INVESTIGATION OF THE EFFECTS OF UNCERTAINTIES OF INFLOW HYDROGRAPH AND DAM BREACH GEOMETRY ON OUTFLOW HYDROGRAPH

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ABSTRACT

INVESTIGATION OF THE EFFECTS OF UNCERTAINTIES OF INFLOW HYDROGRAPH AND DAM BREACH GEOMETRY ON OUTFLOW HYDROGRAPH

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Precise breach outflow hydrograph is crucial for the accurate determination of the flood damage and cost at the downstream region. Precise flood inundation modeling is based on the use of a realistic breach outflow hydrograph as an input. Therefore, comprehensive modeling is essential for an accurate description of breach hydrograph. This study evaluates the effects of dam breach parameters and inflow hydrograph on the peak breach outflow utilizing a probabilistic dam breach model. An experimental model was scaled through Froude similarity, and the deterministic model was developed through HEC-RAS (5.0.7). Dam breach parameters and inflow hydrograph were characterized with probability density functions in accordance with related literature. Probabilistic analyses were conducted using Monte Carlo Simulation through McBreach (5.0.7). Exceedance probability curves and peak flow distribution histograms were obtained for the peak breach outflows, and statistical distributions most widely used in water resources engineering were fitted. The goodness of fit was tested for examination of their suitability. The study showed that the uncertainty of the final breach bottom elevation does not significantly affect the peak breach outflow. The inflow hydrograph characterized with normal Probability Density Function (PDF) covers a broader range of peak breach outflows. The probabilistic peak breach outflow can be characterized with the common extreme type distributions.

Keywords: Dam Breach, Probabilistic Dam Breach Modeling, Monte Carlo Simulation, HEC-RAS, McBreach

ÖZ

GİRİŞ HİDROGRAFI VE BARAJ GEDİK GEOMETRİSİNİN BELİRSİZLİKLERİNİN ÇIKIŞ HİDROGRAFI ÜZERİNDEKİ ETKİLERİNİN ARAŞTIRILMASI

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Mansaptaki taşkın hasarının ve maliyetlerinin doğru hesaplanması için hassas gedik çıkış hidrografı çok önemlidir. Detaylı taşkın yayılım modellemesi, girdi olarak gerçekçi bir gedik çıkış hidrografının kullanımına dayanmaktadır. Bu nedenle, gedik çıkış hidrografının doğru bir tanımı için kapsamlı modelleme gereklidir. Bu çalışmada, baraj gedik parametrelerinin ve giriş hidrografının pik gedik çıkış akımı debisi üzerindeki etkileri baraj yıkılma olasılık modeli kullanılarak değerlendirilmektedir. Froude benzerliği ile ölçeklendirilen deneysel bir modelin sayısal modeli HEC-RAS (5.0.7) programı kullanılarak geliştirilmiştir. Baraj gedik parametreleri ve giriş hidrografı ilgili literatürü göz önünde bulundurarak olasılık yoğunluk fonksiyonları (OYF) ile karakterize edilmiştir. Olasılık analizleri Monte Carlo benzeşimi kullanılarak McBreach (5.0.7) programı aracılığıyla yapılmıştır. Pik gedik çıkış akımı debileri için aşılma olasılığı eğrileri ve pik çıkış akımı debisi histogramları elde edilmiştir. Su kaynakları mühendisliğinde en yaygın olarak kullanılan istatistiksel dağılımların bu histogramlara uygunluğu test edilmiştir. Çalışma sonucunda, gedik taban kotunun belirsizliğinin, pik gedik çıkış debisini

önemli ölçüde etkilemediği görülmüştür. Normal OYF ile karakterize edilen giriş hidrografı, daha geniş bir pik gedik çıkış debisi aralığını kapsar. Pik gedik çıkış debisi yaygın istatistiksel dağılımlar ile karakterize edilebilir.

Anahtar Kelimeler: Baraj Gediklenmesi, Baraj Gediklenme Olasılık Modeli, Monte Carlo Benzeşimi, HEC-RAS, McBreach

To my family…

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LIST OF ABBREVIATIONS

COV	Coefficient of Variation
EP	Exceedance Probability
FEMA	Federal Emergency Management Agency
MCS	Monte Carlo Simulation
PDF	Probability Density Function
PFE	Peak Flow Exceedance
OYF	Olasılık Yoğunluk Fonksiyonu

LIST OF SYMBOLS

A	Flow area (m^2)
B^*	Constant in breach width relation provided by Dewey and Gillette (1993) consistent with SI units
$B_2,\ B_3, B_5$	Coefficients based on dam characteristics in Xu and Zhang (2009) relations
B_{avg}	Average breach width (m)
${B_{avg}}^*$	Dimensionless average breach width
B_t	Breach top width (m)
C	Breach weir coefficient
$c_{1-\alpha,f}$	Critical value in Chi-square test
C_w	Dam crest width (m)
C_b	Constant in breach width relation provided by Von Thun and Gillette (1990)
D_{10}, D_{30}, D_{60}	Grain diameters that correspond to 10, 30 and 60% passing, respectively (mm)
D_h	Hydraulic depth
$d_{overtop}$	Overtopping flow depth at time of failure (m)
E_b	Final breach bottom elevation (m)
E_t	Water surface elevation triggering the failure
f	Degree of freedom for Chi-square test
f_i	Observed frequency for Chi-square test

g	Gravitational acceleration (9.81 m/s^2)
h_b	Breach depth (m)
h_d	Dam height (m)
h_r	Reference dam height (15 m) in Xu and Zhang (2009) relation
h_w	Water head above bottom of the breach (m)
h_w^*	Dimensionless water head above bottom of the breach
I_p	Peak inflow (m^3/s)
K	Number of parameters for Chi-square test
K_o	Correction factor for overtopping
L_r	Length ratio
P_b	Breach progression
P_i	Expected frequency for Chi-square test
Q	Outflow (m^3/s)
Q_f	Final steady-state discharge (m^3/s)
Q_p	Peak discharge (m^3/s)
Q_r	Discharge ratio
S^*	Dimensionless storage
S_0	Channel bed slope
S_f	Slope of the energy grade line
T	Top width of the water surface
t	Time (s)

t_f	Breach formation time (h)
$t_f{}^*$	Dimensionless breach formation time
t_p	Time to peak (s)
T_r	Time ratio
$T_{r'}$	Unit duration (1 h) in Xu and Zhang (2009) relation
V	Flow velocity (m/s)
V_{er}	Volume of eroded material (m^3)
V_{out}	Volume of water discharging through the breach (m^3)
V_r	Velocity ratio
V_t	Total volume of the hydrograph
V_w	Volume of water stored above bottom of the breach (m^3)
W_b	Breach bottom width (m)
$\bar{W}^*$	Dimensionless average embankment width
x	Distance throughout the channel length (m)
y	Flow depth (m)
Z	Side slope (Z×H : 1V)
Z_3	Sum of the upstream and downstream slopes
α	Significance level

CHAPTER 1

INTRODUCTION

1.1 General

Embankment structures, in particular dams, are constructed for flood protection, water supply, transportation, and power generation purposes. For dams, the common types are earth-fill dams, whether homogeneous or zoned, rock-fill dams, whether zoned (i.e., clay core), or zoned with a concrete face (Wu et al., 2011). U.S. Committee on Large Dams (1975) stated that huge percentage of the large dams are made up of erodible materials in the U.S (Wu et al., 2011).

Earthen dams are vulnerable to breach in case of overtopping the flood water from the dam crest since they are made up of erodible materials. Dam breach failures endanger the people that maintain their lives downstream of the dam since they may cause destructive results like the inundation of areas, the loss of human lives, and economic loss. In 1975, Banqiao Dam in China failed by resulting in loss of lives more than 26,000 (Zhong et al., 2018). In 2015, Hurricane Joaquin resulted in breaching of 47 dams, and deaths of 19, and loss of property around 2 billion dollars in South Carolina (Crookston and Hepler, 2016; Sasanakul et al., 2017). In 1977, Kelly-Barnes Dam failed in Georgia and cause 39 loss of lives and $3,000,000 of economic damage (Francis and Fiegle, 2001; Graham, 2001). In 1995, a private dam failed in British Columbia and resulted in the loss of property and infrastructure around $500,000 though there was no loss of lives (Sakamoto, 2001). The South Fork Dam (Johnstown Dam) failed in Pennsylvania in 1889 and resulted in around 2209 casualties. In Pennsylvania, Austin Dam also failed in 1911 with 78 loss of lives. In 1928, failure of St. Francis Dam in California resulted in 420 deaths and

14,000,000 dollars economic damage (Graham, 2001). In 1982, Tous Dam failed during construction in Spain and caused 8 loss of lives, 100,000 people that were evacuated, and economic damage around 1500 million Euros. In Southern Germany, a dam failed in 1999 and resulted in 4 casualties and economic loss over 1,000,000,000 Euro (Morris, 2001).

In earthen dams, occurrences of breaching may result from different mechanisms like overtopping, internal erosion, and foundation flaws. Costa (1985) stated the percentages of occurrences of these failure modes as 34%, 28%, and 30% for overtopping, internal erosion, and foundation flaws, respectively. Overtopping failure is the most common failure mode. There are many reasons for overtopping, such as excessive inflow resulted from excessive rainfall and upstream dam failure, and human-induced problems (e.g., deficiencies in maintenance, design, and construction). For overtopping failure, in homogeneous dams, the breach failure mechanism depends on the cohesiveness of the dam material. For non-cohesive dams, gradual surface erosion is critical, whereas, headcut erosion is critical for cohesive dams (see Figure 1.1 and 1.2). On the other hand, for non-homogeneous dams, either surface erosion or headcut erosion can be observed up to the clay core (Figure 1.3) (Wu et al., 2011).

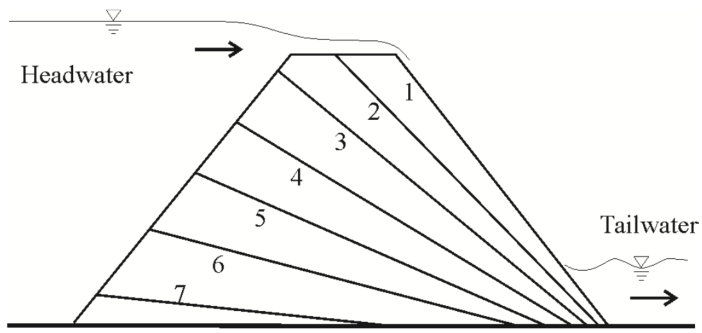


Figure 1.1. Surface erosion breaching mechanism (After Wu, 2016)

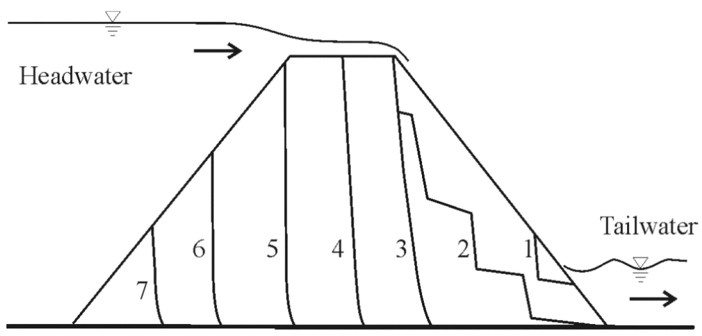


Figure 1.2. Headcut migration breaching mechanism (After Wu, 2016)

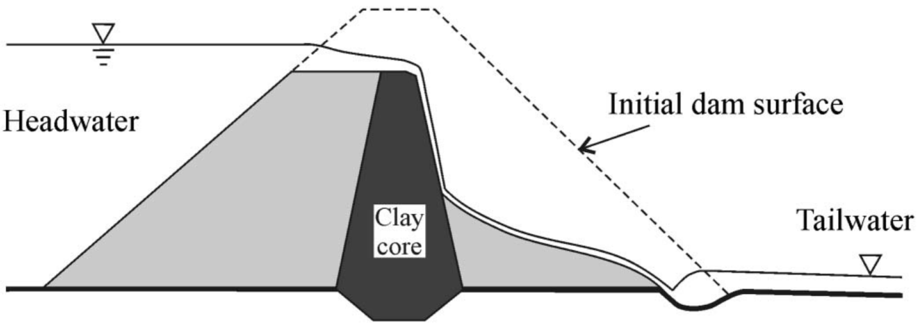


Figure 1.3. Breaching mechanism for composite dam (After Wu et al., 2011)

In general, a breach size and the resulting outflow depend on reservoir features instead of tailwater circumstances. During a breaching process, while the water level in the reservoir decreases, the outflow rises to a peak discharge until the breach reaches the final shape. Then, the decrease in discharge is experienced with a reduction in water level, and reservoir storage volume empties (Wu et al., 2011).

The analysis procedure of the dam breach and flood resulting from the breach can be summarized as the prediction of the breach parameters and mechanism, reservoir routing of the inflow, downstream routing, and hazard assessment. The greatest uncertainty is included in the estimation of breach parameters (Singh, 1996, Wahl 1998, Morris 2000, Wu et al., 2011; Ahmadisharaf et al., 2016; Brunner, 2014). Therefore, the determination of the dam breach parameters is important and studies on this subject covers a large volume in literature.

1.2 Previous Works on Dam Breach due to Overtopping

In most studies, a trapezoidal breach cross-section is assumed, although it can also be approximated as a triangle, parabola, or rectangle (Xu and Zhang, 2009; Wu et al., 2011). For the estimation of the dam breach parameters and peak breach outflow, following models are used: parametric, simplified physically based, and detailed physically based models.

The development of simplified physically based models and detailed physically based models are based upon numerical or analytical and numerical solutions, respectively. On the other hand, parametric ones that are most commonly used models are mostly developed by considering empirical studies, historical data and statistical regression analysis and propose equations (Wu et al., 2011; Wahl et.al, 2008, as cited in Xu and Zhang, 2009). The most widely used studies on parametric models are introduced below.

The relations for the estimation of the breach width, formation time, and side slopes proposed by Froehlich (1995b), Froehlich (2008), Froehlich (2016a) were developed by considering 63, 74, and 111 case studies, respectively. Besides, Froehlich (1995a) and Froehlich (2016b) proposed relations for predicting peak outflow with consideration of 22 and 41 case studies, respectively.

Von Thun and Gillette (1990) and Dewey and Gillette (1993) considered 57 case studies, and proposed relations for estimating dam breach parameters by taking into account the effect of dam material (i.e., erodibility). Xu and Zhang (2009) also considered the dam material properties while proposing relations for the prediction of dam breach parameters and peak outflow taking into consideration 75 case studies.

On the other hand, relations proposed by MacDonald and Langridge-Monopolis (1984) is an iterative solution and predicts the volume of material removed from the dam, breach formation time, side slopes, and peak outflow with 42 case studies at the background of relations.

In the modeling, there is a severe uncertainty because of the uncertainties in the flow state, dam breach parameters, and breach mechanism, model formulations, and material properties, and inadequacy of the knowledge about the concept or previous failure events, and shape of the embankment. Moreover, another crucial cause of uncertainty is the inherent variation in the erodibility of the cohesive material, which is related to the soil type and gradation, its degree of compaction, vegetation, and moisture content (Wu et al., 2011; Wahl et al., 2008).

Wahl (2004) conducted an uncertainty analysis of many of the relations used to predict dam breach parameters and peak outflow using data of 108 dam failures compiled by Wahl (1998, as cited in Wahl, 2004) statistically. Uncertainty confidence bands around the predicted value of parameters were expressed by the use of the mean and standard deviation in terms of log cycles. The uncertainty band was used as 95%. To show an implementation of the uncertainty analysis, a case study of an embankment dam in North Dakota was presented. According to the analysis results, high uncertainty in breach formation time, breach width, and peak breach outflow are observed in the considered models.

Another uncertainty analysis was conducted through Latin Hypercube sampling by Ahmadisharaf et al. (2016). The effects of four parametric models for estimating dam breach parameters on geometry, timing, and outflow characteristics of the breach were assessed. The analysis results show that for breach outflow characteristics, the breach formation time is the more vital parameter compared to geometric parameters. On the other hand, outflow characteristics of a breach cannot be described solely based upon dam breach parameters sufficiently. The study also concluded that there is no certain method that has the minimum uncertainty for all breach parameters. Different methods have the least uncertainty for various parameters. However, the least uncertain methods do not always give the result that is the most critical value for a parameter.

For the prediction of the uncertainty of peak outflow and downstream water elevations, Froehlich (2008) conducted an uncertainty analysis through Monte Carlo simulation. For the expected values of the dam breach parameters (i.e., the final breach width, breach formation time, and side slopes), the mathematical relations were generated by considering case studies. Moreover, the required knowledge for the calculation of the variances of the predicted values were given. Then, Monte Carlo simulation was applied to the statistical analysis results. The research was concluded the high uncertainty in peak outflow.

1.3 Scope of the Study

Although the dam breach concept has such importance and is studied by many researchers in literature, the uncertainty in prediction of dam breach parameters and outflow hydrograph have not been handled comprehensively yet. There is a gap in the literature on this subject. As the author is aware, uncertainties in the side slopes and weir coefficient, use of various statistical distributions for dam breach parameters, and assessment of peak outflows in terms of statistical distribution types have not been studied before.

This study presents a probabilistic dam breach model for assessing the effects of the uncertainties of dam breach parameters and inflow hydrograph, which have different probability density functions (PDF) on peak breach outflow utilizing Monte Carlo simulation. Inflow hydrograph may lead to erosion triggering which is normally more critical than geometrical characteristics of the breach. So, more emphasis needs to be given to the probabilistic characteristics of the inflow hydrograph are considered.

The uniqueness of this study results from consideration of the uncertainties of the weir coefficient and the side slopes, different PDFs for input parameters, and determination of the PDF types of the peak discharges of the outflow hydrographs.

A deterministic model is generated by scaling the experimental model conducted by Feliciano Cestero et al. (2015) through Froude similarity. In the probabilistic model, probability density functions of dam breach parameters that are inputs for Monte

Carlo simulation are determined by considering relations in literature and engineering judgment. As a result of the Monte Carlo simulations, peak flow distributions and peak flow exceedance curves are obtained. Then, the goodness of fit tests are conducted to check the suitability of common extreme type distributions used in water resources engineering for peak flow distributions.

In Chapter 2, methods and software used for analyses are explained. Chapter 3 covers the applications of the proposed method step by step. Analysis results are presented and discussed in Chapter 4. Chapter 5 includes the summary of the results, main findings, and future study recommendations.

CHAPTER 2

METHODS USED

2.1 Numerical Modeling of the Breach and Outflow

In the numerical model, trapezoidal breach shape is assumed for analysis by considering suggestions of the previous studies that include historical dam breach failures (MacDonald and Langridge-Monopolis, 1984; Wahl, 1998; Xu and Zhang, 2009). This approximation is also used for probabilistic analysis (Ahmadisharaf et al., 2016) and in practice (Froehlich, 2008). Moreover, Li et al. (2021) showed that initial and final breach shapes can be defined as trapezoidal for non-cohesive embankments.

The breach initiation can be triggered by setting a water surface elevation or a time or a duration and a water surface elevation (Brunner, 2016). In this study, the breach initiation is triggered when the water surface elevation reaches the crest elevation of the dam in the deterministic analysis, while the triggering water surface elevation is characterized with a PDF in the probabilistic analyses. The breach is progressed linearly in every dimension till it reaches its final shape. The breach parameters are shown in Figure 2.1. In the figure, h_b, h_w, and E_b represent the breach depth, the water head over bottom of the breach, and breach final breach bottom elevation, respectively. Moreover, W_b, B_{avg} and B_t refer to the breach bottom width, the average breach width, and the breach top width, respectively. Lastly, Z symbolizes the side slope (1V:ZH).

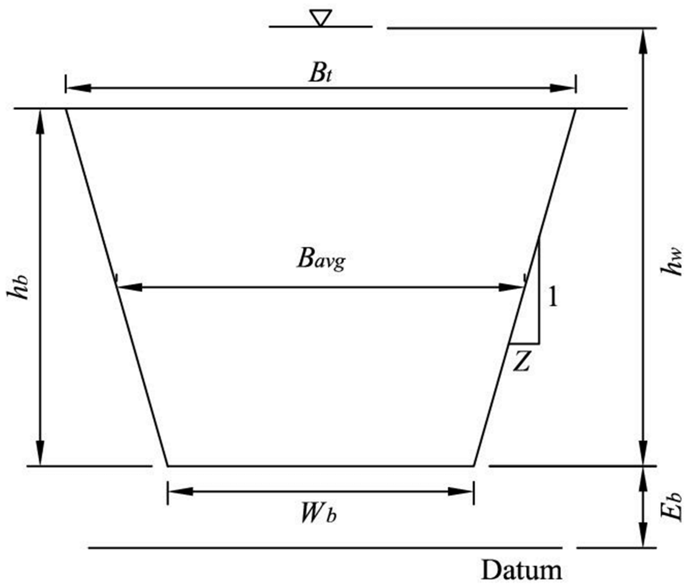


Figure 2.1. Trapezoidal breach cross-section

Dam breach parameters have high uncertainties, and predicting these parameters is not easy despite many studies on statistical regression analysis and physically based models to estimate the parameters. In addition, the nature of the problem makes the evaluation of the uncertainty of parameters almost impossible. In the literature, parametric breach prediction models are commonly developed based on historical data and statistical regression analysis. In probabilistic analysis of this study, probability density functions of dam breach parameters are determined by considering the relations proposed by these parametric models (see Table 2.1). In Table 2.1, the units of the dimensional equations are described in Table 2.2. For simulations, the breach geometry and formation time are randomly generated by considering statistical distributions characterizing parameters. The probabilistic assessment of breaching and application procedures are detailed in the next sections.

Table 2.1 Relations proposed for the estimation of dam breach parameters

Breach prediction model	Relations	Eq.#
USBR (1988)	$B_{avg} = 3h_w$ $t_f = 0.011B_{avg}$	2.1 2.2
Von Thun and Gillette (1990) Easily erodible Erosion resistant	$B_{avg} = 2.5h_w + C_b$ $t_f = 0.015h_w$ $t_f = B_{avg}/(4h_w + 61)$ $Z = 1$ $t_f = 0.02h_w + 0.25$ $t_f = B_{avg}/(4h_w)$ $0.33 \leq Z \leq 0.5$	2.3 2.4 2.5 2.6 2.7
Froehlich (1995b)	$B_{avg} = 0.1803K_0V_w^{0.32}h_b^{0.19}$ $t_f = 0.00254V_w^{0.53}h_b^{-0.90}$ $Z = 1.4\ for\ overtopping$ $K_o = 1.4\ for\ overtopping$	2.8 2.9
MacDonald and Langridge-Monopolis (1984) State of Washington (1992)	$V_{er} = 0.0261(V_{out} \times\ h_w)^{0.769}$ $t_f = 0.0179V_{er}^{0.364}$ $W_b = \frac{V_{er} - h_b^2(C_wZ + h_b(Z)Z_3/3)}{h_b(C_w + h_bZ_3/2)}$	2.10 2.11 2.12
Froehlich (2008)	$B_{avg} = 0.27K_0V_w^{0.32}h_b^{0.04}$ $t_f(s) = 63.2\sqrt{\frac{V_w}{gh_b^2}}$ $Z = 1\ for\ overtopping$ $K_0 = 1.3\ for\ overtopping$	2.13 2.14
Xu and Zhang (2009)	$\frac{B_{avg}}{h_b} = 0.787\left(\frac{h_d}{h_r}\right)^{0.133}\left(\frac{V_w^{1/3}}{h_w}\right)^{0.652} e^{B_3}$ $\frac{B_t}{h_b} = 1.062\left(\frac{h_d}{h_r}\right)^{0.092}\left(\frac{V_w^{1/3}}{h_w}\right)^{0.508} e^{B_2}$ $Z = \frac{B_t - B_{avg}}{h_b}$ $\frac{t_f}{T_{r\prime}} = 0.304\left(\frac{h_d}{h_r}\right)^{0.707}\left(\frac{V_w^{1/3}}{h_w}\right)^{1.228} e^{B_5}$	2.15 2.16 2.17 2.18

Table 2.1 (Contd.)

Froehlich (2016a)	$B_{avg} = 0.23K_0V_w^{1/3}$ $t_f(s) = 60\sqrt{\frac{V_w}{gh_b^2}}$ $Z = 1\ for\ overtopping$ $K_0 = 1.5\ for\ overtopping$	2.19 2.20
Fread (2001) (ft)	$B_{avg} = 9.5K_0(V_wh_w)^{0.25}$ $t_f = 0.3V_w^{0.53}/h_w^{0.90}$ $K_0 = 1\ for\ overtopping$	2.21 2.22
Johnson and Illes (1976)	$0.5h_d \leq B_{avg} \leq 3h_d$ for earthfill dams	2.23
Singh and Snorrason (1982,1984)	$2h_d \leq B_{avg} \leq 5h_d$ $0.15\ m \leq d_{overtop} \leq 0.61\ m$ $0.25\ hr \leq t_f \leq 1\ hr$	2.24
FERC (1987) (B can range) Engineered, compacted dams Non-engineered poorly compacted dams	$1h_d \leq B_{avg} \leq 5h_d$ $0.1\ hr \leq t_f \leq 1\ hr$ $0.25 \leq Z \leq 1$ $0.1\ hr \leq t_f \leq 0.5\ hr$ $1 \leq Z \leq 2$	2.25
Froehlich (1987)	$B_{avg}^* = 0.47K_0(S^*)^{0.25}$ $t_f^* = 79(S^*)^{0.47}$ $Z = 0.75K_c(h_w^*)^{1.57}(\overline{W}^*)^{0.73}$ $K_C = 1\ no\ corewall$ $K_0 = 1.4\ for\ overtopping$	2.26 2.27 2.28
Dewey and Gillette (1993)	$B_{avg} = 2.5h_w + B^*$ $B_{avg}/(4h_w) \leq t_f \leq B_{avg}/(4h_w + 61)$	2.29 2.30
Tabrizi et al. (2017)	$B_{avg} = 5.59h_w^{0.85}$	2.31
Nourani and Mousavi (2013)	$2h_d \leq B_{avg} \leq 3h_d$ $B_{avg} = 2.2839V_w^{0.0635}h_b^{0.8481}$ $0.97\ hr \leq t_f \leq 5.19\ hr$ $t_f = 3.08\ hr\ (average)$ $0.79 \leq Z \leq 1.17$ $Z = 0.98\ (average)$	2.32 2.33

Table 2.2 Units of the variables in Table 2.1

Eq.#	Units of the variables
2.1	B_{avg}: m , h_w: m
2.2	t_f: h , B_{avg}: m
2.3	B_{avg}: m , h_w: m : C_b: constant (consistent with SI units)
2.4	t_f: h , h_w: m
2.5	B_{avg}: m , h_w: m , t_f: h
2.6	t_f: h , h_w: m
2.7	B_{avg}: m , h_w: m , t_f: h
2.8	B_{avg}: m , V_w: m^3 , h_b: m , K_0: constant
2.9	t_f: h , V_w: m^3 , h_b: m
2.10	V_{er}: m^3 , V_{out}: m^3 , h_w: m
2.11	t_f: h , V_{er}: m^3
2.12	W_b: m , V_{er}: m^3 , h_b: m , C_w: m , Z_3: unitless , Z: unitless
2.13	B_{avg}: m , V_w: m^3 , h_b: m , K_0: constant
2.14	t_f: s , V_w: m^3 , h_b: m , g: constant (9.81 m/s^2)
2.15	B_{avg}: m , V_w: m^3 , h_b: m , h_r: m , h_w: m , h_d: constant (m) , B_3: constant
2.16	B_t: m , V_w: m^3 , h_b: m , h_r: m , h_w: m , h_d: constant (m) , B_2: constant
2.17	Z: unitless , B_t: m , B_{avg}: m , h_b: m
2.18	t_f: h , V_w: m^3 , h_b: m , h_r: m , h_w: m , h_d: constant (m) , $T_{r\prime}$: constant (h) , B_5: constant
2.19	B_{avg}: m , V_w: m^3 , h_b: m , K_0: constant
2.20	t_f: s , V_w: m^3 , h_b: m , g: constant (9.81 m/s^2)
2.21	B_{avg}: ft , V_w: ft^3 , h_b: ft , K_0: constant
2.22	t_f: h , V_w: ft^3 , h_w: ft
2.23	B_{avg}: m , h_d: m
2.24	B_{avg}: m , h_d: m
2.25	B_{avg}: m , h_d: m
2.26	B_{avg}^*: dimensionless , S^*: dimensionless , K_0: constant
2.27	t_f^*: dimensionless , S^*: dimensionless
2.28	Z: unitless , h_w^*: dimensionless , $\overline{W}^*$: dimensionless , K_c: constant
2.29	B_{avg}: m , h_w: m , B^*: constant (consistent with SI units)
2.30	B_{avg}: m , h_w: m , t_f: h
2.31	B_{avg}: m , h_w: m
2.32	B_{avg}: m , h_d: m
2.33	B_{avg}: m , V_w: m^3 , h_b: m

The weir equation (Equation 2.34) determines the breach outflow (Q) for a particular time (Cassidy et al., 1998).

$$Q(t) = CW_b(t)h_w(t)^{3/2} \tag{2.34}$$

where *C*, h_w and W_b are the breach weir coefficient in terms of SI unit system, the water head over bottom of the breach in meter and the bottom width of the breach in meter, respectively.

For dam breach models, one-dimensional dynamic wave routing which is considered as the most exact method is applied to inflow hydrograph. The method is based on the Saint-Venant equations (Brunner, 2014). One dimensional Saint-Venant equations are composed of the continuity and the dynamic (momentum) equations. When there is no lateral inflow, the Saint-Venant equations are as follows, for prismatic channels (Akbari and Firoozi, 2010; Sleigh and Goodwill, 2000).

The continuity equation:

$$\frac{\partial y}{\partial t} + D_h \frac{\partial V}{\partial x} + V \frac{\partial y}{\partial x} = 0 \tag{2.35}$$

where

$$D_h = \frac{A}{T} \tag{2.36}$$

The momentum equation:

$$\frac{\partial V}{\partial t} + V \frac{\partial V}{\partial x} + g \frac{\partial y}{\partial x} = g(S_0 - S_f) \tag{2.37}$$

In Equations 2.35 and 2.37, *y*, *V* and *t* represent the depth of flow, velocity of flow, and time, respectively. In these equations, *x* refers to the distance throughout the length of the channel.

In Equation 2.36, D_h is the hydraulic depth which is the ratio of flow area (*A*) to the top width (*T*). In equation 2.37, S_0, S_f, and *g* refer to the bed slope of the channel, slope of the energy grade line and gravitational acceleration, respectively.

The explicit solution of the Saint-Venant equations is not possible without significant assumptions. Therefore, numerical solutions are required (Sleigh and Goodwill, 2000). The Saint-Venant equations are solved implicitly through the finite difference method in HEC-RAS (5.0.7) (Brunner, 2014) (Fallah-Mehdipour et al., 2013).

2.2 Probabilistic Assessment of Breaching at Dams

A reasonable breach outflow hydrograph is an essential input for flood inundation modeling precisely. Therefore, breach hydrograph should be described accurately with a comprehensive model. The probabilistic assessment is required in a dam breach analysis with the intent of the consideration and reduction of the severe uncertainty on dam breach parameters and outflow hydrograph. The Monte Carlo Simulation (MCS) is an efficient tool for probabilistic analysis. Unlike deterministic models, MCS may consider the variability of the input parameters and their long-term effects and has wide ranges of use, such as finance, mathematics, physics, and engineering (Bonate, 2001; Raychaudhuri, 2008). In reliability analysis, the objectives of the implementation of the MCS are validating the analytical solution or solving complicated problems when making assumptions for analytical solutions is challenging (Mahadevan, 1997).

The fundamental of the method is a random sampling of input parameters repeatedly and solving the system mathematically until a single probability value is converged for the simulation outcome. In this study, MCS is applied by utilizing McBreach software (5.0.7) (Goodell, 2019).

In the MCS, firstly, a deterministic model is developed and probability density functions are determined for input parameters. The second step is the generation of random variables by considering probability functions determined for input parameters. Then, an input parameter set is applied on the deterministic model and results an output parameter. This procedure is applied repeatedly until it reaches a predetermined number of simulations. In the final step, statistical analyses of the outcome of simulations are conducted for decision-making (Raychaudhuri, 2008).

In this study, the deterministic model is developed through the software HEC-RAS (5.0.7) (Brunner, 2014), and probability density functions for input parameters, that are final bottom width, final breach bottom elevation, formation time, side slopes, and weir coefficient of the breach, water surface elevation triggering the failure, and peak inflow and time to peak of inflow hydrograph, are determined in accordance with related literature and visual inspection of histograms. Random variables are generated by using McBreach (5.0.7) (Goodell, 2019). The outcome from the deterministic model obtained by HEC-RAS (5.0.7) (Brunner, 2014) through the weir equation is outflow hydrograph parameters (i.e., peak outflow) and the statistical output of the model obtained by McBreach (5.0.7) (Goodell, 2019) is peak flow exceedance curves and peak flow distribution histograms. The computational model is summarized in Figure 2.2.

For the ease of statistical calculations, the frequency histograms are required to be represented with a probability density function. The suitability of the probability density functions proposed for the frequency histogram should be tested. The most common tests used for this purpose are Chi-square and Kolmogorov-Smirnov tests (Yanmaz, 2002). In this research, the Chi-square test is applied to test the goodness of fit. Therefore, solely the Chi-square test is explained.

In the Chi-square test, observed frequency (f_i) is compared to expected frequency (P_i). For this reason, the following parameter is calculated and compared whether its result is less than the critical value. If the result is less than the critical value, proposed probability density function is accepted otherwise it is rejected.

$$\sum_{i=1}^{K} \frac{(f_i - P_i)^2}{P_i} < c_{1-\alpha,f} \tag{2.38}$$

where $c_{1-\alpha,f}$ is the critical value and the function of significance level $(1-\alpha)$ and degree of freedom (f). The degree of freedom is determined from $f = K - 1$ where K is the number of parameters. The critical value is obtained from the Chi-square table by considering these variables (Yanmaz, 2002).

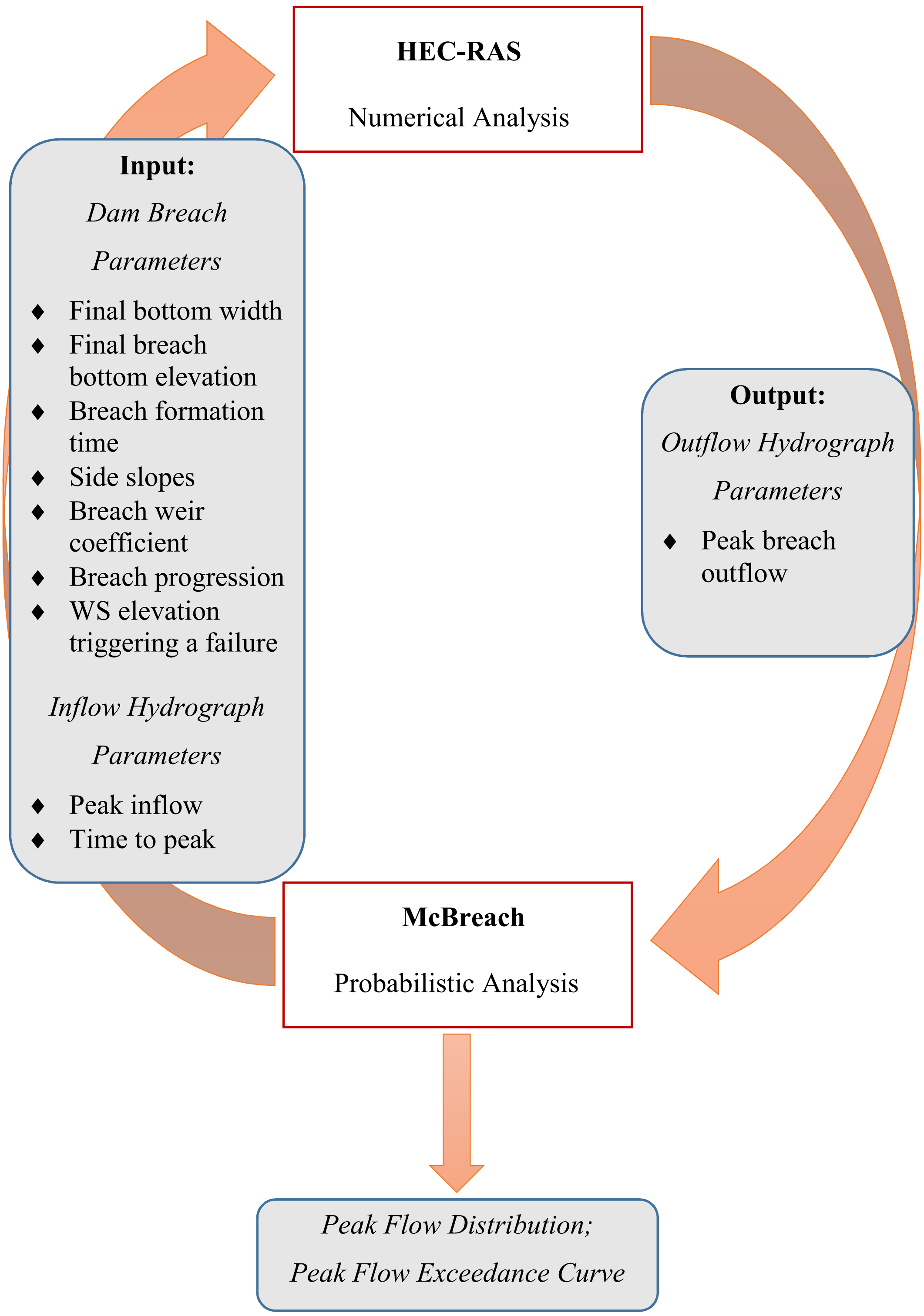


Figure 2.2. Computational model

In this chapter, the numerical modeling of the breach and outflow and probabilistic assessment of breaching at dams are explained with the computational model. The application of the computational model is detailed in the following chapter.

CHAPTER 3

APPLICATION STUDY

3.1 Definition

Feliciano Cestero et al. (2015) conducted an experimental study to examine the effects of dam material properties on dam breaching process of earthen dams due to overtopping. There were 8 experiments that consist of different dam material compositions by changing sand, silt, and clay percentages, including 100% sand case. For all experiments, the channel and dam geometries were the same. The channel length and cross-section dimensions were 14.7 m and 0.5 m × 0.7 m, respectively. The dam is constructed with a height of 0.25 m and a crest width of 0.1 m, while the upstream and downstream slopes are 1V:3H. For controlling the failure, there is a rectangular pilot channel whose depth and width are 0.03 m and 0.1 m, respectively, at the crest center. Two pumps that provide a maximum discharge of 5.4×10^{-3} m^3/s together were used for the experiment. In this study, the second experiment, conducted by Feliciano Cestero et al. (2015), whose dam material is fully sand (i.e., 100% sand) is selected for scaling by Froude similarity. The gradation curve properties of the fill material are D_{10} = 0.33 mm, D_{30}= 0.50 mm, and D_{60}= 0.70 mm.

3.2 Froude Scaling of the Model

Froude scaling is applied to the experimental model since the heights of modeled dams in HEC-RAS (5.0.7) (Brunner, 2014) for dam breach analysis change around 10 m and 100 m in general, although there is no restriction stated in HEC-RAS User's Manual. (Yochum et al., 2008; Yi, 2011; Azeez et al., 2020; Bellos et al., 2020; Najar and Gul, in press; Brunner, 2016).

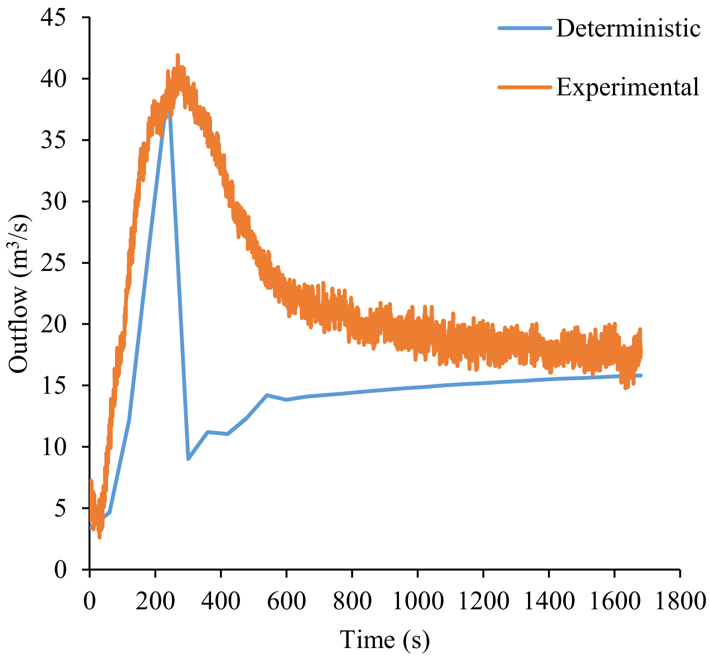
The Froude similarity is applicable for free surface flows since it considers the ratio of inertia force to gravitational force. For the dynamic similarity, the Froude numbers of the model and prototype should be equal (Munson et al., 2013). In the light of Froude number equality, velocity ratio (V_r) and time ratio (T_r) are obtained as the square root of length ratio (L_r). Moreover, the discharge ratio (Q_r) is determined as $L_r^{5/2}$ by considering the velocity and area ratio.

In this research, different length ratios that are 1/25, 1/36, 1/64, and 1/100 are investigated to decrease the relative error as shown in Table 3.1 to the minimum value for the remaining parts of the study. For each alternative, peak discharge (Q_p), time to peak (t_p), final steady-state discharge (Q_f), and volume of the total flow (V_t) are compared to experimental results as shown in Table 3.1 and calculated error rates are compared to length ratio alternatives. The numerical integration method (i.e. the trapezoidal rule) is used for the approximation of the area under the outflow hydrograph which is equal to the volume of total flow.

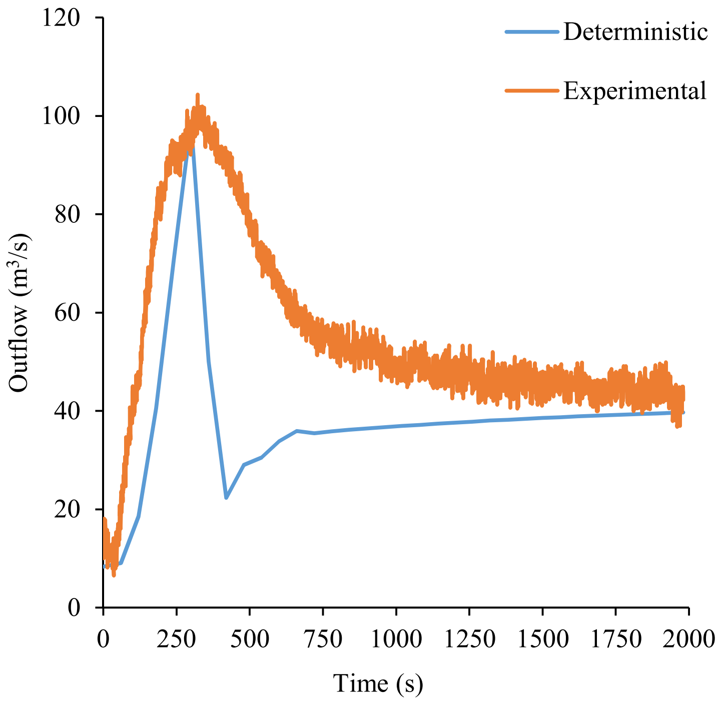
Table 3.1 Comparison of L_r of Froude modeling

Length scale	Model	Q_p (m^3/s)	t_p (s)	Q_f (m^3/s)	V_t (m^3)
1/25	Experimental	41.92	268.50	18.15	37310.55
	Deterministic	39.54	240	15.82	25163.10
	Relative error (%)	5.67	10.61	12.86	32.56
1/36	Experimental	104.30	322.30	42.19	109831.53
	Deterministic	98.85	300	39.68	75468.90
	Relative error (%)	5.22	6.92	5.95	31.29
1/64	Experimental	439.52	429.60	199.91	617105.55
	Deterministic	470.88	420	169.68	441405.30
	Relative error (%)	7.14	2.23	15.12	28.47
1/100	Experimental	1341.30	537	542.56	2354070.85
	Deterministic	1400.48	540	524.45	1729887.90
	Relative error (%)	4.41	0.56	3.34	26.52

Outflow hydrographs for deterministic and experimental models are shown in Figure 3.1 for each alternative.

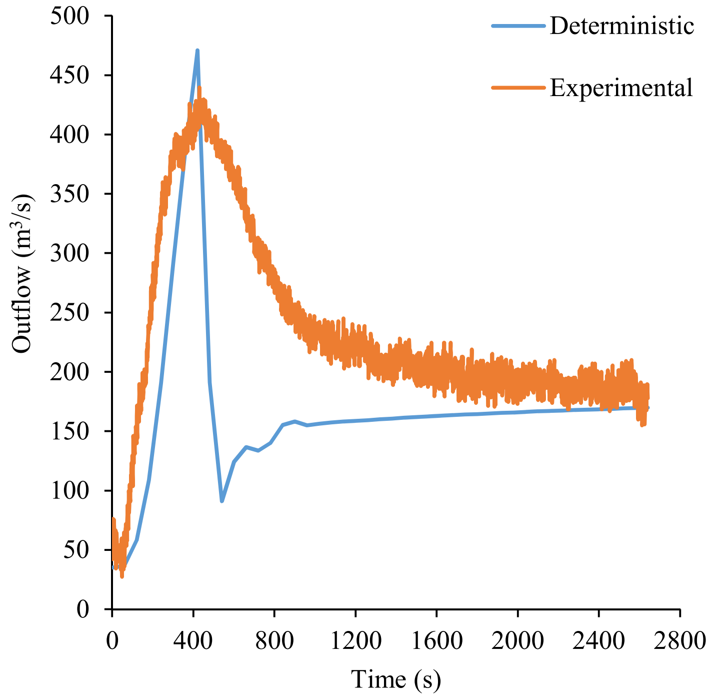


(a)

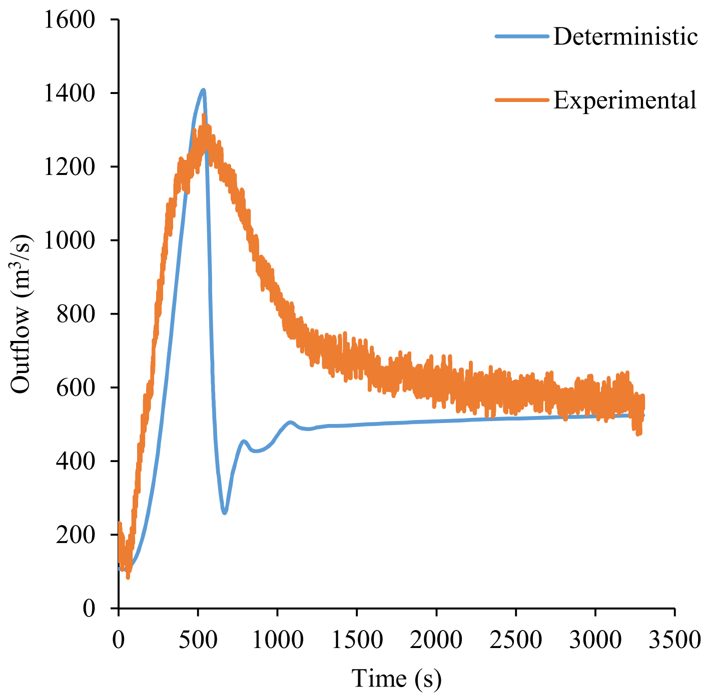


(b)

Figure 3.1. Outflow hydrographs of length ratio alternatives a) $L_r = 1/25$ b) $L_r = 1/36$ c) $L_r = 1/64$ d) $L_r = 1/100$



(c)



d)

Figure 3.1. (Contd.)

Comparisons showed that less error is observed in the 1/100 length ratio. Therefore, the deterministic model which is used for the analysis is constructed based on the length ratio of 1/100 as shown in Figure 3.2.

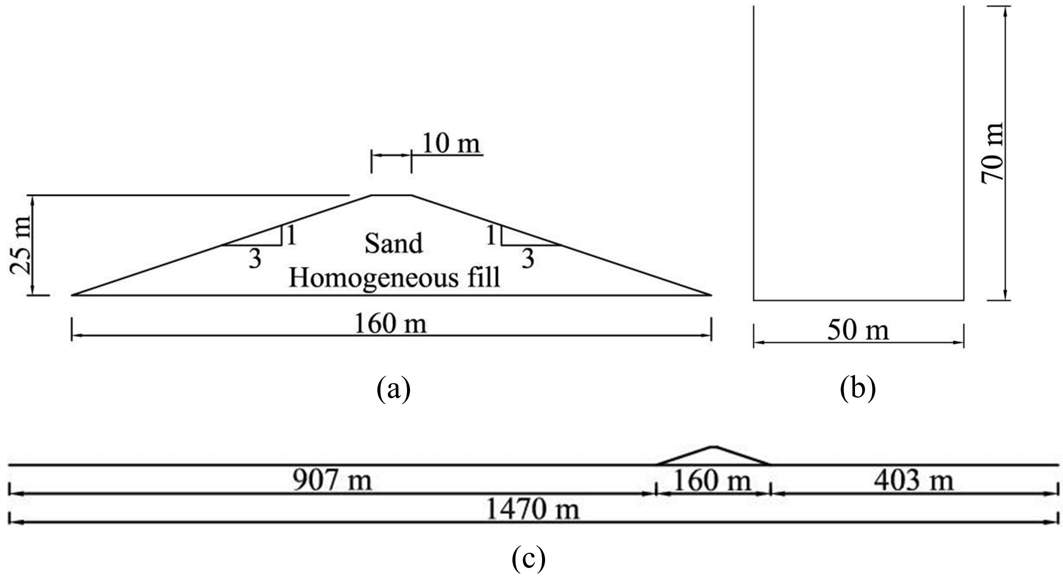


Figure 3.2. Views of the deterministic model a) dam cross-section b) channel cross-section c) channel longitudinal view

3.3 Deterministic Inflow and Breach Characteristics

The inflow hydrograph is determined by considering the discharge ratio mentioned above and plotted for a 10s of time interval (Δt = 10s) with a maximum discharge of 540 m^3/s as shown in Figure 3.3. The inflow hydrograph is directly developed from Feliciano Cestero et al. (2015) research by scaling. Only one hydrograph is considered in this study since Feliciano Cestero et al. (2015) provided one inflow hydrograph.

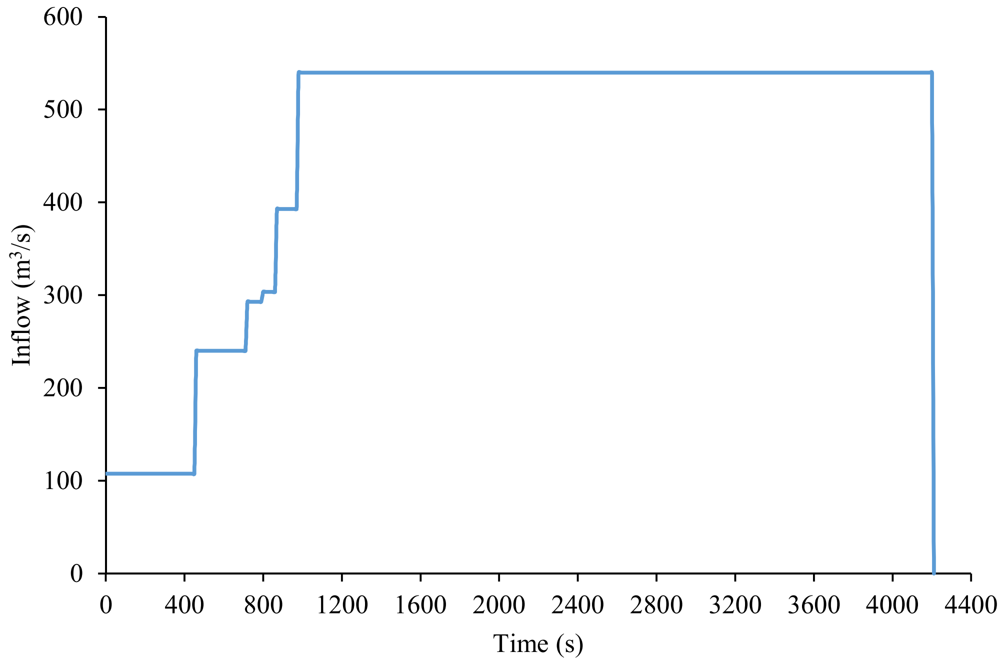


Figure 3.3. Inflow hydrograph of deterministic model

The breach characteristics are determined under the guidance of researches of Feliciano Cestero et al. (2015) and Brunner (2016). The final bottom width is 50 m, such that the dam is completely failed. The failure is triggered by a pilot channel at crest level (25 m). Feliciano Cestero et al. (2015) provided the contour map after the breach reached the final shape and the lowest elevation in contour lines is read as the final breach bottom elevation which is 5 m. Since there is no knowledge about side slopes, they are assumed as 1V:1H which is the most common suggestion for overtopping failure and easily erodible dam material (Wahl, 1998). The breach formation time starts with the observance of considerable erosion and ends when the breach reaches to its final dimensions. Therefore, the time between the beginning of the increase in discharge and the end of the considerable erosion where a significant decrease in discharge ends is breach formation time which is 0.39 hr, according to HEC-RAS User's Manual (Wahl, 2014). Although breach weir coefficient has an important effect on outflow hydrograph in terms of magnitude, its exact value for a dam cannot be known because it depends on reservoir storage volume, dam material and height, inflow, type and degree of protection on dam faces (e.g. riprap, vegetation or bare soil), overtopped water characteristics (i.e. duration, depth) (Brunner, 2014). Therefore, it is an estimated parameter and assumed as 1.44 for this model, in line with the suggestion of Brunner (2014) as the breach weir coefficient for most earth dams. The breach progression is assumed as linear through breach formation time. Dam breach parameters are summarized in Table 3.2 and the breach cross-section is shown in Figure 2.1.

Table 3.2 Breach and inflow parameters of the deterministic model

Parameter	Value
Peak inflow, I_p (m^3/s)	540
Time to peak, t_p (s)	980
Final breach bottom elevation, E_b (m)	5
Final bottom width, W_b (m)	50
Side slopes, Z	1V:1H
Breach formation time, t_f (hr)	0.39
WS elevation triggering the failure, E_t (m)	25
Breach weir coefficient, C	1.44
Breach progression, P_b	Linear

The deterministic analysis is conducted in HEC-RAS (5.0.7) software (Brunner, 2014) by using the aforementioned dam breach parameters to compare its resulting outflow hydrograph with the outflow hydrograph obtained as a result of the experiment (see Figure 3.1(d)). Hereby, validation of the deterministic model is assessed by considering the error rate before proceeding with the probabilistic analysis (see Table 3.1).

3.4 The Probabilistic Analysis

In the probabilistic analysis, the numerical model developed in HEC-RAS (5.0.7) (Brunner, 2014) is used by considering dam breach parameters as probabilistic except the breach progression which is considered as deterministic and linear. Moreover, the inflow hydrograph is considered either deterministic or probabilistic in different alternatives.

In this study, 7 alternatives are assessed by considering different types and characteristics of probability density functions (PDFs) and the nature of the variables (i.e. random or deterministic) for input parameters, with the intent of comparison. All alternatives and input parameters that are explained in the following are summarized in Table 3.3.

Table 3.3 Summary table for alternatives and input parameters

	Variable	Nature	PDF type	μ	COV	Range	Mode	Value
Alternative 1	I_p (m^3/s)	Random	Normal	540	0.2	-	-	-
	t_p (s)	Random	Normal	980	0.2	-	-	-
	E_b (m)	Random	Triangular	-	-	-5.5-17.5	0	-
	W_b (m)	Random	Triangular	-	-	0-43.6	15	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.68	0.25	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear
Alternative 2	I_p (m^3/s)	Random	Uniform	-	-	486-594	-	-
	t_p (s)	Random	Uniform	-	-	880-1080	-	-
	E_b (m)	Random	Triangular	-	-	-5.5-17.5	0	-
	W_b (m)	Random	Triangular	-	-	0-43.6	15	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.68	0.25	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear

Table 3.3 (Contd.)

Alternative 3	I_p (m^3/s)	Deterministic	-	540	-	-	-	-
	t_p (s)	Deterministic	-	980	-	-	-	-
	E_b (m)	Random	Triangular	-	-	-5.5-17.5	0	-
	W_b (m)	Random	Triangular	-	-	0-43.6	15	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.68	0.25	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear
Alternative 4	I_p (m^3/s)	Random	Normal	540	0.2	-	-	-
	t_p (s)	Random	Normal	980	0.2	-	-	-
	E_b (m)	Random	Uniform	-	-	0-10	-	-
	W_b (m)	Random	Triangular	-	-	0-43.6	30	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.73	0.5	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear
Alternative 5	I_p (m^3/s)	Random	Uniform	-	-	486-594	-	-
	t_p (s)	Random	Uniform	-	-	880-1080	-	-
	E_b (m)	Random	Uniform	-	-	0-10	-	-
	W_b (m)	Random	Triangular	-	-	0-43.6	30	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.73	0.5	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear
Alternative 6	I_p (m^3/s)	Deterministic	-	540	-	-	-	-
	t_p (s)	Deterministic	-	980	-	-	-	-
	E_b (m)	Random	Uniform	-	-	0-10	-	-
	W_b (m)	Random	Triangular	-	-	0-43.6	30	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.73	0.5	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear

Table 3.3 (Contd.)

Alternative 7	I_p (m^3/s)	Random	Normal	540	0.2	-	-	-
	t_p (s)	Random	Normal	980	0.2	-	-	-
	E_b (m)	Random	Uniform	-	-	-5.5-17.5	-	-
	W_b (m)	Random	Triangular	-	-	0-43.6	15	-
	Z	Random	Triangular	-	-	0.5-1.4	1	-
	t_f (hr)	Random	Triangular	-	-	0.22-0.68	0.25	-
	E_t (m)	Random	Uniform	-	-	25-25.61	-	-
	C	Random	Uniform	-	-	1.1-1.8	-	-
	P_b	Deterministic	-	-	-	-	-	Linear

Input parameters are probabilistically defined in terms of PDFs, as mentioned above. The determination of the PDFs is based on parametric models for the prediction of dam breach parameters and uncertainty analysis in the literature, and assumptions made by engineering judgment.

The breach width, breach formation time, and side slopes are determined by previous parametric models. The main input of the parametric models is the breach depth which is correlated with the final breach bottom elevation. However, final breach bottom elevation is the most uncertain parameter since any particular relation and approach are not proposed for its prediction except the suggestion for a breach to dam height ratio by Ahmadisharaf et al. (2016). Therefore, PDF for final breach bottom elevation is assumed based on this suggestion and engineering judgment. For the breach depth to dam height ratio, minimum, maximum, and mode values are obtained as 0.3, 1.22, and 1, respectively (Ahmadisharaf et al., 2016). Hereby, for the dam height of 25 m, the final breach bottom elevation is characterized as triangular PDF with minimum, maximum and mode of -5.5, 17.5, and 0 m, respectively. Moreover, the same upper and lower boundaries that are -5.5 and 17.5 are used for characterizing the final breach bottom elevation with a uniform PDF without changing any other parameter distribution to investigate the effect of final breach bottom elevation uncertainty on breach outflow. The final breach bottom elevation of -5.5 m denotes the negative scour depth in which the breach formation expands below the base level, negative scour depth may be observed in breach failures, such as Lake Elizabeth Dam in South Carolina (Tabrizi et al., 2017).

As an alternative for final breach bottom elevation, a uniform PDF is considered with the minimum and maximum values of 0 and 10 m, respectively. Determination of PDF boundaries is based on the assumption that the assumed final breach bottom elevation of the deterministic model (i.e. 5 m) is the mean value for the uniform PDF.

Parametric models are used for the prediction of the breach width, breach formation time, and side slopes by using final breach bottom elevations of 0 and 10 m as shown in Table 3.4-3.5. Then, histograms are generated based on these models to assign PDFs.

Table 3.4 Results of parametric models for final breach bottom elevation = 0 m

Breach prediction model	B_{avg} (m)		t_f (h)		W_b (m)		Z	
USBR (1988)	75		0.825		N/A		N/A	
Von Thun and Gillette (1990) (easily erodible)	68.6		0.43	0.38	43.6		1	
Erosion resistant	68.6		0.69	0.75	56.1		0.33	0.5
Froehlich (1995b)	40.8		0.23		5.8		1.4	
MacDonald and Langridge-Monopolis (1984)	N/A		0.59		-2		0.5	
Froehlich (2008)	35		0.24		10		1	
Xu and Zhang (2009)	43.4		0.68		18.4		1	
Froehlich (2016a)	36.5		0.23		11.5		1	
Fread (2001)	48.5		0.22		N/A		N/A	
Johnson and Illes (1976)	12.5	75	N/A		N/A		N/A	
Singh and Snorrason (1982,1984)	50	125	0.25	1	N/A		N/A	
FERC (1987)	25	125			0	118.8		
Engineered, compacted dams	50	100	0.1	1			0.25	1
Non-engineered poorly compacted dams			0.1	0.5			1	2
Froehlich (1987)	48.5		2.62		2.7		1.83	
Dewey and Gillette (1993)	68.6		0.69	0.43	43.6		1	
Tabrizi et al. (2017)	86.2		N/A		N/A		N/A	
Nourani and Mousavi (2013)	50	75	0.97	5.19	20.75	55.25	0.79	1.17
Nourani and Mousavi (2013)	85.1		3.08		60.6		0.98	

Table 3.5 Results of parametric models for final breach bottom elevation = 10 m

<table>
<tr><td>Reference</td><td colspan="2">B_{avg} (m)</td><td colspan="2">t_f (h)</td><td colspan="2">W_b (m)</td><td colspan="2">Z</td></tr>
<tr><td>USBR (1988)</td><td colspan="2">45</td><td colspan="2">0.495</td><td colspan="2">N/A</td><td colspan="2">N/A</td></tr>
<tr><td>Von Thun and Gillette (1990) (easily erodible)</td><td colspan="2">43.6</td><td>0.36</td><td>0.23</td><td colspan="2">28.6</td><td colspan="2">1</td></tr>
<tr><td>Erosion resistant</td><td colspan="2">43.6</td><td>0.73</td><td>0.55</td><td colspan="2">36.1</td><td>0.33</td><td>0.5</td></tr>
<tr><td>Froehlich (1995b)</td><td colspan="2">37.0</td><td colspan="2">0.37</td><td colspan="2">16.0</td><td colspan="2">1.4</td></tr>
<tr><td>MacDonald and Langridge-Monopolis (1984)</td><td colspan="2">N/A</td><td colspan="2">0.51</td><td colspan="2">6.4</td><td colspan="2">0.5</td></tr>
<tr><td>Froehlich (2008)</td><td colspan="2">34.3</td><td colspan="2">0.41</td><td colspan="2">19.3</td><td colspan="2">1</td></tr>
<tr><td>Xu and Zhang (2009)</td><td colspan="2">36.3</td><td colspan="2">1.27</td><td colspan="2">21.3</td><td colspan="2">1</td></tr>
<tr><td>Froehlich (2016a)</td><td colspan="2">36.5</td><td colspan="2">0.39</td><td colspan="2">21.5</td><td colspan="2">1</td></tr>
<tr><td>Fread (2001)</td><td colspan="2">42.7</td><td colspan="2">0.34</td><td colspan="2">N/A</td><td colspan="2">N/A</td></tr>
<tr><td>Johnson and Illes (1976)</td><td>12.5</td><td>75</td><td colspan="2">N/A</td><td colspan="2">N/A</td><td colspan="2">N/A</td></tr>
<tr><td>Singh and Snorrason (1982,1984)</td><td>50</td><td>125</td><td>0.25</td><td>1</td><td colspan="2">N/A</td><td colspan="2">N/A</td></tr>
<tr><td>FERC (1987)</td><td>25</td><td>125</td><td colspan="2"></td><td>10</td><td>121.3</td><td colspan="2"></td></tr>
<tr><td>Engineered, compacted dams</td><td>50</td><td>100</td><td>0.1</td><td>1</td><td colspan="2"></td><td>0.25</td><td>1</td></tr>
<tr><td>Non-engineered poorly compacted dams</td><td colspan="2"></td><td>0.1</td><td>0.5</td><td colspan="2"></td><td>1</td><td>2</td></tr>
<tr><td>Froehlich (1987)</td><td colspan="2">42.7</td><td colspan="2">4.18</td><td colspan="2">2.8</td><td colspan="2">2.66</td></tr>
<tr><td>Dewey and Gillette (1993)</td><td colspan="2">43.6</td><td>0.73</td><td>0.36</td><td colspan="2">28.6</td><td colspan="2">1</td></tr>
<tr><td>Tabrizi et al. (2017)</td><td colspan="2">55.9</td><td colspan="2">N/A</td><td colspan="2">N/A</td><td colspan="2">N/A</td></tr>
<tr><td>Nourani and Mousavi (2013)</td><td>50</td><td>75</td><td>0.97</td><td>5.19</td><td>32.45</td><td>63.15</td><td>0.79</td><td>1.17</td></tr>
<tr><td>Nourani and Mousavi (2013)</td><td colspan="2">55.2</td><td colspan="2">3.08</td><td colspan="2">40.5</td><td colspan="2">0.98</td></tr>
</table>

Since HEC-RAS (5.0.7) (Brunner, 2014) requires the bottom width of the breach as an input, the bottom widths are determined by considering corresponding side slopes for a model. Therefore, models without side slopes suggestion and whose results are out of channel width are not taken into account for generating the histogram of breach bottom width. Moreover, equations for the erosion-resistant dams are not considered in generating a histogram of any parameter since the dam material in this study is easily erodible. Models with range and without equation suggestion are not taken into account for generating a histogram of any parameter, since they are old-dated researches and only consider dam height whereas there are a lot of parameters that affect the dam breach parameters. To sum up, histograms for breach bottom width, breach formation time, and side slopes are created by considering 6, 8, and 9 relations, respectively. While generating histograms for parameters by considering different final breach bottom elevation PDFs, parametric model results for the final breach bottom elevation of 0 m are used for the histograms belonging to alternatives with triangular PDF of final breach bottom elevation since the mode of the triangular PDF is 0 m. On the other hand, results for both final breach bottom elevations of 0 m and 10 m are used for the histograms belonging to alternatives with uniform PDF of final breach bottom elevation because the minimum and maximum values of the uniform PDF are 0 m and 10 m. Although the number of data that are used to obtain a histogram is insufficient to define a PDF, PDFs are assumed based on the resemblance of the shape of the histogram. The breach bottom width, breach formation time, and side slopes are characterized with triangular PDF by considering shapes of generated histograms (Figure 3.4).

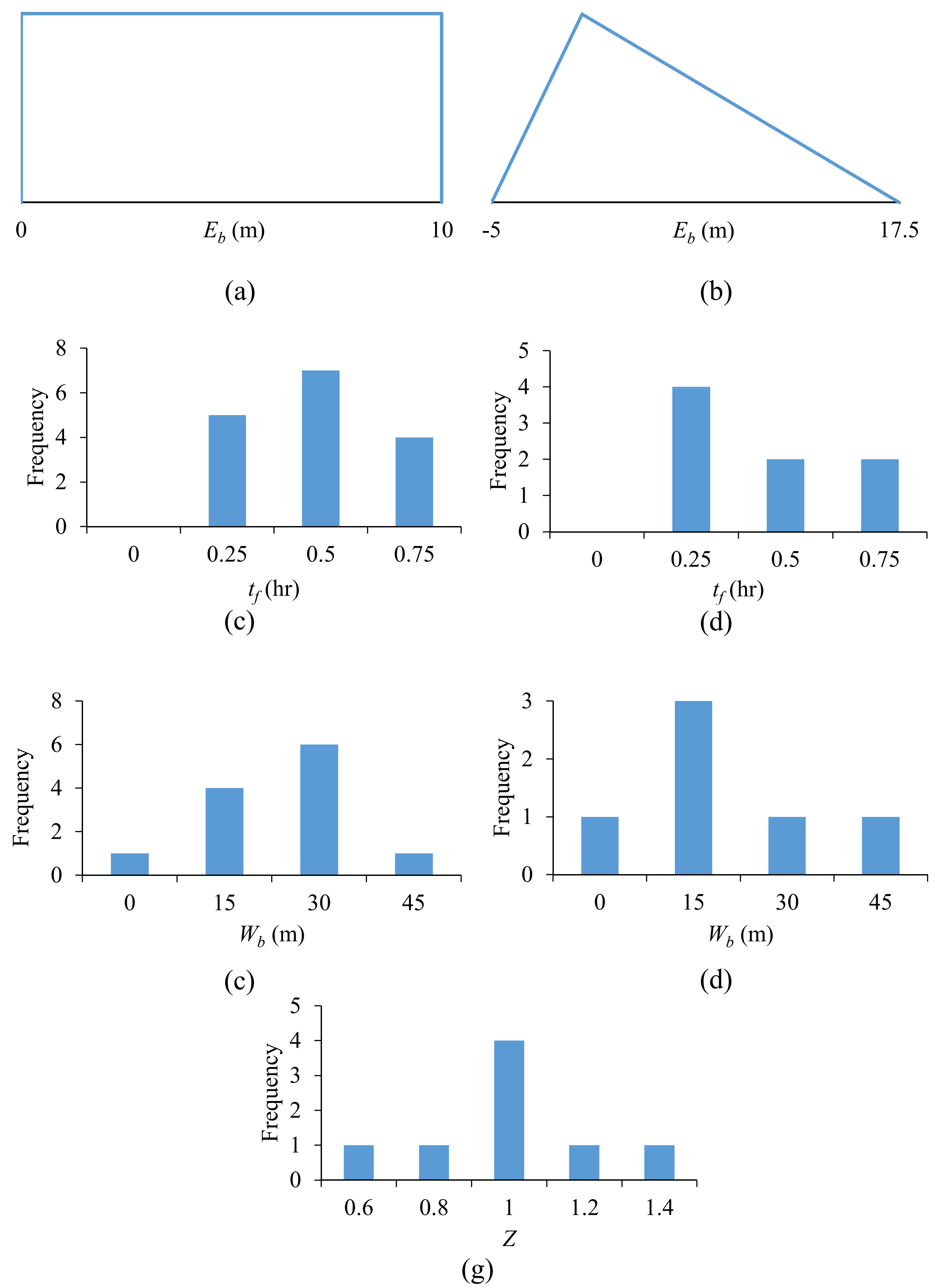


Figure 3.4. Frequency histograms of dam breach parameters for final breach bottom elevation of a) uniform PDF and b) triangular PDF; left columns show histogram of parameters based on E_b = uniform PDF and right column show histogram of parameters based on E_b = triangular PDF: c-d) t_f , e-f) W_b , g) Z

On the other hand, starting water surface elevation for triggering failure is characterized with a uniform PDF. FEMA (1987) suggests that critical overtopping depth changes based on the dam condition between 0 and 0.6 m (Froehlich, 1995b). Moreover, according to Singh and Snorrason's (1982, 1984) suggestion, the critical overtopping depth is between 0.15 m and 0.61 m (Wahl, 1998). Therefore, the minimum and maximum values for starting water surface elevation for triggering failure are defined as 25 m and 25.61 m which gives the critical overtopping depth between 0 m and 0.61 m.

Furthermore, the breach weir coefficient is characterized with a uniform PDF with a minimum and maximum values of 1.1 and 1.8 in the SI system, respectively, since it is the proposed range for overtopping failure by Brunner (2016).

Another important parameter that affects breach progression is the inflow hydrograph. Inflow hydrograph is defined by peak inflow and time to peak. Three different alternatives are considered for peak inflow and time to peak, which are deterministic and probabilistic with a uniform PDF, and normal PDF.

For the deterministic inflow hydrograph, the same inflow hydrograph used in deterministic model is considered (Figure 3.3). For the determination of the inflow hydrograph characterized with normal PDF, the mean and coefficient of variation (COV) values of peak inflow and time to peak are required to be defined. The mean values are defined as 540 m^3/s and 980 s for peak inflow and time to peak, respectively, while the COVs are determined as 0.2 which is the same for both parameters with the guidance of Kentel et al. (2008). In another alternative, inflow hydrograph is characterized with uniform PDF. The minimum and maximum values are defined as 486 and 594 m^3/s and 880 and 1080 s for peak inflow and time to peak, respectively.

The number of Monte Carlo simulations is determined by considering COV(Q_p)s of different sample sizes. A total number of thirty analyses are conducted with sample sizes of 100, 500, 1000, 5000, 7500, and 10,000. For each sample size, five analyses are run with Monte Carlo Simulation. As a result of the analyses, convergence of COV(Q_p) to 0.10 is observed when the number of simulations reaches 10,000, as shown in Figure 3.6. Therefore, 10,000 Monte Carlo simulations are determined sufficient for analyses.

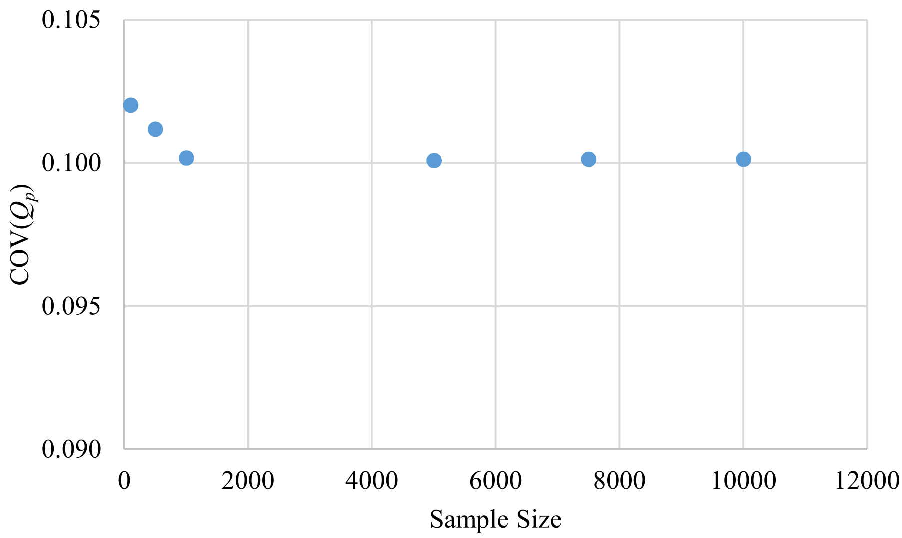


Figure 3.5. Sample size vs COV(Q_p) graph

In this chapter, Froude scaling of the model, deterministic model with inflow and breach characteristics, the probabilistic analysis, and determination of the number of Monte Carlo simulations are covered in detail. Determination of the probability density functions for breach parameters is explained. The analysis results are examined in the following chapter in detail.

CHAPTER 4

RESULTS AND DISCUSSION

In the beginning, interpretation of deterministic and probabilistic analysis comparisons are made. In deterministic analysis, one dam breach geometry and other characteristics and the resulting peak outflow are considered, whereas, in probabilistic analysis, different dam breach geometries and various resulting discharges for three exceedance probabilities are shown as an example (see Table 4.1 and 4.2). Changes in breach characteristics create different peak outflows. All these cases are probable. Ten thousand scenarios are taken into account for each alternative in this study.

The probabilistic analysis considers different dam breach characteristics that are possible to happen with various exceedance probabilities and provides different peak breach outflows, while deterministic analysis considers one. Breach characteristics develop based on the structural composition of the dam. For a real dam, when dam material properties like cohesion, moisture content, compaction degree are considered, different breach geometries may cause different breach outflows. The uncertainty in these properties is high, as mentioned before. Therefore, consideration of various scenarios is beneficial and required for more precise peak breach outflows and taking measures. Probabilistic analysis is superior to deterministic analysis.

Table 4.1 Outline of deterministic analysis

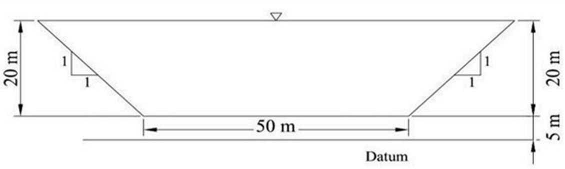
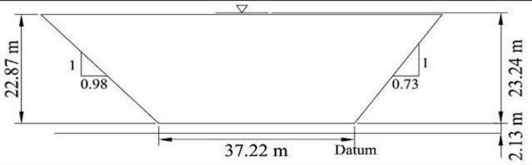
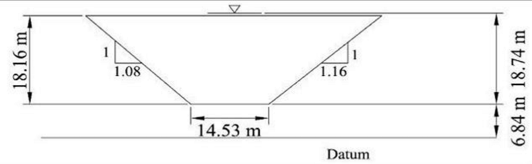
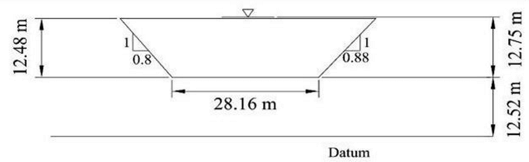
Case	I_p (m^3/s)	Q_p (m^3/s)	Breach characteristics
Deterministic	540	1400.48	 t_f = 23.4 min, C = 1.44

Table 4.2 Outline of probabilistic analysis

Case	I_p (m^3/s)	Q_p (m^3/s)	EP (%)	Breach characteristics
Probabilistic	540	1453	1	 t_f = 16.8 min C = 1.57
Probabilistic	540	1019	50	 t_f = 17.4 min C = 1.71
Probabilistic	540	775	95	 t_f = 26.4 min C = 1.35

When peak flow exceedance (PFE) data are considered, it is seen that peak flow shows a decreasing trend while exceedance probability (EP) is increasing (see Figure 4.1). The graph is generated using EPs provided by McBreach (5.0.7) software (Goodell, 2019) for seven alternatives (see Appendix A). The results are examined according to these outputs. Between 0.2 and 10 % EP, this decline that is concave up looks logarithmic and steeper compared to the remaining part for all alternatives. On the other hand, concave down and milder decreasing are observed between 90 and 99 % EP in general trend while it is steeper for Alternatives 1-3 and 7. The variation in the upper and lower bounds of the final breach bottom elevations may cause this difference. The main behavior of the peak flow against exceedance probability does not change.

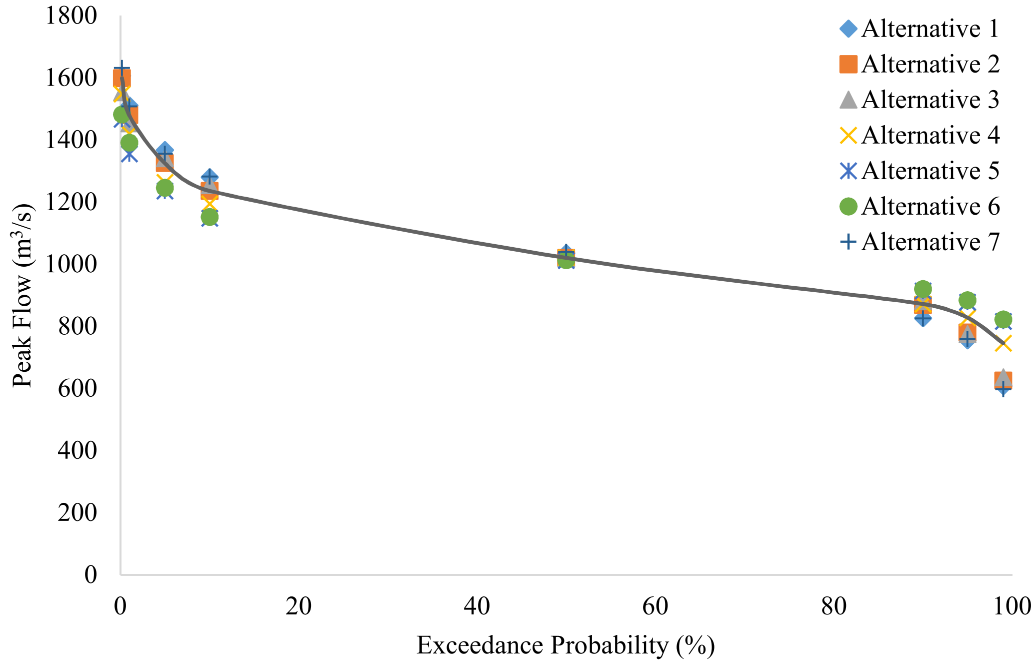


Figure 4.1. Peak flow exceedance plot

Inflow hydrographs defined with normal PDF cause the highest breach outflow for 0.2% exceedance probability (EP) vice versa they cause the least breach outflow for 99% exceedance probability in comparison with other alternatives (see Figure 4.2 and 4.3). This indicates that the inflow hydrograph characterized with normal PDF covers a broader range.

On the other hand, inflow hydrographs that are deterministic or characterized with the uniform PDF show different behavior in changing final breach bottom elevation PDFs and between 0.2 and 99% EPs (see Figure 4.2 and 4.3). However, the difference in boundaries of the final breach bottom elevation may be the reason of this inconsistency. Moreover, these results may vary from analysis to analysis since 10,000 random input sets are created in every analysis.

In sensitivity analysis on the final breach bottom elevation (Alternatives 1 and 7), PFE curves show that the maximum and minimum breach outflow for 0.2 and 99% exceedance probabilities, respectively, are obtained by the final breach bottom elevation characterized with the uniform PDF (see Figure 4.4), however, there is no significant difference. On the other hand, the final breach bottom elevation characterized with triangular PDF results in greater breach outflow for 0.2% EP than defined with uniform PDF one and vice versa for 99% EPs among Alternatives 1-6. The difference in upper and lower bounds of the final breach bottom elevations may cause the increment on this difference more than the type of PDF. Therefore, considering Alternatives 1 and 7 is better for assessing the effect of the final breach bottom elevation on breach outflow.

The consideration of peak flow exceedance data rather than peak flow exceedance curves is better for the interpretation since the trend does not change, although these discharge and exceedance probability results may vary from analysis to analysis due to the generation of 10,000 random input sets in every analysis.

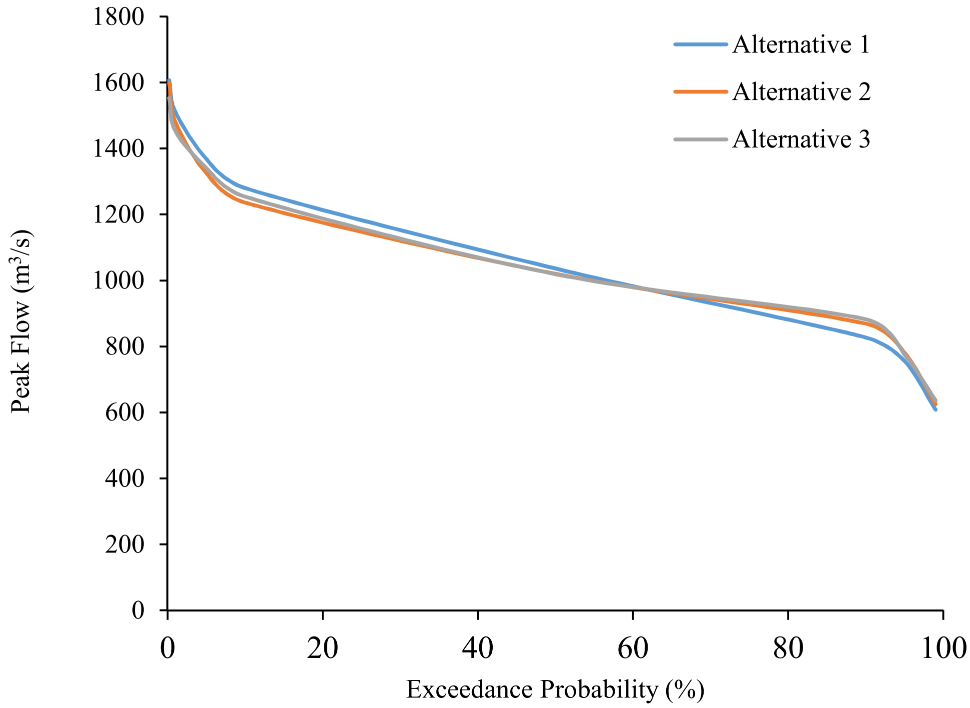


Figure 4.2. Peak flow exceedance curves for E_b with triangular PDF

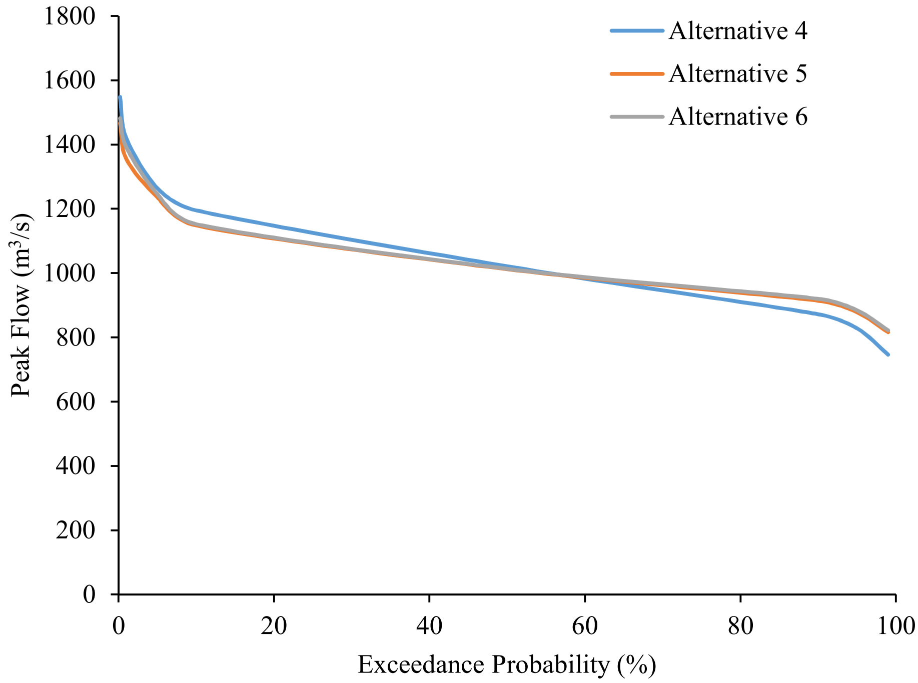


Figure 4.3. Peak flow exceedance curves for E_b with uniform PDF

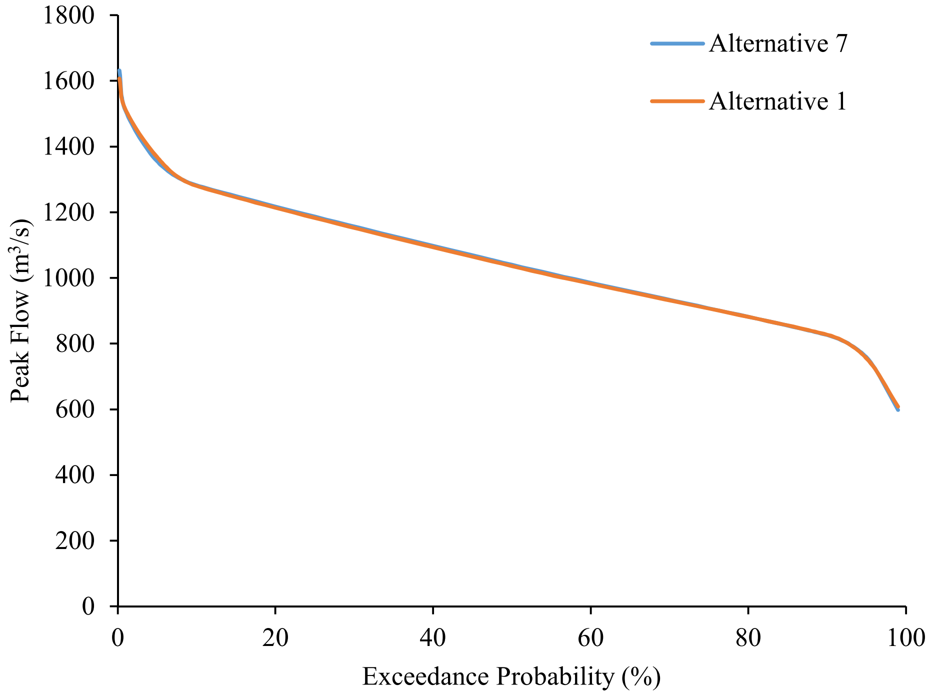


Figure 4.4. Peak flow exceedance curves for sensitivity analysis of E_b

The summary of the analysis results is shown in Table 4.3. The assessment of results in terms of probabilistic parameters provides better judgments. When the mean and standard deviation are sorted in descending order for alternatives with different inflow hydrographs, inflow hydrographs characterized with normal PDF are greater than deterministic inflow hydrograph, and the deterministic one is greater than inflow hydrograph with uniform PDF. However, COV(Q_p) is equal for deterministic and uniform PDF ones while the normal PDF one has the highest COV(Q_p). These show that inflow hydrograph defined with normal PDF is more dispersed around the mean while deterministic and uniform PDF ones are less dispersed. Besides, the important point is that deterministic and uniform PDF ones show a similar manner. For skewness and kurtosis, inflow hydrographs defined with normal PDF results in the least value than deterministic and uniformly defined PDF ones. Although all are right-skewed and heavy-tailed distributions, alternatives with inflow hydrographs characterized with normal PDF are the ones closest to normal distribution. However, ordering skewness and kurtosis for deterministic inflow hydrograph and inflow hydrograph characterized with uniform PDF differs based on the distribution type and boundaries of the final breach bottom elevation. Deterministic inflow hydrograph causes less skewness and kurtosis than inflow hydrograph characterized with uniform PDF for the final breach bottom elevation defined with triangular PDF; on the contrary, the exact opposite situation is observed for the final breach bottom elevation characterized with uniform PDF among six alternatives.

Moreover, for Alternatives 1 and 7, the final breach bottom elevation defined with uniform PDF gives a higher mean and kurtosis than triangular PDF one, whereas reverse of this result is obtained for skewness; however, these differences are minor. Their COV(Q_p)s and standard deviations can be considered equal. This situation also shows that the effect of final breach bottom elevation uncertainty on outflow is negligible.

On the other hand, for the final breach bottom elevation considered probabilistically, characterization as triangular PDF results higher mean, standard deviation, and

COV(Q_p) than that of the uniform PDF, while for skewness, there is the exact opposite situation among six alternatives. Besides, fewer kurtosis values are obtained by triangular PDF ones compared to uniform PDF ones except for inflow hydrograph defined with normal PDF. As stated formerly, it may result from the difference in boundaries of the final breach bottom elevation PDFs.

Table 4.3 Summary of the analysis results

Alternative #	Q_{max}	Q_{min}	0.2% Exceedance	μ	σ	COV	Skewness	Kurtosis
	(m^3/s)							
1	1800	408	1607	1045.76	182.45	0.17	0.19	0.43
2	1720	495	1599	1033.03	157.69	0.15	0.35	1.48
3	1748	540	1553	1040.79	158.14	0.15	0.3	1.1
4	1700	528	1548	1030.79	134.89	0.13	0.56	1.08
5	1691	695	1467	1024.59	103.58	0.1	1.09	2.67
6	1647	740	1482	1029.02	104.76	0.1	1.28	3.18
7	1744	406	1632	1046.9	182.05	0.17	0.11	0.48

Box plots are assessed for all alternatives by comparison (see Figure 4.2). All alternatives are right-skewed since median values shift towards the left from the center of the box. This can also be understood from positive skewness values. When Alternatives 1 and 7 are compared, their interquartile ranges and whisker lengths are very close. In light of this information, the result that the final breach bottom elevation does not severely affect outflow can be reached.

The comparison of Alternatives 2 and 3 shows that their interquartile ranges and whisker lengths do not differ much, although Alternative 3 has higher values. On the other hand, the comparison of Alternatives 5 and 6 shows exact opposite behavior in terms of interquartile ranges and whisker lengths. Therefore, reaching a conclusion on deterministic inflow hydrograph or inflow hydrograph characterized with uniform PDF may not be so accurate. However, it can be said that deterministic inflow hydrograph may be used for analyses to save time compared to inflow hydrograph defined with uniform PDF since their difference is not too much.

Moreover, alternatives with inflow hydrograph characterized with normal PDF have the largest interquartile ranges, and whisker lengths, so more scattered and variable data are implied compared to other inflow hydrograph types. In dam breach analysis, the definition of inflow hydrograph with normal PDF can be more beneficial in terms of consideration of wide ranges.

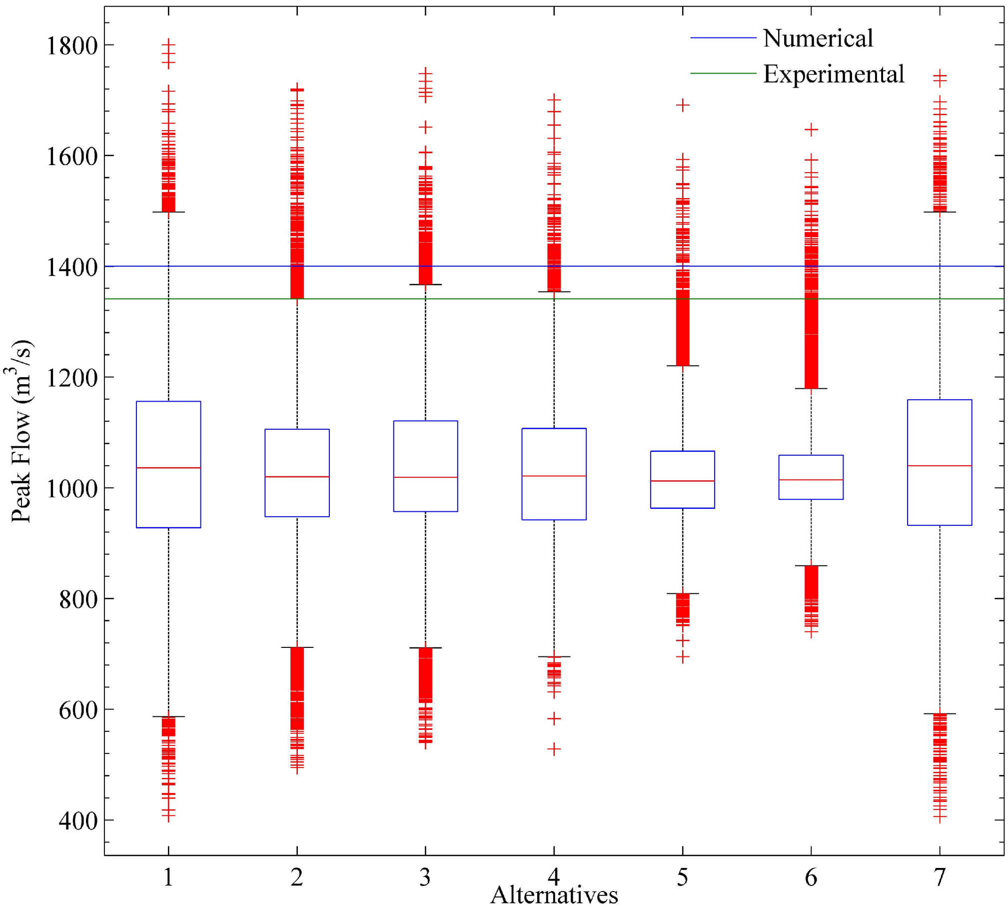


Figure 4.5. Box-plot for alternatives

For all alternatives, frequency histograms are generated based on the peak flow distribution data. For the brevity of the thesis, peak flow distribution data only for Alternative 1 is provided in Appendix B as an example. Distributions most commonly used in water resources engineering (i.e., generalized extreme value, gamma, and lognormal distributions) are fitted to histograms (see Figure 4.6-4.12). Chi-square tests for $\alpha = 0.1$ and 0.05 are conducted to assess the goodness of fit (see Table 4.4). The details of a similar distribution fitting process and goodness of fit test can be found in Calamak et al. (2017). Test results show that the common distributions are suitable for peak outflow histograms at given reliability levels for all alternatives. Thus, the result may be reached that peak outflow can be defined with one of these distributions (i.e., generalized extreme value, gamma, and lognormal distributions).

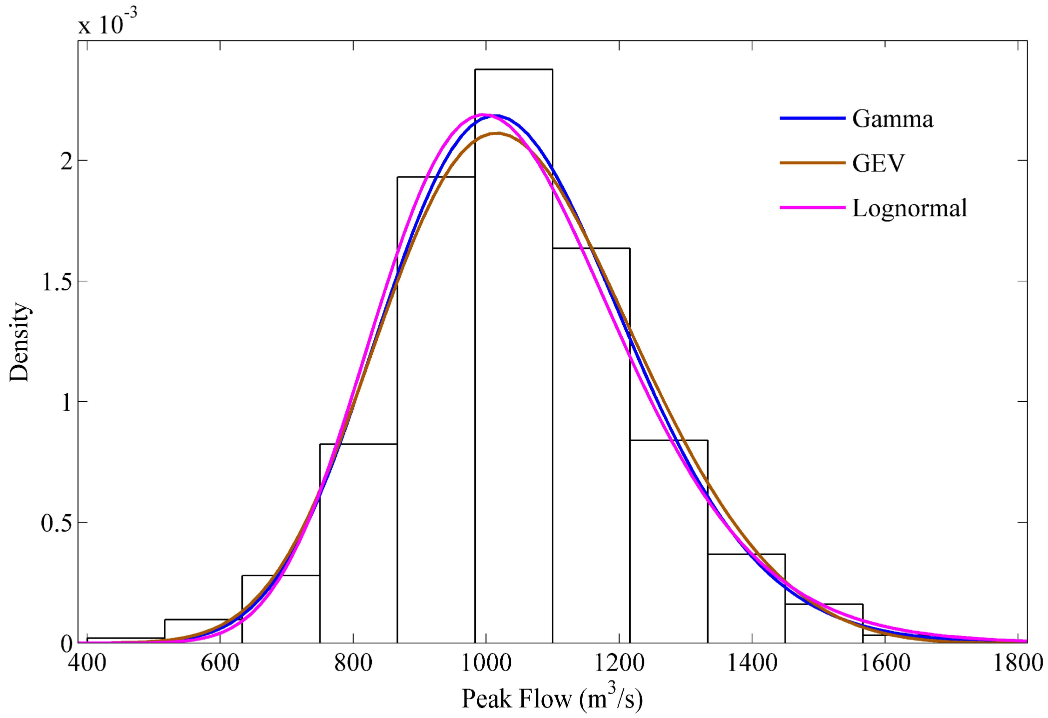


Figure 4.6. Check for fitting the common statistical distributions for Alternative 1

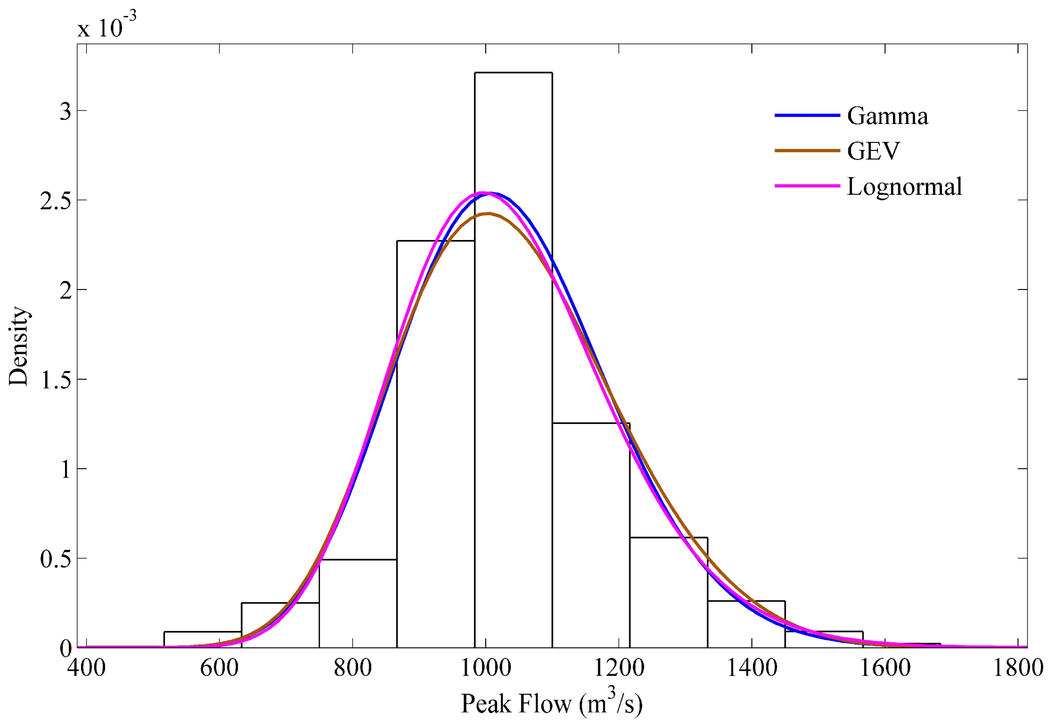


Figure 4.7. Check for fitting the common statistical distributions for Alternative 2

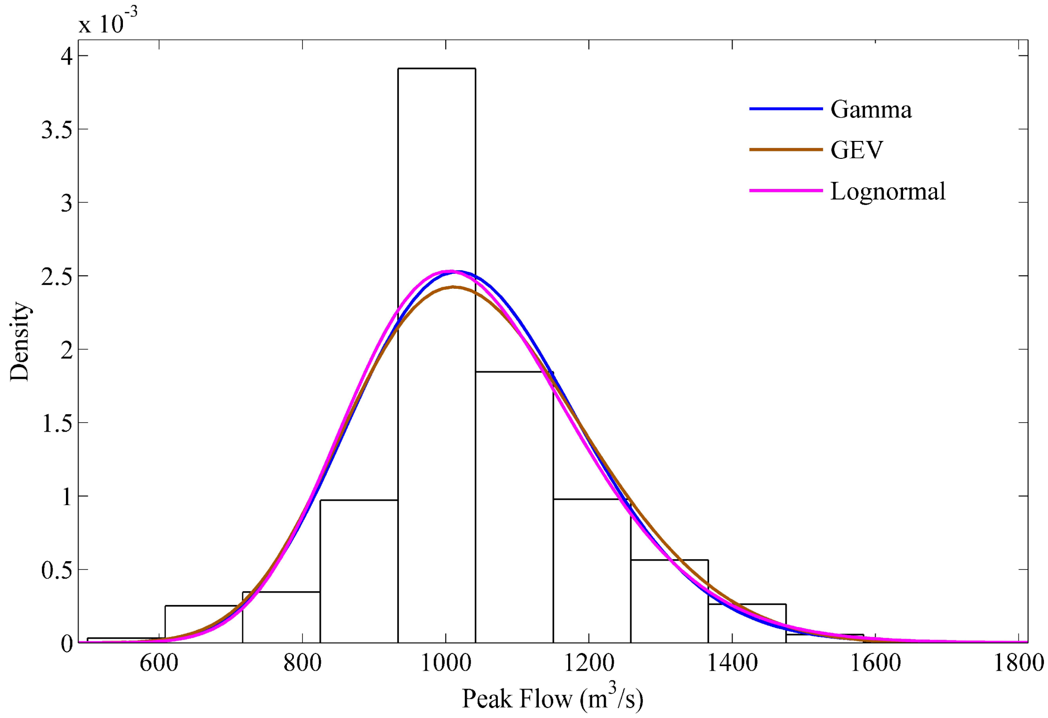


Figure 4.8. Check for fitting the common statistical distributions for Alternative 3

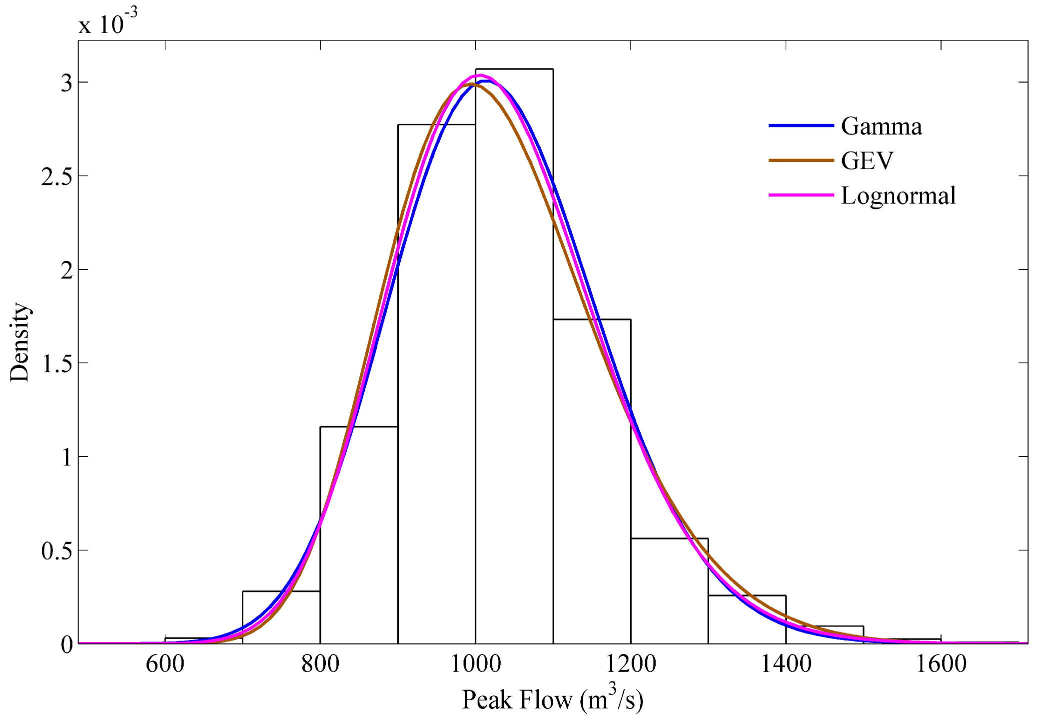


Figure 4.9. Check for fitting the common statistical distributions for Alternative 4

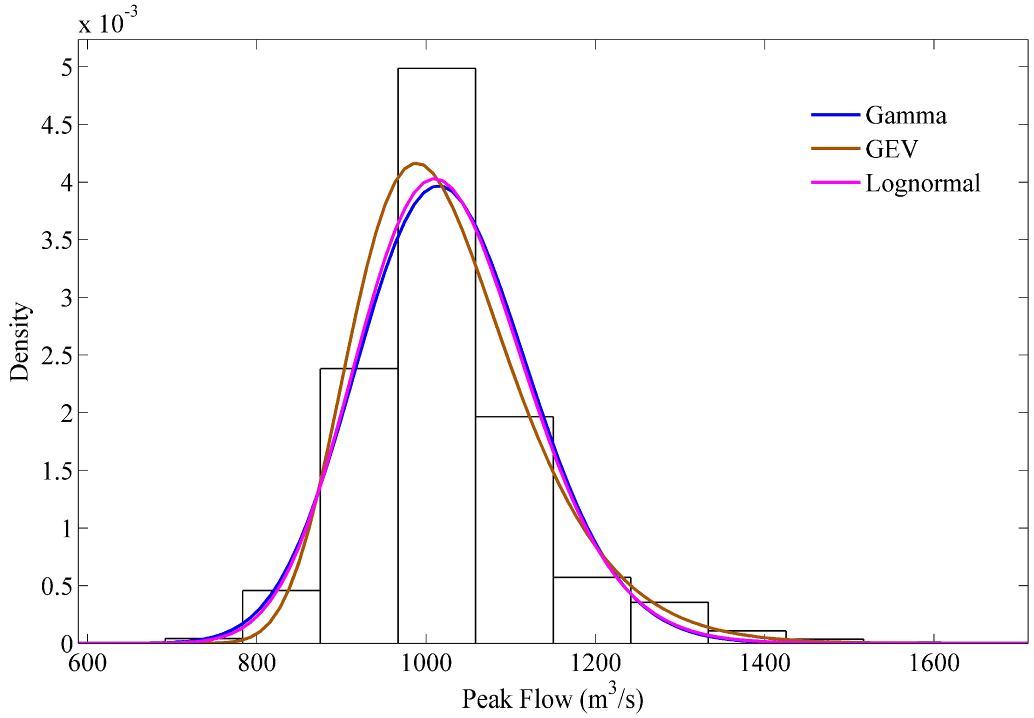


Figure 4.10. Check for fitting the common statistical distributions for Alternative 5

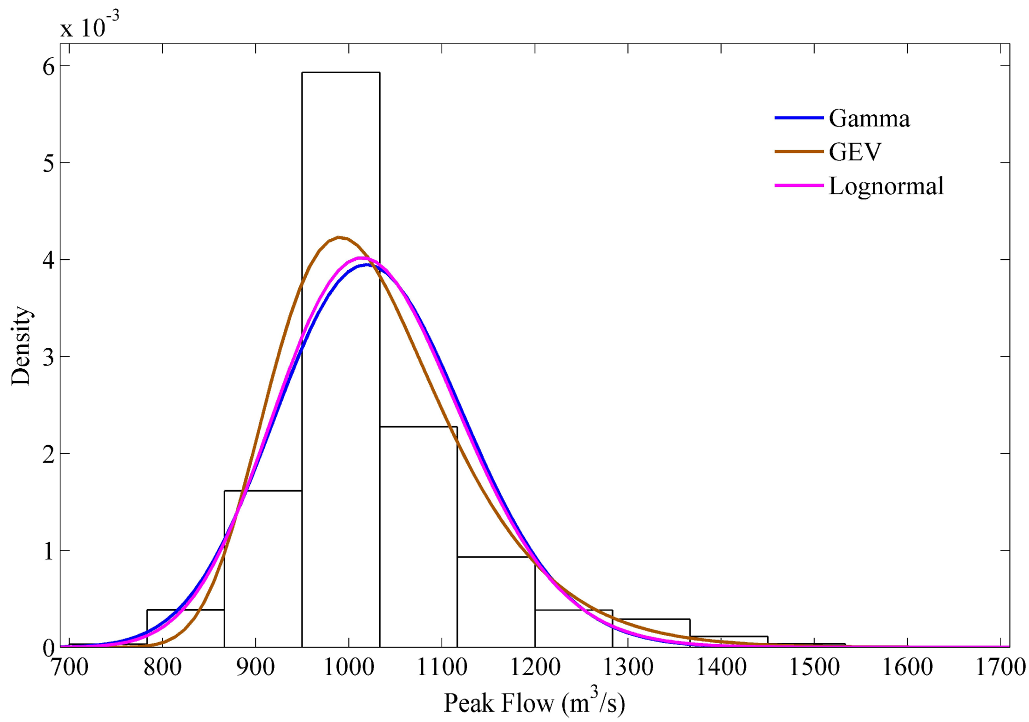


Figure 4.11. Check for fitting the common statistical distributions for Alternative 6

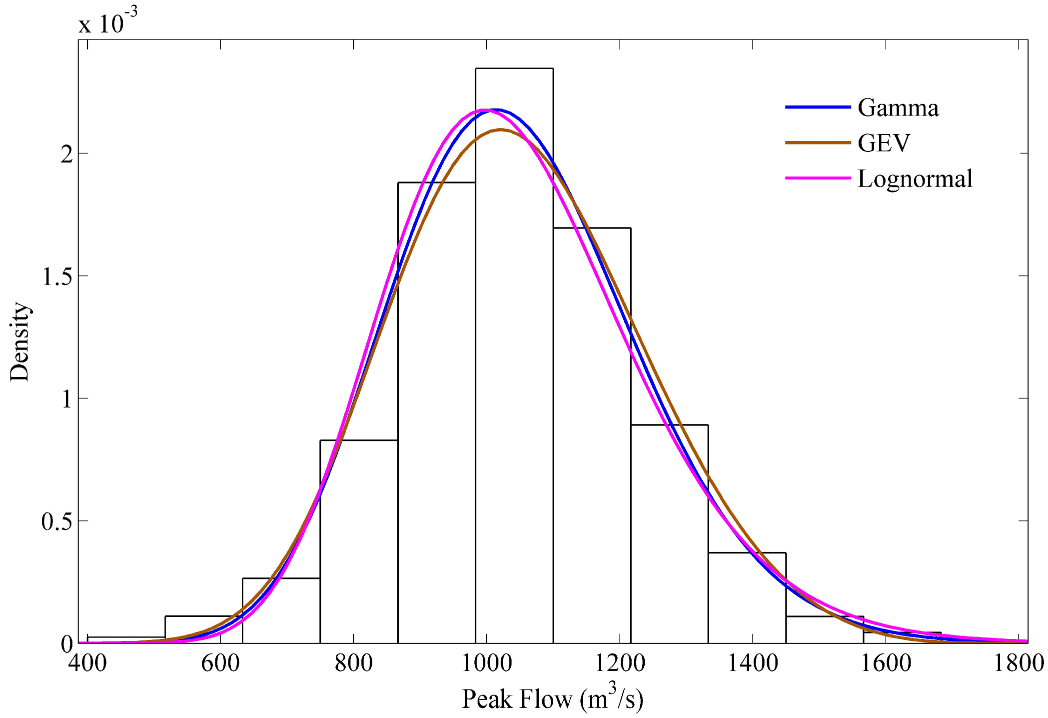


Figure 4.12. Check for fitting the common statistical distributions for Alternative 7

Table 4.4 Summary table of goodness of fit tests

Alternative #	PDF Type	Chi-square (X^2) Decision		Final Decision
		α = 0.1	α = 0.05	
1	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept
2	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept
3	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept
4	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept
5	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept
6	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept
7	Lognormal	Accept	Accept	Accept
	Gamma	Accept	Accept	Accept
	GEV	Accept	Accept	Accept

In this study, peak breach outflow is examined in various alternatives with different final breach bottom elevation and inflow hydrograph distributions. The importance of the study is based on up to flood inundation modeling due to a dam breach failure. Flood inundation maps are generated for various scenarios up to dam failure. The hazard and damage at the downstream are crucial. Precise flood inundation maps provide realistic costs. The more uncertainty is, the more cost. Therefore, breach hydrograph should be precise to obtain the flood damage and cost at the downstream precisely. This study was aimed to assess the uncertainty of the breach outflow so that the flood damage and cost at the downstream are determined accurately.

CHAPTER 5

CONCLUSION

In this study, a probabilistic dam breach model is developed to assess the impacts of inflow hydrograph and dam breach parameters on the peak breach outflow. The deterministic model is developed by scaling the experimental model of Feliciano Cestero et al. (2015) utilizing Froude similarity. Probability density functions characterizing input parameters are proposed by considering the related literature. There are seven alternatives that are varied by the statistical distributions of the inflow hydrograph, and the final breach bottom elevation, for the probabilistic analysis. The probabilistic analyses are conducted through Monte Carlo method with a simulation number of 10,000 for each alternative. Then, frequency histograms for peak outflows and exceedance probability curves are obtained. The goodness of fit is tested through Chi-square test. The conclusions that are acquired as a result of the analyses and specific to the problem can be summarized as follows:

- The peak outflow is overestimated in the deterministic model compared to the experimental peak outflow.
- The probabilistic approach is superior to the deterministic one as it can provide the worst combination of the dam break and downstream flood extents.
- The uncertainty of the final breach bottom elevation does not have a significant impact on peak breach outflow.
- Consideration of either deterministic or uniformly distributed probabilistic inflow hydrographs on the peak outflow does not make any significant difference.
- The common statistical distributions can characterize the probabilistic peak outflow.

- The normally distributed inflow hydrograph covers a wider range of outflow discharges.

This study mainly focuses on the sensitivities of the inflow hydrograph and the final breach bottom elevation on peak breach outflow. In addition, the assumption of deterministic and linear breach progression is made. The sensitivity analyses of the other dam breach parameters (i.e., breach formation time, side slopes, bottom width) can be assessed in future studies. The probabilistic or non-linear assumption of breach progression can be made. Studies can be expanded by considering different dams to generalize the findings. In this study, only a single inflow hydrograph is considered. In a future study, various shapes of inflow hydrographs can also be studied. Detailed probabilistic analyses may be conducted to account for uncertainties of dam breach parameters. In addition, detailed consideration of the dam material and material/soil properties are not included in most parametric models, although these properties are significant for dam breach analysis. In future studies, these aspects may be considered in detailed.

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APPENDICES

A. Peak Flow Exceedance Data

Table A.1 Exceedance probabilities for Alternative 1

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1607
1	1511
5	1368
10	1280
50	1036
90	827
95	755
99	608

Table A.2 Exceedance probabilities for Alternative 2

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1599
1	1480
5	1325
10	1236
50	1020
90	869
95	780
99	625

Table A.3 Exceedance probabilities for Alternative 3

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1553
1	1453
5	1341
10	1254
50	1019
90	882
95	775
99	636

Table A.4 Exceedance probabilities for Alternative 4

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1548
1	1420
5	1264
10	1195
50	1021
90	872
95	828
99	746

Table A.5 Exceedance probabilities for Alternative 5

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1467
1	1355
5	1236
10	1148
50	1012
90	914
95	878
99	816

Table A.6 Exceedance probabilities for Alternative 6

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1482
1	1391
5	1246
10	1152
50	1013
90	920
95	884
99	822

Table A.7 Exceedance probabilities for Alternative 7

Exceedance Probability (%)	Peak Flow (m^3/s)
0.2	1632
1	1508
5	1355
10	1282
50	1040
90	826
95	758
99	598

B. Peak Flow Distribution Data for Alternative 1

Table B.1 Peak flow distribution data for Alternative 1

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1	408	35	542	69	579	103	613
2	418	36	544	70	581	104	613
3	439	37	544	71	582	105	615
4	440	38	544	72	582	106	615
5	446	39	552	73	585	107	615
6	448	40	553	74	585	108	615
7	464	41	555	75	587	109	616
8	466	42	557	76	589	110	617
9	475	43	557	77	590	111	618
10	484	44	558	78	590	112	618
11	488	45	559	79	591	113	618
12	490	46	559	80	591	114	619
13	497	47	560	81	591	115	619
14	501	48	561	82	591	116	619
15	502	49	561	83	591	117	620
16	503	50	562	84	596	118	620
17	510	51	563	85	597	119	620
18	512	52	564	86	597	120	621
19	512	53	564	87	598	121	621
20	514	54	565	88	600	122	621
21	515	55	568	89	601	123	622
22	515	56	569	90	601	124	622
23	515	57	569	91	603	125	624
24	515	58	569	92	603	126	625
25	518	59	570	93	604	127	625
26	521	60	571	94	605	128	626
27	524	61	571	95	605	129	627
28	526	62	572	96	605	130	627
29	527	63	573	97	605	131	627
30	529	64	574	98	606	132	628
31	535	65	575	99	606	133	629
32	535	66	575	100	608	134	631
33	535	67	576	101	612	135	631
34	539	68	578	102	613	136	631

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
137	632	176	659	215	675	254	688
138	633	177	659	216	675	255	688
139	635	178	659	217	675	256	689
140	639	179	659	218	676	257	689
141	639	180	659	219	677	258	691
142	639	181	659	220	677	259	691
143	639	182	659	221	677	260	691
144	640	183	659	222	677	261	691
145	642	184	660	223	677	262	692
146	643	185	660	224	678	263	692
147	643	186	660	225	678	264	693
148	645	187	661	226	679	265	693
149	646	188	661	227	679	266	693
150	647	189	661	228	679	267	693
151	647	190	664	229	679	268	694
152	648	191	664	230	680	269	694
153	648	192	664	231	680	270	694
154	648	193	665	232	680	271	694
155	650	194	665	233	681	272	694
156	650	195	667	234	682	273	695
157	650	196	667	235	682	274	696
158	652	197	667	236	683	275	697
159	652	198	667	237	683	276	697
160	652	199	669	238	683	277	698
161	652	200	669	239	683	278	698
162	653	201	670	240	683	279	698
163	653	202	670	241	683	280	698
164	654	203	671	242	684	281	698
165	654	204	672	243	685	282	699
166	654	205	673	244	685	283	699
167	654	206	673	245	686	284	699
168	656	207	673	246	687	285	699
169	656	208	673	247	687	286	700
170	657	209	673	248	687	287	700
171	657	210	673	249	687	288	700
172	657	211	674	250	688	289	700
173	658	212	674	251	688	290	700
174	658	213	674	252	688	291	701
175	658	214	674	253	688	292	701

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
293	701	332	712	371	727	410	737
294	701	333	714	372	728	411	737
295	702	334	715	373	728	412	737
296	702	335	716	374	728	413	738
297	702	336	716	375	728	414	738
298	703	337	716	376	728	415	738
299	703	338	717	377	729	416	739
300	703	339	718	378	730	417	740
301	703	340	719	379	730	418	740
302	704	341	719	380	730	419	740
303	705	342	720	381	730	420	740
304	705	343	720	382	730	421	740
305	705	344	720	383	730	422	741
306	705	345	720	384	730	423	741
307	706	346	720	385	730	424	741
308	706	347	720	386	730	425	741
309	707	348	721	387	731	426	742
310	708	349	721	388	731	427	742
311	708	350	721	389	732	428	742
312	708	351	721	390	732	429	743
313	709	352	722	391	732	430	743
314	709	353	722	392	732	431	744
315	710	354	723	393	733	432	744
316	710	355	723	394	733	433	744
317	710	356	723	395	734	434	744
318	710	357	723	396	734	435	744
319	710	358	723	397	735	436	744
320	710	359	723	398	735	437	744
321	710	360	723	399	735	438	744
322	711	361	723	400	735	439	745
323	711	362	724	401	735	440	745
324	711	363	724	402	735	441	745
325	711	364	724	403	735	442	745
326	711	365	725	404	736	443	746
327	711	366	726	405	736	444	746
328	711	367	726	406	736	445	746
329	712	368	726	407	736	446	746
330	712	369	726	408	736	447	746
331	712	370	727	409	737	448	746

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
449	746	488	754	527	762	566	768
450	747	489	754	528	762	567	768
451	747	490	754	529	762	568	768
452	747	491	754	530	762	569	768
453	747	492	754	531	762	570	769
454	747	493	754	532	763	571	769
455	747	494	754	533	763	572	769
456	747	495	755	534	763	573	769
457	748	496	755	535	763	574	769
458	748	497	755	536	763	575	769
459	748	498	755	537	763	576	769
460	748	499	755	538	763	577	770
461	748	500	755	539	763	578	770
462	749	501	755	540	763	579	770
463	749	502	756	541	763	580	771
464	749	503	756	542	763	581	771
465	750	504	756	543	763	582	771
466	750	505	757	544	763	583	771
467	750	506	757	545	764	584	771
468	750	507	757	546	764	585	771
469	750	508	757	547	764	586	771
470	751	509	757	548	764	587	771
471	751	510	758	549	764	588	772
472	751	511	758	550	765	589	772
473	751	512	758	551	765	590	772
474	751	513	759	552	765	591	772
475	751	514	759	553	765	592	772
476	751	515	759	554	765	593	772
477	752	516	759	555	766	594	772
478	752	517	759	556	766	595	772
479	752	518	760	557	766	596	773
480	752	519	760	558	766	597	773
481	752	520	761	559	766	598	773
482	752	521	761	560	766	599	773
483	752	522	761	561	766	600	773
484	752	523	761	562	767	601	773
485	753	524	761	563	767	602	773
486	753	525	761	564	767	603	773
487	754	526	762	565	768	604	774

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
605	774	644	780	683	785	722	790
606	774	645	780	684	785	723	790
607	774	646	781	685	785	724	790
608	774	647	781	686	785	725	790
609	774	648	781	687	785	726	790
610	775	649	781	688	785	727	790
611	775	650	781	689	785	728	790
612	775	651	781	690	785	729	791
613	775	652	781	691	785	730	791
614	775	653	781	692	785	731	791
615	776	654	781	693	786	732	792
616	776	655	781	694	786	733	792
617	776	656	781	695	786	734	792
618	776	657	781	696	786	735	793
619	777	658	781	697	786	736	793
620	777	659	782	698	786	737	793
621	777	660	782	699	787	738	793
622	777	661	783	700	787	739	793
623	777	662	783	701	787	740	793
624	777	663	783	702	787	741	793
625	777	664	783	703	787	742	793
626	777	665	783	704	787	743	794
627	778	666	783	705	787	744	794
628	778	667	783	706	788	745	794
629	778	668	783	707	788	746	794
630	778	669	784	708	788	747	794
631	778	670	784	709	788	748	794
632	778	671	784	710	788	749	794
633	778	672	784	711	788	750	794
634	778	673	784	712	789	751	794
635	779	674	784	713	789	752	794
636	779	675	784	714	789	753	794
637	779	676	784	715	789	754	795
638	779	677	785	716	789	755	795
639	779	678	785	717	789	756	795
640	779	679	785	718	789	757	795
641	780	680	785	719	789	758	795
642	780	681	785	720	790	759	795
643	780	682	785	721	790	760	795

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
761	795	800	802	839	808	878	814
762	795	801	802	840	808	879	814
763	796	802	802	841	808	880	814
764	796	803	802	842	808	881	814
765	796	804	803	843	809	882	814
766	796	805	803	844	809	883	815
767	797	806	804	845	809	884	815
768	797	807	804	846	809	885	815
769	797	808	804	847	809	886	815
770	797	809	804	848	810	887	815
771	797	810	804	849	810	888	815
772	797	811	805	850	810	889	815
773	797	812	805	851	810	890	815
774	797	813	805	852	811	891	815
775	798	814	805	853	811	892	816
776	798	815	805	854	811	893	816
777	798	816	805	855	811	894	816
778	798	817	805	856	811	895	816
779	798	818	805	857	811	896	816
780	798	819	805	858	812	897	816
781	799	820	805	859	812	898	816
782	799	821	805	860	812	899	817
783	799	822	806	861	812	900	817
784	799	823	806	862	812	901	817
785	800	824	806	863	812	902	817
786	800	825	806	864	812	903	817
787	800	826	806	865	813	904	817
788	800	827	806	866	813	905	817
789	800	828	806	867	813	906	817
790	800	829	807	868	813	907	817
791	800	830	807	869	813	908	817
792	801	831	807	870	813	909	817
793	801	832	807	871	813	910	817
794	801	833	807	872	813	911	818
795	801	834	807	873	813	912	818
796	801	835	807	874	814	913	818
797	801	836	807	875	814	914	818
798	802	837	807	876	814	915	818
799	802	838	808	877	814	916	818

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
917	818	956	823	995	827	1034	833
918	818	957	823	996	827	1035	833
919	818	958	824	997	827	1036	833
920	818	959	824	998	827	1037	833
921	819	960	824	999	827	1038	833
922	819	961	824	1000	827	1039	833
923	819	962	824	1001	828	1040	833
924	819	963	824	1002	828	1041	833
925	819	964	824	1003	828	1042	833
926	819	965	824	1004	828	1043	833
927	819	966	825	1005	828	1044	834
928	819	967	825	1006	828	1045	834
929	820	968	825	1007	829	1046	834
930	820	969	825	1008	829	1047	834
931	820	970	825	1009	829	1048	834
932	820	971	825	1010	829	1049	834
933	820	972	825	1011	829	1050	834
934	820	973	825	1012	829	1051	834
935	820	974	825	1013	829	1052	834
936	820	975	825	1014	830	1053	835
937	820	976	826	1015	830	1054	835
938	821	977	826	1016	830	1055	835
939	821	978	826	1017	830	1056	835
940	821	979	826	1018	830	1057	835
941	821	980	826	1019	830	1058	835
942	821	981	826	1020	830	1059	835
943	821	982	826	1021	830	1060	835
944	821	983	826	1022	830	1061	835
945	821	984	826	1023	831	1062	835
946	822	985	826	1024	831	1063	836
947	822	986	826	1025	831	1064	836
948	822	987	826	1026	831	1065	836
949	822	988	826	1027	831	1066	836
950	822	989	826	1028	832	1067	836
951	822	990	827	1029	832	1068	836
952	822	991	827	1030	832	1069	836
953	823	992	827	1031	832	1070	836
954	823	993	827	1032	832	1071	836
955	823	994	827	1033	833	1072	836

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1073	836	1112	840	1151	844	1190	848
1074	836	1113	840	1152	844	1191	848
1075	836	1114	840	1153	844	1192	848
1076	836	1115	840	1154	844	1193	848
1077	836	1116	840	1155	844	1194	848
1078	837	1117	840	1156	844	1195	848
1079	837	1118	840	1157	844	1196	848
1080	837	1119	840	1158	844	1197	848
1081	837	1120	840	1159	844	1198	849
1082	837	1121	841	1160	844	1199	849
1083	837	1122	841	1161	845	1200	849
1084	837	1123	841	1162	845	1201	849
1085	837	1124	841	1163	845	1202	850
1086	837	1125	841	1164	845	1203	850
1087	837	1126	841	1165	845	1204	850
1088	837	1127	841	1166	845	1205	850
1089	838	1128	841	1167	845	1206	850
1090	838	1129	841	1168	845	1207	850
1091	838	1130	841	1169	845	1208	850
1092	838	1131	842	1170	845	1209	850
1093	838	1132	842	1171	845	1210	850
1094	838	1133	842	1172	845	1211	850
1095	838	1134	842	1173	845	1212	850
1096	838	1135	842	1174	845	1213	850
1097	838	1136	842	1175	845	1214	850
1098	838	1137	842	1176	845	1215	850
1099	838	1138	842	1177	845	1216	851
1100	839	1139	842	1178	846	1217	851
1101	839	1140	842	1179	846	1218	851
1102	839	1141	843	1180	846	1219	851
1103	839	1142	843	1181	846	1220	851
1104	839	1143	843	1182	846	1221	851
1105	839	1144	843	1183	846	1222	851
1106	839	1145	843	1184	847	1223	851
1107	839	1146	843	1185	847	1224	851
1108	839	1147	843	1186	847	1225	851
1109	839	1148	843	1187	847	1226	851
1110	840	1149	843	1188	848	1227	851
1111	840	1150	844	1189	848	1228	851

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1229	851	1268	855	1307	858	1346	861
1230	852	1269	855	1308	858	1347	861
1231	852	1270	855	1309	858	1348	861
1232	852	1271	855	1310	858	1349	861
1233	852	1272	855	1311	858	1350	861
1234	852	1273	855	1312	858	1351	861
1235	852	1274	855	1313	858	1352	862
1236	852	1275	855	1314	858	1353	862
1237	852	1276	855	1315	858	1354	862
1238	852	1277	855	1316	858	1355	862
1239	852	1278	855	1317	859	1356	862
1240	852	1279	855	1318	859	1357	862
1241	852	1280	856	1319	859	1358	862
1242	853	1281	856	1320	859	1359	862
1243	853	1282	856	1321	859	1360	862
1244	853	1283	856	1322	859	1361	862
1245	853	1284	856	1323	859	1362	862
1246	853	1285	856	1324	859	1363	862
1247	853	1286	856	1325	859	1364	862
1248	853	1287	856	1326	859	1365	862
1249	853	1288	856	1327	859	1366	862
1250	853	1289	856	1328	859	1367	863
1251	853	1290	856	1329	859	1368	863
1252	854	1291	856	1330	859	1369	863
1253	854	1292	856	1331	860	1370	863
1254	854	1293	857	1332	860	1371	863
1255	854	1294	857	1333	860	1372	863
1256	854	1295	857	1334	860	1373	863
1257	854	1296	857	1335	860	1374	863
1258	854	1297	857	1336	861	1375	863
1259	854	1298	857	1337	861	1376	863
1260	854	1299	857	1338	861	1377	863
1261	854	1300	857	1339	861	1378	863
1262	854	1301	857	1340	861	1379	863
1263	854	1302	857	1341	861	1380	863
1264	854	1303	858	1342	861	1381	863
1265	854	1304	858	1343	861	1382	863
1266	855	1305	858	1344	861	1383	863
1267	855	1306	858	1345	861	1384	863

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1385	863	1424	866	1463	868	1502	872
1386	863	1425	866	1464	868	1503	872
1387	864	1426	866	1465	868	1504	872
1388	864	1427	867	1466	868	1505	872
1389	864	1428	867	1467	868	1506	872
1390	864	1429	867	1468	869	1507	872
1391	864	1430	867	1469	869	1508	872
1392	864	1431	867	1470	869	1509	872
1393	864	1432	867	1471	869	1510	872
1394	864	1433	867	1472	869	1511	873
1395	864	1434	867	1473	869	1512	873
1396	864	1435	867	1474	869	1513	873
1397	864	1436	867	1475	869	1514	873
1398	864	1437	867	1476	869	1515	873
1399	864	1438	867	1477	870	1516	873
1400	864	1439	867	1478	871	1517	873
1401	864	1440	867	1479	871	1518	873
1402	864	1441	867	1480	871	1519	873
1403	864	1442	867	1481	871	1520	873
1404	864	1443	867	1482	871	1521	873
1405	864	1444	867	1483	871	1522	873
1406	864	1445	867	1484	871	1523	873
1407	864	1446	867	1485	871	1524	873
1408	865	1447	868	1486	871	1525	873
1409	865	1448	868	1487	871	1526	873
1410	865	1449	868	1488	871	1527	873
1411	865	1450	868	1489	871	1528	873
1412	865	1451	868	1490	871	1529	873
1413	865	1452	868	1491	871	1530	873
1414	865	1453	868	1492	871	1531	874
1415	865	1454	868	1493	871	1532	874
1416	865	1455	868	1494	871	1533	874
1417	866	1456	868	1495	871	1534	874
1418	866	1457	868	1496	872	1535	874
1419	866	1458	868	1497	872	1536	874
1420	866	1459	868	1498	872	1537	874
1421	866	1460	868	1499	872	1538	874
1422	866	1461	868	1500	872	1539	874
1423	866	1462	868	1501	872	1540	874

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1541	874	1580	876	1619	879	1658	881
1542	874	1581	877	1620	879	1659	881
1543	874	1582	877	1621	879	1660	881
1544	874	1583	877	1622	879	1661	881
1545	874	1584	877	1623	879	1662	881
1546	874	1585	877	1624	879	1663	881
1547	874	1586	877	1625	879	1664	881
1548	874	1587	877	1626	879	1665	881
1549	874	1588	877	1627	879	1666	882
1550	874	1589	877	1628	879	1667	882
1551	874	1590	877	1629	879	1668	882
1552	874	1591	877	1630	880	1669	882
1553	874	1592	877	1631	880	1670	882
1554	875	1593	877	1632	880	1671	882
1555	875	1594	877	1633	880	1672	882
1556	875	1595	878	1634	880	1673	882
1557	875	1596	878	1635	880	1674	882
1558	875	1597	878	1636	880	1675	882
1559	875	1598	878	1637	880	1676	882
1560	875	1599	878	1638	880	1677	883
1561	875	1600	878	1639	880	1678	883
1562	875	1601	878	1640	880	1679	883
1563	876	1602	878	1641	880	1680	883
1564	876	1603	878	1642	880	1681	883
1565	876	1604	878	1643	880	1682	883
1566	876	1605	878	1644	880	1683	883
1567	876	1606	878	1645	880	1684	883
1568	876	1607	878	1646	880	1685	883
1569	876	1608	878	1647	881	1686	883
1570	876	1609	878	1648	881	1687	883
1571	876	1610	879	1649	881	1688	883
1572	876	1611	879	1650	881	1689	883
1573	876	1612	879	1651	881	1690	883
1574	876	1613	879	1652	881	1691	883
1575	876	1614	879	1653	881	1692	883
1576	876	1615	879	1654	881	1693	883
1577	876	1616	879	1655	881	1694	883
1578	876	1617	879	1656	881	1695	884
1579	876	1618	879	1657	881	1696	884

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1697	884	1736	886	1775	889	1814	891
1698	884	1737	886	1776	889	1815	891
1699	884	1738	886	1777	889	1816	891
1700	884	1739	886	1778	889	1817	891
1701	884	1740	886	1779	889	1818	892
1702	884	1741	887	1780	889	1819	892
1703	884	1742	887	1781	889	1820	892
1704	884	1743	887	1782	889	1821	892
1705	884	1744	887	1783	889	1822	892
1706	884	1745	887	1784	890	1823	892
1707	884	1746	887	1785	890	1824	892
1708	884	1747	887	1786	890	1825	892
1709	884	1748	887	1787	890	1826	892
1710	884	1749	887	1788	890	1827	892
1711	884	1750	887	1789	890	1828	892
1712	884	1751	887	1790	890	1829	892
1713	884	1752	887	1791	890	1830	892
1714	884	1753	887	1792	890	1831	892
1715	884	1754	887	1793	890	1832	892
1716	885	1755	887	1794	890	1833	892
1717	885	1756	887	1795	890	1834	892
1718	885	1757	887	1796	890	1835	892
1719	885	1758	887	1797	890	1836	892
1720	885	1759	888	1798	891	1837	893
1721	885	1760	888	1799	891	1838	893
1722	885	1761	888	1800	891	1839	893
1723	885	1762	888	1801	891	1840	893
1724	885	1763	888	1802	891	1841	893
1725	885	1764	888	1803	891	1842	893
1726	885	1765	888	1804	891	1843	893
1727	886	1766	888	1805	891	1844	893
1728	886	1767	888	1806	891	1845	893
1729	886	1768	888	1807	891	1846	893
1730	886	1769	888	1808	891	1847	893
1731	886	1770	888	1809	891	1848	894
1732	886	1771	888	1810	891	1849	894
1733	886	1772	888	1811	891	1850	894
1734	886	1773	889	1812	891	1851	894
1735	886	1774	889	1813	891	1852	894

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
1853	894	1892	896	1931	898	1970	900
1854	894	1893	896	1932	898	1971	900
1855	894	1894	896	1933	898	1972	900
1856	894	1895	896	1934	898	1973	900
1857	894	1896	896	1935	898	1974	900
1858	894	1897	896	1936	899	1975	901
1859	894	1898	896	1937	899	1976	901
1860	894	1899	896	1938	899	1977	901
1861	894	1900	896	1939	899	1978	901
1862	894	1901	896	1940	899	1979	901
1863	894	1902	896	1941	899	1980	901
1864	894	1903	896	1942	899	1981	901
1865	895	1904	896	1943	899	1982	901
1866	895	1905	897	1944	899	1983	901
1867	895	1906	897	1945	899	1984	901
1868	895	1907	897	1946	899	1985	901
1869	895	1908	897	1947	899	1986	901
1870	895	1909	897	1948	899	1987	901
1871	895	1910	897	1949	899	1988	901
1872	895	1911	897	1950	899	1989	901
1873	895	1912	897	1951	899	1990	901
1874	895	1913	897	1952	899	1991	901
1875	895	1914	897	1953	899	1992	901
1876	895	1915	897	1954	899	1993	901
1877	895	1916	897	1955	899	1994	901
1878	895	1917	897	1956	899	1995	901
1879	895	1918	897	1957	900	1996	902
1880	896	1919	898	1958	900	1997	902
1881	896	1920	898	1959	900	1998	902
1882	896	1921	898	1960	900	1999	902
1883	896	1922	898	1961	900	2000	902
1884	896	1923	898	1962	900	2001	902
1885	896	1924	898	1963	900	2002	902
1886	896	1925	898	1964	900	2003	902
1887	896	1926	898	1965	900	2004	902
1888	896	1927	898	1966	900	2005	902
1889	896	1928	898	1967	900	2006	902
1890	896	1929	898	1968	900	2007	902
1891	896	1930	898	1969	900	2008	902

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2009	902	2048	904	2087	907	2126	909
2010	902	2049	904	2088	907	2127	909
2011	902	2050	904	2089	907	2128	909
2012	902	2051	904	2090	907	2129	909
2013	902	2052	904	2091	907	2130	909
2014	902	2053	904	2092	907	2131	909
2015	902	2054	905	2093	908	2132	909
2016	902	2055	905	2094	908	2133	909
2017	902	2056	905	2095	908	2134	910
2018	902	2057	905	2096	908	2135	910
2019	902	2058	905	2097	908	2136	910
2020	903	2059	905	2098	908	2137	910
2021	903	2060	905	2099	908	2138	910
2022	903	2061	905	2100	908	2139	910
2023	903	2062	905	2101	908	2140	910
2024	903	2063	905	2102	908	2141	910
2025	903	2064	905	2103	908	2142	910
2026	903	2065	905	2104	908	2143	910
2027	903	2066	905	2105	908	2144	910
2028	903	2067	905	2106	908	2145	910
2029	903	2068	906	2107	908	2146	910
2030	903	2069	906	2108	908	2147	910
2031	903	2070	906	2109	908	2148	910
2032	903	2071	906	2110	908	2149	910
2033	903	2072	906	2111	908	2150	910
2034	903	2073	906	2112	909	2151	910
2035	903	2074	906	2113	909	2152	910
2036	903	2075	906	2114	909	2153	910
2037	903	2076	906	2115	909	2154	911
2038	904	2077	906	2116	909	2155	911
2039	904	2078	906	2117	909	2156	911
2040	904	2079	907	2118	909	2157	911
2041	904	2080	907	2119	909	2158	911
2042	904	2081	907	2120	909	2159	911
2043	904	2082	907	2121	909	2160	911
2044	904	2083	907	2122	909	2161	911
2045	904	2084	907	2123	909	2162	911
2046	904	2085	907	2124	909	2163	911
2047	904	2086	907	2125	909	2164	911

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2165	911	2204	913	2243	915	2282	917
2166	911	2205	913	2244	915	2283	917
2167	911	2206	913	2245	915	2284	917
2168	911	2207	913	2246	915	2285	918
2169	911	2208	913	2247	915	2286	918
2170	911	2209	913	2248	915	2287	918
2171	911	2210	913	2249	915	2288	918
2172	911	2211	913	2250	915	2289	918
2173	911	2212	914	2251	915	2290	918
2174	912	2213	914	2252	915	2291	918
2175	912	2214	914	2253	915	2292	918
2176	912	2215	914	2254	915	2293	918
2177	912	2216	914	2255	916	2294	918
2178	912	2217	914	2256	916	2295	918
2179	912	2218	914	2257	916	2296	918
2180	912	2219	914	2258	916	2297	918
2181	912	2220	914	2259	916	2298	918
2182	912	2221	914	2260	916	2299	918
2183	912	2222	914	2261	916	2300	918
2184	912	2223	914	2262	916	2301	918
2185	912	2224	914	2263	916	2302	918
2186	912	2225	914	2264	916	2303	918
2187	912	2226	914	2265	916	2304	918
2188	912	2227	914	2266	916	2305	918
2189	912	2228	914	2267	916	2306	919
2190	912	2229	914	2268	916	2307	919
2191	913	2230	914	2269	916	2308	919
2192	913	2231	914	2270	917	2309	919
2193	913	2232	914	2271	917	2310	919
2194	913	2233	915	2272	917	2311	919
2195	913	2234	915	2273	917	2312	919
2196	913	2235	915	2274	917	2313	919
2197	913	2236	915	2275	917	2314	919
2198	913	2237	915	2276	917	2315	919
2199	913	2238	915	2277	917	2316	919
2200	913	2239	915	2278	917	2317	919
2201	913	2240	915	2279	917	2318	919
2202	913	2241	915	2280	917	2319	920
2203	913	2242	915	2281	917	2320	920

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2321	920	2360	922	2399	923	2438	925
2322	920	2361	922	2400	923	2439	925
2323	920	2362	922	2401	923	2440	925
2324	920	2363	922	2402	923	2441	925
2325	920	2364	922	2403	923	2442	925
2326	920	2365	922	2404	923	2443	925
2327	920	2366	922	2405	923	2444	925
2328	920	2367	922	2406	924	2445	925
2329	920	2368	922	2407	924	2446	925
2330	920	2369	922	2408	924	2447	926
2331	920	2370	922	2409	924	2448	926
2332	920	2371	922	2410	924	2449	926
2333	920	2372	922	2411	924	2450	926
2334	920	2373	922	2412	924	2451	926
2335	921	2374	922	2413	924	2452	926
2336	921	2375	922	2414	924	2453	926
2337	921	2376	922	2415	924	2454	926
2338	921	2377	922	2416	924	2455	926
2339	921	2378	922	2417	924	2456	926
2340	921	2379	923	2418	924	2457	926
2341	921	2380	923	2419	924	2458	926
2342	921	2381	923	2420	924	2459	926
2343	921	2382	923	2421	924	2460	926
2344	921	2383	923	2422	924	2461	926
2345	921	2384	923	2423	924	2462	926
2346	921	2385	923	2424	924	2463	927
2347	921	2386	923	2425	924	2464	927
2348	921	2387	923	2426	924	2465	927
2349	921	2388	923	2427	924	2466	927
2350	921	2389	923	2428	925	2467	927
2351	921	2390	923	2429	925	2468	927
2352	921	2391	923	2430	925	2469	927
2353	921	2392	923	2431	925	2470	927
2354	921	2393	923	2432	925	2471	927
2355	921	2394	923	2433	925	2472	927
2356	921	2395	923	2434	925	2473	927
2357	921	2396	923	2435	925	2474	927
2358	921	2397	923	2436	925	2475	927
2359	922	2398	923	2437	925	2476	928

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2477	928	2516	929	2555	931	2594	933
2478	928	2517	929	2556	931	2595	933
2479	928	2518	929	2557	931	2596	933
2480	928	2519	929	2558	931	2597	933
2481	928	2520	929	2559	931	2598	933
2482	928	2521	929	2560	931	2599	933
2483	928	2522	929	2561	931	2600	933
2484	928	2523	929	2562	931	2601	933
2485	928	2524	929	2563	931	2602	934
2486	928	2525	930	2564	932	2603	934
2487	928	2526	930	2565	932	2604	934
2488	928	2527	930	2566	932	2605	934
2489	928	2528	930	2567	932	2606	934
2490	928	2529	930	2568	932	2607	934
2491	928	2530	930	2569	932	2608	934
2492	928	2531	930	2570	932	2609	934
2493	928	2532	930	2571	932	2610	934
2494	928	2533	930	2572	932	2611	934
2495	928	2534	930	2573	932	2612	934
2496	928	2535	930	2574	932	2613	934
2497	928	2536	930	2575	932	2614	934
2498	928	2537	930	2576	932	2615	934
2499	928	2538	930	2577	932	2616	934
2500	928	2539	930	2578	932	2617	934
2501	928	2540	930	2579	932	2618	934
2502	928	2541	930	2580	932	2619	934
2503	928	2542	930	2581	932	2620	934
2504	928	2543	930	2582	933	2621	935
2505	929	2544	930	2583	933	2622	935
2506	929	2545	930	2584	933	2623	935
2507	929	2546	930	2585	933	2624	935
2508	929	2547	930	2586	933	2625	935
2509	929	2548	930	2587	933	2626	935
2510	929	2549	931	2588	933	2627	935
2511	929	2550	931	2589	933	2628	935
2512	929	2551	931	2590	933	2629	935
2513	929	2552	931	2591	933	2630	935
2514	929	2553	931	2592	933	2631	935
2515	929	2554	931	2593	933	2632	935

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2633	935	2672	937	2711	939	2750	942
2634	935	2673	937	2712	939	2751	942
2635	935	2674	937	2713	939	2752	942
2636	935	2675	937	2714	939	2753	942
2637	935	2676	937	2715	939	2754	942
2638	935	2677	937	2716	939	2755	942
2639	935	2678	938	2717	939	2756	942
2640	935	2679	938	2718	939	2757	942
2641	935	2680	938	2719	940	2758	942
2642	935	2681	938	2720	940	2759	942
2643	936	2682	938	2721	940	2760	942
2644	936	2683	938	2722	940	2761	943
2645	936	2684	938	2723	940	2762	943
2646	936	2685	938	2724	940	2763	943
2647	936	2686	938	2725	940	2764	943
2648	936	2687	938	2726	940	2765	943
2649	936	2688	938	2727	940	2766	943
2650	936	2689	938	2728	940	2767	943
2651	936	2690	938	2729	940	2768	943
2652	936	2691	938	2730	940	2769	943
2653	936	2692	938	2731	940	2770	943
2654	936	2693	938	2732	940	2771	943
2655	936	2694	938	2733	940	2772	943
2656	936	2695	938	2734	940	2773	943
2657	936	2696	938	2735	940	2774	943
2658	936	2697	938	2736	940	2775	943
2659	936	2698	939	2737	941	2776	943
2660	936	2699	939	2738	941	2777	943
2661	936	2700	939	2739	941	2778	943
2662	936	2701	939	2740	941	2779	943
2663	936	2702	939	2741	941	2780	943
2664	936	2703	939	2742	941	2781	944
2665	937	2704	939	2743	941	2782	944
2666	937	2705	939	2744	941	2783	944
2667	937	2706	939	2745	941	2784	944
2668	937	2707	939	2746	941	2785	944
2669	937	2708	939	2747	941	2786	944
2670	937	2709	939	2748	941	2787	944
2671	937	2710	939	2749	942	2788	944

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2789	944	2828	946	2867	948	2906	949
2790	944	2829	946	2868	948	2907	949
2791	944	2830	946	2869	948	2908	949
2792	944	2831	946	2870	948	2909	950
2793	944	2832	946	2871	948	2910	950
2794	944	2833	946	2872	948	2911	950
2795	944	2834	946	2873	948	2912	950
2796	944	2835	947	2874	948	2913	950
2797	944	2836	947	2875	948	2914	950
2798	944	2837	947	2876	948	2915	950
2799	944	2838	947	2877	948	2916	950
2800	944	2839	947	2878	948	2917	950
2801	944	2840	947	2879	948	2918	950
2802	945	2841	947	2880	949	2919	950
2803	945	2842	947	2881	949	2920	950
2804	945	2843	947	2882	949	2921	950
2805	945	2844	947	2883	949	2922	950
2806	945	2845	947	2884	949	2923	950
2807	945	2846	947	2885	949	2924	950
2808	945	2847	947	2886	949	2925	950
2809	945	2848	947	2887	949	2926	950
2810	945	2849	947	2888	949	2927	950
2811	945	2850	947	2889	949	2928	950
2812	945	2851	947	2890	949	2929	950
2813	945	2852	947	2891	949	2930	951
2814	945	2853	947	2892	949	2931	951
2815	945	2854	947	2893	949	2932	951
2816	945	2855	948	2894	949	2933	951
2817	945	2856	948	2895	949	2934	951
2818	945	2857	948	2896	949	2935	951
2819	945	2858	948	2897	949	2936	951
2820	945	2859	948	2898	949	2937	951
2821	945	2860	948	2899	949	2938	951
2822	945	2861	948	2900	949	2939	951
2823	945	2862	948	2901	949	2940	951
2824	945	2863	948	2902	949	2941	951
2825	945	2864	948	2903	949	2942	951
2826	946	2865	948	2904	949	2943	951
2827	946	2866	948	2905	949	2944	951

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
2945	951	2984	953	3023	955	3062	957
2946	951	2985	953	3024	955	3063	957
2947	951	2986	953	3025	955	3064	957
2948	951	2987	953	3026	955	3065	957
2949	951	2988	953	3027	955	3066	957
2950	951	2989	953	3028	955	3067	957
2951	951	2990	953	3029	955	3068	957
2952	952	2991	953	3030	955	3069	957
2953	952	2992	953	3031	955	3070	957
2954	952	2993	953	3032	955	3071	957
2955	952	2994	953	3033	955	3072	957
2956	952	2995	953	3034	955	3073	957
2957	952	2996	953	3035	955	3074	957
2958	952	2997	953	3036	955	3075	957
2959	952	2998	953	3037	955	3076	958
2960	952	2999	953	3038	955	3077	958
2961	952	3000	953	3039	956	3078	958
2962	952	3001	953	3040	956	3079	958
2963	952	3002	953	3041	956	3080	958
2964	952	3003	954	3042	956	3081	958
2965	952	3004	954	3043	956	3082	958
2966	952	3005	954	3044	956	3083	958
2967	952	3006	954	3045	956	3084	958
2968	952	3007	954	3046	956	3085	958
2969	952	3008	954	3047	956	3086	958
2970	952	3009	954	3048	956	3087	958
2971	952	3010	954	3049	956	3088	958
2972	952	3011	954	3050	956	3089	958
2973	952	3012	954	3051	956	3090	958
2974	952	3013	954	3052	956	3091	959
2975	952	3014	954	3053	956	3092	959
2976	952	3015	954	3054	956	3093	959
2977	952	3016	954	3055	956	3094	959
2978	952	3017	954	3056	956	3095	959
2979	953	3018	954	3057	957	3096	959
2980	953	3019	954	3058	957	3097	959
2981	953	3020	954	3059	957	3098	959
2982	953	3021	955	3060	957	3099	959
2983	953	3022	955	3061	957	3100	959

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
3101	959	3140	961	3179	962	3218	964
3102	959	3141	961	3180	962	3219	964
3103	959	3142	961	3181	962	3220	964
3104	959	3143	961	3182	962	3221	964
3105	959	3144	961	3183	962	3222	964
3106	959	3145	961	3184	962	3223	964
3107	959	3146	961	3185	963	3224	964
3108	960	3147	961	3186	963	3225	964
3109	960	3148	961	3187	963	3226	964
3110	960	3149	961	3188	963	3227	964
3111	960	3150	961	3189	963	3228	964
3112	960	3151	961	3190	963	3229	964
3113	960	3152	961	3191	963	3230	964
3114	960	3153	961	3192	963	3231	964
3115	960	3154	961	3193	963	3232	965
3116	960	3155	961	3194	963	3233	965
3117	960	3156	961	3195	963	3234	965
3118	960	3157	962	3196	963	3235	965
3119	960	3158	962	3197	963	3236	965
3120	960	3159	962	3198	963	3237	965
3121	960	3160	962	3199	963	3238	965
3122	960	3161	962	3200	963	3239	965
3123	960	3162	962	3201	963	3240	965
3124	960	3163	962	3202	963	3241	965
3125	960	3164	962	3203	963	3242	965
3126	960	3165	962	3204	963	3243	965
3127	960	3166	962	3205	963	3244	965
3128	960	3167	962	3206	963	3245	965
3129	960	3168	962	3207	963	3246	965
3130	961	3169	962	3208	963	3247	965
3131	961	3170	962	3209	963	3248	965
3132	961	3171	962	3210	963	3249	965
3133	961	3172	962	3211	963	3250	965
3134	961	3173	962	3212	963	3251	965
3135	961	3174	962	3213	964	3252	965
3136	961	3175	962	3214	964	3253	965
3137	961	3176	962	3215	964	3254	965
3138	961	3177	962	3216	964	3255	965
3139	961	3178	962	3217	964	3256	965

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
3257	965	3296	966	3335	968	3374	970
3258	965	3297	967	3336	968	3375	970
3259	965	3298	967	3337	968	3376	970
3260	965	3299	967	3338	968	3377	970
3261	965	3300	967	3339	968	3378	970
3262	965	3301	967	3340	968	3379	971
3263	965	3302	967	3341	969	3380	971
3264	965	3303	967	3342	969	3381	971
3265	965	3304	967	3343	969	3382	971
3266	965	3305	967	3344	969	3383	971
3267	965	3306	967	3345	969	3384	971
3268	965	3307	967	3346	969	3385	971
3269	966	3308	967	3347	969	3386	971
3270	966	3309	967	3348	969	3387	971
3271	966	3310	967	3349	969	3388	971
3272	966	3311	967	3350	969	3389	971
3273	966	3312	967	3351	969	3390	971
3274	966	3313	967	3352	969	3391	971
3275	966	3314	967	3353	969	3392	971
3276	966	3315	967	3354	969	3393	971
3277	966	3316	967	3355	969	3394	971
3278	966	3317	967	3356	969	3395	971
3279	966	3318	967	3357	969	3396	971
3280	966	3319	967	3358	969	3397	972
3281	966	3320	967	3359	969	3398	972
3282	966	3321	967	3360	970	3399	972
3283	966	3322	967	3361	970	3400	972
3284	966	3323	968	3362	970	3401	972
3285	966	3324	968	3363	970	3402	972
3286	966	3325	968	3364	970	3403	972
3287	966	3326	968	3365	970	3404	972
3288	966	3327	968	3366	970	3405	972
3289	966	3328	968	3367	970	3406	972
3290	966	3329	968	3368	970	3407	972
3291	966	3330	968	3369	970	3408	972
3292	966	3331	968	3370	970	3409	972
3293	966	3332	968	3371	970	3410	972
3294	966	3333	968	3372	970	3411	972
3295	966	3334	968	3373	970	3412	972

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
3413	973	3452	974	3491	976	3530	977
3414	973	3453	974	3492	976	3531	977
3415	973	3454	974	3493	976	3532	977
3416	973	3455	974	3494	976	3533	977
3417	973	3456	974	3495	976	3534	977
3418	973	3457	974	3496	976	3535	977
3419	973	3458	974	3497	976	3536	978
3420	973	3459	975	3498	976	3537	978
3421	973	3460	975	3499	976	3538	978
3422	973	3461	975	3500	976	3539	978
3423	973	3462	975	3501	976	3540	978
3424	973	3463	975	3502	976	3541	978
3425	973	3464	975	3503	976	3542	978
3426	973	3465	975	3504	976	3543	978
3427	973	3466	975	3505	976	3544	978
3428	973	3467	975	3506	976	3545	978
3429	973	3468	975	3507	976	3546	978
3430	973	3469	975	3508	976	3547	978
3431	973	3470	975	3509	976	3548	978
3432	973	3471	975	3510	976	3549	978
3433	973	3472	975	3511	976	3550	978
3434	973	3473	975	3512	976	3551	978
3435	974	3474	975	3513	976	3552	978
3436	974	3475	975	3514	977	3553	978
3437	974	3476	975	3515	977	3554	978
3438	974	3477	975	3516	977	3555	978
3439	974	3478	975	3517	977	3556	978
3440	974	3479	975	3518	977	3557	978
3441	974	3480	975	3519	977	3558	978
3442	974	3481	975	3520	977	3559	978
3443	974	3482	975	3521	977	3560	978
3444	974	3483	975	3522	977	3561	979
3445	974	3484	975	3523	977	3562	979
3446	974	3485	975	3524	977	3563	979
3447	974	3486	975	3525	977	3564	979
3448	974	3487	975	3526	977	3565	979
3449	974	3488	975	3527	977	3566	979
3450	974	3489	975	3528	977	3567	979
3451	974	3490	975	3529	977	3568	979

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
3569	979	3608	980	3647	982	3686	984
3570	979	3609	980	3648	982	3687	984
3571	979	3610	980	3649	982	3688	984
3572	979	3611	980	3650	982	3689	984
3573	979	3612	981	3651	982	3690	984
3574	979	3613	981	3652	982	3691	984
3575	979	3614	981	3653	982	3692	984
3576	979	3615	981	3654	982	3693	984
3577	979	3616	981	3655	982	3694	984
3578	979	3617	981	3656	982	3695	984
3579	979	3618	981	3657	982	3696	984
3580	979	3619	981	3658	982	3697	984
3581	979	3620	981	3659	983	3698	984
3582	979	3621	981	3660	983	3699	984
3583	979	3622	981	3661	983	3700	984
3584	979	3623	981	3662	983	3701	984
3585	980	3624	981	3663	983	3702	984
3586	980	3625	981	3664	983	3703	984
3587	980	3626	981	3665	983	3704	984
3588	980	3627	981	3666	983	3705	984
3589	980	3628	981	3667	983	3706	985
3590	980	3629	981	3668	983	3707	985
3591	980	3630	981	3669	983	3708	985
3592	980	3631	981	3670	983	3709	985
3593	980	3632	981	3671	983	3710	985
3594	980	3633	981	3672	983	3711	985
3595	980	3634	982	3673	983	3712	985
3596	980	3635	982	3674	983	3713	985
3597	980	3636	982	3675	983	3714	985
3598	980	3637	982	3676	983	3715	985
3599	980	3638	982	3677	983	3716	985
3600	980	3639	982	3678	983	3717	985
3601	980	3640	982	3679	983	3718	985
3602	980	3641	982	3680	984	3719	985
3603	980	3642	982	3681	984	3720	985
3604	980	3643	982	3682	984	3721	985
3605	980	3644	982	3683	984	3722	985
3606	980	3645	982	3684	984	3723	985
3607	980	3646	982	3685	984	3724	985

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
3725	985	3764	987	3803	989	3842	990
3726	985	3765	987	3804	989	3843	990
3727	986	3766	987	3805	989	3844	990
3728	986	3767	987	3806	989	3845	990
3729	986	3768	987	3807	989	3846	990
3730	986	3769	987	3808	989	3847	990
3731	986	3770	987	3809	989	3848	991
3732	986	3771	987	3810	989	3849	991
3733	986	3772	987	3811	989	3850	991
3734	986	3773	987	3812	989	3851	991
3735	986	3774	988	3813	989	3852	991
3736	986	3775	988	3814	989	3853	991
3737	986	3776	988	3815	989	3854	991
3738	986	3777	988	3816	989	3855	991
3739	986	3778	988	3817	989	3856	991
3740	986	3779	988	3818	989	3857	991
3741	986	3780	988	3819	989	3858	991
3742	986	3781	988	3820	990	3859	991
3743	986	3782	988	3821	990	3860	991
3744	986	3783	988	3822	990	3861	991
3745	986	3784	988	3823	990	3862	991
3746	986	3785	988	3824	990	3863	991
3747	986	3786	988	3825	990	3864	991
3748	986	3787	988	3826	990	3865	991
3749	987	3788	988	3827	990	3866	991
3750	987	3789	988	3828	990	3867	991
3751	987	3790	988	3829	990	3868	991
3752	987	3791	988	3830	990	3869	991
3753	987	3792	988	3831	990	3870	991
3754	987	3793	988	3832	990	3871	991
3755	987	3794	988	3833	990	3872	991
3756	987	3795	988	3834	990	3873	991
3757	987	3796	988	3835	990	3874	991
3758	987	3797	988	3836	990	3875	991
3759	987	3798	989	3837	990	3876	991
3760	987	3799	989	3838	990	3877	991
3761	987	3800	989	3839	990	3878	991
3762	987	3801	989	3840	990	3879	991
3763	987	3802	989	3841	990	3880	991

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
3881	992	3920	993	3959	995	3998	997
3882	992	3921	993	3960	995	3999	997
3883	992	3922	993	3961	995	4000	997
3884	992	3923	993	3962	995	4001	997
3885	992	3924	993	3963	995	4002	997
3886	992	3925	993	3964	995	4003	997
3887	992	3926	993	3965	995	4004	997
3888	992	3927	993	3966	995	4005	997
3889	992	3928	993	3967	995	4006	997
3890	992	3929	993	3968	995	4007	997
3891	992	3930	993	3969	995	4008	997
3892	992	3931	993	3970	995	4009	997
3893	992	3932	993	3971	995	4010	997
3894	992	3933	993	3972	995	4011	998
3895	992	3934	993	3973	995	4012	998
3896	992	3935	993	3974	995	4013	998
3897	992	3936	994	3975	995	4014	998
3898	992	3937	994	3976	995	4015	998
3899	992	3938	994	3977	995	4016	998
3900	992	3939	994	3978	995	4017	998
3901	992	3940	994	3979	996	4018	998
3902	992	3941	994	3980	996	4019	998
3903	992	3942	994	3981	996	4020	998
3904	992	3943	994	3982	996	4021	998
3905	992	3944	994	3983	996	4022	998
3906	992	3945	994	3984	996	4023	998
3907	992	3946	994	3985	996	4024	998
3908	993	3947	994	3986	996	4025	998
3909	993	3948	994	3987	996	4026	998
3910	993	3949	994	3988	996	4027	998
3911	993	3950	994	3989	996	4028	998
3912	993	3951	994	3990	996	4029	998
3913	993	3952	994	3991	996	4030	998
3914	993	3953	994	3992	996	4031	998
3915	993	3954	994	3993	996	4032	998
3916	993	3955	994	3994	996	4033	998
3917	993	3956	995	3995	996	4034	998
3918	993	3957	995	3996	996	4035	998
3919	993	3958	995	3997	997	4036	999

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4037	999	4076	1000	4115	1002	4154	1003
4038	999	4077	1000	4116	1002	4155	1003
4039	999	4078	1000	4117	1002	4156	1003
4040	999	4079	1000	4118	1002	4157	1003
4041	999	4080	1000	4119	1002	4158	1003
4042	999	4081	1000	4120	1002	4159	1003
4043	999	4082	1000	4121	1002	4160	1003
4044	999	4083	1000	4122	1002	4161	1003
4045	999	4084	1000	4123	1002	4162	1003
4046	999	4085	1000	4124	1002	4163	1004
4047	999	4086	1001	4125	1002	4164	1004
4048	999	4087	1001	4126	1002	4165	1004
4049	999	4088	1001	4127	1002	4166	1004
4050	999	4089	1001	4128	1002	4167	1004
4051	999	4090	1001	4129	1002	4168	1004
4052	999	4091	1001	4130	1002	4169	1004
4053	999	4092	1001	4131	1002	4170	1004
4054	999	4093	1001	4132	1002	4171	1004
4055	999	4094	1001	4133	1002	4172	1004
4056	999	4095	1001	4134	1002	4173	1004
4057	1000	4096	1001	4135	1002	4174	1004
4058	1000	4097	1001	4136	1002	4175	1004
4059	1000	4098	1001	4137	1002	4176	1004
4060	1000	4099	1001	4138	1002	4177	1004
4061	1000	4100	1001	4139	1002	4178	1004
4062	1000	4101	1001	4140	1002	4179	1004
4063	1000	4102	1001	4141	1002	4180	1004
4064	1000	4103	1001	4142	1003	4181	1004
4065	1000	4104	1001	4143	1003	4182	1004
4066	1000	4105	1001	4144	1003	4183	1004
4067	1000	4106	1001	4145	1003	4184	1004
4068	1000	4107	1001	4146	1003	4185	1004
4069	1000	4108	1001	4147	1003	4186	1004
4070	1000	4109	1001	4148	1003	4187	1005
4071	1000	4110	1001	4149	1003	4188	1005
4072	1000	4111	1002	4150	1003	4189	1005
4073	1000	4112	1002	4151	1003	4190	1005
4074	1000	4113	1002	4152	1003	4191	1005
4075	1000	4114	1002	4153	1003	4192	1005

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4193	1005	4232	1006	4271	1008	4310	1010
4194	1005	4233	1006	4272	1008	4311	1010
4195	1005	4234	1006	4273	1008	4312	1010
4196	1005	4235	1006	4274	1008	4313	1010
4197	1005	4236	1006	4275	1008	4314	1010
4198	1005	4237	1006	4276	1008	4315	1010
4199	1005	4238	1006	4277	1008	4316	1010
4200	1005	4239	1006	4278	1008	4317	1010
4201	1005	4240	1006	4279	1008	4318	1010
4202	1005	4241	1006	4280	1008	4319	1010
4203	1005	4242	1006	4281	1008	4320	1010
4204	1005	4243	1006	4282	1008	4321	1010
4205	1005	4244	1006	4283	1008	4322	1010
4206	1005	4245	1006	4284	1008	4323	1010
4207	1005	4246	1006	4285	1008	4324	1010
4208	1005	4247	1006	4286	1008	4325	1010
4209	1005	4248	1007	4287	1008	4326	1010
4210	1005	4249	1007	4288	1009	4327	1010
4211	1005	4250	1007	4289	1009	4328	1010
4212	1005	4251	1007	4290	1009	4329	1010
4213	1005	4252	1007	4291	1009	4330	1010
4214	1005	4253	1007	4292	1009	4331	1011
4215	1005	4254	1007	4293	1009	4332	1011
4216	1005	4255	1007	4294	1009	4333	1011
4217	1005	4256	1007	4295	1009	4334	1011
4218	1005	4257	1007	4296	1009	4335	1011
4219	1006	4258	1007	4297	1009	4336	1011
4220	1006	4259	1007	4298	1009	4337	1011
4221	1006	4260	1007	4299	1009	4338	1011
4222	1006	4261	1007	4300	1009	4339	1011
4223	1006	4262	1007	4301	1009	4340	1011
4224	1006	4263	1007	4302	1009	4341	1011
4225	1006	4264	1007	4303	1009	4342	1011
4226	1006	4265	1007	4304	1009	4343	1011
4227	1006	4266	1007	4305	1009	4344	1011
4228	1006	4267	1007	4306	1009	4345	1011
4229	1006	4268	1007	4307	1009	4346	1011
4230	1006	4269	1007	4308	1009	4347	1011
4231	1006	4270	1007	4309	1010	4348	1011

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4349	1011	4388	1013	4427	1015	4466	1016
4350	1011	4389	1013	4428	1015	4467	1016
4351	1011	4390	1013	4429	1015	4468	1016
4352	1011	4391	1013	4430	1015	4469	1016
4353	1012	4392	1013	4431	1015	4470	1016
4354	1012	4393	1013	4432	1015	4471	1016
4355	1012	4394	1013	4433	1015	4472	1016
4356	1012	4395	1013	4434	1015	4473	1017
4357	1012	4396	1013	4435	1015	4474	1017
4358	1012	4397	1013	4436	1015	4475	1017
4359	1012	4398	1013	4437	1015	4476	1017
4360	1012	4399	1013	4438	1015	4477	1017
4361	1012	4400	1013	4439	1015	4478	1017
4362	1012	4401	1014	4440	1015	4479	1017
4363	1012	4402	1014	4441	1015	4480	1017
4364	1012	4403	1014	4442	1015	4481	1017
4365	1012	4404	1014	4443	1015	4482	1017
4366	1012	4405	1014	4444	1015	4483	1017
4367	1012	4406	1014	4445	1015	4484	1017
4368	1012	4407	1014	4446	1015	4485	1017
4369	1012	4408	1014	4447	1015	4486	1017
4370	1013	4409	1014	4448	1015	4487	1017
4371	1013	4410	1014	4449	1015	4488	1017
4372	1013	4411	1014	4450	1016	4489	1017
4373	1013	4412	1014	4451	1016	4490	1017
4374	1013	4413	1014	4452	1016	4491	1017
4375	1013	4414	1014	4453	1016	4492	1017
4376	1013	4415	1014	4454	1016	4493	1017
4377	1013	4416	1014	4455	1016	4494	1017
4378	1013	4417	1014	4456	1016	4495	1017
4379	1013	4418	1014	4457	1016	4496	1017
4380	1013	4419	1014	4458	1016	4497	1017
4381	1013	4420	1014	4459	1016	4498	1017
4382	1013	4421	1014	4460	1016	4499	1017
4383	1013	4422	1014	4461	1016	4500	1018
4384	1013	4423	1014	4462	1016	4501	1018
4385	1013	4424	1015	4463	1016	4502	1018
4386	1013	4425	1015	4464	1016	4503	1018
4387	1013	4426	1015	4465	1016	4504	1018

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4505	1018	4544	1019	4583	1021	4622	1022
4506	1018	4545	1019	4584	1021	4623	1022
4507	1018	4546	1019	4585	1021	4624	1022
4508	1018	4547	1019	4586	1021	4625	1022
4509	1018	4548	1019	4587	1021	4626	1022
4510	1018	4549	1019	4588	1021	4627	1022
4511	1018	4550	1019	4589	1021	4628	1022
4512	1018	4551	1019	4590	1021	4629	1022
4513	1018	4552	1019	4591	1021	4630	1022
4514	1018	4553	1019	4592	1021	4631	1023
4515	1018	4554	1019	4593	1021	4632	1023
4516	1018	4555	1019	4594	1021	4633	1023
4517	1018	4556	1020	4595	1021	4634	1023
4518	1018	4557	1020	4596	1021	4635	1023
4519	1018	4558	1020	4597	1021	4636	1023
4520	1018	4559	1020	4598	1021	4637	1023
4521	1018	4560	1020	4599	1021	4638	1023
4522	1018	4561	1020	4600	1022	4639	1023
4523	1018	4562	1020	4601	1022	4640	1023
4524	1018	4563	1020	4602	1022	4641	1023
4525	1018	4564	1020	4603	1022	4642	1023
4526	1018	4565	1020	4604	1022	4643	1023
4527	1018	4566	1020	4605	1022	4644	1023
4528	1019	4567	1020	4606	1022	4645	1023
4529	1019	4568	1020	4607	1022	4646	1023
4530	1019	4569	1020	4608	1022	4647	1023
4531	1019	4570	1020	4609	1022	4648	1024
4532	1019	4571	1020	4610	1022	4649	1024
4533	1019	4572	1020	4611	1022	4650	1024
4534	1019	4573	1020	4612	1022	4651	1024
4535	1019	4574	1020	4613	1022	4652	1024
4536	1019	4575	1021	4614	1022	4653	1024
4537	1019	4576	1021	4615	1022	4654	1024
4538	1019	4577	1021	4616	1022	4655	1024
4539	1019	4578	1021	4617	1022	4656	1024
4540	1019	4579	1021	4618	1022	4657	1024
4541	1019	4580	1021	4619	1022	4658	1024
4542	1019	4581	1021	4620	1022	4659	1024
4543	1019	4582	1021	4621	1022	4660	1024

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4661	1024	4700	1025	4739	1027	4778	1028
4662	1024	4701	1025	4740	1027	4779	1028
4663	1024	4702	1026	4741	1027	4780	1028
4664	1024	4703	1026	4742	1027	4781	1028
4665	1024	4704	1026	4743	1027	4782	1028
4666	1024	4705	1026	4744	1027	4783	1028
4667	1024	4706	1026	4745	1027	4784	1028
4668	1024	4707	1026	4746	1027	4785	1028
4669	1024	4708	1026	4747	1027	4786	1029
4670	1024	4709	1026	4748	1027	4787	1029
4671	1024	4710	1026	4749	1027	4788	1029
4672	1024	4711	1026	4750	1027	4789	1029
4673	1024	4712	1026	4751	1027	4790	1029
4674	1024	4713	1026	4752	1027	4791	1029
4675	1024	4714	1026	4753	1027	4792	1029
4676	1024	4715	1026	4754	1027	4793	1029
4677	1024	4716	1026	4755	1027	4794	1029
4678	1024	4717	1026	4756	1027	4795	1029
4679	1024	4718	1026	4757	1027	4796	1029
4680	1024	4719	1026	4758	1028	4797	1029
4681	1024	4720	1026	4759	1028	4798	1029
4682	1024	4721	1026	4760	1028	4799	1029
4683	1024	4722	1026	4761	1028	4800	1029
4684	1025	4723	1026	4762	1028	4801	1029
4685	1025	4724	1026	4763	1028	4802	1029
4686	1025	4725	1026	4764	1028	4803	1029
4687	1025	4726	1026	4765	1028	4804	1029
4688	1025	4727	1026	4766	1028	4805	1029
4689	1025	4728	1026	4767	1028	4806	1029
4690	1025	4729	1027	4768	1028	4807	1029
4691	1025	4730	1027	4769	1028	4808	1030
4692	1025	4731	1027	4770	1028	4809	1030
4693	1025	4732	1027	4771	1028	4810	1030
4694	1025	4733	1027	4772	1028	4811	1030
4695	1025	4734	1027	4773	1028	4812	1030
4696	1025	4735	1027	4774	1028	4813	1030
4697	1025	4736	1027	4775	1028	4814	1030
4698	1025	4737	1027	4776	1028	4815	1030
4699	1025	4738	1027	4777	1028	4816	1030

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4817	1030	4856	1031	4895	1032	4934	1034
4818	1030	4857	1031	4896	1033	4935	1034
4819	1030	4858	1031	4897	1033	4936	1034
4820	1030	4859	1031	4898	1033	4937	1034
4821	1030	4860	1031	4899	1033	4938	1034
4822	1030	4861	1031	4900	1033	4939	1034
4823	1030	4862	1031	4901	1033	4940	1034
4824	1030	4863	1031	4902	1033	4941	1034
4825	1030	4864	1032	4903	1033	4942	1034
4826	1030	4865	1032	4904	1033	4943	1034
4827	1030	4866	1032	4905	1033	4944	1034
4828	1030	4867	1032	4906	1033	4945	1034
4829	1030	4868	1032	4907	1033	4946	1034
4830	1030	4869	1032	4908	1033	4947	1034
4831	1030	4870	1032	4909	1033	4948	1035
4832	1030	4871	1032	4910	1033	4949	1035
4833	1030	4872	1032	4911	1033	4950	1035
4834	1030	4873	1032	4912	1033	4951	1035
4835	1030	4874	1032	4913	1033	4952	1035
4836	1030	4875	1032	4914	1033	4953	1035
4837	1031	4876	1032	4915	1033	4954	1035
4838	1031	4877	1032	4916	1033	4955	1035
4839	1031	4878	1032	4917	1033	4956	1035
4840	1031	4879	1032	4918	1033	4957	1035
4841	1031	4880	1032	4919	1033	4958	1035
4842	1031	4881	1032	4920	1033	4959	1035
4843	1031	4882	1032	4921	1034	4960	1035
4844	1031	4883	1032	4922	1034	4961	1035
4845	1031	4884	1032	4923	1034	4962	1035
4846	1031	4885	1032	4924	1034	4963	1035
4847	1031	4886	1032	4925	1034	4964	1035
4848	1031	4887	1032	4926	1034	4965	1035
4849	1031	4888	1032	4927	1034	4966	1035
4850	1031	4889	1032	4928	1034	4967	1035
4851	1031	4890	1032	4929	1034	4968	1035
4852	1031	4891	1032	4930	1034	4969	1035
4853	1031	4892	1032	4931	1034	4970	1035
4854	1031	4893	1032	4932	1034	4971	1035
4855	1031	4894	1032	4933	1034	4972	1035

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
4973	1035	5012	1037	5051	1039	5090	1040
4974	1035	5013	1037	5052	1039	5091	1040
4975	1035	5014	1037	5053	1039	5092	1040
4976	1036	5015	1037	5054	1039	5093	1040
4977	1036	5016	1037	5055	1039	5094	1040
4978	1036	5017	1037	5056	1039	5095	1040
4979	1036	5018	1037	5057	1039	5096	1040
4980	1036	5019	1037	5058	1039	5097	1040
4981	1036	5020	1037	5059	1039	5098	1041
4982	1036	5021	1037	5060	1039	5099	1041
4983	1036	5022	1037	5061	1039	5100	1041
4984	1036	5023	1037	5062	1039	5101	1041
4985	1036	5024	1037	5063	1039	5102	1041
4986	1036	5025	1037	5064	1039	5103	1041
4987	1036	5026	1037	5065	1039	5104	1041
4988	1036	5027	1037	5066	1039	5105	1041
4989	1036	5028	1038	5067	1039	5106	1041
4990	1036	5029	1038	5068	1039	5107	1041
4991	1036	5030	1038	5069	1039	5108	1041
4992	1036	5031	1038	5070	1039	5109	1041
4993	1036	5032	1038	5071	1039	5110	1041
4994	1036	5033	1038	5072	1039	5111	1041
4995	1036	5034	1038	5073	1039	5112	1041
4996	1036	5035	1038	5074	1039	5113	1041
4997	1036	5036	1038	5075	1039	5114	1041
4998	1036	5037	1038	5076	1039	5115	1041
4999	1036	5038	1038	5077	1039	5116	1042
5000	1036	5039	1038	5078	1040	5117	1042
5001	1036	5040	1038	5079	1040	5118	1042
5002	1036	5041	1038	5080	1040	5119	1042
5003	1036	5042	1038	5081	1040	5120	1042
5004	1036	5043	1038	5082	1040	5121	1042
5005	1037	5044	1038	5083	1040	5122	1042
5006	1037	5045	1038	5084	1040	5123	1042
5007	1037	5046	1039	5085	1040	5124	1042
5008	1037	5047	1039	5086	1040	5125	1042
5009	1037	5048	1039	5087	1040	5126	1042
5010	1037	5049	1039	5088	1040	5127	1042
5011	1037	5050	1039	5089	1040	5128	1042

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
5129	1042	5168	1044	5207	1046	5246	1047
5130	1042	5169	1044	5208	1046	5247	1047
5131	1042	5170	1044	5209	1046	5248	1047
5132	1042	5171	1044	5210	1046	5249	1047
5133	1042	5172	1044	5211	1046	5250	1047
5134	1043	5173	1044	5212	1046	5251	1047
5135	1043	5174	1045	5213	1046	5252	1047
5136	1043	5175	1045	5214	1046	5253	1047
5137	1043	5176	1045	5215	1046	5254	1047
5138	1043	5177	1045	5216	1046	5255	1047
5139	1043	5178	1045	5217	1046	5256	1048
5140	1043	5179	1045	5218	1046	5257	1048
5141	1043	5180	1045	5219	1046	5258	1048
5142	1043	5181	1045	5220	1046	5259	1048
5143	1043	5182	1045	5221	1046	5260	1048
5144	1043	5183	1045	5222	1046	5261	1048
5145	1043	5184	1045	5223	1046	5262	1048
5146	1043	5185	1045	5224	1046	5263	1048
5147	1043	5186	1045	5225	1046	5264	1048
5148	1043	5187	1045	5226	1046	5265	1048
5149	1043	5188	1045	5227	1046	5266	1048
5150	1043	5189	1045	5228	1046	5267	1048
5151	1043	5190	1045	5229	1046	5268	1048
5152	1043	5191	1045	5230	1046	5269	1048
5153	1043	5192	1045	5231	1046	5270	1048
5154	1043	5193	1045	5232	1046	5271	1048
5155	1044	5194	1045	5233	1046	5272	1048
5156	1044	5195	1045	5234	1046	5273	1048
5157	1044	5196	1045	5235	1046	5274	1048
5158	1044	5197	1045	5236	1046	5275	1048
5159	1044	5198	1045	5237	1047	5276	1048
5160	1044	5199	1045	5238	1047	5277	1048
5161	1044	5200	1045	5239	1047	5278	1048
5162	1044	5201	1046	5240	1047	5279	1048
5163	1044	5202	1046	5241	1047	5280	1048
5164	1044	5203	1046	5242	1047	5281	1049
5165	1044	5204	1046	5243	1047	5282	1049
5166	1044	5205	1046	5244	1047	5283	1049
5167	1044	5206	1046	5245	1047	5284	1049

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
5285	1049	5324	1050	5363	1052	5402	1054
5286	1049	5325	1050	5364	1052	5403	1054
5287	1049	5326	1050	5365	1052	5404	1054
5288	1049	5327	1050	5366	1052	5405	1054
5289	1049	5328	1050	5367	1052	5406	1054
5290	1049	5329	1050	5368	1052	5407	1054
5291	1049	5330	1050	5369	1052	5408	1054
5292	1049	5331	1050	5370	1052	5409	1054
5293	1049	5332	1051	5371	1052	5410	1054
5294	1049	5333	1051	5372	1052	5411	1054
5295	1049	5334	1051	5373	1052	5412	1054
5296	1049	5335	1051	5374	1052	5413	1054
5297	1049	5336	1051	5375	1052	5414	1054
5298	1050	5337	1051	5376	1053	5415	1054
5299	1050	5338	1051	5377	1053	5416	1054
5300	1050	5339	1051	5378	1053	5417	1054
5301	1050	5340	1051	5379	1053	5418	1054
5302	1050	5341	1051	5380	1053	5419	1054
5303	1050	5342	1051	5381	1053	5420	1054
5304	1050	5343	1051	5382	1053	5421	1054
5305	1050	5344	1051	5383	1053	5422	1054
5306	1050	5345	1051	5384	1053	5423	1055
5307	1050	5346	1051	5385	1053	5424	1055
5308	1050	5347	1051	5386	1053	5425	1055
5309	1050	5348	1051	5387	1053	5426	1055
5310	1050	5349	1051	5388	1053	5427	1055
5311	1050	5350	1051	5389	1053	5428	1055
5312	1050	5351	1051	5390	1053	5429	1055
5313	1050	5352	1051	5391	1053	5430	1055
5314	1050	5353	1051	5392	1053	5431	1055
5315	1050	5354	1052	5393	1053	5432	1055
5316	1050	5355	1052	5394	1053	5433	1055
5317	1050	5356	1052	5395	1053	5434	1055
5318	1050	5357	1052	5396	1053	5435	1055
5319	1050	5358	1052	5397	1053	5436	1055
5320	1050	5359	1052	5398	1053	5437	1055
5321	1050	5360	1052	5399	1053	5438	1055
5322	1050	5361	1052	5400	1053	5439	1055
5323	1050	5362	1052	5401	1054	5440	1055

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
5441	1055	5480	1057	5519	1058	5558	1059
5442	1055	5481	1057	5520	1058	5559	1060
5443	1055	5482	1057	5521	1058	5560	1060
5444	1055	5483	1057	5522	1058	5561	1060
5445	1055	5484	1057	5523	1058	5562	1060
5446	1055	5485	1057	5524	1058	5563	1060
5447	1055	5486	1057	5525	1058	5564	1060
5448	1055	5487	1057	5526	1058	5565	1060
5449	1055	5488	1057	5527	1058	5566	1060
5450	1055	5489	1057	5528	1058	5567	1060
5451	1055	5490	1057	5529	1059	5568	1060
5452	1056	5491	1057	5530	1059	5569	1060
5453	1056	5492	1057	5531	1059	5570	1060
5454	1056	5493	1057	5532	1059	5571	1060
5455	1056	5494	1057	5533	1059	5572	1060
5456	1056	5495	1057	5534	1059	5573	1060
5457	1056	5496	1057	5535	1059	5574	1060
5458	1056	5497	1057	5536	1059	5575	1060
5459	1056	5498	1057	5537	1059	5576	1060
5460	1056	5499	1057	5538	1059	5577	1060
5461	1056	5500	1057	5539	1059	5578	1060
5462	1056	5501	1057	5540	1059	5579	1060
5463	1056	5502	1057	5541	1059	5580	1060
5464	1056	5503	1057	5542	1059	5581	1060
5465	1056	5504	1057	5543	1059	5582	1060
5466	1056	5505	1057	5544	1059	5583	1060
5467	1056	5506	1057	5545	1059	5584	1060
5468	1056	5507	1058	5546	1059	5585	1060
5469	1056	5508	1058	5547	1059	5586	1060
5470	1056	5509	1058	5548	1059	5587	1060
5471	1056	5510	1058	5549	1059	5588	1060
5472	1056	5511	1058	5550	1059	5589	1061
5473	1056	5512	1058	5551	1059	5590	1061
5474	1056	5513	1058	5552	1059	5591	1061
5475	1057	5514	1058	5553	1059	5592	1061
5476	1057	5515	1058	5554	1059	5593	1061
5477	1057	5516	1058	5555	1059	5594	1061
5478	1057	5517	1058	5556	1059	5595	1061
5479	1057	5518	1058	5557	1059	5596	1061

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
5597	1061	5636	1063	5675	1065	5714	1067
5598	1061	5637	1063	5676	1065	5715	1067
5599	1061	5638	1063	5677	1065	5716	1067
5600	1061	5639	1063	5678	1065	5717	1067
5601	1061	5640	1063	5679	1065	5718	1067
5602	1061	5641	1063	5680	1065	5719	1067
5603	1062	5642	1063	5681	1065	5720	1067
5604	1062	5643	1063	5682	1065	5721	1067
5605	1062	5644	1063	5683	1065	5722	1067
5606	1062	5645	1063	5684	1065	5723	1067
5607	1062	5646	1063	5685	1065	5724	1067
5608	1062	5647	1063	5686	1065	5725	1067
5609	1062	5648	1063	5687	1065	5726	1067
5610	1062	5649	1063	5688	1066	5727	1067
5611	1062	5650	1063	5689	1066	5728	1067
5612	1062	5651	1063	5690	1066	5729	1067
5613	1062	5652	1063	5691	1066	5730	1067
5614	1062	5653	1064	5692	1066	5731	1067
5615	1062	5654	1064	5693	1066	5732	1067
5616	1062	5655	1064	5694	1066	5733	1068
5617	1062	5656	1064	5695	1066	5734	1068
5618	1062	5657	1064	5696	1066	5735	1068
5619	1062	5658	1064	5697	1066	5736	1068
5620	1062	5659	1064	5698	1066	5737	1068
5621	1062	5660	1064	5699	1066	5738	1068
5622	1062	5661	1064	5700	1066	5739	1068
5623	1062	5662	1064	5701	1066	5740	1068
5624	1062	5663	1064	5702	1066	5741	1068
5625	1062	5664	1064	5703	1066	5742	1068
5626	1062	5665	1064	5704	1066	5743	1068
5627	1062	5666	1064	5705	1066	5744	1068
5628	1062	5667	1064	5706	1066	5745	1068
5629	1062	5668	1064	5707	1067	5746	1068
5630	1063	5669	1064	5708	1067	5747	1068
5631	1063	5670	1064	5709	1067	5748	1068
5632	1063	5671	1064	5710	1067	5749	1068
5633	1063	5672	1064	5711	1067	5750	1068
5634	1063	5673	1064	5712	1067	5751	1068
5635	1063	5674	1065	5713	1067	5752	1068

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
5753	1068	5792	1070	5831	1072	5870	1074
5754	1068	5793	1070	5832	1072	5871	1074
5755	1068	5794	1070	5833	1072	5872	1074
5756	1068	5795	1070	5834	1072	5873	1074
5757	1068	5796	1070	5835	1072	5874	1074
5758	1068	5797	1070	5836	1072	5875	1074
5759	1068	5798	1071	5837	1072	5876	1074
5760	1069	5799	1071	5838	1072	5877	1074
5761	1069	5800	1071	5839	1072	5878	1074
5762	1069	5801	1071	5840	1072	5879	1074
5763	1069	5802	1071	5841	1072	5880	1074
5764	1069	5803	1071	5842	1072	5881	1074
5765	1069	5804	1071	5843	1072	5882	1074
5766	1069	5805	1071	5844	1072	5883	1074
5767	1069	5806	1071	5845	1072	5884	1074
5768	1069	5807	1071	5846	1073	5885	1074
5769	1069	5808	1071	5847	1073	5886	1075
5770	1069	5809	1071	5848	1073	5887	1075
5771	1069	5810	1071	5849	1073	5888	1075
5772	1069	5811	1071	5850	1073	5889	1075
5773	1069	5812	1071	5851	1073	5890	1075
5774	1069	5813	1071	5852	1073	5891	1075
5775	1069	5814	1071	5853	1073	5892	1075
5776	1069	5815	1071	5854	1073	5893	1075
5777	1069	5816	1071	5855	1073	5894	1075
5778	1069	5817	1071	5856	1073	5895	1075
5779	1069	5818	1071	5857	1073	5896	1075
5780	1069	5819	1071	5858	1073	5897	1075
5781	1070	5820	1071	5859	1073	5898	1075
5782	1070	5821	1071	5860	1073	5899	1075
5783	1070	5822	1071	5861	1073	5900	1075
5784	1070	5823	1071	5862	1073	5901	1075
5785	1070	5824	1071	5863	1073	5902	1075
5786	1070	5825	1071	5864	1073	5903	1076
5787	1070	5826	1071	5865	1073	5904	1076
5788	1070	5827	1071	5866	1074	5905	1076
5789	1070	5828	1072	5867	1074	5906	1076
5790	1070	5829	1072	5868	1074	5907	1076
5791	1070	5830	1072	5869	1074	5908	1076

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
5909	1076	5948	1077	5987	1079	6026	1081
5910	1076	5949	1077	5988	1079	6027	1081
5911	1076	5950	1077	5989	1079	6028	1081
5912	1076	5951	1077	5990	1079	6029	1081
5913	1076	5952	1077	5991	1079	6030	1081
5914	1076	5953	1077	5992	1079	6031	1081
5915	1076	5954	1077	5993	1079	6032	1081
5916	1076	5955	1078	5994	1079	6033	1081
5917	1076	5956	1078	5995	1079	6034	1081
5918	1076	5957	1078	5996	1079	6035	1082
5919	1076	5958	1078	5997	1079	6036	1082
5920	1076	5959	1078	5998	1079	6037	1082
5921	1076	5960	1078	5999	1079	6038	1082
5922	1076	5961	1078	6000	1079	6039	1082
5923	1076	5962	1078	6001	1080	6040	1082
5924	1076	5963	1078	6002	1080	6041	1082
5925	1076	5964	1078	6003	1080	6042	1082
5926	1076	5965	1078	6004	1080	6043	1082
5927	1076	5966	1078	6005	1080	6044	1082
5928	1076	5967	1078	6006	1080	6045	1082
5929	1076	5968	1078	6007	1080	6046	1082
5930	1077	5969	1078	6008	1080	6047	1082
5931	1077	5970	1078	6009	1080	6048	1082
5932	1077	5971	1078	6010	1080	6049	1082
5933	1077	5972	1078	6011	1080	6050	1082
5934	1077	5973	1079	6012	1080	6051	1082
5935	1077	5974	1079	6013	1080	6052	1082
5936	1077	5975	1079	6014	1080	6053	1082
5937	1077	5976	1079	6015	1080	6054	1083
5938	1077	5977	1079	6016	1080	6055	1083
5939	1077	5978	1079	6017	1080	6056	1083
5940	1077	5979	1079	6018	1081	6057	1083
5941	1077	5980	1079	6019	1081	6058	1083
5942	1077	5981	1079	6020	1081	6059	1083
5943	1077	5982	1079	6021	1081	6060	1083
5944	1077	5983	1079	6022	1081	6061	1083
5945	1077	5984	1079	6023	1081	6062	1083
5946	1077	5985	1079	6024	1081	6063	1083
5947	1077	5986	1079	6025	1081	6064	1083

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
6065	1083	6104	1084	6143	1085	6182	1087
6066	1083	6105	1084	6144	1085	6183	1087
6067	1083	6106	1084	6145	1085	6184	1087
6068	1083	6107	1084	6146	1085	6185	1087
6069	1083	6108	1084	6147	1086	6186	1087
6070	1083	6109	1084	6148	1086	6187	1087
6071	1083	6110	1084	6149	1086	6188	1087
6072	1083	6111	1085	6150	1086	6189	1087
6073	1083	6112	1085	6151	1086	6190	1087
6074	1083	6113	1085	6152	1086	6191	1087
6075	1083	6114	1085	6153	1086	6192	1087
6076	1084	6115	1085	6154	1086	6193	1087
6077	1084	6116	1085	6155	1086	6194	1087
6078	1084	6117	1085	6156	1086	6195	1088
6079	1084	6118	1085	6157	1086	6196	1088
6080	1084	6119	1085	6158	1086	6197	1088
6081	1084	6120	1085	6159	1086	6198	1088
6082	1084	6121	1085	6160	1086	6199	1088
6083	1084	6122	1085	6161	1086	6200	1088
6084	1084	6123	1085	6162	1086	6201	1088
6085	1084	6124	1085	6163	1086	6202	1088
6086	1084	6125	1085	6164	1086	6203	1088
6087	1084	6126	1085	6165	1086	6204	1088
6088	1084	6127	1085	6166	1086	6205	1088
6089	1084	6128	1085	6167	1086	6206	1088
6090	1084	6129	1085	6168	1086	6207	1088
6091	1084	6130	1085	6169	1086	6208	1088
6092	1084	6131	1085	6170	1086	6209	1088
6093	1084	6132	1085	6171	1086	6210	1088
6094	1084	6133	1085	6172	1086	6211	1088
6095	1084	6134	1085	6173	1086	6212	1088
6096	1084	6135	1085	6174	1086	6213	1089
6097	1084	6136	1085	6175	1086	6214	1089
6098	1084	6137	1085	6176	1087	6215	1089
6099	1084	6138	1085	6177	1087	6216	1089
6100	1084	6139	1085	6178	1087	6217	1089
6101	1084	6140	1085	6179	1087	6218	1089
6102	1084	6141	1085	6180	1087	6219	1089
6103	1084	6142	1085	6181	1087	6220	1089

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
6221	1089	6260	1090	6299	1092	6338	1094
6222	1089	6261	1090	6300	1092	6339	1094
6223	1089	6262	1090	6301	1092	6340	1094
6224	1089	6263	1090	6302	1092	6341	1094
6225	1089	6264	1091	6303	1092	6342	1094
6226	1089	6265	1091	6304	1092	6343	1094
6227	1089	6266	1091	6305	1092	6344	1094
6228	1089	6267	1091	6306	1092	6345	1094
6229	1089	6268	1091	6307	1092	6346	1094
6230	1089	6269	1091	6308	1092	6347	1094
6231	1089	6270	1091	6309	1092	6348	1094
6232	1089	6271	1091	6310	1092	6349	1094
6233	1089	6272	1091	6311	1092	6350	1094
6234	1089	6273	1091	6312	1092	6351	1094
6235	1089	6274	1091	6313	1092	6352	1094
6236	1089	6275	1091	6314	1093	6353	1094
6237	1089	6276	1091	6315	1093	6354	1094
6238	1090	6277	1091	6316	1093	6355	1094
6239	1090	6278	1091	6317	1093	6356	1094
6240	1090	6279	1091	6318	1093	6357	1095
6241	1090	6280	1091	6319	1093	6358	1095
6242	1090	6281	1091	6320	1093	6359	1095
6243	1090	6282	1091	6321	1093	6360	1095
6244	1090	6283	1091	6322	1093	6361	1095
6245	1090	6284	1091	6323	1093	6362	1095
6246	1090	6285	1091	6324	1093	6363	1095
6247	1090	6286	1091	6325	1093	6364	1095
6248	1090	6287	1091	6326	1093	6365	1095
6249	1090	6288	1091	6327	1093	6366	1095
6250	1090	6289	1091	6328	1093	6367	1095
6251	1090	6290	1092	6329	1093	6368	1095
6252	1090	6291	1092	6330	1093	6369	1095
6253	1090	6292	1092	6331	1093	6370	1095
6254	1090	6293	1092	6332	1094	6371	1095
6255	1090	6294	1092	6333	1094	6372	1096
6256	1090	6295	1092	6334	1094	6373	1096
6257	1090	6296	1092	6335	1094	6374	1096
6258	1090	6297	1092	6336	1094	6375	1096
6259	1090	6298	1092	6337	1094	6376	1096

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
6377	1096	6416	1098	6455	1100	6494	1102
6378	1096	6417	1098	6456	1100	6495	1102
6379	1096	6418	1098	6457	1100	6496	1102
6380	1096	6419	1098	6458	1100	6497	1102
6381	1096	6420	1098	6459	1100	6498	1102
6382	1096	6421	1098	6460	1100	6499	1102
6383	1096	6422	1098	6461	1100	6500	1102
6384	1096	6423	1098	6462	1100	6501	1102
6385	1096	6424	1098	6463	1100	6502	1102
6386	1096	6425	1098	6464	1100	6503	1102
6387	1096	6426	1098	6465	1100	6504	1102
6388	1096	6427	1098	6466	1100	6505	1102
6389	1096	6428	1098	6467	1100	6506	1102
6390	1096	6429	1098	6468	1101	6507	1102
6391	1096	6430	1098	6469	1101	6508	1102
6392	1096	6431	1098	6470	1101	6509	1103
6393	1096	6432	1098	6471	1101	6510	1103
6394	1096	6433	1098	6472	1101	6511	1103
6395	1097	6434	1098	6473	1101	6512	1103
6396	1097	6435	1098	6474	1101	6513	1103
6397	1097	6436	1098	6475	1101	6514	1103
6398	1097	6437	1099	6476	1101	6515	1103
6399	1097	6438	1099	6477	1101	6516	1103
6400	1097	6439	1099	6478	1101	6517	1103
6401	1097	6440	1099	6479	1101	6518	1103
6402	1097	6441	1099	6480	1101	6519	1103
6403	1097	6442	1099	6481	1101	6520	1103
6404	1097	6443	1099	6482	1101	6521	1103
6405	1097	6444	1099	6483	1101	6522	1103
6406	1097	6445	1099	6484	1101	6523	1103
6407	1097	6446	1099	6485	1101	6524	1103
6408	1097	6447	1099	6486	1101	6525	1103
6409	1097	6448	1099	6487	1101	6526	1103
6410	1097	6449	1099	6488	1101	6527	1103
6411	1097	6450	1099	6489	1101	6528	1103
6412	1098	6451	1099	6490	1102	6529	1103
6413	1098	6452	1099	6491	1102	6530	1103
6414	1098	6453	1100	6492	1102	6531	1104
6415	1098	6454	1100	6493	1102	6532	1104

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
6533	1104	6572	1106	6611	1108	6650	1109
6534	1104	6573	1106	6612	1108	6651	1109
6535	1104	6574	1106	6613	1108	6652	1110
6536	1104	6575	1106	6614	1108	6653	1110
6537	1104	6576	1106	6615	1108	6654	1110
6538	1104	6577	1106	6616	1108	6655	1110
6539	1104	6578	1106	6617	1108	6656	1110
6540	1104	6579	1106	6618	1108	6657	1110
6541	1104	6580	1106	6619	1108	6658	1110
6542	1104	6581	1106	6620	1108	6659	1110
6543	1104	6582	1106	6621	1108	6660	1110
6544	1104	6583	1106	6622	1108	6661	1110
6545	1104	6584	1106	6623	1108	6662	1110
6546	1104	6585	1107	6624	1108	6663	1110
6547	1104	6586	1107	6625	1108	6664	1110
6548	1105	6587	1107	6626	1108	6665	1110
6549	1105	6588	1107	6627	1108	6666	1110
6550	1105	6589	1107	6628	1108	6667	1110
6551	1105	6590	1107	6629	1108	6668	1110
6552	1105	6591	1107	6630	1108	6669	1110
6553	1105	6592	1107	6631	1108	6670	1110
6554	1105	6593	1107	6632	1108	6671	1110
6555	1105	6594	1107	6633	1109	6672	1111
6556	1105	6595	1107	6634	1109	6673	1111
6557	1105	6596	1107	6635	1109	6674	1111
6558	1105	6597	1107	6636	1109	6675	1111
6559	1105	6598	1107	6637	1109	6676	1111
6560	1105	6599	1107	6638	1109	6677	1111
6561	1105	6600	1107	6639	1109	6678	1111
6562	1105	6601	1107	6640	1109	6679	1111
6563	1106	6602	1107	6641	1109	6680	1111
6564	1106	6603	1107	6642	1109	6681	1111
6565	1106	6604	1107	6643	1109	6682	1111
6566	1106	6605	1107	6644	1109	6683	1111
6567	1106	6606	1107	6645	1109	6684	1111
6568	1106	6607	1107	6646	1109	6685	1111
6569	1106	6608	1107	6647	1109	6686	1111
6570	1106	6609	1107	6648	1109	6687	1111
6571	1106	6610	1108	6649	1109	6688	1111

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
6689	1112	6728	1113	6767	1115	6806	1117
6690	1112	6729	1113	6768	1115	6807	1117
6691	1112	6730	1113	6769	1115	6808	1117
6692	1112	6731	1113	6770	1115	6809	1117
6693	1112	6732	1114	6771	1115	6810	1117
6694	1112	6733	1114	6772	1115	6811	1117
6695	1112	6734	1114	6773	1115	6812	1118
6696	1112	6735	1114	6774	1115	6813	1118
6697	1112	6736	1114	6775	1116	6814	1118
6698	1112	6737	1114	6776	1116	6815	1118
6699	1112	6738	1114	6777	1116	6816	1118
6700	1112	6739	1114	6778	1116	6817	1118
6701	1112	6740	1114	6779	1116	6818	1118
6702	1112	6741	1114	6780	1116	6819	1118
6703	1112	6742	1114	6781	1116	6820	1118
6704	1112	6743	1114	6782	1116	6821	1118
6705	1112	6744	1114	6783	1116	6822	1118
6706	1113	6745	1114	6784	1116	6823	1118
6707	1113	6746	1114	6785	1116	6824	1118
6708	1113	6747	1114	6786	1116	6825	1118
6709	1113	6748	1114	6787	1116	6826	1118
6710	1113	6749	1114	6788	1116	6827	1118
6711	1113	6750	1114	6789	1116	6828	1118
6712	1113	6751	1114	6790	1116	6829	1118
6713	1113	6752	1114	6791	1116	6830	1118
6714	1113	6753	1114	6792	1116	6831	1118
6715	1113	6754	1114	6793	1116	6832	1118
6716	1113	6755	1114	6794	1116	6833	1118
6717	1113	6756	1114	6795	1116	6834	1118
6718	1113	6757	1115	6796	1116	6835	1119
6719	1113	6758	1115	6797	1117	6836	1119
6720	1113	6759	1115	6798	1117	6837	1119
6721	1113	6760	1115	6799	1117	6838	1119
6722	1113	6761	1115	6800	1117	6839	1119
6723	1113	6762	1115	6801	1117	6840	1119
6724	1113	6763	1115	6802	1117	6841	1119
6725	1113	6764	1115	6803	1117	6842	1119
6726	1113	6765	1115	6804	1117	6843	1119
6727	1113	6766	1115	6805	1117	6844	1119

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
6845	1119	6884	1121	6923	1123	6962	1125
6846	1119	6885	1121	6924	1123	6963	1125
6847	1119	6886	1121	6925	1123	6964	1125
6848	1119	6887	1121	6926	1124	6965	1126
6849	1119	6888	1121	6927	1124	6966	1126
6850	1119	6889	1121	6928	1124	6967	1126
6851	1119	6890	1121	6929	1124	6968	1126
6852	1119	6891	1121	6930	1124	6969	1126
6853	1119	6892	1121	6931	1124	6970	1126
6854	1120	6893	1121	6932	1124	6971	1126
6855	1120	6894	1122	6933	1124	6972	1126
6856	1120	6895	1122	6934	1124	6973	1126
6857	1120	6896	1122	6935	1124	6974	1126
6858	1120	6897	1122	6936	1124	6975	1126
6859	1120	6898	1122	6937	1124	6976	1126
6860	1120	6899	1122	6938	1124	6977	1126
6861	1120	6900	1122	6939	1124	6978	1126
6862	1120	6901	1122	6940	1124	6979	1126
6863	1120	6902	1122	6941	1124	6980	1126
6864	1120	6903	1122	6942	1124	6981	1126
6865	1120	6904	1122	6943	1124	6982	1126
6866	1120	6905	1122	6944	1124	6983	1126
6867	1120	6906	1122	6945	1124	6984	1126
6868	1120	6907	1122	6946	1124	6985	1126
6869	1120	6908	1122	6947	1125	6986	1127
6870	1120	6909	1122	6948	1125	6987	1127
6871	1120	6910	1122	6949	1125	6988	1127
6872	1120	6911	1122	6950	1125	6989	1127
6873	1120	6912	1122	6951	1125	6990	1127
6874	1120	6913	1122	6952	1125	6991	1127
6875	1120	6914	1123	6953	1125	6992	1127
6876	1120	6915	1123	6954	1125	6993	1127
6877	1120	6916	1123	6955	1125	6994	1127
6878	1120	6917	1123	6956	1125	6995	1127
6879	1120	6918	1123	6957	1125	6996	1128
6880	1121	6919	1123	6958	1125	6997	1128
6881	1121	6920	1123	6959	1125	6998	1128
6882	1121	6921	1123	6960	1125	6999	1128
6883	1121	6922	1123	6961	1125	7000	1128

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7001	1128	7040	1130	7079	1132	7118	1135
7002	1128	7041	1130	7080	1132	7119	1135
7003	1128	7042	1130	7081	1132	7120	1135
7004	1128	7043	1130	7082	1133	7121	1135
7005	1128	7044	1130	7083	1133	7122	1135
7006	1128	7045	1130	7084	1133	7123	1135
7007	1128	7046	1130	7085	1133	7124	1135
7008	1128	7047	1130	7086	1133	7125	1135
7009	1128	7048	1130	7087	1133	7126	1135
7010	1128	7049	1130	7088	1133	7127	1135
7011	1128	7050	1130	7089	1133	7128	1135
7012	1128	7051	1130	7090	1133	7129	1135
7013	1128	7052	1130	7091	1133	7130	1136
7014	1128	7053	1131	7092	1133	7131	1136
7015	1129	7054	1131	7093	1133	7132	1136
7016	1129	7055	1131	7094	1133	7133	1136
7017	1129	7056	1131	7095	1133	7134	1136
7018	1129	7057	1131	7096	1133	7135	1136
7019	1129	7058	1131	7097	1133	7136	1136
7020	1129	7059	1131	7098	1133	7137	1136
7021	1129	7060	1131	7099	1134	7138	1136
7022	1129	7061	1131	7100	1134	7139	1136
7023	1129	7062	1131	7101	1134	7140	1136
7024	1129	7063	1131	7102	1134	7141	1136
7025	1129	7064	1131	7103	1134	7142	1136
7026	1129	7065	1131	7104	1134	7143	1136
7027	1129	7066	1131	7105	1134	7144	1136
7028	1129	7067	1131	7106	1134	7145	1136
7029	1129	7068	1132	7107	1134	7146	1136
7030	1129	7069	1132	7108	1134	7147	1136
7031	1130	7070	1132	7109	1134	7148	1136
7032	1130	7071	1132	7110	1134	7149	1136
7033	1130	7072	1132	7111	1134	7150	1136
7034	1130	7073	1132	7112	1135	7151	1136
7035	1130	7074	1132	7113	1135	7152	1136
7036	1130	7075	1132	7114	1135	7153	1136
7037	1130	7076	1132	7115	1135	7154	1137
7038	1130	7077	1132	7116	1135	7155	1137
7039	1130	7078	1132	7117	1135	7156	1137

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7157	1137	7196	1139	7235	1142	7274	1144
7158	1137	7197	1139	7236	1142	7275	1144
7159	1137	7198	1139	7237	1142	7276	1144
7160	1137	7199	1140	7238	1142	7277	1144
7161	1137	7200	1140	7239	1142	7278	1144
7162	1137	7201	1140	7240	1142	7279	1144
7163	1137	7202	1140	7241	1142	7280	1144
7164	1138	7203	1140	7242	1142	7281	1144
7165	1138	7204	1140	7243	1142	7282	1144
7166	1138	7205	1140	7244	1142	7283	1144
7167	1138	7206	1140	7245	1142	7284	1144
7168	1138	7207	1140	7246	1142	7285	1144
7169	1138	7208	1140	7247	1142	7286	1145
7170	1138	7209	1140	7248	1142	7287	1145
7171	1138	7210	1140	7249	1142	7288	1145
7172	1138	7211	1140	7250	1143	7289	1145
7173	1138	7212	1140	7251	1143	7290	1145
7174	1138	7213	1140	7252	1143	7291	1145
7175	1138	7214	1141	7253	1143	7292	1145
7176	1138	7215	1141	7254	1143	7293	1145
7177	1138	7216	1141	7255	1143	7294	1145
7178	1138	7217	1141	7256	1143	7295	1145
7179	1138	7218	1141	7257	1143	7296	1145
7180	1138	7219	1141	7258	1143	7297	1145
7181	1138	7220	1141	7259	1143	7298	1145
7182	1138	7221	1141	7260	1143	7299	1145
7183	1139	7222	1141	7261	1143	7300	1145
7184	1139	7223	1141	7262	1143	7301	1145
7185	1139	7224	1141	7263	1143	7302	1145
7186	1139	7225	1141	7264	1143	7303	1145
7187	1139	7226	1141	7265	1143	7304	1145
7188	1139	7227	1142	7266	1143	7305	1145
7189	1139	7228	1142	7267	1143	7306	1145
7190	1139	7229	1142	7268	1144	7307	1146
7191	1139	7230	1142	7269	1144	7308	1146
7192	1139	7231	1142	7270	1144	7309	1146
7193	1139	7232	1142	7271	1144	7310	1146
7194	1139	7233	1142	7272	1144	7311	1146
7195	1139	7234	1142	7273	1144	7312	1146

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7313	1146	7352	1149	7391	1151	7430	1153
7314	1146	7353	1149	7392	1151	7431	1153
7315	1146	7354	1149	7393	1151	7432	1153
7316	1146	7355	1149	7394	1151	7433	1153
7317	1146	7356	1149	7395	1151	7434	1153
7318	1146	7357	1149	7396	1151	7435	1153
7319	1146	7358	1149	7397	1151	7436	1153
7320	1146	7359	1149	7398	1151	7437	1153
7321	1147	7360	1149	7399	1151	7438	1153
7322	1147	7361	1149	7400	1151	7439	1153
7323	1147	7362	1149	7401	1151	7440	1153
7324	1147	7363	1149	7402	1151	7441	1153
7325	1147	7364	1149	7403	1151	7442	1153
7326	1147	7365	1149	7404	1151	7443	1153
7327	1147	7366	1149	7405	1151	7444	1153
7328	1147	7367	1149	7406	1152	7445	1153
7329	1147	7368	1150	7407	1152	7446	1153
7330	1147	7369	1150	7408	1152	7447	1153
7331	1147	7370	1150	7409	1152	7448	1153
7332	1147	7371	1150	7410	1152	7449	1153
7333	1147	7372	1150	7411	1152	7450	1154
7334	1148	7373	1150	7412	1152	7451	1154
7335	1148	7374	1150	7413	1152	7452	1154
7336	1148	7375	1150	7414	1152	7453	1154
7337	1148	7376	1150	7415	1152	7454	1154
7338	1148	7377	1150	7416	1152	7455	1154
7339	1148	7378	1150	7417	1152	7456	1154
7340	1148	7379	1150	7418	1152	7457	1154
7341	1148	7380	1150	7419	1152	7458	1154
7342	1148	7381	1150	7420	1152	7459	1154
7343	1148	7382	1150	7421	1152	7460	1154
7344	1148	7383	1150	7422	1152	7461	1154
7345	1148	7384	1150	7423	1152	7462	1154
7346	1148	7385	1150	7424	1152	7463	1154
7347	1148	7386	1150	7425	1152	7464	1154
7348	1149	7387	1150	7426	1152	7465	1154
7349	1149	7388	1150	7427	1152	7466	1155
7350	1149	7389	1151	7428	1152	7467	1155
7351	1149	7390	1151	7429	1152	7468	1155

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7469	1155	7508	1157	7547	1159	7586	1161
7470	1155	7509	1157	7548	1159	7587	1161
7471	1155	7510	1157	7549	1159	7588	1161
7472	1155	7511	1157	7550	1159	7589	1161
7473	1155	7512	1157	7551	1159	7590	1161
7474	1155	7513	1157	7552	1159	7591	1161
7475	1155	7514	1157	7553	1159	7592	1161
7476	1155	7515	1157	7554	1159	7593	1162
7477	1155	7516	1157	7555	1159	7594	1162
7478	1155	7517	1157	7556	1159	7595	1162
7479	1155	7518	1157	7557	1159	7596	1162
7480	1155	7519	1157	7558	1160	7597	1162
7481	1155	7520	1158	7559	1160	7598	1162
7482	1155	7521	1158	7560	1160	7599	1162
7483	1155	7522	1158	7561	1160	7600	1162
7484	1155	7523	1158	7562	1160	7601	1162
7485	1155	7524	1158	7563	1160	7602	1162
7486	1156	7525	1158	7564	1160	7603	1162
7487	1156	7526	1158	7565	1160	7604	1162
7488	1156	7527	1158	7566	1160	7605	1162
7489	1156	7528	1158	7567	1160	7606	1162
7490	1156	7529	1158	7568	1160	7607	1162
7491	1156	7530	1158	7569	1160	7608	1162
7492	1156	7531	1158	7570	1160	7609	1162
7493	1156	7532	1158	7571	1160	7610	1162
7494	1156	7533	1158	7572	1160	7611	1162
7495	1156	7534	1158	7573	1160	7612	1162
7496	1156	7535	1158	7574	1160	7613	1162
7497	1156	7536	1158	7575	1160	7614	1162
7498	1156	7537	1158	7576	1160	7615	1163
7499	1156	7538	1158	7577	1161	7616	1163
7500	1156	7539	1159	7578	1161	7617	1163
7501	1156	7540	1159	7579	1161	7618	1163
7502	1156	7541	1159	7580	1161	7619	1163
7503	1156	7542	1159	7581	1161	7620	1163
7504	1157	7543	1159	7582	1161	7621	1163
7505	1157	7544	1159	7583	1161	7622	1163
7506	1157	7545	1159	7584	1161	7623	1163
7507	1157	7546	1159	7585	1161	7624	1163

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7625	1163	7664	1166	7703	1168	7742	1170
7626	1163	7665	1166	7704	1168	7743	1170
7627	1163	7666	1166	7705	1169	7744	1170
7628	1163	7667	1166	7706	1169	7745	1171
7629	1163	7668	1167	7707	1169	7746	1171
7630	1164	7669	1167	7708	1169	7747	1171
7631	1164	7670	1167	7709	1169	7748	1171
7632	1164	7671	1167	7710	1169	7749	1171
7633	1164	7672	1167	7711	1169	7750	1171
7634	1164	7673	1167	7712	1169	7751	1171
7635	1164	7674	1167	7713	1169	7752	1171
7636	1164	7675	1167	7714	1169	7753	1171
7637	1164	7676	1167	7715	1169	7754	1171
7638	1164	7677	1167	7716	1169	7755	1171
7639	1164	7678	1167	7717	1169	7756	1171
7640	1164	7679	1167	7718	1169	7757	1171
7641	1164	7680	1167	7719	1169	7758	1171
7642	1164	7681	1167	7720	1169	7759	1171
7643	1164	7682	1167	7721	1169	7760	1171
7644	1164	7683	1167	7722	1169	7761	1171
7645	1164	7684	1167	7723	1170	7762	1171
7646	1164	7685	1167	7724	1170	7763	1171
7647	1164	7686	1167	7725	1170	7764	1171
7648	1165	7687	1167	7726	1170	7765	1171
7649	1165	7688	1167	7727	1170	7766	1171
7650	1165	7689	1167	7728	1170	7767	1172
7651	1165	7690	1168	7729	1170	7768	1172
7652	1165	7691	1168	7730	1170	7769	1172
7653	1165	7692	1168	7731	1170	7770	1172
7654	1165	7693	1168	7732	1170	7771	1172
7655	1166	7694	1168	7733	1170	7772	1172
7656	1166	7695	1168	7734	1170	7773	1172
7657	1166	7696	1168	7735	1170	7774	1172
7658	1166	7697	1168	7736	1170	7775	1172
7659	1166	7698	1168	7737	1170	7776	1172
7660	1166	7699	1168	7738	1170	7777	1173
7661	1166	7700	1168	7739	1170	7778	1173
7662	1166	7701	1168	7740	1170	7779	1173
7663	1166	7702	1168	7741	1170	7780	1173

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7781	1173	7820	1175	7859	1178	7898	1180
7782	1173	7821	1175	7860	1178	7899	1180
7783	1173	7822	1175	7861	1178	7900	1180
7784	1173	7823	1175	7862	1178	7901	1180
7785	1173	7824	1176	7863	1178	7902	1180
7786	1173	7825	1176	7864	1178	7903	1180
7787	1173	7826	1176	7865	1178	7904	1180
7788	1173	7827	1176	7866	1178	7905	1180
7789	1173	7828	1176	7867	1178	7906	1181
7790	1173	7829	1176	7868	1178	7907	1181
7791	1173	7830	1176	7869	1178	7908	1181
7792	1173	7831	1176	7870	1179	7909	1181
7793	1173	7832	1176	7871	1179	7910	1181
7794	1173	7833	1176	7872	1179	7911	1181
7795	1174	7834	1176	7873	1179	7912	1181
7796	1174	7835	1176	7874	1179	7913	1181
7797	1174	7836	1176	7875	1179	7914	1181
7798	1174	7837	1176	7876	1179	7915	1181
7799	1174	7838	1176	7877	1179	7916	1181
7800	1174	7839	1176	7878	1179	7917	1181
7801	1174	7840	1177	7879	1179	7918	1181
7802	1174	7841	1177	7880	1179	7919	1181
7803	1174	7842	1177	7881	1179	7920	1181
7804	1174	7843	1177	7882	1179	7921	1181
7805	1174	7844	1177	7883	1179	7922	1181
7806	1174	7845	1177	7884	1179	7923	1181
7807	1174	7846	1177	7885	1179	7924	1181
7808	1174	7847	1177	7886	1179	7925	1182
7809	1174	7848	1177	7887	1179	7926	1182
7810	1174	7849	1177	7888	1180	7927	1182
7811	1175	7850	1177	7889	1180	7928	1182
7812	1175	7851	1177	7890	1180	7929	1182
7813	1175	7852	1177	7891	1180	7930	1182
7814	1175	7853	1177	7892	1180	7931	1182
7815	1175	7854	1177	7893	1180	7932	1182
7816	1175	7855	1177	7894	1180	7933	1182
7817	1175	7856	1178	7895	1180	7934	1182
7818	1175	7857	1178	7896	1180	7935	1182
7819	1175	7858	1178	7897	1180	7936	1182

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
7937	1182	7976	1185	8015	1188	8054	1191
7938	1182	7977	1185	8016	1188	8055	1191
7939	1182	7978	1185	8017	1188	8056	1191
7940	1182	7979	1185	8018	1188	8057	1191
7941	1183	7980	1185	8019	1188	8058	1191
7942	1183	7981	1185	8020	1188	8059	1191
7943	1183	7982	1185	8021	1188	8060	1191
7944	1183	7983	1185	8022	1188	8061	1191
7945	1183	7984	1185	8023	1189	8062	1192
7946	1183	7985	1186	8024	1189	8063	1192
7947	1183	7986	1186	8025	1189	8064	1192
7948	1183	7987	1186	8026	1189	8065	1192
7949	1183	7988	1186	8027	1189	8066	1192
7950	1183	7989	1186	8028	1189	8067	1192
7951	1183	7990	1186	8029	1189	8068	1192
7952	1183	7991	1186	8030	1189	8069	1192
7953	1183	7992	1186	8031	1189	8070	1192
7954	1183	7993	1186	8032	1189	8071	1192
7955	1183	7994	1186	8033	1189	8072	1192
7956	1183	7995	1186	8034	1190	8073	1192
7957	1183	7996	1186	8035	1190	8074	1192
7958	1183	7997	1186	8036	1190	8075	1192
7959	1183	7998	1186	8037	1190	8076	1192
7960	1183	7999	1186	8038	1190	8077	1192
7961	1184	8000	1187	8039	1190	8078	1192
7962	1184	8001	1187	8040	1190	8079	1192
7963	1184	8002	1187	8041	1190	8080	1192
7964	1184	8003	1187	8042	1190	8081	1193
7965	1184	8004	1187	8043	1190	8082	1193
7966	1184	8005	1187	8044	1190	8083	1193
7967	1184	8006	1187	8045	1190	8084	1193
7968	1184	8007	1187	8046	1190	8085	1193
7969	1184	8008	1187	8047	1190	8086	1193
7970	1184	8009	1188	8048	1191	8087	1193
7971	1185	8010	1188	8049	1191	8088	1193
7972	1185	8011	1188	8050	1191	8089	1193
7973	1185	8012	1188	8051	1191	8090	1193
7974	1185	8013	1188	8052	1191	8091	1193
7975	1185	8014	1188	8053	1191	8092	1193

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
8093	1193	8132	1196	8171	1199	8210	1202
8094	1193	8133	1196	8172	1199	8211	1202
8095	1193	8134	1197	8173	1199	8212	1202
8096	1194	8135	1197	8174	1199	8213	1202
8097	1194	8136	1197	8175	1199	8214	1203
8098	1194	8137	1197	8176	1199	8215	1203
8099	1194	8138	1197	8177	1199	8216	1203
8100	1194	8139	1197	8178	1199	8217	1203
8101	1194	8140	1197	8179	1200	8218	1203
8102	1194	8141	1197	8180	1200	8219	1203
8103	1194	8142	1197	8181	1200	8220	1203
8104	1195	8143	1197	8182	1200	8221	1203
8105	1195	8144	1197	8183	1200	8222	1203
8106	1195	8145	1198	8184	1200	8223	1203
8107	1195	8146	1198	8185	1200	8224	1203
8108	1195	8147	1198	8186	1200	8225	1203
8109	1195	8148	1198	8187	1200	8226	1203
8110	1195	8149	1198	8188	1200	8227	1204
8111	1195	8150	1198	8189	1200	8228	1204
8112	1195	8151	1198	8190	1201	8229	1204
8113	1195	8152	1198	8191	1201	8230	1204
8114	1195	8153	1198	8192	1201	8231	1204
8115	1195	8154	1198	8193	1201	8232	1204
8116	1195	8155	1198	8194	1201	8233	1204
8117	1195	8156	1198	8195	1201	8234	1204
8118	1195	8157	1198	8196	1201	8235	1204
8119	1195	8158	1198	8197	1201	8236	1205
8120	1195	8159	1198	8198	1201	8237	1205
8121	1196	8160	1198	8199	1201	8238	1205
8122	1196	8161	1198	8200	1202	8239	1205
8123	1196	8162	1198	8201	1202	8240	1205
8124	1196	8163	1198	8202	1202	8241	1205
8125	1196	8164	1199	8203	1202	8242	1205
8126	1196	8165	1199	8204	1202	8243	1206
8127	1196	8166	1199	8205	1202	8244	1206
8128	1196	8167	1199	8206	1202	8245	1206
8129	1196	8168	1199	8207	1202	8246	1206
8130	1196	8169	1199	8208	1202	8247	1206
8131	1196	8170	1199	8209	1202	8248	1206

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
8249	1206	8288	1210	8327	1213	8366	1218
8250	1206	8289	1210	8328	1214	8367	1218
8251	1206	8290	1210	8329	1214	8368	1218
8252	1206	8291	1210	8330	1214	8369	1218
8253	1207	8292	1210	8331	1214	8370	1218
8254	1207	8293	1211	8332	1214	8371	1218
8255	1207	8294	1211	8333	1214	8372	1218
8256	1207	8295	1211	8334	1214	8373	1218
8257	1207	8296	1211	8335	1214	8374	1218
8258	1207	8297	1211	8336	1214	8375	1218
8259	1208	8298	1211	8337	1214	8376	1218
8260	1208	8299	1211	8338	1214	8377	1219
8261	1208	8300	1211	8339	1214	8378	1219
8262	1208	8301	1212	8340	1214	8379	1219
8263	1208	8302	1212	8341	1214	8380	1219
8264	1208	8303	1212	8342	1215	8381	1219
8265	1208	8304	1212	8343	1215	8382	1219
8266	1208	8305	1212	8344	1215	8383	1219
8267	1208	8306	1212	8345	1215	8384	1220
8268	1208	8307	1212	8346	1215	8385	1220
8269	1209	8308	1212	8347	1215	8386	1220
8270	1209	8309	1212	8348	1215	8387	1220
8271	1209	8310	1212	8349	1215	8388	1220
8272	1209	8311	1212	8350	1215	8389	1220
8273	1209	8312	1212	8351	1215	8390	1220
8274	1209	8313	1212	8352	1215	8391	1220
8275	1209	8314	1212	8353	1216	8392	1220
8276	1209	8315	1212	8354	1216	8393	1220
8277	1209	8316	1213	8355	1216	8394	1220
8278	1209	8317	1213	8356	1216	8395	1220
8279	1209	8318	1213	8357	1216	8396	1220
8280	1210	8319	1213	8358	1216	8397	1220
8281	1210	8320	1213	8359	1216	8398	1220
8282	1210	8321	1213	8360	1216	8399	1221
8283	1210	8322	1213	8361	1217	8400	1221
8284	1210	8323	1213	8362	1217	8401	1221
8285	1210	8324	1213	8363	1217	8402	1221
8286	1210	8325	1213	8364	1217	8403	1221
8287	1210	8326	1213	8365	1217	8404	1221

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
8405	1221	8444	1224	8483	1227	8522	1230
8406	1221	8445	1224	8484	1227	8523	1230
8407	1222	8446	1224	8485	1228	8524	1231
8408	1222	8447	1224	8486	1228	8525	1231
8409	1222	8448	1225	8487	1228	8526	1231
8410	1222	8449	1225	8488	1228	8527	1231
8411	1222	8450	1225	8489	1228	8528	1231
8412	1222	8451	1225	8490	1228	8529	1231
8413	1222	8452	1225	8491	1228	8530	1231
8414	1222	8453	1225	8492	1228	8531	1231
8415	1222	8454	1225	8493	1228	8532	1231
8416	1222	8455	1225	8494	1228	8533	1232
8417	1222	8456	1225	8495	1228	8534	1232
8418	1222	8457	1225	8496	1228	8535	1232
8419	1223	8458	1225	8497	1228	8536	1232
8420	1223	8459	1225	8498	1228	8537	1232
8421	1223	8460	1225	8499	1228	8538	1232
8422	1223	8461	1225	8500	1228	8539	1232
8423	1223	8462	1225	8501	1229	8540	1232
8424	1223	8463	1225	8502	1229	8541	1232
8425	1223	8464	1225	8503	1229	8542	1232
8426	1223	8465	1225	8504	1229	8543	1233
8427	1223	8466	1226	8505	1229	8544	1233
8428	1223	8467	1226	8506	1229	8545	1233
8429	1223	8468	1226	8507	1229	8546	1233
8430	1223	8469	1226	8508	1229	8547	1233
8431	1224	8470	1226	8509	1229	8548	1233
8432	1224	8471	1226	8510	1230	8549	1233
8433	1224	8472	1226	8511	1230	8550	1233
8434	1224	8473	1226	8512	1230	8551	1233
8435	1224	8474	1226	8513	1230	8552	1233
8436	1224	8475	1226	8514	1230	8553	1233
8437	1224	8476	1226	8515	1230	8554	1233
8438	1224	8477	1227	8516	1230	8555	1233
8439	1224	8478	1227	8517	1230	8556	1233
8440	1224	8479	1227	8518	1230	8557	1233
8441	1224	8480	1227	8519	1230	8558	1234
8442	1224	8481	1227	8520	1230	8559	1234
8443	1224	8482	1227	8521	1230	8560	1234

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
8561	1234	8600	1237	8639	1240	8678	1244
8562	1234	8601	1237	8640	1240	8679	1244
8563	1234	8602	1237	8641	1240	8680	1244
8564	1234	8603	1237	8642	1240	8681	1244
8565	1234	8604	1237	8643	1240	8682	1244
8566	1234	8605	1237	8644	1240	8683	1244
8567	1234	8606	1237	8645	1241	8684	1244
8568	1234	8607	1237	8646	1241	8685	1244
8569	1234	8608	1238	8647	1241	8686	1244
8570	1234	8609	1238	8648	1241	8687	1245
8571	1234	8610	1238	8649	1241	8688	1245
8572	1234	8611	1238	8650	1241	8689	1245
8573	1235	8612	1238	8651	1241	8690	1245
8574	1235	8613	1238	8652	1241	8691	1245
8575	1235	8614	1238	8653	1241	8692	1245
8576	1235	8615	1238	8654	1241	8693	1246
8577	1235	8616	1239	8655	1241	8694	1246
8578	1235	8617	1239	8656	1241	8695	1246
8579	1235	8618	1239	8657	1241	8696	1246
8580	1235	8619	1239	8658	1242	8697	1246
8581	1235	8620	1239	8659	1242	8698	1246
8582	1235	8621	1239	8660	1242	8699	1246
8583	1235	8622	1239	8661	1242	8700	1246
8584	1235	8623	1239	8662	1242	8701	1246
8585	1235	8624	1239	8663	1242	8702	1246
8586	1235	8625	1239	8664	1242	8703	1247
8587	1235	8626	1239	8665	1242	8704	1247
8588	1236	8627	1239	8666	1242	8705	1247
8589	1236	8628	1239	8667	1242	8706	1247
8590	1236	8629	1239	8668	1243	8707	1247
8591	1236	8630	1239	8669	1243	8708	1247
8592	1236	8631	1239	8670	1243	8709	1247
8593	1236	8632	1240	8671	1243	8710	1247
8594	1236	8633	1240	8672	1243	8711	1247
8595	1236	8634	1240	8673	1243	8712	1247
8596	1236	8635	1240	8674	1243	8713	1247
8597	1236	8636	1240	8675	1243	8714	1247
8598	1236	8637	1240	8676	1243	8715	1247
8599	1236	8638	1240	8677	1244	8716	1248

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
8717	1248	8756	1251	8795	1255	8834	1258
8718	1248	8757	1251	8796	1255	8835	1259
8719	1248	8758	1252	8797	1255	8836	1259
8720	1248	8759	1252	8798	1255	8837	1259
8721	1248	8760	1252	8799	1255	8838	1259
8722	1248	8761	1252	8800	1255	8839	1259
8723	1248	8762	1252	8801	1255	8840	1259
8724	1248	8763	1252	8802	1255	8841	1259
8725	1248	8764	1252	8803	1256	8842	1259
8726	1248	8765	1252	8804	1256	8843	1259
8727	1249	8766	1252	8805	1256	8844	1259
8728	1249	8767	1252	8806	1256	8845	1260
8729	1249	8768	1252	8807	1256	8846	1260
8730	1249	8769	1252	8808	1256	8847	1260
8731	1249	8770	1252	8809	1256	8848	1260
8732	1249	8771	1252	8810	1256	8849	1260
8733	1249	8772	1253	8811	1256	8850	1260
8734	1249	8773	1253	8812	1256	8851	1260
8735	1250	8774	1253	8813	1256	8852	1260
8736	1250	8775	1253	8814	1256	8853	1261
8737	1250	8776	1253	8815	1256	8854	1261
8738	1250	8777	1253	8816	1256	8855	1261
8739	1250	8778	1253	8817	1256	8856	1261
8740	1250	8779	1253	8818	1256	8857	1261
8741	1250	8780	1253	8819	1256	8858	1261
8742	1250	8781	1253	8820	1257	8859	1261
8743	1250	8782	1254	8821	1257	8860	1261
8744	1251	8783	1254	8822	1257	8861	1261
8745	1251	8784	1254	8823	1257	8862	1262
8746	1251	8785	1254	8824	1257	8863	1262
8747	1251	8786	1254	8825	1257	8864	1262
8748	1251	8787	1254	8826	1257	8865	1262
8749	1251	8788	1254	8827	1257	8866	1262
8750	1251	8789	1254	8828	1258	8867	1263
8751	1251	8790	1254	8829	1258	8868	1263
8752	1251	8791	1254	8830	1258	8869	1263
8753	1251	8792	1254	8831	1258	8870	1263
8754	1251	8793	1254	8832	1258	8871	1263
8755	1251	8794	1255	8833	1258	8872	1263

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
8873	1264	8912	1268	8951	1273	8990	1279
8874	1264	8913	1269	8952	1273	8991	1279
8875	1264	8914	1269	8953	1273	8992	1279
8876	1264	8915	1269	8954	1274	8993	1279
8877	1264	8916	1269	8955	1274	8994	1279
8878	1264	8917	1269	8956	1274	8995	1280
8879	1264	8918	1269	8957	1274	8996	1280
8880	1264	8919	1269	8958	1274	8997	1280
8881	1265	8920	1269	8959	1274	8998	1280
8882	1265	8921	1270	8960	1274	8999	1280
8883	1265	8922	1270	8961	1274	9000	1280
8884	1265	8923	1270	8962	1274	9001	1280
8885	1265	8924	1270	8963	1275	9002	1280
8886	1265	8925	1270	8964	1275	9003	1280
8887	1265	8926	1270	8965	1276	9004	1280
8888	1265	8927	1270	8966	1276	9005	1280
8889	1265	8928	1270	8967	1276	9006	1280
8890	1265	8929	1270	8968	1276	9007	1281
8891	1265	8930	1270	8969	1276	9008	1281
8892	1265	8931	1271	8970	1277	9009	1281
8893	1266	8932	1271	8971	1277	9010	1281
8894	1266	8933	1271	8972	1277	9011	1281
8895	1266	8934	1271	8973	1277	9012	1281
8896	1266	8935	1271	8974	1277	9013	1281
8897	1267	8936	1271	8975	1277	9014	1281
8898	1267	8937	1271	8976	1277	9015	1281
8899	1267	8938	1272	8977	1277	9016	1281
8900	1267	8939	1272	8978	1278	9017	1282
8901	1267	8940	1272	8979	1278	9018	1282
8902	1267	8941	1272	8980	1278	9019	1282
8903	1267	8942	1272	8981	1278	9020	1282
8904	1268	8943	1272	8982	1278	9021	1282
8905	1268	8944	1272	8983	1278	9022	1282
8906	1268	8945	1272	8984	1278	9023	1282
8907	1268	8946	1272	8985	1279	9024	1282
8908	1268	8947	1273	8986	1279	9025	1282
8909	1268	8948	1273	8987	1279	9026	1282
8910	1268	8949	1273	8988	1279	9027	1282
8911	1268	8950	1273	8989	1279	9028	1282

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
9029	1282	9068	1288	9107	1292	9146	1298
9030	1283	9069	1288	9108	1293	9147	1299
9031	1283	9070	1288	9109	1293	9148	1299
9032	1283	9071	1288	9110	1293	9149	1300
9033	1283	9072	1288	9111	1293	9150	1300
9034	1283	9073	1288	9112	1293	9151	1300
9035	1284	9074	1289	9113	1293	9152	1300
9036	1284	9075	1289	9114	1293	9153	1300
9037	1284	9076	1289	9115	1293	9154	1300
9038	1284	9077	1289	9116	1293	9155	1300
9039	1284	9078	1289	9117	1293	9156	1300
9040	1284	9079	1289	9118	1294	9157	1300
9041	1284	9080	1289	9119	1294	9158	1300
9042	1284	9081	1289	9120	1294	9159	1301
9043	1285	9082	1289	9121	1294	9160	1301
9044	1285	9083	1290	9122	1294	9161	1301
9045	1285	9084	1290	9123	1294	9162	1301
9046	1285	9085	1290	9124	1294	9163	1302
9047	1285	9086	1290	9125	1294	9164	1302
9048	1285	9087	1290	9126	1294	9165	1302
9049	1285	9088	1290	9127	1295	9166	1302
9050	1285	9089	1290	9128	1295	9167	1302
9051	1285	9090	1291	9129	1295	9168	1302
9052	1285	9091	1291	9130	1295	9169	1302
9053	1285	9092	1291	9131	1295	9170	1302
9054	1286	9093	1291	9132	1296	9171	1302
9055	1286	9094	1291	9133	1296	9172	1303
9056	1286	9095	1291	9134	1296	9173	1303
9057	1286	9096	1291	9135	1296	9174	1303
9058	1286	9097	1291	9136	1297	9175	1303
9059	1286	9098	1291	9137	1297	9176	1303
9060	1287	9099	1291	9138	1297	9177	1304
9061	1287	9100	1291	9139	1297	9178	1304
9062	1287	9101	1292	9140	1297	9179	1305
9063	1287	9102	1292	9141	1297	9180	1305
9064	1287	9103	1292	9142	1297	9181	1305
9065	1287	9104	1292	9143	1297	9182	1306
9066	1287	9105	1292	9144	1298	9183	1306
9067	1287	9106	1292	9145	1298	9184	1306

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
9185	1306	9224	1313	9263	1319	9302	1327
9186	1306	9225	1313	9264	1319	9303	1327
9187	1306	9226	1313	9265	1320	9304	1327
9188	1307	9227	1313	9266	1320	9305	1328
9189	1307	9228	1314	9267	1321	9306	1328
9190	1307	9229	1314	9268	1321	9307	1329
9191	1307	9230	1314	9269	1321	9308	1329
9192	1307	9231	1314	9270	1321	9309	1329
9193	1308	9232	1314	9271	1321	9310	1329
9194	1308	9233	1314	9272	1321	9311	1329
9195	1308	9234	1314	9273	1322	9312	1329
9196	1308	9235	1314	9274	1322	9313	1329
9197	1308	9236	1314	9275	1322	9314	1330
9198	1309	9237	1315	9276	1322	9315	1330
9199	1309	9238	1315	9277	1323	9316	1330
9200	1309	9239	1315	9278	1323	9317	1330
9201	1309	9240	1316	9279	1323	9318	1330
9202	1309	9241	1316	9280	1323	9319	1330
9203	1309	9242	1316	9281	1323	9320	1330
9204	1309	9243	1316	9282	1323	9321	1330
9205	1309	9244	1316	9283	1323	9322	1330
9206	1309	9245	1316	9284	1323	9323	1330
9207	1309	9246	1317	9285	1323	9324	1330
9208	1309	9247	1317	9286	1323	9325	1330
9209	1309	9248	1317	9287	1323	9326	1330
9210	1310	9249	1317	9288	1323	9327	1331
9211	1310	9250	1317	9289	1324	9328	1331
9212	1310	9251	1318	9290	1324	9329	1332
9213	1310	9252	1318	9291	1324	9330	1332
9214	1311	9253	1318	9292	1324	9331	1332
9215	1311	9254	1318	9293	1324	9332	1332
9216	1311	9255	1318	9294	1326	9333	1332
9217	1311	9256	1319	9295	1326	9334	1333
9218	1311	9257	1319	9296	1326	9335	1333
9219	1311	9258	1319	9297	1326	9336	1333
9220	1311	9259	1319	9298	1326	9337	1333
9221	1312	9260	1319	9299	1326	9338	1333
9222	1312	9261	1319	9300	1326	9339	1333
9223	1312	9262	1319	9301	1327	9340	1333

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
9341	1334	9380	1341	9419	1349	9458	1358
9342	1334	9381	1341	9420	1349	9459	1358
9343	1334	9382	1342	9421	1350	9460	1359
9344	1334	9383	1342	9422	1350	9461	1359
9345	1334	9384	1343	9423	1350	9462	1359
9346	1334	9385	1343	9424	1350	9463	1359
9347	1334	9386	1343	9425	1351	9464	1359
9348	1334	9387	1344	9426	1351	9465	1359
9349	1334	9388	1344	9427	1351	9466	1360
9350	1334	9389	1344	9428	1351	9467	1361
9351	1334	9390	1344	9429	1351	9468	1361
9352	1335	9391	1344	9430	1352	9469	1361
9353	1335	9392	1344	9431	1352	9470	1362
9354	1336	9393	1344	9432	1352	9471	1362
9355	1336	9394	1344	9433	1352	9472	1362
9356	1336	9395	1344	9434	1352	9473	1362
9357	1337	9396	1344	9435	1352	9474	1362
9358	1337	9397	1344	9436	1353	9475	1362
9359	1337	9398	1345	9437	1353	9476	1363
9360	1337	9399	1345	9438	1353	9477	1363
9361	1337	9400	1345	9439	1354	9478	1363
9362	1338	9401	1345	9440	1354	9479	1363
9363	1338	9402	1345	9441	1354	9480	1364
9364	1338	9403	1346	9442	1354	9481	1364
9365	1338	9404	1346	9443	1354	9482	1364
9366	1338	9405	1346	9444	1355	9483	1364
9367	1339	9406	1346	9445	1355	9484	1365
9368	1339	9407	1346	9446	1355	9485	1365
9369	1339	9408	1346	9447	1356	9486	1365
9370	1339	9409	1347	9448	1356	9487	1365
9371	1339	9410	1347	9449	1356	9488	1366
9372	1339	9411	1347	9450	1356	9489	1366
9373	1340	9412	1347	9451	1357	9490	1366
9374	1340	9413	1348	9452	1357	9491	1366
9375	1340	9414	1348	9453	1358	9492	1366
9376	1340	9415	1348	9454	1358	9493	1366
9377	1340	9416	1349	9455	1358	9494	1366
9378	1341	9417	1349	9456	1358	9495	1367
9379	1341	9418	1349	9457	1358	9496	1367

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
9497	1367	9536	1380	9575	1393	9614	1402
9498	1367	9537	1380	9576	1393	9615	1402
9499	1367	9538	1380	9577	1393	9616	1402
9500	1368	9539	1381	9578	1393	9617	1402
9501	1368	9540	1381	9579	1393	9618	1403
9502	1368	9541	1381	9580	1393	9619	1403
9503	1368	9542	1381	9581	1394	9620	1404
9504	1369	9543	1381	9582	1394	9621	1404
9505	1369	9544	1381	9583	1394	9622	1404
9506	1369	9545	1381	9584	1395	9623	1405
9507	1370	9546	1381	9585	1395	9624	1405
9508	1370	9547	1382	9586	1395	9625	1405
9509	1371	9548	1383	9587	1395	9626	1405
9510	1371	9549	1383	9588	1396	9627	1405
9511	1371	9550	1384	9589	1396	9628	1405
9512	1372	9551	1385	9590	1396	9629	1406
9513	1372	9552	1385	9591	1396	9630	1406
9514	1372	9553	1385	9592	1396	9631	1406
9515	1373	9554	1386	9593	1396	9632	1406
9516	1373	9555	1386	9594	1397	9633	1406
9517	1373	9556	1386	9595	1397	9634	1406
9518	1373	9557	1386	9596	1397	9635	1406
9519	1375	9558	1386	9597	1397	9636	1407
9520	1375	9559	1387	9598	1398	9637	1407
9521	1375	9560	1388	9599	1398	9638	1408
9522	1376	9561	1388	9600	1398	9639	1408
9523	1376	9562	1388	9601	1399	9640	1408
9524	1376	9563	1389	9602	1399	9641	1408
9525	1376	9564	1389	9603	1399	9642	1408
9526	1376	9565	1389	9604	1400	9643	1409
9527	1376	9566	1389	9605	1400	9644	1409
9528	1377	9567	1390	9606	1401	9645	1409
9529	1377	9568	1390	9607	1401	9646	1410
9530	1377	9569	1390	9608	1401	9647	1410
9531	1377	9570	1391	9609	1401	9648	1410
9532	1377	9571	1391	9610	1401	9649	1410
9533	1378	9572	1392	9611	1401	9650	1410
9534	1378	9573	1392	9612	1401	9651	1410
9535	1379	9574	1392	9613	1402	9652	1411

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
9653	1411	9692	1423	9731	1437	9770	1450
9654	1412	9693	1423	9732	1437	9771	1451
9655	1412	9694	1424	9733	1437	9772	1452
9656	1412	9695	1424	9734	1438	9773	1452
9657	1412	9696	1425	9735	1439	9774	1452
9658	1413	9697	1425	9736	1440	9775	1452
9659	1413	9698	1425	9737	1440	9776	1452
9660	1413	9699	1426	9738	1440	9777	1453
9661	1413	9700	1426	9739	1441	9778	1453
9662	1413	9701	1426	9740	1441	9779	1453
9663	1414	9702	1427	9741	1441	9780	1454
9664	1414	9703	1427	9742	1441	9781	1454
9665	1414	9704	1427	9743	1441	9782	1454
9666	1414	9705	1427	9744	1442	9783	1454
9667	1414	9706	1427	9745	1442	9784	1454
9668	1414	9707	1428	9746	1442	9785	1455
9669	1415	9708	1428	9747	1442	9786	1455
9670	1415	9709	1428	9748	1443	9787	1456
9671	1415	9710	1429	9749	1443	9788	1456
9672	1415	9711	1429	9750	1443	9789	1457
9673	1415	9712	1429	9751	1444	9790	1457
9674	1416	9713	1430	9752	1444	9791	1457
9675	1416	9714	1430	9753	1444	9792	1458
9676	1416	9715	1430	9754	1444	9793	1458
9677	1416	9716	1430	9755	1445	9794	1458
9678	1417	9717	1431	9756	1445	9795	1458
9679	1417	9718	1431	9757	1445	9796	1458
9680	1418	9719	1431	9758	1445	9797	1459
9681	1418	9720	1432	9759	1445	9798	1460
9682	1418	9721	1432	9760	1446	9799	1460
9683	1420	9722	1432	9761	1447	9800	1461
9684	1420	9723	1433	9762	1447	9801	1461
9685	1421	9724	1434	9763	1448	9802	1461
9686	1422	9725	1434	9764	1448	9803	1461
9687	1422	9726	1434	9765	1448	9804	1462
9688	1422	9727	1434	9766	1449	9805	1462
9689	1422	9728	1434	9767	1449	9806	1463
9690	1422	9729	1435	9768	1449	9807	1463
9691	1422	9730	1437	9769	1449	9808	1463

Table B.1. (Contd.)

Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow	Ranking	Peak Flow
9809	1463	9848	1480	9887	1502	9926	1526
9810	1463	9849	1480	9888	1502	9927	1526
9811	1465	9850	1481	9889	1503	9928	1526
9812	1466	9851	1481	9890	1504	9929	1528
9813	1467	9852	1481	9891	1505	9930	1528
9814	1467	9853	1481	9892	1505	9931	1529
9815	1467	9854	1483	9893	1506	9932	1529
9816	1467	9855	1483	9894	1506	9933	1530
9817	1468	9856	1484	9895	1507	9934	1531
9818	1468	9857	1484	9896	1509	9935	1532
9819	1469	9858	1485	9897	1509	9936	1533
9820	1469	9859	1486	9898	1510	9937	1533
9821	1469	9860	1486	9899	1510	9938	1539
9822	1469	9861	1486	9900	1511	9939	1541
9823	1470	9862	1487	9901	1511	9940	1541
9824	1472	9863	1488	9902	1511	9941	1541
9825	1472	9864	1488	9903	1511	9942	1543
9826	1473	9865	1488	9904	1511	9943	1544
9827	1475	9866	1489	9905	1511	9944	1545
9828	1476	9867	1489	9906	1512	9945	1546
9829	1476	9868	1489	9907	1513	9946	1547
9830	1476	9869	1489	9908	1514	9947	1547
9831	1477	9870	1489	9909	1514	9948	1547
9832	1477	9871	1489	9910	1515	9949	1549
9833	1478	9872	1493	9911	1515	9950	1553
9834	1478	9873	1493	9912	1515	9951	1557
9835	1478	9874	1494	9913	1515	9952	1559
9836	1478	9875	1494	9914	1517	9953	1562
9837	1478	9876	1494	9915	1517	9954	1563
9838	1478	9877	1495	9916	1518	9955	1565
9839	1478	9878	1495	9917	1518	9956	1566
9840	1478	9879	1496	9918	1518	9957	1566
9841	1478	9880	1497	9919	1520	9958	1568
9842	1479	9881	1498	9920	1521	9959	1569
9843	1479	9882	1499	9921	1522	9960	1575
9844	1480	9883	1499	9922	1523	9961	1577
9845	1480	9884	1500	9923	1524	9962	1577
9846	1480	9885	1500	9924	1524	9963	1578
9847	1480	9886	1501	9925	1524	9964	1581

Table B.1. (Contd.)

Ranking	Peak Flow
9965	1582
9966	1583
9967	1585
9968	1586
9969	1587
9970	1587
9971	1588
9972	1589
9973	1592
9974	1593
9975	1593
9976	1594
9977	1597
9978	1602
9979	1604
9980	1607
9981	1612
9982	1612
9983	1613
9984	1619
9985	1620
9986	1626
9987	1626
9988	1634
9989	1638
9990	1638
9991	1640
9992	1645
9993	1658
9994	1679
9995	1683
9996	1693
9997	1716
9998	1768
9999	1784
10000	1800