16 March, 2001
KX03904

City of Quesnel
405 Barlow Avenue
Quesnel, BC V2J 2C3

Dear Mr. Jack Marsh, Director of Public Works

RE: PROJECT UPDATE- MARCH SLOPE INCLINOMETER INSTALLATION READINGS WEST QUESNEL STABILITY STUDY

1.0 INTRODUCTION

This purpose of this letter is to provide the City of Quesnel (CoQ) with a project update for the West Quesnel Stability Study, on which work was commenced by AMEC Earth & Environmental Limited (AMEC) in September, 2000. The following tasks have been completed:

- Inclinometer installations (SI) SI-1 through SI-7.
- Survey of SI locations.
- An initial reading and three additional readings of each SI) with the exception of SI-4 and SI-5 which have had four additional readings completed).
- Provision of a project update letter to the CoQ on 26 January, 2001.

Figure 1 shows the approximate locations of SI-1 through SI-7.

2.0 SI READING SCHEDULE

Table 1 summarizes the SI reading schedule to date:

Table 1: SI Reading Schedule

Borehole:	SI-1	SI-2	SI-3	SI-4	SI-5	SI-6	SI-7
Location	Avery Lane (Lower Elevation)	Avery Lane (Higher Elevation)	Abbott Drive (near Bettcher)	Voyager School	Abbott Drive (near Flamingo)	Dixon Street	Pierce Crescent
A_0* Groove Azimuth	120°	120°	120°	110°	110°	105°	100°
Depth Read	142 ft, 43 m	244 ft, 74 m	334 ft, 102 m	504 ft, 154 m	474 ft, 145 m	502 ft, 153 m	410 ft, 125 m
Finish of Installation/ Grouting	25 Oct., 2000	23 Oct., 2000	27 Oct., 2000	13 Oct., 2000	5 Oct., 2000	16 Oct., 2000	19 Oct., 2000
Initial Reading Date	21 Nov., 2000	21 Nov., 2000	21 Nov., 2000	3 Nov., 2000	28 Oct., 2000	22 Nov., 2000	22 Nov., 2000
First Reading:	7 Dec., 2000	7 Dec., 2000	6 Dec., 2000	24 Nov., 2000	24 Nov., 2000	6 Dec., 2000	7 Dec., 2000
Second Reading	12 Jan., 2001	11 Jan., 2001	12 Jan., 2001	6 Dec., 2000	6 Dec., 2000	11 Jan., 2001	12 Jan., 2001
Third Reading	5 Mar., 2001	5 Mar., 2001	6 Mar., 2001	11 Jan., 2001	12 Jan., 2001	5 Mar., 2001	6 Mar., 2001
Fourth Reading				5 Mar., 2001	6 Mar., 2001		

*The A_0 Groove azimuth refers to the direction of the A channel groove in the SI casing which is aligned approximately parallel to the downslope dip of the slope

AMEC Earth & Environmental Limited
610 Richard Road
Prince George, BC V2K 4L3
Tel +1 (250) 564-3243
Fax +1 (250) 562-7045
www.amec.com

3.0 SI READING RESULTS

Attached in Appendix A are the results of the SI readings to date. The SI readings are presented in cumulative and incremental plots with a 50 mm horizontal scale. The incremental plots show the individual changes in inclination of the casing at each reading elevation. The cumulative plots are constructed by adding together the incremental changes starting from the bottom of the hole and show the overall apparent movement of the SI casing at each elevation relative to the bottom of the hole.

Two channels of readings are presented: A and B. The A channel is oriented to be "downslope" whereas the B channel is across slope. The actual orientation of each of the casings is shown on Figure 1 and summarized in Table 1. Positive movements on the Cumulative Plots are downslope on Channel A and across the slope to the right when looking downhill for Channel B.

Table 2 presents AMEC's preliminary observations based on the limited data gathered to date.

Table 2: SI Data Observations

SI	Location	SI Data Observations
SI-1	Avery Lane (Lower Installation)	Cumulative deflections of up to 8 mm (B Channel) have been observed from depths ranging from 12 to 29 m. There has been little change in the SI installation since the previous reading on 12 January, 2001. There was little or no net deflection of the top of the casing.
SI-2	Avery Lane (Upper Installation)	Cumulative downhill deflections of up to 10 mm were observed above approximately 60 m depth. There has been approximately an additional 7 mm of downhill deflection since 11 January, 2001.
SI-3	Abbott Drive (near Bettcher Street)	Cumulative downhill deflections of up to 10 mm were observed above approximately 54 m depth. There has been approximately an additional 4 mm of downhill deflection since 12 January, 2001.
SI-4	Voyager School	Cumulative downhill deflections of up to 6 mm were observed above approximately 51 m depth. There has been approximately an additional 3 mm of deflection since 6 December, 2000. The dataset taken on 11 January, 2000 appeared to contain a data/reading error and has been removed from the plot included in Appendix A.
SI-5	Abbott Drive (near Flamingo Drive)	"Wave like" cumulative deflections of up to 50 mm were observed in a zone from 36 to 93 m depth. An additional bend has appeared at approximately 72 m depth since the reading of 12 January, 2001. The profile of the cumulative deflection plot indicates that the SI-5 casing may be experiencing vertical compression or settlement.
SI-6	Dixon Street	Cumulative downhill deflections of up to 32 mm were observed above the bottom of the installation at 153 m depth. The deflection of the casing has increased approximately 12 mm since 11 January, 2001. There was also an apparent but gradual systematic shift evident on the plots below 28 m depth.
SI-7	Pierce Crescent	Cumulative deflections towards Baker Creek (B channel) of up to 14 mm were observed above approximately 68 m depth. The deflection of the casing in the B channel has increased approximately 12 mm since 11 January, 2001. There was also an apparent but gradual systematic shift evident on the plot below 68 m depth.

Included in Appendix B are displacement versus time (velocity) plots for SI-1, 2, 3, 4, 6 and 7. A velocity plot has not been included for SI-5 due to the "wave-like" profile of the casing and minimal deflections evident at the top of the casing. Velocity plots are given in the downhill A channel direction for SI-1, 2, 3, 4 and 6 and in the cross slope B channel direction for S1-1 and SI-7 (positive displacements indicate movement toward the south and negative displacements indicate movement toward the north).

AMEC emphasizes to the CoQ that the readings to date have shown relatively small displacements (with the exception of SI-5) and should be considered very preliminary. Due to the extreme depth of the installation and winter monitoring conditions it is likely that some of the preliminary data may be showing the effects of temperature variation, casing grout adjustment instrument drift, depth offset and/or rotation errors. AMEC has presented the raw data in the attached plots and has not applied any corrections. Future readings will allow AMEC to isolate and apply corrections for these factors and get a true picture of how much of the SI deformation may be attributable to lateral ground movement.

4.0 FUTURE WORK

Given the nature of the movements observed to date, AMEC expects to monitor the SI's for at least another four months (specifically during the spring when landslide movements are typically highest) before proceeding to Stage 2 of the West Quesnel Stability Study, the more detailed soils investigation. The next set of readings is planned for April, 2001.

5.0 CLOSURE

Thank you for the opportunity to provide assistance in this matter. Should you have any questions of comments please contact Mr. Nick Polysou at 1-250-564-3243.

Respectfully submitted,

AMEC Earth & Environmental Limited

PROFESSIONAL ENGINEER OF BRITISH COLUMBIA D.L. DEWAR 24936

2001 0316

Doug Dewar, M.Sc., P.Eng.
Geotechnical Engineer

Reviewed by:

Nick Polysou, P.Eng.
Senior Geotechnical Engineer
Regional Manager, Central BC.

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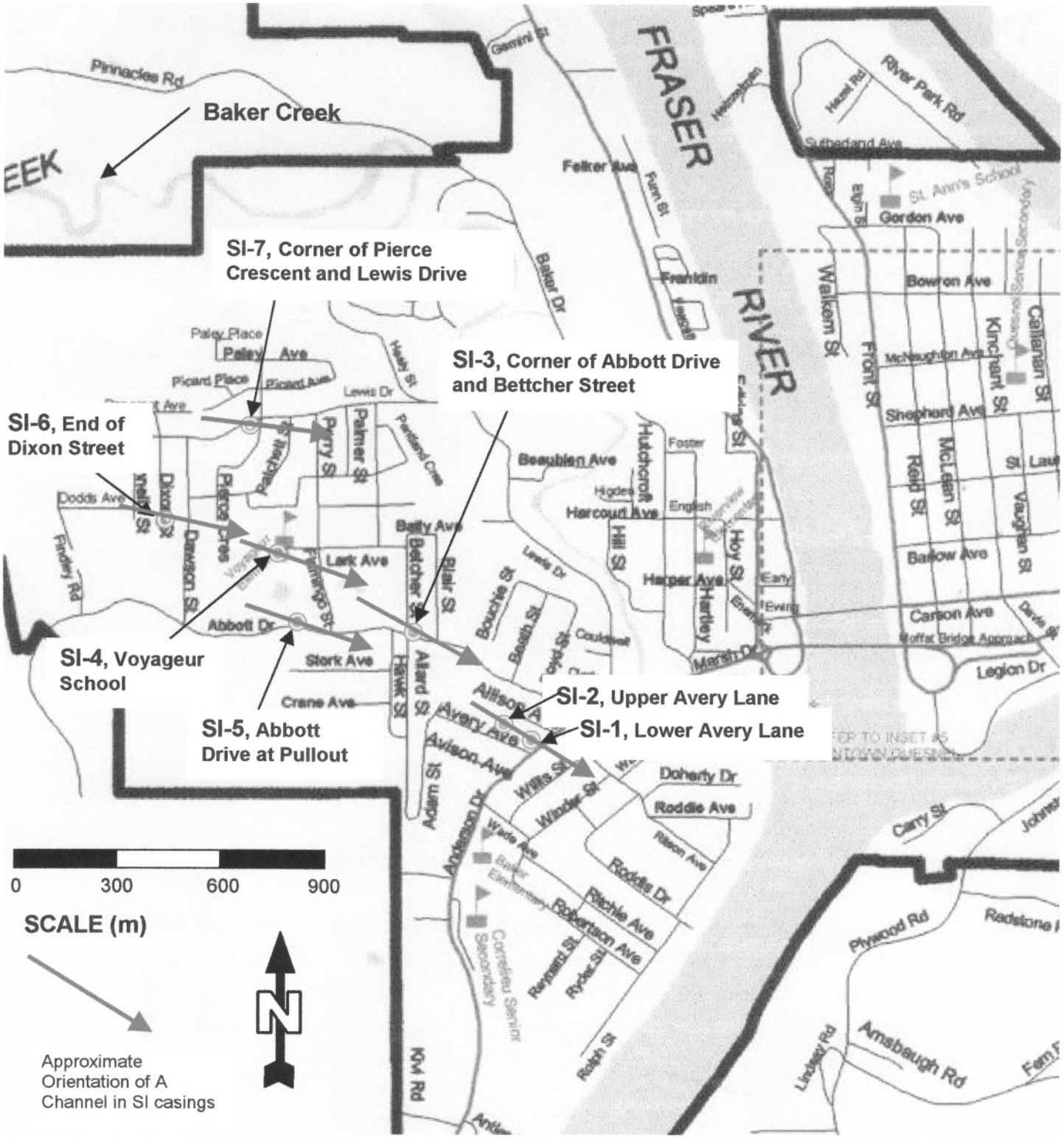


amec

City of Quesnel

West Quesnel Stability Study

Quesnel, BC

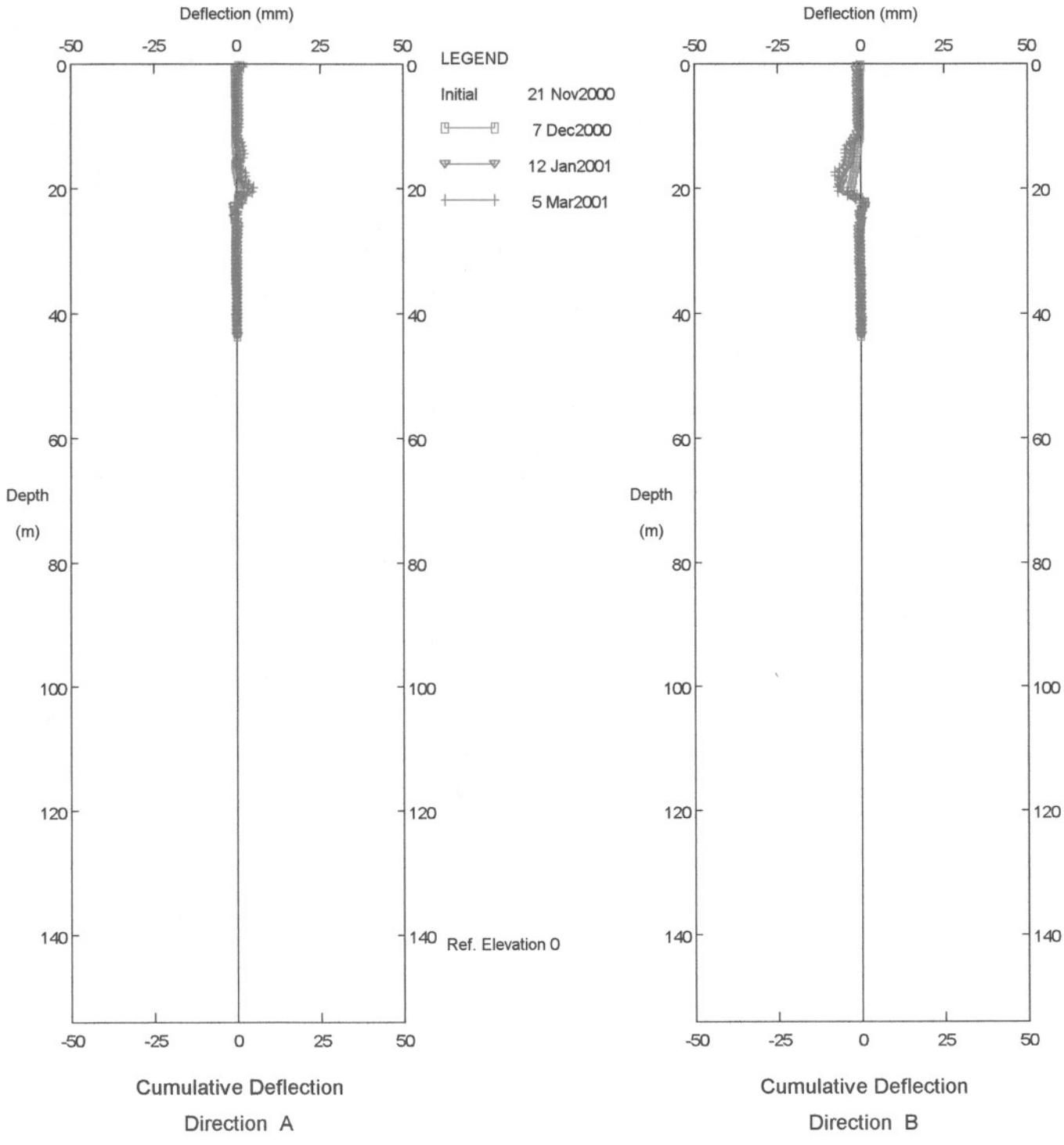
Figure 1: Slope Inclinometer (SI) Locations

DATE:	SCALE:	DRAWN BY:	PROJECT No: KX03904
Jan. 2001	NTS	HMN	

APPENDIX A

SI READING RESULTS

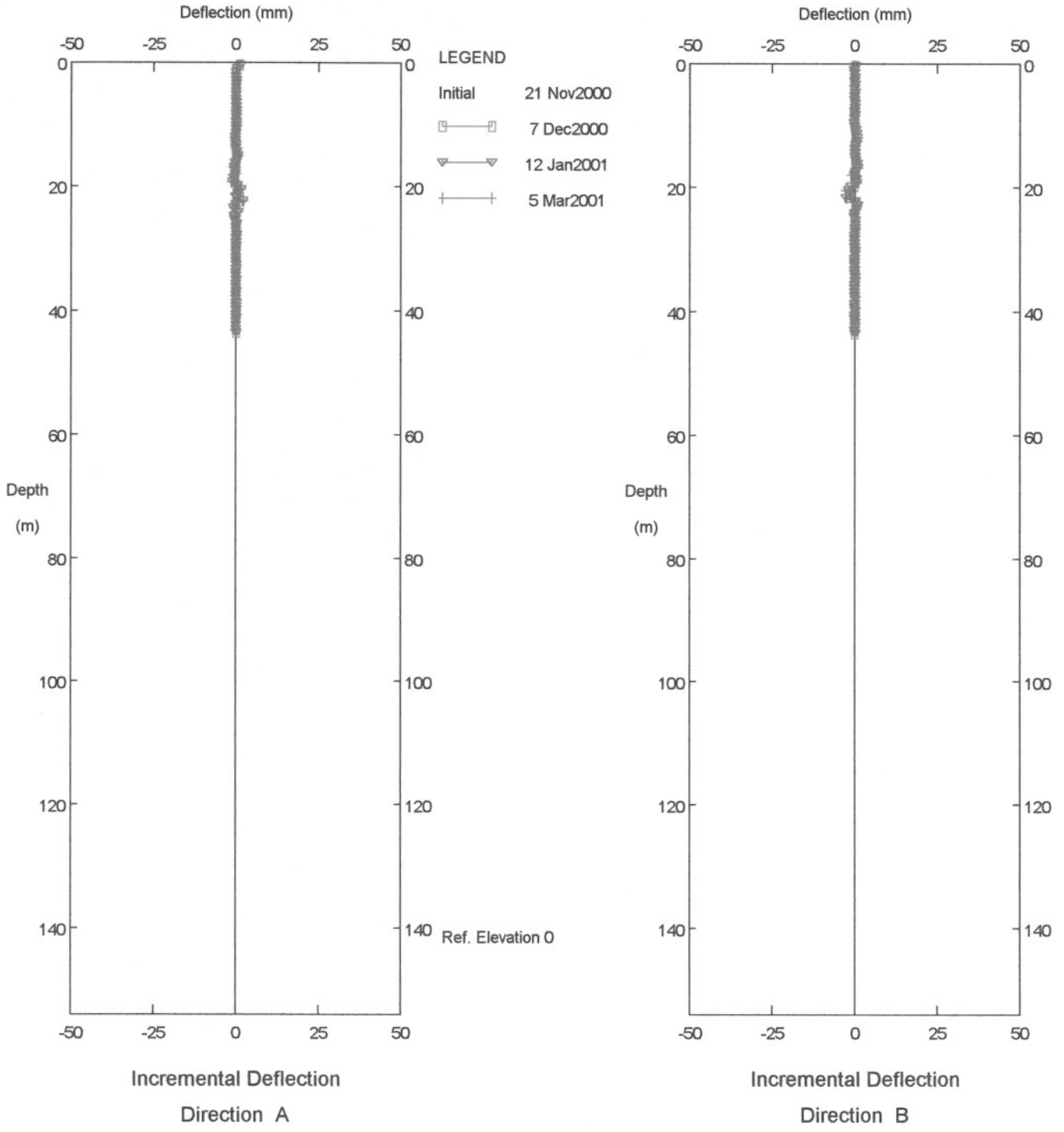
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-1

Lower Avery Lane

AMEC Earth and Environmental - Pr. George



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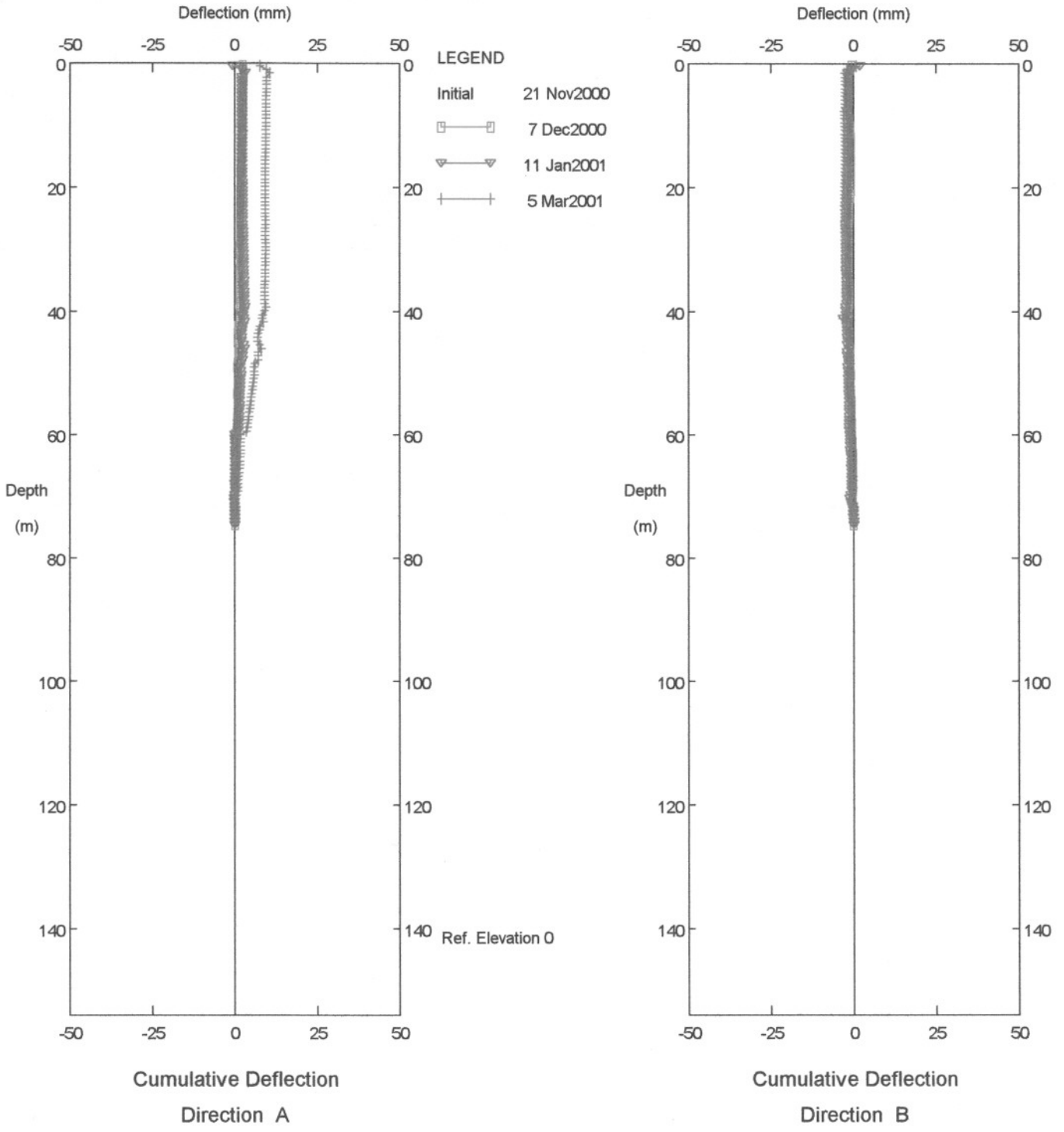
Lower Avery Lane

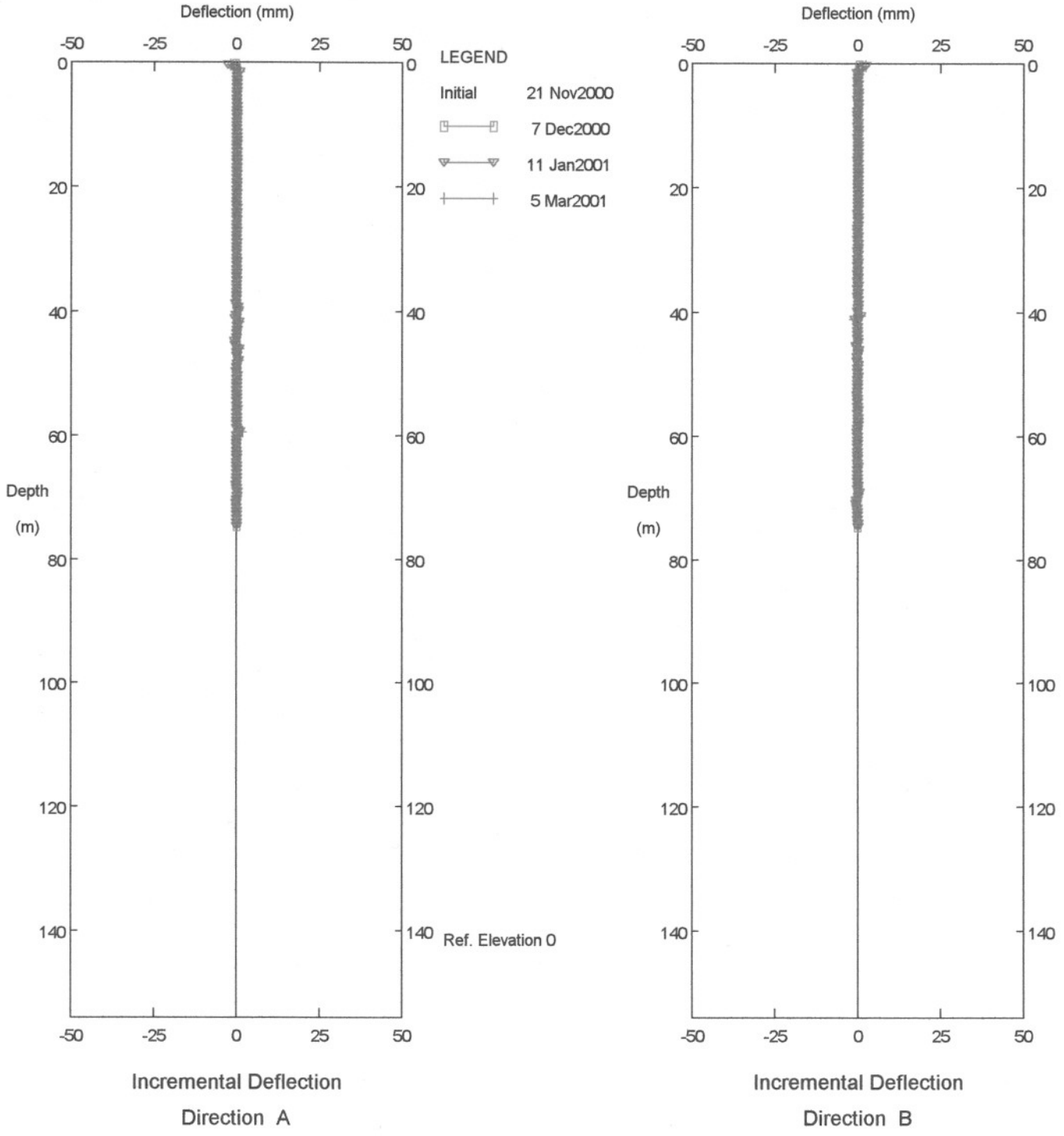
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-2

Upper Avery Lane

AMEC Earth and Environmental - Pr. George



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Upper Avery Lane

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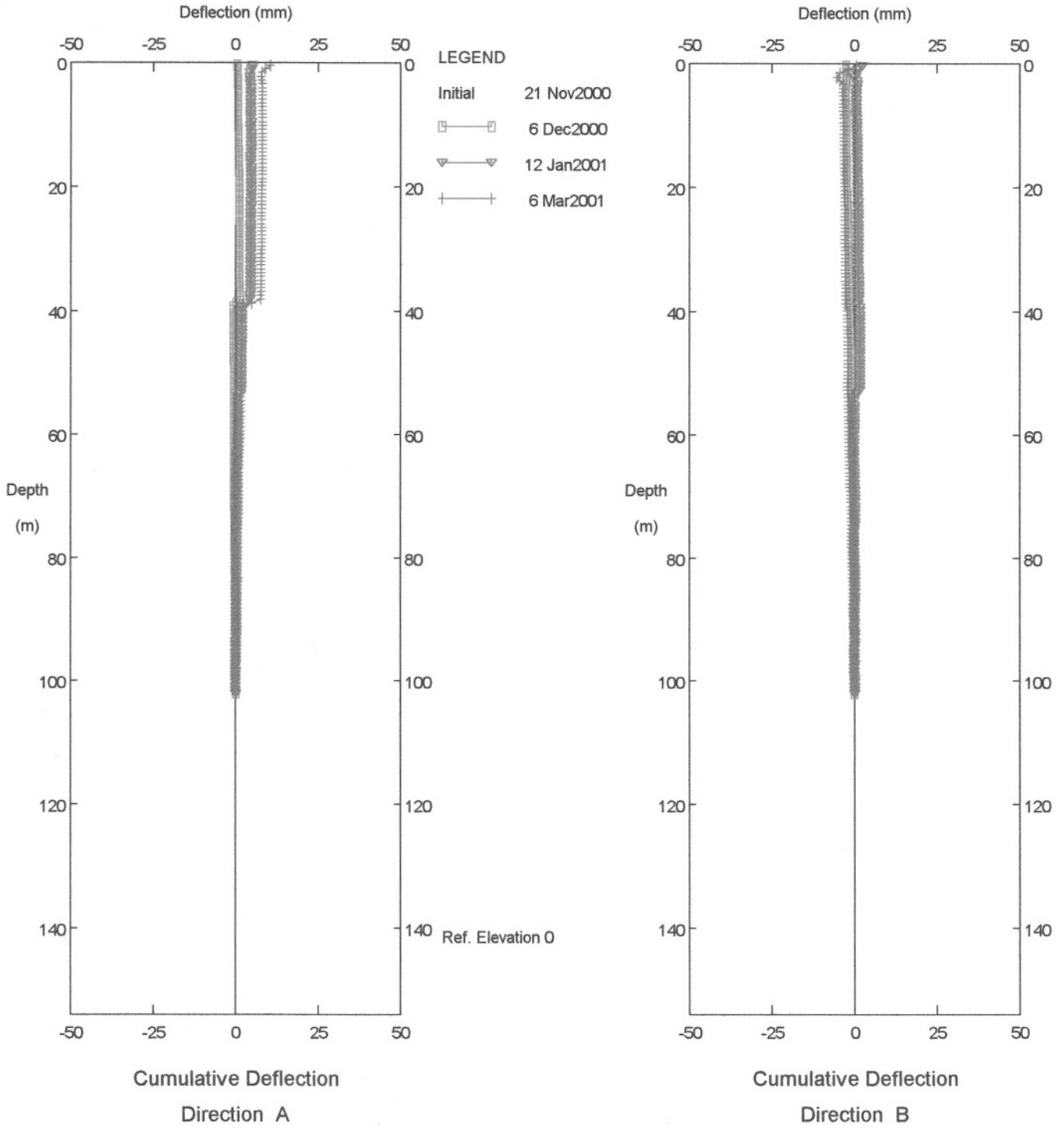
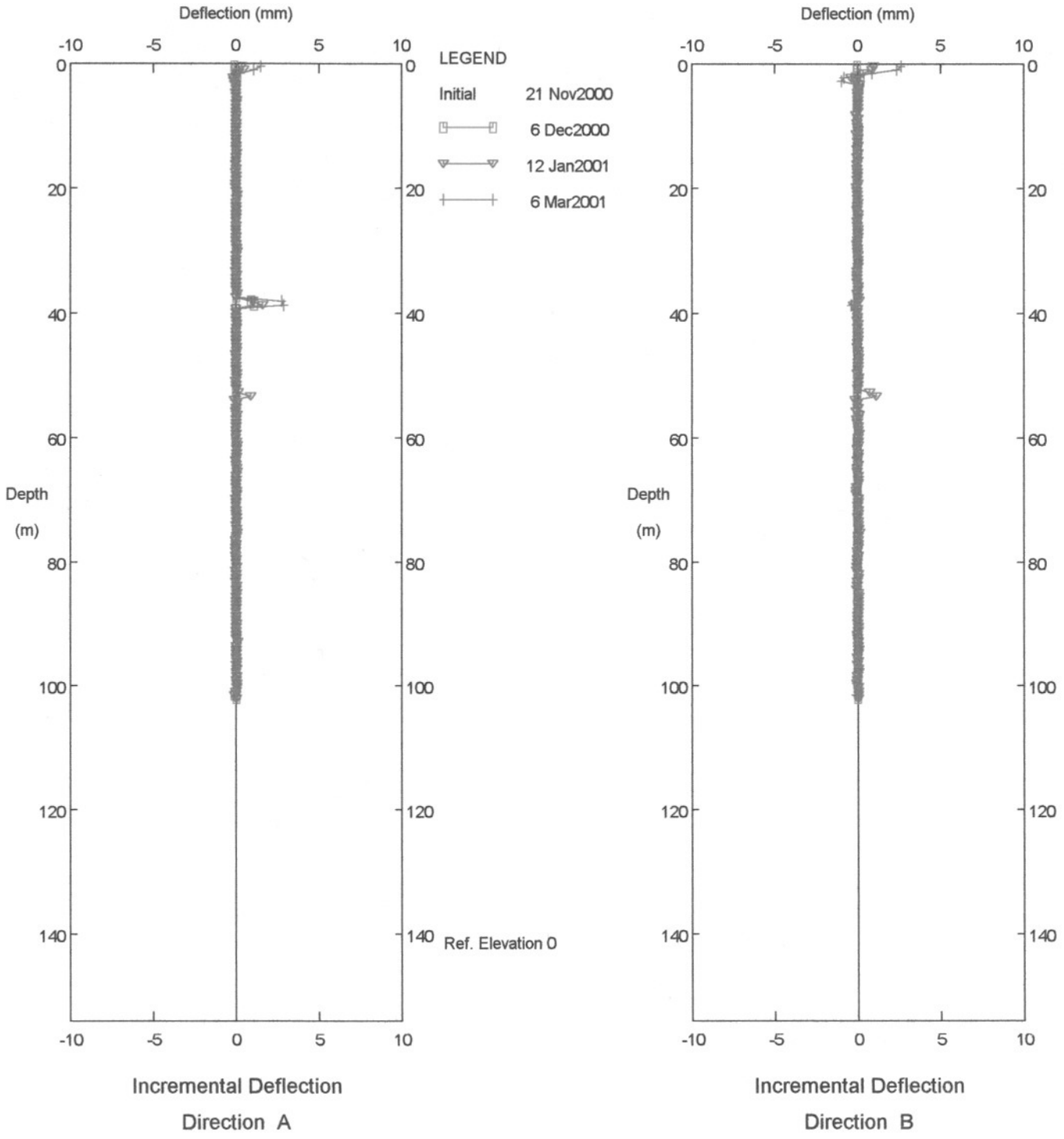


KX03904 W. Quesnel Stability Study, Inclinometer SI-3

Abbott Drive near Bettcher

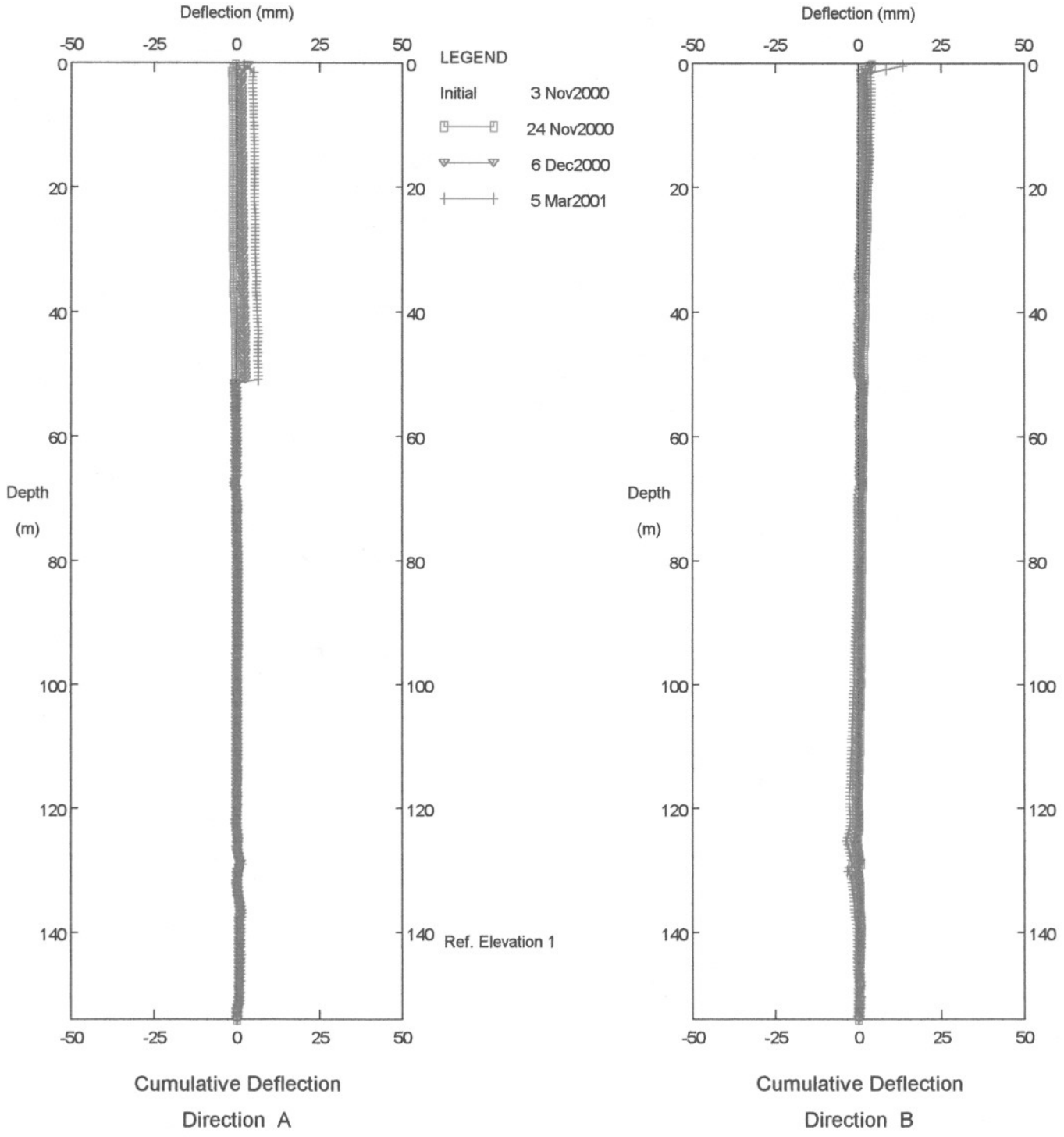
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-3

Abbott Drive near Bettcher

AMEC Earth and Environmental - Pr. George



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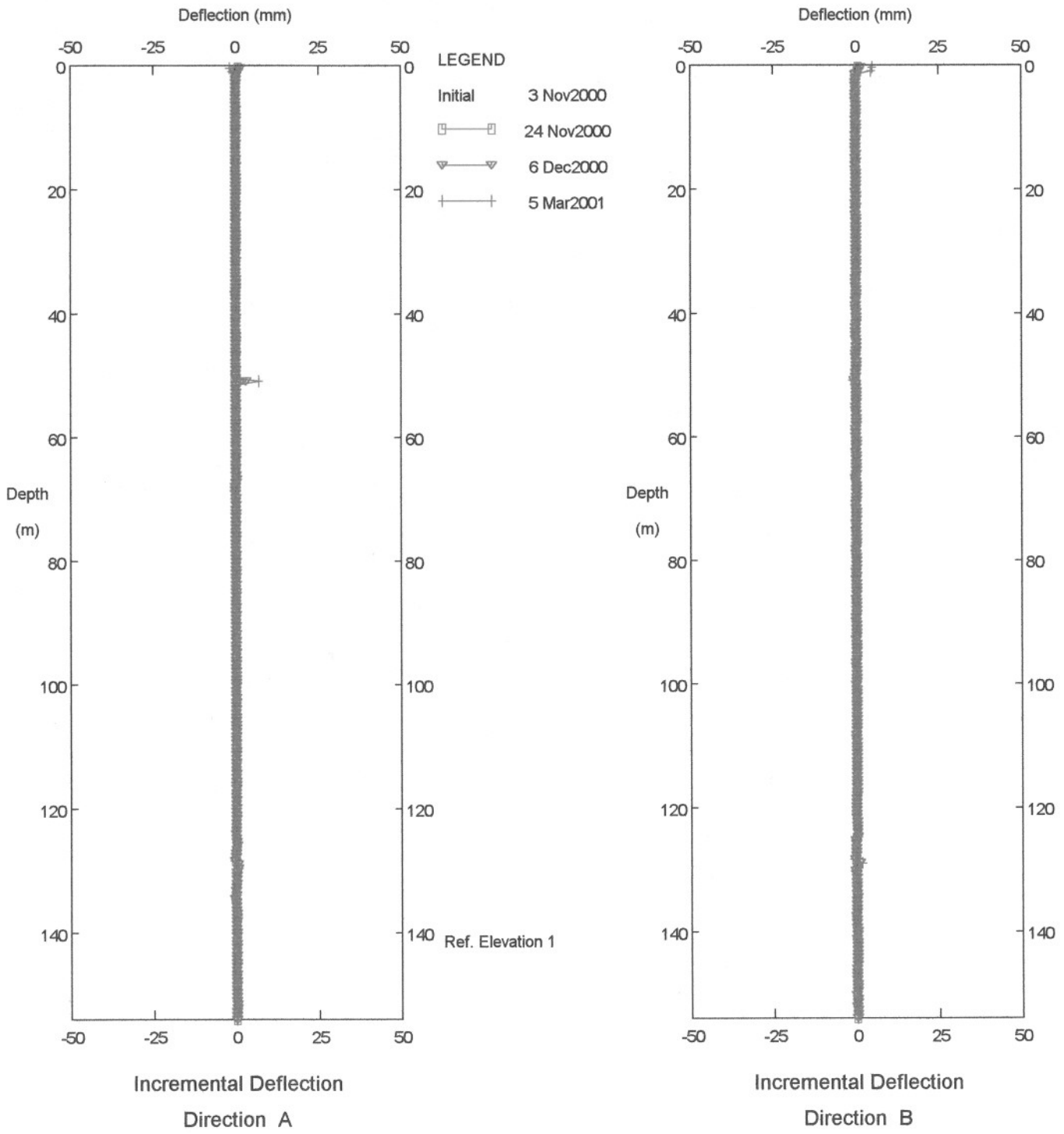
Voyageur School

AMEC Earth and Environmental - Pr. George



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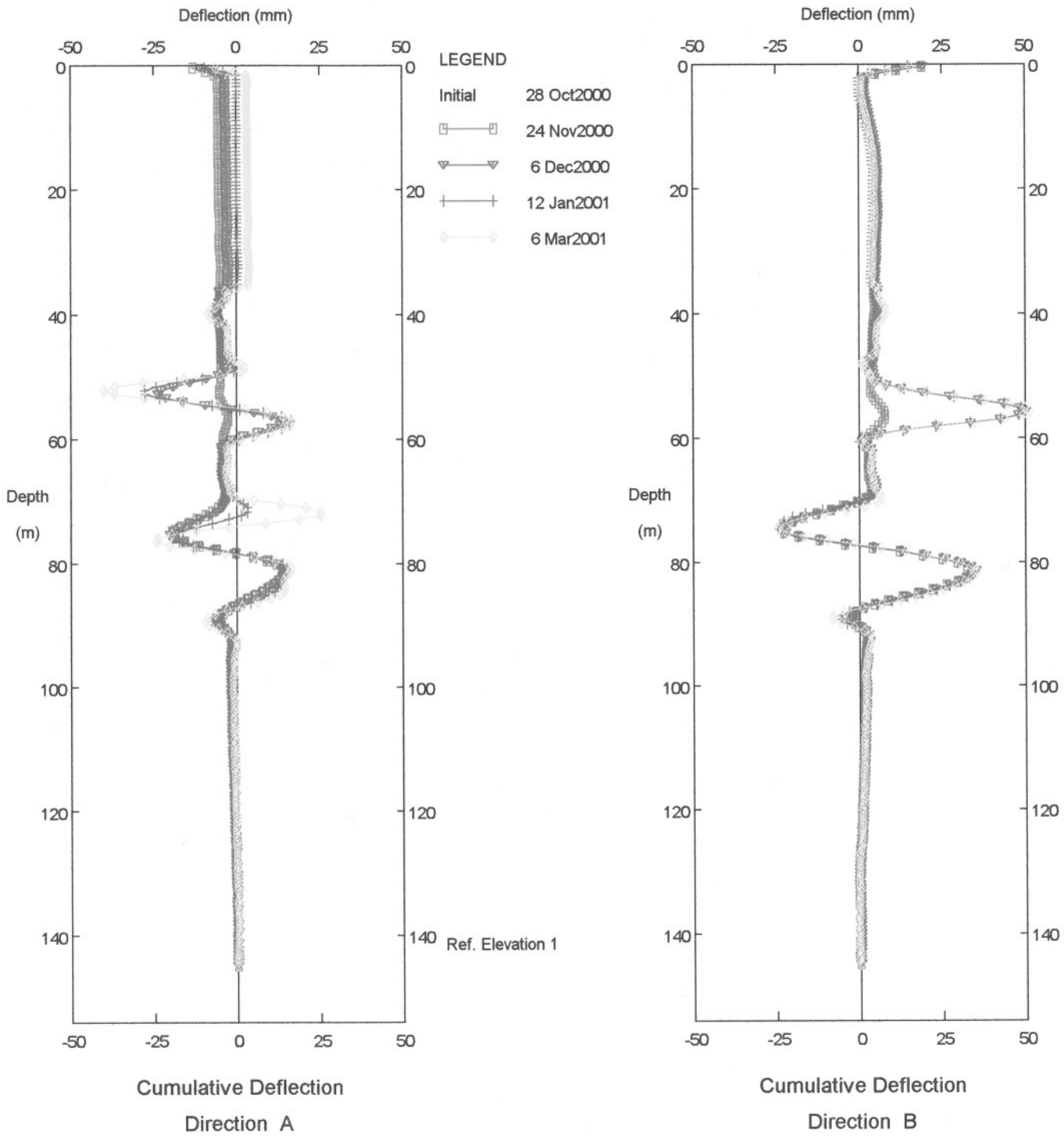
AMEC Earth and Environmental - Pr. George



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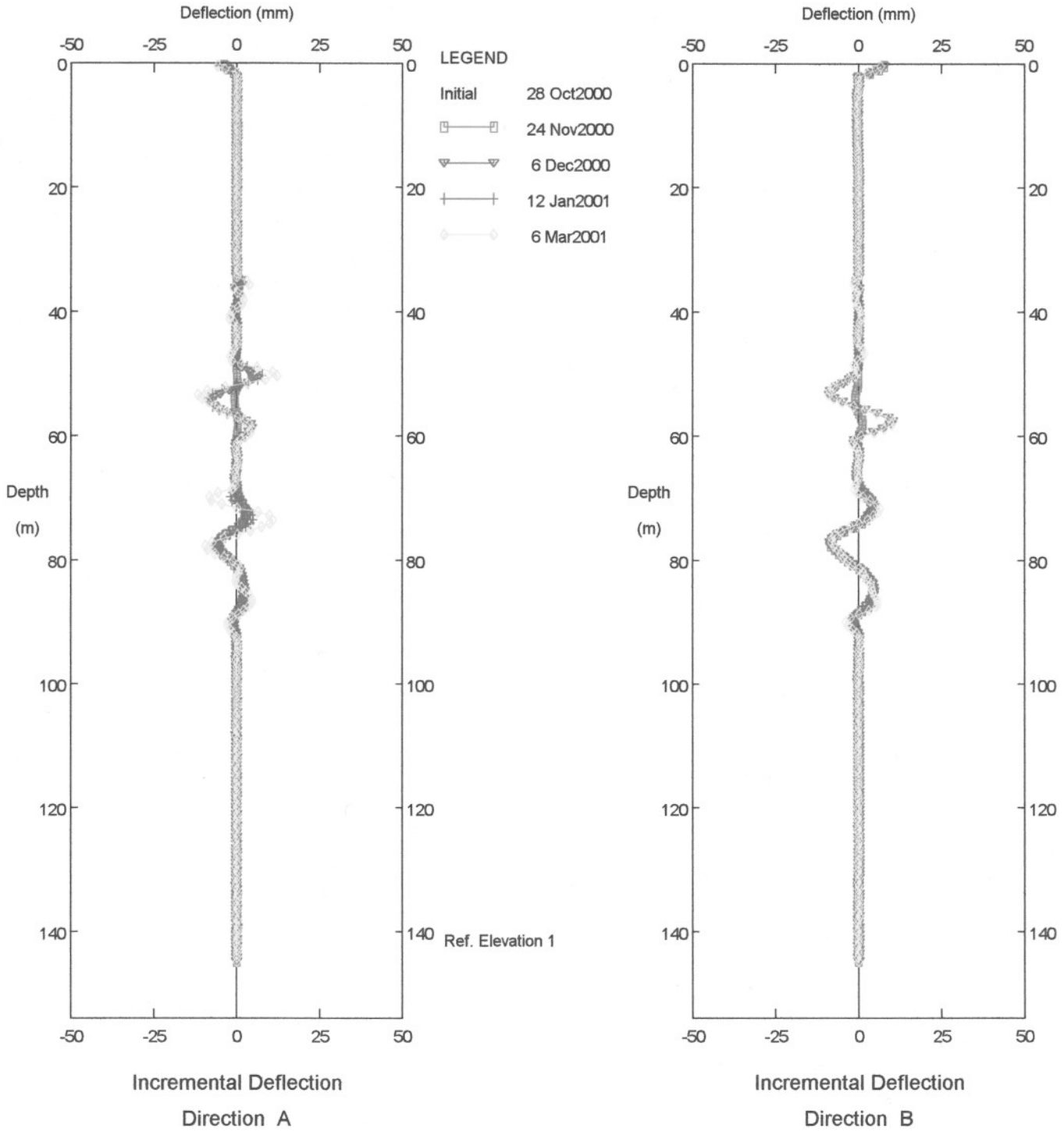
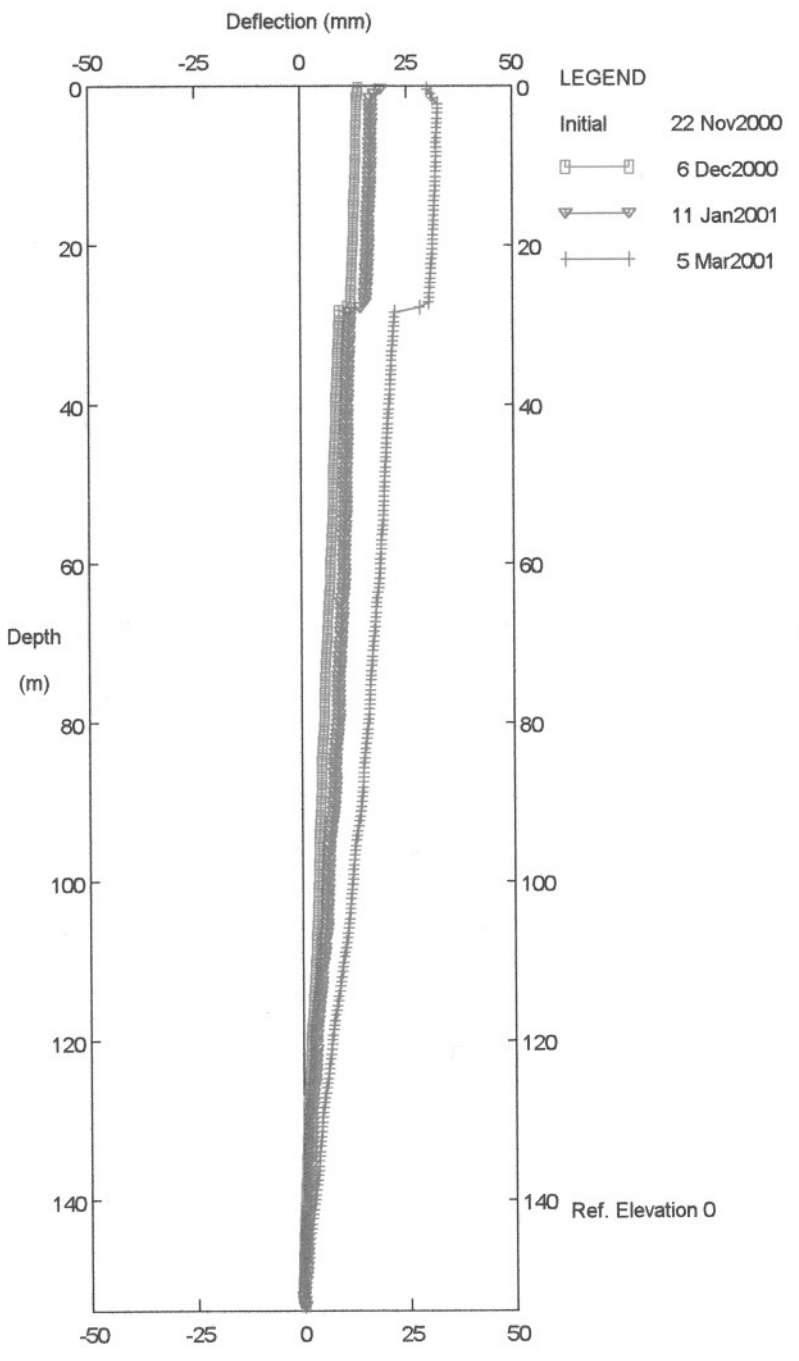
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-5

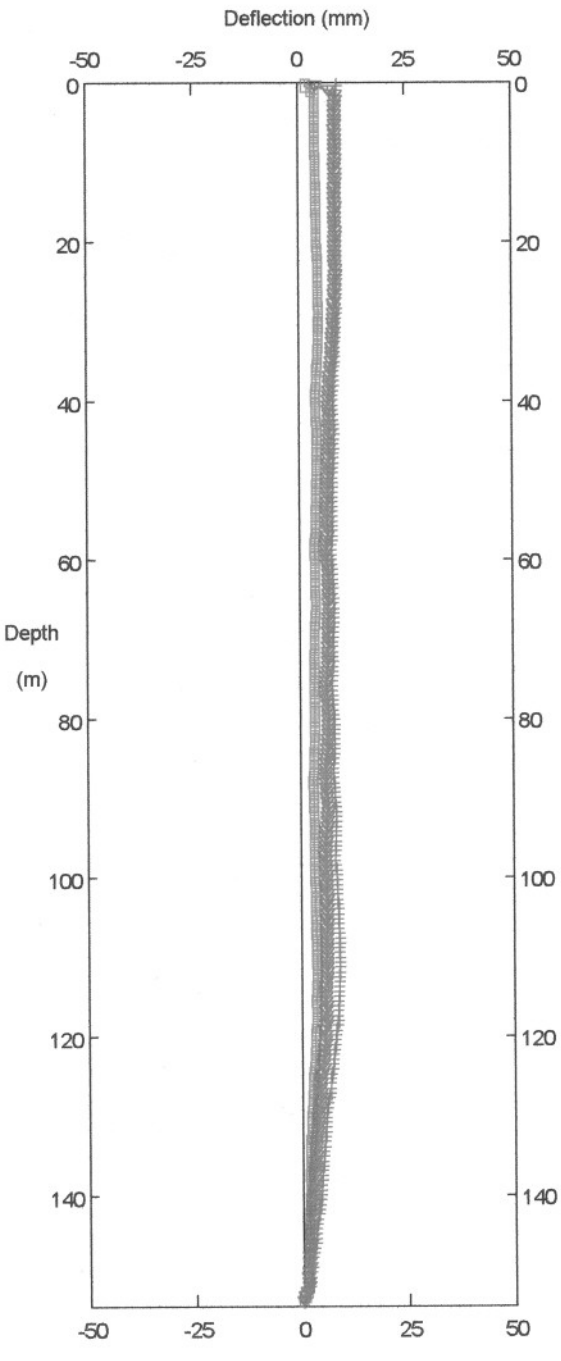
Abbott Drive

AMEC Earth and Environmental - Pr. George



Cumulative Deflection

Direction A



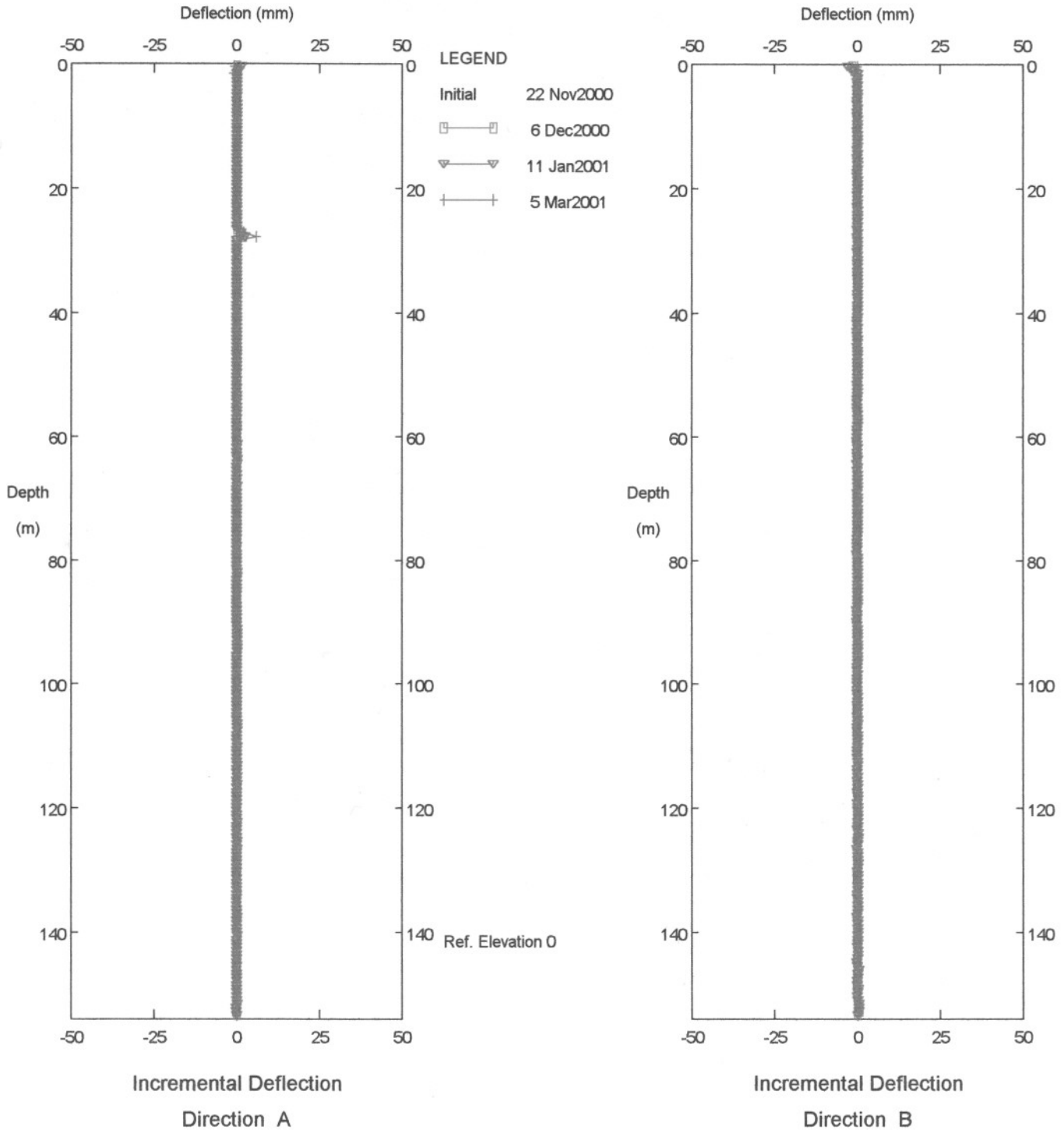
Cumulative Deflection

Direction B

KX03904 W.Quesnel Stability Study, Inclinometer SI-6

End of Dixon Street

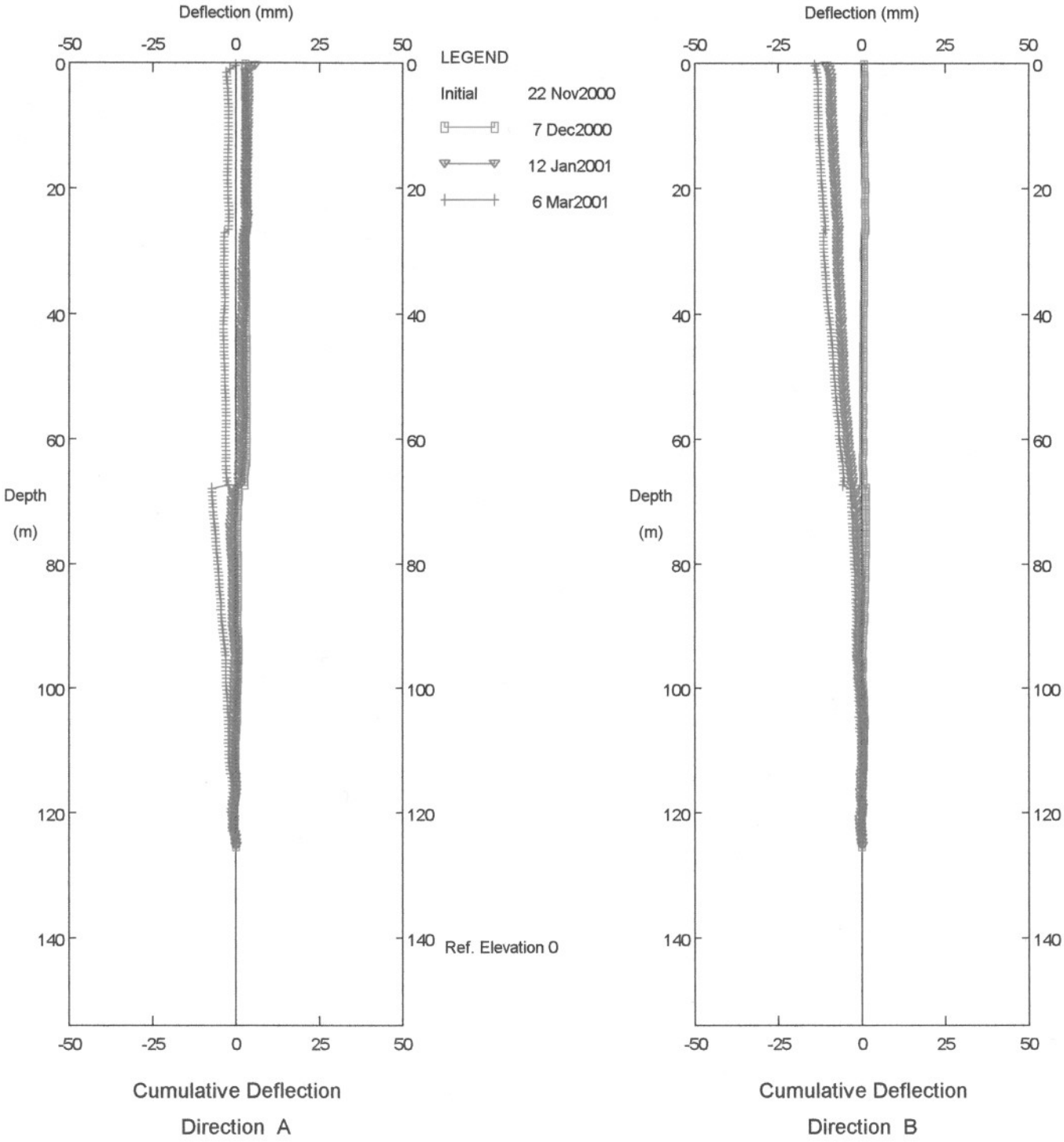
AMEC Earth and Environmental - Pr. George



KX03904 W.Quesnel Stability Study, Inclinometer SI-6

End of Dixon Street

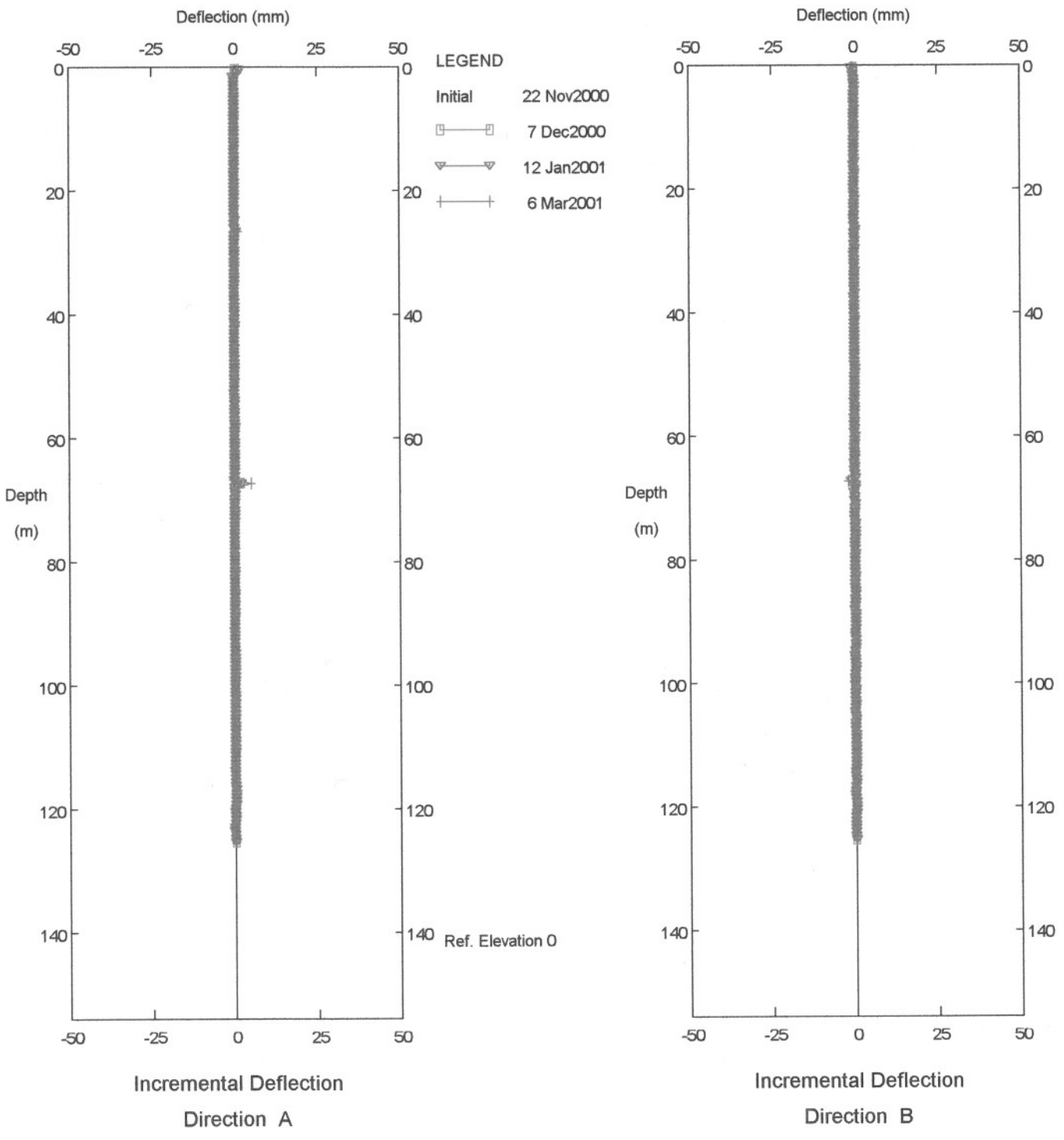
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-7

Pierce Crescent & Lewis Drive

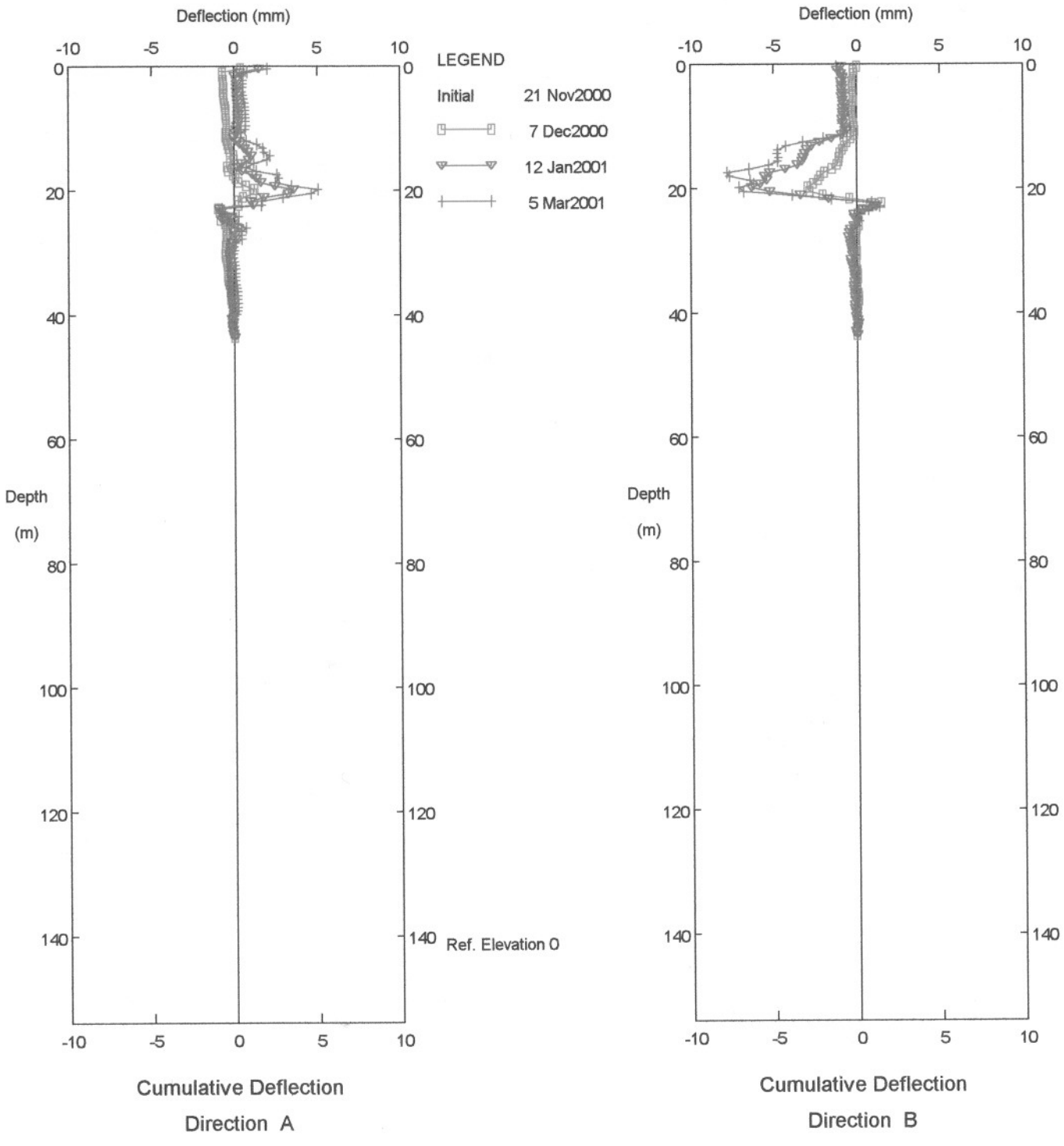
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-7

Pierce Crescent & Lewis Drive

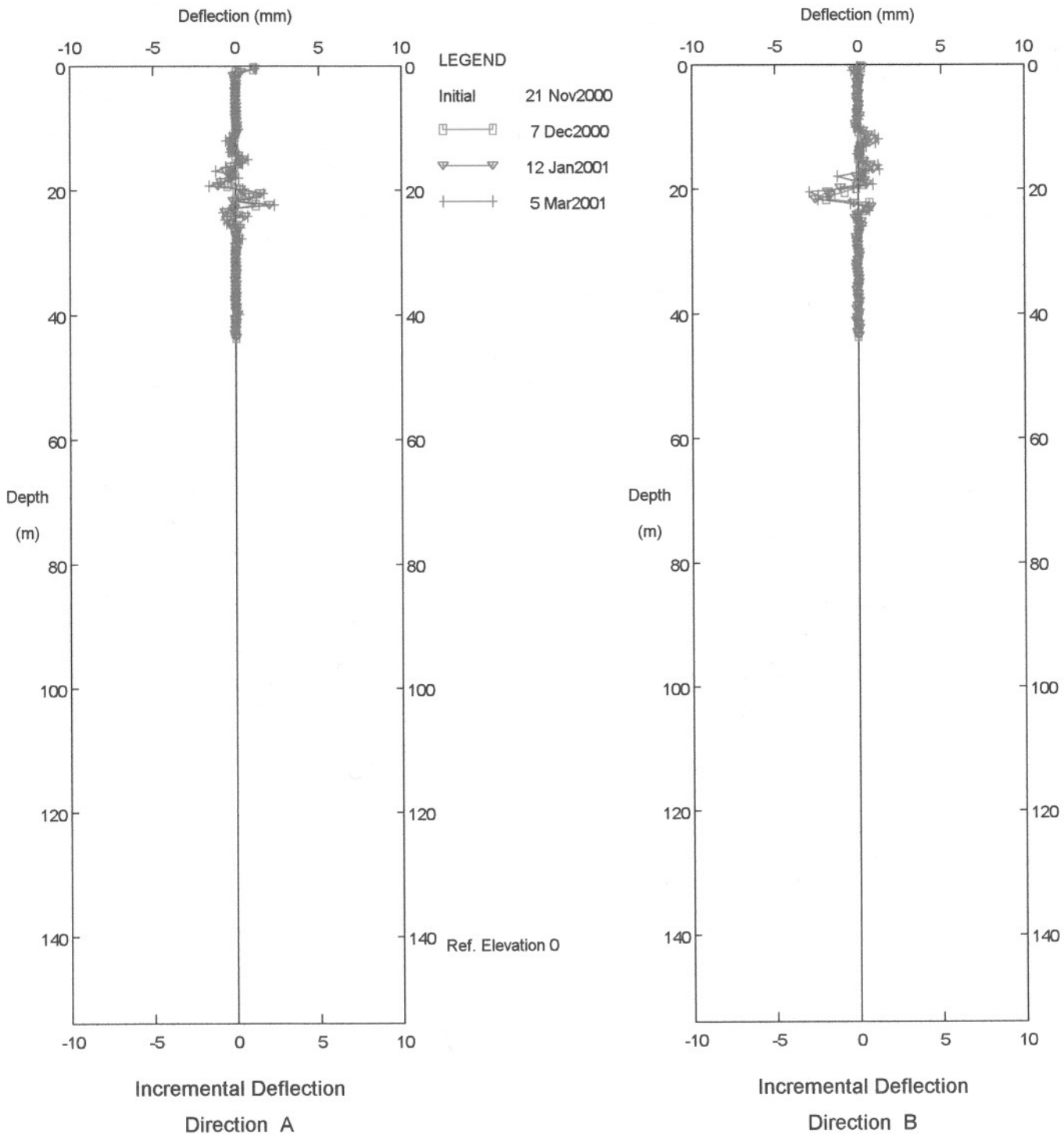
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-1

Lower Avery Lane

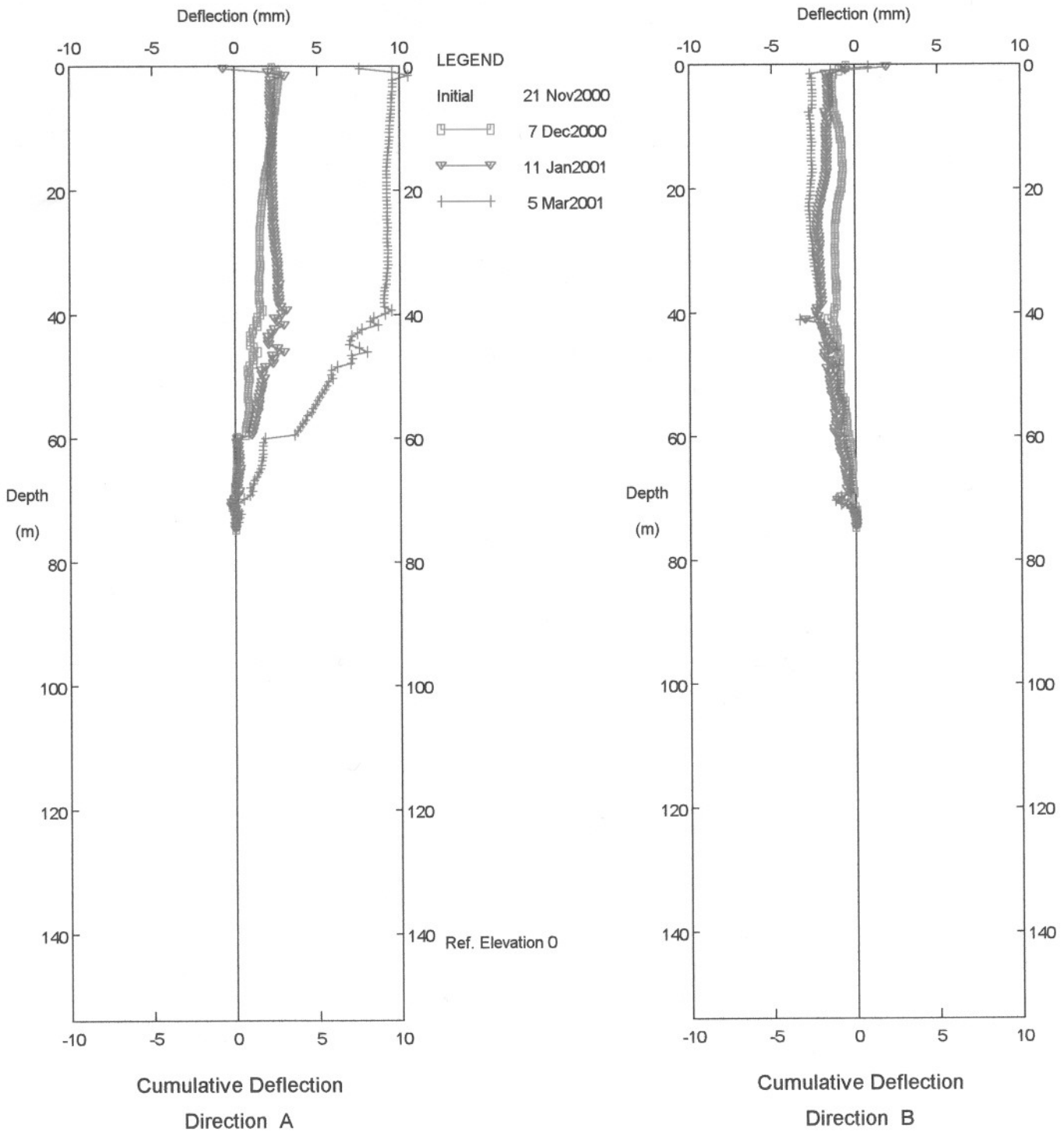
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-1

Lower Avery Lane

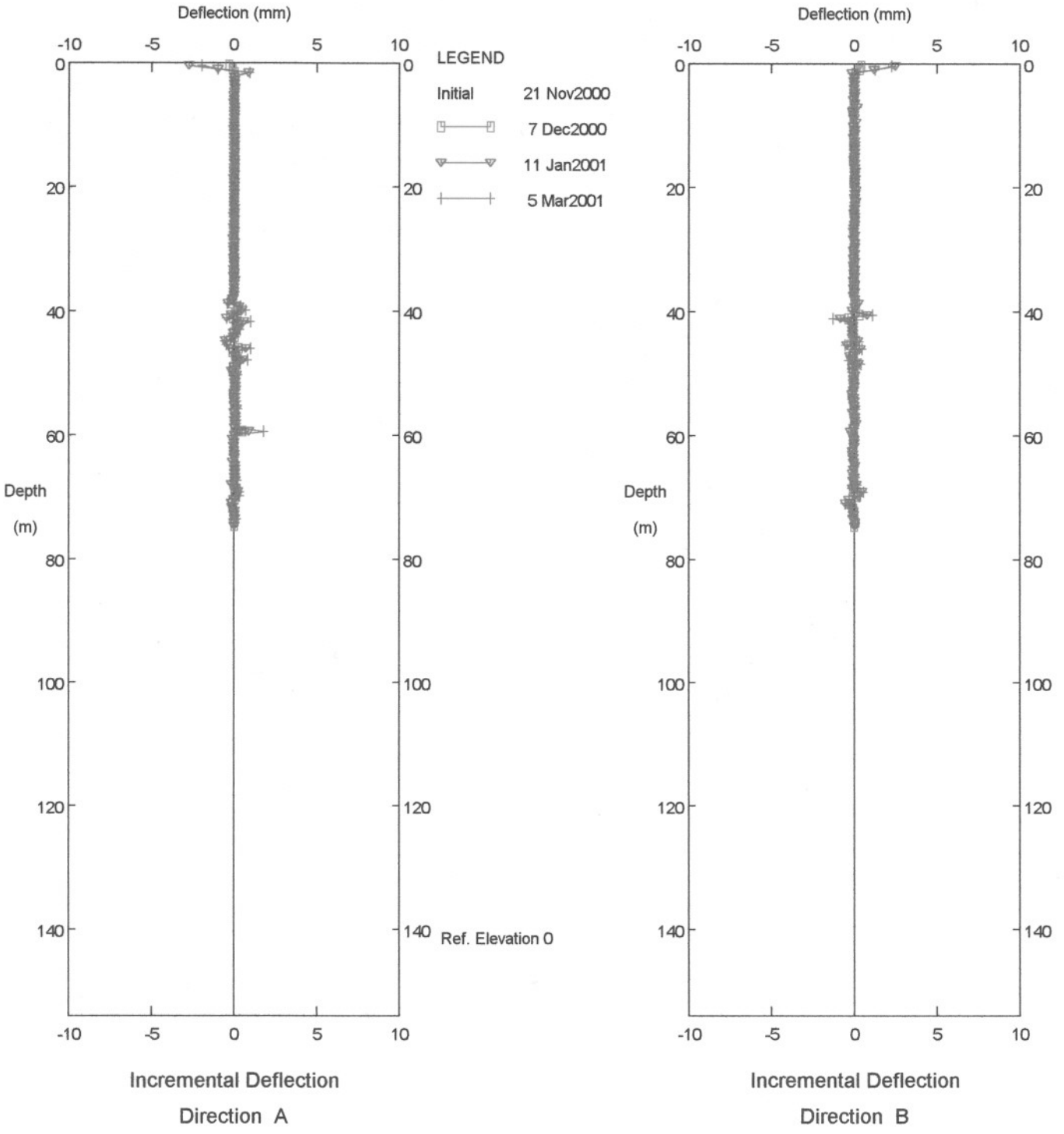
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-2

Upper Avery Lane

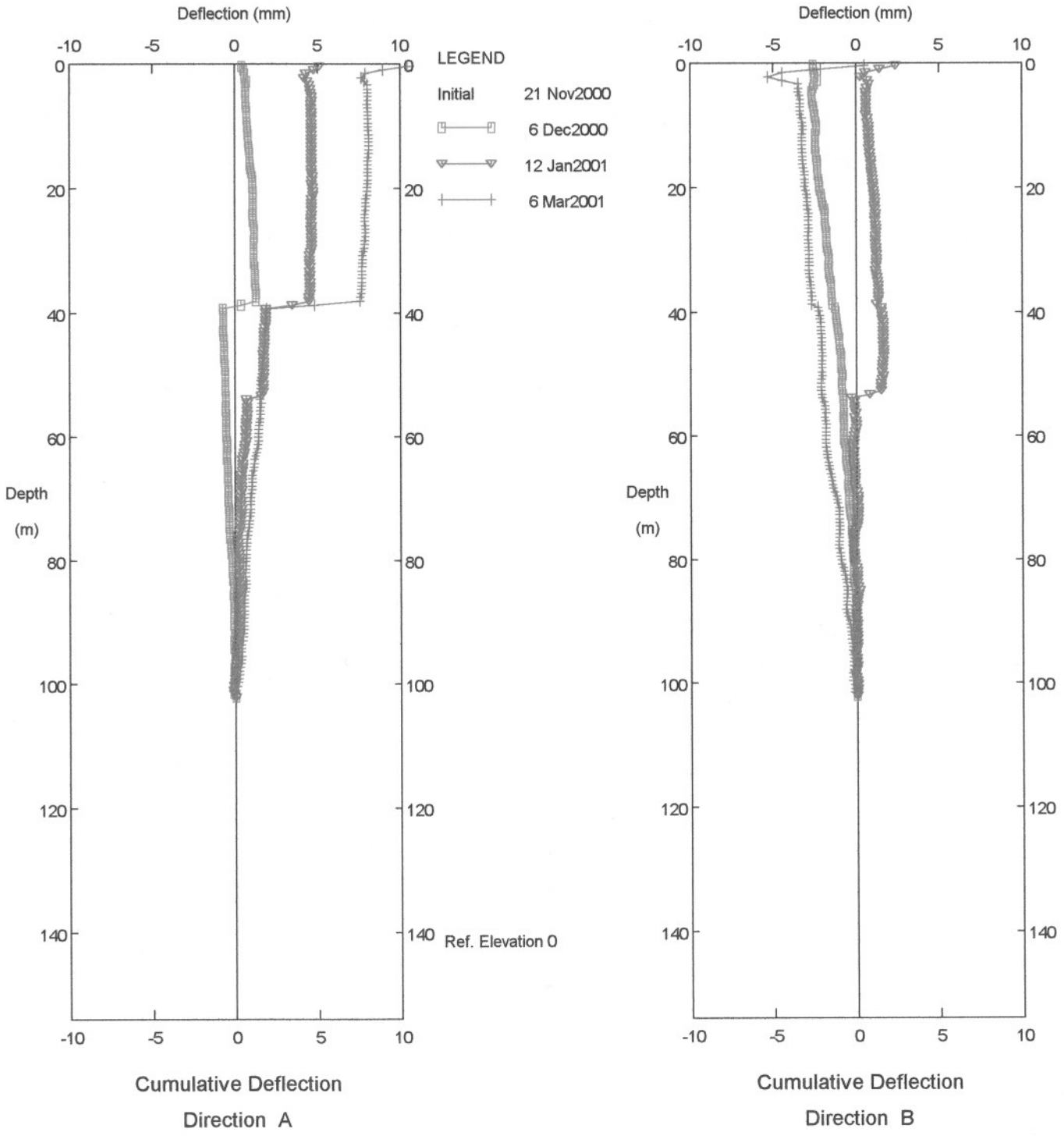
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-2

Upper Avery Lane

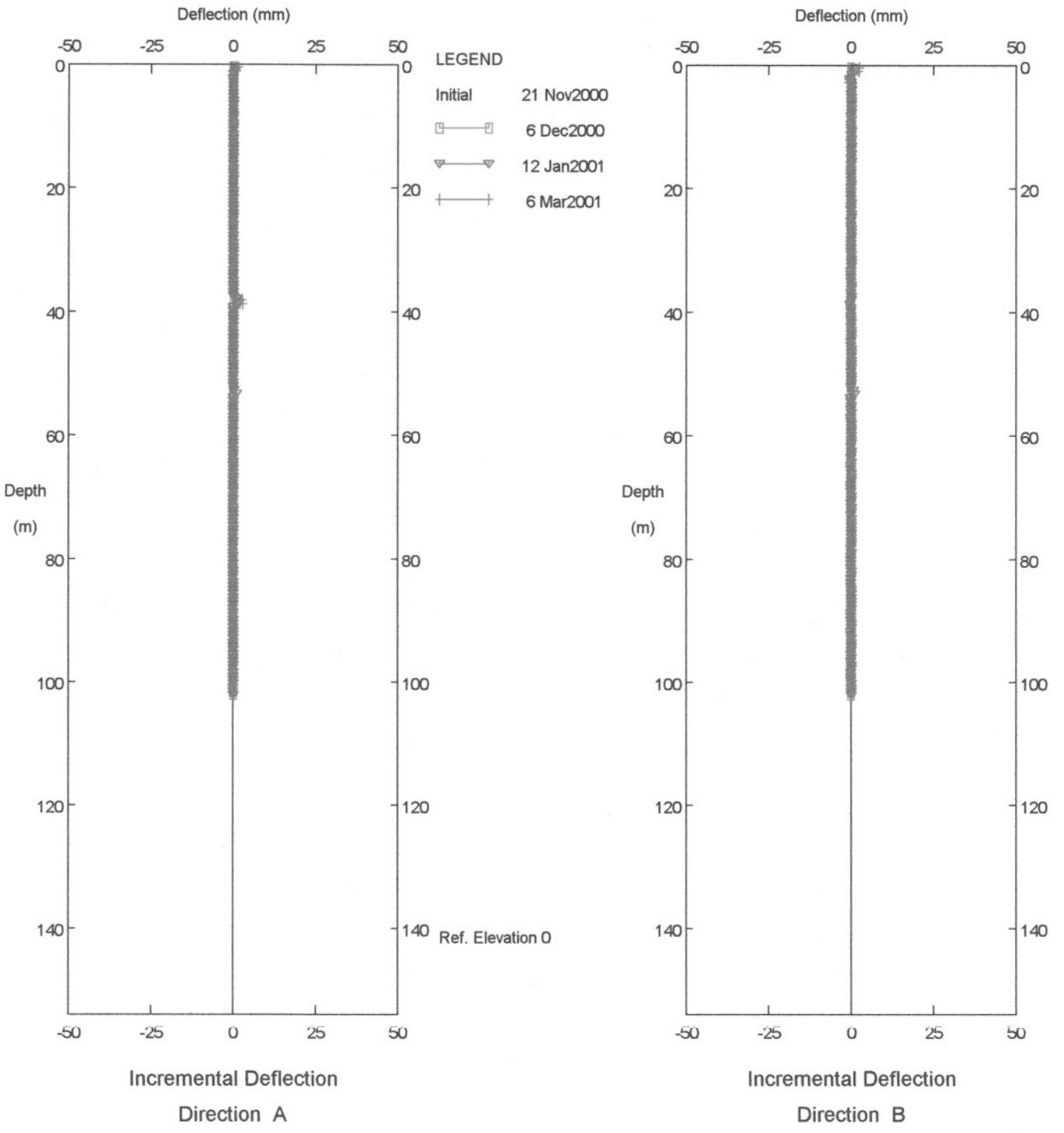
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-3

Abbott Drive near Bettcher

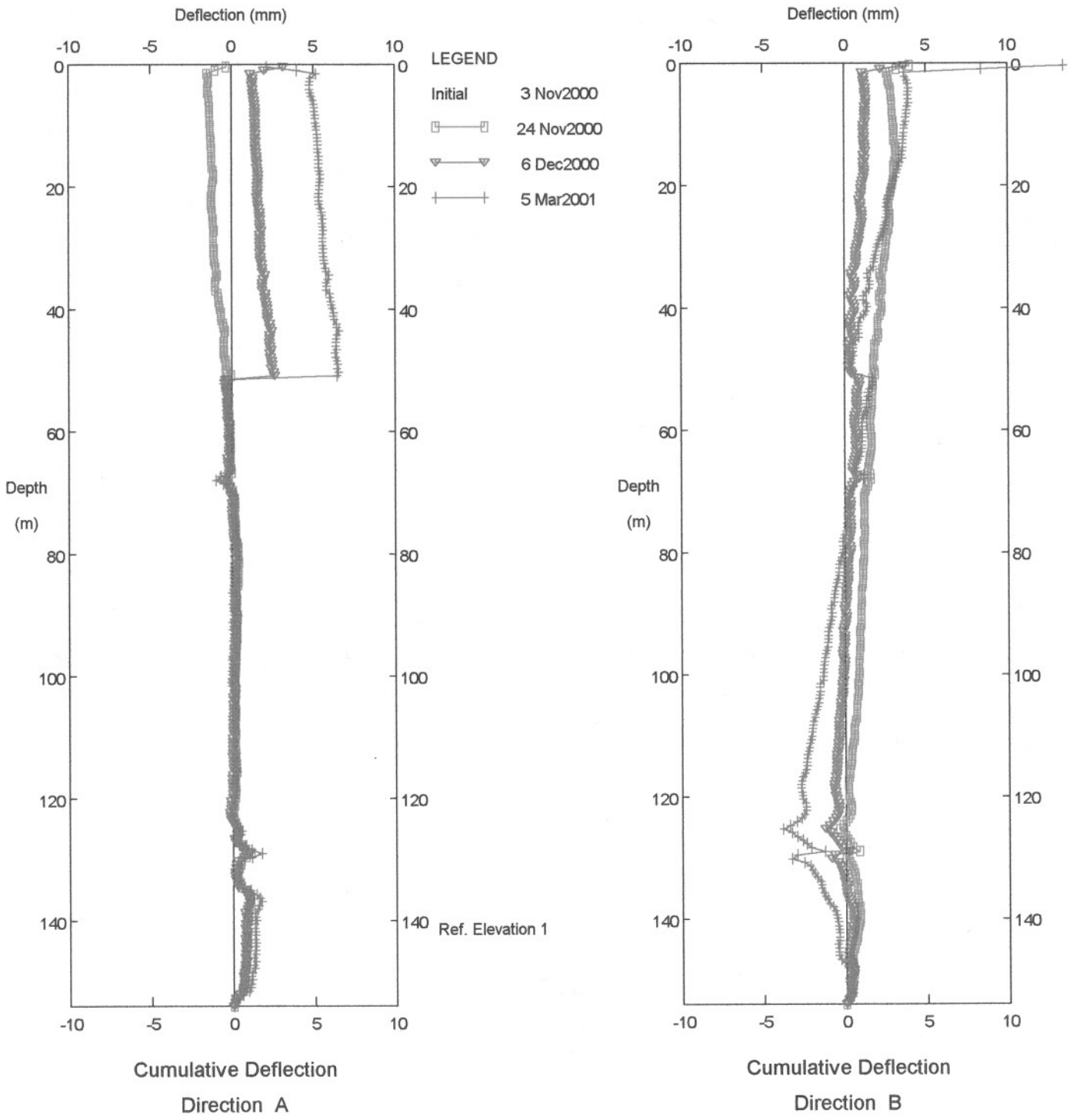
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-3

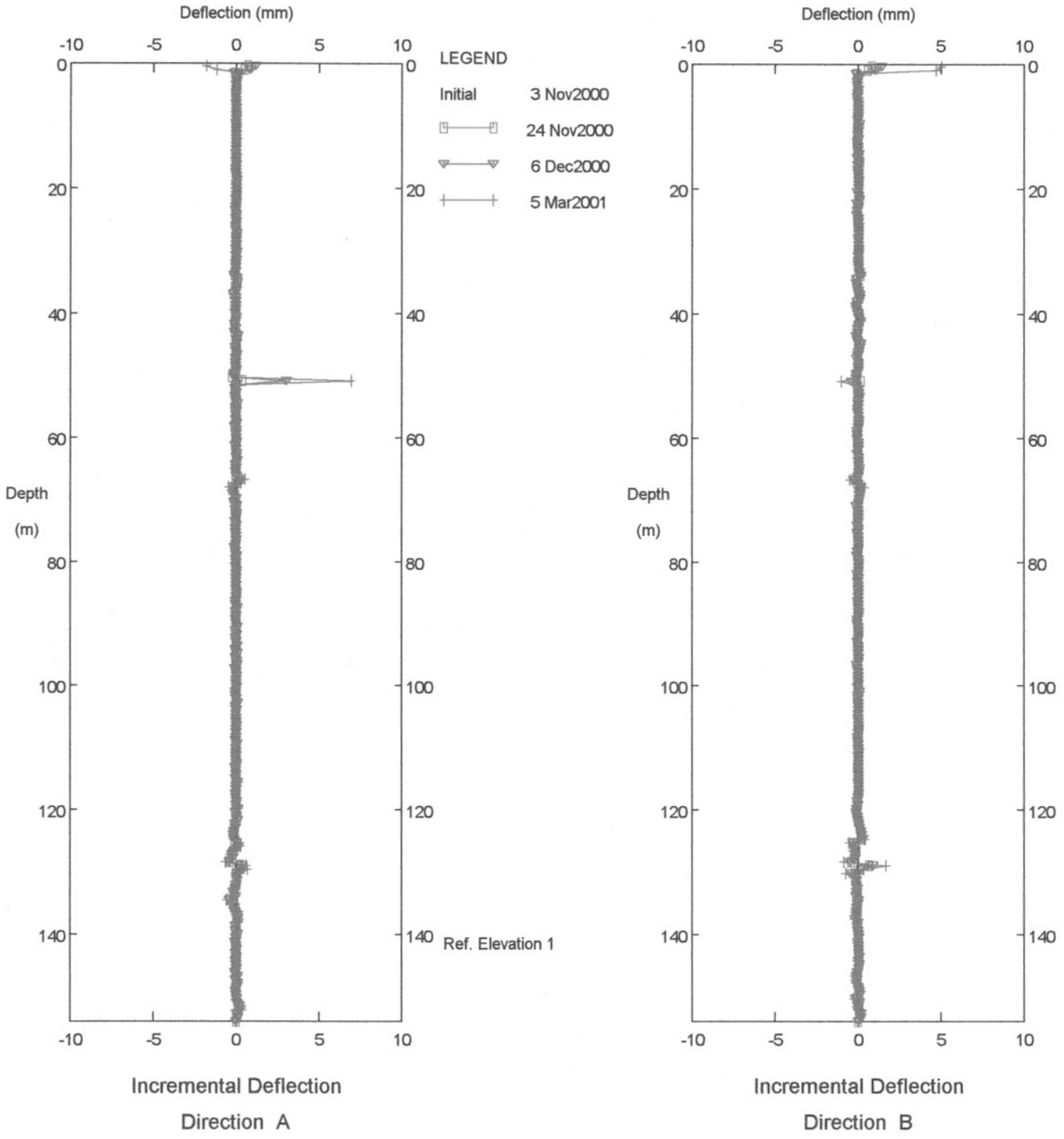
Abbott Drive near Bettcher

AMEC Earth and Environmental - Pr. George



KX03904 W.Quesnel Stability Study, Inclinometer SI-4

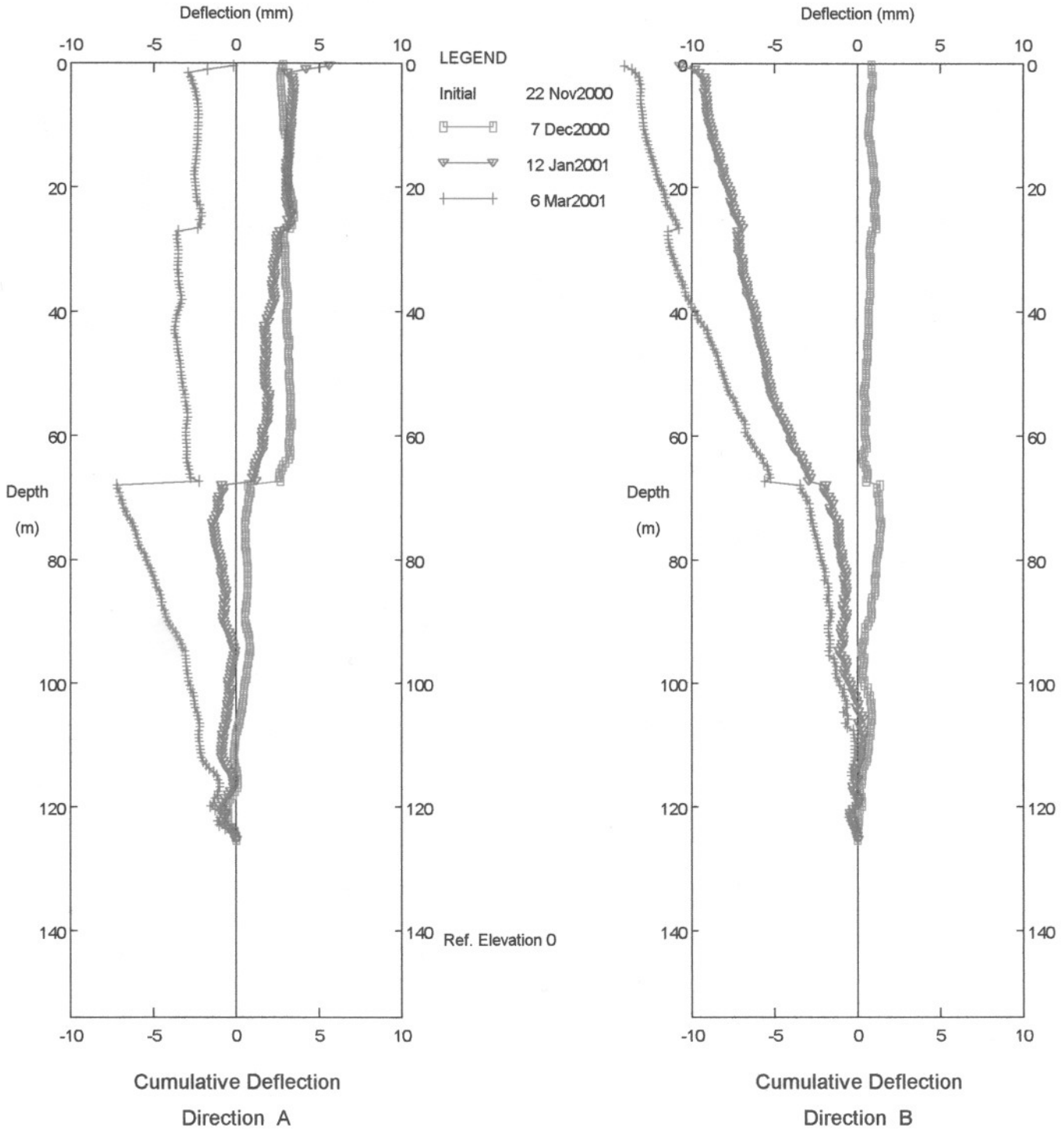
AMEC Earth and Environmental - Pr. George



KX03904 W.Quesnel Stability Study, Inclinometer SI-4

Voyageur School

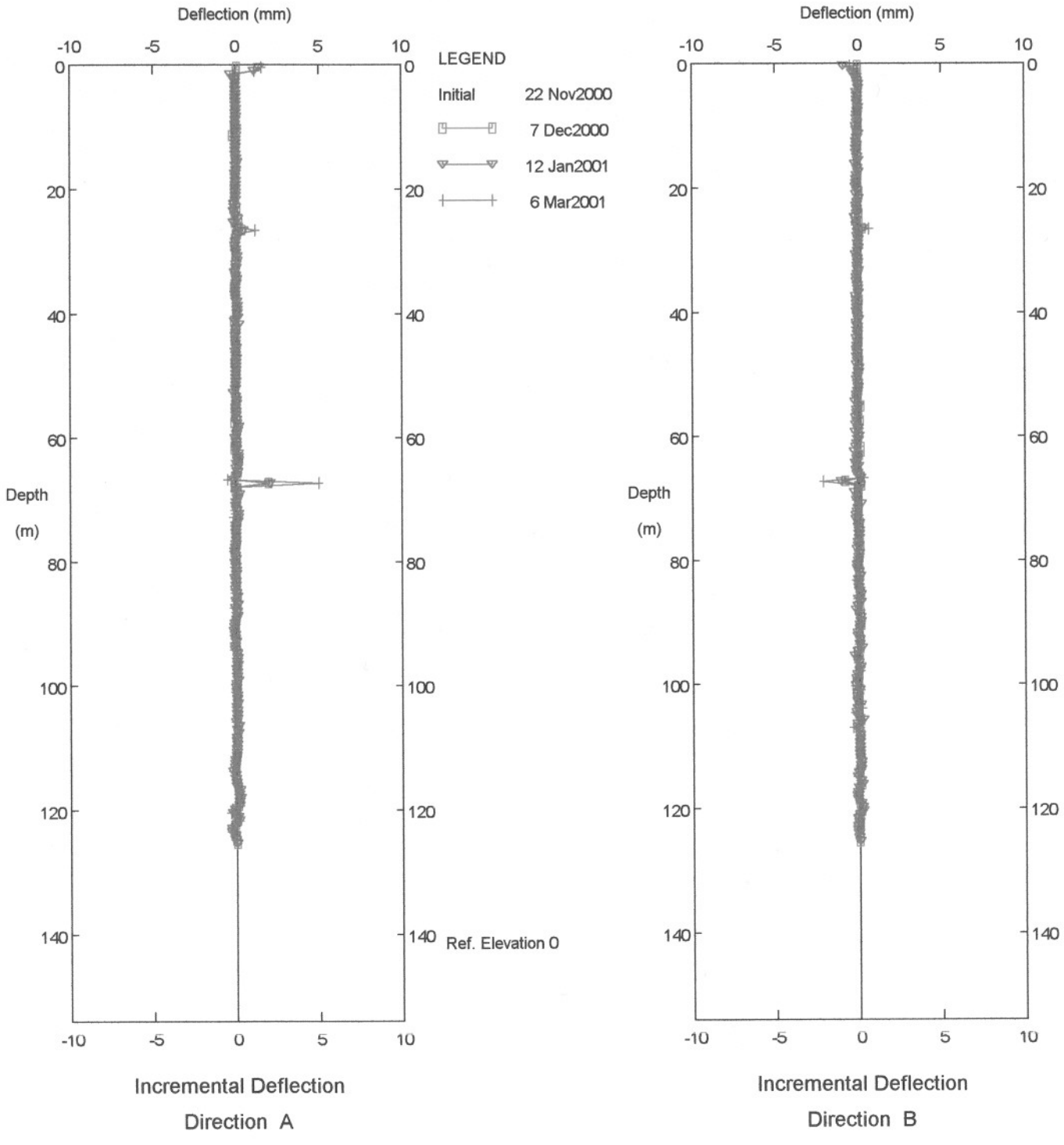
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-7

Pierce Crescent & Lewis Drive

AMEC Earth and Environmental - Pr. George



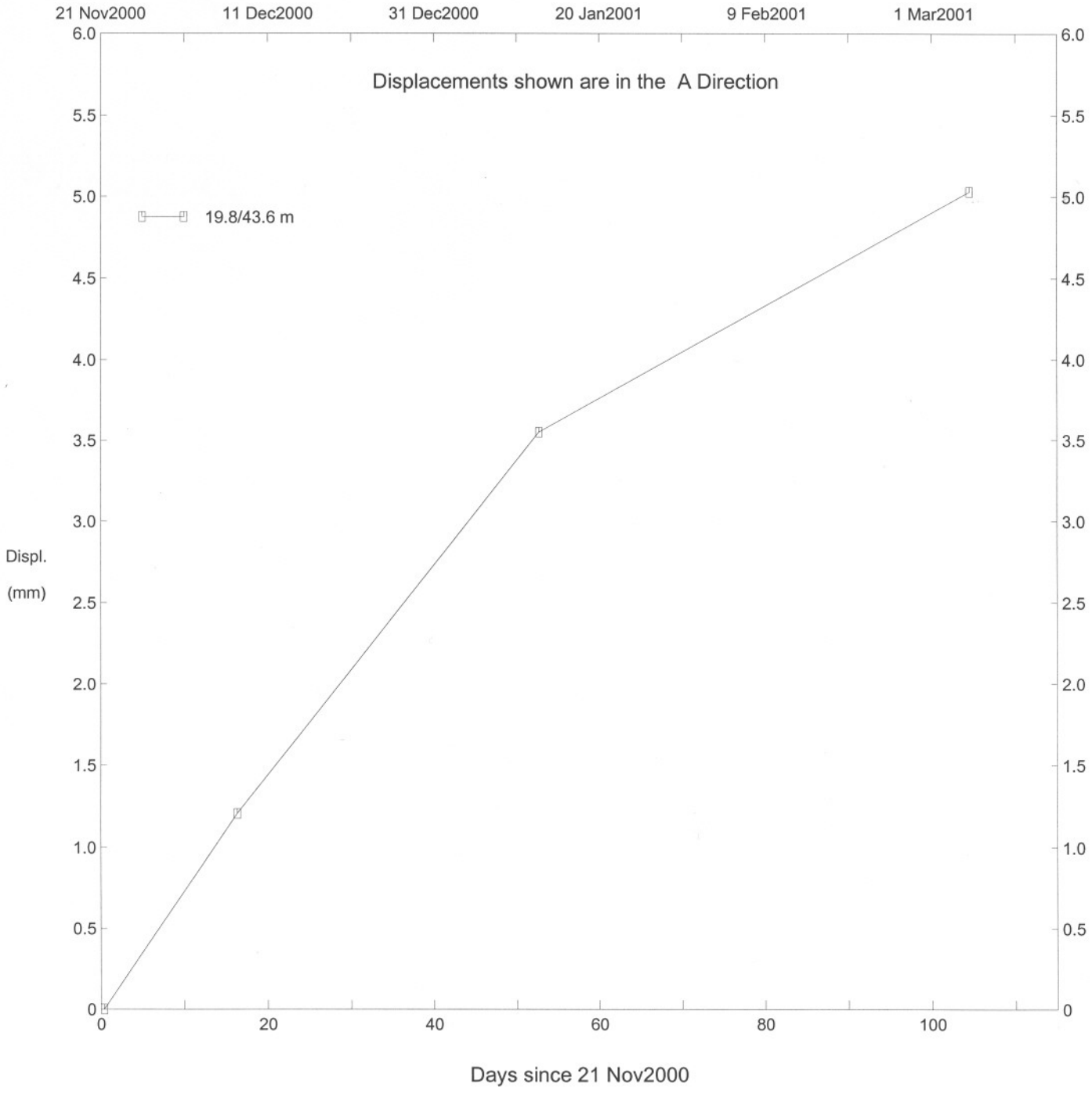
KX03904 W. Quesnel Stability Study, Inclinometer SI-7

Pierce Crescent & Lewis Drive

APPENDIX B

VELOCITY PLOTS

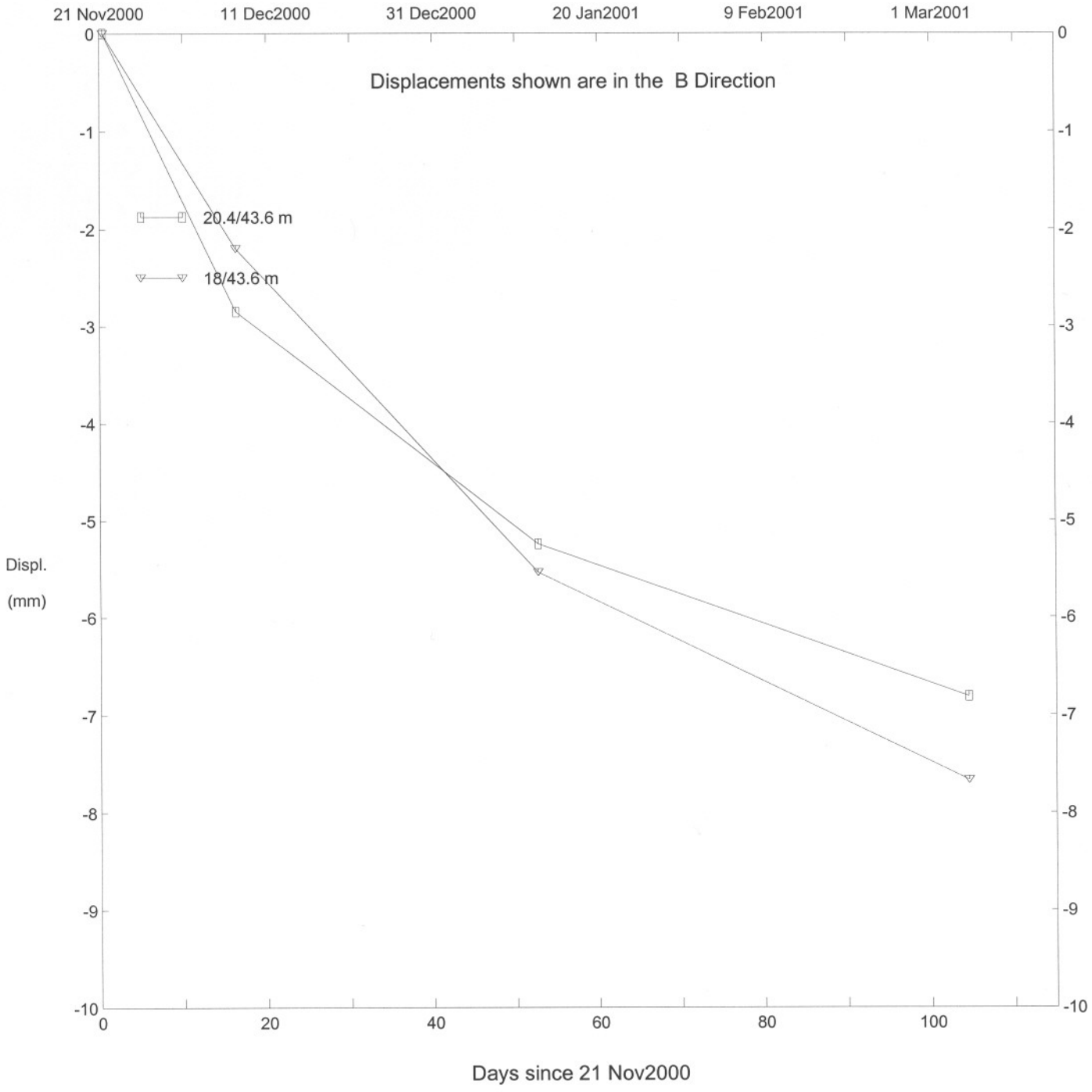
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-1

Lower Avery Lane

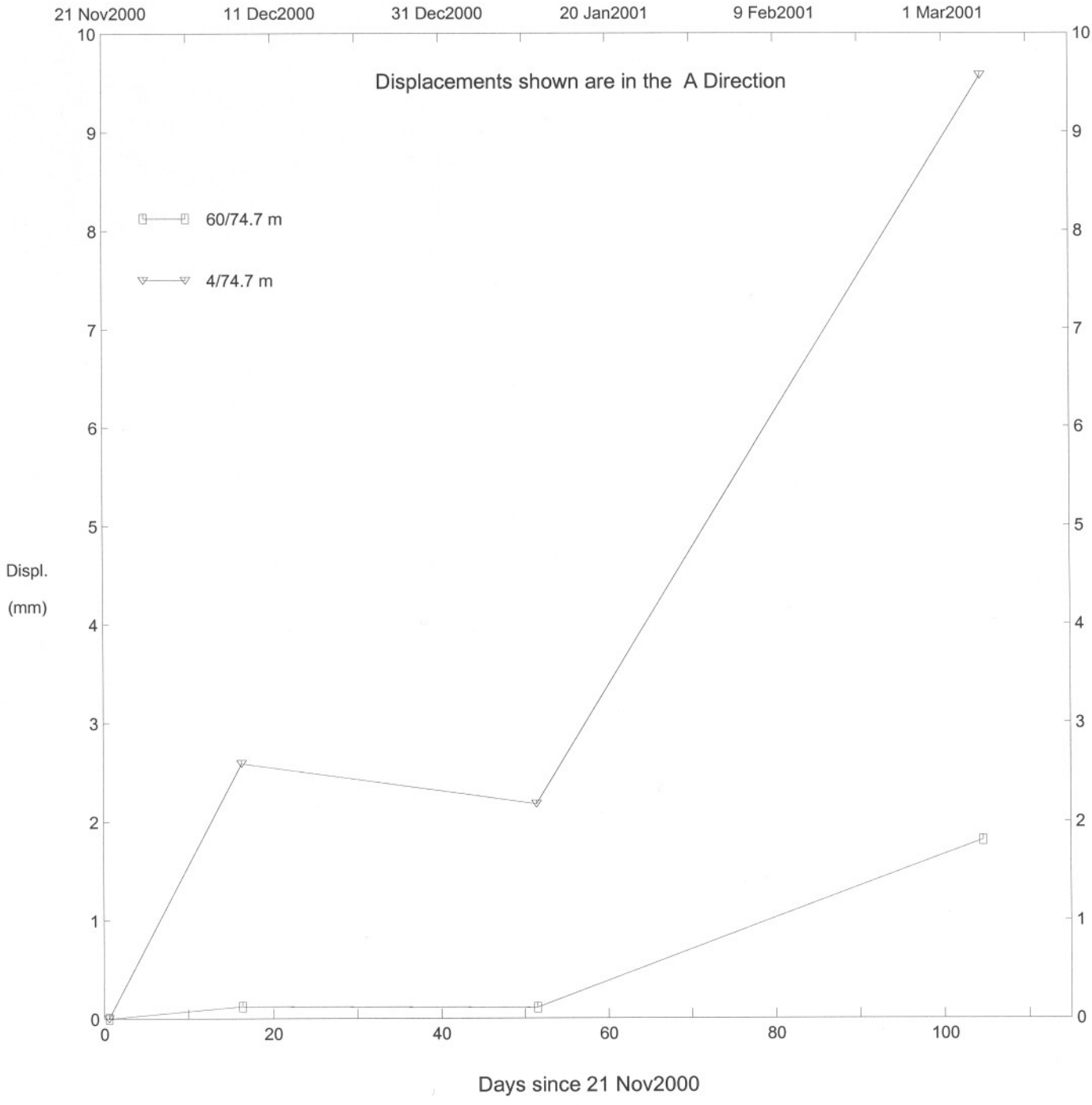
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-1

Lower Avery Lane

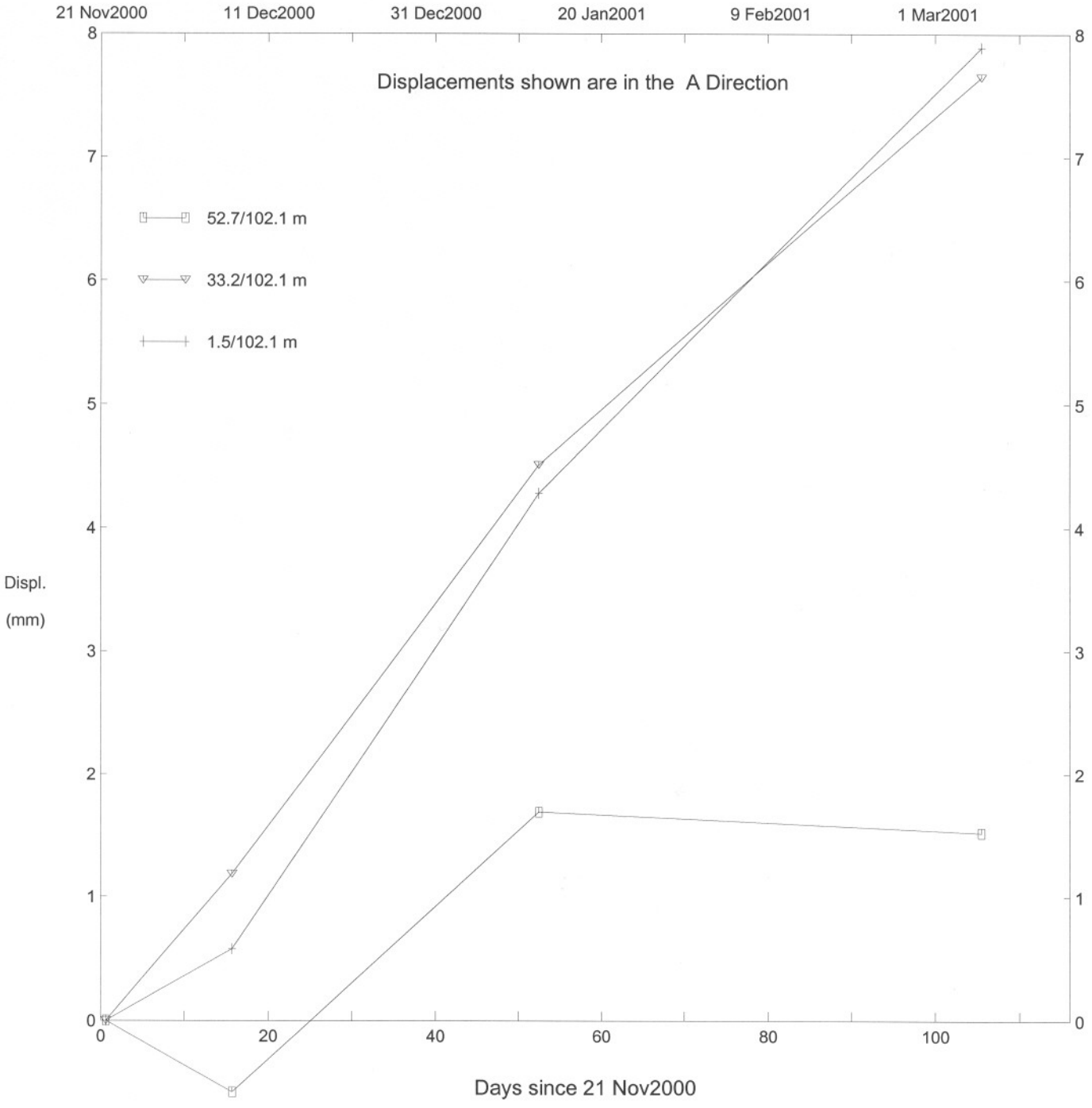
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-2

Upper Avery Lane

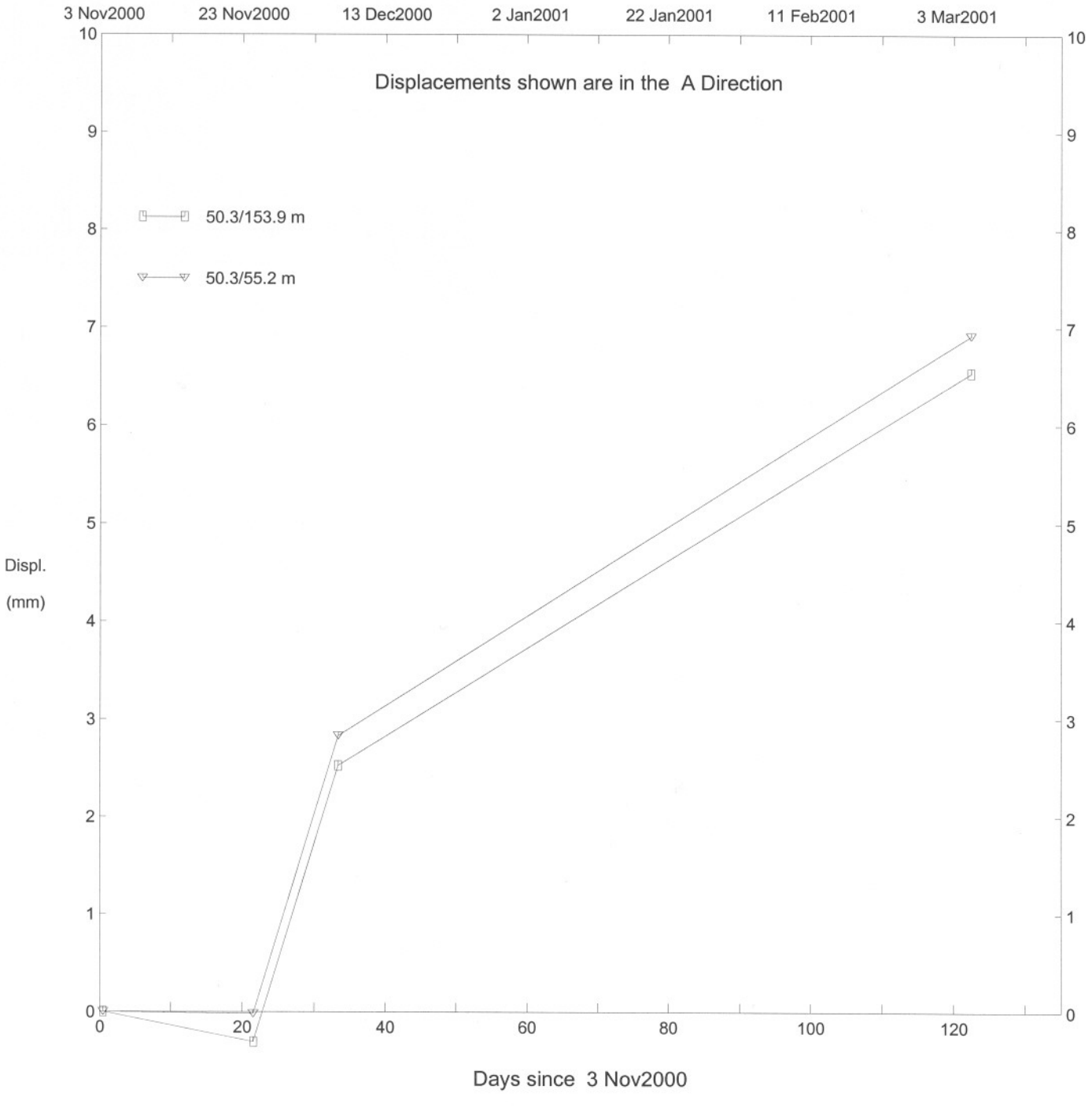
AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-3

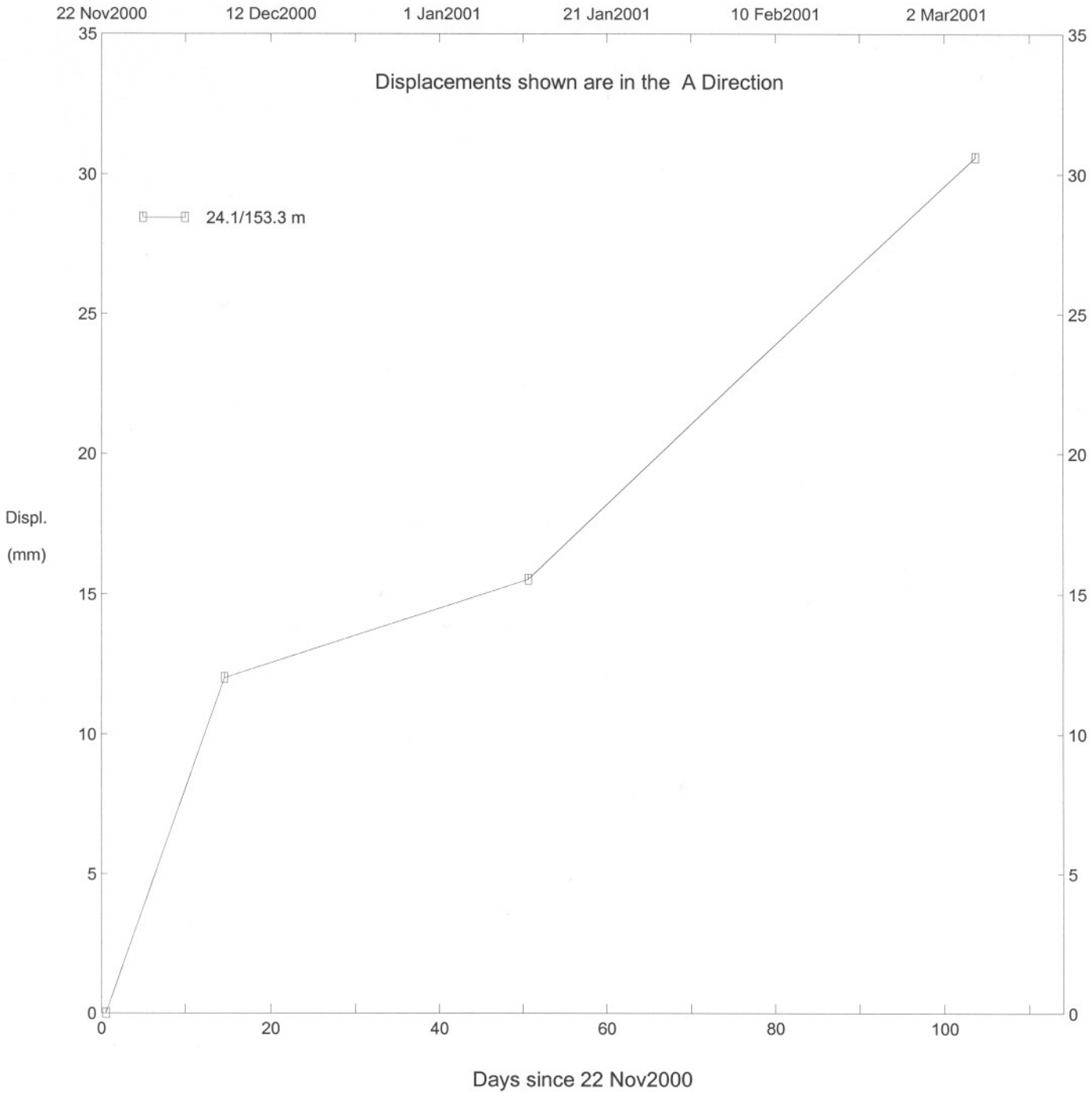
Abbott Drive near Bettcher

AMEC Earth and Environmental - Pr. George



KX03904 W.Quesnel Stability Study, Inclinometer SI-4

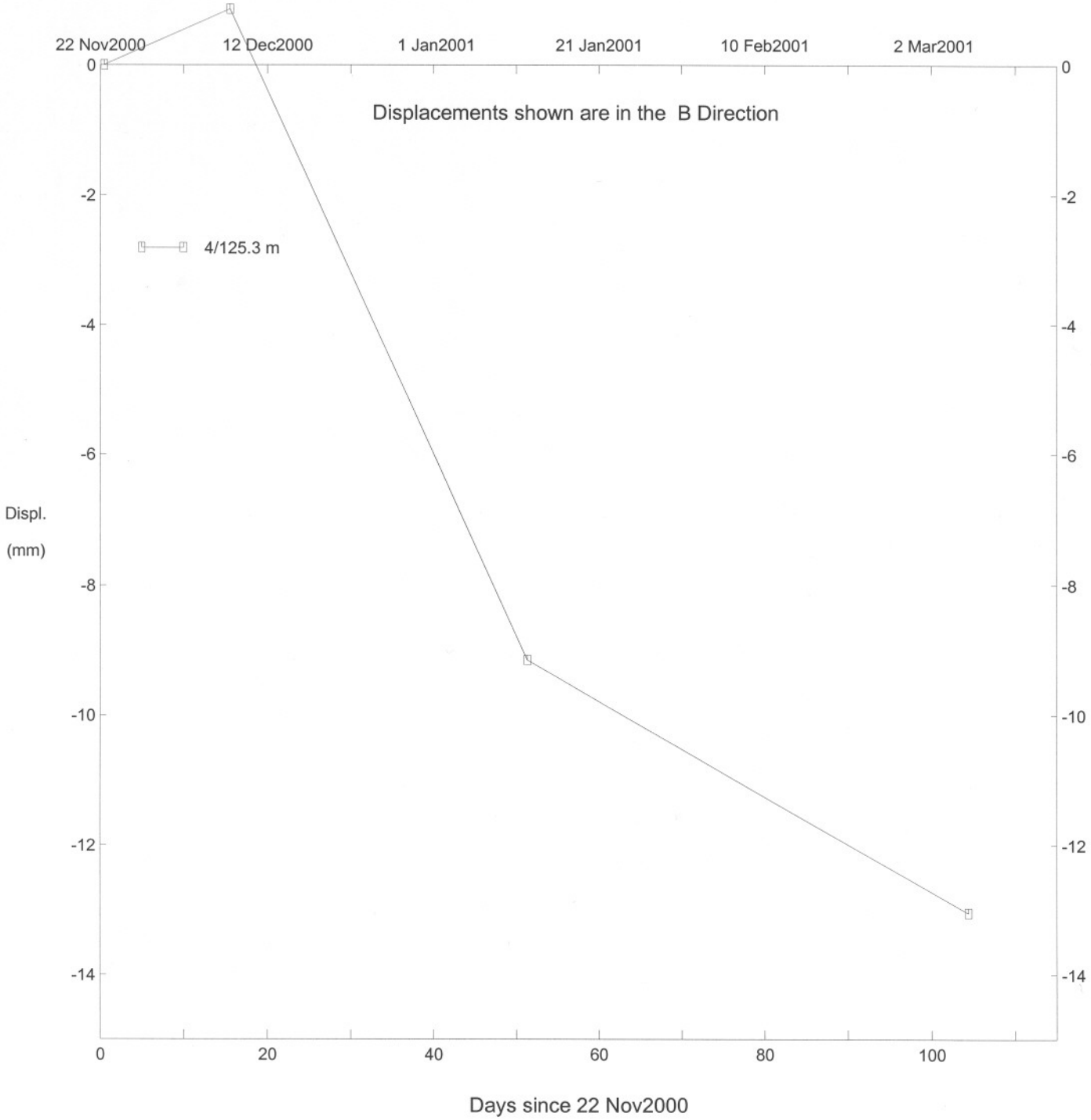
AMEC Earth and Environmental - Pr. George



KX03904 W.Quesnel Stability Study, Inclinometer SI-6

End of Dixon Street

AMEC Earth and Environmental - Pr. George



KX03904 W. Quesnel Stability Study, Inclinometer SI-7

Pierce Crescent & Lewis Drive