

(M2C4-I3.3) PROGETTAZIONE A LIVELLO ESECUTIVO DELLE OPERE DI PROTEZIONE ARGINALE PER IL MANTENIMENTO DELL'ASSETTO AMBIENTALE E IDRAULICO-MORFOLOGICO (SCHEDA 16 LINEA PT) NELL'AMBITO DELL'INVESTIMENTO PNRR M2C4 - I3.3 RINATURAZIONE DELL'AREA DEL PO, FINANZIATO DALL'UNIONE EUROPEA NEXTGENERATIONEU

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## PROGETTO ESECUTIVO

### SCHEDA N° 16 CAORSO (PC) - PROGETTO DIAFRAMMATURE

CODICE ELABORATO

PE.0.1.6.PR.GE.R.T.0.0.1.B

TITOLO DELL'ELABORATO

Relazione di calcolo degli interventi

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-	M2C4 I3.3	Fase	Scheda	Opera	Argomento	Tipo elab.	Progressivo	Rev.
		PE	016	PRG	GE	RT	001	B

#### PROGETTAZIONE

Raggruppamento temporaneo di professionisti

Mandataria



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## 1 PREMESSA

La presente relazione di calcolo riguarda il progetto degli interventi di rafforzamento e consolidamento dell'argine maestro in froldo, posto in destra idraulica tra le progressive di Po PAI 345,5 e 346,5, in località Roncarolo, nel Comune di Caorso (PC); tali interventi consistono nella realizzazione di una diaframmatura in c.a. per un tratto di circa 600m, in adiacenza e a completamento di un tratto di diaframmatura realizzato in passato..

La progettazione di tal interventi rientra nell'INCARICO PER LA PROGETTAZIONE A LIVELLO ESECUTIVO DELLE "OPERE DI PROTEZIONE ARGINALE PER IL MANTENIMENTO DELL'ASSETTO AMBIENTALE E IDRAULICO-MORFOLOGICO" PREVISTI DAL PROGRAMMA DI ATTUAZIONE DEL PNRR M2C4 INVESTIMENTO 3.3 RINATURAZIONE DELL'AREA DEL PO. FINANZIATO DALL'UNIONE EUROPEA -NEXTGENERATIONEU.

In dettaglio, il presente documento illustra il dimensionamento della diaframmatura e le verifiche di stabilità, di filtrazione e strutturali in accordo alle NTC18.

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## 2 DOCUMENTI DI RIFERIMENTO

### 2.1 Normativa di riferimento

- [1] Aspetti geotecnici della progettazione in zona sismica – Linee guida 2005 AGI -Associazione Geotecnica Italiana
- [2] Linee guida per l'esecuzione degli interventi di adeguamento delle arginature di Po sia in corso di esecuzione che di progettazione – Direttiva del Magistrato per il Po (Parma, 22 luglio 1998)
- [3] Decreto Ministeriale del 17/01/2018 - Nuove “Norme tecniche per le costruzioni”
- [4] Circolare del 21/1/2019 n. 7 C.S.LL.PP. – Istruzioni per l'applicazione dell'«Aggiornamento delle “Norme Tecniche per le costruzioni”»
- [5] Raccomandazioni sulla programmazione ed esecuzione delle indagini geotecniche (1977) AGI – Associazione Geotecnica Italiana
- [6] Raccomandazioni sulle prove geotecniche di laboratorio (1994) AGI – Associazione Geotecnica Italiana
- [7] UNI EN 1997-1:2005 Eurocodice 7 – Progettazione geotecnica - Parte 1: Regole generali
- [8] UNI EN 1997-2:2007 Eurocodice 7 – Progettazione geotecnica - Parte 2: Indagini e prove nel sottosuolo
- [9] UNI 11531-1:2014 Costruzione e manutenzione delle opere civili delle infrastrutture - Criteri per l'impiego dei materiali – Parte 1: Terre e miscele di aggregati non legati

### 2.2 Bibliografia

La bibliografia di riferimento per la redazione della presente relazione di calcolo è quella riportata nel seguito:

- [10] Viggiani, C. (2014) – “Fondazioni”, Hevelius
- [11] Lancellotta, R. (2004) – “Geotecnica”, Zanichelli
- [12] GEOSLOPE International Ltd (2012) - Seepage Modelling with TEMP/W – An Engineering Methodology – July 2012 Edition

### 2.3 Documenti di progetto

I documenti di riferimento per la redazione della presente relazione di calcolo sono quelli riportati nel seguito:

- [13] PE.0.1.6.GEO.GE.R.T.0.0.1.A – Relazione Geologica

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- [14] PE.0.1.6.GEO.GE.R.T.0.0.2.B – Relazione Sismica
- [15] PE.0.1.6.GEO.GE.S.Z.0.0.1.A – Sezioni Geologiche
- [16] PE.0.1.6.GEO.GE.P.F.0.0.1.A – Profilo Geologico
- [17] PE.0.1.6.GEO.GE.R.T.0.0.3.A – Report Indagini
- [18] PE.0.1.6.GET.GE.R.T.0.0.1.A – Relazione Geotecnica
- [19] PE.0.1.6.GET.GE.P.L.0.0.1.A – Planimetria indagini geognostiche e geofisiche
- [20] PE.0.1.6.GET.GE.S.Z.0.0.1.A – Sezioni Geotecniche
- [21] PE.0.1.6.GET.GE.P.F.0.0.1.A – Profilo Geotecnico
- [22] PE.0.1.6.PRG.GE.P.L.0.0.1.A – Planimetria generale di progetto
- [23] PE.0.1.6.PRG.GE.P.L.0.0.2.A – Planimetria di tracciamento e progetto
- [24] PE.0.1.6.PRG.GE.P.F.0.0.1.A – Profilo longitudinale
- [25] PE.0.1.6.PRG.GE.S.Z.0.0.1.A – Sezioni trasversali 1/2 – Configurazioni di cantiere
- [26] PE.0.1.6.PRG.GE.S.Z.0.0.2.A – Sezioni trasversali 2/2 – Configurazioni di cantiere
- [27] PE.0.1.6.PRG.GE.S.Z.0.0.3.B – Sezioni trasversali 1/2 – Configurazioni di progetto
- [28] PE.0.1.6.PRG.GE.S.Z.0.0.4.B – Sezioni trasversali 2/2 – Configurazioni di progetto
- [29] PE.0.1.6.PRG.GE.S.Z.0.0.5.A – Sezioni tipo intervento carpenteria e particolari

**2.4 Allegati alla relazione**

- [30] All. A – Tabulati di calcolo Paratie Plus
- [31] All. B – Tabulati di calcolo GeoSlope

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### 3 INQUADRAMENTO GEOLOGICO-GEOTECNICO

#### 3.1 Indagini eseguite

La sponda destra dell'argine maestro in froldo in corrispondenza della loc. Roncarolo è stata rinforzata con una diaframmatura strutturale, costituita da pannelli di paratie in c.a, eseguita nel 2005, che risulta tuttavia non continua; dalla documentazione dei lavori eseguiti e dalle testimonianze di tecnici di AIPO, infatti, non vi era certezza della realizzazione del diaframma in corrispondenza dell'abitato di Roncarolo; inoltre più a valle risulta, in modo abbastanza definito, la mancanza di una tratta di più di 500 m priva di diaframmatura. I tratti mancanti comprendono due rampe di collegamento tra la strada in coronamento argine e la zona golenale in destra Po.

Circa la stratigrafia dei terreni, erano disponibili i dati relativi a qualche sondaggio pregresso che individua formazioni sabbiose e ghiaiose al di sopra di una bancata argillosa a partire da circa 25-30 m di profondità, entro cui sono stati immorsati i diaframmi esistenti.

Nel 2023 è stata così definita una campagna di indagini avente i seguenti obiettivi:

- definire l'ubicazione e l'estensione delle due tratte prive di diaframmatura;
- caratterizzare sotto l'aspetto geologico, idrogeologico e geotecnico la stratigrafia dei terreni nelle tratte di interesse.

La campagna di indagini è stata condotta a cavallo tra il 2023 e il 2024 ed è consistita in:

- accertamento diretto della presenza della diaframmatura tramite saggi eseguiti con un escavatore; ciò ha permesso di individuare:
  - o l'estremo di valle della nuova diaframmatura nella sua tratta più estesa, scoprendo la testa di inizio del della tratta successiva esistente;
  - o la zona in cui ricade l'estremo di monte della stessa tratta di cui sopra, in corrispondenza di una rampa di discesa al Po, poco a monte della cascina Gerre, da definire esattamente a inizio cantiere, dopo la temporanea rimozione della rampa;
  - o l'estremo di valle della nuova diaframmatura nella sua tratta più corta, scoprendo la testa di inizio del della tratta successiva esistente;
  - o la zona in cui ricade l'estremo di monte della stessa tratta di cui sopra, in corrispondenza della rampa di discesa all'attracco in sponda destra Po, da definire esattamente a inizio cantiere, dopo la temporanea rimozione della rampa;
- esecuzione di indagini geofisiche costituite da:
  - o n. 2 profili di tomografia geoelettrica lungo il coronamento del rilevato, n.1 sezione trasversale;
  - o n. 2 profili MASW 2D associati alle tomografie geoelettriche e n.1 prova MASW per la caratterizzazione della categoria di terreno ai sensi della NTC 2018;

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- n. 1 prova down hole;
- esecuzione di n. 3 sondaggi a carotaggio continuo (S3DH, S4, S5) completi di esecuzione di prove di permeabilità Lefranc, prove penetrometriche SPT a punta aperta Raymond (in n°  $6+5+4 = 15$ ), e prove pressiometriche Menard (in n°  $1+2+1 = 4$ );
- esecuzione di n. 8 prove CPTU disposte lungo il tracciato, in coronamento argine;
- posa in opera di n. 2 piezometri ad infissione per l'acquisizione del livello di falda in continuo; tale tipologia di strumento, differentemente dai piezometri a tubo aperto, permette di controllare il livello dell'acqua nel terreno senza creare una via preferenziale di risalita ella stessa, da evitare nell'argine maestro del fiume; i piezometri sono stati collegati in modo wireless ad una piattaforma di raccolta dati appositamente predisposta per l'accesso via internet al sistema di monitoraggio automatizzato;
- esecuzione di n.2 prove di pompaggio, in corrispondenza dell'abitato di Roncarolo e più a valle nella campagna lungo la tratta più estesa priva di diaframmatura, con pozzo di estrazione acqua e 3 piezometri di controllo del livello piezometrico;
- esecuzione di prove di laboratorio di classificazione e caratterizzazione meccanica sui campioni di terreno indisturbati e rimaneggiati prelevati dai sondaggi.

La documentazione relativa alle indagini geognostiche è allegata alla Relazione Geologica.

### 3.2 Stratigrafia di progetto

I dati ottenuti dalle indagini geognostiche sono stati elaborati e valutati sotto l'aspetto geologico e geotecnico, come riportato nella Relazione Geologica e nella Relazione Geotecnica, con i relativi elaborati grafici.

In estrema sintesi, le indagini hanno messo in evidenza una successione stratigrafica media così composta, dall'alto (coronamento del rilevato) verso il basso stratigrafico:

- Livello 1: costituente la parte alta del rilevato, si estende fino a pochi metri di profondità ed è generalmente rappresentato da terreni misti, tipo da misti sabbiosi a misti limosi: da limi argillosi a argille limose;
- Livello 2: rappresenta la parte bassa del rilevato ed è costituito da terreni prevalentemente coesivi, da misti limosi a argille: da argille limose a argille; si estende fino a circa 8-9 m dal coronamento del rilevato;
- Livelli 3 e 4: rappresentano le alluvioni in sito al di sotto del rilevato arginale; sono costituiti da terreni francamente granulari (sabbie e limo, livello 3, e sabbie limose in cui sono presenti orizzonti di ghiaia fine, livello 4, in generale in modo crescente con la profondità) che si estendono fino alle massime profondità raggiunte dalle prove (oltre 24 m); i livelli sono tra loro non sempre ben distinguibili.

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Sottostante ai livelli di cui sopra, identificati a mezzo delle prove penetrometriche, ad una profondità di circa 30 m dal piano sommitale del rilevato, compare un livello basale di argille limose plastiche grigie di spessore medio sui tre sondaggi pari a circa 7,6 m.

Nella seguente figura si riporta il profilo geologico dell'opera in oggetto.

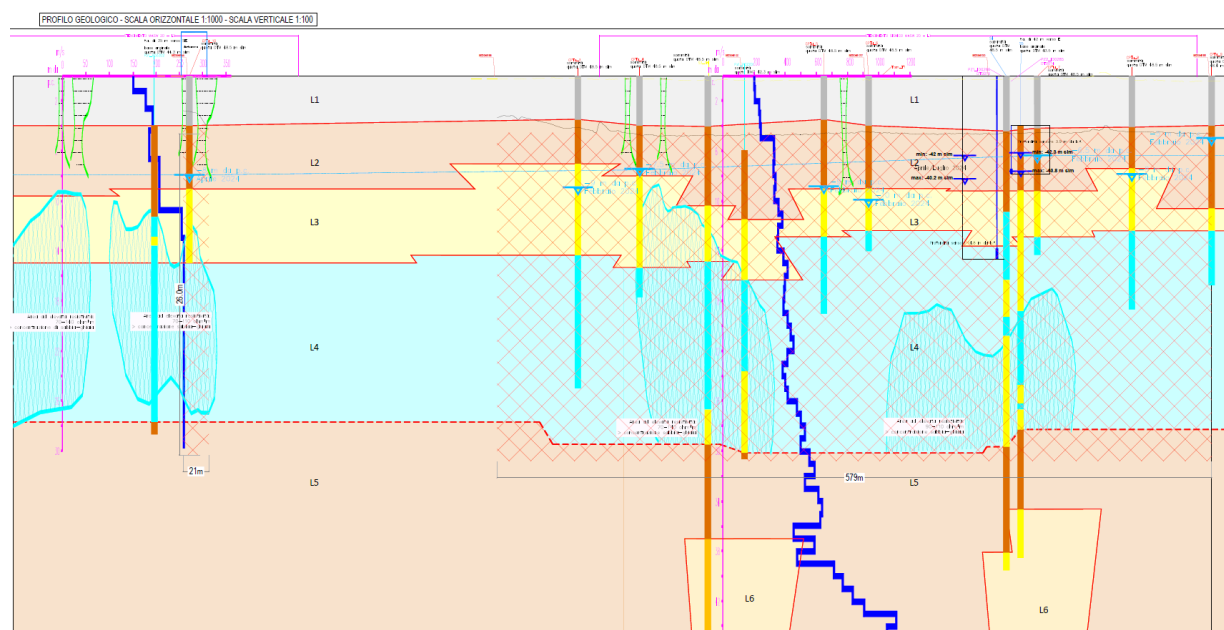


Figura 3-1 Sezione 1 - Profilo geologico dell'opera in oggetto

### 3.3 Sintesi dei parametri geotecnici

Sulla base di quanto illustrato nella Relazione Geotecnica di Progetto, i parametri caratteristici fisici e meccanici assunti per le unità geotecniche individuate sono i seguenti.

Tabella 3-1 Parametri di resistenza e di permeabilità – Modello A

Unità	Peso naturale $\gamma_{nat}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{sat}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19-20 [19.5]	20.5	-	12-13 [12.5]	25-27 [26]	1.22E-08 – 1.31E-06
UG2 - Coesivo	19-20 [19.5]	20.5	60-70 [65]	12-13 [12.5]	27.5-28.5 [28]	1.22E-08 – 1.31E-06
UG3 - Granulare	19.5-20.5 [20]	21	-	0	36-37 [36.5]	1.17E-03 – 2.38E-03
UG4 - Granulare	19.5-20.5 [20]	21	-	0	36-38 [37]	1.17E-03 – 2.38E-03
UG5 – Coesivo	19.5-20.5 [20]	21	60-70 [65]	21-23 [22]	20-21 [20.5]	1.22E-09 – 3.65E-08

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Tabella 3-2 Parametri di resistenza e di permeabilità – Modello B

Unità	Peso naturale $\gamma_{nat}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{sat}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19-20 [19.5]	20.5	-	12-13 [12.5]	25-27 [26]	1.22E-08 – 1.31E-06
UG2 - Coesivo	19-20 [19.5]	20.5	60-70 [65]	12-13 [12.5]	27.5-28.5 [28]	1.22E-08 – 1.31E-06
UG3 - Granulare	19.5-20.5 [20]	21	-	0	34-37 [34.5]	1.17E-03 – 2.38E-03
UG4 - Granulare	19.5-20.5 [20]	21	-	0	36-38 [37]	1.17E-03 – 2.38E-03
UG5 – Coesivo	19.5-20.5 [20]	21	60-70 [65]	21-23 [22]	20-21 [20.5]	1.22E-09 – 3.65E-08

Tabella 3-3 Parametri di resistenza e di permeabilità – Modello C

Unità	Peso naturale $\gamma_{nat}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{sat}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19-20 [19.5]	20.5	-	12-13 [12.5]	25-27 [26]	1.22E-08 – 1.31E-06
UG2 - Coesivo	19-20 [19.5]	20.5	60-70 [65]	12-13 [12.5]	27.5-28.5 [28]	1.22E-08 – 1.31E-06
UG3 - Granulare	19.5-20.5 [20]	21	-	0	32-36 [34]	1.17E-03 – 2.38E-03
UG4 - Granulare	19.5-20.5 [20]	21	-	0	38-39 [38.5]	1.17E-03 – 2.38E-03
UG5 – Coesivo	19.5-20.5 [20]	21	60-70 [65]	21-23 [22]	20-21 [20.5]	1.22E-09 – 3.65E-08

Tabella 3-4 Parametri di resistenza e di permeabilità – Modello D

Unità	Peso naturale $\gamma_{nat}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{sat}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19-20 [19.5]	20.5	-	12-13 [12.5]	25-27 [26]	1.22E-08 – 1.31E-06
UG2 - Coesivo	19-20 [19.5]	20.5	60-70 [65]	12-13 [12.5]	27.5-28.5 [28]	1.22E-08 – 1.31E-06
UG3 - Granulare	19.5-20.5 [20]	21	-	0	32-36 [34]	1.17E-03 – 2.38E-03
UG4 - Granulare	19.5-20.5 [20]	21	-	0	35-37 [36]	1.17E-03 – 2.38E-03
UG5 – Coesivo	19.5-20.5 [20]	21	60-70 [65]	21-23 [22]	20-21 [20.5]	1.22E-09 – 3.65E-08

## 4 DEFINIZIONE AZIONE SISMICA DI PROGETTO

L'azione sismica di riferimento per le analisi è stata definita in base alle indicazioni delle Norme Tecniche per le Costruzioni (Decreto Ministeriale 17 gennaio 2018). L'azione sismica viene valutata a partire dalla cosiddetta "pericolosità sismica di base" riferita a un sito con suolo rigido (categoria A) e superficie topografica orizzontale. In assenza di studi sismotettonici specifici e di pericolosità sismica, si fa riferimento a quanto stabilito nelle NTC, che prevedono la seguente classificazione per le opere in progetto:

- Vita nominale

La vita nominale di un'opera è definita come il numero di anni durante i quali deve poter essere utilizzata per lo scopo al quale è destinata. Secondo le NTC, essa dipende dal tipo di costruzione. Per il presente intervento si considera una vita nominale  $V_N$  pari a 100 anni che corrisponde a "Costruzioni con livelli di prestazioni elevati";

- Classe d'uso

In presenza di azioni sismiche, per valutare le conseguenze di un'eventuale interruzione di operatività o collasso della struttura, le costruzioni vengono classificate in 4 classi d'uso (par. 2.4.2, NTC 2018), ciascuna associata a un valore del coefficiente d'uso  $C_u$ . Per l'opera in esame viene assegnata una Classe d'uso IV, con un coefficiente d'uso  $C_u$  pari a 2.0 (Progetto generale di fattibilità tecnica ed economica).

Sulla base delle definizioni precedenti le azioni sismiche si possono valutare in relazione ad un periodo di riferimento  $V_R$ , che si ricava moltiplicando la vita nominale  $V_N$  per il coefficiente d'uso  $C_u$ . Nel caso in esame si ottiene quindi un periodo di riferimento  $V_R$  pari a 200 anni.

### 4.1 Parametri sismici

I valori dei parametri  $a_g$  (accelerazione orizzontale massima al sito),  $F_0$  (valore massimo del fattore di amplificazione dello spettro in accelerazione orizzontale) e  $T_c^*$  (periodo di inizio del tratto a velocità costante dello spettro in accelerazione orizzontale) per i periodi di ritorno associati ai quattro stati limite sono riportati nella tabella seguente (forniti tramite l'applicativo 'Spettri' elaborato dal M.LL.PP).

Tabella 4-1 Valori della sismicità per il sito in oggetto

STATO LIMITE	$T_R$ [anni]	$a_g$ [g]	$F_0$ [-]	$T_c^*$ [s]
SLO	120	0.055	2.578	0.265
SLD	201	0.067	2.563	0.281
SLV	1898	0.141	2.547	0.311
SLC	3899	0.151	2.546	0.314



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L'accelerazione di riferimento  $a_g$  così ottenuta deve essere modificata per tenere conto sia delle condizioni stratigrafiche locali che della morfologia del sito. L'accelerazione massima orizzontale di riferimento si calcola con la seguente espressione:

$$a_{max} = a_g \times S_s \times S_t$$

dove  $S_s$  è il coefficiente di amplificazione stratigrafica e  $S_t$  è il coefficiente di amplificazione topografica.

Il valore delle velocità delle onde di taglio  $V_s$  ottenuto dalla prova sismica MASW è risultato pari a 232 m/s calcolato in sommità arginale e 288 m/s calcolato al piano campagna. Sulla base di tali valori si individua una categoria di sottosuolo di tipo C: "Depositi di terreni a grana grossa mediamente addensati o terreni a grana fina mediamente consistenti, con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di  $V_{s,30}$  compresi tra 180 m/s e 360 m/s."

Dato che l'area in oggetto è pianeggiante, si assegna la categoria topografica T1: "Superficie pianeggiante, pendii e rilievi isolati con inclinazione media  $i \leq 15^\circ$ ".

Nel caso in esame, con riferimento allo Stato Limite di Salvaguardia della Vita (SLV), si ottiene un coefficiente di amplificazione stratigrafica  $S_s$  pari a 1.48 (categoria stratigrafica C) e un coefficiente di amplificazione topografica  $S_t$  pari a 1.00 (categoria topografica T1) al quale corrisponde un valore dell'accelerazione massima di progetto pari a:

$$a_{max} = a_g \times S_s \times S_t = 0.141g \cdot 1.48 \cdot 1.00 = 0.209g$$

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## 5 CONSIDERAZIONI IN MERITO ALLA VALUTAZIONE DELLA LIQUEFAZIONE

Si riportano di seguito alcune considerazioni in merito ad eventuali fenomeni di liquefazione a partire da quanto descritto in [14].

Le verifiche di liquefazione sono state svolte considerando due differenti scenari, nei quali la falda risulta ubicata rispettivamente a piano campagna e a -2.5m da piano campagna, considerando esclusivamente le verticali di indagine della campagna svolta ad hoc per il progetto in esame.

Nel primo caso, nel quale la falda è ubicata a piano campagna, il potenziale di liquefazione risulta basso (inferiore a 5) ad esclusione di 2 verticali di indagine; mentre nel secondo caso, nel quale la falda è ubicata a -2.5m da piano campagna, il potenziale di liquefazione risulta basso per tutte le verticali di indagine.

Alla luce della tipologia di indagini svolte per la campagna di indagine del progetto in esame, si ritiene ragionevole considerare che le verifiche di liquefazione abbiano valenza puntuale e non si possa quindi attribuire ai risultati ottenuti dalle verifiche svolte un carattere globale valido lungo tutta l'estensione dell'intervento.

Si sottolinea inoltre che l'oggetto principale del progetto non riguarda la verifica alla liquefazione del corpo arginale, quanto l'individuazione ed il dimensionamento delle opere di diaframmatura per ridurre i fenomeni di filtrazione, sebbene nei documenti di progetto sia stata comunque esaminata ed illustrata la valutazione delle verifiche della suscettività alla liquefazione dei terreni in corrispondenza delle verticali di indagine (verifiche puntuali). Risulta pertanto ragionevole attribuire alle verifiche svolte un carattere puntuale strettamente correlato alla zona indagata, che non può essere esteso lungo tutto lo sviluppo dell'intervento.

Alla luce di quanto sopra, si può quindi osservare che il rischio residuo per l'arginatura a seguito di un eventuale fenomeno sismico sia generalmente basso ed assolutamente accettabile per la tipologia di opera, ed anche qualora dovessero verificarsi cedimenti del corpo arginale essi potrebbero essere compensati con un intervento di manutenzione finalizzato al ripristino della sagoma e della quota di coronamento.

Si specifica infine che le analisi svolte nell'ambito della valutazione della RSL mostrano che in corrispondenza dell'area in esame la FA PGA determinata (1.52) è risultata in linea e di poco maggiormente cautelativa rispetto a quella ottenuta con l'approccio semplificato (1.48, parametro S delle NTC2018 per terreni di categoria C); il valore di amplificazione comprensivo di amplificazione stratigrafica e topografica ottenuto dall'analisi di RSL risulta 1.52 [ $S_s=1.52$  (da RSL) e  $S_t=1.0$  (da NTC2018)]; pertanto il valore di  $a_{max}$  risulta 0.2143 g.

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I risultati ottenuti attraverso l'analisi RSL risultano quindi confrontabili con quanto ottenuto dagli spettri desunti dalle NTC2018; si specifica infine che la combinazione sismica non risulta dimensionante.

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## 6 DESCRIZIONE INTERVENTI DI PROGETTO

Il progetto descritto nella presente relazione ha l'obiettivo di migliorare la tenuta idraulica di un tratto dell'argine in sponda destra del fiume Po, situato nella località di Caorso.

La lavorazione principale dell'intervento consiste nella realizzazione di una diaframmatura strutturale continua di circa 580 m di lunghezza, avente spessore 0,80 m e profondità di 26 m a partire da una bancata intermedia dell'argine in froldo, posta circa 5 m al di sotto del coronamento del corpo arginale stesso. Alla base del diaframma è presente uno stato di terreno naturale limoso-argilloso a bassa permeabilità, cosicché si viene a creare una schermatura di contrasto al fenomeno di filtrazione che ha originato i fontanazzi osservati e che nel tempo potrebbe innescare instabilità dell'argine stesso per effetto di sifonamenti.

La diaframmatura a bassa permeabilità è dimensionata in modo da ridurre il gradiente che in condizioni di massima piena prolungata del Po viene a stabilirsi tra il fiume e il piano campagna esterno all'argine, fino a valori che impediscono la risalita idraulica fino a tale piano e il verificarsi di fenomeni di sifonamento nell'argine. Infatti, il diaframma intercetterà la maggior parte dei flussi di filtrazione nei terreni di fondazione, costituendo così una barriera "impermeabile" lungo tutta la sua profondità. Questo intervento ridurrà significativamente i percorsi di filtrazione sotto l'argine, garantendo una maggiore sicurezza idraulica.

Inoltre, la diaframmatura in c.a. garantisce una funzionalità di tipo statico nei riguardi di possibili azioni erosive che possano indebolire il paramento lato fiume dell'argine, assicurando la stabilità del setto impermeabile anche in tali condizioni particolari.

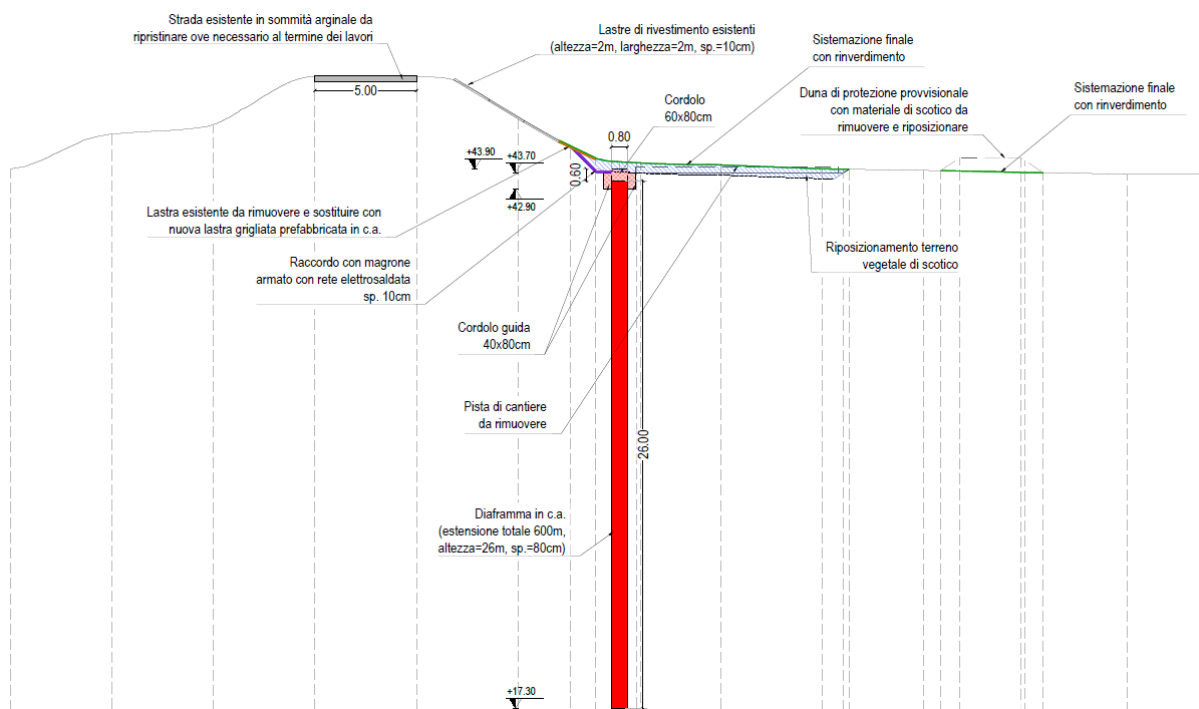


Figura 6-1 Sezione trasversale di progetto

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## 7 VERIFICHE DI SICUREZZA DEL RILEVATO ARGINALE

### 7.1 Introduzione

Le verifiche di sicurezza agli Stati Limite Ultimi (SLU) sono state condotte secondo quanto previsto nelle Norme Tecniche per le Costruzioni di cui al DM del 17 Gennaio 2018 e si articolano in:

- Verifiche agli stati limite idraulici: sifonamento, sollevamento;
- Verifiche di stabilità globale: condizione di massima piena, svaso rapido e sismica.

Tali verifiche sono state eseguite sia per lo stato attuale dell'argine sia per lo stato di progetto.

Le verifiche di stabilità globale vengono condotte in condizioni statiche considerando la quota del fiume al livello di massima piena (SIMPO '82) mentre in condizioni sismiche considerando la quota del fiume da un livello inferiore (piena ordinaria).

Di seguito sono riportate le quote significative del Fiume Po in corrispondenza del sito in oggetto:

- Quota piena SIMPO '82: 47.83 m s.l.m. (valore medio fra le sezioni PAI 22A e 22B del fiume Po' poste rispettivamente a monte e a valle del tratto in progetto).
- Quota piena ordinaria: per il presente tratto in progetto non sono disponibili presso ARPA le statistiche recenti per la quota della piena ordinaria corrispondente ad un tempo di ritorno  $T_R$  di 2-5 anni. Per il dimensionamento dei diaframmi in condizioni sismiche, per il sito in esame si assume in via cautelativa la quota di piena associata ad un tempo di ritorno  $T_R$  pari a 20 anni, pari a 46.44 m s.l.m. riportata all'interno del documento "Piano per la valutazione e gestione del rischio di alluvioni – Profili di Piena dei corsi d'acqua del reticolo principale Marzo 2016" (valore medio fra le sezioni PAI 22A e 22B del fiume Po' poste rispettivamente a monte e a valle del tratto in progetto);

### 7.2 Sezioni di analisi

Sulla base dell'analisi della geometria delle sezioni trasversali e della valutazione delle proprietà dei terreni di fondazione, si eseguono le verifiche di sicurezza sulle seguenti sezioni:

- Tratto Sud Sezione geotecnica AA (PE.0.1.6.GET.GE.S.Z.0.0.1.A);
- Tratto Nord Sezione geotecnica BB (PE.0.1.6.GET.GE.S.Z.0.0.1.A);
- Tratto Nord Sezione geotecnica CC (PE.0.1.6.GET.GE.S.Z.0.0.1.A);
- Tratto Nord Sezione geotecnica DD (PE.0.1.6.GET.GE.S.Z.0.0.1.A).

La stratigrafia di progetto delle sezioni di calcolo è simile per le varie sezioni, ossia costituita dal rilevato arginale UG1 seguito dalle quattro unità geotecniche del terreno di fondazione UG2, UG3, UG4, UG5, con spessori differenti in funzione della sezione, in accordo ai modelli geotecnici illustrati

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nel precedente capitolo 3 e definiti in dettaglio nella Relazione Geotecnica di Progetto [18] e nelle Sezioni Geotecniche di Progetto [20].

Nelle seguenti figure si riportano le sezioni di progetto adottate nella verifiche di sicurezza del rilevato arginale e le relative sezioni geotecniche.

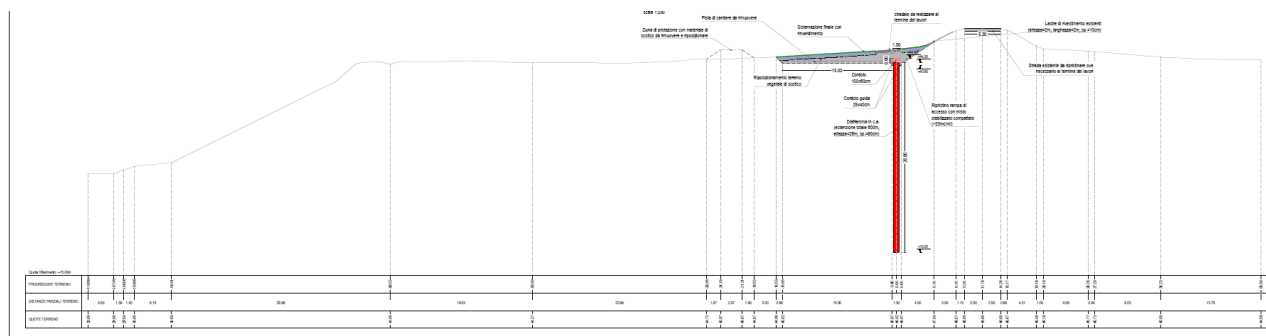


Figura 7-1 Sezione di calcolo AA

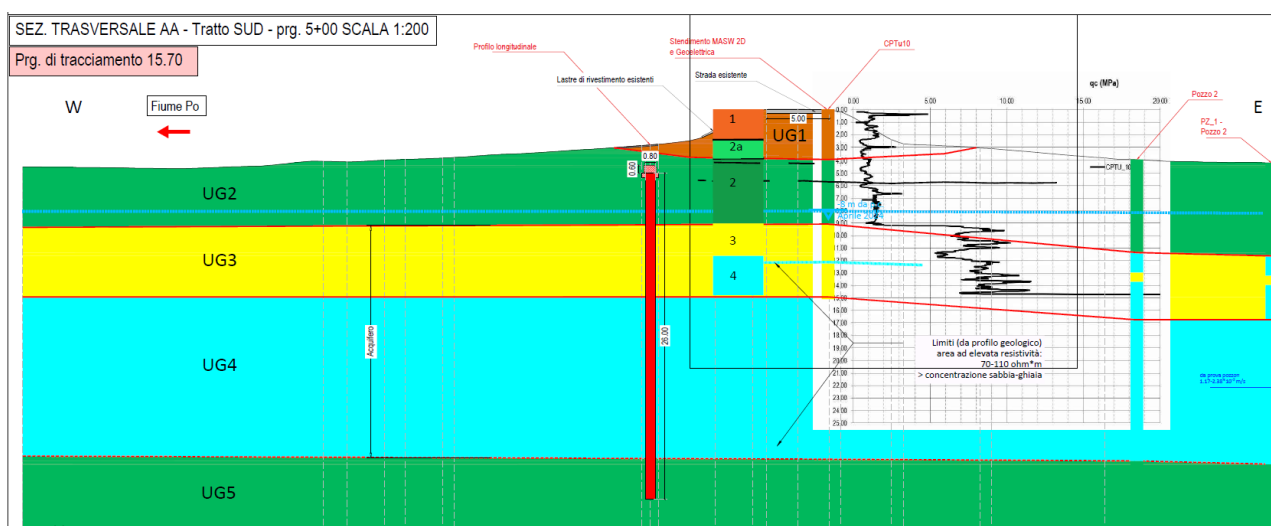


Figura 7-2 Sezione geotecnica AA

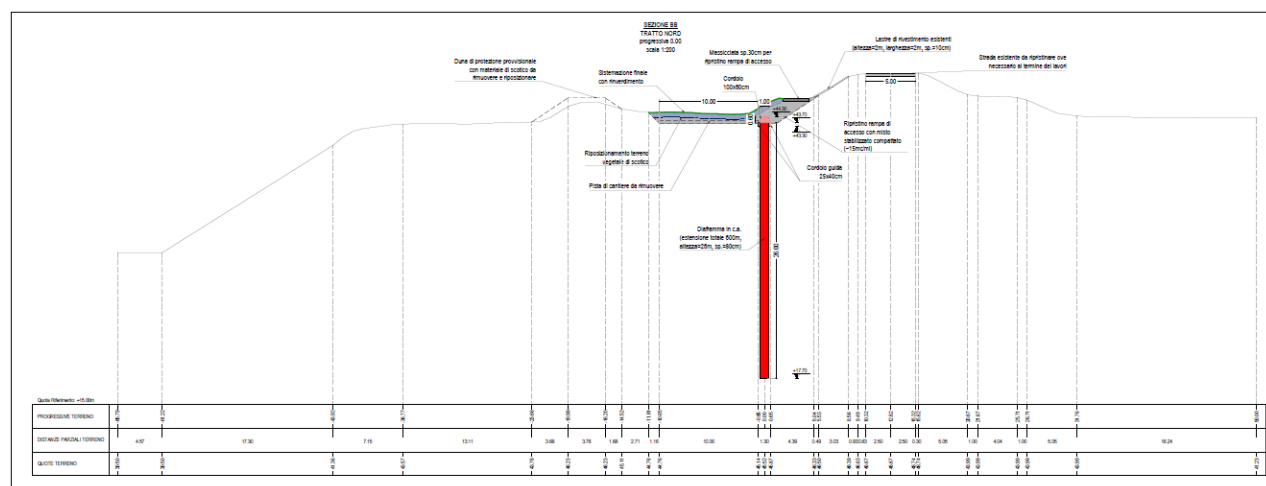


Figura 7-3 Sezione di calcolo BB

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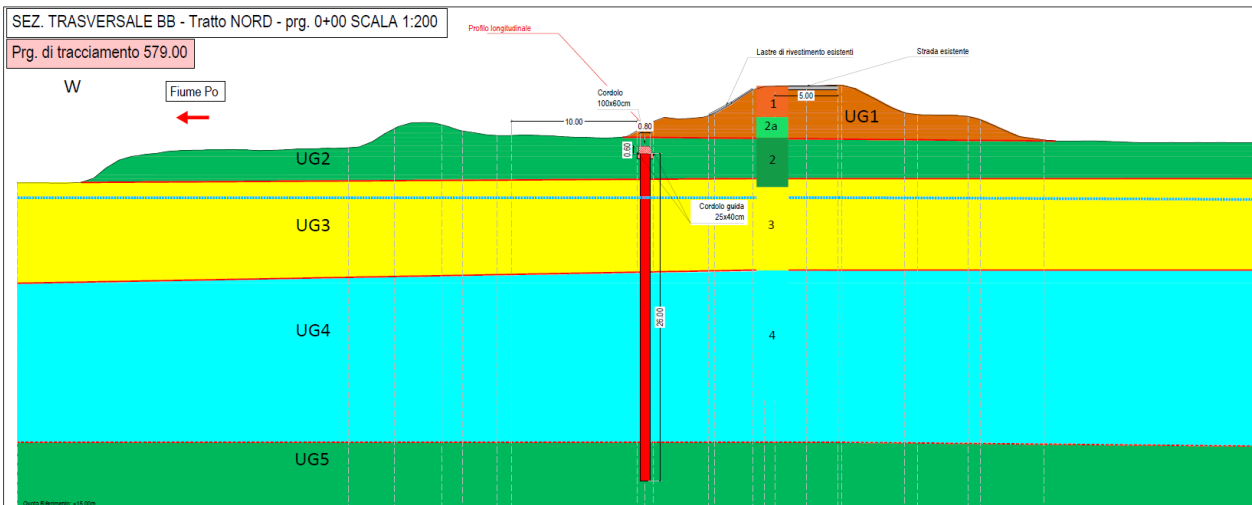


Figura 7-4 Sezione geotecnica BB

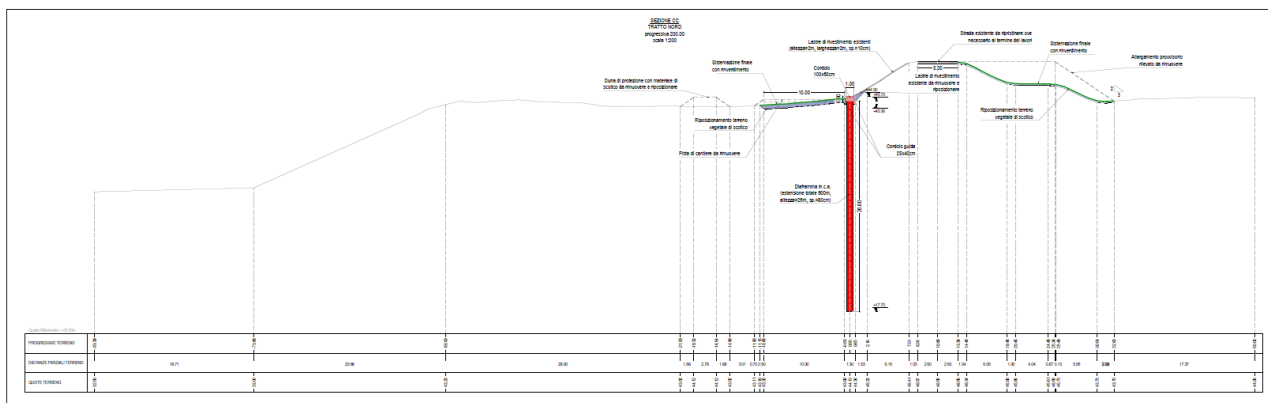


Figura 7-5 Sezione di calcolo CC

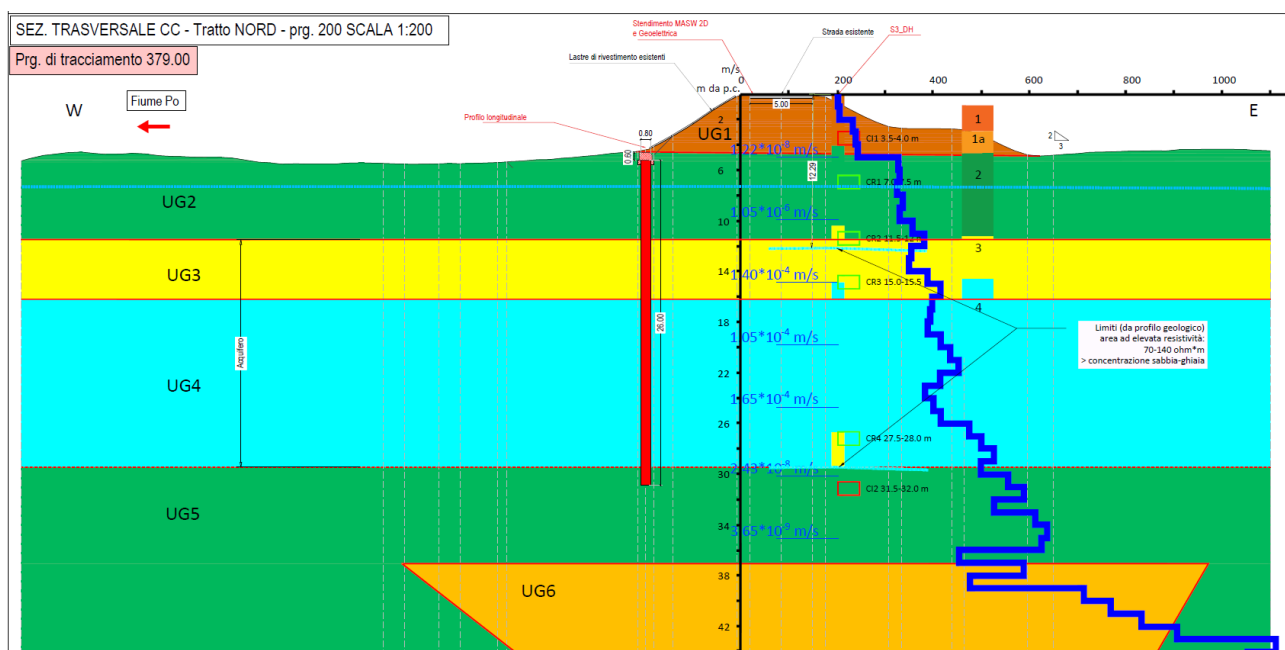
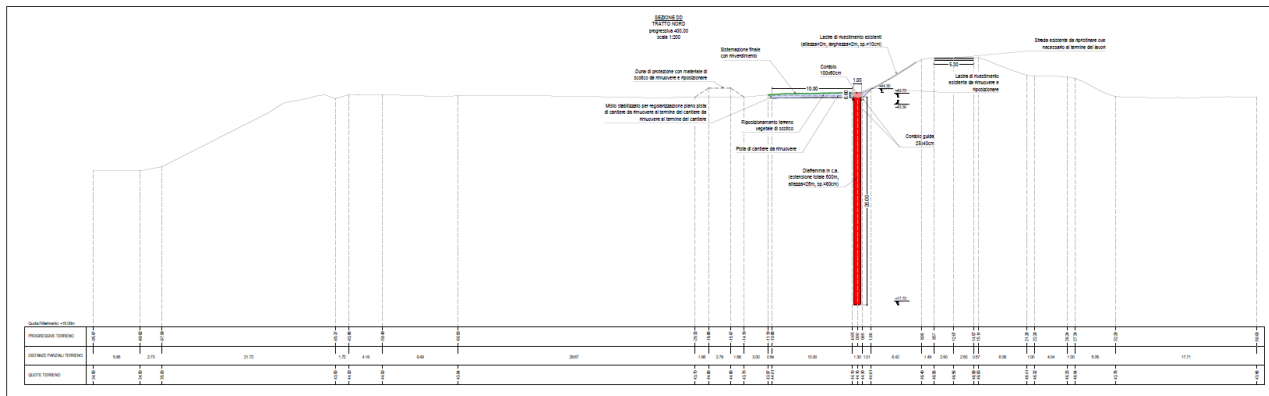
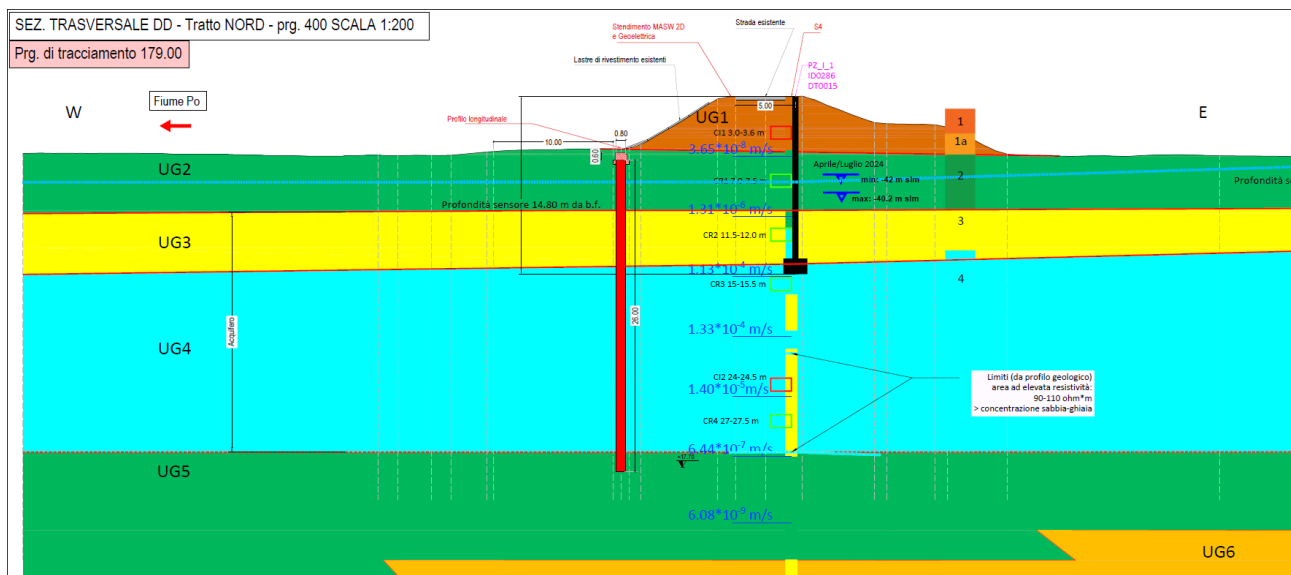


Figura 7-6 Sezione geotecnica CC



*Figura 7-7 Sezione di calcolo DD*



*Figura 7-8 Sezione geotecnica DD*

### 7.3 Parametri geotecnici e idraulici di progetto

Le sezioni di calcolo considerate all'interno delle verifiche sono costituite dal rilevato arginale e dal terreno di fondazione suddiviso nelle differenti unità geotecniche individuate nella Relazione Geotecnica di Progetto [18]. Sulla base di quanto illustrato al capitolo 3.3, i parametri di resistenza e di permeabilità caratteristici delle unità geotecniche considerati all'interno dei modelli numerici sono riportati nelle seguenti tabelle.

Al diaframma in c.a. è stata assegnata una permeabilità di  $1\text{E-}10$  m/s per le verifiche di filtrazione ed un comportamento elastico per quanto riguarda le verifiche di stabilità globale.



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Tabella 7-1 Parametri di resistenza e di permeabilità – Modello A

Unità	Peso naturale $\gamma_{\text{nat}}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{\text{sat}}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19.5	20.5	65	12.5	26	5E-07
UG2 - Coesivo	19.5	20.5	65	12.5	28	1E-07
UG3 - Granulare	20	21	-	0	36.5	1.78E-03
UG4 - Granulare	20	21	-	0	37	1.78E-03
UG5 – Coesivo	20	21	65	22	20.5	1.89E-08

Tabella 7-2 Parametri di resistenza e di permeabilità – Modello B

Unità	Peso naturale $\gamma_{\text{nat}}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{\text{sat}}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19.5	20.5	65	12.5	26	5E-07
UG2 - Coesivo	19.5	20.5	65	12.5	28	1E-07
UG3 - Granulare	20	21	-	0	34.5	1.78E-03
UG4 - Granulare	20	21	-	0	37	1.78E-03
UG5 – Coesivo	20	21	65	22	20.5	1.89E-08

Tabella 7-3 Parametri di resistenza e di permeabilità – Modello C

Unità	Peso naturale $\gamma_{\text{nat}}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{\text{sat}}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19.5	20.5	65	12.5	26	5E-07
UG2 - Coesivo	19.5	20.5	65	12.5	28	1E-07
UG3 - Granulare	20	21	-	0	34	1.78E-03
UG4 - Granulare	20	21	-	0	38.5	1.78E-03
UG5 – Coesivo	20	21	65	22	20.5	1.89E-08

Tabella 7-4 Parametri di resistenza e di permeabilità – Modello D

Unità	Peso naturale $\gamma_{\text{nat}}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{\text{sat}}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]	Permeabilità $k$ [m/s]
UG1 – Rilevato arginale (misto)	19.5	20.5	65	12.5	26	5E-07
UG2 - Coesivo	19.5	20.5	65	12.5	28	1E-07
UG3 - Granulare	20	21	-	0	34	1.78E-03
UG4 - Granulare	20	21	-	0	36	1.78E-03
UG5 – Coesivo	20	21	65	22	20.5	1.89E-08

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## 7.4 Criteri di verifica

### 7.4.1 Verifica di filtrazione

Come previsto dalle NTC18 le verifiche di sicurezza di tipo idraulico comprendono il pericolo di sifonamento e sollevamento al piede a campagna per effetto dei gradienti di filtrazione in concomitanza con gli eventi di piena.

I fenomeni di collasso per sifonamento e sollevamento a campagna nella zona al piede del corpo arginale sono tra loro strettamente correlati; con il termine sifonamento si intende l'erosione progressiva del terreno di fondazione di natura incoerente per effetto del dislivello idraulico tra monte e valle, fenomeno che innesci la formazione dei fontanazzi in occasione di eventi di piena. In presenza a campagna di terreni superficiali coesivi di bassa permeabilità si può avere sollevamento e rottura del terreno stesso per effetto delle sottopressioni con successivo innesco del sifonamento. Le analisi di filtrazione sono state eseguite mediante analisi numerica agli elementi finiti simulando il terreno di tipo poroso come un mezzo continuo permeabile. L'analisi di filtrazione consente di determinare il profilo di saturazione, la velocità del flusso, la portata d'acqua che filtra all'interno del terreno ed il relativo gradiente idraulico, note le caratteristiche di permeabilità dei diversi materiali e le condizioni idrauliche al contorno definite sia nella zona esterna all'argine che nella zona interna. La verifica di filtrazione viene condotta in accordo a quanto riportato al capitolo 6.2.4.2 delle NTC18 per la condizione di efflusso libero.

La verifica a sifonamento con il metodo del gradiente di efflusso viene svolta determinando il coefficiente di sicurezza  $F_S$  definito come rapporto tra il gradiente idraulico critico  $i_c$  e quello di efflusso in uscita  $i_E$  della zona interessata dal fenomeno. Tale coefficiente definito come segue, deve risultare maggiore del fattore  $\gamma_R=2$  affinché la verifica si possa considerare soddisfatta.

Questo metodo di verifica consente di mettere a confronto i massimi gradienti che si determinano nel dominio di filtrazione con il cosiddetto gradiente critico.

$$F_S = \frac{i_c}{i_E} > \gamma_R = 2$$

$$i_c = \frac{\gamma'}{\gamma_w} = \frac{\gamma_t - \gamma_w}{\gamma_w}$$

Dove:

- $\gamma_t$  è il peso per unità di volume del terreno di cui è costituito l'argine assunto pari a 20.5 kN/m<sup>3</sup>;
- $\gamma_t$  è il peso per unità di volume dell'acqua assunto pari a 10 kN/m<sup>3</sup>;
- $i_c$  è il gradiente critico pari quindi a  $i_c = (20.5 - 10)/10 = 1.05$ ;
- $i_E$  è il gradiente di efflusso libero al piede dell'argine estratto dal software.

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## 7.4.2 Verifica di stabilità globale

Le analisi di stabilità sono state eseguite utilizzando il metodo dell'equilibrio limite, che ipotizza un comportamento rigido-plastico alla Mohr-Coulomb per i materiali coinvolti nell'analisi. La stabilità del pendio nei confronti dello scivolamento viene valutata mediante il valore del fattore di sicurezza ( $F_s$ ), che è definito come il rapporto tra la massima resistenza al taglio disponibile e la massima azione tagliante sollecitante, valutate lungo la superficie di scivolamento analizzata.

Per tutte le condizioni analizzate è stata svolta una analisi di stabilità volta a determinare quale sia la superficie di scivolamento più probabile, ossia quella caratterizzata dal fattore di sicurezza più basso. Per fare ciò è stato utilizzato il metodo rigoroso di Spencer. Tale metodo introduce un'ipotesi semplificativa allo scopo di risolvere una serie di equazioni, necessarie a garantire le condizioni di equilibrio della porzione di terreno posta al di sopra della linea di scivolamento, che viene suddivisa in un numero finito di conci verticali.

Il metodo di Spencer stabilisce la direzione della risultante delle azioni scambiate tra i conci imponendo che essa sia uguale per tutte le strisce e pari all'angolo  $\vartheta$ . All'interno del metodo sono risolte contemporaneamente l'equilibrio delle forze normali alla base, l'equilibrio delle forze parallele alla base e l'equilibrio dei momenti.

Le analisi di stabilità sono state condotte con il metodo dell'equilibrio limite mediante il software Slope/W (Geostudio). Il criterio di ricerca utilizzato, chiamato "exit&entry" prevede l'individuazione di un'area d'inizio delle superfici potenzialmente instabili, che coincide con l'area a monte dell'opera, e un'area d'uscita, che coincide con l'area di valle dell'opera.

Il software discretizza tali aree in un numero finito di punti e analizza tutte le possibili superfici di scivolamento possibili fra le due aree, calcolando per ognuna il fattore di sicurezza e determinandone, alla fine, quella più critica. Queste operazioni vengono svolte sulla base della geometria del pendio, del peso proprio e delle caratteristiche di resistenza dei materiali che lo costituiscono e di eventuali carichi esterni.

## 7.5 Software di calcolo

Le analisi di filtrazione sono state condotte mediante analisi numeriche implementate per mezzo del codice di calcolo SEEP/W (GeoStudio) che consente di analizzare problemi di filtrazione attraverso un'analisi numerica bidimensionale agli elementi finiti. Il software di modellazione consente di condurre analisi in regime stazionario e in regime transiente tenendo in considerazione differenti configurazioni di calcolo definite dall'utente.

Le analisi di stabilità globale sono invece state condotte mediante analisi numeriche implementate per mezzo del codice di calcolo SLOPE/W (GeoStudio) che consente di analizzare problemi di instabilità globale attraverso un'analisi all'equilibrio limite bidimensionale. Il software di modellazione

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consente di condurre analisi in condizioni statiche e sismiche tenendo in considerazione l'effetto dei carichi esterni e della falda.

I due codici di calcolo, facenti parte dello stesso pacchetto di software della Geostudio, permettono di eseguire analisi accoppiate. Tale funzionalità permette di eseguire dapprima le analisi di filtrazione ed in seguito le verifiche di stabilità globale tenendo in considerazione le configurazioni delle pressioni dell'acqua determinate nelle analisi precedenti.

## 7.6 Verifica di filtrazione

Nel presente paragrafo viene illustrata l'analisi di filtrazione del rilevato arginale al fine di determinare il profilo di saturazione, la velocità del flusso e la portata d'acqua che filtra all'interno del rilevato. Il profilo di saturazione ottenuto sarà utilizzato in seguito per le verifiche di stabilità globale. Il flusso d'acqua interno all'argine e quello di efflusso al piede ed i loro relativi gradienti consentono di eseguire le verifiche dell'opera a sifonamento.

Le analisi di filtrazione vengono condotte su diverse sezioni bidimensionali del rilevato poste in posizioni differenti lungo le sponde interessate dall'intervento; le analisi vengono eseguite considerando il livello di piena SIMPO '82 (47.83 m s.l.m.).

Le verifiche agli stati limite idraulici nei confronti del pericolo di sifonamento sono state successivamente condotte valutando che il rapporto tra il gradiente idraulico critico  $i_c$  pari a 1.05 ed il gradiente idraulico in uscita a piano campagna  $i_e$  sia superiore a 2, come indicato dalla normativa vigente (§6.2.4.2 NTC18).

### 7.6.1 Modello di calcolo, parametri idraulici e condizioni al contorno

Il presente modello di calcolo ha lo scopo di simulare i possibili moti di filtrazione all'interno del corpo arginale in fase di esercizio, allo scopo di definire il profilo di saturazione, le pressioni interstiziali, le velocità e i flussi d'acqua all'interno dell'argine stesso.

Le analisi di filtrazione sono condotte realizzando dei modelli numerici bidimensionali agli elementi finiti mediante l'utilizzo del software di calcolo SEEP/W (GeoStudio).

La modellazione agli elementi finiti necessita della definizione dei seguenti parametri:

- Dimensioni del modello: tale dato è funzione della grandezza dell'argine che presenta una larghezza di circa 30m e un'altezza di circa 5m rispetto al piano campagna. Le dimensioni del modello devono essere tali da non creare effetti di bordo e quindi sufficientemente ampi da non alterare i risultati all'interno. Per tale motivo le dimensioni del dominio di calcolo sono state assunte pari a 180x60m (larghezza x altezza).

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- Caratteristiche di permeabilità dei materiali: tali parametri sono funzione del tipo di materiale e vengono dedotte dalle prove eseguite. I valori di permeabilità adottati all'interno del modello numerico sono riportati al paragrafo 7.3.
- Condizioni idrauliche al contorno: esse simulano le condizioni idrauliche del sito e costituiscono la base del calcolo di filtrazione. Le condizioni idrauliche che si possono definire all'interno del software di calcolo sono di tipologie differenti:
  - o Quota piezometrica: è data dalla somma della quota geoidica e della altezza piezometrica di un determinato punto;
  - o Altezza piezometrica: è data dal rapporto fra la pressione dell'acqua in un determinato punto e il peso specifico dell'acqua;
  - o Pressione idrostatica: è la pressione dell'acqua in un determinato punto;
  - o Flusso d'acqua: è il valore del flusso d'acqua in un determinato punto; esso può essere uguale a zero se è impermeabile o diverso da zero se permeabile.

Nel presente modello numerico sono state adottate le seguenti condizioni al contorno:

- Bordo laterale destro: è stata applicata una quota piezometrica corrispondente alla quota del piano campagna;
- Bordo laterale sinistro, alveo e scarpata interna dell'argine: è stata applicata una quota piezometrica corrispondente alla quota di piena SIMPO '82;
- Sommità dell'argine e scarpata esterna dell'argine: è stata applicata una condizione di flusso d'acqua nullo;
- Piano campagna: è stata applicata una condizione di pressione idrostatica nulla.

Nelle seguenti figure si riportano riportati i modelli di calcolo implementati all'interno del codice di calcolo SEEP/W per le diverse sezioni in esame. Nello specifico si riporta una vista globale del modello di calcolo e una vista di dettaglio sull'opera in cui è mostrata la mesh di calcolo.

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Color	Name	Model	Vol. WC Function	K Function	Ky/Ko' Ratio
	Diaframma	Saturated / Unsaturated	CLS - Vol WC Function - Diaframma	CLS - Hyd Conductivity Function - Diaframma	1
	UG1 - Misto	Saturated / Unsaturated	UG1 - Vol WC Function - Misto	UG1 - Hyd Conductivity Function - Misto	1
	UG2 - Limo Agiloso	Saturated / Unsaturated	UG2 - Vol WC Function - Limo Agiloso	UG2 - Hyd Conductivity Function - Limo Agiloso	1
	UG3 - Sabbia Limo Ghiaiosa	Saturated / Unsaturated	UG3 - Vol WC Function - Sabbia Limo Ghiaiosa	UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa	1
	UG4 - Sabbia Ghiaiosa	Saturated / Unsaturated	UG4 - Vol WC Function - Sabbia Ghiaiosa	UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa	1
	UG5 - Argilla Limosa	Saturated / Unsaturated	UG5 - Vol WC Function - Argilla Limosa	UG5 - Hyd Conductivity Function - Argilla limosa	1

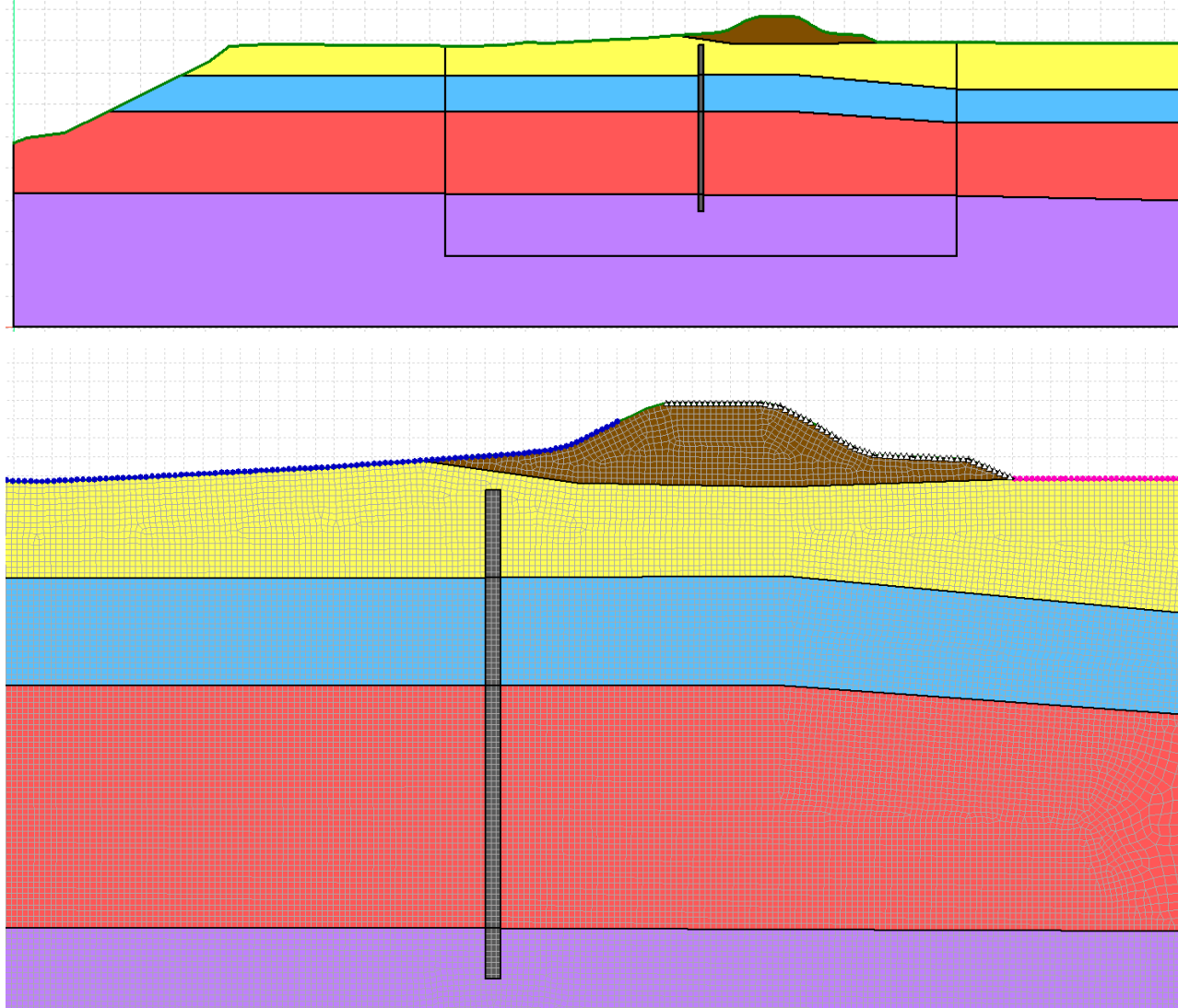


Figura 7-9 Modello di calcolo – Sezione AA

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Color	Name	Model	Vol WC. Function	K-Function	Ky/Kx Ratio
	Diaframma	Saturated / Unsaturated	CLS - VolWC Function - Diaframma	CLS - Hyd Conductivity Function - Diaframma	1
	UG1 - Misto	Saturated / Unsaturated	UG1 - VolWC Function - Misto	UG1 - Hyd Conductivity Function - Misto	1
	UG2 - Limo Argilloso	Saturated / Unsaturated	UG2 - VolWC Function - Limo Argilloso	UG2 - Hyd Conductivity Function - Limo argilloso	1
	UG3 - Sabbia Limo Ghiaiosa	Saturated / Unsaturated	UG3 - VolWC Function - Sabbia Limo Ghiaiosa	UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa	1
	UG4 - Sabbia Ghiaiosa	Saturated / Unsaturated	UG4 - VolWC Function - Sabbia Ghiaiosa	UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa	1
	UG5 - Argilla Limosa	Saturated / Unsaturated	UG5 - VolWC Function - Argilla Limosa	UG5 - Hyd Conductivity Function - Argilla limosa	1

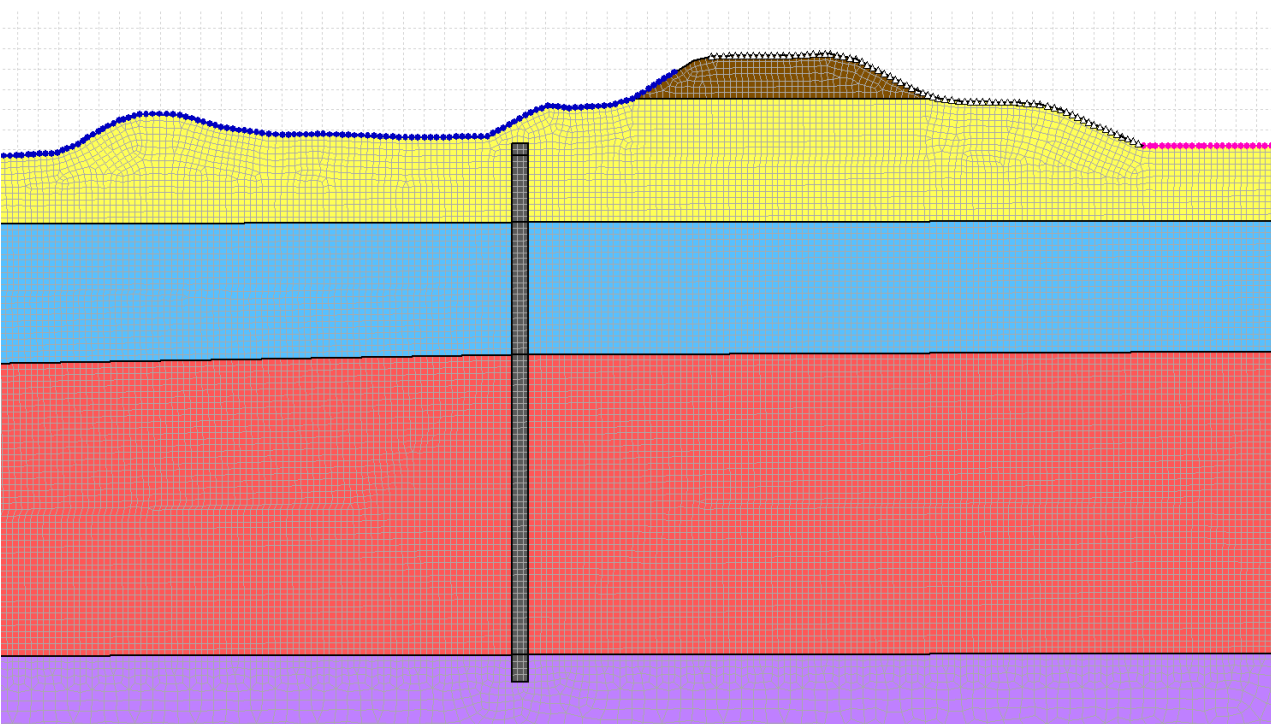
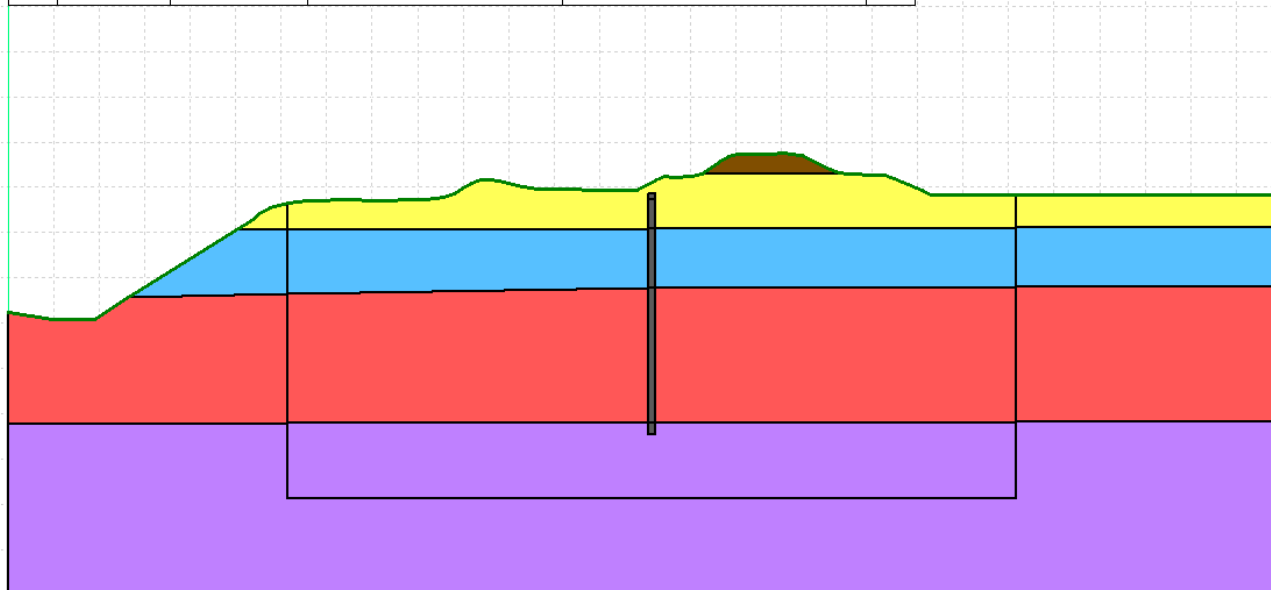


Figura 7-10 Modello di calcolo – Sezione BB

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Color	Name	Model	Vol WC. Function	K-Function	Ky/Kx Ratio
	Diaframma	Saturated / Unsaturated	CLS - VolWC Function - Diaframma	CLS - Hyd Conductivity Function - Diaframma	1
	UG1 - Misto	Saturated / Unsaturated	UG1 - VolWC Function - Misto	UG1 - Hyd Conductivity Function - Misto	1
	UG2 - Limo Argilloso	Saturated / Unsaturated	UG2 - VolWC Function - Limo Argilloso	UG2 - Hyd Conductivity Function - Limo Argilloso	1
	UG3 - Sabbia Limo Ghiaiosa	Saturated / Unsaturated	UG3 - VolWC Function - Sabbia Limo Ghiaiosa	UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa	1
	UG4 - Sabbia Ghiaiosa	Saturated / Unsaturated	UG4 - VolWC Function - Sabbia Ghiaiosa	UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa	1
	UG5 - Argilla Limosa	Saturated / Unsaturated	UG5 - VolWC Function - Argilla Limosa	UG5 - Hyd Conductivity Function - Argilla Limosa	1

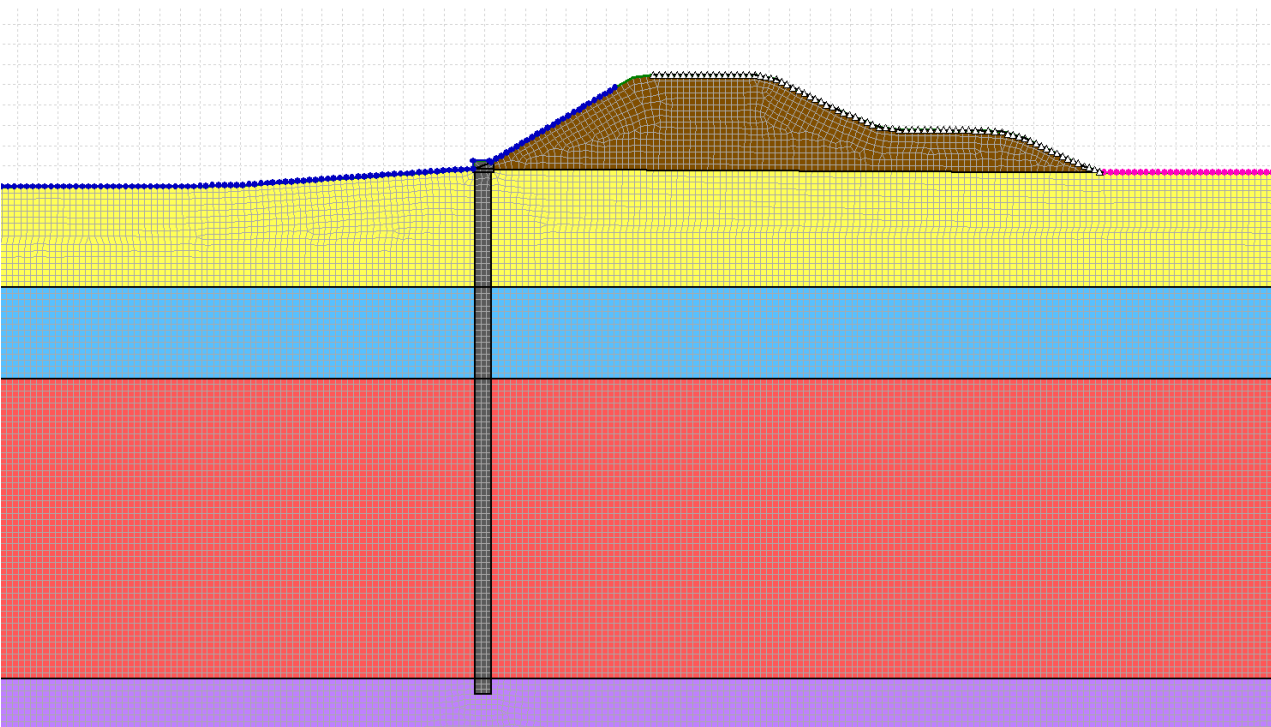
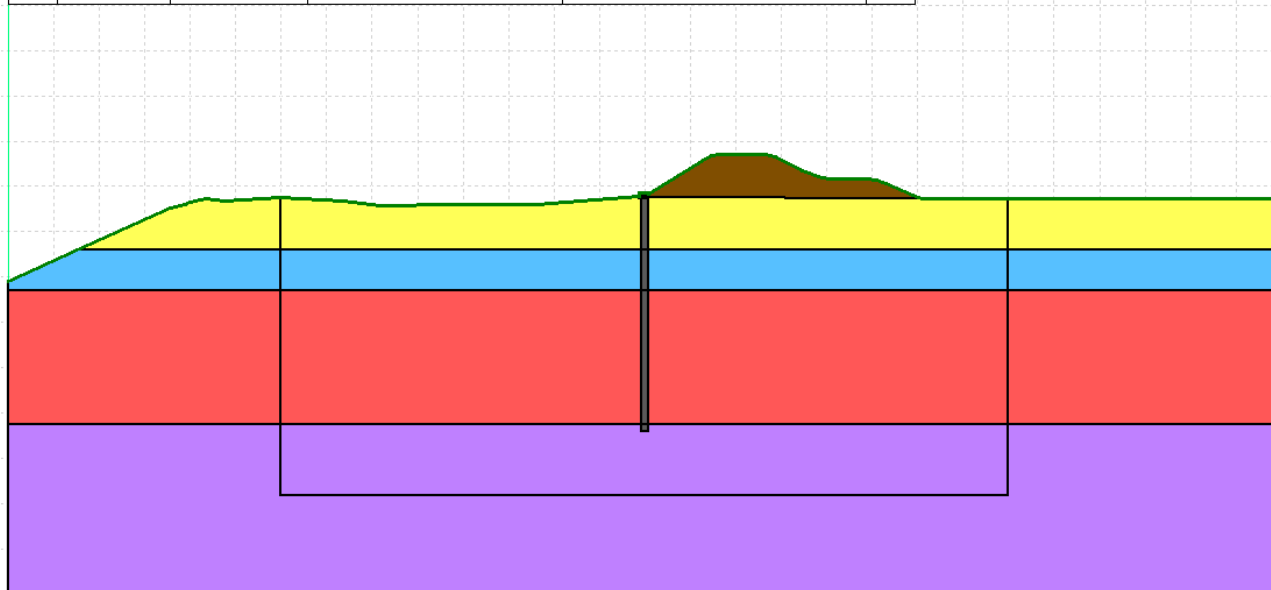


Figura 7-11 Modello di calcolo – Sezione CC



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Color	Name	Model	Vol. WC. Function	KFunction	Ky/Kx' Ratio
	Diaframma	Saturated / Unsaturated	CLS - Vol WC Function - Diaframma	CLS - Hyd Conductivity Function - Diaframma	1
	UG1 - Misto	Saturated / Unsaturated	UG1 - Vol WC Function - Misto	UG1 - Hyd Conductivity Function - Misto	1
	UG2 - Limo Agilloso	Saturated / Unsaturated	UG2 - Vol WC Function - Limo Agilloso	UG2 - Hyd Conductivity Function - Limo Agilloso	1
	UG3 - Sabbia Limo Ghiaiosa	Saturated / Unsaturated	UG3 - Vol WC Function - Sabbia Limo Ghiaiosa	UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa	1
	UG4 - Sabbia Ghiaiosa	Saturated / Unsaturated	UG4 - Vol WC Function - Sabbia Ghiaiosa	UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa	1
	UG5 - Argilla Limosa	Saturated / Unsaturated	UG5 - Vol WC Function - Argilla Limosa	UG5 - Hyd Conductivity Function - Argilla Limosa	1

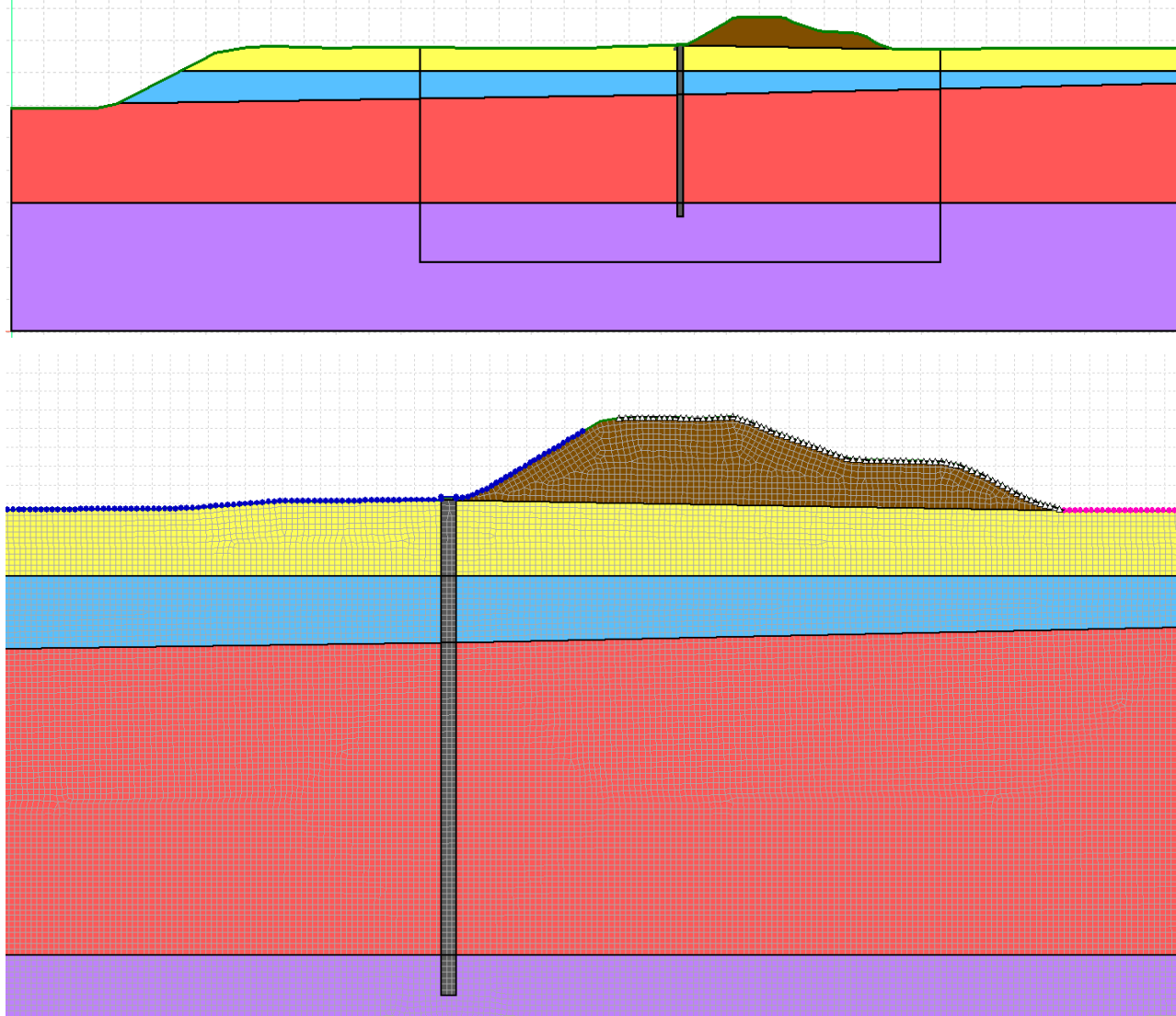


Figura 7-12 Modello di calcolo – Sezione DD

Come illustrato nei seguenti paragrafi, la realizzazione del diaframma in ca risulta benefica per tutte le sezioni di calcolo implementate, apportando significative riduzioni del gradiente idraulico ed aumentando quindi i fattori di sicurezza valutati per le verifiche a sifonamento. Le motivazioni principali che portano a questa riduzione sono legate alla stratigrafia del sito che risulta eterogenea con la presenza di uno strato principale di natura sabbiosa-ghiaiosa ad elevata permeabilità posto

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al di sopra di uno strato a ridotta permeabilità (UG5 – argilla limosa); l'immorsamento del diaframma all'interno di tale strato costituisce una netta barriera nei confronti dei flussi orizzontali dell'acqua.

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## 7.6.1 Risultati del modello e verifiche a sifonamento – Sezione AA

Nel seguente paragrafo sono presentati i risultati relativi alla verifica a sifonamento per la sezione AA; si riportano le figure rappresentanti i valori delle sottopressioni idrauliche, il gradiente di efflusso nella zona del piede dell'argine, e l'andamento del profilo di saturazione.

L'analisi è stata condotta considerando la configurazione attuale dello stato di fatto e la configurazione di progetto per la quale è prevista la messa in opera di un diaframma in c.a.

Tale confronto permette di ottenere una panoramica generale sull'efficacia dell'intervento progettuale, evidenziando i benefici in termini di mitigazione del rischio di sifonamento.

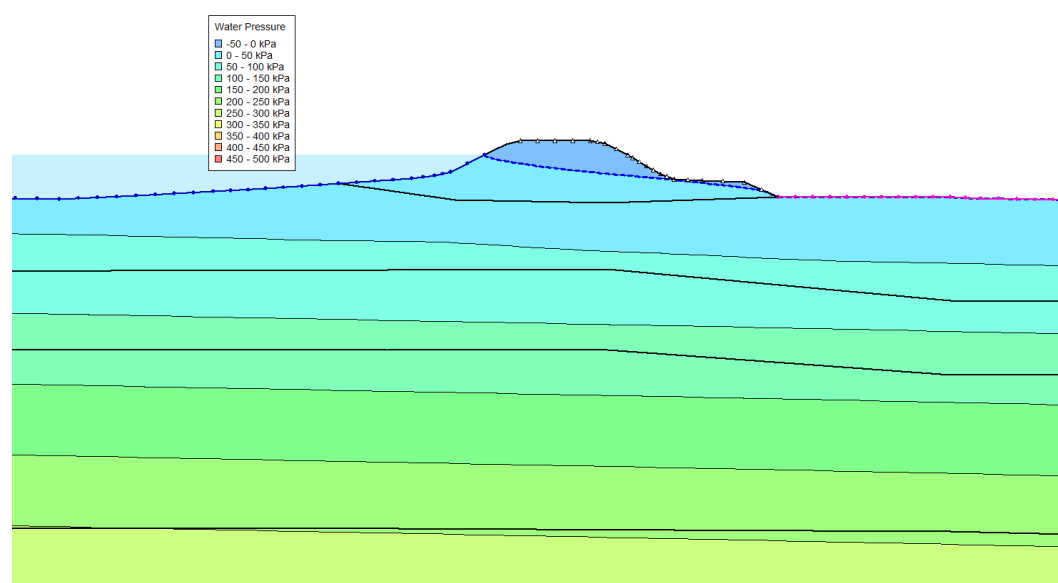


Figura 7-13 Sezione AA - Stato di fatto - Valori delle sottopressioni e livello della falda

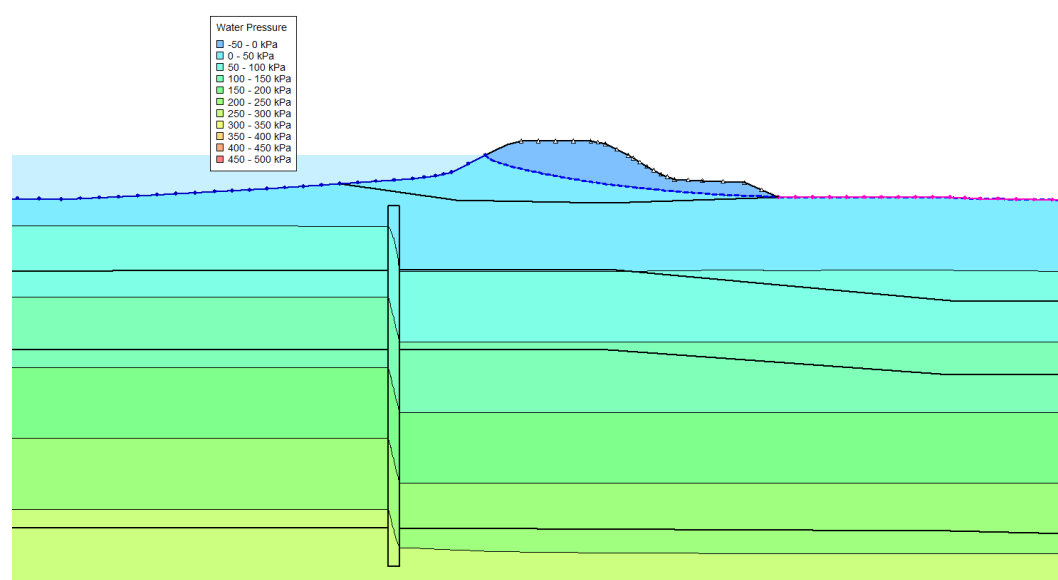


Figura 7-14 Sezione AA - Stato di progetto - Valori delle sottopressioni e livello della falda

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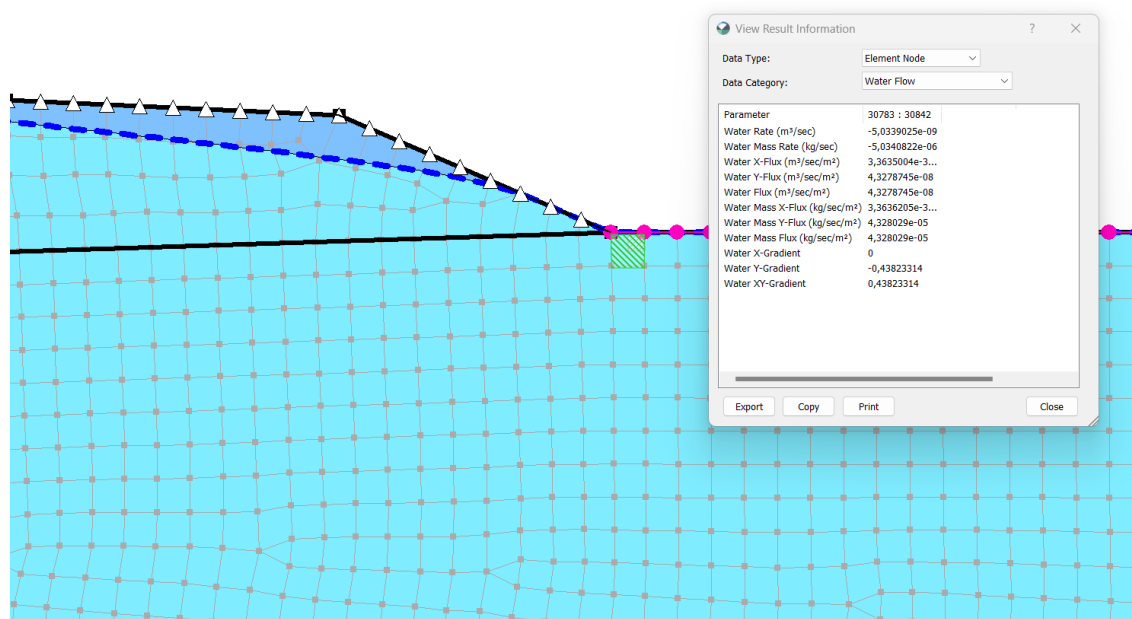


Figura 7-15 Sezione AA - Stato di fatto - Valori del gradiente idraulico di efflusso al piede dell'argine

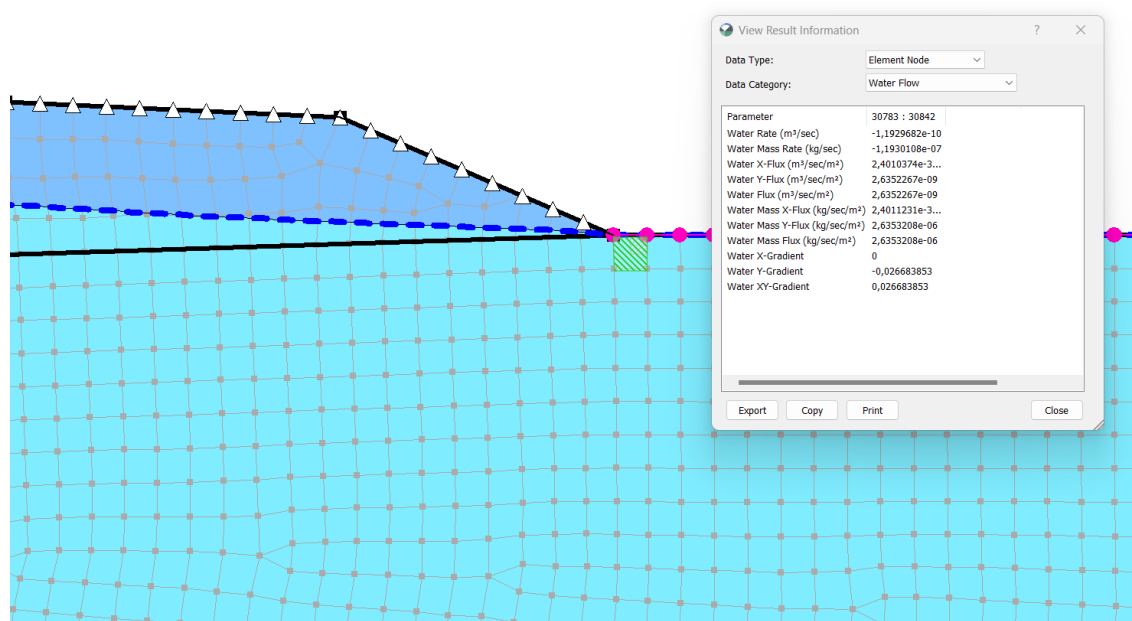


Figura 7-16 Sezione AA - Stato di progetto - Valori del gradiente idraulico di efflusso al piede dell'argine

Come mostrato nelle figure precedenti il gradiente di efflusso in condizione di progetto risulta essere pari a 0.027, registrando un notevole decremento rispetto allo stato attuale per il quale si osserva un gradiente di efflusso pari a 0.438.

Nella tabella seguente si riporta l'esito delle verifiche a sifonamento per la configurazione attuale dello stato di fatto e per la configurazione di progetto.

Tabella 7-5 Verifica a sifonamento sezione AA

	i [-]	i <sub>c</sub> [-]	Fs [-]	VERIFICA	
STATO DI FATTO	0,438	1,050	2,40	OK	> 2
DIAFRAMMA DI PROGETTO	0,027	1,050	39,41	OK	> 2

Si osserva come il fattore di sicurezza nei confronti del sifonamento risulta essere di poco superiore al valore minimo imposto da normativa nella configurazione dello stato attuale, mentre, nella condizione di progetto, le diaframature previste comportano un aumento sostanziale del fattore di sicurezza.

### 7.6.1 Risultati del modello e verifiche a sifonamento – Sezione BB

Nel seguente paragrafo sono presentati i risultati relativi alla verifica a sifonamento per la sezione BB; si riportano le figure rappresentanti i valori delle sottopressioni idrauliche, il gradiente di efflusso nella zona del piede dell'argine, e l'andamento del profilo di saturazione.

L'analisi è stata condotta considerando la configurazione attuale dello stato di fatto e la configurazione di progetto per la quale è prevista la messa in opera di un diaframma in c.a.

Tale confronto permette di ottenere una panoramica generale sull'efficacia dell'intervento progettuale, evidenziando i benefici in termini di mitigazione del rischio di sifonamento.

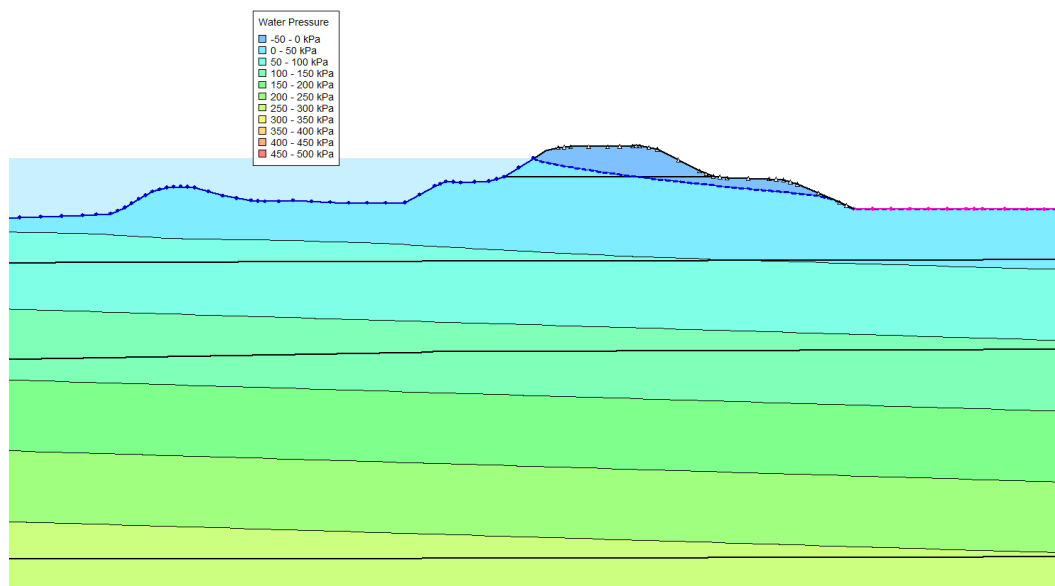


Figura 7-17 Sezione BB - Stato di fatto - Valori delle sottopressioni e livello della falda

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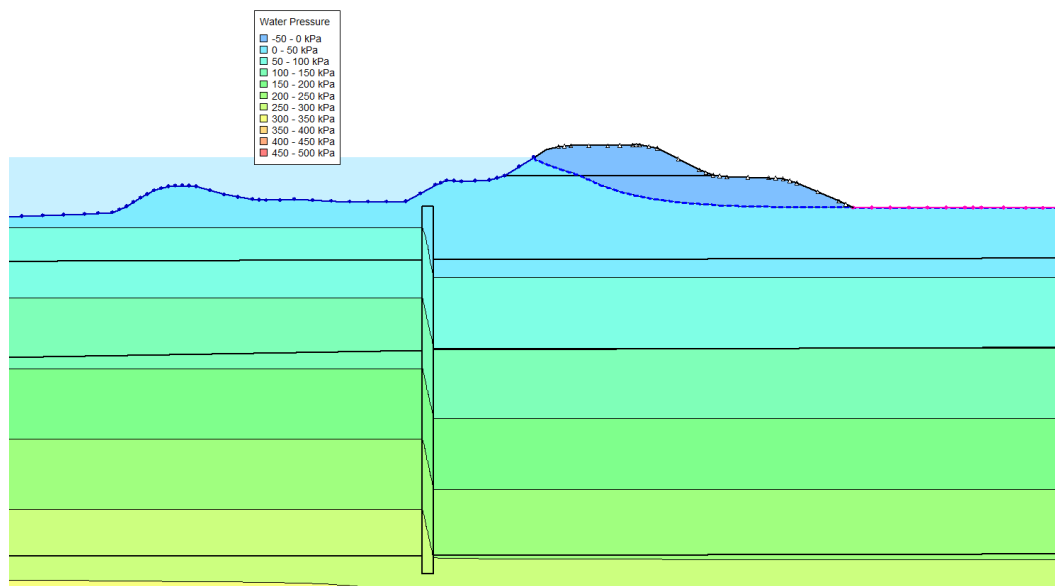


Figura 7-18 Sezione BB - Stato di progetto - Valori delle sottopressioni e livello della falda

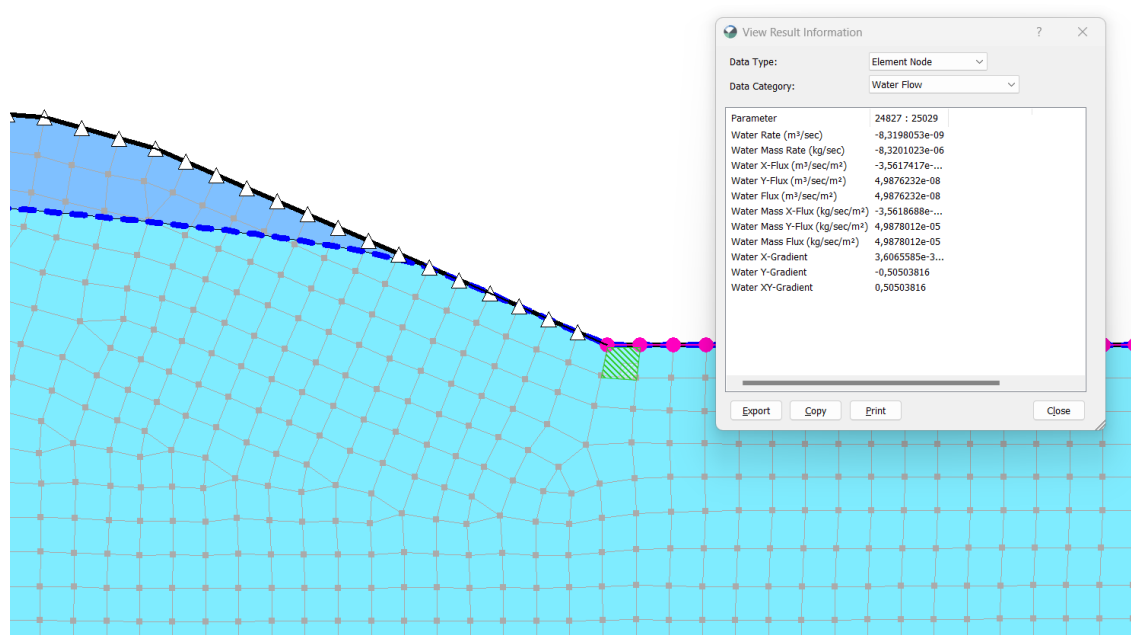


Figura 7-19 Sezione BB - Stato di fatto - Valori del gradiente idraulico di efflusso al piede dell'argine

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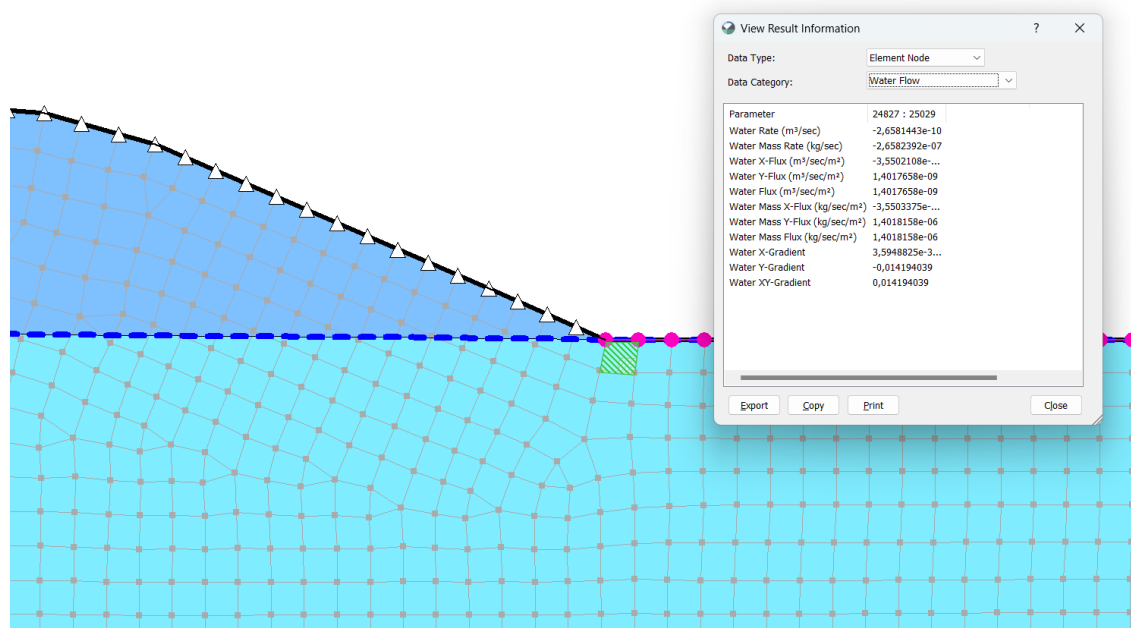


Figura 7-20 Sezione BB - Stato di progetto - Valori del gradiente idraulico di efflusso al piede dell'argine

Come mostrato nelle figure precedenti il gradiente di efflusso in condizione di progetto risulta essere pari a 0.014, registrando un notevole decremento rispetto allo stato attuale per il quale si osserva un gradiente di efflusso pari a 0.505.

Nella tabella seguente si riporta l'esito delle verifiche a sifonamento per la configurazione attuale dello stato di fatto e per la configurazione di progetto.

Tabella 7-6 Verifica a sifonamento sezione BB

	$i$ [-]	$i_c$ [-]	$F_s$ [-]	VERIFICA	
STATO DI FATTO	0.505	1.050	2.08	OK	> 2
DIAFRAMMA DI PROGETTO	0.014	1.050	75.00	OK	> 2

Si osserva come il fattore di sicurezza nei confronti del sifonamento risulta essere di poco superiore al valore minimo imposto da normativa nella configurazione dello stato attuale, mentre, nella condizione di progetto, le diaframature previste comportano un aumento sostanziale del fattore di sicurezza.

### 7.6.1 Risultati del modello e verifiche a sifonamento – Sezione CC

Nel seguente paragrafo sono presentati i risultati relativi alla verifica a sifonamento per la sezione CC, si riportano le figure rappresentanti i valori delle sottopressioni idrauliche, il gradiente di efflusso nella zona del piede dell'argine, e l'andamento del profilo di saturazione.

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L'analisi è stata condotta considerando la configurazione attuale dello stato di fatto e la configurazione di progetto per la quale è prevista la messa in opera di un diaframma in c.a.

Tale confronto permette di ottenere una panoramica generale sull'efficacia dell'intervento progettuale, evidenziando i benefici in termini di mitigazione del rischio di sifonamento.

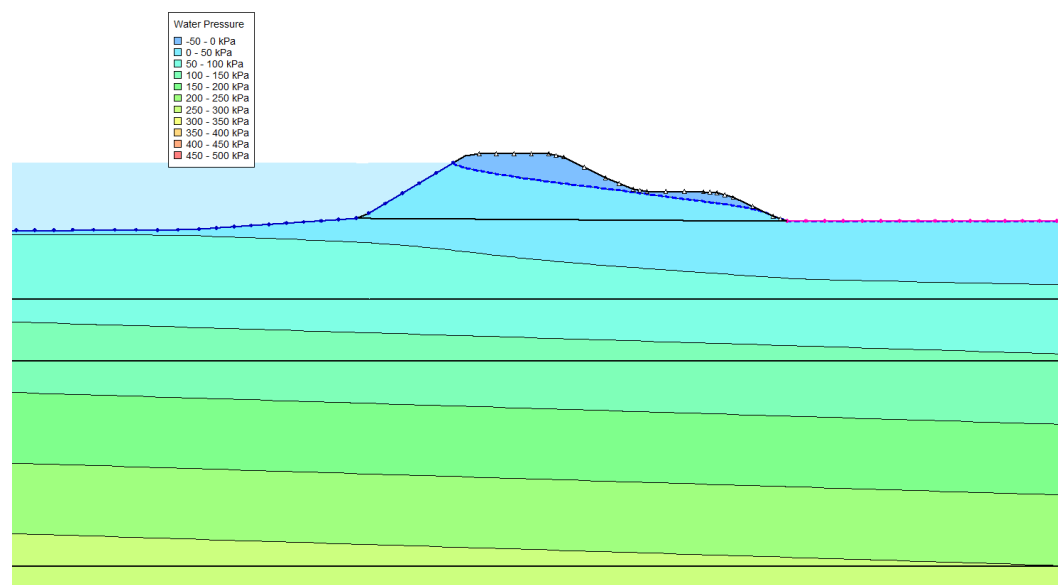


Figura 7-21 Sezione CC - Stato di fatto - Valori delle sottopressioni e livello della falda

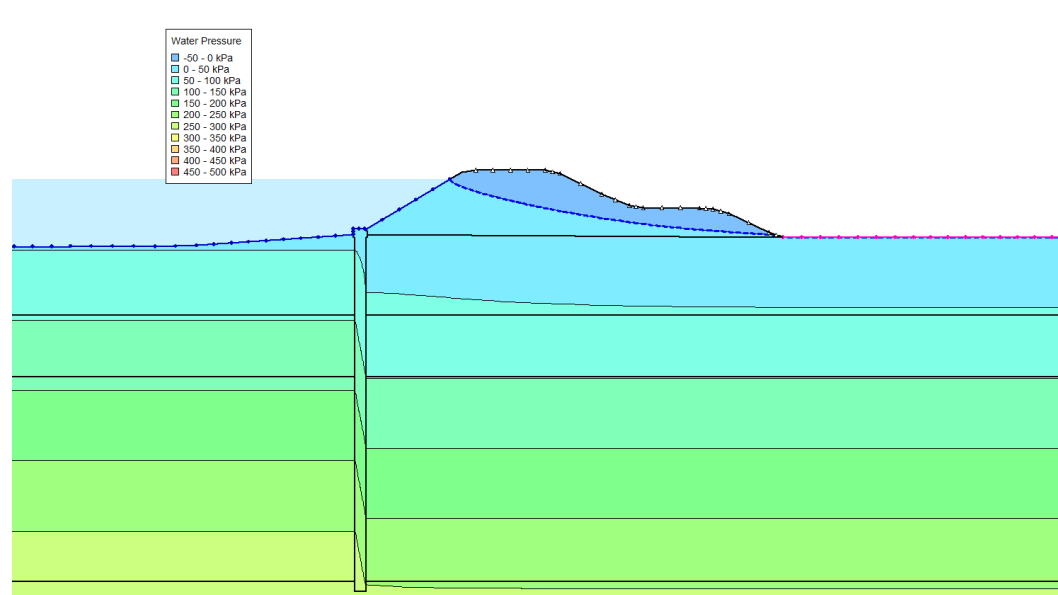


Figura 7-22 Sezione CC - Stato di progetto - Valori delle sottopressioni e livello della falda



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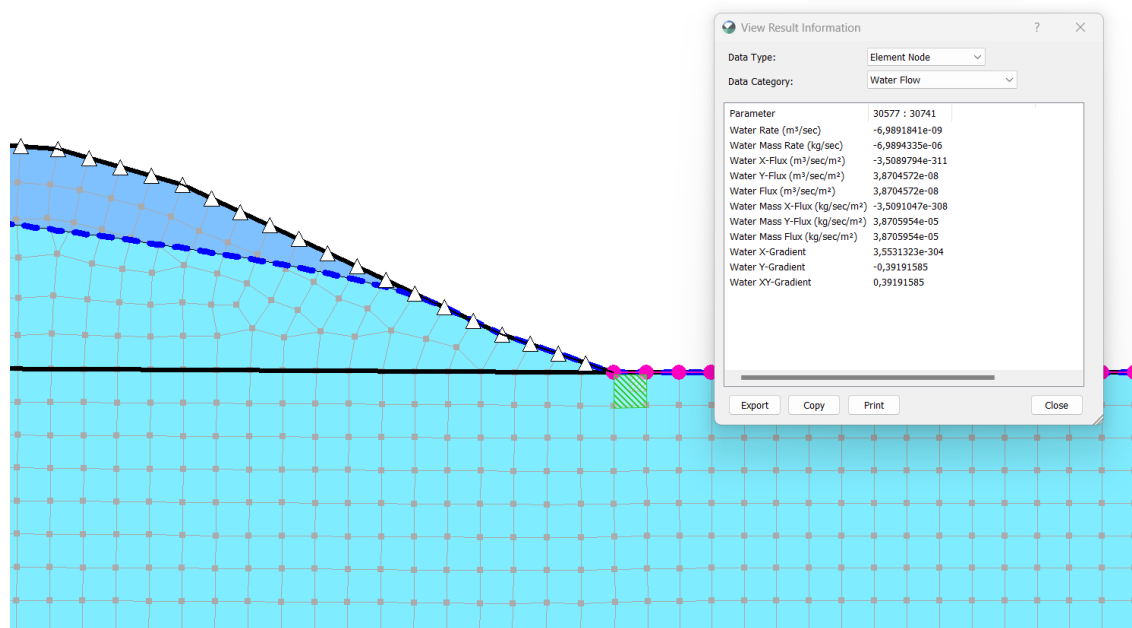


Figura 7-23 Sezione CC - Stato di fatto - Valori del gradiente idraulico di efflusso al piede dell'argine

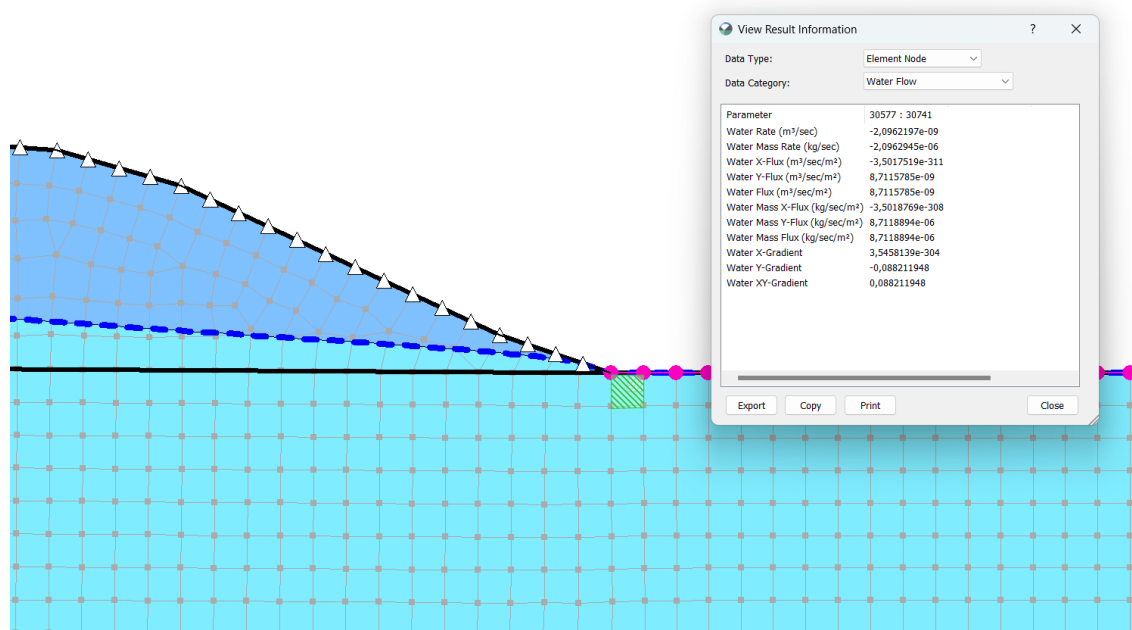


Figura 7-24 Sezione CC - Stato di progetto - Valori del gradiente idraulico di efflusso al piede dell'argine

Come mostrato nelle figure precedenti il gradiente di efflusso in condizione di progetto risulta essere pari a 0.088, registrando un notevole decremento rispetto allo stato attuale per il quale si osserva un gradiente di efflusso pari a 0.391.

Nella tabella seguente si riporta l'esito delle verifiche a sifonamento per la configurazione attuale dello stato di fatto e per la configurazione di progetto.

Tabella 7-7 Verifica a sifonamento sezione CC

	i [-]	i <sub>c</sub> [-]	Fs [-]	VERIFICA	
STATO DI FATTO	0.391	1.050	2.69	OK	> 2
DIAFRAMMA DI PROGETTO	0.088	1.050	11.90	OK	> 2

Si osserva come il fattore di sicurezza nei confronti del sifonamento risulta essere di poco superiore al valore minimo imposto da normativa nella configurazione dello stato attuale, mentre, nella condizione di progetto, le diaframature previste comportano un aumento sostanziale del fattore di sicurezza.

### 7.6.1 Risultati del modello e verifiche a sifonamento – Sezione DD

Nel seguente paragrafo sono presentati i risultati relativi alla verifica a sifonamento per la sezione DD, si riportano le figure rappresentanti i valori delle sottopressioni idrauliche, il gradiente di efflusso nella zona del piede dell'argine, e l'andamento del profilo di saturazione.

L'analisi è stata condotta considerando la configurazione attuale dello stato di fatto e la configurazione di progetto per la quale è prevista la messa in opera di un diaframma in c.a.

Tale confronto permette di ottenere una panoramica generale sull'efficacia dell'intervento progettuale, evidenziando i benefici in termini di mitigazione del rischio di sifonamento.

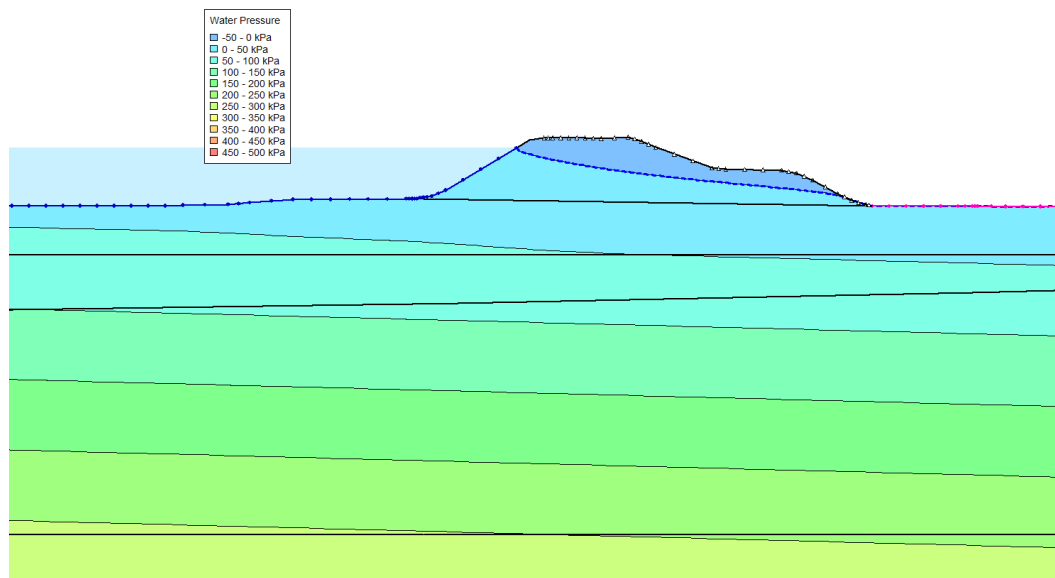


Figura 7-25 Sezione DD - Stato di fatto - Valori delle sottopressioni e livello della falda

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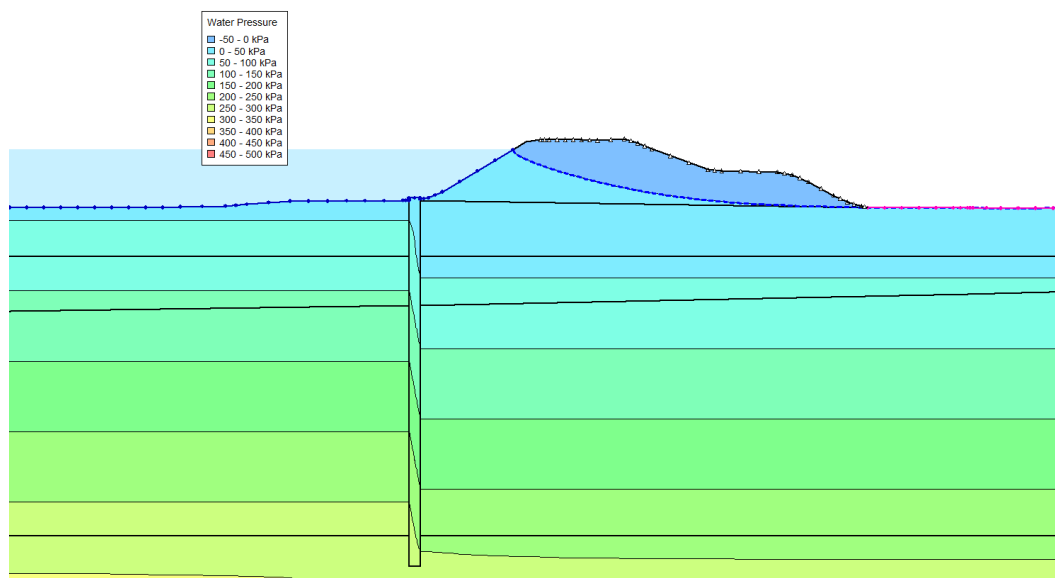


Figura 7-26 Sezione DD - Stato di progetto - Valori delle sottopressioni e livello della falda

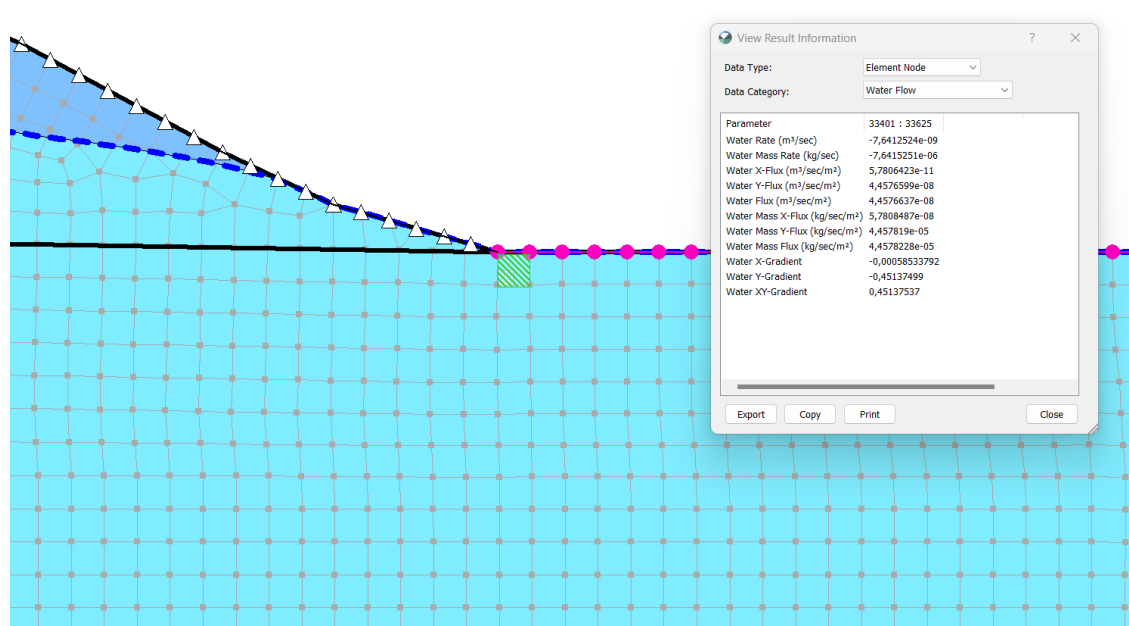


Figura 7-27 Sezione DD - Stato di fatto - Valori del gradiente idraulico di efflusso al piede dell'argine

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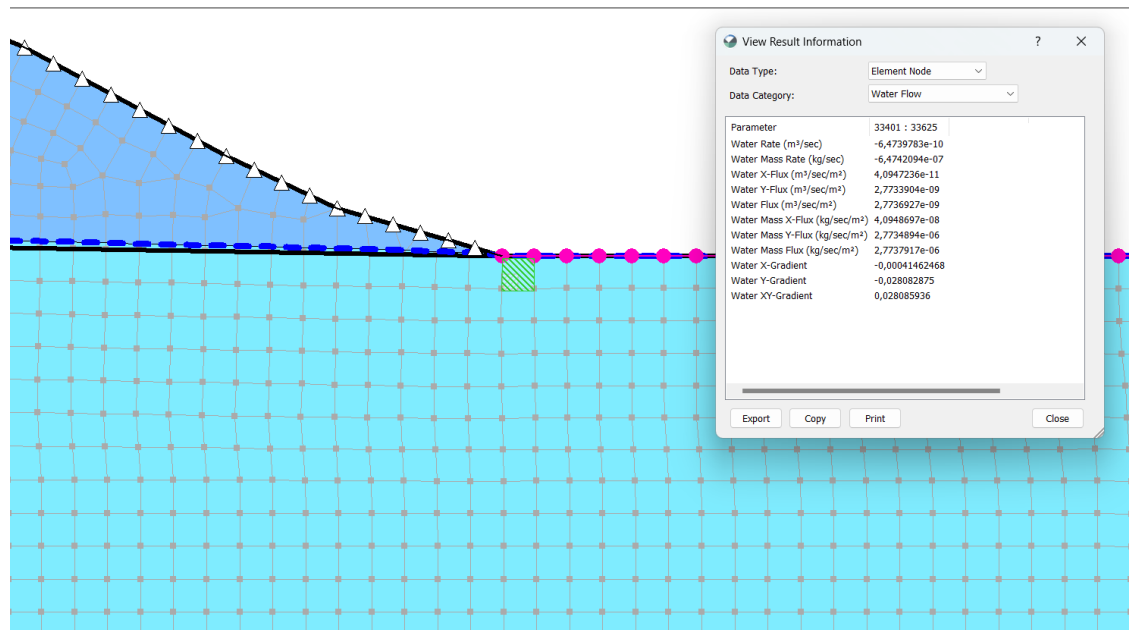


Figura 7-28 Sezione DD - Stato di progetto - Valori del gradiente idraulico di efflusso al piede dell'argine

Come mostrato nelle figure precedenti il gradiente di efflusso in condizione di progetto risulta essere pari a 0.028, registrando un notevole decremento rispetto allo stato attuale per il quale si osserva un gradiente di efflusso pari a 0.451.

Nella tabella seguente si riporta l'esito delle verifiche a sifonamento per la configurazione attuale dello stato di fatto e per la configurazione di progetto.

Tabella 7-8 Verifica a sifonamento sezione DD

	$i$ [-]	$i_c$ [-]	$F_s$ [-]	VERIFICA	
STATO DI FATTO	0.451	1.050	2.33	OK	> 2
DIAFRAMMA DI PROGETTO	0.028	1.050	37.50	OK	> 2

Si osserva come il fattore di sicurezza nei confronti del sifonamento risulta essere di poco superiore al valore minimo imposto da normativa nella configurazione dello stato attuale, mentre, nella condizione di progetto, le diaframature previste comportano un aumento sostanziale del fattore di sicurezza.

<b>PNRR - M2C4 Investimento 3.3 - RINATURAZIONE DELL'AREA DEL PO</b>	
Progetto Esecutivo	
<b>SCHEDA N. 16 CAORSO (PC) – PROGETTO DIAFRAMMATURE</b>	
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## 7.7 Verifiche di stabilità globale

### 7.7.1 Modello di calcolo, parametri geotecnici e coefficienti di sicurezza

Le verifiche sono state eseguite mediante modelli numerici bidimensionali tramite il software di calcolo SLOPE/W (GeoStudio) utilizzando il metodo rigoroso di Spencer. Data la compatibilità fra il software di analisi della filtrazione SEEP/W e quello di stabilità globale SLOPE/W, la presente modellazione numerica viene condotta sul medesimo modello di calcolo utilizzato in precedenza.

Le verifiche di stabilità globale dell'insieme rilevato arginale-terreno di fondazione sono state condotte nelle condizioni più critiche, cioè:

- Configurazione statica: considerando la quota di piena SIMPO '82 pari a 47.83 m s.l.m. e utilizzando le pressioni neutre derivanti da un'analisi in condizione di moto permanente (ipotesi più cautelativa);
- Rapido svasso: si considera una diminuzione del livello del fiume Po dalla quota di piena SIMPO '82 fino alla quota dell'area golenale, tramite un'analisi in condizioni di moto transitorio assumendo una curva di discesa in un arco di tempo pari a circa 5 giorni; la stabilità viene calcolata in diversi istanti durante la fase di decrescita del livello idrico;
- Configurazione sismica: considerando la quota del fiume al livello di piena ordinaria pari a 46.44 m s.l.m. (assunta cautelativamente pari alla piena con TR=20 anni) e utilizzando le pressioni neutre derivanti da un'analisi in condizione di moto permanente (ipotesi più cautelativa).

Le azioni di calcolo considerate all'interno del modello numerico sono:

- Carichi permanenti: i carichi permanenti quali peso del terreno, peso dell'acqua e le relative spinte sono calcolate in automatico all'interno del software di calcolo;
- Carichi variabili: in corrispondenza della strada sommitale dell'argine è stato considerato un carico variabile pari a 10 kPa per tenere in conto l'eventuale passaggio di mezzi sulla sommità arginale;
- Azione sismica: applicata mediante un approccio pseudostatico. In tale approccio si applica all'argine, in aggiunta agli altri carichi già presenti, l'azione dinamica rappresentata da carichi statici equivalenti. Tali azioni generate dal sisma vengono considerate come forze d'inerzia orizzontali  $F_h$  e verticali  $F_v$  dei pesi del terreno e dell'acqua, valutate con la seguente formulazione:

$$F_h = k_h \cdot W_i$$

$$F_v = k_v \cdot W_i$$

$$k_h = \beta \cdot \frac{a_{g,max}}{g}$$

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$$k_v = \pm 0.5 \cdot k_h$$

$$a_{g,max}/g = S_s \cdot S_T \cdot a_g/g$$

Dove:

- $k_h$  è il coefficiente di accelerazione sismica orizzontale;
- $k_v$  è il coefficiente di accelerazione sismica verticale;
- $W_i$  è il peso proprio dell'elemento considerato;
- $\beta$  è un coefficiente riduttivo assunto pari a 0.38 per la verifica SLV come riportato al capitolo 7.11.4 delle NTC18;
- $a_{g,max}/g$  è l'accelerazione massima attesa al suolo calcolata a partire dal coefficiente di amplificazione stratigrafica  $S_s$ , dal coefficiente di amplificazione topografica  $S_T$  e dall'accelerazione attesa al suolo di riferimento  $a_g/g$ . Tali parametri sono riportati al paragrafo 4.1.

Per quanto riguarda le stratigrafie di progetto e i parametri geotecnici dei materiali si fa riferimento a quanto riportato nella Relazione Geotecnica di progetto [18] e nelle Sezione Geotecniche di progetto [20]. I valori dei parametri adottati all'interno dei modelli numerici sono riportati al paragrafo 7.3.

Le analisi di stabilità globale sono state eseguite in condizioni statiche SLU e sismiche SLV.

Le analisi statiche allo SLU sono state eseguite considerando una condizione non drenata a breve termine e una condizione drenata a lungo termine mentre per quanto riguarda le analisi sismiche allo SLV è stata considerata unicamente la condizione non drenata.

Le verifiche in condizioni statiche sono state effettuate con la combinazione "A2+M2+R2", tenendo conto dei coefficienti parziali riportati nelle tabella 6.2.I, 6.2.II e 6.8.I delle NTC18 e di seguito riportati in Figura 7-29. Per le verifiche in condizioni sismiche, invece, si pongono pari all'unità i coefficienti parziali sulle azioni e sui parametri geotecnici e si considera un coefficiente di resistenza globale  $\gamma_r$  pari a 1.2 (§ 7.11.4 NTC18).

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**Tab. 6.2.I – Coefficienti parziali per le azioni o per l'effetto delle azioni**

	Effetto	Coefficiente Parziale $\gamma_F$ (o $\gamma_E$ )	EQU	(A1)	(A2)
Carichi permanenti $G_1$	Favorevole	$\gamma_{G1}$	0,9	1,0	1,0
	Sfavorevole		1,1	1,3	1,0
Carichi permanenti $G_2^{(1)}$	Favorevole	$\gamma_{G2}$	0,8	0,8	0,8
	Sfavorevole		1,5	1,5	1,3
Azioni variabili Q	Favorevole	$\gamma_Q$	0,0	0,0	0,0
	Sfavorevole		1,5	1,5	1,3

**Tab. 6.2.II – Coefficienti parziali per i parametri geotecnici del terreno**

Parametro	Grandezza alla quale applicare il coefficiente parziale	Coefficiente parziale $\gamma_M$	(M1)	(M2)
Tangente dell'angolo di resistenza al taglio	$\tan \varphi'_k$	$\gamma_{\varphi'}$	1,0	1,25
Coesione efficace	$c'_k$	$\gamma_c$	1,0	1,25
Resistenza non drenata	$c_{uk}$	$\gamma_{cu}$	1,0	1,4
Peso dell'unità di volume	$\gamma_\gamma$	$\gamma_\gamma$	1,0	1,0

**Tab. 6.8.I - Coefficienti parziali per le verifiche di sicurezza di opere di materiali sciolti e di fronti di scavo**

COEFFICIENTE	R2
$\gamma_R$	1,1

Figura 7-29 Coefficienti da normativa NTC18 utilizzati per le verifiche di stabilità globale

## 7.7.2 Risultati del modello e verifiche di stabilità globale – Sezione AA

Nelle seguenti tabelle si riportano i fattori di sicurezza relativi alle analisi di stabilità globale per la sezione AA.

Tabella 7-9 Sezione AA - Risultati delle analisi di stabilità globale

	Stato di Fatto	Diaframma di Progetto	BREVE TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto	LUNGO TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto
SLU - BREVE TERMINE	3,261	3,262	0 d	5,346	5,346	0 d	2,609	2,678
SLU - LUNGO TERMINE	2,065	2,193	1 d	4,642	4,643	1 d	2,294	2,345
SLV - BREVE TERMINE	3,286	3,292	2 d	4,164	4,179	2 d	2,194	2,236
			3 d	3,898	4,052	3 d	2,300	2,333
			4 d	3,879	4,052	4 d	2,377	2,390
			5 d	3,879	4,052	5 d	2,390	2,390

Come mostrato nelle precedenti tabelle, le verifiche di stabilità globale risultano soddisfatte sia per lo stato di progetto che per lo stato di fatto. Si osserva in generale un lieve incremento dei fattori di sicurezza con conseguente miglioramento del grado di sicurezza relativo alla stabilità globale in seguito all'intervento.

Nelle figure seguenti si riportano gli esiti delle verifiche di stabilità globale per la sezione AA mostrando le superfici di scivolamento valutate con l'ausilio del software di calcolo, per le analisi di stabilità globale riguardanti il rapido svaso si riporta unicamente la situazione più critica che risulta

essere quella relativa al 3° giorno di svaso per il modello in condizioni non drenate e al 2° giorno di svaso per il modello in condizioni drenate.

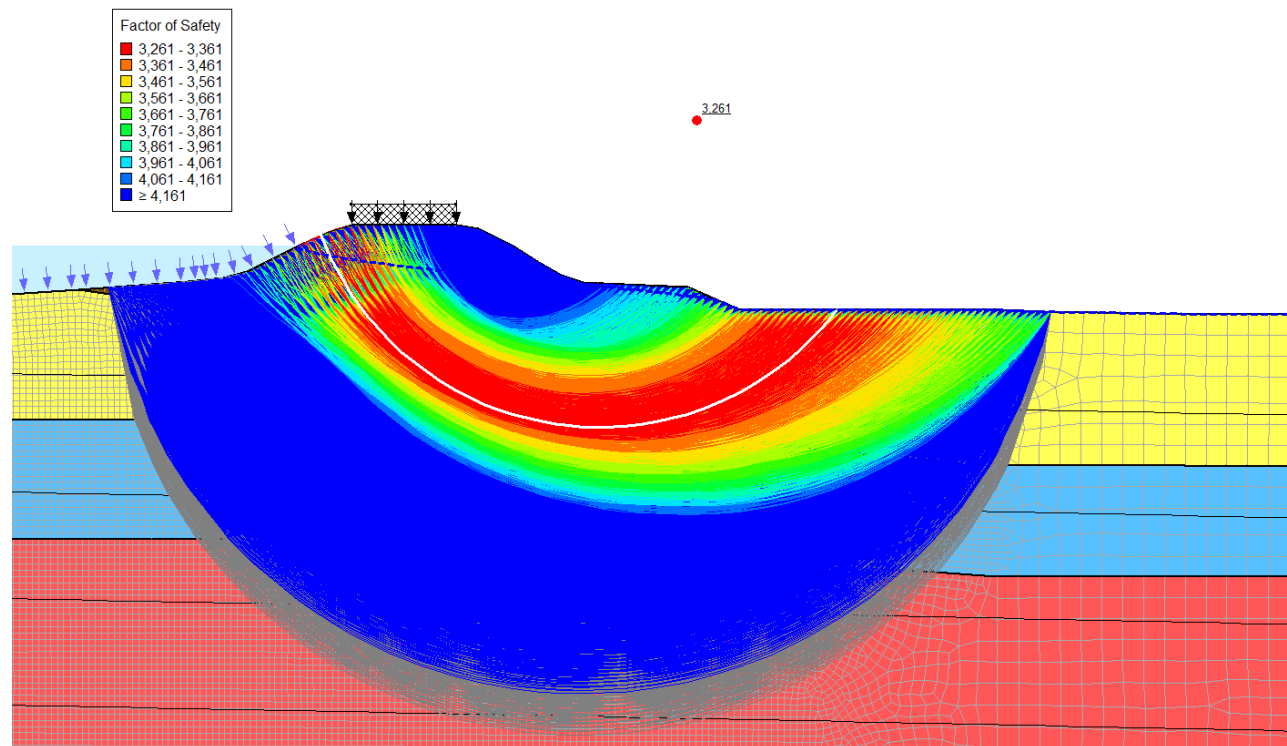


Figura 7-30 Sezione AA - Stato di fatto - Analisi statica Breve Termine

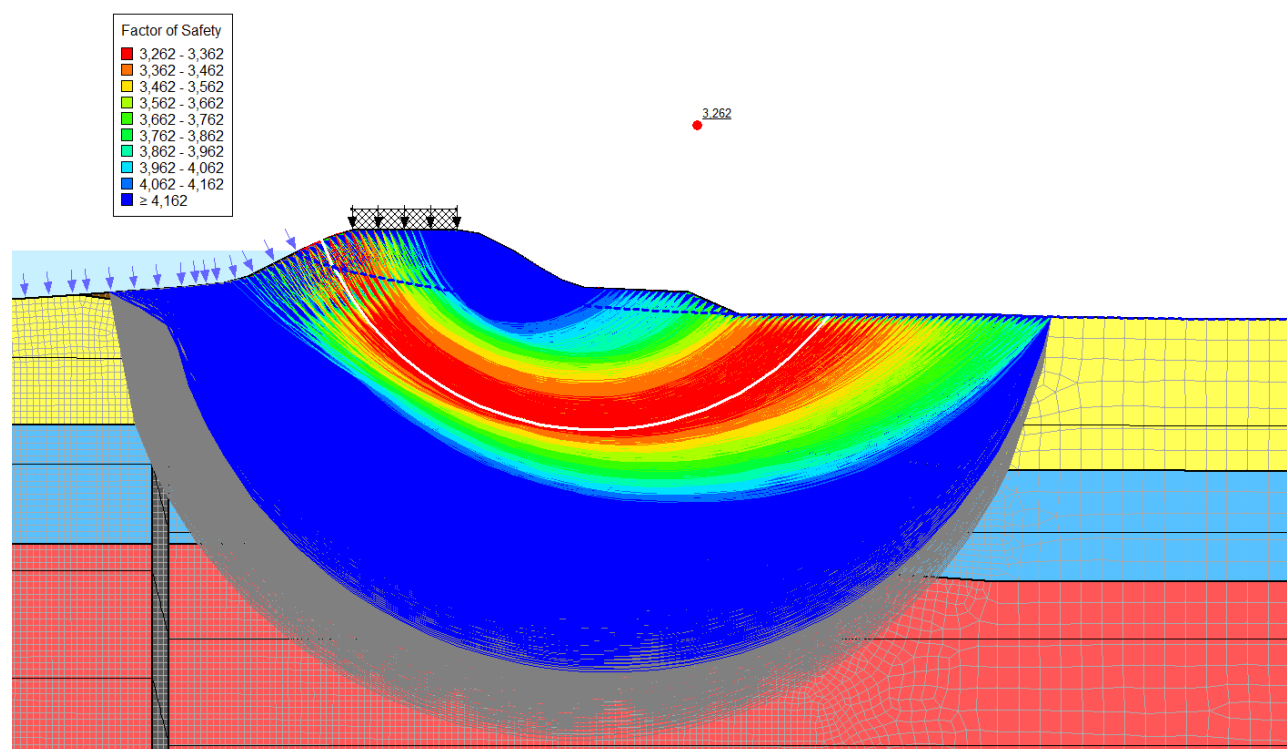


Figura 7-31 Sezione AA - Stato di progetto - Analisi statica Breve Termine



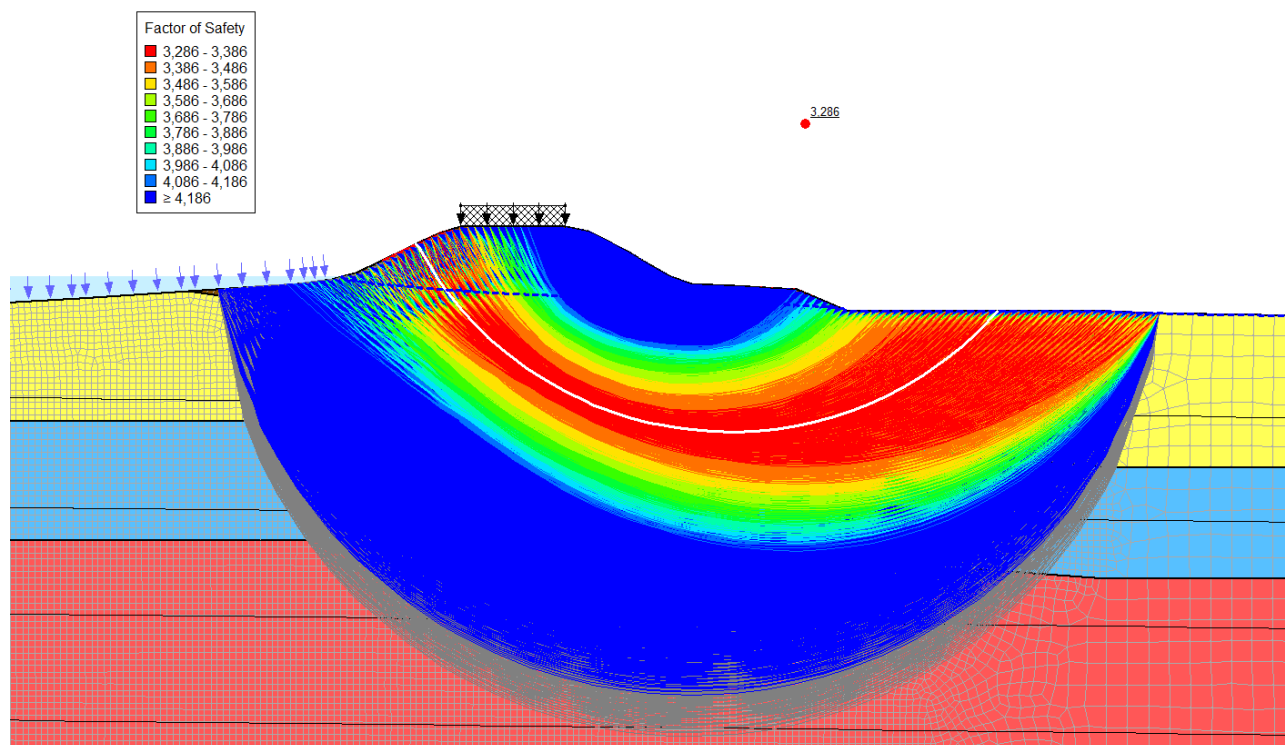


Figura 7-32 Sezione AA - Stato di fatto - Analisi sismica Breve Termine

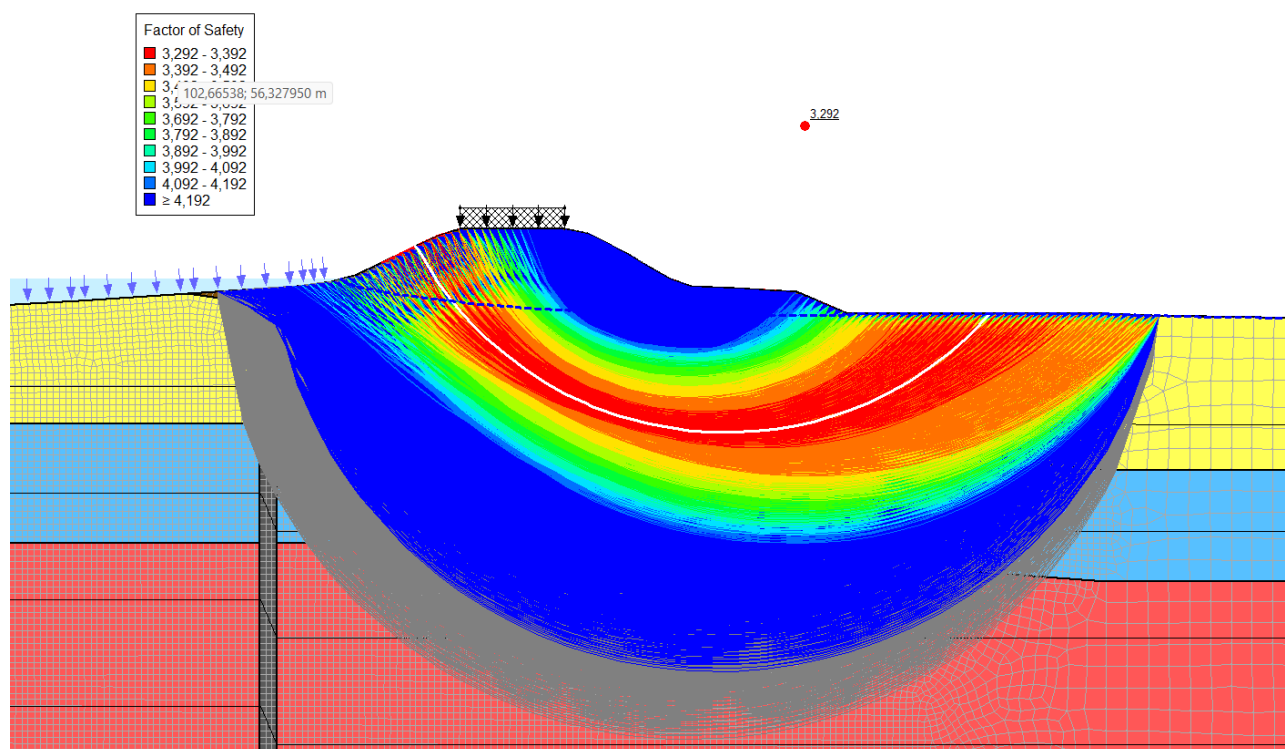


Figura 7-33 Sezione AA - Stato di progetto - Analisi sismica Breve Termine

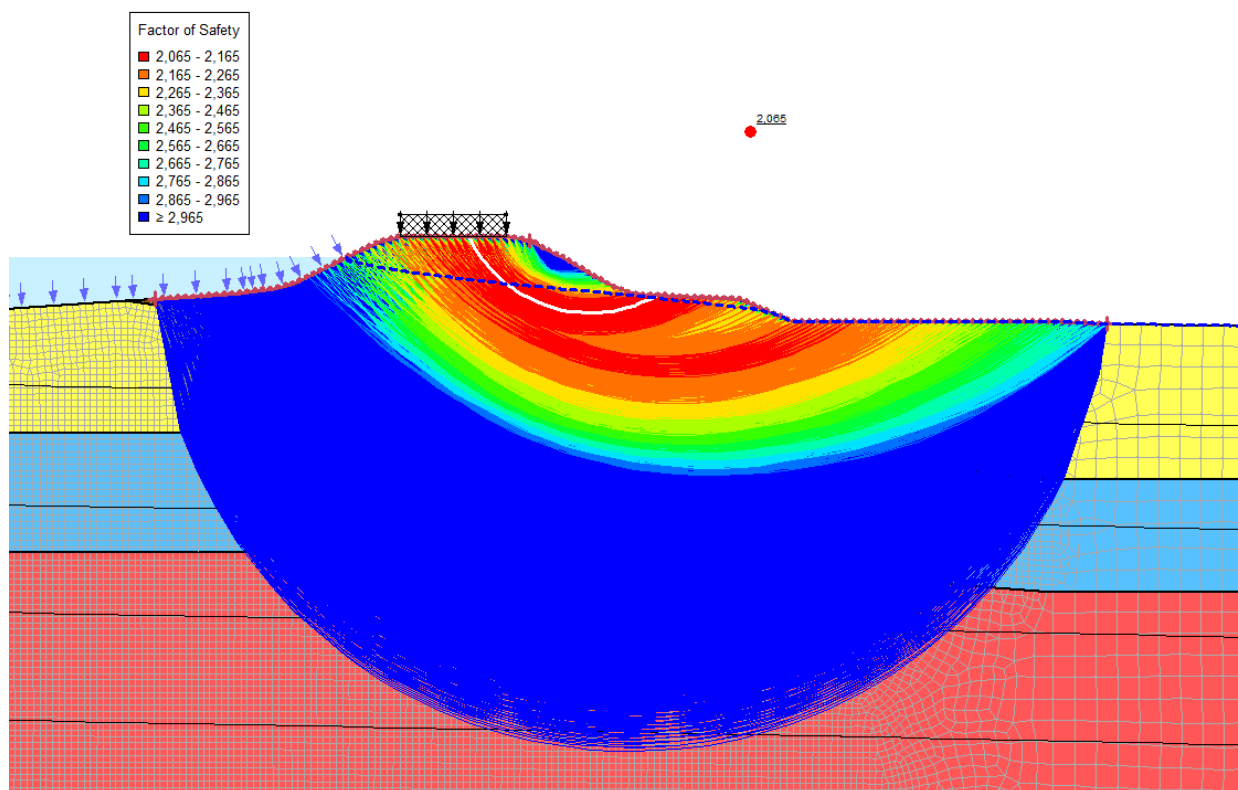


Figura 7-34 Sezione AA - Stato di fatto - Analisi statica Lungo Termine

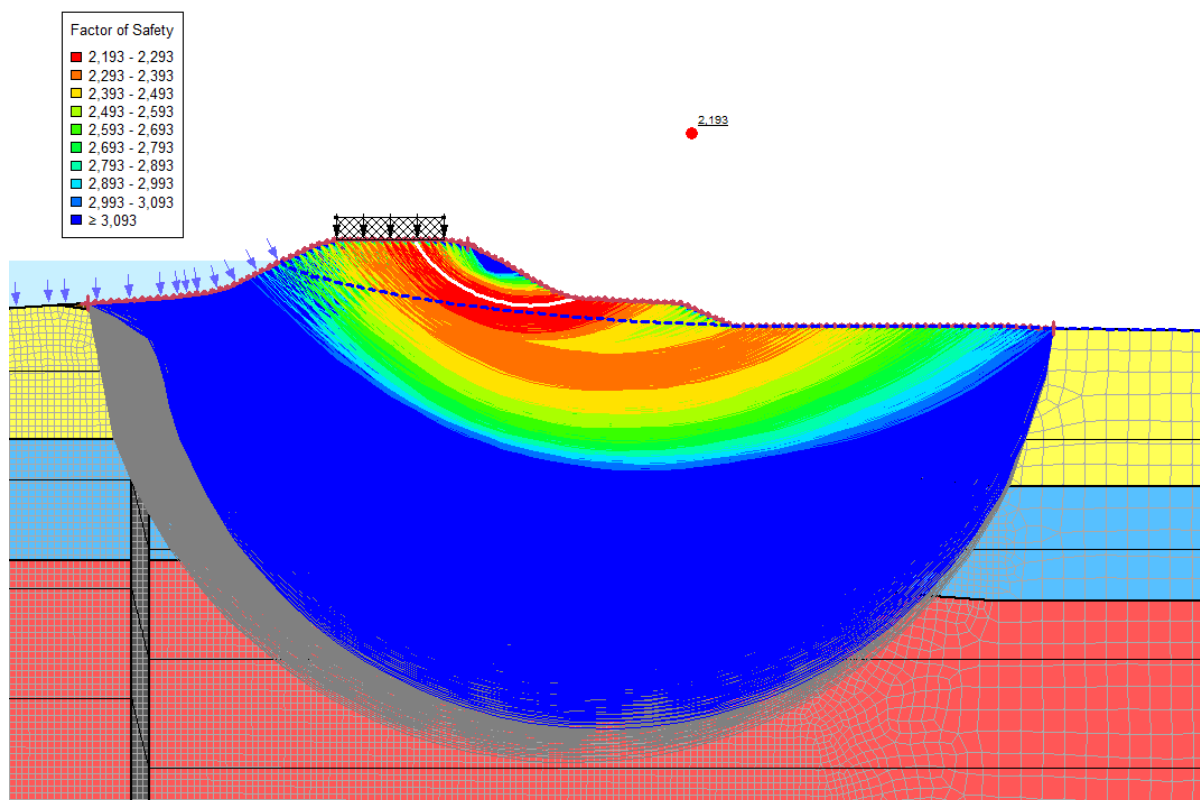


Figura 7-35 Sezione AA - Stato di progetto - Analisi statica Lungo Termine

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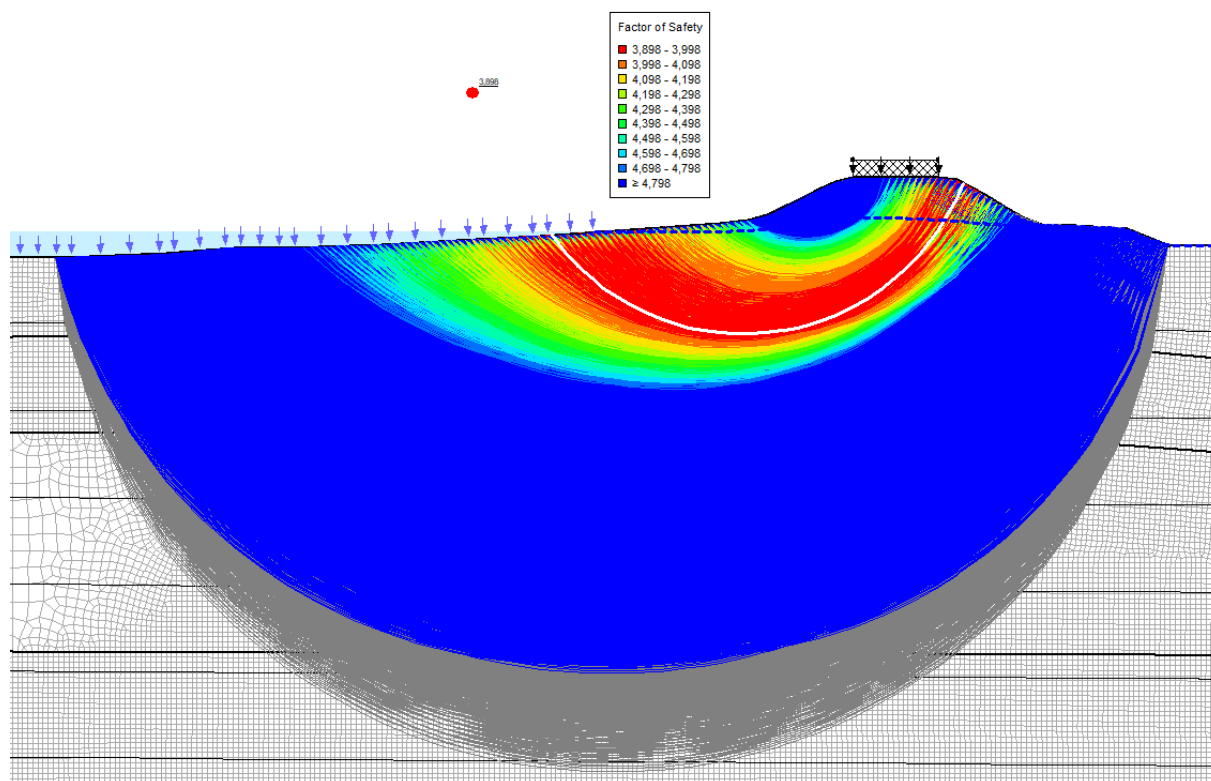


Figura 7-36 Sezione AA - Stato di fatto – Rapido Svaso Breve Termine

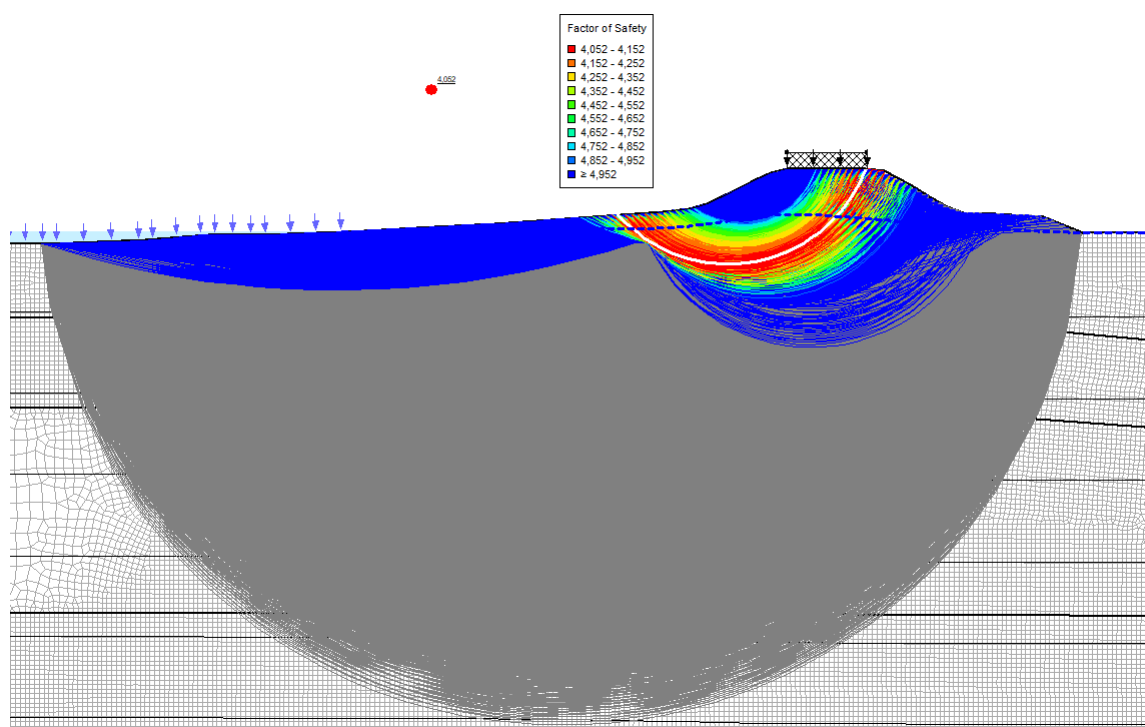


Figura 7-37 Sezione AA - Stato di progetto – Rapido Svaso Breve Termine

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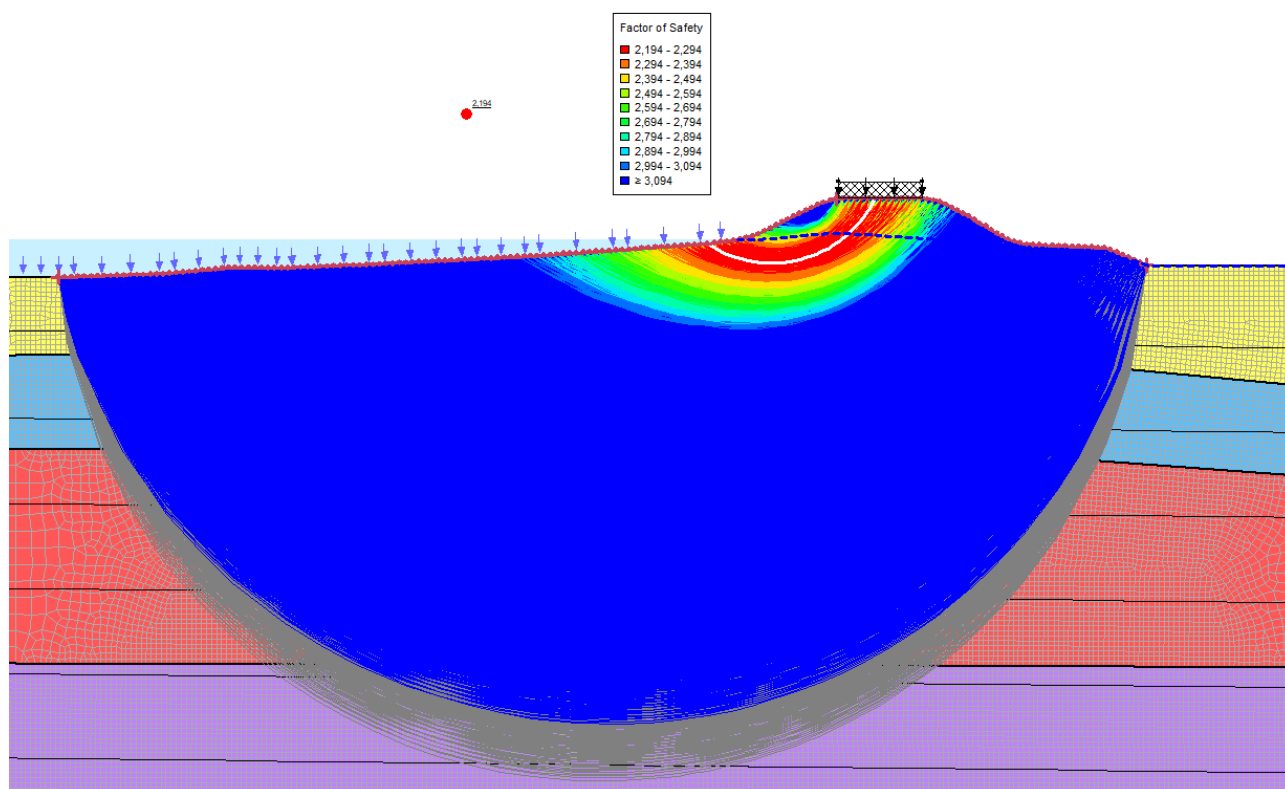


Figura 7-38 Sezione AA - Stato di fatto – Rapido Svaso Lungo Termine

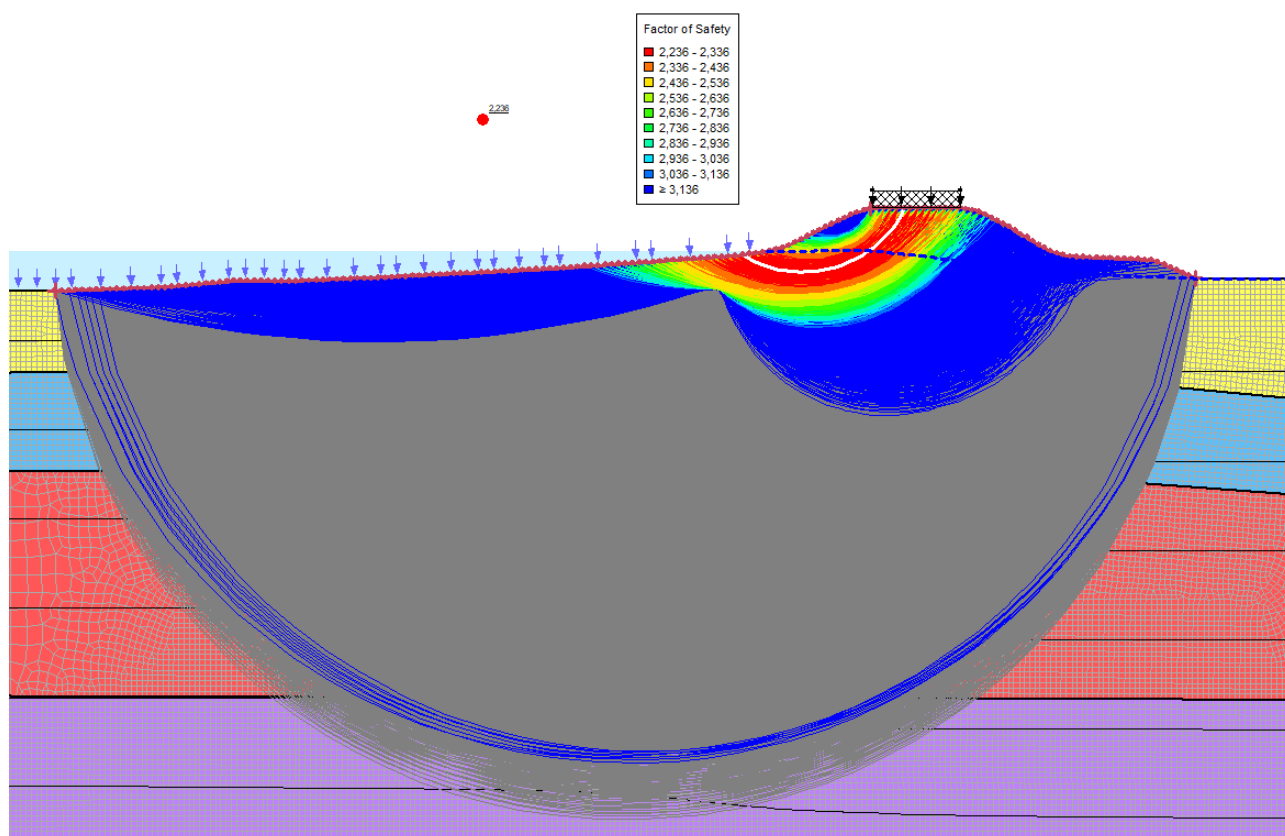


Figura 7-39 Sezione AA - Stato di progetto – Rapido Svaso Lungo Termine



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## 7.7.3 Risultati del modello e verifiche di stabilità globale – Sezione BB

Nelle seguenti tabelle si riportano i fattori di sicurezza relativi alle analisi di stabilità globale per la sezione BB.

Tabella 7-10 Sezione BB - Risultati delle analisi di stabilità globale

	Stato di Fatto	Diaframma di Progetto	BREVE TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto	LUNGO TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto
SLU - BREVE TERMINE	2,927	3,144	0 d	4,785	5,317	0 d	2,747	2,855
SLU - LUNGO TERMINE	2,172	2,480	1 d	4,093	4,486	1 d	2,329	2,412
SLV - BREVE TERMINE	2,920	3,047	2 d	3,594	3,959	2 d	2,269	2,348
			3 d	3,311	3,855	3 d	2,251	2,392
			4 d	3,189	3,855	4 d	2,281	2,392
			5 d	3,211	3,855	5 d	2,373	2,392

Come mostrato nelle precedenti tabelle, le verifiche di stabilità globale risultano soddisfatte sia per lo stato di progetto che per lo stato di fatto. Si osserva in generale un lieve incremento dei fattori di sicurezza con conseguente miglioramento del grado di sicurezza relativo alla stabilità globale in seguito all'intervento.

Nelle figure seguenti si riportano gli esiti delle verifiche di stabilità globale per la sezione BB mostrando le superfici di scivolamento valutate con l'ausilio del software di calcolo. Per le analisi di stabilità globale riguardanti il rapido svaso si riporta unicamente la situazione più critica che risulta essere quella relativa al 4° giorno di svaso sia per il modello in condizioni non drenate che per il modello in condizioni drenate.

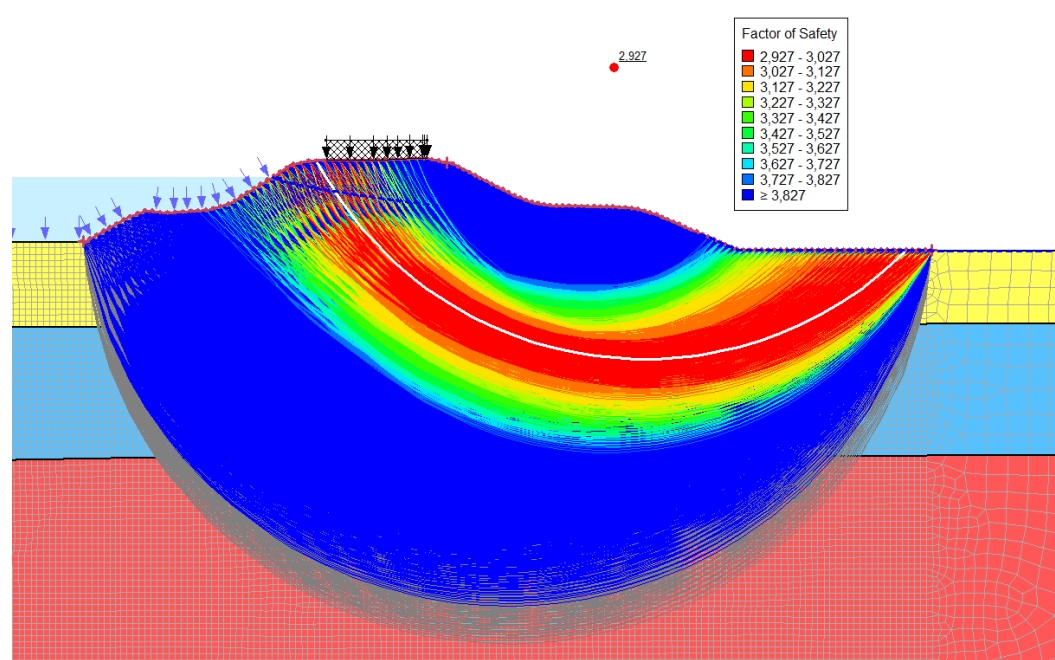


Figura 7-40 Sezione BB - Stato di fatto - Analisi statica Breve Termine

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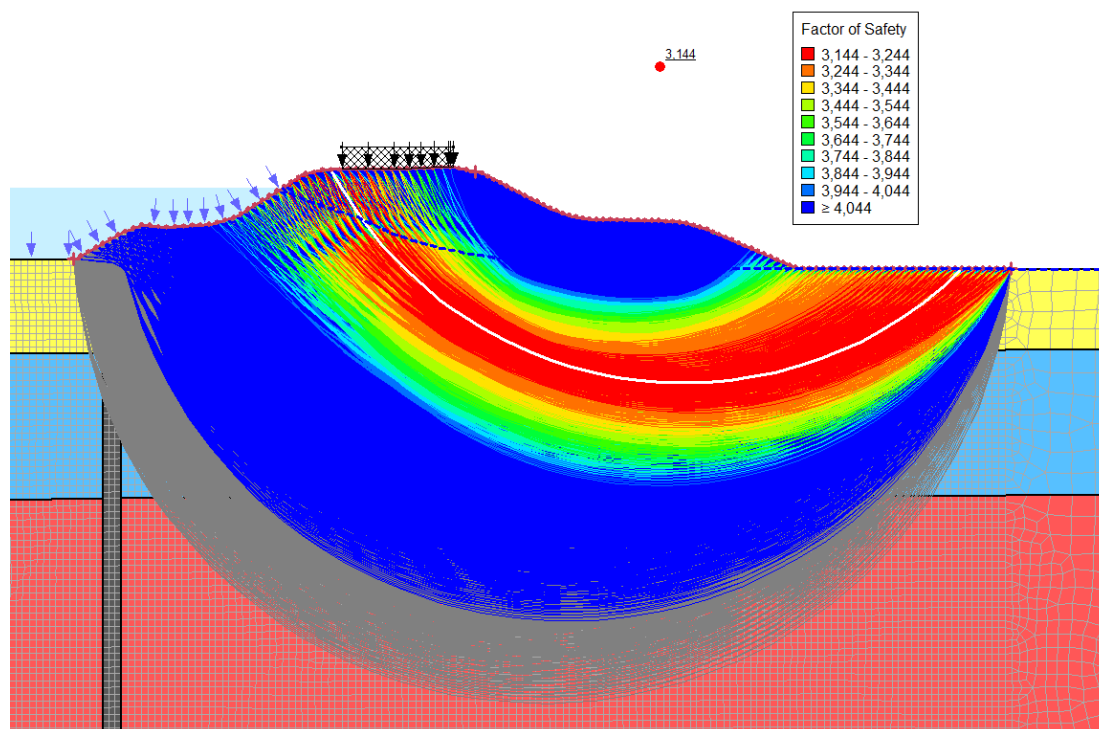


Figura 7-41 Sezione BB - Stato di progetto - Analisi statica Breve Termine

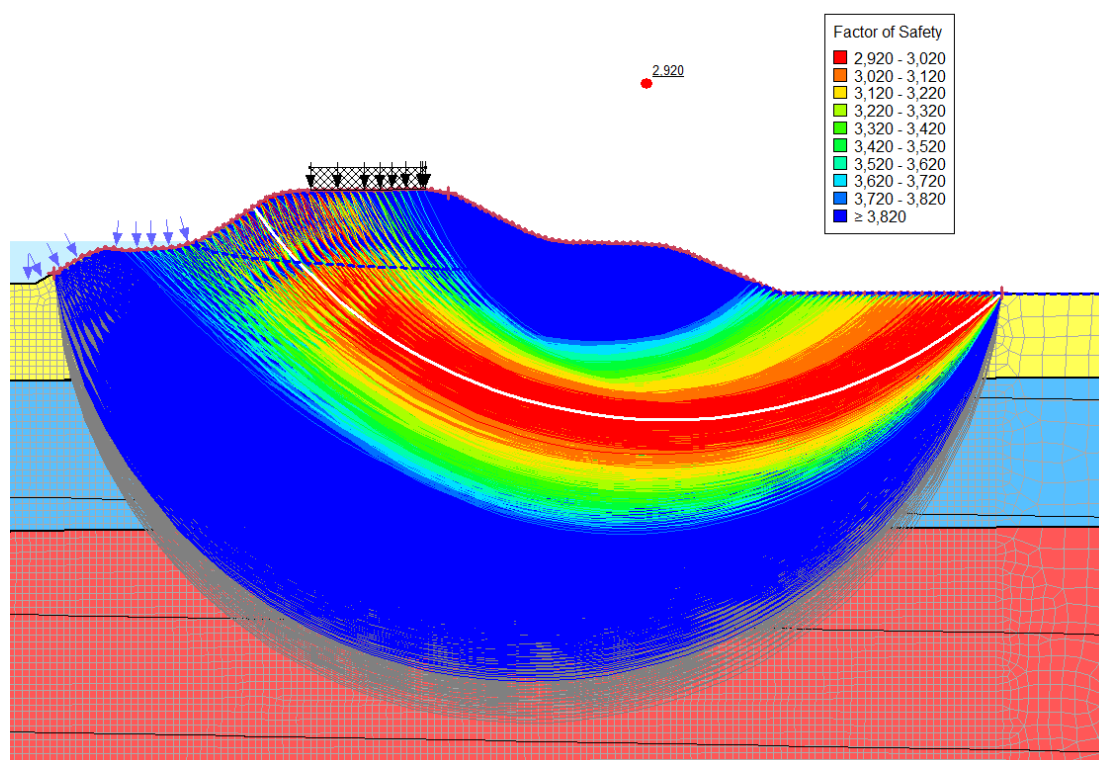


Figura 7-42 Sezione BB - Stato di fatto - Analisi sismica Breve Termine

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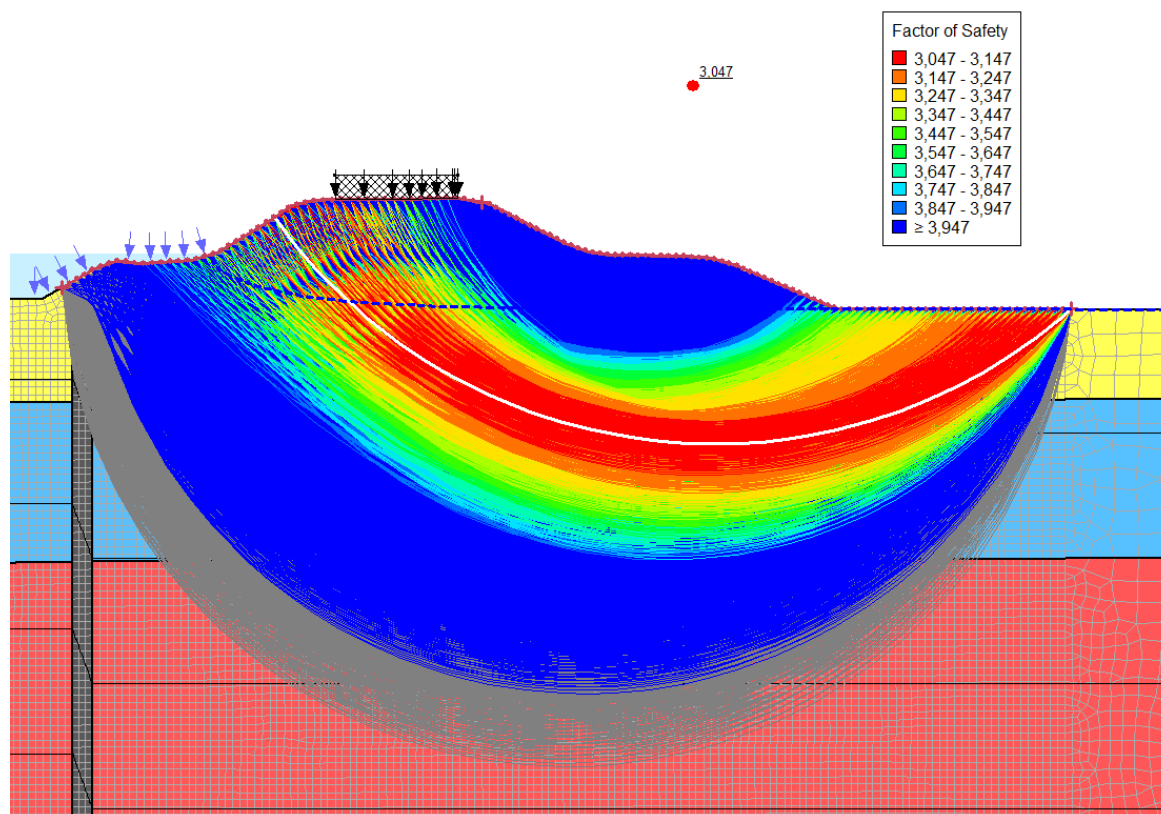


Figura 7-43 Sezione BB - Stato di progetto - Analisi sismica Breve Termine

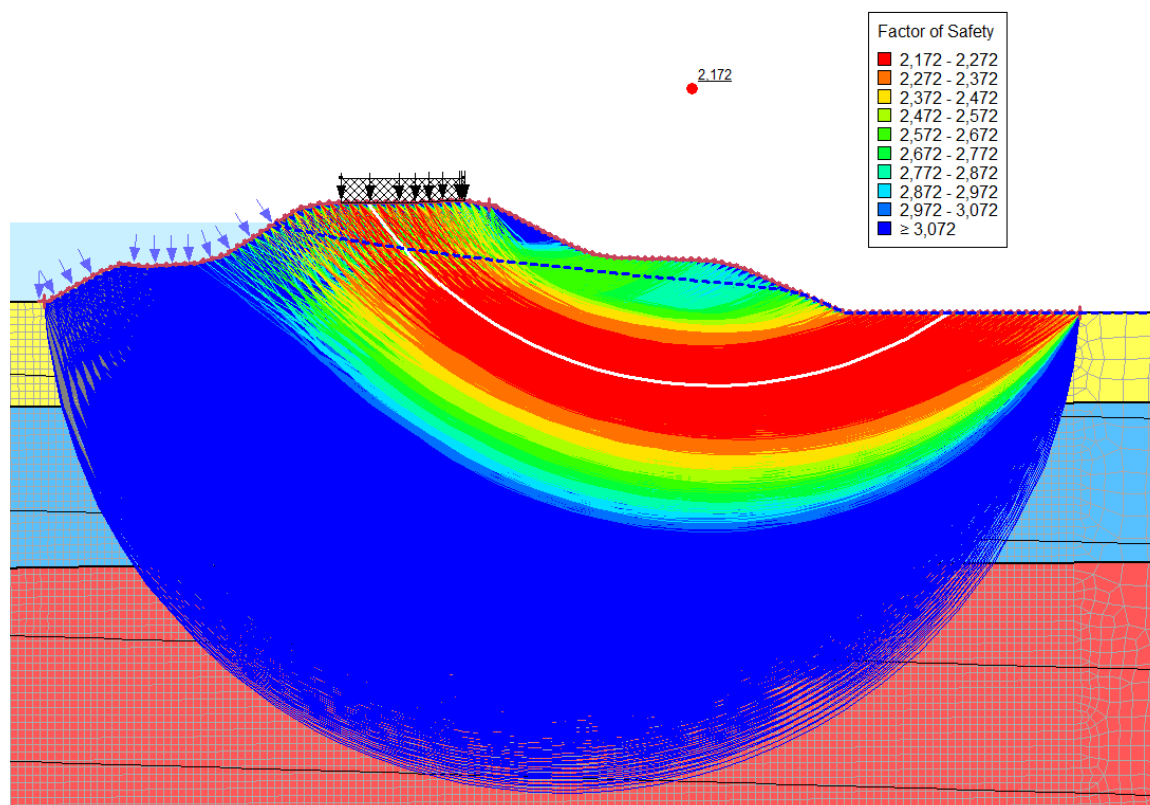


Figura 7-44 Sezione BB - Stato di fatto - Analisi statica Lungo Termine

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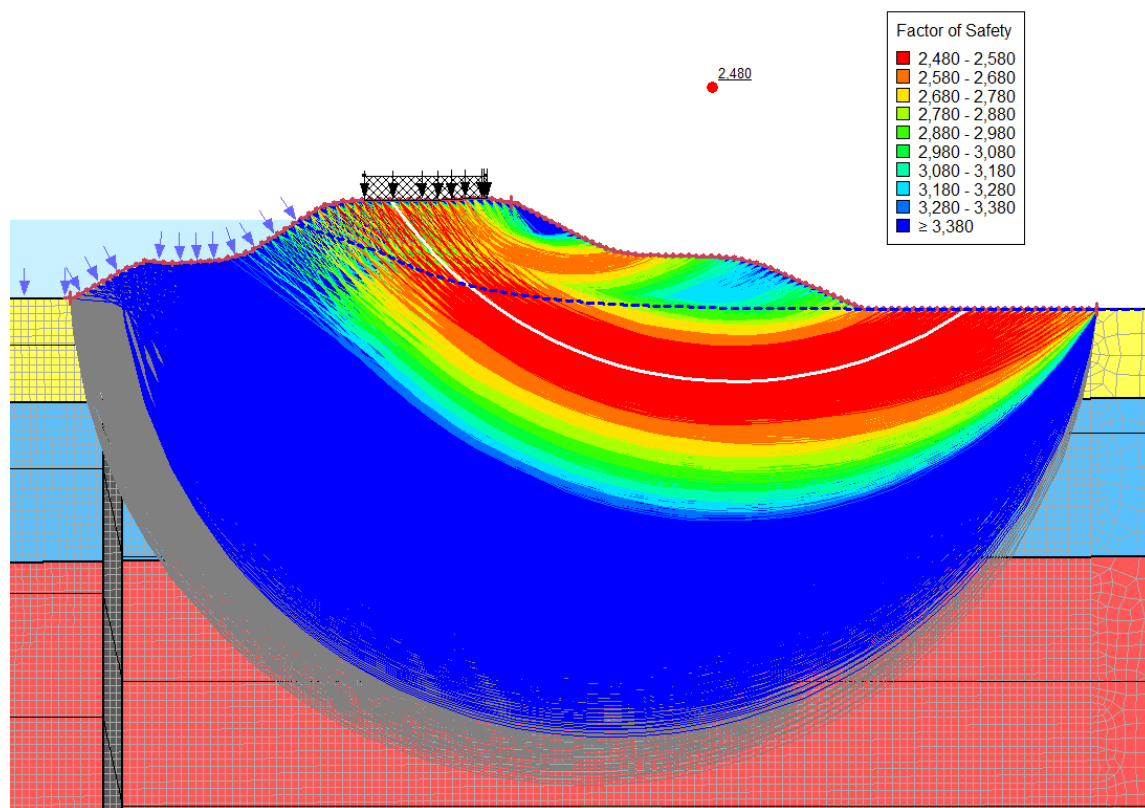


Figura 7-45 Sezione BB - Stato di progetto - Analisi statica Lungo Termine

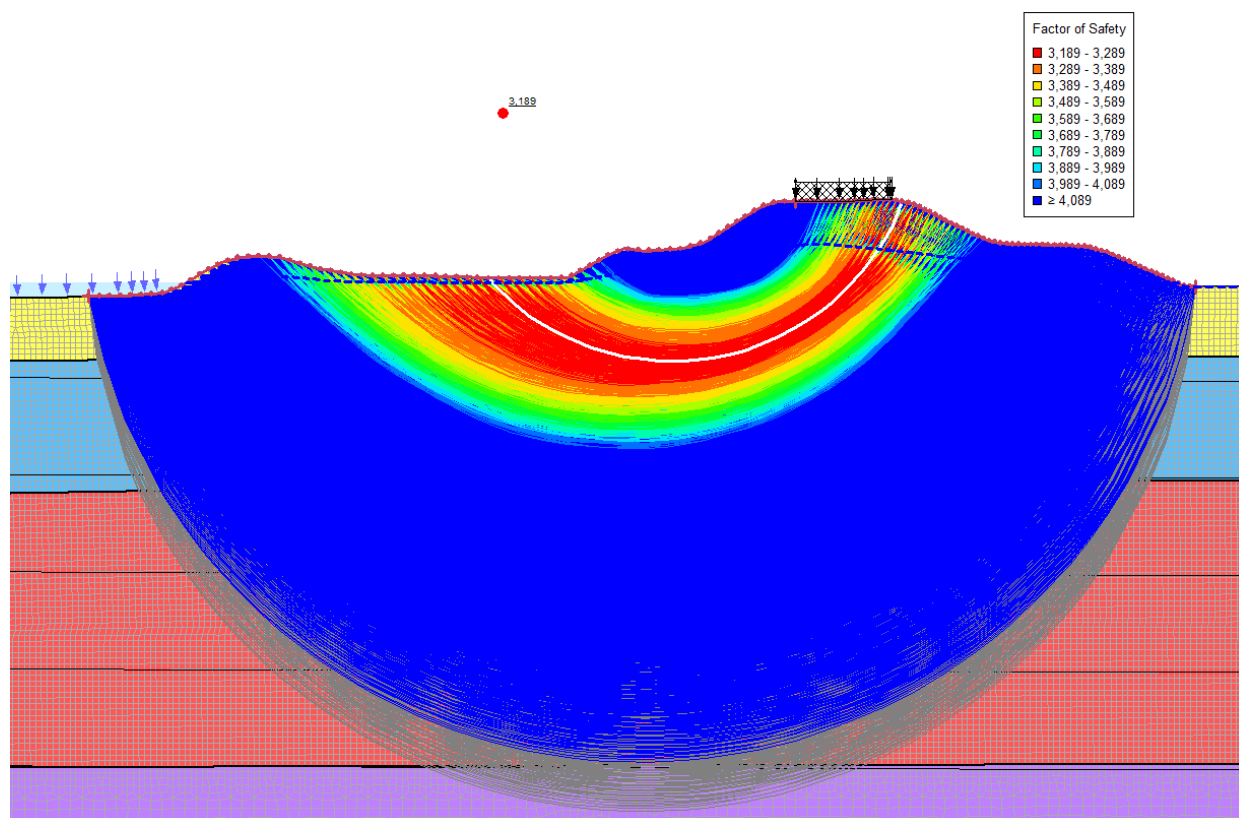


Figura 7-46 Sezione BB - Stato di fatto – Rapido Svaso Breve Termine



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Codice elaborato: PE.0.1.6.PRG.GE.R.T.0.0.1.B

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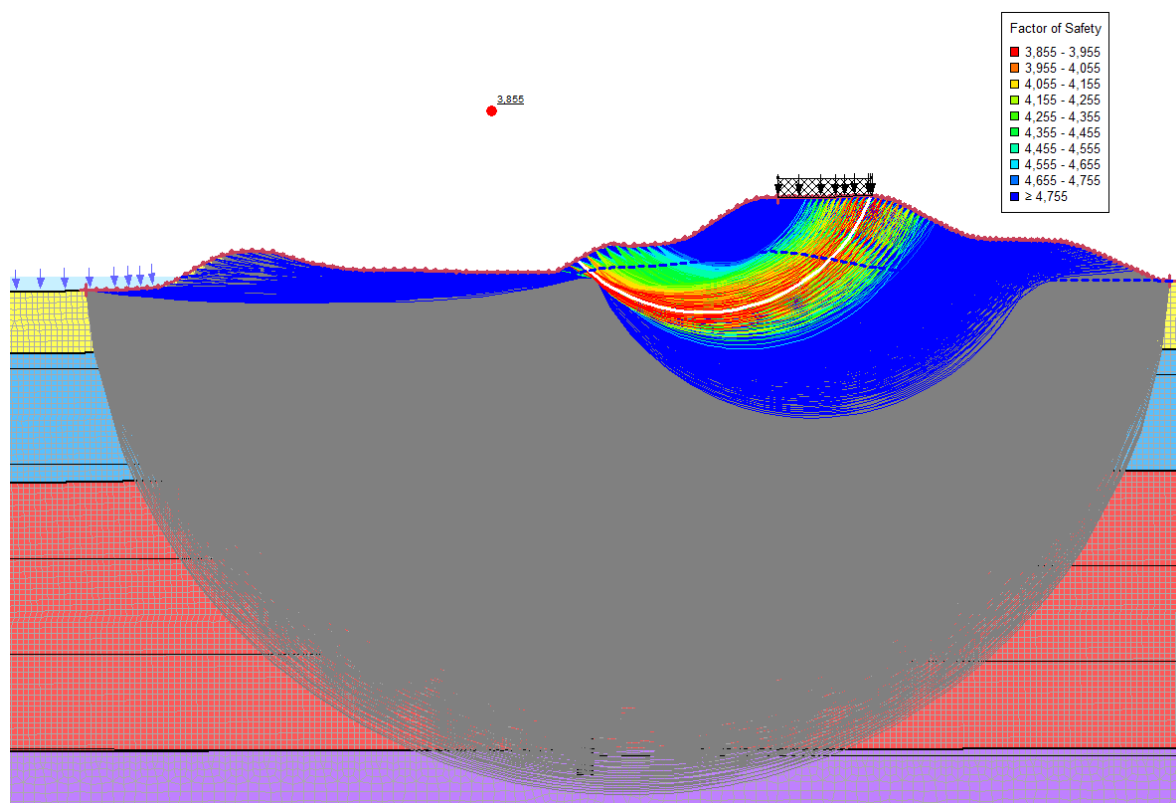


Figura 7-47 Sezione BB - Stato di progetto – Rapido Svaso Breve Termine

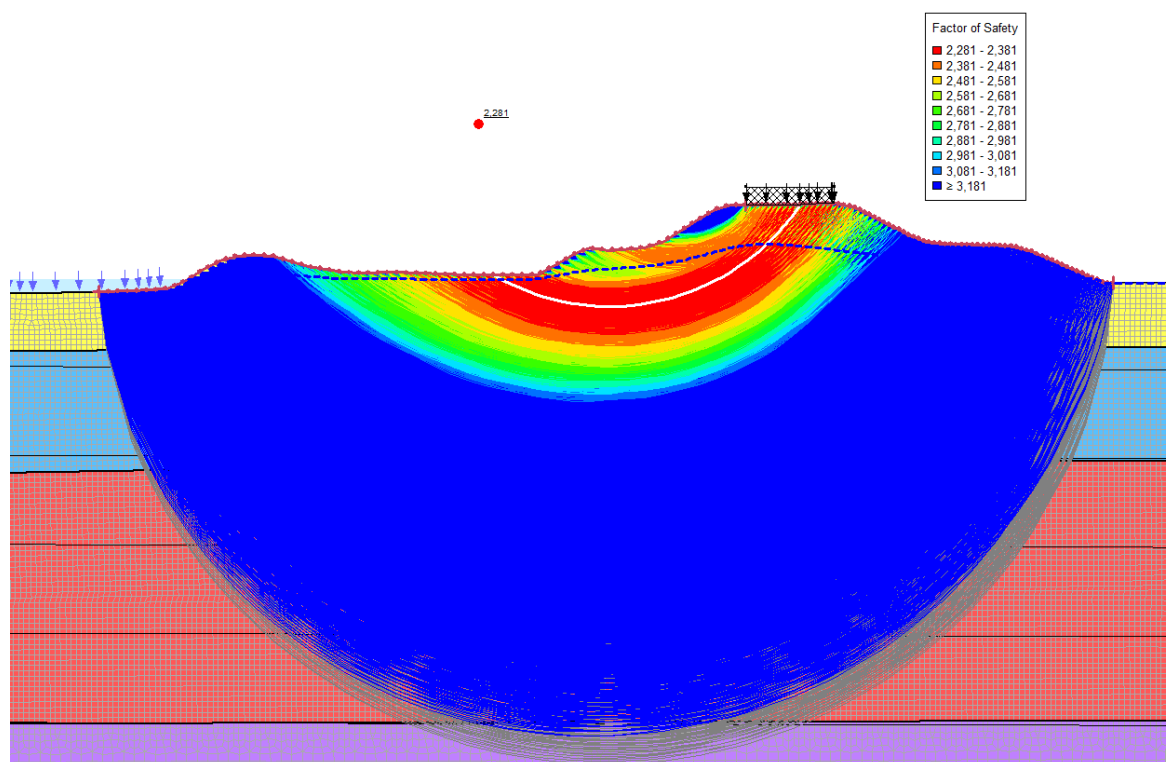


Figura 7-48 Sezione BB - Stato di fatto – Rapido Svaso Lungo Termine

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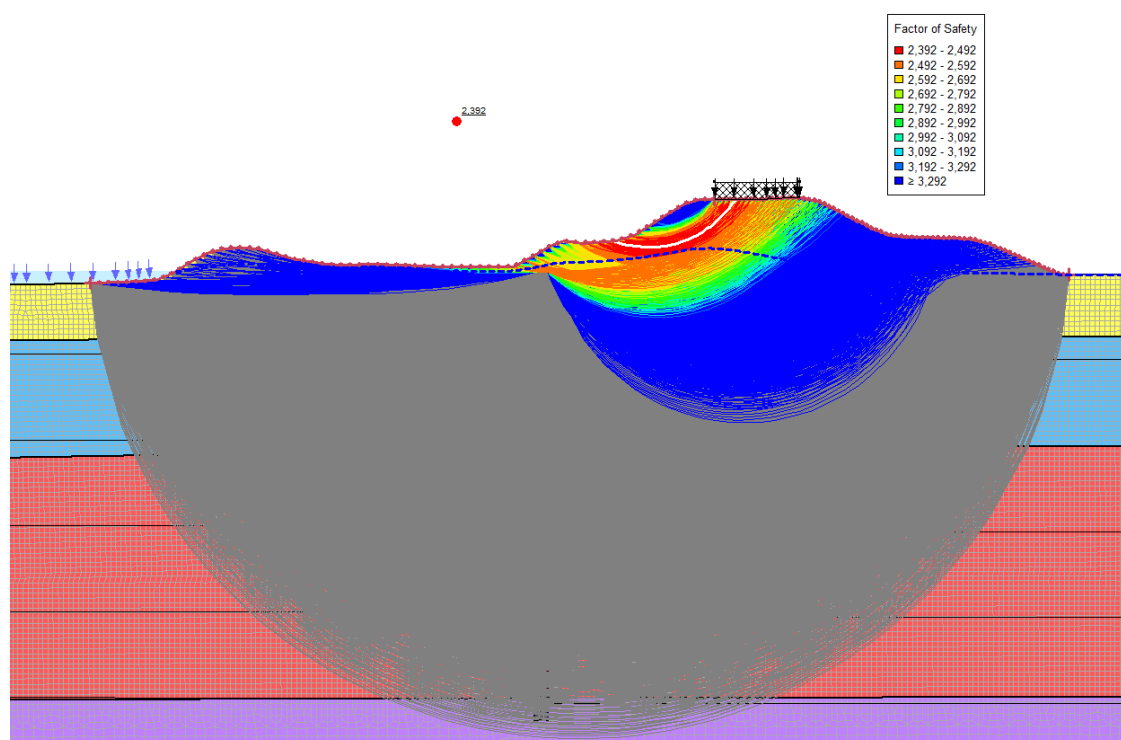


Figura 7-49 Sezione BB - Stato di progetto – Rapido Svaso Lungo Termine

## 7.7.4 Risultati del modello e verifiche di stabilità globale – Sezione CC

Nelle seguenti tabelle si riportano i fattori di sicurezza relativi alle analisi di stabilità globale per la sezione CC.

Tabella 7-11 Sezione CC - Risultati delle analisi di stabilità globale

	Stato di Fatto	Diaframma di Progetto	BREVE TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto	LUNGO TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto
SLU - BREVE TERMINE	2,938	2,942	0 d	4,058	4,444	0 d	2,151	2,234
SLU - LUNGO TERMINE	2,122	2,358	1 d	3,537	3,776	1 d	1,832	1,891
SLV - BREVE TERMINE	2,879	2,946	2 d	3,136	3,341	2 d	1,645	1,692
			3 d	2,849	3,094	3 d	1,560	1,604
			4 d	2,585	3,005	4 d	1,537	1,618
			5 d	2,404	3,005	5 d	1,585	1,674

Come mostrato nelle precedenti tabelle, le verifiche di stabilità globale risultano soddisfatte sia per lo stato di progetto che per lo stato di fatto. Si osserva in generale un lieve incremento dei fattori di sicurezza con conseguente miglioramento del grado di sicurezza relativo alla stabilità globale in seguito all'intervento.

Nelle figure seguenti si riportano gli esiti delle verifiche di stabilità globale per la sezione CC mostrando le superfici di scivolamento valutate con l'ausilio del software di calcolo. Per le analisi di stabilità globale riguardanti il rapido svaso si riporta unicamente la situazione più critica che risulta

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essere quella relativa al 5° giorno di svaso per il modello in condizioni non drenate e al 3° giorno di svaso per il modello in condizioni drenate.

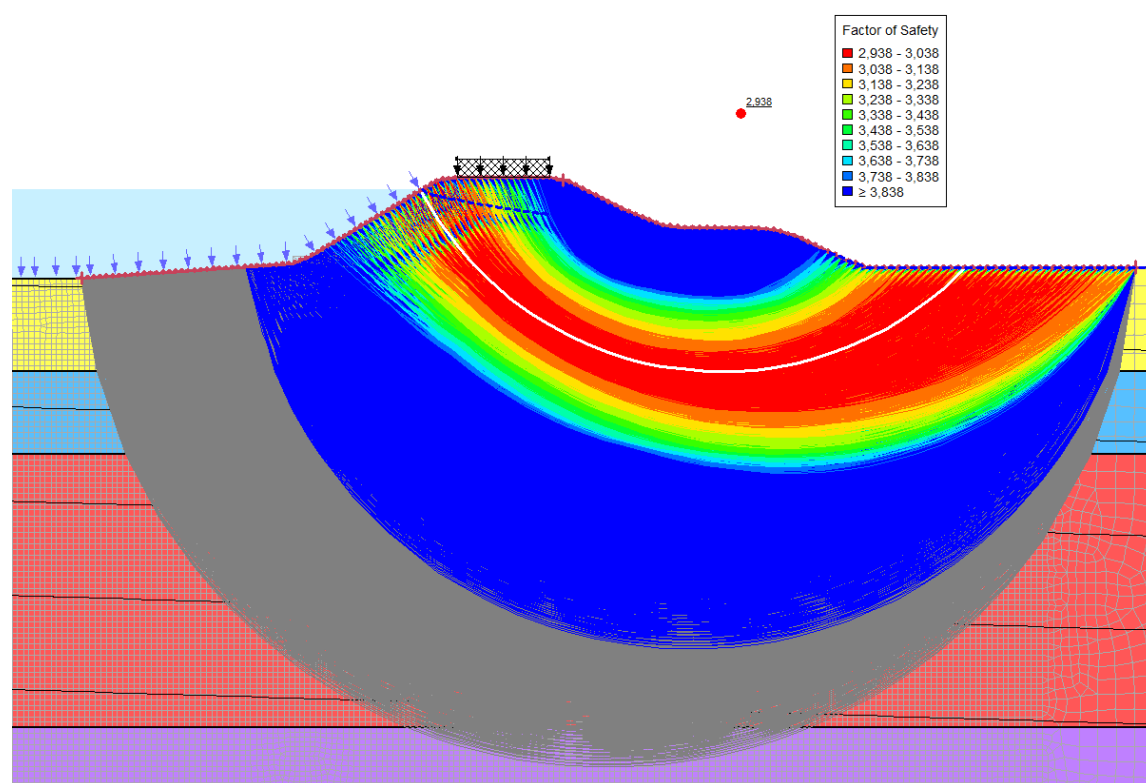


Figura 7-50 Sezione CC - Stato di fatto - Analisi statica Breve Termine

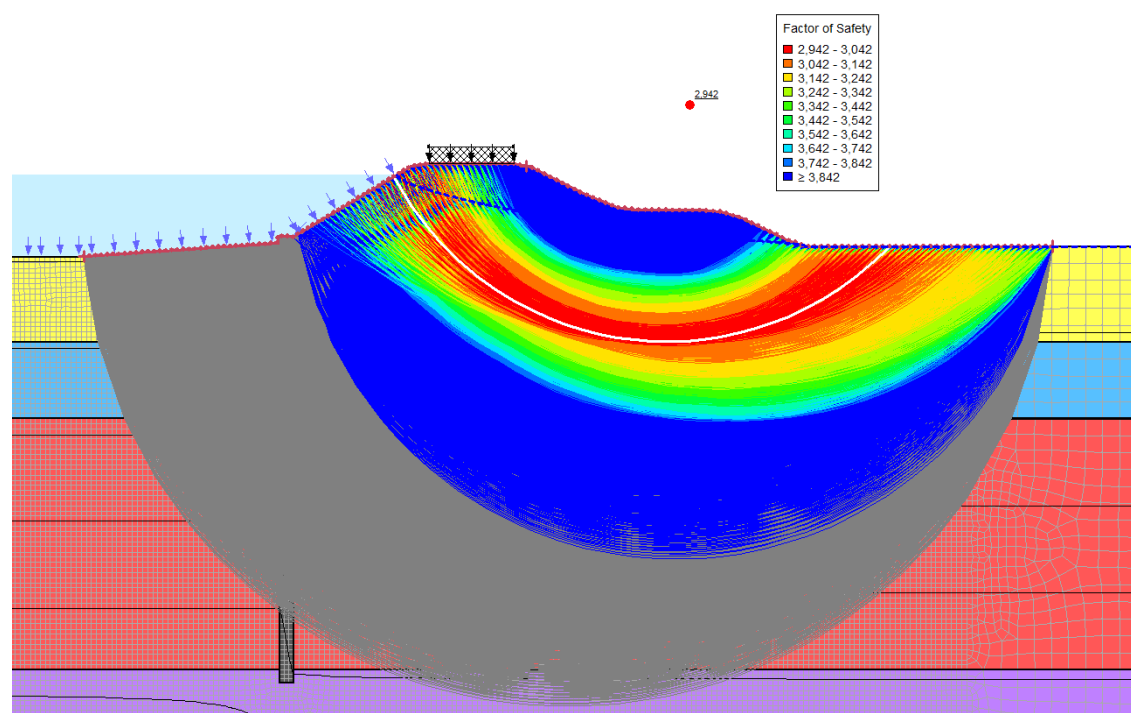


Figura 7-51 Sezione CC - Stato di progetto - Analisi statica Breve Termine

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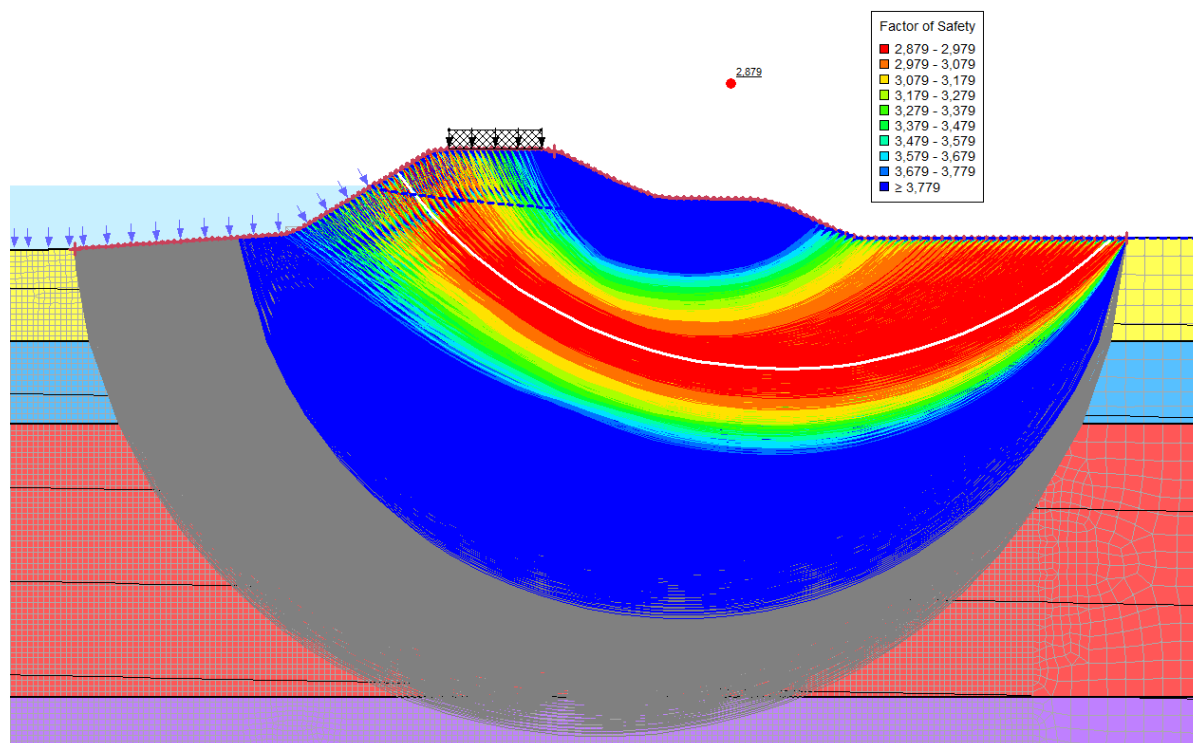


Figura 7-52 Seizone CC - Stato di fatto - Analisi sismica Breve Termine

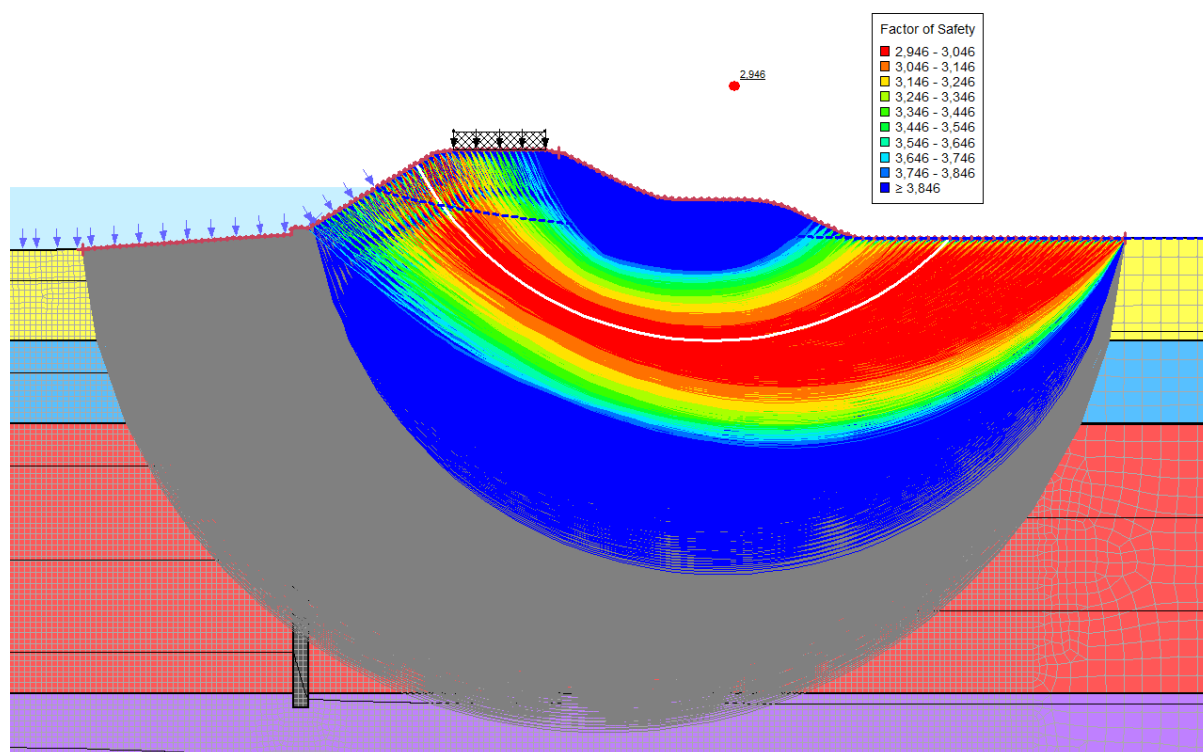


Figura 7-53 Seizone CC - Stato di progetto - Analisi sismica Breve Termine

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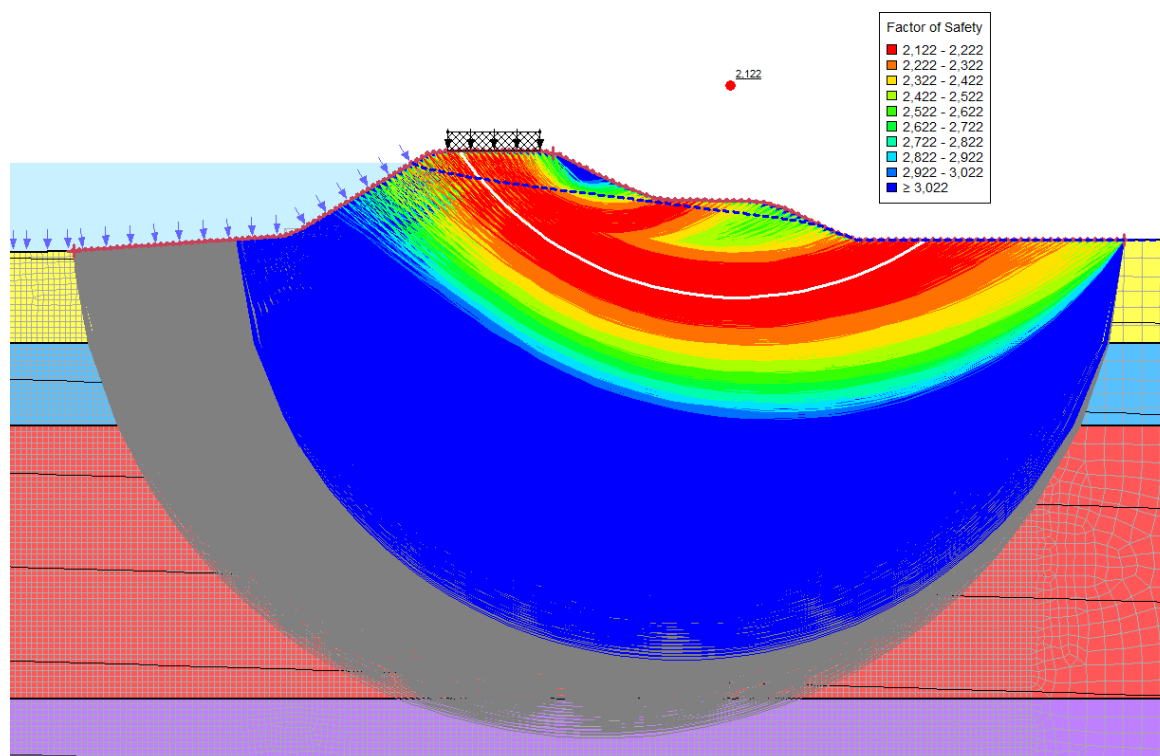


Figura 7-54 Sezione CC - Stato di fatto - Analisi statica Lungo Termine

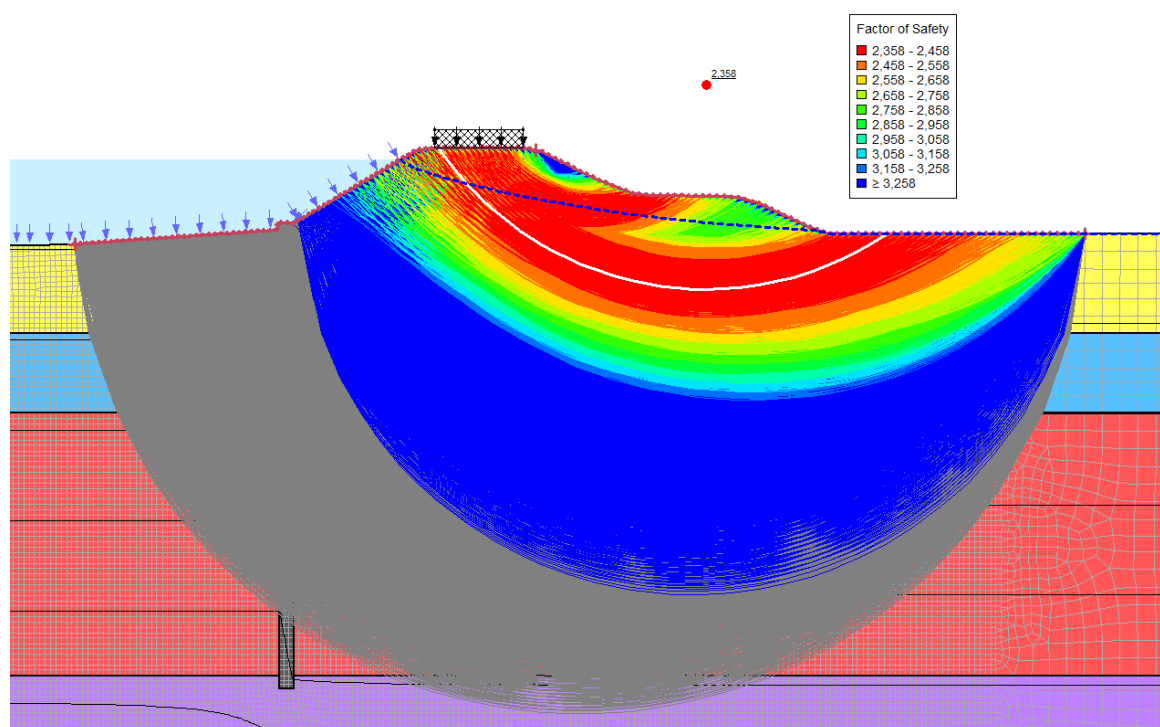


Figura 7-55 Sezione CC - Stato di progetto - Analisi statica Lungo Termine



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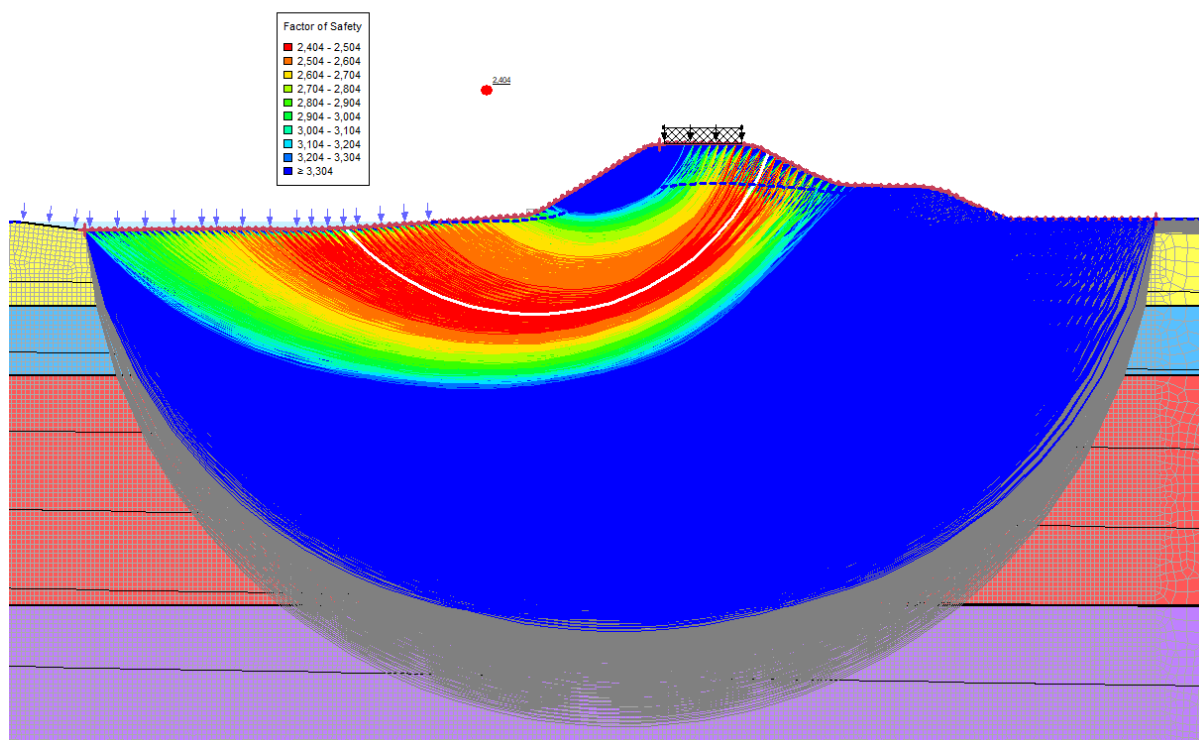


Figura 7-56 Sezione CC - Stato di fatto – Rapido Svaso Breve Termine

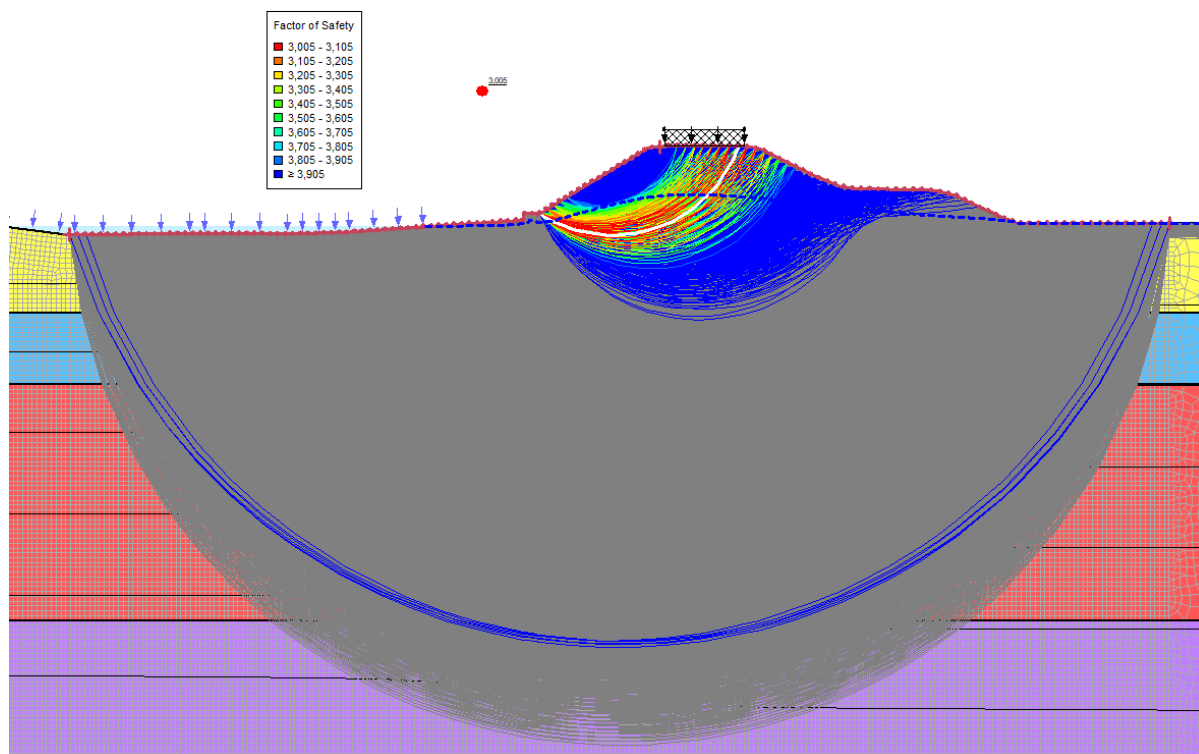


Figura 7-57 Sezione CC - Stato di progetto – Rapido Svaso Breve Termine

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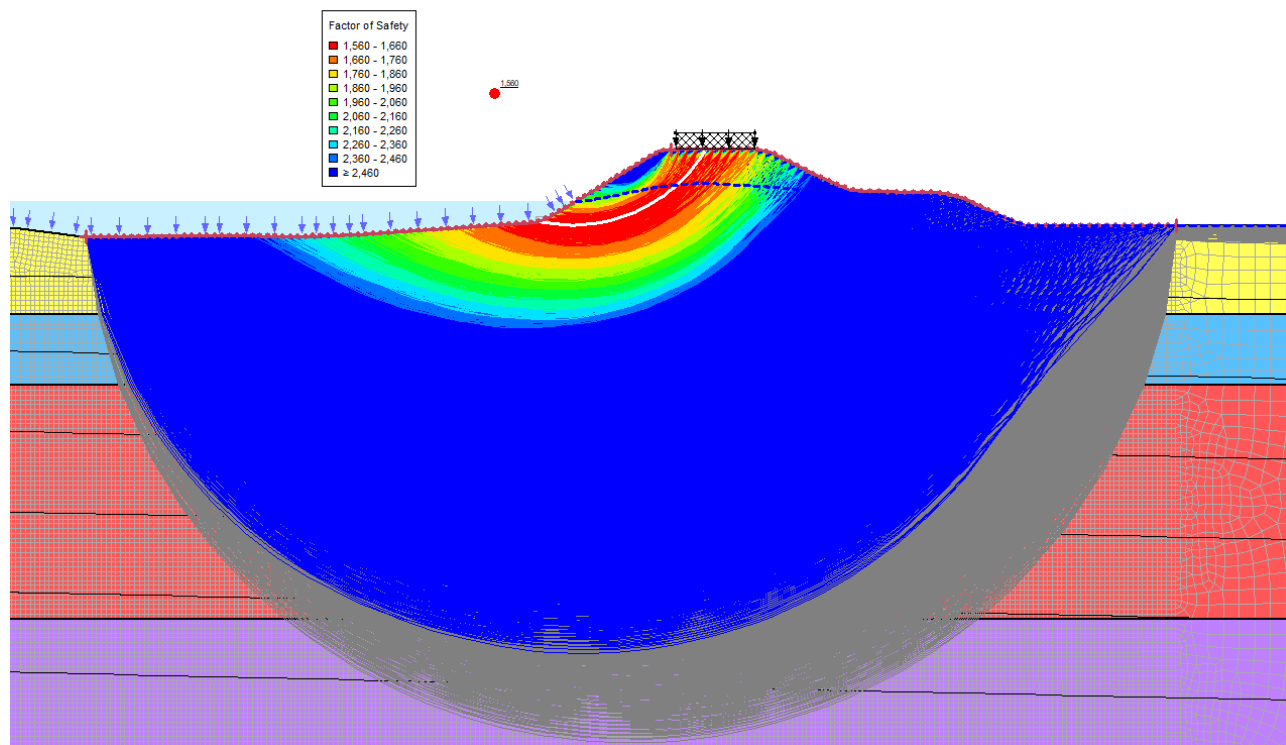


Figura 7-58 Sezione CC - Stato di fatto – Rapido Svaso Lungo Termine

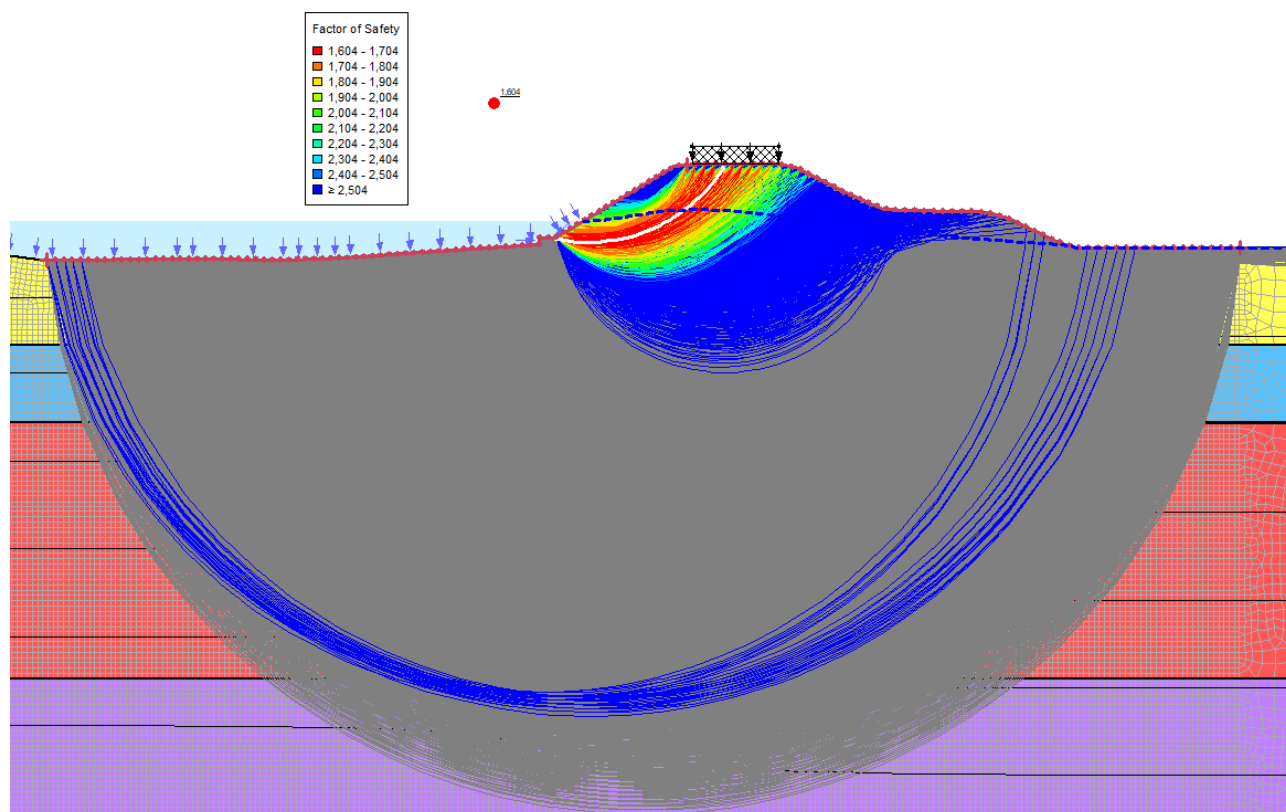


Figura 7-59 Sezione CC - Stato di progetto – Rapido Svaso Lungo Termine

### 7.7.5 Risultati del modello e verifiche di stabilità globale – Sezione DD

Nelle seguenti tabelle si riportano i fattori di sicurezza relativi alle analisi di stabilità globale per la sezione DD.

Tabella 7-12 Sezione DD - Risultati delle analisi di stabilità globale

	Stato di Fatto	Diaframma di Progetto	BREVE TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto	LUNGO TERMINE RAPIDO SVASO	Stato di Fatto	Diaframma di Progetto
SLU - BREVE TERMINE	2,797	3,023	0 d	4,248	4,304	0 d	2,993	3,204
SLU - LUNGO TERMINE	2,157	2,460	1 d	3,703	3,734	1 d	2,586	2,743
SLV - BREVE TERMINE	2,760	2,894	2 d	3,318	3,342	2 d	2,316	2,439
			3 d	3,044	3,081	3 d	2,144	2,255
			4 d	2,825	2,938	4 d	2,050	2,171
			5 d	2,730	2,914	5 d	2,070	2,211

Come mostrato nelle precedenti tabelle, le verifiche di stabilità globale risultano soddisfatte sia per lo stato di progetto che per lo stato di fatto. Si osserva in generale un lieve incremento dei fattori di sicurezza con conseguente miglioramento del grado di sicurezza relativo alla stabilità globale in seguito all'intervento.

Nelle figure seguenti si riportano gli esiti delle verifiche di stabilità globale per la sezione CC mostrando le superfici di scivolamento valutate con l'ausilio del software di calcolo. Per le analisi di stabilità globale riguardanti il rapido svaso si riporta unicamente la situazione più critica che risulta essere quella relativa al 5° giorno di svaso per il modello in condizioni non drenate e al 4° giorno di svaso per il modello in condizioni drenate.



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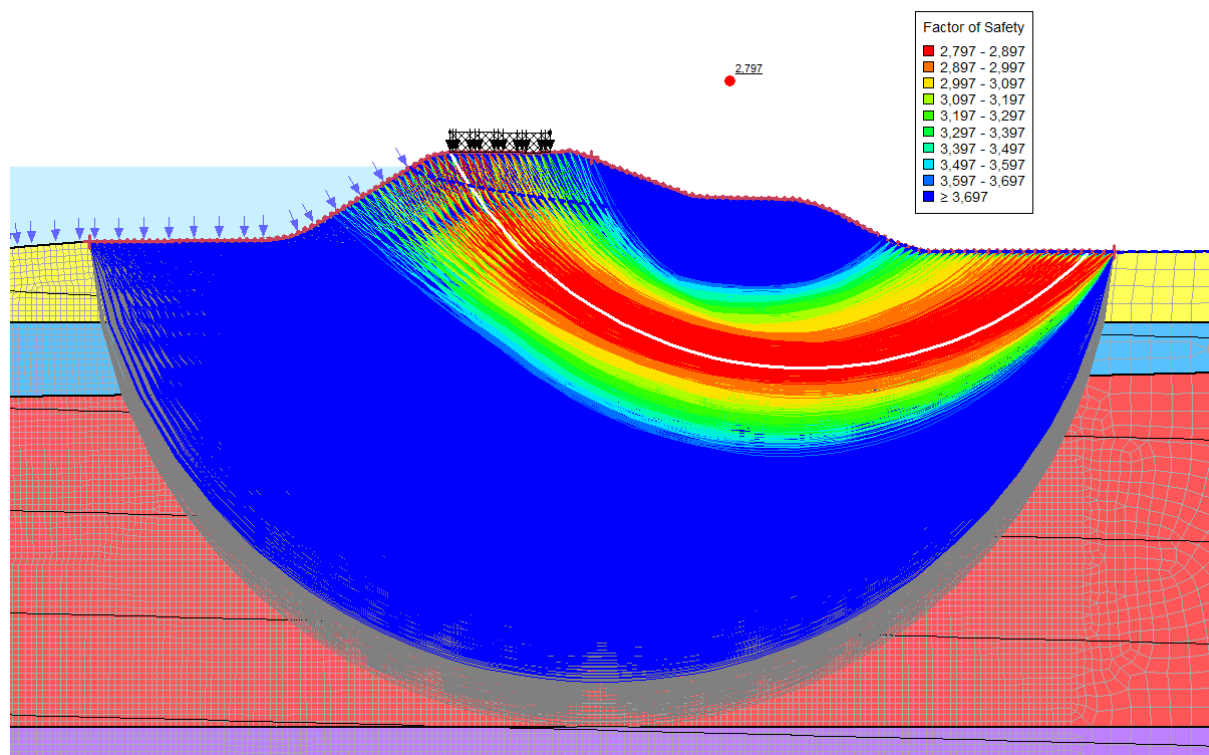


Figura 7-60 Sezione DD - Stato di fatto - Analisi statica Breve Termine

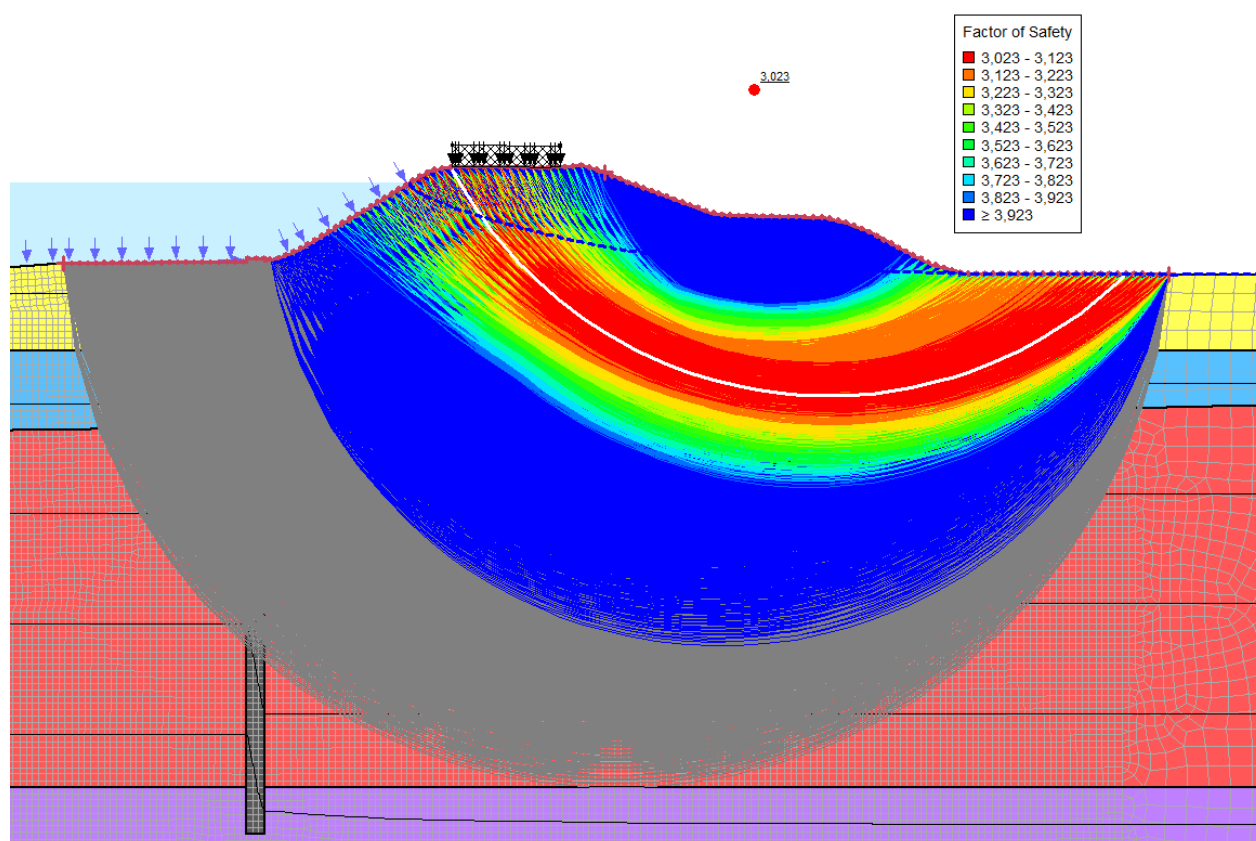


Figura 7-61 Sezione DD - Stato di progetto - Analisi statica Breve Termine

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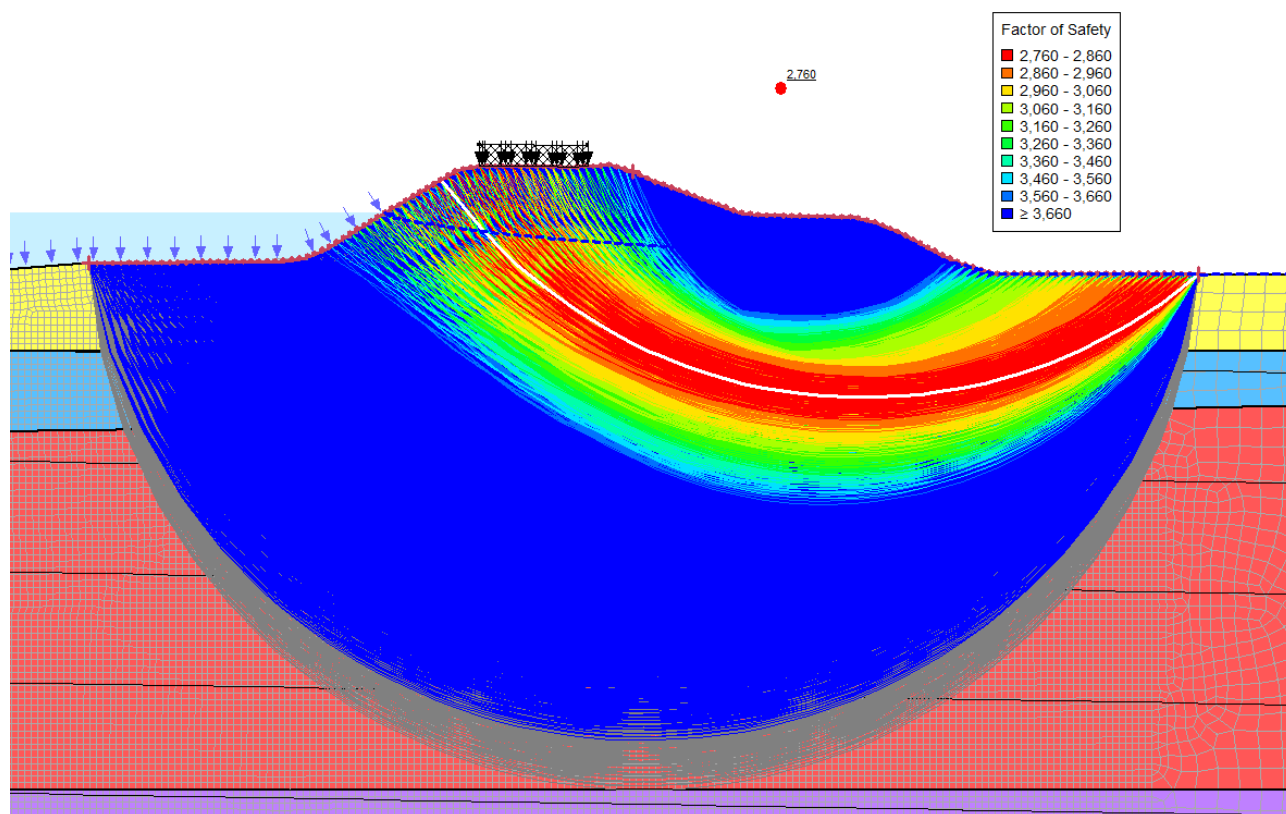


Figura 7-62 Sezione DD - Stato di fatto - Analisi sismica Breve Termine

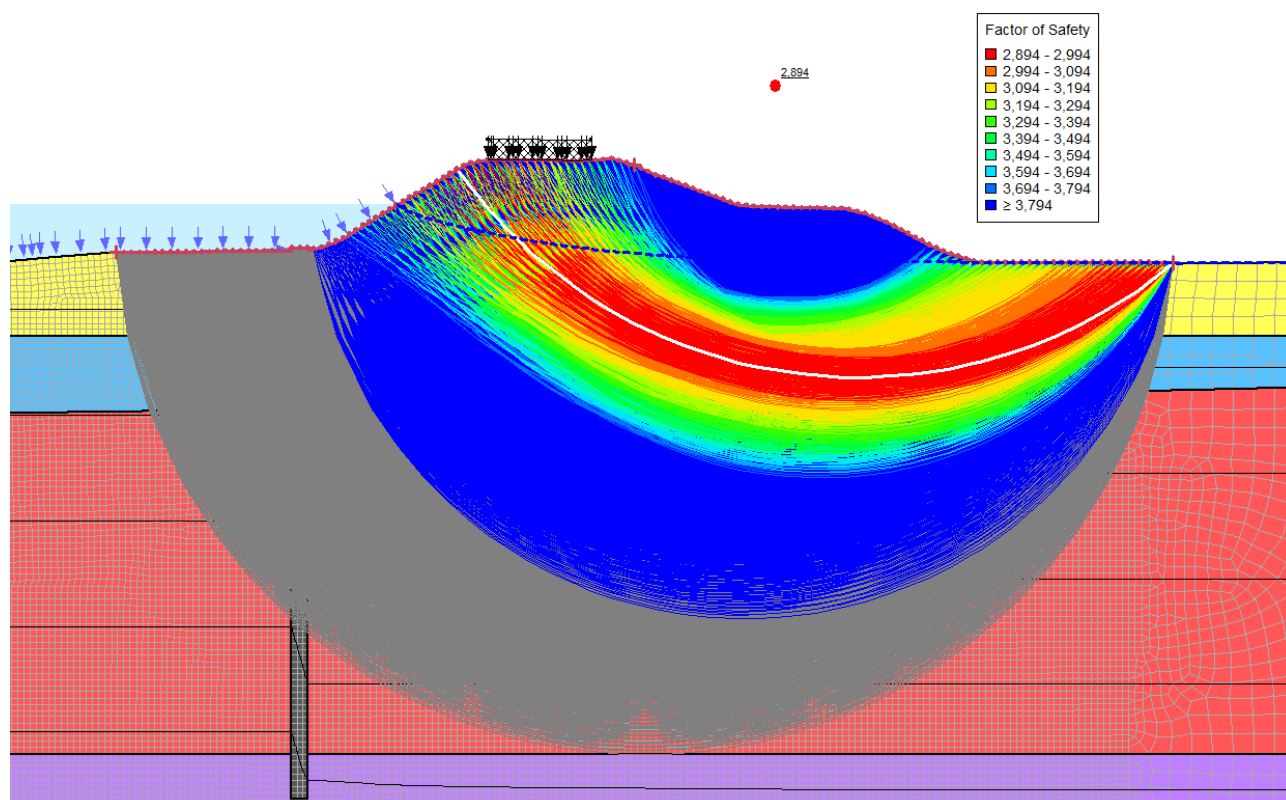


Figura 7-63 Sezione DD - Stato di progetto - Analisi sismica Breve Termine

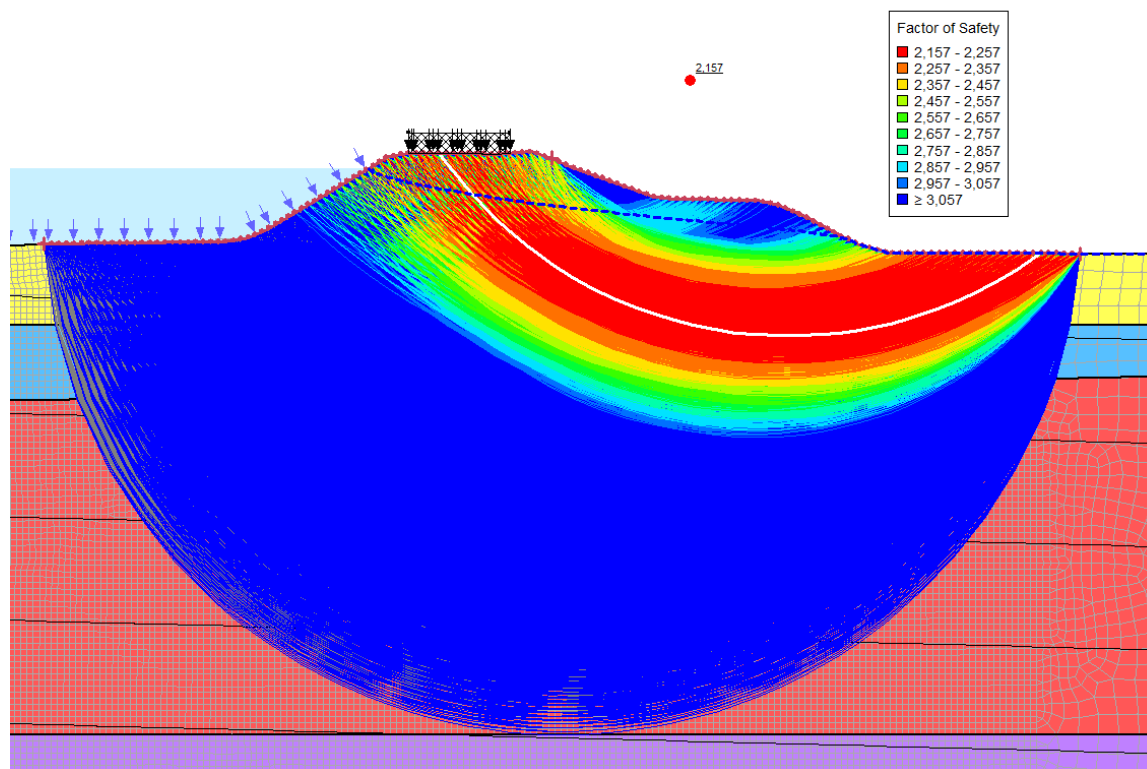


Figura 7-64 Sezione DD - Stato di fatto - Analisi statica Lungo Termine

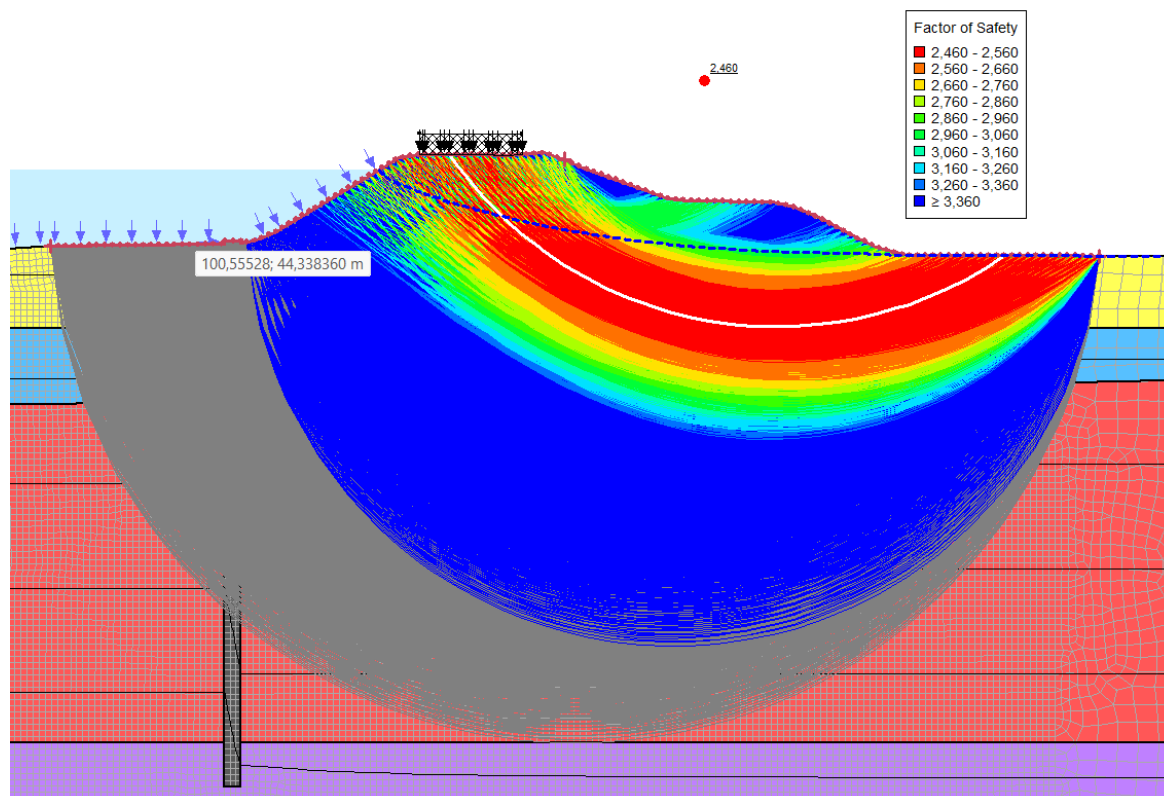


Figura 7-65 Sezione DD - Stato di progetto - Analisi statica Lungo Termine

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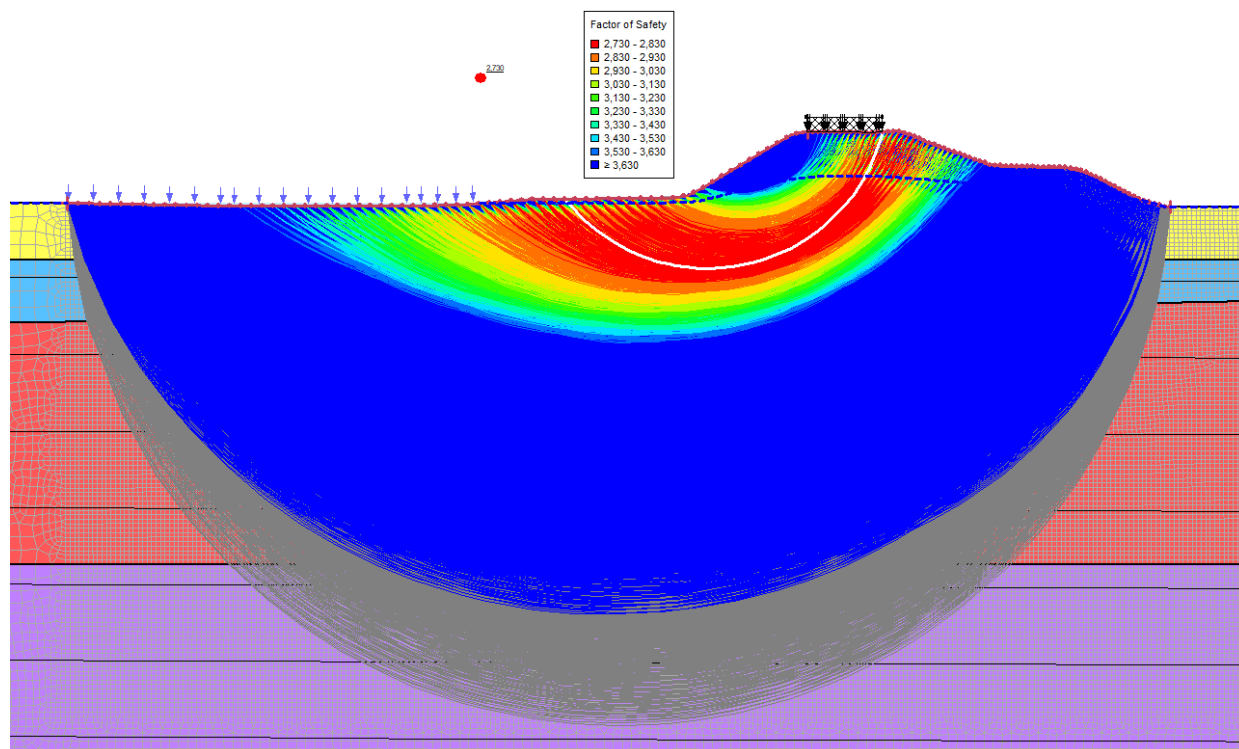


Figura 7-66 Sezione DD - Stato di fatto – Rapido Svaso Breve Termine

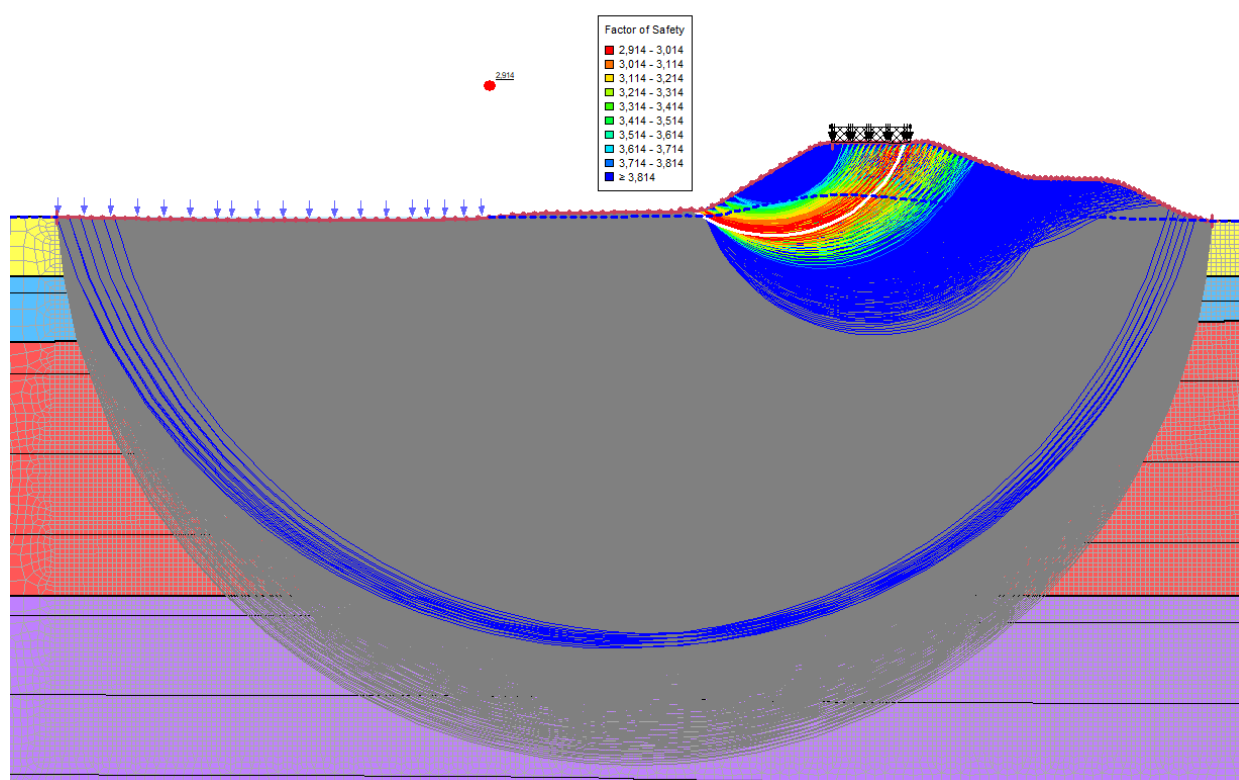


Figura 7-67 Sezione DD - Stato di progetto – Rapido Svaso Breve Termine



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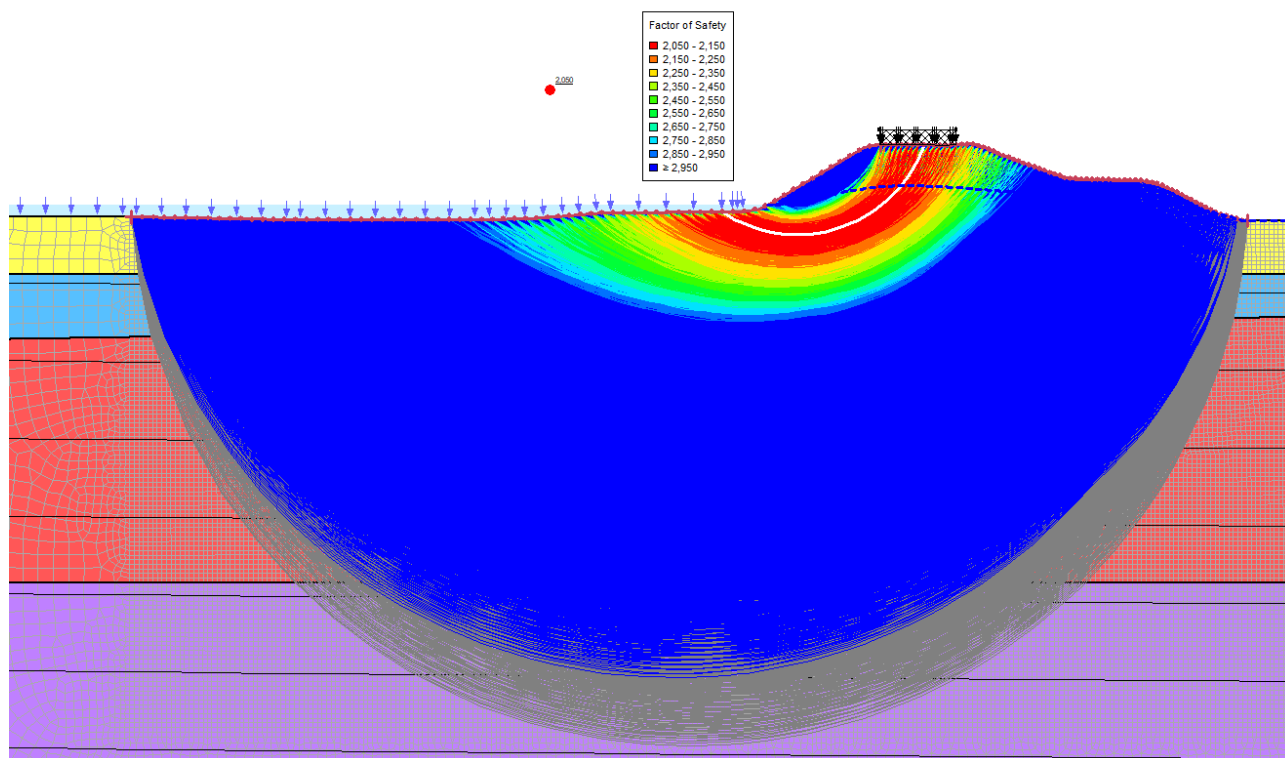


Figura 7-68 Sezione DD - Stato di fatto – Rapido Svaso Lungo Termine

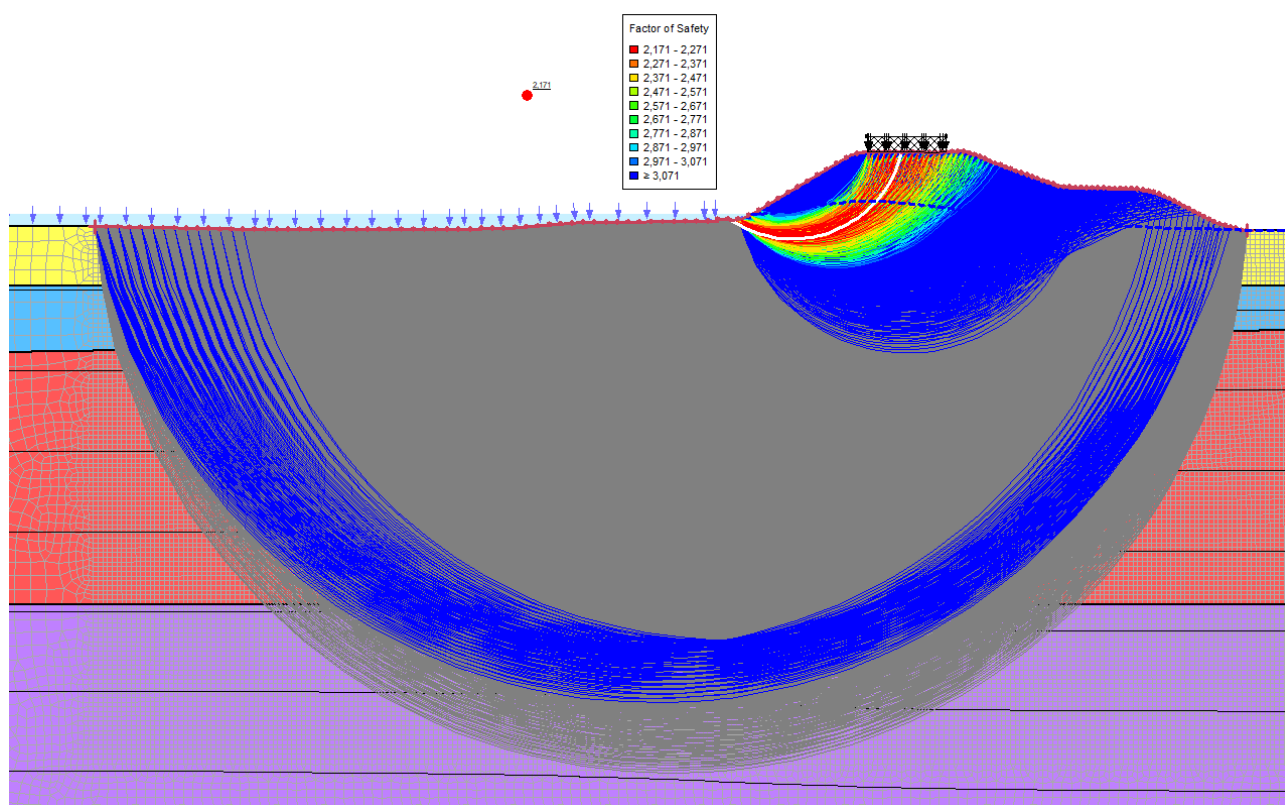


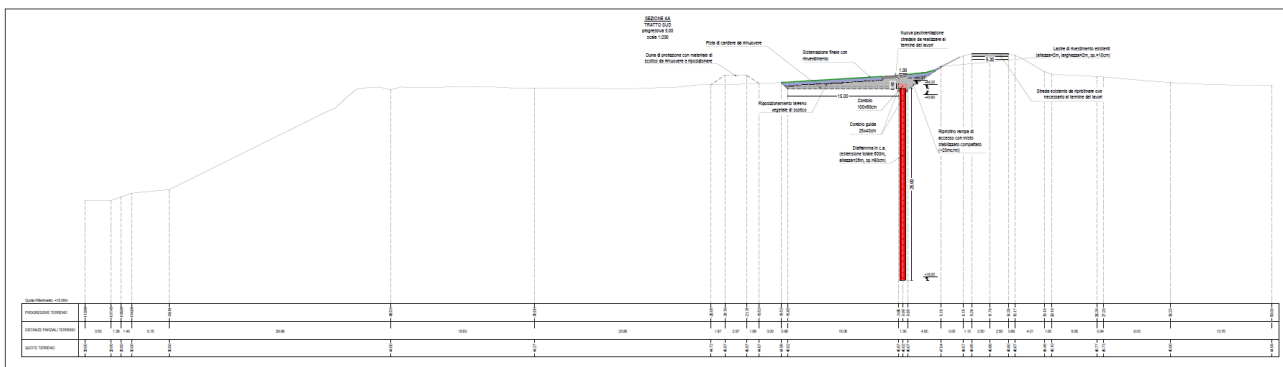
Figura 7-69 Sezione DD - Stato di progetto – Rapido Svaso Lungo Termine

## 8 VERIFICHE DEL DIAFRAMMA IN C.A.

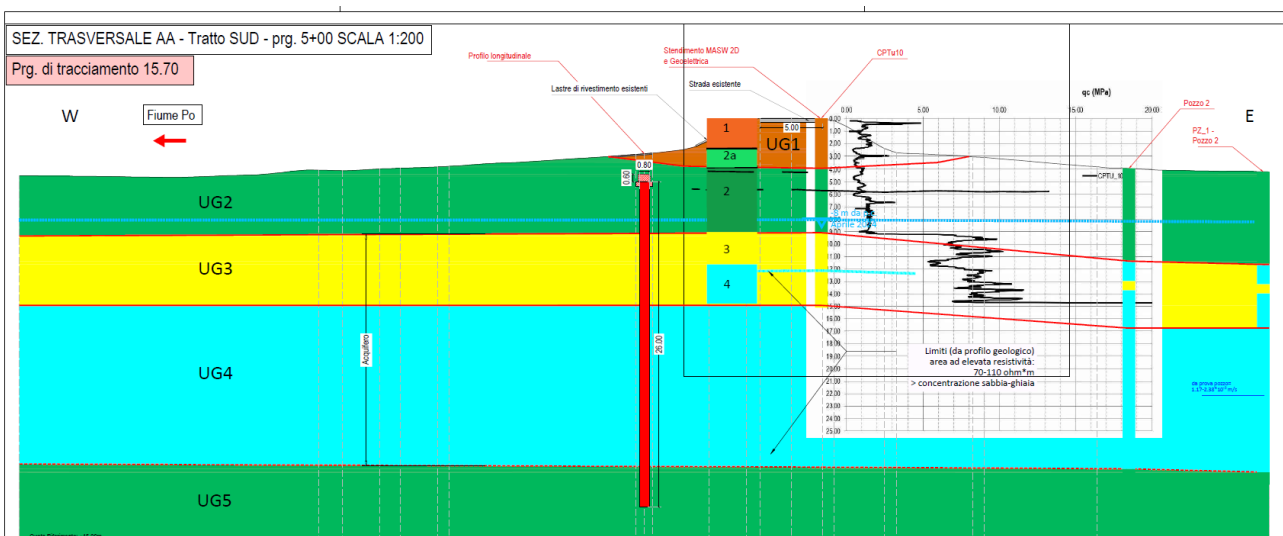
## 8.1 Modello ed ipotesi di calcolo

Per il dimensionamento del diaframma in c.a. è stata esaminata la sezione più critica tra le quattro sezioni di analisi individuate al paragrafo 7.2. Nello specifico è stata scelta la sezione AA che è caratterizzata da un importante spessore degli strati coesivi facenti parte delle unità geotecniche UG1 e UG2.

Tale sezione risulta essere la più critica per via della presenza delle unità coesive, attraversate dal diaframma nella parte più superficiale, e caratterizzate da più bassi parametri di resistenza e deformabilità. Nelle seguenti figure si riporta rispettivamente la sezione di calcolo e la sezione geotecnica adottata nell'analisi della diaframmatatura.



*Figura 8-1 Sezione di calcolo AA*



*Figura 8-2 Sezione geotecnica AA*

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Come mostrato nelle precedenti figure, la diaframmatura in c.a. di progetto presenta uno spessore di 0.80m e una lunghezza di 26m. In testa ai diaframmi è presente un cordolo di collegamento in c.a. di dimensioni 0.60x0.80m.

La diaframmatura in c.a. viene dimensionata nell'ipotesi che l'azione della piena possa nel tempo erodere parzialmente il terreno costituente il rilevato arginale, fino a scoprire completamente il diaframma strutturale per una certa altezza; nel caso in esame, si considera un'altezza libera del setto per effetto dell'erosione pari a 5m.

Nel modello di calcolo implementato si applica dunque un'altezza di scavo a valle del diaframma pari a -5 m.

La stratigrafia di calcolo utilizzata all'interno del modello numerico è quella individuata nella Relazione Geotecnica di Progetto [18]. Sulla base di quanto illustrato al capitolo 3.3, i parametri di resistenza caratteristici delle unità geotecniche considerate all'interno dei modelli numerici sono riportati nella seguente tabella.

Tabella 8-1 Parametri di resistenza caratteristici

Unità	Peso naturale $\gamma_{nat}$ [kN/m <sup>3</sup> ]	Peso saturo $\gamma_{sat}$ [kN/m <sup>3</sup> ]	Resistenza al taglio non drenata $c_u$ [kPa]	Coesione efficace $c'$ [kPa]	Angolo di attrito efficace $\phi'$ [-]
UG1 – Rilevato arginale (misto)	19.5	20.5	-	12.5	26
UG2 - Coesivo	19.5	20.5	65	-	-
UG3 - Granulare	20	21	-	0	34
UG4 - Granulare	20	21	-	0	36
UG5 – Coesivo	20	21	65	-	-

La posizione della falda è stata assunta cautelativamente coincidente con il fondo scavo ossia alla base della parte di rilevato erosa dalla piena a -5 m da testa diaframma.

Per tenere in considerazione l'eventuale presenza di sovraccarichi associati al passaggio di mezzi sulla strada in sommità arginale, in corrispondenza della sommità del rilevato si considera agente un sovraccarico variabile pari a 10 kPa.

Nelle seguenti figure si riportano le fasi di modellazione implementate all'interno del software di calcolo ossia:

- Fase 1: configurazione dello stato di fatto (geostatica);
- Fase 2: costruzione del cordolo e diaframma in c.a.;
- Fase 3: applicazione del carico sulla strada sommitale al rilevato;

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- Fase 4: simulazione dell'erosione del rilevato lato fiume.

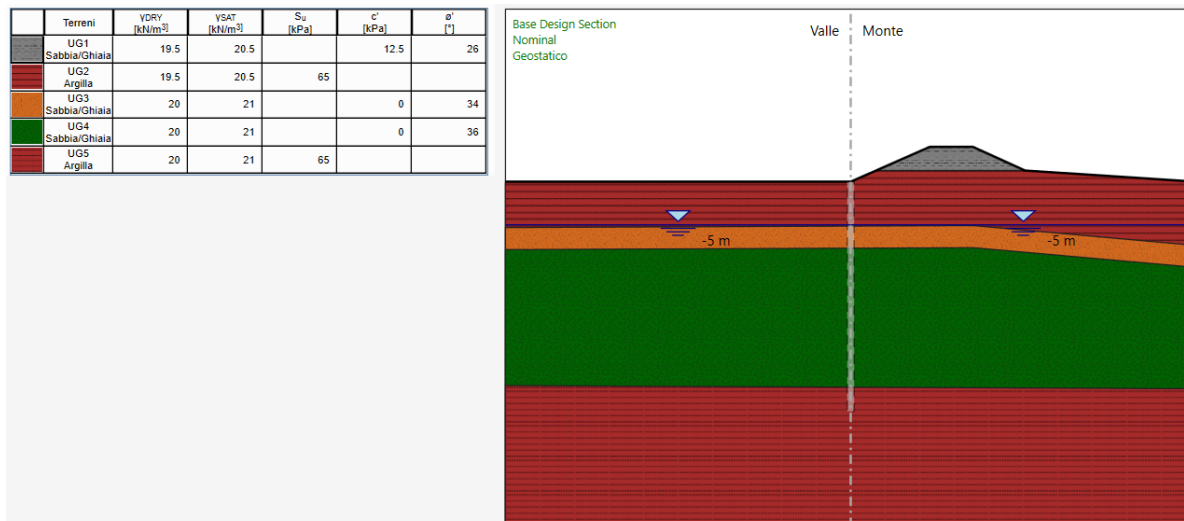


Figura 8-3 Modello di calcolo per la verifica del diaframma in c.a. – Fase 1

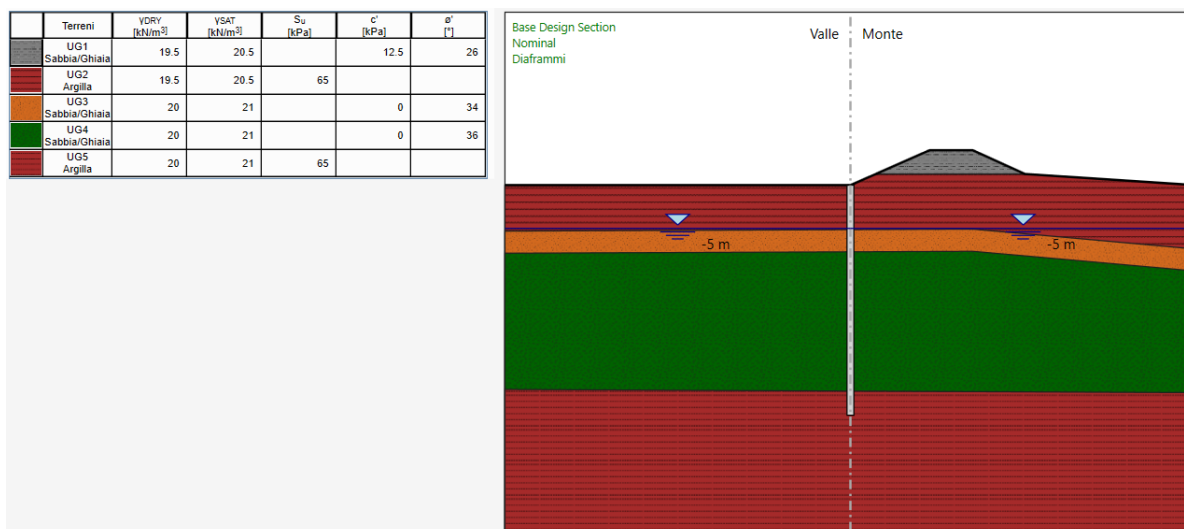


Figura 8-4 Modello di calcolo per la verifica del diaframma in c.a. – Fase 2



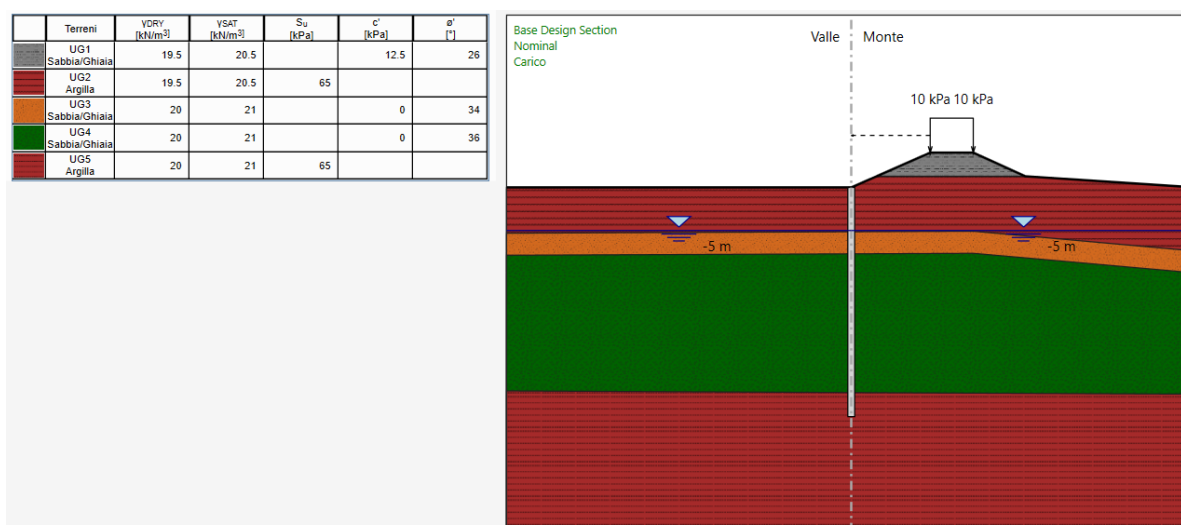


Figura 8-5 Modello di calcolo per la verifica del diaframma in c.a. – Fase 3

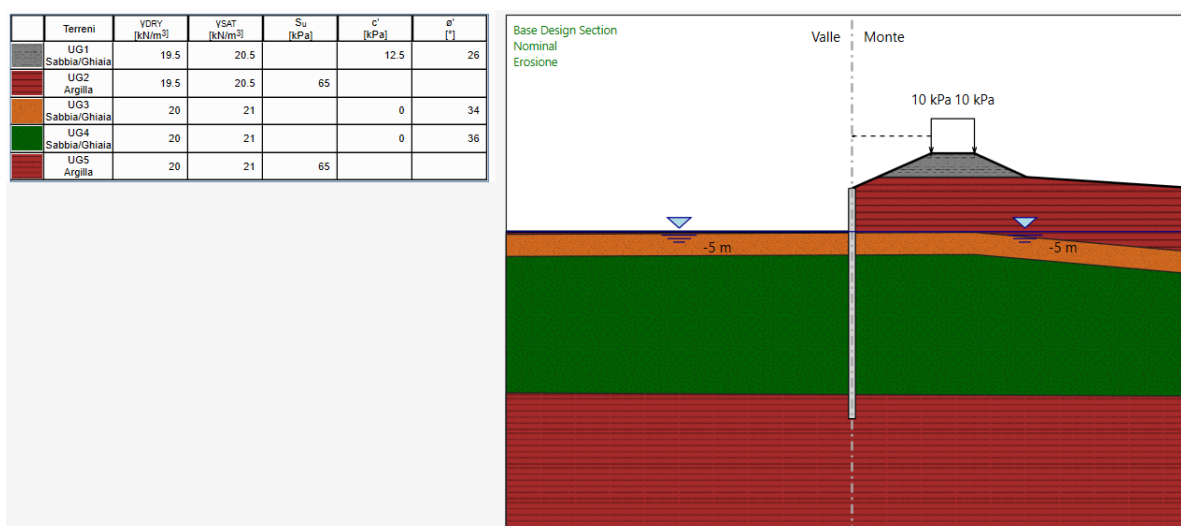


Figura 8-6 Modello di calcolo per la verifica del diaframma in c.a. – Fase 4

## 8.2 Combinazioni di calcolo

Le verifiche sono condotte, in osservanza al D.M. del 17.01.2018 “Aggiornamento delle Norme Tecniche per le Costruzioni (Gazzetta ufficiale 20/02/2018 n. 42)”, attraverso il metodo semiprobabilistico agli Stati Limite.

Il calcolo della diaframmatura viene eseguito in accordo con il § 6.5.3.1.2 delle NTC, per quanto riguarda la verifica nei confronti degli Stati Limite Ultimi in condizioni statiche.

Le verifiche vengono effettuate secondo l'Approccio 1 considerando le due combinazioni di coefficienti: SLU Combinazioni 1 (A1+M1+R1) e SLU Combinazioni 2 (A2+M2+R1) tenendo conto dei valori parziali nelle Tabelle 6.2.I e 6.2.II delle NTC18, con i coefficienti  $\gamma_R$  del gruppo R1 pari all'unità. Qui di seguito si riportano le tabelle estratte dalle NTC con i relativi valori dei coefficienti.

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Tab. 6.2.I – Coefficienti parziali per le azioni o per l'effetto delle azioni

	Effetto	Coefficiente Parziale $\gamma_F$ (o $\gamma_E$ )	EQU	(A1)	(A2)
Carichi permanenti $G_1$	Favorevole	$\gamma_{G1}$	0,9	1,0	1,0
	Sfavorevole		1,1	1,3	1,0
Carichi permanenti $G_2^{(0)}$	Favorevole	$\gamma_{G2}$	0,8	0,8	0,8
	Sfavorevole		1,5	1,5	1,3
Azioni variabili Q	Favorevole	$\gamma_{Q1}$	0,0	0,0	0,0
	Sfavorevole		1,5	1,5	1,3

Figura 8-7 Coefficienti parziali per le azioni

Tab. 6.2.II – Coefficienti parziali per i parametri geotecnici del terreno

Parametro	Grandezza alla quale applicare il coefficiente parziale	Coefficiente parziale $\gamma_M$	(M1)	(M2)
Tangente dell'angolo di resistenza al taglio	$\tan \varphi'_k$	$\gamma_{\varphi'}$	1,0	1,25
Coesione efficace	$c'_k$	$\gamma_{c'}$	1,0	1,25
Resistenza non drenata	$c_{uk}$	$\gamma_{cu}$	1,0	1,4
Peso dell'unità di volume	$\gamma_\gamma$	$\gamma_\gamma$	1,0	1,0

Figura 8-8 Coefficienti parziali per i parametri geotecnici del terreno

## 8.3 Software di calcolo

Al fine di rappresentare il comportamento delle berlinesi durante le fasi di lavoro (scavi, forze esterne, inserimento degli elementi di contrasto, ecc.) è opportuno l'impiego di un metodo di calcolo iterativo atto a simulare l'interazione, in campo elasto-plastico, tra terreno e paratia per ciascuna fase esecutiva.

Per questo scopo si impiega il programma di calcolo "HarpaCeAs - Paratie ver.21" che consente di studiare elementi strutturali tipo "beam" disposti su un letto di molle di tipo elasto-plastico.

La simulazione numerica del problema reale è condotta con il metodo degli elementi finiti; in dettaglio:

- si analizza un problema piano (i gradi di libertà nodali attivi sono lo spostamento laterale e la rotazione fuori piano);
- la schematizzazione del fenomeno fisico è del tipo 'trave su suolo elastico - alla Winkler: la parete di sostegno è schematizzata da una serie di elementi finiti verticali il cui comportamento flessionale è definito dalla rigidezza flessionale  $EJ$ ; il terreno è simulato da elementi finiti monodimensionali (molle) con legge costitutiva di tipo elasto-plastico; gli altri elementi strutturali (tiranti, solette, puntoni...) sono schematizzati tramite molle puntuali convergenti in alcuni nodi della parete;

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- l'analisi svolta è una analisi statica incrementale di tipo elasto-plastico: ogni configurazione, quindi, dipende in generale dalle configurazioni precedenti e lo sviluppo di deformazioni plastiche ad un certo step di carico condiziona la risposta della struttura negli step successivi. Il programma calcola l'energia potenziale del modello così concepito e ne impone la stazionarietà, ottenendo un sistema di equazioni che risolvono il problema. Tali equazioni hanno il significato fisico di equazioni di equilibrio ai nodi: la matrice dei coefficienti del sistema è una matrice di rigidezza, mentre i termini noti assumono il significato di forze applicate ai nodi. In quest'ottica, il metodo porta ad un modello matematico identico a quello ottenuto dal metodo degli spostamenti, approccio usuale nello studio delle strutture a telaio.

La legge costitutiva, rappresentativa del comportamento elasto-plastico del terreno, è identificata dai parametri di spinta/reazione e di deformabilità del terreno, e prevede cicli di scarico e ricarico.

I parametri di spinta/reazione del terreno sono:

- il coefficiente di spinta riposo  $K_0$  (corrispondente alla condizione iniziale indeformata);
- i coefficienti di spinta attiva  $K_A$  e passiva  $K_P$  (corrispondenti alle condizioni di equilibrio limite inferiore e superiore).

I parametri di deformabilità del terreno compaiono nella definizione della rigidezza delle molle. In particolare tale rigidezza viene definita come:

$$K = \frac{E\Delta}{L}$$

dove  $E$  è il modulo elastico del terreno,  $\Delta$  il passo di discretizzazione della struttura ed  $L$  una grandezza geometrica caratteristica, diversa tra monte ( $L_A$ ) e valle ( $L_P$ ) in quanto diversa è la dimensione del cuneo di terreno coinvolto nel movimento.

## 8.4 Risultati e verifiche geotecniche e strutturali

### 8.4.1 Risultati del modello di calcolo

I seguenti diagrammi illustrano le sollecitazioni di momento flettente e taglio agenti sulla diaframmatura in progetto ottenute dal modello di calcolo.

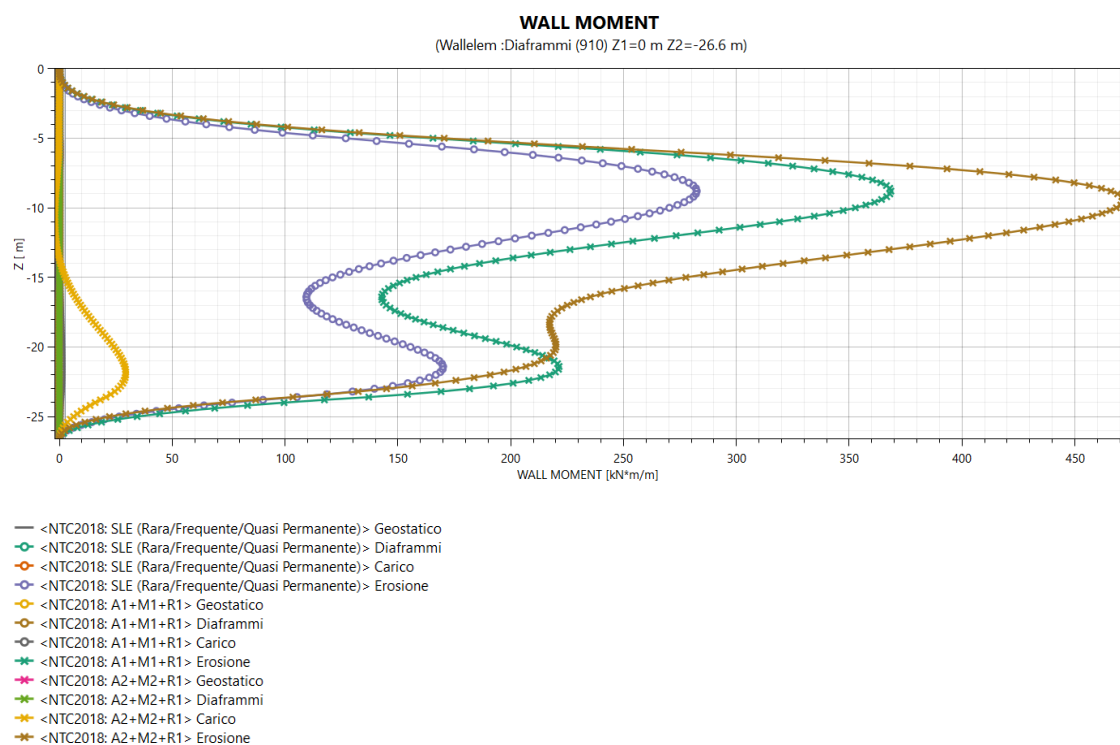


Figura 8-9 Diaframmi in c.a. – Momento flettente – Combinazioni A1+M1+R1, A2+M2+R1, SLE

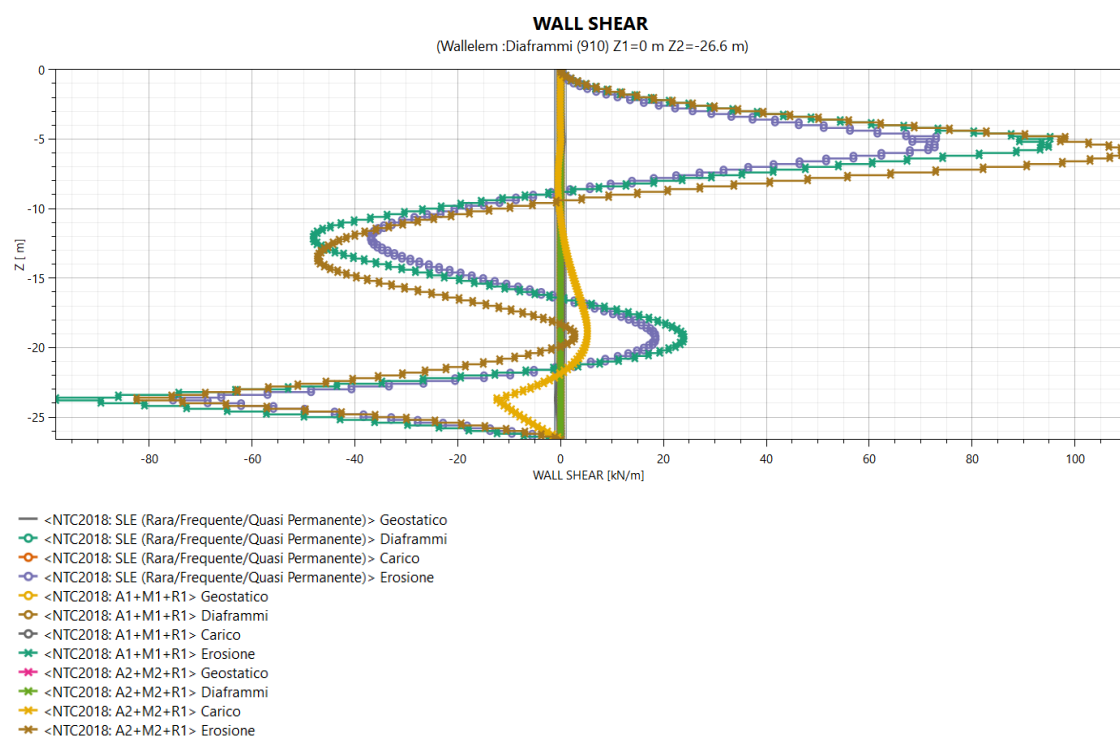


Figura 8-10 Diaframmi in c.a. – Taglio – Combinazioni A1+M1+R1, A2+M2+R1, SLE

<b>PNRR - M2C4 Investimento 3.3 - RINATURAZIONE DELL'AREA DEL PO</b>	
Progetto Esecutivo	
<b>SCHEDA N. 16 CAORSO (PC) – PROGETTO DIAFRAMMATURE</b>	
Codice elaborato:	<b>PE.0.1.6.PRG.GE.R.T.0.0.1.B</b>
Titolo elaborato:	<b>Relazione Calcolo</b>
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Dalle precedenti figure si evince che la diaframmatura in progetto è sollecitata da un momento flettente massimo allo SLU pari a circa 472 kNm/m, da un momento flettente massimo allo SLE pari a circa 282 kNm/m e da un taglio massimo allo SLU pari a circa 110 kN/m.

Il singolo pannello di lunghezza 2.5m sarà quindi sollecitato da un momento allo SLU pari a 1179 kNm, da un momento allo SLE pari a 706 kNm e da un taglio pari a 274 kN.

L'azione assiale sollecitante viene valutata considerando l'effettiva posizione del punto di massima sollecitazione che è pari a -9.4 m da testa diaframma per il momento SLU e pari a -8.8 m da testa diaframma per il momento SLE.

### 8.4.2 Verifiche strutturali del diaframma in c.a.

Il diaframma in c.a. è costituito da conci di dimensioni 0.8x2.5m. L'armatura longitudinale di progetto prevista è costituita da 12Ø20 lato scavo e 12Ø26 lato terreno mentre l'armatura a taglio prevista è costituita da 4 staffe Ø12 passo 30 cm. Il copriferro di progetto è pari a 8 cm.

Come riportato nella seguente figura, le verifiche strutturali allo SLU e allo SLE risultano soddisfatte.

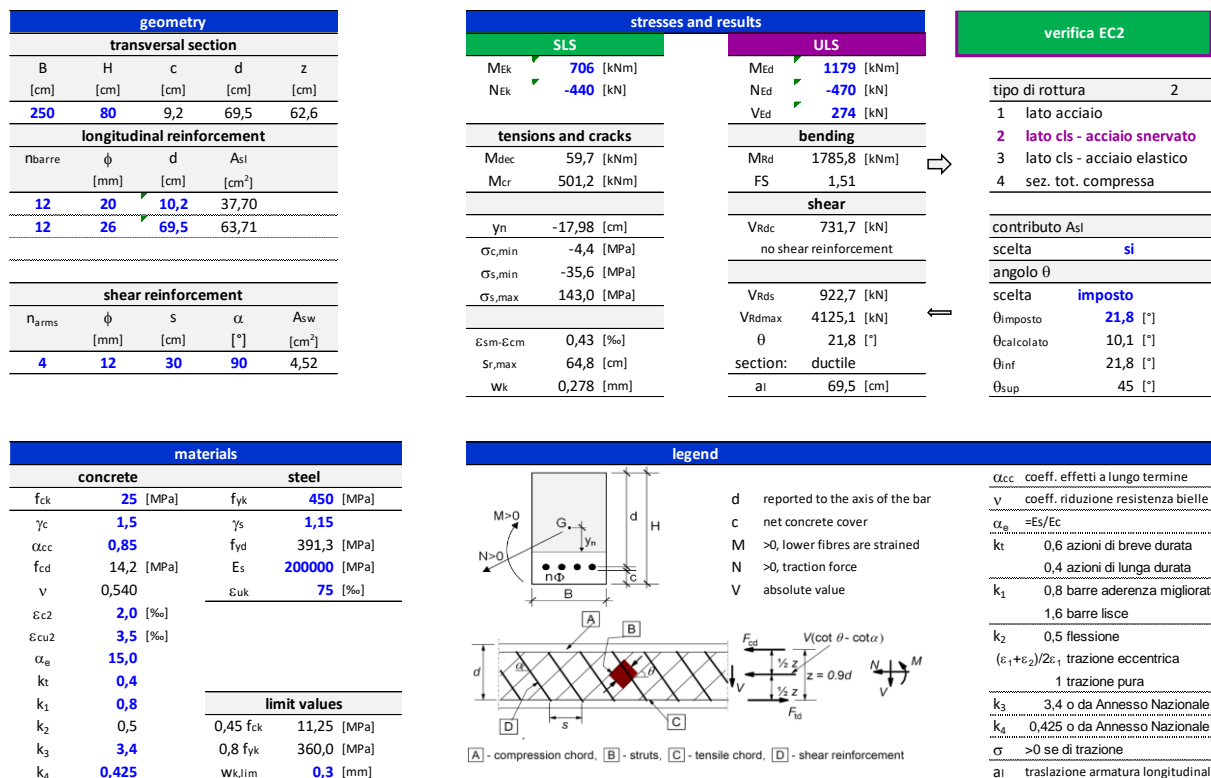


Figura 8-11 Verifica strutturale del diaframma in c.a.

### 8.4.3 Verifiche della resistenza del terreno a valle

Per la verifica di stabilità si valuta la percentuale di spinta passiva mobilitata in corrispondenza della massima altezza di scavo, per la combinazione A2+M2+R1 (GEO) statica. I coefficienti di sicurezza sono incorporati nei coefficienti parziali che si riferiscono all'approccio di calcolo prescelto: pertanto

nei riguardi di una verifica allo Stato Limite Ultimo, la spinta sollecitante potrebbe, al limite, eguagliare la resistenza passiva di progetto.

Come illustrato nella figura seguente in corrispondenza della massima altezza di scavo si mobilita circa il 27% della spinta passiva e la verifica di stabilità è quindi soddisfatta.

### Massimi rapporti di mobilitazione spinta passiva

D.A. <NTC2018: A2+M2+R1>

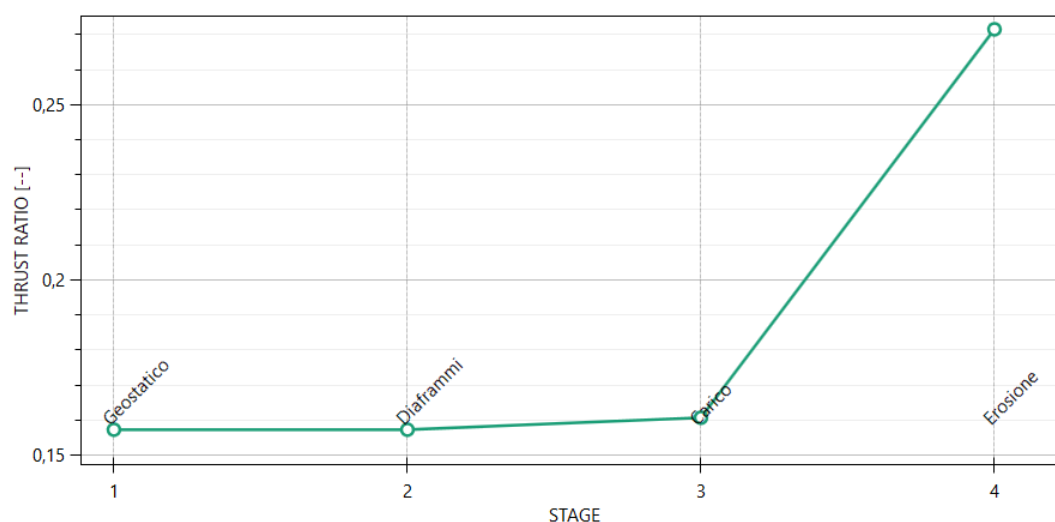


Figura 8-12 Combinazione A2+M2+R1 – Mobilitazione della spinta passiva a valle del diaframma in c.a.

### 8.4.4 Deformazioni SLE

La seguente figura illustra le deformate del diaframma in c.a. per le varie fasi di calcolo allo SLE.

Il massimo spostamento orizzontale, relativo alla fase in cui viene simulata l'erosione del rilevato lato fiume, risulta essere in corrispondenza della testa del diaframma con un valore pari a circa 17 mm. Le deformazioni attese sono compatibili con la funzionalità dell'opera.

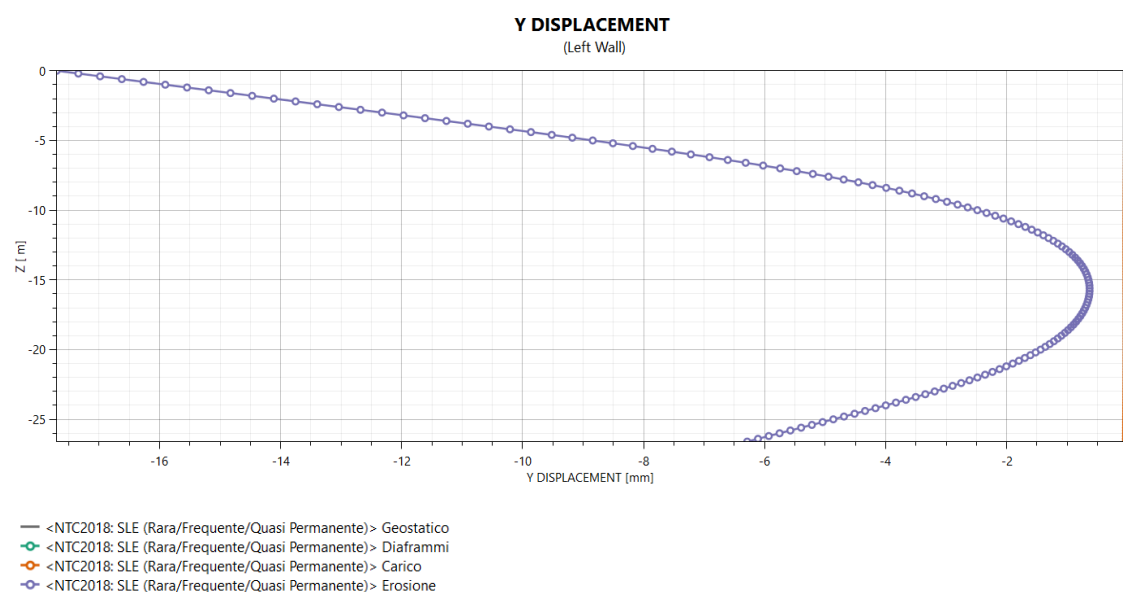


Figura 8-13 Combinazione SLE – Spostamento orizzontale del diaframma in c.a.



## SCHEMA N. 16 CAORSO (PC) – PROGETTO DIAFRAMMATURE

Codice elaborato: PE.0.1.6.PRG.GE.R.T.0.0.1.B

Titolo elaborato: Relazione Calcolo

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## 8.5 Giudizio di accettabilità dei risultati

In accordo con le indicazioni contenute nel capitolo 10 delle NTC 2018, è stata eseguita una valutazione comparativa finalizzata alla conferma dell'accettabilità dei risultati del modello numerico, confrontando le spinte definite in condizioni di equilibrio limite dal software con valutazione analitica per la sezione in esame.

Il software di calcolo fornisce un riepilogo di calcolo di valutazione delle spinte in condizione attiva e passiva e il relativo rapporto rispetto all'aliquota effettivamente mobilitata; come di seguito illustrato, in condizioni nominali, in spinta attiva è prevista la mobilitazione della minima spinta ammissibile pari a 2200 kN/m, mentre in condizione passiva, può mobilitarsi la massima spinta pari a 13670 kN/m.



Figura 8-14 Riepilogo spinte ottenute dal software di calcolo in condizioni nominali

Si riportano a seguire la valutazione svolta analiticamente per la definizione della spinta attiva e passiva mobilitabili per il caso in esame.

**SCHEDA N. 16 CAORSO (PC) – PROGETTO DIAFRAMMATURE**

Codice elaborato: **PE.0.1.6.PR.GE.R.T.0.0.1.B**

Titolo elaborato: **Relazione Calcolo**

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STRATIGRAFIA DI PROGETTO LATO VALLE							
	Spessore	$V_{DRY}$	$V_{SAT}$	$c_u$	$c'$	$\phi'$	$k_p$
	[m]	[kN/mc]	[kN/mc]	[kPa]	[kPa]	[°]	[#]
Sabbia/Ghiaia UG3	2.6	20	21		0	34	5.504
Sabbia/Ghiaia UG4	16	20	21		0	36	6.289
Argilla UG5	3	20	21	65			

CONFRONTO SPINTE PASSIVE						
	$z$	$\sigma_v$	$u_w$	$\sigma'_v$	$\sigma'_h$	$S_p$
	[m]	[kPa]	[kPa]	[kPa]	[kPa]	[kN/m]
UG3	0	0	0	0	0	205
	2.6	55	26	29	157	
UG4	2.6	55	26	29	157	11553
	18.6	391	186	205	1287	
UG5	18.6	391			521	1656
	21.6	454			584	
RISULTANTE SPINTA PASSIVA ANALITICA [kN/m]						13414
RISULTANTE SPINTA PASSIVA PARATIE PLUS [kN/m]						13670
RAPPORTO SPINTE $P_{PLUS}/P_{AN}$						1.02

STRATIGRAFIA DI PROGETTO LATO MONTE							
	Spessore	$V_{DRY}$	$V_{SAT}$	$c_u$	$c'$	$\phi'$	$k_a$
	[m]	[kN/mc]	[kN/mc]	[kPa]	[kPa]	[°]	[#]
Terreno rilevato UG1		19.5	20.5		12.5	26	0.361
Argilla UG2	5	19.5	20.5	65			
Sabbia/Ghiaia UG3	2.6	20	21		0	34	0.283
Sabbia/Ghiaia UG4	16	20	21		0	36	0.26
Argilla UG5	3	20	21	65			

CONFRONTO SPINTE ATTIVE						
	$z$	$\sigma_v$	$u_w$	$\sigma'_v$	$\sigma'_h$	$S_p$
	[m]	[kPa]	[kPa]	[kPa]	[kPa]	[kN/m]
UG1						
	0	0	0	0	0	
UG2	5	98	0	98	35	88
	5	98	0	98	28	
UG3	7.6	152	26	126	36	82
	7.6	152	26	126	36	
UG4	23.6	488	186	302	79	914
	23.6	488	186		358	
UG5	26.2	551	212		421	1169
RISULTANTE SPINTA ATTIVA ANALITICA [kN/m]						2253
RISULTANTE SPINTA PASSIVA PARATIE PLUS [kN/m]						2200
RAPPORTO SPINTE $P_{PLUS}/P_{AN}$						0.98

Figura 8-15 Valutazione della spinta in condizione attiva e passiva per il caso in esame

Come mostrato nella precedente tabella, i valori di spinte valutati dal modello di calcolo e analiticamente sono simili e del tutto confrontabili, per tale motivo si può affermare che i risultati del modello numerico sono affidabili.





## ***Report di Calcolo***

Nome Progetto: Diaframmi AIPO - Caorso

Autore: StAP

Jobname: Diaframmi AIPO - Caorso.pplus

Data: 08/05/2025 13:01:30

Design Section: Base Design Section

# Sommario

## Contenuto Sommario

## 1. Descrizione della Stratigrafia e degli Strati di Terreno

Tipo : POLYLINE

Punti

(-40;10)  
(40;10)  
(40;-40)  
(-40;-40)

OCR : 1

Tipo : POLYLINE

Punti

(-40;1.3)  
(40;1.3)  
(40;-40)  
(-40;-40)

OCR : 1

Tipo : POLYLINE

Punti

(-40;-5.31)  
(14.17;-5.08)  
(40;-7.39)  
(40;-40)  
(-40;-40)

OCR : 1

Tipo : POLYLINE

Punti

(-40;-7.86)  
(14.17;-7.64)  
(40;-9.93)  
(40;-40)  
(-40;-40)

OCR : 1

Tipo : POLYLINE

Punti

(-40;-23.61)  
(40;-23.99)  
(40;-40)  
(-40;-40)

OCR : 1

Strato di Terreno	Terreno	$\gamma$ dry	$\gamma$ sat	$\phi'$	$\phi$	$c'$	$S_u$	Modulo	Elastico	Eu	Evc	Eur	Ah	Avexp	Pa	Rur/Rvc	Rvc	Ku	Kvc	Kur
		kN/m <sup>3</sup>	kN/m <sup>3</sup>	°	°	kPa	kPa				kPa	kPa			kPa			kPa	kN/m <sup>3</sup>	kN/m <sup>3</sup>
1	UG1	19.5	20.5	26		12.5		Constant			15000	24000								
2	UG2	19.5	20.5	31	28	0	65	Constant		20000	15000	24000								
3	UG3	20	21	34		0		Constant			27000	43200								
4	UG4	20	21	36		0		Constant			27000	43200								
5	UG5	20	21	31	20.5	20.5	0	65	Constant		25000	20000	32000							

## 2. Descrizione Pareti

X : 0 m

Quota in alto : 0 m

Quota di fondo : -26.6 m

Muro di sinistra

Sezione : Diaframma 80cm

Area equivalente : 0.8 m

Inerzia equivalente : 0.0427 m<sup>4</sup>/m

Materiale calcestruzzo : C25/30

Tipo sezione : Solid

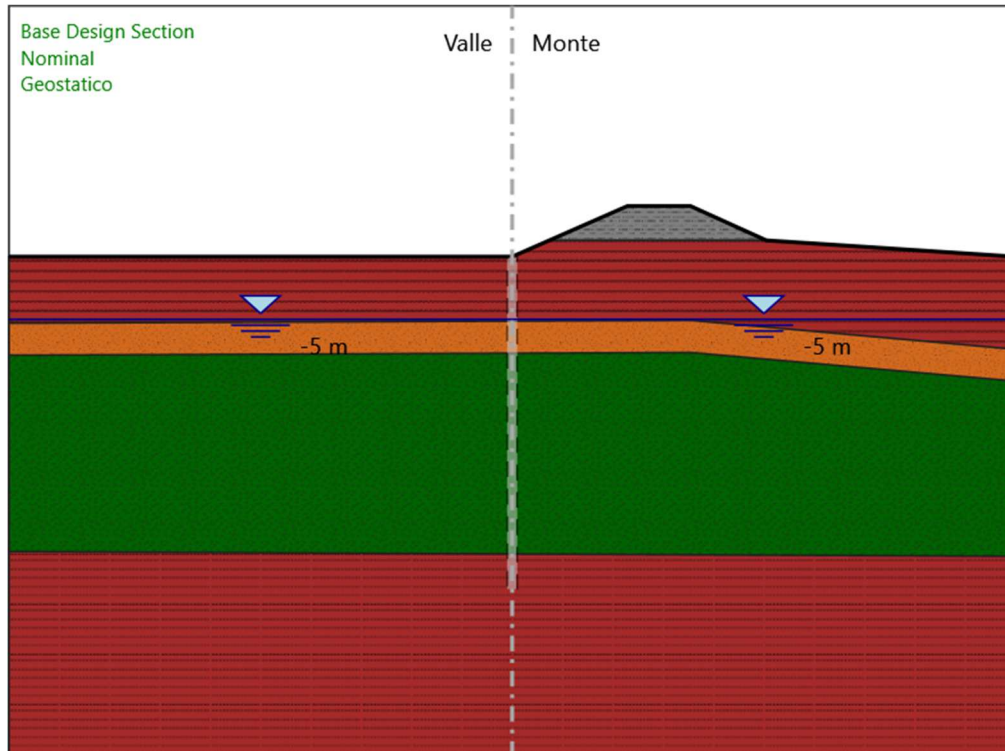
Spessore : 0.8 m

Efficacia : 1



### 3. Fasi di Calcolo

#### 3.1. Geostatico



Geostatico

Scavo

Muro di sinistra

Lato monte : 0 m

Lato valle : 0 m

Linea di scavo di sinistra (Orizzontale)

0 m

Linea di scavo di destra (Irregolare)

(0;0)

(9.16;4.04)

(14.16;4.04)

(20.19;1.3)

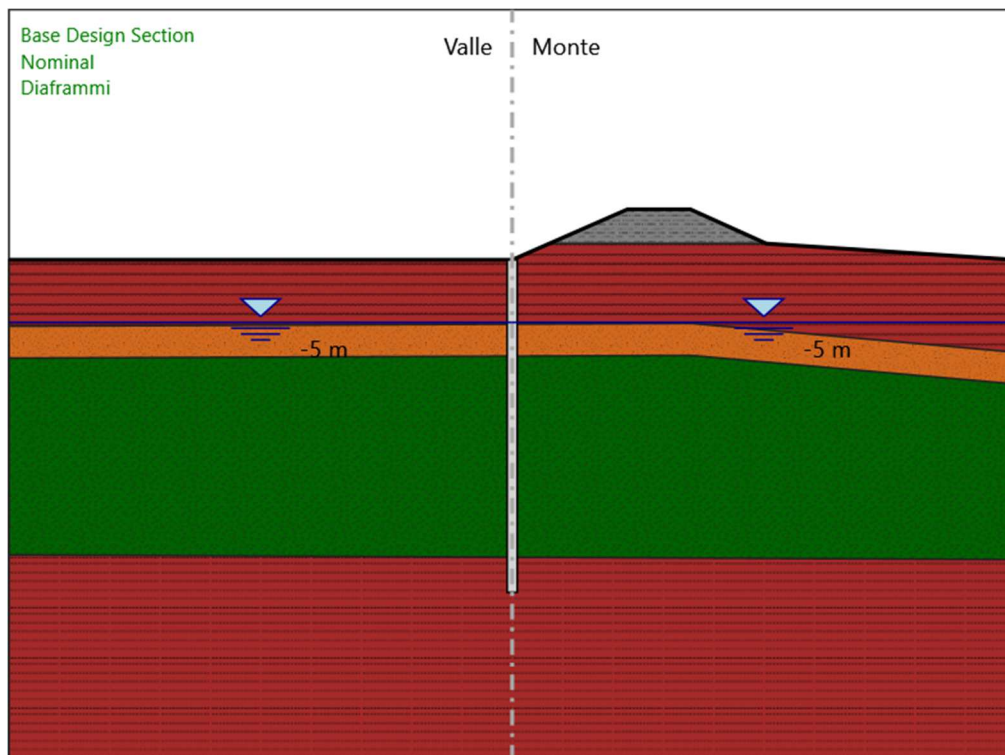
(40;0)

Falda acquifera

Falda di sinistra : -5 m

Falda di destra : -5 m

### 3.2. Diaframmi



Diaframmi

Scavo

Muro di sinistra

Lato monte : 0 m

Lato valle : 0 m

Linea di scavo di sinistra (Orizzontale)

0 m

Linea di scavo di destra (Irregolare)

(0;0)

(9.16;4.04)

(14.16;4.04)

(20.19;1.3)

(40;0)

Falda acquifera

Falda di sinistra : -5 m

Falda di destra : -5 m

Elementi strutturali

Paratia : Diaframmi

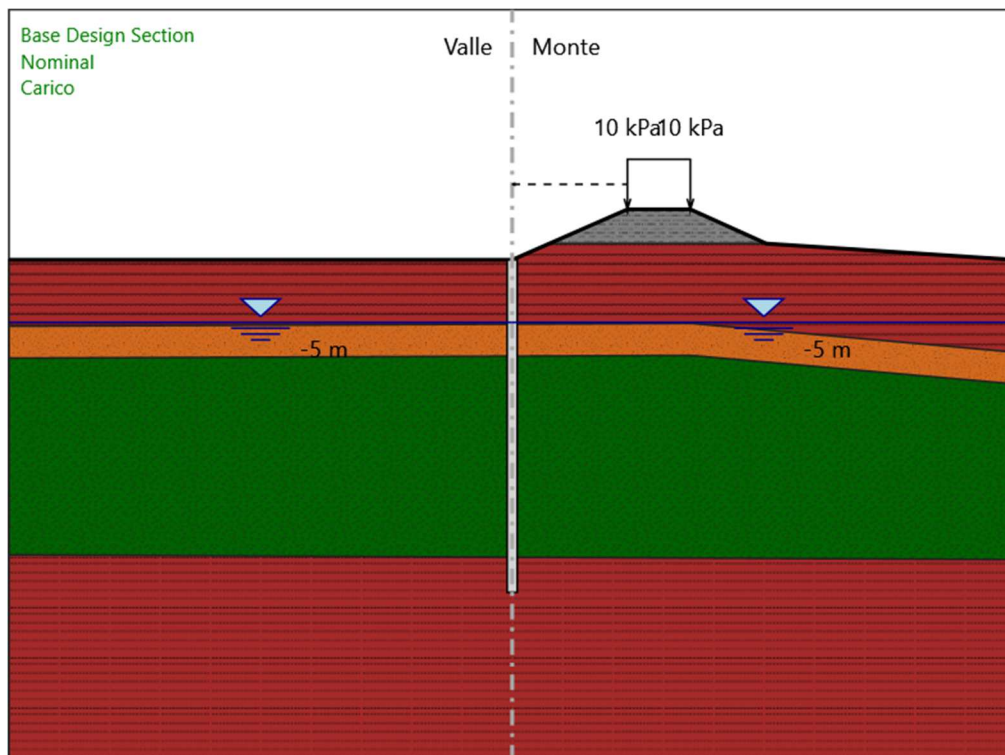
X : 0 m

Quota in alto : 0 m

Quota di fondo : -26.6 m

Sezione : Diaframma 80cm

### 3.3. Carico



Carico

Scavo

Muro di sinistra

Lato monte : 0 m

Lato valle : 0 m

Linea di scavo di sinistra (Orizzontale)

0 m

Linea di scavo di destra (Irregolare)

(0;0)

(9.16;4.04)

(14.16;4.04)

(20.19;1.3)

(40;0)

Falda acquifera

Falda di sinistra : -5 m

Falda di destra : -5 m

Carichi

Carico lineare in superficie : Carico Strada SOMMITALE

X iniziale : 9.16 m

X finale : 14.16 m

Pressione iniziale : 10 kPa

Pressione finale : 10 kPa

Elementi strutturali

Paratia : Diaframmi

X : 0 m

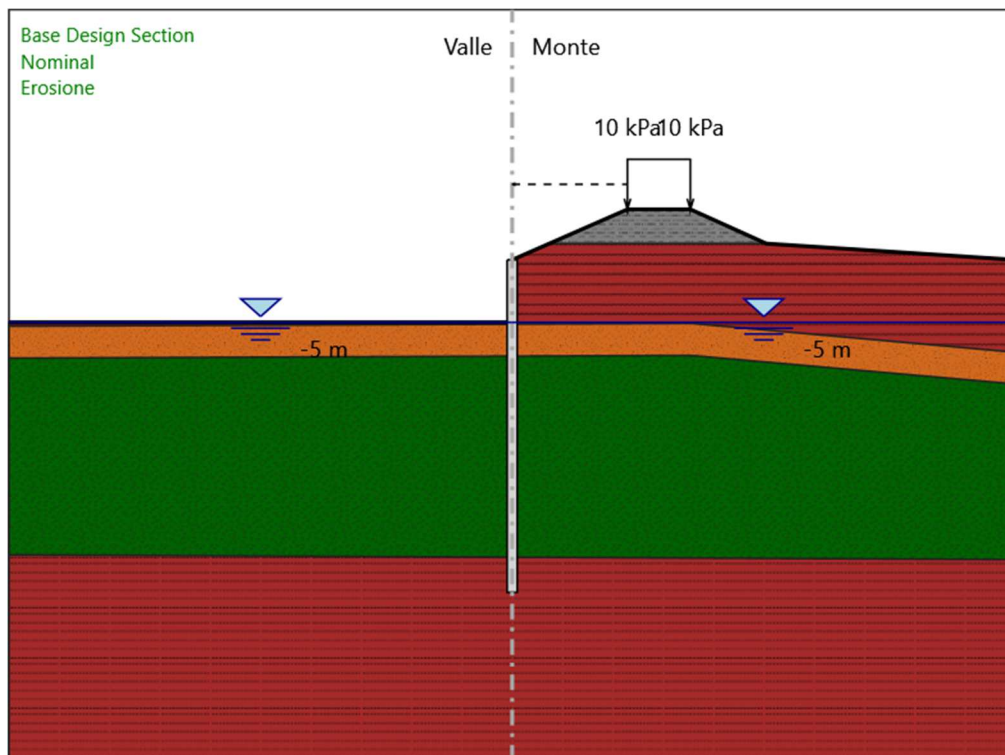
Quota in alto : 0 m

Quota di fondo : -26.6 m

Sezione : Diaframma 80cm



### 3.4. Erosione



Erosione

Scavo

Muro di sinistra

Lato monte : 0 m

Lato valle : -5 m

Linea di scavo di sinistra (Orizzontale)

-5 m

Linea di scavo di destra (Irregolare)

(0;0)

(9.16;4.04)

(14.16;4.04)

(20.19;1.3)

(40;0)

Falda acquifera

Falda di sinistra : -5 m

Falda di destra : -5 m

Carichi

Carico lineare in superficie : Carico Strada SOMMITALE

X iniziale : 9.16 m

X finale : 14.16 m

Pressione iniziale : 10 kPa

Pressione finale : 10 kPa

## Elementi strutturali

Paratia : Diaframmi

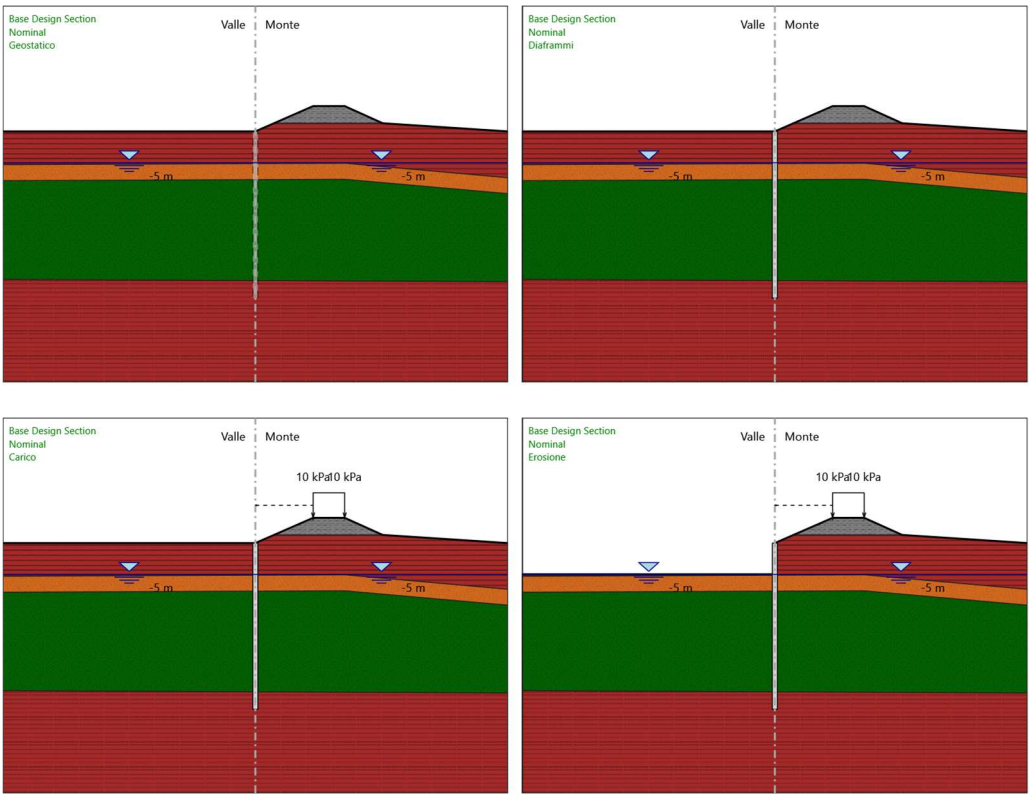
X : 0 m

Quota in alto : 0 m

Quota di fondo : -26.6 m

Sezione : Diaframma 80cm

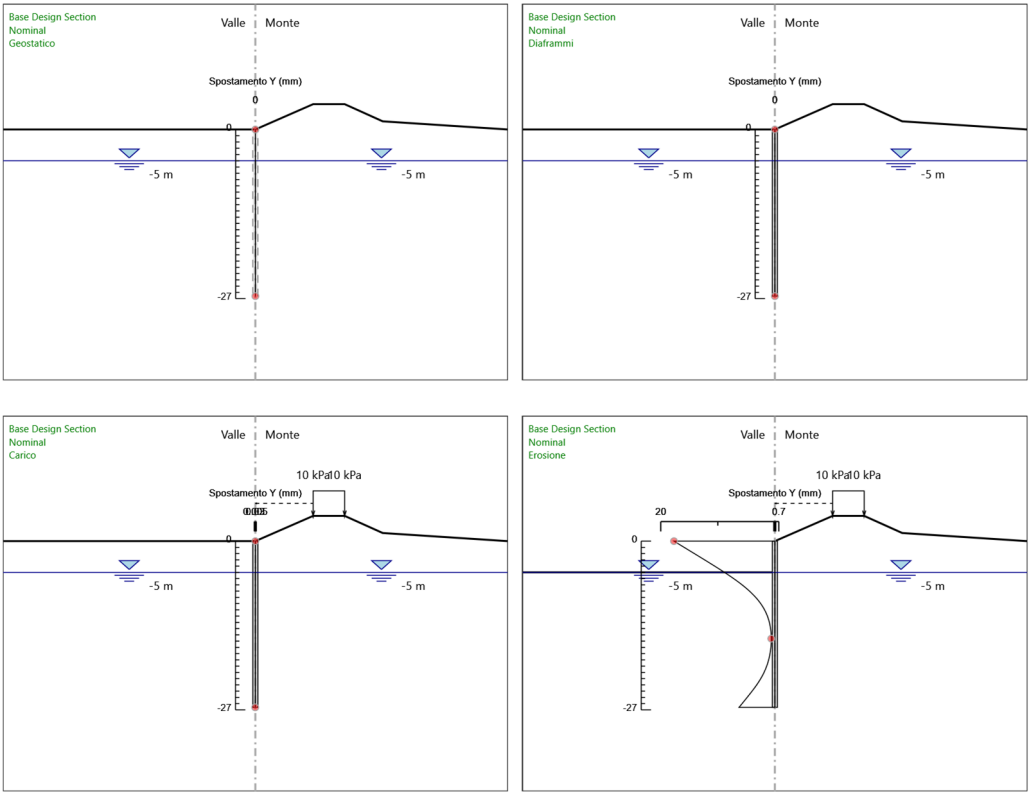
### 3.5. Tabella Configurazione Stage (Nominal)



# 4. Grafici dei Risultati

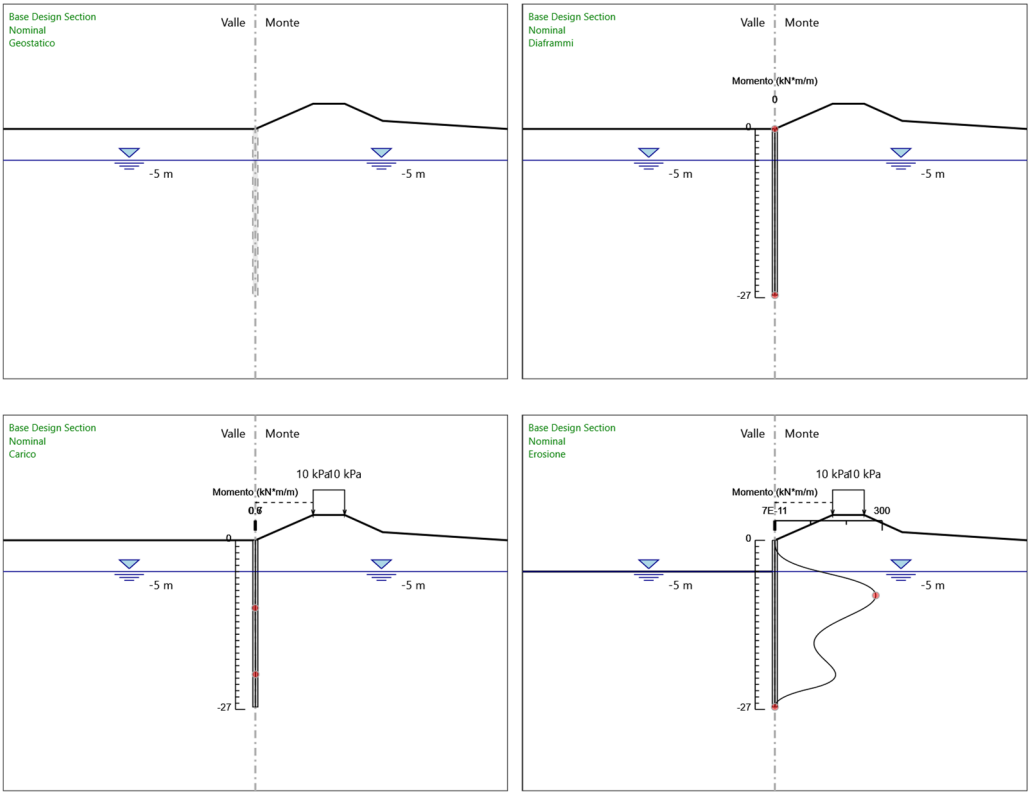
## 4.1. Design Assumption : Nominal

### 4.1.1. Grafici Spostamento in tabella

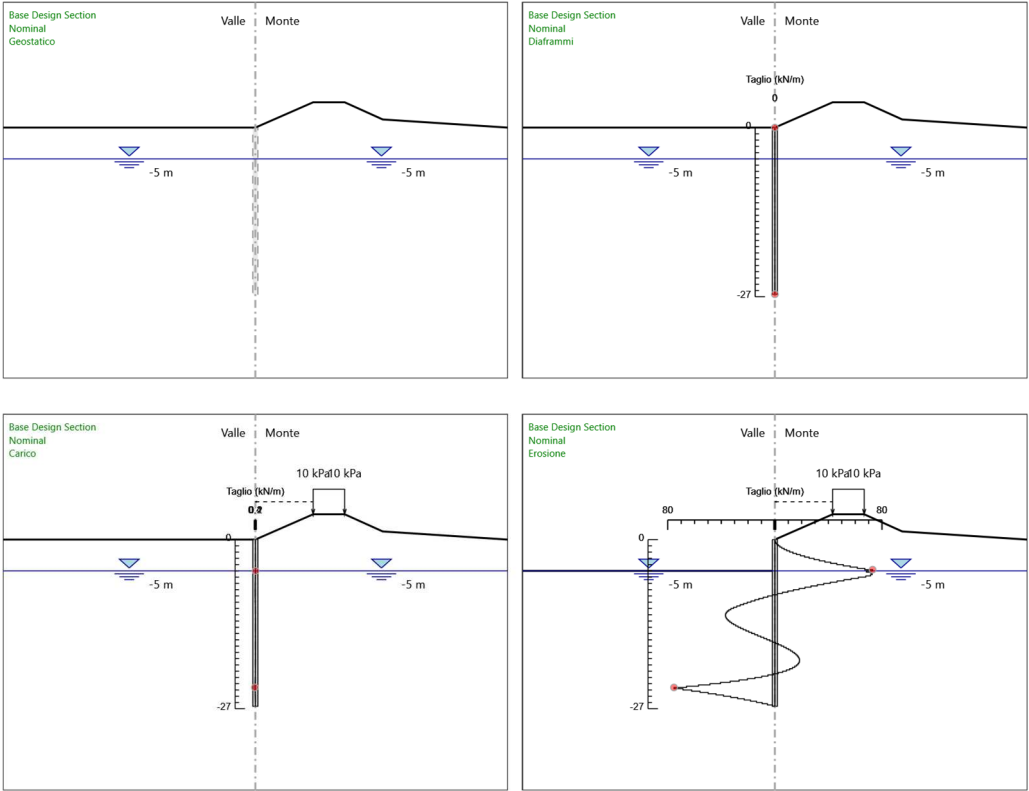


### 4.3. Risultati Paratia

#### 4.3.1. Grafico Momento Nominal



4.3.2. Grafico Taglio Nominal



#### 4.4. Riepilogo spinte

Design Assumption: Tipo Risultato: Riepilogo spinte		Muro: LEFT		Lato LEFT			
Nominal Stage	Vera effettiva (kN/m)	Pressione neutra (kN/m)	Vera Totale (kN/m)	Min ammissibile (kN/m)	Max ammissibile (kN/m)	Percentuale di resistenza massima	Vera / Attiva
Geostatico	2868	1748.4	4616.4	2188.2	25587.9	11.21%	1.31
Diaframmi	2868	1748.4	4616.4	2188.2	25587.9	11.21%	1.31
Carico	2873.1	1748.4	4621.5	2188.3	25587.9	11.23%	1.31
Erosione	2427.3	1748.4	4175.7	1350.7	13670.5	17.76%	1.8

Design Assumption: Tipo Risultato: Riepilogo spinte		Muro: LEFT		Lato RIGHT			
Nominal Stage	Vera effettiva (kN/m)	Pressione neutra (kN/m)	Vera Totale (kN/m)	Min ammissibile (kN/m)	Max ammissibile (kN/m)	Percentuale di resistenza massima	Vera / Attiva
Geostatico	2868	1748.4	4616.4	2188.2	25587.9	11.21%	1.31
Diaframmi	2868	1748.4	4616.4	2188.2	25587.9	11.21%	1.31
Carico	2873.1	1748.4	4621.5	2200.4	25760.7	11.15%	1.31
Erosione	2427.3	1748.4	4175.7	2200.4	25755.6	9.42%	1.1

## 5. Descrizione Coefficienti Design Assumption

### Coefficienti A

Nome	Carichi Per- manenti Sfavorevoli (F_dead_lo ad_unfa- vour)	Carichi Per- manenti Favorevoli (F_dead_lo ad_favour)	Carichi Va- riabili Sfa- vorevoli (F_live_loa d_unfa- vour)	Carichi Va- riabili Fa- vorevoli (F_live_loa d_favour)	Carico Si- smico (F_seism_ load)	Pres sioni Lato Mon te (F_ Wa- terD R)	Pres sioni Lato Vall e (F_ Wa- ter Res)	Carichi Perma- nenti De- stabiliz- zanti (F_UPL_G DStab)	Carichi Perma- nenti Sta- bilizzanti (F_UPL_G Stab)	Carichi Va- riabili De- stabiliz- zanti (F_UPL_Q DStab)	Carichi Perma- nenti De- stabiliz- zanti (F_HYD_G DStab)	Carichi Perma- nenti Sta- bilizzanti (F_HYD_G Stab)	Carichi Va- riabili De- stabiliz- zanti (F_HYD_Q DStab)
Simbolo	$\gamma_G$	$\gamma_G$	$\gamma_Q$	$\gamma_Q$	$\gamma_{QE}$	$\gamma_G$	$\gamma_G$	$\gamma_{Gdst}$	$\gamma_{Gstb}$	$\gamma_{Qdst}$	$\gamma_{Gdst}$	$\gamma_{Gstb}$	$\gamma_{Qdst}$
Nominal	1	1	1	1	1	1	1	1	1	1	1	1	1
NTC2018 : SLE (Rara/Fr equente /Quasi Perma- nente)	1	1	1	1	0	1	1	1	1	1	1	1	1
NTC2018 : A1+M1+ R1	1.3	1	1.5	1	0	1.3	1	1	1	1	1.3	0.9	1
NTC2018 : A2+M2+ R1	1	1	1.3	1	0	1	1	1	1	1	1.3	0.9	1

### Coefficienti M

Nome	Parziale su $\tan(\phi')$ (F_Fr)	Parziale su $c'$ (F_eff_cohe)	Parziale su Su (F_Su)	Parziale su qu (F_qu)	Parziale su peso specifico (F_gamma)
Simbolo	$\gamma_\phi$	$\gamma_c$	$\gamma_{cu}$	$\gamma_{qu}$	$\gamma_\gamma$
Nominal	1	1	1	1	1
NTC2018: SLE (Rara/Frequente/Quasi Permanente)	1	1	1	1	1
NTC2018: A1+M1+R1	1	1	1	1	1
NTC2018: A2+M2+R1	1.25	1.25	1.4	1	1

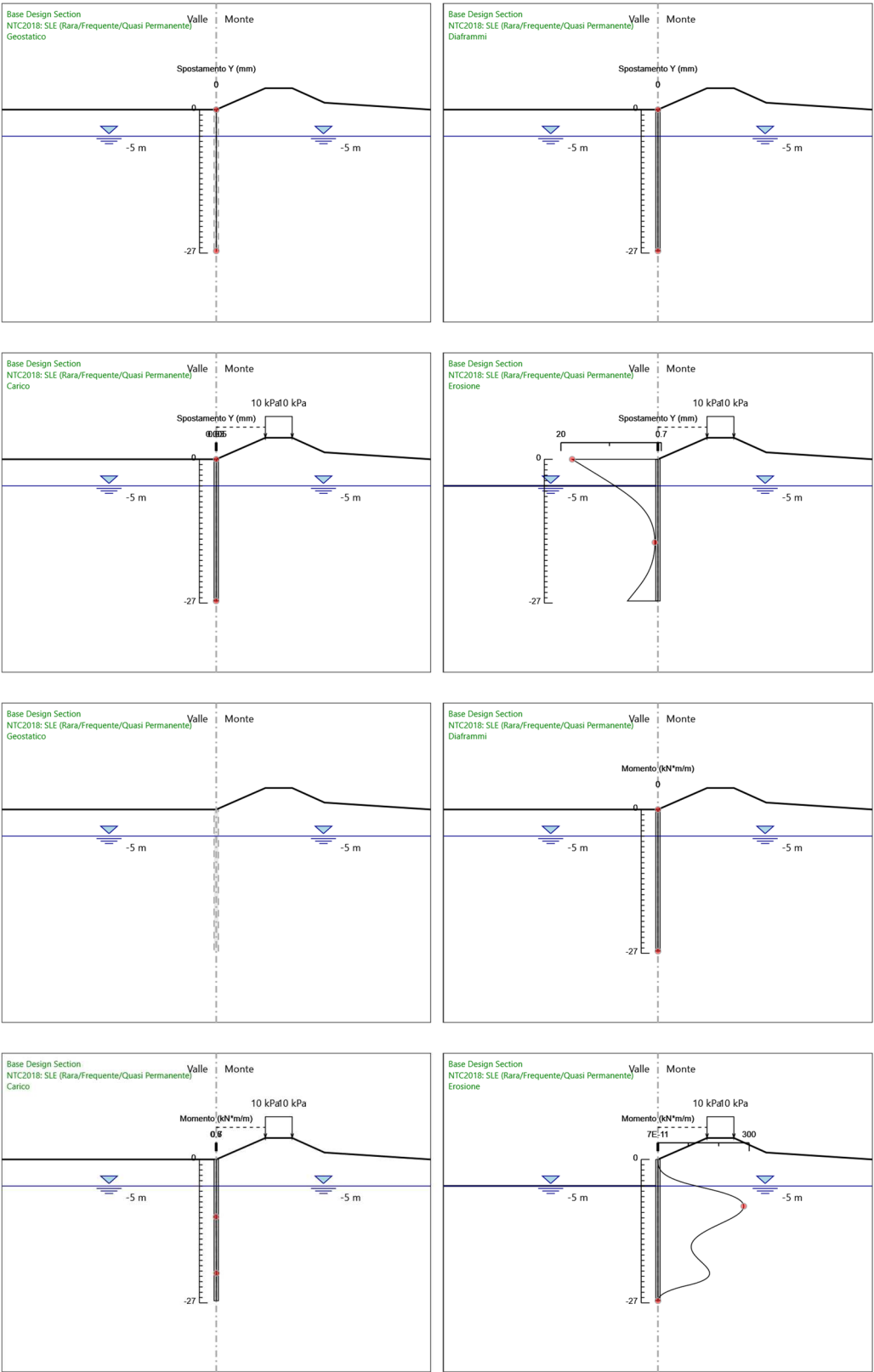
### Coefficienti R

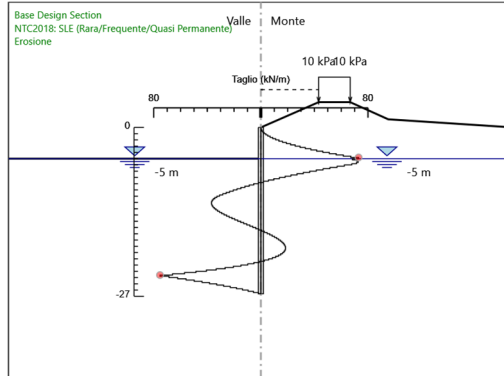
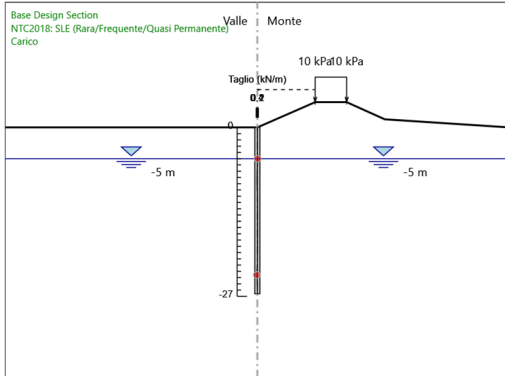
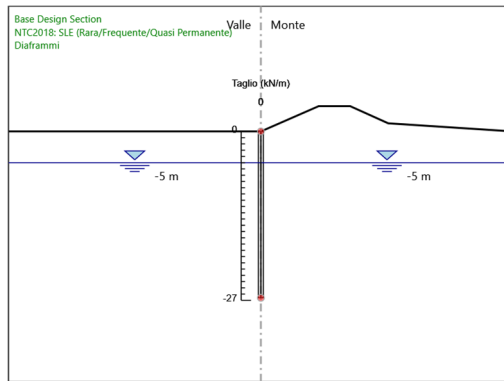
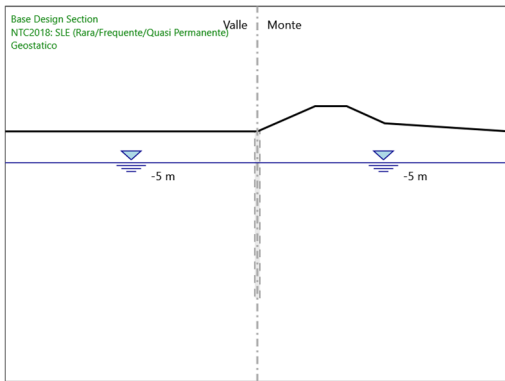
Nome	Parziale resistenza terreno (es. Kp) (F_Soil_Res_walls)	Parziale resistenza Tiranti permanenti (F_Anch_P)	Parziale resistenza Tiranti temporanei (F_Anch_T)	Parziale elementi strutturali (F_wall)
Simbolo	$\gamma_{Re}$	$\gamma_{ap}$	$\gamma_{at}$	
Nominal	1	1	1	1
NTC2018: SLE (Rara/Fre- quente/Quasi Permanente)	1	1	1	1
NTC2018: A1+M1+R1	1	1	1	1
NTC2018: A2+M2+R1	1	1.2	1.1	1



## 5.1. Risultati NTC2018: SLE (Rara/Frequente/Quasi Permanente)

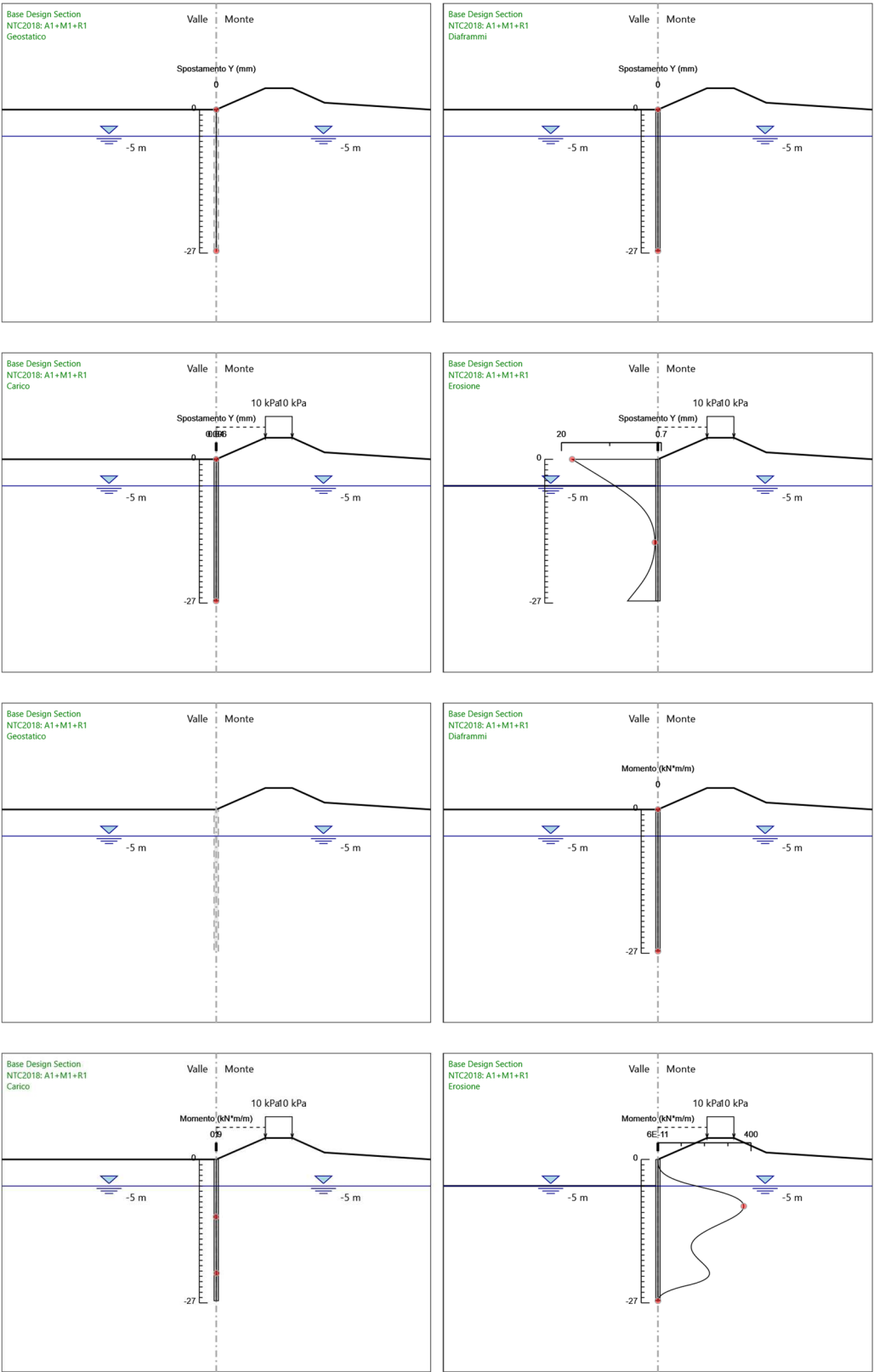
### 5.1.1. Tabella Grafici dei Risultati

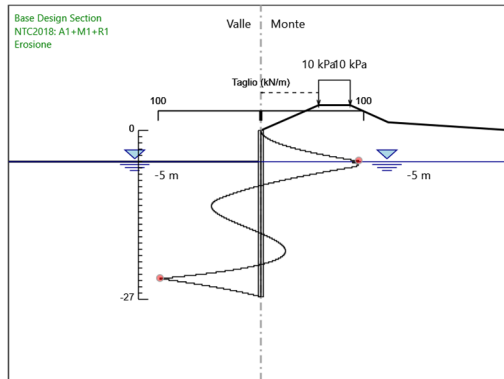
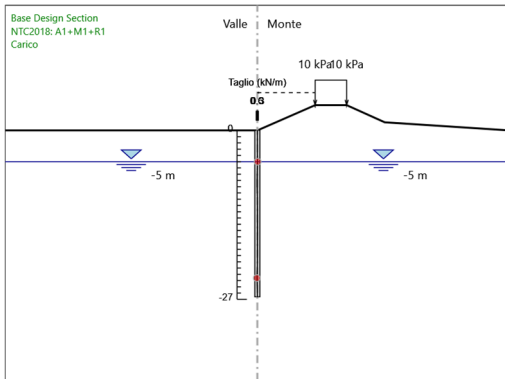
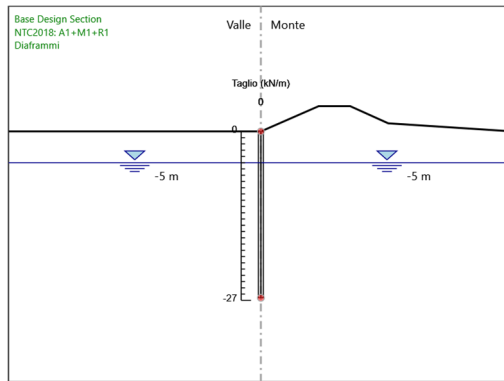
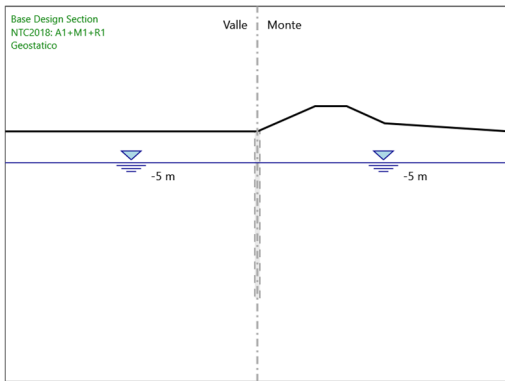




## 5.2. Risultati NTC2018: A1+M1+R1

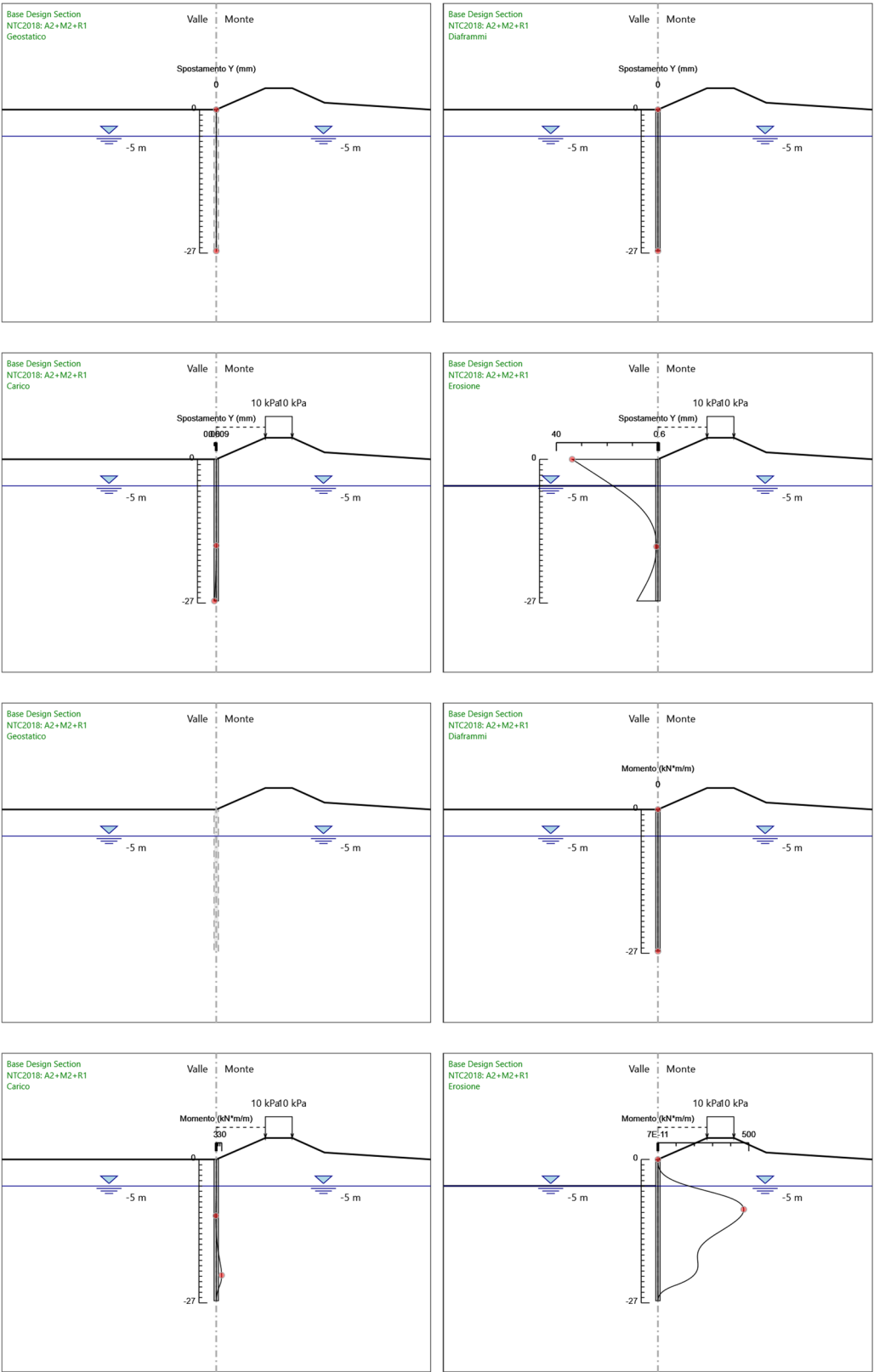
### 5.2.1. Tabella Grafici dei Risultati

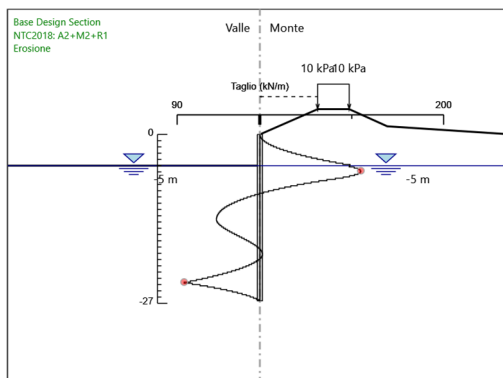
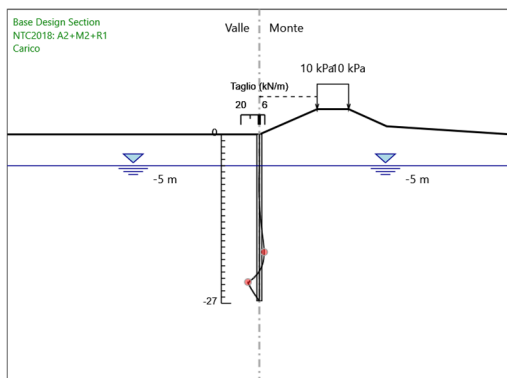
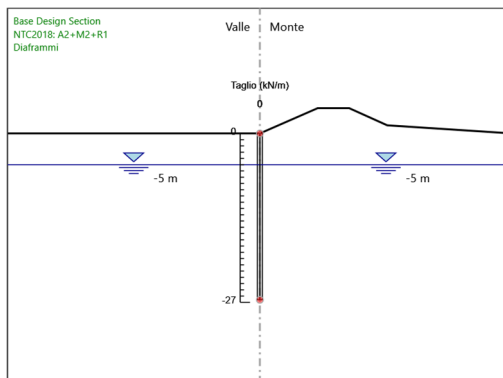
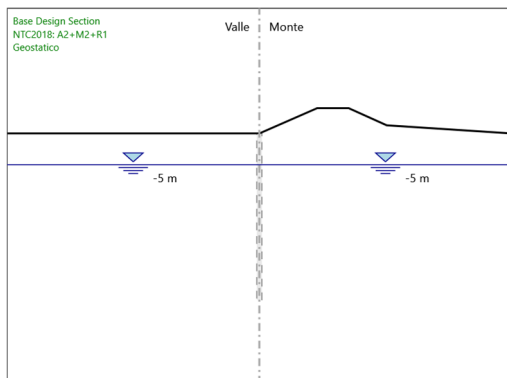




### 5.3. Risultati NTC2018: A2+M2+R1

#### 5.3.1. Tabella Grafici dei Risultati

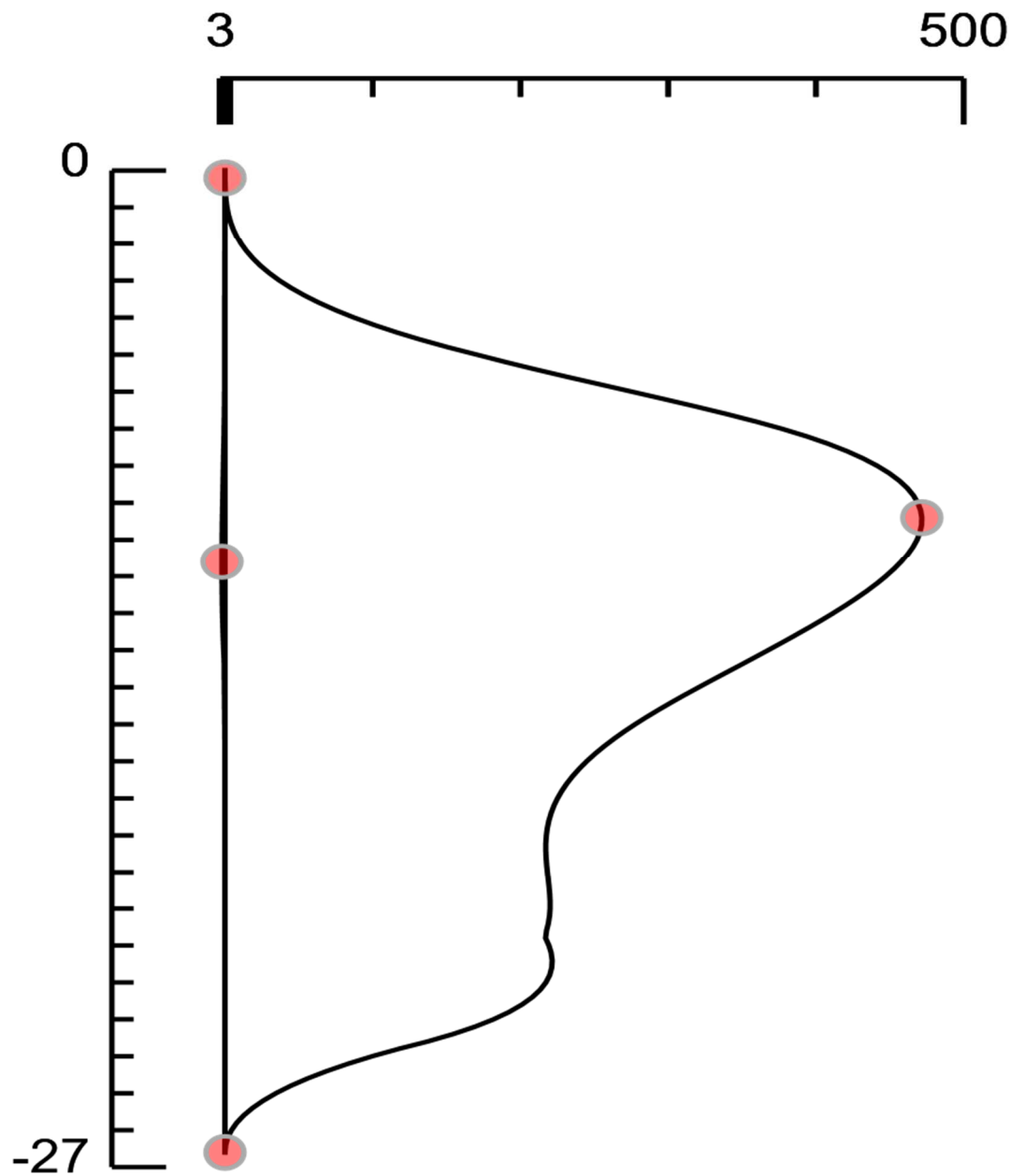




6. Descrizione sintetica dei risultati delle Design Assumption (Inviluppi)

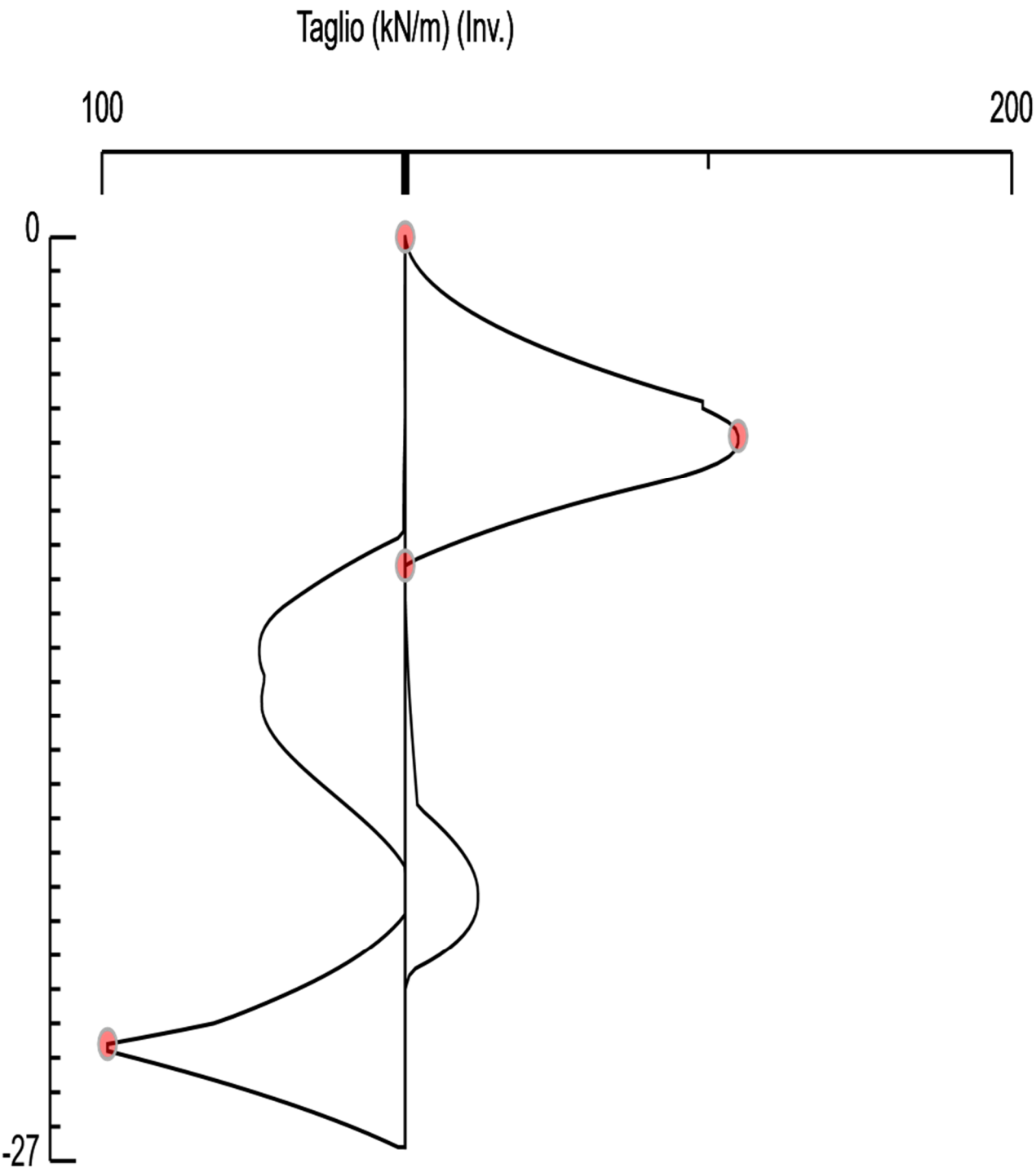
6.1. Grafico Inviluppi Momento

Momento (kN\*m/m) (Inv.)



Muro: Diaframmi  
Momento

6.2. Grafico Involuppi Taglio



Muro: Diaframmi  
Taglio



### 6.3. Inviluppo Spinta Reale Efficace / Spinta Passiva

Design Assumption	Stage	Muro	Lato	Inviluppo Spinta Reale Efficace / Spinta Passiva %
NTC2018: A2+M2+R1 Erosione Left Wall		LEFT		27.15
NTC2018: A2+M2+R1 Carico		Left Wall	RIGHT	15.93

### 6.4. Inviluppo Spinta Reale Efficace / Spinta Attiva

Design Assumption	Stage	Muro	Lato	Inviluppo Spinta Reale Efficace / Spinta Attiva %
NTC2018: A2+M2+R1 Geostatico	Left Wall	LEFT		110.8
NTC2018: A2+M2+R1 Erosione	Left Wall	RIGHT		102.2

## SEZIONE AA

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 141  
Date: 18/09/2024  
Time: 20:08:15  
Tool Version: 10.1.1.18972  
File Name: Tratto Sud Sezione AA pk 5 - BT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione AA\  
Last Solved Date: 18/09/2024  
Last Solved Time: 20:08:18

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo Argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,5766 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo Argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)



Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,14999785](#)  
Residual Water Content: [0,014999785](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	127,6371 m	46,1022 m
Point 2	126,6342 m	46,4588 m
Point 3	149,6281 m	44,6992 m
Point 4	129,6427 m	46,006 m
Point 5	122,6516 m	48,6709 m
Point 6	121,6 m	48,85 m
Point 7	125,6314 m	47,0226 m
Point 8	124,6285 m	47,6429 m
Point 9	157,4427 m	44,5766 m
Point 10	122,8958 m	39,6391 m
Point 11	122,8958 m	33,8298 m
Point 12	107,8427 m	33,8298 m
Point 13	107,8427 m	39,5768 m
Point 14	183,3495 m	37,219 m
Point 15	183,3495 m	44,5766 m
Point 16	183,3495 m	19,8837 m
Point 17	183,3495 m	32,0178 m
Point 18	116,6 m	48,85 m

Point 19	76,4922 m	44,342 m
Point 20	70,4751 m	44,1409 m
Point 21	83,5121 m	44,6648 m
Point 22	80,3647 m	44,7196 m
Point 23	183,3495 m	0 m
Point 24	65,7029 m	44,1914 m
Point 25	57,4427 m	44,265 m
Point 26	89,0419 m	44,9046 m
Point 27	111,5916 m	46,6094 m
Point 28	110,463 m	46,3361 m
Point 29	115,603 m	48,5719 m
Point 30	114,6001 m	48,1152 m
Point 31	98,3405 m	45,396 m
Point 32	94,5433 m	45,2101 m
Point 33	108,7954 m	46,138 m
Point 34	111,8875 m	44,5777 m
Point 35	107,0427 m	33,8298 m
Point 36	0 m	29 m
Point 37	2,0871 m	29,75 m
Point 38	132,6513 m	45,8694 m
Point 39	0 m	21,1069 m
Point 40	25,9936 m	39,3909 m
Point 41	30,4705 m	41,5948 m
Point 42	7,9333 m	30,5 m
Point 43	14,672 m	33,8298 m
Point 44	67,4427 m	44,1614 m
Point 45	122,9008 m	44,4048 m
Point 46	103,5679 m	45,767 m
Point 47	67,4427 m	20,9933 m
Point 48	67,4427 m	39,497 m
Point 49	33,6839 m	44,1517 m
Point 50	107,0427 m	18,2 m
Point 51	107,0427 m	20,9427 m
Point 52	114,0304 m	47,83 m
Point 53	107,8427 m	18,2 m
Point 54	107,0427 m	44,2 m
Point 55	107,0427 m	39,5768 m
Point 56	107,8427 m	20,9427 m
Point 57	107,8427 m	44,2 m



Point 58	124,2928 m	47,83 m
Point 59	147,4427 m	37,3655 m
Point 60	147,4427 m	44,803 m
Point 61	39,5928 m	44,3665 m
Point 62	147,4427 m	32,0178 m
Point 63	67,4427 m	11,2 m
Point 64	67,5679 m	44,1594 m
Point 65	147,4427 m	20,7658 m
Point 66	147,4427 m	11,2 m
Point 67	67,4427 m	33,8298 m
Point 68	135,1149 m	44,803 m
Point 69	0 m	0 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	46	33	Profilo di Piena - FIUME	5,2406 m	4,06 °
Line 2	33	28	Profilo di Piena - FIUME	1,6793 m	6,77 °
Line 3	28	27	Profilo di Piena - FIUME	1,1612 m	13,6 °
Line 4	27	52	Profilo di Piena - FIUME	2,7272 m	26,6 °
Line 5	52	30		0,6371 m	26,6 °
Line 6	30	29		1,102 m	24,5 °
Line 7	29	18		1,0351 m	15,6 °
Line 8	18	6	Drainage	5 m	0 °
Line 9	6	5	Drainage	1,0667 m	-9,67 °
Line 10	5	58	Drainage	1,8441 m	-27,1 °
Line 11	58	8		0,38432 m	-29,1 °
Line 12	8	7	Drainage	1,1792 m	-31,7 °
Line 13	7	2	Drainage	1,1504 m	-29,3 °
Line 14	2	1	Drainage	1,0644 m	-19,6 °
Line 15	1	4	Drainage	2,0079 m	-2,75 °
Line 16	4	38	Drainage	3,0117 m	-2,6 °
Line 17	38	68	Drainage	2,6845 m	-23,4 °
Line 18	68	45		12,221 m	1,87 °
Line 19	45	34		11,015 m	-0,899 °
Line 20	34	46		8,4042 m	-8,14 °
Line 21	40	41	Profilo di Piena - FIUME	4,99 m	26,2 °
Line 22	41	49	Profilo di Piena - FIUME	4,1065 m	38,5 °
Line 23	49	61	Profilo di Piena - FIUME	5,9128 m	2,08 °
Line 24	61	25	Profilo di Piena - FIUME	17,85 m	-0,326 °
Line 25	25	24	Profilo di Piena - FIUME	8,2605 m	-0,511 °

Line 26	24	44	Profilo di Piena - FIUME	1,7401 m	-0,988 °
Line 27	44	48		4,6644 m	90 °
Line 28	48	40		41,449 m	0,147 °
Line 29	44	20	Profilo di Piena - FIUME	3,0325 m	-0,387 °
Line 30	20	19	Profilo di Piena - FIUME	6,0205 m	1,91 °
Line 31	19	22	Profilo di Piena - FIUME	3,8909 m	5,57 °
Line 32	22	21	Profilo di Piena - FIUME	3,1479 m	-0,997 °
Line 33	21	26	Profilo di Piena - FIUME	5,535 m	2,48 °
Line 34	26	32	Profilo di Piena - FIUME	5,5099 m	3,18 °
Line 35	32	31	Profilo di Piena - FIUME	3,8017 m	2,8 °
Line 36	31	46	Profilo di Piena - FIUME	5,2405 m	4,06 °
Line 37	68	60	Zero Pressure	12,328 m	0 °
Line 38	60	59		7,4375 m	90 °
Line 39	59	10		24,652 m	-5,29 °
Line 40	10	13		15,053 m	0,237 °
Line 41	13	57		4,6232 m	90 °
Line 42	57	54		0,8 m	0 °
Line 43	54	55		4,6232 m	90 °
Line 44	55	48		39,6 m	0,115 °
Line 45	60	3	Zero Pressure	2,1879 m	-2,72 °
Line 46	3	9	Zero Pressure	7,8156 m	-0,899 °
Line 47	9	15	Zero Pressure	25,907 m	0 °
Line 48	15	14	BC - Lato DX	7,3576 m	90 °
Line 49	14	59		35,907 m	-0,234 °
Line 50	17	14	BC - Lato DX	5,2012 m	90 °
Line 51	59	62		5,3477 m	90 °
Line 52	62	17		35,907 m	0 °
Line 53	12	13		5,747 m	90 °
Line 54	62	11		24,614 m	-4,22 °
Line 55	11	12		15,053 m	0 °
Line 56	43	40	Profilo di Piena - FIUME	12,614 m	26,2 °
Line 57	48	67		5,6672 m	90 °
Line 58	67	43		52,771 m	0 °
Line 59	55	35		5,747 m	90 °
Line 60	35	67		39,6 m	0 °
Line 61	65	62		11,252 m	90 °
Line 62	17	16	BC - Lato DX	12,134 m	90 °
Line 63	16	65		35,918 m	-1,41 °
Line 64	56	65		39,6 m	-0,256 °

Line 65	67	47		12,836 m	90 °
Line 66	47	51		39,6 m	-0,0732 °
Line 67	39	36	BC - Lato SX	7,8931 m	90 °
Line 68	36	37	Profilo di Piena - FIUME	2,2178 m	19,8 °
Line 69	37	42	Profilo di Piena - FIUME	5,8941 m	7,31 °
Line 70	42	43	Profilo di Piena - FIUME	7,5165 m	26,3 °
Line 71	47	39		67,443 m	-0,0965 °
Line 72	69	39	BC - Lato SX	21,107 m	90 °
Line 73	47	63		9,7933 m	90 °
Line 74	63	66		80 m	0 °
Line 75	66	65		9,5658 m	90 °
Line 76	16	23	BC - Lato DX	19,884 m	90 °
Line 77	23	69		183,35 m	0 °
Line 78	51	50		2,7427 m	90 °
Line 79	50	53		0,8 m	0 °
Line 80	53	56		2,7427 m	90 °
Line 81	51	56		0,8 m	0 °
Line 82	35	12		0,8 m	0 °
Line 83	55	13		0,8 m	0 °
Line 84	51	35		12,887 m	90 °
Line 85	12	56		12,887 m	90 °

## Regions

	Material	Points	Area
Region 1	UG1 - Misto	46;33;28;27;52;30;29;18;6;5;58;8;7;2;1;4;38;68;45;34	72,462 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	40;41;49;61;25;24;44;48	178,88 m <sup>2</sup>
Region 3	UG2 - Limo Argilloso	48;44;20;19;22;21;26;32;31;46;34;45;68;60;59;10;13;57;54;55	439,6 m <sup>2</sup>
Region 4	UG2 - Limo Argilloso	59;60;3;9;15;14	262,42 m <sup>2</sup>
Region 5	UG3 - Sabbia Limo Ghiaiosa	17;14;59;62	189,39 m <sup>2</sup>
Region 6	UG3 - Sabbia Limo Ghiaiosa	12;13;10;59;62;11	223,91 m <sup>2</sup>

Region 7	UG3 - Sabbia Limo Ghiaiosa	43;40;48;67	264,18 m <sup>2</sup>
Region 8	UG3 - Sabbia Limo Ghiaiosa	67;48;55;35	226 m <sup>2</sup>
Region 9	UG4 - Sabbia Ghiaiosa	65;62;17;16	419,86 m <sup>2</sup>
Region 10	UG4 - Sabbia Ghiaiosa	56;65;62;11;12	491,59 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	51;35;67;47	509,33 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	39;36;37;42;43;67;47	819,72 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	69;39;47;63;66;65;16;23	3.045,5 m <sup>2</sup>
Region 14	UG5 - Argilla Limosa	63;47;51;50;53;56;65;66	774,72 m <sup>2</sup>
Region 15	Diaframma	50;51;56;53	2,1942 m <sup>2</sup>
Region 16	Diaframma	12;35;51;56	10,31 m <sup>2</sup>
Region 17	Diaframma	35;55;13;12	4,5976 m <sup>2</sup>
Region 18	Diaframma	55;54;57;13	3,6986 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 149  
Date: 18/09/2024  
Time: 20:08:22  
Tool Version: 10.1.1.18972  
File Name: Tratto Sud Sezione AA pk 5 - BT SLV.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione AA\  
Last Solved Date: 18/09/2024  
Last Solved Time: 20:12:26

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo Argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,5766 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 46,44 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 46,44 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo Argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %



Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	127,6371 m	46,1022 m
Point 2	126,6342 m	46,4588 m
Point 3	149,6281 m	44,6992 m
Point 4	129,6427 m	46,006 m
Point 5	122,6516 m	48,6709 m
Point 6	121,6 m	48,85 m
Point 7	125,6314 m	47,0226 m
Point 8	124,6285 m	47,6429 m
Point 9	157,4427 m	44,5766 m
Point 10	122,8958 m	39,6391 m
Point 11	122,8958 m	33,8298 m
Point 12	107,8427 m	33,8298 m
Point 13	107,8427 m	39,5768 m
Point 14	183,3495 m	37,219 m
Point 15	183,3495 m	44,5766 m
Point 16	183,3495 m	19,8837 m
Point 17	183,3495 m	32,0178 m
Point 18	116,6 m	48,85 m



Point 19	76,4922 m	44,342 m
Point 20	70,4751 m	44,1409 m
Point 21	83,5121 m	44,6648 m
Point 22	80,3647 m	44,7196 m
Point 23	183,3495 m	0 m
Point 24	65,7029 m	44,1914 m
Point 25	57,4427 m	44,265 m
Point 26	89,0419 m	44,9046 m
Point 27	111,5916 m	46,6094 m
Point 28	110,463 m	46,3361 m
Point 29	115,603 m	48,5719 m
Point 30	114,6001 m	48,1152 m
Point 31	98,3405 m	45,396 m
Point 32	94,5433 m	45,2101 m
Point 33	108,7954 m	46,138 m
Point 34	111,8875 m	44,5777 m
Point 35	107,0427 m	33,8298 m
Point 36	0 m	29 m
Point 37	2,0871 m	29,75 m
Point 38	132,6513 m	45,8694 m
Point 39	0 m	21,1069 m
Point 40	25,9936 m	39,3909 m
Point 41	30,4705 m	41,5948 m
Point 42	7,9333 m	30,5 m
Point 43	14,672 m	33,8298 m
Point 44	67,4427 m	44,1614 m
Point 45	122,9008 m	44,4048 m
Point 46	103,5679 m	45,767 m
Point 47	67,4427 m	20,9933 m
Point 48	67,4427 m	39,497 m
Point 49	33,6839 m	44,1517 m
Point 50	107,0427 m	18,2 m
Point 51	107,0427 m	20,9427 m
Point 52	114,0304 m	47,83 m
Point 53	107,8427 m	18,2 m
Point 54	107,0427 m	44,2 m
Point 55	107,0427 m	39,5768 m
Point 56	107,8427 m	20,9427 m
Point 57	107,8427 m	44,2 m

Point 58	124,2928 m	47,83 m
Point 59	147,4427 m	37,3655 m
Point 60	147,4427 m	44,803 m
Point 61	39,5928 m	44,3665 m
Point 62	147,4427 m	32,0178 m
Point 63	67,4427 m	11,2 m
Point 64	67,5679 m	44,1594 m
Point 65	147,4427 m	20,7658 m
Point 66	147,4427 m	11,2 m
Point 67	67,4427 m	33,8298 m
Point 68	135,1149 m	44,803 m
Point 69	0 m	0 m
Point 70	110,9 m	46,44 m

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	68	45	12,221 m	1,87 °	
Line 2	45	34	11,015 m	-0,899 °	
Line 3	34	46	8,4042 m	-8,14 °	
Line 4	40	41	4,99 m	26,2 °	Profilo di Piena - FIUME
Line 5	41	49	4,1065 m	38,5 °	Profilo di Piena - FIUME
Line 6	49	61	5,9128 m	2,08 °	Profilo di Piena - FIUME
Line 7	61	25	17,85 m	-0,326 °	Profilo di Piena - FIUME
Line 8	25	24	8,2605 m	-0,511 °	Profilo di Piena - FIUME
Line 9	24	44	1,7401 m	-0,988 °	Profilo di Piena - FIUME
Line 10	44	48	4,6644 m	90 °	
Line 11	48	40	41,449 m	0,147 °	
Line 12	44	20	3,0325 m	-0,387 °	Profilo di Piena - FIUME
Line 13	20	19	6,0205 m	1,91 °	Profilo di Piena - FIUME
Line 14	19	22	3,8909 m	5,57 °	Profilo di Piena - FIUME
Line 15	22	21	3,1479 m	-0,997 °	Profilo di Piena - FIUME
Line 16	21	26	5,535 m	2,48 °	Profilo di Piena - FIUME
Line 17	26	32	5,5099 m	3,18 °	Profilo di Piena - FIUME
Line 18	32	31	3,8017 m	2,8 °	Profilo di Piena - FIUME
Line 19	31	46	5,2405 m	4,06 °	Profilo di Piena - FIUME
Line 20	68	60	12,328 m	0 °	Zero Pressure
Line 21	60	59	7,4375 m	90 °	
Line 22	59	10	24,652 m	-5,29 °	
Line 23	10	13	15,053 m	0,237 °	
Line 24	13	57	4,6232 m	90 °	

Line 25	57	54	0,8 m	0 °	
Line 26	54	55	4,6232 m	90 °	
Line 27	55	48	39,6 m	0,115 °	
Line 28	60	3	2,1879 m	-2,72 °	Zero Pressure
Line 29	3	9	7,8156 m	-0,899 °	Zero Pressure
Line 30	9	15	25,907 m	0 °	Zero Pressure
Line 31	15	14	7,3576 m	90 °	BC - Lato DX
Line 32	14	59	35,907 m	-0,234 °	
Line 33	17	14	5,2012 m	90 °	BC - Lato DX
Line 34	59	62	5,3477 m	90 °	
Line 35	62	17	35,907 m	0 °	
Line 36	12	13	5,747 m	90 °	
Line 37	62	11	24,614 m	-4,22 °	
Line 38	11	12	15,053 m	0 °	
Line 39	43	40	12,614 m	26,2 °	Profilo di Piena - FIUME
Line 40	48	67	5,6672 m	90 °	
Line 41	67	43	52,771 m	0 °	
Line 42	55	35	5,747 m	90 °	
Line 43	35	67	39,6 m	0 °	
Line 44	65	62	11,252 m	90 °	
Line 45	17	16	12,134 m	90 °	BC - Lato DX
Line 46	16	65	35,918 m	-1,41 °	
Line 47	56	65	39,6 m	-0,256 °	
Line 48	67	47	12,836 m	90 °	
Line 49	47	51	39,6 m	-0,0732 °	
Line 50	39	36	7,8931 m	90 °	BC - Lato SX
Line 51	36	37	2,2178 m	19,8 °	Profilo di Piena - FIUME
Line 52	37	42	5,8941 m	7,31 °	Profilo di Piena - FIUME
Line 53	42	43	7,5165 m	26,3 °	Profilo di Piena - FIUME
Line 54	47	39	67,443 m	-0,0965 °	
Line 55	69	39	21,107 m	90 °	BC - Lato SX
Line 56	47	63	9,7933 m	90 °	
Line 57	63	66	80 m	0 °	
Line 58	66	65	9,5658 m	90 °	
Line 59	16	23	19,884 m	90 °	BC - Lato DX
Line 60	23	69	183,35 m	0 °	
Line 61	51	50	2,7427 m	90 °	
Line 62	50	53	0,8 m	0 °	
Line 63	53	56	2,7427 m	90 °	

Line 64	51	56	0,8 m	0 °	
Line 65	35	12	0,8 m	0 °	
Line 66	55	13	0,8 m	0 °	
Line 67	46	33	5,2406 m	4,06 °	Profilo di Piena - FIUME
Line 68	33	28	1,6793 m	6,77 °	Profilo di Piena - FIUME
Line 69	28	70	0,44918 m	13,4 °	Profilo di Piena - FIUME
Line 70	70	27	0,71204 m	13,8 °	
Line 71	27	52	2,7272 m	26,6 °	
Line 72	52	30	0,6371 m	26,6 °	
Line 73	30	29	1,102 m	24,5 °	
Line 74	29	18	1,0351 m	15,6 °	
Line 75	18	6	5 m	0 °	Drainage
Line 76	6	5	1,0667 m	-9,67 °	Drainage
Line 77	5	58	1,8441 m	-27,1 °	Drainage
Line 78	58	8	0,38432 m	-29,1 °	
Line 79	8	7	1,1792 m	-31,7 °	Drainage
Line 80	7	2	1,1504 m	-29,3 °	Drainage
Line 81	2	1	1,0644 m	-19,6 °	Drainage
Line 82	1	4	2,0079 m	-2,75 °	Drainage
Line 83	4	38	3,0117 m	-2,6 °	Drainage
Line 84	38	68	2,6845 m	-23,4 °	Drainage
Line 85	51	35	12,887 m	90 °	
Line 86	12	56	12,887 m	90 °	

## Regions

	Material	Points	Area
Region 1	UG2 - Limo Argilloso	40;41;49;61;25;24;44;48	178,88 m²
Region 2	UG2 - Limo Argilloso	48;44;20;19;22;21;26;32;31;46;34;45;68;60;59;10;13;57;54;55	439,6 m²
Region 3	UG2 - Limo Argilloso	59;60;3;9;15;14	262,42 m²
Region 4	UG3 - Sabbia Limo Ghiaiosa	17;14;59;62	189,39 m²
Region 5	UG3 - Sabbia Limo Ghiaiosa	12;13;10;59;62;11	223,91 m²

Region 6	UG3 - Sabbia Limo Ghiaiosa	43;40;48;67	264,18 m <sup>2</sup>
Region 7	UG3 - Sabbia Limo Ghiaiosa	67;48;55;35	226 m <sup>2</sup>
Region 8	UG4 - Sabbia Ghiaiosa	65;62;17;16	419,86 m <sup>2</sup>
Region 9	UG4 - Sabbia Ghiaiosa	56;65;62;11;12	491,59 m <sup>2</sup>
Region 10	UG4 - Sabbia Ghiaiosa	51;35;67;47	509,33 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	39;36;37;42;43;67;47	819,72 m <sup>2</sup>
Region 12	UG5 - Argilla Limosa	69;39;47;63;66;65;16;23	3.045,5 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	63;47;51;50;53;56;65;66	774,72 m <sup>2</sup>
Region 14	Diaframma	50;51;56;53	2,1942 m <sup>2</sup>
Region 15	Diaframma	12;35;51;56	10,31 m <sup>2</sup>
Region 16	Diaframma	35;55;13;12	4,5976 m <sup>2</sup>
Region 17	Diaframma	55;54;57;13	3,6986 m <sup>2</sup>
Region 18	UG1 - Misto	46;33;28;70;27;52;30;29;18;6;5;58;8;7;2;1;4;38;68;45;34	72,461 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 142  
Date: 18/09/2024  
Time: 20:08:27  
Tool Version: 10.1.1.18972  
File Name: Tratto Sud Sezione AA pk 5 - LT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione AA\  
Last Solved Date: 18/09/2024  
Last Solved Time: 20:12:26

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo Argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,5766 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)



Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo Argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)



Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,14999785](#)  
Residual Water Content: [0,014999785](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)



Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	127,6371 m	46,1022 m
Point 2	126,6342 m	46,4588 m
Point 3	149,6281 m	44,6992 m
Point 4	129,6427 m	46,006 m
Point 5	122,6516 m	48,6709 m
Point 6	121,6 m	48,85 m
Point 7	125,6314 m	47,0226 m
Point 8	124,6285 m	47,6429 m
Point 9	157,4427 m	44,5766 m
Point 10	122,8958 m	39,6391 m
Point 11	122,8958 m	33,8298 m
Point 12	107,8427 m	33,8298 m
Point 13	107,8427 m	39,5768 m
Point 14	183,3495 m	37,219 m
Point 15	183,3495 m	44,5766 m
Point 16	183,3495 m	19,8837 m
Point 17	183,3495 m	32,0178 m
Point 18	116,6 m	48,85 m

Point 19	76,4922 m	44,342 m
Point 20	70,4751 m	44,1409 m
Point 21	83,5121 m	44,6648 m
Point 22	80,3647 m	44,7196 m
Point 23	183,3495 m	0 m
Point 24	65,7029 m	44,1914 m
Point 25	57,4427 m	44,265 m
Point 26	89,0419 m	44,9046 m
Point 27	111,5916 m	46,6094 m
Point 28	110,463 m	46,3361 m
Point 29	115,603 m	48,5719 m
Point 30	114,6001 m	48,1152 m
Point 31	98,3405 m	45,396 m
Point 32	94,5433 m	45,2101 m
Point 33	108,7954 m	46,138 m
Point 34	111,8875 m	44,5777 m
Point 35	107,0427 m	33,8298 m
Point 36	0 m	29 m
Point 37	2,0871 m	29,75 m
Point 38	132,6513 m	45,8694 m
Point 39	0 m	21,1069 m
Point 40	25,9936 m	39,3909 m
Point 41	30,4705 m	41,5948 m
Point 42	7,9333 m	30,5 m
Point 43	14,672 m	33,8298 m
Point 44	67,4427 m	44,1614 m
Point 45	122,9008 m	44,4048 m
Point 46	103,5679 m	45,767 m
Point 47	67,4427 m	20,9933 m
Point 48	67,4427 m	39,497 m
Point 49	33,6839 m	44,1517 m
Point 50	107,0427 m	18,2 m
Point 51	107,0427 m	20,9427 m
Point 52	114,0304 m	47,83 m
Point 53	107,8427 m	18,2 m
Point 54	107,0427 m	44,2 m
Point 55	107,0427 m	39,5768 m
Point 56	107,8427 m	20,9427 m
Point 57	107,8427 m	44,2 m

Point 58	124,2928 m	47,83 m
Point 59	147,4427 m	37,3655 m
Point 60	147,4427 m	44,803 m
Point 61	39,5928 m	44,3665 m
Point 62	147,4427 m	32,0178 m
Point 63	67,4427 m	11,2 m
Point 64	67,5679 m	44,1594 m
Point 65	147,4427 m	20,7658 m
Point 66	147,4427 m	11,2 m
Point 67	67,4427 m	33,8298 m
Point 68	135,1149 m	44,803 m
Point 69	0 m	0 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	46	33	Profilo di Piena - FIUME	5,2406 m	4,06 °
Line 2	33	28	Profilo di Piena - FIUME	1,6793 m	6,77 °
Line 3	28	27	Profilo di Piena - FIUME	1,1612 m	13,6 °
Line 4	27	52	Profilo di Piena - FIUME	2,7272 m	26,6 °
Line 5	52	30		0,6371 m	26,6 °
Line 6	30	29		1,102 m	24,5 °
Line 7	29	18		1,0351 m	15,6 °
Line 8	18	6	Drainage	5 m	0 °
Line 9	6	5	Drainage	1,0667 m	-9,67 °
Line 10	5	58	Drainage	1,8441 m	-27,1 °
Line 11	58	8		0,38432 m	-29,1 °
Line 12	8	7	Drainage	1,1792 m	-31,7 °
Line 13	7	2	Drainage	1,1504 m	-29,3 °
Line 14	2	1	Drainage	1,0644 m	-19,6 °
Line 15	1	4	Drainage	2,0079 m	-2,75 °
Line 16	4	38	Drainage	3,0117 m	-2,6 °
Line 17	38	68	Drainage	2,6845 m	-23,4 °
Line 18	68	45		12,221 m	1,87 °
Line 19	45	34		11,015 m	-0,899 °
Line 20	34	46		8,4042 m	-8,14 °
Line 21	40	41	Profilo di Piena - FIUME	4,99 m	26,2 °
Line 22	41	49	Profilo di Piena - FIUME	4,1065 m	38,5 °
Line 23	49	61	Profilo di Piena - FIUME	5,9128 m	2,08 °
Line 24	61	25	Profilo di Piena - FIUME	17,85 m	-0,326 °
Line 25	25	24	Profilo di Piena - FIUME	8,2605 m	-0,511 °

Line 26	24	44	Profilo di Piena - FIUME	1,7401 m	-0,988 °
Line 27	44	48		4,6644 m	90 °
Line 28	48	40		41,449 m	0,147 °
Line 29	44	20	Profilo di Piena - FIUME	3,0325 m	-0,387 °
Line 30	20	19	Profilo di Piena - FIUME	6,0205 m	1,91 °
Line 31	19	22	Profilo di Piena - FIUME	3,8909 m	5,57 °
Line 32	22	21	Profilo di Piena - FIUME	3,1479 m	-0,997 °
Line 33	21	26	Profilo di Piena - FIUME	5,535 m	2,48 °
Line 34	26	32	Profilo di Piena - FIUME	5,5099 m	3,18 °
Line 35	32	31	Profilo di Piena - FIUME	3,8017 m	2,8 °
Line 36	31	46	Profilo di Piena - FIUME	5,2405 m	4,06 °
Line 37	68	60	Zero Pressure	12,328 m	0 °
Line 38	60	59		7,4375 m	90 °
Line 39	59	10		24,652 m	-5,29 °
Line 40	10	13		15,053 m	0,237 °
Line 41	13	57		4,6232 m	90 °
Line 42	57	54		0,8 m	0 °
Line 43	54	55		4,6232 m	90 °
Line 44	55	48		39,6 m	0,115 °
Line 45	60	3	Zero Pressure	2,1879 m	-2,72 °
Line 46	3	9	Zero Pressure	7,8156 m	-0,899 °
Line 47	9	15	Zero Pressure	25,907 m	0 °
Line 48	15	14	BC - Lato DX	7,3576 m	90 °
Line 49	14	59		35,907 m	-0,234 °
Line 50	17	14	BC - Lato DX	5,2012 m	90 °
Line 51	59	62		5,3477 m	90 °
Line 52	62	17		35,907 m	0 °
Line 53	12	13		5,747 m	90 °
Line 54	62	11		24,614 m	-4,22 °
Line 55	11	12		15,053 m	0 °
Line 56	43	40	Profilo di Piena - FIUME	12,614 m	26,2 °
Line 57	48	67		5,6672 m	90 °
Line 58	67	43		52,771 m	0 °
Line 59	55	35		5,747 m	90 °
Line 60	35	67		39,6 m	0 °
Line 61	65	62		11,252 m	90 °
Line 62	17	16	BC - Lato DX	12,134 m	90 °
Line 63	16	65		35,918 m	-1,41 °
Line 64	56	65		39,6 m	-0,256 °

Line 65	67	47		12,836 m	90 °
Line 66	47	51		39,6 m	-0,0732 °
Line 67	39	36	BC - Lato SX	7,8931 m	90 °
Line 68	36	37	Profilo di Piena - FIUME	2,2178 m	19,8 °
Line 69	37	42	Profilo di Piena - FIUME	5,8941 m	7,31 °
Line 70	42	43	Profilo di Piena - FIUME	7,5165 m	26,3 °
Line 71	47	39		67,443 m	-0,0965 °
Line 72	69	39	BC - Lato SX	21,107 m	90 °
Line 73	47	63		9,7933 m	90 °
Line 74	63	66		80 m	0 °
Line 75	66	65		9,5658 m	90 °
Line 76	16	23	BC - Lato DX	19,884 m	90 °
Line 77	23	69		183,35 m	0 °
Line 78	51	50		2,7427 m	90 °
Line 79	50	53		0,8 m	0 °
Line 80	53	56		2,7427 m	90 °
Line 81	51	56		0,8 m	0 °
Line 82	35	12		0,8 m	0 °
Line 83	55	13		0,8 m	0 °
Line 84	51	35		12,887 m	90 °
Line 85	12	56		12,887 m	90 °

## Regions

	Material	Points	Area
Region 1	UG1 - Misto	46;33;28;27;52;30;29;18;6;5;58;8;7;2;1;4;38;68;45;34	72,462 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	40;41;49;61;25;24;44;48	178,88 m <sup>2</sup>
Region 3	UG2 - Limo Argilloso	48;44;20;19;22;21;26;32;31;46;34;45;68;60;59;10;13;57;54;55	439,6 m <sup>2</sup>
Region 4	UG2 - Limo Argilloso	59;60;3;9;15;14	262,42 m <sup>2</sup>
Region 5	UG3 - Sabbia Limo Ghiaiosa	17;14;59;62	189,39 m <sup>2</sup>
Region 6	UG3 - Sabbia Limo Ghiaiosa	12;13;10;59;62;11	223,91 m <sup>2</sup>

Region 7	UG3 - Sabbia Limo Ghiaiosa	43;40;48;67	264,18 m <sup>2</sup>
Region 8	UG3 - Sabbia Limo Ghiaiosa	67;48;55;35	226 m <sup>2</sup>
Region 9	UG4 - Sabbia Ghiaiosa	65;62;17;16	419,86 m <sup>2</sup>
Region 10	UG4 - Sabbia Ghiaiosa	56;65;62;11;12	491,59 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	51;35;67;47	509,33 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	39;36;37;42;43;67;47	819,72 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	69;39;47;63;66;65;16;23	3.045,5 m <sup>2</sup>
Region 14	UG5 - Argilla Limosa	63;47;51;50;53;56;65;66	774,72 m <sup>2</sup>
Region 15	Diaframma	50;51;56;53	2,1942 m <sup>2</sup>
Region 16	Diaframma	12;35;51;56	10,31 m <sup>2</sup>
Region 17	Diaframma	35;55;13;12	4,5976 m <sup>2</sup>
Region 18	Diaframma	55;54;57;13	3,6986 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 149  
Date: 18/09/2024  
Time: 20:36:25  
Tool Version: 10.1.1.18972  
File Name: Tratto Sud Sezione AA pk 5 - Rapido Svaso BT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione AA\  
Last Solved Date: 18/09/2024  
Last Solved Time: 20:36:30

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo Argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)



# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,5766 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo Argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)



Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)  
Function: [Volumetric Water Content vs. Water Pressure](#)  
Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,14999785](#)  
Residual Water Content: [0,014999785](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Porosity: [0,14999785](#)  
Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)  
Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	127,6371 m	46,1022 m
Point 2	126,6342 m	46,4588 m
Point 3	149,6281 m	44,6992 m
Point 4	129,6427 m	46,006 m
Point 5	122,6516 m	48,6709 m
Point 6	121,6 m	48,85 m
Point 7	125,6314 m	47,0226 m
Point 8	124,6285 m	47,6429 m
Point 9	157,4427 m	44,5766 m
Point 10	122,8958 m	39,6391 m
Point 11	122,8958 m	33,8298 m
Point 12	107,8427 m	33,8298 m
Point 13	107,8427 m	39,5768 m
Point 14	183,3495 m	37,219 m
Point 15	183,3495 m	44,5766 m
Point 16	183,3495 m	19,8837 m
Point 17	183,3495 m	32,0178 m
Point 18	116,6 m	48,85 m

Point 19	76,4922 m	44,342 m
Point 20	70,4751 m	44,1409 m
Point 21	83,5121 m	44,6648 m
Point 22	80,3647 m	44,7196 m
Point 23	183,3495 m	0 m
Point 24	65,7029 m	44,1914 m
Point 25	57,4427 m	44,265 m
Point 26	89,0419 m	44,9046 m
Point 27	111,5916 m	46,6094 m
Point 28	110,463 m	46,3361 m
Point 29	115,603 m	48,5719 m
Point 30	114,6001 m	48,1152 m
Point 31	98,3405 m	45,396 m
Point 32	94,5433 m	45,2101 m
Point 33	108,7954 m	46,138 m
Point 34	111,8875 m	44,5777 m
Point 35	107,0427 m	33,8298 m
Point 36	0 m	29 m
Point 37	2,0871 m	29,75 m
Point 38	132,6513 m	45,8694 m
Point 39	0 m	21,1069 m
Point 40	25,9936 m	39,3909 m
Point 41	30,4705 m	41,5948 m
Point 42	7,9333 m	30,5 m
Point 43	14,672 m	33,8298 m
Point 44	67,4427 m	44,1614 m
Point 45	122,9008 m	44,4048 m
Point 46	103,5679 m	45,767 m
Point 47	67,4427 m	20,9933 m
Point 48	67,4427 m	39,497 m
Point 49	33,6839 m	44,1517 m
Point 50	107,0427 m	18,2 m
Point 51	107,0427 m	20,9427 m
Point 52	114,0304 m	47,83 m
Point 53	107,8427 m	18,2 m
Point 54	107,0427 m	44,2 m
Point 55	107,0427 m	39,5768 m
Point 56	107,8427 m	20,9427 m
Point 57	107,8427 m	44,2 m

Point 58	124,2928 m	47,83 m
Point 59	147,4427 m	37,3655 m
Point 60	147,4427 m	44,803 m
Point 61	39,5928 m	44,3665 m
Point 62	147,4427 m	32,0178 m
Point 63	67,4427 m	11,2 m
Point 64	147,4427 m	20,7658 m
Point 65	147,4427 m	11,2 m
Point 66	67,4427 m	33,8298 m
Point 67	135,1149 m	44,803 m
Point 68	0 m	0 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	46	33	Profilo di Piena - FIUME	5,2406 m	4,06 °
Line 2	33	28	Profilo di Piena - FIUME	1,6793 m	6,77 °
Line 3	28	27	Profilo di Piena - FIUME	1,1612 m	13,6 °
Line 4	27	52	Profilo di Piena - FIUME	2,7272 m	26,6 °
Line 5	52	30		0,6371 m	26,6 °
Line 6	30	29		1,102 m	24,5 °
Line 7	29	18		1,0351 m	15,6 °
Line 8	18	6	Drainage	5 m	0 °
Line 9	6	5	Drainage	1,0667 m	-9,67 °
Line 10	5	58	Drainage	1,8441 m	-27,1 °
Line 11	58	8		0,38432 m	-29,1 °
Line 12	8	7	Drainage	1,1792 m	-31,7 °
Line 13	7	2	Drainage	1,1504 m	-29,3 °
Line 14	2	1	Drainage	1,0644 m	-19,6 °
Line 15	1	4	Drainage	2,0079 m	-2,75 °
Line 16	4	38	Drainage	3,0117 m	-2,6 °
Line 17	38	67	Drainage	2,6845 m	-23,4 °
Line 18	67	45		12,221 m	1,87 °
Line 19	45	34		11,015 m	-0,899 °
Line 20	34	46		8,4042 m	-8,14 °
Line 21	40	41	Profilo di Piena - FIUME	4,99 m	26,2 °
Line 22	41	49	Profilo di Piena - FIUME	4,1065 m	38,5 °
Line 23	49	61	Profilo di Piena - FIUME	5,9128 m	2,08 °
Line 24	61	25	Profilo di Piena - FIUME	17,85 m	-0,326 °
Line 25	25	24	Profilo di Piena - FIUME	8,2605 m	-0,511 °
Line 26	24	44	Profilo di Piena - FIUME	1,7401 m	-0,988 °

Line 27	44	48		4,6644 m	90 °
Line 28	48	40		41,449 m	0,147 °
Line 29	44	20	Profilo di Piena - FIUME	3,0325 m	-0,387 °
Line 30	20	19	Profilo di Piena - FIUME	6,0205 m	1,91 °
Line 31	19	22	Profilo di Piena - FIUME	3,8909 m	5,57 °
Line 32	22	21	Profilo di Piena - FIUME	3,1479 m	-0,997 °
Line 33	21	26	Profilo di Piena - FIUME	5,535 m	2,48 °
Line 34	26	32	Profilo di Piena - FIUME	5,5099 m	3,18 °
Line 35	32	31	Profilo di Piena - FIUME	3,8017 m	2,8 °
Line 36	31	46	Profilo di Piena - FIUME	5,2405 m	4,06 °
Line 37	67	60	Zero Pressure	12,328 m	0 °
Line 38	60	59		7,4375 m	90 °
Line 39	59	10		24,652 m	-5,29 °
Line 40	10	13		15,053 m	0,237 °
Line 41	13	57		4,6232 m	90 °
Line 42	57	54		0,8 m	0 °
Line 43	54	55		4,6232 m	90 °
Line 44	55	48		39,6 m	0,115 °
Line 45	60	3	Zero Pressure	2,1879 m	-2,72 °
Line 46	3	9	Zero Pressure	7,8156 m	-0,899 °
Line 47	9	15	Zero Pressure	25,907 m	0 °
Line 48	15	14	BC - Lato DX	7,3576 m	90 °
Line 49	14	59		35,907 m	-0,234 °
Line 50	17	14	BC - Lato DX	5,2012 m	90 °
Line 51	59	62		5,3477 m	90 °
Line 52	62	17		35,907 m	0 °
Line 53	12	13		5,747 m	90 °
Line 54	62	11		24,614 m	-4,22 °
Line 55	11	12		15,053 m	0 °
Line 56	43	40	Profilo di Piena - FIUME	12,614 m	26,2 °
Line 57	48	66		5,6672 m	90 °
Line 58	66	43		52,771 m	0 °
Line 59	55	35		5,747 m	90 °
Line 60	35	66		39,6 m	0 °
Line 61	64	62		11,252 m	90 °
Line 62	17	16	BC - Lato DX	12,134 m	90 °
Line 63	16	64		35,918 m	-1,41 °
Line 64	56	64		39,6 m	-0,256 °
Line 65	66	47		12,836 m	90 °

Line 66	47	51		39,6 m	-0,0732 °
Line 67	39	36	BC - Lato SX	7,8931 m	90 °
Line 68	36	37	Profilo di Piena - FIUME	2,2178 m	19,8 °
Line 69	37	42	Profilo di Piena - FIUME	5,8941 m	7,31 °
Line 70	42	43	Profilo di Piena - FIUME	7,5165 m	26,3 °
Line 71	47	39		67,443 m	-0,0965 °
Line 72	68	39	BC - Lato SX	21,107 m	90 °
Line 73	47	63		9,7933 m	90 °
Line 74	63	65		80 m	0 °
Line 75	65	64		9,5658 m	90 °
Line 76	16	23	BC - Lato DX	19,884 m	90 °
Line 77	23	68		183,35 m	0 °
Line 78	51	50		2,7427 m	90 °
Line 79	50	53		0,8 m	0 °
Line 80	53	56		2,7427 m	90 °
Line 81	51	56		0,8 m	0 °
Line 82	35	12		0,8 m	0 °
Line 83	55	13		0,8 m	0 °
Line 84	51	35		12,887 m	90 °
Line 85	12	56		12,887 m	90 °

## Regions

	Material	Points	Area
Region 1	UG1 - Misto	46;33;28;27;52;30;29;18;6;5;58;8;7;2;1;4;38;67;45;34	72,462 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	40;41;49;61;25;24;44;48	178,88 m <sup>2</sup>
Region 3	UG2 - Limo Argilloso	48;44;20;19;22;21;26;32;31;46;34;45;67;60;59;10;13;57;54;55	439,6 m <sup>2</sup>
Region 4	UG2 - Limo Argilloso	59;60;3;9;15;14	262,42 m <sup>2</sup>
Region 5	UG3 - Sabbia Limo Ghiaiosa	17;14;59;62	189,39 m <sup>2</sup>
Region 6	UG3 - Sabbia Limo Ghiaiosa	12;13;10;59;62;11	223,91 m <sup>2</sup>
Region 7	UG3 - Sabbia	43;40;48;66	264,18 m <sup>2</sup>

	Limo Ghiaiosa		
Region 8	UG3 - Sabbia Limo Ghiaiosa	66;48;55;35	226 m <sup>2</sup>
Region 9	UG4 - Sabbia Ghiaiosa	64;62;17;16	419,86 m <sup>2</sup>
Region 10	UG4 - Sabbia Ghiaiosa	56;64;62;11;12	491,59 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	51;35;66;47	509,33 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	39;36;37;42;43;66;47	819,72 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	68;39;47;63;65;64;16;23	3.045,5 m <sup>2</sup>
Region 14	UG5 - Argilla Limosa	63;47;51;50;53;56;64;65	774,72 m <sup>2</sup>
Region 15	Diaframma	50;51;56;53	2,1942 m <sup>2</sup>
Region 16	Diaframma	12;35;51;56	10,31 m <sup>2</sup>
Region 17	Diaframma	35;55;13;12	4,5976 m <sup>2</sup>
Region 18	Diaframma	55;54;57;13	3,6986 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 155  
Date: 18/09/2024  
Time: 20:36:32  
Tool Version: 10.1.1.18972  
File Name: Tratto Sud Sezione AA pk 5 - Rapido Svaso LT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione AA\  
Last Solved Date: 18/09/2024  
Last Solved Time: 20:36:36

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d



# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo Argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,5766 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: [\(0,01; 1e-10\)](#)  
Data Point: [\(0,018329807; 9,8537502e-11\)](#)  
Data Point: [\(0,033598183; 9,6642125e-11\)](#)  
Data Point: [\(0,061584821; 9,4197688e-11\)](#)  
Data Point: [\(0,11288379; 9,1054741e-11\)](#)  
Data Point: [\(0,20691381; 8,7032912e-11\)](#)  
Data Point: [\(0,37926902; 8,19208e-11\)](#)  
Data Point: [\(0,6951928; 7,5483248e-11\)](#)  
Data Point: [\(1,274275; 6,7486396e-11\)](#)  
Data Point: [\(2,3357215; 5,775836e-11\)](#)  
Data Point: [\(4,2813324; 4,6317939e-11\)](#)  
Data Point: [\(7,8475997; 3,3627236e-11\)](#)  
Data Point: [\(14,384499; 2,0941088e-11\)](#)  
Data Point: [\(26,366509; 1,0378701e-11\)](#)  
Data Point: [\(48,329302; 3,80402e-12\)](#)  
Data Point: [\(88,586679; 1,0129493e-12\)](#)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo Argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20



### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,14999785](#)  
Residual Water Content: [0,014999785](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	127,6371 m	46,1022 m
Point 2	126,6342 m	46,4588 m
Point 3	149,6281 m	44,6992 m
Point 4	129,6427 m	46,006 m
Point 5	122,6516 m	48,6709 m
Point 6	121,6 m	48,85 m
Point 7	125,6314 m	47,0226 m
Point 8	124,6285 m	47,6429 m
Point 9	157,4427 m	44,5766 m
Point 10	122,8958 m	39,6391 m
Point 11	122,8958 m	33,8298 m
Point 12	107,8427 m	33,8298 m
Point 13	107,8427 m	39,5768 m
Point 14	183,3495 m	37,219 m
Point 15	183,3495 m	44,5766 m
Point 16	183,3495 m	19,8837 m
Point 17	183,3495 m	32,0178 m
Point 18	116,6 m	48,85 m

Point 19	76,4922 m	44,342 m
Point 20	70,4751 m	44,1409 m
Point 21	83,5121 m	44,6648 m
Point 22	80,3647 m	44,7196 m
Point 23	183,3495 m	0 m
Point 24	65,7029 m	44,1914 m
Point 25	57,4427 m	44,265 m
Point 26	89,0419 m	44,9046 m
Point 27	111,5916 m	46,6094 m
Point 28	110,463 m	46,3361 m
Point 29	115,603 m	48,5719 m
Point 30	114,6001 m	48,1152 m
Point 31	98,3405 m	45,396 m
Point 32	94,5433 m	45,2101 m
Point 33	108,7954 m	46,138 m
Point 34	111,8875 m	44,5777 m
Point 35	107,0427 m	33,8298 m
Point 36	0 m	29 m
Point 37	2,0871 m	29,75 m
Point 38	132,6513 m	45,8694 m
Point 39	0 m	21,1069 m
Point 40	25,9936 m	39,3909 m
Point 41	30,4705 m	41,5948 m
Point 42	7,9333 m	30,5 m
Point 43	14,672 m	33,8298 m
Point 44	67,4427 m	44,1614 m
Point 45	122,9008 m	44,4048 m
Point 46	103,5679 m	45,767 m
Point 47	67,4427 m	20,9933 m
Point 48	67,4427 m	39,497 m
Point 49	33,6839 m	44,1517 m
Point 50	107,0427 m	18,2 m
Point 51	107,0427 m	20,9427 m
Point 52	114,0304 m	47,83 m
Point 53	107,8427 m	18,2 m
Point 54	107,0427 m	44,2 m
Point 55	107,0427 m	39,5768 m
Point 56	107,8427 m	20,9427 m
Point 57	107,8427 m	44,2 m

Point 58	124,2928 m	47,83 m
Point 59	147,4427 m	37,3655 m
Point 60	147,4427 m	44,803 m
Point 61	39,5928 m	44,3665 m
Point 62	147,4427 m	32,0178 m
Point 63	67,4427 m	11,2 m
Point 64	147,4427 m	20,7658 m
Point 65	147,4427 m	11,2 m
Point 66	67,4427 m	33,8298 m
Point 67	135,1149 m	44,803 m
Point 68	0 m	0 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	46	33	Profilo di Piena - FIUME	5,2406 m	4,06 °
Line 2	33	28	Profilo di Piena - FIUME	1,6793 m	6,77 °
Line 3	28	27	Profilo di Piena - FIUME	1,1612 m	13,6 °
Line 4	27	52	Profilo di Piena - FIUME	2,7272 m	26,6 °
Line 5	52	30		0,6371 m	26,6 °
Line 6	30	29		1,102 m	24,5 °
Line 7	29	18		1,0351 m	15,6 °
Line 8	18	6	Drainage	5 m	0 °
Line 9	6	5	Drainage	1,0667 m	-9,67 °
Line 10	5	58	Drainage	1,8441 m	-27,1 °
Line 11	58	8		0,38432 m	-29,1 °
Line 12	8	7	Drainage	1,1792 m	-31,7 °
Line 13	7	2	Drainage	1,1504 m	-29,3 °
Line 14	2	1	Drainage	1,0644 m	-19,6 °
Line 15	1	4	Drainage	2,0079 m	-2,75 °
Line 16	4	38	Drainage	3,0117 m	-2,6 °
Line 17	38	67	Drainage	2,6845 m	-23,4 °
Line 18	67	45		12,221 m	1,87 °
Line 19	45	34		11,015 m	-0,899 °
Line 20	34	46		8,4042 m	-8,14 °
Line 21	40	41	Profilo di Piena - FIUME	4,99 m	26,2 °
Line 22	41	49	Profilo di Piena - FIUME	4,1065 m	38,5 °
Line 23	49	61	Profilo di Piena - FIUME	5,9128 m	2,08 °
Line 24	61	25	Profilo di Piena - FIUME	17,85 m	-0,326 °
Line 25	25	24	Profilo di Piena - FIUME	8,2605 m	-0,511 °
Line 26	24	44	Profilo di Piena - FIUME	1,7401 m	-0,988 °

Line 27	44	48		4,6644 m	90 °
Line 28	48	40		41,449 m	0,147 °
Line 29	44	20	Profilo di Piena - FIUME	3,0325 m	-0,387 °
Line 30	20	19	Profilo di Piena - FIUME	6,0205 m	1,91 °
Line 31	19	22	Profilo di Piena - FIUME	3,8909 m	5,57 °
Line 32	22	21	Profilo di Piena - FIUME	3,1479 m	-0,997 °
Line 33	21	26	Profilo di Piena - FIUME	5,535 m	2,48 °
Line 34	26	32	Profilo di Piena - FIUME	5,5099 m	3,18 °
Line 35	32	31	Profilo di Piena - FIUME	3,8017 m	2,8 °
Line 36	31	46	Profilo di Piena - FIUME	5,2405 m	4,06 °
Line 37	67	60	Zero Pressure	12,328 m	0 °
Line 38	60	59		7,4375 m	90 °
Line 39	59	10		24,652 m	-5,29 °
Line 40	10	13		15,053 m	0,237 °
Line 41	13	57		4,6232 m	90 °
Line 42	57	54		0,8 m	0 °
Line 43	54	55		4,6232 m	90 °
Line 44	55	48		39,6 m	0,115 °
Line 45	60	3	Zero Pressure	2,1879 m	-2,72 °
Line 46	3	9	Zero Pressure	7,8156 m	-0,899 °
Line 47	9	15	Zero Pressure	25,907 m	0 °
Line 48	15	14	BC - Lato DX	7,3576 m	90 °
Line 49	14	59		35,907 m	-0,234 °
Line 50	17	14	BC - Lato DX	5,2012 m	90 °
Line 51	59	62		5,3477 m	90 °
Line 52	62	17		35,907 m	0 °
Line 53	12	13		5,747 m	90 °
Line 54	62	11		24,614 m	-4,22 °
Line 55	11	12		15,053 m	0 °
Line 56	43	40	Profilo di Piena - FIUME	12,614 m	26,2 °
Line 57	48	66		5,6672 m	90 °
Line 58	66	43		52,771 m	0 °
Line 59	55	35		5,747 m	90 °
Line 60	35	66		39,6 m	0 °
Line 61	64	62		11,252 m	90 °
Line 62	17	16	BC - Lato DX	12,134 m	90 °
Line 63	16	64		35,918 m	-1,41 °
Line 64	56	64		39,6 m	-0,256 °
Line 65	66	47		12,836 m	90 °

Line 66	47	51		39,6 m	-0,0732 °
Line 67	39	36	BC - Lato SX	7,8931 m	90 °
Line 68	36	37	Profilo di Piena - FIUME	2,2178 m	19,8 °
Line 69	37	42	Profilo di Piena - FIUME	5,8941 m	7,31 °
Line 70	42	43	Profilo di Piena - FIUME	7,5165 m	26,3 °
Line 71	47	39		67,443 m	-0,0965 °
Line 72	68	39	BC - Lato SX	21,107 m	90 °
Line 73	47	63		9,7933 m	90 °
Line 74	63	65		80 m	0 °
Line 75	65	64		9,5658 m	90 °
Line 76	16	23	BC - Lato DX	19,884 m	90 °
Line 77	23	68		183,35 m	0 °
Line 78	51	50		2,7427 m	90 °
Line 79	50	53		0,8 m	0 °
Line 80	53	56		2,7427 m	90 °
Line 81	51	56		0,8 m	0 °
Line 82	35	12		0,8 m	0 °
Line 83	55	13		0,8 m	0 °
Line 84	51	35		12,887 m	90 °
Line 85	12	56		12,887 m	90 °

## Regions

	Material	Points	Area
Region 1	UG1 - Misto	46;33;28;27;52;30;29;18;6;5;58;8;7;2;1;4;38;67;45;34	72,462 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	40;41;49;61;25;24;44;48	178,88 m <sup>2</sup>
Region 3	UG2 - Limo Argilloso	48;44;20;19;22;21;26;32;31;46;34;45;67;60;59;10;13;57;54;55	439,6 m <sup>2</sup>
Region 4	UG2 - Limo Argilloso	59;60;3;9;15;14	262,42 m <sup>2</sup>
Region 5	UG3 - Sabbia Limo Ghiaiosa	17;14;59;62	189,39 m <sup>2</sup>
Region 6	UG3 - Sabbia Limo Ghiaiosa	12;13;10;59;62;11	223,91 m <sup>2</sup>
Region 7	UG3 - Sabbia	43;40;48;66	264,18 m <sup>2</sup>

	Limo Ghiaiosa		
Region 8	UG3 - Sabbia Limo Ghiaiosa	66;48;55;35	226 m <sup>2</sup>
Region 9	UG4 - Sabbia Ghiaiosa	64;62;17;16	419,86 m <sup>2</sup>
Region 10	UG4 - Sabbia Ghiaiosa	56;64;62;11;12	491,59 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	51;35;66;47	509,33 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	39;36;37;42;43;66;47	819,72 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	68;39;47;63;65;64;16;23	3.045,5 m <sup>2</sup>
Region 14	UG5 - Argilla Limosa	63;47;51;50;53;56;64;65	774,72 m <sup>2</sup>
Region 15	Diaframma	50;51;56;53	2,1942 m <sup>2</sup>
Region 16	Diaframma	12;35;51;56	10,31 m <sup>2</sup>
Region 17	Diaframma	35;55;13;12	4,5976 m <sup>2</sup>
Region 18	Diaframma	55;54;57;13	3,6986 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m



SEZIONE BB

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 157  
Date: 19/09/2024  
Time: 09:18:07  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione BB pk 0 - BT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione BB\

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,2105 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: [\(0,01; 1e-10\)](#)  
Data Point: [\(0,018329807; 9,8537502e-11\)](#)  
Data Point: [\(0,033598183; 9,6642125e-11\)](#)  
Data Point: [\(0,061584821; 9,4197688e-11\)](#)  
Data Point: [\(0,11288379; 9,1054741e-11\)](#)  
Data Point: [\(0,20691381; 8,7032912e-11\)](#)  
Data Point: [\(0,37926902; 8,19208e-11\)](#)  
Data Point: [\(0,6951928; 7,5483248e-11\)](#)  
Data Point: [\(1,274275; 6,7486396e-11\)](#)  
Data Point: [\(2,3357215; 5,775836e-11\)](#)  
Data Point: [\(4,2813324; 4,6317939e-11\)](#)  
Data Point: [\(7,8475997; 3,3627236e-11\)](#)  
Data Point: [\(14,384499; 2,0941088e-11\)](#)  
Data Point: [\(26,366509; 1,0378701e-11\)](#)  
Data Point: [\(48,329302; 3,80402e-12\)](#)  
Data Point: [\(88,586679; 1,0129493e-12\)](#)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)



Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: [1 m](#)

## Points

	X	Y
Point 1	9,4459 m	30,4826 m
Point 2	4,8778 m	30,4826 m
Point 3	13,2198 m	32,8531 m
Point 4	26,7425 m	41,3471 m
Point 5	25,0333 m	40,2736 m
Point 6	0 m	31,2226 m
Point 7	45,9138 m	43,709 m
Point 8	39,8597 m	43,5367 m
Point 9	47,9318 m	43,8381 m
Point 10	49,9498 m	44,9042 m
Point 11	48,9408 m	44,2524 m
Point 12	28,7606 m	42,7883 m
Point 13	27,6703 m	42,1136 m
Point 14	30,3383 m	43,146 m
Point 15	37,8417 m	43,6062 m
Point 16	32,9014 m	43,4914 m
Point 17	71,1287 m	44,3 m
Point 18	71,1287 m	43,7 m

Point 19	70,3287 m	43,7 m
Point 20	140 m	40,605 m
Point 21	71,1287 m	40,4064 m
Point 22	140 m	34,0308 m
Point 23	140 m	0 m
Point 24	69,1211 m	44,6388 m
Point 25	0 m	0 m
Point 26	70,3287 m	17,7 m
Point 27	71,1287 m	19,0417 m
Point 28	71,1287 m	17,7 m
Point 29	70,3287 m	44,3 m
Point 30	140 m	19,2037 m
Point 31	70,3287 m	33,8741 m
Point 32	71,1287 m	33,8884 m
Point 33	70,3287 m	40,4041 m
Point 34	70,3287 m	19,0398 m
Point 35	0 m	18,8744 m
Point 36	50,9589 m	45,4359 m
Point 37	97,3735 m	45,9708 m
Point 38	109,5446 m	44,1879 m
Point 39	140 m	44,2105 m
Point 40	113,9358 m	44,1633 m
Point 41	91,3194 m	46,5304 m
Point 42	90,3104 m	46,924 m
Point 43	92,3284 m	46,3998 m
Point 44	96,3645 m	46,2513 m
Point 45	95,3555 m	46,3372 m
Point 46	110,7287 m	40,5206 m
Point 47	110,7287 m	44,1813 m
Point 48	110,7287 m	34,0308 m
Point 49	110,7287 m	10,7 m
Point 50	110,7287 m	19,1348 m
Point 51	30,7287 m	40,29 m
Point 52	30,7287 m	43,1986 m
Point 53	30,7287 m	33,1661 m
Point 54	30,7287 m	10,7 m
Point 55	30,7287 m	18,9467 m
Point 56	87,2834 m	48,4898 m
Point 57	61,049 m	44,777 m

Point 58	59,031 m	44,7304 m
Point 59	65,0851 m	44,6045 m
Point 60	72,0957 m	46,1592 m
Point 61	71,2477 m	45,8382 m
Point 62	52,9769 m	45,7743 m
Point 63	51,9679 m	45,7319 m
Point 64	53,9859 m	45,7144 m
Point 65	58,022 m	44,7912 m
Point 66	56,0039 m	45,1149 m
Point 67	81,03 m	48,6565 m
Point 68	80,14 m	48,6137 m
Point 69	83,6984 m	48,6562 m
Point 70	86,03 m	48,726 m
Point 71	85,4771 m	48,7298 m
Point 72	75,1752 m	46,1819 m
Point 73	73,1572 m	46,0558 m
Point 74	76,2634 m	46,5027 m
Point 75	79,2517 m	48,3918 m
Point 76	78,3631 m	47,83 m
Point 77	100,4005 m	44,6558 m
Point 78	101,4628 m	44,1879 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	74	76	Profilo di Piena - FIUME	2,484 m	32,3 °
Line 2	76	75		1,0513 m	32,3 °
Line 3	75	68		0,9156 m	14 °
Line 4	68	67	Drainage	0,89103 m	2,75 °
Line 5	67	69	Drainage	2,6684 m	-0,00644 °
Line 6	69	71	Drainage	1,7802 m	2,37 °
Line 7	71	70	Drainage	0,55291 m	-0,394 °
Line 8	70	56	Drainage	1,2755 m	-10,7 °
Line 9	56	42	Drainage	3,408 m	-27,4 °
Line 10	42	41	Drainage	1,0831 m	-21,3 °
Line 11	41	74		15,056 m	0,105 °
Line 12	5	4	Profilo di Piena - FIUME	2,0184 m	32,1 °
Line 13	4	13	Profilo di Piena - FIUME	1,2035 m	39,6 °
Line 14	13	12	Profilo di Piena - FIUME	1,2822 m	31,8 °
Line 15	12	14	Profilo di Piena - FIUME	1,6177 m	12,8 °
Line 16	14	52	Profilo di Piena - FIUME	0,39393 m	7,67 °

Line 17	52	51		2,9086 m	90 °
Line 18	51	5		5,6954 m	0,165 °
Line 19	47	46		3,6607 m	90 °
Line 20	46	21		39,6 m	0,165 °
Line 21	21	18		3,2936 m	90 °
Line 22	18	17		0,6 m	90 °
Line 23	17	29		0,8 m	0 °
Line 24	29	19		0,6 m	90 °
Line 25	19	33		3,2959 m	90 °
Line 26	33	51		39,6 m	0,165 °
Line 27	47	40	Zero Pressure	3,2072 m	-0,322 °
Line 28	40	39	Zero Pressure	26,064 m	0,104 °
Line 29	39	20	BC - Lato DX	3,6055 m	90 °
Line 30	20	46		29,271 m	0,165 °
Line 31	22	20	BC - Lato DX	6,5742 m	90 °
Line 32	46	48		6,4898 m	90 °
Line 33	48	22		29,271 m	0 °
Line 34	32	21		6,518 m	90 °
Line 35	48	32		39,6 m	0,206 °
Line 36	48	50		14,896 m	90 °
Line 37	50	27		39,6 m	0,135 °
Line 38	22	30	BC - Lato DX	14,827 m	90 °
Line 39	30	50		29,271 m	0,135 °
Line 40	53	51		7,1239 m	90 °
Line 41	33	31		6,53 m	90 °
Line 42	31	53		39,606 m	1,02 °
Line 43	55	53		14,219 m	90 °
Line 44	34	55		39,6 m	0,135 °
Line 45	3	5	Profilo di Piena - FIUME	13,951 m	32,1 °
Line 46	53	3		17,512 m	1,02 °
Line 47	35	6	BC - Lato SX	12,348 m	90 °
Line 48	6	2	Profilo di Piena - FIUME	4,9336 m	-8,63 °
Line 49	2	1	Profilo di Piena - FIUME	4,5681 m	0 °
Line 50	1	3	Profilo di Piena - FIUME	4,4566 m	32,1 °
Line 51	55	35		30,729 m	0,135 °
Line 52	25	35	BC - Lato SX	18,874 m	90 °
Line 53	55	54		8,2467 m	90 °
Line 54	54	49		80 m	0 °
Line 55	49	50		8,4348 m	90 °



Line 56	30	23	BC - Lato DX	19,204 m	90 °
Line 57	23	25		140 m	0 °
Line 58	34	26		1,3398 m	90 °
Line 59	26	28		0,8 m	0 °
Line 60	28	27		1,3417 m	90 °
Line 61	34	27		0,8 m	0,136 °
Line 62	31	32		0,80013 m	1,02 °
Line 63	33	21		0,8 m	0,165 °
Line 64	19	18		0,8 m	0 °
Line 65	52	16	Profilo di Piena - FIUME	2,1923 m	7,68 °
Line 66	16	15	Profilo di Piena - FIUME	4,9416 m	1,33 °
Line 67	15	8	Profilo di Piena - FIUME	2,0192 m	-1,97 °
Line 68	8	7	Profilo di Piena - FIUME	6,0566 m	1,63 °
Line 69	7	9	Profilo di Piena - FIUME	2,0221 m	3,66 °
Line 70	9	11	Profilo di Piena - FIUME	1,0907 m	22,3 °
Line 71	11	10	Profilo di Piena - FIUME	1,2012 m	32,9 °
Line 72	10	36	Profilo di Piena - FIUME	1,1406 m	27,8 °
Line 73	36	63	Profilo di Piena - FIUME	1,0515 m	16,3 °
Line 74	63	62	Profilo di Piena - FIUME	1,0099 m	2,41 °
Line 75	62	64	Profilo di Piena - FIUME	1,0108 m	-3,4 °
Line 76	64	66	Profilo di Piena - FIUME	2,1052 m	-16,5 °
Line 77	66	65	Profilo di Piena - FIUME	2,0439 m	-9,11 °
Line 78	65	58	Profilo di Piena - FIUME	1,0108 m	-3,45 °
Line 79	58	57	Profilo di Piena - FIUME	2,0185 m	1,32 °
Line 80	57	59	Profilo di Piena - FIUME	4,0398 m	-2,45 °
Line 81	59	24	Profilo di Piena - FIUME	4,0361 m	0,487 °
Line 82	24	61	Profilo di Piena - FIUME	2,4415 m	29,4 °
Line 83	61	60	Profilo di Piena - FIUME	0,90672 m	20,7 °
Line 84	60	73	Profilo di Piena - FIUME	1,0665 m	-5,56 °
Line 85	73	72	Profilo di Piena - FIUME	2,0219 m	3,58 °
Line 86	72	74	Profilo di Piena - FIUME	1,1345 m	16,4 °
Line 87	41	43	Drainage	1,0174 m	-7,38 °
Line 88	43	45	Drainage	3,0277 m	-1,18 °
Line 89	45	44	Drainage	1,0126 m	-4,87 °
Line 90	44	37	Drainage	1,0473 m	-15,5 °
Line 91	37	77	Drainage	3,3003 m	-23,5 °
Line 92	77	78	Drainage	1,1608 m	-23,8 °
Line 93	78	38	Zero Pressure	8,0818 m	0 °
Line 94	38	47	Zero Pressure	1,1841 m	-0,319 °

Line 95	31	34		14,834 m	90 °
Line 96	27	32		14,847 m	90 °

## Regions

	Material	Points
Region 1	UG1 - Misto	74;76;75;68;67;69;71;70;56;42;41
Region 2	UG2 - Limo Argilloso	5;4;13;12;14;52;51
Region 3	UG2 - Limo Argilloso	46;47;40;39;20
Region 4	UG3 - Sabbia Limo Ghiaiosa	22;20;46;48
Region 5	UG3 - Sabbia Limo Ghiaiosa	32;21;46;48
Region 6	UG4 - Sabbia Ghiaiosa	27;32;48;50
Region 7	UG4 - Sabbia Ghiaiosa	50;48;22;30
Region 8	UG3 - Sabbia Limo Ghiaiosa	53;51;33;31
Region 9	UG4 - Sabbia Ghiaiosa	55;53;31;34
Region 10	UG3 - Sabbia Limo Ghiaiosa	3;5;51;53
Region 11	UG4 - Sabbia Ghiaiosa	35;6;2;1;3;53;55
Region 12	UG5 - Argilla Limosa	25;35;55;54;49;50;30;23

Region 13	UG5 - Argilla Limosa	54;55;34;26;28;27;50;49
Region 14	Diaframma	26;34;27;28
Region 15	Diaframma	32;31;34;27
Region 16	Diaframma	31;33;21;32
Region 17	Diaframma	33;19;18;21
Region 18	Diaframma	19;29;17;18
Region 19	UG2 - Limo Argilloso	51;52;16;15;8;7;9;11;10;36;63;62;64;66;65;58;57;59;24;61;60;73;72;74;41;43;45;44;37

## Mesh Properties

Global Element Size: 0,3 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 165  
Date: 19/09/2024  
Time: 09:18:12  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione BB pk 0 - BT SLV.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione BB\

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,2105 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 46,44 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 46,44 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)



Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	9,4459 m	30,4826 m
Point 2	4,8778 m	30,4826 m
Point 3	13,2198 m	32,8531 m
Point 4	26,7425 m	41,3471 m
Point 5	25,0333 m	40,2736 m
Point 6	0 m	31,2226 m
Point 7	45,9138 m	43,709 m
Point 8	39,8597 m	43,5367 m
Point 9	47,9318 m	43,8381 m
Point 10	49,9498 m	44,9042 m
Point 11	48,9408 m	44,2524 m
Point 12	28,7606 m	42,7883 m
Point 13	27,6703 m	42,1136 m
Point 14	30,3383 m	43,146 m
Point 15	37,8417 m	43,6062 m
Point 16	32,9014 m	43,4914 m
Point 17	71,1287 m	44,3 m
Point 18	71,1287 m	43,7 m

Point 19	70,3287 m	43,7 m
Point 20	140 m	40,605 m
Point 21	71,1287 m	40,4064 m
Point 22	140 m	34,0308 m
Point 23	140 m	0 m
Point 24	69,1211 m	44,6388 m
Point 25	0 m	0 m
Point 26	70,3287 m	17,7 m
Point 27	71,1287 m	19,0417 m
Point 28	71,1287 m	17,7 m
Point 29	70,3287 m	44,3 m
Point 30	140 m	19,2037 m
Point 31	70,3287 m	33,8741 m
Point 32	71,1287 m	33,8884 m
Point 33	70,3287 m	40,4041 m
Point 34	70,3287 m	19,0398 m
Point 35	0 m	18,8744 m
Point 36	50,9589 m	45,4359 m
Point 37	101,4628 m	44,1879 m
Point 38	97,3735 m	45,9708 m
Point 39	109,5446 m	44,1879 m
Point 40	140 m	44,2105 m
Point 41	113,9358 m	44,1633 m
Point 42	91,3194 m	46,5304 m
Point 43	90,3104 m	46,924 m
Point 44	92,3284 m	46,3998 m
Point 45	96,3645 m	46,2513 m
Point 46	95,3555 m	46,3372 m
Point 47	110,7287 m	40,5206 m
Point 48	110,7287 m	44,1813 m
Point 49	110,7287 m	34,0308 m
Point 50	110,7287 m	10,7 m
Point 51	110,7287 m	19,1348 m
Point 52	30,7287 m	40,29 m
Point 53	30,7287 m	43,1986 m
Point 54	30,7287 m	33,1661 m
Point 55	30,7287 m	10,7 m
Point 56	30,7287 m	18,9467 m
Point 57	87,2834 m	48,4898 m



Point 58	61,049 m	44,777 m
Point 59	59,031 m	44,7304 m
Point 60	65,0851 m	44,6045 m
Point 61	72,0957 m	46,1592 m
Point 62	71,2477 m	45,8382 m
Point 63	52,9769 m	45,7743 m
Point 64	51,9679 m	45,7319 m
Point 65	53,9859 m	45,7144 m
Point 66	58,022 m	44,7912 m
Point 67	56,0039 m	45,1149 m
Point 68	81,03 m	48,6565 m
Point 69	80,14 m	48,6137 m
Point 70	83,6984 m	48,6562 m
Point 71	86,03 m	48,726 m
Point 72	85,4771 m	48,7298 m
Point 73	75,1752 m	46,1819 m
Point 74	73,1572 m	46,0558 m
Point 75	76,2634 m	46,5027 m
Point 76	79,2517 m	48,3918 m
Point 77	78,3631 m	47,83 m
Point 78	100,4005 m	44,6558 m
Point 79	76,05 m	46,44 m

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	75	77	2,484 m	32,3 °	
Line 2	77	76	1,0513 m	32,3 °	
Line 3	76	69	0,9156 m	14 °	
Line 4	69	68	0,89103 m	2,75 °	Drainage
Line 5	68	70	2,6684 m	-0,00644 °	Drainage
Line 6	70	72	1,7802 m	2,37 °	Drainage
Line 7	72	71	0,55291 m	-0,394 °	Drainage
Line 8	71	57	1,2755 m	-10,7 °	Drainage
Line 9	57	43	3,408 m	-27,4 °	Drainage
Line 10	43	42	1,0831 m	-21,3 °	Drainage
Line 11	42	75	15,056 m	0,105 °	
Line 12	5	4	2,0184 m	32,1 °	Profilo di Piena - FIUME
Line 13	4	13	1,2035 m	39,6 °	Profilo di Piena - FIUME
Line 14	13	12	1,2822 m	31,8 °	Profilo di Piena - FIUME
Line 15	12	14	1,6177 m	12,8 °	Profilo di Piena - FIUME

Line 16	14	53	0,39393 m	7,67 °	Profilo di Piena - FIUME
Line 17	53	52	2,9086 m	90 °	
Line 18	52	5	5,6954 m	0,165 °	
Line 19	48	47	3,6607 m	90 °	
Line 20	47	21	39,6 m	0,165 °	
Line 21	21	18	3,2936 m	90 °	
Line 22	18	17	0,6 m	90 °	
Line 23	17	29	0,8 m	0 °	
Line 24	29	19	0,6 m	90 °	
Line 25	19	33	3,2959 m	90 °	
Line 26	33	52	39,6 m	0,165 °	
Line 27	48	41	3,2072 m	-0,322 °	Zero Pressure
Line 28	41	40	26,064 m	0,104 °	Zero Pressure
Line 29	40	20	3,6055 m	90 °	BC - Lato DX
Line 30	20	47	29,271 m	0,165 °	
Line 31	22	20	6,5742 m	90 °	BC - Lato DX
Line 32	47	49	6,4898 m	90 °	
Line 33	49	22	29,271 m	0 °	
Line 34	32	21	6,518 m	90 °	
Line 35	49	32	39,6 m	0,206 °	
Line 36	49	51	14,896 m	90 °	
Line 37	51	27	39,6 m	0,135 °	
Line 38	22	30	14,827 m	90 °	BC - Lato DX
Line 39	30	51	29,271 m	0,135 °	
Line 40	54	52	7,1239 m	90 °	
Line 41	33	31	6,53 m	90 °	
Line 42	31	54	39,606 m	1,02 °	
Line 43	56	54	14,219 m	90 °	
Line 44	34	56	39,6 m	0,135 °	
Line 45	3	5	13,951 m	32,1 °	Profilo di Piena - FIUME
Line 46	54	3	17,512 m	1,02 °	
Line 47	35	6	12,348 m	90 °	BC - Lato SX
Line 48	6	2	4,9336 m	-8,63 °	Profilo di Piena - FIUME
Line 49	2	1	4,5681 m	0 °	Profilo di Piena - FIUME
Line 50	1	3	4,4566 m	32,1 °	Profilo di Piena - FIUME
Line 51	56	35	30,729 m	0,135 °	
Line 52	25	35	18,874 m	90 °	BC - Lato SX
Line 53	56	55	8,2467 m	90 °	
Line 54	55	50	80 m	0 °	

Line 55	50	51	8,4348 m	90 °	
Line 56	30	23	19,204 m	90 °	BC - Lato DX
Line 57	23	25	140 m	0 °	
Line 58	34	26	1,3398 m	90 °	
Line 59	26	28	0,8 m	0 °	
Line 60	28	27	1,3417 m	90 °	
Line 61	34	27	0,8 m	0,136 °	
Line 62	31	32	0,80013 m	1,02 °	
Line 63	33	21	0,8 m	0,165 °	
Line 64	19	18	0,8 m	0 °	
Line 65	75	79	0,22242 m	16,4 °	
Line 66	79	73	0,91208 m	16,4 °	Profilo di Piena - FIUME
Line 67	73	74	2,0219 m	3,58 °	Profilo di Piena - FIUME
Line 68	74	61	1,0665 m	-5,56 °	Profilo di Piena - FIUME
Line 69	61	62	0,90672 m	20,7 °	Profilo di Piena - FIUME
Line 70	62	24	2,4415 m	29,4 °	Profilo di Piena - FIUME
Line 71	24	60	4,0361 m	0,487 °	Profilo di Piena - FIUME
Line 72	60	58	4,0398 m	-2,45 °	Profilo di Piena - FIUME
Line 73	58	59	2,0185 m	1,32 °	Profilo di Piena - FIUME
Line 74	59	66	1,0108 m	-3,45 °	Profilo di Piena - FIUME
Line 75	66	67	2,0439 m	-9,11 °	Profilo di Piena - FIUME
Line 76	67	65	2,1052 m	-16,5 °	Profilo di Piena - FIUME
Line 77	65	63	1,0108 m	-3,4 °	Profilo di Piena - FIUME
Line 78	63	64	1,0099 m	2,41 °	Profilo di Piena - FIUME
Line 79	64	36	1,0515 m	16,3 °	Profilo di Piena - FIUME
Line 80	36	10	1,1406 m	27,8 °	Profilo di Piena - FIUME
Line 81	10	11	1,2012 m	32,9 °	Profilo di Piena - FIUME
Line 82	11	9	1,0907 m	22,3 °	Profilo di Piena - FIUME
Line 83	9	7	2,0221 m	3,66 °	Profilo di Piena - FIUME
Line 84	7	8	6,0566 m	1,63 °	Profilo di Piena - FIUME
Line 85	8	15	2,0192 m	-1,97 °	Profilo di Piena - FIUME
Line 86	15	16	4,9416 m	1,33 °	Profilo di Piena - FIUME
Line 87	16	53	2,1923 m	7,68 °	Profilo di Piena - FIUME
Line 88	48	39	1,1841 m	-0,319 °	Zero Pressure
Line 89	39	37	8,0818 m	0 °	Zero Pressure
Line 90	37	78	1,1608 m	-23,8 °	Drainage
Line 91	78	38	3,3003 m	-23,5 °	Drainage
Line 92	38	45	1,0473 m	-15,5 °	Drainage
Line 93	45	46	1,0126 m	-4,87 °	Drainage

Line 94	46	44	3,0277 m	-1,18 °	Drainage
Line 95	44	42	1,0174 m	-7,38 °	Drainage
Line 96	31	34	14,834 m	90 °	
Line 97	27	32	14,847 m	90 °	

## Regions

	Material	Points
Region 1	UG1 - Misto	75;77;76;69;68;70;72;71;57;43;42
Region 2	UG2 - Limo Argilloso	5;4;13;12;14;53;52
Region 3	UG2 - Limo Argilloso	47;48;41;40;20
Region 4	UG3 - Sabbia Limo Ghiaiosa	22;20;47;49
Region 5	UG3 - Sabbia Limo Ghiaiosa	32;21;47;49
Region 6	UG4 - Sabbia Ghiaiosa	27;32;49;51
Region 7	UG4 - Sabbia Ghiaiosa	51;49;22;30
Region 8	UG3 - Sabbia Limo Ghiaiosa	54;52;33;31
Region 9	UG4 - Sabbia Ghiaiosa	56;54;31;34
Region 10	UG3 - Sabbia Limo Ghiaiosa	3;5;52;54
Region 11	UG4 - Sabbia Ghiaiosa	35;6;2;1;3;54;56

Region 12	UG5 - Argilla Limosa	25;35;56;55;50;51;30;23
Region 13	UG5 - Argilla Limosa	55;56;34;26;28;27;51;50
Region 14	Diaframma	26;34;27;28
Region 15	Diaframma	32;31;34;27
Region 16	Diaframma	31;33;21;32
Region 17	Diaframma	33;19;18;21
Region 18	Diaframma	19;29;17;18
Region 19	UG2 - Limo Argilloso	75;79;73;74;61;62;24;60;58;59;66;67;65;63;64;36;10;11;9;7;8;15;16;53;52;33;19;29;17

## Mesh Properties

Global Element Size: 0,3 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 158  
Date: 19/09/2024  
Time: 09:18:18  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione BB pk 0 - LT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione BB\

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,2105 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: [\(0,01; 1e-10\)](#)  
Data Point: [\(0,018329807; 9,8537502e-11\)](#)  
Data Point: [\(0,033598183; 9,6642125e-11\)](#)  
Data Point: [\(0,061584821; 9,4197688e-11\)](#)  
Data Point: [\(0,11288379; 9,1054741e-11\)](#)  
Data Point: [\(0,20691381; 8,7032912e-11\)](#)  
Data Point: [\(0,37926902; 8,19208e-11\)](#)  
Data Point: [\(0,6951928; 7,5483248e-11\)](#)  
Data Point: [\(1,274275; 6,7486396e-11\)](#)  
Data Point: [\(2,3357215; 5,775836e-11\)](#)  
Data Point: [\(4,2813324; 4,6317939e-11\)](#)  
Data Point: [\(7,8475997; 3,3627236e-11\)](#)  
Data Point: [\(14,384499; 2,0941088e-11\)](#)  
Data Point: [\(26,366509; 1,0378701e-11\)](#)  
Data Point: [\(48,329302; 3,80402e-12\)](#)  
Data Point: [\(88,586679; 1,0129493e-12\)](#)



Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)



Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)



Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: [1 m](#)

## Points

	X	Y
Point 1	9,4459 m	30,4826 m
Point 2	4,8778 m	30,4826 m
Point 3	13,2198 m	32,8531 m
Point 4	26,7425 m	41,3471 m
Point 5	25,0333 m	40,2736 m
Point 6	71,1287 m	20,7 m
Point 7	70,3287 m	20,7 m
Point 8	70,3287 m	23,9055 m
Point 9	0 m	31,2226 m
Point 10	71,1287 m	23,9055 m
Point 11	45,9138 m	43,709 m
Point 12	39,8597 m	43,5367 m
Point 13	47,9318 m	43,8381 m
Point 14	49,9498 m	44,9042 m
Point 15	48,9408 m	44,2524 m
Point 16	28,7606 m	42,7883 m
Point 17	27,6703 m	42,1136 m
Point 18	30,3383 m	43,146 m

Point 19	37,8417 m	43,6062 m
Point 20	32,9014 m	43,4914 m
Point 21	71,1287 m	44,3 m
Point 22	71,1287 m	43,7 m
Point 23	70,3287 m	43,7 m
Point 24	140 m	40,605 m
Point 25	71,1287 m	40,4064 m
Point 26	140 m	34,0308 m
Point 27	140 m	0 m
Point 28	69,1211 m	44,6388 m
Point 29	0 m	0 m
Point 30	70,3287 m	17,7 m
Point 31	71,1287 m	19,0417 m
Point 32	71,1287 m	17,7 m
Point 33	70,3287 m	44,3 m
Point 34	140 m	19,2037 m
Point 35	70,3287 m	33,8741 m
Point 36	71,1287 m	33,8884 m
Point 37	70,3287 m	40,4041 m
Point 38	70,3287 m	19,0398 m
Point 39	0 m	18,8744 m
Point 40	50,9589 m	45,4359 m
Point 41	97,3735 m	45,9708 m
Point 42	109,5446 m	44,1879 m
Point 43	140 m	44,2105 m
Point 44	113,9358 m	44,1633 m
Point 45	91,3194 m	46,5304 m
Point 46	90,3104 m	46,924 m
Point 47	92,3284 m	46,3998 m
Point 48	96,3645 m	46,2513 m
Point 49	95,3555 m	46,3372 m
Point 50	110,7287 m	40,5206 m
Point 51	110,7287 m	44,1813 m
Point 52	110,7287 m	34,0308 m
Point 53	110,7287 m	10,7 m
Point 54	110,7287 m	19,1348 m
Point 55	30,7287 m	40,29 m
Point 56	30,7287 m	43,1986 m
Point 57	30,7287 m	33,1661 m

Point 58	30,7287 m	10,7 m
Point 59	30,7287 m	18,9467 m
Point 60	87,2834 m	48,4898 m
Point 61	61,049 m	44,777 m
Point 62	59,031 m	44,7304 m
Point 63	65,0851 m	44,6045 m
Point 64	72,0957 m	46,1592 m
Point 65	71,2477 m	45,8382 m
Point 66	52,9769 m	45,7743 m
Point 67	51,9679 m	45,7319 m
Point 68	53,9859 m	45,7144 m
Point 69	58,022 m	44,7912 m
Point 70	56,0039 m	45,1149 m
Point 71	81,03 m	48,6565 m
Point 72	80,14 m	48,6137 m
Point 73	83,6984 m	48,6562 m
Point 74	86,03 m	48,726 m
Point 75	85,4771 m	48,7298 m
Point 76	75,1752 m	46,1819 m
Point 77	73,1572 m	46,0558 m
Point 78	76,2634 m	46,5027 m
Point 79	79,2517 m	48,3918 m
Point 80	78,3631 m	47,83 m
Point 81	100,4005 m	44,6558 m
Point 82	101,4628 m	44,1879 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	78	80	Profilo di Piena - FIUME	2,484 m	32,3 °
Line 2	80	79		1,0513 m	32,3 °
Line 3	79	72		0,9156 m	14 °
Line 4	72	71	Drainage	0,89103 m	2,75 °
Line 5	71	73	Drainage	2,6684 m	-0,00644 °
Line 6	73	75	Drainage	1,7802 m	2,37 °
Line 7	75	74	Drainage	0,55291 m	-0,394 °
Line 8	74	60	Drainage	1,2755 m	-10,7 °
Line 9	60	46	Drainage	3,408 m	-27,4 °
Line 10	46	45	Drainage	1,0831 m	-21,3 °
Line 11	45	78		15,056 m	0,105 °
Line 12	5	4	Profilo di Piena - FIUME	2,0184 m	32,1 °

Line 13	4	17	Profilo di Piena - FIUME	1,2035 m	39,6 °
Line 14	17	16	Profilo di Piena - FIUME	1,2822 m	31,8 °
Line 15	16	18	Profilo di Piena - FIUME	1,6177 m	12,8 °
Line 16	18	56	Profilo di Piena - FIUME	0,39393 m	7,67 °
Line 17	56	55		2,9086 m	90 °
Line 18	55	5		5,6954 m	0,165 °
Line 19	51	50		3,6607 m	90 °
Line 20	50	25		39,6 m	0,165 °
Line 21	25	22		3,2936 m	90 °
Line 22	22	21		0,6 m	90 °
Line 23	21	33		0,8 m	0 °
Line 24	33	23		0,6 m	90 °
Line 25	23	37		3,2959 m	90 °
Line 26	37	55		39,6 m	0,165 °
Line 27	51	44	Zero Pressure	3,2072 m	-0,322 °
Line 28	44	43	Zero Pressure	26,064 m	0,104 °
Line 29	43	24	BC - Lato DX	3,6055 m	90 °
Line 30	24	50		29,271 m	0,165 °
Line 31	26	24	BC - Lato DX	6,5742 m	90 °
Line 32	50	52		6,4898 m	90 °
Line 33	52	26		29,271 m	0 °
Line 34	36	25		6,518 m	90 °
Line 35	52	36		39,6 m	0,206 °
Line 36	31	6		1,6583 m	90 °
Line 37	6	10		3,2055 m	90 °
Line 38	10	36		9,9829 m	90 °
Line 39	52	54		14,896 m	90 °
Line 40	54	31		39,6 m	0,135 °
Line 41	26	34	BC - Lato DX	14,827 m	90 °
Line 42	34	54		29,271 m	0,135 °
Line 43	57	55		7,1239 m	90 °
Line 44	37	35		6,53 m	90 °
Line 45	35	57		39,606 m	1,02 °
Line 46	59	57		14,219 m	90 °
Line 47	35	8		9,9686 m	90 °
Line 48	8	7		3,2055 m	90 °
Line 49	7	38		1,6602 m	90 °
Line 50	38	59		39,6 m	0,135 °
Line 51	3	5	Profilo di Piena - FIUME	13,951 m	32,1 °

Line 52	57	3		17,512 m	1,02 °
Line 53	39	9	BC - Lato SX	12,348 m	90 °
Line 54	9	2	Profilo di Piena - FIUME	4,9336 m	-8,63 °
Line 55	2	1	Profilo di Piena - FIUME	4,5681 m	0 °
Line 56	1	3	Profilo di Piena - FIUME	4,4566 m	32,1 °
Line 57	59	39		30,729 m	0,135 °
Line 58	29	39	BC - Lato SX	18,874 m	90 °
Line 59	59	58		8,2467 m	90 °
Line 60	58	53		80 m	0 °
Line 61	53	54		8,4348 m	90 °
Line 62	34	27	BC - Lato DX	19,204 m	90 °
Line 63	27	29		140 m	0 °
Line 64	38	30		1,3398 m	90 °
Line 65	30	32		0,8 m	0 °
Line 66	32	31		1,3417 m	90 °
Line 67	38	31		0,8 m	0,136 °
Line 68	7	6		0,8 m	0 °
Line 69	8	10		0,8 m	0 °
Line 70	35	36		0,80013 m	1,02 °
Line 71	37	25		0,8 m	0,165 °
Line 72	23	22		0,8 m	0 °
Line 73	56	20	Profilo di Piena - FIUME	2,1923 m	7,68 °
Line 74	20	19	Profilo di Piena - FIUME	4,9416 m	1,33 °
Line 75	19	12	Profilo di Piena - FIUME	2,0192 m	-1,97 °
Line 76	12	11	Profilo di Piena - FIUME	6,0566 m	1,63 °
Line 77	11	13	Profilo di Piena - FIUME	2,0221 m	3,66 °
Line 78	13	15	Profilo di Piena - FIUME	1,0907 m	22,3 °
Line 79	15	14	Profilo di Piena - FIUME	1,2012 m	32,9 °
Line 80	14	40	Profilo di Piena - FIUME	1,1406 m	27,8 °
Line 81	40	67	Profilo di Piena - FIUME	1,0515 m	16,3 °
Line 82	67	66	Profilo di Piena - FIUME	1,0099 m	2,41 °
Line 83	66	68	Profilo di Piena - FIUME	1,0108 m	-3,4 °
Line 84	68	70	Profilo di Piena - FIUME	2,1052 m	-16,5 °
Line 85	70	69	Profilo di Piena - FIUME	2,0439 m	-9,11 °
Line 86	69	62	Profilo di Piena - FIUME	1,0108 m	-3,45 °
Line 87	62	61	Profilo di Piena - FIUME	2,0185 m	1,32 °
Line 88	61	63	Profilo di Piena - FIUME	4,0398 m	-2,45 °
Line 89	63	28	Profilo di Piena - FIUME	4,0361 m	0,487 °
Line 90	28	65	Profilo di Piena - FIUME	2,4415 m	29,4 °

Line 91	65	64	Profilo di Piena - FIUME	0,90672 m	20,7 °
Line 92	64	77	Profilo di Piena - FIUME	1,0665 m	-5,56 °
Line 93	77	76	Profilo di Piena - FIUME	2,0219 m	3,58 °
Line 94	76	78	Profilo di Piena - FIUME	1,1345 m	16,4 °
Line 95	45	47	Drainage	1,0174 m	-7,38 °
Line 96	47	49	Drainage	3,0277 m	-1,18 °
Line 97	49	48	Drainage	1,0126 m	-4,87 °
Line 98	48	41	Drainage	1,0473 m	-15,5 °
Line 99	41	81	Drainage	3,3003 m	-23,5 °
Line 100	81	82	Drainage	1,1608 m	-23,8 °
Line 101	82	42	Zero Pressure	8,0818 m	0 °
Line 102	42	51	Zero Pressure	1,1841 m	-0,319 °

## Regions

	Material	Points
Region 1	UG1 - Misto	78;80;79;72;71;73;75;74;60;46;45
Region 2	UG2 - Limo Argilloso	5;4;17;16;18;56;55
Region 3	UG2 - Limo Argilloso	50;51;44;43;24
Region 4	UG3 - Sabbia Limo Ghiaiosa	26;24;50;52
Region 5	UG3 - Sabbia Limo Ghiaiosa	36;25;50;52
Region 6	UG4 - Sabbia Ghiaiosa	31;6;10;36;52;54
Region 7	UG4 - Sabbia Ghiaiosa	54;52;26;34
Region 8	UG3 - Sabbia Limo Ghiaiosa	57;55;37;35
Region 9	UG4 - Sabbia Ghiaiosa	59;57;35;8;7;38

Region 10	UG3 - Sabbia Limo Ghiaiosa	3;5;55;57
Region 11	UG4 - Sabbia Ghiaiosa	39;9;2;1;3;57;59
Region 12	UG5 - Argilla Limosa	29;39;59;58;53;54;34;27
Region 13	UG5 - Argilla Limosa	58;59;38;30;32;31;54;53
Region 14	Diaframma	30;38;31;32
Region 15	Diaframma	38;7;6;31
Region 16	Diaframma	7;8;10;6
Region 17	Diaframma	8;35;36;10
Region 18	Diaframma	35;37;25;36
Region 19	Diaframma	37;23;22;25
Region 20	Diaframma	23;33;21;22
Region 21	UG2 - Limo Argilloso	55;56;20;19;12;11;13;15;14;40;67;66;68;70;69;62;61;63;28;65;64;77;76;78;45;47;49;48

## Mesh Properties

Global Element Size: 0,3 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 160  
Date: 18/09/2024  
Time: 21:52:53  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione BB pk 0 - Rapido Svaso BT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione BB\  
Last Solved Date: 18/09/2024  
Last Solved Time: 21:52:56

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d



# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,2105 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20



### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,14999785](#)  
Residual Water Content: [0,014999785](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

### Settings

View: [2D](#)  
Element Thickness: [1 m](#)

### Points

	X	Y
Point 1	9,4459 m	30,4826 m
Point 2	4,8778 m	30,4826 m
Point 3	13,2198 m	32,8531 m
Point 4	26,7425 m	41,3471 m
Point 5	25,0333 m	40,2736 m
Point 6	0 m	31,2226 m
Point 7	45,9138 m	43,709 m
Point 8	39,8597 m	43,5367 m
Point 9	47,9318 m	43,8381 m
Point 10	49,9498 m	44,9042 m
Point 11	48,9408 m	44,2524 m
Point 12	28,7606 m	42,7883 m
Point 13	27,6703 m	42,1136 m
Point 14	30,3383 m	43,146 m
Point 15	37,8417 m	43,6062 m
Point 16	32,9014 m	43,4914 m
Point 17	71,1287 m	44,3 m
Point 18	71,1287 m	43,7 m

Point 19	70,3287 m	43,7 m
Point 20	140 m	40,605 m
Point 21	71,1287 m	40,4064 m
Point 22	140 m	34,0308 m
Point 23	140 m	0 m
Point 24	69,1211 m	44,6388 m
Point 25	0 m	0 m
Point 26	70,3287 m	17,7 m
Point 27	71,1287 m	19,0417 m
Point 28	71,1287 m	17,7 m
Point 29	70,3287 m	44,3 m
Point 30	140 m	19,2037 m
Point 31	70,3287 m	33,8741 m
Point 32	71,1287 m	33,8884 m
Point 33	70,3287 m	40,4041 m
Point 34	70,3287 m	19,0398 m
Point 35	0 m	18,8744 m
Point 36	50,9589 m	45,4359 m
Point 37	97,3735 m	45,9708 m
Point 38	109,5446 m	44,1879 m
Point 39	140 m	44,2105 m
Point 40	113,9358 m	44,1633 m
Point 41	91,3194 m	46,5304 m
Point 42	90,3104 m	46,924 m
Point 43	92,3284 m	46,3998 m
Point 44	96,3645 m	46,2513 m
Point 45	95,3555 m	46,3372 m
Point 46	110,7287 m	40,5206 m
Point 47	110,7287 m	44,1813 m
Point 48	110,7287 m	34,0308 m
Point 49	110,7287 m	10,7 m
Point 50	110,7287 m	19,1348 m
Point 51	30,7287 m	40,29 m
Point 52	30,7287 m	43,1986 m
Point 53	30,7287 m	33,1661 m
Point 54	30,7287 m	10,7 m
Point 55	30,7287 m	18,9467 m
Point 56	87,2834 m	48,4898 m
Point 57	61,049 m	44,777 m

Point 58	59,031 m	44,7304 m
Point 59	65,0851 m	44,6045 m
Point 60	72,0957 m	46,1592 m
Point 61	71,2477 m	45,8382 m
Point 62	52,9769 m	45,7743 m
Point 63	51,9679 m	45,7319 m
Point 64	53,9859 m	45,7144 m
Point 65	58,022 m	44,7912 m
Point 66	56,0039 m	45,1149 m
Point 67	81,03 m	48,6565 m
Point 68	80,14 m	48,6137 m
Point 69	83,6984 m	48,6562 m
Point 70	86,03 m	48,726 m
Point 71	85,4771 m	48,7298 m
Point 72	75,1752 m	46,1819 m
Point 73	73,1572 m	46,0558 m
Point 74	76,2634 m	46,5027 m
Point 75	79,2517 m	48,3918 m
Point 76	78,3631 m	47,83 m
Point 77	100,4005 m	44,6558 m
Point 78	101,4628 m	44,1879 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	74	76	Profilo di Piena - FIUME	2,484 m	32,3 °
Line 2	76	75		1,0513 m	32,3 °
Line 3	75	68		0,9156 m	14 °
Line 4	68	67	Drainage	0,89103 m	2,75 °
Line 5	67	69	Drainage	2,6684 m	-0,00644 °
Line 6	69	71	Drainage	1,7802 m	2,37 °
Line 7	71	70	Drainage	0,55291 m	-0,394 °
Line 8	70	56	Drainage	1,2755 m	-10,7 °
Line 9	56	42	Drainage	3,408 m	-27,4 °
Line 10	42	41	Drainage	1,0831 m	-21,3 °
Line 11	41	74		15,056 m	0,105 °
Line 12	5	4	Profilo di Piena - FIUME	2,0184 m	32,1 °
Line 13	4	13	Profilo di Piena - FIUME	1,2035 m	39,6 °
Line 14	13	12	Profilo di Piena - FIUME	1,2822 m	31,8 °
Line 15	12	14	Profilo di Piena - FIUME	1,6177 m	12,8 °
Line 16	14	52	Profilo di Piena - FIUME	0,39393 m	7,67 °

Line 17	52	51		2,9086 m	90 °
Line 18	51	5		5,6954 m	0,165 °
Line 19	47	46		3,6607 m	90 °
Line 20	46	21		39,6 m	0,165 °
Line 21	21	18		3,2936 m	90 °
Line 22	18	17		0,6 m	90 °
Line 23	17	29		0,8 m	0 °
Line 24	29	19		0,6 m	90 °
Line 25	19	33		3,2959 m	90 °
Line 26	33	51		39,6 m	0,165 °
Line 27	47	40	Zero Pressure	3,2072 m	-0,322 °
Line 28	40	39	Zero Pressure	26,064 m	0,104 °
Line 29	39	20	BC - Lato DX	3,6055 m	90 °
Line 30	20	46		29,271 m	0,165 °
Line 31	22	20	BC - Lato DX	6,5742 m	90 °
Line 32	46	48		6,4898 m	90 °
Line 33	48	22		29,271 m	0 °
Line 34	32	21		6,518 m	90 °
Line 35	48	32		39,6 m	0,206 °
Line 36	48	50		14,896 m	90 °
Line 37	50	27		39,6 m	0,135 °
Line 38	22	30	BC - Lato DX	14,827 m	90 °
Line 39	30	50		29,271 m	0,135 °
Line 40	53	51		7,1239 m	90 °
Line 41	33	31		6,53 m	90 °
Line 42	31	53		39,606 m	1,02 °
Line 43	55	53		14,219 m	90 °
Line 44	34	55		39,6 m	0,135 °
Line 45	3	5	Profilo di Piena - FIUME	13,951 m	32,1 °
Line 46	53	3		17,512 m	1,02 °
Line 47	35	6	BC - Lato SX	12,348 m	90 °
Line 48	6	2	Profilo di Piena - FIUME	4,9336 m	-8,63 °
Line 49	2	1	Profilo di Piena - FIUME	4,5681 m	0 °
Line 50	1	3	Profilo di Piena - FIUME	4,4566 m	32,1 °
Line 51	55	35		30,729 m	0,135 °
Line 52	25	35	BC - Lato SX	18,874 m	90 °
Line 53	55	54		8,2467 m	90 °
Line 54	54	49		80 m	0 °
Line 55	49	50		8,4348 m	90 °

Line 56	30	23	BC - Lato DX	19,204 m	90 °
Line 57	23	25		140 m	0 °
Line 58	34	26		1,3398 m	90 °
Line 59	26	28		0,8 m	0 °
Line 60	28	27		1,3417 m	90 °
Line 61	34	27		0,8 m	0,136 °
Line 62	31	32		0,80013 m	1,02 °
Line 63	33	21		0,8 m	0,165 °
Line 64	19	18		0,8 m	0 °
Line 65	52	16	Profilo di Piena - FIUME	2,1923 m	7,68 °
Line 66	16	15	Profilo di Piena - FIUME	4,9416 m	1,33 °
Line 67	15	8	Profilo di Piena - FIUME	2,0192 m	-1,97 °
Line 68	8	7	Profilo di Piena - FIUME	6,0566 m	1,63 °
Line 69	7	9	Profilo di Piena - FIUME	2,0221 m	3,66 °
Line 70	9	11	Profilo di Piena - FIUME	1,0907 m	22,3 °
Line 71	11	10	Profilo di Piena - FIUME	1,2012 m	32,9 °
Line 72	10	36	Profilo di Piena - FIUME	1,1406 m	27,8 °
Line 73	36	63	Profilo di Piena - FIUME	1,0515 m	16,3 °
Line 74	63	62	Profilo di Piena - FIUME	1,0099 m	2,41 °
Line 75	62	64	Profilo di Piena - FIUME	1,0108 m	-3,4 °
Line 76	64	66	Profilo di Piena - FIUME	2,1052 m	-16,5 °
Line 77	66	65	Profilo di Piena - FIUME	2,0439 m	-9,11 °
Line 78	65	58	Profilo di Piena - FIUME	1,0108 m	-3,45 °
Line 79	58	57	Profilo di Piena - FIUME	2,0185 m	1,32 °
Line 80	57	59	Profilo di Piena - FIUME	4,0398 m	-2,45 °
Line 81	59	24	Profilo di Piena - FIUME	4,0361 m	0,487 °
Line 82	24	61	Profilo di Piena - FIUME	2,4415 m	29,4 °
Line 83	61	60	Profilo di Piena - FIUME	0,90672 m	20,7 °
Line 84	60	73	Profilo di Piena - FIUME	1,0665 m	-5,56 °
Line 85	73	72	Profilo di Piena - FIUME	2,0219 m	3,58 °
Line 86	72	74	Profilo di Piena - FIUME	1,1345 m	16,4 °
Line 87	41	43	Drainage	1,0174 m	-7,38 °
Line 88	43	45	Drainage	3,0277 m	-1,18 °
Line 89	45	44	Drainage	1,0126 m	-4,87 °
Line 90	44	37	Drainage	1,0473 m	-15,5 °
Line 91	37	77	Drainage	3,3003 m	-23,5 °
Line 92	77	78	Drainage	1,1608 m	-23,8 °
Line 93	78	38	Zero Pressure	8,0818 m	0 °
Line 94	38	47	Zero Pressure	1,1841 m	-0,319 °

Line 95	31	34		14,834 m	90 °
Line 96	27	32		14,847 m	90 °

## Regions

	Material	Points
Region 1	UG1 - Misto	74;76;75;68;67;69;71;70;56;42;41
Region 2	UG2 - Limo Argilloso	5;4;13;12;14;52;51
Region 3	UG2 - Limo Argilloso	46;47;40;39;20
Region 4	UG3 - Sabbia Limo Ghiaiosa	22;20;46;48
Region 5	UG3 - Sabbia Limo Ghiaiosa	32;21;46;48
Region 6	UG4 - Sabbia Ghiaiosa	27;32;48;50
Region 7	UG4 - Sabbia Ghiaiosa	50;48;22;30
Region 8	UG3 - Sabbia Limo Ghiaiosa	53;51;33;31
Region 9	UG4 - Sabbia Ghiaiosa	55;53;31;34
Region 10	UG3 - Sabbia Limo Ghiaiosa	3;5;51;53
Region 11	UG4 - Sabbia Ghiaiosa	35;6;2;1;3;53;55
Region 12	UG5 - Argilla Limosa	25;35;55;54;49;50;30;23



Region 13	UG5 - Argilla Limosa	54;55;34;26;28;27;50;49
Region 14	Diaframma	26;34;27;28
Region 15	Diaframma	32;31;34;27
Region 16	Diaframma	31;33;21;32
Region 17	Diaframma	33;19;18;21
Region 18	Diaframma	19;29;17;18
Region 19	UG2 - Limo Argilloso	51;52;16;15;8;7;9;11;10;36;63;62;64;66;65;58;57;59;24;61;60;73;72;74;41;43;45;44;37

## Mesh Properties

Global Element Size: 0,3 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 162  
Date: 18/09/2024  
Time: 21:53:00  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione BB pk 0 - Rapido Svaso LT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione BB\  
Last Solved Date: 18/09/2024  
Last Solved Time: 21:53:04

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 44,2105 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)



Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

### Settings

View: [2D](#)  
Element Thickness: [1 m](#)

### Points

	X	Y
Point 1	9,4459 m	30,4826 m
Point 2	4,8778 m	30,4826 m
Point 3	13,2198 m	32,8531 m
Point 4	26,7425 m	41,3471 m
Point 5	25,0333 m	40,2736 m
Point 6	0 m	31,2226 m
Point 7	45,9138 m	43,709 m
Point 8	39,8597 m	43,5367 m
Point 9	47,9318 m	43,8381 m
Point 10	49,9498 m	44,9042 m
Point 11	48,9408 m	44,2524 m
Point 12	28,7606 m	42,7883 m
Point 13	27,6703 m	42,1136 m
Point 14	30,3383 m	43,146 m
Point 15	37,8417 m	43,6062 m
Point 16	32,9014 m	43,4914 m
Point 17	71,1287 m	44,3 m
Point 18	71,1287 m	43,7 m

Point 19	70,3287 m	43,7 m
Point 20	140 m	40,605 m
Point 21	71,1287 m	40,4064 m
Point 22	140 m	34,0308 m
Point 23	140 m	0 m
Point 24	69,1211 m	44,6388 m
Point 25	0 m	0 m
Point 26	70,3287 m	17,7 m
Point 27	71,1287 m	19,0417 m
Point 28	71,1287 m	17,7 m
Point 29	70,3287 m	44,3 m
Point 30	140 m	19,2037 m
Point 31	70,3287 m	33,8741 m
Point 32	71,1287 m	33,8884 m
Point 33	70,3287 m	40,4041 m
Point 34	70,3287 m	19,0398 m
Point 35	0 m	18,8744 m
Point 36	50,9589 m	45,4359 m
Point 37	97,3735 m	45,9708 m
Point 38	109,5446 m	44,1879 m
Point 39	140 m	44,2105 m
Point 40	113,9358 m	44,1633 m
Point 41	91,3194 m	46,5304 m
Point 42	90,3104 m	46,924 m
Point 43	92,3284 m	46,3998 m
Point 44	96,3645 m	46,2513 m
Point 45	95,3555 m	46,3372 m
Point 46	110,7287 m	40,5206 m
Point 47	110,7287 m	44,1813 m
Point 48	110,7287 m	34,0308 m
Point 49	110,7287 m	10,7 m
Point 50	110,7287 m	19,1348 m
Point 51	30,7287 m	40,29 m
Point 52	30,7287 m	43,1986 m
Point 53	30,7287 m	33,1661 m
Point 54	30,7287 m	10,7 m
Point 55	30,7287 m	18,9467 m
Point 56	87,2834 m	48,4898 m
Point 57	61,049 m	44,777 m

Point 58	59,031 m	44,7304 m
Point 59	65,0851 m	44,6045 m
Point 60	72,0957 m	46,1592 m
Point 61	71,2477 m	45,8382 m
Point 62	52,9769 m	45,7743 m
Point 63	51,9679 m	45,7319 m
Point 64	53,9859 m	45,7144 m
Point 65	58,022 m	44,7912 m
Point 66	56,0039 m	45,1149 m
Point 67	81,03 m	48,6565 m
Point 68	80,14 m	48,6137 m
Point 69	83,6984 m	48,6562 m
Point 70	86,03 m	48,726 m
Point 71	85,4771 m	48,7298 m
Point 72	75,1752 m	46,1819 m
Point 73	73,1572 m	46,0558 m
Point 74	76,2634 m	46,5027 m
Point 75	79,2517 m	48,3918 m
Point 76	78,3631 m	47,83 m
Point 77	100,4005 m	44,6558 m
Point 78	101,4628 m	44,1879 m

## Lines

	Start Point	End Point	Hydraulic Boundary	Length	Angle
Line 1	74	76	Profilo di Piena - FIUME	2,484 m	32,3 °
Line 2	76	75		1,0513 m	32,3 °
Line 3	75	68		0,9156 m	14 °
Line 4	68	67	Drainage	0,89103 m	2,75 °
Line 5	67	69	Drainage	2,6684 m	-0,00644 °
Line 6	69	71	Drainage	1,7802 m	2,37 °
Line 7	71	70	Drainage	0,55291 m	-0,394 °
Line 8	70	56	Drainage	1,2755 m	-10,7 °
Line 9	56	42	Drainage	3,408 m	-27,4 °
Line 10	42	41	Drainage	1,0831 m	-21,3 °
Line 11	41	74		15,056 m	0,105 °
Line 12	5	4	Profilo di Piena - FIUME	2,0184 m	32,1 °
Line 13	4	13	Profilo di Piena - FIUME	1,2035 m	39,6 °
Line 14	13	12	Profilo di Piena - FIUME	1,2822 m	31,8 °
Line 15	12	14	Profilo di Piena - FIUME	1,6177 m	12,8 °
Line 16	14	52	Profilo di Piena - FIUME	0,39393 m	7,67 °

Line 17	52	51		2,9086 m	90 °
Line 18	51	5		5,6954 m	0,165 °
Line 19	47	46		3,6607 m	90 °
Line 20	46	21		39,6 m	0,165 °
Line 21	21	18		3,2936 m	90 °
Line 22	18	17		0,6 m	90 °
Line 23	17	29		0,8 m	0 °
Line 24	29	19		0,6 m	90 °
Line 25	19	33		3,2959 m	90 °
Line 26	33	51		39,6 m	0,165 °
Line 27	47	40	Zero Pressure	3,2072 m	-0,322 °
Line 28	40	39	Zero Pressure	26,064 m	0,104 °
Line 29	39	20	BC - Lato DX	3,6055 m	90 °
Line 30	20	46		29,271 m	0,165 °
Line 31	22	20	BC - Lato DX	6,5742 m	90 °
Line 32	46	48		6,4898 m	90 °
Line 33	48	22		29,271 m	0 °
Line 34	32	21		6,518 m	90 °
Line 35	48	32		39,6 m	0,206 °
Line 36	48	50		14,896 m	90 °
Line 37	50	27		39,6 m	0,135 °
Line 38	22	30	BC - Lato DX	14,827 m	90 °
Line 39	30	50		29,271 m	0,135 °
Line 40	53	51		7,1239 m	90 °
Line 41	33	31		6,53 m	90 °
Line 42	31	53		39,606 m	1,02 °
Line 43	55	53		14,219 m	90 °
Line 44	34	55		39,6 m	0,135 °
Line 45	3	5	Profilo di Piena - FIUME	13,951 m	32,1 °
Line 46	53	3		17,512 m	1,02 °
Line 47	35	6	BC - Lato SX	12,348 m	90 °
Line 48	6	2	Profilo di Piena - FIUME	4,9336 m	-8,63 °
Line 49	2	1	Profilo di Piena - FIUME	4,5681 m	0 °
Line 50	1	3	Profilo di Piena - FIUME	4,4566 m	32,1 °
Line 51	55	35		30,729 m	0,135 °
Line 52	25	35	BC - Lato SX	18,874 m	90 °
Line 53	55	54		8,2467 m	90 °
Line 54	54	49		80 m	0 °
Line 55	49	50		8,4348 m	90 °



Line 56	30	23	BC - Lato DX	19,204 m	90 °
Line 57	23	25		140 m	0 °
Line 58	34	26		1,3398 m	90 °
Line 59	26	28		0,8 m	0 °
Line 60	28	27		1,3417 m	90 °
Line 61	34	27		0,8 m	0,136 °
Line 62	31	32		0,80013 m	1,02 °
Line 63	33	21		0,8 m	0,165 °
Line 64	19	18		0,8 m	0 °
Line 65	52	16	Profilo di Piena - FIUME	2,1923 m	7,68 °
Line 66	16	15	Profilo di Piena - FIUME	4,9416 m	1,33 °
Line 67	15	8	Profilo di Piena - FIUME	2,0192 m	-1,97 °
Line 68	8	7	Profilo di Piena - FIUME	6,0566 m	1,63 °
Line 69	7	9	Profilo di Piena - FIUME	2,0221 m	3,66 °
Line 70	9	11	Profilo di Piena - FIUME	1,0907 m	22,3 °
Line 71	11	10	Profilo di Piena - FIUME	1,2012 m	32,9 °
Line 72	10	36	Profilo di Piena - FIUME	1,1406 m	27,8 °
Line 73	36	63	Profilo di Piena - FIUME	1,0515 m	16,3 °
Line 74	63	62	Profilo di Piena - FIUME	1,0099 m	2,41 °
Line 75	62	64	Profilo di Piena - FIUME	1,0108 m	-3,4 °
Line 76	64	66	Profilo di Piena - FIUME	2,1052 m	-16,5 °
Line 77	66	65	Profilo di Piena - FIUME	2,0439 m	-9,11 °
Line 78	65	58	Profilo di Piena - FIUME	1,0108 m	-3,45 °
Line 79	58	57	Profilo di Piena - FIUME	2,0185 m	1,32 °
Line 80	57	59	Profilo di Piena - FIUME	4,0398 m	-2,45 °
Line 81	59	24	Profilo di Piena - FIUME	4,0361 m	0,487 °
Line 82	24	61	Profilo di Piena - FIUME	2,4415 m	29,4 °
Line 83	61	60	Profilo di Piena - FIUME	0,90672 m	20,7 °
Line 84	60	73	Profilo di Piena - FIUME	1,0665 m	-5,56 °
Line 85	73	72	Profilo di Piena - FIUME	2,0219 m	3,58 °
Line 86	72	74	Profilo di Piena - FIUME	1,1345 m	16,4 °
Line 87	41	43	Drainage	1,0174 m	-7,38 °
Line 88	43	45	Drainage	3,0277 m	-1,18 °
Line 89	45	44	Drainage	1,0126 m	-4,87 °
Line 90	44	37	Drainage	1,0473 m	-15,5 °
Line 91	37	77	Drainage	3,3003 m	-23,5 °
Line 92	77	78	Drainage	1,1608 m	-23,8 °
Line 93	78	38	Zero Pressure	8,0818 m	0 °
Line 94	38	47	Zero Pressure	1,1841 m	-0,319 °

Line 95	31	34		14,834 m	90 °
Line 96	27	32		14,847 m	90 °

## Regions

	Material	Points
Region 1	UG1 - Misto	74;76;75;68;67;69;71;70;56;42;41
Region 2	UG2 - Limo Argilloso	5;4;13;12;14;52;51
Region 3	UG2 - Limo Argilloso	46;47;40;39;20
Region 4	UG3 - Sabbia Limo Ghiaiosa	22;20;46;48
Region 5	UG3 - Sabbia Limo Ghiaiosa	32;21;46;48
Region 6	UG4 - Sabbia Ghiaiosa	27;32;48;50
Region 7	UG4 - Sabbia Ghiaiosa	50;48;22;30
Region 8	UG3 - Sabbia Limo Ghiaiosa	53;51;33;31
Region 9	UG4 - Sabbia Ghiaiosa	55;53;31;34
Region 10	UG3 - Sabbia Limo Ghiaiosa	3;5;51;53
Region 11	UG4 - Sabbia Ghiaiosa	35;6;2;1;3;53;55
Region 12	UG5 - Argilla Limosa	25;35;55;54;49;50;30;23

Region 13	UG5 - Argilla Limosa	54;55;34;26;28;27;50;49
Region 14	Diaframma	26;34;27;28
Region 15	Diaframma	32;31;34;27
Region 16	Diaframma	31;33;21;32
Region 17	Diaframma	33;19;18;21
Region 18	Diaframma	19;29;17;18
Region 19	UG2 - Limo Argilloso	51;52;16;15;8;7;9;11;10;36;63;62;64;66;65;58;57;59;24;61;60;73;72;74;41;43;45;44;37

## Mesh Properties

Global Element Size: 0,3 m

## SEZIONE CC

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 147  
Date: 19/09/2024  
Time: 02:01:34  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione CC pk 200 - BT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione CC\  
Last Solved Date: 19/09/2024  
Last Solved Time: 02:01:38

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Limo e Argilla](#)

K-Function: [UG1 - Hyd Conductivity Function - Limo e Argilla](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia e Ghiaia](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia e Ghiaia](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia e Ghiaia](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia e Ghiaia](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 43,6355 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\)](#), [Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Limo e Argilla

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Limo e Argilla  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %



Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG3 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia e Ghiaia  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia e Ghiaia  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Limo e Argilla

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia e Ghiaia

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia e Ghiaia

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,14999785](#)  
Residual Water Content: [0,014999785](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y	Hydraulic Boundary
Point 1	70,44 m	43,8338 m	
Point 2	69,44 m	43,84 m	
Point 3	58,0964 m	43,0438 m	
Point 4	70,3091 m	44,1709 m	
Point 5	70,44 m	43,64 m	
Point 6	70,44 m	44,04 m	
Point 7	70,24 m	44,24 m	
Point 8	55,0932 m	42,9569 m	
Point 9	29,825 m	43,7496 m	
Point 10	40,8073 m	42,9232 m	
Point 11	48,9621 m	42,9747 m	
Point 12	36,8166 m	43,4108 m	
Point 13	19,94 m	43,1697 m	
Point 14	21,7496 m	43,6199 m	
Point 15	23,8118 m	43,4165 m	
Point 16	70,34 m	43,64 m	
Point 17	139,94 m	18,6903 m	
Point 18	0 m	18,6903 m	



Point 19	0 m	33,4905 m	
Point 20	0 m	0 m	
Point 21	140 m	0 m	
Point 22	139,94 m	33,4905 m	
Point 23	69,44 m	44,24 m	
Point 24	69,44 m	43,64 m	
Point 25	69,54 m	43,64 m	
Point 26	83,2958 m	48,4858 m	
Point 27	139,94 m	37,9905 m	
Point 28	78,2958 m	48,4858 m	
Point 29	77,2679 m	48,3444 m	
Point 30	19,3941 m	42,9666 m	
Point 31	70,34 m	17,9403 m	
Point 32	109,94 m	10,9403 m	
Point 33	109,94 m	18,6903 m	
Point 34	69,54 m	17,9403 m	
Point 35	76,4103 m	47,83 m	
Point 36	7,5539 m	37,9905 m	
Point 37	140 m	43,6355 m	
Point 38	109,94 m	33,4905 m	
Point 39	29,94 m	33,4905 m	
Point 40	29,94 m	18,6903 m	
Point 41	29,94 m	10,9403 m	
Point 42	29,94 m	37,9905 m	
Point 43	109,94 m	37,9905 m	
Point 44	109,94 m	43,6355 m	
Point 45	29,94 m	43,744 m	
Point 46	70,34 m	37,9905 m	
Point 47	95,4376 m	45,6673 m	
Point 48	90,3904 m	45,7903 m	
Point 49	89,381 m	45,9156 m	
Point 50	96,5699 m	45,3449 m	
Point 51	0 m	34,5721 m	
Point 52	100,4847 m	43,6355 m	Drainage
Point 53	99,4753 m	43,984 m	
Point 54	84,3339 m	48,2749 m	
Point 55	69,54 m	33,4905 m	
Point 56	70,34 m	33,4905 m	
Point 57	69,54 m	37,9905 m	

Point 58	70,34 m	18,6903 m	
Point 59	87,3622 m	46,7434 m	
Point 60	94,4281 m	45,7472 m	
Point 61	69,54 m	18,6903 m	
Point 62	17,7304 m	42,5956 m	
Point 63	70,29014 m	43,64 m	

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	1	6	0,2062 m	90 °	
Line 2	6	4	0,18512 m	-45 °	
Line 3	4	35	7,1143 m	31 °	Profilo di Piena - FIUME
Line 4	35	29	1 m	31 °	
Line 5	29	28	1,0376 m	7,83 °	
Line 6	28	26	5 m	0 °	Drainage
Line 7	26	54	1,0593 m	-11,5 °	Drainage
Line 8	54	59	3,3935 m	-26,8 °	Drainage
Line 9	59	49	2,1819 m	-22,3 °	Drainage
Line 10	49	48	1,0171 m	-7,08 °	Drainage
Line 11	48	60	4,0379 m	-0,612 °	Drainage
Line 12	60	47	1,0127 m	-4,53 °	Drainage
Line 13	47	50	1,1773 m	-15,9 °	Drainage
Line 14	50	53	3,2083 m	-25,1 °	Drainage
Line 15	53	52	1,0679 m	-19 °	Drainage
Line 16	52	1	30,045 m	-0,378 °	
Line 17	1	5	0,1938 m	90 °	
Line 18	5	16	0,1 m	0 °	
Line 19	16	46	5,6495 m	90 °	
Line 20	46	43	39,6 m	0 °	
Line 21	43	44	5,645 m	90 °	
Line 22	44	52	9,4553 m	0 °	Zero Pressure
Line 23	25	24	0,1 m	0 °	
Line 24	24	2	0,2 m	90 °	
Line 25	46	57	0,8 m	0 °	
Line 26	57	25	5,6495 m	90 °	
Line 27	46	56	4,5 m	90 °	
Line 28	56	55	0,8 m	0 °	
Line 29	55	57	4,5 m	90 °	
Line 30	56	58	14,8 m	90 °	
Line 31	58	61	0,8 m	0 °	

Line 32	61	55	14,8 m	90 °	
Line 33	34	61	0,75 m	90 °	
Line 34	58	31	0,75 m	90 °	
Line 35	31	34	0,8 m	0 °	
Line 36	42	45	5,7535 m	90 °	
Line 37	45	12	6,8847 m	-2,77 °	Profilo di Piena - FIUME
Line 38	12	10	4,0204 m	-6,97 °	Profilo di Piena - FIUME
Line 39	10	11	8,155 m	0,362 °	Profilo di Piena - FIUME
Line 40	11	8	6,1311 m	-0,166 °	Profilo di Piena - FIUME
Line 41	8	3	3,0045 m	1,66 °	Profilo di Piena - FIUME
Line 42	3	2	11,372 m	4,01 °	Profilo di Piena - FIUME
Line 43	57	42	39,6 m	0 °	
Line 44	36	62	11,17 m	24,3 °	Profilo di Piena - FIUME
Line 45	62	30	1,7046 m	12,6 °	Profilo di Piena - FIUME
Line 46	30	13	0,58246 m	20,4 °	Profilo di Piena - FIUME
Line 47	13	14	1,8648 m	14 °	Profilo di Piena - FIUME
Line 48	14	15	2,0722 m	-5,63 °	Profilo di Piena - FIUME
Line 49	15	9	6,0224 m	3,17 °	Profilo di Piena - FIUME
Line 50	9	45	0,11514 m	-2,79 °	
Line 51	42	36	22,386 m	0 °	
Line 52	19	51	1,0816 m	90 °	BC - Lato SX
Line 53	51	36	8,2914 m	24,3 °	Profilo di Piena - FIUME
Line 54	42	39	4,5 m	90 °	
Line 55	39	19	29,94 m	0 °	
Line 56	55	39	39,6 m	0 °	
Line 57	18	19	14,8 m	90 °	BC - Lato SX
Line 58	39	40	14,8 m	90 °	
Line 59	40	18	29,94 m	0 °	
Line 60	61	40	39,6 m	0 °	
Line 61	43	38	4,5 m	90 °	
Line 62	38	56	39,6 m	0 °	
Line 63	38	33	14,8 m	90 °	
Line 64	33	58	39,6 m	0 °	
Line 65	44	37	30,06 m	0 °	Zero Pressure
Line 66	37	27	5,6453 m	89,4 °	BC - Lato DX
Line 67	27	43	30 m	0 °	
Line 68	27	22	4,5 m	90 °	BC - Lato DX
Line 69	22	38	30 m	0 °	
Line 70	22	17	14,8 m	90 °	BC - Lato DX

Line 71	17	33	30 m	0 °	
Line 72	41	40	7,75 m	90 °	
Line 73	33	32	7,75 m	90 °	
Line 74	32	41	80 m	0 °	
Line 75	20	18	18,69 m	90 °	BC - Lato SX
Line 76	17	21	18,69 m	-89,8 °	BC - Lato DX
Line 77	21	20	140 m	0 °	
Line 78	4	2	0,92996 m	20,8 °	
Line 79	2	1	1 m	-0,355 °	
Line 80	16	63	0,04986 m	0 °	
Line 81	63	25	0,75014 m	0 °	
Line 82	2	23	0,4 m	90 °	Profilo di Piena - FIUME
Line 83	23	7	0,8 m	0 °	Profilo di Piena - FIUME
Line 84	7	4	0,097722 m	-45 °	

## Regions

	Material	Points	Area
Region 1	UG1 - Limo Argilloso	1;6;4;35;29;28;26;54;59;49;48;60;47;50;53;52	84,692 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	1;5;16;46;43;44;52	226,52 m <sup>2</sup>
Region 3	Diaframma	25;63;16;46;57	4,5196 m <sup>2</sup>
Region 4	Diaframma	57;46;56;55	3,6 m <sup>2</sup>
Region 5	Diaframma	55;56;58;61	11,84 m <sup>2</sup>
Region 6	Diaframma	34;61;58;31	0,6 m <sup>2</sup>
Region 7	UG2 - Limo Argilloso	42;45;12;10;11;8;3;2;24;25;57	207,46 m <sup>2</sup>
Region 8	UG2 - Limo Argilloso	36;62;30;13;14;15;9;45;42	89,644 m <sup>2</sup>
Region 9	UG3 - Sabbia Limo Ghiaiosa	19;51;36;42;39	121,82 m <sup>2</sup>
Region 10	UG3 - Sabbia Limo Ghiaiosa	39;42;57;55	178,2 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	18;19;39;40	443,12 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	40;39;55;61	586,09 m <sup>2</sup>

Region 13	UG3 - Sabbia Limo Ghiaiosa	56;46;43;38	178,2 m <sup>2</sup>
Region 14	UG4 - Sabbia Ghiaiosa	58;56;38;33	586,09 m <sup>2</sup>
Region 15	UG2 - Limo Argilloso	43;44;37;27	169,52 m <sup>2</sup>
Region 16	UG3 - Sabbia Limo Ghiaiosa	38;43;27;22	135 m <sup>2</sup>
Region 17	UG4 - Sabbia Ghiaiosa	33;38;22;17	444,01 m <sup>2</sup>
Region 18	UG5 - Argilla Limosa	41;40;61;34;31;58;33;32	619,4 m <sup>2</sup>
Region 19	UG5 - Argilla Limosa	20;18;40;41;32;33;17;21	1.996,1 m <sup>2</sup>
Region 20	Diaframma	1;6;4;2	0,18164 m <sup>2</sup>
Region 21	Diaframma	24;25;63;16;5;1;2	0,1969 m <sup>2</sup>
Region 22	Diaframma	2;23;7;4	0,20146 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 149  
Date: 19/09/2024  
Time: 02:01:49  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione CC pk 200 - BT SLV.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione CC\  
Last Solved Date: 19/09/2024  
Last Solved Time: 02:05:12

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Limo e Argilla](#)

K-Function: [UG1 - Hyd Conductivity Function - Limo e Argilla](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia e Ghiaia](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia e Ghiaia](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia e Ghiaia](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia e Ghiaia](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 43,6355 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 46,44 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 46,44 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)



Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Limo e Argilla

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Limo e Argilla  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia e Ghiaia  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia e Ghiaia  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Limo e Argilla

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia e Ghiaia

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)



Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia e Ghiaia

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)



Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	70,44 m	43,8338 m
Point 2	69,44 m	43,84 m
Point 3	58,0964 m	43,0438 m
Point 4	70,3091 m	44,1709 m
Point 5	70,44 m	43,64 m
Point 6	70,44 m	44,04 m
Point 7	70,24 m	44,24 m
Point 8	55,0932 m	42,9569 m
Point 9	29,825 m	43,7496 m
Point 10	40,8073 m	42,9232 m
Point 11	48,9621 m	42,9747 m
Point 12	36,8166 m	43,4108 m
Point 13	19,94 m	43,1697 m
Point 14	21,7496 m	43,6199 m
Point 15	23,8118 m	43,4165 m
Point 16	70,34 m	43,64 m
Point 17	139,94 m	18,6903 m
Point 18	0 m	18,6903 m

Point 19	0 m	33,4905 m
Point 20	0 m	0 m
Point 21	140 m	0 m
Point 22	139,94 m	33,4905 m
Point 23	69,44 m	44,24 m
Point 24	69,44 m	43,64 m
Point 25	69,54 m	43,64 m
Point 26	83,2958 m	48,4858 m
Point 27	139,94 m	37,9905 m
Point 28	78,2958 m	48,4858 m
Point 29	77,2679 m	48,3444 m
Point 30	19,3941 m	42,9666 m
Point 31	70,34 m	17,9403 m
Point 32	109,94 m	10,9403 m
Point 33	109,94 m	18,6903 m
Point 34	69,54 m	17,9403 m
Point 35	76,4103 m	47,83 m
Point 36	7,5539 m	37,9905 m
Point 37	140 m	43,6355 m
Point 38	109,94 m	33,4905 m
Point 39	29,94 m	33,4905 m
Point 40	29,94 m	18,6903 m
Point 41	29,94 m	10,9403 m
Point 42	29,94 m	37,9905 m
Point 43	109,94 m	37,9905 m
Point 44	109,94 m	43,6355 m
Point 45	29,94 m	43,744 m
Point 46	70,34 m	37,9905 m
Point 47	95,4376 m	45,6673 m
Point 48	90,3904 m	45,7903 m
Point 49	89,381 m	45,9156 m
Point 50	96,5699 m	45,3449 m
Point 51	0 m	34,5721 m
Point 52	100,4847 m	43,6355 m
Point 53	99,4753 m	43,984 m
Point 54	84,3339 m	48,2749 m
Point 55	69,54 m	33,4905 m
Point 56	70,34 m	33,4905 m
Point 57	69,54 m	37,9905 m

Point 58	70,34 m	18,6903 m
Point 59	87,3622 m	46,7434 m
Point 60	94,4281 m	45,7472 m
Point 61	69,54 m	18,6903 m
Point 62	17,7304 m	42,5956 m
Point 63	70,29014 m	43,64 m
Point 64	74,1 m	46,44 m

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	1	6	0,2062 m	90 °	
Line 2	6	4	0,18512 m	-45 °	
Line 3	52	1	30,045 m	-0,378 °	
Line 4	1	5	0,1938 m	90 °	
Line 5	5	16	0,1 m	0 °	
Line 6	16	46	5,6495 m	90 °	
Line 7	46	43	39,6 m	0 °	
Line 8	43	44	5,645 m	90 °	
Line 9	44	52	9,4553 m	0 °	Zero Pressure
Line 10	25	24	0,1 m	0 °	
Line 11	24	2	0,2 m	90 °	
Line 12	46	57	0,8 m	0 °	
Line 13	57	25	5,6495 m	90 °	
Line 14	46	56	4,5 m	90 °	
Line 15	56	55	0,8 m	0 °	
Line 16	55	57	4,5 m	90 °	
Line 17	56	58	14,8 m	90 °	
Line 18	58	61	0,8 m	0 °	
Line 19	61	55	14,8 m	90 °	
Line 20	34	61	0,75 m	90 °	
Line 21	58	31	0,75 m	90 °	
Line 22	31	34	0,8 m	0 °	
Line 23	42	45	5,7535 m	90 °	
Line 24	45	12	6,8847 m	-2,77 °	Profilo di Piena - FIUME
Line 25	12	10	4,0204 m	-6,97 °	Profilo di Piena - FIUME
Line 26	10	11	8,155 m	0,362 °	Profilo di Piena - FIUME
Line 27	11	8	6,1311 m	-0,166 °	Profilo di Piena - FIUME
Line 28	8	3	3,0045 m	1,66 °	Profilo di Piena - FIUME
Line 29	3	2	11,372 m	4,01 °	Profilo di Piena - FIUME
Line 30	57	42	39,6 m	0 °	

Line 31	36	62	11,17 m	24,3 °	Profilo di Piena - FIUME
Line 32	62	30	1,7046 m	12,6 °	Profilo di Piena - FIUME
Line 33	30	13	0,58246 m	20,4 °	Profilo di Piena - FIUME
Line 34	13	14	1,8648 m	14 °	Profilo di Piena - FIUME
Line 35	14	15	2,0722 m	-5,63 °	Profilo di Piena - FIUME
Line 36	15	9	6,0224 m	3,17 °	Profilo di Piena - FIUME
Line 37	9	45	0,11514 m	-2,79 °	
Line 38	42	36	22,386 m	0 °	
Line 39	19	51	1,0816 m	90 °	BC - Lato SX
Line 40	51	36	8,2914 m	24,3 °	Profilo di Piena - FIUME
Line 41	42	39	4,5 m	90 °	
Line 42	39	19	29,94 m	0 °	
Line 43	55	39	39,6 m	0 °	
Line 44	18	19	14,8 m	90 °	BC - Lato SX
Line 45	39	40	14,8 m	90 °	
Line 46	40	18	29,94 m	0 °	
Line 47	61	40	39,6 m	0 °	
Line 48	43	38	4,5 m	90 °	
Line 49	38	56	39,6 m	0 °	
Line 50	38	33	14,8 m	90 °	
Line 51	33	58	39,6 m	0 °	
Line 52	44	37	30,06 m	0 °	Zero Pressure
Line 53	37	27	5,6453 m	89,4 °	BC - Lato DX
Line 54	27	43	30 m	0 °	
Line 55	27	22	4,5 m	90 °	BC - Lato DX
Line 56	22	38	30 m	0 °	
Line 57	22	17	14,8 m	90 °	BC - Lato DX
Line 58	17	33	30 m	0 °	
Line 59	41	40	7,75 m	90 °	
Line 60	33	32	7,75 m	90 °	
Line 61	32	41	80 m	0 °	
Line 62	20	18	18,69 m	90 °	BC - Lato SX
Line 63	17	21	18,69 m	-89,8 °	BC - Lato DX
Line 64	21	20	140 m	0 °	
Line 65	4	2	0,92996 m	20,8 °	
Line 66	2	1	1 m	-0,355 °	
Line 67	16	63	0,04986 m	0 °	
Line 68	63	25	0,75014 m	0 °	
Line 69	2	23	0,4 m	90 °	Profilo di Piena - FIUME

Line 70	23	7	0,8 m	0 °	Profilo di Piena - FIUME
Line 71	7	4	0,097722 m	-45 °	
Line 72	4	64	4,4181 m	30,9 °	Profilo di Piena - FIUME
Line 73	64	35	2,6962 m	31 °	
Line 74	35	29	1 m	31 °	
Line 75	29	28	1,0376 m	7,83 °	
Line 76	28	26	5 m	0 °	Drainage
Line 77	26	54	1,0593 m	-11,5 °	Drainage
Line 78	54	59	3,3935 m	-26,8 °	Drainage
Line 79	59	49	2,1819 m	-22,3 °	Drainage
Line 80	49	48	1,0171 m	-7,08 °	Drainage
Line 81	48	60	4,0379 m	-0,612 °	Drainage
Line 82	60	47	1,0127 m	-4,53 °	Drainage
Line 83	47	50	1,1773 m	-15,9 °	Drainage
Line 84	50	53	3,2083 m	-25,1 °	Drainage
Line 85	53	52	1,0679 m	-19 °	Drainage

## Regions

	Material	Points	Area
Region 1	UG2 - Limo Argilloso	1;5;16;46;43;44;52	226,52 m <sup>2</sup>
Region 2	Diaframma	25;63;16;46;57	4,5196 m <sup>2</sup>
Region 3	Diaframma	57;46;56;55	3,6 m <sup>2</sup>
Region 4	Diaframma	55;56;58;61	11,84 m <sup>2</sup>
Region 5	Diaframma	34;61;58;31	0,6 m <sup>2</sup>
Region 6	UG2 - Limo Argilloso	42;45;12;10;11;8;3;2;24;25;57	207,46 m <sup>2</sup>
Region 7	UG2 - Limo Argilloso	36;62;30;13;14;15;9;45;42	89,644 m <sup>2</sup>
Region 8	UG3 - Sabbia Limo Ghiaiosa	19;51;36;42;39	121,82 m <sup>2</sup>
Region 9	UG3 - Sabbia Limo Ghiaiosa	39;42;57;55	178,2 m <sup>2</sup>
Region 10	UG4 - Sabbia Ghiaiosa	18;19;39;40	443,12 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	40;39;55;61	586,09 m <sup>2</sup>

Region 12	UG3 - Sabbia Limo Ghiaiosa	56;46;43;38	178,2 m <sup>2</sup>
Region 13	UG4 - Sabbia Ghiaiosa	58;56;38;33	586,09 m <sup>2</sup>
Region 14	UG2 - Limo Argilloso	43;44;37;27	169,52 m <sup>2</sup>
Region 15	UG3 - Sabbia Limo Ghiaiosa	38;43;27;22	135 m <sup>2</sup>
Region 16	UG4 - Sabbia Ghiaiosa	33;38;22;17	444,01 m <sup>2</sup>
Region 17	UG5 - Argilla Limosa	41;40;61;34;31;58;33;32	619,4 m <sup>2</sup>
Region 18	UG5 - Argilla Limosa	20;18;40;41;32;33;17;21	1.996,1 m <sup>2</sup>
Region 19	Diaframma	1;6;4;2	0,18164 m <sup>2</sup>
Region 20	Diaframma	24;25;63;16;5;1;2	0,1969 m <sup>2</sup>
Region 21	Diaframma	2;23;7;4	0,20146 m <sup>2</sup>
Region 22	UG1 - Limo Argilloso	4;64;35;29;28;26;54;59;49;48;60;47;50;53;52;1;6	84,679 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 146  
Date: 19/09/2024  
Time: 09:35:14  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione CC pk 200 - LT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione CC\

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Misto

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Misto](#)

K-Function: [UG1 - Hyd Conductivity Function - Misto](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo Argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia Limo Ghiaiosa](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia Ghiaiosa](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)



# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 43,6355 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\)](#), [Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Misto

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Misto  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo Argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Hyd Conductivity Function - Sabbia Limo Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)

Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia Limo Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia Ghiaiosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia Ghiaiosa  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Misto

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia Limo Ghiaiosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)



Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia Ghiaiosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y	Hydraulic Boundary
Point 1	70,44 m	43,8338 m	
Point 2	69,44 m	43,84 m	
Point 3	58,0964 m	43,0438 m	
Point 4	70,3091 m	44,1709 m	
Point 5	70,44 m	43,64 m	
Point 6	70,44 m	44,04 m	
Point 7	70,24 m	44,24 m	
Point 8	55,0932 m	42,9569 m	
Point 9	29,825 m	43,7496 m	
Point 10	40,8073 m	42,9232 m	
Point 11	48,9621 m	42,9747 m	
Point 12	36,8166 m	43,4108 m	
Point 13	19,94 m	43,1697 m	
Point 14	21,7496 m	43,6199 m	
Point 15	23,8118 m	43,4165 m	
Point 16	70,34 m	43,64 m	
Point 17	139,94 m	18,6903 m	
Point 18	0 m	18,6903 m	

Point 19	0 m	33,4905 m	
Point 20	0 m	0 m	
Point 21	140 m	0 m	
Point 22	139,94 m	33,4905 m	
Point 23	69,44 m	44,24 m	
Point 24	69,44 m	43,64 m	
Point 25	69,54 m	43,64 m	
Point 26	83,2958 m	48,4858 m	
Point 27	139,94 m	37,9905 m	
Point 28	78,2958 m	48,4858 m	
Point 29	77,2679 m	48,3444 m	
Point 30	19,3941 m	42,9666 m	
Point 31	70,34 m	17,9403 m	
Point 32	109,94 m	10,9403 m	
Point 33	109,94 m	18,6903 m	
Point 34	69,54 m	17,9403 m	
Point 35	76,4103 m	47,83 m	
Point 36	7,5539 m	37,9905 m	
Point 37	140 m	43,6355 m	
Point 38	109,94 m	33,4905 m	
Point 39	29,94 m	33,4905 m	
Point 40	29,94 m	18,6903 m	
Point 41	29,94 m	10,9403 m	
Point 42	29,94 m	37,9905 m	
Point 43	109,94 m	37,9905 m	
Point 44	109,94 m	43,6355 m	
Point 45	29,94 m	43,744 m	
Point 46	70,34 m	37,9905 m	
Point 47	95,4376 m	45,6673 m	
Point 48	90,3904 m	45,7903 m	
Point 49	89,381 m	45,9156 m	
Point 50	96,5699 m	45,3449 m	
Point 51	0 m	34,5721 m	
Point 52	100,4847 m	43,6355 m	Drainage
Point 53	99,4753 m	43,984 m	
Point 54	84,3339 m	48,2749 m	
Point 55	69,54 m	33,4905 m	
Point 56	70,34 m	33,4905 m	
Point 57	69,54 m	37,9905 m	

Point 58	70,34 m	18,6903 m	
Point 59	87,3622 m	46,7434 m	
Point 60	94,4281 m	45,7472 m	
Point 61	69,54 m	18,6903 m	
Point 62	17,7304 m	42,5956 m	
Point 63	70,29014 m	43,64 m	

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	1	6	0,2062 m	90 °	
Line 2	6	4	0,18512 m	-45 °	
Line 3	4	35	7,1143 m	31 °	Profilo di Piena - FIUME
Line 4	35	29	1 m	31 °	
Line 5	29	28	1,0376 m	7,83 °	
Line 6	28	26	5 m	0 °	Drainage
Line 7	26	54	1,0593 m	-11,5 °	Drainage
Line 8	54	59	3,3935 m	-26,8 °	Drainage
Line 9	59	49	2,1819 m	-22,3 °	Drainage
Line 10	49	48	1,0171 m	-7,08 °	Drainage
Line 11	48	60	4,0379 m	-0,612 °	Drainage
Line 12	60	47	1,0127 m	-4,53 °	Drainage
Line 13	47	50	1,1773 m	-15,9 °	Drainage
Line 14	50	53	3,2083 m	-25,1 °	Drainage
Line 15	53	52	1,0679 m	-19 °	Drainage
Line 16	52	1	30,045 m	-0,378 °	
Line 17	1	5	0,1938 m	90 °	
Line 18	5	16	0,1 m	0 °	
Line 19	16	46	5,6495 m	90 °	
Line 20	46	43	39,6 m	0 °	
Line 21	43	44	5,645 m	90 °	
Line 22	44	52	9,4553 m	0 °	Zero Pressure
Line 23	25	24	0,1 m	0 °	
Line 24	24	2	0,2 m	90 °	
Line 25	46	57	0,8 m	0 °	
Line 26	57	25	5,6495 m	90 °	
Line 27	46	56	4,5 m	90 °	
Line 28	56	55	0,8 m	0 °	
Line 29	55	57	4,5 m	90 °	
Line 30	56	58	14,8 m	90 °	
Line 31	58	61	0,8 m	0 °	

Line 32	61	55	14,8 m	90 °	
Line 33	34	61	0,75 m	90 °	
Line 34	58	31	0,75 m	90 °	
Line 35	31	34	0,8 m	0 °	
Line 36	42	45	5,7535 m	90 °	
Line 37	45	12	6,8847 m	-2,77 °	Profilo di Piena - FIUME
Line 38	12	10	4,0204 m	-6,97 °	Profilo di Piena - FIUME
Line 39	10	11	8,155 m	0,362 °	Profilo di Piena - FIUME
Line 40	11	8	6,1311 m	-0,166 °	Profilo di Piena - FIUME
Line 41	8	3	3,0045 m	1,66 °	Profilo di Piena - FIUME
Line 42	3	2	11,372 m	4,01 °	Profilo di Piena - FIUME
Line 43	57	42	39,6 m	0 °	
Line 44	36	62	11,17 m	24,3 °	Profilo di Piena - FIUME
Line 45	62	30	1,7046 m	12,6 °	Profilo di Piena - FIUME
Line 46	30	13	0,58246 m	20,4 °	Profilo di Piena - FIUME
Line 47	13	14	1,8648 m	14 °	Profilo di Piena - FIUME
Line 48	14	15	2,0722 m	-5,63 °	Profilo di Piena - FIUME
Line 49	15	9	6,0224 m	3,17 °	Profilo di Piena - FIUME
Line 50	9	45	0,11514 m	-2,79 °	
Line 51	42	36	22,386 m	0 °	
Line 52	19	51	1,0816 m	90 °	BC - Lato SX
Line 53	51	36	8,2914 m	24,3 °	Profilo di Piena - FIUME
Line 54	42	39	4,5 m	90 °	
Line 55	39	19	29,94 m	0 °	
Line 56	55	39	39,6 m	0 °	
Line 57	18	19	14,8 m	90 °	BC - Lato SX
Line 58	39	40	14,8 m	90 °	
Line 59	40	18	29,94 m	0 °	
Line 60	61	40	39,6 m	0 °	
Line 61	43	38	4,5 m	90 °	
Line 62	38	56	39,6 m	0 °	
Line 63	38	33	14,8 m	90 °	
Line 64	33	58	39,6 m	0 °	
Line 65	44	37	30,06 m	0 °	Zero Pressure
Line 66	37	27	5,6453 m	89,4 °	BC - Lato DX
Line 67	27	43	30 m	0 °	
Line 68	27	22	4,5 m	90 °	BC - Lato DX
Line 69	22	38	30 m	0 °	
Line 70	22	17	14,8 m	90 °	BC - Lato DX

Line 71	17	33	30 m	0 °	
Line 72	41	40	7,75 m	90 °	
Line 73	33	32	7,75 m	90 °	
Line 74	32	41	80 m	0 °	
Line 75	20	18	18,69 m	90 °	BC - Lato SX
Line 76	17	21	18,69 m	-89,8 °	BC - Lato DX
Line 77	21	20	140 m	0 °	
Line 78	4	2	0,92996 m	20,8 °	
Line 79	2	1	1 m	-0,355 °	
Line 80	16	63	0,04986 m	0 °	
Line 81	63	25	0,75014 m	0 °	
Line 82	2	23	0,4 m	90 °	Profilo di Piena - FIUME
Line 83	23	7	0,8 m	0 °	Profilo di Piena - FIUME
Line 84	7	4	0,097722 m	-45 °	

## Regions

	Material	Points	Area
Region 1	UG1 - Misto	1;6;4;35;29;28;26;54;59;49;48;60;47;50;53;52	84,692 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	1;5;16;46;43;44;52	226,52 m <sup>2</sup>
Region 3	Diaframma	25;63;16;46;57	4,5196 m <sup>2</sup>
Region 4	Diaframma	57;46;56;55	3,6 m <sup>2</sup>
Region 5	Diaframma	55;56;58;61	11,84 m <sup>2</sup>
Region 6	Diaframma	34;61;58;31	0,6 m <sup>2</sup>
Region 7	UG2 - Limo Argilloso	42;45;12;10;11;8;3;2;24;25;57	207,46 m <sup>2</sup>
Region 8	UG2 - Limo Argilloso	36;62;30;13;14;15;9;45;42	89,644 m <sup>2</sup>
Region 9	UG3 - Sabbia Limo Ghiaiosa	19;51;36;42;39	121,82 m <sup>2</sup>
Region 10	UG3 - Sabbia Limo Ghiaiosa	39;42;57;55	178,2 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	18;19;39;40	443,12 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	40;39;55;61	586,09 m <sup>2</sup>

Region 13	UG3 - Sabbia Limo Ghiaiosa	56;46;43;38	178,2 m <sup>2</sup>
Region 14	UG4 - Sabbia Ghiaiosa	58;56;38;33	586,09 m <sup>2</sup>
Region 15	UG2 - Limo Argilloso	43;44;37;27	169,52 m <sup>2</sup>
Region 16	UG3 - Sabbia Limo Ghiaiosa	38;43;27;22	135 m <sup>2</sup>
Region 17	UG4 - Sabbia Ghiaiosa	33;38;22;17	444,01 m <sup>2</sup>
Region 18	UG5 - Argilla Limosa	41;40;61;34;31;58;33;32	619,4 m <sup>2</sup>
Region 19	UG5 - Argilla Limosa	20;18;40;41;32;33;17;21	1.996,1 m <sup>2</sup>
Region 20	Diaframma	1;6;4;2	0,18164 m <sup>2</sup>
Region 21	Diaframma	24;25;63;16;5;1;2	0,1969 m <sup>2</sup>
Region 22	Diaframma	2;23;7;4	0,20146 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Transient FIUME Con Barriera Rapido Svaso

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 149  
Date: 19/09/2024  
Time: 08:16:23  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione CC pk 200 - Rapido Svaso BT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione CC\  
Last Solved Date: 19/09/2024  
Last Solved Time: 08:20:44

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Transient FIUME Con Barriera Rapido Svaso

Kind: SEEP/W  
Parent: Steady-State FIUME Con Barriera  
Method: Transient  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Initial PWP Conditions from: Parent Analysis  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>



Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa

#### Settings

Exclude cumulative values: No

#### Time

Starting Time: 0 d

Duration: 5 d

# of Steps: 120

Step Generation Method: Linear

Time Increment: 0,041666667 d

Save Steps Every: 1

## Materials

### Diaframma

#### Hydraulic

Model: Saturated / Unsaturated

Vol. WC. Function: CLS - Vol WC Function - Diaframma

K-Function: CLS - Hyd Conductivity Function - Diaframma

Ky'/Kx' Ratio: 1

Rotation: 0 °

### UG1 - Limo Argilloso

#### Hydraulic

Model: Saturated / Unsaturated

Vol. WC. Function: UG1 - Vol WC Function - Limo e Argilla

K-Function: UG1 - Hyd Conductivity Function - Limo e Argilla

Ky'/Kx' Ratio: 1

Rotation: 0 °

### UG2 - Limo Argilloso

#### Hydraulic

Model: Saturated / Unsaturated

Vol. WC. Function: UG2 - Vol WC Function - Limo Argilloso

K-Function: UG2 - Hyd Conductivity Function - Limo argilloso

Ky'/Kx' Ratio: 1

Rotation: 0 °

### UG3 - Sabbia Limo Ghiaiosa

#### Hydraulic

Model: Saturated / Unsaturated

Vol. WC. Function: UG3 - Vol WC Function - Sabbia e Ghiaia

K-Function: UG3 - Hyd Conductivity Function - Sabbia e Ghiaia

Ky'/Kx' Ratio: 1

Rotation: 0 °

### UG4 - Sabbia Ghiaiosa

#### Hydraulic

Model: Saturated / Unsaturated

Vol. WC. Function: UG4 - Vol WC Function - Sabbia e Ghiaia

K-Function: UG4 - Hyd Conductivity Function - Sabbia e Ghiaia

Ky'/Kx' Ratio: 1

Rotation: 0 °

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: 1

Rotation: 0 °

## Boundary Conditions

### Drainage

Category: [Hydraulic](#)

Kind: [Water Rate 0 m³/sec](#)

Review: [Yes](#)

### BC - Lato DX

Category: [Hydraulic](#)

Kind: [Water Total Head 43,6355 m](#)

Review: [No](#)

### BC - Lato SX

Category: [Hydraulic](#)

Kind: [Water Total Head 47,83 m](#)

Review: [No](#)

### Zero Pressure

Category: [Hydraulic](#)

Kind: [Water Pressure Head 0 m](#)

### Rapido Svaso - FIUME

Category: [Hydraulic](#)

Kind: [Water Total Head](#)

Seep Head vs. Time Function: [Rapido Svaso](#)

Review: [No](#)

## Water K Functions

### CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)

Function: [Water X-Conductivity vs. Water Pressure](#)

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: [1e-10 m/sec](#)

Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)

Data Point: (0,01; 1e-10)

Data Point: (0,018329807; 9,8537502e-11)

Data Point: (0,033598183; 9,6642125e-11)

Data Point: (0,061584821; 9,4197688e-11)

Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)  
Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: [Van Genuchten Function](#)  
Saturated Kx: [0 m/sec](#)  
Residual Water Content: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG1 - Hyd Conductivity Function - Limo e Argilla

Model: [Hyd K Data Point Function](#)

Function: [Water X-Conductivity vs. Water Pressure](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Saturated Kx: [4,9378677e-07 m/sec](#)

Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: [Van Genuchten Function](#)

Volume Water Content Function: **UG1 - Vol WC Function - Limo e Argilla**

Saturated Kx: **5e-07 m/sec**

Residual Water Content: **0**

Maximum Suction: **1.000 kPa**

Minimum Suction: **0,01 kPa**

Num. Points: **20**

## **UG2 - Hyd Conductivity Function - Limo argilloso**

Model: **Hyd K Data Point Function**

Function: **Water X-Conductivity vs. Water Pressure**

Curve Fit to Data: **100 %**

Segment Curvature: **100 %**

Saturated Kx: **9,8757353e-08 m/sec**

Data Points: **Matric Suction (kPa), Water X-Conductivity (m/sec)**

Data Point: **(0,01; 9,8757353e-08)**

Data Point: **(0,018329807; 9,8172855e-08)**

Data Point: **(0,033598183; 9,7313172e-08)**

Data Point: **(0,061584821; 9,6054365e-08)**

Data Point: **(0,11288379; 9,4214619e-08)**

Data Point: **(0,20691381; 9,1535677e-08)**

Data Point: **(0,37926902; 8,765776e-08)**

Data Point: **(0,6951928; 8,2095404e-08)**

Data Point: **(1,274275; 7,4237455e-08)**

Data Point: **(2,3357215; 6,3432543e-08)**

Data Point: **(4,2813324; 4,9310523e-08)**

Data Point: **(7,8475997; 3,2635836e-08)**

Data Point: **(14,384499; 1,6530307e-08)**

Data Point: **(26,366509; 5,6594009e-09)**

Data Point: **(48,329302; 1,249941e-09)**

Data Point: **(88,586679; 1,9632064e-10)**

Data Point: **(162,37767; 2,5503576e-11)**

Data Point: **(297,63514; 3,0437185e-12)**

Data Point: **(545,55948; 3,5113603e-13)**

Data Point: **(1.000; 3,9988098e-14)**

Estimation Properties

Hyd. K-Function Estimation Method: **Van Genuchten Function**

Volume Water Content Function: **UG2 - Vol WC Function - Limo Argilloso**

Saturated Kx: **1e-07 m/sec**

Residual Water Content: **0**

Maximum Suction: **1.000 kPa**

Minimum Suction: **0,01 kPa**

Num. Points: **20**

## **UG3 - Hyd Conductivity Function - Sabbia e Ghiaia**

Model: **Hyd K Data Point Function**

Function: **Water X-Conductivity vs. Water Pressure**

Curve Fit to Data: **100 %**

Segment Curvature: **100 %**

Saturated Kx: **0,0017623904 m/sec**

Data Points: **Matric Suction (kPa), Water X-Conductivity (m/sec)**

Data Point: **(0,01; 0,0017623904)**

Data Point: **(0,018329807; 0,0017511321)**

Data Point: **(0,033598183; 0,0017297944)**

Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: [Van Genuchten Function](#)  
Volume Water Content Function: [UG3 - Vol WC Function - Sabbia e Ghiaia](#)  
Saturated Kx: [0,001775 m/sec](#)  
Residual Water Content: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1,8021393e-08 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: [Van Genuchten Function](#)

Volume Water Content Function: [UG5 - Vol WC Function - Argilla Limosa](#)

Saturated Kx: [1,89e-08 m/sec](#)

Residual Water Content: [0](#)

Maximum Suction: [1.000 kPa](#)

Minimum Suction: [0,01 kPa](#)

Num. Points: [20](#)

### UG4 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: [Hyd K Data Point Function](#)

Function: [Water X-Conductivity vs. Water Pressure](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Saturated Kx: [0,0017623904 m/sec](#)

Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)

Data Point: [\(0,01; 0,0017623904\)](#)

Data Point: [\(0,018329807; 0,0017511321\)](#)

Data Point: [\(0,033598183; 0,0017297944\)](#)

Data Point: [\(0,061584821; 0,0016896346\)](#)

Data Point: [\(0,11288379; 0,001614579\)](#)

Data Point: [\(0,20691381; 0,0014766658\)](#)

Data Point: [\(0,37926902; 0,0012340209\)](#)

Data Point: [\(0,6951928; 0,00085197529\)](#)

Data Point: [\(1,274275; 0,00039737869\)](#)

Data Point: [\(2,3357215; 9,5966126e-05\)](#)

Data Point: [\(4,2813324; 1,1451285e-05\)](#)

Data Point: [\(7,8475997; 8,856542e-07\)](#)

Data Point: [\(14,384499; 5,7597373e-08\)](#)

Data Point: [\(26,366509; 3,5423998e-09\)](#)

Data Point: [\(48,329302; 2,1427698e-10\)](#)

Data Point: [\(88,586679; 1,2898895e-11\)](#)

Data Point: [\(162,37767; 7,7539833e-13\)](#)

Data Point: [\(297,63514; 4,6593226e-14\)](#)

Data Point: [\(545,55948; 2,7994361e-15\)](#)

Data Point: [\(1.000; 1,6819145e-16\)](#)

#### Estimation Properties

Hyd. K-Function Estimation Method: [Van Genuchten Function](#)

Volume Water Content Function: [UG4 - Vol WC Function - Sabbia e Ghiaia](#)

Saturated Kx: [0,001775 m/sec](#)

Residual Water Content: [0](#)

Maximum Suction: [1.000 kPa](#)

Minimum Suction: [0,01 kPa](#)

Num. Points: [20](#)

## Hydraulic Boundary Functions

### Rapido Svaso

Model: [Spline Data Point Function](#)

Function: [Water Total Head vs. Time](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: 100 %

Y-Intercept: 47,83 m

Data Points: Time (d), Water Total Head (m)

Data Point: (0; 47,83)  
Data Point: (0,04; 47,79)  
Data Point: (0,08; 47,76)  
Data Point: (0,13; 47,72)  
Data Point: (0,17; 47,68)  
Data Point: (0,21; 47,65)  
Data Point: (0,25; 47,61)  
Data Point: (0,29; 47,57)  
Data Point: (0,33; 47,54)  
Data Point: (0,38; 47,5)  
Data Point: (0,42; 47,46)  
Data Point: (0,46; 47,42)  
Data Point: (0,5; 47,39)  
Data Point: (0,54; 47,35)  
Data Point: (0,58; 47,31)  
Data Point: (0,63; 47,28)  
Data Point: (0,67; 47,24)  
Data Point: (0,71; 47,2)  
Data Point: (0,75; 47,17)  
Data Point: (0,79; 47,13)  
Data Point: (0,83; 47,09)  
Data Point: (0,88; 47,06)  
Data Point: (0,92; 47,02)  
Data Point: (0,96; 46,98)  
Data Point: (1; 46,95)  
Data Point: (1,04; 46,91)  
Data Point: (1,08; 46,87)  
Data Point: (1,13; 46,84)  
Data Point: (1,17; 46,8)  
Data Point: (1,21; 46,76)  
Data Point: (1,25; 46,73)  
Data Point: (1,29; 46,69)  
Data Point: (1,33; 46,65)  
Data Point: (1,38; 46,61)  
Data Point: (1,42; 46,58)  
Data Point: (1,46; 46,54)  
Data Point: (1,5; 46,5)  
Data Point: (1,54; 46,47)  
Data Point: (1,58; 46,43)  
Data Point: (1,63; 46,39)  
Data Point: (1,67; 46,36)  
Data Point: (1,71; 46,32)  
Data Point: (1,75; 46,28)  
Data Point: (1,79; 46,25)  
Data Point: (1,83; 46,21)  
Data Point: (1,88; 46,17)  
Data Point: (1,92; 46,14)  
Data Point: (1,96; 46,1)  
Data Point: (2; 46,06)  
Data Point: (2,04; 46,03)

Data Point: (2,08; 45,99)  
Data Point: (2,13; 45,95)  
Data Point: (2,17; 45,91)  
Data Point: (2,21; 45,88)  
Data Point: (2,25; 45,84)  
Data Point: (2,29; 45,8)  
Data Point: (2,33; 45,77)  
Data Point: (2,38; 45,73)  
Data Point: (2,42; 45,69)  
Data Point: (2,46; 45,66)  
Data Point: (2,5; 45,62)  
Data Point: (2,54; 45,58)  
Data Point: (2,58; 45,55)  
Data Point: (2,63; 45,51)  
Data Point: (2,67; 45,47)  
Data Point: (2,71; 45,44)  
Data Point: (2,75; 45,4)  
Data Point: (2,79; 45,36)  
Data Point: (2,83; 45,33)  
Data Point: (2,88; 45,29)  
Data Point: (2,92; 45,25)  
Data Point: (2,96; 45,21)  
Data Point: (3; 45,18)  
Data Point: (3,04; 45,14)  
Data Point: (3,08; 45,1)  
Data Point: (3,13; 45,07)  
Data Point: (3,17; 45,03)  
Data Point: (3,21; 44,99)  
Data Point: (3,25; 44,96)  
Data Point: (3,29; 44,92)  
Data Point: (3,33; 44,88)  
Data Point: (3,38; 44,85)  
Data Point: (3,42; 44,81)  
Data Point: (3,46; 44,77)  
Data Point: (3,5; 44,74)  
Data Point: (3,54; 44,7)  
Data Point: (3,58; 44,66)  
Data Point: (3,63; 44,63)  
Data Point: (3,67; 44,59)  
Data Point: (3,71; 44,55)  
Data Point: (3,75; 44,51)  
Data Point: (3,79; 44,48)  
Data Point: (3,83; 44,44)  
Data Point: (3,87; 44,4)  
Data Point: (3,92; 44,37)  
Data Point: (3,96; 44,33)  
Data Point: (4; 44,29)  
Data Point: (4,04; 44,26)  
Data Point: (4,08; 44,22)  
Data Point: (4,12; 44,18)  
Data Point: (4,17; 44,15)  
Data Point: (4,21; 44,11)  
Data Point: (4,25; 44,07)



Data Point: (4,29; 44,04)  
Data Point: (4,33; 44)  
Data Point: (4,38; 43,96)  
Data Point: (4,42; 43,93)  
Data Point: (4,46; 43,89)  
Data Point: (4,5; 43,85)  
Data Point: (4,54; 43,82)  
Data Point: (4,58; 43,78)  
Data Point: (4,63; 43,74)  
Data Point: (4,67; 43,7)  
Data Point: (4,71; 43,67)  
Data Point: (4,75; 43,63)  
Data Point: (4,79; 43,59)  
Data Point: (4,83; 43,56)  
Data Point: (4,88; 43,52)  
Data Point: (4,92; 43,48)  
Data Point: (4,96; 43,45)  
Data Point: (5; 43,41)

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,0099999871

Residual Water Content: 0,00099999871

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,0099999871

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,0099999871)

Data Point: (0,018329807; 0,0099999719)

Data Point: (0,033598183; 0,0099999373)

Data Point: (0,061584821; 0,0099998576)

Data Point: (0,11288379; 0,0099996712)

Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)

Data Point: (0,6951928; 0,0099956409)

Data Point: (1,274275; 0,0099895105)

Data Point: (2,3357215; 0,00997465)

Data Point: (4,2813324; 0,0099386827)

Data Point: (7,8475997; 0,0098524595)

Data Point: (14,384499; 0,0096512903)

Data Point: (26,366509; 0,0092114104)

Data Point: (48,329302; 0,0083717462)

Data Point: (88,586679; 0,0071035776)

Data Point: (162,37767; 0,0056868026)

Data Point: (297,63514; 0,0044719057)

Data Point: (545,55948; 0,0035670653)

Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)

Saturated Water Content: 0

Sample Material: [Clay](#)

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG1 - Vol WC Function - Limo e Argilla

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)

Saturated Water Content: 0,25

Sample Material: [Silty Clay](#)

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG3 - Vol WC Function - Sabbia e Ghiaia

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)  
Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,15](#)  
Sample Material: [Sand](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG5 - Vol WC Function - Argilla Limosa

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)  
Saturated Water Content: [0,25999967](#)  
Residual Water Content: [0,025999967](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)

Porosity: [0,25999967](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,25999967)  
Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)

Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,26  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Vol WC Function - Sabbia e Ghiaia

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,14999785  
Residual Water Content: 0,014999785  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)  
Data Point: (0,018329807; 0,14999307)  
Data Point: (0,033598183; 0,14997751)  
Data Point: (0,061584821; 0,14992669)  
Data Point: (0,11288379; 0,14976069)  
Data Point: (0,20691381; 0,14922008)  
Data Point: (0,37926902; 0,14748155)  
Data Point: (0,6951928; 0,14211614)  
Data Point: (1,274275; 0,12746687)  
Data Point: (2,3357215; 0,097911043)  
Data Point: (4,2813324; 0,062504835)  
Data Point: (7,8475997; 0,037546148)  
Data Point: (14,384499; 0,024015429)  
Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %

Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: 2D Geometry

## Settings

View: 2D  
Element Thickness: 1 m

## Points

	X	Y
Point 1	70,44 m	43,8338 m
Point 2	69,44 m	43,84 m
Point 3	58,0964 m	43,0438 m
Point 4	70,3091 m	44,1709 m
Point 5	70,44 m	43,64 m
Point 6	70,44 m	44,04 m
Point 7	70,24 m	44,24 m
Point 8	55,0932 m	42,9569 m
Point 9	29,825 m	43,7496 m
Point 10	40,8073 m	42,9232 m
Point 11	48,9621 m	42,9747 m
Point 12	36,8166 m	43,4108 m
Point 13	19,94 m	43,1697 m
Point 14	21,7496 m	43,6199 m
Point 15	23,8118 m	43,4165 m
Point 16	70,34 m	43,64 m
Point 17	139,94 m	18,6903 m
Point 18	0 m	18,6903 m
Point 19	0 m	33,4905 m
Point 20	0 m	0 m
Point 21	140 m	0 m
Point 22	139,94 m	33,4905 m
Point 23	69,44 m	44,24 m
Point 24	69,44 m	43,64 m
Point 25	69,54 m	43,64 m
Point 26	83,2958 m	48,4858 m
Point 27	139,94 m	37,9905 m

Point 28	78,2958 m	48,4858 m
Point 29	77,2679 m	48,3444 m
Point 30	19,3941 m	42,9666 m
Point 31	70,34 m	17,9403 m
Point 32	109,94 m	10,9403 m
Point 33	109,94 m	18,6903 m
Point 34	69,54 m	17,9403 m
Point 35	76,4103 m	47,83 m
Point 36	7,5539 m	37,9905 m
Point 37	140 m	43,6355 m
Point 38	109,94 m	33,4905 m
Point 39	29,94 m	33,4905 m
Point 40	29,94 m	18,6903 m
Point 41	29,94 m	10,9403 m
Point 42	29,94 m	37,9905 m
Point 43	109,94 m	37,9905 m
Point 44	109,94 m	43,6355 m
Point 45	29,94 m	43,744 m
Point 46	70,34 m	37,9905 m
Point 47	95,4376 m	45,6673 m
Point 48	90,3904 m	45,7903 m
Point 49	89,381 m	45,9156 m
Point 50	96,5699 m	45,3449 m
Point 51	0 m	34,5721 m
Point 52	100,4847 m	43,6355 m
Point 53	99,4753 m	43,984 m
Point 54	84,3339 m	48,2749 m
Point 55	69,54 m	33,4905 m
Point 56	70,34 m	33,4905 m
Point 57	69,54 m	37,9905 m
Point 58	70,34 m	18,6903 m
Point 59	87,3622 m	46,7434 m
Point 60	94,4281 m	45,7472 m
Point 61	69,54 m	18,6903 m
Point 62	17,7304 m	42,5956 m
Point 63	70,29014 m	43,64 m

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	1	6	0,2062 m	90 °	

Line 2	6	4	0,18512 m	-45 °	
Line 3	4	35	7,1143 m	31 °	Rapido Svaso - FIUME
Line 4	35	29	1 m	31 °	
Line 5	29	28	1,0376 m	7,83 °	
Line 6	28	26	5 m	0 °	Drainage
Line 7	26	54	1,0593 m	-11,5 °	Drainage
Line 8	54	59	3,3935 m	-26,8 °	Drainage
Line 9	59	49	2,1819 m	-22,3 °	Drainage
Line 10	49	48	1,0171 m	-7,08 °	Drainage
Line 11	48	60	4,0379 m	-0,612 °	Drainage
Line 12	60	47	1,0127 m	-4,53 °	Drainage
Line 13	47	50	1,1773 m	-15,9 °	Drainage
Line 14	50	53	3,2083 m	-25,1 °	Drainage
Line 15	53	52	1,0679 m	-19 °	Drainage
Line 16	52	1	30,045 m	-0,378 °	
Line 17	1	5	0,1938 m	90 °	
Line 18	5	16	0,1 m	0 °	
Line 19	16	46	5,6495 m	90 °	
Line 20	46	43	39,6 m	0 °	
Line 21	43	44	5,645 m	90 °	
Line 22	44	52	9,4553 m	0 °	Zero Pressure
Line 23	25	24	0,1 m	0 °	
Line 24	24	2	0,2 m	90 °	
Line 25	46	57	0,8 m	0 °	
Line 26	57	25	5,6495 m	90 °	
Line 27	46	56	4,5 m	90 °	
Line 28	56	55	0,8 m	0 °	
Line 29	55	57	4,5 m	90 °	
Line 30	56	58	14,8 m	90 °	
Line 31	58	61	0,8 m	0 °	
Line 32	61	55	14,8 m	90 °	
Line 33	34	61	0,75 m	90 °	
Line 34	58	31	0,75 m	90 °	
Line 35	31	34	0,8 m	0 °	
Line 36	42	45	5,7535 m	90 °	
Line 37	45	12	6,8847 m	-2,77 °	Rapido Svaso - FIUME
Line 38	12	10	4,0204 m	-6,97 °	Rapido Svaso - FIUME
Line 39	10	11	8,155 m	0,362 °	Rapido Svaso - FIUME
Line 40	11	8	6,1311 m	-0,166 °	Rapido Svaso - FIUME



Line 41	8	3	3,0045 m	1,66 °	Rapido Svaso - FIUME
Line 42	3	2	11,372 m	4,01 °	Rapido Svaso - FIUME
Line 43	57	42	39,6 m	0 °	
Line 44	36	62	11,17 m	24,3 °	Rapido Svaso - FIUME
Line 45	62	30	1,7046 m	12,6 °	Rapido Svaso - FIUME
Line 46	30	13	0,58246 m	20,4 °	Rapido Svaso - FIUME
Line 47	13	14	1,8648 m	14 °	Rapido Svaso - FIUME
Line 48	14	15	2,0722 m	-5,63 °	Rapido Svaso - FIUME
Line 49	15	9	6,0224 m	3,17 °	Rapido Svaso - FIUME
Line 50	9	45	0,11514 m	-2,79 °	
Line 51	42	36	22,386 m	0 °	
Line 52	19	51	1,0816 m	90 °	BC - Lato SX
Line 53	51	36	8,2914 m	24,3 °	Rapido Svaso - FIUME
Line 54	42	39	4,5 m	90 °	
Line 55	39	19	29,94 m	0 °	
Line 56	55	39	39,6 m	0 °	
Line 57	18	19	14,8 m	90 °	BC - Lato SX
Line 58	39	40	14,8 m	90 °	
Line 59	40	18	29,94 m	0 °	
Line 60	61	40	39,6 m	0 °	
Line 61	43	38	4,5 m	90 °	
Line 62	38	56	39,6 m	0 °	
Line 63	38	33	14,8 m	90 °	
Line 64	33	58	39,6 m	0 °	
Line 65	44	37	30,06 m	0 °	Zero Pressure
Line 66	37	27	5,6453 m	89,4 °	BC - Lato DX
Line 67	27	43	30 m	0 °	
Line 68	27	22	4,5 m	90 °	BC - Lato DX
Line 69	22	38	30 m	0 °	
Line 70	22	17	14,8 m	90 °	BC - Lato DX
Line 71	17	33	30 m	0 °	
Line 72	41	40	7,75 m	90 °	
Line 73	33	32	7,75 m	90 °	
Line 74	32	41	80 m	0 °	
Line 75	20	18	18,69 m	90 °	BC - Lato SX
Line 76	17	21	18,69 m	-89,8 °	BC - Lato DX
Line 77	21	20	140 m	0 °	
Line 78	4	2	0,92996 m	20,8 °	
Line 79	2	1	1 m	-0,355 °	

Line 80	16	63	0,04986 m	0 °	
Line 81	63	25	0,75014 m	0 °	
Line 82	2	23	0,4 m	90 °	Rapido Svaso - FIUME
Line 83	23	7	0,8 m	0 °	Rapido Svaso - FIUME
Line 84	7	4	0,097722 m	-45 °	Rapido Svaso - FIUME

## Regions

	Material	Points	Area
Region 1	UG1 - Limo Argilloso	1;6;4;35;29;28;26;54;59;49;48;60;47;50;53;52	84,692 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	1;5;16;46;43;44;52	226,52 m <sup>2</sup>
Region 3	Diaframma	25;63;16;46;57	4,5196 m <sup>2</sup>
Region 4	Diaframma	57;46;56;55	3,6 m <sup>2</sup>
Region 5	Diaframma	55;56;58;61	11,84 m <sup>2</sup>
Region 6	Diaframma	34;61;58;31	0,6 m <sup>2</sup>
Region 7	UG2 - Limo Argilloso	42;45;12;10;11;8;3;2;24;25;57	207,46 m <sup>2</sup>
Region 8	UG2 - Limo Argilloso	36;62;30;13;14;15;9;45;42	89,644 m <sup>2</sup>
Region 9	UG3 - Sabbia Limo Ghiaiosa	19;51;36;42;39	121,82 m <sup>2</sup>
Region 10	UG3 - Sabbia Limo Ghiaiosa	39;42;57;55	178,2 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	18;19;39;40	443,12 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	40;39;55;61	586,09 m <sup>2</sup>
Region 13	UG3 - Sabbia Limo Ghiaiosa	56;46;43;38	178,2 m <sup>2</sup>
Region 14	UG4 - Sabbia Ghiaiosa	58;56;38;33	586,09 m <sup>2</sup>
Region 15	UG2 - Limo Argilloso	43;44;37;27	169,52 m <sup>2</sup>
Region 16	UG3 - Sabbia Limo Ghiaiosa	38;43;27;22	135 m <sup>2</sup>
Region 17	UG4 - Sabbia Ghiaiosa	33;38;22;17	444,01 m <sup>2</sup>

Region 18	UG5 - Argilla Limosa	41;40;61;34;31;58;33;32	619,4 m <sup>2</sup>
Region 19	UG5 - Argilla Limosa	20;18;40;41;32;33;17;21	1.996,1 m <sup>2</sup>
Region 20	Diaframma	1;6;4;2	0,18164 m <sup>2</sup>
Region 21	Diaframma	24;25;63;16;5;1;2	0,1969 m <sup>2</sup>
Region 22	Diaframma	2;23;7;4	0,20146 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

# Steady-State FIUME Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 151  
Date: 19/09/2024  
Time: 08:17:55  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione CC pk 200 - Rapido Svaso LT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione CC\  
Last Solved Date: 19/09/2024  
Last Solved Time: 08:18:00

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Steady-State FIUME Con Barriera

Kind: SEEP/W  
Method: Steady-State  
Physics  
    Water Transfer  
        Free convection: thermal effects: No  
        Free convection: solute effects: No  
        Vapor transfer: isothermal: No  
        Vapor transfer: thermal: No  
Water Settings  
    Maximum Number of Iterations: 500  
    Maximum Difference: 0,005  
    Significant Digits: 2  
    Max # of Reviews: 10  
    Under-Relaxation Criteria  
        Initial Rate: 1  
        Minimum Rate: 0,1  
        Rate Reduction Factor: 0,65  
        Reduction Frequency (iterations): 10  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
    Bulk Modulus of Pore-Fluid: 2.083.333,3 kPa  
Time  
    Starting Time: 0 d  
    Duration: 0 d  
    Ending Time: 0 d

# Materials

## Diaframma

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [CLS - Vol WC Function - Diaframma](#)

K-Function: [CLS - Hyd Conductivity Function - Diaframma](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG1 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG1 - Vol WC Function - Limo e Argilla](#)

K-Function: [UG1 - Hyd Conductivity Function - Limo e Argilla](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG2 - Limo Argilloso

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG2 - Vol WC Function - Limo Argilloso](#)

K-Function: [UG2 - Hyd Conductivity Function - Limo argilloso](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG3 - Sabbia Limo Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG3 - Vol WC Function - Sabbia e Ghiaia](#)

K-Function: [UG3 - Hyd Conductivity Function - Sabbia e Ghiaia](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG4 - Sabbia Ghiaiosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG4 - Vol WC Function - Sabbia e Ghiaia](#)

K-Function: [UG4 - Hyd Conductivity Function - Sabbia e Ghiaia](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

## UG5 - Argilla Limosa

Hydraulic

Model: [Saturated / Unsaturated](#)

Vol. WC. Function: [UG5 - Vol WC Function - Argilla Limosa](#)

K-Function: [UG5 - Hyd Conductivity Function - Argilla limosa](#)

Ky'/Kx' Ratio: [1](#)

Rotation: [0 °](#)

# Boundary Conditions

## Drainage

Category: [Hydraulic](#)  
Kind: [Water Rate 0 m<sup>3</sup>/sec](#)  
Review: [Yes](#)

## BC - Lato DX

Category: [Hydraulic](#)  
Kind: [Water Total Head 43,6355 m](#)  
Review: [No](#)

## BC - Lato SX

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Profilo di Piena - FIUME

Category: [Hydraulic](#)  
Kind: [Water Total Head 47,83 m](#)  
Review: [No](#)

## Zero Pressure

Category: [Hydraulic](#)  
Kind: [Water Pressure Head 0 m](#)

# Water K Functions

## CLS - Hyd Conductivity Function - Diaframma

Model: [Hyd K Data Point Function](#)  
Function: [Water X-Conductivity vs. Water Pressure](#)  
Curve Fit to Data: [100 %](#)  
Segment Curvature: [100 %](#)  
Saturated Kx: [1e-10 m/sec](#)  
Data Points: [Matric Suction \(kPa\), Water X-Conductivity \(m/sec\)](#)  
Data Point: (0,01; 1e-10)  
Data Point: (0,018329807; 9,8537502e-11)  
Data Point: (0,033598183; 9,6642125e-11)  
Data Point: (0,061584821; 9,4197688e-11)  
Data Point: (0,11288379; 9,1054741e-11)  
Data Point: (0,20691381; 8,7032912e-11)  
Data Point: (0,37926902; 8,19208e-11)  
Data Point: (0,6951928; 7,5483248e-11)  
Data Point: (1,274275; 6,7486396e-11)  
Data Point: (2,3357215; 5,775836e-11)  
Data Point: (4,2813324; 4,6317939e-11)  
Data Point: (7,8475997; 3,3627236e-11)  
Data Point: (14,384499; 2,0941088e-11)  
Data Point: (26,366509; 1,0378701e-11)  
Data Point: (48,329302; 3,80402e-12)  
Data Point: (88,586679; 1,0129493e-12)

Data Point: (162,37767; 2,0902525e-13)  
Data Point: (297,63514; 3,6899317e-14)  
Data Point: (545,55948; 6,0167763e-15)  
Data Point: (1.000; 9,4610471e-16)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Saturated Kx: 0 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG1 - Hyd Conductivity Function - Limo e Argilla

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Saturated Kx: 4,9378677e-07 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 4,9378677e-07)  
Data Point: (0,018329807; 4,9086428e-07)  
Data Point: (0,033598183; 4,8656586e-07)  
Data Point: (0,061584821; 4,8027183e-07)  
Data Point: (0,11288379; 4,710731e-07)  
Data Point: (0,20691381; 4,5767839e-07)  
Data Point: (0,37926902; 4,382888e-07)  
Data Point: (0,6951928; 4,1047702e-07)  
Data Point: (1,274275; 3,7118728e-07)  
Data Point: (2,3357215; 3,1716272e-07)  
Data Point: (4,2813324; 2,4655261e-07)  
Data Point: (7,8475997; 1,6317918e-07)  
Data Point: (14,384499; 8,2651536e-08)  
Data Point: (26,366509; 2,8297004e-08)  
Data Point: (48,329302; 6,249705e-09)  
Data Point: (88,586679; 9,8160321e-10)  
Data Point: (162,37767; 1,2751788e-10)  
Data Point: (297,63514; 1,5218592e-11)  
Data Point: (545,55948; 1,7556801e-12)  
Data Point: (1.000; 1,9994049e-13)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG1 - Vol WC Function - Limo e Argilla  
Saturated Kx: 5e-07 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## UG2 - Hyd Conductivity Function - Limo argilloso

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Saturated Kx: 9,8757353e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 9,8757353e-08)

Data Point: (0,018329807; 9,8172855e-08)

Data Point: (0,033598183; 9,7313172e-08)

Data Point: (0,061584821; 9,6054365e-08)

Data Point: (0,11288379; 9,4214619e-08)

Data Point: (0,20691381; 9,1535677e-08)

Data Point: (0,37926902; 8,765776e-08)

Data Point: (0,6951928; 8,2095404e-08)

Data Point: (1,274275; 7,4237455e-08)

Data Point: (2,3357215; 6,3432543e-08)

Data Point: (4,2813324; 4,9310523e-08)

Data Point: (7,8475997; 3,2635836e-08)

Data Point: (14,384499; 1,6530307e-08)

Data Point: (26,366509; 5,6594009e-09)

Data Point: (48,329302; 1,249941e-09)

Data Point: (88,586679; 1,9632064e-10)

Data Point: (162,37767; 2,5503576e-11)

Data Point: (297,63514; 3,0437185e-12)

Data Point: (545,55948; 3,5113603e-13)

Data Point: (1.000; 3,9988098e-14)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Volume Water Content Function: UG2 - Vol WC Function - Limo Argilloso

Saturated Kx: 1e-07 m/sec

Residual Water Content: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG3 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 0,0017623904 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 0,0017623904)

Data Point: (0,018329807; 0,0017511321)

Data Point: (0,033598183; 0,0017297944)

Data Point: (0,061584821; 0,0016896346)

Data Point: (0,11288379; 0,001614579)

Data Point: (0,20691381; 0,0014766658)

Data Point: (0,37926902; 0,0012340209)

Data Point: (0,6951928; 0,00085197529)

Data Point: (1,274275; 0,00039737869)

Data Point: (2,3357215; 9,5966126e-05)

Data Point: (4,2813324; 1,1451285e-05)

Data Point: (7,8475997; 8,856542e-07)

Data Point: (14,384499; 5,7597373e-08)

Data Point: (26,366509; 3,5423998e-09)

Data Point: (48,329302; 2,1427698e-10)



Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG3 - Vol WC Function - Sabbia e Ghiaia  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG5 - Hyd Conductivity Function - Argilla limosa

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Saturated Kx: 1,8021393e-08 m/sec

Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)

Data Point: (0,01; 1,8021393e-08)  
Data Point: (0,018329807; 1,7757831e-08)  
Data Point: (0,033598183; 1,7416257e-08)  
Data Point: (0,061584821; 1,6975736e-08)  
Data Point: (0,11288379; 1,6409333e-08)  
Data Point: (0,20691381; 1,5684543e-08)  
Data Point: (0,37926902; 1,4763269e-08)  
Data Point: (0,6951928; 1,3603132e-08)  
Data Point: (1,274275; 1,2161988e-08)  
Data Point: (2,3357215; 1,040886e-08)  
Data Point: (4,2813324; 8,3471372e-09)  
Data Point: (7,8475997; 6,0600956e-09)  
Data Point: (14,384499; 3,7738752e-09)  
Data Point: (26,366509; 1,870386e-09)  
Data Point: (48,329302; 6,8553723e-10)  
Data Point: (88,586679; 1,8254752e-10)  
Data Point: (162,37767; 3,7669252e-11)  
Data Point: (297,63514; 6,6497693e-12)  
Data Point: (545,55948; 1,0843067e-12)  
Data Point: (1.000; 1,7050122e-13)

#### Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG5 - Vol WC Function - Argilla Limosa  
Saturated Kx: 1,89e-08 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG4 - Hyd Conductivity Function - Sabbia e Ghiaia

Model: Hyd K Data Point Function

Function: Water X-Conductivity vs. Water Pressure

Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Saturated Kx: 0,0017623904 m/sec  
Data Points: Matric Suction (kPa), Water X-Conductivity (m/sec)  
Data Point: (0,01; 0,0017623904)  
Data Point: (0,018329807; 0,0017511321)  
Data Point: (0,033598183; 0,0017297944)  
Data Point: (0,061584821; 0,0016896346)  
Data Point: (0,11288379; 0,001614579)  
Data Point: (0,20691381; 0,0014766658)  
Data Point: (0,37926902; 0,0012340209)  
Data Point: (0,6951928; 0,00085197529)  
Data Point: (1,274275; 0,00039737869)  
Data Point: (2,3357215; 9,5966126e-05)  
Data Point: (4,2813324; 1,1451285e-05)  
Data Point: (7,8475997; 8,856542e-07)  
Data Point: (14,384499; 5,7597373e-08)  
Data Point: (26,366509; 3,5423998e-09)  
Data Point: (48,329302; 2,1427698e-10)  
Data Point: (88,586679; 1,2898895e-11)  
Data Point: (162,37767; 7,7539833e-13)  
Data Point: (297,63514; 4,6593226e-14)  
Data Point: (545,55948; 2,7994361e-15)  
Data Point: (1.000; 1,6819145e-16)  
Estimation Properties  
Hyd. K-Function Estimation Method: Van Genuchten Function  
Volume Water Content Function: UG4 - Vol WC Function - Sabbia e Ghiaia  
Saturated Kx: 0,001775 m/sec  
Residual Water Content: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Vol. Water Content Functions

### CLS - Vol WC Function - Diaframma

Model: Vol WC Data Point Function  
Function: Volumetric Water Content vs. Water Pressure  
Compressibility: 0 /kPa  
Saturated Water Content: 0,0099999871  
Residual Water Content: 0,00099999871  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %  
Porosity: 0,0099999871  
Data Points: Matric Suction (kPa), Volumetric Water Content  
Data Point: (0,01; 0,0099999871)  
Data Point: (0,018329807; 0,0099999719)  
Data Point: (0,033598183; 0,0099999373)  
Data Point: (0,061584821; 0,0099998576)  
Data Point: (0,11288379; 0,0099996712)  
Data Point: (0,20691381; 0,00999923)

Data Point: (0,37926902; 0,0099981762)  
Data Point: (0,6951928; 0,0099956409)  
Data Point: (1,274275; 0,0099895105)  
Data Point: (2,3357215; 0,00997465)  
Data Point: (4,2813324; 0,0099386827)  
Data Point: (7,8475997; 0,0098524595)  
Data Point: (14,384499; 0,0096512903)  
Data Point: (26,366509; 0,0092114104)  
Data Point: (48,329302; 0,0083717462)  
Data Point: (88,586679; 0,0071035776)  
Data Point: (162,37767; 0,0056868026)  
Data Point: (297,63514; 0,0044719057)  
Data Point: (545,55948; 0,0035670653)  
Data Point: (1.000; 0,002907782)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0  
Sample Material: [Clay](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

### UG1 - Vol WC Function - Limo e Argilla

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: 0 /kPa  
Saturated Water Content: 0,24999958  
Residual Water Content: 0,024999958  
Curve Fit to Data: 100 %  
Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,24999958)  
Data Point: (0,018329807; 0,24999901)  
Data Point: (0,033598183; 0,24999761)  
Data Point: (0,061584821; 0,24999411)  
Data Point: (0,11288379; 0,24998527)  
Data Point: (0,20691381; 0,24996268)  
Data Point: (0,37926902; 0,24990455)  
Data Point: (0,6951928; 0,24975435)  
Data Point: (1,274275; 0,24936543)  
Data Point: (2,3357215; 0,24836067)  
Data Point: (4,2813324; 0,24579249)  
Data Point: (7,8475997; 0,23942633)  
Data Point: (14,384499; 0,22480452)  
Data Point: (26,366509; 0,19636452)  
Data Point: (48,329302; 0,15501041)  
Data Point: (88,586679; 0,11324679)  
Data Point: (162,37767; 0,081833037)  
Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

## UG2 - Vol WC Function - Limo Argilloso

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,24999958

Residual Water Content: 0,024999958

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,24999958

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,24999958)

Data Point: (0,018329807; 0,24999901)

Data Point: (0,033598183; 0,24999761)

Data Point: (0,061584821; 0,24999411)

Data Point: (0,11288379; 0,24998527)

Data Point: (0,20691381; 0,24996268)

Data Point: (0,37926902; 0,24990455)

Data Point: (0,6951928; 0,24975435)

Data Point: (1,274275; 0,24936543)

Data Point: (2,3357215; 0,24836067)

Data Point: (4,2813324; 0,24579249)

Data Point: (7,8475997; 0,23942633)

Data Point: (14,384499; 0,22480452)

Data Point: (26,366509; 0,19636452)

Data Point: (48,329302; 0,15501041)

Data Point: (88,586679; 0,11324679)

Data Point: (162,37767; 0,081833037)

Data Point: (297,63514; 0,06112695)

Data Point: (545,55948; 0,047516107)

Data Point: (1.000; 0,038054667)

#### Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,25

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG3 - Vol WC Function - Sabbia e Ghiaia

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,14999785

Residual Water Content: 0,014999785

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,14999785

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)

Data Point: (48,329302; 0,012490157)

Data Point: (88,586679; 0,0097830103)

Data Point: (162,37767; 0,0079285548)

Data Point: (297,63514; 0,0065794303)

Data Point: (545,55948; 0,0055438399)

Data Point: (1.000; 0,004706915)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0,15

Sample Material: Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum Suction: 1.000 kPa

Minimum Suction: 0,01 kPa

Num. Points: 20

### UG5 - Vol WC Function - Argilla Limosa

Model: Vol WC Data Point Function

Function: Volumetric Water Content vs. Water Pressure

Compressibility: 0 /kPa

Saturated Water Content: 0,25999967

Residual Water Content: 0,025999967

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0,25999967

Data Points: Matric Suction (kPa), Volumetric Water Content

Data Point: (0,01; 0,25999967)

Data Point: (0,018329807; 0,25999927)  
Data Point: (0,033598183; 0,25999837)  
Data Point: (0,061584821; 0,2599963)  
Data Point: (0,11288379; 0,25999145)  
Data Point: (0,20691381; 0,25997998)  
Data Point: (0,37926902; 0,25995258)  
Data Point: (0,6951928; 0,25988666)  
Data Point: (1,274275; 0,25972727)  
Data Point: (2,3357215; 0,2593409)  
Data Point: (4,2813324; 0,25840575)  
Data Point: (7,8475997; 0,25616395)  
Data Point: (14,384499; 0,25093355)  
Data Point: (26,366509; 0,23949667)  
Data Point: (48,329302; 0,2176654)  
Data Point: (88,586679; 0,18469302)  
Data Point: (162,37767; 0,14785687)  
Data Point: (297,63514; 0,11626955)  
Data Point: (545,55948; 0,092743697)  
Data Point: (1.000; 0,075602333)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: [0,26](#)  
Sample Material: [Clay](#)  
Liquid Limit: [0 %](#)  
Diameter at 10% passing: [0](#)  
Diameter at 60% passing: [0](#)  
Maximum Suction: [1.000 kPa](#)  
Minimum Suction: [0,01 kPa](#)  
Num. Points: [20](#)

### UG4 - Vol WC Function - Sabbia e Ghiaia

Model: [Vol WC Data Point Function](#)

Function: [Volumetric Water Content vs. Water Pressure](#)

Compressibility: [0 /kPa](#)

Saturated Water Content: [0,14999785](#)

Residual Water Content: [0,014999785](#)

Curve Fit to Data: [100 %](#)

Segment Curvature: [100 %](#)

Porosity: [0,14999785](#)

Data Points: [Matric Suction \(kPa\), Volumetric Water Content](#)

Data Point: (0,01; 0,14999785)

Data Point: (0,018329807; 0,14999307)

Data Point: (0,033598183; 0,14997751)

Data Point: (0,061584821; 0,14992669)

Data Point: (0,11288379; 0,14976069)

Data Point: (0,20691381; 0,14922008)

Data Point: (0,37926902; 0,14748155)

Data Point: (0,6951928; 0,14211614)

Data Point: (1,274275; 0,12746687)

Data Point: (2,3357215; 0,097911043)

Data Point: (4,2813324; 0,062504835)

Data Point: (7,8475997; 0,037546148)

Data Point: (14,384499; 0,024015429)

Data Point: (26,366509; 0,016739386)  
Data Point: (48,329302; 0,012490157)  
Data Point: (88,586679; 0,0097830103)  
Data Point: (162,37767; 0,0079285548)  
Data Point: (297,63514; 0,0065794303)  
Data Point: (545,55948; 0,0055438399)  
Data Point: (1.000; 0,004706915)

#### Estimation Properties

Vol. WC Estimation Method: [Sample functions](#)  
Saturated Water Content: 0,15  
Sample Material: [Sand](#)  
Liquid Limit: 0 %  
Diameter at 10% passing: 0  
Diameter at 60% passing: 0  
Maximum Suction: 1.000 kPa  
Minimum Suction: 0,01 kPa  
Num. Points: 20

## Geometry

Name: [2D Geometry](#)

## Settings

View: [2D](#)  
Element Thickness: 1 m

## Points

	X	Y
Point 1	70,44 m	43,8338 m
Point 2	69,44 m	43,84 m
Point 3	58,0964 m	43,0438 m
Point 4	70,3091 m	44,1709 m
Point 5	70,44 m	43,64 m
Point 6	70,44 m	44,04 m
Point 7	70,24 m	44,24 m
Point 8	55,0932 m	42,9569 m
Point 9	29,825 m	43,7496 m
Point 10	40,8073 m	42,9232 m
Point 11	48,9621 m	42,9747 m
Point 12	36,8166 m	43,4108 m
Point 13	19,94 m	43,1697 m
Point 14	21,7496 m	43,6199 m
Point 15	23,8118 m	43,4165 m
Point 16	70,34 m	43,64 m
Point 17	139,94 m	18,6903 m
Point 18	0 m	18,6903 m

Point 19	0 m	33,4905 m
Point 20	0 m	0 m
Point 21	140 m	0 m
Point 22	139,94 m	33,4905 m
Point 23	69,44 m	44,24 m
Point 24	69,44 m	43,64 m
Point 25	69,54 m	43,64 m
Point 26	83,2958 m	48,4858 m
Point 27	139,94 m	37,9905 m
Point 28	78,2958 m	48,4858 m
Point 29	77,2679 m	48,3444 m
Point 30	19,3941 m	42,9666 m
Point 31	70,34 m	17,9403 m
Point 32	109,94 m	10,9403 m
Point 33	109,94 m	18,6903 m
Point 34	69,54 m	17,9403 m
Point 35	76,4103 m	47,83 m
Point 36	7,5539 m	37,9905 m
Point 37	140 m	43,6355 m
Point 38	109,94 m	33,4905 m
Point 39	29,94 m	33,4905 m
Point 40	29,94 m	18,6903 m
Point 41	29,94 m	10,9403 m
Point 42	29,94 m	37,9905 m
Point 43	109,94 m	37,9905 m
Point 44	109,94 m	43,6355 m
Point 45	29,94 m	43,744 m
Point 46	70,34 m	37,9905 m
Point 47	95,4376 m	45,6673 m
Point 48	90,3904 m	45,7903 m
Point 49	89,381 m	45,9156 m
Point 50	96,5699 m	45,3449 m
Point 51	0 m	34,5721 m
Point 52	100,4847 m	43,6355 m
Point 53	99,4753 m	43,984 m
Point 54	84,3339 m	48,2749 m
Point 55	69,54 m	33,4905 m
Point 56	70,34 m	33,4905 m
Point 57	69,54 m	37,9905 m



Point 58	70,34 m	18,6903 m
Point 59	87,3622 m	46,7434 m
Point 60	94,4281 m	45,7472 m
Point 61	69,54 m	18,6903 m
Point 62	17,7304 m	42,5956 m
Point 63	70,29014 m	43,64 m

## Lines

	Start Point	End Point	Length	Angle	Hydraulic Boundary
Line 1	1	6	0,2062 m	90 °	
Line 2	6	4	0,18512 m	-45 °	
Line 3	4	35	7,1143 m	31 °	Profilo di Piena - FIUME
Line 4	35	29	1 m	31 °	
Line 5	29	28	1,0376 m	7,83 °	
Line 6	28	26	5 m	0 °	Drainage
Line 7	26	54	1,0593 m	-11,5 °	Drainage
Line 8	54	59	3,3935 m	-26,8 °	Drainage
Line 9	59	49	2,1819 m	-22,3 °	Drainage
Line 10	49	48	1,0171 m	-7,08 °	Drainage
Line 11	48	60	4,0379 m	-0,612 °	Drainage
Line 12	60	47	1,0127 m	-4,53 °	Drainage
Line 13	47	50	1,1773 m	-15,9 °	Drainage
Line 14	50	53	3,2083 m	-25,1 °	Drainage
Line 15	53	52	1,0679 m	-19 °	Drainage
Line 16	52	1	30,045 m	-0,378 °	
Line 17	1	5	0,1938 m	90 °	
Line 18	5	16	0,1 m	0 °	
Line 19	16	46	5,6495 m	90 °	
Line 20	46	43	39,6 m	0 °	
Line 21	43	44	5,645 m	90 °	
Line 22	44	52	9,4553 m	0 °	Zero Pressure
Line 23	25	24	0,1 m	0 °	
Line 24	24	2	0,2 m	90 °	
Line 25	46	57	0,8 m	0 °	
Line 26	57	25	5,6495 m	90 °	
Line 27	46	56	4,5 m	90 °	
Line 28	56	55	0,8 m	0 °	
Line 29	55	57	4,5 m	90 °	
Line 30	56	58	14,8 m	90 °	
Line 31	58	61	0,8 m	0 °	

Line 32	61	55	14,8 m	90 °	
Line 33	34	61	0,75 m	90 °	
Line 34	58	31	0,75 m	90 °	
Line 35	31	34	0,8 m	0 °	
Line 36	42	45	5,7535 m	90 °	
Line 37	45	12	6,8847 m	-2,77 °	Profilo di Piena - FIUME
Line 38	12	10	4,0204 m	-6,97 °	Profilo di Piena - FIUME
Line 39	10	11	8,155 m	0,362 °	Profilo di Piena - FIUME
Line 40	11	8	6,1311 m	-0,166 °	Profilo di Piena - FIUME
Line 41	8	3	3,0045 m	1,66 °	Profilo di Piena - FIUME
Line 42	3	2	11,372 m	4,01 °	Profilo di Piena - FIUME
Line 43	57	42	39,6 m	0 °	
Line 44	36	62	11,17 m	24,3 °	Profilo di Piena - FIUME
Line 45	62	30	1,7046 m	12,6 °	Profilo di Piena - FIUME
Line 46	30	13	0,58246 m	20,4 °	Profilo di Piena - FIUME
Line 47	13	14	1,8648 m	14 °	Profilo di Piena - FIUME
Line 48	14	15	2,0722 m	-5,63 °	Profilo di Piena - FIUME
Line 49	15	9	6,0224 m	3,17 °	Profilo di Piena - FIUME
Line 50	9	45	0,11514 m	-2,79 °	
Line 51	42	36	22,386 m	0 °	
Line 52	19	51	1,0816 m	90 °	BC - Lato SX
Line 53	51	36	8,2914 m	24,3 °	Profilo di Piena - FIUME
Line 54	42	39	4,5 m	90 °	
Line 55	39	19	29,94 m	0 °	
Line 56	55	39	39,6 m	0 °	
Line 57	18	19	14,8 m	90 °	BC - Lato SX
Line 58	39	40	14,8 m	90 °	
Line 59	40	18	29,94 m	0 °	
Line 60	61	40	39,6 m	0 °	
Line 61	43	38	4,5 m	90 °	
Line 62	38	56	39,6 m	0 °	
Line 63	38	33	14,8 m	90 °	
Line 64	33	58	39,6 m	0 °	
Line 65	44	37	30,06 m	0 °	Zero Pressure
Line 66	37	27	5,6453 m	89,4 °	BC - Lato DX
Line 67	27	43	30 m	0 °	
Line 68	27	22	4,5 m	90 °	BC - Lato DX
Line 69	22	38	30 m	0 °	
Line 70	22	17	14,8 m	90 °	BC - Lato DX

Line 71	17	33	30 m	0 °	
Line 72	41	40	7,75 m	90 °	
Line 73	33	32	7,75 m	90 °	
Line 74	32	41	80 m	0 °	
Line 75	20	18	18,69 m	90 °	BC - Lato SX
Line 76	17	21	18,69 m	-89,8 °	BC - Lato DX
Line 77	21	20	140 m	0 °	
Line 78	4	2	0,92996 m	20,8 °	
Line 79	2	1	1 m	-0,355 °	
Line 80	16	63	0,04986 m	0 °	
Line 81	63	25	0,75014 m	0 °	
Line 82	2	23	0,4 m	90 °	Profilo di Piena - FIUME
Line 83	23	7	0,8 m	0 °	Profilo di Piena - FIUME
Line 84	7	4	0,097722 m	-45 °	

## Regions

	Material	Points	Area
Region 1	UG1 - Limo Argilloso	1;6;4;35;29;28;26;54;59;49;48;60;47;50;53;52	84,692 m <sup>2</sup>
Region 2	UG2 - Limo Argilloso	1;5;16;46;43;44;52	226,52 m <sup>2</sup>
Region 3	Diaframma	25;63;16;46;57	4,5196 m <sup>2</sup>
Region 4	Diaframma	57;46;56;55	3,6 m <sup>2</sup>
Region 5	Diaframma	55;56;58;61	11,84 m <sup>2</sup>
Region 6	Diaframma	34;61;58;31	0,6 m <sup>2</sup>
Region 7	UG2 - Limo Argilloso	42;45;12;10;11;8;3;2;24;25;57	207,46 m <sup>2</sup>
Region 8	UG2 - Limo Argilloso	36;62;30;13;14;15;9;45;42	89,644 m <sup>2</sup>
Region 9	UG3 - Sabbia Limo Ghiaiosa	19;51;36;42;39	121,82 m <sup>2</sup>
Region 10	UG3 - Sabbia Limo Ghiaiosa	39;42;57;55	178,2 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	18;19;39;40	443,12 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	40;39;55;61	586,09 m <sup>2</sup>

Region 13	UG3 - Sabbia Limo Ghiaiosa	56;46;43;38	178,2 m <sup>2</sup>
Region 14	UG4 - Sabbia Ghiaiosa	58;56;38;33	586,09 m <sup>2</sup>
Region 15	UG2 - Limo Argilloso	43;44;37;27	169,52 m <sup>2</sup>
Region 16	UG3 - Sabbia Limo Ghiaiosa	38;43;27;22	135 m <sup>2</sup>
Region 17	UG4 - Sabbia Ghiaiosa	33;38;22;17	444,01 m <sup>2</sup>
Region 18	UG5 - Argilla Limosa	41;40;61;34;31;58;33;32	619,4 m <sup>2</sup>
Region 19	UG5 - Argilla Limosa	20;18;40;41;32;33;17;21	1.996,1 m <sup>2</sup>
Region 20	Diaframma	1;6;4;2	0,18164 m <sup>2</sup>
Region 21	Diaframma	24;25;63;16;5;1;2	0,1969 m <sup>2</sup>
Region 22	Diaframma	2;23;7;4	0,20146 m <sup>2</sup>

## Mesh Properties

Global Element Size: 1 m

## SEZIONE DD

# Slope Stability Spencer Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 134  
Date: 19/09/2024  
Time: 09:03:16  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione DD pk 400 - BT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione DD\  
Last Solved Date: 19/09/2024  
Last Solved Time: 09:05:08

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Slope Stability Spencer Con Barriera

Kind: SLOPE/W  
Parent: Steady-State FIUME Con Barriera  
Method: Spencer  
Settings  
PWP Conditions from: Parent Analysis  
Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
Slip Surface  
Direction of movement: Left to Right  
Use Passive Mode: No  
Slip Surface Option: Entry and Exit  
Critical slip surfaces saved: 1  
Optimize Critical Slip Surface Location: No  
Tension Crack Option: (none)  
Distribution  
F of S Calculation Option: Constant  
Advanced  
Geometry Settings  
Minimum Slip Surface Depth: 0,1 m  
Number of Slices: 30  
Factor of Safety Convergence Settings  
Maximum Number of Iterations: 100  
Tolerable difference in F of S: 0,001  
Solution Settings  
Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3  
Maximum iterations to calculate converged lambda: 20  
Max Absolute Lambda: 2

## Materials

### Diaframma

Model: High Strength  
Unit Weight: 25 kN/m<sup>3</sup>

### UG1 - Limo Argilloso

Model: Undrained (Phi=0)  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion: 46,42 kPa

### UG2 - Limo Argilloso

Model: Undrained (Phi=0)  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion: 46,42 kPa

### UG3 - Sabbia Limo Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 28,35 °  
Phi-B: 0 °

### UG4 - Sabbia Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 30,16 °  
Phi-B: 0 °

### UG5 - Argilla Limosa

Model: Undrained (Phi=0)  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion: 46,42 kPa

## Slip Surface Entry and Exit

Left Type: Range  
Left-Zone Left Coordinate: (94; 44,112565) m  
Left-Zone Right Coordinate: (119; 48,330769) m  
Left-Zone Increment: 70  
Right Type: Range  
Right-Zone Left Coordinate: (119; 48,330769) m  
Right-Zone Right Coordinate: (145; 43,603199) m  
Right-Zone Increment: 70  
Radius Increments: 10

# Slip Surface Limits

Left Coordinate: (0; 34,5023) m  
Right Coordinate: (180; 43,6552) m

# Surcharge Loads

## Surcharge Load 1

Surcharge (Unit Weight): 10 kN/m³  
Direction: Vertical

### Coordinates

	X	Y
	111,9379 m	49,5755 m
	116,93 m	49,57 m

# Geometry

Name: 2D Geometry

## Settings

View: 2D  
Element Thickness: 1 m

## Points

	X	Y
Point 1	143,2301 m	43,6423 m
Point 2	141,8404 m	43,6318 m
Point 3	152,8587 m	43,6552 m
Point 4	109,975 m	47,83 m
Point 5	180 m	43,6552 m
Point 6	131,3059 m	45,5268 m
Point 7	130,1354 m	46,0245 m
Point 8	134,1452 m	44,0673 m
Point 9	135,1547 m	43,7765 m
Point 10	133,1358 m	44,5382 m
Point 11	145,2489 m	43,5977 m
Point 12	135,6414 m	43,6343 m
Point 13	102,4587 m	40,0899 m
Point 14	103,2587 m	36,5707 m
Point 15	103,2587 m	40,0899 m
Point 16	102,4587 m	44,3512 m
Point 17	103,2587 m	44,3512 m



Point 18	102,4587 m	44,1911 m
Point 19	103,2587 m	44,2584 m
Point 20	103,2587 m	44,1842 m
Point 21	103,8625 m	44,3488 m
Point 22	102,8093 m	44,1911 m
Point 23	104,872 m	44,7679 m
Point 24	111,9379 m	48,5755 m
Point 25	110,9285 m	48,4021 m
Point 26	180 m	0 m
Point 27	73,5798 m	43,6572 m
Point 28	93,85 m	44,1111 m
Point 29	85,9207 m	43,6897 m
Point 30	120,0133 m	47,8802 m
Point 31	119,0039 m	48,3296 m
Point 32	124,051 m	46,4109 m
Point 33	129,0981 m	46,2315 m
Point 34	125,0604 m	46,3246 m
Point 35	113,7485 m	48,5912 m
Point 36	112,578 m	48,5874 m
Point 37	114,919 m	48,5779 m
Point 38	117,9945 m	48,6321 m
Point 39	116,0895 m	48,5353 m
Point 40	102,4587 m	36,5594 m
Point 41	31,184 m	43,0094 m
Point 42	36,2311 m	43,981 m
Point 43	29,1652 m	41,7632 m
Point 44	16,2578 m	35,2505 m
Point 45	25,8489 m	40,0899 m
Point 46	55,2237 m	43,8561 m
Point 47	54,4008 m	43,8771 m
Point 48	40 m	44,0023 m
Point 49	50,3631 m	43,8067 m
Point 50	13,0317 m	34,5023 m
Point 51	15,766 m	35,0023 m
Point 52	0 m	34,5023 m
Point 53	0 m	0 m
Point 54	0 m	19,8933 m
Point 55	180 m	38,349 m
Point 56	180 m	40,0899 m

Point 57	89,168 m	43,7425 m
Point 58	90,74 m	43,8878 m
Point 59	102,0435 m	44,1911 m
Point 60	103,2587 m	19,8933 m
Point 61	102,4587 m	19,8933 m
Point 62	103,2587 m	17,7023 m
Point 63	180 m	19,8933 m
Point 64	102,4587 m	17,7023 m
Point 65	142,8587 m	37,4126 m
Point 66	142,8587 m	19,8933 m
Point 67	142,8587 m	40,0899 m
Point 68	62,8587 m	43,8519 m
Point 69	142,8587 m	43,6395 m
Point 70	62,8587 m	10,7023 m
Point 71	142,8587 m	10,7023 m
Point 72	62,8587 m	40,0899 m
Point 73	62,8587 m	19,8933 m
Point 74	62,8587 m	36,0002 m

## Regions

	Material	Points	Area
Region 1	Diaframma	18;22;20;15;13	3,2794 m <sup>2</sup>
Region 2	Diaframma	13;15;14;40	2,8199 m <sup>2</sup>
Region 3	Diaframma	14;40;61;60	13,337 m <sup>2</sup>
Region 4	Diaframma	61;60;62;64	1,7528 m <sup>2</sup>
Region 5	UG1 - Limo Argilloso	20;19;21;23;4;25;24;36;35;37;39;38;31;30;32;34;33;7;6;10;8;9;12	90,823 m <sup>2</sup>
Region 6	UG2 - Limo Argilloso	45;43;41;42;48;49;47;46;68;72	125,83 m <sup>2</sup>
Region 7	UG3 - Sabbia Limo Ghiaiosa	44;45;72;74	184,84 m <sup>2</sup>
Region 8	UG4 - Sabbia Ghiaiosa	54;52;50;51;44;74;73	971,63 m <sup>2</sup>

Region 9	UG5 - Argilla Limosa	53;54;73;70;71;66;63;26	2.845,5 m <sup>2</sup>
Region 10	UG2 - Limo Argilloso	72;68;27;29;57;58;28;59;18;13	148,28 m <sup>2</sup>
Region 11	UG3 - Sabbia Limo Ghiaiosa	74;72;13;40	150,88 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	73;74;40;61	648,91 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	70;73;61;64;62;60;66;71	733,53 m <sup>2</sup>
Region 14	UG2 - Limo Argilloso	15;20;12;2;69;67	149,26 m <sup>2</sup>
Region 15	UG3 - Sabbia Limo Ghiaiosa	14;15;67;65	122,69 m <sup>2</sup>
Region 16	UG4 - Sabbia Ghiaiosa	60;14;65;66	677,09 m <sup>2</sup>
Region 17	UG2 - Limo Argilloso	67;69;1;11;3;5;56	132,12 m <sup>2</sup>
Region 18	UG3 - Sabbia Limo Ghiaiosa	65;67;56;55	82,049 m <sup>2</sup>
Region 19	UG4 - Sabbia Ghiaiosa	66;65;55;63	668,08 m <sup>2</sup>
Region 20	Diaframma	22;20;19	0,016673 m <sup>2</sup>
Region 21	Diaframma	18;16;17;19;22	0,11296 m <sup>2</sup>

## Slip Results

Slip Surfaces Analysed: 24152 of 55451 converged

## Current Slip Surface

Slip Surface: 40.553

Factor of Safety: 3,023

Volume: 174,53599 m<sup>3</sup>

Weight: 3.590,3783 kN

Resisting Moment: 34.819,507 kN·m

Activating Moment: 11.519,059 kN·m

Resisting Force: 1.520,0058 kN

Activating Force: 502,79944 kN

Slip Rank: 1 of 55.451 slip surfaces

Exit: (143,07918; 43,641162) m

Entry: (111,87932; 48,565437) m

Radius: 19,643279 m

Center: (129,30027; 57,641169) m

## Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	111,90861 m	48,509654 m	-16,080139 kPa	-22,386364 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 2	112,25795 m	47,894267 m	-11,258951 kPa	-1,1474732 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 3	113,16325 m	46,4879 m	-1,383241 kPa	28,236489 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 4	114,33375 m	44,950909 m	9,1874518 kPa	60,801054 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 5	115,05136 m	44,12119 m	14,878512 kPa	78,536863 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 6	115,63661 m	43,542769 m	17,203071 kPa	90,945758 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 7	116,50975 m	42,743042 m	20,203796 kPa	108,58815 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 8	117,46225 m	41,979927 m	23,62472 kPa	117,11796 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 9	118,4992 m	41,245133 m	27,517394 kPa	131,32203 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 10	119,5086 m	40,622281 m	31,324373 kPa	138,33509 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 11	120,24625 m	40,210903 m	34,120702 kPa	141,85477 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 12	121,0745 m	39,815199 m	37,681501 kPa	144,17763 kPa	57,462193 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa

Slice 13	122,2651 m	39,312007 m	42,615715 kPa	148,3103 kPa	57,029704 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 14	123,4557 m	38,897889 m	46,676421 kPa	150,52225 kPa	56,032169 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 15	124,5557 m	38,586591 m	49,728824 kPa	153,73304 kPa	56,117632 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 16	125,56511 m	38,363132 m	51,919846 kPa	158,99907 kPa	57,776815 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 17	126,57454 m	38,1946 m	53,572212 kPa	163,8209 kPa	59,486964 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 18	127,58396 m	38,079574 m	54,69985 kPa	167,5954 kPa	60,915132 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 19	128,59339 m	38,01711 m	55,312012 kPa	170,32545 kPa	62,057885 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 20	129,61675 m	38,00729 m	55,407904 kPa	170,09528 kPa	61,881953 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 21	130,72065 m	38,058099 m	54,909179 kPa	163,66505 kPa	58,681483 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 22	131,76337 m	38,158384 m	53,92527 kPa	152,76296 kPa	53,329924 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 23	132,67833 m	38,296104 m	52,57428 kPa	140,56951 kPa	47,479649 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 24	133,6405 m	38,490372 m	50,668724 kPa	127,16341 kPa	41,274295 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 25	134,64995 m	38,747673 m	48,144968 kPa	114,37325 kPa	35,734842 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 26	135,39805 m	38,970068 m	45,963648 kPa	105,46972 kPa	32,107734 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa

Slice 27	136,26139 m	39,284654 m	42,87817 kPa	97,829763 kPa	29,650271 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 28	137,50136 m	39,804832 m	37,776302 kPa	87,465225 kPa	26,810688 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 29	138,58623 m	40,339405 m	32,519429 kPa	81,488358 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 30	139,51599 m	40,872115 m	27,260001 kPa	71,665945 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 31	140,44576 m	41,475843 m	21,296683 kPa	60,31343 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 32	141,37552 m	42,158945 m	14,549655 kPa	47,231623 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 33	142,34955 m	42,974529 m	6,5078686 kPa	31,411699 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 34	142,96894 m	43,534348 m	1,0340154 kPa	20,460852 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso

# Slope Stability Spencer Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 138  
Date: 19/09/2024  
Time: 09:03:33  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione DD pk 400 - BT SLV.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione DD\  
Last Solved Date: 19/09/2024  
Last Solved Time: 09:11:40

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Slope Stability Spencer Con Barriera

Kind: SLOPE/W  
Parent: Steady-State FIUME Con Barriera  
Method: Spencer  
Settings  
PWP Conditions from: Parent Analysis  
Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
Slip Surface  
Direction of movement: Left to Right  
Use Passive Mode: No  
Slip Surface Option: Entry and Exit  
Critical slip surfaces saved: 1  
Optimize Critical Slip Surface Location: No  
Tension Crack Option: (none)  
Distribution  
F of S Calculation Option: Constant  
Advanced  
Geometry Settings  
Minimum Slip Surface Depth: 0,1 m  
Number of Slices: 30  
Factor of Safety Convergence Settings  
Maximum Number of Iterations: 100  
Tolerable difference in F of S: 0,001  
Solution Settings  
Search Method: Root Finder



Tolerable difference between starting and converged F of S: 3  
Maximum iterations to calculate converged lambda: 20  
Max Absolute Lambda: 2

## Materials

### Diaframma

Model: High Strength  
Unit Weight: 25 kN/m<sup>3</sup>

### UG1 - Limo Argilloso

Model: Undrained (Phi=0)  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion: 65 kPa

### UG2 - Limo Argilloso

Model: Undrained (Phi=0)  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion: 65 kPa

### UG3 - Sabbia Limo Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 34 °  
Phi-B: 0 °

### UG4 - Sabbia Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 36 °  
Phi-B: 0 °

### UG5 - Argilla Limosa

Model: Undrained (Phi=0)  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion: 65 kPa

## Slip Surface Entry and Exit

Left Type: Range  
Left-Zone Left Coordinate: (94; 44,112565) m  
Left-Zone Right Coordinate: (119; 48,330769) m  
Left-Zone Increment: 70  
Right Type: Range  
Right-Zone Left Coordinate: (119; 48,330769) m  
Right-Zone Right Coordinate: (145; 43,603199) m  
Right-Zone Increment: 70  
Radius Increments: 10

# Slip Surface Limits

Left Coordinate: (0; 34,5023) m  
Right Coordinate: (180; 43,6552) m

# Seismic Coefficients

Horz Seismic Coef.: 0,078  
Vert Seismic Coef.: 0,039

# Surcharge Loads

## Surcharge Load 1

Surcharge (Unit Weight): 10 kN/m³  
Direction: Vertical

### Coordinates

	X	Y
	111,9379 m	49,5755 m
	116,93 m	49,57 m

# Geometry

Name: 2D Geometry

## Settings

View: 2D  
Element Thickness: 1 m

## Points

	X	Y
Point 1	143,2301 m	43,6423 m
Point 2	141,8404 m	43,6318 m
Point 3	152,8587 m	43,6552 m
Point 4	109,975 m	47,83 m
Point 5	180 m	43,6552 m
Point 6	131,3059 m	45,5268 m
Point 7	130,1354 m	46,0245 m
Point 8	134,1452 m	44,0673 m
Point 9	135,1547 m	43,7765 m
Point 10	133,1358 m	44,5382 m
Point 11	145,2489 m	43,5977 m
Point 12	135,6414 m	43,6343 m
Point 13	102,4587 m	40,0899 m

Point 14	103,2587 m	36,5707 m
Point 15	103,2587 m	40,0899 m
Point 16	102,4587 m	44,3512 m
Point 17	103,2587 m	44,3512 m
Point 18	102,4587 m	44,1911 m
Point 19	103,2587 m	44,2584 m
Point 20	103,2587 m	44,1842 m
Point 21	103,8625 m	44,3488 m
Point 22	102,8093 m	44,1911 m
Point 23	104,872 m	44,7679 m
Point 24	111,9379 m	48,5755 m
Point 25	110,9285 m	48,4021 m
Point 26	180 m	0 m
Point 27	73,5798 m	43,6572 m
Point 28	93,85 m	44,1111 m
Point 29	85,9207 m	43,6897 m
Point 30	120,0133 m	47,8802 m
Point 31	119,0039 m	48,3296 m
Point 32	124,051 m	46,4109 m
Point 33	129,0981 m	46,2315 m
Point 34	125,0604 m	46,3246 m
Point 35	113,7485 m	48,5912 m
Point 36	112,578 m	48,5874 m
Point 37	114,919 m	48,5779 m
Point 38	117,9945 m	48,6321 m
Point 39	116,0895 m	48,5353 m
Point 40	102,4587 m	36,5594 m
Point 41	31,184 m	43,0094 m
Point 42	36,2311 m	43,981 m
Point 43	29,1652 m	41,7632 m
Point 44	16,2578 m	35,2505 m
Point 45	25,8489 m	40,0899 m
Point 46	55,2237 m	43,8561 m
Point 47	54,4008 m	43,8771 m
Point 48	40 m	44,0023 m
Point 49	50,3631 m	43,8067 m
Point 50	13,0317 m	34,5023 m
Point 51	15,766 m	35,0023 m
Point 52	0 m	34,5023 m

Point 53	0 m	0 m
Point 54	0 m	19,8933 m
Point 55	180 m	38,349 m
Point 56	180 m	40,0899 m
Point 57	89,168 m	43,7425 m
Point 58	90,74 m	43,8878 m
Point 59	102,0435 m	44,1911 m
Point 60	103,2587 m	19,8933 m
Point 61	102,4587 m	19,8933 m
Point 62	103,2587 m	17,7023 m
Point 63	180 m	19,8933 m
Point 64	102,4587 m	17,7023 m
Point 65	142,8587 m	37,4126 m
Point 66	142,8587 m	19,8933 m
Point 67	142,8587 m	40,0899 m
Point 68	62,8587 m	43,8519 m
Point 69	142,8587 m	43,6395 m
Point 70	62,8587 m	10,7023 m
Point 71	142,8587 m	10,7023 m
Point 72	62,8587 m	40,0899 m
Point 73	62,8587 m	19,8933 m
Point 74	62,8587 m	36,0002 m
Point 75	107,6 m	46,44 m

Regions

	Material	Points	Area
Region 1	Diaframma	18;22;20;15;13	3,2794 m <sup>2</sup>
Region 2	Diaframma	13;15;14;40	2,8199 m <sup>2</sup>
Region 3	Diaframma	14;40;61;60	13,337 m <sup>2</sup>
Region 4	Diaframma	61;60;62;64	1,7528 m <sup>2</sup>
Region 5	UG2 - Limo Argilloso	45;43;41;42;48;49;47;46;68;72	125,83 m <sup>2</sup>
Region 6	UG3 - Sabbia Limo Ghiaiosa	44;45;72;74	184,84 m <sup>2</sup>

Region 7	UG4 - Sabbia Ghiaiosa	54;52;50;51;44;74;73	971,63 m <sup>2</sup>
Region 8	UG5 - Argilla Limosa	53;54;73;70;71;66;63;26	2.845,5 m <sup>2</sup>
Region 9	UG2 - Limo Argilloso	72;68;27;29;57;58;28;59;18;13	148,28 m <sup>2</sup>
Region 10	UG3 - Sabbia Limo Ghiaiosa	74;72;13;40	150,88 m <sup>2</sup>
Region 11	UG4 - Sabbia Ghiaiosa	73;74;40;61	648,91 m <sup>2</sup>
Region 12	UG5 - Argilla Limosa	70;73;61;64;62;60;66;71	733,53 m <sup>2</sup>
Region 13	UG2 - Limo Argilloso	15;20;12;2;69;67	149,26 m <sup>2</sup>
Region 14	UG3 - Sabbia Limo Ghiaiosa	14;15;67;65	122,69 m <sup>2</sup>
Region 15	UG4 - Sabbia Ghiaiosa	60;14;65;66	677,09 m <sup>2</sup>
Region 16	UG2 - Limo Argilloso	67;69;1;11;3;5;56	132,12 m <sup>2</sup>
Region 17	UG3 - Sabbia Limo Ghiaiosa	65;67;56;55	82,049 m <sup>2</sup>
Region 18	UG4 - Sabbia Ghiaiosa	66;65;55;63	668,08 m <sup>2</sup>
Region 19	Diaframma	22;20;19	0,016673 m <sup>2</sup>
Region 20	Diaframma	18;16;17;19;22	0,11296 m <sup>2</sup>
Region 21	UG1 - Limo Argilloso	19;21;23;75;4;25;24;36;35;37;39;38;31;30;32;34;33;7;6;10;8;9;12;20	90,912 m <sup>2</sup>

## Slip Results

Slip Surfaces Analysed: 23080 of 55451 converged

### Current Slip Surface

Slip Surface: 37.483

Factor of Safety: 2,894

Volume: 189,64517 m<sup>3</sup>

Weight: 3.900,5435 kN

Resisting Moment: 59.920,698 kN·m

Activating Moment: 20.705,242 kN·m

Resisting Force: 2.237,5914 kN

Activating Force: 773,17943 kN

Slip Rank: 1 of 55.451 slip surfaces

Exit: (145; 43,603199) m

Entry: (110,46147; 48,121883) m

Radius: 23,665015 m

Center: (129,80917; 61,749042) m

## Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	110,69499 m	47,801858 m	-23,61992 kPa	-15,476628 kPa	0 kPa	65 kPa	0 kPa	UG1 - Limo Argilloso
Slice 2	111,4332 m	46,858979 m	-15,723537 kPa	8,2366341 kPa	0 kPa	65 kPa	0 kPa	UG1 - Limo Argilloso
Slice 3	112,25795 m	45,8821 m	-8,1197882 kPa	39,332725 kPa	0 kPa	65 kPa	0 kPa	UG1 - Limo Argilloso
Slice 4	113,16325 m	44,948223 m	-1,017873 kPa	59,695506 kPa	0 kPa	65 kPa	0 kPa	UG1 - Limo Argilloso
Slice 5	113,95302 m	44,183746 m	4,8582431 kPa	76,514087 kPa	0 kPa	65 kPa	0 kPa	UG1 - Limo Argilloso
Slice 6	114,53827 m	43,677402 m	8,1901302 kPa	87,757904 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 7	115,50425 m	42,911256 m	13,059398 kPa	104,8477 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 8	116,50975 m	42,181207 m	18,12881 kPa	121,6363 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 9	117,46225 m	41,569915 m	22,684634 kPa	127,53172 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 10	118,4992 m	40,969549 m	27,456288 kPa	139,37286 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 11	119,5086 m	40,450758 m	31,815885 kPa	144,51366 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 12	120,14378 m	40,148284 m	34,458607 kPa	146,52066 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso

Slice 13	120,90372 m	39,834111 m	37,485322 kPa	148,13192 kPa	74,632074 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 14	122,16263 m	39,363312 m	42,102129 kPa	151,46147 kPa	73,763806 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 15	123,42154 m	38,971777 m	45,941602 kPa	153,02893 kPa	72,231312 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 16	124,5557 m	38,680317 m	48,799684 kPa	155,85338 kPa	72,208627 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 17	125,56511 m	38,473353 m	50,829156 kPa	161,04857 kPa	74,343933 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 18	126,57454 m	38,311668 m	52,414575 kPa	166,0103 kPa	76,621284 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 19	127,58396 m	38,194332 m	53,565072 kPa	170,10836 kPa	78,60944 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 20	128,59339 m	38,120682 m	54,287137 kPa	173,33943 kPa	80,301786 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 21	129,61675 m	38,090494 m	54,582973 kPa	173,73047 kPa	80,366003 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 22	130,72065 m	38,108841 m	54,402813 kPa	167,99391 kPa	76,618161 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 23	131,76337 m	38,16932 m	53,809478 kPa	157,76987 kPa	70,122171 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 24	132,67833 m	38,263121 m	52,889378 kPa	146,26481 kPa	62,982523 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 25	133,6405 m	38,401831 m	51,528853 kPa	133,76446 kPa	55,468619 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 26	134,64995 m	38,590159 m	49,681716 kPa	122,22108 kPa	48,928417 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa



Slice 27	135,39805 m	38,754811 m	48,066811 kPa	114,42725 kPa	44,760683 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 28	136,25851 m	38,988825 m	45,771669 kPa	108,51894 kPa	42,32357 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 29	137,49274 m	39,375621 m	41,9781 kPa	101,14636 kPa	39,909496 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 30	138,72697 m	39,838726 m	37,436178 kPa	91,730999 kPa	36,622319 kPa	0 kPa	0 kPa	UG3 - Sabbia Limo Ghiaiosa
Slice 31	139,96816 m	40,386685 m	32,043209 kPa	87,360628 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 32	141,21632 m	41,027016 m	25,720127 kPa	75,529713 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 33	142,34955 m	41,688851 m	19,180359 kPa	63,043309 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 34	143,0444 m	42,132431 m	14,791596 kPa	54,578209 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 35	143,67257 m	42,577689 m	10,370187 kPa	45,603595 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso
Slice 36	144,55752 m	43,250428 m	3,6093464 kPa	31,674489 kPa	0 kPa	65 kPa	0 kPa	UG2 - Limo Argilloso

# Slope Stability Spencer Con Barriera

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 132  
Date: 19/09/2024  
Time: 09:03:55  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione DD pk 400 - LT SLU.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione DD\  
Last Solved Date: 19/09/2024  
Last Solved Time: 09:11:16

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Slope Stability Spencer Con Barriera

Kind: SLOPE/W  
Parent: Steady-State FIUME Con Barriera  
Method: Spencer  
Settings  
PWP Conditions from: Parent Analysis  
Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
Slip Surface  
Direction of movement: Left to Right  
Use Passive Mode: No  
Slip Surface Option: Entry and Exit  
Critical slip surfaces saved: 1  
Optimize Critical Slip Surface Location: No  
Tension Crack Option: (none)  
Distribution  
F of S Calculation Option: Constant  
Advanced  
Geometry Settings  
Minimum Slip Surface Depth: 0,1 m  
Number of Slices: 30  
Factor of Safety Convergence Settings  
Maximum Number of Iterations: 100  
Tolerable difference in F of S: 0,001  
Solution Settings  
Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3  
Maximum iterations to calculate converged lambda: 20  
Max Absolute Lambda: 2

## Materials

### Diaframma

Model: High Strength  
Unit Weight: 25 kN/m<sup>3</sup>

### UG1 - Limo Argilloso

Model: Mohr-Coulomb  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion': 10 kPa  
Phi': 21,3 °  
Phi-B: 0 °

### UG2 - Limo Argilloso

Model: Mohr-Coulomb  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion': 10 kPa  
Phi': 23,04 °  
Phi-B: 0 °

### UG3 - Sabbia Limo Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 28,35 °  
Phi-B: 0 °

### UG4 - Sabbia Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 30,16 °  
Phi-B: 0 °

### UG5 - Argilla Limosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 10 kPa  
Phi': 16,65 °  
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Type: Range  
Left-Zone Left Coordinate: (94; 44,112565) m  
Left-Zone Right Coordinate: (119; 48,330769) m  
Left-Zone Increment: 70

Right Type: [Range](#)  
Right-Zone Left Coordinate: [\(119; 48,330769\) m](#)  
Right-Zone Right Coordinate: [\(145; 43,603199\) m](#)  
Right-Zone Increment: [70](#)  
Radius Increments: [10](#)

## Slip Surface Limits

Left Coordinate: [\(0; 34,5023\) m](#)  
Right Coordinate: [\(180; 43,6552\) m](#)

## Surcharge Loads

### Surcharge Load 1

Surcharge (Unit Weight): [10 kN/m³](#)  
Direction: [Vertical](#)

#### Coordinates

	X	Y
	<a href="#">111,9379 m</a>	<a href="#">49,5755 m</a>
	<a href="#">116,93 m</a>	<a href="#">49,57 m</a>

## Geometry

Name: [2D Geometry](#)

### Settings

View: [2D](#)  
Element Thickness: [1 m](#)

### Points

	X	Y
Point 1	<a href="#">143,2301 m</a>	<a href="#">43,6423 m</a>
Point 2	<a href="#">141,8404 m</a>	<a href="#">43,6318 m</a>
Point 3	<a href="#">152,8587 m</a>	<a href="#">43,6552 m</a>
Point 4	<a href="#">109,975 m</a>	<a href="#">47,83 m</a>
Point 5	<a href="#">180 m</a>	<a href="#">43,6552 m</a>
Point 6	<a href="#">131,3059 m</a>	<a href="#">45,5268 m</a>
Point 7	<a href="#">130,1354 m</a>	<a href="#">46,0245 m</a>
Point 8	<a href="#">134,1452 m</a>	<a href="#">44,0673 m</a>
Point 9	<a href="#">135,1547 m</a>	<a href="#">43,7765 m</a>
Point 10	<a href="#">133,1358 m</a>	<a href="#">44,5382 m</a>
Point 11	<a href="#">145,2489 m</a>	<a href="#">43,5977 m</a>
Point 12	<a href="#">135,6414 m</a>	<a href="#">43,6343 m</a>

Point 13	102,4587 m	40,0899 m
Point 14	103,2587 m	36,5707 m
Point 15	103,2587 m	40,0899 m
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Point 26	180 m	0 m
Point 27	73,5798 m	43,6572 m
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Point 29	85,9207 m	43,6897 m
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Point 37	114,919 m	48,5779 m
Point 38	117,9945 m	48,6321 m
Point 39	116,0895 m	48,5353 m
Point 40	102,4587 m	36,5594 m
Point 41	31,184 m	43,0094 m
Point 42	36,2311 m	43,981 m
Point 43	29,1652 m	41,7632 m
Point 44	16,2578 m	35,2505 m
Point 45	25,8489 m	40,0899 m
Point 46	55,2237 m	43,8561 m
Point 47	54,4008 m	43,8771 m
Point 48	40 m	44,0023 m
Point 49	50,3631 m	43,8067 m
Point 50	13,0317 m	34,5023 m
Point 51	15,766 m	35,0023 m

Point 52	0 m	34,5023 m
Point 53	0 m	0 m
Point 54	0 m	19,8933 m
Point 55	180 m	38,349 m
Point 56	180 m	40,0899 m
Point 57	89,168 m	43,7425 m
Point 58	90,74 m	43,8878 m
Point 59	102,0435 m	44,1911 m
Point 60	103,2587 m	19,8933 m
Point 61	102,4587 m	19,8933 m
Point 62	103,2587 m	17,7023 m
Point 63	180 m	19,8933 m
Point 64	102,4587 m	17,7023 m
Point 65	142,8587 m	37,4126 m
Point 66	142,8587 m	19,8933 m
Point 67	142,8587 m	40,0899 m
Point 68	62,8587 m	43,8519 m
Point 69	142,8587 m	43,6395 m
Point 70	62,8587 m	10,7023 m
Point 71	142,8587 m	10,7023 m
Point 72	62,8587 m	40,0899 m
Point 73	62,8587 m	19,8933 m
Point 74	62,8587 m	36,0002 m

## Regions

	Material	Points	Area
Region 1	Diaframma	18;22;20;15;13	3,2794 m <sup>2</sup>
Region 2	Diaframma	13;15;14;40	2,8199 m <sup>2</sup>
Region 3	Diaframma	14;40;61;60	13,337 m <sup>2</sup>
Region 4	Diaframma	61;60;62;64	1,7528 m <sup>2</sup>
Region 5	UG1 - Limo Argilloso	20;19;21;23;4;25;24;36;35;37;39;38;31;30;32;34;33;7;6;10;8;9;12	90,823 m <sup>2</sup>
Region 6	UG2 - Limo Argilloso	45;43;41;42;48;49;47;46;68;72	125,83 m <sup>2</sup>
Region 7	UG3 - Sabbia	44;45;72;74	184,84 m <sup>2</sup>

	Limo Ghiaiosa		
Region 8	UG4 - Sabbia Ghiaiosa	54;52;50;51;44;74;73	971,63 m <sup>2</sup>
Region 9	UG5 - Argilla Limoso	53;54;73;70;71;66;63;26	2.845,5 m <sup>2</sup>
Region 10	UG2 - Limo Argilloso	72;68;27;29;57;58;28;59;18;13	148,28 m <sup>2</sup>
Region 11	UG3 - Sabbia Limo Ghiaiosa	74;72;13;40	150,88 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	73;74;40;61	648,91 m <sup>2</sup>
Region 13	UG5 - Argilla Limoso	70;73;61;64;62;60;66;71	733,53 m <sup>2</sup>
Region 14	UG2 - Limo Argilloso	15;20;12;2;69;67	149,26 m <sup>2</sup>
Region 15	UG3 - Sabbia Limo Ghiaiosa	14;15;67;65	122,69 m <sup>2</sup>
Region 16	UG4 - Sabbia Ghiaiosa	60;14;65;66	677,09 m <sup>2</sup>
Region 17	UG2 - Limo Argilloso	67;69;1;11;3;5;56	132,12 m <sup>2</sup>
Region 18	UG3 - Sabbia Limo Ghiaiosa	65;67;56;55	82,049 m <sup>2</sup>
Region 19	UG4 - Sabbia Ghiaiosa	66;65;55;63	668,08 m <sup>2</sup>
Region 20	Diaframma	22;20;19	0,016673 m <sup>2</sup>
Region 21	Diaframma	18;16;17;19;22	0,11296 m <sup>2</sup>

## Slip Results

Slip Surfaces Analysed: 28660 of 55451 converged

### Current Slip Surface

Slip Surface: 43.599

Factor of Safety: 2,460

Volume: 109,57177 m<sup>3</sup>

Weight: 2.246,2212 kN

Resisting Moment: 20.450,307 kN·m

Activating Moment: 8.311,9247 kN·m

Resisting Force: 961,32928 kN

Activating Force: 390,71137 kN

Slip Rank: 1 of 55.451 slip surfaces

Exit: (140,38945; 43,632385) m

Entry: (113,38764; 48,590028) m

Radius: 19,335225 m

Center: (129,34764; 59,504668) m



## Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	113,56807 m	48,335131 m	-19,369668 kPa	6,9637281 kPa	2,7150441 kPa	10 kPa	0 kPa	UG1 - Limo Argilloso
Slice 2	114,33375 m	47,3569 m	-12,389719 kPa	22,247944 kPa	8,674111 kPa	10 kPa	0 kPa	UG1 - Limo Argilloso
Slice 3	115,50425 m	46,032204 m	-3,2991025 kPa	44,523721 kPa	17,359073 kPa	10 kPa	0 kPa	UG1 - Limo Argilloso
Slice 4	116,50975 m	45,057405 m	3,3438507 kPa	62,656527 kPa	23,125046 kPa	10 kPa	0 kPa	UG1 - Limo Argilloso
Slice 5	117,40594 m	44,309924 m	8,3664976 kPa	70,037566 kPa	24,044545 kPa	10 kPa	0 kPa	UG1 - Limo Argilloso
Slice 6	117,93819 m	43,894721 m	11,061703 kPa	78,426657 kPa	28,650246 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 7	118,4992 m	43,511222 m	12,672377 kPa	83,821636 kPa	30,259707 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 8	119,5086 m	42,870355 m	15,740619 kPa	90,911148 kPa	31,969949 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 9	120,51801 m	42,312616 m	18,773903 kPa	95,955222 kPa	32,825136 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 10	121,52744 m	41,830089 m	21,695267 kPa	100,32745 kPa	33,442185 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 11	122,53686 m	41,416734 m	24,435881 kPa	103,36423 kPa	33,568145 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 12	123,54629 m	41,067877 m	26,932559 kPa	105,10467 kPa	33,246521 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso

Slice 13	124,5557 m	40,779903 m	29,129129 kPa	108,29705 kPa	33,670034 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 14	125,56511 m	40,550024 m	30,977893 kPa	113,73176 kPa	35,195136 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 15	126,57454 m	40,376136 m	32,436961 kPa	118,77945 kPa	36,721375 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 16	127,58396 m	40,25672 m	33,472049 kPa	122,82982 kPa	38,003769 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 17	128,59339 m	40,190764 m	34,055633 kPa	125,87614 kPa	39,051169 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 18	129,61675 m	40,178275 m	34,159682 kPa	125,97362 kPa	39,048375 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 19	130,72065 m	40,227181 m	33,688458 kPa	119,81593 kPa	36,629926 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 20	131,76337 m	40,326489 m	32,73076 kPa	109,0375 kPa	32,453178 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 21	132,67833 m	40,464138 m	31,394308 kPa	96,825727 kPa	27,827916 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 22	133,6405 m	40,659129 m	29,485417 kPa	83,29497 kPa	22,885148 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 23	134,64995 m	40,918089 m	26,927581 kPa	70,309426 kPa	18,450254 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 24	135,39805 m	41,142266 m	24,697818 kPa	61,210791 kPa	15,52893 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 25	136,11621 m	41,399958 m	22,12934 kPa	54,585024 kPa	13,803369 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 26	137,06582 m	41,78427 m	18,299029 kPa	46,89323 kPa	12,161085 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso

Slice 27	138,01543 m	42,229303 m	13,878865 kPa	37,50361 kPa	10,04758 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 28	138,96504 m	42,739913 m	8,8230332 kPa	26,146339 kPa	7,3675845 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 29	139,91465 m	43,322339 m	3,0644119 kPa	12,445705 kPa	3,9898543 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso

# Slope Stability Spencer Con Barriera 5d

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 138  
Date: 19/09/2024  
Time: 09:29:40  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione DD pk 400 - Rapido Svaso BT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione DD\  
Last Solved Date: 19/09/2024  
Last Solved Time: 09:44:16

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Slope Stability Spencer Con Barriera 5d

Kind: SLOPE/W  
Parent: Transient FIUME Con Barriera Rapido Svaso  
Method: Spencer  
Settings  
PWP Conditions from: Parent Analysis  
Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
Slip Surface  
Direction of movement: Right to Left  
Use Passive Mode: No  
Slip Surface Option: Entry and Exit  
Critical slip surfaces saved: 1  
Optimize Critical Slip Surface Location: No  
Tension Crack Option: (none)  
Distribution  
F of S Calculation Option: Constant  
Advanced  
Geometry Settings  
Minimum Slip Surface Depth: 0,1 m  
Number of Slices: 30  
Factor of Safety Convergence Settings  
Maximum Number of Iterations: 100  
Tolerable difference in F of S: 0,001  
Solution Settings  
Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3  
Maximum iterations to calculate converged lambda: 20  
Max Absolute Lambda: 2

## Materials

### Diaframma

Model: High Strength  
Unit Weight: 25 kN/m<sup>3</sup>

### UG1 - Limo Argilloso

Model: Undrained (Phi=0)  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion: 46,42 kPa

### UG2 - Limo Argilloso

Model: Undrained (Phi=0)  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion: 46,42 kPa

### UG3 - Sabbia Limo Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 28,35 °  
Phi-B: 0 °

### UG4 - Sabbia Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 30,16 °  
Phi-B: 0 °

### UG5 - Argilla Limosa

Model: Undrained (Phi=0)  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion: 46,42 kPa

## Slip Surface Entry and Exit

Left Type: Range  
Left-Zone Left Coordinate: (63; 43,849334) m  
Left-Zone Right Coordinate: (112; 48,576654) m  
Left-Zone Increment: 70  
Right Type: Range  
Right-Zone Left Coordinate: (112; 48,576654) m  
Right-Zone Right Coordinate: (136; 43,634155) m  
Right-Zone Increment: 70  
Radius Increments: 10

# Slip Surface Limits

Left Coordinate: (0; 34,5023) m  
Right Coordinate: (180; 43,6552) m

# Surcharge Loads

## Surcharge Load 1

Surcharge (Unit Weight): 10 kN/m³  
Direction: Vertical

### Coordinates

	X	Y
	111,9379 m	49,5755 m
	116,93 m	49,57 m

# Geometry

Name: 2D Geometry

## Settings

View: 2D  
Element Thickness: 1 m

## Points

	X	Y
Point 1	143,2301 m	43,6423 m
Point 2	141,8404 m	43,6318 m
Point 3	152,8587 m	43,6552 m
Point 4	109,975 m	47,83 m
Point 5	180 m	43,6552 m
Point 6	131,3059 m	45,5268 m
Point 7	130,1354 m	46,0245 m
Point 8	134,1452 m	44,0673 m
Point 9	135,1547 m	43,7765 m
Point 10	133,1358 m	44,5382 m
Point 11	145,2489 m	43,5977 m
Point 12	135,6414 m	43,6343 m
Point 13	102,4587 m	40,0899 m
Point 14	103,2587 m	36,5707 m
Point 15	103,2587 m	40,0899 m
Point 16	102,4587 m	44,3512 m
Point 17	103,2587 m	44,3512 m

Point 18	102,4587 m	44,1911 m
Point 19	103,2587 m	44,2584 m
Point 20	103,2587 m	44,1842 m
Point 21	103,8625 m	44,3488 m
Point 22	102,8093 m	44,1911 m
Point 23	104,872 m	44,7679 m
Point 24	111,9379 m	48,5755 m
Point 25	110,9285 m	48,4021 m
Point 26	180 m	0 m
Point 27	73,5798 m	43,6572 m
Point 28	93,85 m	44,1111 m
Point 29	85,9207 m	43,6897 m
Point 30	120,0133 m	47,8802 m
Point 31	119,0039 m	48,3296 m
Point 32	124,051 m	46,4109 m
Point 33	129,0981 m	46,2315 m
Point 34	125,0604 m	46,3246 m
Point 35	113,7485 m	48,5912 m
Point 36	112,578 m	48,5874 m
Point 37	114,919 m	48,5779 m
Point 38	117,9945 m	48,6321 m
Point 39	116,0895 m	48,5353 m
Point 40	102,4587 m	36,5594 m
Point 41	31,184 m	43,0094 m
Point 42	36,2311 m	43,981 m
Point 43	29,1652 m	41,7632 m
Point 44	16,2578 m	35,2505 m
Point 45	25,8489 m	40,0899 m
Point 46	55,2237 m	43,8561 m
Point 47	54,4008 m	43,8771 m
Point 48	40 m	44,0023 m
Point 49	50,3631 m	43,8067 m
Point 50	13,0317 m	34,5023 m
Point 51	15,766 m	35,0023 m
Point 52	0 m	34,5023 m
Point 53	0 m	0 m
Point 54	0 m	19,8933 m
Point 55	180 m	38,349 m
Point 56	180 m	40,0899 m

Point 57	89,168 m	43,7425 m
Point 58	90,74 m	43,8878 m
Point 59	102,0435 m	44,1911 m
Point 60	103,2587 m	19,8933 m
Point 61	102,4587 m	19,8933 m
Point 62	103,2587 m	17,7023 m
Point 63	180 m	19,8933 m
Point 64	102,4587 m	17,7023 m
Point 65	142,8587 m	37,4126 m
Point 66	142,8587 m	19,8933 m
Point 67	142,8587 m	40,0899 m
Point 68	62,8587 m	43,8519 m
Point 69	142,8587 m	43,6395 m
Point 70	62,8587 m	10,7023 m
Point 71	142,8587 m	10,7023 m
Point 72	62,8587 m	40,0899 m
Point 73	62,8587 m	19,8933 m
Point 74	62,8587 m	36,0002 m

## Regions

	Material	Points	Area
Region 1	Diaframma	18;22;20;15;13	3,2794 m <sup>2</sup>
Region 2	Diaframma	13;15;14;40	2,8199 m <sup>2</sup>
Region 3	Diaframma	14;40;61;60	13,337 m <sup>2</sup>
Region 4	Diaframma	61;60;62;64	1,7528 m <sup>2</sup>
Region 5	UG1 - Limo Argilloso	20;19;21;23;4;25;24;36;35;37;39;38;31;30;32;34;33;7;6;10;8;9;12	90,823 m <sup>2</sup>
Region 6	UG2 - Limo Argilloso	45;43;41;42;48;49;47;46;68;72	125,83 m <sup>2</sup>
Region 7	UG3 - Sabbia Limo Ghiaiosa	44;45;72;74	184,84 m <sup>2</sup>
Region 8	UG4 - Sabbia Ghiaiosa	54;52;50;51;44;74;73	971,63 m <sup>2</sup>



Region 9	UG5 - Argilla Limosa	53;54;73;70;71;66;63;26	2.845,5 m <sup>2</sup>
Region 10	UG2 - Limo Argilloso	72;68;27;29;57;58;28;59;18;13	148,28 m <sup>2</sup>
Region 11	UG3 - Sabbia Limo Ghiaiosa	74;72;13;40	150,88 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	73;74;40;61	648,91 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	70;73;61;64;62;60;66;71	733,53 m <sup>2</sup>
Region 14	UG2 - Limo Argilloso	15;20;12;2;69;67	149,26 m <sup>2</sup>
Region 15	UG3 - Sabbia Limo Ghiaiosa	14;15;67;65	122,69 m <sup>2</sup>
Region 16	UG4 - Sabbia Ghiaiosa	60;14;65;66	677,09 m <sup>2</sup>
Region 17	UG2 - Limo Argilloso	67;69;1;11;3;5;56	132,12 m <sup>2</sup>
Region 18	UG3 - Sabbia Limo Ghiaiosa	65;67;56;55	82,049 m <sup>2</sup>
Region 19	UG4 - Sabbia Ghiaiosa	66;65;55;63	668,08 m <sup>2</sup>
Region 20	Diaframma	22;20;19	0,016673 m <sup>2</sup>
Region 21	Diaframma	18;16;17;19;22	0,11296 m <sup>2</sup>

## Slip Results

Slip Surfaces Analysed: 7281 of 55451 converged

## Current Slip Surface

Slip Surface: 43.887

Factor of Safety: 2,914

Volume: 44,172601 m<sup>3</sup>

Weight: 905,53832 kN

Resisting Moment: 6.655,1468 kN·m

Activating Moment: 2.284,1993 kN·m

Resisting Force: 620,7205 kN

Activating Force: 212,98757 kN

Slip Rank: 1 of 55.451 slip surfaces

Exit: (103,25911; 44,258461) m

Entry: (116,63094; 48,562813) m

Radius: 8,8379656 m

Center: (108,30132; 51,516958) m

## Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	103,31483 m	44,220381 m	-3,5830717 kPa	14,995779 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 2	103,61653 m	44,02842 m	-1,4384767 kPa	19,144392 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 3	104,11487 m	43,738705 m	1,8038275 kPa	26,89573 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 4	104,61962 m	43,487157 m	4,7078547 kPa	35,283315 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 5	105,10395 m	43,281388 m	7,1779317 kPa	43,467496 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 6	105,56786 m	43,115864 m	9,2369099 kPa	51,553478 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 7	106,03177 m	42,978737 m	11,016009 kPa	58,990479 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 8	106,49568 m	42,868653 m	12,523651 kPa	65,811463 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 9	106,95959 m	42,784585 m	13,777717 kPa	72,041031 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 10	107,4235 m	42,725784 m	14,792995 kPa	77,696823 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 11	107,88741 m	42,691744 m	15,580141 kPa	82,790453 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 12	108,35132 m	42,682178 m	16,154867 kPa	87,32809 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso

Slice 13	108,81523 m	42,697006 m	16,522152 kPa	91,310768 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 14	109,27914 m	42,736352 m	16,694009 kPa	94,734449 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 15	109,74305 m	42,800549 m	16,670306 kPa	97,589855 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 16	110,21337 m	42,891759 m	16,450601 kPa	99,885238 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 17	110,69012 m	43,011553 m	16,031337 kPa	101,5807 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 18	111,18085 m	43,165511 m	15,372244 kPa	100,48894 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 19	111,68555 m	43,357181 m	14,464103 kPa	96,570983 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 20	112,25795 m	43,622243 m	13,095264 kPa	99,52314 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 21	112,7791 m	43,90088 m	11,566271 kPa	91,985505 kPa	0 kPa	46,42 kPa	0 kPa	UG2 - Limo Argilloso
Slice 22	113,17228 m	44,146046 m	9,7412242 kPa	85,514347 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 23	113,55643 m	44,415102 m	7,2652465 kPa	78,552109 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 24	113,94358 m	44,719151 m	4,4496506 kPa	70,787469 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 25	114,33375 m	45,063427 m	1,2483047 kPa	62,095771 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 26	114,72392 m	45,452381 m	-2,3028609 kPa	52,398635 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso

Slice 27	115,11408 m	45,895403 m	-6,0899122 kPa	41,417465 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 28	115,50425 m	46,406801 m	-10,285329 kPa	28,790108 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 29	115,89442 m	47,01048 m	-15,225516 kPa	13,93446 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso
Slice 30	116,36022 m	47,950997 m	-23,564986 kPa	-9,1281467 kPa	0 kPa	46,42 kPa	0 kPa	UG1 - Limo Argilloso

# Slope Stability Spencer Con Barriera 4d

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## File Information

File Version: 10.01  
Created By: Milano StAP  
Last Edited By: Milano StAP  
Revision Number: 140  
Date: 19/09/2024  
Time: 09:29:47  
Tool Version: 10.1.1.18972  
File Name: Tratto Nord Sezione DD pk 400 - Rapido Svaso LT.gsz  
Directory: N:\Server StAP\278 - AIPO - Sistemazioni Sponde Po\07 - Verifiche\S 16 - Caorso\Sezione DD\  
Last Solved Date: 19/09/2024  
Last Solved Time: 09:50:26

## Project Settings

Unit System: International System of Units (SI)

## Analysis Settings

### Slope Stability Spencer Con Barriera 4d

Kind: SLOPE/W  
Parent: Transient FIUME Con Barriera Rapido Svaso  
Method: Spencer  
Settings  
    PWP Conditions from: Parent Analysis  
    Unit Weight of Water: 9,807 kN/m<sup>3</sup>  
Slip Surface  
    Direction of movement: Right to Left  
    Use Passive Mode: No  
    Slip Surface Option: Entry and Exit  
    Critical slip surfaces saved: 1  
    Optimize Critical Slip Surface Location: No  
    Tension Crack Option: (none)  
Distribution  
    F of S Calculation Option: Constant  
Advanced  
    Geometry Settings  
        Minimum Slip Surface Depth: 0,1 m  
        Number of Slices: 30  
    Factor of Safety Convergence Settings  
        Maximum Number of Iterations: 100  
        Tolerable difference in F of S: 0,001  
    Solution Settings  
        Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3  
Maximum iterations to calculate converged lambda: 20  
Max Absolute Lambda: 2

## Materials

### Diaframma

Model: High Strength  
Unit Weight: 25 kN/m<sup>3</sup>

### UG1 - Limo Argilloso

Model: Mohr-Coulomb  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion': 21,3 kPa  
Phi': 27,4 °  
Phi-B: 0 °

### UG2 - Limo Argilloso

Model: Mohr-Coulomb  
Unit Weight: 20,5 kN/m<sup>3</sup>  
Cohesion': 10 kPa  
Phi': 23 °  
Phi-B: 0 °

### UG3 - Sabbia Limo Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 28,35 °  
Phi-B: 0 °

### UG4 - Sabbia Ghiaiosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 0 kPa  
Phi': 30,16 °  
Phi-B: 0 °

### UG5 - Argilla Limosa

Model: Mohr-Coulomb  
Unit Weight: 21 kN/m<sup>3</sup>  
Cohesion': 17,6 kPa  
Phi': 16,65 °  
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Type: Range  
Left-Zone Left Coordinate: (63; 43,849334) m  
Left-Zone Right Coordinate: (112; 48,576654) m  
Left-Zone Increment: 70

Right Type: [Range](#)  
Right-Zone Left Coordinate: [\(112; 48,576654\) m](#)  
Right-Zone Right Coordinate: [\(136; 43,634155\) m](#)  
Right-Zone Increment: [70](#)  
Radius Increments: [10](#)

## Slip Surface Limits

Left Coordinate: [\(0; 34,5023\) m](#)  
Right Coordinate: [\(180; 43,6552\) m](#)

## Surcharge Loads

### Surcharge Load 1

Surcharge (Unit Weight): [10 kN/m<sup>3</sup>](#)  
Direction: [Vertical](#)

#### Coordinates

	X	Y
	<a href="#">111,9379 m</a>	<a href="#">49,5755 m</a>
	<a href="#">116,93 m</a>	<a href="#">49,57 m</a>

## Geometry

Name: [2D Geometry](#)

### Settings

View: [2D](#)  
Element Thickness: [1 m](#)

### Points

	X	Y
Point 1	<a href="#">143,2301 m</a>	<a href="#">43,6423 m</a>
Point 2	<a href="#">141,8404 m</a>	<a href="#">43,6318 m</a>
Point 3	<a href="#">152,8587 m</a>	<a href="#">43,6552 m</a>
Point 4	<a href="#">109,975 m</a>	<a href="#">47,83 m</a>
Point 5	<a href="#">180 m</a>	<a href="#">43,6552 m</a>
Point 6	<a href="#">131,3059 m</a>	<a href="#">45,5268 m</a>
Point 7	<a href="#">130,1354 m</a>	<a href="#">46,0245 m</a>
Point 8	<a href="#">134,1452 m</a>	<a href="#">44,0673 m</a>
Point 9	<a href="#">135,1547 m</a>	<a href="#">43,7765 m</a>
Point 10	<a href="#">133,1358 m</a>	<a href="#">44,5382 m</a>
Point 11	<a href="#">145,2489 m</a>	<a href="#">43,5977 m</a>
Point 12	<a href="#">135,6414 m</a>	<a href="#">43,6343 m</a>



Point 13	102,4587 m	40,0899 m
Point 14	103,2587 m	36,5707 m
Point 15	103,2587 m	40,0899 m
Point 16	102,4587 m	44,3512 m
Point 17	103,2587 m	44,3512 m
Point 18	102,4587 m	44,1911 m
Point 19	103,2587 m	44,2584 m
Point 20	103,2587 m	44,1842 m
Point 21	103,8625 m	44,3488 m
Point 22	102,8093 m	44,1911 m
Point 23	104,872 m	44,7679 m
Point 24	111,9379 m	48,5755 m
Point 25	110,9285 m	48,4021 m
Point 26	180 m	0 m
Point 27	73,5798 m	43,6572 m
Point 28	93,85 m	44,1111 m
Point 29	85,9207 m	43,6897 m
Point 30	120,0133 m	47,8802 m
Point 31	119,0039 m	48,3296 m
Point 32	124,051 m	46,4109 m
Point 33	129,0981 m	46,2315 m
Point 34	125,0604 m	46,3246 m
Point 35	113,7485 m	48,5912 m
Point 36	112,578 m	48,5874 m
Point 37	114,919 m	48,5779 m
Point 38	117,9945 m	48,6321 m
Point 39	116,0895 m	48,5353 m
Point 40	102,4587 m	36,5594 m
Point 41	31,184 m	43,0094 m
Point 42	36,2311 m	43,981 m
Point 43	29,1652 m	41,7632 m
Point 44	16,2578 m	35,2505 m
Point 45	25,8489 m	40,0899 m
Point 46	55,2237 m	43,8561 m
Point 47	54,4008 m	43,8771 m
Point 48	40 m	44,0023 m
Point 49	50,3631 m	43,8067 m
Point 50	13,0317 m	34,5023 m
Point 51	15,766 m	35,0023 m

Point 52	0 m	34,5023 m
Point 53	0 m	0 m
Point 54	0 m	19,8933 m
Point 55	180 m	38,349 m
Point 56	180 m	40,0899 m
Point 57	89,168 m	43,7425 m
Point 58	90,74 m	43,8878 m
Point 59	102,0435 m	44,1911 m
Point 60	103,2587 m	19,8933 m
Point 61	102,4587 m	19,8933 m
Point 62	103,2587 m	17,7023 m
Point 63	180 m	19,8933 m
Point 64	102,4587 m	17,7023 m
Point 65	142,8587 m	37,4126 m
Point 66	142,8587 m	19,8933 m
Point 67	142,8587 m	40,0899 m
Point 68	62,8587 m	43,8519 m
Point 69	142,8587 m	43,6395 m
Point 70	62,8587 m	10,7023 m
Point 71	142,8587 m	10,7023 m
Point 72	62,8587 m	40,0899 m
Point 73	62,8587 m	19,8933 m
Point 74	62,8587 m	36,0002 m

## Regions

	Material	Points	Area
Region 1	Diaframma	18;22;20;15;13	3,2794 m <sup>2</sup>
Region 2	Diaframma	13;15;14;40	2,8199 m <sup>2</sup>
Region 3	Diaframma	14;40;61;60	13,337 m <sup>2</sup>
Region 4	Diaframma	61;60;62;64	1,7528 m <sup>2</sup>
Region 5	UG1 - Limo Argilloso	20;19;21;23;4;25;24;36;35;37;39;38;31;30;32;34;33;7;6;10;8;9;12	90,823 m <sup>2</sup>
Region 6	UG2 - Limo Argilloso	45;43;41;42;48;49;47;46;68;72	125,83 m <sup>2</sup>
Region 7	UG3 - Sabbia	44;45;72;74	184,84 m <sup>2</sup>

	Limo Ghiaiosa		
Region 8	UG4 - Sabbia Ghiaiosa	54;52;50;51;44;74;73	971,63 m <sup>2</sup>
Region 9	UG5 - Argilla Limosa	53;54;73;70;71;66;63;26	2.845,5 m <sup>2</sup>
Region 10	UG2 - Limo Argilloso	72;68;27;29;57;58;28;59;18;13	148,28 m <sup>2</sup>
Region 11	UG3 - Sabbia Limo Ghiaiosa	74;72;13;40	150,88 m <sup>2</sup>
Region 12	UG4 - Sabbia Ghiaiosa	73;74;40;61	648,91 m <sup>2</sup>
Region 13	UG5 - Argilla Limosa	70;73;61;64;62;60;66;71	733,53 m <sup>2</sup>
Region 14	UG2 - Limo Argilloso	15;20;12;2;69;67	149,26 m <sup>2</sup>
Region 15	UG3 - Sabbia Limo Ghiaiosa	14;15;67;65	122,69 m <sup>2</sup>
Region 16	UG4 - Sabbia Ghiaiosa	60;14;65;66	677,09 m <sup>2</sup>
Region 17	UG2 - Limo Argilloso	67;69;1;11;3;5;56	132,12 m <sup>2</sup>
Region 18	UG3 - Sabbia Limo Ghiaiosa	65;67;56;55	82,049 m <sup>2</sup>
Region 19	UG4 - Sabbia Ghiaiosa	66;65;55;63	668,08 m <sup>2</sup>
Region 20	Diaframma	22;20;19	0,016673 m <sup>2</sup>
Region 21	Diaframma	18;16;17;19;22	0,11296 m <sup>2</sup>

## Slip Results

Slip Surfaces Analysed: 7962 of 55451 converged

### Current Slip Surface

Slip Surface: 43.811

Factor of Safety: 2,171

Volume: 29,675694 m<sup>3</sup>

Weight: 608,35173 kN

Resisting Moment: 3.133,6384 kN·m

Activating Moment: 1.443,5168 kN·m

Resisting Force: 351,34239 kN

Activating Force: 161,8334 kN

Slip Rank: 1 of 55.451 slip surfaces

Exit: (103,26431; 44,259239) m

Entry: (114,13799; 48,586774) m

Radius: 7,1365678 m

Center: (107,19052; 50,218723) m

## Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	103,32416 m	44,220656 m	4,1885644 kPa	18,699634 kPa	7,5218238 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 2	103,62326 m	44,043861 m	5,593441 kPa	16,123374 kPa	4,4696913 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 3	104,03075 m	43,822533 m	7,2900428 kPa	22,298661 kPa	6,3707805 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 4	104,36725 m	43,666915 m	8,520213 kPa	26,938792 kPa	7,8182228 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 5	104,70375 m	43,531843 m	9,6346633 kPa	31,529882 kPa	9,293969 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 6	105,05425 m	43,412074 m	10,669691 kPa	37,689045 kPa	11,469035 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 7	105,41875 m	43,308149 m	11,634127 kPa	44,125363 kPa	13,791711 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 8	105,78325 m	43,224752 m	12,473225 kPa	49,835969 kPa	15,859544 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 9	106,14775 m	43,161153 m	13,184563 kPa	54,888138 kPa	17,702117 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 10	106,51225 m	43,116819 m	13,775641 kPa	59,331941 kPa	19,337502 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 11	106,87675 m	43,09139 m	14,248886 kPa	63,205672 kPa	20,780923 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 12	107,24125 m	43,084663 m	14,603725 kPa	66,538123 kPa	22,044844 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso

Slice 13	107,60575 m	43,096584 m	14,84034 kPa	69,350139 kPa	23,138037 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 14	107,97025 m	43,127249 m	14,959713 kPa	71,655904 kPa	24,066105 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 15	108,33475 m	43,176902 m	14,962119 kPa	73,463802 kPa	24,832491 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 16	108,69925 m	43,24595 m	14,846426 kPa	74,776848 kPa	25,438955 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 17	109,06375 m	43,334979 m	14,611808 kPa	75,592813 kPa	25,884901 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 18	109,42825 m	43,444778 m	14,253583 kPa	75,904062 kPa	26,169076 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 19	109,79275 m	43,576382 m	13,7731 kPa	75,697283 kPa	26,285256 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 20	110,17872 m	43,741768 m	13,112077 kPa	74,875143 kPa	26,216866 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 21	110,58615 m	43,946032 m	12,248647 kPa	73,329979 kPa	25,927487 kPa	10 kPa	0 kPa	UG2 - Limo Argilloso
Slice 22	110,85918 m	44,097858 m	11,433488 kPa	69,43931 kPa	30,067362 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 23	111,09673 m	44,249496 m	10,197725 kPa	66,304991 kPa	29,083244 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 24	111,4332 m	44,48405 m	8,2503641 kPa	60,812349 kPa	27,245545 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 25	111,76967 m	44,749365 m	6,01691 kPa	54,77008 kPa	25,271243 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 26	112,09793 m	45,041914 m	3,5338668 kPa	55,163916 kPa	26,762476 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso

Slice 27	112,41797 m	45,365993 m	0,77808808 kPa	47,130488 kPa	24,026802 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 28	112,77308 m	45,783949 m	-2,6427863 kPa	37,678295 kPa	19,530573 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 29	113,16325 m	46,329083 m	-6,6882673 kPa	26,352881 kPa	13,660036 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 30	113,55342 m	47,016248 m	-11,530889 kPa	13,402874 kPa	6,9473899 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso
Slice 31	113,94325 m	47,995313 m	-18,919054 kPa	-2,4756716 kPa	-1,2832663 kPa	21,3 kPa	0 kPa	UG1 - Limo Argilloso