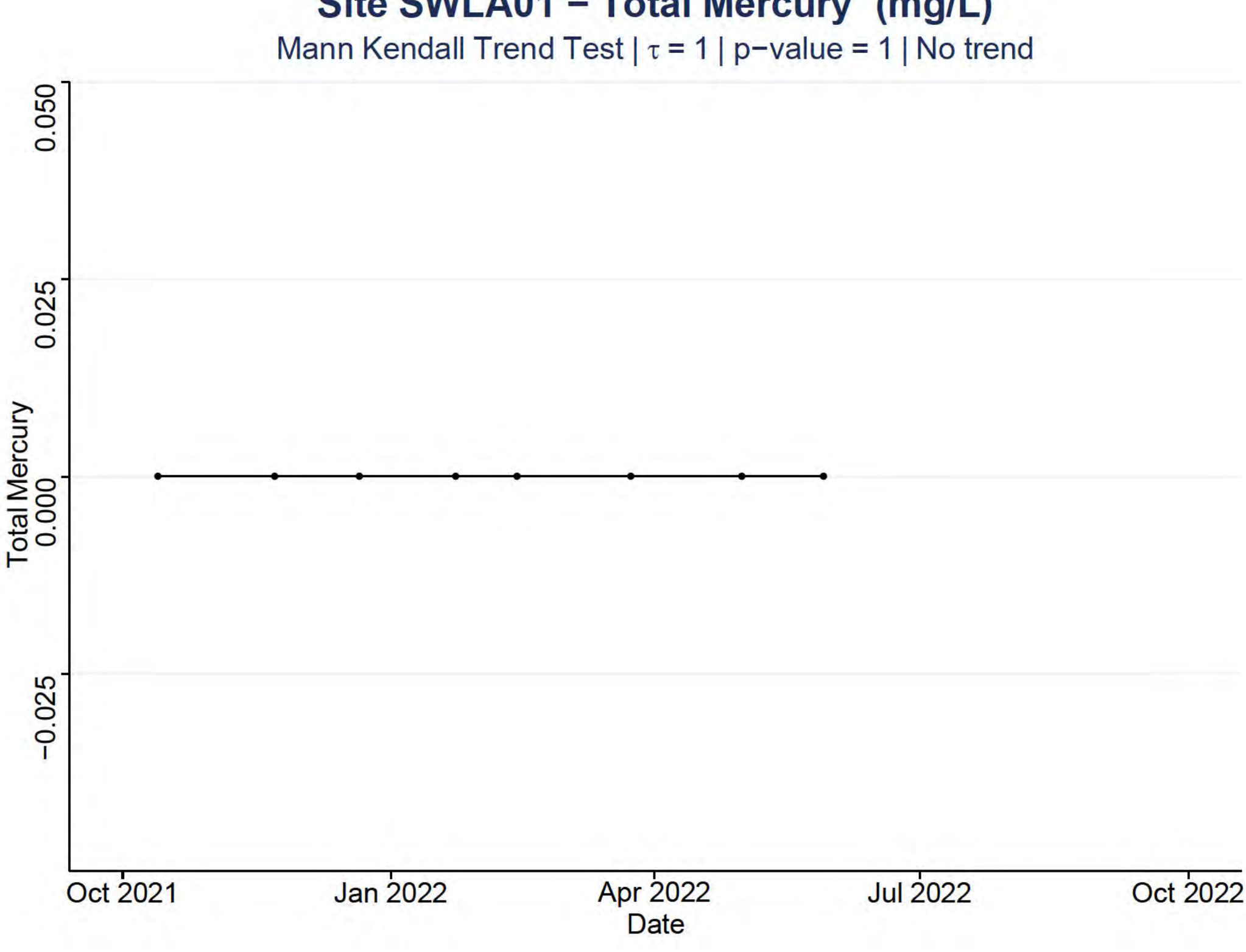

Site SWLA01 – Total Copper (mg/L)
Mann Kendall Trend Test | τ = −0.39 | p−value = 0.272 | No trend
Total Copper
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

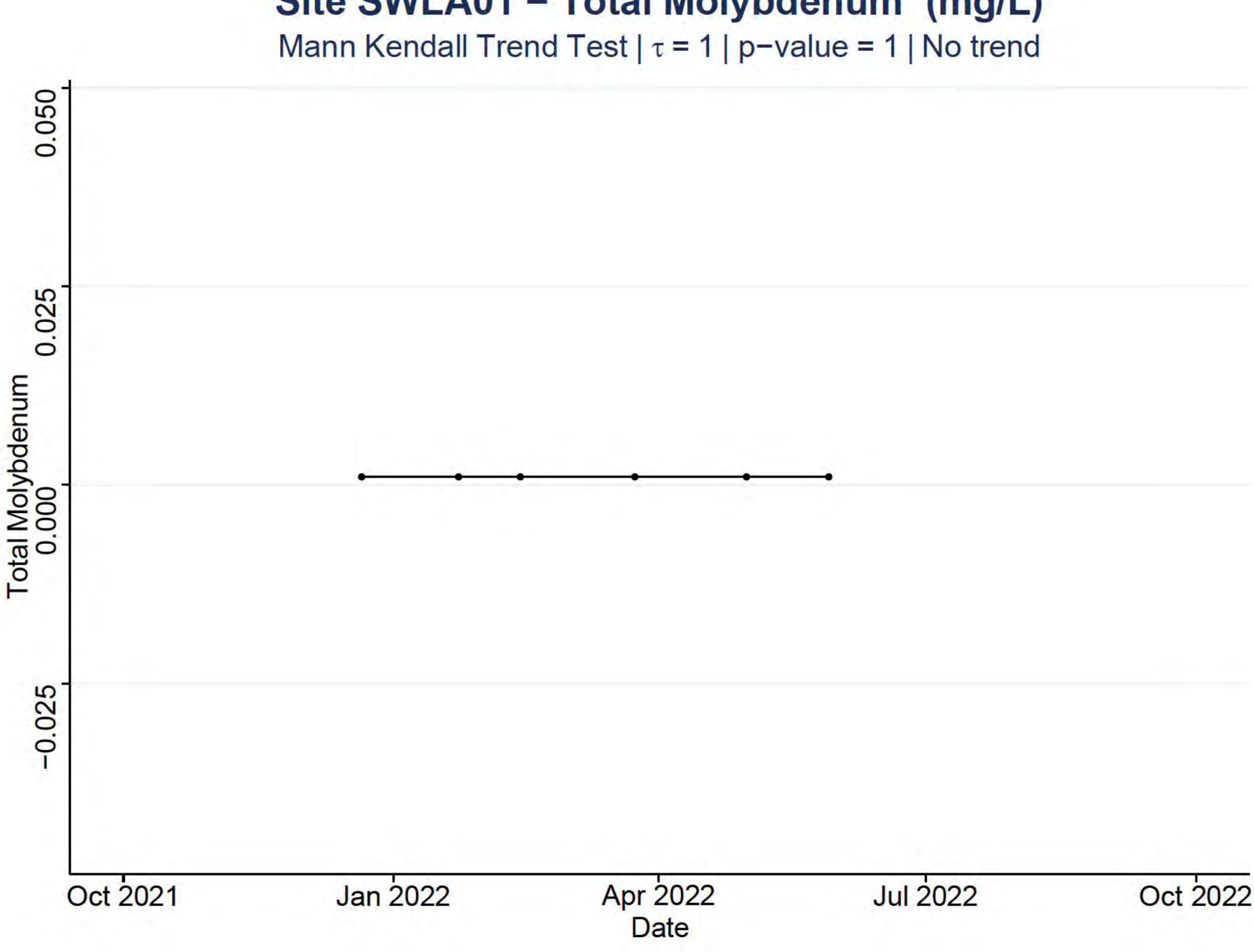

Site SWLA01 – Total Cyanide (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Cyanide
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

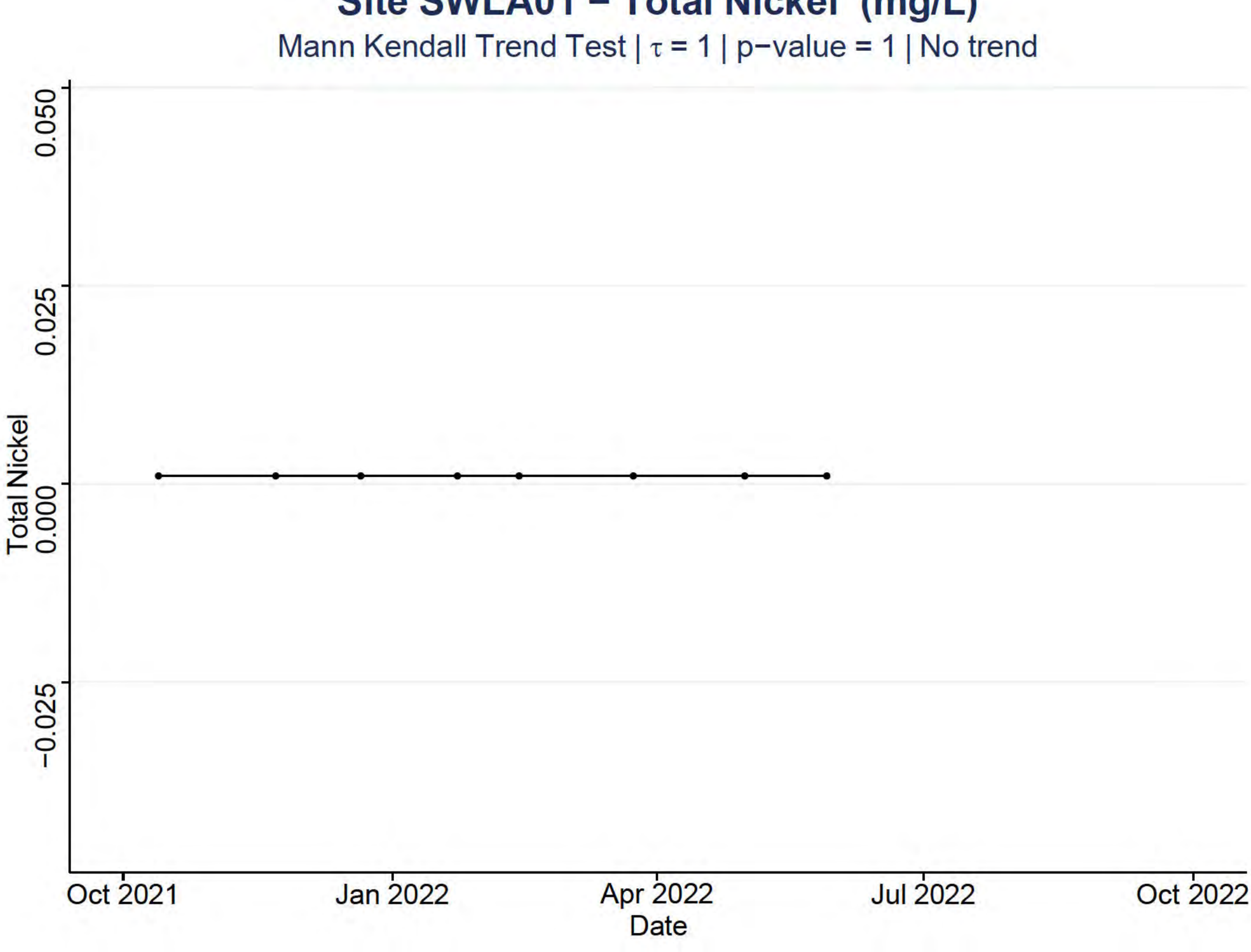

Site SWLA01 − Total Dissolved Solids(mg/L)
Mann Kendall Trend Test | τ = −0.764 | p−value = 0.0126 | Negative trend
Total Dissolved Solids
100
75
50
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

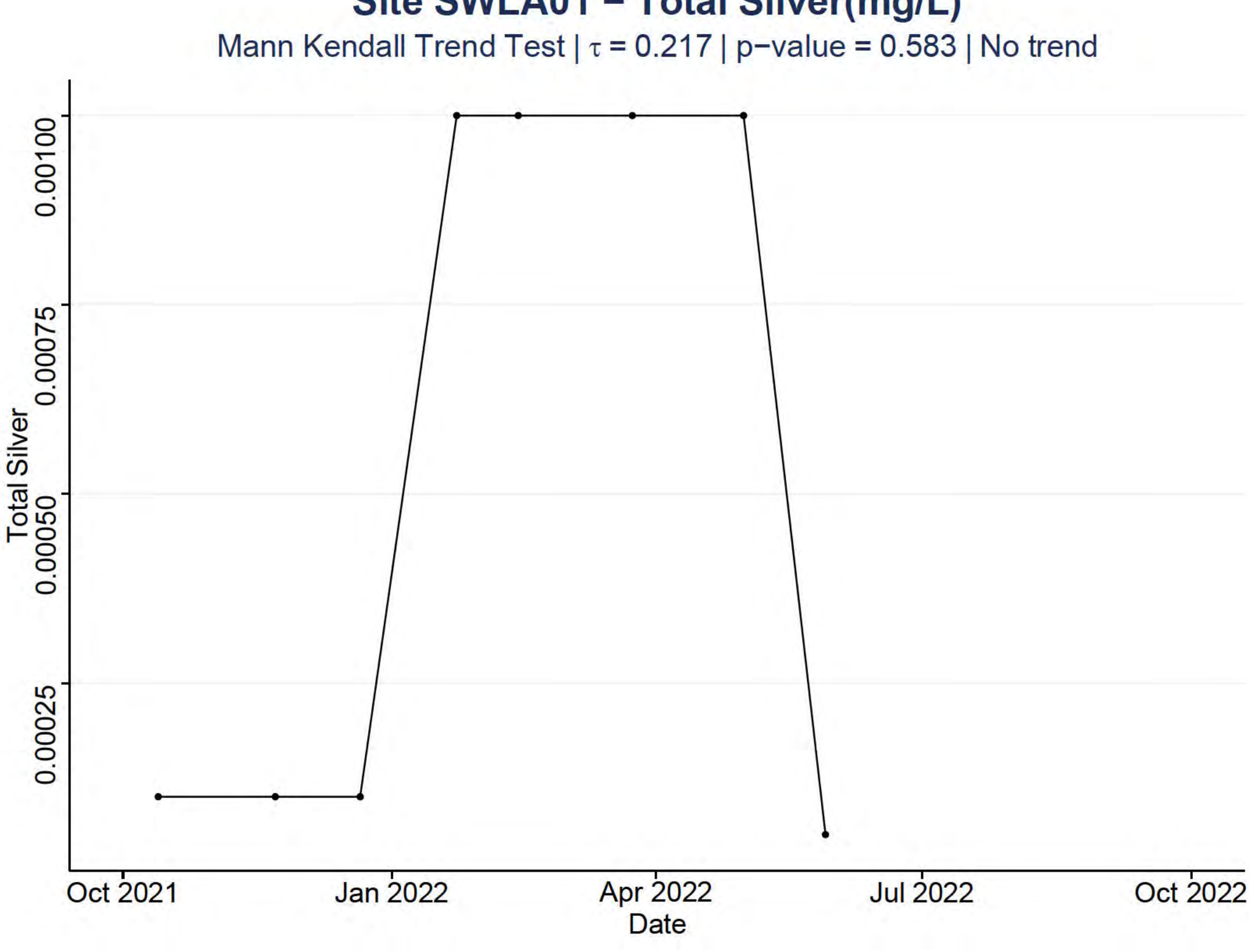

Site SWLA01 – Total Lead (mg/L)
Mann Kendall Trend Test | τ = −0.439 | p−value = 0.233 | No trend
Total Lead
0.00200
0.00175
0.00150
0.00125
0.00100
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

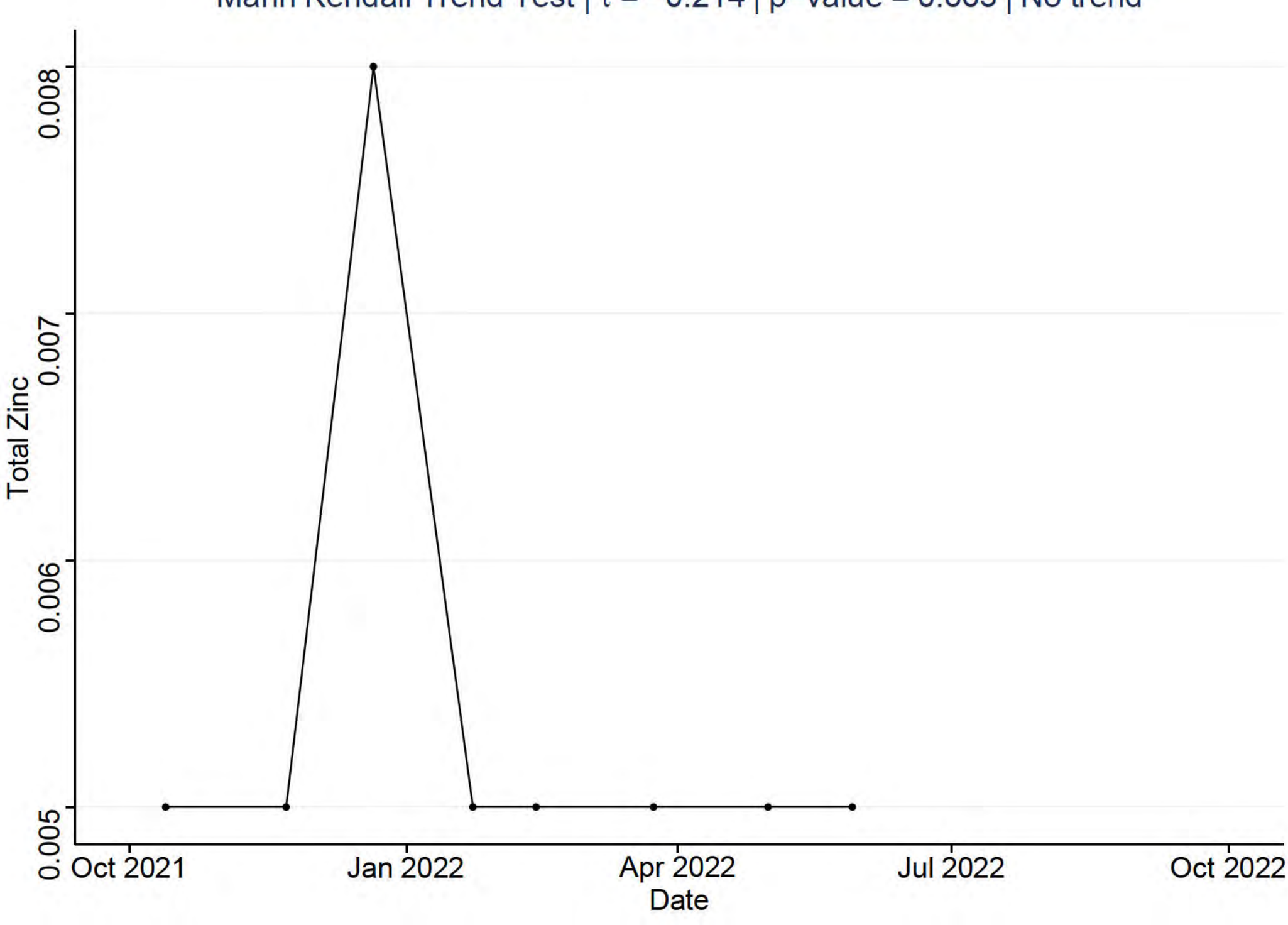

Site SWLA01 – Total Manganese(mg/L)
Mann Kendall Trend Test | τ = −0.143 | p−value = 0.711 | No trend
Total Manganese
0.15
0.10
0.05
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

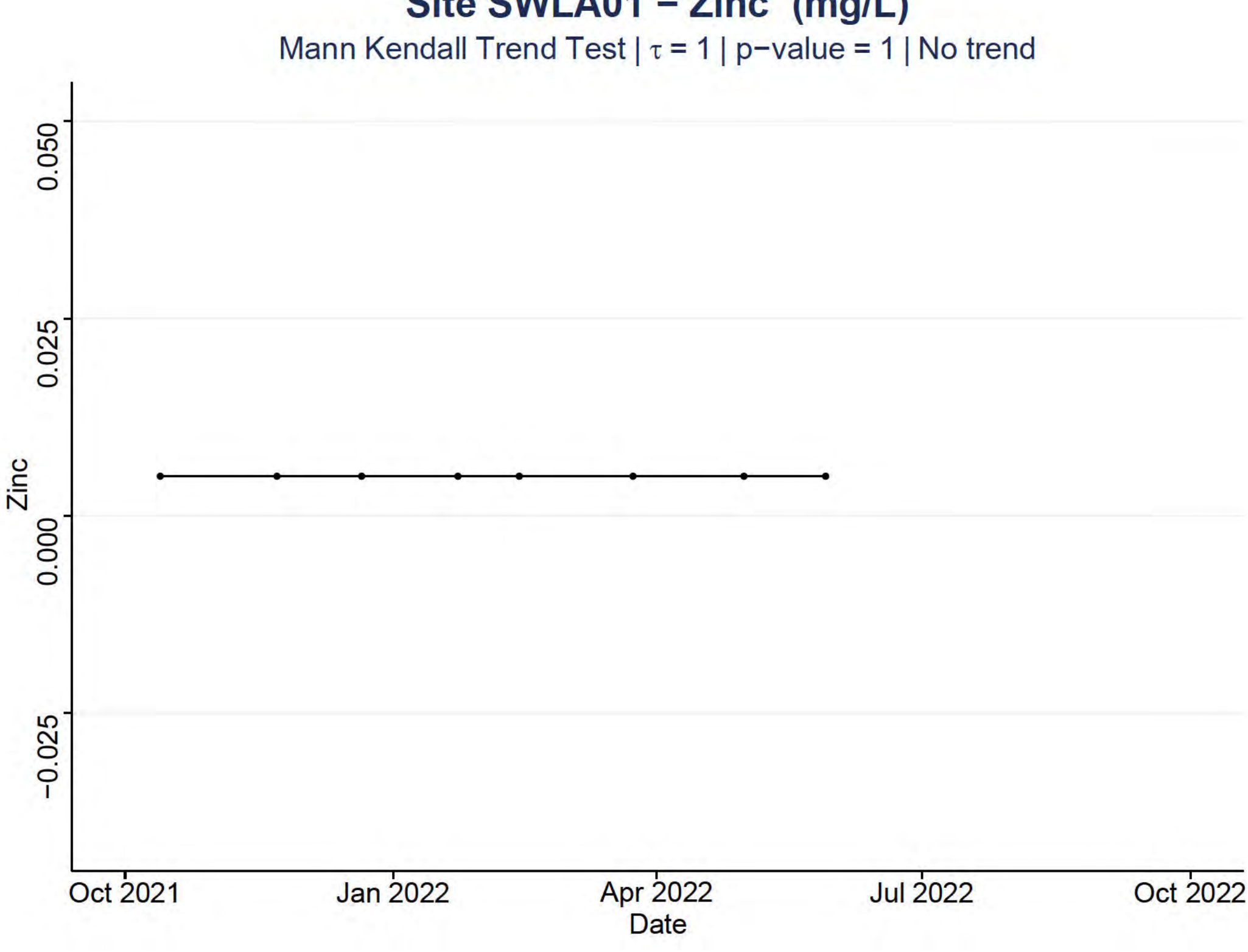

Site SWLA01 – Total Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

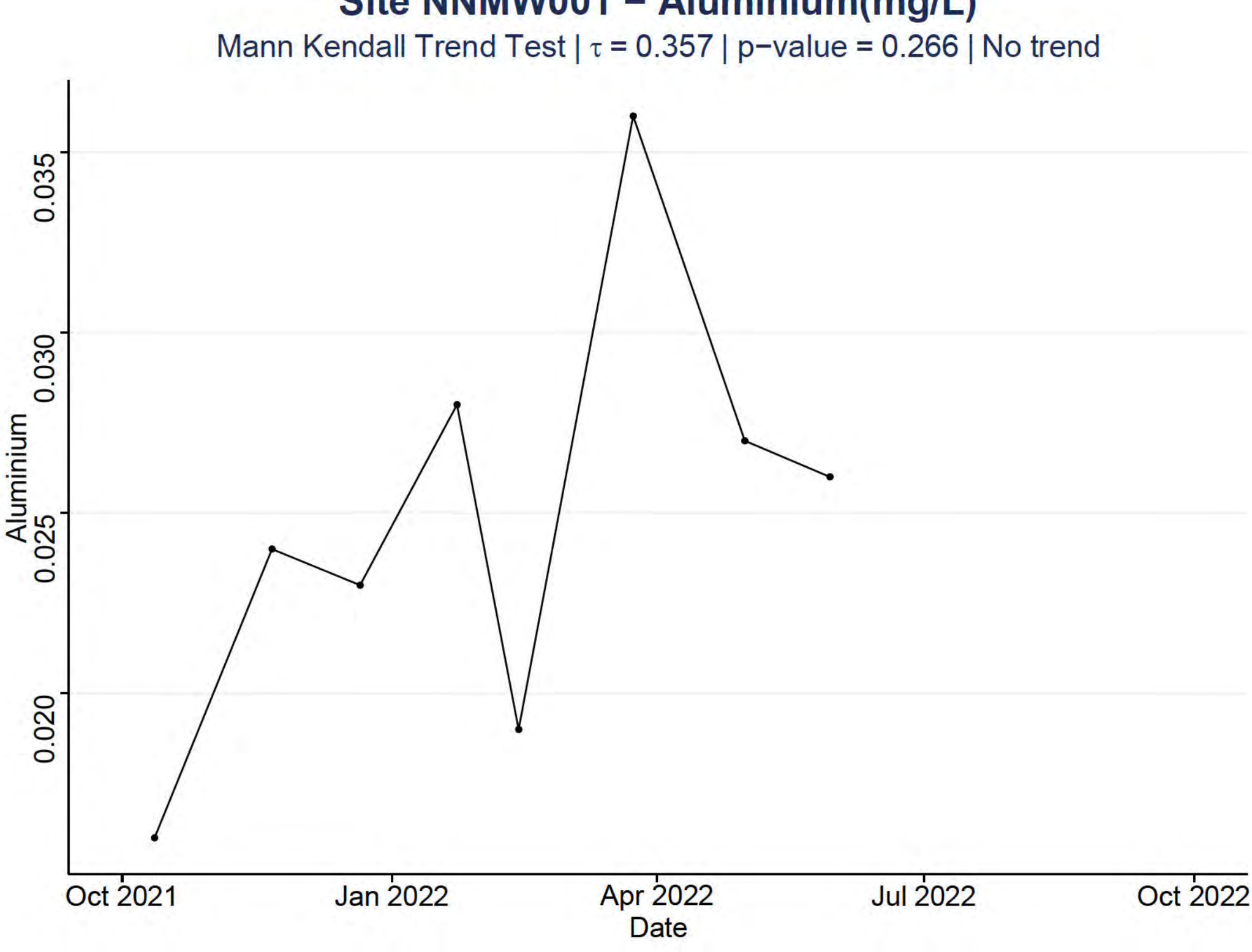

Site SWLA01 – Total Molybdenum (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Molybdenum
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

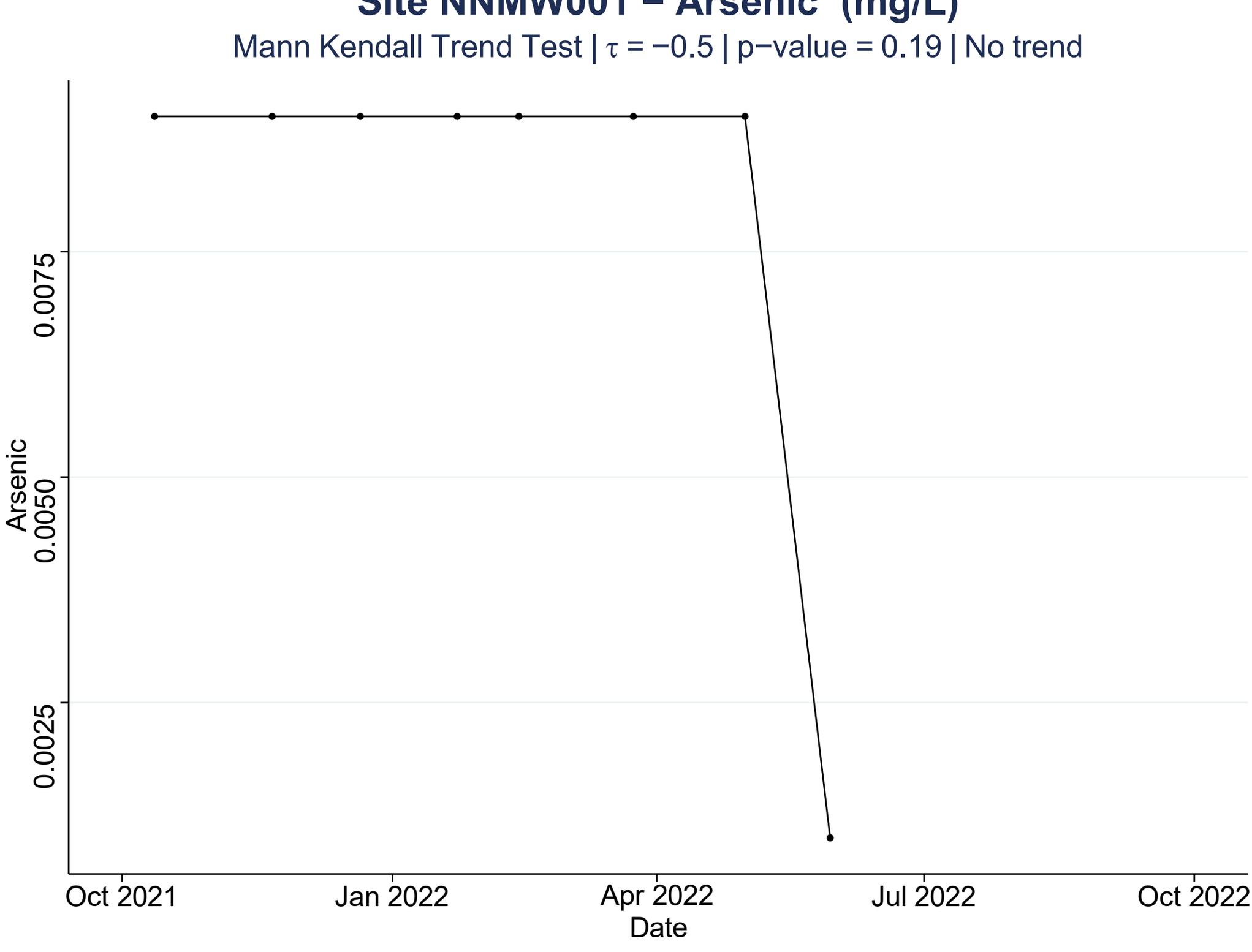

Site SWLA01 – Total Nickel (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Total Nickel
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

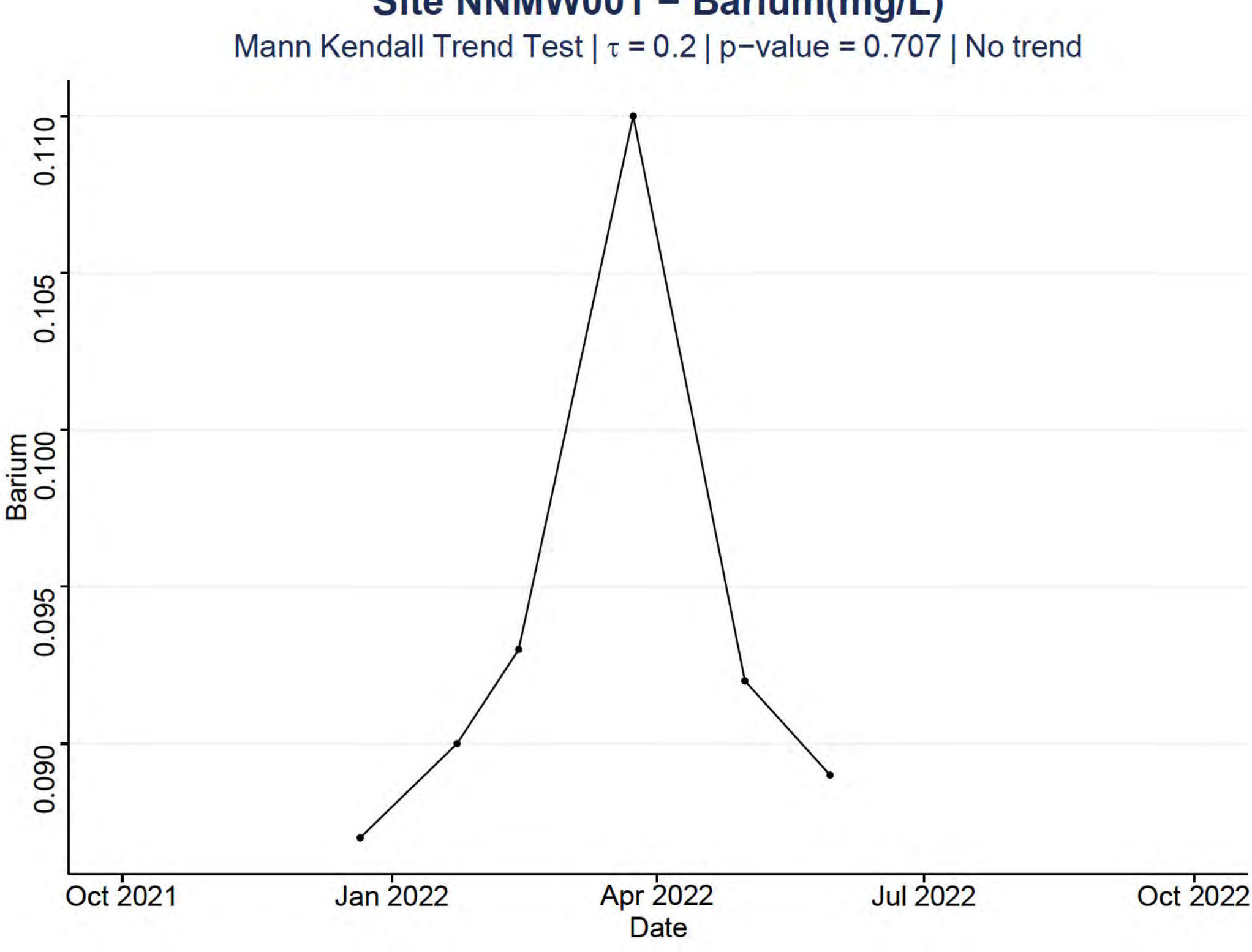

Site SWLA01 – Total Silver(mg/L)
Mann Kendall Trend Test | τ = 0.217 | p−value = 0.583 | No trend
Total Silver
0.00100
0.00075
0.00050
0.00025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

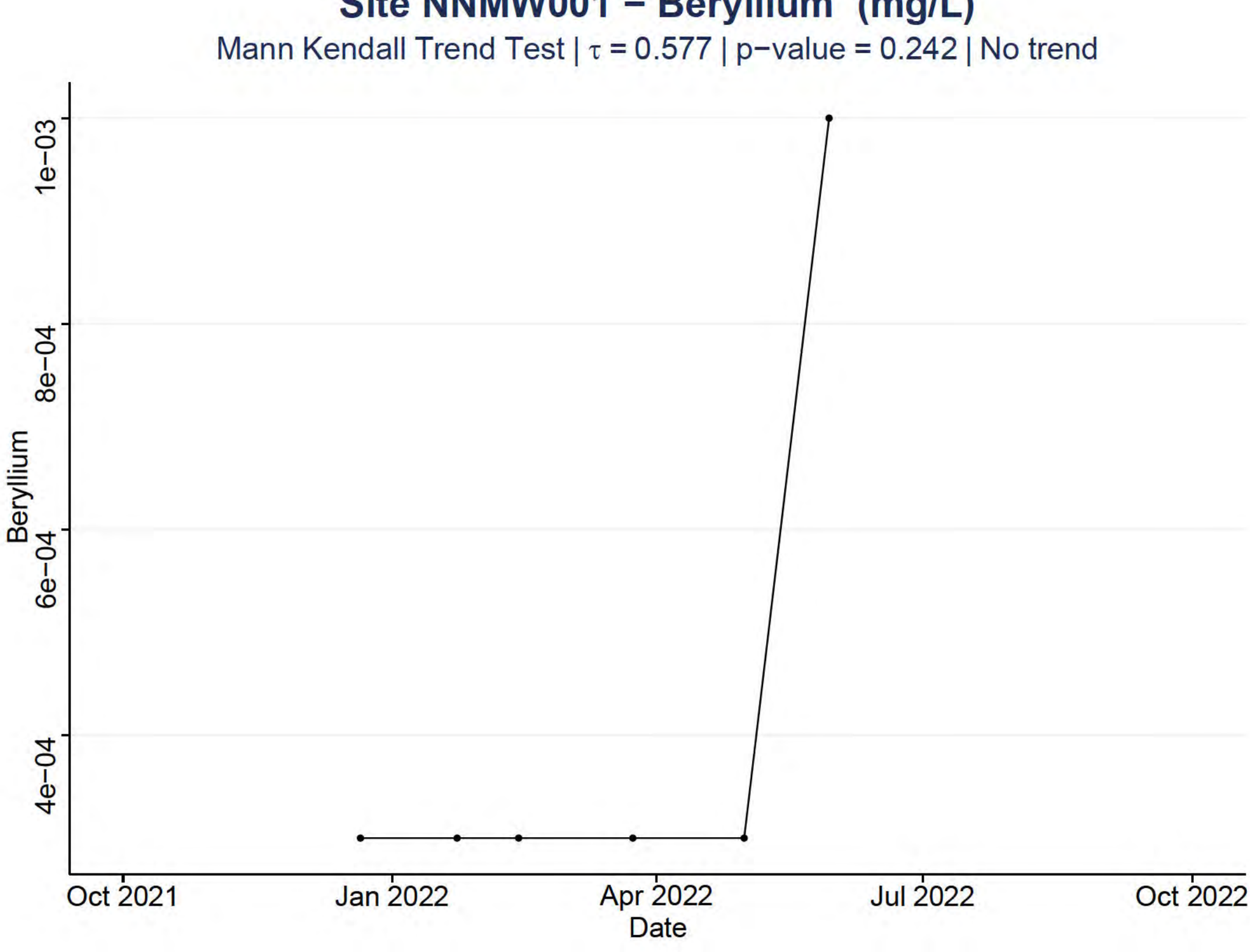

Site SWLA01 − Total Zinc(mg/L)
Mann Kendall Trend Test | τ = −0.214 | p−value = 0.663 | No trend
Total Zinc
0.005
0.006
0.007
0.008
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

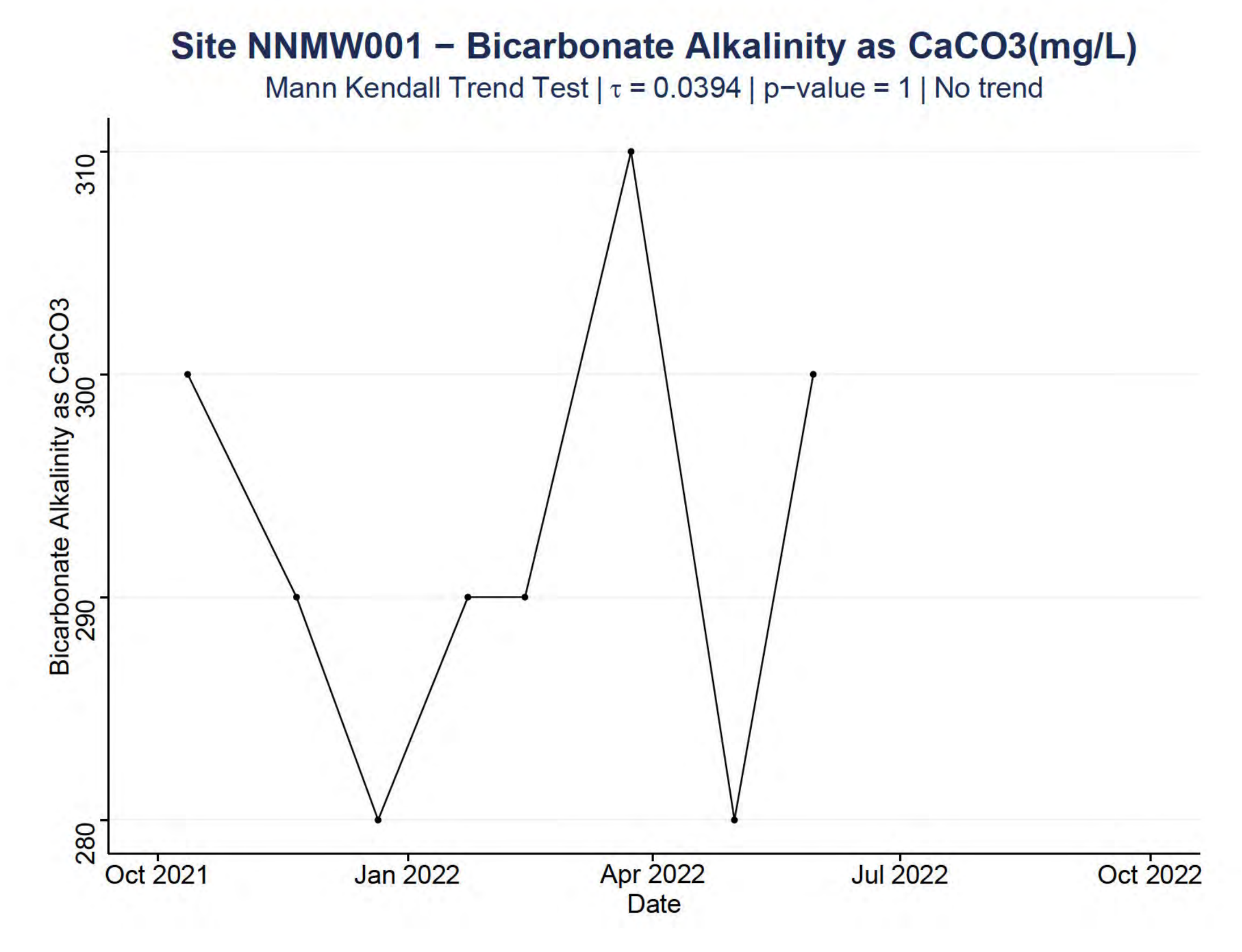

Site SWLA01 – Zinc (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
0.050
0.025
0.000
−0.025
Zinc
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

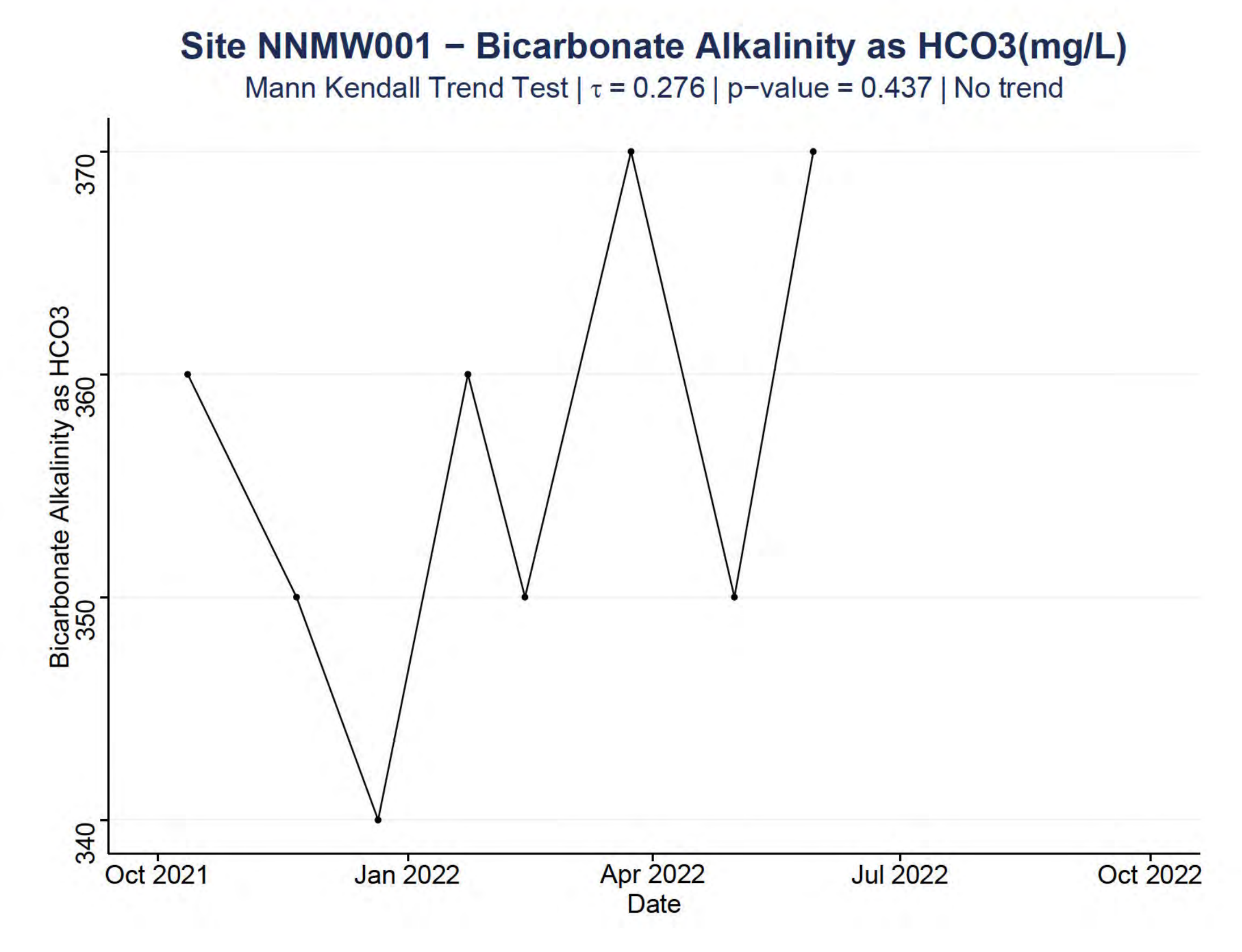

Site NNMW001 – Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.357 | p−value = 0.266 | No trend
Aluminium
0.020
0.025
0.030
0.035
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

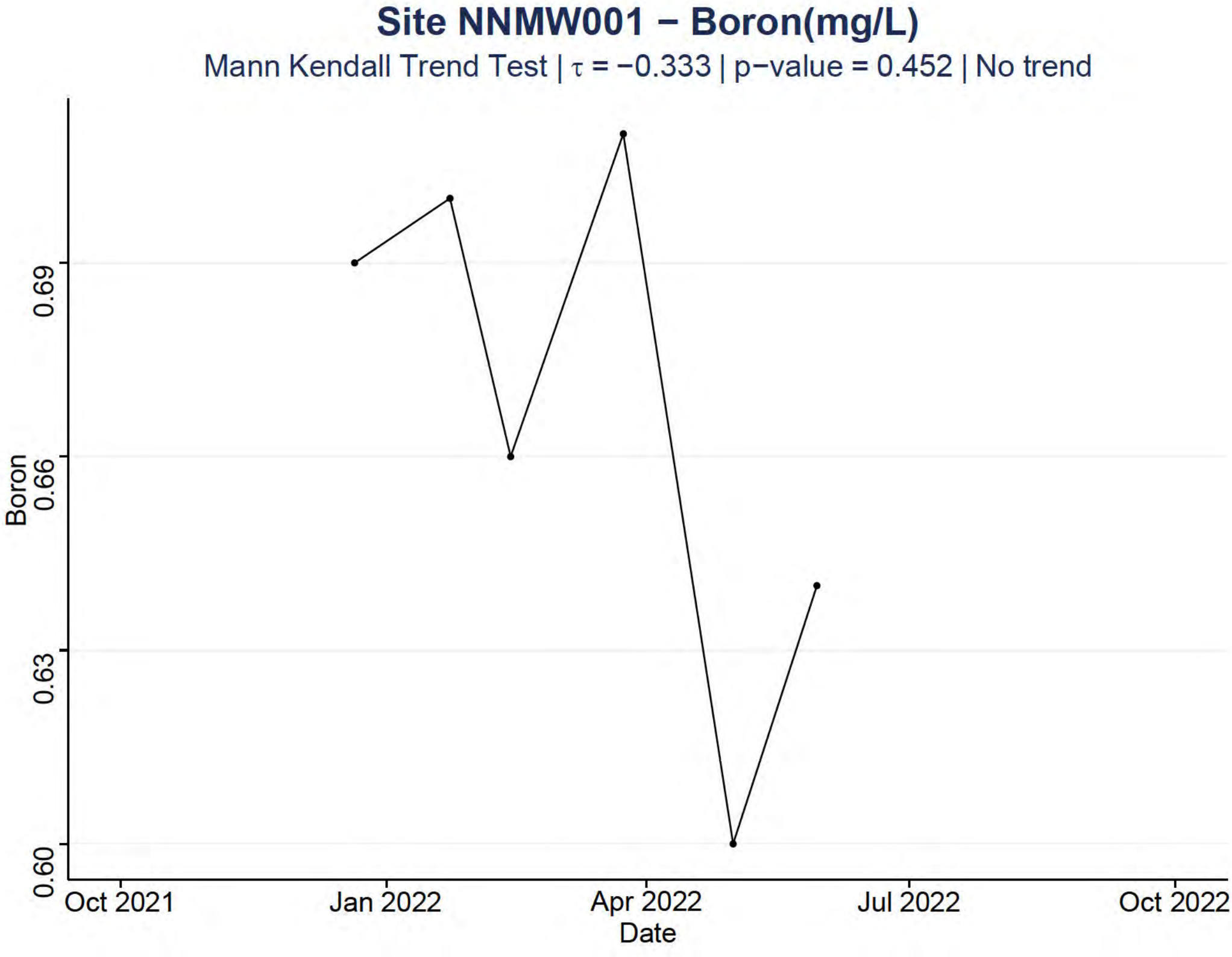

Site NNMW001 − Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

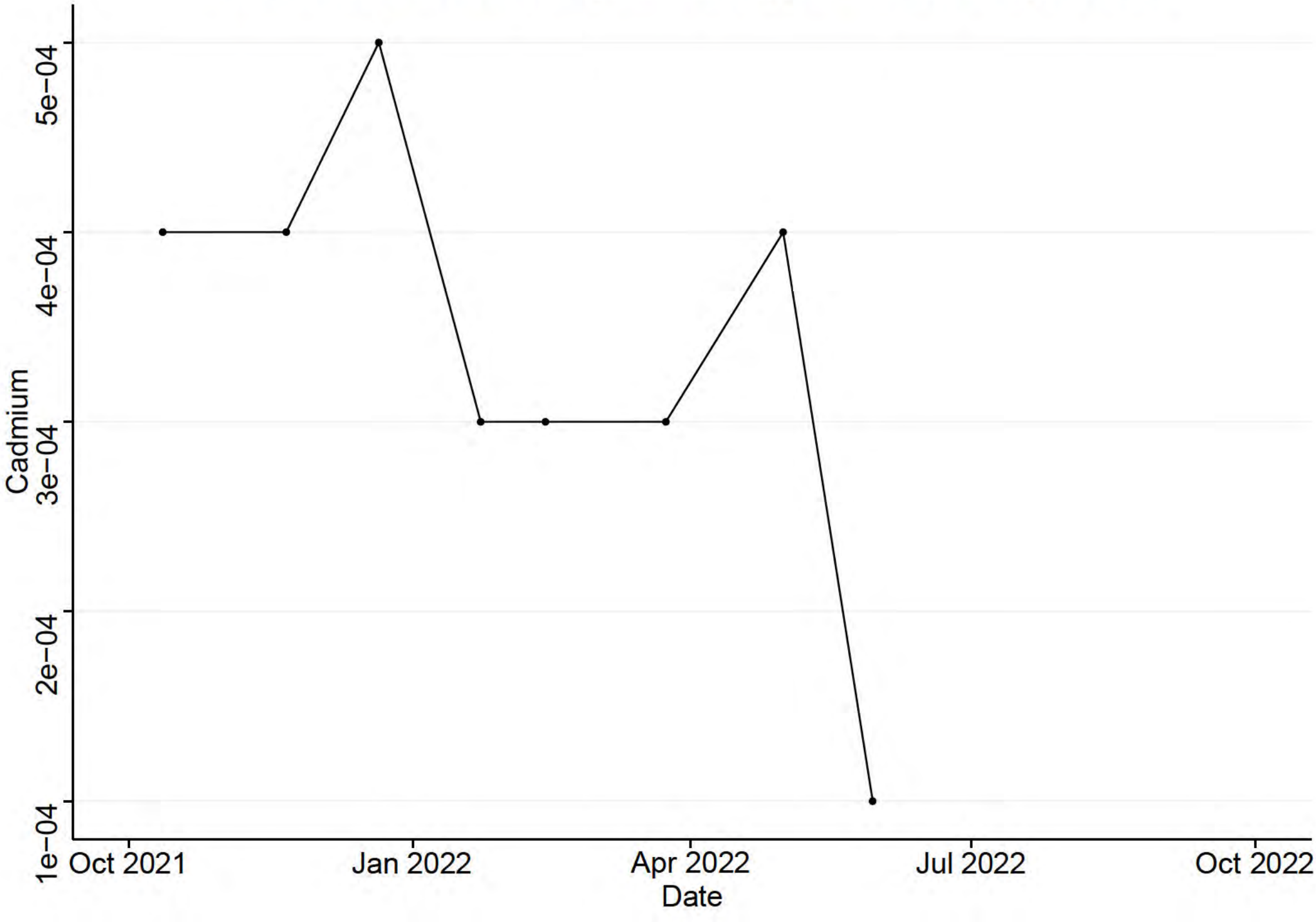

Site NNMW001 − Barium(mg/L)
Mann Kendall Trend Test | τ = 0.2 | p−value = 0.707 | No trend
Barium
0.110
0.105
0.100
0.095
0.090
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

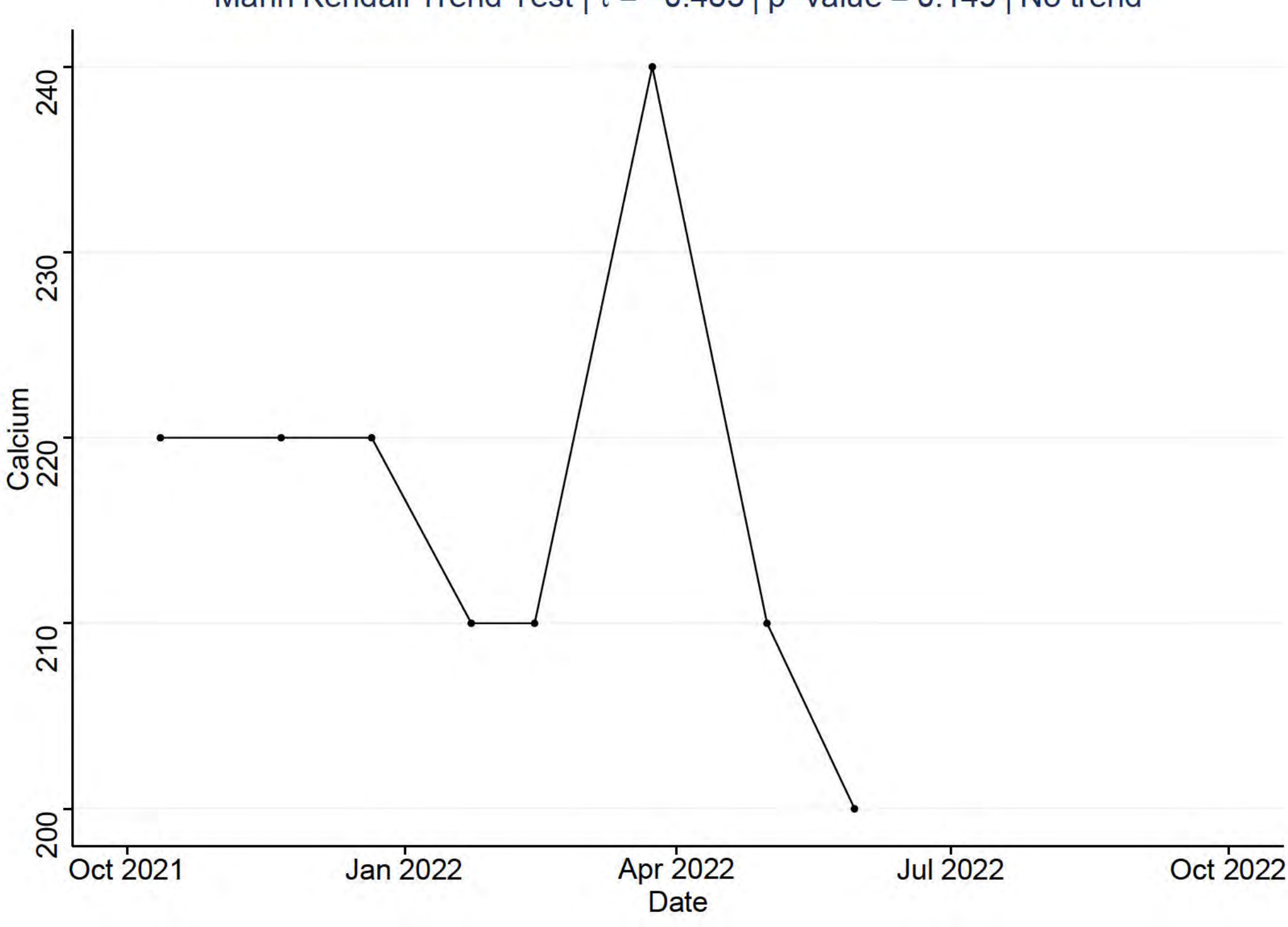

Site NNMW001 – Beryllium (mg/L)
Mann Kendall Trend Test | τ = 0.577 | p−value = 0.242 | No trend
Beryllium
1e−03
8e−04
6e−04
4e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

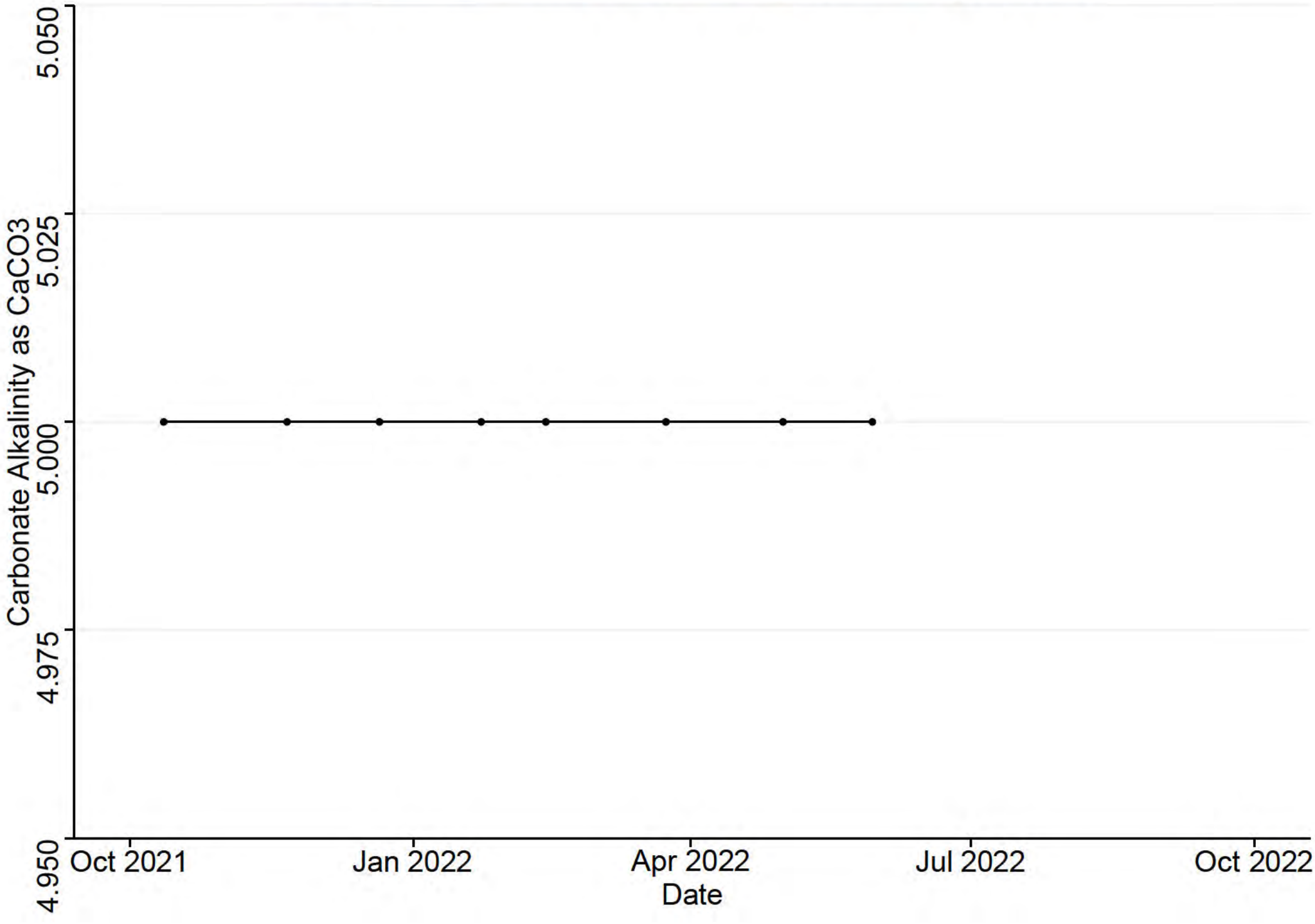

Site NNMW001 − Bicarbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 0.0394 | p−value = 1 | No trend
Bicarbonate Alkalinity as CaCO3
310
300
290
280
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

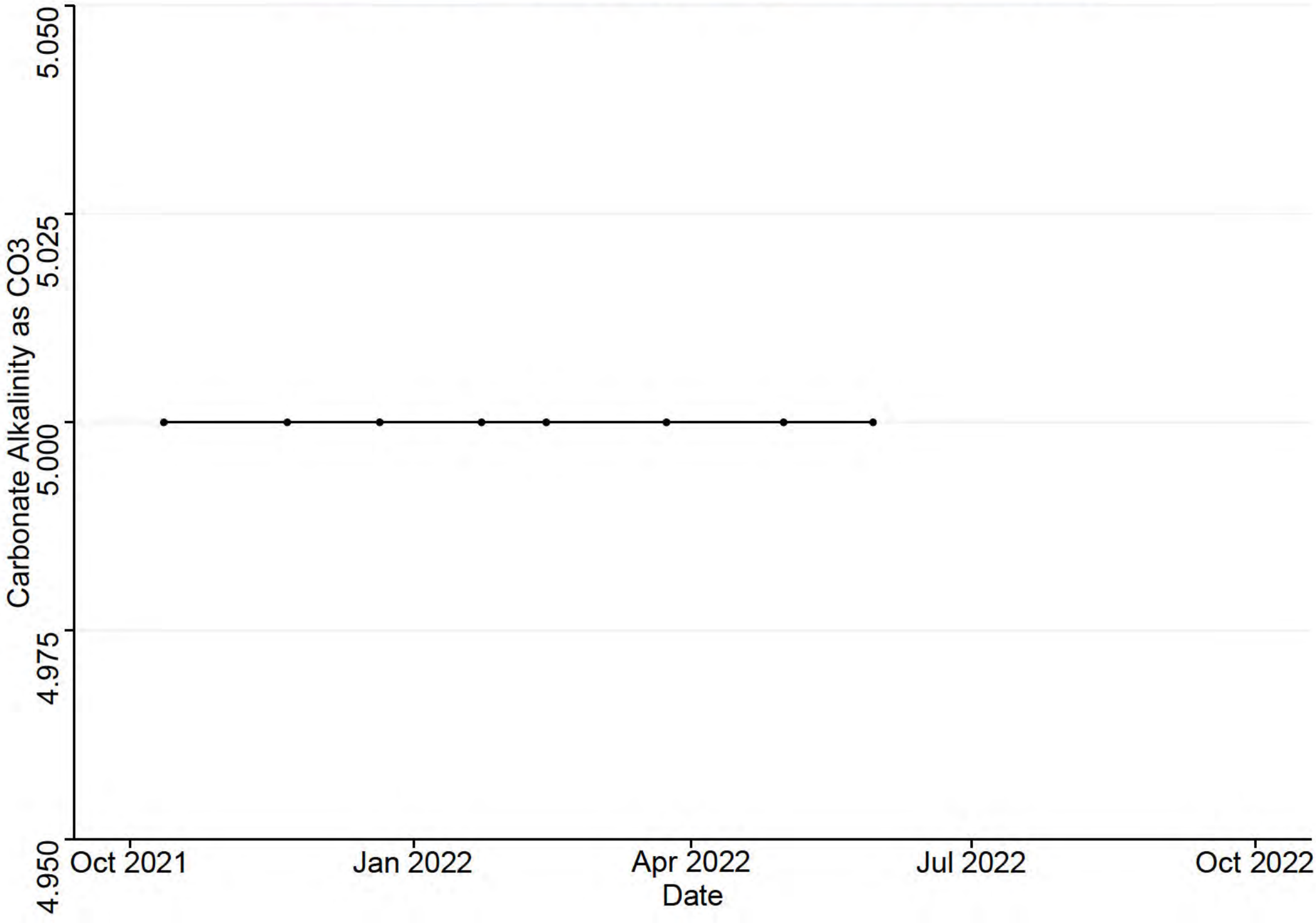

Site NNMW001 − Bicarbonate Alkalinity as HCO3(mg/L)
Mann Kendall Trend Test | τ = 0.276 | p−value = 0.437 | No trend
Bicarbonate Alkalinity as HCO3
370
360
350
340
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

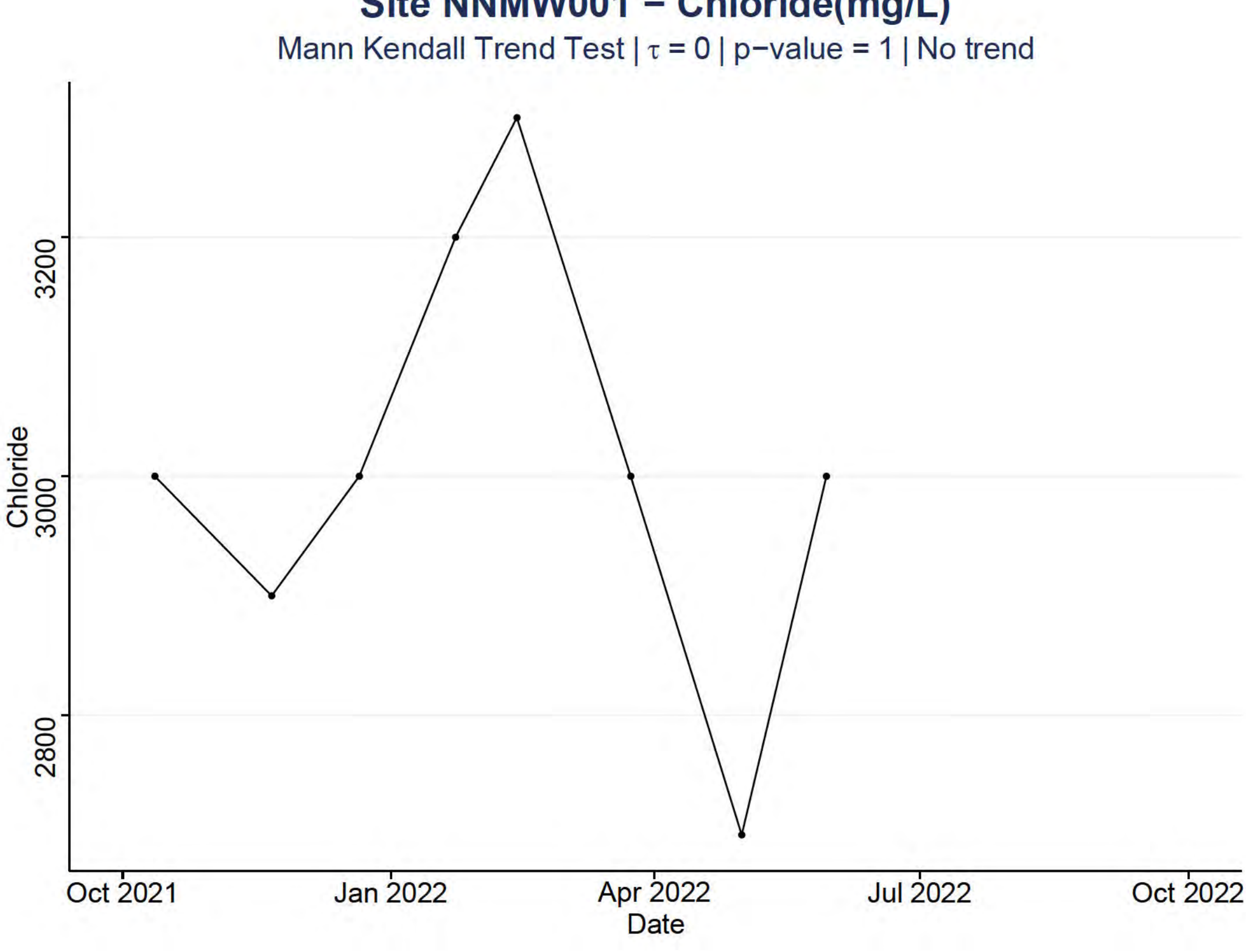

Site NNMW001 – Boron(mg/L)
Mann Kendall Trend Test | τ = −0.333 | p−value = 0.452 | No trend
Boron
0.69
0.66
0.63
0.60
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

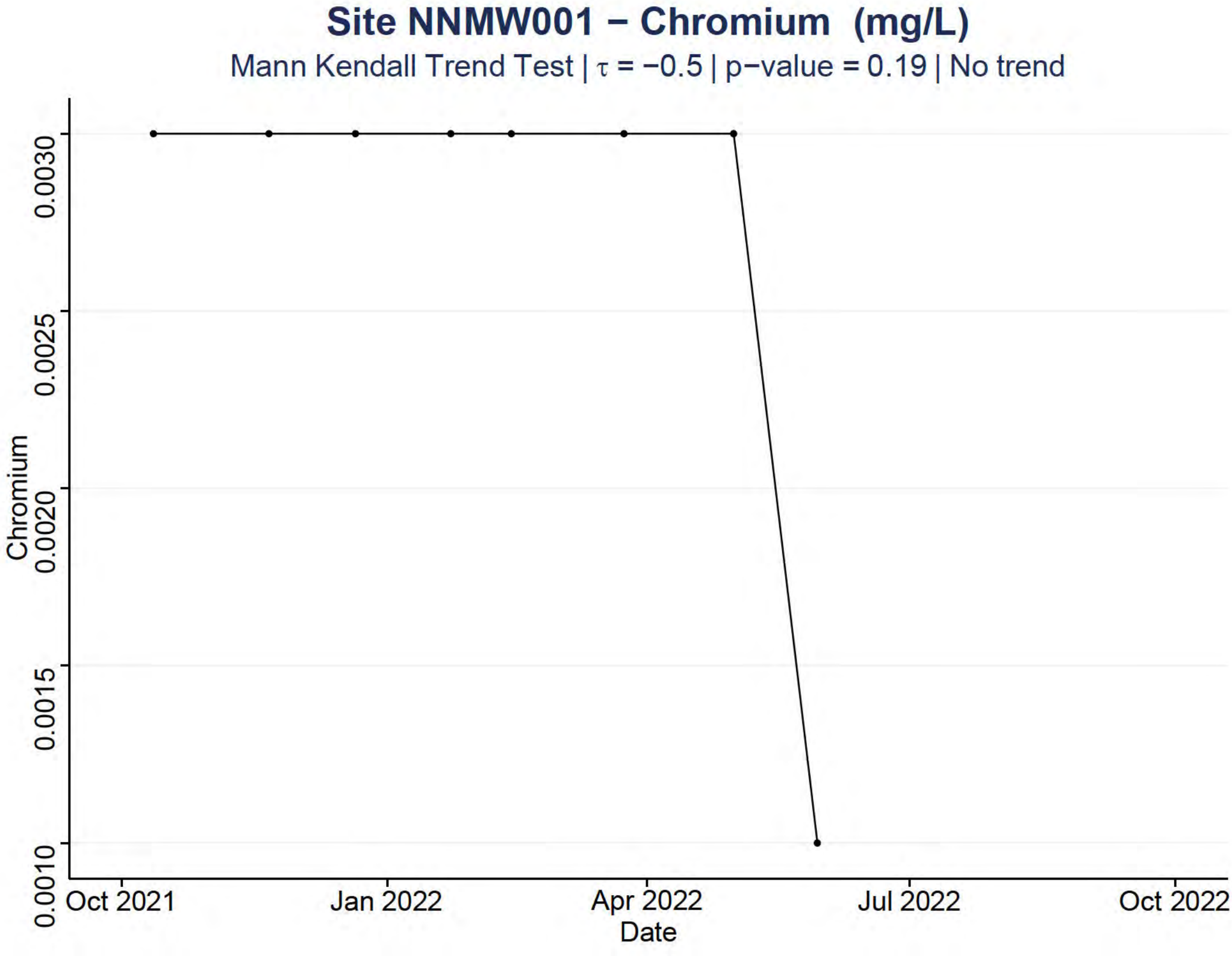

Site NNMW001 – Cadmium (mg/L)
Mann Kendall Trend Test | τ = −0.483 | p−value = 0.149 | No trend
Cadmium
5e−04
4e−04
3e−04
2e−04
1e−04
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

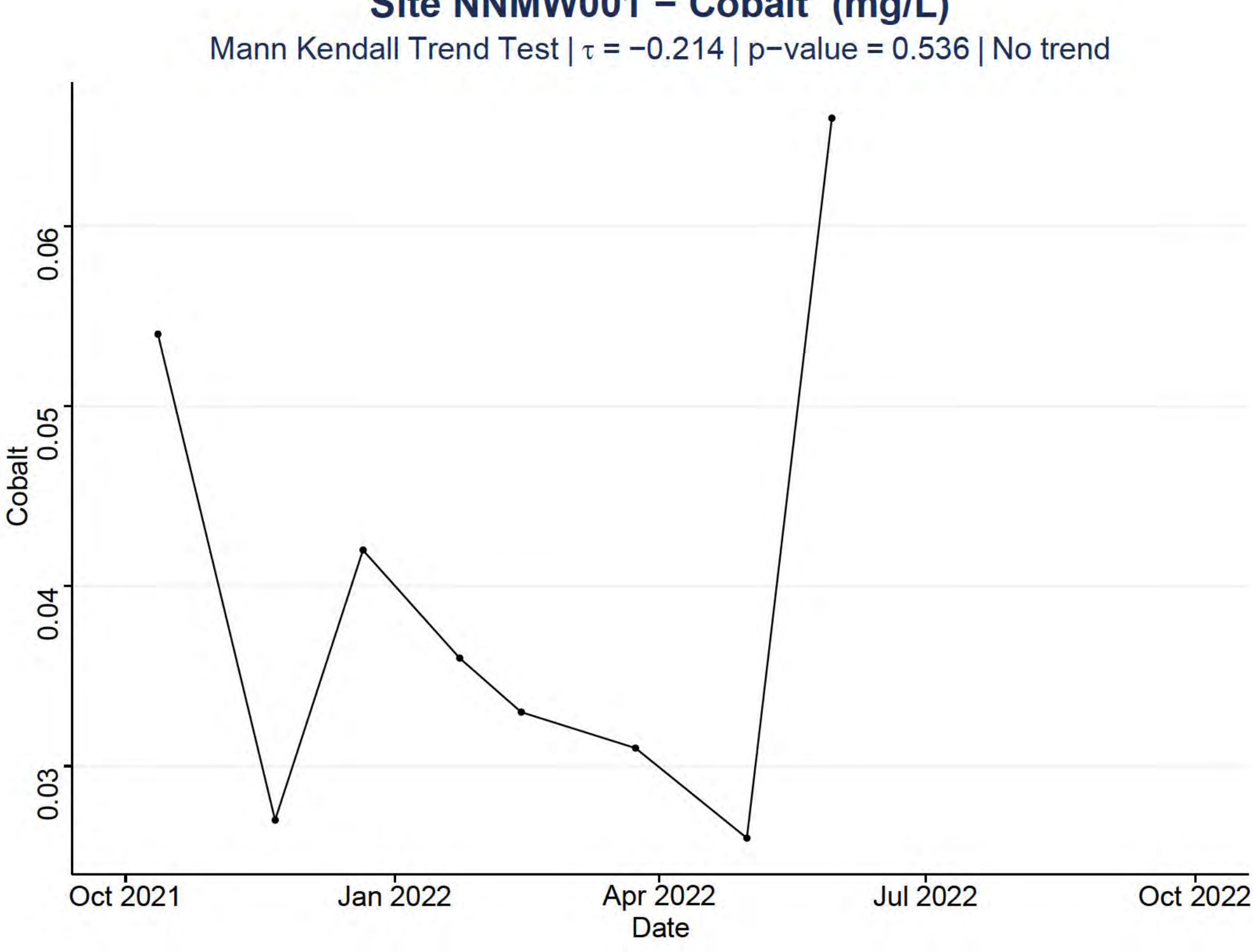

Site NNMW001 – Calcium(mg/L)
Mann Kendall Trend Test | τ = −0.483 | p−value = 0.149 | No trend
Calcium
240
230
220
210
200
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

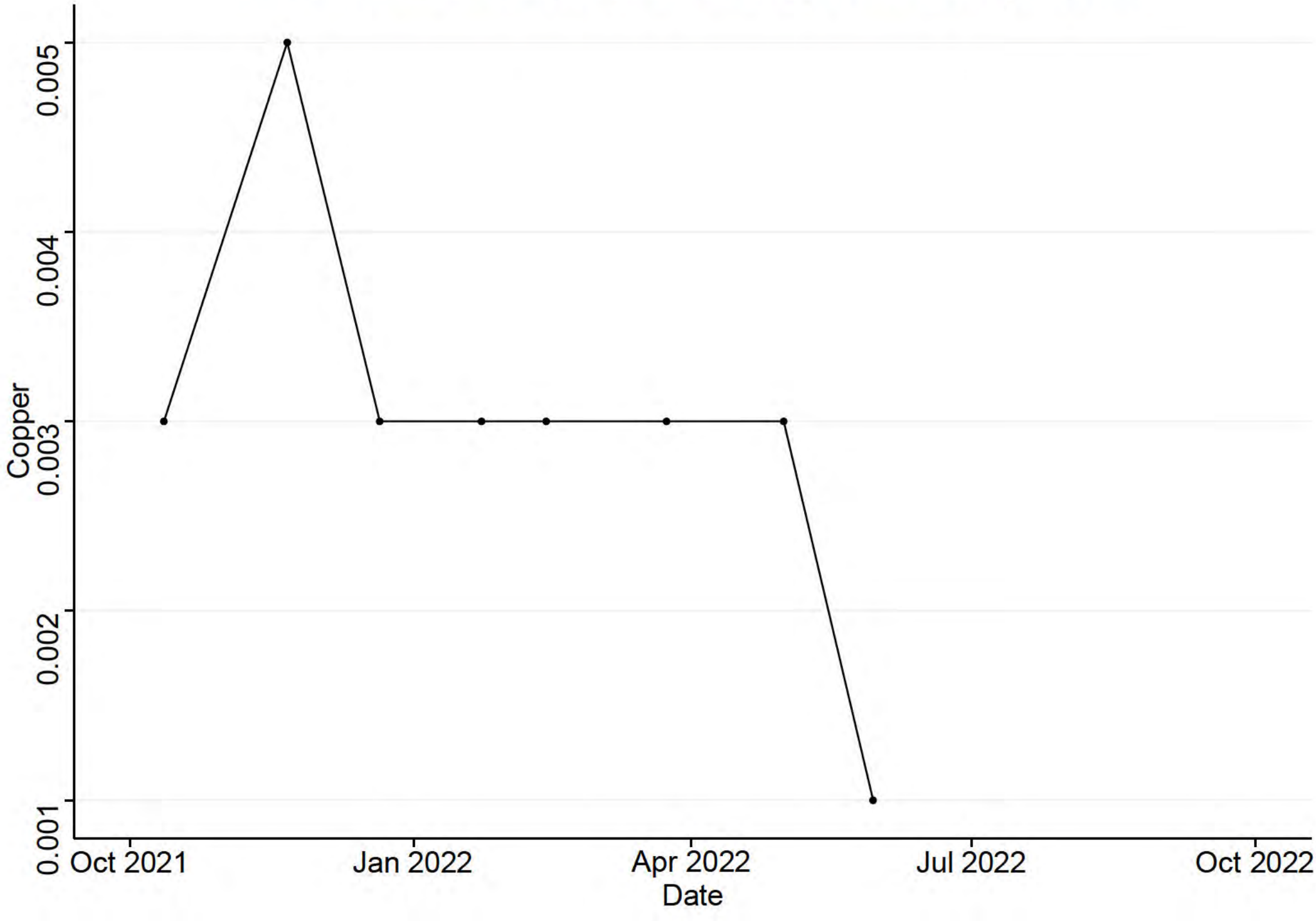

Site NNMW001 – Carbonate Alkalinity as CaCO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CaCO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

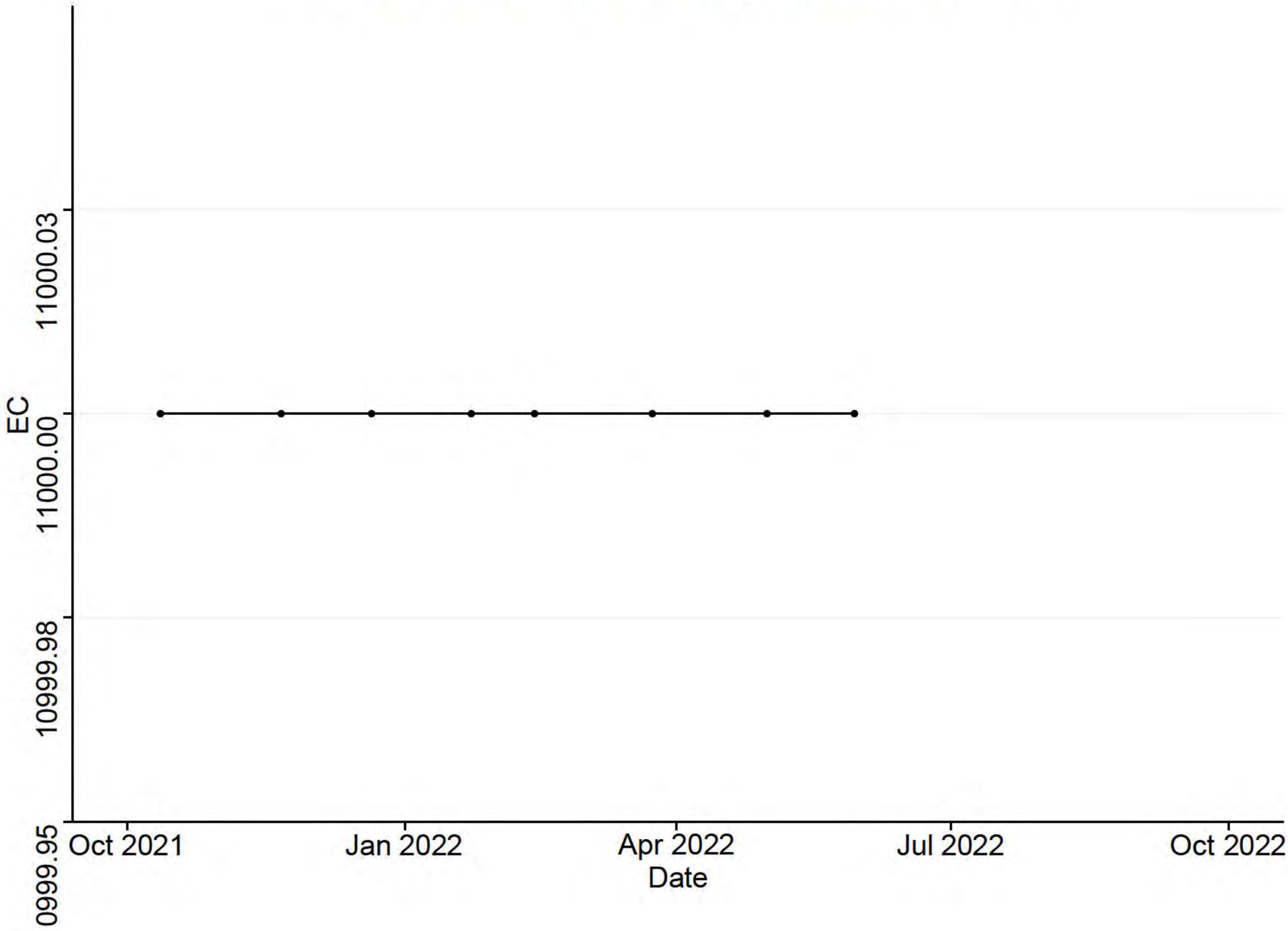

Site NNMW001 – Carbonate Alkalinity as CO3(mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Carbonate Alkalinity as CO3
5.050
5.025
5.000
4.975
4.950
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

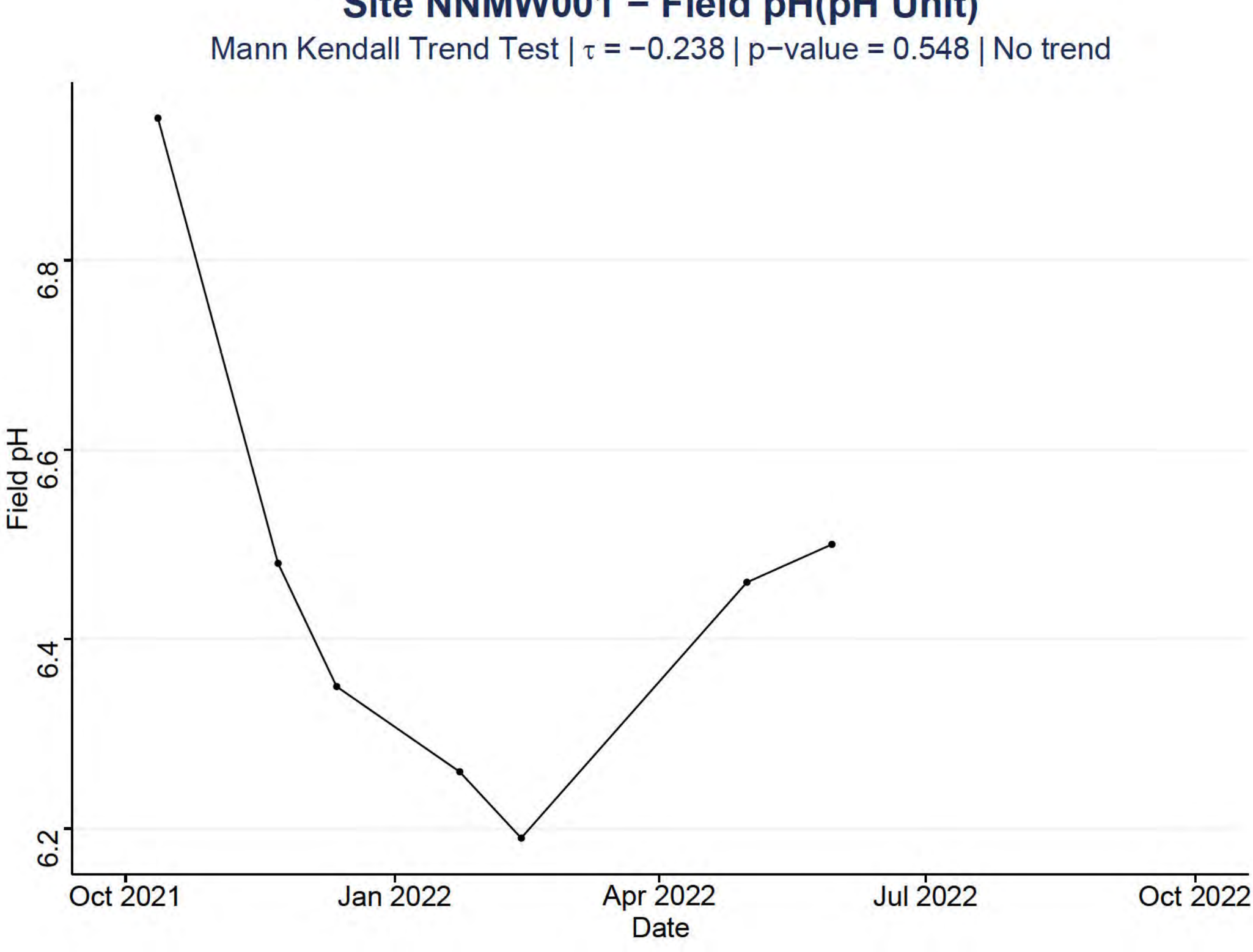

Site NNMW001 – Chloride(mg/L)
Mann Kendall Trend Test | τ = 0 | p−value = 1 | No trend
Chloride
3200
3000
2800
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

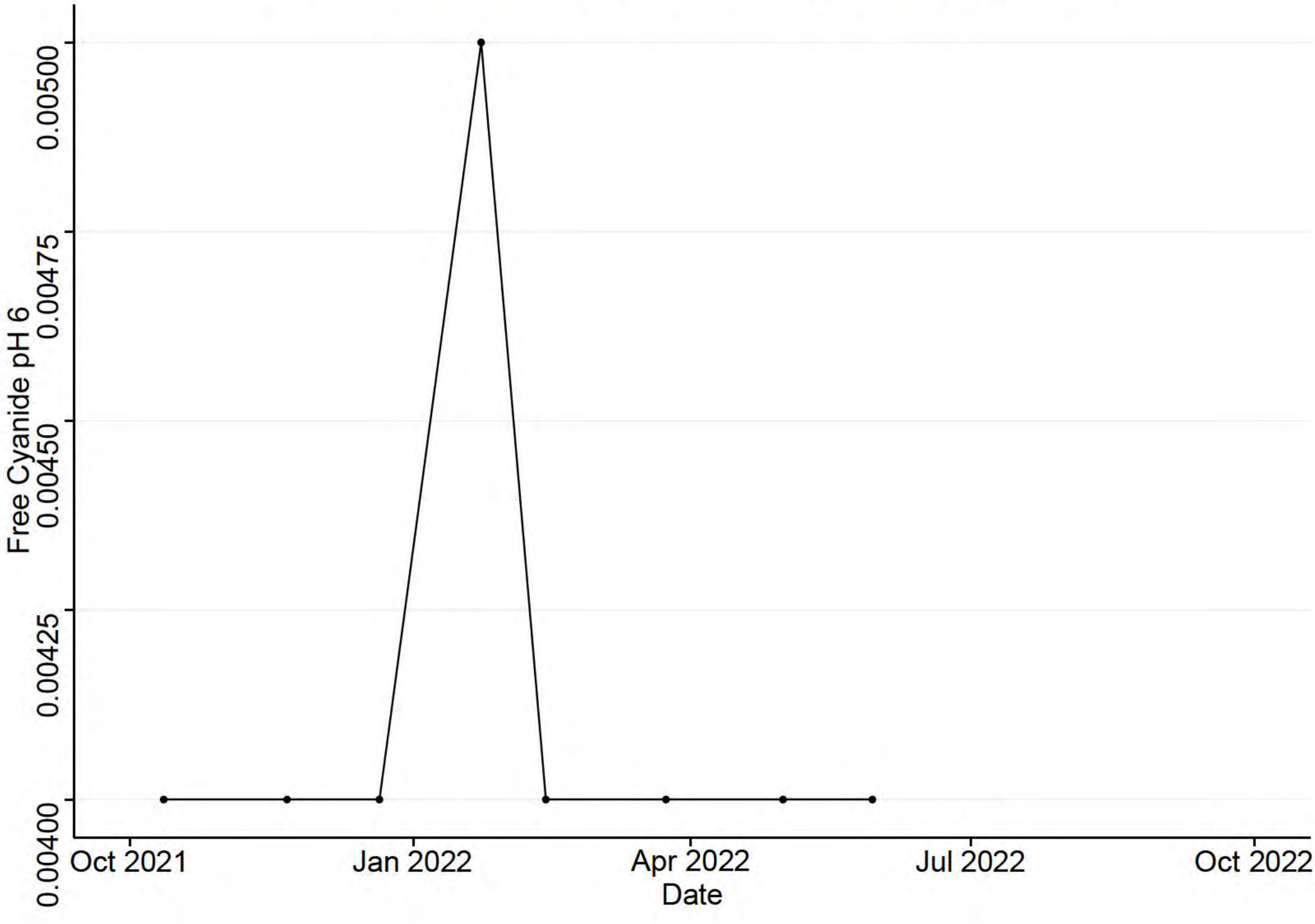

Site NNMW001 – Chromium (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Chromium
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

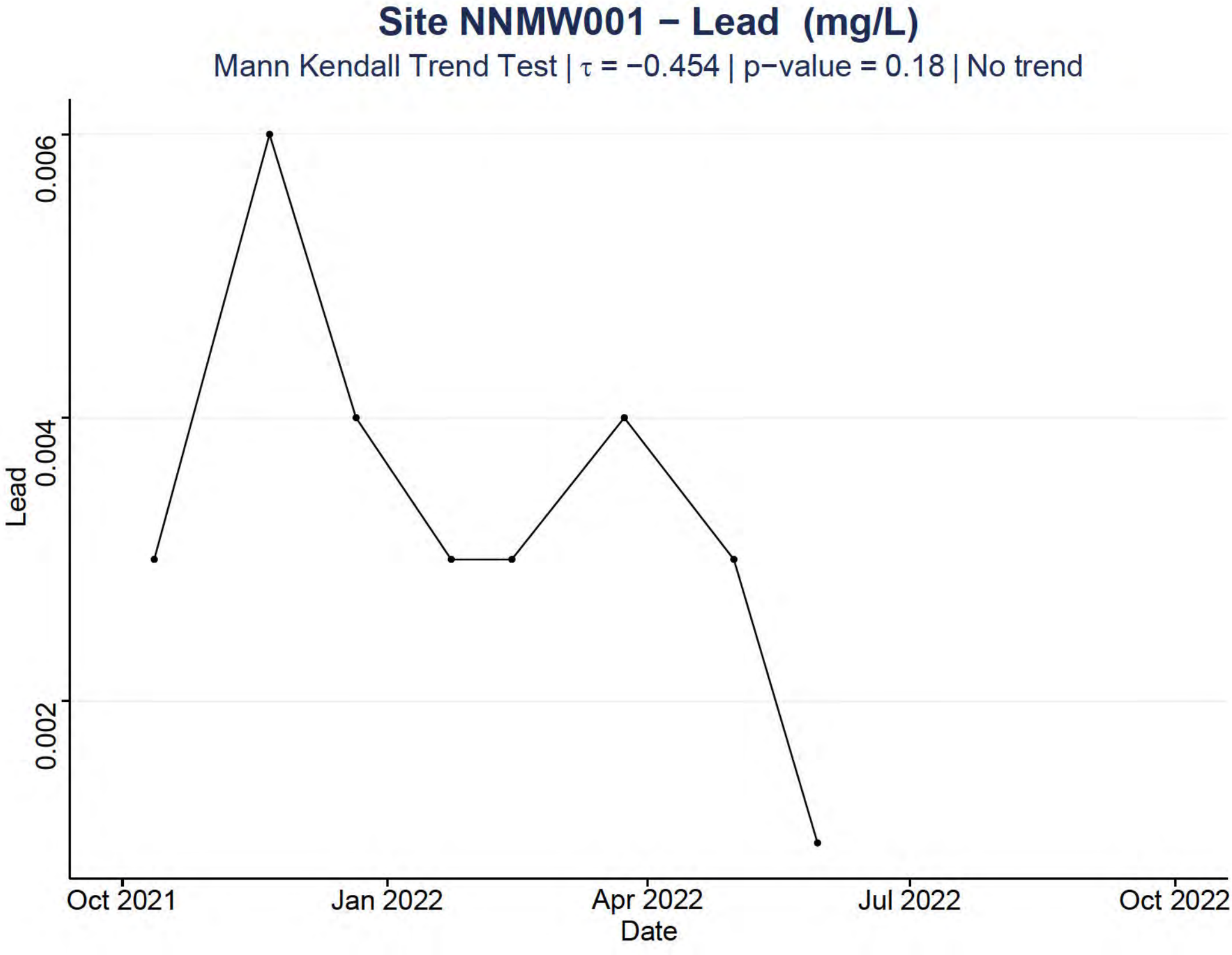

Site NNMW001 – Cobalt (mg/L)
Mann Kendall Trend Test | τ = −0.214 | p−value = 0.536 | No trend
Cobalt
0.06
0.05
0.04
0.03
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

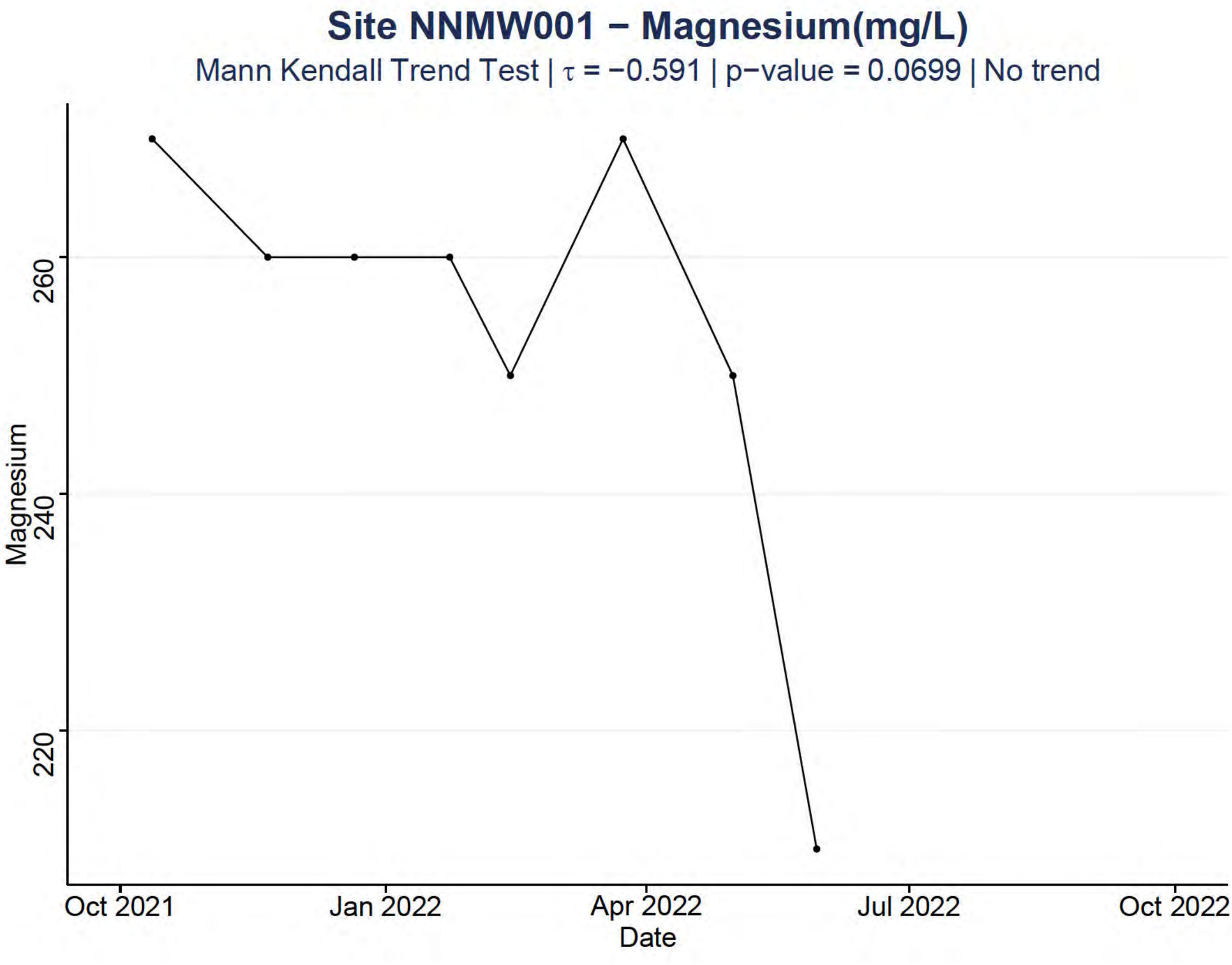

Site NNMW001 – Copper (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.1 | No trend
Copper
0.005
0.004
0.003
0.002
0.001
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

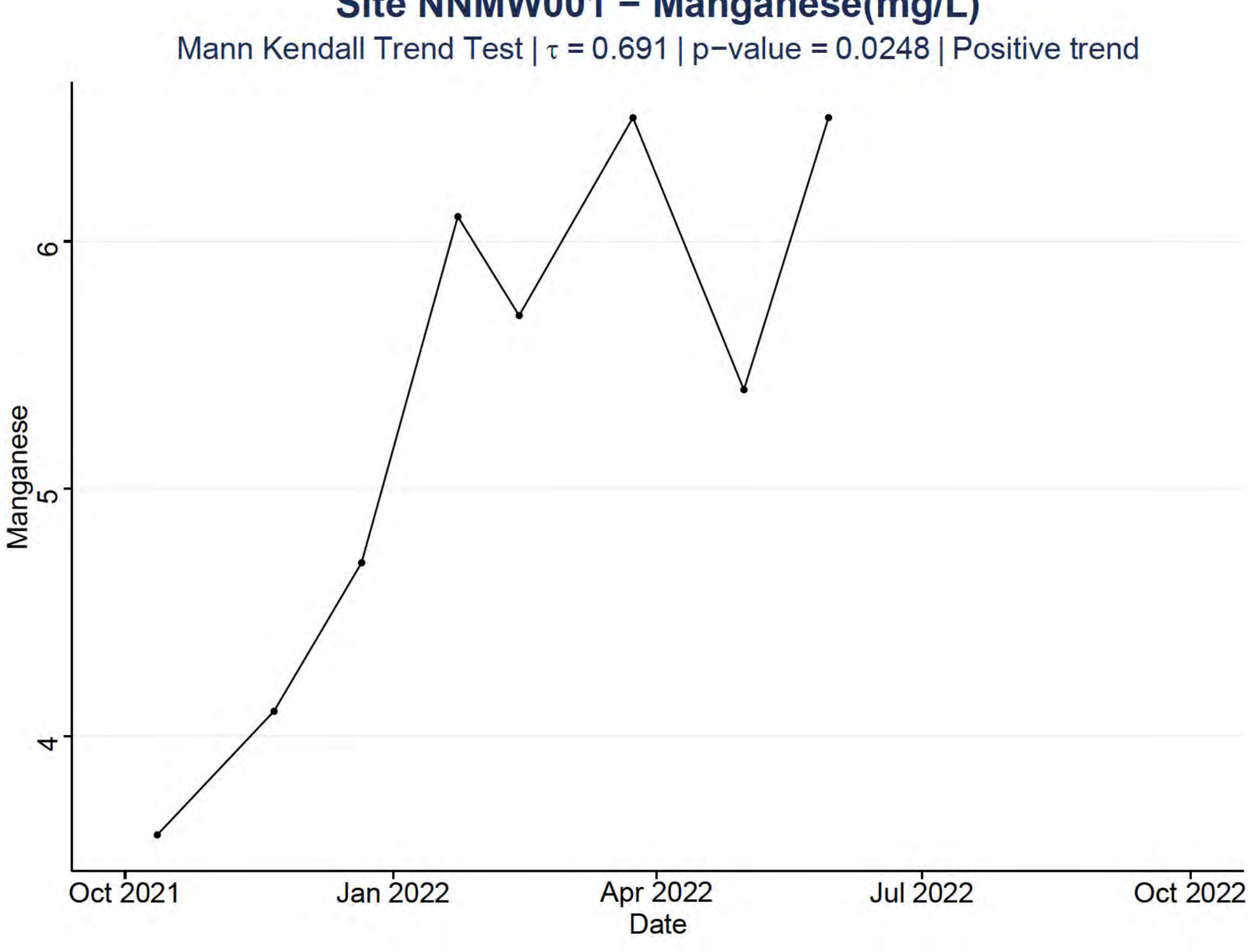

Site NNMW001 – EC(µS/cm)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
EC
11000.03
11000.00
10999.98
0999.95
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

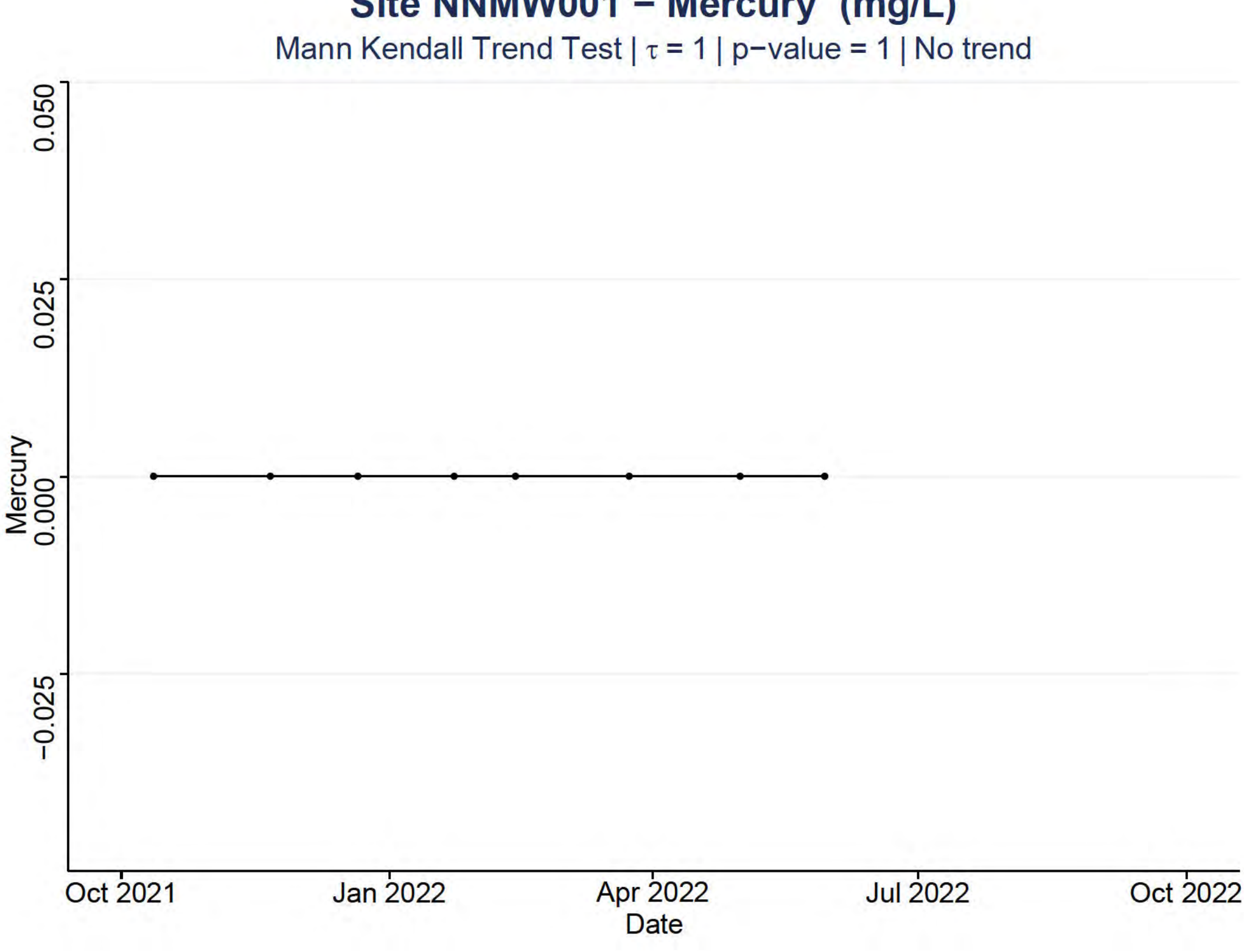

Site NNMW001 – Field pH(pH Unit)
Mann Kendall Trend Test | τ = −0.238 | p−value = 0.548 | No trend
Field pH
6.8
6.6
6.4
6.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

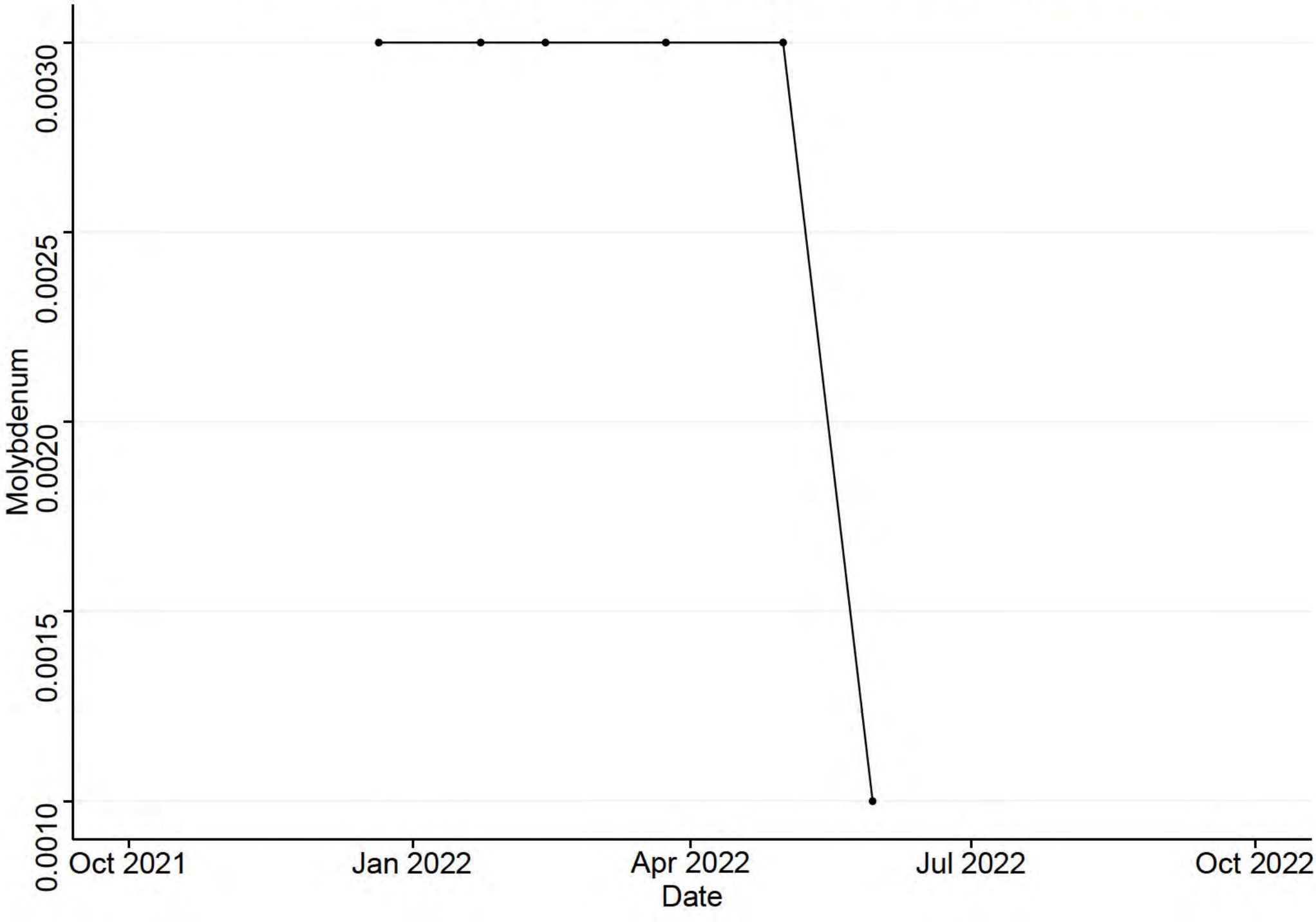

Site NNMW001 – Free Cyanide pH 6 (mg/L)
Mann Kendall Trend Test | τ = −0.0714 | p−value = 1 | No trend
Free Cyanide pH 6
0.00500
0.00475
0.00450
0.00425
0.00400
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

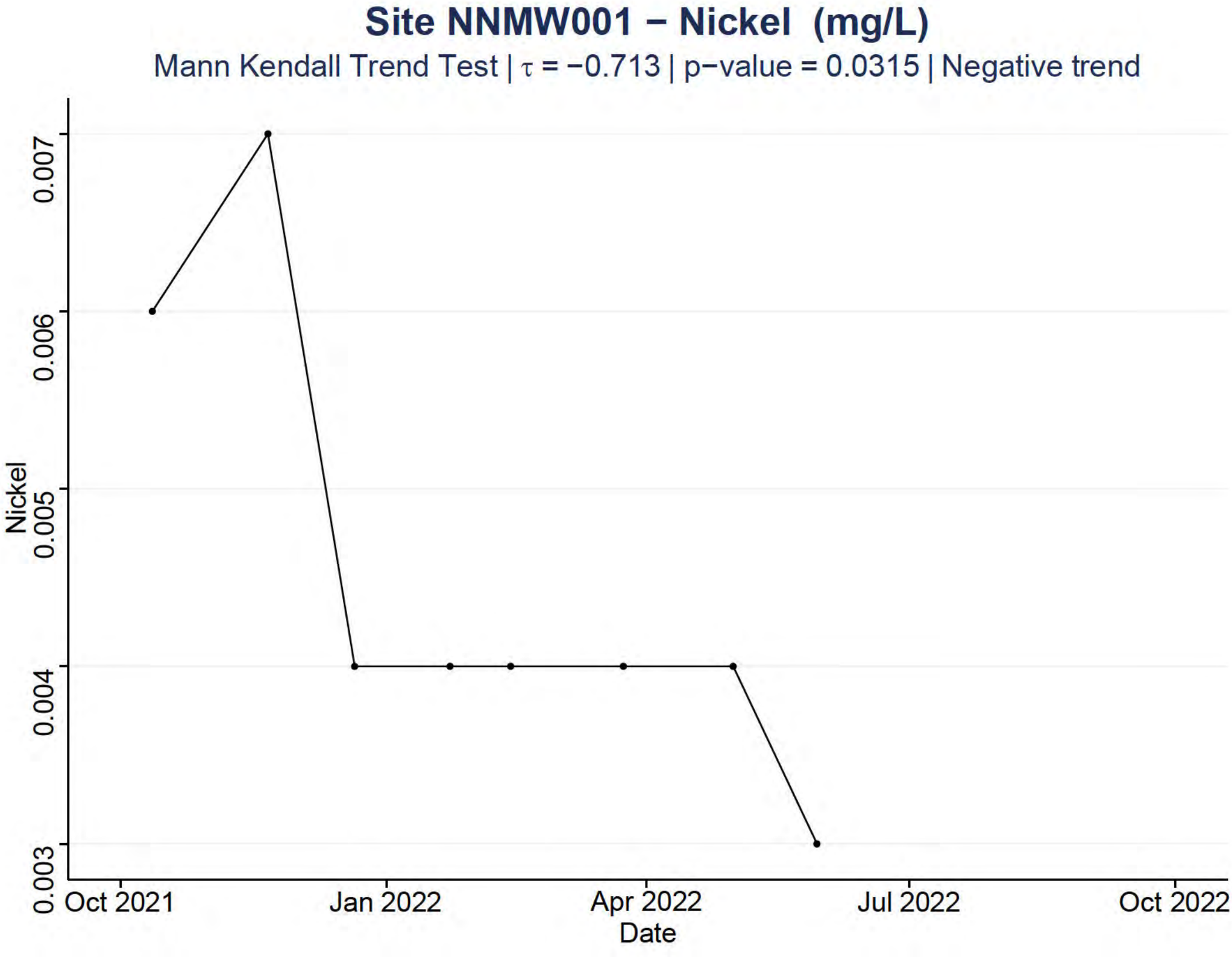

Site NNMW001 − Lead (mg/L)
Mann Kendall Trend Test | τ = −0.454 | p−value = 0.18 | No trend
Lead
0.006
0.004
0.002
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

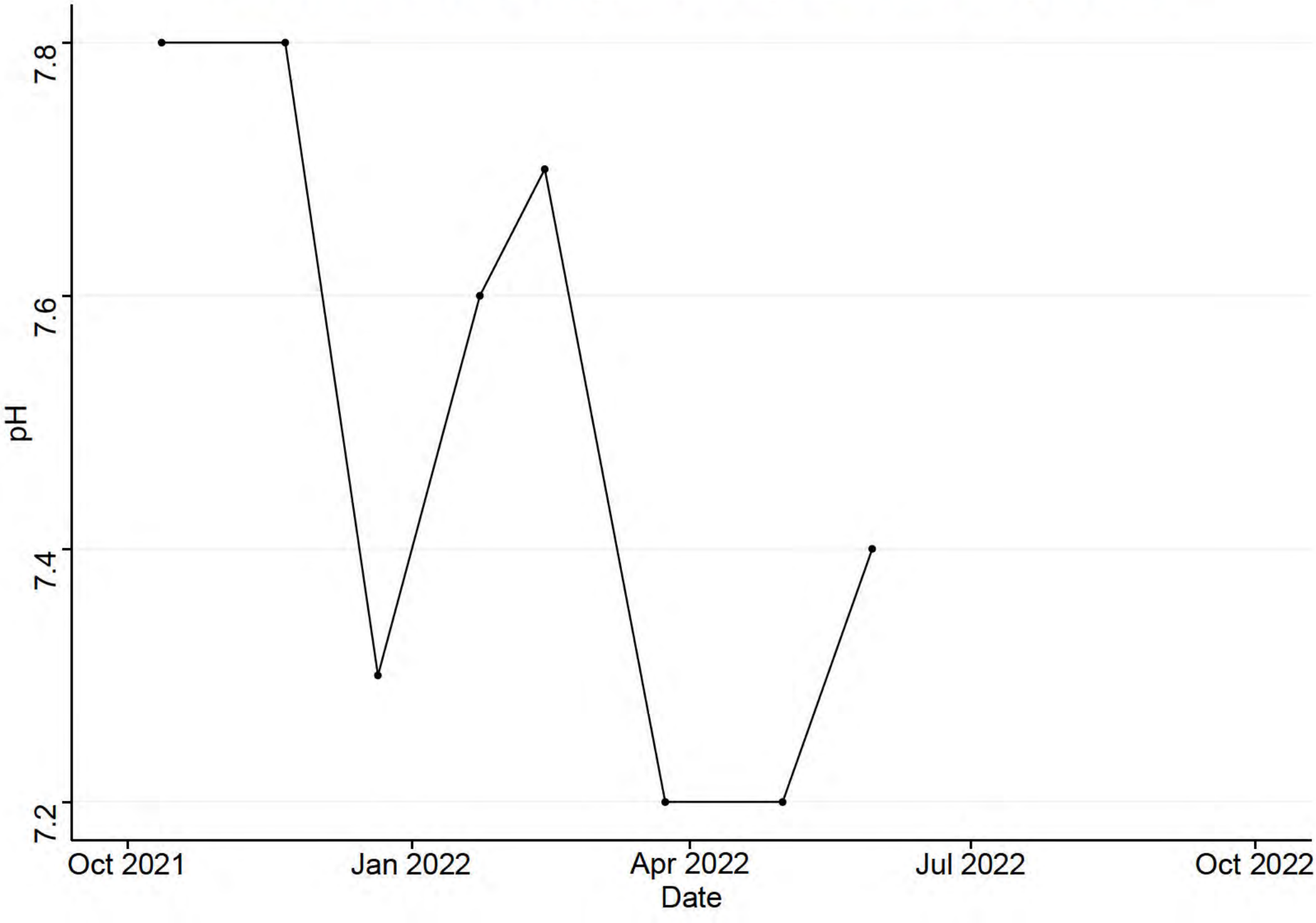

Site NNMW001 – Magnesium(mg/L)
Mann Kendall Trend Test | τ = −0.591 | p−value = 0.0699 | No trend
Magnesium
260
240
220
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

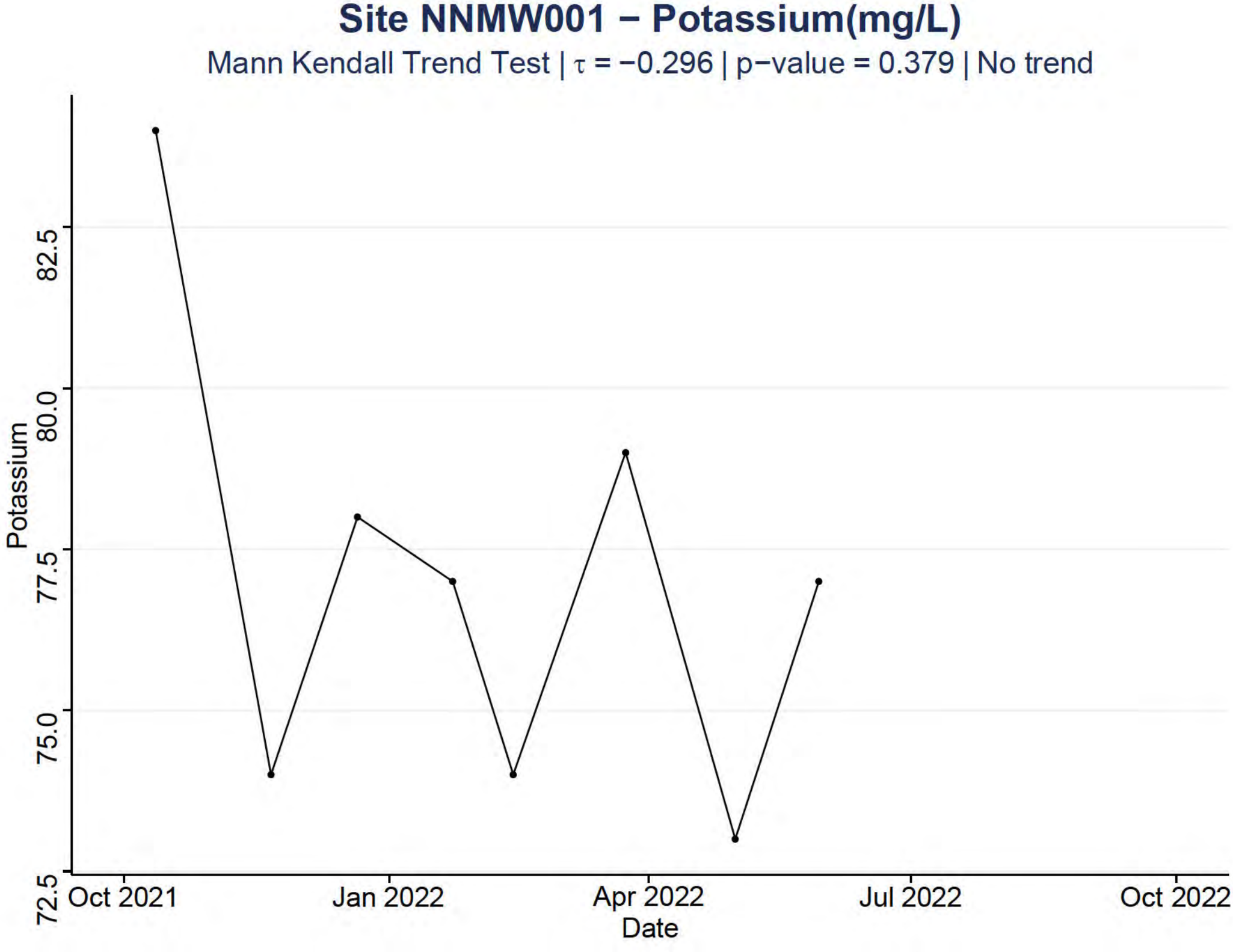

Site NNMW001 − Manganese(mg/L)
Mann Kendall Trend Test | τ = 0.691 | p−value = 0.0248 | Positive trend
Manganese
6
5
4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

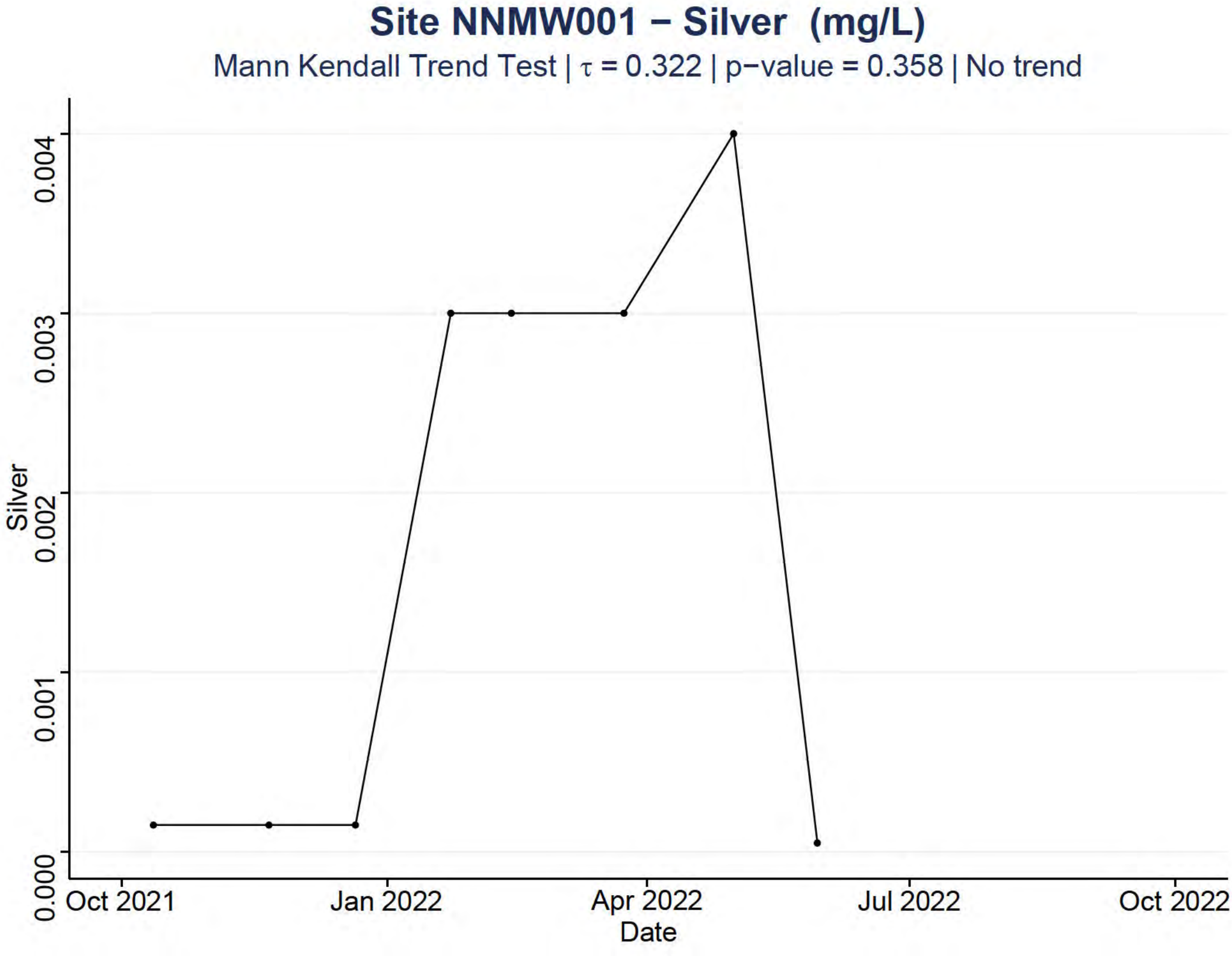

Site NNMW001 – Mercury (mg/L)
Mann Kendall Trend Test | τ = 1 | p−value = 1 | No trend
Mercury
0.050
0.025
0.000
−0.025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

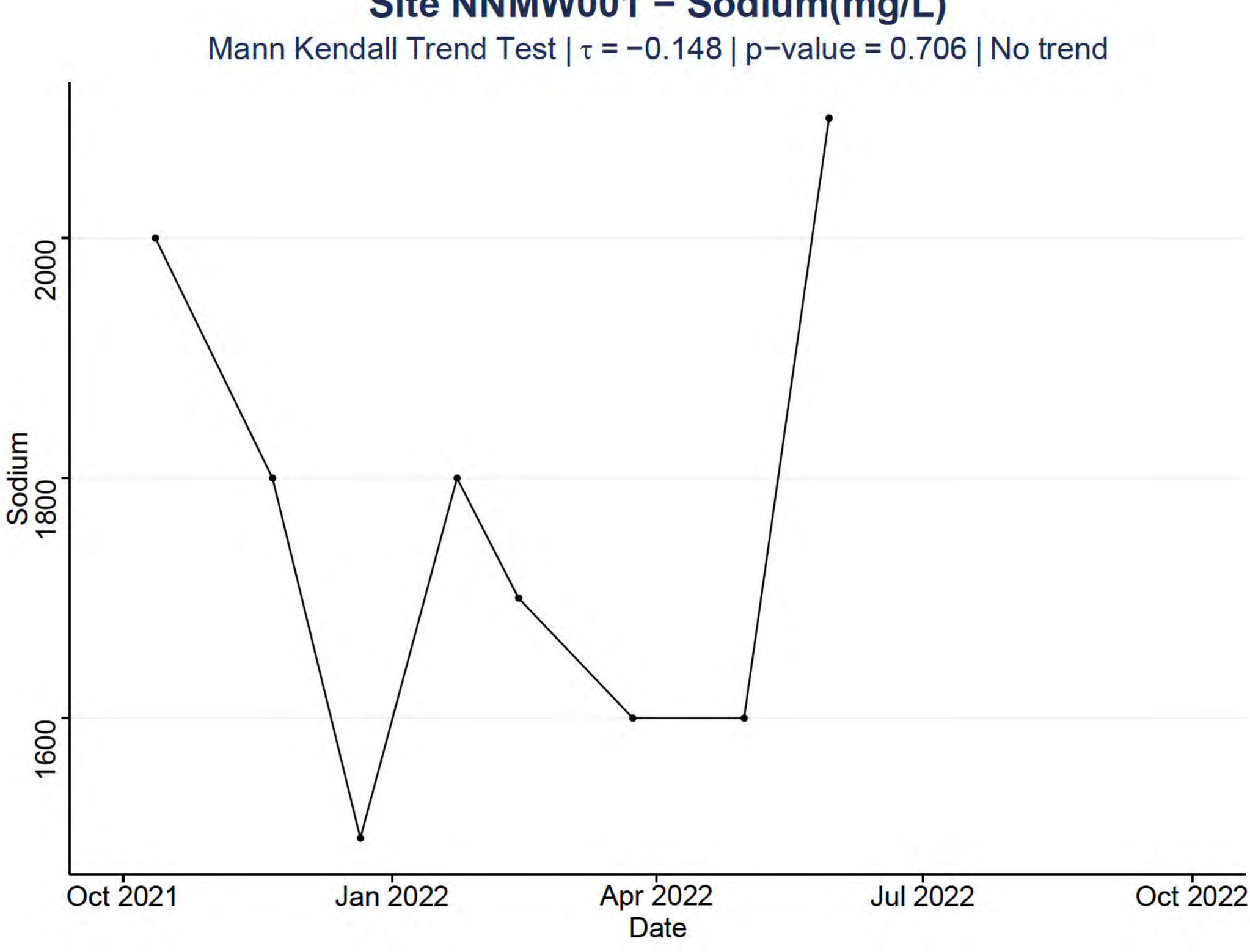

Site NNMW001 – Molybdenum (mg/L)
Mann Kendall Trend Test | τ = −0.577 | p−value = 0.242 | No trend
Molybdenum
0.0030
0.0025
0.0020
0.0015
0.0010
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

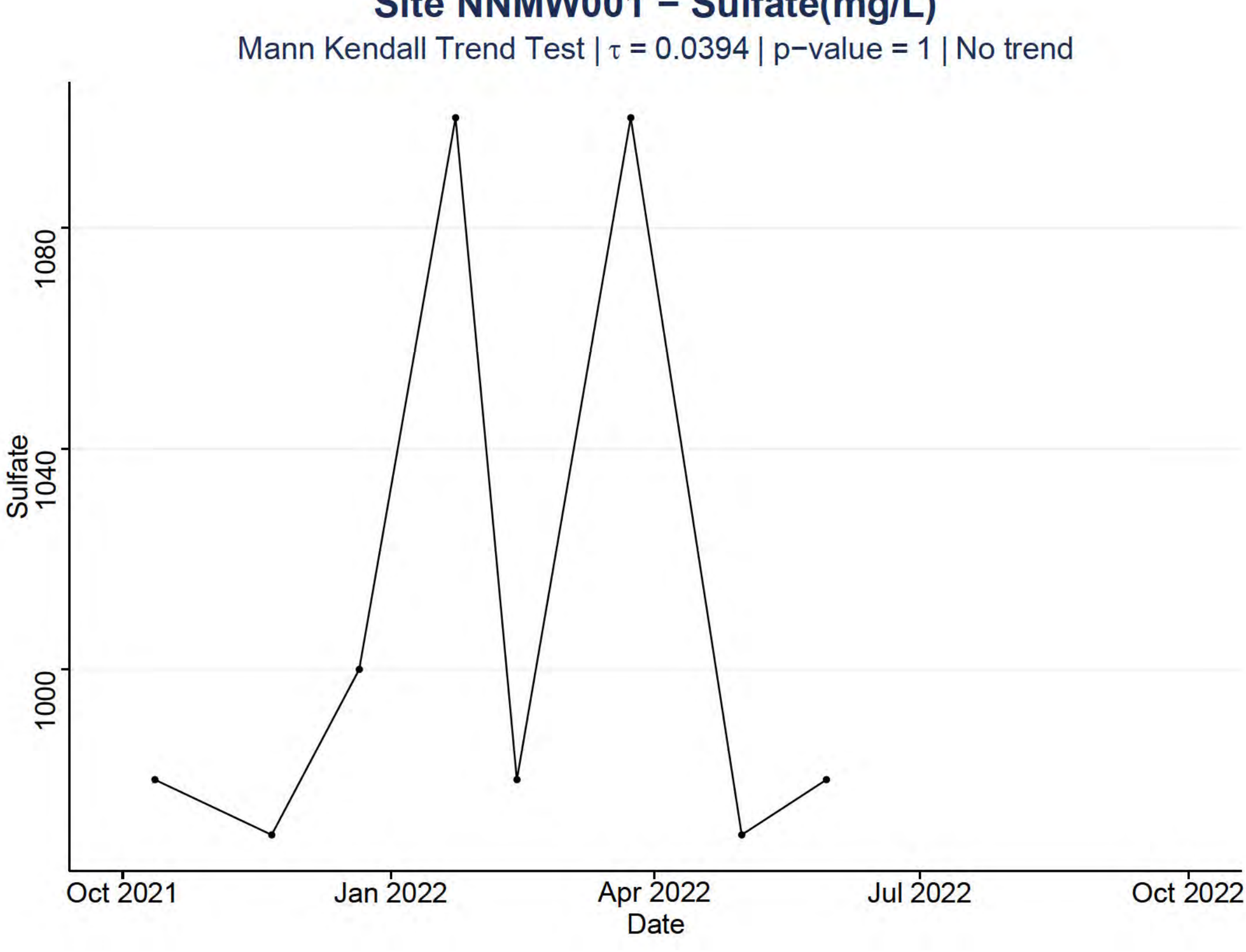

Site NNMW001 – Nickel (mg/L)
Mann Kendall Trend Test | τ = −0.713 | p−value = 0.0315 | Negative trend
Nickel
0.007
0.006
0.005
0.004
0.003
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

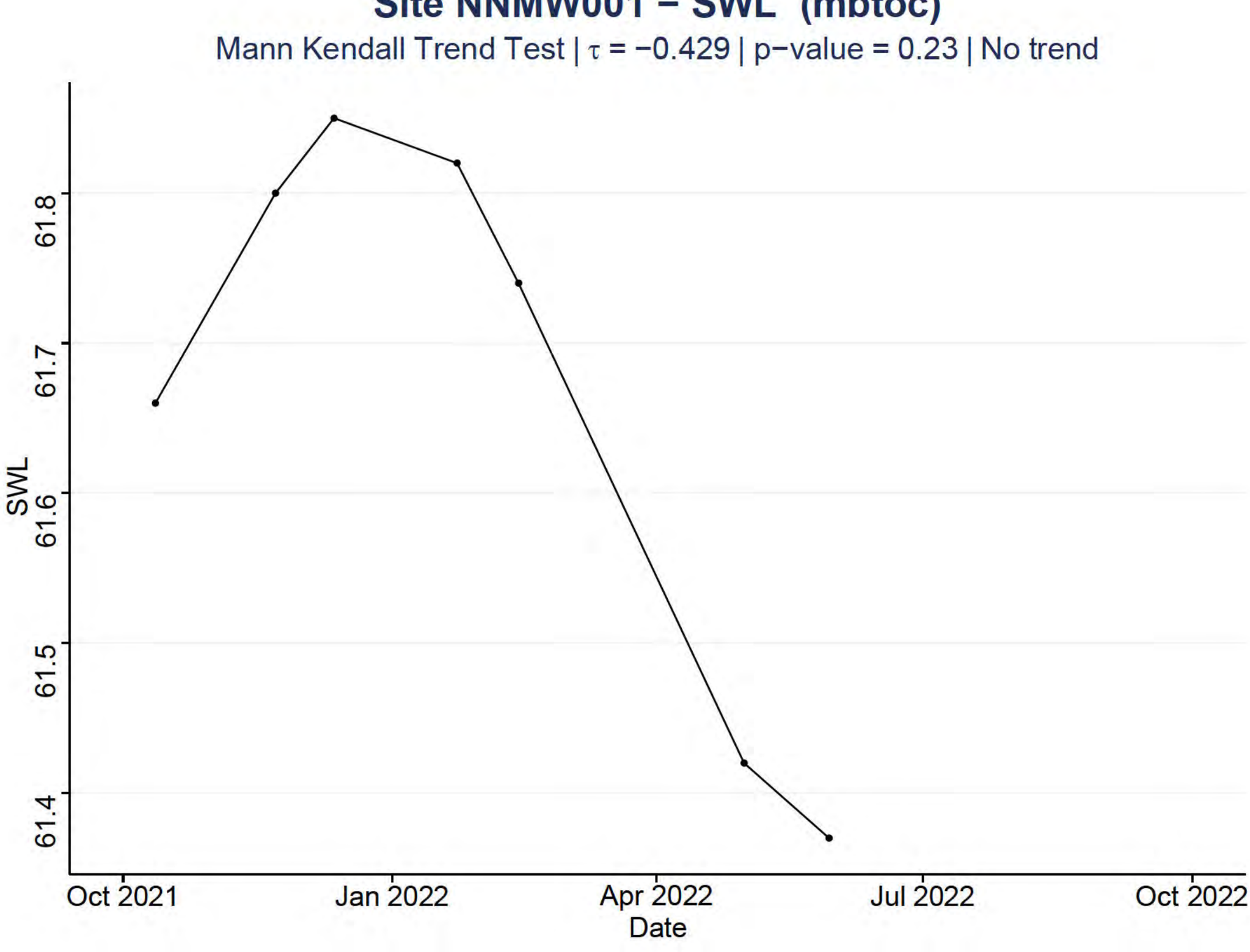

Site NNMW001 – pH(pH Unit)
Mann Kendall Trend Test | τ = −0.519 | p−value = 0.102 | No trend
pH
7.8
7.6
7.4
7.2
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

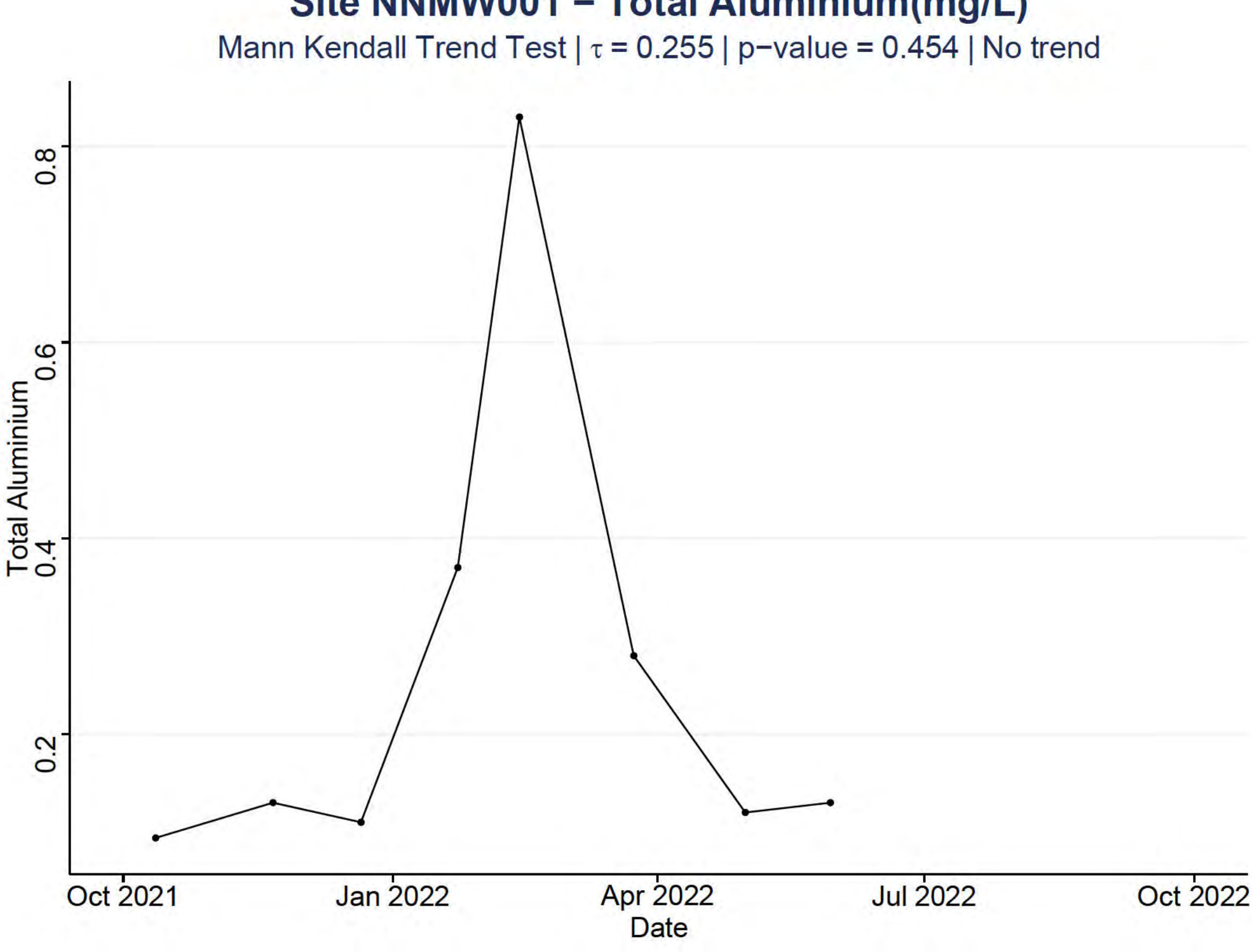

Site NNMW001 – Potassium(mg/L)
Mann Kendall Trend Test | τ = −0.296 | p−value = 0.379 | No trend
Potassium
82.5
80.0
77.5
75.0
72.5
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

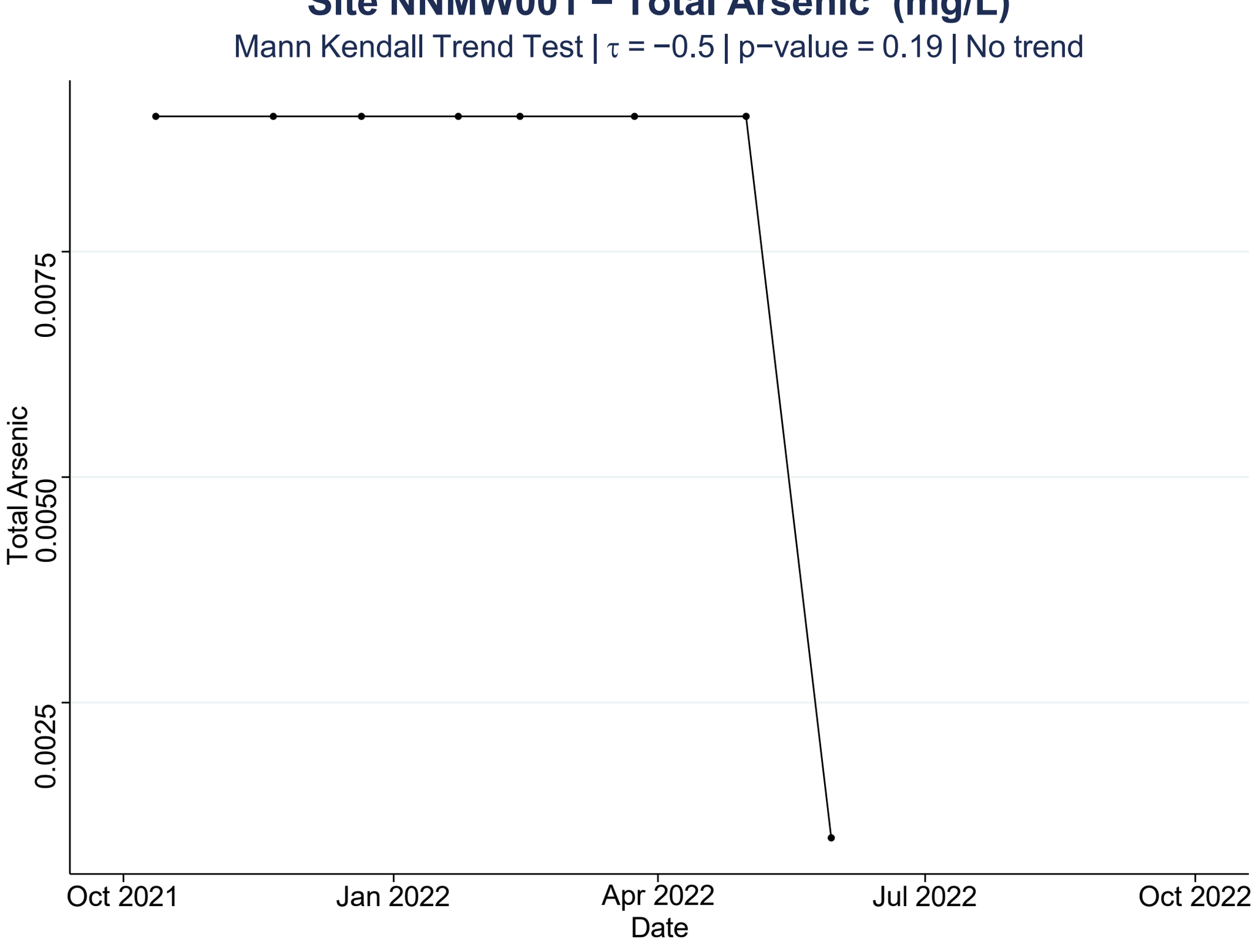

Site NNMW001 – Silver (mg/L)
Mann Kendall Trend Test | τ = 0.322 | p−value = 0.358 | No trend
Silver
0.000
0.001
0.002
0.003
0.004
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

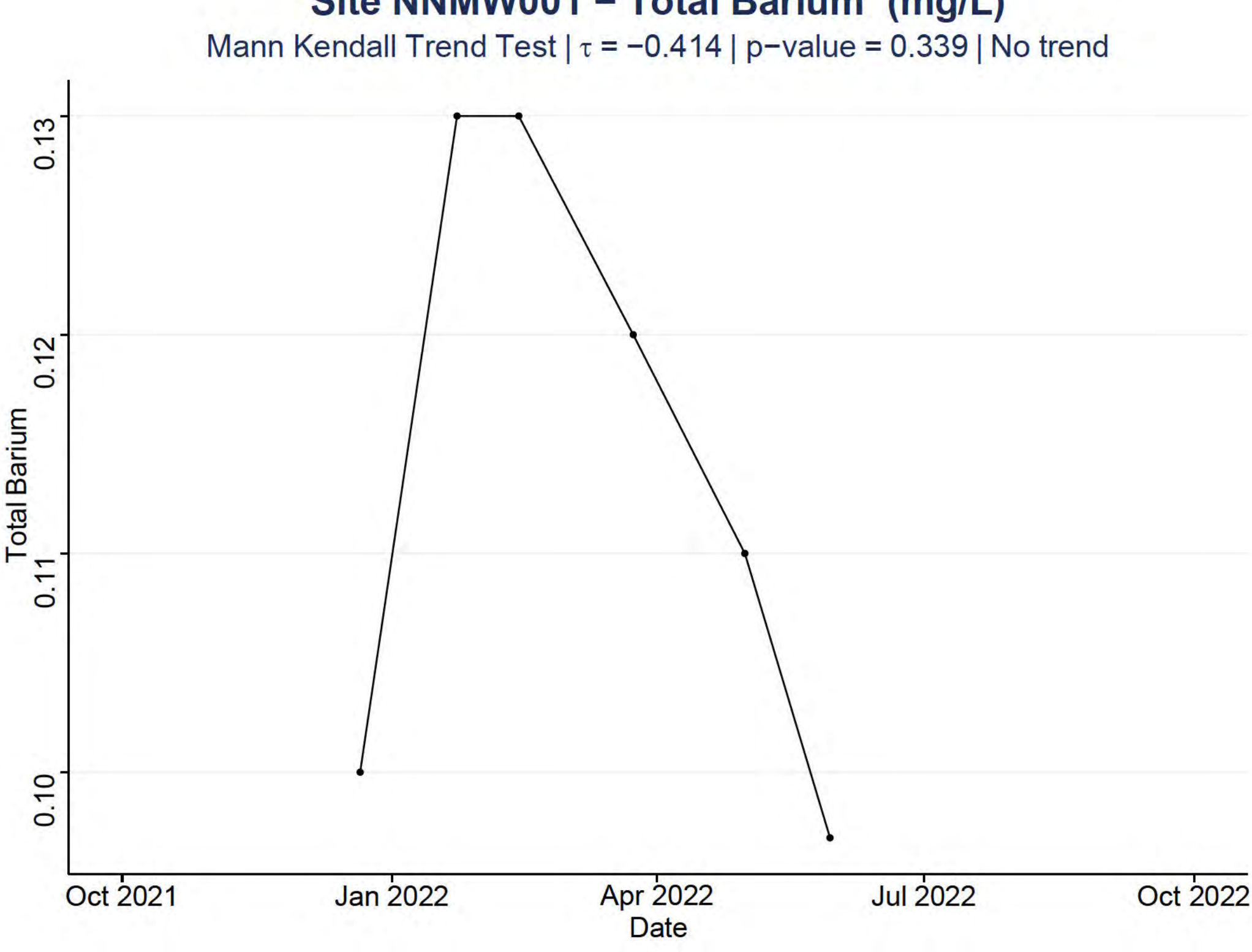

Site NNMW001 − Sodium(mg/L)
Mann Kendall Trend Test | τ = −0.148 | p−value = 0.706 | No trend
Sodium
2000
1800
1600
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW001 − Sulfate(mg/L)
Mann Kendall Trend Test | τ = 0.0394 | p−value = 1 | No trend
Sulfate
1080
1040
1000
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW001 – SWL (mbtoc)
Mann Kendall Trend Test | τ = −0.429 | p−value = 0.23 | No trend
SWL
61.8
61.7
61.6
61.5
61.4
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW001 – Total Aluminium(mg/L)
Mann Kendall Trend Test | τ = 0.255 | p−value = 0.454 | No trend
Total Aluminium
0.2
0.4
0.6
0.8
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW001 − Total Arsenic (mg/L)
Mann Kendall Trend Test | τ = −0.5 | p−value = 0.19 | No trend
Total Arsenic
0.0075
0.0050
0.0025
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date


Site NNMW001 – Total Barium (mg/L)
Mann Kendall Trend Test | τ = −0.414 | p−value = 0.339 | No trend
Total Barium
0.13
0.12
0.11
0.10
Oct 2021
Jan 2022
Apr 2022
Jul 2022
Oct 2022
Date

APPENDIX K SOURCE OF CAPPING MATERIAL FOR REHABILITATION

TENNANT MINING
Tennant Consolidated Mining Group Pty Ltd
trading as Tennant Mining ABN 72 645 263 547

Department of Industry, Tourism and Trade
Northern Territory Government of Australia
Arid Zone Research Institute,
519 South Stuart Highway
Alice Springs NT 0871

9 May 2022

Dear Sir/Madam,

RE: Source of capping material for rehabilitation of the geotubes tailings storage facility

This letter is to support the source and suitability of the capping material planned to be used to cover the geotubes tailings storage facility for the Nobles Nob Gold Project. The geotubes will be rehabilitated by covering with capping material and revegetating. Capping material will be to a depth of 2 m, which will be carried out in alignment with the closure planning and rehabilitation implementation plan outlined within the Nobles Nob and Juno MMP.

Source of capping material

The total geotubes platform area is 7.5 ha = 75,000 m^2 which includes the geotubes surface area as well as the surrounding drainage footprint. For a 2 m capping layer, a total volume of 150,000 m^3 capping material is therefore needed. This capping material will be sourced from the lower base layer of the Southern Waste Rock Dump (WRD).

The lower layer of the Southern WRD is a lower grade than the upper sections of the dump, at approximately 0.2g/t Au, which is below the grade of material that will be processed. It therefore does not represent a resource and is material that will be exposed as the upper layers of the southern WRD are mined back, therefore representing a good source of capping material.

The volume of material present in the lower layer of the southern WRD is outlined in Table 1 below. The sections mentioned are outlined in the Operating Plan included in Appendix I of the MMP. There is 377,453 m^3 of material available in the lower layer in total, which provides adequate material for the 150,000 m^3 of capping material required.

Table 1. Volume of material available in the lower section of the Southern Waste Rock Dump.

Basegrade	**Dump**	**Volume (m^3)**	**Tonnes (t)**
BOT	EAST_DUMP	99,919	189,846
BOT	MAIN_DUMP	240,436	456,829
BOT	OLD_ROM	37,098	70,485
Total		377,453	717,160

Suitability of capping material

The Wasterock Characterisation report included in Appendix C of the MMP analysed 26 samples taken from the Southern WRD. This study concluded that there is some potential of metalliferous drainage, with 6 samples recording metals in significant abundance according

to their geochemical abundance index (GAI). The potential for metalliferous drainage is however significantly reduced in non-acidic conditions. Given that all samples recorded a negative acid producing potential, this indicates that the mobility of these metals is expected to be low, even in aqueous conditions, such as when subjected to rainfall. The study also concluded that saline drainage is unlikely from this material. Based on these results, it is expected that the material in the lower section of the Southern WRD is chemically suitable for use as a capping material, and for subsequent revegetation. The material is course with large particle size that is also geotechnically suitable for capping and revegetation.

Yours Sincerely,

MAUSIMM #317009

Marty Costello
Executive Director