AC CONSULTING GROUP LIMITED

*Consulting Engineers*

# RANGITAIKI RIVER HYDROLOGICAL MODELLING
# PEER REVIEW

Report No. W1522 01 Rev 0
17 October 2000


Prepared by

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Prepared for

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## Executive Summary

AC Consulting Group were engaged by Environment BOP to peer review the hydrological model of the Rangitaiki River developed by Environment BOP. The purpose of the peer review was to establish the validity of the model and comment on the proposed flood protection measures.

AC Consulting Group reviewed the hydrological model developed by Environment BOP using the hydrological modelling software "MIKE11". AC Consulting Group, working closely with BOP staff identified a number of areas where modifications to the model were required to ensure the model made a reasonable approximation of the flow in the Rangitaiki River. Some discrepancies were also found that had a marked affect on results. We can now confirm that the model is adequate for the calibration event and for the preliminary design work currently being undertaken. Some improvements will however be needed before the results can be used for detailed design and estimating.

Comparison of the surveyed stopbank heights with the water levels recorded from the 1998 flood (464cumecs and a return period of 15 years ) confirms that there was only 100mm of freeboard in some places. The scheme is supposed to have a freeboard, during an event with a 100 year return period, of 300mm or 600mm depending on location. It is clear that the stop banks will be overtopped for the design event. Even a 50 year return period event is predicted to over top the existing stop banks.

Reids Central canal is also predicted to be at, or near, maximum capacity which will limit options for routing more water down this channel. The flows are, however, very dependent on the spillway configuration and more work is required on this aspect of the model before these results can be confirmed. More time than anticipated was spent reviewing the main channel configuration and we were unable to complete the analysis of this area of the model in the time available.

## 1 Introduction

AC Consulting Group were engaged by the Technical Services Division of Environment BOP to peer review the hydrological modelling of the Rangitaiki River which they had developed using the river modelling software MIKE11.

The scope of the review included site inspection of the river downstream of Te Teko, checking of the numerical model inputs, interpretation of the model output and commenting on the proposed flood protection options. The review is focused on the lower reaches (below Edgecumbe) where there is concern about the capacity of the existing stop banks. Refer Appendix A

## 2 Site Inspection

AC Consulting Group visited the site on 1 September 2000 accompanied by Peter Blackwood of Environment BOP. The site visit involved inspection of the Rangitaiki River from both banks between the mouth and Te Teko.

From the site inspection it becomes obvious that the Rangitaiki is almost canal like with very small and often non-existent berms. The majority of the flow perhaps as much as 90%, will therefore be confined to the main channel.

With the exception of the Edgecumbe bridges, there does not appear to be any significant feature of the river, which would present any difficulty in terms of numerical modelling.

## 3 Data Collection

Following the site inspection, relevant data was collected from the offices of Environment BOP. The data collected included:

- Long Profile of the stop banks:
- Colour copies of aerial photographs marked with 1998 flood (calibration) levels:
- Aerial Photographs 1:5000:
- Observed 1998 flood levels (calibration event):
- Post Earthquake Flood Evaluation Report July 1987:
- Rangitaiki River Scheme Post 1987 Earthquake October 1988:
- Rangitaiki River Flood Hazard Study June 1995:
- File Note on Rangitaiki MIKE11 model 12 June 2000.

Some time was also spent interrogating the MIKE11 model file and output at the offices of Environment BOP. An apparent discrepancy in the model chainage was identified and raised with Environment BOP which was later investigated by Environment BOP and was discovered to have been related to the exchange of the model file from the previous version of the software to the latest. Environment BOP subsequently reran the model and reported an improvement in downstream results.

## 4 Preliminary Review

The preliminary review involved comparison of the recorded 1998 flood water levels (464m$^3$/s) with the surveyed stop bank levels to determine the freeboard for this event and highlight regions of the stop bank where the free board is likely to be inadequate for higher flows.

With the data available, a direct comparison is only possible for the right-hand bank up to Edgecumbe (BM27); there are no water levels recorded for the left bank. The results of this exercise show that the minimum freeboard for the right-hand bank is approximately 300mm between the mouth and Thornton Bridge and approximately 370mm between Thornton Bridge and Edgecumbe. However, these are isolated points. More significantly, there is a total length of some 600m along the right-hand bank where the freeboard is calculated to be less than 500mm.

Assuming the same recorded water levels (right-hand bank) for the left-hand bank shows that there is a total length of approximately 400m where the freeboard is less than 500mm. The minimum free board is estimated to be approximately 30mm at a distance of 1655m upstream of the Thornton Bridge. Refer to Appendix B.

The model predicts that the water levels for the Q100 flood will to be approximately 1.5m higher than the 1998 flood levels so it can be concluded that there will be significant lengths where the freeboard is less considerably less than the design values of 300mm for the left bank between Edgecumbe and the mouth and 500mm for the right bank.

## 5 Detailed Review

A detailed review of the hydrological model was undertaken including the following:

- Verification of software
- Verification of model input
- Review Calibration
- Review 100yr flood results
- Review cross sections particularly at the mouth.
- Refine Bed Resistance
- Compare historical cross sections

### 5.1 Verification of Software

The peer review has been undertaken using version 1999 of the river modelling software MIKE11. Environment BOP has used the latest version of the software.

In order to establish if there were any differences between different hardware platforms or software versions, the model files supplied by Environment BOP were reanalysed without modification and the results files compared with those obtained by Environment BOP.

This indicated that there were some very minor (10 to 20mm) differences in maximum water levels at the first three (upstream) cross sections. Environment BOP were able to confirm that this was because they had used version 2000 of the software. When they used version 1999 the results were identical. These differences are insignificant and it is considered to be acceptable to use version 1999 for the peer review.

## 5.2 Verification of Model Input

a) Boundary Conditions

The boundary conditions are the flow at the most upstream cross section and the sea level at the mouth, which is tidal. The values of the input hydrograph and tidal hydrographs have been reviewed separately by Environment BOP. The values provided have been accepted as is.

*b) Cross sections*

The cross sections used in the model were compared with the cross sections output by Ricoda. The sections used in the model are identical to those from Ricoda confirming that the as surveyed data has been used.

It was observed in animations of the cross section water level that water appeared to be flowing outside the main channel even though the maximum water level was well below the height of the stop banks for the calibration model. Further investigation was undertaken to confirm how the cross sections were being used in the analysis.

The cross sections as supplied had the markers positioned at the extremity of the surveyed cross section, which in most instances was beyond the stop banks. Thus the survey data outside of the markers was being used to determine the section properties. The net effect is that the conveyance was overestimated.

With the modified cross sections the water level is approximately 50 to 100mm higher than the results given by the model originally provided by Environment BOP. The greatest increase in water levels occurs in the upper reaches of the model; the water levels in the area of interest being affected in a minor way only. This results in an improvement to the match between the calculated values and the calibration flood levels.

The sensitivity to cross-section properties; area and hydraulic radius was investigated by increasing the number of levels at which the cross-section

properties are calculated. Increasing the number of levels at which the properties are calculated from 10 to 40 gives a slight increase in water levels of some 50mm generally in the lower reaches.

c) Bed Resistance

The bed resistance has been modelled as uniform across every cross section. This is considered to be reasonable for flows contained well within the main channel of the river. Refinement in the distribution of bed resistance is unlikely to have a significant effect on the calibration match.

An error in the value of one of the chainages in the hydrodynamic parameter (HD) file was reported by Environment BOP during the review. This has been corrected.

## 5.3 Calibration Review

Generally there is a reasonable match between the results of the model and the observed water levels for the calibration event. The recorded flood levels and the Environment BOP simulated flood levels for the calibration event are summarised together with the differences in Table 1.

| Section | Distance Downstream (km) | Observed Water RL (m) | EnvBOP Simulation (m) | Difference (m) |
|---|---|---|---|---|
| 59 | 0 | **11.410** | 11.398 | -0.012 |
| 55 | 1.597 | **10.970** | 10.646 | -0.324 |
| 52 | 2.94 | **10.010** | 9.849 | -0.161 |
| 49 | 4.47 | **8.955** | 8.7 | -0.255 |
| 47a | 5.43 | **8.200** | 8.15 | -0.050 |
| 46 | 5.94 | **7.780** | 7.808 | 0.028 |
| 44 | 6.7 | **7.300** | 7.268 | -0.032 |
| 41 | 8.59 | **6.660** | 6.507 | -0.153 |
| 40 | 8.78 | **6.380** | 6.415 | 0.035 |
| 38 | 9.44 | **6.070** | 6.241 | 0.171 |
| 36 | 10.06 | **6.160** | 6.089 | -0.071 |
| 34 | 10.87 | **6.040** | 5.872 | -0.168 |
| 32 | 11.69 | **6.000** | 5.771 | -0.229 |
| 30 | 12.41 | **5.780** | 5.621 | -0.159 |
| 28a | 13.21 | **5.530** | 5.408 | -0.122 |
| 26 | 13.81 | **5.250** | 5.265 | 0.015 |
| 24 | 14.66 | **5.100** | 4.951 | -0.149 |
| 22 | 15.4 | **4.620** | 4.687 | 0.067 |
| 20 | 16.35 | **4.400** | 4.412 | 0.012 |
| 18 | 17.12 | **4.180** | 4.174 | -0.006 |
| 16 | 17.81 | **3.910** | 3.94 | 0.030 |
| 14 | 18.78 | **3.630** | 3.621 | -0.009 |
| 12 | 19.59 | **3.430** | 3.352 | -0.078 |
| 11 | 19.92 | **3.380** | 3.231 | -0.149 |
| 9 | 20.74 | **2.910** | 2.929 | 0.019 |
| 8 | 21.12 | **2.670** | 2.74 | 0.070 |
| 6 | 21.92 | **2.640** | 2.4 | -0.240 |
| 4 | 22.87 | **1.900** | 1.931 | 0.031 |

| | | | | |
|---|---|---|---|---|
| 2 | 23.66 | **1.470** | 1.497 | 0.027 |
| 1a | 24.55 | **2.250** | 1.273 | -0.977 |

*Table 1: Calibration Results – Simulated and Observed*

Based on these figures we believe the model configuration is sufficiently accurate for the purpose of preliminary design. A number of refinements are recommended before using the model for detailed design.

# 6 Model Refinement

## 6.1 Cross Sections

Most of the cross sections are considered to be reasonable for the calibration event. However there are some cross sections which are not considered to be representative of the channel particularly for the design flood. There are also a number of cross sections where the survey data is insufficient to define the full cross section. Appendix C lists cross-sections where further definition, realignment or re-surveying is recommended.

## 6.2 Bridges

The largest differences between the results of the calibration model and the observed flood levels are in most instances attributed to the losses associated with the bridges, particularly at Edgecumbe and to a lessor degree super-elevation at significant bends both of which cannot be modelled explicitly using MIKE11. It is expected that if the bridges are modelled more accurately the match with the observed water levels could be improved. For the velocities predicted, super-elevation is estimated to be 50 to 100mm.

## 6.3 Calculation of Cross Section Propeties

As described above, refinement in the calculation of cross section properties and confinement of the flow to between the stop banks improves the calibration. Most of the improvement in calibration can be attributed to the correct definition of the extent of the channel i.e. with the markers properly positioned. The increase in the number of levels used to calculate the section properties is dominant above cross section 40 since the calibration water levels fall below the natural ground level outside of the stop banks. However, the resulting higher water levels upstream of cross sections 36/37 will cause greater flows to be predicted in Reids Central Canal during the design flood.

It is important, therefore, that a good match between the predicted and the observed water levels is achieved in the vicinity of Reids Central because this will have a significant effect on the amount of water carried by the canal under higher flows. Re-calibration of the model taking cognisance of the above modifications is strongly recommended before using the model for design purposes.

# 7 Design Flood Event (Q100)

The same model files are used for modelling the design flood event with the exception of the addition of a branch defining Reids Central Canal. The cross sections and the hydrodynamic parameters are unchanged. Two sets of boundary conditions are considered; 100year flow of 780cumes and 20year tide and 20year flood of 505cumecs and 100year tide. The latter is not critical in terms of evaluation of the behaviour of the model. This is because the tidal effects extend only some half kilometre upstream of the mouth.

## *7.1* Cross Sections

As identified in the review of the calibration model the definition of some cross sections is inadequate and requires further survey to complete the definition or modification to better represent the river channel e.g. realignment perpendicular to the flow. Further modification may be required for the Q100 model since cross sections, which are perpendicular to the calibration flow, may not be perpendicular to the flow at higher water levels. Similarly, cross sections which include large berm areas particularly on bends may require modification to better represent the berm flow which will be occuring. Appendix A lists cross-sections which require further definition, realignment or re-surveying.

A number of cross-sections along Reids Central Canal appear to be overtopped by the design flood. Additional survey data is required at these locations to confirm whether the flow actually overtops the cross-sections.

## 7.2 Bed Resistance

The bed resistance used for the design flood has been taken as the same as for the calibration flow.

It could be argued that some refinement of the roughness distribution around the cross sections is preferable particularly for higher flows.

Reids Central Canal has been modelled with a uniform Mannings roughness around the cross section of 0.05 at every cross section.

## 7.3 Reids Central Canal Spillway

The spillway linking the Rangitaiki River channel to Reids Central Canal has been modelled by connecting two consecutive cross sections to a single channel representing Reids Central Canal. The cross sections of the links are rotated. This is the method suggested in the MIKE11 software manuals and is accepted industry practice.

The behaviour of this part of the model has not been fully investigated at this stage and it is recommended that this representation of the spillway be checked more thoroughly before using the model for design purposes.

PMW,

## 7.4 Re-calibration

The model was re-calibrated by AC Consulting Group to account for the effects of confinement of the flow to the channel and refinement of the cross section properties (increased levels of calculation) using the existing cross sections. The re-calibration involved adjusting the bed resistance between sections 57-59 and 34-50. It was not considered appropriate to adjust the Manning's number between sections 50 and 57. The re-calibration concentrates on achieving as best as possible match in the vicinity of the Reids Central Canal spillway.

With modification to the Manning's numbers it was possible to achieve a improved calibration.

## 7.5 Results

It was expected that the results of the design flood prediction would be adversely affected by the relocation of marker positions (flow confinement) and to a lessor degree by the increase in levels of cross-section property calculation. The net increase is potentially significant in terms of the amount of flow in Reids Central Canal

To confirm the degree to which the design flood levels would be affected, the 100year flood / 20year tide scenario was reanalysed using the re-calibrated model.

As expected the water levels given by the re-calibrated model are increased in the upper reaches by approximately 100 to 200mm and in Reids central Canal by up to 400mm. However, water levels in the downstream reaches of interest the water levels are only changed by approximately 50mm compared with the results obtained from the work completed by Environment BOP.

# 8 Review of Historical Bed Levels

A brief review of the bed levels as surveyed at 1986, 1987, 1993, 1995 and 1997 was undertaken to ascertain what changes had taken place as a result of and subsequent to the March 1987 Edgecumbe earthquake.

## 9 Design Options

Environment BOP have identified a number of design options which can be summarised as follows:

- Increase stop-bank height to accommodate 100year design flood
- Revise design flood to 50 year and increase flow in Reids Central canal
- Modify Reids Central canal
- Excavation

Other possibilities include combinations of the above options.

From the results of the hydrological modelling it can be concluded that modification of Reids Central canal only would be insufficient to allow the 100year design flood to be contained without topping up the stop banks.

The option of excavation has not been investigated.

## 10 Recommendations

It is recommended that the following refinements be made to the model:

*Cross Sections*

A number of cross sections are insufficiently defined for the calibration flow. Addition survey data should be obtained to determine the full extent of these cross sections.

There are also cross sections that are not considered to be fully representative either because they are not perpendicular to the flow or because they include a significant berm at a bend. Realignment or re-survey of these sections is recommended to improve the calibration and predictive ability of the model.

These cross sections are identified in Appendix C

The markers defining the extent of the cross sections in the model must be repositioned to restrict the flow to the river channel and prevent flow outside the stop banks.

The number of levels at which the cross section properties are calculated should be increased until further incremental changes have a negligible effect.

*Bridges*

The losses associated with the bridges particularly at Thornton should be modelled to improve calibration match. A weir or culvert can be used to model these losses which can be determined from other software with the capability to model bridges.

*Reids Central Canal*

Additional survey data is recommended to determine the full extent of the cross sections used to model Reids Central canal. It is also recommended that the route of the canal be walked to determine appropriate bed resistance factors for the canal.

The modelling of the spillway as should be investigated in more detail to determine that it behaving in a satisfactory manor. It is noted that lack of calibrated data makes modelling of Reids Central canal difficult.

*Calibration*

It will be necessary to re-calibrate the model once the above refinements are made. It is expected that re-calibration with the above refinements will allow an improved match with the observed water levels and therefore will provide greater confidence in the predictive ability of the model.

A larger number of recorded water levels of the calibration event would have been desirable particularly more pairs of right and left bank measurements. It is recommended that this be taken into account in future surveys.

*Sea Level Rise*

It is recommended that consideration be given to the effects of future seawater rise.

## 11 Conclusions

It is concluded from our review that the models supplied by Environment BOP are sufficiently accurate for the purposes of preliminary design and correctly identifies that there is a significant problem in terms of the capacity of the Rangitaiki River.

With minor topping up of the stop bank levels it should be possible to contain a 20 year flood event.

Reids Central canal is likely to overtop in a 100year flood.

# Appendix A: Our Letter Dated 4 September 2000

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enquiries@acconsulting.co.nz

Our Ref: W1522

4 September 2000

Environment BOP
Quay Street
P O Box 364
**WHAKATANE**

Attention Peter Blackwood

Dear Peter

**HYDROLOGICAL MODELLING OF THE RANGITAIKI RIVER PEER REVIEW**

Following our visit to Whakatane to discuss the Rangitaiki River with you, our proposal to peer review Environment BOP's hydrological modelling of the Rangitaiki is outlined below.

**Objective**

The objective of the review is to confirm whether the results of the current hydrological analysis are a reasonable approximation of the one hundred year return period flood levels on the Rangitaiki River between the mouth and Edgecumbe.

**Scope**

It is proposed that the scope of work will comprise two stages.

The first stage will be limited to a check on the input data, review of the calibration and 100yr return period flood results and interpretation.

The scope of the second stage will be confirmed during the first stage but it is envisaged that It will focus on comparison of pre 1987 cross sections and mean bed level with the 1989 and 1999 data, refinement of the bed resistance distribution at each cross section and reanalysis and comparison with the results of the current model.

**Programme**

The first stage is to be completed by 5pm Wednesday 6th September 2000. The timing of findings of the second stage and a final report will be confirmed following the outcome of the first stage.

**Fees**

The estimated budget fee for the first stage is $3,160 plus disbursements of $700.00 both exclusive of GST. The fee for the second stage is to be confirmed once the scope has been determined as part of the first stage.

**Deliverables**

The deliverable for this project will be a report summarising the review and its findings. At this stage it is envisaged that the contents of the report will include; input checks, calibration, Q100 results, interpretation, assessment of Manning roughness factors, comparison of cross sections with pre 1987 data and possible refinements to the model.

**Inputs**

The following inputs are required from Environment BOP:

Mike 11 files (model and results for latest model)
Cross section data and mean bed levels in electronic format
Pre 1987
1987
1999
Aerial photographs with cross sections marked
Relationship between M11 distances and Richoda Distances
1987 report
Electronic version of the long-section plots (received)
Cross section at all bridges
Thornton
Edgecumbe Road
Rail
Texas

**Conditions of Engagement**

The conditions of engagement proposed for this project are the ACENZ/IPENZ Model Conditions of Engagement 1999.

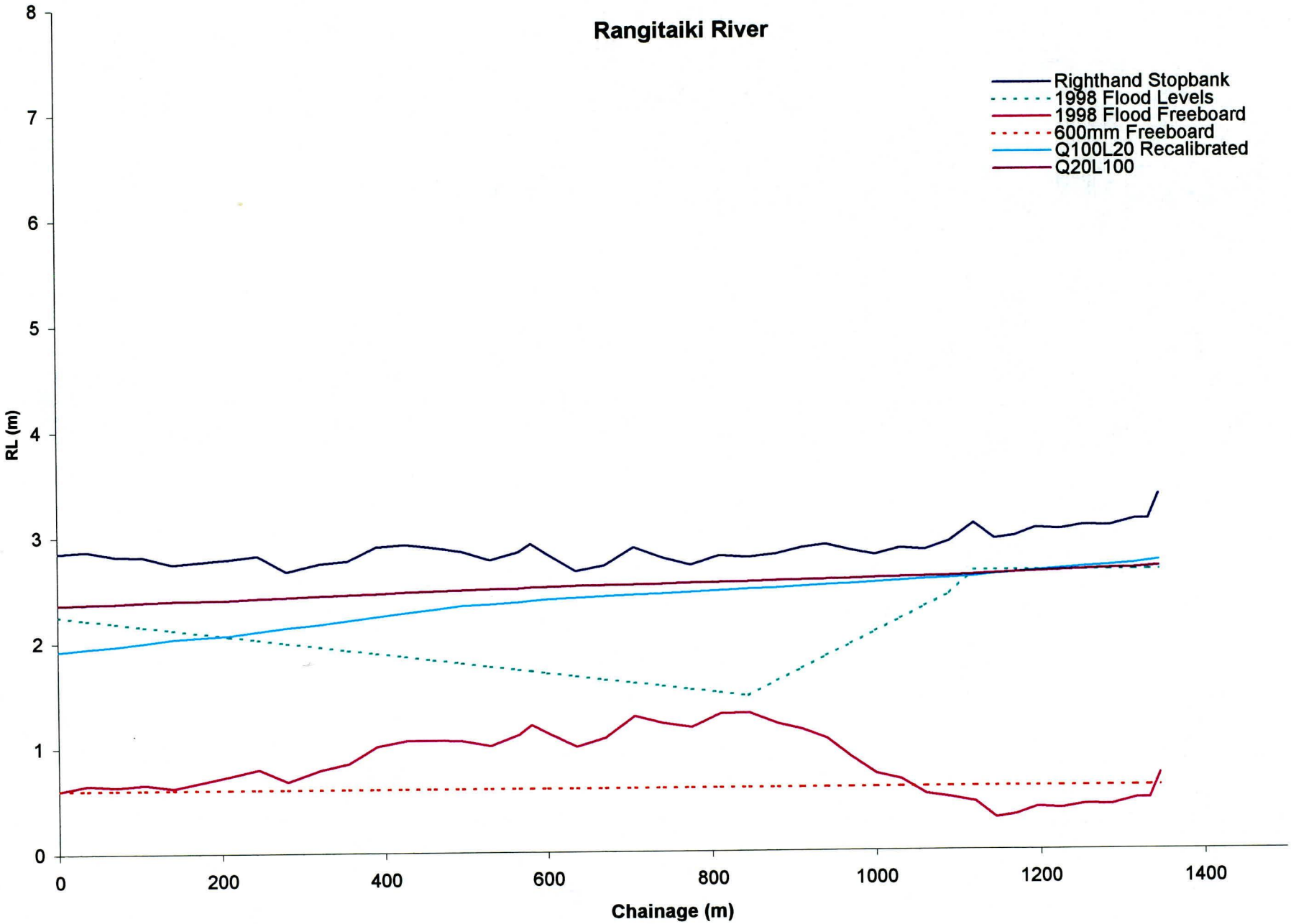
We trust that this meets your requirements. Please do not hesitate to contact us should you wish to discuss any aspect of the above further.

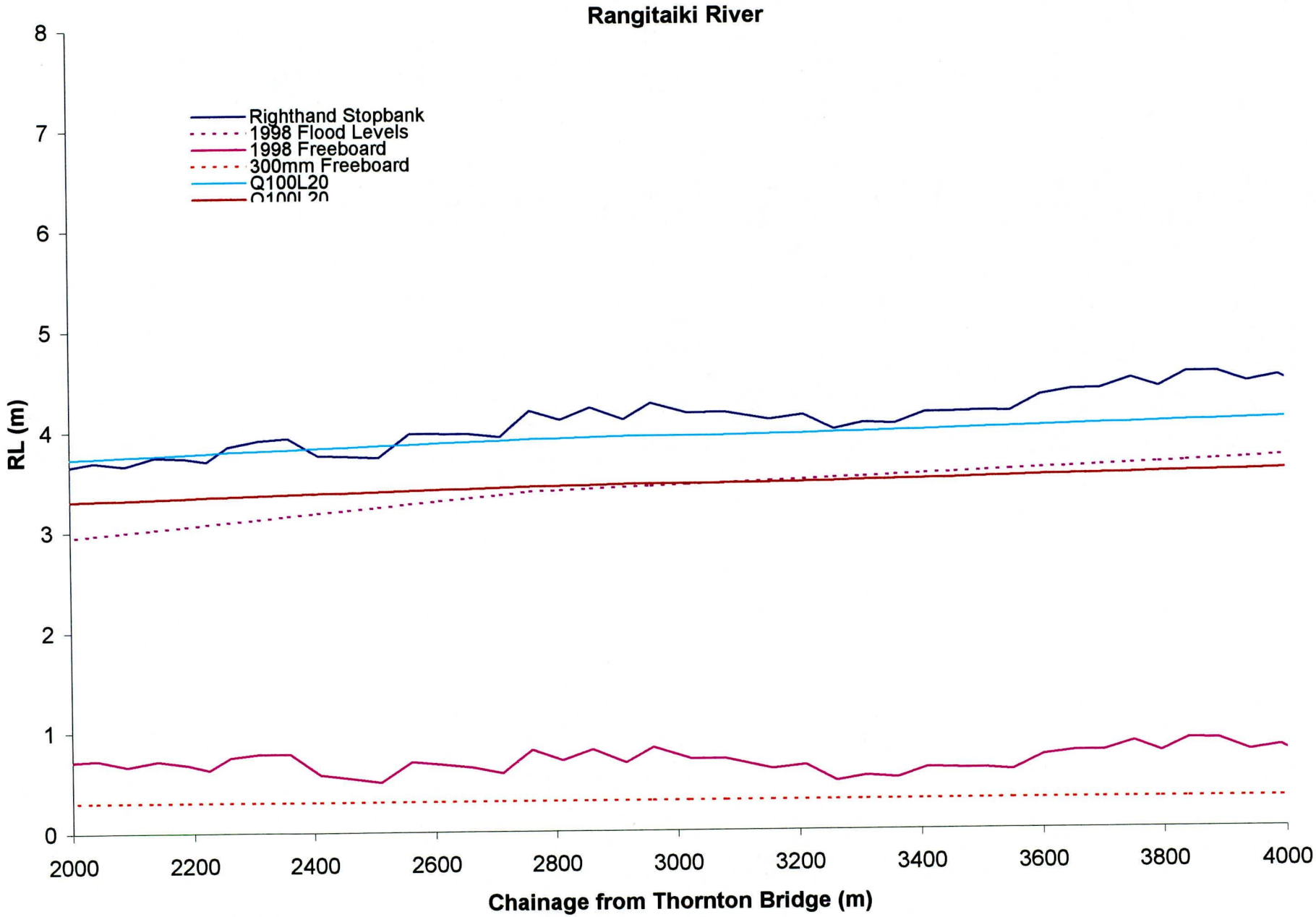
Yours sincerely
**AC CONSULTING GROUP LIMITED**

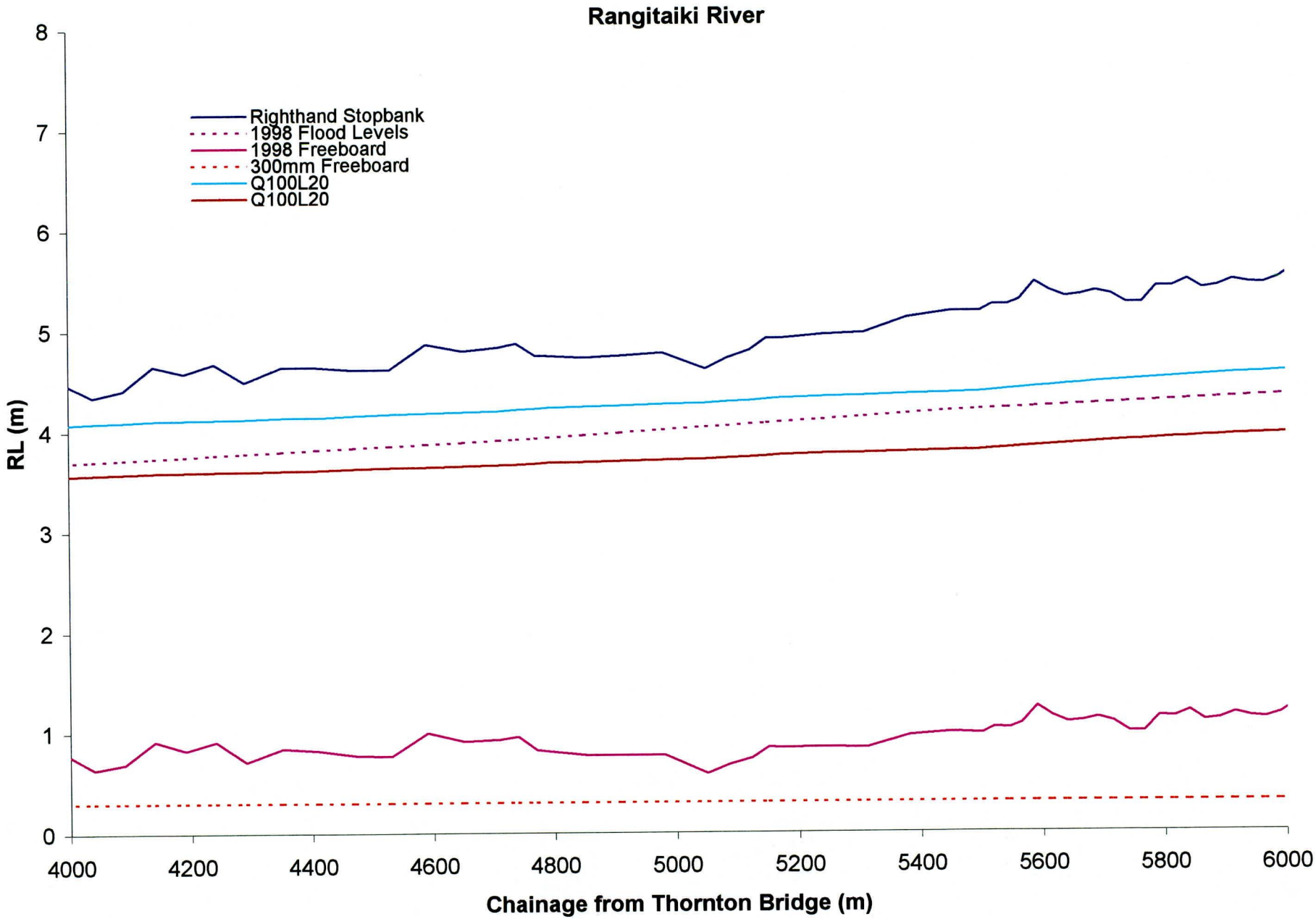
Graeme Campbell
**DIRECTOR**

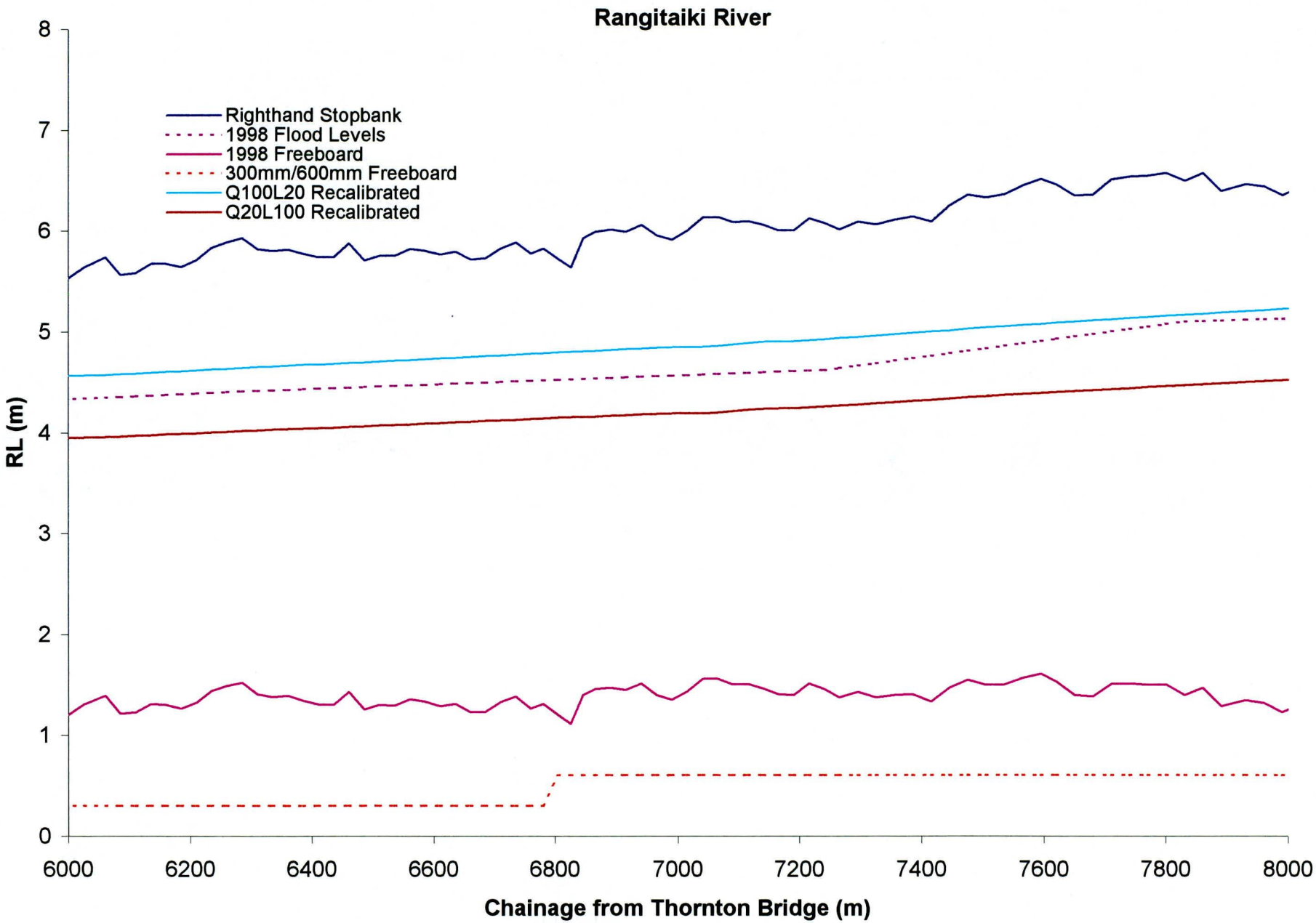
Wellington Office

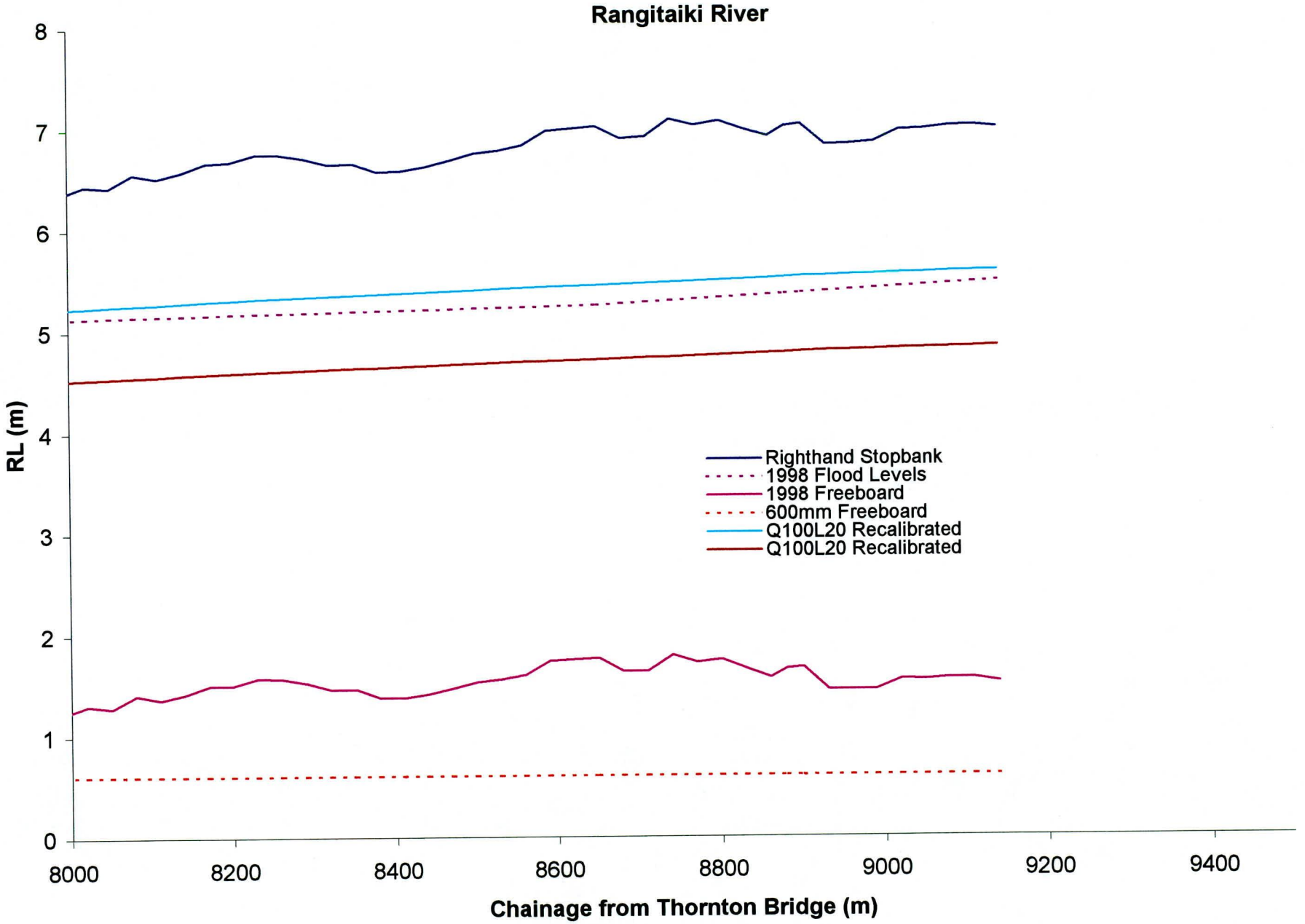
# Appendix B: Long Sections of Stopbank

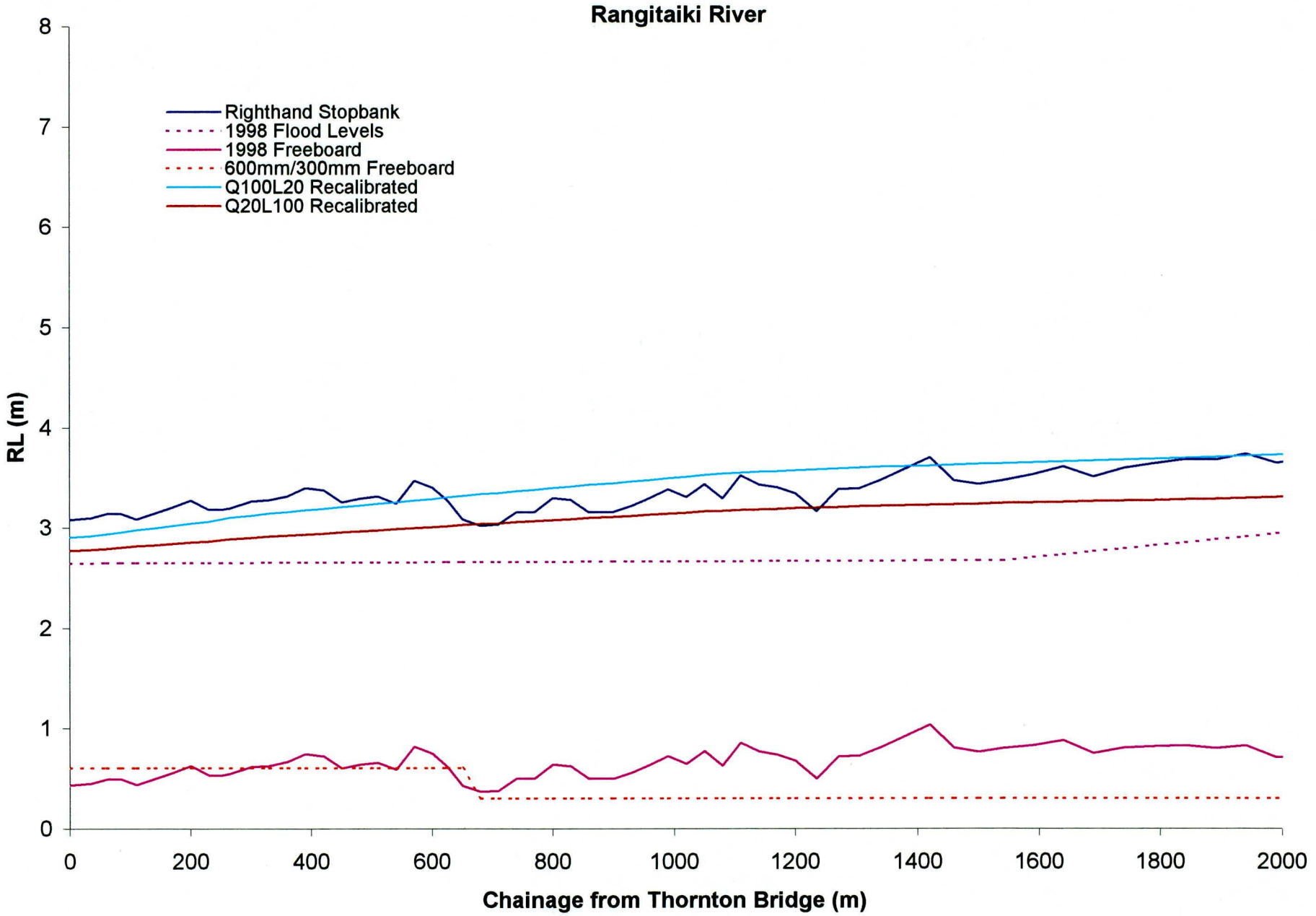

Rangitaiki River
Righthand Stopbank
1998 Flood Levels
1998 Flood Freeboard
600mm Freeboard
Q100L20 Recalibrated
Q20L100
RL (m)
0
1
2
3
4
5
6
7
8
0
200
400
600
800
1000
1200
1400
Chainage (m)

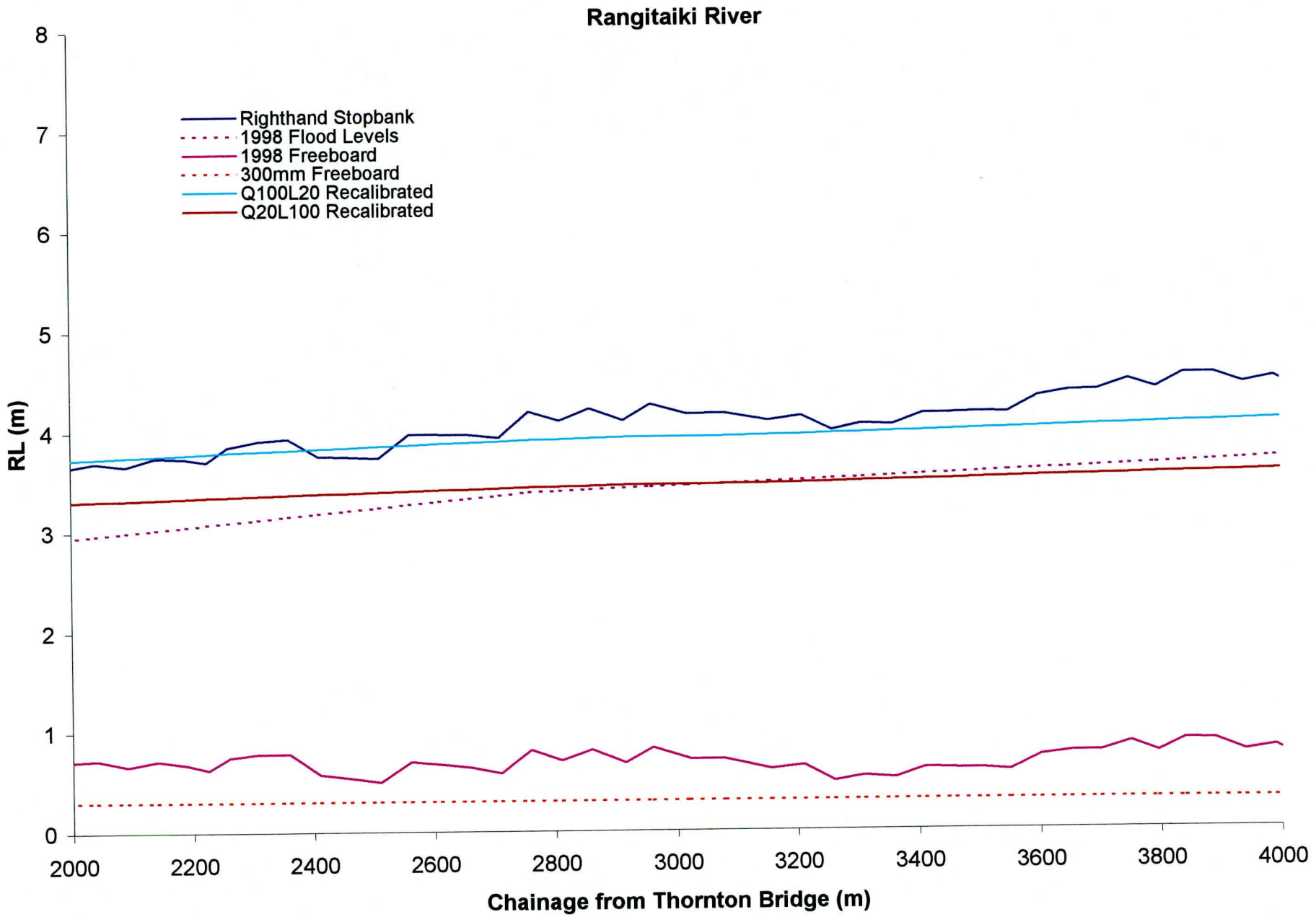

Rangitaiki River
Righthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20
Q100L20
RL (m)
0
1
2
3
4
5
6
7
8
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Chainage from Thornton Bridge (m)

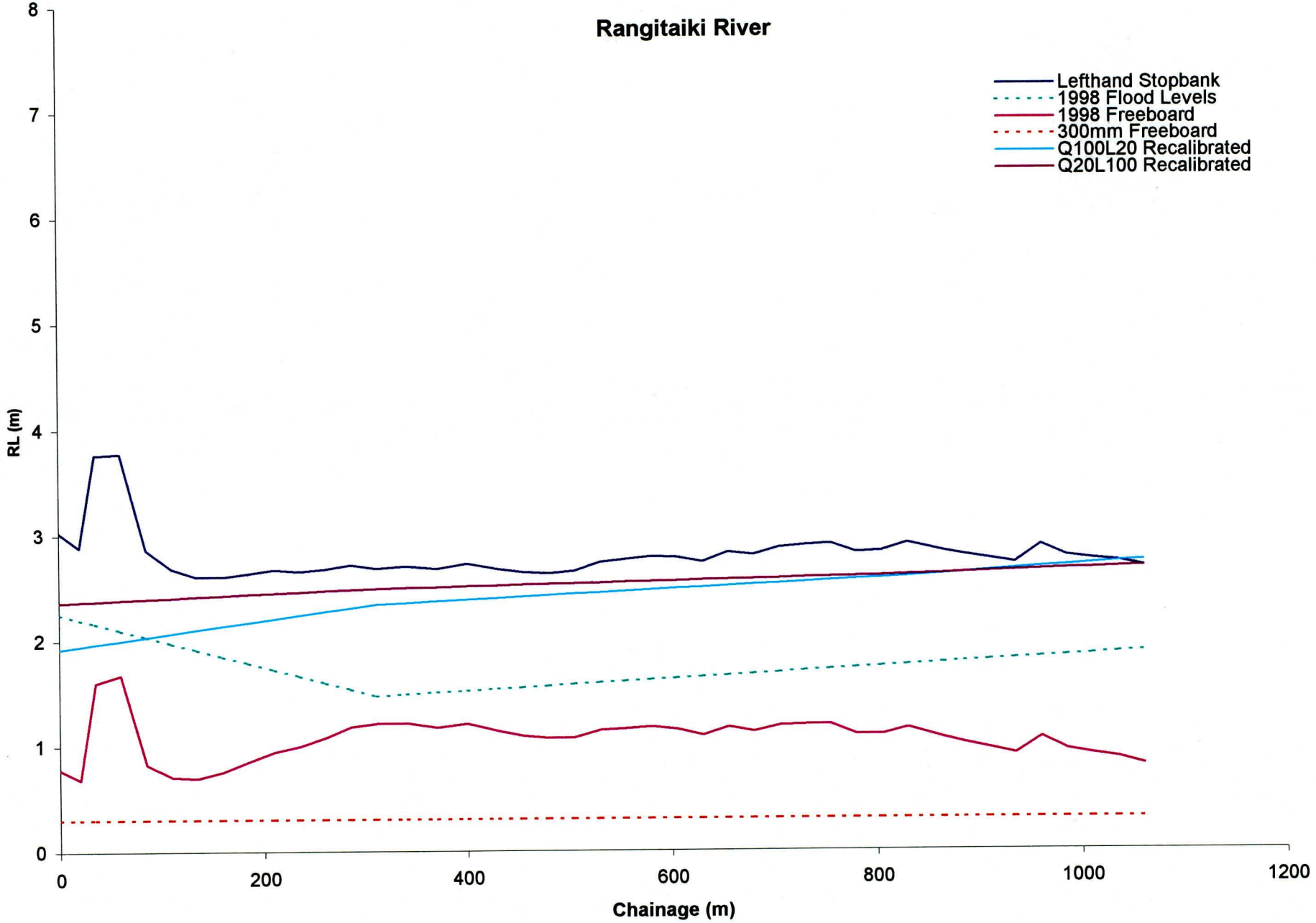

Rangitaiki River
Righthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20
Q100L20
RL (m)
0
1
2
3
4
5
6
7
8
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
Chainage from Thornton Bridge (m)

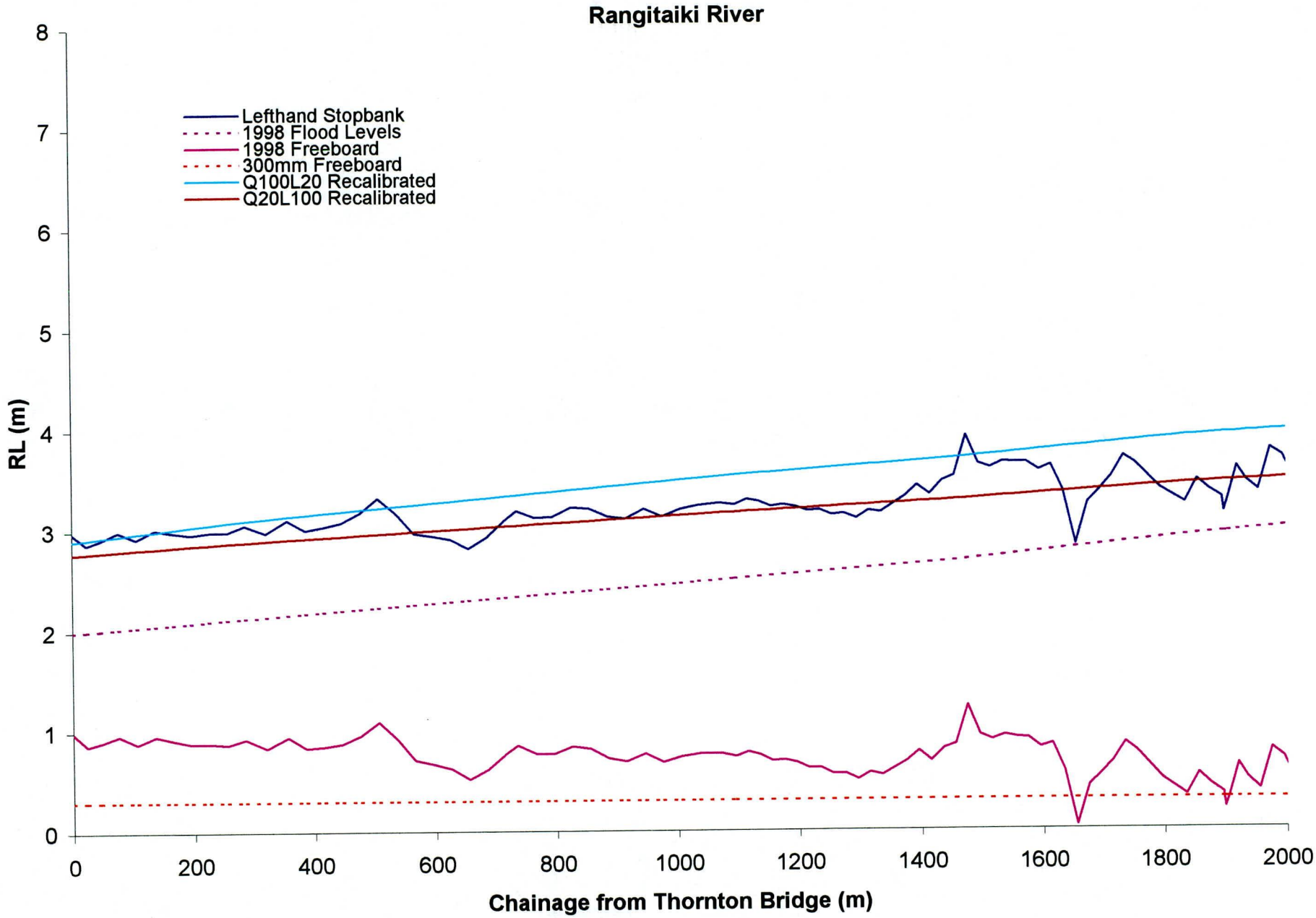

Rangitaiki River
Righthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm/600mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
6000
6200
6400
6600
6800
7000
7200
7400
7600
7800
8000
Chainage from Thornton Bridge (m)

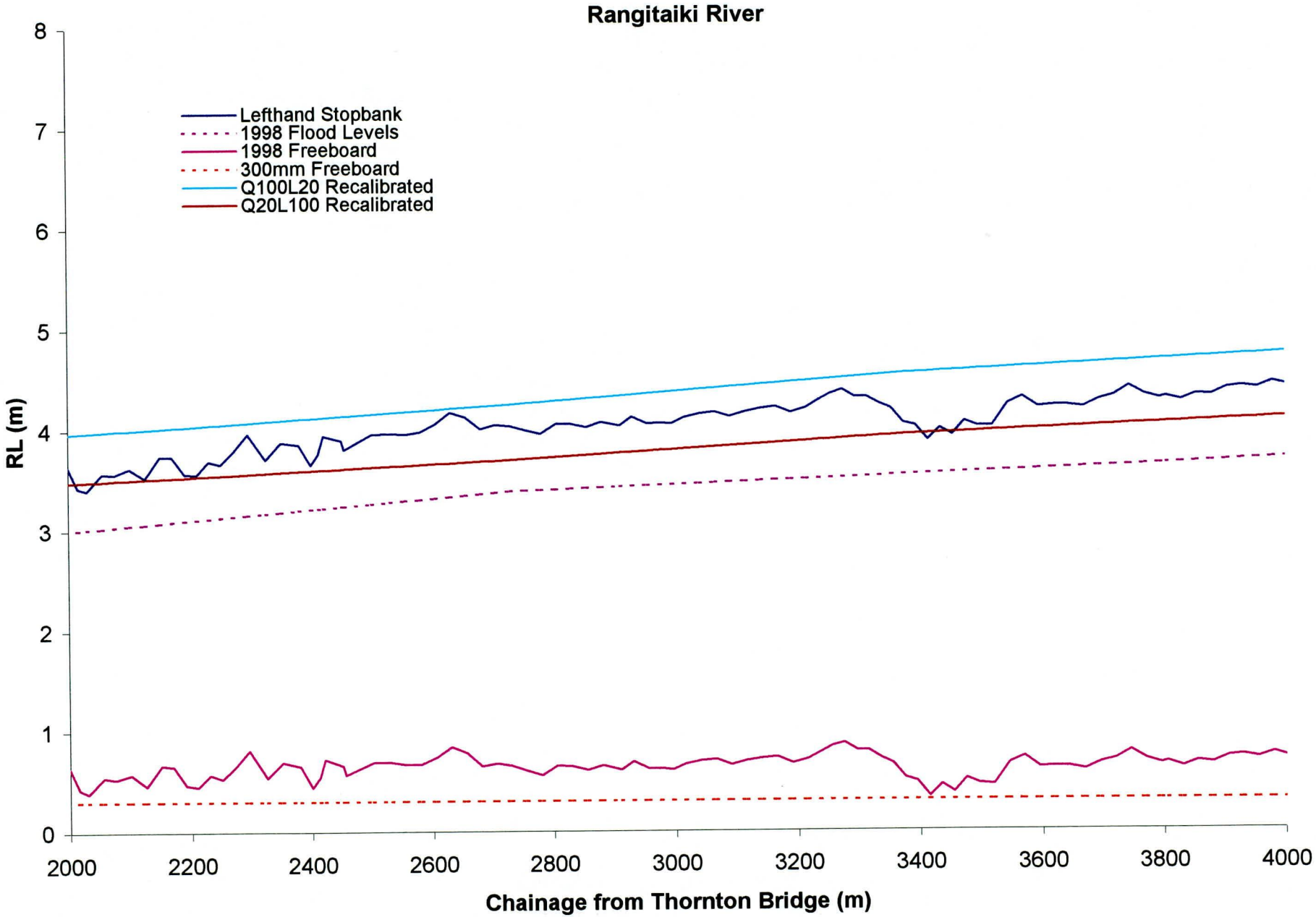

Rangitaiki River
RL (m)
Chainage from Thornton Bridge (m)
0
1
2
3
4
5
6
7
8
8000
8200
8400
8600
8800
9000
9200
9400
Righthand Stopbank
1998 Flood Levels
1998 Freeboard
600mm Freeboard
Q100L20 Recalibrated
Q100L20 Recalibrated

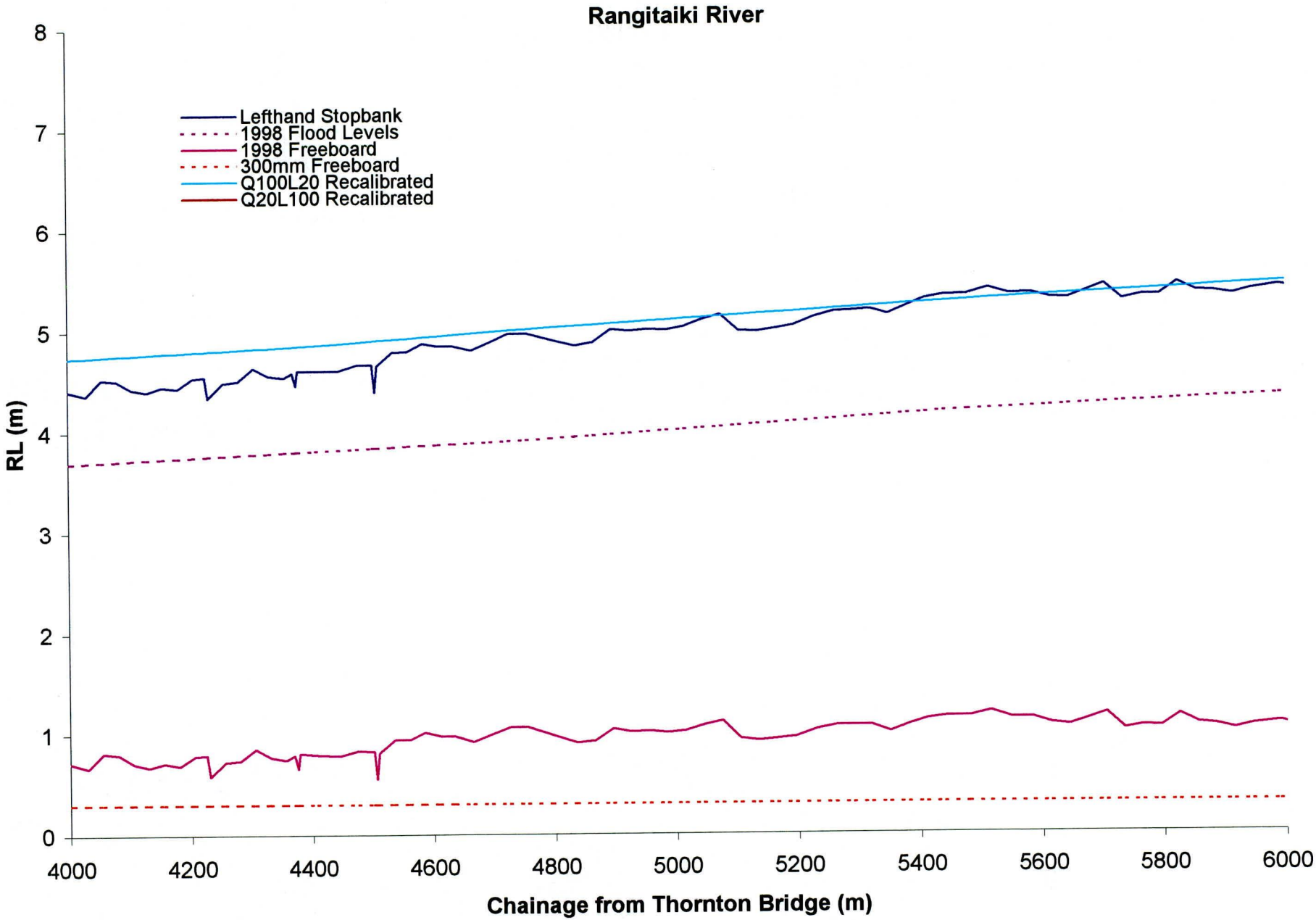

Rangitaiki River
Righthand Stopbank
1998 Flood Levels
1998 Freeboard
600mm/300mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Chainage from Thornton Bridge (m)

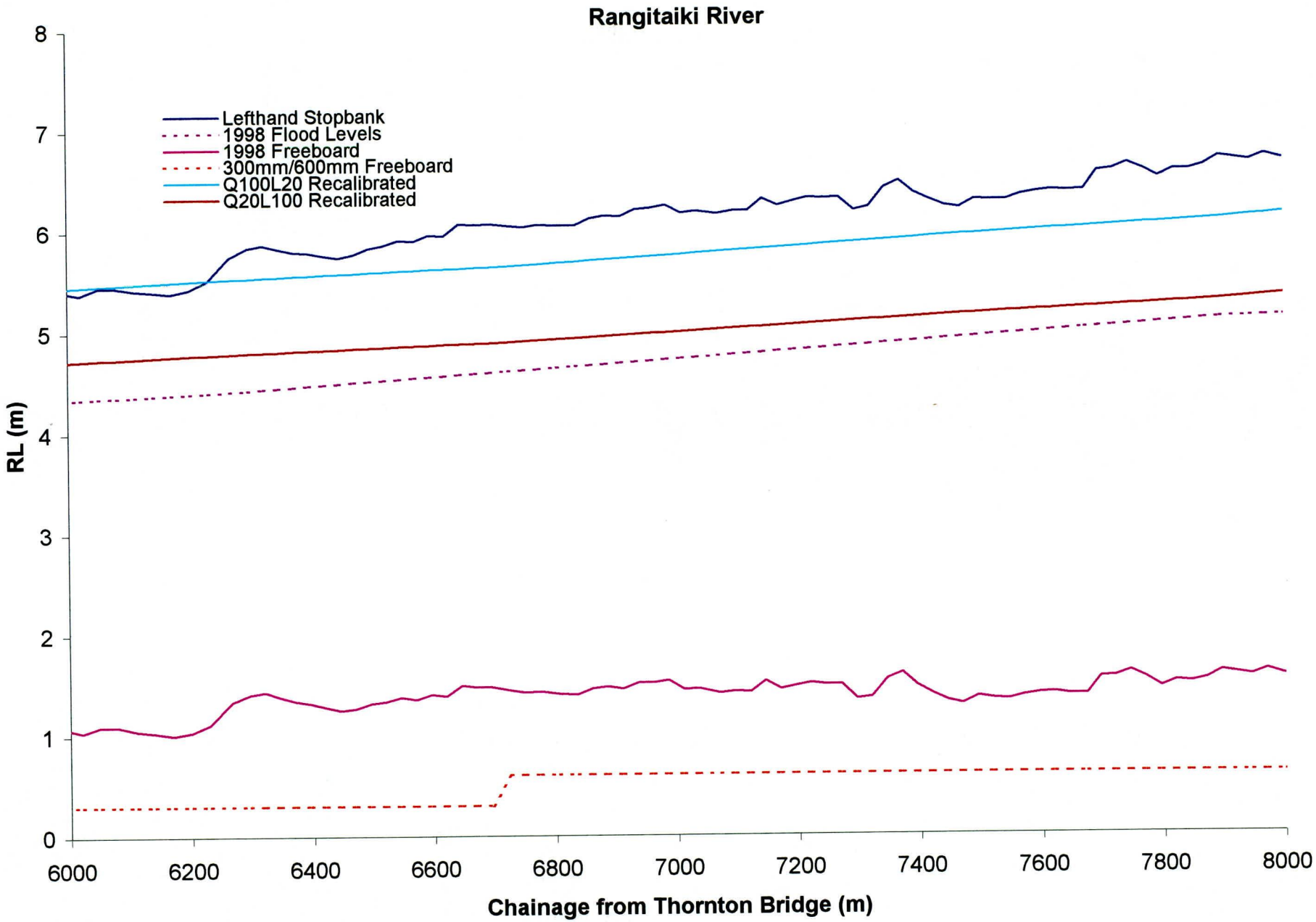

Rangitaiki River
Righthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Chainage from Thornton Bridge (m)

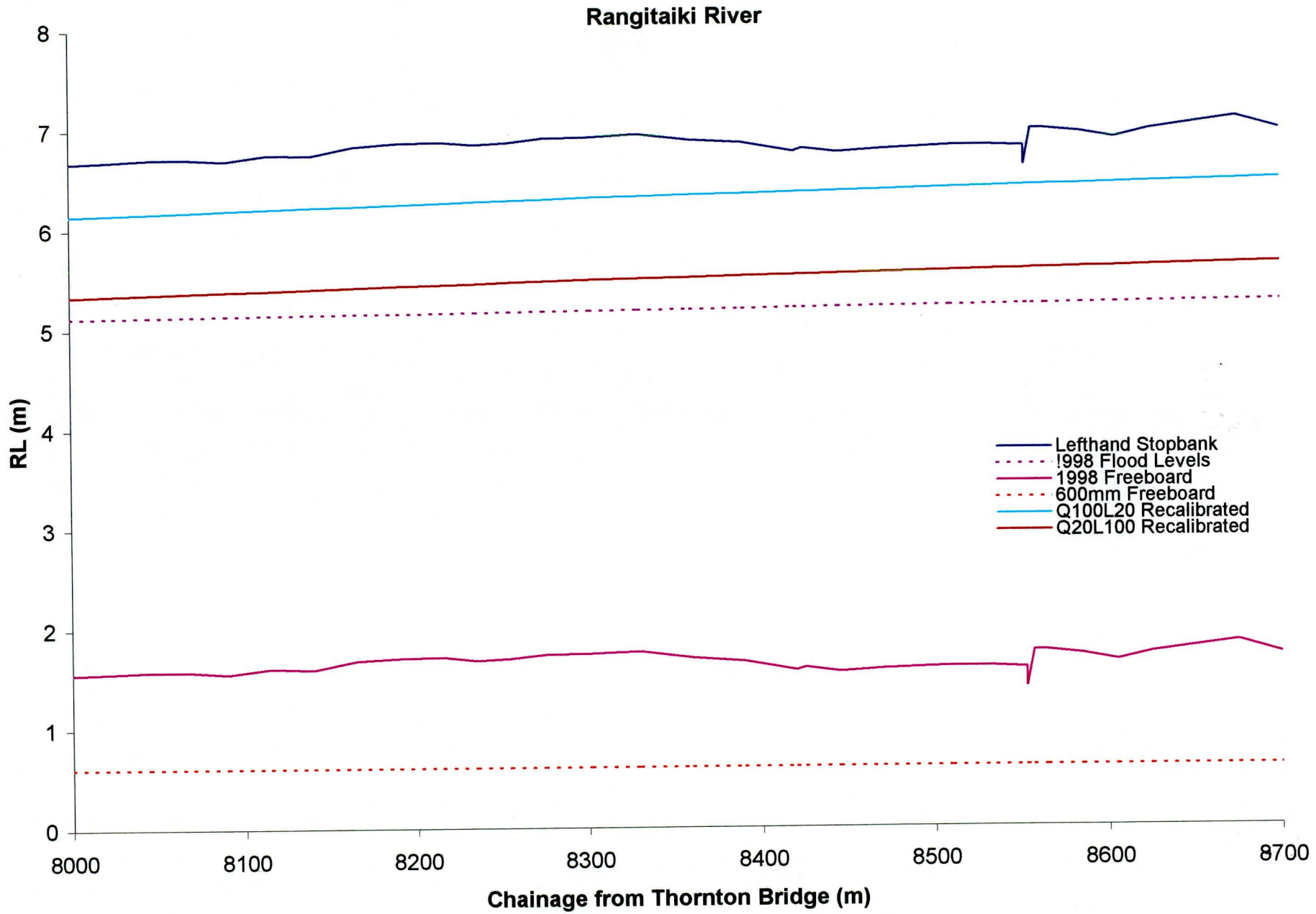

Rangitaiki River
Lefthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
0
200
400
600
800
1000
1200
Chainage (m)


Rangitaiki River
Lefthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Chainage from Thornton Bridge (m)


Rangitaiki River
Lefthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Chainage from Thornton Bridge (m)


Rangitaiki River
Lefthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
Chainage from Thornton Bridge (m)


Rangitaiki River
Lefthand Stopbank
1998 Flood Levels
1998 Freeboard
300mm/600mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated
RL (m)
0
1
2
3
4
5
6
7
8
6000
6200
6400
6600
6800
7000
7200
7400
7600
7800
8000
Chainage from Thornton Bridge (m)


Rangitaiki River
RL (m)
0
1
2
3
4
5
6
7
8
8000
8100
8200
8300
8400
8500
8600
8700
Chainage from Thornton Bridge (m)
Lefthand Stopbank
!998 Flood Levels
1998 Freeboard
600mm Freeboard
Q100L20 Recalibrated
Q20L100 Recalibrated

# Appendix C: Comment on River Cross Sections

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 59 | 0 | Does not represent cross sections down stream. I.e. approx 180m sb distance c.f. 120 m upto 1km d/s |
| 58 | 0.39 | No indication of where they lie on the aerial map. More information required. |
| 57 | 0.793 | No indication of where they lie on the aerial map. More information required. |
| 56 | 1.094 | No indication of where they lie on the aerial map. More information required. Incomplete Survey Information. Not an adequate section for the Calibration event. |
| 55 | 1.597 | No indication of where they lie on the aerial map. More information required as the calibration results exceed the survey height (Glass Wall). Incomplete Survey Information. Not an adequate section for the Calibration event. What are the effects of super elevation around the bend. |
| 54 | 2.31 | No indication of where they lie on the aerial map. More information required as the calibration results exceed the survey height. Incomplete Survey Information. Not an adequate section for the Calibration event. |
| 53 | 2.52 | No indication of where they lie on the aerial map. More information required as the calibration results exceed the survey height. Incomplete Survey Information. Not an adequate section for the Calibration event. |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 52 | 2.94 | More information required as the calibration results exceed the survey height. Incomplete Survey Information. Not an adequate section for the Calibration event. |
| 51c | 3.24 | More information required as the calibration results exceed the survey height. Incomplete Survey Information. Not an adequate section for the Calibration event. |
| 51b | 3.59 | Although Section apperas to be satisfactory for calibration event, it may need to be adjusted for the 100 year event, to be indicative of the channel d/s. |
| 51a | 3.94 | Although Section apperas to be satisfactory for calibration event, it may need to be adjusted for the 100 year event, to be indicative of the channel d/s. |
| 50 | 4.19 | Appears to be satisfactory for calib event, but does not appear to have sufficient data for the 100 yr event. |
| 49 | 4.47 | Section appears skewed. This may explaimn the difference in the calibration result vs observed. |
| 48 | 4.99 | Section appears skewed on calibration flow |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 47b | 5.21 | Section appears to be OK for calibration event, although may need to be adjusted for the 100 yr event. |
| 47a | 5.43 | Section possibly adequate for calib event but does not represent the d/s section of the river. XS should be taken further d/s to represent the reach of the river under the 100 yr event. Calib result may not take into account the super elevation around the channel. |
| 46 | 5.94 | Appear OK |
| 45 | 6.3 | Appear OK, potentially other XS information required DS to define the channel around the bend. |
| 44 | 6.7 | Section appears OK. May not take into account the super elevation around the channel. |
| 43c | 7.09 | Appear to be OK for the calibration event, may have to be adjusted for the 100 year event. Skewed to calib flow? |
| 43b | 7.41 | Appear to be OK for the calibration event, may have to be adjusted for the 100 year event. Skewed to calib flow? |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 43a | 7.58 | Appear to be OK for the calibration event, may have to be adjusted for the 100 year event. Skewed to calib flow? |
| 42 | 8.01 | Appears OK |
| 41a | 8.39 | Cross section data insufficient for calibration event. |
| 41 | 8.59 | May not take into account the super elevation. |
| 40 | 8.78 | Appear OK, potentially other XS information required DS to define the channel around the bend. |
| 39 | 9.09 | Appears OK for the calibration event. |
| 38 | 9.44 | Observed results mirrored? More survey data required around the bend. Channel skewed to calib flow. |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 37 | 9.69 | Appears OK for calibration event. Additional information possibly required for 100 yr event. |
| 36 | 10.06 | Appears to be OK. Additional XS required around the bend. However, channel width appears to be consistent with d/s XS. |
| 35 | 10.47 | Appear to be OK for calibration event for this section of channel. |
| 34 | 10.87 | XS appears to be indicative of this section of channel. Unsure why such a variance in calibration vs. observed. |
| 33 | 11.32 | Appear to be OK for calibration event for this section of channel. |
| 32 | 11.69 | Sizeable variance in observed vs calibration. Does not appear to take into account super elevation. |
| 31 | 12.04 | Cross section appears OK. |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 30 | 12.41 | Cross Section appears OK. Potentially require a few more cross sections to better define the channel around the bend. |
| 29 | 12.7 | Cross Section appears OK |
| 28b | 13.01 | Cross Section appears OK for the calibration event. |
| 28a | 13.21 | Cross Section appears OK for the calibration event. May need some adjustment for the 100 yr event as there is no information on bridge structure? |
| 27 | 13.36 | Cross Section appears OK for the calibration event. May need some adjustment for the 100 yr event as there is no information on bridge structure? More XS sections required d/s around the bend. |
| 26 | 13.81 | Section appears OK for the calibration event, but does not represent the channel d/s. More xs information required around the bend. |
| 25 | 14.16 | Section appears scewed to calibration flow. More survey information required d/s around the bend. Potential area of variance with d/s calibration vs observed result. |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 24 | 14.66 | Section appears OK for calibration event. More survey xs required d/s around the bend. |
| 23 | 15.04 | Section OK. Appears to represent channel d/s |
| 22 | 15.4 | Section OK. Appears to represent channel d/s |
| 21 | 15.8 | Section OK. Appears to represent channel d/s |
| 20 | 16.35 | Section OK. Appears to represent channel d/s |
| 19 | 16.61 | Section OK. Appears to represent channel d/s |
| 18 | 17.12 | Section OK. Appears to represent channel d/s |

## Rangitaiki River

## Comment on River Cross Sections

| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 17 | 17.44 | Section OK. Appears to represent channel d/s |
| 16 | 17.81 | Section OK. Appears to represent channel d/s |
| 15 | 18.21 | Section OK. Appears to represent channel d/s |
| 14 | 18.78 | Section OK. Additional XS required either side to represent channel around the bend. Results appear quite good, but have they taken into account the super elevation. |
| 13 | 19.18 | Section OK. Appears to represent channel d/s |
| 12 | 19.59 | Section OK. Appears to represent channel d/s |
| 11 | 19.92 | xs appears OK for calibratiuon event. May have to be adjusted for 100 yr event. |

## Rangitaiki River

## Comment on River Cross Sections

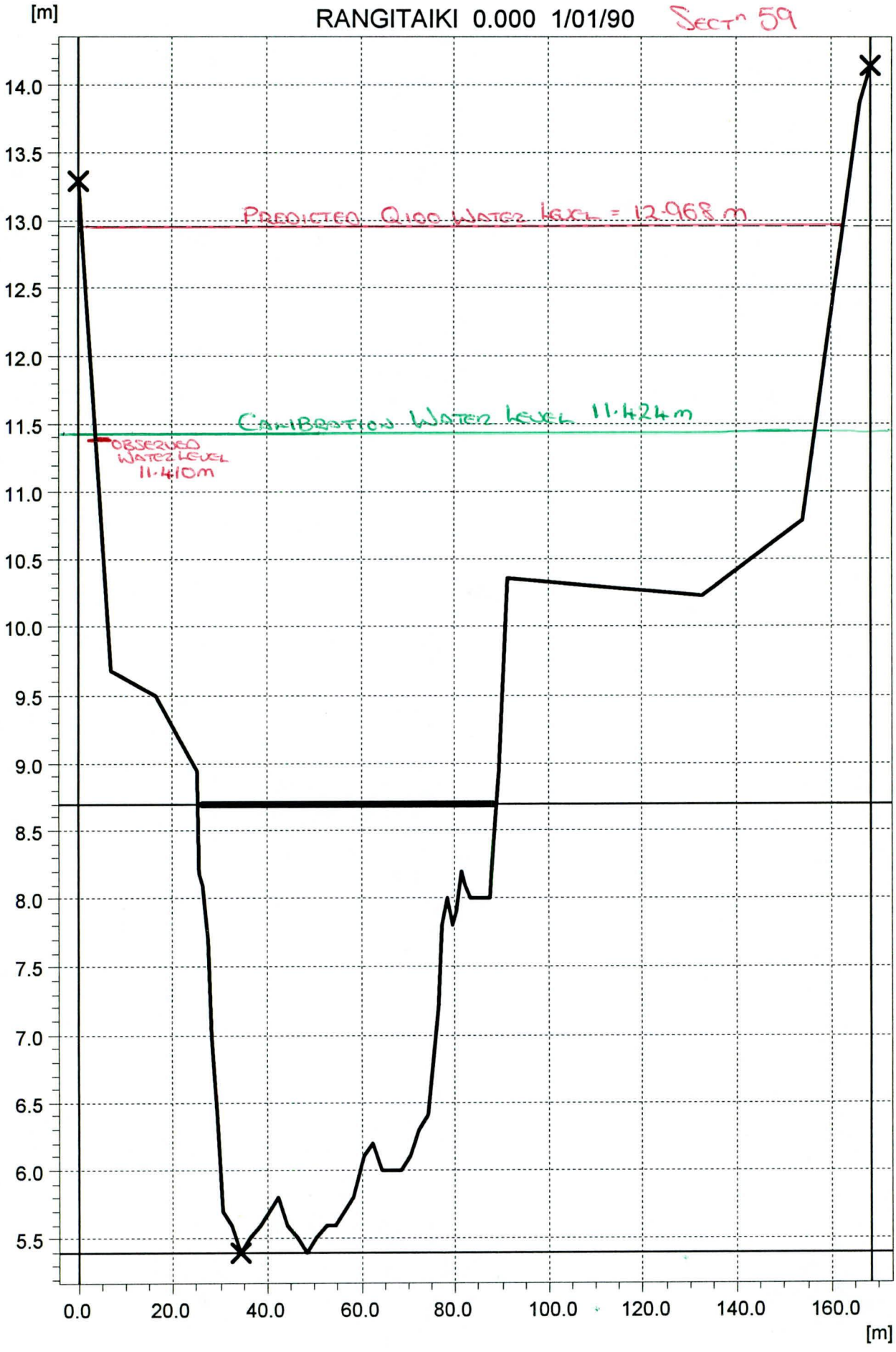
| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 10 | 20.38 | xs skewed to calibration flow. More xs info required d/s around the bend. |
| 9 | 20.74 | Section OK. Appears to represent channel d/s |
| 8 | 21.12 | Section OK. Appears to represent channel d/s |
| 7 | 21.51 | Additional sections required either side around bend. |
| 6 | 21.92 | Section OK. Appears to represent channel d/s |
| 5 | 22.32 | Section OK. Appears to represent channel d/s |
| 4 | 22.87 | Section OK. Appears to represent channel d/s |

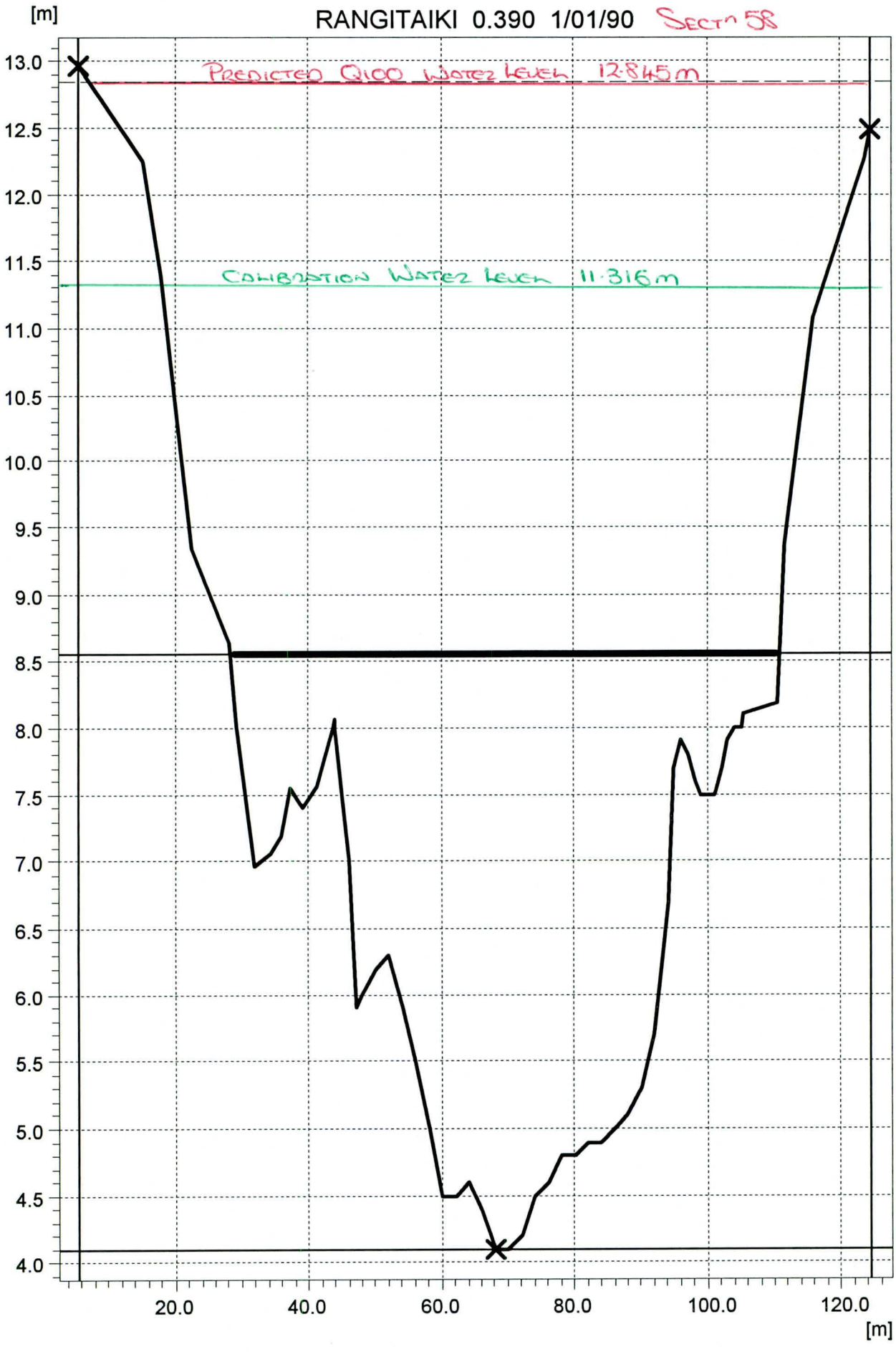
## Rangitaiki River

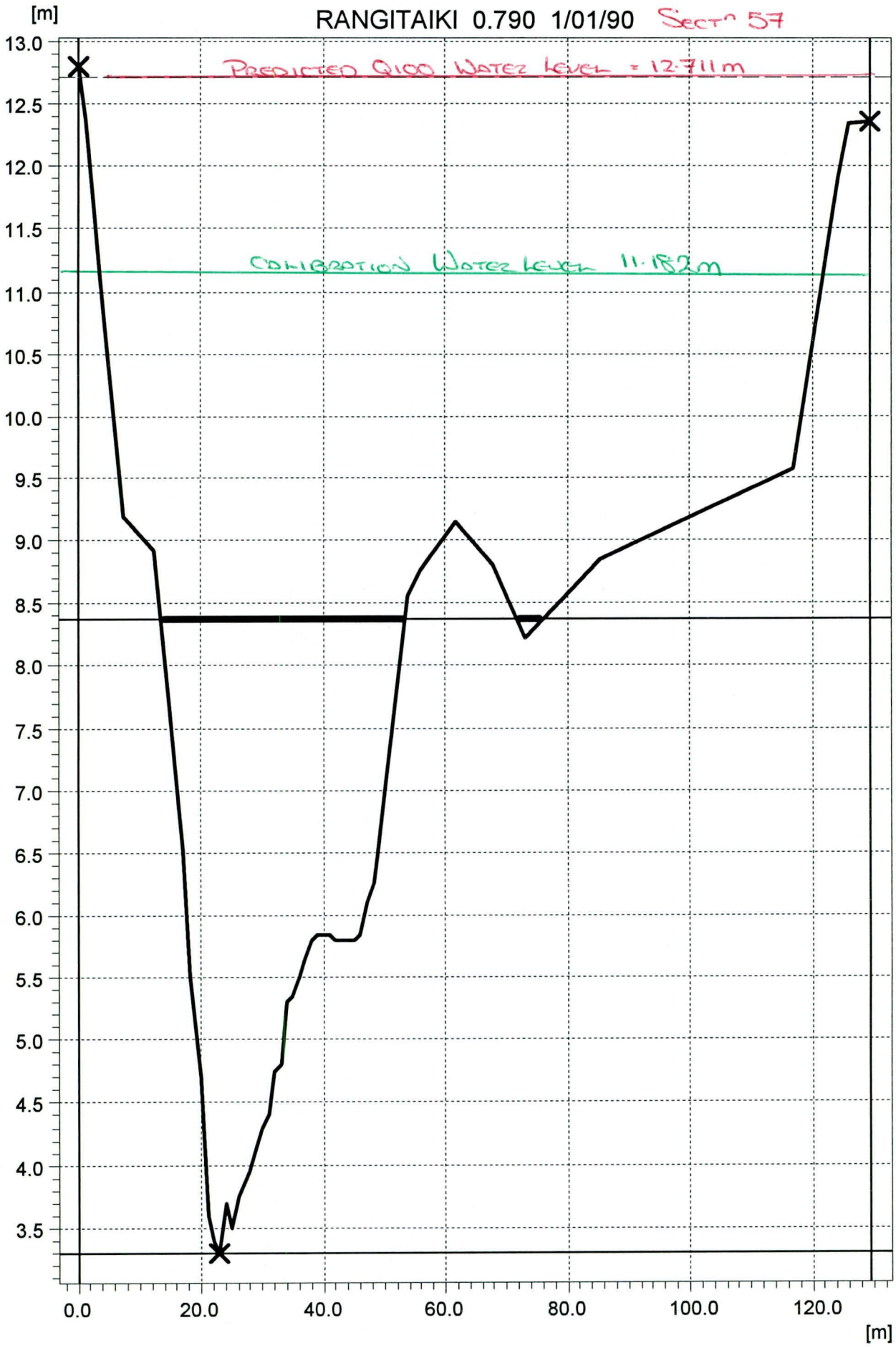
## Comment on River Cross Sections

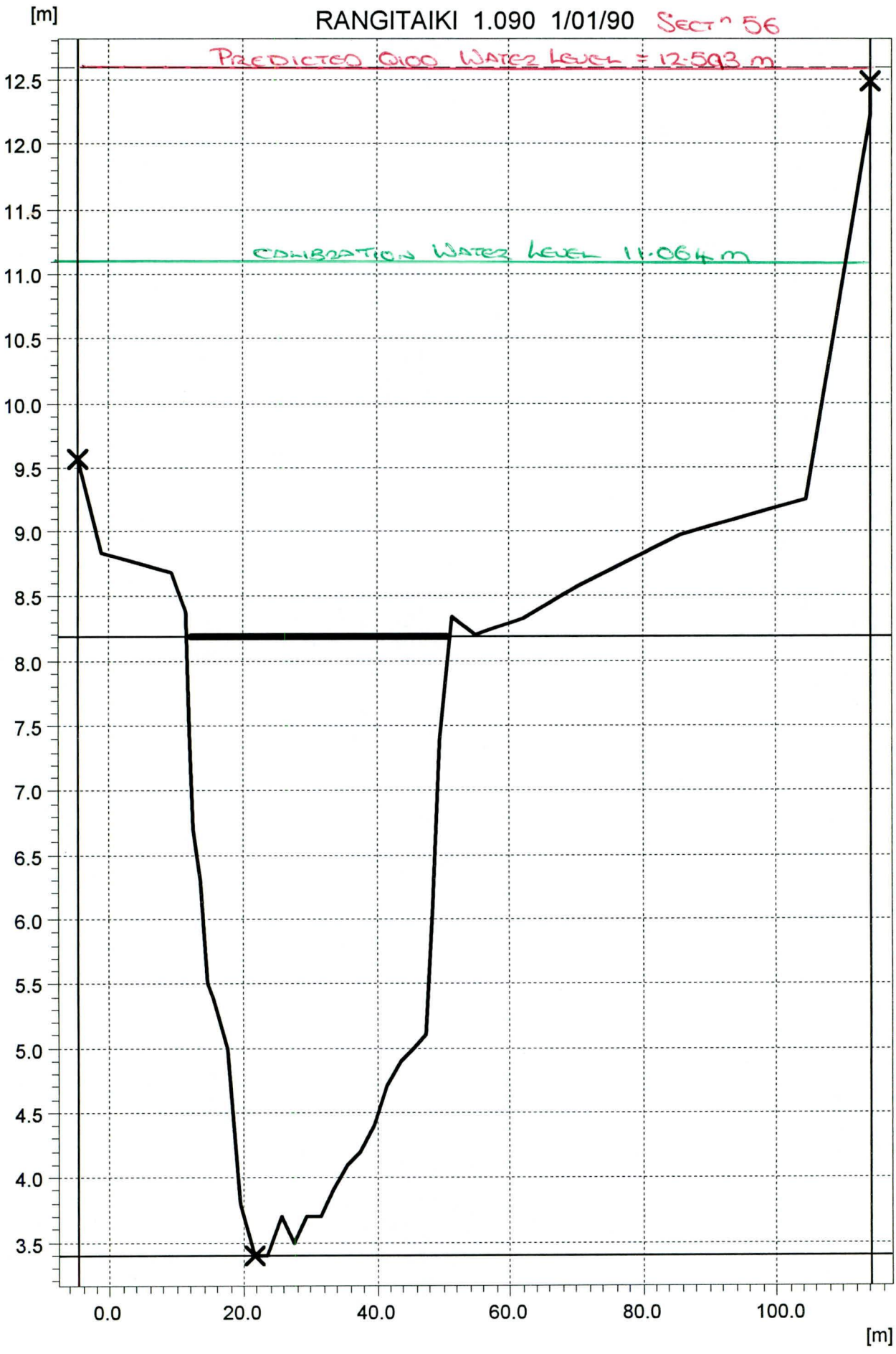
| Cross Section No | Mike 11Chainage (km) | Comment |
|---|---|---|
| 3 | 23.12 | Appears to be a good representation of the flow between section 1 and 5 |
| 2 | 23.66 | Section OK. Appears to represent channel d/s |
| 1 | 23.97 | Section OK. Appears to represent channel d/s |
| 1a | 24.55 | Mouth of River Calibration event overtops survey data. |
| Sea | 25.00 | Mouth of River Calibration event overtops survey data. |

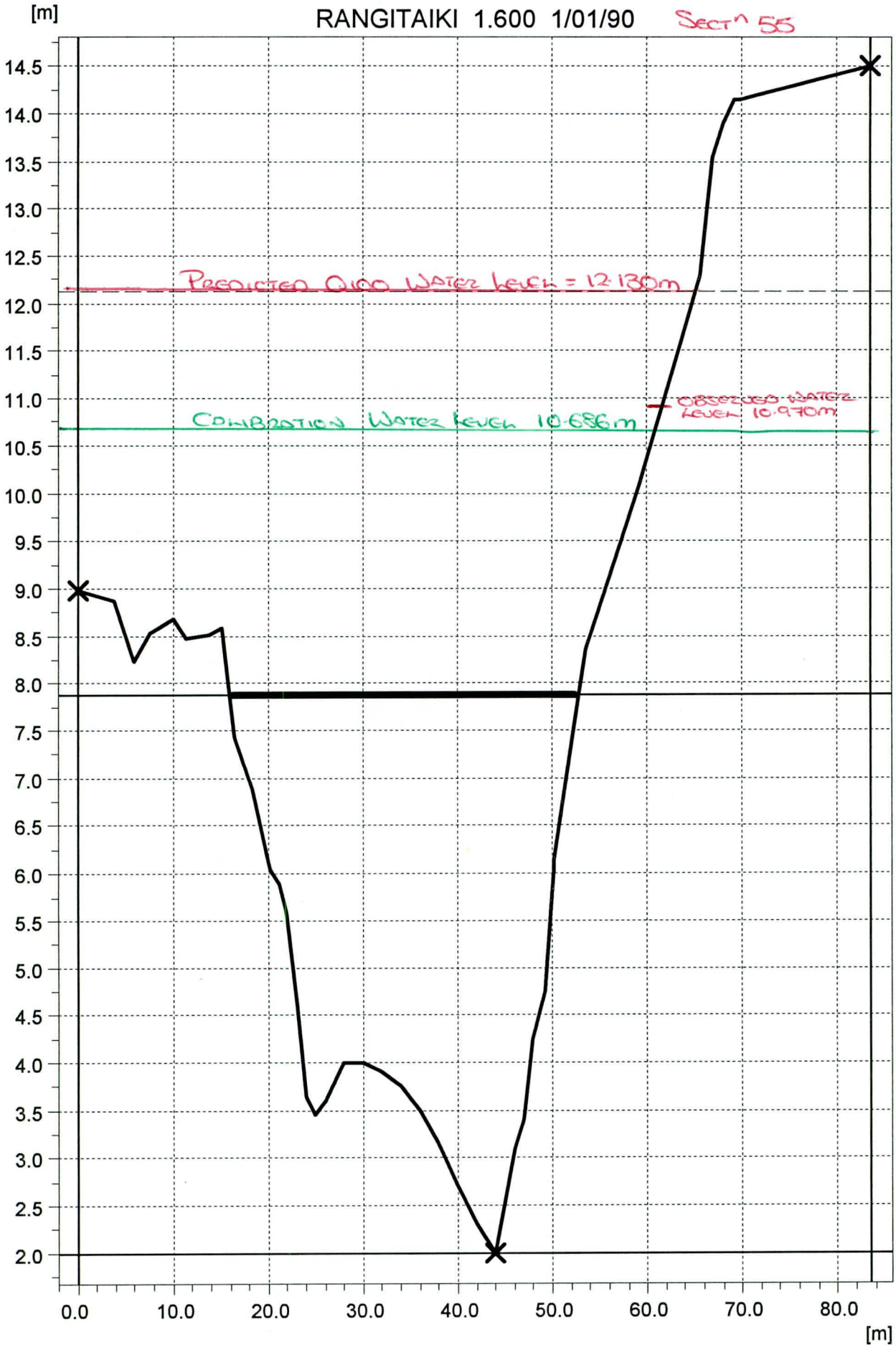
# Appendix D: Rangitaiki River, Main Channel, Cross Sections

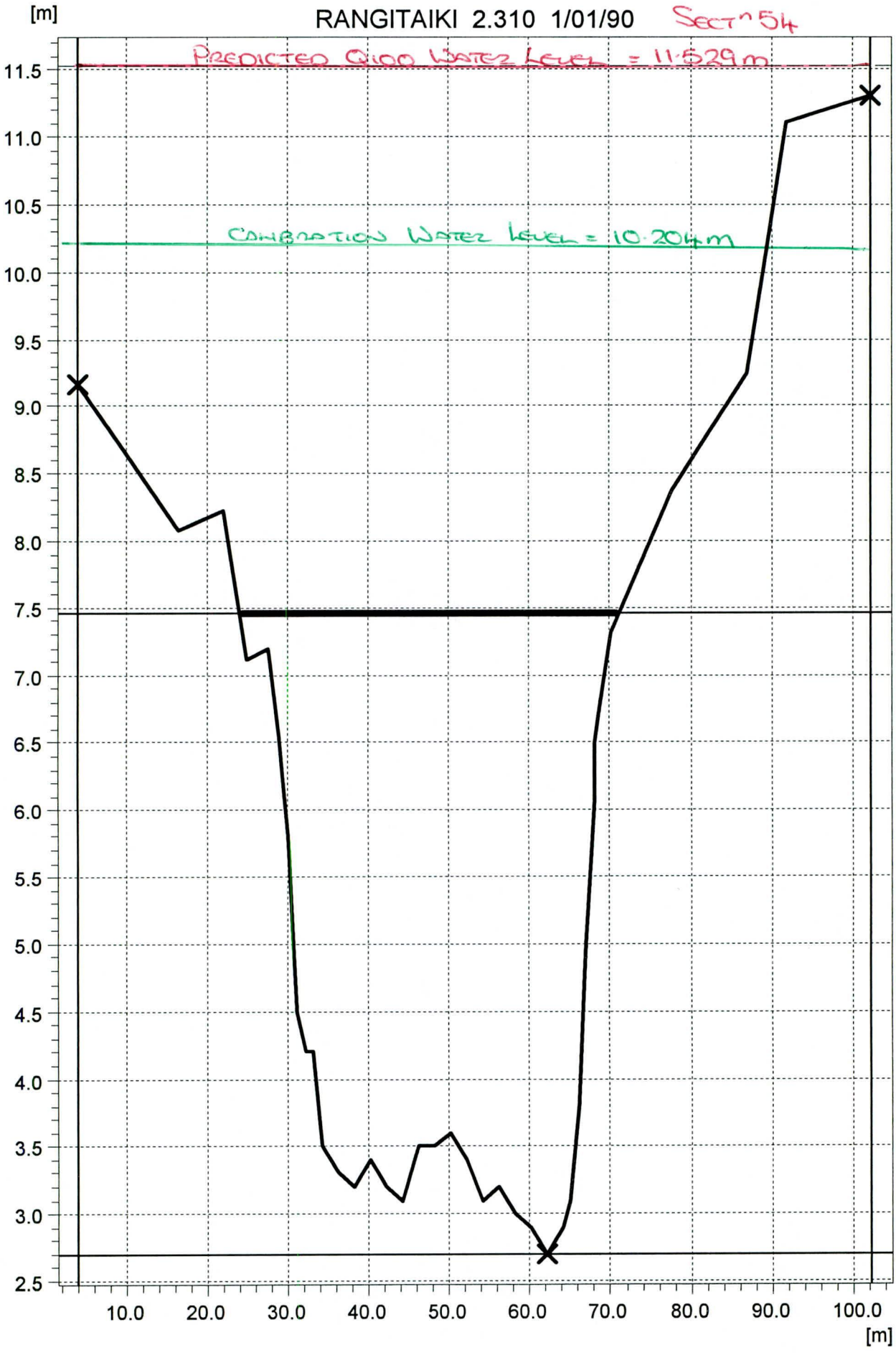

[m]
RANGITAIKI 0.000 1/01/90
Sect^n 59
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
PREDICTED Q100 WATER LEVEL = 12.968 m
CALIBRATION WATER LEVEL 11.424 m
OBSERVED WATER LEVEL 11.410m
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

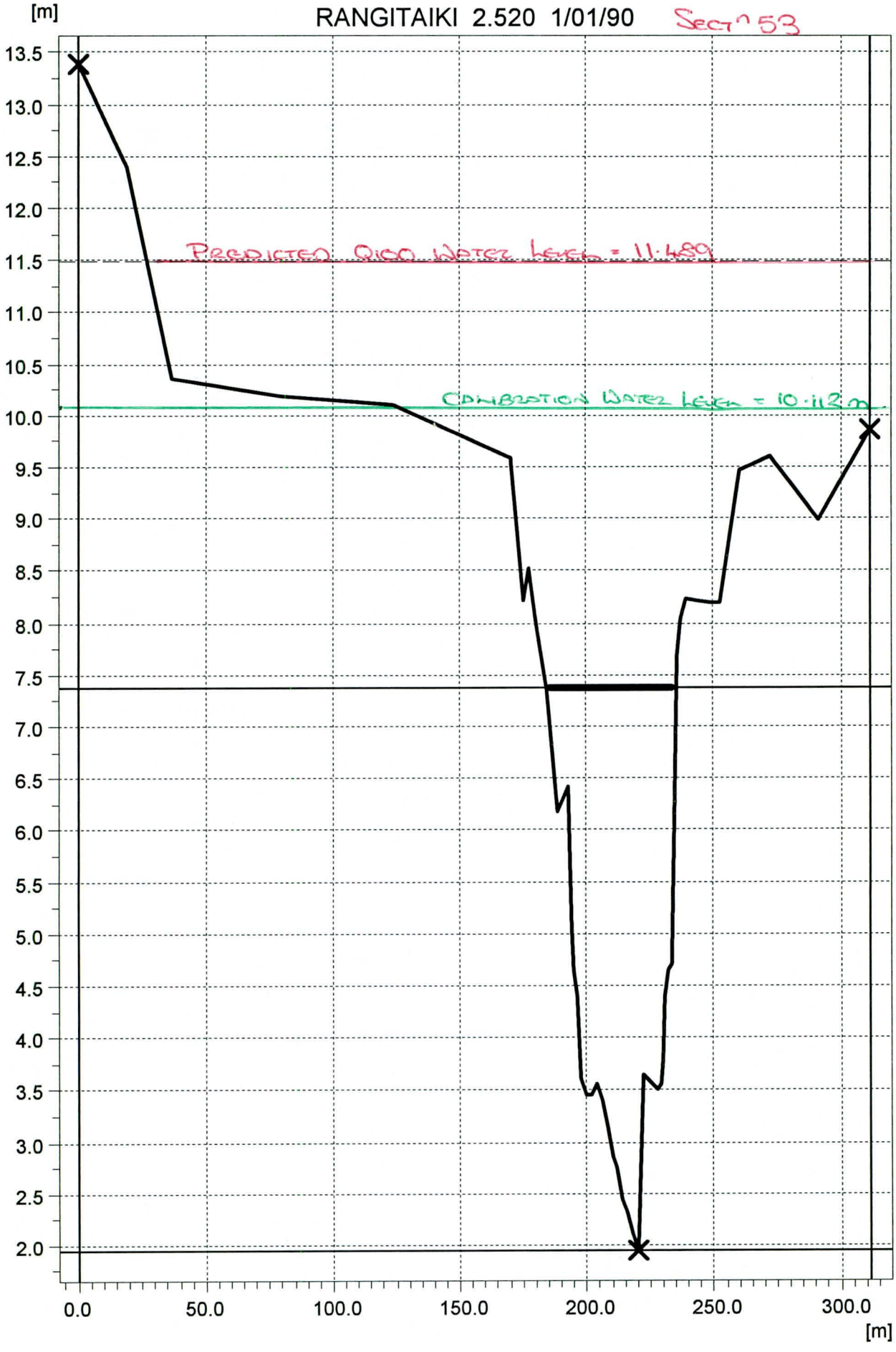

[m]
RANGITAIKI 0.390 1/01/90 SECTN 58
PREDICTED Q100 WATER LEVEL 12.845m
CALIBRATION WATER LEVEL 11.316m
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
20.0
40.0
60.0
80.0
100.0
120.0
[m]

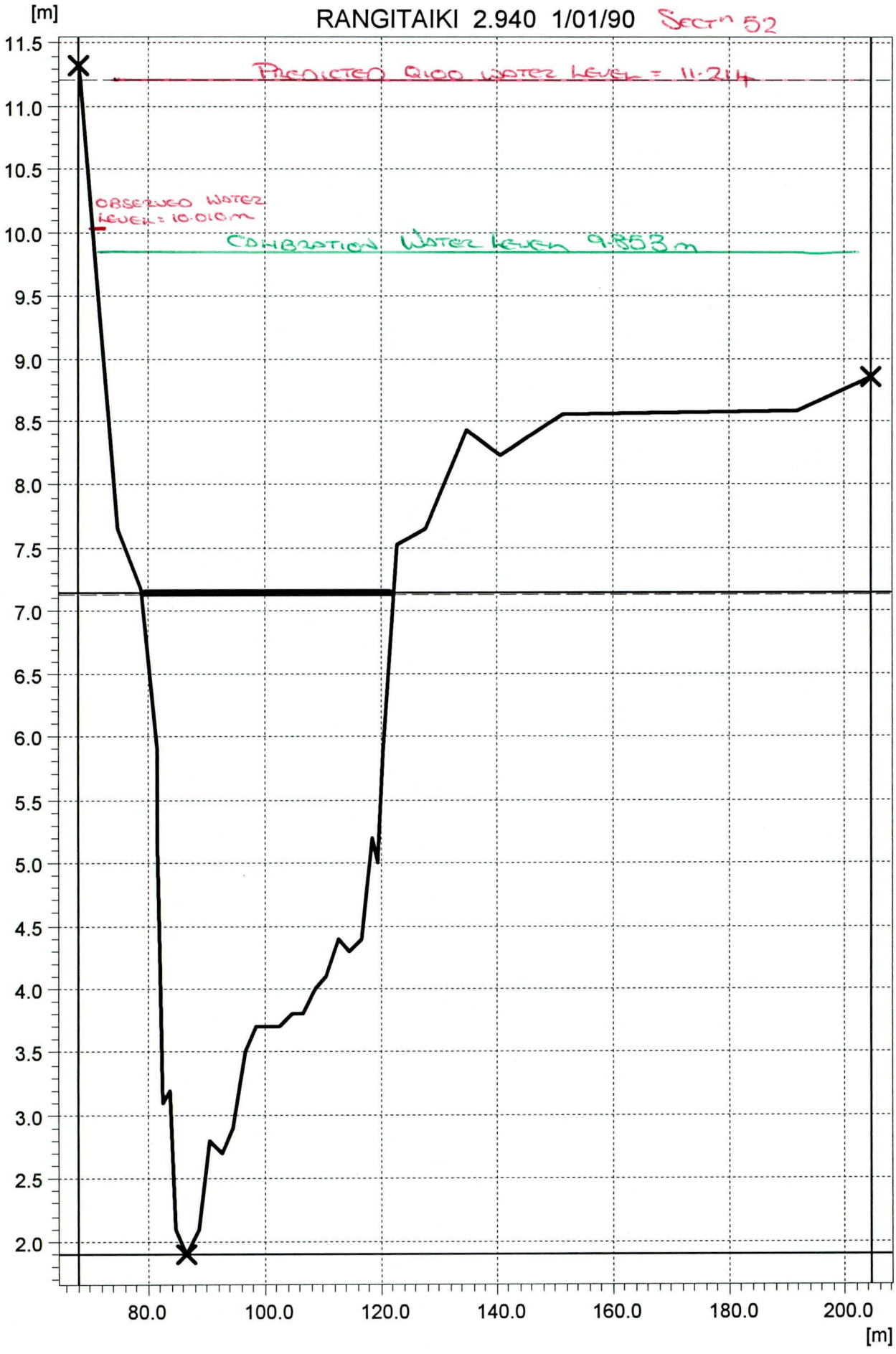

[m]
RANGITAIKI 0.790 1/01/90 Sect^ 57
PREDICTED Q100 WATER LEVEL = 12.711m
CALIBRATION WATER LEVEL 11.182m
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
0.0
20.0
40.0
60.0
80.0
100.0
120.0
[m]

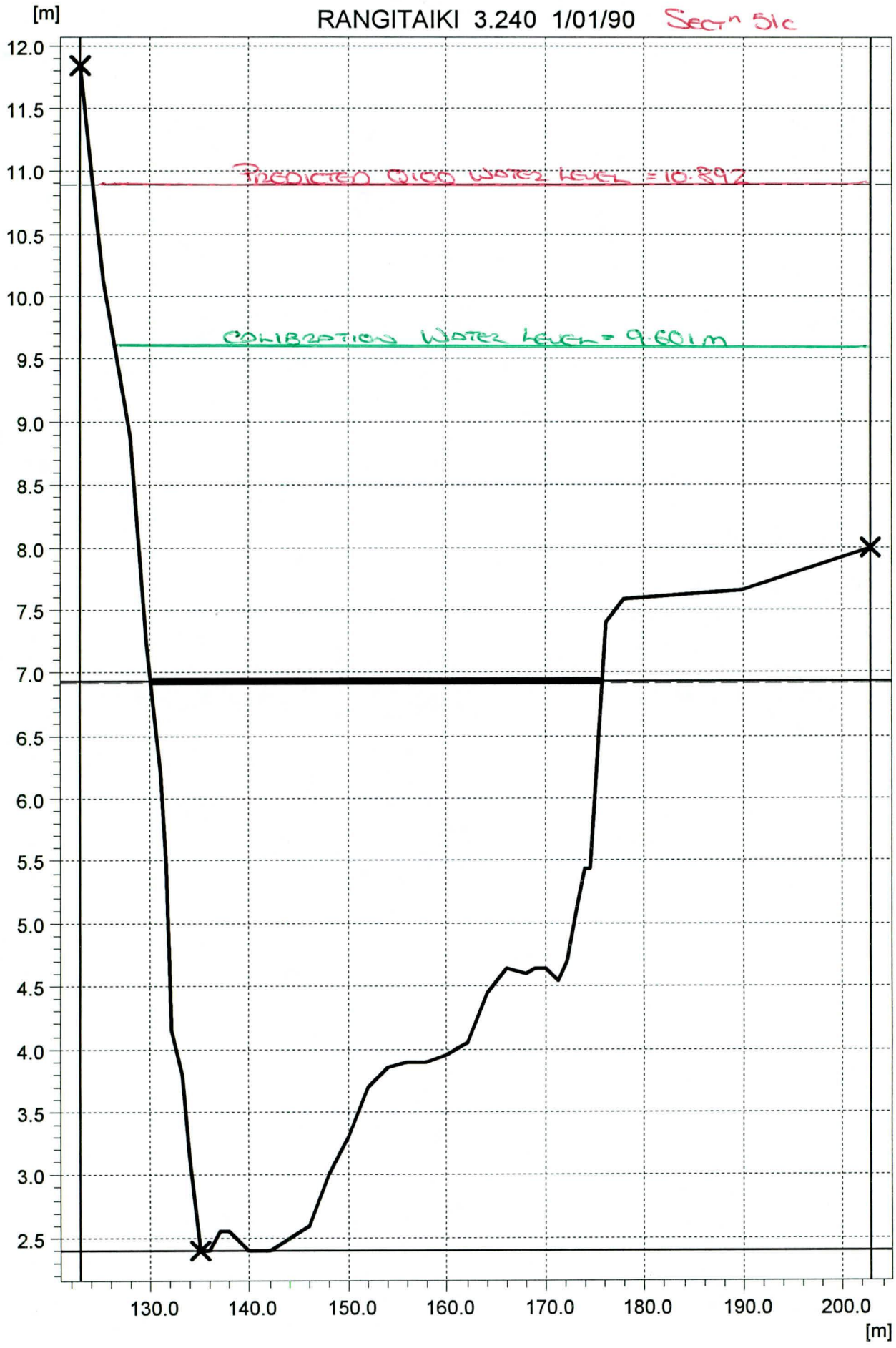

[m]
RANGITAIKI 1.090 1/01/90 SECT^ 56
PREDICTED Q100 WATER LEVEL = 12.593 m
CALIBRATION WATER LEVEL 11.064 m
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
0.0
20.0
40.0
60.0
80.0
100.0
[m]

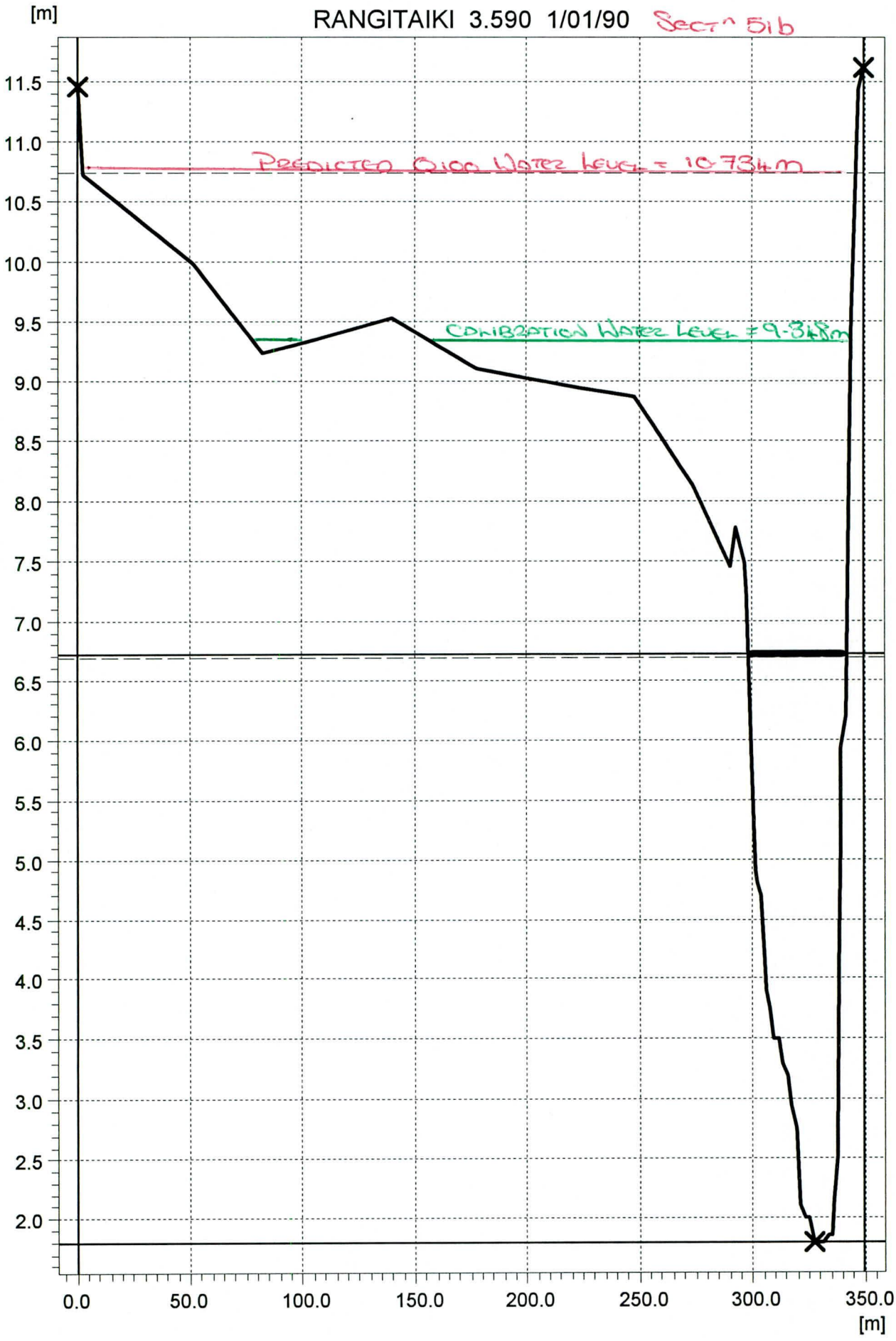

[m]
RANGITAIKI 1.600 1/01/90
SECT^N 55
PREDICTED Q100 WATER LEVEL = 12.130m
COMBINATION WATER LEVEL 10.686m
OBSERVED WATER LEVEL 10.970m
14.5
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
[m]

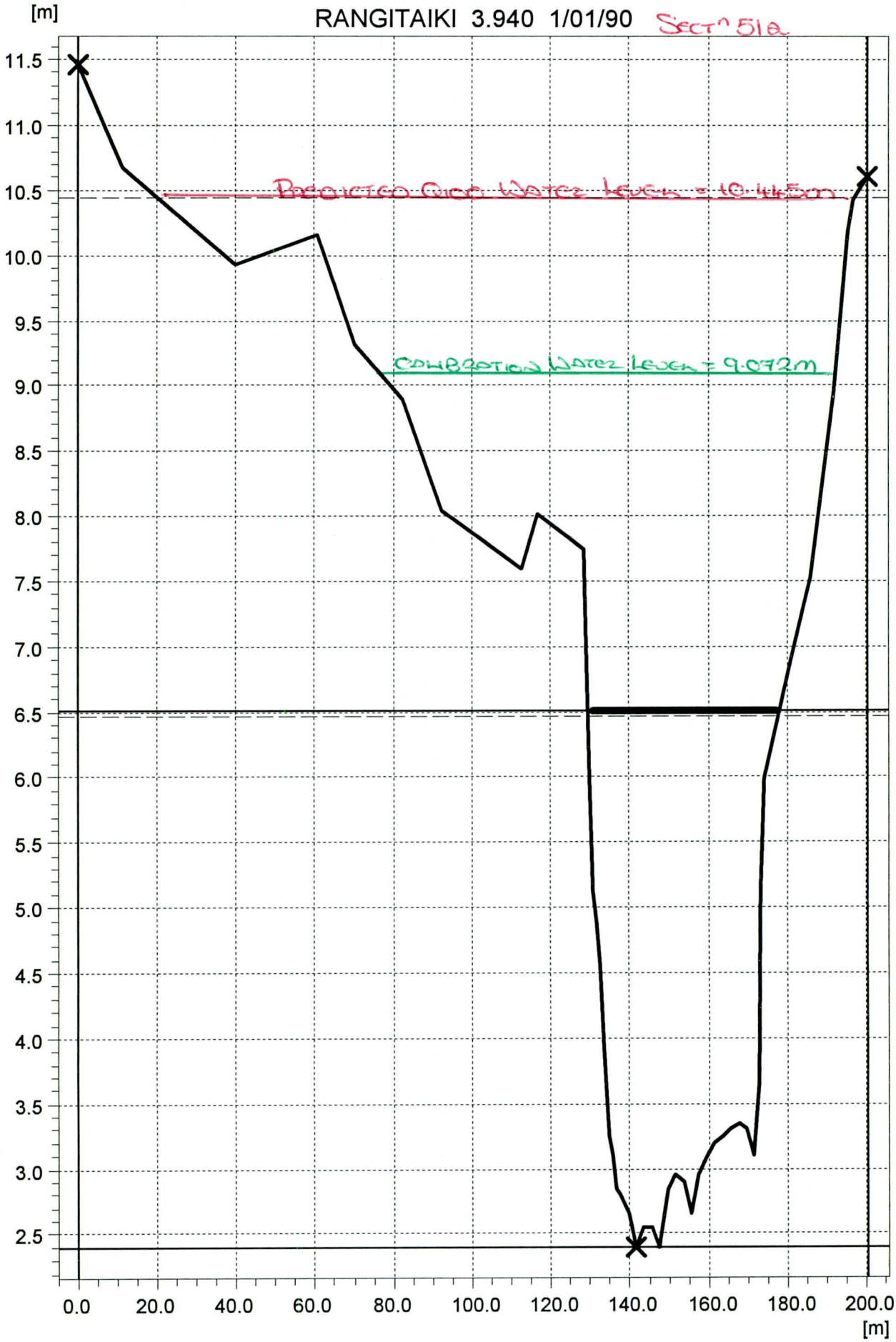

[m]
RANGITAIKI 2.310 1/01/90
Sect^ 54
PREDICTED Q100 WATER LEVEL = 11.529m
CONSENTION WATER LEVEL = 10.204m
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
[m]

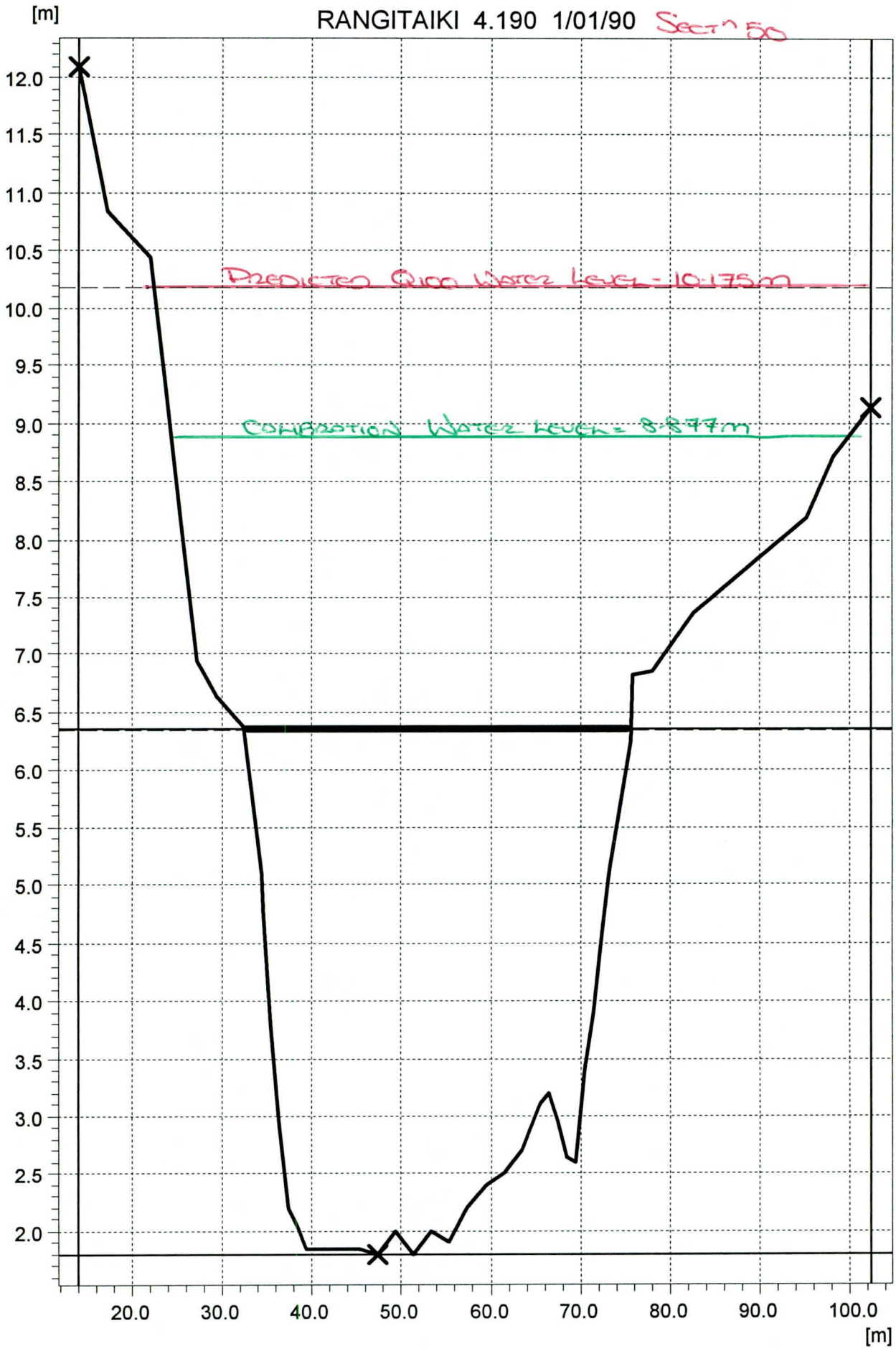

[m]
RANGITAIKI 2.520 1/01/90
Sect^53
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
PREDICTED 0.1% WATER LEVEL = 11.489
CONSTRUCTION WATER LEVEL = 10.112 m
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]

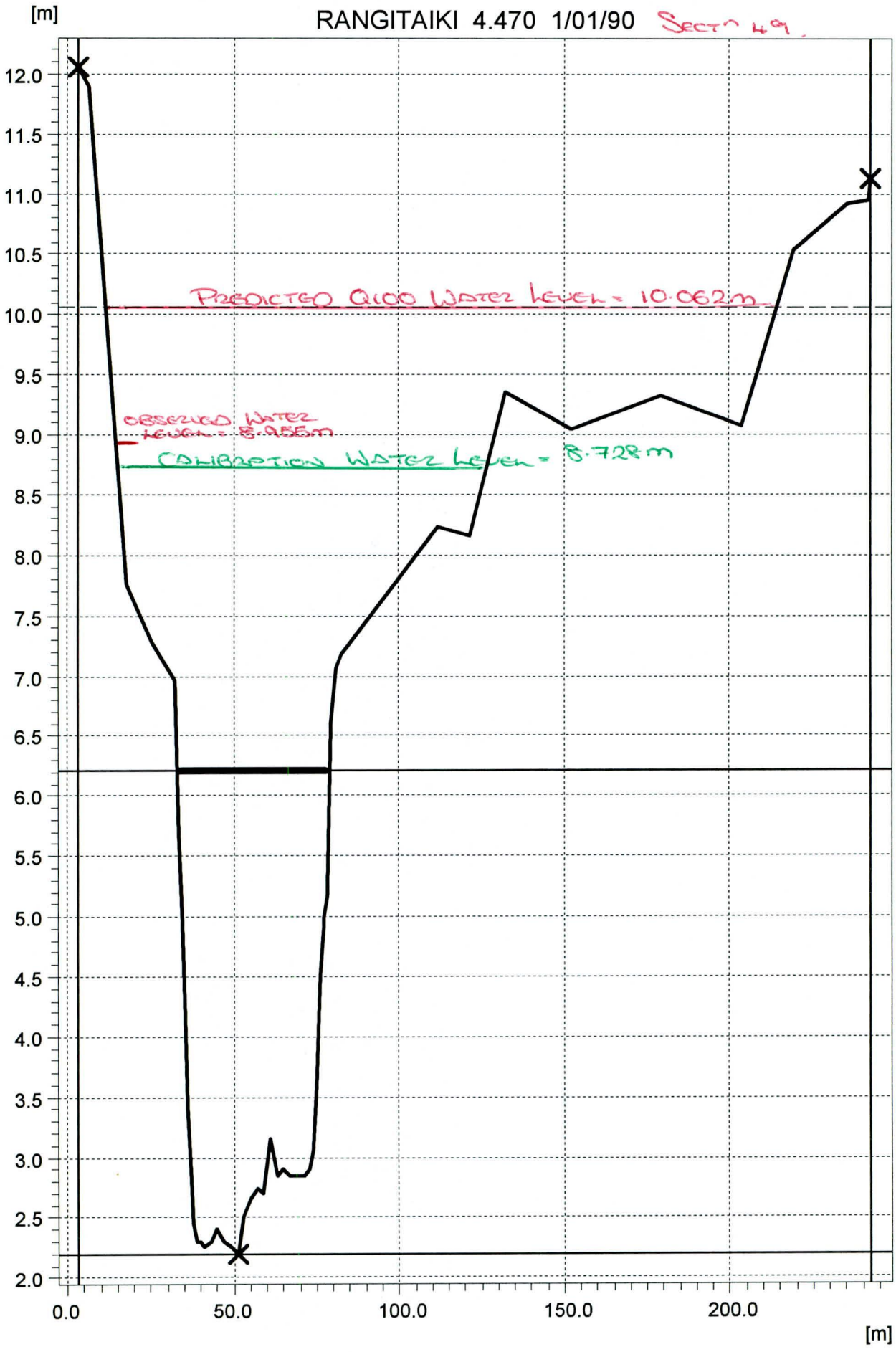

[m]
RANGITAIKI 2.940 1/01/90 Sectn 52
PREDICTED Q100 WATER LEVEL = 11.214
OBSERVED WATER LEVEL = 10.010m
CONDITION WATER LEVEL 9.353m
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

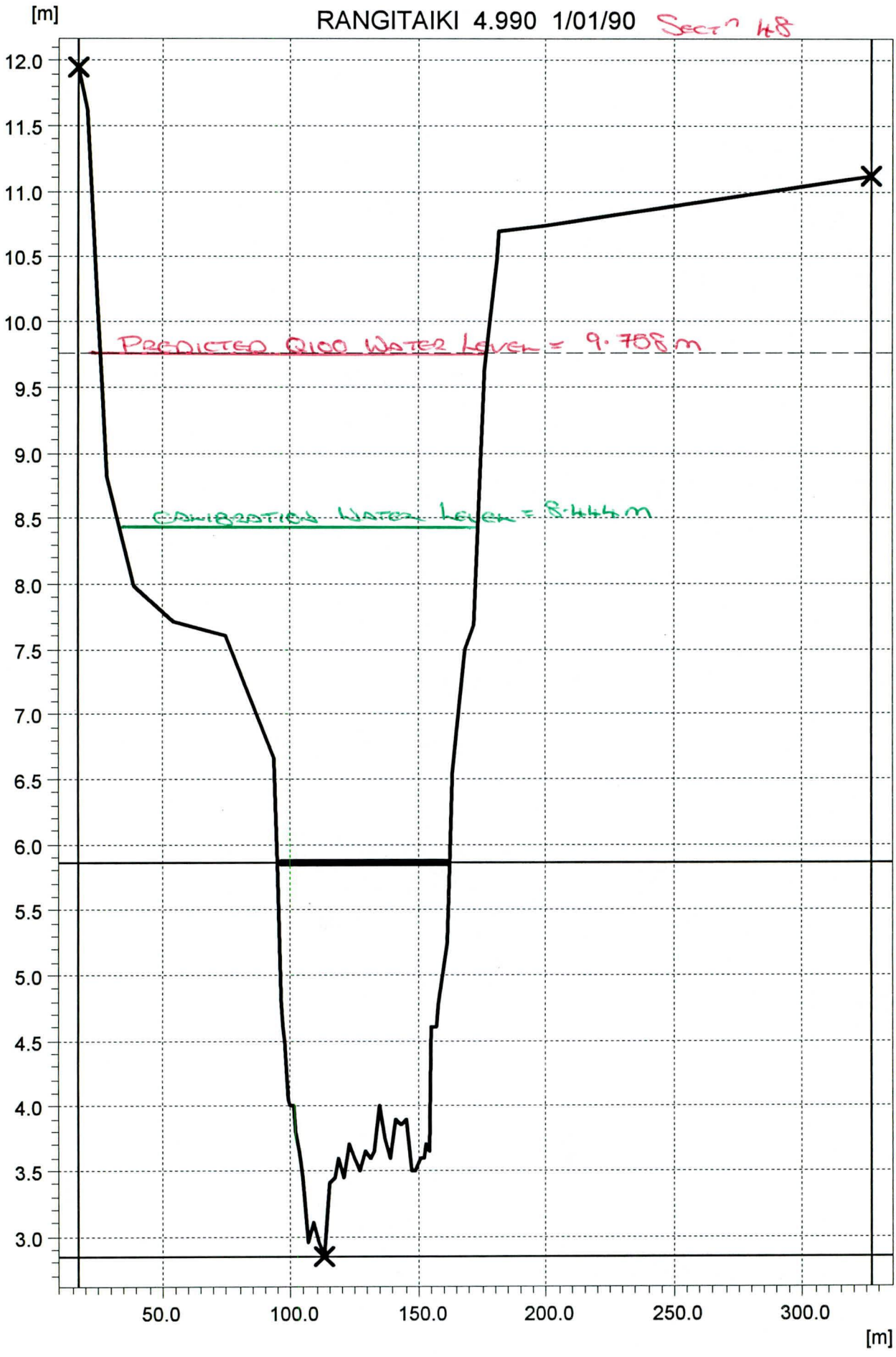

[m]
RANGITAIKI 3.240 1/01/90
Sectn 51c
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
PREDICTED Q100 WATER LEVEL = 10.892
CALIBRATION WATER LEVEL = 9.601 m
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
[m]


[m]
RANGITAIKI 3.590 1/01/90 Sect^ 51b
PREDICTED 0100 WATER LEVEL = 10.734m
CALIBRATION WATER LEVEL = 9.34m
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
[m]

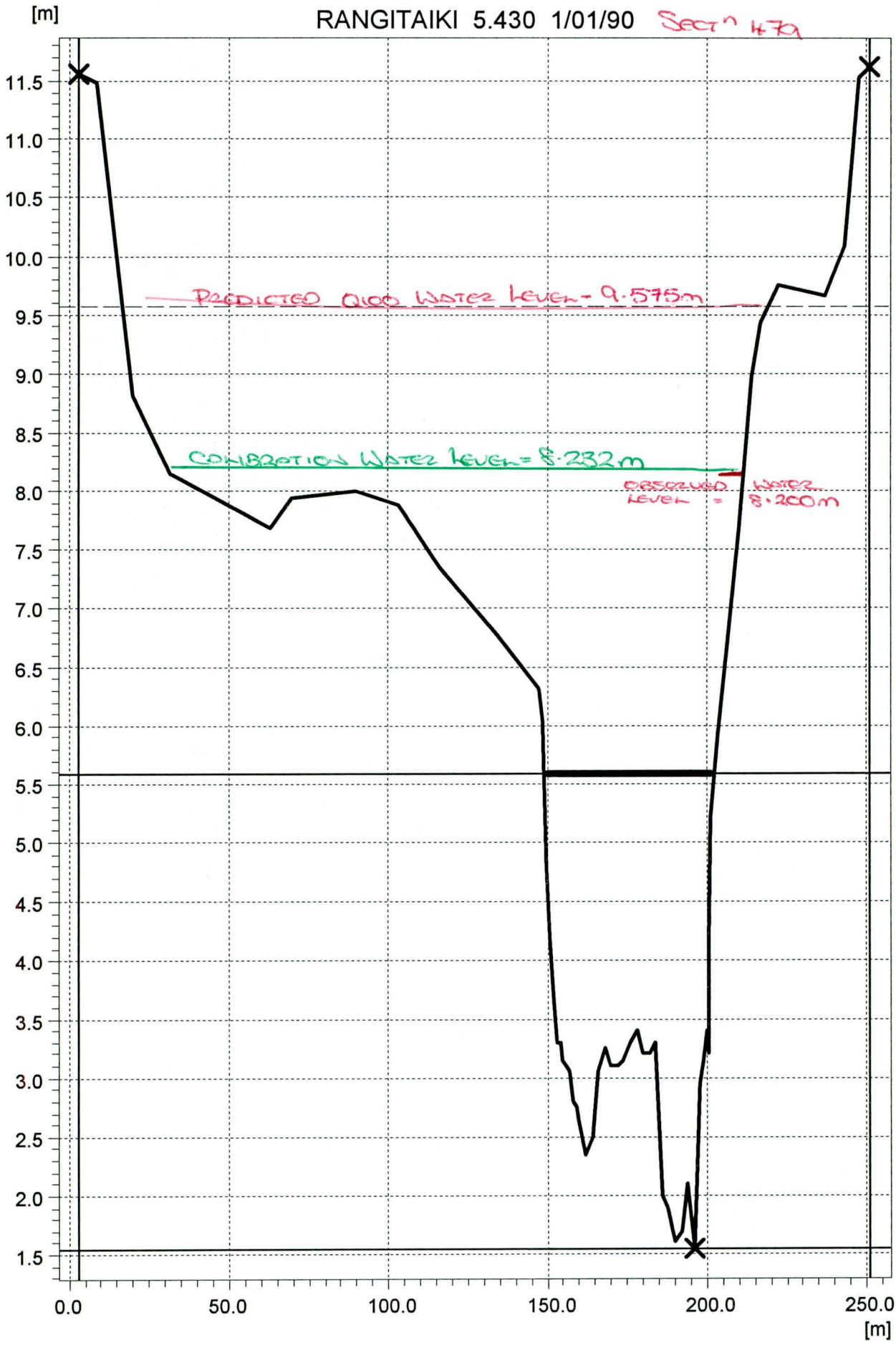

[m]
RANGITAIKI 3.940 1/01/90 Sect^ 51a
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

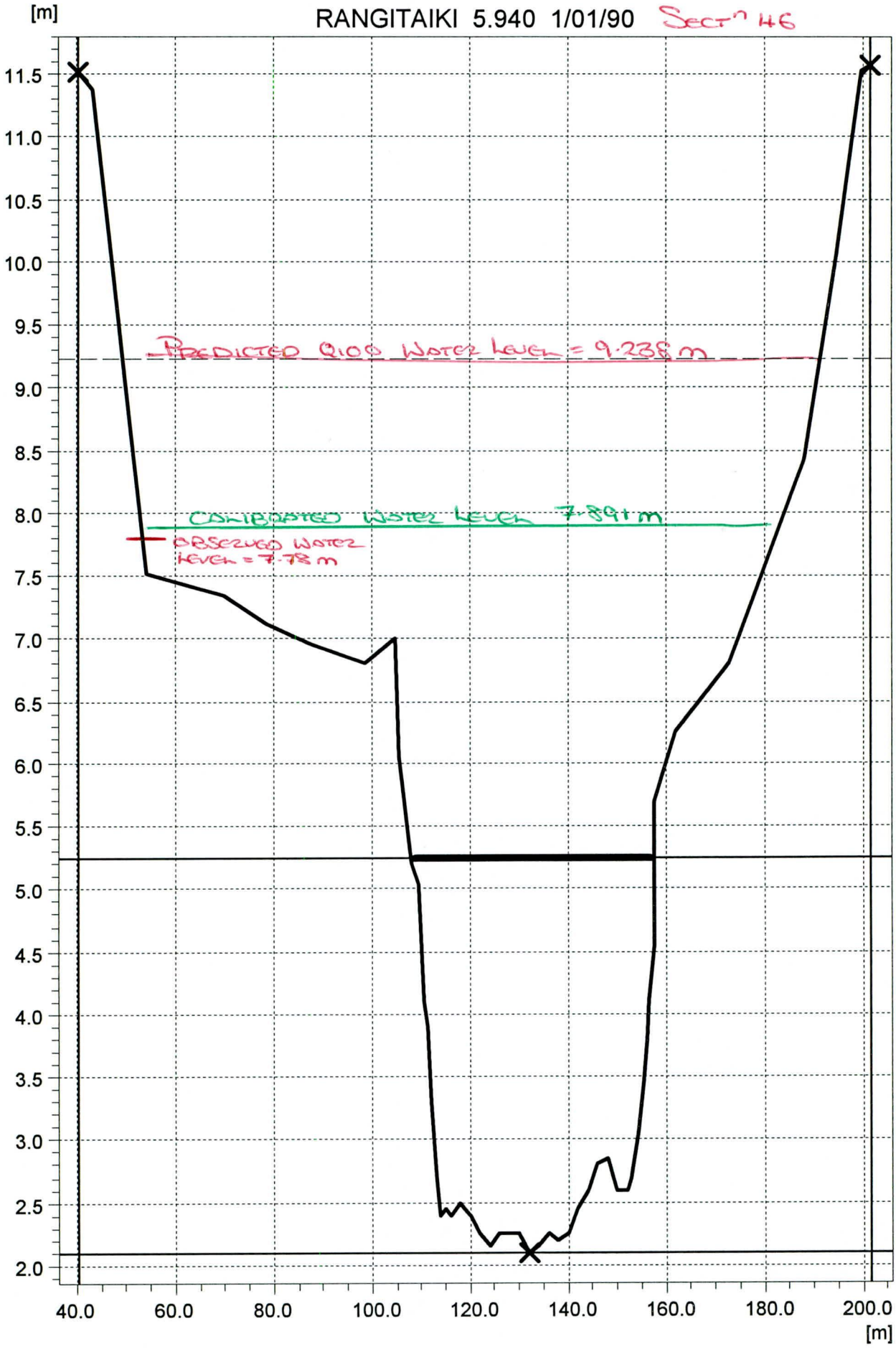

[m]
RANGITAIKI 4.190 1/01/90 Sect^n 50
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
Predicted 100 Water Level - 10.175m
Consented Water Level = 8.877m
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
[m]

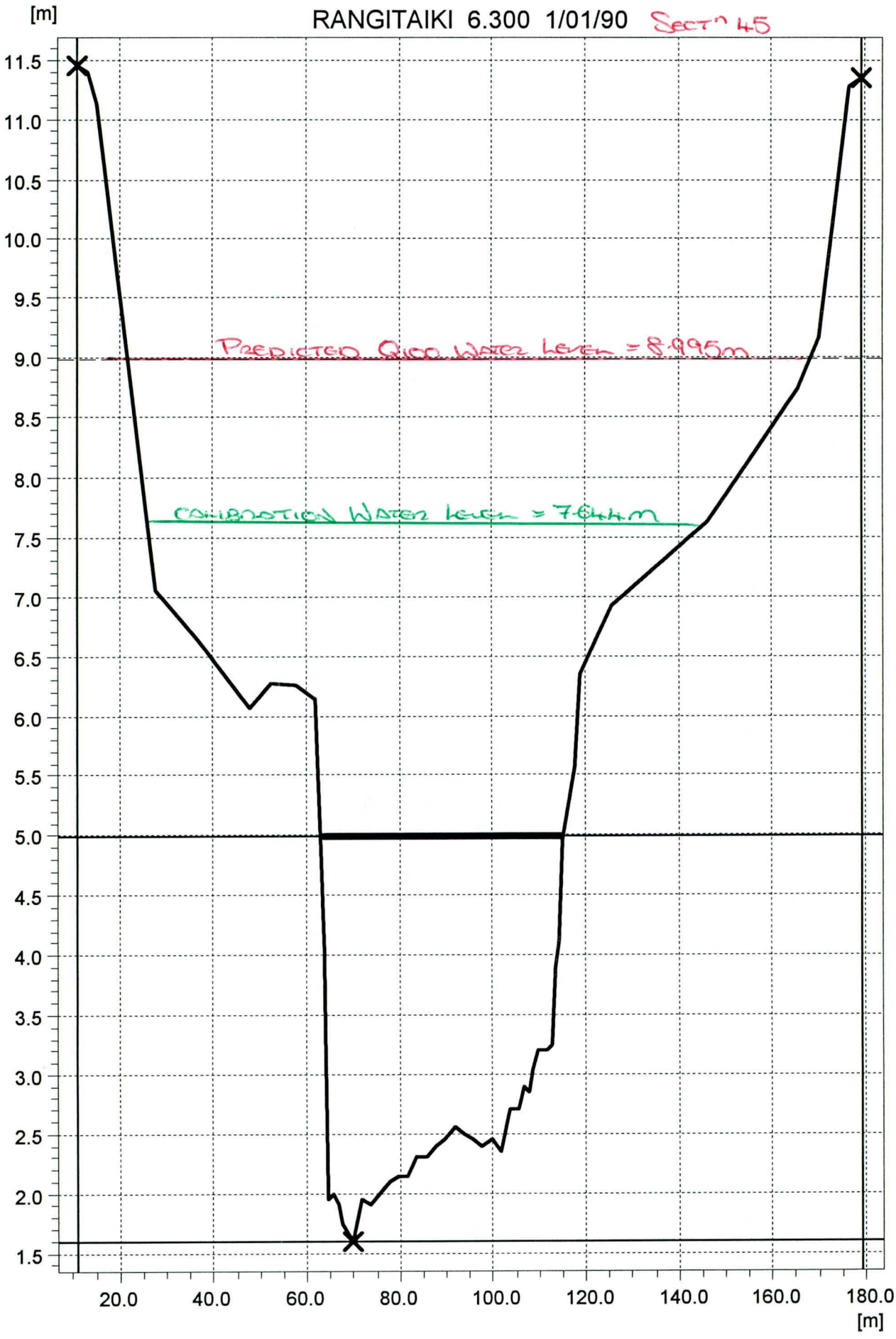

[m]
RANGITAIKI 4.470 1/01/90 Sect^ 49.
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
PREDICTED Q100 WATER LEVEL = 10.062m
OBSERVED WATER LEVEL = 8.955m
CALIBRATION WATER LEVEL = 8.728m
0.0
50.0
100.0
150.0
200.0
[m]

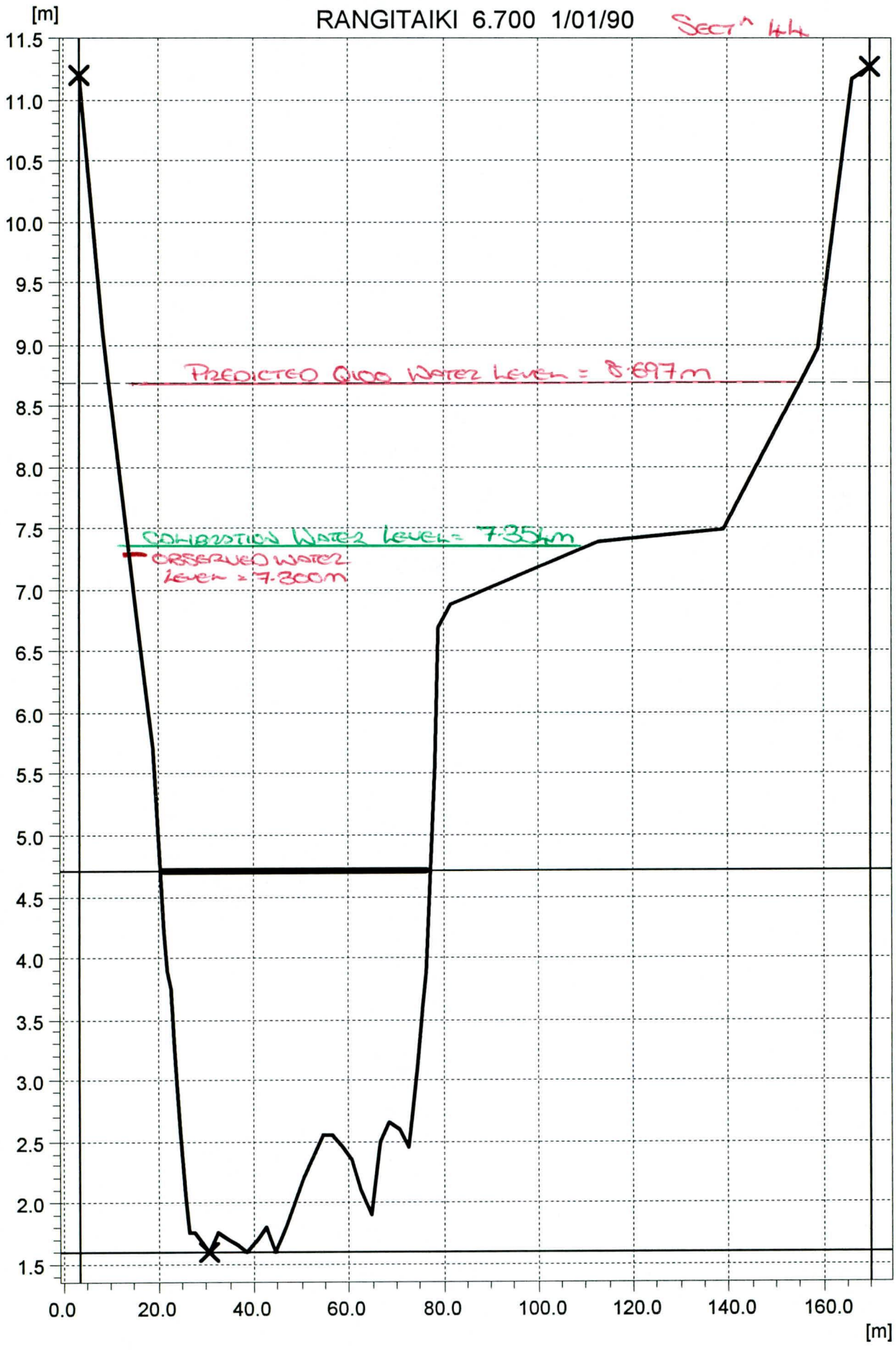

RANGITAIKI 4.990 1/01/90 Sect^n 48
[m]
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
PREDICTED Q100 WATER LEVEL = 9.708 m
CALIBRATION WATER LEVEL = 8.444 m
50.0
100.0
150.0
200.0
250.0
300.0
[m]

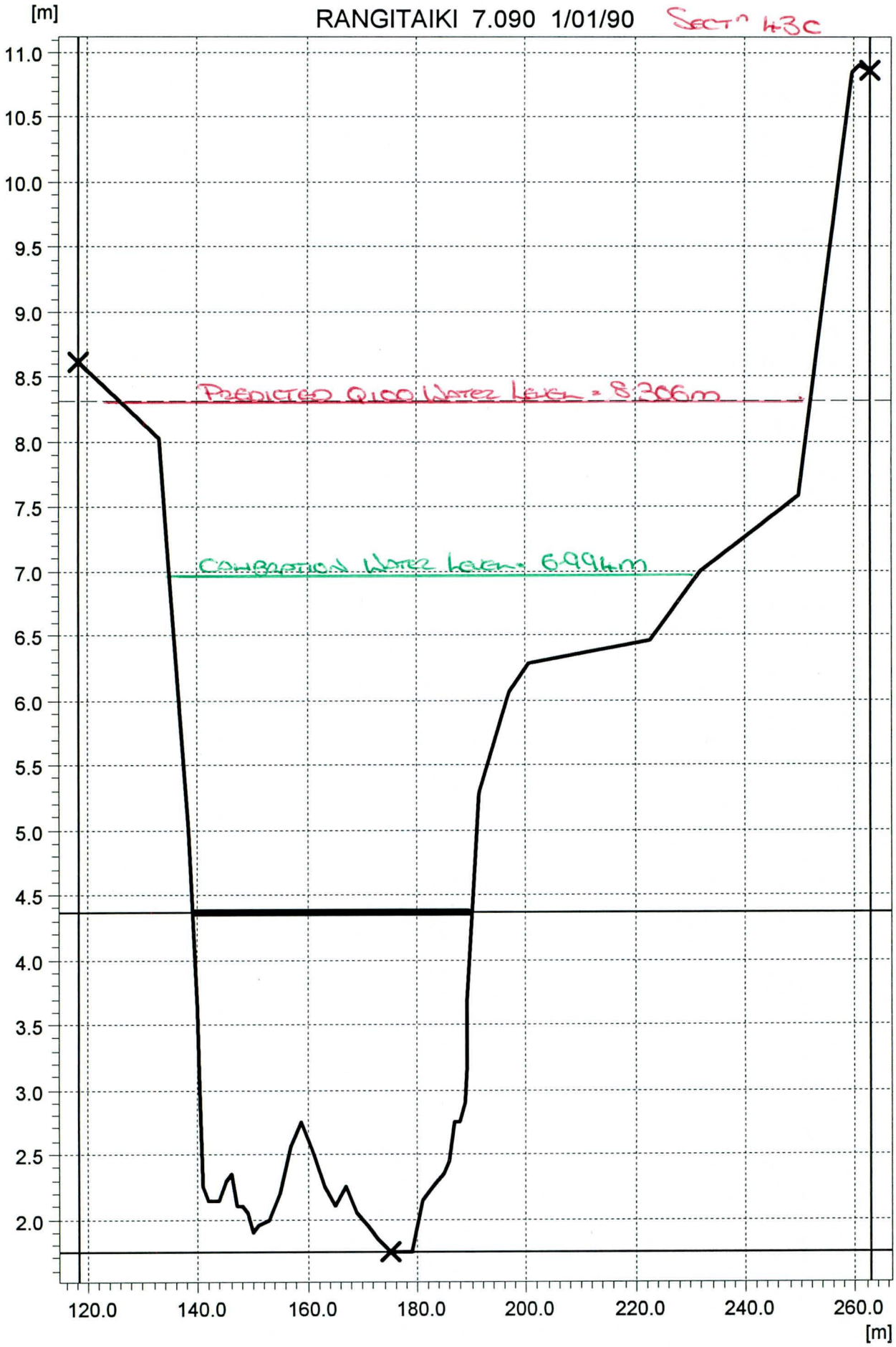

[m]
RANGITAIKI 5.210 1/01/90
Sect^ 47b
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
PREDICTED Q100 WATER LEVEL = 9.685m
CALIBRATION WATER LEVEL = 8.360m
0.0
50.0
100.0
150.0
200.0
[m]

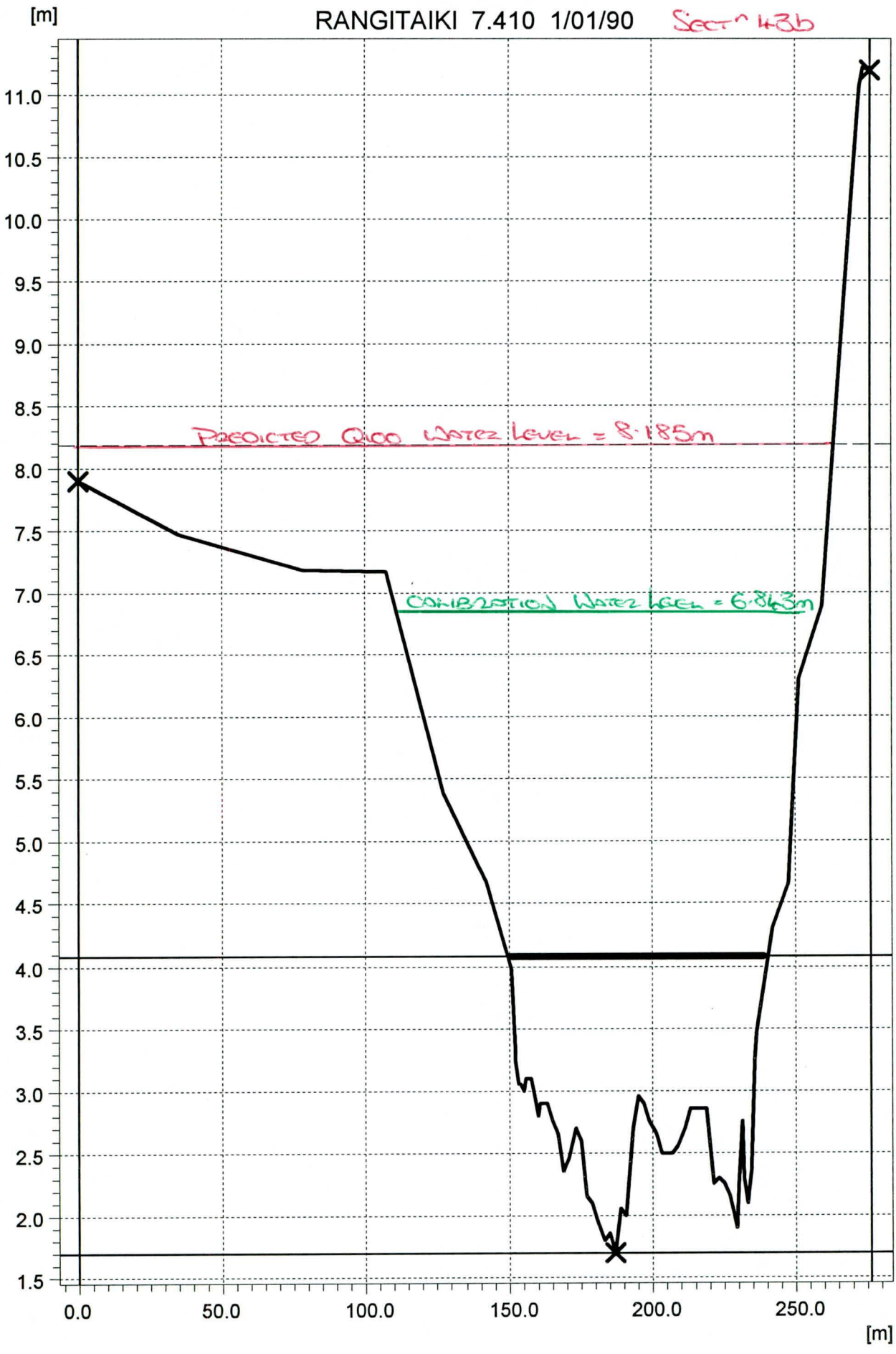

[m]
RANGITAIKI 5.430 1/01/90 Sect^n 479
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
PREDICTED Q100 WATER LEVEL - 9.575m
CONFIRMATION WATER LEVEL = 8.232m
OBSERVED WATER LEVEL = 8.200m
0.0
50.0
100.0
150.0
200.0
250.0
[m]

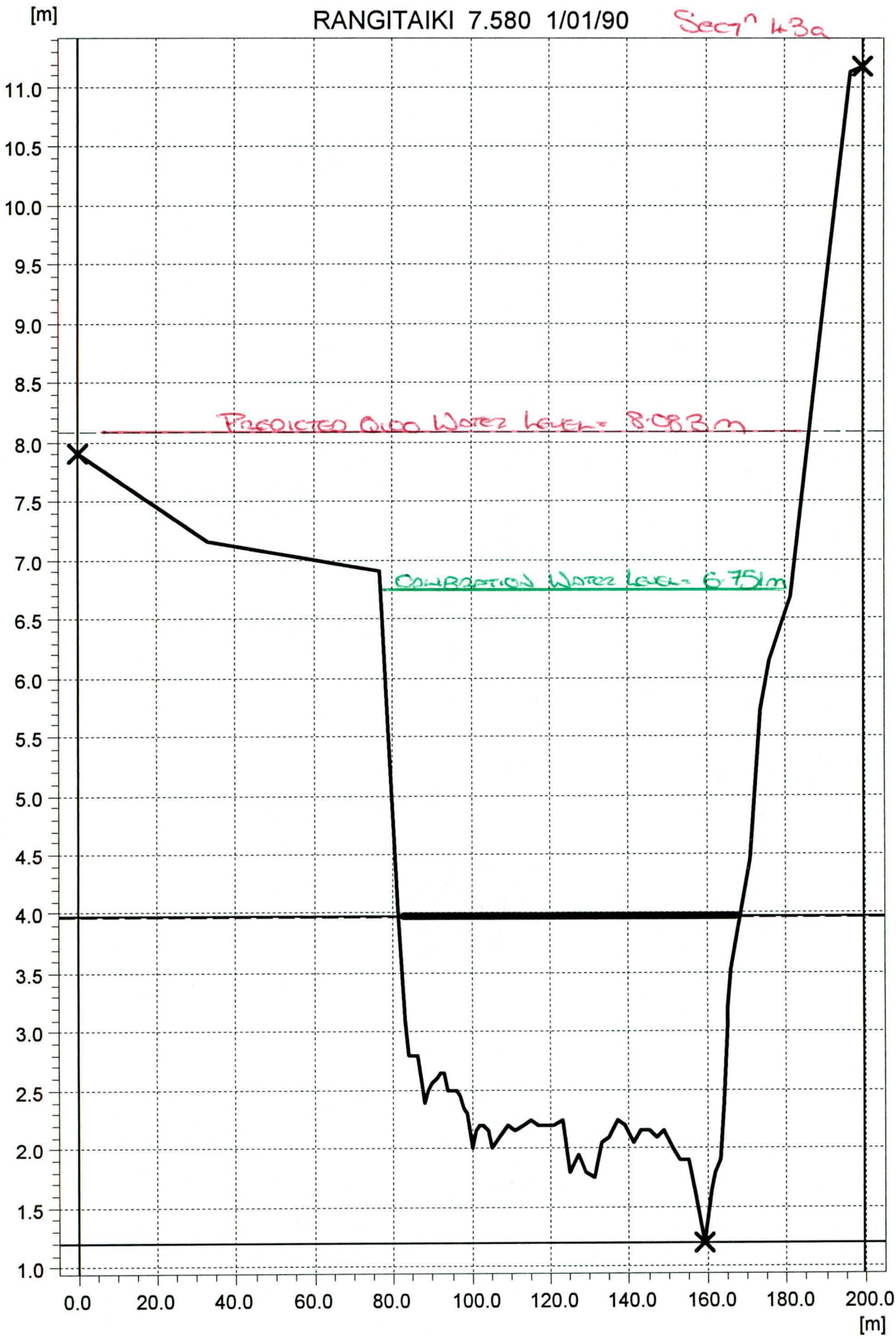

[m]
RANGITAIKI 5.940 1/01/90 Sect^n 46
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
PREDICTED Q100 WATER LEVEL = 9.238 m
CALIBRATED WATER LEVEL 7.891 m
OBSERVED WATER LEVEL = 7.78 m
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

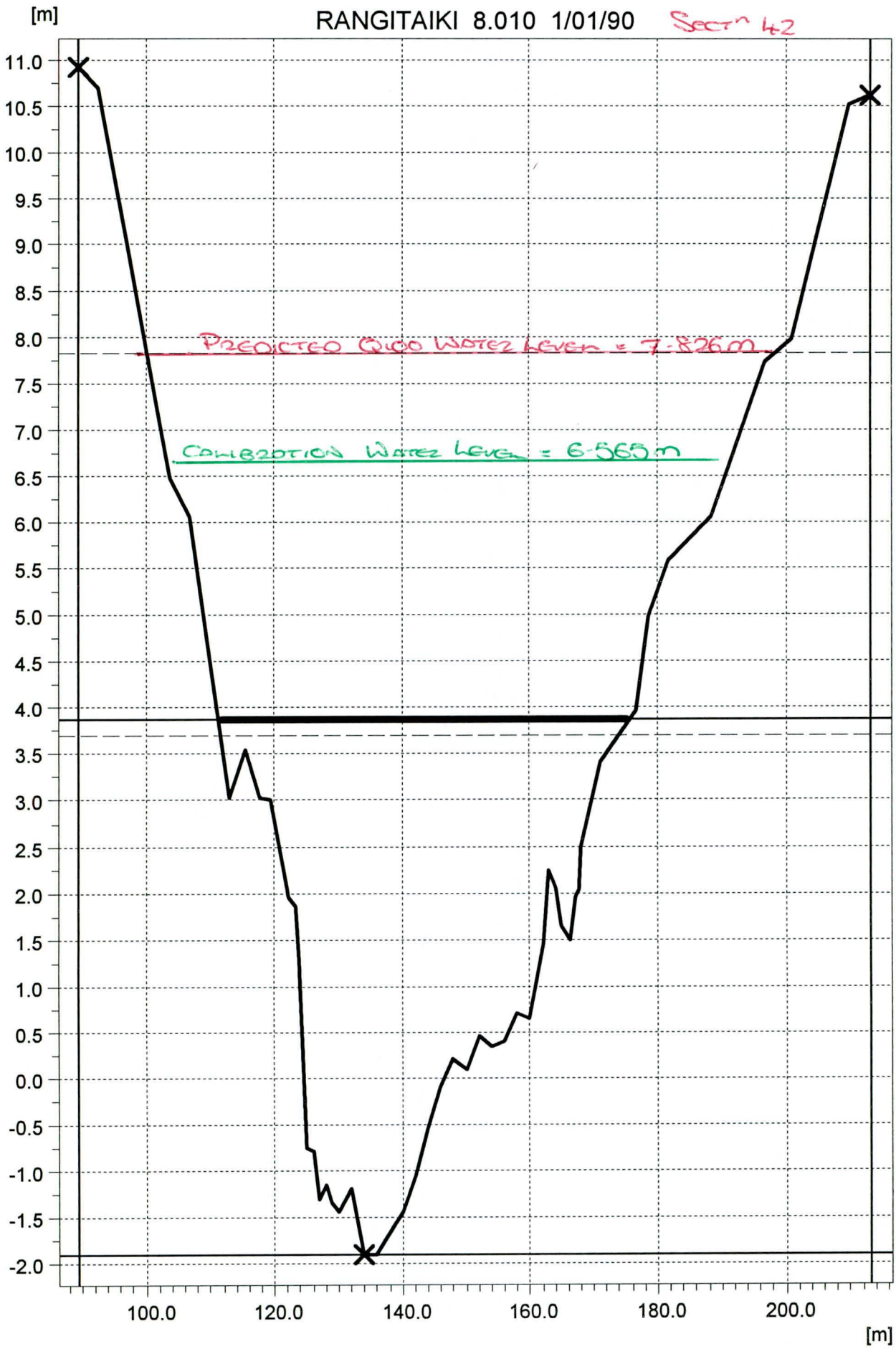

[m]
RANGITAIKI 6.300 1/01/90 Sect^n 45
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
PREDICTED Q100 WATER LEVEL = 8.995m
CALIBRATION WATER LEVEL = 7.644m
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
[m]

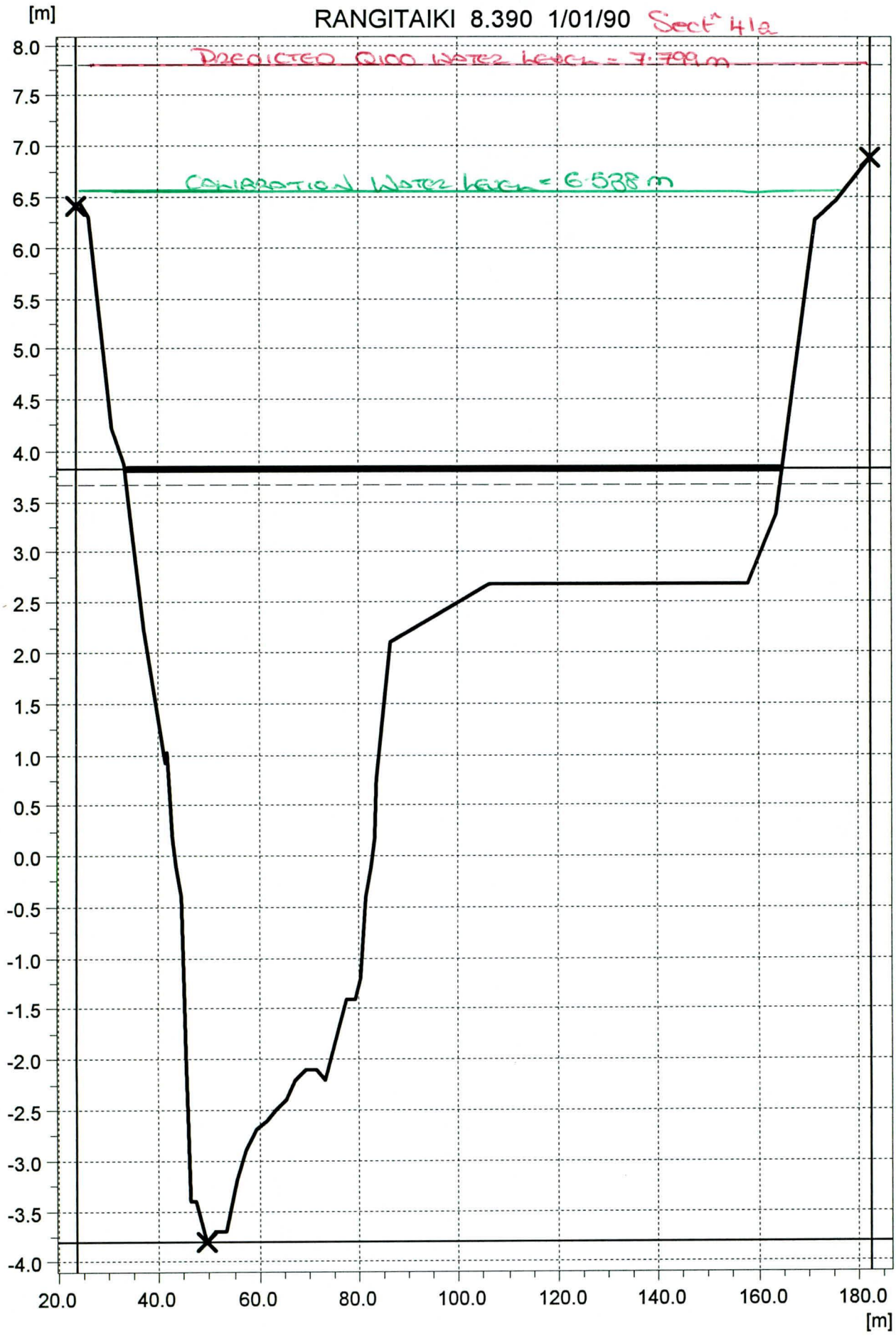

[m]
RANGITAIKI 6.700 1/01/90
Sect^ 44
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
PREDICTED QUOD WATER LEVEL = 8.697m
COMBUSTION WATER LEVEL = 7.35m
OBSERVED WATER LEVEL = 7.300m
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

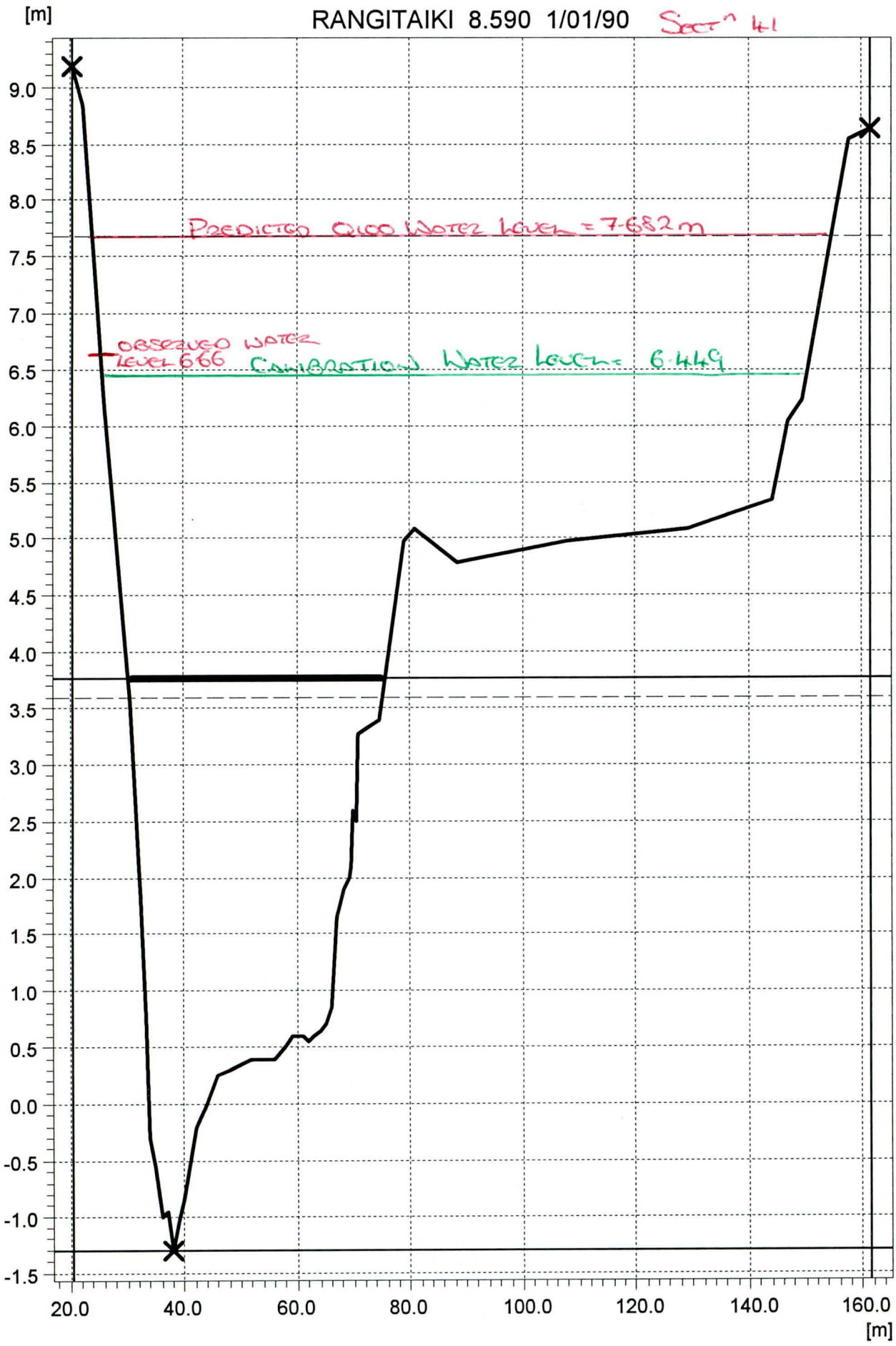

[m]
RANGITAIKI 7.090 1/01/90
Sect^ 43C
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
PREDICTED Q100 WATER LEVEL = 8.306m
CALIBRATED WATER LEVEL = 6.994m
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
[m]

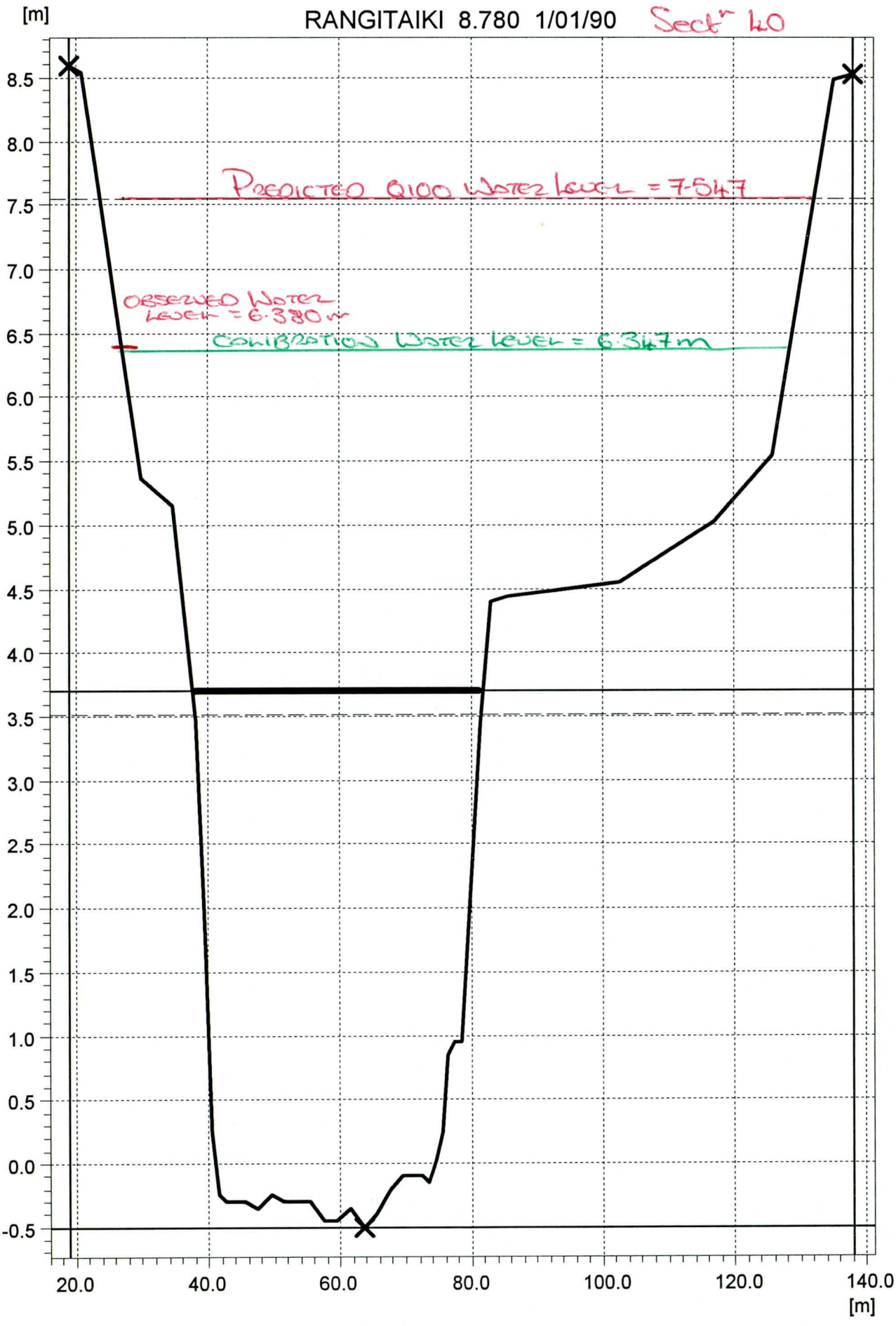

[m]
RANGITAIKI 7.410 1/01/90
Sect^ 43b
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
PREDICTED Q100 WATER LEVEL = 8.185m
CALIBRATION WATER LEVEL = 6.843m
0.0
50.0
100.0
150.0
200.0
250.0
[m]

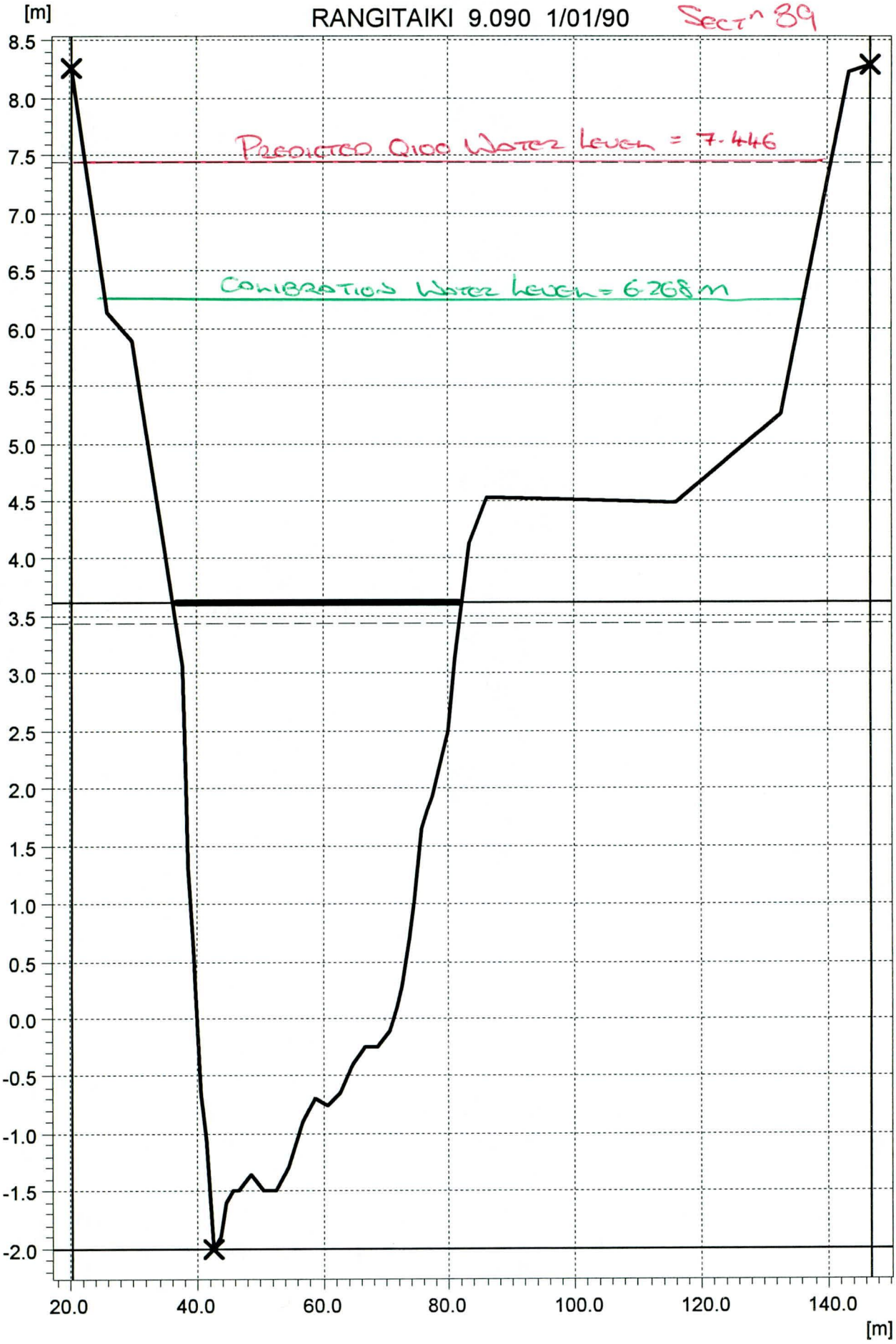

[m]
RANGITAIKI 7.580 1/01/90
Sect^ 43a
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
PREDICTED 100Q WATER LEVEL = 8.083m
CONSERVATION WATER LEVEL = 6.75m
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

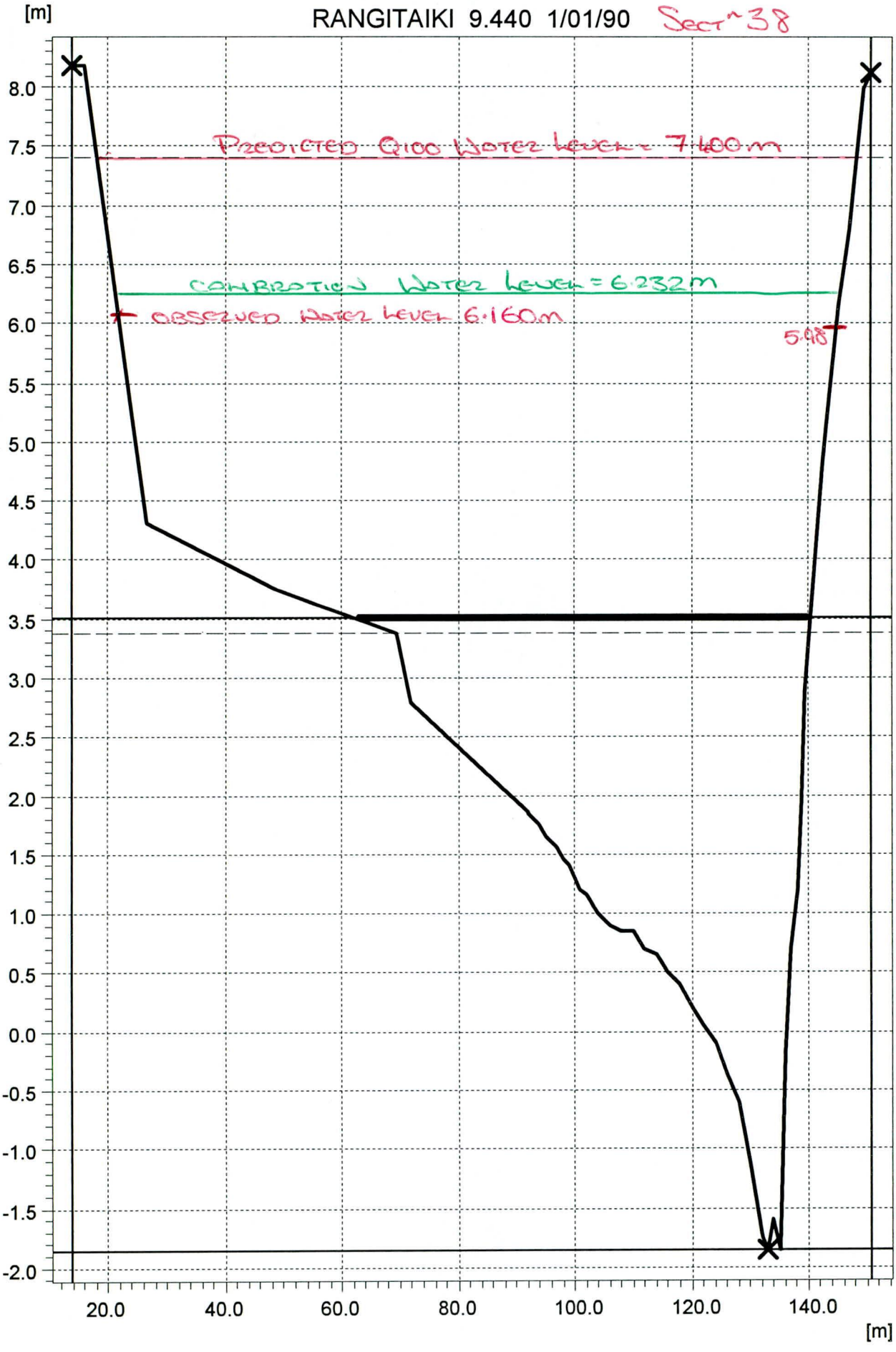

[m]
RANGITAIKI 8.010 1/01/90
Sect^n 42
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
PREDICTED Q100 WATER LEVEL = 7.826 m
CALIBRATION WATER LEVEL = 6.565 m
100.0
120.0
140.0
160.0
180.0
200.0
[m]

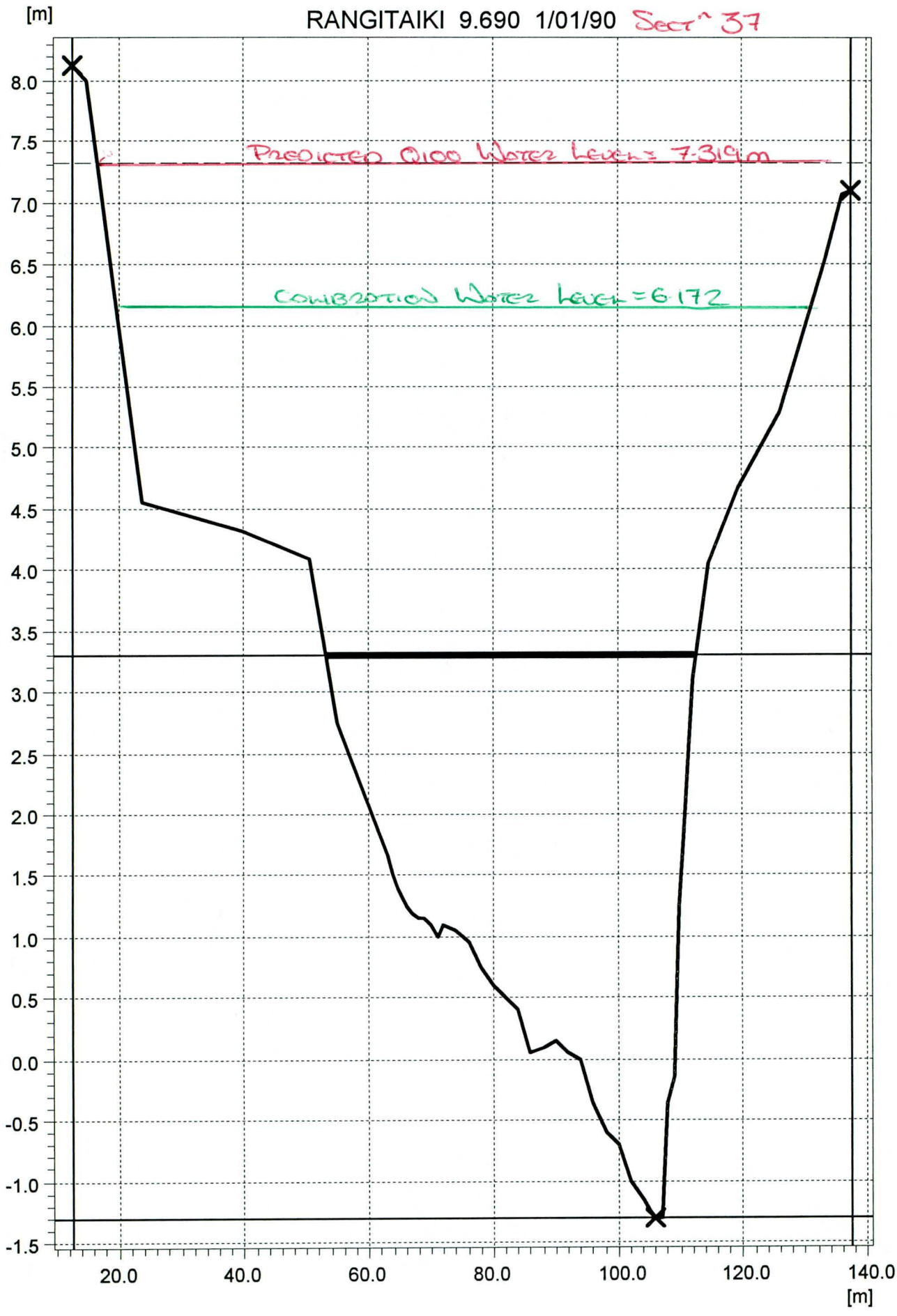

[m]
RANGITAIKI 8.390 1/01/90 Sect 41a
PREDICTED Q100 WATER LEVEL = 7.799 m
CALIBRATION WATER LEVEL = 6.538 m
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
[m]

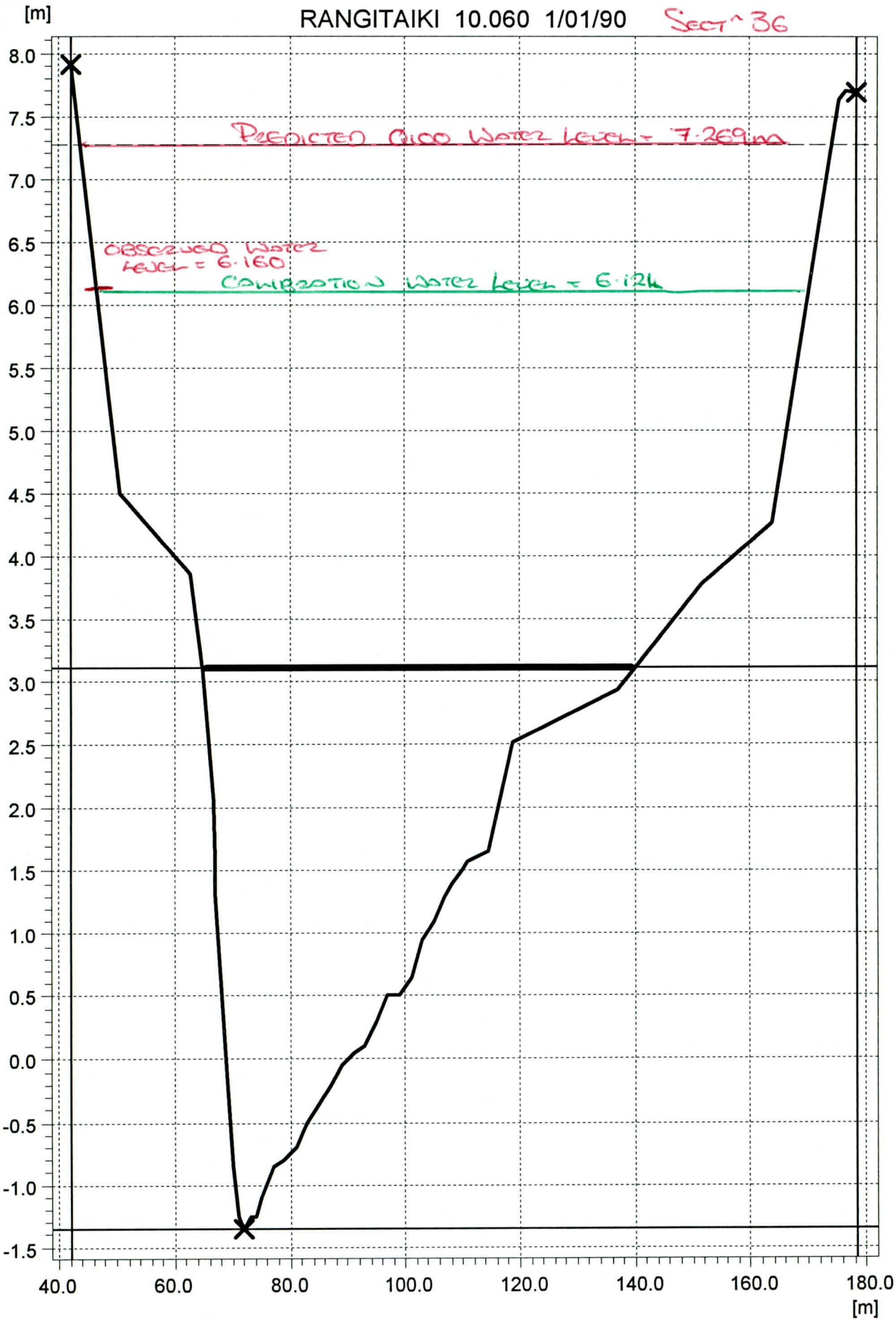

[m]
RANGITAIKI 8.590 1/01/90 Sect^ 41
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
PREDICTED 0100 WATER LEVEL = 7.682 m
OBSERVED WATER LEVEL 666
CALIBRATION WATER LEVEL = 6.449
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]


[m]
RANGITAIKI 8.780 1/01/90
Sect^n 40
PREDICTED Q100 WATER LEVEL = 7.547
OBSERVED WATER LEVEL = 6.380 m
CALIBRATION WATER LEVEL = 6.347m
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
20.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]

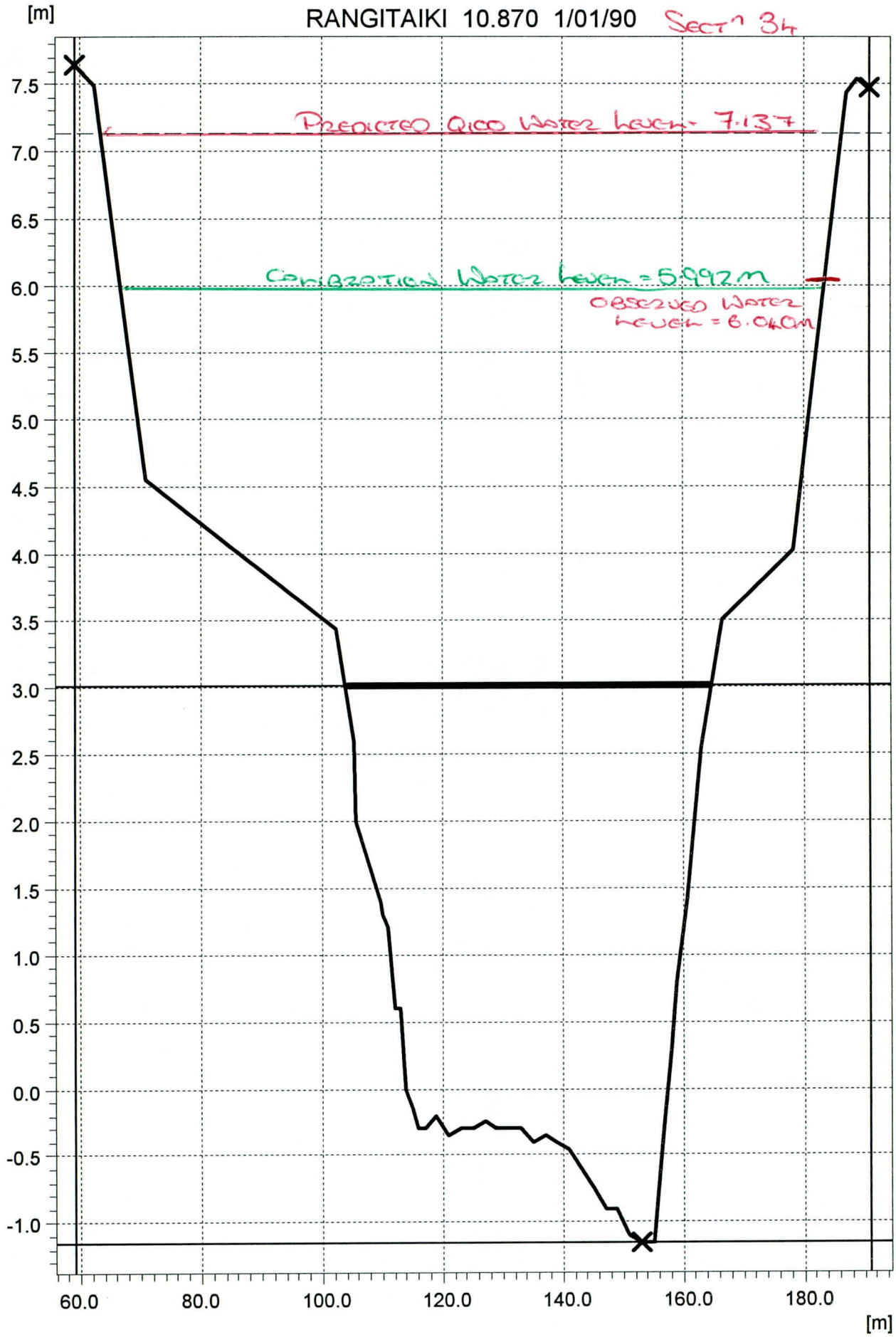

[m]
RANGITAIKI 9.090 1/01/90
Sect^ 39
PREDICTED Q100 WATER LEVEL = 7.446
CALIBRATION WATER LEVEL = 6.268 m
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]

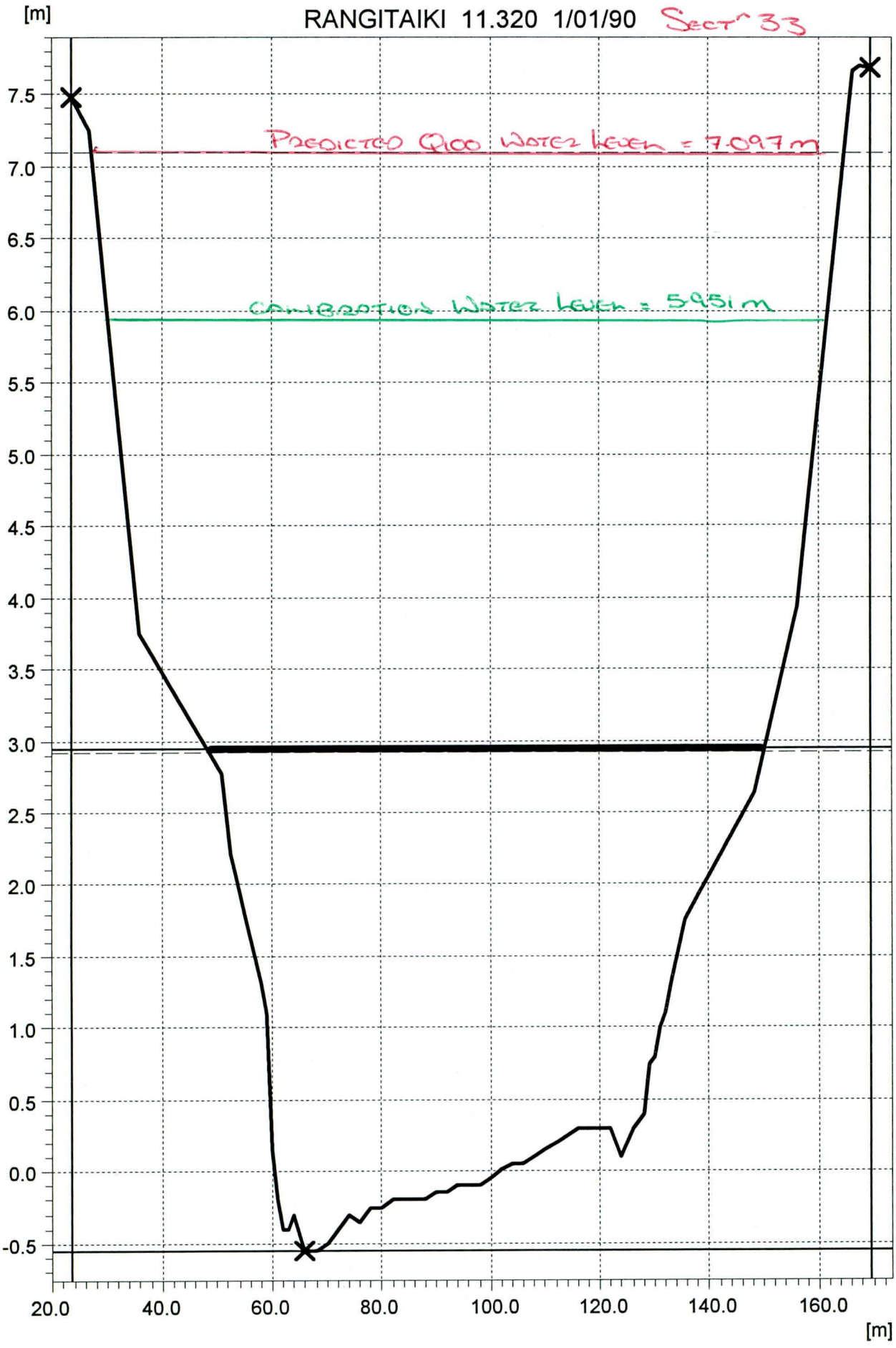

[m]
RANGITAIKI 9.440 1/01/90
Sect^38
PREDICTED Q100 WATER LEVEL = 7.400m
CALIBRATION WATER LEVEL = 6.232m
OBSERVED WATER LEVEL 6.160m
5.98
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]


[m]
RANGITAIKI 9.690 1/01/90 Sect^ 37
PREDICTED Q100 WATER LEVEL = 7.319m
COMBZOTION WATER LEVEL = 6.172
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
20.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]

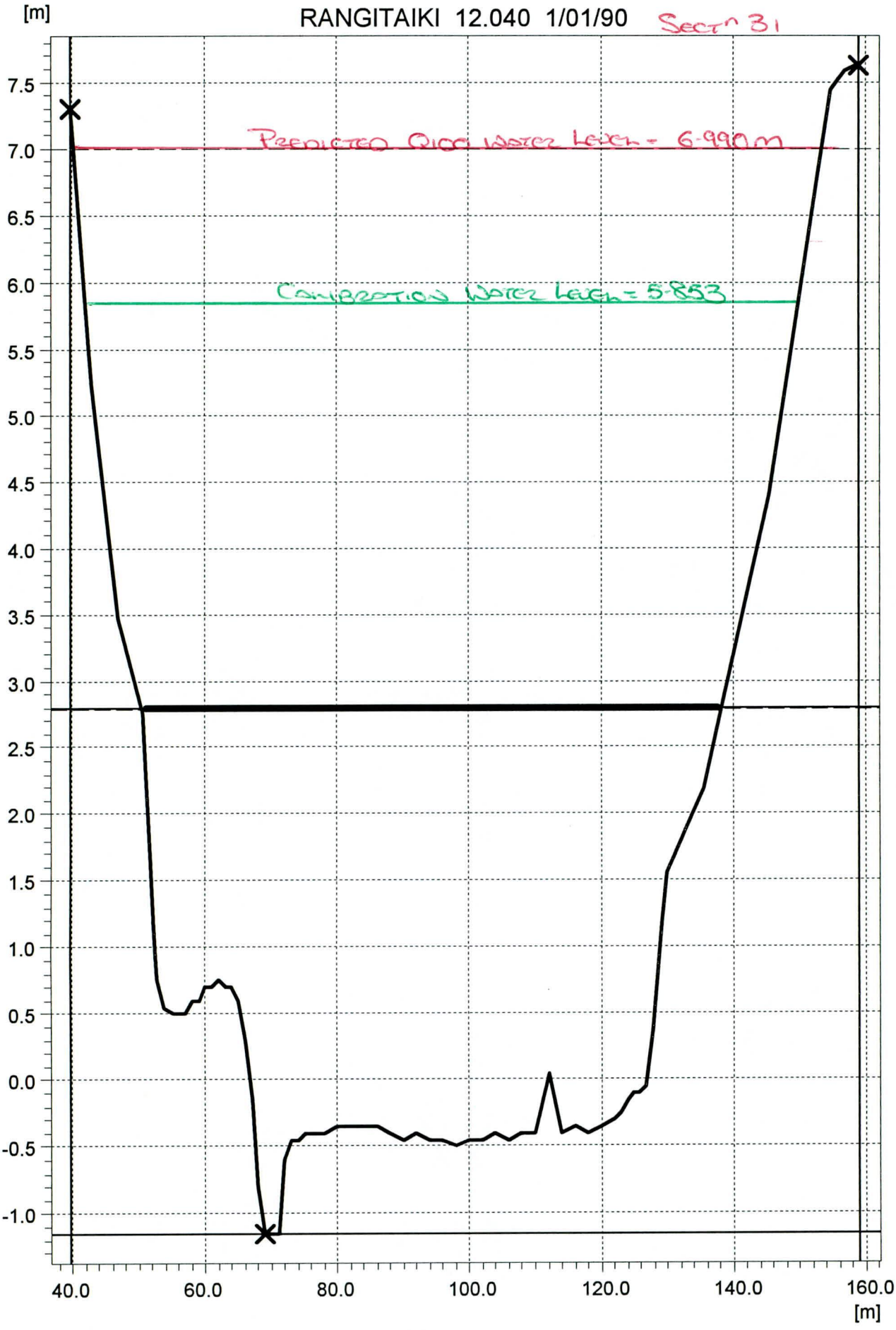

[m]
RANGITAIKI 10.060 1/01/90
Sect^ 36
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
PREDICTED CALCO WATER LEVEL = 7.269m
OBSERVED WATER LEVEL = 6.160
CALIBRATION WATER LEVEL = 6.12k
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
[m]

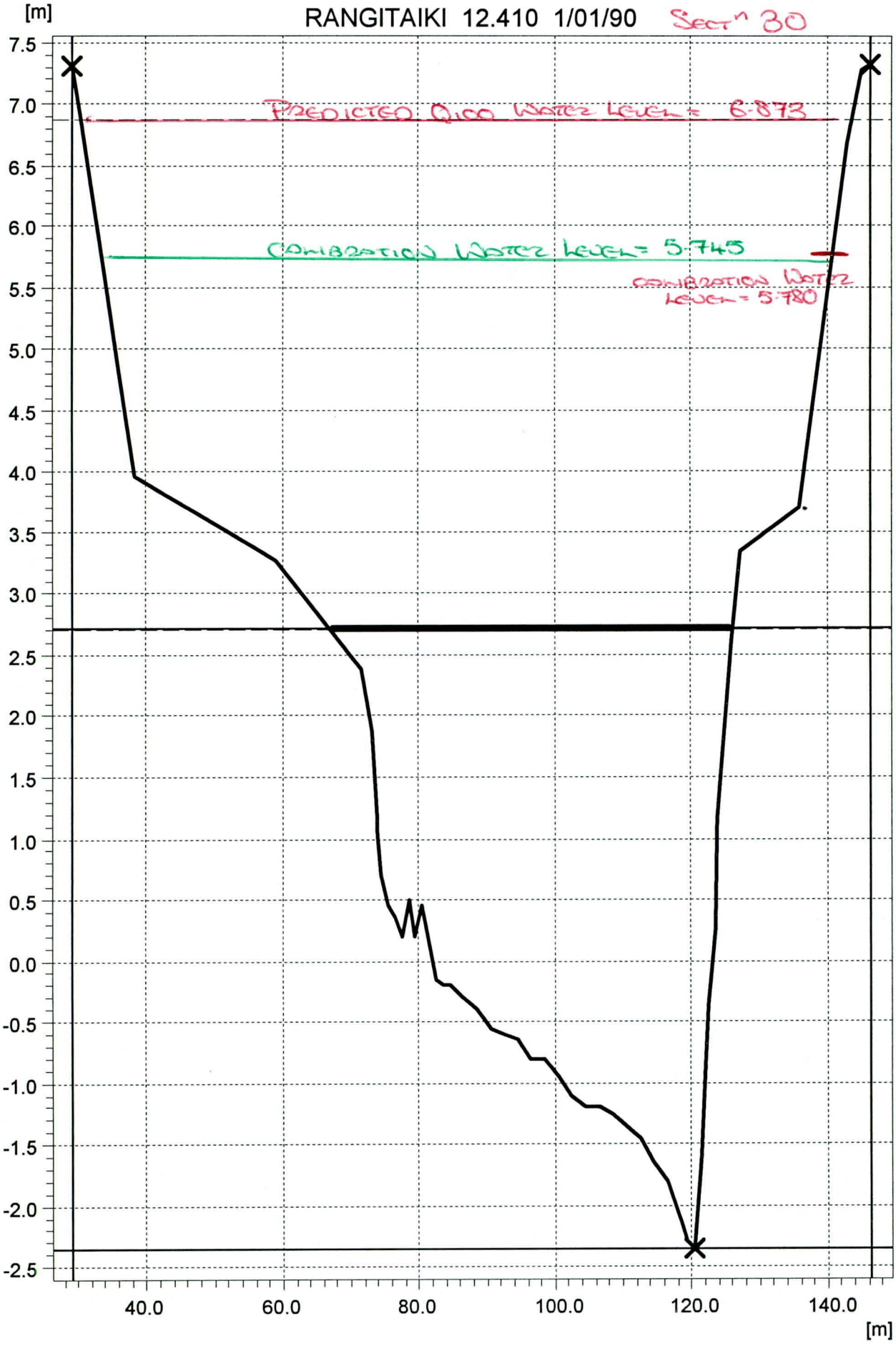

[m]
RANGITAIKI 10.470 1/01/90
Sect^ 35
PREDICTED Q100 WATER LEVEL = 7.187m
CALIBRATION WATER LEVEL = 6.044m
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

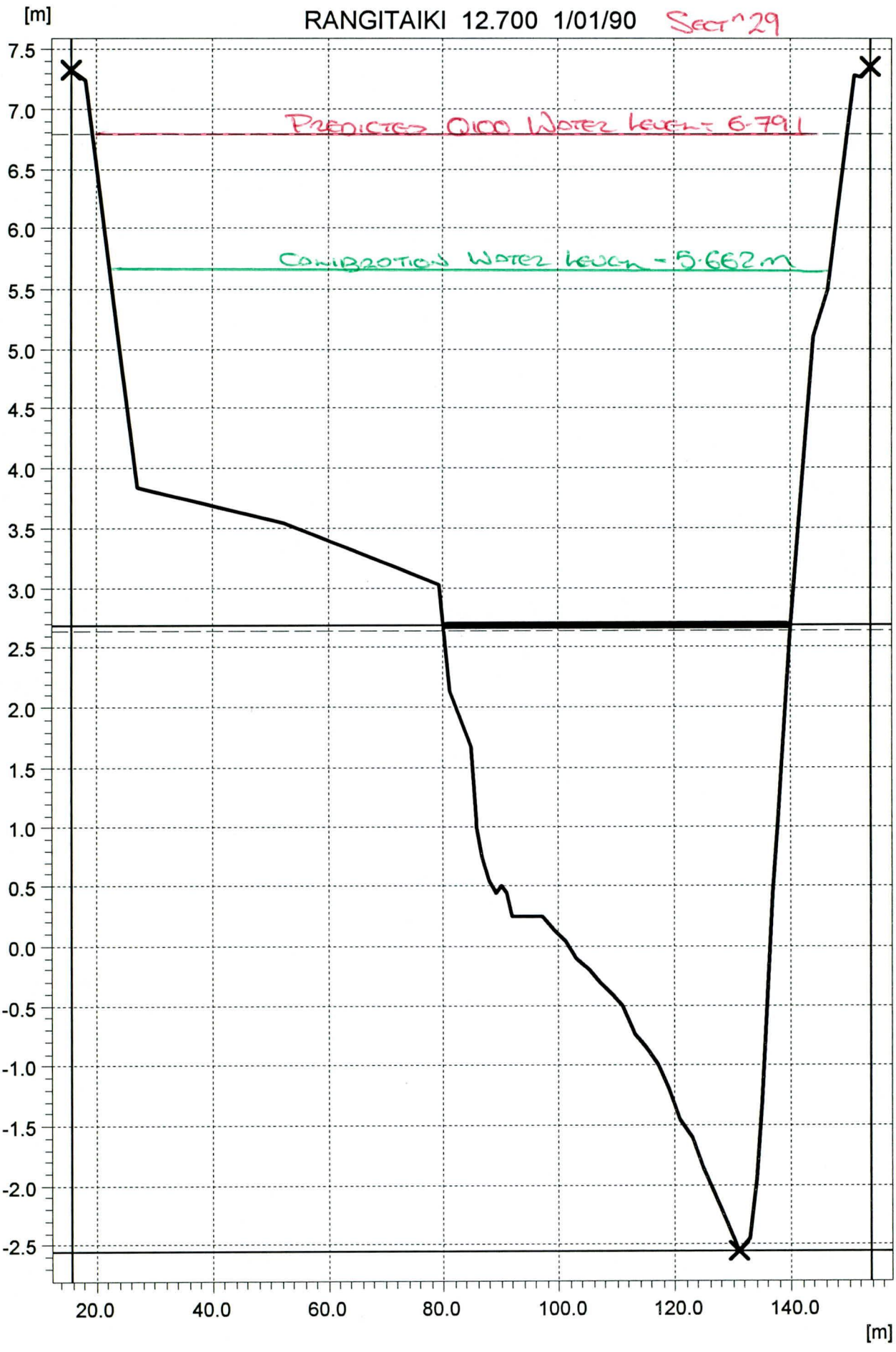

[m]
RANGITAIKI 10.870 1/01/90 Sect^n 34
PREDICTED QIGD WATER LEVEL = 7.137
CALIBRATION WATER LEVEL = 5.992m
OBSERVED WATER LEVEL = 6.04m
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
[m]

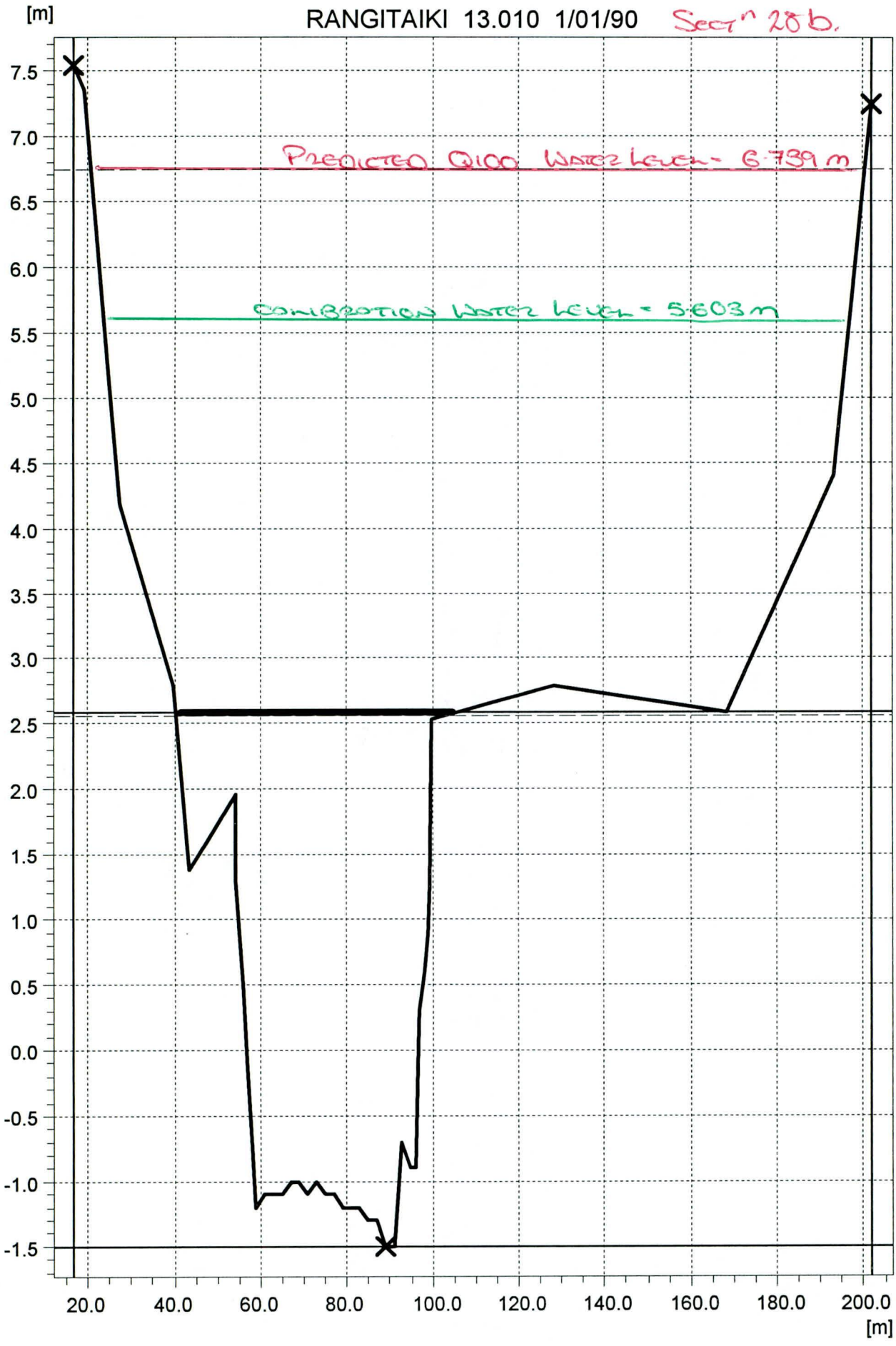

[m]
RANGITAIKI 11.320 1/01/90 Sect^ 33
Predicted Q100 Water Level = 7.097 m
Calibration Water Level = 5.951 m
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

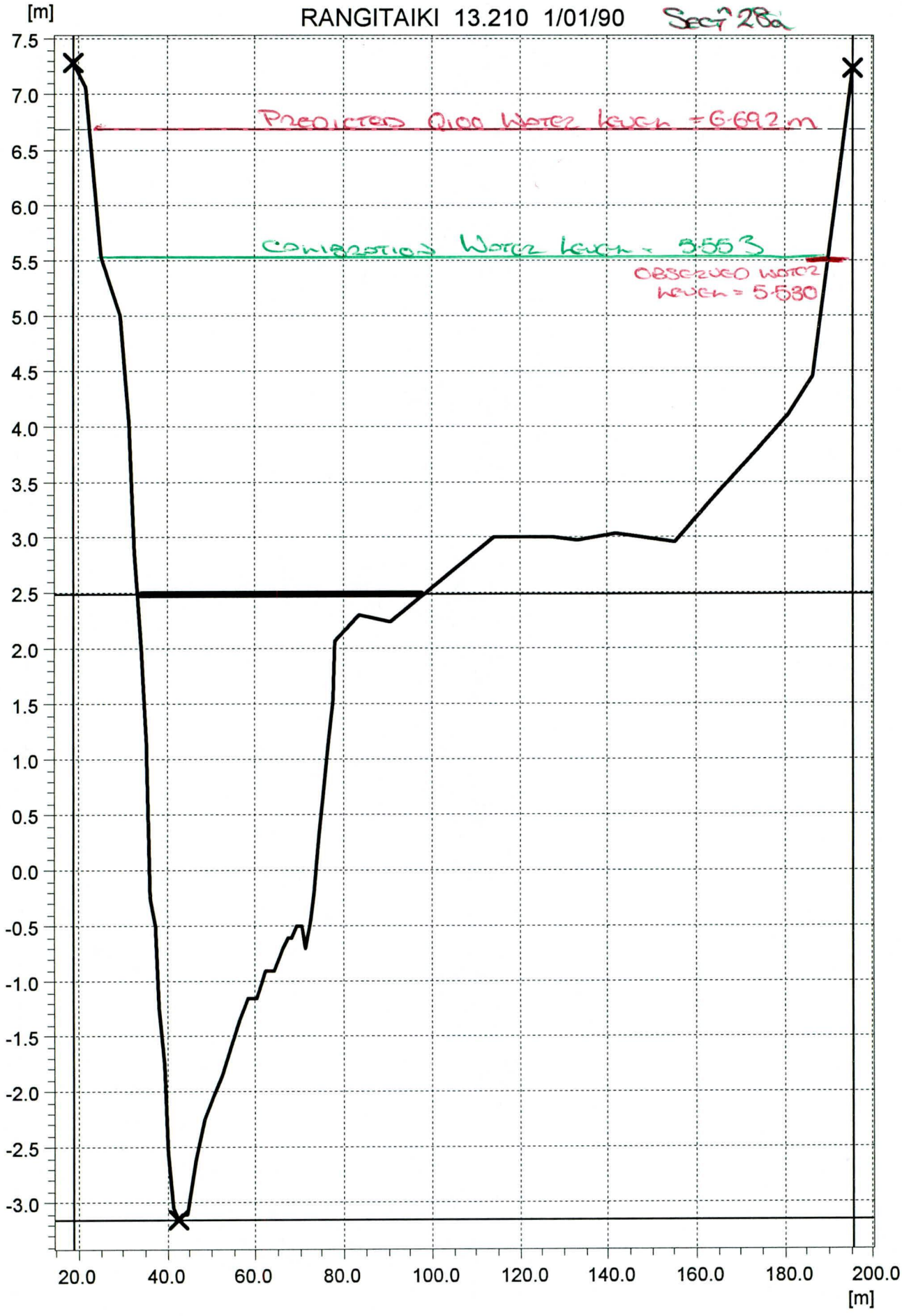

[m]
RANGITAIKI 11.690 1/01/90
SECT^ 32
PREDICTED Q100 WATER LEVEL = 7.070m
OBSERVED WATER LEVEL = 6.000
CALIBRATION WATER LEVEL = 5.922
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
[m]

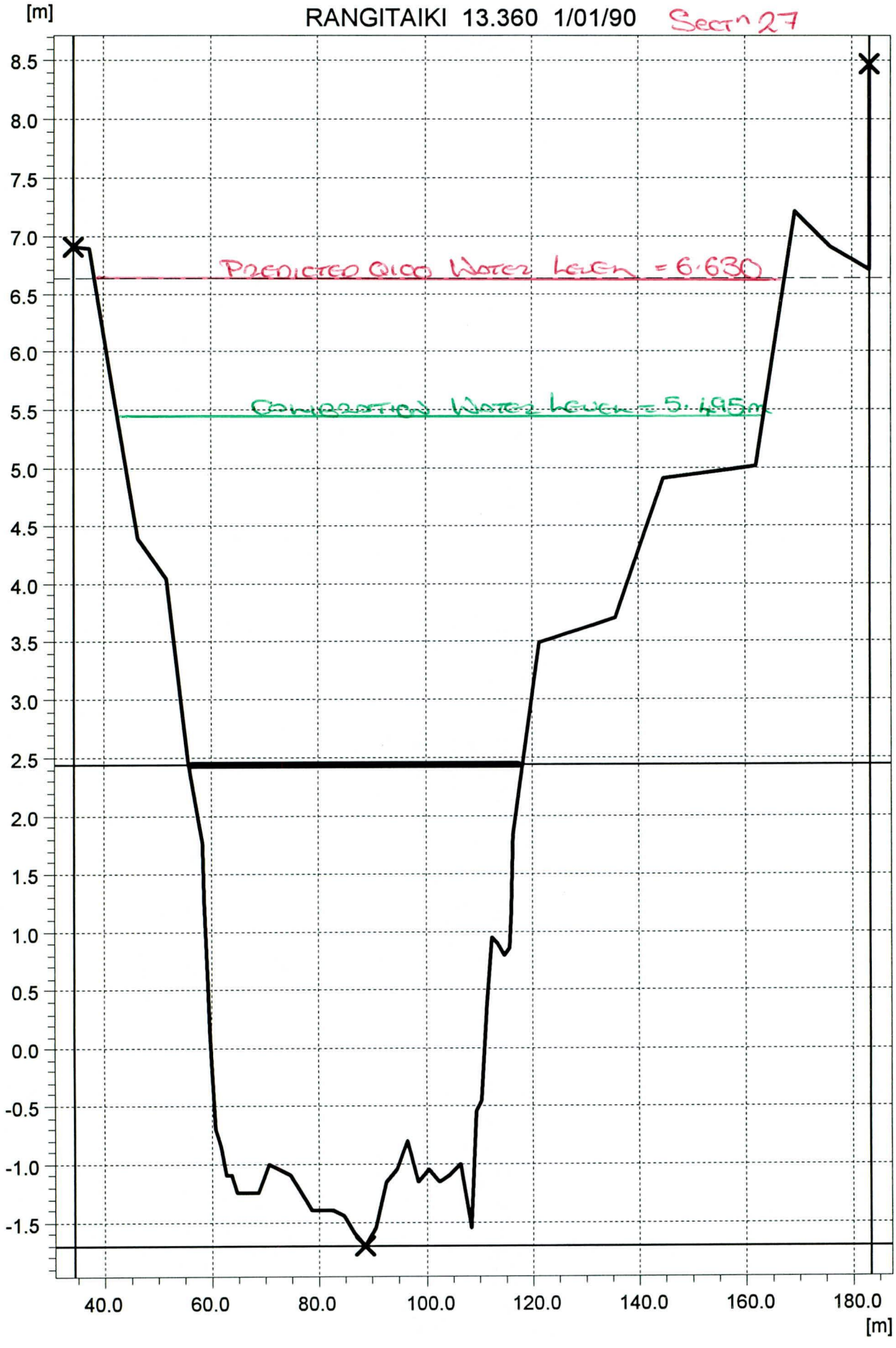

[m]
RANGITAIKI 12.040 1/01/90
Sect^ 31
PREDICTED 100 YEAR FLOOD WATER LEVEL = 6.990 m
CALIBRATION WATER LEVEL = 5.853
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

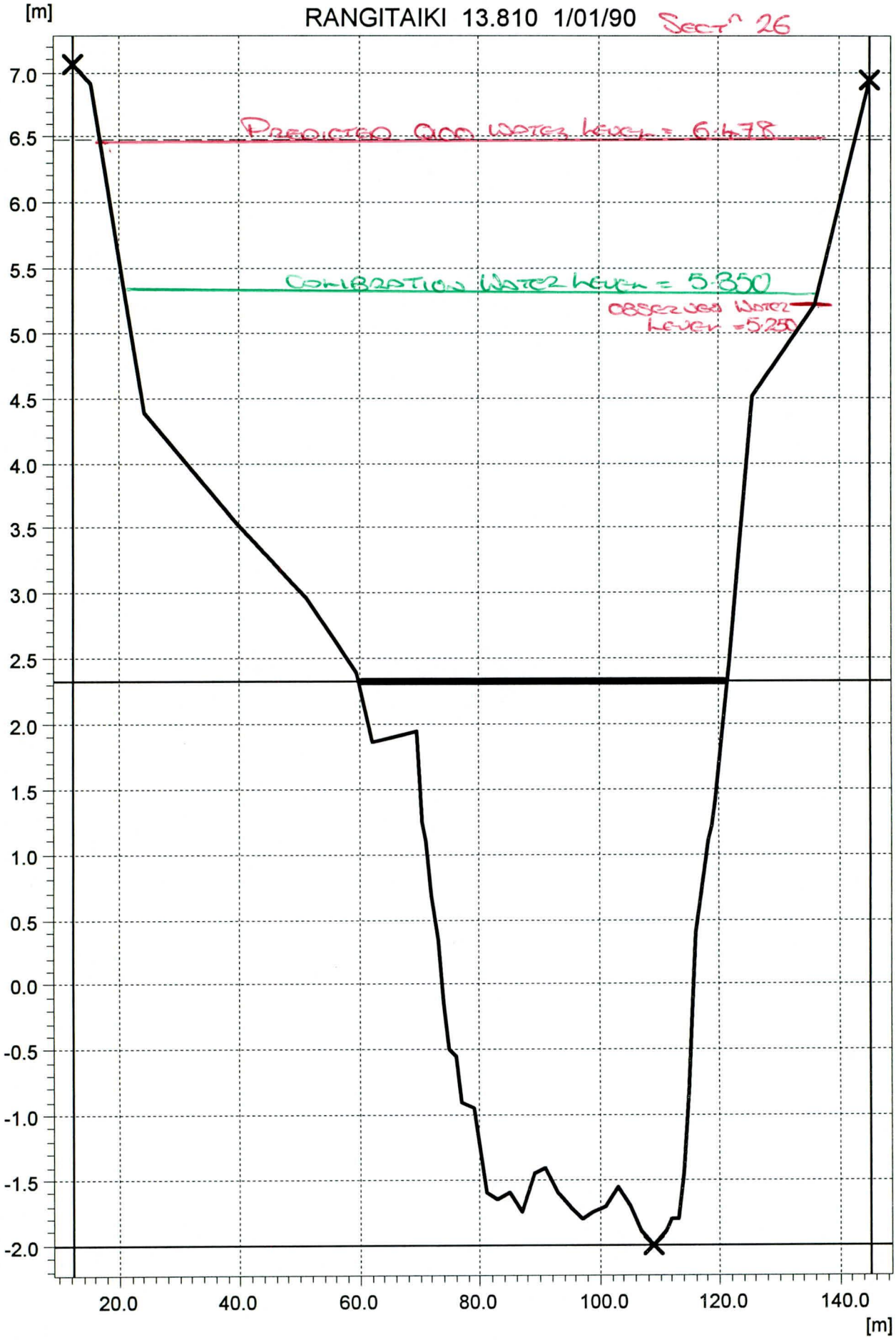

[m]
RANGITAIKI 12.410 1/01/90
Sectn 30
PREDICTED QUICK WATER LEVEL = 6.873
CALIBRATION WATER LEVEL = 5.745
CALIBRATION WATER LEVEL = 5.780
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
40.0
60.0
80.0
100.0
120.0
140.0
[m]

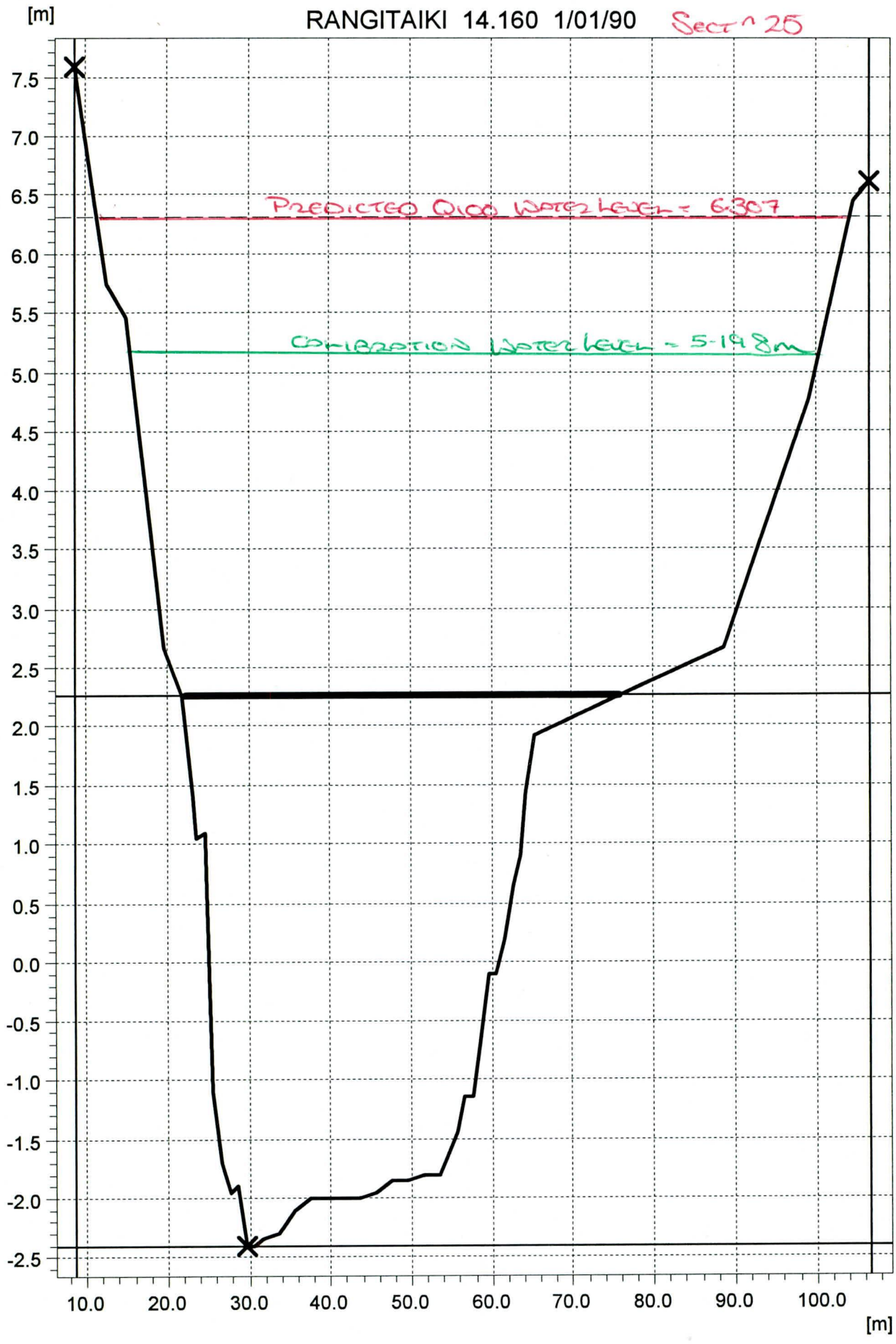

[m]
RANGITAIKI 12.700 1/01/90
Sect^29
PREDICTED Q100 WATER LEVEL = 6.79 L
CALIBRATION WATER LEVEL = 5.662 m
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
20.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]

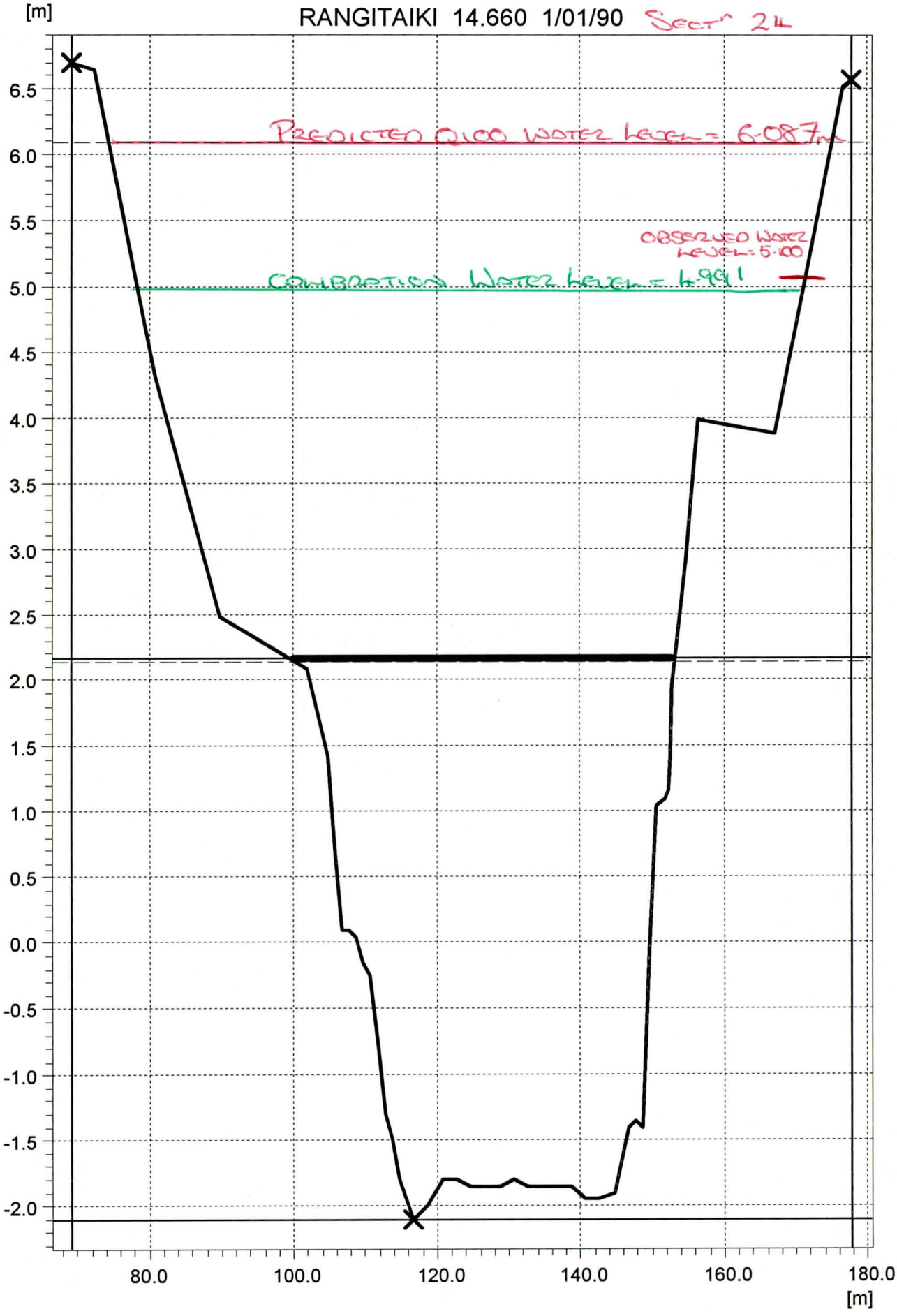

[m]
RANGITAIKI 13.010 1/01/90
Sect^n 28b.
PREDICTED Q100 WATER LEVEL = 6.739 m
CONSENTED WATER LEVEL = 5.603 m
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

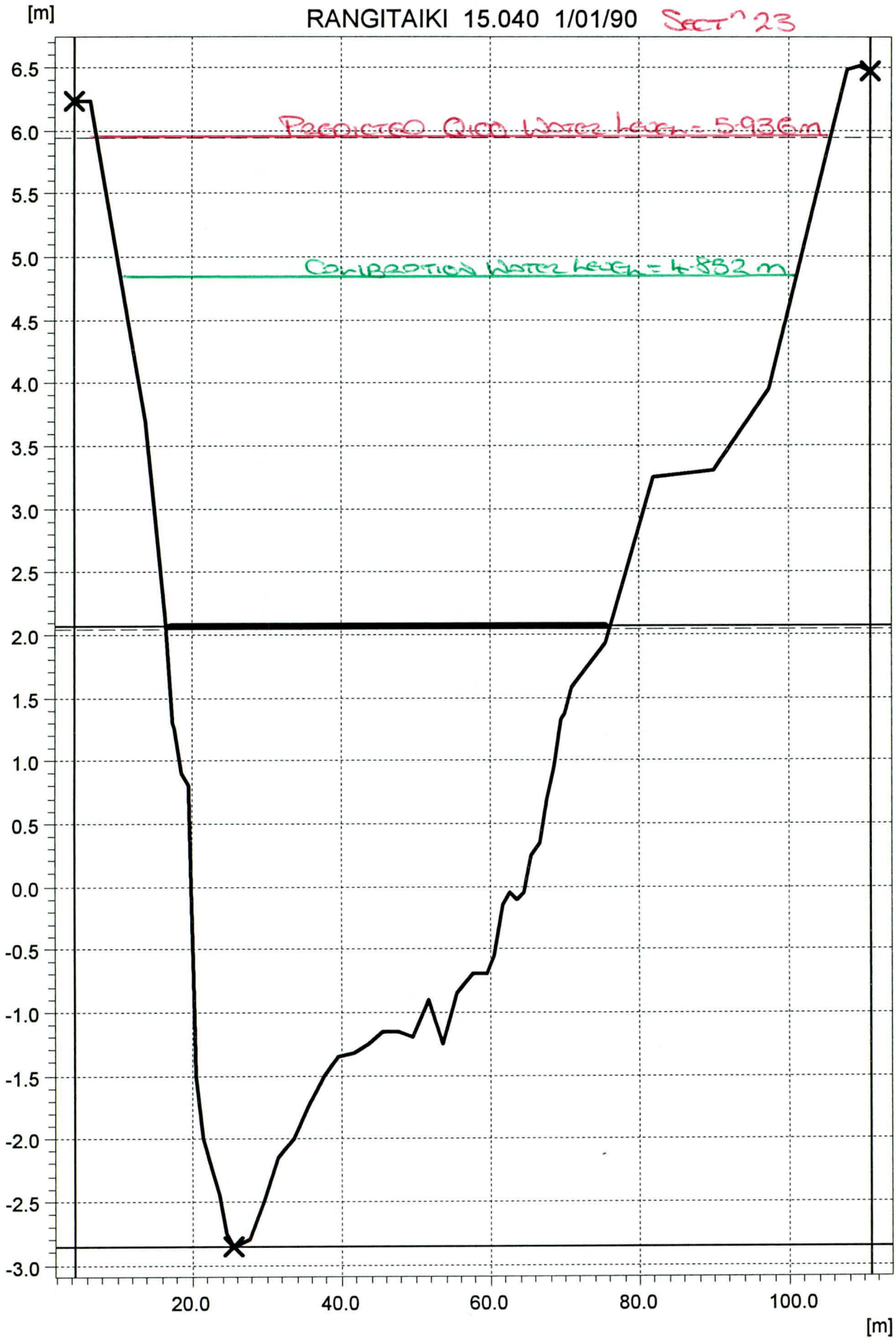

[m]
RANGITAIKI 13.210 1/01/90
Sect 28a
PREDICTED Q100 WATER LEVEL = 6.692 m
CALIBRATION WATER LEVEL = 5.553
OBSERVED WATER LEVEL = 5.530
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

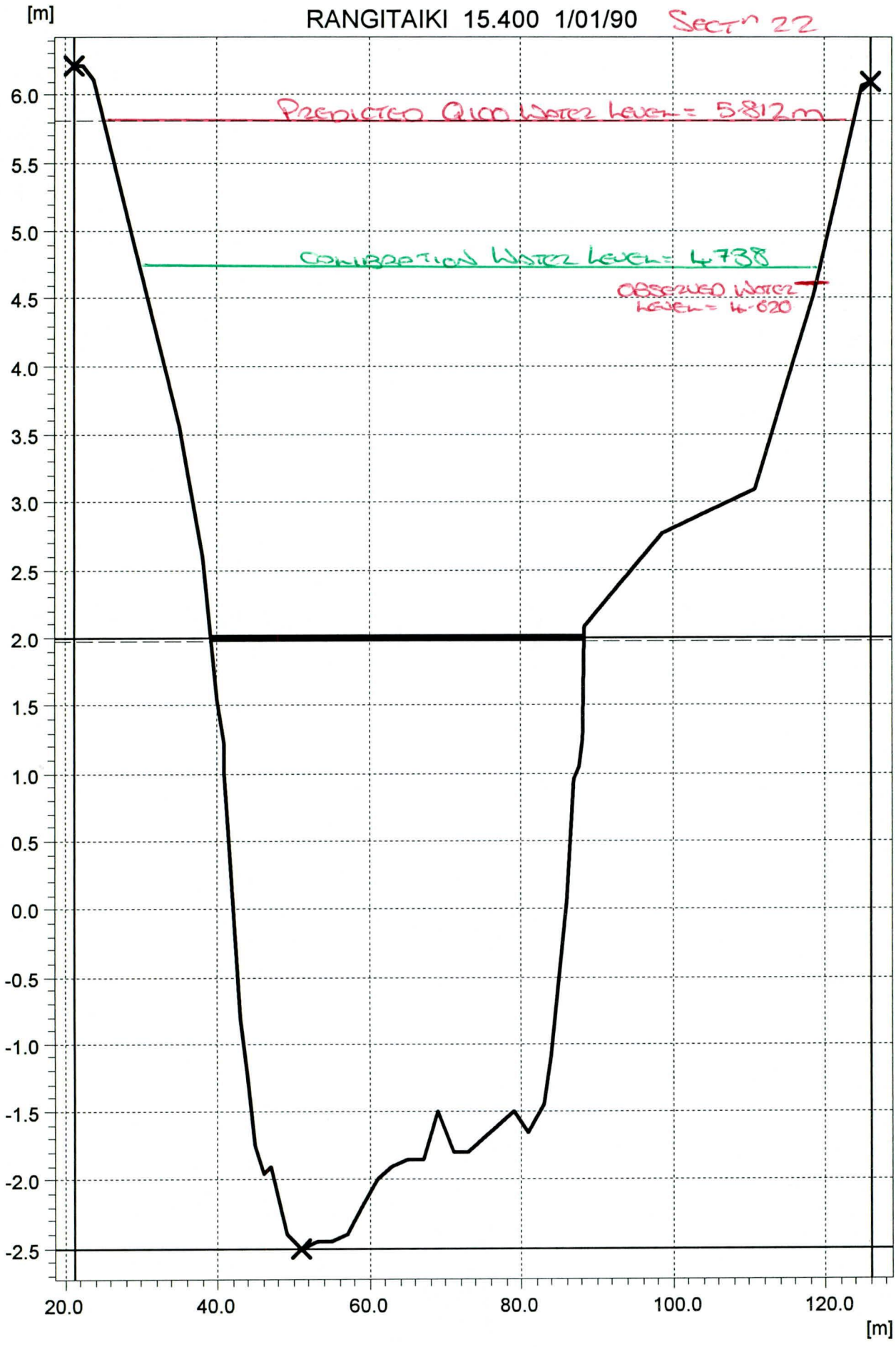

[m]
RANGITAIKI 13.360 1/01/90
Sectn 27
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
PREDICTED QIOO WATER LEVEL = 6.630
CONSTRUCTION WATER LEVEL = 5.495m
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
[m]

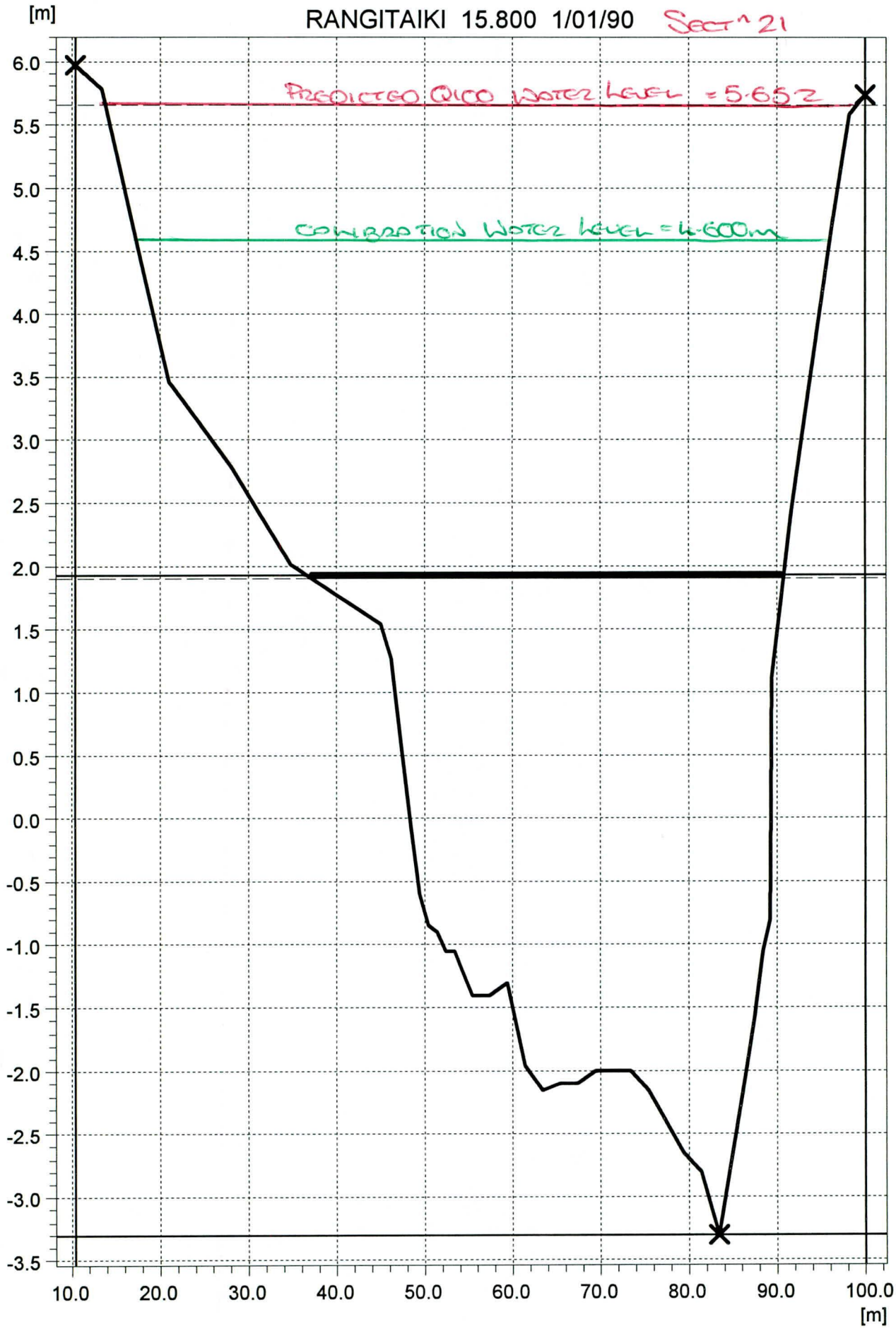

[m]
RANGITAIKI 13.810 1/01/90 Sect^ 26
PREDICTED Q100 WATER LEVEL = 6.478
CALIBRATION WATER LEVEL = 5.350
OBSERVED WATER LEVEL = 5.250
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]

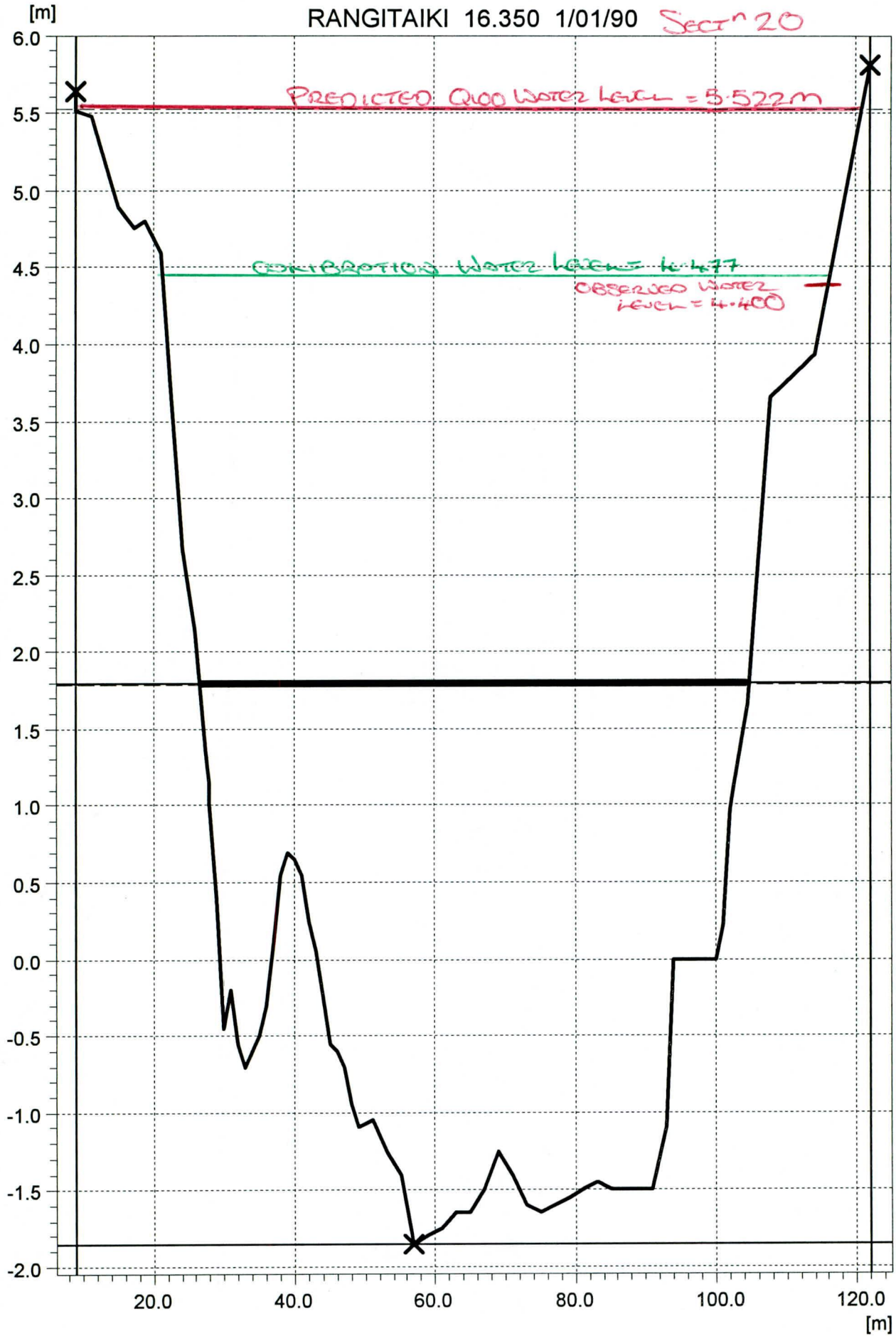

[m]
RANGITAIKI 14.160 1/01/90
Sect^ 25
PREDICTED Q100 WATER LEVEL = 6.307
CALIBRATION WATER LEVEL = 5.198m
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
[m]

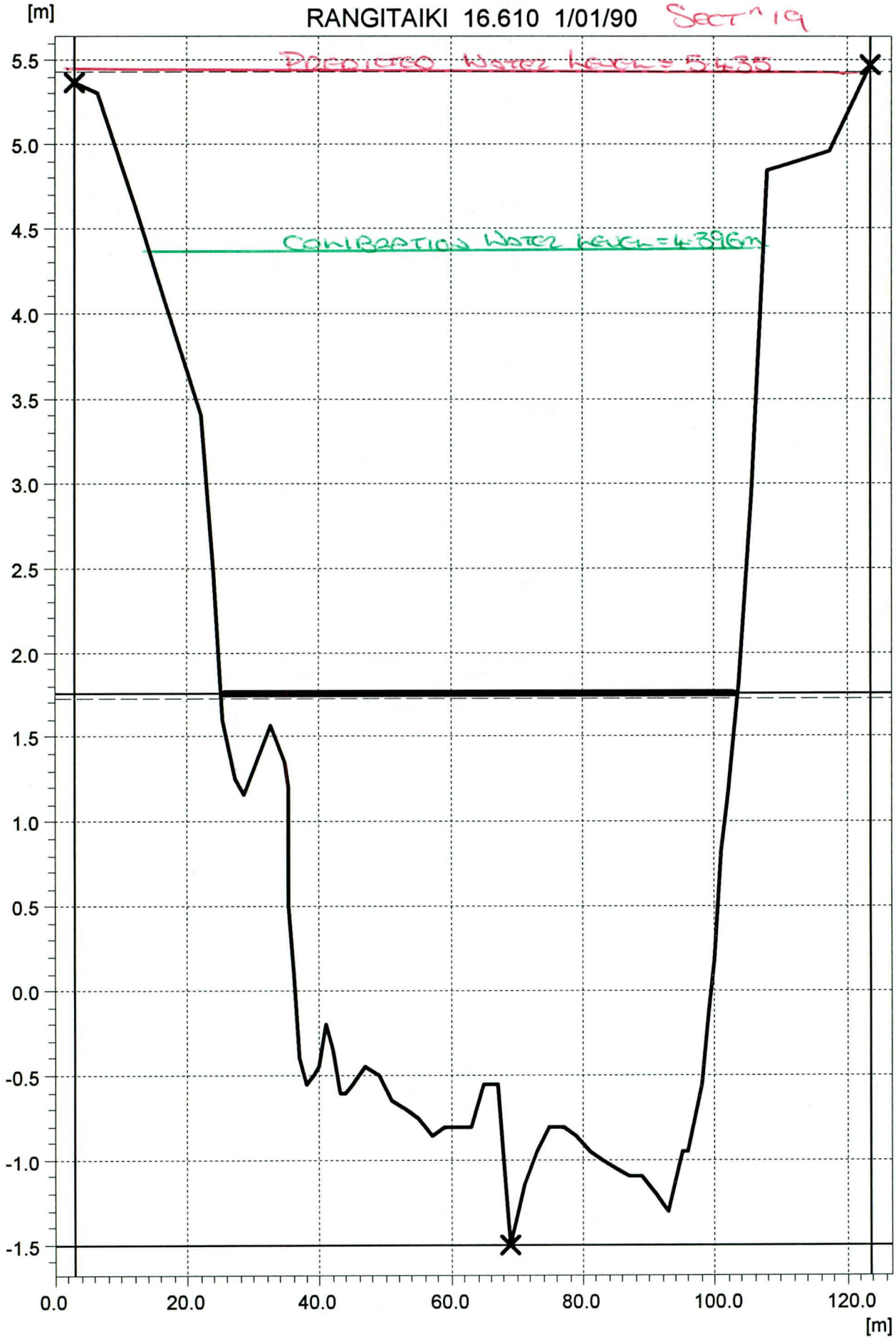

[m]
RANGITAIKI 14.660 1/01/90 Sect^ 2L
PREDICTED Q100 WATER LEVEL = 6.087m
OBSERVED WATER LEVEL = 5.100
CALIBRATION WATER LEVEL = 4.991
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
80.0
100.0
120.0
140.0
160.0
180.0
[m]

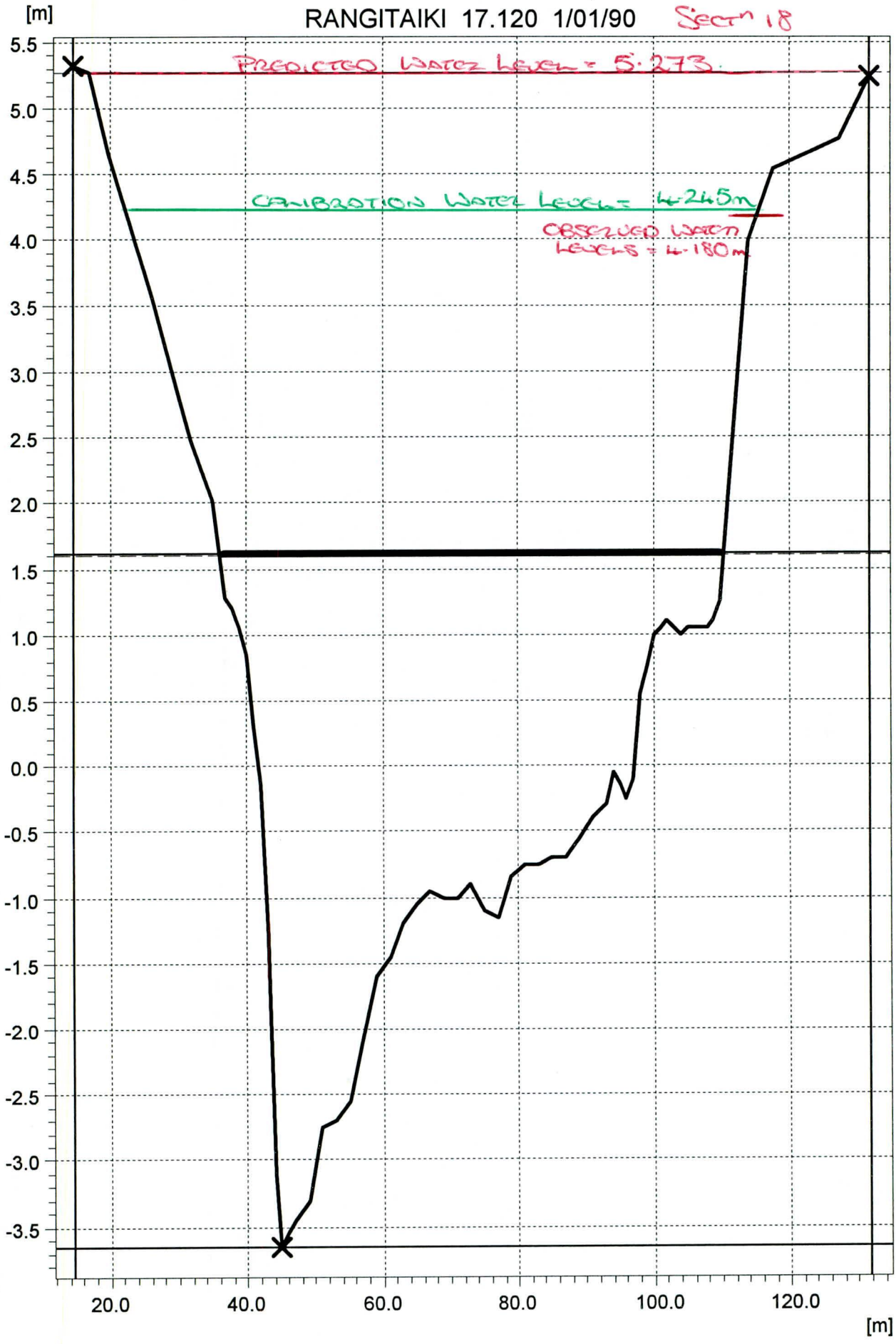

[m]
RANGITAIKI 15.040 1/01/90 Sect^ 23
PROJECTED QUAN WATER LEVEL = 5.936m
CALIBRATION WATER LEVEL = 4.852 m
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
20.0
40.0
60.0
80.0
100.0
[m]

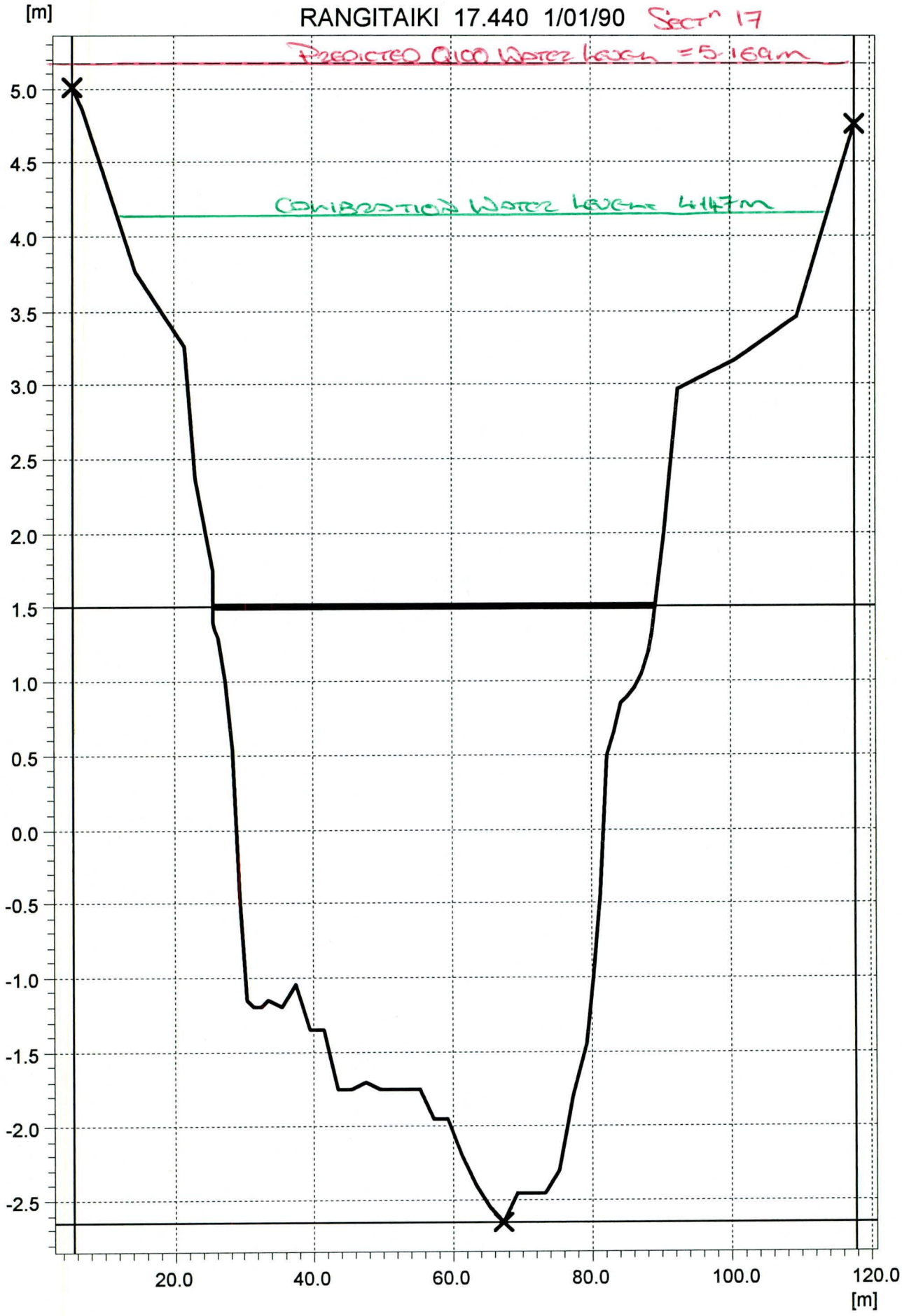

[m]
RANGITAIKI 15.400 1/01/90
Sect^n 22
PREDICTED Q100 WATER LEVEL = 5.812m
CONVERGENCE WATER LEVEL = 4.738
OBSERVED WATER LEVEL = 4.620
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
20.0
40.0
60.0
80.0
100.0
120.0
[m]

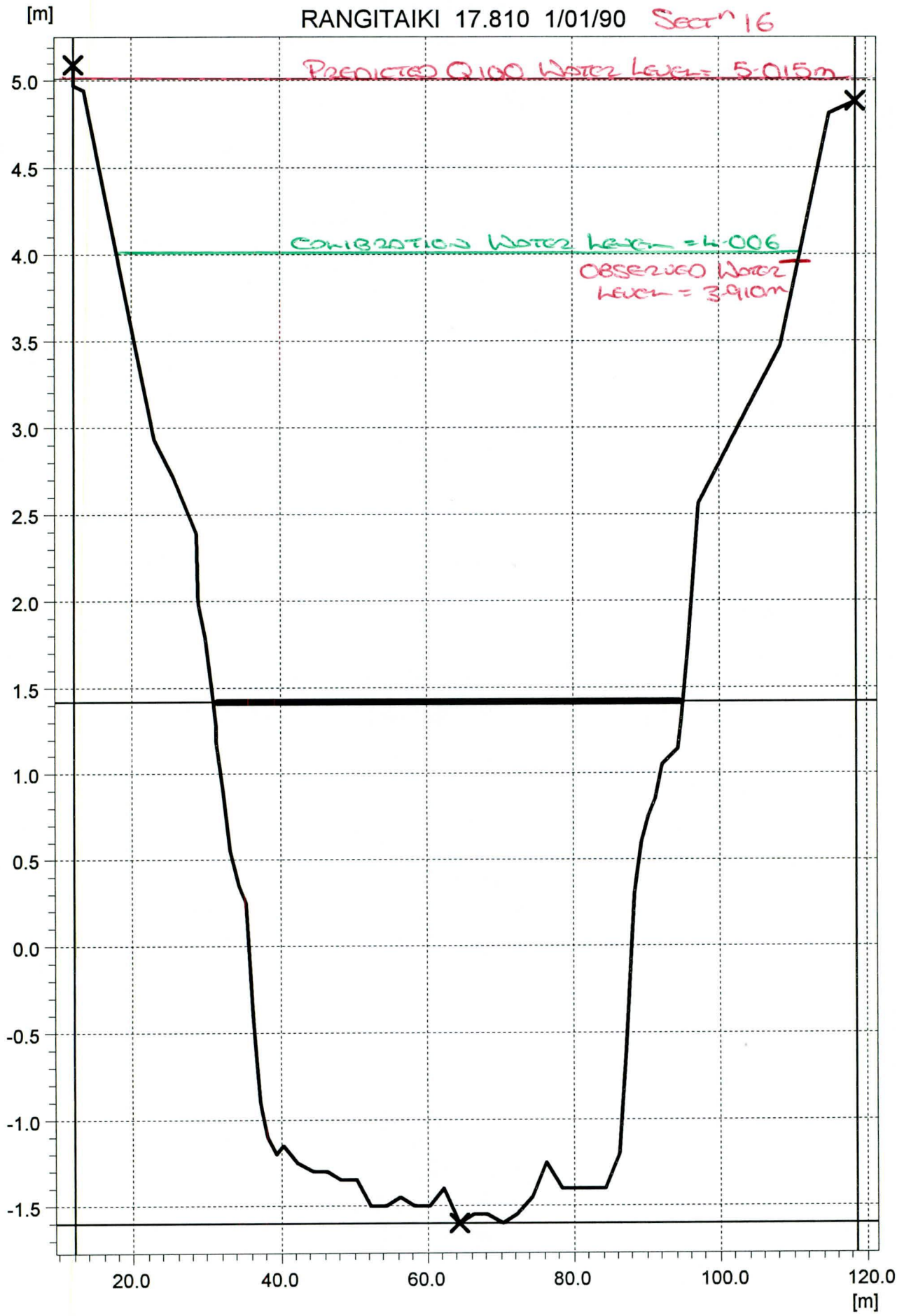

[m]
RANGITAIKI 15.800 1/01/90
Sect^21
PREDICTED Q100 WATER LEVEL = 5.652
CONSTRUCTION WATER LEVEL = 4.600m
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
[m]

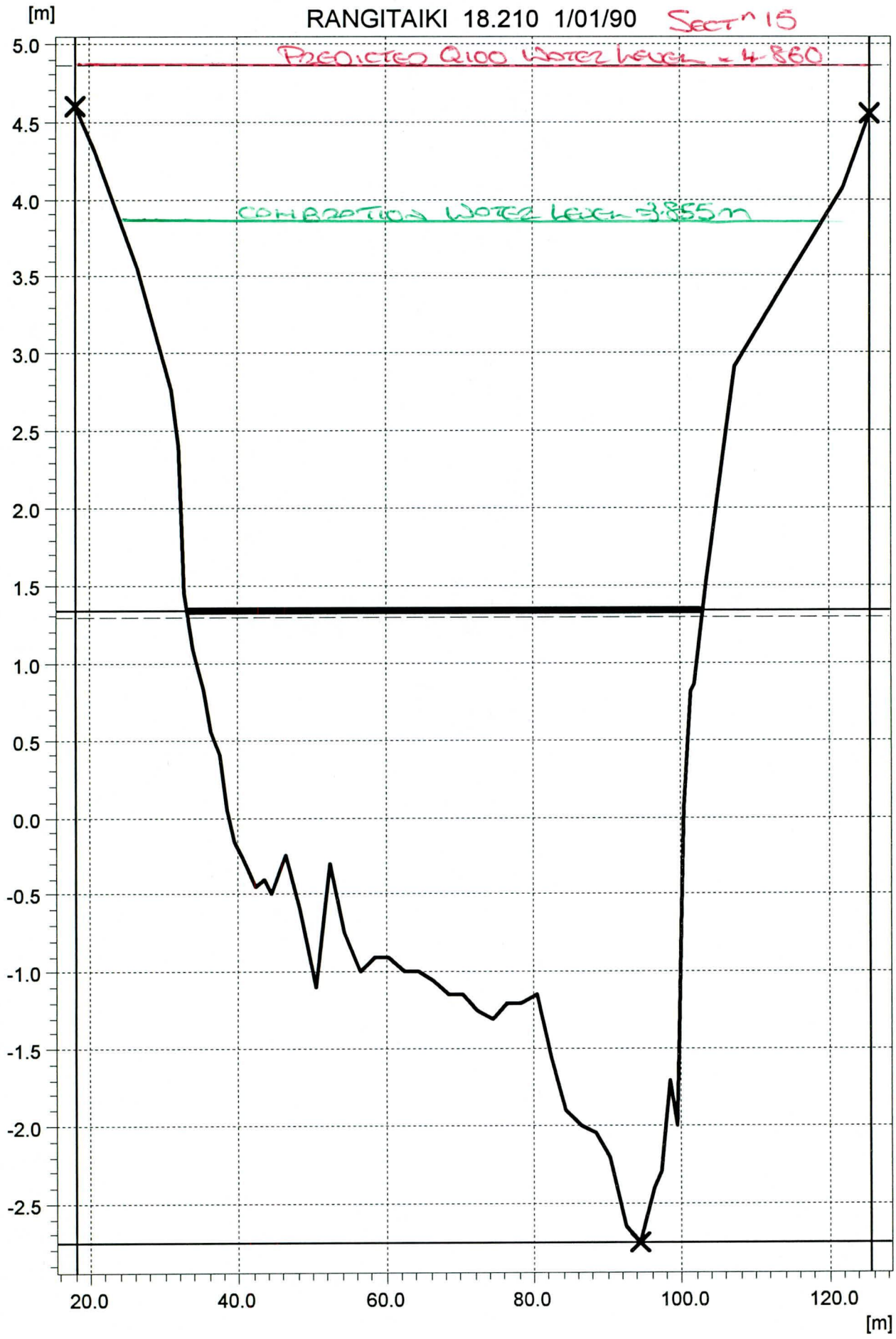

RANGITAIKI 16.350 1/01/90 Sect^ 20
[m]
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
PREDICTED Q100 WATER LEVEL = 5.522m
CALIBRATION WATER LEVEL = 4.477
OBSERVED WATER LEVEL = 4.400
20.0
40.0
60.0
80.0
100.0
120.0
[m]

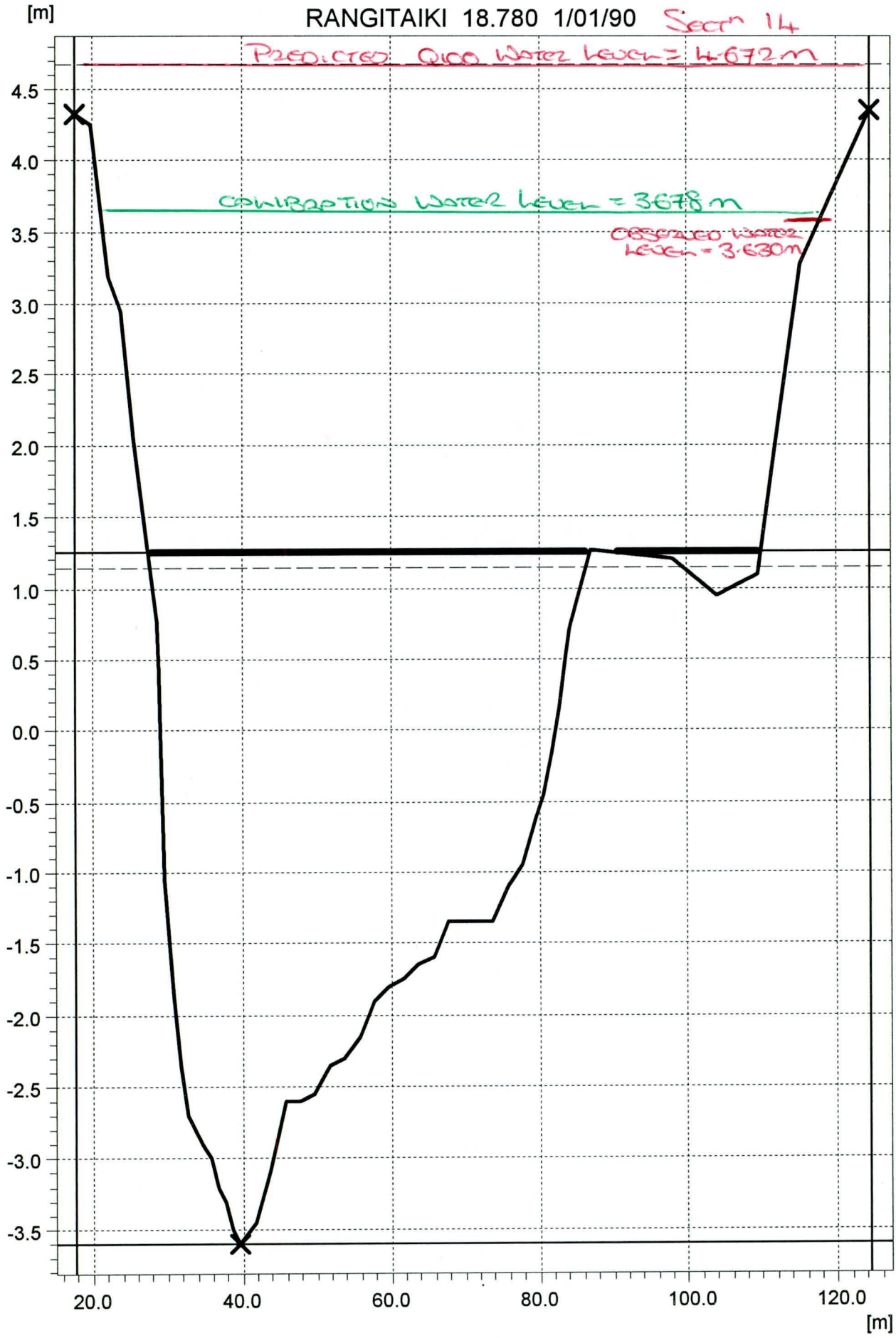

[m]
RANGITAIKI 16.610 1/01/90
SECT 19
PREDICTED WATER HEIGHT = 5.435
CONFIRMATION WATER HEIGHT = 4.396m
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.0
20.0
40.0
60.0
80.0
100.0
120.0
[m]

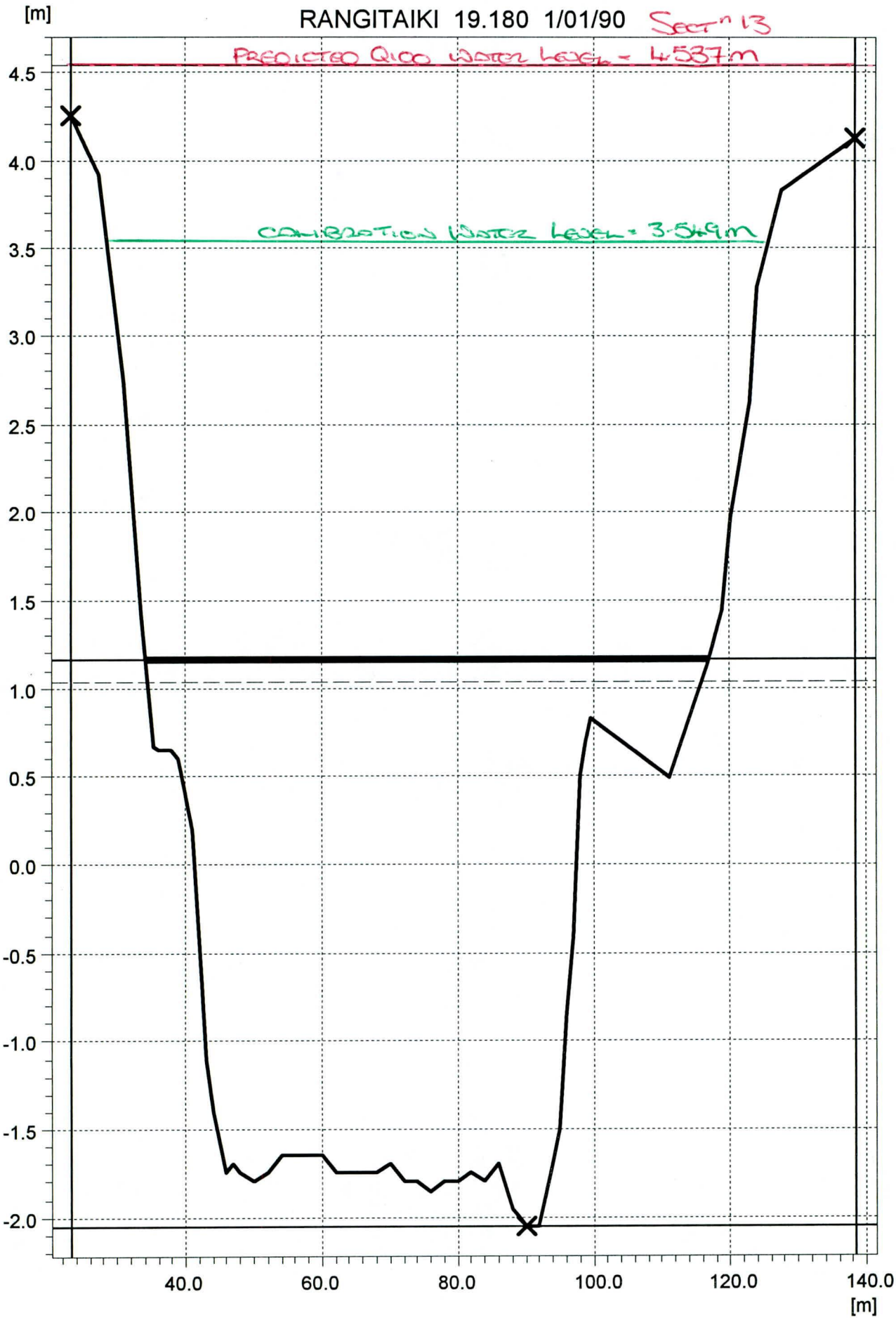

[m]
RANGITAIKI 17.120 1/01/90
Sectn 18
PREDICTED WATER LEVEL = 5.273
CALIBRATION WATER LEVEL = 4.245m
OBSERVED WATER LEVELS = 4.180m
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
20.0
40.0
60.0
80.0
100.0
120.0
[m]

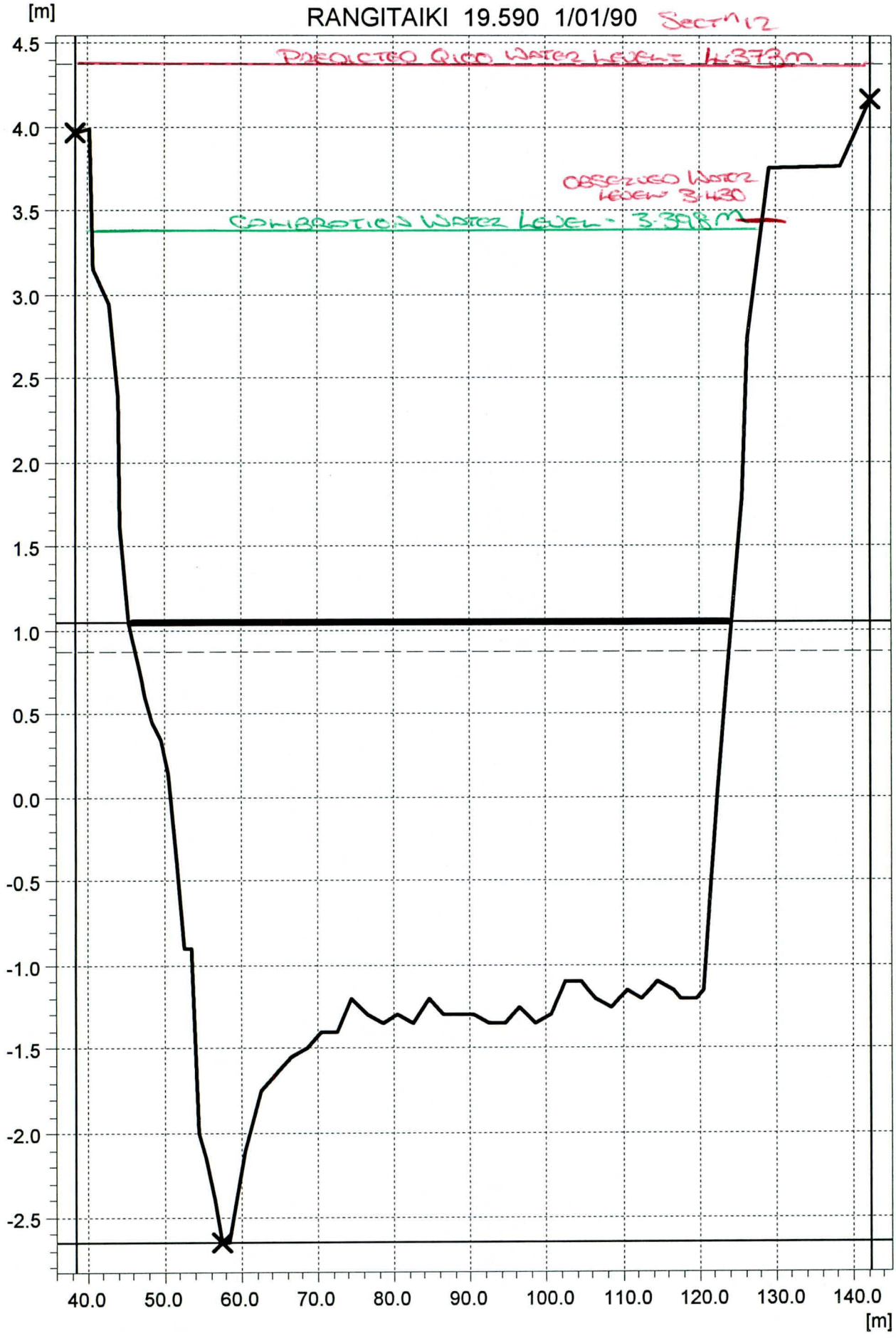

[m]
RANGITAIKI 17.440 1/01/90 Sect^ 17
PREDICTED Q100 WATER LEVEL =5.169m
COMBUSTION WATER LEVEL 4.147m
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
20.0
40.0
60.0
80.0
100.0
120.0
[m]

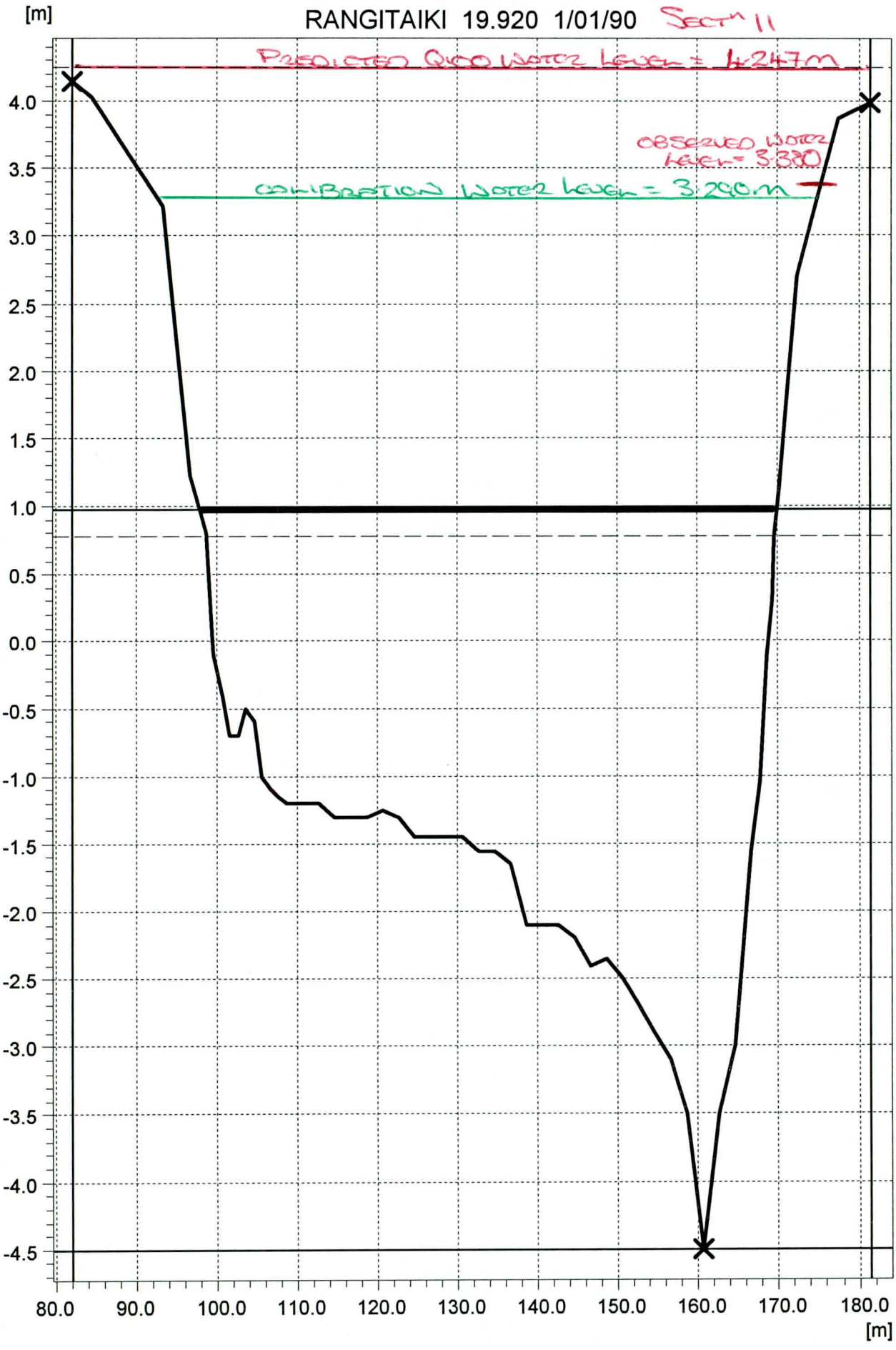

[m]
RANGITAIKI 17.810 1/01/90 Sectn 16
PREDICTED Q100 WATER LEVEL = 5.015m
CONFIGURATION WATER LEVEL = 4.006
OBSERVED WATER LEVEL = 3.910m
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
20.0
40.0
60.0
80.0
100.0
120.0
[m]

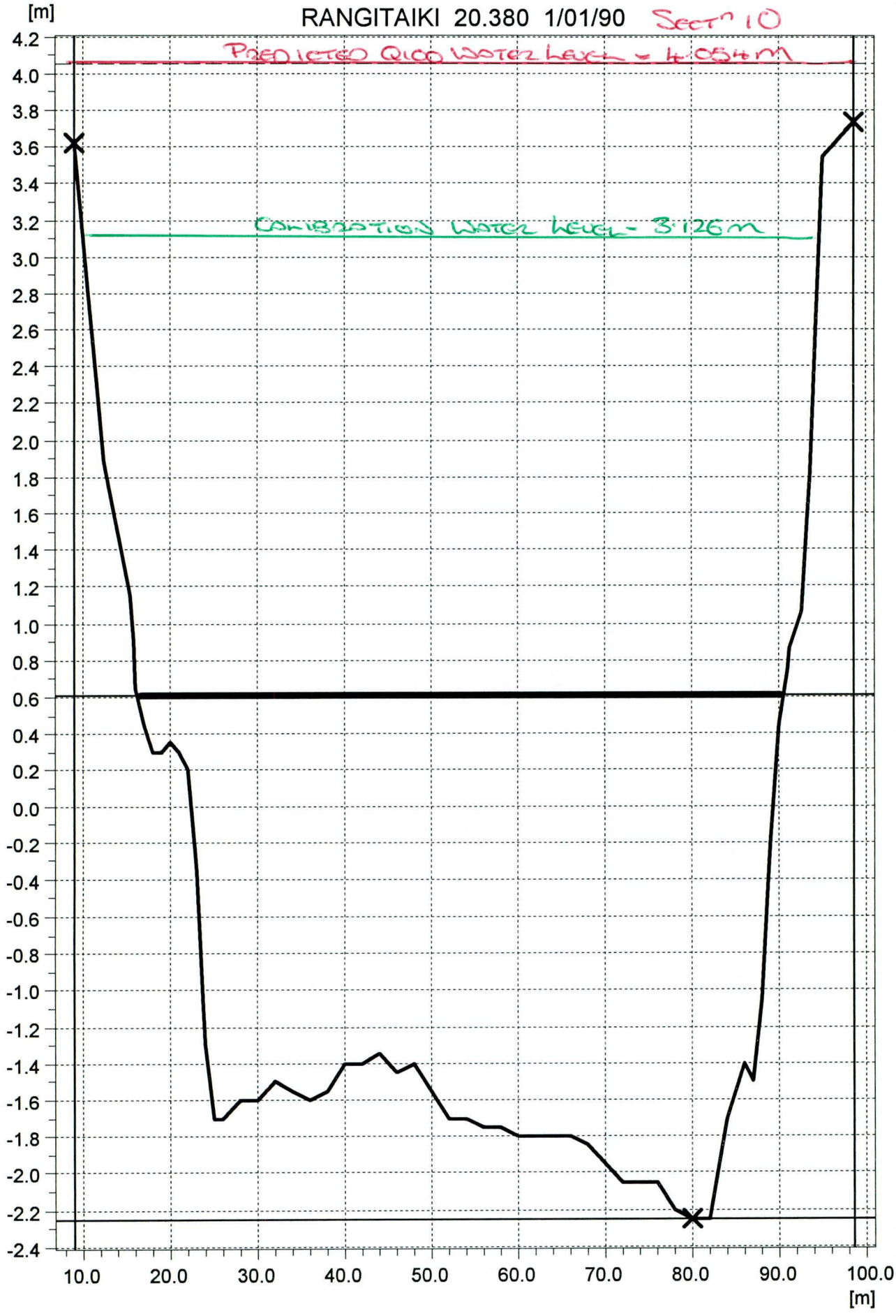

[m]
RANGITAIKI 18.210 1/01/90
Sect^ 15
PROJECTED Q100 WATER LEVEL = 4.860
CONSENTED WATER LEVEL = 3.855m
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
20.0
40.0
60.0
80.0
100.0
120.0
[m]

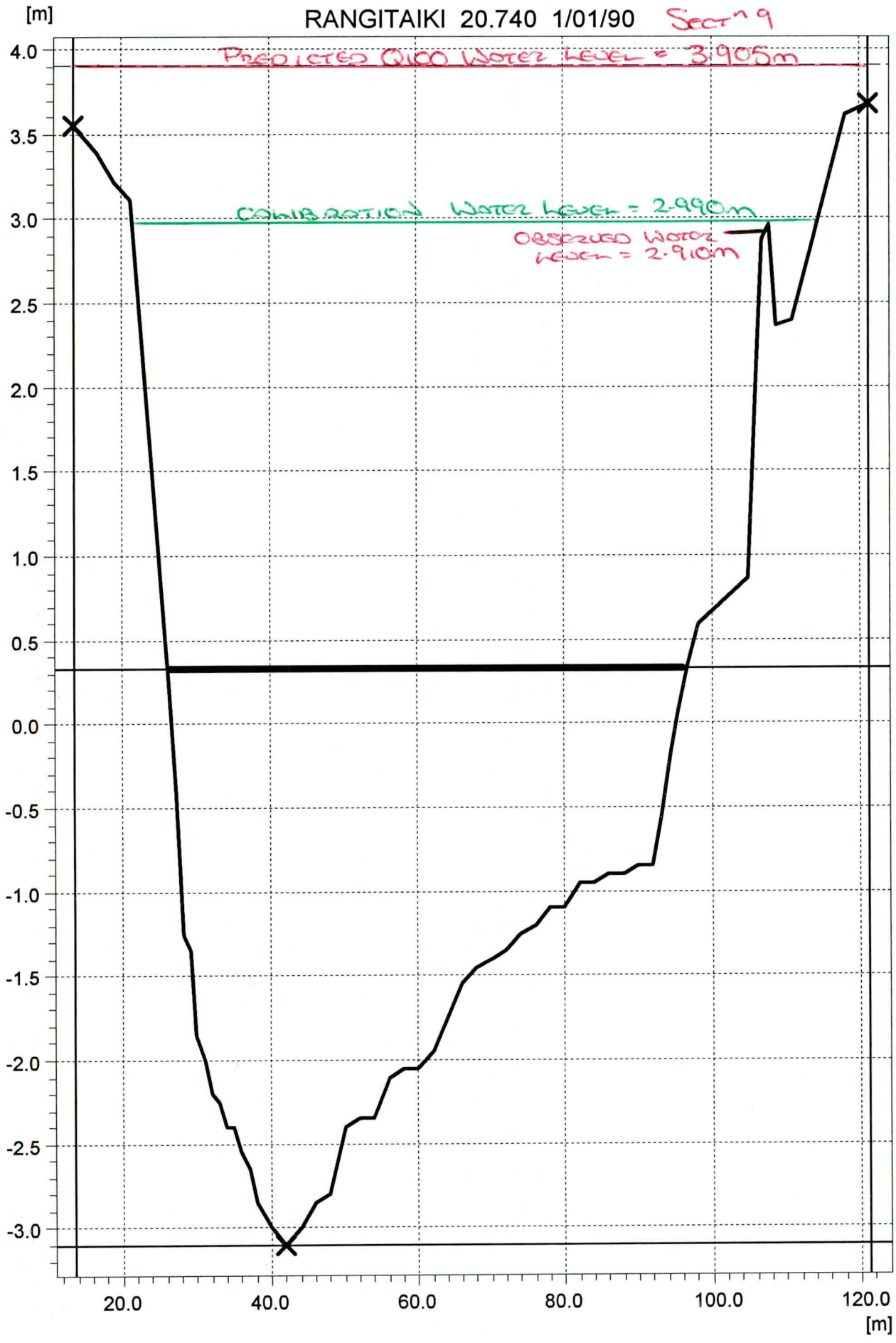

[m]
RANGITAIKI 18.780 1/01/90 Sect 14
PREDICTED Q100 WATER LEVEL = 4.672 m
CONSTRUCTION WATER LEVEL = 3.678 m
OBSERVED WATER LEVEL = 3.630 m
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
20.0
40.0
60.0
80.0
100.0
120.0
[m]

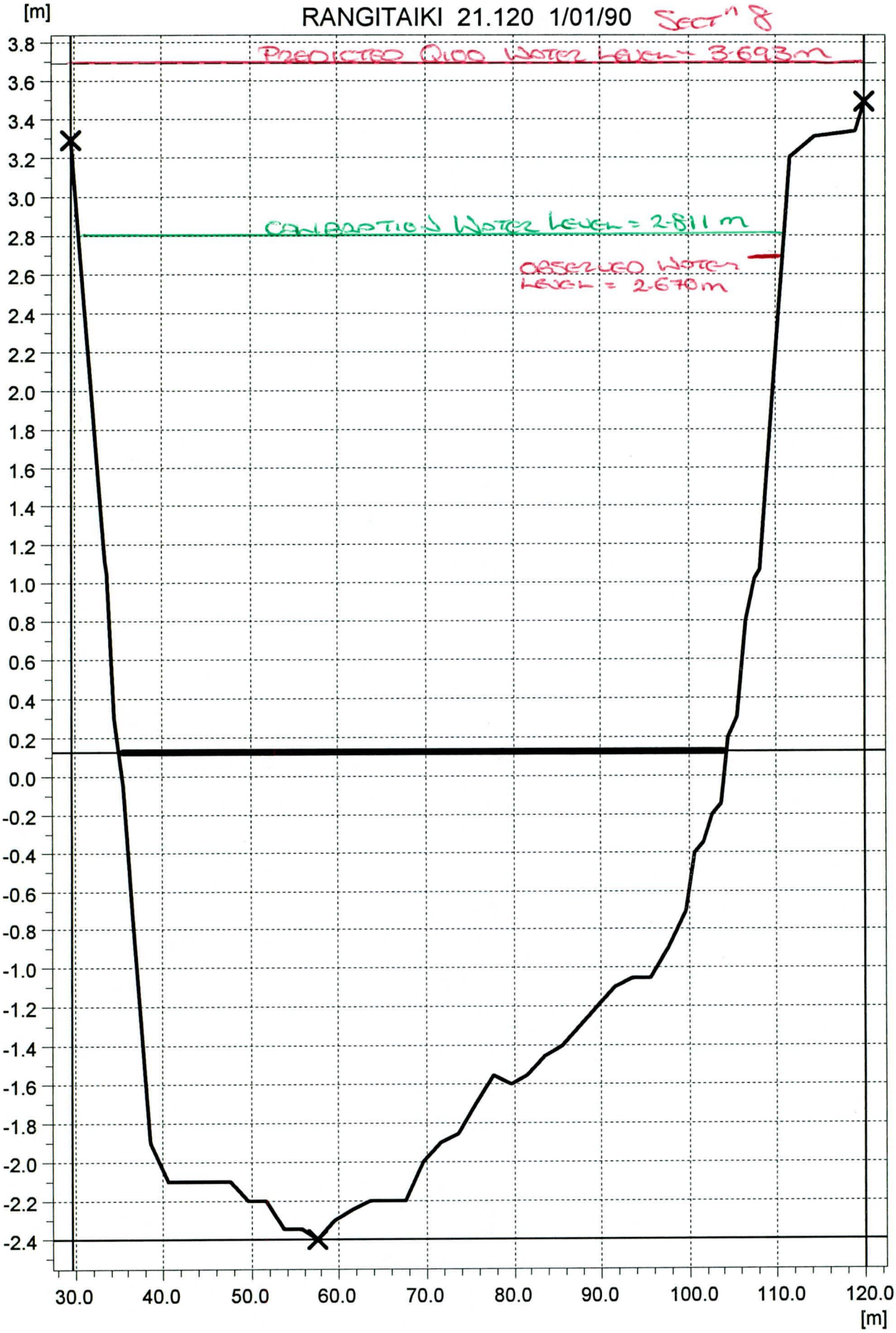

[m]
RANGITAIKI 19.180 1/01/90 Sect^n 13
PREDICTED Q100 WATER LEVEL = 4.537m
CALIBRATION WATER LEVEL = 3.549m
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
40.0
60.0
80.0
100.0
120.0
140.0
[m]


[m]
RANGITAIKI 19.590 1/01/90 Sectn 12
PREDICTED RIGO WATER LEVEL = 4.373m
OBSERVED WATER LEVEL 3.430
CALIBRATION WATER LEVEL = 3.398m
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
[m]

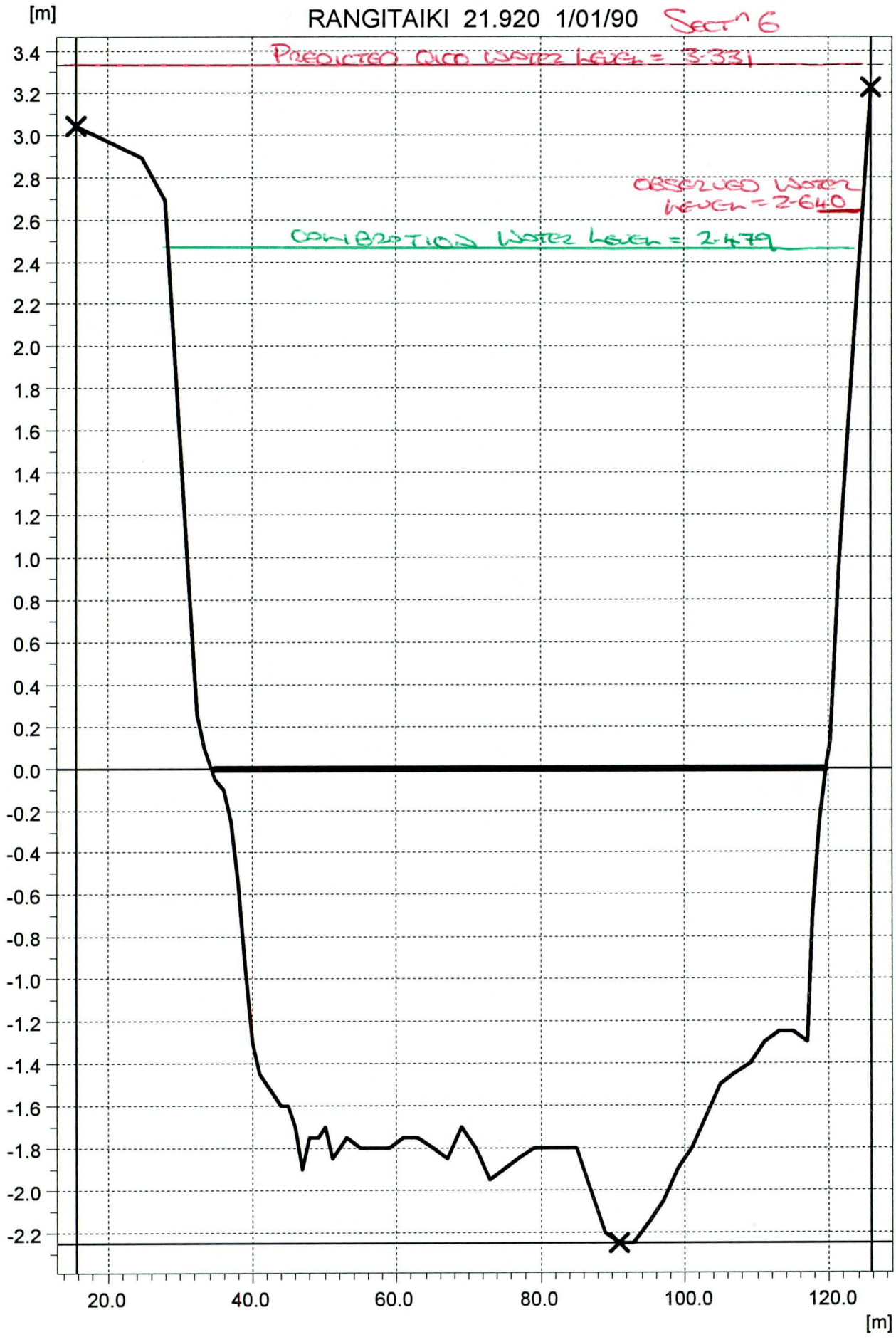

[m]
RANGITAIKI 19.920 1/01/90 SECT^N 11
PREDICTED QUOD WATER LEVEL = 4.247m
OBSERVED WATER LEVEL = 3.330
CALIBRATION WATER LEVEL = 3.290m
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
[m]

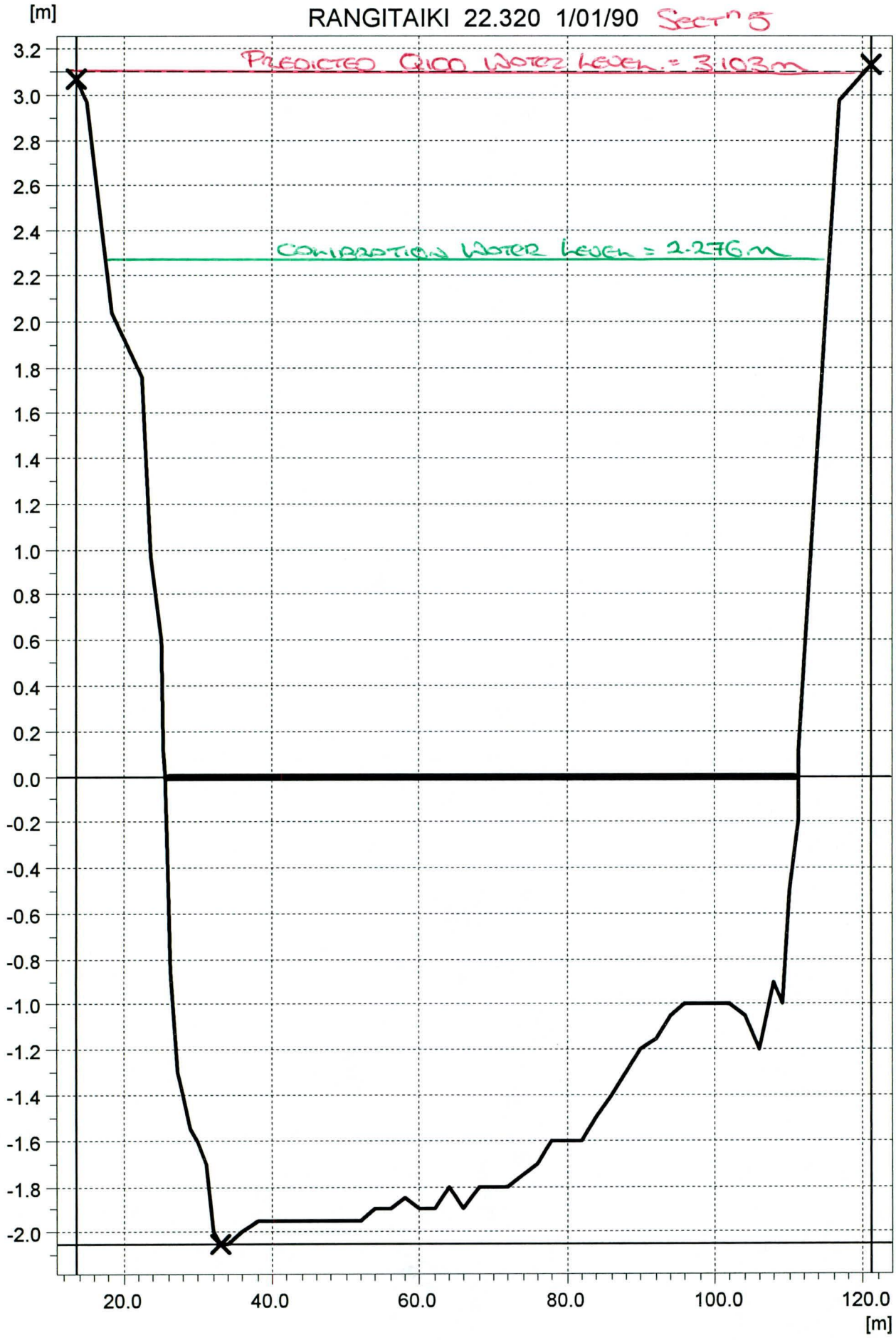

[m]
RANGITAIKI 20.380 1/01/90 Sect^n 10
PREDICTED QUOD WATER LEVEL = 4.054m
CALIBRATION WATER LEVEL = 3.126m
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
[m]

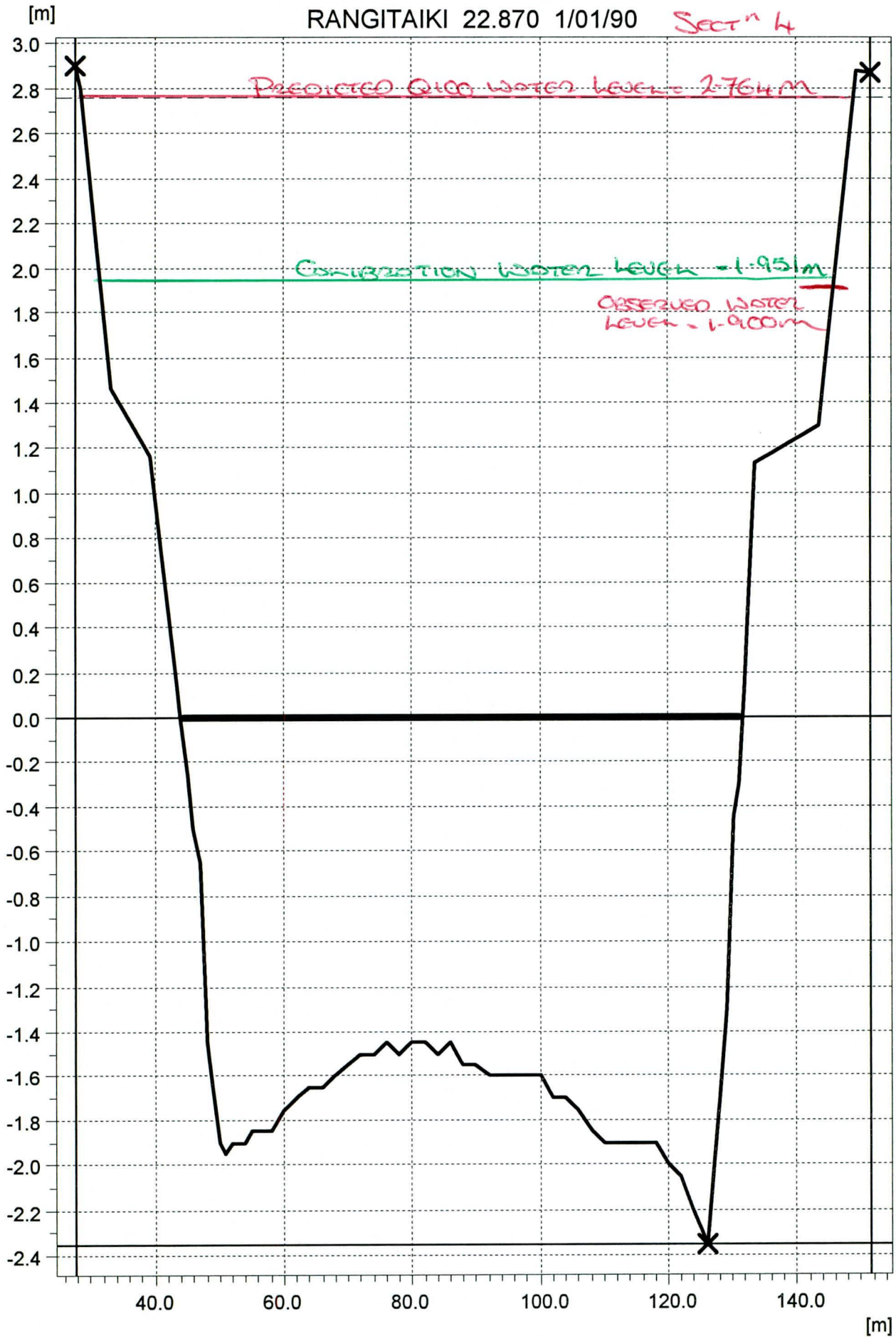

[m]
RANGITAIKI 20.740 1/01/90 Sect^n 9
PREDICTED Q100 WATER LEVEL = 3.905m
CALIBRATION WATER LEVEL = 2.990m
OBSERVED WATER LEVEL = 2.910m
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
20.0
40.0
60.0
80.0
100.0
120.0
[m]

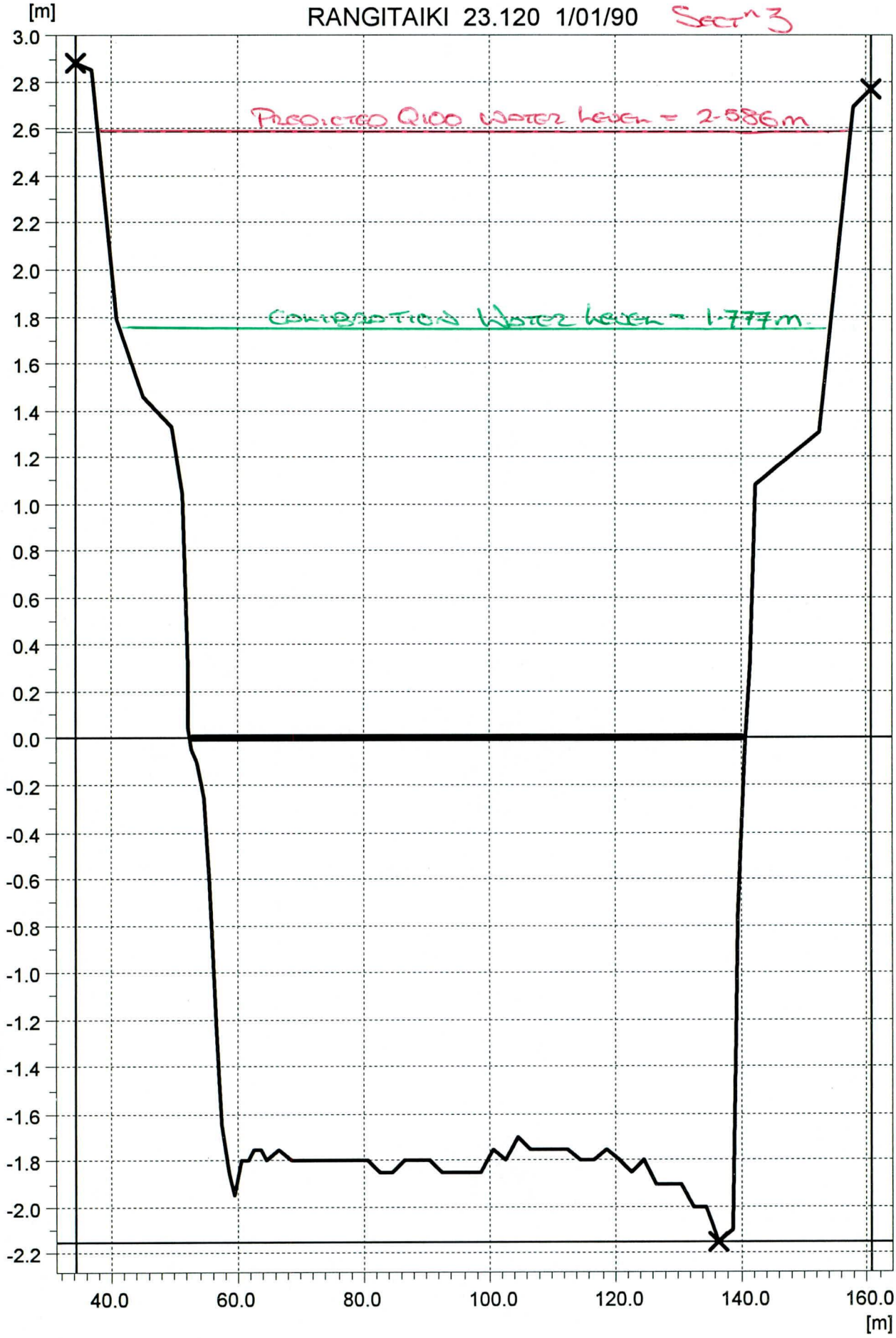

RANGITAIKI 21.120 1/01/90 SECT 8
PREDICTED Q100 WATER LEVEL = 3.693m
CALIBRATION WATER LEVEL = 2.811 m
OBSERVED WATER LEVEL = 2.670m
[m]
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
[m]

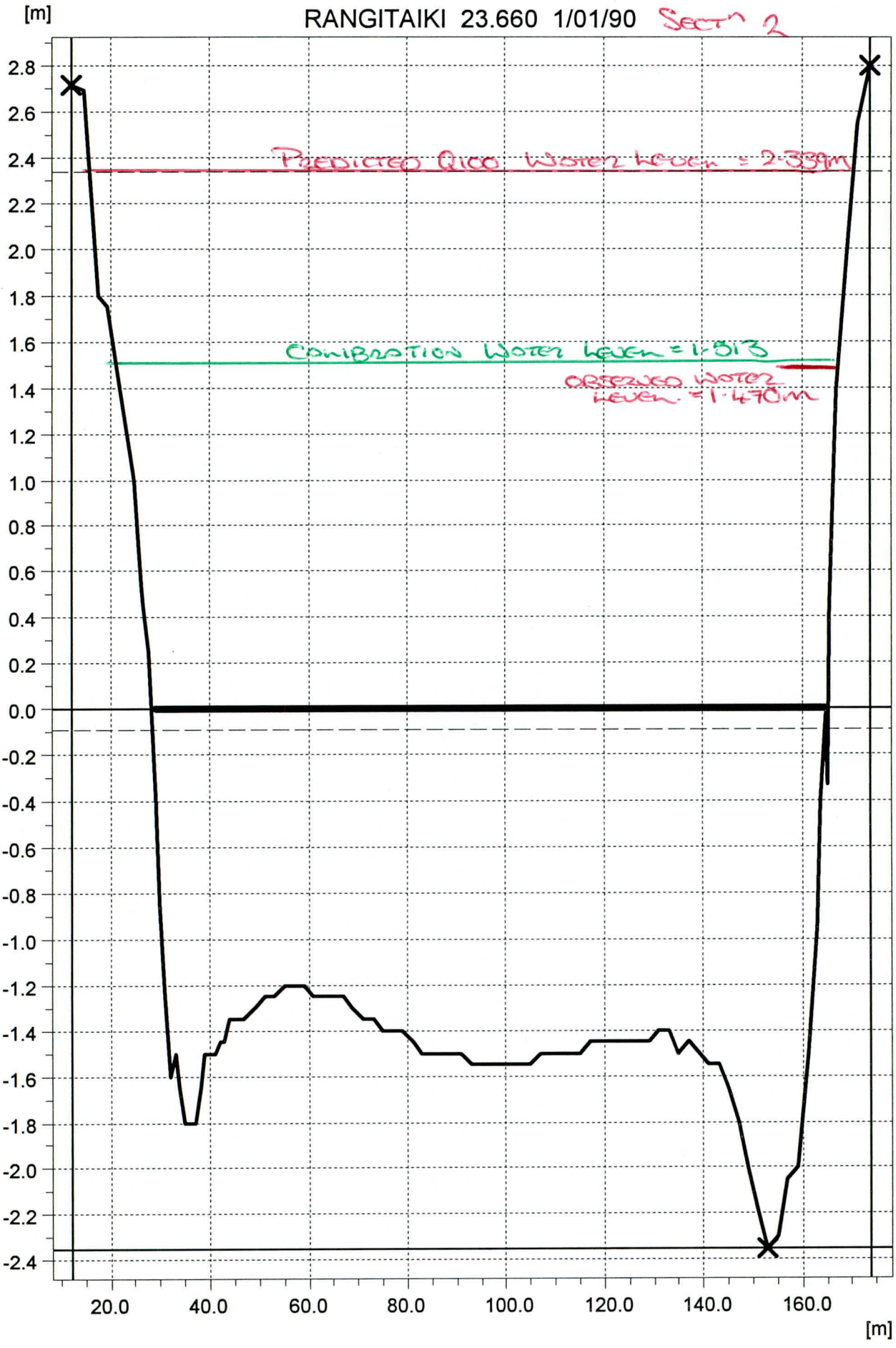

[m]
RANGITAIKI 21.510 1/01/90 Sect^n 7
PREDICTED QUCO WATER LEVEL = 3.526
CONSTRUCTION WATER LEVEL = 2.654 m
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
20.0
40.0
60.0
80.0
100.0
120.0
[m]

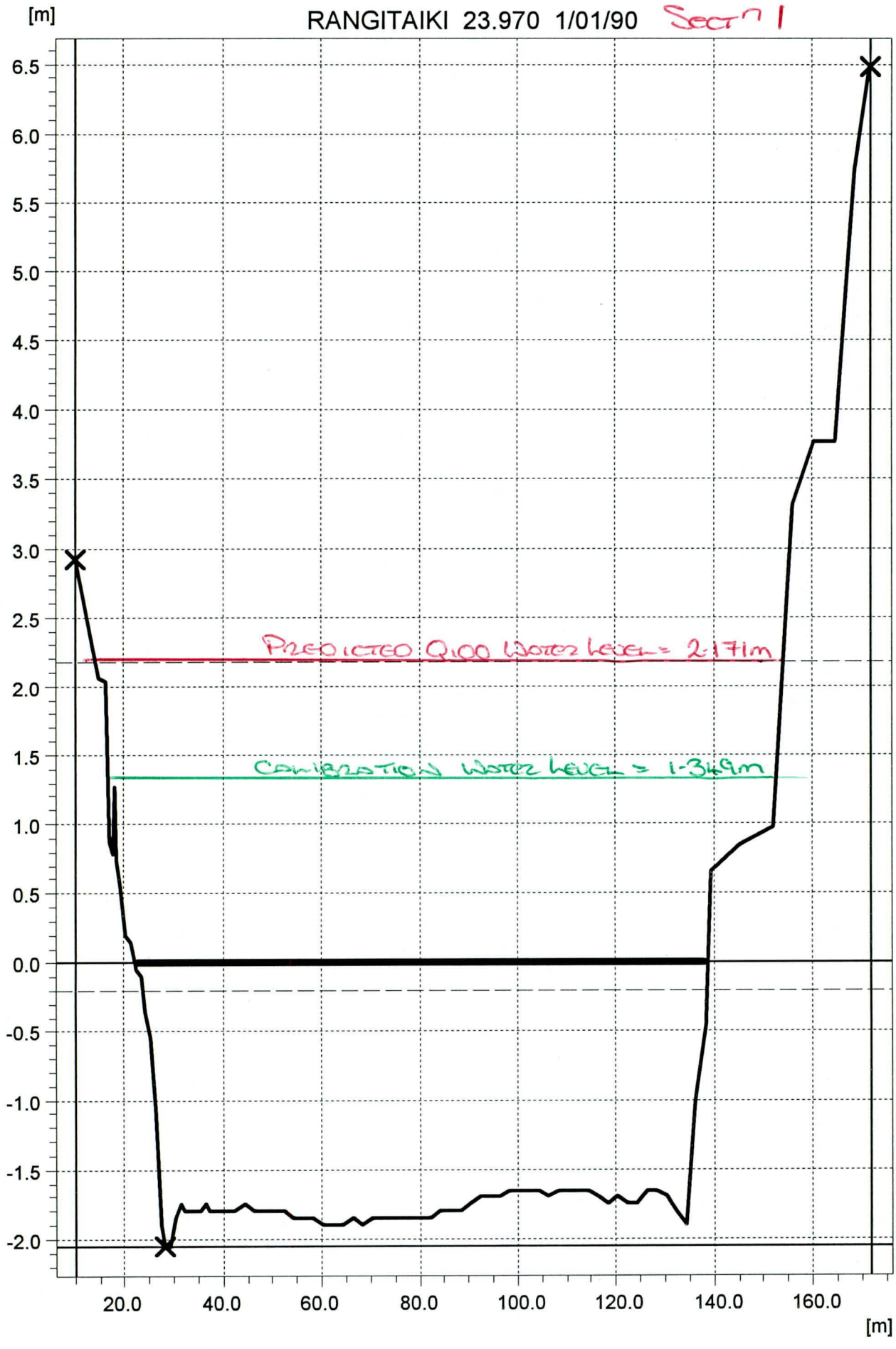

[m]
RANGITAIKI 21.920 1/01/90
Sect^ 6
PREDICTED 100 WATER LEVEL = 3.331
OBSERVED WATER LEVEL = 2.640
CONFLUENCE WATER LEVEL = 2.479
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
20.0
40.0
60.0
80.0
100.0
120.0
[m]


[m]
RANGITAIKI 22.320 1/01/90 Sect^n 5
PREDICTED 100 YEAR WATER LEVEL = 3.103m
CONSTRUCTION WATER LEVEL = 2.276m
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
20.0
40.0
60.0
80.0
100.0
120.0
[m]

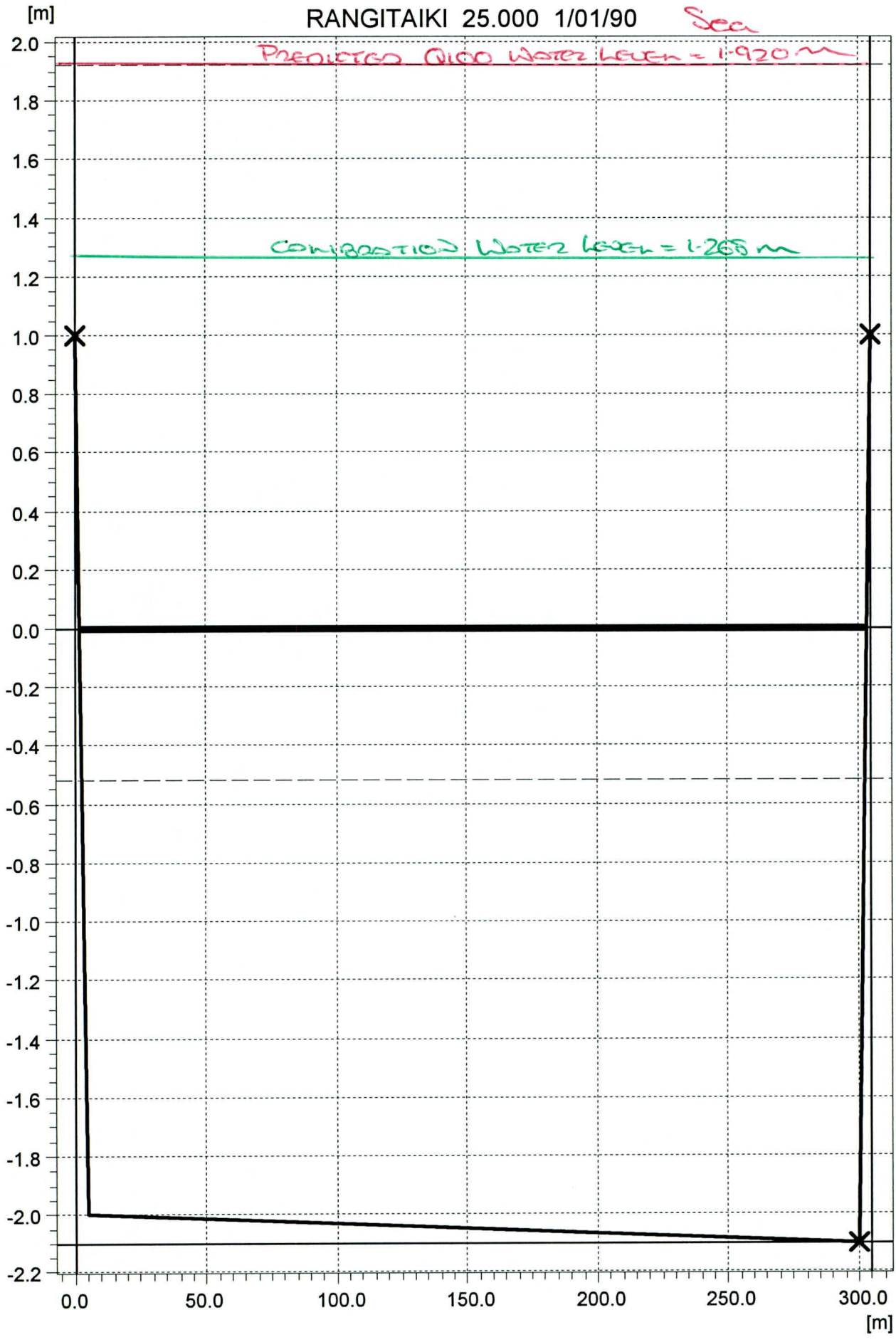

[m]
RANGITAIKI 22.870 1/01/90
Sectn 4
PROJECTED Q100 WATER LEVEL = 2.764m
CALIBRATION WATER LEVEL = 1.951m
OBSERVED WATER LEVEL = 1.900m
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
40.0
60.0
80.0
100.0
120.0
140.0
[m]


RANGITAIKI 23.120 1/01/90
Sect^3
[m]
PREDICTED Q100 WATER LEVEL = 2.586m
CONSTRICTED WATER LEVEL = 1.777m
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

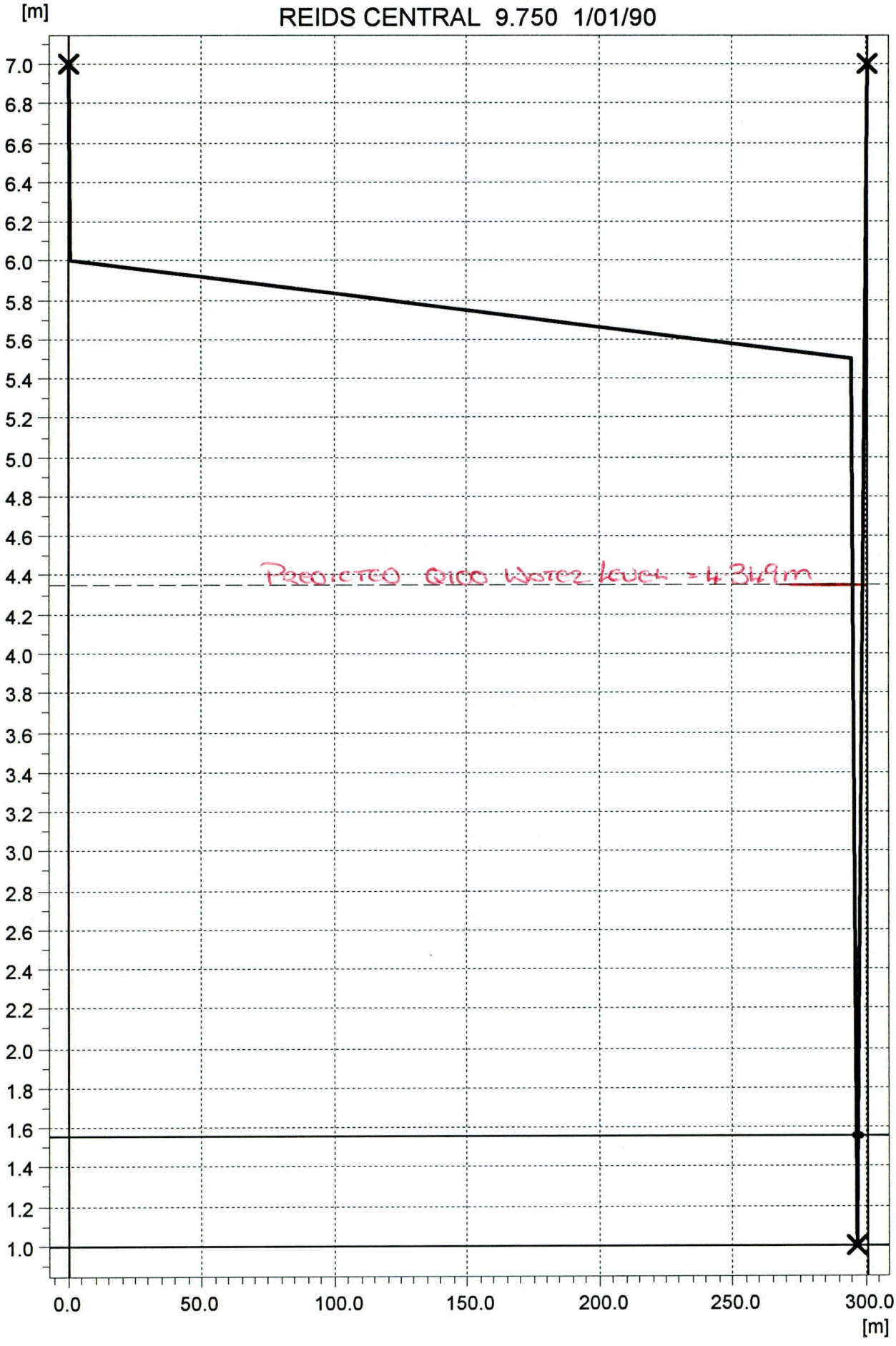

[m]
RANGITAIKI 23.660 1/01/90 Sect^n 2
PREDICTED Q100 WATER LEVEL = 2.339m
CONIBRATION WATER LEVEL = 1.513
OBSERVED WATER LEVEL = 1.470m
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

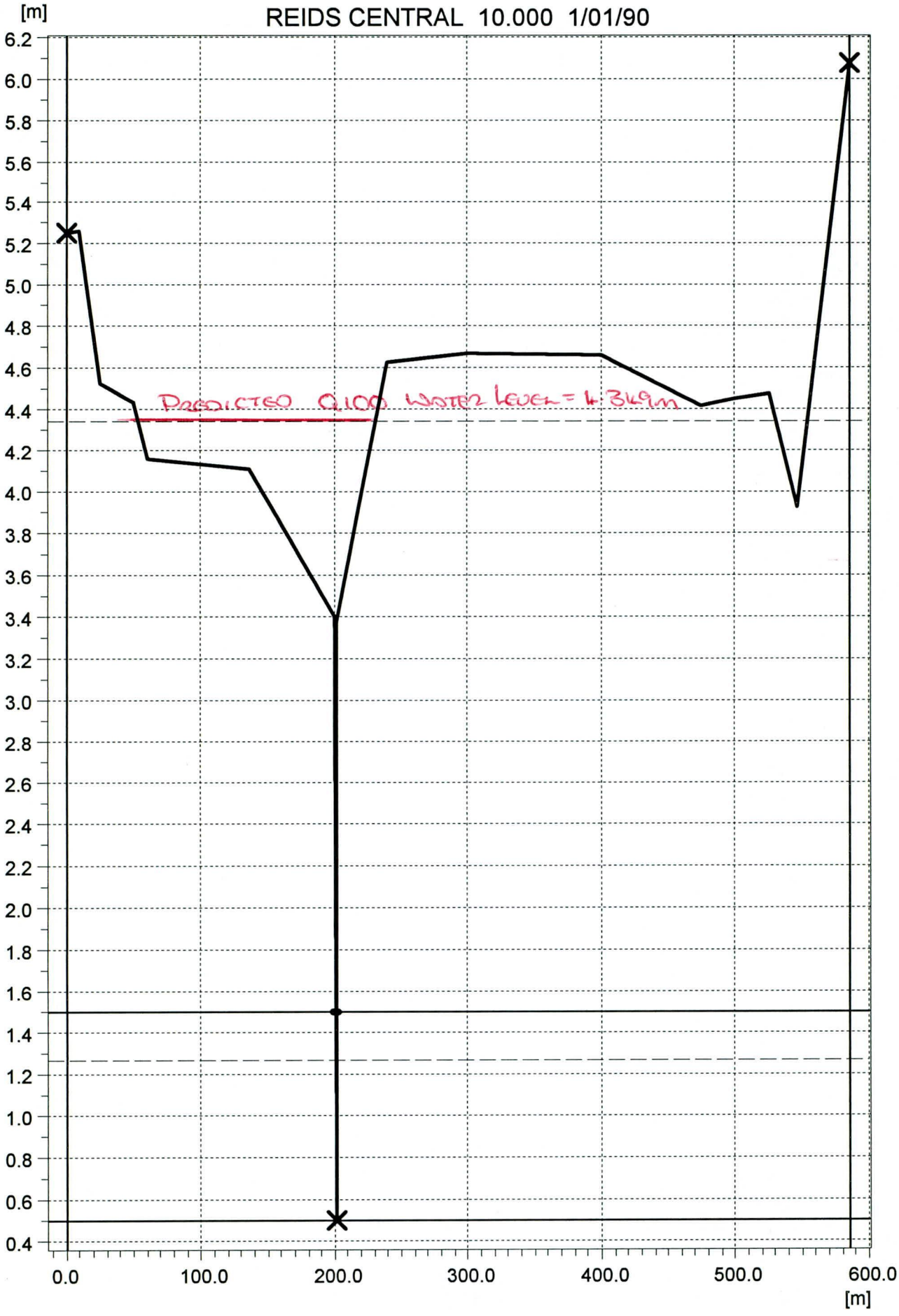

[m]
RANGITAIKI 23.970 1/01/90 Sect 1
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
PREDICTED Q100 WATER LEVEL = 2.17m
CALIBRATION WATER LEVEL = 1.349m
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
[m]

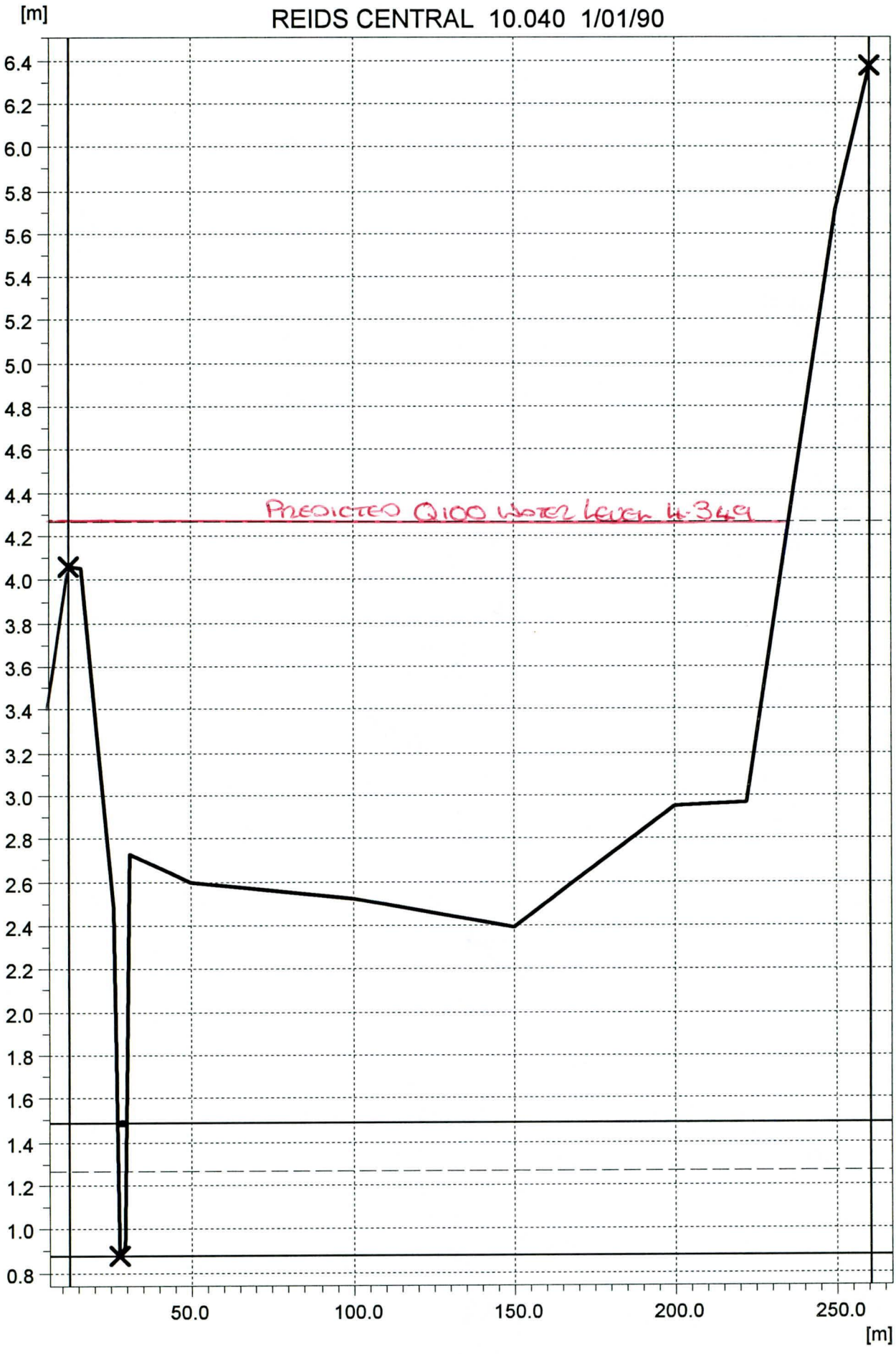

[m]
RANGITAIKI 24.550 1/01/90
Sect^n 1a
PROJECTED Q100 WATER LEVEL = 1.937m
CONSTRUCTION WATER LEVEL = 1.273m
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
[m]

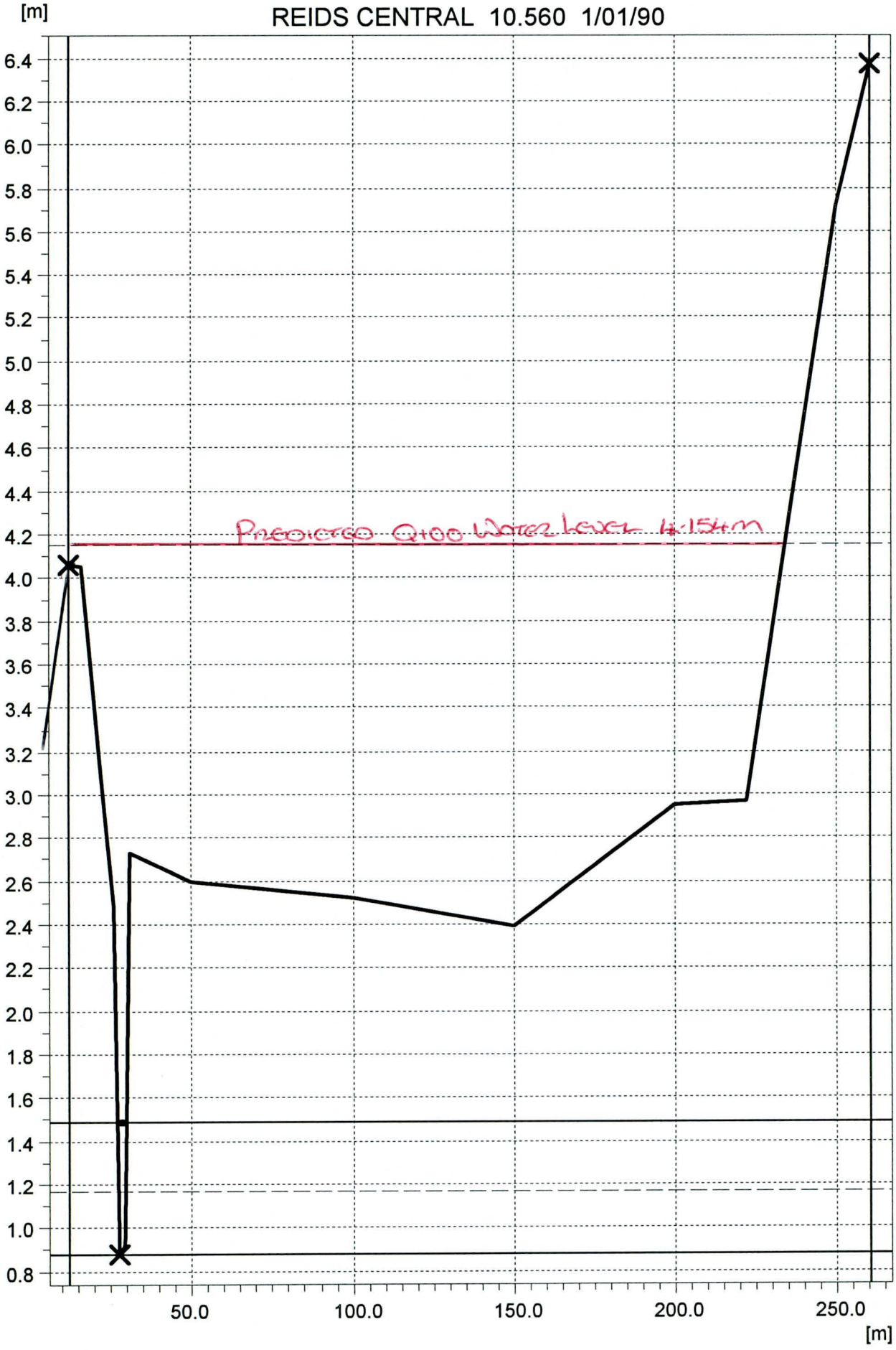

[m]
RANGITAIKI 25.000 1/01/90
Sea
PREDICTED Q100 WATER LEVEL = 1.920 m
COMBINATION WATER LEVEL = 1.265 m
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]

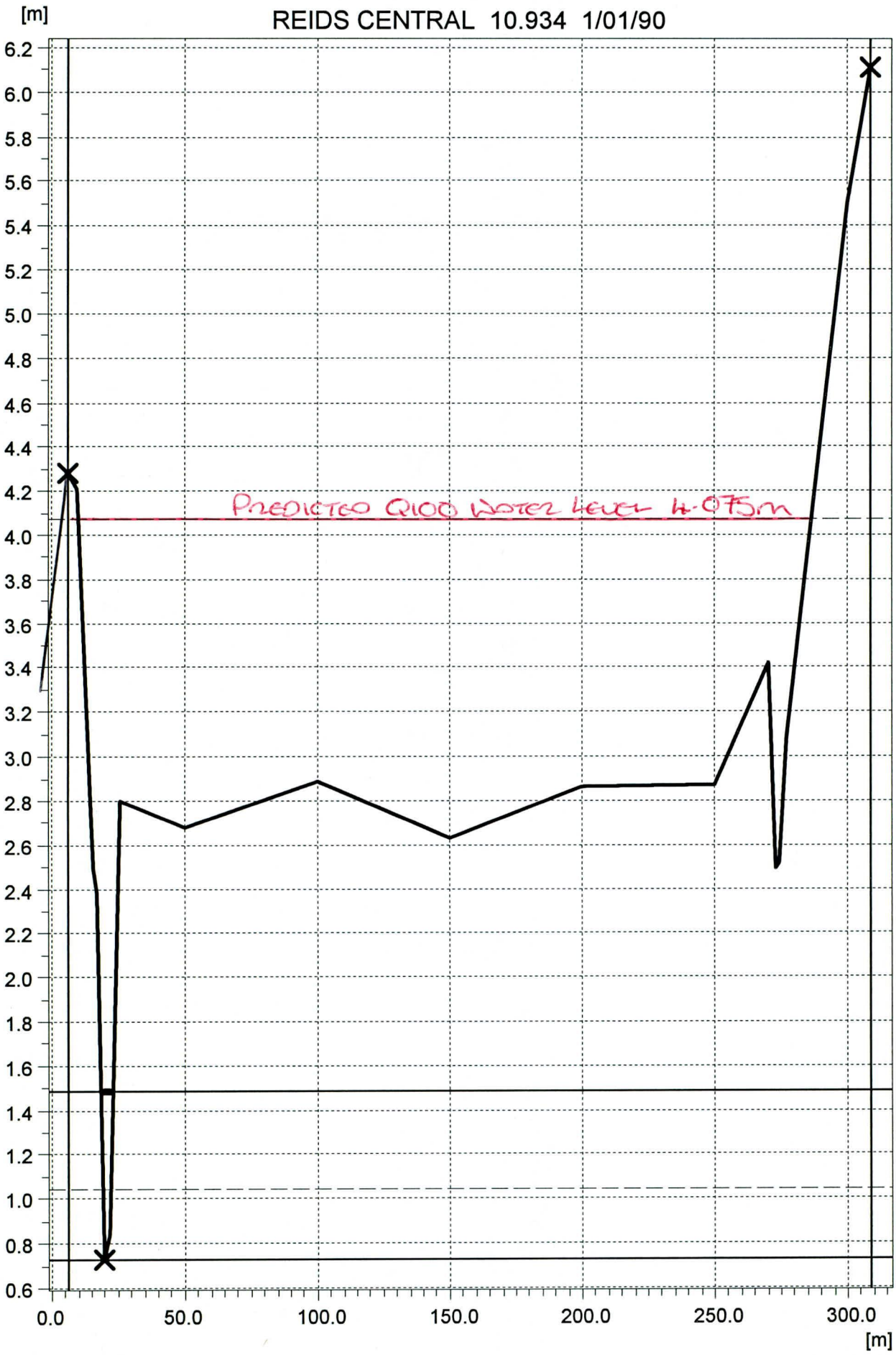
# Appendix E: Reid Central Canal, Cross Sections

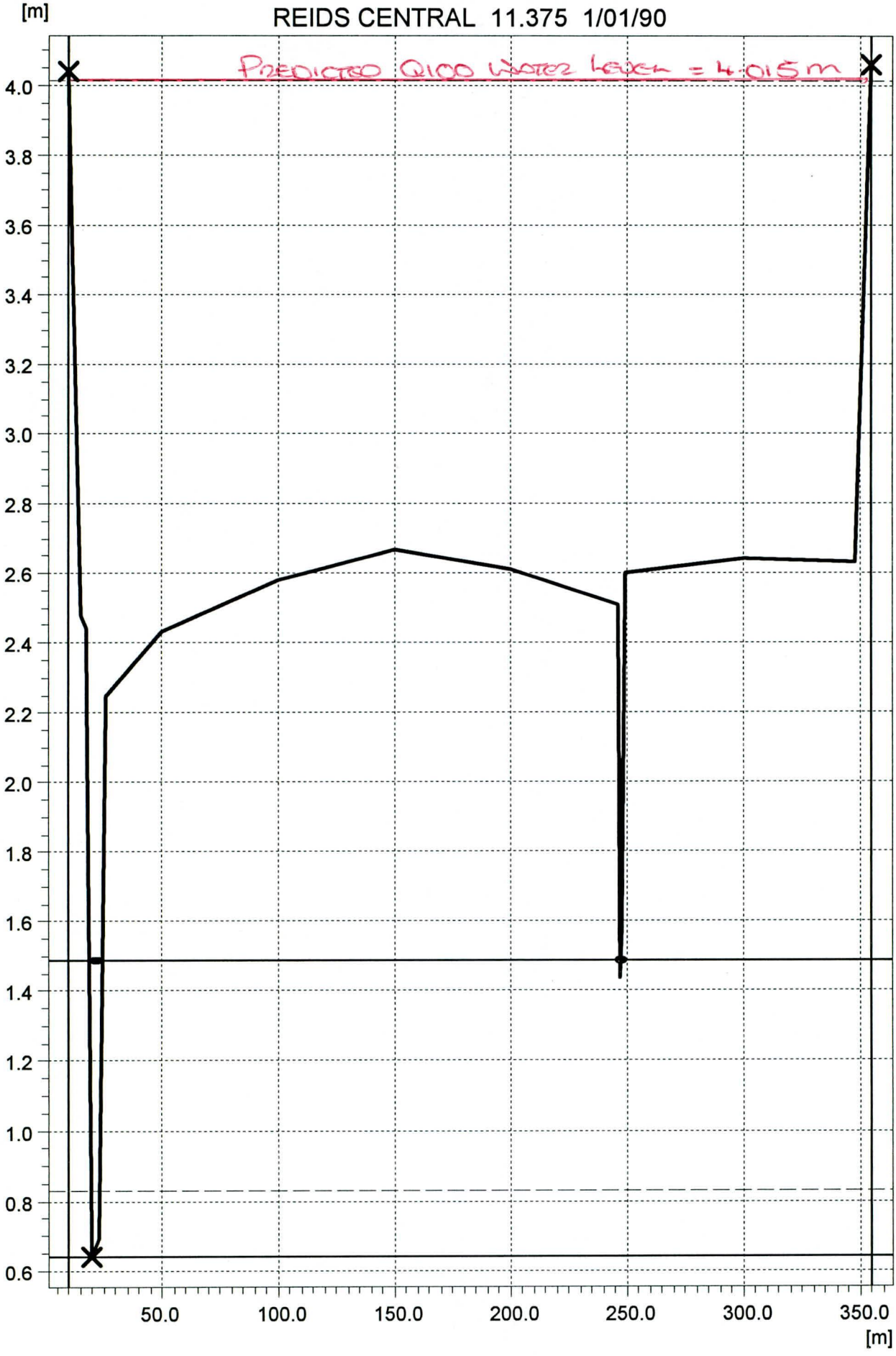

REIDS CENTRAL 9.750 1/01/90
[m]
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
PROJECTED 100 YEAR WATER LEVEL = 4.349m
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]

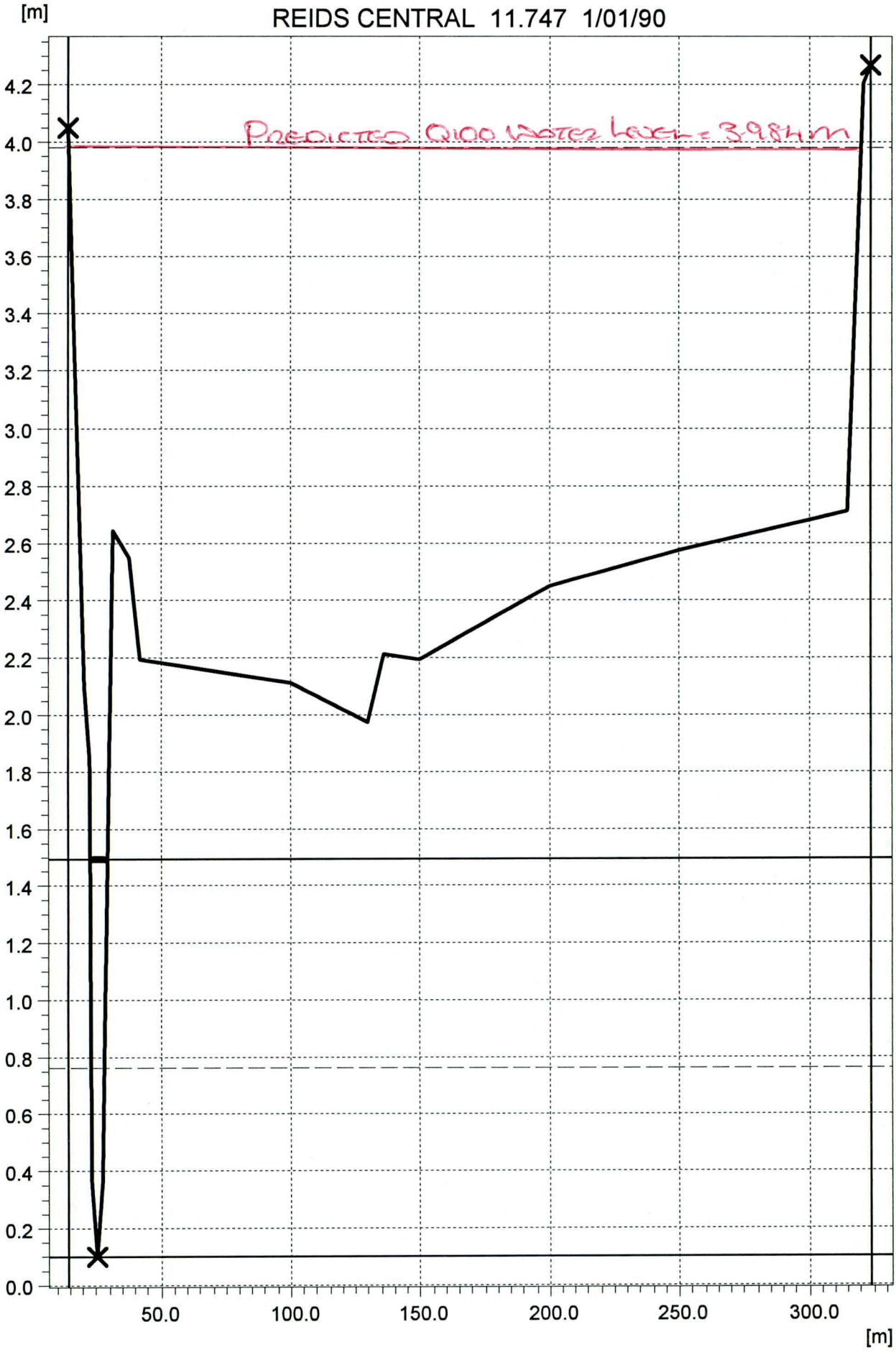

REIDS CENTRAL 10.000 1/01/90
[m]
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
PREDICTED Q100 WATER LEVEL = 4.349m
0.0
100.0
200.0
300.0
400.0
500.0
600.0
[m]

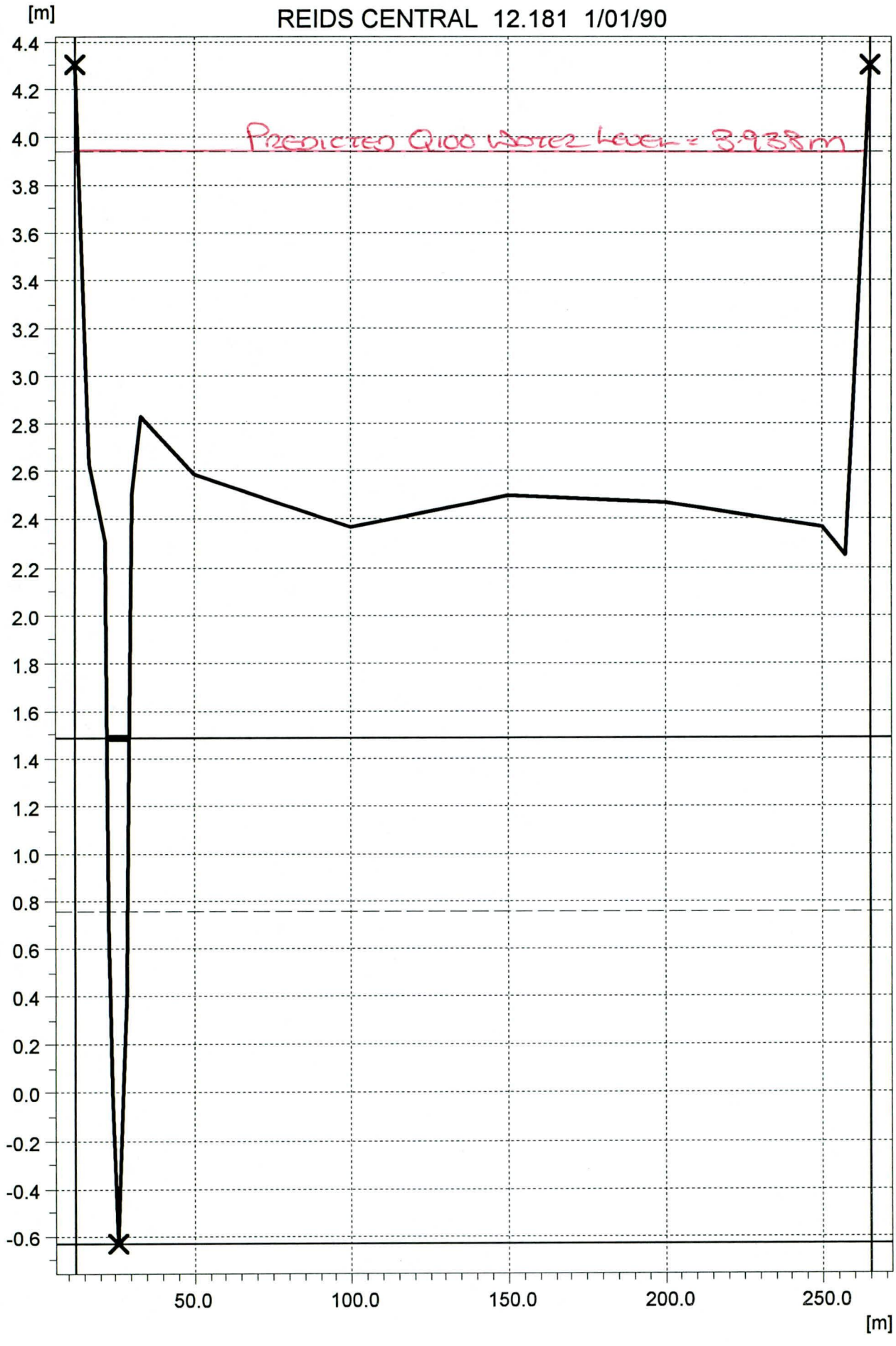

REIDS CENTRAL 10.040 1/01/90
[m]
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
PREDICTED Q100 WATER LEVEL 4.349
50.0
100.0
150.0
200.0
250.0
[m]

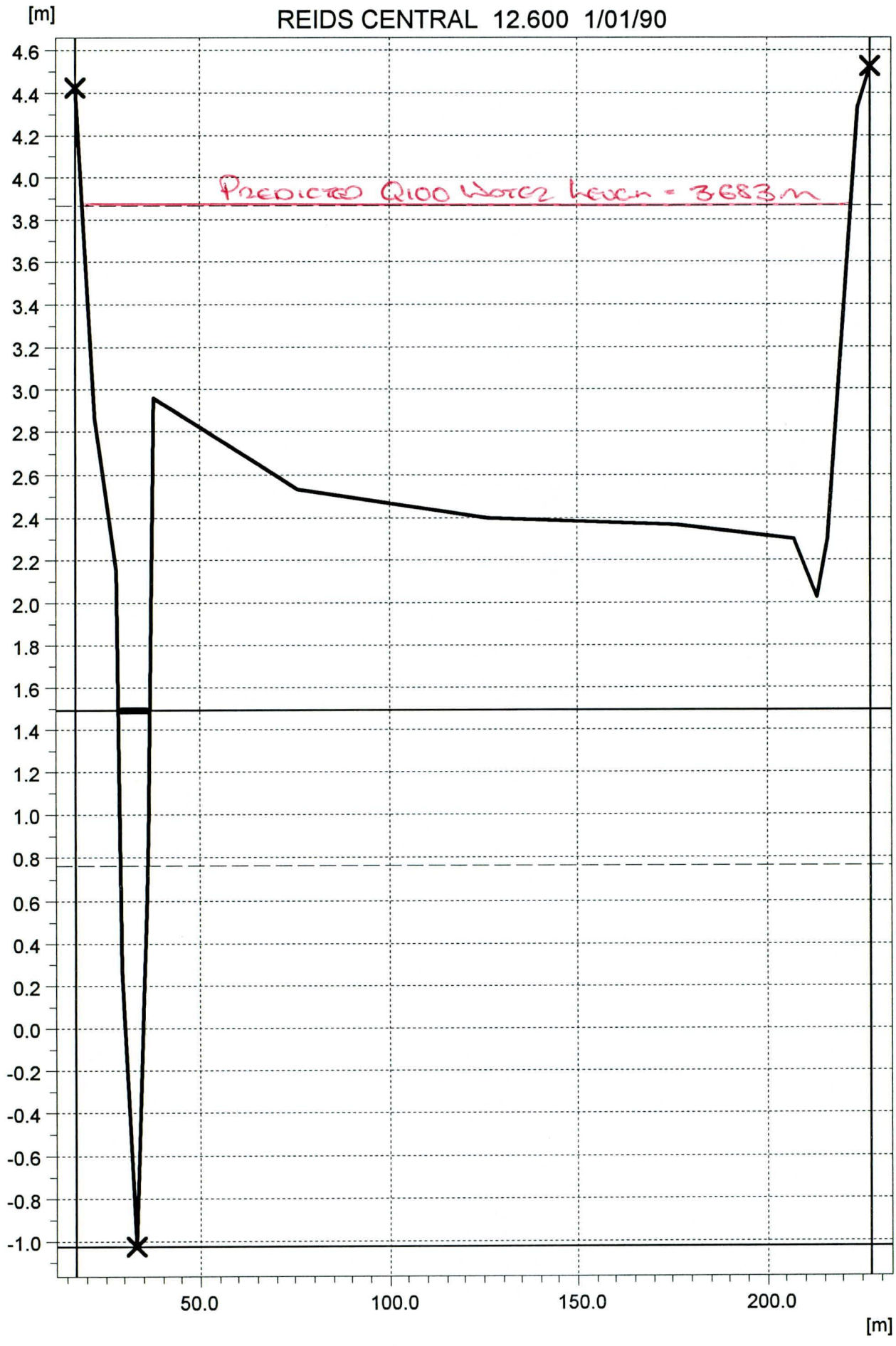

[m]
REIDS CENTRAL 10.560 1/01/90
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
PREDICTED Q100 WATER LEVEL 4.154m
50.0
100.0
150.0
200.0
250.0
[m]

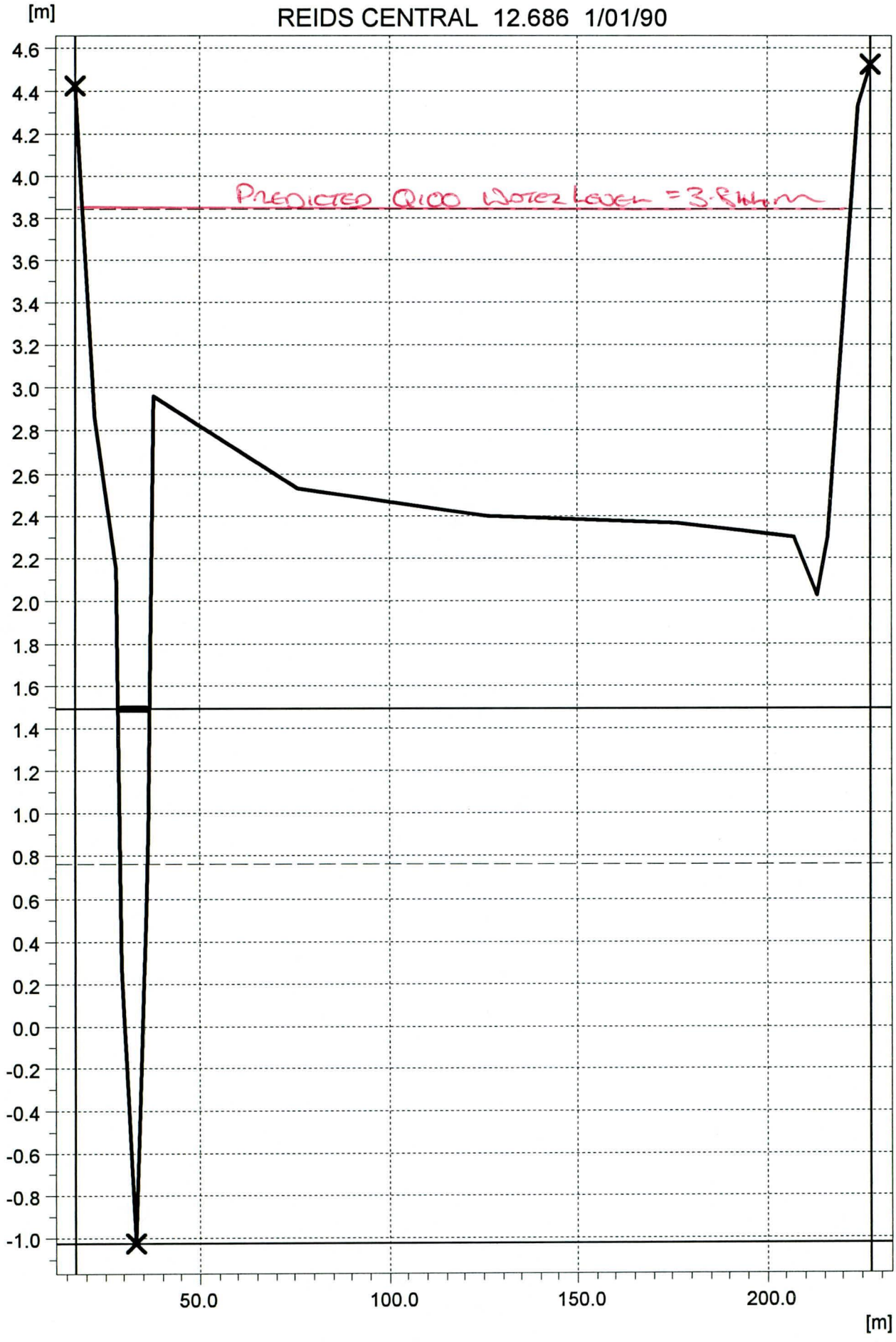

REIDS CENTRAL 10.934 1/01/90
[m]
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
PREDICTED Q100 WATER LEVEL 4.075m
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]

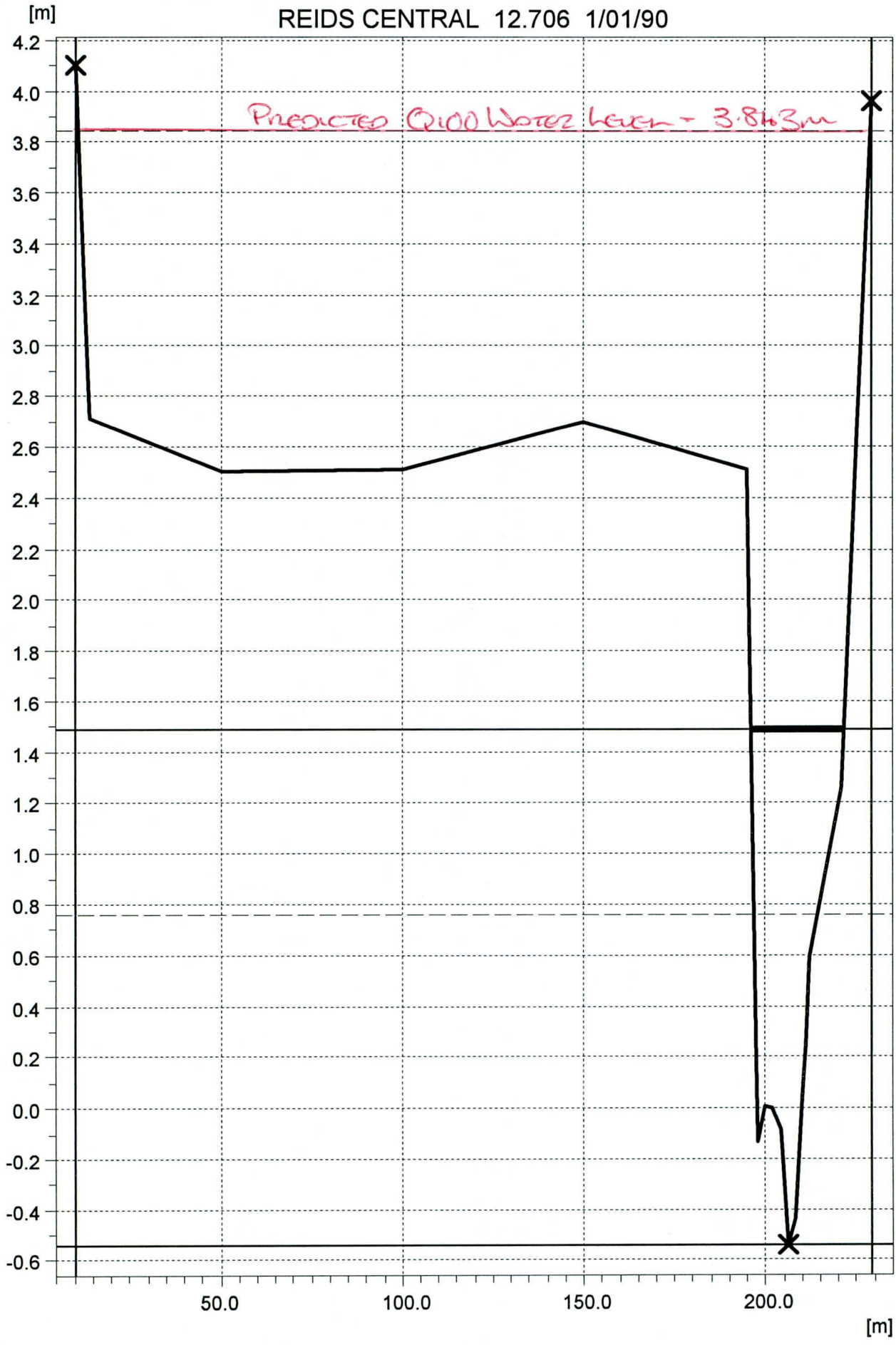

[m]
REIDS CENTRAL 11.375 1/01/90
PREDICTED Q100 WATER LEVEL = 4.015 m
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
50.0
100.0
150.0
200.0
250.0
300.0
350.0
[m]

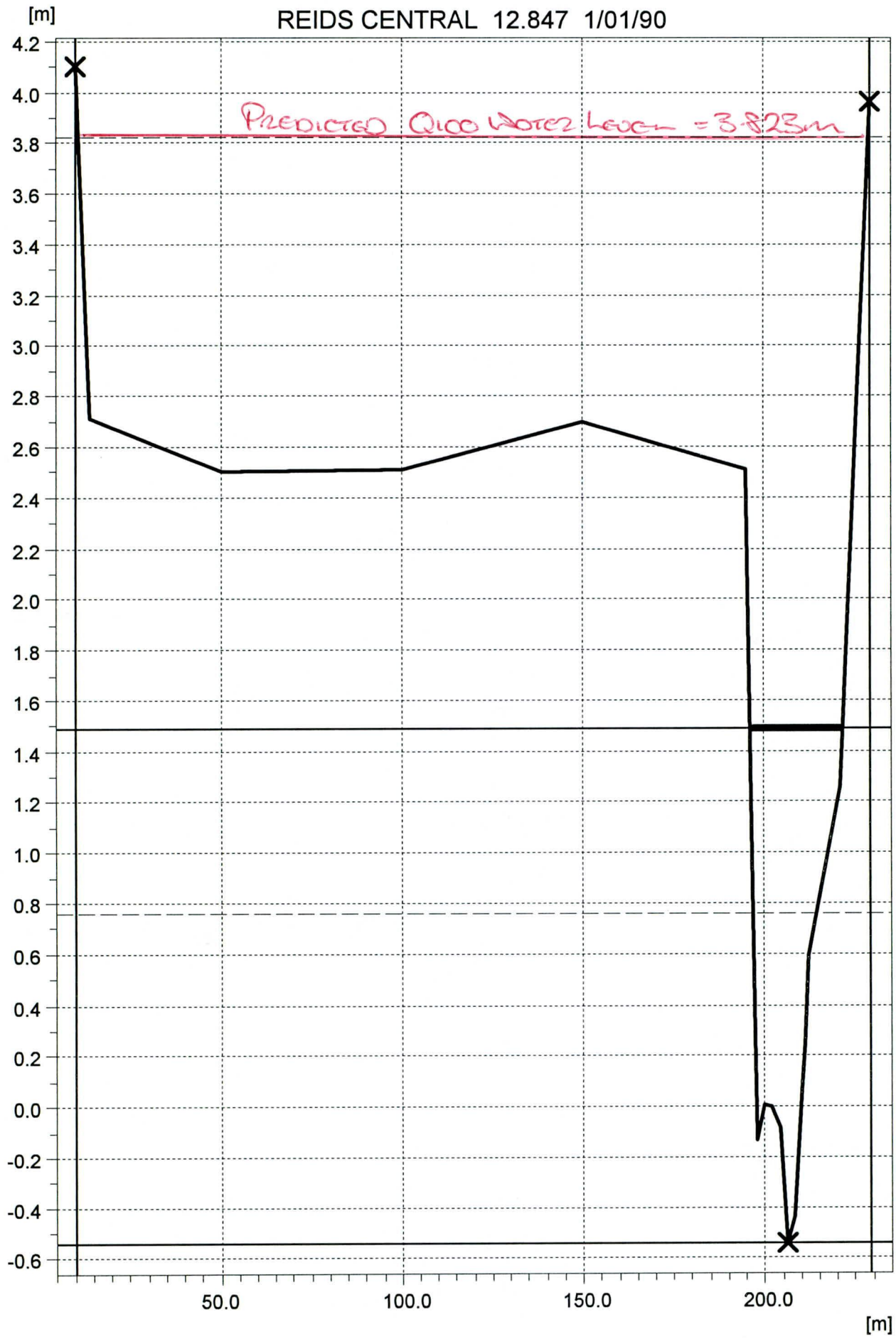

[m]
REIDS CENTRAL 11.747 1/01/90
PREDICTED Q100 WATER LEVEL = 3.984 m
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]

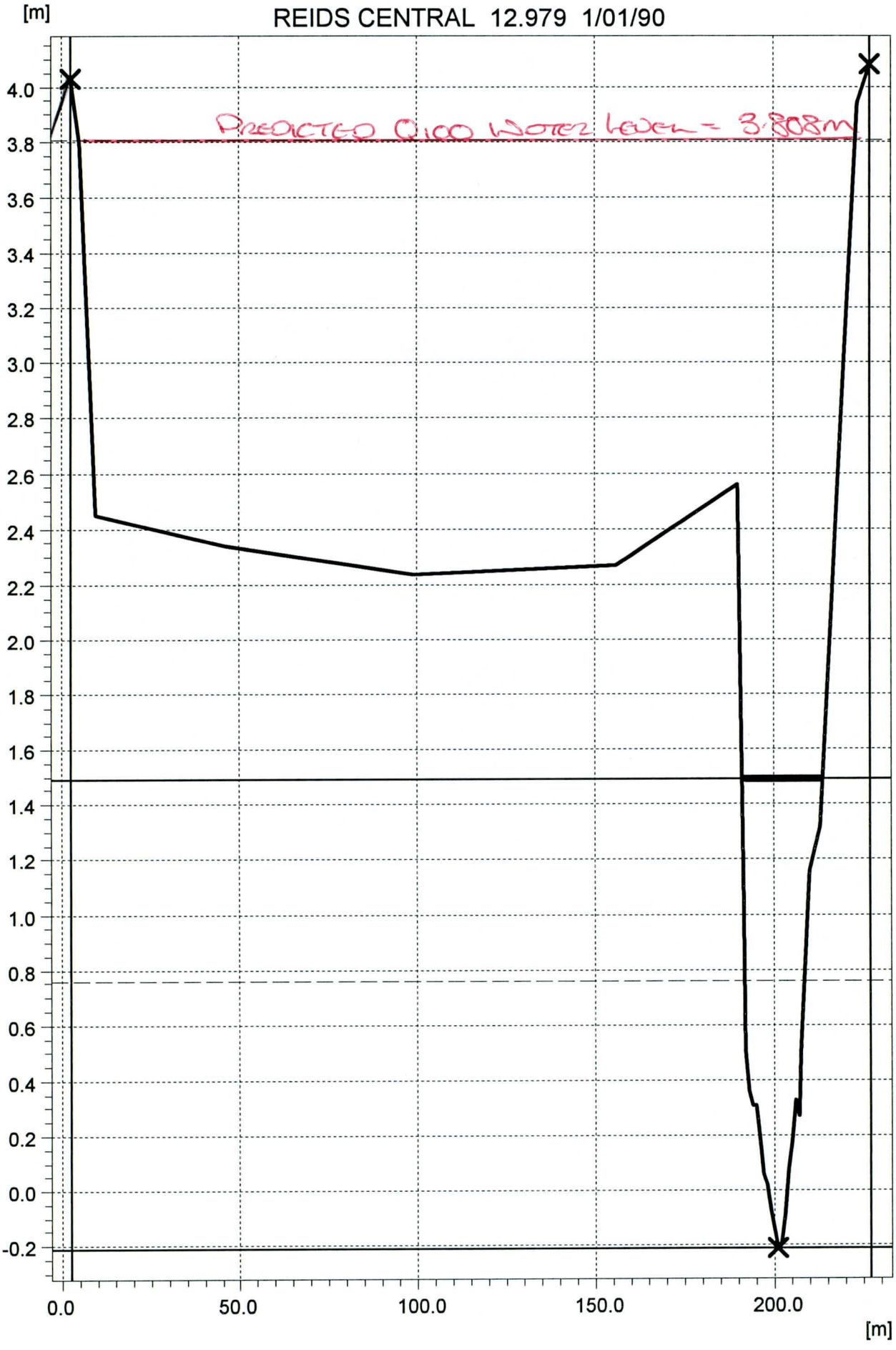

REIDS CENTRAL 12.181 1/01/90
[m]
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
PREDICTED Q100 WATER LEVEL = 3.933m
50.0
100.0
150.0
200.0
250.0
[m]

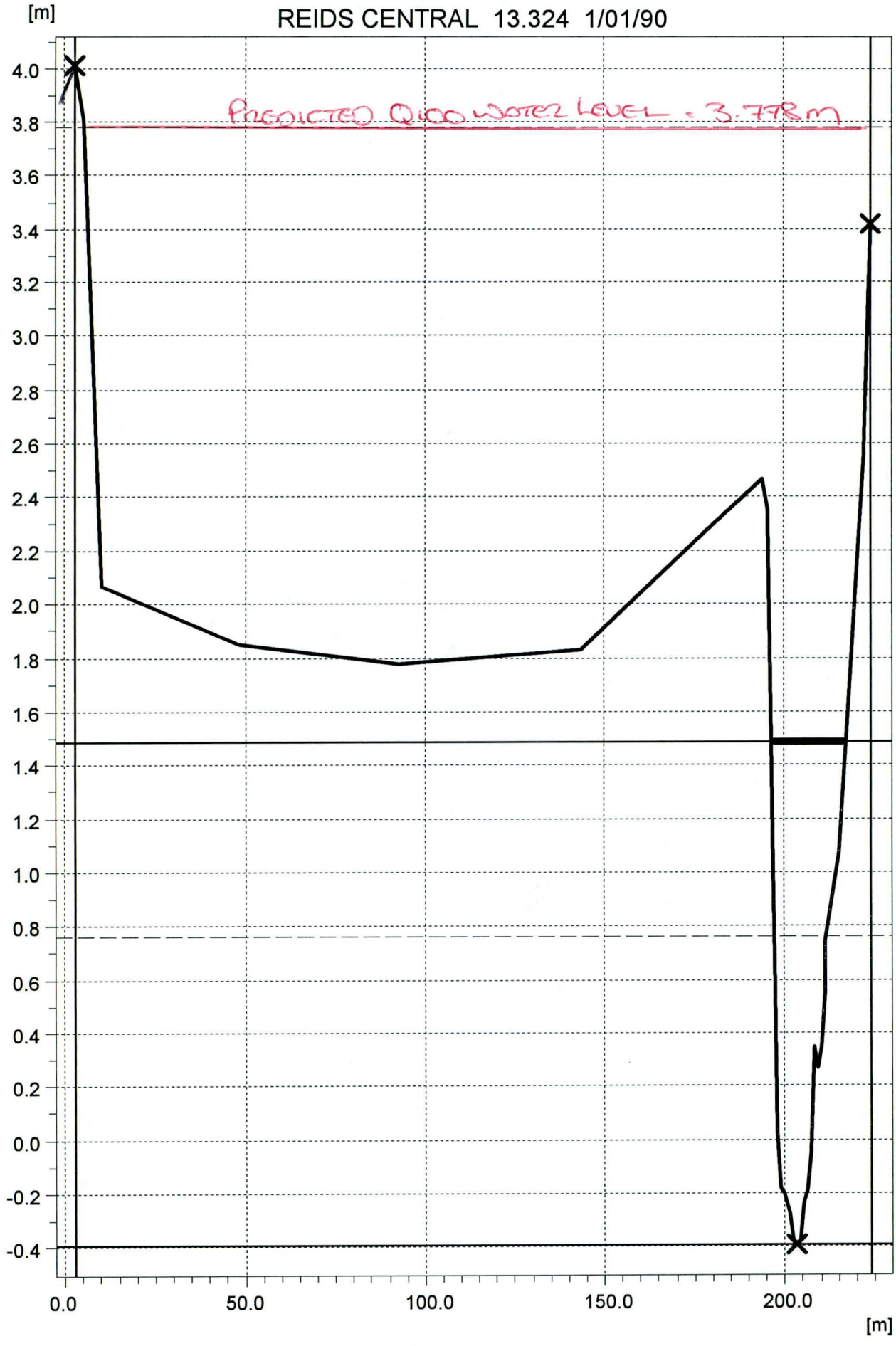

[m]
REIDS CENTRAL 12.600 1/01/90
PREDICTED Q100 WATER LEVEL = 3.683m
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
50.0
100.0
150.0
200.0
[m]

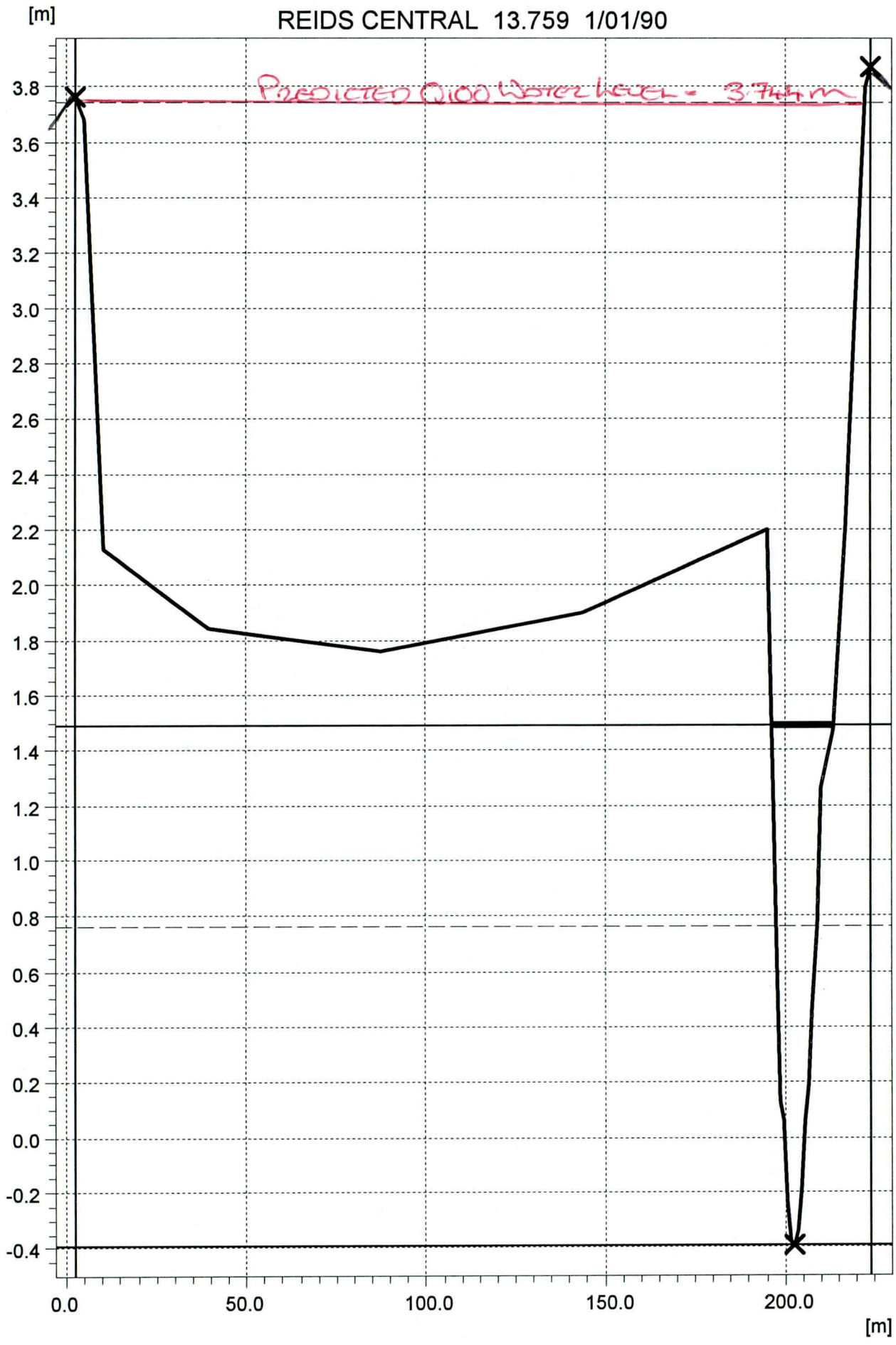

[m]
REIDS CENTRAL 12.686 1/01/90
PREDICTED Q100 WATER LEVEL = 3.8[illegible]m
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
50.0
100.0
150.0
200.0
[m]

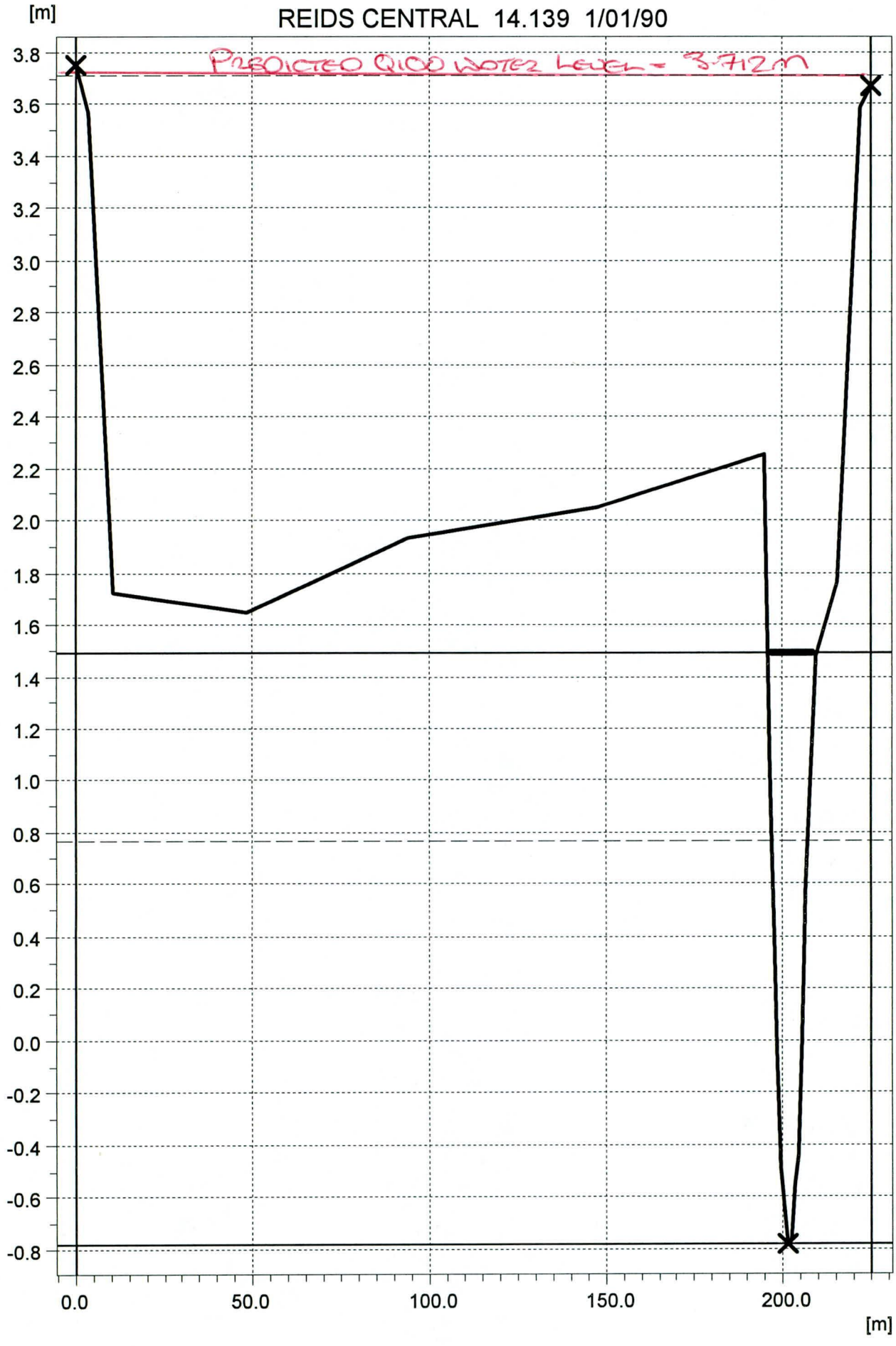

[m]
REIDS CENTRAL 12.706 1/01/90
PREDICTED Q100 WATER LEVEL = 3.843m
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
50.0
100.0
150.0
200.0
[m]

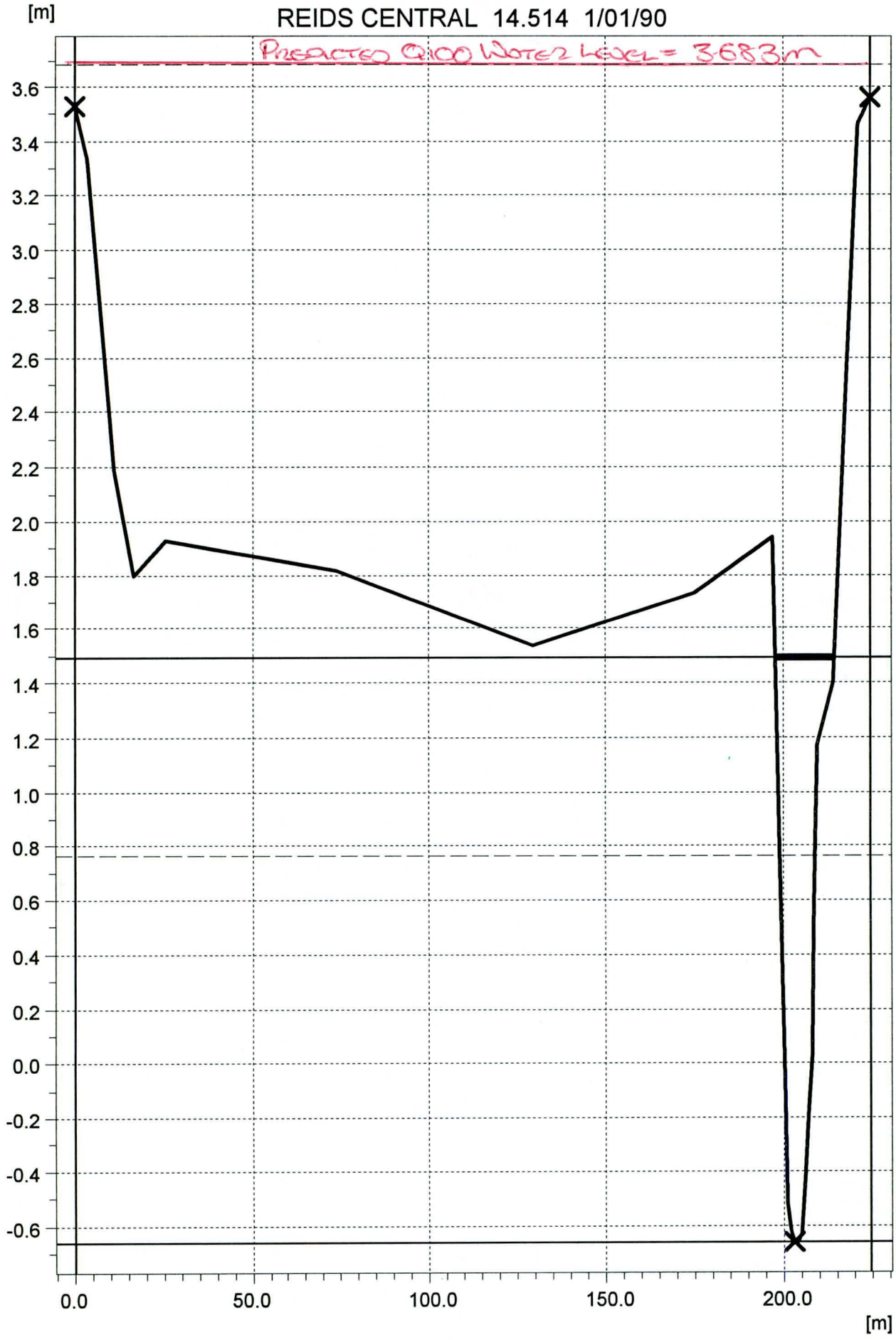

[m]
REIDS CENTRAL 12.847 1/01/90
PREDICTED Q100 WATER LEVEL = 3.823m
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
50.0
100.0
150.0
200.0
[m]

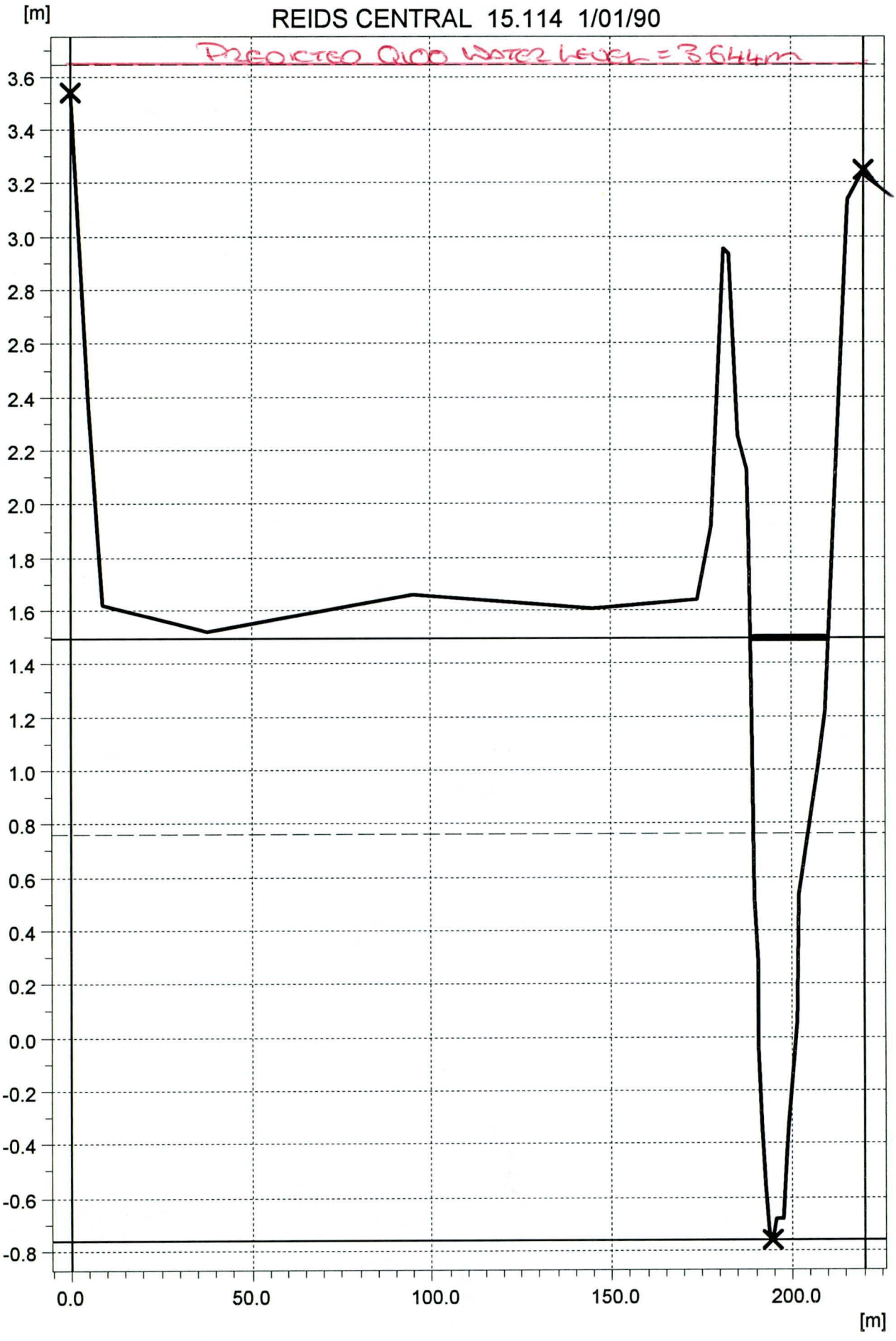

[m]
REIDS CENTRAL 12.979 1/01/90
PREDICTED Q100 WATER LEVEL = 3.808M
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0.0
50.0
100.0
150.0
200.0
[m]

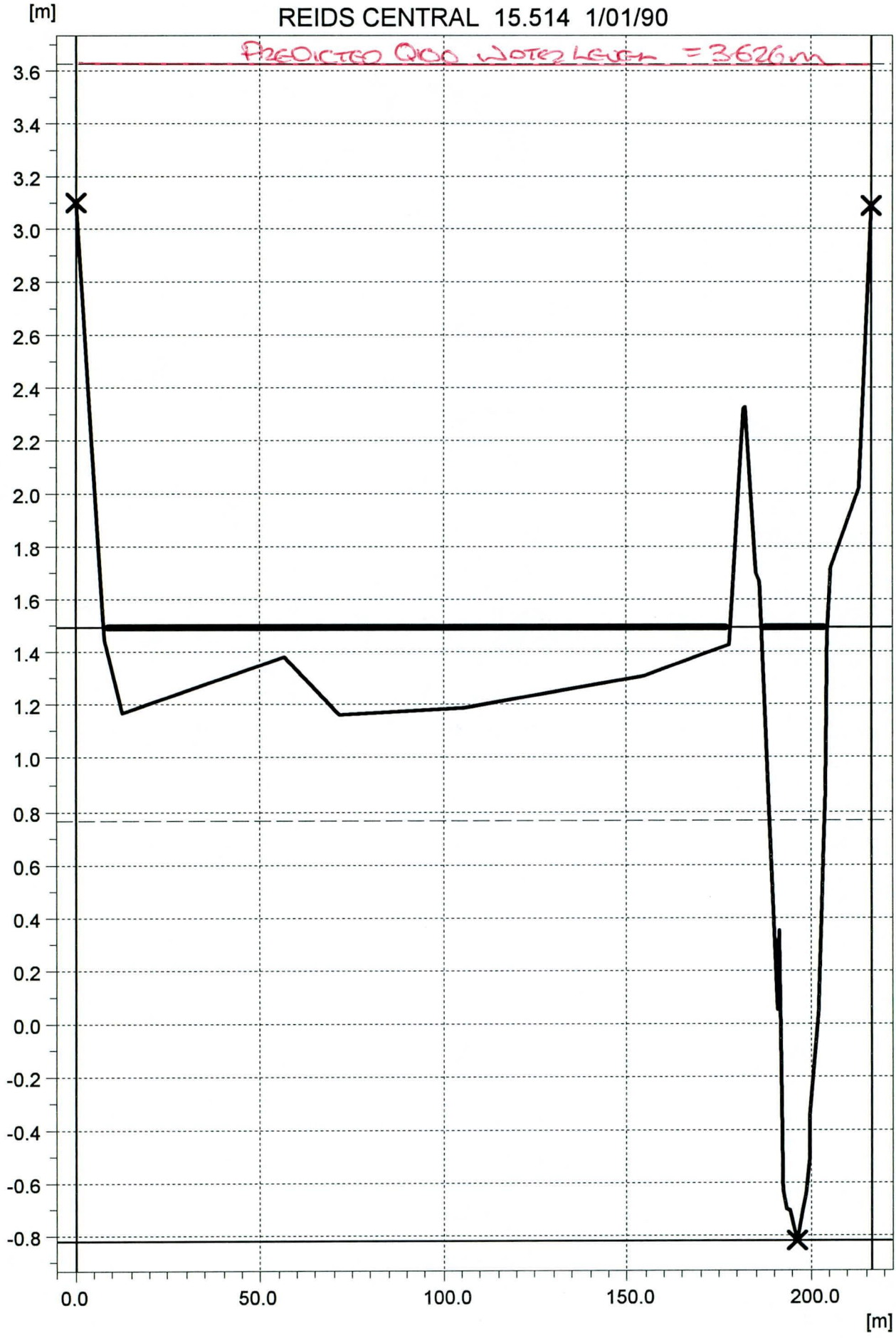

[m]
REIDS CENTRAL 13.324 1/01/90
PREDICTED Q100 WATER LEVEL = 3.778m
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
0.0
50.0
100.0
150.0
200.0
[m]

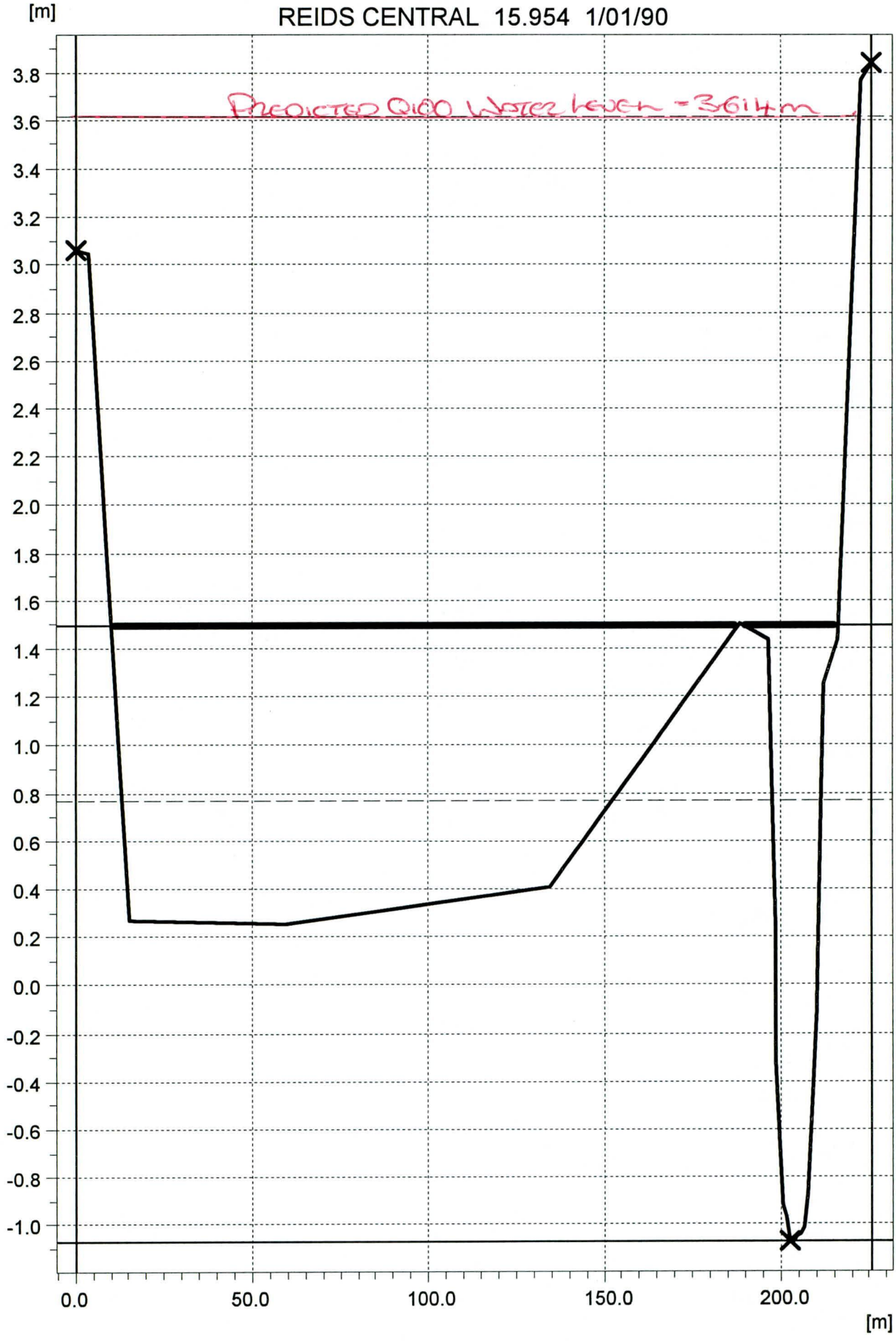

[m]
REIDS CENTRAL 13.759 1/01/90
PREDICTED Q100 WATER LEVEL = 3.744 m
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
0.0
50.0
100.0
150.0
200.0
[m]


[m]
REIDS CENTRAL 14.139 1/01/90
PROJECTED Q100 WATER LEVEL = 3.712m
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.0
50.0
100.0
150.0
200.0
[m]

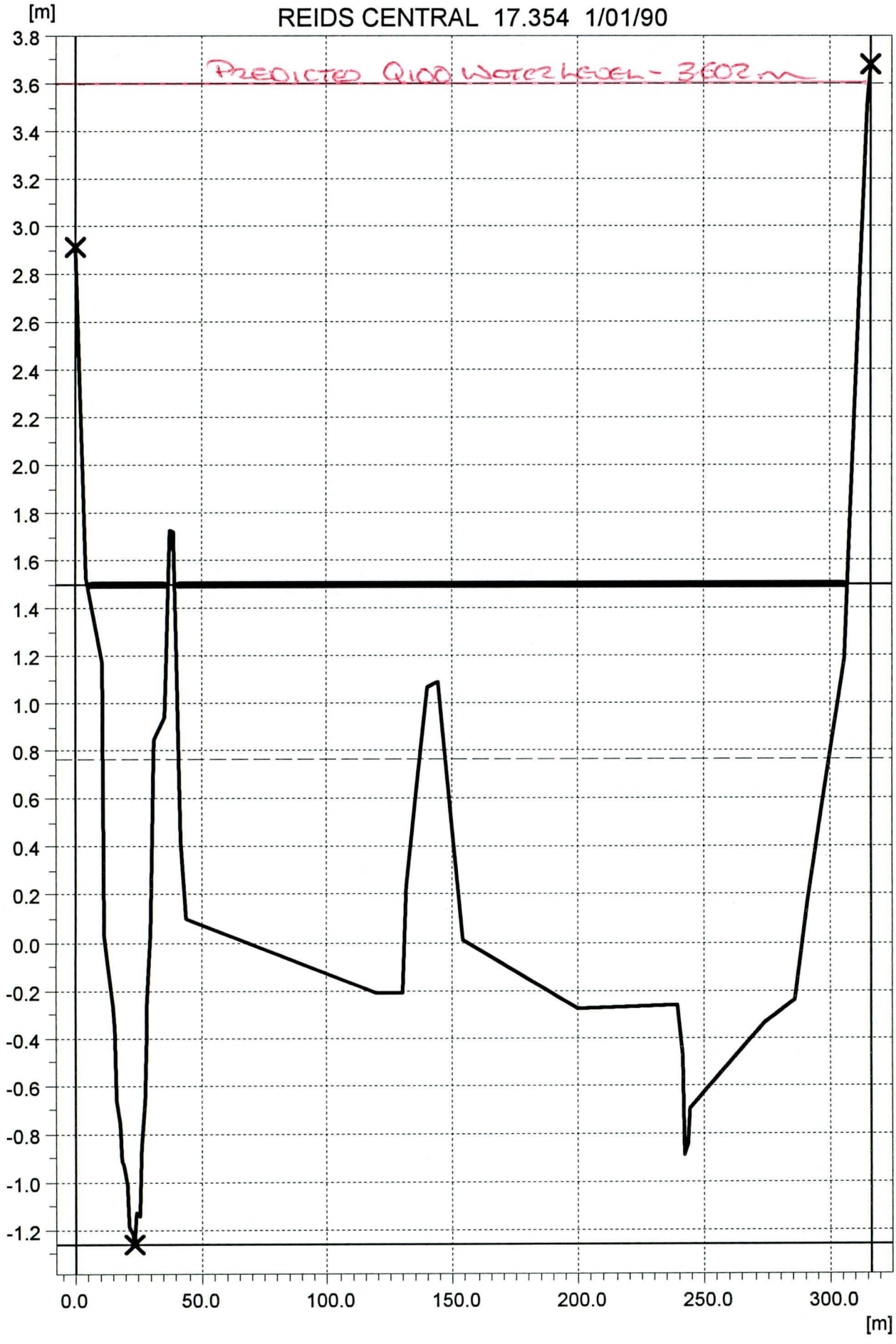

[m]
REIDS CENTRAL 14.514 1/01/90
PREDICTED Q100 WATER LEVEL = 3.683m
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.0
50.0
100.0
150.0
200.0
[m]


[m]
REIDS CENTRAL 15.114 1/01/90
PROJECTED QICO WATER LEVEL = 3.644m
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.0
50.0
100.0
150.0
200.0
[m]

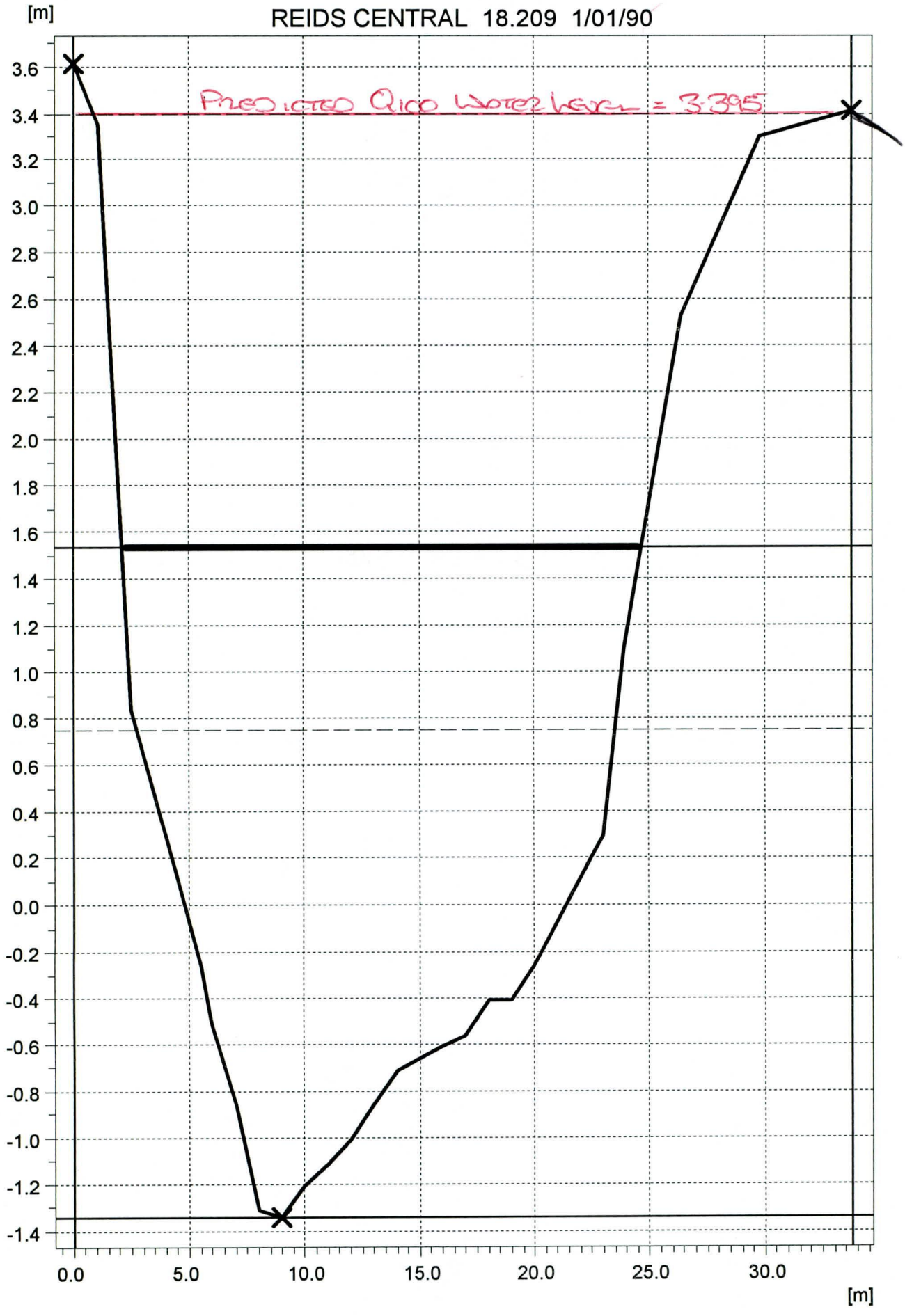

[m]
REIDS CENTRAL 15.514 1/01/90
PREDICTED Q100 WATER LEVEL = 3.626m
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.0
50.0
100.0
150.0
200.0
[m]

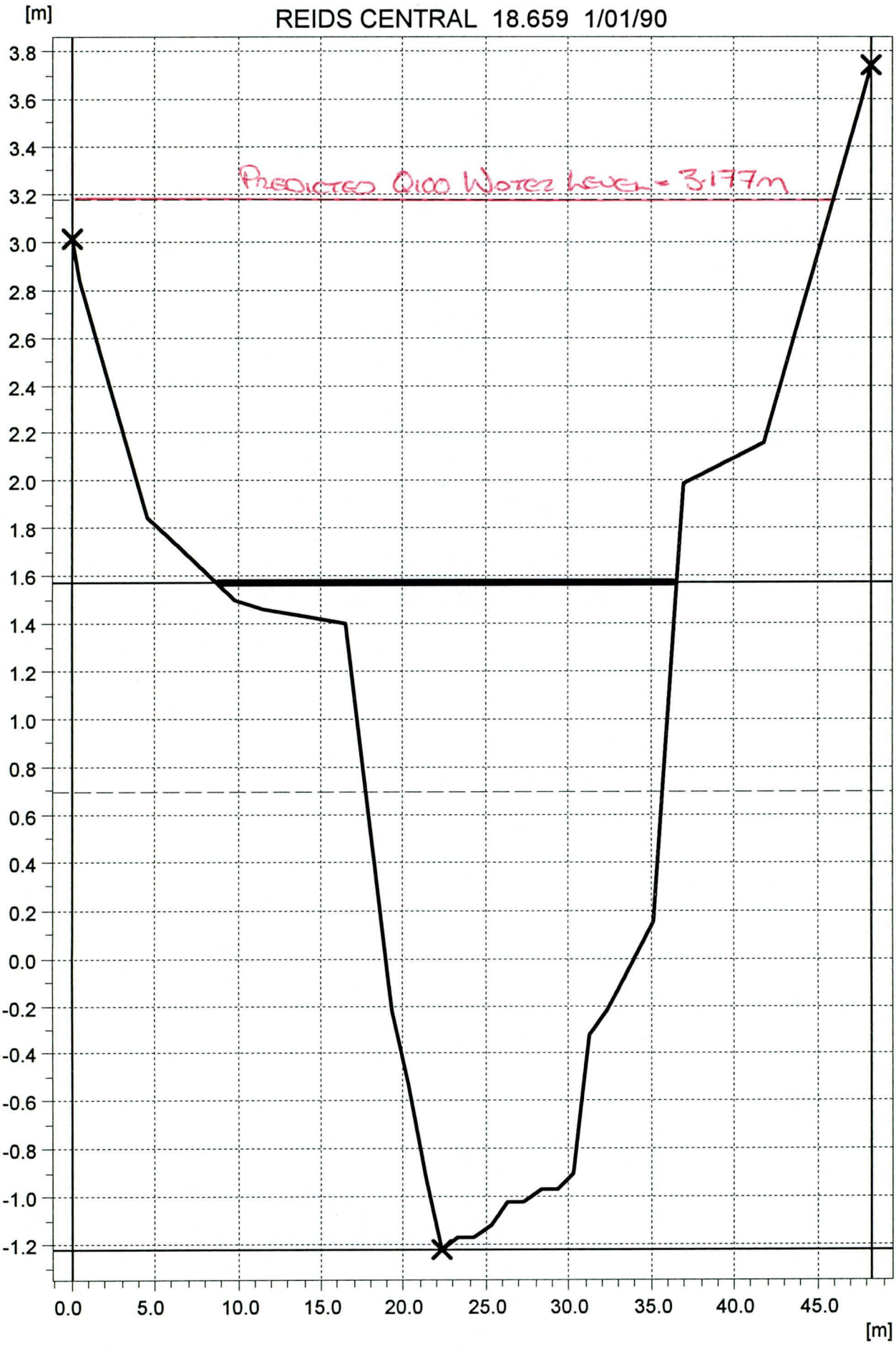

[m]
REIDS CENTRAL 15.954 1/01/90
PREDICTED Q100 WATER LEVEL = 3.614 m
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.0
50.0
100.0
150.0
200.0
[m]

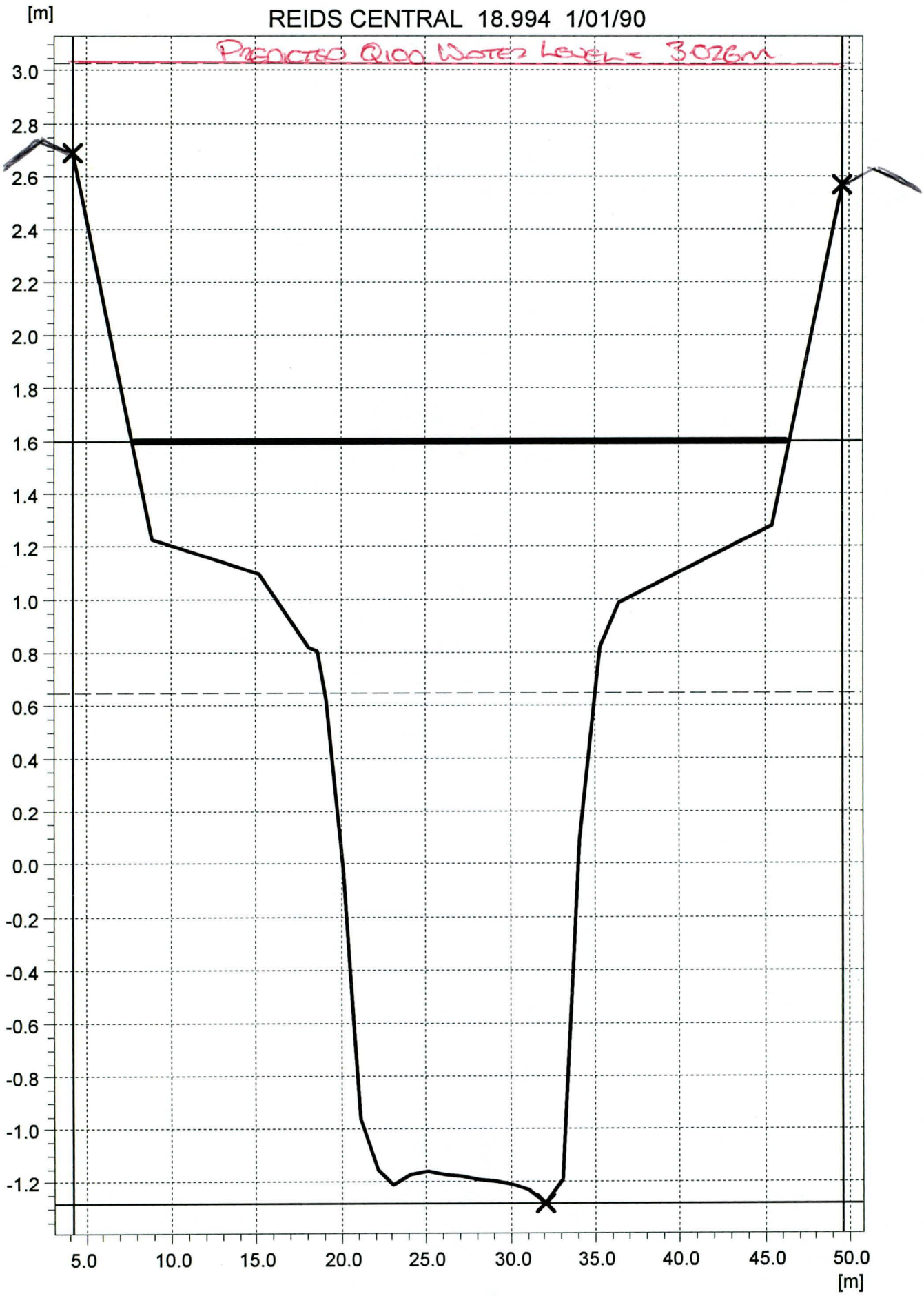

[m]
REIDS CENTRAL 16.759 1/01/90
PREDICTED Q100 WATER LEVEL = 3.606m
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]


REIDS CENTRAL 17.354 1/01/90
[m]
PREDICTED Q100 WATER LEVEL - 3.602 m
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0.0
50.0
100.0
150.0
200.0
250.0
300.0
[m]

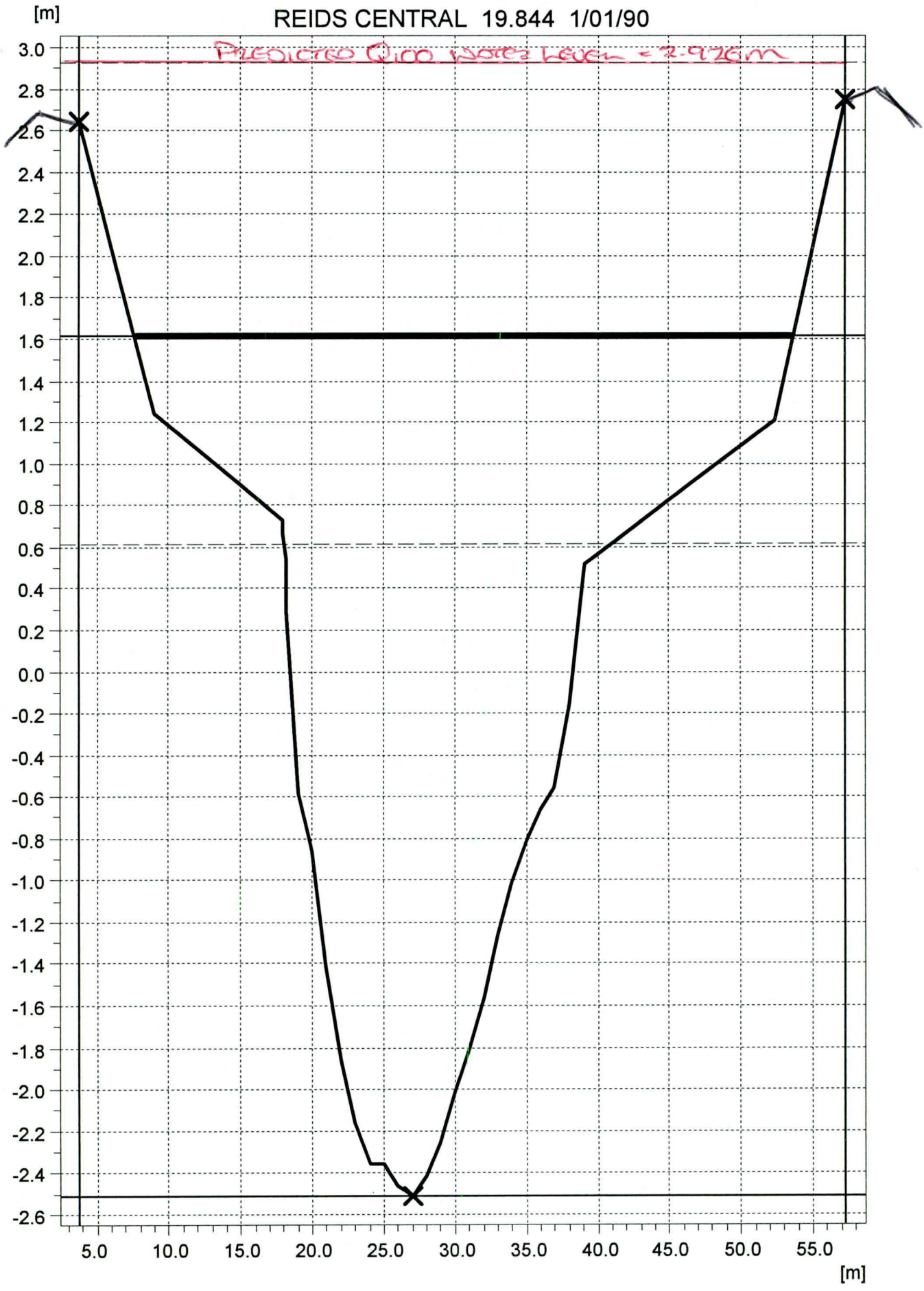

[m]
REIDS CENTRAL 17.784 1/01/90
PREDICTED Q100 WATER LEVEL = 3.581 m
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
[m]

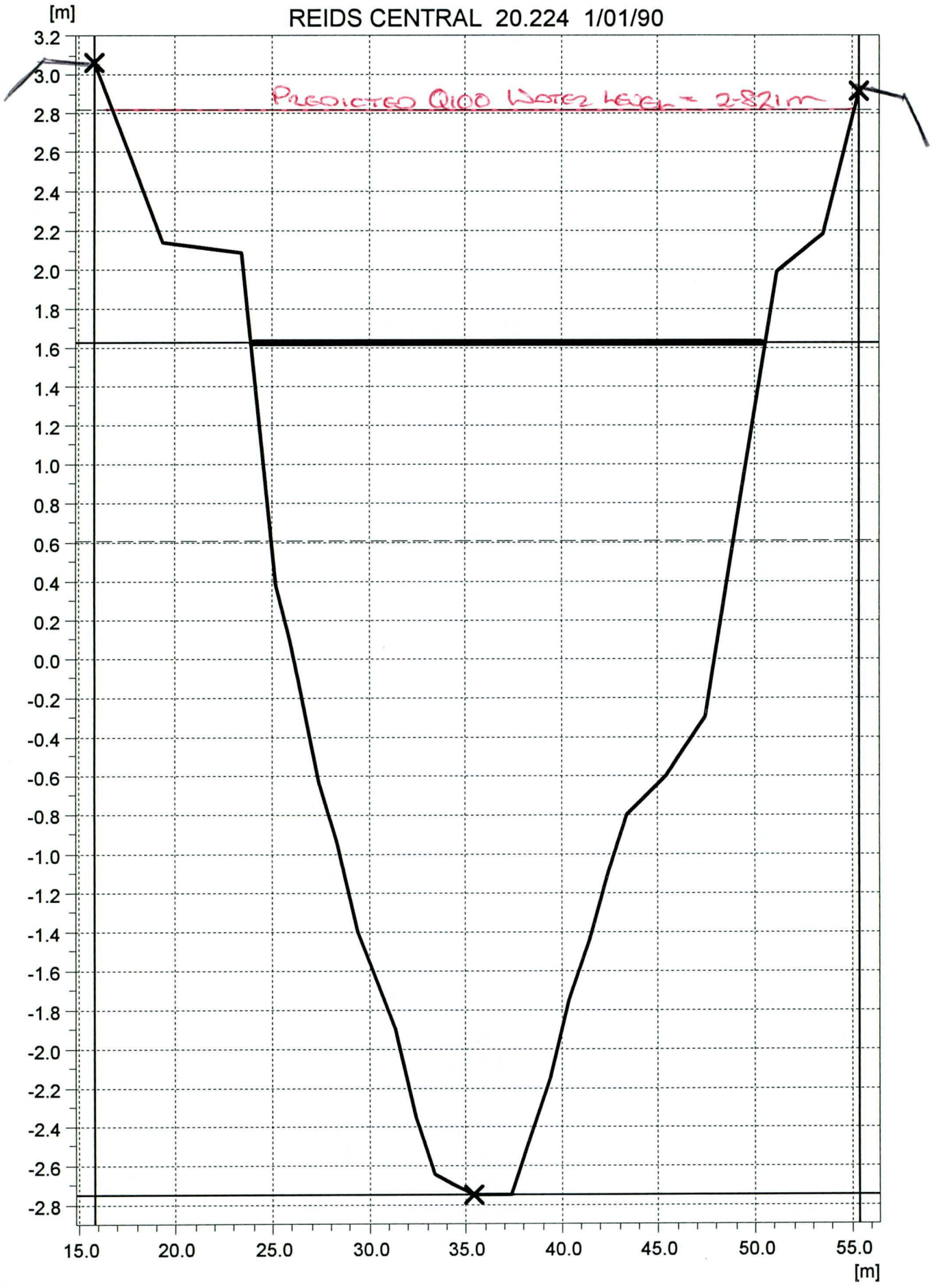

[m]
REIDS CENTRAL 18.209 1/01/90
PREDICTED Q100 WATER LEVEL = 3.395
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
0.0
5.0
10.0
15.0
20.0
25.0
30.0
[m]

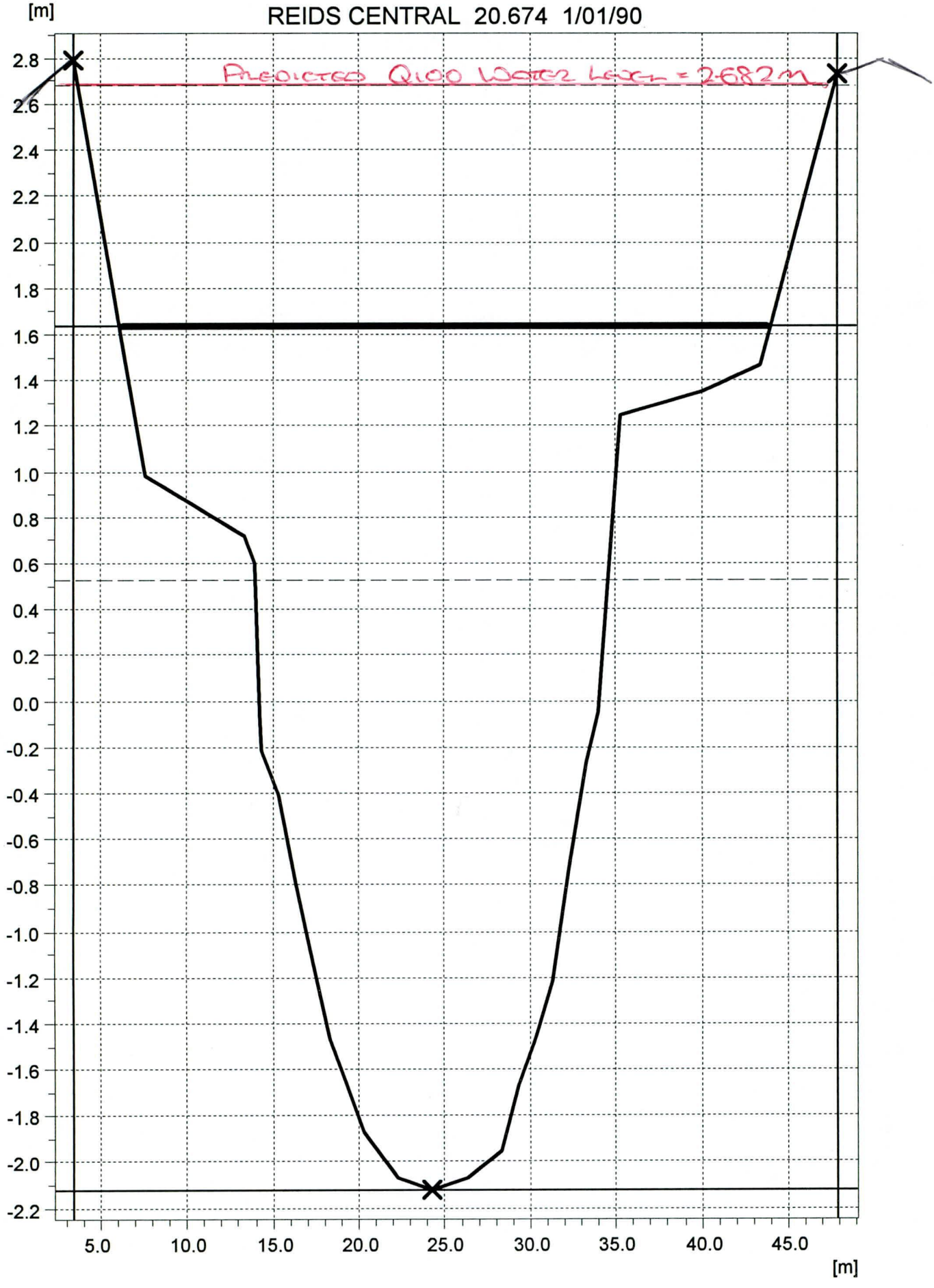

[m]
REIDS CENTRAL 18.659 1/01/90
PREDICTED Q100 WATER LEVEL = 3.177m
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
[m]

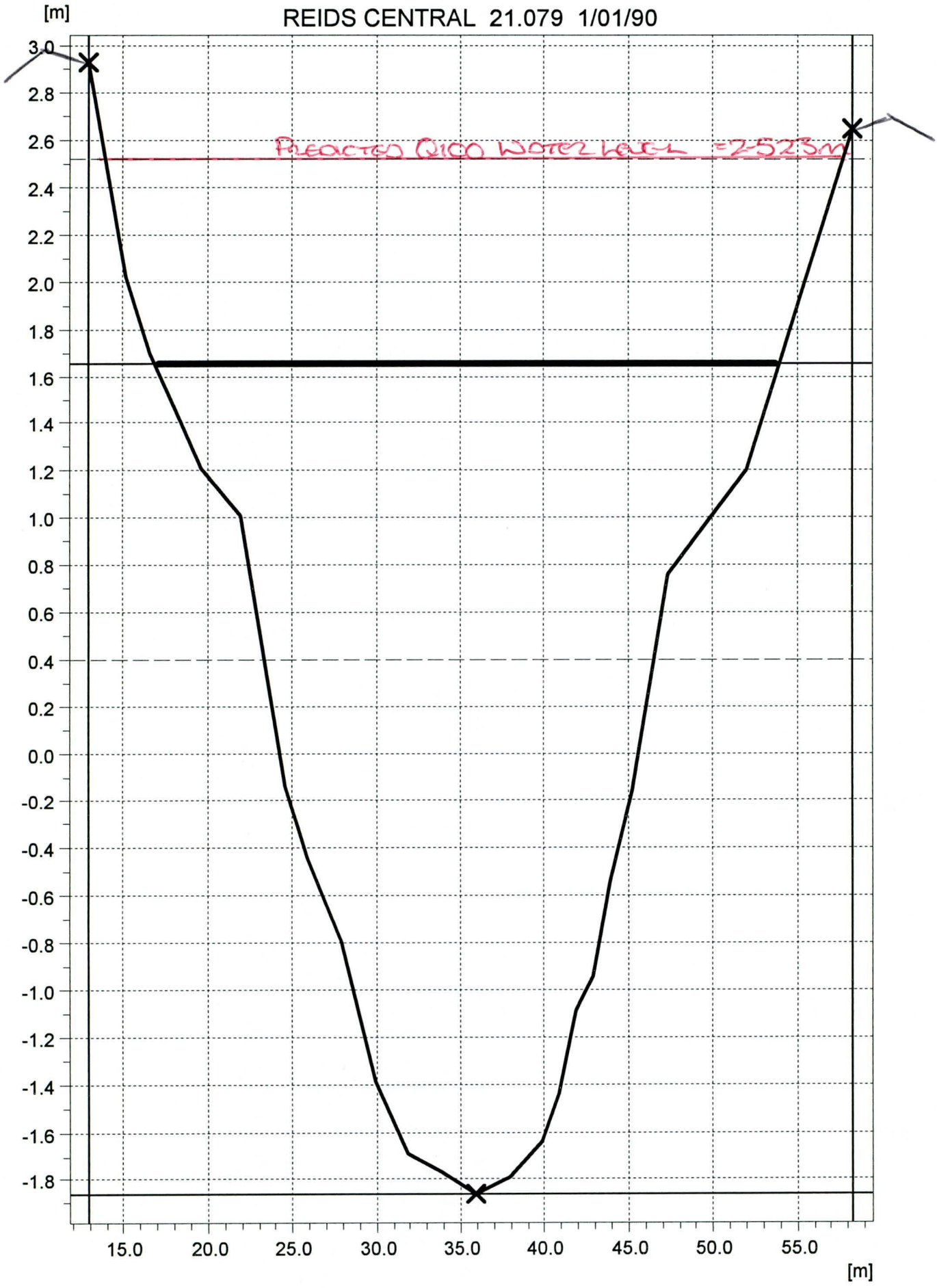

[m]
REIDS CENTRAL 18.994 1/01/90
PREDICTED Q100 WATER LEVEL = 3.026M
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
[m]

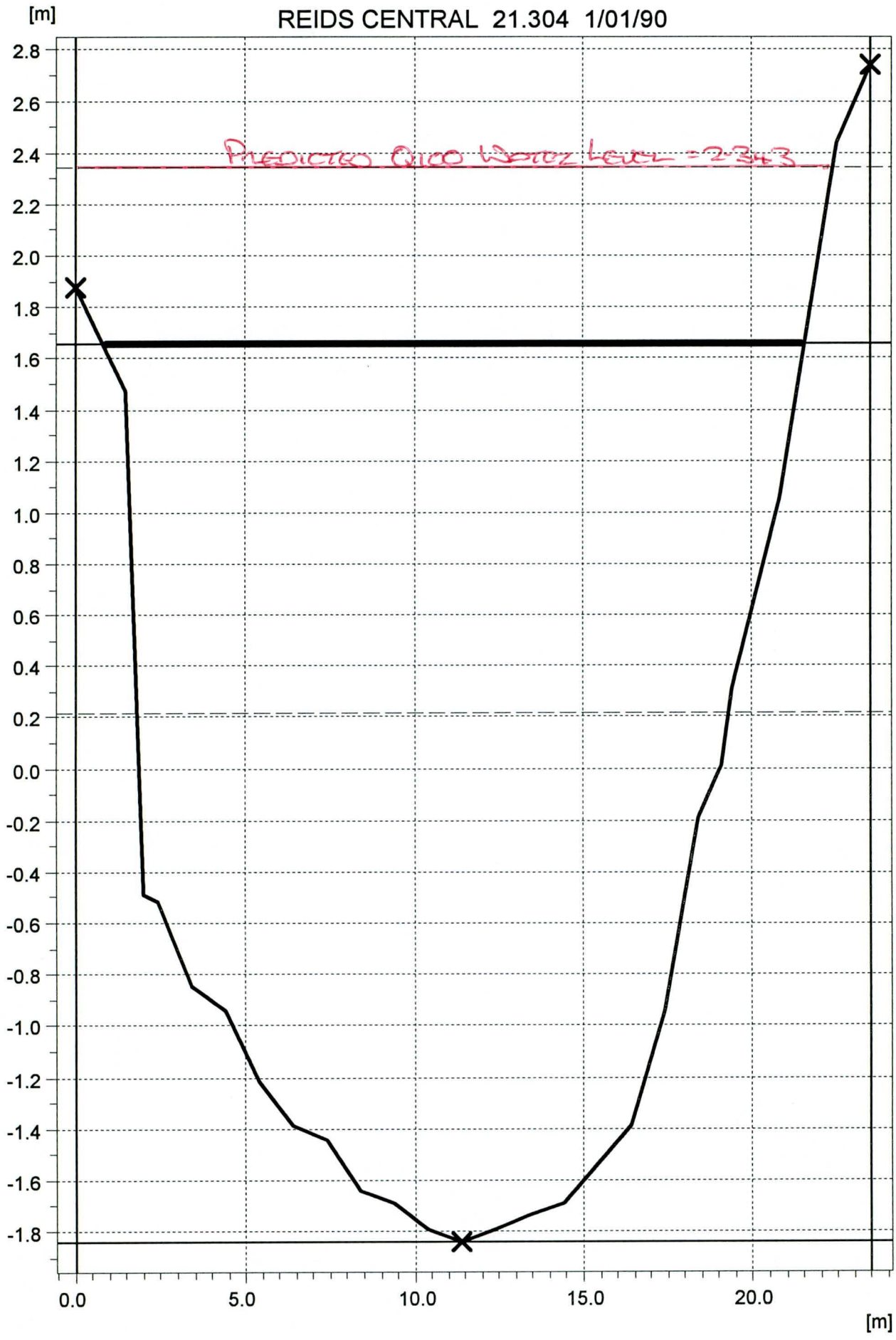

REIDS CENTRAL 19.449 1/01/90
PREDICTED Q100 WATER LEVEL = 2.978 m
[m]
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
0.0
20.0
40.0
60.0
80.0
100.0
[m]

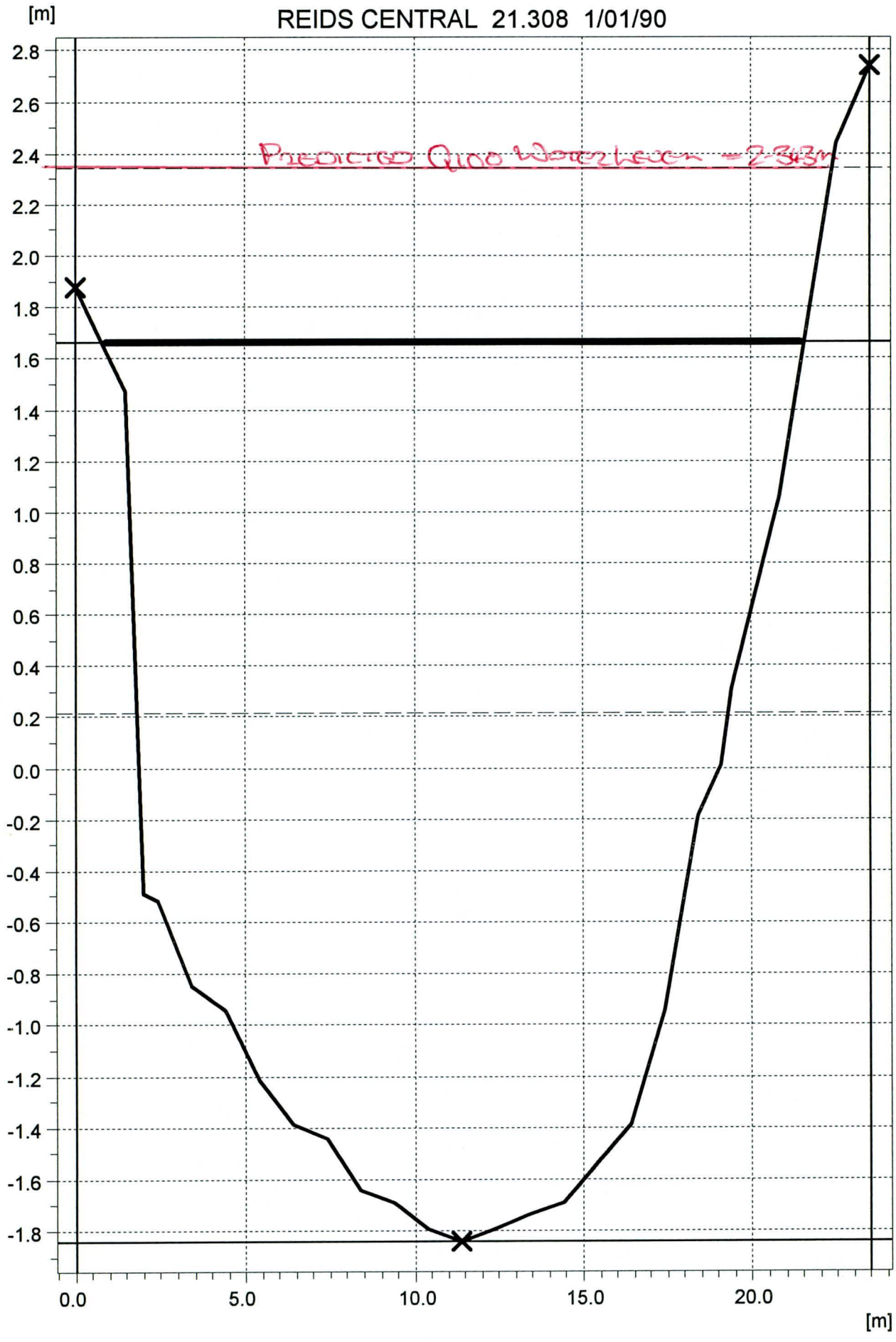

[m]
REIDS CENTRAL 19.844 1/01/90
PREDICTED Q100 WATER LEVEL = 2.926m
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
-2.6
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
[m]

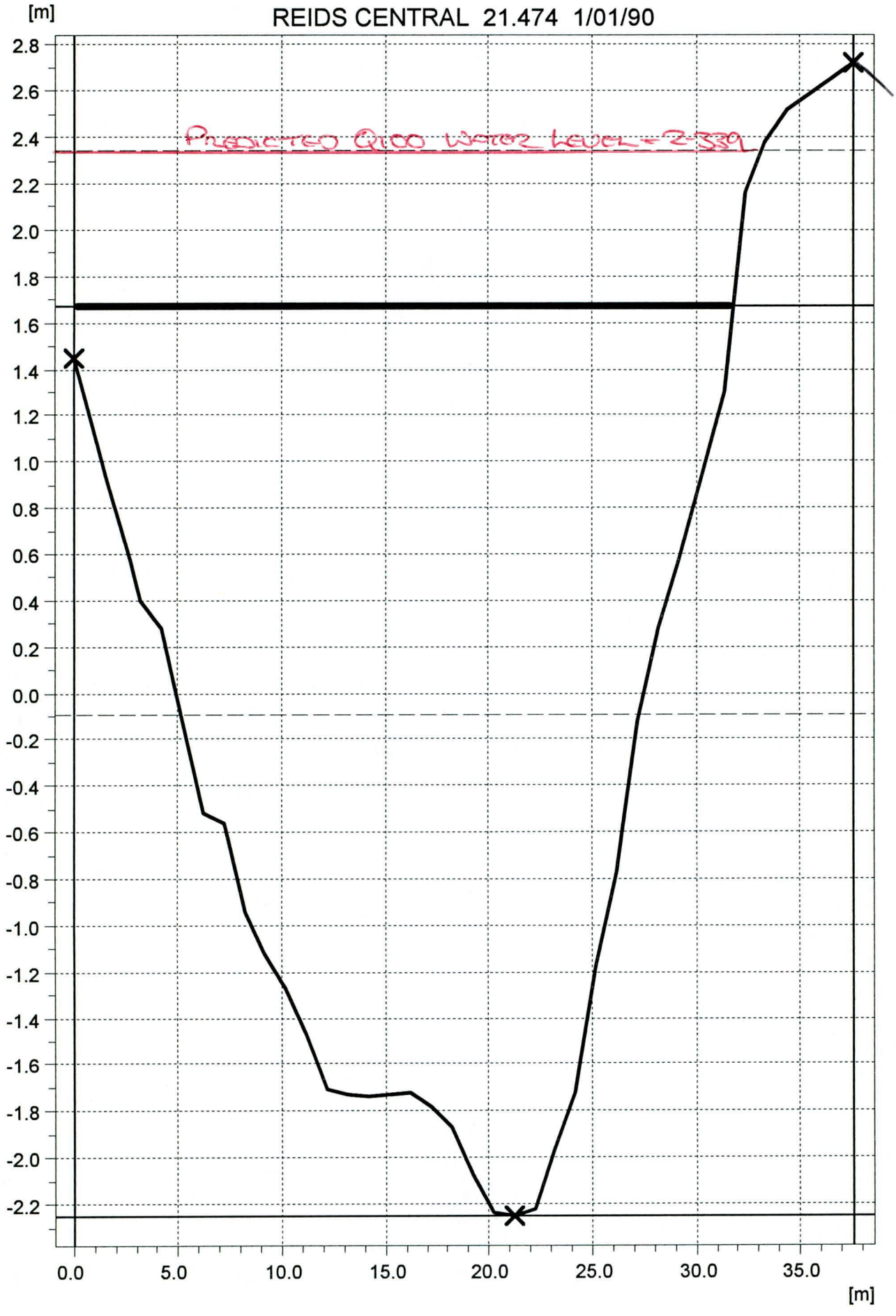

REIDS CENTRAL 20.224 1/01/90
[m]
PREDICTED Q100 WATER LEVEL = 2.82m
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
-2.6
-2.8
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
[m]


[m]
REIDS CENTRAL 20.674 1/01/90
PREDICTED Q100 WATER LEVEL = 2.682 m
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
[m]


[m]
REIDS CENTRAL 21.079 1/01/90
PREDICTED Q100 WATER LEVEL =2.523m
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
[m]


REIDS CENTRAL 21.304 1/01/90
[m]
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
0.0
5.0
10.0
15.0
20.0
[m]


REIDS CENTRAL 21.308 1/01/90
[m]
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
0.0
5.0
10.0
15.0
20.0
[m]


[m]
REIDS CENTRAL 21.474 1/01/90
PREDICTED Q100 WATER LEVEL = 2.339
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
[m]