STORMWATER MANAGEMENT STRATEGIES REPORT FOR

THREE SISTERS MOUNTAIN VILLAGE PROPERTIES LTD.

SEPTEMBER 2016

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Revisions Summary

Document Revision	Date	Summary of Changes	Author	Reviewer
0.0	06 June 2016,	Draft for Internal Review	GI	JM/ML
1.0	20 June, 2016	Client Submission	GI	ML
2.0	08 September	Client Submission	GI	ML

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APPENDICES

1.0 INTRODUCTION

1.1 General

The Three Sisters Mountain Village (TSMV) development extends approximately 10 km along the southwest side of Highway 1, in the Town of Canmore, Alberta (Refer Figure 1.1). It encompasses Sections 7, 11, 12, 13, 14, 15, 21 and 22 of Township 24, Range 10, West 5th Meridian. The prominent creeks that flow through the proposed development are Three Sisters Creek, Stewart Creek, Smith Creek, and Pigeon Creek, in addition to a few other seasonal unnamed drainage courses. The creeks originate from high mountainous terrain and generally flow from southwest to northeast, all eventually draining into the Bow River. The watershed areas are forested up to the treeline and consist of exposed rock surfaces above the treeline. The project area is part of the third reach of the Bow River basin which extends from Banff National Park to upstream of the Bearspaw Dam. Bow basin is the most populated river basin in Alberta and supplies water to more than a million people (the Bow River flow rate at Canmore is 698 m^3/s for a 100 year event). In 2007, the Bow River Basin Council recognized the need to develop and achieve a sustainable watershed management plan focusing on main source control and monitoring water bodies within the basin. A hydrological study for the aforementioned creeks within the TSMV area is presented in this report.

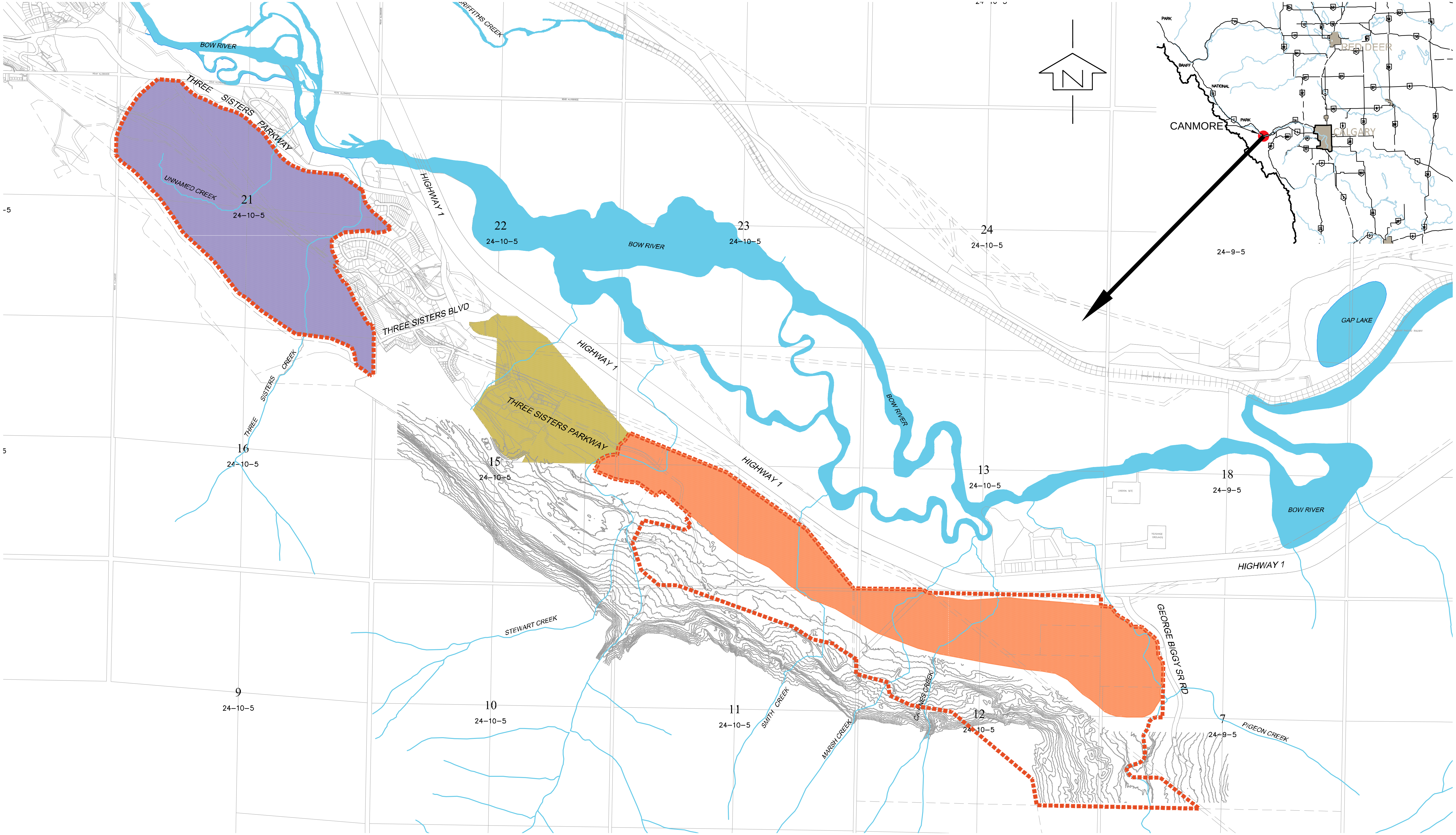
1.2 Study Objectives

Stormwater management and other supporting studies are conducted to comply with regulatory requirements. The purpose of this study is to present the stormwater management strategies for the proposed layout of the TSMV development which is comprised of the Resort Centre and Smith Creek and existing Stewart Creek developments. The main objectives are to provide a hydrological assessment to determine the maximum permissible release rates from the new development to the existing creeks and to estimate the on-site stormwater storage requirements.

1.3 Previous Studies

- UMA Engineering Ltd. 1991: Technical Report 9.5b Water Quality, Environmental Impact Assessment Report for the Three Sisters Golf Resorts Inc., September, 1991.
- UMA Engineering Ltd. (November 1994, Calgary Alberta): Grassi - Three Sisters Area Structure Plan, Technical Appendix C, Hydrology & Stormwater Management. Prepared for Three Sisters Resorts Inc.
- UMA Engineering Ltd. (May 1998, Calgary Alberta): Proposed Three Sisters Creek Subdivision, Storm Water Management Plan. Prepared for Three Sisters Resorts Inc.
- Stantec Consulting Ltd. (June 2001, Calgary Alberta): Three Sisters Site 2A Phase 1 Stormwater management. Prepared for Three Sisters Resorts Inc.

- Stantec Consulting Ltd. (July 2001, Calgary Alberta): Three Sisters Site 2A Stormwater management. Prepared for Three Sisters Resorts Inc.
- Stantec Consulting Ltd. (September 2003, Calgary Alberta): Three Sisters Site 2A, Phase 2 - Stage 2. Prepared for Three Sisters Mountain Village Ltd.
- Stantec Consulting Ltd. (May 2004, Calgary Alberta): DC sites 1 to 6 Stormwater Master Drainage Plan. Prepared for Three Sisters Mountain Village Ltd.
- UMA Engineering Ltd. (May 2004, Edmonton Alberta): Three Sisters Creek - Regional Frequency Floods. Prepared for Three Sisters Mountain Village Ltd.
- Westhoff Engineering Resources, Inc., (February 2004, Calgary Alberta): Master Drainage Plan prepared for Three Sisters Mountain Village.
- Westhoff Engineering Resources, Inc., (May 2006, Calgary Alberta): Three Sisters Creek Golf Resort Management Strategies Prepared for Three Sisters Mountain Village.
- Westhoff Engineering Resources, Inc., (February 2013, Calgary Alberta): Master Drainage Plan for Three Sisters Mountain Village, Prepared for Three Sisters Mountain Village.



LEGEND

- THREE SISTERS MOUNTAIN VILLAGE PROPERTY
- RESORT CENTRE ASP
- SMITH CREEK ASP
- STEWART CREEK ASP

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FILE PATH:P:\5216016-000 QUANTUM-TSMV RESORT ASP AMENDMENT\3_IN\3.5_DRAWINGS\3.5.2_CIVIL\SKETCHES\5216016-SWMR_FIG-1.1_SITE_LOCATION.DWG

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SITE LOCATION

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-08-29	5215046-000	FIGURE 1.1

2.0 HYDROLOGICAL ANALYSIS

2.1 Regional Frequency Analysis

In many cases hydrological information is not available for a subject site (as in this case). In this event it is necessary to undertake a regional frequency analysis using hydrologically similar stations to allow estimation of discharge from the project site. The main parameters that inform the regional analysis are the peak flow, catchment area and runoff depth. The following sections provide a description of the hydrological analysis that has been undertaken.

2.1.1 Regional Mean Annual Runoff Analysis

The median annual runoff represents the impact of various watershed and climatic variables which are typically used in regional analyses, such as annual precipitation, basin slope, length of drainage courses and evapotranspiration. Regional frequency analysis of the mean annual runoff provides basic information about how basins respond to annual precipitation.

The mean annual runoff in millimeters is calculated as follows:

$$\frac{\text{Total volume of water passing one point of the drainage course during a year (cubic meters)}}{\text{Effective drainage area at that point (square kilometers)}}$$

2.1.2 Regional Frequency Analysis for Peak Discharges

The main goal of this analysis is to provide assessment of the permissible flow rate at any location of the study area where this estimation may be required. The most familiar method for the determination of design flood magnitudes is statistical analysis applied to historical records of flow discharges at the study locations. The objective of regional frequency analysis is to interpret the historical flow records to determine future probability distribution. In general, the regional frequency analysis includes the following steps:

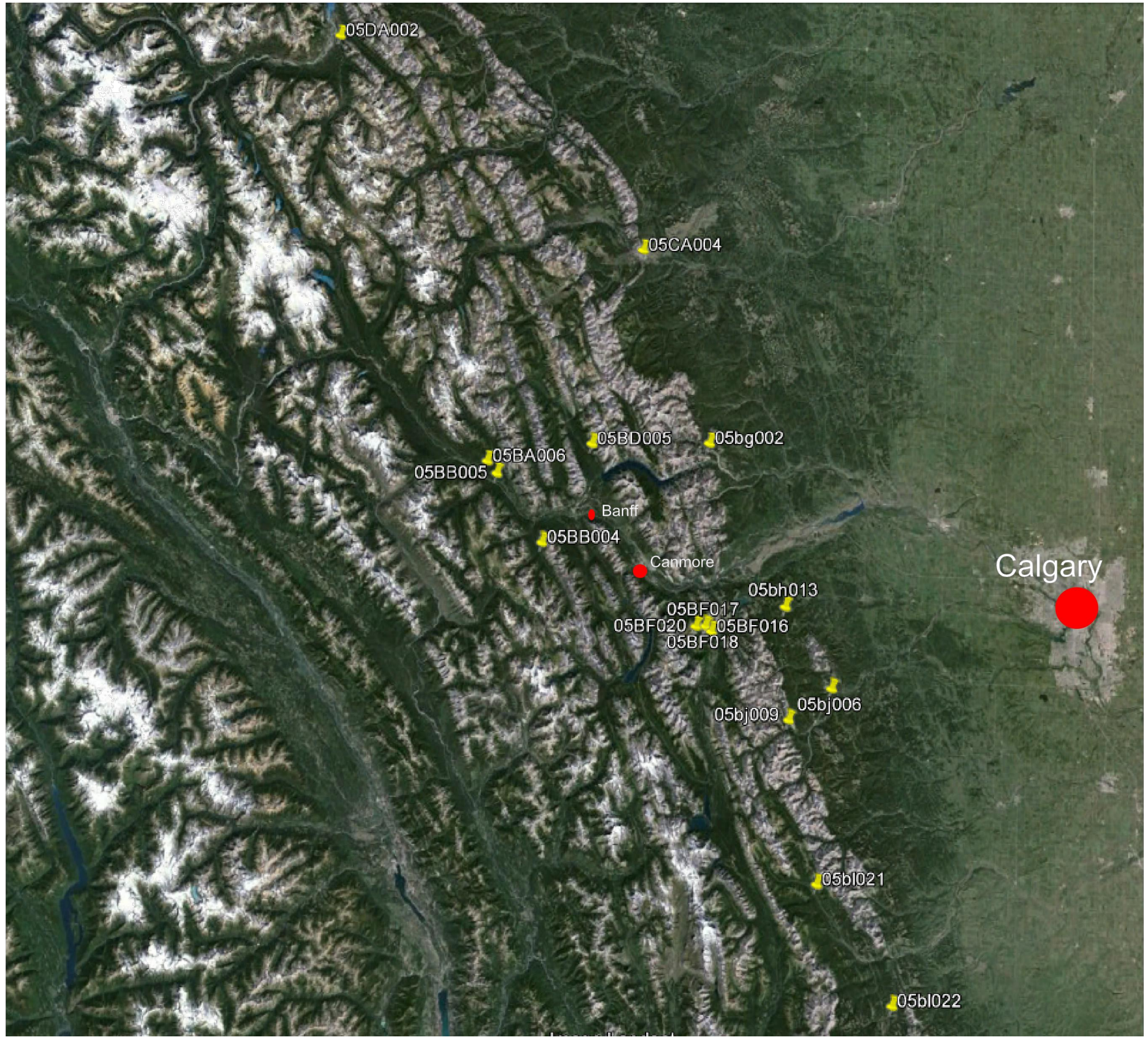
- Definition of the regional boundaries and identification of hydrometric stations within the defined boundaries.
- Screening of hydrometric stations within the regional area.
- Single-station frequency analysis for acceptable stations to calculate flow discharges in terms of future probability of occurrence.
- Postulation of relationships between physiographic and climate characteristics of the basin of the analyzed stations and flood discharge values.
- Determination of required physiographic and climatic characteristics for each analyzed basin.
- Regression analysis to determine predictive relationships for flood discharges as a function of analyzed physiographic and climatic characteristics. The strength of correlation is also determined.

A total of 21 hydrometric stations were found within this area and various criteria were set to screen the stations. The first criterion for the selection was that the basin size should be smaller than 1000 km^2. In addition, only uncontrolled or unregulated streams were considered. Using these criteria, and in addition to setting a limit to availability of records to be more than 20 years (maximum instantaneous peak discharges), 17 hydrometric stations were selected for further analysis. The completed stream record database for the selected 17 Water Survey of Canada gauges was scrutinized, and screened for independence, homogeneity and stationary of the data. Four stations were subsequently disregarded. The selected stations are shown in Figure 2.1.

Table 1 shows the 17 selected gauges including the associated effective catchment area and the number of years of data records.

Table 1 Selected stream gauges and associated effective areas

Code	Water Survey of Canada Stream Gauge	Effective Area (Km^2)	Years of Record
05BA006	Johnston Creek near the mouth	124	1973 - 1996
05BB004	Brewster Creek near Banff	109	1971 - 1996
05BB005	Redearth Creek near the mouth	147	1973 - 1996
05BD005	Cascade River above Lake Minnewanka	454	1973 - 1996
05BF016	Marmot Creek main stem near Seebe	9.1	1962 - 2012
05BF017	Middle Fork Creek near Seebe	2.85	1963 - 1986
05BF018	Twin Creek near Seebe	2.64	1963 - 1986
05BF019	Cabin Creek near Seebe	2.12	1963 - 1986
05BF020	Middle Fork Creek in cirque near Seebe	1.17	1964 - 1986
BG002	Ghost River near Black Rock Mountain	211	1941 - 1993
05BH013	Jumping pound Creek near Cox Hill	36.9	1976 - 2012
05BJ006	Elbow River above Elbow Falls	437	1967 - 1995
05BJ009	Little Elbow River above Nihahi Creek	129	1978 - 1995
05BL021	Highwood River below Picklejar	132	1965 - 1985
05BL022	Cataract Creek near Forestry Road	165.5	1966 - 2012
05CA004	Red Deer River above Panther River	941.4	1967 - 2012
05DA002	Siffleur River near the Mouth	515	1915 - 1996



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STATIONS

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HYDROMETRIC STATIONS

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-06-16	5215046-000	FIGURE 2.1

After statistical analysis, a frequency analysis was performed for each station. The HYFRAN software package was used to find the best fit potential probability distributions. Two parameter distributions (Gumbel and LogNormal II) were fitted as well as three parameter distributions (Generalized Extreme Value, LogNormal III, Pearson III and LogPearson III). Fitting methods included Method of Moments, Method of Maximum Likelihood and Method of Weighted Moments.

Table 2 shows the obtained extreme values for the various return periods.

Table 2 Estimated Peak Discharges

Station Code	Effective Area (Km^2)	Annual Runoff (mm)	Estimated Instantaneous Peak Discharge for Return Period						
			1:500 yr (m^3/s)	1:200 yr (m^3/s)	1:100 yr (m^3/s)	1:50 yr (m^3/s)	1:20 yr (m^3/s)	1:10 yr (m^3/s)	1:5 yr (m^3/s)
05BA006	124	467.3	67.64	62.5	56.7	50.7	42.8	36.7	30.4
05BB004	109	356.6	28.65	26.7	24.5	22.3	19.3	17.1	14.7
05BB005	147	694.8	49.83	48.1	45.8	43.3	39.6	36.3	32.4
05BD005	454	225	145.75	136	125	113	97	83.8	69.5
05BF016	9.1	414.3	3.83	3.54	3.19	2.85	2.37	2	1.61
05BF017	2.85	492.7	0.97	0.92	0.867	0.811	0.731	0.664	0.587
05BF018	2.64	539.8	1.13	1.07	0.996	0.917	0.806	0.715	0.614
05BF019	2.12	340.3	0.74	0.711	0.668	0.62	0.547	0.483	0.408
05BF020	1.17	769.6	0.65	0.591	0.526	0.464	0.388	0.333	0.279
05BG002	211	399.8	253.63	194	149	114	79.3	59.3	43.4
05BH013	36.9	252.5	109.75	73.6	51	35.1	21.1	14	8.96
05BJ006	437	390.1	429.50	254	203	158	112	85.2	63.6
05BJ009	129	381.4	336.38	261	162	104	58.6	38.1	25
05BL021	132	671.9	77.34	71.3	64.6	58	49.3	42.7	35.9
05BL022	165.5	356.3	300.00	222	165	122	81	57.9	39.9
05CA004	941.4	363.5	356.13	307	260	219	171	139	110
05DA002	515	508.9	258.38	204	163	131	98.8	80.2	65.3

In the absence of flow records along drainage courses in the study area, the median annual runoff can be estimated using regional information. In particular, the median annual runoff was calculated for 17 hydrometric stations, as shown in Table 2.

Subsequently, a non-linear correlation on the logarithms of peak discharge, annual median runoff and drainage area was conducted.

The following mathematical relationship was obtained for each analyzed return period :

$$K = K.A^{a}.R^{b}$$

Where:
Q = flow rate (in m^3/s)
A = area size (in km^2),
R = mean annual runoff (in mm).

Table 3 shows the calculated relationships and the coefficients of determination.

Table 3 Regional Relationships

Relationship	Coefficient
$Q_{100} = 3.1488\ A^{1.0024}\ R^{-0.3241}$	$r^2 = 0.950$
$Q_{50} = 1.5275\ \ A^{0.9871}\ R^{-0.2239}$	$r^2 = 0.960$
$Q_{20} = 0.5512\ \ A^{0.9692}\ R^{-0.0848}$	$r^2 = 0.975$
$Q_{10} = 0.2302\ \ A^{0.9577}\ R^{-0.6378}$	$r^2 = 0.983$
$Q_{5} = 0.0829\ \ A^{0.9495}\ R^{0.1682}$	$r^2 = 0.990$

The equations presented in Table 3 can be used to estimate allowable discharges at any desired point along the drainage courses in project area. These formulas have been tested for sensitivity and it has been shown that the discharge is less sensitive to the runoff depth for extreme storms. That is, the discharge is a significant function of catchment area for all events but it is a significant function of catchment area and runoff depth for a 5 year event. Accordingly, the Regional Relationships shown in Table 3 can be adjusted as shown in Table 4.

Table 4 Adjusted Regional Relationships

Relationship	Coefficient
$Q_{100} = 0.4161\ A^{1.0183}$	$r^2 = 0.950$
$Q_{50} = 0.3774\ A^{0.9981}$	$r^2 = 0.960$
$Q_{20} = 0.3245\ A^{0.9734}$	$r^2 = 0.975$
$Q_{10} = 0.2825\ A^{0.9562}$	$r^2 = 0.984$
$Q_{5} = 0.0829\ A^{0.9495}\ R^{0.1682}$	$r^2 = 0.990$

The drainage area (A) at the point of interest must be delineated for use in the equations to estimate the discharge for 100 year, 50 year, 20 year and 10 year storm events. The median annual runoff (R) must be determined in addition to the catchment area to estimate the discharge for the 5 year storm event. However, if there is difficulty in estimating the median annual runoff for the specific project site, then R can eliminated from the formula by substituting R=1. In this case, the discharge for 5 year storm event will be over-estimated by a factor of 5%.

2.2 SWMHYMO Model

A single event hydrologic and hydraulic computer model (SWMHYMO) is used to analyze the overland drainage control of the study area. The model is used as a method of analysis for sizing stormwater management system components. The model is applied using either a real historic storm or a theoretical design storm. Single event analysis is acceptable under the Guidelines for Stormwater Management in the Province of Alberta. The guidelines require that the major drainage system, including storage facilities, shall be designed to accommodate the runoff resulting from a 1:100 year return period storm event. Accordingly, a 1:100 year design storm event with Chicago distribution was used for this study. The SWMHYMO model is capable of:

- Single event modeling to simulate rural, urban and urban/rural watershed conditions for specific design storm events,
- Producing hydrographs, flow volumes, and flow rates at any significant point,
- Routing hydrographs through channels, pipes and reservoirs,
- Determining flows for future land use conditions and,
- Accepting input in the form of hydrographs.

The SWMHYMO model uses the same techniques as its predecessors INTERHYMO (Wisner et al., 1989), HYMO (Williams and Hann, USDA, 1973) and OTTHYMO (Wisner and P'ng, University of Ottawa, 1983). SWMHYMO is based on many years of development and hundreds of practical applications. The model is capable of simulating dual drainage systems (i.e., the underground sewer pipe system and overland major system) and can be structured to incorporate internal storage facilities such as ponds.

2.2.1 Model Setup

The setup of the computer model for the Resort Centre, Stewart Creek, and Smith Creek development areas was accomplished using the following steps:

- Divide the area into sub-catchments based on drainage direction to each creek.
- Determine model parameters including size and infiltration characteristics; and
- Determine stormwater storage capacities and requirements.

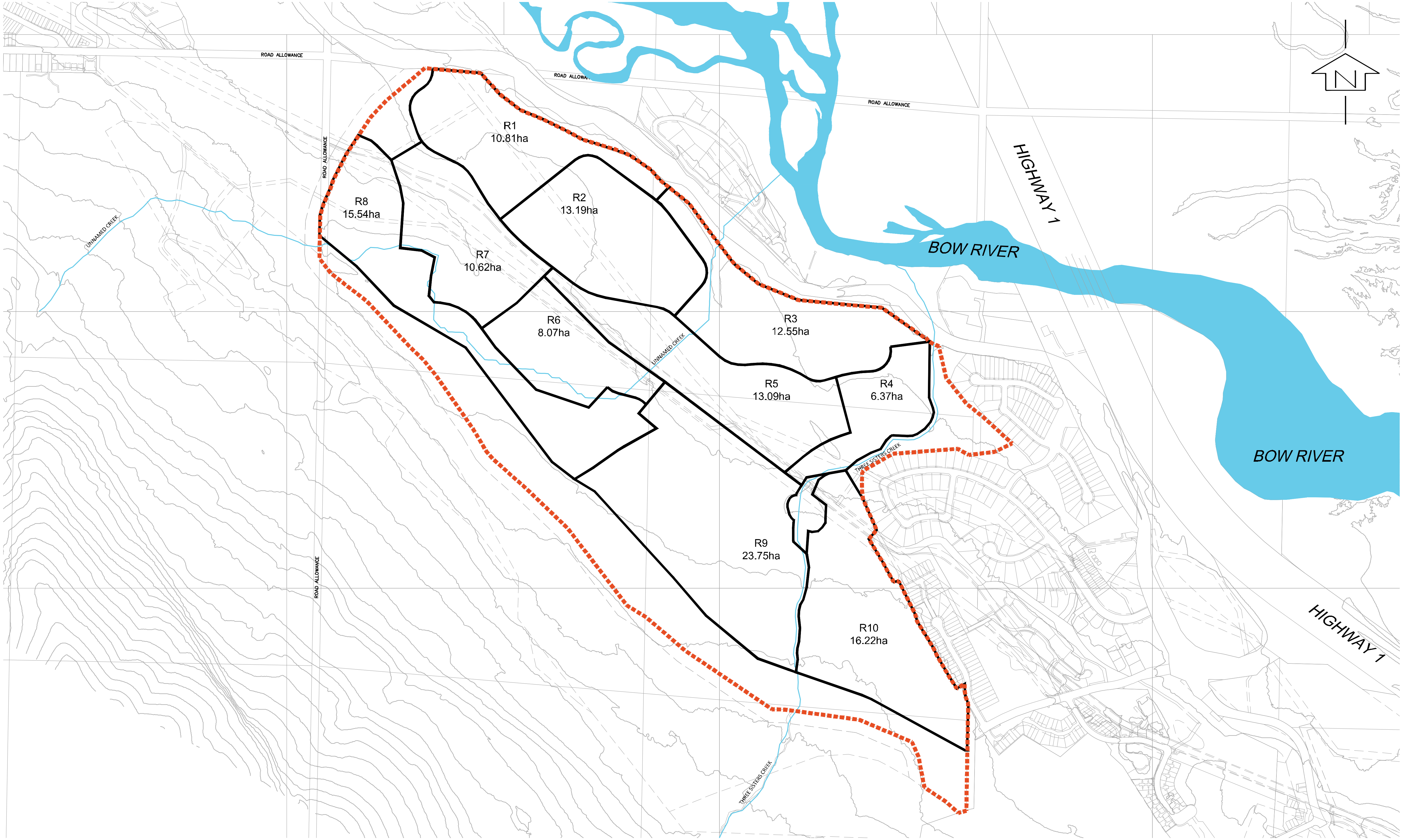
Drainage characteristics for each sub-catchment were determined such as catchment area, impervious area, slope, initial abstraction, and SCS curve numbers. Curve numbers were selected to represent soil infiltration, and to account for variations in hydrologic soil group, land use, soil cover and antecedent moisture. Table 5 below shows the various sub-catchment characteristics based on proposed plans shown in Figures 2.2 and 2.3.

Table 5 – Sub-catchment Characteristics

Subcatchment	Area (ha)	Impervious %	Hydrograph Type	IA (mm)	CN
Residential	209	60	Standhydro	3.2	72
Industrial	25	75	Standhydro	3.2	72
Commercial	57	85	Standhydro	3.2	72

2.3 Design Storm

A 24 hour, 1:100 year storm with ‘Chicago’ distribution was used to simulate the rainfall-runoff process for post-development conditions. Intensity-Duration-Frequency data was obtained from Environment Canada’s Meteorological Service of Canada for the Calgary International Airport.



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THREE SISTERS MOUNTAIN VILLAGE PROPERTY

CATCHMENT BOUNDARIES

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PRELIMINARY SITE PLAN

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-08-29	5216016-000	FIGURE 2.2

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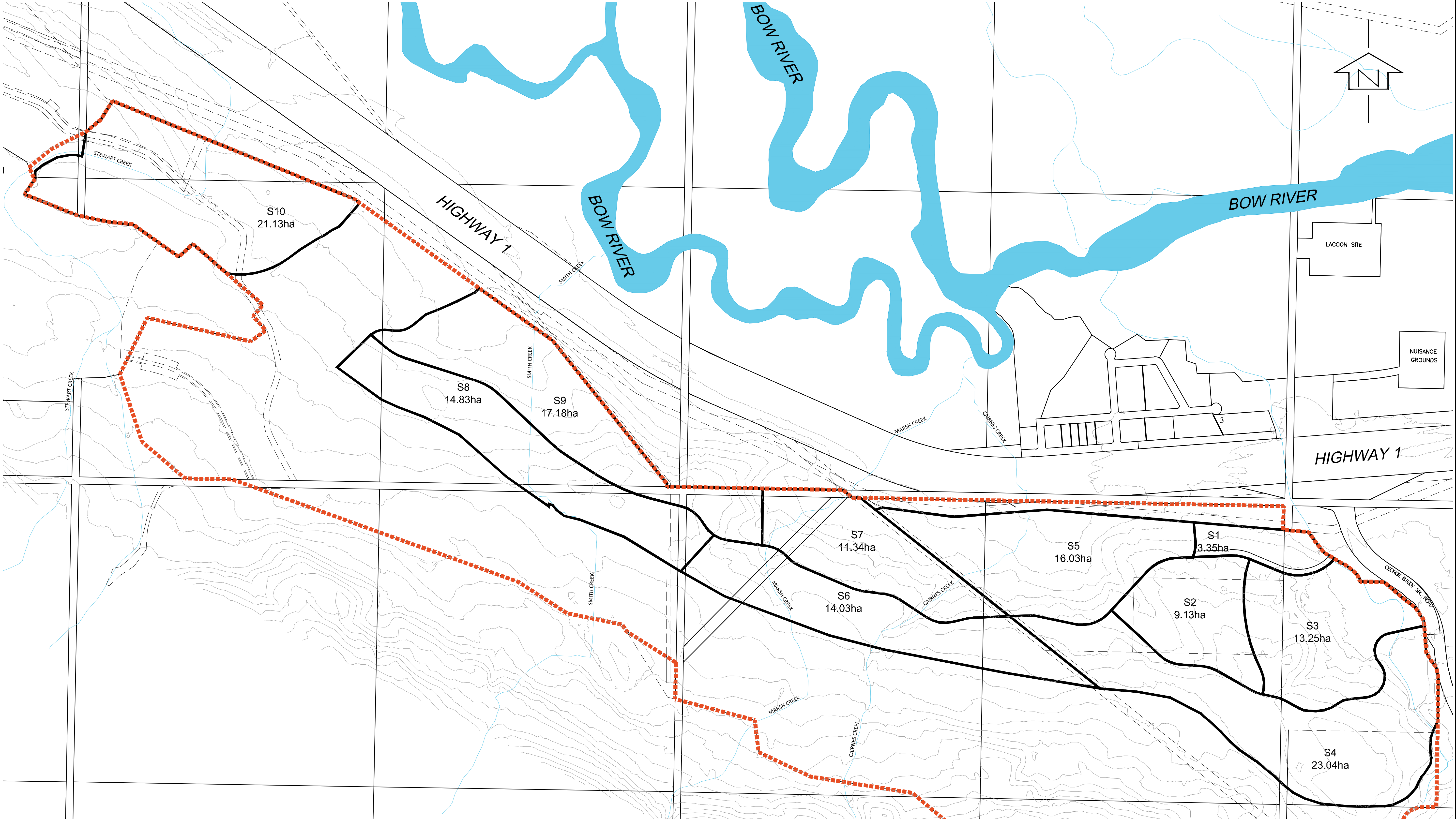

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THREE SISTERS MOUNTAIN VILLAGE PROPERTY

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THREE SISTERS MOUNTAIN VILLAGE - SMITH CREEK
STORMWATER MANAGEMENT STRATEGIES

PRELIMINARY SITE PLAN

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-09-02	5215046-000	FIGURE 2.3

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3.0 RESULTS OF ANALYSIS

3.1 Permissible Release Rate

The project site is located within catchment areas of Three Sisters Creek, Stewart Creek, Smith Creek, Marsh & Cairnes Creek, Pigeon Creek and one unnamed creek, refer to Figure 3.1. As a result, the maximum permissible release rate from each catchment area for a 1:100 year return period event, using the equations listed in Table 4, is shown in Table 6.

Table 6 Maximum Permissible Release Rate

Creek	Catchment Area (Km^2)	Flow Rate for 100 year Storm (m^3/s)	Unit Area Release Rates (L/s/ha)
Three Sisters	10.20	4.43	4.3
Stewart	10.85	4.72	4.3
Smith	2.39	1.01	4.2
Marsh and Cairnes	3.18	1.35	4.2
Pigeon	56.65	25.35	4.5
Unnamed	6.84	2.95	4.3

For a new a development, the permissible release rate depends on the proximity to the creeks listed in Table 6. The estimated maximum permissible release rates for all of the subject creeks ranges from 4.2L/s/ha to 4.5 L/s/ha, so it is recommended to use one single aggregated value of 4.3 L/s/ha as the maximum permissible release rate for the entire TSMV development area to simplify future stormwater management plans.

3.2 Storage Requirements

A preliminary estimation of the runoff that needs to be stored in-site was conducted using a SWMHYMO model. The result of analysis is based on the proposed landuse and maximum release rate proposed in this study. These results could be adjusted at a future date when more detailed design of future developments has been completed. Tables 7 and 8 show the storage requirements for each of the proposed developments.

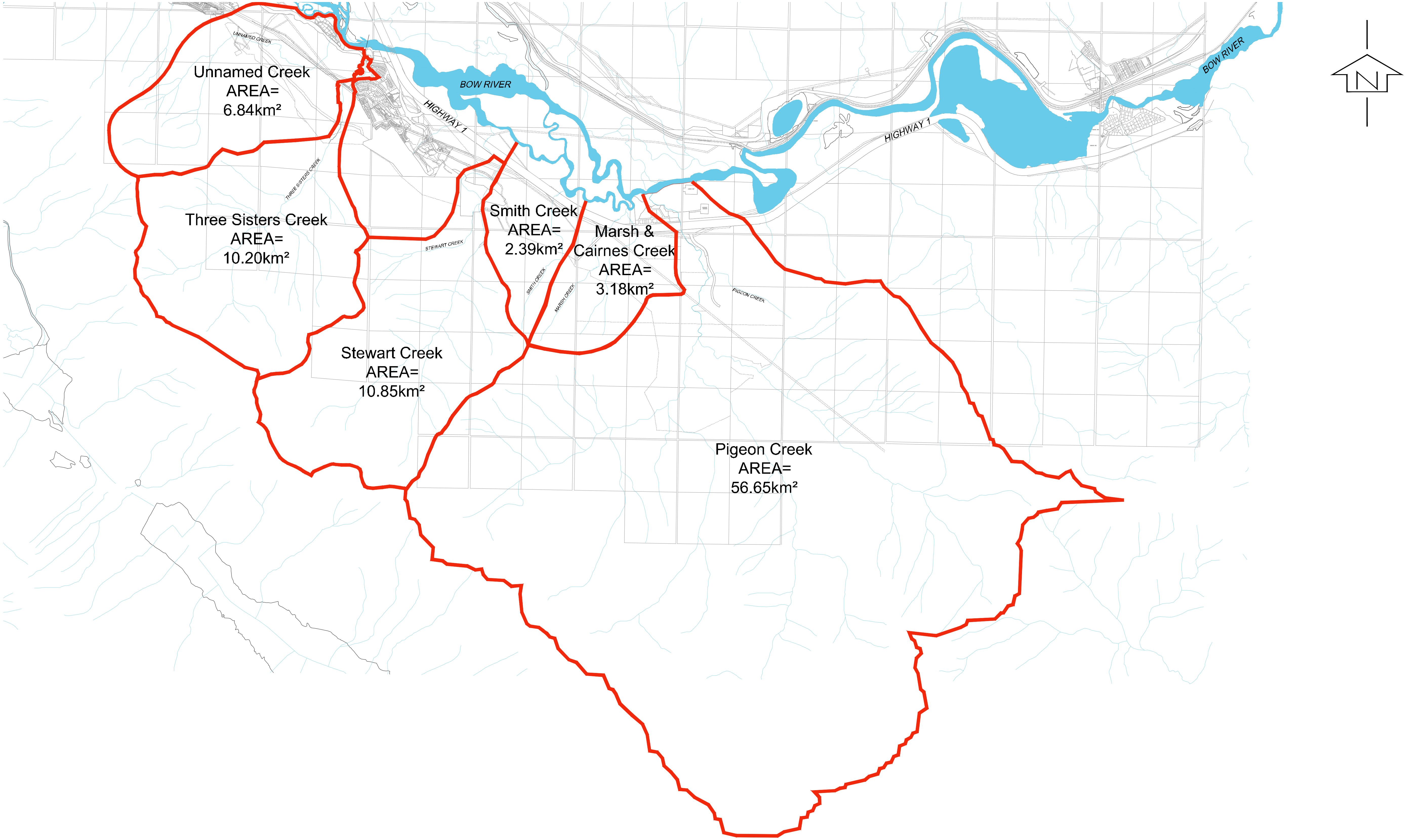
The mountainous nature of the site is a significant constraining factor to building a stormwater storage facility in each development, so it is proposed that more than one development area can share each storage facility. In this study, four storage facilities were proposed for the Resort Centre and another three storage facilities for Smith Creek. The proposed storage facilities locations are shown in Figures 3.2 and 3.3.

Table 7 Storage Requirements (Resort Centre)

Development Area	Area (ha)	Landuse	Storage Volume (m^3)
R1	10.81	Residential	5114
R2	13.19	Residential	6240
R3	12.55	Industrial	6838
R4	6.37	Residential	3013
R5	13.09	Commercial	7763
R6	8.07	Residential	3818
R7	10.62	Residential	5024
R8	15.54	Commercial	9215
R9	23.75	Residential	11235
R10	16.22	Commercial	9619

Table 8 Storage Requirements (Smith Creek)

Development Area	Area (ha)	Landuse	Storage Volume (m^3)
S1	3.35	Commercial	2000
S2	9.13	Industrial	4960
S3	13.25	Residential	6270
S4	23.04	Residential	11000
S5	16.03	Residential	7580
S6	14.03	Residential	6640
S7	11.34	Residential	5360
S8	14.83	Residential	7000
S9	17.18	Residential	8130
S10	21.13	Residential	10000



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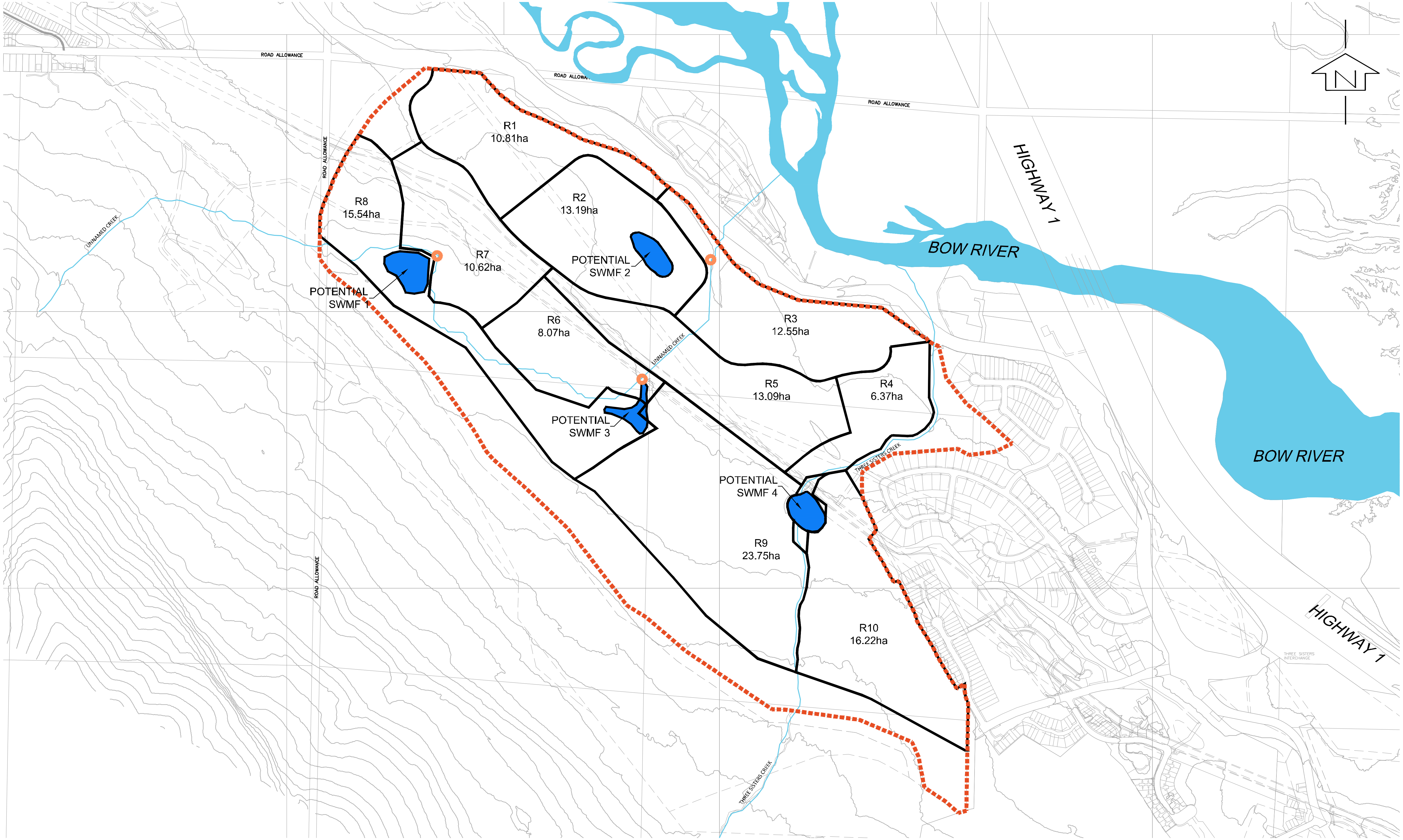
CREEK WATERSHED AREAS

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-06-16	5215046-000	FIGURE 3.1



LEGEND

- THREE SISTERS MOUNTAIN VILLAGE PROPERTY
- CATCHMENT BOUNDARIES
- POTENTIAL STORM WATER STORAGE FACILITY
- POTENTIAL STORM WATER OUTFALL

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THREE SISTERS MOUNTAIN VILLAGE - RESORT CENTRE
STORMWATER MANAGEMENT STRATEGIES

CONCEPTUAL STORMWATER STORAGE FACILITY LOCATIONS

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-08-29	5216016-000	FIGURE 3.2

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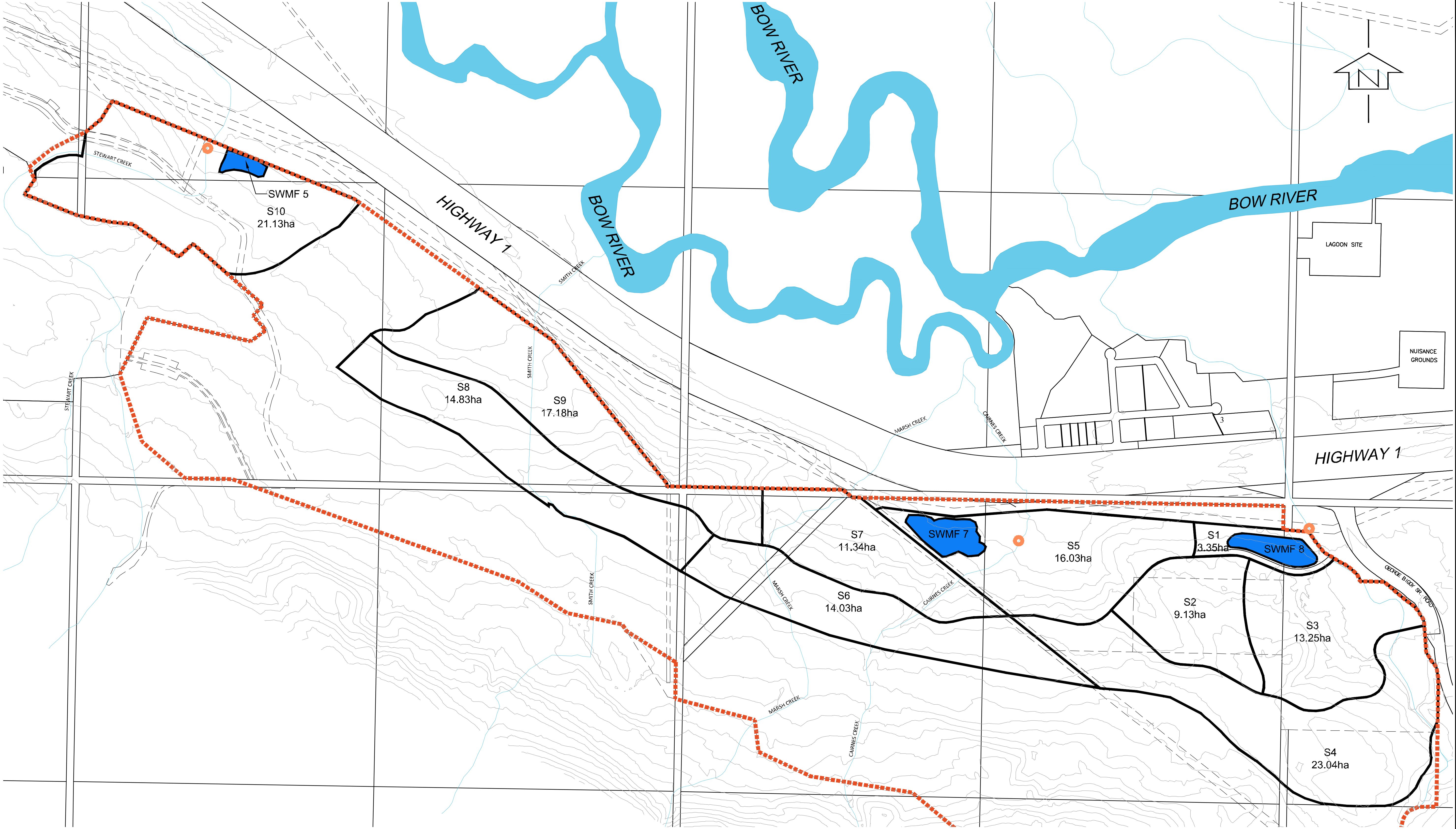

LEGEND

- THREE SISTERS MOUNTAIN VILLAGE PROPERTY
- CATCHMENT BOUNDARIES
- POTENTIAL STORM WATER STORAGE FACILITY
- POTENTIAL STORM WATER OUTFALL

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THREE SISTERS MOUNTAIN VILLAGE - SMITH CREEK
STORMWATER MANAGEMENT STRATEGIES

CONCEPTUAL STORMWATER
STORAGE FACILITY LOCATIONS

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2016-09-02	5215046-000	FIGURE 3.3

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4.0 CONCLUSIONS

Based on the regional frequency and model analysis results, the following conclusions are presented:

- None of the existing creeks (Three Sisters, Stewart, Smith, Marsh and Cairnes, and Pigeon) that flow through the proposed developments have historical flow records. Therefore, a regional frequency analysis was considered appropriate for determining peak flows (maximum permissible release rates) from each catchments area.
- A mathematical relation of the form $\mathrm{K} = \mathrm{K}.\mathrm{A}^{\mathrm{a}}.\mathrm{R}^{\mathrm{b}}$ was obtained for each analyzed return period (1 in 5, 10, 20, 50, 100, 200, and 500-years). The equations presented in Tables 3 and 4 can be used to estimate the maximum permissible release rate at any desired point along drainage courses within the project area. The equations presented in Table 3 can be used if the runoff depth information is available for the specific site. The equations presented in Table 4 can be used if the runoff depth information is not available for the specific site.
- The Unit Permissible Release Rate proposed by UMA was 4.1 L/s/ha using hydrometric flow records up to 1996 (UMA Engineering Ltd. May 2004, Edmonton Alberta, Three Sisters Creek - Regional Frequency Floods, Prepared for Three Sisters Mountain Village Ltd).
- The Unit Permissible Release Rate proposed by Westhoff Engineering Resources was 3.9 L/s/ha using a broader drainage area with the same formulas proposed by UMA on 2004 (Westhoff Engineering Resources, Inc., February 2013, Calgary Alberta, Master Drainage Plan for Three Sisters Mountain Village, prepared for Three Sisters Mountain Village).
- Previous studies by UMA and Westhoff estimated the Permissible Release Rate for the project site based on one creek (Three Sisters Creek) and recommended applying this rate to the Resort Centre, Stewart Creek and Smith Creek areas.
- The current study includes the following changes and improvements over previous studies:
    - 17 hydrometric stations were considered and hydrometric information records for four stations were extended up to 2012 (including the 2005 flood event).
    - All 17 stations are included in the analysis without excluding any station (three main stations were excluded in the previous study).
    - The estimated discharge is estimated based on the runoff depth and the catchment areas (only the catchment areas were included in the previous study).
    - The maximum permissible release rate for each creek has been estimated and tabulated in Table 6. Ideally, a specific permissible release rate would be proposed for each new development based on its proximity to each creek since each creek has different hydrological and morphological characteristics. However, due to the narrow range of

calculated values, this study recommends the use of one single aggregated value of 4.3 L/s/ha as the maximum permissible release rate for the entire TSMV development area to simplify future stormwater management plans

- A preliminary estimation of the runoff that must be stored on-site was estimated using a SWMHYMO model. Tables 7 and 8 show the storage requirements for each of the proposed development areas. The recommended storage requirements are subject to change and further analysis during the detailed design stage of future developments.

- Stormwater storage facilities locations were proposed to serve individual or multiple development areas. Refer to Figures 3.2 and 3.3.

- The number and type of storage facilities (e.g. ponds or wetlands) would be determined by the development site plan and the total storage volume required to be detained on-site.

- There are opportunities to incorporate stormwater management Best Management Practices into the overall design. This might include creating natural features such as increased use of vegetation, water bodies, and natural drainage pathways which can help protect water features by reducing stormwater runoff, providing runoff storage, reducing flooding, and promoting infiltration.

5.0 REFERENCES

- Alberta Environmental Protection (1997): Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems. Standards and Guidelines Branch, Environmental Assessment Division, Environmental Service. Edmonton, Alberta. December 1997.
- J.F. Sabourin & Associates Inc. (1998): SWMHYMO Storm Water Management Hydrologic Model, User's Manual Ottawa, Ontario, 1998.
- Alberta Environmental Protection (1999): Stormwater Management Guidelines for the Province of Alberta. Municipal Program Development Branch, Environmental Sciences Division, Environmental Service. Edmonton, Alberta. January 1999.
- Town of Canmore (2005): Engineering Design Guidelines. Town of Canmore Environmental Services, Engineering Department, Parks Department. Canmore, Alberta, 2005.
- The City of Calgary (2011): Stormwater Management & Design Manual. Wastewater & Drainage, Calgary, Alberta, 2011.

CORPORATE AUTHORIZATION

This document entitled "Stormwater Management Strategies” was prepared by MMM Group Limited (MMM) for the account of Three Sisters Mountain Village Ltd. The material in this report reflects MMM’s best judgment in light of the information available to them at the time of preparation. Any use which a third party makes of this report, or reliance on or decisions made based on it, are the responsibilities of such third parties. MMM accepts no responsibilities for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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Report Review by:	Joshua Maxwell, P.Eng
	Matt Luik, P.Eng, PMP, LEED AP ND

APPENDIX A –SWMHYMO INPUT/OUTPUT FILES

```
2     Metric units
*#*****************************************************************************
*#  Project Name  :
*#  Project Number: 5215046
*#  File Name     : Smith Creek
*#  Date          : 16-05-2016
*#  Modeller      : GI
*#  Reviewed by   :
*#  Company       : MMM Group Inc.
*#  License #     : 5006505
*#  Client        :
*#  Descripttion  : 24 Hour, 1:100 year storm event with Chicago distribution
*#  Revised       :
*#*****************************************************************************
*  Input 100 year Chicago Storm (A,B,C parameters as per City of Calgary
*  guidelines for 100 year)
*******************************************************************************
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                    [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
CHICAGO STORM        IUNITS=[2],  TD=[24](hrs), TPRAT=[0.3],  CSDT=[5](min),
                     ICASEcs=[1],
                     A=[663.1],  B=[1.87], and C=[0.712],
*%-----------------|-----------------------------------------------------------|
*# Catchment A1 (100 ha)
*%|----------------|-----------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["   1001   "], DT=[ 5  ]min, AREA=[100](ha),
                     DWF=[ 0 ](cms),  CN/C=[  30], IA=[ 6.4 ](mm),
                     N=[ 3  ], TP=[ 0.30  ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|---------------------------------------------------------|
COMPUTE VOLUME       ID=[ 1 ], STRATE=[  0  ](cms), RELRATE=[ 0.43  ](cms)
*%-----------------|---------------------------------------------------------|
*%---------------|-----------------------------------------------------------|
PRINT HYD            ID=[1],   # OF PCYCLES=[1]
*%-----------------|---------------------------------------------------------|
*# Residential (203 ha)
*%|----------------|---------------------------------------------------------|
CALIB STANDHYD       ID=[2], NHYD=["1002"], DT=[5](min), AREA=[203](ha),
                     XIMP=[0.6], TIMP=[0.6], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[72],
                     Pervious   surfaces: IAper=[3.2](mm), SLPP=[2](%),
                                          LGP=[50](m), MNP=[0.25], SCP=[30](min),
                     Impervious surfaces: IAimp=[1.6](mm), SLPI=[2](%),
                                          LGI=[50](m), MNI=[0.013], SCI=[30](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*
*%-----------------|----------------------------------------------------------|
COMPUTE VOLUME       ID=[ 2 ], STRATE=[  0  ](cms), RELRATE=[ 0.873  ](cms)
*%-----------------|----------------------------------------------------------|
*%-----------------|----------------------------------------------------------|
PRINT HYD            ID=[2],   # OF PCYCLES=[1]
*%-----------------|----------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
*# Industrial (35 ha)
*%|----------------|---------------------------------------------------------|
CALIB STANDHYD       ID=[3], NHYD=["1003"], DT=[5](min), AREA=[35](ha),
                     XIMP=[0.75], TIMP=[0.75], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[72],
                     Pervious   surfaces: IAper=[3.2](mm), SLPP=[2](%),
                                          LGP=[50](m), MNP=[0.25], SCP=[30](min),
                     Impervious surfaces: IAimp=[1.6](mm), SLPI=[2](%),
                                          LGI=[50](m), MNI=[0.013], SCI=[30](min),
```

```
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*
*%-----------------|-----------------------------------------------------------|
COMPUTE VOLUME      ID=[ 3 ], STRATE=[  0  ](cms), RELRATE=[ 0.151 ](cms)
*%-----------------|-----------------------------------------------------------|
*%-----------------|-----------------------------------------------------------|
PRINT HYD           ID=[3],   # OF PCYCLES=[1]
*%-----------------|-----------------------------------------------------------|
*%-----------------|----------------------------------------------------------|
*# Commenrtial (53 ha)
*%|----------------|----------------------------------------------------------|
CALIB STANDHYD      ID=[4], NHYD=["1004"], DT=[5](min), AREA=[53](ha),
                    XIMP=[0.85], TIMP=[0.85], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[72],
                    Pervious   surfaces: IAper=[3.2](mm), SLPP=[2](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[30](min),
                    Impervious surfaces: IAimp=[1.6](mm), SLPI=[2](%),
                                         LGI=[50](m), MNI=[0.013], SCI=[30](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*
*%-----------------|-----------------------------------------------------------|
COMPUTE VOLUME      ID=[ 4 ], STRATE=[  0  ](cms), RELRATE=[ 0.228  ](cms)
*%-----------------|-----------------------------------------------------------|
*%-----------------|-----------------------------------------------------------|
PRINT HYD           ID=[4],   # OF PCYCLES=[1]
*%-----------------|-----------------------------------------------------------|
*%-----------------|----------------------------------------------------------|
*
FINISH
```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                       9   9 9   9   # 4313781
        StormWater Management HYdrologic Model          999   999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858            *********
 *********                  E-Mail: swmhymo@jfsa.Com                    *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: McCormick Rankin Corporation                 +++++++++
 +++++++++                Kitchener            SERIAL#:4313781         +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********            ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********            Maximum value for ID numbers  :     10           *********
 *********            Max. number of rainfall points: 105408           *********
 *********            Max. number of flow points    : 105408           *********
 *******************************************************************************


 *********************   D E T A I L E D   O U T P U T   *********************
 *******************************************************************************
 *        DATE: 2016-06-01     TIME: 11:01:09     RUN COUNTER: 000033          *
 *******************************************************************************
 * Input   filename: H:\WORK\THREES~1\WORK\SWMHYMO\3Sis2.DAT                    *
 * Output  filename: H:\WORK\THREES~1\WORK\SWMHYMO\3Sis2.out                    *
 * Summary filename: H:\WORK\THREES~1\WORK\SWMHYMO\3Sis2.sum                    *
 * User comments:                                                               *
 * 1:___________________________________________________________________________*
 * 2:___________________________________________________________________________*
 * 3:___________________________________________________________________________*
 *******************************************************************************

---------------------------------------------------------------------------------
--
001:0001-------------------------------------------------------------------------
--
*#******************************************************************************
*#  Project Name  :
*#  Project Number: 5215046
*#  File Name     : Smith Creek
*#  Date          : 16-05-2016
*#  Modeller      : GI
*#  Reviewed by   :
*#  Company       : MMM Group Inc.
*#  License #     : 5006505
*#  Client        :
*#  Descripttion  : 24 Hour, 1:100 year storm event with Chicago distribution
```

```
*#  Revised      :
*#*****************************************************************************
*  Input 100 year Chicago Storm (A,B,C parameters as per City of Calgary
*  guidelines for 100 year)
*******************************************************************************
--------------------
| START            |  Project  dir.: H:\WORK\THREES~1\WORK\SWMHYMO\
--------------------  Rainfall dir.: H:\WORK\THREES~1\WORK\SWMHYMO\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-----------------------------------------------------------------------------------
--
001:0002---------------------------------------------------------------------------
--
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 663.100
| Ptotal= 89.67 mm |                          B=   1.870
--------------------                          C=    .712
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .30
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.094	6.08	4.259	12.08	2.597	18.08	1.467
.17	1.103	6.17	4.519	12.17	2.566	18.17	1.460
.25	1.113	6.25	4.821	12.25	2.536	18.25	1.452
.33	1.122	6.33	5.176	12.33	2.506	18.33	1.444
.42	1.132	6.42	5.601	12.42	2.478	18.42	1.436
.50	1.143	6.50	6.120	12.50	2.450	18.50	1.429
.58	1.153	6.58	6.773	12.58	2.423	18.58	1.421
.67	1.163	6.67	7.624	12.67	2.396	18.67	1.414
.75	1.174	6.75	8.785	12.75	2.371	18.75	1.407
.83	1.185	6.83	10.488	12.83	2.346	18.83	1.399
.92	1.197	6.92	13.283	12.92	2.321	18.92	1.392
1.00	1.208	7.00	18.961	13.00	2.297	19.00	1.385
1.08	1.220	7.08	40.516	13.08	2.274	19.08	1.378
1.17	1.232	7.17	168.138	13.17	2.252	19.17	1.372
1.25	1.245	7.25	54.372	13.25	2.229	19.25	1.365
1.33	1.257	7.33	31.748	13.33	2.208	19.33	1.358
1.42	1.270	7.42	23.236	13.42	2.187	19.42	1.352
1.50	1.284	7.50	18.660	13.50	2.166	19.50	1.345
1.58	1.297	7.58	15.763	13.58	2.146	19.58	1.339
1.67	1.311	7.67	13.746	13.67	2.126	19.67	1.332
1.75	1.326	7.75	12.251	13.75	2.107	19.75	1.326
1.83	1.341	7.83	11.093	13.83	2.088	19.83	1.320
1.92	1.356	7.92	10.166	13.92	2.069	19.92	1.313
2.00	1.372	8.00	9.405	14.00	2.051	20.00	1.307
2.08	1.388	8.08	8.768	14.08	2.034	20.08	1.301
2.17	1.404	8.17	8.225	14.17	2.016	20.17	1.295
2.25	1.421	8.25	7.756	14.25	1.999	20.25	1.289
2.33	1.439	8.33	7.346	14.33	1.983	20.33	1.284
2.42	1.457	8.42	6.985	14.42	1.966	20.42	1.278
2.50	1.476	8.50	6.664	14.50	1.950	20.50	1.272
2.58	1.495	8.58	6.376	14.58	1.935	20.58	1.266
2.67	1.515	8.67	6.116	14.67	1.919	20.67	1.261
2.75	1.535	8.75	5.880	14.75	1.904	20.75	1.255

2.83	1.556	8.83	5.665	14.83	1.889	20.83	1.250
2.92	1.578	8.92	5.468	14.92	1.875	20.92	1.244
3.00	1.601	9.00	5.287	15.00	1.860	21.00	1.239
3.08	1.624	9.08	5.119	15.08	1.846	21.08	1.234
3.17	1.648	9.17	4.964	15.17	1.833	21.17	1.229
3.25	1.674	9.25	4.819	15.25	1.819	21.25	1.223
3.33	1.700	9.33	4.684	15.33	1.806	21.33	1.218
3.42	1.727	9.42	4.558	15.42	1.793	21.42	1.213
3.50	1.755	9.50	4.440	15.50	1.780	21.50	1.208
3.58	1.784	9.58	4.329	15.58	1.767	21.58	1.203
3.67	1.815	9.67	4.224	15.67	1.755	21.67	1.198
3.75	1.846	9.75	4.125	15.75	1.743	21.75	1.193
3.83	1.880	9.83	4.032	15.83	1.731	21.83	1.188
3.92	1.914	9.92	3.943	15.92	1.719	21.92	1.184
4.00	1.950	10.00	3.859	16.00	1.707	22.00	1.179
4.08	1.988	10.08	3.780	16.08	1.696	22.08	1.174
4.17	2.028	10.17	3.704	16.17	1.685	22.17	1.170
4.25	2.070	10.25	3.631	16.25	1.673	22.25	1.165
4.33	2.113	10.33	3.562	16.33	1.663	22.33	1.160
4.42	2.159	10.42	3.496	16.42	1.652	22.42	1.156
4.50	2.208	10.50	3.433	16.50	1.641	22.50	1.151
4.58	2.259	10.58	3.373	16.58	1.631	22.58	1.147
4.67	2.313	10.67	3.315	16.67	1.621	22.67	1.143
4.75	2.371	10.75	3.259	16.75	1.611	22.75	1.138
4.83	2.432	10.83	3.206	16.83	1.601	22.83	1.134
4.92	2.497	10.92	3.154	16.92	1.591	22.92	1.130
5.00	2.566	11.00	3.105	17.00	1.581	23.00	1.125
5.08	2.640	11.08	3.057	17.08	1.572	23.08	1.121
5.17	2.719	11.17	3.011	17.17	1.562	23.17	1.117
5.25	2.805	11.25	2.967	17.25	1.553	23.25	1.113
5.33	2.897	11.33	2.924	17.33	1.544	23.33	1.109
5.42	2.997	11.42	2.883	17.42	1.535	23.42	1.105
5.50	3.105	11.50	2.843	17.50	1.526	23.50	1.101
5.58	3.224	11.58	2.805	17.58	1.517	23.58	1.097
5.67	3.354	11.67	2.767	17.67	1.509	23.67	1.093
5.75	3.497	11.75	2.731	17.75	1.500	23.75	1.089
5.83	3.656	11.83	2.696	17.83	1.492	23.83	1.085
5.92	3.833	11.92	2.662	17.92	1.484	23.92	1.081
6.00	4.033	12.00	2.629	18.00	1.476	24.00	1.077

```
----------------------------------------------------------------------------------
--
001:0003--------------------------------------------------------------------------
--
*# Catchment A1 (100 ha)
----------------------
| CALIB NASHYD        |   Area    (ha)=  100.00   Curve Number   (CN)=30.00
| 01:   100 DT= 5.00 |   Ia      (mm)=   6.400   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .300

     Unit Hyd Qpeak  (cms)=   12.732

     PEAK FLOW       (cms)=    1.042 (i)
     TIME TO PEAK    (hrs)=    7.500
     RUNOFF VOLUME    (mm)=   10.257
     TOTAL RAINFALL   (mm)=   89.667
     RUNOFF COEFFICIENT   =     .114

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
--
001:0004--------------------------------------------------------------------------
```

```
--
--------------------
| COMPUTE VOLUME   |
| ID:01  (   100)  |              DISCHARGE      TIME
--------------------                (cms)       (hrs)
           START CONTROLLING AT      .000       4.333
           INFLOW HYD. PEAKS AT     1.042       7.500
           STOP  CONTROLLING AT      .430       8.298

           REQUIRED STORAGE VOLUME (ha.m.)=     .1523
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    1.0258
           % OF HYDROGRAPH TO STORE        =  14.8465

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .430  (cms).

      *** WARNING: Calculated volume may not be the maximum.

-----------------------------------------------------------------------------------
--
001:0005---------------------------------------------------------------------------
--
--------------------
| PRINT HYD        |   AREA       (ha)=  100.000
| ID=01 (   100)   |   QPEAK     (cms)=    1.042 (i)
| DT= 5.00 PCYC= 1 |   TPEAK     (hrs)=    7.500
--------------------   VOLUME     (mm)=   10.257

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
  TIME     FLOW |  TIME     FLOW |  TIME     FLOW |  TIME     FLOW |  TIME     FLOW
   hrs      cms |   hrs      cms |   hrs      cms |   hrs      cms |   hrs      cms
    .00     .000|   5.17     .002|  10.33     .184|  15.50     .103|  20.67     .079
    .08     .000|   5.25     .003|  10.42     .181|  15.58     .103|  20.75     .079
    .17     .000|   5.33     .003|  10.50     .178|  15.67     .102|  20.83     .078
    .25     .000|   5.42     .004|  10.58     .176|  15.75     .102|  20.92     .078
    .33     .000|   5.50     .005|  10.67     .173|  15.83     .101|  21.00     .078
    .42     .000|   5.58     .006|  10.75     .170|  15.92     .101|  21.08     .078
    .50     .000|   5.67     .006|  10.83     .168|  16.00     .100|  21.17     .077
    .58     .000|   5.75     .007|  10.92     .166|  16.08     .100|  21.25     .077
    .67     .000|   5.83     .008|  11.00     .163|  16.17     .099|  21.33     .077
    .75     .000|   5.92     .009|  11.08     .161|  16.25     .099|  21.42     .077
    .83     .000|   6.00     .011|  11.17     .159|  16.33     .098|  21.50     .076
    .92     .000|   6.08     .012|  11.25     .157|  16.42     .098|  21.58     .076
   1.00     .000|   6.17     .014|  11.33     .155|  16.50     .097|  21.67     .076
   1.08     .000|   6.25     .016|  11.42     .153|  16.58     .097|  21.75     .076
   1.17     .000|   6.33     .018|  11.50     .152|  16.67     .096|  21.83     .075
   1.25     .000|   6.42     .020|  11.58     .150|  16.75     .096|  21.92     .075
   1.33     .000|   6.50     .023|  11.67     .148|  16.83     .095|  22.00     .075
   1.42     .000|   6.58     .027|  11.75     .147|  16.92     .095|  22.08     .075
   1.50     .000|   6.67     .031|  11.83     .145|  17.00     .094|  22.17     .075
   1.58     .000|   6.75     .037|  11.92     .143|  17.08     .094|  22.25     .074
   1.67     .000|   6.83     .044|  12.00     .142|  17.17     .093|  22.33     .074
   1.75     .000|   6.92     .054|  12.08     .141|  17.25     .093|  22.42     .074
   1.83     .000|   7.00     .071|  12.17     .139|  17.33     .092|  22.50     .074
   1.92     .000|   7.08     .109|  12.25     .138|  17.42     .092|  22.58     .073
   2.00     .000|   7.17     .312|  12.33     .136|  17.50     .092|  22.67     .073
   2.08     .000|   7.25     .616|  12.42     .135|  17.58     .091|  22.75     .073
   2.17     .000|   7.33     .864|  12.50     .134|  17.67     .091|  22.83     .073
   2.25     .000|   7.42    1.003|  12.58     .133|  17.75     .090|  22.92     .073
   2.33     .000|   7.50    1.042|  12.67     .131|  17.83     .090|  23.00     .072
   2.42     .000|   7.58    1.012|  12.75     .130|  17.92     .090|  23.08     .072
   2.50     .000|   7.67     .942|  12.83     .129|  18.00     .089|  23.17     .072
   2.58     .000|   7.75     .855|  12.92     .128|  18.08     .089|  23.25     .072
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    2.67    .000|   7.83    .767|  13.00    .127|  18.17    .089|  23.33    .072
    2.75    .000|   7.92    .683|  13.08    .126|  18.25    .088|  23.42    .071
    2.83    .000|   8.00    .610|  13.17    .125|  18.33    .088|  23.50    .071
    2.92    .000|   8.08    .547|  13.25    .124|  18.42    .087|  23.58    .071
    3.00    .000|   8.17    .495|  13.33    .123|  18.50    .087|  23.67    .071
    3.08    .000|   8.25    .451|  13.42    .122|  18.58    .087|  23.75    .071
    3.17    .000|   8.33    .415|  13.50    .121|  18.67    .086|  23.83    .070
    3.25    .000|   8.42    .385|  13.58    .120|  18.75    .086|  23.92    .070
    3.33    .000|   8.50    .360|  13.67    .119|  18.83    .086|  24.00    .070
    3.42    .000|   8.58    .339|  13.75    .118|  18.92    .085|  24.08    .066
    3.50    .000|   8.67    .321|  13.83    .118|  19.00    .085|  24.17    .058
    3.58    .000|   8.75    .306|  13.92    .117|  19.08    .085|  24.25    .048
    3.67    .000|   8.83    .292|  14.00    .116|  19.17    .084|  24.33    .038
    3.75    .000|   8.92    .280|  14.08    .115|  19.25    .084|  24.42    .029
    3.83    .000|   9.00    .270|  14.17    .114|  19.33    .084|  24.50    .021
    3.92    .000|   9.08    .260|  14.25    .114|  19.42    .083|  24.58    .015
    4.00    .000|   9.17    .252|  14.33    .113|  19.50    .083|  24.67    .010
    4.08    .000|   9.25    .245|  14.42    .112|  19.58    .083|  24.75    .007
    4.17    .000|   9.33    .238|  14.50    .111|  19.67    .082|  24.83    .005
    4.25    .000|   9.42    .232|  14.58    .111|  19.75    .082|  24.92    .003
    4.33    .000|   9.50    .226|  14.67    .110|  19.83    .082|  25.00    .002
    4.42    .000|   9.58    .220|  14.75    .109|  19.92    .082|  25.08    .001
    4.50    .000|   9.67    .215|  14.83    .108|  20.00    .081|  25.17    .001
    4.58    .000|   9.75    .211|  14.92    .108|  20.08    .081|  25.25    .001
    4.67    .000|   9.83    .206|  15.00    .107|  20.17    .081|  25.33    .000
    4.75    .000|   9.92    .202|  15.08    .107|  20.25    .080|  25.42    .000
    4.83    .001|  10.00    .198|  15.17    .106|  20.33    .080|  25.50    .000
    4.92    .001|  10.08    .194|  15.25    .105|  20.42    .080|  25.58    .000
    5.00    .001|  10.17    .191|  15.33    .105|  20.50    .080|  25.67    .000
    5.08    .002|  10.25    .187|  15.42    .104|  20.58    .079|
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001:0006------------------------------------------------------------------------
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*# Residential (203 ha)
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| CALIB STANDHYD      |   Area    (ha)=  203.00
| 02:1002   DT= 5.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
----------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        121.80         81.20
     Dep. Storage     (mm)=          1.60          3.20
     Average Slope     (%)=          2.00          2.00
     Length            (m)=         50.00         50.00
     Mannings n           =          .013          .250

      *** NOTE: User defined Storage Coefficients were used
                for Unit Hydrograph calculations.
     Max.eff.Inten.(mm/hr)=         56.16         22.73
                over (min)         30.00         30.00
     Storage Coeff.  (min)=        30.00 (ii)    30.00 (ii)
     Unit Hyd. Tpeak (min)=         5.00          5.00
     Unit Hyd. peak  (cms)=          .04           .04
                                                              *TOTALS*
     PEAK FLOW       (cms)=        12.50          3.10          15.593 (iii)
     TIME TO PEAK    (hrs)=         7.58          7.67           7.583
     RUNOFF VOLUME    (mm)=        88.06         40.36          68.984
     TOTAL RAINFALL   (mm)=        89.67         89.67          89.667
     RUNOFF COEFFICIENT   =          .98           .45            .769

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  72.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
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        THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0007---------------------------------------------------------------------------
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| COMPUTE VOLUME    |
| ID:02  (1002  )   |             DISCHARGE       TIME
--------------------                (cms)        (hrs)
           START CONTROLLING AT      .000        1.333
           INFLOW HYD. PEAKS AT    15.593        7.583
           STOP  CONTROLLING AT      .873       16.236

           REQUIRED STORAGE VOLUME (ha.m.)=    9.6033
           TOTAL HYDROGRAPH VOLUME (ha.m.)=   14.0040
           % OF HYDROGRAPH TO STORE       =   68.5759

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .873  (cms).

      *** WARNING: Calculated volume may not be the maximum.

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001:0008---------------------------------------------------------------------------
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| PRINT HYD         |   AREA       (ha)=  203.000
| ID=02 (1002  )    |   QPEAK     (cms)=   15.593 (i)
| DT= 5.00 PCYC= 1  |   TPEAK     (hrs)=    7.583
--------------------    VOLUME     (mm)=   68.984

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.000	6.00	1.081	12.00	1.438	18.00	.765	24.00	.554
.08	.000	6.08	1.125	12.08	1.417	18.08	.760	24.08	.543
.17	.000	6.17	1.173	12.17	1.397	18.17	.756	24.17	.521
.25	.000	6.25	1.227	12.25	1.378	18.25	.752	24.25	.489
.33	.000	6.33	1.288	12.33	1.359	18.33	.748	24.33	.448
.42	.000	6.42	1.356	12.42	1.341	18.42	.744	24.42	.397
.50	.000	6.50	1.433	12.50	1.324	18.50	.739	24.50	.336
.58	.000	6.58	1.523	12.58	1.307	18.58	.736	24.58	.284
.67	.000	6.67	1.628	12.67	1.290	18.67	.732	24.67	.241
.75	.000	6.75	1.754	12.75	1.275	18.75	.728	24.75	.204
.83	.000	6.83	1.910	12.83	1.259	18.83	.724	24.83	.172
.92	.000	6.92	2.113	12.92	1.244	18.92	.720	24.92	.146
1.00	.000	7.00	2.398	13.00	1.230	19.00	.716	25.00	.124
1.08	.000	7.08	2.922	13.08	1.216	19.08	.713	25.08	.105
1.17	.000	7.17	4.688	13.17	1.202	19.17	.709	25.17	.089
1.25	.000	7.25	6.813	13.25	1.189	19.25	.705	25.25	.075
1.33	.000	7.33	9.094	13.33	1.176	19.33	.702	25.33	.063
1.42	.005	7.42	11.428	13.42	1.164	19.42	.698	25.42	.054
1.50	.018	7.50	13.702	13.50	1.151	19.50	.695	25.50	.045
1.58	.039	7.58	15.593	13.58	1.140	19.58	.691	25.58	.038
1.67	.069	7.67	15.169	13.67	1.128	19.67	.688	25.67	.033
1.75	.107	7.75	14.261	13.75	1.117	19.75	.685	25.75	.028
1.83	.153	7.83	13.230	13.83	1.106	19.83	.681	25.83	.023
1.92	.198	7.92	12.195	13.92	1.095	19.92	.678	25.92	.020
2.00	.236	8.00	11.203	14.00	1.085	20.00	.675	26.00	.017

2.08	.270	8.08	10.279	14.08	1.074	20.08	.672	26.08	.014
2.17	.299	8.17	9.428	14.17	1.064	20.17	.669	26.17	.012
2.25	.324	8.25	8.654	14.25	1.055	20.25	.666	26.25	.010
2.33	.347	8.33	7.953	14.33	1.045	20.33	.662	26.33	.009
2.42	.367	8.42	7.321	14.42	1.036	20.42	.659	26.42	.007
2.50	.385	8.50	6.753	14.50	1.027	20.50	.656	26.50	.006
2.58	.400	8.58	6.244	14.58	1.018	20.58	.653	26.58	.005
2.67	.415	8.67	5.787	14.67	1.009	20.67	.651	26.67	.004
2.75	.428	8.75	5.378	14.75	1.000	20.75	.648	26.75	.004
2.83	.440	8.83	5.012	14.83	.992	20.83	.645	26.83	.003
2.92	.452	8.92	4.683	14.92	.984	20.92	.642	26.92	.003
3.00	.463	9.00	4.389	15.00	.976	21.00	.639	27.00	.002
3.08	.473	9.08	4.124	15.08	.968	21.08	.636	27.08	.002
3.17	.483	9.17	3.887	15.17	.960	21.17	.634	27.17	.002
3.25	.493	9.25	3.673	15.25	.953	21.25	.631	27.25	.001
3.33	.503	9.33	3.480	15.33	.945	21.33	.628	27.33	.001
3.42	.513	9.42	3.306	15.42	.938	21.42	.625	27.42	.001
3.50	.523	9.50	3.148	15.50	.931	21.50	.623	27.50	.001
3.58	.533	9.58	3.006	15.58	.924	21.58	.620	27.58	.001
3.67	.542	9.67	2.876	15.67	.917	21.67	.618	27.67	.001
3.75	.553	9.75	2.758	15.75	.910	21.75	.615	27.75	.001
3.83	.563	9.83	2.650	15.83	.903	21.83	.612	27.83	.000
3.92	.573	9.92	2.551	15.92	.897	21.92	.610	27.92	.000
4.00	.584	10.00	2.461	16.00	.891	22.00	.608	28.00	.000
4.08	.595	10.08	2.378	16.08	.884	22.08	.605	28.08	.000
4.17	.607	10.17	2.301	16.17	.878	22.17	.603	28.17	.000
4.25	.619	10.25	2.230	16.25	.872	22.25	.600	28.25	.000
4.33	.631	10.33	2.165	16.33	.866	22.33	.598	28.33	.000
4.42	.644	10.42	2.104	16.42	.860	22.42	.595	28.42	.000
4.50	.657	10.50	2.047	16.50	.854	22.50	.593	28.50	.000
4.58	.671	10.58	1.994	16.58	.849	22.58	.591	28.58	.000
4.67	.686	10.67	1.945	16.67	.843	22.67	.588	28.67	.000
4.75	.701	10.75	1.899	16.75	.838	22.75	.586	28.75	.000
4.83	.717	10.83	1.855	16.83	.832	22.83	.584	28.83	.000
4.92	.734	10.92	1.814	16.92	.827	22.92	.582	28.92	.000
5.00	.752	11.00	1.776	17.00	.822	23.00	.580	29.00	.000
5.08	.770	11.08	1.739	17.08	.816	23.08	.577	29.08	.000
5.17	.790	11.17	1.705	17.17	.811	23.17	.575	29.17	.000
5.25	.811	11.25	1.672	17.25	.806	23.25	.573	29.25	.000
5.33	.833	11.33	1.641	17.33	.801	23.33	.571	29.33	.000
5.42	.857	11.42	1.612	17.42	.797	23.42	.569	29.42	.000
5.50	.882	11.50	1.583	17.50	.792	23.50	.567	29.50	.000
5.58	.910	11.58	1.557	17.58	.787	23.58	.565	29.58	.000
5.67	.939	11.67	1.531	17.67	.782	23.67	.563	29.67	.000
5.75	.970	11.75	1.506	17.75	.778	23.75	.561		
5.83	1.004	11.83	1.483	17.83	.773	23.83	.558		
5.92	1.041	11.92	1.460	17.92	.769	23.92	.556		

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001:0009----------------------------------------------------------------------------
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*# Industrial (35 ha)
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| CALIB STANDHYD      |   Area    (ha)=   35.00
| 03:1003   DT= 5.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   75.00
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       26.25          8.75
     Dep. Storage     (mm)=        1.60          3.20
     Average Slope     (%)=        2.00          2.00
     Length            (m)=       50.00         50.00
     Mannings n          =         .013          .250
```

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 *** NOTE: User defined Storage Coefficients were used
           for Unit Hydrograph calculations.
Max.eff.Inten.(mm/hr)=      56.16          22.73
           over (min)       30.00          30.00
Storage Coeff.  (min)=      30.00 (ii)     30.00 (ii)
Unit Hyd. Tpeak (min)=       5.00           5.00
Unit Hyd. peak  (cms)=        .04            .04
                                                         *TOTALS*
PEAK FLOW       (cms)=       2.69            .33           3.027 (iii)
TIME TO PEAK    (hrs)=       7.58           7.67           7.583
RUNOFF VOLUME    (mm)=      88.06          40.36          76.140
TOTAL RAINFALL   (mm)=      89.67          89.67          89.667
RUNOFF COEFFICIENT   =        .98            .45            .849

  (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
      CN* =  72.0    Ia = Dep. Storage  (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
      THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0010-------------------------------------------------------------------------
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| COMPUTE VOLUME   |
| ID:03  (1003  )  |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT     .000       1.333
           INFLOW HYD. PEAKS AT    3.027       7.583
           STOP  CONTROLLING AT     .151      16.865

           REQUIRED STORAGE VOLUME (ha.m.)=   1.9045
           TOTAL HYDROGRAPH VOLUME (ha.m.)=   2.6649
           % OF HYDROGRAPH TO STORE       =  71.4652

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .151  (cms).

      *** WARNING: Calculated volume may not be the maximum.

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001:0011-------------------------------------------------------------------------
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| PRINT HYD        |   AREA      (ha)=   35.000
| ID=03 (1003  )   |   QPEAK    (cms)=    3.027 (i)
| DT= 5.00 PCYC= 1 |   TPEAK    (hrs)=    7.583
--------------------   VOLUME     (mm)=   76.140

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.000	5.83	.210	11.67	.281	17.50	.144	23.33	.103
.08	.000	5.92	.217	11.75	.276	17.58	.143	23.42	.103
.17	.000	6.00	.225	11.83	.272	17.67	.142	23.50	.102
.25	.000	6.08	.234	11.92	.268	17.75	.141	23.58	.102
.33	.000	6.17	.244	12.00	.264	17.83	.141	23.67	.102
.42	.000	6.25	.255	12.08	.260	17.92	.140	23.75	.101
.50	.000	6.33	.267	12.17	.256	18.00	.139	23.83	.101
.58	.000	6.42	.280	12.25	.253	18.08	.138	23.92	.101

.67	.000	6.50	.296	12.33	.249	18.17	.137	24.00	.100
.75	.000	6.58	.314	12.42	.246	18.25	.137	24.08	.098
.83	.000	6.67	.335	12.50	.242	18.33	.136	24.17	.094
.92	.000	6.75	.360	12.58	.239	18.42	.135	24.25	.088
1.00	.000	6.83	.391	12.67	.236	18.50	.134	24.33	.081
1.08	.000	6.92	.432	12.75	.233	18.58	.134	24.42	.072
1.17	.000	7.00	.488	12.83	.230	18.67	.133	24.50	.061
1.25	.000	7.08	.592	12.92	.228	18.75	.132	24.58	.051
1.33	.000	7.17	.937	13.00	.225	18.83	.131	24.67	.043
1.42	.001	7.25	1.348	13.08	.222	18.92	.131	24.75	.037
1.50	.004	7.33	1.788	13.17	.220	19.00	.130	24.83	.031
1.58	.008	7.42	2.236	13.25	.217	19.08	.129	24.92	.026
1.67	.015	7.50	2.670	13.33	.215	19.17	.129	25.00	.022
1.75	.023	7.58	3.027	13.42	.213	19.25	.128	25.08	.019
1.83	.033	7.67	2.935	13.50	.210	19.33	.127	25.17	.016
1.92	.043	7.75	2.752	13.58	.208	19.42	.127	25.25	.014
2.00	.051	7.83	2.547	13.67	.206	19.50	.126	25.33	.011
2.08	.058	7.92	2.342	13.75	.204	19.58	.125	25.42	.010
2.17	.064	8.00	2.147	13.83	.202	19.67	.125	25.50	.008
2.25	.070	8.08	1.966	13.92	.200	19.75	.124	25.58	.007
2.33	.075	8.17	1.800	14.00	.198	19.83	.124	25.67	.006
2.42	.079	8.25	1.649	14.08	.196	19.92	.123	25.75	.005
2.50	.083	8.33	1.513	14.17	.194	20.00	.122	25.83	.004
2.58	.086	8.42	1.390	14.25	.193	20.08	.122	25.92	.004
2.67	.089	8.50	1.280	14.33	.191	20.17	.121	26.00	.003
2.75	.092	8.58	1.181	14.42	.189	20.25	.121	26.08	.003
2.83	.095	8.67	1.093	14.50	.187	20.33	.120	26.17	.002
2.92	.097	8.75	1.014	14.58	.186	20.42	.120	26.25	.002
3.00	.100	8.83	.944	14.67	.184	20.50	.119	26.33	.002
3.08	.102	8.92	.881	14.75	.182	20.58	.118	26.42	.001
3.17	.104	9.00	.824	14.83	.181	20.67	.118	26.50	.001
3.25	.106	9.08	.773	14.92	.179	20.75	.117	26.58	.001
3.33	.108	9.17	.728	15.00	.178	20.83	.117	26.67	.001
3.42	.110	9.25	.687	15.08	.176	20.92	.116	26.75	.001
3.50	.112	9.33	.650	15.17	.175	21.00	.116	26.83	.001
3.58	.114	9.42	.617	15.25	.174	21.08	.115	26.92	.000
3.67	.116	9.50	.587	15.33	.172	21.17	.115	27.00	.000
3.75	.118	9.58	.559	15.42	.171	21.25	.114	27.08	.000
3.83	.120	9.67	.535	15.50	.170	21.33	.114	27.17	.000
3.92	.123	9.75	.512	15.58	.168	21.42	.113	27.25	.000
4.00	.125	9.83	.492	15.67	.167	21.50	.113	27.33	.000
4.08	.127	9.92	.473	15.75	.166	21.58	.112	27.42	.000
4.17	.129	10.00	.456	15.83	.165	21.67	.112	27.50	.000
4.25	.132	10.08	.440	15.92	.163	21.75	.111	27.58	.000
4.33	.134	10.17	.426	16.00	.162	21.83	.111	27.67	.000
4.42	.137	10.25	.412	16.08	.161	21.92	.110	27.75	.000
4.50	.140	10.33	.400	16.17	.160	22.00	.110	27.83	.000
4.58	.142	10.42	.389	16.25	.159	22.08	.110	27.92	.000
4.67	.145	10.50	.378	16.33	.158	22.17	.109	28.00	.000
4.75	.149	10.58	.368	16.42	.157	22.25	.109	28.08	.000
4.83	.152	10.67	.359	16.50	.155	22.33	.108	28.17	.000
4.92	.155	10.75	.350	16.58	.154	22.42	.108	28.25	.000
5.00	.159	10.83	.342	16.67	.153	22.50	.107	28.33	.000
5.08	.163	10.92	.334	16.75	.152	22.58	.107	28.42	.000
5.17	.167	11.00	.327	16.83	.151	22.67	.106	28.50	.000
5.25	.171	11.08	.320	16.92	.150	22.75	.106	28.58	.000
5.33	.175	11.17	.314	17.00	.149	22.83	.106	28.67	.000
5.42	.180	11.25	.307	17.08	.148	22.92	.105	28.75	.000
5.50	.185	11.33	.302	17.17	.148	23.00	.105	28.83	.000
5.58	.191	11.42	.296	17.25	.147	23.08	.104		
5.67	.197	11.50	.291	17.33	.146	23.17	.104		
5.75	.203	11.58	.286	17.42	.145	23.25	.104		

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001:0012-----------------------------------------------------------------------------------
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*# Commenrtial (53 ha)
----------------------
| CALIB STANDHYD      |   Area    (ha)=   53.00
| 04:1004   DT= 5.00 |   Total Imp(%)=   85.00   Dir. Conn.(%)=   85.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      45.05         7.95
     Dep. Storage     (mm)=       1.60         3.20
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      50.00        50.00
     Mannings n          =       .013         .250

      *** NOTE: User defined Storage Coefficients were used
                for Unit Hydrograph calculations.
     Max.eff.Inten.(mm/hr)=      56.16        22.73
                over (min)       30.00        30.00
     Storage Coeff.  (min)=      30.00 (ii)   30.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=        .04          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.62          .30         4.925 (iii)
     TIME TO PEAK    (hrs)=       7.58         7.67         7.583
     RUNOFF VOLUME    (mm)=      88.06        40.36        80.911
     TOTAL RAINFALL   (mm)=      89.67        89.67        89.667
     RUNOFF COEFFICIENT   =        .98          .45          .902

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  72.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0013-----------------------------------------------------------------------------------
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*
--------------------
| COMPUTE VOLUME    |
| ID:04  (1004  )  |              DISCHARGE      TIME
--------------------                (cms)       (hrs)
           START CONTROLLING AT      .000       1.333
           INFLOW HYD. PEAKS AT     4.925       7.583
           STOP  CONTROLLING AT      .228      17.346

           REQUIRED STORAGE VOLUME (ha.m.)=   3.1424
           TOTAL HYDROGRAPH VOLUME (ha.m.)=   4.2883
           % OF HYDROGRAPH TO STORE       =  73.2787

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .228  (cms).

      *** WARNING: Calculated volume may not be the maximum.

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001:0014-----------------------------------------------------------------------------------
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| PRINT HYD         |   AREA       (ha)=   53.000
```

```
| ID=04 (1004  )    |   QPEAK     (cms)=    4.925 (i)
| DT= 5.00 PCYC= 1 |   TPEAK     (hrs)=    7.583
--------------------   VOLUME     (mm)=   80.911
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.000	5.83	.354	11.67	.443	17.50	.225	23.33	.161
.08	.000	5.92	.367	11.75	.436	17.58	.224	23.42	.161
.17	.000	6.00	.380	11.83	.429	17.67	.223	23.50	.160
.25	.000	6.08	.395	11.92	.422	17.75	.221	23.58	.159
.33	.000	6.17	.411	12.00	.415	17.83	.220	23.67	.159
.42	.000	6.25	.429	12.08	.409	17.92	.219	23.75	.158
.50	.000	6.33	.449	12.17	.403	18.00	.217	23.83	.158
.58	.000	6.42	.471	12.25	.398	18.08	.216	23.92	.157
.67	.000	6.50	.497	12.33	.392	18.17	.215	24.00	.157
.75	.000	6.58	.527	12.42	.387	18.25	.214	24.08	.153
.83	.000	6.67	.562	12.50	.382	18.33	.213	24.17	.147
.92	.000	6.75	.603	12.58	.377	18.42	.211	24.25	.138
1.00	.000	6.83	.655	12.67	.372	18.50	.210	24.33	.126
1.08	.000	6.92	.722	12.75	.367	18.58	.209	24.42	.112
1.17	.000	7.00	.815	12.83	.363	18.67	.208	24.50	.095
1.25	.000	7.08	.986	12.92	.358	18.75	.207	24.58	.080
1.33	.000	7.17	1.548	13.00	.354	18.83	.206	24.67	.068
1.42	.002	7.25	2.216	13.08	.350	18.92	.205	24.75	.057
1.50	.007	7.33	2.929	13.17	.346	19.00	.203	24.83	.049
1.58	.015	7.42	3.653	13.25	.342	19.08	.202	24.92	.041
1.67	.025	7.50	4.354	13.33	.338	19.17	.201	25.00	.035
1.75	.039	7.58	4.925	13.42	.334	19.25	.200	25.08	.030
1.83	.056	7.67	4.766	13.50	.331	19.33	.199	25.17	.025
1.92	.073	7.75	4.462	13.58	.327	19.42	.198	25.25	.021
2.00	.087	7.83	4.124	13.67	.324	19.50	.197	25.33	.018
2.08	.100	7.92	3.789	13.75	.321	19.58	.196	25.42	.015
2.17	.111	8.00	3.469	13.83	.317	19.67	.195	25.50	.013
2.25	.120	8.08	3.173	13.92	.314	19.75	.194	25.58	.011
2.33	.128	8.17	2.902	14.00	.311	19.83	.193	25.67	.009
2.42	.136	8.25	2.656	14.08	.308	19.92	.192	25.75	.008
2.50	.142	8.33	2.434	14.17	.305	20.00	.191	25.83	.007
2.58	.148	8.42	2.234	14.25	.302	20.08	.190	25.92	.006
2.67	.153	8.50	2.055	14.33	.299	20.17	.190	26.00	.005
2.75	.158	8.58	1.895	14.42	.297	20.25	.189	26.08	.004
2.83	.163	8.67	1.752	14.50	.294	20.33	.188	26.17	.003
2.92	.167	8.75	1.624	14.58	.291	20.42	.187	26.25	.003
3.00	.171	8.83	1.509	14.67	.289	20.50	.186	26.33	.002
3.08	.175	8.92	1.407	14.75	.286	20.58	.185	26.42	.002
3.17	.178	9.00	1.316	14.83	.284	20.67	.184	26.50	.002
3.25	.182	9.08	1.234	14.92	.282	20.75	.183	26.58	.001
3.33	.185	9.17	1.160	15.00	.279	20.83	.183	26.67	.001
3.42	.189	9.25	1.094	15.08	.277	20.92	.182	26.75	.001
3.50	.192	9.33	1.034	15.17	.275	21.00	.181	26.83	.001
3.58	.196	9.42	.981	15.25	.272	21.08	.180	26.92	.001
3.67	.199	9.50	.932	15.33	.270	21.17	.179	27.00	.001
3.75	.203	9.58	.889	15.42	.268	21.25	.179	27.08	.001
3.83	.206	9.67	.849	15.50	.266	21.33	.178	27.17	.000
3.92	.210	9.75	.813	15.58	.264	21.42	.177	27.25	.000
4.00	.213	9.83	.780	15.67	.262	21.50	.176	27.33	.000
4.08	.217	9.92	.750	15.75	.260	21.58	.176	27.42	.000
4.17	.221	10.00	.722	15.83	.258	21.67	.175	27.50	.000
4.25	.225	10.08	.697	15.92	.256	21.75	.174	27.58	.000
4.33	.229	10.17	.674	16.00	.254	21.83	.173	27.67	.000
4.42	.234	10.25	.653	16.08	.252	21.92	.173	27.75	.000
4.50	.238	10.33	.633	16.17	.251	22.00	.172	27.83	.000
4.58	.243	10.42	.614	16.25	.249	22.08	.171	27.92	.000

```
   4.67    .248| 10.50    .597| 16.33    .247| 22.17    .170| 28.00    .000
   4.75    .253| 10.58    .581| 16.42    .245| 22.25    .170| 28.08    .000
   4.83    .258| 10.67    .567| 16.50    .244| 22.33    .169| 28.17    .000
   4.92    .264| 10.75    .553| 16.58    .242| 22.42    .168| 28.25    .000
   5.00    .270| 10.83    .540| 16.67    .240| 22.50    .168| 28.33    .000
   5.08    .276| 10.92    .527| 16.75    .239| 22.58    .167| 28.42    .000
   5.17    .283| 11.00    .516| 16.83    .237| 22.67    .166| 28.50    .000
   5.25    .290| 11.08    .505| 16.92    .236| 22.75    .166| 28.58    .000
   5.33    .297| 11.17    .495| 17.00    .234| 22.83    .165| 28.67    .000
   5.42    .305| 11.25    .485| 17.08    .233| 22.92    .164| 28.75    .000
   5.50    .314| 11.33    .476| 17.17    .231| 23.00    .164| 28.83    .000
   5.58    .323| 11.42    .467| 17.25    .230| 23.08    .163| 28.92    .000
   5.67    .333| 11.50    .459| 17.33    .228| 23.17    .162| 29.00    .000
   5.75    .343| 11.58    .451| 17.42    .227| 23.25    .162|
----------------------------------------------------------------------------
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001:0015--------------------------------------------------------------------
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*
      FINISH
----------------------------------------------------------------------------
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****************************************************************************
**
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0004 COMPUTE VOLUME
      *** WARNING: Calculated volume may not be the maximum.
 001:0006 CALIB STANDHYD
      *** NOTE: User defined Storage Coefficients were used
                for Unit Hydrograph calculations.
 001:0007 COMPUTE VOLUME
      *** WARNING: Calculated volume may not be the maximum.
 001:0009 CALIB STANDHYD
      *** NOTE: User defined Storage Coefficients were used
                for Unit Hydrograph calculations.
 001:0010 COMPUTE VOLUME
      *** WARNING: Calculated volume may not be the maximum.
 001:0012 CALIB STANDHYD
      *** NOTE: User defined Storage Coefficients were used
                for Unit Hydrograph calculations.
 001:0013 COMPUTE VOLUME
      *** WARNING: Calculated volume may not be the maximum.
   Simulation ended on 2016-06-01     at 11:01:09
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```