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7 April 2020

Nicole Brewer
Director - Energy Assessments - Planning and Assessment
Department of Planning, Industry & Environment
4 Parramatta Square, 12 Darcy Street
Parramatta NSW 2150

Re: Response to DPIE RFI - 2 April 2020 -on-land emplacement areas

Dear Nicole,

This letter provides a response to a request for further information received via email on 2 April 2020 from the NSW Department of Planning, Industry and Environment's (DPIE) regarding the proposed on-land emplacement areas for Snowy 2.0 Main Works. The information requested was regarding:

- topsoil management for on-land emplacement areas;
- drainage construction details and long-term outcome design specifications for GF01; and
- geotechnical information.

1 Background and context

The information requested within the correspondence of 2 April 2020 originated from the DPIE independent reviewer for on-land emplacement areas, Chris Waygood.

It should be noted that Snowy Hydro submitted a Preferred Excavated Rock Management Strategy report to DPIE on 24 March 2020, which provided additional information regarding the concept design development program and water management for the on-land excavated rock emplacement areas. These areas are:

- Ravine Bay (at Talbingo Reservoir);
- GF01 (at Talbingo Reservoir);
- Main Yard (at Lobs Hole);
- Peninsula (at Tantangara Reservoir); and
- Rock Forest (outside Kosciuszko National Park), with excavated materials from Marica.

The information provided in this previously submitted report is expected to provide some of the requested information and provides context for the responses herein. As outlined in this report the on-land emplacement areas will be constructed and rehabilitated to achieve stable and non-polluting landforms with similar characteristics to the surrounding landscapes. These emplacement areas will be revegetated with native endemic vegetation. The concept design includes key design principles as well as a range of construction and rehabilitation measures to achieve this objective.

The outcomes of the proposed rehabilitation measures are defined in the Rehabilitation Strategy prepared as part of the Main Works EIS. The active domains and final land use domains provided in the Rehabilitation Strategy provide Snowy Hydro's commitment to achieving rehabilitation outcomes for the Main Works including on-land emplacement areas.

The Preferred Infrastructure Report and Response to Submissions report (PIR-RTS) provided further information on the concept design development for the on-land emplacement areas and the key considerations for their successful rehabilitation. This information is provided below for context.

> Rehabilitation within alpine areas presents some challenges which need careful consideration when carrying out the detailed design of rehabilitation techniques. Some of these key considerations have been informed by the rehabilitation activities carried out by NPWS on the historic Snowy Scheme rehabilitation sites. These considerations include:
>
> - Climate – differences between lower altitude areas such as Talbingo and Lobs Hole compared to the higher altitudes of the Plateau and Tantangara.
> - Topography – the slope variability of the undulating landforms to be rehabilitated.
> - Soils – varying nature of the physical, chemical and microbiological properties of the soils which will guide the selection and use of alternative growth media should they be needed.
> - Excavated materials for landforming – geotechnical and geomorphological stability of excavated materials to understand erodibility and erosivity.
> - Native vegetation – aspect of the landforms and accounting for micro-climates to support vegetation establishment, particularly in the Plateau and Tantangara.
> - Weeds – topsoils from weed infested areas should be avoided with targeted weed control programs carried out where practical prior to vegetation clearance and excavated rock emplacement to reduce for weed infestation.
> - Fauna activity – fencing and feral animal controls programs within the rehabilitation areas may be required to protect soils and vegetation.
> - Fire – establishing native vegetation has a low tolerance to fire, analogous to natural vegetation communities in the early stages of re-growth after fire.
>
> In addition, the success of rehabilitation will also be informed by targeted erosion and landform evolution modelling, combined with revegetation establishment trials, are strongly recommended in order to identify key risks and constraints, and required controls.

The following sections provide further information in response to the request for further information.

2 Topsoil management

- ***Topsoil volumes, nature of the material and scheduling / management of the topsoil can be addressed for all the sites.***

A key timing constraint for the project to carry out extensive detailed intrusive investigations to obtain geotechnical information within the design footprint has been approval framework within KNP.

There are currently two sources of preliminary information on topsoil management which have informed the concept design for the on-land emplacement areas:

- Two completed Geotechnical Investigation Program (GIP) campaigns carried out to inform the Reference Design (the first described within the Snowy Hydro Feasibility Study) and also the design presented in the Main Works EIS. A third GIP investigation is currently underway, with additional geotechnical investigations potentially being required to inform the detailed design process; and

- Excavation and construction works undertaken as part of the Exploratory Works program.

2.1 Geotechnical Investigation Program

Snowy Hydro has undertaken a number of Geotechnical Investigation Programs (GIP) prior and throughout the assessment process for the Main Works EIS Approval. The GIP works have focused principally on the characterisation of the rock, rather than the surface soil, as the significant and complex underground excavations represent the fundamental components of the project and require detailed investigation to enable successful design outcomes.

Nevertheless, these GIP works have provided preliminary information which have guided the development for topsoil management principles outlined within the Rehabilitation Strategy presented in the EIS. Snowy Hydro will be carrying out additional surface drilling as required to inform the detailed design development of these on-land emplacement areas.

Most of the boreholes were augered/hand excavated to residual soil or highly weathered bedrock with a depth of around 30 cm recorded in most locations. No testing was undertaken on the topsoil as part of the GIP.

Table 2.1 provides a summary of the limited topsoil information available in the key areas of the project: Tantangara, Marica and Talbingo.

Table 2.1 Summary of soils data from GIP

Area	Description	BH reference
Tantangara	0.4 m thick of dark grey and brown clayey silt, some sand and organics	BH1114
Marica	0.2 to 0.5m thick (0.4m as weighted average to account for all river flats area): black to dark brown cLAY and sILT, contains some sand and gravel and organics	BH5102
Talbingo	0.3m thick of black silty sAND, contains organics	BH7106

2.2 Exploratory Works

The information available as part of the Exploratory Works access road upgrades is somewhat limited and has not been able to provide further information to guide the detailed development of the on-land emplacement areas within proximity to these works, Main Yard and GF01.

Under the Exploratory Works construction to date, the Contractor responsible for the access roads upgrades has completed bulk earthworks of approximately 200,000 m^3 of material. Within this work, approximately 2,500 m^3 of topsoil material has been stripped for revegetation of road batters. There is therefore a relatively low amount of natural topsoil being uncovered and it has not been able to inform detailed topsoil management.

3 GF01

- ***For GF01, more information is required on:***

- ***the long-term velocities, tractive stresses and armouring required for the drainage lines post construction; and***

- ***the construction sequencing and management of water during construction.***

3.1 Background

Material from the excavation of the tunnels and power station complex of Snowy 2.0 will be placed in spoil emplacement locations, some of which are constructed within creeks or gullies.

The placement of the excavated rock material will block the existing natural drainage path of existing small creeks and thereby requires the stormwater run-off of the catchments upstream of the spoil embankments to be diverted so as not to allow the run-off to back up in the creeks upstream of the spoil embankments and eventually find an uncontrolled way over or around the spoil embankments causing erosion and potential instability of the spoil embankments.

3.2 Long-term velocities

A report generated from GeoFluv for maximum flow velocities and volumetric flow rate of the concept design is provided in Appendix A.

3.3 Tractive Stresses

A report generated from GeoFluv inputs for GF01 for tractive stresses is provided in Appendix A. It must be noted that, as described in the Preferred Excavated Rock Management Strategy report, the concept designs presented in the PIR-RTS will be further developed with detailed design to follow.

3.4 Conceptual design

A design concept for the GF01 spoil emplacement stormwater drainage system involves is provided in Appendix B. The concept design involves construction of small, 2 to 3 m high check weirs in the creek beds at a short distance upstream of the upper boundary of the spoil emplacement footprints. From there, the stormwater run-off would be distributed into drainage culverts skirting around the side of the spoil embankments and lead to the edge of the reservoir to a level below minimum operating level (MOL).

The drainage culverts would be constructed either on excavated ground or placed directly on compacted spoil material. Tapering precast concrete culverts are envisaged which would be placed in an uphill direction starting from the reservoir edge. Each subsequently placed culvert would interlock with the previously placed culvert similar to the interlocking system of roof tiles. This will prevent downhill dislocation but yet the system would remain flexible enough for some degree of movement to accommodate differential settlement of the spoil material.

Culvert elements of 1.5 m length and 1.2 m high side walls sloping at 1v: 1.5h are proposed to limit the weight of each culvert to about 1 tonne making the culvert easy to transport and position in place with the aid of an excavator.

Due to the steepness of the terrain, the invert slope of the culvert would need to be limited to 3% to keep flow velocities within acceptable limits for water flowing over concrete surfaces but yet keep the culvert section as small as possible i.e. 0.75 m at invert level and < 3.0 m at the top.

Because of the limits set for the invert slope of the culverts, drop structures will need to be provided along the culvert route where kinetic energy can be dissipated before the stormwater run-off exits the drop structure and continues on its way in the culvert section and into the reservoir. The size of the drop structures is expected to be limited to 4 m length and 3 m width and not exceeding 1.5 m depth to facilitate access into the drop structure and removal of soil or debris within the reach of a small excavator. A baffle wall may be required to deflect the trajectory of the water jet entering the drop structure and achieve maximum energy dissipation.

The proposed stormwater drainage system is expected to require little maintenance as there are no physical obstructions placed into the flow path of the stormwater run-off as would be the case for closed flow sections like pipes or covered culverts. Tree branches and sediment, however, would need to be removed from time to time from the pits of the drop structures.

An alternative to the concrete culverts that may be investigated further through detailed design, is an excavation of an open channel into the GF01 emplacement. The trapezoidal shape of the channel cross section would be considerably wider to limit the flow velocities (to say < 1.5 m/s) and the invert and side walls of the channel would require armouring with select graded rockfill to avoid scouring. Drop structures would also be required as with the concrete culvert option.

The final drainage designs will be completed during the detailed design phase for the emplacement areas. The final cross-sectional design of the required drainage system will be strongly dependent on the final flow conditions of the final landform design, as well as a detailed geotechnical stability analysis.

3.5 Temporary diversion during construction

Managing or diverting flows around the GF01 on-land emplacement area will be a critical component for consideration in the construction methodology.

As the spoil will be placed and compacted in the embankment in near horizontal layers starting from the bottom up until the upper boundary is reached, a temporary diversion of the stormwater run-off will be required. This is expected to be achieved by constructing a temporary earth and rockfill bund in the creekbed at some distance, say 10 m in elevation above the embankment under construction. From there, the same culverts which are used for the final drainage system will be placed along a contour line from the bund towards the embankment boundary and connected to the already installed culverts of the final drainage system. As the construction of the spoil embankment progresses, the temporary bund and culverts will be relocated uphill until the upper boundary of the spoil embankment is reached.

Alternatively, temporary water diversions will be constructed to divert natural flows from within the gully, around the perimeter of the stockpile area. The conceptual staging of water flow management during the construction phase of the emplacement area is provided in Figure 2.7 and described below.

- Stage 1: Prior to any placement of material, a diversion trench (typically an armoured V channel) will be constructed around the perimeter of the emplacement footprint.
- Stage 2: Once stage one is complete, the natural gully a temporary diversion structure will be constructed, diverting the flows into the newly constructed diversion trench.
- Stage 3: Placement of material can begin within the emplacement footprint, with flow being diverted through the temporary drainage channel around the perimeter of the footprint.
- Stage 4: Whilst placement is occurring and if required, a second diversion trench can be constructed to allow for expansion of the emplacement area, with a new diversion constructed to divert flows.

As mentioned in the Preferred excavated rock management strategy report, no further conceptual design is proposed, with the final construction drainage configuration to be determined during the detail design phase of the project.

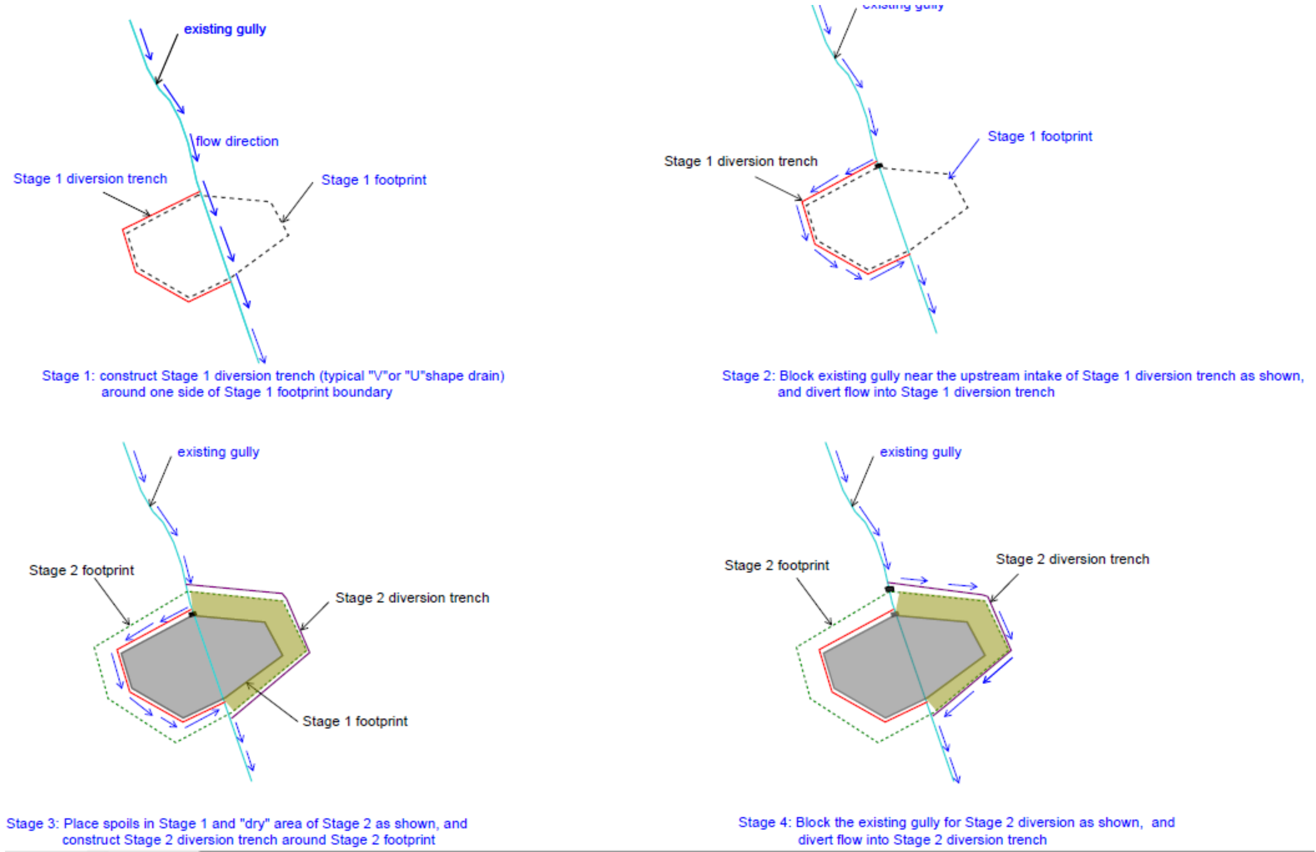


Figure 3.1 Conceptual staging of water flows for construction phase excavated rock emplacement

Concept design principles for the emplacement methods and construction water management of the emplacement areas were provided in Section 4.2 of the Preferred Excavated Rock Strategy report. As stated in that report, during construction where practical, clean water runoff from upslope areas will be diverted around construction areas using either gravity or pump assisted diversions. All watercourses and drainage lines that will be reinstated into rehabilitated landforms will be designed and constructed to be geomorphologically stable using natural channel design techniques.

4 Geotechnical information

- ***For Talbingo, further information on the geotechnical investigations in the area (to the extent possible with the current levels of access) to confirm the long-term viability of the proposed diversion.***

Additional geotechnical information from GIP drill hole engineering logs relevant to the emplacement areas is provided in the sections below.

4.1.1 Tantangara

An extract from the drill hole engineering log undertaken near the Tantangara intake location (BH1114) is provided in Figure 4.1. A map is also provided to show the location in Figure 4.2.

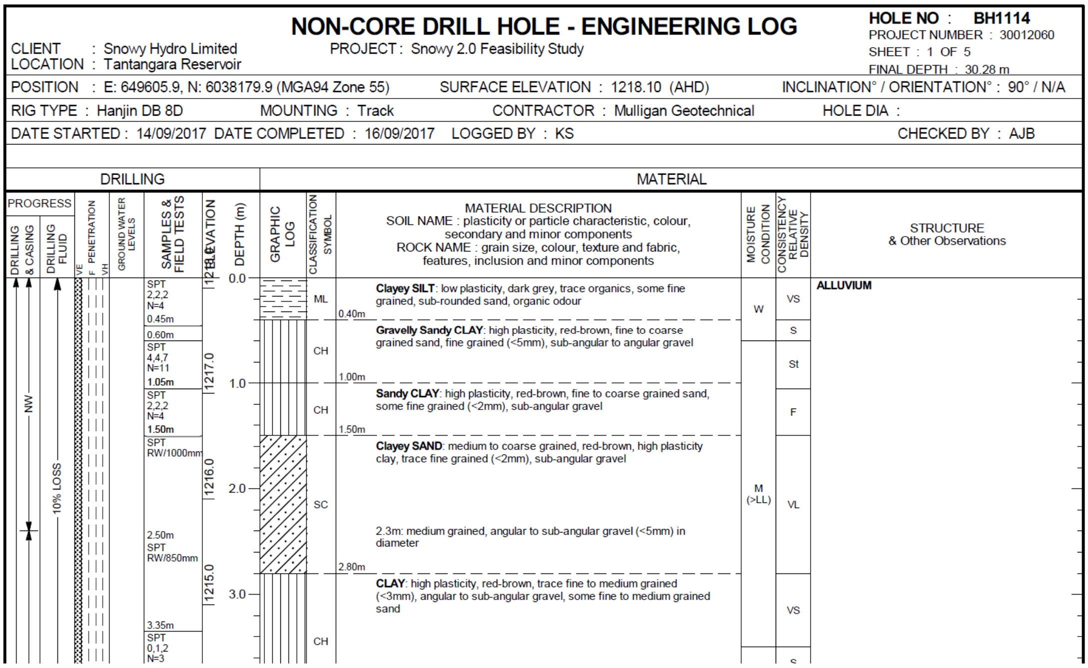


Figure 4.1 Tantangara GIP drill hole engineering log (BH1114)

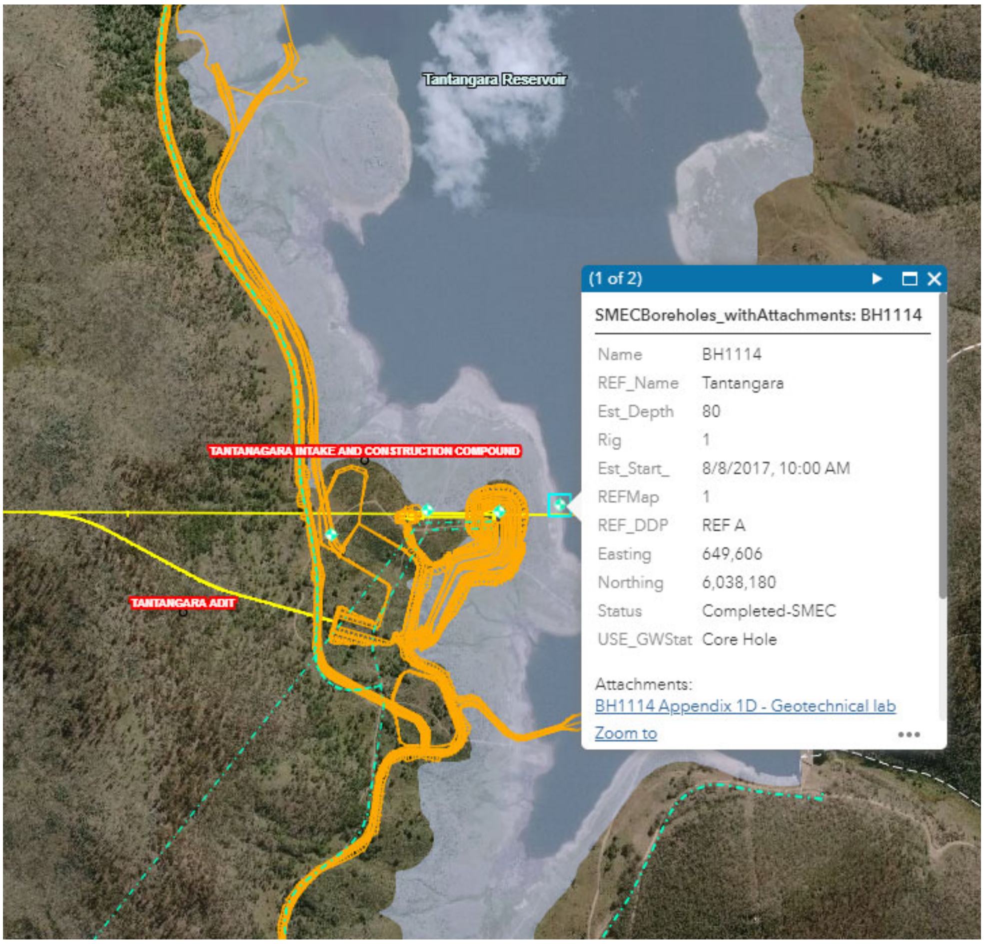
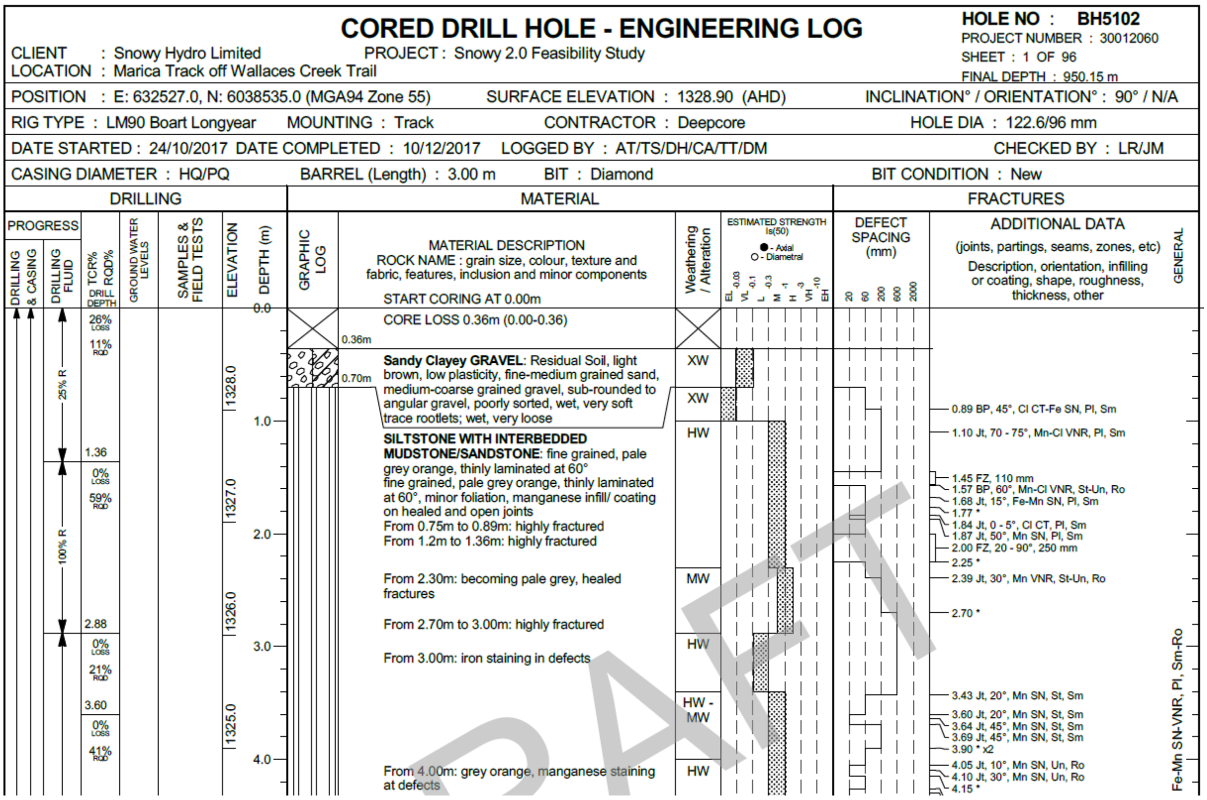


Figure 4.2 Tantangara GIP borehole location (BH1114)

4.1.2 Marica

Marica has been a key focus of the GIP as the area comprises large excavations, notably the upstream surge tank, inclined pressure shaft and underground power station cavern. As an example of the type of soil material at this location, the drill hole log for BH5102 is provided in Figure 4.3. The location of BH5102 is provided in Figure 4.4.



CORED DRILL HOLE - ENGINEERING LOG

HOLE NO : BH5102
PROJECT NUMBER : 30012060
SHEET : 1 OF 96
FINAL DEPTH : 950.15 m

CLIENT : Snowy Hydro Limited
PROJECT : Snowy 2.0 Feasibility Study
LOCATION : Marica Track off Wallaces Creek Trail
POSITION : E: 632527.0, N: 6038535.0 (MGA94 Zone 55)
SURFACE ELEVATION : 1328.90 (AHD)
INCLINATION° / ORIENTATION° : 90° / N/A
RIG TYPE : LM90 Boart Longyear
MOUNTING : Track
CONTRACTOR : Deepcore
HOLE DIA : 122.6/96 mm
DATE STARTED : 24/10/2017
DATE COMPLETED : 10/12/2017
LOGGED BY : AT/TS/DH/CA/TT/DM
CHECKED BY : LR/JM
CASING DIAMETER : HQ/PQ
BARREL (Length) : 3.00 m
BIT : Diamond
BIT CONDITION : New

DRILLING | MATERIAL | FRACTURES

START CORING AT 0.00m

CORE LOSS 0.36m (0.00-0.36)

Sandy Clayey GRAVEL: Residual Soil, light brown, low plasticity, fine-medium grained sand, medium-coarse grained gravel, sub-rounded to angular gravel, poorly sorted, wet, very soft trace rootlets; wet, very loose

SILTSTONE WITH INTERBEDDED MUDSTONE/SANDSTONE: fine grained, pale grey orange, thinly laminated at 60°
fine grained, pale grey orange, thinly laminated at 60°, minor foliation, manganese infill/ coating on healed and open joints
From 0.75m to 0.89m: highly fractured
From 1.2m to 1.36m: highly fractured

From 2.30m: becoming pale grey, healed fractures

From 2.70m to 3.00m: highly fractured

From 3.00m: iron staining in defects

From 4.00m: grey orange, manganese staining at defects

0.89 BP, 45°, Cl CT-Fe SN, Pl, Sm
1.10 Jt, 70 - 75°, Mn-Cl VNR, Pl, Sm
1.45 FZ, 110 mm
1.57 BP, 60°, Mn-Cl VNR, St-Un, Ro
1.68 Jt, 15°, Fe-Mn SN, Pl, Sm
1.77 *
1.84 Jt, 0 - 5°, Cl CT, Pl, Sm
1.87 Jt, 50°, Mn SN, Pl, Sm
2.00 FZ, 20 - 90°, 250 mm
2.25 *
2.39 Jt, 30°, Mn VNR, St-Un, Ro
2.70 *
3.43 Jt, 20°, Mn SN, St, Sm
3.60 Jt, 20°, Mn SN, St, Sm
3.64 Jt, 45°, Mn SN, St, Sm
3.69 Jt, 45°, Mn SN, St, Sm
3.90 * x2
4.05 Jt, 10°, Mn SN, Un, Ro
4.10 Jt, 30°, Mn SN, Un, Ro
4.15 *

Fe-Mn SN-VNR, Pl, Sm-Ro

DRAFT

Figure 4.3 Marica GIP drill hole engineering log (BH5102)

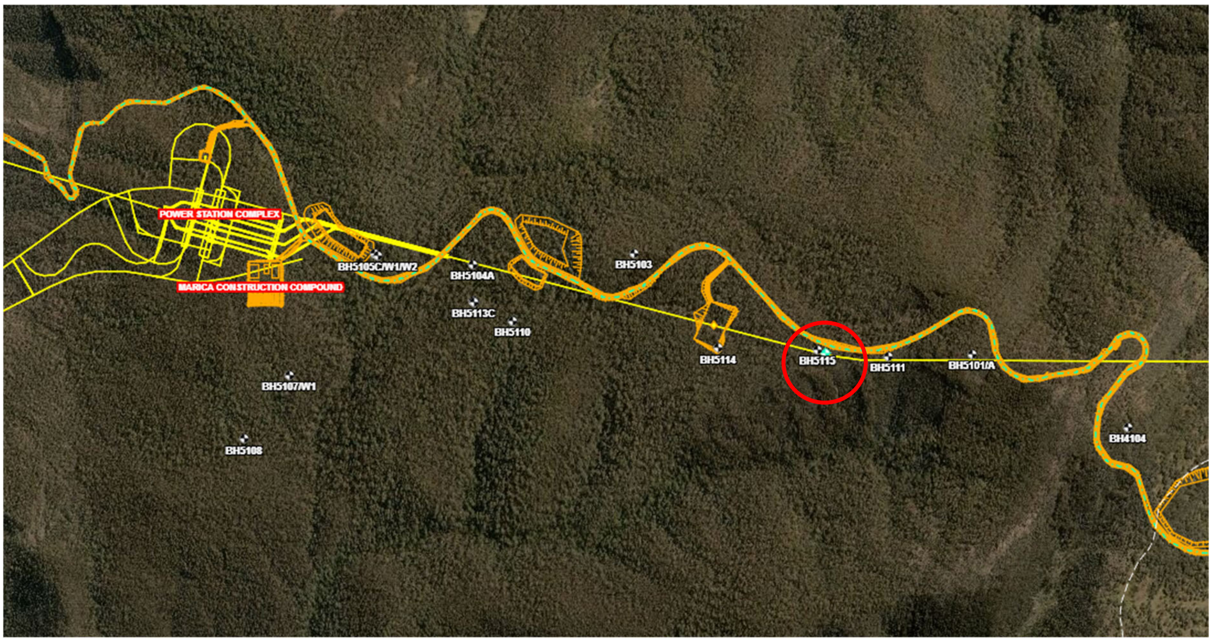


Figure 4.4 Marica GIP borehole location (BH5102)

4.1.3 Talbingo

Numerous drill holes have been executed in the Talbingo area of the Project to inform the design of the Talbingo intake. Currently, no geotechnical investigations have been undertaken at the Ravine Bay emplacement area. These investigations will form part of the activities carried out once approved, as described in the EIS, to inform the detailed design process. See Figure 4.5 providing drill hole locations for reference below.

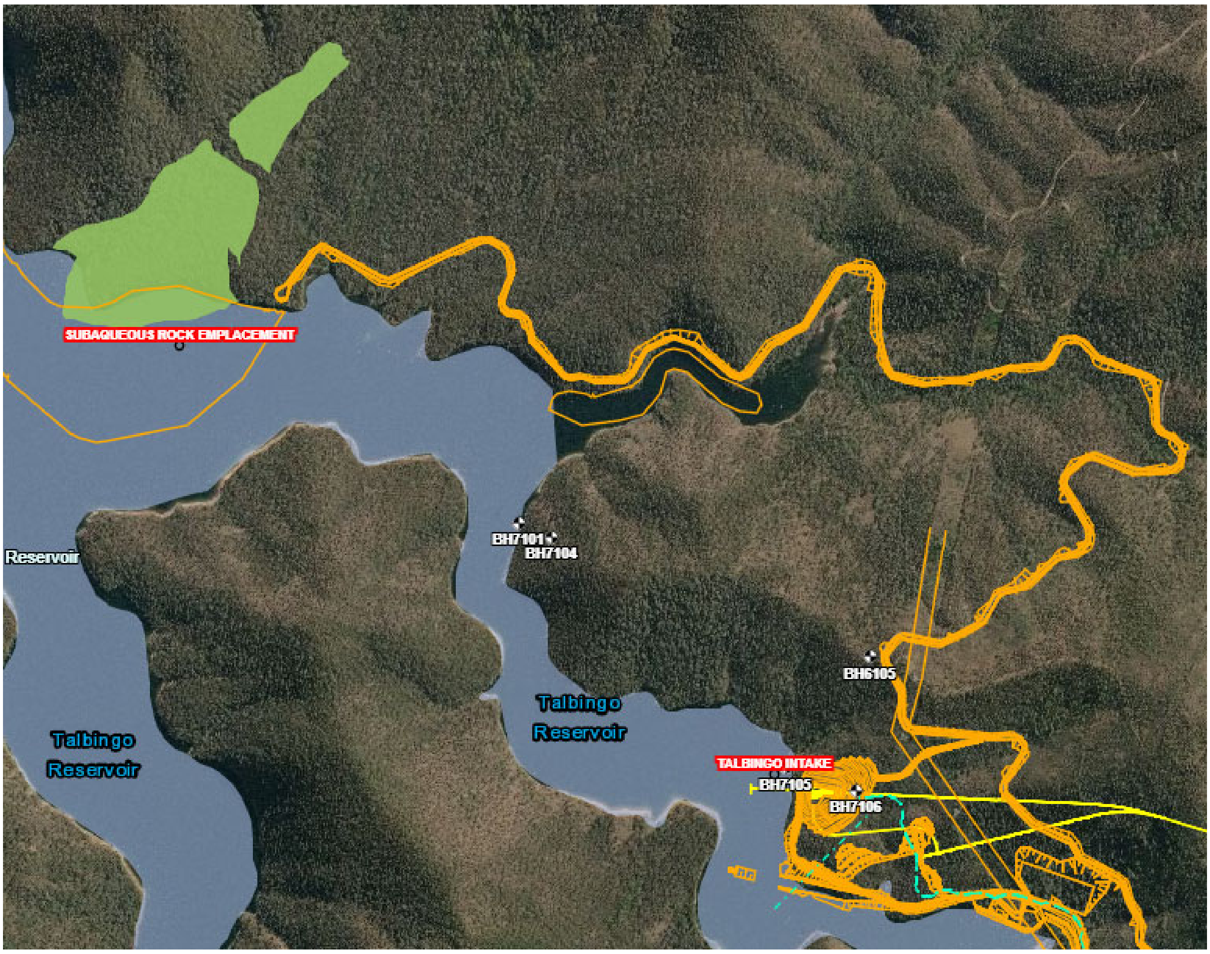


Figure 4.5 Talbingo GIP borehole locations

Based on the geotechnical investigations (borehole drilling and seismic refraction lines) at the nearby Talbingo intake and the Feasibility Study intake site (BH7101, BH7104, BH7105, BH7106 and BH6105), conditions at the Ravine Bay emplacement area can be inferred as follows:

- The bedrock is the Ravine Beds East formation, a succession of shale, slate, sandstone, gritty sandstone and conglomerate.
- Geotechnical strength is expected to have shallow weathering of the bedrock in the initial 2-3 m and low to medium strength. Below this the rock is generally fresh and has high to very high strength.

A drill hole engineering log for BH7106 is provided in Figure 4.6 below.

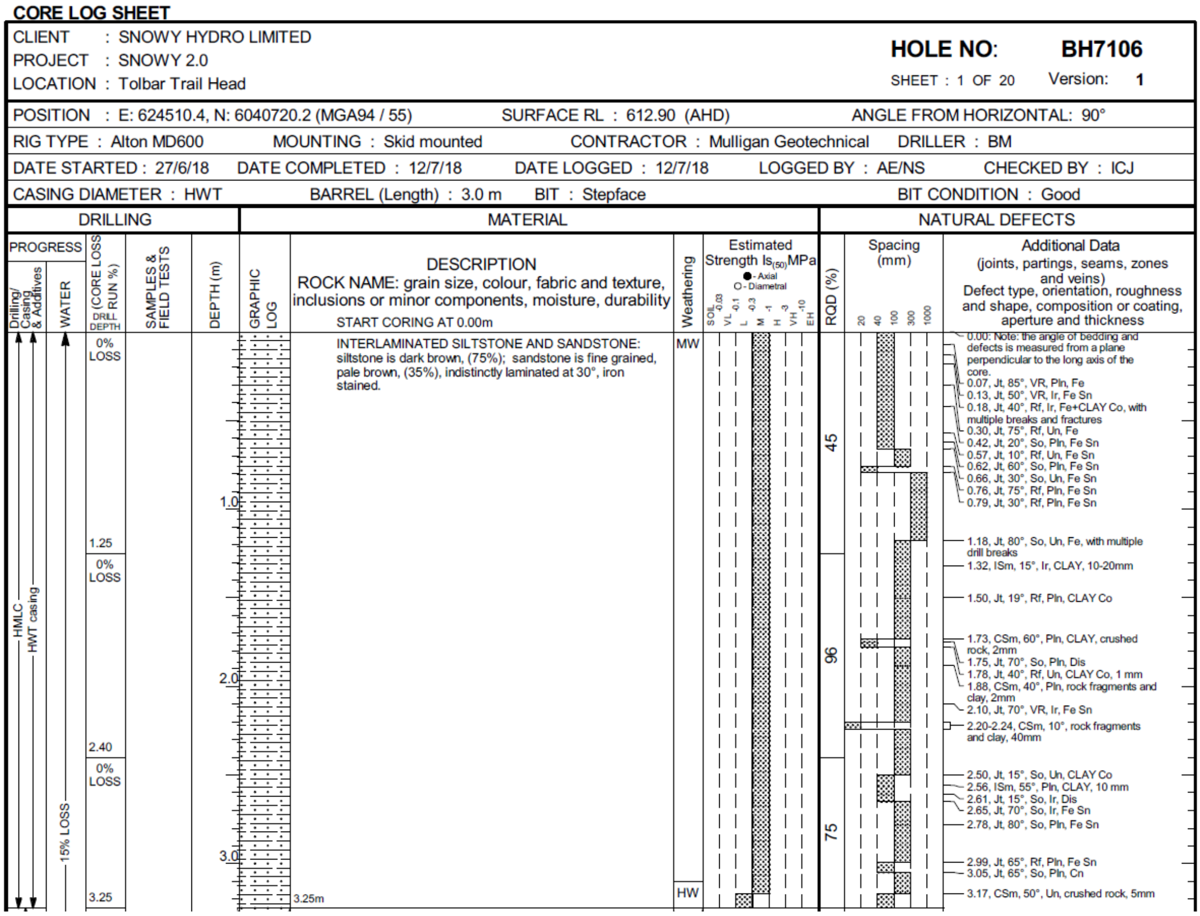
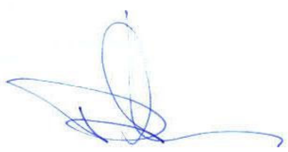


Figure 4.6 Talbingo GIP drill hole engineering log (BH7106)

5 Closing

Should you have any questions about the information provided, please don't hesitate to contact me.

Yours sincerely



Duncan Peake
Director
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Appendix A

GF01-Dec 03_inspector-Natural Regrade Summary Report on Channel ‘main’

```
Natural Regrade Summary Report on Channel 'main'       Fri Apr  3 18:07:10 2020
Report is based on GeoFluv inputs, not on any built channels in the drawing.

watershed area (Ha)                                   9.77
add'l watershed area (Ha)                             0.00
valley length (m)                                     793.86
drainage density (m/Ha)                               107.54
head elevation (m)                                    678.00
head elevation (m)                                    555.72
relief (m)                                            122.27
head slope                                            -0.17
base slope                                            -0.05
slope range                                           -0.187 to -0.054
bankfull width range (m)                              0.11 to 1.04
bankfull depth range (m)                              0.01 to 0.10
width to depth ratio, when slope < -0.04              12.50
width to depth ratio, when slope > -0.04              10.00
flood prone width range (m)                           0.27 to 2.56
flood prone depth range (m)                           0.03 to 0.29
entrenchment ratio                                    2.45
radius of curvature range (m)                         n/a*
meander length range (m)                              n/a*
meander belt width range (m)                          n/a*
sinuosity (channel average)                           1.02
meander width ratio                                   n/a*
maximum design velocity (m/s)                         1.37
runoff coefficient                                    0.30
Tractive force, bankfull width (kg/m^2)               1.88 to 13.70
Tractive force, flood prone width (kg/m^2)            2.86 to 20.80
manual Qpk?                                           no
bankfull Qpk (m^3/s)                                  0.15
flood prone Qpk (m^3/s)                               0.56
*GeoFluv(TM) approach is used for channels steeper than -0.04 in lieu of
Williams (1986) approach.

--------------------------------------------------------------
Cross-section reports are done every 50.00(m).
Chainages are measured along the centerline, starting from the headwaters.
The length of the centerline is 806.17(m).
Left and right are from the point of view of looking downstream.

--------------------------------------------------------------
chainage(m)                 50.00
slope at chainage(%)        -0.18
flood prone width (m)       0.55
flood prone depth (m)       0.06
flood prone area (m^2)      0.02
bankfull width (m)          0.23
bankfull depth (m)          0.02
bankfull area (m^2)         0.00
bottom width (m)            0.05
Tractive force, bankfull width    (kg/m^2)  3.87
Tractive force, flood prone width (kg/m^2)  5.87
right side slope (%)        25.00
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left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                100.00
slope at chainage(%)       -0.18
flood prone width (m)      0.78
flood prone depth (m)      0.09
flood prone area (m^2)     0.04
bankfull width (m)         0.32
bankfull depth (m)         0.03
bankfull area (m^2)        0.01
bottom width (m)           0.06
Tractive force, bankfull width    (kg/m^2)  5.68
Tractive force, flood prone width (kg/m^2)  8.62
right side slope (%)       25.00
left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                150.00
slope at chainage(%)       -0.19
flood prone width (m)      0.96
flood prone depth (m)      0.11
flood prone area (m^2)     0.06
bankfull width (m)         0.39
bankfull depth (m)         0.04
bankfull area (m^2)        0.01
bottom width (m)           0.08
Tractive force, bankfull width    (kg/m^2)  7.11
Tractive force, flood prone width (kg/m^2)  10.79
right side slope (%)       25.00
left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                200.00
slope at chainage(%)       -0.19
flood prone width (m)      1.11
flood prone depth (m)      0.13
flood prone area (m^2)     0.08
bankfull width (m)         0.45
bankfull depth (m)         0.05
bankfull area (m^2)        0.01
bottom width (m)           0.09
Tractive force, bankfull width    (kg/m^2)  8.24
Tractive force, flood prone width (kg/m^2)  12.51
right side slope (%)       25.00
left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                250.00
slope at chainage(%)       -0.19
flood prone width (m)      1.24
flood prone depth (m)      0.14
flood prone area (m^2)     0.10
bankfull width (m)         0.50
```

```
bankfull depth (m)          0.05
bankfull area (m^2)         0.02
bottom width (m)            0.10
Tractive force, bankfull width    (kg/m^2)  9.19
Tractive force, flood prone width (kg/m^2)  13.95
right side slope (%)        25.00
left side slope (%)         25.00

--------------------------------------------------------------
chainage(m)                 300.00
slope at chainage(%)        -0.18
flood prone width (m)       1.36
flood prone depth (m)       0.16
flood prone area (m^2)      0.11
bankfull width (m)          0.55
bankfull depth (m)          0.06
bankfull area (m^2)         0.02
bottom width (m)            0.11
Tractive force, bankfull width    (kg/m^2)  9.93
Tractive force, flood prone width (kg/m^2)  15.07
right side slope (%)        25.00
left side slope (%)         25.00

--------------------------------------------------------------
chainage(m)                 350.00
slope at chainage(%)        -0.18
flood prone width (m)       1.93
flood prone depth (m)       0.22
flood prone area (m^2)      0.23
bankfull width (m)          0.79
bankfull depth (m)          0.08
bankfull area (m^2)         0.04
bottom width (m)            0.16
Tractive force, bankfull width    (kg/m^2)  13.82
Tractive force, flood prone width (kg/m^2)  20.98
right side slope (%)        25.00
left side slope (%)         25.00

--------------------------------------------------------------
chainage(m)                 400.00
slope at chainage(%)        -0.17
flood prone width (m)       2.01
flood prone depth (m)       0.23
flood prone area (m^2)      0.25
bankfull width (m)          0.82
bankfull depth (m)          0.08
bankfull area (m^2)         0.04
bottom width (m)            0.16
Tractive force, bankfull width    (kg/m^2)  13.79
Tractive force, flood prone width (kg/m^2)  20.94
right side slope (%)        25.00
left side slope (%)         25.00

--------------------------------------------------------------
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```
chainage(m)                 450.00
slope at chainage(%)        -0.17
flood prone width (m)       2.08
flood prone depth (m)       0.24
flood prone area (m^2)      0.27
bankfull width (m)          0.85
bankfull depth (m)          0.08
bankfull area (m^2)         0.04
bottom width (m)            0.17
Tractive force, bankfull width    (kg/m^2)  13.76
Tractive force, flood prone width (kg/m^2)  20.88
right side slope (%)        25.00
left side slope (%)         25.00

-----------------------------------------------------------------
chainage(m)                 500.00
slope at chainage(%)        -0.15
flood prone width (m)       2.15
flood prone depth (m)       0.25
flood prone area (m^2)      0.29
bankfull width (m)          0.88
bankfull depth (m)          0.09
bankfull area (m^2)         0.05
bottom width (m)            0.18
Tractive force, bankfull width    (kg/m^2)  13.24
Tractive force, flood prone width (kg/m^2)  20.09
right side slope (%)        25.00
left side slope (%)         25.00

-----------------------------------------------------------------
chainage(m)                 550.00
slope at chainage(%)        -0.14
flood prone width (m)       2.23
flood prone depth (m)       0.26
flood prone area (m^2)      0.31
bankfull width (m)          0.91
bankfull depth (m)          0.09
bankfull area (m^2)         0.05
bottom width (m)            0.18
Tractive force, bankfull width    (kg/m^2)  12.42
Tractive force, flood prone width (kg/m^2)  18.85
right side slope (%)        25.00
left side slope (%)         25.00

-----------------------------------------------------------------
chainage(m)                 600.00
slope at chainage(%)        -0.13
flood prone width (m)       2.30
flood prone depth (m)       0.26
flood prone area (m^2)      0.33
bankfull width (m)          0.94
bankfull depth (m)          0.09
bankfull area (m^2)         0.05
bottom width (m)            0.19
```

```
Tractive force, bankfull width    (kg/m^2)  11.79
Tractive force, flood prone width (kg/m^2)  17.89
right side slope (%)       25.00
left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                650.00
slope at chainage(%)       -0.11
flood prone width (m)      2.36
flood prone depth (m)      0.27
flood prone area (m^2)     0.35
bankfull width (m)         0.96
bankfull depth (m)         0.10
bankfull area (m^2)        0.06
bottom width (m)           0.19
Tractive force, bankfull width    (kg/m^2)  10.32
Tractive force, flood prone width (kg/m^2)  15.67
right side slope (%)       25.00
left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                700.00
slope at chainage(%)       -0.10
flood prone width (m)      2.43
flood prone depth (m)      0.28
flood prone area (m^2)     0.37
bankfull width (m)         0.99
bankfull depth (m)         0.10
bankfull area (m^2)        0.06
bottom width (m)           0.20
Tractive force, bankfull width    (kg/m^2)  9.23
Tractive force, flood prone width (kg/m^2)  14.00
right side slope (%)       25.00
left side slope (%)        25.00

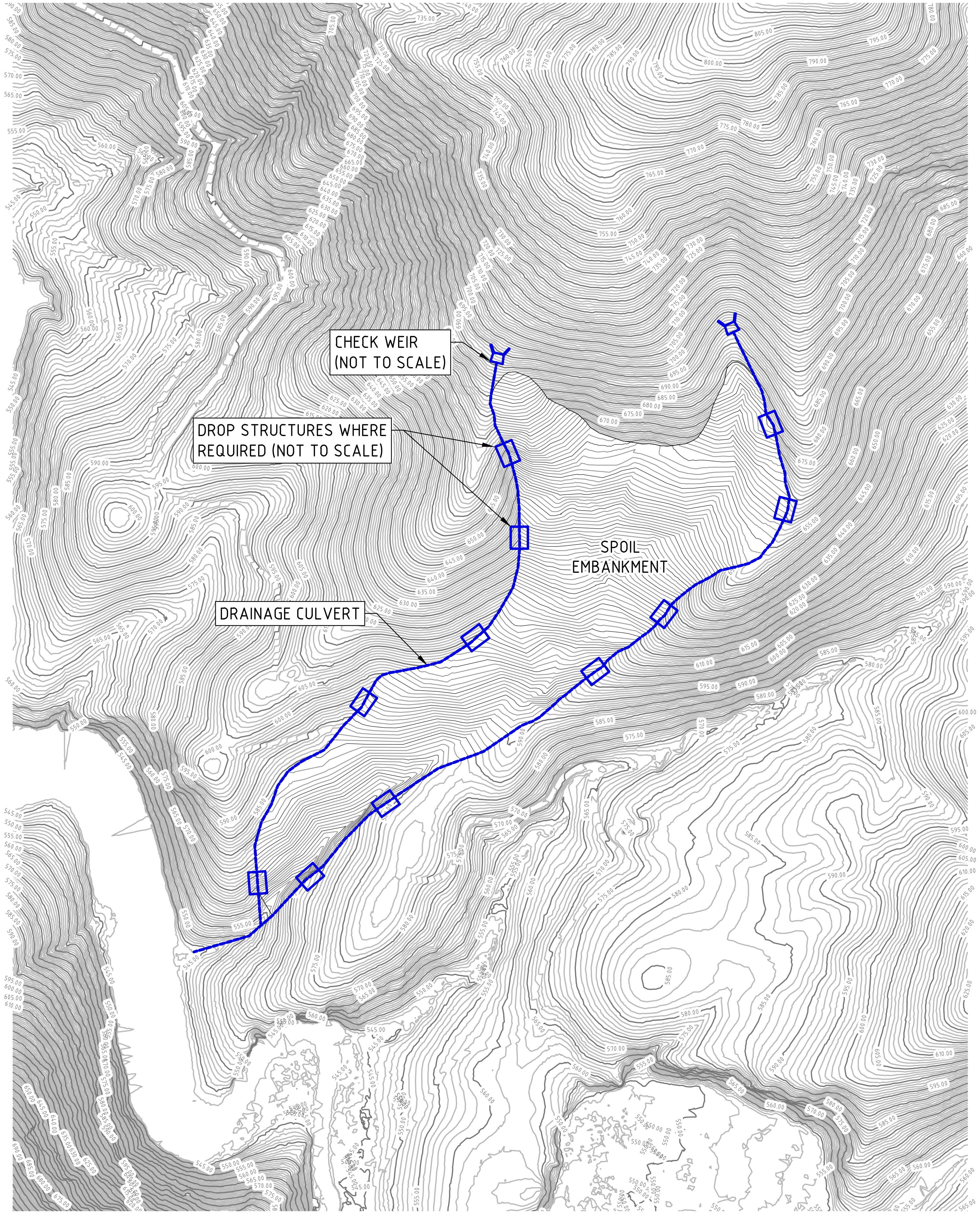
--------------------------------------------------------------
chainage(m)                750.00
slope at chainage(%)       -0.07
flood prone width (m)      2.49
flood prone depth (m)      0.29
flood prone area (m^2)     0.38
bankfull width (m)         1.01
bankfull depth (m)         0.10
bankfull area (m^2)        0.06
bottom width (m)           0.20
Tractive force, bankfull width    (kg/m^2)  7.09
Tractive force, flood prone width (kg/m^2)  10.77
right side slope (%)       25.00
left side slope (%)        25.00

--------------------------------------------------------------
chainage(m)                800.00
slope at chainage(%)       -0.05
flood prone width (m)      2.55
```

```
flood prone depth (m)      0.29
flood prone area (m^2)     0.40
bankfull width (m)         1.04
bankfull depth (m)         0.10
bankfull area (m^2)        0.06
bottom width (m)           0.21
Tractive force, bankfull width    (kg/m^2)  5.53
Tractive force, flood prone width (kg/m^2)  8.39
right side slope (%)       25.00
left side slope (%)        25.00
```

Appendix B

GF01 drainage concept design



NOT FOR CONSTRUCTION

SNOWY 2.0

SPOIL EMBANKMENT

DRAINAGE GENERAL ARRANGEMENT

INFORMATION DOCUMENT

S2-200403-INF-SPOIL-101

snowy2.0

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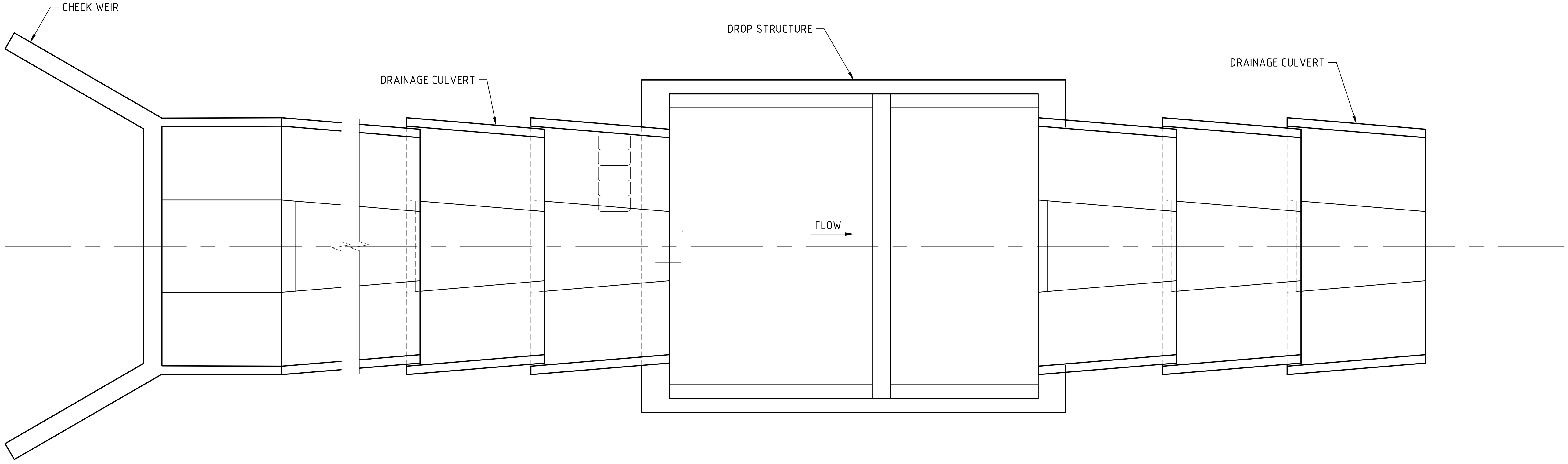

DRAINAGE GENERAL ARRANGEMENT
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NOT FOR CONSTRUCTION

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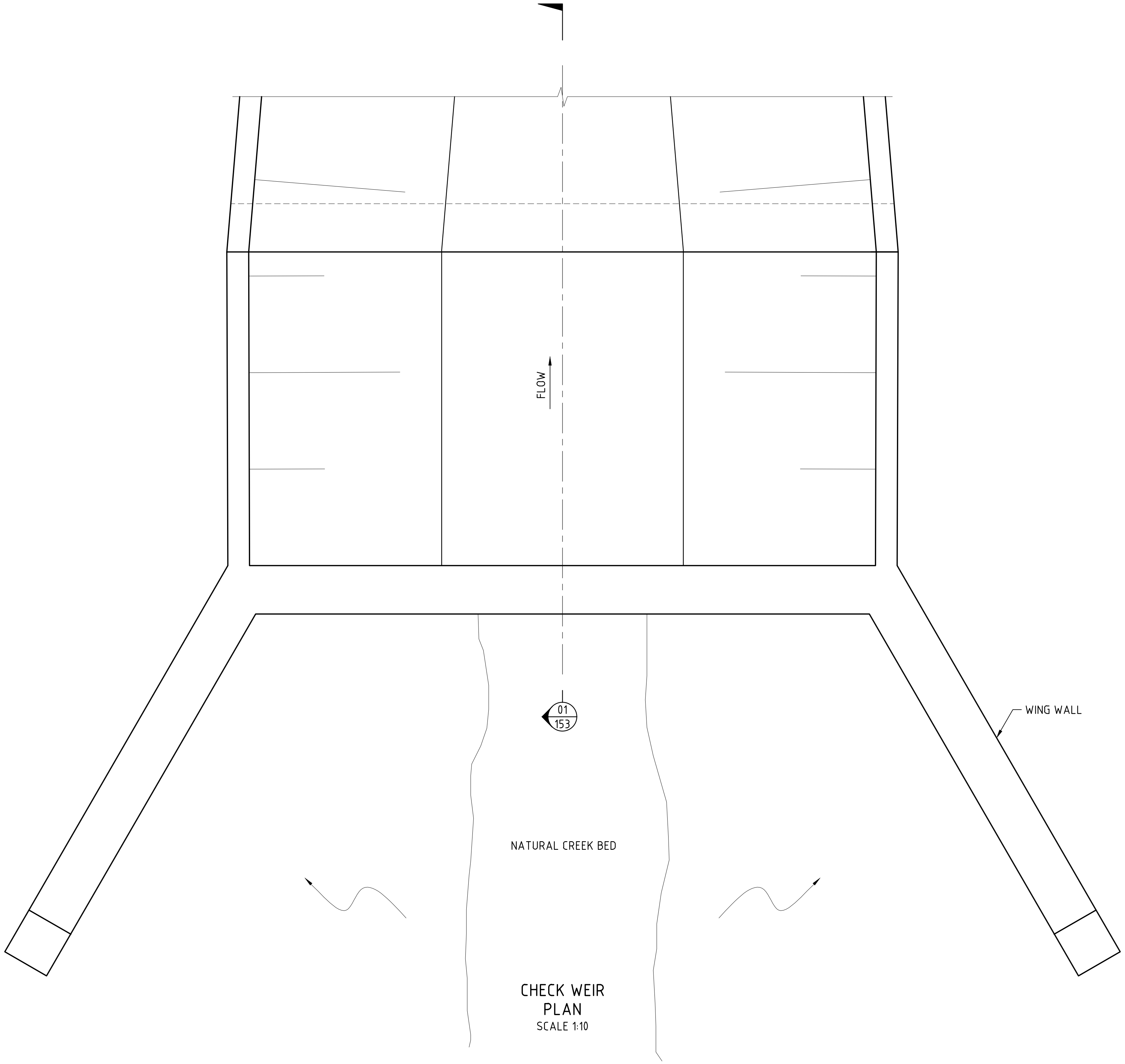
SNOWY 2.0
DRAINAGE STRUCTURES
GENERAL ARRANGEMENT

INFORMATION DOCUMENT

S2-200403-INF-SPOIL-151

snowy 2.0



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NOT FOR CONSTRUCTION

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SPOIL EMBANKMENT
CHECK WEIR

INFORMATION DOCUMENT

S2-200403-INF-SPOIL-152

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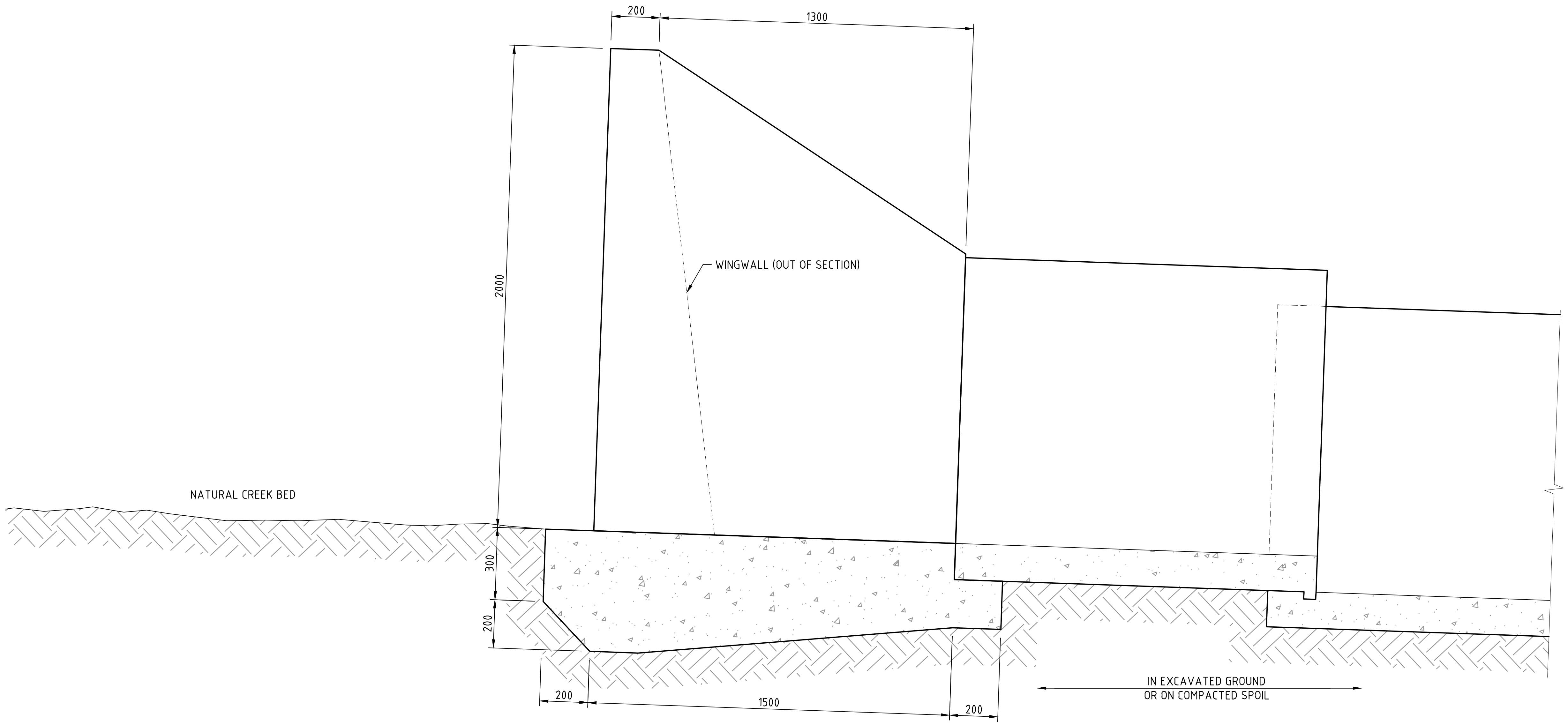

SECTION 01/152
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NOT FOR CONSTRUCTION

SCALE 1:10

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SPOIL EMBANKMENT
CHECK WEIR

INFORMATION DOCUMENT

S2-200403-INF-SPOIL-153

snowy2.0

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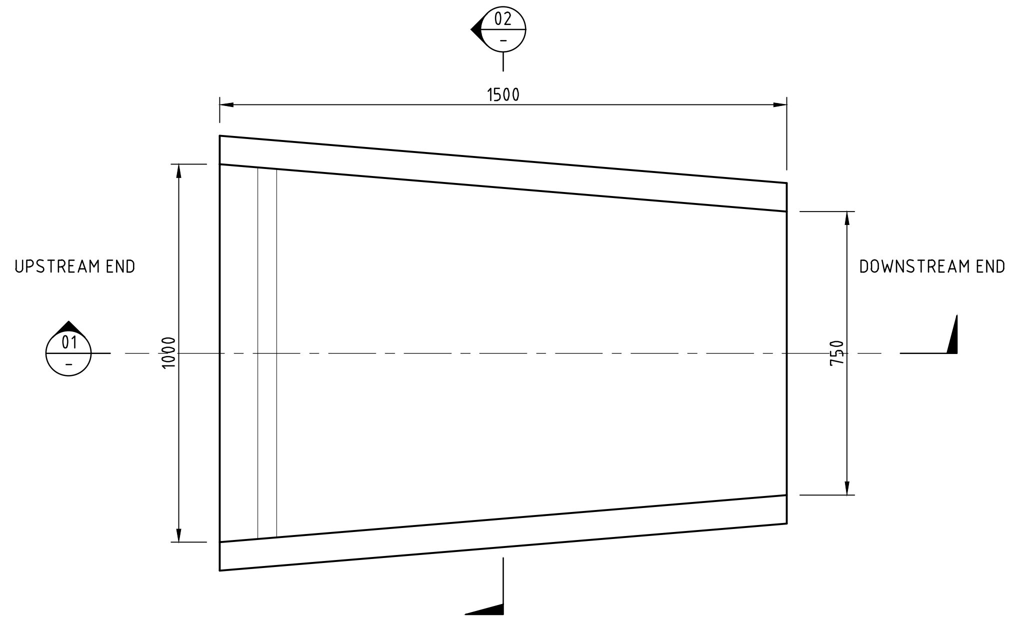

DRAINAGE CULVERT
PLAN AT INVERT
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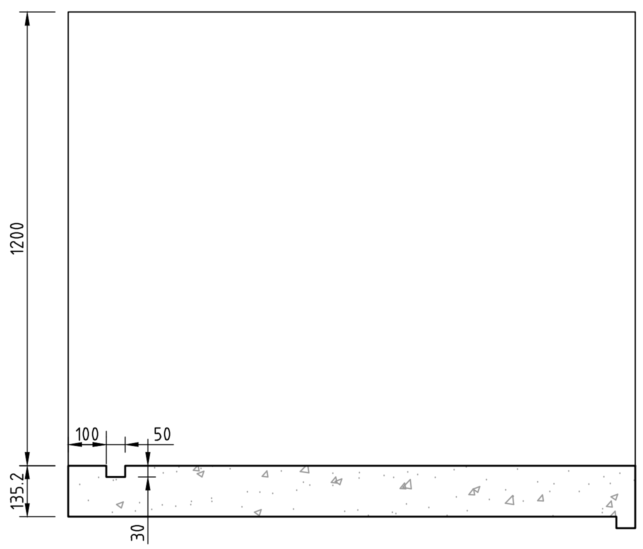

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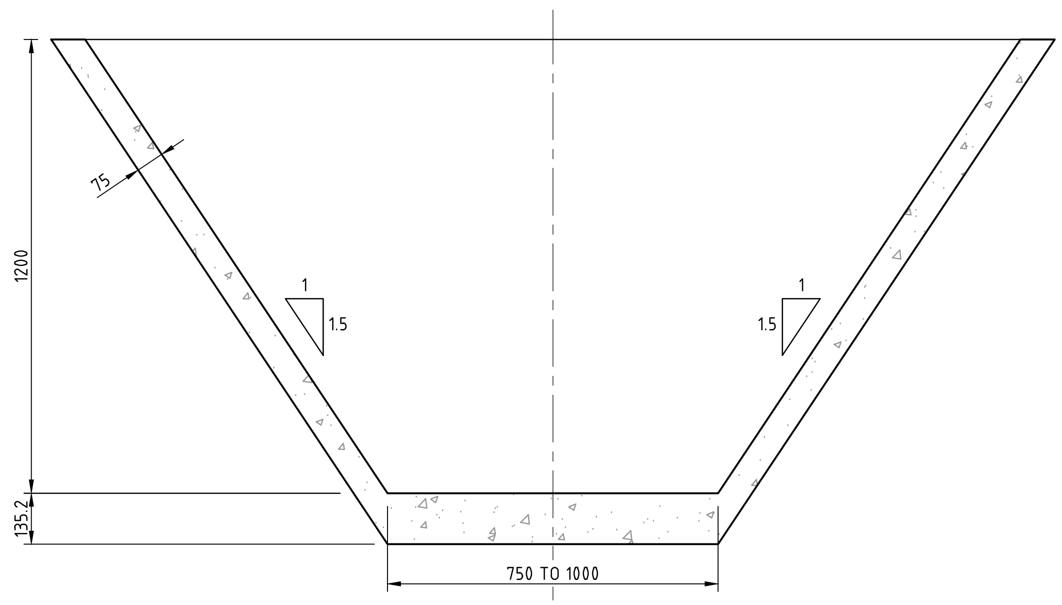

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NOT FOR CONSTRUCTION

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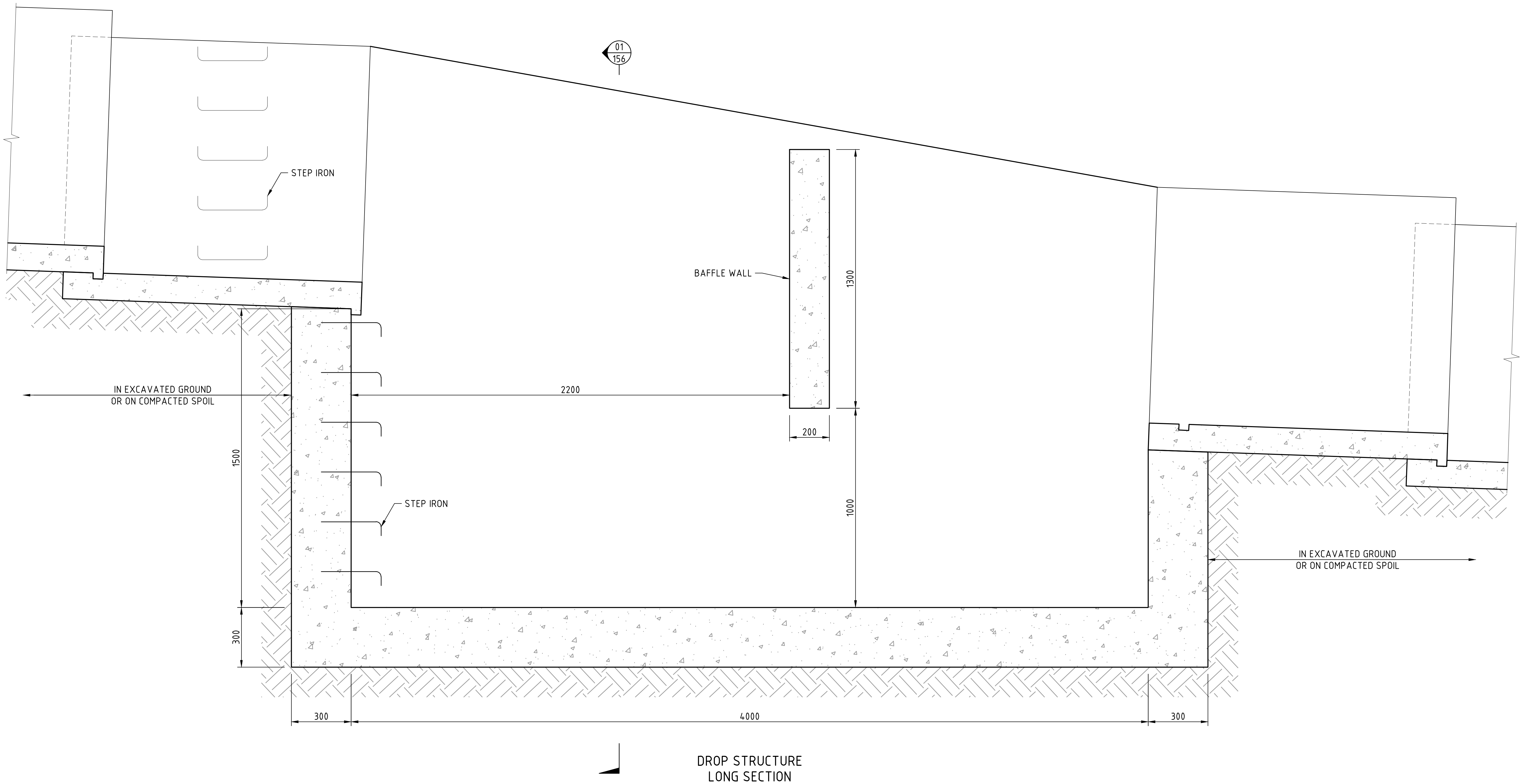
SNOWY 2.0
SPOIL EMBANKMENT
CULVERT

INFORMATION DOCUMENT

S2-200403-INF-SPOIL-154

snowy2.0



DROP STRUCTURE
LONG SECTION
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NOT FOR CONSTRUCTION

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SNOWY 2.0
SPOIL EMBANKMENT
DROP STRUCTURE

INFORMATION DOCUMENT

S2-200403-INF-SPOIL-155

snowy 2.0

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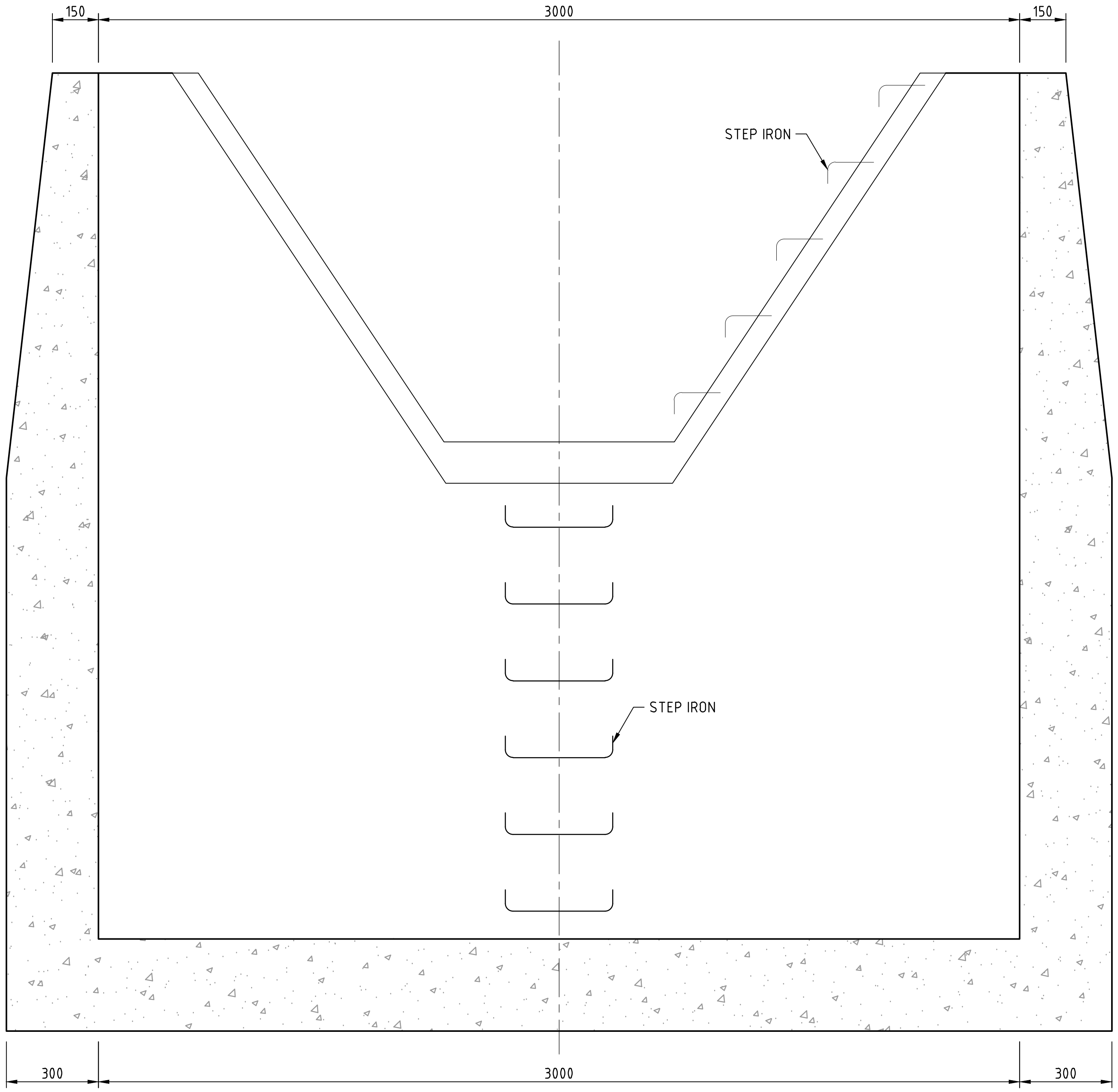

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NOT FOR CONSTRUCTION

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SNOWY 2.0
SPOIL EMBANKMENT
DROP STRUCTURE

INFORMATION DOCUMENT

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