

THRASHER

2019 Monongalia County Aerial Triangulation And Ground Control Report

Prepared by:

Craig Fry, CP

The Thrasher Group

10125 Mason Dixon Highway

Burton, WV 26562

Phone: (304) 662-2626

cfry@thethrashergroup.com

The Thrasher Group (TTG) has successfully completed the aerial triangulation (AT) for the countywide spring flight.

Using semi-automatic analytical aerial triangulation procedures, TTG determined the exterior orientation parameters for each exposure in the photography that covers the project area.

The results of the final adjustments are sufficient to enable TTG to photogrammetrically produce orthophotos from the photography. The AT solution ensures that the project data will meet or exceed the accuracy expectation as outlined in the contract.

Ground Control

The ground control network was designed to provide a geometrically strong horizontal and vertical control system within the project area.

Sufficiently identified ground control points (GCPS) were surveyed within the block to provide horizontal and vertical control.

Aerial Photography

Aerial photography for the project was captured between April 3, 2019 and April 16, 2019.

The photography was acquired with an approximate 60 percent overlap and an approximate 30 percent side lap. The flight altitude of the photography was approximately 7,700 feet above mean terrain.

Airborne GPS

Airborne-GPS (ABGPS) data was captured during the acquisition of the aerial photography. An appropriate GPS antenna was mounted on each aircraft used on the project, and the relationship between the antenna phase centers and the camera perspective centers was then determined through close-range survey techniques. Dual frequency, geodetic quality receivers were utilized for the data collection.

The GPS data was post-processed, and the appropriate interpolations, transformations and reductions were applied to derive the camera's spatial position referenced to the World Geodetic System of 1984 (WGS84) at each instant of exposure.

Flight

The flight plan was comprised of 24 flight lines. The designed ground sample distance per pixel was 10 centimeters.

The block consisted of a total of 1,675 images.

A fully equipped aircraft was employed for the photographic mission. In the aircraft, the instrumentation utilized in the acquisition of aerial photography and ABGPS data comprised of a Zeiss DMC III aerial camera featuring forward motion compensation, and a GPS Novatel Span Receiver with a collection rate of one half-second.

During each flight, every exposure triggered by each camera was recorded in the associated GPS data file as an external event. A time stamp for each event later allowed the interpolation of the camera position at each instant or exposure.

Aerial Triangulation

Aerial triangulation is the simultaneous space resection of image rays projected and recorded at one source, the perspective center of the aerial camera. These image rays projected from two or more overlapping images (stereo-models) intersect at the corresponding ground location to determine the three-dimensional coordinates of each point measured. This collection of image rays is fit to known ground survey control in a simultaneous three-dimensional least squares adjustment. After the completion of this adjustment, coordinates of the 'unknown' ground points are derived by the intersection of the adjusted image points.

The aerial triangulation was performed utilizing the ground control and the airborne GPS-assisted techniques. These data are then introduced along with the reduced image coordinates, as observations, into a combined three-dimensional simultaneous least squares adjustment by bundles. This approach allows a substantial reduction in the amount of ground control required for the AT solutions.

The purpose of aerial triangulation is to densify horizontal and vertical control from relatively few ground control points (GCPs). Since obtaining GCPs is a relatively significant expense in any mapping project, AT procedures are used to reduce the amount of field survey required by extending control to all stereo-models.

Internal software checks were performed to detect gross errors in the photo measurements.

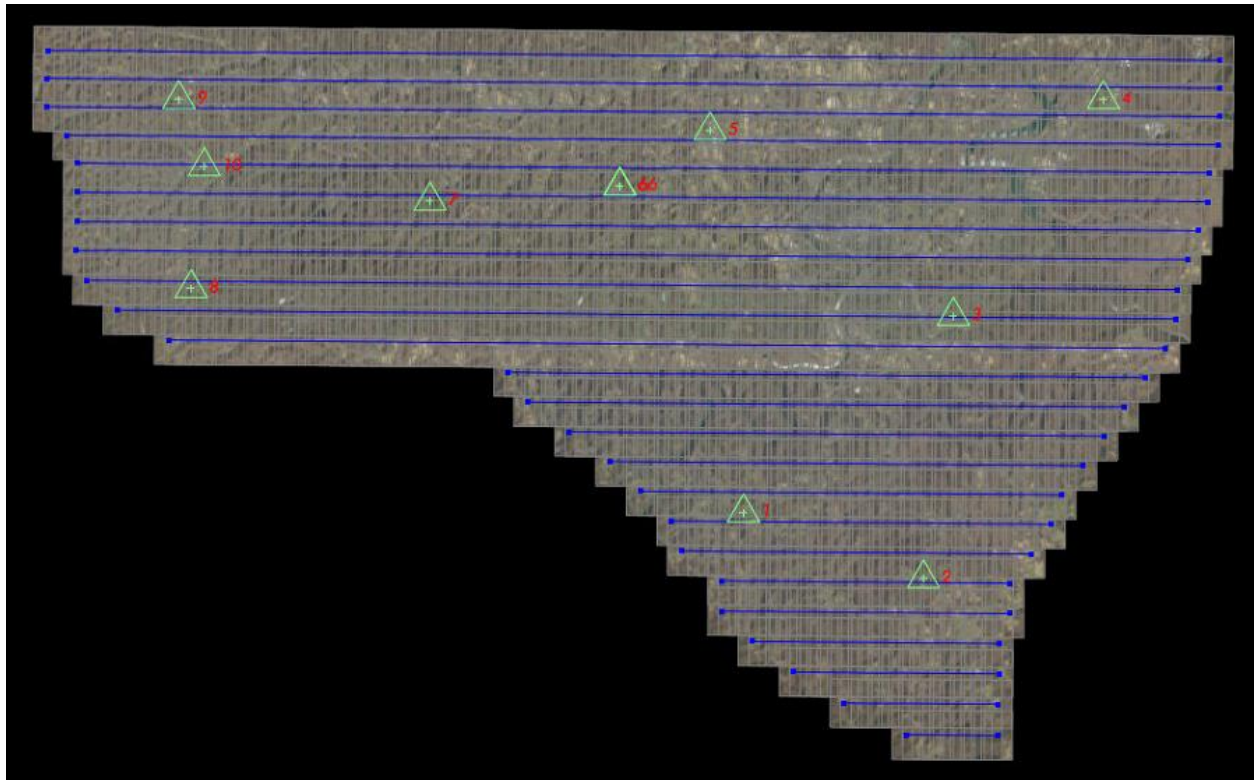
Bundle Adjustment

The surveyed control, along with the reduced image coordinates, served as input into the 'combined' block adjustment. Three-dimensional, simultaneous least squares adjustments by bundles, were undertaken using Match-AT bundle adjustment software. This bundle block adjustment software has proven to be a very rigorous and stable platform.

Ten control points were used to constrain the AT solution. The sigma naught is a significant indicator of the quality of the adjustment. The sigma value derived by the block adjustment is the root mean square of all photo measurement residuals for the entire block. The lower the sigma naught, the less tension within the AT solution. The sigma naught for this adjustment was 0.6 microns. The residuals of the control points from measured position to surveyed position are as follows:

Residual point x y z (ft.)

1	0.026	0.006	n/a
2	-0.042	0.028	0.005
3	0.045	0.059	-0.030
4	0.026	-0.021	0.087
5	0.082	-0.042	0.220
6	0.012	-0.029	0.117
7	-0.022	-0.022	-0.057
8	-0.062	0.017	-0.200
9	0.018	-0.011	0.045
10	0.036	-0.036	0.030
66	-0.017	0.015	-0.156



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – SMITHTOWN ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: MARK GALLAGHER

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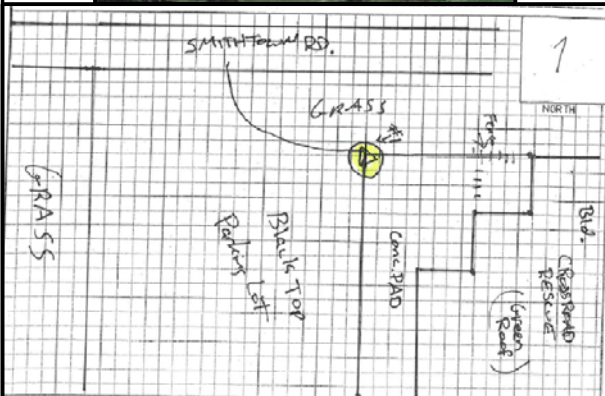
NORTHING (Y) = 372737.002

EASTING (X) = 1820080.649

ELEVATION (Z) = 1250.545

DETAILED DESCRIPTION:

NW CORNER OF CONCRETE PAD
ALONG ASPHALT PARKING AREA.
CROSS ROADS RESCUE PARKING
LOT; 3335 SMITHTOWN ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – GRAFTON ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: MARK GALLAGHER

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NORTHING (Y) = 361683.509

EASTING (X) = 1850254.032

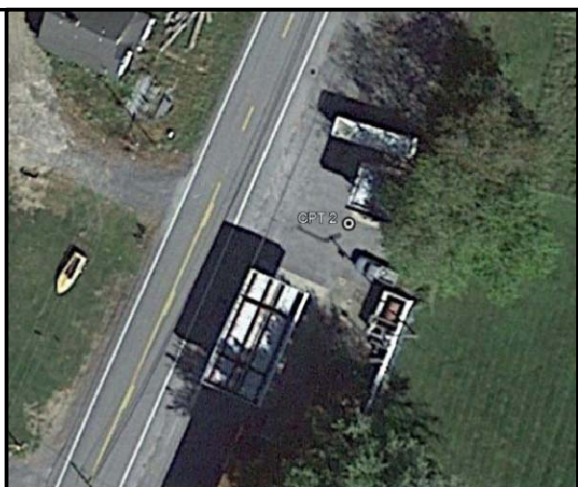
ELEVATION (Z) = 1940.838

DETAILED DESCRIPTION:

SW CORNER OF CONCRETE PAD.

CLOSED DOWN GAS STATION;

3755 GRAFTON ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – BROOKHAVEN ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: MARK GALLAGHER

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NORTHING (Y) = 405681.348

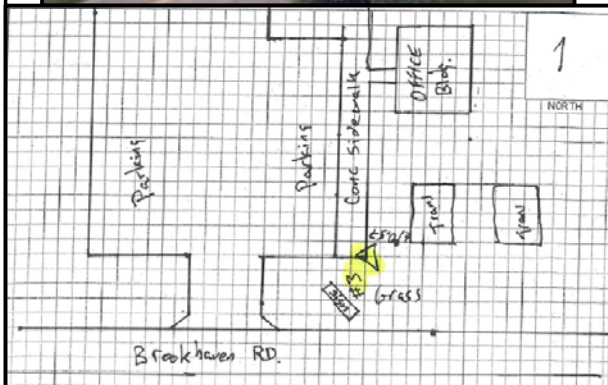
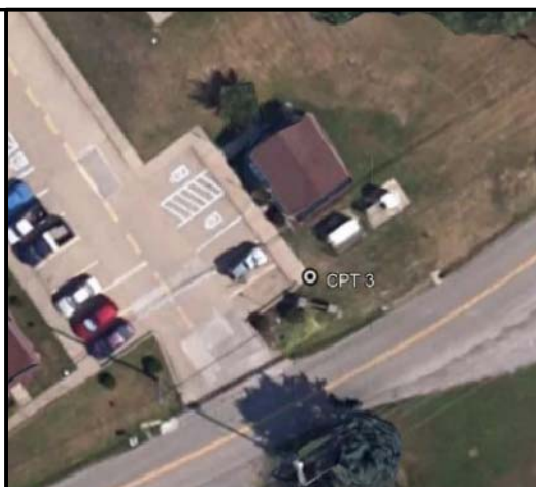
EASTING (X) = 1855272.505

ELEVATION (Z) = 1087.650

DETAILED DESCRIPTION:

SE CORNER OF CONCRETE
SIDEWALK.

BROOKVIEW APARTMENTS;
486 BROOKHAVEN ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – FRANK BURCHINAL ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: CHRIS DEFINO

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NORTHING (Y) = 442022.052

EASTING (X) = 1880406.894

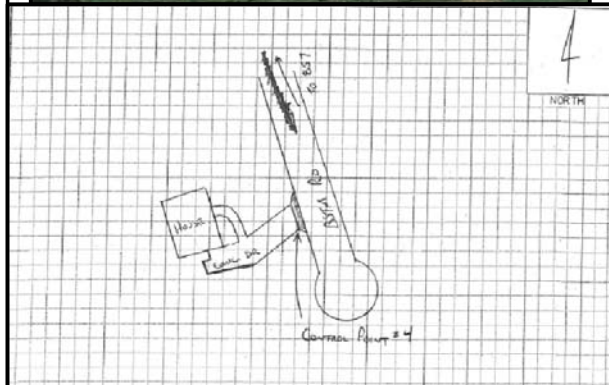
ELEVATION (Z) = 1152.438

DETAILED DESCRIPTION:

SE CORNER OF CONCRETE

DRIVEWAY ALONG ASPHALT DRIVE.

OFF OF FRANK BURCHINAL ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – INT. 79 REST AREA MM 158.5

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: CHRIS DEFINO

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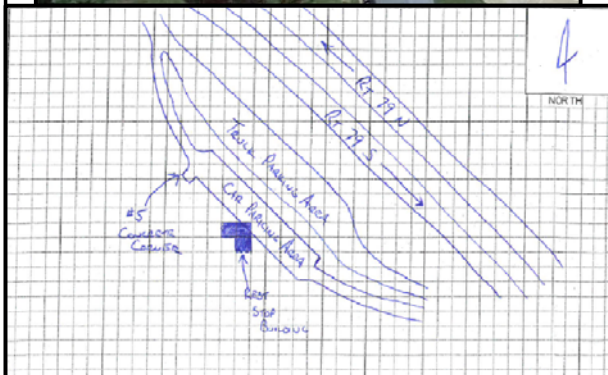
NORTHING (Y) = 436739.570

EASTING (X) = 1814471.903

ELEVATION (Z) = 1327.259

DETAILED DESCRIPTION:

NW CORNER OF CONCRETE
TURN AROUND ON SW SIDE
OF REST STOP PARKING LOT.
INTERSTATE 79 REST AREA;
MILE MARKER 158.5



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – MASON DIXON HWY

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: CHRIS DEFINO

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NORTHING (Y) = 427432.333

EASTING (X) = 1799308.812

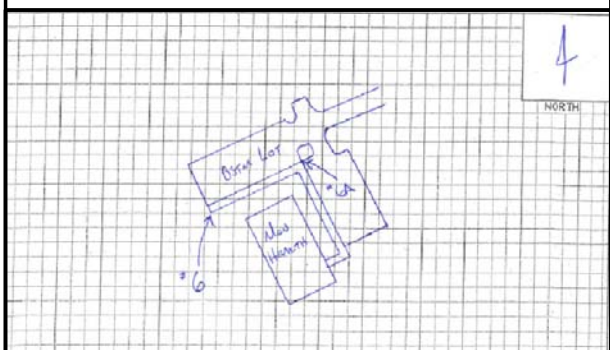
ELEVATION (Z) = 974.437

DETAILED DESCRIPTION:

SW CORNER OF CONCRETE

SIDEWALK AT MON HEALTH.

OFF OF MASON DIXON HWY.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – MASON DIXON HWY

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: CHRIS DEFINO

6A

NORTHING (Y) = 427482.203

EASTING (X) = 1799392.145

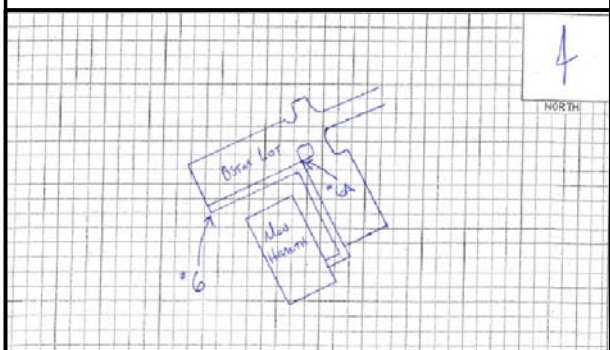
ELEVATION (Z) = 974.698

DETAILED DESCRIPTION:

NE CORNER OF CONCRETE

SIDEWALK AT MON HEALTH.

OFF OF MASON DIXON HWY.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – DAYBROOK ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: CHRIS DEFINO

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NORTHING (Y) = 424977.848

EASTING (X) = 1767533.538

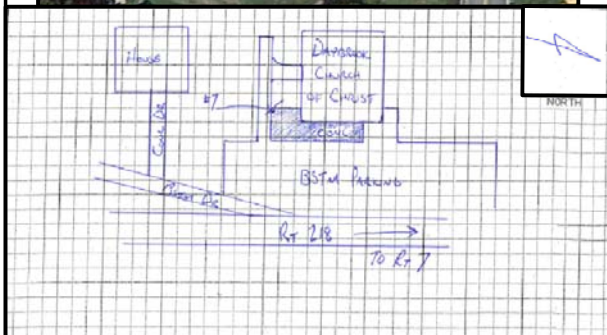
ELEVATION (Z) = 1011.924

DETAILED DESCRIPTION:

SW CORNER OF CONCRETE PAD

AT DAYBROOK CHURCH OF CHRIST

ALONG DAY BROOK ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – ST. LEO ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: BUD BARGY

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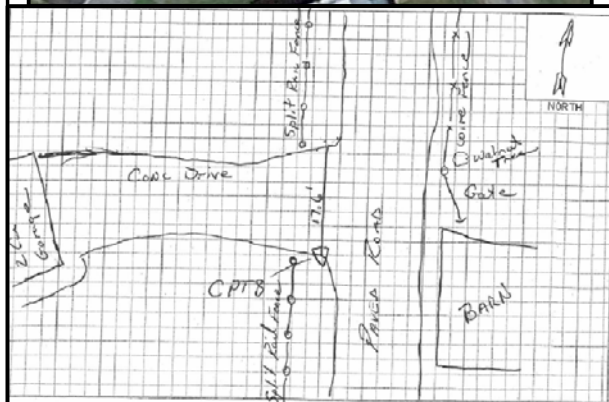
NORTHING (Y) = 410319.800

EASTING (X) = 1727476.437

ELEVATION (Z) = 1129.515

DETAILED DESCRIPTION:

SE CORNER OF CONCRETE DRIVE
ALONG ST. LEO ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – WHITE CREEK ROAD

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: BUD BARGY

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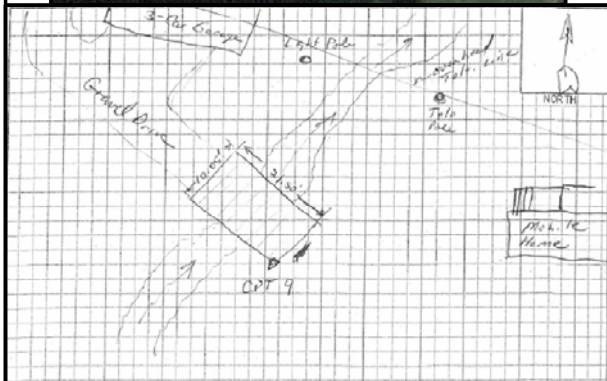
NORTHING (Y) = 442027.772

EASTING (X) = 1725393.565

ELEVATION (Z) = 1102.991

DETAILED DESCRIPTION:

SOUTHERN MOST CORNER OF A
WOOD PLANK BRIDGE, OFF OF
WHITE CREEK ROAD.



CONTROL POINT LOCATION SHEET

VERTICAL DATUM: GEOID 12B COORDINATE DATUM: NAD 83 (FT), WV NORTH ZONE

ORDER OF ACCURACY: RTK GPS 1/100,000

YEAR: 2019

ADDRESS: MONONGALIA COUNTY, WEST VIRGINIA – BLUE MTN. MASON DIXON HWY

ESTABLISHED BY: THE THRASHER GROUP

CHIEF OF PARTY: BUD BARGY

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NORTHING (Y) = 430748.009

EASTING (X) = 1729692.953

ELEVATION (Z) = 1023.185

DETAILED DESCRIPTION:

NW CORNER OF CONCRETE

SIDEWALK AT BLUE MOUNTAIN

BUILDING; 10125 MASON DIXON

HWY.

