James Bay Native Development Corporation

Hydraulic Study

Hydraulic study of the bridge located at the 4th kilometer of Chemin de Wemindji in the municipality of Wemindji, James Bay.

Preliminairy Report

Prepared for:
James Bay Native Development Corporation

Prepared by:
Stantec Experts-conseils ltée

December 21th 2022

O/Réf. : 158100425

Sign-off sheet

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RECORD OF REVISIONS AND ISSUES		
Revision N°	**Date**	**Description**
A	2022-12-21	Preliminairy report

Stantec

Project nº 158100425

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APPENDIX

1.0 INTRODUCTION

The James Bay Native Development Corporation mandated Stantec Expert-Conseil ltée to produce a hydraulic study of the bridge located at the 4th kilometer of Chemin de Wemindji in the municipality of Wemindji, James Bay. The study will establish the requirements for the design of the future bridge if necessary. This investigation will define the flows and water levels for different return periods by modeling with HEC-RAS software. Simulations for actual and future conditions will be carried out.

This report presents the evaluation of the river flow, model inputs and simulation results necessary for the bridge design.

2.0 INFORMATION GATHERING

2.1 PROJECT INPUTS

The data used for this study are:

- IGO2's website IGO2 - Données Québec (gouv.qc.ca)
- MELCC'S website MELCC (gouv.qc.ca)
- Forêt ouverte's website Forêt ouverte (gouv.qc.ca)
- Stantec's bridge and field survey done on 11th of august 2022. It is presented in appendix 2

2.2 FIELD SURVEY

There was no hydraulic field survey done for this report, consequently the information used comes from structural survey, land survey as well as the satellite pictures of Google earth, Bing maps and *Satellites.pro* able us to make the following conclusions.

The Maquatua river, at the crossing of the bridge, is straight and stable. No evidence of beaver dams nor debris jams can be observed. No evidence of scouring on the banks. The banks are composed mainly of medium vegetation and trees further inland. A substantial bedrock is located directly under and downstream the structure.

During the field survey, the waterflow was too strong to allow bathymetry survey. Therefore, the waterbed is absent from the terrain model. In order to modelize the terrain, the lowest point, which correspond mostly of the water surface elevation of the day, was lowered by 500 mm while respecting the average slope of the bank. To ensure the validity of this assumption, simulations were done with a flow corresponding to 75% of the 2 years flood, which is close to the high watermark flow. The water surface elevation obtained from the model was compared to the high watermark elevation.

2.3 WATERSHED

2.3.1 Delimitation and average slope of the watershed

The limits of the watershed upstream of the bridge location, has been determined with ArcGIS software. The watershed of the Maquatua River, upstream of the bridge location, covers 1045 km^2. A map of this watershed is at the appendix 1. This watershed has an average slope of 3,2%.

2.3.2 Watershed surface occupancy

Wetland occupancy was determined using data from the Northern Quebec Ecoforestry Inventory Project (ENIP) and Natural Resources Canada. The watershed of the bridge located at the 4th kilometer of the Northern Road is occupied at approximately 11% of lakes and of wetlands.

Google Earth Pro's aerial pictures show that the territory is mostly occupied by forest. Paved surfaces are negligeable.

2.4 FLOW ASSESSMENT

The peak flow of Maquatua River was first assessed using regional, basin transfer, HP33 and HP40 methods since the area of the watersheds is greater than 25 km².

The peak flows selected for modelling are the median of methods HP30, HP40 and regional methods even thought the methods values obtains were outside the accepted range.

A flow increases of 15% was added to consider climate change as recommended by the Ministry of Transportation (MTQ, tome III, ch.2, 2022). These peak flows are summarized in Table 1 and the calculation details are in appendix 3.

2.4.1 Floods frequency analysis for Quebec (H.P. 33)

Analysis method H.P. 33 uses the data from 76 hydrometric stations across 12 Quebec regions to determine the daily and instant flow rates of watersheds in these regions.

This method is limited to certain Quebec regions and, for each of them, the area of the watershed has to be inside the recommended limits.

2.4.2 Estimation of daily flow of fall floods from meridional Quebec river method (H.P.40)

H.P. 40 method is another statistical method, similar to H.P. 33 previously described. H.P. 40's method is an analysis carried out from 81 hydrometric stations divided in 6 Quebec regions.

H.P. 40' method considers a more detailed application zone compared to H.P. 33's method since it compares the length of the waterway, the slope of the watershed, the importance of the forest cover, the surface of the lakes and the marsh, the altitude, and annual precipitations in addition to the area of the watersheds used for H.P. 33.

2.4.3 Comparison by watershed transfer

This method statistically analyse the maximal flows registered at a hydrometric station of Quebec gage station network. The data from the gage station are used to determine a recurrence-flow relation.

An inventory of the existing hydrometric stations in the hydrographic region studied was conducted. The stations presenting a natural or lightly influenced flow regime and sufficient hydrometric data were retained. Other parameters were considered, including the topography, the watershed elevation, the precipitation intensity and more, to select the rivers that best match the studied site.

In this analysis, one (1) stations was selected: station 81101 located on Pontax river. Then the calculation of the floods flow by transposition to the studied site was done.

It is important to note the recommended boundaries of this method: a watershed area ration between 0.5 and 2.0. This is respected for all selected stations. However, these stations are not in the same hydrometric region due to the localization of the studied site. There are zero stations in the region that present an area ration close to 0.5 or 2.0. The values obtained with this method should be used with caution.

2.4.4 Regional method

The regional method is a statistical method that uses a methematical equation based on the region (the province of Quebec is divided in three (3) regions). The necessary informations to obtain the floods flow are, the watershed area and the region of the watershed.

In the present case, the studied watershed is located in region III. This method comes from ANCTIL, François, Nicolas MARTEL et Van Diem HOANG (1998). « Analyse régionale des crues journalières de la province de Québec », Revue canadienne de génie civil, vol. 25, n° 2, p. 360-369.

2.4.5 Retained flow values

After analysis, three methods were retained for modelling, HP33, HP40 and regional method. The average and median of the three methods were analyzed on HEC RAS and the average was closest to the data received from the field survey. The average of methods HP33, HP40 and regional method was used for the model.

Table 1 - Peak flows of the Maquatua River – Area 1045 km2

RETURN PERIOD (Years)	Calculated PEAK FLOW (m^3/s)	PEAK FLOW (Includes 15 % increase - m^3/s)
2	87.69	100.85
10	121.89	140.18
25	140.31	161.36
50	155.22	178.50
100	170.13	195.64

3.0 HYDRAULIC ANALYSIS

3.1 DESIGN CRITERIA

According to the MTQ, hydraulic criteria to be consider when modeling a bridge are the clearance of the structure above water surface, the increase of the water level compared to natural flow conditions, flow velocity as well as the flow surface width.

The table 2 presents the requirements related to each criteria as well as their applicability to this specific study.

Conception criteria are based on the 50 years flood. The annual average daily traffic (AADT) is not available for the structure. Therefore, an AADT over 200 is set so the bridge would not be considered as a low traffic road.

Table 2 - Hydraulic conception criterias of a bridge

Criteria	Requirements	Applicability
CAN/CSA S6-19 (art. 1.9.7.1)	Soffit located at least 300 mm above conception high watermark.	☑
MTQ – Tome III		
Presence of ice jams or debris (Without tide)	Clearance under the bridge: 1 m above expected extreme ice or debris level.	•
Without tide and without jams	Clearance under the bridge: 1 m above conception high watermark (except low traffic road).	☑
	Clearance under the bridge: 300 mm above centennial high watermark.	☑
Without tide and without jams (low traffic road)	Clearance under the bridge for a low traffic road: 300 mm above conception high watermark.	•
Tides with ice jams or debris	1 m above expected extreme ice or debris level.	•
Navigable waterway for small embarkations	Soffit located at 1.5 m above high watermark	•
Road profile elevation	The elevation of the road profile is fixed as anticipating a security margin sufficient above the conception high watermark (E.H.C). The minimal clearance is 1000mm for highways and national roads, and 600mm for other roads.	☑
Free opening (Tome III, Chapter2, page22)	The high watermarks of a return period of 2 years correspond to the yearly water level average.	☑
	The minimal free opening between a bridge abutment has to approach the top width measured at the yearly high watermark.	☑
Fishing and Oceans Canada	Conservation of natural flow conditions by maintaining the physical characteristics of the existing watercourse; the substrat, slope and width.	☑
Maximum flow velocity	It is recommended to limit the increase of the flow speeds compared to natural conditions. The protections usually support velocities inferior to 3,4 m/s for the 100-year flood.	☑

3.2 HYDRAULIC MODELISATION

The numeric model Geo HEC-RAS version 3.1.10.1274 was used to simulate the water flow regime. The use of this model allowed establishing the actual flow conditions as well as simulate the natural flow conditions.

Manning's n is considered to be 0,035 for the waterbed upstream the structure and to be 0,07 downstream the structure due to the presence of massif boulder. The banks Manning's n is considered to be 0,065.

A sketch including the localisation of the vertical cross-sections used for the modelization is available at the top of appendix 5 as well as hydraulic profiles and sections for both simulations.

The simulations results tables for both conditions are presented in appendix 6.

3.3 RESULT SIMULATION – UNDEVELOPED AREA

In this scenario, the hydraulic model simulates the watercourse from the flow data presented in table 1. This model represents water flow without any human intervention. In this case, the bridge is not modelized. The results of this section gives the reference conditions for further analysis. The table 3 presents flow characteristics in natural conditions in cross section 1180 located upstream of the studied bridge. This section was chosen since it gives the most critical water levels for the subsequent analyse. The waterbed elevation at this cross section is 15.26 meters.

Table 3 - Flow characteristics in natural conditions – cross section 1180

Recurrence									
2 years		10 years		25 years		50 years *		100 years	
Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)
16.64	2.11	16.93	2.40	17.07	2.52	17.18	2.63	17.29	2.70

*design recurrence

3.4 RESULT SIMULATION – ACTUAL CONDITIONS

The hydraulic model for existing conditions was modelized from the characteristics presented in table 4:

Table 4 - Characteristic of the actual structure

Characteristic	Actual bridge
Type of structure	Wood steel bridge
Bias relative to the stream (degree)	0
Total width of opening (m)	50
Pier width - upper part - perpendicular to flow (m)	2.1
Pier width - lower part - perpendicular to flow (m)	2.9
Height of the structure (approximate) (m)	6.0
Geodesic elevation of the road (m)	24.03
Geodesic elevation of the soffit upstream (m)	21.89
Geodesic elevation of the soffit downstream (m)	21.89
upstream chanel elevation (m)	15.14
downstream chanel elevation (m)	15.14

The actual conditions were simulated for recurrences of 2, 10, 25, 50 and 100 years. Detailed results are presented in appendix 4, 5 and 6. The figure 1 and table 5 compare the flow characteristics from natural and actual conditions.

Figure 1 - Hydraulic profiles, actual vs natural conditions

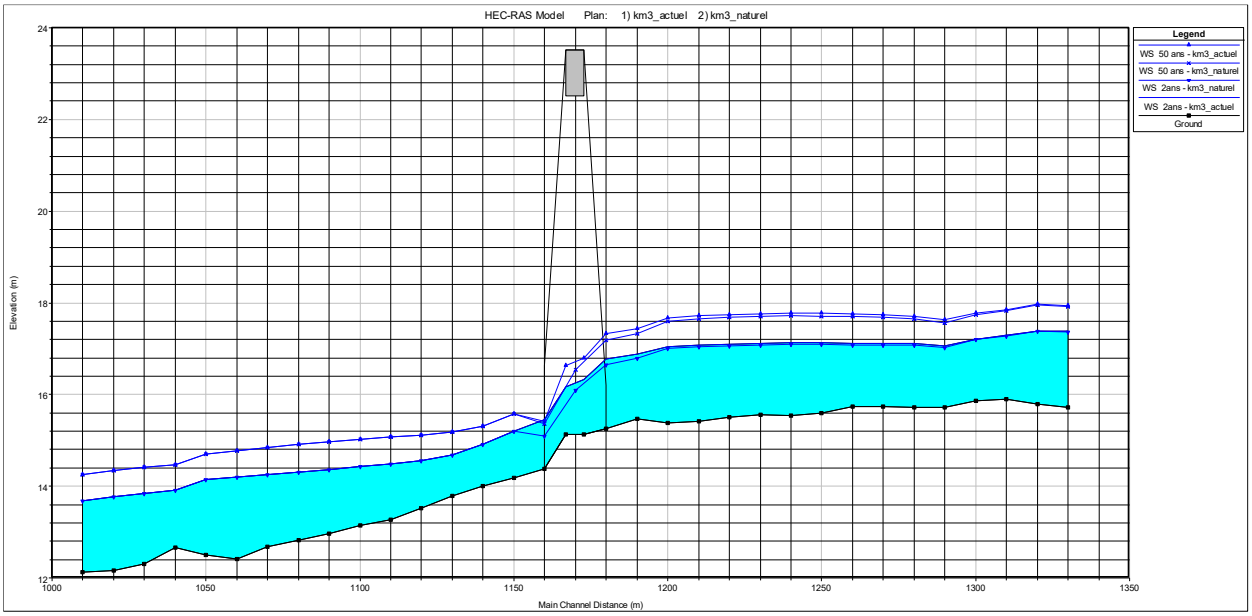


Table 5 – Flow characteristics – Cross section 1180

Recurrence – Cross section 370									
2 years		10 years		25 years		50 years (1)		100 years	
Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)	Water surface elevation (m)	Velocity (m/s)
Natural conditions									
16.64	2.11	16.93	2.40	17.07	2.52	17.18	2.63	17.29	2.70
Actual conditions									
16.77	1.92	17.07	2.19	17.22	2.31	17.33	2.40	17.45	2.48

(1) The conception is based on the 50 years flood

The hydraulic profile analysis from natural and actual conditions indicates that the bridge causes a water rise of the order of 150 mm (17.33 – 17.18) for the 50-year flood. This is under the recommended maximum value of 300 mm. Therefore, the bridge is considered non-restrictive.

The speed at the exit of the bridge for the centennial flood is 3.84 m/s[1], which is over the maximum recommended of 3.4 m/s for rock lining of caliber 300-500 (mm). The speed at the entrance of the bridge for the centennial flood is also 3.84 m/s. Those high velocities are created by the waterfall downstream of the bridge.

[1] Velocity of the simulation for the actual conditions inside the bridge downstream. The table can be found in appendix 6.

Table 6 - Bridge analysis

Norm	Conception criteria		Actual characteristic of the structure	Conformity
Soffit clearance above conception high watermark	Soffit minimum elevation = $E.H_{50}$[2] + 0.1m	17.33m + 1m = 18.33m	21.89m	Yes
Without tide and without jams	Soffit minimum elevation > $E.H_{100}$ + 0.3 m	17.33m + 0.3m = 17.63m	21.89m	Yes
Road profile	Road profile elevation > $E.H_{50}$+0.6 m	17.33m + 0.6m = 17.93	24.03	Yes
Free opening	Minimum opening = 80% High watermark line average width of three sections upstream	(39.70+42.03+47.8) /3X 80% = 43.18 m	50m	Yes
Velocity	Maximum velocity (m/s) – 100 years	< 3,4 m/s	3.84[3]m/s	No

[2] Water surface level for the conception high watermark (50 years) for the actual conditions simulation.
[3] For the 100-year flood under the bridge in actual conditions simulation.

4.0 PROTECTIVE STRUCTURE

The channel under and at both ends of the bridge is made of resurgence of rock as presented on the picture in appendix 2. There is already rip rap protecting one overbank under the bridge nevertheless considering the MTQ's norm (Tome III, chap.2, art. 2.18.2.2), a superior erosion resistance protection should be considered because the velocities at the edges of the bridge are over 3.4 m/s.

5.0 CONCLUSION

The present hydraulic study aims to analyze the impact of the existing bridge at kilometer 4 of Chemin de Wemindji crossing *Maquatua's river*.

The generated terrain by the software is incomplete. Thereby, if the conception of a new bridge is intended, this analysis should be done again with a complete bathymetry.

Two scenarios were analysed: natural and actual conditions. The actual conditions simulation allows us to confirm that the actual steel-wood bridge for all applicable norms except the norm concerning the velocity under the bridge.

Comparing the natural and actual condition simulations shows that the bridge is non-restrictive.

6.0 BIBLIOGRAPHICAL REFERENCES

ENVIRONNEMENT CANADA. (2021). Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée. https://donneesclimatiques.ca/telechargement/#idf-download

MISTÈRE DES FORÊTS; SERVICE DES INVENTAIRES FORESTIERS. https://mffp.gouv.qc.ca/les-forets/inventaire-ecoforestier/

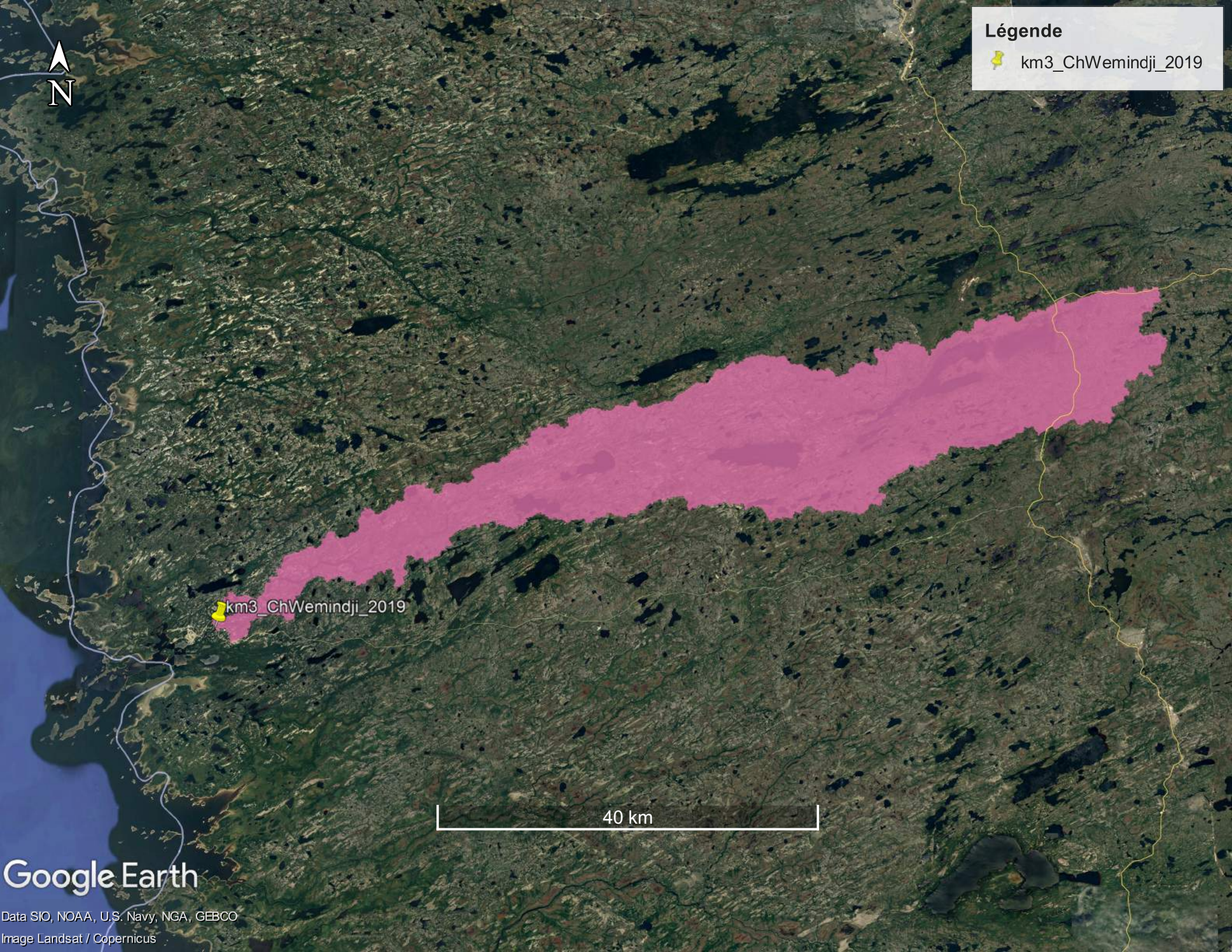
MISTÈRE DES FORÊTS; SERVICE DES INVENTAIRES FORESTIERS. (2000). Carte de dépôts de surface-Document de travail : Lac des Montagnes Municipalité de la Baie-James, Québec 32O/12. https://diffusion.mffp.gouv.qc.ca/Diffusion/DonneeGratuite/Foret/DONNEES_FOR_ECO_SUD/Depots_surface/32O/

MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES. (2020). Débits de crue aux stations hydrométriques du Québec (Débits moyens journaliers). https://www.cehq.gouv.qc.ca/debits-crues/index.htm

MINISTÈRE DU TRANSPORT DU QUÉBEC. (2022). Tome III - Conception des ouvrages d'art. https://www2.publicationsduquebec.gouv.qc.ca/transports/html/3c2.html

APPENDIX 1

Waster shed boundary


Légende
km3_ChWemindji_2019
N
km3_ChWemindji_2019
40 km
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

APPENDIX 2

Pictures of the studied site and field survey forms

No.

Date. Page.

No. Relevé Structure 2022

Date. 2022-08-11 Page.

Relevé Rivière Maguatua
Wemindji

2022-08-11

Francis Mathon, Arpenteur
Jacinthe Daoust, Biologiste
Alexander Christiano, Biologiste

GPS R12i, récepteur
GPS R8, base
Station totale 1203+

Température : 16°C ensoleillé

No.
Date. Page

# point				
1	Station permanente (clou)			
11 à 16	Station temporaire (piquet)			
B,C,D	Mise en station (station totale).			

1011 et 1014 pas exactement au dessous du point 1010 et 1013, plus profond vers le centre du pont. Élévation bonne.

Stations :

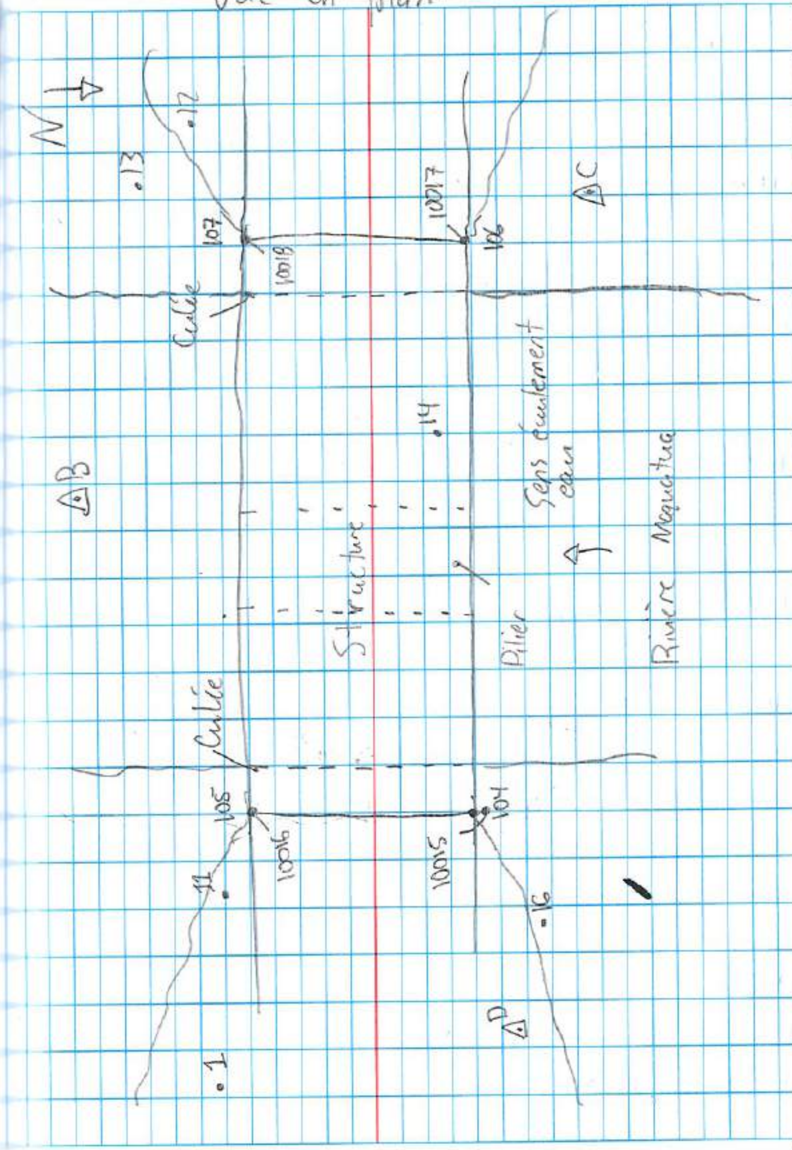
B: Δx : 0,012 m
Δy : 0,013 m
Δz : 0,004 m

C: Δx : 0,031 m
Δy : 0,035 m
Δz : 0,004

D: Δx : 0,007 m
Δy : 0,009 m
Δz : 0,007 m

No.
Date. Page

Vue en plan



No.....

Date..... Page .....

Transects de amont vers aval

#12 rive gauche déboisé, végétation très dense

#11 rive gauche, idem

#9 rive gauche marque TAB, végétation très dense, impossible même avec station totale.

#5 EAJ, TAB et LHE pas prise, végétation extrêmement dense GPS ne capte pas et station totale on voit rien
rive gauche

#4 Idem, on a essayé longtemps et en cherchant de place mais, aucun signal
rive gauche

#1 Rive gauche, idem

10015 à 10018 Dessous du tablier

1000, 1008 et 1009 faire un cercle

1001, 1009 et 1006 Idem

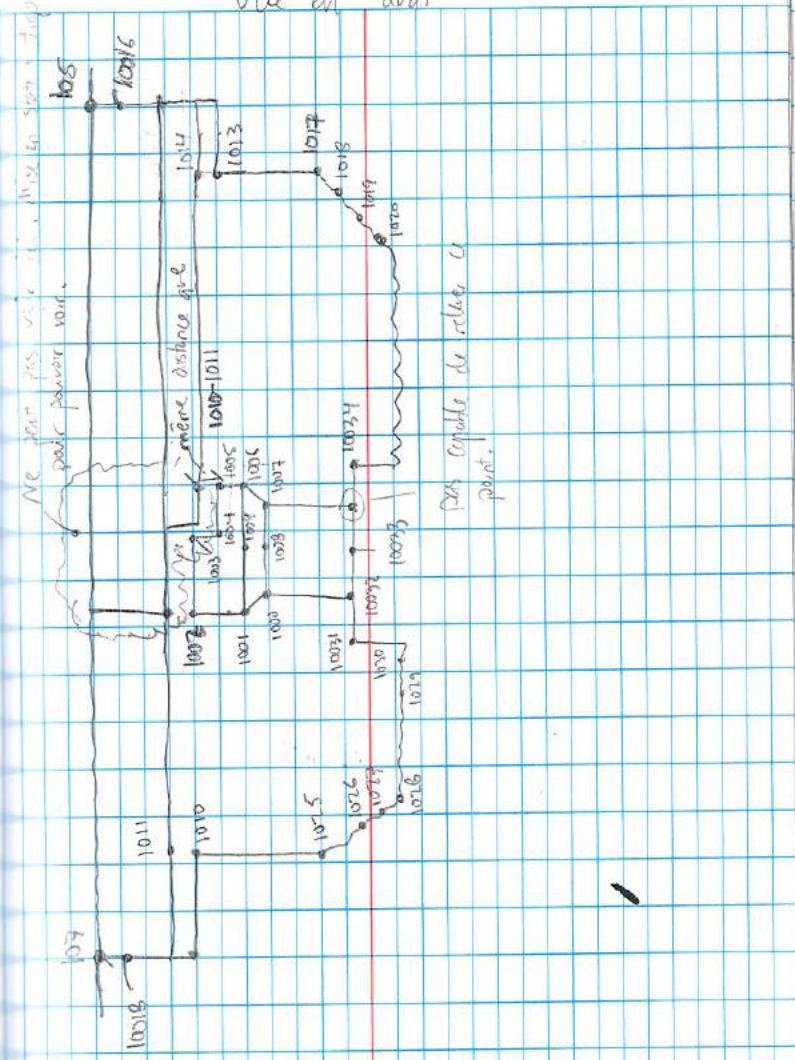
1002 et 1004 demi cercle

1014 et 1015 Idem

No.....

Date..... Page.....

Vue en aval



No.....

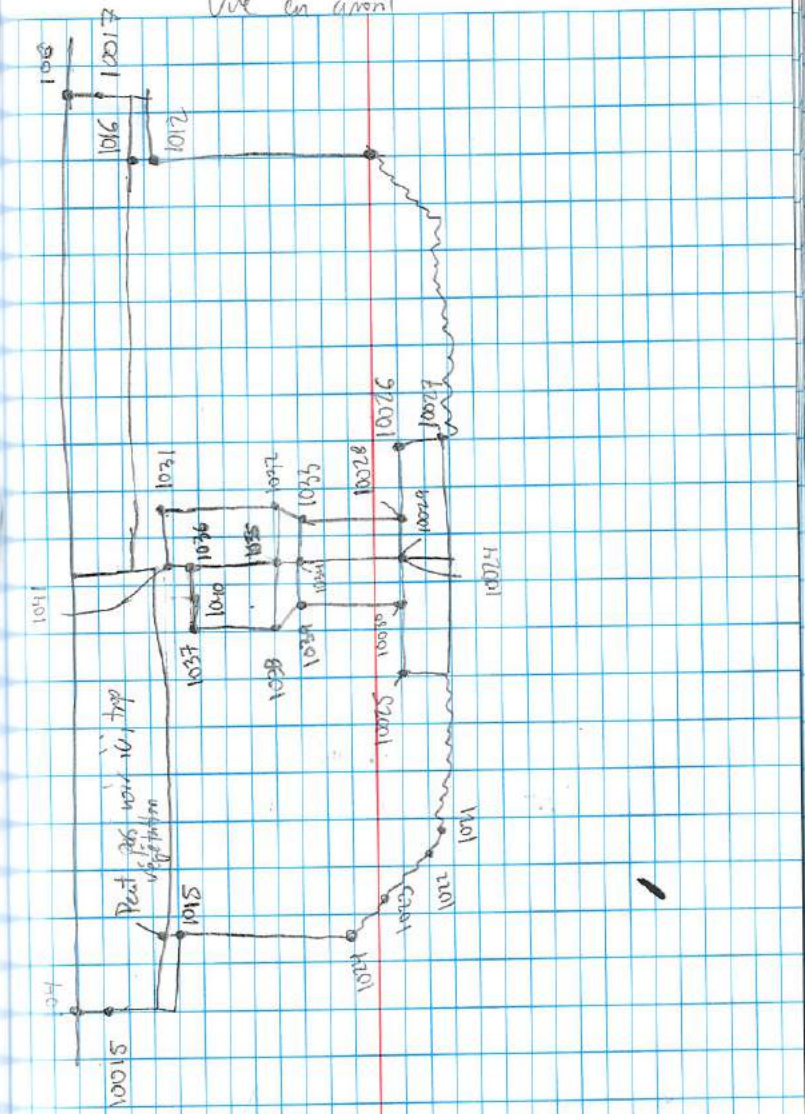
Date..... Page .....

10032 et 10033	Forme un cercle
1036 et 1037	Demi cercle
1031 et 1041	Idem
1036, 1035 et 1032	Arc de cercle
1039, 1034 et 1033	Idem
10030, 10029 et 10028	Idem

No.....

Date..... Page.....

Vue en avant



APPENDIX 3

Flow calculation

Méthode de transfert

Station respectant presque le critère régional

Station :	**81101**
St. fédérale	**03BF001**
Nom :	**Pontax**
Bassin :	5970.0 km²
Q2 :	594.0 m³/s
Q10 :	911.0 m³/s
Q20 :	1028.0 m³/s
Q25 :	1065.0 m³/s
Q50 :	1178.0 m³/s
Q100 :	1290.0 m³/s
Période :	1976-2018, sans 1997,

Région hydrographique : Baies de Hannah et de Rupe
Régime d'écoulement : Naturel
Distance station météo la + près : Matagami A 197km
Élévation station météo la + près : ± 281 m
Élévation approx. de 081101 : ±98m - Google Earth

Exemple :				Récurrence	Débit (m³/s)
T :	25.00	ans	0.0	2.0	123.8
QTu :	221.94	m³/s	0.0	10.0	189.8
QTj :	1065.00	m³/s	0.0	20.0	214.2
Au :	1045.17	km²	0.0	25.0	221.9
Aj :	5970.00	km²	0.0	50.0	245.5
n :	0.9	0.0	0.0	100.0	268.8

Au/Aj : 0.1751 **NON APPLICABLE !**

Station respectant le critère régional

Station :	**92715**
St. fédérale	
Nom :	**De Pontois**
Bassin :	13200.0 km²
Q2 :	917.0 m³/s
Q10 :	1172.0 m³/s
Q20 :	1252.0 m³/s
Q25 :	1276.0 m³/s
Q50 :	1346.0 m³/s
Q100 :	1412.0 m³/s
Période :	1972-1991

Région hydrographique : Baies James et d'Hudson
Régime d'écoulement : Naturel

Exemple :				Récurrence	Débit (m³/s)
T :	25.00	ans	0.0	2.0	2638.5
QTu :	130.20	m³/s	0.0	10.0	3372.2
QTj :	1276.00	m³/s	0.0	20.0	3602.4
Au :	1045.17	km²	0.0	25.0	3671.4
Aj :	13200.00	km²	0.0	50.0	3872.9
n :	0.90	0.0	0.0	100.0	4062.8

Au/Aj : 0.0792 **NON APPLICABLE !**

Station respectant le critère Au/Aj

Station :	**023401**
St. fédérale	**02PJ007**
Nom :	**Beaurivage**
Bassin :	709.0 km²
Q2 :	189.0 m³/s
Q10 :	258.0 m³/s
Q20 :	277.0 m³/s
Q25 :	283.0 m³/s
Q50 :	302.0 m³/s
Q100 :	320.0 m³/s
Période :	1970-2011 sans 2005 et 2007

Région hydrographique : St-Laurent sud-est
Régime d'écoulement : Naturel
Distance station météo la + près : Saint-Flavien ±28 km
Élévation station météo la + près : ± 137 m
Élévation approx. de 023401 : ±125 m - Google Earth

Exemple :				Récurrence	Débit (m³/s)
T :	25.00	ans	0.0	2.0	268.0
QTu :	401.30	m³/s	0.0	10.0	365.9
QTj :	283.00	m³/s	0.0	20.0	392.8
Au :	1045.17	km²	0.0	25.0	401.3
Aj :	709.00	km²	0.0	50.0	428.2
n :	0.90	0.0	0.0	100.0	453.8

Au/Aj : 1.4741 **OK**

Méthode HP40

Récurrence	Constante	Q journalier	Q instantanné
-	Région 6	m³/s	m³/s
2.33	1.03	70.481	88.528
5	1.22	83.482	104.859
10	1.36	93.062	116.892
20	1.5	102.642	128.925
25	1.54	105.379	132.363
50	1.66	113.591	142.677
100	1.8	123.171	154.710

Méthode régionale

RÉCURRENCES	III
2	203.58
5	252.63
10	281.70
20	307.28
25	314.95
50	337.33
100	357.80

Méthode HP33

Récurrence (ans)	Débit (m3/s)
2	87.694
5	106.109
10	121.894
20	136.802
25	140.310
50	155.218
100	170.126

Moyenne HP33, HP40 et Régionale (15%inclus)

Récurrence	Débit (m³/s)
2	134.84
5	169.52
10	190.38
20	209.58
25	214.91
50	232.35
100	249.59

Médiane HP33, HP40 et régionale (15% inclus)

Récurrence	Débit (m³/s)
2	100.847842
5	122.026
10	140.179
20	157.323
25	161.357
50	178.501
100	195.645

Stantec

Identification du projet

Date : 2022-12-19

Client : Société de développement autochtone de la Baie-James (SODAB) | Réf. Client :

Projet : **La Grande Alliance - Feasibility Study Phase 1** | N./Réf.: **158100425**

Route : Rue Spruce | Chaînage : km4 | Municipalité : Gouvernement régional d'Eeyou Istchee Baie-James

N° bassin versant : 1 | Cours d'eau : **Rivière Maquata** | Analyste : -

$$Q_{2,33} = 0{,}3048^3 K_2 \left(\frac{A}{2{,}59}\right)^{K_1}$$

1

km4

Hydrologie_ selon la méthode HP33

Carte ou plan de référence : Carte des BV (LiDAR) | Échelle : 1 : 10000 | Méthode de calcul du BV : CDAO

Superficie totale du bassin (A) : **104 517.00** **ha** | Mesurée par : | Catégorie de bassin : **Grand bassin**

Choix de la région

Selon la figure 1 du Guide de préparation des projets routiers (annexe Hydraulique) Choix de la région : **M**

Figure 1 – Délimitation des régions où s'applique la méthode H.P.-33

Coefficient K_2 : **18.1** | Coefficient k_1 : **0.857** | (ha): 99 710 | Limite BV sup.. (A_2) : 5 749 770

(Version 2)

Détermination des débits

Débit moy. annuel ($Q_{2,33}$) : **87.694** **m^3/s**

Récurrence (ans)	Débit (m^3/s)
2	87.694
5	106.109
10	121.894
20	136.802
25	140.310
50	155.218
100	170.126

Débit de conception

50 ans

155.218 **m^3/s**

Notes

Dossier : Projet : 158100425
N.Réf. : 158100425

Estimation des débits journaliers de crue printanière des rivières du Québec méridional (H.P.-40)

La méthode de transfert des sonnées est tirée de l'annexe HYD du Guide de préparation des projets routiers du MTQ. L'équation tirée de la section 2.3.2 de la page 1.9 est la suivante :

$$Q_1 = 0{,}3048^3 e^K \left(\frac{A}{2{,}59}\right)^a \qquad \text{(éq. 4b)}$$

où : Q_1 : débit journalier annuel – 1 jour (m³/s)

e : constante népérienne (2,718)

A : superficie du bassin versant (km²)

K, a : constantes régionales données au tableau 3

Tableau 3 – Coefficients et intervalles de récurrence pour la méthode H.P.-40

Région	K	a	Intervalle de récurrence (ans)						
			2,33	5	10	20	25	50	100
I	3,48	0,90	1,07	1,33	1,51	1,68	1,73	1,90	2,06
II	3,18	0,95	1,08	1,33	1,50	1,63	1,68	1,82	1,94
III	3,77	0,76	1,05	1,30	1,49	1,67	1,73	1,90	2,07
IV	3,60	0,92	1,05	1,32	1,54	1,76	1,83	2,05	2,29
V	4,01	0,81	1,05	1,27	1,42	1,57	1,62	1,76	1,91
VI	1,85	0,99	1,03	1,22	1,36	1,50	1,54	1,66	1,80

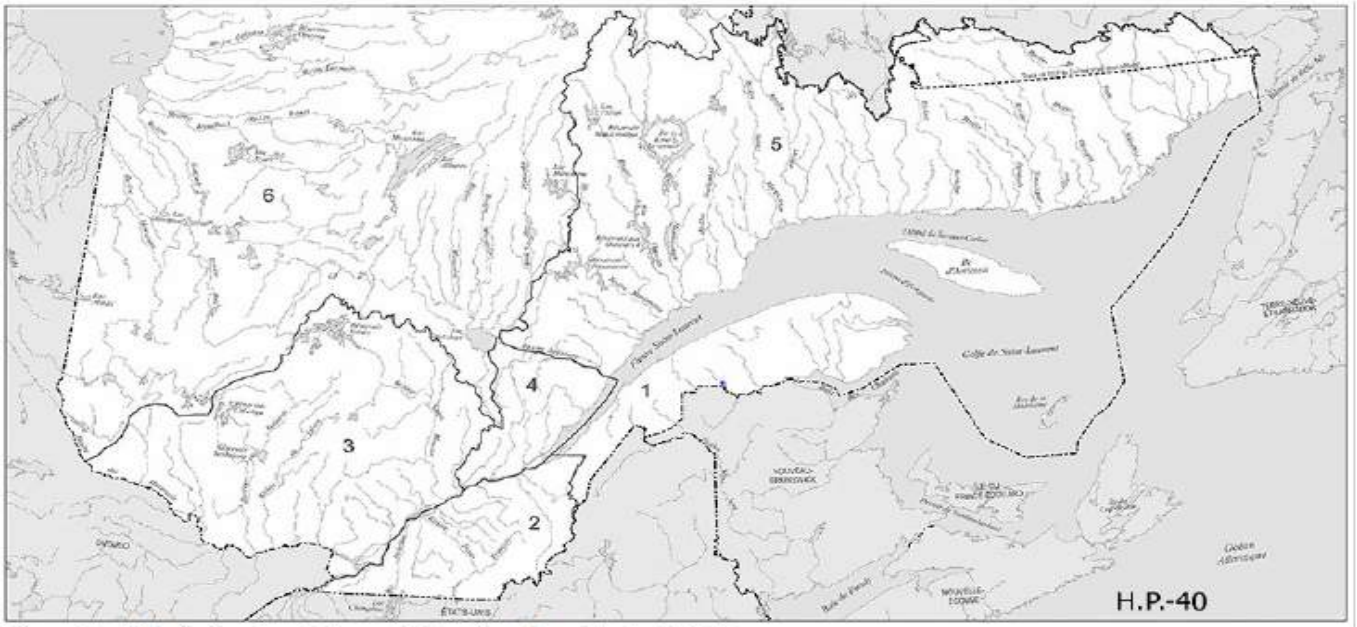


Figure 2 – Délimitation des régions où s'applique la méthode H.P.-40

Basssin versant de la Rivière Maquata

A =	1045.17	km²	**Q (1 jour) =**	**68.428 m³/s**
K =	1.85			
a =	0.99			

Calcul du débit pour différentes récurrences

Récurrence	Constante	Q journalier	Q instantanné
-	Région 6	m³/s	m³/s
2.33	1.03	70.481	88.528
5	1.22	83.482	104.859
10	1.36	93.062	116.892
20	1.5	102.642	128.925
25	1.54	105.379	132.363
50	1.66	113.591	142.677
100	1.8	123.171	154.710

Limites de la méthode HP-40

Tableau 4 – Limites de la méthode H.P.-40

Caractéristique	Limite inférieure	Limite supérieure
Superficie (km²)	150,7	56 980
Pente (%)	0,02	0,95
Longueur (km)	18,5	482,8
Couvert forestier (%)	18	100
Lac et marécage (%)	Trace	36
Élévation (m)	73,2	725,4
Précipitation annuelle (mm)	711,2	1 422,4

Bassin versant à l'étude :

			Conforme
Superficie	km²	1045.17	VRAI
Pente moy.	%	4.1	FAUX
Longueur	km	15.051	FAUX
Couvert forestier	%		FAUX
Lacs et marécage	%		FAUX
Élévation	m		
Précipitations annuelles	mm		FAUX

ANALYSE PAR LA MÉTHODE RÉGIONALE

Tableau des paramètres

Région	epsilon	alpha	kapa
I	0.8397	0.2819	0.0086
II	0.8659	0.2754	0.0993
III	0.891	0.2308	0.1173

Calcul Qmoyen

Superficie	1045.17	km²
Qmoyen =	209.05	m³/s

Équation 8.6 Q = Qr / Qmoyen

Équation 8.7

Équation 8.8 Qmoyen = 1,61 $A^{0,7}$

RÉCURRENCES	Calcul Q normalisé			Calcul Qr du site			m³/s/km²
	I	II	III	I	II	III	I
2	0.94285733	0.965022941	0.973798592	197.11	201.74	203.58	0.19
5	1.259817607	1.249692423	1.20844185	263.37	261.25	252.63	0.25
10	1.467979345	1.421288056	1.347488069	306.89	297.12	281.70	0.29
20	1.666394679	1.57429655	1.469842192	348.37	329.11	307.28	0.33
25	1.729078487	1.620592048	1.506545305	361.47	338.79	314.95	0.35
50	1.921405782	1.756784105	1.613624547	401.68	367.26	337.33	0.38
100	2.111165831	1.882882392	1.711524787	441.35	393.62	357.80	0.42

Note: La rivière Bleue est située dans la zone I

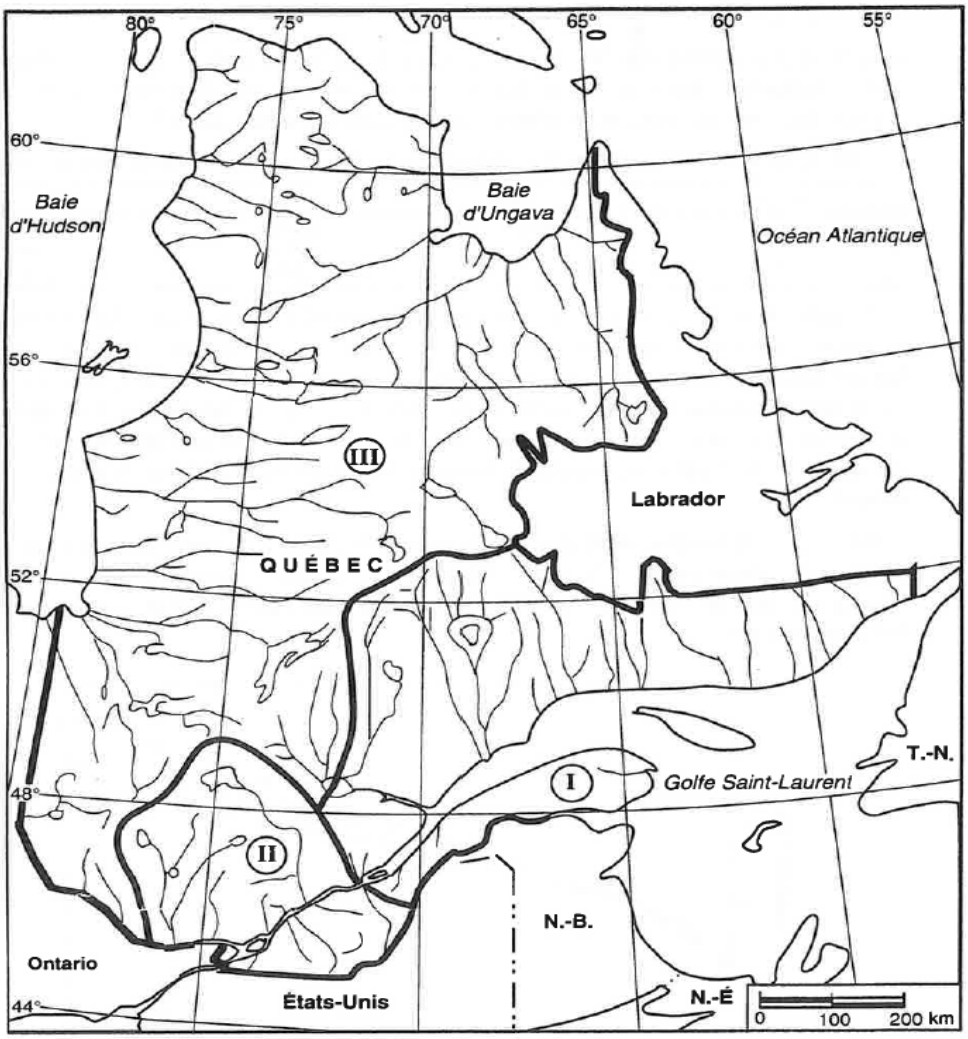
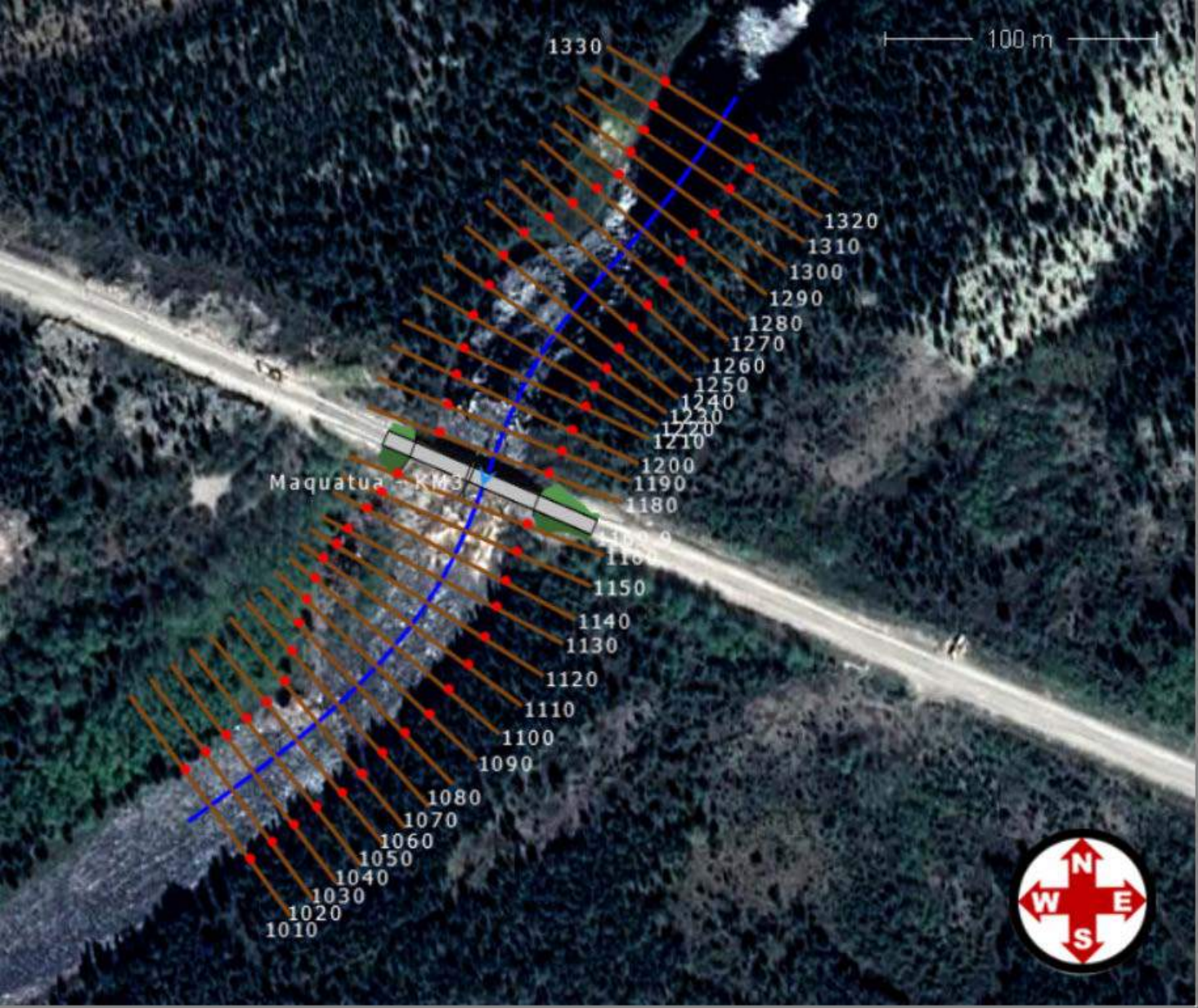


FIGURE 8.3 - Localisation des régions homogènes pour le Québec et des stations de jaugeages retenues et éliminées (Anctil *et al.*, 1998)

APPENDIX 4
Hydraulic profiles


100 m
1330
1320
1310
1300
1290
1280
1270
1260
1250
1240
1230
1220
1210
1200
1190
1180
Maquatua - KM3
1150
1140
1130
1120
1110
1100
1090
1080
1070
1060
1050
1040
1030
1020
1010
N
W
E
S

APPENDIX 5

Cross-sections

HEC-RAS Model Plan: km3_actuel
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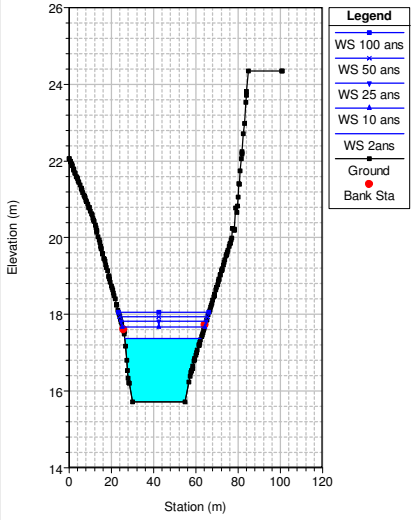

HEC-RAS Model Plan: km3_actuel
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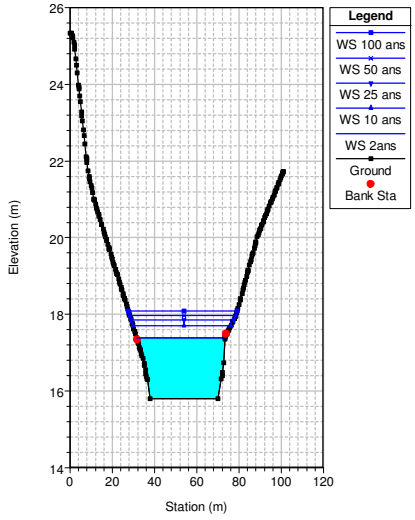

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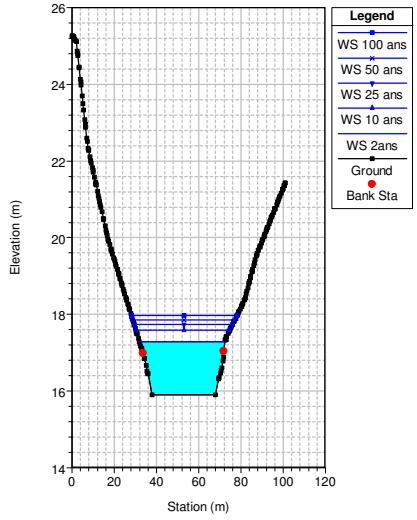

HEC-RAS Model Plan: km3_actuel
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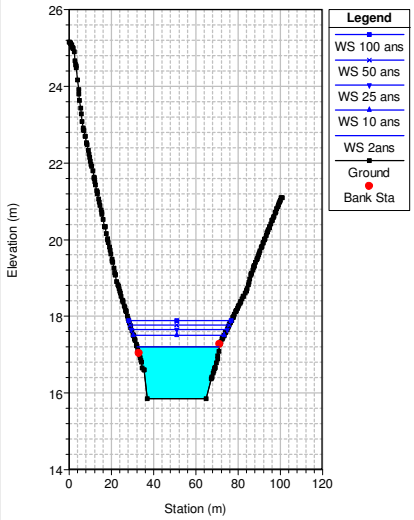

HEC-RAS Model Plan: km3_actuel
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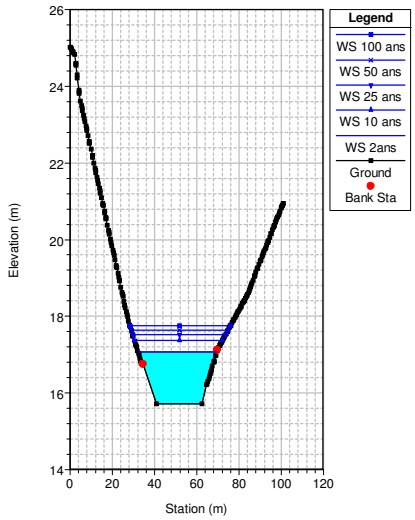

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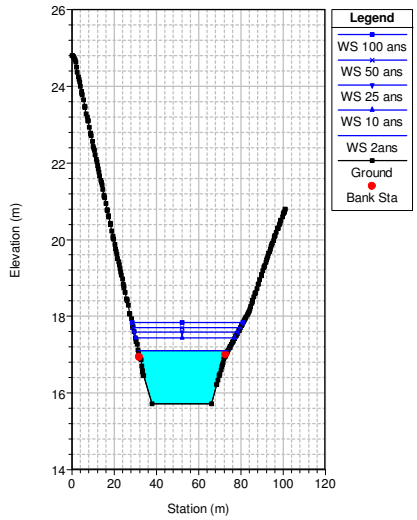

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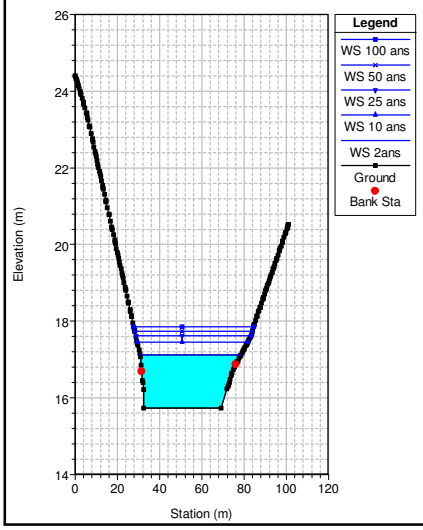

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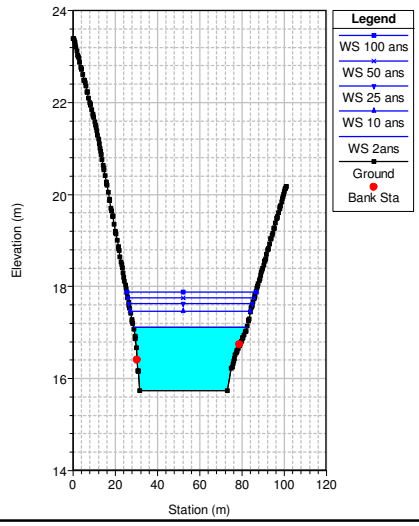

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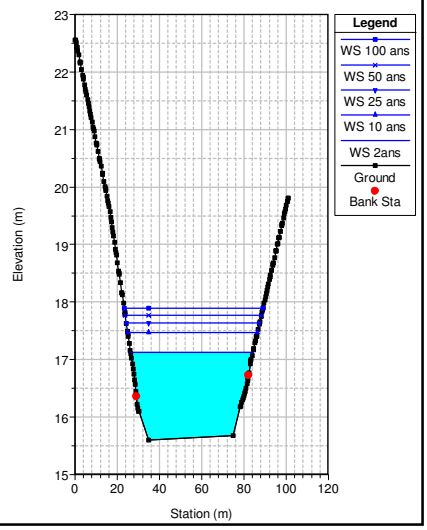

HEC-RAS Model Plan: km3_actuel
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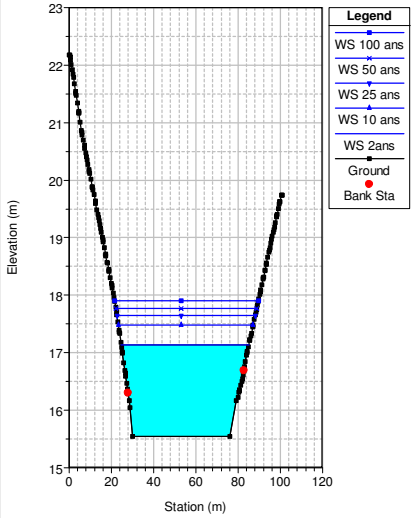

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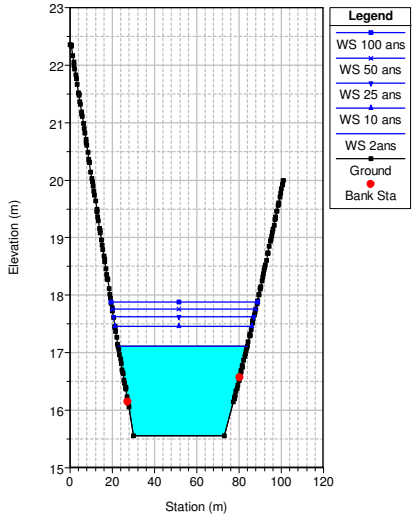

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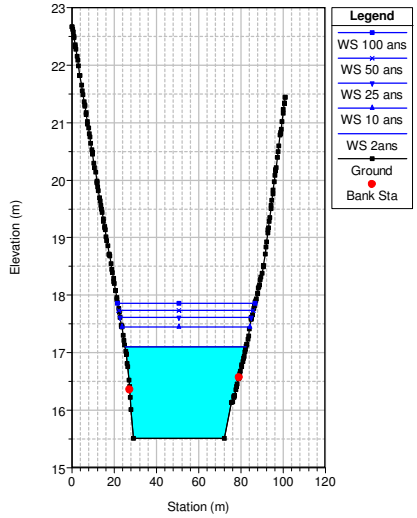

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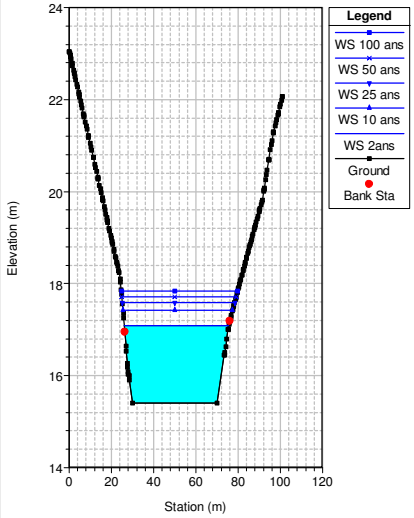

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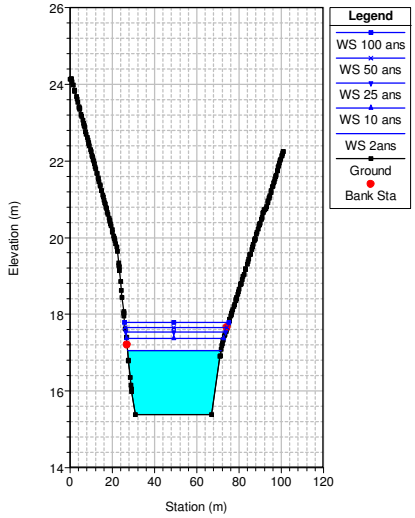

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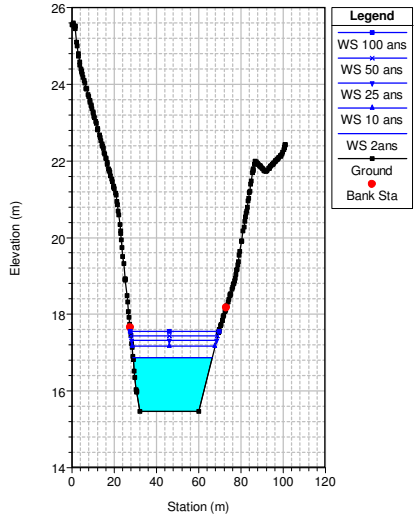

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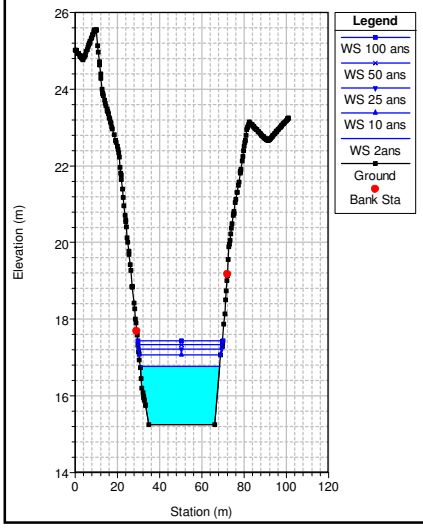

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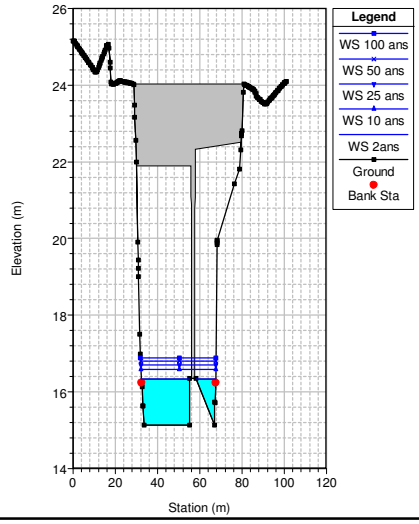

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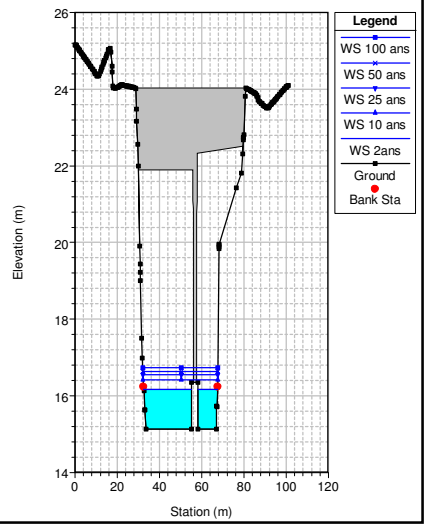
RS = 1169.9 BR



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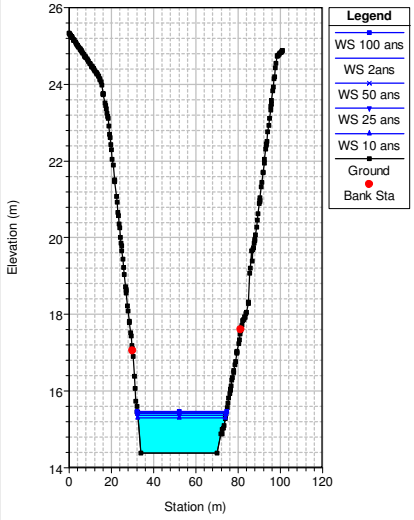

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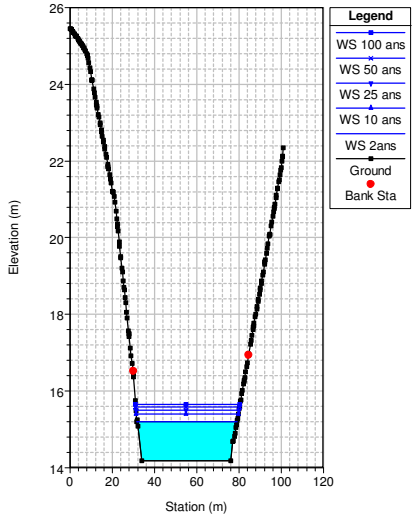

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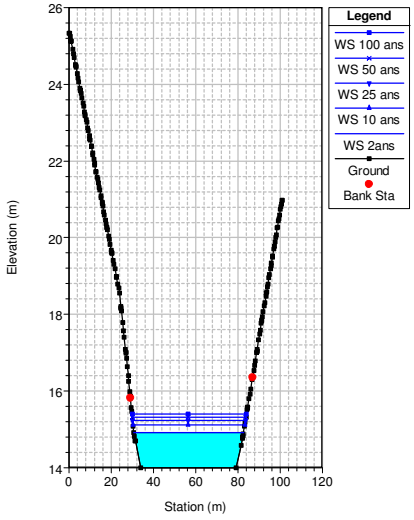

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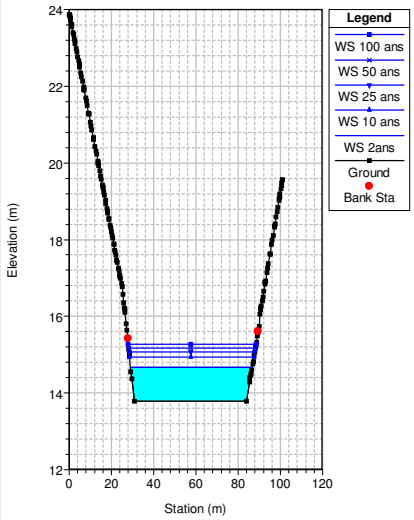

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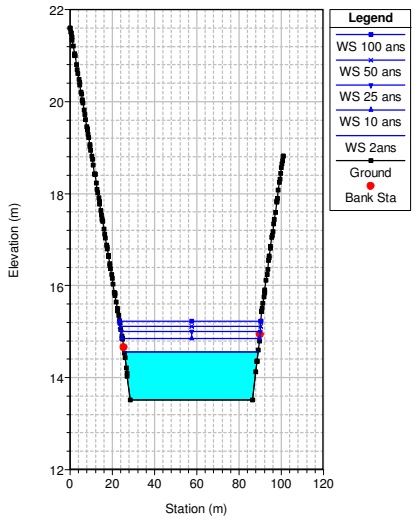

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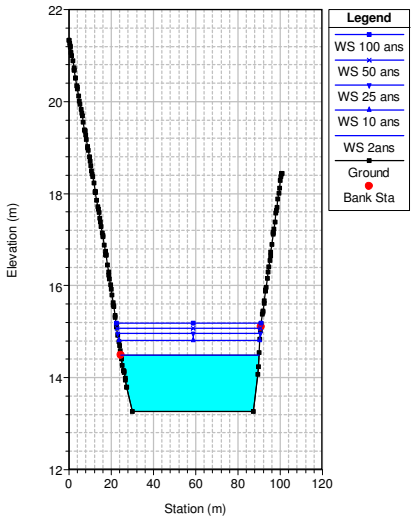

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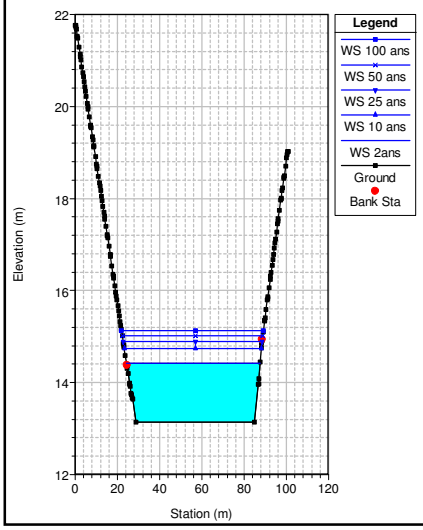

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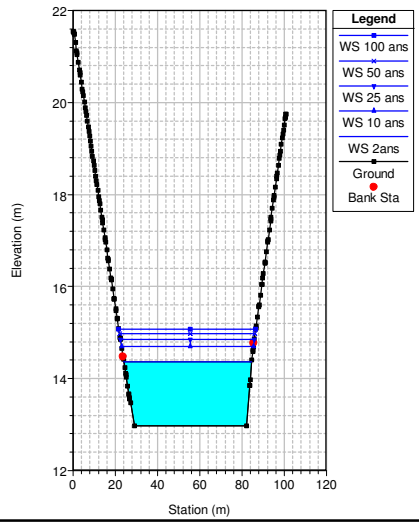

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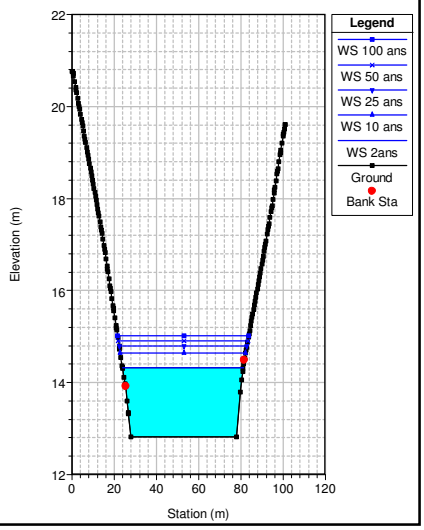

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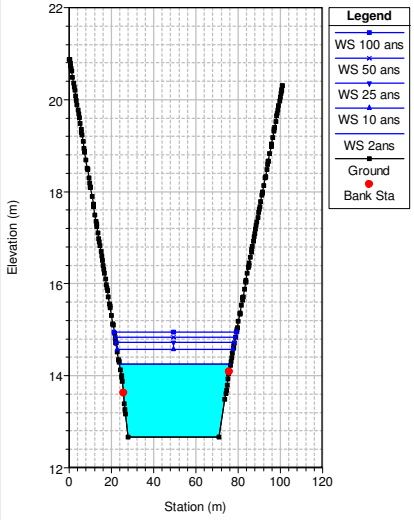

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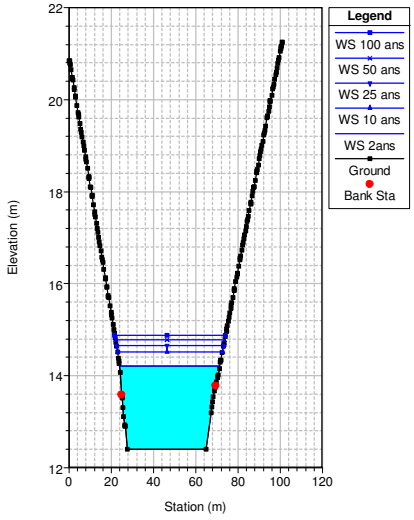

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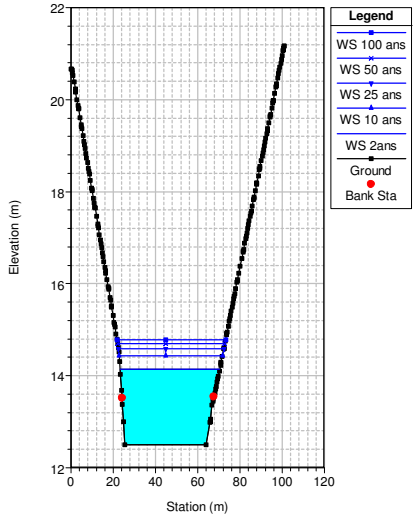

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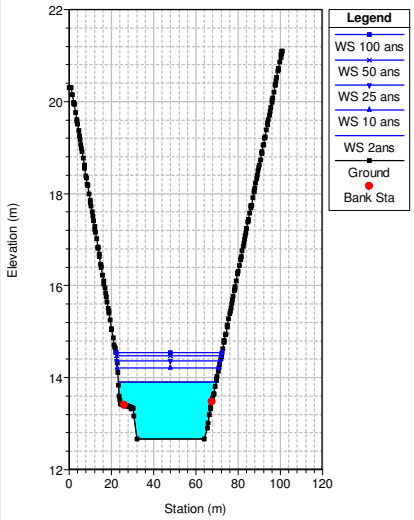

HEC-RAS Model Plan: km3_actuel
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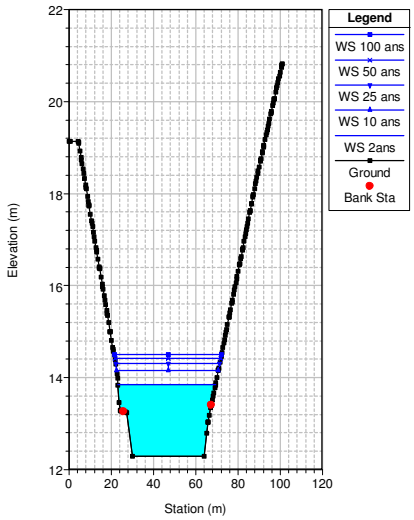

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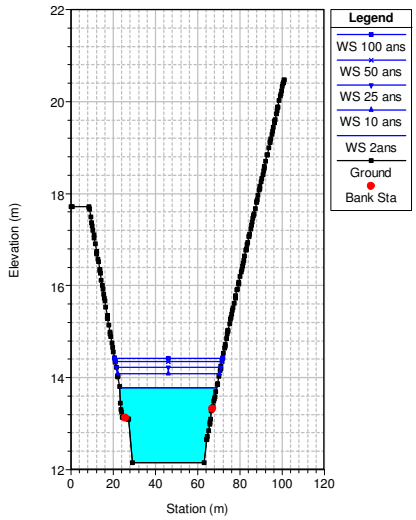

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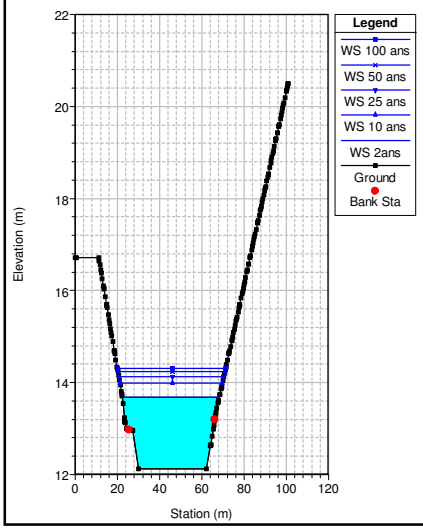

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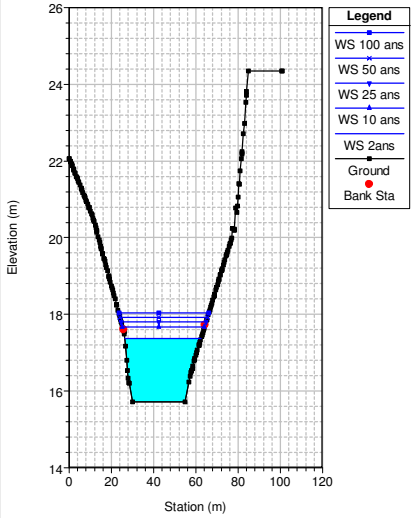

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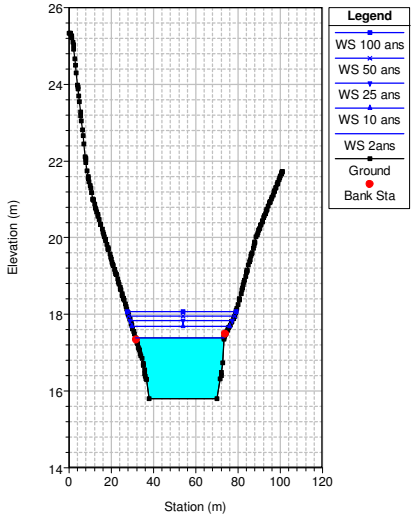

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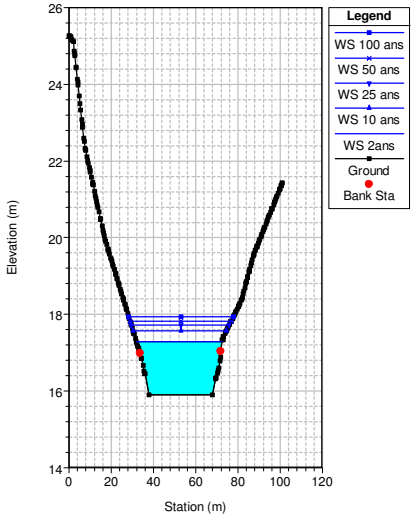
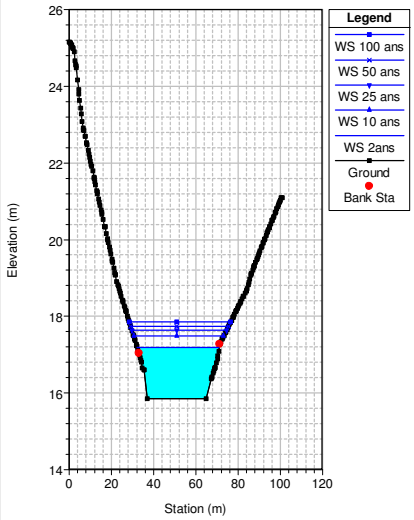
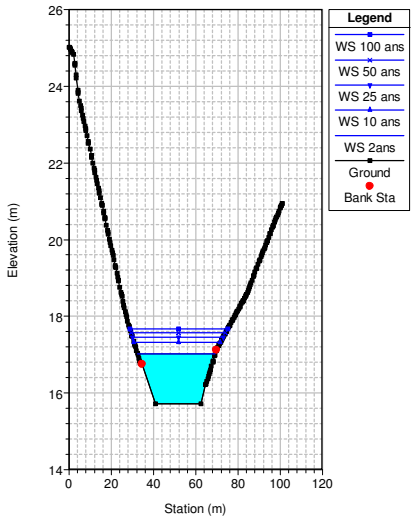


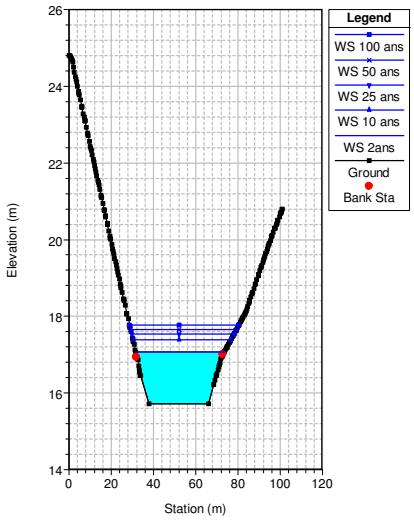
HEC-RAS Model Plan: 1) km3_naturel
RS = 1300



HEC-RAS Model Plan: 1) km3_naturel
RS = 1290



HEC-RAS Model Plan: 1) km3_naturel
RS = 1280



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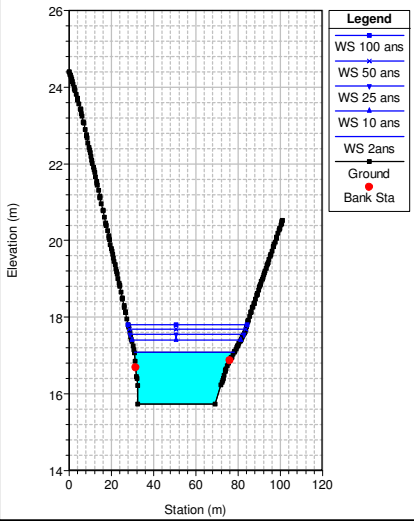
RS = 1270



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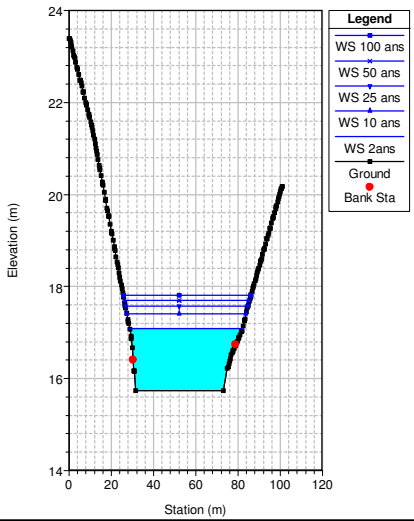
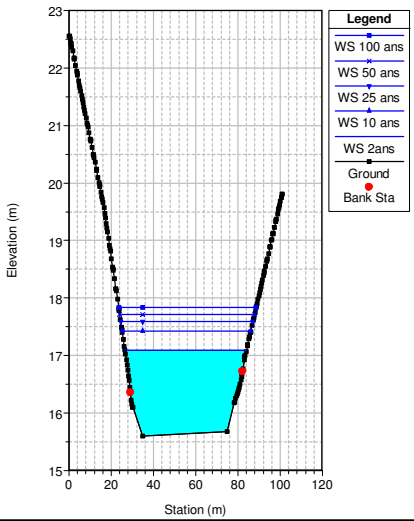
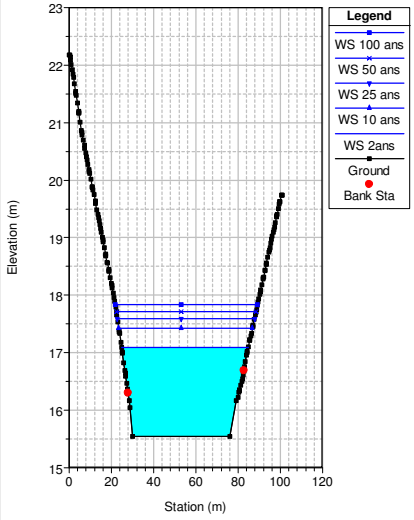
RS = 1260



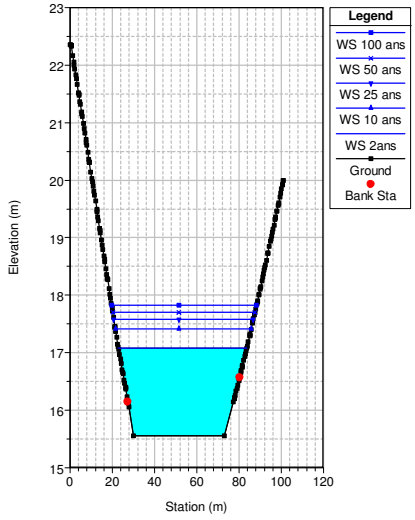
HEC-RAS Model Plan: 1) km3_naturel
RS = 1250



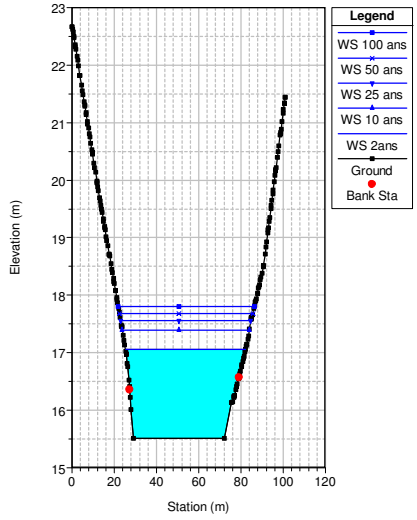
HEC-RAS Model Plan: 1) km3_naturel
RS = 1240



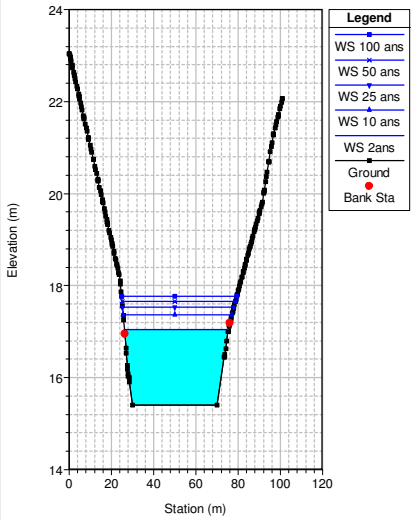
HEC-RAS Model Plan: 1) km3_naturel
RS = 1230



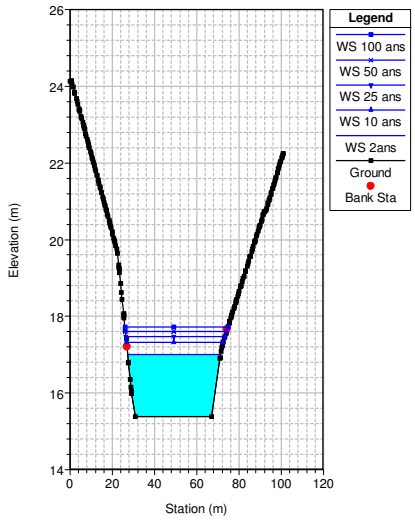
HEC-RAS Model Plan: 1) km3_naturel
RS = 1220



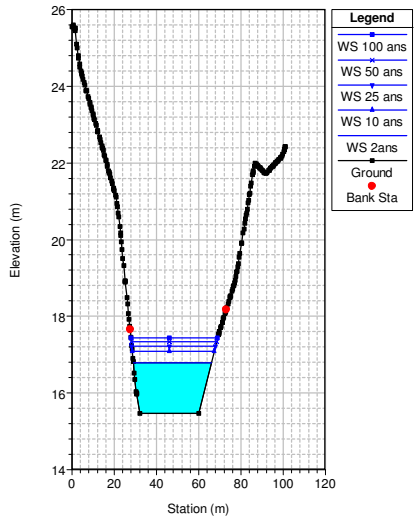
HEC-RAS Model Plan: 1) km3_naturel
RS = 1210



HEC-RAS Model Plan: 1) km3_naturel
RS = 1200



HEC-RAS Model Plan: 1) km3_naturel
RS = 1190



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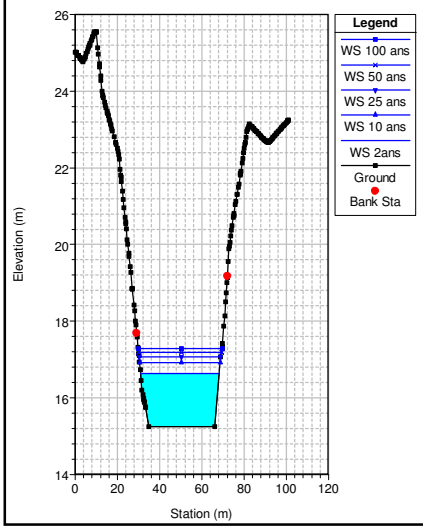
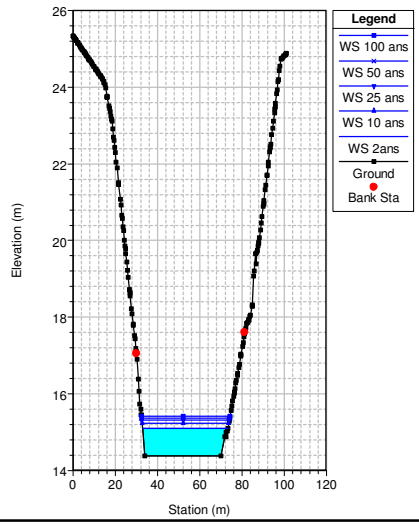
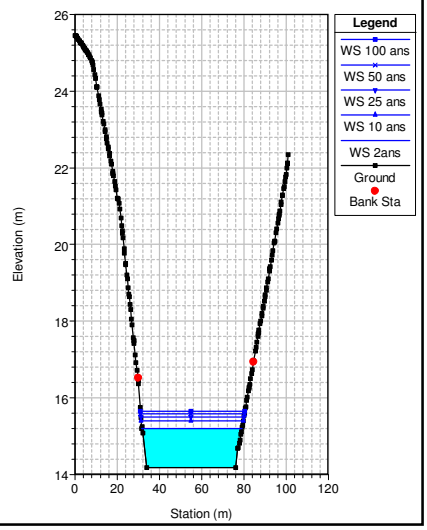
RS = 1180



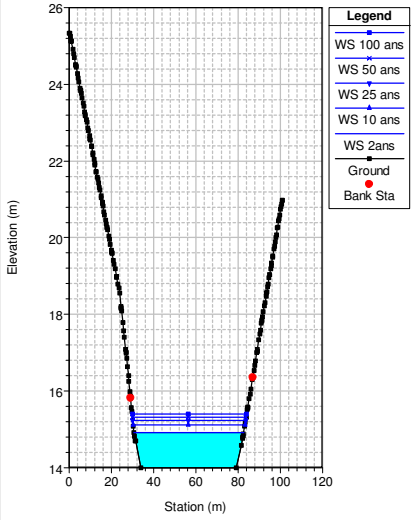
HEC-RAS Model Plan: 1) km3_naturel
RS = 1160



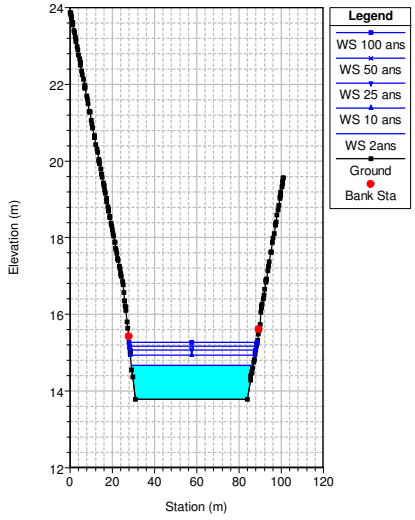
HEC-RAS Model Plan: 1) km3_naturel
RS = 1150



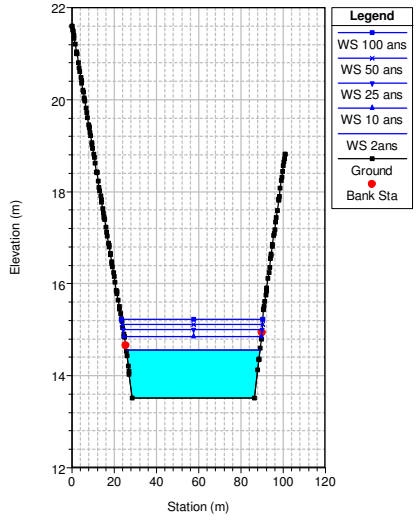
HEC-RAS Model Plan: 1) km3_naturel
RS = 1140



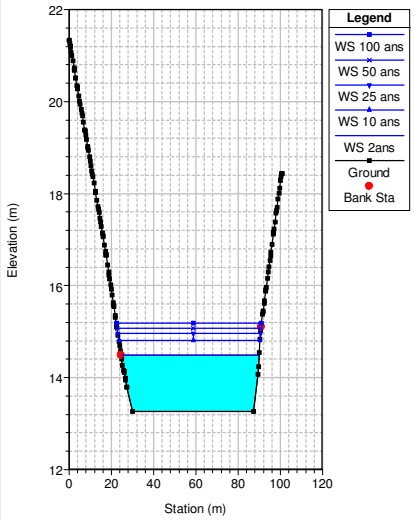
HEC-RAS Model Plan: 1) km3_naturel
RS = 1130



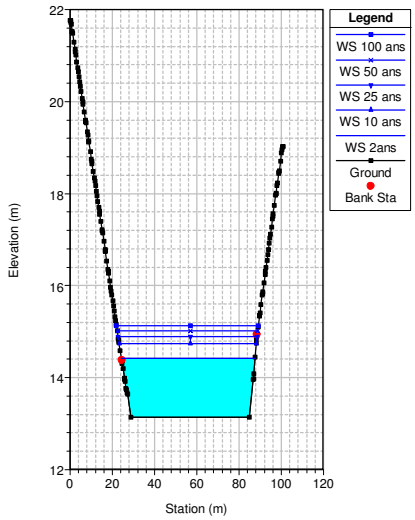
HEC-RAS Model Plan: 1) km3_naturel
RS = 1120



HEC-RAS Model Plan: 1) km3_naturel
RS = 1110



HEC-RAS Model Plan: 1) km3_naturel
RS = 1100



HEC-RAS Model Plan: 1) km3_naturel
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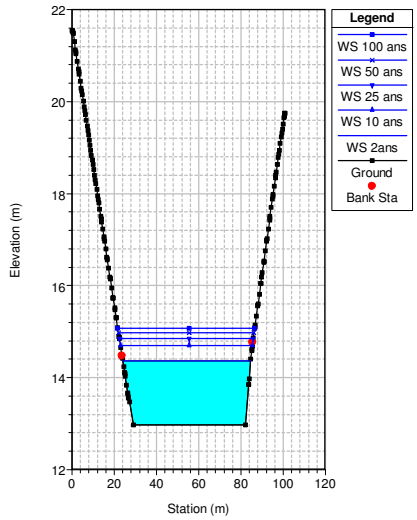
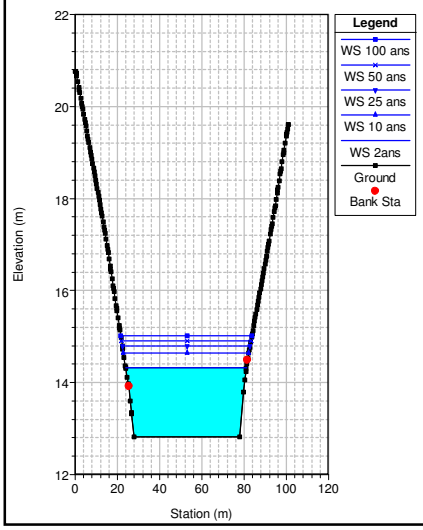
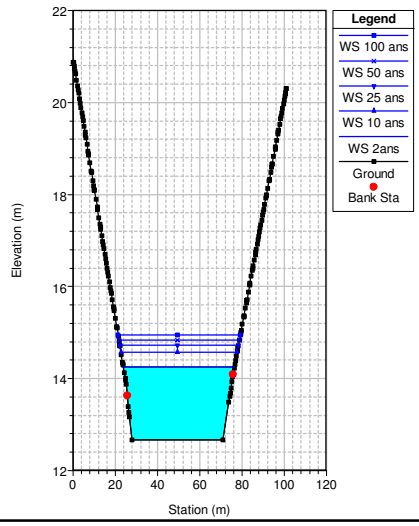


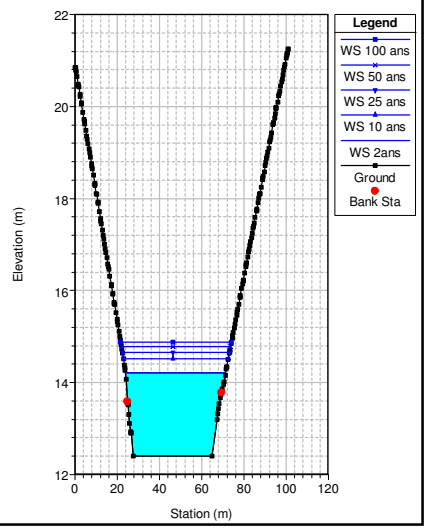
HEC-RAS Model Plan: 1) km3_naturel
RS = 1080



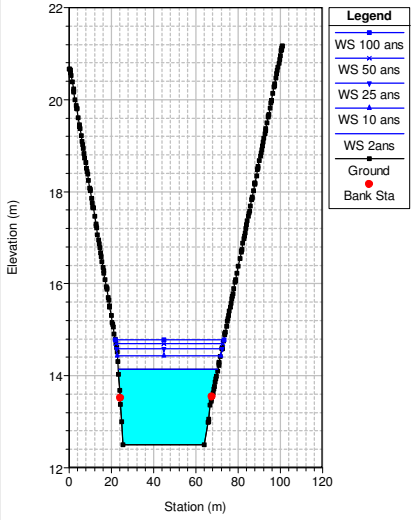
HEC-RAS Model Plan: 1) km3_naturel
RS = 1070



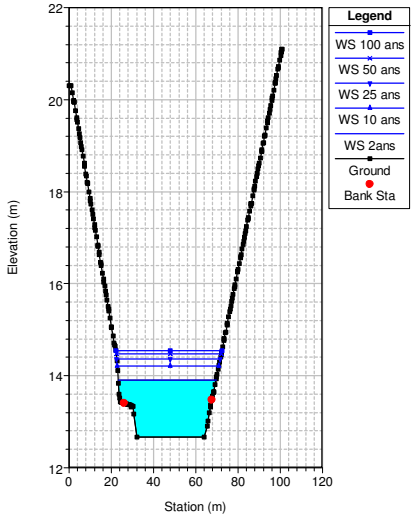
HEC-RAS Model Plan: 1) km3_naturel
RS = 1060



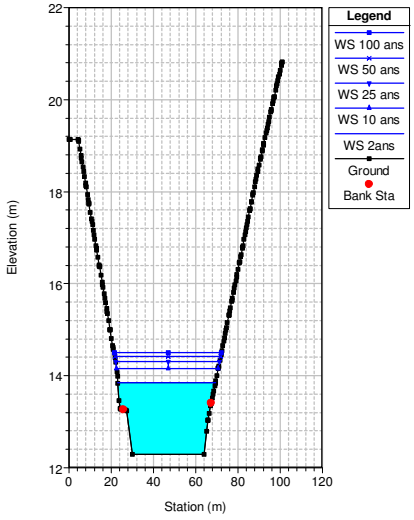
HEC-RAS Model Plan: 1) km3_naturel
RS = 1050



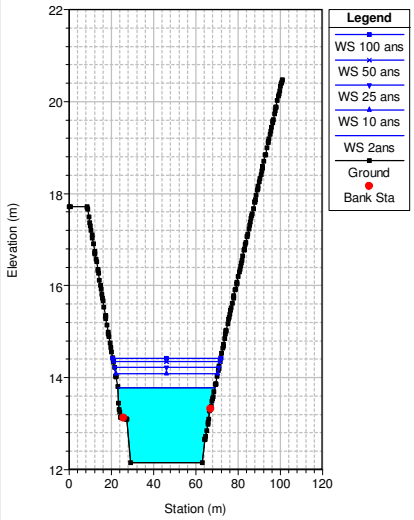
HEC-RAS Model Plan: 1) km3_naturel
RS = 1040



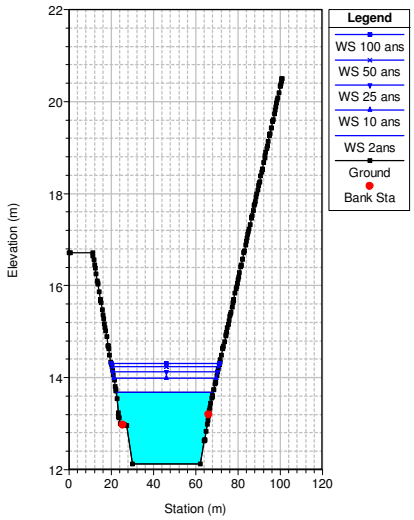
HEC-RAS Model Plan: 1) km3_naturel
RS = 1030



HEC-RAS Model Plan: 1) km3_naturel
RS = 1020



HEC-RAS Model Plan: 1) km3_naturel
RS = 1010



APPENDIX 6

Hydraulic Tables

HEC-RAS Plan: km3_actuel River: Maquatua Reach: KM3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
KM3	1330	2ans	100.85	15.71	17.38	16.83	17.58	0.002631	1.99	50.76	36.09	0.53
KM3	1330	10 ans	140.18	15.71	17.68	17.09	17.94	0.002830	2.26	62.07	38.89	0.57
KM3	1330	25 ans	161.36	15.71	17.83	17.22	18.12	0.002813	2.38	67.99	40.45	0.57
KM3	1330	50 ans	178.50	15.71	17.94	17.31	18.25	0.002783	2.47	72.71	41.66	0.58
KM3	1330	100 ans	195.64	15.71	18.05	17.41	18.39	0.002756	2.55	77.39	42.81	0.58
KM3	1320	2ans	100.85	15.80	17.39		17.54	0.001966	1.72	58.62	41.98	0.46
KM3	1320	10 ans	140.18	15.80	17.70		17.90	0.001962	1.95	72.46	46.39	0.48
KM3	1320	25 ans	161.36	15.80	17.86		18.07	0.001938	2.05	79.80	48.64	0.48
KM3	1320	50 ans	178.50	15.80	17.98		18.21	0.001920	2.13	85.72	50.40	0.48
KM3	1320	100 ans	195.64	15.80	18.09		18.34	0.001901	2.20	91.60	51.62	0.49
KM3	1310	2ans	100.85	15.90	17.29		17.51	0.003203	2.07	49.09	40.43	0.58
KM3	1310	10 ans	140.18	15.90	17.59		17.86	0.003038	2.32	61.80	44.45	0.59
KM3	1310	25 ans	161.36	15.90	17.74		18.04	0.002963	2.43	68.58	46.62	0.59
KM3	1310	50 ans	178.50	15.90	17.86		18.17	0.002907	2.51	74.06	48.31	0.59
KM3	1310	100 ans	195.64	15.90	17.97		18.31	0.002853	2.59	79.54	49.93	0.59
KM3	1300	2ans	100.85	15.86	17.21		17.47	0.004271	2.26	44.74	38.98	0.67
KM3	1300	10 ans	140.18	15.86	17.51		17.83	0.003833	2.49	57.13	43.02	0.65
KM3	1300	25 ans	161.36	15.86	17.66		18.00	0.003658	2.59	63.76	45.22	0.65
KM3	1300	50 ans	178.50	15.86	17.78		18.14	0.003538	2.67	69.12	46.92	0.65
KM3	1300	100 ans	195.64	15.86	17.89		18.27	0.003431	2.74	74.49	48.57	0.64
KM3	1290	2ans	100.85	15.72	17.06		17.41	0.006078	2.60	39.15	37.20	0.79
KM3	1290	10 ans	140.18	15.72	17.37		17.77	0.005220	2.82	51.13	41.62	0.76
KM3	1290	25 ans	161.36	15.72	17.52		17.95	0.004894	2.92	57.57	43.97	0.75
KM3	1290	50 ans	178.50	15.72	17.64		18.09	0.004677	3.00	62.80	45.78	0.74
KM3	1290	100 ans	195.64	15.72	17.75		18.22	0.004487	3.07	68.07	47.54	0.73
KM3	1280	2ans	100.85	15.71	17.11		17.33	0.003477	2.06	48.96	42.57	0.60
KM3	1280	10 ans	140.18	15.71	17.43		17.69	0.003000	2.25	63.46	47.10	0.58
KM3	1280	25 ans	161.36	15.71	17.59		17.87	0.002838	2.34	71.09	49.14	0.58
KM3	1280	50 ans	178.50	15.71	17.71		18.01	0.002733	2.40	77.20	50.99	0.57
KM3	1280	100 ans	195.64	15.71	17.83		18.14	0.002642	2.47	83.30	52.56	0.57
KM3	1270	2ans	100.85	15.73	17.12		17.28	0.002344	1.77	57.42	47.79	0.50
KM3	1270	10 ans	140.18	15.73	17.45		17.64	0.002078	1.94	74.10	52.38	0.49
KM3	1270	25 ans	161.36	15.73	17.62		17.82	0.001987	2.03	82.79	54.48	0.49
KM3	1270	50 ans	178.50	15.73	17.74		17.96	0.001926	2.09	89.69	55.69	0.48
KM3	1270	100 ans	195.64	15.73	17.86		18.09	0.001874	2.15	96.46	56.77	0.48
KM3	1260	2ans	100.85	15.73	17.12		17.25	0.001814	1.58	64.69	53.86	0.44
KM3	1260	10 ans	140.18	15.73	17.46		17.61	0.001603	1.74	83.53	56.86	0.43
KM3	1260	25 ans	161.36	15.73	17.63		17.79	0.001535	1.81	93.08	58.59	0.43
KM3	1260	50 ans	178.50	15.73	17.75		17.93	0.001491	1.87	100.60	59.88	0.43
KM3	1260	100 ans	195.64	15.73	17.88		18.06	0.001453	1.92	107.99	61.13	0.43
KM3	1250	2ans	100.85	15.60	17.13		17.22	0.001251	1.37	74.72	57.86	0.37
KM3	1250	10 ans	140.18	15.60	17.47		17.59	0.001142	1.52	95.24	61.38	0.37
KM3	1250	25 ans	161.36	15.60	17.64		17.77	0.001106	1.59	105.65	63.09	0.37
KM3	1250	50 ans	178.50	15.60	17.77		17.90	0.001082	1.64	113.84	64.40	0.37
KM3	1250	100 ans	195.64	15.60	17.89		18.04	0.001062	1.69	121.87	65.67	0.37
KM3	1240	2ans	100.85	15.54	17.13		17.21	0.000897	1.22	83.97	60.37	0.32
KM3	1240	10 ans	140.18	15.54	17.48		17.57	0.000859	1.37	105.46	63.79	0.32
KM3	1240	25 ans	161.36	15.54	17.65		17.75	0.000847	1.45	116.31	65.44	0.33
KM3	1240	50 ans	178.50	15.54	17.77		17.89	0.000839	1.50	124.84	66.73	0.33
KM3	1240	100 ans	195.64	15.54	17.90		18.02	0.000832	1.55	133.19	67.99	0.33
KM3	1230	2ans	100.85	15.55	17.12		17.20	0.001001	1.28	81.31	61.15	0.34
KM3	1230	10 ans	140.18	15.55	17.46		17.56	0.000945	1.43	103.12	64.84	0.34
KM3	1230	25 ans	161.36	15.55	17.63		17.74	0.000926	1.50	114.16	66.52	0.34
KM3	1230	50 ans	178.50	15.55	17.76		17.88	0.000914	1.56	122.83	67.97	0.34
KM3	1230	100 ans	195.64	15.55	17.88		18.01	0.000903	1.61	131.34	69.23	0.34
KM3	1220	2ans	100.85	15.51	17.10		17.19	0.001002	1.29	79.32	57.34	0.34
KM3	1220	10 ans	140.18	15.51	17.45		17.55	0.000966	1.46	99.61	60.70	0.34
KM3	1220	25 ans	161.36	15.51	17.61		17.73	0.000953	1.53	109.87	62.18	0.34
KM3	1220	50 ans	178.50	15.51	17.74		17.87	0.000945	1.59	117.95	63.76	0.35
KM3	1220	100 ans	195.64	15.51	17.86		18.00	0.000938	1.64	125.88	65.07	0.35
KM3	1210	2ans	100.85	15.41	17.09		17.18	0.001057	1.34	75.38	49.48	0.35
KM3	1210	10 ans	140.18	15.41	17.42		17.54	0.001056	1.52	92.52	51.91	0.36
KM3	1210	25 ans	161.36	15.41	17.59		17.72	0.001054	1.61	101.16	53.16	0.36
KM3	1210	50 ans	178.50	15.41	17.71		17.86	0.001052	1.67	107.91	54.11	0.36
KM3	1210	100 ans	195.64	15.41	17.84		17.99	0.001051	1.73	114.51	55.02	0.37

HEC-RAS Plan: km3_actuel River: Maquatua Reach: KM3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
KM3	1200	2ans	100.85	15.38	17.05		17.16	0.001356	1.50	67.06	44.21	0.39
KM3	1200	10 ans	140.18	15.38	17.38		17.53	0.001415	1.71	81.95	46.20	0.41
KM3	1200	25 ans	161.36	15.38	17.54		17.71	0.001439	1.81	89.49	47.41	0.42
KM3	1200	50 ans	178.50	15.38	17.66		17.84	0.001451	1.87	95.41	48.32	0.42
KM3	1200	100 ans	195.64	15.38	17.78		17.97	0.001438	1.94	101.21	49.23	0.42
KM3	1190	2ans	100.85	15.47	16.88		17.12	0.017936	2.18	46.21	37.47	0.63
KM3	1190	10 ans	140.18	15.47	17.18		17.48	0.017545	2.42	57.87	39.37	0.64
KM3	1190	25 ans	161.36	15.47	17.33		17.65	0.017312	2.53	63.85	40.32	0.64
KM3	1190	50 ans	178.50	15.47	17.44		17.79	0.017130	2.60	68.57	41.05	0.64
KM3	1190	100 ans	195.64	15.47	17.56		17.92	0.016982	2.67	73.26	41.92	0.65
KM3	1180	2ans	100.85	15.26	16.77	16.25	16.96	0.011964	1.92	52.43	37.62	0.52
KM3	1180	10 ans	140.18	15.26	17.07	16.48	17.32	0.012426	2.19	63.95	38.66	0.54
KM3	1180	25 ans	161.36	15.26	17.22	16.60	17.49	0.012656	2.31	69.75	39.39	0.56
KM3	1180	50 ans	178.50	15.26	17.33	16.69	17.63	0.012782	2.40	74.30	39.92	0.56
KM3	1180	100 ans	195.64	15.26	17.45	16.77	17.76	0.012792	2.48	78.81	40.28	0.57
KM3	1169.9		Bridge									
KM3	1160	2ans	100.85	14.38	15.45		15.75	0.030013	2.43	41.48	42.02	0.78
KM3	1160	10 ans	140.18	14.38	15.30	15.50	16.10	0.095580	3.95	35.45	41.33	1.36
KM3	1160	25 ans	161.36	14.38	15.37	15.61	16.28	0.100555	4.23	38.11	41.64	1.41
KM3	1160	50 ans	178.50	14.38	15.42	15.69	16.42	0.103466	4.44	40.25	41.88	1.44
KM3	1160	100 ans	195.64	14.38	15.47	15.77	16.56	0.106477	4.63	42.30	42.22	1.48
KM3	1150	2ans	100.85	14.18	15.21		15.46	0.025191	2.21	45.69	47.14	0.72
KM3	1150	10 ans	140.18	14.18	15.40	15.20	15.73	0.027086	2.54	55.11	48.43	0.76
KM3	1150	25 ans	161.36	14.18	15.50	15.30	15.87	0.027645	2.70	59.84	48.89	0.78
KM3	1150	50 ans	178.50	14.18	15.58	15.38	15.98	0.027939	2.81	63.56	49.21	0.79
KM3	1150	100 ans	195.64	14.18	15.65	15.45	16.08	0.028181	2.91	67.17	49.52	0.80
KM3	1140	2ans	100.85	14.00	14.92		15.18	0.030546	2.25	44.79	52.06	0.78
KM3	1140	10 ans	140.18	14.00	15.12		15.45	0.029942	2.53	55.32	52.95	0.79
KM3	1140	25 ans	161.36	14.00	15.23		15.59	0.029082	2.65	60.95	53.40	0.79
KM3	1140	50 ans	178.50	14.00	15.31		15.69	0.028137	2.72	65.61	53.78	0.79
KM3	1140	100 ans	195.64	14.00	15.40		15.80	0.027377	2.79	70.10	54.14	0.78
KM3	1130	2ans	100.85	13.78	14.67		14.89	0.025415	2.04	49.35	57.67	0.71
KM3	1130	10 ans	140.18	13.78	14.93		15.18	0.020754	2.17	64.47	58.86	0.66
KM3	1130	25 ans	161.36	13.78	15.07		15.32	0.018937	2.23	72.43	59.47	0.64
KM3	1130	50 ans	178.50	13.78	15.18		15.44	0.017735	2.27	78.78	60.01	0.63
KM3	1130	100 ans	195.64	13.78	15.27		15.55	0.016949	2.31	84.67	60.49	0.62
KM3	1120	2ans	100.85	13.52	14.56		14.69	0.012560	1.59	63.29	63.33	0.51
KM3	1120	10 ans	140.18	13.52	14.86		15.00	0.010334	1.70	82.38	65.09	0.48
KM3	1120	25 ans	161.36	13.52	15.01		15.16	0.009524	1.76	92.08	65.87	0.47
KM3	1120	50 ans	178.50	13.52	15.12		15.28	0.008984	1.80	99.69	66.45	0.46
KM3	1120	100 ans	195.64	13.52	15.22		15.40	0.008671	1.84	106.62	66.97	0.46
KM3	1110	2ans	100.85	13.27	14.49		14.58	0.007304	1.34	75.40	65.35	0.40
KM3	1110	10 ans	140.18	13.27	14.80		14.91	0.006409	1.46	95.97	66.75	0.39
KM3	1110	25 ans	161.36	13.27	14.96		15.08	0.006110	1.52	106.24	67.46	0.38
KM3	1110	50 ans	178.50	13.27	15.08		15.20	0.005923	1.57	114.27	68.11	0.38
KM3	1110	100 ans	195.64	13.27	15.18		15.31	0.005829	1.62	121.52	68.75	0.38
KM3	1100	2ans	100.85	13.14	14.43		14.51	0.006622	1.32	76.64	63.25	0.38
KM3	1100	10 ans	140.18	13.14	14.74		14.85	0.005936	1.45	97.06	64.86	0.37
KM3	1100	25 ans	161.36	13.14	14.90		15.02	0.005714	1.51	107.20	65.65	0.37
KM3	1100	50 ans	178.50	13.14	15.02		15.14	0.005553	1.56	115.12	66.40	0.37
KM3	1100	100 ans	195.64	13.14	15.13		15.26	0.005492	1.61	122.23	67.06	0.37
KM3	1090	2ans	100.85	12.97	14.37		14.45	0.005522	1.27	79.61	60.48	0.35
KM3	1090	10 ans	140.18	12.97	14.69		14.79	0.005246	1.41	99.44	62.45	0.36
KM3	1090	25 ans	161.36	12.97	14.85		14.96	0.005119	1.48	109.30	63.44	0.36
KM3	1090	50 ans	178.50	12.97	14.97		15.09	0.005014	1.53	117.02	64.20	0.36
KM3	1090	100 ans	195.64	12.97	15.08		15.20	0.005007	1.59	123.89	64.88	0.36
KM3	1080	2ans	100.85	12.83	14.32		14.40	0.005035	1.27	79.47	57.18	0.34
KM3	1080	10 ans	140.18	12.83	14.64		14.74	0.004948	1.44	98.17	59.35	0.35
KM3	1080	25 ans	161.36	12.83	14.79		14.91	0.004896	1.51	107.52	60.49	0.35
KM3	1080	50 ans	178.50	12.83	14.91		15.04	0.004856	1.57	114.86	61.36	0.35
KM3	1080	100 ans	195.64	12.83	15.02		15.15	0.004904	1.63	121.34	62.13	0.36
KM3	1070	2ans	100.85	12.67	14.25		14.35	0.005231	1.34	75.46	52.59	0.35
KM3	1070	10 ans	140.18	12.67	14.57		14.69	0.005285	1.53	92.45	54.99	0.36

HEC-RAS Plan: km3_actuel River: Maquatua Reach: KM3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
KM3	1070	25 ans	161.36	12.67	14.72		14.86	0.005305	1.62	100.98	56.17	0.37
KM3	1070	50 ans	178.50	12.67	14.84		14.99	0.005309	1.69	107.70	57.08	0.37
KM3	1070	100 ans	195.64	12.67	14.94		15.10	0.005411	1.76	113.56	57.85	0.38
KM3	1060	2ans	100.85	12.41	14.21		14.30	0.004414	1.34	75.85	47.39	0.33
KM3	1060	10 ans	140.18	12.41	14.51		14.64	0.004846	1.57	90.74	49.65	0.35
KM3	1060	25 ans	161.36	12.41	14.66		14.80	0.005021	1.67	98.22	50.79	0.36
KM3	1060	50 ans	178.50	12.41	14.78		14.93	0.005134	1.75	104.13	51.68	0.37
KM3	1060	100 ans	195.64	12.41	14.88		15.04	0.005332	1.84	109.19	52.43	0.38
KM3	1050	2ans	100.85	12.49	14.14		14.25	0.005728	1.46	69.95	47.13	0.37
KM3	1050	10 ans	140.18	12.49	14.44		14.58	0.006134	1.69	84.30	48.86	0.39
KM3	1050	25 ans	161.36	12.49	14.58		14.75	0.006297	1.80	91.47	49.83	0.40
KM3	1050	50 ans	178.50	12.49	14.69		14.87	0.006404	1.88	97.10	50.75	0.41
KM3	1050	100 ans	195.64	12.49	14.79		14.98	0.006639	1.97	101.85	51.48	0.42
KM3	1040	2ans	100.85	12.67	13.91		14.14	0.018923	2.12	48.43	46.40	0.64
KM3	1040	10 ans	140.18	12.67	14.21		14.48	0.016195	2.29	62.62	48.12	0.61
KM3	1040	25 ans	161.36	12.67	14.36		14.64	0.015337	2.38	69.67	48.97	0.61
KM3	1040	50 ans	178.50	12.67	14.47		14.77	0.014777	2.45	75.19	49.64	0.60
KM3	1040	100 ans	195.64	12.67	14.55		14.87	0.015047	2.55	79.27	50.14	0.61
KM3	1030	2ans	100.85	12.30	13.85		13.99	0.008524	1.67	61.32	46.19	0.44
KM3	1030	10 ans	140.18	12.30	14.16		14.34	0.008471	1.90	75.78	48.11	0.46
KM3	1030	25 ans	161.36	12.30	14.30		14.50	0.008475	2.00	82.95	49.09	0.46
KM3	1030	50 ans	178.50	12.30	14.42		14.63	0.008476	2.08	88.57	49.99	0.47
KM3	1030	100 ans	195.64	12.30	14.50		14.73	0.008890	2.19	92.59	50.67	0.48
KM3	1020	2ans	100.85	12.16	13.78		13.91	0.007405	1.60	63.91	46.00	0.42
KM3	1020	10 ans	140.18	12.16	14.08		14.25	0.007577	1.84	78.33	48.30	0.44
KM3	1020	25 ans	161.36	12.16	14.23		14.42	0.007659	1.94	85.52	49.45	0.44
KM3	1020	50 ans	178.50	12.16	14.34		14.55	0.007710	2.03	91.18	50.52	0.45
KM3	1020	100 ans	195.64	12.16	14.42		14.65	0.008174	2.14	95.01	51.16	0.47
KM3	1010	2ans	100.85	12.12	13.68	13.09	13.83	0.008683	1.69	60.71	45.95	0.45
KM3	1010	10 ans	140.18	12.12	13.99	13.31	14.17	0.008677	1.92	75.05	48.46	0.46
KM3	1010	25 ans	161.36	12.12	14.13	13.41	14.34	0.008690	2.03	82.22	49.69	0.47
KM3	1010	50 ans	178.50	12.12	14.24	13.49	14.46	0.008685	2.11	87.89	50.75	0.48
KM3	1010	100 ans	195.64	12.12	14.31	13.57	14.56	0.009310	2.23	91.26	51.38	0.49

HEC-RAS Plan: km3_naturel River: Maquatua Reach: KM3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
KM3	1330	2ans	100.85	15.71	17.37	16.83	17.57	0.002662	1.99	50.56	36.04	0.54
KM3	1330	10 ans	140.18	15.71	17.67	17.09	17.93	0.002899	2.28	61.57	38.75	0.57
KM3	1330	25 ans	161.36	15.71	17.81	17.22	18.11	0.002904	2.40	67.32	40.27	0.58
KM3	1330	50 ans	178.50	15.71	17.92	17.32	18.24	0.002883	2.50	71.90	41.45	0.59
KM3	1330	100 ans	195.64	15.71	18.03	17.41	18.37	0.002867	2.58	76.41	42.57	0.59
KM3	1320	2ans	100.85	15.80	17.38		17.54	0.001993	1.73	58.38	41.95	0.47
KM3	1320	10 ans	140.18	15.80	17.69		17.89	0.002012	1.96	71.87	46.20	0.48
KM3	1320	25 ans	161.36	15.80	17.84		18.06	0.001997	2.07	79.02	48.41	0.49
KM3	1320	50 ans	178.50	15.80	17.96		18.19	0.001984	2.15	84.77	50.20	0.49
KM3	1320	100 ans	195.64	15.80	18.07		18.32	0.001972	2.23	90.45	51.39	0.49
KM3	1310	2ans	100.85	15.90	17.28		17.50	0.003268	2.08	48.78	40.37	0.59
KM3	1310	10 ans	140.18	15.90	17.57		17.85	0.003151	2.34	61.05	44.20	0.60
KM3	1310	25 ans	161.36	15.90	17.72		18.03	0.003093	2.46	67.57	46.30	0.60
KM3	1310	50 ans	178.50	15.90	17.83		18.16	0.003047	2.55	72.84	47.94	0.60
KM3	1310	100 ans	195.64	15.90	17.94		18.29	0.003007	2.63	78.07	49.50	0.61
KM3	1300	2ans	100.85	15.86	17.20		17.46	0.004407	2.28	44.30	38.90	0.67
KM3	1300	10 ans	140.18	15.86	17.49		17.81	0.004042	2.53	56.14	42.69	0.67
KM3	1300	25 ans	161.36	15.86	17.63		17.99	0.003887	2.64	62.46	44.80	0.67
KM3	1300	50 ans	178.50	15.86	17.74		18.12	0.003776	2.72	67.58	46.44	0.67
KM3	1300	100 ans	195.64	15.86	17.85		18.25	0.003684	2.80	72.65	48.01	0.66
KM3	1290	2ans	100.85	15.72	17.02		17.40	0.006809	2.70	37.69	36.78	0.83
KM3	1290	10 ans	140.18	15.72	17.31	17.14	17.75	0.005989	2.94	48.82	40.77	0.81
KM3	1290	25 ans	161.36	15.72	17.46	17.26	17.93	0.005634	3.05	54.83	43.00	0.80
KM3	1290	50 ans	178.50	15.72	17.57	17.35	18.06	0.005385	3.13	59.75	44.73	0.79
KM3	1290	100 ans	195.64	15.72	17.68	17.44	18.19	0.005190	3.21	64.60	46.39	0.78
KM3	1280	2ans	100.85	15.71	17.07		17.30	0.003854	2.13	47.43	42.00	0.63
KM3	1280	10 ans	140.18	15.71	17.38		17.66	0.003352	2.33	61.17	46.37	0.61
KM3	1280	25 ans	161.36	15.71	17.54		17.83	0.003176	2.42	68.43	48.44	0.61
KM3	1280	50 ans	178.50	15.71	17.65		17.97	0.003056	2.49	74.28	50.10	0.60
KM3	1280	100 ans	195.64	15.71	17.77		18.10	0.002964	2.55	80.01	51.74	0.60
KM3	1270	2ans	100.85	15.73	17.08		17.25	0.002580	1.82	55.70	47.30	0.52
KM3	1270	10 ans	140.18	15.73	17.41		17.61	0.002302	2.01	71.61	51.72	0.51
KM3	1270	25 ans	161.36	15.73	17.56		17.78	0.002203	2.09	79.93	53.84	0.51
KM3	1270	50 ans	178.50	15.73	17.68		17.92	0.002134	2.15	86.58	55.17	0.51
KM3	1270	100 ans	195.64	15.73	17.80		18.05	0.002081	2.22	93.02	56.23	0.51
KM3	1260	2ans	100.85	15.73	17.08		17.22	0.001998	1.63	62.70	53.48	0.46
KM3	1260	10 ans	140.18	15.73	17.41		17.58	0.001773	1.79	80.80	56.44	0.45
KM3	1260	25 ans	161.36	15.73	17.57		17.75	0.001698	1.87	89.99	58.05	0.45
KM3	1260	50 ans	178.50	15.73	17.70		17.88	0.001647	1.93	97.28	59.31	0.45
KM3	1260	100 ans	195.64	15.73	17.82		18.01	0.001603	1.98	104.45	60.54	0.45
KM3	1250	2ans	100.85	15.60	17.09		17.19	0.001370	1.41	72.59	57.49	0.39
KM3	1250	10 ans	140.18	15.60	17.43		17.55	0.001255	1.56	92.33	60.89	0.38
KM3	1250	25 ans	161.36	15.60	17.59		17.72	0.001216	1.63	102.38	62.55	0.38
KM3	1250	50 ans	178.50	15.60	17.71		17.86	0.001188	1.69	110.32	63.84	0.38
KM3	1250	100 ans	195.64	15.60	17.84		17.99	0.001165	1.74	118.13	65.09	0.38
KM3	1240	2ans	100.85	15.54	17.09		17.17	0.000975	1.25	81.76	60.00	0.33
KM3	1240	10 ans	140.18	15.54	17.43		17.53	0.000939	1.41	102.44	63.32	0.34
KM3	1240	25 ans	161.36	15.54	17.59		17.71	0.000926	1.49	112.93	64.93	0.34
KM3	1240	50 ans	178.50	15.54	17.72		17.84	0.000916	1.54	121.22	66.19	0.34
KM3	1240	100 ans	195.64	15.54	17.84		17.97	0.000907	1.59	129.35	67.40	0.34
KM3	1230	2ans	100.85	15.55	17.08		17.16	0.001094	1.32	78.97	60.73	0.35
KM3	1230	10 ans	140.18	15.55	17.41		17.52	0.001037	1.47	99.96	64.37	0.35
KM3	1230	25 ans	161.36	15.55	17.58		17.70	0.001017	1.55	110.62	65.94	0.35
KM3	1230	50 ans	178.50	15.55	17.70		17.83	0.001002	1.60	119.04	67.30	0.36
KM3	1230	100 ans	195.64	15.55	17.82		17.96	0.000989	1.65	127.32	68.64	0.36
KM3	1220	2ans	100.85	15.51	17.06		17.15	0.001099	1.33	76.99	56.89	0.35
KM3	1220	10 ans	140.18	15.51	17.40		17.51	0.001061	1.50	96.57	60.28	0.36
KM3	1220	25 ans	161.36	15.51	17.56		17.68	0.001047	1.58	106.48	61.67	0.36
KM3	1220	50 ans	178.50	15.51	17.68		17.82	0.001037	1.64	114.30	63.25	0.36
KM3	1220	100 ans	195.64	15.51	17.80		17.95	0.001027	1.69	122.02	64.37	0.36
KM3	1210	2ans	100.85	15.41	17.04		17.14	0.001156	1.38	73.29	49.28	0.36
KM3	1210	10 ans	140.18	15.41	17.37		17.50	0.001161	1.56	89.83	51.52	0.37
KM3	1210	25 ans	161.36	15.41	17.53		17.67	0.001159	1.65	98.16	52.73	0.38
KM3	1210	50 ans	178.50	15.41	17.66		17.81	0.001156	1.72	104.72	53.66	0.38
KM3	1210	100 ans	195.64	15.41	17.77		17.94	0.001154	1.78	111.13	54.55	0.38

HEC-RAS Plan: km3_naturel River: Maquatua Reach: KM3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
KM3	1200	2ans	100.85	15.38	17.00		17.12	0.001491	1.55	65.05	44.02	0.41
KM3	1200	10 ans	140.18	15.38	17.32		17.48	0.001559	1.77	79.36	45.77	0.43
KM3	1200	25 ans	161.36	15.38	17.48		17.65	0.001588	1.86	86.59	46.95	0.44
KM3	1200	50 ans	178.50	15.38	17.60		17.79	0.001606	1.94	92.30	47.85	0.44
KM3	1200	100 ans	195.64	15.38	17.71		17.92	0.001601	2.00	97.92	48.73	0.45
KM3	1190	2ans	100.85	15.47	16.80		17.07	0.021961	2.33	43.24	36.94	0.69
KM3	1190	10 ans	140.18	15.47	17.08		17.42	0.021578	2.59	54.03	38.75	0.70
KM3	1190	25 ans	161.36	15.47	17.22		17.60	0.021306	2.71	59.58	39.65	0.71
KM3	1190	50 ans	178.50	15.47	17.33		17.73	0.021027	2.79	64.01	40.35	0.71
KM3	1190	100 ans	195.64	15.47	17.44		17.86	0.020680	2.86	68.45	41.04	0.71
KM3	1180	2ans	100.85	15.26	16.64		16.87	0.016048	2.11	47.77	37.22	0.60
KM3	1180	10 ans	140.18	15.26	16.93		17.22	0.016429	2.40	58.49	38.21	0.62
KM3	1180	25 ans	161.36	15.26	17.07		17.39	0.016482	2.52	63.93	38.66	0.63
KM3	1180	50 ans	178.50	15.26	17.18		17.53	0.016554	2.62	68.23	39.20	0.63
KM3	1180	100 ans	195.64	15.26	17.29		17.66	0.016508	2.70	72.56	39.73	0.64
KM3	1170	2ans	100.85	15.14	16.10	16.10	16.58	0.052056	3.07	32.90	34.82	1.01
KM3	1170	10 ans	140.18	15.14	16.34	16.34	16.93	0.048531	3.41	41.16	35.27	1.01
KM3	1170	25 ans	161.36	15.14	16.45	16.45	17.10	0.046943	3.57	45.25	35.35	1.00
KM3	1170	50 ans	178.50	15.14	16.54	16.54	17.24	0.045633	3.68	48.50	35.42	1.00
KM3	1170	100 ans	195.64	15.14	16.63	16.63	17.37	0.044941	3.80	51.50	35.48	1.00
KM3	1160	2ans	100.85	14.38	15.09	15.29	15.81	0.118798	3.74	26.97	40.33	1.46
KM3	1160	10 ans	140.18	14.38	15.24	15.50	16.16	0.120991	4.26	32.93	41.04	1.52
KM3	1160	25 ans	161.36	14.38	15.31	15.61	16.34	0.121932	4.50	35.87	41.38	1.54
KM3	1160	50 ans	178.50	14.38	15.37	15.69	16.48	0.122440	4.68	38.17	41.64	1.56
KM3	1160	100 ans	195.64	14.38	15.42	15.77	16.61	0.122609	4.84	40.42	41.90	1.57
KM3	1150	2ans	100.85	14.18	15.21	15.00	15.46	0.025191	2.21	45.69	47.14	0.72
KM3	1150	10 ans	140.18	14.18	15.40	15.20	15.73	0.027086	2.54	55.11	48.43	0.76
KM3	1150	25 ans	161.36	14.18	15.50	15.30	15.87	0.027645	2.70	59.84	48.89	0.78
KM3	1150	50 ans	178.50	14.18	15.58	15.38	15.98	0.027939	2.81	63.56	49.21	0.79
KM3	1150	100 ans	195.64	14.18	15.65	15.45	16.08	0.028181	2.91	67.17	49.52	0.80
KM3	1140	2ans	100.85	14.00	14.92		15.18	0.030546	2.25	44.79	52.06	0.78
KM3	1140	10 ans	140.18	14.00	15.12		15.45	0.029941	2.53	55.32	52.95	0.79
KM3	1140	25 ans	161.36	14.00	15.23		15.59	0.029082	2.65	60.95	53.40	0.79
KM3	1140	50 ans	178.50	14.00	15.31		15.69	0.028136	2.72	65.61	53.78	0.79
KM3	1140	100 ans	195.64	14.00	15.40		15.80	0.027376	2.79	70.10	54.14	0.78
KM3	1130	2ans	100.85	13.78	14.67		14.89	0.025415	2.04	49.35	57.67	0.71
KM3	1130	10 ans	140.18	13.78	14.93		15.18	0.020754	2.17	64.47	58.86	0.66
KM3	1130	25 ans	161.36	13.78	15.07		15.32	0.018937	2.23	72.43	59.47	0.64
KM3	1130	50 ans	178.50	13.78	15.18		15.44	0.017735	2.27	78.78	60.01	0.63
KM3	1130	100 ans	195.64	13.78	15.27		15.55	0.016949	2.31	84.67	60.49	0.62
KM3	1120	2ans	100.85	13.52	14.56		14.69	0.012560	1.59	63.29	63.33	0.51
KM3	1120	10 ans	140.18	13.52	14.86		15.00	0.010333	1.70	82.38	65.09	0.48
KM3	1120	25 ans	161.36	13.52	15.01		15.16	0.009523	1.76	92.08	65.87	0.47
KM3	1120	50 ans	178.50	13.52	15.12		15.28	0.008984	1.80	99.69	66.45	0.46
KM3	1120	100 ans	195.64	13.52	15.22		15.40	0.008671	1.84	106.62	66.97	0.46
KM3	1110	2ans	100.85	13.27	14.49		14.58	0.007304	1.34	75.40	65.35	0.40
KM3	1110	10 ans	140.18	13.27	14.80		14.91	0.006409	1.46	95.97	66.75	0.39
KM3	1110	25 ans	161.36	13.27	14.96		15.08	0.006110	1.52	106.24	67.46	0.38
KM3	1110	50 ans	178.50	13.27	15.08		15.20	0.005923	1.57	114.27	68.11	0.38
KM3	1110	100 ans	195.64	13.27	15.18		15.31	0.005829	1.62	121.52	68.75	0.38
KM3	1100	2ans	100.85	13.14	14.43		14.51	0.006622	1.32	76.64	63.25	0.38
KM3	1100	10 ans	140.18	13.14	14.74		14.85	0.005936	1.45	97.07	64.86	0.37
KM3	1100	25 ans	161.36	13.14	14.90		15.02	0.005714	1.51	107.20	65.65	0.37
KM3	1100	50 ans	178.50	13.14	15.02		15.14	0.005553	1.56	115.12	66.40	0.37
KM3	1100	100 ans	195.64	13.14	15.13		15.26	0.005492	1.61	122.23	67.06	0.37
KM3	1090	2ans	100.85	12.97	14.37		14.45	0.005522	1.27	79.61	60.48	0.35
KM3	1090	10 ans	140.18	12.97	14.69		14.79	0.005246	1.41	99.44	62.45	0.36
KM3	1090	25 ans	161.36	12.97	14.85		14.96	0.005118	1.48	109.30	63.44	0.36
KM3	1090	50 ans	178.50	12.97	14.97		15.09	0.005014	1.53	117.02	64.20	0.36
KM3	1090	100 ans	195.64	12.97	15.08		15.20	0.005007	1.59	123.89	64.88	0.36
KM3	1080	2ans	100.85	12.83	14.32		14.40	0.005035	1.27	79.47	57.18	0.34
KM3	1080	10 ans	140.18	12.83	14.64		14.74	0.004948	1.44	98.17	59.35	0.35
KM3	1080	25 ans	161.36	12.83	14.79		14.91	0.004896	1.51	107.52	60.49	0.35
KM3	1080	50 ans	178.50	12.83	14.91		15.04	0.004856	1.57	114.86	61.36	0.35

HEC-RAS Plan: km3_naturel River: Maquatua Reach: KM3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
KM3	1080	100 ans	195.64	12.83	15.02		15.15	0.004904	1.63	121.34	62.13	0.36
KM3	1070	2ans	100.85	12.67	14.25		14.35	0.005231	1.34	75.46	52.59	0.35
KM3	1070	10 ans	140.18	12.67	14.57		14.69	0.005284	1.53	92.45	54.99	0.36
KM3	1070	25 ans	161.36	12.67	14.72		14.86	0.005305	1.62	100.98	56.17	0.37
KM3	1070	50 ans	178.50	12.67	14.84		14.99	0.005309	1.69	107.70	57.08	0.37
KM3	1070	100 ans	195.64	12.67	14.94		15.10	0.005411	1.76	113.56	57.85	0.38
KM3	1060	2ans	100.85	12.41	14.21		14.30	0.004414	1.34	75.85	47.39	0.33
KM3	1060	10 ans	140.18	12.41	14.51		14.64	0.004846	1.57	90.74	49.65	0.35
KM3	1060	25 ans	161.36	12.41	14.66		14.80	0.005021	1.67	98.22	50.79	0.36
KM3	1060	50 ans	178.50	12.41	14.78		14.93	0.005134	1.75	104.13	51.68	0.37
KM3	1060	100 ans	195.64	12.41	14.88		15.04	0.005332	1.84	109.19	52.43	0.38
KM3	1050	2ans	100.85	12.49	14.14		14.25	0.005728	1.46	69.95	47.13	0.37
KM3	1050	10 ans	140.18	12.49	14.44		14.58	0.006134	1.69	84.30	48.86	0.39
KM3	1050	25 ans	161.36	12.49	14.58		14.75	0.006297	1.80	91.47	49.83	0.40
KM3	1050	50 ans	178.50	12.49	14.69		14.87	0.006404	1.88	97.10	50.75	0.41
KM3	1050	100 ans	195.64	12.49	14.79		14.98	0.006639	1.97	101.85	51.48	0.42
KM3	1040	2ans	100.85	12.67	13.91		14.14	0.018923	2.12	48.43	46.40	0.64
KM3	1040	10 ans	140.18	12.67	14.21		14.48	0.016193	2.29	62.62	48.12	0.61
KM3	1040	25 ans	161.36	12.67	14.36		14.64	0.015336	2.38	69.67	48.97	0.61
KM3	1040	50 ans	178.50	12.67	14.47		14.77	0.014777	2.45	75.19	49.64	0.60
KM3	1040	100 ans	195.64	12.67	14.55		14.87	0.015046	2.55	79.27	50.14	0.61
KM3	1030	2ans	100.85	12.30	13.85		13.99	0.008524	1.67	61.32	46.19	0.44
KM3	1030	10 ans	140.18	12.30	14.16		14.34	0.008469	1.90	75.78	48.12	0.46
KM3	1030	25 ans	161.36	12.30	14.30		14.50	0.008474	2.00	82.95	49.09	0.46
KM3	1030	50 ans	178.50	12.30	14.42		14.63	0.008475	2.08	88.57	49.99	0.47
KM3	1030	100 ans	195.64	12.30	14.50		14.73	0.008889	2.19	92.59	50.67	0.48
KM3	1020	2ans	100.85	12.16	13.78		13.91	0.007405	1.60	63.91	46.00	0.42
KM3	1020	10 ans	140.18	12.16	14.08		14.25	0.007575	1.84	78.34	48.30	0.44
KM3	1020	25 ans	161.36	12.16	14.23		14.42	0.007659	1.94	85.52	49.45	0.44
KM3	1020	50 ans	178.50	12.16	14.34		14.55	0.007710	2.03	91.18	50.52	0.45
KM3	1020	100 ans	195.64	12.16	14.42		14.65	0.008174	2.14	95.01	51.16	0.47
KM3	1010	2ans	100.85	12.12	13.68	13.09	13.83	0.008683	1.69	60.71	45.95	0.45
KM3	1010	10 ans	140.18	12.12	13.99	13.31	14.17	0.008677	1.92	75.05	48.46	0.46
KM3	1010	25 ans	161.36	12.12	14.13	13.41	14.34	0.008690	2.03	82.22	49.69	0.47
KM3	1010	50 ans	178.50	12.12	14.24	13.49	14.46	0.008685	2.11	87.89	50.75	0.48
KM3	1010	100 ans	195.64	12.12	14.31	13.57	14.56	0.009310	2.23	91.26	51.38	0.49

Plan: km3_actuel Maquatua KM3 RS: 1169.9 Profile: 2ans

E.G. US. (m)	16.96	Element	Inside BR US	Inside BR DS
W.S. US. (m)	16.77	E.G. Elev (m)	16.83	16.67
Q Total (m3/s)	100.85	W.S. Elev (m)	16.33	16.16
Q Bridge (m3/s)	100.85	Crit W.S. (m)	16.33	16.16
Q Weir (m3/s)		Max Chl Dpth (m)	1.20	1.03
Weir Sta Lft (m)		Vel Total (m/s)	3.14	3.14
Weir Sta Rgt (m)		Flow Area (m2)	32.09	32.10
Weir Submerg		Froude # Chl	1.00	1.00
Weir Max Depth (m)		Specif Force (m3)	50.23	48.66
Min El Weir Flow (m)	23.52	Hydr Depth (m)	1.00	1.00
Min El Prs (m)	22.52	W.P. Total (m)	34.94	35.43
Delta EG (m)	1.21	Conv. Total (m3/s)	434.8	429.3
Delta WS (m)	1.32	Top Width (m)	32.15	32.06
BR Open Area (m2)	250.73	Frctn Loss (m)		
BR Open Vel (m/s)	3.14	C & E Loss (m)		
BR Sluice Coef		Shear Total (N/m2)	484.48	490.29
BR Sel Method	Momentum	Power Total (N/m s)	1522.67	1540.53

Plan: km3_actuel Maquatua KM3 RS: 1169.9 Profile: 10 ans

E.G. US. (m)	17.32	Element	Inside BR US	Inside BR DS
W.S. US. (m)	17.07	E.G. Elev (m)	17.19	17.03
Q Total (m3/s)	140.18	W.S. Elev (m)	16.59	16.43
Q Bridge (m3/s)	140.18	Crit W.S. (m)	16.59	16.43
Q Weir (m3/s)		Max Chl Dpth (m)	1.45	1.29
Weir Sta Lft (m)		Vel Total (m/s)	3.45	3.45
Weir Sta Rgt (m)		Flow Area (m2)	40.66	40.64
Weir Submerg		Froude # Chl	0.92	0.97
Weir Max Depth (m)		Specif Force (m3)	76.47	75.16
Min El Weir Flow (m)	23.52	Hydr Depth (m)	1.20	1.20
Min El Prs (m)	22.52	W.P. Total (m)	37.60	38.07
Delta EG (m)	1.22	Conv. Total (m3/s)	619.4	610.5
Delta WS (m)	1.77	Top Width (m)	33.96	33.84
BR Open Area (m2)	250.73	Frctn Loss (m)		
BR Open Vel (m/s)	3.45	C & E Loss (m)		
BR Sluice Coef		Shear Total (N/m2)	543.23	551.79
BR Sel Method	Momentum	Power Total (N/m s)	1872.94	1903.32

Plan: km3_actuel Maquatua KM3 RS: 1169.9 Profile: 25 ans

E.G. US. (m)	17.49	Element	Inside BR US	Inside BR DS
W.S. US. (m)	17.22	E.G. Elev (m)	17.37	17.21
Q Total (m3/s)	161.36	W.S. Elev (m)	16.71	16.55
Q Bridge (m3/s)	161.36	Crit W.S. (m)	16.71	16.55
Q Weir (m3/s)		Max Chl Dpth (m)	1.58	1.41
Weir Sta Lft (m)		Vel Total (m/s)	3.59	3.60
Weir Sta Rgt (m)		Flow Area (m2)	44.95	44.77
Weir Submerg		Froude # Chl	0.91	0.97
Weir Max Depth (m)		Specif Force (m3)	91.69	90.39
Min El Weir Flow (m)	23.52	Hydr Depth (m)	1.32	1.32
Min El Prs (m)	22.52	W.P. Total (m)	38.13	38.57
Delta EG (m)	1.21	Conv. Total (m3/s)	727.9	714.0
Delta WS (m)	1.85	Top Width (m)	34.05	33.93
BR Open Area (m2)	250.73	Frctn Loss (m)		
BR Open Vel (m/s)	3.60	C & E Loss (m)		

Plan: km3_actuel Maquatua KM3 RS: 1169.9 Profile: 25 ans (Continued)

BR Sluice Coef		Shear Total (N/m2)	568.16	581.36
BR Sel Method	Momentum	Power Total (N/m s)	2039.77	2095.31

Plan: km3_actuel Maquatua KM3 RS: 1169.9 Profile: 50 ans

E.G. US. (m)	17.63	Element	Inside BR US	Inside BR DS
W.S. US. (m)	17.33	E.G. Elev (m)	17.51	17.35
Q Total (m3/s)	178.50	W.S. Elev (m)	16.80	16.64
Q Bridge (m3/s)	178.50	Crit W.S. (m)	16.80	16.64
Q Weir (m3/s)		Max Chl Dpth (m)	1.67	1.50
Weir Sta Lft (m)		Vel Total (m/s)	3.72	3.74
Weir Sta Rgt (m)		Flow Area (m2)	48.02	47.77
Weir Submerg		Froude # Chl	0.92	0.98
Weir Max Depth (m)		Specif Force (m3)	104.51	103.21
Min El Weir Flow (m)	23.52	Hydr Depth (m)	1.41	1.41
Min El Prs (m)	22.52	W.P. Total (m)	38.51	38.94
Delta EG (m)	1.21	Conv. Total (m3/s)	809.2	792.5
Delta WS (m)	1.92	Top Width (m)	34.11	33.99
BR Open Area (m2)	250.73	Frctn Loss (m)		
BR Open Vel (m/s)	3.74	C & E Loss (m)		
BR Sluice Coef		Shear Total (N/m2)	594.95	610.26
BR Sel Method	Momentum	Power Total (N/m s)	2211.69	2280.25

Plan: km3_actuel Maquatua KM3 RS: 1169.9 Profile: 100 ans

E.G. US. (m)	17.76	Element	Inside BR US	Inside BR DS
W.S. US. (m)	17.45	E.G. Elev (m)	17.64	17.48
Q Total (m3/s)	195.64	W.S. Elev (m)	16.89	16.73
Q Bridge (m3/s)	195.64	Crit W.S. (m)	16.89	16.73
Q Weir (m3/s)		Max Chl Dpth (m)	1.76	1.59
Weir Sta Lft (m)		Vel Total (m/s)	3.82	3.84
Weir Sta Rgt (m)		Flow Area (m2)	51.15	50.95
Weir Submerg		Froude # Chl	0.92	0.97
Weir Max Depth (m)		Specif Force (m3)	117.73	116.44
Min El Weir Flow (m)	23.52	Hydr Depth (m)	1.50	1.50
Min El Prs (m)	22.52	W.P. Total (m)	38.89	39.32
Delta EG (m)	1.20	Conv. Total (m3/s)	895.6	879.0
Delta WS (m)	1.98	Top Width (m)	34.18	34.06
BR Open Area (m2)	250.73	Frctn Loss (m)		
BR Open Vel (m/s)	3.84	C & E Loss (m)		
BR Sluice Coef		Shear Total (N/m2)	615.62	629.52
BR Sel Method	Momentum	Power Total (N/m s)	2354.45	2417.28