PHASE 2 INITIAL BOREHOLE DRILLING AND TESTING, IGNACE AREA

WP02 Data Report - Drilling and Coring for IG_BH04

APM-REP-01332-0242 **December 2021**

Wood Plc.

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WP02 Data Report – Drilling and Coring for IG_BH04

Project Number: SCB1912026
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Prepared for:

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December 2021

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Table of Contents

Page

List of Tables

List of Figures

List of Appendices

Abbreviation List

APM	Adaptive Phased Management
BATT	Battery
BET	Brunauer, Emmet and Teller Method
BH	Borehole
CEC	Cation Exchange Capacity
CO	Carbon Monoxide
D_e	Effective Diffusion Coefficient
DMP	Data Management Plan
DWR	Drill Water Return
FIG	Figure
HQ	BH size (Hole diameter = 95mm)
HQ3	Core Diameter (61.1mm)
HSEP	Health Safety and Environment Programme
ID	Identification
IG	Ignace
K	Potassium
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LIS	List
MAN	Manual
mbgs	meters below ground surface
MEM	Memorandum
N	No
NWMO	Nuclear Waste Management Organization
OGW	Opportunistic Ground Water
PE	Polyethylene
PLC	Programmable Logic Controller
PLN	Plan
PPE	Personal Protective Equipment
PQP	Project Quality Plan
PRA	Potential Repository Area
PVC	Polyvinyl Chloride
QC	Quality Control
QA	Quality Assurance
QMS	Quality Management System
R	Realign
RFP	Request for Proposal
SOW	Scope of Work
TBD	To be Determined
Th	Thorium
U	Uranium
WP	Work Packages

1.0 Introduction

1.1 General Overview

The Initial Borehole Drilling and Testing project in the Wabigoon and Ignace Area, Ontario is part of Phase 2 Geoscientific Preliminary Field Investigations of the NWMO's Adaptive Phased Management (APM) Site Selection Phase.

This second phase involves the drilling and testing of the first of up to six deep boreholes in the northern portion of the Revell batholith. Borehole IG_BH04 is located approximately (21) km southeast of the Wabigoon Lake Ojibway Nation, and approximately 43 km northwest of the Town of Ignace. Site access is via Highway 17 to the turnoff, then along logging roads. The location of the project boreholes is shown on Figure 1.

The project was carried out by a team led by Wood plc (wood) on behalf of the NWMO. This report describes the methodology, activities and results for Work Package 2 (WP02): Borehole Drilling and Coring for IG_BH02, which includes: borehole drilling, coring and casing installation, borehole deviation, and drilling fluid management and use of tracers.

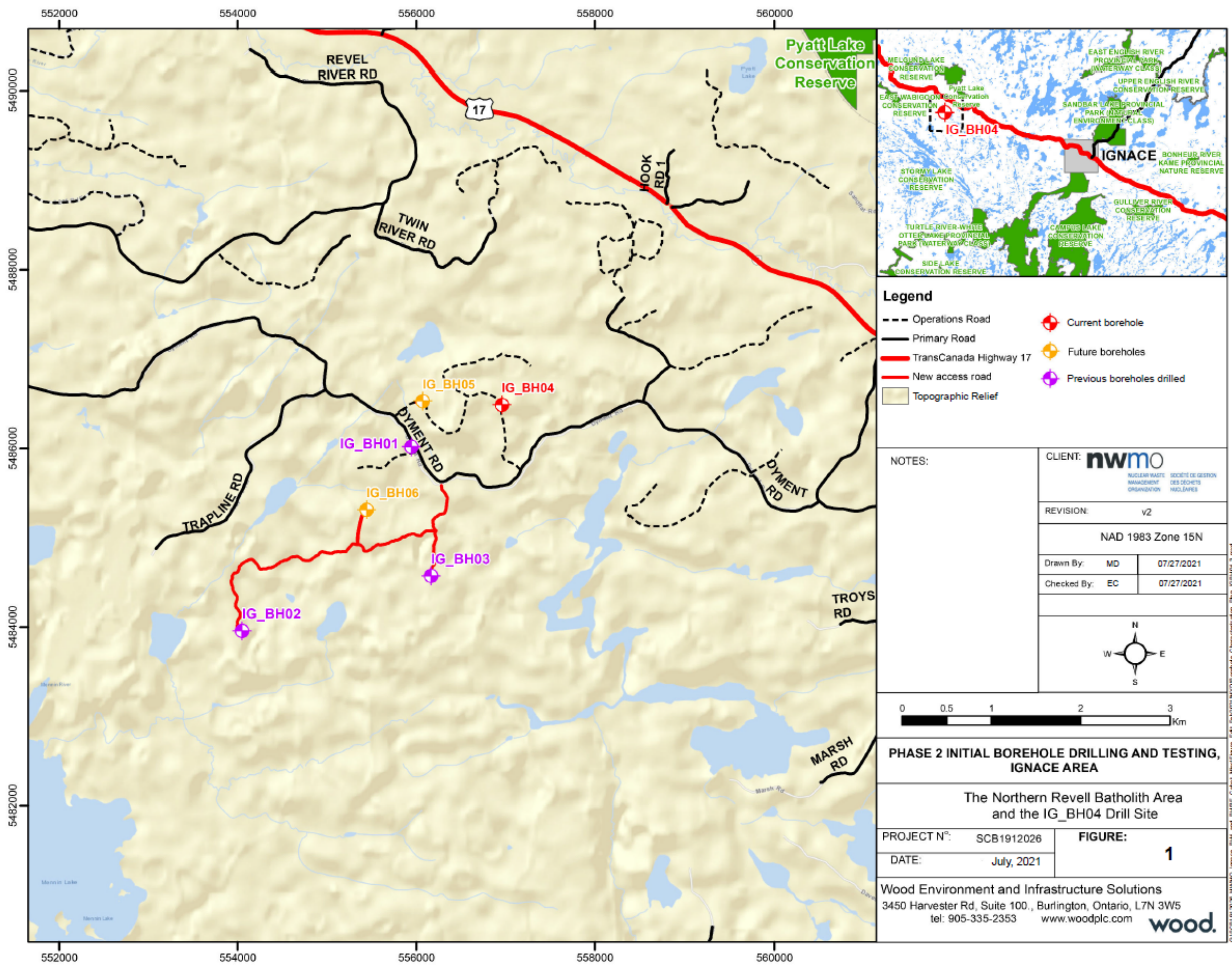


Figure 1: Ignace Borehole Site Locations for IG_BH01 to IG_BH06. Borehole IG_BH04 (in Red) is the borehole and subject of this report

1.2 WP02 Data Delivery

This report is complimentary to the WP02 Data Delivery - Drilling and Coring Data for IG_BH04, issued initially to NWMO October 22, 2020, which following NWMO's review of November 24, 2020 was resubmitted February 5, 2021, and with edited legal disclaimer reissued April 21, 2021 and accepted and approved by NWMO June 9, 2021. The Meta Data Abstract summarizing all the main data files is in Appendix A.

2.0 Background Information

2.1 Geological Setting

The approximately 2.7 billion year old Revell batholith is located in the western part of the Wabigoon Subprovince of the Archean Superior Province. The batholith is roughly elliptical in shape trending northwest, is approximately 40 km in length, 15 km in width, and covers an area of approximately

455 km^2. Based on geophysical modelling, the batholith has a relatively flat base that extends to depths of nearly 4 km in some regions (SGL, 2020). The batholith is surrounded by supracrustal rocks of the Raleigh Lake (to the north and east) and Bending Lake (to the southwest) greenstone belts (Figure 2).

Four main rock units are identified in the supracrustal rock group: mafic metavolcanic rocks, intermediate to felsic metavolcanic rocks, metasedimentary rocks, and mafic intrusive rocks. Sedimentation within the supracrustal rock assemblage was largely synvolcanic, although sediment deposition in the Bending Lake area may have continued past the volcanic period (Stone, 2009; Stone, 2010a; Stone, 2010b). All supracrustal rocks are affected, to varying degrees, by penetrative brittle-ductile to ductile deformation under greenschist- to amphibolite-facies metamorphic conditions (Blackburn and Hinz, 1996; Stone et al., 1998). In some locations, primary features, such as pillow basalt or bedding in sedimentary rocks are preserved, in other locations, primary relationships are completely masked by penetrative deformation. Uranium-lead (U-Pb) geochronological analysis of the supracrustal rocks produced ages that range between 2734.6 +/-1.1 Ma and 2725 +/-5 Ma (Stone et al., 2010).

Three main suites of plutonic rock are recognized in the Revell batholith, including, from oldest to youngest: a Biotite Tonalite to Granodiorite suite, a Hornblende Tonalite to Granodiorite suite, and a Biotite Granite to Granodiorite suite. Plutonic rocks of the Biotite Tonalite to Granodiorite suite occur along the southwestern and northeastern margins of the Revell batholith. The principal type of rock within this suite is a white to grey, medium-grained, variably massive to foliated or weakly gneissic, biotite tonalite to granodiorite. One sample of foliated and medium-grained biotite tonalite produced a U-Pb age of 2734.2+/-0.8 Ma (Stone et al., 2010). The Hornblende Tonalite to Granodiorite suite occurs in two irregularly-shaped zones surrounding the central core of the Revell batholith. Rocks of the Hornblende Tonalite to Granodiorite suite range compositionally from tonalite through granodiorite to granite and also include significant proportions of quartz diorite and quartz monzodiorite. One sample of coarse-grained grey mesocratic hornblende tonalite produced a U-Pb age of 2732.3+/-0.8 Ma (Stone et al., 2010). Rocks of the Biotite Granite to Granodiorite suite underlie most of the northern, central and southern portions of the Revell batholith. Rocks of this suite are typically coarse-grained, massive to weakly foliated, and white to pink in colour. The Biotite Granite to Granodiorite suite ranges compositionally from granite through granodiorite to tonalite. This suite includes the oval-shaped potasium-feldspar megacrystic granite body in the central portion of the Revell batholith. One sample of coarse-grained, pink, massive potassium-feldspar megacrystic biotite granite produced a U-Pb age of 2694.0+/-0.9 Ma (Stone et al., 2010).

Borehole IG_BH04 is located within an investigation area of approximately 19 km^2 in size, situated in the northern portion of the Revell batholith. Bedrock exposure in the area is generally very good due to minimal overburden, few water bodies, and relatively recent logging activities. Ground elevations generally range from 400 to 450 m above sea level. The ground surface broadly slopes towards the northwest as indicated by the flow direction of the main rivers in the area. Local water courses tend to flow to the southwest towards Mennin Lake (Figure 1).

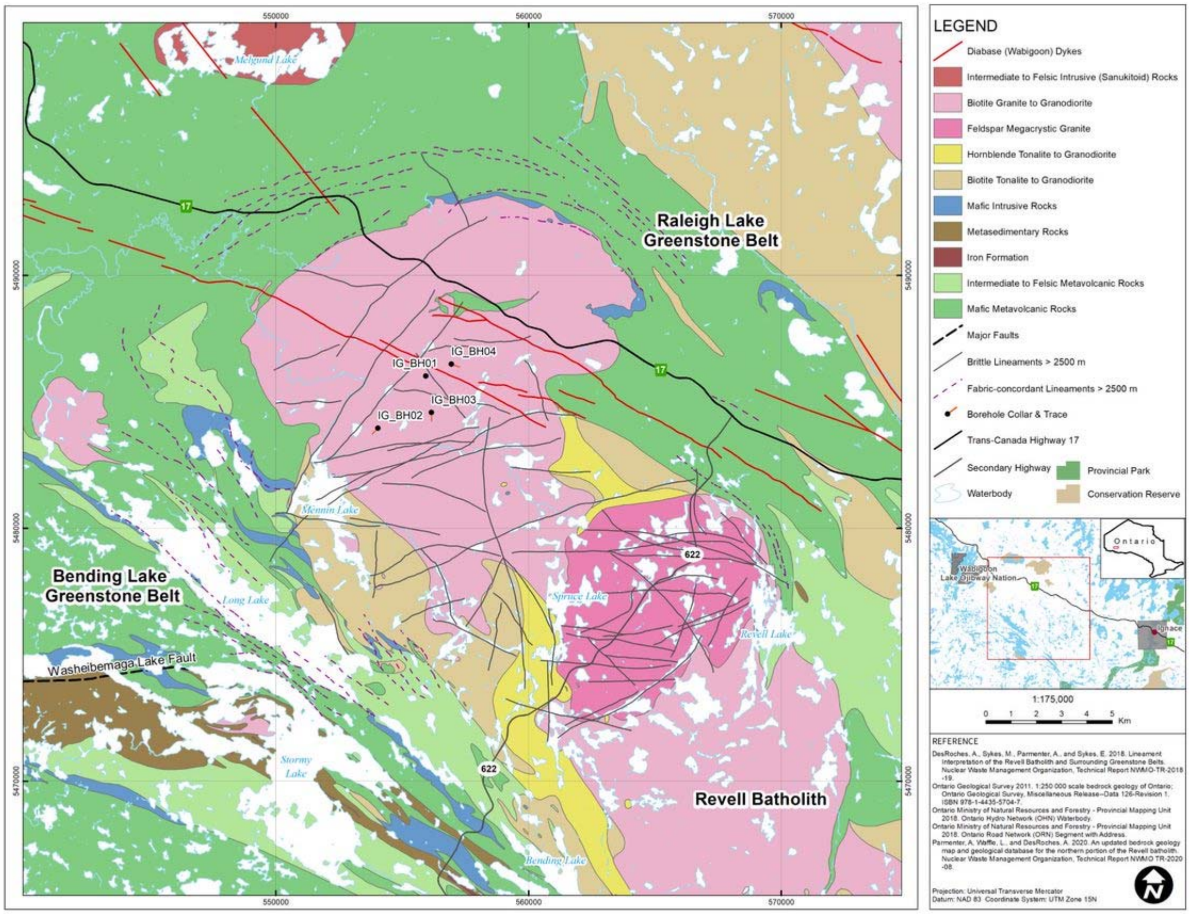


Figure 2: Map Shows Geological Setting of the Northern Portion of the Revell Batholith (Parmenter et al., 2020)

The bedrock surrounding IG_BH04 is composed mainly of massive to weakly foliated felsic intrusive rocks that vary in composition between granodiorite and tonalite, and together form a relatively homogeneous intrusive complex. Bedrock identified as tonalite transitions gradationally into granodiorite and no distinct contact relationships between these two rock types are typically observed (SRK and Golder, 2015; Golder and PGW, 2017). Massive to weakly foliated granite is identified at the ground surface to the northwest of the feldspar-megacrystic granite. The granite is observed to intrude into the granodiorite-tonalite bedrock, indicating it is distinct from, and younger than, the intrusive complex (Golder and PGW, 2017).

West-northwest trending mafic dykes interpreted from aeromagnetic data extend across the northern portion of the Revell batholith and into the surrounding greenstone belts. One mafic dyke occurrence, located to the southwest of IG_BH04, is approximately 15-20 m wide. All of these mafic dykes have a similar character and are interpreted to be part of the Wabigoon dyke swarm. One sample from the same Wabigoon swarm produced a U-Pb age of 1887+/-13 Ma (Stone et al., 2010), indicating that these mafic dykes are Proterozoic in age. It is assumed based on surface measurements that these mafic dykes are sub-vertical (Golder and PGW, 2017).

Long, narrow valleys are located along the western and southern limits of the investigation area. These local valleys host creeks and small lakes that drain to the southwest and may represent the surface expression of structural features that extend into the bedrock. A broad valley is located along the eastern limits of the investigation area and hosts a more continuous, un-named water body that flows to the south. The linear and segmented nature of this waterbody's shorelines may also represent the surface expression of structural features that extend into the bedrock.

Regional observations from mapping have indicated that structural features are widely spaced (typical 30 to 500 cm spacing range) and dominantly comprised of sub-vertical joints with two dominant orientations, northeast and northwest trending (Golder and PGW, 2017). Interpreted bedrock lineaments generally follow these same dominant orientations in the northern portion of the Revell batholith (DesRoches *et al.*, 2018). Minor sub-horizontal joints have been observed with minimal alteration, suggesting they are younger and perhaps related to glacial unloading. One mapped regional-scale fault, the Washeibemaga Lake fault, trends east and is located to the west of the Revell batholith (Figure 2). Ductile lineaments, also shown on Figure 2, follow the trend of foliation mapped in the surrounding greenstone belts. Additional details of the lithological units and structures found at surface within the investigation area are reported in Golder and PGW (2017).

2.2 Work Package Technical Objectives

The technical objectives of the borehole drilling for IG_BH04 coring and casing installation activities included:

- The collection of high-quality bedrock core that will allow geological and geotechnical core logging and the collection of core samples for use in laboratory testing programs and to characterize the bedrock environment.
- To provide opportunities to complete supplementary studies such as borehole geophysical logging, hydraulic testing, and opportunistic groundwater sampling while drilling.
- To provide stable borehole walls that allow for future testing.
- To ensure the subsurface groundwater is not contaminated and that water table environments are isolated through the use of casing and of borehole grouting following testing, where necessary.
- To maintain the set borehole orientation (N110˚, -70˚) within a ±5 degree cone tolerance from the surface collar location using various drilling techniques (borehole centralizer, wedging) if required.

In addition, drilling Fluid Management and Use of Tracers activities were used for the following purposes:

- To optimize drilling to minimize borehole deterioration.
- To effectively remove any cuttings to maintain efficient drilling.
- To prevent a release of drilling fluids to the near-surface and surface environment.
- To trace the drilling fluids using a combination of stable water isotopes, tritium, a fluorescein tracer, and field measured parameters to recognize drilling fluid contamination of groundwater and porewater samples.

- To maintain drilling fluids in a closed recirculation system to maximize the ability to recycle drilling fluid while maintaining quality.
- To collect Opportunistic Groundwater Samples (OGWS) as per WP07 Opportunistic Groundwater Sampling and Testing (SCB1912026-PLN-015 I04).

3.0 Description of Activities

The main activities described in this section pertain to the Borehole Drilling and Coring for borehole IG_BH04. All activities were overseen by the Lead Contractor Wood Engineering & Environmental Services with Major Drilling, headquartered in Winnipeg, Manitoba, contracted to perform the drilling for IG_BH04.

Formal notification to mobilize to site was given to Wood by the NWMO on September 24, 2019, following the Ministry of Natural Resources and Forestry (MNRF) permission to drill. NWMO requested that Wood's and their subcontractors mobilise to site on October 3 or after, depending on availability. WP01 technical lead mobilised to site on October 15, 2019, while WP02 technical lead mobilised to site on November 11, 2019. Drilling sub-contractor (Major Drilling) started mobilizing equipment to site on November 8, 2019. Drilling of IG_BH04 officially started on November 19, 2021 (see Figure 3).

Drilling was performed 24 hours per day and seven days per week on two shifts. Day shift started at 7 a.m. and finished at 7 p.m.; night shift started at 7 p.m. and finished at 7 a.m. This schedule was followed by both Wood and Major personnel. Staffing for Major for each shift consisted of a driller and a helper. A drill foreman was also present on site; while he typically worked day shift, his shift would adjust to cover part of night shift as necessary.

Wood staffing consisted of a core logger and a drill supervisor for each shift. A site coordinator was also present during day shift to facilitate HSE meeting, control site access and monitor equipment and supply inventory. In January 2020, a site support worker was added to assist with data management, quality control and management tasks as well as supervision of site activities. A site manager was introduced in January 2020 to assist the WP02 technical lead with resolving any technical difficulties that would arise at site and minimize drilling interruptions. Personnel in the site coordinator and site manager roles typically worked the same hours as the dayshift crew, adjusting schedules in response to changing conditions and needs at site.

3.1 Site Activities

Wood's drilling supervisor's responsibilities included:

- Measuring and recording depth of every run
- Monitoring and recording drill parameters
- Monitoring and recording drill fluid parameters
- Measuring and recording the volume of drill fluid before and after every run
- Monitoring borehole deviation with the EZ-Gyro

- Retrieving the core orientation on every run with the ACT III and time of core retrieval for the core logger for sensitive sampling procedure
- Programming and performing calibration check of the equipment used
- Collecting fluid samples from Fresh Water, Drilling Fluids, and OGWS
- Recognizing and identifying the conditions that triggered the groundwater sampling procedures and communicating these to site personnel
- Supervising borehole flushing and purging prior to geophysical survey and OGW sampling.
- Supervising borehole grouting
- Directing all drilling personnel
- Assisting the Core Logger as needed
- Act as Site Manager when the Site Coordinator or actual Site Manager is not on site (night shift) or on duty.

3.2 Health and Safety

The drilling and testing program for IG_BH04 conformed to all applicable health and safety standards for the duration of the program with the implementation of some additional safety measures to mitigate the COVID-19 pandemic. Prior to the commencement of the program, a comprehensive "pre-drill" rig inspection was completed by Wood and Major on November 18, 2019. The inspection included checks on the following:

- Operating switches are in working order
- All equipment and protective guards are in place and properly secured
- Cables, chains, pulleys, cable winches, and all latches / lifting devices are in proper working order
- Drill rods are consistent length and manufacturer recommended
- Drill rig mast is per the manufacturer's specifications and has not been modified, and has been regularly inspected
- Drill controls are appropriate and easily accessible (no obstructions)
- Hydraulic lines are secured and not bent/pinched
- Pump lines are in good condition with whip checks installed where required
- Fire prevention supplies are present
- Exhaust piping for the drill motor is properly vented
- Fuel is properly stored
- Maintenance logs were available to confirm inspections were made

In addition to the "pre-drill" rig inspection, daily and monthly rig inspections were also carried out by Major to ensure rig safety and proper operation were maintained during the drilling program.

At the start of the drilling program, hearing protection zones were established by measuring sound levels with a Larson Davis 831 Sound Level Meter. Hearing protection zones were established in all areas where the sound exposure level exceeded 83 dBA considering the 12-hour shift exposure to the same noise levels (O.Reg. 851/139). Based on the measurements, a hearing protection zone was established on the drill deck and all around the sides and back of the drill, including the AMC, STS, and the extra rod storage area.

An RKI Instruments GX-2012 gas detector was used to monitor for the presence of oxygen, carbon monoxide, hydrogen sulphide, and combustible gasses. Initial readings were taken to establish baseline levels prior to the start of drilling; continuous monitoring was performed during the drilling program by mounting the unit in the drill rig, with visual and audible alarms enabled. No alarms were triggered during the drilling program due to gas levels being exceeded. Occasionally the intake lines for the unit would get clogged at the filter and the unit would not get any air; this condition was quickly rectified by replacing the filter in the field.

Toolbox meetings for health and safety were held at the beginning of each shift (day/night), and attendance of all site personnel was mandatory. Each meeting reviewed the daily safety topic, discussed any safety hazards or concerns and their required mitigation efforts, and discussed all activities to be completed during the upcoming shift. Visiting workers were also required to partake in the toolbox meetings; if they were not present at the time of the meeting, they were required to review and acknowledge the toolbox report before being allowed to start work on the site.

3.3 Quality Confirmation

Cross shift meetings were held between day and night shift personnel to make sure knowledge and information from the previous shift was transferred to the next. Each meeting was typically on the order of 15 minutes; longer when necessary. Cross shifts were also carried out between crews as rotations ended and new personnel came on site. Each new crew typically spent a shift or half shift with the departing crew prior to handover. This procedure ensured consistencies between each crew rotation.

For each 24-hour period, the drilling supervisors completed the Quality Confirmation Report. This report included the start and end drill depths for the 24-hour period, a verification of the quality of drill parameters recorded, and the results of checks on the following parameters:

- Drill fluid parameters
- Drill fluid volume
- Borehole deviation
- Fluid sampling (drill water, water source, ground water, purge water, and cuttings)

Calibration of all tools and meters were conducted by the equipment suppliers prior to the start of the project. Further calibration checks were performed daily (or twice daily) at the start of each day shift or night shift for the instruments that were to be used that day. Where use of a tool was not anticipated prior to the start of the shift and the tool was required, the calibration was then checked prior to its use.

4.0 Summary of Drilling, Coring, and Casing

Drilling of IG_BH04 commenced during night shift on November 19, 2019 and was completed at 14h49 on March 14, 2020. A timeline for the drilling activities and progress is shown in Figure 3.

The borehole was advanced to a depth of 1000.2 metres. At the borehole collar (see Appendix B), 0.67 m of construction gravel, followed by 0.94 m of PQ core was drilled initially to seat the PWT casing. Then a total of 998.59 m of HQ3 rock core was drilled over 359 core runs for a total depth below collar of 1000.2 m. Both the PQ and HQ3 core were logged as part of WP03 for a total drilled core length of 999.53 m (= 998.59 m + 0.94 m). See WP03 Data report - SCB1912026-REP-008_WP03 Geological and Geotechnical Core Logging, Photography and Sampling for IG_BH04 (Wood, 2021a). The borehole was set at an azimuth and dip of N110°, -70°, and the average core run length was 3m.

4.1 Drilling Progress

Over the course of the drill program, coring progress was variable due to multiple factors, including surface casing installation and cementing, grouting of inflow zones, bore hole deviation monitoring (survey and installation of wedge), maintenance, weather delays, equipment failures (power supply issues associated with cold weather), and stoppages related to a) data collection in acQuire for core logging, core photography and sampling (WP03 Data Report, Wood, 2021a), b) time sensitive sampling and sampling and c) water sampling or testing activities (WP07 Data Report, Wood, 2021b). Drilling progress is shown graphically on Figure 4 for the overall project, and Figure 5 for the daily progress by shift. The maximum meterage attained for a single shift during the program was 27 m on night shift on December 29. The average meterage per shift was 10.25 m. This average does not include downtime or delays associated with WP07 Opportunistic ground water sampling activities, surface casing installation and cementing, grouting of inflow zones, and the installation of wedges for borehole deviation.

In total two opportunistic ground water sampling (OGWS) events occurred (see section 6.0). A potential third sampling event (between March 9 to 11, 2020) near the end of the hole (950m) was discussed but did not occur.

As previously stated, drilling of IG_BH04 started on November 19, 2019 and was completed during dayshift on March 14, 2020. A final EZ-GYRO survey of the hole was then completed on March 15, followed by borehole flushing. Packer testing was performed at 970 m deep on March 16, 2020. Following this testing, the rods were removed from the hole. Force majeure was declared at 19h00 on March 17, 2020, due to the COVID-19 virus pandemic. On March 19, 2020, approval was received from the NWMO for the installation of two Van Ruth plugs, which were installed sequentially in the borehole at 584.5 m and 584.21 m to subsequently grout the hole between 560.0 and 584.2 meters.

Decommissioning was commenced on March 20, 2020 and a borehole cap was installed on March 24, 2020. All equipment was demobilized, and the site was cleared and vacated on March 29, 2020.

Task Name	Duration (days)	Start	Finish
Mobilization and Fluid Monitoring Setup	12	08-Nov-19	19-Nov-19
PWT Casing Installation	3	19-Nov-19	21-Nov-19
Drilling & Coring Activities	117	19-Nov-19	14-Mar-20
Televiewer Survey	1	01-Dec-19	01-Dec-19
HWT Casing Installation and Cementing	5	02-Dec-19	06-Dec-19
WP07 Groundwater Sample Collection and Preparation	8 24	10-Dec-19 22-Jan-20	17-Dec-19 13-Feb-20
Borehole Deviation Correction	6	03-Jan-20	07-Jan-20

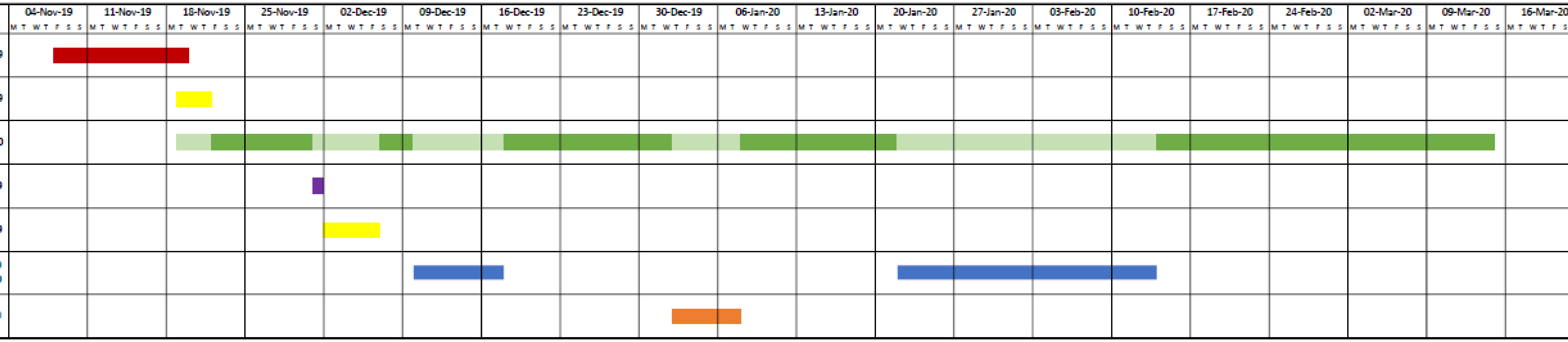


Figure 3: Timeline of drilling, coring, casing and sampling for IG_BH04

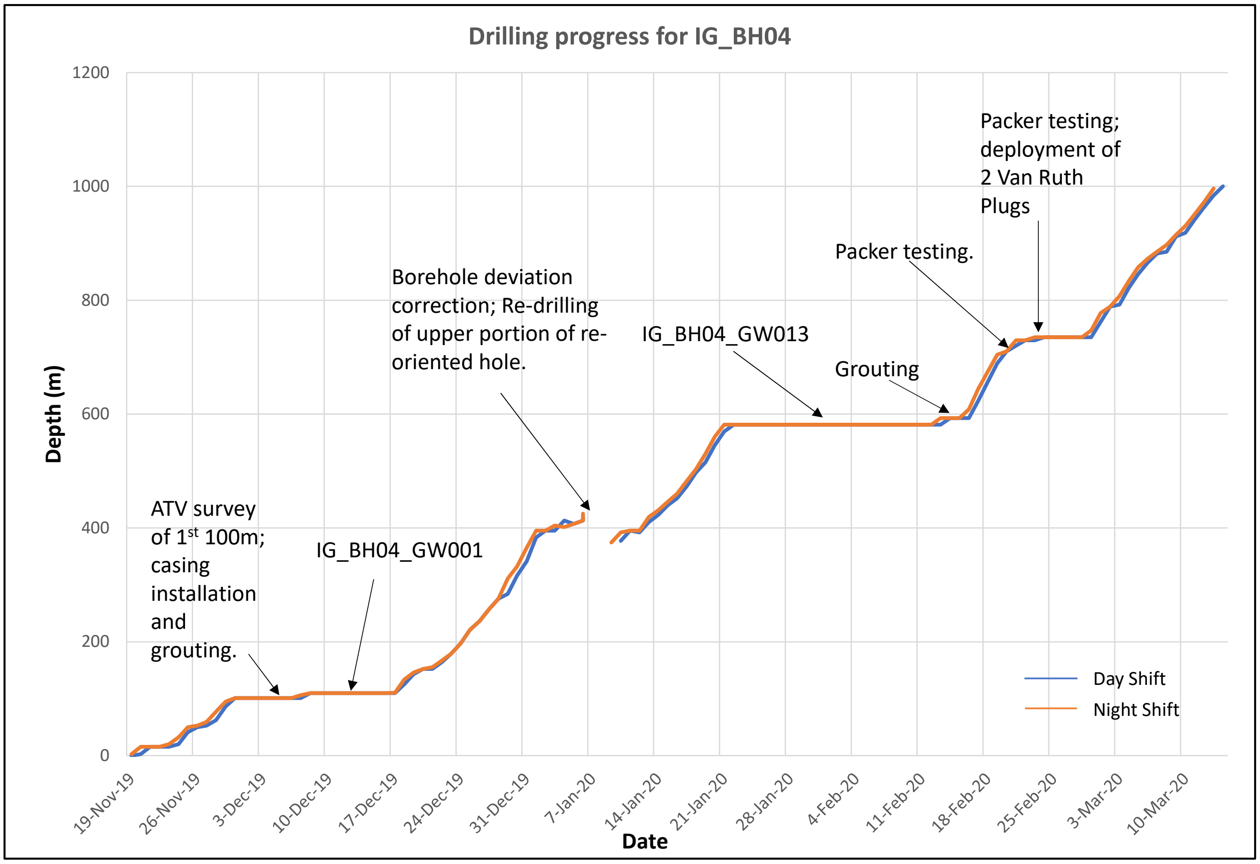


Figure 4: IG_BH04 Drilling Progress

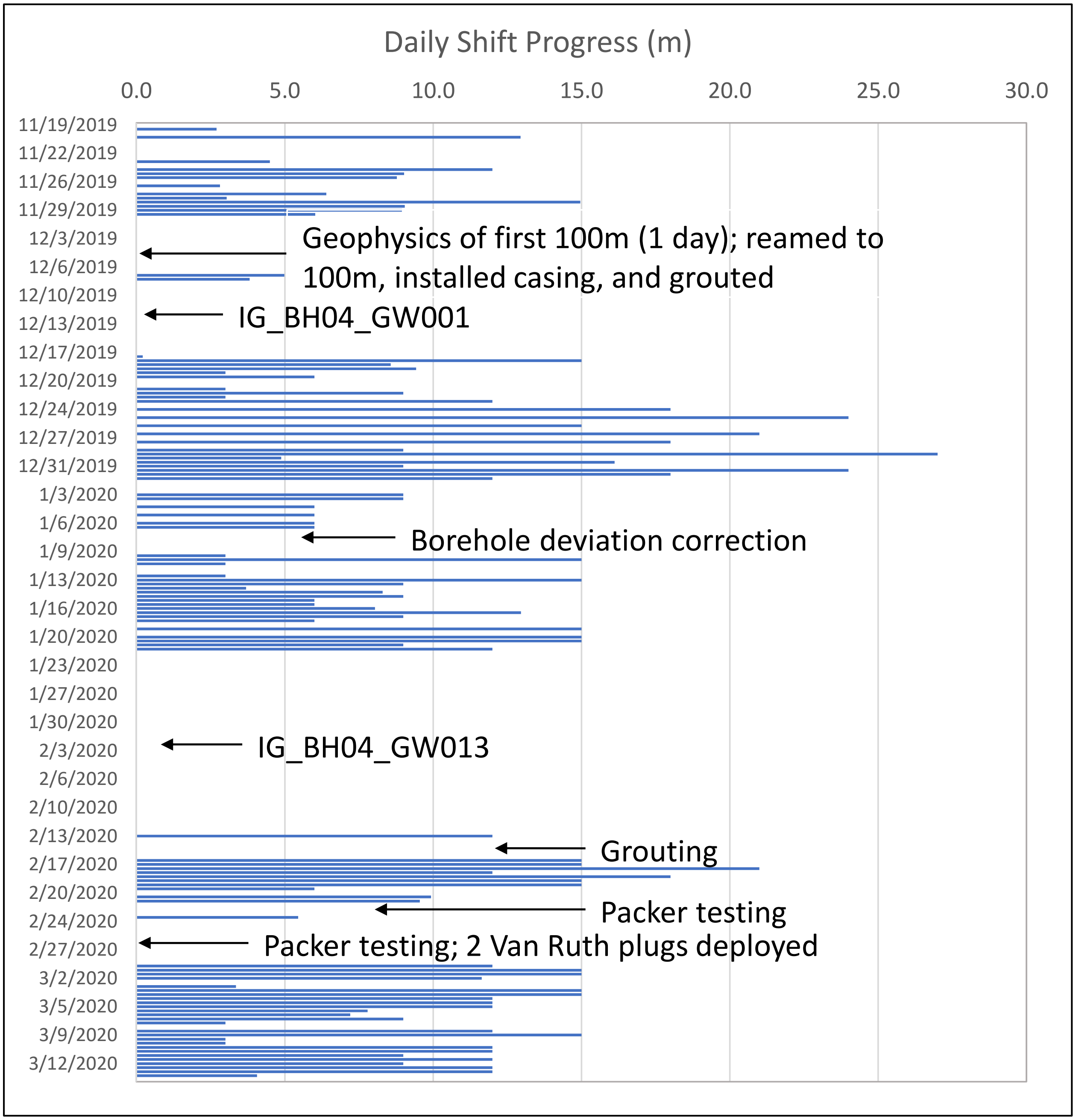


Figure 5: IG_BH04 Daily Shift Progress

4.2 Drilling Details

4.2.1 Drill Rig Setup

Drilling for IG_BH04 was performed using the Atelier Val d'Or Inc (AVD) Skid-Mounted Diamond Drill Rig, model VD8000, as shown in Figure 6. The rig was equipped with a custom designed cover and tarpaulin for winter drilling. The rig was also equipped with a fluid containment system to minimize the potential for drill fluids to enter the environment.

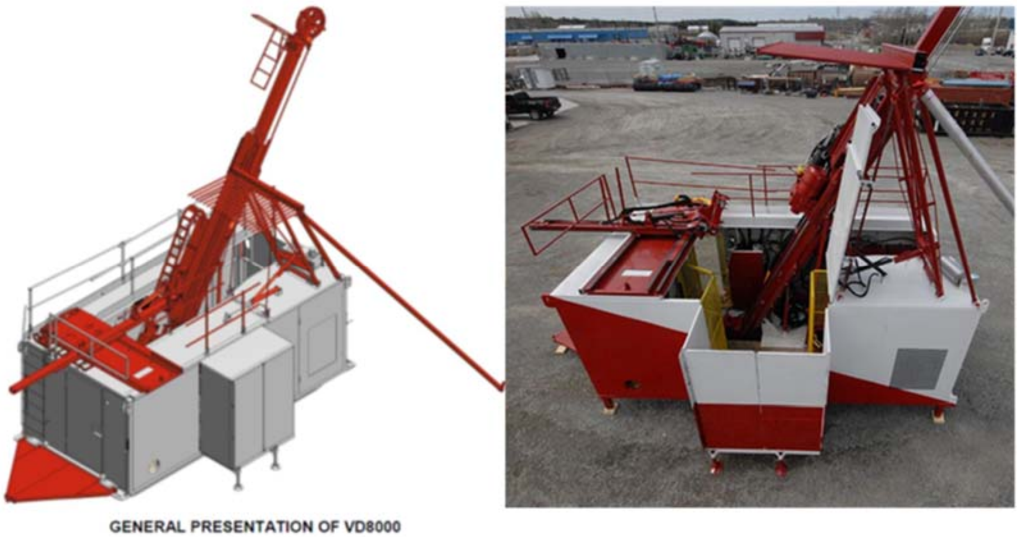


Figure 6: Major Drilling's VD8000 series drill rig schematic (left) and actual rig (right) (courtesy Major)

Drilling was carried out with a constant water flush, and solid drill cuttings removed from the fluid using an Australian Mud Company Pty Ltd. (AMC) Solids Removal System™ (SRU). With this system, the cuttings are removed from the return drill fluid via a centrifuge, allowing re-use of the drilling fluid. The SRU setup is shown in Figure 7.

Figure 7: Typical Solids Recovery Unit (Courtesy AMC)

Major commenced mobilization to the site on November 8, 2019, following completion of the pad preparation as part of WP01. Wood personnel mobilized to site on November 11, 2019; and between November 12, 2019 and the commencement of drilling activities on November 19, 2019, worked on unpacking and setting up the site for the program. During this time, testing and calibration of key equipment was also performed (Wood, 2019a). Major prepared the drilling infrastructure, including rig placement and alignment (as described below), installation and preparation of the drill support shack or Dry shack (Wood, 2019b), core logging shack or Dry shack (Wood, 2019b), drill deck, and connection of all hoses and lines for the drilling. Figure 8 shows an overall view of the drill site.

Figure 8: Aerial view of the site, looking North-East. Access road is in the lower right corner of photo

4.2.2 Rig Maintenance

Routine maintenance was carried out for both the drill rig and for the coring equipment during the drilling for IG_BH04. In addition to these routine activities, additional maintenance on the drill transmission, drill pump and core tube release mechanism were performed.

Also, repair to the fluid recirculation system (leaks) and adjustments to the trailblazer system (frozen sensors) were performed as required to minimize the environmental footprint and ensure proper monitoring and recording of the drill data.

4.2.3 Tracking Borehole Depth

Borehole depth was tracked using multiple methods. The primary method was to count the drill rods and combine the number of rods with the known measurement of the drill bit assembly and the stickup of the drill rods above the surface. This depth, which is an indication of the length of hole drilled rather than the depth below the ground surface, was determined using the following relation:

Drill Depth (m) = (Length of Bit and Coring Assembly (containing the inner barrel, ACTIII) + (Number of drill rods x 3.0 m)) – Stick-Up

New rods were used for the drilling program, and the drill rods length were confirmed prior to drilling. Rods were stored on a skid mounted sloop so that mis-matched rods would be obvious. The calculated depth was checked at the end of each run and at the end of each shift.

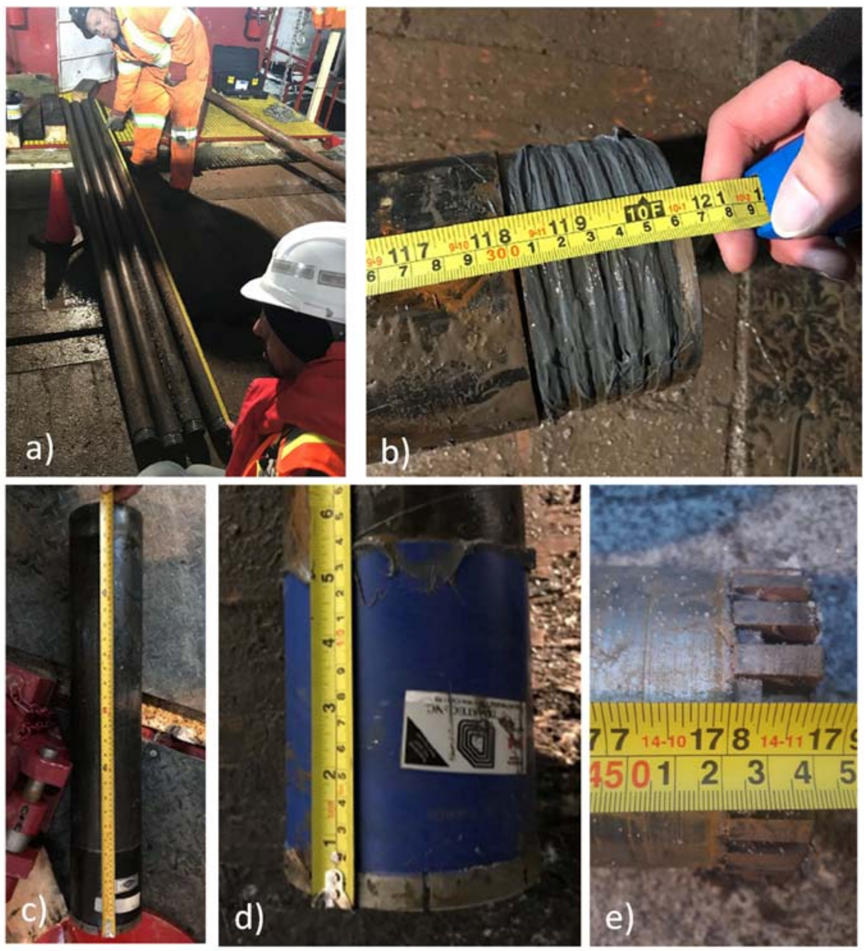


Figure 9: Drill String Measurements a) drill rods (full length) b) drill rods (close up) c) PWT shoe d) Diamond HWT core bit e) core barrel (close up)

The second method used to track the borehole depth was via the Trailblazer system, which monitored the drilling parameters and had a laser distance measurement device mounted to the head (i.e., chuck) of the drill that had been programmed to calculate the depth of the borehole. This system is reported to be accurate to 1 mm. The Trailblazer system required fine tuning and adjustment from the operator at the beginning of the hole (depth less than 100m) and experienced freezing during the advancement of a couple runs. The system was investigated by a Major specialist, recalibrated in a timely manner and continued to work as intended. As a consequence, data gap exists sporadically in the database.

At the end of each run and at the end of the shift, the calculated depth was compared to the laser distance measurement for confirmation. However, the drill string measurement was used as the primary record for borehole depth. In addition, for each bit change or other activity that required the rods to be removed from the hole, the number of rods were recounted and checked to confirm the depth.

A final rod count was performed on March 16, 2019 at drilling completion, once the use of the IPI equipment at 970m was completed. The total number of 3 m rods (332) was compared to the count recorded in WP02 DQC form dated March 14, 2019 (CR359) to confirm the final borehole depth.

4.2.4 Drill Cutting Management

The cutting-laden drill return fluid was pumped directly into the AMC SRU™ unit, which used centrifugal action to separate the fine solids from the water before returning the drilling fluid to the Clean Water Tank. These cutting solids were then transferred to 1 m^3 tote bags, which, when full, were picked up by a skid steer and placed in a storage area which was located in a secondary containment.

Once a sufficient quantity of tote bags was collected, a sample from each bag was taken and sent to ALS Environmental Laboratories for Toxicity Characteristic Leaching Procedure (TCLP) testing under the Federal and Provincial Waste Regulations (Mar, 2008) – Ontario Ministry of the Environment Conservation and Parks, General Waste Control Regulation No. 347/90. The samples were tested for Cyanide, Fluoride, Mercury, Ignitability, Leachate Procedure, Leachable Metals, Nitrate/Nitrite-N, PAH, PCB's, VOC's. The lab results were forwarded to the Waste Management at the Township of Ignace, and once approval was granted, the totes were transported to the local landfill using triaxial haul trucks.

4.3 Casing Installation Details

Following alignment of the drill rig to azimuth 110° and setting the plunge angle to 70°, PWT Conductor Casing was installed into the bedrock to 1.83 m and cemented to minimize fluid loss in the near-surface fractured bedrock. Overburden and fill (gravel) at the hole location was 0.67 m thick, measured down dip along the borehole. The PWT was then temporarily sealed to the water retention tub (dimensions: 1.2 m x 1.8 m x 0.6 m deep) using a rubber gasket and a bolted flange. The tub was also equipped with a rubber flap to prevent water loss associated with splashing.

Core was retrieved from the casing shoe upon removal; this core has a diameter of 127 mm, and represents between 0.67 m and 1.61 m. HQ3 coring was then conducted within the PWT Conductor Casing, advancing to 2.7 m, followed by reaming and installation of HWT Surface casing to 2.83 m. The PWT Conductor Casing was then advanced to 3.09 m.

The HQ3 coring continued, with the HWT Surface Casing following 3 m behind. At a depth of 15.65 m, the rods were pulled, and the hole was reamed for HWT Surface Casing down to 14.76 m (Figure 11). The PWT Conductor Casing was then advanced to 5.97 m. The placement depth for the PWT Conductor Casing was based on extending the casing beyond an undulating fracture and broken core zone located between 5.45 and 5.69 m, associated with drilling fluid loss.

Figure 10: IG_BH04 : First core boxes illustrating PQ core and broken HQ3 core zone cased (5.45 and 5.69 m)

Following placement of the PWT Conductor Casing, the HWT Surface Casing was retracted, and the hole grouted on November 21. Calculations indicated that the volume to be grouted was approximately 225 litres. A total of 31 – 20 kg bags of HS cement were mixed with 400 litres of water for a total volume of 500 litres. As the ground below the casing was good, the drillers preferred to grout the bottom of the hole instead of installing a Van Ruth plug. When the borehole was filled, the PWT casing lifted. The drillers pumped the 400 litres of cement until the back pressure cause the casing to lift again, breaking the blocking. Note at the time of grouting, the 0.67 m thick gravel at surface was frozen. One hundred litres of cement was left in the mixing tote. Following grout cure, the HWT Surface Casing was re-advanced down to 14.76 m, and HQ3 coring resumed.

Coring continued to a depth of 101.2 m (CR039), achieved on November 20, 2019. At this time, the borehole was flushed and prepared for the televiewer survey, which was conducted on November 30, 2019. A casing shoe was then installed, and the hole reamed down to 100.77 m, and the HWT Surface Casing was installed and grouted. The installation depth was selected in discussion with NWMO and was chosen to ensure the casing depth was located below both a fractured zone located between 99.4 and 99.7 m, and a steeply dipping features encountered at 100.0 and 100.48 m depth.

To install and grout in the casing, the reaming tool was run to a depth of 100.77 mbgs, and then the casing was pulled and a shoe bit, which has grooves cut in the end to allow grout to flow through it, was installed and the HWT casing reset to 100.79 m. For grouting, 350 litres of potable water were placed in a 1m tote, and 20 – 20 kg bags of HS cement were added. A hydraulic mixer was used to stir the solution, producing approximately 600 litres of grout. Following mixing, the grout was pumped down the casing, displacing the water from the top of the previously grouted PWT surface casing into the collection tub. No grout was observed flowing from the top of the casing.

A vulcanized Wiper Plug was inserted into the HWT casing below the water swivel, and 740 litres of potable water was added to the tote. Water was pumped through the HWT Surface Casing until the grout was observed flowing from the PWT Conductor Casing into the collection tub, at which point the pumping ceased. The grouting was completed at 4:30 p.m. on December 5, 2017; a total of 410 litres of water was pumped into the HWT Surface Casing.

On December 7, 2019, the grout had cured sufficiently, and drilling resumed, first coring down through the grout, followed by a return to HQ3 coring of the bedrock on night shift.

4.4 Cement Grouting Details

In addition to the grouting associated with the installation of the PWT Conductor Casing and the HWT Surface casing, grouting was performed in three other cases and attempted in one other unsuccessfully due to premature deployment of a Van Ruth plug.

The first instance of grouting occurred over the interval between 101.5 and 110.0 m and was associated with two large undulating fractures that were sub-parallel to the borehole axis. The first of these was present between 101.76 m and 104.20 m, and the second was present between 107.7 m and 108.74 m. The fractures were associated with a loss of drilling fluid in excess of 1000 litres and was tested for an Opportunistic Groundwater Sample. To seal the fractures, on December 16, 2019, a drillable VK Type A grout plug was placed in good ground below the bottom of the HWT Surface Casing at 101.2 m. Twelve bags of 20 kg bags were mixed in 200 litres of water, but the resulting mixture was found to have too low of a water : cement (w:c) ratio and was not pumpable. An additional 60 litres of water were added, which gave a mixture with a pea soup consistency (an approximate w:c ratio of 0.4). This was pumped into the hole at a final pressure of 500 psi, filling the voids and fractures between 101.5 and 110 m.

The second instance of grouting following the installation of the casing was related to the borehole re-orientation attempts using the Clappison Wedges discussed in Section 4.6 below. The placement of the two wedges were not successful in correcting the borehole orientation, so on January 6, 2020 the rods were pulled back to 374.21 m and the two orphaned hole stubs associated with the Clappison Wedges were grouted. The grout mixture consisted of 48 bags of GU cement and 475 litres of water for a water : cement (w:c ratio of 0.5 with a final volume of approximately 680 litres. Due to cold temperatures, the cement bags were placed in the heated Wood core storage container prior to mixing. The mixed cement was pumped down the hole for the required volume of 475 to 500 litres. The grout was allowed to cure for 6 hours, then the hole was wash-bored down to 377.7 m depth; the water was pumped into totes and was removed using the vacuum truck.

This procedure was followed by the placement of two steel wedges described in Section 4.6 and the resumption of drilling.

The third instance of grouting was performed on February 14, 2020 in response to the three large fractures/faults and associated broken core zones between 576.27 and 581.0 m. The design called for grouting 18 m of the borehole with 0.65 w:c grout with a VK plug. Nineteen bags of warmed GU cement were mixed with 260 litres of water, producing 300 litres of grout mix. A slug of 275 litres was pumped down the hole, which corresponds to 38 m of borehole volume. A cement slug and displacement plug were installed at 572.21 m, so the grouted zone extended from 572.21 to 593.21 m. The grout was allowed to cure for 24 hours before resumption of drilling.

After several days of drilling the hole had been advanced to 735.14m on 24 February 2020, the zone described above became water-producing again, likely due to poor penetration of grout into the structures. This was the final determination after several days of packer testing the bottom of the borehole to identify where the water loss was occurring. The decision to re-grout the zone was made on February 26, 2020 using a thinner grout to penetrate, followed by a thicker grout to refill the hole. The plan was to place a Van Ruth plug to be deployed at 590.21 m (below the zone), and a groutable VK type A plug was to be deployed at 572.21 m (above the zone). The proposed batch mix was the first 200 litre batch of grout to be prepared with a w:c ratio of 0.75. For this mixture, 200 litres of water were to be mixed with 13 bags of GU cement, and 150 litres were pumped into the hole. A second batch of grout was then to be prepared with a 0.55 w:c ratio by mixing 250 litres of water with 22 bags of GU cement. On February 27, 2020 during the deployment of the second plug, the VK plug, above the zone, following some difficulty in passing the first steel wedge, the VK plug prematurely deployed 61 m above the planned zone. In consultation with NWMO the decision was taken to abort the grouting of this section and continue drilling with a known loss of water that would have to be made up during the completion of the borehole. There had been some expectation that the dewatered zone (note water extraction of this zone was performed for over 21 days) and with the drill cuttings the loss would reduce. This was found not to be the case. After the two plugs were drilled out borehole coring resumed on February 29, 2020.

A final cement grout was applied following completion of the borehole, as the water bearing zone described above again became water producing (Grout 5). To grout this zone, two Van Ruth (deployable drillable total seal) plugs were set below the zone at 584.5 and 584.21 m. A displacement plug was pumped on top of the Van Ruth plugs to push them out of the drill rods. A 0.65 w:c grout was prepared by mixing 225 litres of water with 17 bags of GU cement. This slug was pumped down with a displacement plug on top at 560.1 m. The cement plug extends from 560.1 to 584.21 m, with a bottom plug at 584.85 m. This plug was installed on March 18, 2020 and was left in place when the borehole was abandoned at the cessation of site activities associated with the COVID-19 precautions.

A schematic showing the plug locations and their extents is shown in Figure 11.

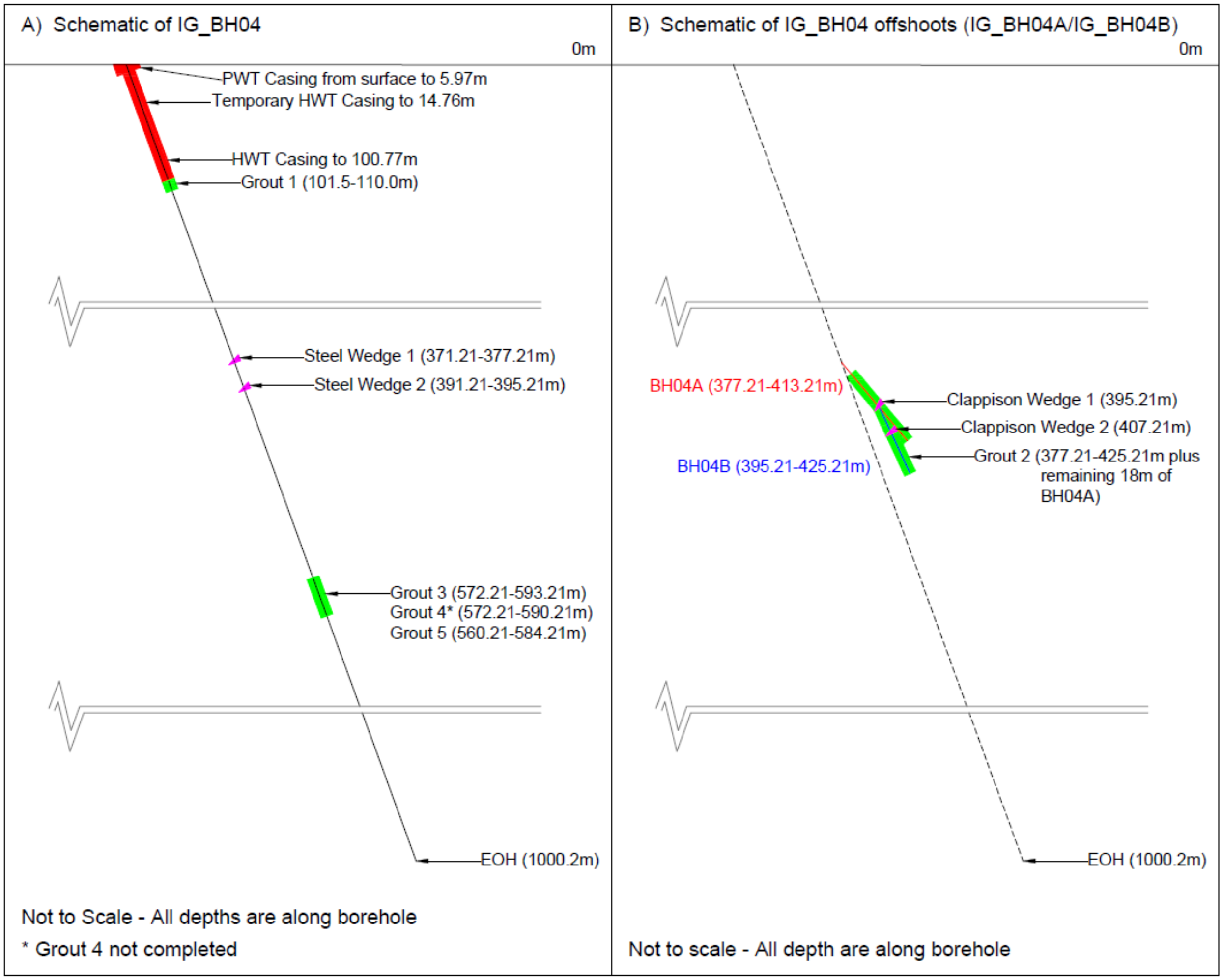


Figure 11: Schematic of Borehole IG_BH04 showing casing, wedge, and grout locations/intervals

4.5 Coring Details

Drilling was performed using HQ3 wireline diamond drilling techniques and three-metre-long HQ-sized drill rods, with the exception of the beginning of the hole that was cored using a PQ bit and one meter PQ size drill rod. As specified in section 4.3, at a depth of 15.65 m, the rods were pulled, and the hole was reamed for HWT Surface Casing down to 14.76 m. No HQ/PQ borehole opener were used.

Each HQ rod was manually added to the string as drilling advanced. Two – triple tube core barrels were in use at all times so that one core barrel could be inserted and locked into the drill string to resume drilling while the core was being extracted from the second core barrel on surface. Core tubes were retrieved using a wireline system, whereby an overshot tool is locked onto the end of the core barrel, which is then pumped down and locked into the core barrel.

The HQ3 triple tube drilling system makes use of two semi-circular trays to line the inside of the core barrel. These trays, called splits, minimize the disturbance of the core due to the drilling, helping to keep the core in position both while drilling and when the core is pumped out of the core barrel. The splits also minimize the fluid circulation within the core tube, which helps to retain any fine-grained infilling on discontinuity surfaces. The details of the casing and coring diameters used are summarized in Table 1.

Table 1: Dimensions of all Drilling Equipment and Core

Casing Type	Outer Diameter (mm)	Inner Diameter (mm)	Borehole Size (mm)
PWT Casing	139.7	127	N/A
PWT Shoe Bit	143.76	122.94	143.76
PQ Rods	117.5	103.2	N/A
PQ Bit	122.3	85.09	122.3
PQ Core	85.0	N/A	N/A
HQ to PQ Hole Opener	122.3	88.9	122.3
HWT Casing	114.30	101.60	N/A
HWT shoe bit	117.60	99.82	117.60
HWT casing advancer pilot bit	117.60	99.82	117.60
HQ rods	88.90	77.80	N/A
HQ3 bit	95.76	61.24	95.76
HQ3 core	61.10	N/A	N/A

4.5.1 Ground Conditions

Ground conditions encountered in IG_BH04 were generally good. IG_BH04 intersected eight faults, 15 broken core zones, 20 brittle-ductile shear zones, and 10 ductile shear zones (see WP03 Data Report for IG_BH04 SCB1912026-REP-008 (Wood, 2021a). Structures intersected with a width larger than 20 cm are found in Table 2 below. A partially intact, epidote infilled fracture was observed running parallel to the core axis from approximately 99.20 m and ends at 104.2 m The fracture caused the drill bit to seize.

Table 2: Summary of Logged Structures Greater than 20cm

Borehole ID	Project Code	Depth From	Structure Type	Structure Width (cm)	Defining Mineral	Defining Mineral
IG_BH04	IGNACE	122.12	BCZ	48		
IG_BH04	IGNACE	276.69	SHR	22	Iron Oxide	
IG_BH04	IGNACE	328.24	FLT	161		
IG_BH04	IGNACE	375.00	SHR	38	Calcite	Chlorite
IG_BH04	IGNACE	410.34	SHRD	26	Hematite	Calcite
IG_BH04	IGNACE	576.07	SHR	56	Hematite	
IG_BH04	IGNACE	945.68	SHR	28	Epidote	Alkali-feldspar
IG_BH04	IGNACE	945.79	FLT	20		
IG_BH04	IGNACE	968.93	BCZ	20		

4.5.2 Core Quality

The overall core quality for IG_BH04 was good and on several occasions a solid 3 m drill core was removed from the core barrel. Possible core loss was observed in 26 potential areas (Core loss zone logged only in 2 areas). These areas were mainly due to mechanical processes from grinding of the drill core or from core which slipped from the catcher and was retrieved on the next drill run. Wood was unable to confirm if the lost core zones were driller induced or cavities in the borehole due to only receiving the televiewer results for the first 100 m. Structural features and RQD (fracture frequency) are described in SCB1912026-REP-008_WP03 Core Logging (Wood, 2021a).

A "candy cane" pattern was observed on the core from 152.48 m to 164.21 m. The "candy cane" pattern is due to a failure of the locking mechanism in the backend assembly. During the drilling process, a locking mechanism is engaged in the backend assembly, this prevents the core tube from rotating. If the locking mechanism fails, the core tube spins in the core barrel causing the "candy cane" pattern along the core. This pattern is common in deep inclined drill holes.

Drill bits are worn down during drilling by intersecting lithological units with a greater hardness and when intersecting certain structural features. Hard ground conditions can wear a drill bit quickly. When drill bits are worn down, drilling requires increased torque and creates and uneven or wavy core diameter. These patterns were observed in the borehole when the bits were worn. Drillers were often aware when the drill bit was worn as they noticed increase torque during cutting.

4.5.3 Drill Bit Changes

Bit changes were required as coring progressed and as drill bits became worn down. Bit changes involved extracting the last core tube from the borehole. The driller then removed all the drill rods from the borehole in 6 m lengths. The 6 m drill rods were stacked in the drill shack using the core handler and stored to be easily accessible to return down the borehole once the drill bit is changed. The condition of the drill rods, core barrel and bit were all inspected for signs of damage or wear, and tear. The bit was replaced if needed. Ground conditions in IG_BH04 were very hard and frequent drill bit changes were required. Table 3Table 3 below is a summary of Drill Bit changes for IG_BH04, including drill bit types.

Table 3: Summary of Drill Bit Changes

HQ3 Drill Bit Changes		
Bit type	**Start Depth (m)**	**End depth (m)**
Hobic 11AC	92	110
Hobic 11AC	110	197
Hobic 11AC	197	236
Hobic 11AC	236	314
Safari 9AA	314	460
Safari 9AA	460	592
Safari 9AA	592	788
Hobic 11AC	788	868
Safari 9AA	868	EOH

4.6 Borehole Location and Orientation Details

The borehole trajectory was tracked using the Reflex EZ-Gyro, in single shot mode, a survey tool that is not subject to magnetic interference (Wood, 2019a). The details of the how the trajectory was maintained is explained below.

4.6.1 Borehole Location and Orientation

The collar coordinates of IG_BH04 were surveyed by Tulloch prior to drilling on November 18, 2019 as shown in Table 4 and Appendix B.

Table 4: IG_BH04 Final Surveyed Collar Coordinates

Borehole	Northing (m)	Easting (m)	Elevation (m)
IG_BH04	5486488.05	556957.25	443.46

Note: Coordinates shown are UTM Zone 15N NAD83 CSRS (2010). Elevation shown are referred to vertical control monument 0011993U067 having published elevation of 419.358m CGVD28-78.

IG_BH04 was planned to be drilled at a dip of -70° with an azimuth of 110°. Maintaining the dip and azimuth of the hole within a 5° tolerance cone was part of the scope of work. Once a shift, the Reflex EZ-Gyro was used during drilling to confirm the borehole trajectory, with the exception of the following depth interval 452.2 to 506.21 m, which was surveyed with the EZ-Trac tool due to failure of the Gyro's rotor-release-lock, and until a replacement could be obtained. Calibration checks of the equipment used were performed on surface before each use. Borehole survey readings can be found in Appendix C (or in the Data Delivery file called: IG_BH04_WP02_Gyro_Downhole_Survey_Drilling).

A final borehole survey was also carried out upon completion of drilling for the full length of the borehole with the EZ-GYRO using a measurement interval of 10 m (See Appendix C or Data delivery file IG_BH04_WP02_Gyro_Downhole_Survey_Final_R1). Due to elongation in the wireline, the final survey points do not correspond exactly to the incremental ones performed on each shift, there are slight differences in the survey location, typically +- 1 m X-Y.

For borehole survey measurements during drilling, the bottom of the borehole/bottom of the EZ-Gyro was taken as the depth of measurement. The point of measurement on the EZ-Gyro is actually located 0.84 m above the bottom of the tool. The incremental survey results were then corrected by 0.84 m post drilling. The corrected survey result taken during drilling and the final survey measurements collected upon completion of the borehole are presented in Figure 12.

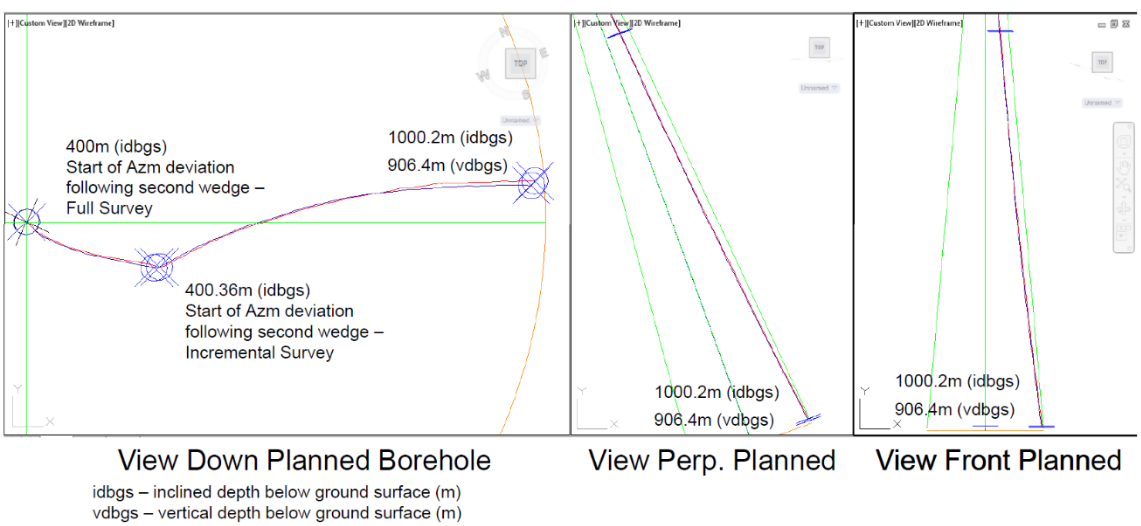
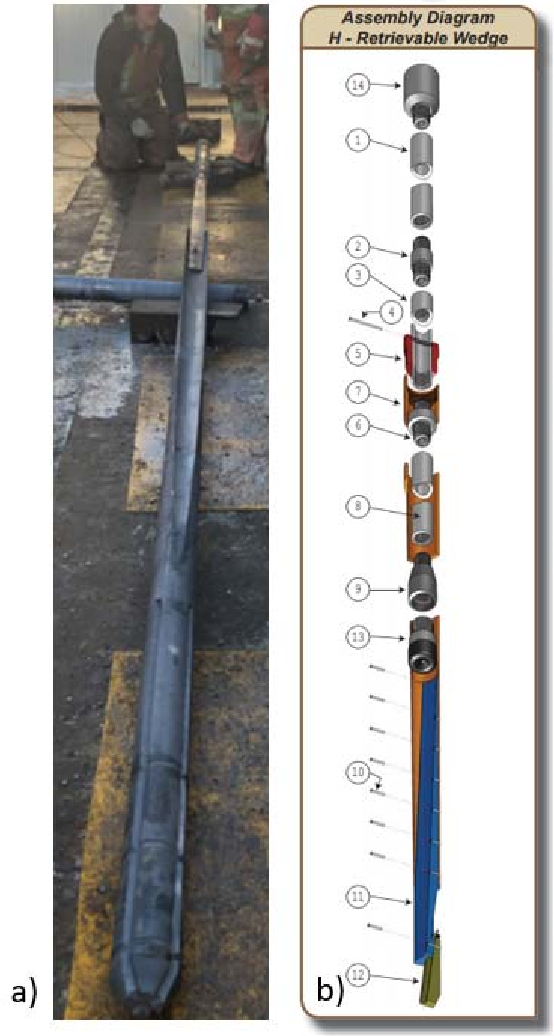


Figure 12: Orientation of Corrected Incremental vs Final Downhole Survey. Green indicates the 5° tolerance cone

4.6.2 Borehole Corrections

To maintain the borehole trajectory within the 5 degrees cone tolerance, two types of wedges and one core barrell stabilizer were used (Figure 13). Details are presented in the sections below.



Item	Qty	Description / Material	Size/Pt. No
1	1	10' BW Drill Rod (less coupling)	91-10-310
2	1	BW Rod Coupling	91-10-319
3	1	Wedging Barrel (2ft BW Rod)	629-07
4	1	Shear Pin, 5" Common Nail	625-49
5	1	Wedge Housing Collar	629-04
6	1	Retrieving Coupling	629-08
7	1	Wedge Housing	629-03
8	1	5' BW Drill Rod (less coupling)	91-10-305
9	1	Tapered Sub	629-09
10	8	Shear Pin, 4" Common Nail	625-50
11	1	Wedge Blade	629-00
12	1	Locking Wedge	629-01
The following items are not included in the assembly, but are supplied by TIME			
13	1	NWC Concave Bit	629-13
14 A	1	Sub, HWL Rod Box to BW Rod Pin	93-55-502
14 B	1	Sub, HT Rod Box to BW Rod Pin	93-55-512

Figure 13: Borehole correction a) Steel Wedge b) Clappison Wedge Schematic & Part details (Courtesy of Time) c) HEX Barrel Stabilizer

4.6.2.1 Clappison Wedging

Two Clappison wedges were placed during the drilling of IG_BH04 (Figure 14). Due to the significant and relatively sudden reduction in the dip, it was determined that the borehole would leave the 5° Error cone A Clappison retrievable wedge IG_BH04 – CL#1 was placed on January 03, 2020. The Pre-Wedge Actual Azimuth was 133.4° and the Actual Dip was -60.5° at a depth of 392.2 m. The goal of the wedge was to correct the dip to closer to -70° and to reduce the azimuth to closer to 110° .

The drillers lowered the Clappison wedge down the borehole and oriented the wedge manually to 179.9° at a depth of 395.2 m. The Clappison wedge azimuth was measured using a Reflex EZ-Trac (this instrument was used and available from Major Drilling as the correct extension part for the muleshoe on the Gyro had not been shipped with the equipment) and two successive measurements were taken. The Reflex EZ-Trac sat in the muleshoe adaptor on top of the Clappison. Once the Clappison was orientated, downward pressure was applied shearing off the shear pin, and setting the shoe at the bottom of the borehole. Once the pin was sheared, the drillers began reaming the hole.

The Bullnose reamer was lowered down the borehole to the wedge. The Bullnose deflected off the wedge in the desired direction. The final depth of the HQ Bullnose/Ream was 396.11 m. The drillers reamed the hole up and down a couple of times to make sure the borehole was free of obstruction. After reaming was complete, the drillers pulled the rods with the Clappison retrievable wedge attached.

The Clappison wedge was removed at surface and a tapered wedge bit was attached onto the HQ rods and lowered down the borehole. The Tapered wedge bit was used to ream past the cut. (Tapered bit 45 degrees on each side to get back in the borehole.) Once the drillers completed reaming with the tapered wedge bit, the drill rods were removed from the borehole and a standard crown coring bit was attached to ream past the cut and to continue drilling.

The post-wedge survey was measured on January 4, 2020 and had an actual azimuth of 114.7° and an actual dip of -58.4° at a survey depth of 410.2 m. Table 5 below summarized the Clappison results. The Clappison was successful in correcting the azimuth from 133.4° (pre-wedge azimuth) to 114.7° (post-wedge azimuth). The Clappison wedge was unsuccessful at steepening the borehole to the planned dip of -70°. The pre-wedge dip was -60.5° and the post-wedge dip was -58.4°. A straight borehole was established by coring with a square bit, to develop the borehole back to the previous readings.

Table 5: Summary of First Clappison Wedge (CL1) Results

	NWMO IGNACE DRILLING - DATA QUALITY CONFIRMATION (DOC ID: SCB1912026-FOR-052 WP02 DQC Drilling R0) BOREHOLE WEDGING			
Borehole	IG_BH04 - CL#1			
Date Wedge Planned Azimuth Planned Dip	03/01/2020 110° 70°		Date Survey #1 (Pre-Wedge) Actual Azimuth Actual Dip Depth of Survey	02/01/2020 133.4° 60.5° 392.2 m
Depth Wedge Set Wedge Azimuth Check #1 Wedge Azimuth Check #2 Final Depth of NWC Drilling Final Depth of HQ Bullnose/Ream	395.2 179.9° 179.9° 396.11 m 396.11 m		Date Survey #2 (Post-Wedge) Actual Azimuth Actual Dip Depth of Survey	04/01/2020 114.7° 58.4° 410.2 m

A second Clappison retrievable wedge correction was attempted with the wedge placed t 407.21 m. Clappison retrievable wedge IG_BH04-CL#2 commenced January 5, 2020. The actual azimuth was 114.3° and the actual dip was -59.8° at a survey depth of 404.21 m. The goal was the same as above to correct the borehole to a planned azimuth of 110° and a planed dip of -70°. The process is the same mentioned above with a wedge azimuth set at 182.2°. Borehole wedging data for IG_BH04-CL#2 is presented in Table 6 below. The azimuth deviated from 114.3° to 111.2° and the dip shallowed from -59.8° to -58.9° at a post-wedge survey depth of 422.2 m. The dip was a concern therefore a decision was made to install a steel wedge.

Table 6: Summary of Second Clappison Wedge (CL2) Results

	NWMO IGNACE DRILLING - DATA QUALITY CONFIRMATION (DOC ID: SCB1912026-FOR-052 WP02 DQC Drilling R0) BOREHOLE WEDGING			
Borehole	IG_BH04 - CL#2			
Date Wedge	05/01/2020		Date Survey #1 (Pre-Wedge)	05/01/2020
Planned Azimuth	110˚		Actual Azimuth	114.3˚
Planned Dip	70˚		Actual Dip	59.8˚
			Depth of Survey	404.21 m
Depth Wedge Set	407.21		Date Survey #2 (Post-Wedge)	07/01/2020
Wedge Azimuth Check #1	182.2˚		Actual Azimuth	111.2˚
Wedge Azimuth Check #2	182.2˚		Actual Dip	58.9˚
Final Depth of NWC Drilling	408.14		Depth of Survey	422.2 m
Final Depth of HQ Bullnose/Ream	408.14 m			

It is believed that one key thing may have contributed to the more sudden deviation. Firstly, from a depth of 320m, the drilling went to one shift as this was during the Christmas period, and drilling and logging rate increased. This in tern by increasing the advance rate, resulted in greater deviation of the drill string.

By the time the mule shoe which had not been shipped with the equipment arrived on site in in the New Year, January 2, 2020, (Note Reflex was shut down for two weeks over the Christmas break), the borehole deviation had become more excessive.

The reason that the Clappison wedge did not work can be speculated that past a certain inclination in a given rock mass structure, it become more increasingly difficult with such a small wedge to increase the dip. The reason why the hole actually shallowed, could be attributed to the smaller size of the bullnose used to develop the start of the new hole. With it being smaller, then greater deviation can occur.

In order to correct the borehole dip and trajectory, to stay in the 5° tolerance cone, then the decision in consultation with NWMO was taken to use larger installed steel by-pass wedges, a stiff hexagonal core barrel stabilizer and plan the borehole to keep the trajectory within the tolerance cone.

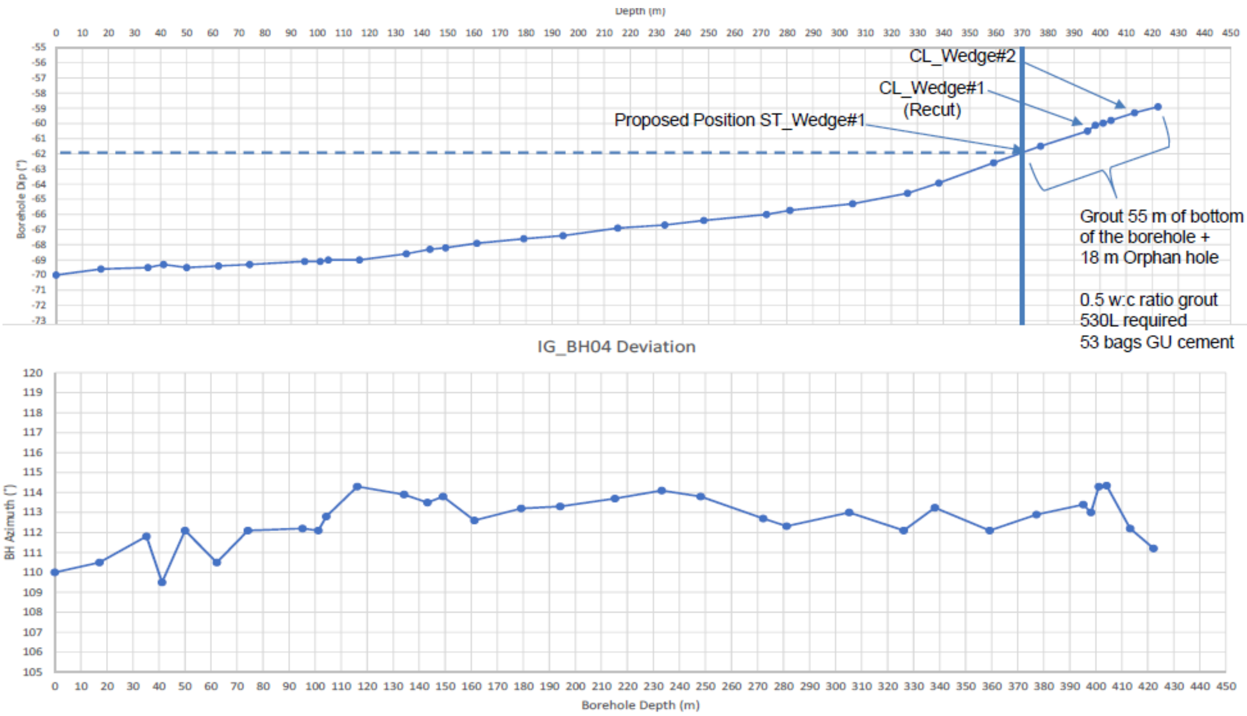


Figure 14: Borehole deviation Dip (Top graph) & Azimuth (Bottom graph) with Clappison Wedges

4.6.2.2 Steel By-Pass Wedging

Two steel by-pass wedges were performed during the drilling of IG_BH04 (Figure 15). The first steel wedge was installed on January 9, 2020 and the second on January 11, 2020. The goal of both wedges was to steer the borehole to the planned azimuth of 110 ° and to the planned dip of -70°.

A HQ steel axe wedge was installed to correct the borehole azimuth from 113.3° to 110° and the dip from -61.9° to -70° at a depth of 371.21 m. The wedge IG_BH04_ST#1 was set at 371.21 m with a gravity toolface reading of 181.4°. To install the steel wedge, first the drillers needed to install a Bradley plug.

The Bradley plug attachment was screwed onto an open end of an HQ drill rod. The Bradley plug was held into place using set screws. The bottom of the Bradley plug attachment is called a basket. The basket grabs inside the borehole to prevent the Bradley plug from turning when the drill rods rotate. The Bradley plug was lowered to the desired wedge depth of 371.21 m.

The rods were then slowly rotated clockwise until the Bradley plug was fully torqued in the borehole, and the Bradley plug sheared from the Bradley plug adaptor. The drill rods were then pulled back to surface and the Bradley plug adaptor was removed. The basket and the Bradley plug were left down the borehole. The Bradley plug became the new bottom of the borehole. A wooden plug was then lowered down the borehole. Once the wooden plug reached the water table, the wooden plug was held below the water table to become saturated and was pushed down the borehole using the drill rods until the wooden plug reached the Bradley plug. Once the wooden plug reached the Bradley plug, the drillers left the drill rods on top of the Bradley plug until the wooden plug absorbed water and swelled down the borehole. The drill rods were then removed from the borehole and the steel wedge assembly commenced.

The wedge dropper was attached onto the blunt nose steel wedge using 6 brass rivets. The wedge was leveled using the cutting face on the steel wedge, cut side facing up. The EZ-Trac Reflex tool was inserted into the mule shoe adaptor and the wedge was leveled across the cutting face and the gravity toolface was set to 0°. The wedge was then hoisted up onto the drill using a hoisting cable. The wedge was then lowered down the borehole with the drill rods to the wooden plug. The Reflex EZ trac was then sent down the borehole. The drill rods were rotated manually using a pipe wrench until 181.4°. A plastic indicator pin sheared off in the EZ-Trac when it was properly seated in the mule shoe. The rods were then slowly lowered using the drill head, pushing the axe wedge into the wooden plug. Downward pressure was applied using the drill head to push the steel axe wedge into the wooden plug until the brass rivets sheared, setting the steel axe wedge into the wooden plug, and separating the wedge dropper from the steel axe wedge.

The drill rods were then removed with the dropper attached, leaving the steel wedge in the hole. The wedge was then set, and all the drill rods were out of the borehole. A bullnose bit was then added to the rod string, the rods were lowered down to the steel wedge, and the drillers began reaming past the wedge. Nine meters was drilled and then all the drill rods were pulled back to surface. The bullnose bit was removed from the rod string, and a tapered wedge bit was lowered down the borehole. The drillers continued to ream 9 m past the wedge, removed the rods from the borehole, and lowered down the drill string using a standard coring bit. The drillers reamed past the steel wedge and continued to core. After 18 m were drilled, a survey was taken to verify the azimuth and dip.

A second steel wedge was set at a depth of 395.2 m. The setup of the second steel wedge was the same as the first steel wedge with the addition of 9 slow set resin cartridges. After the wedge was hoisted up the drill tower, 9 slow set resin cartridges were inserted into the borehole. The wedge was then lowered until the last joint was flush with the top of the drill head. The EZ-Trac Reflex tool was then lowered into the borehole making sure the EZ-Trac had been properly seated into the mule shoe, which was indicated by the plastic indicator pin. The plastic indicator pin was sheared off on the EZ-Trac Reflex tool. The EZ-Trac Reflex tool was then removed from the borehole and the azimuth was checked. The drill string was turned manually using a pipe wrench, to the approximate desired azimuth. The EZ-Trac Reflex tool was used and the azimuth was checked again. This process was repeated until we reached the desired azimuth of 179.6°. The rod string was then lowered with a blunt nose wedge into the resin, it was held firmly for several minutes until the resin and hardener had mixed and the blunt nose wedge was set on top of Bradley plug. Downward pressure was applied until the brass rivets sheared, separating the dropper from the blunt nose steel wedge. The rods were then removed from the borehole, the wedge dropper was removed, and the drill rods were lowered down the borehole with a bull nose bit.

The first pre-wedge azimuth was 113.3° and the post-wedge azimuth was 112.9°. The wedge was successful at correcting the azimuth by 0.99°. The pre-wedge dip was -61.09° and the post-wedge dip was -63.67°. The first wedge was successful at correcting the dip by -2.58°. The second wedge took the pre-wedge azimuth was 113.6° and the post-wedge azimuth was 112.67°, and the pre-wedge dip was -63.03° and the post-wedge dip was -64.67°, correcting the dip in this case by -1.64°. This increases the dip of the borehole by a total of -4.22°. The overall borehole trajectory is illustrated Figure 12..

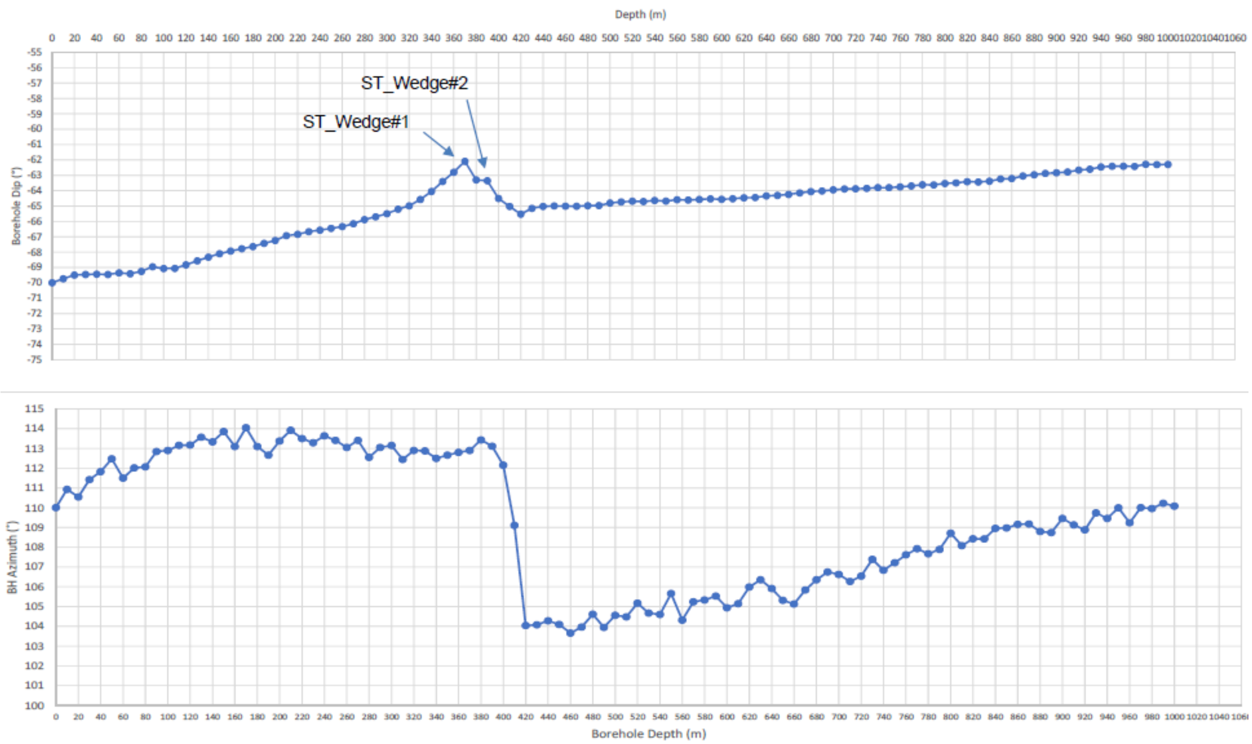


Figure 15: Borehole deviation Dip (Top graph) & Azimuth (Bottom graph) with Steel Wedges

4.6.2.3 Barrel Stabilizer

Following correction using the steel by-pass wedges, a 3m long Octagonal stiff stabilizer was placed behind the core barrel assembly. Review of the calculated flattening after 10 runs using the stabilizer barrel indicated that as long as the flattening did not increase but stayed at the same rate of 0.078° / m cored, the borehole should stay within the tolerance cone until completion.

The final incremental survey indicated that the borehole was 1.5 m from the edge of the cone at the final depth.

4.7 Monitoring Drilling Parameters

Drilling parameters were monitored by the drilling supervisors during drilling activities. The drilling supervisor recorded the start and end times of each core run, the start and end depths, the results presented on the Trailblazer system screen, monitored quality (chemistry) and pressure of the drill fluid, and monitored levels of the water tanks for any water lose or gain, as well as potential overflows or spills (see section 5.5.4). Basic drilling parameters and the water flow measured in and out of the borehole, was measured manually and recorded in the DQC Workbook (Drill and Fluid parameters).

4.7.1 Manual Monitoring

Prior to and after drilling each core run, the ultrasonic totalizer volumes (volume ''in'' and ''out'' of the drill fluid recirculation system) were recorded from the Trailblazer system (Wood, 2019a). Early on in the drilling process, it became clear that the totalizer ''out'' was reading incorrect values, and as such, manual tank measurements were utilized to measure how much water was in the drill fluid system to determine the amount of water lost or gained during the drilling process for each core run.

Using the trailblazer system (described in Section 4.7.2), an instantaneous measurement for rate of penetration, bit rotation (rotations per minute), torque, holdback pressure, fluid injection pressure, and water flow rate were recorded once per run (see Appendix D) from the input screen as shown in Figure 16. The thrust pressure was also recorded from the associated gauge on the drill rig. Additionally, drill fluid monitoring was conducted for each of the core runs (described in detail in Section 5).

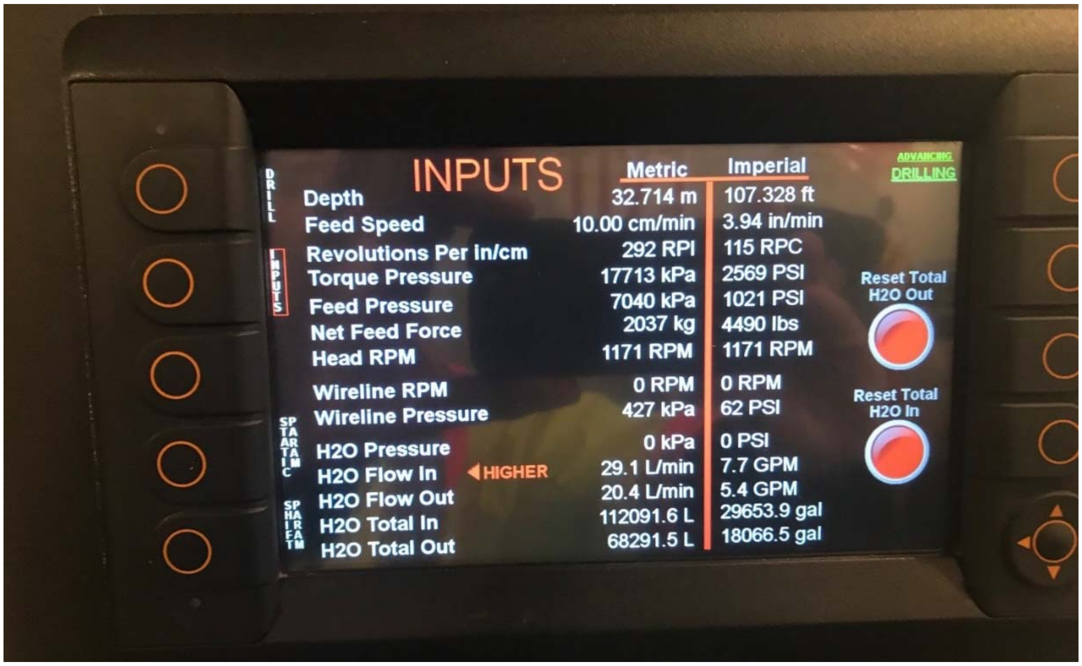


Figure 16: Inputs Screen of Trailblazer System During Drilling

4.7.2 Trailblazer System

The Trailblazer system was utilized for the recording and partial monitoring of drilling parameters during the drilling of IG_BH04. Various strength, pressure and depth sensors on the drill rig collected data four to seven times per second with a timeline that the data could be viewed in various configurations. The following data was collected:

- Date
- Time (HH:MM:SS)
- Chuck closed: (ON/OFF)
- Foot clamp closed: (ON/OFF)
- Depth (Meters) - Head Laser to the nearest 1mm
- Rotation PSI, kPa (7/sec) – Avg / sec

- Rotation RPM (7/sec) – Avg / sec
- Feed PSI , kPa (7/sec) – Avg / sec
- Hold Back PSI
- Feed position (cm's, m's, mm's)
- Rate of Penetration ROP - Feed traveling speed (cm/s, m/)s)
- Water pressure (PSI , kPa)
- Water flow (GPM, L/min) – In flow
- Water usage (Total – In flow)
- Water flow (GPM, L/min) – Out flow
- Water usage (Total – Out flow)
- Water Temperature C in
- Water Temperature C out
- Oil Temp (F)
- Comments - Process (Standby, Pump-Inner, Drilling, Reaming…)

Data was stored in .csv format on the Programmable Logic Controller (PLC) and then uploaded to a server every shift using an Android Tablet (connected by the local Wi-Fi network). The data could then be analyzed and downloaded by Wood using MS Power BI as shown in Figure 17.

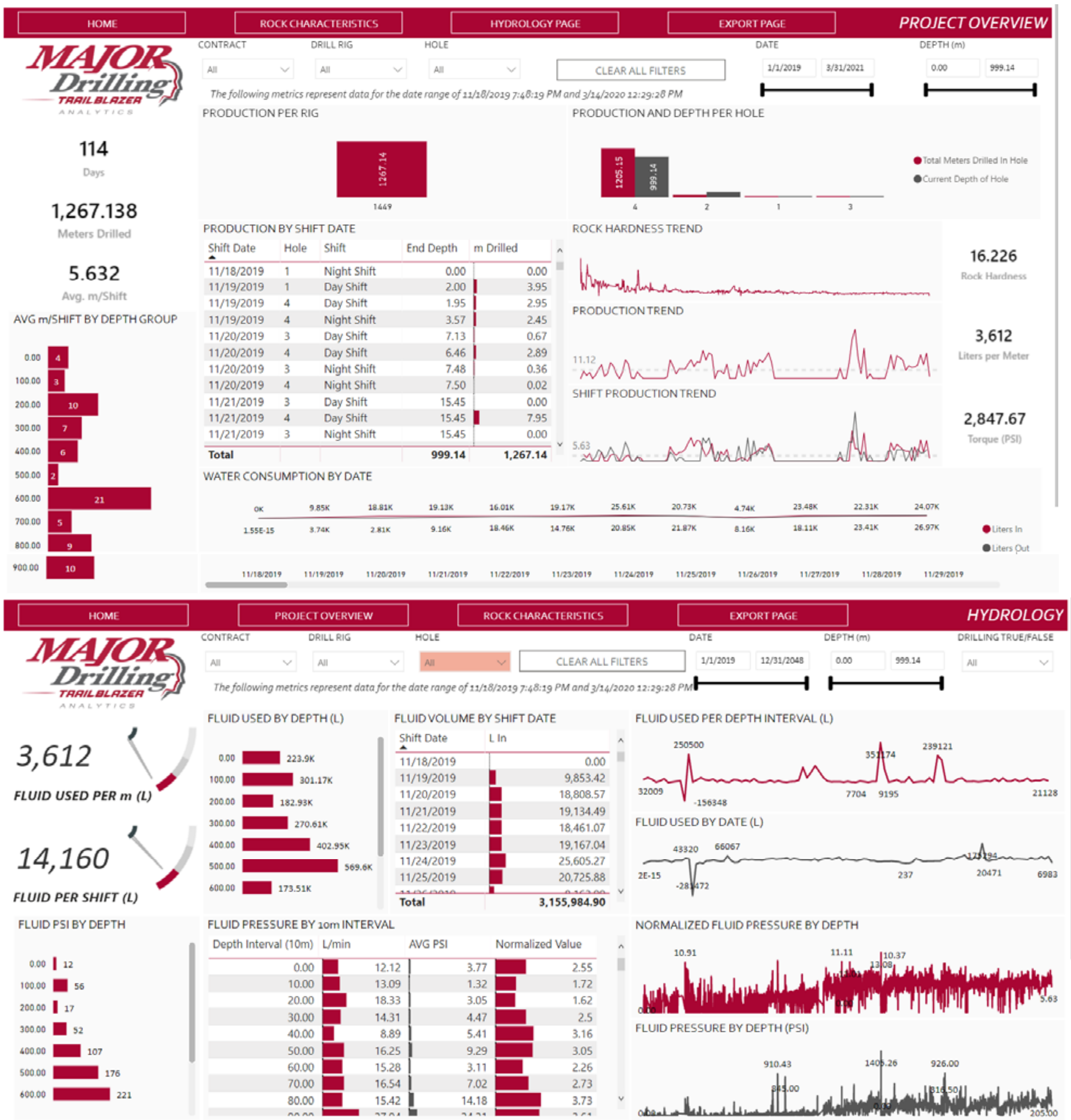


Figure 17: Real-time Remote Monitoring Data from the Trailblazer Analytic Dash Board (Partial Data for IG_BH04)

Note that the total metres recorded by the Trailblazer is slightly different than the one recorded in the log (Wood, 2021a), which was based on the count of steel rods and stickup measurements, as difficulty were encountered with the system and manual adjustments were required (see section 4.2.2).

Data could also be viewed live on either a Tablet in the drilling shack, or on the mounted unit in the core shack. An example of the unit that was in the core shack is shown in Figure 16.

Figure 18: Example of Trailblazer Unit Mounted in Coreshack

4.7.3 Comparison of Manual Intermittent versus Continuous Trailblazer Readings

The Core Shack Trailblazer Unit was used to monitor the basic drilling parameters during drilling activities. Both the manually recorded measurements (screen capture of the trailblazer once during the run, preferably at the start of the run) and continuous Trailblazer measurements (data base export) were plotted alongside the RQD, major lithology, and fracture types logged during drilling (Wood, 2021a). Figure 19 to Figure 24 below show both sets of data for torque, thrust pressure, and holdback pressure.

Note that the torque represents the force required to turn the head of the drill, while the thrust, measured at the top of the feed cylinder, indicates the pressure pushing down during drilling. The hold back, is the counter part of the thrust pressure, measured at the bottom of the feed cylinder, it gives the pressure required to restrict the flow out of the cylinder.

Not illustrated below, but noticed in the data set, the rate of penetration was observed to be relatively consistent during the drilling process at approximately 5.6 centimeters per minute, excluding an anomalous value for a 28 cm core run of 1.4 centimetres per minute before a drill bit change at 701.21 m.

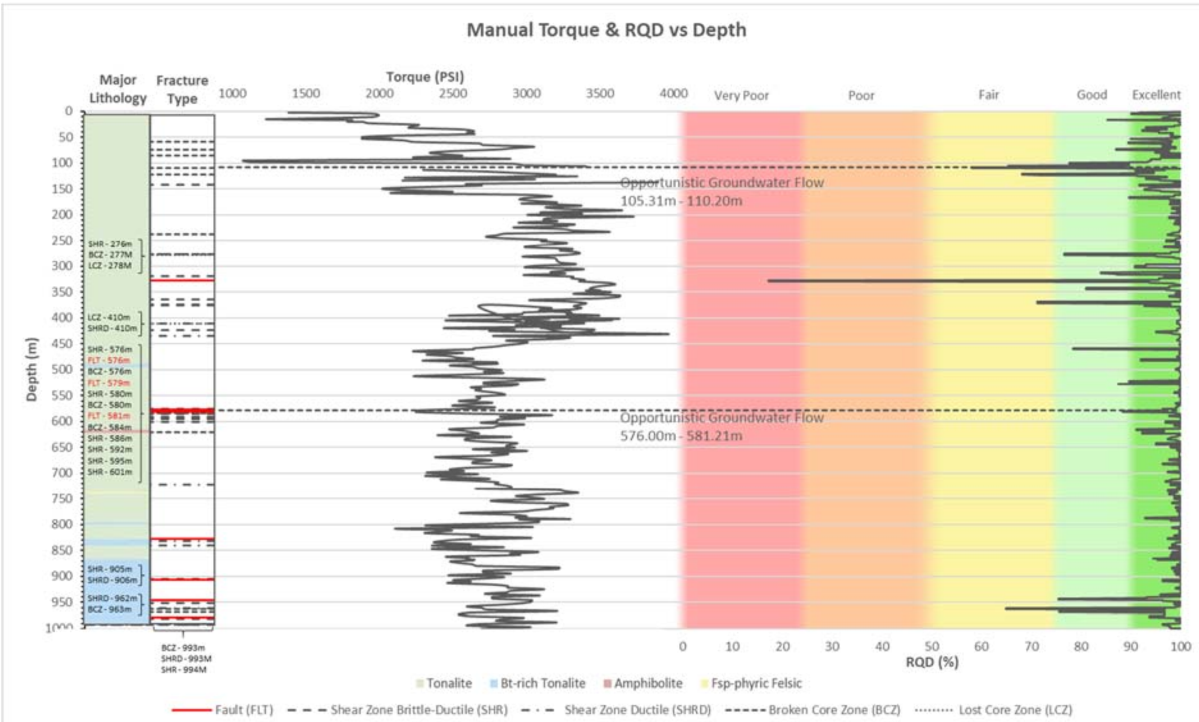


Figure 19: Manual Torque Measurements & RQD vs Depth

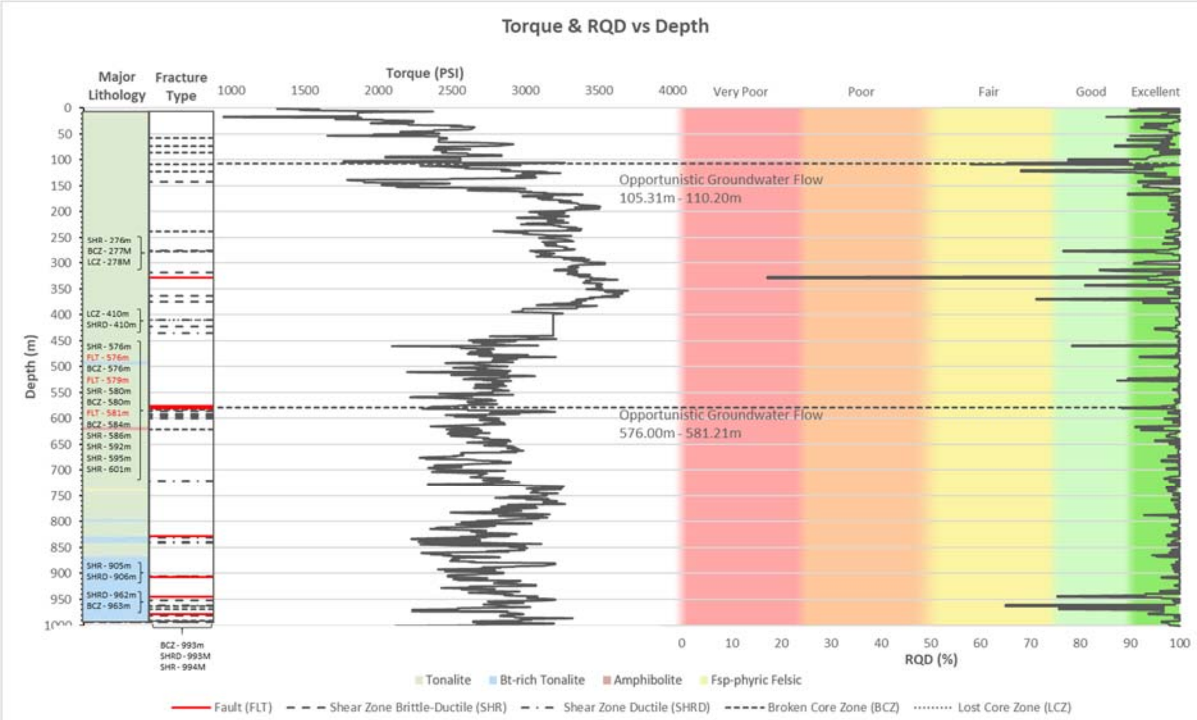


Figure 20: Continuous Torque Measurements & RQD vs Depth

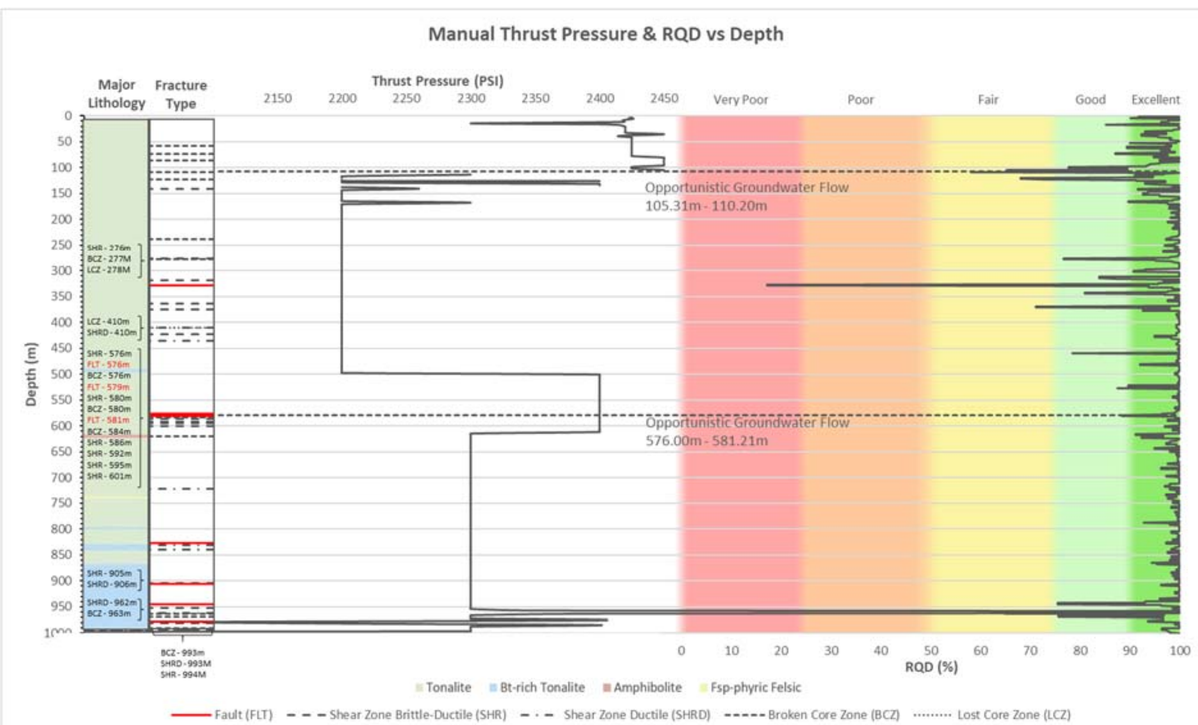


Figure 21: Manual Thrust Pressure Measurements & RQD vs Depth

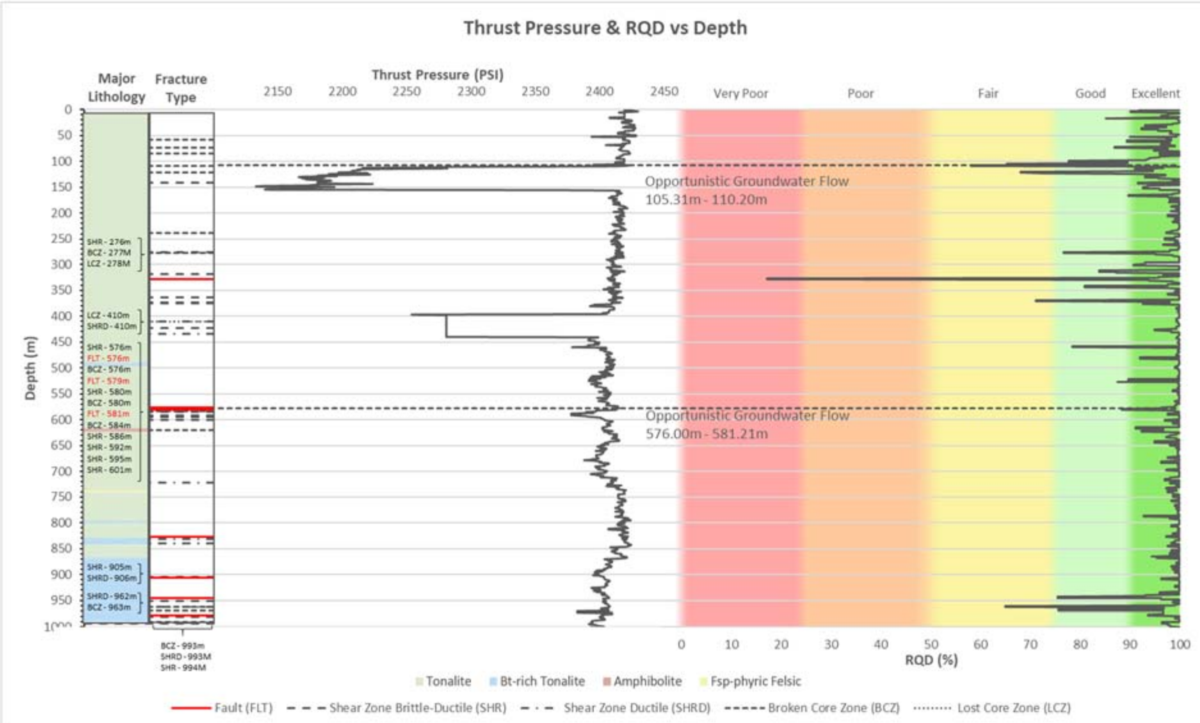


Figure 22: Continuous Thrust Pressure Measurements & RQD vs Depth

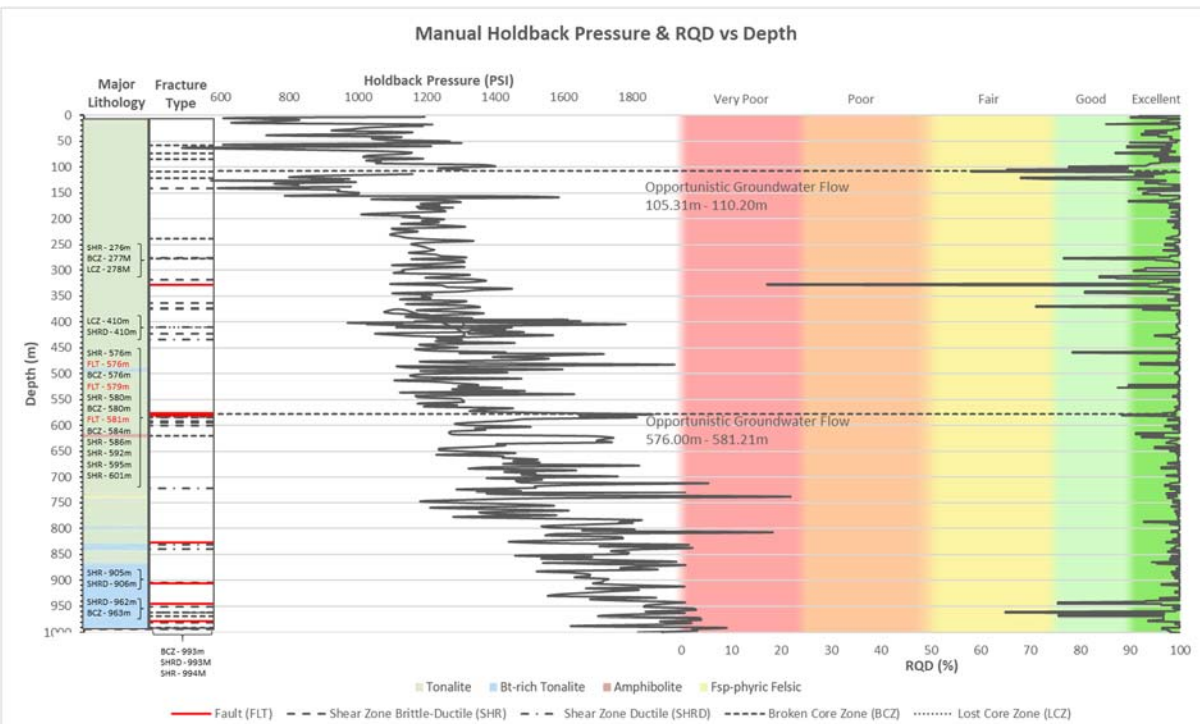


Figure 23: Manual Holdback Pressure Measurements & RQD vs Depth

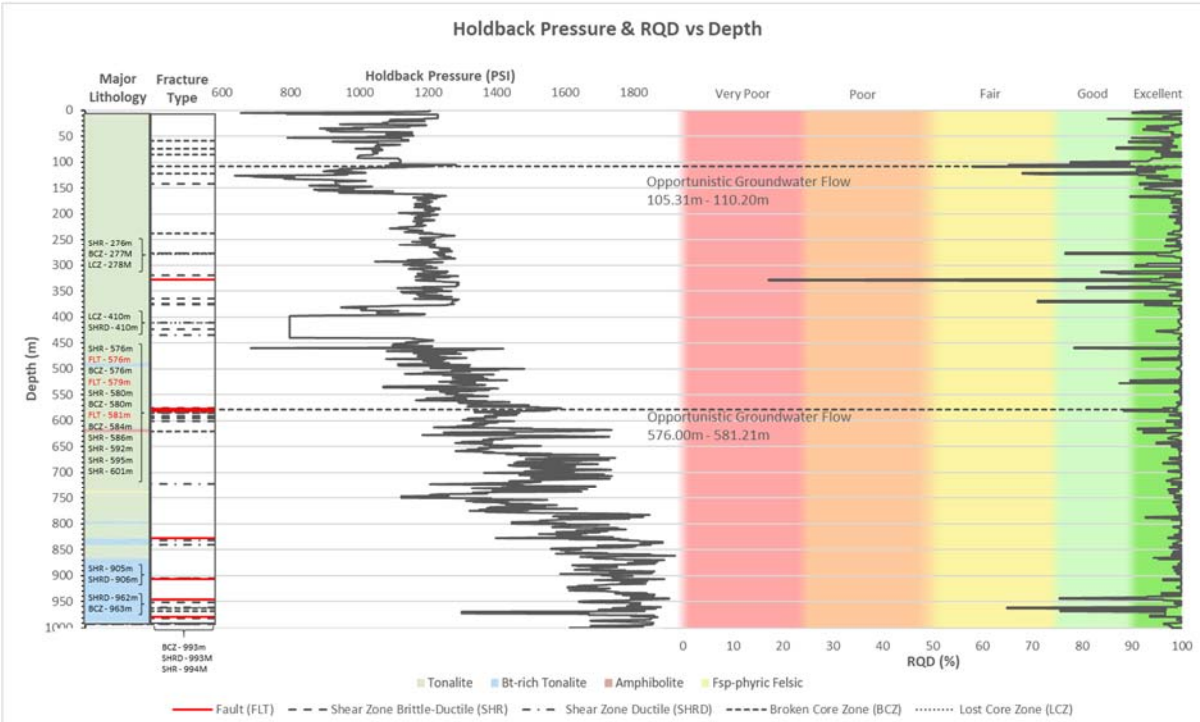


Figure 24: Continuous Holdback Pressure Measurements & RQD vs Depth

For both manual and continuous readings torque and down pressure increased with depth, with the down pressure adjusted from thrust to holdback pressure at approximately 550 m depth. Down pressure was displayed on a single gauge, and the adjustment from thrust to holdback pressure had to be communicated by the driller to the drilling supervisor. The pump pressure generally increased with depth as a higher pump rate was required to adequately push water through a larger borehole. Overall manual and continuous readings show similar trends for torque and holdback pressure. However, for thrust pressure the manual readings are lower than the continuous by 100-200 psi below 100 m depth apart from a spike around 950 m. This could be explained by an omission of the manual thrust reading, and use of former run values from 100 to 500 m. The continuous thrust readings also have a gap of missing data from 398 m to 440 m due to a recording error with the Trailblazer system.

4.8 Borehole Flushing

The borehole was flushed at 100 m depth prior to the installation of the surface casing, and after the completion of drilling activities in order to remove any drill cuttings and to ensure the borehole walls were clean to provide clear fluid conditions for geophysical well logging.

Prior to flushing the borehole, the drill fluid system on surface was emptied, including the AMC, STS, and the drill water tank. The drill string was left at the bottom of the borehole during flushing. Fresh water, mixed with fluorescein to create a concentration higher than 100 ppb, was added to the STS and was sufficiently mixed. This water was then sent to the drill rig tank and then pumped downhole, to flush the borehole. Wastewater from flushing was sent to the AMC, and then to the wastewater tank. This process was repeated until a minimum of three borehole volumes had been pumped downhole. During the flushing process, the water became visibly less turbid, until the wastewater tanks had been filled and flushing activities ceased until they could be emptied. After emptying the wastewater tanks, flushing activities were continued. The turbidity in the wastewater spiked immediately after flushing activities resumed, and progressively became less turbid until the completion of flushing activities. Upon completion of borehole flushing, the water was clear, with a green/yellow tint caused by the fluorescein concentration. Throughout the flushing activities, the wastewater quality was measured for fluorescein concentration, temperature, pH, ORP, conductivity, and turbidity. The final wastewater quality measurements is presented in the table below (Table 7). Additional data can be found in Appendix G.

Table 7: IG_BH04 Final wastewater quality measurement results

	Borehole Flushing Wastewater
Volume of Water Flushed	22,845 L
Fluorescein Concentration	124.4 ppb
Temperature	10.24 °C
pH	9.98
ORP	94 mV
Conductivity	0.101 mS/cm
Turbidity	147 NTU

One borehole volume including the HQ drill rods in the borehole is approximately 7,140 litres. After the completion of flushing, approximately 3.2 borehole volumes have been replaced.

4.9 Temporary Shutdowns

A total of three temporary shutdowns occurred during the drilling of IG_BH04. A suspension of services occurred during the first OGWS event between December 12 and 15, 2019 until the situation was rectified to NWMO’s satisfaction. A second shut down due to community intervention occurred on February 1 to 3, 2020. Lastly, a third shut down occurred on March 17, 2020 due to the Covid 19 pandemic.

5.0 Summary of Drill Fluid Management and use of Tracers

5.1 Drill Fluid Closed System

The management and monitoring of drilling fluids is important to ensure that representative water samples can be identified, and high data quality is obtained. It is essential that the drilling fluids are managed as carefully as possible to minimize potential interferences with sampling and analysis. A drilling fluid recirculation system was used to maximize the ability to recycle drilling fluid while maintaining quality. The following sections will explain the main components of the system, along with the fluid preparation, monitoring, sampling and testing.

The Drilling Fluid Management System (discussed also in Drilling Fluid Management System of the IG_BH04 Test Plan - SCB1912026-PLN-006 I04 WP02 Drilling and Coring R4D0) to be used is illustrated in Figure 25 and consists of the following steps:

- Waste drill fluid leaves borehole into the retention tub around the drill collar.
- Drill fluid is pumped from the retention tub into the cuttings removal system (AMC Centrifuge) using a sump pump.
- Cuttings are removed, collected and stored in totes or barrels contained in a geomembrane berm for secondary containments and disposed of. Disposal of cuttings will occur periodically during drilling. Prior to disposal, a representative sample of the cuttings to be disposed of will be tested following the MECP's Toxicity Characteristic Leaching Procedure (TCLP). Disposal of cuttings occurred at a licensed waster handler, Northwest Sewage and Septic, located in Ignace.
- Clean drill fluid from the centrifuge is sent to a storage tank of the STS (housed next to the STS mixing unit).
- As water is required for the drilling rig it is transferred from the STS storage tank to the STS Mixing unit where it is agitated. Note the tracer will be mixed in the STS Mixing tank with batches of freshwater addition. If required, the system will be recirculated on surface to ensure uniform fluid is going down the borehole at all times.
- Drill fluid is transferred from the STS mixing tank to the active tank inside the drill rig to be pumped down the borehole.
- Drill fluid travels down the rod string past the drill bit and back up to the surface as stated above.
- Clean water from a fresh water source will be added to system as downhole losses occur the 20,000 to 30,000 L fresh water supply is housed in a heated unit and is adjacent to the STS and the drill rig.
- To minimize water loss and improve the efficiency of the system, a retention tub or drill pot is used at the borehole collar and, with the exception of the clean water tank, all storage/mixing tanks and storage areas are equipped with secondary containment to prevent uncontrolled releases to the environment.
- To monitor water levels and flows, graduated tanks, and flow meters (totalizers) are installed in specific locations.

- A wastewater storage tank of 8,000 L is located adjacent to the AMC and STS was used and also had a secondary spill containment in the form of pond liner and 6" high berm.

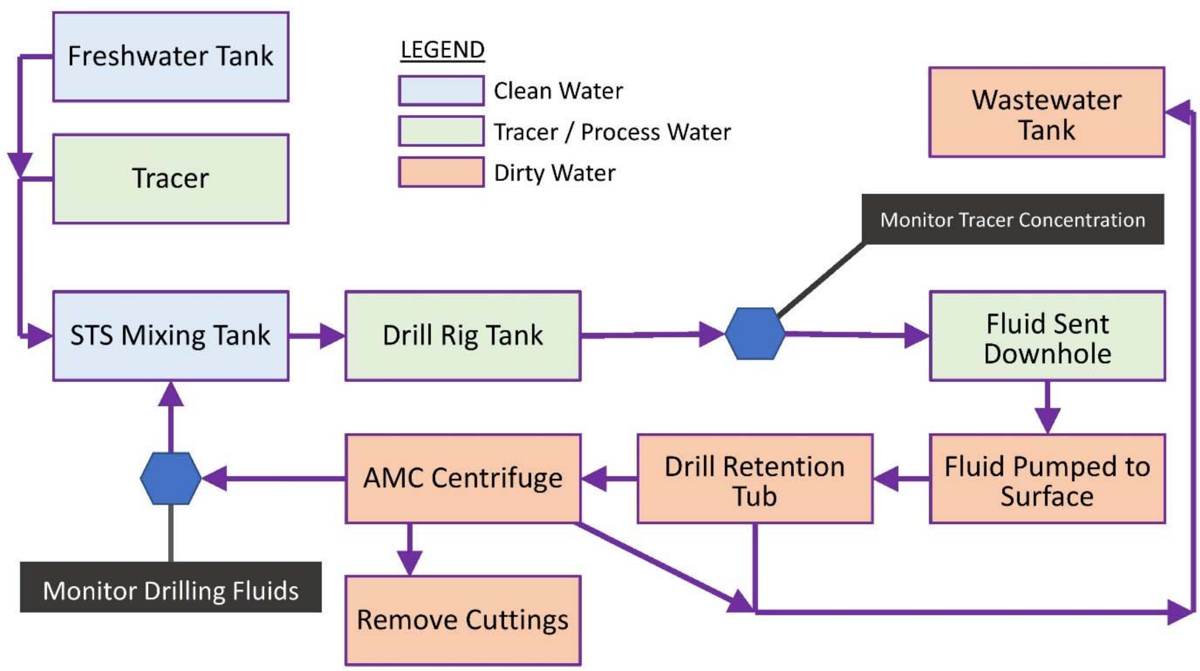


Figure 25: Drilling Fluid Management System IG_BH04

5.2 Fresh Water Management and Sampling

5.2.1 Water Source Samples and Testing

Water source samples were collected from all batches of fresh water delivered to site, prior to the addition of the fluorescein tracer and prior to introducing the water to the drill system. Water was collected from the storage tank into a clean, triple rinsed 19 litre bucket, and then transferred into labelled bottles using new syringes and a metals filter for samples that required field filtering. Samples were collected for submission to Maxxam Analytics and Isotope Tracer Technologies. See WP02 Data Delivery and WP07 Data Report – Opportunistic Groundwater Sampling for IG_BH04 for discussion on samples taken.

5.2.2 Fluorescein Addition and Balancing

Fluorescein was used as a tracer for the drilling fluid. The concentration of fluorescein was measured using an AquaFluor Handheld Fluorometer prior to and after drilling each core run. This was completed by collecting a small sample of water using a syringe between the STS Mixing Tank and the Drill Rig Tank and filtering the water prior to measuring the fluorescein concentration.

To create fluorescein fluid prior to the addition to the drill fluid system, uranine was measured using a scientific scale and added to the appropriate amount of distilled water to create a standardized concentration solution. This fluorescein solution was then added to the STS Mixing Tank as needed and then sufficiently mixed using submersible pumps into the drill fluid system by cycling the water between tanks. This process was completed anytime the fluorescein concentration had dropped below the target drilling fluid concentration.

To determine how much fluorescein solution to add, the fluorescein concentration of the current drill fluid system was measured, and the amount of water in the drill fluid system was calculated based on the level of water in each tank, and the depth of the borehole.

After the addition of fluorescein solution, the tanks were mixed by cycling the water between the tanks until the fluorescein concentration had stabilized (the target concentration was 100 ppb). If the concentration was still too low, the process was repeated until the fluorescein concentration was above the target concentration.

A similar process was completed when adding new water to the drill fluid system, where 1 litre of fluorescein solution was added per 1000 litres of fresh water, the system was mixed together, and then the above process was followed to ensure the fluorescein concentration of the entire drill fluid system was above target concentration.

5.3 Drill Fluid Parameters

5.3.1 Drill Fluid Parameter Data

Drill fluid parameters, including water quality measurements were taken during every core run. Samples were collected from the AMC and were monitored for pH, Temperature, Conductivity, ORP, Dissolved Oxygen, and Turbidity using a Horiba U-52 Water Quality Meter, and Density using a Hydrometer. The turbidity of the water was typically higher than the limits of the Horiba U-52 Unit (above 1000 NTU). See the WP02 Data Delivery and Appendix F.

5.4 Drill Fluid Additives

Drill fluid additive, AMC CRC650, was added by the driller to the drill fluid system to increase the lifting ability of the drill fluid to remove cuttings from the borehole. This was added to the drill fluid system in small quantities, and added by the drillers when deemed necessary, or when fresh water was introduced to the drill fluid system. When this was first added a drill water sample was taken as a baseline.

The other additive that was used was AMC's Pure Vis which was primarily used towards the end of the borehole and during final borehole flushing to remove as much drill cutting from the borehole as possible. Again, when this was added a drill water sample was taken.

5.5 Drill Fluid Flow Monitoring Data

Drill fluid volumes were monitored at the start and end of every run to determine the drill fluid volume change. If a change in volume greater than 100L was observed then it triggered a potential opportunistic groundwater sampling event. See WP02 Data Delivery and Appendix D.

5.5.1 Pre-Casing Volume Observations

An undulating vertical fracture and a broken core zone were observed between 5.45-5.69 m. A fluid volume loss of 3000 L was observed. From 0.00 to approximately 8.00 m, the pump pressure dropped, low water pressure due to close to surface around of 0 to 25 psi. The fluid volume loss was due to the vertical fractures intercepted at surface. PWT surface casing depth was located at a depth of 6.00 m below ground surface and below the fractured zone. The last two runs of HQ3 from 8.07-15.45 m had good return of approximately 80%. PWT conductor casing was installed 21 November 2019 with a w:c ratio of 0.65 (400 L of water to 31 (20 Kg) bags of HS cement). After cementing, 100 L of left in the mixing tote.

A broken core zone was observed between 99.40-99.70 m and steeply dipping joints were observed from 100.00-100.48 m. A volume loss of 170 L was recorded from 98.17-101.17 m and tracer concentration change was 4%. There was a general concern with the borehole stability due to the sub-parallel joints. Casing was then decided to be set at 100.77 m downhole and below the fractured zone at 99.40-99.70 m and below the steeply dipping features from 100.00-100.48 m.

5.5.2 Post-Casing Volume Observations

Interval 1 (101.50 - 110.00 m) Permeable zones were encountered between 101.76 to 104.2 m and from 107.7 to 108.74 m. The key criteria to cement the permeable zone included:

1) Core logging observations of a large undulating parallel fracture from 101.76 to 104.20 m and another from 107.70 to 108.74 m.
2) Drilling fluid volume measurements exceeded a loss of 1000 L.
3) The drill rods jammed between 101.76 to 104.20 m and the driller noted draining of the drill tank during recirculation.
4) The core barrel wedged twice and the threads sheared requiring the rods to be retrieved from the borehole (fishing).
5) An opportunistic groundwater sample was taken. The zones were described to be large undulating joint parallel to the core axis. The fractures terminated in a broken core zone of 10 cm long.

At 1:30 am on 16 December 2019, a VK Type A plug was placed at 101.2 m (bottom of plug). Twelve bags of 20 Kg cement were used in 260 L of water. The atmospheric pressure was -25°C and affected the original planned measurements. The final pressure held at 500 psi and samples were taken at the beginning, middle, and end. All samples cured.

Interval 2 (572.21 – 593.21 m), the permeable zone depth ranges are from 576.27-576.34 m, 579.36-579.39 m, and 580.93-581.00 m. The key criteria to cement the permeable zone included:

1) Core logging observations included three large fractures/faults/broken core zones between 576.27 and 581.00 m.
2) Drilling fluid volume measurements exceeded a loss of 1000 L.

3) During recirculation, the driller noted draining of the drill tank of a loss over 1000 L.
4) The core barrel wedged twice and the threads on the drill rods sheared. The rod string was retrieved down the borehole during "fishing" activities.
5) An opportunistic ground water sample was taken from 575.21-581.21 m.

5.5.3 Ultrasonic Flow Totalizers

As indicated in section 4.7, Ultrasonic totalizers were installed to continuously measure the volume of fluid "in/out" of the drill fluid circulation system (see Appendix D). This data was then displayed and saved to the server in the Trailblazer system using the same process as the other drill parameters described in Section 4.7.2. At the start and end of each run a reading was taken from the Core Shack Trailblazer screen unit to calculate the drill fluid volume change for that run. At the start of drilling activities, there was an issue with the totalizer "out" readings due to either the high turbidity of the drilling fluid or air getting into the fluid line, affecting the data collection. The issue persisted "on" and "off" throughout drilling. As an alternative plan and quality control measure, Wood staff implemented the addition of manual tank measurements alongside the ultrasonic totalizers.

5.5.4 Manual Tank Measurements

As indicated in Section 4.7, drilling fluid volume loss or gain was monitored on site by measuring the depth of fluid in the AMC centrifuge, STS mixing tank, and drill rig tank right before and after a core run was drilled. Dimensions of the three tanks were used to estimate the volume from the depth measurements (see Appendix E).

To conduct the manual tank measurements, the insides of each tank were emptied, and all dimensions measured. A 2" x 4" piece of wood was mounted vertically in each of the tanks, except the drill retention tub, and a cut off measuring tape was secured, where zero was at the bottom of the tank as shown in Figure 26.

Figure 26: Measuring Tape Installed in STS Tank

To measure the height of water in the retention tube, a measuring tape was either lowered down, or the retention tub was emptied, making the volume in the tub zero. Using the height of water and dimensions of each tub, a total volume could be calculated before and after the completion of the core run using the IG_BH04_WP02_Manual_Tank_Readings_R2.xlsx spreadsheet (Included in the WP02 data delivery and Appendix E). During drilling, the borehole was pressurized with water in circulation, which would pour out of the annulus space around the drill rods after the completion of drilling the core run. Wood staff waited until after the water in the borehole stopped spilling out before taking the measurements for after a core run. Because of the freezing conditions during drilling activities, it was necessary to continue circulated water between tanks, and as such, Wood staff measured all tanks in quick succession to allow for the most accurate reading of total volume.

5.5.5 Comparison of Continuous vs Manual Drill Fluid Volume Change

Both the manual and continuous drill fluid volume changes were plotted alongside the RQD, major lithology, and fracture types logged during drilling (shown in Figure 27 and Figure 28).

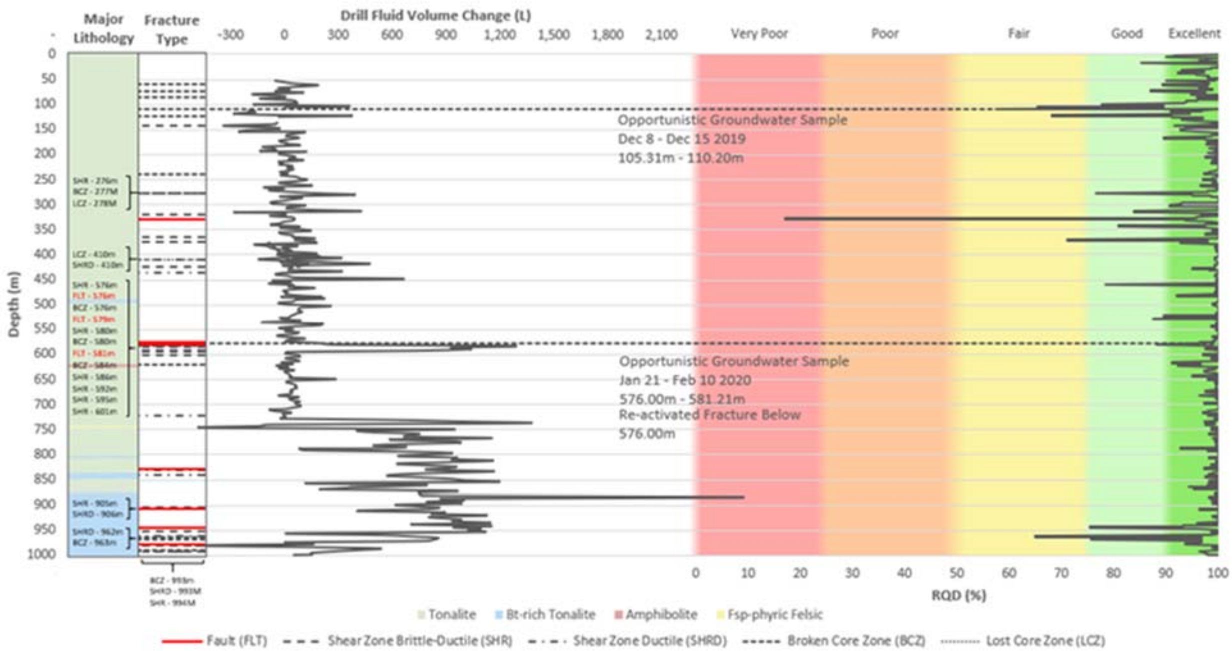


Figure 27: Manual Drill Fluid Volume Change & RQD vs Depth

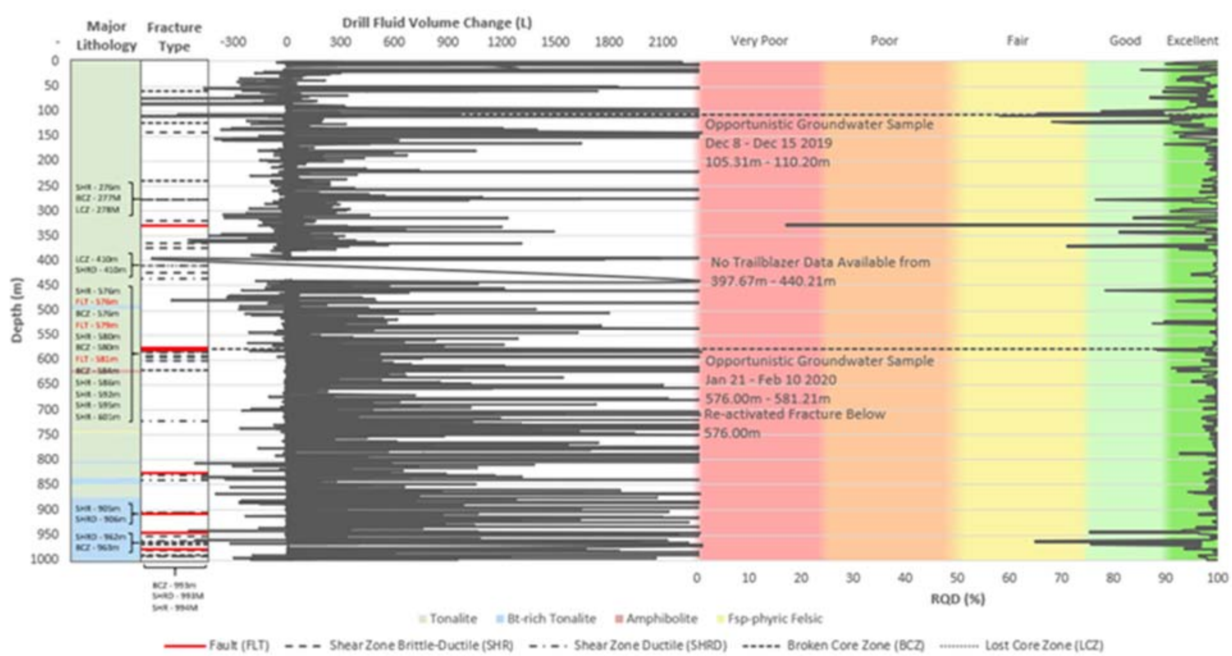


Figure 28: Continuous Drill Fluid Volume Change & RQD vs Depth

The continuous drill fluid volume change is much more sporadic from run to run compared to the manual readings due to the issues with the ultrasonic totalizers. It has values ranging from -3533 L to +206596 L. The continuous drill fluid volume change also shows the same gap of data (from 398 to 440 m) that was present with the other continuous drill parameters. The manual readings show a much smaller range of values (from -496 L to +2558 L) and were considered to be more reliable indicators of volume changes. The spikes in drill fluid volume change associated with both opportunistic groundwater sampling events are visible around 110m and 575 m. There is an increase in drill fluid volume change that occurs below approximately 725 m in the manual measurements due to the decision to not re-grout the previous opportunistic groundwater sampling zone around 575 m and continue drilling. Below the 725 m depth observations of the core were the primary indicator of trigger for the OGW sampling as the volume measurements was masked by the significant water loss at the 575 m depth.

5.6 Drill Fluid Archive Samples and Testing

Drill fluid samples were collected and archived in 1 litre bottles every 50 m during drilling advance. The samples were collected from the centrifuge in the same manner as the other drill water samples. See WP02 Data Delivery and WP07 Data Report – Opportunistic Ground Water Sampling for tables and discussion.

6.0 Opportunistic Groundwater Sample Locations

A total of five potential location were considered in IG_BH04 for collecting Opportunistic Ground Water Samples (OGWS). Out of these, only two resulted in the collection of a ground water sample. The potential testing locations, that where isolated with a packer system (either the RST packer, IPI packer or HDDP system) and purged are listed below while some characteristics of the actual OGWS collected are summarised in Table 6.

The potential ground water testing locations are listed below:

- 24 Nov 2019 – HDDP Deployment 24m (Sol Experts system) - training
- 8 Dec 2019 – RST Deployment at 105.31 to 110.0 m – OGWS # 1
- 21 Jan 2020 – RST Deployment at 576.0 to 593.21 m - OGWS # 2
- 22 Feb 2020 – RST / IPI Deployment from 592.28 to 735.14 m
- 9 Mar 2020 – RST Deployment 589.47 to 915.14 m

Table 8: Summary of Opportunistic Ground Water Samples (OGWS)

OGWS Event # (GW #)	Date		Depth (m)		Dates Sampled	Geological/Hydrogeological Triggers
	From	To	From	To		
OGWS#1 (GW	8/12/2019	15/12/2019	105.31	110.00	12/12/2019 to 15/12/2019	Fluid volume change of 600 L from CR042 – CR043
OGWS#2	21/01/2020	10/02/2020	576.00	581.21	8/02/2020 to 10/02/2020	Evidence of structure noted in CR213 but <200 L loss in drilling fluid. Fault encountered in CR214 and fluid loss >200 L noted.

For additional information please refer to WP07 Data Report – Opportunistic Groundwater Sampling for IG_BH04 (Wood, 2021b).

7.0 References

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Appendix A

Metadata Abstract from Data Delivery

Object: NWMO – IGBH-04: Description of WP03 Final Data Delivery Package for Metadata Editor

The Initial Borehole Drilling and Testing project in the Wabigoon and Ignace Area, Ontario is part of Phase 2 Geoscientific Preliminary Field Investigations of the NWMO's Adaptive Phased Management (APM) Site Selection Phase.
This project involves the drilling and testing of an inclined borehole, IG_BH04, within the northern portion of the Revell batholith.

Work Package WP02 included several activities, which together implemented the safe, efficient, comprehensive and traceable handling and initial visual investigation and documentation of continuous core drilling and fluid management from IG_BH04 at Ignace, Ontario. A total of 1000.20 m plus 36 m of IG_BH04A (377.21 to 413.21) and 30m of IG_BH04B (395.21 to 425.21) for a total of 1066.2 m of bedrock drilling was performed. Initial conductor casing (PWT size) was cemented in place from surface to 5.97 m, and surface casing (HWT Size) cemented from surface to 100.79 m. Coring of bedrock using HQ3 (triple barrel) was performed from 1.07m to the end of the hole. During drilling in order to maintain the trajectory of the borehole within 5 degree tolerance cone, four (4) borehole corrections were made, two (2) using Clappison retrievable wedges (at 395.21 m and 407.21 m) and two (2) using steel by-pass wedges (at 371.21 m and 395.21 m). The use of the by-pass wedge and initial Clappison wedge resulted in the latter two borehole arms that were grouted. In addition, two zones in which opportunistic ground water samples were taken, were also grouted to prevent water loss and seal the borehole. These zones were at 101.5 to 110.0 m and 560.21 to 584.21 m. The drilling fluid was recycled in a closed circuit and continuously monitored for volume changes and fluorescein tracer levels changes as well as other hydrochemical properties. The drilling parameters of drill torque, rotation rate, penetration rate, etc were all monitored during the drill progress automatically for the entire borehole and with manual averages every run. The system that performed this is called the Trailblazer system (formerly termed Unidrill in test plans) and data for this was exported to NWMO outside of the metadata editor.

This data package includes the following deliverables for WP02 (Drilling and Coring) relating to IG_BH04:

Generals

- WP02 Data Delivery Checklist (xlsx)

Borehole Survey

- Final Surveyed Borehole Coordinates and Report from Tulloch (pdf)
- Schematic of Drill Pad and Final Surveyed Borehole (pdf)

Calibration Certificates

- Summary file of all equipment calibrations and serial numbers (xls).
- Calibration Memo for Ultrasonic Totalizers (pdf)
- Pipette Calibration Certificates (pdf)
- Aquafluor Fluorometer Calibration Certificate (pdf)
- Gas Monitor GX2012 Calibration Certificate (pdf)
- Horiba_ Calibration Certificate (pdf)
- Hydrometer Statement of Accuracy (pdf)
- Noise Monitor Larson Davis LXT Calibration Certificate (pdf)
- Reflex EZ-Gyro Calibration Certificate (pdf)
- Van Essen Vibrating Wire Water Level Transducer Calibration Certificates (pdf)

- McNaught Totalizer Calibration Certificates(used for calibrating the Ultrasonic Totalizers (pdf)
- Keyence Ultrasonic Totalizer Manual (pdf)
- Drill Pressure Gauges Certificate Labels (pdf)
- Reflex EZ TracD Calibration Certificate (pdf)
- IG_BH04_WP02_Sartorius_Scale_R0 (pdf)

Daily Calibration Records

- Daily in field calibration checks for instruments primarily associated with water monitoring (pdf)
- Record of totalizer calibration check during drilling (pdf)
- Daily (while in use) calibration check forms of the Reflex EZ GyroD (pdf)

Downhole Survey

- Downhole surveys using the EZ GyroD (and occasionally the EZ TracD) every shift during drilling Uncorrected (pdf);
- Downhole surveys using the EZ GyroD (and occasionally the EZ TracD) every shift during drilling Corrected (pdf); (i.e., 0.84m was subtracted from all depths to account for the rota-lock)
- Downhole surveys at the end of drilling every 10m using the EZ GyroD (pdf)
- Borehole location calculation file from Polar to Cartesian coordinates original Uncorrected (xls)
- Borehole location calculation file from Polar to Cartesian coordinates Corrected (xls) (i.e., 0.84m was subtracted from all depths to account for the rota-lock and reflex ACTIII)
- Borehole wedge forms for Clappison Wedges and Steel By-Pass Wedges (pdf)
- Borehole Orientation Plots during drilling (pdf)

Drill Monitoring

- Borehole Schematic As-Built (pdf)
- Borehole Cementing DQC forms (pdf)
- Borehole Data quality confirmation DQC Reports (pdf)
- Borehole Drill Monitoring Parameters (manual averages every run) (xls)
- Manual Tank Readings Every Run (xls)
- Drill Record Forms Every Run (pdf)
- Drill Fluid Parameters measured every 50 m and Source Water parameters (fresh shipments) for Archived and Shipped Samples in a list (pdf)
- Drill flushing parameters at the end of the borehole prior to WP05 (xls)
- PWT and HWT Casing DQC Check Lists (pdf)

Predrill Activities

- Drill Rig Alignment Survey from Tulloch (pdf)
- Drill Rig Inspection Report from Major (pdf)

TCLP Results

- Records of Chain of Custody for TCLP testing of drill cuttings (pdf)
- Results from laboratory of TCLP testing of drill cuttings (pdf)

Importers In a separate Zip file to the above data

- Planned Borehole Details (IG_BH04_WP02_IMP_01_Planned_Borehole_Details_R1.csv)
- Borehole Details (IG_BH04_WP02_IMP_02_ Borehole_Details_R1.csv)
- Borehole Deviation Surveys BH04
  (IG_BH04_WP02_IMP_03_Borehole_Deviation_Drilling_Survey_R1.csv)
- (IG_BH04_WP02_IMP_03_Borehole_Deviation_Final_Survey_R1.csv)
- Borehole Deviation Surveys BH04A
  (IG_BH04A_WP02_IMP_03_Borehole_Deviation_Survey_R1.csv)
- Borehole Deviation Surveys BH04B
  (IG_BH04B_WP02_IMP_03_Borehole_Deviation_Survey_R1.csv)
- Borehole Diameter Details BH04 (IG_BH04_WP02_IMP_04_Borehole_Diameter_Details_R1.csv)
- Borehole Diameter Details BH04A
  (IG_BH04A_WP02_IMP_04_Borehole_Diameter_Details_R1.csv)
- Borehole Diameter Details BH04B
  (IG_BH04B_WP02_IMP_04_Borehole_Diameter_Details_R1.csv)
- Borehole Construction Details BH04
  - (IG_BH04_WP02_IMP_05_Borehole_Construction_Details_R1.csv)
- Borehole Construction Details BH04A
  - (IG_BH04A_WP02_IMP_05_Borehole_Construction_Details_R1.csv)
- Borehole Construction Details BH04B
  - (IG_BH04B_WP02_IMP_05_Borehole_Construction_Details_R1.csv)
- Borehole Drilling Parameters BH04 – (IG_BH04_WP02_IMP_16_Drilling_Parameters_R1.csv)
- Borehole Drilling Parameters BH04 - (IG_BH04A_WP02_IMP_16_Drilling_Parameters_R1.csv)
- Borehole Drilling Parameters BH04B - (IG_BH04B_WP02_IMP_16_Drilling_Parameters_R1.csv)

Appendix B

Original IG_BH04 Site Survey by Tulloch

TOPOGRAPHIC SURVEY OF

PRE–CONSTRUCTION CONDITIONS

OF

PROPOSED BORE HOLE BH–04

PART OF REVELL LAKE AREA

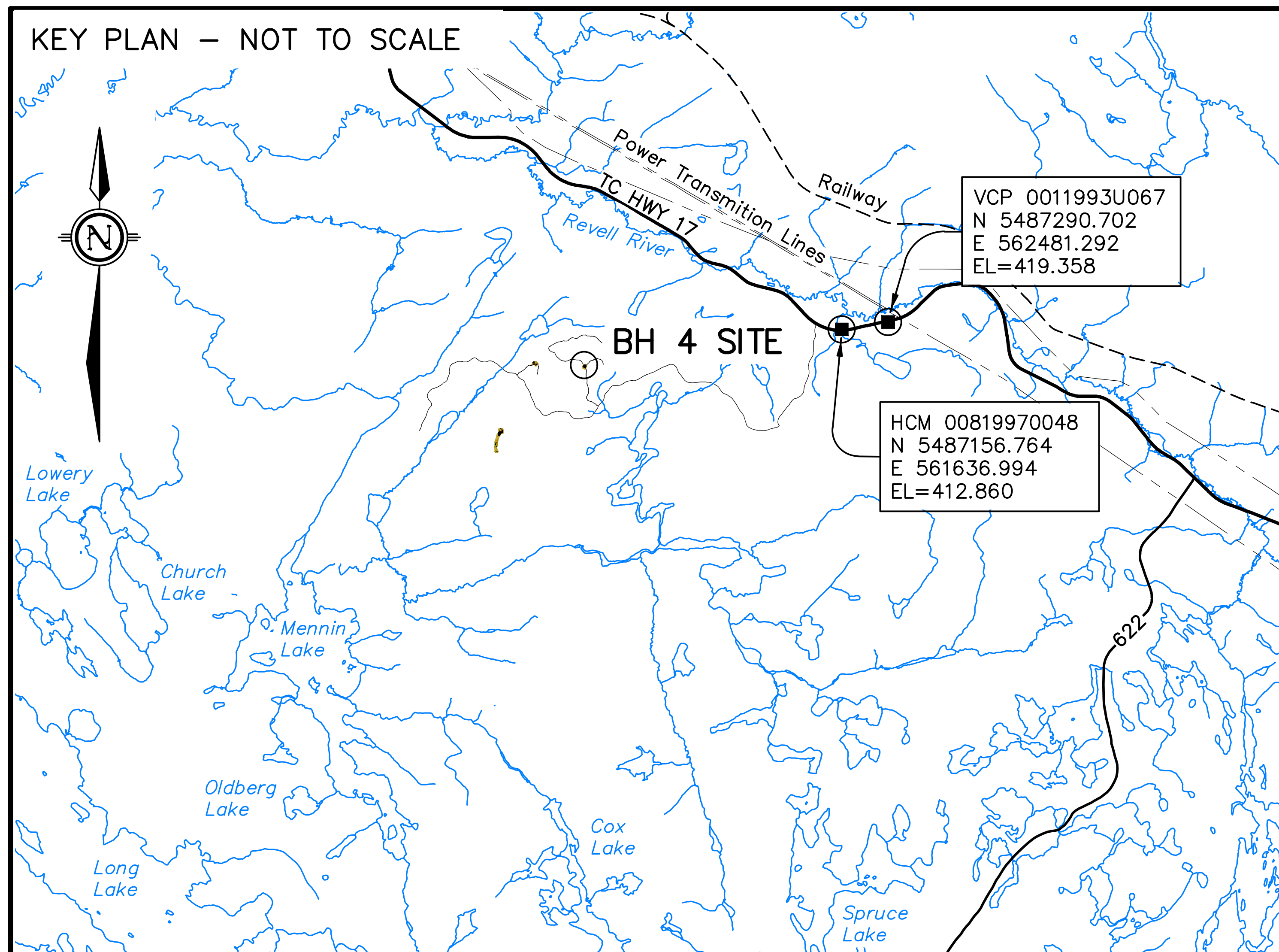
DISTRICT OF KENORA

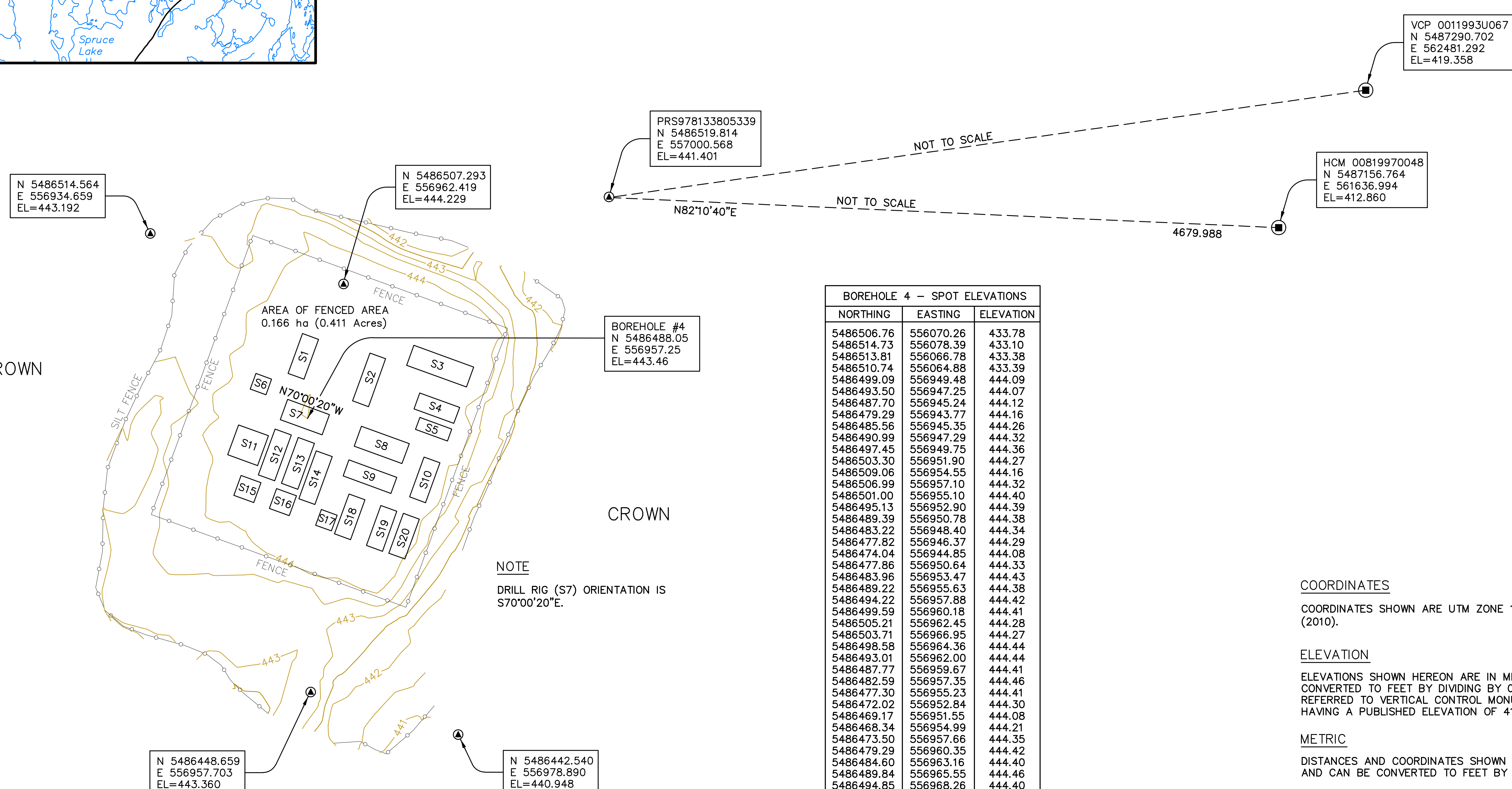
SCALE: 1 : 500

0 10 20 30 METRES

TULLOCH GEOMATICS INC.
2019

KEY PLAN – NOT TO SCALE





NOTE

DRILL RIG (S7) ORIENTATION IS S70°00'20"E.

STRUCTURE	DESCRIPTION	SIZE
S1	DRILL SHACK	2.44x6.10
S2	STORAGE	2.39x7.32
S3	MAJOR SUPER	3.05x9.14
S4	DG1	2.44x6.10
S5	RESTROOM	1.83x4.88
S6	TRANSPORT CUBE	2.40x2.40
S7	DRILL RIG	3.10x6.40
S8	SOL EXPERTS	3.05x7.32
S9	CORE SHACK	2.44x7.32
S10	OFFICE 2	2.44x6.10
S11	FRESH WATER	4.56x4.58
S12	STS	2.49x7.01
S13	AMC	2.49x7.01
S14	CORE SHACK	2.44x7.31
S15	WASTE WATER	3.05x3.05
S16	DRILL CUTTING	3.05x3.05
S17	TRANSPORT CUBE	2.40x2.40
S18	CORE STORAGE	2.45x6.10
S19	WOOD EQUIPMENT	2.45x6.10
S20	OFFICE 1	2.45x6.10

BOREHOLE 4 – SPOT ELEVATIONS

NORTHING	EASTING	ELEVATION
5486506.76	556070.26	433.78
5486514.73	556078.39	433.10
5486513.81	556066.78	433.38
5486510.74	556064.88	433.39
5486499.09	556949.48	444.09
5486493.50	556947.25	444.07
5486487.70	556945.24	444.12
5486479.29	556943.77	444.16
5486485.56	556945.35	444.26
5486490.99	556947.29	444.32
5486497.45	556949.75	444.36
5486503.30	556951.90	444.27
5486509.06	556954.55	444.16
5486506.99	556957.10	444.32
5486501.00	556955.10	444.40
5486495.13	556952.90	444.39
5486489.39	556950.78	444.38
5486483.22	556948.40	444.34
5486477.82	556946.37	444.29
5486474.04	556944.85	444.08
5486477.86	556950.64	444.33
5486483.96	556953.47	444.43
5486489.22	556955.63	444.38
5486494.22	556957.88	444.42
5486499.59	556960.18	444.41
5486505.21	556962.45	444.28
5486503.71	556966.95	444.27
5486498.58	556964.36	444.44
5486493.01	556962.00	444.44
5486487.77	556959.67	444.41
5486482.59	556957.35	444.46
5486477.30	556955.23	444.41
5486472.02	556952.84	444.30
5486469.17	556951.55	444.08
5486468.34	556954.99	444.21
5486473.50	556957.66	444.35
5486479.29	556960.35	444.42
5486484.60	556963.16	444.40
5486489.84	556965.55	444.46
5486494.85	556968.26	444.40
5486499.60	556970.95	444.33
5486504.38	556973.57	444.19
5486507.37	556975.04	444.04
5486499.93	556974.54	444.26
5486494.83	556971.91	444.33
5486489.80	556969.40	444.38
5486484.44	556966.93	444.39
5486478.91	556964.28	444.42
5486473.54	556961.63	444.41
5486468.71	556959.16	444.30
5486465.83	556958.07	444.06
5486469.27	556963.56	444.36
5486475.60	556967.29	444.37
5486481.27	556970.29	444.38
5486486.73	556973.05	444.35
5486492.46	556976.29	444.31
5486497.58	556978.86	444.21
5486501.31	556984.26	444.05
5486475.85	556975.57	444.14
5486470.18	556972.78	444.02
5486465.26	556969.73	444.00
5486463.19	556966.61	444.03

LEGEND

- DENOTES SITE CONTROL MONUMENT
- DENOTES FENCE
- DENOTES TOE OF SLOPE
- DENOTES EDGE OF SHOULDER
- DENOTES BUSH EDGE
- DENOTES EDGE OF VEGETATION
- 444 DENOTES CONTOUR (0.5m INTERVAL)
- DENOTES MINISTRY OF NATURAL RESOURCES AND FORESTRY GEODETIC SURVEY CONTROL MONUMENT

COORDINATES

COORDINATES SHOWN ARE UTM ZONE 15 (NORTH) NAD83 CSRS (2010).

ELEVATION

ELEVATIONS SHOWN HEREON ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048. ELEVATIONS ARE REFERRED TO VERTICAL CONTROL MONUMENT 0011993U067 HAVING A PUBLISHED ELEVATION OF 419.358m CGVD28–78.

METRIC

DISTANCES AND COORDINATES SHOWN HEREON ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

2. THE SURVEY WAS COMPLETED ON DECEMBER 4th, 2019.

December 11th, 2019.
SAULT STE MARIE, ONTARIO

BILL WEBB
ONTARIO LAND SURVEYOR

TULLOCH

TULLOCH GEOMATICS INC.
71 BLACK ROAD
UNIT 8
SAULT STE MARIE
P6B 0A3
T. 705 949.1457
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866 806.6602
saultstemarie@tulloch.ca

DRAWN BY: WSM | FILE: 19–3047

ACAD FILE SSM:\2019\GEOMATICS\193047 Wood Borehole Survey Ignace_GEOMATICS\001–Project Drawings\19–3047ms.DWG [BH4]

Appendix C

Final and Interim EZ-Gyro Borehole Orientation Measurements

	NWMO IGNACE DRILLING - DATA QUALITY CONFIRMATION **(DOC ID: SCB1912026-FOR-052 WP02 DQC Drilling R1)** BOREHOLE SURVEY FORM
Borehole	IG_BH04

Tool Make:	Reflex IMDX
Tool Model:	Ez-Gyro
Serial Number:	8LTSC09077
Manufacturer's Calibration Date:	15-Oct-19

Location				**Tool Measurement**		**Survey Performed by**	**Depth Check**	**Dev Check**
Depth (m)	Date (YYMMDD)	Time (HH:MM)	CR	Azimuth (˚)	Dip (˚)	Name	Depth (m)	(Y/N)
0	191119	15:45	0	111.5	-70.1	Adam Coulson/ Michael Anderson		Y
17.15	191123	21:45	8	110.5	-69.6	Frank Grivich		Y
35.15	191125	11:30	16	111.8	-69.5	Michael Anderson		Y
41.17	191125	23:30	19	109.5	-69.3	Frank Grivich		Y
50.0	191126	6:13	22	112.1	-69.5	Frank Grivich		Y
62.21	191128	12:10	26	110.5	-69.4	Michael Anderson		Y
74.17	191129	6:00	31	112.1	-69.3	Frank Grivich		Y
95.17	191130	6:00	37	112.2	-69.1	Frank Grivich		Y
101.2	191130	14:05	39	112.1	-69.1	Michael Anderson		Y
104.3	191215	18:05	40	112.8	-69.0	C. McCann		y
116.2	191218	12:40	46	114.3	-69.0	C. McCann		y
134.2	191219	10:45	55	113.9	-68.6	Randall Secord		y
143.2	191220	20:00	59	113.5	-68.3	C. McCann		y
149.2	191221	12:30	61	113.8	-68.2	Randall Secord		y
161.2	191222	18:30	67	112.6	-67.9	Frank Grivich		y
179.2	191223	8:30	74	113.2	-67.6	Frank Grivich		y
194.2	191224	17:00	79	113.3	-67.4	Frank Grivich		y
215.2	191225	17:30	87	113.7	-66.9	Frank Grivich		y
233.2	191226	16:00	94	114.1	-66.7	Frank Grivich		y
248.2	191227	16:30	99	113.8	-66.4	Frank Grivich		y
272.21	191228	17:15	107	112.7	-66	Michael Anderson		Y
281.21	191229	17:20	110	112.3	-65.7	Michael Anderson		Y
305.2	191230	6:00	118	113	-65.3	Frank Grivich		y
326.21	191231	6:00	126	112.1	-64.6	Frank Grivich		y
338.21	191231	17:37	130	113.24	-63.93	Michael Anderson		Y
359.2	200101	5:30	138	112.1	-62.6	Frank Grivich		y
377.21	200101	16:30	144	112.89	-61.5	Michael Anderson		Y
395.2	200102	3:00	149	113.4	-60.5	Frank Grivich		y
401.2	200104	6:00	153	113.8	-59	Frank Grivich		Y
410.2	200104	18:20	156	114.75	-58.41	Michael Anderson		Y
398.2	200105	6:00	151A	113	-60.12	Frank Grivich		Y
401.2	200105	9:13	152A	114.29	-59.98	Michael Anderson		Y
404.2	200105	10:45	153A	114.35	-59.8	Michael Anderson		Y
413.2	200106	13:33	157	112.2	-59.3	Michael Anderson		Y
422.2	200107	4:20	160	111.2	-58.9	Frank Grivich		Y
371.2	200109	2:00	142B	113.3	-61.9	Frank Grivich		Y
374.2	200110	18:17	143	114.3	-62.3	Michael Anderson		Y
377.2	200110	22:00	144	113.56	-63.25	Frank Grivich		Y
380.2	200111	0:50	145	112.9	-63.67	Frank Grivich		Y
383.2	200111	2:30	146	112.57	-63.58	Frank Grivich		Y
386.2	200111	4:10	147	112.87	-63.43	Frank Grivich		Y
389.2	200111	6:20	148	113.2	-63.28	Frank Grivich		Y
392.2	200111	12:00	149	113.66	-63.03	Michael Anderson		Y
395.2	200113	9:10	150	113.64	-64.31	Michael Anderson		Y
398.2	200113	12:09	151	113.01	-64.63	Michael Anderson		Y
401.2	200113	14:20	152	112.67	-64.67	Michael Anderson		Y
404.2	200113	16:36	153	110.3	-64.72	Michael Anderson		Y
407.2	200112	20:00	154	108.97	-64.91	Frank Grivich		Y
410.2	200113	23:30	155	106.12	-65.21	Frank Grivich		Y
413.2	200114	4:30	156	105.28	-65.44	Frank Grivich		Y
416.2	200114	6:40	157	103.46	-65.46	Frank Grivich		Y
419.2	200114	10:40	158	104.16	-65.42	Michael Anderson		Y
422.2	200114	12:30	159	104.16	-65.35	Michael Anderson		Y
425.2	200115	5:30	160	103.84	-65.14	Frank Grivich		Y
428.2	200115	7:30	161	104.22	-65.08	Michael Anderson		Y
431.2	200115	12:10	162	105.05	-65	Michael Anderson		Y
434.2	200115	14:14	163	104.53	-65.01	Michael Anderson		Y
437.2	200115	16:27	164	104.4	-64.96	Michael Anderson		Y
440.2	200116	4:00	165	103.9	-64.92	Frank Grivich		Y
443.2	200116	6:00	166	104.78	-64.95	Frank Grivich		Y
446.2	200116	10:54	167	104.44	-64.95	Michael Anderson		Y

Location				Tool Measurement		Survey Performed by	Depth Check	Dev Check
Depth (m)	Date (YYMMDD)	Time (HH:MM)	CR	Azimuth (˚)	Dip (˚)	Name	Depth (m)	(Y/N)
449.2	200116	2:59	168	104.18	-64.98	Michael Anderson		Y
452.2	200116	20:30	169	104.1	-65.3	Frank Grivich		Y. Survey done with EZ-Trac
455.2	200116	20:45	169	104.2	-65.1	Frank Grivich		Y. Survey done with EZ-Trac
458.2	200116	23:00	170	104.0	-65.0	Frank Grivich		Y. Survey done with EZ-Trac
461.2	200117	9:38	172	104.1	-65.0	Tyler Patten		Y. Survey done with EZ-Trac
464.2	200117	11:35	173	103.1	-65.0	Tyler Patten		Y. Survey done with EZ-Trac
467.2	200117	14:15	174	104.8	-65.0	Tyler Patten		Y. Survey done with EZ-Trac
470.2	200117	16:20	175	103.9	-64.9	Tyler Patten	477.02	Y. Survey done with EZ-Trac
473.2	200117	18:38	176	104.2	-64.9	Tyler Patten		Y. Survey done with EZ-Trac
476.2	200117	21:30	177	103.3	-65.21	Frank Grivich		Y. Survey done with EZ-Trac
479.2	200117	23:45	178	104.3	-64.9	Frank Grivich		Y. Survey done with EZ-Trac
482.2	200117	2:45	179	103.9	-64.9	Frank Grivich		Y. Survey done with EZ-Trac
485.21	200118	8:55	181	103.4	-65.1	Tyler Patten		Y. Survey done with EZ-Trac
488.21	200118	10:40	182	104.6	-65.2	Tyler Patten		Y. Survey done with EZ-Trac
491.21	200118	14:20	183	104.1	-64.9	Tyler Patten		Y. Survey done with EZ-Trac
494.21	200118	15:45	184	104.7	-64.9	Tyler Patten		Y. Survey done with EZ-Trac
497.21	200118	17:40	185	103.8	-65	Tyler Patten		Y. Survey done with EZ-Trac
500.2	200119	2:50	186	104.4	-64.8	Frank Grivich		Y. Survey done with EZ-Trac
503.2	200119	5:15	187	104.2	-65.2	Frank Grivich		Y. Survey done with EZ-Trac
506.21	200119	8:45	188	104.3	-64.8	Tyler Patten		Y. Survey done with EZ-Trac
506.21	200119	14:28	189	105.09	-64.76	Tyler Patten		Y
509.21	200119	16:19	190	104	-64.73	Tyler Patten		Y
512.21	200119	17:39	191	104.83	-64.75	Tyler Patten		Y
515.21	200119	22:10	192	105.9	-64.73	Sepehr Rahimi		Y
518.21	200120	0:15	193	104.76	-64.72	Sepehr Rahimi		Y
521.21	200120	2:15	194	104.88	-64.7	Sepehr Rahimi		Y
524.21	200120	4:15	195	104.57	-64.68	Sepehr Rahimi		Y
527.21	200120	6:10	197	105.03	-64.65	Sepehr Rahimi		Y
530.21	200120	9:10	198	103.9	-64.65	Tyler Patten		Y
533.21	200120	10:51	199	105.63	-64.63	Tyler Patten		Y
536.21	200120	12:30	200	105.38	-64.63	Tyler Patten		Y
539.21	200120	14:30	201	105.47	-64.61	Tyler Patten		Y
542.21	200120	16:32	202	104.62	-64.62	Tyler Patten		Y
554.21	200120	4:45	206	105.9	-64.56	Sepehr Rahimi		Y
569.2	200121	19:45	211	105.15	-64.49	Sepehr Rahimi		Y
578.2	200122	2:55	214	104.69	-64.52	Sepehr Rahimi		Y
590.2	200214	4:10	218	104.99	-64.49	Sepehr Rahimi		Y
605.2	200217	4:50	223	105.53	-64.46	Sepehr Rahimi		Y
617.21	200217	14:34	227	105.99	-64.45	Cameron McCann		Y
638.2	200218	5:20	234	105.44	-64.35	Sepehr Rahimi		Y
644.2	200218	10:30	236	105.4	-64.32	Tyler Patten		Y
671.2	200219	4:50	245	106.11	-64.1	Sepehr Rahimi		Y
683.21	200219	16:13	249	106.48	-63.98	Tyler Patten		Y
695.21	200220	1:34	253	106.6	-63.93	Sepehr Rahimi		Y
701.21	200220	5:20	254	107	-63.89	Sepehr Rahimi		Y
704.21	200220	10:15	256	106.67	-63.9	Tyler Patten		Y
711.14	200221	14:00	259	107.05	-63.84	Tyler Patten		Y
717.14	200221	17:40	261	106.06	-63.86	Tyler Patten		Y
723.14	200222	0:20	264	107.12	-63.87	Sepehr Rahimi		Y
738.1	200229	0:44	269	106.53	-63.78	Michael Anderson		Y
750.14	200301	11:45	273	106.95	-63.76	Tyler Patten		Y
771.14	200302	3:44	280	107.51	-63.73	Michael Anderson		Y
777.14	200302	8:43	282	107.24	-63.71	Tyler Patten		Y
789.14	200303	13:45	287	107.81	-63.6	Tyler Patten		Y
804.1	200304	5:00	288	107.45	-63.54	Michael Anderson		Y
816.14	200304	17:00	296	106.88	-63.48	Tyler Patten		Y
834.14	200305	9:30	302	108.31	-63.44	Tyler Patten		Y
858.14	200306	9:05	310	107.88	-63.26	Brad Walsh		Y
861.14	200306	12:00	311	108.12	-63.24	Brad Walsh		Y
873.14	200307	15:00	317	108.55	-63.09	Brad Walsh		Y
876.14	200307	18:15	318	108.3	-63.04	Brad Walsh		Y
882.14	200308	1:44	320	108.97	-62.99	Michael Anderson		Y
894.14	200309	5:17	324	109.63	-62.88	Michael Anderson		Y
906.14	200309	14:16	328	109.46	-62.82	Brad Walsh		Y
918.14	200310	21:28	333	109.38	-62.71	Michael Anderson		Y
933.14	200311	9:30	337	109.76	-62.58	C. McCann & Brad Walsh		Y
951.1	200312	21:30	343	109.19	-62.49	Michael Anderson		Y
957.1	200312	13:30	345	109.02	-62.43	C. McCann		Y
969.14	200313	4:15	349	110.43	-62.39	Michael Anderson		Y
981.14	200313	18:00	353	109.74	-62.36	C. McCann		Y
993.14	200314	5:33	357	109.51	-62.36	Michael Anderson		Y
997.2	200314	14:20	359	109.92	-62.33	C. McCann		Y

	NWMO IGNACE DRILLING - DATA QUALITY CONFIRMATION **(DOC ID: SCB1912026-FOR-052 WP02 DQC Drilling R1)** BOREHOLE SURVEY FORM CORRECTED 0.84m
Borehole	IG_BH04

Tool Make:	Reflex IMDX
Tool Model:	Ez-Gyro
Serial Number:	8LTSC09077
Manufacturer's Calibration Date:	15-Oct-19

Location				**Tool Measurement**		**Survey Performed by**	**Depth Check**	**Dev Check**
Depth (m)	Date (YYMMDD)	Time (HH:MM)	CR	Azimuth (˚)	Dip (˚)	Name	Depth (m)	(Y/N)
0	191119	15:45	0	111.5	-70.1	Adam Coulson/ Michael Anderson		Y
16.31	191123	21:45	8	110.5	-69.6	Frank Grivich		Y
34.31	191125	11:30	16	111.8	-69.5	Michael Anderson		Y
40.33	191125	23:30	19	109.5	-69.3	Frank Grivich		Y
49.2	191126	6:13	22	112.1	-69.5	Frank Grivich		Y
61.37	191128	12:10	26	110.5	-69.4	Michael Anderson		Y
73.33	191129	6:00	31	112.1	-69.3	Frank Grivich		Y
94.33	191130	6:00	37	112.2	-69.1	Frank Grivich		Y
100.36	191130	14:05	39	112.1	-69.1	Michael Anderson		Y
103.46	191215	18:05	40	112.8	-69.0	C. McCann		y
115.36	191218	12:40	46	114.3	-69.0	C. McCann		y
133.36	191219	10:45	55	113.9	-68.6	Randall Secord		y
142.36	191220	20:00	59	113.5	-68.3	C. McCann		y
148.36	191221	12:30	61	113.8	-68.2	Randall Secord		y
160.36	191222	18:30	67	112.6	-67.9	Frank Grivich		y
178.36	191223	8:30	74	113.2	-67.6	Frank Grivich		y
193.36	191224	17:00	79	113.3	-67.4	Frank Grivich		y
214.36	191225	17:30	87	113.7	-66.9	Frank Grivich		y
232.36	191226	16:00	94	114.1	-66.7	Frank Grivich		y
247.36	191227	16:30	99	113.8	-66.4	Frank Grivich		y
271.37	191228	17:15	107	112.7	-66	Michael Anderson		Y
280.37	191229	17:20	110	112.3	-65.7	Michael Anderson		Y
304.36	191230	6:00	118	113	-65.3	Frank Grivich		y
325.37	191231	6:00	126	112.1	-64.6	Frank Grivich		y
337.37	191231	17:37	130	113.24	-63.93	Michael Anderson		Y
358.36	200101	5:30	138	112.1	-62.6	Frank Grivich		y
376.37	200101	16:30	144	112.89	-61.5	Michael Anderson		Y
394.36	200102	3:00	149	113.4	-60.5	Frank Grivich		y
400.36	200104	6:00	153	113.8	-59	Frank Grivich		Y
409.36	200104	18:20	156	114.75	-58.41	Michael Anderson		Y
397.36	200105	6:00	151A	113	-60.12	Frank Grivich		Y
400.36	200105	9:13	152A	114.29	-59.98	Michael Anderson		Y
403.36	200105	10:45	153A	114.35	-59.8	Michael Anderson		Y
412.36	200106	13:33	157	112.2	-59.3	Michael Anderson		Y
421.36	200107	4:20	160	111.2	-58.9	Frank Grivich		Y
370.36	200109	2:00	142B	113.3	-61.9	Frank Grivich		Y
373.36	200110	18:17	143	114.3	-62.3	Michael Anderson		Y
376.36	200110	22:00	144	113.56	-63.25	Frank Grivich		Y
379.36	200111	0:50	145	112.9	-63.67	Frank Grivich		Y
382.36	200111	2:30	146	112.57	-63.58	Frank Grivich		Y
385.36	200111	4:10	147	112.87	-63.43	Frank Grivich		Y
388.36	200111	6:20	148	113.2	-63.28	Frank Grivich		Y
391.36	200111	12:00	149	113.66	-63.03	Michael Anderson		Y
394.36	200113	9:10	150	113.64	-64.31	Michael Anderson		Y
397.36	200113	12:09	151	113.01	-64.63	Michael Anderson		Y
400.36	200113	14:20	152	112.67	-64.67	Michael Anderson		Y
403.36	200113	16:36	153	110.3	-64.72	Michael Anderson		Y
406.36	200112	20:00	154	108.97	-64.91	Frank Grivich		Y
409.36	200113	23:30	155	106.12	-65.21	Frank Grivich		Y
412.36	200114	4:30	156	105.28	-65.44	Frank Grivich		Y
415.36	200114	6:40	157	103.46	-65.46	Frank Grivich		Y
418.36	200114	10:40	158	104.16	-65.42	Michael Anderson		Y
421.36	200114	12:30	159	104.16	-65.35	Michael Anderson		Y
424.36	200115	5:30	160	103.84	-65.14	Frank Grivich		Y
427.36	200115	7:30	161	104.22	-65.08	Michael Anderson		Y
430.36	200115	12:10	162	105.05	-65	Michael Anderson		Y
433.36	200115	14:14	163	104.53	-65.01	Michael Anderson		Y
436.36	200115	16:27	164	104.4	-64.96	Michael Anderson		Y
439.36	200116	4:00	165	103.9	-64.92	Frank Grivich		Y
442.36	200116	6:00	166	104.78	-64.95	Frank Grivich		Y
445.36	200116	10:54	167	104.44	-64.95	Michael Anderson		Y

Location				Tool Measurement		Survey Performed by	Depth Check	Dev Check
Depth (m)	Date (YYMMDD)	Time (HH:MM)	CR	Azimuth (˚)	Dip (˚)	Name	Depth (m)	(Y/N)
448.36	200116	2:59	168	104.18	-64.98	Michael Anderson		Y
451.36	200116	20:30	169	104.1	-65.3	Frank Grivich		Y. Survey done with EZ-Trac
454.36	200116	20:45	169	104.2	-65.1	Frank Grivich		Y. Survey done with EZ-Trac
457.36	200116	23:00	170	104.0	-65.0	Frank Grivich		Y. Survey done with EZ-Trac
460.36	200117	9:38	172	104.1	-65.0	Tyler Patten		Y. Survey done with EZ-Trac
463.36	200117	11:35	173	103.1	-65.0	Tyler Patten		Y. Survey done with EZ-Trac
466.36	200117	14:15	174	104.8	-65.0	Tyler Patten		Y. Survey done with EZ-Trac
469.36	200117	16:20	175	103.9	-64.9	Tyler Patten	477.02	Y. Survey done with EZ-Trac
472.36	200117	18:38	176	104.2	-64.9	Tyler Patten		Y. Survey done with EZ-Trac
475.36	200117	21:30	177	103.3	-65.21	Frank Grivich		Y. Survey done with EZ-Trac
478.36	200117	23:45	178	104.3	-64.9	Frank Grivich		Y. Survey done with EZ-Trac
481.36	200117	2:45	179	103.9	-64.9	Frank Grivich		Y. Survey done with EZ-Trac
484.37	200118	8:55	181	103.4	-65.1	Tyler Patten		Y. Survey done with EZ-Trac
487.37	200118	10:40	182	104.6	-65.2	Tyler Patten		Y. Survey done with EZ-Trac
490.37	200118	14:20	183	104.1	-64.9	Tyler Patten		Y. Survey done with EZ-Trac
493.37	200118	15:45	184	104.7	-64.9	Tyler Patten		Y. Survey done with EZ-Trac
496.37	200118	17:40	185	103.8	-65	Tyler Patten		Y. Survey done with EZ-Trac
499.36	200119	2:50	186	104.4	-64.8	Frank Grivich		Y. Survey done with EZ-Trac
502.36	200119	5:15	187	104.2	-65.2	Frank Grivich		Y. Survey done with EZ-Trac
505.37	200119	8:45	188	104.3	-64.8	Tyler Patten		Y. Survey done with EZ-Trac
505.37	200119	14:28	189	105.09	-64.76	Tyler Patten		Y
508.37	200119	16:19	190	104	-64.73	Tyler Patten		Y
511.37	200119	17:39	191	104.83	-64.75	Tyler Patten		Y
514.37	200119	22:10	192	105.9	-64.73	Sepehr Rahimi		Y
517.37	200120	0:15	193	104.76	-64.72	Sepehr Rahimi		Y
520.37	200120	2:15	194	104.88	-64.7	Sepehr Rahimi		Y
523.37	200120	4:15	195	104.57	-64.68	Sepehr Rahimi		Y
526.37	200120	6:10	197	105.03	-64.65	Sepehr Rahimi		Y
529.37	200120	9:10	198	103.9	-64.65	Tyler Patten		Y
532.37	200120	10:51	199	105.63	-64.63	Tyler Patten		Y
535.37	200120	12:30	200	105.38	-64.63	Tyler Patten		Y
538.37	200120	14:30	201	105.47	-64.61	Tyler Patten		Y
541.37	200120	16:32	202	104.62	-64.62	Tyler Patten		Y
553.37	200120	4:45	206	105.9	-64.56	Sepehr Rahimi		Y
568.36	200121	19:45	211	105.15	-64.49	Sepehr Rahimi		Y
577.36	200122	2:55	214	104.69	-64.52	Sepehr Rahimi		Y
589.36	200214	4:10	218	104.99	-64.49	Sepehr Rahimi		Y
604.36	200217	4:50	223	105.53	-64.46	Sepehr Rahimi		Y
616.37	200217	14:34	227	105.99	-64.45	Cameron McCann		Y
637.36	200218	5:20	234	105.44	-64.35	Sepehr Rahimi		Y
643.36	200218	10:30	236	105.4	-64.32	Tyler Patten		Y
670.36	200219	4:50	245	106.11	-64.1	Sepehr Rahimi		Y
682.37	200219	16:13	249	106.48	-63.98	Tyler Patten		Y
694.37	200220	1:34	253	106.6	-63.93	Sepehr Rahimi		Y
700.37	200220	5:20	254	107	-63.89	Sepehr Rahimi		Y
703.37	200220	10:15	256	106.67	-63.9	Tyler Patten		Y
710.3	200221	14:00	259	107.05	-63.84	Tyler Patten		Y
716.3	200221	17:40	261	106.06	-63.86	Tyler Patten		Y
722.3	200222	0:20	264	107.12	-63.87	Sepehr Rahimi		Y
737.26	200229	0:44	269	106.53	-63.78	Michael Anderson		Y
749.3	200301	11:45	273	106.95	-63.76	Tyler Patten		Y
770.3	200302	3:44	280	107.51	-63.73	Michael Anderson		Y
776.3	200302	8:43	282	107.24	-63.71	Tyler Patten		Y
788.3	200303	13:45	287	107.81	-63.6	Tyler Patten		Y
803.26	200304	5:00	288	107.45	-63.54	Michael Anderson		Y
815.3	200304	17:00	296	106.88	-63.48	Tyler Patten		Y
833.3	200305	9:30	302	108.31	-63.44	Tyler Patten		Y
857.3	200306	9:05	310	107.88	-63.26	Brad Walsh		Y
860.3	200306	12:00	311	108.12	-63.24	Brad Walsh		Y
872.3	200307	15:00	317	108.55	-63.09	Brad Walsh		Y
875.3	200307	18:15	318	108.3	-63.04	Brad Walsh		Y
881.3	200308	1:44	320	108.97	-62.99	Michael Anderson		Y
893.3	200309	5:17	324	109.63	-62.88	Michael Anderson		Y
905.3	200309	14:16	328	109.46	-62.82	Brad Walsh		Y
917.3	200310	21:28	333	109.38	-62.71	Michael Anderson		Y
932.3	200311	9:30	337	109.76	-62.58	C. McCann & Brad Walsh		Y
950.26	200312	21:30	343	109.19	-62.49	Michael Anderson		Y
956.26	200312	13:30	345	109.02	-62.43	C. McCann		Y
968.3	200313	4:15	349	110.43	-62.39	Michael Anderson		Y
980.3	200313	18:00	353	109.74	-62.36	C. McCann		Y
992.3	200314	5:33	357	109.51	-62.36	Michael Anderson		Y
996.36	200314	14:20	359	109.92	-62.33	C. McCann		Y

	NWMO IGNACE DRILLING - DATA QUALITY CONFIRMATION **(DOC ID: SCB1912026-FOR-052 WP02 DQC Drilling R1)** BOREHOLE SURVEY FORM
Borehole	IG_BH04

Tool Make:	Reflex IMDX
Tool Model:	Ez-Gyro
Serial Number:	8LTSC09077
Manufacturer's Calibration Date:	15-Oct-19

Location				**Tool Measurement**		**Survey Performed by**	**Depth Check**	**Dev Check**
Depth (m)	Date (YYMMDD)	Time (HH:MM)	CR	Azimuth (˚)	Dip (˚)	Name	Depth (m)	(Y/N)
0	200316	22:42	N/A	110.01	-69.80	Michael Anderson		Y
10	200316	22:38	N/A	110.93	-69.74	Michael Anderson		Y
20	200316	22:33	N/A	110.55	-69.49	Michael Anderson		Y
30	200316	22:28	N/A	111.42	-69.46	Michael Anderson		Y
40	200316	22:23	N/A	111.83	-69.44	Michael Anderson		Y
50	200316	22:19	N/A	112.47	-69.46	Michael Anderson		Y
60	200316	22:14	N/A	111.50	-69.35	Michael Anderson		Y
70	200316	22:09	N/A	112.02	-69.41	Michael Anderson		Y
80	200316	22:05	N/A	112.07	-69.25	Michael Anderson		Y
90	200316	22:00	N/A	112.85	-68.95	Michael Anderson		Y
100	200316	21:55	N/A	112.90	-69.07	Michael Anderson		Y
110	200316	21:51	N/A	113.16	-69.06	Michael Anderson		Y
120	200316	21:46	N/A	113.17	-68.83	Michael Anderson		Y
130	200316	21:41	N/A	113.57	-68.57	Michael Anderson		Y
140	200316	21:37	N/A	113.33	-68.33	Michael Anderson		Y
150	200316	21:31	N/A	113.86	-68.11	Michael Anderson		Y
160	200316	21:26	N/A	113.10	-67.93	Michael Anderson		Y
170	200316	21:22	N/A	114.05	-67.78	Michael Anderson		Y
180	200316	21:17	N/A	113.10	-67.64	Michael Anderson		Y
190	200316	21:12	N/A	112.66	-67.43	Michael Anderson		Y
200	200316	21:08	N/A	113.38	-67.25	Michael Anderson		Y
210	200316	21:03	N/A	113.92	-66.93	Michael Anderson		Y
220	200316	20:58	N/A	113.50	-66.84	Michael Anderson		Y
230	200316	20:54	N/A	113.29	-66.67	Michael Anderson		Y
240	200316	20:49	N/A	113.64	-66.57	Michael Anderson		Y
250	200316	20:44	N/A	113.41	-66.46	Michael Anderson		Y
260	200316	16:45	N/A	113.05	-66.34	Cameron McCann		Y
270	200316	16:41	N/A	113.41	-66.16	Cameron McCann		Y
280	200316	16:36	N/A	112.55	-65.89	Cameron McCann		Y
290	200316	16:31	N/A	113.05	-65.70	Cameron McCann		Y
300	200316	16:27	N/A	113.15	-65.50	Cameron McCann		Y
310	200316	16:22	N/A	112.44	-65.21	Cameron McCann		Y
320	200316	16:17	N/A	112.90	-64.99	Cameron McCann		Y

330	200316	16:13	N/A	112.88	-64.57	Cameron McCann		Y
340	200316	16:06	N/A	112.50	-64.05	Cameron McCann		Y
350	200316	16:02	N/A	112.66	-63.41	Cameron McCann		Y
360	200316	15:57	N/A	112.80	-62.80	Cameron McCann		Y
370	200316	15:52	N/A	112.90	-62.09	Cameron McCann		Y
380	200316	15:48	N/A	113.43	-63.30	Cameron McCann		Y
390	200316	15:43	N/A	113.11	-63.36	Cameron McCann		Y
400	200316	15:38	N/A	112.15	-64.51	Cameron McCann		Y
410	200316	15:34	N/A	109.11	-65.03	Cameron McCann		Y
420	200316	15:29	N/A	104.04	-65.53	Cameron McCann		Y
430	200316	15:24	N/A	104.08	-65.15	Cameron McCann		Y
440	200316	15:19	N/A	104.28	-65.03	Cameron McCann		Y
450	200316	15:14	N/A	104.09	-65.00	Cameron McCann		Y
460	200316	15:10	N/A	103.66	-65.01	Cameron McCann		Y
470	200316	15:04	N/A	103.96	-65.02	Cameron McCann		Y
480	200316	14:59	N/A	104.61	-64.98	Cameron McCann		Y
490	200316	14:53	N/A	103.95	-64.97	Cameron McCann		Y
500	200316	14:22	N/A	104.56	-64.81	Cameron McCann		Y
510	200316	14:17	N/A	104.48	-64.74	Cameron McCann		Y
520	200316	14:13	N/A	105.17	-64.69	Cameron McCann		Y
530	200316	14:06	N/A	104.67	-64.71	Cameron McCann		Y
540	200316	14:01	N/A	104.60	-64.64	Cameron McCann		Y
550	200316	13:56	N/A	105.66	-64.68	Cameron McCann		Y
560	200316	13:52	N/A	104.31	-64.59	Cameron McCann		Y
570	200316	13:47	N/A	105.24	-64.61	Cameron McCann		Y
580	200316	13:41	N/A	105.33	-64.57	Cameron McCann		Y
590	200316	13:36	N/A	105.53	-64.54	Cameron McCann		Y
600	200316	13:31	N/A	104.94	-64.56	Cameron McCann		Y
610	200316	13:25	N/A	105.14	-64.53	Cameron McCann		Y
620	200316	13:21	N/A	105.99	-64.47	Cameron McCann		Y
630	200316	13:16	N/A	106.35	-64.45	Cameron McCann		Y
640	200316	13:11	N/A	105.91	-64.34	Cameron McCann		Y
650	200316	13:07	N/A	105.32	-64.31	Cameron McCann		Y
660	200316	13:02	N/A	105.13	-64.25	Cameron McCann		Y
670	200316	12:57	N/A	105.84	-64.15	Cameron McCann		Y
680	200316	12:50	N/A	106.35	-64.06	Cameron McCann		Y
690	200316	12:42	N/A	106.75	-64.02	Cameron McCann		Y
700	200316	12:38	N/A	106.63	-63.95	Cameron McCann		Y
710	200316	12:33	N/A	106.27	-63.89	Cameron McCann		Y
720	200316	12:28	N/A	106.54	-63.88	Cameron McCann		Y
730	200316	12:24	N/A	107.39	-63.85	Cameron McCann		Y
740	200316	12:09	N/A	106.84	-63.80	Cameron McCann		Y
750	200316	11:26	N/A	107.22	-63.80	Cameron McCann		Y
760	200316	11:20	N/A	107.62	-63.75	Cameron McCann		Y
770	200316	11:14	N/A	107.93	-63.70	Cameron McCann		Y
780	200316	11:09	N/A	107.67	-63.62	Cameron McCann		Y
790	200316	11:04	N/A	107.89	-63.63	Cameron McCann		Y
800	200316	10:59	N/A	108.71	-63.53	Cameron McCann		Y
810	200316	10:54	N/A	108.08	-63.49	Cameron McCann		Y
820	200316	10:50	N/A	108.43	-63.42	Cameron McCann		Y
830	200316	10:45	N/A	108.42	-63.44	Cameron McCann		Y

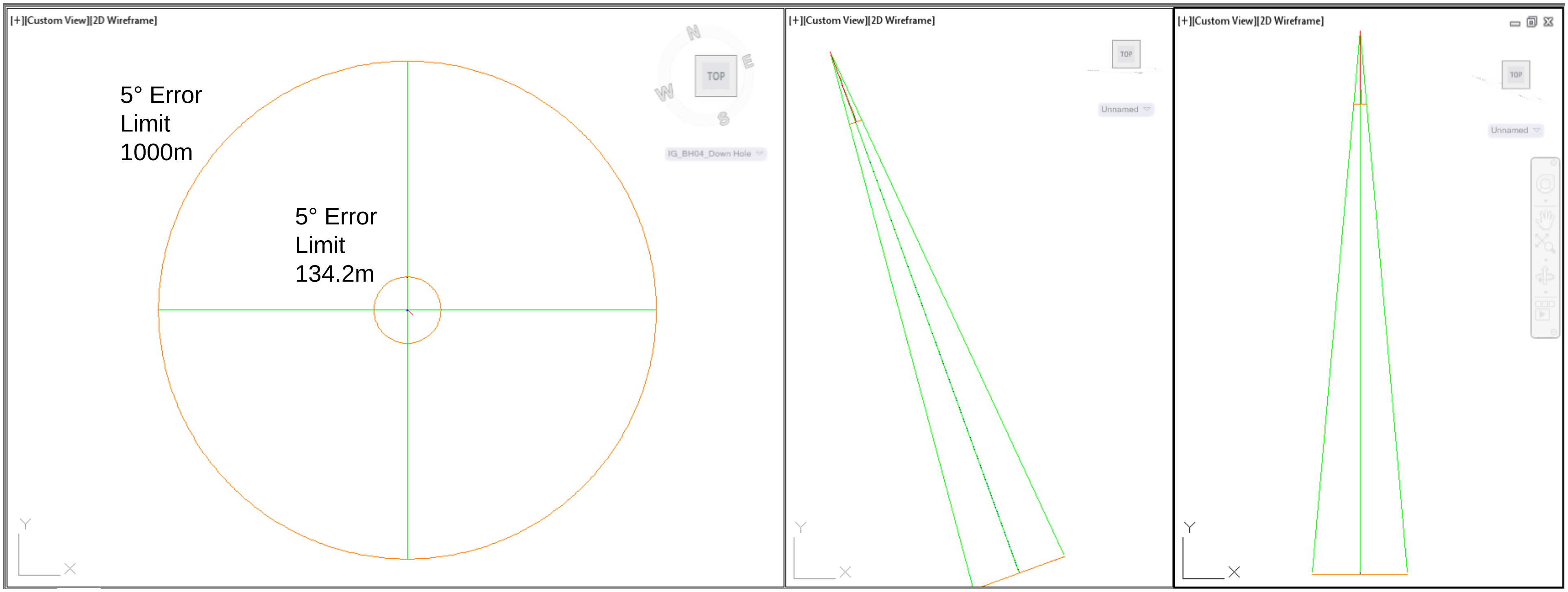
840	200316	10:40	N/A	108.96	-63.39	Cameron McCann		Y
850	200316	10:36	N/A	108.98	-63.24	Cameron McCann		Y
860	200316	10:28	N/A	109.16	-63.21	Cameron McCann		Y
870	200316	10:22	N/A	109.18	-63.05	Cameron McCann		Y
880	200316	10:17	N/A	108.80	-62.96	Cameron McCann		Y
890	200316	10:12	N/A	108.74	-62.88	Cameron McCann		Y
900	200316	10:08	N/A	109.46	-62.84	Cameron McCann		Y
910	200316	10:02	N/A	109.13	-62.79	Cameron McCann		Y
920	200316	9:57	N/A	108.88	-62.66	Cameron McCann		Y
930	200316	9:52	N/A	109.74	-62.61	Cameron McCann		Y
940	200316	9:47	N/A	109.46	-62.46	Cameron McCann		Y
950	200316	9:42	N/A	110.00	-62.41	Cameron McCann		Y
960	200316	9:37	N/A	109.24	-62.41	Cameron McCann		Y
970	200316	9:33	N/A	110.01	-62.42	Cameron McCann		Y
980	200316	9:28	N/A	109.96	-62.29	Cameron McCann		Y
990	200316	9:23	N/A	110.23	-62.31	Cameron McCann		Y
1000	200316	8:43	N/A	110.08	-62.30	Cameron McCann		Y

IG_BH04 Downhole Survey Results

Ez-Gyro Survey Plotted Results

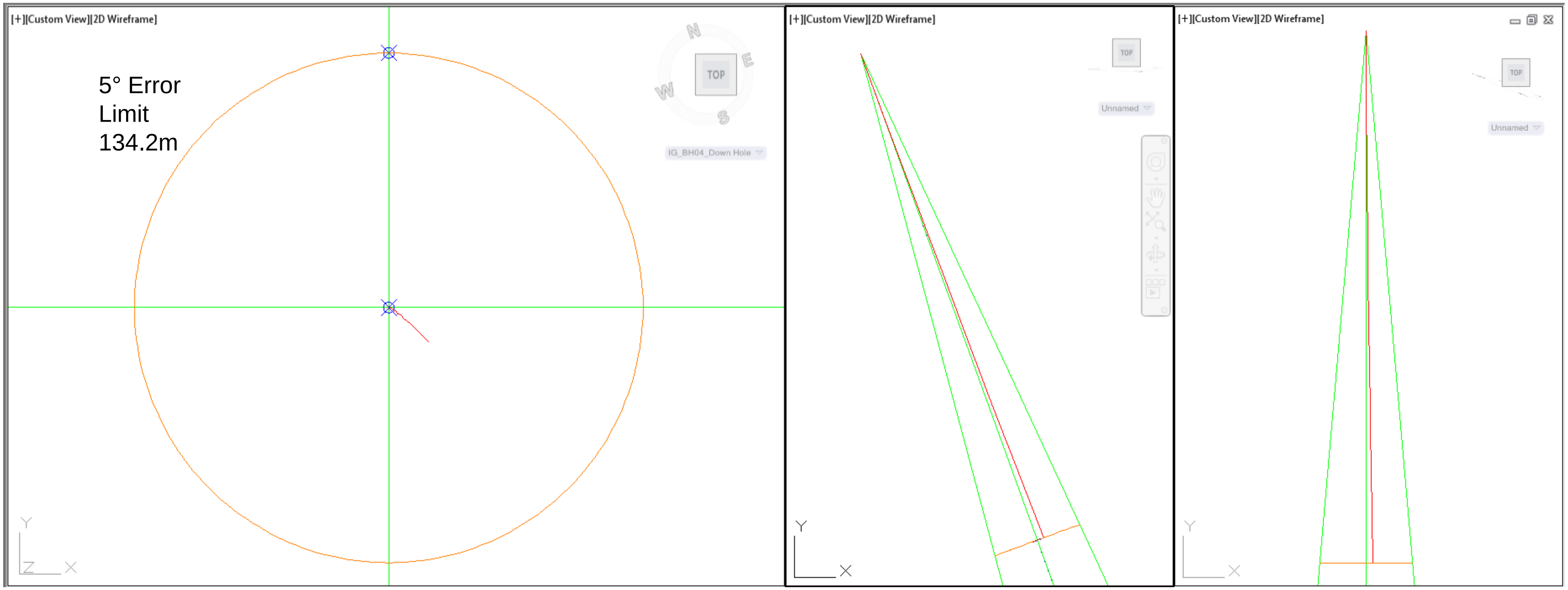
19 Dec 2019
24 Dec 2019
26 Dec 2019
29 Dec 2019
01 Jan 2020
04 Jan 2020
07 Jan 2020
13 Jan 2020
14 Jan 2020_1
14 Jan 2020_2
15 Jan 2020_1
16 Jan 2020_1
20 Jan 2020_1
20 Jan 2020_2
22 Jan 2020_1
17 Feb 2020_1
18 Feb 2020_1
20 Feb 2020_1
02 Mar 2020_1
03 Mar 2020_1
06 Mar 2020_1
07 Mar 2020_1
11 Mar 2020_1
12 Mar 2020_1
16 Mar 2020_1

191219 at 134.2m



View Down Planned Borehole View Perp. Planned View Front Planned

191219 at 134.2m Zoomed

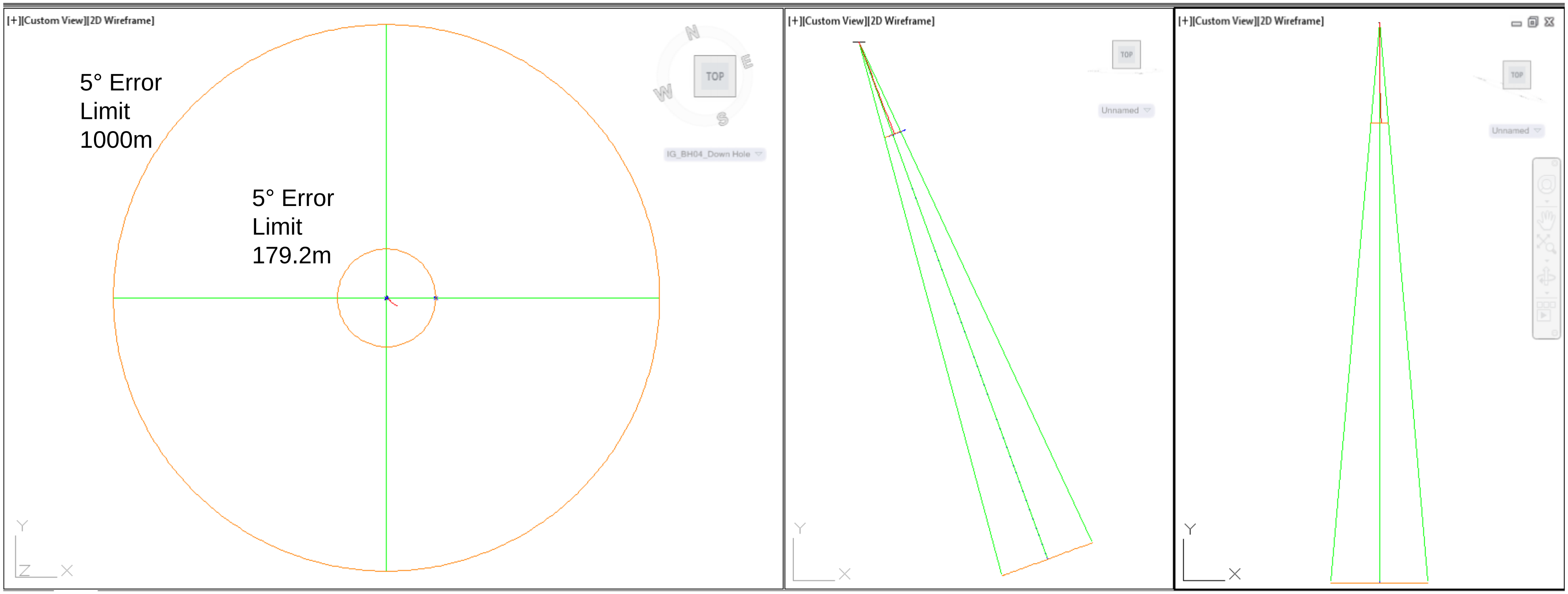


View Down Planned Borehole

View Perp. Planned

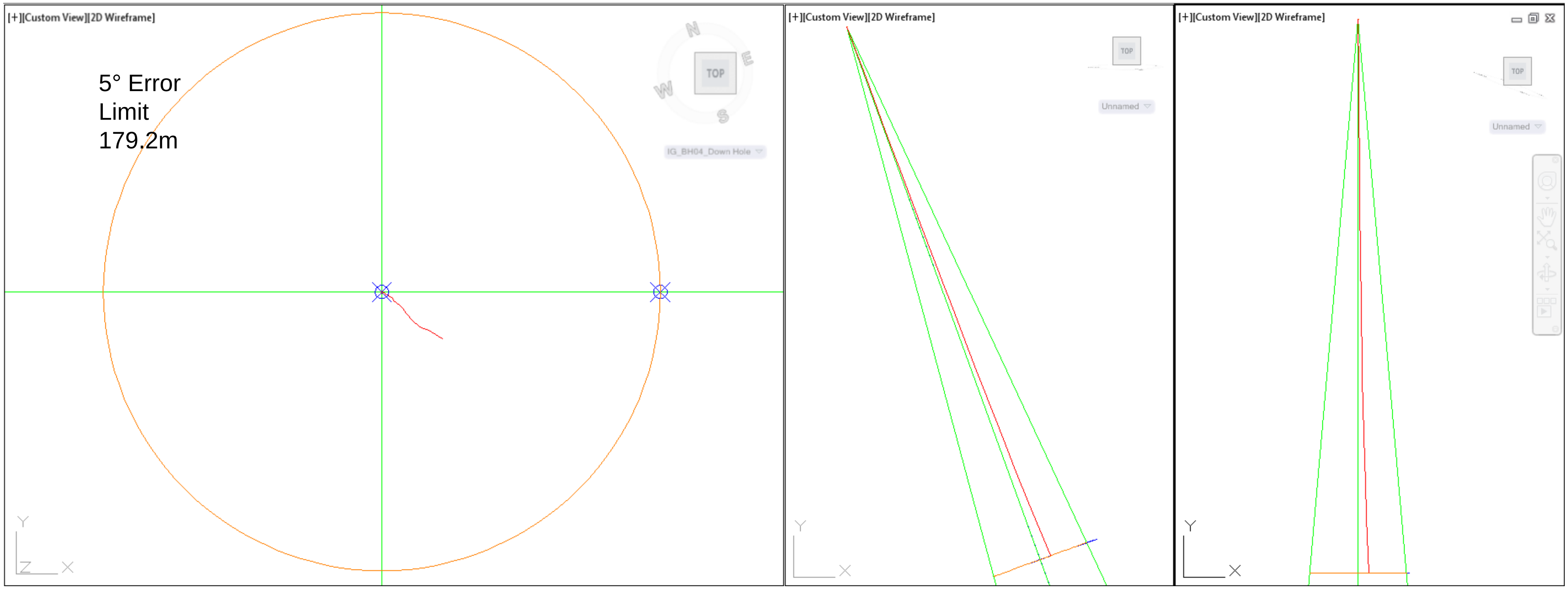
View Front Planned

191224 at 179.2m



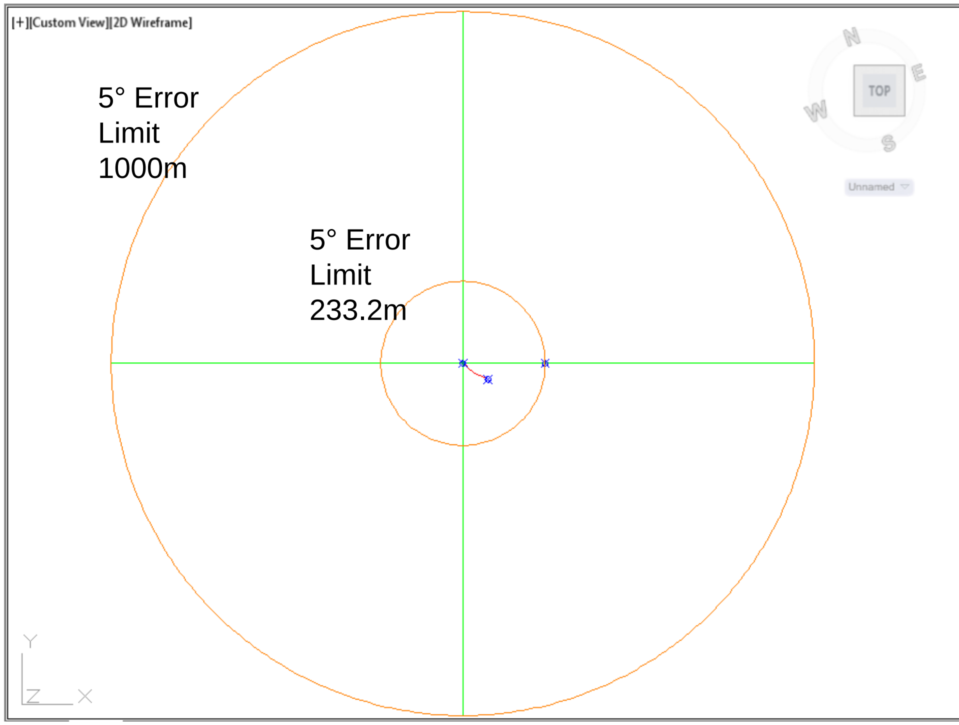
View Down Planned Borehole | View Perp. Planned | View Front Planned

191224 at 179.2m Zoomed

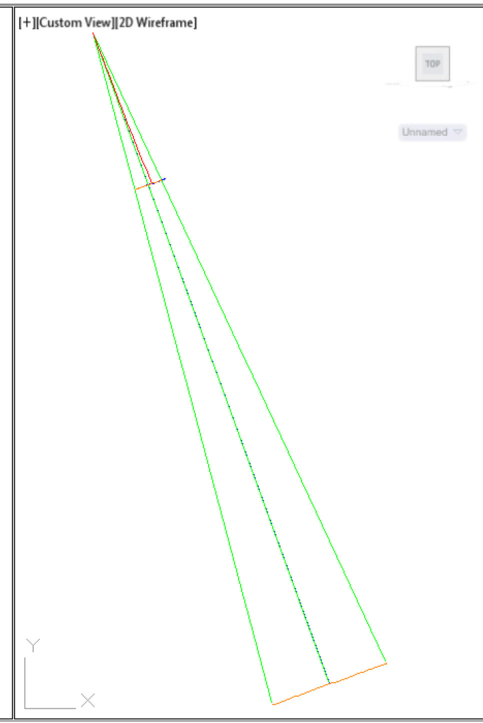


View Down Planned Borehole View Perp. Planned View Front Planned

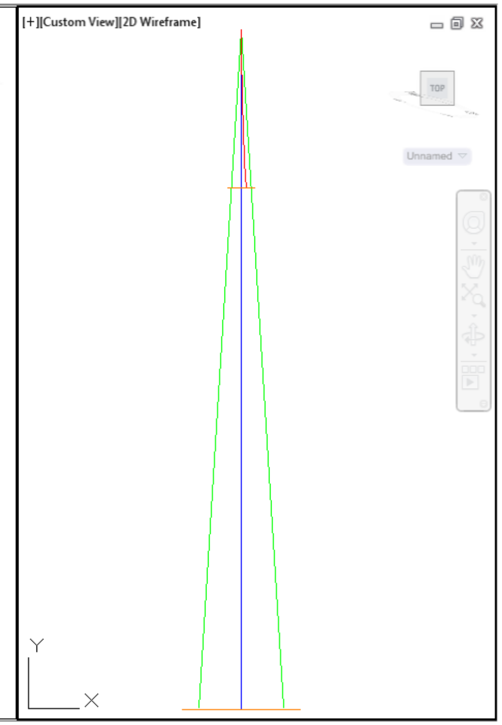
191226 at 233.2m



View Down Planned Borehole

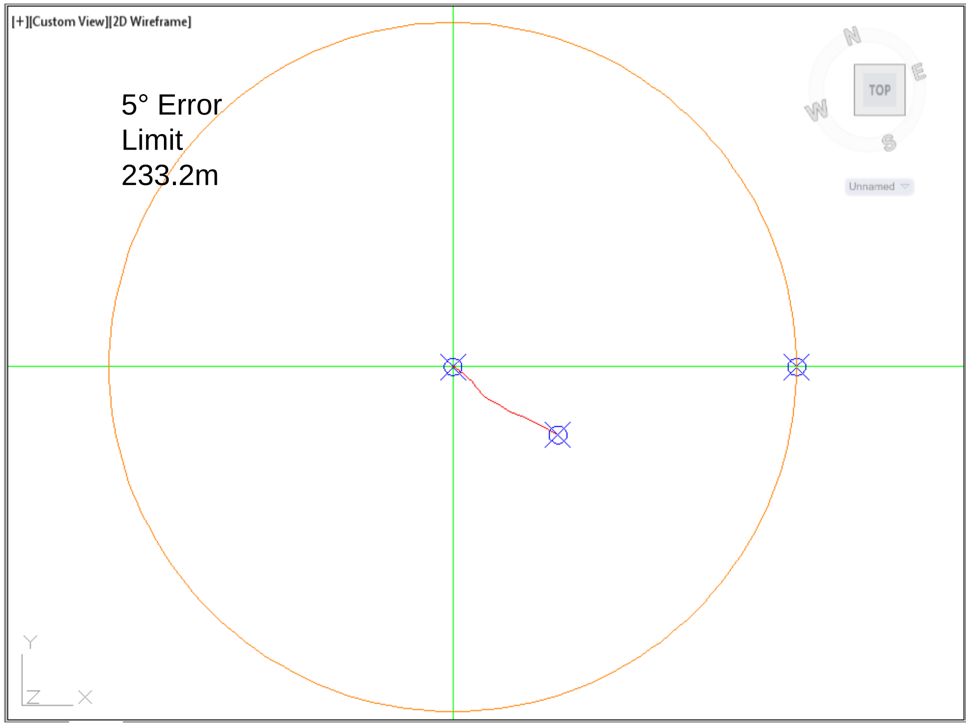


View Perp. Planned

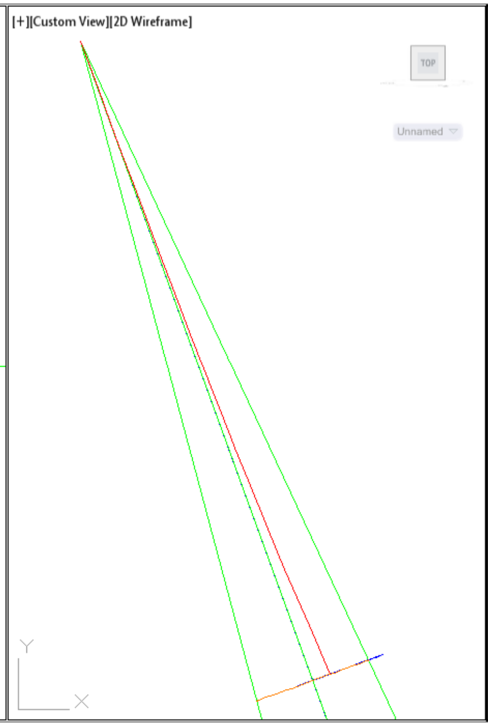


View Front Planned
Looking towards 045

191226 at 233.2m Zoomed



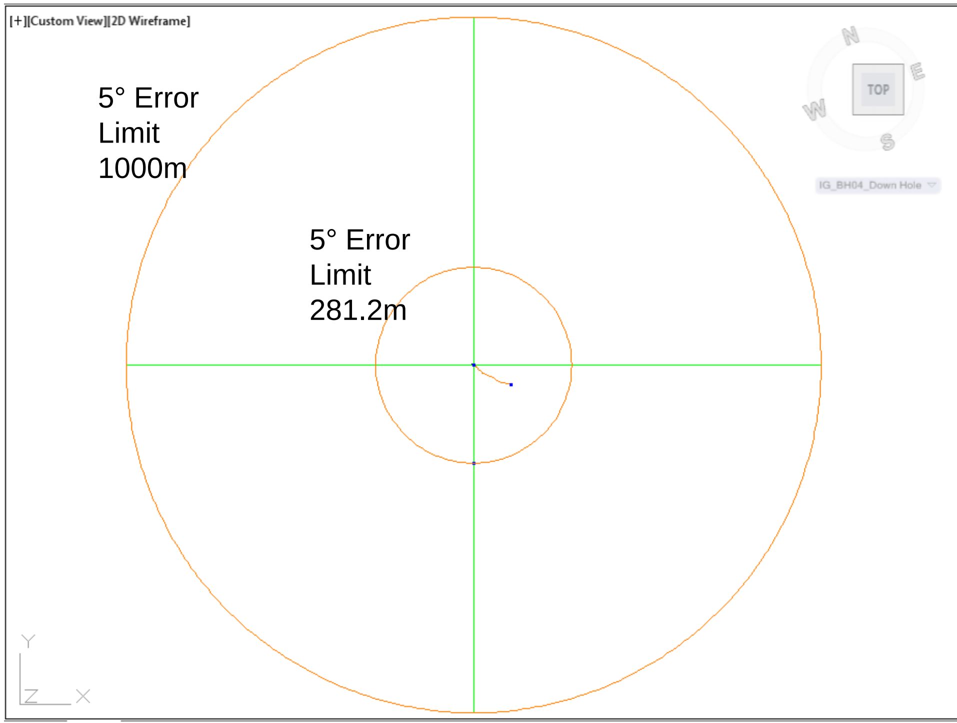
View Down Planned Borehole



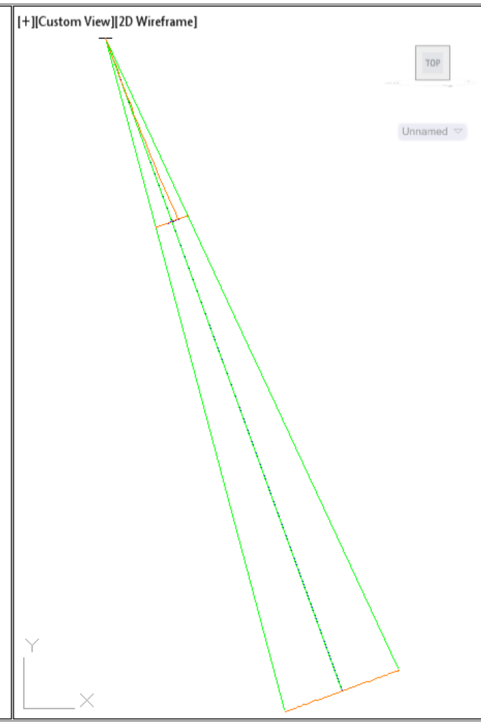
View Perp. Planned

View Front Planned
Looking towards 045

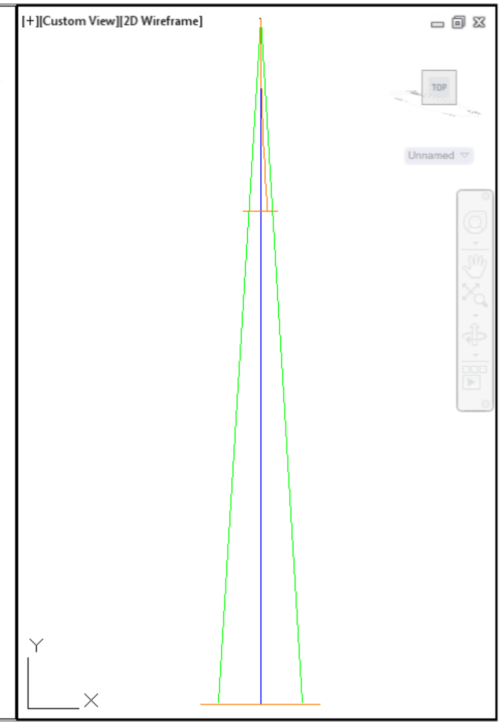
191229 at 281.2m



View Down Planned Borehole

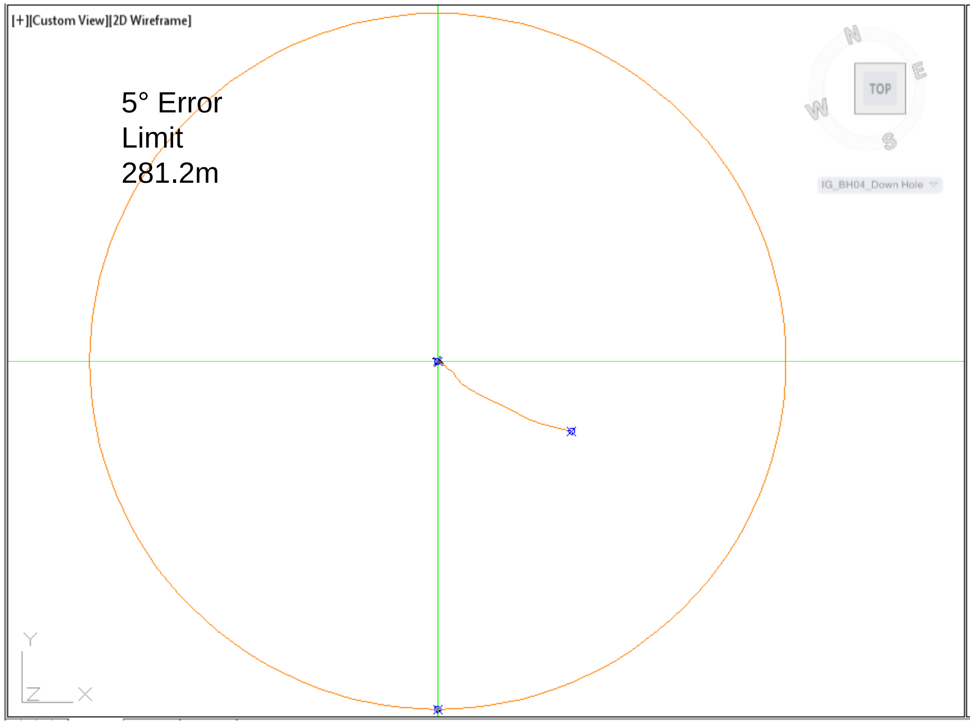


View Perp. Planned

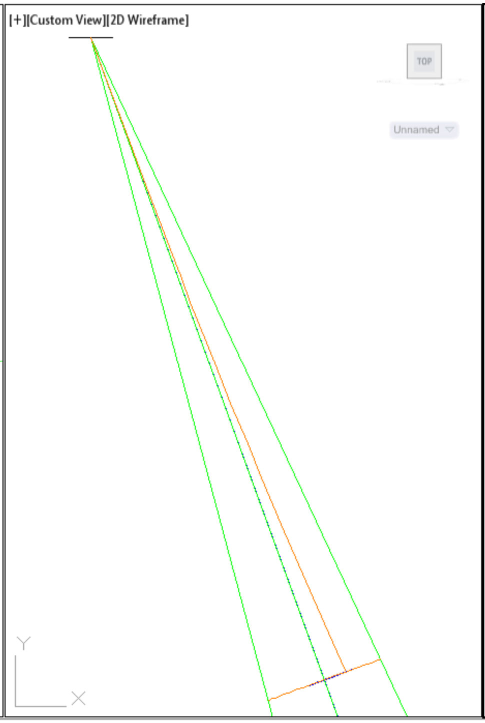


View Front Planned
Looking towards 045

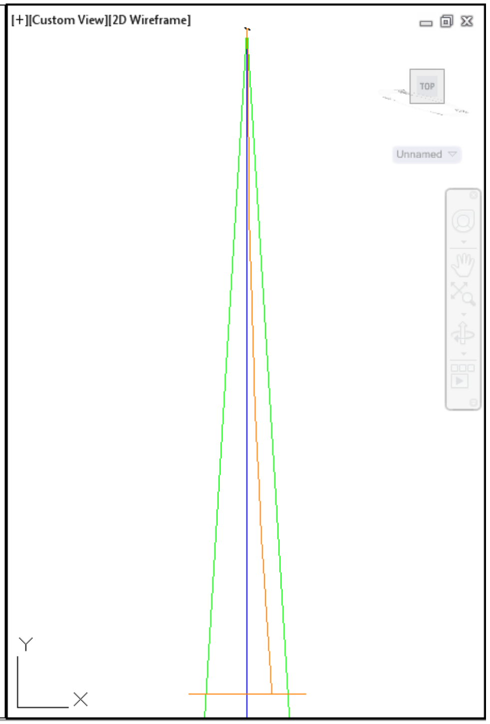
191229 at 281.2m Zoomed



View Down Planned Borehole

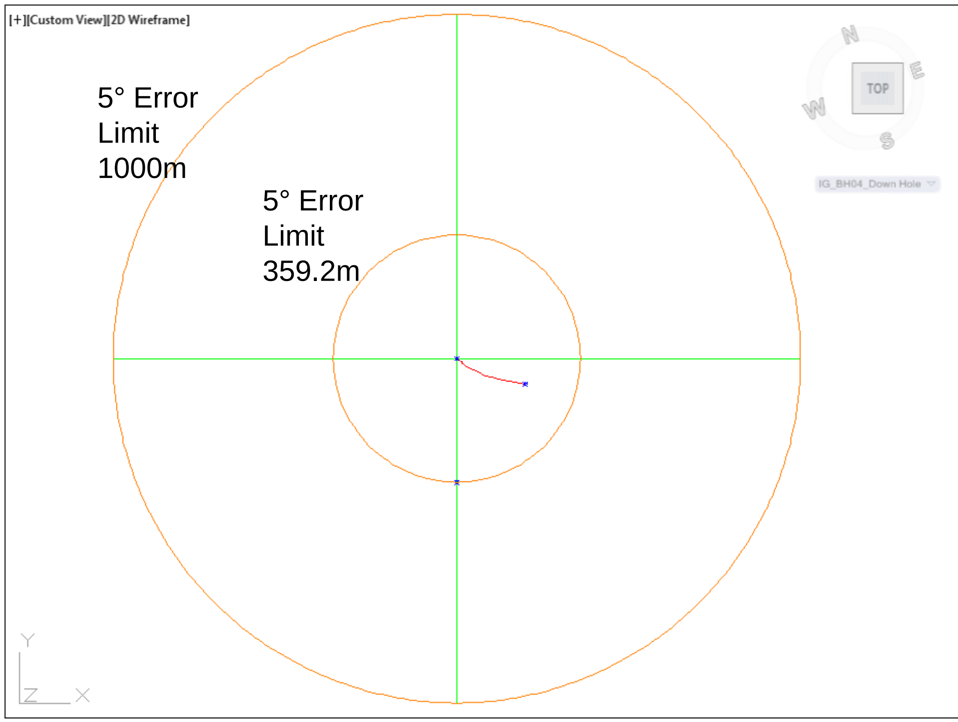


View Perp. Planned

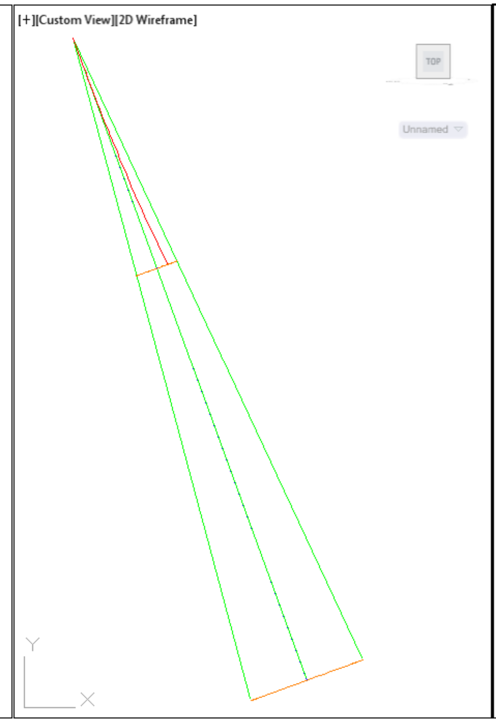


View Front Planned
Looking towards 045

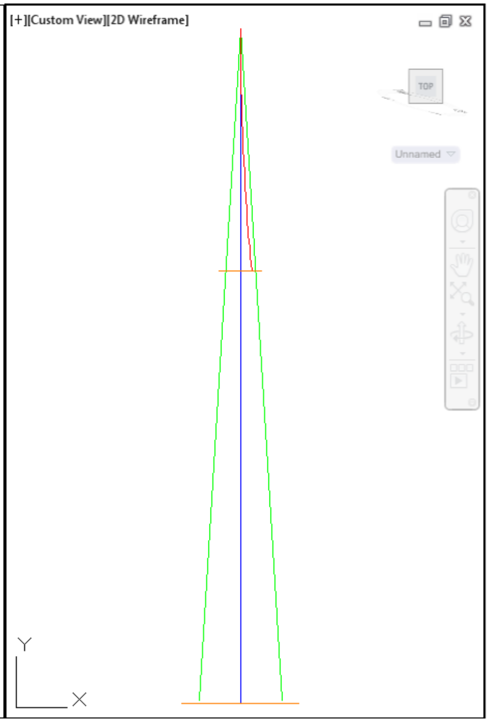
200101 at 359.2m



View Down Planned Borehole

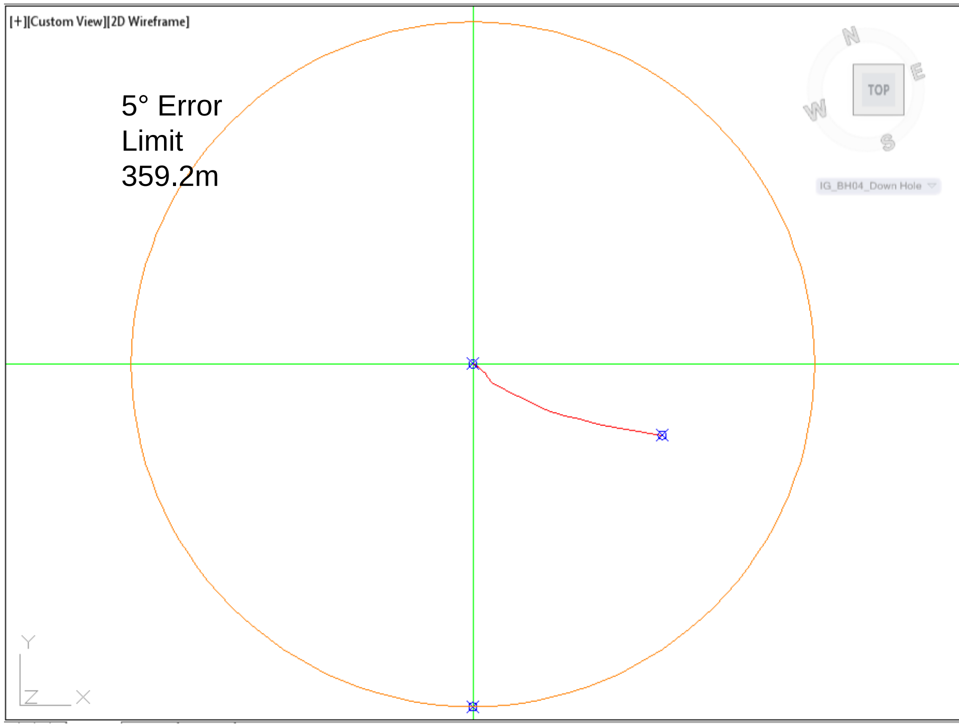


View Perp. Planned

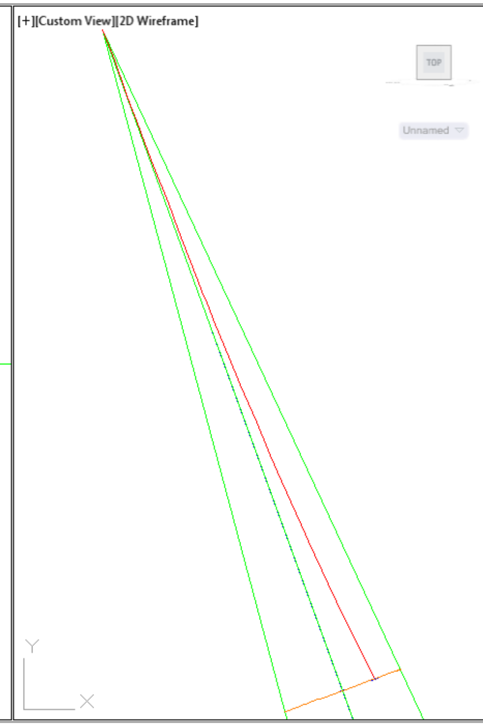


View Front Planned Looking towards 045

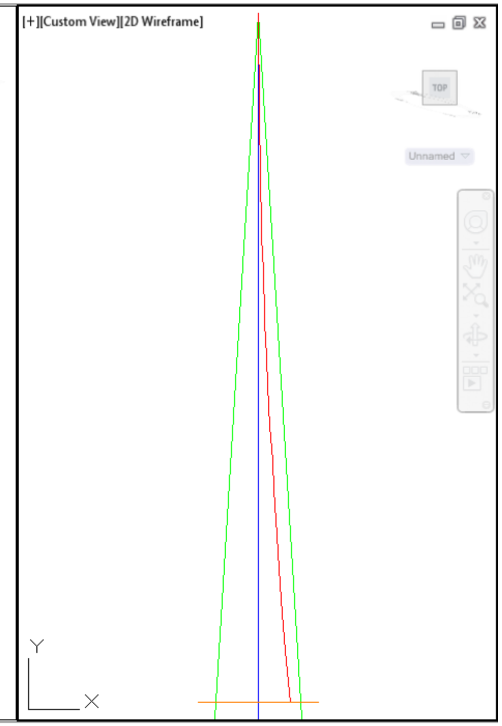
200101 at 359.2m Zoomed



View Down Planned Borehole

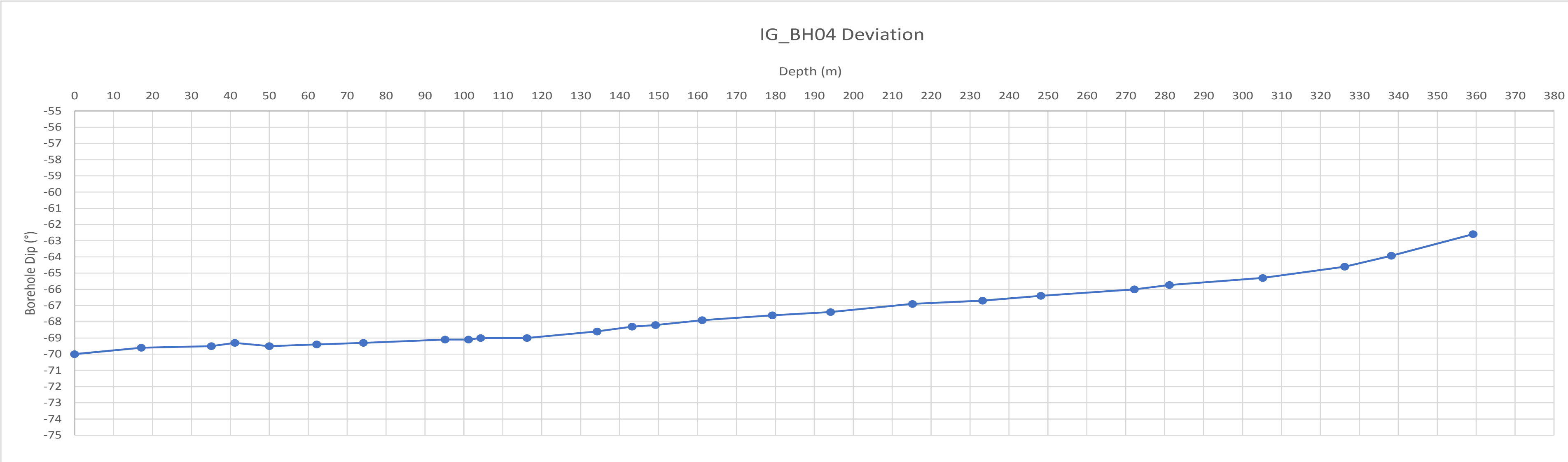


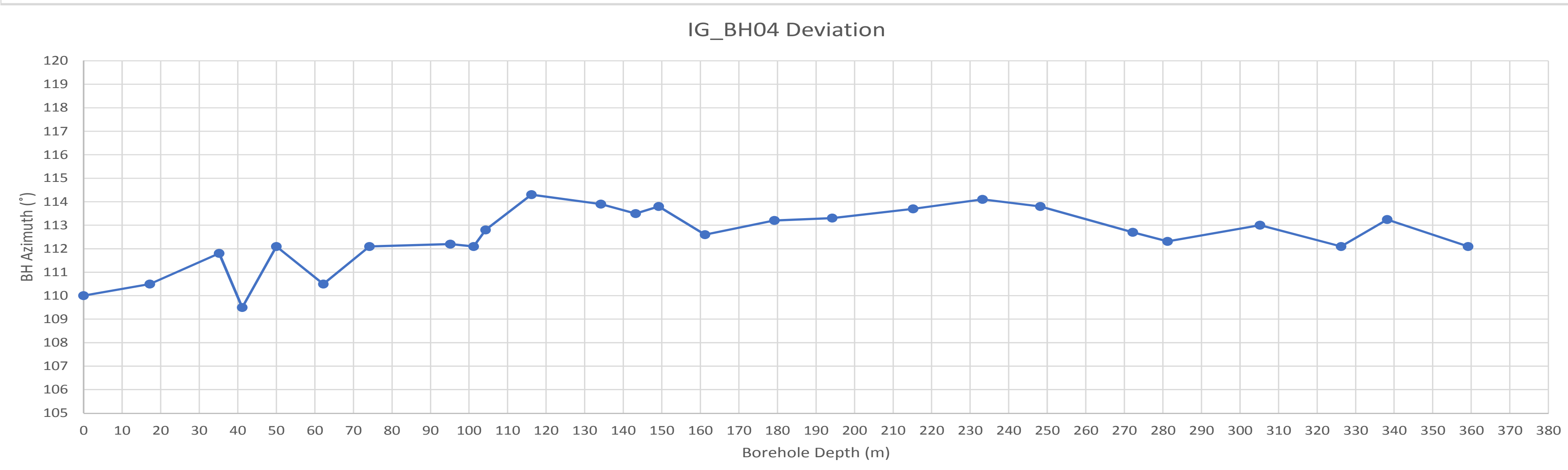
View Perp. Planned



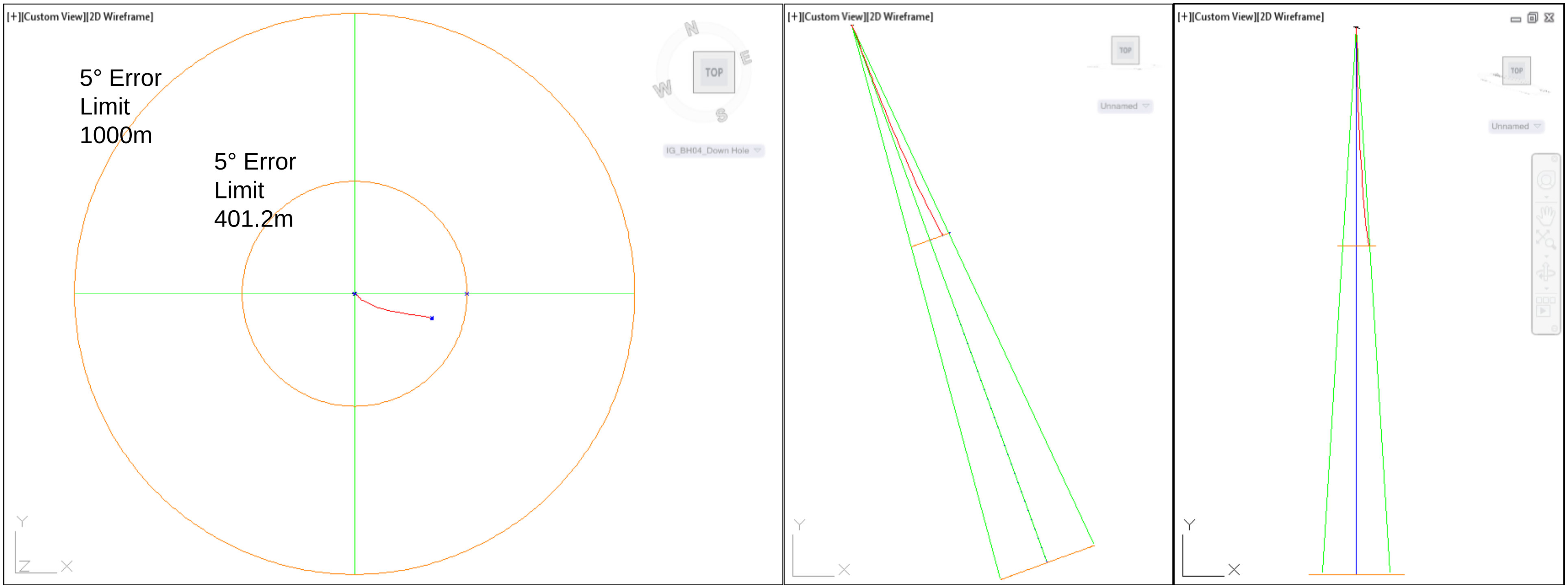
View Front Planned
Looking towards 045

200101 at 359.2m





200104 at 401.2m

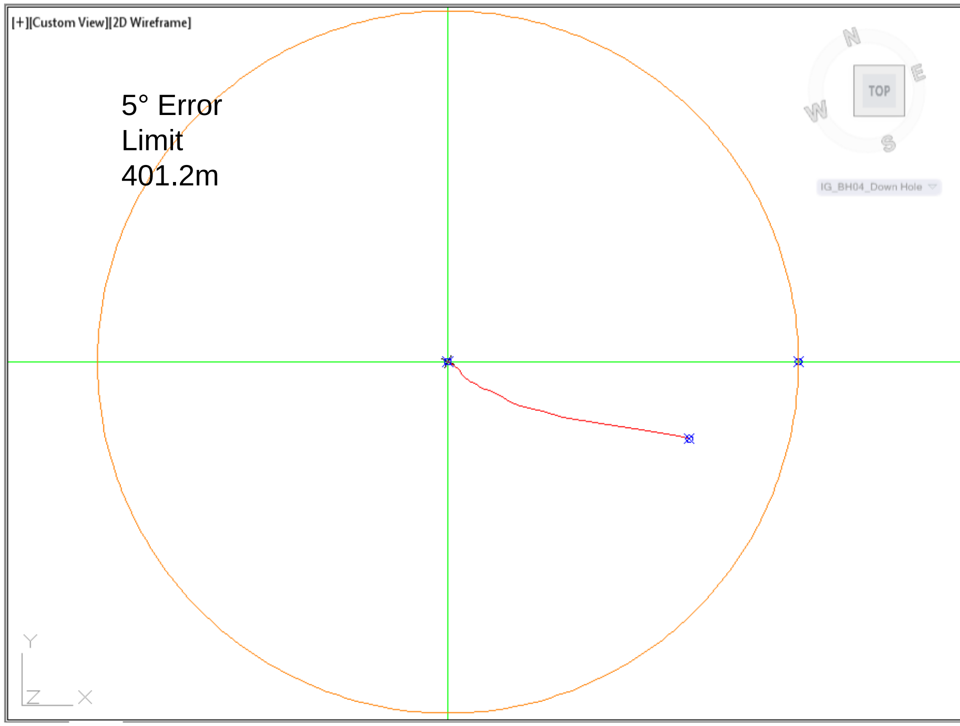


View Down Planned Borehole

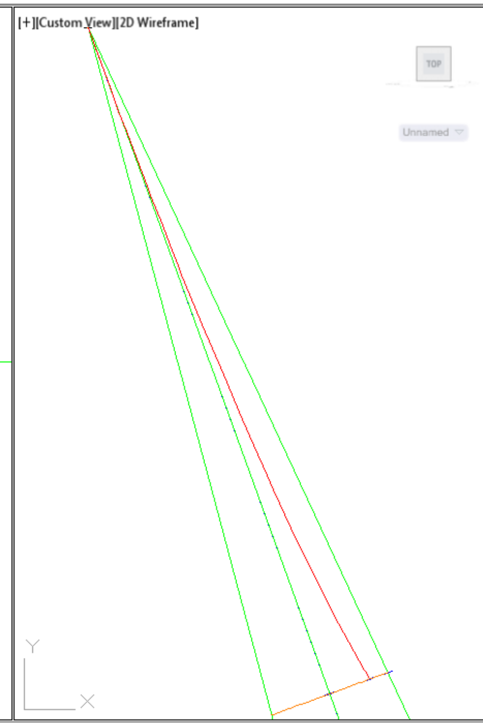
View Perp. Planned

View Front Planned Looking towards 045

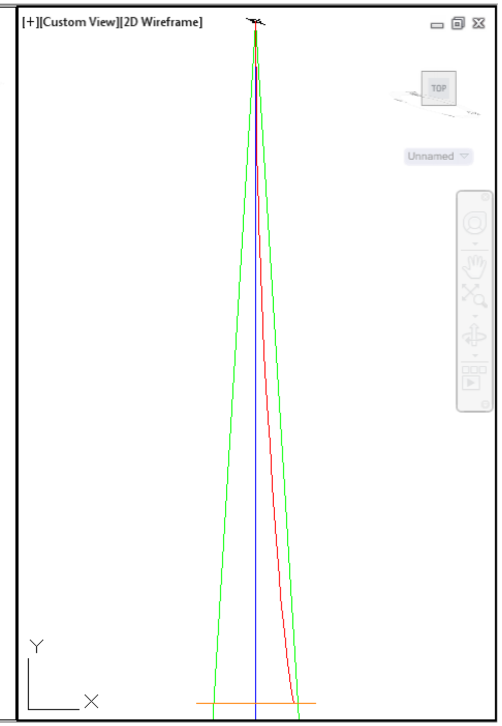
200104 at 401.2m Zoomed



View Down Planned Borehole

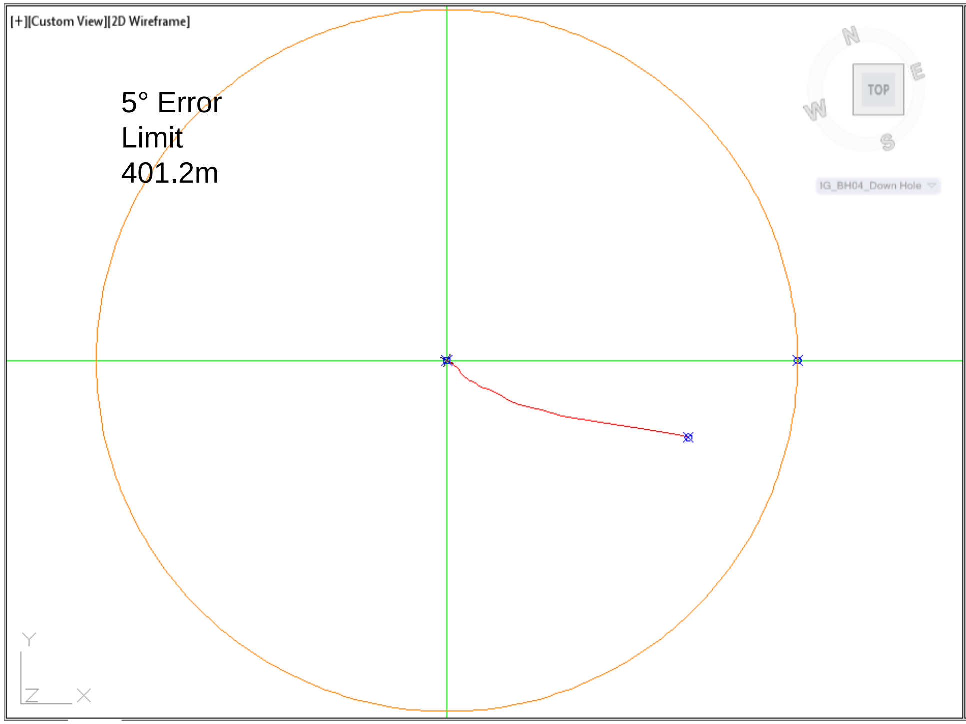


View Perp. Planned



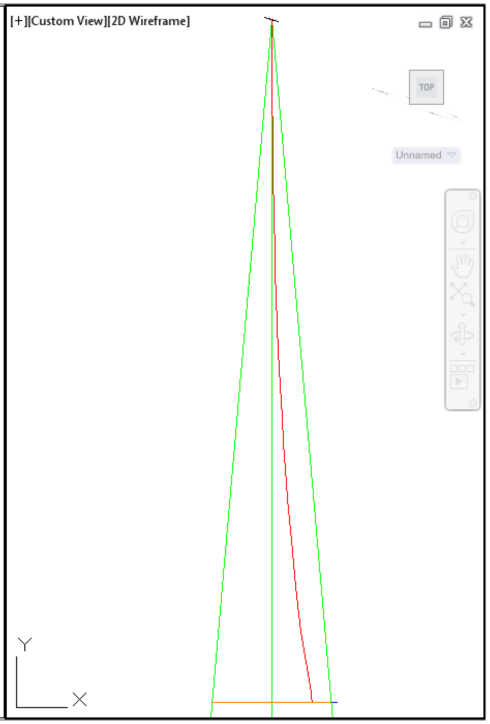
View Front Planned
Looking towards 045

200104 at 401.2m Zoomed



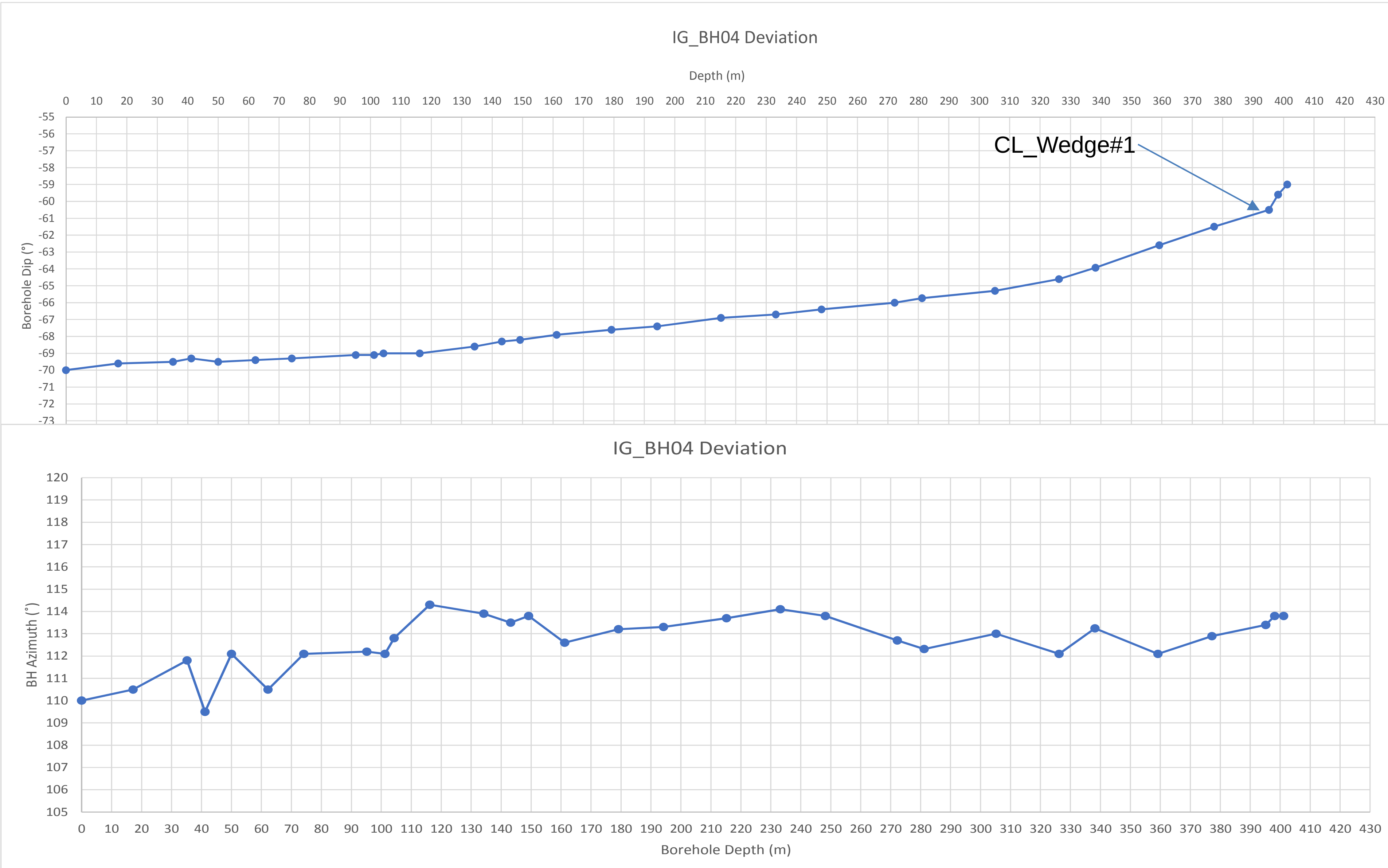
View Down Planned Borehole

View Perp. Planned

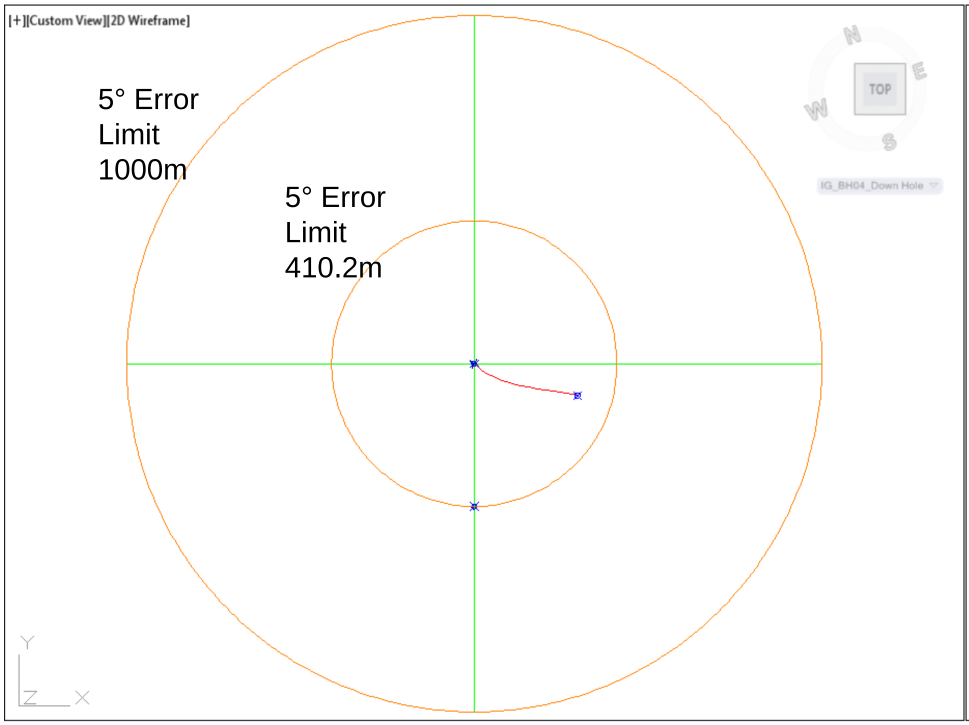


View Front Planned

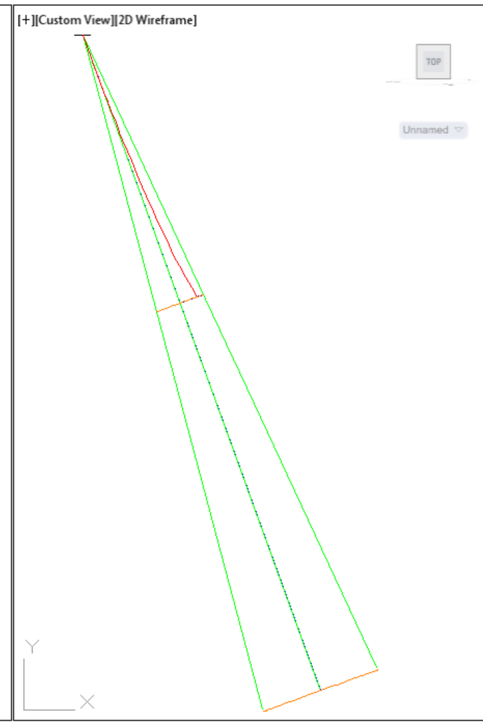
200104 at 401.2m



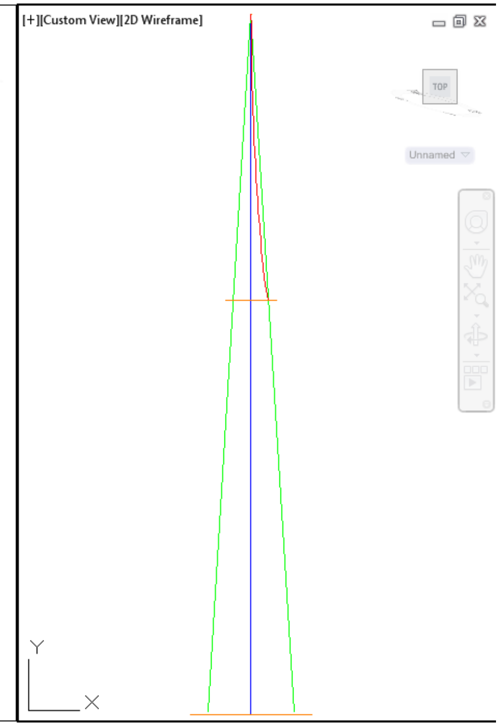
200104 at 410.2m



View Down Planned Borehole

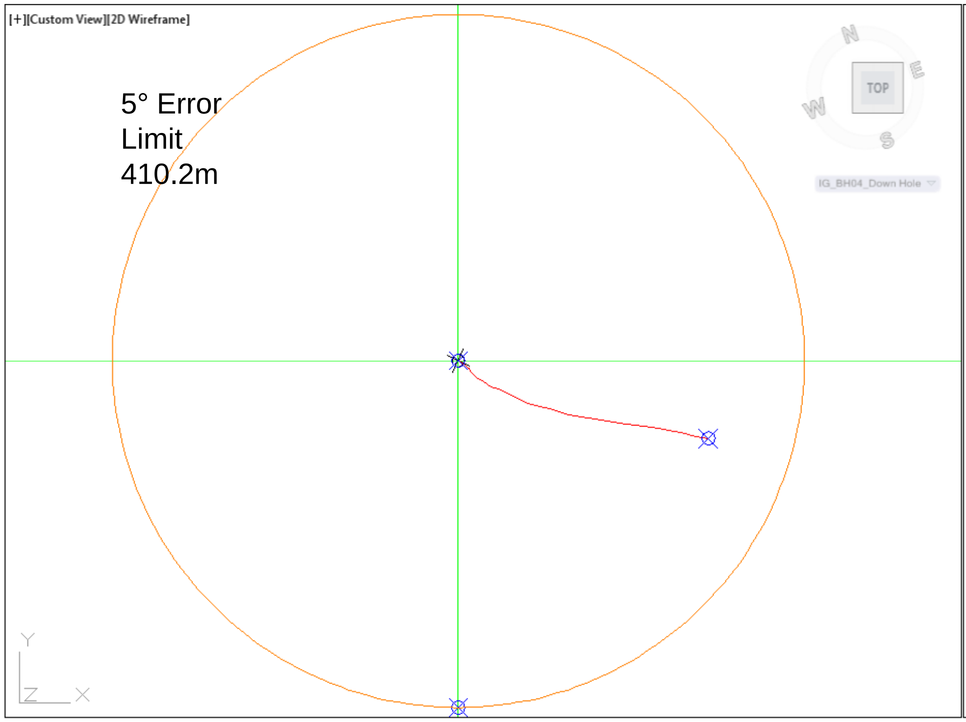


View Perp. Planned

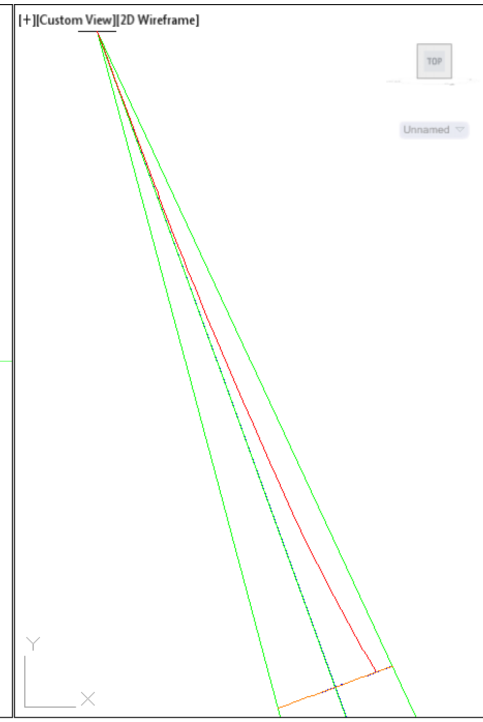


View Front Planned
Looking towards 045

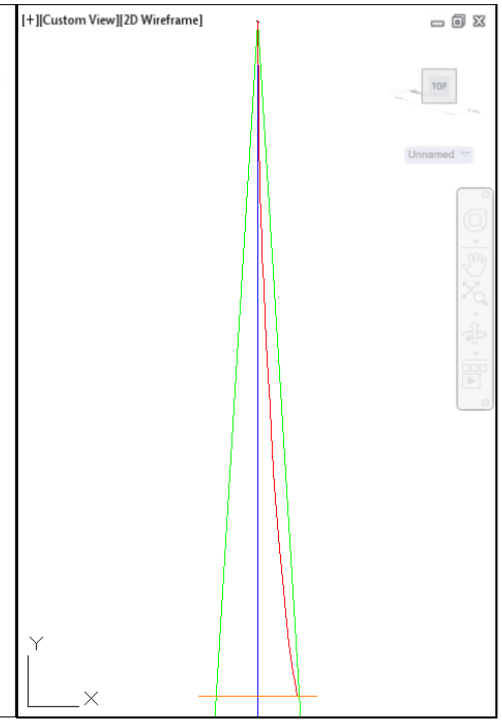
200104 at 410.2m Zoomed



View Down Planned Borehole

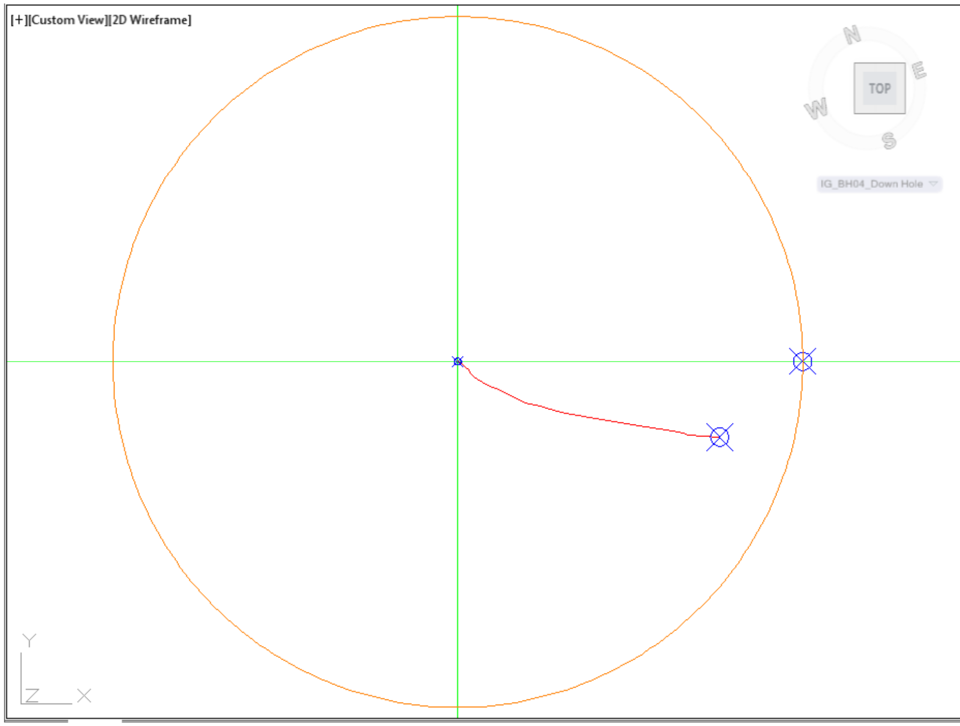


View Perp. Planned

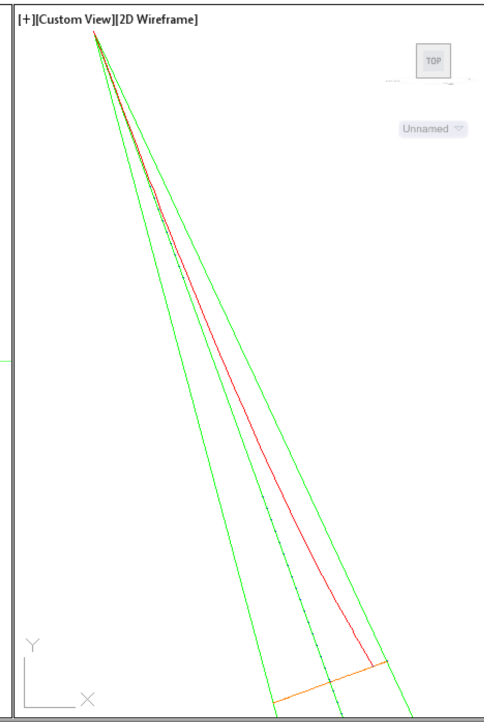


View Front Planned
Looking towards 045

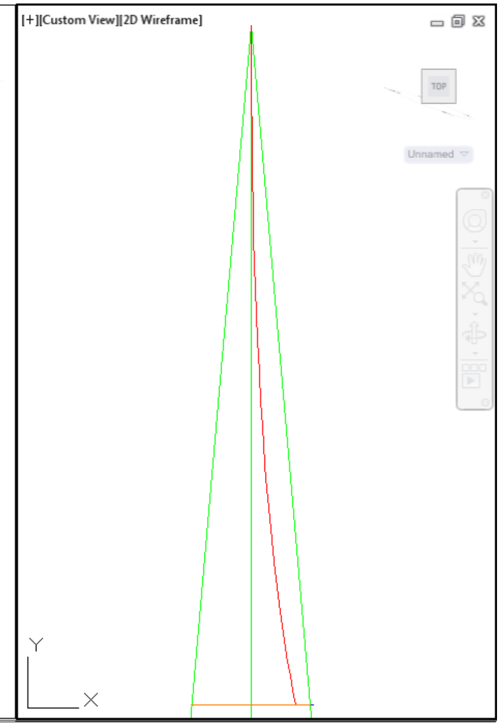
200104 at 410.2m Zoomed



View Down Planned Borehole

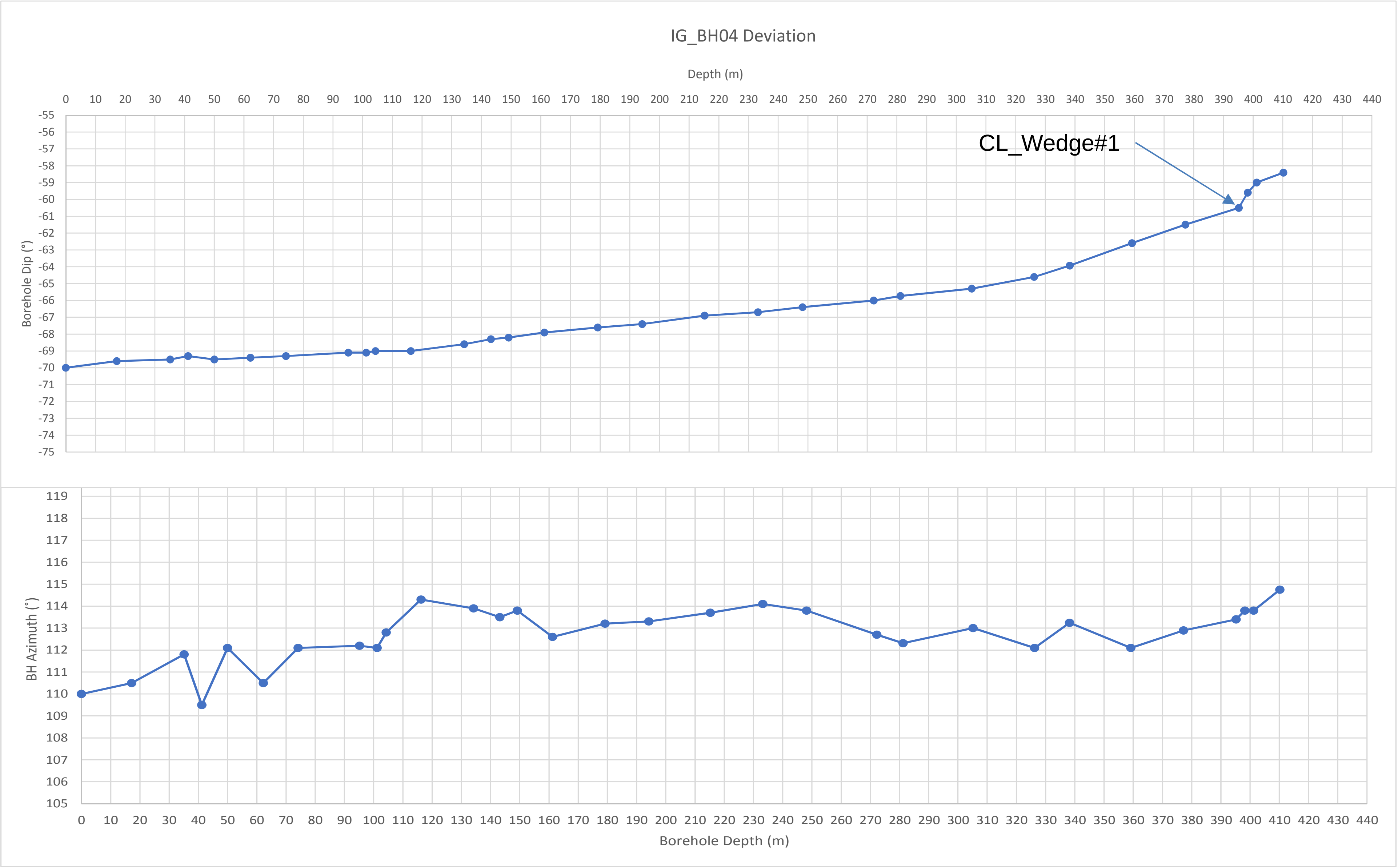


View Perp. Planned

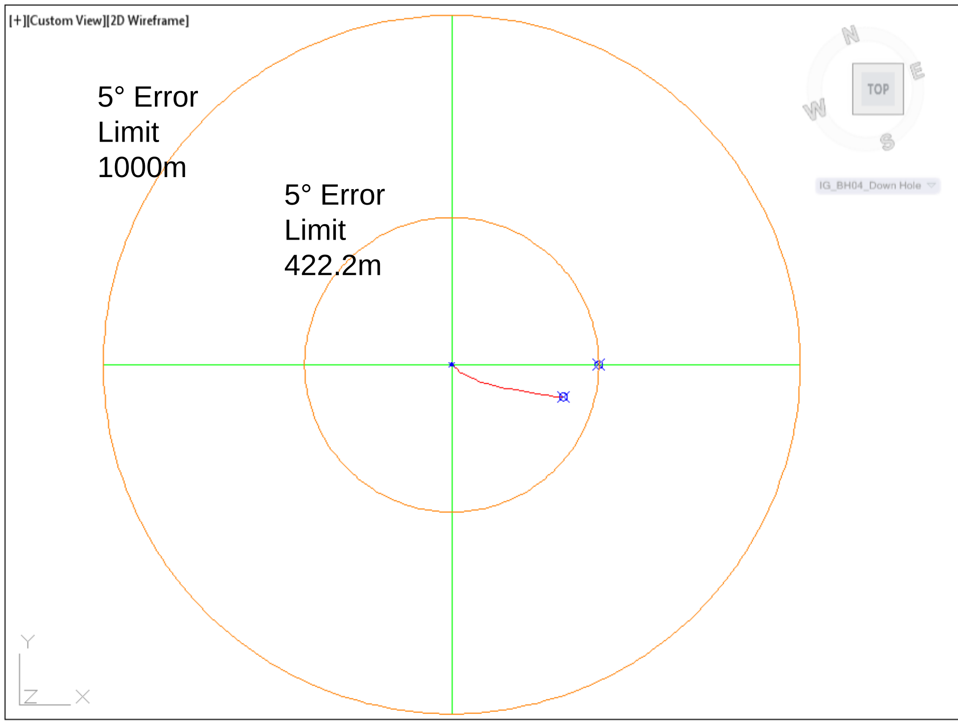


View Front Planned

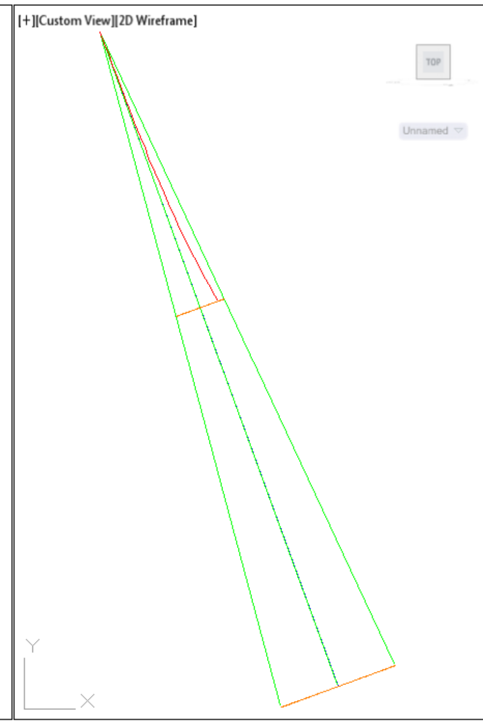
200104 at 410.2m



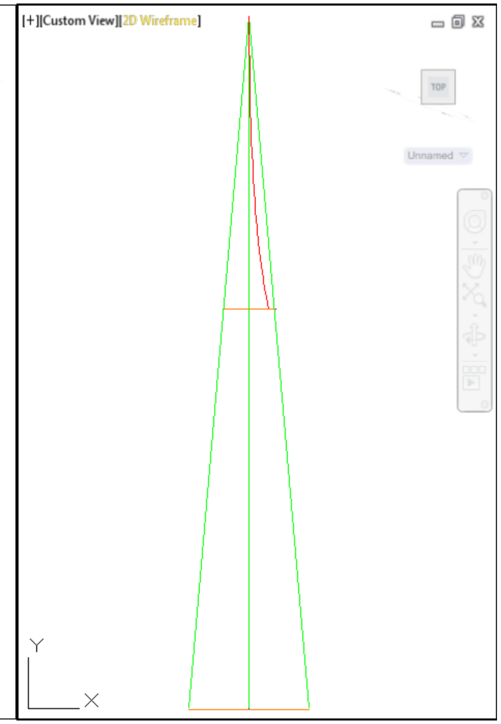
200107 at 422.2m



View Down Planned Borehole

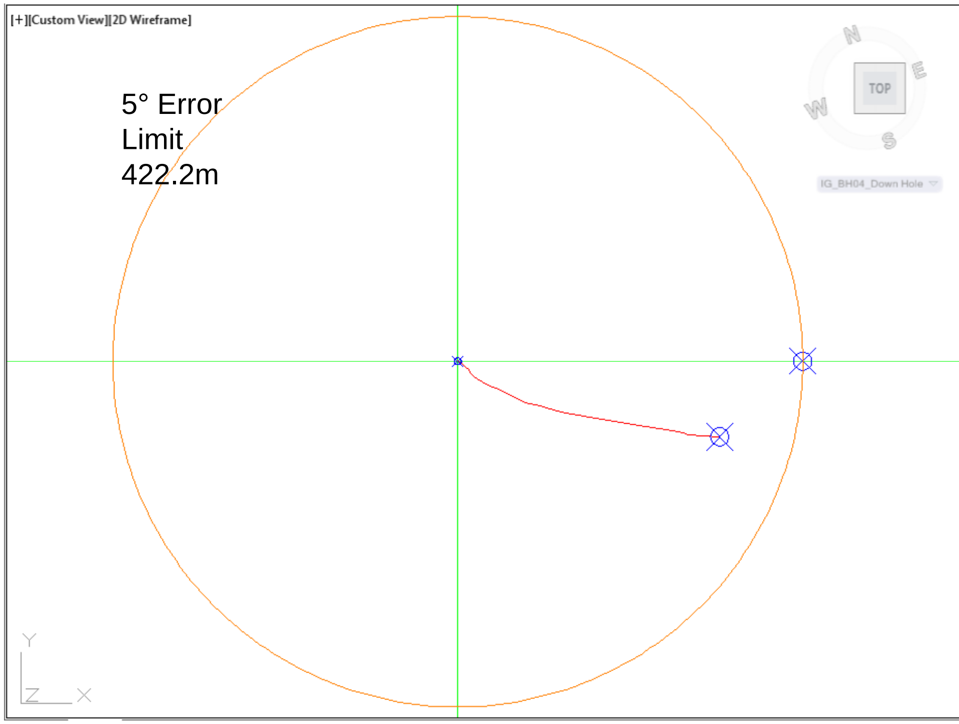


View Perp. Planned

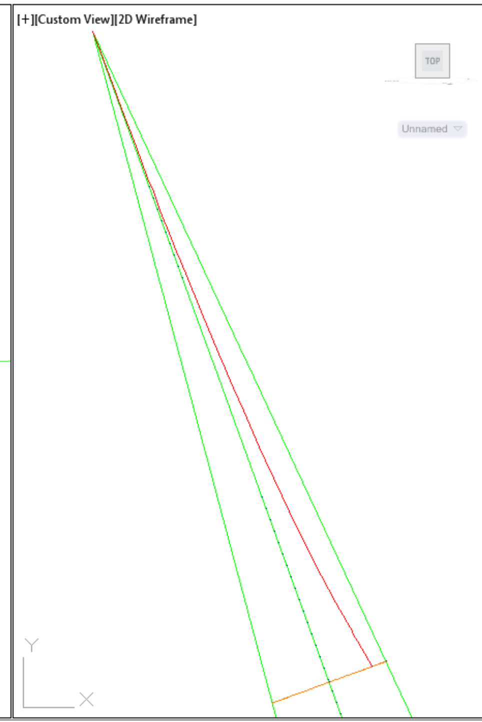


View Front Planned
Looking towards 045

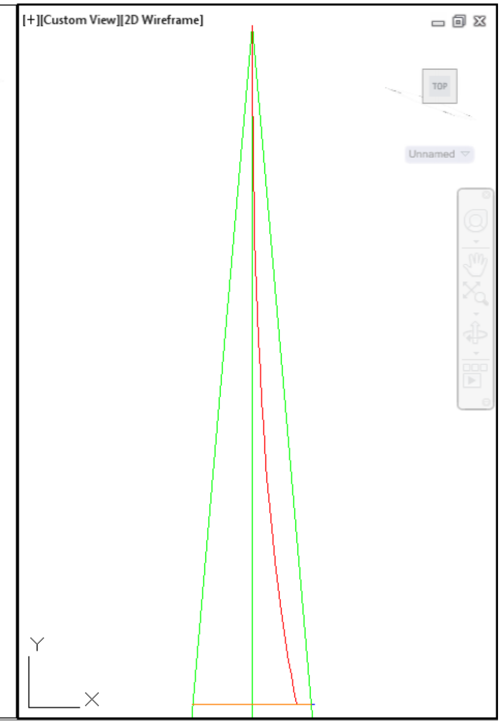
200107 at 422.2m Zoomed



View Down Planned Borehole

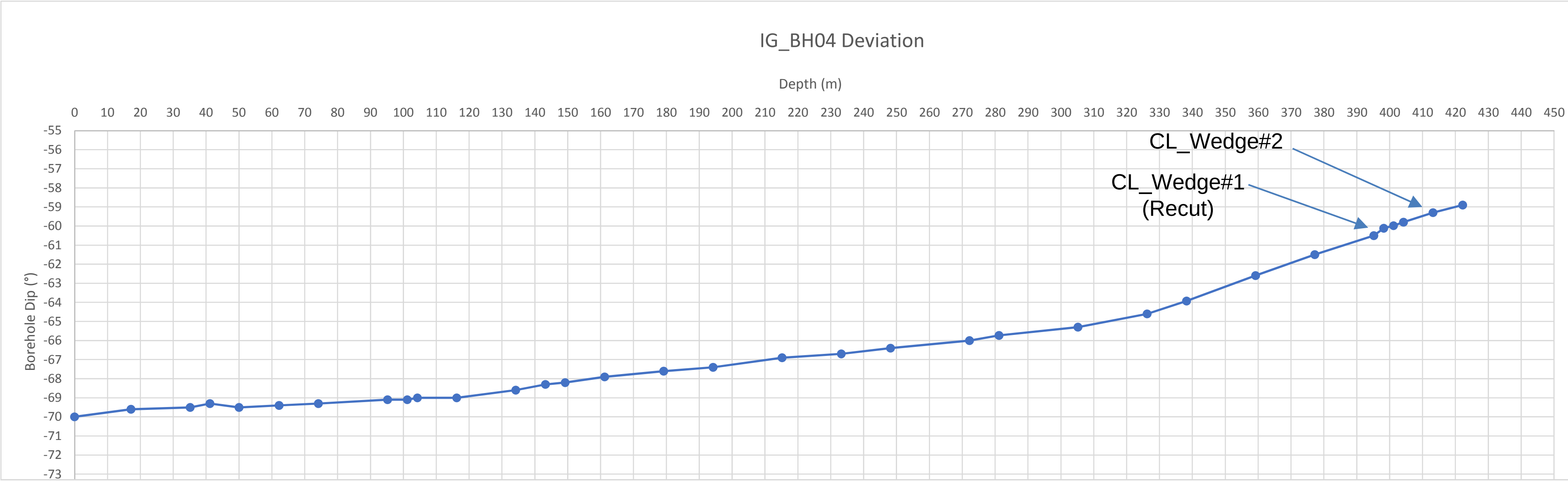


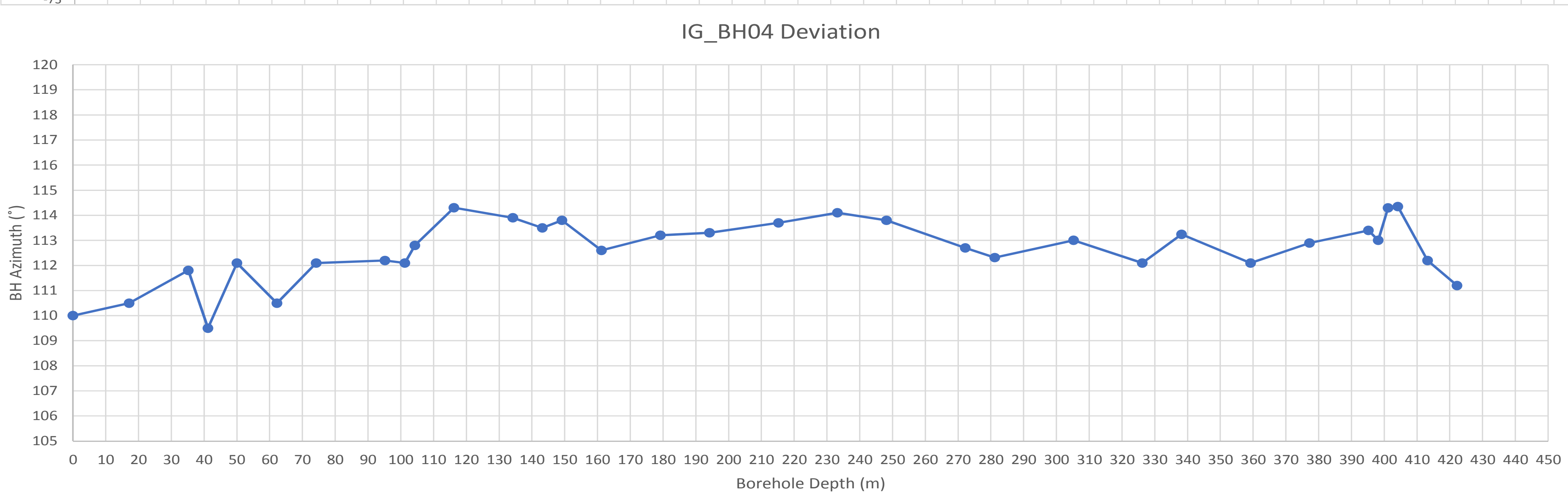
View Perp. Planned



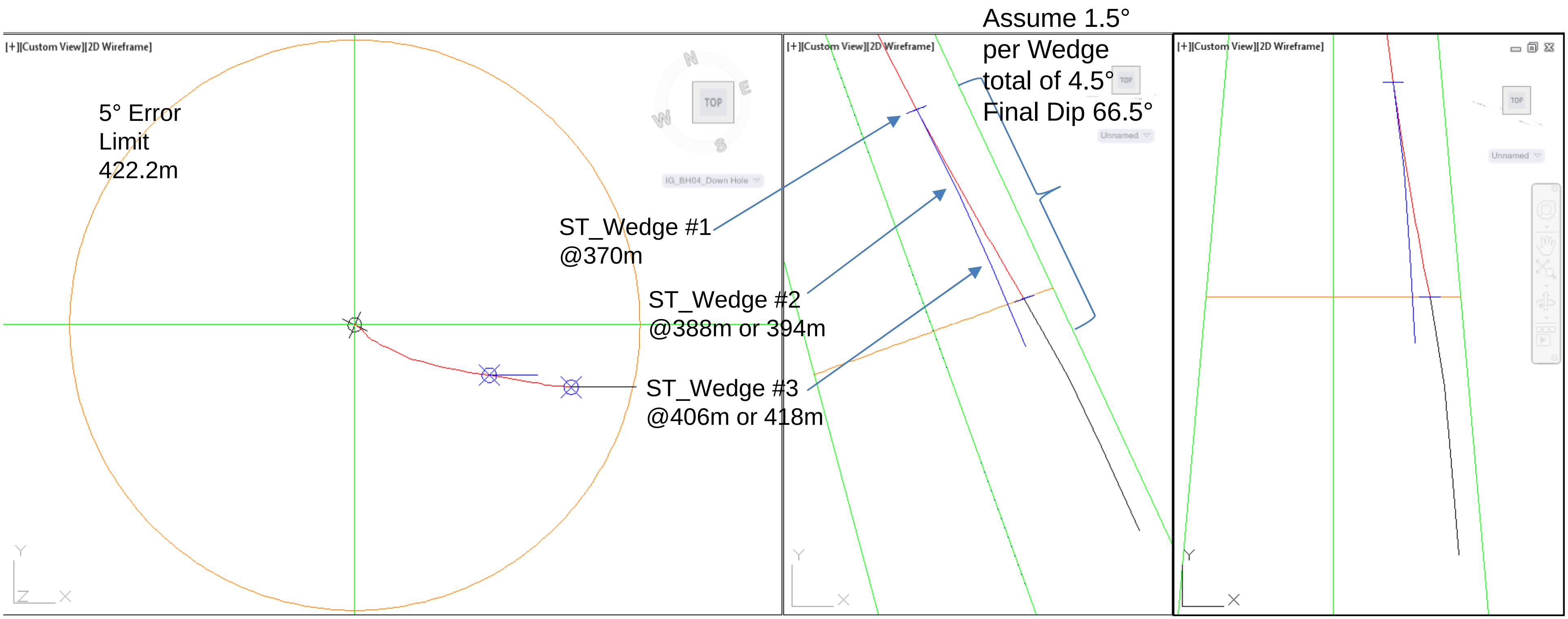
View Front Planned

200104 at 422.2m



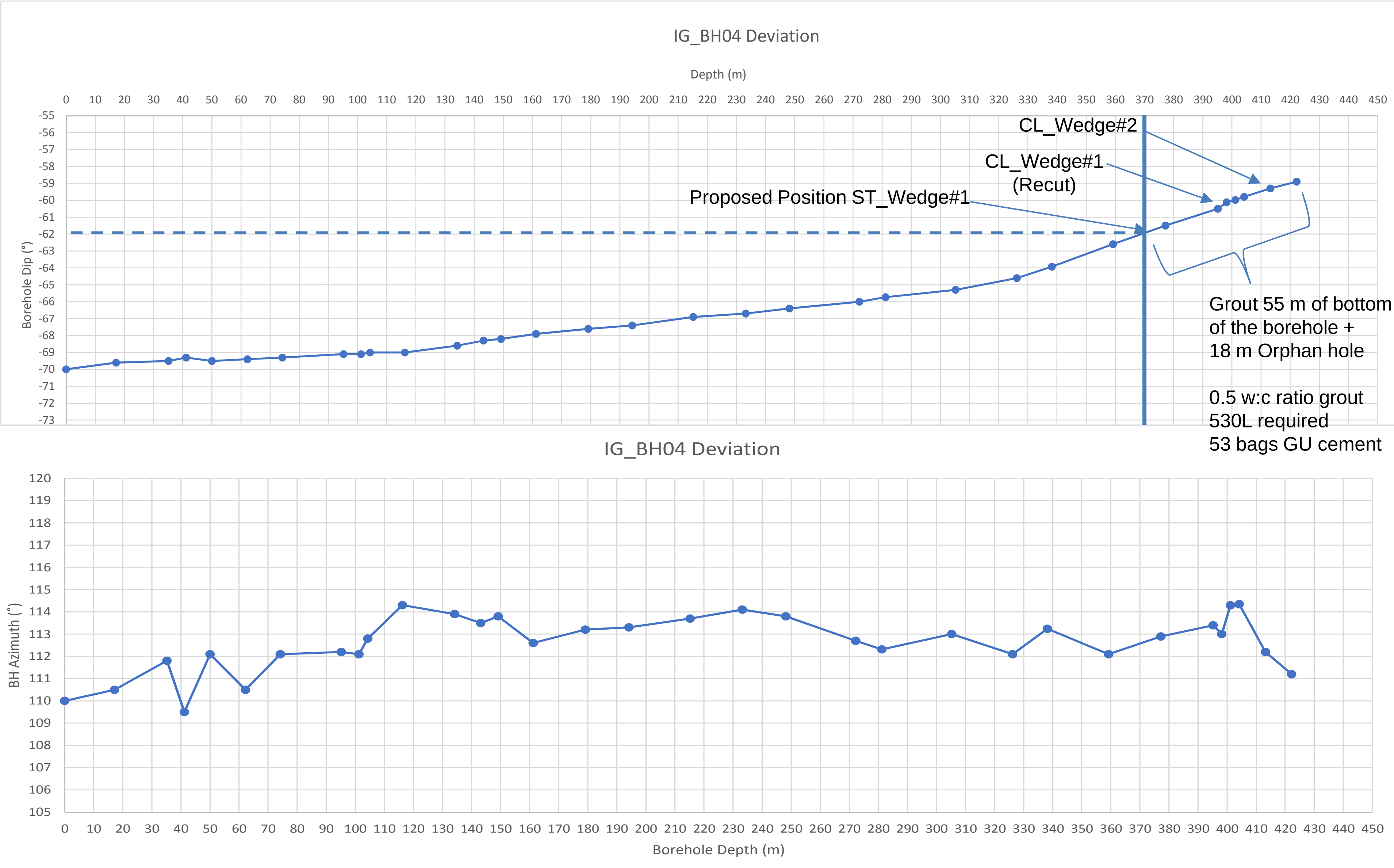


200107 Plan Steel Wedge Placement



View Down Planned Borehole　View Perp. Planned　View Front Planned

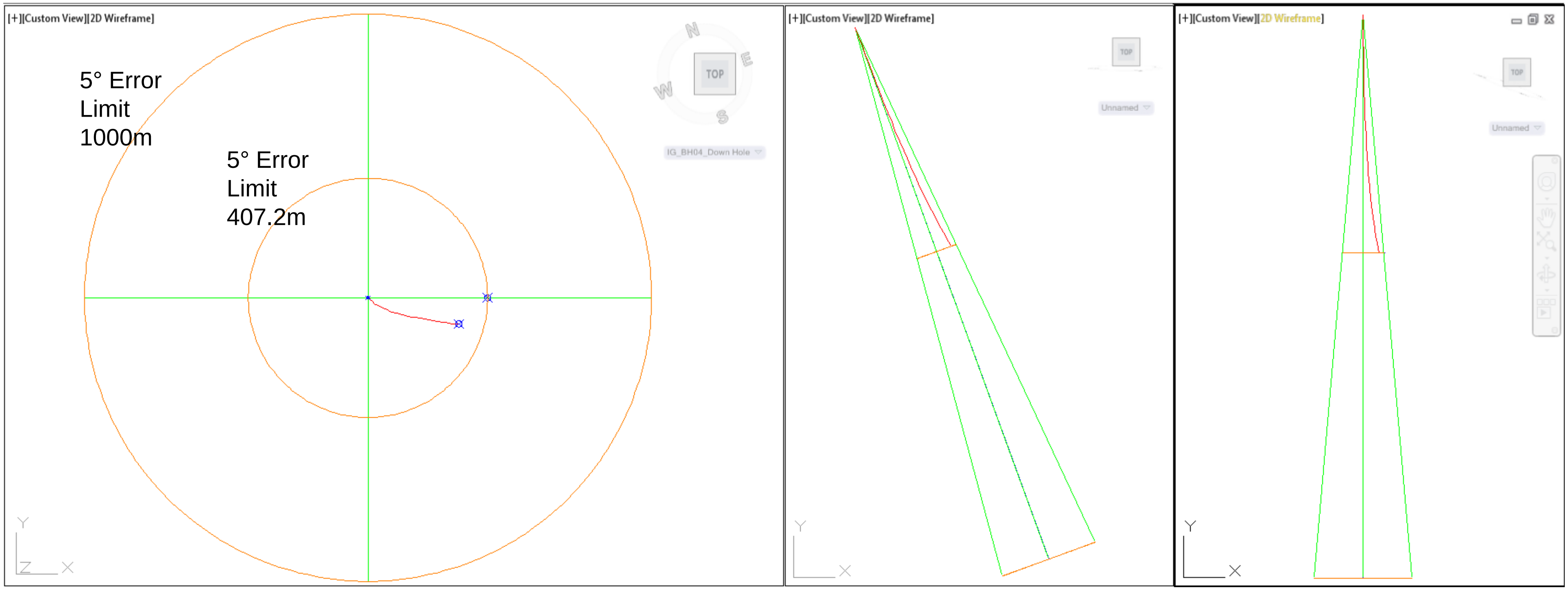
200104 at 422.2m



Grout 55 m of bottom of the borehole + 18 m Orphan hole

0.5 w:c ratio grout
530L required
53 bags GU cement

200113 at 407.2m New BH

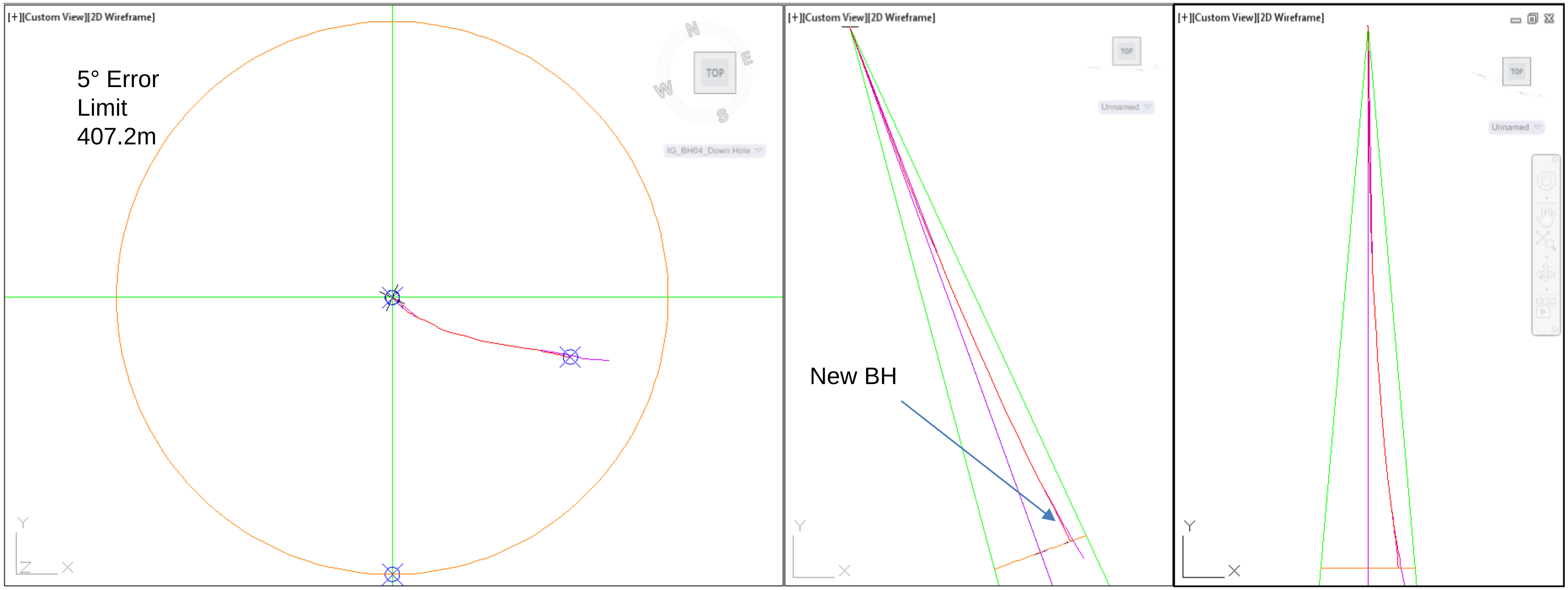


View Down Planned Borehole

View Perp. Planned

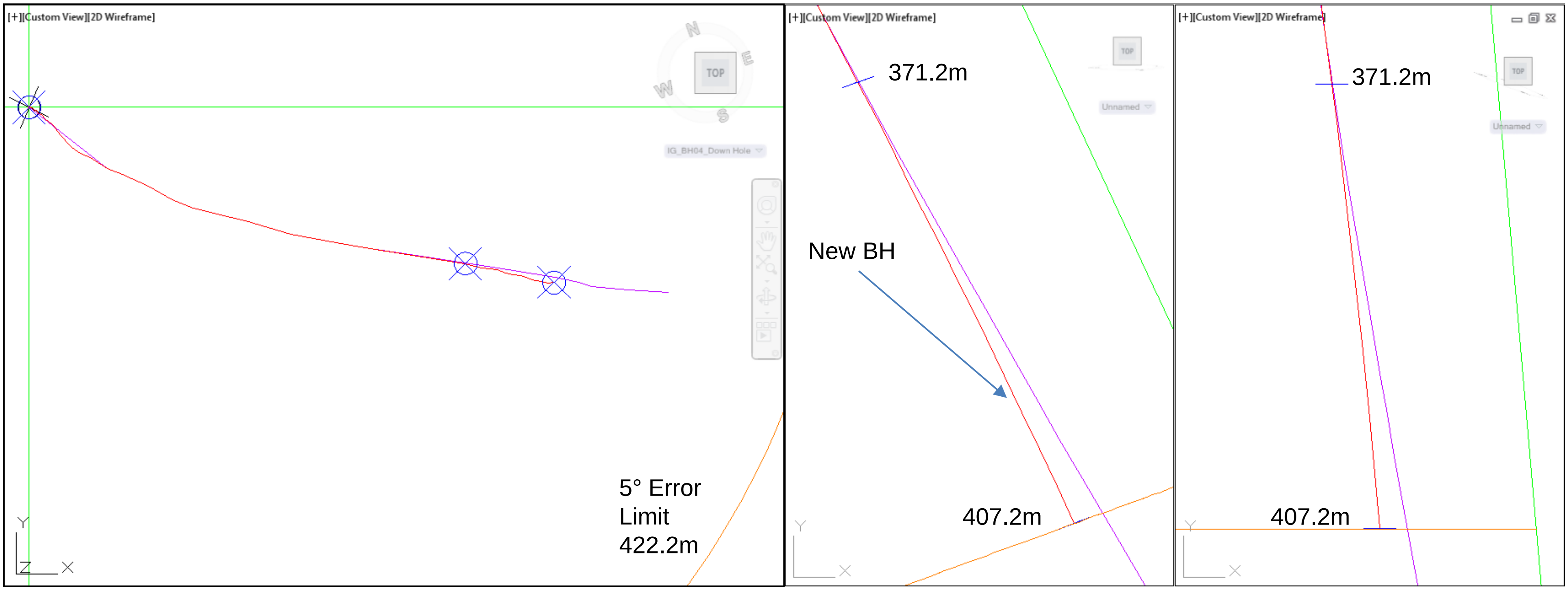
View Front Planned

200113 at 407.2m New BH Zoomed



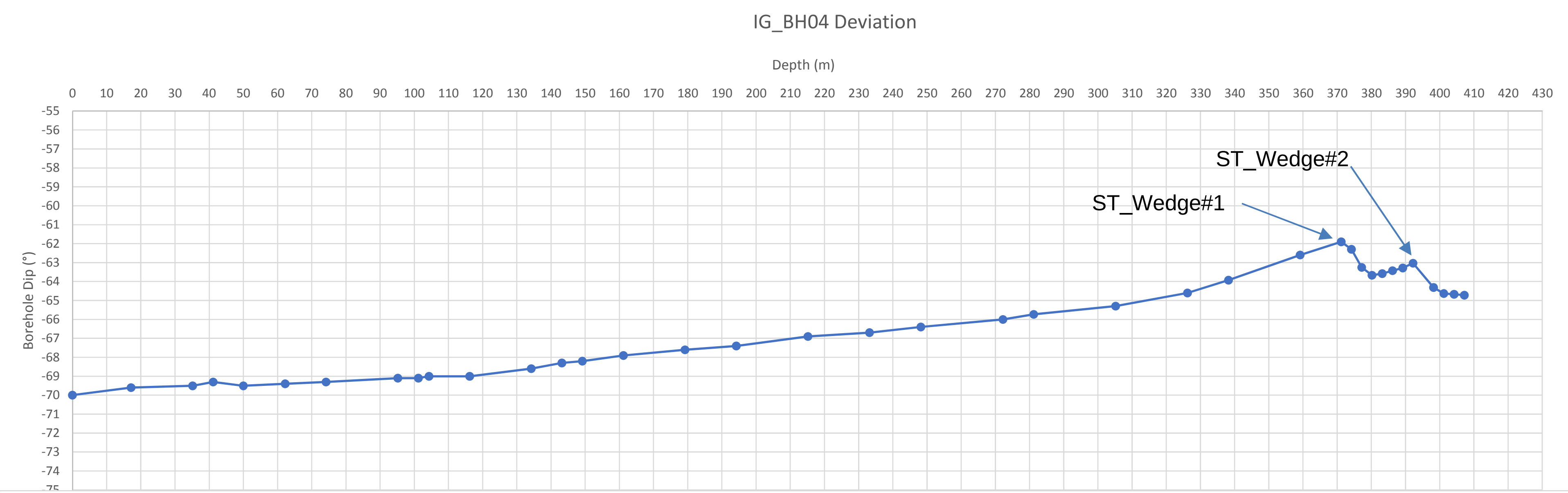
View Down Planned Borehole View Perp. Planned View Front Planned

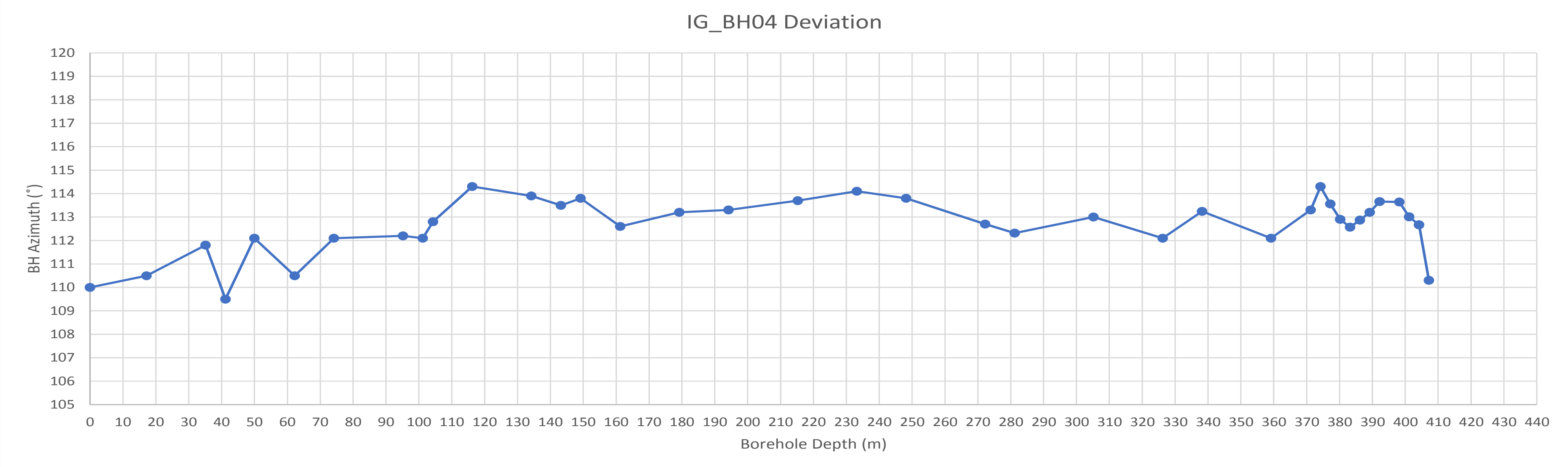
200113 at 407.2m New BH VZoomed



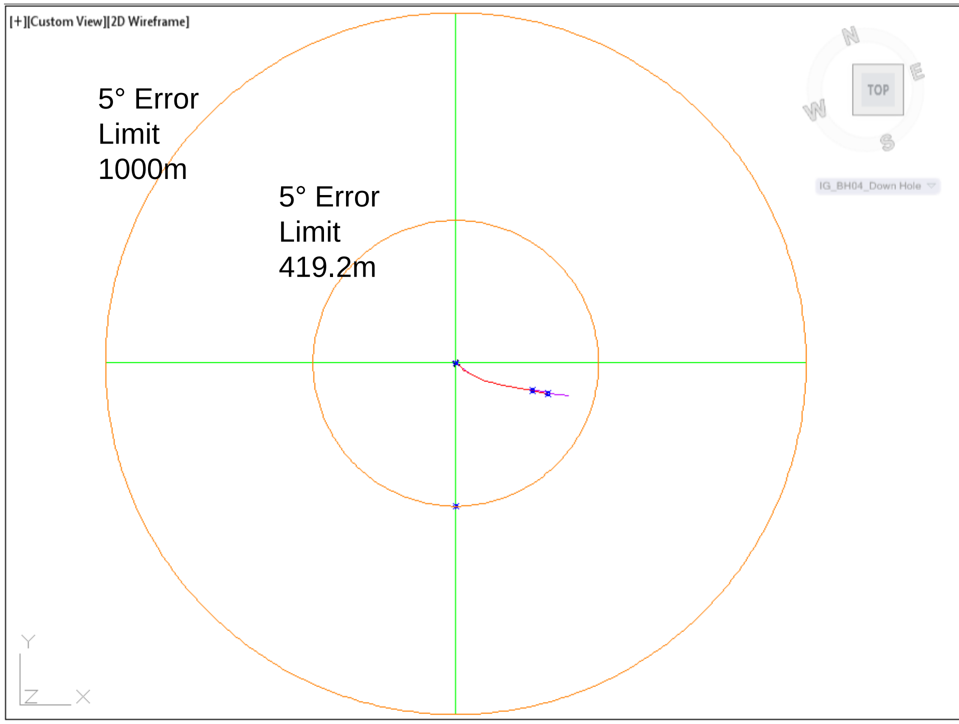
View Down Planned Borehole　View Perp. Planned　View Front Planned

200113 at 407.2m New BH

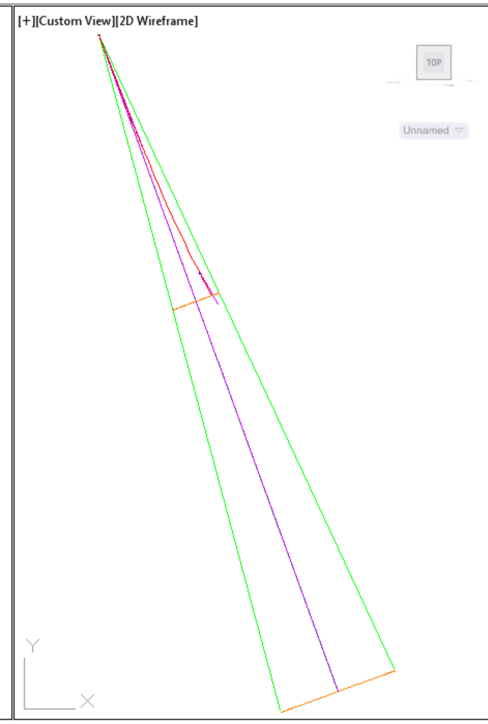




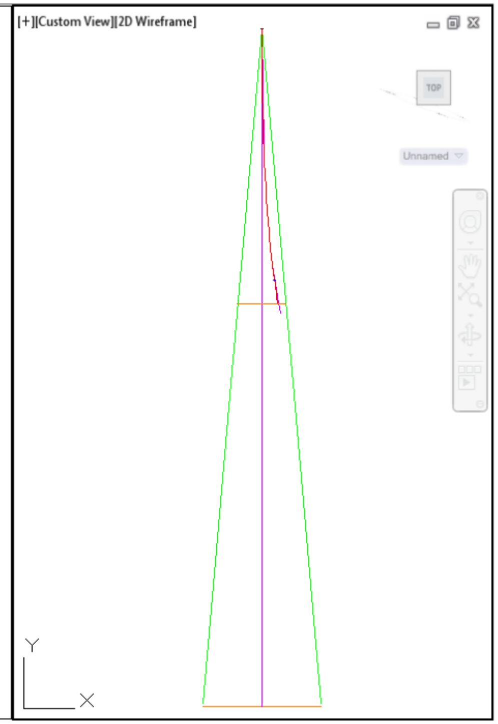
200114 at 419.2m New BH



View Down Planned Borehole

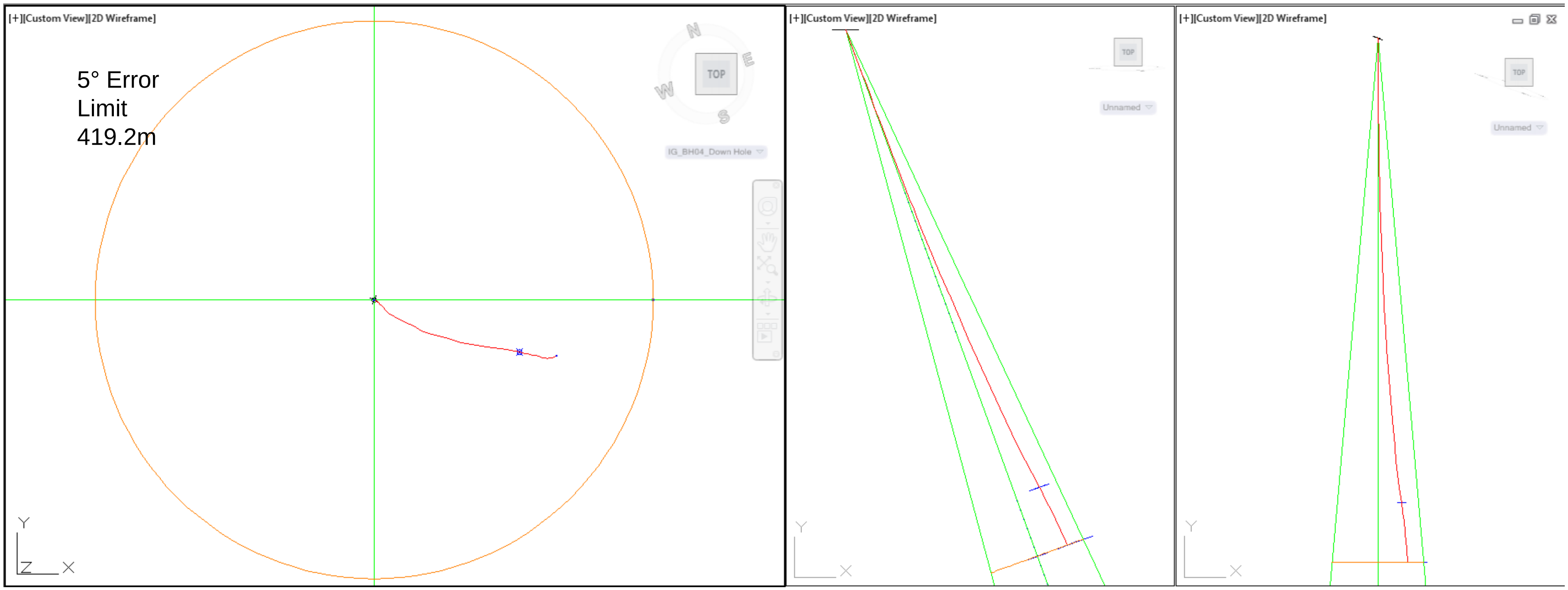


View Perp. Planned



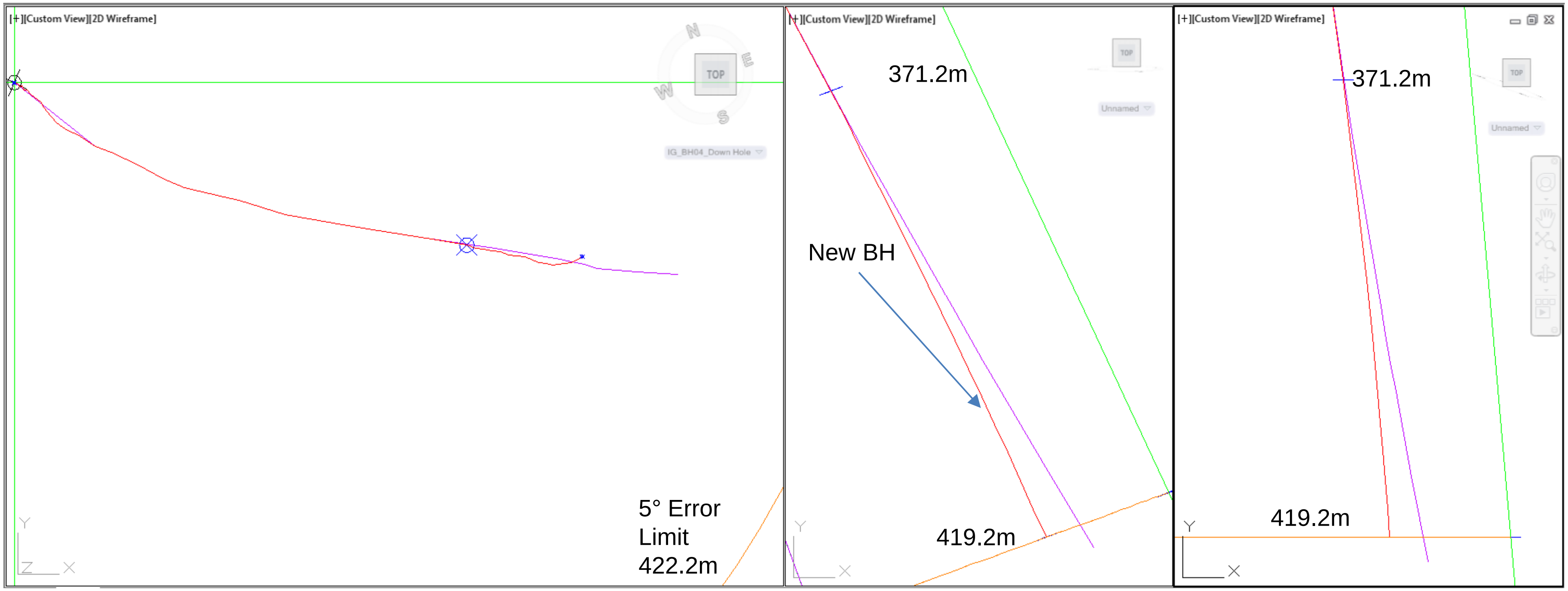
View Front Planned

200114 at 419.2m New BH Zoomed



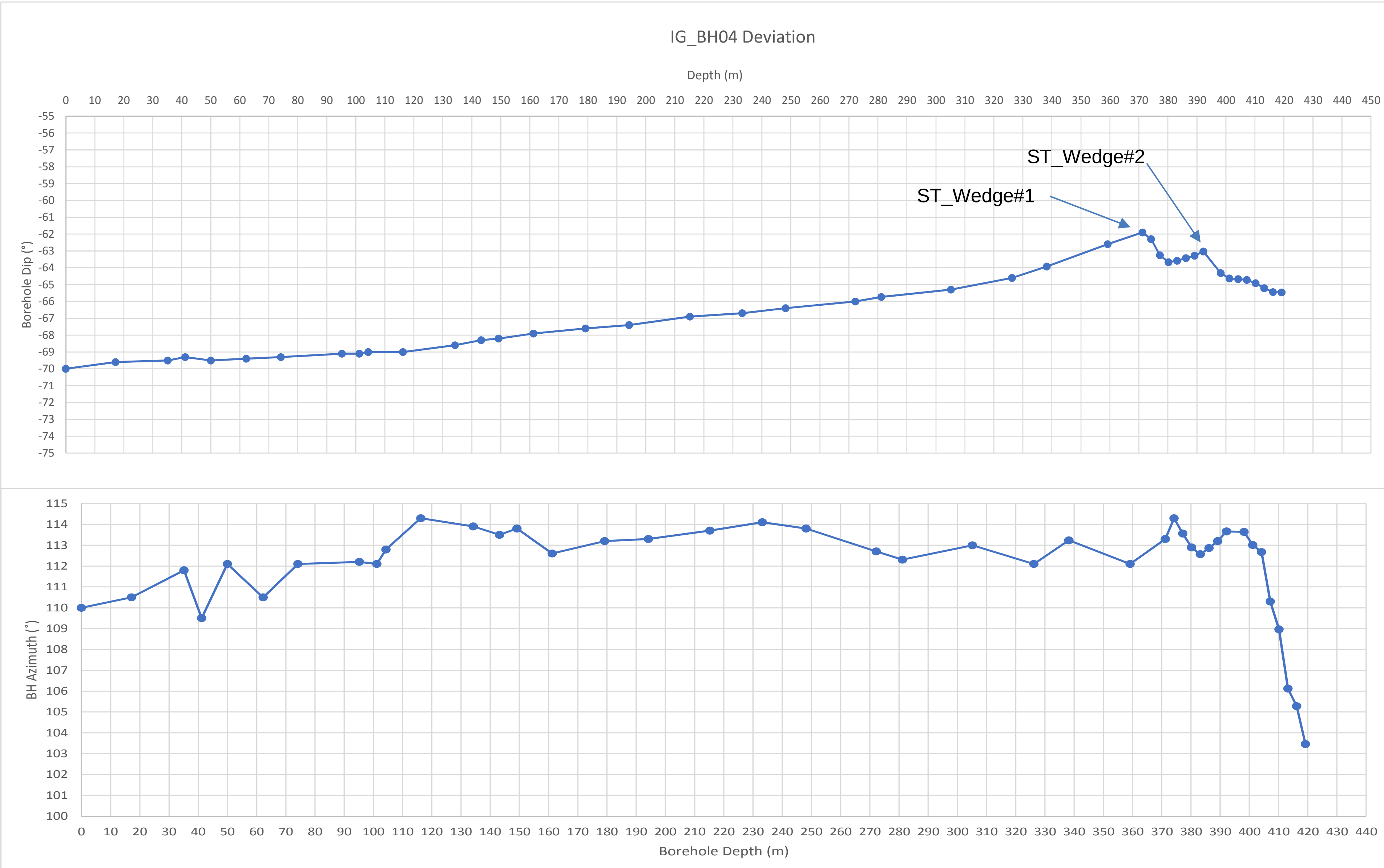
View Down Planned Borehole View Perp. Planned View Front Planned

200114 at 419.2m New BH VZoomed

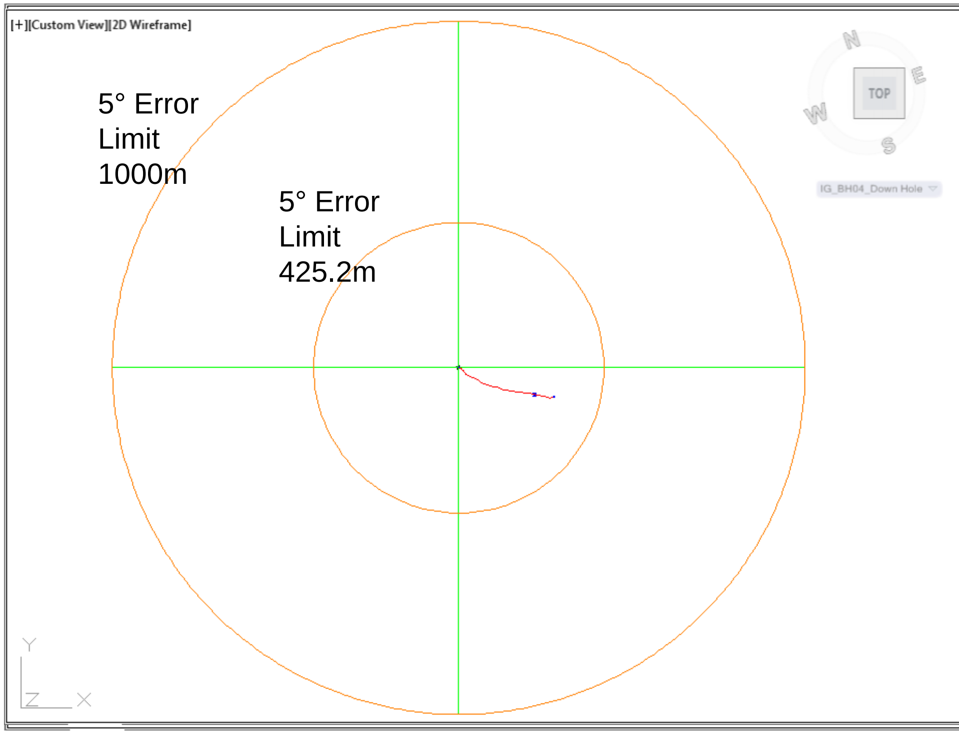


View Down Planned Borehole | View Perp. Planned | View Front Planned

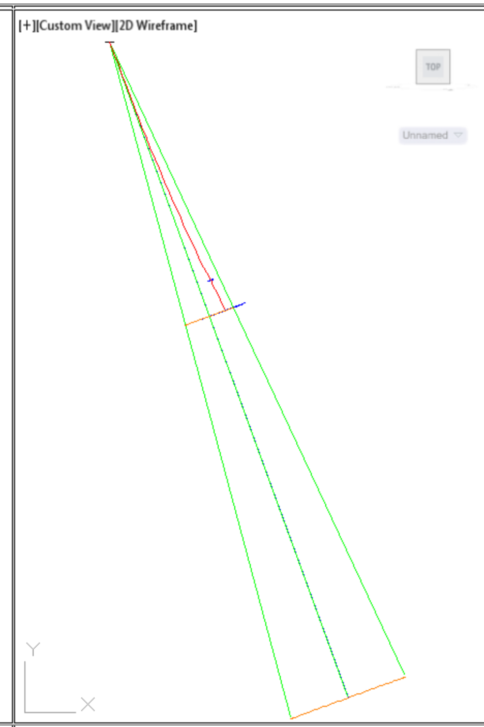
200114 at 419.2m New BH



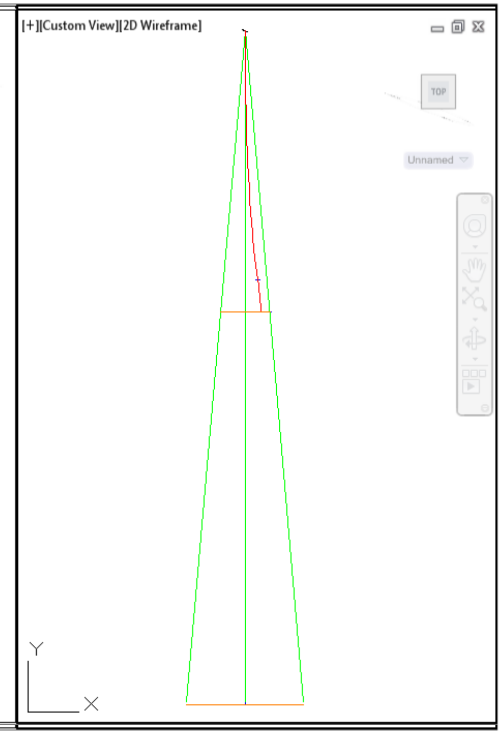
200114 at 425.2m New BH



View Down Planned Borehole

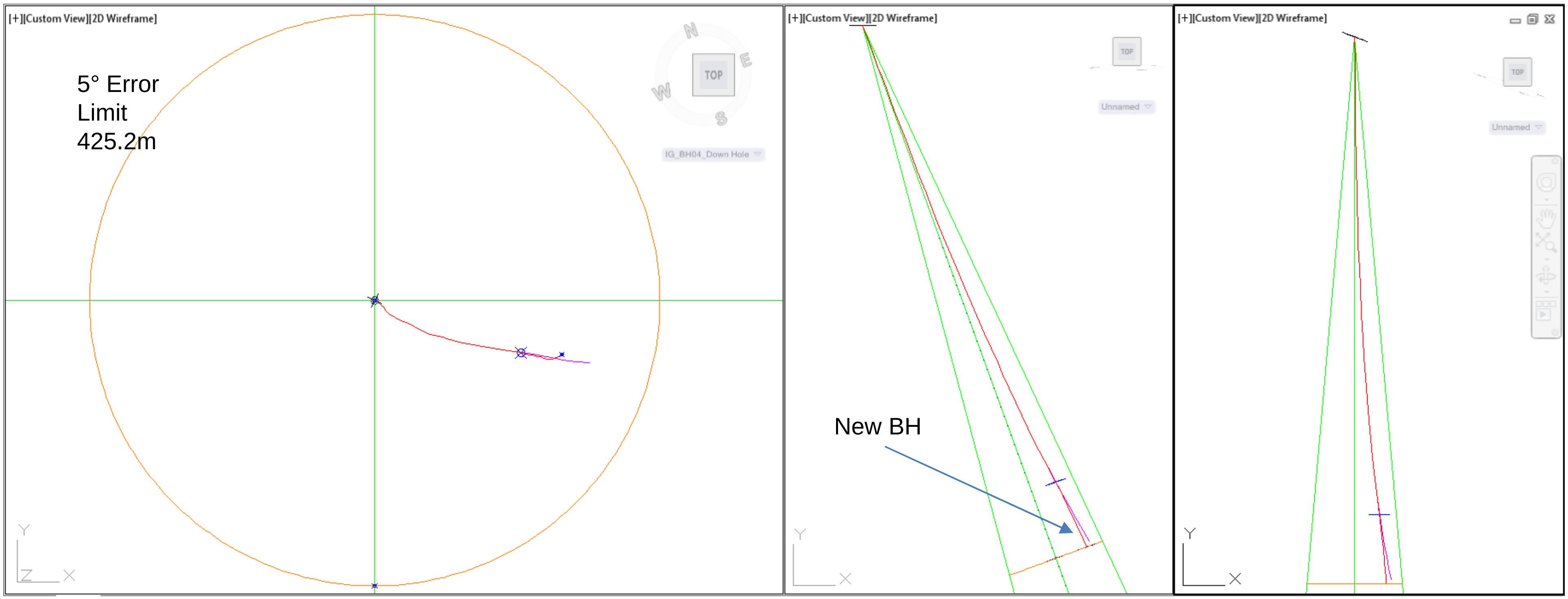


View Perp. Planned



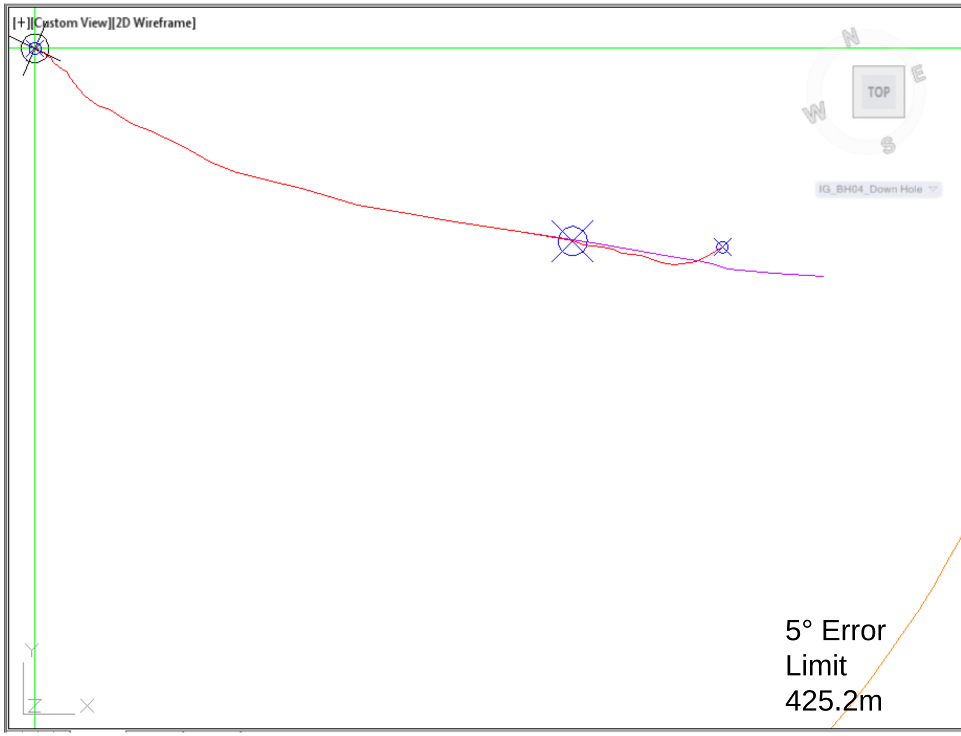
View Front Planned

200114 at 425.2m New BH Zoomed

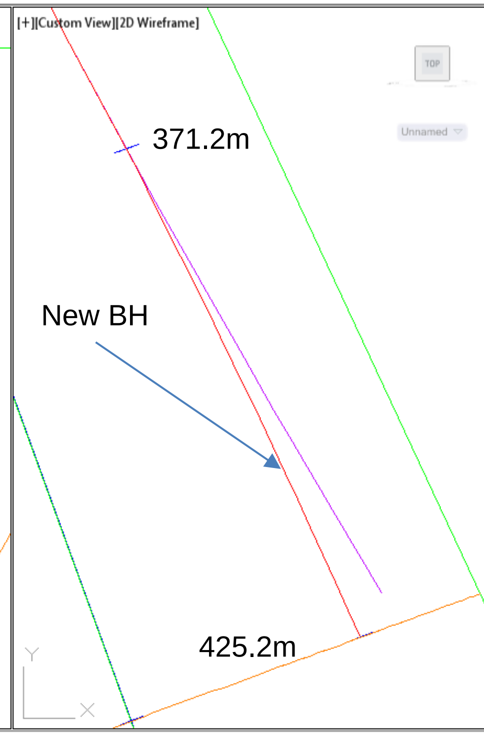


View Down Planned Borehole   View Perp. Planned   View Front Planned

200114 at 425.2m New BH VZoomed



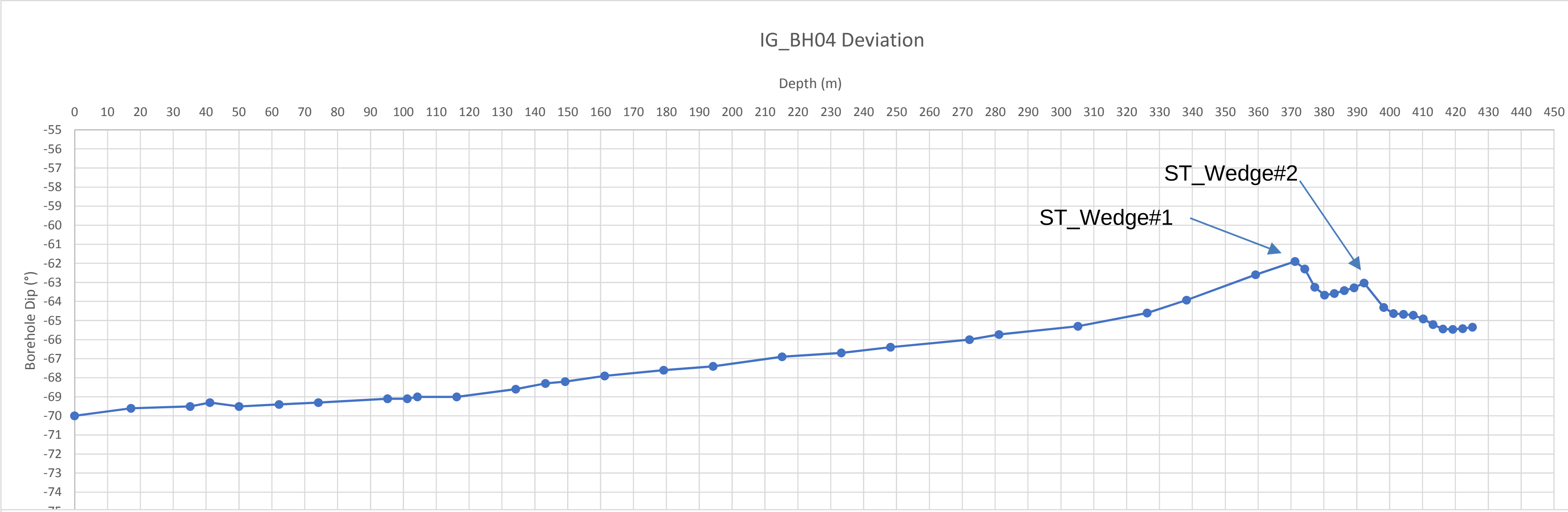
View Down Planned Borehole

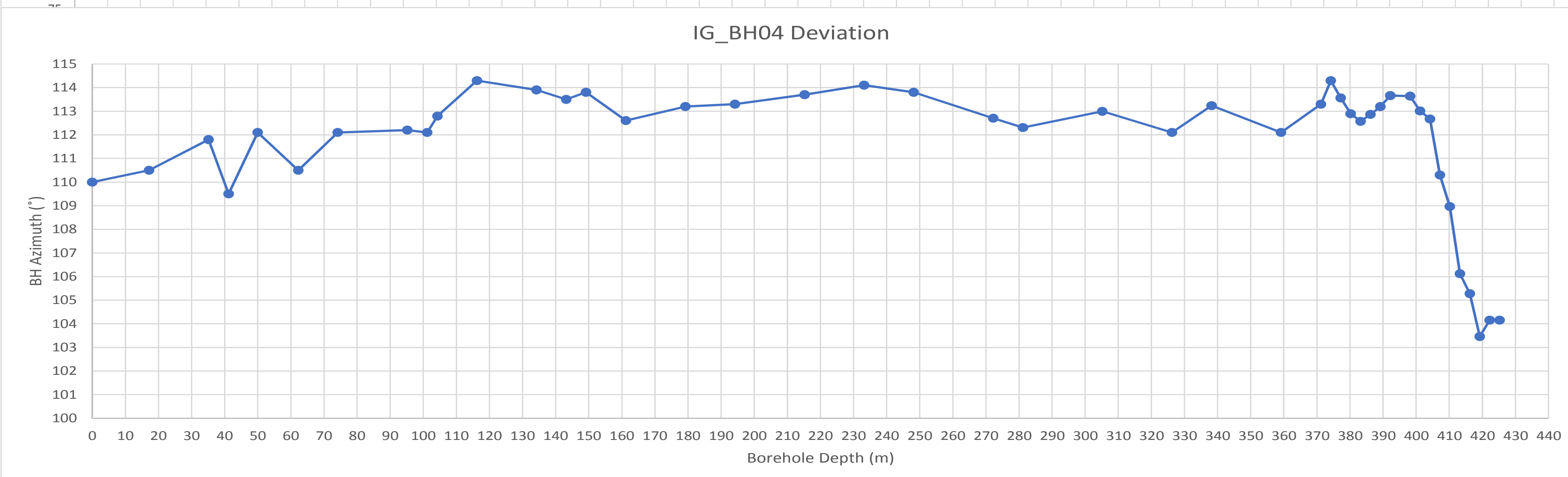


View Perp. Planned

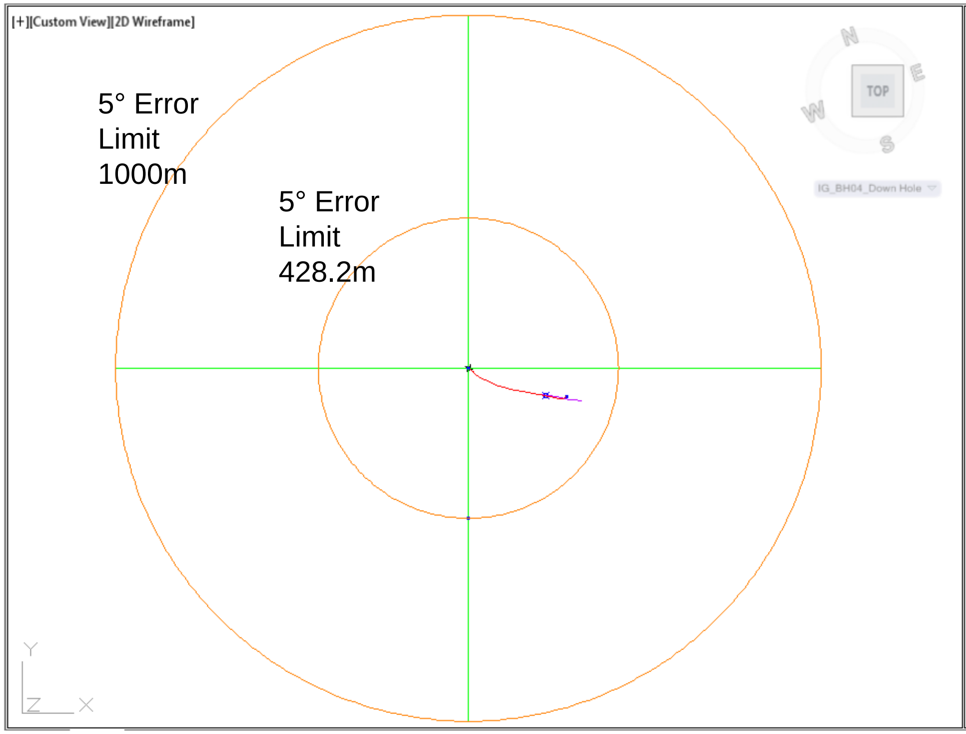
View Front Planned

200114 at 425.2m New BH

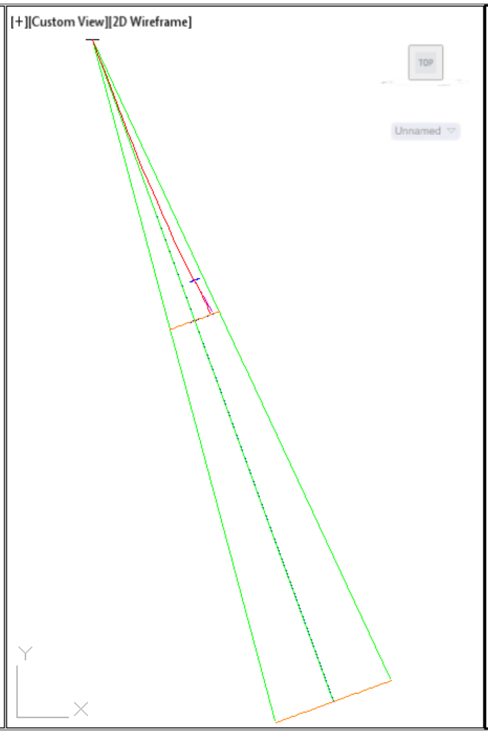




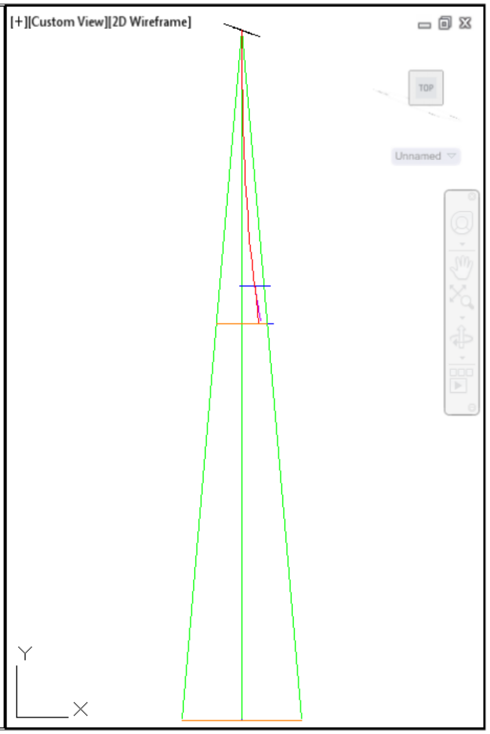
200115 at 428.2m New BH



View Down Planned Borehole

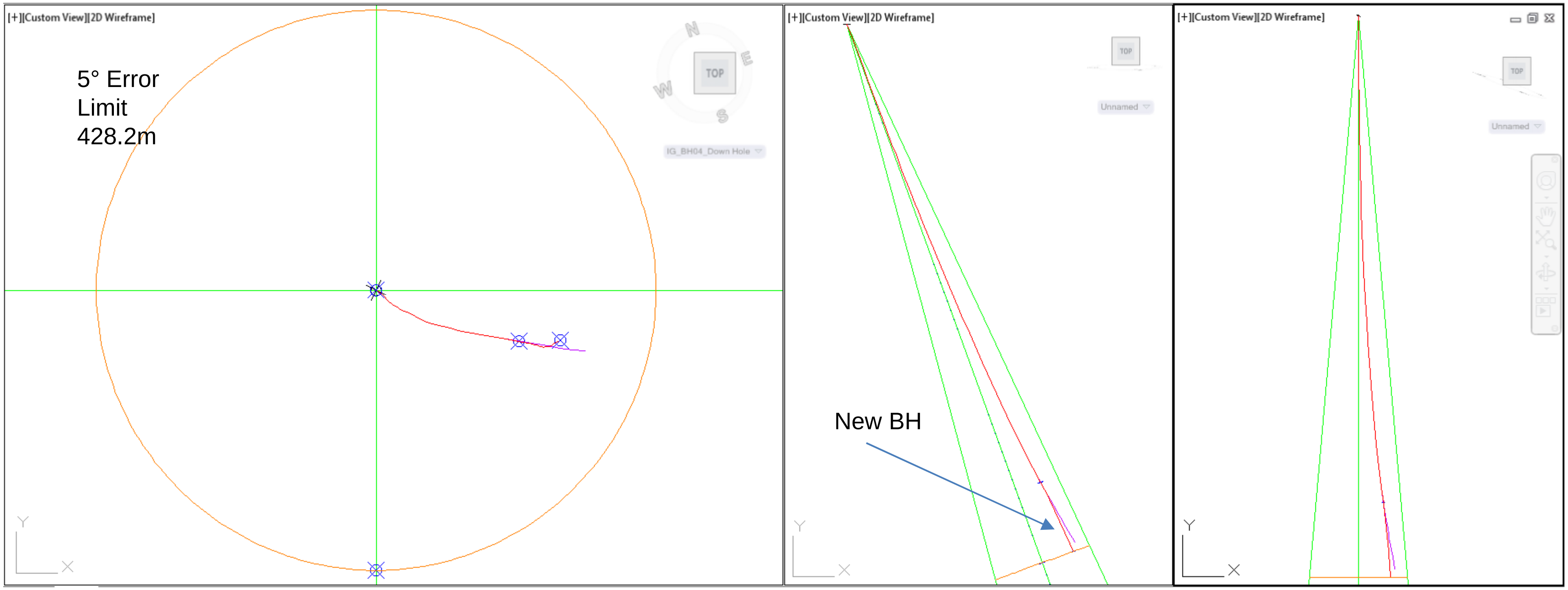


View Perp. Planned



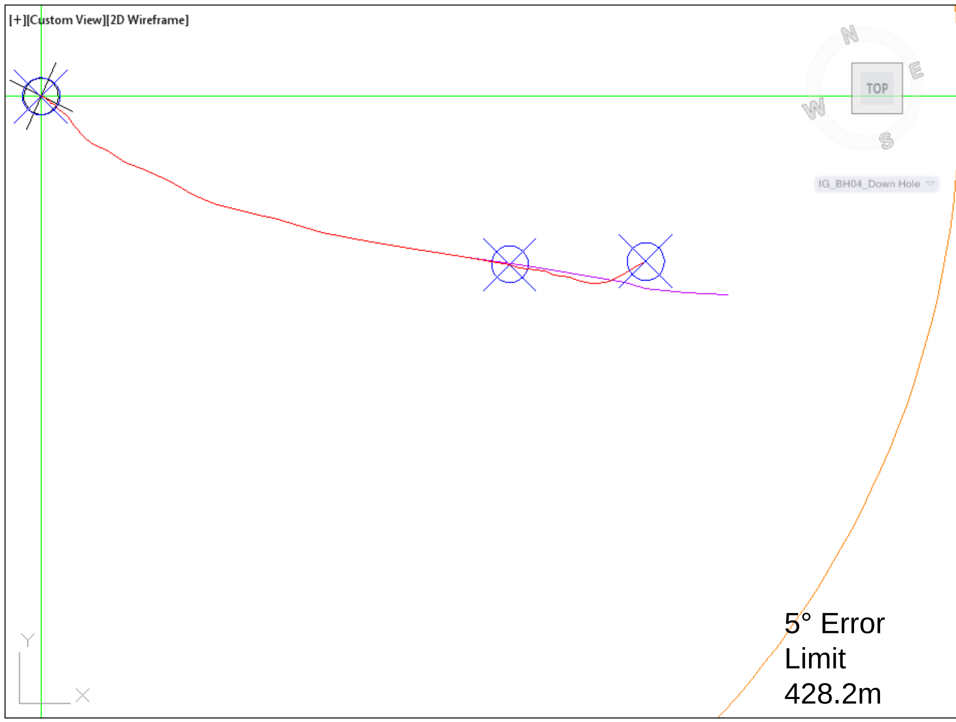
View Front Planned

200115 at 428.2m New BH Zoomed



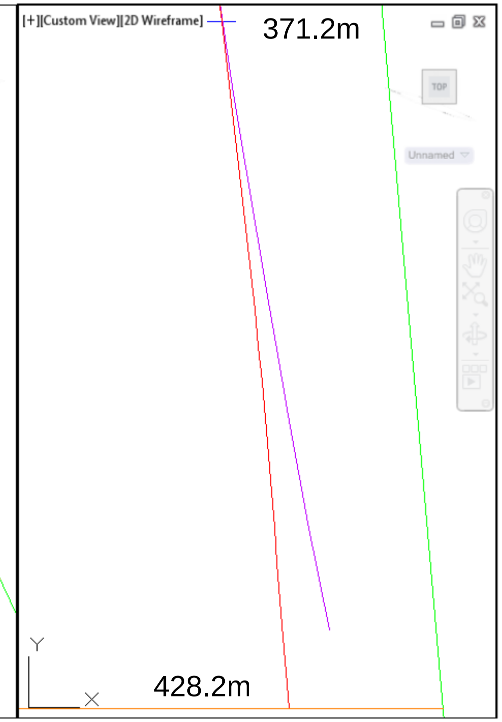
View Down Planned Borehole   View Perp. Planned   View Front Planned

200115 at 428.2m New BH VZoomed



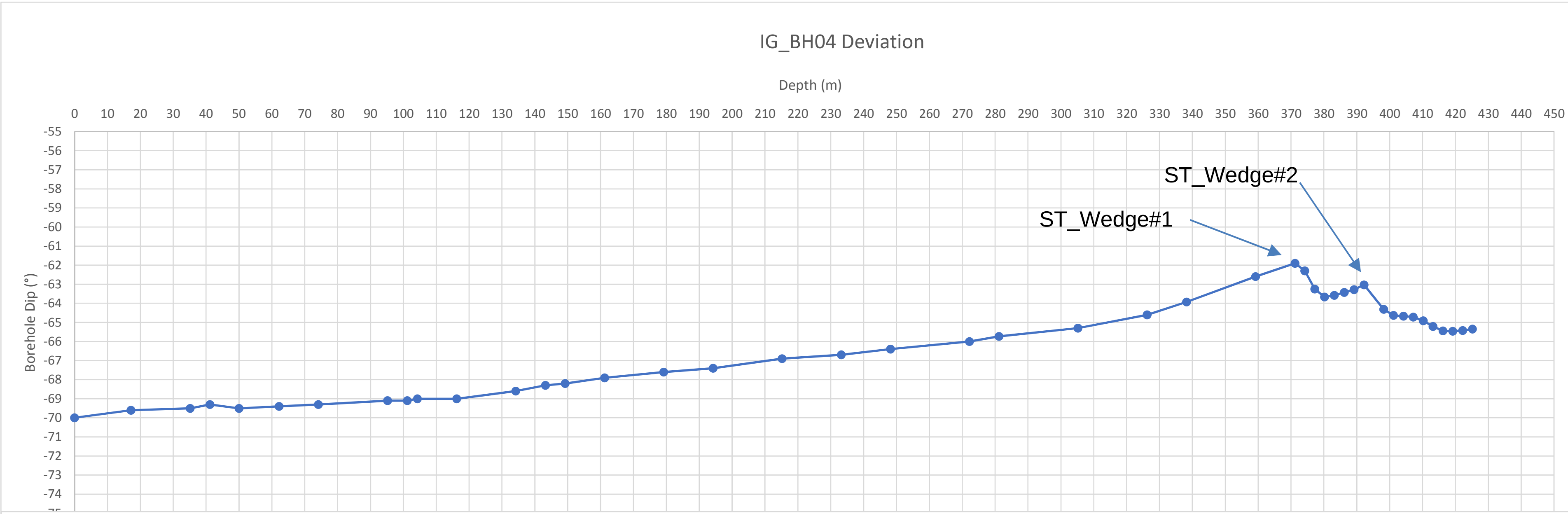
View Down Planned Borehole

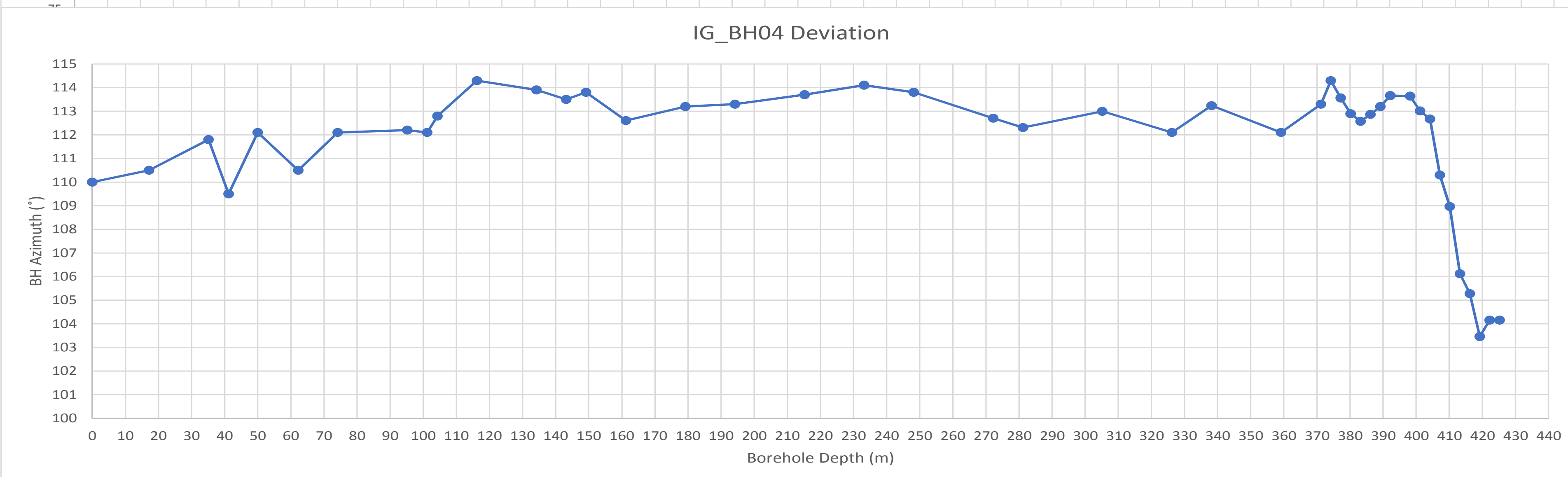
View Perp. Planned



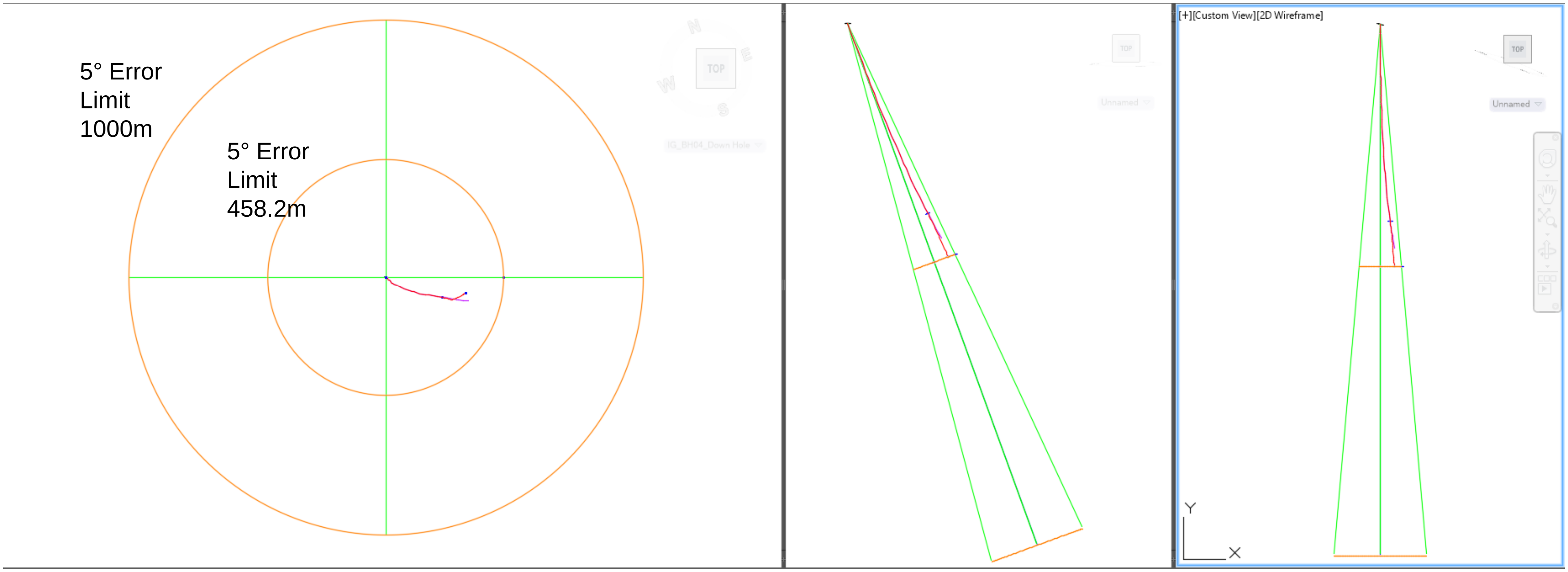
View Front Planned

200115 at 428.2m New BH



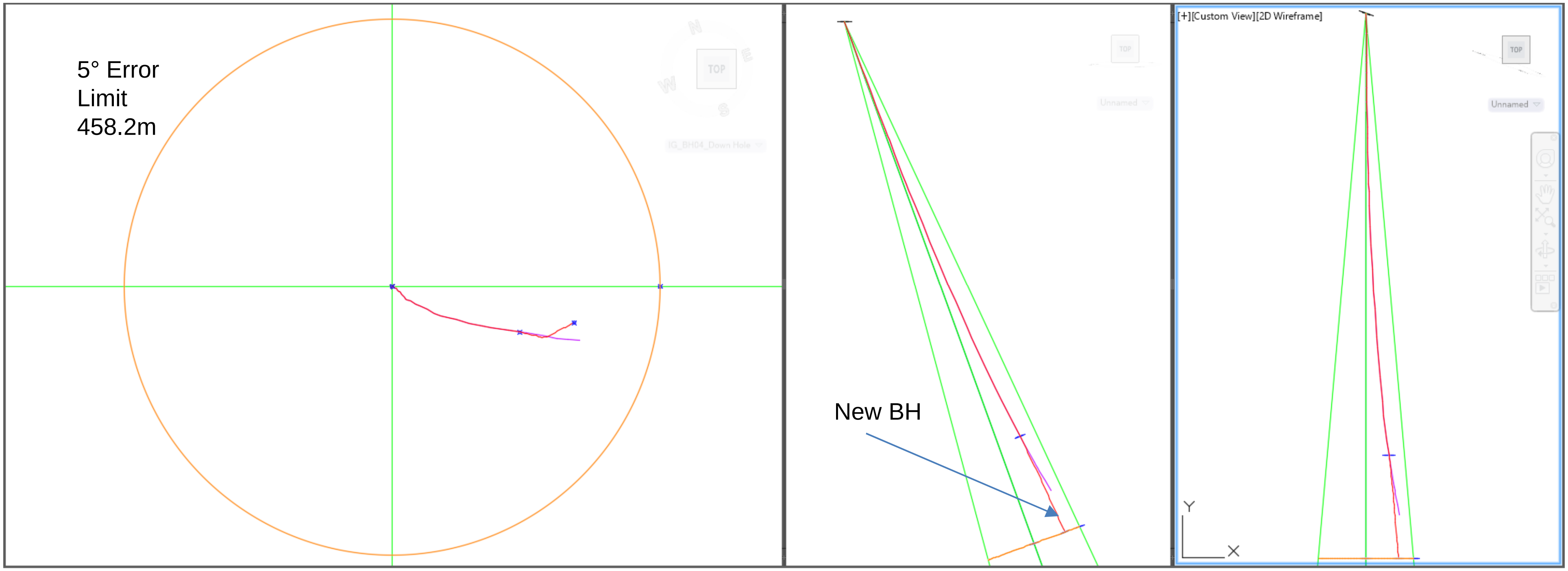


200116 at 458.2m New BH



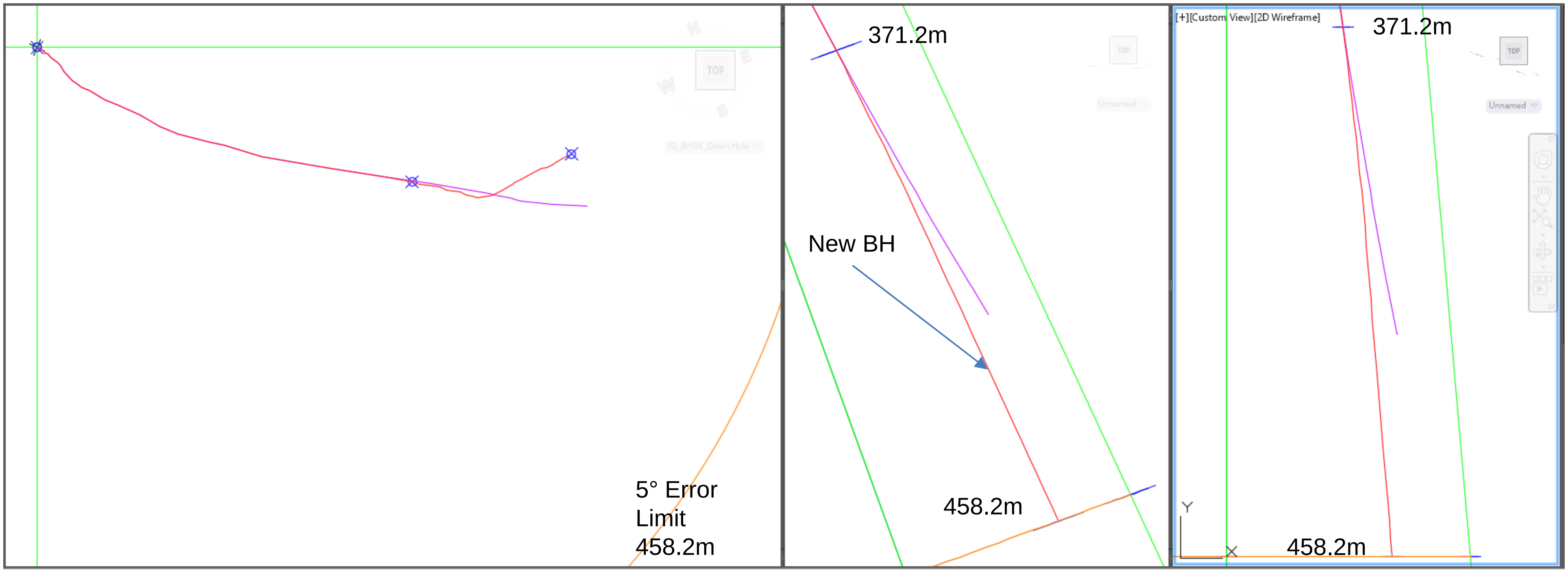
View Down Planned Borehole View Perp. Planned View Front Planned

200116 at 458.2m New BH Zoomed



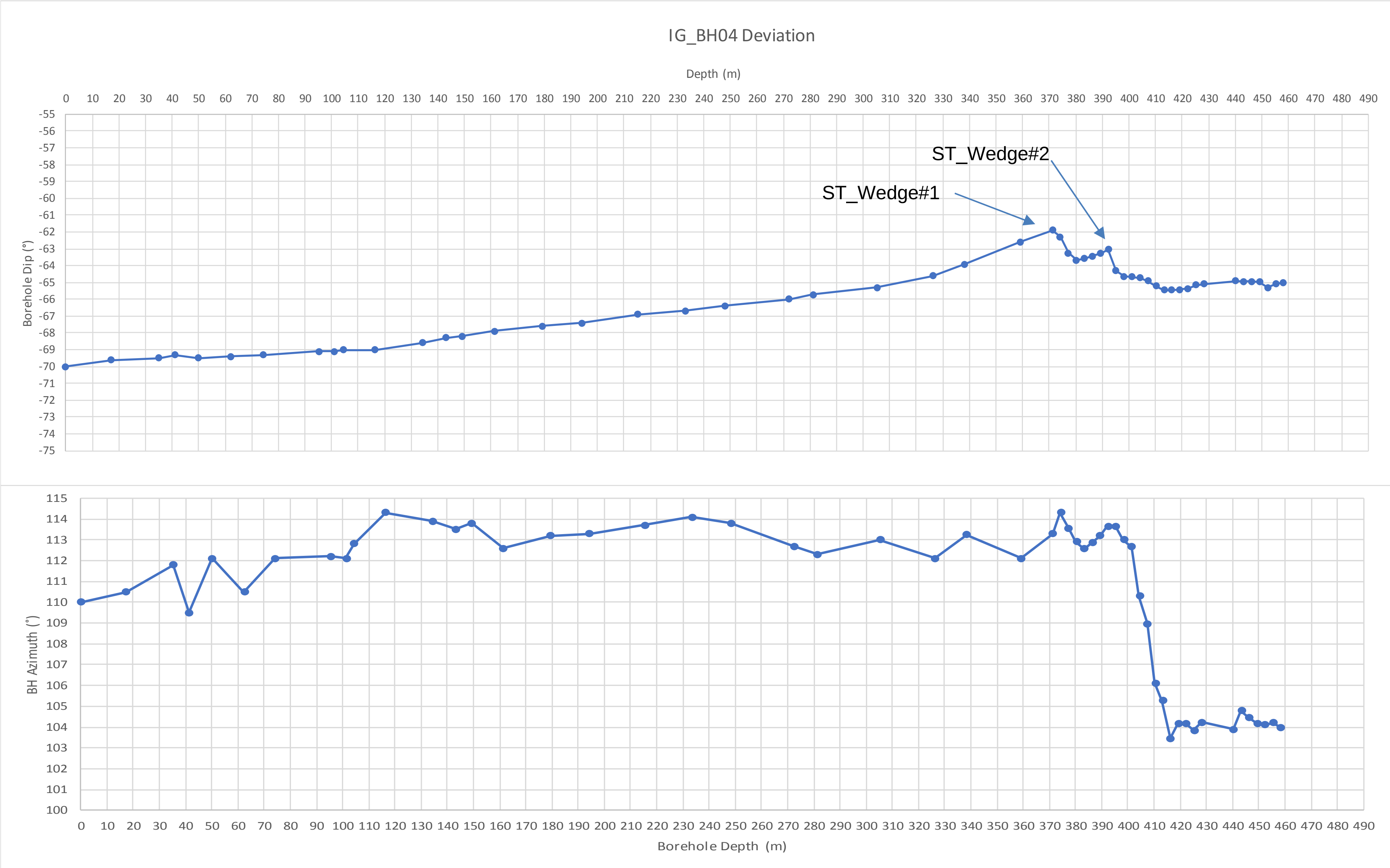
View Down Planned Borehole View Perp. Planned View Front Planned

200116 at 458.2m New BH VZoomed

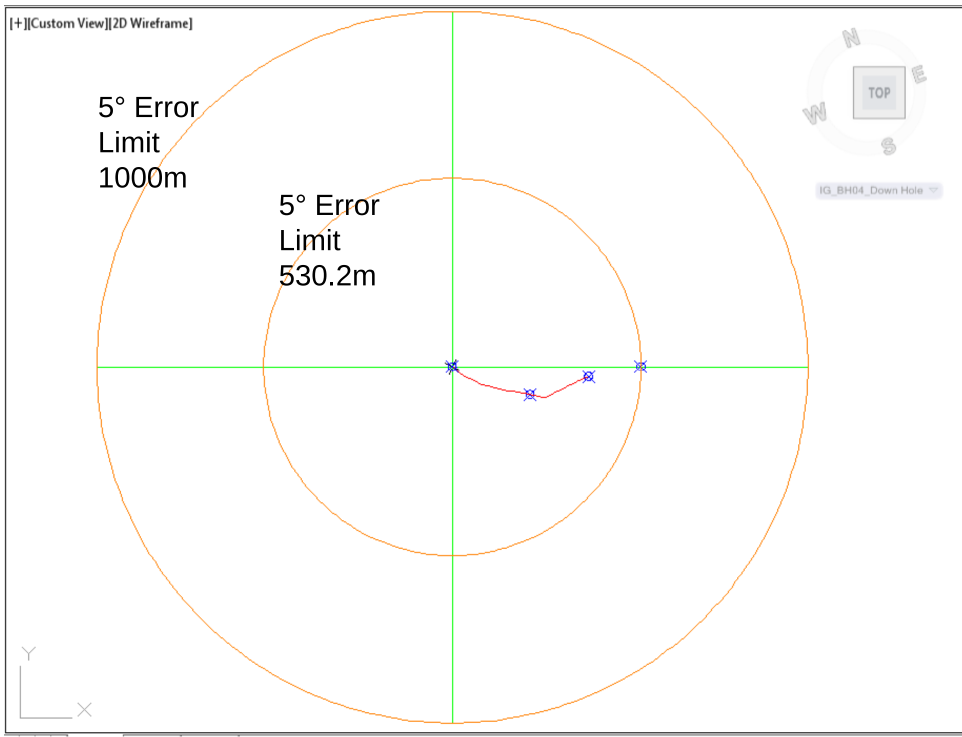


View Down Planned Borehole View Perp. Planned View Front Planned

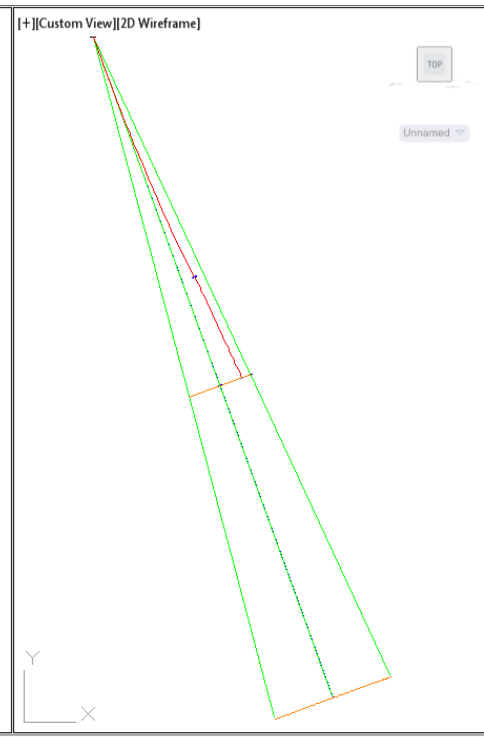
200116 at 458.2m New BH



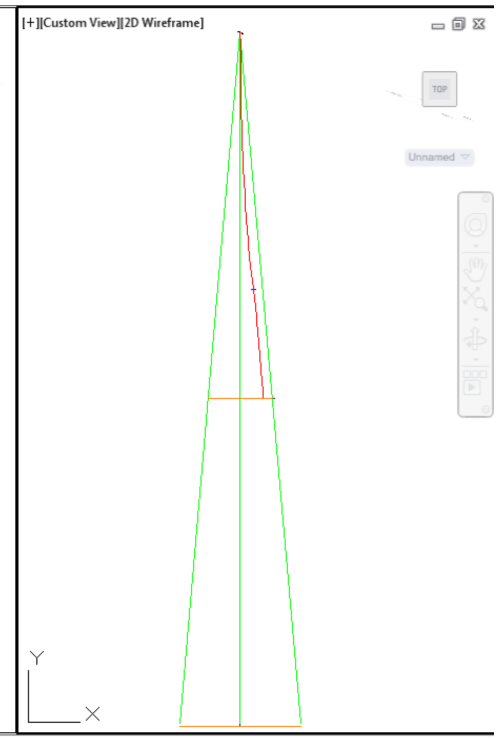
200120 at 530.2m New BH



View Down Planned Borehole

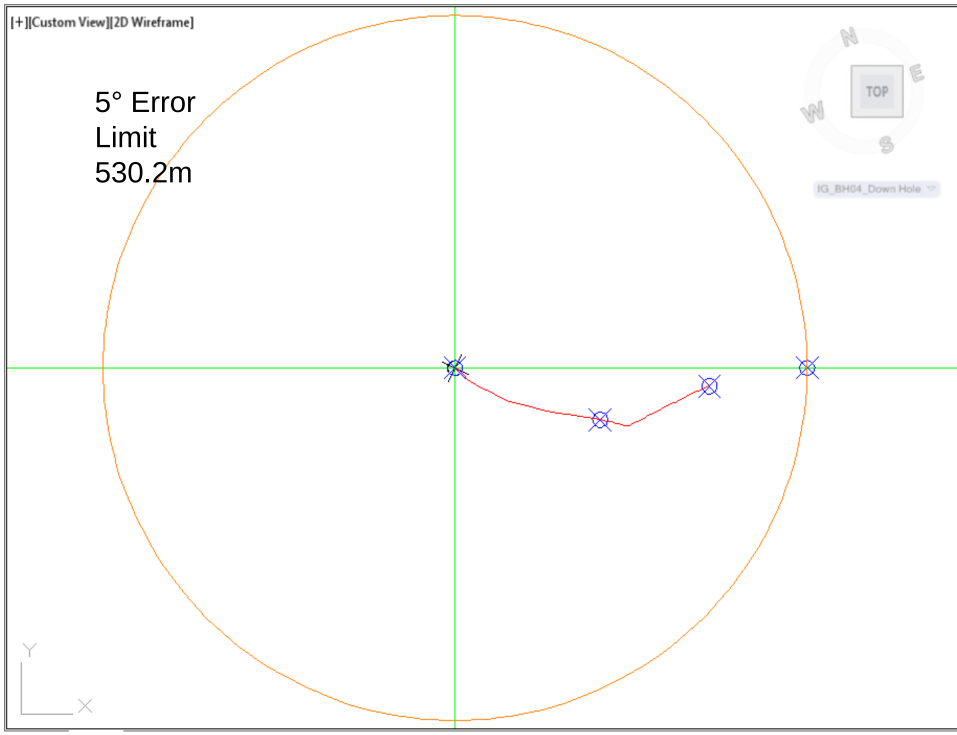


View Perp. Planned

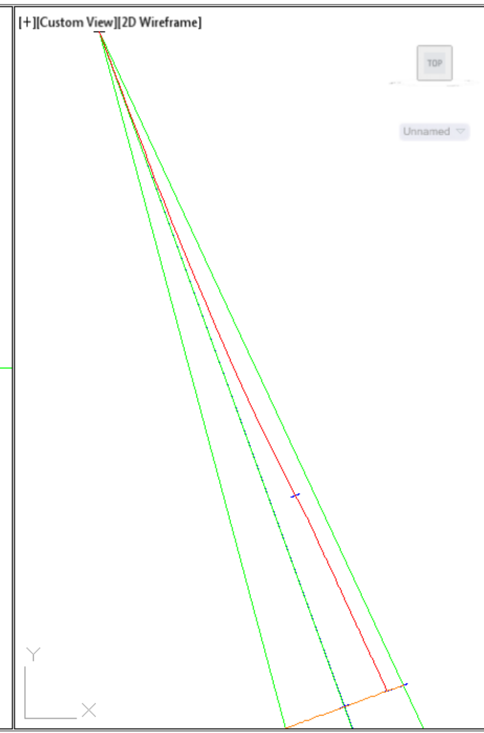


View Front Planned

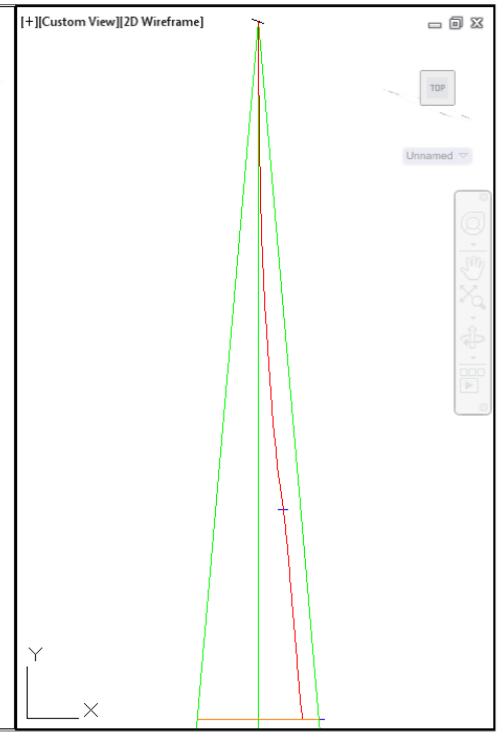
200120 at 530.2m New BH Zoomed



View Down Planned Borehole

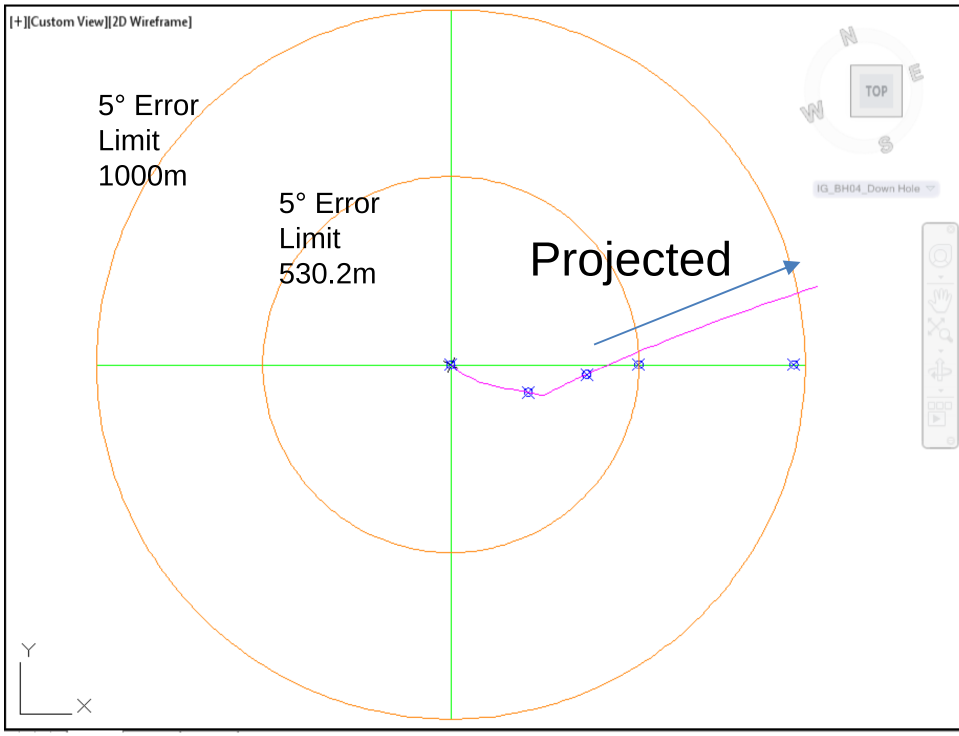


View Perp. Planned

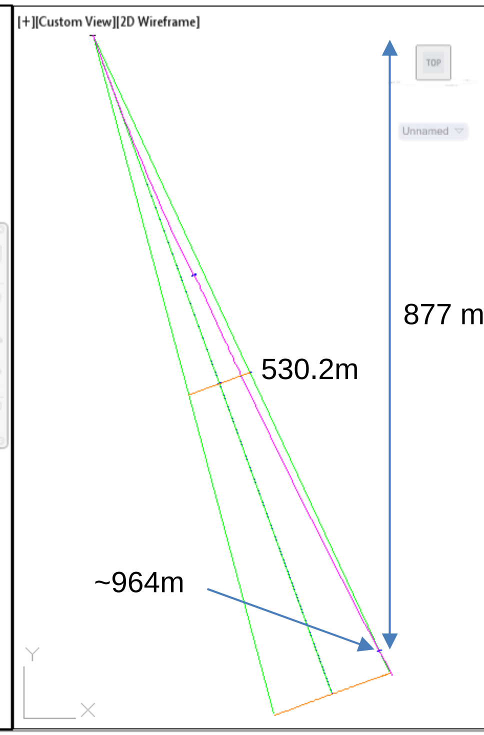


View Front Planned

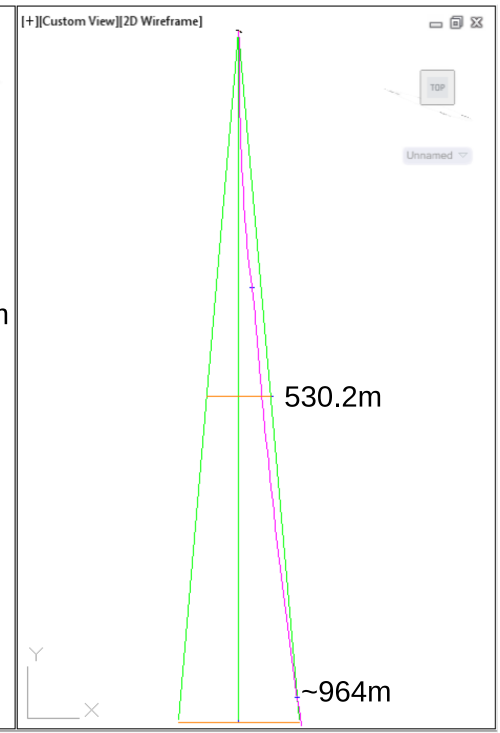
200120 Projected BH from 530.2m New BH



View Down Planned Borehole

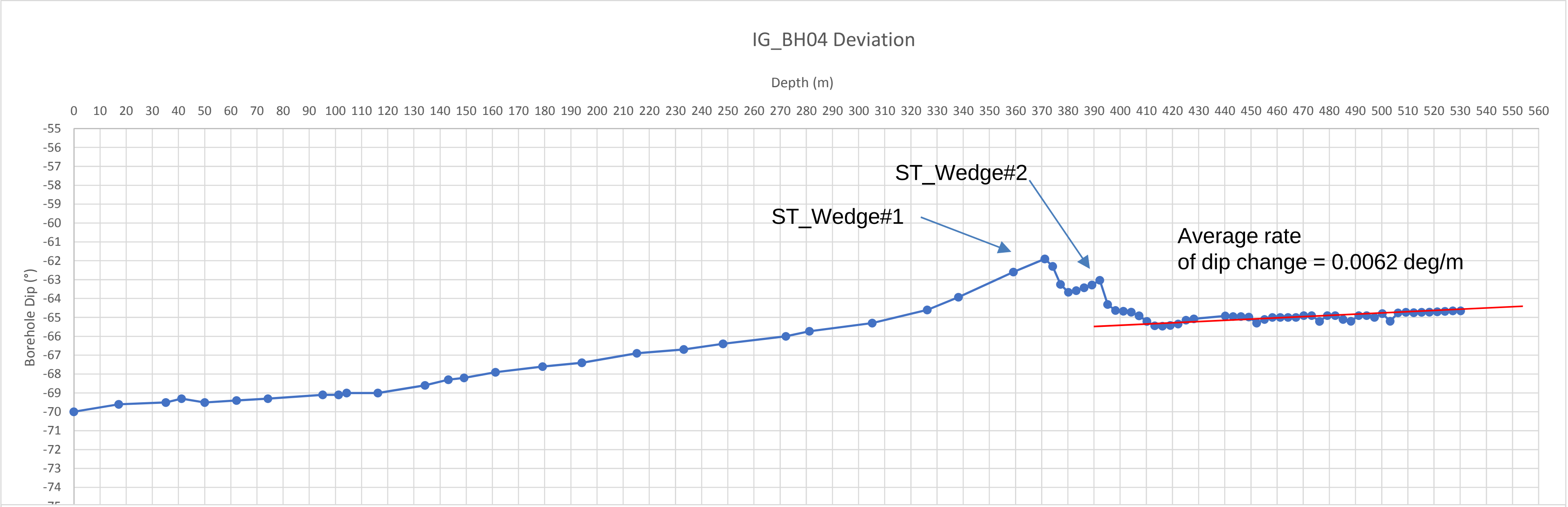


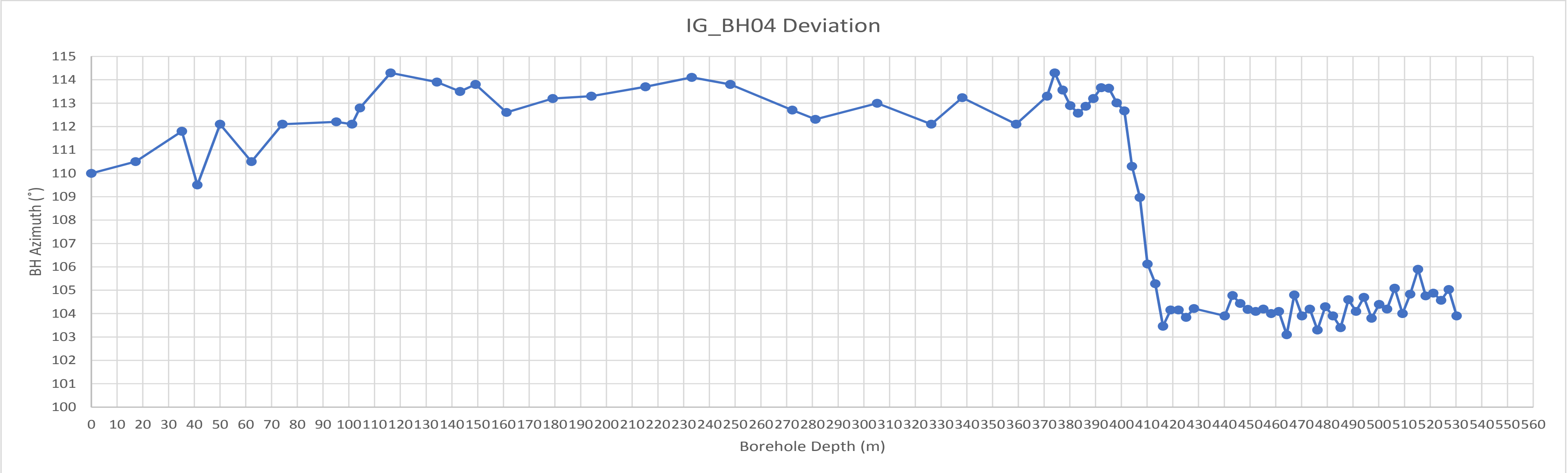
View Perp. Planned



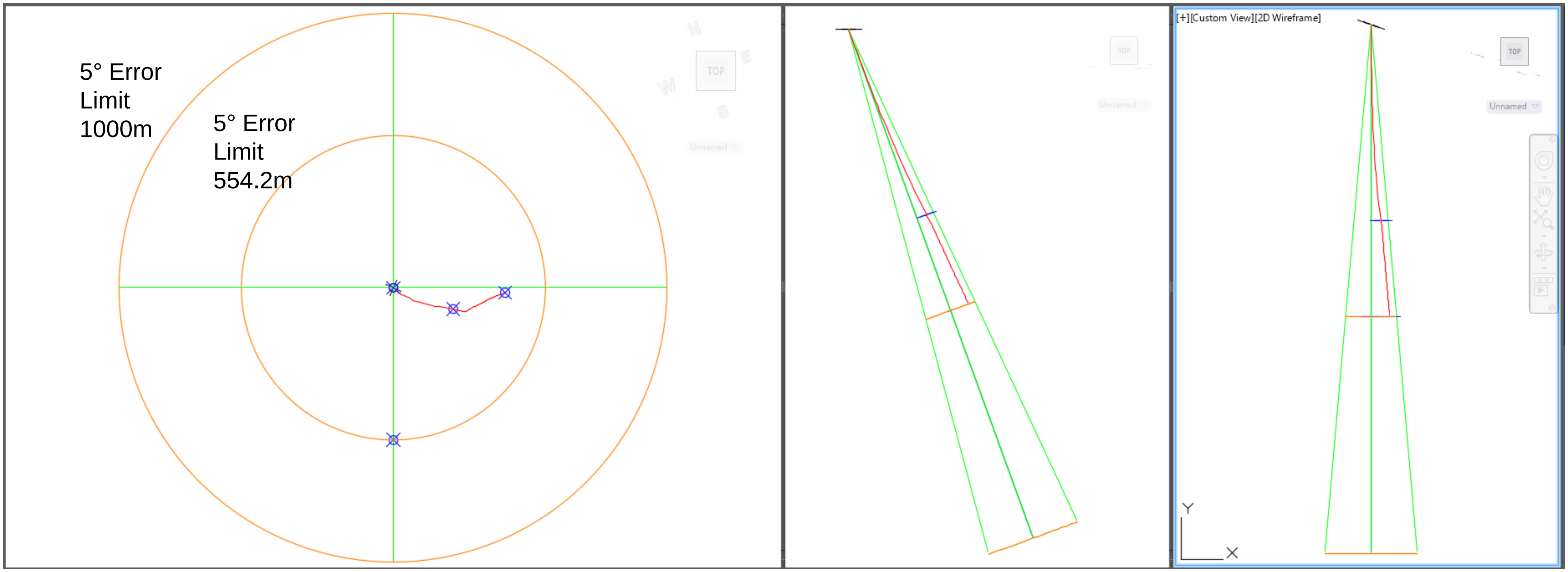
View Front Planned

200120 at 530.2m New BH



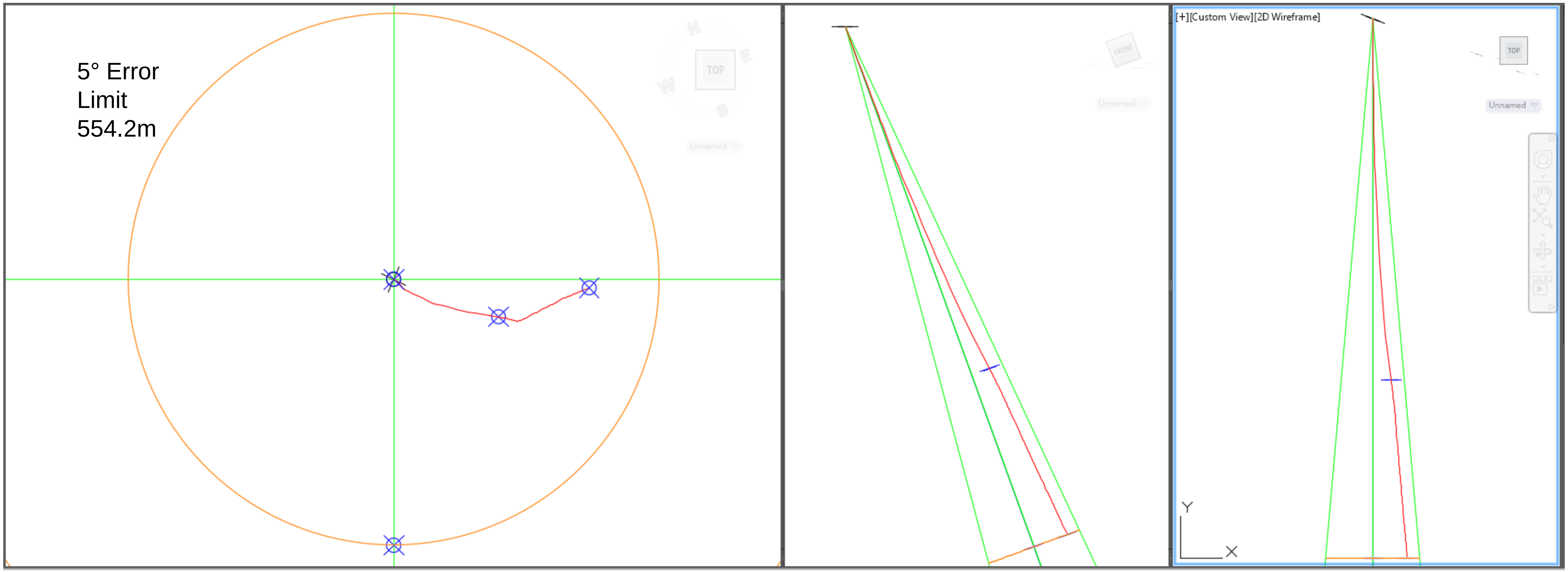


200120 at 554.2m New BH



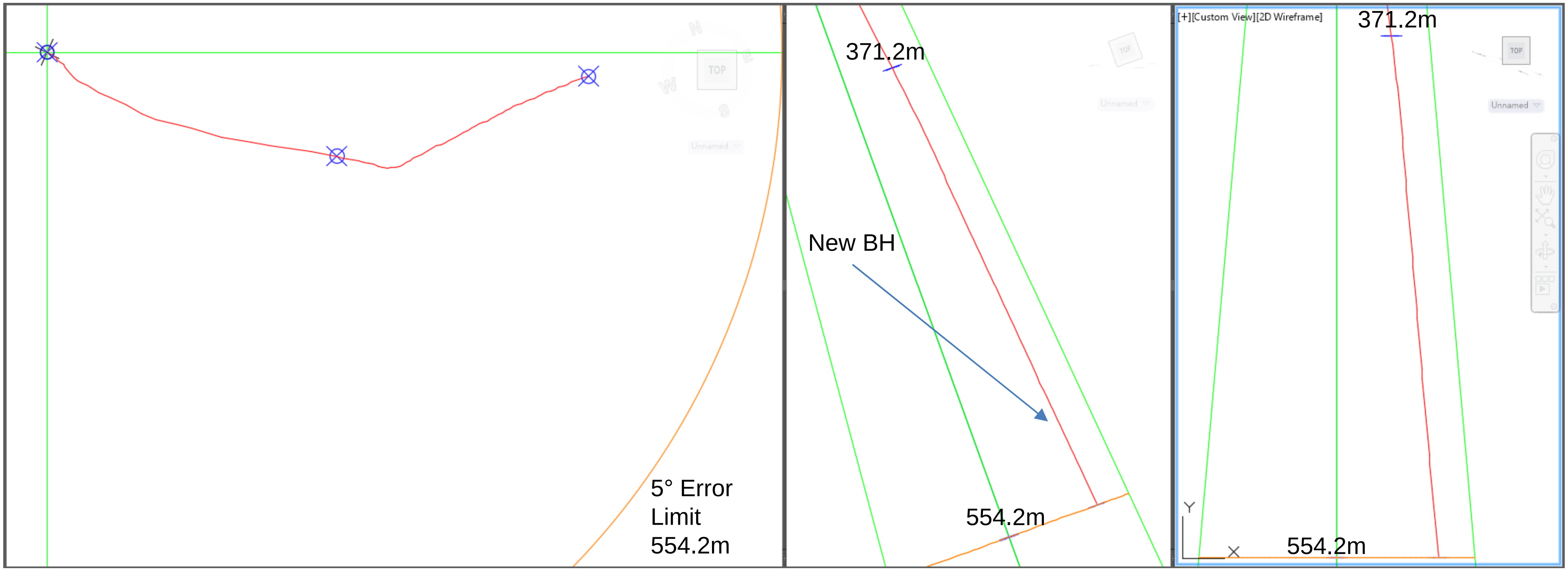
View Down Planned Borehole View Perp. Planned View Front Planned

200120 at 554.2m New BH Zoomed



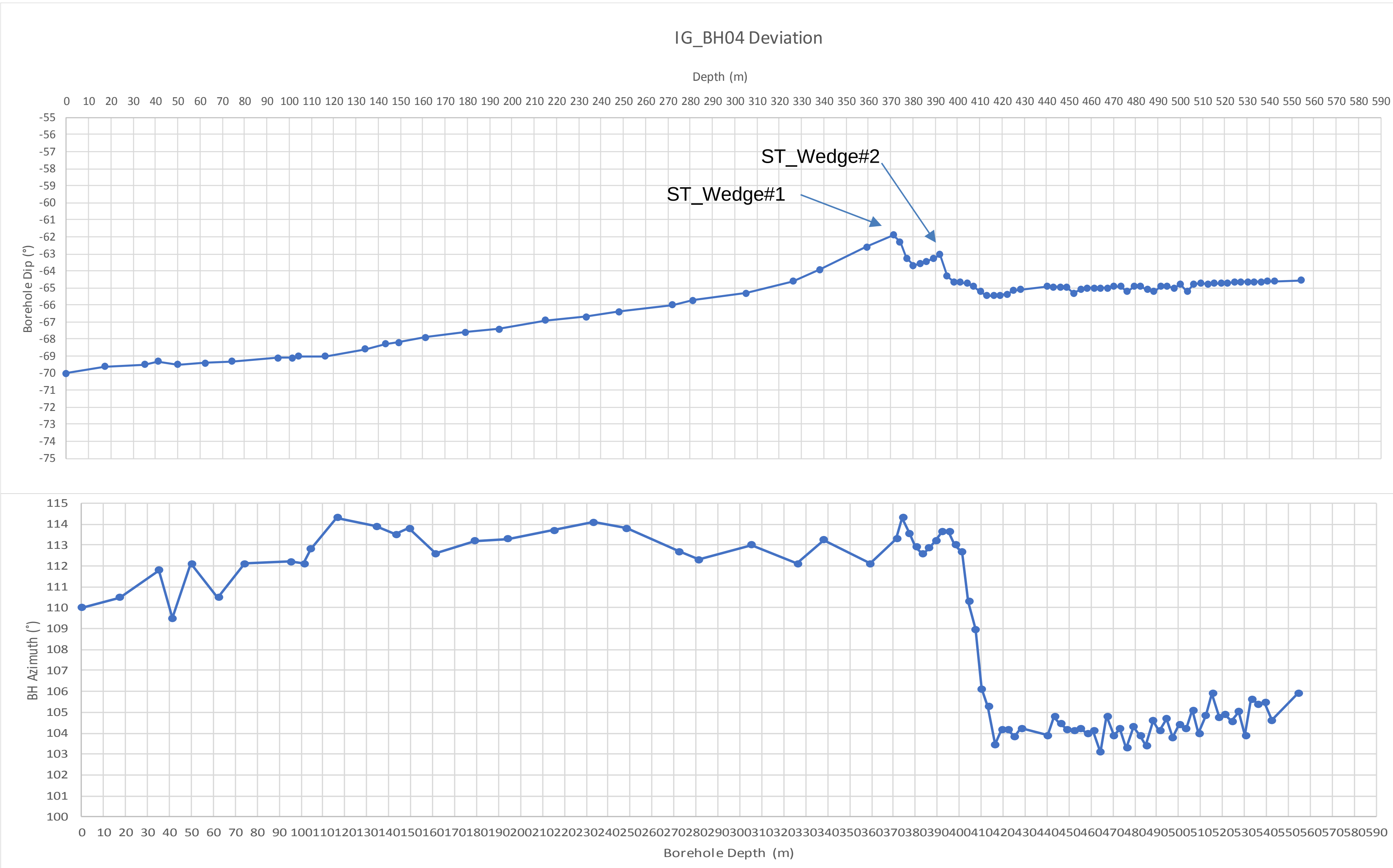
View Down Planned Borehole View Perp. Planned View Front Planned

200120 at 554.2m New BH VZoomed

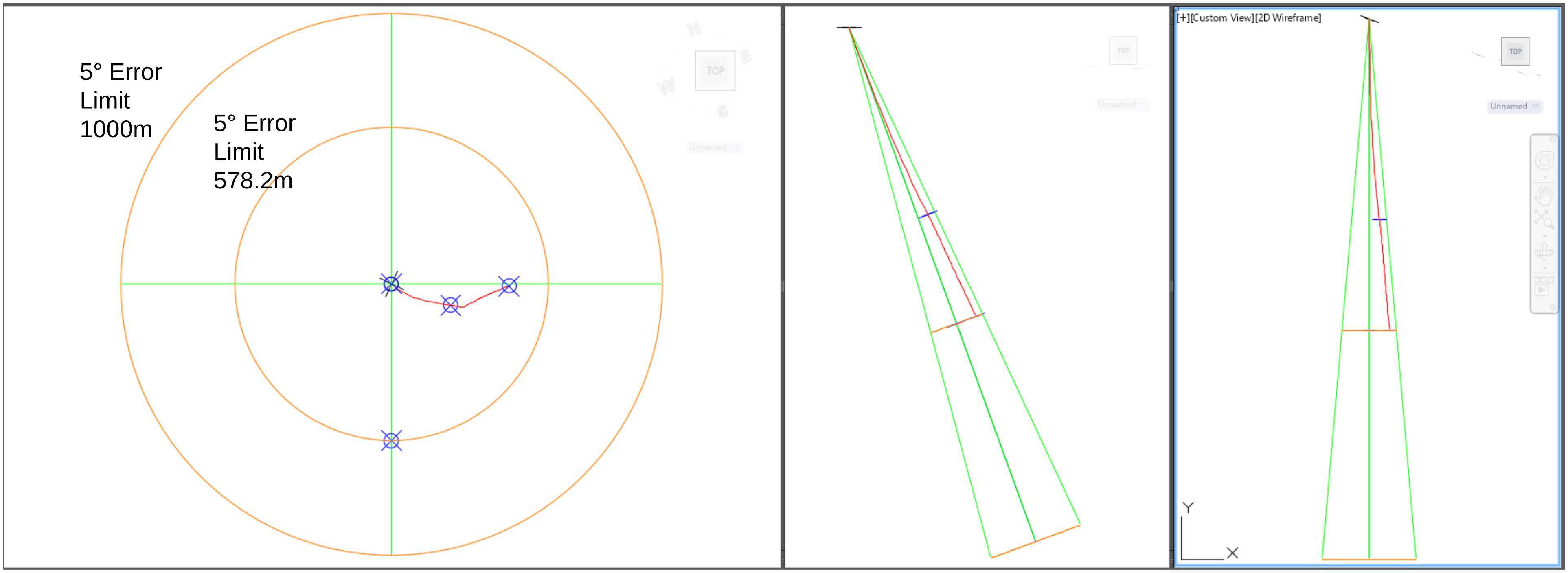


View Down Planned Borehole View Perp. Planned View Front Planned

200120 at 554.2m New BH



200122 at 578.2m New BH

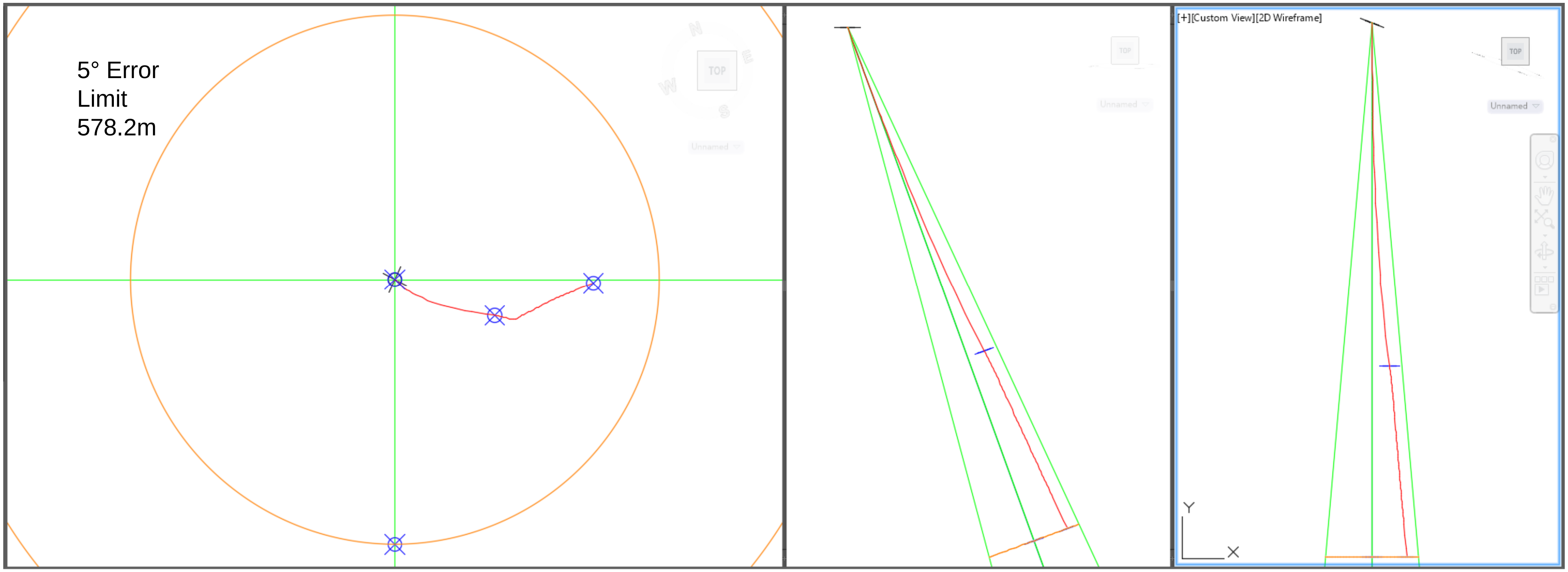


View Down Planned Borehole

View Perp. Planned

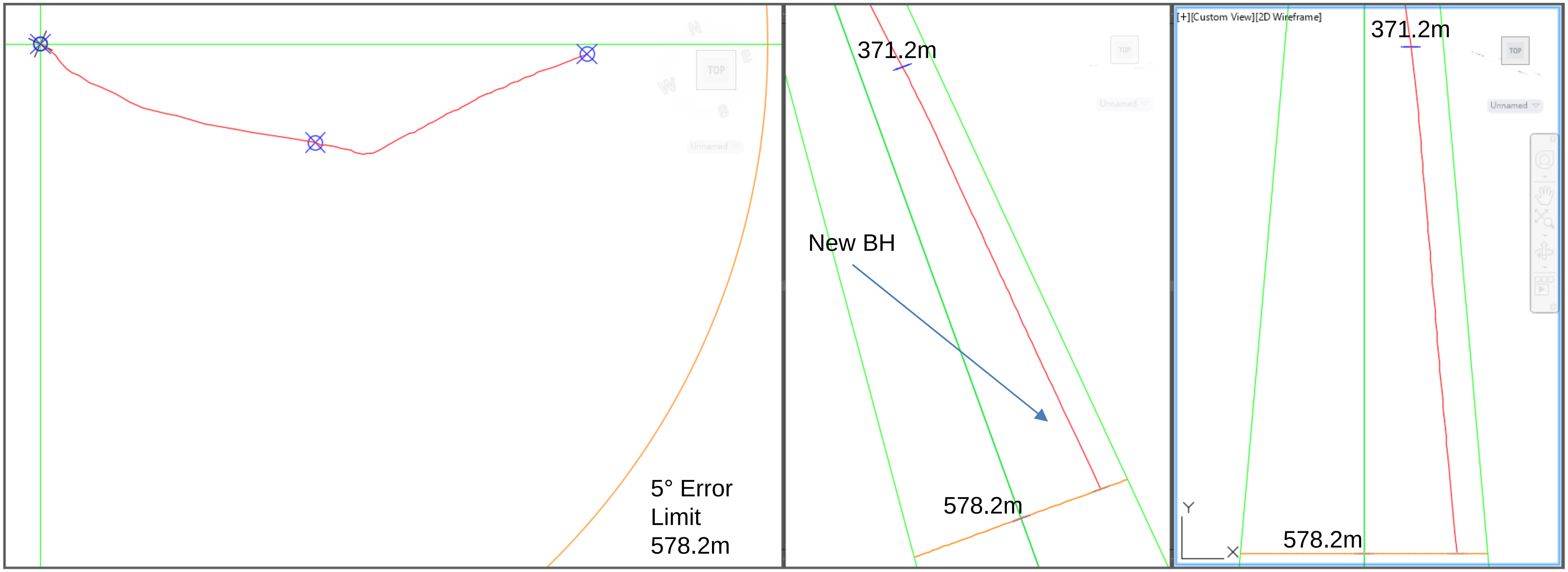
View Front Planned

200122 at 578.2m New BH Zoomed



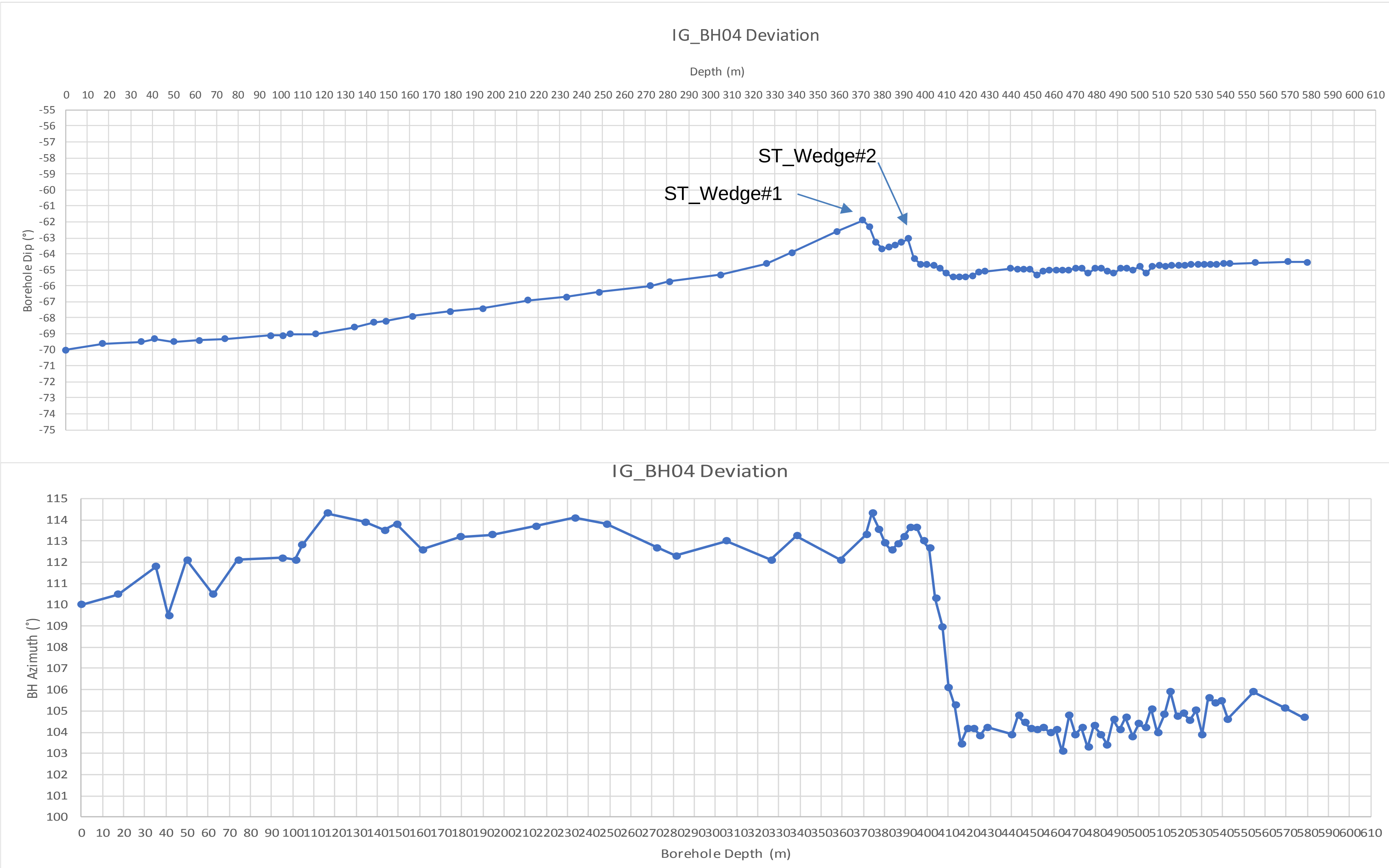
View Down Planned Borehole | View Perp. Planned | View Front Planned

200122 at 578.2m New BH VZoomed

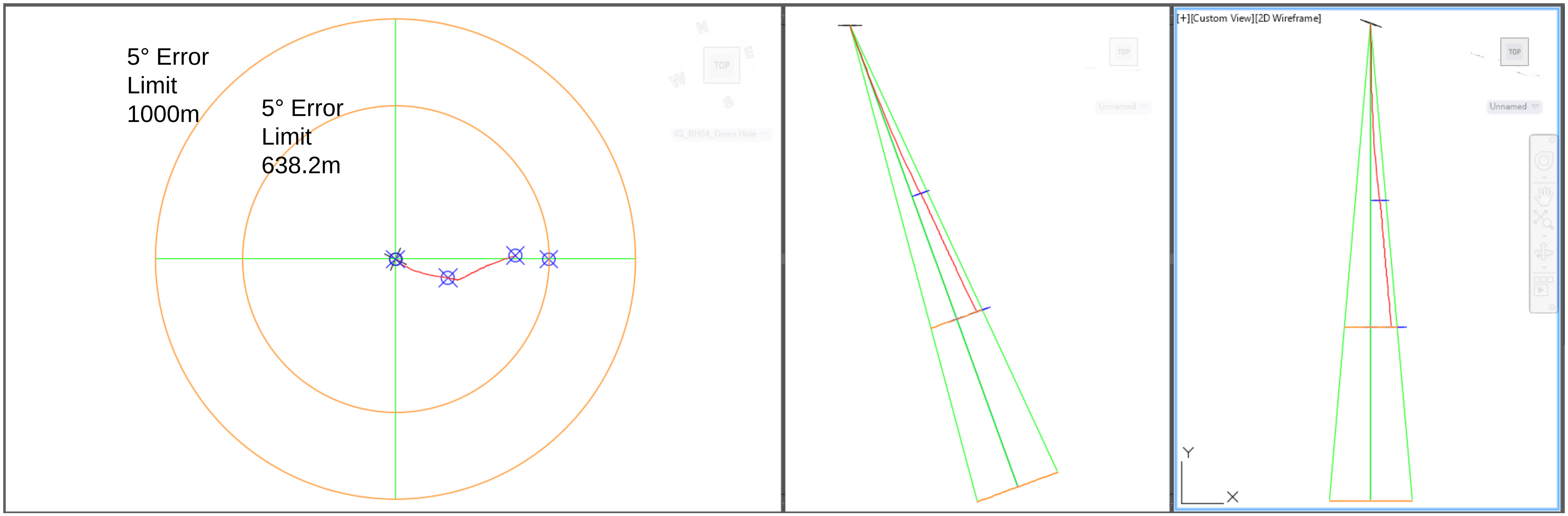


View Down Planned Borehole   View Perp. Planned   View Front Planned

200122 at 578.2m New BH



200217 at 638.2m New BH

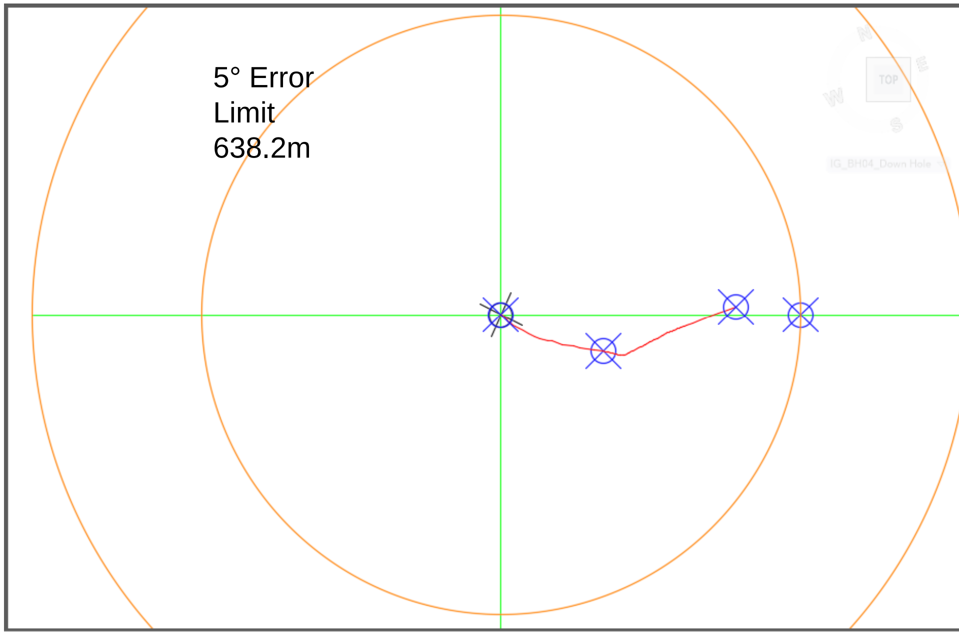


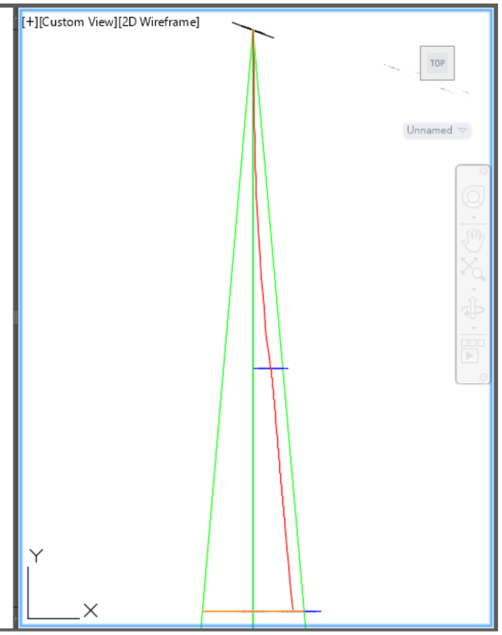
View Down Planned Borehole

View Perp. Planned

View Front Planned

200217 at 638.2m New BH Zoomed



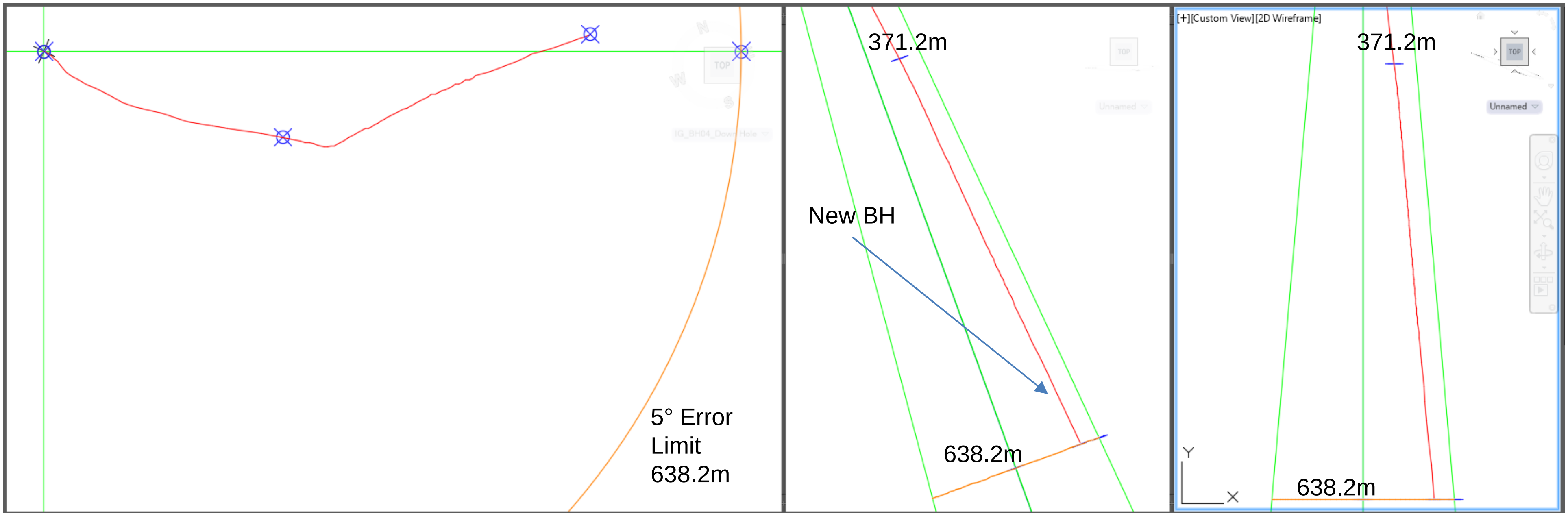


View Down Planned Borehole

View Perp. Planned

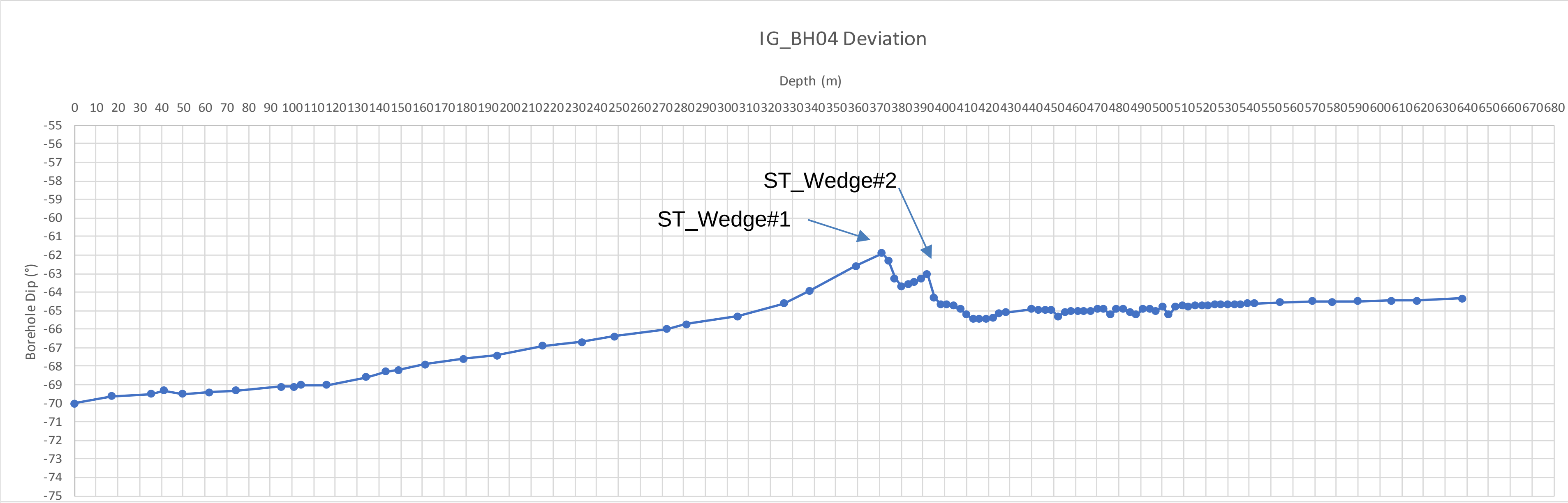
View Front Planned

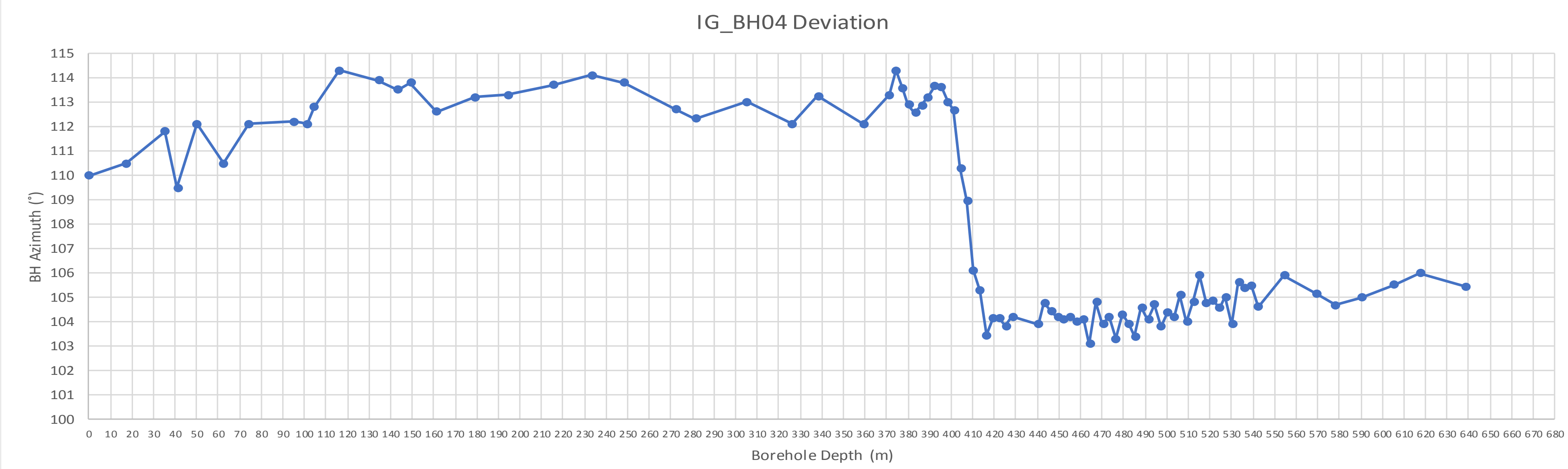
200217 at 638.2m New BH VZoomed



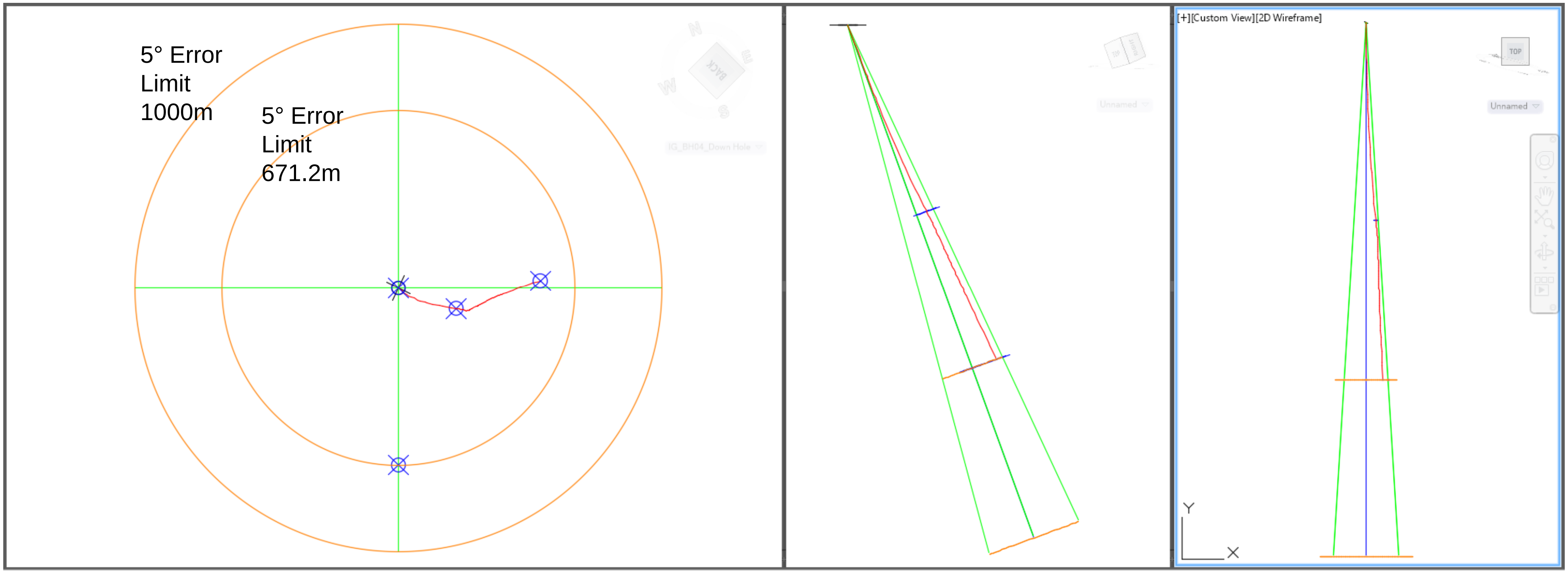
View Down Planned Borehole View Perp. Planned View Front Planned

200217 at 638.2m New BH



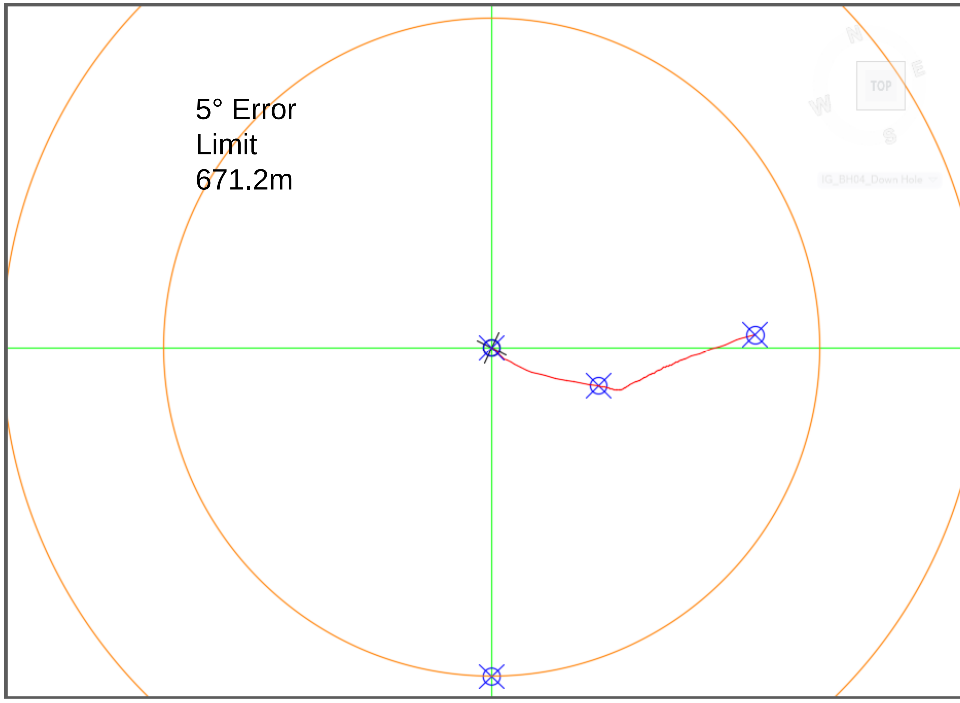


200218 at 671.2m New BH

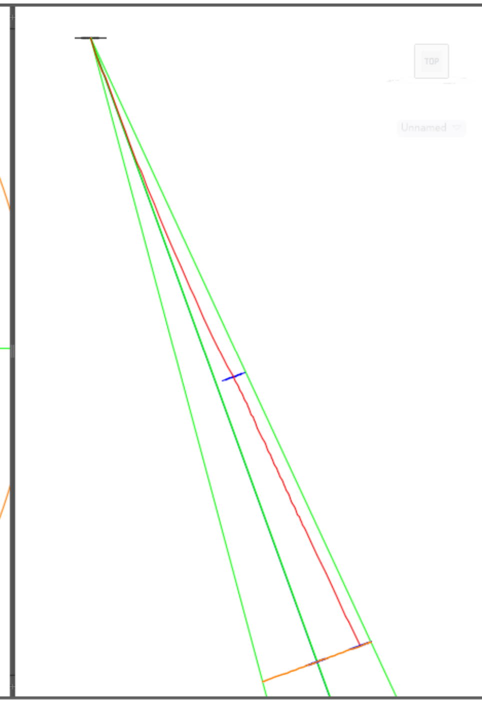


View Down Planned Borehole View Perp. Planned View Front Planned

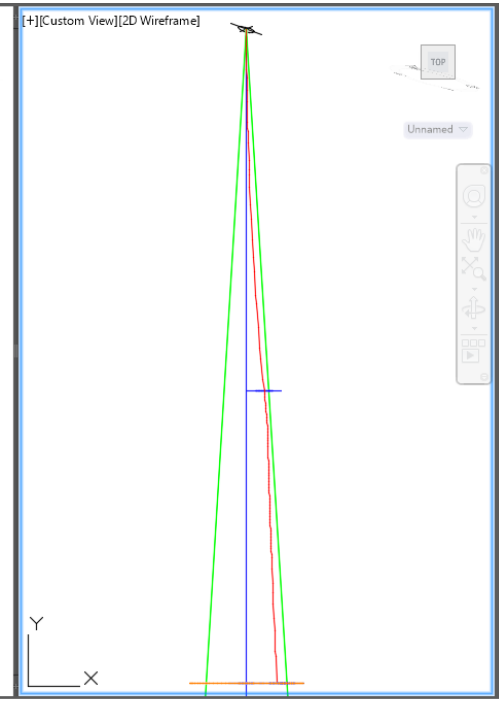
200218 at 671.2m New BH Zoomed



View Down Planned Borehole

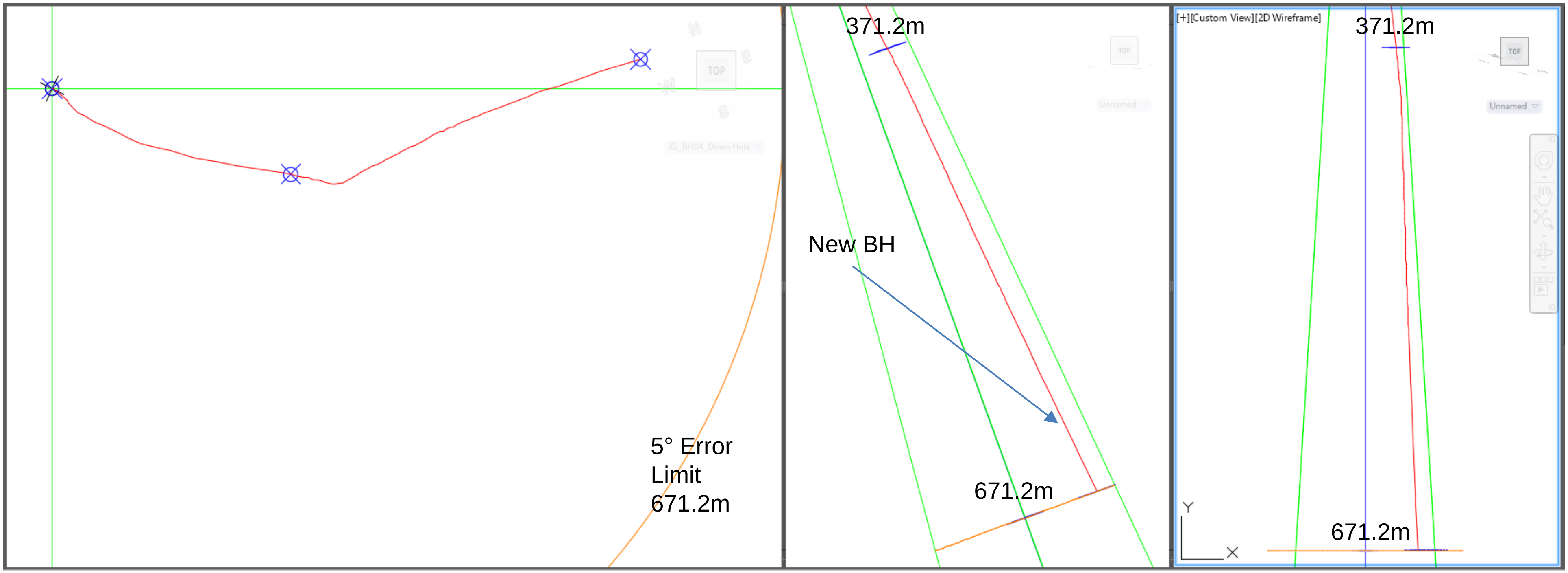


View Perp. Planned



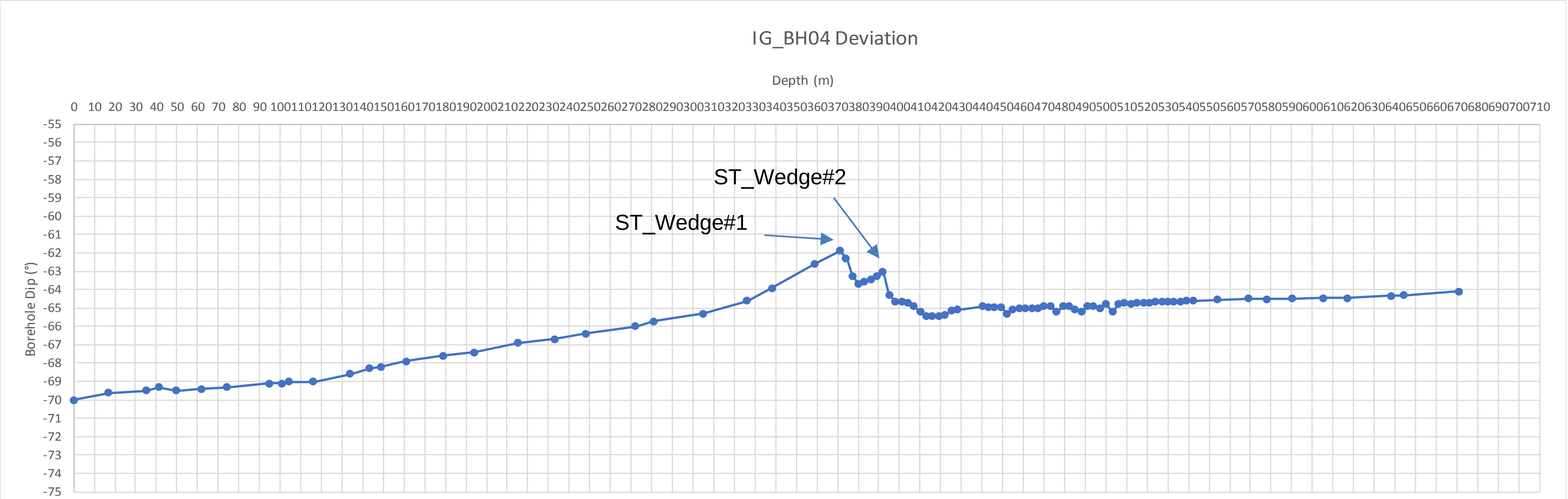
View Front Planned

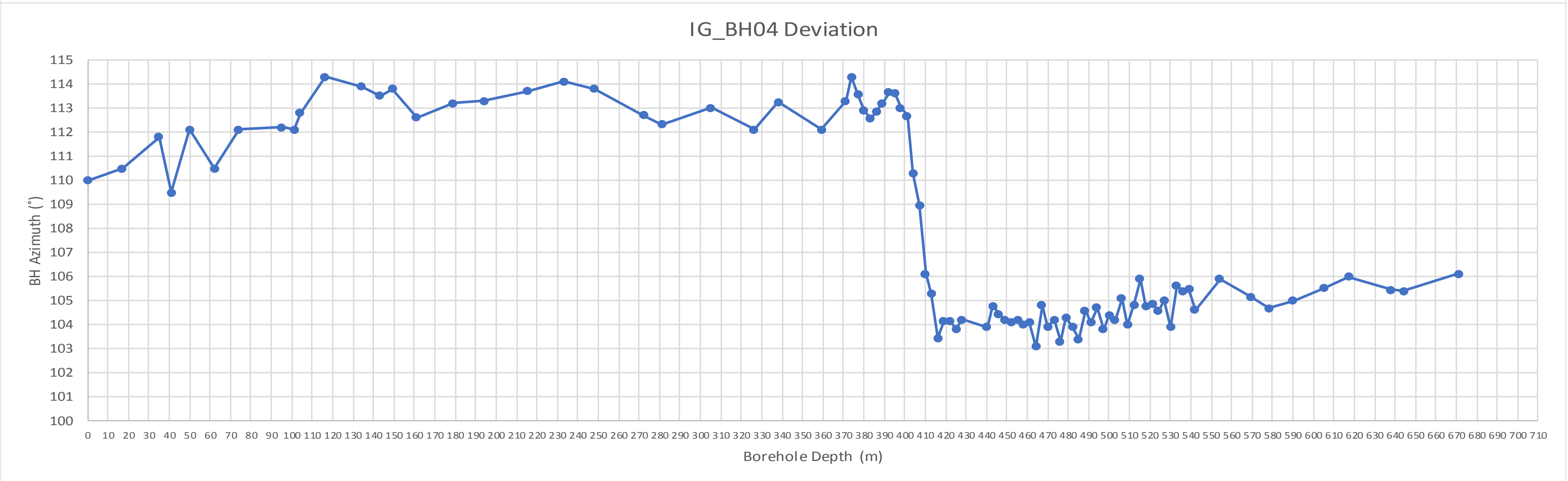
200218 at 671.2m New BH VZoomed



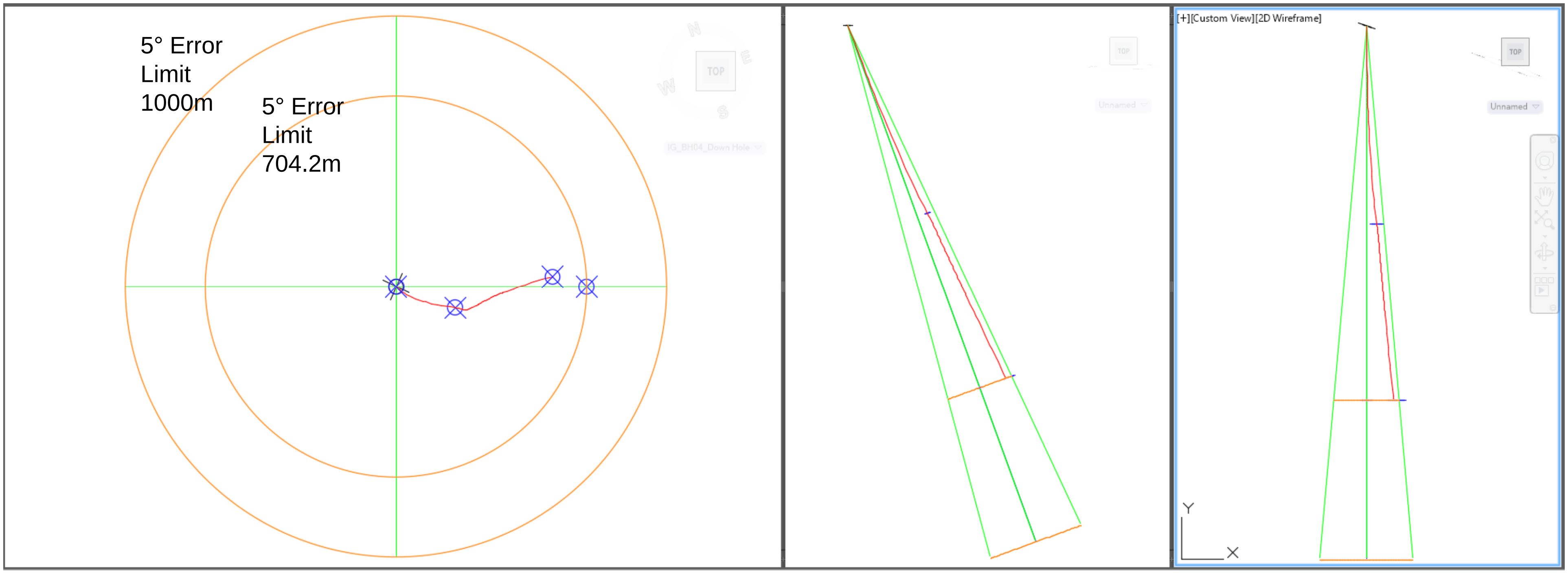
View Down Planned Borehole | View Perp. Planned | View Front Planned

200218 at 671.2m New BH



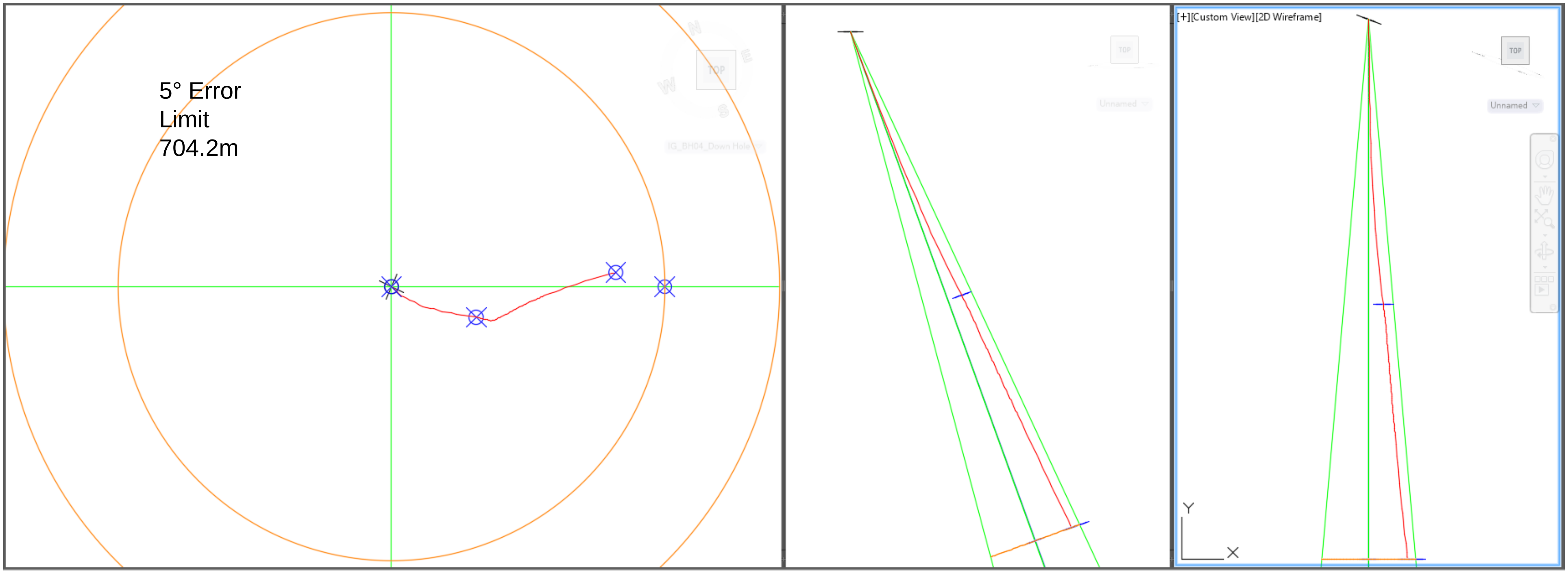


200220 at 704.2m New BH



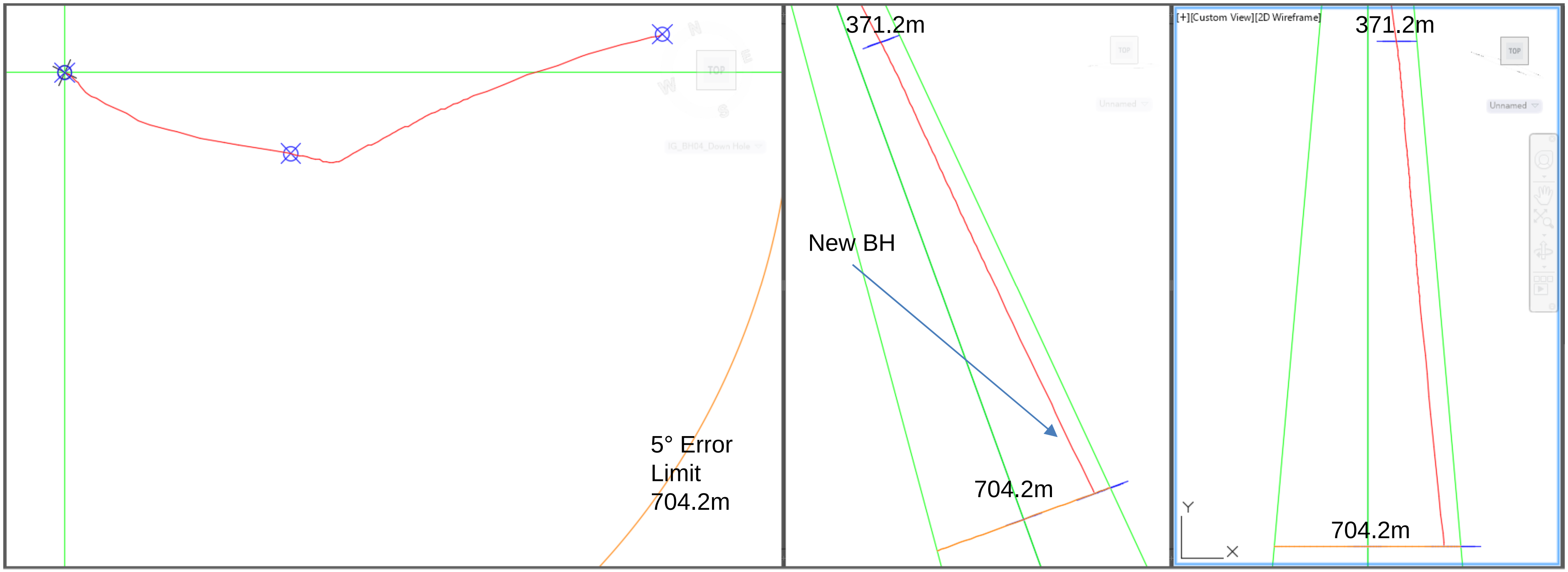
View Down Planned Borehole | View Perp. Planned | View Front Planned

200220 at 704.2m New BH Zoomed



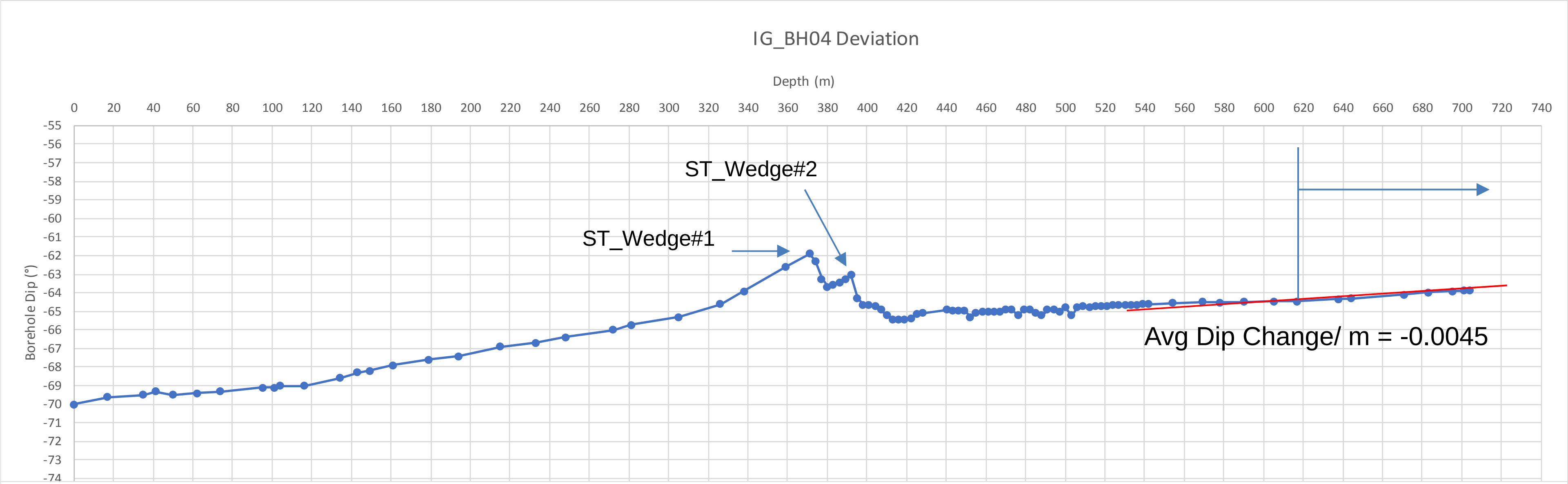
View Down Planned Borehole View Perp. Planned View Front Planned

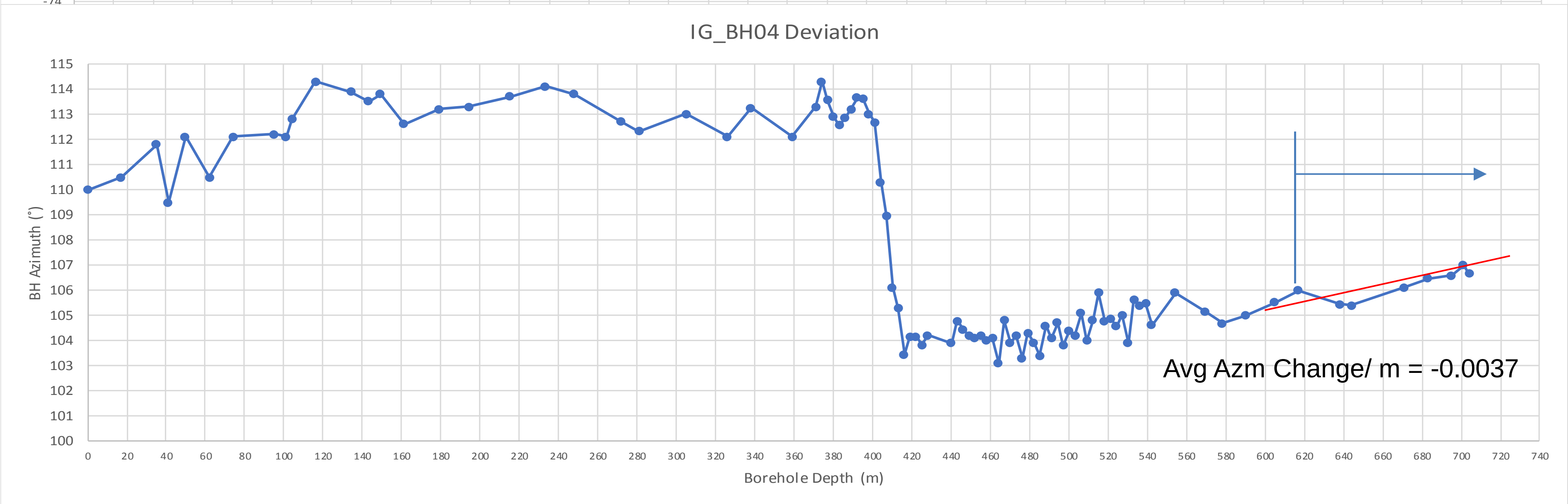
200220 at 704.2m New BH VZoomed



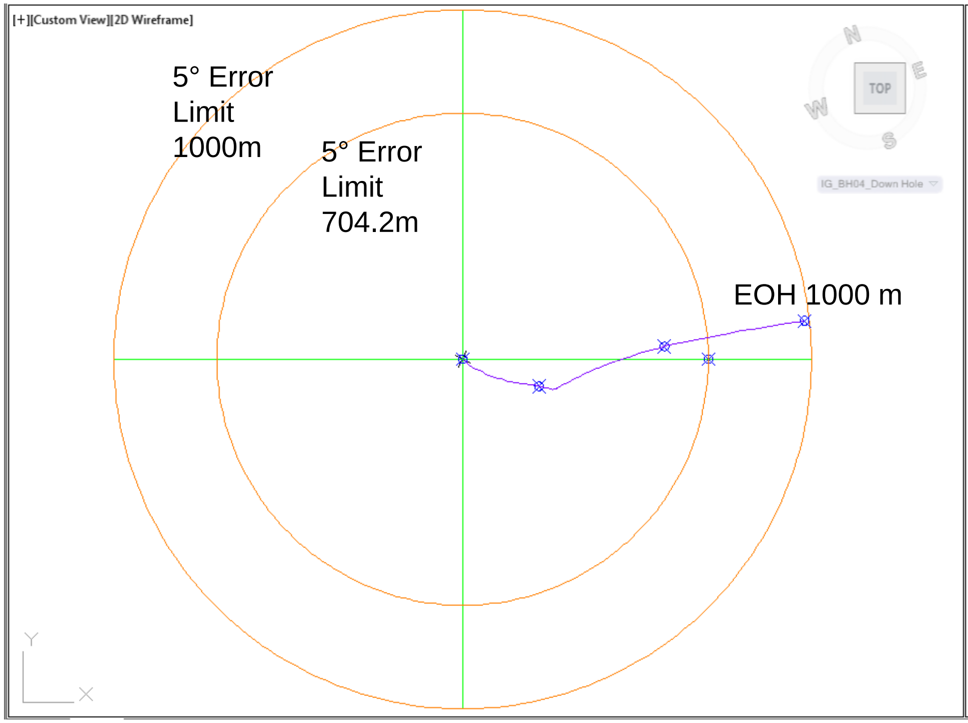
View Down Planned Borehole View Perp. Planned View Front Planned

200220 at 704.2m New BH

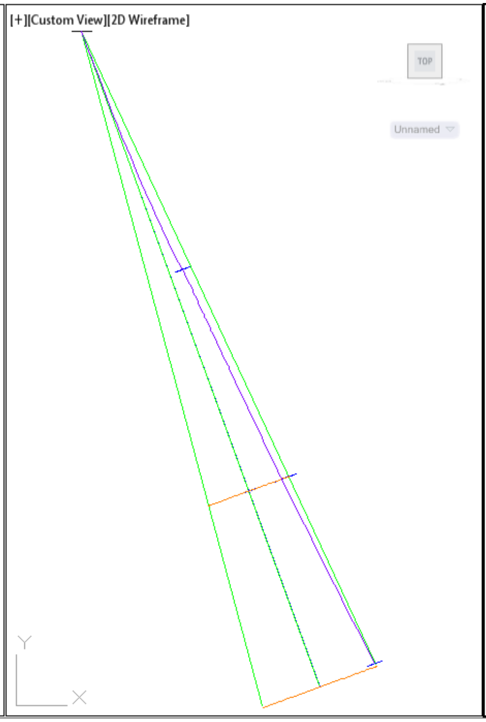




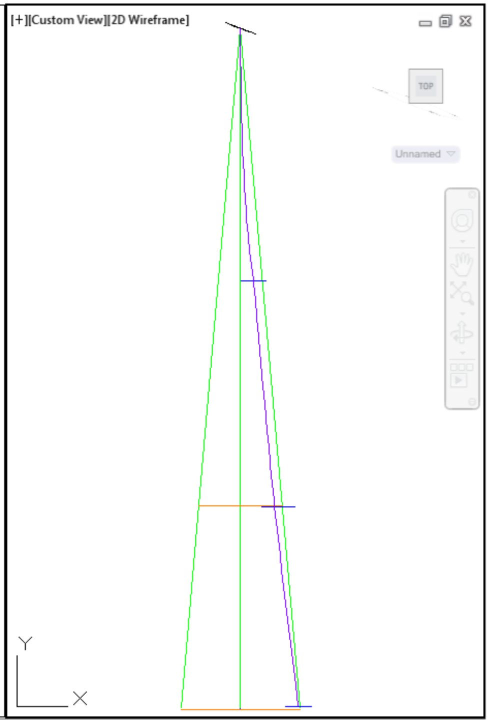
Projected Borehole Deviation



View Down Planned Borehole



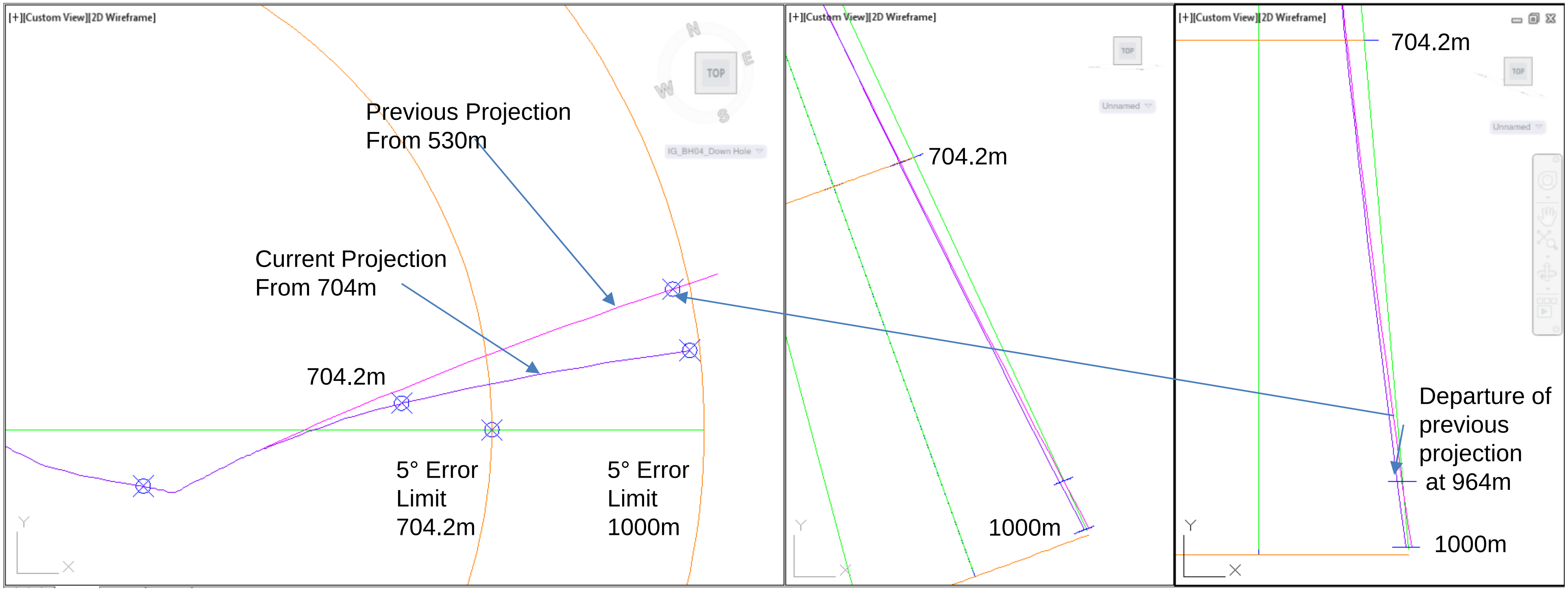
View Perp. Planned



View Front Planned

Based on present rate of dip loss 0.0045 deg/m the borehole **will stay inside the Error cone**. This may change if there is another inflection in the dip softening rate.

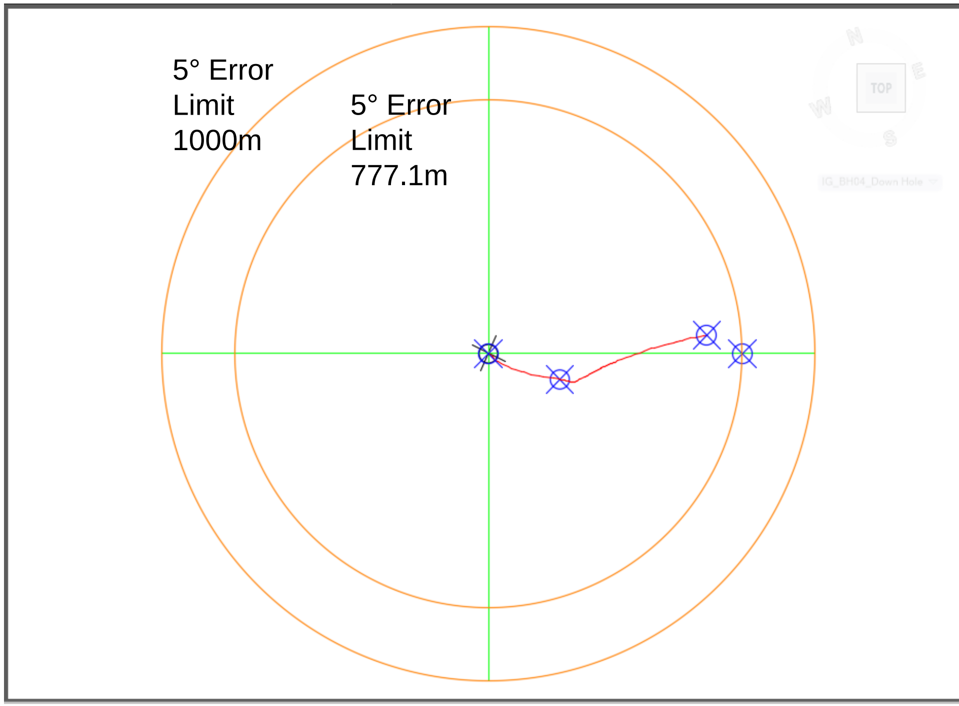
Projected Borehole Deviation Zoomed



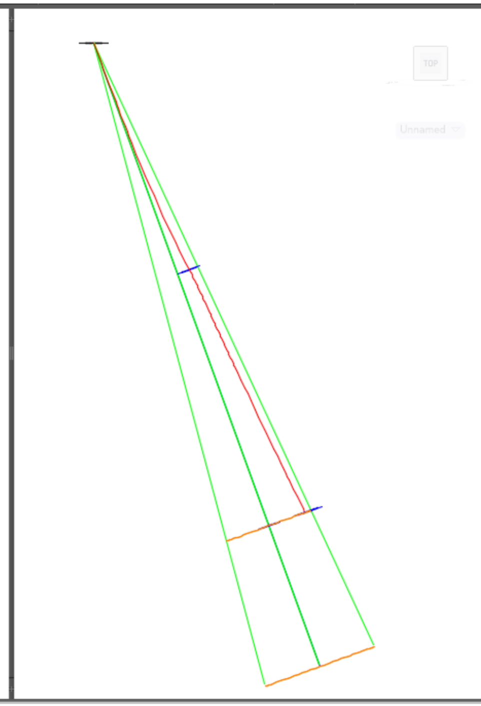
View Down Planned Borehole | View Perp. Planned | View Front Planned

Based on present rate of dip loss 0.0045 deg/m the borehole **<u>will stay inside the Error cone</u>**. This may change if there is another inflection in the dip softening rate.

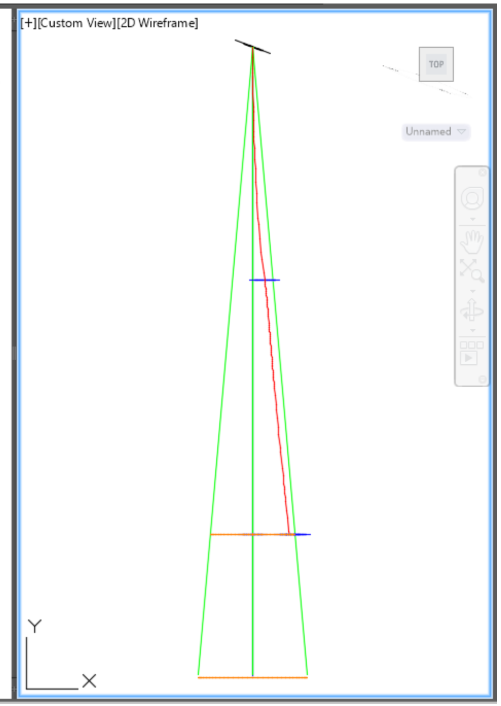
200302 at 777.1m New BH



View Down Planned Borehole

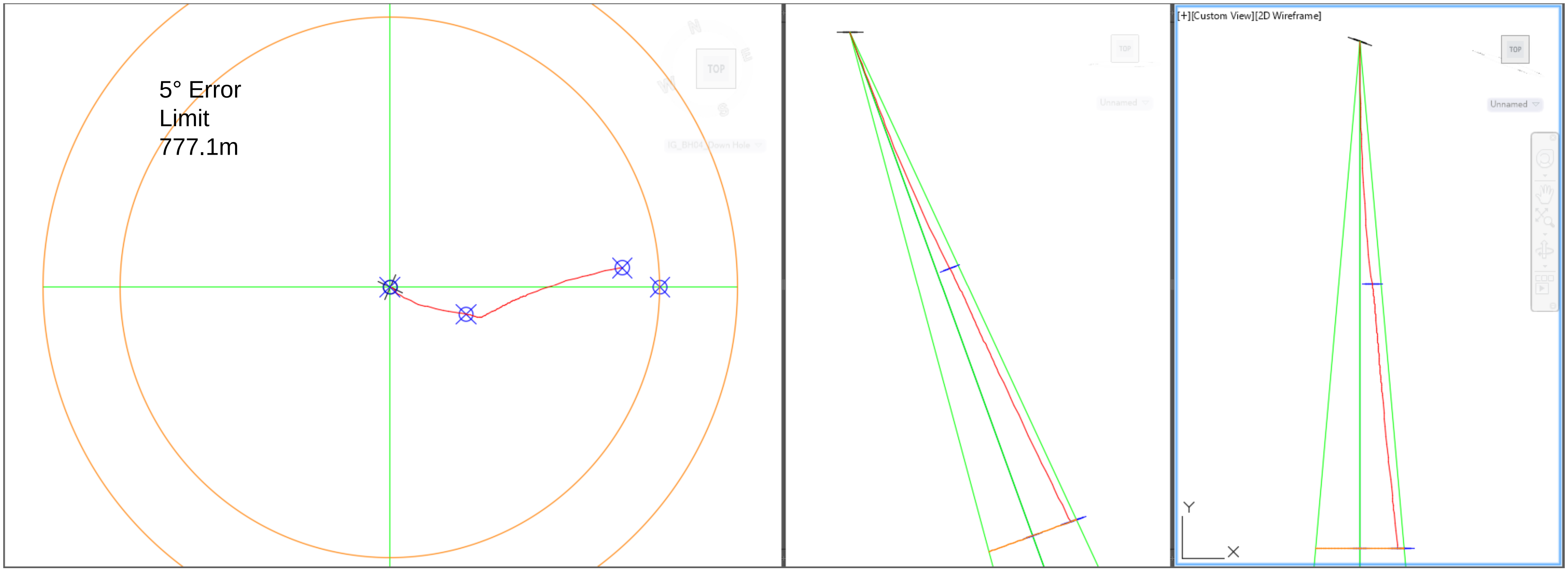


View Perp. Planned



View Front Planned

200302 at 777.1m New BH Zoomed

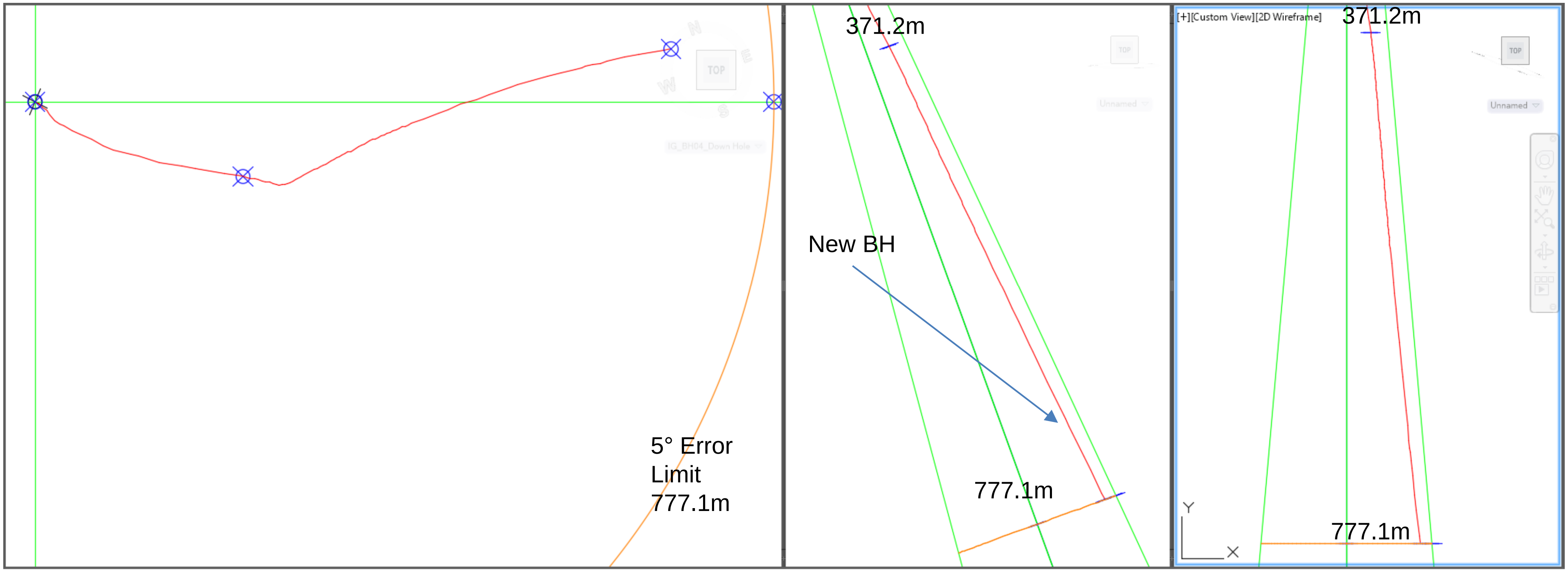


View Down Planned Borehole

View Perp. Planned

View Front Planned

200302 at 777.1m New BH VZoomed

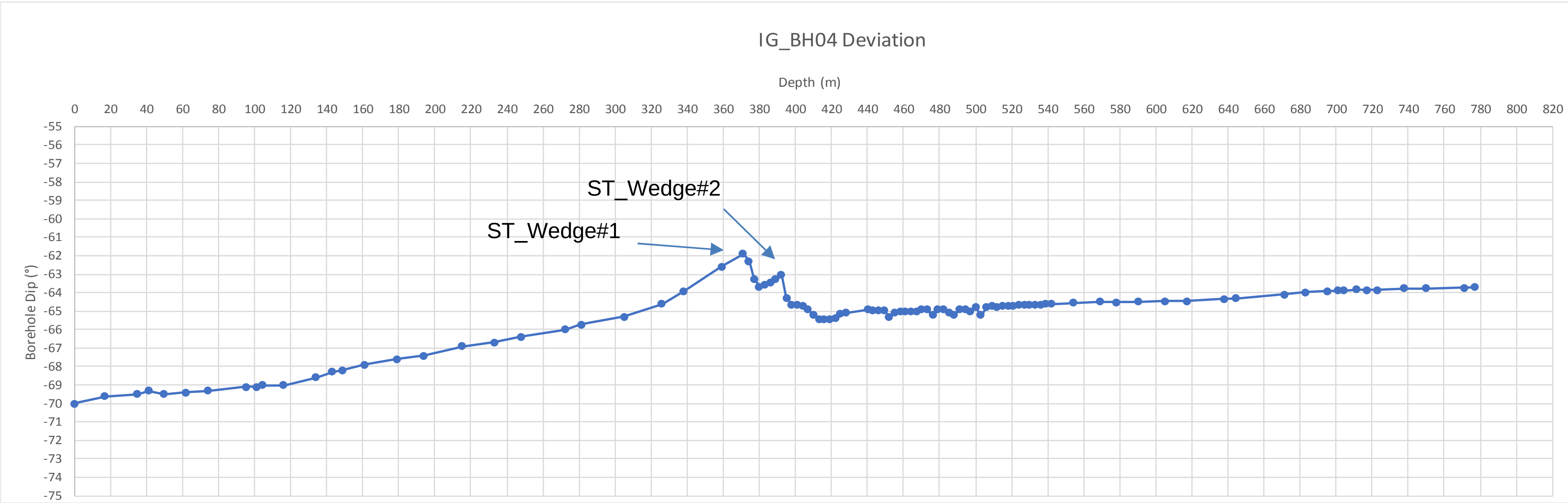


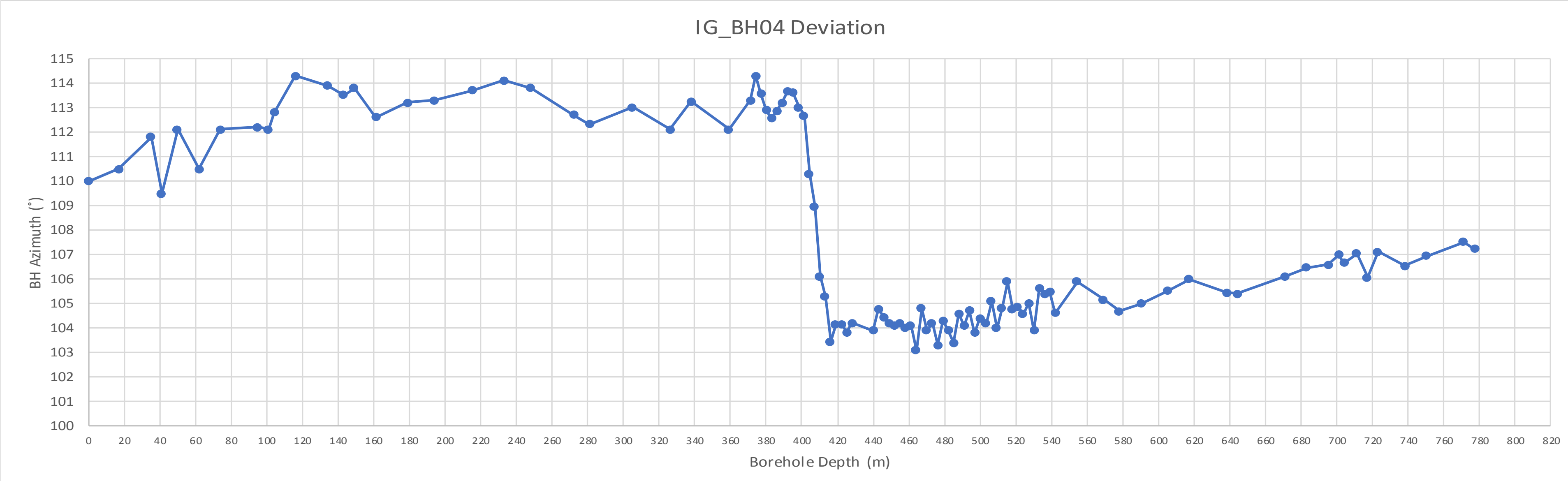
View Down Planned Borehole

View Perp. Planned

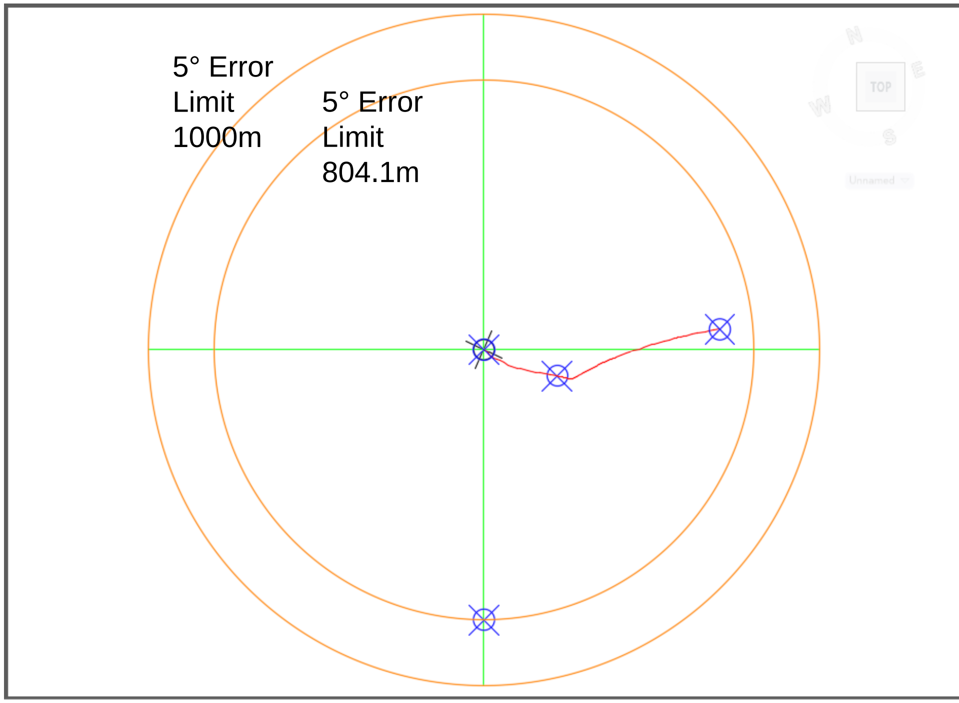
View Front Planned

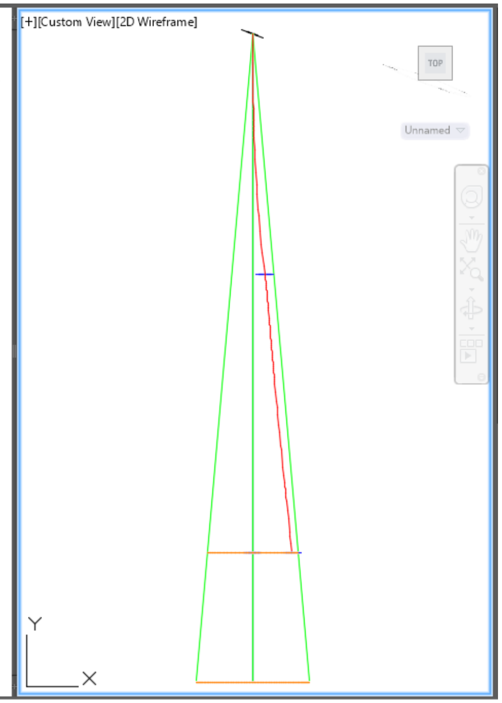
200302 at 777.1m New BH





200303 at 804.1m New BH



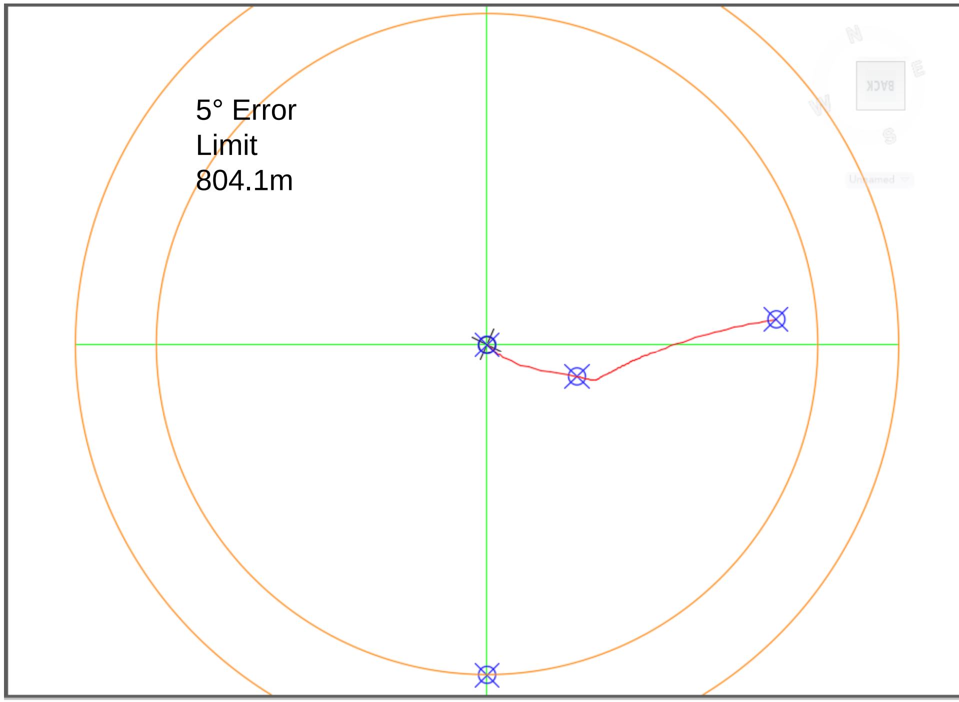


View Down Planned Borehole

View Perp. Planned

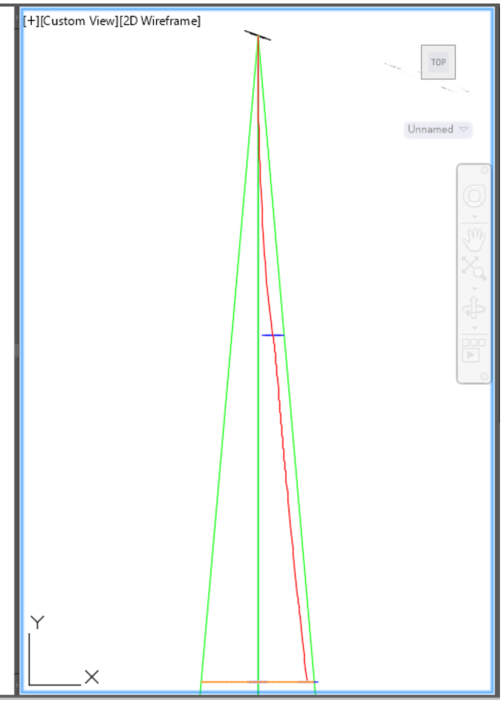
View Front Planned

200303 at 804.1m New BH Zoomed



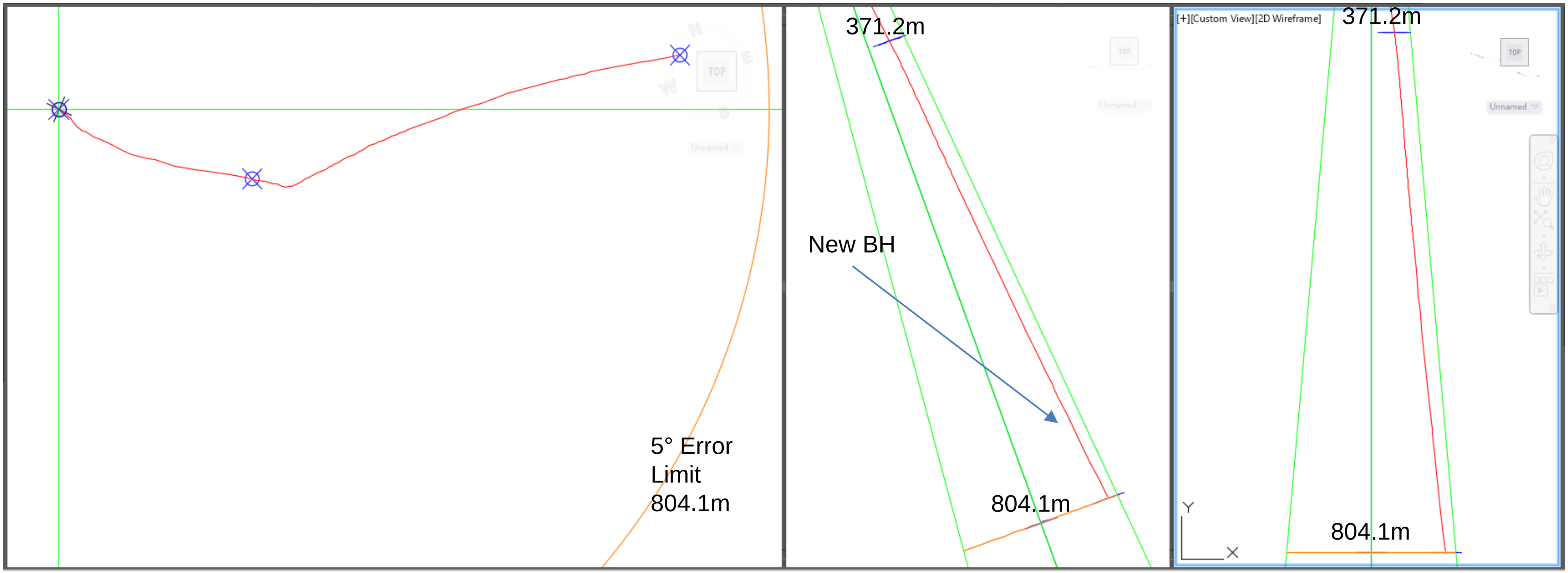
View Down Planned Borehole

View Perp. Planned



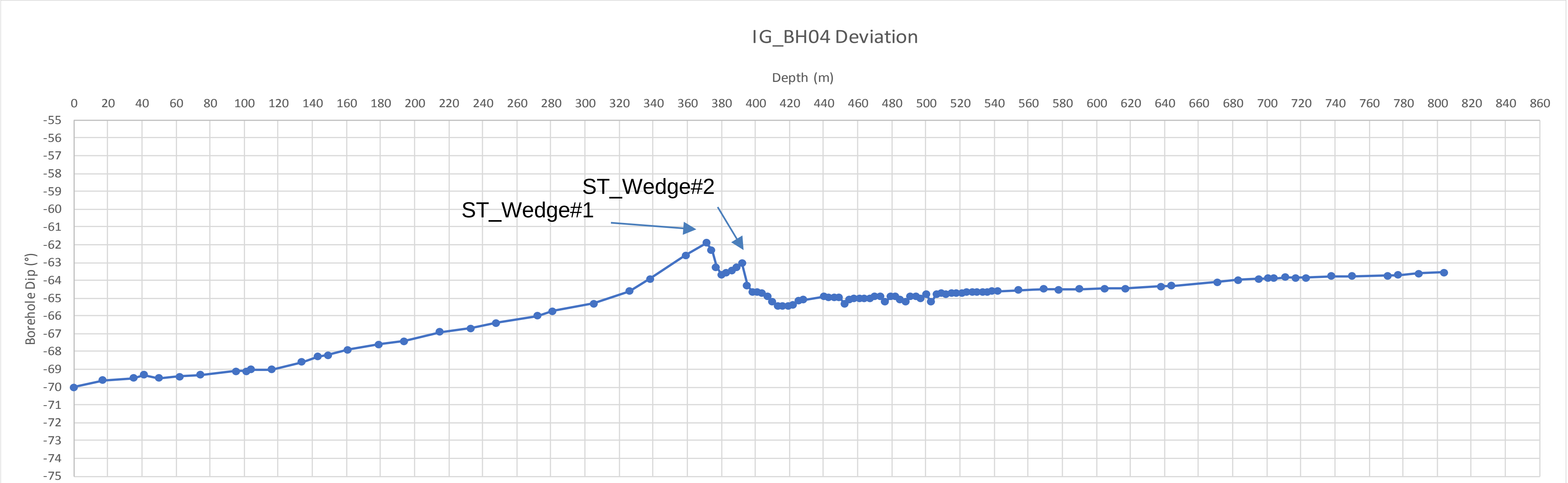
View Front Planned

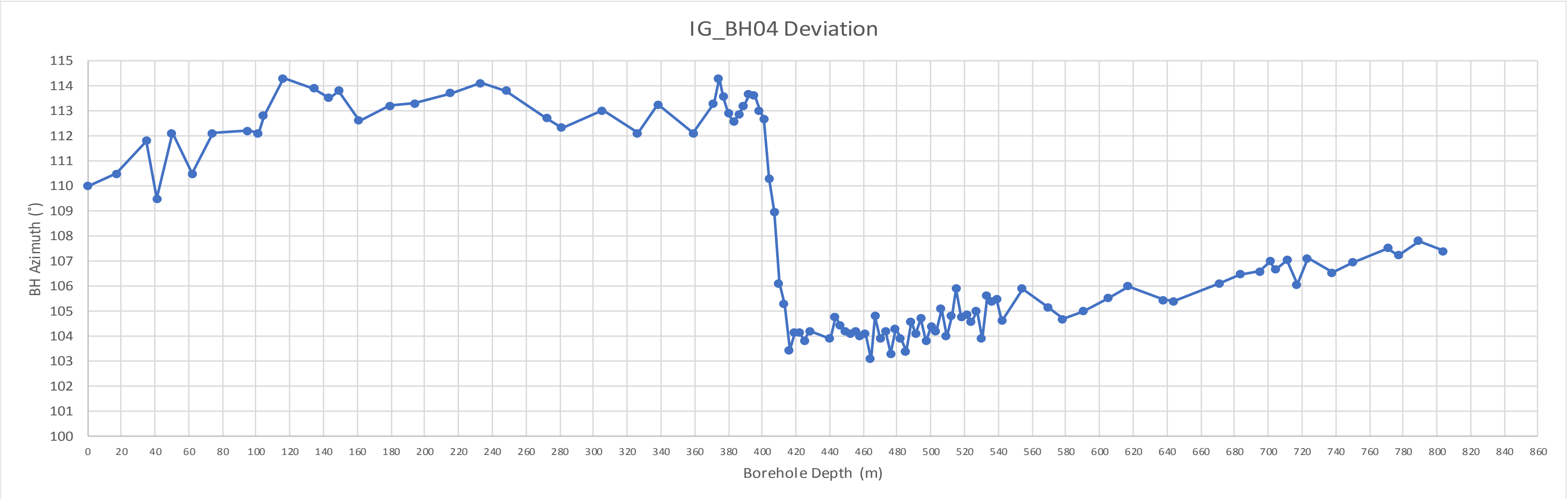
200303 at 804.1m New BH VZoomed



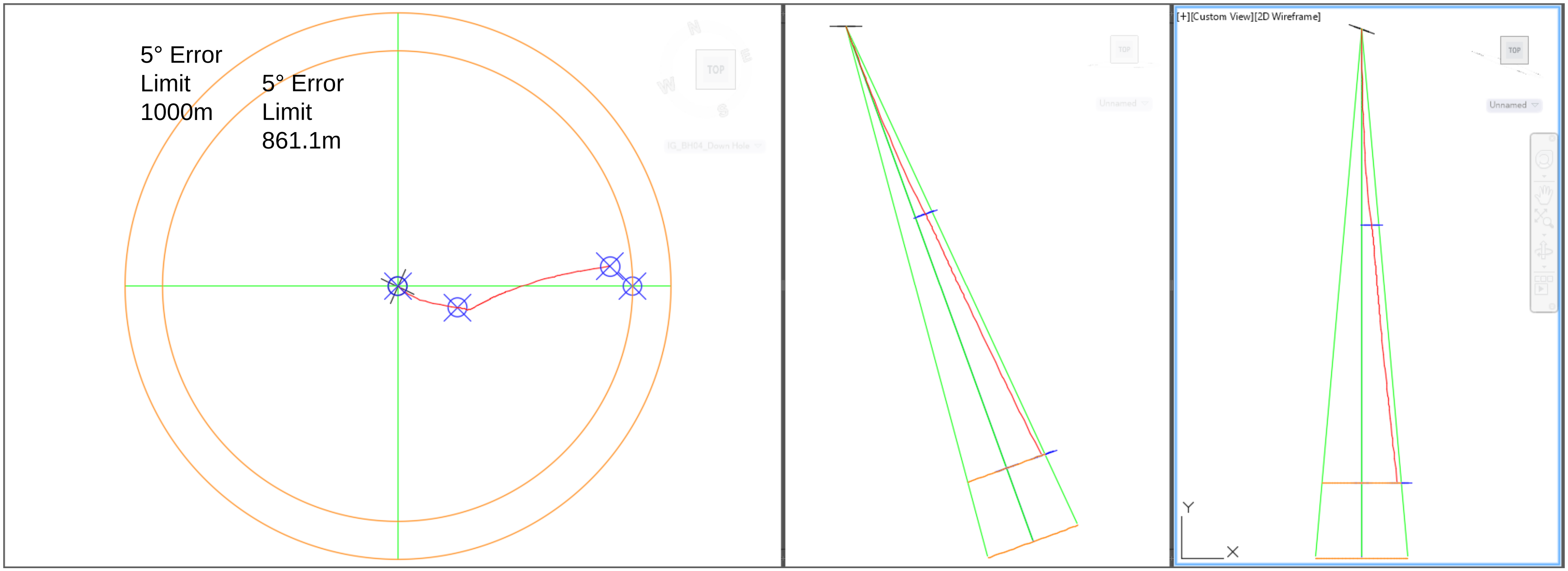
View Down Planned Borehole View Perp. Planned View Front Planned

200303 at 804.1m New BH





200306 at 861.1m New BH

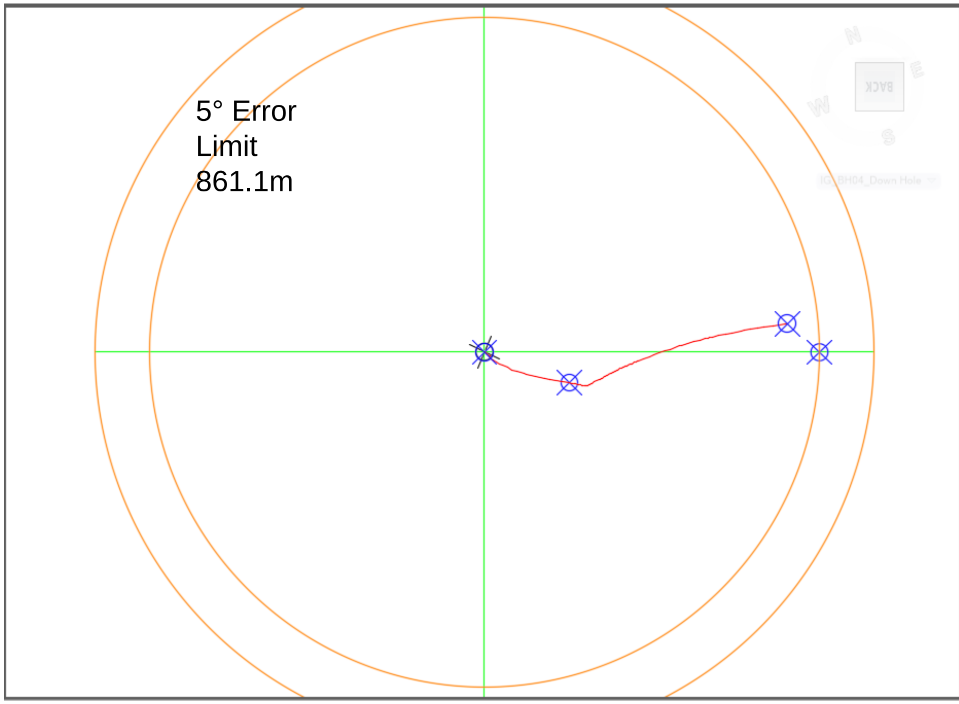


View Down Planned Borehole

View Perp. Planned

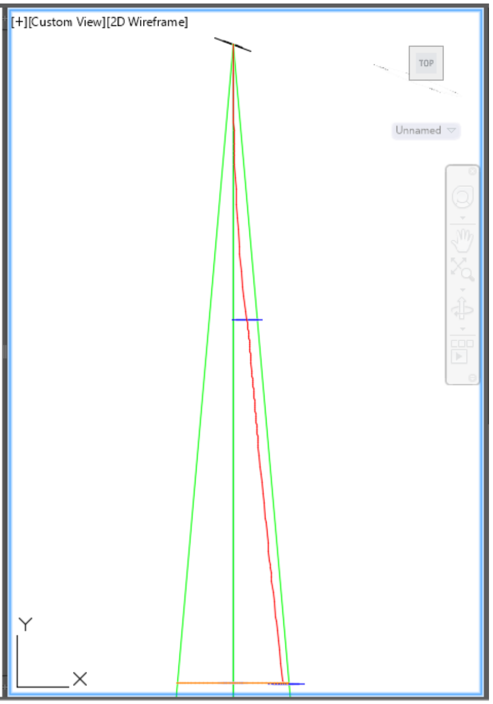
View Front Planned

200306 at 861.1m New BH Zoomed



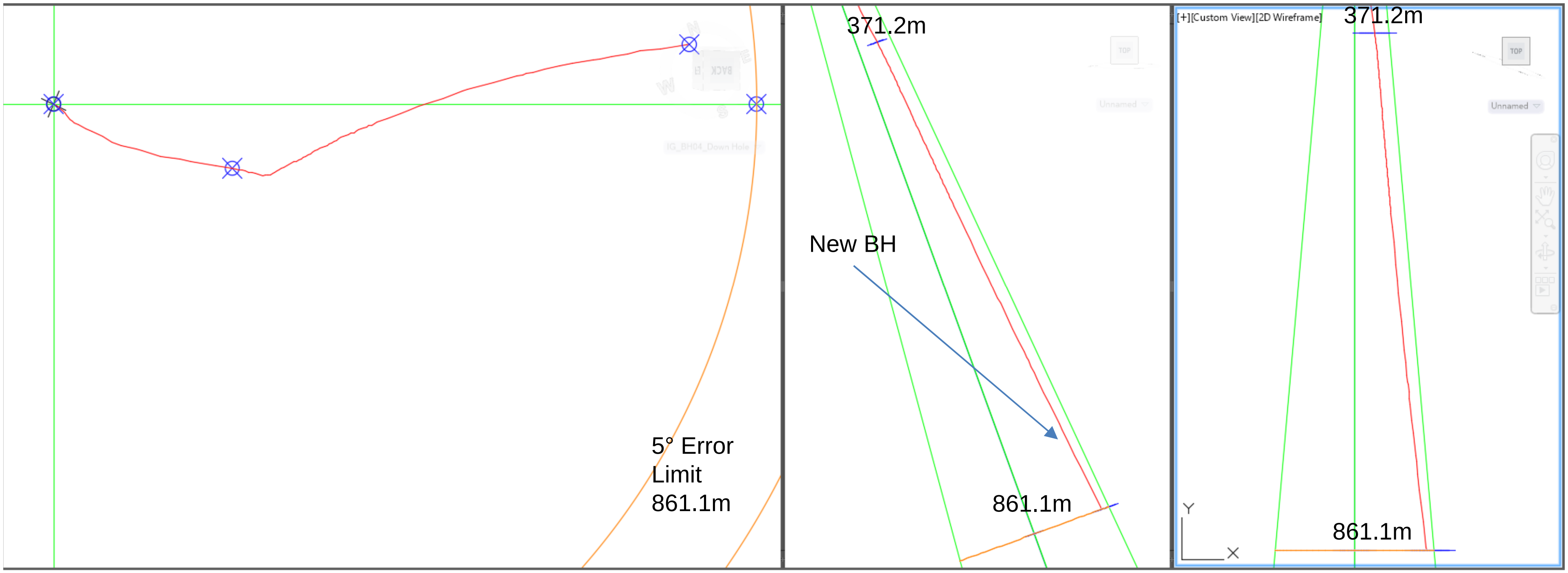
View Down Planned Borehole

View Perp. Planned



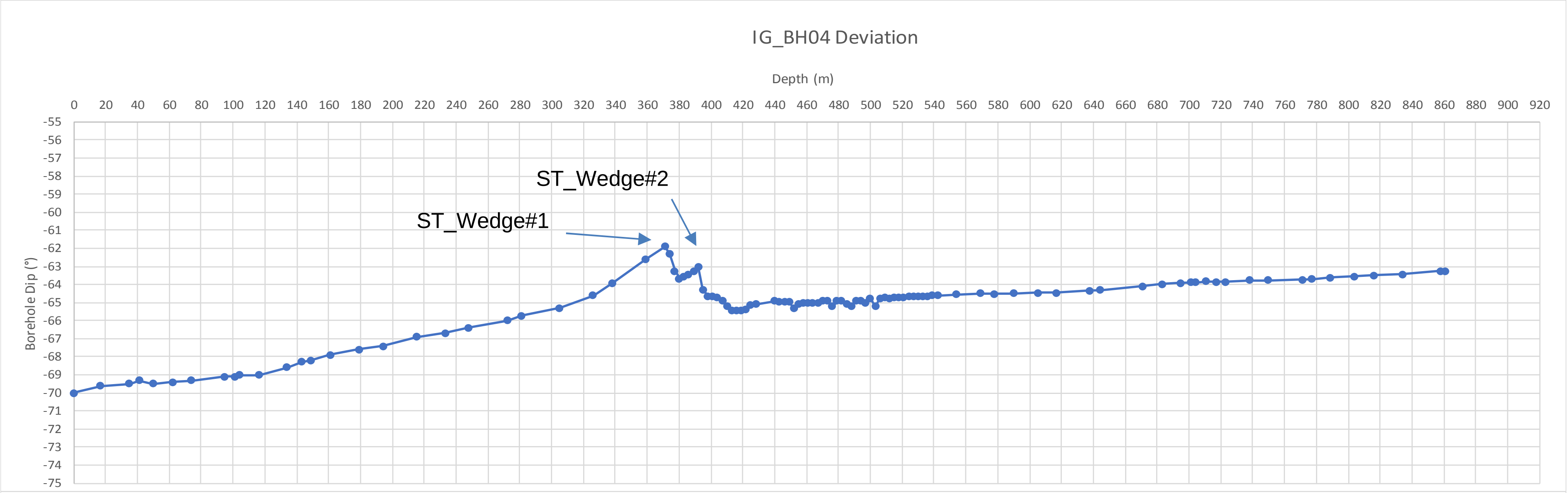
View Front Planned

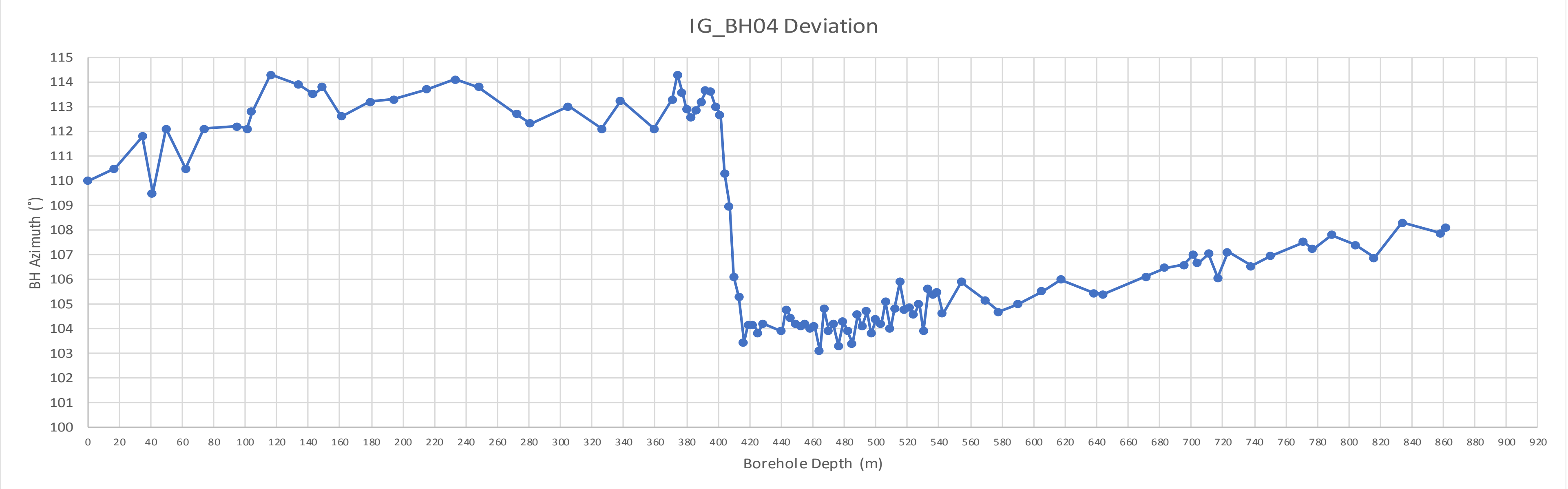
200306 at 861.1m New BH VZoomed



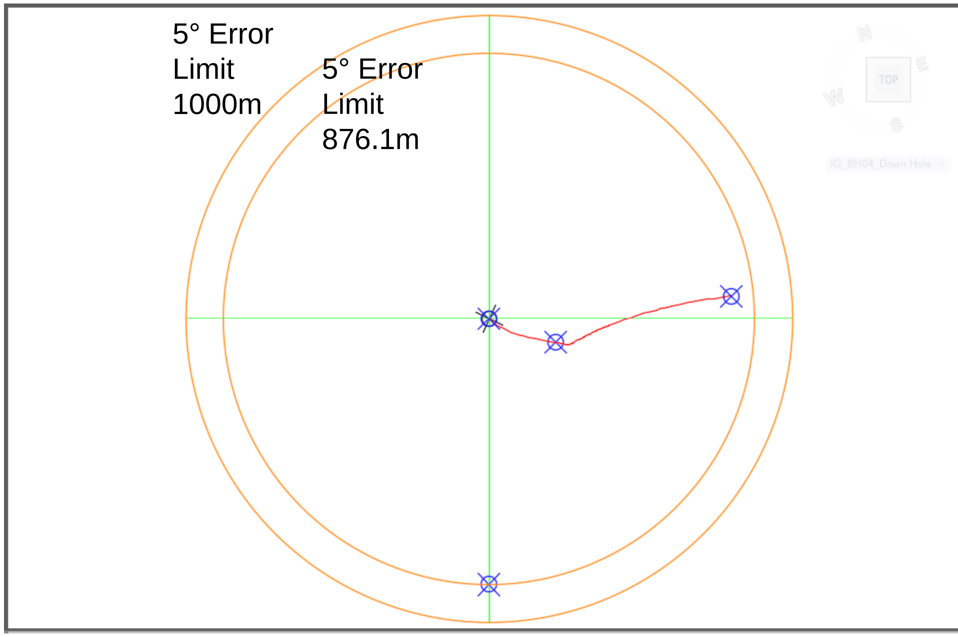
View Down Planned Borehole View Perp. Planned View Front Planned

200306 at 861.1m New BH



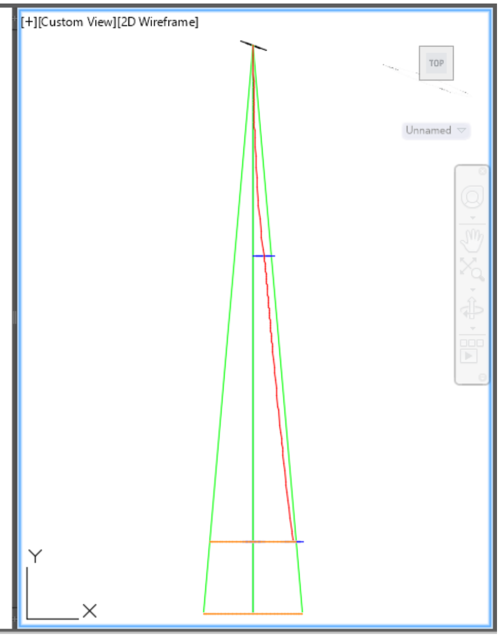


200307 at 876.1m New BH



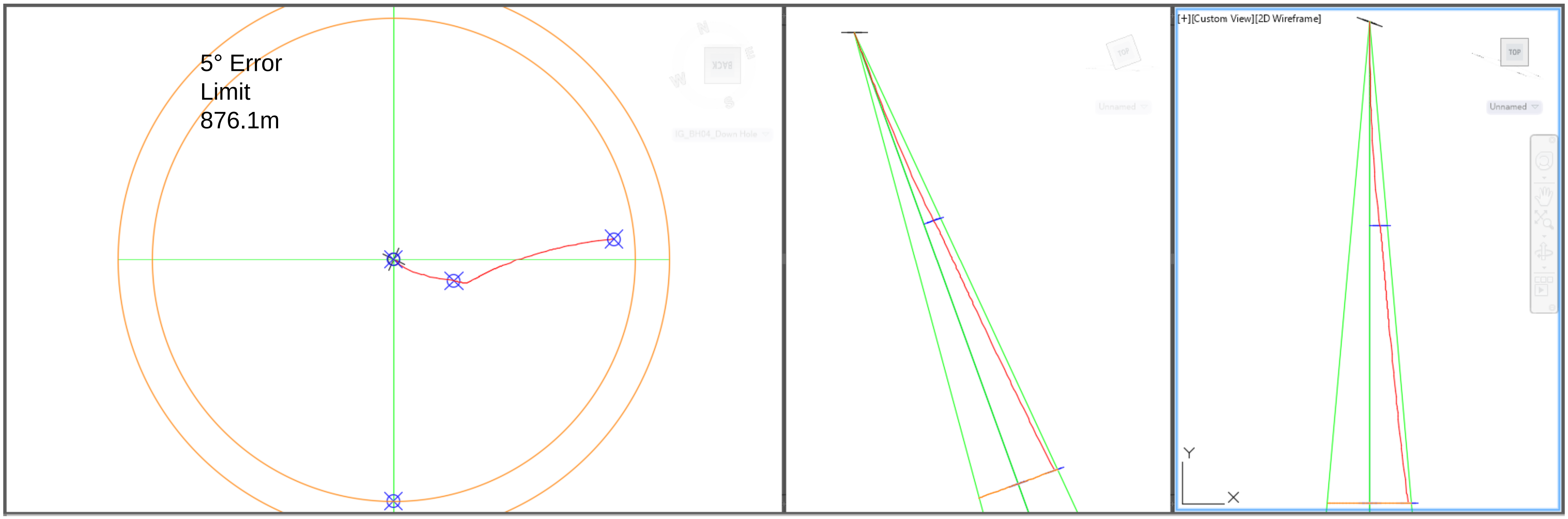
View Down Planned Borehole

View Perp. Planned



View Front Planned

200307 at 876.1m New BH Zoomed

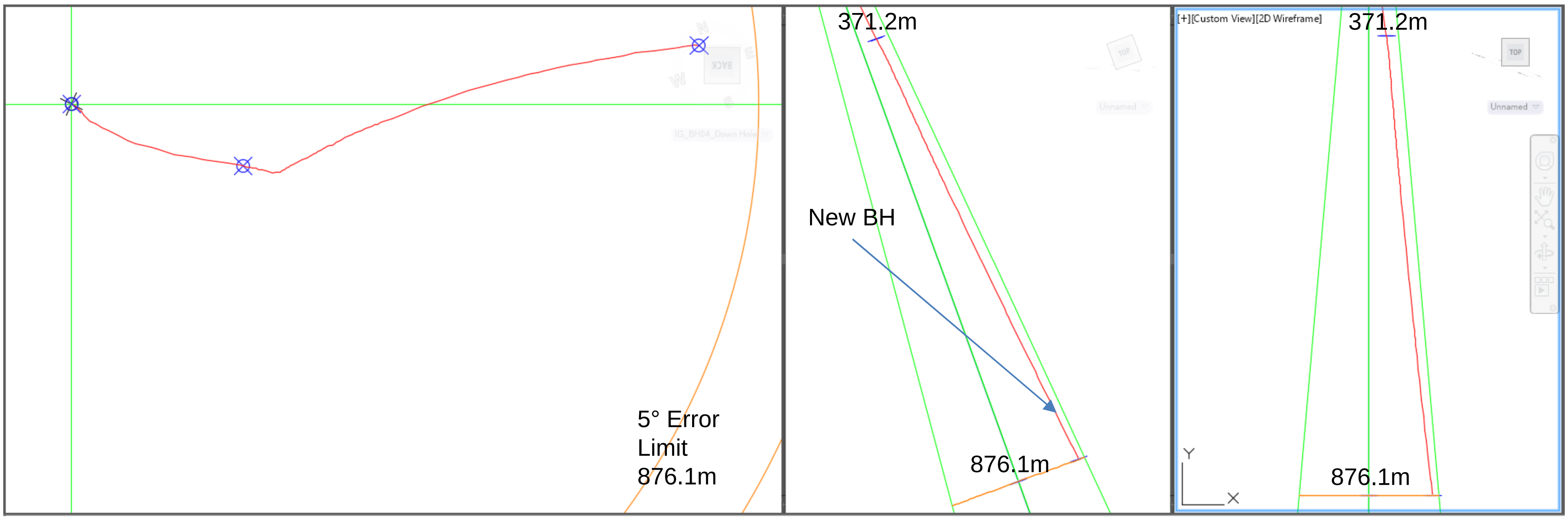


View Down Planned Borehole

View Perp. Planned

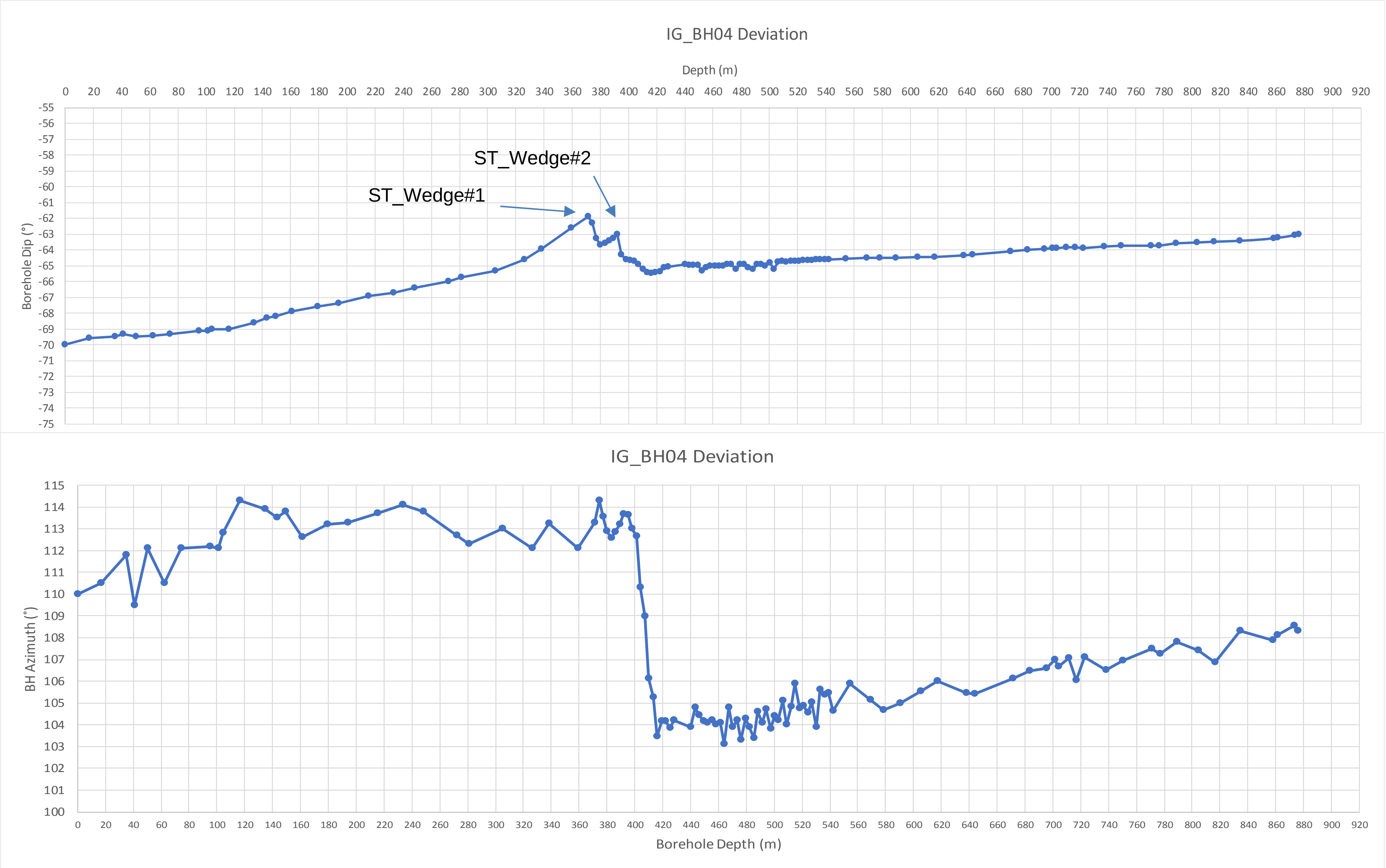
View Front Planned

200307 at 876.1m New BH VZoomed

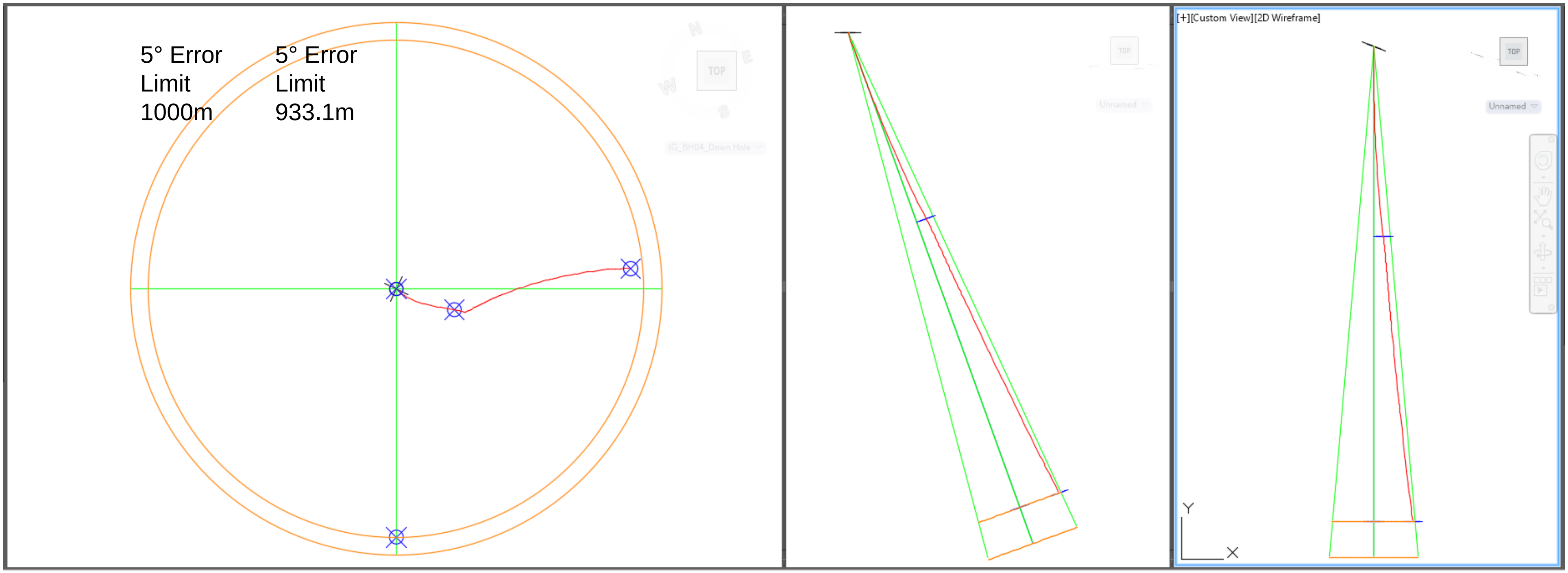


View Down Planned Borehole View Perp. Planned View Front Planned

200307 at 876.1m New BH



200311 at 933.1m New BH

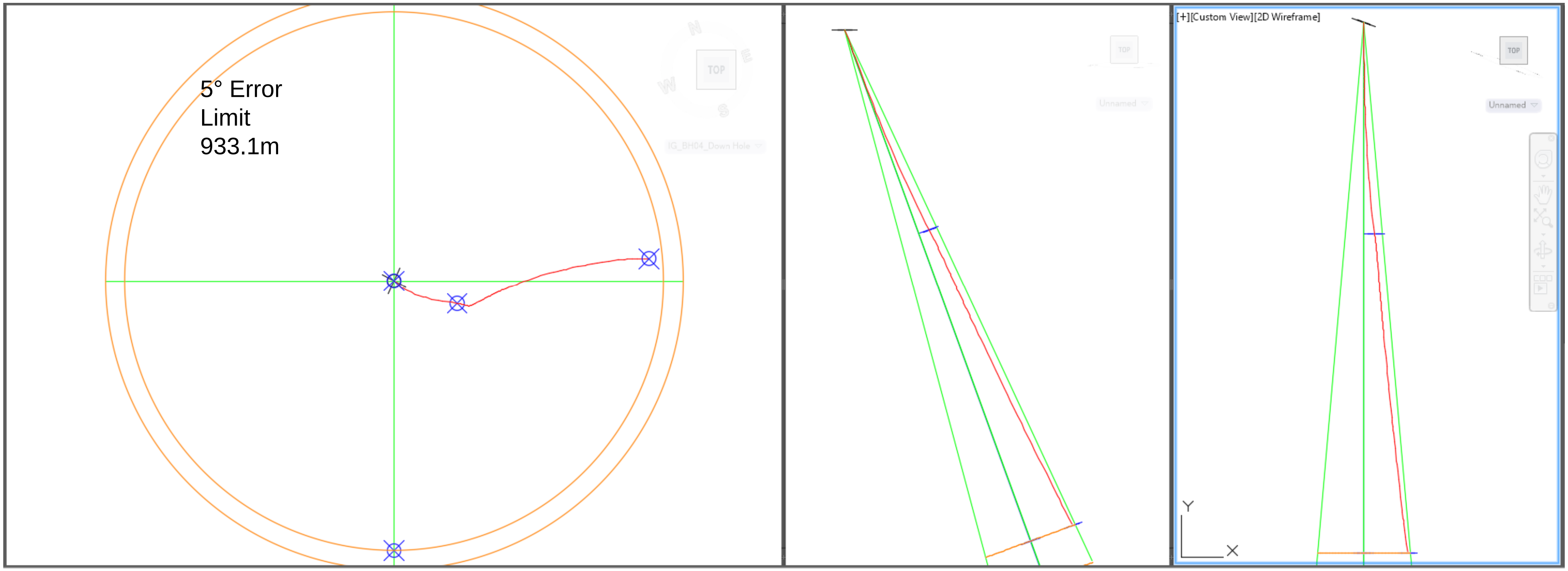


View Down Planned Borehole

View Perp. Planned

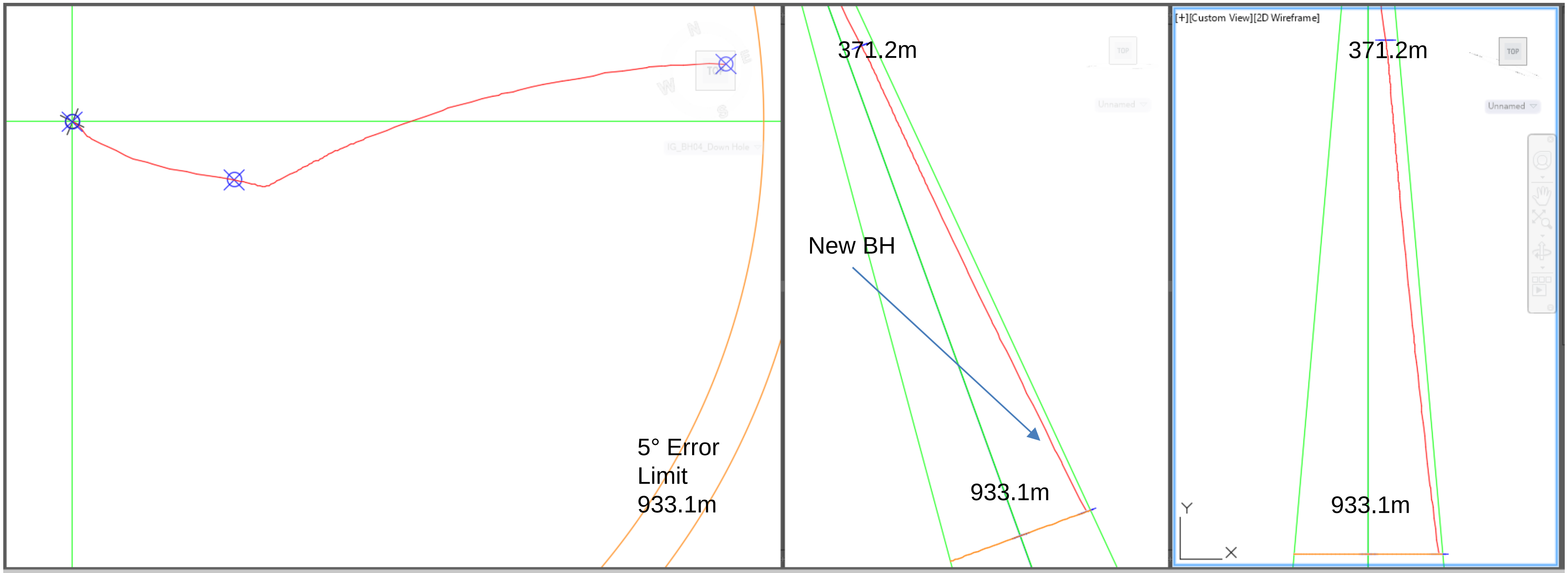
View Front Planned

200311 at 933.1m New BH Zoomed



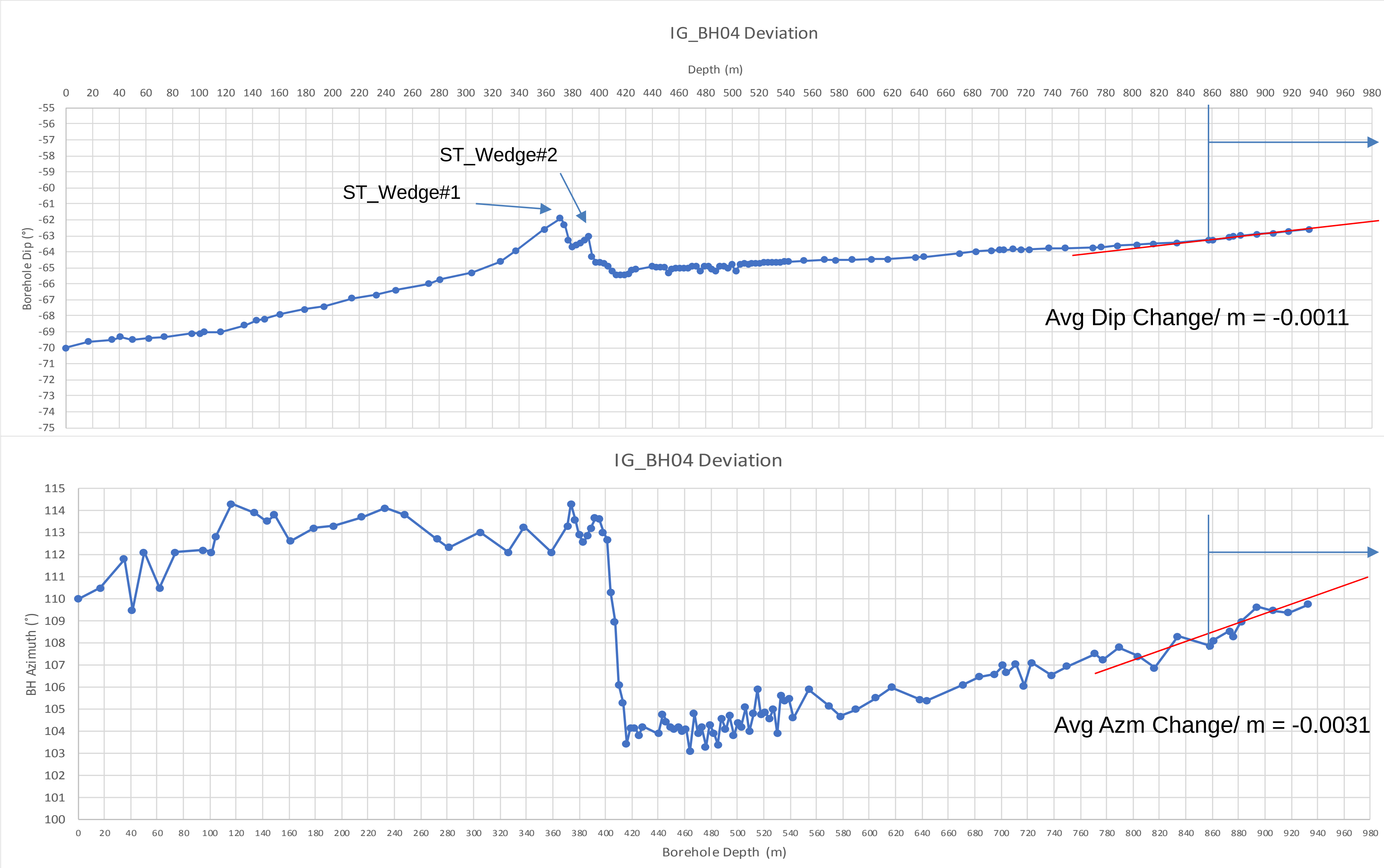
View Down Planned Borehole View Perp. Planned View Front Planned

200311 at 933.1m New BH VZoomed

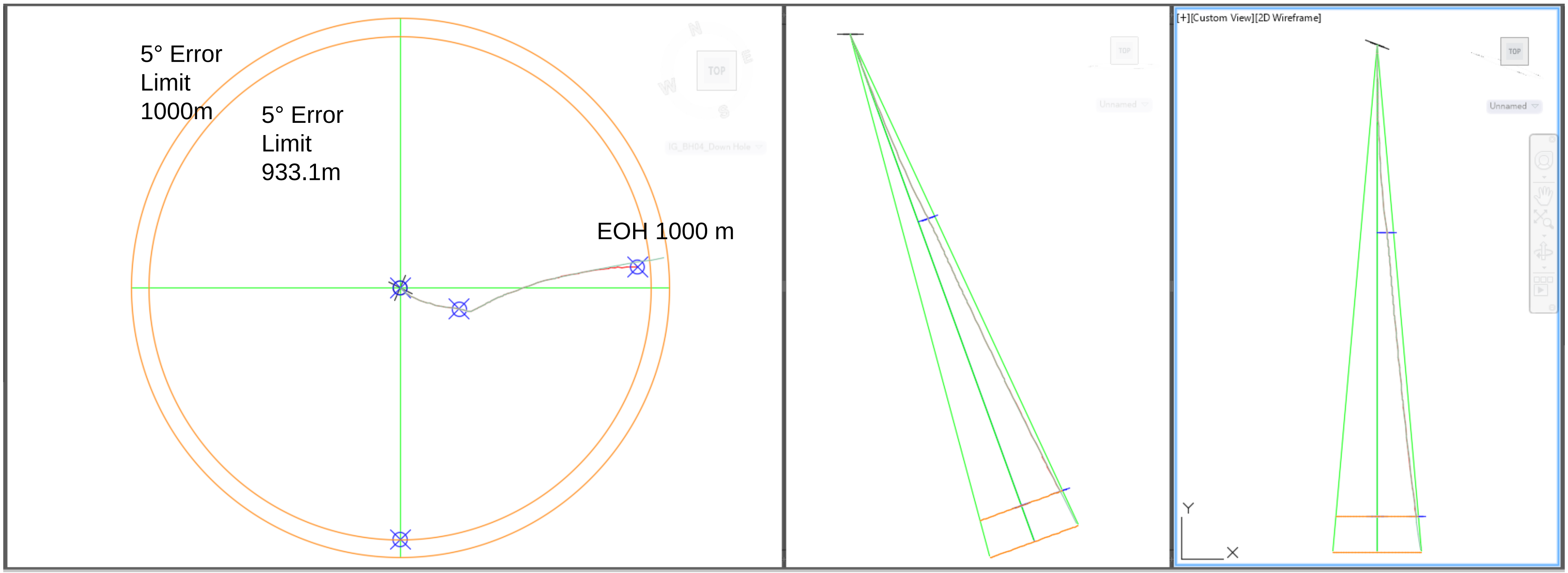


View Down Planned Borehole | View Perp. Planned | View Front Planned

200311 at 933.1m New BH



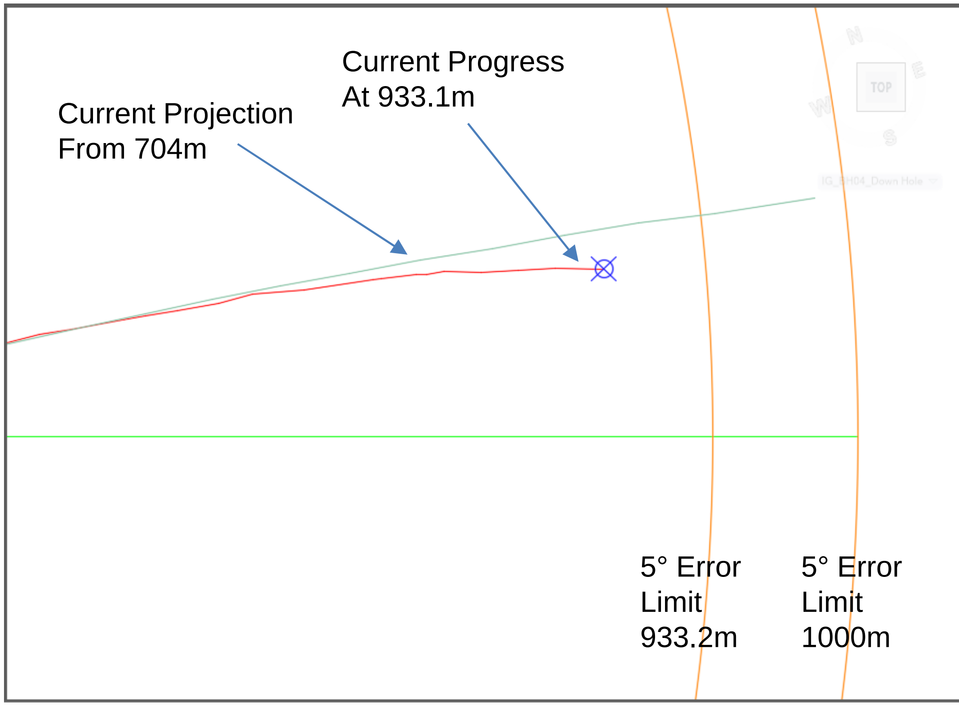
Projected Borehole Deviation



View Down Planned Borehole | View Perp. Planned | View Front Planned

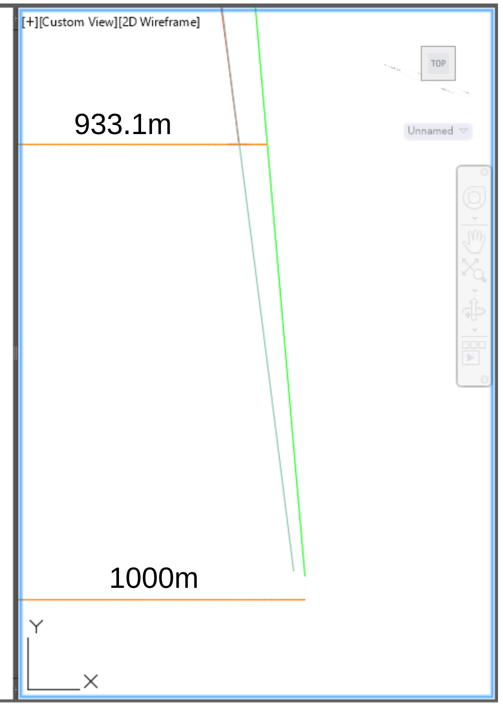
The projected borehole deviation shown above was calculated at depth: 704.2 M.

Projected Borehole Deviation Zoomed



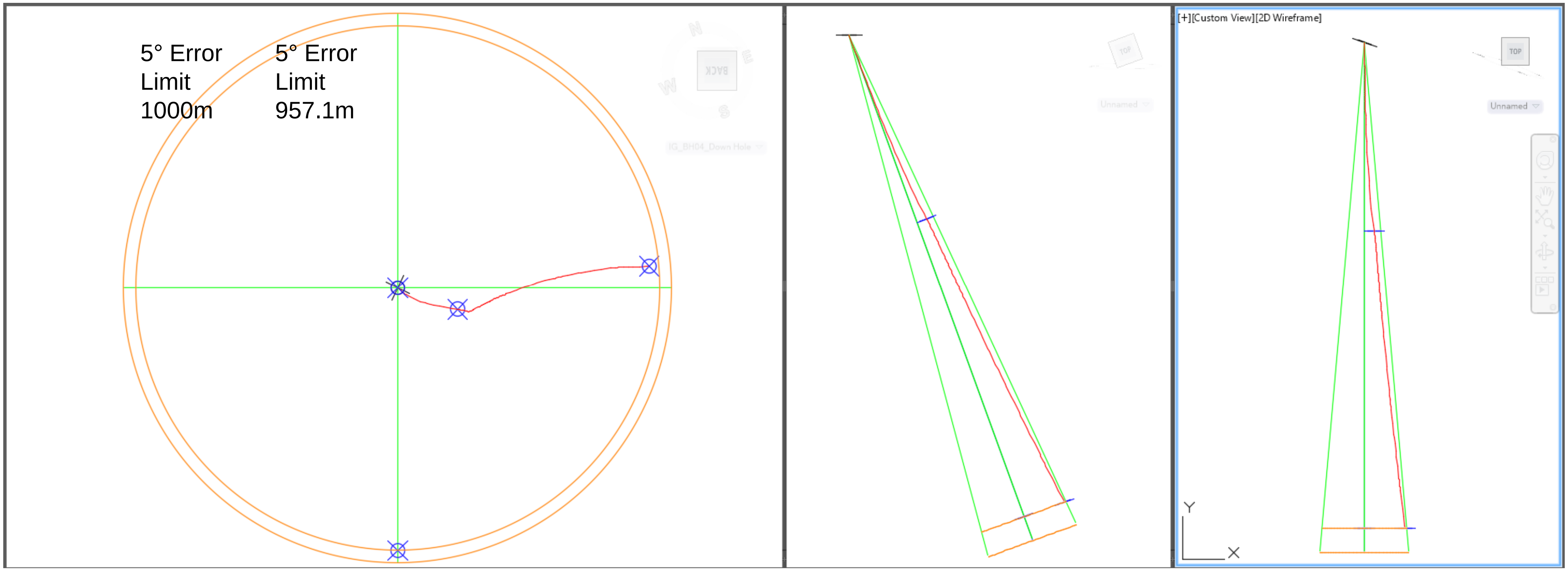
View Down Planned Borehole

View Perp. Planned



View Front Planned

200312 at 957.1m New BH

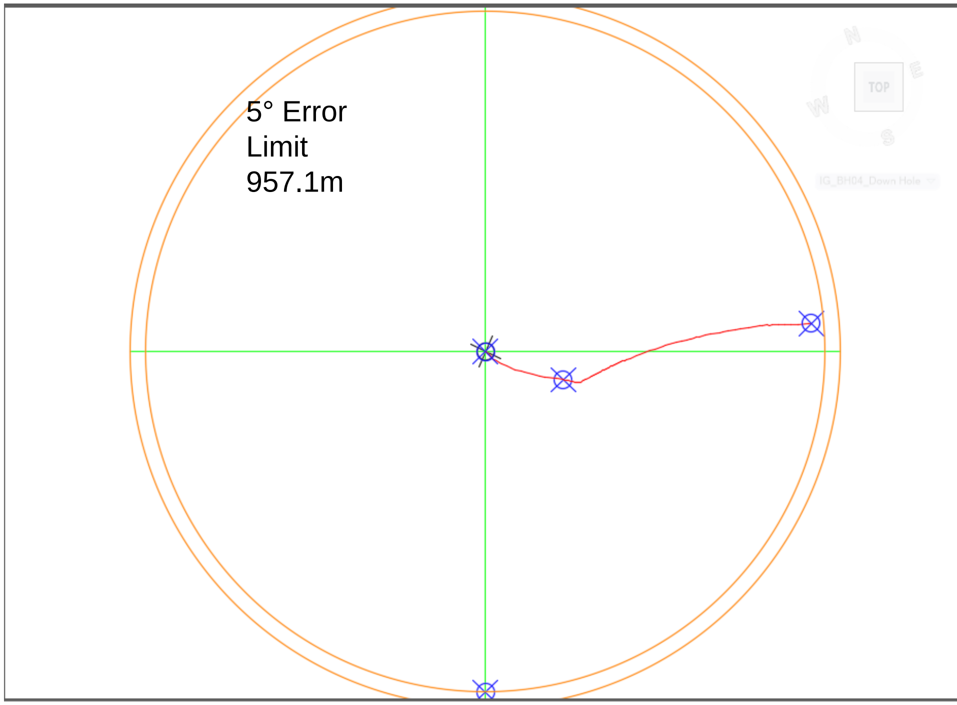


View Down Planned Borehole

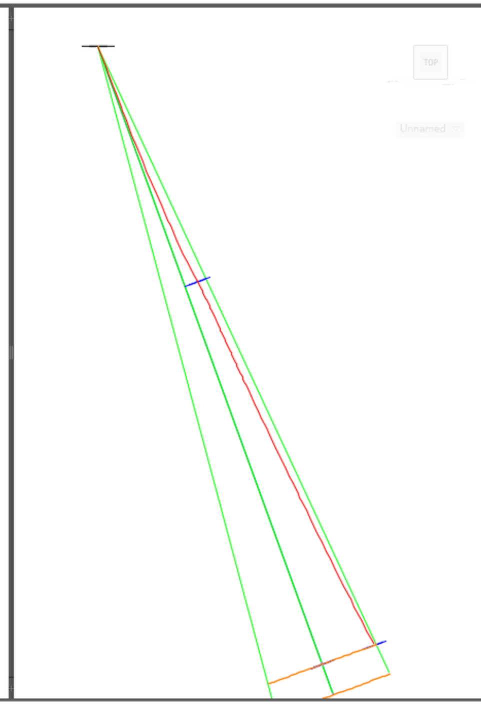
View Perp. Planned

View Front Planned

200312 at 957.1m New BH Zoomed



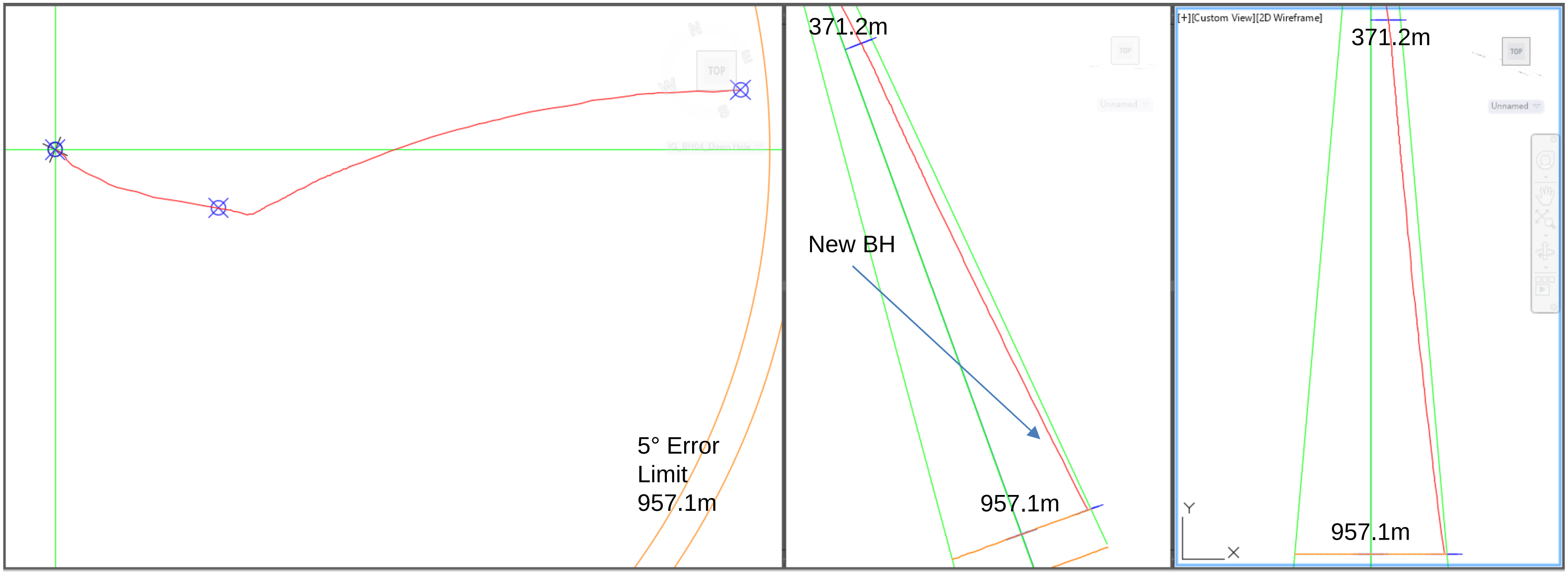
View Down Planned Borehole



View Perp. Planned

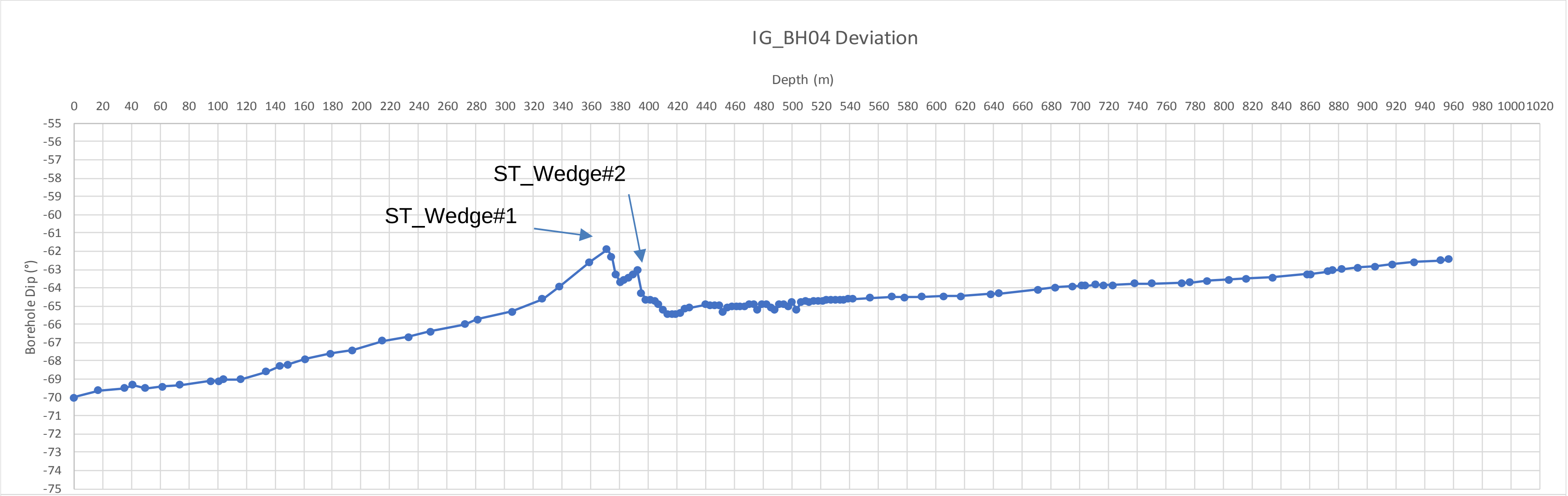
View Front Planned

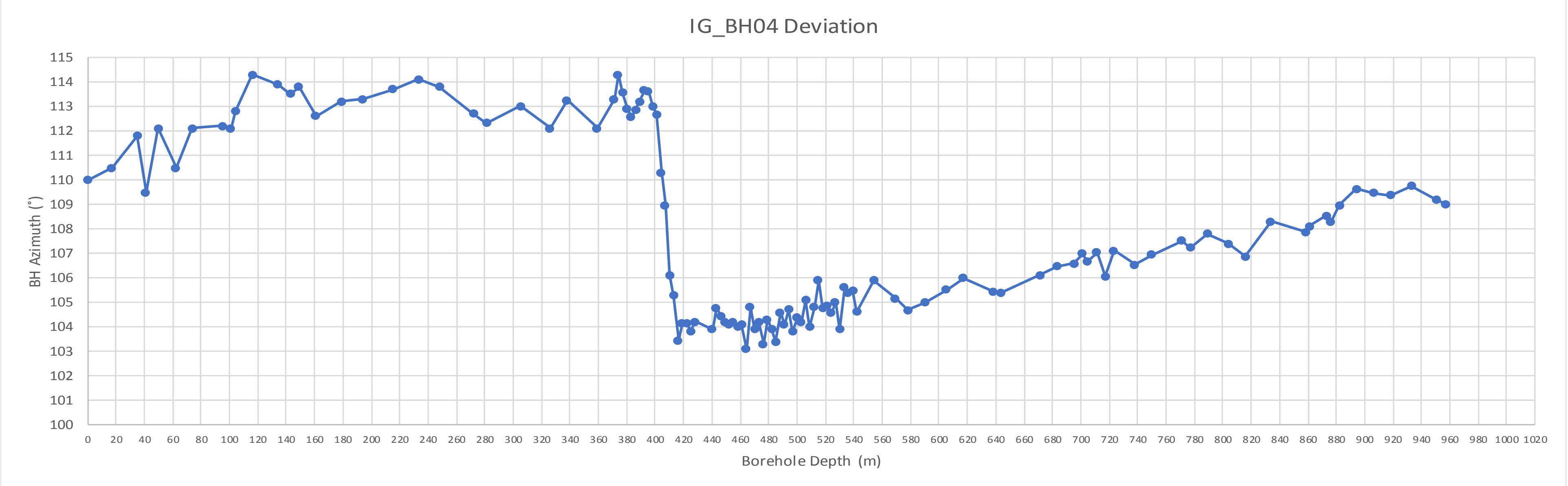
200312 at 957.1m New BH VZoomed



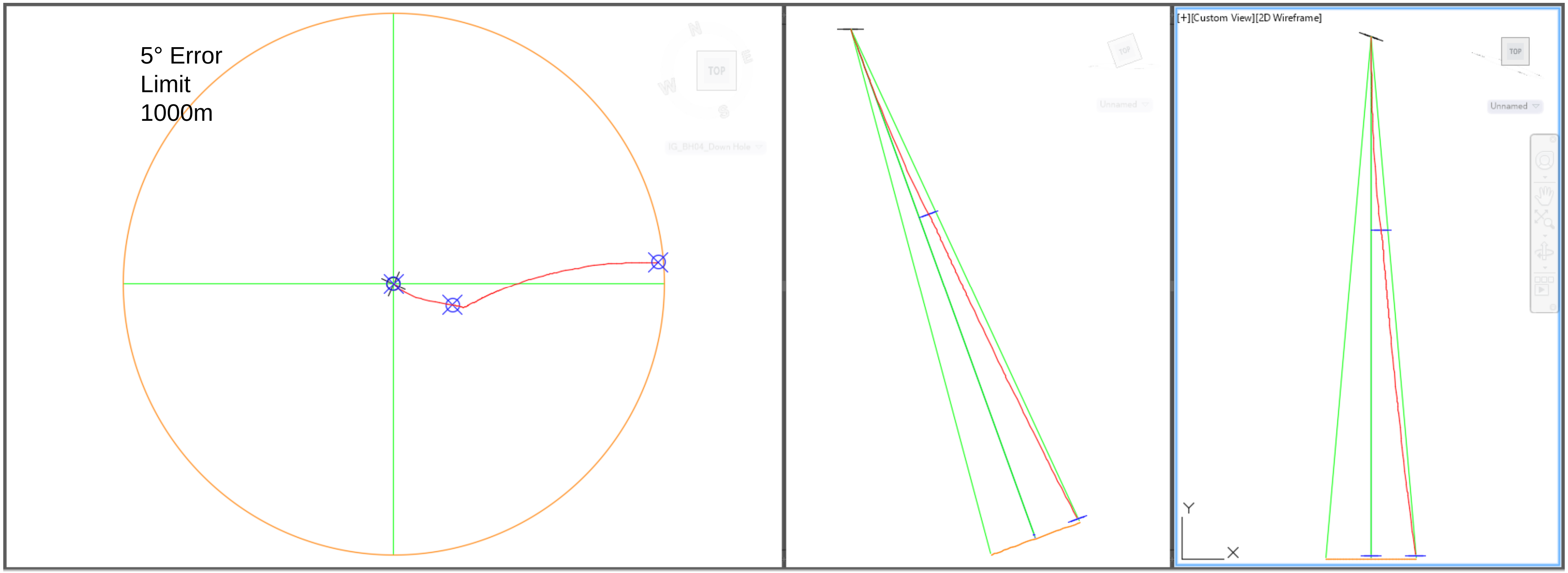
View Down Planned Borehole　　View Perp. Planned　　View Front Planned

200312 at 957.1m New BH



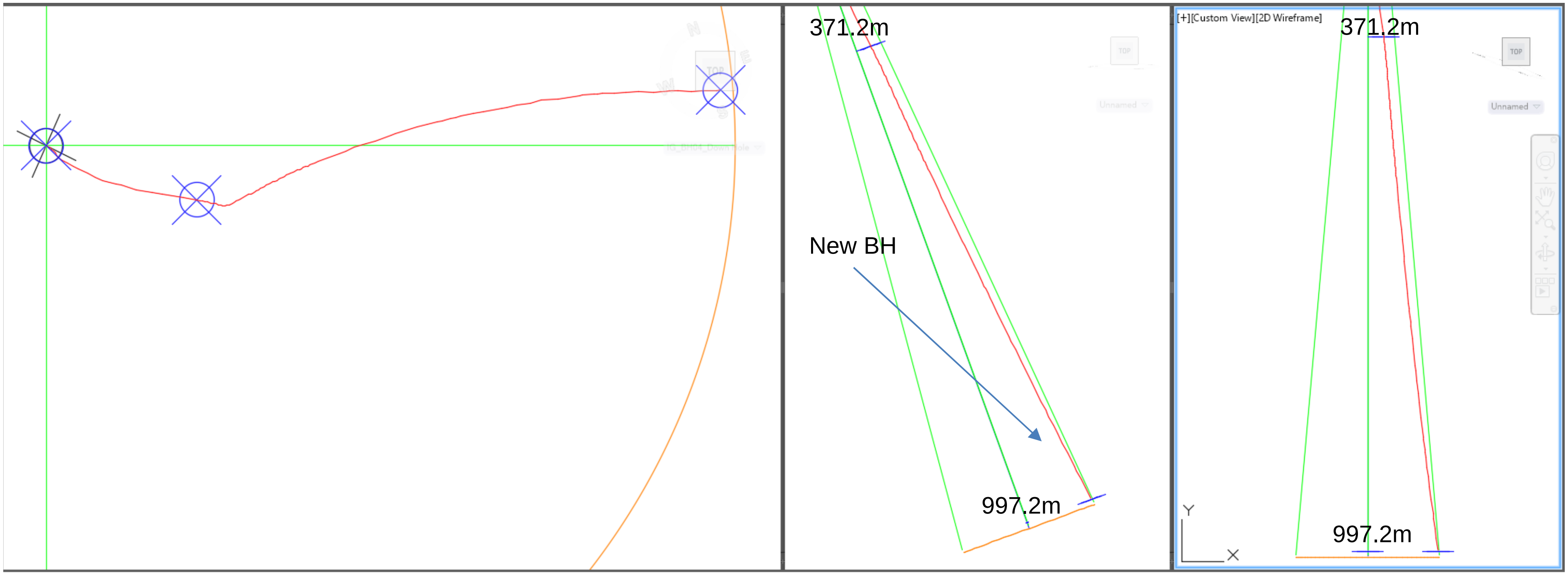


200316 at 997.2m New BH



View Down Planned Borehole View Perp. Planned View Front Planned

200316 at 997.2m New BH Zoomed

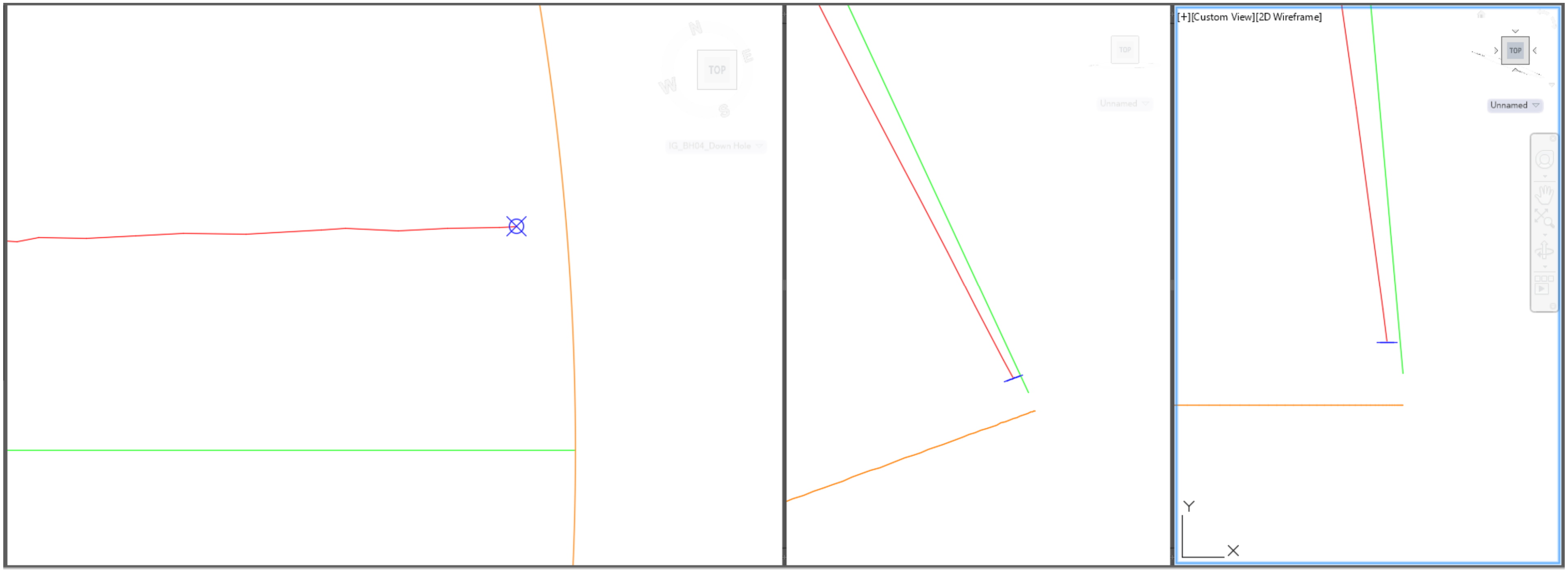


View Down Planned Borehole

View Perp. Planned

View Front Planned

200316 at 997.2m New BH VZoomed

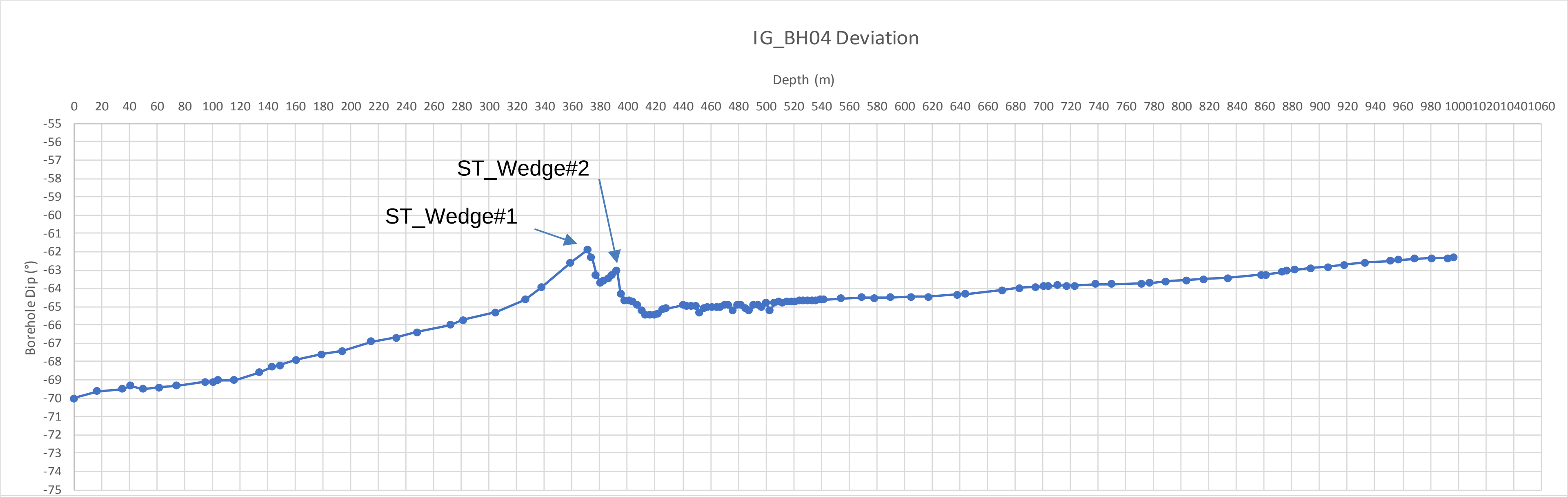


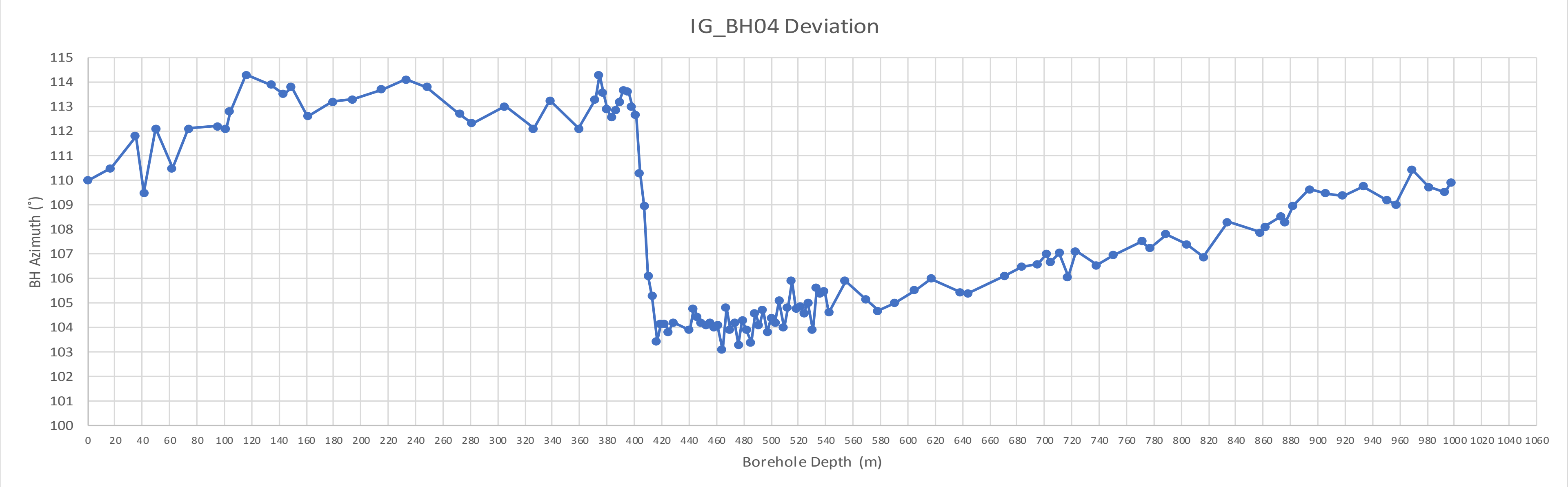
View Down Planned Borehole

View Perp. Planned

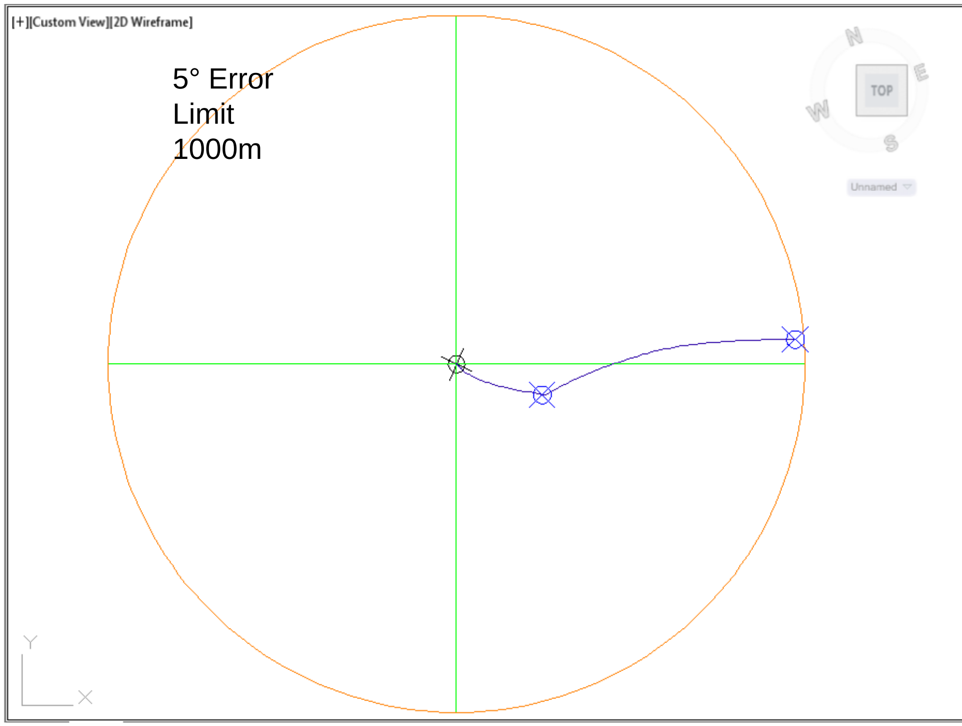
View Front Planned

200316 at 997.2m New BH

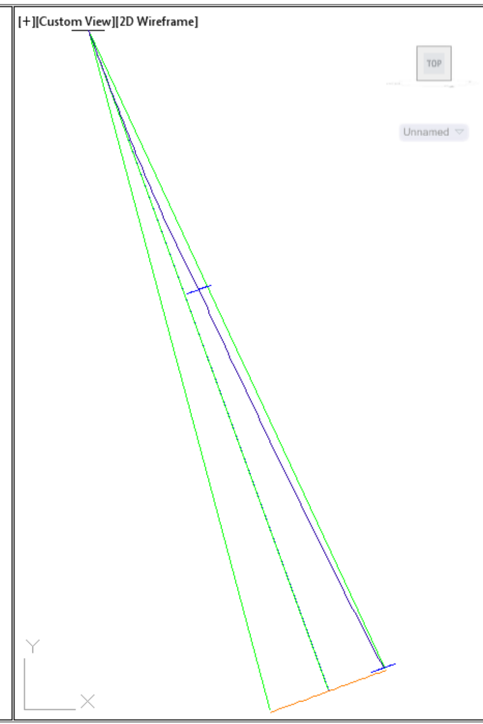




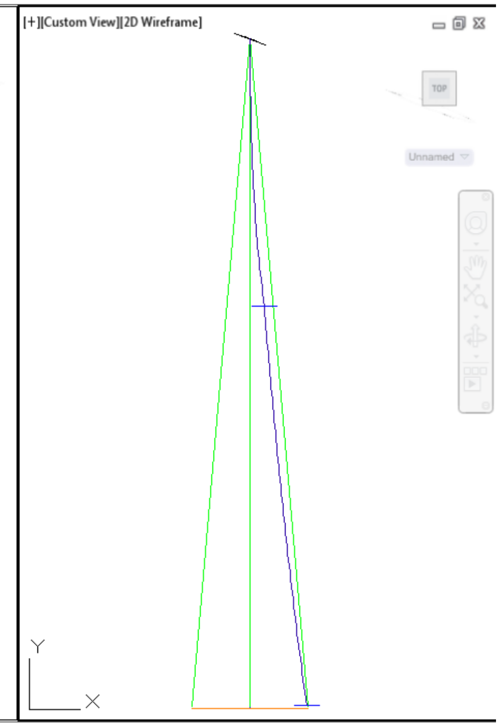
200316 at Final Survey From 1000.2m - New BH



View Down Planned Borehole

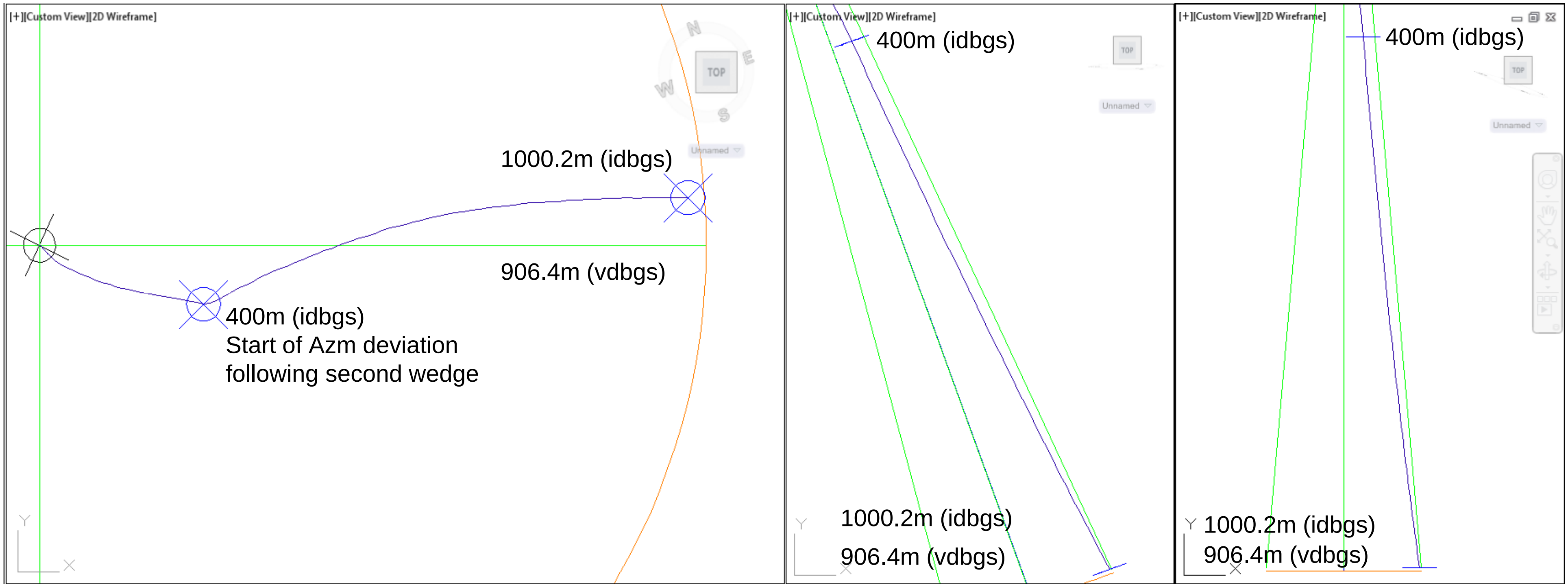


View Perp. Planned



View Front Planned

200316 at Final Survey From 1000.2m - New BH Zoomed



View Down Planned Borehole

View Perp. Planned

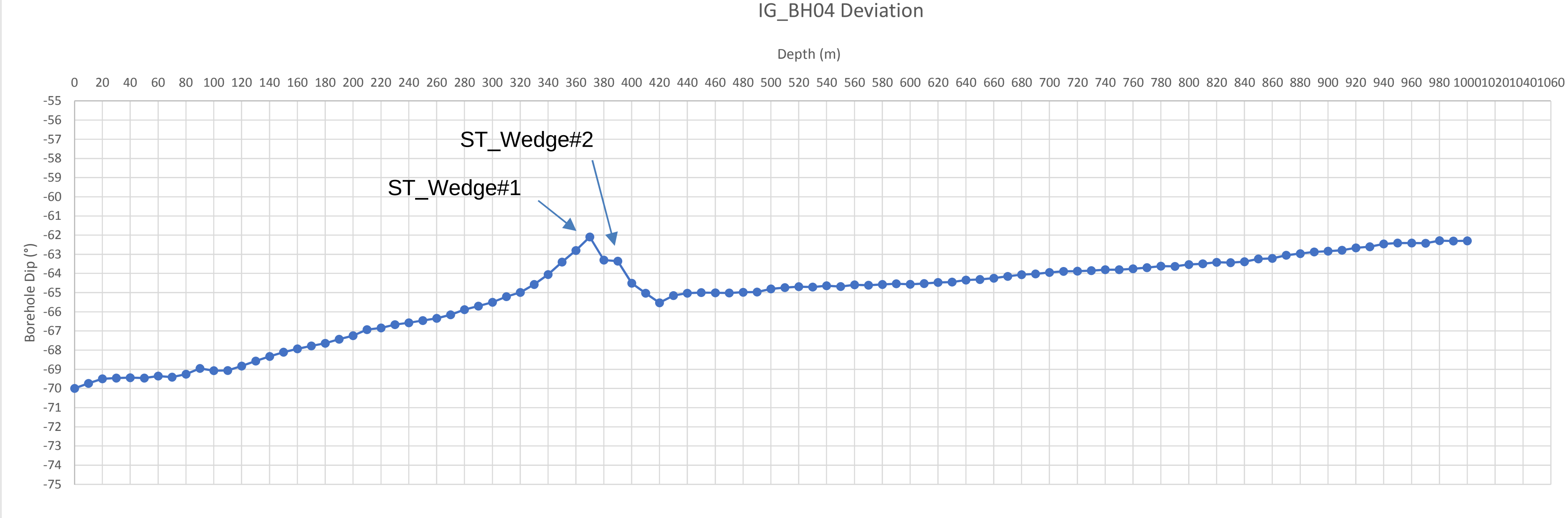
View Front Planned

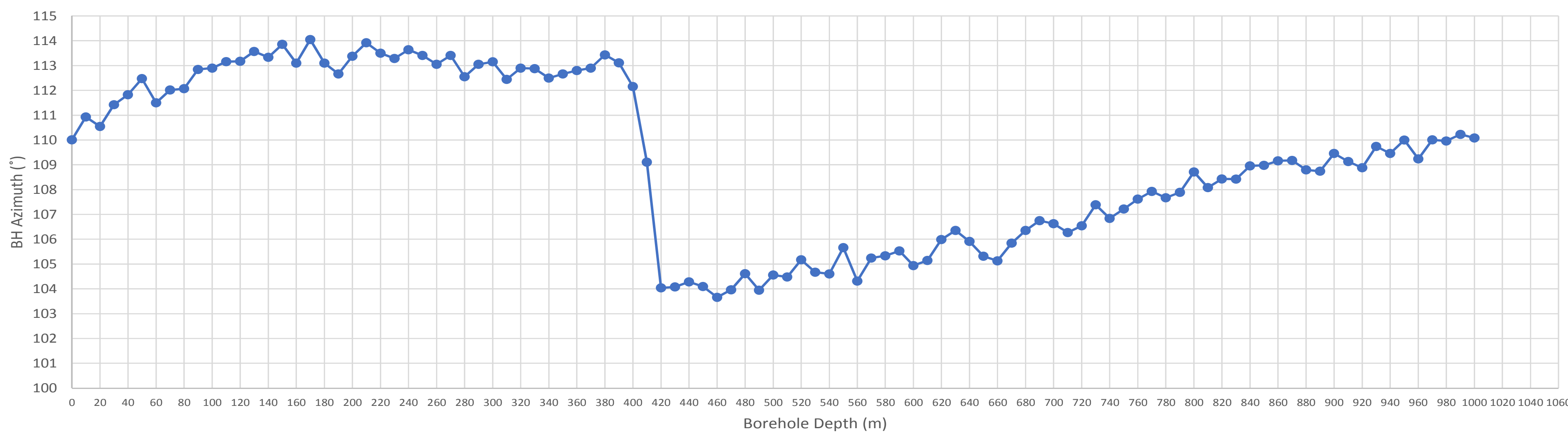
idbgs – inclined depth below ground surface (m)
vdbgs – vertical depth below ground surface (m)

200316

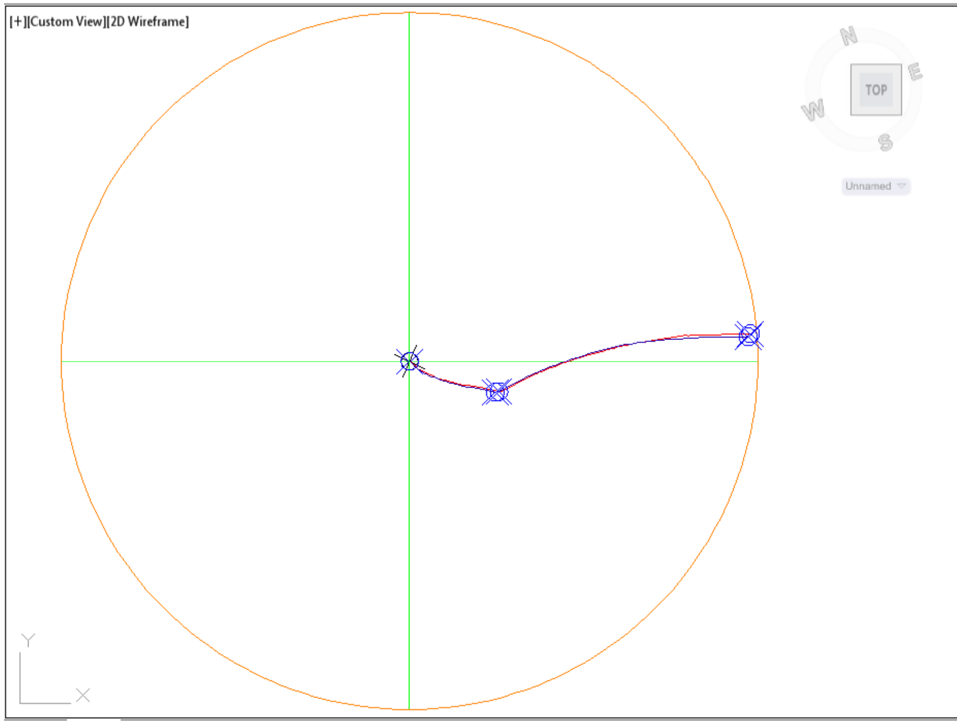
FINAL CONTINUOUS BOREHOLE SURVEY

200316 at Final Survey From 1000.2m - New BH

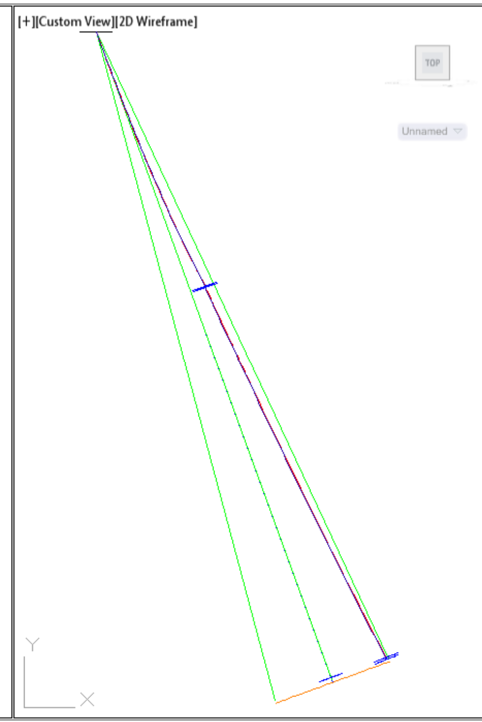




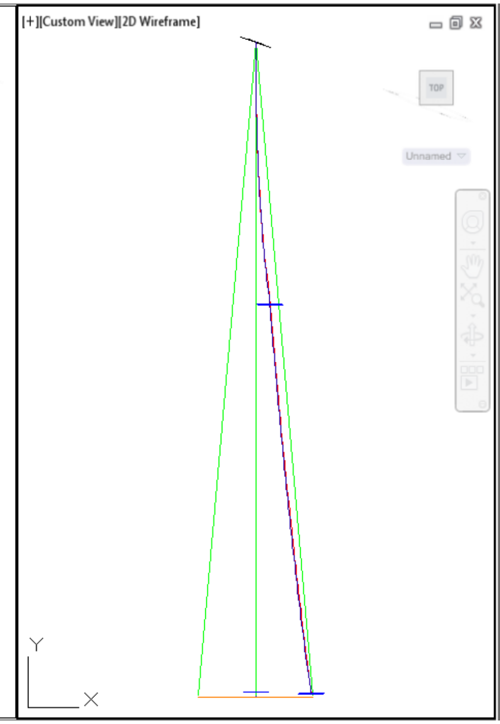
200316 Comparison Incremental Surveys versus Final Survey



View Down Planned Borehole

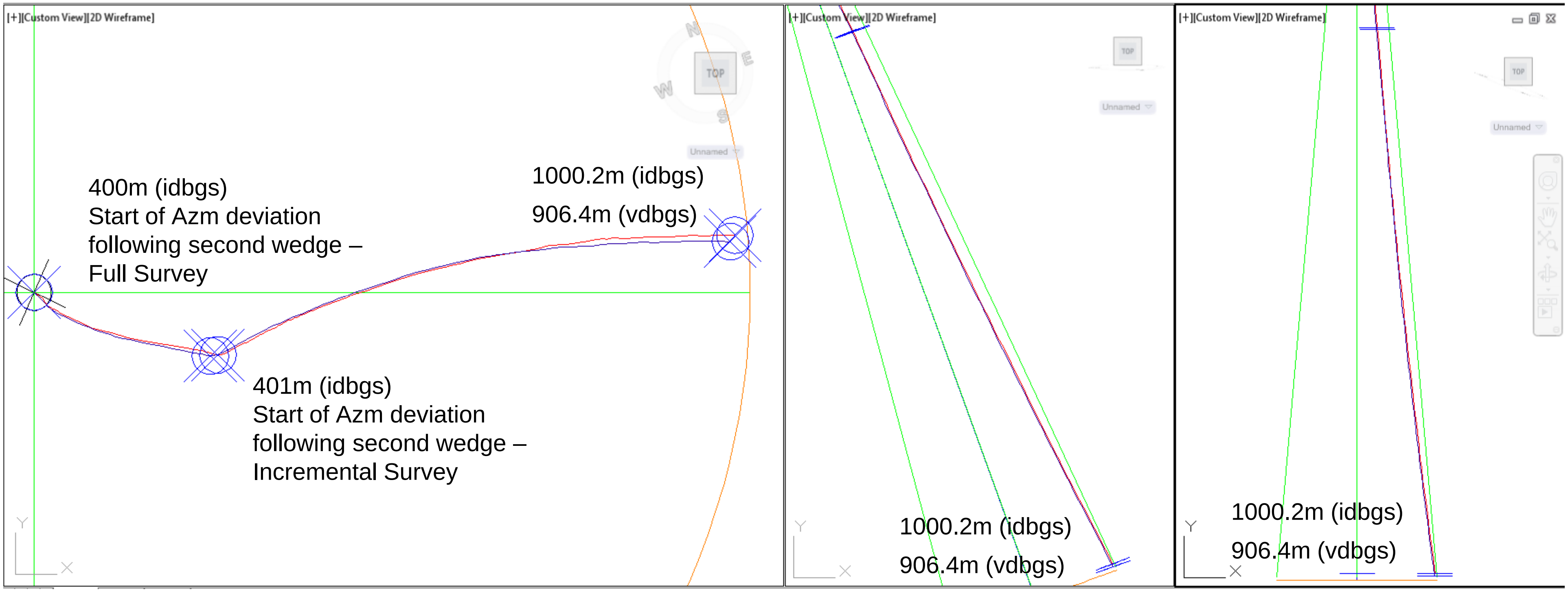


View Perp. Planned



View Front Planned

200316 Comparison Incremental Surveys versus Final Survey



View Down Planned Borehole View Perp. Planned View Front Planned

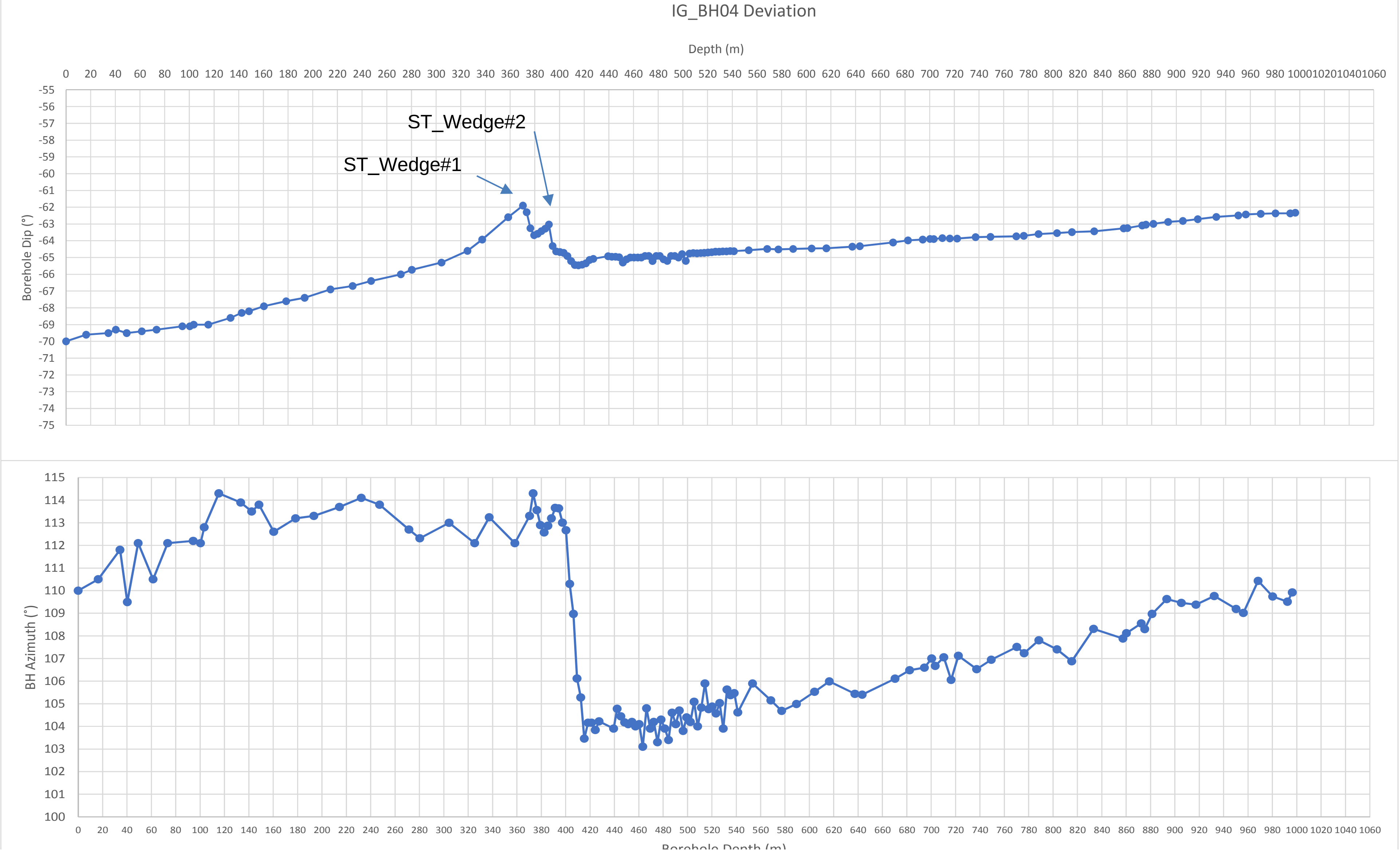
idbgs – inclined depth below ground surface (m)
vdbgs – vertical depth below ground surface (m)

Note : Due to elongation in the wireline there is around a 1m difference in the Depth Measurement at around the mid point for comparison.

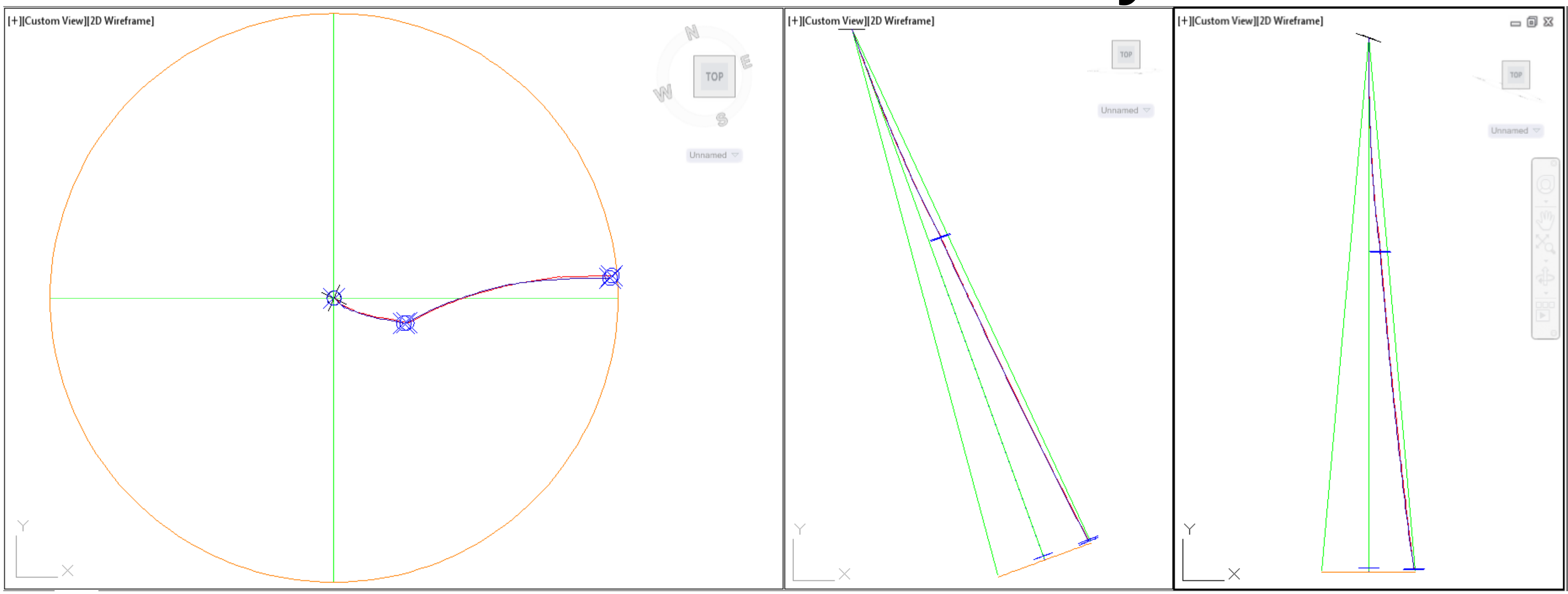
210205 – (Note after comparison review of the actual location of the Ez-Gyro was noted to be 0.84m less than recorded during the program. This is due to not accounting for the rotor-lock of the Gyro and spearhead of the inner barrel plus ACTIII instrument, hence instead of the tool being 3m (inner barrel length) away from the bottom of the borehole, the tool is actually 3.84m when everything is accounted for. Note, this does not correct the X-Y difference which is a function of the spacing and timing of the two difference surveys. Note the incremental survey is expected to be superior to the final survey, due to the fact it is based on the borehole depth at the time of the survey, and more readings during the deviation.

INCREMENTAL BOREHOLE SURVEY - CORRECTED

200316 at 996.36m New BH Corrected (-0.84m) – EOH 1000.2

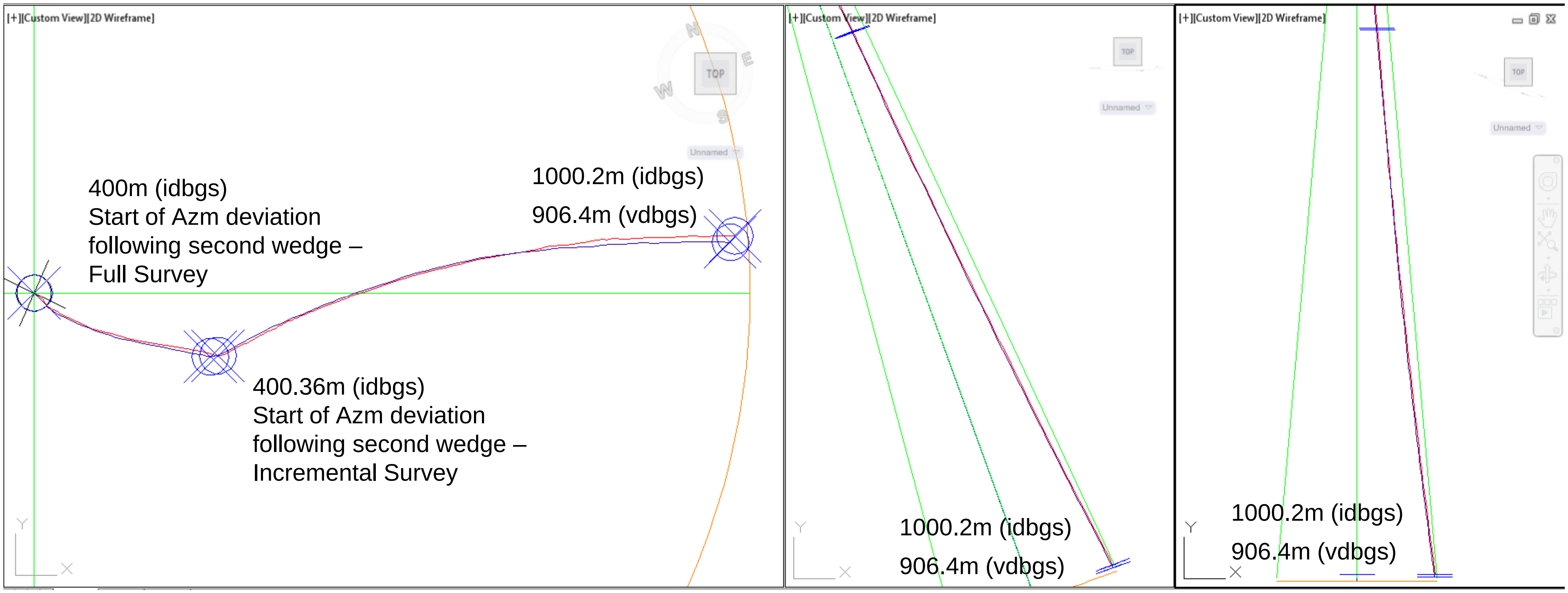


200316 Comparison Incremental Surveys - Corrected versus Final Survey



View Down Planned Borehole | View Perp. Planned | View Front Planned

200316 Comparison Incremental Surveys – Corrected versus Final Survey



View Down Planned Borehole View Perp. Planned View Front Planned

idbgs – inclined depth below ground surface (m)
vdbgs – vertical depth below ground surface (m)

Note : Due to elongation in the wireline, the final survey completed after casing of the upper 100m of the borehole, survey spacing overall coarser than the incremental survey, there are slight differences in the survey location, typically +- 1m X-Y

Appendix D

IG_BH04 Drilling and Drill Fluid Parameters

NWMO IGNACE DRILLING - FIELD DATA

DRILL MONITORING PARAMETERS

Date	Time	Core Run #	Top of Run	Bottom of Run	Drill Parameters: ROP	Bit Rotation Speed (Head RPM)	Torque (Torque Pressure)	Injection Fluid Pressure (H2O Pressure In)	Down hole Fluid Flow Rate (H2O Flow in)	Thrust Pressure (Downpressure) - (Pump 1)	Holdback Pressure (Feed Pressure)	Drill Fluid Parameters: Drill Fluid Volume Change (Ultra Sonic)	Drill Fluid Volume Change (Manual)	Fluoro Conc. Inlet (Rig Poly)	Fluoro Conc. Outlet (SRU)	Change in Fluoro Conc.	Temp	Density		ORP	pH	Change in pH	Electrical Conductivity	Change in Electrical Conductivity	DO	Change in DO	Turbidity	Change in Turbidity	Notes: Core Observations	Comments
-	-	-	mbgs	mbgs	cm/min	RPM	psi	psi	L/min	psi	psi	L >100L	L	ppb	ppb	% >20% change	(°C)	API Gravity	SG	mV	-	- >0.5 change	mS/cm	% >10% change	mg/L	- >10% change	NTU	- >10% change		
19-11-2019	7:00 PM	0																												
19-11-2019	9:30 PM	0	0.00	1.20								3,168																		
20-11-2019	11:20 PM	0	1.20	1.61								0																		
20-11-2019	6:40 AM	1	1.61	2.70	6	1256	1384.1	58	42.00	2425	1195.1	1,194																		
20-11-2019	8:45 AM	2	2.70	3.88	9.3	1207	1860	0	37.22	2423	695	667																		
20-11-2019	10:25 AM	3	3.88	5.16	5.5	1177	1974	0	26.64	2426	607	4,154																		
20-11-2019	17:24 AM	4	5.16	8.07	10.5	992	1999	0	13.85	2418	824	464																		
20-11-2019	18:32 AM	5	8.07	11.15	10.3	998	1950	0	14.27	2419	753	483																		
20-11-2019	10:15 PM	6	11.15	14.15	8.4	1072	1459.1	0	35.90	2300	634.6	803																		
20-11-2019	11:00 PM	7	14.15	15.65	12	1155	1240.4	0	30.30	2400	931	503																		Casing Grouted
23-11-2019	8:45 PM	8	15.65	17.15	5.9	1156	1817	0	29.80	2416	1211	186																	Large vertical Fracture with iron staining going to surface	
24-11-2019	12:07 AM	9	17.15	17.38	5.7	1141	1805	0	30.43	2416	1139	99																		
24-11-2019	1:15 AM	10	17.38	20.15	4.1	1284	1785	0	27.54	2420	1190	171		293.4	293.4	0%	14.55	8.6	1.01	-148	11.81		0.576		7.71		1000			Flourozine needs rebalancing
24-11-2019	9:30 PM	11	20.15	20.63	4.8	820	1893	0	36.5	2420	1135	44		212	223	5%	13.5	8.6	1.01	-72	11.84	0.03	0.428	-26%	8.07	5%	909	-9%		Removed 230 impG (1000L) and added 230 Gallons around 1000 L of fresh water to reduce conc by 60ppb
24-11-2019	11:15 PM	12	20.63	23.15	6	1224	1929	0	29.1	2420	1029	191		239.2	236.7	-1%	18.6	7.2	1.02	-98	11.76	-0.08	0.539	26%	8.39	4%	1000	10%		
25-11-2019	1:00 AM	13	23.15	26.15	6	1420	2267	0	31.8	2420	983	357		215.3	228.5	6%	18.55	8.6	1.01	-98	11.76	0.00	0.539	0%	8.39	0%	1000	0%		
25-11-2019	5:00 AM	14	26.15	29.15	3	1163	2217	0	27.2	2420	929	197		242	229.9	-5%	24.5	8.6	1.01	-82	11.51	-0.25	0.57	6%	5.84	-30%	1000	0%		
25-11-2019	8:30 AM	15	29.15	32.15	3	1192	2202	0	28.4	2420	1158	-31		240.7	199.1	-17%	26.7	8.6	1.01	-69	11.28	-0.23	0.361	-37%	5.71	-2%	1000	0%		
25-11-2019	11:45 AM	16	32.15	35.15	10	1171	2569	0	29.1	2450	1021	6		231.8	216.7	-7%	20.67	7.2	1.02	-132	11.22	-0.06	0.437	21%	7.39	29%	1000	0%		
25-11-2019	4:50 PM	17	35.15	38.15	3	1092	2647.1	11.02	26.5	2415	733	7		132.3	130.5	-1%	13.67	7.2	1.02	-22	11.14	-0.08	0.424	-3%	9.3	26%	1000	0%		Removed 450 impG (2000L) and added 450 impG (2000L) of fresh water to reduce conc by 100 ppb
25-11-2019	6:30 PM	18	38.15	41.17	9	1026	2598.1	17.9	28.7	2425	1120	-33		134.7	132.5	-2%	15.57	7.2	1.02	-3	10.26	-0.88	0.304	-28%	7.55	-19%	1000	0%		
26-11-2019	12:10 AM	19	41.17	44.17	2.5	1126	2646	87	39.3	2425	1041	-452		120.2	129.9	8%	13.85	7.2	1.02	-121	10.72	0.46	0.336	11%	7.18	-5%	1000	0%		
26-11-2019	3:35 AM	20	44.17	47.17	2.7	1046	2087	0	18.1	2425	1089	-271		134.7	126.8	-6%	10.29	8.6	1.01	-95	10.58	-0.14	0.55	64%	9.04	26%	1000	0%		change the drill bit, the length of the core barrel is still the same
26-11-2019	6:00 AM	21	47.17	49.95	2.5	756	1883	0	45	2425	1269	-371		130.6	125.4	-4%	19.7	7.2	1.02	-158	10.43	-0.15	0.371	-33%	6.26	-31%	1000	0%		
27-11-2019	6:50 AM	22	49.95	52.77	2.5	1130	2087	0	55.9	2425	1081	1,748		128.9	89.9	-30%	23	8.6	1.01	-84	10.65	0.22	0.45	21%	8.72	39%	1000	0%		Driller added CR650 could not get a clean sample to perform flourizine
28-11-2019	1:00 AM	23	52.77	53.17	1.3	929	1883	0	17.8	2425	1289	-202	-54	98.74	94.07	-5%	16.92	7.2	1.02	-29	8.67	-1.98	0.113	-75%	8.48	-3%	1000	0%		System pumped dry and hole flushed, 4000 L of Fresh Water Added, and 2 L of Flourizine Solution B (98.5 ppb)
28-11-2019	3:30 AM	24	53.17	56.17	2.5	967	2169	0	40.89	2425	606	-220	-2	99.9	103.7	4%	13.5	8.6	1.01	-40	10.3	1.63	0.115	2%	8.25	-3%	1000	0%		
28-11-2019	6:50 AM	25	56.17	59.17	2.5	878	2239	0	21.5	2425	1214	-48	57	105.6	92.68	-12%	13.6	7.2	1.02	-40	10.13	-0.17	0.127	10%	10.88	32%	1000	0%		
28-11-2019	12:37 PM	26	59.17	62.21	8	780	2685.1	0	23	2425	500.1	599	186	98.33	97.58	-1%	12.39	8.6	1.01	-27	9.33	-0.80	0.157	24%	9.22	-15%	1000	0%		
28-11-2019	8:37 PM	27	62.21	65.18	6	719	2707.1	0	20.5	2425	763.5	295	76	96.29	95.28	-1%	11.8	8.6	1.01	-24	8.82	-0.51	0.182	16%	8.13	-12%	1000	0%		
28-11-2019	9:30 PM	28	65.18	68.17	10	874	3050	0	19.7	2425	1034	183	-36	93.22	88.99	-5%	19	7.2	1.02	-48	9.7	0.88	0.176	-3%	7.9	-3%	1000	0%		
28-11-2019	11:30 PM	29	68.17	71.17	6	995	2916	0	49.9	2425	1156	-63	27	88.96	70.14	-21%	18.8	7.2	1.02	-193	10.05	0.35	0.209	19%	6.18	-22%	1000	0%		
29-11-2019	1:30AM	30	71.17	74.17	6	1013	2786	0	21.9	2425	1139	130	-53	83.99	76.1	-9%	15.48	7.2	1.02	-193	10.09	0.04	0.217	4%	7.51	22%	1000	0%		
29-11-2019	6:00AM	31	74.17	77.17	6	1025	2484	0	37.8	2425	1030	16	99	82.26	69.11	-16%	14.9	7.2	1.02	-10	8.43	-1.66	0.224	3%	7.25	-3%	1000	0%		
29-11-2019	8:45 AM	32	77.17	80.18	6	1029	2345	0	37.8	2450	1017	-11	-178	72.01	74.86	4%	11.92	8.6	1.01	-78	9.29	0.86	0.255	14%	11.83	63%	1000	0%		
29-11-2019	11:00 AM	33	80.18	83.19	6	908	2447	30.2	38	2450	1191	-151	-52	74.34	65.99	-11%	12.72	8.6	1.01	-53	9.56	0.27	0.263	3%	9.41	-20%	1000	0%		
29-11-2019	5:00 PM	34	83.19	86.22	6	836	2561	47	45.7	2450	1028	146	0	64.19	65.23	2%	12.52	8.6	1.01	-90	9.95	0.39	0.281	7%	8.46	-10%	1000	0%		
30-11-2019	12:20 AM	35	86.22	89.17	5	946	2236	92	31	2450	1067	39	-139	78.3	96.7	23%	16.36	7.2	1.02	-122	9.2	-0.75	0.321	14%	7.45	-12%	1000	0%		
30-11-2019	2:40 AM	36	89.17	92.17	6	929	2865	12	45	2450	1054	243	36	90.1	79.9	-11%	14.7	7.2	1.02	-124	9.57	0.37	0.332	3%	7.52	1%	1000	0%		
30-11-2019	6:40 AM	37	92.17	95.17	5	959	1080	0	63.5	2450	1368	-57	64	85.94	79.89	-7%	10	7.2	1.02	-109	9.58	0.01	0.353	6%	7.65	2%	1000	0%		
30-11-2019	10:30 AM	38	95.17	98.20	5	967	1137	0	30.1	2425	1401	656	66	75.6	66.45	-12%	17.5	7.2	1.02	-81	9.39	-0.19	0.366	4%	8.53	12%	1000	0%		
30-11-2019	13:38:00 AM	39	98.20	101.20	6	1037	2896	38	49.5	2425	1238	4612.4	-168.1	71.5	74.24	4%	11.75	8.6	1.01	-51	9.28	-0.11	0.406	11%	11.19	31%	1000	0%		totalizer readings off due to pumping water when blocked and retrieving partial run
08-12-2019	11:15 AM	40	101.20	104.20	9.81	1145	2981	49	26.5	2450	1296	92	358	189.8			14.09	10.0	1	-81	7.46	-1.82	1.20	196%	13.91	24%	1000	0%		
08-12-2019	12:22 AM	41	104.20	106.19	4.95	1111	3410	31	31	2450	1323	0	0	203.3			12.91	10.0	1	-103	7.39	-0.07	1.07	-11%	12.65	-9%	1000	0%		
08-12-2019		42	106.19	107.21																										
08-12-2019	1:40pm	43	107.21	110.00	6	966	2945	0	46.5	2450	1258	667	386	136.8			13.7	10.0	1	-103	11.66									
17-12-2019		44	110.00	110.21										44.57			11.1			-166	14	2.34	2.56		10.02		323			
18-12-2019	10:58am	45	110.21	113.21		1140	2300	0	31.8	2300	1160	60	-202.3	152.3	153.1	1%	7.95			-223	14	0.00	1.75	-32%	13.3	33%	1000	210%		
18-12-2019	11:49am	46	113.21	116.21	5.8	1150	2700	0	53.7	2200	890	-245	-168	158.1	156.2	-1%	0.38	10.0	1	-210	14	0.00	1.77	1%	12.6	-5%	1000	0%		
18-12-2019	12:54am	47	116.21	119.21	5.4	1130	2950	0	42	2200	800	-250	-281.6	155.4	158.3	2%	11.95	10.0	1	-195	14	0.00	1.63	-8%	11	-13%	1000	0%		
18-12-2019	2:09pm	48	119.21	122.22	8.65	1100	3200	0	33.3		975	56	-1.9	156.9	145.4	-7%	13.37	10.0	1	-171	14	0.00	1.59	-2%	10.04	-9%	806	-19%		
18-12-2019	3:18pm	49	122.22	123.38	6.8	1066	3100	0	60.1	2200	865	-173	374	145.7	145.3	0%	14.3	10.0	1	-191	14	0.00	1.55	-3%	9.3	-7%	650	-19%		
18-12-2019	6:00pm	50	123.38	125.21	4	1080	3100	0	35	2200	950	-161	-34.5	145	145.4	0%	14.28	10.0	1	-200	14	0.00	1.54	-1%	8.5	-9%	909	40%		
18-12-2019	8:00pm	51	125.21	125.54	2.06	1036	2926	0	9.3	2400	622	45.9		141.2	139.6	-1%	14.86	10.0	1	-208	14	0.00	1.45	-6%	7.5	-12%	823	-9%		
18-12-2019	9:00pm	52	125.54	125.71	2	856	3329	86	23.7	2400	577	49		138.1	136.3	-1%	15.08	10.0	1	-210	14	0.00	1.4	-3%	6.71	-11%	857	4%		
18-12-2019	11:22pm	53	125.71	128.21	4.3	956	2177	0	33	2200	992			137.2	136.3	-1%	15.57			-250	14	0.00	1.45	4%	7.94	18%	745	-13%		
19-12-2019	1:00am	54	128.21	131.21	7.88	814	3063	0	25	2400	761	96.5		135.6	133.6	-1%	15.92	10.0	1	-215	14	0.00	1.41	-3%	7.5	-6%	616	-17%		
19-12-2019	4:00am	55	131.21	133.78	4	789	2160	0	25	2400	827			138.1	133.5	-3%	16.88	10.0	1	-201	14	0.00	1.3	-8%	9.53	27%	984	60%		
19-12-2019	9:35am	56	133.78	134.21																										
19-12-2019	11:26am	57	134.21	137.21	4.3	970	3900	0	38	2200	980	-26	-41	137.9		-100%	18.52	10.0	1	-195	14		1.77		7.5		1000			
19-12-2019	2:30pm	58	137.21	140.21	3.8	859	2600	75	51.4	2260	590	382	-59	60.3	59.03	-2%	20.4	10.0	1	-51	11.63	-2.37	1.68	-5%	10.6	41%	1000	0%		
19-12-2019	6:30pm	59	140.21	143.21	6	506	2700	0	32.5	2200	945	756	-343	58.5	59.69	2%	20.77			-172	14	2.37	1.54	-8%	9.7	-8%	714	-29%		
20-12-2019	1:00am	60	143.21	146.21	6.5	304	2300	0	31	2200	940	1896	-85.9	64.54	66.45	3%	18.71			-161	13.38	-0.62	1.44	-6%	10.55	9%	742	4%		
20-12-2019	12:00pm	61	146.21	149.21	5	800	2024	0	31.4	2200	1004	250	-30.3	72.78	71.94	-1%	14.33			-155	12.36	-1.02	1.46	1%	8.45	-20%	915	23%		
20-12-2019	2:00pm	62	149.21	152.21	4	630	2150	0	36.5	2200	995	324	-207	68.67	70.65	3%	17.56			-200	12.64	0.28	1.35	-8%	8.5	1%	1000	9%		
21-12-2019	7:00pm	63	152.21	155.21	5.9	584	2500	0	41.6	2200	800	268	-250	70.88	72.89	3%	16.6			-134	11.64	-1.00	0.93	-31%	11	29%	1000	0%		
22-12-2019	1:30pm	64	155.21	155.65	1.1	692	2290	18	46.1	2200	1430	65	110	68.93	68.81	0%	19.15			-131	11.68	0.04	0.9	-3%	8.23	-25%				
22-12-2019	3:00pm	65	155.65	158.21	6	680	2100	0	38.9	2200	1580	-87.3	76.8	67.59	68.52	1%	18.9	5.9	1.03	-134	11.86	0.18	1.24	38%	8.8	7%	860			
22-12-2019	4:30pm	66	158.21	161.21	7.5	787	2998	0	42.7	2200	1048	1158	12.5	69.76	69.59	0%	15.51	5.9	1.03	-116	11.68	-0.18	1.08	-13%	6.26	-29%	1000	16%		
22-12-2019	6:30pm	67	161.21	164.21	5	720	3177	0	33.3	2200	1251	1124	9.6	68.5	68.22	0%	17.02	5.9	1.03	-140	11.9	0.22	0.99	-8%	5.76	-8%	1000	0%		
22-12-2019	10:30pm	68	164.21	167.21	1.1	773	3000	0	39.3	2300	1300	4602	79.6	62.96	69.18	10%	21.45			-141	11.77	-0.13	1.01	2%	5.78	0%				
23-12-2019	9:00am	69	167.21	170,21	7.6	745	2957	0	30,2	2200	1184	167.8	29	108.1	112.1	4%	17.6	2.0	1.06	-148	12	0.23	1.08	7%	7.21	25%	1000			
23-12-2019	1:30pm	70	170.21	173.21	10.44	762	3079	0	37	2200	1239	287.2	-28.8	114.1	118.1	4%	13.7	4.6	1.04	-100	11.86	-0.14	0.77	-29%	8.24	14%	1000	0%		
23-12-2019	4:45 PM	71	173.21	176.21	8	754	3210	0	41.2	2200	1172	-177	-17.1	119.7	118	-1%	14.38	3.3	1.05	-106	11.76	-0.10	0.677	-12%	7.49	-9%	1000	0%		
23-12-2019	5:45 PM	72	176.21	177.82	6.3	765	2970	35	43.5	2200	1278	-255	13.0	117.2	119.7	2%	14.07	4.6	1.04	-114	11.76	0.00	0.664	-2%	6.54	-13%	1000	0%		
23-12-2019	7:00 PM	73	177.82	179.21	6.5	761	3131	0	40.4	2200	1178	-89	5.9	118.7	111.6	-6%	16.61	4.6	1.04	-115	11.66	-0.10	0.64	-4%	6.31	-4%	1000	0%		
24-12-2019	8:45 AM	74	179.21	182.21	7.9	734	3378	0	43.1	2200	1245	-93	81.2	116.5	105.3	-10%	16.04	5.9	1.03	-298	11.85	0.19	0.776	21%	8.35	32%	1000	0%		
24-12-2019	10:20 AM	75	182.21	185.21	8.5	725	3135	0	33.3	2200	1255	-40	-119.9	100.9	106.9	6%	17.24	5.9	1.03	-129	11.77	-0.08	0.729	-6%	6.33	-24%	1000	0%		
24-12-2019	12:00 PM	76	185.21	188.21	4.8	648	3240	13	38.2	2200	1102	85	-61.8	109.1	104.6	-4%	18.9	5.9	1.03	-102	11.62	-0.15	0.691	-5%	6.33	0%	1000	0%		
24-12-2019	2:15 PM	77	188.21	191.21	5.8	651	3655	17	35.9	2200	1011	-27	-52.8	108.4	102.6	-5%	18.61	5.9	1.03	-111	11.51	-0.11	0.669	-3%	5.7	-10%	1000	0%		
24-12-2019	3:45 PM	78	191.21	194.21	4.7	611	3225	0	40.1	2200	1176	-89	-133.3	107.1	103.6	-3%	19.32	4.6	1.04	-89	11.4	-0.11	0.667	0%	6.41	12%	1000	0%		
24-12-2019	4:45 PM	79	194.21	195.08	3	780	3100	0	25.3	2200	1129	53	118.0	99.26	103.5	4%	19.06	5.9	1.03	-117	11.4	0.00	0.658	-1%	5.96	-7%	1000	0%		
24-12-2019	6:40 PM	80	195.08	197.21	5.9	616	3382	0	34.4	2200	1163	-21	-28.6	99.05	98.6	0%	19.48	3.3	1.05	-127	11.33	-0.07	0.65	-1%	6.17	4%	1000	0%		
25-12-2019	9:00 AM	81	197.21	200.21	9.52	698	3015	0	40.8	2200	1252	-8	-27.7	99.58	93.3	-6%	18.95	8.6	1.01	-116	11.37	0.04	0.672	3%	6.28	2%	1000	0%		
25-12-2019	10:45 AM	82	200.21	203.21	6	646	3733	0	35.9	2200	1187	34	30.5	96.89	99.73	3%	19.48	8.6	1.01	-125	11.25	-0.12	0.678	1%	6.78	8%	1000	0%		
25-12-2019	12:15 PM	83	203.21	206.21	6	633	3146	0	40.8	2200	1236	39	57.0	98.3	98.44	0%	19.41	8.6	1.01	-125	11.16	-0.09	0.671	-1%	6.67	-2%	1000	0%		
25-12-2019	1:45 PM	84	206.21	209.21	6.3	663	3118	0	42.3	2200	1126	-55	23.3	98.3	99.5	1%	19.41	8.6	1.01	-145	11.13	-0.03	0.681	1%	6.41	-4%	1000	0%		
25-12-2019	2:45 PM	85	209.21	212.21	7.5	681	3210	0	45.1	2200	1256	-35	102.5	99.18	98.9	0%	20.17	8.6	1.01	-110	11.17	0.04	0.714	5%	6.68	4%	1000	0%		
25-12-2019	4:20 PM	86	212.21	215.21	7.8	668	2950	0	42.3	2200	1308	3	-32.1	103	96.78	-6%	19.1	8.6	1.01	-111	11	-0.17	0.691	-3%	6.5	-3%	1000	0%		
25-12-2019	5:40 PM	87	215.21	218.21	6.5	681	3327	0	40.1	2200	1101	-10	-13.9	93.05	96.87	4%	20.1	8.6	1.01	-143	11.2	0.20	0.71	3%	6.54	1%	1000	0%		
25-12-2019	6:55 PM	88	218.21	221.21	6	659	3189	0	41.2	2200	1120	29	-29.0	104.18	102.7	-1%	19.88	8.6	1.01	-122	11.34	0.14	0.744	5%	6.89	5%	1000	0%		
26-12-2019	9:40 AM	89	221.21	221.57	3.5	667	3276	0	36.3	2200	1146	24	13.4	99.98	89.98	-10%	16.64	8.6	1.01	-196	11.85	0.51	0.933	25%	9.06	31%	1000	0%		
26-12-2019	10:40 AM	90	221.57	224.21	7.8	667	2914	0	47.2	2200	1174	38	41.3	93.96	91.06	-3%	15.68	10.0	1	-138	11.66	-0.19	0.707	-24%	8	-12%	1000	0%		
26-12-2019	12:00 PM	91	224.21	227.21	9	665	3242	0	36.7	2200	1108	74	13.9	90.64	95.3	5%	15.38	10.0	1	-141	11.62	-0.04	0.77	9%	7.19	-10%	1000	0%		
26-12-2019	1:30 PM	92	227.21	230.21	6.8	678	3324	0	37.4	2200	1094	16	46.6	97.19	97.6	0%	16.25	10.0	1	-144	11.46	-0.16	0.767	0%	6.83	-5%	1000	0%		
26-12-2019	2:30 PM	93	230.21	233.21	6.7	646	3556	0	40.1	2200	1123	-76	17.7	90.32	86.17	-5%	17.13	10.0	1	-134	11.34	-0.12	0.696	-9%	7.2	5%	1000	0%		
26-12-2019	4:20 PM	94	233.21	236.21	6.9	665	2860	0	45.7	2200	1145	51	-25.7	90.89	94.28	4%	16.95	10.0	1	-113	11.34	0.00	0.685	-2%	7.35	2%	1000	0%		
27-12-2019	8:50 AM	95	236.21	239.21	7.3	665	2806	0	41.2	2200	1219	58	15.8	80.84	71.78	-11%	16.44	10.0	1	-138	11.52	0.18	0.665	-3%	8.69	18%	1000	0%		
27-12-2019	10:50 AM	96	239.21	242.21	6	680	2728	0	31.8	2200	1338	69	-21.8	79.76	82.39	3%	16.42	8.6	1.01	-100	11.24	-0.28	0.659	-1%	8.37	-4%	1000	0%		
27-12-2019	1:30 PM	97	242.21	245.21	3.8	669	2849	0	35.5	2200	1200	50	63.2	50.61	47.69	-6%	16.1	8.6	1.01	-97	11.24	0.00	0.639	-3%	6.61	-21%	1000	0%		
27-12-2019	3:00 PM	98	245.21	248.21	7.9	677	3138	0	30.6	2200	1156	1	82.0	140.1	138.2	-1%	17.66	8.6	1.01	-82	11.14	-0.10	0.646	1%	6.46	-2%	1000	0%		
27-12-2019	4:30 PM	99	248.21	251.21	6.5	678	3103	0	40.4	2200	1176	-52	123.5	132.1	128.2	-3%	16.32	8.6	1.01	-91	11.5	0.36	0.642	-1%	8.19	27%	1000	0%		

NWMO IGNACE DRILLING - FIELD DATA
DRILL MONITORING PARAMETERS

Date	Time	Core Run #	Top of Run	Bottom of Run	Drill Parameters							Drill Fluid Parameters																	Notes	
					ROP	Bit Rotation Speed (Head RPM)	Torque (Torque Pressure)	Injection Fluid Pressure (H2O Pressure In)	Down hole Fluid Flow Rate (H2O Flow in)	Thrust Pressure (Downpressure) - (Pump 1)	Holdback Pressure (Feed Pressure)	Drill Fluid Volume Change (Ultra Sonic)	Drill Fluid Volume Change (Manual)	Fluoro Conc. Inlet (Rig Poly)	Fluoro Conc. Outlet (SRU)	Change in Fluoro Conc.	Temp	Density		ORP	pH	Change in pH	Electrical Conductivity	Change in Electrical Conductivity	DO	Change in DO	Turbidity	Change in Turbidity	Core Observations	Comments
-	-	-	mbgs	mbgs	cm/min	RPM	psi	psi	L/min	psi	psi	L >100L	L	ppb	ppb	% >20% change	(°C)	API Gravity	SG	mV	-	- >0.5 change	mS/cm	% >10% change	mg/L	- >10% change	NTU	- >10% change		
27-12-2019	5:50 PM	100	251.21	254.21	8.6	681	3278	0	44.2	2200	1196	-14	60.3	140.1	130.1	-7%	18.21	8.6	1.01	-93	11.05	-0.45	0.652	2%	7.82	-5%	1000	0%		
27-12-2019	7:00 PM	101	254.21	257.21	9.1	681	3189	0	45.3	2200	1207	24	-34.4	128.9	138.5	7%	18.51	8.6	1.01	-94	11.02	-0.03	0.659	1%	7.01	-10%	1000	0%		
28-12-2019	9:30 AM	102	257.21	260.21	7.56	660	3042	0	39.3	2200	1223	49	53.0	121.5	124.4	2%	21.05	8.6	1.01	-108	10.99	-0.03	0.641	-3%	7.09	1%	1000	0%		
28-12-2019	10:30 AM	103	260.21	263.21	7.5	661	2996	0	40.1	2200	1198	-177	146.7	120.1	126.9	6%	17.99	8.6	1.01	-105	10.74	-0.25	0.649	1%	6.52	-8%	1000	0%		
28-12-2019	12:30 PM	104	263.21	266.21	4.34	662	3310	0	38.6	2200	1149	208	-112.4	130.3	131.1	1%	17.61	8.6	1.01	-83	10.79	0.05	0.682	5%	7.27	12%	1000	0%		
28-12-2019	2:05 PM	105	266.21	269.21	6.61	653	3229	39	52.5	2200	1224	635	-6.2	129.8	132.2	2%	18.22	8.6	1.01	-72	10.8	0.01	0.707	4%	7.44	2%	1000	0%		
28-12-2019	4:06 PM	106	269.21	272.21	5.14	657	3337	21	43.5	2200	1245	900	-88.4	131.6	132.1	0%	16.39	8.6	1.01	-59	11.06	0.26	0.722	2%	7.5	1%	1000	0%		
28-12-2019	6:15 PM	107	272.21	275.21	6.03	611	3365	49	37.8	2200	1315	404	30.1	127.3	128.4	1%	18.44	8.6	1.01	-57	11.12	0.06	0.717	-1%	7.5	0%	1000	0%		
29-12-2019	9:00 AM	108	275.21	278.21	5.85	624	3258	37	38.6	2200	1156	131	177.9	156.6	159.7	2%	18.55	8.6	1.01	-124	12.01	0.89	0.744	4%	8.73	16%	1000	0%		
29-12-2019	1:55 PM	109	278.21	281.21	6.65	623	2976	18	36.3	2200	1307	-38	387.0	158.8	141.8	-11%	18.49	8.6	1.01	-72	12.26	0.25	0.787	6%	8.91	2%	1000	0%		
29-12-2019	3:58 PM	110	281.21	284.21	7.23	624	3192	47	42.3	2200	1311	65	-18.1	168.2	168.4	0%	14.75	8.6	1.01	-73	12.2	-0.06	0.833	6%	9.08	2%	1000	0%		
29-12-2019	7:30 PM	111	284.21	287.21	5.23	620	3209	19	43.5	2200	1224	79	94.3	162.5	113.9	-30%	14.21	8.6	1.01	-63	12.21	0.01	0.672	-19%	10.35	14%	1000	0%		
29-12-2019	9:00 PM	112	287.21	290.21	5.5	671	3214	9	37.8	2200	1101	79	40.6	130.1	129.9	0%	15.21	8.6	1.01	-120	12.21	0.00	0.669	0%	10.56	2%	1000	0%		
29-12-2019	10:00 PM	113	290.21	293.21	6.7	654	3235	26	37.4	2200	1311	-30	-16.4	128.5	135.1	5%	18.2	8.6	1.01	-104	12.21	0.00	0.667	0%	10.76	2%	1000	0%		
29-12-2019	11:00 PM	114	293.21	296.21	7.34	658	3336	0	38.6	2200	1177	73	-80.0	117.5	130.1	11%	18.1	8.6	1.01	-104	12	-0.21	0.67	0%	10.53	-2%	1000	0%		
30-12-2019	12:00 AM	115	296.21	299.21	7.2	630	3055	41	43.5	2200	1130	-79	-68.0	135.5	129.7	-4%	17.8	8.6	1.01	-99	12.11	0.11	0.687	3%	10.33	-2%	1000	0%		
30-12-2019	1:30 AM	116	299.21	302.21	8.1	639	2998	72	48	2200	1134	53	113.5	125.2	123.4	-1%	16.64	8.6	1.01	-80	11.91	-0.20	0.67	-2%	9.35	-9%	1000	0%		
30-12-2019	2:45 AM	117	302.21	305.21	7.3	625	3383	67	48.4	2200	1107	17	22.3	127.8	125.9	-1%	17.99	8.6	1.01	-83	12.07	0.16	0.666	-1%	9.98	7%	1000	0%		
30-12-2019	6:00 AM	118	305.21	308.21	8.5	663	3280	100	45.4	2200	1322	-89	10.4	109.1	101.9	-7%	18.1	8.6	1.01	-82	12.06	-0.01	0.65	-2%	8.69	-13%	1000	0%		
30-12-2019	7:00 AM	119	308.21	311.21	9.8	659	3166	49	51	2200	1275	-88	136.7	97.05	109	12%	18.5	8.6	1.01	-72	11.84	-0.22	0.65	0%	9.32	7%	1000	0%		
30-12-2019	8:45 AM	120	311.21	314.21	6.87	623	3266	70	39.3	2200	1197	-52	415.3	108.4	116.4	7%	17.98	8.6	1.01	-84	12.08	0.24	0.69	6%	8.25	-11%	1000	0%		
30-12-2019	11:35 AM	121	314.21	316.09	3.65	610	3056	372	35.2	2200	1286	40	-270.2	120.8	116	-4%	17.62	8.6	1.01	-107	11.81	-0.27	0.711	3%	9.07	10%	1000	0%		
30-12-2019	11:15 PM	122	316.09	317.21	8.4	657	2991	50	44.2	2200	1340	-46	-30.7	101.1	99.21	-2%	18.1	8.6	1.01	-91	12.06	0.25	0.69	-3%	8.57	-6%	1000	0%		
31-12-2019	12:30 AM	123	317.21	320.21	10.5	697	3322	53	44.2	2200	1374	54	5.4	95.6	99.1	4%	17.56	8.6	1.01	-93	12.11	0.05	0.67	-3%	8.63	1%	1000	0%		
31-12-2019	2:30 AM	124	320.21	323.21	8.7	701	3309	14	40.1	2200	1311	-57	-82.3	99.8	103.4	4%	18.01	8.6	1.01	-89	12.13	0.02	0.667	0%	8.87	3%	1000	0%		
31-12-2019	5:00 AM	125	323.21	326.21	7.8	707	3400	0	52.2	2200	1095	-1	44.3	103.1	96.1	-7%	19.13	8.6	1.01	-78	11.89	-0.24	0.681	2%	9.01	2%	1000	0%		
31-12-2019	6:00 AM	126	326.21	329.21	8.3	693	3365	34	39.3	2200	1246	-7	54.4	99.1	99.2	0%	17.47	8.6	1.01	-130	11.97	0.08	0.791	16%	8.65	-4%	1000	0%	Two Major Shear with very weak fraiable ground	
31-12-2019	7:00 AM	127	329.21	332.21	7.5	688	3568	53	46.1	2200	1262	-51	48.1	103.1	101.1	-2%	17.23	8.6	1.01	-123	11.89	-0.08	0.661	-16%	8.55	-1%	1000	0%		
31-12-2019	2:15 PM	128	332.21	335.21	9.27	684	3608	34	40.8	2200	1449	-87	-7.8	99.06	100.5	1%	12.96	8.6	1.01	-98	12.01	0.12	0.555	-16%	9.85	15%	1000	0%		
31-12-2019	3:40 PM	129	335.21	338.21	7.93	675	3510	35	38.6	2200	1346	-92	-27.8	100.9	103.4	2%	13.67	8.6	1.01	-90	11.79	-0.22	0.532	-4%	9.69	-2%	1000	0%		
31-12-2019	5:18 PM	130	338.21	341.21	7.67	693	3450	25	34.4	2200	1286	78	-74.7	103.8	98.88	-5%	13.6	8.6	1.01	-87	11.74	-0.05	0.549	3%	8.94	-8%	1000	0%		
31-12-2019	9:30 PM	131	341.21	344.21	8.01	669	3435	72	37.8	2200	1101	51	79.2	97.1	96.89	0%	18.52	8.6	1.01	-100	11.68	-0.06	0.562	2%	8.93	0%	1000	0%		
31-12-2019	10:30 PM	132	344.21	346.91	7.72	674	3506	63	38.2	2200	1215	-55	55.4	99.1	95.3	-4%	18.1	8.6	1.01	-95	11.9	0.22	0.571	2%	9.5	6%	1000	0%		
31-12-2019	11:10 PM	133	346.91	347.21	8.1	661	3408	19	41.2	2200	1198	18	-27.0	99	104.3	5%	17.45	8.6	1.01	-101	11.88	-0.02	0.567	-1%	9.2	-3%	1000	0%		
01-01-2020	1:00 AM	134	347.21	350.21	8.2	661	3578	79	32.9	2200	1187	-25	95.1	90.1	87.64	-3%	19.17	8.6	1.01	-112	11.61	-0.27	0.573	1%	8.55	-7%	1000	0%		
01-01-2020	2:00 AM	135	350.21	353.21	8.5	671	3323	53	42.3	2200	1211	71	140.5	85.33	84.88	-1%	18.01	8.6	1.01	-99	11.71	0.10	0.553	-3%	8.3	-3%	1000	0%		
01-01-2020	3:20 AM	136	353.21	356.21	7.9	661	3640	63	41.2	2200	1125	-72	-30.1	101.1	99.8	-1%	18.99	8.6	1.01	-129	11.62	-0.09	0.578	5%	7.78	-6%	1000	0%		
01-01-2020	4:30 AM	137	356.21	359.21	8.1	663	3634	63	38.2	2200	1314	83	-16.4	97.7	95.3	-2%	18.55	8.6	1.01	-110	11.7	0.08	0.58	0%	7.81	0%	1000	0%		
01-01-2020	5:45 AM	138	359.21	362.21	9.1	652	3489	75	59.7	2200	1287	73	44.5	94.1	102.2	9%	19.1	8.6	1.01	-103	12.01	0.31	0.561	-3%	8.78	12%	1000	0%		
01-01-2020	6:50 AM	139	362.21	365.21	9.5	643	3025	68	48.4	2200	1140	54	45.9	95.2	91.71	-4%	20.1	8.6	1.01	-120	11.5	-0.51	0.598	7%	7.98	-9%	1000	0%		
01-01-2020	9:50 AM	140	365.21	368.21	8.16	627	3293	19	38.6	2200	1325	-97	167.6	85.1	82.12	-4%	14.23	8.6	1.01	-94	11.6	0.10	0.465	-22%	8.88	11%	1000	0%		
01-01-2020	11:23 AM	141	368.21	371.21	8.99	654	3409	35	30.6	2200	1356	4	54.9	70.5	79.56	13%	15.44	8.6	1.01	74	11.38	-0.22	0.445	-4%	9.42	6%	1000	0%		
01-01-2020	12:50 PM	142	371.21	374.21	8.6	653	3367	15	34.8	2200	1262	65	163.5	75.35	77.57	3%	13.45	8.6	1.01	-75	11.78	0.40	0.498	12%	9.25	-2%	1000	0%		
01-01-2020	2:39 PM	143	374.21	377.21	7.85	665	3325	80	38.9	2200	1171	-165	175.8	75.41	76.25	1%	13.84	8.6	1.01	-97	11.52	-0.26	0.48	-4%	8.75	-5%	1000	0%		
01-01-2020	4:06 PM	144	377.21	380.21	9.76	642	3378	49	36.3	2200	1294	77	-163.4	79.26	77.54	-2%	14.74	8.6	1.01	-90	11.51	-0.01	0.491	2%	8.64	-1%	1000	0%		
01-01-2020	5:52 PM	145	380.21	383.21	9.05	651	3326	51	43.8	2200	1367	71	-101.6	77.83	75.86	-3%	16.39	8.6	1.01	-79	11.6	0.09	0.489	0%	8.59	-1%	1000	0%		
01-01-2020	9:40 PM	146	383.21	386.21	6.2	612	3086	98	48.4	2200	1249	-73	-83.8	79.3	80.13	1%	17.12	8.6	1.01	-65	11.43	-0.17	0.501	2%	8.97	4%	1000	0%		
01-01-2020	11:30 PM	147	386.21	389.21	5	675	3308	0	32.9	2200	1188	67	-51.0	81.2	80	-1%	18.01	8.6	1.01	-71	11.72	0.29	0.511	2%	8.45	-6%	1000	0%		
02-01-2020	1:30 AM	148	389.21	392.21	5.2	650	3278	103	51	2200	1334	-7	34.7	79.8	83.4	5%	17.58	8.6	1.01	-69	11.56	-0.16	0.505	-1%	8.01	-5%	1000	0%		
02-01-2020	3:00 AM	149	392.21	395.21	5.6	642	3494	72	40.8	2200	1240	-75	14.8	73.4	78.1	6%	19.95	8.6	1.01	-90	11.56	0.00	0.589	17%	9.51	19%	1000	0%		
04-01-2020	1:00 AM	150	395.21	398.21	3.8	701	2982	56	26.5	2200	1648	-51	-36.9	66.6	66.02	-1%	15.31	8.6	1.01	-81	11.23	-0.33	0.589	0%	9.06	-5%	1000	0%		
04-01-2020	2:30 AM	151	398.21	401.21	5.14	657	3632	53	41.6	2200	985	-27	114.1	69.1	68.2	-1%	17.32	8.6	1.01	-97	11.43	0.20	0.59	0%	9.31	3%	1000	0%		
04-01-2020	4:30 AM	152	401.21	403.32	4.98	687	3297	6	38.1	2200	1129	-11	70.5	65.6	70.1	7%	16.43	8.6	1.01	-88	11.23	-0.20	0.581	-2%	8.91	-4%	1000	0%		
04-01-2020	6:00 AM	153	403.32	404.21	4.25	674	3586	66	46.1	2200	1027	-36	-5.7	66.6	69.1	4%	16.1	8.6	1.01	-83	11.11	-0.12	0.578	-1%	8.64	-3%	1000	0%		
04-01-2020	1:45 PM	154	404.21	407.21	3.76	679	3184	12	33.3	2200	1214	160	315.4	88.23	89.03	1%	14.63	8.6	1.01	-87	11.27	0.16	0.349	-40%	9.13	6%	1000	0%		
04-01-2020	3:42 PM	155	407.21	410.21	5.3	669	3393	49	36.7	2200	1249	304	84.4	68.12	62.05	-9%	14.52	8.6	1.01	-58	11.22	-0.05	0.449	29%	9.1	0%	1000	0%		
04-01-2020	5:42 PM	156	410.21	413.21	6.54	642	2931	34	34.4	2200	1369	-8	-28.4	68.73	58.73	-15%	16.28	8.6	1.01	-54	11.13	-0.09	0.444	-1%	8.88	-2%	1000	0%		
05-01-2020	2:00 AM	150A	396.18	398.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
05-01-2020	5:00 AM	151A	398.21	401.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-96	-42.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
05-01-2020	8:55 PM	152A	401.21	404.21	10.07	678	2995	77	42.7	2200	1308	50	26.5	46.23	46.75	1%	16.39	8.6	1.01	-45	10.89	N/A	0.475	N/A	7.77	N/A	1000	N/A		
05-01-2020	10:17 AM	153A	404.21	407.21	8	656	3174	64	40.1	2200	1314	16	-33.7	46.3	46.87	1%	15.15	8.6	1.01	-51	11.08	0.19	0.496	4%	8.07	4%	1000	0%		
06-01-2020	10:05 AM	154A	407.21	410.21	3.65	595	3204	24	39.3	2200	1450	-2	-144.1	67.76	63.48	-6%	22.3	8.6	1.01	-62	11.09	0.01	0.47	-5%	8.76	9%	1000	0%		
06-01-2020	11:46 AM	155A	410.21	413.21	6.74	614	3237	74	35.9	2200	1346	111	44.1	65.31	64.38	-1%	19.12	8.6	1.01	-56	11.2	0.11	0.505	7%	11.73	34%	1000	0%		
06-01-2020	1:15 PM	157	413.21	416.21	7.84	606	3101	47	32.5	2200	1332	201	259.1	70.22	71.83	2%	17.31	8.6	1.01	-63	11.12	-0.08	0.526	4%	7.81	-33%	1000	0%		
06-01-2020	4:50 PM	158	416.21	419.21	6.15	618	3102	48	34.4	2200	1309	532	469.7	71.84	74.83	4%	13.55	8.6	1.01	-143	11.14	0.02	0.569	8%	7.45	-5%	1000	0%		
06-01-2020	10:00 PM	159	419.21	422.21	4.85	610	3467	47	42.3	2200	1050	-52	100.5	55.1	58.3	6%	17.96	8.6	1.01	-62	11.14	0.00	0.406	-29%	6.65	-11%	1000	0%		
07-01-2020	4:30 AM	160	422.21	425.21	6.1	670	3213	56	51.1	2200	1311	-78	71.4	143.2	139.5	-3%	15.57	8.6	1.01	-72	11.04	-0.10	0.399	-2%	8.21	23%	1000	0%		Fluorescein added to system
10-01-2020	6:00 PM	143	374.21	377.21	3.88	615	2676	29	35.2	2200	1142	43	-87.5	34.25	48.66	42%	11.36	8.6	1.01	-139	13.45	2.41	5.71	1331%	9.86	20%	1000	0%		
10-01-2020	10:30 PM	144	377.21	380.21	5.39	683	3168	54	46.1	2200	1077	29	-91.0	46.15	48.2	4%	13.4	8.6	1.01	-112	12.99	-0.46	5.45	-5%	8.96	-9%	1000	0%		
11-01-2020	1:30 AM	145	380.21	383.21	4.9	662	3097	49	40.5	2200	1104	-42	70.4	103.9	95.78	-8%	13.01	8.6	1.01	-121	13.1	0.11	4.87	-11%	8.9	-1%	1000	0%		
11-01-2020	3:00 AM	146	383.21	386.21	5.23	670	3298	31	51.2	2200	1209	-60	-9.6	93.3	90.02	-4%	15.47	8.6	1.01	-151	13.33	0.23	4.6	-6%	9.58	8%	1000	0%		
11-01-2020	4:30 AM	147	386.21	389.21	4.69	683	2983	5	32.5	2200	1139	-64	20.5	85.05	85.5	1%	16.01	8.6	1.01	-132	13.54	0.21	4.45	-3%	8.99	-6%	1000	0%		
11-01-2020	6:30 AM	148	389.21	392.21	4.95	663	2974	75	37.4	2200	1189	-92	11.8	95.23	102.2	7%	16.95	8.6	1.01	-167	13.45	-0.09	4.04	-9%	9.95	11%	1000	0%		
11-01-2020	12:00 PM	149	392.21	395.21	3.2	672	2478	50	35.9	2200	1288	14	7.2	51.45	73.14	42%	15.3	8.6	1.01	-163	13.95	0.50	3.55	-12%	10.25	3%	1000	0%		
13-01-2020	6:30 AM	149Dup	392.21	395.21	2.75	661	2801	3	47.2	2200	1612	-10	31.1	68.8	68.7	0%	16.3	8.6	1.01	-165	13.28	-0.67	1.18	-67%	8.27	-19%	1000	0%		
13-01-2020	9:00 AM	150	395.21	398.21	2.97	632	3022	10	40.8	2200	1172	207	175.7	56.41	53.55	-5%	18.66	8.6	1.01	-121	12.59	-0.69	0.878	-26%	8.81	7%	1000	0%		
13-01-2020	11:45 AM	151	398.21	401.21	2.87	671	3147	10	40.4	2200	1361	191	120.8	55.55	52.19	-6%	18.05	8.6	1.01	-149	12.76	0.17	0.836	-5%	9.9	12%	1000	0%		
13-01-2020	2:00 PM	152	401.21	404.21	3.25	691	2459	10	31.8	2200	1782	343	191.8	69.42	68.87	-1%	14.95	8.6	1.01	-128	12.65	-0.11	0.821	-2%	8.93	-10%	1000	0%		
13-01-2020	4:00 PM	153	404.21	407.21	4.03	674	2803	16	35.9	2200	1329	684	62.4	69.15	69.04	0%	14.72	8.6	1.01	-70	12.33	-0.32	0.766	-7%	9.38	5%	1000	0%		
13-01-2020	6:10 PM	154	407.21	410.21	5.5	678	3196	34	42	2200	1113	216	36.0	67.95	69.38	2%	15.71	8.6	1.01	-97	12.48	0.15	0.843	10%	9.96	6%	1000	0%		
14-01-2020	12:00 AM	155	410.21	413.21	3.99	652	3178	48	49.1	2200	1425	87	30.5	79.85	77.1	-3%	19.9	8.6	1.01	-125	12.65	0.17	0.834	-1%	8.63	-13%	1000	0%		
14-01-2020	5:00 AM	156	413.21	416.21	4.12	671	3232	37	39.3	2200	1332	96	-18.6	75.4	71.2	-6%	19.01	8.6	1.01	-121	12.56	-0.09	0.845	1%	8.71	1%	1000	0%		
14-01-2020	7:00 AM	157	416.21	419.21	3.89	693	2444	62	57.5	2200	1485	3,350	131.3	68.82	69.99	2%	18.95	8.6	1.01	-130	12.55	-0.01	0.844	0%	8.81	1%	1000	0%		
14-01-2020	10:25 AM	158	419.21	422.21	5.71	706	2917	42	38.9	2200	1323	2,454	-9.4	72.91	70.7	-3%	17.58	8.6	1.01	-59	12.39	-0.16	0.664	-21%	10.06	14%	1000	0%		
14-01-2020	12:20 AM	159	422.21	425.21	5.73	696	2762	22	35.2	2200	1570	518	42.8	54.75	52.57	-4%	17.78	8.6	1.01	-114	12.45	0.06	0.618	-7%	9.23	-8%	1000	0%		
15-01-2020	5:20 AM	160	425.21	428.21	6.01	604	3373	64	35.2	2200	1367	435	29.6	89.21	88.93	0%	16.66	8.6	1.01	-99	12.39	-0.06	0.602	-3%	10.2	11%	1000	0%		
15-01-2020	7:00 AM	161	428.21	431.21	5.91	583	3959	106	34.8	2200	1232	281	21.3	87.21	89.55	3%	16.04	8.6	1.01	-103	12.43	0.04	0.612	2%	10.21	0%	1000	0%		
15-01-2020	11:50 AM	162	431.21	434.21	3.28	683	2791	144	37	2200	1304	103	318.6	82.15	74.17	-10%	18.7	8.6	1.01	-138	12.31	-0.12	0.679	11%	9.26	-9%	1000	0%		
15-01-2020	2:00 PM	163	434.21	437.21	3.11	665	3291	63	31	2200	1231	358	-11.9	63.84	63.18	-1%	17.5	8.6	1.01	-60	12.03	-0.28	0.612	-10%	13.6	47%	1000	0%		
15-01-2020	4:00 PM	164	437.21	440.21	2.87	663	3217	210	32.5	2200	1458	-94	-52.1	53.59	53.74	0%	17.55	8.6	1.01	-89	12.09	0.06	0.697	14%	9.86	-28%	1000	0%		
16-01-2020	4:30 AM	165	440.21	443.21	2.02	634	2869	103	36.7	2200	1182	94	17.6	80.51	81.92	2%	17.23	8.6	1.01	-110	12.14	0.05	0.562	-19%	9.51	-4%	1000	0%		
16-01-2020	6:45 AM	166	443.21	446.21	3.5	626	3009	141	35.2	2200	1208	97	59.5	81.13	81.71	1%	18.23	8.6	1.01	-105	12.13	-0.01	0.589	5%	9.73	2%	1000	0%		
16-01-2020	10:45 AM	167	446.21	449.21	3.1	626	2973	89	28	2200	1291	472	662.6	81.7	82.69	1%	13.19	8.6	1.01	-32	11.91	-0.22	0.552	-6%	15.54	60%	1000	0%		
16-01-2020	2:50 PM	168	449.21	452.21	2.96	598	2867	156	27.2	2200	1168	514	-60.0	81.85	76.99	-6%	15.1	8.6	1.01	-91	11.79	-0.12	0.556	1%	10.29	-34%	1000	0%		
16-01-2020	9:00 PM	169	452.21	455.21	3.05	670	2781	95	35.5	2200	1213	608	33.1	69.94	83.82	20%	15.71	8.6	1.01	-100	11.62	-0.17	0.553	-1%	8.84	-14%	1000	0%		
16-01-2020	11:45 PM	170	455.21	458.21	2.5	632	2645	124	39.7	2200	1431	432	-88.9	81.23	79.76	-2%	17.29	8.6	1.01	-95	11.32	-0.30	0.545	-1%	9.55	8%	1000	0%		
17-01-2020	1:45 AM	171	458.21	460.25	2.85	632	2645	173	33.6	2200	1304	210	0.6	80.56	81.24	1%	16.55	8.6	1.01	-102	11.43	0.11	0.561	3%	10.02	5%	1000	0%		
17-01-2020	8:42 AM	172	460.25	461.21	4.7	604	2516	163	26.8	2200	1708	267	48.4	76.79	76.65	0%	20.1	8.6	1.01	-63	11	-0.43	0.532	-5%	8.04	-20%	1000	0%		
17-01-2020	11:01 AM	173	461.21	464.21	4.62	634	2231	327	26.8	2200	1583	225	21.9	77.54	74.61	-4%	17.48	8.6	1.01	-72	11.12	0.12	0.586	10%	12.87	60%	1000	0%		
17-01-2020	12:38 PM	174	464.21	467.21	4.54	620	2571	106	27.2	2200	1394	338	166.3	74.44	78.87	6%	17.7	8.6	1.01	-77	11.09	-0.03	0.593	1%	12.09	-6%	1000	0%		
17-01-2020	3:25 PM	175	467.21	470.21	4.2	626	2325	86	24.6	2200	1557	335	41.5	78.27	76.34	-2%	16.2	8.6	1.01	-91	11.16	0.07	0.604	2%	12.96	7%	1000	0%		
17-01-2020	5:43 PM	176	470.21	473.21	4.03	619	2470	112	25.3	2200	1481	56	-7.6	76.28	72.66	-5%	18.1	8.6	1.01	-105	11.26	0.10	0.616	2%	7.9	-39%	1000	0%		

NWMO IGNACE DRILLING - FIELD DATA

DRILL MONITORING PARAMETERS

					Drill Parameters							Drill Fluid Parameters																	Notes	
Date	Time	Core Run #	Top of Run	Bottom of Run	ROP	Bit Rotation Speed (Head RPM)	Torque (Torque Pressure)	Injection Fluid Pressure (H2O Pressure In)	Down hole Fluid Flow Rate (H2O Flow in)	Thrust Pressure (Downpressure) - (Pump 1)	Holdback Pressure (Feed Pressure)	Drill Fluid Volume Change (Ultra Sonic)	Drill Fluid Volume Change (Manual)	Fluoro Conc. Inlet (Rig Poly)	Fluoro Conc. Outlet (SRU)	Change in Fluoro Conc.	Temp	Density		ORP	pH	Change in pH	Electrical Conductivity	Change in Electrical Conductivity	DO	Change in DO	Turbidity	Change in Turbidity	Core Observations	Comments
-	-	-	mbgs	mbgs	cm/min	RPM	psi	psi	L/min	psi	psi	L	L	ppb	ppb	%	(°C)	API Gravity	SG	mV	-	-	mS/cm	%	mg/L	-	NTU	-		
												>100L				>20% change						>0.5 change		>10% change		>10% change		>10% change		
17-01-2020	9:45 PM	177	473.21	476.21	3.8	617	2534	174	38.2	2200	1182	212	13.9	75.24	75.55	0%	16.88	8.6	1.01	-82	11.31	0.05	0.612	-1%	9.51	20%	1000	0%		
18-01-2020	12:00 AM	178	476.21	479.21	3.87	626	2636	137	30.2	2200	1315	186	4.5	75.74	79.13	4%	17.23	8.6	1.01	-109	11.35	0.04	0.623	2%	8.56	-10%	1000	0%		
18-01-2020	3:00 AM	179	479.21	482.21	2.9	611	2298	196	42	2200	1925	-165	72.5	71.23	68.56	-4%	15.56	8.6	1.01	-91	11.13	-0.22	0.617	-1%	9.18	7%	1000	0%		
18-01-2020	8:00 AM	180	482.21	485.08	4.87	585	2793	67	20.8	2200	1252	3,350	203.0	66.7	66.73	0%	16.9	8.6	1.01	-142	11.29	0.16	0.569	-8%	8.24	-10%	1000	0%		
18-01-2020	8:20 AM	181	485.08	485.21	4.52	592	2632	81	21.2	2200	1113	-15	-19.9	67.1	66.8	0%	16.7	8.6	1.01	-132	11.21	-0.08	0.579	2%	8.97	9%	1000	0%		
18-01-2020	9:31 AM	182	485.21	488.21	6.77	616	2807	147	28.7	2200	1156	134	219.5	72.44	73.12	1%	14.3	8.6	1.01	-102	11.03	-0.18	0.563	-3%	8.71	-3%	1000	0%		
18-01-2020	12:35 PM	183	488.21	491.21	6.7	627	2484	91	23.8	2200	1598	340	62.0	71.14	73.54	3%	14.9	8.6	1.01	-76	10.93	-0.10	0.594	6%	14.07	62%	1000	0%		
18-01-2020	3:20 PM	184	491.21	494.21	7.37	625	2639	224	29.5	2200	1184	-98	46.5	72.52	73.37	1%	13.9	8.6	1.01	-123	11.08	0.15	0.604	2%	11.81	-16%	1000	0%		
18-01-2020	5:05 PM	185	494.21	497.21	6.74	635	2681	121	28.4	2200	1437	221	-36.5	71.71	72.52	1%	14.8	8.6	1.01	-48	10.93	-0.15	0.607	0%	9.43	-20%	1000	0%		
19-01-2020	3:00 AM	186	497.21	500.21	5.4	547	2835	68	22.7	2400	1197	341	14.5	69.86	70.25	1%	20.28	8.6	1.01	-84	9.72	-1.21	0.304	-50%	3.76	-60%	1000	0%		
19-01-2020	5:30 AM	187	500.21	503.21	4.1	581	2714	101	20.8	2400	1152	575	255.8	65.56	64.38	-2%	18.5	8.6	1.01	-91	10.71	0.99	0.623	105%	4.06	8%	1000	0%		
19-01-2020	8:15 AM	188	503.21	506.21	5.9	635	2845	188	29.1	2400	1177	2,684	91.5	62.17	60.02	-3%	16.7	8.6	1.01	88	10.51	-0.20	0.635	2%	3.6	-11%	1000	0%		
19-01-2020	1:55 PM	189	506.21	509.21	3.8	450	2567	146	26.1	2400	1478	770	76.0	54.37	48.55	-11%	13.5	8.6	1.01	133	10.2	-0.31	0.478	-25%	5.18	44%	1000	0%		
19-01-2020	3:49 PM	190	509.21	512.21	4.1	657	2237	163	31	2400	1115	62	76.3	50.15	50.16	0%	13.8	8.6	1.01	124	10.28	0.08	0.519	9%	3.58	-31%	1000	0%		
19-01-2020	5:26 PM	191	512.21	515.21	5.1	642	2708	187	35.5	2400	1224	-43	94.8	49.06	46.4	-5%	14.9	8.6	1.01	117	10.29	0.01	0.509	-2%	3.74	4%	1000	0%		
19-01-2020	10:30 PM	192	515.21	518.21	6.21	667	3121	134	26.8	2400	1292	836	65.2	50.1	48.88	-2%	15.55	8.6	1.01	120	10.35	0.06	0.499	-2%	3.85	3%	1000	0%		
20-01-2020	12:45 AM	193	518.21	521.21	6.67	586	2936	134	25.3	2400	1352	628	48.6	48.99	51.27	5%	15.92	8.6	1.01	108	10.38	0.03	0.521	4%	3.97	3%	1000	0%		
20-01-2020	2:45 AM	194	521.21	524.21	6.43	614	2714	121	26.1	2400	1294	1,182	27.8	50.67	48.71	-4%	14.68	8.6	1.01	98	10.54	0.16	0.507	-3%	3.83	-4%	1000	0%		
20-01-2020	4:30 AM	195	524.21	526.97	7.32	604	2714	143	28.4	2400	1420	-268	23.5	46.52	46.67	0%	17.86	8.6	1.01	107	10.45	-0.09	0.511	1%	3.65	-5%	1000	0%		
20-01-2020	5:00 AM	196	526.97	527.21	6.9	613	2945	135	31.2	2400	1346	527	-27.7	47.59	45.87	-4%	17.01	8.6	1.01	113	10.47	0.02	0.514	1%	3.74	2%	1000	0%		
20-01-2020	6:45 AM	197	527.21	530.21	5.9	625	2898	199	24.6	2400	1280	565	4.0	50.49	51.22	1%	14.69	8.6	1.01	105	10.29	-0.18	0.55	7%	3.51	-6%	1000	0%		
20-01-2020	8:38 AM	198	530.21	533.21	4.8	668	2631	197	32.1	2400	1486	722	84.5	48.87	46.53	-5%	16	8.6	1.01	101	10.32	0.03	0.613	11%	3.51	0%	1000	0%		
20-01-2020	10:24 AM	199	533.21	536.21	5.6	670	2695	104	25.7	2400	1124	-108	-126.3	45.61	50.14	10%	16.8	8.6	1.01	78	10.36	0.04	0.603	-2%	11.48	227%	1000	0%		
20-01-2020	12:05 PM	200	536.21	539.21	5.3	647	2656	176	29	2400	1632	518	210.0	48.96	48.43	-1%	16.8	8.6	1.01	110	10.36	0.00	0.616	2%	9.93	-14%	1000	0%		
20-01-2020	2:01 PM	201	539.21	542.21	5	651	2738	184	36.3	2400	1169	792	197.8	49.21	51.44	5%	18.1	8.6	1.01	119	10.3	-0.06	0.635	3%	14.57	47%	1000	0%		
20-01-2020	3:58 PM	202	542.21	545.21	4.5	631	2829	170	36.7	2400	1176	548	48.0	50.23	49.79	-1%	18.2	8.6	1.01	96	10.26	-0.04	0.648	2%	10.21	-30%	1000	0%		
21-01-2020	12:30 AM	203	545.21	548.21	5.26	616	2855	211	23.4	2400	1299	380	-31.0	115.78	107.98	-7%	15.72	8.6	1.01	118	10.45	0.19	0.56	-14%	9.96	-2%	1000	0%		
21-01-2020	2:00 AM	204	548.21	551.21	6.56	640	2663	171	24.6	2400	1307	1,061	44.9	107.1	110.43	3%	14.7	8.6	1.01	142	10.31	-0.14	0.562	0%	10.58	6%	1000	0%		
21-01-2020	3:35 AM	205	551.21	554.21	5.83	702	2689	186	25.3	2400	1310	641	1.1	106.99	109.56	2%	14.98	8.6	1.01	125	10.41	0.10	0.56	0%	10.07	-5%	1000	0%		
21-01-2020	5:00 AM	206	554.21	557.21	5.27	671	2667	212	28.7	2400	1174	1,139	76.1	103.5	99.89	-3%	15.66	8.6	1.01	146	10.45	0.04	0.596	6%	9.88	-2%	1000	0%		
21-01-2020	7:00 AM	207	557.21	560.21	6.32	667	2544	111	30.2	2400	1290	1,148	43.9	101.29	100.07	-1%	16.04	8.6	1.01	129	10.46	0.01	0.582	-2%	10.15	3%	1000	0%		
21-01-2020	8:39 AM	208	560.21	563.21	4.7	713	2771	208	35.2	2400	1196	1,125	-42.4	97.97	92.38	-6%	16.2	8.6	1.01	130	10.23	-0.23	0.627	8%	11.94	18%	1000	0%		
21-01-2020	11:54 AM	209	563.21	566.21	5.1	726	2610	208	34.3	2400	1449	513	14.4	98.76	102.6	4%	15.7	8.6	1.01	167	10.14	-0.09	0.643	3%	10.91	-9%	1000	0%		
21-01-2020	1:47 PM	210	566.21	569.21	4.3	728	2503	183	37.4	2400	1355	2,466	112.5	99.69	96.07	-4%	16.4	8.6	1.01	170	10.22	0.08	0.663	3%	8.19	-25%	1000	0%		
21-01-2020	8:00 PM	211	569.21	572.21	6.2	726	2790	250	32.5	2400	1329	621	21.1	93.08	97.09	4%	17.06	8.6	1.01	49	10.18	-0.04	0.681	3%	10.03	22%	1000	0%		
21-01-2020	9:30 PM	212	572.21	575.21	6.38	678	2565	181	35.5	2400	1540	1,043	5.9	98.81	100.57	2%	16.93	8.6	1.01	110	10.39	0.21	0.67	-2%	10.57	5%	1000	0%		
21-01-2020	11:00 PM	213	575.21	578.21	7.67	659	2264	191	36.3	2400	1862	1,741	187.4	101.65	97.85	-4%	16.98	8.6	1.01	104	10.38	-0.01	0.65	-3%	10.09	-5%	1000	0%		
22-01-2020	3:15 AM	214	578.21	581.21	7.23	666	2252	281	35.9	2400	1647	1,861	264.3	125.98	120.13	-5%	14.57	8.6	1.01	137	10.21	-0.17	0.526	-19%	9.58	-5%	1000	0%		
13-02-2020	7:30 PM	215	581.21	584.21	6.06	646	2600	218	35.9	2400	1813	2,582	1269.9	137	113.6	-17%	11.22	8.6	1.01	166	9.22	-0.99	0.929	77%	6.94	-28%	624	-38%		
14-02-2020	12:30 AM	216	584.21	587.21	5.52	564	3176	51	27.2	2400	1491	1,284	931.8	131.3	127.9	-3%	10.94	10.0	1	202	10.33	1.11	0.38	-59%	7.11	2%	711	14%		
14-02-2020	2:30 AM	217	587.21	590.21	5.52	577	2825	130	27.6	2400	1445	2,112	1037.0	125.1	123.5	-1%	9	10.0	1	317	9.78	-0.55	0.626	65%	7.18	1%	1000	41%		
14-02-2020	4:45 AM	218	590.21	593.21	4.82	557	2994	104	31.2	2400	1354	1,233	775.1	120.86	121.94	1%	11.45	10.0	1	180	10.37	0.59	0.578	-8%	7.72	8%	1000	0%		
16-02-2020	10:00 PM	219	593.21	596.21	4.8	573	2804	93	21.2	2400	1283	1,293	9.3	105.56	108.6	3%	9.56	10.0	1	53	12.99	2.62	8.51	1372%	9.49	23%	903	-10%		
16-02-2020	11:30 PM	220	596.21	599.21	7.5	646	2804	147	22.7	2400	1314	761	4.5	103.21	100.41	-3%	10.14	10.0	1	88	12.92	-0.07	7.46	-12%	9.64	2%	853	-6%		
17-02-2020	1:00 AM	221	599.21	602.21	6.12	643	2697	127	23.1	2400	1505	669	73.4	101.13	99.42	-2%	11.9	10.0	1	88	13.04	0.12	6.47	-13%	9.17	-5%	1000	17%		
17-02-2020	3:00 AM	222	602.21	605.21	6.5	653	2987	89	24.8	2400	1345	643	82.7	100.87	101.6	1%	11.35	10.0	1	48	13.11	0.07	6.61	2%	9.23	1%	1000	0%		
17-02-2020	5:15 AM	223	605.21	608.21	5.56	676	2805	233	29.5	2400	1372	3,343	3.9	100.04	99.35	-1%	12.05	10.0	1	76	12.96	-0.15	5.55	-16%	9.13	-1%	1000	0%		
17-02-2020	7:30 AM	224	608.21	611.21	6.01	654	2775	292	29.5	2400	1271	3,268	51.9	99.98	101.17	1%	11.65	10.0	1	71	12.97	0.01	5.01	-10%	9.65	6%	1000	0%		
17-02-2020	10:17 AM	225	611.21	614.21	2.77	623	2485	185	30.6	2300	1266	2,980	76.7	88.06	83.94	-5%	16.01	8.4	1.01	45	12.74	-0.23	6.75	35%	8.89	-8%	1000	0%		
17-02-2020	12:57 PM	226	614.21	617.21	4.71	581	2565	229	20.9	2300	1280	2,128	-19.9	91.49	92	1%	15.22	8.4	1.01	39	12.71	-0.03	6.07	-10%	9.98	12%	1000	0%		
17-02-2020	2:31 PM	227	617.21	620.21	10.34	624	2639	212	35.2	2300	1684	1,717	44.9	88.58	98.62	11%	15.6	8.4	1.01	45	12.75	0.04	5.2	-14%	9.14	-8%	1000	0%		
17-02-2020	4:04 PM	228	620.21	623.21	7.97	612	2677	251	40.1	2300	1746	1,875	-47.3	102.9	104.9	2%	16.12	8.4	1.01	39	12.81	0.06	5.04	-3%	8.74	-4%	935	-7%		
17-02-2020	10:00 PM	229	623.21	626.21	8.41	541	2401	242	26.1	2300	1718	809	18.8	108.8	109.2	0%	15.28	8.4	1.01	14	12.88	0.07	5.63	12%	6.4	-27%	1000	7%		
17-02-2020	11:00 PM	230	626.21	629.21	7.56	567	2898	219	27.6	2300	1698	1,496	-30.0	105.8	106.5	1%	16.28	8.4	1.01	31	12.87	-0.01	5.22	-7%	7.05	10%	1000	0%		
18-02-2020	12:00 AM	231	629.21	632.21	7.98	610	2594	219	31.4	2300	1738	525	52.3	103.8	101.32	-2%	18.98	8.4	1.01	36	12.91	0.04	5.13	-2%	10.81	53%	1000	0%		
18-02-2020	1:05 AM	232	632.21	635.21	6.27	528	2584	197	30.6	2300	1407	2,079	0.5	100.09	98.8	-1%	16.06	8.4	1.01	54	12.89	-0.02	5.11	0%	9.55	-12%	1000	0%		
18-02-2020	3:05 AM	233	635.21	638.21	514	569	2704	256	31.4	2300	1431	1,962	12.3	103.5	99.5	-4%	15.76	8.4	1.01	37	12.91	0.02	5.08	-1%	9.2	-4%	1000	0%		
18-02-2020	5:30 AM	234	638.21	641.21	4.73	562	2937	216	35.5	2300	1350	1,212	25.9	104.4	103.43	-1%	16.28	8.4	1.01	53	12.88	-0.03	4.68	-8%	8.37	-9%	1000	0%		
18-02-2020	8:00 AM	235	641.21	644.21	4.7	588	2893	193	33.6	2300	1238	709	34.7	103.98	104.45	0%	15.98	8.4	1.01	49	12.87	-0.01	4.78	2%	8.31	-1%	1000	0%		
18-02-2020	10:09 AM	236	644.21	647.21	5.2	531	2865	115	27.6	2300	1237	690	26.6	111.7	115.5	3%	14.78	8.4	1.01	44	12.65	-0.22	4.48	-6%	6.4	-23%	1000	0%		
18-02-2020	12:35 PM	237	647.21	650.21	4.8	583	2920	142	28.4	2300	1327	1,405	284.5	111.3	109.6	-2%	14.48	8.4	1.01	29	12.82	0.17	4.29	-4%	9.39	47%	1000	0%		
18-02-2020	3:15 PM	238	650.21	653.21	5.4	601	2638	310	27.6	2300	1459	661	40.1	111.1	109.5	-1%	13.9	8.4	1.01	12	12.39	-0.43	4.17	-3%	5.74	-39%	849	-15%		
18-02-2020	5:06 PM	239	653.21	656.21	5	543	3007	279	28.7	2300	1229	751	8.7	108.7	111.7	3%	13.95	8.4	1.01	16	12.36	-0.03	3.92	-6%	6.22	8%	1000	18%		
18-02-2020	9:15 PM	240	656.21	659.21	6.73	581	2766	306	36.7	2300	1425	1,745	38.3	104.4	107.8	3%	14.95	8.6	1.01	20	12.35	-0.01	4.01	2%	7.43	19%	1000	0%		
18-02-2020	11:00 PM	241	659.21	662.21	6.75	594	2880	223	35.9	2300	1422	659	60.2	105.7	105	-1%	13.58	8.6	1.01	15	12.54	0.19	3.99	0%	8.68	17%	1000	0%		
19-02-2020	12:30 AM	242	662.21	665.21	6.77	572	2776	244	34.8	2300	1526	910	58.3	103.8	104.6	1%	15.55	8.6	1.01	21	12.39	-0.15	3.76	-6%	7.39	-15%	1000	0%		
19-02-2020	2:00 AM	243	665.21	668.21	6.2	591	2385	248	35.5	2300	1454	751	64.5	101.7	103.3	2%	17.99	8.6	1.01	25	12.45	0.06	3.87	3%	10.07	36%	1000	0%		
19-02-2020	3:30 AM	244	668.21	671.21	5.85	587	2586	291	34.8	2300	1531	681	38.4	98.9	104.5	6%	15.28	8.6	1.01	11	12.4	-0.05	3.75	-3%	9.46	-6%	1000	0%		
19-02-2020	5:10 AM	245	671.21	674.21	6.08	524	2766	229	37.4	2300	1434	600	29.7	109.7	106.4	-3%	13.17	8.6	1.01	24	12.22	-0.18	3.3	-12%	8.45	-11%	1000	0%		
19-02-2020	8:00 AM	246	674.21	677.21	6.43	593	2641	208	34	2300	1822	1,112	41.0	110.4	108.8	-1%	15.3	8.6	1.01	27	12.25	0.03	3.41	3%	10.16	20%	1000	0%		
19-02-2020	10:02 AM	247	677.21	680.21	5.4	621	2636	214	32.9	2300	1389	1,071	28.5	114.4	109.8	-4%	12.04	8.4	1.01	10	12.36	0.11	3.18	-7%	5.33	-48%	1000	0%		
19-02-2020	2:42 PM	248	680.21	683.21	5.8	645	2901	135	28	2300	1326	434	-34.1	95.12	99.21	4%	10.46	8.4	1.01	35	12.23	-0.13	2.68	-16%	8.23	54%	1000	0%		
19-02-2020	4:32 PM	249	683.21	686.21	4.8	625	2869	217	42.7	2300	1637	1,001	77.0	96.73	91.57	-5%	12.64	8.4	1.01	61	12.51	0.28	2.19	-18%	5.03	-39%	1000	0%		
19-02-2020	6:16 PM	250	686.21	689.21	6	579	2591	181	31.8	2300	1430	1,125	25.5	90.85	90.47	0%	12.71	8.4	1.01	65	12.09	-0.42	2.01	-8%	8.82	75%	1000	0%		
19-02-2020	9:00 PM	251	689.21	692.21	5.07	607	2481	233	35.2	2300	1519	868	37.6	94.14	91.45	-3%	12.86	8.4	1.01	74	11.93	-0.16	1.89	-6%	10.02	14%	1000	0%		
20-02-2020	12:00 AM	252	692.21	695.21	4.95	596	2576	147	34.8	2300	1482	1,125	83.5	96.61	94.3	-2%	11.05	8.4	1.01	65	11.95	0.02	1.84	-3%	9	-10%	1000	0%		
20-02-2020	2:00 AM	253	695.21	698.21	5.15	594	2324	215	27.2	2300	1759	1,025	56.7	95.5	94.11	-1%	13.5	8.4	1.01	59	11.87	-0.08	1.8	-2%	9.23	3%	1000	0%		
20-02-2020	3:45 AM	254	698.21	701.21	4.99	590	2674	178	24.2	2300	1381	455	72.4	93.81	95.87	2%	14.5	8.4	1.01	61	11.79	-0.08	1.75	-3%	8.94	-3%	1000	0%		
20-02-2020	7:00 AM	255	701.21	704.21	4.8	587	2316	256	24.6	2300	1537	1,154	88.0	94.2	94.5	0%	15.72	8.4	1.01	52	11.74	-0.05	1.74	-1%	9.6	7%	1000	0%		
20-02-2020	10:54 AM	256	704.21	707.21	5.3	615	2540	390	26.8	2300	1462	1,819	44.1	87.52	84.05	-4%	13.59	8.4	1.01	38	12.01	0.27	1.67	-4%	9.72	1%	1000	0%		
20-02-2020	13:35	257	707.21	710.21	4.7	602	2752	281	38.6	2300	1482	1,515	-2.2	100.9	99.4	-1%	13.18	8.4	1.01	50	12.05	0.04	1.62	-3%	6.62	-32%	1000	0%		
21-02-2020	11:47 AM	258	710.21	711.14	7.2	619	2421	221	29.1	2300	2022	544	-84.3	100.8	99.94	-1%	15.51	8.4	1.01	32	11.97	-0.08	1.45	-10%	6.89	4%	1000	0%		
21-02-2020	2:26 PM	259	711.14	714.14	6.1	652	2651	231	34.8	2300	1674	895	-53.0	98.12	99.52	1%	13.61	8.4	1.01	39	11.95	-0.02	1.39	-4%	12.82	86%	1000	0%		
21-02-2020	4:37 PM	260	714.14	717.14	5.9	657	2811	207	32.9	2300	1516	796	34.3	102.3	104.9	3%	12.91	8.4	1.01	41	11.93	-0.02	1.32	-5%	10.54	-18%	1000	0%		
21-02-2020	6:45 PM	261	717.14	720.14	6.4	609	2790	185	31	2300	1520	1,120	-8.5	105.1	107.5	2%	11.89	8.4	1.01	37	11.89	-0.04	1.34	2%	7.28	-31%	1000	0%		
21-02-2020	9:00 PM	262	720.14	723.14	5.75	601	2862	221	32.9	2300	1288	1,123	-5.8	105.5	105	0%	12.87	8.4	1.01	38	11.81	-0.08	1.32	-1%	10.67	47%	1000	0%		
21-02-2020	11:00 PM	263	723.14	726.14	6.61	687	2902	198	33.2	2300	1476	409	2.6	104.7	105.32	1%	13.87	8.4	1.01	43	11.77	-0.04	1.34	2%	7.96	-25%	1000	0%		
22-02-2020	12:50 AM	264	726.14	729.14	6.87	702	2895	204	28.7	2300	1358	1,626	-20.6	105.98	103.87	-2%	15.56	8.4	1.01	29	11.78	0.01	1.34	0%	8.05	1%	1000	0%		
22-02-2020	2:30 AM	265	729.14	729.69	4.35	622	2664	202	34.8	2300	1957	271	126.1	106.67	105.25	-1%	14.71	8.4	1.01	32	11.77	-0.01	1.35	1%	10	24%	1000	0%		
24-02-2020	3:30 AM	266	729.69	732.14	4.5	521	3216	163	34	2300	1384	1,738	654.8	100.9	98.86	-2%	18.98	8.4	1.01	72	12.21	0.44	2.18	61%	9.98	0%	1000	0%		
24-02-2020	6:30 AM	267	732.14	735.14	5.36	439	3272	168	37.4	2300	1573	1,946	1003.2	97.47	95.14	-2%	14.54	8.4	1.01	137	11.52	-0.69	0.635	-71%	9.96	0%	1000	0%		
29-02-2020	8:30 PM	268	735.14	738.14	2.5	528	3350	141	34.8	2300	2264	1,931	1335.1	81.44	82.56	1%	876	8.4	1.01	-155	10.97	-0.55	0.441	-31%	5.62	-44%	876	-12%		
03/01/20	12:16 AM	269	738.14	741.14	6.45	459	3084	309	35.9	2300	1562	1,051	-92.2	114	96.96	-15%	12.92	8.4	1.01	85	10.33	-0.64	0.436	-1%	9.34	66%	600	-32%		
03/01/20	2:25 AM	270	741.14	744.14	3.9	462	2931	534	35.2	2300	1335	1,393	-140.7	94.95	90.25	-5%	11.2	8.4	1.01	42	10.19	-0.14	0.247	-43%	8.91	-5%	1000	67%		
03/01/20	5:30 AM	271	744.14	747.14	3.78	441	3054	428	3.8	2300	1182	1,149	-447.9	88.44	92.18	4%	10.17	8.4	1.01	57	10.34	0.15	0.225	-9%	8.36	-6%	1000	0%		
03/01/20	9:34 AM	272	747.14	750.14	3.3	517	3117	320	29.1	2300	1298	1,099	926.1	80.66	84.35	5%	14.57	8.4	1.01	25	10.67	0.33	0.337	50%	6.57	-21%	1000	0%		
03/01/20	12:16	273	750.14	753.14	6.1	503	2765	309	23.1	2300	1480	908	410.7	91.92	93.66	2%	12.45	8.4	1.01	6	10.76	0.09	0.883	162%	6.61	1%	1000	0%		
03/01/20	13:40	274	753.14	756.14	6.3	506	2894	167	24.6	2300	1562	1,141	484.1	88.64	88.01	-1%	12.71	8.4	1.01	-5	10.66	-0.10	0.933	6%	12.06	82%	1000	0%		
03/01/20	15:42	275	756.14	759.14	5.3	484	3276	123	23.8	2300	1215	1,455	745.9	96.52	87.77	-9%	13.29	8.4	1.01	55	10.63	-0.03	0.899	-4%	6.37	-47%	1000	0%		
03/01/20	17:33	276	759.14	762.14	5.3	485	3288	192	26.5	2300	1379	1,116	693.4	90.3	88.99	-1%	13.01	8.4	1.01	-6	10.74	0.11	0.841	-6%	7.36	16%	1000	0%		
03/01/20	19:54	277	762.14	765.14	6.7	488	3163	169	24.9	2300	1616	979	667.6	91.56	91.65	0%	12.45	8.4	1.01	70	10.53	-0.21	0.699	-17%	7.51	2%	1000	0%		
43833	10:05 PM	278	765.14	768.14	5.51	464	3186	454	38.2	2300	1358	433	1153.7	90.29	91.44	1%	12.04	8.4	1.01	52	10.59	0.06	0.835	19%	6.83	-9%	1000	0%		
03/02/20	1:03 AM	279	768.14	771.14	5.66	497	3064	256	35.9	2300	1387	1,416	587.1	83.66	88.3	6%	12.03	8.4	1.01	89	10.21	-0.38	0.748	-10%	8.49	24%	1000	0%		

NWMO IGNACE DRILLING - FIELD DATA
DRILL MONITORING PARAMETERS

					Drill Parameters							Drill Fluid Parameters																	Notes	
Date	Time	Core Run #	Top of Run	Bottom of Run	ROP	Bit Rotation Speed (Head RPM)	Torque (Torque Pressure)	Injection Fluid Pressure (H2O Pressure In)	Down hole Fluid Flow Rate (H2O Flow in)	Thrust Pressure (Downpressure) - (Pump 1)	Holdback Pressure (Feed Pressure)	Drill Fluid Volume Change (Ultra Sonic)	Drill Fluid Volume Change (Manual)	Fluoro Conc. Inlet (Rig Poly)	Fluoro Conc. Outlet (SRU)	Change in Fluoro Conc.	Temp	Density		ORP	pH	Change in pH	Electrical Conductivity	Change in Electrical Conductivity	DO	Change in DO	Turbidity	Change in Turbidity	Core Observations	Comments
-	-	-	mbgs	mbgs	cm/min	RPM	psi	psi	L/min	psi	psi	L >100L	L	ppb	ppb	% >20% change	(°C)	API Gravity	SG	mV	-	- >0.5 change	mS/cm	% >10% change	mg/L	- >10% change	NTU	- >10% change		
03/02/20	3:14 AM	280	771.14	774.14	6.67	501	2961	235	34.4	2300	1579	2,239	934.5	88.45	84.25	-5%	10.64	8.4	1.01	112	10.78	0.57	0.672	-10%	8.62	2%	1000	0%		
03/02/20	6:15	281	774.14	777.14	6	502	2549	549	38.6	2300	1279	1,649	977.1	82.79	78.94	-5%	12.17	8.4	1.01	63	10.6	-0.18	0.885	32%	7.08	-18%	1000	0%		
03/02/20	7:39 AM	282	777.14	780.14	6.4	504	2899	232	28	2300	1519	1,232	644.1	77.37	71.76	-7%	12.7	8.4	1.01	-563	10.59	-0.01	0.704	-20%	1.16	-84%	1000	0%		
03/02/20	10:20 AM	283	780.14	783.14	6	460	3005	247	31	2300	1824	2,074	494.3	76.74	81.02	6%	11.04	8.4	1.01	87	10.62	0.03	0.687	-2%	7.56	552%	1000	0%		
03/02/20	1:19 PM	284	783.14	786.14	5.4	510	2934	240	35.9	2300	1771	2,068	677.2	81.09	75.23	-7%	11.96	8.4	1.01	67	10.64	0.02	0.733	7%	7.26	-4%	1000	0%		
03/02/20	2:57 PM	285	786.14	788.78	5.4	459	3303	204	35.5	2300	1762	1,427	481.7	78.23	80.64	3%	11.86	8.4	1.01	-507	10.64	0.00	0.195	-73%	0.31	-96%	1000	0%		High % change between values due to calculation of 7.21's % increase of 0.31
03/03/20	12:23	286	788.78	789.14	5.1	480	2957	222	30.6	2300	1800	349	82.2	57.39	59.07	3%	13.67	8.4	1.01	-166	10.93	0.29	0.245	26%	1.77	471%	1000	0%		
03/03/20	14:18	287	789.14	792.14	5.4	479	3091	127	31.4	2300	1663	1,818	108.1	57.44	65.2	14%	14.82	8.4	1.01	99	10.73	-0.20	0.286	17%	8.64	388%	1000	0%		
03/03/20	19:20	288	792.14	795.14	6	438	3083	112	30.6	2300	1537	1,853	694.4	124.5	116.8	-6%	11.13	8.4	1.01	48	10.58	-0.15	0.228	-20%	8.46	-2%	1000	0%		
03/03/20	21:17	289	795.14	798.14	6.23	504	2700	156	34.4	2300	1565	1,821	932.0	81.63	73.93	-9%	12.11	8.4	1.01	129	10.4	-0.18	0.23	1%	8.84	4%	1000	0%		
03/03/20	23:55	290	798.14	801.14	5.82	513	2322	302	35.2	2300	1807	1,639	781.6	91.62	109.4	19%	13.3	8.4	1.01	126	10.26	-0.14	0.238	3%	8.87	0%	1000	0%		
03/04/20	2:15	291	801.14	804.14	6.78	515	3046	134	34.4	2300	1667	1,302	635.9	78.92	79.19	0%	11.4	8.4	1.01	193	10.31	0.05	0.197	-17%	8.62	-3%	1000	0%		
03/04/20	5:29	292	804.14	807.14	4.14	547	2122	1951	39.3	2300	2212	1,107	958.4	82.9	79.69	-4%	11.72	8.4	1.01	174	10.35	0.04	0.233	18%	8.45	-2%	1000	0%		
43924	9:05 AM	293	807.14	810.14	5.2	474	2488	131	32.9	2300	1580	1,553	931.1	55.7	59.12	6%	12.15	8.4	1.01	135	10.45	0.10	0.26	12%	8.07	-4%	1000	0%		
03/04/20	11:48 AM	294	810.14	813.14	5.2	521	2406	237	31.4	2300	1548	2,129	1160.9	88.13	78.5	-11%	11.51	8.4	1.01	130	10.26	-0.19	0.3	15%	9.12	13%	1000	0%		
03/04/20	1:45 PM	295	813.14	816.14	5.2	513	2320	278	34.4	2300	1770	1,718	897.6	77.17	69	-11%	11.91	8.4	1.01	67	10.23	-0.03	0.284	-5%	5.97	-35%	1000	0%		
03/04/20	16:42	296	816.14	819.14	5.5	466	2677	222	32.5	2300	1774	2,264	627.9	131.6	118.6	-10%	10.05	8.4	1.01	-184	10.32	0.09	0.314	11%	5.39	-10%	1000	0%		
03/04/20	18:19	297	819.14	822.14	5.2	490	2628	149	32.5	2300	1624	2,373	773.0	123.9	77.89	-37%	11.31	8.4	1.01	22	10.02	-0.30	0.3	-4%	7.12	32%	1000	0%		
03/04/20	21:52	298	822.14	825.14	6.35	506	3037	208	35.5	2300	1441	1,874	954.1	96.78	98.86	2%	11.68	8.4	1.01	77	10.36	0.34	0.267	-11%	6.94	-3%	1000	0%		
03/04/20	23:51	299	825.14	828.14	5.76	518	2566	288	36	2300	1567	1,655	880.5	110	99.42	-10%	11.91	8.4	1.01	78	9.98	-0.38	0.327	22%	7.45	7%	1000	0%		
03/05/20	2:30	300	828.14	831.14	4.68	523	2424	228	37.8	2300	1966	1,417	794.4	71.21	79.96	12%	11.81	8.4	1.01	81	9.64	-0.34	0.284	-13%	4.78	-36%	1000	0%		
03/05/20	6:10	301	831.14	834.14	7.29	527	2378	388	42.3	2300	1705	2,036	1165.2	92.7	84.6	-9%	10.91	8.4	1.01	128	10.17	0.53	0.267	-6%	8.68	82%	1000	0%		
03/05/20	9:22	302	834.14	837.14	5.36	489	2626	231	40.8	2300	1976	1,758	899.4	79.04	88.47	12%	13.78	8.4	1.01	55	9.66	-0.51	0.316	18%	7.75	-11%	1000	0%		
03/05/20	11:54	303	837.14	840.14	5.56	485	2363	265	40.8	2300	1820	1,576	650.1	89.61	72.42	-19%	13.83	8.4	1.01	119	10.27	0.61	0.258	-18%	7.37	-5%	1000	0%		
03/05/20	16:37	304	840.14	843.14	5.77	421	2850	168	35.2	2300	1739	1,376	571.1	124.5	84.71	-32%	12.42	8.4	1.01	106	10.65	0.38	0.233	-10%	13.96	89%	1000	0%		
03/05/20	18:36	305	843.14	846.14	5.34	461	2361	168	32.9	2300	1792	1,492	741.6	86.46	87.1	1%	12.09	8.4	1.01	109	10.56	-0.09	0.234	0%	7.73	-45%	1000	0%		
03/05/20	22:05	306	846.14	849.14	7.46	534	2683	343	44.2	2300	1786	2,570	921.3	88.99	85.62	-4%	11.91	8.4	1.01	171	10.25	-0.31	0.198	-15%	8.87	15%	1000	0%		
03/06/20	0:41	307	849.14	852.14	5.06	527	3081	338	39.3	2300	1460	1,388	1005.3	85.78	88.56	3%	12.23	8.4	1.01	144	10.3	0.05	0.244	23%	8.4	-5%	1000	0%		
03/06/20	3:18	308	852.14	855.14	4.8	557	2893	363	41.6	2300	1684	1,869	1178.2	89.21	83.65	-6%	11.61	8.4	1.01	110	10.17	-0.13	0.255	5%	8.37	0%	1000	0%		
03/06/20	5:35	309	855.14	858.14	5.3	543	2955	296	40.8	2300	1536	1,765	119.7	98.8	94.22	-5%	10.19	8.4	1.01	194	10.12	-0.05	0.196	-23%	7.49	-11%	1000	0%		
03/06/20	11:54	310	858.14	861.14	5	464	2465	255	34	2300	1773	1,781	771.4	89.74	72.29	-19%	10.52	8.4	1.01	103	10.32	0.20	0.29	48%	11.04	47%	1000	0%		
03/06/20	16:37	311	861.14	864.14	5.08	445	2610	208	35.2	2300	1924	2,318	612.8	116.6	101.2	-13%	12.58	8.4	1.01	119	10.15	-0.17	0.253	-13%	10.28	-7%	1000	0%		
03/06/20	18:36	312	864.14	865.93	4.06	441	2592	322	35.2	2300	1549	1,575	365.4	81.92	98.92	21%	13.83	8.4	1.01	152	10.11	-0.04	0.255	1%	10.05	-2%	1000	0%		
03/06/20	22:05	313	865.93	867.14	3.02	477	2650	193	28.7	2300	1625	1,305	354.2	96.14	118.7	23%	14.43	8.4	1.01	100	10.17	0.06	0.278	9%	7.86	-22%	1000	0%		
03/06/20	0:41	314	867.14	868.66	2.49	527	2636	333	34.4	2300	1710	2,194	274.9	118.6	87.19	-26%	13	8.4	1.01	159	9.86	-0.31	0.254	-9%	10.91	39%	1000	0%		
03/07/20	3:18	315	868.66	870.14	3.44	493	2487	169	30.6	2300	1955	1,616	201.6	101.3	76.89	-24%	13.22	8.4	1.01	133	9.8	-0.06	0.245	-4%	6.63	-39%	1000	0%		
03/07/20	5:35	316	870.14	873.14	6.25	520	2538	164	32.5	2300	1829	2,039	945.2	88.47	78.93	-11%	13.79	8.4	1.01	97	9.99	0.19	0.285	16%	5.16	-22%	1000	0%		
03/07/20	11:54	317	873.14	876.14	5.45	511	2638	152	30.6	2300	1767	1,966	747.3	83.71	87.71	5%	14.6	8.4	1.01	85	9.96	-0.03	0.299	5%	4.68	-9%	1000	0%		
03/07/20	16:37	318	876.14	879.14	4.29	556	2664	191	29.9	2300	1869	2,744	753.1	149.9	91.78	-39%	13.89	8.4	1.01	119	9.79	-0.17	0.293	-2%	6.32	35%	1000	0%		
03/07/20	18:36	319	879.14	882.14	5.59	363	3227	195	39.3	2300	1531	2,467	764.5	106.72	104.8	-2%	13.13	8.4	1.01	154	9.86	0.07	0.274	-6%	6.58	4%	1000	0%		
03/08/20	1:15	320	882.14	885.14	1.64	398	3217	241	37	2300	1624	3,070	2558.2	97.71	94.66	-3%	12.6	8.4	1.01	270	9.1	-0.76	0.166	-39%	7.46	13%	1000	0%		
03/08/20	21:32	321	885.14	888.14	7.7	508	2709	266	39.3	2300	1677	2,433	879.6	93.6	91.86	-2%	12.72	8.4	1.01	203	9.32	0.22	0.248	49%	6.73	-10%	1000	0%		
03/08/20	23:32	322	888.14	891.14	7.7	508	2709	266	39.3	2300	1677	1,819	998.9	86.09	86.28	0%	11.76	8.4	1.01	186	9.6	0.28	0.285	15%	8.69	29%	1000	0%		
03/09/20	1:44	323	891.14	894.14	5.77	416	2893	209	38.2	2300	1634	735	790.4	92.72	94.15	2%	10.98	8.4	1.01	197	9.55	-0.05	0.272	-5%	9.32	7%	1000	0%		
03/09/20	5:34	324	894.14	897.14	5.85	520	2472	231	37.4	2300	1731	2,323	983.3	90.65	101.8	12%	7.84	8.4	1.01	286	9.17	-0.38	0.185	-32%	8.73	-6%	1000	0%		
03/09/20	8:09	325	897.14	900.14	5.71	460	2842	253	41.2	2300	1718	1,365	623.8	100.7	86.7	-14%	9.34	8.4	1.01	78	9.73	0.56	0.279	51%	5.52	-37%	1000	0%		
03/09/20	11:01	326	900.14	903.14	5.08	476	2739	227	37.4	2300	1713	2,418	754.8	81.1	74.38	-8%	10.63	8.4	1.01	158	9.75	0.02	0.288	3%	7.41	34%	1000	0%		
03/09/20	13:16	327	903.14	906.14	5.08	461	2506	213	33.6	2300	1689	2,286	862.9	129.2	85.75	-34%	12.2	8.4	1.01	146	9.79	0.04	0.232	-19%	4.73	-36%	1000	0%		
03/09/20	15:01	328	906.14	909.14	5.77	470	2626	240	42	2300	1807	2,105	743.1	81.63	101.8	25%	11.49	8.4	1.01	127	10	0.21	0.304	31%	5.21	10%	1000	0%		
03/09/20	17:18	329	909.14	912.14	4.91	437	2466	240	38.6	2300	1952	2,012	404.4	106.6	109.9	3%	9.76	8.4	1.01	151	10.05	0.05	0.314	3%	7.62	46%	1000	0%		
03/09/20	20:11	330	912.14	915.14	5.26	511	2771	262	42.7	2300	1668	2,417	886.1	120.3	67.24	-44%	10.74	8.4	1.01	151	9.87	-0.18	0.236	-25%	7.23	-5%	1000	0%		
03/10/20	18:17	331	915.14	918.14	5.45	480	2879	292	39.7	2300	1820	2,245	821.0	121.7	120.3	-1%	12.19	8.4	1.01	172	9.97	0.10	0.32	36%	5.76	-20%	1000	0%		
03/10/20	21:28	332	918.14	921.14	6.33	502	2874	285	44.6	2300	1740	2,626	1127.2	116	110.4	-5%	13.01	8.4	1.01	187	9.89	-0.08	0.311	-3%	6.84	19%	1000	0%		
03/10/20	23:04	333	921.14	924.14	8.47	382	3124	268	42.3	2300	1661	1,959	811.1	90.62	94.89	5%	13.35	8.4	1.01	207	9.83	-0.06	0.254	-18%	6.78	-1%	1000	0%		
03/11/20	1:55	334	924.14	927.14	6.97	506	2896	355	43.1	2300	1581	2,259	888.7	108.1	110.4	2%	13.23	8.4	1.01	176	9.64	-0.19	0.341	34%	6.47	-5%	1000	0%		
03/11/20	4:47	335	927.14	930.14	5.97	501	2868	315	41.2	2300	1557	1,712	985.1	89.22	85.25	-4%	14.346	8.4	1.01	193	9.77	0.13	0.277	-19%	5.76	-11%	1000	0%		
03/11/20	7:50	336	930.14	933.14	6.79	507	2726	314	48.4	2300	1870	2,313	938.0	83.69	90.85	9%	14.96	8.4	1.01	193	9.62	-0.15	0.285	3%	6.28	9%	1000	0%		
03/11/20	11:15	337	933.14	936.14	6.52	489	3095	276	35.5	2300	1680	1,772	1141.6	176.8	156.7	-11%	15.574	8.4	1.01	223	9.81	0.19	0.278	-2%	9.79	56%	1000	0%		
03/11/20	12:37	338	936.14	939.14	5.78	495	2770	241	36.7	2300	1780	2,193	704.3	114.8	116.2	1%	16.188	8.4	1.01	183	9.83	0.02	0.289	4%	10.79	10%	1000	0%		
03/11/20	15:11	339	939.14	942.14	6.2	487	2772	245	41.6	2300	1952	2,363	1149.7	108.1	108	0%	12.78	8.4	1.01	187	9.84	0.01	0.292	1%	13.14	22%	1000	0%		
03/11/20	23:10	340	942.14	945.14	5.96	468	3040	320	37	2300	1900	2,923	940.5	131.3	132.1	1%	13.67	8.4	1.01	187	9.44	-0.40	0.335	15%	8.17	-38%	1000	0%		
03/12/20	1:04	341	945.14	948.14	7.2	518	3037	281	44.2	2300	1841	2,529	1092.4	99.09	102.4	3%	13.92	8.4	1.01	186	9.05	-0.39	0.309	-8%	6.19	-24%	1000	0%		
03/12/20	4:40	342	948.14	951.14	6.55	514	2969	359	42.7	2300	1836	1,820	1022.7	111.1	100.42	-10%	14.87	8.4	1.01	182	9.37	0.32	0.296	-4%	7.07	14%	1000	0%		
03/12/20	7:26	343	951.14	954.14	7.24	532	2819	380	41.2	2300	1980	2,551	1111.4	91.29	90.53	-1%	13.82	8.4	1.01	186	9.31	-0.06	0.294	-1%	7.42	5%	1000	0%		
03/12/20	9:45	344	954.14	957.14	6.76	494	2600	260	35.2	2350	1987	1,789	18.4	96.95	93.49	-4%	16.55	8.4	1.01	169	9.35	0.04	0.358	22%	9.9	33%	1000	0%		
03/12/20	14:02	345	957.14	960.14	6.06	485	2700	497	39.7	3900	1840	2,116	513.1	92.78	91.03	-2%	15.06	8.4	1.01	220	9.34	-0.01	0.289	-19%	11.7	18%	1000	0%		
03/12/20	17:51	346	960.14	963.14	5.55	469	2730	290	40.4	2400	1955	2,924	712.7	90.98	89.44	-2%	13.21	8.4	1.01	165	9.39	0.05	0.283	-2%	17.38	49%	1000	0%		
03/12/20	21:55	347	963.14	966.14	6.49	457	3213	271	45.4	2300	1773	3,593	854.4	78.74	80.82	3%	14.17	8.4	1.01	186	9.34	-0.05	0.338	19%	6.76	-61%	1000	0%		
13/3/2020	0:52	348	966.14	969.14	7.62	513	2620	318	39.7	2300	1709	2,003	832.7	100.8	97.57	-3%	13.29	8.4	1.01	181	9.14	-0.20	0.308	-9%	6.35	-6%	1000	0%		
13/3/2020	4:25	349	969.14	972.14	5.03	526	2542	491	46.1	2300	1998	2,817	791.9	82.54	86.04	4%	13.25	8.4	1.01	179	9.14	0.00	0.326	6%	6.55	3%	1000	0%		
13/3/2020	11:53	350	972.14	975.14	6.87	466	2613	272	38.2	2400	2003	1,146	11.1	111.5	94.3	-15%	13.18	8.4	1.01	177	9.66	0.52	0.308	-6%	13.23	102%	1000	0%		
13/3/2020	13:33	351	975.14	978.14	6.37	490	2980	200	34.8	2100	1882	2,197	153.2	83.2	84.63	2%	14.16	8.4	1.01	190	9.46	-0.20	0.313	2%	11.98	-9%	1000	0%		
13/3/2020	16:27	352	978.14	981.14	5.16	488	2840	210	38.9	2200	1975	2,509	-496.5	119.8	105	-12%	14.25	8.4	1.01	189	9.52	0.06	0.319	2%	10.8	-10%	1000	0%		
13/3/2020	18:31	353	981.14	984.14	5.38	503	2800	280	37	2400	1860	2,571	82.3	94.53	84.77	-10%	13.38	8.4	1.01	172	9.62	0.10	0.306	-4%	11.82	9%	1000	0%		
13/3/2020	23:02	354	984.14	987.14	4.36	467	3208	324	45.4	2300	1625	2,276	522.9	90.39	85.2	-6%	12.94	8.4	1.01	152	9.4	-0.22	0.309	1%	9.08	-23%	1000	0%		
14/3/2020	1:20	355	987.14	990.14	7.77	522	2683	327	43.5	2300	2068	2,938	413.8	82.24	80.33	-2%	12.55	8.4	1.01	187	9.36	-0.04	0.304	-2%	7.04	-22%	1000	0%		
14/3/2020	3:40	356	990.14	993.14	7.45	516	2600	564	44.6	2300	1977	2,508	271.2	85.64	81.21	-5%	12.65	8.4	1.01	168	9.51	0.15	0.299	-2%	5.76	-18%	1000	0%		
14/3/2020	6:12	357	993.14	996.14	6.95	503	3031	392	45	2300	1990	2,400	149.0	88.9	90.05	1%	12.13	8.4	1.01	137	9.45	-0.06	0.305	2%	6.16	7%	1000	0%		
14/3/2020	12:51	358	996.14	999.14	5.78	507	2700	430	37.4	400	1820	2,183	149.3	101.8	108.9	7%	10.68	8.4	1.01	190	9.53	0.08	0.323	6%	10.64	73%	1000	0%		
15/3/2020	14:49	359	999.14	1000.2	7.31	525	2890	230	41.2	550	1890	685	49.5	97.36	73.29	-25%	9.15	8.4	1.01	103	9.62	0.09	0.411	27%	6.7	-37%	1000	0%		

Appendix E

IG_BH04 Volume Measurements Parameters

NWMO IGNACE DRILLING - FIELD DATA
MANUAL TANK MEASUREMENTS

ALL TANK MEASUREMENTS ARE FROM THE BASE OF THE TANK TO THE WATER LEVEL

				Calculated			Calculated	Calculated	Calculated			Calculated			Calculated	Calculated			Water Added to the System (fresh)	Flouroscein Added to the System	Fluoroscein Measured
		STS			AMC					Drill			Tub Below Drill					Comments		(Solution B)	(ppb)
Date/Time	Core Run	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	(L) Rectangular sections	(L) Sloped sectio	Delta (L)	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	Delta (L)	Total Delta (L)	High Vol.. Loss?		(L)	(ml)	
191127 6:00 pm	-																		4,000	3000	98.5
191128 12:50 AM	23	54.5	88.0	-644.2	74.0	56.0	454.1	40.0	494.1	75.5	62.5	96.3				-53.8					
191128 3:30 AM	24	91.0	71.5	375.0	53.0	75.0	-555.0	-52.1	-607.1	63.0	32.0	229.6				-2.5					
191128 6:50 AM	25	69.5	71.0	-28.8	78.5	52.0	668.5	58.0	726.5	3.5	90.0	-640.7				56.9					
191128 11:49 AM	26	83	71	230.8	54	53	25.2	3.9	29.1	66	76	-74.1				185.8		Reviewed Core No OWGS attempted			
191128 8:30 PM	27	78	76	38.5	46.5	46	12.6	2.5	15.1	79	76	22.2				75.8					
191118 08:20 PM	28	43	64.5	-413.5	69	52	428.9	48.9	477.7	63.5	77	-100.0				-35.8					
191118 08:20 PM	29	59	47	230.8	68.5	59	239.7	22.8	262.5	3.5	66.5	-466.7				26.6					
191118 08:20 PM	30	51	64	-250.0	57	53.5	88.3	12.7	101.0	66.5	53.5	96.3				-52.7					
191118 08:20 PM	31	64	79	-288.5	54	35.5	466.7	95.2	561.9	53	76.5	-174.1				99.4					
191129 08:45 AM	32	69	76.5	-144.2	38.5	39	-12.6	-3.0	-15.6	76	78.5	-18.5				-178.4					
191129 10:55 AM	33	48	51	-57.7	75	75.5	-12.6	-0.4	-13.0	78	75.5	18.5				-52.2					
191129 5:00PM	34			0.0			0.0	0.0	0.0			0.0						No Manual Measurement Taken			
191130 12:20 AM	35	57	51	115.4	39	38	25.2	6.1	31.3	75	75.5	-3.7				-139.5					
191130 2:40 AM	36	51	50	19.2	38.5	47	-214.4	-46.2	-260.6	60	22.5	277.8				36.4					
191130 6:40 AM	37	50	53.5	-67.3	47	30	428.9	102.9	531.7	22.5	76.5	-400.0				64.4					
191130 10:30 AM	38	31	49	-346.2	40	24	403.6	111.8	515.5	64	78	-103.7				65.6					
191130 1:38 PM	39	49	60	-211.5	34	21	327.9	99.3	427.3	78.5	76	18.5				234.2	high vol loss				
191207 11:35 PM	40	55.88	54.61	24.4	57.785	47.625	256.3	40.6	296.9	68	63	37.0				358.4	high vol loss		3,000	3000	189.8
19-12-07 11:35 PM	41			0.0			0.0	0.0	0.0			0.0						No Manual Measurement Taken			
	42			0.0			0.0	0.0	0.0			0.0						No Manual Measurement Taken			
191207 11:35 PM	43	79	64	288.5	52	45	176.6	32.2	208.8	75	88	-96.3				-168.1					
Dec-18-19 11:35 PM	45	100	102	-38.5	81	75	151.4	2.1	153.4	77	67	74.1				189.1			3,000	3000	189.8
Dec-18-19 12:54	46	92	95	-57.7	72	81	-227.0	-5.1	-232.1	72	74	-14.8				-304.6					
Dec-18-19 12:54	47	99	99	0.0	74	77	-75.7	-2.1	-77.8	68	74	-44.4				-122.2					
Dec-18-19 14:09	48	98	98	0.0	77	74	75.7	2.1	77.8	67	78	-81.5				-3.7					
Dec-18-19 15:18	49	98	95	57.7	57	73	-403.6	-35.6	-439.2	78	79	-7.4				-388.9					
Dec-19-19 11:28	57	86	91	-96.2	73	67	151.4	9.0	160.4	73	67	44.4				108.7					
Dec-19-19 14:28	58	93	96	-57.7	48	43	126.1	25.2	151.3	73	76	-22.2				71.4					
Dec-19-19 17:28	59	90	71	365.4	43	43	0.0	0.0	0.0	68	71	-22.2				343.2	high vol loss				
Dec-20-19 00:35	60	60	72	-230.8	65	56	227.0	25.9	252.9	37	28	66.7				88.8					
Dec-20-19 12:07	61	86	93	-134.6	35	28	176.6	49.4	226.0	61	65	-29.6				61.8					
Dec-20-19 13:xx	62	92	71	403.8	22	32	-252.3	-77.1	-329.4	72	61	81.5	0	0	0.0	155.9					
Dec-21-19 18:40	63	65	64	19.2	60	53	176.6	24.2	200.7	76	90	-103.7	5	5	0.0	116.3					
Dec-21-19 18:41	64	62	72	-192.3	72	58	353.2	31.1	384.3	47	42	37.0	6.5	15	-18.7	210.4	high vol loss				
Dec-22-19 15:00	65	60	63	-57.7	63	58	126.1	14.4	140.5	30	54	-177.8	11	2	19.8	-75.2					
Dec-22-19 16:30	66	43	58	-288.5	64.5	57	189.2	21.3	210.5	69.5	57	92.6	2	2	0.0	14.6					
Dec-22-19 18:30	67	51	70	-365.4	57	43.5	340.6	58.8	399.3	66	66	0.0	4	4	0.0	34.0					
Dec-22-19 18:31	68	35	56	-403.8	74	63	277.5	18.9	296.4	28	4	177.8	0	0	0.0	70.3					
Dec-23-19 9:00	69	56	53	57.7	8	8	0.0	0.0	0.0	58	58	0.0	14	27	-28.5	29.1					
Dec-23-19 13:30	70	74	67	134.6	61.5	76.5	-378.4	-24.7	-403.1	65	32	244.4	14	10	8.8	-15.3					
Dec-23-19 16:45	71	71	73	-38.5	70.5	62	214.4	17.4	231.8	28	57	-214.8	12	10	4.4	-17.1					
Dec-23-19 17:45	72	86.5	77	182.7	56	61	-126.1	-15.8	-141.9	40	47	-51.9	22	11	24.2	13.0					
Dec-23-19 19:00	73	75	57	346.2	58	69	-277.5	-26.9	-304.3	48	57	-66.7	24	10	30.7	5.9					
Dec-24-19 8:45	74	63	80	-326.9	67	55	302.7	33.6	336.3	52	43.5	63.0	10	6	8.8	81.2					
Dec-24-19 10:20	75	82	50	615.4	38	75.5	-946.0	-128.1	-1074.1	73	32	303.7	22	6	35.1	-119.9					
Dec-24-19 12:00	76	36	73	-711.5	80	52	706.3	58.2	764.6	46	61.5	-114.8	5	5	0.0	-61.8					
Dec-24-19 2:15	77	62	72	-192.3	36	39	-75.7	-18.6	-94.3	78	50	207.4	25	13	26.4	-52.8					
Dec-24-19 3:45	78	70	50	384.6	33	53	-504.5	-108.0	-612.6	62	51	81.5	24	18	13.2	-133.3					
Dec-24-19 4:45	79	51	78.5	-528.8	52	29	580.2	132.5	712.7	49	57	-59.3	20	23	-6.6	118.0		got stuck			
Dec-24-19 6:40	80	52	59	-134.6	56	47	227.0	37.6	264.6	21	43	-163.0	14	12	4.4	-28.6					
Dec-25-19 9:00	81	59	61	-38.5	30	29	25.2	7.4	32.6	63.5	70	-48.1	20	8	26.4	-27.7					
Dec-25-19 10:45	82	71	66	96.2	22	26	-100.9	-32.6	-133.5	59	54	37.0	28	14	30.7	30.5					
Dec-25-19 12:15	83	55	54	19.2	24	20	100.9	33.7	134.6	52	63	-81.5	17	24	-15.4	57.0					
Dec-25-19 13:45	84	59	74	-288.5	30	24	151.4	46.3	197.6	68	52	118.5	8	10	-4.4	23.3					
Dec-25-19 14:45	85	74	79	-96.2	20	15	126.1	45.4	171.5	56	47	66.7	7	25	-39.5	102.5					
Dec-25-19 16:20	86	66	58	153.8	31	38	-176.6	-46.4	-223.0	28	23	37.0	7	7	0.0	-32.1					
Dec-25-19 17:40	87	58	64	-115.4	30	28	50.5	14.8	65.3	47	43	29.6	10	7	6.6	-13.9					
Dec-25-19 18:55	88	77	51	500.0	11	28	-428.9	-149.5	-578.4	47	43	29.6	17	8	19.8	-29.0					
Dec-26-19 9:40	89	111	105	115.4	66	72.5	-164.0	-10.5	-174.4	49	41	59.3	20	14	13.2	13.4		water added to system, core got blocked			
Dec-26-19 10:40	90	95	101	-115.4	69	63	151.4	12.5	163.8	61	59	14.8	12	22	-22.0	41.3					
Dec-26-19 12:00	91	90.5	92	-28.8	70	69	25.2	1.6	26.8	55	49	44.4	9	22	-28.5	13.9					
Dec-26-19 13:30	92	85	114	-557.7	72	44	706.3	90.6	796.9	44	70	-192.6	20	20	0.0	46.6					
Dec-26-19 14:30	93	100	95	96.2	57	64	-176.6	-20.1	-196.7	59	46	96.3	24	14	22.0	17.7					
Dec-26-19 16:20	94	79	112	-634.6	65	57	201.8	22.4	224.2	50	4	340.7	24	4	43.9	-25.7					
Dec-27-19 8:50	95	70	98	-538.5	66	45	529.8	75.5	605.3	56	62	-44.4	10	13	-6.6	15.8					
Dec-27-19 10:50	96	89	93	-76.9	43	42	25.2	5.5	30.7	59	56	22.2	21	20	2.2	-21.8					
Dec-27-19 13:30	97	83	87	-76.9	49	46	75.7	14.3	89.9	65	60	37.0	17	11	13.2	63.2		Blue Fluorescein filter was used			
Dec-27-19 15:00	98	79	100	-403.8	47	33	353.2	81.7	434.8	58	52	44.4	17	14	6.6	82.0					
Dec-27-19 16:30	99	78	96	-346.2	47	31	403.6	95.7	499.3	61	65	-29.6	15	15	0.0	123.5					

NWMO IGNACE DRILLING - FIELD DATA
MANUAL TANK MEASUREMENTS

ALL TANK MEASUREMENTS ARE FROM THE BASE OF THE TANK TO THE WATER LEVEL

				Calculated			Calculated	Calculated	Calculated			Calculated			Calculated	Calculated			Water Added to the System	Flouroscein Added to the System	Fluoroscein Measured	
		STS			AMC					Drill			Tub Below Drill					Comments	(fresh)	(Solution B)		
Date/Time	Core Run	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	(L) Rectangular sections	(L) Sloped sectio	Delta (L)	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	Delta (L)	Total Delta (L)	High Vol.. Loss?		(L)	(ml)	(ppb)	
Dec-27-19 17:50	100	61	76	-288.5	49	38	277.5	58.6	336.1	67	65	14.8	23	24	-2.2	60.3						
Dec-27-19 19:00	101	70	69	19.2	33	40	-176.6	-44.4	-221.0	82	60	163.0	24	22	4.4	-34.4						
Dec-28-19 9:30	102	85.5	73	240.4	33	38	-126.1	-32.4	-158.6	49	52	-22.2	23	26	-6.6	53.0						
Dec-28-19 10:30	103	89	102	-250.0	33	22	277.5	84.0	361.5	36	36	0.0	28	12	35.1	146.7		good rock , only 2 mechanical breaks, continued drilling				
Dec-28-19 12:30	104	81	42	750.0	24	45	-529.8	-139.2	-669.0	36	63	-200.0	12	9	6.6	-112.4						
Dec-28-19 14:05	105	65	72	-134.6	33	28	126.1	36.0	162.2	59	68	-66.7	22	7	32.9	-6.2						
Dec-28-19 16:06	106	77	81	-76.9	21	22	-25.2	-8.5	-33.7	50	47	22.2	1	1	0.0	-88.4						
Dec-28-19 18:15	107	71	69	38.5	27	24	75.7	23.8	99.5	57	72	-111.1	1.5	0	3.3	30.1						
Dec-29-19 9:00	108	58	50	153.8	15	14	25.2	9.5	34.7	73	70	22.2	11	26	-32.9	177.9		Reading after recirculating 1 hr.: 131 L loss				
Dec-29-19 13:55	109	49	51	-38.5	24	7	428.9	159.3	588.2	52	75	-170.4	105	101.5	7.7	387.0	high vol loss					
Dec-29-19 15:58	110	46	57	-211.5	19	9	252.3	95.9	348.1	37	57	-148.1	11	14	-6.6	-18.1						
Dec-29-19 19:30	111	74	9	1250.0	45.5	89.5	-1110.0	-82.0	-1192.0	37	33	29.6	15	12	6.6	94.3		Fluorescein probably didn't mix properly ,Fluorescein readings will be check more closely after this run				
Dec-29-19 21:00	112	72	71	19.2	43	42.5	12.6	2.7	15.3	64	62	14.8	10	14	-8.8	40.6						
Dec-29-19 22:00	113	59	76	-326.9	51	33	454.1	99.8	553.9	30	67	-274.1	24	10	30.7	-16.4						
Dec-29-19 23:00	114	79	67	230.8	28	34	-151.4	-42.8	-194.2	49	68	-140.7	27	16	24.2	-80.0						
Dec-30-19 00:00	115	61	63	-38.5	33	34	-25.2	-6.8	-32.0	43	48	-37.0	26	8	39.5	-68.0						
Dec-30-19 01:30	116	64	76	-230.8	35	26	227.0	64.9	291.9	50	45	37.0	24	17	15.4	113.5						
Dec-30-19 02:45	117	69	55	269.2	27	31	-100.9	-29.7	-130.6	59	75	-118.5	11	10	2.2	22.3						
Dec-30-19 06:00	118	94	47	903.8	21	32	-277.5	-85.6	-363.1	4	75	-525.9	20	22	-4.4	10.4						
Dec-30-19 07:00	119	33	56	-442.3	43	27	403.6	104.9	508.5	46	35	81.5	19	24	-11.0	136.7						
Dec-30-19 08:45	120	77	40	711.5	11	26	-378.4	-134.1	-512.5	74	46	207.4	17	13	8.8	415.3	high vol loss	Recirculated for an hour and manual readings showed gain of 118 L				
Dec-30-19 11:35	121	48.5	42	125.0	7	17	-252.3	-98.8	-351.0	60	63	-22.2	18	28	-22.0	-270.2		Manual tank readings taken at start and end of run (36 min). Some fractures in the core which are fresh or slightly altered with no iron oxide. Drilling continued				
Dec-30-19 23:15	122	55	48	134.6	13	18	-126.1	-46.9	-173.0	14	10	29.6	18	28	-22.0	-30.7						
Dec-31-19 00:30	123	26	56	-576.9	24	14	252.3	88.7	340.9	61	29	237.0	22	20	4.4	5.4						
Dec-31-19 02:30	124	45	35	192.3	11	16	-126.1	-48.3	-174.4	55	70	-111.1	25	20	11.0	-82.3						
Dec-31-19 05:00	125	35	17	346.2	25	21	100.9	33.2	134.1	2	57	-407.4	8	21	-28.5	44.3						
Dec-31-19 06:00	126	10	41	-596.2	29	11	454.1	157.0	611.1	15	7	59.3	15	24	-19.8	54.4		Two Major Shear with very weak friable ground				
Dec-31-19 07:00	127	26	21	96.2	5	5	0.0	0.0	0.0	50	55	-37.0	20	25	-11.0	48.1		Intact with only mechanical breaks. Recirculated for 1 hour and manual tank readings showed gain of 45.6 L.				
Dec-31-19 14:15	128	54	36	346.2	76.5	96	-491.9	16.5	-475.5	29	12	125.9	20	22	-4.4	-7.8						
Dec-31-19 15:40	129	38	103.5	-1259.6	69	35	857.7	139.4	997.2	83.5	53	225.9	20.5	16.5	8.8	-27.8						
Dec-31-19 17:18	130	28	33	-96.2	26.5	25	37.8	11.8	49.7	50	55	-37.0	24	20	8.8	-74.7						
Dec-31-19 21:30	131	36	40	-76.9	27	25	50.5	15.7	66.2	31	15	118.5	7	20	-28.5	79.2		core was short, the remaining of it will come with the next run				
Dec-31-19 22:30	132	50	38	230.8	26	25	25.2	7.9	33.2	33	65	-237.0	30	17	28.5	55.4						
Dec-31-19 23:10	133	49	40	173.1	23	27	-100.9	-32.0	-132.9	50	65	-111.1	30	10	43.9	-27.0						
Jan-01-20 1:00	134	53	53	0.0	26	17	227.0	76.5	303.6	29	53	-177.8	14	28	-30.7	95.1						
Jan-01-20 2:00	135	48	54	-115.4	23	11	302.7	109.9	412.6	61	78	-125.9	11	25	-30.7	140.5		some of the water loss was due to drill water sampling				
Jan-01-20 3:20	136	46	45	19.2	19	20	-25.2	-8.8	-34.0	63	71	-59.3	30	10	43.9	-30.1						
Jan-01-20 4:30	137	42	45	-57.7	18	16	50.5	18.3	68.8	26	30	-29.6	25	24	2.2	-16.4						
Jan-01-20 5:45	138	46	41	96.2	11	10	25.2	10.1	35.3	50	57	-51.9	14	30	-35.1	44.5						
Jan-01-20 6:50	139	30	33	-57.7	18	19	-25.2	-8.9	-34.2	43	25	133.3	25	23	4.4	45.9						
Jan-01-20 9:50	140	80	102	-423.1	49	28	529.8	127.1	656.8	50	61	-81.5	25	18	15.4	167.6						
Jan-01-20 11:23	141	91	79	230.8	45	49	-100.9	-19.3	-120.2	61	70	-66.7	18	13	11.0	54.9						
Jan-01-20 12:50	142	70	109	-750.0	55	29.5	643.3	140.5	783.8	71	52	140.7	14.5	19.5	-11.0	163.5						
Jan-01-20 14:39	143	74	103	-557.7	47	26	529.8	133.1	662.9	78	65.5	92.6	17	27	-22.0	175.8						
Jan-01-20 16:06	144	69	84	-288.5	53	42	277.5	52.3	329.8	37	67	-222.2	19	11	17.6	-163.4						
Jan-01-20 17:52	145	101	88	250.0	27	35	-201.8	-57.1	-258.9	55	69	-103.7	20	15	11.0	-101.6						
Jan-01-20 21:40	146	73	74	-19.2	47	48	-25.2	-4.8	-30.0	10	20	-74.1	22	4	39.5	-83.8						
Jan-01-20 23:30	147	64	70	-115.4	27	22	126.1	40.4	166.5	24	20	29.6	24	84	-131.8	-51.0						
Jan-02-20 01:30	148	60	65	-96.2	40	37	75.7	18.2	93.8	25	20	37.0	10	10	0.0	34.7						
Jan-02-20 03:00	149	63	70	-134.6	20	21	-25.2	-8.6	-33.9	30	10	148.1	26	10	35.1	14.8						
Jan-04-20 01:00	150	45	50	-96.2	9	9	0.0	0.0	0.0	30	22	59.3	30	30	0.0	-36.9		1.16m of core was lost because of wedging				
Jan-04-20 02:30	151	37	24	250.0	19	8	277.5	106.3	383.8	4	70	-488.9	10	24	-30.7	114.1		water sample taken at 400m				
Jan-04-20 04:30	152	60	48	230.8	8	8	0.0	0.0	0.0	4	20	-118.5	11	30	-41.7	70.5						
Jan-04-20 06:00	153	31	50	-365.4	10	8	50.5	20.6	71.1	40	4	266.7	20	10	22.0	-5.7						
Jan-04-20 13:45	154	72.5	77	-86.5	53	44.5	214.4	38.9	253.3	50	28	163.0	20.5	27	-14.3	315.4	high vol loss	1 natural fracture with minor iron oxide staining. Continued drilling				
Jan-04-20 15:42	155	78	79	-19.2	32	34	-50.5	-13.7	-64.1	69.5	47	166.7	22.5	22	1.1	84.4		1 natural fracture with mafic dyke. Continued drilling				
Jan-04-20 17:42	156	70	65	96.2	37	46	-227.0	-50.6	-277.6	53	31	163.0	21.5	26	-9.9	-28.4						
Jan-05-20 2:00	150A	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A	N/A	N/A		Borehole recut with square bit				
Jan-05-20 5:00	151A	70	58	230.8	27	43	-403.6	-104.9	-508.5	40	10	222.2	20	14	13.2	-42.4						
Jan-05-20 8:55	152A	75	81	-115.4	35	24	277.5	80.9	358.3	16	47	-229.6	19	13	13.2	26.5						
Jan-05-20 8:55	153A	73	84	-211.5	17	10	176.6	67.6	244.2	47	53	-44.4	13	23	-22.0	-33.7						
Jan-06-20 10:05	154A	44	59	-288.5	12	8	100.9	40.7	141.6	66	68	-14.8	22	14	17.6	-144.1						
Jan-06-20 11:46	155A	52.5	38	278.8	8	9	-25.2	-10.4	-35.6	50	76	-192.6	17	20	-6.6	44.1						
Jan-06-20 13:15	157	46	45.5	9.6	17	6	277.5	109.4	386.9	36	51	-111.1	14	26	-26.4	259.1	high vol loss	Circulated for an hour and manual readings showed loss of 39 L				
Jan-06-20 16:50	158	48	37	211.5	23	9	353.2	130.2	483.4	27	54	-200.0	4.5	16	-25.3	469.7	high vol loss	Circulated for an hour and manual readings showed gain of 131 L				
Jan-06-20 22:00	159	71	70	19.2	60.5	48	315.3	47.2	362.5	35	70	-259.3	5	15	-22.0	100.5						
Jan-07-20 4:30	160	78	80	-38.5	42	40	50.5	11.4	61.8	50	45	37.0	10	5	11.0	71.4		Fluorescein added to system (Jan 8, 2020)	2555	1500	100.1	Tank data from email from Tyler dated Jan 21, 2020. Data incomplete prior to this

ALL TANK MEASUREMENTS ARE FROM THE BASE OF THE TANK TO THE WATER LEVEL

Date/Time	Core Run	STS Before (cm)	STS After (cm)	STS Calculated Delta (L)	AMC Before (cm)	AMC After (cm)	AMC Calculated (L) Rectangular sections	AMC Calculated (L) Sloped sectio	AMC Calculated Delta (L)	Drill Before (cm)	Drill After (cm)	Drill Calculated Delta (L)	Tub Below Drill Before (cm)	Tub Below Drill After (cm)	Tub Below Drill Calculated Delta (L)	Calculated Total Delta (L)	High Vol.. Loss?	Comments	Water Added to the System (fresh) (L)	Flouroscein Added to the System (Solution B) (ml)	Fluoroscein Measured (ppb)
Jan-10-20 18:00	143	73	77	-64.8	10	10	0.0	0.0	0.0	57	66	-66.7	14	12	43.9	**-87.5**					
Jan-10-20 22:30	144	58	28	486.0	8	20	-302.7	-115.1	-417.8	47	68.5	-159.3	25	25	0.0	**-91.0**		Fluorescein added to system (Jan 10, 2020)	2273	1650	103.9
Jan-11-20 1:30	145	41	76	-567.0	22	9	327.9	121.8	449.8	4	35	-229.6	25	6	417.2	**70.4**					
Jan-11-20 3:00	146	71	60	178.2	8	8	0.0	0.0	0.0	25	80	-407.4	20	10	219.6	**-9.6**		Fluorescein added to system	1574	1500	51.45
Jan-11-20 4:30	147	63	74	-178.2	10	9	25.2	10.2	35.5	44	19	185.2	9	10	-22.0	**20.5**					
Jan-11-20 6:30	148	48	30	291.6	8	10	-50.5	-20.6	-71.1	7	50	-318.5	10	5	109.8	**11.8**					
Jan-11-20 12:30	149	80	64	259.2	48	53	-126.1	-21.6	-147.7	56	76	-148.1	14	12	43.9	**7.2**					
Jan-13-20 6:30	149Dup	96	88	129.6	64	67	-75.7	-6.5	-82.1	58	78	-148.1	10	4	131.8	**31.1**		Fluorescein added to system (Jan 12+13, 2020)	1005	2260	79.85
Jan-13-20 9:00	150	93.5	78	251.1	57	53	100.9	14.7	115.6	19	27	-59.3	7	13	-131.8	**175.7**		Intact core, drilling duration twice as long			
Jan-13-20 11:45	151	86	76	162.0	52.5	52	12.6	2.0	14.6	21.5	32	-77.8	3	2	22.0	**120.8**		Intact core, drilling duration twice as long			
Jan-13-20 14:00	152	51	66	-243.0	64	53	277.5	34.8	312.3	91.5	72	144.4	3	4	-22.0	**191.8**		Intact core, drilling duration twice as long			
Jan-13-20 16:00	153	71	52	307.8	39	48	-227.0	-48.0	-275.0	72	68	29.6	4	4	0.0	**62.4**					
Jan-13-20 18:10	154	72	62	162.0	35	54	-479.3	-98.5	-577.8	68	7	451.9	5	5	0.0	**36.0**					
Jan-14-20 00:00	155	93	80	210.6	37	38	-25.2	-6.2	-31.4	48	74	-192.6	6	4	43.9	**30.5**		Drill water sample taken, Fluoroscein before the run	2273	150	89.21
Jan-14-20 05:00	156	97	89	129.6	32	39	-176.6	-45.4	-222.0	60	53	51.9	10	9	22.0	**-18.6**					
Jan-14-20 07:00	157	78	95	-275.4	36	20	403.6	121.1	524.7	60	70	-74.1	6	8	-43.9	**131.3**					
Jan-14-20 10:25	158	82	98	-259.2	69	55.5	340.6	35.4	375.9	61	81	-148.1	5	4	22.0	**-9.4**					
Jan-14-20 12:20	159	103	82	340.2	57	59	-50.5	-6.5	-56.9	56	85.5	-218.5	4	5	-22.0	**42.8**					
Jan-15-20 5:20	160	88	89.5	-24.3	42	40	50.5	11.4	61.8	65	72	-51.9	6	4	43.9	**29.6**					
Jan-15-20 7:00	161	86	92	-97.2	44	39	126.1	28.1	154.2	65	55	74.1	5	10	-109.8	**21.3**					
Jan-15-20 11:50	162	100	50	810.0	26	39	-327.9	-89.9	-417.9	79	83	-29.6	6	8	-43.9	**318.6**	high vol loss	Run duration ~4 hours (stopped midway). Intact core			
Jan-15-20 14:00	163	60	70	-162.0	38	20	454.1	133.6	587.7	53	76.5	-174.1	12	24	-263.5	**-11.9**		Water added	2727	85	80.51
Jan-15-20 16:00	164	74	21	858.6	17	50	-832.5	-223.5	-1056.0	65	78	-96.3	22	11	241.6	**-52.1**					
Jan-16-20 4:30	165	87	100	-210.6	84	60	605.4	29.1	634.6	33	76	-318.5	20	24	-87.8	**17.6**					
Jan-16-20 4:31	166	93	102	-145.8	63	60	75.7	8.2	83.9	43	77	-251.9	29	12	373.3	**59.5**					
Jan-16-20 10:45	167	87	72	243.0	78	53	630.7	53.8	684.5	60	75	-111.1	4	11	-153.7	**662.6**	high vol loss	2 hr. run duration. Intact core. Gain of 91 L after circulating for 1 hr.			
Jan-16-20 14:50	168	89	93	-64.8	53	38	378.4	75.6	454.0	52	83	-229.6	24	34	-219.6	**-60.0**					
Jan-16-20 9:00	169	105	57	777.6	51	72	-529.8	-57.3	-587.1	76	35	303.7	1	22	-461.2	**33.1**					
Jan-16-20 11:45	170	49	101	-842.4	106	48	1463.1	28.5	1491.6	5	75	-518.5	5	15	-219.6	**-88.9**		DW sample taken for 450m mark			
Jan-17-20 1:45	171	87	72	243.0	47	46	25.2	4.9	30.1	47	66	-140.7	7	13	-131.8	**0.6**		Water added	1500	100	75.74
Jan-17-20 8:42	172	90	65	405.0	24	34	-252.3	-74.2	-326.5	70	80	-74.1	17	15	43.9	**48.4**					
Jan-17-20 11:01	173	87	79	129.6	29	33	-100.9	-28.5	-129.4	75	78	-22.2	7	5	43.9	**21.9**					
Jan-17-20 11:01	174	72	87	-243.0	38	16	555.0	169.6	724.6	77	84	-51.9	5	17	-263.5	**166.3**					
Jan-17-20 15:25	175	61	74	-210.6	27	20	176.6	57.5	234.1	78	40	281.5	17	29	-263.5	**41.5**					
Jan-17-20 17:43	176	74	82	-129.6	20	21	-25.2	-8.6	-33.9	40	99	-437.0	29	2	592.9	**-7.6**					
Jan-17-20 21:45	177	82	83	-16.2	70	65	126.1	9.3	135.4	44	34.5	70.4	22	30	-175.7	**13.9**					
Jan-18-20 00:00	178	76	86	-162.0	82	74	201.8	2.8	204.6	45	62	-125.9	23	19	87.8	**4.5**					
Jan-18-20 03:00	179	88	92	-64.8	57	41	403.6	72.6	476.2	35	60	-185.2	13	20	-153.7	**72.5**					
Jan-18-20 08:00	180	88	63	405.0	48	38	252.3	54.0	306.3	51	87	-266.7	10	21	-241.6	**203.0**	high vol loss	Run duration 4.5 hours, continue drilling			
Jan-18-20 08:22	181	63	64	-16.2	38	40	-50.5	-12.0	-62.4	87	85	14.8	21	19	43.9	**-19.9**					
Jan-18-20 10:25	182	61	71	-162.0	44	35	227.0	53.2	280.2	55	68	-96.3	24	15	197.6	**219.5**	high vol loss	Two natural fractures, recirculated for 1 hr. and losses 133, continued drilling.			
Jan-18-20 13:45	183	53	60	-113.4	49	29	504.5	119.6	624.1	56	81	-185.2	7	19	-263.5	**62.0**					
Jan-18-20 15:20	184	52	52	0.0	43	40	75.7	16.9	92.5	48	72	-177.8	13	7	131.8	**46.5**					
Jan-18-20 19:05	185	44	45	-16.2	47	38	227.0	49.3	276.3	38	81	-318.5	14	13	22.0	**-36.5**					
Jan-19-20 3:00	186	27	21	97.2	50	59	-227.0	-33.7	-260.7	55	28	200.0	5	6	-22.0	**14.5**		started to use the new Horiba			
Jan-19-20 5:30	187	15	107	-1490.4	62.5	9	1349.6	345.0	1694.6	30	26	29.6	6	5	22.0	**255.8**	high vol loss	took the drill water sample at 500m mark circulated longer. Core looks intact			
Jan-19-20 8:15	188	88	41	761.4	10	22	-302.7	-111.6	-414.3	64	57	51.9	7	21	-307.4	**91.5**		Manual tank readings taken over 2.5 hour interval. Core intact.			
Jan-19-20 13:55	189	86	91	-81.0	80	59	529.8	33.1	562.8	47	84	-274.1	8	14	-131.8	**76.0**		Water added, along with dilute Fluoroscein	1500	13000	54.87
Jan-19-20 14:35	190	93	99	-97.2	50	53	-75.7	-12.5	-88.2	53	74	-155.6	27	8	417.2	**76.3**					
Jan-19-20 14:35	191	90	63	437.4	47	52	-126.1	-22.3	-148.4	49	93	-325.9	26	20	131.8	**94.8**					
Jan-19-20 22:30	192	99	97	32.4	47	49	-50.5	-9.4	-59.8	71	58.5	92.6	7	7	0.0	**65.2**					
Jan-20-20 00:45	193	85	97	-194.4	54	43	277.5	50.7	328.2	58.5	70	-85.2	7	7	0.0	**48.6**					
Jan-20-20 02:45	194	96	92	64.8	46	47	-25.2	-4.9	-30.1	58.5	53.5	37.0	8	10	-43.9	**27.8**		Water added	1500	350	107.98
Jan-20-20 04:30	195	90	88	32.4	45	43	50.5	10.5	61.0	60	63.5	-25.9	6	8	-43.9	**23.5**					
Jan-20-20 05:00	196	81	65	259.2	49	60	-277.5	-41.1	-318.6	71	43	207.4	7	15	-175.7	**-27.7**					
Jan-20-20 06:45	197	84	85	-16.2	40	43	-75.7	-16.9	-92.5	43.5	52	-63.0	15	7	175.7	**4.0**					
Jan-20-20 08:38	198	82	87	-81.0	40	25	378.4	103.8	482.2	61	83	-163.0	7	14	-153.7	**84.5**					
Jan-20-20 10:24	199	64	58	97.2	31	41	-252.3	-64.1	-316.4	38	64	-192.6	26	13	285.5	**-126.3**					
Jan-20-20 12:05	200	62	62	0.0	26	19	176.6	58.5	235.1	44	80	-266.7	34	23	241.6	**210.0**	high vol loss				
Jan-20-20 14:01	201	60	62	-32.4	37	16	529.8	163.5	693.2	39	60	-155.6	8	22	-307.4	**197.8**					
Jan-20-20 15:58	202	44	37	113.4	32	32	0.0	0.0		73	67	44.4	7	12	-109.8	**48.0**					
Jan-21-20 00:30	203	105	93	194.4	48	58	-252.3	-39.6	-291.8	45.5	39.5	44.4	8	7	22.0	**-31.0**		1500 L of water and 350 ml of Fluorescein added to system			
Jan-21-20 02:00	204	68	83	-243.0	64	59	126.1	13.6	139.8	67	47	148.1	7	7	0.0	**44.9**		DW sample taken for 550m mark			
Jan-21-20 03:35	205	90	89	16.2	54	54	0.0	0.0	0.0	51	56	-37.0	14	13	22.0	**1.1**					
Jan-21-20 05:00	206	90	101	-178.2	52	39	327.9	65.5	393.5	45.5	88	-314.8	15	7	175.7	**76.1**					
Jan-21-20 07:00	207	97	91	97.2	37	42	-126.1	-29.5	-155.7	65	66	-7.4	13	8	109.8	**43.9**					
Jan-21-20 08:39	208	80	82	-32.4	44	40	100.9	22.2	123.1	63	78	-111.1	8	9	-22.0	**-42.4**					
Jan-21-20 08:39	209	31	68	-599.4	61	36	630.7	115.2	745.8	74	77	-22.2	6	11	-109.8	**14.4**					
Jan-21-20 13:47	210	67	68	-16.2	38	30	201.8	53.6	255.4	47	73	-192.6	19	16	65.9	**112.5**					
Jan-21-20 20:00	211	67	69	-32.4	37	36	25.2	6.3	31.6	78	78	0.0	2	1	22.0	**21.1**					

NWMO IGNACE DRILLING - FIELD DATA
MANUAL TANK MEASUREMENTS

ALL TANK MEASUREMENTS ARE FROM THE BASE OF THE TANK TO THE WATER LEVEL

Date/Time	Core Run	STS Before (cm)	STS After (cm)	STS Calculated Delta (L)	AMC Before (cm)	AMC After (cm)	AMC Calculated (L) Rectangular sections	AMC Calculated (L) Sloped sectio	AMC Calculated Delta (L)	Drill Before (cm)	Drill After (cm)	Drill Calculated Delta (L)	Tub Below Drill Before (cm)	Tub Below Drill After (cm)	Tub Below Drill Calculated Delta (L)	Calculated Total Delta (L)	High Vol.. Loss?	Comments	Water Added to the System (fresh) (L)	Flouroscein Added to the System (Solution B) (ml)	Fluoroscein Measured (ppb)
Jan-21-20 21:30	212	98	97	16.2	18	26	-201.8	-67.5	-269.3	68	36	237.0	3	2	22.0	**5.9**					
Jan-21-20 23:00	213	95	92	48.6	20	14	151.4	54.9	206.3	55.5	73.5	-133.3	7	4	65.9	**187.4**		started to recirculate water for 1 hour			
Jan-22-20 3:15	214	91	80	178.0	56.5	54	63.1	9.1	72.1	50	51	-7.3	7	6	21.4	**264.3**	high vol loss	started to recirculate water for 1 hour. Water added (3000L)			
Feb-13-20 19:30	215	80	80	0.0	80	41	983.8	112.1	1095.9	78	54	174.0	5	5	0.0	**1269.9**		14.5 L of Fluorescein added			
Feb-14-20 00:30	216	112	78	550.1	58	53	126.1	18.0	144.1	61	43	130.5	10	5	107.1	**931.8**		Added 3300 L of water and 200 mL of concentrated fluorescein			
Feb-14-20 02:30	217	87	68	307.4	51	23	706.3	175.5	881.8	40	61	-152.3	5	5	0.0	**1037.0**					
Feb-14-20 04:45	218	63	10	857.5	23	22	25.2	8.4	33.6	69	85	-116.0	5	5	0.0	**775.1**					
Feb-16-20 22:00	219	100	86	226.5	67	76	-227.0	-11.6	-238.6	61	61	0.0	3	2	21.4	**9.3**					
Feb-16-20 23:30	220	77	100	-372.1	75	66	227.0	12.9	239.9	71	61	72.5	5	2	64.3	**4.5**					
Feb-17-20 01:00	221	75	76	-16.2	82	74	201.8	2.8	204.6	60	67	-50.8	2	5	-64.3	**73.4**					
Feb-17-20 03:00	222	56	92	-582.5	90	66	605.4	8.3	613.8	63	50	94.3	4	6	-42.8	**82.7**					
Feb-17-20 05:15	223	96	62	550.1	56	77	-529.8	-42.2	-571.9	60	53.5	47.1	4	5	-21.4	**3.9**					
Feb-17-20 07:30	224	107	88	307.4	43	53	-252.3	-46.8	-299.1	75	69	43.5	4	4	0.0	**51.9**					
Feb-17-20 10:17	225	61	74	-210.3	69	63	151.4	12.5	163.8	61	44	123.3	0	0	0.0	**76.7**		1500 L fresh water and 2.5 L fluorescien added.			
Feb-17-20 12:57	226	111	87	388.3	73	97	-605.4	15.9	-589.5	65	40	181.3	0	0	0.0	**-19.9**					
Feb-17-20 14:31	227	111	103	129.4	71	72	-25.2	-1.3	-26.5	61	69	-58.0	0	0	0.0	**44.9**					
Feb-17-20 16:04	228	94	94	0.0	73	76	-75.7	-2.6	-78.2	77	55	159.5	0	6	-128.5	**-47.3**					
Feb-17-20 22:00	229	88	83	80.9	80	86	-151.4	2.2	-149.1	46	34	87.0	3	3	0.0	**18.8**					
Feb-17-20 23:00	230	91.5	101	-153.7	68	64	100.9	8.3	109.2	63	61	14.5	3	3	0.0	**-30.0**					
Feb-18-20 00:00	231	92	87	80.9	60	67	-176.6	-17.1	-193.7	69	61	58.0	10	5	107.1	**52.3**					
Feb-18-20 01:05	232	83	76	113.3	69	67	50.5	3.6	54.0	48	71	-166.8	5	5	0.0	**0.5**					
Feb-18-20 03:05	233	79	97	-291.2	70	60	252.3	22.2	274.5	80	76	29.0	5	5	0.0	**12.3**					
Feb-18-20 05:30	234	100	82	291.2	55	58	-75.7	-10.4	-86.0	71	78	-50.8	4	10	-128.5	**25.9**					
Feb-18-20 08:00	235	80	70	161.8	54	53	25.2	3.9	29.1	51	43	58.0	14	24	-214.2	**34.7**					
Feb-18-20 10:09	236	86	93	-113.3	51	48	75.7	13.4	89.1	54	47	50.8	0	0	0.0	**26.6**					
Feb-18-20 12:35	237	82	80	32.4	48	41	176.6	36.3	212.9	62	30	232.0	0	9	-192.8	**284.5**	High vol loss	Recirculated for an hour and manual readings showed loss of 15 L.			
Feb-18-20 15:15	238	86	85	16.2	40	39	25.2	5.9	31.1	63	64	-7.3	0	0	0.0	**40.1**					
Feb-18-20 17:06	239	82	82	0.0	42	35	176.6	42.4	218.9	44	73	-210.3	0	0	0.0	**8.7**					
Feb-18-20 21:15	240	76	104	-453.0	35	23	302.7	89.1	391.8	71	10	442.3	4	20	-342.7	**38.3**					
Feb-18-20 23:00	241	99	84	242.7	27	34	-176.6	-50.4	-227.0	25	10	108.8	5	8	-64.3	**60.2**					
Feb-19-20 00:30	242	80	97	-275.1	20	15	126.1	45.4	171.5	68	25	311.8	14	21	-149.9	**58.3**					
Feb-19-20 02:00	243	94	101	-113.3	5	13	-201.8	-82.5	-284.3	71	25	333.5	20	14	128.5	**64.5**					
Feb-19-20 03:30	244	90	102	-194.2	5	6	-25.2	-10.8	-36.0	68.5	61	54.4	26	16	214.2	**38.4**					
Feb-19-20 05:10	245	78	75	48.5	6	17	-277.5	-109.4	-386.9	71	35	261.0	25	20	107.1	**29.7**					
Feb-19-20 08:00	246	78	70	129.4	7	13	-151.4	-61.0	-212.4	63	40	166.8	14	16	-42.8	**41.0**					
Feb-19-20 10:02	247	70	71	-16.2	12	13	-25.2	-9.8	-35.0	58	47	79.8	0	0	0.0	**28.5**		2000 L of fresh water and 2.2 L fluorescien solution B added.			
Feb-19-20 14:42	248	84	84	0.0	62	64	-50.5	-5.0	-55.5	61	61	0.0	8	7	21.4	**-34.1**					
Feb-19-20 16:32	249	80	92	-194.2	62	54	201.8	25.9	227.7	69	63	43.5	4	4	0.0	**77.0**					
Feb-19-20 18:16	250	93	85	129.4	49	57	-201.8	-31.7	-233.5	69	60	65.3	7	4	64.3	**25.5**					
Feb-19-20 21:00	251	70	87	-275.1	23	30	-176.6	-54.5	-231.1	45	35	72.5	42	20	471.2	**37.6**					
Feb-20-20 00:00	252	80	98	-291.2	27	18	227.0	75.3	302.3	78	68	72.5	14	14	0.0	**83.5**					
Feb-20-20 02:00	253	70	93	-372.1	35	24	277.5	80.9	358.3	73.5	81.5	-58.0	8	2	128.5	**56.7**					
Feb-20-20 03:45	254	50	92	-679.6	43	21	555.0	153.8	708.7	76	73	21.8	13	12	21.4	**72.4**					
Feb-20-20 07:00	255	64	81	-275.1	31	23	201.8	61.7	263.5	68	72	-29.0	10	4	128.5	**88.0**					
Feb-20-20 10:54	256	63	84	-339.8	82	78	100.9	0.2	101.1	46	7	282.8	4	4	0.0	**44.1**		1500 L of fresh water and 100 mL concentrate added.			
Feb-20-20 13:35	257	96	83	210.3	34	52	-454.1	-97.2	-551.3	70	41	210.3	28	22	128.5	**-2.2**					
Feb-21-20 11:47	258	92	95	-48.5	52	41	277.5	53.9	331.3	46	73	-195.8	0	8	-171.4	**-84.3**		No fluid changes but added stabiliser to core barrel.			
Feb-21-20 14:26	259	96	84	194.2	38	42	-100.9	-23.3	-124.2	56	70	-101.5	6	7	-21.4	**-53.0**					
Feb-21-10 16:37	260	70	80	-161.8	34	44	-252.3	-59.8	-312.1	74	63	79.8	22	2	428.4	**34.3**					
Feb-21-10 18:45	261	84	97	-210.3	47	39	201.8	43.2	245.0	35	38	-21.8	1	2	-21.4	**-8.5**					
Feb-21-10 21:00	262	56	54	32.4	48	43	126.1	25.2	151.3	76	78.5	-18.1	4	12	-171.4	**-5.8**					
Feb-21-10 23:00	263	60	42	291.2	37	41	-100.9	-23.9	-124.8	79	75	29.0	4	13	-192.8	**2.6**					
Feb-22-10 00:50	264	50	78	-453.0	41	27	353.2	93.8	447.0	73	75	-14.5	4	4	0.0	**-20.6**					
Feb-22-10 02:30	265	63	74	-178.0	21	13	201.8	73.2	275.1	86	82	29.0	5	5	0.0	**126.1**	rculate water for 1 hour				
Feb-24-10 03:00	266	73	73	0.0	31	6	630.7	223.5	854.1	50	77.5	-199.4	5	5	0.0	**654.8**					
Feb-24-10 06:30	267	91	73	291.2	42	17	630.7	183.8	814.4	58	81	-166.8	8	5	64.3	**1003.2**		added 3000L of water and 150ml of concentrated fluorescien solution			
Feb-29-20 20:30	268	88	21	1084.1	16	19	-75.7	-27.2	-102.9	54	82	-203.0	26	0	556.9	**1335.1**					
Mar-01-20 00:16	269	78	86	-129.4	46	44	50.5	10.2	60.7	56	74	-130.5	9	4	107.1	**-92.2**					
Mar-01-20 02:25	270	84	89	-80.9	30	32	-50.5	-14.3	-64.7	59	79	-145.0	18	11	149.9	**-140.7**					
Mar-01-20 05:30	271	75	84	-145.6	6	26	-504.5	-186.0	-690.5	68.5	77	-61.6	25	4	449.8	**-447.9**					
Mar-01-20 09:43	272	74	30	711.9	21	10	277.5	103.1	380.6	55	75	-145.0	4	5	-21.4	**926.1**					
Mar-01-20 09:43	273	95	87	129.4	57	33	605.4	122.7	728.1	33	71	-275.5	2	10	-171.4	**410.7**					
Mar-01-20 13:40	274	76	83	-113.3	42	25	428.9	115.1	544.0	72	41	224.8	2	10	-171.4	**484.1**					
Mar-01-20 15:42	275	86	79	113.3	76	44	807.2	94.3	901.5	47	90	-311.8	2	0	42.8	**745.9**					
Mar-01-20 17:33	276	88	58	485.4	49	37	302.7	64.8	367.5	60	82	-159.5	0	0	0.0	**693.4**					
Mar-01-20 19:54	277	88	91	-48.5	87	61	655.9	24.0	679.9	50	45	36.3	0	0	0.0	**667.6**					
Mar-01-20 22:05	278	92	71	339.8	44	15	731.6	213.2	944.7	63	84	-152.3	4	3	21.4	**1153.7**					
Mar-02-20 01:03	279	94	90	64.7	49	22	681.1	175.1	856.2	85	69	116.0	4	25	-449.8	**587.1**					
Mar-02-20 3:14	280	79	62	275.1	29	8	529.8	187.7	717.5	50	58	-58.0	5	5	0.0	**934.5**					
Mar-02-20 6:15	281	80	68	194.2	30	9	529.8	184.7	714.4	48	74	-188.5	16	4	257.0	**977.1**					

NWMO IGNACE DRILLING - FIELD DATA
MANUAL TANK MEASUREMENTS

ALL TANK MEASUREMENTS ARE FROM THE BASE OF THE TANK TO THE WATER LEVEL

				Calculated			Calculated	Calculated	Calculated			Calculated			Calculated	Calculated			Water Added to the System	Flouroscein Added to the System	Fluoroscein Measured
		STS			AMC					Drill			Tub Below Drill					Comments	(fresh)	(Solution B)	(ppb)
Date/Time	Core Run	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	(L) Rectangular sections	(L) Sloped sectio	Delta (L)	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	Delta (L)	Total Delta (L)	High Vol.. Loss?		(L)	(ml)	
Mar-02-20 07:39	282	31	51	-323.6	39	12	681.1	214.1	895.2	79	69	72.5	0	0	0.0	**644.1**					
Mar-02-20 10:20	283	88	87	16.2	60	49	277.5	41.1	318.6	57	35	159.5	0	0	0.0	**494.3**					
Mar-02-20 13:19	284	92	92	0.0	40	19	529.8	154.4	684.1	82	80	14.5	9	10	-21.4	**677.2**					
Mar-02-20 14:57	285	78	77	16.2	38	19	479.3	142.4	621.7	76	68	58.0	3	13	-214.2	**481.7**					
Mar-03-20 12:23	286	63	65	-32.4	32	23	227.0	68.8	295.8	49	74	-181.3	0	0	0.0	**82.2**					
Mar-03-20 14:18	287	64	76	-194.2	27	18	227.0	75.3	302.3	51	51	0.0	0	0	0.0	**108.1**		930 L moved to the STS mid-run, total Delta (L) 1047			
Mar-03-20 19:20	288	106	92	226.5	45	31	353.2	85.7	438.9	69	65	29.0	1	1	0.0	**694.4**					
Mar-03-20 21:17	289	77	65	194.2	73	43	756.8	97.1	853.8	70	86	-116.0	5	5	0.0	**932.0**					
Mar-03-20 23:55	290	88	92	-64.7	55	14	1034.3	271.8	1306.0	55	80	-181.3	4	17	-278.5	**781.6**					
Mar-04-20 02:15	291	80	60	323.6	42	31	277.5	69.7	347.2	82	75	50.8	12	16	-85.7	**635.9**					
Mar-04-20 05:29	292	65	54	178.0	40	5	882.9	292.6	1175.6	53	75	-159.5	11	22	-235.6	**958.4**					
Mar-04-20 09:05	293	88	94	-97.1	69	32	933.4	159.8	1093.1	55	61	-43.5	6	7	-21.4	**931.1**					
Mar-04-20 11:48	294	81	48	533.9	38	10	706.3	228.0	934.4	67	71	-29.0	0	13	-278.5	**1160.9**					
Mar-04-20 13:45	295	78	69	145.6	45	19	655.9	181.7	837.6	60	60	0.0	2	6	-85.7	**897.6**					
Mar-04-20 16:42	296	81	99	-291.2	68	35	832.5	137.7	970.2	55	65	-72.5	3	2	21.4	**627.9**					
Mar-04-20 18:19	297	90	75	242.7	43	29	353.2	89.8	442.9	72	57	108.8	3	4	-21.4	**773.0**					
Mar-04-20 21:52	298	94	74	323.6	79	51	706.3	62.3	768.6	55	77	-159.5	4	3	21.4	**954.1**					
Mar-04-20 23:51	299	56	65	-145.6	48	12	908.2	262.0	1170.2	70	81	-79.8	3	6	-64.3	**880.5**					
Mar-05-20 02:30	300			0.0			0.0	0.0	0.0			0.0			0.0	**794.4**					
Mar-05-20 06:10	301	104	70	550.1	69	50	479.3	57.4	536.7	67	68	-7.3	7	3	85.7	**1165.2**					
Mar-05-20 09:22	302	94	100	-97.1	51	11	1009.1	285.4	1294.4	87	69	130.5	3	23	-428.4	**899.4**					
Mar-05-20 11:54	303	83	57	420.7	30	17	327.9	106.8	434.8	75	59	116.0	3	18	-321.3	**650.1**					
Mar-05-20 16:37	304	89	91	-32.4	33	17	403.6	128.0	531.6	72	68	29.0	22	20	42.8	**571.1**					
Mar-05-20 18:36	305	84	75	145.6	24	17	176.6	60.5	237.1	74	57	123.3	22	11	235.6	**741.6**					
Mar-05-20 22:05	306	97	81	258.9	83	45	958.6	90.0	1048.6	74	80	-43.5	3	19	-342.7	**921.3**					
Mar-06-20 00:41	307	77	60	275.1	66	29	933.4	175.8	1109.2	85	90	-36.3	18	34	-342.7	**1005.3**					
Mar-06-20 03:18	308	84	70	226.5	79	43	908.2	100.9	1009.0	81	83	-14.5	5	7	-42.8	**1178.2**					
Mar-06-20 05:35	309	89	93	-64.7	69	54	378.4	40.9	419.3	85	79	43.5	1	14	-278.5	**119.7**		920 L moved to the STS mid-run, total Delta (L) 1040			
Mar-06-20 09:16	310	85	99	-226.5	91	57	857.7	31.4	889.1	79	64	108.8	0	0	0.0	**771.4**					
Mar-06-20 12:20	311	84	78	97.1	48	25	580.2	145.8	726.0	47	76	-210.3	1	1	0.0	**612.8**					
Mar-06-20 13:47	312	76	72	64.7	28	19	227.0	74.0	301.0	68	71	-21.8	1	0	21.4	**365.4**					
Mar-06-20 15:26	313	74	30	711.9	9	21	-302.7	-113.3	-416.0	78	67	79.8	0	1	-21.4	**354.2**					
Mar-06-20 17:52	314	90	61	469.2	72	71	25.2	1.3	26.5	54	49	36.3	0	12	-257.0	**274.9**					
Mar-07-20 11:45	315	86	89	-48.5	61	54	176.6	23.2	199.7	61	57	29.0	1	0	21.4	**201.6**					
Mar-07-20 13:31	316	90	81	145.6	39	20	479.3	139.7	619.0	80	61	137.8	2	0	42.8	**945.2**					
Mar-07-20 15:26	317	78	53	404.5	18	10	201.8	76.7	278.5	66	66	0.0	3	0	64.3	**747.3**					
Mar-07-20 18:33	318	62	62	0.0	43	18	630.7	180.1	810.8	63	68	-36.3	1	2	-21.4	**753.1**					
Mar-07-20 21:14	319	89	57	517.8	41	22	479.3	134.2	613.5	53	77	-174.0	1	10	-192.8	**764.5**					
Mar-08-20 01:15	320	85	41	711.9	64	10	1362.2	338.4	1700.7	57	31	188.5	1	3	-42.8	**2558.2**		720L/hour.			
Mar-08-20 21:32	321	66	60	97.1	56	28	706.3	155.3	861.6	65	70	-36.3	1	3	-42.8	**879.6**					
Mar-08-20 23:32	322	75.5	72	56.6	55	20	882.9	216.8	1099.8	75	79	-29.0	14	20	-128.5	**998.9**					
Mar-09-20 01:44	323	94	55	631.0	42	31	277.5	69.7	347.2	51	71	-145.0	1	3	-42.8	**790.4**					
Mar-09-20 05:34	324	66	67	-16.2	52	9	1084.7	309.9	1394.6	58	80	-159.5	1	12	-235.6	**983.3**					
Mar-09-20 08:09	325	101	74	436.9	54	36	454.1	92.0	546.1	50	70	-145.0	10	20	-214.2	**623.8**					
Mar-09-20 11:01	326	80	74	97.1	68	42	655.9	95.4	751.3	62	69	-50.8	1	3	-42.8	**754.8**					
Mar-09-20 13:16	327	73	75	-32.4	40	10	756.8	240.0	996.8	64	78	-101.5	2	2	0.0	**862.9**					
Mar-09-20 15:01	328	103	83	323.6	51	37	353.2	73.6	426.8	69	70	-7.3	1	1	0.0	**743.1**					
Mar-09-20 17:18	329	88	80	129.4	48	39	227.0	48.0	275.0	58	58	0.0	1	1	0.0	**404.4**					
Mar-09-20 20:11	330	79	65	226.5	31	8	580.2	202.3	782.5	59	73	-101.5	0	1	-21.4	**886.1**					
Mar-10-20 18:17	331	100	94	97.1	63	35	706.3	127.0	833.3	52	73	-152.3	2	0	42.8	**821.0**					
Mar-10-20 21:28	332	77	77	0.0	51	16	882.9	237.0	1120.0	81	80	7.3	2	2	0.0	**1127.2**					
Mar-10-20 23:04	333	88	74	226.5	66	38	706.3	114.8	821.2	76	85	-65.3	1	9	-171.4	**811.1**					
Mar-11-20 01:55	334	72	76	-64.7	45	15	756.8	218.3	975.1	77	80	-21.8	1	1	0.0	**888.7**					
Mar-11-20 04:47	335	86	85	16.2	63	27	908.2	184.0	1092.2	62	79	-123.3	1	1	0.0	**985.1**					
Mar-11-20 07:50	336	87	74	210.3	58	33	630.7	126.0	756.7	81	85	-29.0	1	1	0.0	**938.0**					
Mar-11-20 10:57	337	94	74	323.6	56	46	252.3	42.5	294.7	84	65	137.8	18	0	385.6	**1141.6**					
Mar-11-20 12:37	338	66	81	-242.7	65	27	958.6	188.8	1147.4	69	73	-29.0	0	8	-171.4	**704.3**					
Mar-11-20 15:11	339	88	81	113.3	38	11	681.1	218.0	899.1	77	61	116.0	1	0	21.4	**1149.7**					
Mar-11-20 23:10	340	68	73	-80.9	40	13	681.1	210.2	891.3	69	54	108.8	1	0	21.4	**940.5**					
Mar-12-20 01:04	341	96	66	485.4	72	45	681.1	85.4	766.5	62	84	-159.5	1	1	0.0	**1092.4**					
Mar-12-20 04:40	342	84	66	291.2	24	14	252.3	88.7	340.9	54	74	-145.0	26	1	535.5	**1022.7**					
Mar-12-20 07:26	343	83	87	-64.7	77	30	1185.6	182.6	1368.2	45.5	72	-192.1	1	1	0.0	**1111.4**					
Mar-12-20 09:45	344	79	74	80.9	56	49	176.6	28.2	204.8	57	85	-203.0	0	3	-64.3	**18.4**					
Mar-12-20 14:02	345	66	74	-129.4	42	24	454.1	123.2	577.3	75	66	65.3	0	0	0.0	**513.1**					
Mar-12-20 17:51	346	104	81	372.1	71	63	201.8	15.5	217.3	76	59	123.3	0	0	0.0	**712.7**					
Mar-12-20 21:55	347	84	68	258.9	72	49	580.2	66.1	646.3	75	82	-50.8	1	1	0.0	**854.4**					
Mar-13-20 00:52	348	78	74	64.7	56	30	655.9	140.4	796.3	77	75	14.5	1	3	-42.8	**832.7**					
Mar-13-20 04:19	349	69	70	-16.2	49	20	731.6	192.2	923.8	61	74	-94.3	1	2	-21.4	**791.9**					
Mar-13-20 04:19	350	100	88	194.2	49	56	-176.6	-28.2	-204.8	75	72	21.8	0	0	0.0	**11.1**					
Mar-13-20 13:33	351	86	78	129.4	52	60	-201.8	-28.2	-230.0	70	35	253.8	0	0	0.0	**153.2**					

NWMO IGNACE DRILLING - FIELD DATA
MANUAL TANK MEASUREMENTS

ALL TANK MEASUREMENTS ARE FROM THE BASE OF THE TANK TO THE WATER LEVEL

				Calculated			Calculated	Calculated	Calculated			Calculated			Calculated	Calculated			Water Added to the System (fresh)	Flouroscein Added to the System	Fluoroscein Measured
		STS			AMC					Drill			Tub Below Drill							(Solution B)	
Date/Time	Core Run	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	(L) Rectangular sections	(L) Sloped sectio	Delta (L)	Before (cm)	After (cm)	Delta (L)	Before (cm)	After (cm)	Delta (L)	Total Delta (L)	High Vol.. Loss?	Comments	(L)	(ml)	(ppb)
Mar-13-20 16:27	352	74	102	-453.0	46	46	0.0	0.0	0.0	65	71	-43.5	0	0	0.0	**-496.5**					
Mar-13-20 18:31	353	102	76	420.7	76	86	-252.3	0.9	-251.4	52	64	-87.0	0	0	0.0	**82.3**					
Mar-13-20 23:02	354	99	60	631.0	58	59	-25.2	-3.2	-28.4	78	89	-79.8	0	0	0.0	**522.9**					
Mar-14-20 01:20	355	99	82	275.1	58	49	227.0	35.0	262.0	63	80	-123.3	0	0	0.0	**413.8**					
Mar-14-20 03:40	356	96	84	194.2	66	54	302.7	35.4	338.1	48	84	-261.0	0	0	0.0	**271.2**					
Mar-14-20 06:12	357	79	65	226.5	39	38	25.2	6.1	31.3	74	89	-108.8	0	0	0.0	**149.0**					
Mar-14-20 12:51	358	112	75	598.7	53	72	-479.3	-49.1	-528.4	75	70	36.3	8	6	42.8	**149.3**					
Mar-14-20 14:49	359	47	31	258.9	1	6	-126.1	-55.5	-181.7	39	31	58.0	0	4	-85.7	**49.5**					

STS Initial Updated **Updated (last done 05/02/2020 by SG/AC, using measurements from AC and check CM)** 4.54L = 1 imperial gallon
19.23 **16.20** **16.18 L/cm** 2.54 cm = I inch

Initial numbers estimated by monitoring rise after filling with a 50L volume. Numbers retained as a check against volumes calculated by tank dimensions
Updated numbers from measurements of tank dimensions collected by Adnan (early Jan, 2020) and checked against those collected by Adam Coulson (Jan 21, 2020)

AMC
1.8cm = 50L 27.78 **27.78** **See Formula L/cm** Note calculate the difference in area of two trapeziums for the sloped portion
1cm=(2,220L+(z2+y2)^2*1.08 1.1 2865.2 Formula based, assuming angle of sloped section is 30.96 degrees (tan(X)=0.81/1.36)
Drill 38.65 30.8 Angle of sloped section (degrees 0.54 Angle of slope radians
6.75cm = 50L 7.41 **7.41** **7.25 L/cm**

Tub
X.XXcm = 50L 2.20 **21.96** **21.42 L/cm**

Negative values of Delta = Fluid Gain

Appendix F

Field Parameters of Archived Drill Water Samples

	NWMO IGNACE DRILLING - FIELD DATA (DOC ID: SCB1912026-FOR-052 WP02 DQC Drilling R0) FIELD PARAMETERS OF ARCHIVED DRILL FLUID (DW)
Borehole	IG_BH04

Sample ID	Run Number	Depth From	Depth To	Date	Time	Fluorescein Concentration	Density	Temperature	EC	pH	DO	ORP	Turbidity
		(mbgs)	(mbgs)	dd-mmm-yy	hh:mm	(ppb)	g/cc	(˚C)	(mS/cm)	-	mg/L	mV	NTU
IG_BH04_WS001	n/a	n/a	n/a	28-Nov-19	n/a	n/a	n/a	n/a	n/a	7.1	n/a	n/a	n/a
IG_BH04_WS002	n/a	n/a	n/a	01-Dec-19	n/a	n/a	n/a	9.37	0.072	6.94	n/a	109	n/a
IG_BH04_DW001	39	98.20	101.20	30-Nov-19	13:40	89.9	1.01	23	0.45	10.65	8.72	-84	1000
IG_BH04_WS003	40	101.20	104.20	06-Dec-19	9:45	n/a	n/a	10	0.096	6.89	10	158	29.3
IG_BH04_DW003	45	110.21	113.21	18-Dec-19	12:00	137	-	7.61	1.82	14	11.98	-222	782
IG_BH04_WS004	n/a	110.21	110.21	17-Dec-19	14:00	0	n/a	7	0.052	6.59	10	518	0
IG_BH04_DW005	63	152.21	155.21	21-Dec-19	19:45	72	-	16.3	0.906	11.26	-	-77	1000
IG_BH04_DW006	82	200.21	203.21	25-Dec-19	9:40	99.73	1.01	19.48	0.68	11.3	6.78	-125	1000
IG_BH04_DW007	99	248.21	251.21	27-Dec-19	16:00	128.20	1.01	16.32	0.64	11.5	8.19	-91	1000
IG_BH04_DW008	116	299.21	302.21	30-Dec-19	0:30	128.20	1.01	16.64	0.67	11.9	9.35	-90	1000
IG_BH04_DW009	135	350.21	353.21	01-Jan-20	1:30	84.88	1.01	18.01	0.55	11.71	8.3	-99	1000
IG_BH04_DW010	151	398.21	401.21	04-Jan-20	2:30	68.20	1.01	17.32	0.59	11.43	9.31	-97	1000
IG_BH04_WS005	n/a	n/a	n/a	13-Jan-20	7:45	n/a	n/a	12.97	0.054	7.75	13.35	286	29.5
IG_BH04_DW011	155	410.21	413.21	14-Jan-20	23:00	68.81	1.01	19.53	0.814	12.66	8.95	-91	1000
IG_BH04_DW012	170	455.21	458.21	16-Jan-20	23:00	79.96	1.01	17.29	0.545	11.32	9.55	-95	1000
IG_BH04_DW013	187	500.21	503.21	19-Jan-20	4:30	63.47	1.01	18.36	0.645	10.23	4.11	-97	1000
IG_BH04_WS006	n/a	n/a	n/a	20-Jan-20	18:00	n/a	n/a	11.34	0.052	7.74	12.61	651	15.6
IG_BH04_DW014	204	548.21	551.21	21-Jan-20	1:00	111.71	1.01	15.65	0.655	10.45	10.22	134	1000
IG_BH04_DW015	214	581.21	581.21	22-Jan-20	19:25	46.00	1.01	15.15	0.5	11.08	8	-51	1000
IG_BH04_DW016	214	574.91	581.21	25-Jan-20	19:16	99.46	1.01	17.27	0.213	9.2	23.36	244	N/A
IG_BH04_WS007	n/a	n/a	n/a	13-Feb-20	9:30	0.023	n/a	5.49	0.005	6.6	10.46	725	0
IG_BH04_WS009	n/a	n/a	n/a	23-Feb-20	9:53	0.035	n/a	11.24	0.118	7.07	12.69	776	0
IG_BH04_WS008	n/a	n/a	n/a	16-Feb-20	9:30	0.084	n/a	8.7	0.076	6.31	13.19	756	0
IG_BH04_DW017	225	611.21	614.21	17-Feb-20	9:10	108.10	-	15.11	6.6	12.9	6.9	9	1000
IG_BH04_DW018	237	647.21	650.21	18-Feb-20	11:00	111.60	-	10.93	4.26	12.32	5.68	19	586
IG_BH04_DW019	256	704.21	707.21	20-Feb-20	8:30	102.90	-	12.71	1.69	11.99	5.52	24	1000
IG_BH04_DW020	272	747.14	750.14	02-Mar-20	11:00	93.66	-	11.86	1.01	10.5	7.14	24	1000
IG_BH04_WS010	n/a	n/a	n/a	02-Mar-20	13:00	0	n/a	9.76	0.237	7.44	13.19	586	0
IG_BH04_WS011	n/a	n/a	n/a	02-Mar-20	11:00	0	n/a	10.26	0.109	7.13	10.33	654	0
IG_BH04_DW021	288	792.14	795.14	03-Mar-20	18:00	116.80	1.01	11	0.255	10.24	13.5	63	1000
IG_BH04_WS012	n/a	n/a	n/a	05-Mar-20	10:00	0	n/a	9.36	0.112	6.83	12.2	721	0
IG_BH04_DW022	305	843.14	846.14	05-Mar-20	18:30	87.1	1.01	11.02	0.26	10.43	10.77	89	1000
IG_BH04_WS013	n/a	n/a	n/a	08-Mar-20	15:00	0	n/a	11.05	0.069	6.67	9.28	784	0
IG_BH04_DW023	326	900.14	903,14	09-Mar-20	8:20	82.52	1.01	8.2	0.303	9.88	5.77	139	1000
IG_BH04_WS014	n/a	n/a	n/a	10-Mar-20	9:30	0.1	n/a	9.04	0.07	6.84	7.53	811	0
IG_BH04_DW024	344	954.14	957.14	12-Mar-20	8:12	94.14	1.01	14.96	0.365	9.08	5.86	184	1000
IG_BH04_DW025	359	999.14	1000.2	14-Mar-20	14:00	80.17	1.01	9.13	0.411	9.65	6.63	102	1000

Appendix G

Final IG_BH04 Flushing Data

NWMO IGNACE DRILLING - FIELD DATA

FINAL FLUSH PARAMETERS

Date/Time	Borehole Flushing Interval	Fluorescein Level in STS prior to Purging (ppb)	Volume Purged During Interval (L)	Total Volume Purged (L)	Fluorescein in Borehole After Purge (ppb)	Temp (°C)	pH	ORP (mV)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Total Dissolved Solids (g/L)
	Mike Anderson purged overnight											
16/03/20	1	94.26	625	13000	96.87	12.88	9.8	74	0.18	628	12.36	0.117
	2	97.43	1635	14635	99.07	11.42	10.1	63	0.131	734	16.46	0.085
	3	95.67	1800	16435	124.4	10.24	9.98	94	0.101	147	17.59	0.066

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