Appendix F
3D Computer Model Development

December 2019

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LIST OF ANNEXES

1. INTRODUCTION

This Appendix describes the tools, data sources, and techniques used to develop a 3D computer model of the Vale S.A. ("Vale") Córrego do Feijão Mine Dam I ("Dam I") in Brumadinho, Brazil. The development of a computer model was necessary to produce a 3D representation of the outer surface and internal stratigraphy of Dam I for input into seepage, deformation, and limit equilibrium stability analyses. The 3D model was used as the basis for 2D and 3D numerical models of stability and deformation set forth in Appendix H.

As will be described below, a detailed model of the dam was created through review of available design and construction documents, aerial and satellite photography, and data from Cone Penetration Tests with pore-pressure dissipation measurements (CPTu) in order to create a 3D internal stratigraphic representation of Dam I. In addition, aerial and satellite images of Dam I were used to establish the location of the pond over time. These data were used to estimate beach lengths for each construction stage.

2. TOOLS

Data used to develop the 3D computer model were viewed and manipulated using computer aided design (CAD) software. This software was used to:

- View topographic surveys, aerial and satellite images, and design surveys;
- Plot CPTu and borehole locations in plan;
- Generate 3D surfaces for input to seepage, deformation, and limit equilibrium stability models;
- View and cut 3D surfaces to produce sections/profiles; and
- Produce true scale plan and section figures.

All data used to develop the 3D computer model were set to the projection and datum listed in Table 1.

Table 1: Projection and Datum Summary

Item	Description
Projection	Universal Transverse Mercator (UTM)
Zone	23S
Datum	SIRGAS2000

3. DATA SOURCES

3.1 General

The information used in this Appendix is based on documents and records provided by Vale and third parties. A limited number of topographic surveys were available at the time of this investigation. Topographic data, which show the physical state of the facility at the time of the survey, tend to be the most valuable source of information when examining construction history. As a result, it was necessary to fill these data gaps with supporting data sources including:

- design and construction drawings (further described in Appendix A); and
- aerial and satellite images of the dam over time.

The primary sources of data used to construct the 3D computer model of Dam I are discussed in the following sections.

3.2 Topographic Surveys

A summary of the topographic surveys used as part of the 3D computer model development is provided in Table 2. Figure 1 in Annex 1 provides a plan view of the Dam I design sections (1-1', 2-2' and 3-3') used to develop the 2D sections. Figure 2 of Annex 1 provides a profile view through Dam I at each of the three design sections shown in Figure 1.

Table 2: Summary of Topographic Surveys Used to Develop 3D Computer Model

Data Title	Description/Reason for Use
Pre-Dam Topography	Defines the local topography prior to the construction of Dam I.
2018 topographic information	Defines the local topography as of June 2018, which is well after the completion of construction/tailings deposition of Dam I.
September 2018 LiDAR	Defines the local topography at the completion of construction/tailings deposition of Dam I. Served as a secondary check on the 2018 topographic information.
February 2019 LiDAR	Defines the post-failure local topography of Dam I.

3.3 Design Surfaces of Compacted Containment Berms

Appendix A provides an overview of the design and construction history of Dam I. Design and construction drawings described in that Appendix were used to produce 3D representations of the compacted containment berms located on the downstream slope of Dam I. Figure 3 of Annex 1 shows a profile view through Dam I illustrating the compacted containment berm surfaces.

3.4 Delineated CPTu Data

As discussed in Appendix E, a review of available CPTu data was completed. This included delineation of tailings within Dam I into similar types (i.e., Fine and Coarse Tailings, and Slimes). Delineated CPTu data were used to develop stick diagrams highlighting layers of Fine Tailings. These stick diagrams were overlain on the nearest design section, as shown in Figure 4 of Annex 1. The interpreted CPTu data were then used to produce a spatial distribution of Fine and Coarse Tailings, and Slimes.

3.5 Aerial and Satellite Images

The Expert Panel obtained aerial and satellite imagery dating from 1987 to 2018. Elevation data were generated from two of the satellite images, providing supplementary topographic data from 2008 and 2010. In total, 14 aerial photographs and 28 satellite images were used in the development of the 3D computer model. The satellite and aerial images used for this assessment are presented in Annexes 2 and 3, respectively.

4. 3D MODEL DEVELOPMENT

4.1 General

AutoCAD Civil 3D 2018™ (Civil 3D) was used as a central repository to import topographic surveys, containment berm surfaces and CPTu locations. These data were used to develop a "base model" which would form the basis for development of subsequent components of the 3D model.

4.2 Satellite Image Review

A review of the available aerial and satellite image data was undertaken with the intent of estimating geometric features of Dam I at each stage of construction (as described in Appendix A). The data extracted included:

- The gradient of tailings deposition;
- Pond location over time; and
- The area of Slimes deposition.

This review was conducted in two stages. The first stage (stage 1) focused on a review of satellite and aerial images available during the initial stages of the investigation. This included a review of five satellite images and 14 aerial photographs, taken at various stages of construction since 1999. The data extracted from this first stage of review formed the basis for the inputs into the 3D computer model development. The second stage focused on a review of an additional 23

satellite images and two topographic surveys obtained by the Expert Panel. This information was used as a check on the data extracted from the stage 1 review. The results from the two stages of review were found to be in general agreement.

During review of the aerial and satellite images, it was observed that the left abutment subaerial beach length was consistently longer than the right abutment beach length. This observation was supported by the 2018 topographic information and September 2018 LiDAR Survey in which the subaerial beach was shown to be at a similar angle to the crest alignment for the final construction stage. Additionally, there was a difference of 1 m between the maximum beach elevation along the right and left abutments, respectively. It was concluded that the deposition of tailings did not occur parallel to the crest alignment during construction of the dam. Based on these observations the following assumptions were used for development of the 3D computer model:

- The maximum beach elevations at the left and right abutments were assumed to be approximately 3 m and 4 m below the dam crest for each construction stage, respectively.

- The beach deposition was assumed to be at an oblique angle to the crest alignment and the angle of deposition was consistent with that observed in the 2018 topographic information.

4.2.1 Gradient of Tailings Deposition

Beach lengths at the left and right abutment were measured from each aerial and satellite image. Using the available pond elevation data and the beach geometry assumptions listed in Section 4.2, an average beach gradient of approximately 1% was calculated. This gradient was consistent with the 2018 topographic information and the September 2018 LiDAR Survey. This gradient was also consistent with supplementary topographic surveys.

Using these estimates, a beach surface above and below the pond level was modelled in Civil 3D for each construction stage. These surfaces are shown in Figure 5 of Annex 1.

4.2.2 Staged Pond Elevations

The pond elevation was assigned to each construction stage using the modelled beach surfaces, measured beach lengths discussed in Section 4.2.1 and pond elevation data,[1] where available. Since each construction stage spanned several years, multiple satellite/aerial images were available for a single construction stage. Each aerial/satellite image had a different beach length; therefore, the average of measured beach lengths for a specific construction stage was used to

[1] Periodic Review of Dam Safety of the Córrego Feijão Mine – Dam I Technical Report (TÜV SÜD 2018) ("2018 TÜV SÜD Periodic Safety Review").

calculate the pond elevation for that stage. In addition, due to a lack of information prior to 1999, beach lengths from 1976 through 1998 were assumed to be the same as those measured from the July 17, 1999 aerial image.

Using these estimates, pond elevation surfaces for each construction stage were modelled in Civil 3D. A summary of the selected pond elevations is provided in Table 3.

Table 3: Summary of Selected Pond Elevations

Stage	Dam Crest El. (m)	Pond El. (m)	Stage	Dam Crest El. (m)	Pond El. (m)
1	874.0	870.2	9	905.0	899.9
2	877.0	873.2	10	910.0	904.9
3	879.0	876.2	11	916.5	910.1
4	884.0	880.0	12	922.5	917.6
5	889.0	885.1	13	929.5	924.5
6	891.5	887.2	14	937.0	931.9
7	895.0	890.5	15	942.0	936.2
8	899.0	894.6			

A pond boundary surface, representing the intersection between pond surfaces and beach surfaces, was created for the full height of Dam I. A schematic illustrating the development of the pond boundary at Section 3-3' is shown on Figure 6 in Annex 1. The staged pond surfaces and the pond boundary surface, representing the intersection between pond surfaces and beach surfaces, are shown in Figure 7 of Annex 1.

4.2.3 Staged Water Table Development

Using the pond elevation surfaces and CPTu data, water table surfaces within Dam I were developed for each stage of construction. These water tables were used in initial analyses and checked against the seepage analysis results summarized in Appendix G. The developed water tables were found to be in general agreement with those of the seepage analyses. Adjustments were made to the water table surfaces, where required, for later analyses once the seepage analysis results were available.

4.2.4 Slimes Boundary

The boundary of Slimes deposition was initially assumed to be at the modelled pond boundary for each raise; however, when reviewing this assumption, it was observed that some CPTu tests with Coarse and Fine Tailings were located upstream of that boundary. This observation suggested that the modelled pond boundary was not representative of a Slimes boundary. Three CPTu tests, B1-CPTu-01, 02, and 03, located within the pond area of Dam I, were shown to exhibit very low strengths and high porewater pressures, indicative of Slimes. Upon review of

B1-CPTU-01, it was observed that Coarse and Fine Tailings appeared to be interbedded with Slimes material, indicating that B1-CPTU-01 was located near this Slimes boundary. The final location of the Slimes boundary assumed the following:

- The Slimes boundary was located just upstream of CPTu-PZE-23-08, ensuring all Coarse and Fine Tailings delineated from CPTu data were located downstream of the Slimes boundary and the Slimes-dominated CPTu tests (B1-CPTu-01, 02 and 03) were located upstream of this boundary.

- The Slimes boundary was approximately 115 m upstream of the pond boundary.

- The Slimes boundary was parallel to the crest alignment.

The Slimes boundary surface, representing the boundary between Fine/Coarse Tailings and Slimes material, is shown in Figure 8 of Annex 1.

4.3 Tailings Stratigraphic Model

As discussed in Appendix E, CPTu data were used to create a spatial delineation of tailings types by grouping regions with similar strengths and CPTu behavior.

4.3.1 2D Tailings Delineation Model

At each CPTu location, Fine and Coarse Tailings were projected in the downstream and upstream directions. These projections were truncated when they encountered an adjacent CPTu, downstream raising berm or the Slimes boundary.

The final 2D tailings delineation is presented in Figure 9 of Annex 1.

4.3.2 3D Tailings Delineation Model

The 2D tailings models were used as the basis for the development of the 3D model. In this case, the 2D tailings models at Sections 1-1', 2-2' and 3-3' were projected in the direction perpendicular to the section alignments, as shown in Figure 10 of Annex 1. In addition, the following was assumed during development of the 3D tailings delineation model:

- Fine Tailings identified in Section 1-1' would be projected to the right abutment and to Line 1-2 (an equal distance between Section 1-1' and 2-2');

- Fine Tailings identified in Section 2-2' would be projected to line 1-2 (an equal distance between Section 1-1' and 2-2') and 2-3 (an equal distance between Section 2-2' and 3-3');

- Fine Tailings identified in Section 3-3' would be projected to line 2-3 (an equal distance between Section 1-1' and 2-2') and to the left abutment;

- Fine Tailings layers would be truncated at the Slimes boundary in the upstream direction; and

- Fine Tailings layers would be truncated at the raising berms in the downstream direction.

Appendix F

Annex 1 – Figures

December 2019

591,600 E
591,800 E
592,000 E
592,200 E
592,400 E
7,775,400 N
7,775,200 N
7,775,000 N
1'
2'
3'
1
2
3

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- DESIGN SECTIONS
- 2 m CONTOURS (JUNE 2018 TOPOGRAPHIC SURVEY)
- 10 m CONTOURS (JUNE 2018 TOPOGRAPHIC SURVEY)

1:3,000 0 30 60 m BASED ON A 11"X 17" DRAWING SIZE

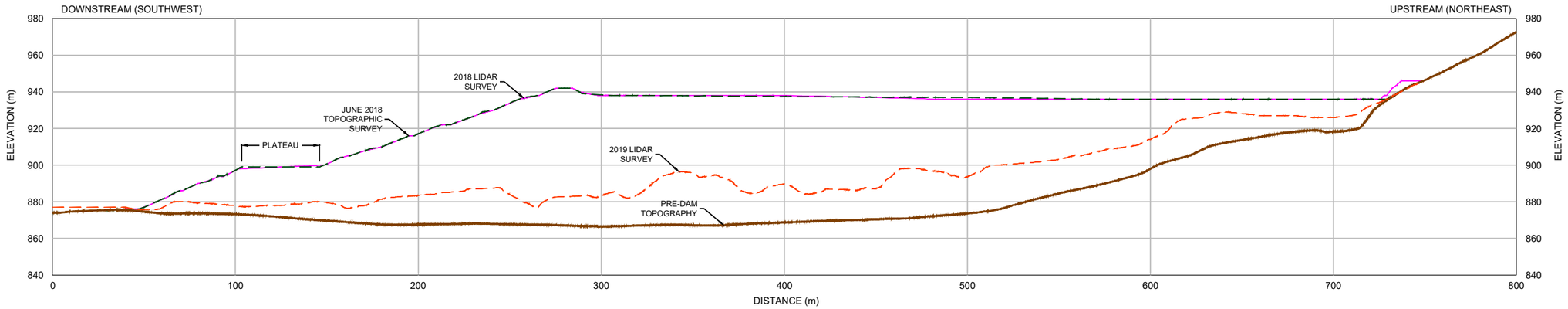
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
DAM 1 DESIGN SECTION LOCATIONS
PLAN VIEW

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	1

KCB-F-FIG-B4-L



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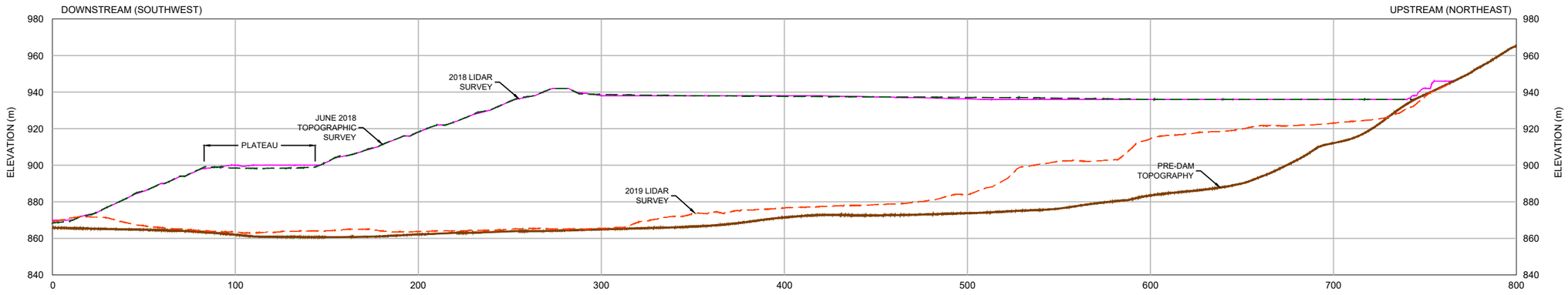

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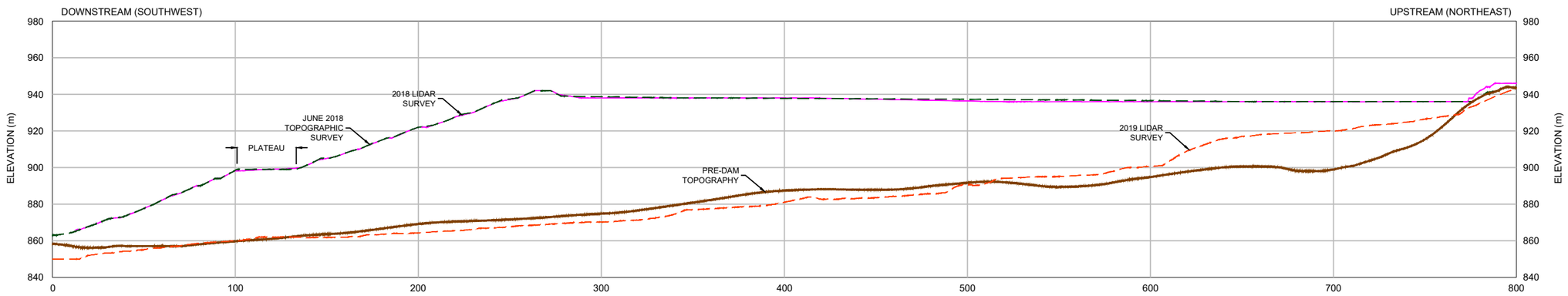

DESIGN SECTION 3-3'

1:2,500 0 25 50 m BASED ON A 11"X 17" DRAWING SIZE

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- JUNE 2018 TOPOGRAPHY SURVEY
- 2018 LIDAR SURVEY
- 2019 LIDAR SURVEY

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
TOPOGRAPHIC SURVEY PROFILES
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
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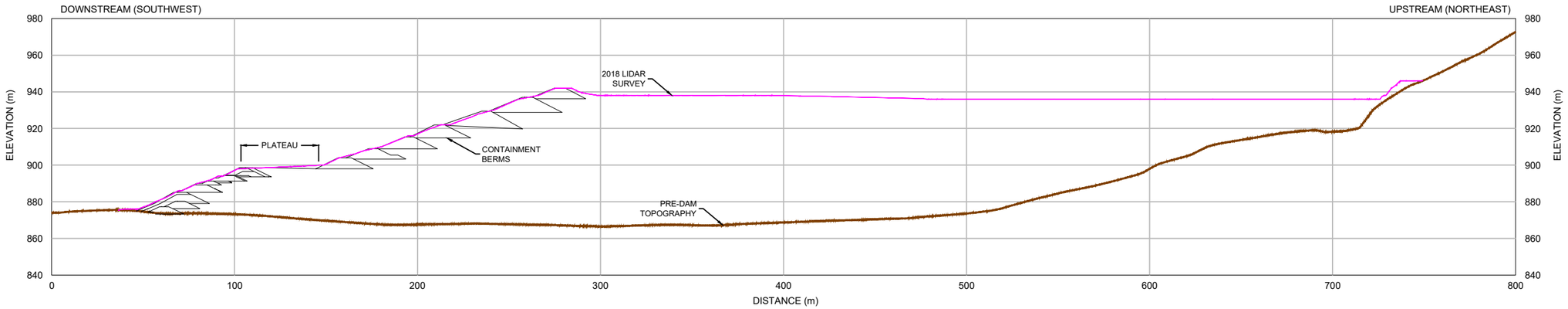
KCB-F-03-L



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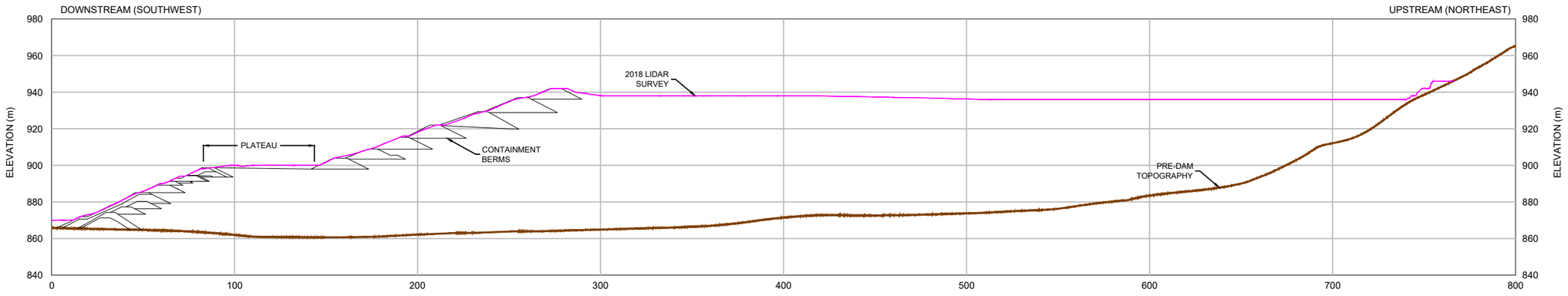
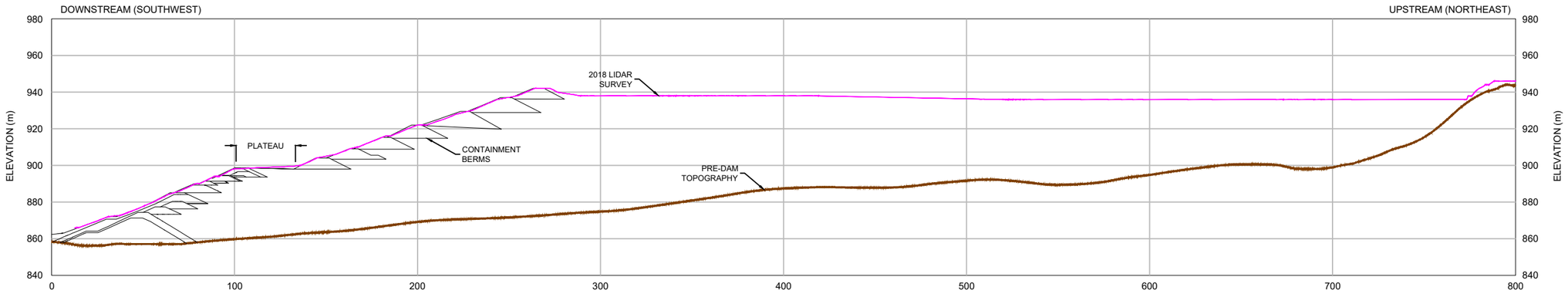


DESIGN SECTION 2-2'



DESIGN SECTION 3-3'

1:2,500 0 25 50 m BASED ON A 11"X 17" DRAWING SIZE

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

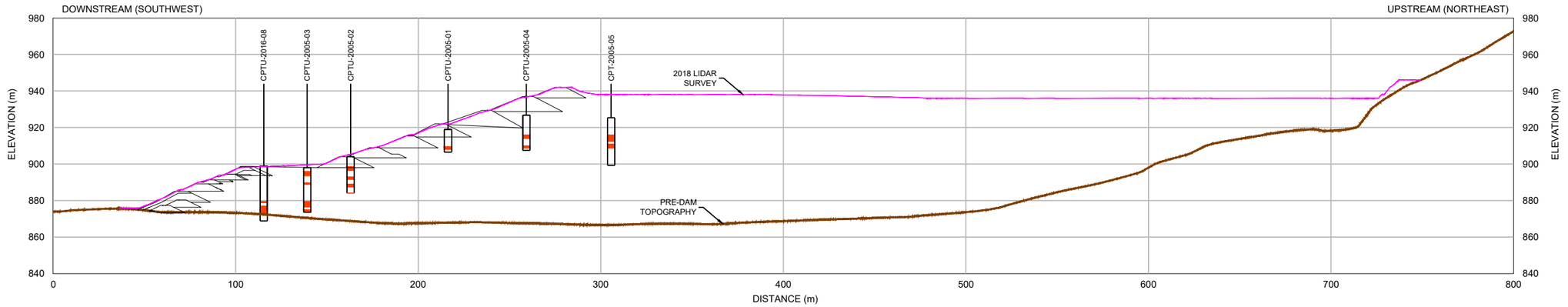
- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
CONTAINMENT BERM SURFACE PROFILES
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
1:2,500	A03355A01	3



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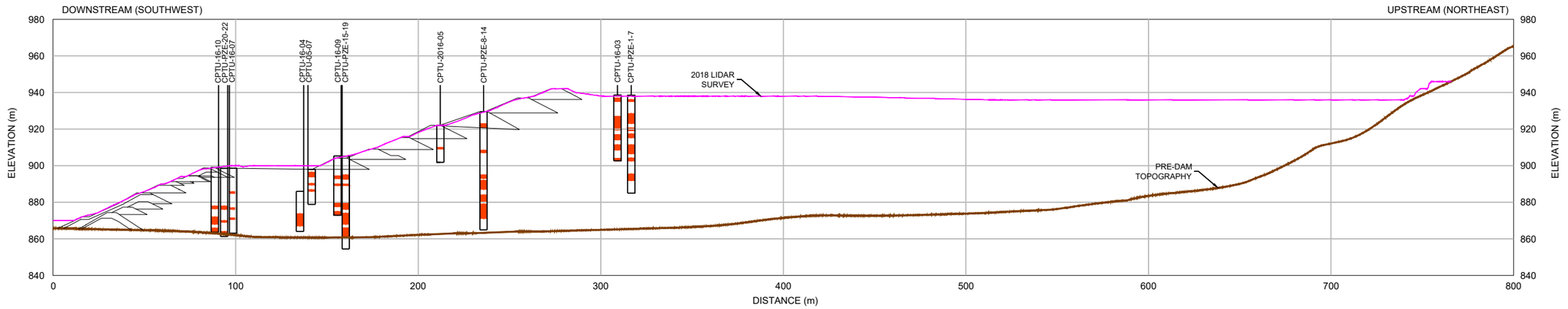

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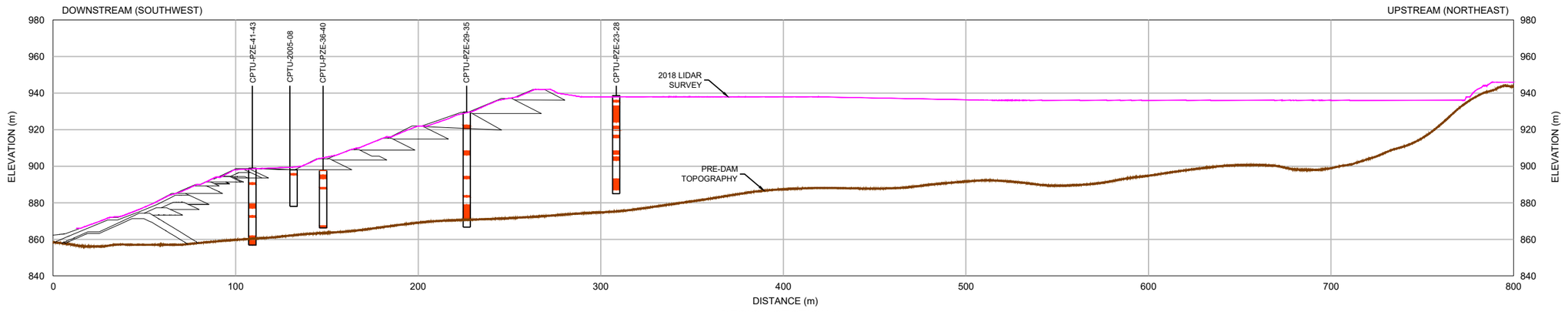

DESIGN SECTION 3-3'

1:2,500 0 25 50 m BASED ON A 11"X 17" DRAWING SIZE

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS
- DELINEATED FINE TAILINGS

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
DELINEATED CPT DATA PROFILES
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
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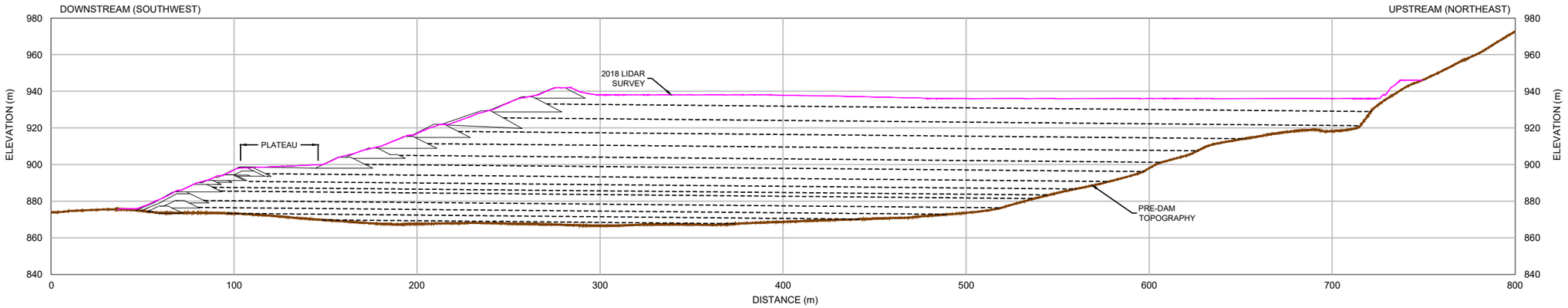
K:\2I-FIG-E4-L



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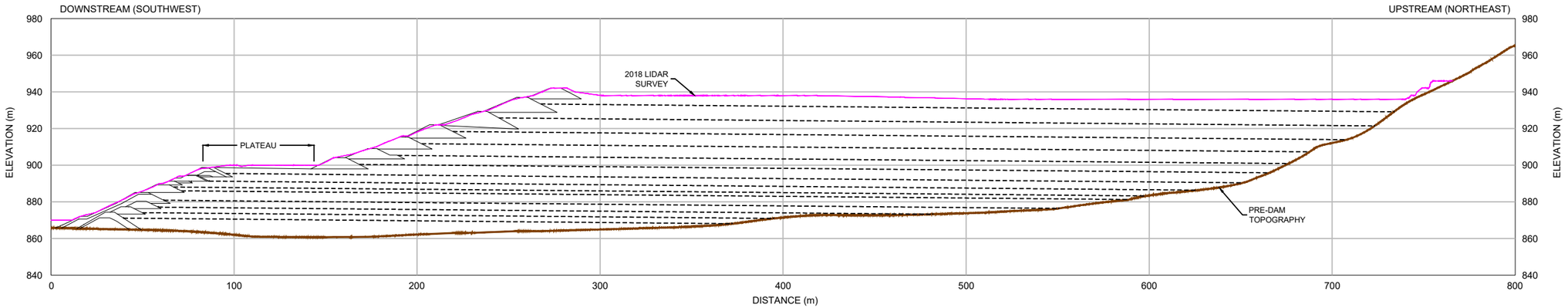

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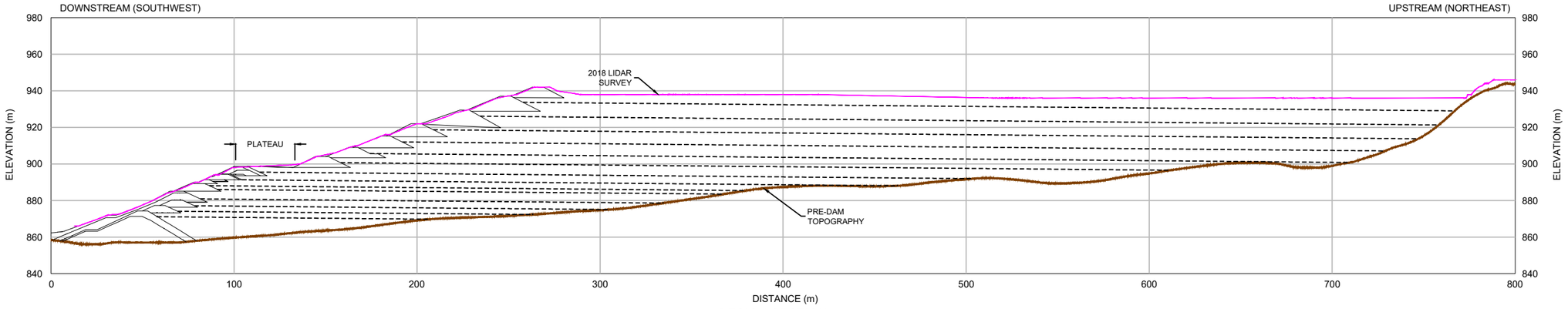


DESIGN SECTION 3-3'

1:2,500 0 25 50 m BASED ON A 11"X 17" DRAWING SIZE

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS
- STAGED BEACH SURFACES

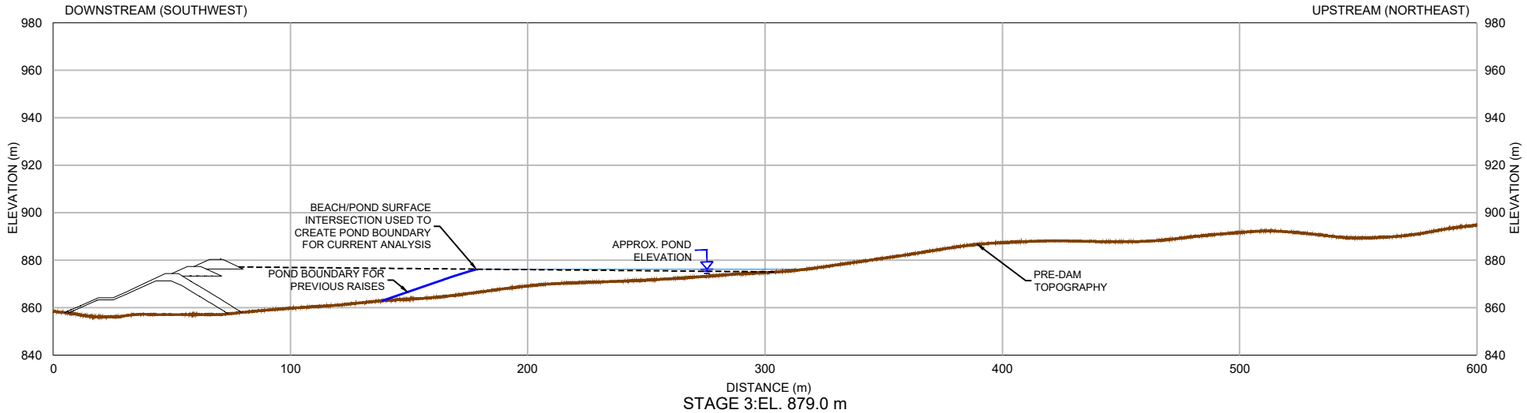
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

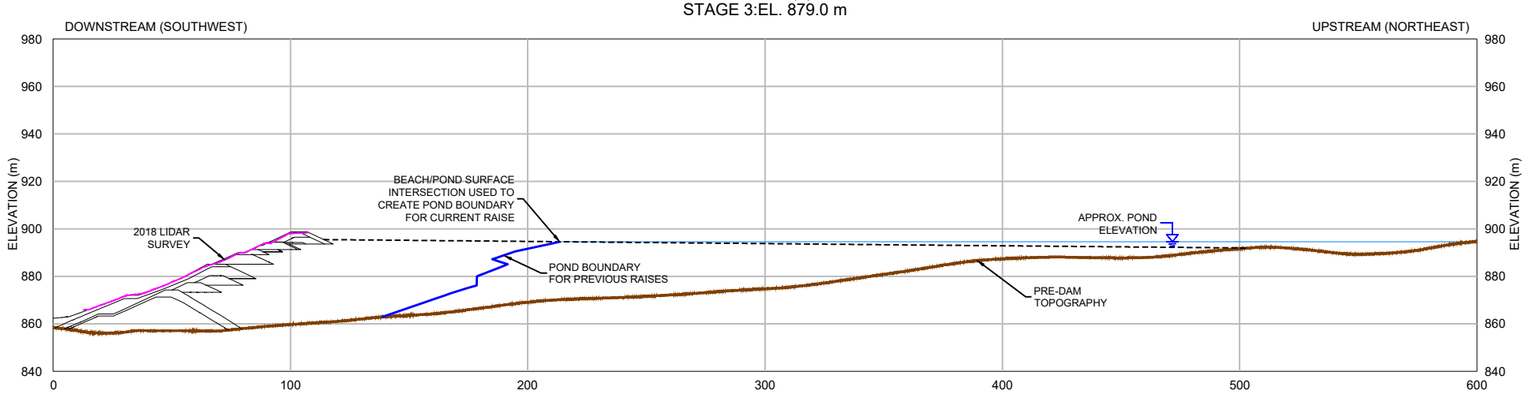
TITLE
APPENDIX F
STAGED BEACH SURFACE PROFILES
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
1:2,500	A03355A01	5

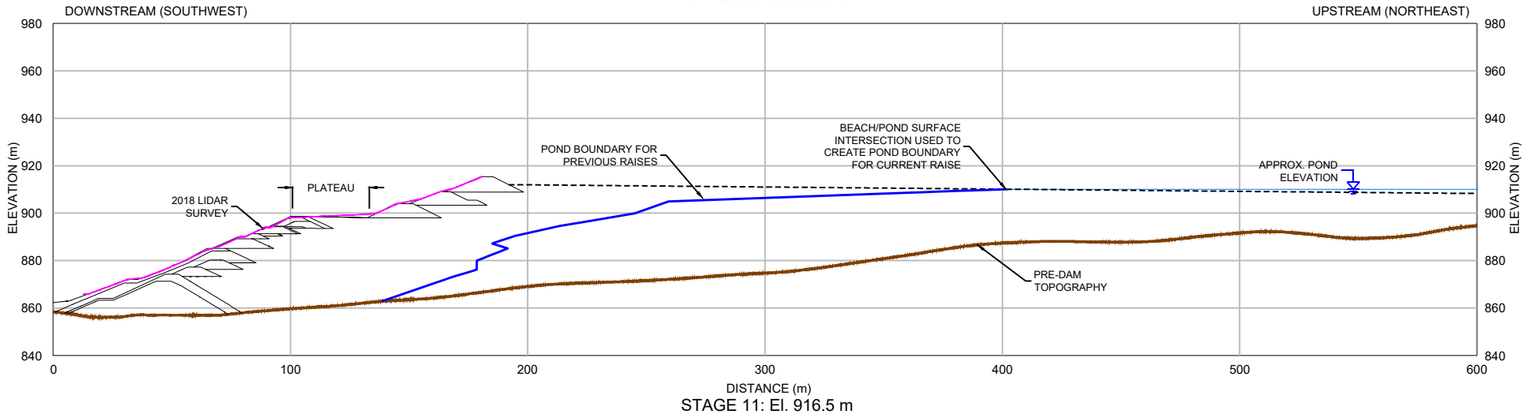
K28-FIG-64-L



STAGE 3:EL. 879.0 m



STAGE 8: EL. 899.0 m



STAGE 11: El. 916.5 m

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NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS
- STAGED BEACH SURFACES
- STAGED POND SURFACES
- POND BOUNDARY

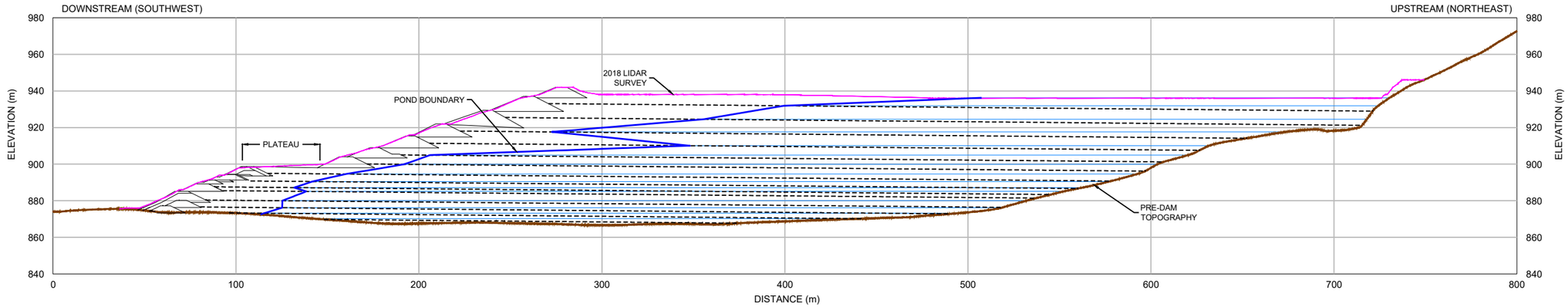
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

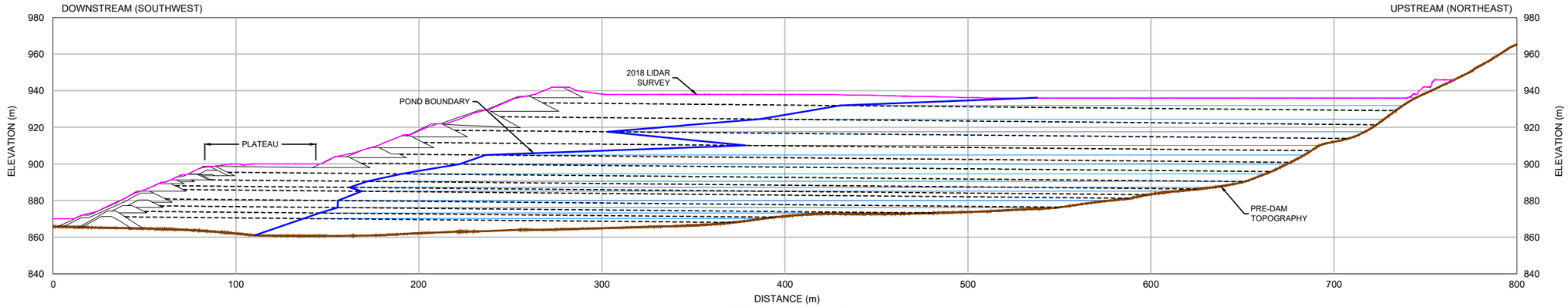
TITLE
APPENDIX F
POND BOUNDARY DEVELOPMENT SCHEMATIC: SECTION 3-3'

SCALE	PROJECT No.	FIG. No.
1:2,500	A03355A01	6

KCB-F-IG-8-L



DESIGN SECTION 1-1'



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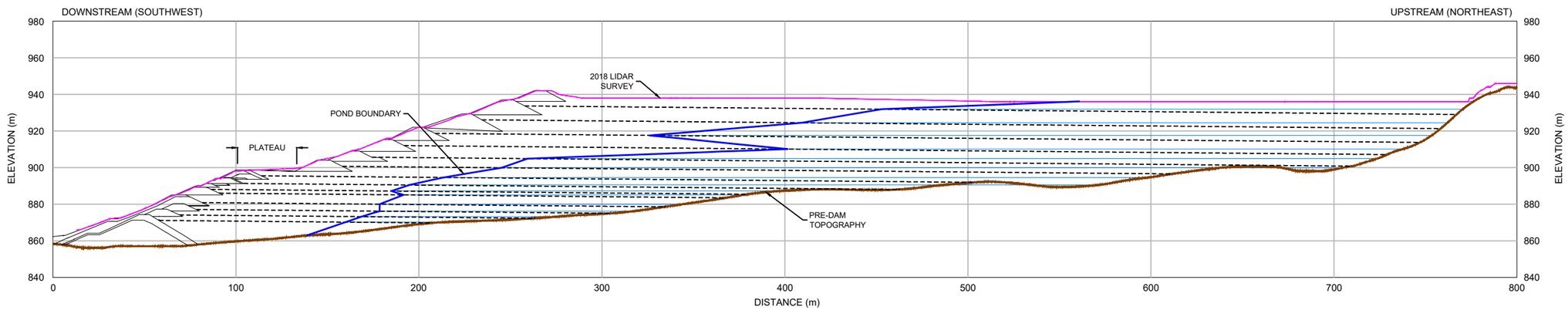

DESIGN SECTION 3-3'

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NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS
- STAGED BEACH SURFACES
- STAGED POND SURFACES
- POND BOUNDARY

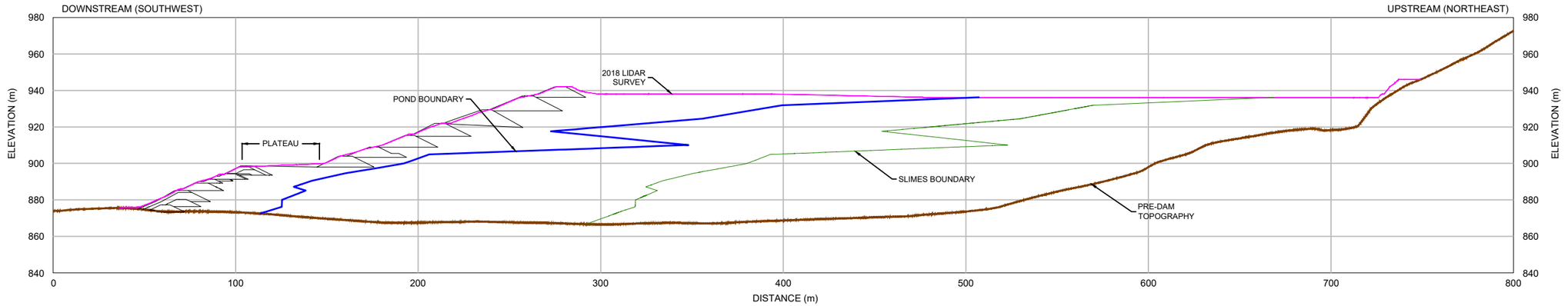
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

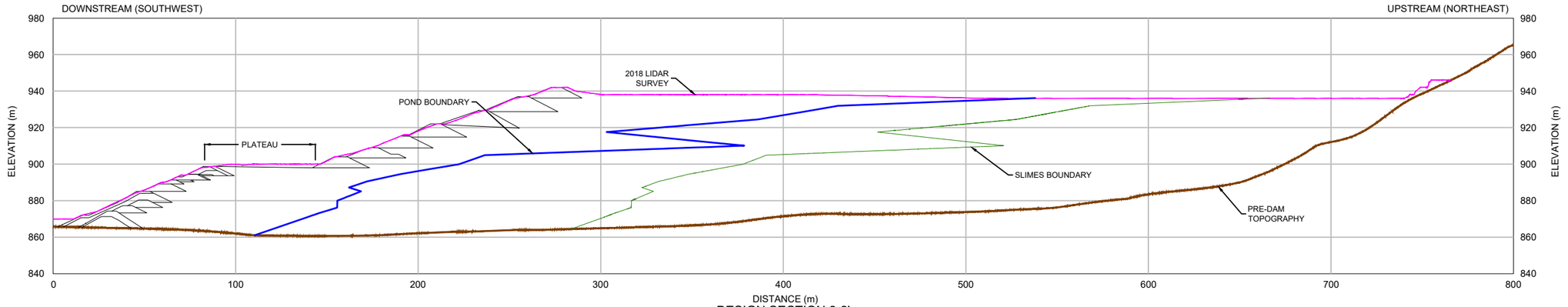
TITLE
APPENDIX F
STAGED POND SURFACE PROFILES
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
1:2,500	A03355A01	7

KCB-FIG-B4-L



DESIGN SECTION 1-1'



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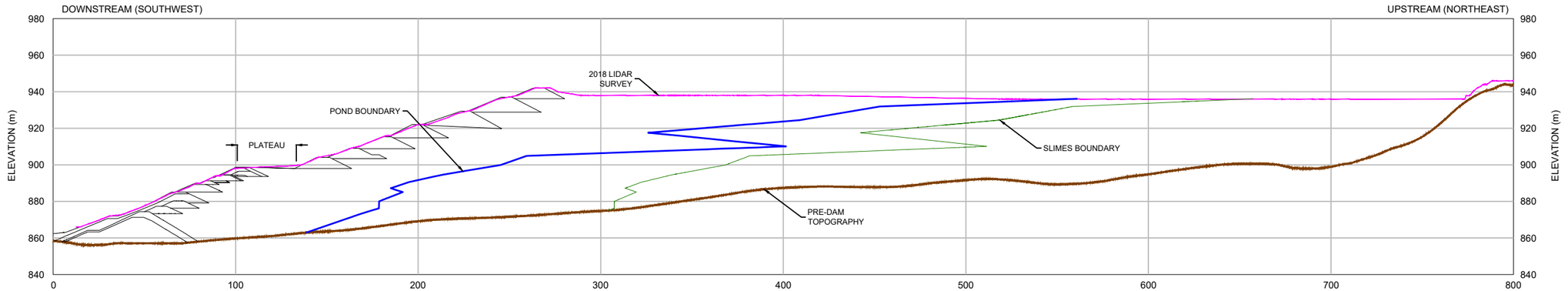


DESIGN SECTION 3-3'

1:2,500 0 25 50 m BASED ON A 11"X 17" DRAWING SIZE

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS
- POND BOUNDARY
- SLIMES BOUNDARY

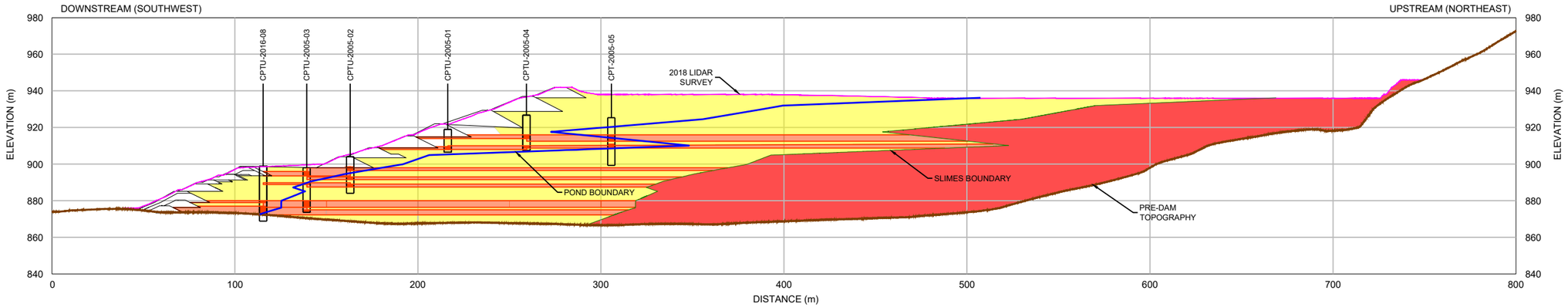
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

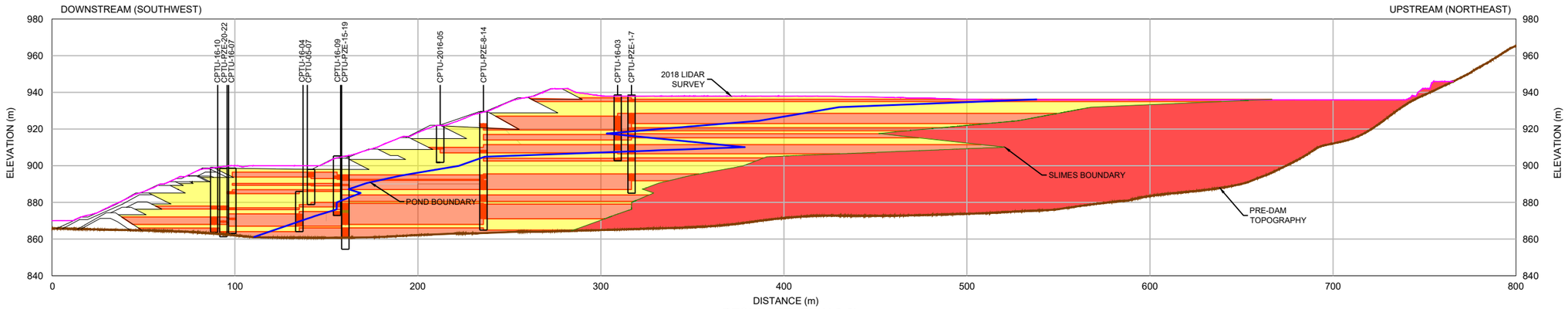
TITLE
APPENDIX F
SLIMES BOUNDARY PROFILES
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
1:2,500	A03355A01	8

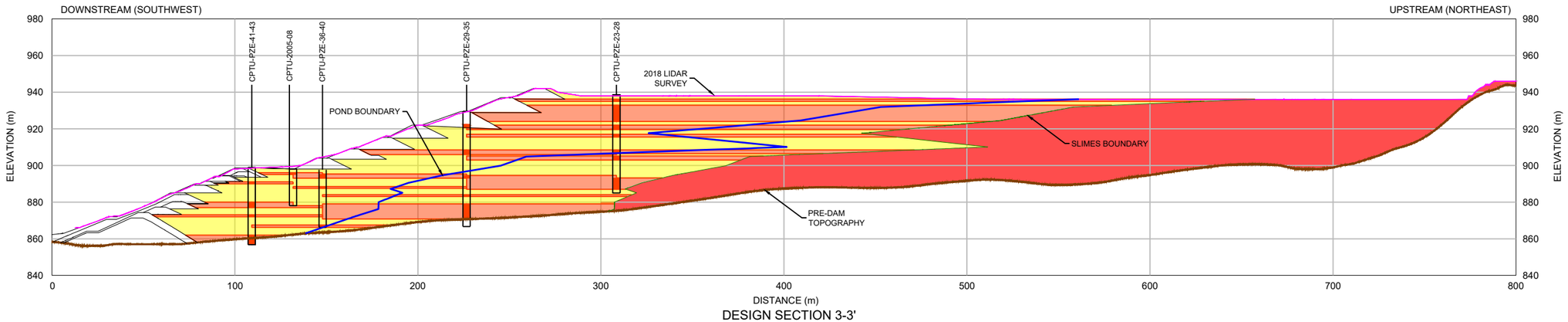
KCB-FG-84



DESIGN SECTION 1-1'



DESIGN SECTION 2-2'



DESIGN SECTION 3-3'

1:2,500 0 25 50 m BASED ON A 11"X 17" DRAWING SIZE

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- PRE-DAM TOPOGRAPHY
- 2018 LIDAR SURVEY
- CONTAINMENT BERMS
- POND BOUNDARY
- SLIMES BOUNDARY
- FINE TAILINGS
- COARSE TAILINGS
- SLIMES

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
2D TAILINGS DELINEATIONS MODELS
SECTIONS 1-1', 2-2' & 3-3'

SCALE	PROJECT No.	FIG. No.
1:2,500	A03355A01	9

KCB-F-IG-8-L

591,600 E

591,800 E

592,000 E

592,200 E

592,400 E

7,775,400 N

7,775,200 N

7,775,000 N

RIGHT ABUTMENT

3D TAILINGS DELINEATION PROJECTED FROM SECTION 1-1' 2D DELINEATION

3D TAILINGS DELINEATION PROJECTED FROM SECTION 2-2' 2D DELINEATION

3D TAILINGS DELINEATION PROJECTED FROM SECTION 3-3' 2D DELINEATION

LINE 1-2

LINE 2-3

1'

2'

3'

1

2

3

LEFT ABUTMENT

N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

LEGEND:

- DESIGN SECTIONS
- LINES 1-2 & 2-3
- 2 m CONTOURS (JUNE 2018 TOPOGRAPHIC SURVEY)
- 10 m CONTOURS (JUNE 2018 TOPOGRAPHIC SURVEY)

1:3,000 0 30 60 m BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
3D TAILINGS DELINEATION PROJECTION
PLAN VIEW

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	10

KCB-FIG-84

Appendix F

Annex 2 – Satellite Images

December 2019

591,600 E

591,800 E

592,000 E

592,200 E

592,400 E

592,600 E

7,775,400 N

7,775,200 N

7,775,000 N

7,774,800 N

N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

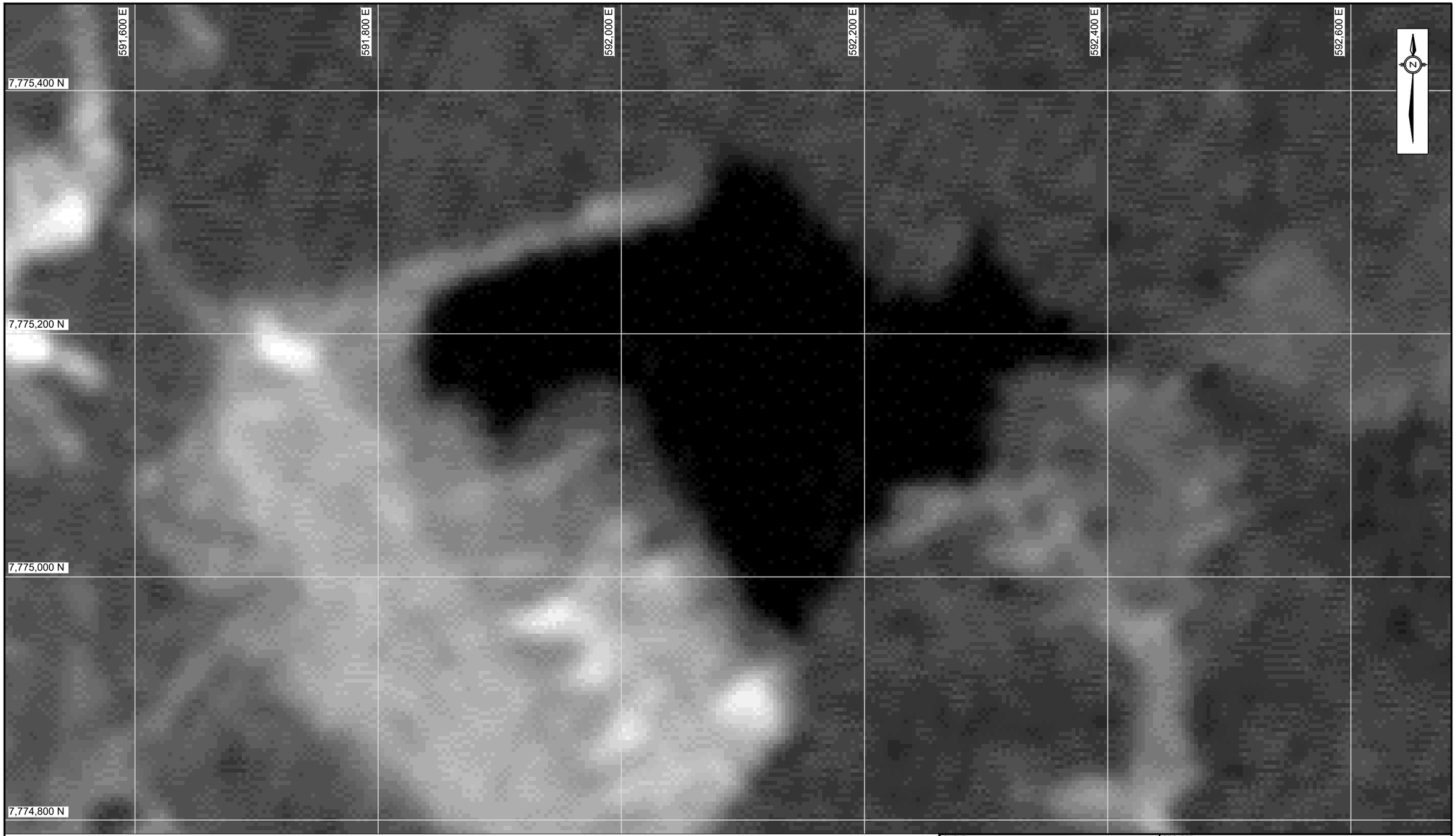
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
1987

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	1

KCB-F-IG-8-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

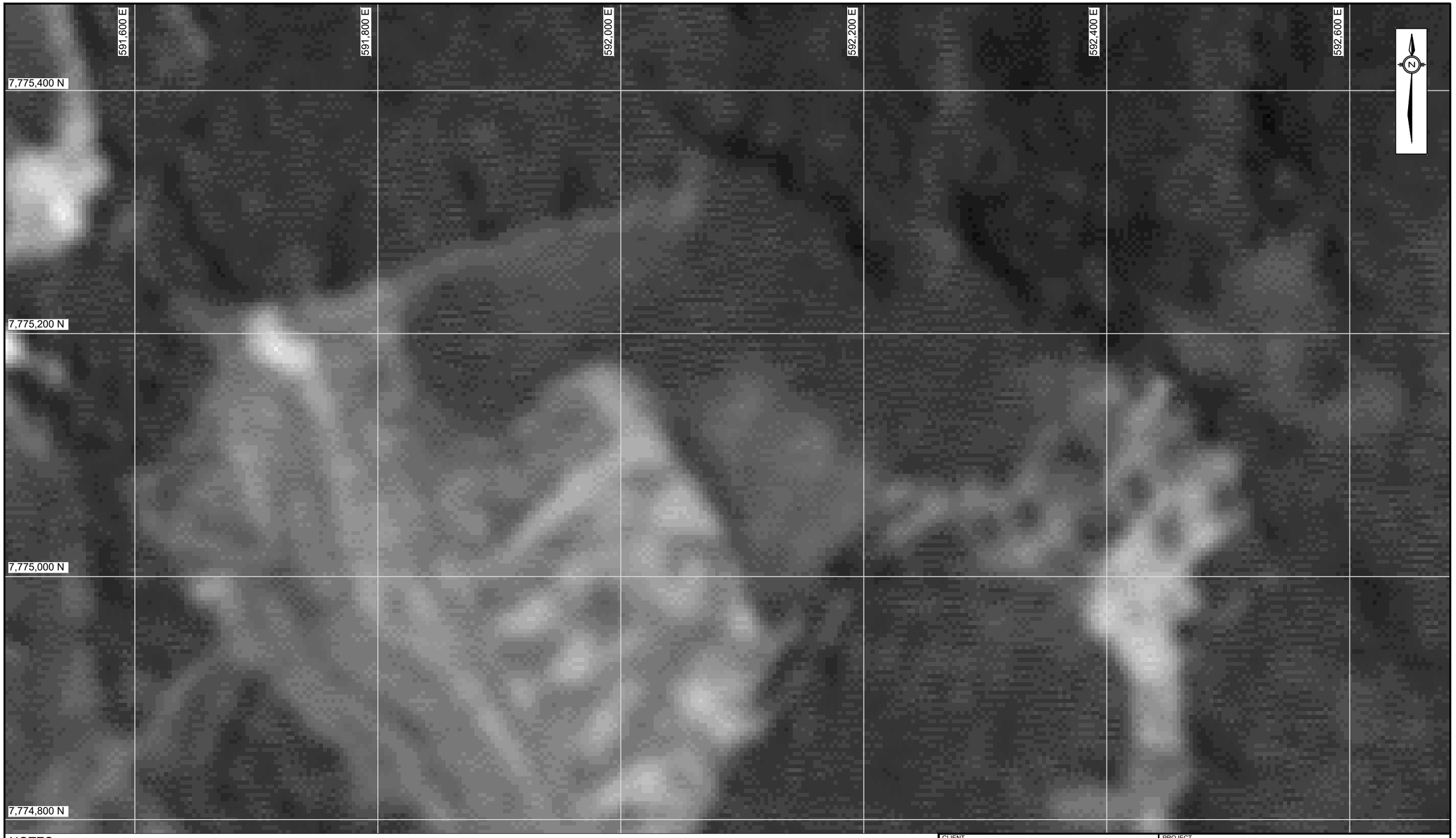
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
FEBRUARY 1998

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	2

K:\2F-FIG\4-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
MARCH 1998

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	3

KCB-FIG-B4

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
DECEMBER 1999

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	4

KCB-FG-B-L

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
APRIL 2000

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	5

KCB-F-IG-8-L

591,600 E
591,800 E
592,000 E
592,200 E
592,400 E
592,600 E
7,775,400 N
7,775,200 N
7,775,000 N
7,774,800 N

N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

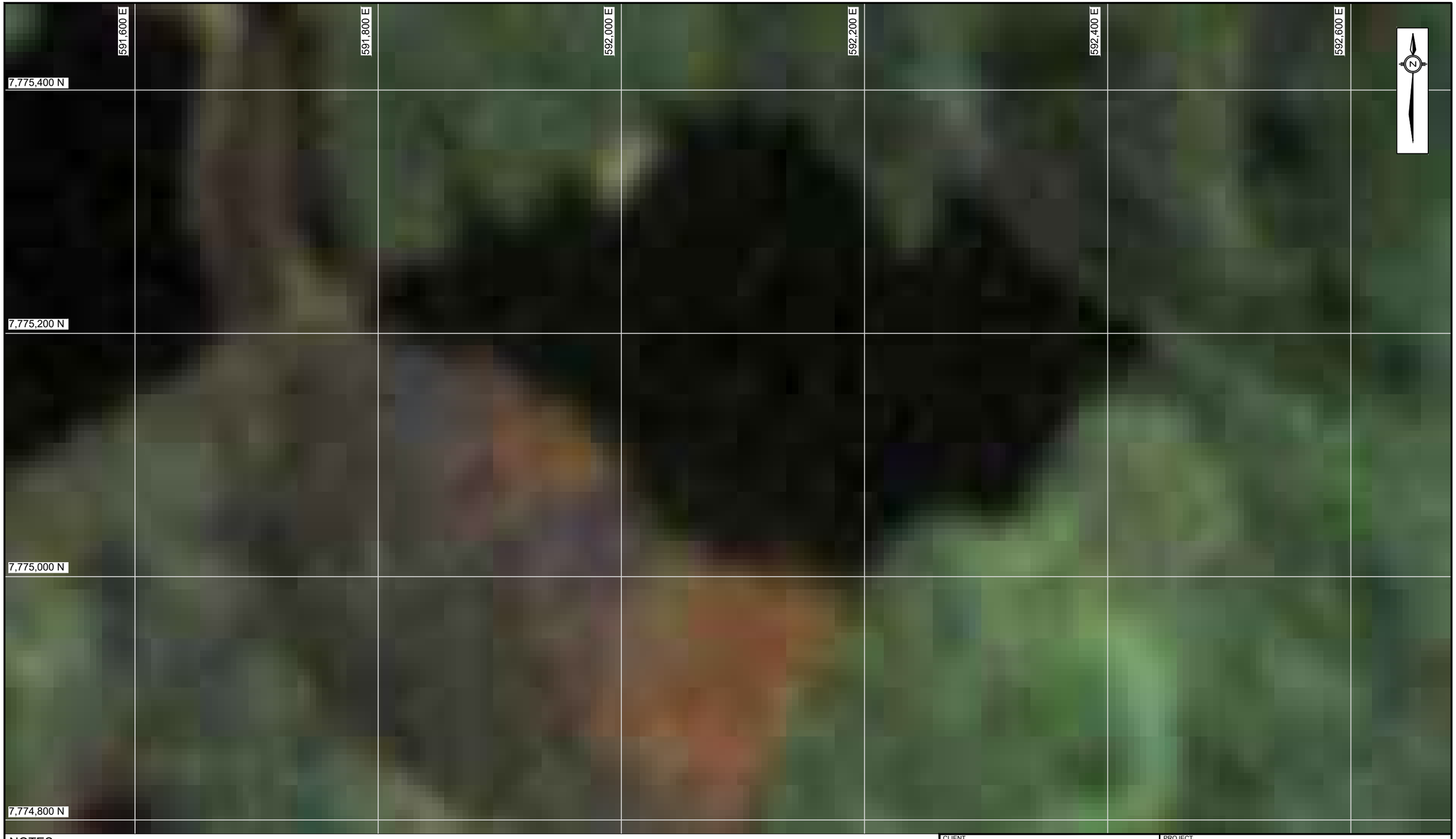
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
JULY 2000

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	6

KGS-FIG-BAL



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

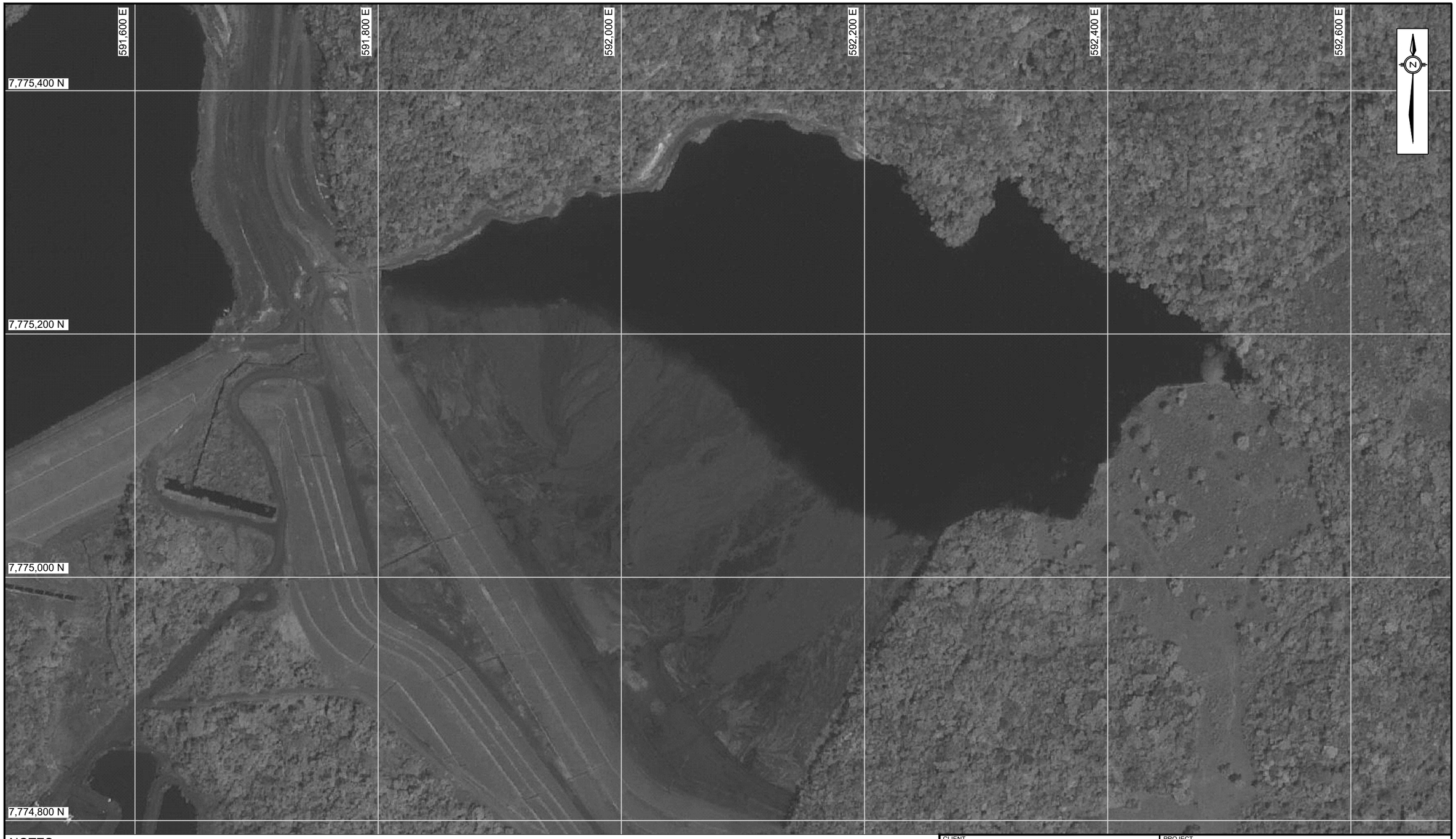
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
MAY 2001

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	7

KGB-FIG-BAL



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

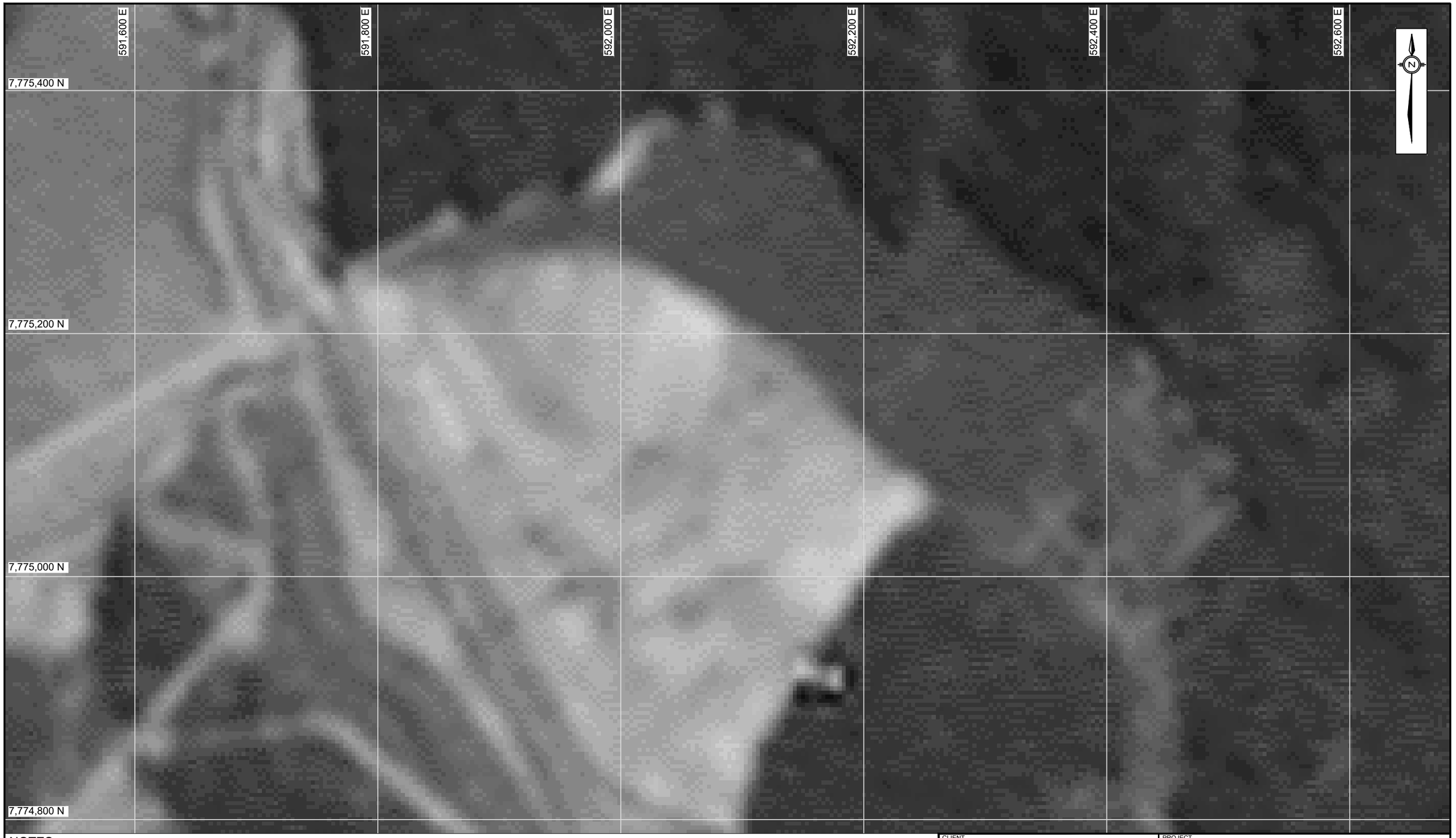
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
OCTOBER 13, 2001

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	8

K28-F-IG-8-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
APRIL 21, 2002

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	9

KCB-FIGBL

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
JANUARY 10, 2003

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	10

KCB-F-IG-8-L

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

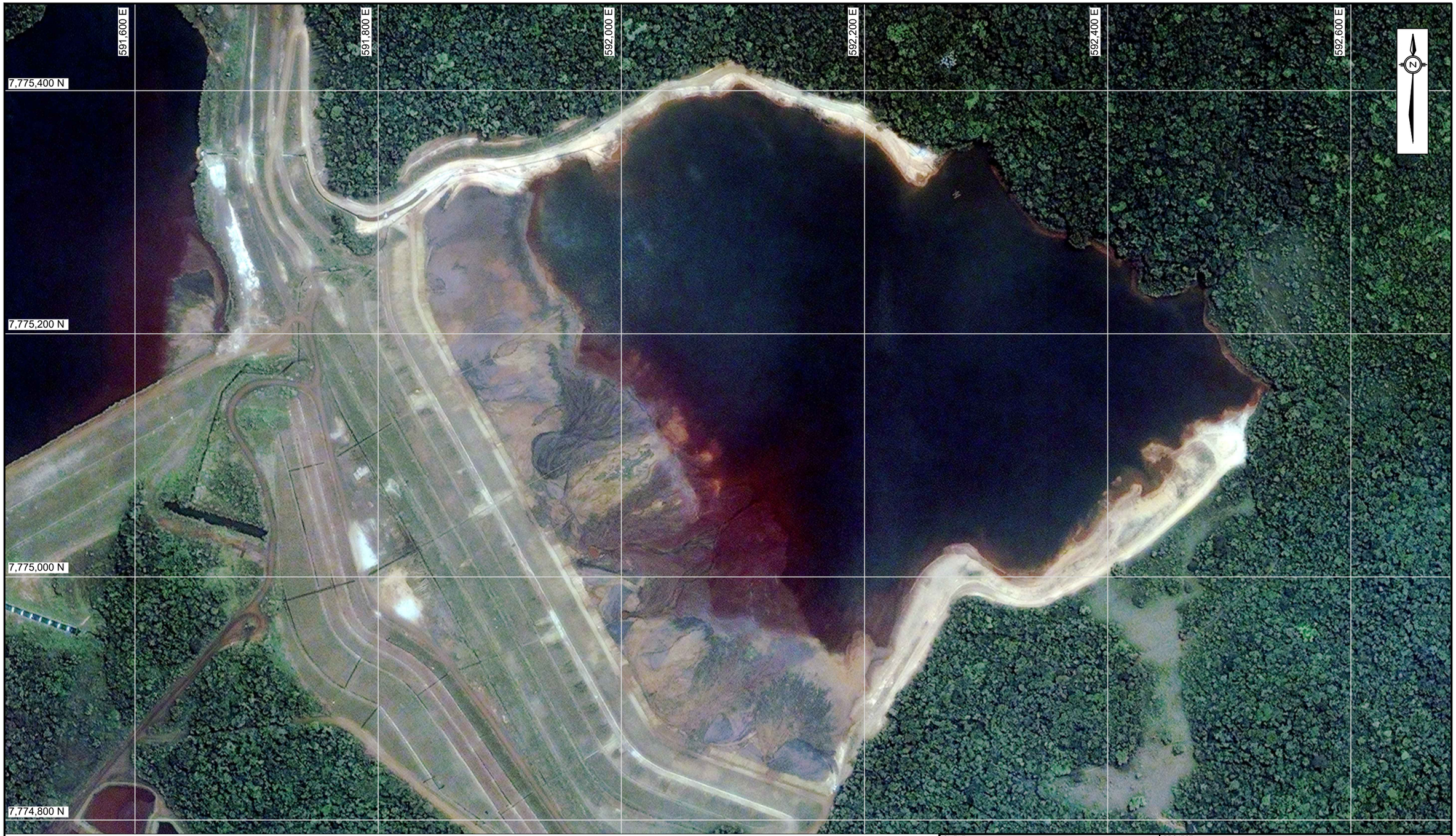
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
MAY 18, 2003

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	11

KCB-FIG-B-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

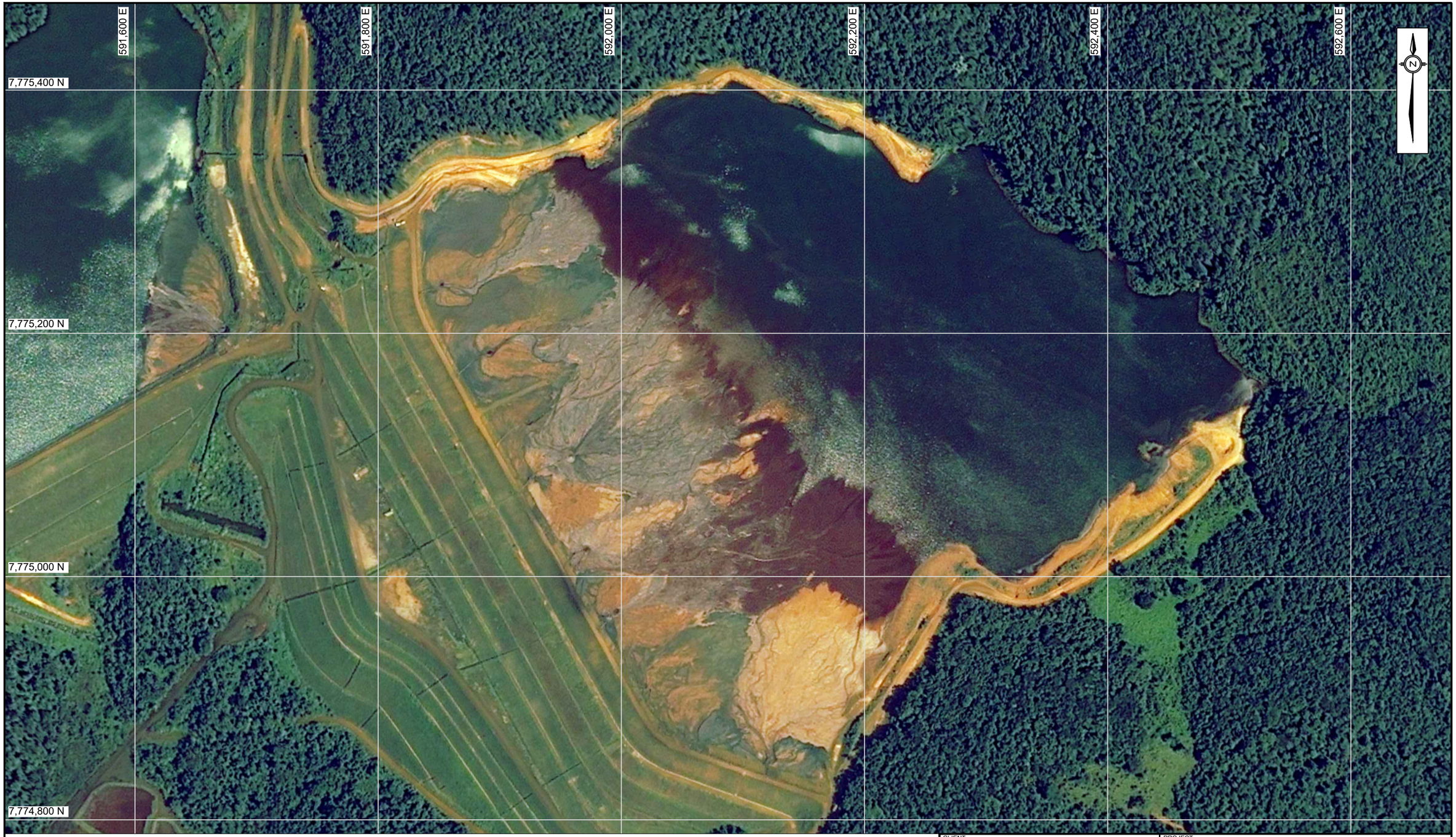
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
OCTOBER 5, 2005

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	12

KGI-FIG-BAL



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
JANUARY 26, 2006

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	13

KGS-FIG-BH-L

591,600 E

591,800 E

592,000 E

592,200 E

592,400 E

592,600 E

N

7,775,400 N

7,775,200 N

7,775,000 N

7,774,800 N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

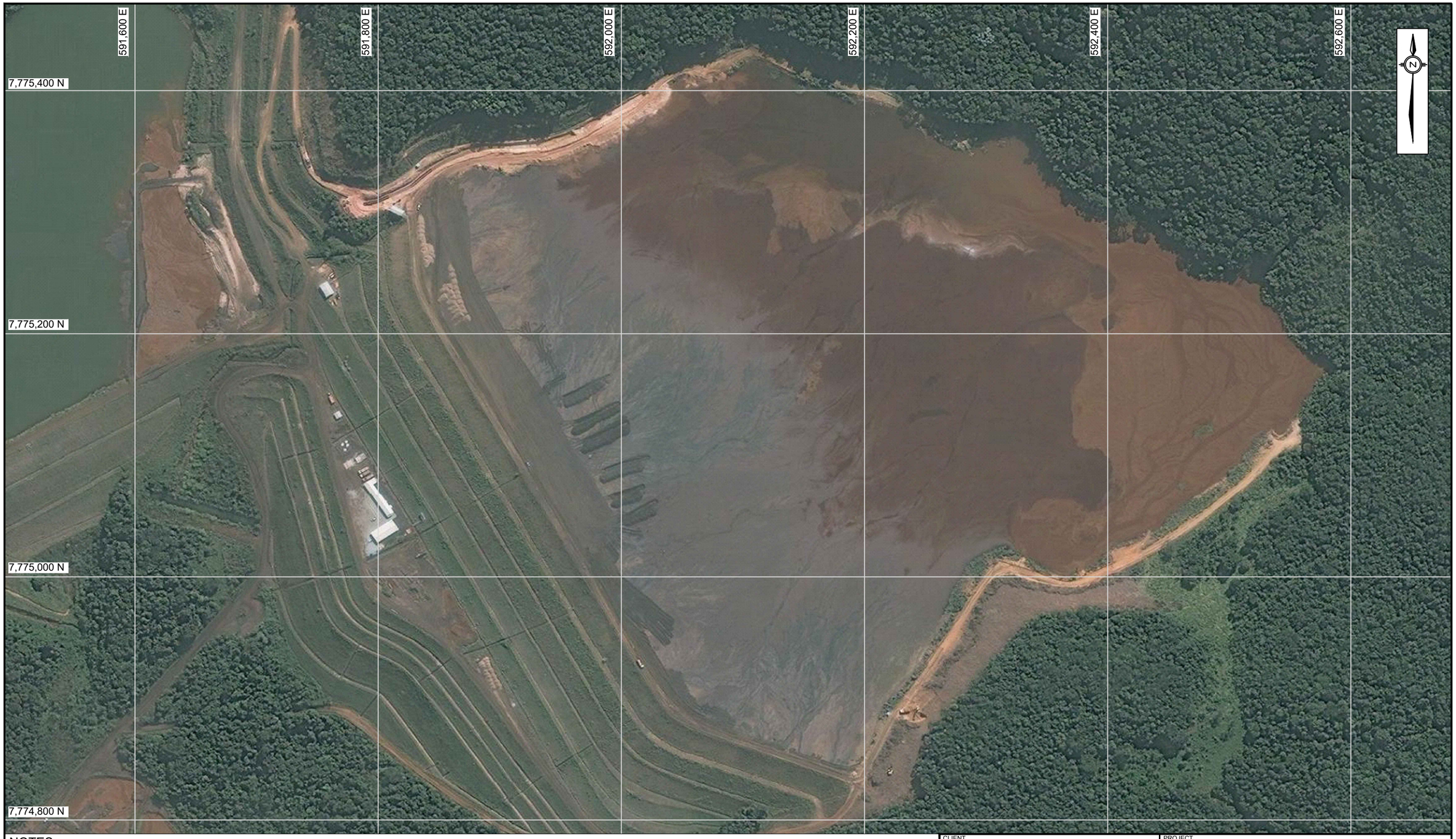
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
FEBRUARY 19, 2006

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	14

K:\03-FIG-B4-



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
MAY 12, 2007

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	15

KCB-FIG-BL

591,600 E
591,800 E
592,000 E
592,200 E
592,400 E
592,600 E
N
7,775,400 N
7,775,200 N
7,775,000 N
7,774,800 N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

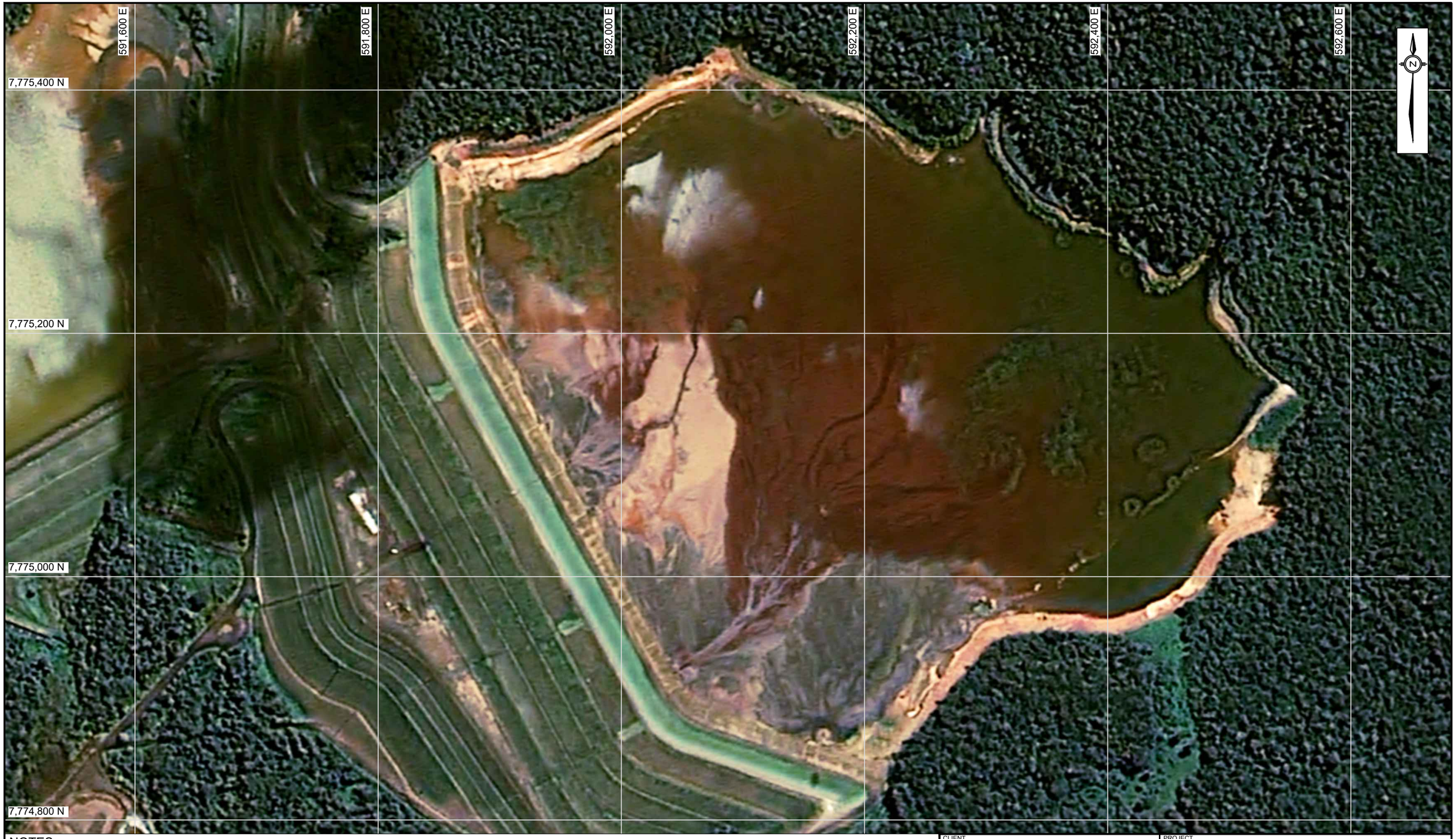
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
NOVEMBER 1, 2007

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	16

KCB-FIG-B4



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

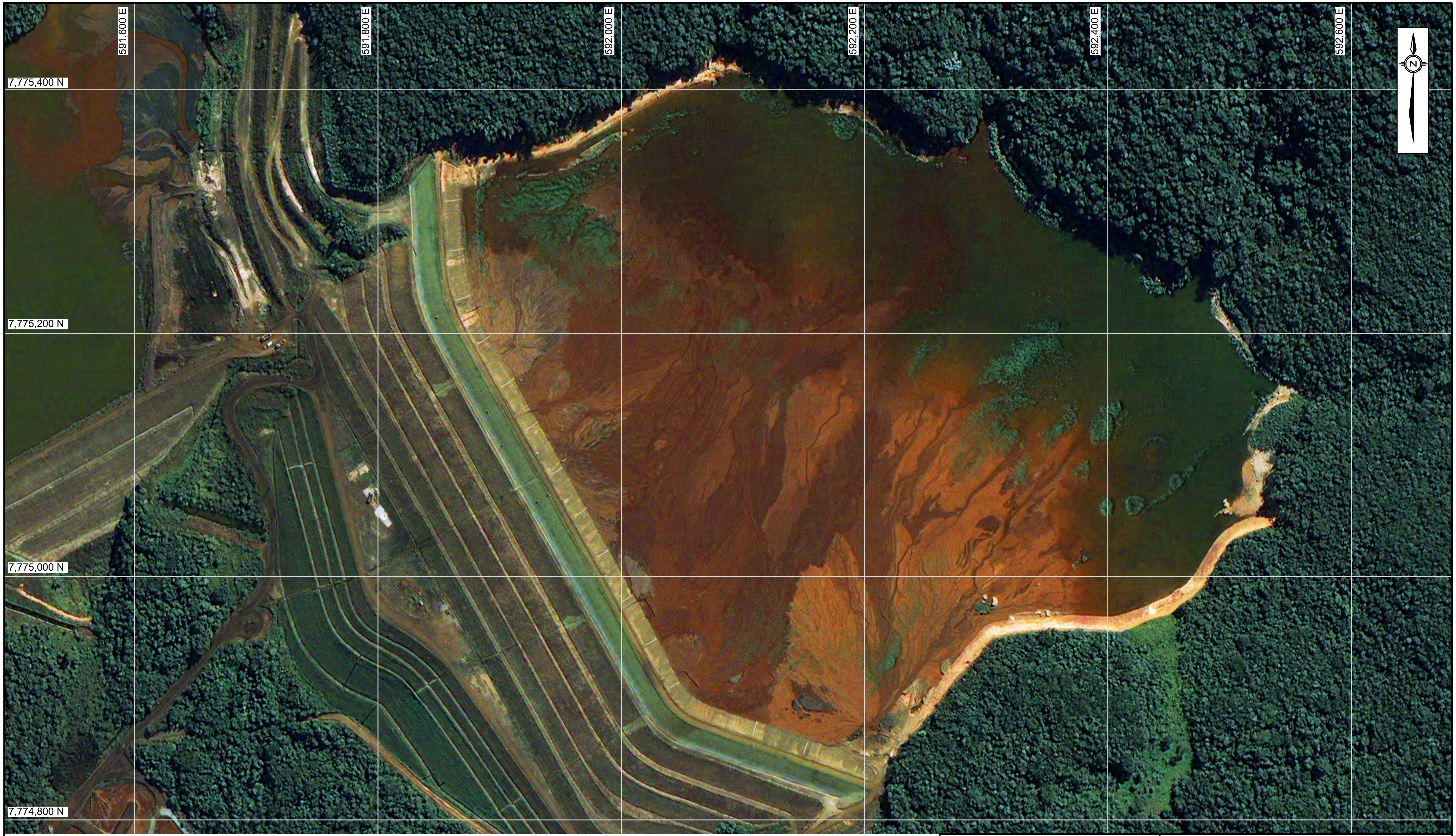
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
MARCH 30, 2008

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	17

K:\3-FIG-B4-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT	PROJECT
	REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1
	TITLE: APPENDIX F SATELLITE IMAGES JUNE 6, 2008

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	18

KCB-FIG-B-L

591,600 E
591,800 E
592,000 E
592,200 E
592,400 E
592,600 E
7,775,400 N
7,775,200 N
7,775,000 N
7,774,800 N

N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

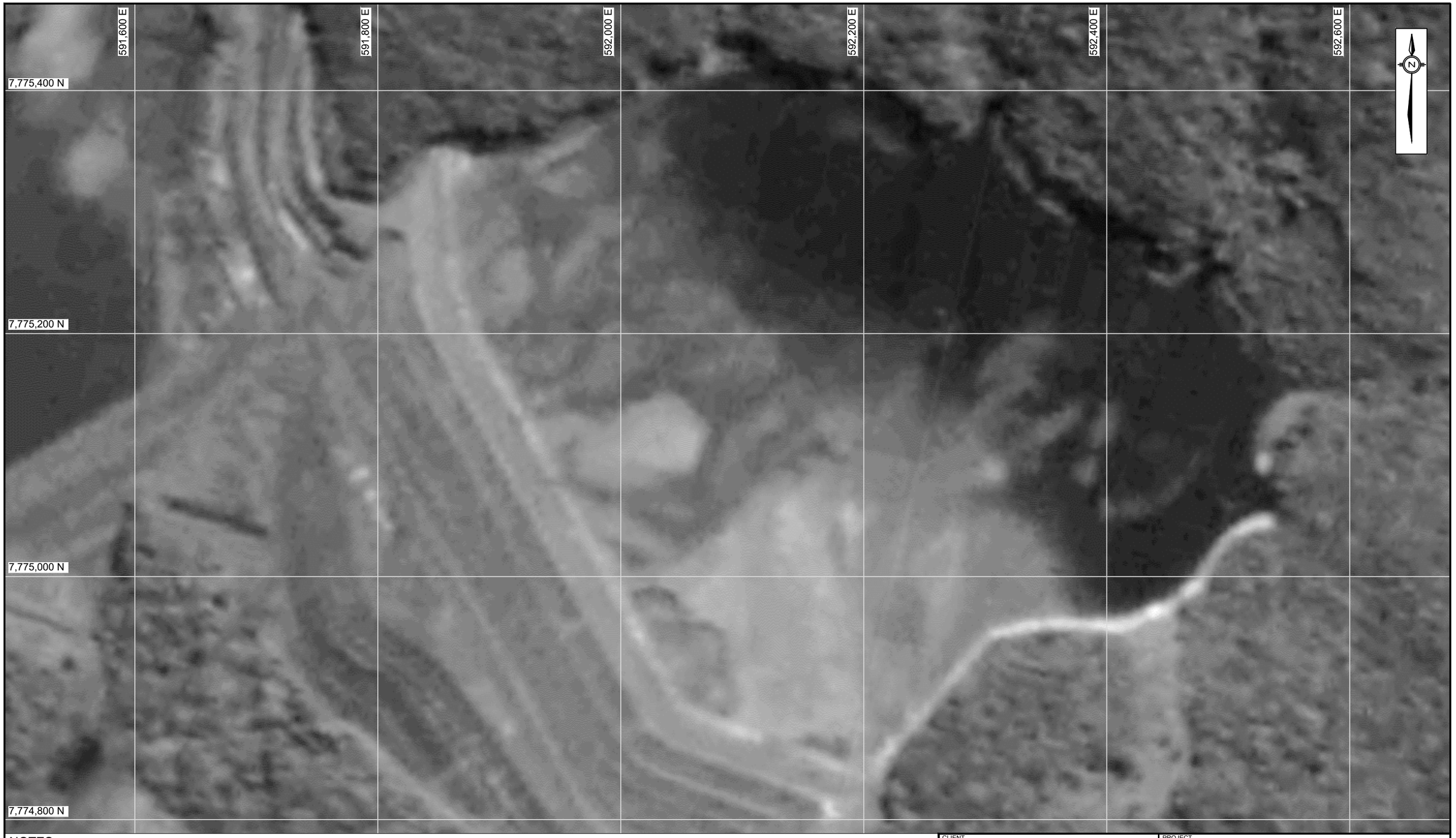
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
JULY 7, 2008

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	19

KCB-F-IG-8-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
APRIL 28, 2009

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	20

K23-FG-84-L

591,600 E

591,800 E

592,000 E

592,200 E

592,400 E

592,600 E

7,775,400 N

7,775,200 N

7,775,000 N

7,774,800 N

N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
JULY 26, 2009

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	21

KCJ-FIG-BAL

591,600 E

591,800 E

592,000 E

592,200 E

592,400 E

592,600 E

7,775,400 N

7,775,200 N

7,775,000 N

7,774,800 N

N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

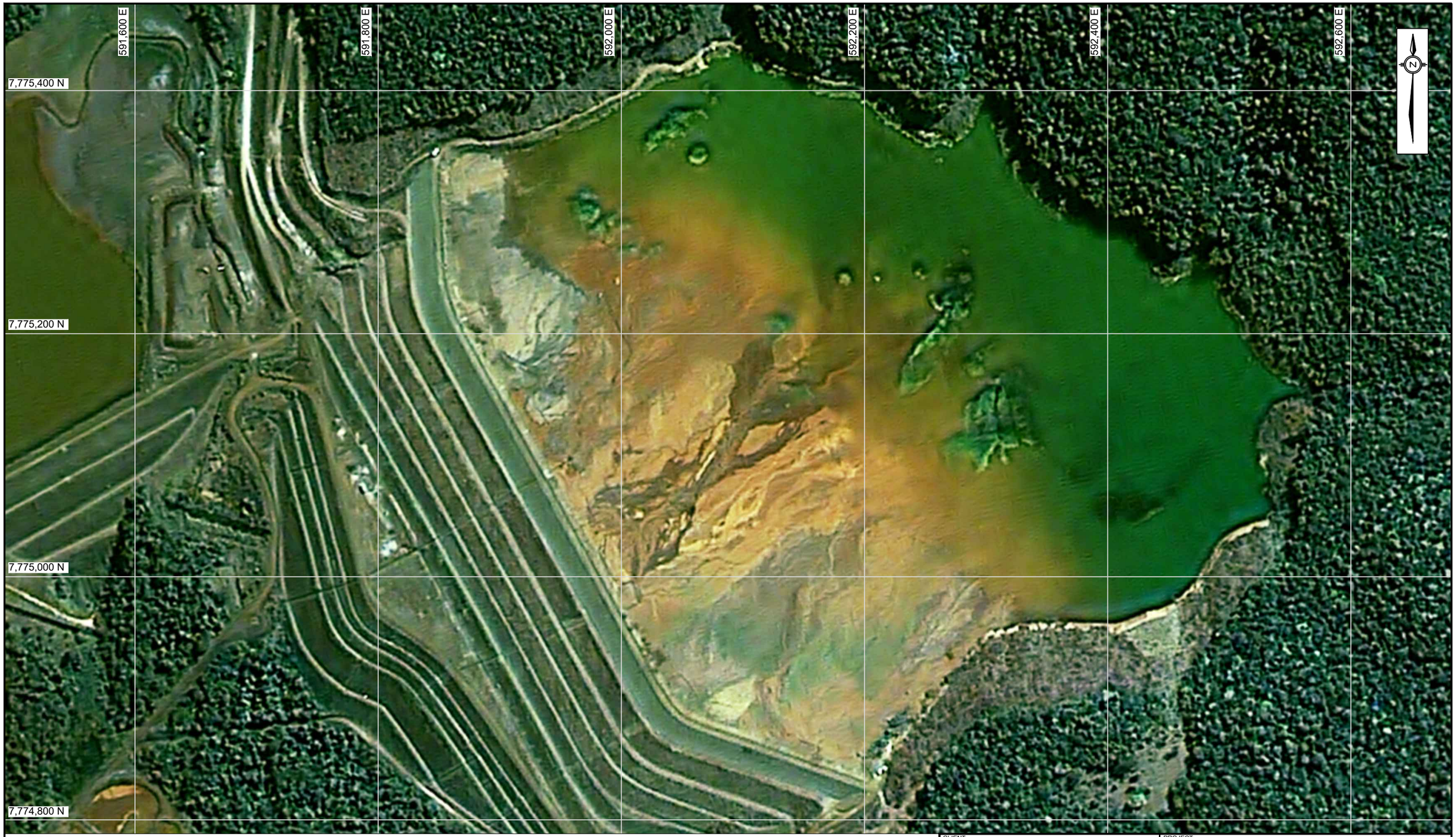
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
JUNE 13, 2010

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	22

KCB-F-IG-8-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
AUGUST 24, 2010

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	23

KCB-FIG-B4L

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

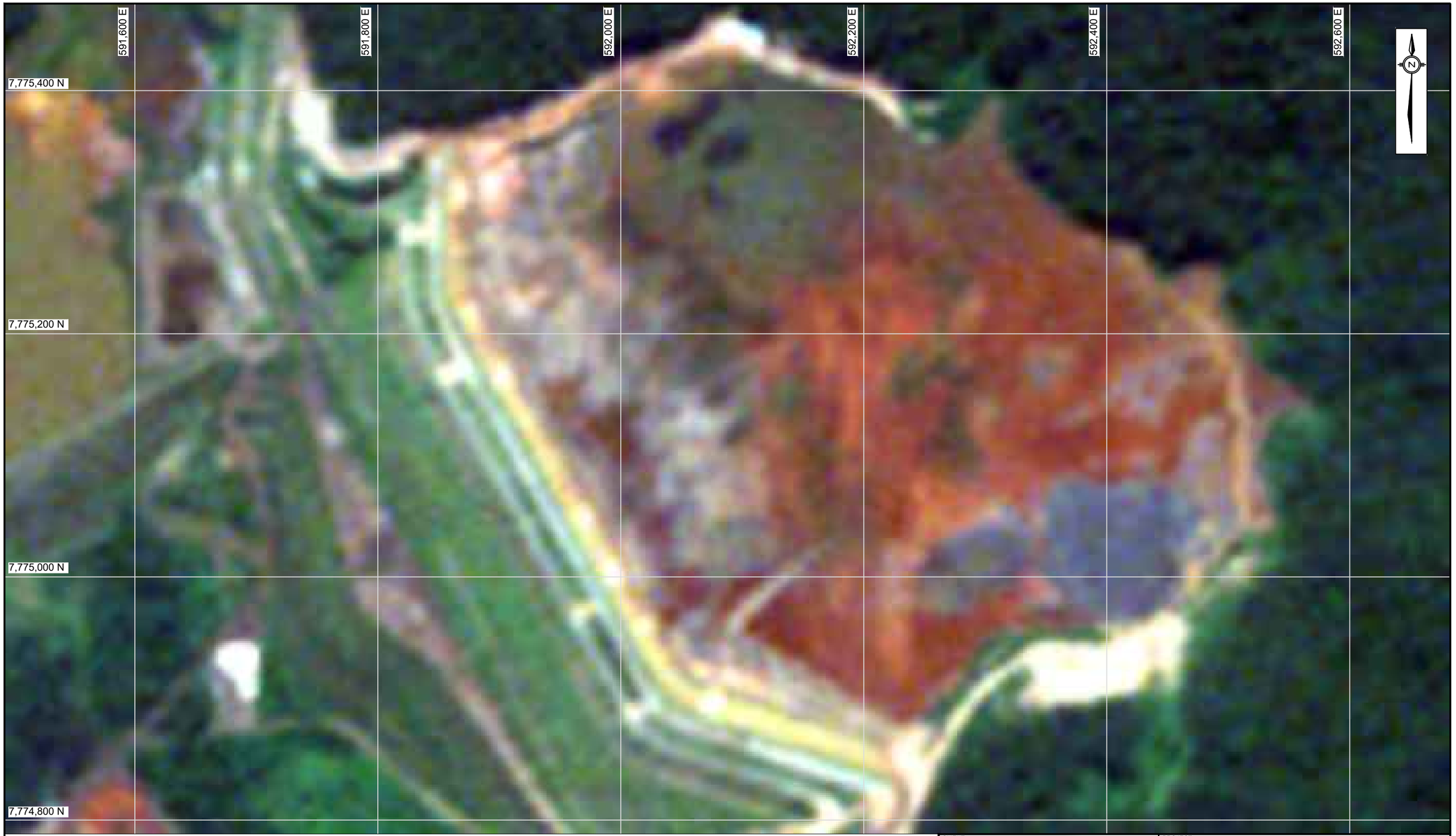
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
APRIL 10, 2012

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	24

KCB-FIG-64-L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

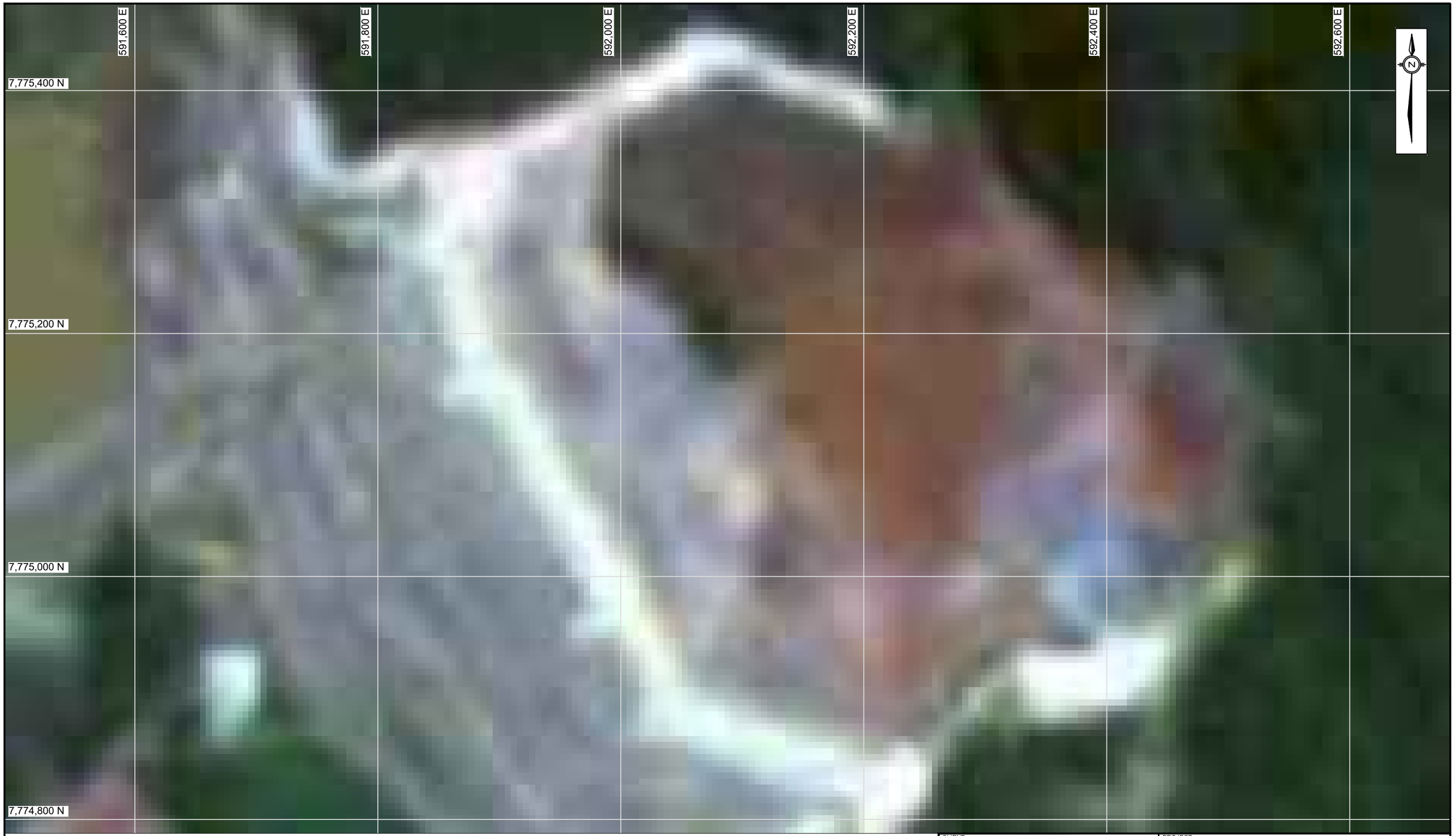
CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
APRIL 27, 2013

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	25

KGI-FIG-B4L



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
SEPTEMBER 26, 2013

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	26

KCB-FIG-B4

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
SEPTEMBER 11, 2016

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	27

KGS-FIG-BAL

591,600 E
591,800 E
592,000 E
592,200 E
592,400 E
592,600 E
7,775,400 N
7,775,200 N
7,775,000 N
7,774,800 N
N

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL COORDINATES AND ELEVATIONS ARE REFERENCED TO UTM SIRGAS2000 ZONE 23S.

1:3,000 0 30 60

BASED ON A 11"X 17" DRAWING SIZE

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
SATELLITE IMAGES
OCTOBER 9, 2016

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	28

K:\03-FIG\B4-L

Appendix F

Annex 3 – Aerial Images

December 2019

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JULY 17, 1999

SCALE	PROJECT No.	FIG. No.
N.T.S	A03355A01	1

KCB-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JANUARY 2002

SCALE	PROJECT No.	FIG. No.
N.T.S	A03355A01	2

KOB-FIG-BAL

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JULY 2003

SCALE	PROJECT No.	FIG. No.
N.T.S	A03355A01	3

KGI-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JULY 2004

SCALE	PROJECT No.	FIG. No.
N.T.S	A03355A01	4

KGS-FIG-B4-L

CLIENT	
PROJECT	REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1
TITLE	APPENDIX F AERIAL IMAGES JULY 2005
SCALE	N.T.S
PROJECT No.	A03355A01
FIG. No.	5

KGS-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
AUGUTS 2006

SCALE	PROJECT No.	FIG. No.
N.T.S	A03355A01	6

KOB-FIG-B4

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PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
MAY 2008

SCALE	PROJECT No.	FIG. No.
N.T.S	A03355A01	7

KCB-FIG-8-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
MAY 2009

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	8

KCB-FIG-R4

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JUNE 2010

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	9

KCB-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JULY 2011

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	10

KGI-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
AUGUST 2012

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	11

KCB-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JUNE 2014

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	12

KGS-FIG-B4-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
AUGUST 2015

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	13

XCB-F13-L

CLIENT

PROJECT
REPORT OF THE EXPERT PANEL ON THE TECHNICAL CAUSES OF THE FAILURE OF FEIJÃO DAM 1

TITLE
APPENDIX F
AERIAL IMAGES
JULY 2018

SCALE	PROJECT No.	FIG. No.
1:3,000	A03355A01	14

KOB-FIG-B4