Riverscape Enhancement Consultancy

Memo prepared for: Department of Conservation

Waimatuku Stream

Inanga spawning habitat

Saltwater wedge

July 2025, Version 1.1

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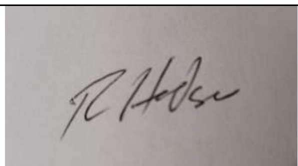
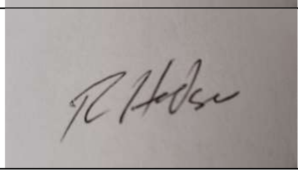
Version	Reviewed By:	
Draft 14/6/2025 V1.0	Roger Hodson	
Final 16/07/2025 V1.1	Roger Hodson	

Background and Introduction

The Department of Conservation (DOC) have engaged Riverscape Enhancement Consulting to assist with delineation of potential Inanga spawning habitat in the Waimatuku Stream.

Inanga spawning is associated with parts of the riverscape which are subject to tidally varied water height and/or elevated salinity. Within these reaches of the river eggs are laid in the riparian vegetation toward maximum high-water levels often in the vicinity of the upstream extent of salt water influence. Larvae are then transported downstream toward the estuarine or coastal habitat where they grow until traveling upstream into freshwater habitat as ‘whitebait’.

Inanga spawning habitat delineation in the memo is based on conductivity and water level data collected at five-minute intervals at five sites in the Waimatuku Stream. At each site a pair of conductivity/Temperature and water pressure/level data loggers were deployed, and one ambient atmospheric pressure logger was deployed on the 18th of February 2025 by Department of Conservation staff at various locations within the Waimatuku stream as illustrated in Figure 1. Loggers recorded data from the 20th of February until data storage was full (26 April for Conductivity and 7th May for Water Level). Data collection included two spring high tide events occurring in early March and April (Figure 2). Data loggers were retrieved by Department of Conservation Staff on the 19th of May 2025, a Riverscape Enhancement representative was in attendance.

Water Level

Analysis of the water level data sets indicates that tidal fluctuations in water level occurred at sites: five (Most downstream); four (Corner); and three (Gowan Lea farm). There was no evidence of tidal influences on water level at sites one or two. The presence of tidal fluctuations in the water level data suggests that the upstream extent of tidally influenced water level fluctuations is located between site three and site two, i.e downstream of the Rance Rd. Bridge site and upstream of the Gowan Lea Farm site, illustrated in green on Figure 1.0.

At site five (the most downstream site) tidal like water level fluctuations were observed throughout the monitoring period, however there were two periods in March and April where tidal fluctuations were not apparent (Figure 4). One of these occurred around the 19th to 24thth of March and coincided with an increase in freshwater discharge (Figure 3). The increase in freshwater discharge may have suppressed tidal influence for a short period of time. The second occurred around the 20th to 22nd of April during neap tides. Collectively suggesting that freshwater flows in excess of approximately one cubic meter per second may have the potential to temporarily suppress tidal influence. It is likely that the effect is dynamically related to the tide size, estuary mouth sand bar conditions and magnitude of stream flow. However, there is limited evidence available to corroborate, and investigations of relationships stream flow were beyond the scope of this memo.

Timing of Waimatuku Stream High Water level

During the spring high tides occurring between the 1st and 4th of March, at site three, the most upstream site with tidal influence, the time of maximum high-water level was tide between 25 and 38 min after the Bluff high tide (Figure 2 and Figure 8.)

Conductivity

Analysis of conductivity data indicates a regular sinusoidal saline influence at site five (Figure 5) however with several periods of more brackish conductivity lasting periods of around 10 days. There is a periodic saline influence at site four, with maximum values at both sites of c.a. 35,000 uS/cm. At site four maximum recorded conductivity coincided with the spring high tides between the 1st and 4 of March. At site four during the spring high tides between the 1st and fourth of April a maximum conductivity of c.a. 35000 uS/cm indicating a strong periodic saline influence from upstream tidal ingress.

At site three a maximum conductivity of c.a. 4,000 uS/cm occurred coincidental to the early March spring high tides. Similar magnitude saline influence was not observed during the early April spring high tides at site 3.

At sites one and two conductivity values were typically around 350 us/cm, indicating that sites one and two are upstream of the salt wedge and comprise of freshwater. There are intermittent peaks in conductivity at site 2, these may indicate short periods of concentrated runoff contribution to the stream or sensor error.

Upstream extent of tidal influence and Salt Wedge

From the combination of water level and conductivity data collected over spring high tides during March and April of 2025, the upstream extent of tidal influence and the salt wedge appears to sit in the 1km stream reach between sites two and three. The approximate location is illustrated on the site map in Figure 1.

Recommendations and Summary

The sensor deployment has confirmed:

- The approximate location of the salt wedge to be within a 1km reach between sites 2 and 3.
- The timing of spring high tides in the Waimatuku Stream to be approximately 30min after the Bluff high tide.

The location of the salt wedge could be further refined by:

a) Follow up deployment of the five loggers at equal 200m spacings along the stream reach or
b) Undertaking a longitudinal survey during spring high tide(s) using a hand held conductivity meter.

Further refinement of the salt wedge locations may be helpful to increase the efficiency of searching for and counting of eggs or the deployment of resources to enhances the quality of spawning habitat or pest control efforts to reduce mortality.

Figure 1. Site locations 1-5 (yellow flags) and approximate location of the upstream tidal water level influence and salt wedge (green line) between sites two and three.

Bluff

Lat. 46° 36´S., Long. 168° 21´E.

Time Zone −1200 | Times and Heights of High and Low Waters | Year 2025

Standard Ports

March

Day	Time	m	Day	Time	m
1 Sa	0232 0843 1449 2108	2.9 0.5 3.0 0.5	16 Su	0300 0911 1515 2132	2.7 0.8 2.6 0.9
2 Su	0317 0928 1536 2156	2.9 0.5 3.0 0.5	17 Mo	0333 0945 1550 2206	2.6 0.9 2.6 0.9
3 Mo	0403 1016 1626 2245	2.9 0.5 2.9 0.6	18 Tu	0407 1021 1627 2242	2.6 0.9 2.5 1.0
4 Tu	0452 1107 1719 2337	2.8 0.6 2.8 0.7	19 We	0442 1059 1707 2321	2.5 1.0 2.5 1.1
5 We	0544 1202 1818	2.7 0.7 2.7	20 Th	0522 1141 1752	2.4 1.1 2.4
6 Th	0034 0644 1303 1924	0.8 2.6 0.8 2.6	21 Fr	0005 0609 1231 1846	1.2 2.3 1.1 2.3
7 Fr	0138 0752 1411 2036	1.0 2.5 0.9 2.5	22 Sa	0058 0707 1330 1948	1.2 2.3 1.2 2.3
8 Sa	0249 0905 1522 2147	1.1 2.5 0.9 2.5	23 Su	0200 0815 1435 2056	1.3 2.3 1.2 2.3
9 Su	0359 1016 1628 2252	1.1 2.5 0.9 2.5	24 Mo	0309 0924 1540 2200	1.2 2.3 1.1 2.4
10 Mo	0502 1115 1726 2347	1.0 2.5 0.8 2.6	25 Tu	0413 1024 1639 2256	1.1 2.4 0.9 2.5
11 Tu	0555 1205 1816	0.9 2.6 0.8	26 We	0509 1116 1732 2347	1.0 2.6 0.8 2.7
12 We	0033 0641 1248 1901	2.6 0.9 2.7 0.8	27 Th	0559 1205 1822	0.8 2.7 0.6
13 Th	0114 0722 1328 1942	2.7 0.8 2.7 0.7	28 Fr	0034 0646 1252 1910	2.8 0.7 2.9 0.5
14 Fr ○	0152 0800 1405 2020	2.7 0.8 2.7 0.8	29 Sa ●	0120 0732 1339 1958	2.9 0.6 3.0 0.5
15 Sa	0227 0836 1440 2057	2.7 0.8 2.7 0.8	30 Su	0206 0819 1426 2046	3.0 0.5 3.0 0.5
			31 Mo	0253 0906 1516 2135	3.0 0.5 3.0 0.5

April

Day	Time	m	Day	Time	m
1 Tu	0341 0956 1608 2225	2.9 0.5 2.9 0.6	16 We	0336 0952 1559 2213	2.5 0.9 2.5 1.0
2 We	0431 1048 1703 2318	2.8 0.6 2.8 0.7	17 Th	0413 1031 1640 2254	2.5 1.0 2.5 1.1
3 Th	0526 1145 1804	2.7 0.7 2.7	18 Fr	0454 1115 1727 2339	2.4 1.0 2.4 1.1
4 Fr	0018 0629 1248 1912	0.9 2.6 0.8 2.6	19 Sa	0542 1205 1819	2.3 1.1 2.4
5 Sa	0122 0739 1357 2024	1.0 2.5 0.9 2.5	20 Su	0031 0638 1301 1918	1.2 2.3 1.1 2.4
6 Su	0233 0853 1506 2133	1.1 2.5 0.9 2.5	21 Mo	0130 0741 1402 2022	1.2 2.3 1.1 2.4
7 Mo	0341 0959 1609 2232	1.1 2.5 0.9 2.5	22 Tu	0234 0847 1505 2123	1.2 2.4 1.0 2.5
8 Tu	0441 1054 1704 2323	1.0 2.5 0.9 2.6	23 We	0336 0947 1604 2221	1.1 2.5 0.9 2.6
9 We	0531 1141 1752	1.0 2.6 0.8	24 Th	0434 1043 1700 2314	0.9 2.6 0.8 2.7
10 Th	0006 0614 1222 1835	2.6 0.9 2.6 0.8	25 Fr	0527 1134 1753	0.8 2.8 0.6
11 Fr	0045 0654 1300 1914	2.6 0.8 2.6 0.8	26 Sa	0004 0617 1225 1844	2.8 0.6 2.9 0.6
12 Sa	0120 0730 1335 1951	2.6 0.8 2.7 0.8	27 Su	0053 0707 1315 1934	2.9 0.5 3.0 0.5
13 Su ○	0155 0806 1410 2026	2.6 0.8 2.6 0.9	28 Mo ●	0141 0756 1406 2025	2.9 0.5 3.0 0.5
14 Mo	0228 0840 1445 2101	2.6 0.8 2.6 0.9	29 Tu	0230 0846 1458 2116	2.9 0.5 3.0 0.6
15 Tu	0301 0915 1521 2136	2.6 0.9 2.6 0.9	30 We	0321 0938 1552 2208	2.9 0.5 2.9 0.7

May

Day	Time	m	Day	Time	m
1 Th	0414 1032 1650 2302	2.8 0.6 2.8 0.8	16 Fr	0351 1010 1621 2233	2.5 0.9 2.5 1.0
2 Fr	0511 1130 1751	2.7 0.7 2.7	17 Sa	0434 1055 1707 2318	2.4 1.0 2.5 1.1
3 Sa	0000 0613 1232 1855	0.9 2.6 0.8 2.6	18 Su	0521 1143 1757	2.4 1.0 2.5
4 Su	0103 0721 1336 2002	1.0 2.5 0.9 2.5	19 Mo	0008 0614 1236 1851	1.1 2.4 1.0 2.5
5 Mo	0209 0829 1441 2105	1.1 2.5 0.9 2.5	20 Tu	0102 0712 1333 1949	1.1 2.4 1.0 2.5
6 Tu	0313 0930 1540 2200	1.1 2.5 0.9 2.5	21 We	0201 0813 1432 2048	1.1 2.5 0.9 2.5
7 We	0410 1023 1633 2249	1.0 2.5 0.9 2.5	22 Th	0302 0913 1532 2147	1.0 2.6 0.9 2.6
8 Th	0459 1108 1720 2332	1.0 2.5 0.9 2.5	23 Fr	0401 1011 1630 2243	0.9 2.7 0.8 2.7
9 Fr	0543 1150 1803	0.9 2.6 0.9	24 Sa	0458 1107 1727 2337	0.8 2.8 0.7 2.8
10 Sa	0011 0622 1228 1843	2.6 0.9 2.6 0.9	25 Su	0552 1202 1821	0.6 2.9 0.6
11 Su	0048 0700 1305 1921	2.6 0.9 2.6 0.9	26 Mo	0029 0645 1256 1915	2.8 0.5 2.9 0.6
12 Mo	0124 0736 1342 1958	2.6 0.9 2.6 0.9	27 Tu ●	0121 0737 1349 2007	2.9 0.5 2.9 0.6
13 Tu ○	0159 0813 1419 2034	2.6 0.9 2.6 0.9	28 We	0212 0830 1444 2059	2.9 0.5 2.9 0.6
14 We	0235 0850 1458 2112	2.6 0.9 2.6 1.0	29 Th	0304 0922 1538 2151	2.8 0.5 2.8 0.7
15 Th	0312 0929 1538 2151	2.5 0.9 2.5 1.0	30 Fr	0357 1017 1634 2244	2.8 0.6 2.8 0.8
			31 Sa	0453 1112 1731 2339	2.7 0.7 2.7 0.9

June

Day	Time	m	Day	Time	m
1 Su	0551 1209 1829	2.6 0.8 2.6	16 Mo	0500 1122 1734 2344	2.5 0.9 2.6 1.0
2 Mo	0036 0652 1307 1928	1.0 2.5 0.9 2.5	17 Tu	0550 1212 1824	2.5 0.9 2.5
3 Tu	0135 0753 1405 2024	1.0 2.5 1.0 2.5	18 We	0036 0645 1306 1918	1.0 2.5 0.9 2.5
4 We	0234 0851 1502 2118	1.1 2.5 1.0 2.4	19 Th	0132 0743 1403 2016	1.0 2.6 0.9 2.6
5 Th	0330 0943 1554 2208	1.1 2.5 1.0 2.4	20 Fr	0232 0844 1504 2117	0.9 2.6 0.9 2.6
6 Fr	0421 1030 1643 2254	1.0 2.5 1.0 2.5	21 Sa	0334 0946 1605 2217	0.9 2.7 0.8 2.6
7 Sa	0507 1114 1729 2336	1.0 2.5 1.0 2.5	22 Su	0435 1046 1706 2316	0.8 2.7 0.8 2.7
8 Su	0550 1156 1812	1.0 2.5 1.0	23 Mo	0533 1145 1804	0.7 2.8 0.8
9 Mo	0017 0630 1237 1852	2.5 0.9 2.5 1.0	24 Tu	0012 0629 1242 1859	2.8 0.6 2.8 0.7
10 Tu	0056 0709 1318 1932	2.5 0.9 2.5 1.0	25 We ●	0105 0723 1337 1952	2.8 0.6 2.8 0.7
11 We ○	0134 0748 1358 2011	2.6 0.9 2.6 1.0	26 Th	0158 0815 1431 2043	2.8 0.5 2.8 0.7
12 Th	0213 0828 1439 2051	2.5 0.9 2.6 1.0	27 Fr	0249 0907 1523 2133	2.8 0.6 2.8 0.7
13 Fr	0252 0909 1520 2131	2.6 0.8 2.6 1.0	28 Sa	0340 0958 1614 2222	2.8 0.6 2.7 0.8
14 Sa	0332 0951 1603 2213	2.6 0.8 2.6 1.0	29 Su	0430 1049 1704 2311	2.7 0.7 2.7 0.9
15 Su	0415 1035 1647 2257	2.5 0.8 2.6 1.0	30 Mo	0522 1139 1754	2.6 0.8 2.6

Figure 2 LINZ tidal times and heights, with spring tides highlighted. Taken from the New Zealand Nautical Almanac. Bluff is the primary port. Secondary tidal locations for Riverton t-55min and New River Entrance t-22min suggest the Waimatuku high tide will occur approximately 30 min prior to high tide at Bluff.
https://www.linz.govt.nz/sites/default/files/doc/hydro_202425-almanac_full-nautical-almanac_pdf.pdf

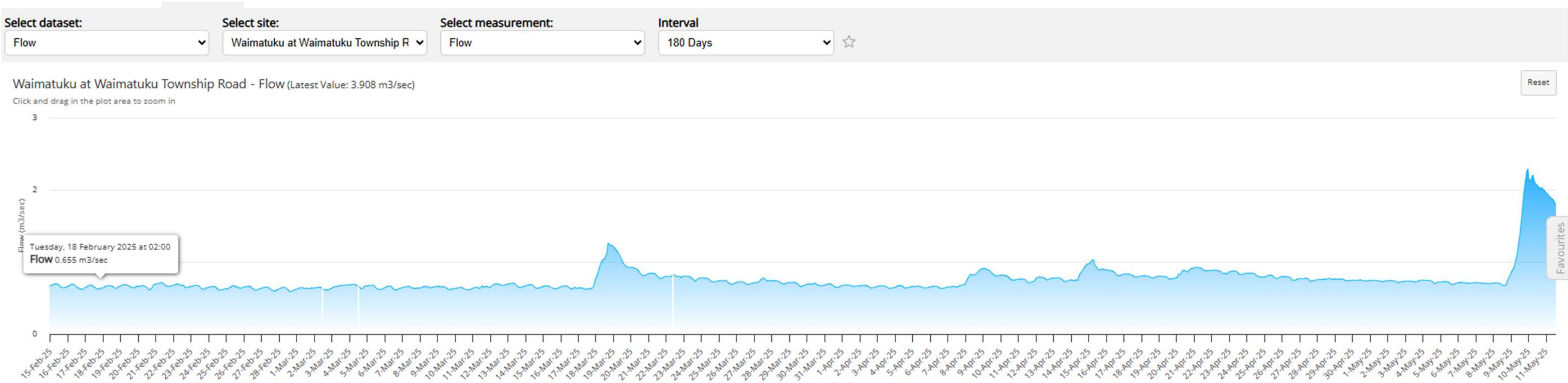


Figure 3 Environment Southland Flow data for the Waimatuku at Waimatuku Township Road 15 February 2025 – 11 May 2025

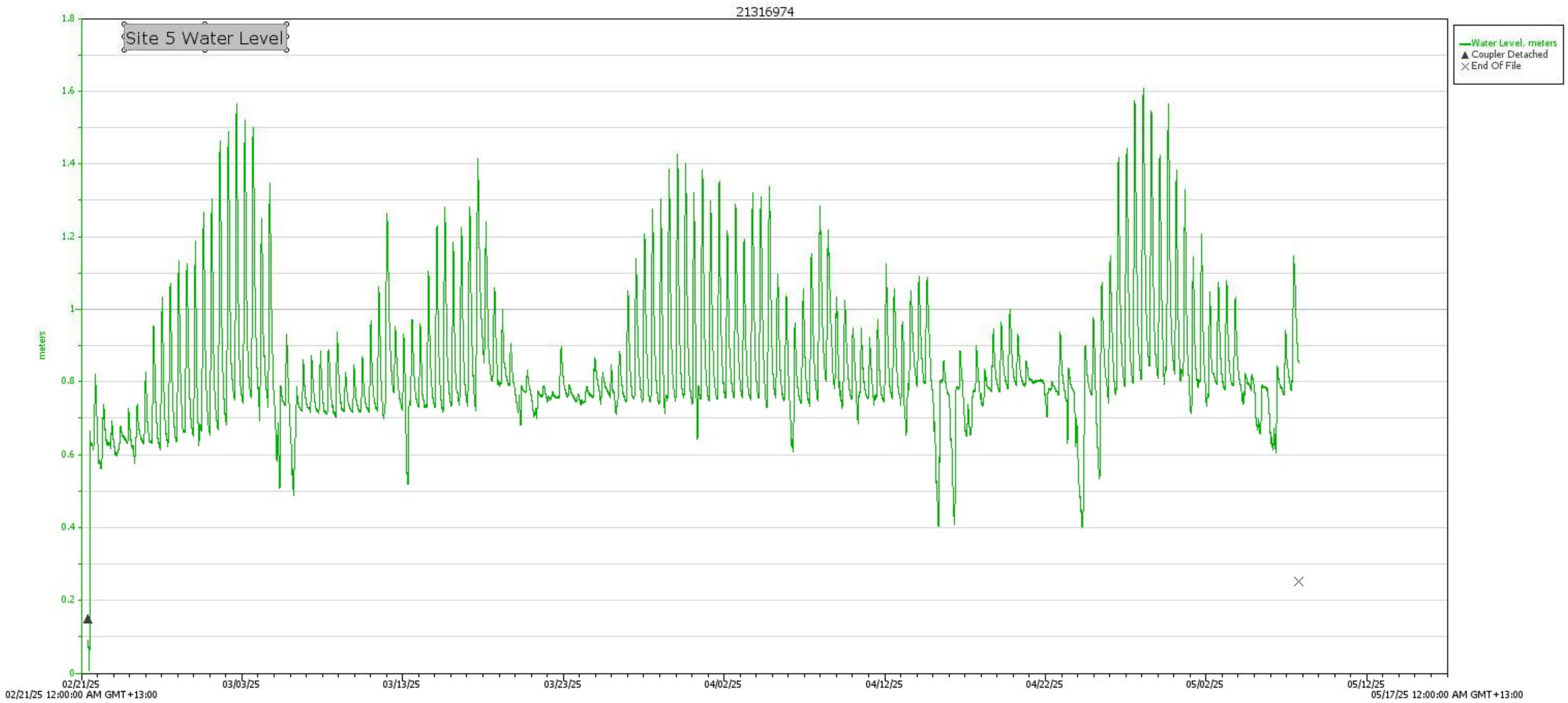


Figure 4 Site 5 Water Level record

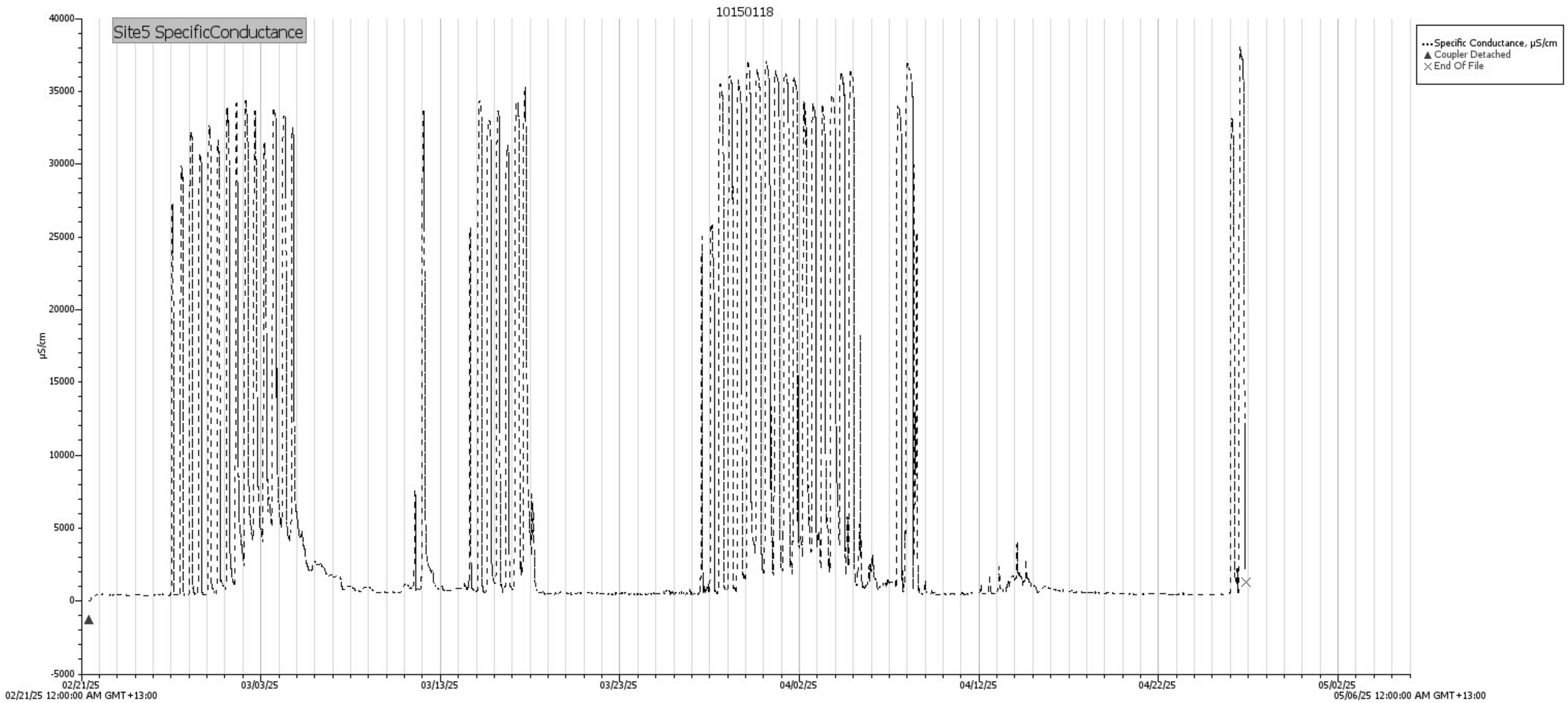


Figure 5 Site 5 Specific Conductance record.

Figure 6 Site 4 Water Level

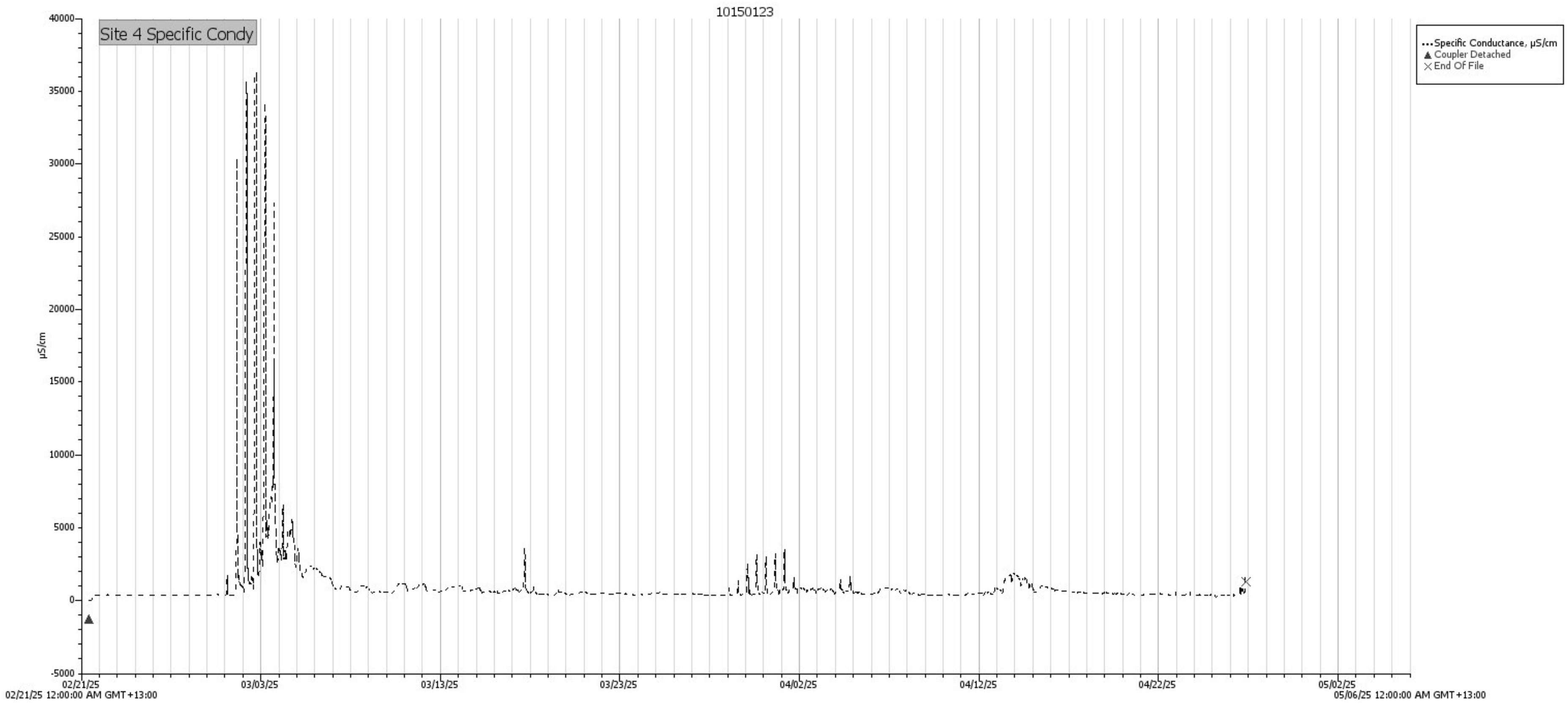


Figure 7 Site 4 Specific Conductance

Figure 8 Site 3 Water Level

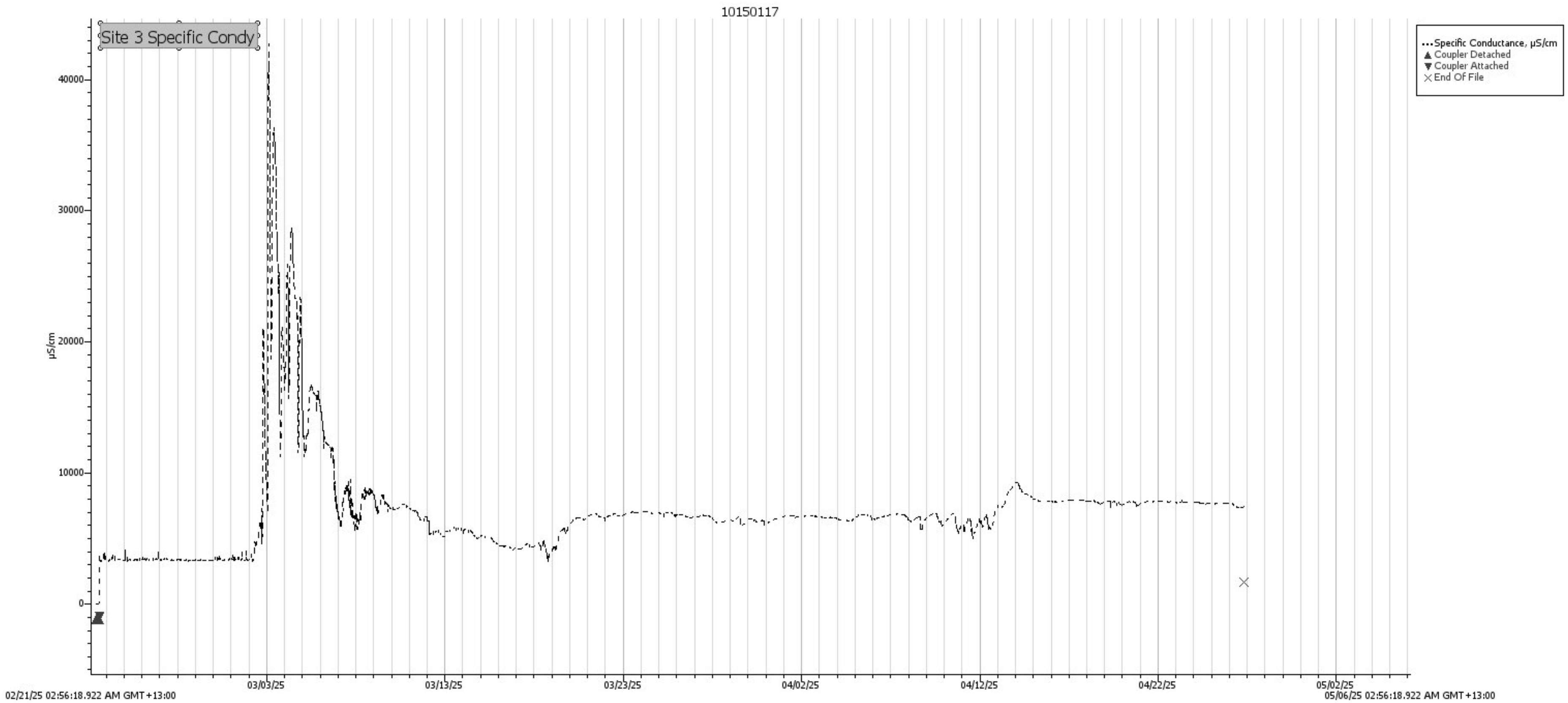


Figure 9 Site 3 Specific Conductance. N

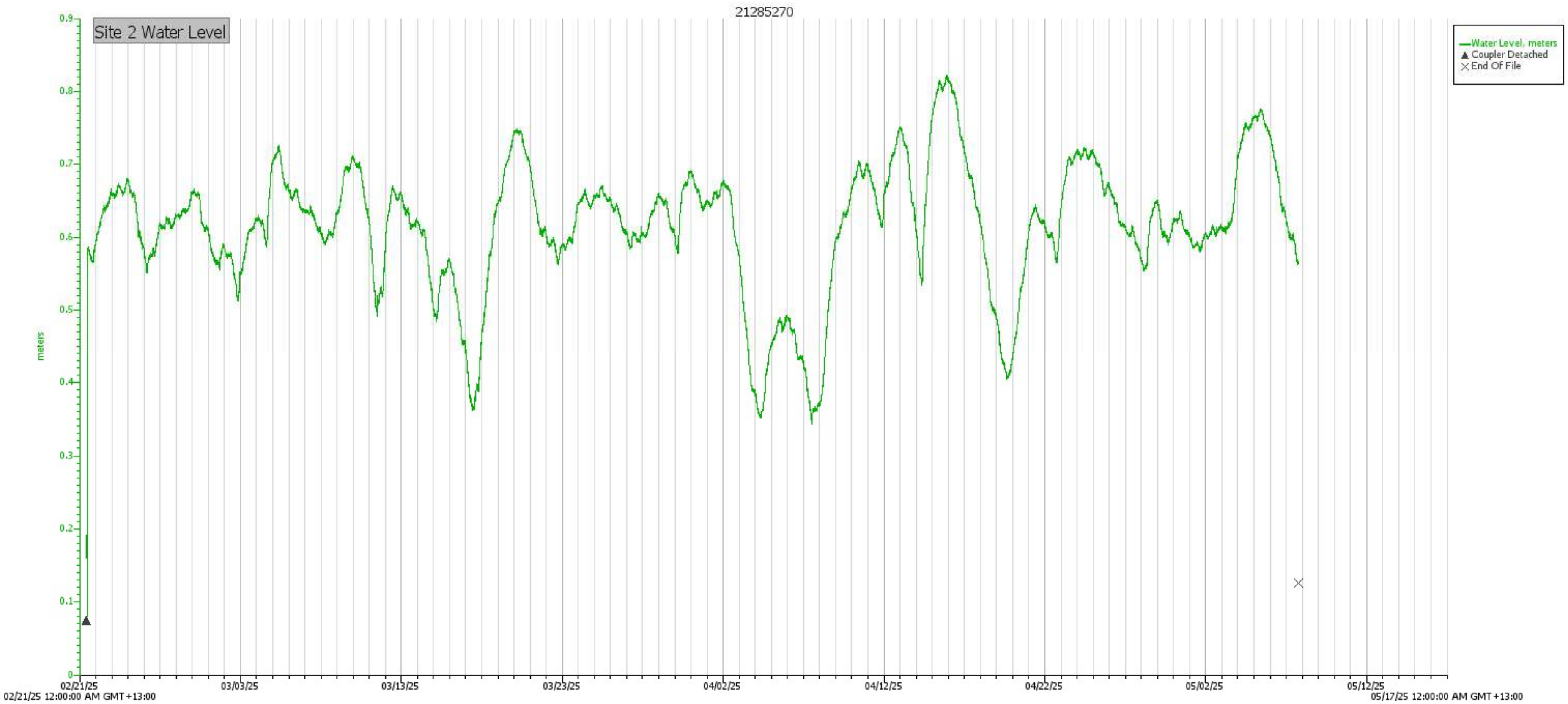


Figure 10 Site 2 Water Level.

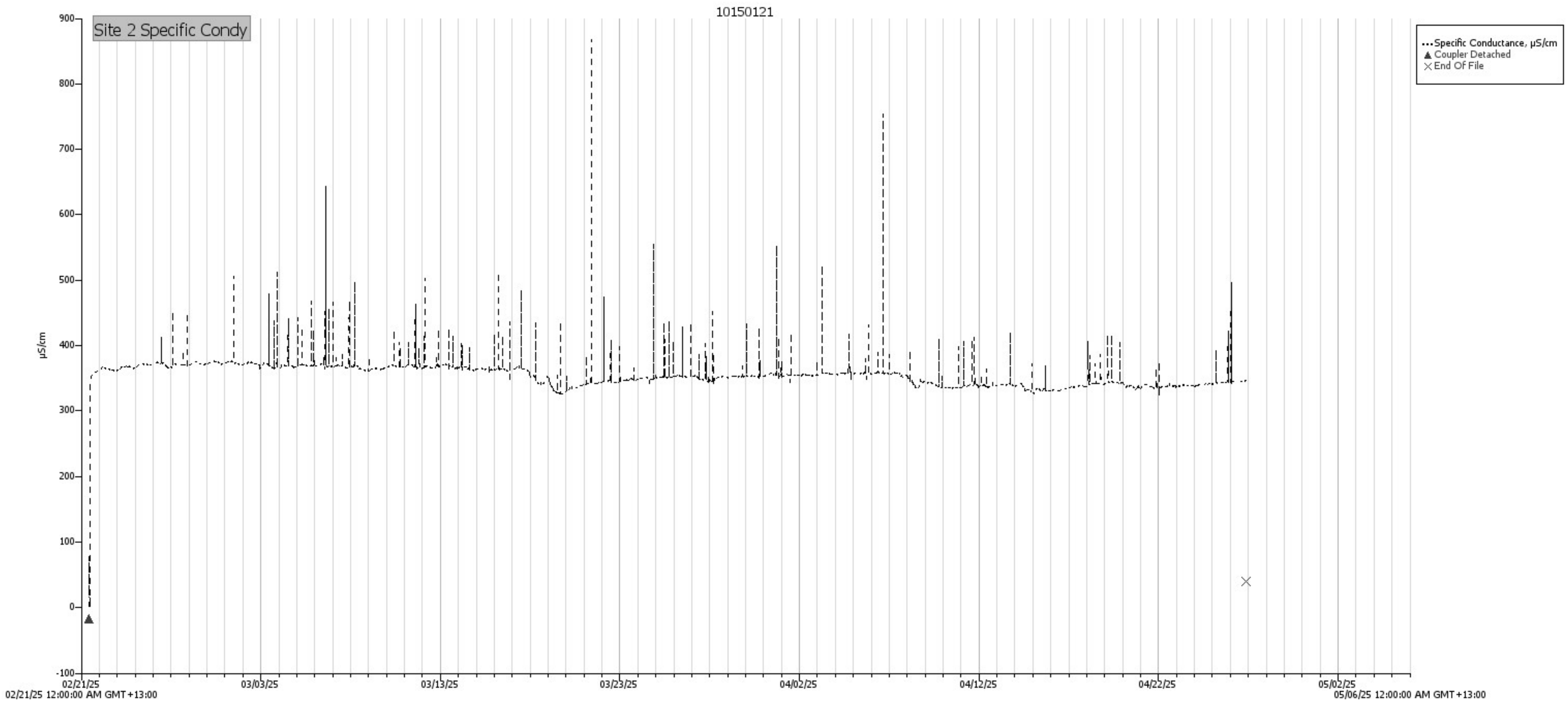


Figure 11 Site 2 Specific Conductance.

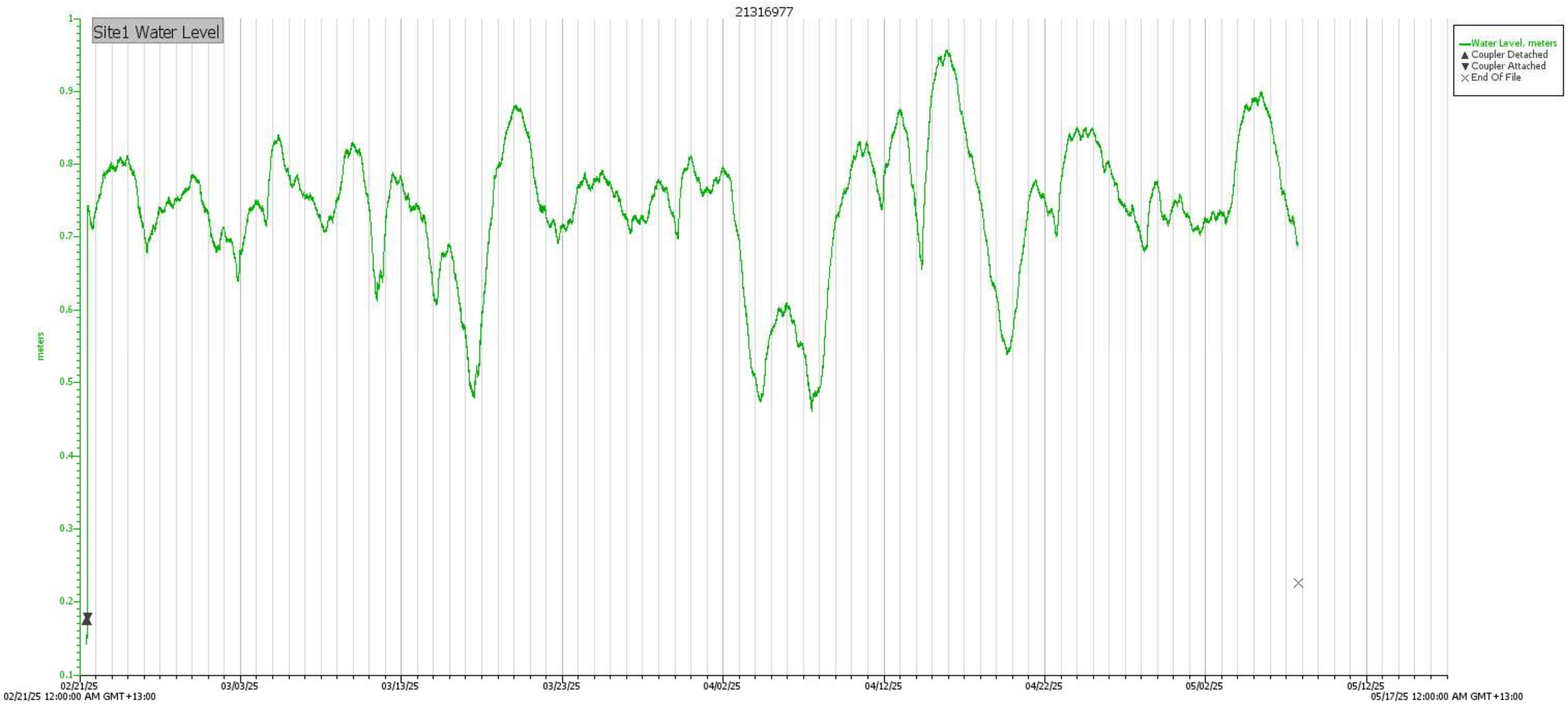


Figure 12 Site 1 Water Level

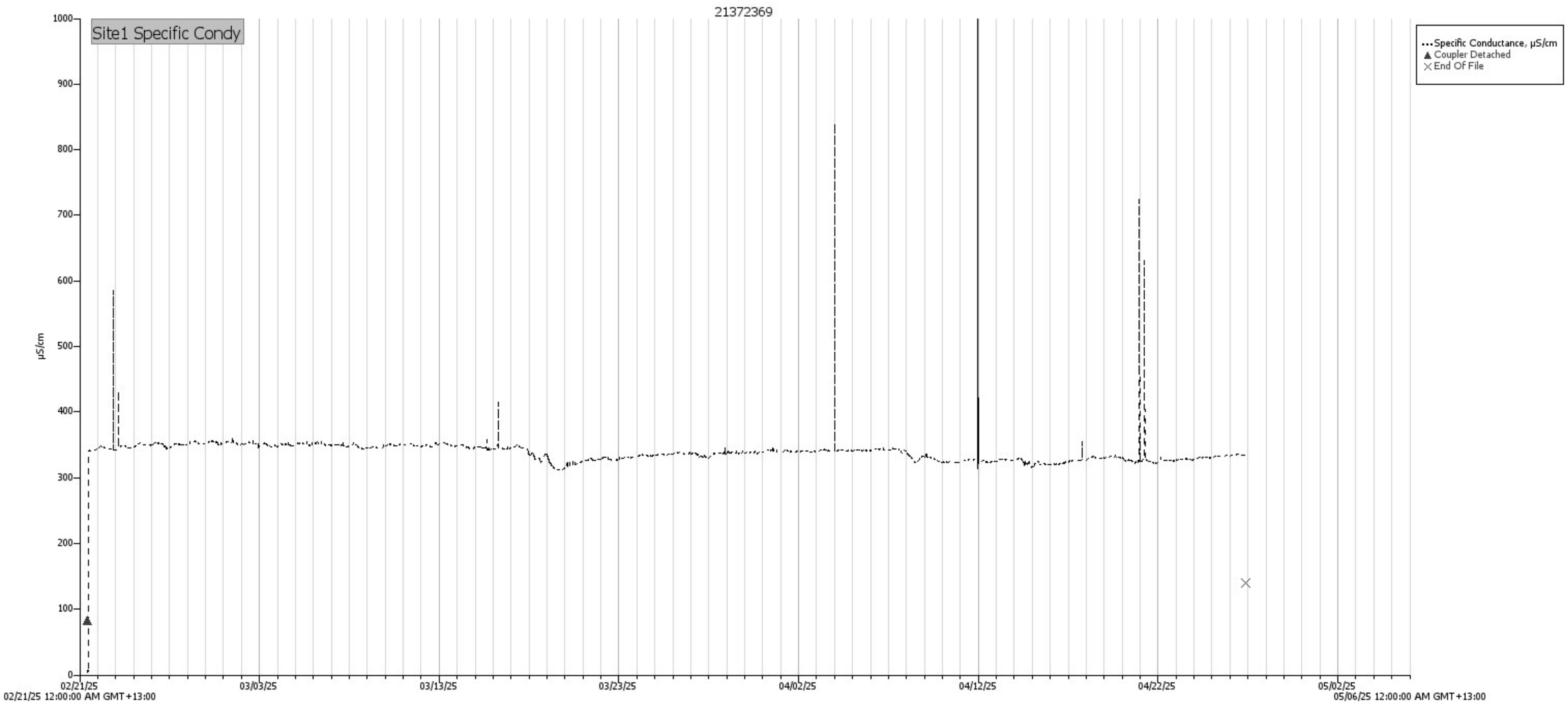


Figure 13 Site 1 Specific Conductance.