



WATER AND POWER DEVELOPMENT AUTHORITY
PAKISTAN

ENGINEERING, PROCUREMENT AND CONSTRUCTION (EPC) OF ATTABAD LAKE HYDROPOWER PROJECT (54 MW) PACKAGE-III: ELECTRO-MECHANICAL WORKS

**VOLUME-III: ADDITIONAL INFORMATION
PART-III: TOPOGRAPHIC SURVEY MAP BOOK**

ATPM WATER AND HYDROPOWER
MANAGEMENT CONSULTANTS



MARCH 2026

BOOK 7

DOCUMENT NO: BD-ALHPP-03 (V3-TSMB)

**ENGINEERING, PROCUREMENT AND CONSTRUCTION (EPC) OF
ATTABAD LAKE HYDROPOWER PROJECT (54 MW)
PACKAGE-III: ELECTRO-MECHANICAL WORKS
INDEX TO BIDDING DOCUMENTS**

VOLUME-I: BIDDING PROCEDURES AND CONDITIONS OF CONTRACT

Part-I: Bidding Procedures

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VOLUME-II: EMPLOYER'S REQUIREMENTS

Part-I: Special Provisions

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GEODETIC SURVEY CONTROL REPORT

ATTABAD LAKE HYDROPOWER PROJECT (54MW)

GEODETIC SURVEY CONTROL REPORT

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LIST OF ABBREVIATIONS

AOI	Area of Interest
BM	Benchmark
CAO	Computer Aided Design
CP	Control Point
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DSM	Digital Surface Model
DTM	Digital Terrain Model
DWG	Drawing
EDM	Electromagnetic Distance Measurement
EGM	Earth Gravitational Model
GCP	Ground Control Point
Gao-TIFF	Geographic Tag Image File Format
GIS	Geographic Information System
GOP	Government of Pakistan
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
NFZ	No Fly Zone
NESPAK	National Engineering Services Pakistan Private Limited
PC	Personal Computer
RTK	Real Time Kinematic
SD Card	Secure Digital Card
TBC	Trimble Business Center
TOR	Terms of Reference
UAV	Unmanned Aerial Vehicle
UTM	Universal Transverse Mercator
WGS	World Geodetic System

1 GEODETIC SURVEY CONTROL

A geodetic control lays the foundation for the creation of an accurate topographic survey. The system permits the spatial referencing of all identifiable land features using permanent structures and control points.

1.1 REFERENCE SURVEY BENCHMARK

During the topographic survey, two permanent benchmarks named BM-01 and BM-02 were found that were established during the feasibility study. These benchmarks were found stay able and intact. Figures are shown below.



Figure 1.1: Permanent Benchmarks in Project Area

These benchmarks were used as reference control points for the extension of survey control network and to conduct the aerial topographic survey.

The details of coordinates of benchmarks are listed below.

Table 1.1: List of R Geodetic Survey Control Points (CPs)

REFERENCE SURVEY CONTROL POINTS			
Name	Easting (m)	Northing (m)	Elevation (m)
BM-1	481492.111	4017731.973	2384.005
BM-2	482046.978	4017941.760	2360.841

The location map of the reference benchmarks is given in Figure 1.2.

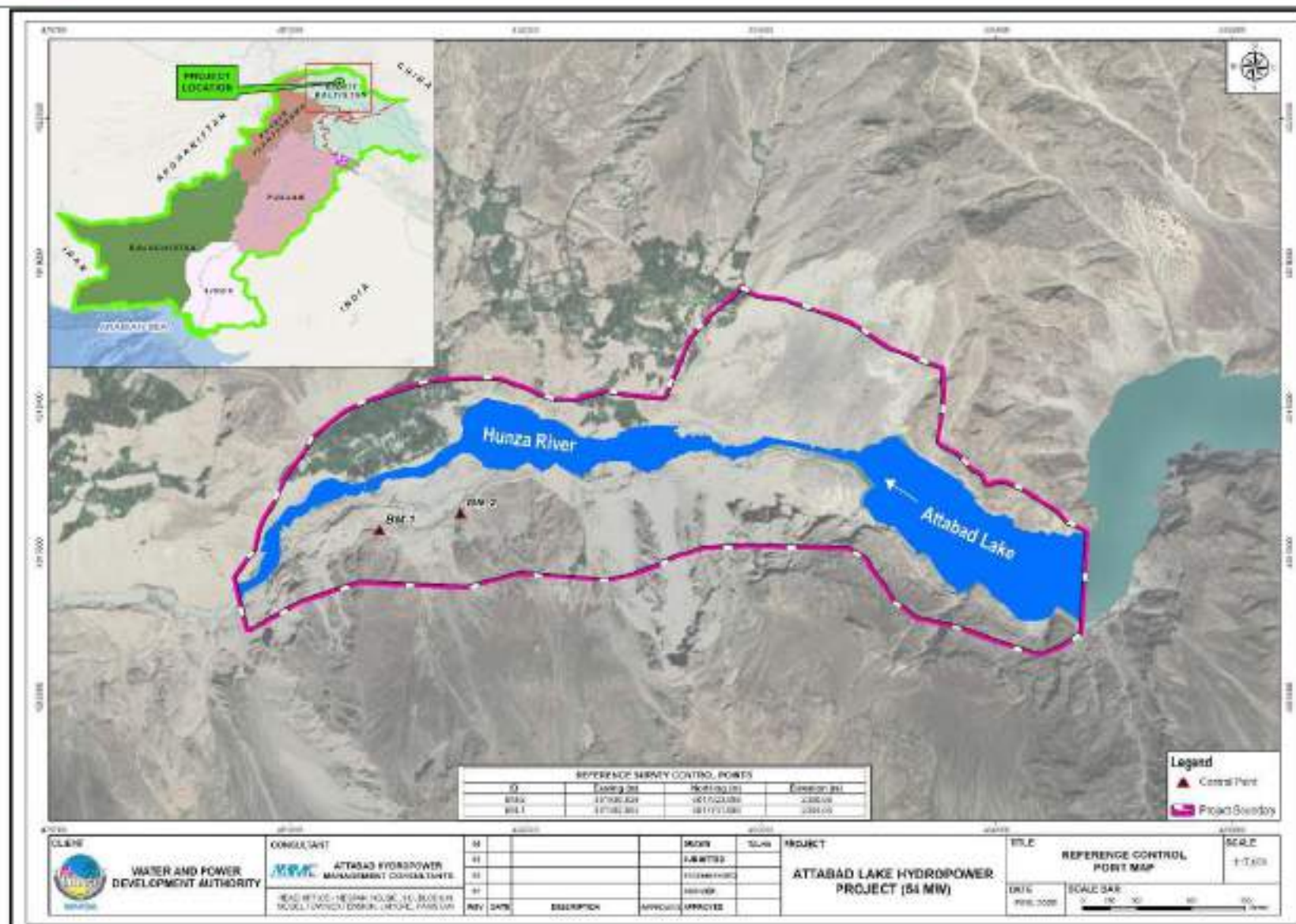


Figure 1.2: Location Map of Reference Survey Control in the Project Area

1.2 ESTABLISHMENT OF CONTROL NETWORK

A wide variety of GPS satellite networks were available and processed to establish reliable baselines in static mode and hence were used to densify the project control network through static survey technique. Unlike terrestrial triangulation, trilateration, and EDM traverse surveying, the shape or geometry of the GPS/GNSS network design is usually not as significant. Care was taken to avoid including trivial baselines in the final network adjustment. No previous benchmark control was found in the project site. Therefore, a new control network was established using Trimble Dual-Frequency DGPS.

Table 1.2: List of Established Geodetic Survey Control Points (CPs)

Serial No.	Control Point Name	Easting	Northing	Elevation
		(Meter)	(Meter)	(Meter)
1	ALD2B	481298.784	4017715.022	2396.44
2	APH-5	483642.674	4018013.34	2490.69
3	ALD-6	484047.319	4017955.711	2478.97
4	ALD-7	485705.464	4017438.092	2457.45

The listed above coordinates are computed in ground coordinates with UTM (Universal Transverse Mercator) projection system in zone 43 N.

The location map of the Control Points (CPs) is given in Figure 1.3.

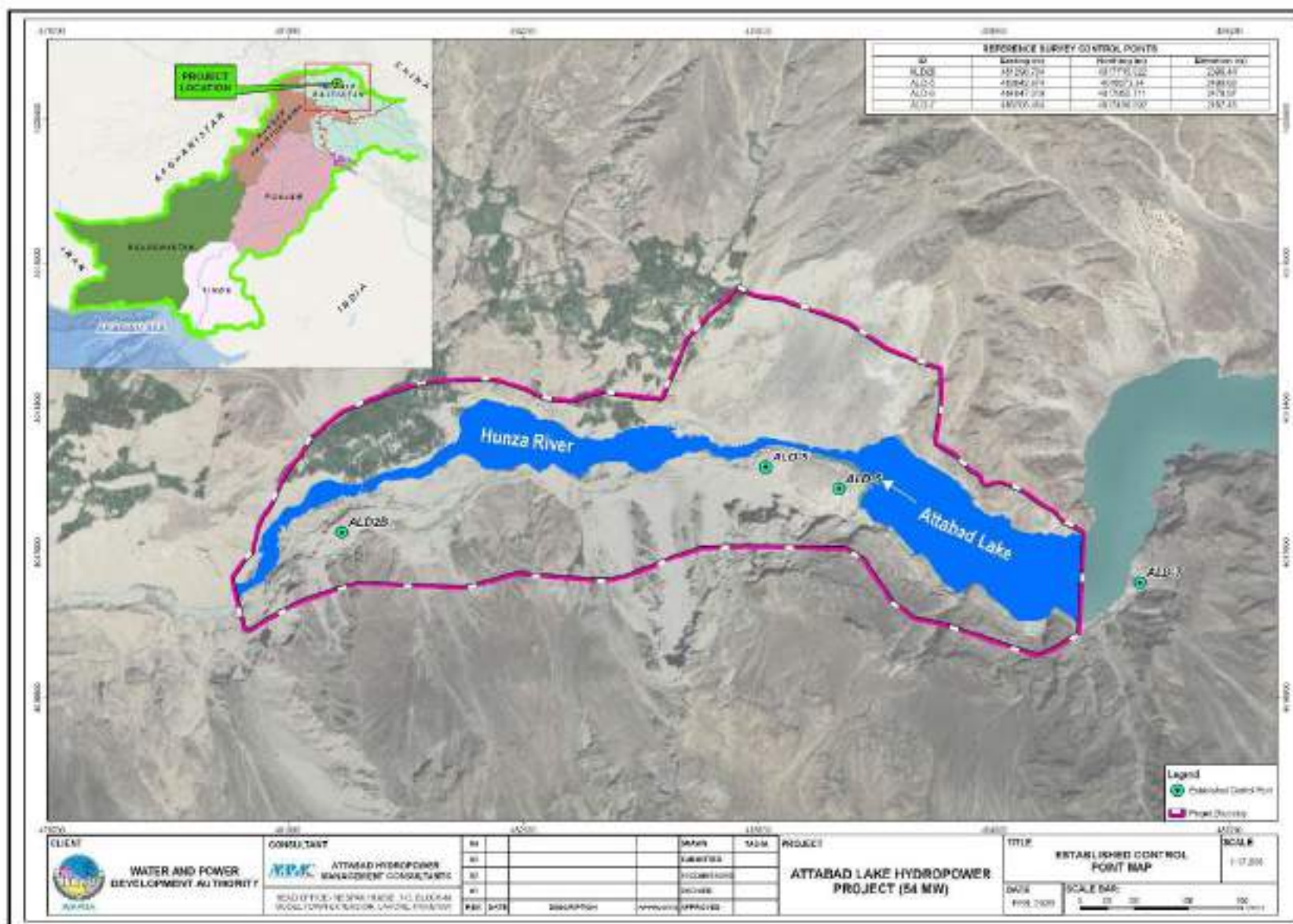


Figure 1.3: Location Map of Established Control Map

The on site views during the establishment of the control network as shown in Figure 1.4:



Figure 1.4: Onsite Views of Control Points (CPs)

1.3 LOCATION OF MONUMENTS AND SURVEY MARKERS

The most effective precaution taken to ensure marker's stability and survival is to choose an appropriate location. Therefore, good judgment has been exercised.

The survey team selected the locations of the monuments based on the following aspects:

- **SECURITY:** The security of a survey monument is the foremost in the list of evaluation considerations. To avoid the susceptibility to damage or destruction by local people, animals, etc., the selected location should be safe and secure.
- **AVOIDANCE OF FLOODPLAIN:** Markers located in floodplains may be buried in sediment or washed out due to erosion. To avoid such damages, the floodplains were avoided during site selection for monuments.
- **ACCESSIBILITY:** Accessibility of the markers is a vital criterion in the selection of the location for survey markers. These yields are time-saving for observation and workability.
- **STABILITY:** The markers are subject to the effects of geologic and soil activity. The consistency of the soil, soil type, vegetation, and its roots, surface geology, and corrosion were considered for the selection of the location of the control monuments.
- **SATELLITE VISIBILITY:** Since all the markers are being observed and established using the GNSS system, hence the satellite visibility was also considered for the selection of the location of the marker. Sites that provide maximum visibility above the horizon, plus 15 degrees were selected.
- **INTER-VISIBILITY:** The locations were precisely refined in such a way that all the markers should be inter-visible to adjacent markers. This ensured the usability of terrestrial survey equipment such as the Total Station for survey works during construction.

1.4 DESIGNATING SURVEY CONTROL MONUMENTS

It is a standard practice to assign understandable names to the control monuments for identification. In this case, Control Points were named "CP" while Ground Control Points were shown with the "GCP" acronym.

1.5 DATUM AND COORDINATE SYSTEM

The survey was conducted in the WGS-84 datum, UTM (Universal Transverse Mercator) zone 43 N (Northern Hemisphere) using geodetic parameters as listed below:

All of the quoted coordinates in this report are referred to the following parameters:

- Spheroid: WGS-84
- Semi-major axis (a): 6378137 m
- Semi-minor axis (b): 6356752.314 m
- Inverse Flattening (f): 298.25722

The project area lies in the UTM 43 Northern Zone. The parameters for Universal Transverse Mercator (UTM) Zone 43 N are as under:

- Latitude of Origin: 0.000000° equator
- Central meridian: 63.000000° E
- False easting: 500000.000000 m
- False northing: 0.000000 m
- Scale factor: 0.999600
- Linear Unit: Meter (m)

1.6 TOOLS AND SOFTWARE

A Trimble® R9 GNSS system and Trimble R2 GNSS system were used for the establishment of horizontal and vertical control networks within the periphery of the project boundary.

The data collected by GNSS was processed by using the licensed software Trimble® Business Centre (TBC) v5.4. It comes with the dedicated Geoid Model for Pakistan based on EGM (Earth Gravitational Model) 2008 Geoid Model. This model was used to derive orthometric heights (elevations) of the control network during the processing of GNSS data.

1.7 PRECISION AND ACCURACY STANDARDS

The Geodetic Survey Control Network was established by following the International standards and protocols. Special care was taken in setup of equipment in field like measuring the antenna height and centering. The specifications of GNSS equipment are shown below:

Positioning	Mode	Horizontal Accuracy (RMS)	Vertical Accuracy (RMS)
RTK (OTF)	Synchronized	1 cm + 1 ppm (× baseline length)	2 cm + 1 ppm (× baseline length)
	Low Latency	2 cm + 2 ppm (× baseline length) ²	3 cm + 2 ppm (× baseline length) ²
L1 C/A Code Phase	Synchronized/ Low Latency	25 m + 1 ppm RMS	50 m + 1 ppm RMS
Static/ FastStatic	N/A	5 mm + 0.5 ppm (× baseline length)	5 mm + 1 ppm (× baseline length)
WAAS	N/A	Less than 5 m ³	Less than 5 m ³

Special protocols were adopted in post-processing and the accuracy was achieved according to the standards.

2 PREPARATION OF TOPOGRAPHIC SURVEY PLAN

As stated, all the data was processed with reference to the geodetic control network. The topographic survey data and aerial mapping were executed in the metric system.

The final Ortho-rectified very high-resolution image of 4 cm pixel size, was used for visual interpretation. Spatial features were digitized on the ortho-rectified image that included:

- Road
- Tracks
- Orchard
- Lake
- River
- Built-up
- Structures
- Road Debris
- Transmission Pole
- Trees
- Transmission Line
- Agriculture Boundary
- Drain

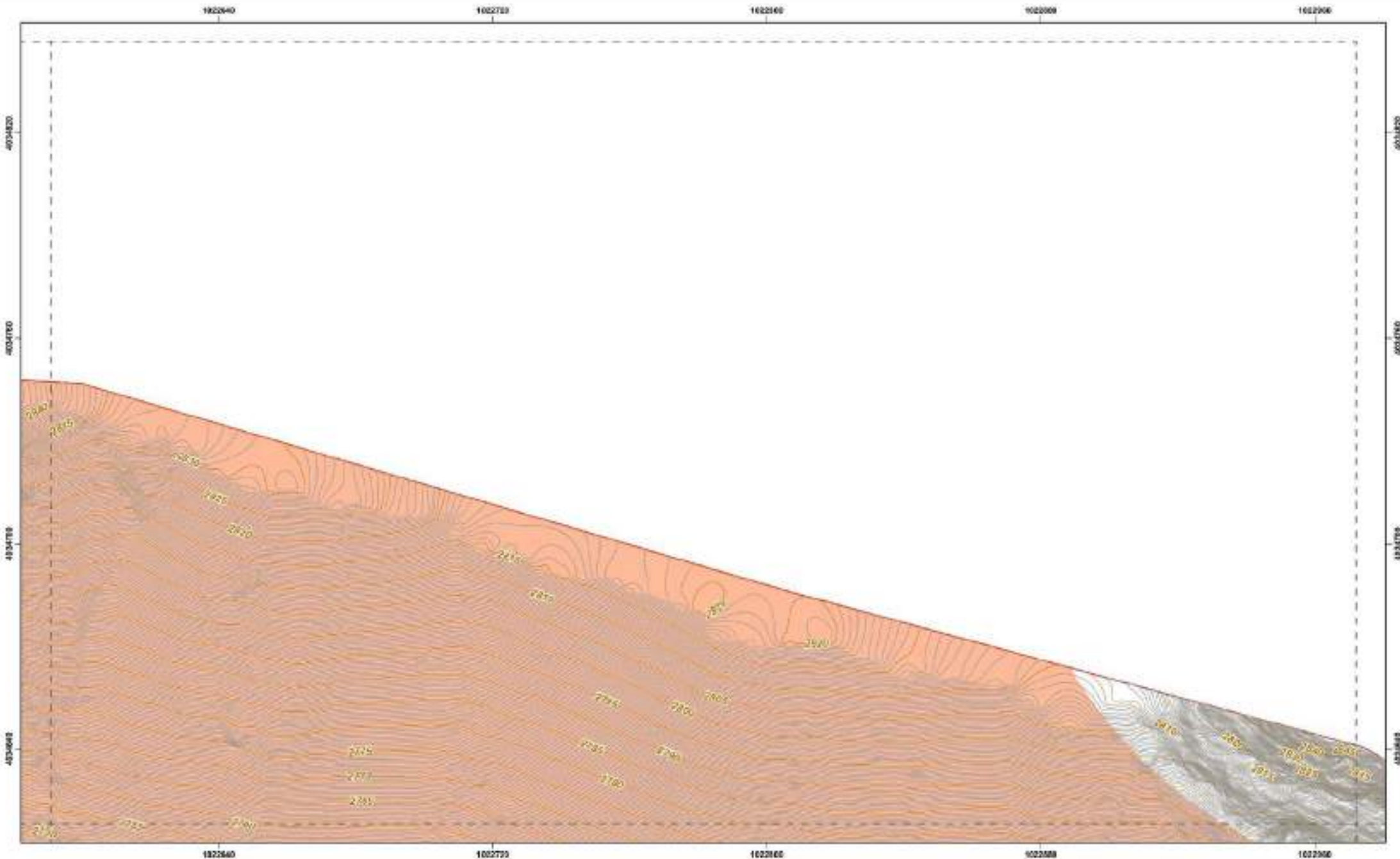
These vector features were incorporated into the map to develop topographic survey drawing.

The contours were extracted from Digital Terrain Model (DTM) at 0.5m interval.

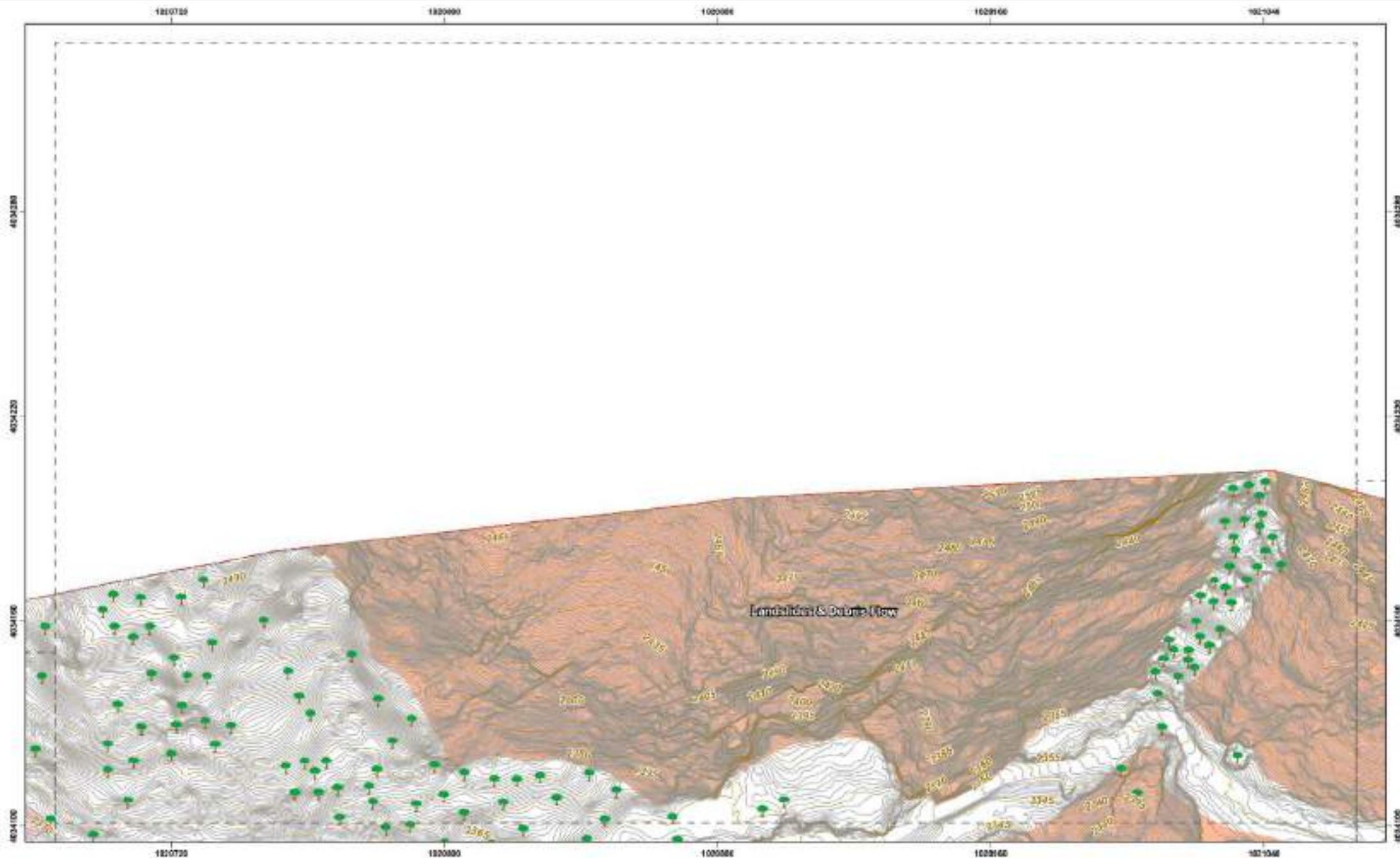
Furthermore, GIS based map book was generated at a 1:1000 scale for the Topographic Survey Plan in the metric System having fifty-six (56) sheets of A3 page size (**Annexure -A**).



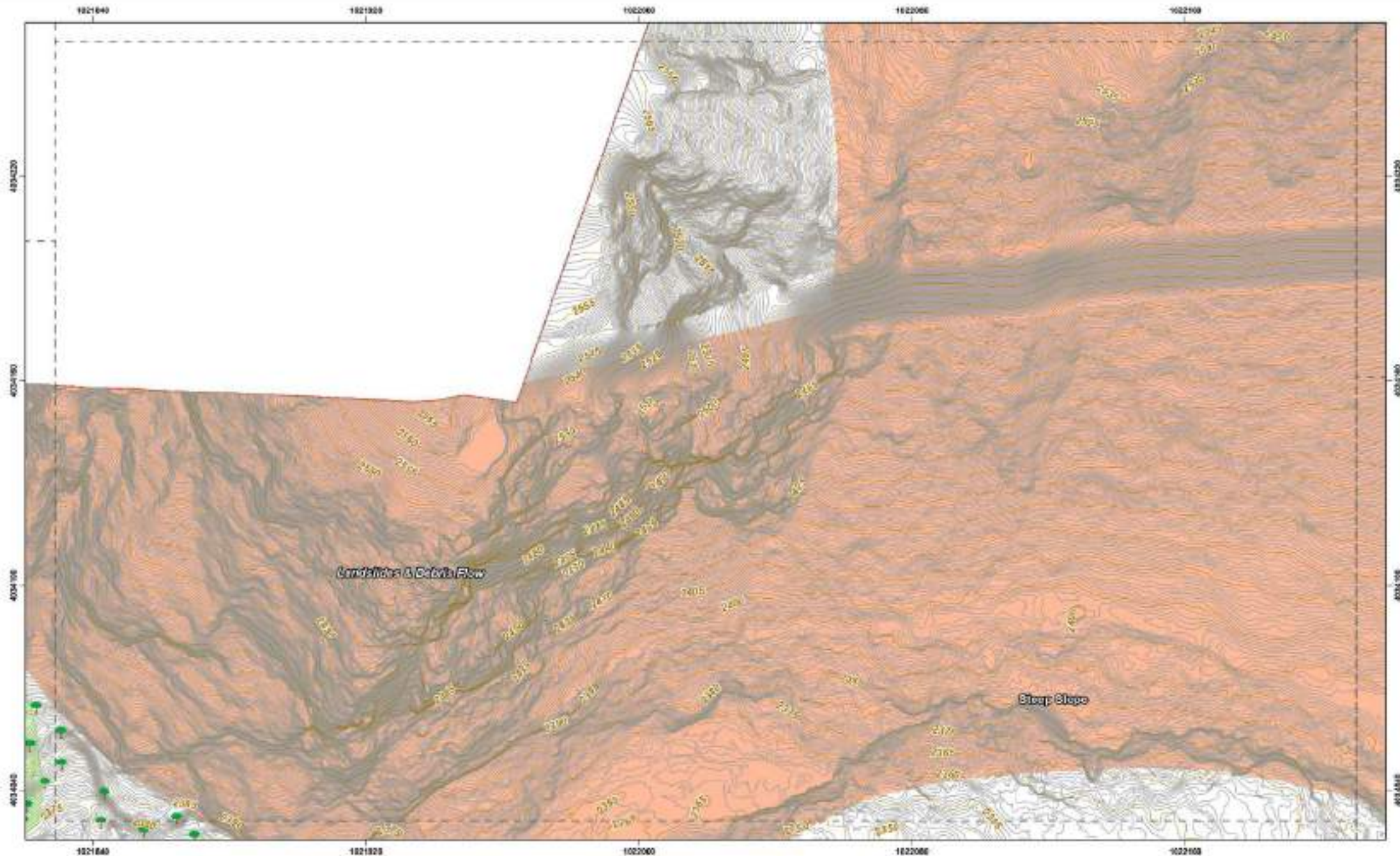
ANNEXURE-A TOPOGRAPHIC SURVEY PLAN MAP BOOK



CLIENT  WATER AND POWER DEVELOPMENT AUTHORITY	CONSULTANT  ATTABAD HYDROPOWER MANAGEMENT CONSULTANTS HEAD OFFICE: HESRAKH ROAD, T-2, BLOCK-B, MODEL TOWN EXTENSION, LAHORE, PAKISTAN	LEGEND  Control Point  Spot  Topographic Point  Survey  DL Line  Topographic Line  Interference Control  Water Control  Dam  Dam Lake  Highland Point  Hydro  Spot  Landmark Point  Thermal Plant  Dam  Dam  Dam  Dam  Dam  Dam INDEX MAP  DISCLAIMER 1. This Map has been prepared by National Engineering Services Pakistan PVT. LTD. exclusively for the purpose of the project and is not to be used for any other purpose. 2. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD. 3. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD. 4. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD. 5. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD. PROJECT ATTABAD LAKE HYDROPOWER PROJECT (54 MW) TITLE TOPOGRAPHIC SURVEY PLAN ATTABAD LAKE DAM SCALE 1:1000 DATE FEB 2025 SHEET NO. Page 2 of 73 SCALE BAR 
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CLIENT  WATER AND POWER DEVELOPMENT AUTHORITY	CONSULTANT  ATTABAD HYDROPOWER MANAGEMENT CONSULTANTS HEAD OFFICE: HESRAK HOUSE, 1-C, BLOCK-B MODEL TOWN EXTENSION, LAHORE, PAKISTAN	LEGEND Control Point Spot Topographic Profile D/L Line Topographic Line Intersection Center Water Course River Agricultural Field Road Landslide Zone Dam Dam Dam Dam Dam	INDEX MAP 	DISCLAIMER 1. This Map has been prepared by National Engineering Services Pakistan PVT. LTD. exclusively for the purpose of the project and is not to be used for any other purpose. 2. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD. 3. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD. 4. The map is not to be used for any other purpose without the written consent of the National Engineering Services Pakistan PVT. LTD.	PROJECT ATTABAD LAKE HYDROPOWER PROJECT (54 MW)	TITLE TOPOGRAPHIC SURVEY PLAN ATTABAD LAKE DAM	SCALE 1:1000
					DATE FEB 2025	SHEET NO. Page 6 of 73	SCALE BAR 



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MODEL TOWN EXTENSION, LAHORE, PAKISTAN

LEGEND

- | | | |
|----------------------|----------------|---------------|
| Control Point | Water Control | Proposed Road |
| Spot | Stream | Intersect |
| Topographic Point | Highland Point | Over |
| Stream | Hydro | Canal |
| DL Line | Hydro | Bridge |
| Topographic Line | Hydro | Shed |
| Intersecting Control | Landslide Zone | DL Line |

INDEX MAP



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PROJECT

ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

SCALE

1:1000

DATE

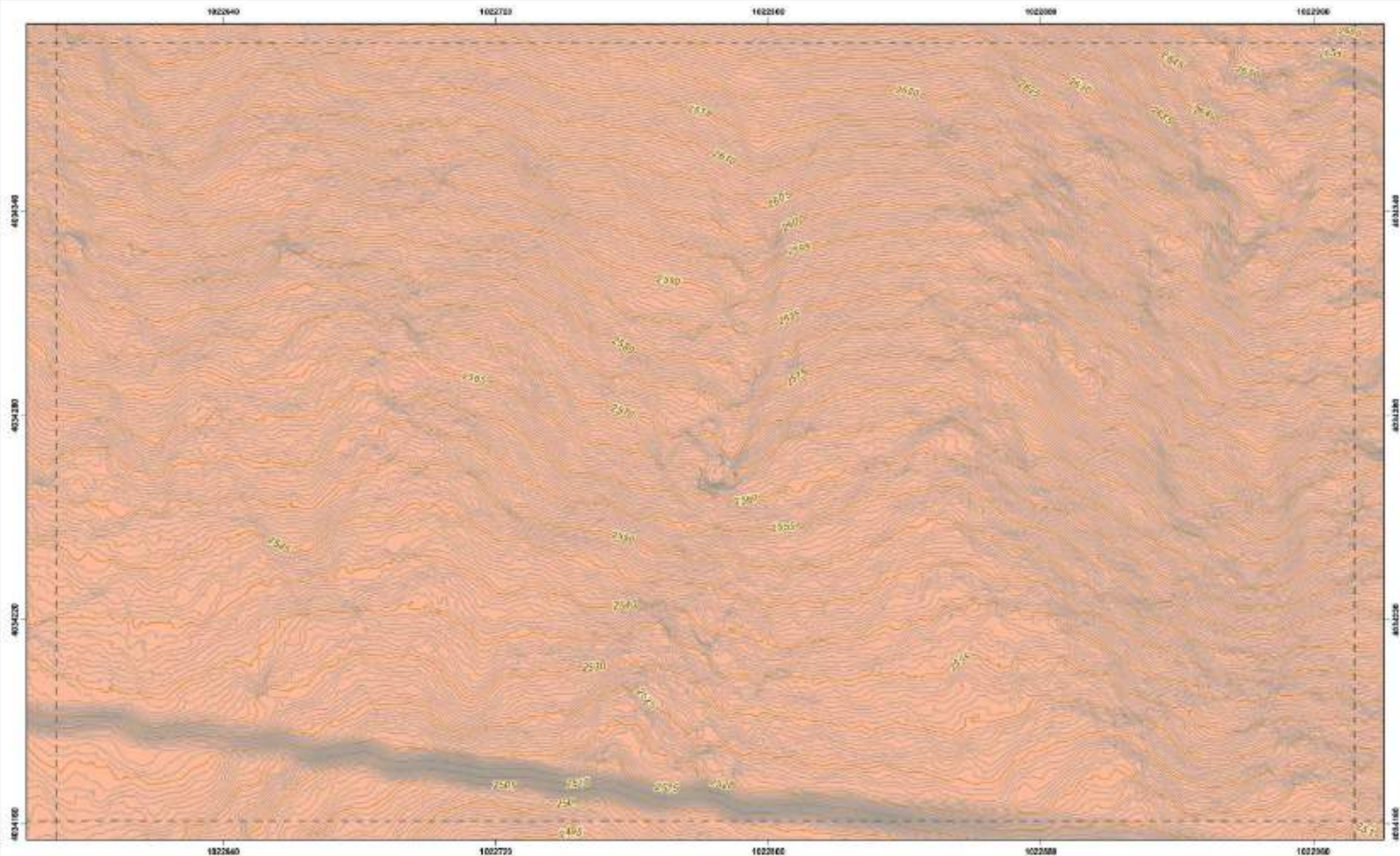
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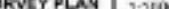
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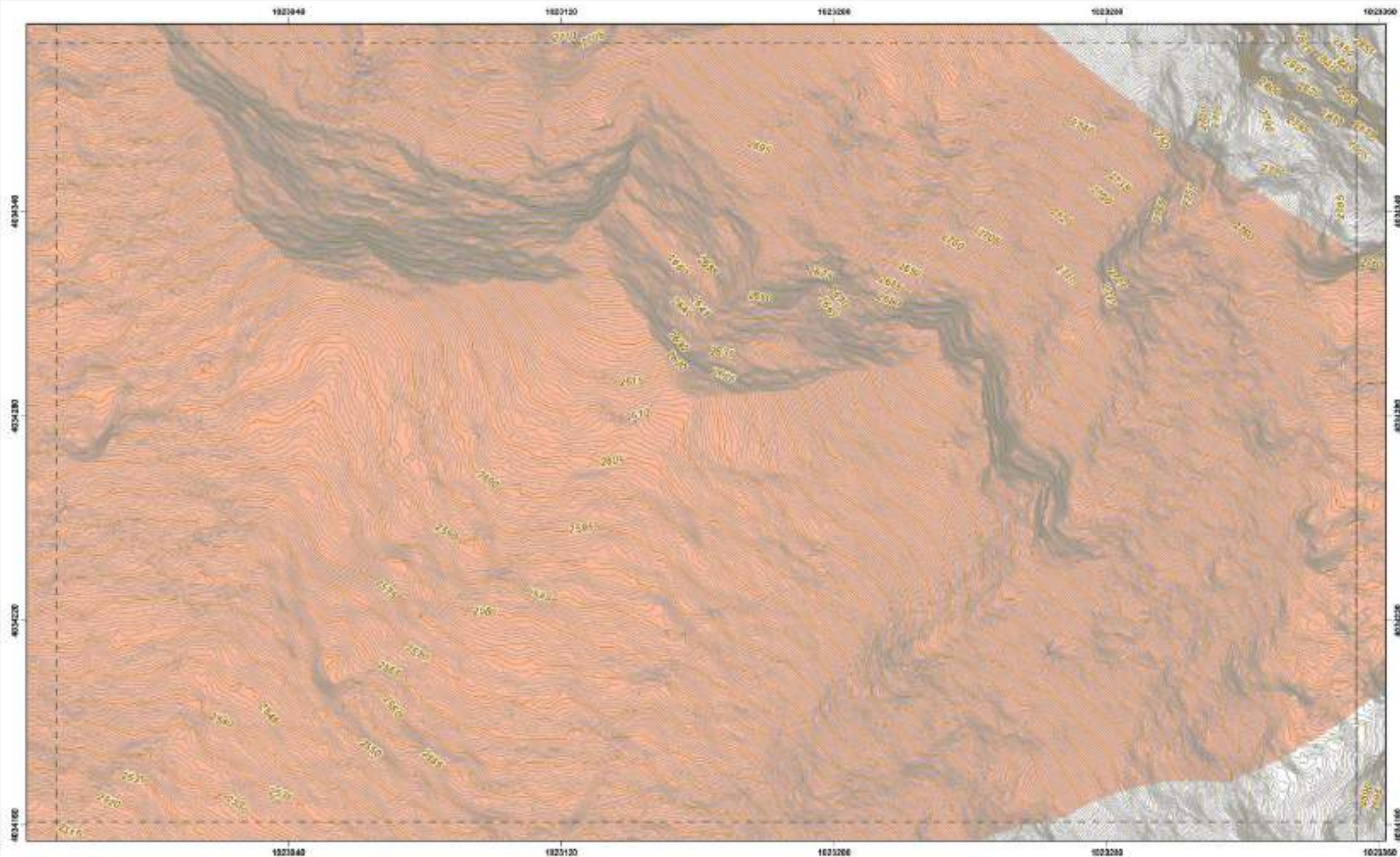
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SQUARE, LONDON, W.C.1

LEGEND

- [illegible]

INDEX MAP



DISCLAIMER

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PROJECT	
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ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

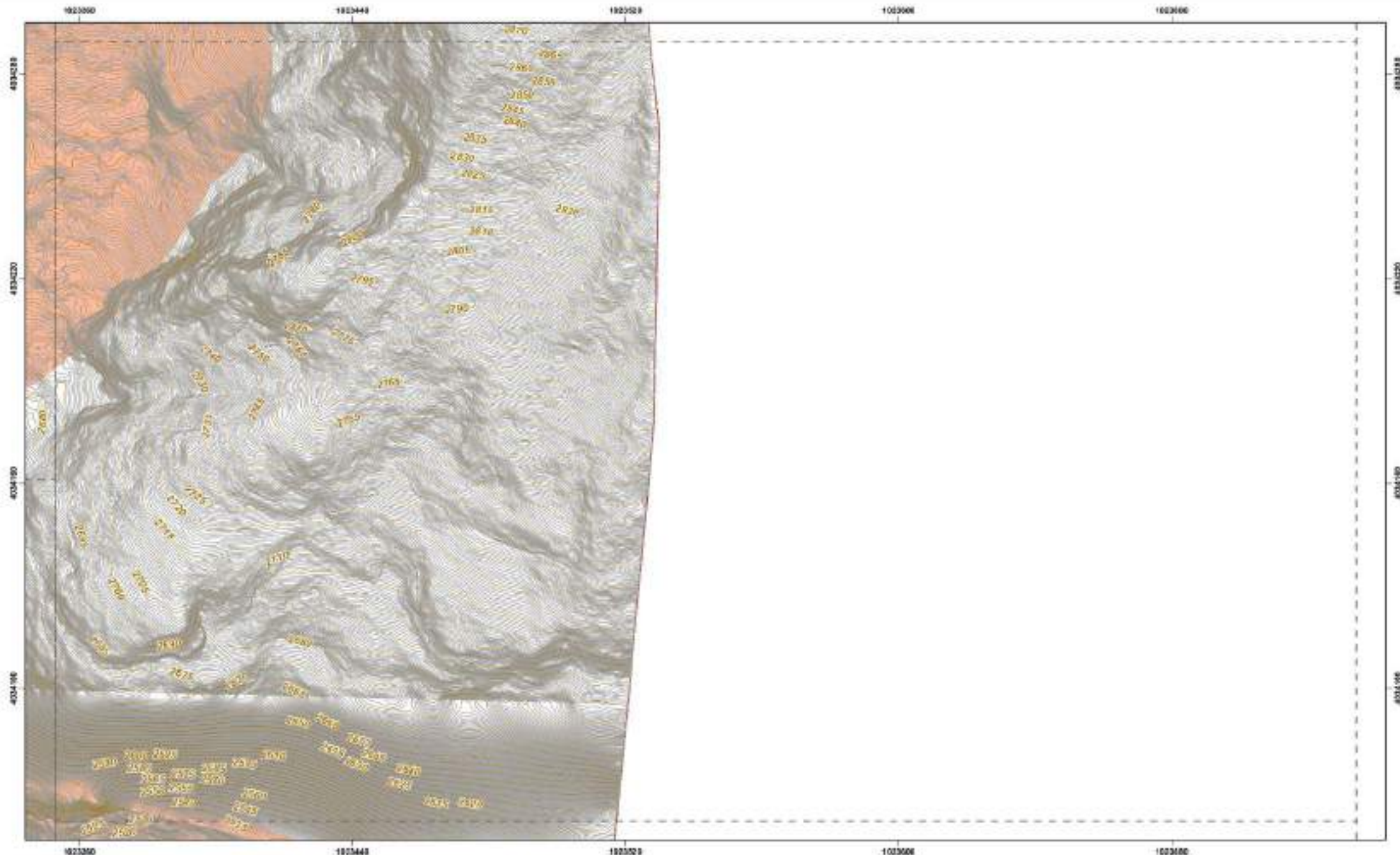
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SCALE BAR

SCALE

1:1000



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HEAD OFFICE: HESRAK HOUSE, 1-C, BLOCK-B
MODEL TOWN EXTENSION, LAHORE, PAKISTAN

LEGEND

- Control Point
- Spot
- Topographic Point
- Survey
- DL Line
- Topographic Line
- Interim Control
- Water Control
- Flow
- Highland point
- Hydro
- Flow
- Flow Line
- Landmark Point
- Thermal and
- Interim
- Open
- Control
- Bridge
- Flow
- DL Line

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PROJECT

ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

SCALE

1:1000

DATE

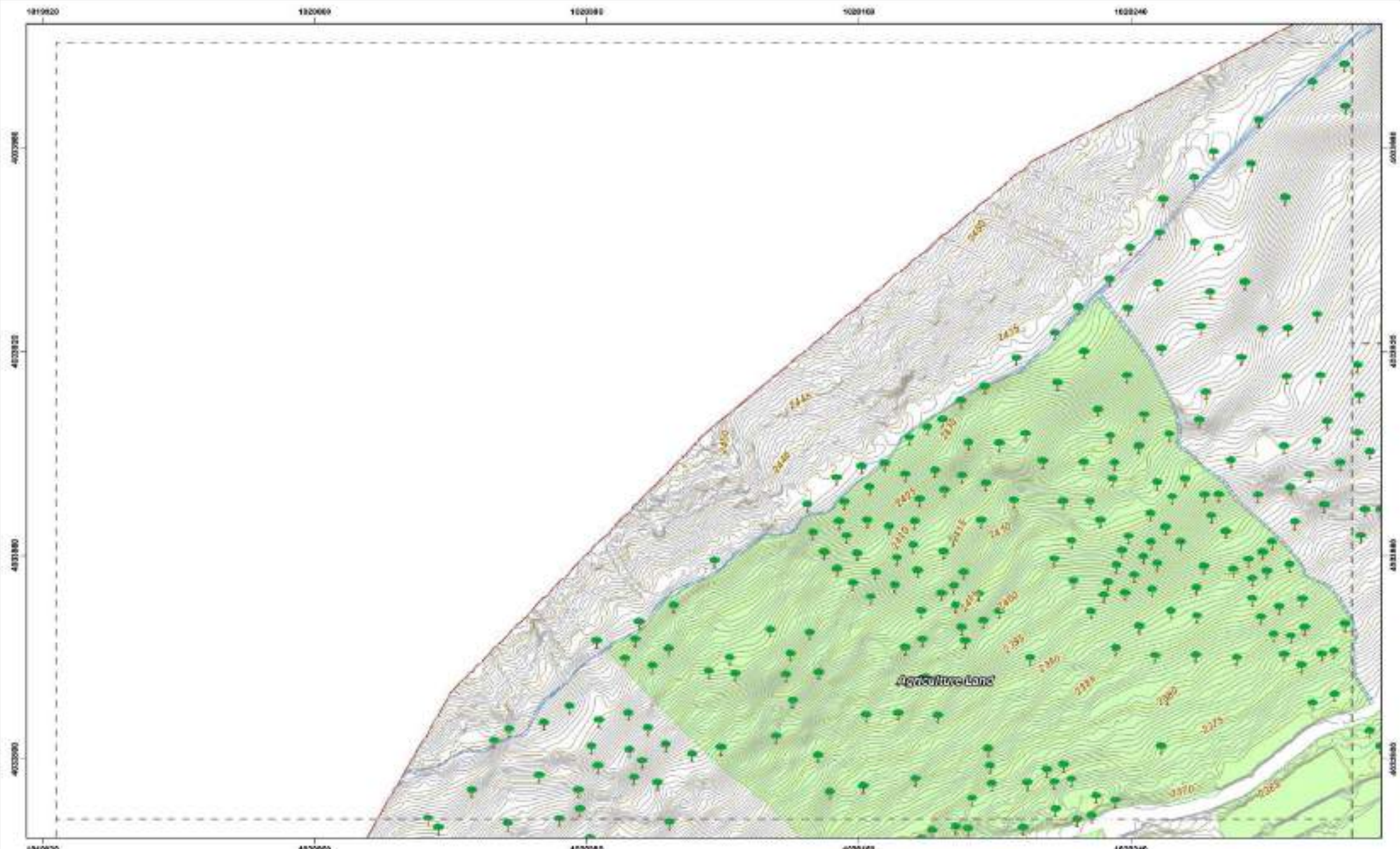
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HEAD OFFICE: HESRAK HILL, 1-C, BLOCK B
MODEL TOWN EXTENSION, LAHORE, PAKISTAN

LEGEND

Control Point	Water Control	Proposed Dam
Spot	Stream	Intake
Topographic Point	Drain	Over
Survey	Agriculture Plot	Canal
DL Line	Hydro	Bridge
Topographic Line	Water	Bed
Interference Control	Shade	1:1000 LRS
	Landmark	

INDEX MAP



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PROJECT

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HYDROPOWER
PROJECT (54 MW)**

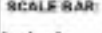
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**TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM**

DATE
FEB 2025

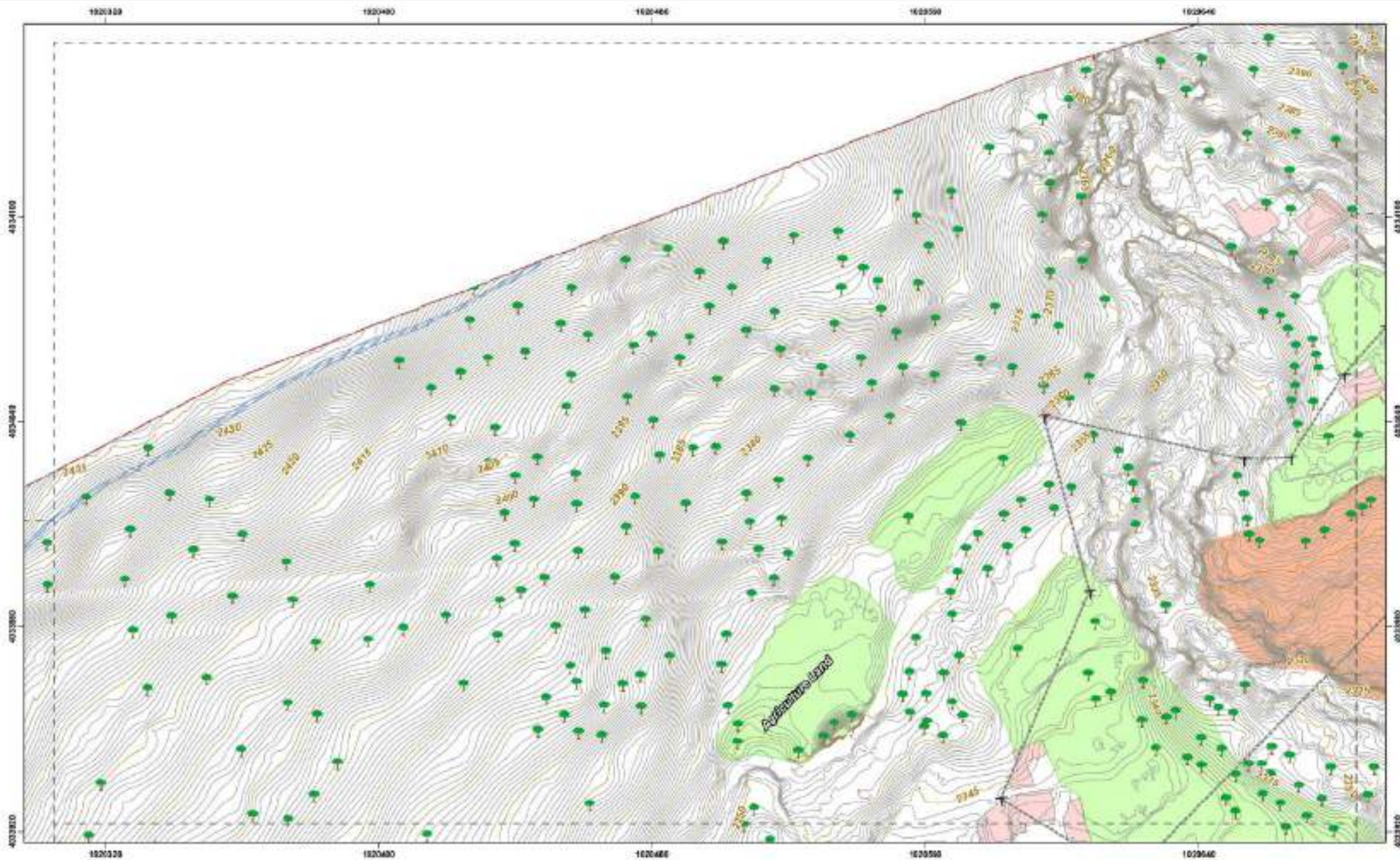
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SCALE

1:1000



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MODEL TOWN EXTENSION, LAHORE, PAKISTAN

LEGEND

Control Point	Water Control	Proposed
Spot	Stream	Intake
Topographic Point	Drain	Over
Survey	Highland point	Canal
Dr Line	Hydro	Bridge
Topographic Line	Hydro	Shed
Interconnection	Hydro	U. T. (G.S. L.S.)
Landmark	Landmark	

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PROJECT

ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

SCALE

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DATE

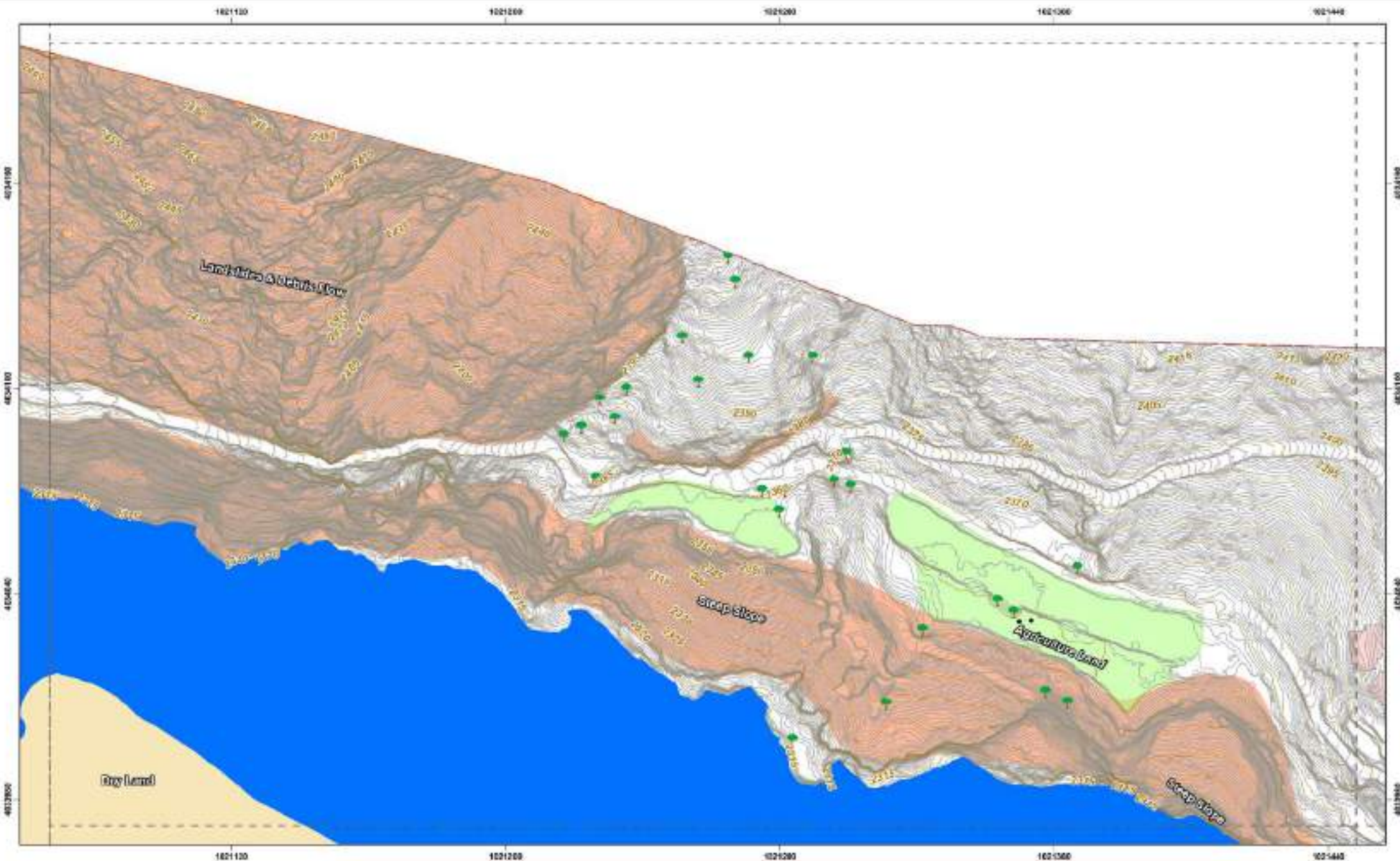
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MODEL TOWN EXTENSION, LAHORE, PAKISTAN

LEGEND

Control Point	Water Control	Proposed Dam
Spot	Stream	Intake
Topographic Point	Dry Lake	Over
Survey	Agriculture Land	Concrete
DL Line	Hydro	Bridge
Topographic Line	Shade	Steel
Interference Control	Shade	U-1 (S-100 LPS)
	Landscape Design	

INDEX MAP



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PROJECT

ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

SCALE

1:1000

DATE

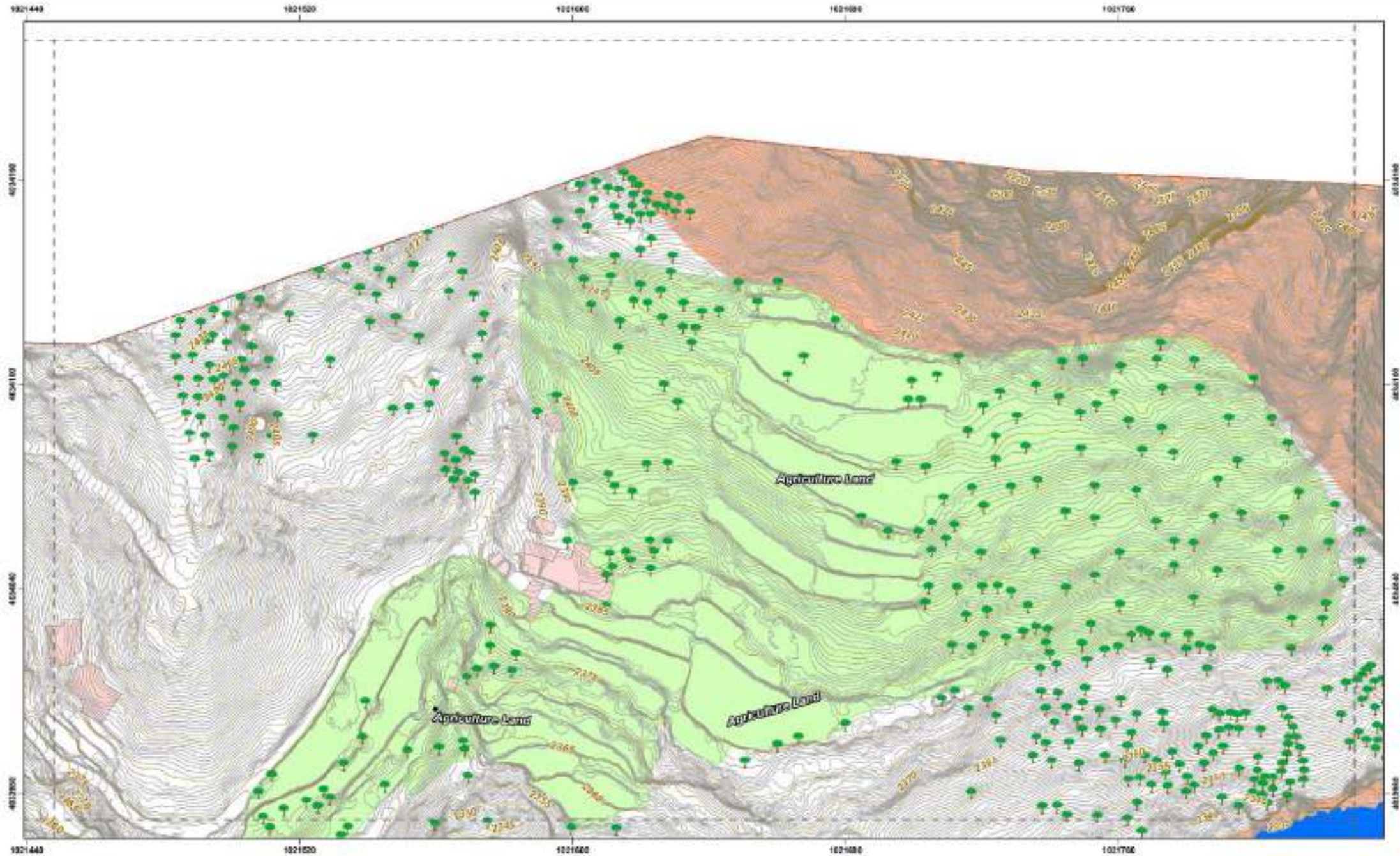
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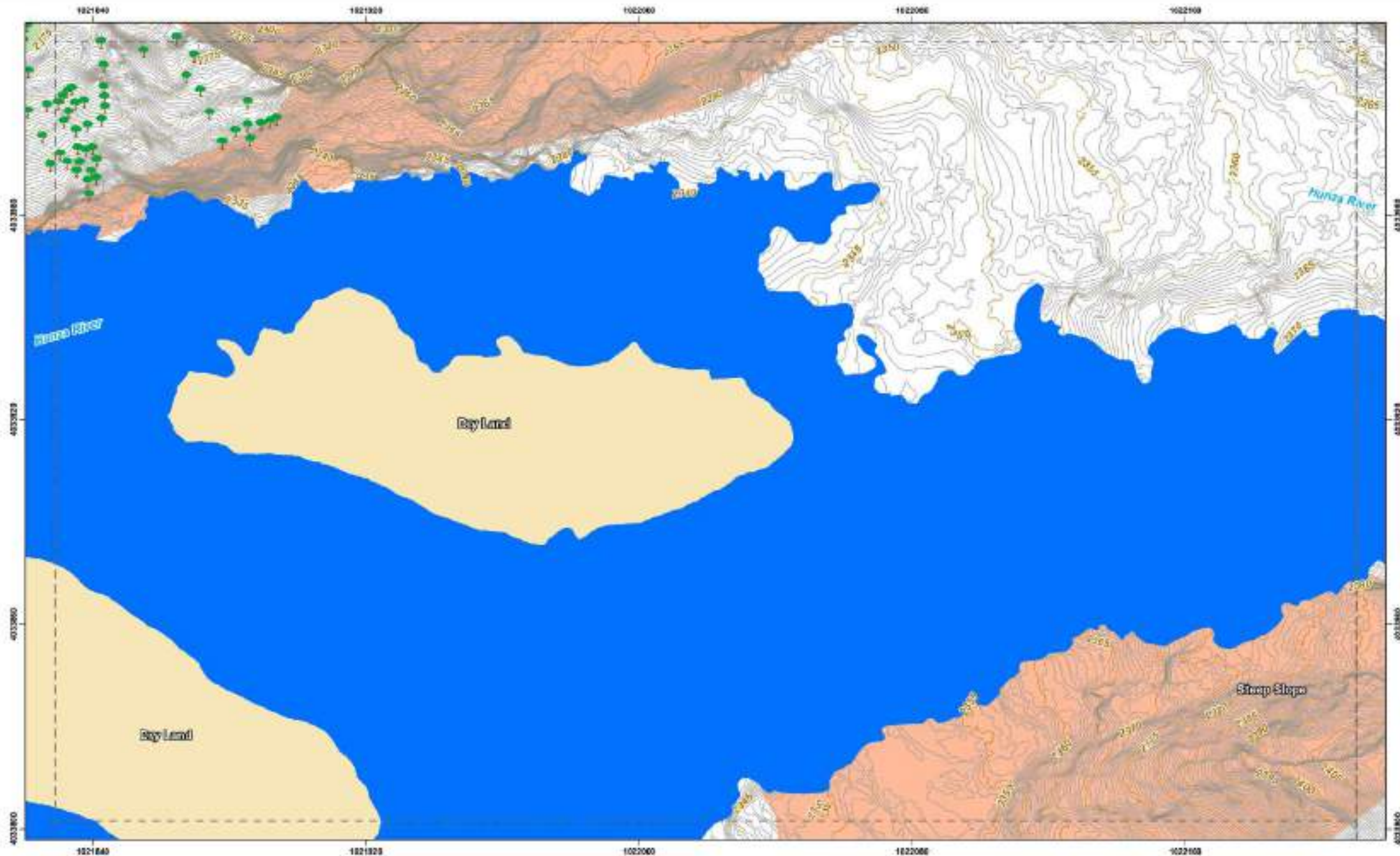
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CLIENT  RATE AND POWER DEVELOPMENT AUTHORITY	CONSULTANT  ATTABAD HYDROPOWER MANAGEMENT CONSULTANTS HEAD OFFICE: HESKARDI LANE, 1-C, BLOCK-B, MODEL TOWN EXTENSION, LAHORE, PAKISTAN	LEGEND Control Point Spot Topographic Profile Tunnel DL Line Topographic Line Interim Line Water Course River Agricultural Land Field Road Landmark Line Proposed Road Dam Canal Bridge Road U-Turn Line INDEX MAP 	DISCLAIMER 1. This Map has been prepared by National Engineering Services Pakistan PVT. LTD. exclusively for the purpose of the project mentioned in the title and shall not be used for any other purpose without the written consent of the project authority. The project authority shall be responsible for the accuracy of the data and information provided to the project authority. The project authority shall be responsible for the accuracy of the data and information provided to the project authority. The project authority shall be responsible for the accuracy of the data and information provided to the project authority.	PROJECT ATTABAD LAKE HYDROPOWER PROJECT (54 MW)	TITLE TOPOGRAPHIC SURVEY PLAN ATTABAD LAKE DAM SCALE 1:1000	DATE FEB 2025 Page 18 of 73	SHEET NO. Page 18 of 73	SCALE BAR 
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MODEL TOWN EXTENSION, LAHORE, PAKISTAN

LEGEND

Control Point	Water Control	Proposed Road
Spot	Bank	Intersect
Topographic Point	Big Land	Open
Survey	Highland point	Canal
DL Line	Bridge	Bridge
Topographic Line	Steep Slope	Steep Slope
Intersecting Control	Landmark Point	Landmark Point

INDEX MAP



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PROJECT

ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

SCALE

1:1000

DATE

FEB 2025

SHEET NO.

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SCALE BAR





CLIENT

WATER AND POWER
DEVELOPMENT AUTHORITY

CONSULTANT

ATTARAD HYDROPOWER
MANAGEMENT CONSULTANTS

HEAD OFFICE: NESAAR HOUSE, 1-2, BLOCK M
(MOOL) TOWNSHIP EXTENSION, LAHORE, PAKISTAN

LEGEND

- Legend
- | | | |
|---------------------------------|---------------------------------|---------------------------------|
| Green circle | Green circle | Green circle |
| Red circle | Red circle | Red circle |
| Blue circle | Blue circle | Blue circle |
| Yellow circle | Yellow circle | Yellow circle |
| Orange circle | Orange circle | Orange circle |
| Purple circle | Purple circle | Purple circle |
| Light blue circle | Light blue circle | Light blue circle |
| Light green circle | Light green circle | Light green circle |
| Light orange circle | Light orange circle | Light orange circle |
| Light purple circle | Light purple circle | Light purple circle |
| Light light blue circle | Light light blue circle | Light light blue circle |
| Light light green circle | Light light green circle | Light light green circle |
| Light light orange circle | Light light orange circle | Light light orange circle |
| Light light purple circle | Light light purple circle | Light light purple circle |
| Light light light blue circle | Light light light blue circle | Light light light blue circle |
| Light light light green circle | Light light light green circle | Light light light green circle |
| Light light light orange circle | Light light light orange circle | Light light light orange circle |
| Light light light purple circle | Light light light purple circle | Light light light purple circle |

INDEX MAP



DISCLAIMER

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PROJECT

ATTABAD LAKE
HYDROPOWER
PROJECT (54 MW)

TITLE

TOPOGRAPHIC SURVEY PLAN
ATTABAD LAKE DAM

DATE
FEB 2020

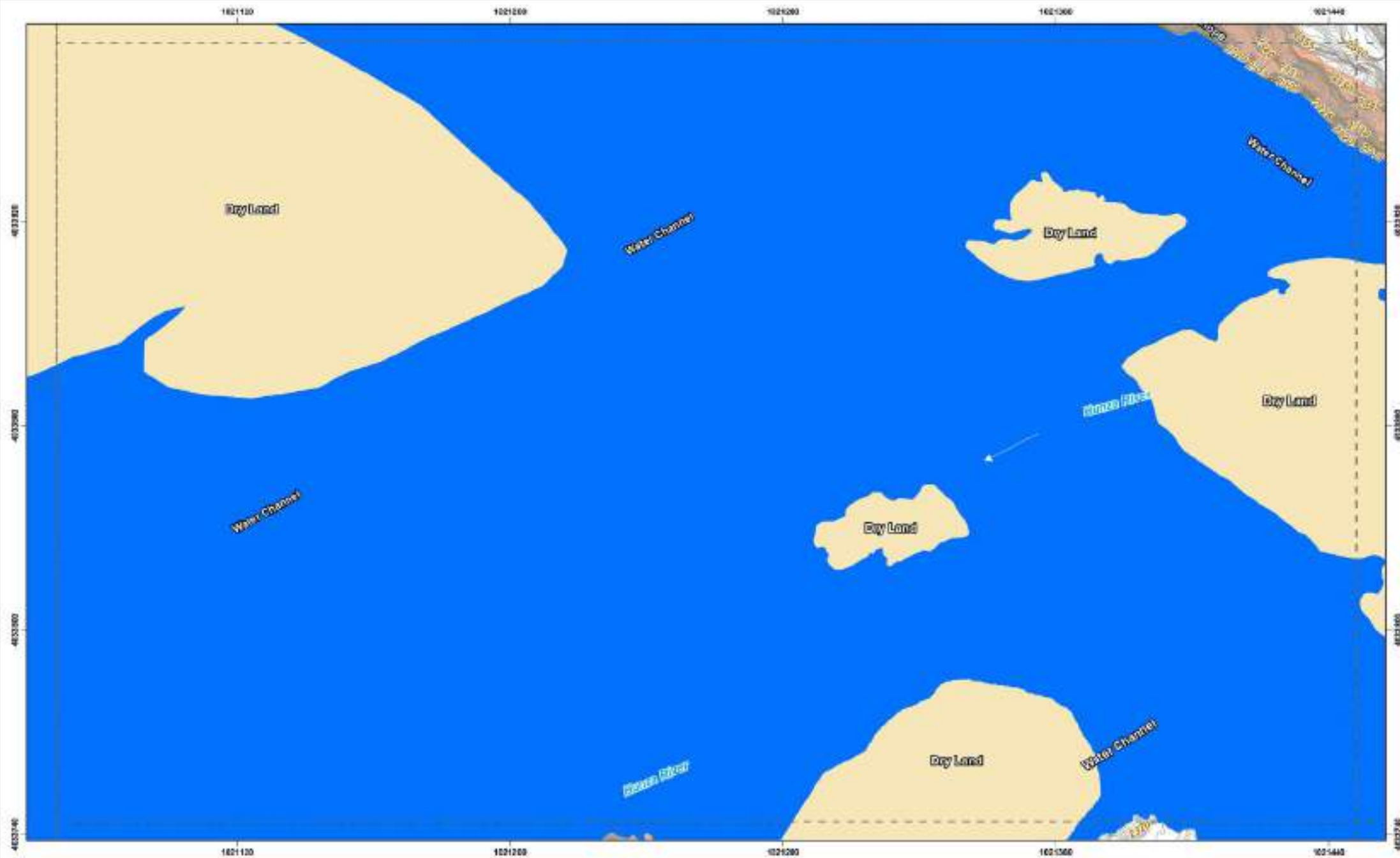
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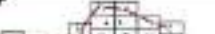
SCALE BAR:

	1	2	3
1	1	2	3
2	2	1	3
3	3	3	1

SCALE

1:2000



CLIENT  WATER AND POWER DEVELOPMENT AUTHORITY	CONSULTANT ATTABAD HYDROPOWER MANAGEMENT CONSULTANTS HEAD OFFICE: HESPAR HOUSE, 1-E, BLOCK N, MOOL TOWN EXTENSION, LAHORE, PAKISTAN	LEGEND Green Patch Red Blue Yellow Orange Light Blue Dark Blue Light Green Dark Green Water Canals River High Land Agricultural Land Settled Wetland Water Body Low Land Subsistence Crops Proposed Dam ATMHC Open Canal Bridge Road Highway Lowest Line	INDEX MAP 	DISCLAIMER This Map has been prepared by National Engineering Services Pakistan PVT. Ltd. (NESPAK) for the purpose of providing a general overview of the project area. It is not intended to be used for any legal or financial purposes. The map is provided as a reference only and should not be used for any other purpose without the prior written consent of NESPAK.	PROJECT ATTABAD LAKE HYDROPOWER PROJECT (54 MW)	TITLE TOPOGRAPHIC SURVEY PLAN ATTABAD LAKE DAM	SCALE 1:1000
					DATE FEB 2026	SHEET NO. Page 27 of 73	SCALE BAR 