PROPOSED UPPER'S QUARRY

MAXIMUM PREDICTED WATER TABLE REPORT

WALKER AGGREGATES INC.

WSP PROJECT NO.: 161-11633-00
DATE: OCTOBER 2021

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October 29, 2021

Mr. Kevin Kehl
Walker Aggregates Inc.
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P.O. Box 100
Thorold, ON L4V 3Y8

Subject: **Proposed Upper's Quarry**
Maximum Predicted Water Table Report
WSP Project No. 161-11633-00

Dear Mr. Kehl:

We are pleased to provide the Maximum Predicted Water Table Report to meet the study requirements for the Walker Aggregates Inc (WAI) proposed Upper's Quarry (Site). This report provides an interpretation of the water level monitoring data collected since 2011 and the maximum predicted water table at the Site.

We trust that this report satisfies your requirements.

Yours truly,
WSP Canada Inc.

Kevin Fitzpatrick

Kevin Fitzpatrick, P.Eng.
Senior Project Engineer

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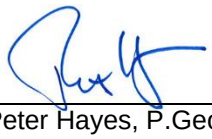

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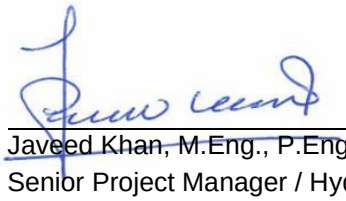

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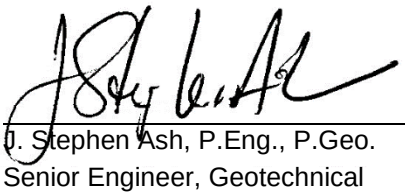

J. Stephen Ash, P.Eng., P.Geo.
Senior Engineer, Geotechnical

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1 INTRODUCTION

1.1 BACKGROUND

The proposed Upper's Quarry (Site) is situated in the City of Niagara Falls in Lots 119, 120, 136 and 137 in the geographic Township of Stamford. T This assessment also takes into account potential extraction of the portion of Upper's Lane and Part of the unopened road allowance between Lots 120 and 136 (geographic Township of Stamford), where they exist between Thorold Townline Road and Beechwood Road, all in the City of Niagara Falls, Regional Municipality of Niagara. The proposed limits of extraction are shown on **Figure 1**. The Site lands (with the exception of Upper's Lane and the unopened road allowance) have been acquired over time by Walker Aggregates Inc. (WAI) and cover an area of approximately 106 ha. Additional lands to west of the Site within the City of Thorold are also owned by WAI but are not proposed for aggregate extraction.

The proposed quarry will be developed below the natural groundwater table to a maximum depth of approximately 45 m below ground surface (approximately 141 masl), corresponding to the base of the Gasport dolostone of the Lockport Group. In order to maintain dry working conditions, the quarry will be actively dewatered. WAI is required to obtain a Class A Licence (Quarry Below Groundwater) for the Site under the Aggregate Resources Act (ARA). A Niagara Region Official Plan Amendment, City of Niagara Falls Official Plan Amendment and City of Niagara Falls Zoning By-law Amendment are also required to permit industrial extraction at the Site.

WSP Canada Inc. (WSP) was retained by WAI to provide hydrogeologic services, including the completion of this ARA Maximum Predicted Water Table report to meet the study requirements for the proposed quarry licence application.

1.2 EVALUATION REQUIREMENTS

In the Aggregate Resources of Ontario Provincial Standards (Ministry of Natural Resources and Forestry (MNRF), August 2020), Part 2.1 outlines the following requirements for the Maximum Predicted Water Table Report for a Class A quarry below groundwater:

> *A report must be prepared that details how the maximum predicted water table is identified in metres above sea level, relative to the proposed depth of excavation at the site.*
>
> *The maximum predicted water table shall be determined by monitoring the ground water table at the site for a minimum of one (1) year to account for seasonal variations and influences due to precipitation, unless alternative information already exists (e.g. previous hydrogeological study, existing well data) to support a determination of the maximum predicted water table by a qualified person.*
>
> *An alternative method may be used for sites determining the maximum water table in Precambrian rocks of the Canadian Shield where it is difficult to determine the elevation of the water table. In such cases, the maximum predicted water table may be assumed at an elevation (metres above sea level) that is a minimum of 2.5 metres below the deepest sump or pond on the site, provided a qualified person develops and oversees a drilling and*

monitoring program to determine if the ground water table would be intercepted at the assumed maximum predicted water table.

The number of drill holes and seasonal monitoring frequency shall be determined by a qualified person based on site conditions.

This report addresses the requirements of the Maximum Predicted Water Table report for the proposed quarry.

1.3 STUDY METHODOLOGY

1.3.1 DRILLING PROGRAMS

Boreholes were advanced during two separate drilling programs at the Site. The locations of boreholes completed as part of this undertaking are shown in the Site Plan, **Figure 1**.

2004

Prior to the current study, Jagger Hims Limited (now WSP) advanced five (5) boreholes as part of an initial resource assessment for the Site. Of these original boreholes, BH03-2 was retrofitted during the initial drilling program undertaken in 2016. The resource assessment boreholes dating from 2004 were completed as open holes in the bedrock; the retrofit included the installation of two smaller diameter riser pipes within the open hole, with the screen and filter pack installed at selected intervals aligned with the current monitoring network configuration. The retrofitted wells are referred to as BH03-2A and BH03-2B. Continuous monitoring of the retrofitted wells was initiated in 2016.

2011

More recently, four (4) boreholes were advanced by others during 2011 at the four corners of the proposed quarry footprint, referred to as well nests MW11-1 through MW11-4. The initial boreholes are believed to have been completed as open holes in the bedrock. The available logs indicate that geophysical testing was completed in the open holes to establish bedrock lithology. Later, the initial boreholes were retrofitted by installing two riser pipes within the open hole, with screen and filter packs installed at selected intervals. The screen intervals were identified as 'A', the deep bedrock roughly corresponding to the base of the Gasport member of the Lockport Formation and the underlying DeCew and Rochester Formations, and 'B', the shallow bedrock corresponding to the Eramosa member of the Lockport Formation. Separate overburden 'OB' series wells were installed at each of the four nests, with screen intervals completed to the top of bedrock. In 2012, dataloggers were installed in each well (12 wells in total) and set to record water level elevations at 4-hour intervals. These wells have therefore established a continuous water level record at the Site since 2012.

2016

In the summer of 2016, WSP completed an initial drilling program at the Site to install monitoring well nests MW16-5 through MW16-19 in order to establish an improved groundwater monitoring network. A total of thirty-two (32) wells were installed at these fifteen (15) nests. The well nests typically consist of three (3) wells screened at selected intervals as shown in the schematic section on **Figure 1A** and described below:

- ➔ Interval ‘A’ corresponds solely to the base of the Gasport member of the Lockport Formation (i.e., the deep bedrock aquifer). We note that this is equivalent to the proposed final quarry depth (excavation will not be completed into the DeCew Formation).
- ➔ Interval ‘B’ corresponds to the Eramosa member of the Lockport Formation (i.e., the shallow bedrock aquifer).
- ➔ Interval ‘OB’ roughly corresponds to the interval of overburden immediately overlying the top of bedrock; in studies by others, this interval is typically referred to as the contact-zone or contact aquifer.

We note that although the 2011 well nests use the same A / B nomenclature, the intervals screened differ from the screen intervals selected as part of the current study. In particular, the MW11 nest ‘A’ series wells are generally screened from the base of the Gasport member across the DeCew / Rochester contacts, whereas the remainder of the ‘A’ series wells were screened solely at the base of the Gasport member bedrock. As such, the water levels of the MW11 nest ‘A’ reflect the properties of the screened interval.

Four (4) well nests along Townline Road along the west property boundary include only a single contact aquifer ‘OB’ monitoring well.

Finally, monitoring well nest MW11-3 was decommissioned and replaced with nest MW11-3R as part of the initial drilling program. The detailed Site survey as part of the current study indicated that the original well nest had been installed slightly outside of the property boundary and was re-located.

2017

The supplemental drilling program in 2017 included the installation of four (4) well nests. One (1) complete well nest, MW17-20, was installed in the vicinity of the mapped wetland to the east of the Site, at address 5584 Beechwood Road. An ‘SP’ series standpipe was also installed at this nest to facilitate monitoring of the shallow weathered overburden. The designation ‘SP’ was chosen for this depth interval to distinguish from the existing ‘OB’ series wells. In general, the screened intervals for ‘SP’ series standpipes are no more than 3 m below ground surface. The wells and drivepoint completed during the supplemental drilling program were installed with the permission of the property owner. Three (3) additional well nests, MW17-21 to MW17-23, were also installed to the west of the Site in the vicinity of the woodlot feature west of Townline Road. These nests only consist of ‘B’, ‘OB’ and ‘SP’ series wells / standpipes and are intended to monitor the shallower units. An ‘SP’ series standpipe was also added at well nest MW16-9 for this purpose.

Finally, well MW16-5AR was installed in the vicinity of well nest MW16-5 to confirm the drawdown observed in the deep bedrock aquifer during the pumping test. MW16-5A was left in place.

Both the initial and supplemental drilling programs and monitoring well installations undertaken as part of the current study were completed by Orbit Garant Drilling Inc. of Sharon, Ontario. Boreholes advanced through the overburden were completed with hollow-stem augers (108 mm inner diameter) to allow measurement of in-situ geotechnical parameters and detailed soil logging.

Boreholes that were advanced into bedrock were completed with an HQ (64 mm diameter) diamond drill bit. The ‘A’ series boreholes were continuously cored from the bedrock surface to the interpreted depth of the DeCew Formation. Rock core was placed into core boxes and stored at the Site for review by a

senior geological engineer. Descriptions included stratigraphy, percent recovery and rock quality designation (RQD).

Monitoring wells were generally constructed of 51 mm diameter PVC riser pipe and a 10 slot (0.25 mm) well screen of varying lengths to accommodate the interval screened. The borehole annulus around the screen was filled with number 2 silica sand to a nominal height above the screen to provide a filter pack. The remainder of the borehole annulus was sealed with bentonite pellets and / or grout. A lockable protective steel casing was cemented in place at the surface to provide a surface seal. Dedicated inertial lift sampling equipment (Waterra) was installed and the wells were developed to set the filter pack. Cluster MECP well records were submitted for the separate drilling programs.

The wells and drivepoints included in the current monitoring network were surveyed by WSP to establish ground surface and top of pipe elevations to a geodetic datum and UTM location coordinates.

1.3.2 GROUNDWATER ELEVATION MONITORING

The baseline groundwater elevation monitoring consisted of the following:

- ➔ Continuous groundwater level monitoring using dataloggers installed at fourteen (14) 'A' series deep bedrock aquifer wells, eighteen (18) 'B' series shallow bedrock aquifer wells, twenty-three (23) 'OB' series contact aquifer wells, and five (5) 'SP' series shallow weathered overburden standpipes included in the monitoring network. Loggers were programmed to collect data every four (4) hours. One barologger was installed at nest MW11-1 to correct for atmospheric pressure changes over time.
- ➔ Periodic manual water level measurements at each monitoring well were made over the course of the baseline monitoring period, generally occurring on a quarterly basis and / or prior to sampling events. The manual measurements were used to confirm the datalogger water levels. The manual water levels were measured with an electric contact gauge.

There are a total of sixty (60) monitoring wells included in the current monitoring network. The extent of baseline water level data has expanded with to the installation of additional wells over several drilling programs.

2 BASELINE GROUNDWATER ELEVATION DATA

The overburden and bedrock units at the Site have been divided into five aquifers or aquitards based on the regional groundwater setting interpretation as depicted in the schematic cross section in **Figure 1A**. The upper-most aquifer is referred to as the contact aquifer.

The contact aquifer consists of the inferred intermittent basal till deposit present in localized areas overlying the bedrock. The maximum water table at the Site is inferred to occur within this hydrostratigraphic unit, although since it is generally confined within the Site boundary, it is referred to as a potentiometric surface. There are twenty-three 'OB' series wells which are interpreted to be completed into this hydrostratigraphic unit at the Site.

The groundwater hydrographs for the contact aquifer wells are shown on **Figures E-2 through E-24** (MW11-1OB through MW17-23OB). Water level data is typically available starting in winter 2016, although some wells have data starting in 2012.

There appears to be a muted response to precipitation events, with a change on the order of 0.5 m to 1.0 m during some precipitation events. In addition, most of the wells exhibit a seasonal variation on the order of 1 m to 3 m between the spring and late summer. Both of these patterns indicate greater variations than observed for the shallow weathered overburden and suggest that recharge of the contact aquifer is not only related to infiltration through the overlying upper aquitard, but also lateral groundwater flows from further afield. Along the meander valley at MW16-16 in the south to MW16-19 in the north, the seasonal variation is less, at about 1 m to 1.5 m.

The potentiometric surface for the contact aquifer on October 1, 2017, and May 1, 2018, is shown on **Figures 2 and 3**, respectively. The seasonality of the water table between the late autumn and spring is notable; most May water table elevations are 1 m to 2 m above the October elevations. The inferred groundwater flow direction in the contact aquifer is a subtle reflection of the ground surface topography, with flow from the elevated areas east and west of the Site towards the tributary of Beaverdams Creek meander valley that bisects the Site. Although the overall potentiometric surface elevation fluctuates seasonally, this flow pattern appears to be consistent throughout the year.

The maximum contact aquifer groundwater elevations within the Site boundary are consistently observed at MW16-13OB, in the western portion of the Site near Upper's Lane. Based on the hydrograph shown on **Figure E-14**, the maximum groundwater elevation at MW16-13OB observed during the baseline monitoring period is approximately 184.9 masl.

3 SUMMARY OF FINDINGS

The following is a summary of the key findings of the Maximum Predicted Water Table report for the proposed Upper's Quarry Class A License (Quarry Below Groundwater) application.

- ➔ The proposed quarry will be developed below the natural groundwater table to a maximum depth of approximately 45 m below ground surface (approximately 141 masl), corresponding to the base of the Gasport dolostone of the Lockport Group.
- ➔ The maximum water table at the Site is inferred to occur within the contact aquifer, although since it is generally confined within the Site boundary, it is referred to as a potentiometric surface. The maximum contact aquifer groundwater elevations within the Site boundary are consistently observed at MW16-13OB, in the western portion of the Site near Upper's Lane. The maximum groundwater elevation at MW16-13OB observed during the baseline monitoring period is approximately 184.9 masl.

STATEMENT OF LIMITATIONS

WSP Canada Inc. (“WSP”) prepared this report solely for the use of the intended recipient Walker Aggregates Inc., to support the regulatory review process for the proposed Uppers Quarry and in connection therewith, the report may be reviewed and used by Governmental Authorities participating in the review process in the normal course of their duties.

The report is intended to be used in its entirety.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no representations whatsoever concerning the legal significance of its findings.

The intended recipient is solely responsible for the disclosure of any information contained in this report. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report.

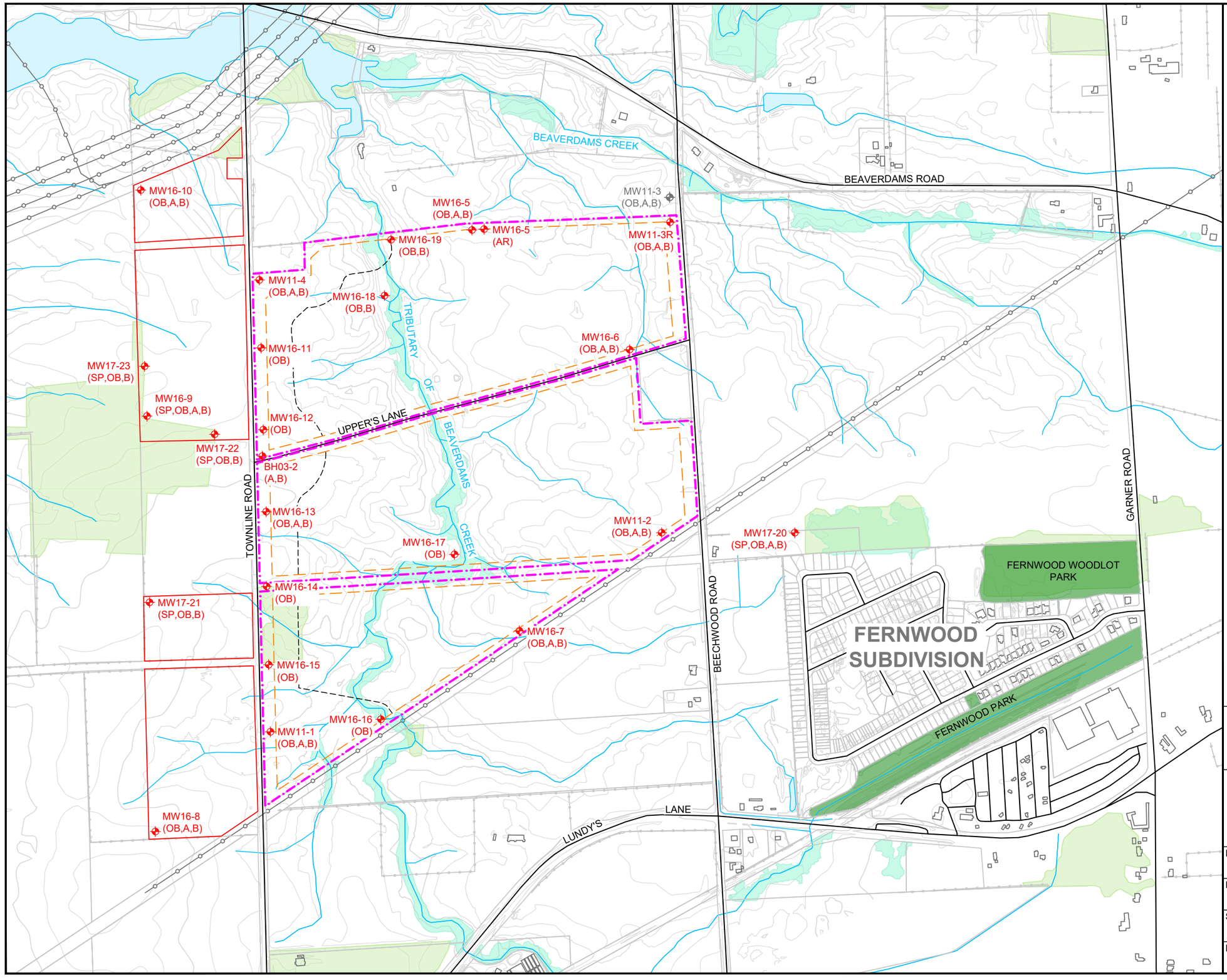
WSP has provided services to the intended recipient in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

The original of this digital file will be kept by WSP for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP, its integrity cannot be assured. As such, WSP does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.

This limitations statement is considered an integral part of the report.

FIGURES



SITE PLAN

MAXIMUM PREDICTED WATER TABLE REPORT
PROPOSED UPPER'S QUARRY
THOROLD / NIAGARA FALLS, ON
For Walker Aggregates Inc.

DATE: OCTOBER 2021	
PROJECT: 161-11633-00	
SCALE: 1 : 9,000	
DRAWN BY: JLD	FIGURE No: 1

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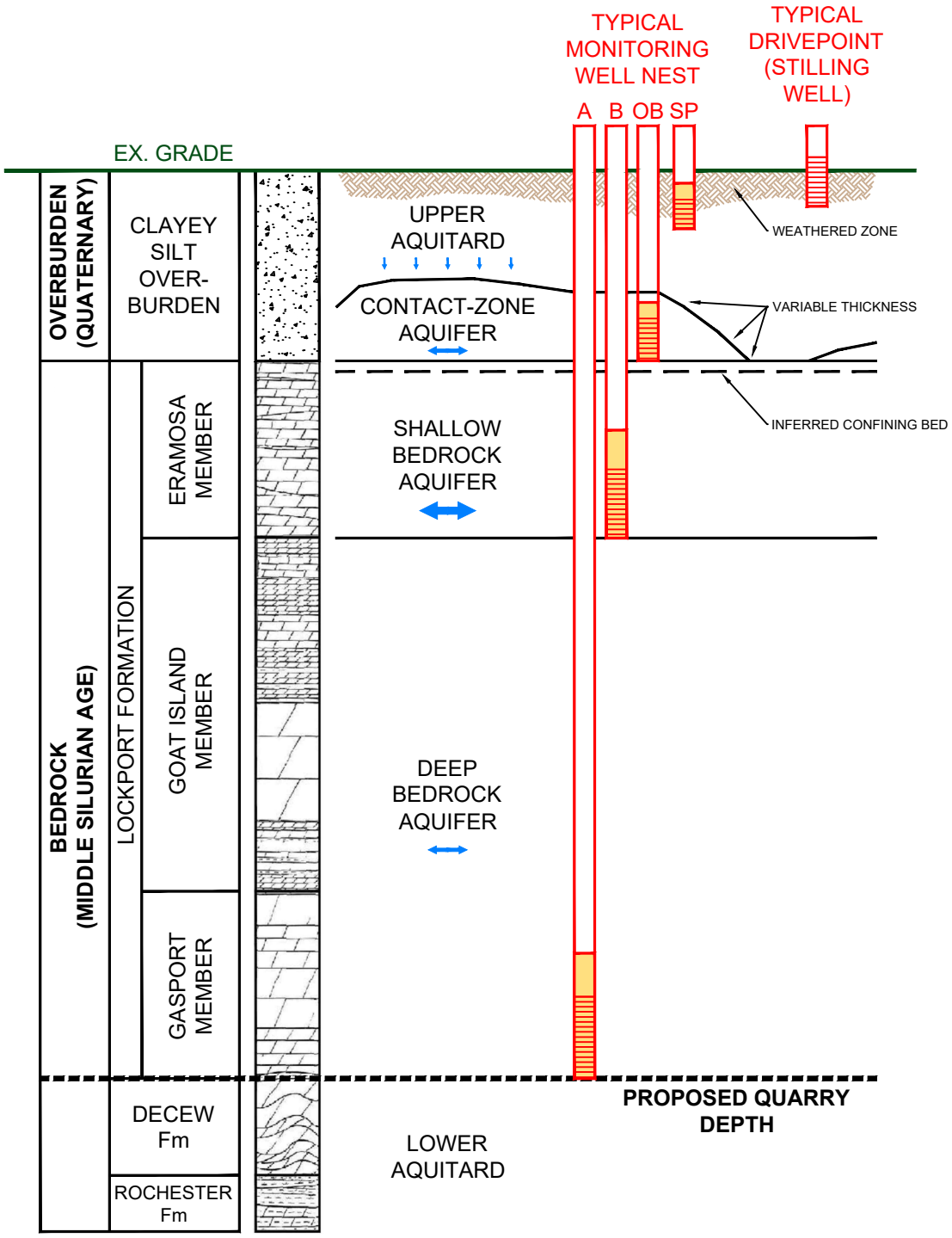
\\CASCR1DAT01\VOL1\PROJECTS\2016\161-11633 UPPERS LANE\00\03 LEVEL 2 HYDROG\GRAPHICS\MAX WATER TABLE RPT\161-11633-3-F1-SP.DWG



LEGEND

INFERRED GROUNDWATER FLOW

NOTES:
1. ARROW SIZE INDICATES RELATIVE MAGNITUDE OF INFERRED FLOW.
2. TYPE SECTIONS AFTER LINCOLN QUARRY AND THOROLD QUARRY, LIMESTONE INDUSTRIES OF ONTARIO, VOLUME III (MNRF, 1989)

CONCEPTUAL MODEL SCHEMATIC DIAGRAM

MAXIMUM PREDICTED WATER TABLE REPORT
PROPOSED UPPER'S QUARRY
THOROLD / NIAGARA FALLS, ON
For Walker Aggregates Inc.

SCALE:	AS SHOWN
DRAWN BY:	JLD
DATE:	OCTOBER 2021
PROJECT:	161-11633-00
FIGURE No:	1A

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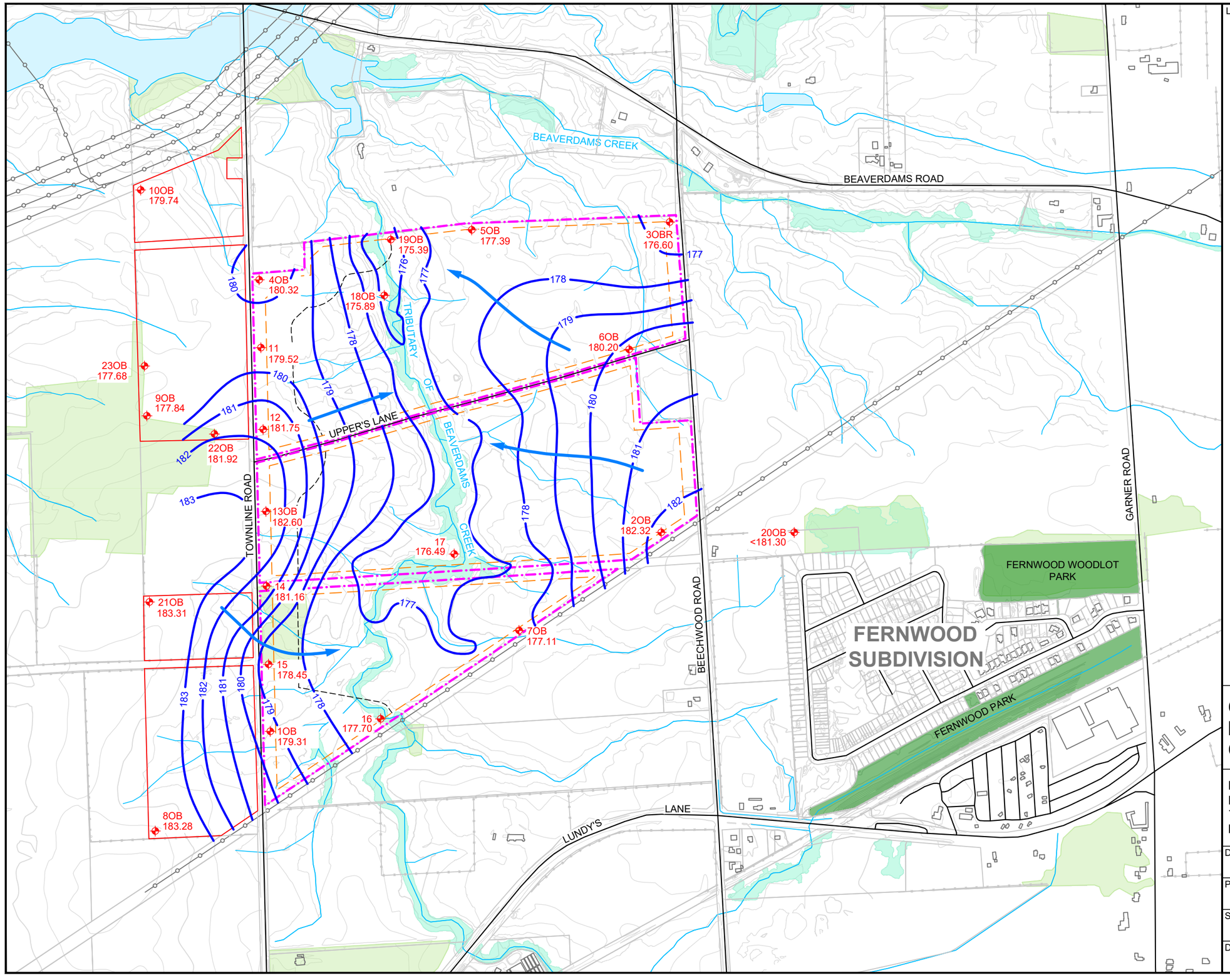

LEGEND

- SITE BOUNDARY
- PROPOSED LIMIT OF EXTRACTION
- REALIGNED WATERCOURSE SETBACK
- ADDITIONAL LANDS OWNED BY WAI
- APPROXIMATE LAND PARCELS
- WOODLOT
- WETLAND
- DESIGNATED PARK AREA
- SURFACE WATER COURSE
- GROUND SURFACE CONTOUR, 5 m INTERVAL
- GROUND SURFACE CONTOUR, 1 m INTERVAL
- FENCELINE
- UTILITY LINE
- 1OB — MONITORING WELL LOCATION AND DESIGNATION
- 179.31 — GROUNDWATER ELEVATION, OCTOBER 1, 2017 (masl)
- 179 — INTERPOLATED POTENTIOMETRIC CONTOURS (masl)
- INFERRED GROUNDWATER FLOW DIRECTION

CONTACT AQUIFER POTENTIOMETRIC CONTOURS - OCTOBER 2017

MAXIMUM PREDICTED WATER TABLE REPORT
PROPOSED UPPER'S QUARRY
THOROLD / NIAGARA FALLS, ON
For Walker Aggregates Inc.

DATE: OCTOBER 2021	
PROJECT: 161-11633-00	
SCALE: 1 : 9,000	
DRAWN BY: JLD	FIGURE No: 2

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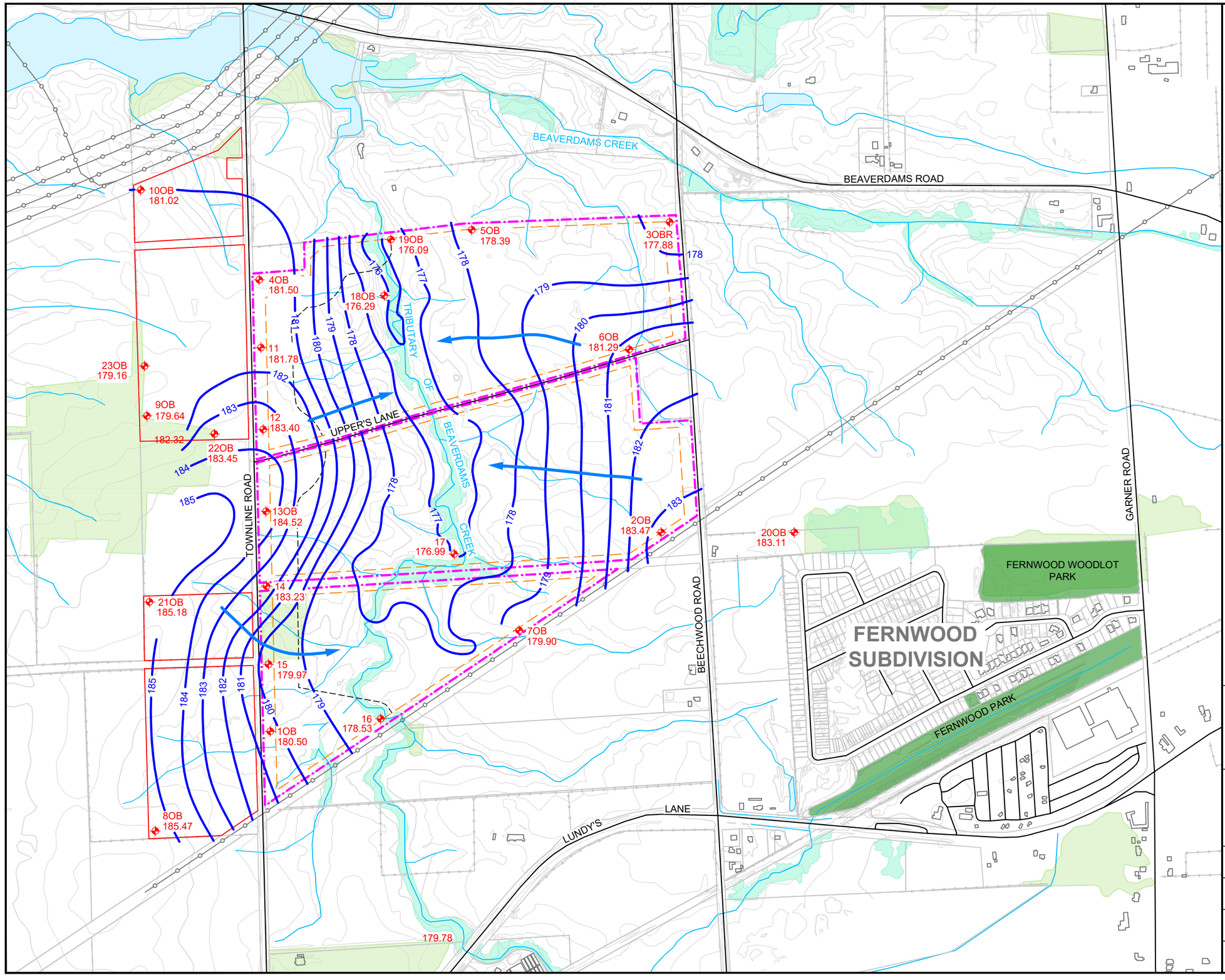

LEGEND

- SITE BOUNDARY
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- GROUND SURFACE CONTOUR, 1 m INTERVAL
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- 1OB — MONITORING WELL LOCATION AND DESIGNATION
- 179.31 — GROUNDWATER ELEVATION, MAY 1, 2018 (masl)
- 179 — INTERPOLATED POTENTIOMETRIC CONTOURS (masl)
- INFERRED GROUNDWATER FLOW DIRECTION

N

0 180 360 m

CONTACT AQUIFER POTENTIOMETRIC CONTOURS - MAY 2018

MAXIMUM PREDICTED WATER TABLE REPORT
PROPOSED UPPER'S QUARRY
THOROLD / NIAGARA FALLS, ON
For Walker Aggregates Inc.

DATE: OCTOBER 2021	
PROJECT: 161-11633-00	
SCALE: 1 : 9,000	
DRAWN BY: JLD	FIGURE No: 3

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APPENDIX

E WATER LEVEL DATA

Figure E-1 - Groundwater Hydrograph for Well Nest BH03-2

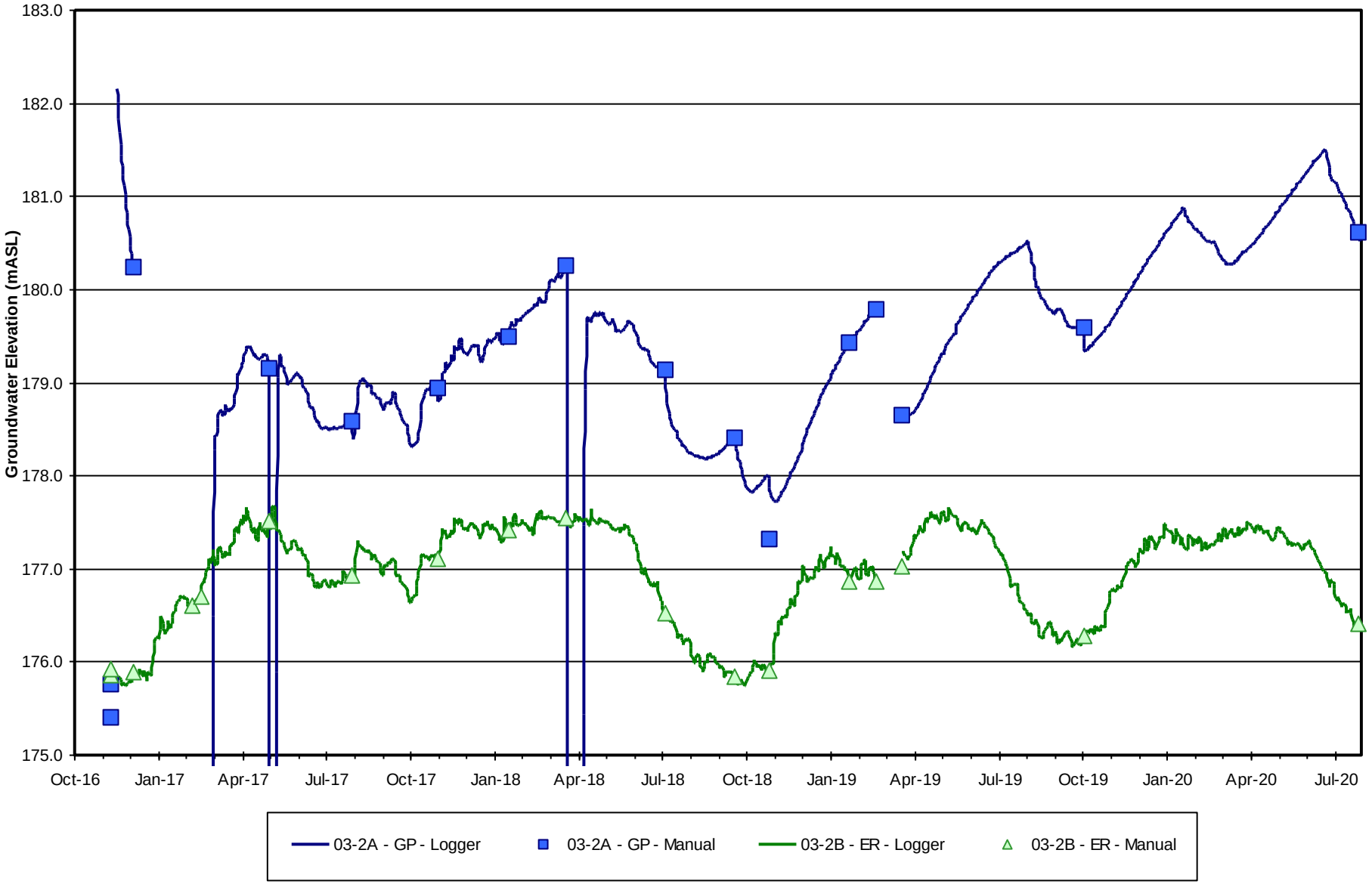

Figure E-2 - Groundwater Hydrograph for Well Nest MW11-1

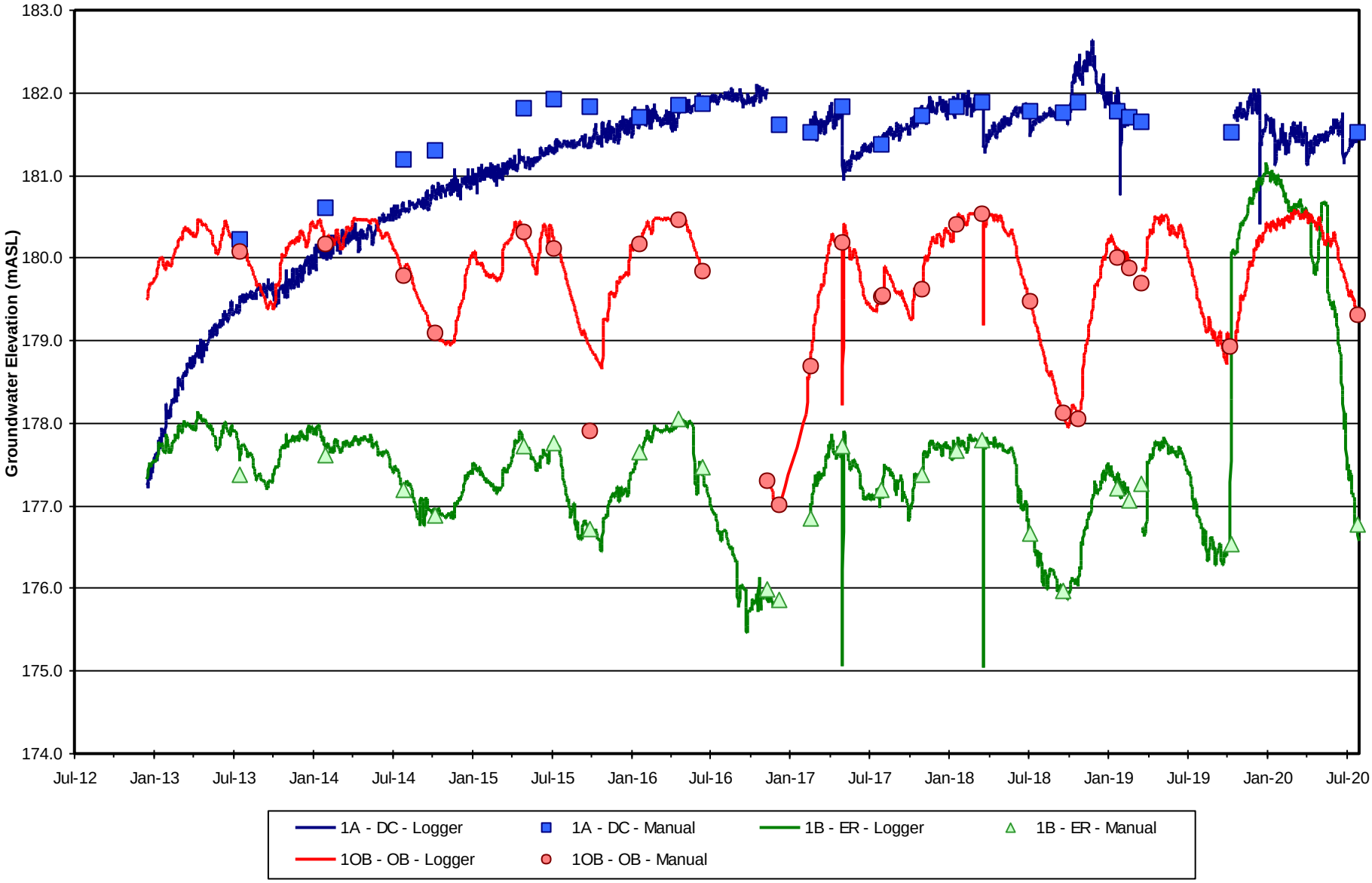

Figure E-3 - Groundwater Hydrograph for Well Nest MW11-2

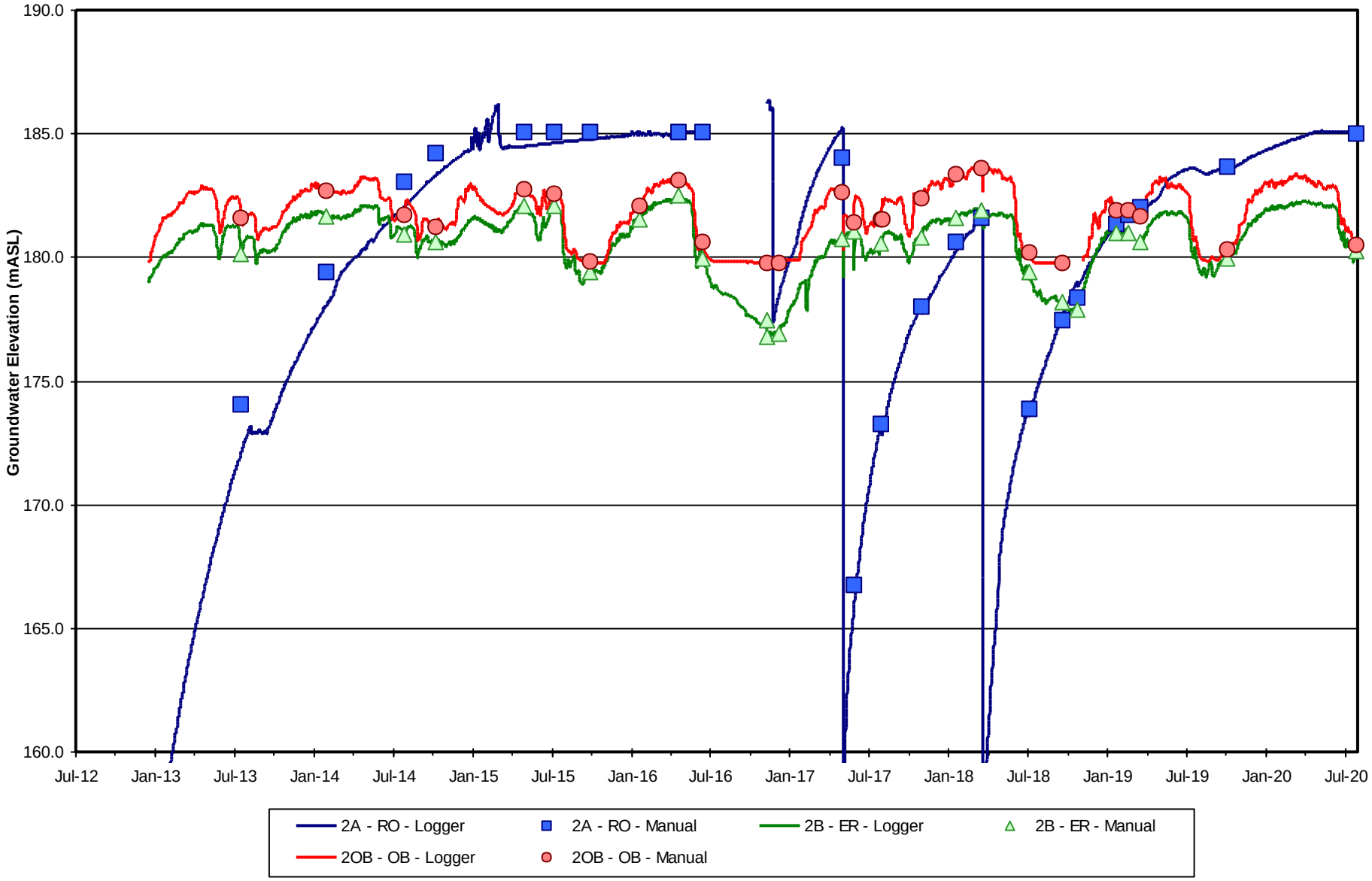

Figure E-4 - Groundwater Hydrograph for Well Nest MW11-3

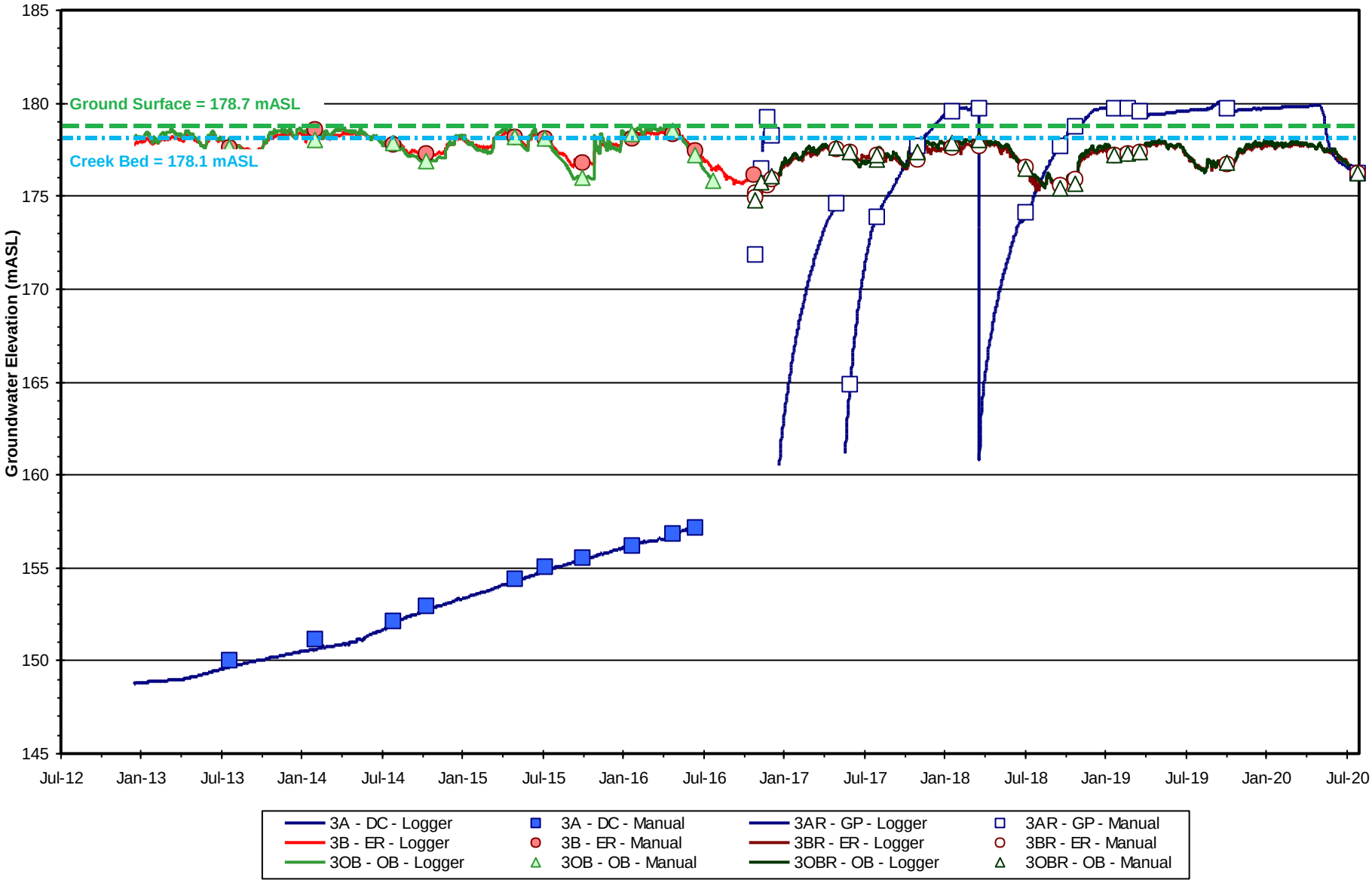

Figure E-5 - Groundwater Hydrograph for Well Nest MW11-4

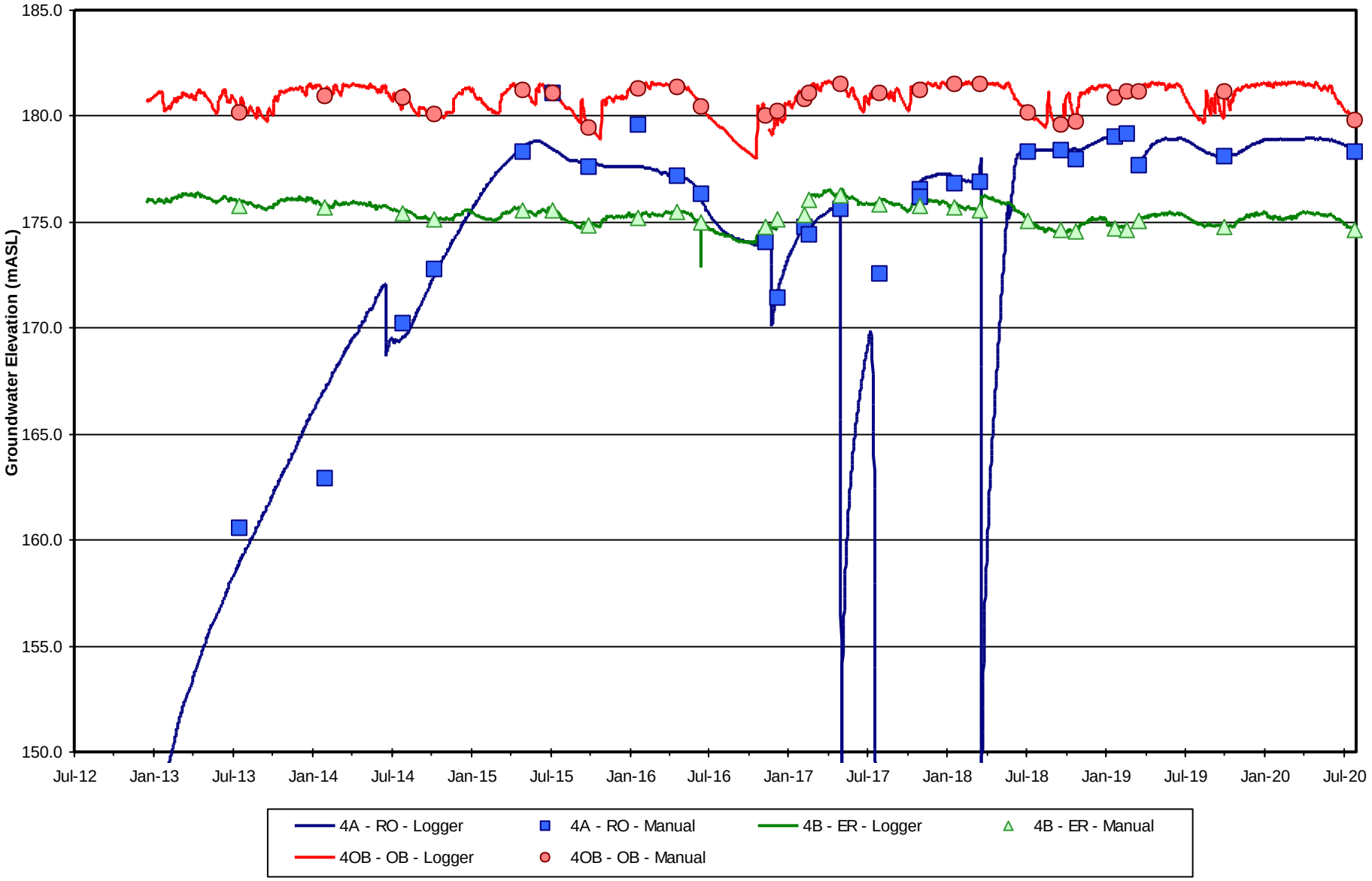

Figure E-6 - Groundwater Hydrograph for Well Nest MW16-5

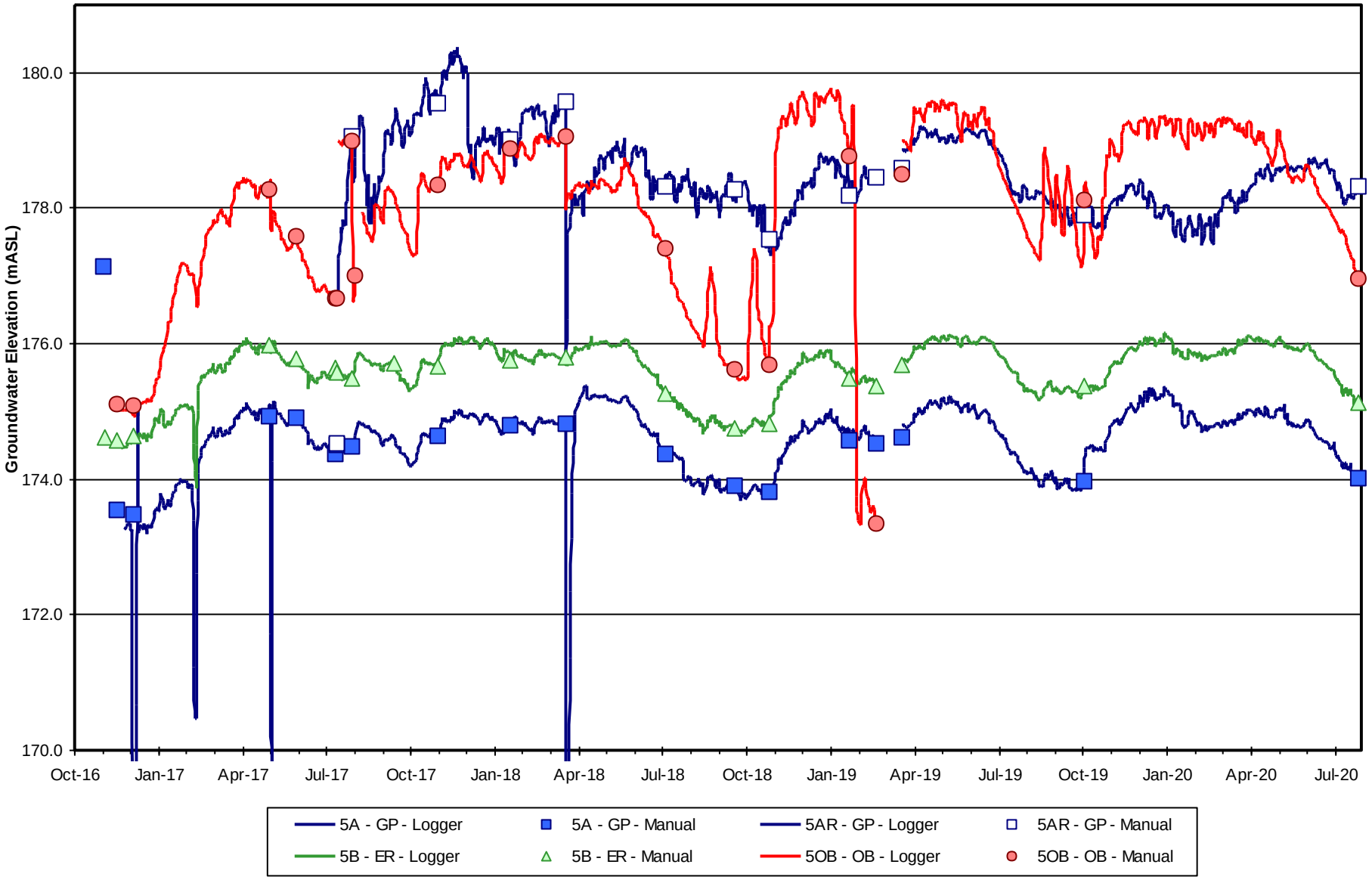

Figure E-7 - Groundwater Hydrograph for Well Nest MW16-6

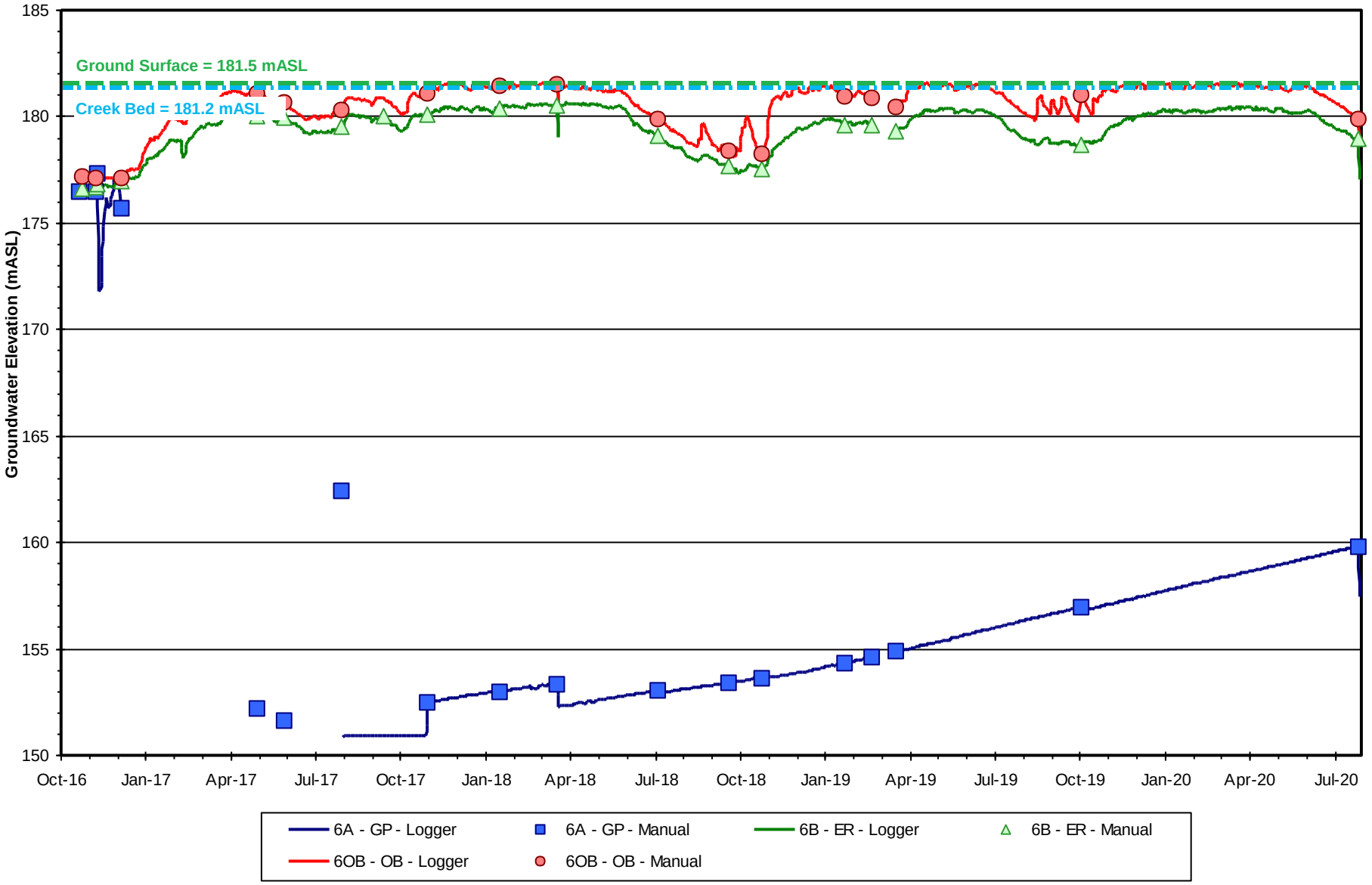

Figure E-8 - Groundwater Hydrograph for Well Nest MW16-7

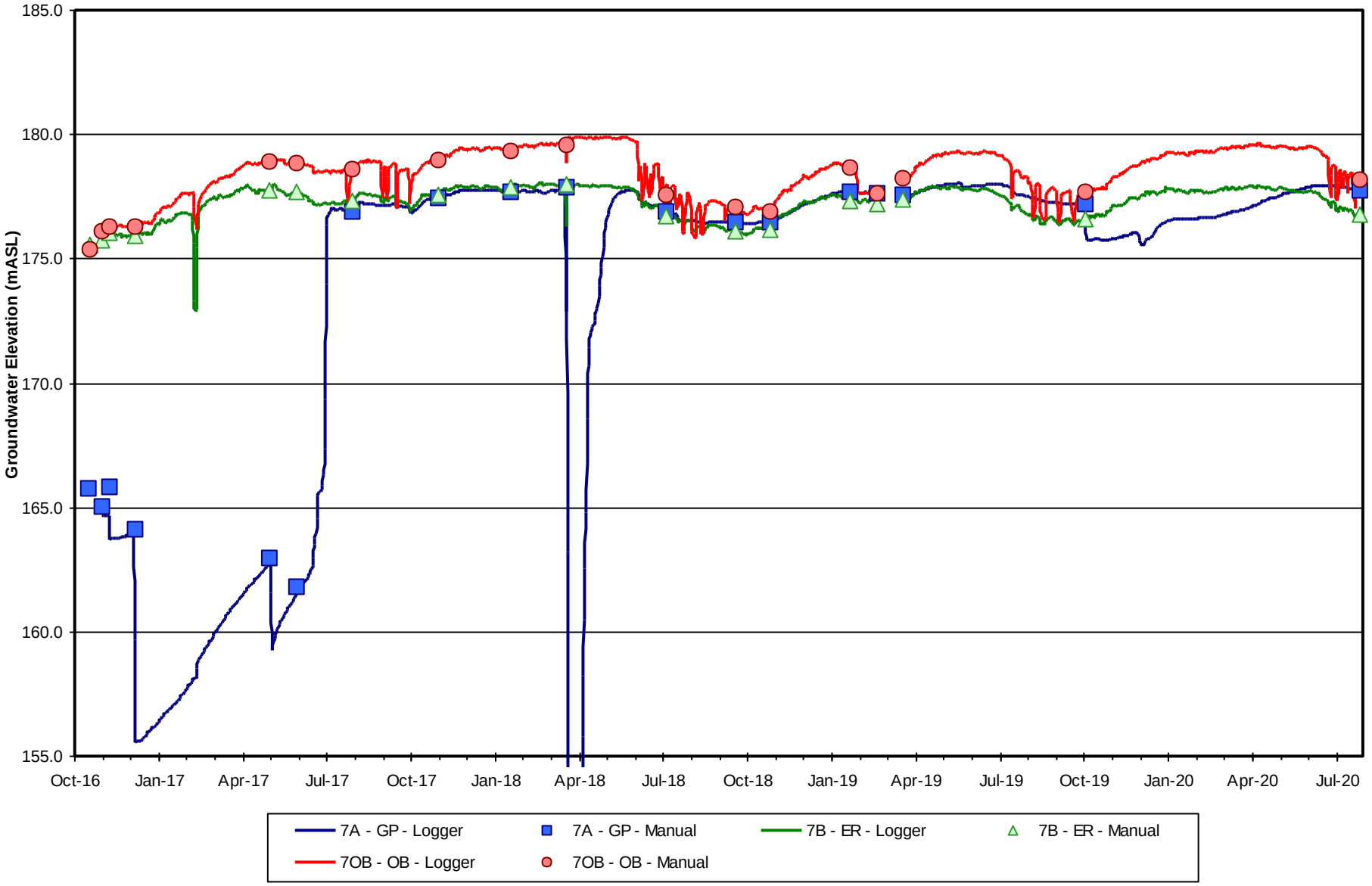

Figure E-9 - Groundwater Hydrograph for Well Nest MW16-8

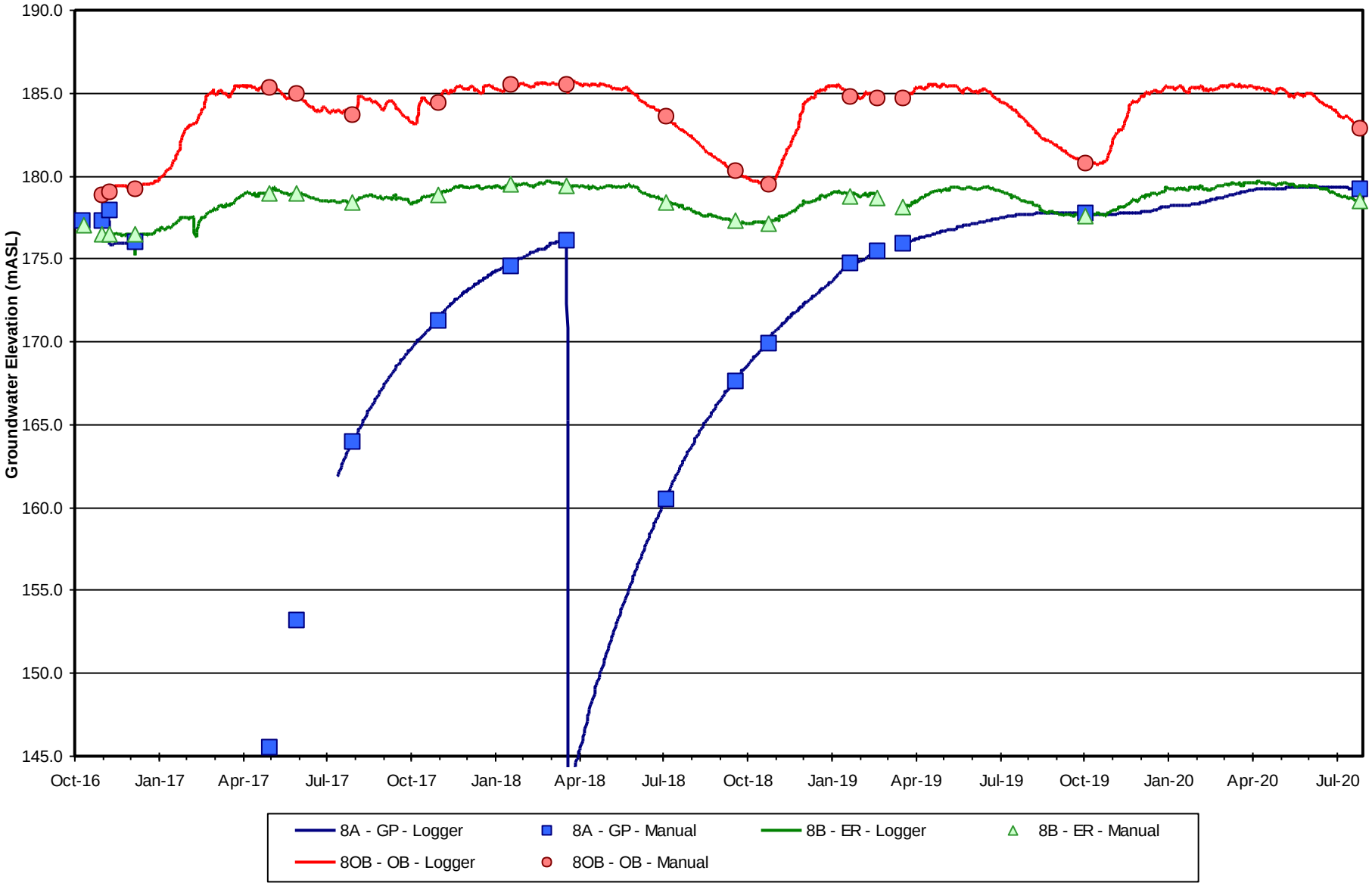

Figure E-10 - Groundwater Hydrograph for Well Nest MW16-9

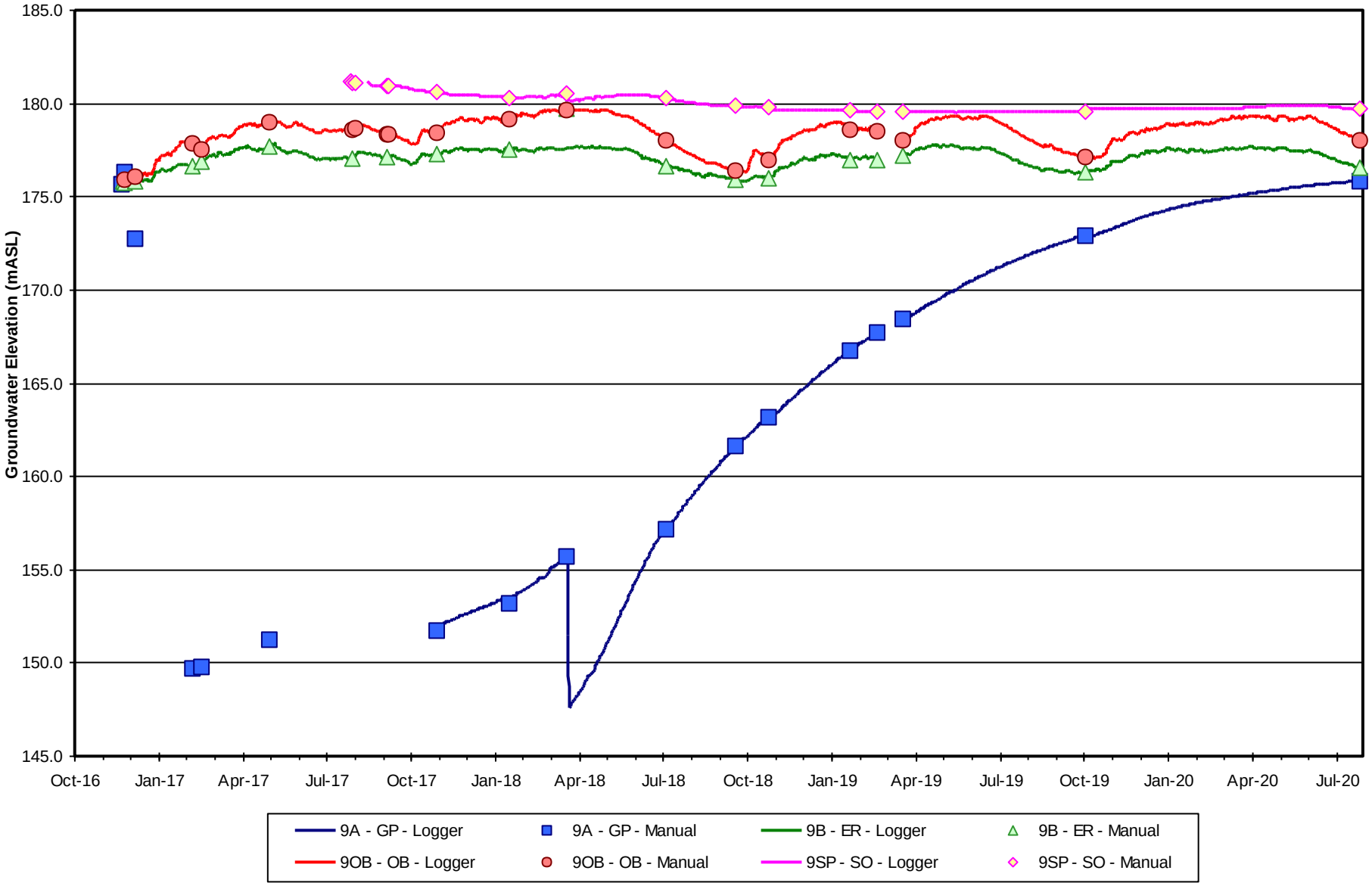

Figure E-11 - Groundwater Hydrograph for Well Nest MW16-10

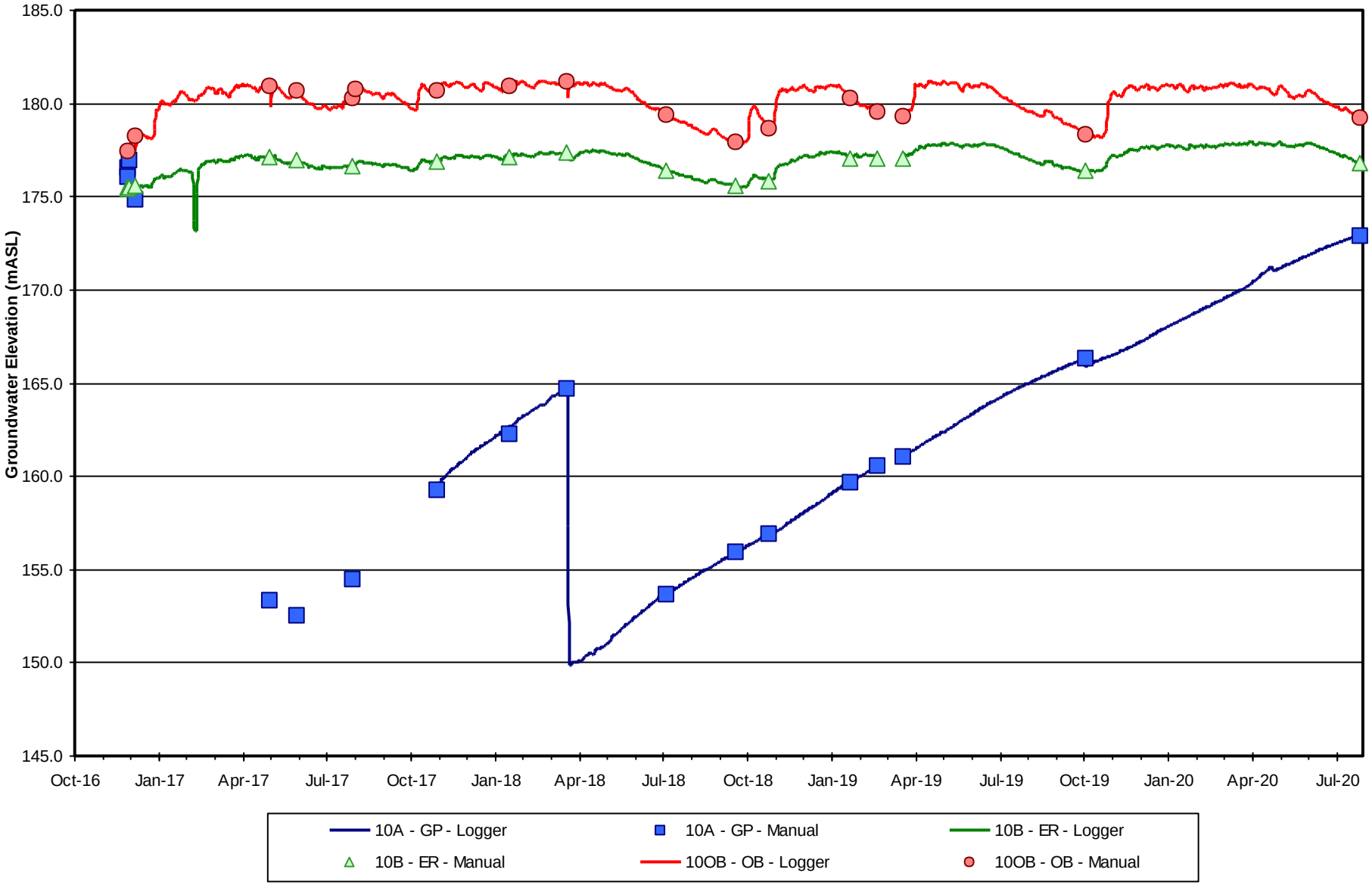

Figure E-12 - Groundwater Hydrograph for Well MW16-11

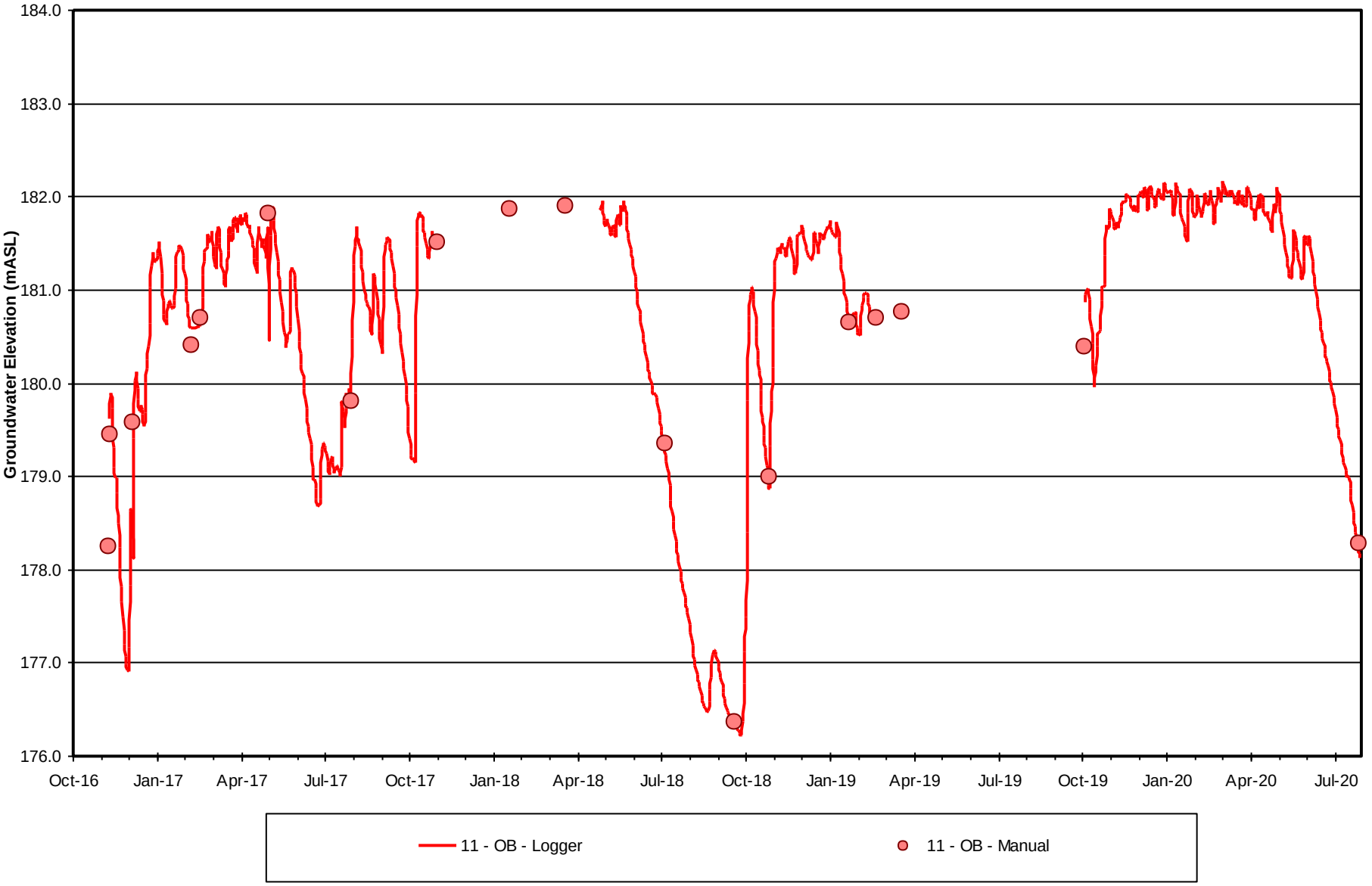

Figure E-13 - Groundwater Hydrograph for Well MW16-12

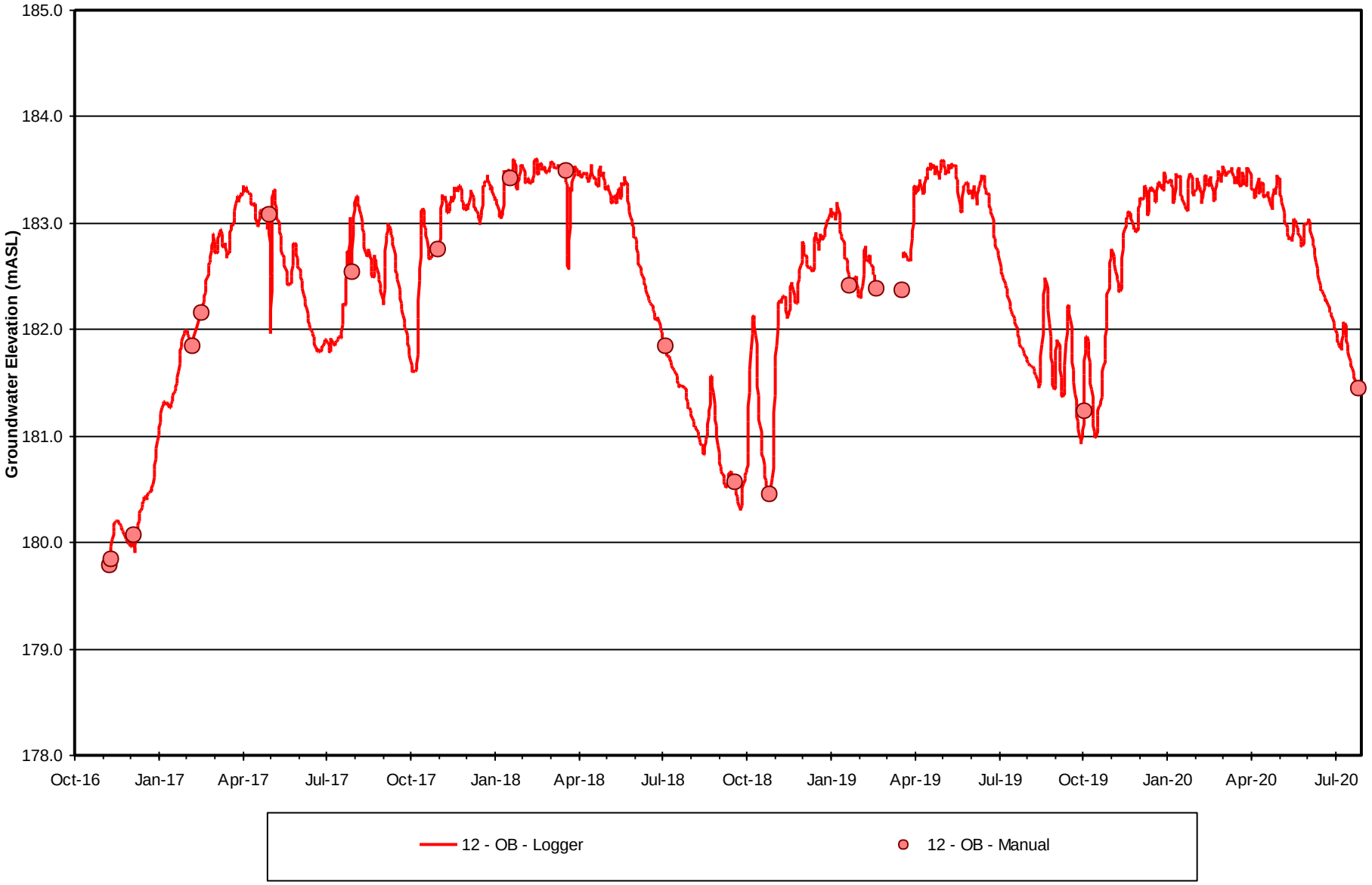

Figure E-14 - Groundwater Hydrograph for Well Nest MW16-13

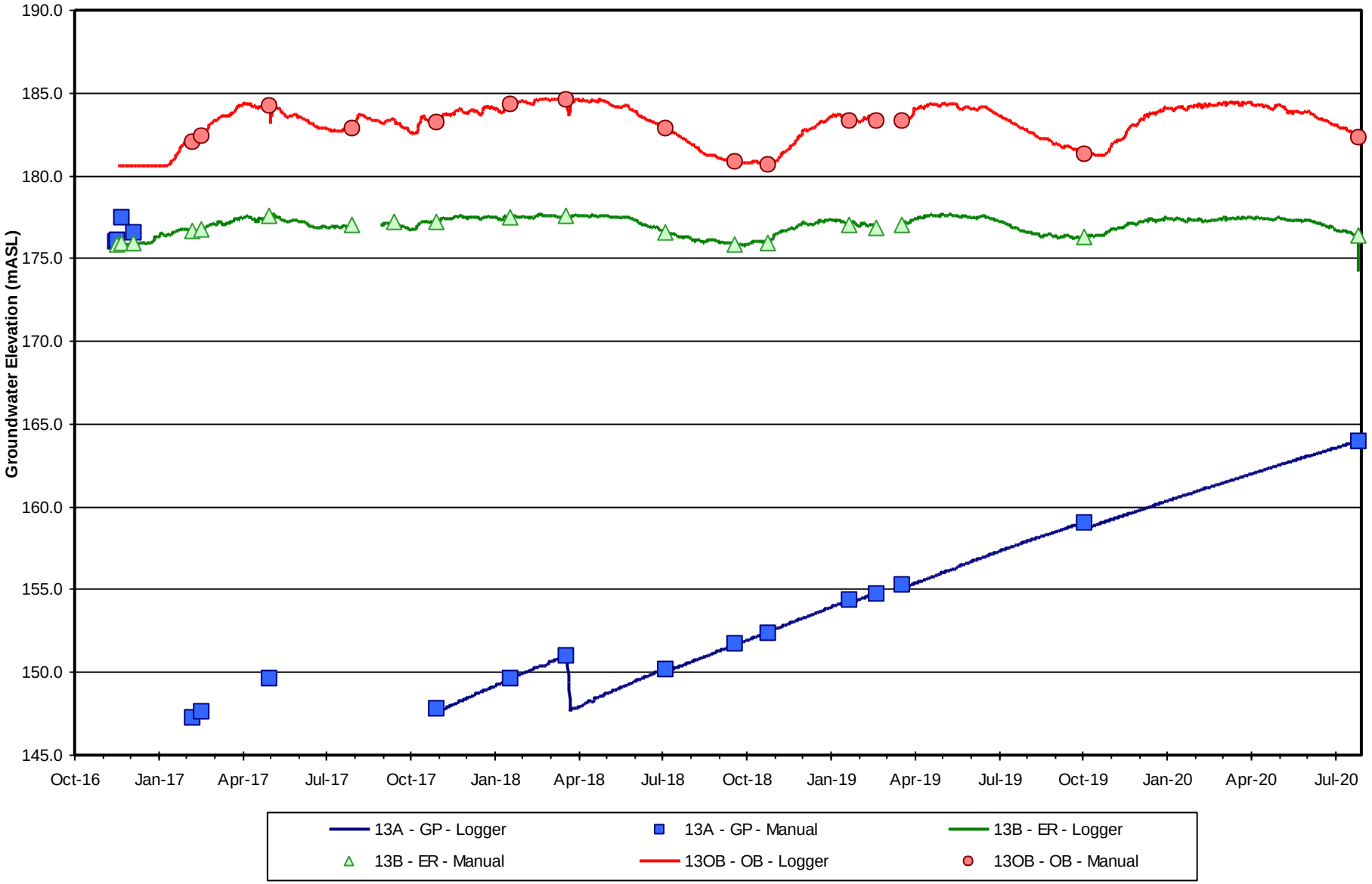

Figure E-15 - Groundwater Hydrograph for Well MW16-14

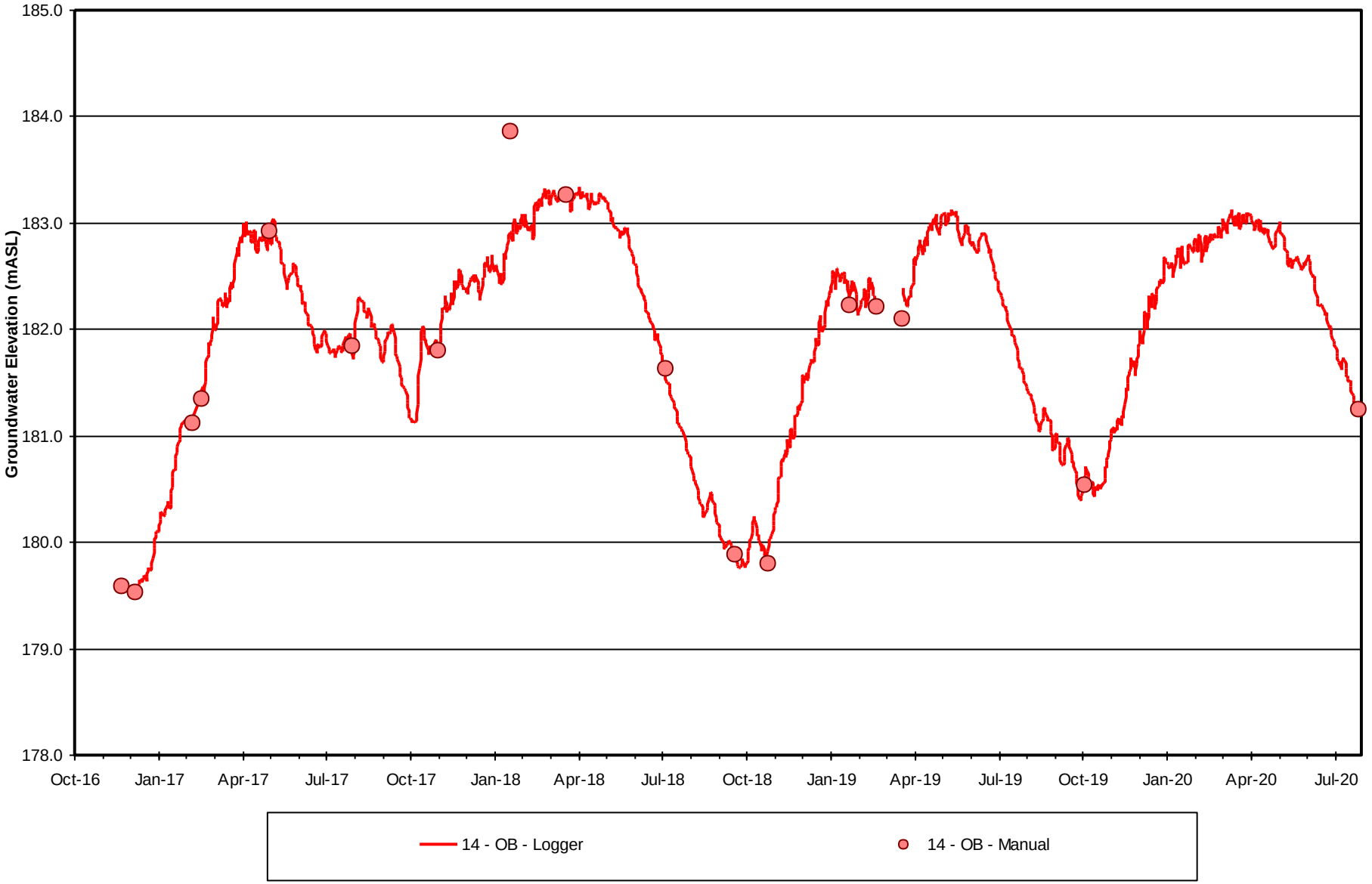

Figure E-16 - Groundwater Hydrograph for Well MW16-15

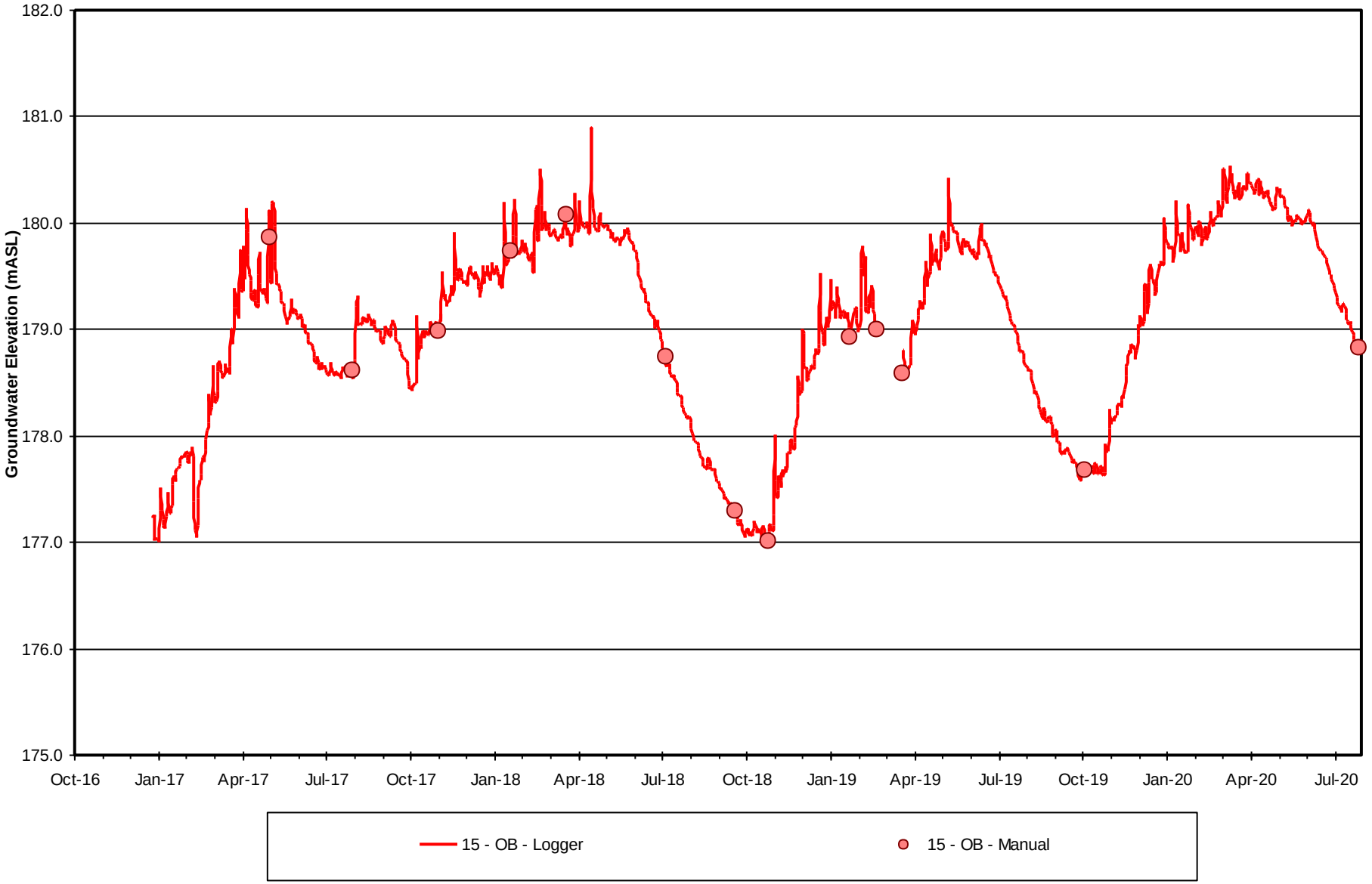

Figure E-17 - Groundwater Hydrograph for Well MW16-16

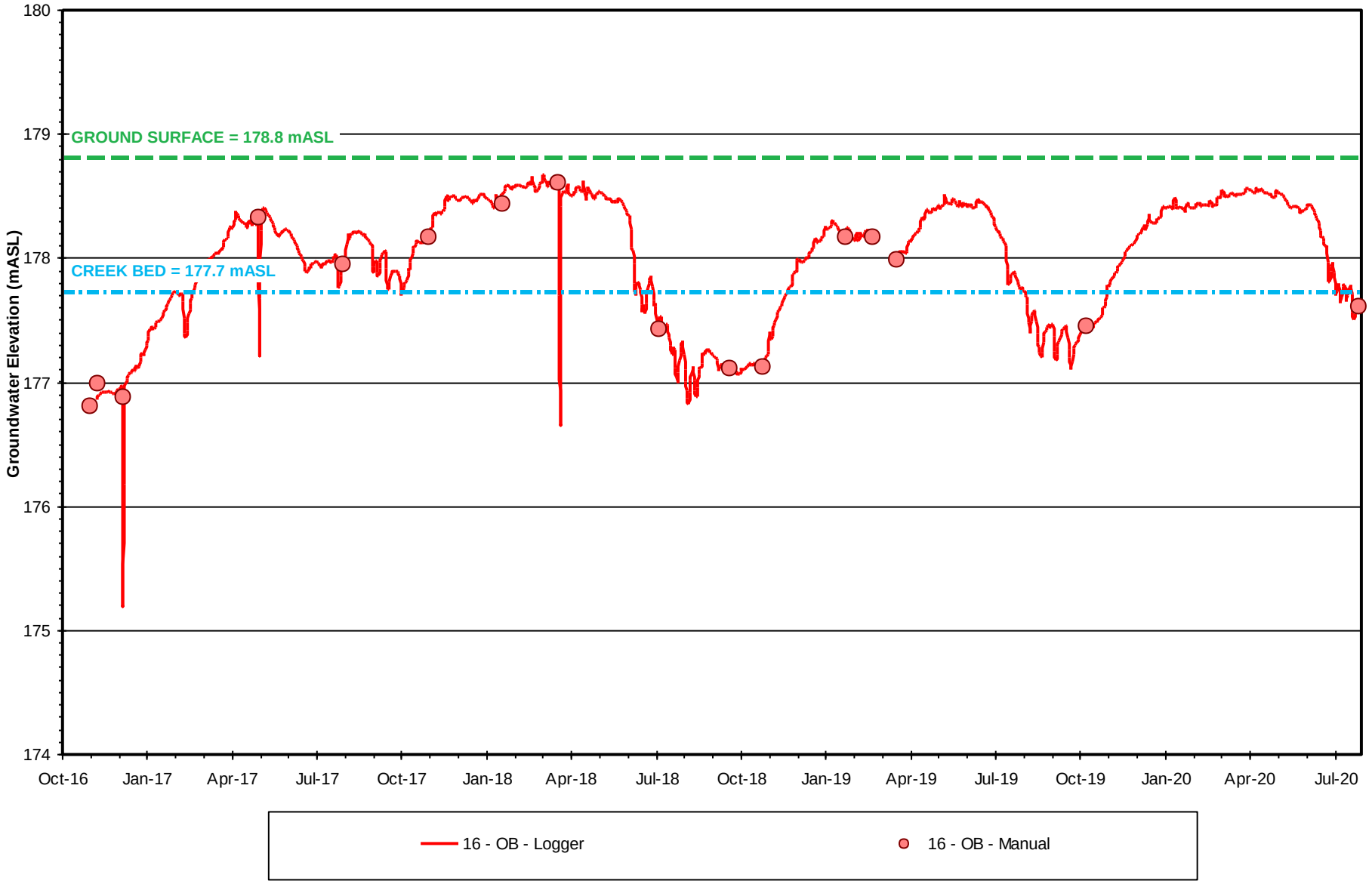

Figure E-18 - Groundwater Hydrograph for Well MW16-17

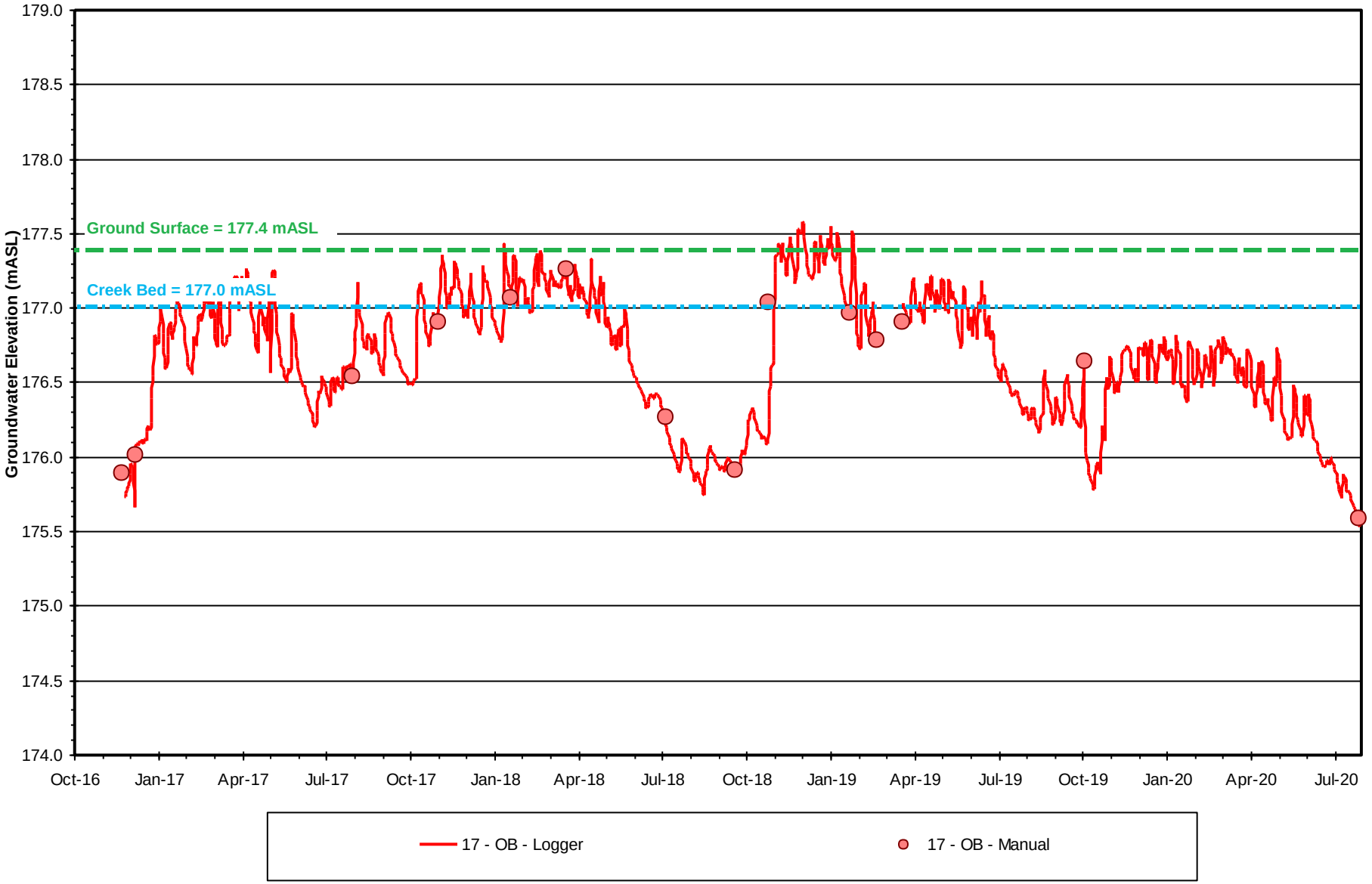

Figure E-19 - Groundwater Hydrograph for Well Nest MW16-18

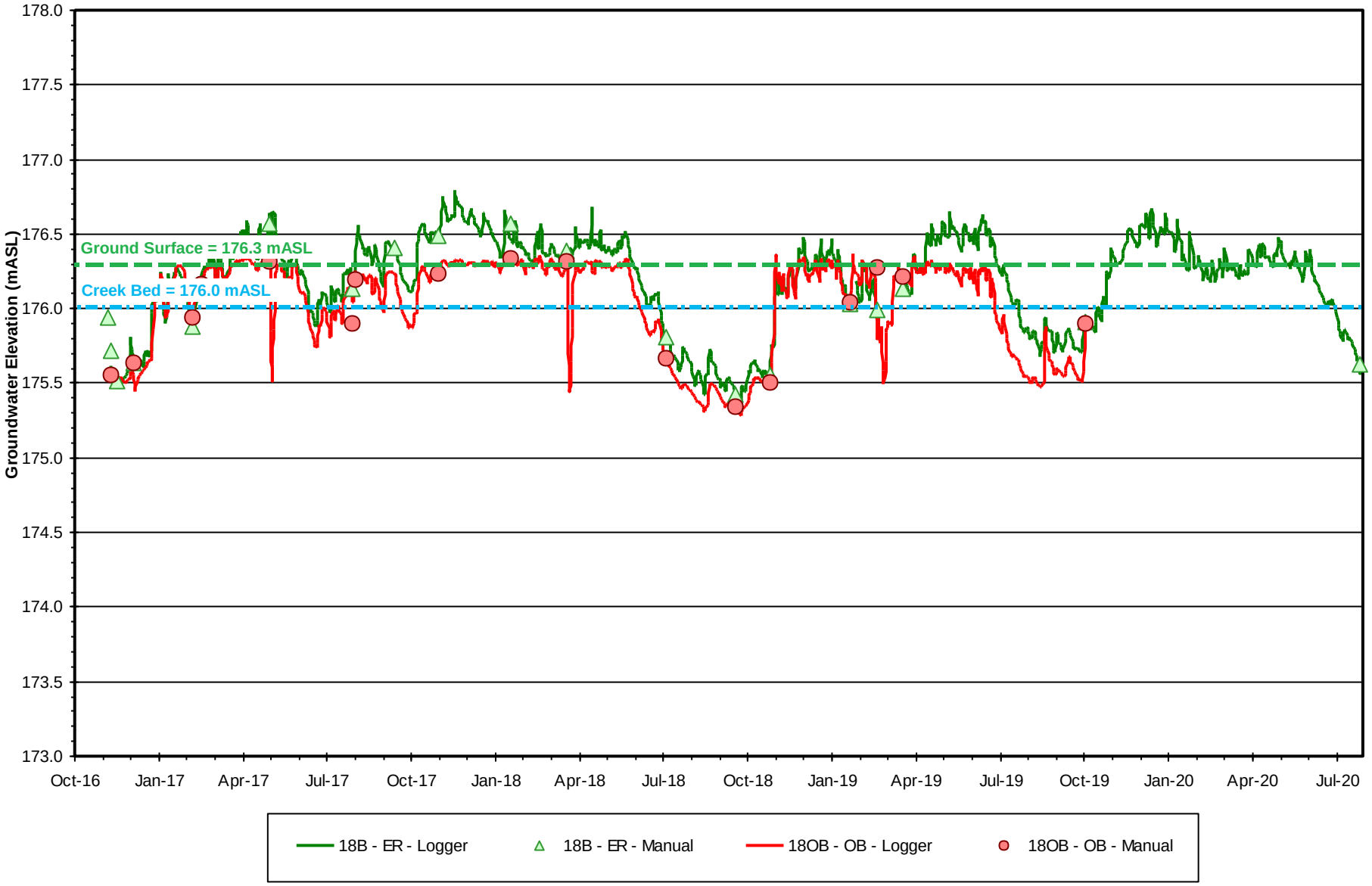

Figure E-20 - Groundwater Hydrograph for Well Nest MW16-19

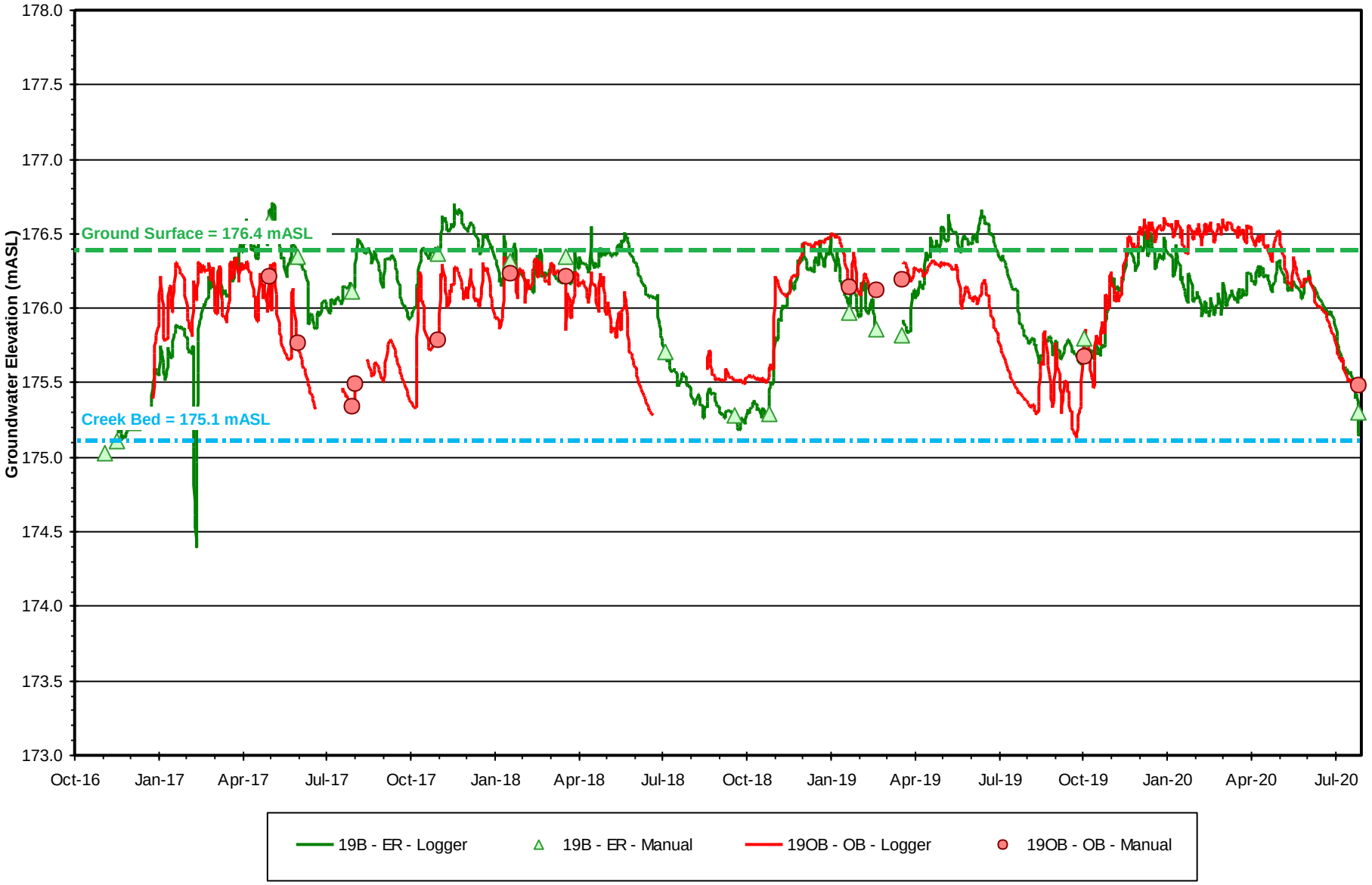

Figure E-21 - Groundwater Hydrograph for Well Nest MW17-20

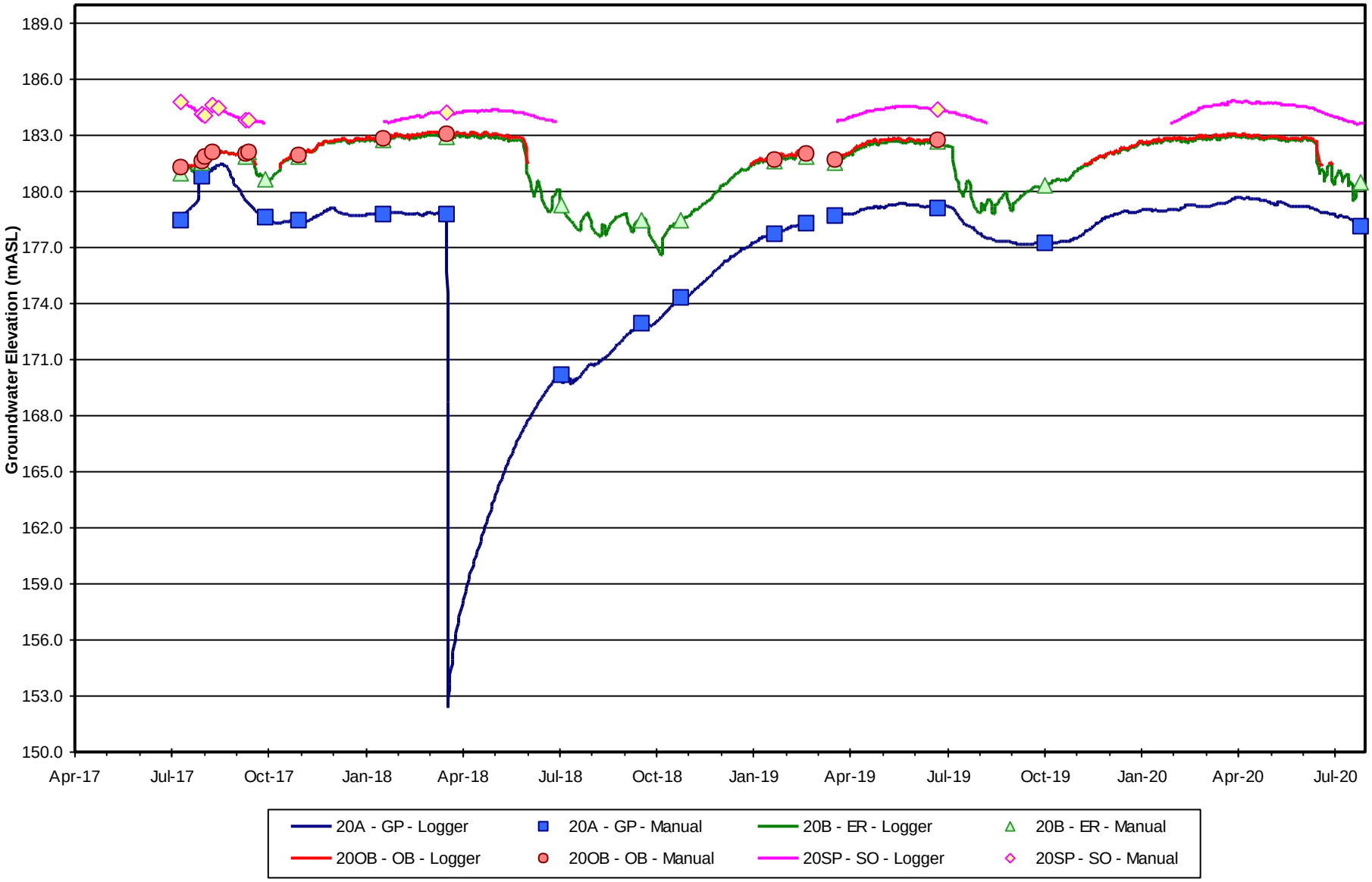

Figure E-22 - Groundwater Hydrograph for Well Nest MW17-21

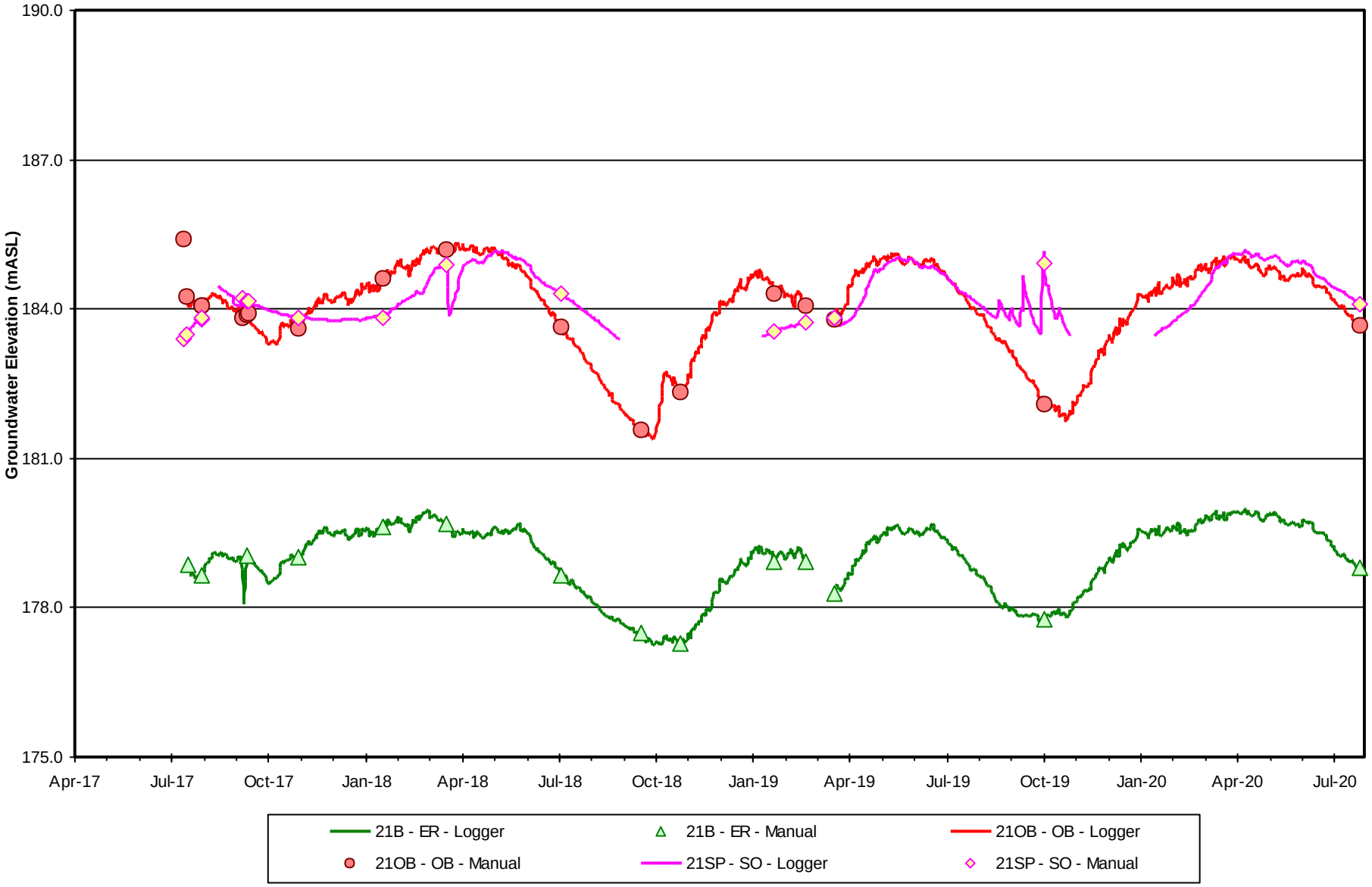

Figure E-23 - Groundwater Hydrograph for Well Nest MW17-22

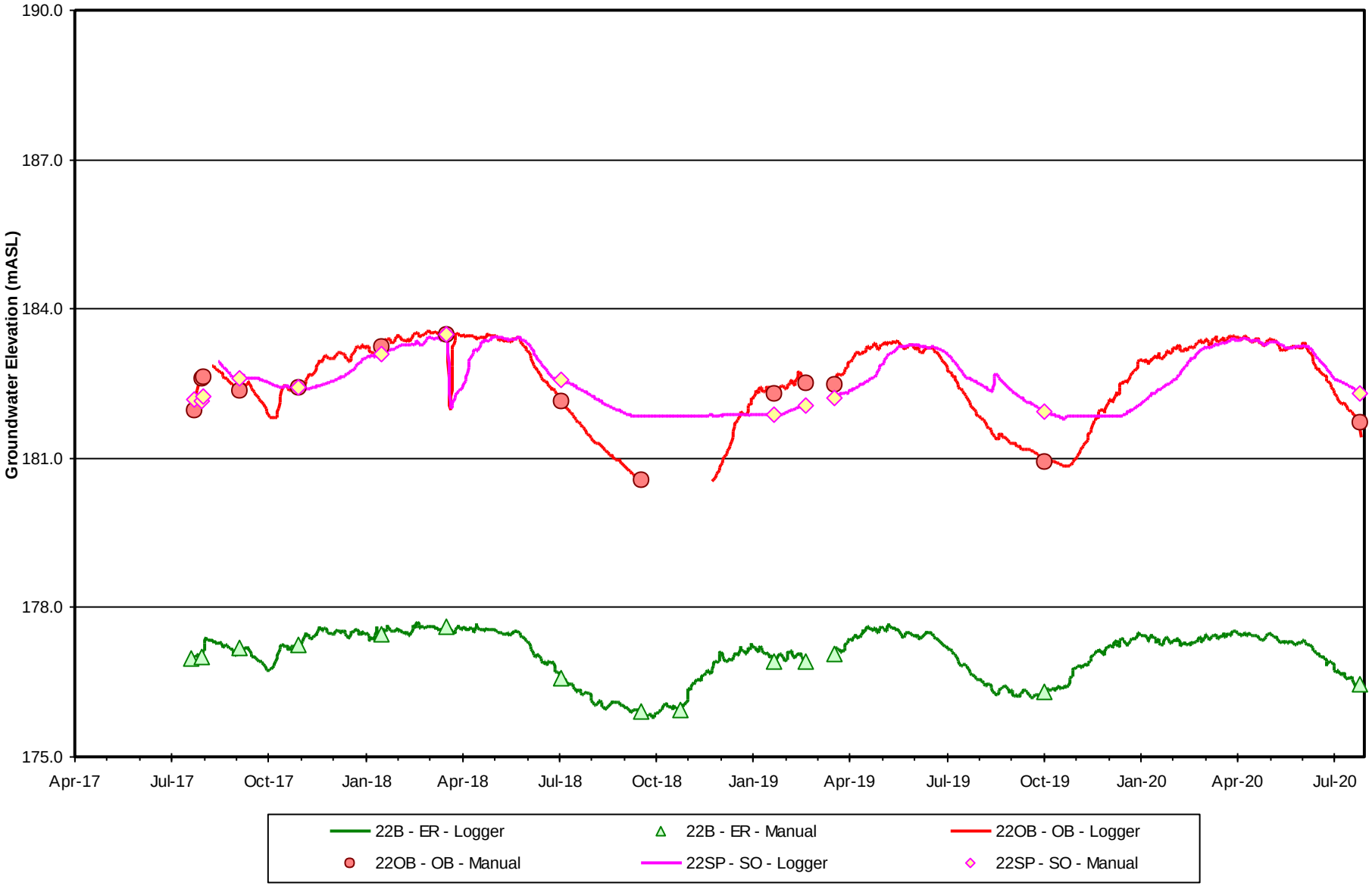

Figure E-24 - Groundwater Hydrograph for Well Nest MW17-23