Robinson
Consultants

Rideau River Floodline Mapping
Regional Road 6 to Burritts Rapids

General Report

Prepared For:

RIDEAU VALLEY CONSERVATION AUTHORITY
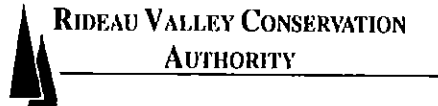
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Our Project No. 00004
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EXECUTIVE SUMMARY

In fall of 2001, flood risk mapping of the Rideau River between Kars (Regional Road 6) to Burritt's Rapids was completed by Robinson Consultants Inc. (RCI).

The objective of this study, authorized by the Rideau Valley Conservation Authority (RVCA) was to update a portion of the flood risk mapping previously completed in 1976. Updating of the existing flood risk mapping became desirable for two reasons:

1.   Flow data collected and assessed (Rideau River- Long Reach Flood Damage Reduction Study, 1993) since the existing mapping was completed in 1976, indicates a significant increase in peak flow rates.
2.   Ongoing development along the Rideau River and Kemptville Creek has made existing flood risk mapping out of date.

The flood risk mapping was accomplished through the following analytical and technical steps:

Hydrologic Analysis

Design flows for the 2, 5, 10, 20, 50 and 100 year return periods were computed for the Rideau River- Long Reach Flood Damage Reduction Study (1993). These peak flows were based on the a station frequency analysis at Manotick and were used in the HEC-2 analysis.

The above flows were reviewed by RVCA. Flow measurements taken at Long Island , Kemptville Creek and Andrewsville allowed for the estimation flows along the Rideau River. Flows between Kemptville Creek and Burritt's Rapids were generated through a flow-area relation calculated from the above noted data.

Slight variations of flow distribution were noted during the comparison. The RVCA flow distribution had only marginal effects on the water levels. However, the revised flows were used to calculate the water surface elevations.

Hydraulic Analysis

Water surface elevations for the 2, 5, 10, 20, 50 and 100 year return periods were achieved through the HEC-2 computer program, developed by the US Army Corps of Engineer, Water Resources Support Centre.

Water levels increased considerably from previous mapping. The RVCA reviewed the model using data collected by RVCA staff on April 6, 1999. The finding confirmed the validity of the mapping from Regional Road 6 to Beckett's Landing, and the new Steven Creek. The water surface elevations from Beckett's Landing to Burritt's Rapids were found to be inconsistent and outside of what is considered to be the margin of error.

The model was reviewed and found to be sensitive to variations in Manning's 'n'. The floodplain between Beckett's Landing and Burritt's Rapids is considered to be narrow or non-existent in which case 'n' has a much greater impact on water depths.

A lower 'n' value was used to more accurately represent the area between Beckett's Landing and Burritt's Rapids. The model was rerun using the lower 'n' value of 0.020. The results compared well with measured water surface elevations. The study concludes that the new water surface elevations represent the best available estimate for the 2, 5, 10, 20, 50, and 100 year flood return period for the section of the Rideau River between Regional Road 6 (Kars) to Burritt's Rapids.

1.0   INTRODUCTION

In fall of 1992, Robinson Consultant Inc (RCI) was retained by the Rideau Valley
Conservation Authority (RVCA) to produce updated flood risk mapping for the reaches of the
Rideau River between Regional Road 6 (Kars) to Burrits Rapids.

The need to update the existing mapping within this area was necessary because the
existing mapping had become outdated as a result of development along the Rideau River
and Kemptville Creek and revised peak flow estimates within the study area.

The need to revise the existing flow estimates was identified during the Long Reach Flood
Damage Reduction Study (RCI, 1993), when analysis indicated a significant increase in
peak flow rates during the preceding decade.

To complete the Rideau River flood risk mapping update, a number of discrete study tasks
needed to be completed, there were:

- Produce topographical mapping of the study area
- map checking to confirm the accuracy of the base mapping
- Hydrologic analysis to determine the flood flows at key locations
- Hydraulic analysis to assess flood stages
- Produce Map Check/Hydrology/Hydraulics reports
- Produce a general report to summarize the entire project and all main findings.

The current report is the final stage of this study. The report summarizes the technical
findings on which the floodline mapping is based, including the above mentioned steps.

The downstream conditions (at RR No. 6) from which the starting water levels were taken,
are based on the 1989 flood risk mapping study of Rideau River from Mooney's Bay to
Regional Road 6 by M.M. Dillon Ltd.

1.1   Study Area

The study area consists of the section of the Rideau River between Regional Road 6 (Kars)
to Burritt's Rapids including portions of the former Township of Rideau (City of Ottawa) and
the Township of North Grenville. The limits of the study area is shown in Figure 1.1.

2.0   MAPPING

The extent of the mapping was determined by the Rideau Valley Conservation Authority in
consultation with the Base Mapping Co. The study area consists of the section of the
Rideau River between Kars and Burritt's Rapids including portions of the former Township
of Rideau (City of Ottawa), and the Township of North Grenville. The cartographic mapping
was produced by The Base Mapping Co Ltd., from arial photgraphy produced on November
9, 1992, by Champlain Air Surveys Ltd. The mapping of the study area consists of 23-
1:5000 scale maps and 3- 1:2000 scale maps. The mapping layout is shown in Figure 2.1

Robinson Consultants	Rideau River Floodplain Mapping Update	PROJECT NO. 00004
	HEC-2 Cross-Section Locations	FIGURE NO. 1.1
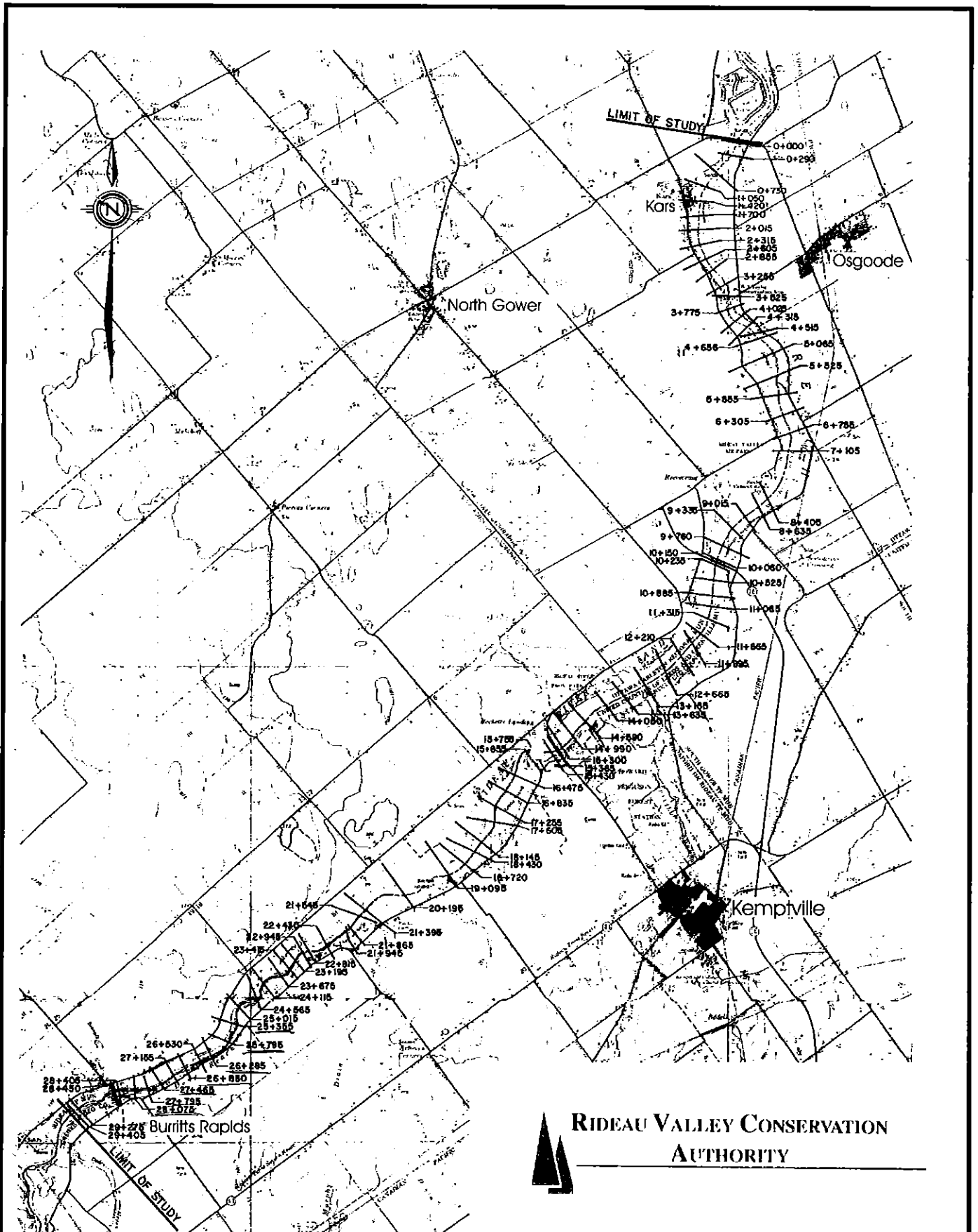
RIDEAU VALLEY CONSERVATION
AUTHORITY
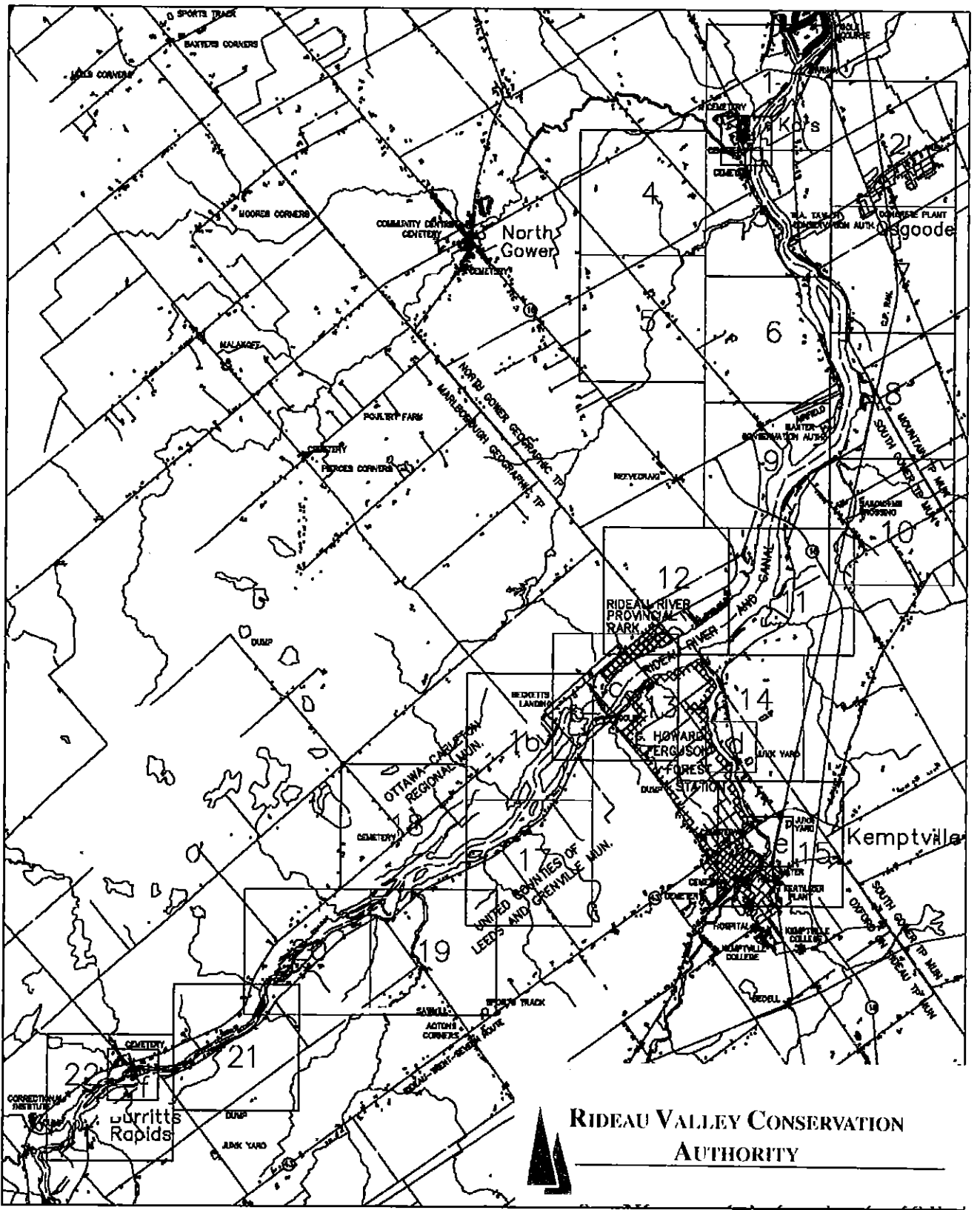
Robinson Consultants	Rideau River Floodplain Mapping Update	PROJECT NO. 00004
	Map Sheet Index	FIGURE NO. 2.1

2.1   Mapping Standards

The following standards are outlined in the Technical Specifications for Large Scale Topographic Mapping for the Canada- Ontario Flood Damage Reduction Program (1990);

▸   90 % of all well defined features must fall within the absolute accuracy limits of 0.6 m horizontal and 0.3 m vertical
▸   all digitized contours and elevations of points derived from contours must be accurate within half the contour interval

2.2   Map Inspection

The objective of map checking is to evaluate the horizontal and vertical accuracy of the cartographic mapping described in the Technical Specifications for Large Scale Topographic Mapping for the Canada-Ontario Flood Damage Reduction Program (1990).   The horizontal and vertical control surveys were carried out by Fairhall, Moffat & Woodland Limited, Ontario Land Surveyors. The horizontal and vertical control survey networks were reviewed with and approved by the Ministry of the Natural Resources.

Map sheets 1, 13 and 22 were selected for field inspection. For each sheet, a total of 10 contour crossing and 10 spot elevations were selected for examination of vertical accuracy, and 3 well defined features were selected to check horizontal accuracy.

The following items were examined on Map Sheets 1, 13 and 22 : provincial and municipal boundaries, street and road names, Township fabric, nomenclature of significant geographic features, edge ties of adjacent map sheets, lettering and any other significant errors.

All other maps were reviewed in lesser detail.

2.2.1   Mapping Results

The results of the inspection revealed the following :

▸   minor discrepancies between map elevations and field elevations
▸   all vertical checks meet the map accuracy criterion
▸   Maps 13 and 22 meet the horizontal map accuracy criterion
▸   Map 1 did not meet the horizontal map accuracy criterion

A number of features were found to be missing on the maps, while others were showing that should not be.

Based on the inspection, RCI recommended the approval of the mapping by the RVCA, subject to correction of all deficiencies :

▸   Correction of all deficiencies
▸   review and correction of veritical elevations on Map 1
▸   manual review and correction of spot elevations on Fairmile Drive to account for recent resurfacing activities

The verification of the aerial photography was found to be in accordance with the ICAS Manual of Procedures, and the ICAS Specifications for Aerial Survey Photography, 1982.

3.0 HYDROLOGY

Flow records from the Manotick and Long Island monitoring stations provides a continuous record from 1948. Data collected between 1948 to 1989 were used for a station-frequency analysis, using the Consolidated Frequency Analysis Program (CFA, Verison 2), produced by Environment Canada. This required the conversion of maximum daily flows to maximum instantaneous flows for the record before 1981. Using the above data, peak flow estimates at several points along the Rideau River were generated by means of the modified drainage area ratio. This ratio is expressed as:

$$Qx = Qt \ (Ax/At)^K$$

Where:
- Qx = flow at specified station
- Qt = known flow rate (gauge)
- Ax = total catchment area upstream of specified station
- At = total area upstream of gauge
- K = empirical constant depending on return period

For the Rideau River, K values vary between <u>1.27 and 2.27</u>   *usually* $< 1 \cdot 0$

The regulatory flood for the Rideau River is the 100 year return period flow. Flow for return periods from 2 to 100 years had been determined previously by RCI for the Rideau River - Long reach Flood Damage reduction Study (1993).

Previously, HSPF modelling had be carried out and it was decided to use this model to obtain the necessary flow distribution along the study section of the river. The HSPF Version 9.01 was obtained from the U.S. Environmental Protection Agency and was run using the data set supplied by the RVCA. During the review of the model, it was noted that measured flows varied from simulated flows up to 175 % and identical datasets did not produce the same results. Consequently, it was decided to use the peak flow estimates for the Long Reach Flood Damage Reduction Study for the HEC-2 analysis. Table 3.1 lists the peak flows at specified locations along the river.

Table 3.1
Flows at Specified Locations

Location	Maximum Instantaneous (m³/sec) Flow Return Period (years)					
	2	5	10	20	50	100
Manotick Monitoring Station	255	327	372	414	466	504
Kars Bridge	197	266	311	353	407	447
Upstream of Steven Creek	196	263	306	348	401	445
Upstream of Cranberry Creek	188	254	297	339	392	433
Upstream of Kemptville Creek	104	157	196	235	287	329
Kemptville Creek Flows	89	122	150	174	202	225

4.0   HYDRAULIC ANALYSIS

The objective of the hydraulic analysis is to determine water surface elevations for return periods of 2, 5, 10, 20, 25, 50 and 100 years.

4.1   Initial Analysis

In 1976, an RBACK hydraulic model was developed as a part of the mapping study completed by MacLaren Ltd.

The validity of this model was checked prior to its use in the new flood risk mapping. A review of the RBACK model sections and the survey cross sections was completed . Surveyed and modeled results were compared to the cross sections generated from sounding and the information obtained from the Canadian Hydrographic Survey (CHS). When comparing the two, significant differences in both cross section shape and channel invert were found. Based on the interpretation of the comparison study, it was concluded that the RBACK coding did not provide accurate representation of the reach in its current state. It was not possible to validate the RBACK model. The study concluded that the cross sections taken from the CHS field sheets would be adequate for modeling purposes. It was recommended that a new HEC-2 model be implemented for the new mapping.

4.2   Updated Analysis

Water surface elevations for various return periods were generated using the HEC-2 computer program, developed by the US Army Corps of Engineers, Water Resources Support Centre. The starting water surface elevations were established in the Long Reach Flood Damage Reduction Study, Hydrology and Hydraulic Report (1993).

In 1997, the Rideau River floodplain mapping was updated between Kars (Regional Road 6) to Burrits Rapids. As a result of higher design flows and more accurate channel definition, the design (100 year) water levels increased from 0.25 to 0.60 from previous mapping, completed in 1976. Due to the considerably higher 100 year water levels, the technical merits of the mapping were questioned and the RVCA decided to undertake further analysis to evaluate the accuracy of the modelling assumptions.

5.0   RVCA REVIEW

5.1   General

To determine the consistency of the HEC2 results that had been used in the mapping and obtain a more accurate flow distribution throughout the study area, the RVCA undertook a comparison of observed vs. modelled water levels at a number of locations. The results of this review are discussed in the following sections.

5.2   Hydrology

On April 6th 1999, hourly flow measurements were taken at Long Island, Kemptville Creek and Andrewsville. From the measurement at the above noted points a flow-area relation was generated. The flows estimated for the model verification (based on the measurements taken on April 6, 1999) are provided in Table 5.1.

Table 5.1
Flow Estimates

Location	Area (km²)	Flow (m³/s)
Kars Bridge	2987	259
Steven Creek	2844	241
Cranberry Creek	2800	236
Kemptville Creek	2254	172
Burritts Rapids	2019	147

The RVCA examined the flow distribution and the influence it has on in-channel water levels. Flows between Kemptville Creek and Burritt's Rapids were distributed using a flow-area relationship. The review indicated that the flow distribution of the 1999 spring freshet event is slightly different from the flows used in the original model. Table 5.2 illustrates the difference between the distributions at key locations.

Table 5.2
Flow Distribution Comparison

Location	Station	Original Model Flow (m³/s)						Revised RVCA Flow (m³/s)					
	return period	2	5	10	20	50	100	2	5	10	20	50	100
Kars Bridge	00+000	197	266	311	353	407	447	197	266	311	353	407	447
	00+073	197	266	311	353	407	447	193	261	305	346	399	438
	01+420	197	266	311	353	407	447	187	253	295	335	387	425
Steven Creek	02+015	196	263	306	348	401	445	183	247	289	328	379	416
Cranberry Creek	02+855	188	254	297	339	392	433	179	242	283	321	370	407
	06+755	188	254	297	339	392	433	175	237	277	314	362	398
	10+235	188	254	297	339	392	433	171	231	271	307	354	389
Kemptville Creek D/S	13+155	188	254	297	339	392	433	167	226	264	300	346	380

Table 5.2 cont'd
Flow Distribution Comparison

Location	Station	Original Model Flow (m³/s)						Revised RVCA Flow (m³/s)					
Kemptville Creek U/S	14+050	104	157	196	235	287	329	130	176	205	233	269	295
	16+475	104	157	196	235	287	329	126	170	199	226	260	286
	19+095	104	157	196	235	287	329	124	168	196	222	256	282
	21+865	104	157	196	235	287	329	120	162	190	215	248	273
	24+565	104	157	196	235	287	329	116	157	183	208	240	264
Burritts Rapids	27+155	104	157	196	235	287	329	112	152	177	201	232	255

The RVCA recommended that the new flow distributions be adopted for the new HEC-2 model.

5.3 Hydraulics

As a review, the HEC2 model was re-run from Regional Road 6 to Burritt's Rapids. Comparisons of HEC-2 (modeled) and measured elevations at Lorne Bridge, WA Taylor, McDermott Drain, Arcand Drain, Hilly Lane, and Beckett's Landing all displayed a variation of under 8 centimeters. However, the results at Burritt's Rapids showed a difference between modelled and observed water surface elevations of almost 70 centimeters. The findings are provided in Table 5.3.

Table 5.3
Comparison of Measured and Modeled Water Surface Elevations

Location	Section No.	Water Surface Elevation (m)		Difference (m)
		HEC-2 Model	**Measured**	
Kars (RR No. 6)	00 + 000	86.28	86.28	0
Lorne Bridge	01 + 420	86.31	86.28	-0.03
W.A Taylor	03 + 525	86.35	86.3	-0.05
Mc Dermont Drain	08 + 405	86.39	86.32	-0.07
Arcand Drain	11 + 315	86.41	86.41	0
Hilly Lane	12 + 210	86.42	86.37	-0.05
Beckett's Landings	15 + 855	86.44	86.36	-0.08
Burritts Rapids	28 + 450	87.2	86.51	-0.69

The 1999 Staff Report confirmed the validity of the new flood risk mapping for the section of the Rideau River from Regional Road 6 to Beckett's Landing, and the new Steven Creek. The report concluded that the drainage area used by RCI in the 1997 mapping was warranted. It was recommended that the RVCA board of Directors formally adopt the new portion of the Rideau River flood plain mapping for the flood plain management program to represent the best available estimate of the 1:100 year flood plain limits for those reaches. However, the attempt to verify the modeling beyond the Beckett's Landing towards Burritt's Rapids was inconsistent and therefore it was necessary to verify the modeling using spring 2000 flows and water levels before adopting any new mapping for this reach.

6.0   DISCUSSION

6.1   Hydrology

A sensitivity analysis conducted by RVCA staff, determined that the water surface elevations are not sensitive to the flow distribution. A more detailed flow distribution only has a marginal effect on water levels. The RVCA revised flow distributions were used to calculate the new water surface elevations.

6.2   Hydraulics

A hydraulic verification of the model was performed in order toassess differences in water levels and more accurately predict the regulatory flood levels at Burritt's Rapids. For the modelling to be valid, the flood level estimates must be within a margin of error of +/- 30 centimeters. Therefore, the original results could not be adopted for flood risk mapping.

The model review consisted of model verification and a discussion of the sensitivity analysis of the empirical constant "K" and Manning's n, as presented in the 1999 staff report. The 1999 staff report concludes that the model is sensitive to variations in Manning's n in the reaches upstream of Kemptville Creek. The in-channel values of 'n' were based on the relative roughness of the channel bottom and channel geometry for a wide slow moving river. In the area between Beckett's Landing and Burritt's Rapids, the floodplain is narrow or non-existent and, therefore, 'n' has a much greater impact on depth.

Originally the 'n' value varied from 0.035 for the channel portion of the river to 0.15 for the floodplain areas. As part of the review, simulations with 'n' values of 0.020 and 0.017 were run. An 'n' value of 0.020 was found to provide results that are close to the 1999 observed values.

6.3   Results

The results of the revised HEC2 analysis indicates that a revision of the initial flood elevations between Beckett's Landing and Burritt's Rapids is warranted. The revised model shows an impact on the 100 year flood levels from the Arcand Drain upstream. It is suggested that the Manning 'n' of 0.020 and 0.017 be adopted. Rerunning the model in accordance with the new 'n' values presents a close correlation between modeled and measured water levels at Burritt's Rapids. The results from the model are provided in Appendix B. The results have been summarized and tabulated in Table 5.4.

Table 5.4
Final Comparison of Modelled Vs. Measured Water Surface Elevations

Location	Section No.	Water Surface Elevation (m)		Measured	Difference (m)	
		HEC-2 Model				
		n = 0.020	n= 0.017		n = 0.020	n = 0.017
Kars (RR No. 6)	00 + 000	86.28	86.28	86.28	0	0.01
Lorne Bridge	01 + 420	86.29	86.29	86.28	0.01	0.01
W.A Taylor	03 + 525	86.31	86.31	86.3	0.01	0.01
Mc Dermont Drain	08 + 405	86.33	86.33	86.32	0.01	0.01
Arcand Drain	11 + 315	86.34	86.33	86.41	-0.07	-0.08
Hilly Lane	12 + 210	86.34	86.33	86.37	-0.03	-0.04
Beckett's Landings	15 + 855	86.35	86.34	86.36	-0.01	-0.02
Burritts Rapids	28 + 450	86.61	86.55	86.51	0.1	0.04

7.0   FLOOD LINE AND FILL DELINEATIONS

The revised model was then used to evaluate the water levels associated with the 2,5,10, 20, 50, and 100 year return period flows. As starting water level for the hydraulic analysis, the results from the earlier flood risk mapping analysis by M.M. Dillion Ltd. in 1989. (*Rideau River Flood Risk Mapping Study Mooney's Bay to Regional Road 6*). These water levels were adopted even though the hydrological analysis indicates higher peak flows than were used in Dillon's study. It was felt that using these starting water levels was appropriate because:

> ► It provides matching water levels between the two sections
> ► The reach at Kars is not very sensitive to variations in flow
> ► Observed water levels at the Kars bridge suggest that the stage-discharge relationship in the Dillon Study is conservative, hence increasing the starting water surface elevation could not be justified.

Table 7.1 illustrates the revised flows used to calculate the new water surface elevation for various return periods.

Table 7.1
Revised Flow and Water Surface Elevations
for Various Return Periods

Location	Station	Revised RVCA Flow (m³/s)						New Water Surface Elevation (m)					
		2	5	10	20	50	100	2	5	10	20	50	100
Kars Bridge	00+000	197	266	311	353	407	447	86.24	86.69	86.94	87.16	87.43	87.63
	00+073	193	261	305	346	399	438	86.25	86.70	86.95	87.17	87.44	87.65
	01+420	187	253	295	335	387	425	86.25	86.70	86.95	87.17	87.44	87.65
Steven Creek	02+015	183	247	289	328	379	416	86.26	86.71	86.97	87.19	87.47	87.67
Cranberry Creek	02+855	179	242	283	321	370	407	86.26	86.72	86.97	87.20	87.47	87.68
	06+755	175	237	277	314	362	398	86.27	86.73	86.99	87.22	87.50	87.70
	10+235	171	231	271	307	354	389	86.28	86.74	87.00	87.23	87.51	87.72
Kemptville Creek D/S	13+155	167	226	264	300	346	380	86.28	86.74	87.00	87.23	87.51	87.72
Kemptville Creek U/S	14+050	130	176	205	233	269	295	86.28	86.75	87.01	87.24	87.52	87.72
	16+475	126	170	199	226	260	286	86.29	86.76	87.02	87.25	87.53	87.74
	19+095	124	168	196	222	256	282	86.29	86.76	87.02	87.25	87.54	87.75
	21+865	120	162	190	215	248	273	86.30	86.77	87.03	87.27	87.55	87.76
	24+565	116	157	183	208	240	264	86.32	86.79	87.06	87.26	87.58	87.79
Burritts Rapids	27+155	112	152	177	201	232	255	86.40	86.87	87.14	87.37	87.66	87.87

8.0   REFERENCES

M.M. Dillion Ltd.1989. *Rideau River Flood Risk Mapping Study Mooney's Bay to Regional Road 6*

A.J. Robinson & Associates Inc.1994. *Flood Risk Mapping Update Rideau River Regional Road 6 to Burritt's Rapids Progress Report- Hydrology and Hydraulics 1993 Work Program*

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Robinson Consultants Inc.1996. *Rideau River Floodplain Mapping Update Regional Road No. 6 to Burritt's Rapids Map Inspection Report*

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Appendix A

Water Elevations

WATER ELEVATIONS
The Robinson model, from Regional Road 6 to Burritt's Rapids.

Location	Secno	Water Elevation	April 6,1999 Measured Elevations	Difference
Regional Road 6	0.000	86.28	86.280	
	0.290	86.29	86.280	
	0.730	86.29	86.280	
	1.050	86.30	86.280	
Lorne Bridge	1.420	86.31	86.280	-0.030
	1.700	86.32	86.282	
	2.015	86.33	86.285	
	2.315	86.33	86.288	
	2.605	86.34	86.290	
	2.855	86.34	86.293	
	3.255	86.35	86.296	
WA Taylor	3.525	86.35	86.299	-0.051
	3.775	86.35	86.301	
	4.025	86.35	86.303	
	4.315	86.36	86.305	
	4.515	86.36	86.307	
	4.665	86.36	86.309	
	5.065	86.37	86.312	
	5.525	86.37	86.316	
	5.855	86.38	86.319	
	6.305	86.38	86.323	
	6.755	86.38	86.327	
	7.105	86.39	86.330	
McDermott Drain	8.405	86.39	86.341	-0.049
	8.635	86.40	86.343	
	9.015	86.40	86.347	
	9.335	86.40	86.350	
	9.760	86.40	86.353	
	10.060	86.40	86.356	
	10.150	86.40	86.357	
	10.235	86.41	86.358	
	10.525	86.41	86.360	
	10.885	86.41	86.363	
	11.065	86.41	86.365	
Argand Drain	11.315	86.41	86.367	-0.043
	11.665	86.41	86.370	
	11.895	86.42	86.372	
Hilly Lane	12.210	86.42	86.375	-0.045
	12.665	86.42	86.379	
	13.155	86.42	86.383	
	13.635	86.43	86.387	
	14.050	86.43	86.391	
	14.590	86.43	86.396	
	14.990	86.43	86.399	
	15.300	86.44	86.402	

WATER ELEVATIONS
The Robinson model, from Regional Road 6 to Burritt's Rapids.

Location	Secno	Water Elevation	April 6,1999 Measured Elevations	Difference
	15.365	86.44	86.403	
	15.430	86.44	86.403	
	15.755	86.44	86.406	
Beckett's Landing	15.855	86.44	86.407	-0.033
	16.475	86.45	86.412	
	16.835	86.46	86.416	
	17.255	86.46	86.419	
	17.605	86.47	86.422	
	18.145	86.47	86.427	
	18.430	86.48	86.430	
	18.720	86.48	86.432	
	19.095	86.48	86.435	
	20.195	86.50	86.445	
	21.395	86.52	86.456	
	21.545	86.52	86.457	
	21.865	86.54	86.460	
	21.945	86.54	86.460	
	22.430	86.57	86.465	
	22.815	86.60	86.468	
	22.945	86.61	86.469	
	23.195	86.62	86.471	
	23.415	86.62	86.473	
	23.675	86.63	86.476	
	24.115	86.65	86.480	
	24.565	86.67	86.484	
	25.015	86.68	86.487	
	25.355	86.69	86.490	
	25.795	86.73	86.494	
	26.285	86.82	86.499	
	26.530	86.84	86.501	
	26.880	86.87	86.504	
	27.155	86.89	86.506	
	27.465	86.92	86.509	-0.411
	27.795	86.94	86.512	
	28.075	86.99	86.514	
	28.405	87.04	86.517	
Burritt's Rapids	28.450	87.05	86.518	
	28.475	87.08	86.518	
	29.275	87.17	86.525	
	29.405	87.20	86.526	

WATER ELEVATIONS
The Dillon model, from Kelly's Landing to Regional Road 6.

Location	Secno	Water Elevation	April 6,1999 Measured Elevations	Difference
Kelly's Landing	23780	86.10	86.094	-0.006
	24000	86.12		
	24165	86.15		
	24350	86.15		
	24560	86.17		
	24680	86.17		
	25110	86.19		
	25300	86.19		
	25500	86.19		
	25810	86.19		
	26060	86.19		
	26230	86.19		
	26545	86.20		
	26830	86.20		
	27160	86.20		
	27540	86.20		
Doyle Creek	27870	86.21	86.280	0.070
	28075	86.21		
	28245	86.21		
	28435	86.21		
	28715	86.21		
	28727	86.21		
Regional Road 6	29000	86.22		

Appendix B

HEC-2 Summary

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*------------------------------------*
|           S U M P O                |
|                                    |
|    Interactive Summary Printout    |
|   for MS/PC-DOS micro computers    |
|           September 1990           |
*------------------------------------*
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NOTE – Asterisk (*) at left of profile number
        indicates message in summary of errors
        list

File RID3020.hec

Summary Printout

	SECNO	Q	CWSEL	VCH	ELMIN	
	.00	2 197.00	86.24	.31	78.18	← CALIBRATION TO APR. 6/99
	.00	259.00	86.28	.40	78.18	
	.00	5 266.00	86.69	.38	78.18	
	.00	10 311.00	86.94	.42	78.18	
	.00	20 353.00	87.16	.46	78.18	
	.00	50 407.00	87.43	.51	78.18	
	.00	100 447.00	87.63	.54	78.18	
*	.29	197.00	86.24	.18	77.88	
*	.29	259.00	86.29	.23	77.88	
*	.29	266.00	86.70	.22	77.88	
*	.29	311.00	86.95	.24	77.88	
*	.29	353.00	87.17	.26	77.88	
*	.29	407.00	87.44	.28	77.88	
*	.29	447.00	87.65	.30	77.88	
	.73	193.00	86.25	.27	77.88	
	.73	253.00	86.29	.35	77.88	
	.73	261.00	86.70	.33	77.88	
	.73	305.00	86.95	.37	77.88	
	.73	346.00	87.17	.40	77.88	
	.73	399.00	87.44	.44	77.88	
	.73	438.00	87.64	.46	77.88	
	1.05	193.00	86.25	.24	77.88	
	1.05	253.00	86.29	.31	77.88	
	1.05	261.00	86.70	.29	77.88	
	1.05	305.00	86.95	.32	77.88	
	1.05	346.00	87.17	.35	77.88	
	1.05	399.00	87.45	.39	77.88	
	1.05	438.00	87.65	.41	77.88	
*	1.42	187.00	86.25	.37	79.40	
*	1.42	246.00	86.29	.49	79.40	
*	1.42	253.00	86.70	.46	79.40	
*	1.42	295.00	86.95	.51	79.40	
*	1.42	335.00	87.17	.56	79.40	
*	1.42	387.00	87.44	.61	79.40	
*	1.42	425.00	87.65	.65	79.40	
	1.70	187.00	86.25	.24	76.20	
	1.70	246.00	86.30	.31	76.20	
	1.70	253.00	86.71	.29	76.20	
	1.70	295.00	86.96	.32	76.20	
	1.70	335.00	87.19	.34	76.20	
	1.70	387.00	87.46	.37	76.20	
	1.70	425.00	87.67	.39	76.20	
	2.01	183.00	86.26	.20	77.88	
	2.01	241.00	86.31	.26	77.88	

2.01	247.00	86.71	.24	77.88
2.01	289.00	86.97	.26	77.88
2.01	328.00	87.19	.28	77.88
2.01	379.00	87.47	.31	77.88
2.01	416.00	87.67	.33	77.88
2.32	183.00	86.26	.22	77.57
2.32	241.00	86.31	.29	77.57
2.32	247.00	86.71	.27	77.57
2.32	289.00	86.97	.30	77.57
2.32	328.00	87.19	.33	77.57
2.32	379.00	87.47	.36	77.57
2.32	416.00	87.67	.38	77.57
2.61	183.00	86.26	.21	76.66
2.61	241.00	86.31	.28	76.66
2.61	247.00	86.71	.26	76.66
2.61	289.00	86.97	.29	76.66
2.61	328.00	87.19	.31	76.66
2.61	379.00	87.47	.35	76.66
2.61	416.00	87.68	.37	76.66
2.86	179.00	86.26	.23	77.57
2.86	236.00	86.31	.30	77.57
2.86	242.00	86.72	.28	77.57
2.86	283.00	86.97	.31	77.57
2.86	321.00	87.20	.34	77.57
2.86	370.00	87.47	.37	77.57
2.86	407.00	87.68	.39	77.57
3.26	179.00	86.26	.21	76.05
3.26	236.00	86.31	.27	76.05
3.26	242.00	86.72	.26	76.05
3.26	283.00	86.97	.29	76.05
3.26	321.00	87.20	.31	76.05
3.26	370.00	87.47	.34	76.05
3.26	407.00	87.68	.36	76.05
3.53	179.00	86.26	.24	78.49
3.53	236.00	86.31	.31	78.49
3.53	242.00	86.72	.29	78.49
3.53	283.00	86.97	.32	78.49
3.53	321.00	87.20	.35	78.49
3.53	370.00	87.48	.39	78.49
3.53	407.00	87.68	.41	78.49
*	3.78	179.00	86.26	.17	76.05
*	3.78	236.00	86.32	.23	76.05
*	3.78	242.00	86.72	.21	76.05
*	3.78	283.00	86.98	.24	76.05
*	3.78	321.00	87.20	.26	76.05
3.78	370.00	87.48	.29	76.05
3.78	407.00	87.69	.30	76.05
4.03	179.00	86.26	.18	76.66
4.03	236.00	86.32	.24	76.66
4.03	242.00	86.72	.22	76.66
4.03	283.00	86.98	.24	76.66
4.03	321.00	87.20	.26	76.66
4.03	370.00	87.48	.28	76.66
4.03	407.00	87.69	.29	76.66
4.32	179.00	86.26	.18	76.97
4.32	236.00	86.32	.24	76.97
4.32	242.00	86.72	.22	76.97
4.32	283.00	86.98	.24	76.97
4.32	321.00	87.21	.25	76.97
4.32	370.00	87.48	.27	76.97
4.32	407.00	87.69	.29	76.97
4.51	179.00	86.26	.23	75.75
4.51	236.00	86.32	.30	75.75
4.51	242.00	86.72	.28	75.75

	4.51	283.00	86.98	.32	75.75
	4.51	321.00	87.20	.34	75.75
	4.51	370.00	87.48	.37	75.75
	4.51	407.00	87.69	.40	75.75
	4.66	179.00	86.26	.16	76.97
*	4.66	236.00	86.32	.20	76.97
*	4.66	242.00	86.73	.19	76.97
*	4.66	283.00	86.98	.21	76.97
*	4.66	321.00	87.21	.22	76.97
*	4.66	370.00	87.49	.24	76.97
*	4.66	407.00	87.70	.26	76.97
*	5.07	179.00	86.27	.18	76.51
*	5.07	236.00	86.32	.23	76.51
*	5.07	242.00	86.73	.21	76.51
*	5.07	283.00	86.98	.23	76.51
*	5.07	321.00	87.21	.25	76.51
*	5.07	370.00	87.49	.26	76.51
*	5.07	407.00	87.70	.28	76.51
	5.53	179.00	86.27	.14	76.66
	5.53	236.00	86.33	.19	76.66
	5.53	242.00	86.73	.16	76.66
	5.53	283.00	86.99	.17	76.66
	5.53	321.00	87.22	.18	76.66
	5.53	370.00	87.49	.20	76.66
	5.53	407.00	87.70	.20	76.66
*	5.86	179.00	86.27	.13	76.20
*	5.86	236.00	86.33	.17	76.20
*	5.86	242.00	86.73	.15	76.20
*	5.86	283.00	86.99	.16	76.20
*	5.86	321.00	87.22	.18	76.20
	5.86	370.00	87.50	.19	76.20
	5.86	407.00	87.70	.20	76.20
	6.30	179.00	86.27	.13	77.60
	6.30	236.00	86.33	.17	77.60
	6.30	242.00	86.73	.15	77.60
	6.30	283.00	86.99	.16	77.60
	6.30	321.00	87.22	.17	77.60
	6.30	370.00	87.50	.19	77.60
	6.30	407.00	87.70	.19	77.60
	6.76	175.00	86.27	.13	76.10
	6.76	231.00	86.33	.17	76.10
	6.76	237.00	86.73	.15	76.10
	6.76	277.00	86.99	.17	76.10
	6.76	314.00	87.22	.18	76.10
	6.76	362.00	87.50	.19	76.10
	6.76	398.00	87.70	.20	76.10
	7.11	175.00	86.27	.14	74.83
	7.11	231.00	86.33	.18	74.83
	7.11	237.00	86.73	.17	74.83
	7.11	277.00	86.99	.18	74.83
	7.11	314.00	87.22	.20	74.83
	7.11	362.00	87.50	.22	74.83
	7.11	398.00	87.71	.23	74.83
	8.40	175.00	86.27	.13	75.44
	8.40	231.00	86.33	.16	75.44
	8.40	237.00	86.74	.15	75.44
	8.40	277.00	86.99	.17	75.44
	8.40	314.00	87.22	.18	75.44
	8.40	362.00	87.50	.20	75.44
	8.40	398.00	87.71	.21	75.44
	8.64	175.00	86.27	.12	78.18
	8.64	231.00	86.34	.15	78.18
	8.64	237.00	86.74	.15	78.18
	8.64	277.00	86.99	.16	78.18

	8.64	314.00	87.22	.17	78.18
	8.64	362.00	87.50	.19	78.18
	8.64	398.00	87.71	.20	78.18
*	9.01	175.00	86.27	.16	78.79
*	9.01	231.00	86.34	.21	78.79
*	9.01	237.00	86.74	.20	78.79
*	9.01	277.00	86.99	.22	78.79
*	9.01	314.00	87.22	.23	78.79
	9.01	362.00	87.50	.25	78.79
	9.01	398.00	87.71	.27	78.79
	9.34	175.00	86.27	.11	79.10
	9.34	231.00	86.34	.14	79.10
	9.34	237.00	86.74	.13	79.10
	9.34	277.00	87.00	.14	79.10
*	9.34	314.00	87.22	.15	79.10
*	9.34	362.00	87.51	.16	79.10
*	9.34	398.00	87.71	.17	79.10
	9.76	175.00	86.27	.13	78.18
	9.76	231.00	86.34	.17	78.18
	9.76	237.00	86.74	.15	78.18
	9.76	277.00	87.00	.17	78.18
	9.76	314.00	87.23	.18	78.18
	9.76	362.00	87.51	.20	78.18
	9.76	398.00	87.71	.21	78.18
	10.06	175.00	86.28	.15	77.60
	10.06	231.00	86.34	.19	77.60
	10.06	237.00	86.74	.18	77.60
	10.06	277.00	87.00	.20	77.60
	10.06	314.00	87.23	.21	77.60
	10.06	362.00	87.51	.23	77.60
	10.06	398.00	87.71	.25	77.60
	10.15	175.00	86.27	.18	77.26
	10.15	231.00	86.34	.23	77.26
	10.15	237.00	86.74	.21	77.26
	10.15	277.00	87.00	.24	77.26
	10.15	314.00	87.23	.25	77.26
	10.15	362.00	87.51	.28	77.26
	10.15	398.00	87.71	.29	77.26
*	10.23	171.00	86.28	.09	78.79
*	10.23	225.00	86.34	.12	78.79
*	10.23	231.00	86.74	.11	78.79
*	10.23	271.00	87.00	.12	78.79
*	10.23	307.00	87.23	.13	78.79
*	10.23	354.00	87.51	.15	78.79
*	10.23	389.00	87.72	.16	78.79
*	10.52	171.00	86.28	.13	78.79
*	10.52	225.00	86.34	.17	78.79
*	10.52	231.00	86.74	.15	78.79
*	10.52	271.00	87.00	.16	78.79
*	10.52	307.00	87.23	.17	78.79
*	10.52	354.00	87.51	.19	78.79
*	10.52	389.00	87.72	.20	78.79
	10.89	171.00	86.28	.11	77.88
	10.89	225.00	86.34	.15	77.88
	10.89	231.00	86.74	.13	77.88
	10.89	271.00	87.00	.15	77.88
	10.89	307.00	87.23	.16	77.88
	10.89	354.00	87.51	.17	77.88
	10.89	389.00	87.72	.18	77.88
	11.06	171.00	86.28	.12	77.88
	11.06	225.00	86.34	.15	77.88
	11.06	231.00	86.74	.14	77.88
	11.06	271.00	87.00	.15	77.88
	11.06	307.00	87.23	.16	77.88

11.06	354.00	87.51	.17	77.88
11.06	389.00	87.72	.18	77.88
11.31	171.00	86.28	.10	79.40
11.31	225.00	86.34	.12	79.40
11.31	231.00	86.74	.11	79.40
11.31	271.00	87.00	.12	79.40
11.31	307.00	87.23	.13	79.40
11.31	354.00	87.51	.14	79.40
11.31	389.00	87.72	.15	79.40
11.66	171.00	86.28	.10	80.93
11.66	225.00	86.34	.13	80.93
11.66	231.00	86.74	.12	80.93
11.66	271.00	87.00	.13	80.93
11.66	307.00	87.23	.14	80.93
11.66	354.00	87.51	.15	80.93
11.66	389.00	87.72	.15	80.93
11.90	171.00	86.28	.10	81.24
11.90	225.00	86.34	.13	81.24
11.90	231.00	86.74	.11	81.24
11.90	271.00	87.00	.12	81.24
11.90	307.00	87.23	.13	81.24
11.90	354.00	87.51	.14	81.24
11.90	389.00	87.72	.15	81.24
12.21	171.00	86.28—	.10	81.24
12.21	225.00	86.34—	.13	81.24
12.21	231.00	86.74	.12	81.24
12.21	271.00	87.00	.13	81.24
12.21	307.00	87.23	.14	81.24
12.21	354.00	87.51	.15	81.24
12.21	389.00	87.72	.15	81.24
12.66	171.00	86.28	.10	80.01
12.66	225.00	86.35	.13	80.01
12.66	231.00	86.74	.12	80.01
12.66	271.00	87.00	.13	80.01
12.66	307.00	87.23	.14	80.01
12.66	354.00	87.51	.15	80.01
12.66	389.00	87.72	.15	80.01

Hilly Lane (handwritten annotation beside the 12.21 block)

*	13.15	167.00	86.28	.14	82.45
*	13.15	220.00	86.35	.18	82.45
*	13.15	226.00	86.74	.15	82.45
*	13.15	264.00	87.00	.16	82.45
*	13.15	300.00	87.23	.17	82.45
*	13.15	346.00	87.51	.18	82.45
*	13.15	380.00	87.72	.18	82.45
*	13.64	167.00	86.28	.09	80.62
*	13.64	220.00	86.35	.12	80.62
*	13.64	226.00	86.75	.10	80.62
*	13.64	264.00	87.01	.11	80.62
*	13.64	300.00	87.23	.12	80.62
*	13.64	346.00	87.52	.12	80.62
*	13.64	380.00	87.72	.13	80.62
	14.05	130.00	86.28	.09	80.62
	14.05	171.00	86.35	.11	80.62
	14.05	176.00	86.75	.10	80.62
	14.05	205.00	87.01	.11	80.62
	14.05	233.00	87.24	.11	80.62
	14.05	269.00	87.52	.12	80.62
	14.05	295.00	87.72	.13	80.62
	14.59	130.00	86.28	.10	79.40
	14.59	171.00	86.35	.12	79.40
	14.59	176.00	86.75	.11	79.40
	14.59	205.00	87.01	.12	79.40
	14.59	233.00	87.24	.12	79.40
	14.59	269.00	87.52	.13	79.40

	14.59	295.00	87.73	.14	79.40
*	14.99	130.00	86.28	.14	80.32
*	14.99	171.00	86.35	.18	80.32
*	14.99	176.00	86.75	.15	80.32
*	14.99	205.00	87.01	.16	80.32
*	14.99	233.00	87.24	.17	80.32
*	14.99	269.00	87.52	.18	80.32
*	14.99	295.00	87.73	.18	80.32
*	15.30	130.00	86.28	.13	80.01
*	15.30	171.00	86.35	.16	80.01
	15.30	176.00	86.75	.14	80.01
	15.30	205.00	87.01	.15	80.01
	15.30	233.00	87.24	.16	80.01
	15.30	269.00	87.52	.17	80.01
	15.30	295.00	87.73	.18	80.01
	15.36	130.00	86.28	.21	79.40
	15.36	171.00	86.35	.28	79.40
	15.36	176.00	86.75	.26	79.40
	15.36	205.00	87.01	.29	79.40
	15.36	233.00	87.24	.32	79.40
	15.36	269.00	87.52	.35	79.40
	15.36	295.00	87.72	.38	79.40
	15.43	130.00	86.29	.12	80.01
	15.43	171.00	86.36	.15	80.01
	15.43	176.00	86.75	.14	80.01
	15.43	205.00	87.01	.15	80.01
	15.43	233.00	87.24	.16	80.01
	15.43	269.00	87.52	.17	80.01
	15.43	295.00	87.73	.17	80.01
	15.76	130.00	86.29	.18	80.31
	15.76	171.00	86.36	.23	80.31
	15.76	176.00	86.75	.22	80.31
	15.76	205.00	87.01	.24	80.31
	15.76	233.00	87.24	.25	80.31
	15.76	269.00	87.52	.28	80.31
	15.76	295.00	87.73	.29	80.31
*	15.85	130.00	86.28	.24	80.92
*	15.85	171.00	86.35	.31	80.92
*	15.85	176.00	86.75	.28	80.92
*	15.85	205.00	87.01	.29	80.92
*	15.85	233.00	87.24	.31	80.92
*	15.85	269.00	87.52	.33	80.92
	15.85	295.00	87.73	.34	80.92
*	16.48	126.00	86.29	.15	79.71
*	16.48	167.00	86.36	.20	79.71
*	16.48	170.00	86.76	.18	79.71
	16.48	199.00	87.02	.19	79.71
	16.48	226.00	87.25	.20	79.71
	16.48	260.00	87.53	.21	79.71
	16.48	286.00	87.74	.22	79.71
	16.83	126.00	86.29	.15	78.79
	16.83	167.00	86.36	.20	78.79
	16.83	170.00	86.76	.17	78.79
	16.83	199.00	87.02	.19	78.79
	16.83	226.00	87.25	.20	78.79
	16.83	260.00	87.53	.21	78.79
	16.83	286.00	87.74	.22	78.79
	17.25	126.00	86.29	.14	79.71
	17.25	167.00	86.37	.18	79.71
	17.25	170.00	86.76	.16	79.71
	17.25	199.00	87.02	.17	79.71
	17.25	226.00	87.25	.19	79.71
	17.25	260.00	87.53	.20	79.71
	17.25	286.00	87.74	.20	79.71

*	17.60	126.00	86.29	.17	78.79
*	17.60	167.00	86.37	.22	78.79
*	17.60	170.00	86.76	.20	78.79
*	17.60	199.00	87.02	.22	78.79
*	17.60	226.00	87.25	.23	78.79
*	17.60	260.00	87.53	.25	78.79
*	17.60	286.00	87.74	.26	78.79
	18.15	126.00	86.29	.14	81.23
	18.15	167.00	86.37	.18	81.23
	18.15	170.00	86.76	.16	81.23
	18.15	199.00	87.02	.17	81.23
	18.15	226.00	87.25	.18	81.23
	18.15	260.00	87.54	.19	81.23
	18.15	286.00	87.74	.20	81.23
*	18.43	126.00	86.29	.14	80.32
*	18.43	167.00	86.37	.19	80.32
*	18.43	170.00	86.76	.16	80.32
*	18.43	199.00	87.02	.17	80.32
*	18.43	226.00	87.25	.18	80.32
*	18.43	260.00	87.54	.20	80.32
*	18.43	286.00	87.74	.20	80.32
	18.72	126.00	86.29	.14	79.40
	18.72	167.00	86.37	.18	79.40
	18.72	170.00	86.76	.16	79.40
	18.72	199.00	87.02	.18	79.40
	18.72	226.00	87.25	.19	79.40
	18.72	260.00	87.54	.20	79.40
	18.72	286.00	87.75	.21	79.40
	19.09	124.00	86.29	.18	81.23
	19.09	163.00	86.37	.23	81.23
	19.09	168.00	86.76	.21	81.23
	19.09	196.00	87.02	.22	81.23
	19.09	222.00	87.25	.24	81.23
	19.09	256.00	87.54	.25	81.23
	19.09	282.00	87.75	.27	81.23
*	20.19	124.00	86.30	.19	80.62
*	20.19	163.00	86.37	.24	80.62
*	20.19	168.00	86.76	.22	80.62
*	20.19	196.00	87.03	.24	80.62
*	20.19	222.00	87.26	.26	80.62
*	20.19	256.00	87.54	.28	80.62
*	20.19	282.00	87.75	.29	80.62
*	21.40	124.00	86.30	.25	83.06
*	21.40	163.00	86.37	.32	83.06
*	21.40	168.00	86.76	.28	83.06
*	21.40	196.00	87.03	.30	83.06
*	21.40	222.00	87.26	.31	83.06
*	21.40	256.00	87.54	.33	83.06
*	21.40	282.00	87.75	.34	83.06
	21.55	124.00	86.30	.33	80.62
	21.55	163.00	86.37	.42	80.62
	21.55	168.00	86.76	.37	80.62
	21.55	196.00	87.03	.40	80.62
	21.55	222.00	87.26	.43	80.62
	21.55	256.00	87.54	.45	80.62
	21.55	282.00	87.75	.47	80.62
	21.86	120.00	86.30	.15	80.93
	21.86	158.00	86.38	.19	80.93
	21.86	162.00	86.77	.17	80.93
	21.86	190.00	87.03	.18	80.93
*	21.86	215.00	87.27	.18	80.93
*	21.86	248.00	87.55	.19	80.93
*	21.86	273.00	87.76	.20	80.93

*	21.94	120.00	86.30	.51	80.01
*	21.94	158.00	86.38	.65	80.01
*	21.94	162.00	86.77	.58	80.01
*	21.94	190.00	87.03	.61	80.01
*	21.94	215.00	87.26	.64	80.01
*	21.94	248.00	87.55	.68	80.01
*	21.94	273.00	87.76	.70	80.01
	22.43	120.00	86.30	.47	81.53
	22.43	158.00	86.38	.61	81.53
	22.43	162.00	86.77	.55	81.53
	22.43	190.00	87.03	.60	81.53
	22.43	215.00	87.26	.64	81.53
	22.43	248.00	87.54	.68	81.53
	22.43	273.00	87.75	.71	81.53
*	22.82	120.00	86.31	.32	82.14
*	22.82	158.00	86.40	.40	82.14
*	22.82	162.00	86.78	.34	82.14
*	22.82	190.00	87.05	.35	82.14.
*	22.82	215.00	87.28	.36	82.14
	22.82	248.00	87.57	.38	82.14
	22.82	273.00	87.78	.39	82.14
*	22.94	120.00	86.31	.26	81.54
*	22.94	158.00	86.40	.33	81.54
*	22.94	162.00	86.78	.29	81.54
*	22.94	190.00	87.05	.31	81.54
*	22.94	215.00	87.28	.33	81.54
*	22.94	248.00	87.57	.35	81.54
*	22.94	273.00	87.78	.36	81.54
	23.19	120.00	86.31	.24	81.84
	23.19	158.00	86.40	.30	81.84
	23.19	162.00	86.79	.27	81.84
	23.19	190.00	87.05	.28	81.84
	23.19	215.00	87.28	.30	81.84
	23.19	248.00	87.57	.31	81.84
	23.19	273.00	87.78	.32	81.84
	23.42	120.00	86.32	.20	78.79
	23.42	158.00	86.41	.25	78.79
	23.42	162.00	86.79	.22	78.79
	23.42	190.00	87.05	.24	78.79
	23.42	215.00	87.29	.25	78.79
	23.42	248.00	87.57	.26	78.79
	23.42	273.00	87.78	.27	78.79
*	23.67	120.00	86.32	.29	81.23
*	23.67	158.00	86.40	.36	81.23
*	23.67	162.00	86.79	.31	81.23
	23.67	190.00	87.05	.32	81.23
	23.67	215.00	87.29	.34	81.23
	23.67	248.00	87.57	.35	81.23
	23.67	273.00	87.78	.36	81.23
*	24.11	116.00	86.32	.19	80.62
*	24.11	153.00	86.41	.23	80.62
*	24.11	157.00	86.79	.20	80.62
*	24.11	183.00	87.06	.21	80.62
*	24.11	208.00	87.29	.21	80.62
*	24.11	240.00	87.58	.22	80.62
*	24.11	264.00	87.79	.23	.80.62
*	24.57	116.00	86.32	.33	81.84
*	24.57	153.00	86.41	.42	81.84
*	24.57	157.00	86.79	.38	81.84
*	24.57	183.00	87.06	.40	81.84
*	24.57	208.00	87.29	.43	81.84
*	24.57	240.00	87.58	.45	81.84
*	24.57	264.00	87.79	.47	81.84
*	25.03	116.00	86.32	.34	81.53

*	25.03	153.00	86.42	.43	81.53
*	25.03	157.00	86.80	.40	81.53
*	25.03	183.00	87.06	.44	81.53
*	25.03	208.00	87.29	.47	81.53
*	25.03	240.00	87.58	.51	81.53
*	25.03	264.00	87.79	.54	81.53
*	25.35	116.00	86.33	.40	82.14
*	25.35	153.00	86.42	.51	82.14
	25.35	157.00	86.80	.46	82.14
	25.35	183.00	87.06	.49	82.14
	25.35	208.00	87.30	.52	82.14
	25.35	240.00	87.58	.55	82.14
	25.35	264.00	87.80	.58	82.14
*	25.80	116.00	86.33	.71	81.84
*	25.80	153.00	86.43	.89	81.84
*	25.80	157.00	86.80	.78	81.84
*	25.80	183.00	87.07	.82	81.84
*	25.80	208.00	87.30	.86	81.84
*	25.80	240.00	87.59	.90	81.84
*	25.80	264.00	87.80	.92	81.84
*	26.28	116.00	86.37	.49	83.06
*	26.28	153.00	86.49	.61	83.06
*	26.28	157.00	86.85	.54	83.06
*	26.28	183.00	87.11	.57	83.06
*	26.28	208.00	87.35	.60	83.06
*	26.28	240.00	87.63	.63	83.06
*	26.28	264.00	87.84	.65	83.06
	26.53	116.00	86.38	.47	83.36
	26.53	153.00	86.51	.58	83.36
	26.53	157.00	86.86	.52	83.36
	26.53	183.00	87.12	.55	83.36
	26.53	208.00	87.36	.58	83.36
	26.53	240.00	87.64	.61	83.36
	26.53	264.00	87.85	.63	83.36
	26.88	116.00	86.39	.48	83.06
	26.88	153.00	86.52	.60	83.06
	26.88	157.00	86.87	.54	83.06
	26.88	183.00	87.13	.57	83.06
	26.88	208.00	87.36	.61	83.06
	26.88	240.00	87.65	.64	83.06
	26.88	264.00	87.86	.67	83.06
	27.16	112.00	86.40	.48	83.36
	27.16	148.00	86.53	.60	83.36
	27.16	152.00	86.87	.54	83.36
	27.16	177.00	87.14	.57	83.36
	27.16	201.00	87.37	.60	83.36
	27.16	232.00	87.66	.64	83.36
	27.16	255.00	87.87	.66	83.36
	27.47	112.00	86.41	.45	83.36
	27.47	148.00	86.55	.57	83.36
	27.47	152.00	86.88	.52	83.36
	27.47	177.00	87.15	.55	83.36
	27.47	201.00	87.38	.58	83.36
	27.47	232.00	87.67	.62	83.36
	27.47	255.00	87.88	.64	83.36
	27.80	112.00	86.42	.65	83.36
	27.80	148.00	86.56	.82	83.36
	27.80	152.00	86.89	.75	83.36
	27.80	177.00	87.15	.81	83.36
	27.80	201.00	87.39	.85	83.36
	27.80	232.00	87.67	.91	83.36
*	27.80	255.00	87.88	.94	83.36
	28.08	112.00	86.44	.59	83.67
	28.08	148.00	86.59	.72	83.67

		28.08	152.00	86.91	.64	83.67
		28.08	177.00	87.18	.68	83.67
		28.08	201.00	87.41	.70	83.67
		28.08	232.00	87.70	.74	83.67
		28.08	255.00	87.92	.76	83.67
	*	28.41	112.00	86.45	.76	83.97
		28.41	148.00	86.61	.93	83.97
		28.41	152.00	86.93	.82	83.97
		28.41	177.00	87.19	.85	83.97
		28.41	201.00	87.43	.88	83.97
		28.41	232.00	87.72	.91	83.97
		28.41	255.00	87.93	.93	83.97
		28.45	112.00	86.46	.79	83.97
		28.45	148.00	86.61	.98	83.97
		28.45	152.00	86.93	.89	83.97
		28.45	177.00	87.19	.95	83.97
		28.45	201.00	87.43	1.00	83.97
		28.45	232.00	87.71	1.07	83.97
		28.45	255.00	87.92	1.11	83.97
	*	28.48	112.00	86.48	.52	83.52
	*	28.48	148.00	86.65	.65	83.52
	*	28.48	152.00	86.96	.60	83.52
	*	28.48	177.00	87.23	.64	83.52
	*	28.48	201.00	87.47	.67	83.52
	*	28.48	232.00	87.76	.71	83.52
	*	28.48	255.00	87.97	.74	83.52
800m	*	29.27	112.00	86.52	.72	83.06
	*	29.27	148.00	86.70	.85	83.06
	*	29.27	152.00	87.00	.75	83.06
	*	29.27	177.00	87.26	.76	83.06
	*	29.27	201.00	87.50	.78	83.06
	*	29.27	232.00	87.79	.79	83.06
		29.27	255.00	88.01	.80	83.06
140 M	*	29.41	112.00	86.55	.34	83.06
	*	29.41	148.00	86.74	.42	83.06
	*	29.41	152.00	87.03	.40	83.06
	*	29.41	177.00	87.29	.43	83.06
	*	29.41	201.00	87.53	.46	83.06
	*	29.41	232.00	87.82	.50	83.06
	*	29.41	255.00	88.03	.52	83.06