DEWATERING MANAGEMENT PLAN

465-469 PRINCES HIGHWAY & 5-7 GEEVES AVENUE, ROCKDALE NSW

Prepared for:

EMAG APARTMENTS PTY LTD

Reference: P3324_04

14 January 2025

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Dewatering Management Plan

Contents

1 INTRODUCTION

1.1 Overview

Morrow Geotechnics Pty Ltd has carried out a Groundwater Study and prepared a Site Hydrogeology Report for the proposed development at 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW (the site) also known as Lot A & B in DP 315664, Lot A in DP 306355, Lot 1 in DP 131822 and Lot A & B in DP 402977.

The following geotechnical report has been prepared for the site:

- Morrow Geotechnics Pty Ltd, Geotechnical Investigation Report, *465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW,* referenced P3324_01 and dated 24 September 2024 (MG 2024-1).
- Morrow Geotechnics Pty Ltd, Site Hydrogeology Report, *465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW* referenced P3324_03 and dated 14 January 2025 (MG 2025).

The previous geotechnical reports present the results of a site investigation for the proposed development and geotechnical recommendations for design and construction. The 2024-1 Geotechnical Report outlines the measures and techniques to manage geotechnical stability issues.

1.2 Proposed Development

Architectural drawings have been provided by Axel Richter Architects, *Co-Living 465-469 Princes Highway & 5-7 Geeves Avenue Rockdale NSW 2216*, Rev A, dated 30 April 2024, including:

- A100 Site Plan;
- A101 Basement 2;
- A102 Basement 1;
- A200 East Elevation; and
- A201 North Elevation.

From the documentation provided, Morrow Geotechnics understands that the proposed development involves the construction of a six storey multi-dwelling structure over a two level basement. Excavation for the proposed basement is expected to extend to a maximum depth of up to 6.0 m below existing ground level (mBGL) to a depth of RL 9.1 mAHD.

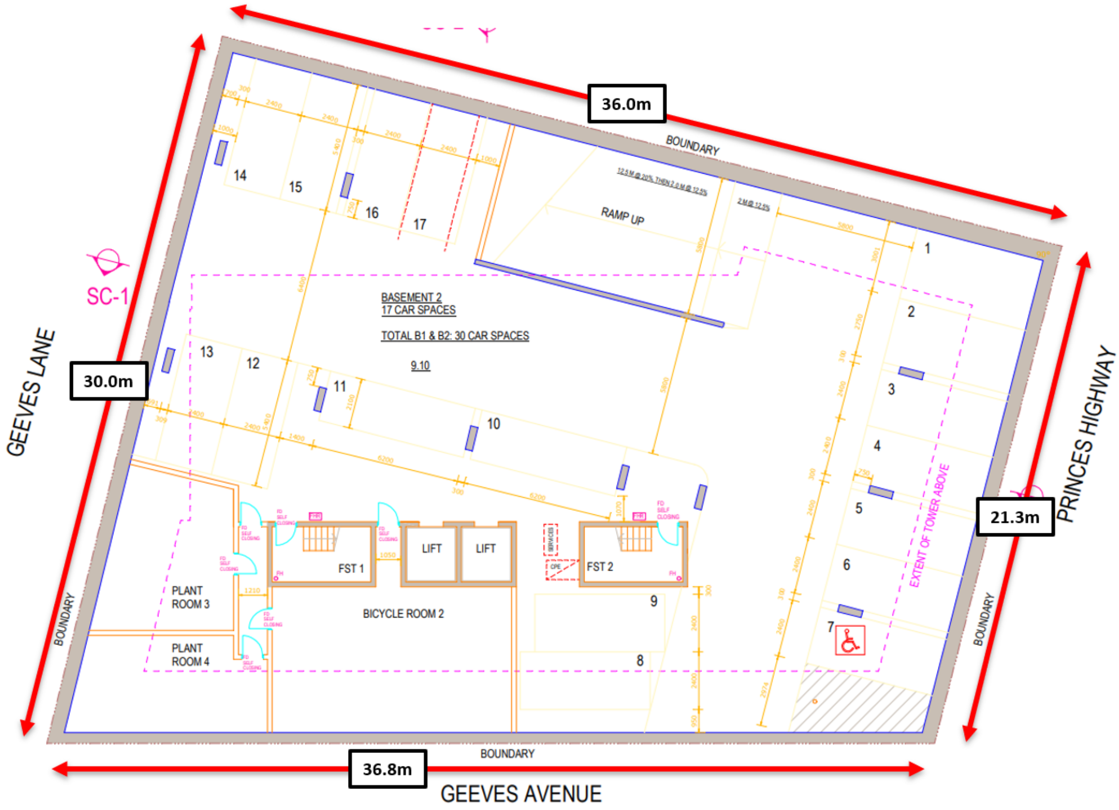

Figure 1: Proposed Basement Dimensions (area 927.3 m², perimeter 124.1m)

1.3 Proposed Dewatering Schedule

Given the moderate to high permeability of the alluvium profile encountered in the geotechnical investigation it is proposed to construct the basement using a cut-off wall socketed into bedrock to minimise groundwater flows. Minor groundwater seepage around the cut-off wall will be allowed to drain through sub-slab drainage and collected by sump pits within the basement.

The excavation program for the proposed basement is expected to take up to 4 months. Temporary construction dewatering is expected to occur for construction seepage inflows during this 4 month period

1.4 Objectives

The objective of this Dewatering Management Plan is to identify a methodology for construction dewatering of the site such that:

- Construction dewatering volumes are quantified to be within acceptable thresholds;
- The location of any groundwater extraction works, if required, is clearly delineated;
- The process for disposal of extracted groundwater, if required, is clearly defined;
- The quality of any groundwater is assessed in accordance with ANZEC freshwater guidelines for disposal off site, if required;
- The impact of groundwater drawdown on neighbouring properties is assessed;
- Provide a NSW Aquifer Interference Policy assessment of the proposed activity;
- Monitoring and contingency plans are outlined for safe management of construction dewatering.
- This Dewatering Management Plan will be used as the basis for approval to enable connection and discharge into the City of Sydney's stormwater system.

2 GEOLOGICAL MODEL

Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130)indicates that the site is underlain by (Rh) Hawkesbury Sandstone, which is typically comprised of medium to coarse-grained quartz sandstone, with very minor shale and laminite lenses.

The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 (2nd Edition) indicates that the site overlies the Newport Landscape. This landscape type typically includes gently undulating plains of Holocene sands to rolling rises over other soils or bedrock. Soils are generally shallow (< 0.5 m) siliceous sands overlaying moderately deep buried sands (< 1.5m) yellow podzolic soil with sandy topsoil on crests and deep (> 2.0m) podzols in depressions earthy sands. These soils are noted present high soil erosion hazards, localized steep slopes, very low soil fertility and non-cohesive topsoil.

Further discussion of the geological and geotechnical conditions at the site is provided in the Geotechnical Investigation Report (MG 2024-1) and in the Site Hydrogeology Report (MG 2025).

3 HYDROGEOLOGICAL MODEL

3.1 Hydrogeological Summary

A full hydrogeological assessment of the site has been carried out by Morrow Geotechnics as referenced in Section 1.1 above and hereafter referred to as MG 2025.

3.2 Summary of Groundwater Observations

Average groundwater levels at the three piezometers are within the Unit 2 – Alluvial Soil and range from RL 12.28 to 12.38 mAHD. The groundwater levels within the alluvial soil represent a stable hydraulic gradient approximately 2.8 to 3.3 mBGL.

Water levels within the boreholes were only slightly responsive to rainfall events during the three month monitoring period. This is inferred to result from surface water infiltration following rainfall recharging the groundwater.

The results of the water level monitoring show a stable hydraulic gradient across the site at approximately 12.3 mAHD. On the basis of ongoing groundwater monitoring at the site it is recommended that a design groundwater level for site is taken at 500 mm above the highest recorded groundwater level (i.e. RL 12.8 mAHD).

On the basis of average permeability testing at the site it is recommended that a design permeability of the alluvium of 5.1×10^{-4} m/s is adopted, representing worst-case permeability taken from the borehole testing.

4 GROUNDWATER FLOW MODELLING

4.1 Proposed Shoring and Groundwater Management

Morrow Geotechnics understands that the structural design will be for a drained basement using a secant pile cut-off wall socketed into rock. Drainage will be allowed below the slab on ground for minor seepage flows around the cut-off wall.

No spear points or wells are proposed for extraction of groundwater at the site. Groundwater seepage will be allowed to drain through strip drainage installed behind shotcrete panels and collected by sump pits within the basement to a sump pit within the excavation. Any accumulation of groundwater within the sump pit would be dewatered by pumping from the sump pit using appropriate environmental controls as discussed in this Dewatering Management Plan.

All discharged water will pass through a suitably designed containment device located on site, before being released into the stormwater system. The discharge water monitoring locations will be determined in conjunction with Council prior to the commencement of the dewatering process.

The anticipated discharge rate would be limited to 10 L/sec per pump to ensure no damage is caused to Council infrastructure. The proposed pumping rate is low in comparison to the capacity of all but the smallest stormwater drains and is highly unlikely to cause overload at any point in the drainage system.

4.2 Analytical Seepage Modelling

Groundwater seepage analysis for flow into the drained basement has been calculated using a Plaxis 2D Flow Module. Plaxis is a 2D finite element and limit equilibrium software package used for design of geotechnical and hydrogeological design of structures such as excavations, dams, embankments and tunnels. PLAXIS 2D calculates deformations, soil stresses, water flow and groundwater pressures.

4.2.1 Modelling Inputs

Geological profiles, groundwater levels and hydraulic permeabilities have been entered into the analytical model as per the hydrogeological model presented in the MG 2024-2 SHR for the site.

For the formation of the model a mean annual deep drainage groundwater recharge flux of 20 mm per year (Australian National Water Commission, 2005) has been assumed.

Two cross sections have been modelled as shown on **Figure 2** below.

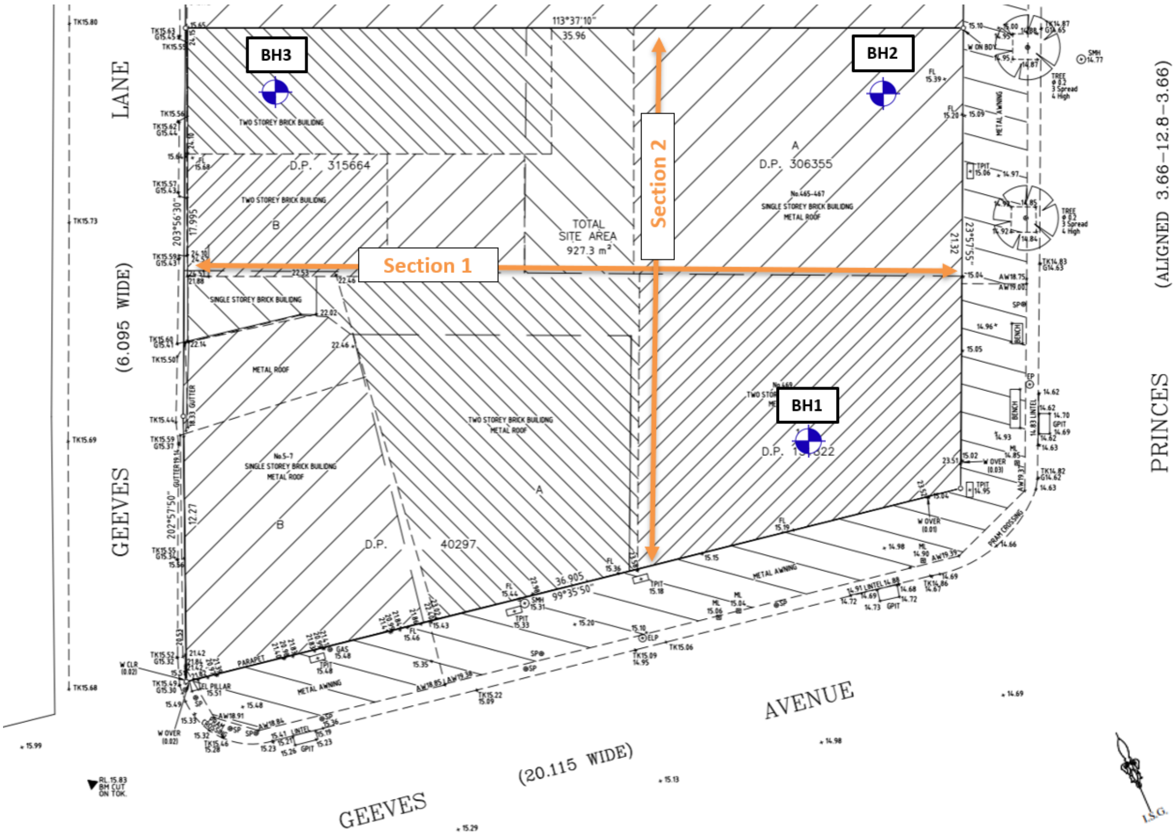

Figure 2: Modelling Sections 1 and 2

The Plaxis model has been set up as a "Flow Only" calculation using the "Transient Groundwater Flow" stage types. Given the relatively low permeability of soil and rock units obtained from the hydraulic conductivity testing, a model width of 300 m and model depth of 75 m was adequate for modelling the full extent of groundwater impacts from the proposed development.

Vertical model boundaries were set as open to allow infinite recharge of flow at model boundaries at the initial ground levels.

Short term flow modelling was based on the initial 24 hour period following excavation. The flow rates from short term modelling have been applied to the entire construction period as a worst case scenario given that flow rates reduce quickly after the initial 24 hour flow period. This has been taken as a conservative approach.

Long term flow modelling was based off stabilized flow after allowing the model to run for a 100 day period. Steady flow rates for all models had been achieved at 100 days.

4.2.2 Modelled Seepage

Typical Plaxis outputs for each groundwater flow modelling and groundwater head drawdown curves are shown in **Figures 3** and **4 below**.

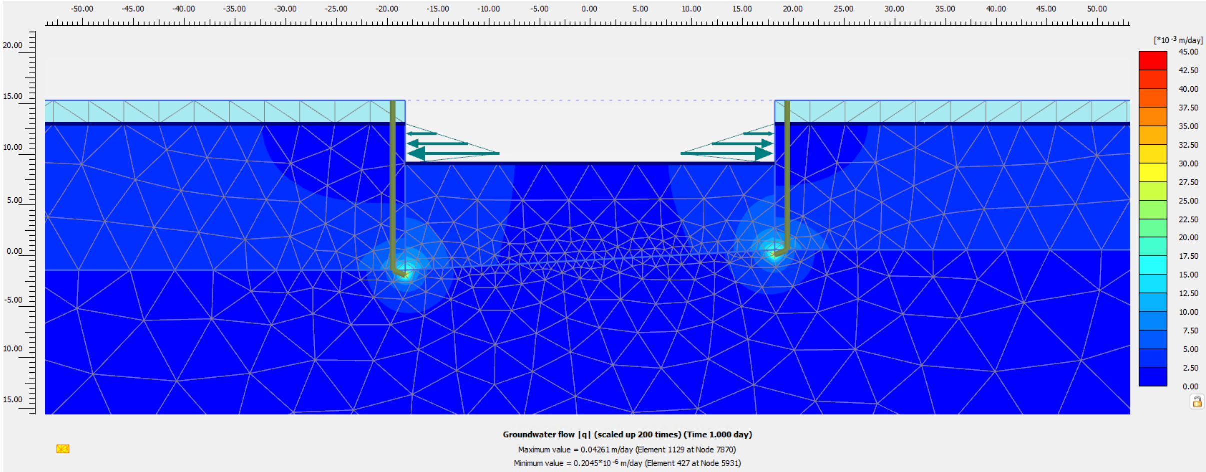

Figure 3: Typical aquifer flow conditions (Section 1 short term flow shown).

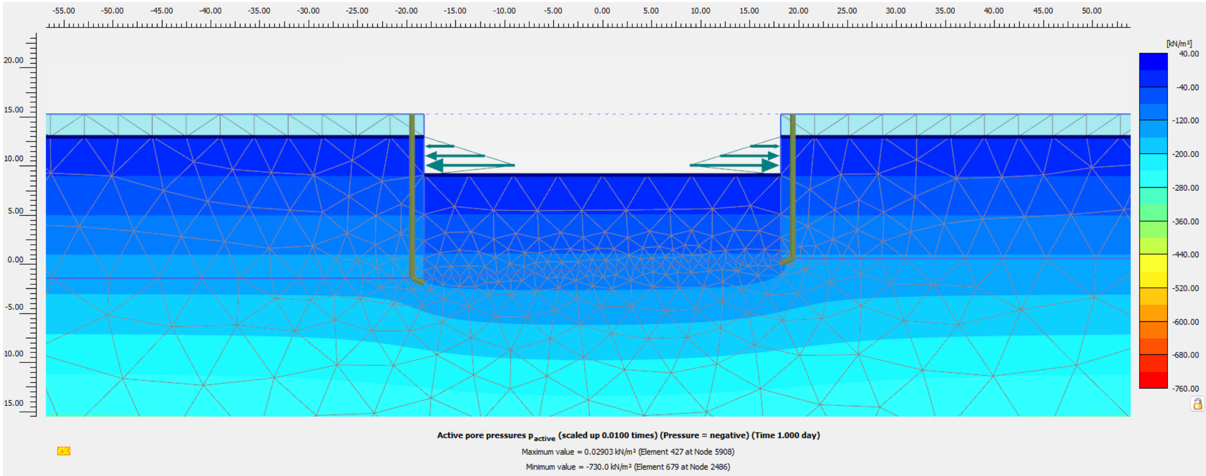

Figure 4: Typical groundwater head drawdown (Section 1 long term flow shown).

Full outputs of Plaxis results are included in the Plaxis output reports attached as **Appendix A.**

Tabulated results of seepage calculations for each of the above cases are presented in **Table 1.**

TABLE 1 MODELLED SEEPAGE INFLOW RATES

Analysis Case	Up Gradient Seepage to Excavation Face (L/day/m)	Down Gradient Seepage to Excavation Face (L/day/m)	Excavation Base Seepage (L/day/m^2)
Section 1 Short Term	0.0	0.0	2.90
Section 1 Long Term	0.0	0.0	2.88
Section 2 Short Term	0.0	0.0	3.85
Section 2 Long Term	0.0	0.0	3.80

Peak upgradient and downgradient seepage rates have been generalized across the 50% of the basement area each as a worst-case projection of groundwater flows. Calculations of total volume of seepage inflow have been based on an excavation perimeter of approximately 124.1 m and an excavation base area of approximately 927.3 m^2.

Based on the above seepage rates and the size of the proposed excavation, the expected seepage to a drained basement is modelled to be:

- Short Term Flows for Temporary Dewatering During Construction
  1.14 ML/year
- Long Term Flows during Service Life of Structure Following Completion of Construction
  1.10 ML/year

Projected seepage inflows for a drained basement are below the WaterNSW threshold for exemption from the requirement of a Water Access License.

4.2.3 Modelled Groundwater drawdown

Groundwater drawdown has been minimized through the use of a cut-off wall. Tabulated results of drawdown calculations for each of the above cases are presented in **Table 2**.

TABLE 2 MODELLED GROUNDWATER DRAWDOWN

Analysis Case	Up Gradient Drawdown (m)				Up Gradient Drawdown (m)				Distance to Minimal Drawdown < (200 mm)
	Distance Behind Excavation Face				Distance Behind Excavation Face				
	0.5 m	5 m	10 m	20 m	0.5 m	5 m	10 m	20 m	
Section 1 Short Term	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Section 1 Long Term	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Section 2 Short Term	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Section 2 Long Term	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Based on the modelling the predicted groundwater drawdown impact on neighbouring properties is negligible.

5 NSW AQUIFER INTERFERENCE POLICY IMPACT ASSESSMENT

The Water Management Act 2000 includes the concept of ensuring “no more than minimal harm” for the granting of approvals.

For the purposes of this assessment and based on the regional hydrogeological profile, the groundwater source at the site is a “less productive” source as it does not contain water supply works that can yield water at a rate greater than 5 L/sec. The Groundwater Source is assessed as a “Alluvial Water Source”.

The impact assessment has been based on the following three assessment criteria:

- **Water Table -**
  Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan” variations, 40m from any:
  (a) high priority groundwater dependent ecosystem; or
  (b) high priority culturally significant site;
  listed in the schedule of the relevant water sharing plan.
  A maximum of a 2m decline cumulatively at any water supply work.

Measured variations in the water table were shown at between 0.36 m and 0.55 m over the monitoring period. Morrow Geotechnics has carried out a search of registered water supply works and none are present within 100 m of the proposed excavation.

Analysis presented within this DMP shows that all drawdown effects of the proposed works are less than 200 mm at less than approximately 5 m away from the excavation, therefore Morrow Geotechnics can confirm that the proposed works will have “minimal impact” on the Water Table.

- **Water Pressure -**
  A cumulative pressure head decline of not more than a 2m decline, at any water supply work.

As discussed, no registered water supply works are present within 100 m of the proposed excavation. Analysis presented within this DMP shows that all drawdown effects of the proposed works are less than 200 mm at less than 5 m away from the excavation, therefore Morrow Geotechnics can confirm that the proposed works will have “minimal impact” on the Water Pressure.

- **Water Quality -**
  Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.

Water quality monitoring will be carried out throughout the works as indicated in Section 6 of this report. The works are not projected to cause any detrimental effect to the water quality beyond 40 m from the activity.

Based on the assessment of the proposed works achieving the requirements of Level 1 minimal impact considerations, Morrow Geotechnics can confirm that the proposed works will do no more than minimal harm to Water Quality.

6 WATER DISCHARGE METHODOLOGY

During the works it will be necessary to discharge water from site when seepage accumulates within the sump or following heavy rainfall.

The process for assessing that water is safe for discharge to Council stormwater systems is as follows:

1. All seepage water within the proposed excavation must be detained on site for testing prior to discharge to stormwater. The site detention should comprise a sump pit which is a minimum 2 m x 2 m x 1 m deep, maintained at the lowest point of the site as shown on **Figure 5** below.
2. Prior to the discharge of water from the site, sampling of the detained water must be undertaken by an environmental specialist. **Water quality testing must take place prior to the discharge of any stormwater/groundwater from the site.**
   Water quality testing is to the published threshold values of the ANZG (2018) guidelines for fresh water systems. Where thresholds for analytes are not given in ANZG (2018), ANZECC (2000) and NEPM (2013) guidelines have been used.
3. If water quality testing returns analyte values within ANZG, ANZECC and NEPM a threshold values then the detained water can be discharged to Council stormwater system in accordance with the following requirements:
   a. The discharge rate will be limited to 10 L/sec per pump to ensure no damage is caused to Council infrastructure. The proposed pumping rate is low in comparison to the capacity of all but the smallest stormwater drains and is highly unlikely to cause overload at any point in the drainage system.
   b. Water quality testing must be undertaken prior to discharge as per the schedule shown in **Table 7** below. No groundwater is to be discharged before the laboratory results are received and interpretated.

- If water quality testing exceeds ANZG, ANZECC and NEPM threshold values then water treatment facilities must be set up on site prior to any discharge from site. This can be achieved by either mixing the discharge water with fresh water to dilute the metal concentration. This may require water storage on site in tanks depending on the progression of the excavation works. Alternatively, water treatment facilities such as those shown below must be established on site to treat stormwater/groundwater prior to any discharge from site. The system must be verified to have reduced analyte levels to below relevant thresholds prior to discharge to stormwater. An indicative water treatment option prior to discharge to stormwater is shown in **Figure 6** below.

There are various water treatment solutions available for wastewater management, tailored to remove contaminants efficiently. A qualified contractor can design and implement the appropriate system based on specific needs. Potential treatment options include:

- **Sediment Tanks**: These tanks offer a simple and effective solution for water with high levels of suspended solids. Internal baffles increase settling time for continuous water flow, improving sediment separation. Chemical dosing units can also be integrated to enhance settling rates, effectively reducing Total Suspended Solids (TSS).
- **Siltstoppers**: Designed to accelerate the settling process, siltstoppers significantly reduce the time needed to remove sediment from impacted water, lowering TSS levels.
- **Chemical Dosing Units**: A variety of chemical dosing systems are available to manage pH levels, reduce TSS, and remove heavy metals from wastewater.

- **Chemically Enhanced Primary Treatment (CEPT)**: CEPT systems combine clarification with chemical dosing and control to treat wastewater through a physio-chemical process. These systems manage pH levels, reduce TSS, remove heavy metals and hydrocarbons, and facilitate solids and sludge handling.
- **Media Filtration**: Media filtration systems are designed to treat contaminants that cannot be removed by physio-chemical methods. These systems adsorb dissolved-phase pollutants and can be used for particle filtration or water polishing (removal of colour and odor). The media type determines the contaminants removed, including heavy metals, hydrocarbons, Total Organic Carbon (TOC), nitrates, and ammonia.
- **Sludge Thickening Tanks**: These tanks are used to store and separate sludge and slurry by-products, facilitating efficient solids management and handling.

These solutions ensure efficient wastewater treatment, addressing a variety of contaminants and enabling safe discharge or reuse.

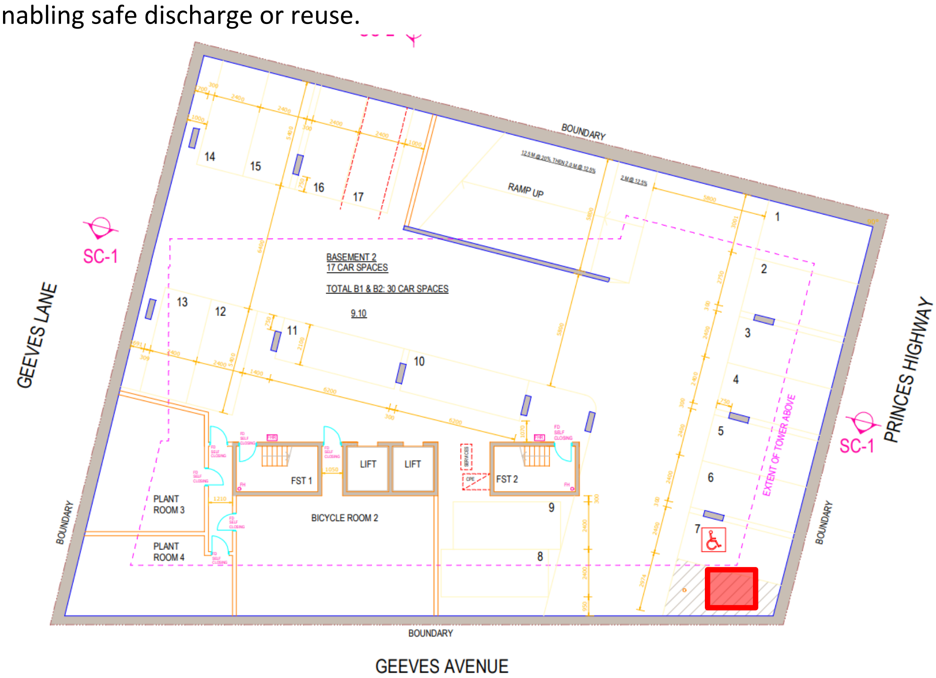

Figure 5: Proposed sump pit location shown in red

Figure 6: Indicative possible treatment system where analyte values exceed Council, ANZG or NEPM threshold values.

7 GROUNDWATER MONITORING

7.1 Water Level Monitoring

During the excavation period the water level must be monitored **daily** within the installed groundwater monitoring wells to ensure that excessive groundwater drawdown does not occur.

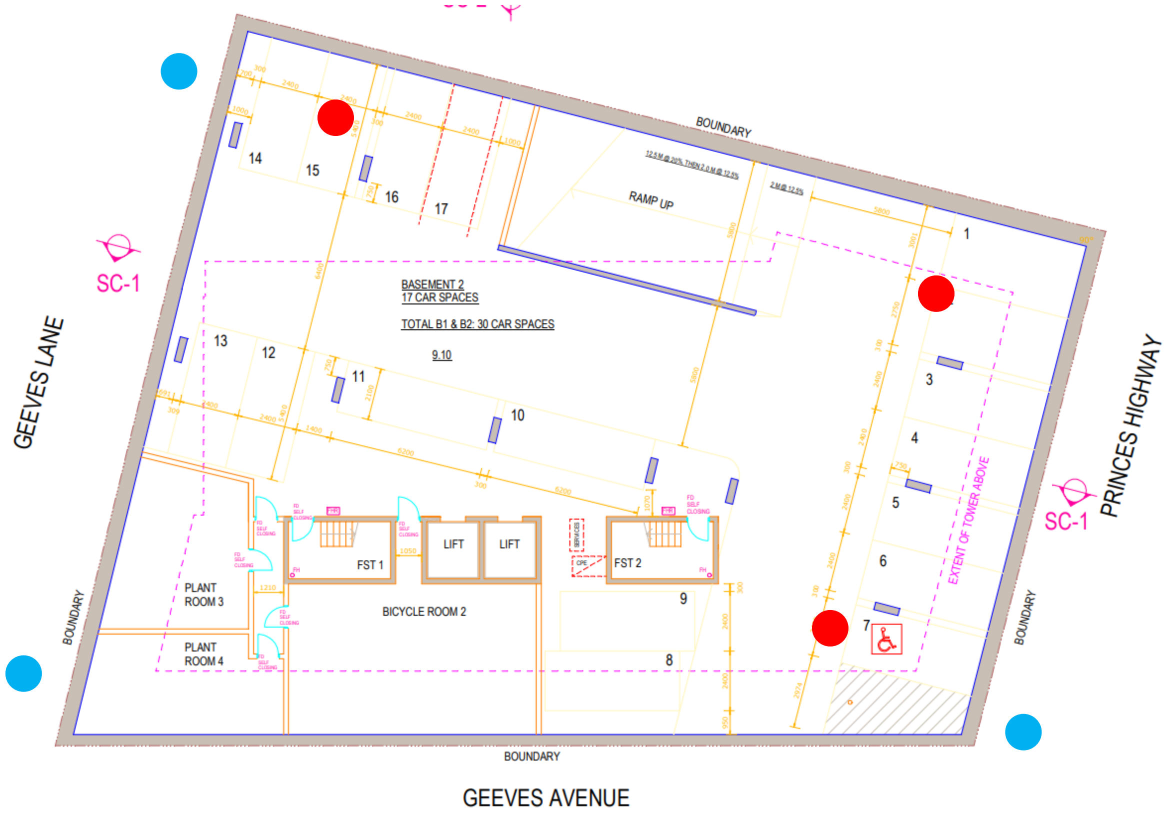

Figure 7: Groundwater level monitoring locations

Existing Monitoring Well Location

Proposed Monitoring Well Location

Groundwater readings are to be taken at a minimum of three monitoring wells during construction. Due to the existing wells being within the proposed basement excavation they must be replaced with a “like for like” well. “Like for like” protocols include all aspects of well construction such as well materials, screened zone, plug depth, etc. Installation details of the existing wells can be found in Section 3.1 of the MG 2023-2 Site Hydrogeology Report.

Prior to the commencement of bulk earthworks at least one round of monitoring should be undertaken to establish baseline readings. Pre works measurements should be forwarded to the project stakeholders outlined in **Table 5**. During the works phase readings should be taken **daily** until works have been completed and no further drawdown is detected.

All groundwater data is to be presented to the project geotechnical and structural engineers along with details of the monitoring visit including:

- date and time of monitoring;
- progress of works at time of monitoring;
- weather conditions during and preceding the monitoring; and
- any further comments relative to the monitoring.

Morrow Geotechnics recommends that drawdown limits are set at 500 mm below baseline readings. Groundwater modelling showed drawdown of up to approximately 0.0 m within 0.5 m of the excavation face. The finite element modelling also showed that the impacts of groundwater drawdown are negligible on neighbouring structures within the geological profile encountered at the site.

The following threshold criteria should be adopted during construction:

- **Alert**: If drawdown levels are less than 70% of the agreed value, works should continue. Monitoring should continue to be carried out at the nominated intervals and monitoring reports forwarded to the relevant stakeholders as outlined in **Table 5**.
- **Alarm**: If drawdown levels are greater than 70% but less than 100% of the agreed value, the geotechnical engineer, structural engineer and client representatives should be notified and the monitoring data reviewed. Ongoing monitoring events should continue undertaken at 24 hour intervals until notified otherwise by nominated engineers in consultation with client and WaterNSW.
- **Action**: If drawdown levels are greater than 100% of the agreed value excavation should cease immediately. The geotechnical engineer, structural engineer, WaterNSW and client representatives should be notified and work should cease until a risk management/contingency plan is implemented to safeguard neighbouring structures. Monitoring should continue daily during this period.

TABLE 3 SUMMARY OF MONITORING CONDITIONS

	Criteria
Monitoring Points	Well locations as shown in Figure 8 above
Agreed Drawdown Limit	500 mm
Alert Level	< 350 mm
Alarm Level	350 - 500 mm
Action Level	> 500 mm

7.2 Water Quality Monitoring

During excavation works water quality samples from the discharged water must be tested according to the frequency outlined in **Table 4** below.

Water samples are to be sent to a NATA accredited laboratory for testing against council, ANZG (2018), ANZECC (2000) and NEPM (2013) standards. Relevant water quality results are presented in **Table 7** to **Table 11** of the MG2024-2 report, lab results are attached in **Appendix B**.

If analyte values exceed the published threshold values of the council, ANZG (2018), ANZECC (2000) and NEPM (2013) guidelines for fresh water systems then the geotechnical engineer, structural engineer, WaterNSW and client representatives should be notified.

Initial water quality testing indicated that the natural groundwater concentrations of **Copper and Zinc** are above the ANZG (2018), ANZECC (2000) and NEPM (2013) freshwater guidelines. Baseline conditions at the site must be considered in preparation of a response to exceedances of ANZG, ANZECC and NEPM thresholds.

TABLE 4 LIST OF REQUIRED LABORATORY TESTS AND SCHEDULE

Type	Corresponding laboratory analyses	Testing requirements	Testing Frequency
Physical Parameters	Alkalinity (bicarbonate, carbonate, hydroxide and total), electrical conductivity (EC), pH, redox potential (Eh), total dissolved solids (TDS), total hardness, temperature, dissolved oxygen (DO)	Mandatory	Daily while discharging water
Other Physical Parameters	Turbidity* (NTU), total suspended solids* (TSS), total organic carbon* (TOC), sodium absorption ratio* (SAR)	Mandatory for discharge to any receiving waters	Weekly while discharging water
Major Anions	Sulfate (SO4), chloride (Cl), carbonates (CO3), bromide (Br), fluoride (F)	Mandatory	Weekly while discharging water
Major Cations	Calcium (Ca), magnesium (Mg), sodium (Na), potassium (K)	Mandatory	Weekly while discharging water
Ionic Balance	Cation/anion balance (as a percentage)	Mandatory	Weekly while discharging water
Dissolved Inorganics and Dissolved Heavy metals	Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silica (dissolved SiO2), silver (Ag), strontium (Sr), uranium (U), vanadium (V), zinc (Zn)	Mandatory for baseline thereafter negotiable, depending on site setting unless otherwise required by another regulatory body	Weekly while discharging water
Nutrients	Ammonia (NH3), nitrate (NO3), total nitrogen (N), oxidised nitrogen (N), total phosphorus (P), reactive phosphorus (P)	Mandatory for baseline thereafter negotiable, depending on site setting unless otherwise required by another regulatory body	As specified by WaterNSW
Microbiological Organisms	Faecal coliforms, faecal streptococci, Escherichia coli	Mandatory for baseline thereafter negotiable, depending on site setting unless otherwise required by another regulatory body	As specified by WaterNSW

Type	Corresponding laboratory analyses	Testing requirements	Testing Frequency
Organics	Benzene toluene ethylbenzene xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRHs)	Mandatory for baseline thereafter negotiable, depending on site contamination status unless otherwise required by another regulatory body	As specified by WaterNSW
Other	Range of analytes relevant to site-specific contaminants of environmental concern—for example: • pesticides (OCPS, OPPs) • polychlorinated biphenyls (PCBs) • semivolatile chlorinated hydrocarbons (SVOCs) • volatile chlorinated hydrocarbons (VOCs) • chlorinated aliphatics • phenols • perfluoroalkyl and polyfluoroalkyl substances (PFAS)	As required by the NSW EPA or accredited site auditor (for properties regulated under the Contaminated Land Management Act 1997), on the advice of a specialist environmental consultant or as required by another regulatory body	As specified by WaterNSW

7.3 Contingency Measures

Contingency measures are to be determined by the project geotechnical and structural engineers in response to groundwater drawdown behaviour observed during the excavation. Possible contingency measures may include:

- Inspection of ground conditions on neighbouring sites;
- Ceasing excavation during updates to excavation support design;
- Groundwater reinjection;
- Permeation grouting to reduce the permeability of native material.

7.4 Reporting and Record Keeping

The project will be operating under the exemption for aquifer interference activities taking up to 3 ML per water year. A record of estimated extraction volumes must be completed for each period of take within 24 hours of the end of take. The completed *Record of Groundwater Take Under Exemption* (attached in **appendix B)** form must be submitted to WaterNSW upon the completion of the project or after the completion of the water year (1 July – 30 June).

7.5 Project Stakeholders

TABLE 5 STAKEHOLDER CONTACTS

	Contact Person	Contact Details
	Wil Nino Emag Apartments Pty Ltd	info@constructora.com.au 0411 299 865
Hydrogeologist/Geotechnical Engineer	Andrew Butel Morrow Geotechnics	andy@morrowgeo.com.au 0427 357 856
WaterNSW		enquiries@waternsw.com.au 1300 662 077

8 CONCLUSIONS AND RECOMMENDATIONS

This report has been prepared in response to WaterNSW General Terms of Approval and the Water Management Act 2000. Licensing for temporary construction dewatering from WaterNSW and DPIE will be required for the excavation works at the site.

Water shares within the water source are not easily available. The findings of this report are that the expected groundwater seepage volumes to the site are below the WaterNSW threshold for exemption from the requirement of a Water Access License. It is recommended that the client makes an application for a Water Access License exemption for the project.

Seepage water will need to be managed within the open excavation during excavation. Approval by NSW DPI Office of Water for a Temporary Dewatering License will be required along with approval from local council to discharge water to the stormwater system.

9 STATEMENT OF LIMITATIONS

The advice and parameters presented in this Groundwater Management Plan are for assessment of the expected groundwater seepage based upon the proposed development and encountered site conditions at the investigation locations.

We draw your attention to the document “Important Information”, which is attached to this letter. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Morrow Geotechnics, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

10 CLOSURE

Please do not hesitate to contact the undersigned should you have any questions.

For and on behalf of Morrow Geotechnics Pty Ltd,

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P3324 - Borehole Location Plan

Client No:	Job No: P3324

Client: Emag Apartments Pty Ltd

Project: Rockdale

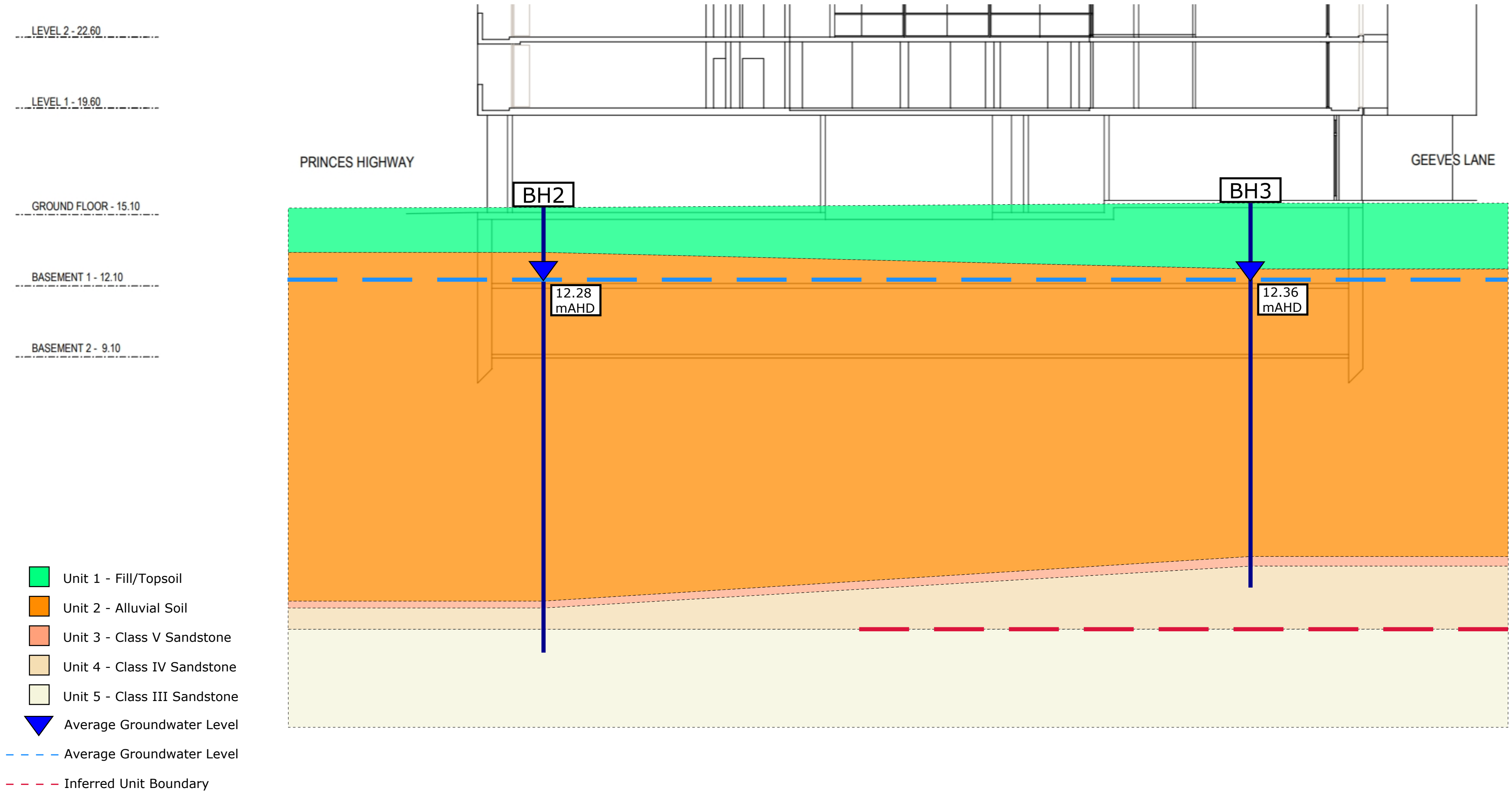
Address: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW

Legend:

Borehole Locations

Image Source: NearMap	Viewed: 2024-09-23

Drawn By: Mark Peach	Checked By: Rhiannon McKeon	Date: 2024-09-23	Figure: 1



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Project
Geotechnical Investigation

Project Address
465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW 2027

Drawing Title
Section 1

Client
EMAG Apartments Pty Ltd

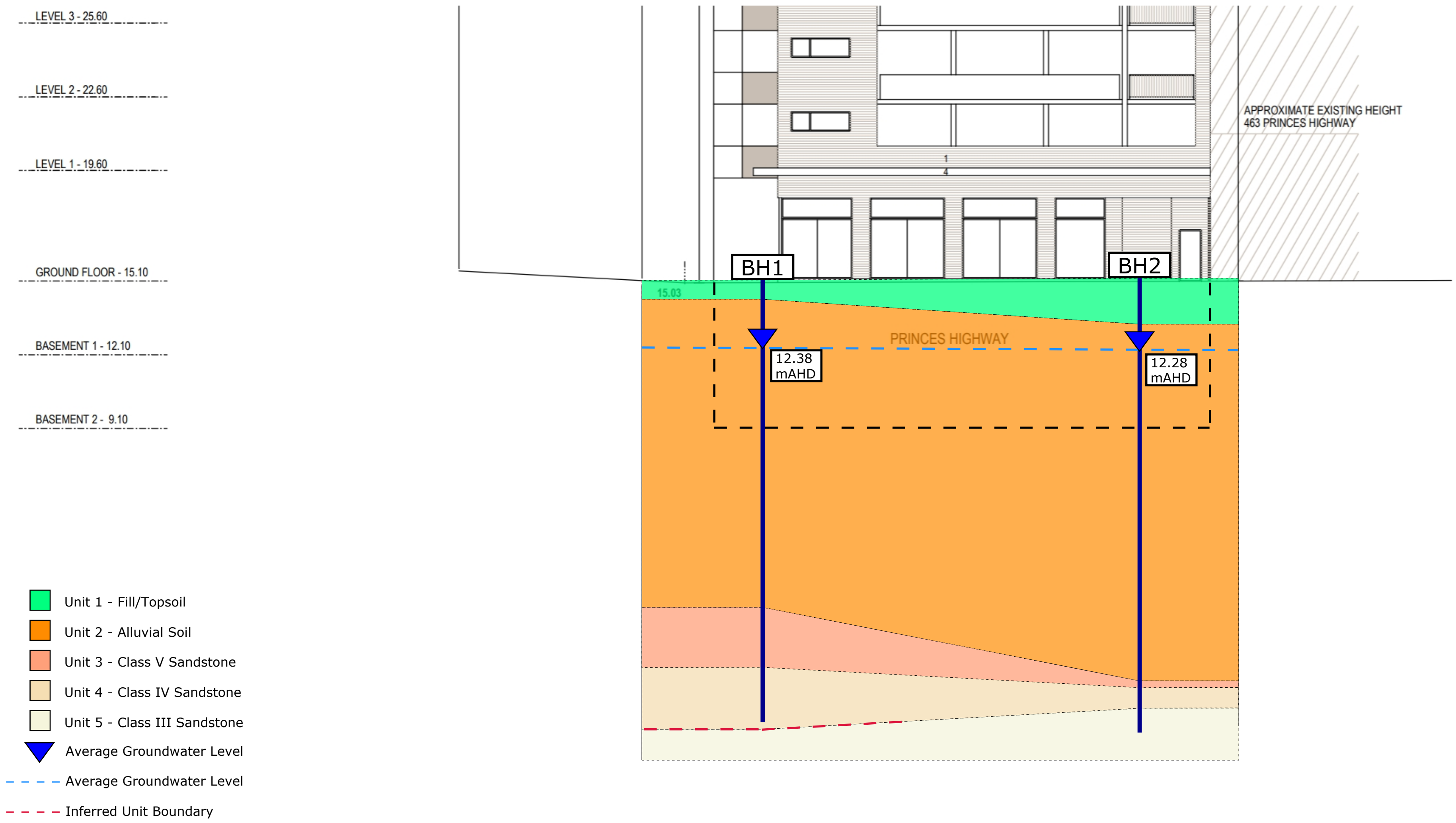
Project Number
P3324

Figure
2

Scale:
Not To Scale

Drawn By:
AB

Date:
13 January 2025



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Project
Geotechnical Investigation

Project Address
465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW 2027

Drawing Title
Section 1

Client
EMAG Apartments Pty Ltd

Project Number
P3324

Figure
3

Scale:
Not To Scale

Drawn By:
AB

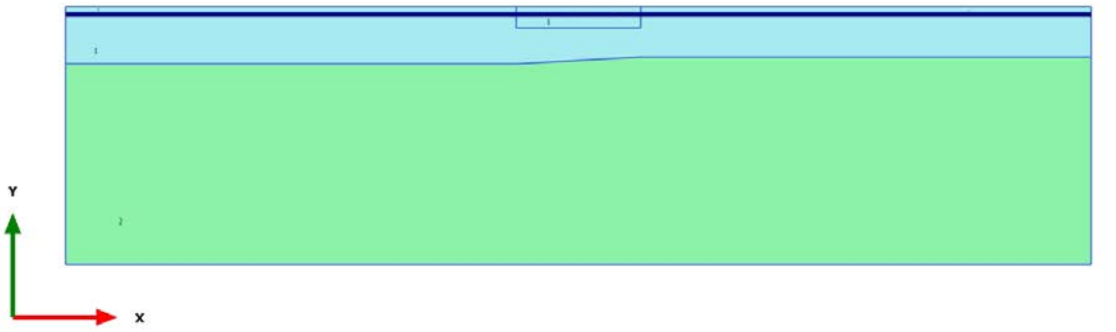
Date:
13 January 2025

PLAXIS FLOW MODELLING REPORTS

Appendix A

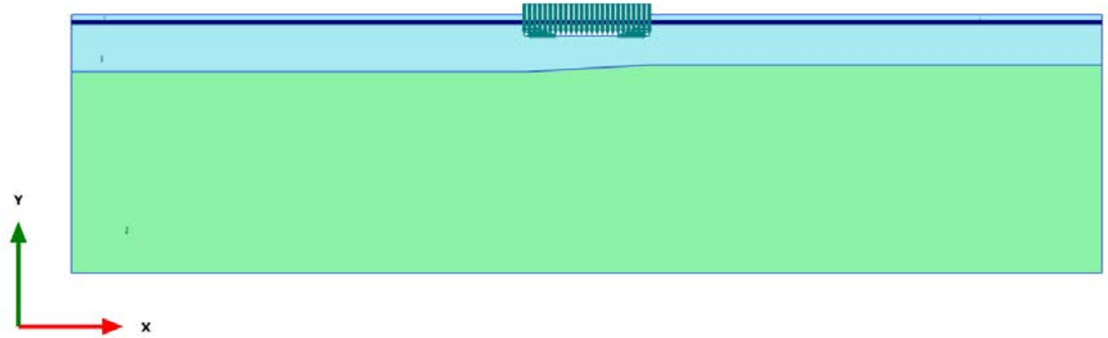
PLAXIS Report

1.1.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Materials plot



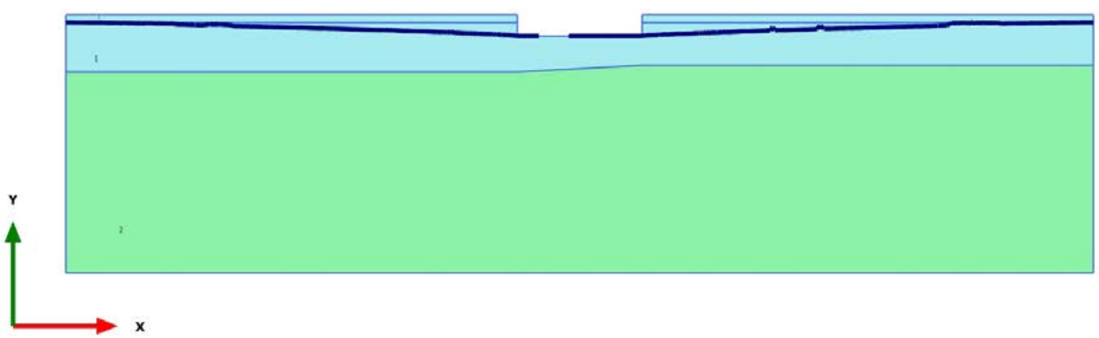
Materials plot

1.1.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Materials plot



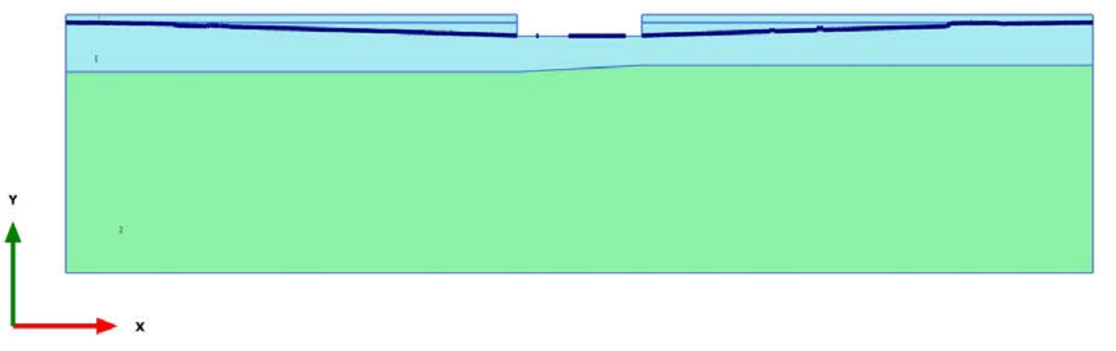
Materials plot

1.1.1.3 Calculation results, Short Term [Phase_2] (2/15), Materials plot



Materials plot

1.1.1.4 Calculation results, Long Term [Phase_3] (3/28), Materials plot



Materials plot

1.1.2.1.1 Materials - Soil and interfaces - Mohr-Coulomb

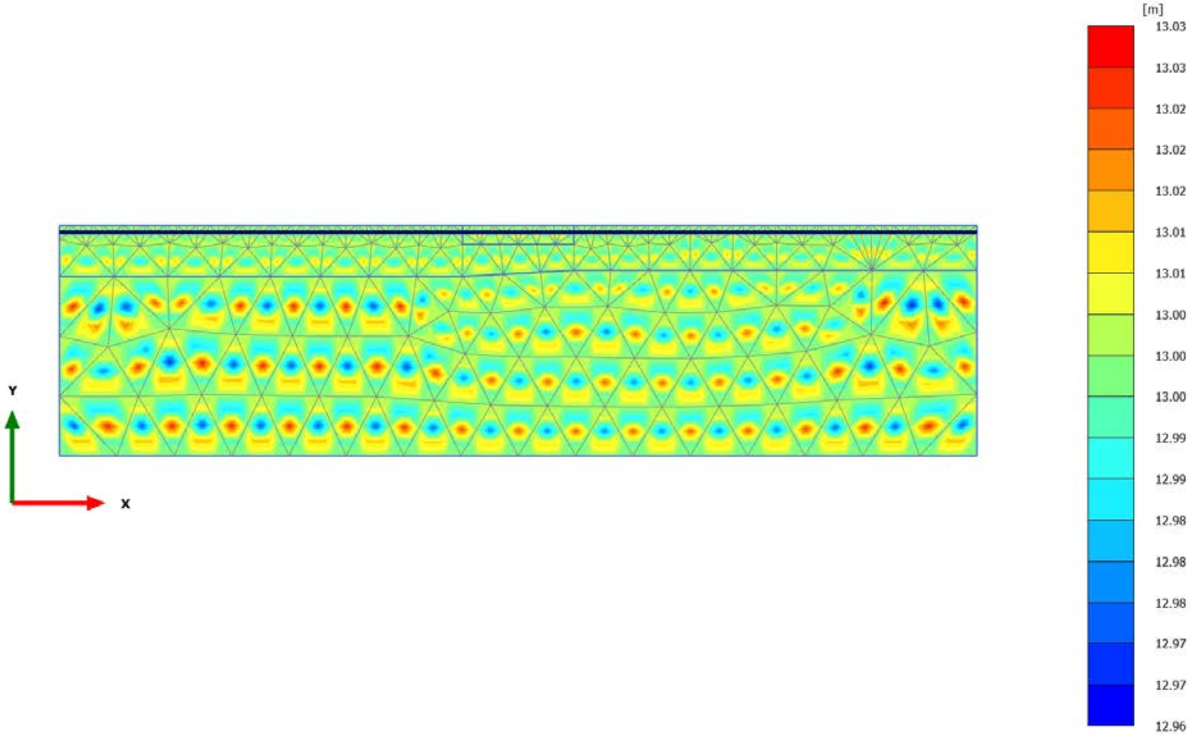
Identification number		1	2
Identification		Soil	Rock
Soil model		Mohr-Coulomb	Mohr-Coulomb
Drainage type		Drained	Drained
Colour			
Comments			
γ_unsat	kN/m³	18.00	24.00
γ_sat	kN/m³	19.00	24.00
e_init		0.5000	0.5000
n_init		0.3333	0.3333
Input method		SDOF equivalent	SDOF equivalent
Rayleigh α		0.000	0.000
Rayleigh β		0.000	0.000
ξ_1	%	0.000	0.000
ξ_2	%	0.000	0.000
f_1	Hz	0.1000	0.1000
f_2	Hz	1.000	1.000

Identification number		1	2
E'_ref	kN/m²	20.00E3	200.0E3
ν (nu)		0.3000	0.3000
G_ref	kN/m²	7692	76.92E3
E_oed	kN/m²	26.92E3	269.2E3
E'_inc	kN/m²/m	0.000	0.000
y_ref	m	0.000	0.000
V_s	m/s	64.75	177.3
V_p	m/s	121.1	331.7
c'_ref	kN/m²	100.0	100.0
φ' (phi)	°	45.00	45.00
ψ (psi)	°	0.000	0.000
c'_inc	kN/m²/m	0.000	0.000
y_ref	m	0.000	0.000
Tension cut-off		True	True
Tensile strength	kN/m²	0.000	0.000
Determination		ν-undrained definition	ν-undrained definition
ν_u definition method		Direct	Direct
ν_u,equivalent (nu)		0.4950	0.4950
Skempton B		0.9783	0.9783

Identification number		1	2
K_w,ref/n	kN/m²	750.0E3	7.500E6
Classification type		Standard	Standard
Soil class (Standard)		Coarse	Coarse
< 2 μm	%	10.00	10.00
2 μm - 50 μm	%	13.00	13.00
50 μm - 2 mm	%	77.00	77.00
Use defaults		False	False
k_x	m/day	44.06	8.640E-3
k_y	m/day	44.06	8.640E-3
Void ratio dependency		False	False
c_k		1000E12	1000E12
n_init		0.3333	0.3333
-ψ_unsat	m	10.00E3	10.00E3
c_s	kJ/t/K	0.000	0.000
λ_s	kW/m/K	0.000	0.000
ρ_s	t/m³	2.600	2.600
Thermal expansion type		Isotropic	Isotropic
α_sv	1/K	0.000	0.000
Phase change		False	False

Identification number		1	2
D_v	m²/day	0.000	0.000
f_Tv		0.000	0.000
Stiffness determination		Derived	Derived
Strength determination		Rigid	Rigid
R_inter		1.000	1.000
Consider gap closure		True	True
Cross permeability		Impermeable	Impermeable
Drainage conductivity, dk	m³/day/m	0.000	0.000
R_thermal	m² K/kW	0.000	0.000
K_0 determination		Automatic	Automatic
K_0,x		0.2929	0.2929
K_0,z		0.2929	0.2929

2.1.1.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Groundwater head

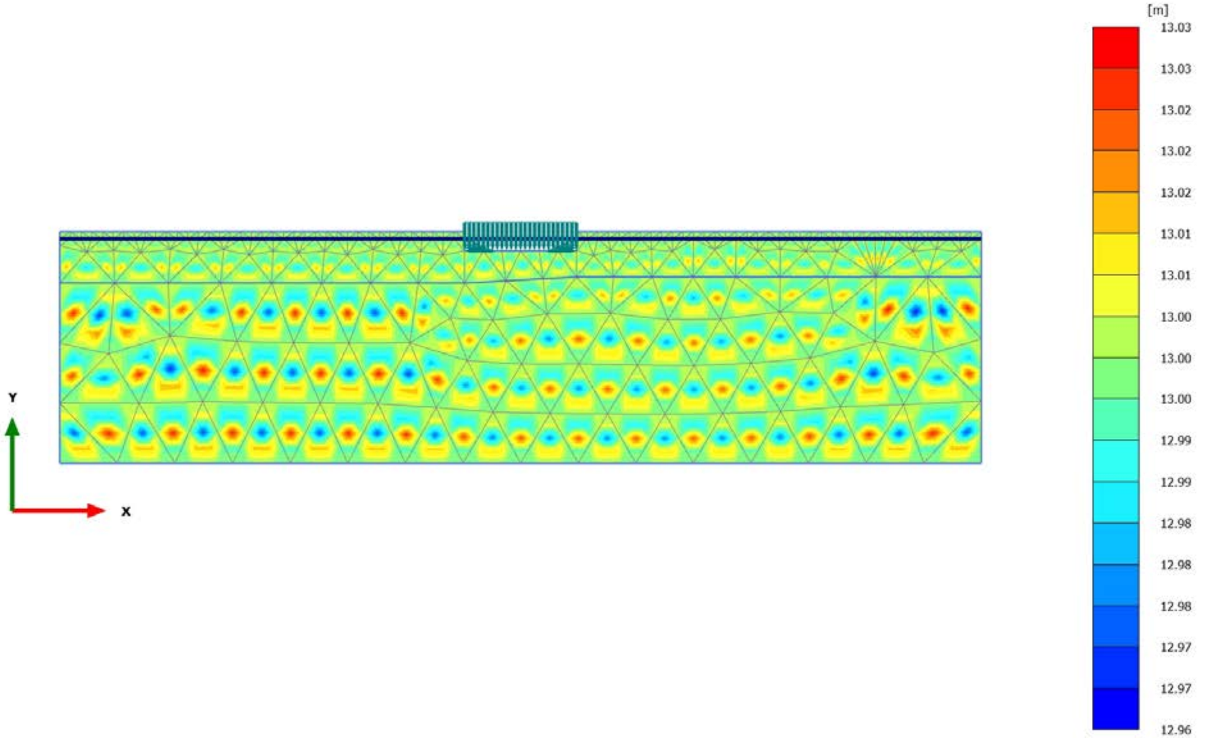


Groundwater head (scaled up 0.500 times) (Time 0.000 day)

Maximum value = 13.03 m (Element 400 at Node 3602)

Minimum value = 12.97 m (Element 386 at Node 3613)

2.1.1.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Groundwater head

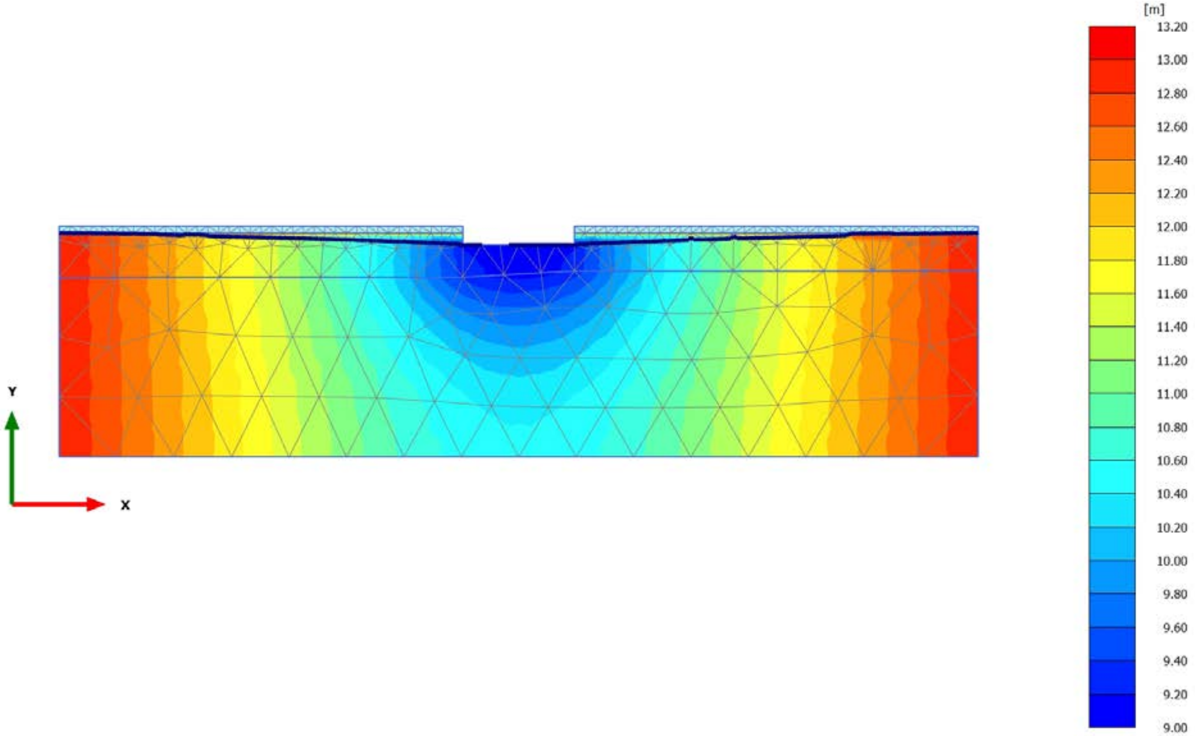


Groundwater head (scaled up 0.500 times) (Time 0.000 day)

Maximum value = 13.03 m (Element 400 at Node 3602)

Minimum value = 12.97 m (Element 386 at Node 3613)

2.1.1.1.3 Calculation results, Short Term [Phase_2] (2/15), Groundwater head

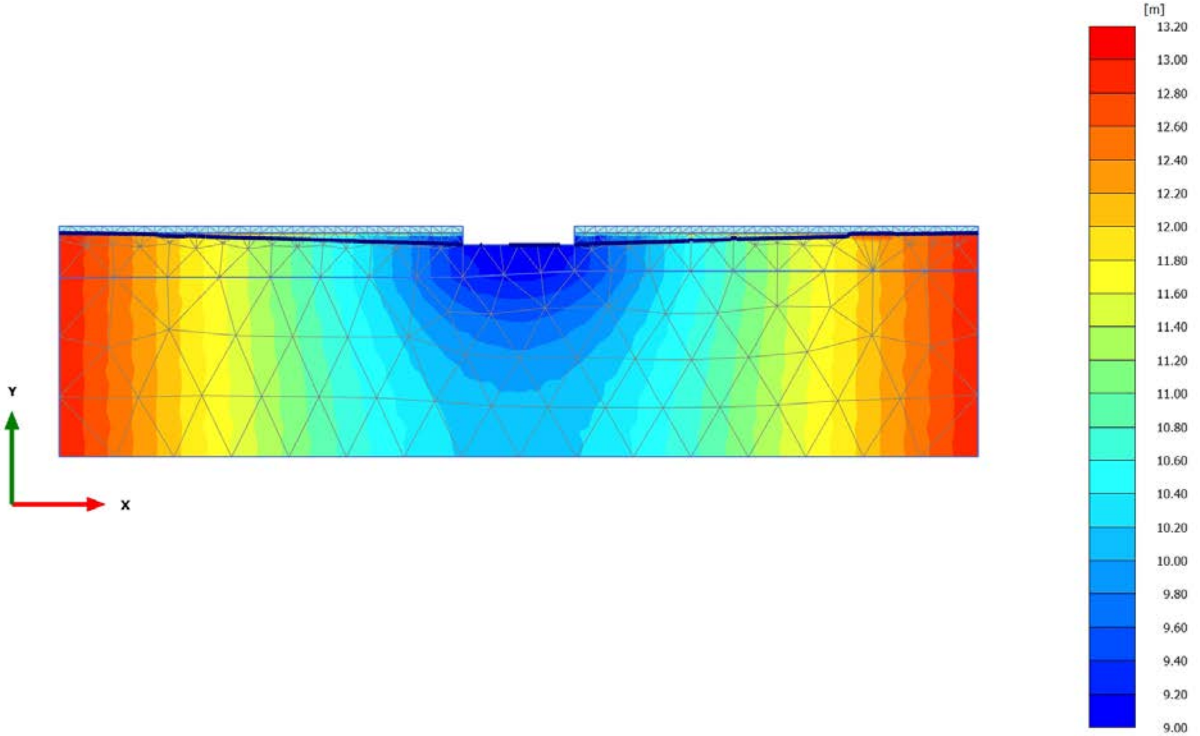


Groundwater head (scaled up 0.500 times) (Time 1.000 day)

Maximum value = 13.01 m (Element 338 at Node 3527)

Minimum value = 9.054 m (Element 217 at Node 1651)

2.1.1.1.4 Calculation results, Long Term [Phase_3] (3/28), Groundwater head

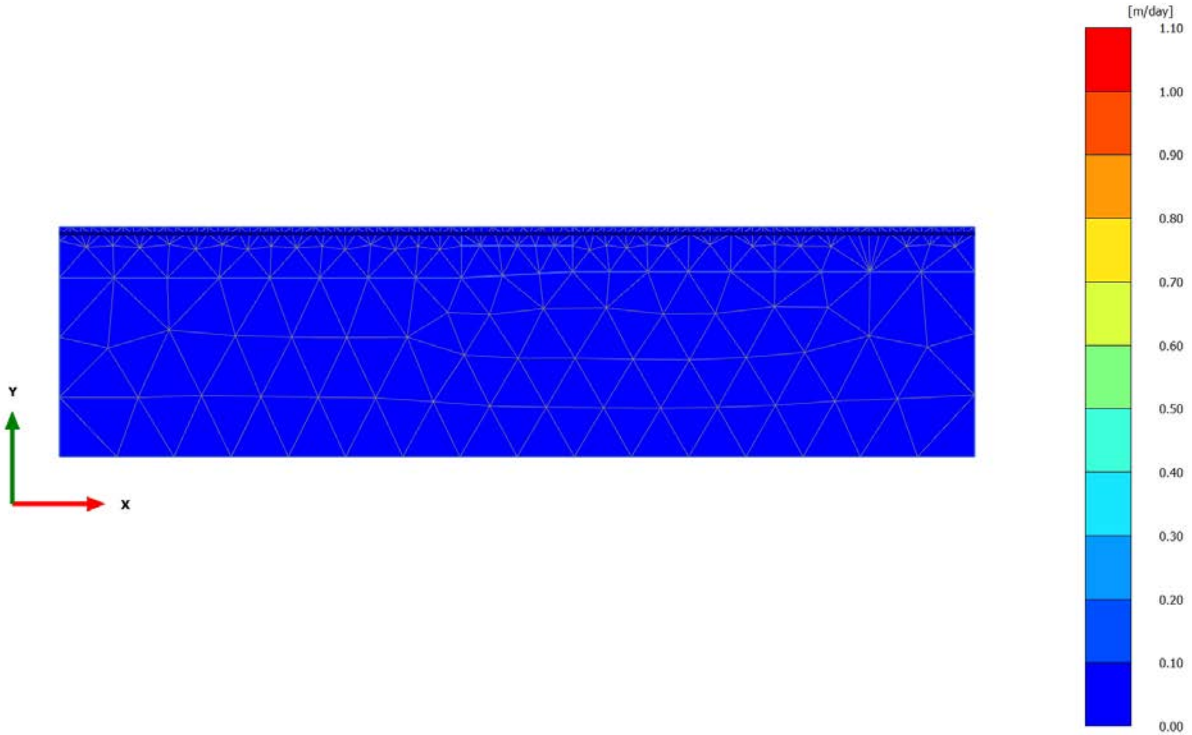


Groundwater head (scaled up 0.500 times) (Time 101.0 day)

Maximum value = 13.01 m (Element 338 at Node 3527)

Minimum value = 9.063 m (Element 262 at Node 2061)

2.1.2.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Groundwater flow |q|

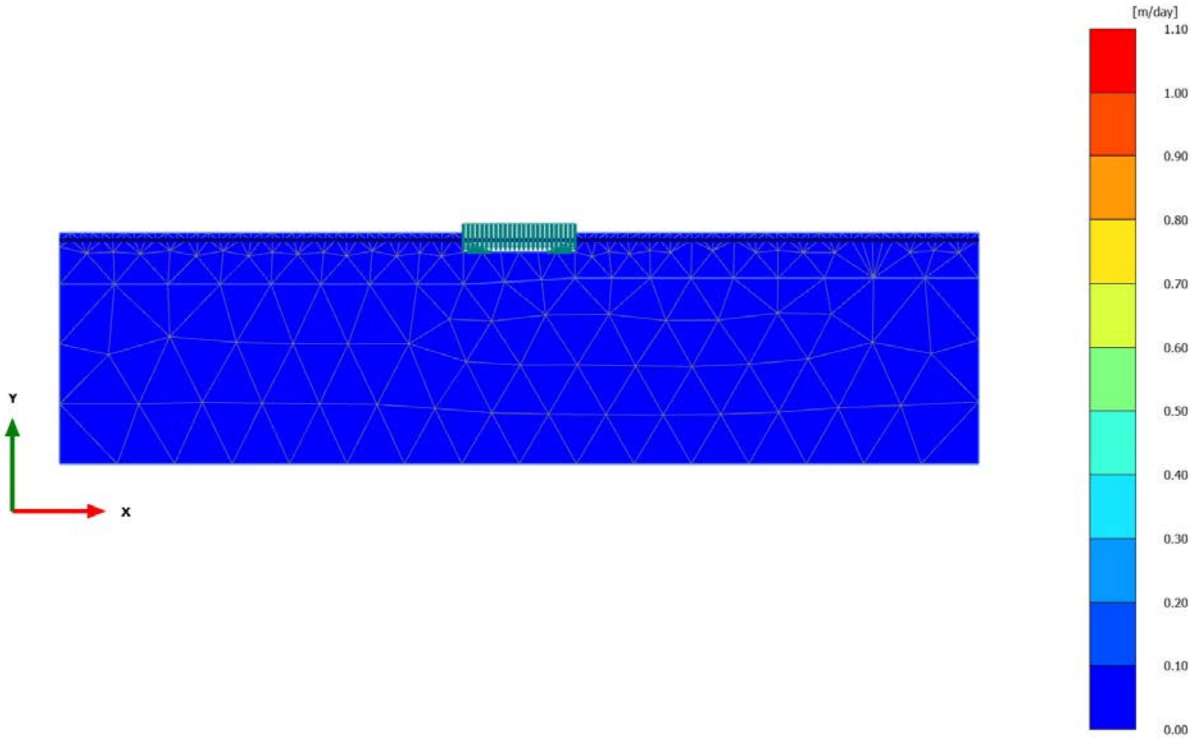


Groundwater flow |q| (scaled up 1.00*10⁹ times) (Time 0.000 day)

Maximum value = $0.7306*10^{-12}$ m/day (Element 202 at Node 223)

Minimum value = 0.000 m/day (Element 193 at Node 486)

2.1.2.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Groundwater flow |q|

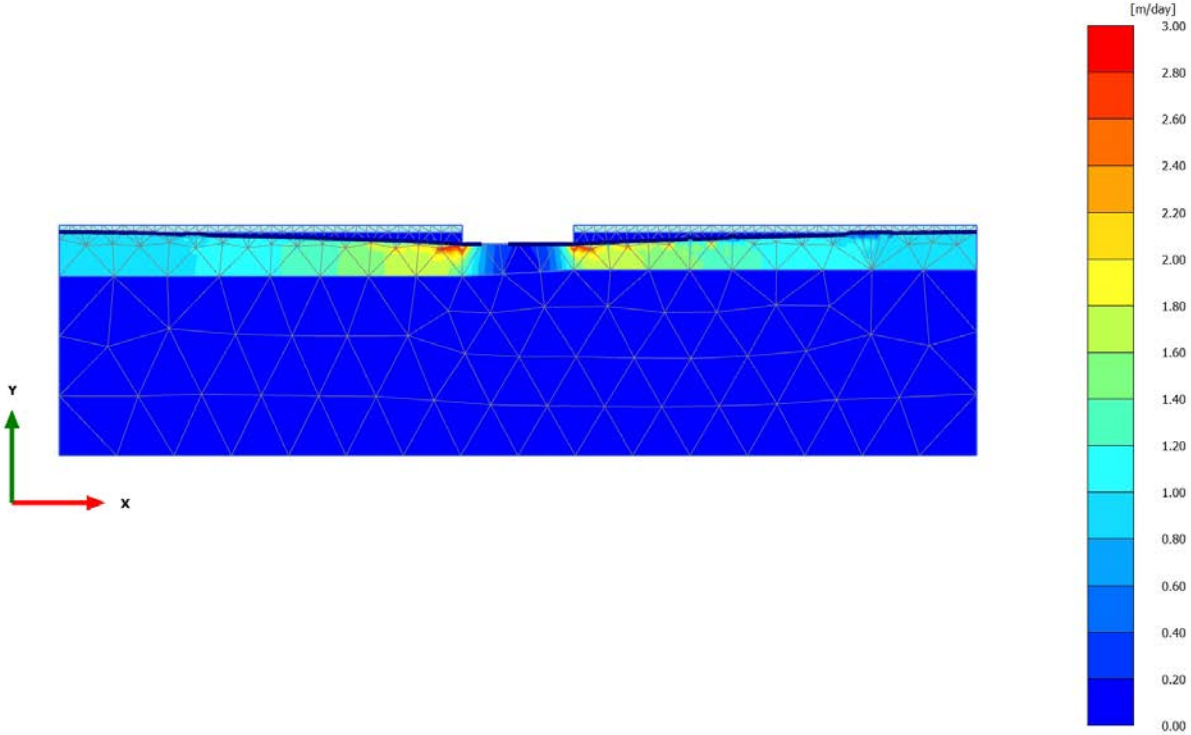


Groundwater flow |q| (scaled up $1.00*10^9$ times) (Time 0.000 day)

Maximum value = $0.7154*10^{-12}$ m/day (Element 202 at Node 223)

Minimum value = 0.000 m/day (Element 202 at Node 230)

2.1.2.1.3 Calculation results, Short Term [Phase_2] (2/15), Groundwater flow |q|

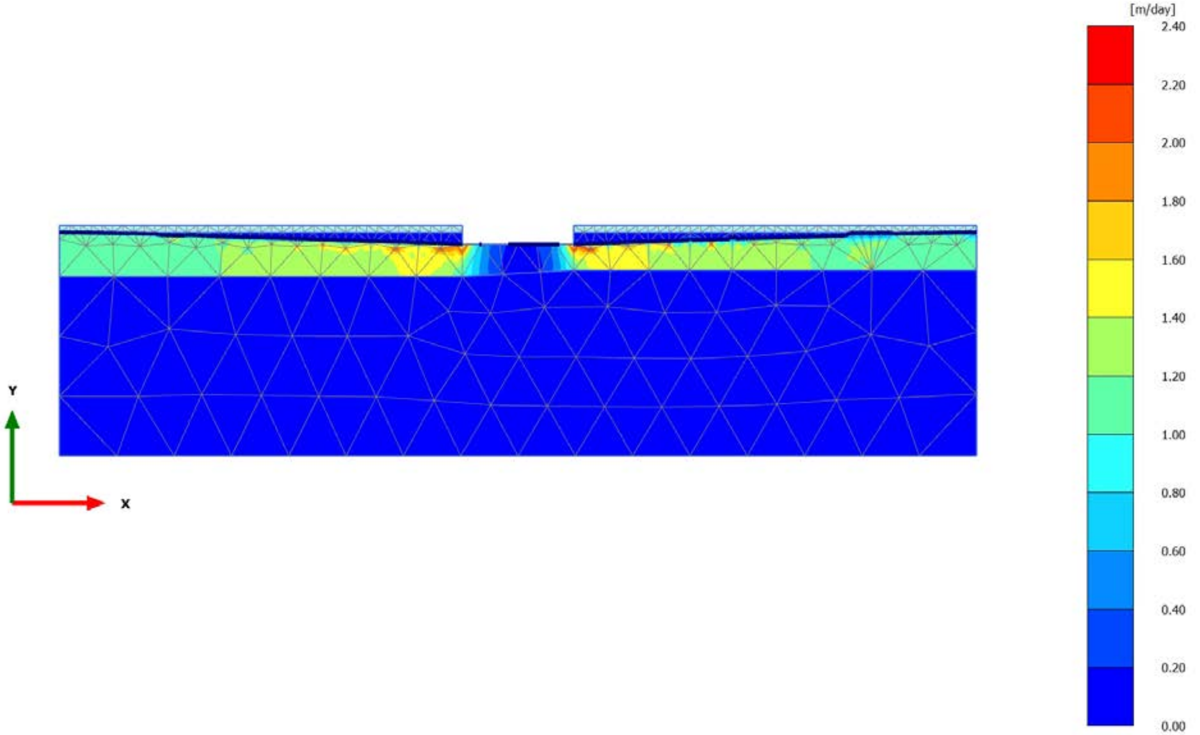


Groundwater flow |q| (scaled up 5.00 times) (Time 1.000 day)

Maximum value = 2.966 m/day (Element 187 at Node 1625)

Minimum value = 2.331×10^{-6} m/day (Element 349 at Node 2171)

2.1.2.1.4 Calculation results, Long Term [Phase_3] (3/28), Groundwater flow |q|

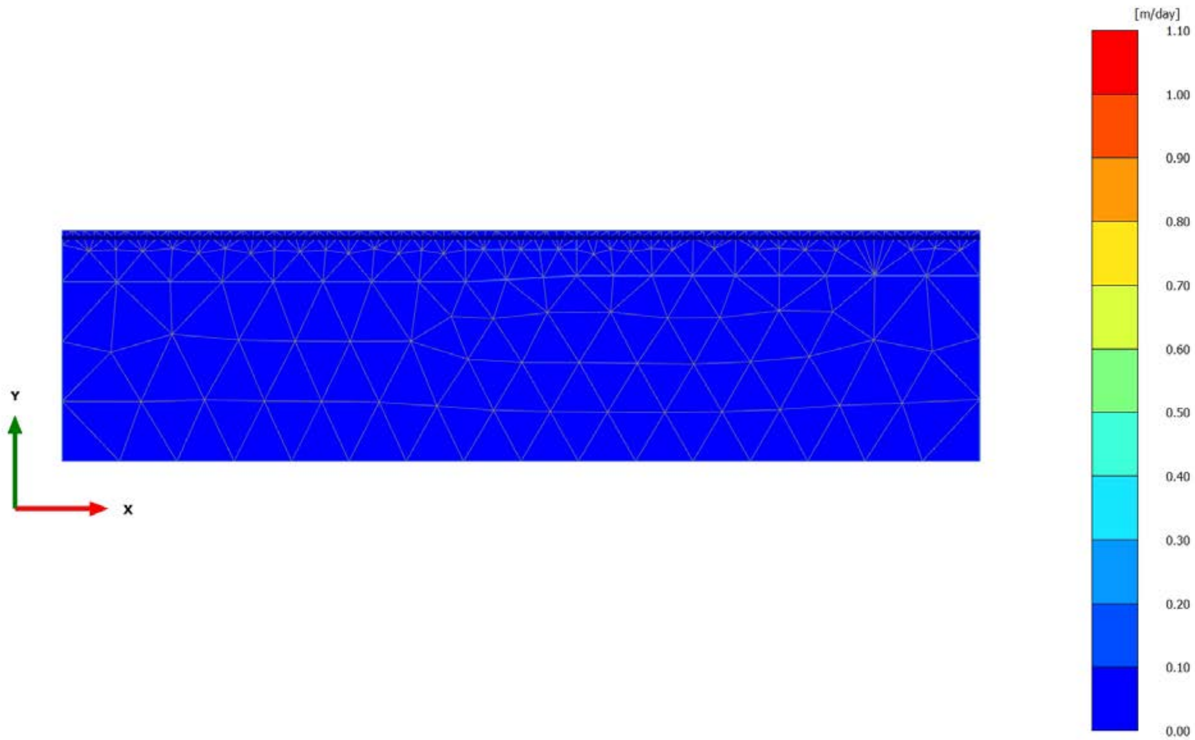


Groundwater flow |q| (scaled up 5.00 times) (Time 101.0 day)

Maximum value = 2.342 m/day (Element 204 at Node 2249)

Minimum value = $1.259*10^{-6}$ m/day (Element 349 at Node 2171)

4.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Groundwater flow |q|

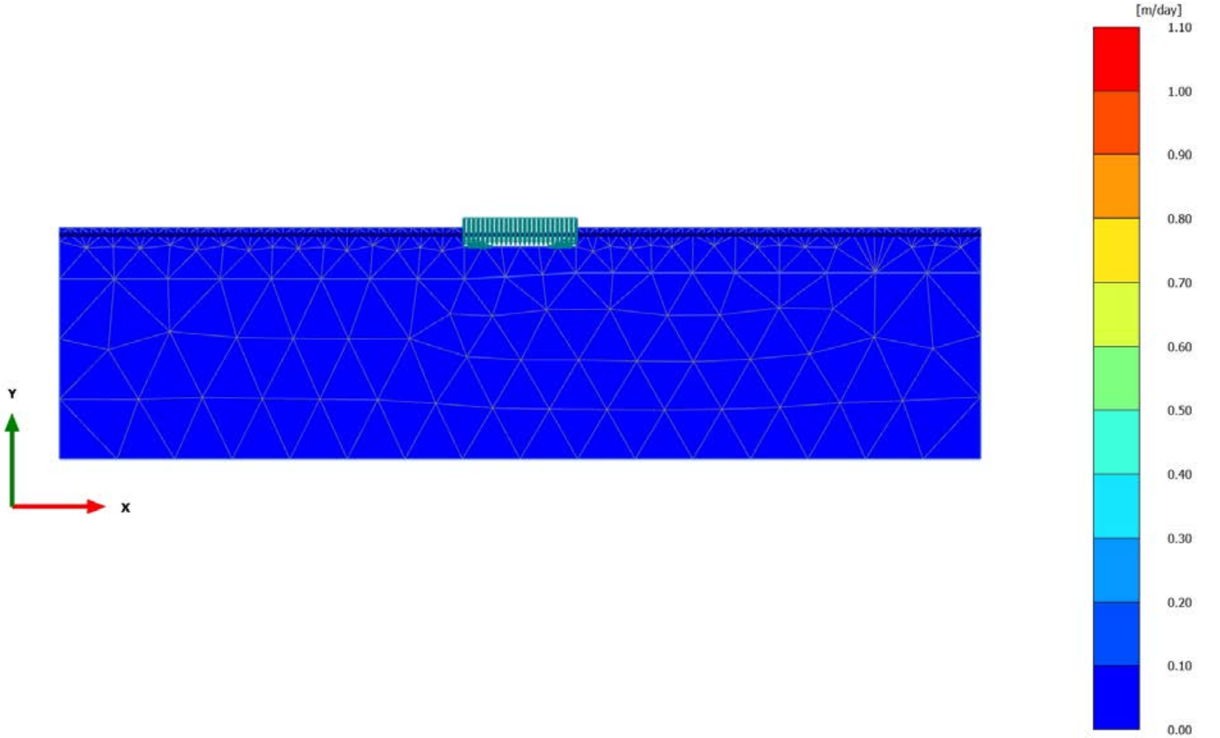


Groundwater flow |q| (scaled up $1.00*10^{9}$ times) (Time 0.000 day)

Maximum value = $0.7306*10^{-12}$ m/day (Element 202 at Node 223)

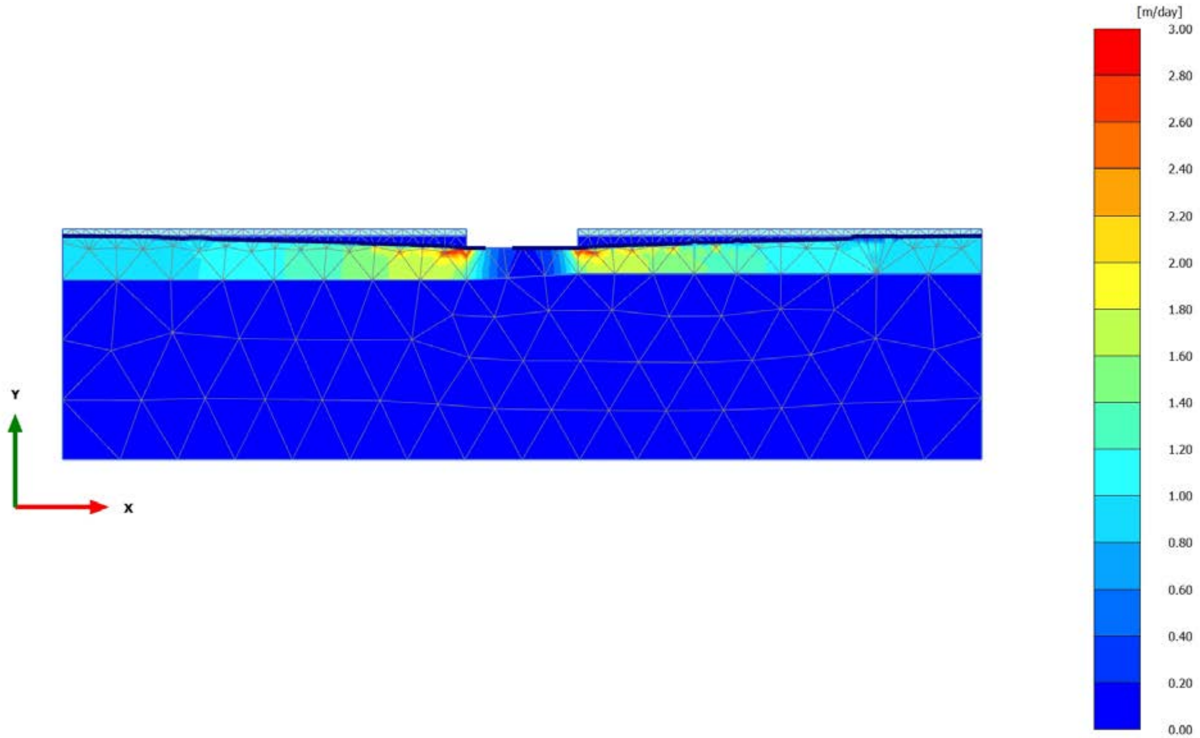
Minimum value = 0.000 m/day (Element 193 at Node 486)

4.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Groundwater flow |q|



Groundwater flow |q| (scaled up $1.00*10^9$ times) (Time 0.000 day)
Maximum value = $0.7154*10^{-12}$ m/day (Element 202 at Node 223)
Minimum value = 0.000 m/day (Element 202 at Node 230)

4.1.3 Calculation results, Short Term [Phase_2] (2/15), Groundwater flow |q|

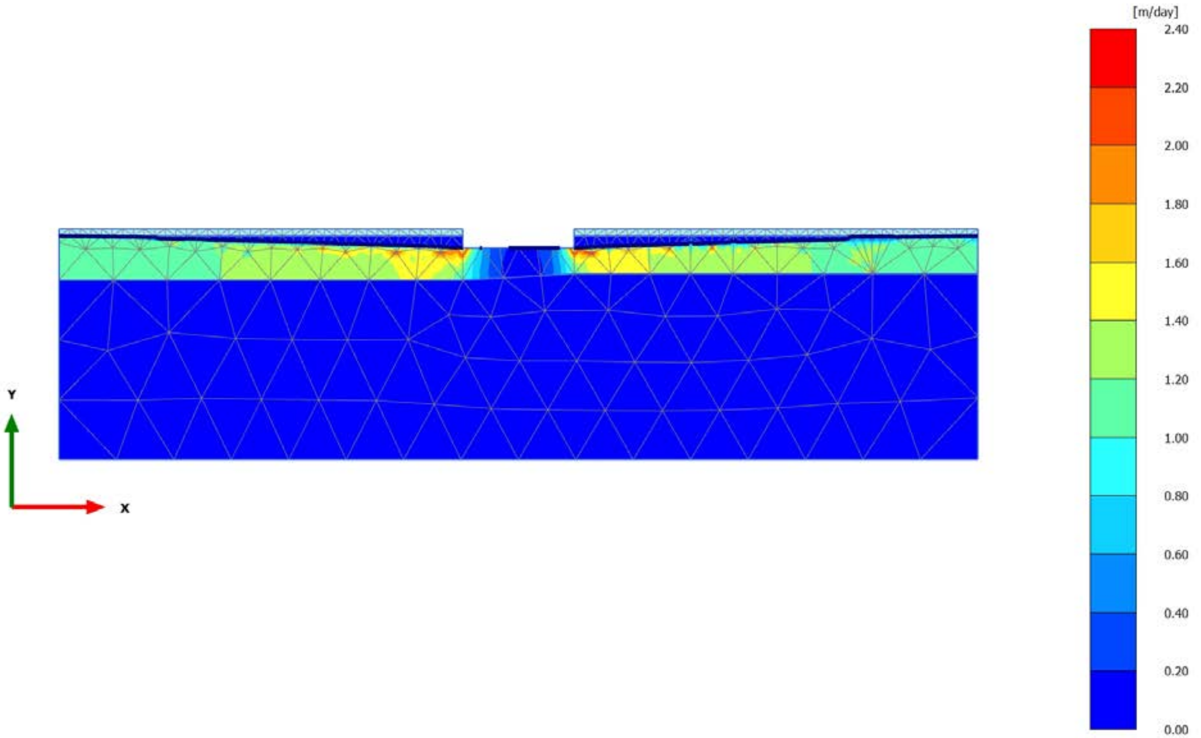


Groundwater flow |q| (scaled up 5.00 times) (Time 1.000 day)

Maximum value = 2.966 m/day (Element 187 at Node 1625)

Minimum value = $2.331*10^{-6}$ m/day (Element 349 at Node 2171)

4.1.4 Calculation results, Long Term [Phase_3] (3/28), Groundwater flow |q|



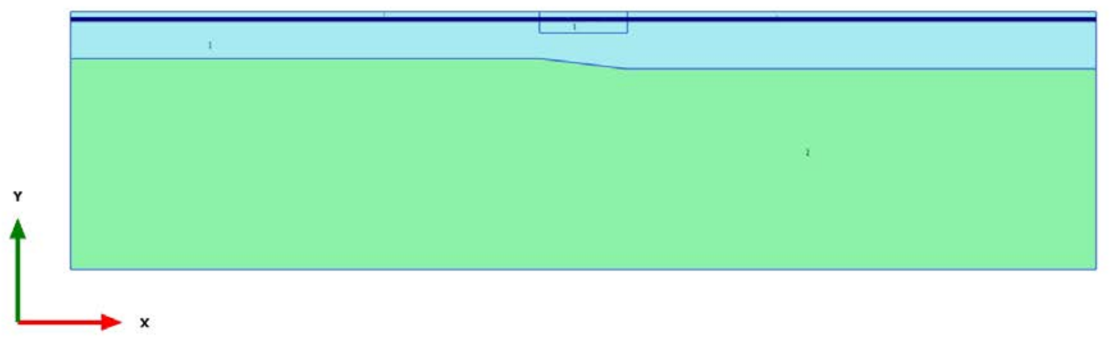
Groundwater flow |q| (scaled up 5.00 times) (Time 101.0 day)

Maximum value = 2.342 m/day (Element 204 at Node 2249)

Minimum value = $1.259*10^{-6}$ m/day (Element 349 at Node 2171)

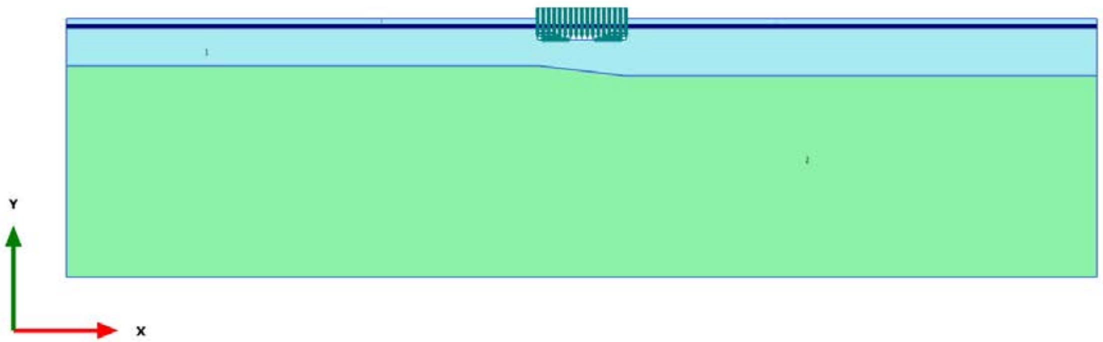
PLAXIS Report

1.1.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Materials plot



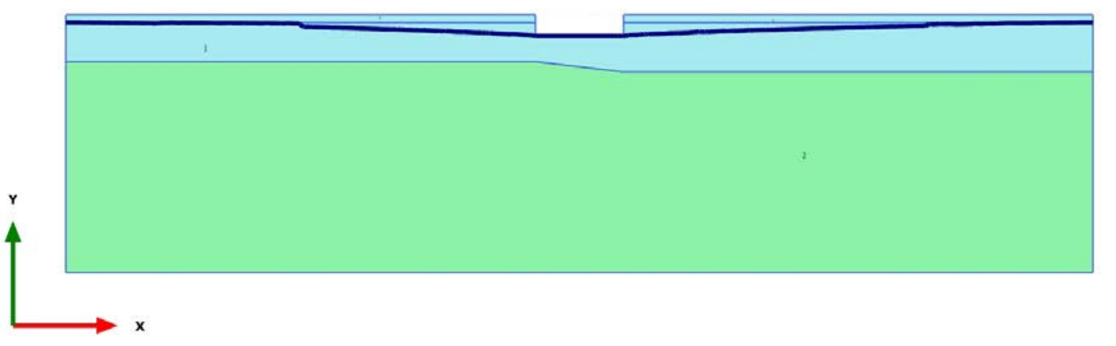
Materials plot

1.1.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Materials plot



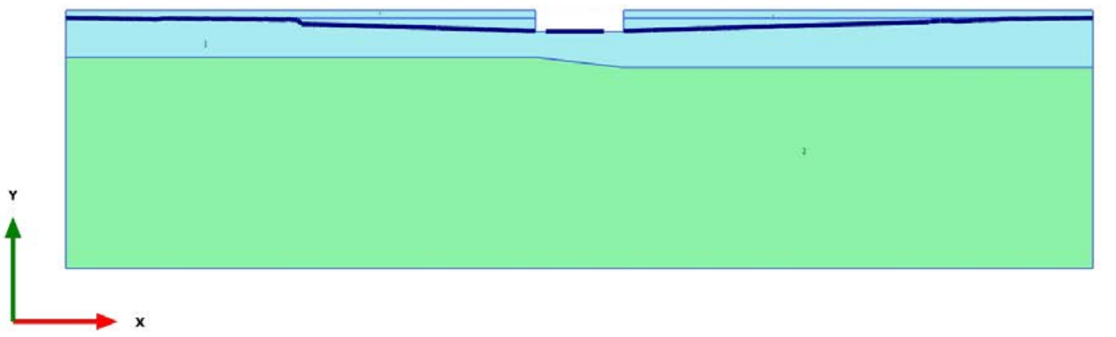
Materials plot

1.1.1.3 Calculation results, Short Term [Phase_2] (2/21), Materials plot



Materials plot

1.1.1.4 Calculation results, Long Term [Phase_3] (3/34), Materials plot



Materials plot

1.1.2.1.1 Materials - Soil and interfaces - Mohr-Coulomb

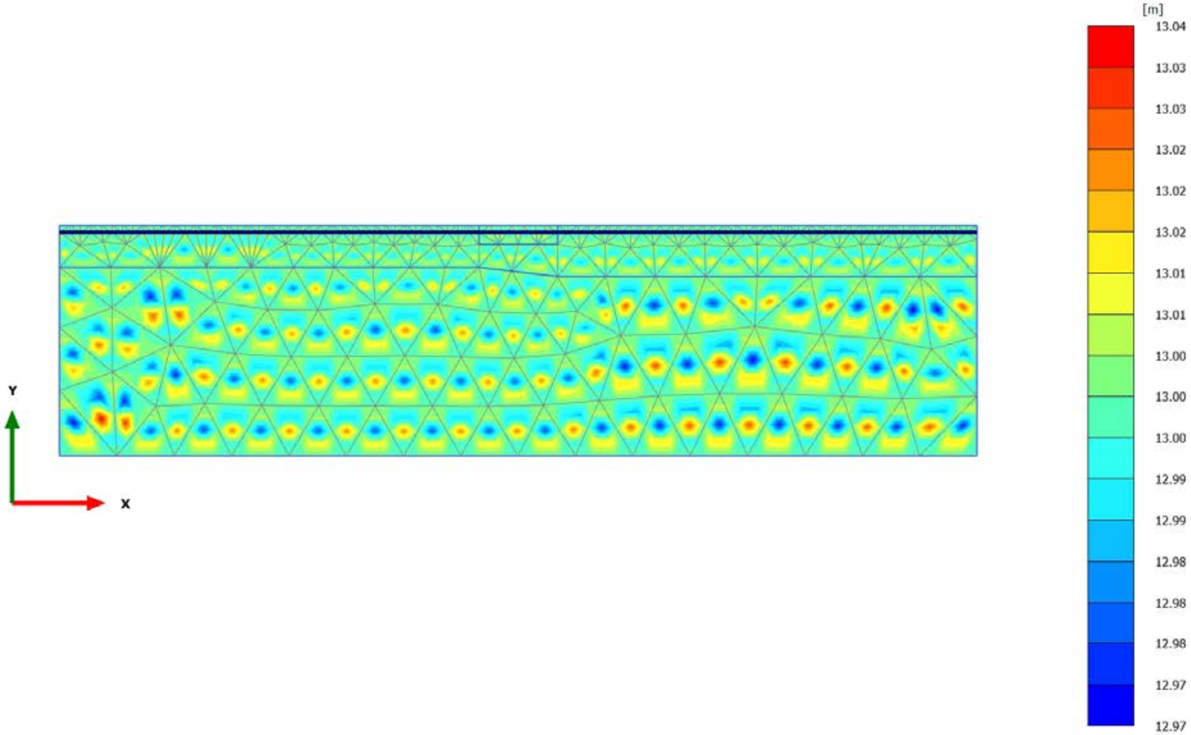
Identification number		1	2
Identification		Soil	Rock
Soil model		Mohr-Coulomb	Mohr-Coulomb
Drainage type		Drained	Drained
Colour			
Comments			
γ_unsat	kN/m³	18.00	24.00
γ_sat	kN/m³	19.00	24.00
e_init		0.5000	0.5000
n_init		0.3333	0.3333
Input method		SDOF equivalent	SDOF equivalent
Rayleigh α		0.000	0.000
Rayleigh β		0.000	0.000
ξ_1	%	0.000	0.000
ξ_2	%	0.000	0.000
f_1	Hz	0.1000	0.1000
f_2	Hz	1.000	1.000

Identification number		1	2
E'_ref	kN/m²	20.00E3	200.0E3
ν (nu)		0.3000	0.3000
G_ref	kN/m²	7692	76.92E3
E_oed	kN/m²	26.92E3	269.2E3
E'_inc	kN/m²/m	0.000	0.000
y_ref	m	0.000	0.000
V_s	m/s	64.75	177.3
V_p	m/s	121.1	331.7
c'_ref	kN/m²	100.0	100.0
φ' (phi)	°	45.00	45.00
ψ (psi)	°	0.000	0.000
c'_inc	kN/m²/m	0.000	0.000
y_ref	m	0.000	0.000
Tension cut-off		True	True
Tensile strength	kN/m²	0.000	0.000
Determination		ν-undrained definition	ν-undrained definition
ν_u definition method		Direct	Direct
ν_u,equivalent (nu)		0.4950	0.4950
Skempton B		0.9783	0.9783

Identification number		1	2
K_w,ref/n	kN/m²	750.0E3	7.500E6
Classification type		Standard	Standard
Soil class (Standard)		Coarse	Coarse
< 2 µm	%	10.00	10.00
2 µm - 50 µm	%	13.00	13.00
50 µm - 2 mm	%	77.00	77.00
Use defaults		False	False
k_x	m/day	44.06	8.640E-3
k_y	m/day	44.06	8.640E-3
Void ratio dependency		False	False
c_k		1000E12	1000E12
n_init		0.3333	0.3333
-ψ_unsat	m	10.00E3	10.00E3
c_s	kJ/t/K	0.000	0.000
λ_s	kW/m/K	0.000	0.000
ρ_s	t/m³	2.600	2.600
Thermal expansion type		Isotropic	Isotropic
α_sv	1/K	0.000	0.000
Phase change		False	False

Identification number		1	2
D_v	m²/day	0.000	0.000
f_Tv		0.000	0.000
Stiffness determination		Derived	Derived
Strength determination		Rigid	Rigid
R_inter		1.000	1.000
Consider gap closure		True	True
Cross permeability		Impermeable	Impermeable
Drainage conductivity, dk	m³/day/m	0.000	0.000
R_thermal	m² K/kW	0.000	0.000
K_0 determination		Automatic	Automatic
K_0,x		0.2929	0.2929
K_0,z		0.2929	0.2929

2.1.1.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Groundwater head

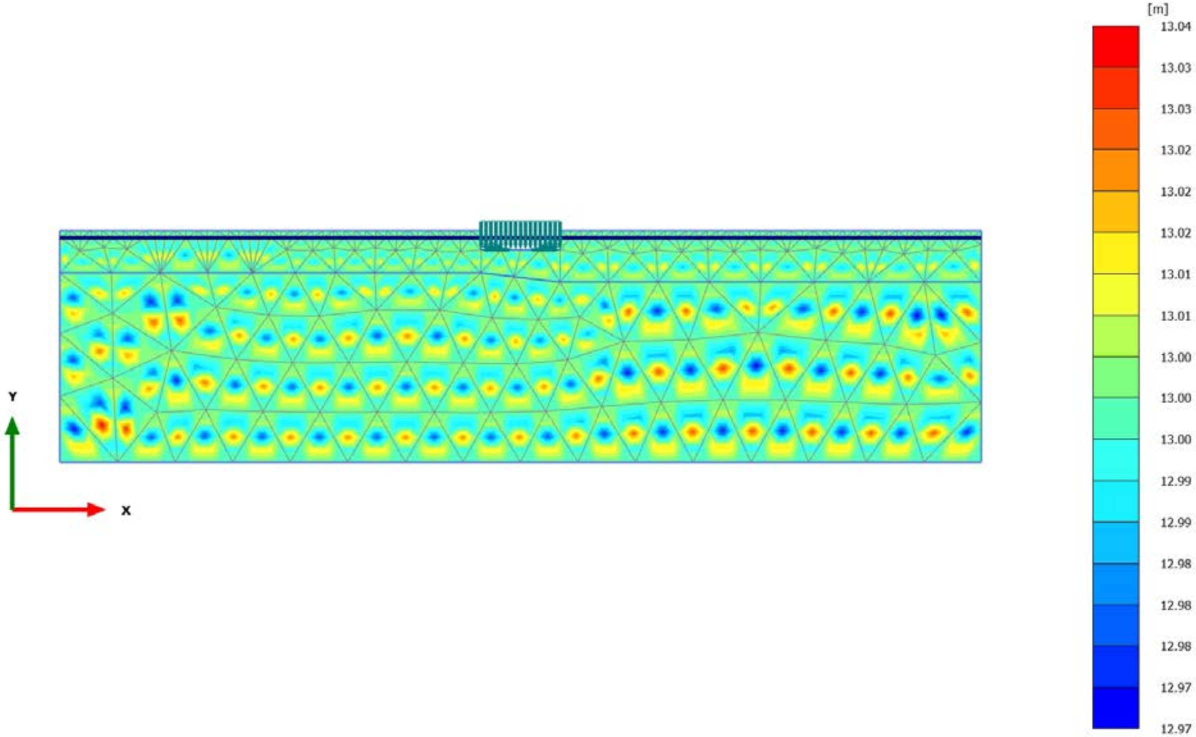


Groundwater head (scaled up 0.500 times) (Time 0.000 day)

Maximum value = 13.03 m (Element 339 at Node 545)

Minimum value = 12.97 m (Element 370 at Node 3603)

2.1.1.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Groundwater head

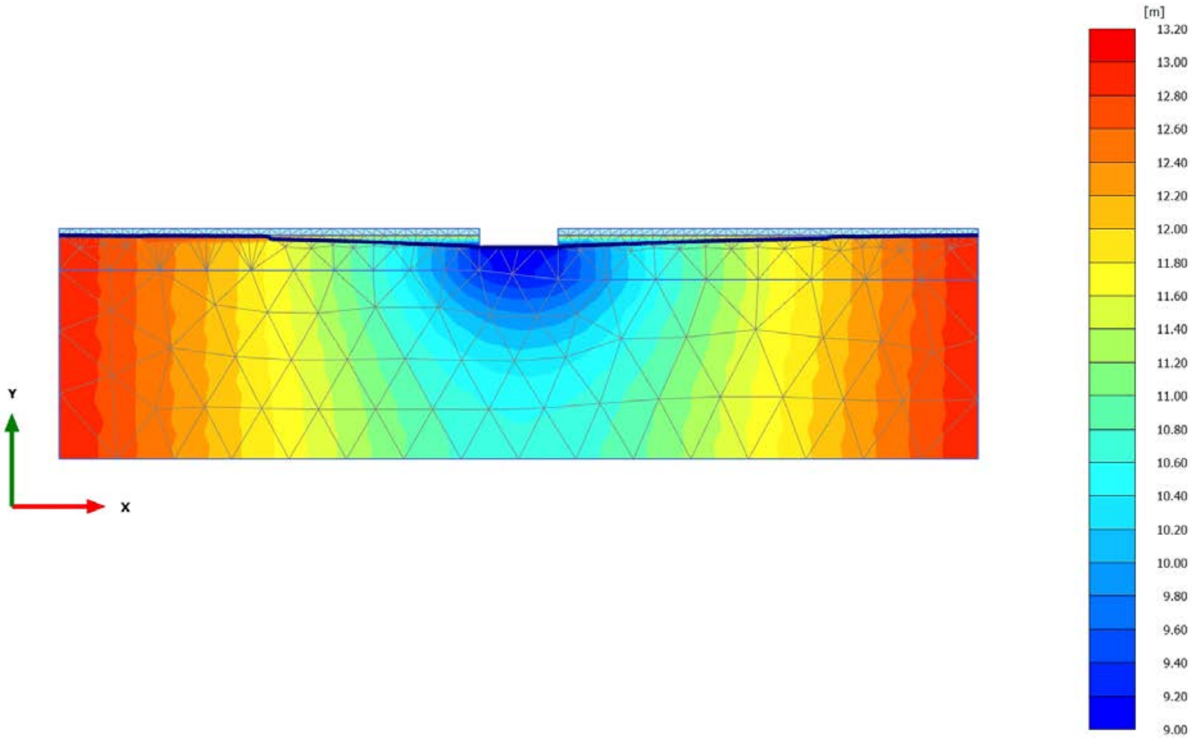


Groundwater head (scaled up 0.500 times) (Time 0.000 day)

Maximum value = 13.03 m (Element 339 at Node 545)

Minimum value = 12.97 m (Element 370 at Node 3603)

2.1.1.1.3 Calculation results, Short Term [Phase_2] (2/21), Groundwater head

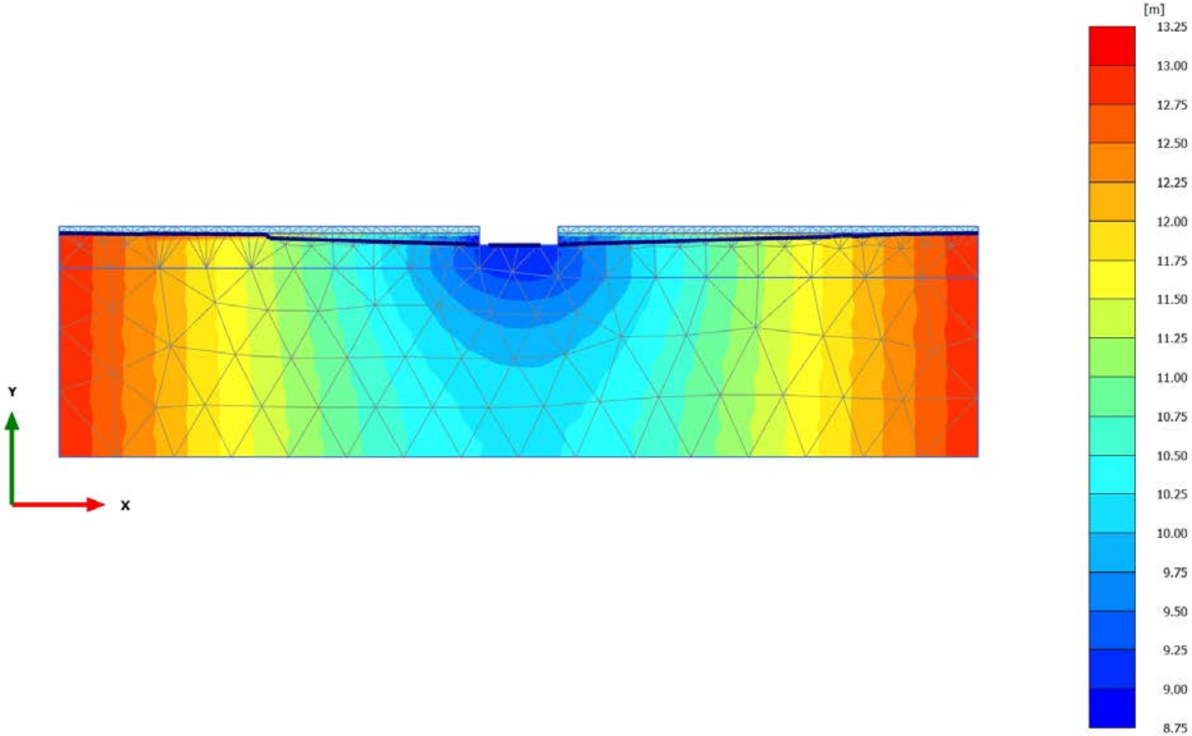


Groundwater head (scaled up 0.500 times) (Time 1.000 day)

Maximum value = 13.01 m (Element 338 at Node 547)

Minimum value = 9.022 m (Element 207 at Node 2151)

2.1.1.1.4 Calculation results, Long Term [Phase_3] (3/34), Groundwater head

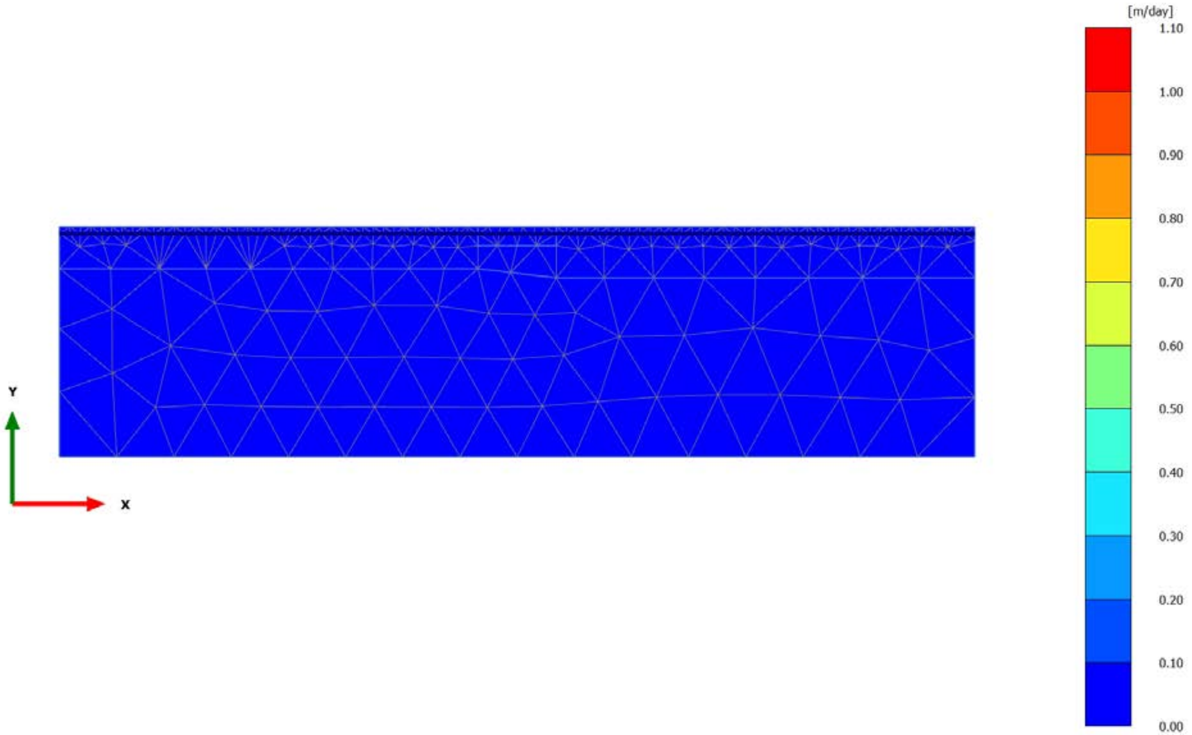


Groundwater head (scaled up 0.500 times) (Time 101.0 day)

Maximum value = 13.01 m (Element 338 at Node 547)

Minimum value = 8.812 m (Element 274 at Node 1647)

2.1.2.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Groundwater flow |q|

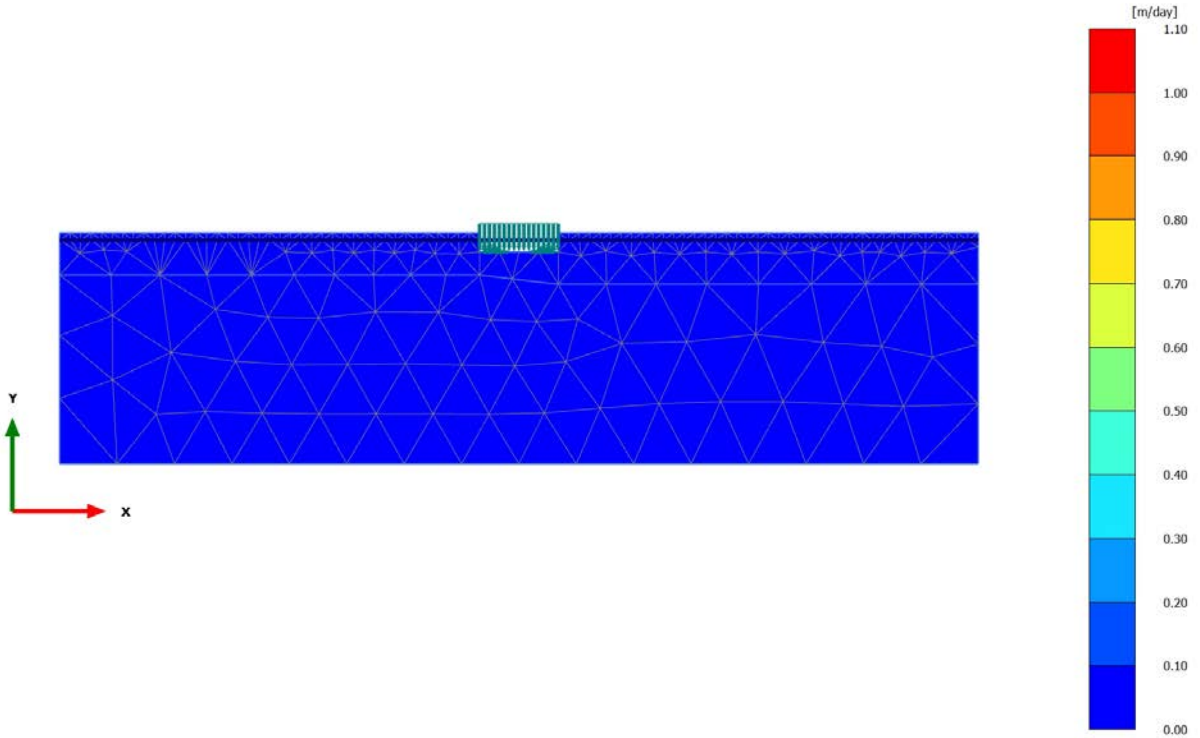


Groundwater flow |q| (scaled up $1.00*10^9$ times) (Time 0.000 day)

Maximum value = $0.3076*10^{-12}$ m/day (Element 199 at Node 3790)

Minimum value = 0.000 m/day (Element 182 at Node 2344)

2.1.2.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Groundwater flow |q|

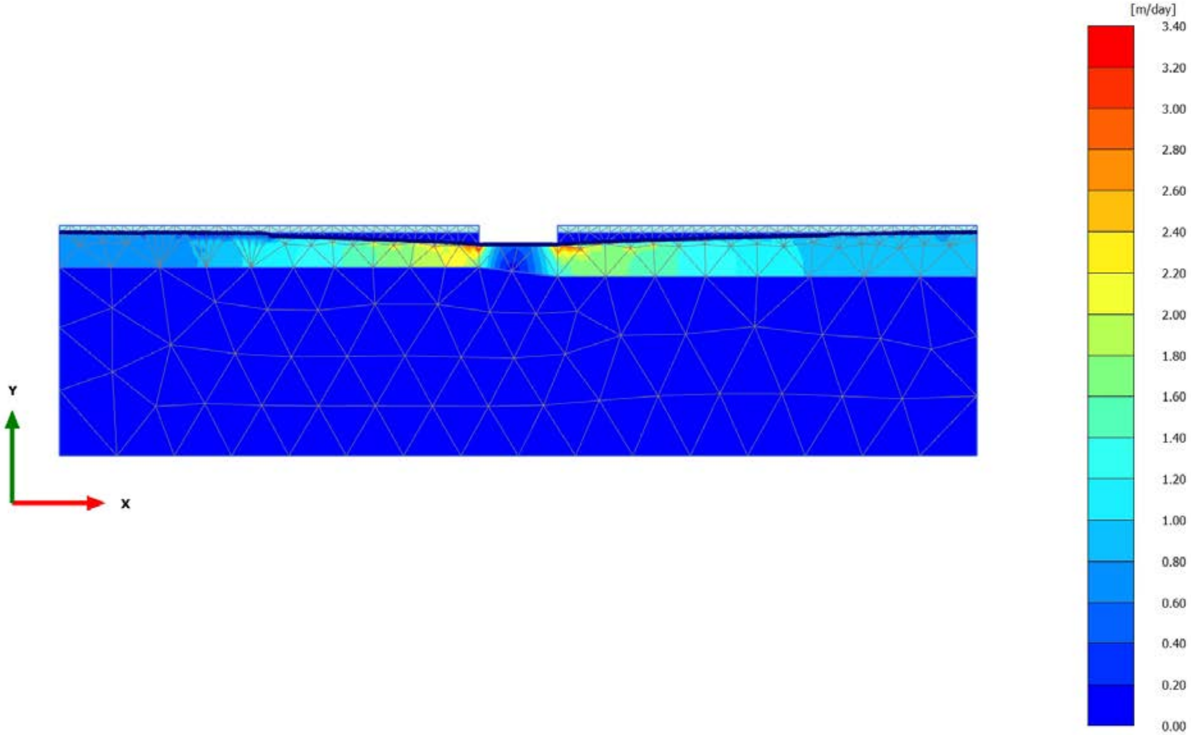


Groundwater flow |q| (scaled up $1.00*10^{9}$ times) (Time 0.000 day)

Maximum value = $0.3534*10^{-12}$ m/day (Element 317 at Node 1759)

Minimum value = 0.000 m/day (Element 179 at Node 2784)

2.1.2.1.3 Calculation results, Short Term [Phase_2] (2/21), Groundwater flow |q|

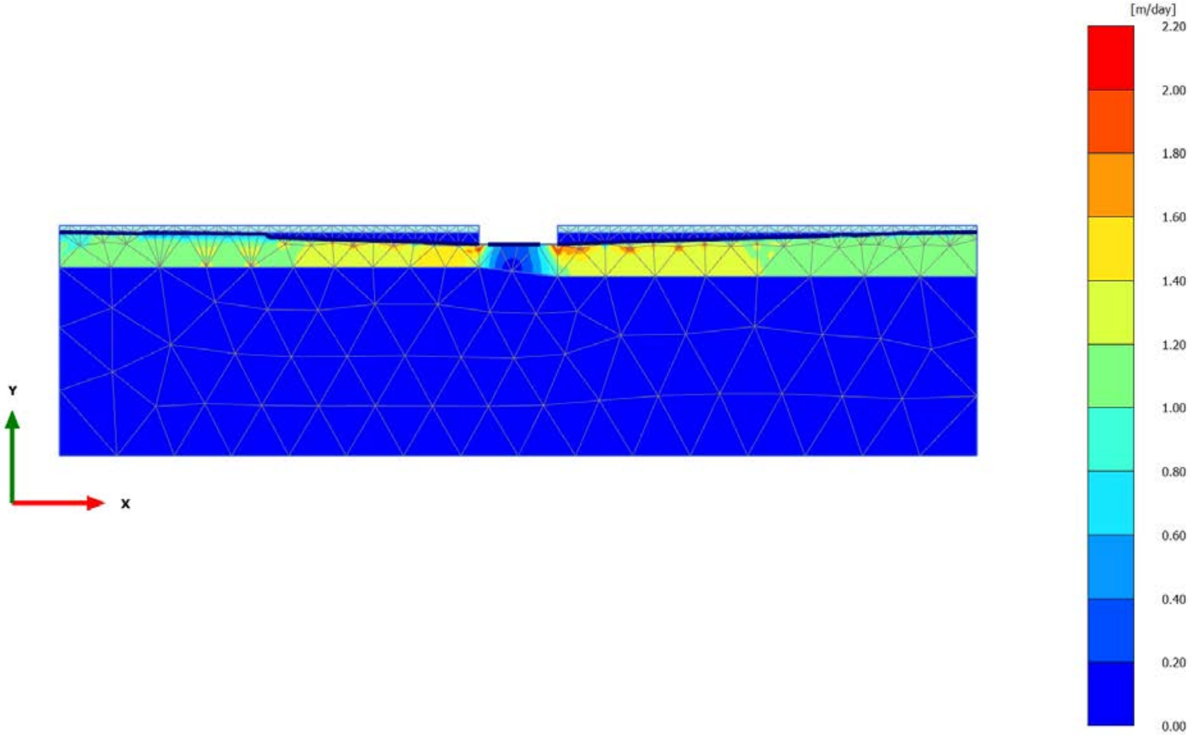


Groundwater flow |q| (scaled up 5.00 times) (Time 1.000 day)

Maximum value = 3.215 m/day (Element 241 at Node 1776)

Minimum value = 9.901×10^{-6} m/day (Element 349 at Node 2097)

2.1.2.1.4 Calculation results, Long Term [Phase_3] (3/34), Groundwater flow |q|

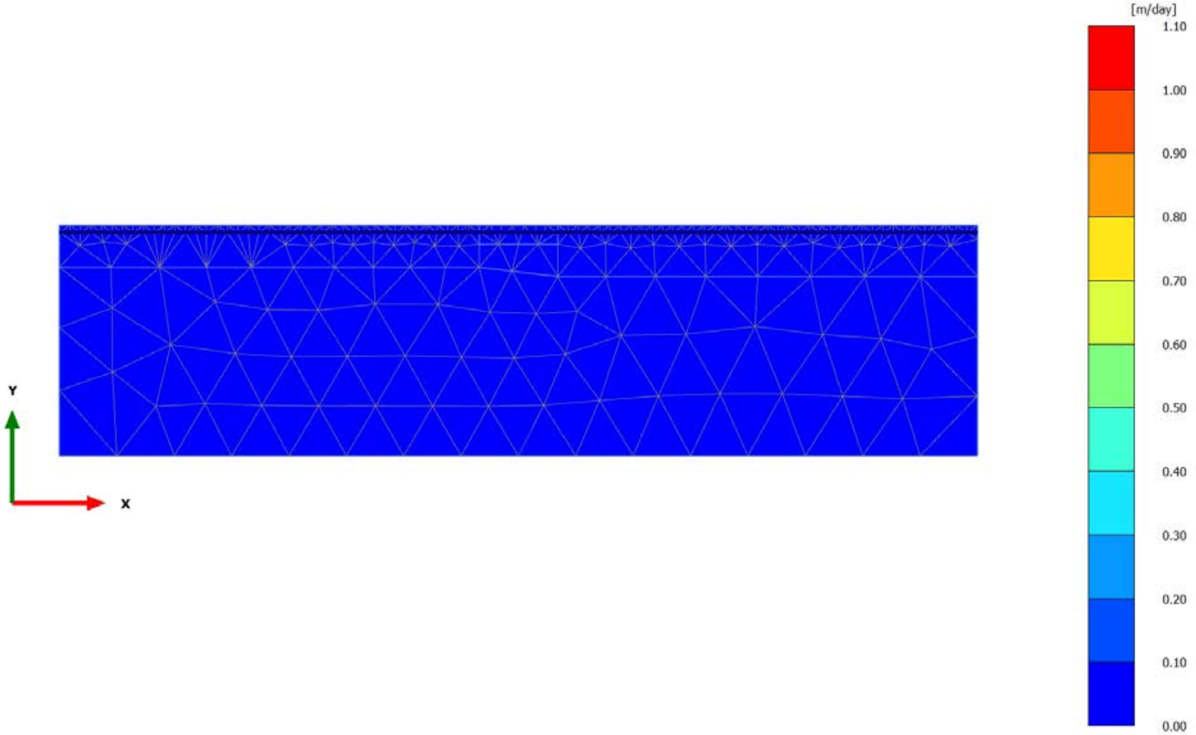


Groundwater flow |q| (scaled up 5.00 times) (Time 101.0 day)

Maximum value = 2.104 m/day (Element 241 at Node 1776)

Minimum value = $2.393*10^{-6}$ m/day (Element 348 at Node 2093)

4.1.1 Calculation results, Initial phase [InitialPhase] (0/0), Groundwater flow |q|

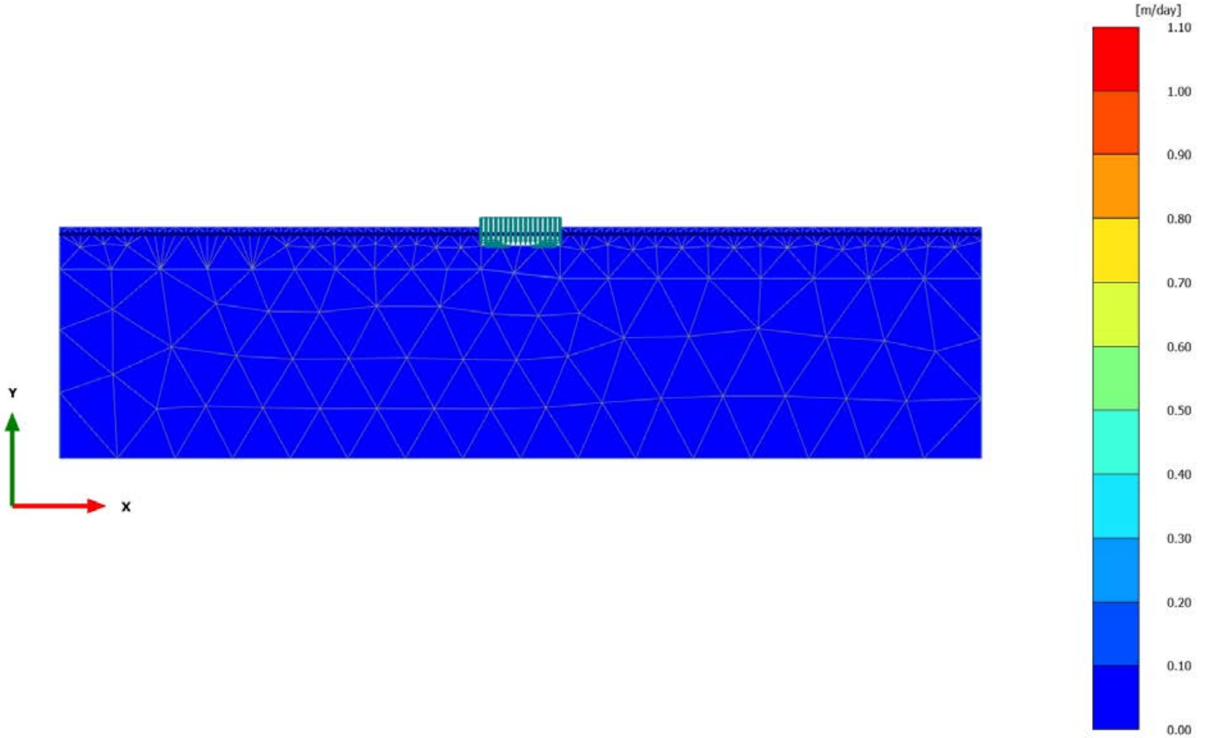


Groundwater flow |q| (scaled up $1.00*10^{9}$ times) (Time 0.000 day)

Maximum value = $0.3076*10^{-12}$ m/day (Element 199 at Node 3790)

Minimum value = 0.000 m/day (Element 182 at Node 2344)

4.1.2 Calculation results, Phase_1 [Phase_1] (1/1), Groundwater flow |q|

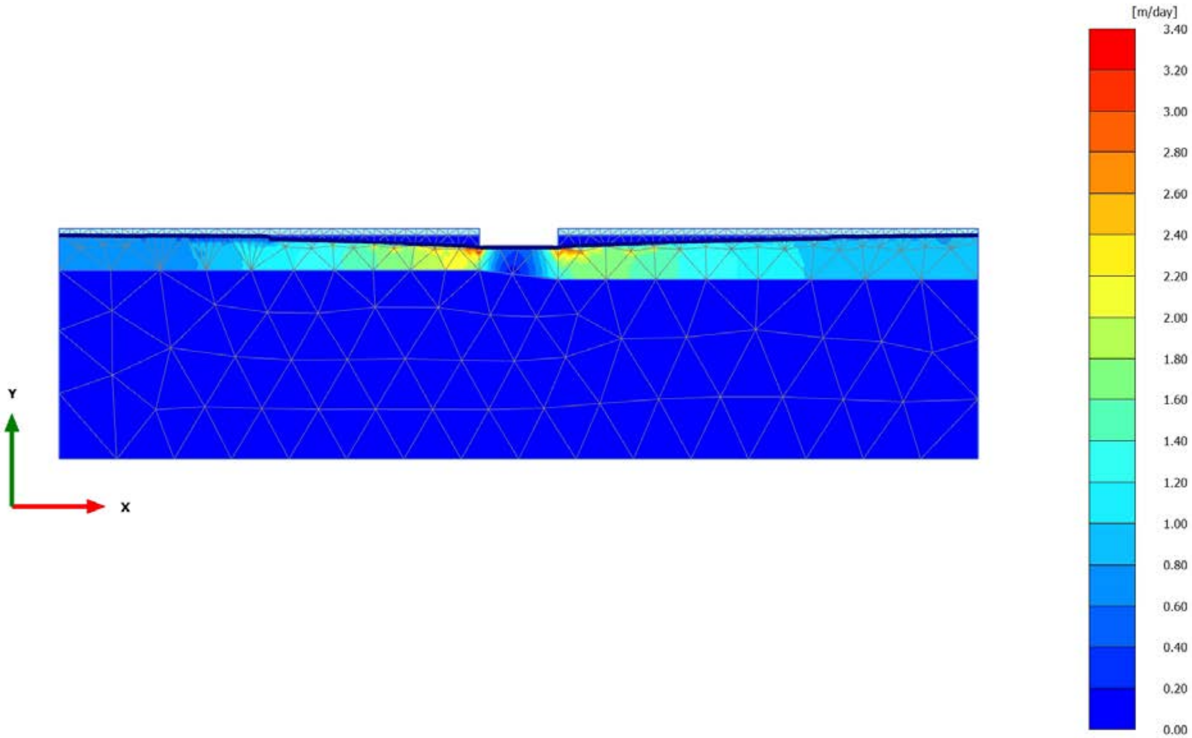


Groundwater flow |q| (scaled up 1.00*10⁹ times) (Time 0.000 day)

Maximum value = 0.3534×10^{-12} m/day (Element 317 at Node 1759)

Minimum value = 0.000 m/day (Element 179 at Node 2784)

4.1.3 Calculation results, Short Term [Phase_2] (2/21), Groundwater flow |q|

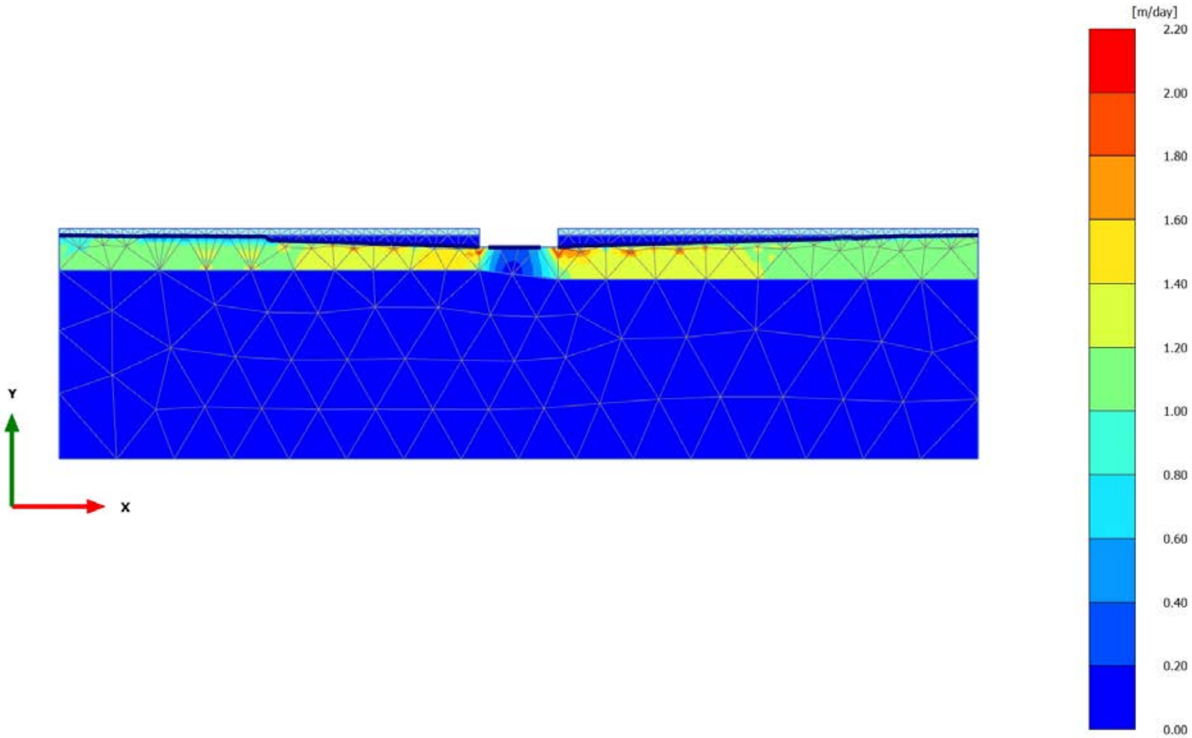


Groundwater flow |q| (scaled up 5.00 times) (Time 1.000 day)

Maximum value = 3.215 m/day (Element 241 at Node 1776)

Minimum value = 9.901×10^{-6} m/day (Element 349 at Node 2097)

4.1.4 Calculation results, Long Term [Phase_3] (3/34), Groundwater flow |q|



Groundwater flow |q| (scaled up 5.00 times) (Time 101.0 day)

Maximum value = 2.104 m/day (Element 241 at Node 1776)

Minimum value = 2.393×10^{-6} m/day (Element 348 at Node 2093)

IMPORTANT INFORMATION

Appendix B

Important Information

This Document has been provided by Morrow Geotechnics Pty Ltd subject to the following limitations:

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