WINNIPEG RIVER WATER LEVEL SURVEY

1978

R. Solvason

B. Tinney

LIST OF PERSONNEL

R. SOLVASON	TIDAL TECHNICIAN	MAY 10 TO 20
B. TINNEY	TIDAL OFFICER	MAY 10 TO 20
D. ROBERTSON *	SEAMAN	May 11,12,13,15,16, 18
P. HARRISON *	STUDENT ASSISTANT	MAY 17

*available from Winnipeg River Survey

OBJECTIVES:

The 1978 Winnipeg River Water Level Survey was a continuation of a project started in 1977. The primary objective of the survey was to establish chart and sounding datum for the stretch of river from the Whitedog Falls generating station downstream to the Ontario-Manitoba border. A further requirement was to confirm the values of datum and the various datum zones established in the previous year from Kenora downstream to the Whitedog Falls generating station.

PREPARATION:

Prior to the actual field survey work, all water level information for the stretch of river under examination was collected. Both Ontario Hydro and Water Survey of Canada were extremely helpful in making their water level information available to us.

The information made available to us from Ontario Hydro included:

(1) Minaki (Gun Lake) daily mean levels 1958-1977
(2) Whitedog Falls (Headwater & Tailwater) daily mean levels 1958-1977
(3) Caribou Falls (Tailwater) daily mean levels 1958-1977.

Water Survey of Canada provided information from

(1) Kenora Dam (Tailwater) daily mean levels 1959-1976
(2) Norman Dam (Tailwater) daily mean levels 1959-1976.

Only historical water level data since the fall of 1958 was used as this marked the time the river became controlled by the Whitedog Falls dam.

All of the water level information was stored on magnetic tape for further processing. Computer programs were written to read in the data and calculate the all time mean water level, all the hydrograph information and finally do a frequency distribution analysis on the water levels.

Using these computations, it was possible to select an appropriate preliminary datum for each of the gauge locations.

Following this preliminary work, it was necessary to conduct a field survey of the area to determine the changes in water level between these gauges, where each drop occurs and the size of the drop.

SURVEY RESULTS: KENORA TO WHITEDOG GENERATING STATION

The field survey operations began on May 10th, upon arrival at Minaki, the location of the hydrographic survey camp.

Since sounding operations had already begun, our first task was to establish a water level gauge and staff at the base camp. This gauge, which was established below the CNR bridge at Minaki, would supply water level reductions to the survey party. The zeros of the gauge and staff were set to sounding datum of 316.1 metres (G.S.C.) by levelling from B.M. CNRY 944 (20) located on the railway bridge. At the same time two additional benchmarks were established adjacent to the gauge site.

A reconnaissance of the river from Minaki to the Dalles and through the West Arm was made to check for any evidence of swift water overlooked during last year's survey. The 1977 survey encountered a record low water level on the river. Water levels in 1978 were at a more normal level, therefore differences were anticipated. At this time benchmarks were established below the Dalles, above and below Myrtle Rapids and above and below Throat Rapids. These benchmarks would be used to determine the drop through each constriction and also allow a means of relating water levels measured in future years. Only assumed heights were given to these benchmarks as level circuits from Geodetic benchmarks were not possible.

This year water levels in the upper stretches of the river are approximately 0.3 metres to 0.5 metres above the levels of last year. Consequently there was a noticeable current and drop visible at both Myrtle and Throat Rapids in the West Arm. The current through the Dalles was quite swift.

Water levels were read at the Kenora Dam tailwater, the staff at Millers Rapids and above the Dalles (from B.M. 26K G.S.C.).

These levels allowed an evaluation to be made of the previously established datums in the upper stretch of the river.

Level lines were not run along the Dalles from B.M. 26K (G.S.C.) to the newly established B.M. below the Dalles. The terrain in the area makes this task extremely difficult and beyond the scope of this survey.

Level circuits were run between the benchmarks established at Myrtle Rapids and water levels heights were obtained above and below the rapids. The same procedure was followed at Throat Rapids.

Working downstream from Minaki, benchmark 27-K (G.S.C.) on Wild Edge Island in Sand Lake was recovered and water level elevations were taken. The cap of the benchmark was missing but the shank remained and was accurate enough for determining water levels.

From Sand Lake to Roughrock Lake there didn't appear to be any stretches of swift water. It was hoped a benchmark near the outlet of Roughrock Lake could be recovered so the levels of Roughrock and Sand Lakes could be compared but the B. M. appears to have been destroyed.

At the outlet of Roughrock Lake, there is a noticeable constriction (See Plate 4). The complete constriction comprises a fairly large area and is made up of numerous rocks and islands blocking the channel.

An Ontario Hydro benchmark (Bolt.) located just below the above mentioned constriction was recovered and a level line from that B. M. to the water surface was made. This gave an elevation for the upstream end of the Whitedog generating station forebay, which was compared with the elevation of the headwater at the dam.

The following is a summary of the water levels measured along the river from Kenora to the Whitedog generating station. Also listed are the measured drops at Myrtle Rapids and at Throat Rapids.

LOCATION	DATE	WATER LEVEL	MEASURED DROP
BELOW KENORA DAM	15/5/78	316.76 m G.S.C.	
AT MILLERS RAPIDS	15/5/78	316.57 m G.S.C.	
ABOVE THE DALLES	18/5/78	316.42 m G.S.C.	
MYRTLE RAPIDS	17/5/78		0.043 m
THROAT RAPIDS	17/5/78		0.163 m
GUN LAKE	12/5/78	316.25 m G.S.C.	
BELOW MINAKI BRIDGE	12/5/78	316.20 m G.S.C.	
AT WILD EDGE IS.	12/5/78	316.20 m G.S.C.	
AT B. M. BOLT. (WHITE DOG FOREBAY)	18/5/78	315.99 m G.S.C.	
WHITEDOG HEADWATER	18/5/78	316.00 m G.S.C.	

CHART DATUM AND HIGH WATER LIMIT SELECTION

Based on the foregoing information the values selected for chart datum in the previous year were confirmed. These values are:

Zone 1 From Kenora to Throat Rapids and the Dalles.
316.5 metres (G.S.C.) High Water Limit 2.0 metres.

Zone 2 From Throat Rapids and the Dalles to the constriction just below the outlet of Roughrock Lake.
316.1 metres (G.S.C.) High Water Limit 1.0 metres.

Zone 3 From the constriction just below the outlet of Roughrock Lake to Whitedog Generating Station.
314.9 metres (G.S.C.) High Water Limit 1.2 metres.

See plates 1, 2, 3 and 4 for the areas covered by each zone.

Note: Datum for Zone 1 is based on 4.56% of daily means at Kenora Dam, for Zone 2 datum is based on 5.04% of daily means at Minaki (Gun Lake) and for Zone 3 datum is based on 5.56% of daily means at Whitedog Generating Station Headwater.

High Water Limit for Zone 1 is based on 95.13% of daily means at Kenora Dam, for Zone 2 it is based on 95.69% of daily means at Minaki (Gun Lake), and for Zone 3 it is based on 90.20% of daily means at Whitedog Generating Station Headwater.

SURVEY RESULTS: WHITEDOG GENERATING STATION TO ONTARIO-MANITOBA BORDER

The stretch of river from Whitedog generating station downstream to the Ontario-Manitoba border was as yet an unknown area. Our only knowledge of water levels on this stretch of river were from Whitedog Dam tailwater and Caribou Falls tailwater near the outlet of the English River.

Initially it was necessary to make a reconnaissance of the river to determine the nature of the water level gradient. The reconnaissance revealed a number of interesting constrictions requiring further investigation.

The first constriction was located immediately below Whitedog Dam. This constriction is known as lower Whitedog Falls. There is a stretch of swift water approximately 3 km downstream of lower Whitedog Falls. This occurred through an area where the river makes two 180^{o} changes in course, and covers a stretch about 1 km in length. The next area of swift water occurred near the outlet of Tetu Lake about 1.5 km upstream of Boundary Island. At Boundary Island we found two distinct constrictions and resultant waterfalls. The first is located at the north tip of Boundary Island and is called North Boundary Falls. The second is located at the south tip of Boundary Island and has been dubbed South Boundary Falls. Further investigation downstream to the Ontario Manitoba border revealed no other constrictions.

During the reconnaissance, benchmarks were established at the Ontario-Manitoba border, and above and below North and South Boundary Falls. Three benchmarks were later established below lower Whitedog Falls.

A level circuit was run from Ontario-Hydro benchmark #2 on the Whitedog Dam to the three benchmarks below Whitedog Falls. Elevations based on G.S.C. datum were established for these benchmarks and water level elevations were taken below lower Whitedog Falls.

A G.S.C. benchmark (30-K) was recovered just west of the village of Whitedog. Only the shank remains of this benchmark, the

head had been chiseled off. Water level elevations were taken from this benchmark to define the level below the first constriction below lower Whitedog Falls.

Another G.S.C. benchmark (31-K) was recovered opposite the outlet of the English River into Tetu Lake. Water level elevations were taken from this benchmark.

No previously established benchmarks in the vicinity of North or South Boundary Falls were located; therefore, only differential heights could be given for the new benchmarks installed here. Water level heights above and below the two falls were taken and the total drop at each was calculated.

A G.S.C. benchmark at Boundary Monument 82 along the Ontario-Manitoba border was recovered. From this benchmark, elevations were carried to two benchmarks established in the vicinity and water levels were taken at the site. This location along with the site below lower Whitedog Falls are proposed as possible gauging sites to supply water level reductions to the hydrographic survey party.

Listed below is a summary of water levels taken along the river from Whitedog generating station to the Ontario-Manitoba border. Also listed are the measured drops at North and South Boundary Falls.

LOCATION	DATE	WATER LEVEL	MEASURED DROP
WHITEDOG DAM TAILWATER	16/5/78	301.01 m G.S.C.	
BELOW LOWER WHITEDOG FALLS	16/5/78	301.02 m G.S.C.	
FROM B. M. 30-K	16/5/78	300.90 m G.S.C.	
FROM B. M. 31-K	16/5/78	300.88 m G.S.C.	
AT NORTH BOUNDARY FALLS	16/5/78		0.315 m
AT SOUTH BOUNDARY FALLS	16/5/78		0.294 m
AT ONTARIO-MANITOBA BORDER	16/5/78	300.48 m G.S.C.	

CHART DATUM AND HIGH WATER LIMIT SELECTION

Based on these results, the following chart datums are proposed. See Plates 5, 6, 7 and 8 for location of each zone.

(4) From Whitedog generating station tailwater to North and South Boundary Falls, and Caribou Falls 300.0 metres G.S.C. High Water Limit 2.5 metres.

(5) From North and South Boundary Falls to the Ontario Manitoba border 299.7 metres G.S.C.* High Water Limit 2.5 metres.

Note: Datum for Whitedog Generating Station tailwater to North and South Boundary Falls is based on 9.12% daily means at Whitedog Dam tailwater and 8.35% daily means at Caribou Falls tailwater. High Water Limit for Zone 4 is based on 92.16% of daily means at Whitedog Generating Station tailwater and on 96.72% of daily means at Caribou Falls tailwater.

*It should be noted that C.H.S. Chart 6207 shows a value of chart datum at the Ontario-Manitoba border equal to 986.0 ft (300.53 m) G.S.C. This value of chart datum appears to have been selected from the lowest water level recorded during the time of the survey in 1970-1971. The value proposed in this report should be a more realistic value of datum since it is based on a more comprehensive set of data.

SUMMARY OF BENCHMARK ELEVATIONS

BENCHMARK NUMBER	LOCATION	ELEVATION (G.S.C.)	ELEVATION (ASSUMED)
A-1 1978	MINAKI	317.896 m	
A-2 1978	MINAKI	317.404 m	
A-3 1978			
A-4 1978	MYRTLE NARROWS		30.120 m
A-5 1978	MYRTLE NARROWS		30.480 m
A-6 1978	THROAT RAPIDS		32.120 m
A-7 1978	THROAT RAPIDS		30.480 m
A-8 1978	ONTARIO-MANITOBA BORDER	302.873 m	
A-9 1978	ONTARIO-MANITOBA BORDER	301.868 m	
A-10 1978	NORTH BOUNDARY FALLS		30.480 m
A-11 1978	NORTH BOUNDARY FALLS		31.706 m
A-12	SOUTH BOUNDARY FALLS		30.480 m
A-13 1978	SOUTH BOUNDARY FALLS		29.946 m
A-14	LOWER WHITEDOG FALLS	303.257 m	
A-15	LOWER WHITEDOG FALLS	304.257 m	
A-16	LOWER WHITEDOG FALLS	301.943 m	

See Plates 1 to 8 for location of benchmarks.

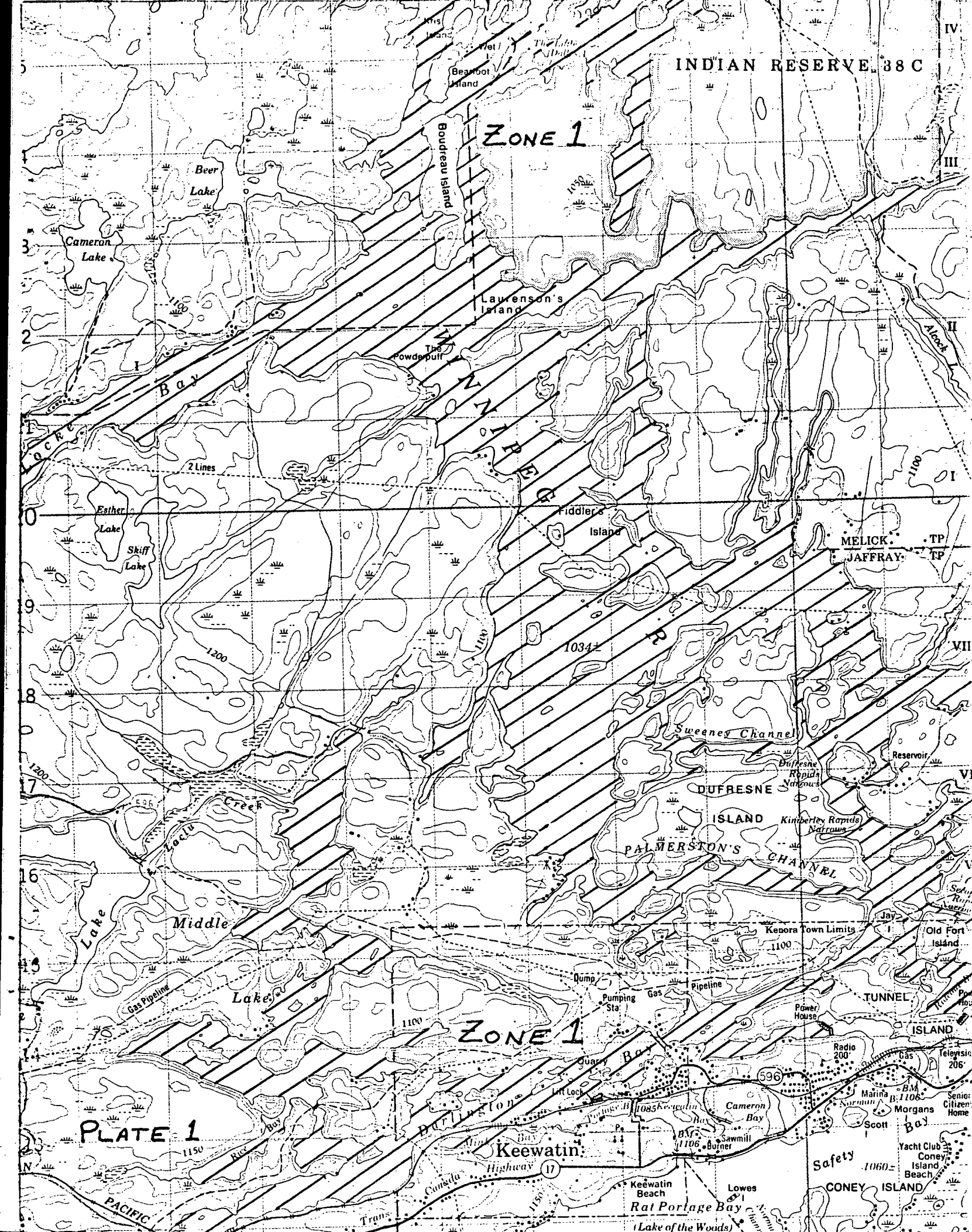
CONCLUSIONS:

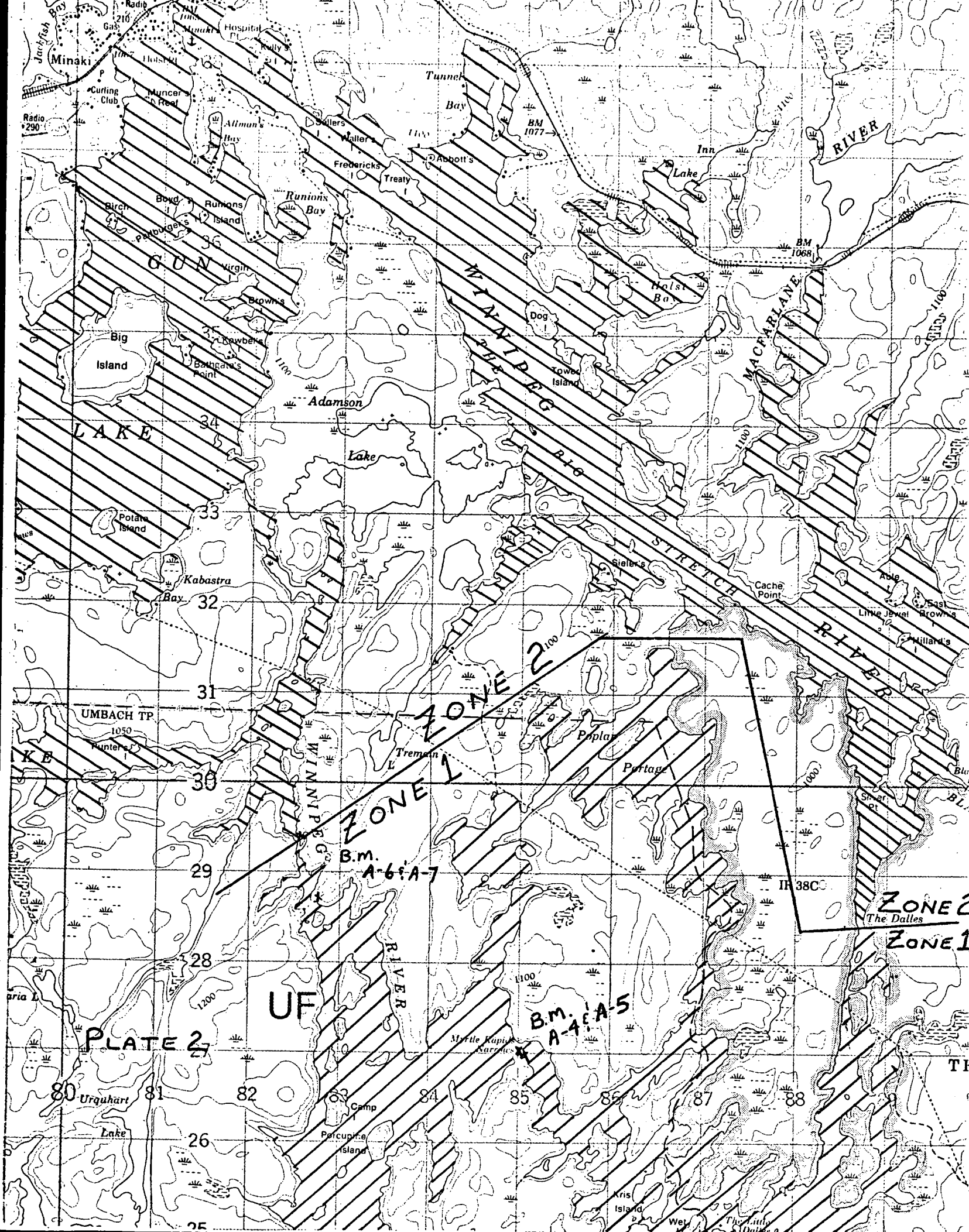
During the 1977 Water Level survey of the Winnipeg River, the water was extremely low and flows recorded at Whitedog Dam were only in the neighbourhood of 2200 c.f.s. It was hoped that 1978 would be a more normal year as water levels were concerned. Upon arrival at the survey area, it was immediately apparent that the water level was indeed higher. Flow rate records received from Ontario Hydro for the period of the 1978 survey show flows between 12000 and 13000 c.f.s., a more normal state for this time of year.

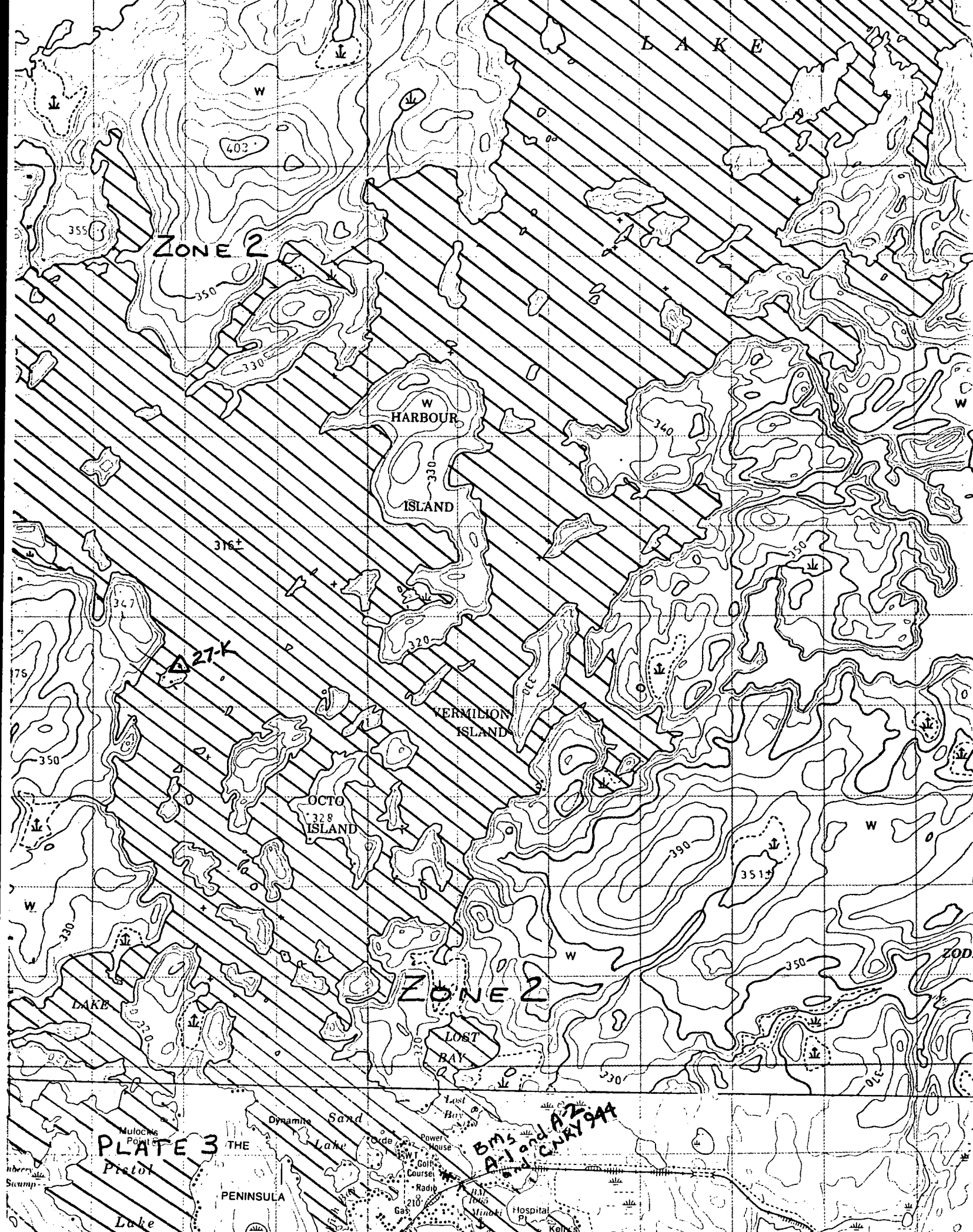
The values presented in this report for Chart Datum and high water limit differ from the values used for sounding datum. Due to a delay between the start of survey operations and the final selection of datum values, the survey party was required to work with preliminary values of datum and high water limit. It is proposed that these differences be changed when the field sheets reach the compilation stage.

Listed below is a comparison between sounding datum and chart datum and also between the High Water Limit used by the survey party and our proposed High Water Limit.

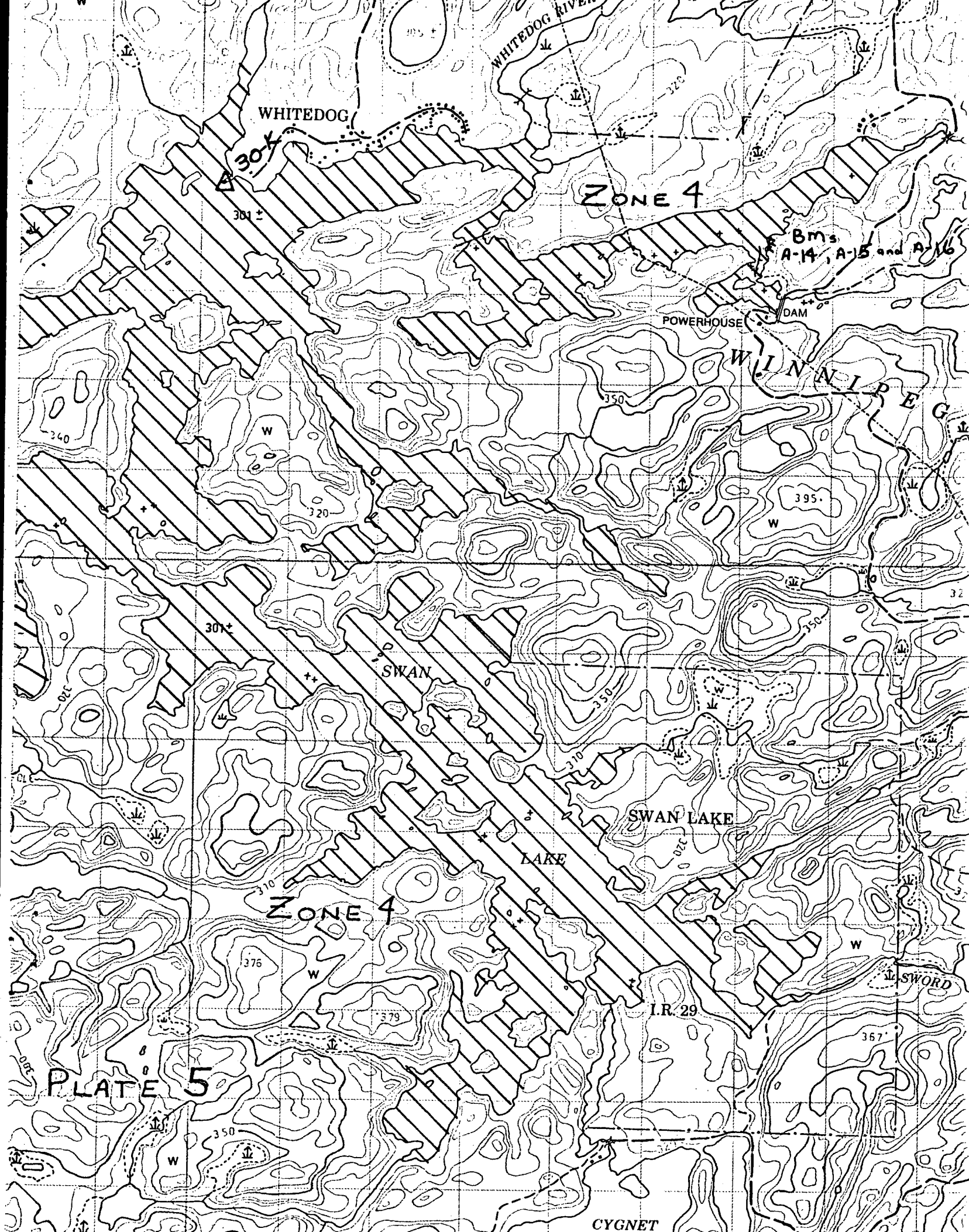
ZONE	SOUNDING DATUM	H.W.L. (SURVEY)	CHART DATUM	H.W.L. (PROPOSED)
1	316.7 m	2.0 m	316.5 m	2.0 m
2	316.1 m	2.0 m	316.1 m	1.0 m
3	314.9 m	2.0 m	314.9 m	1.2 m
4	a 300.2 m b 300.1 m c 300.0 m	2.0 m	300.0 m	2.5 m
5	299.7 m	2.0 m	299.7 m	2.5 m

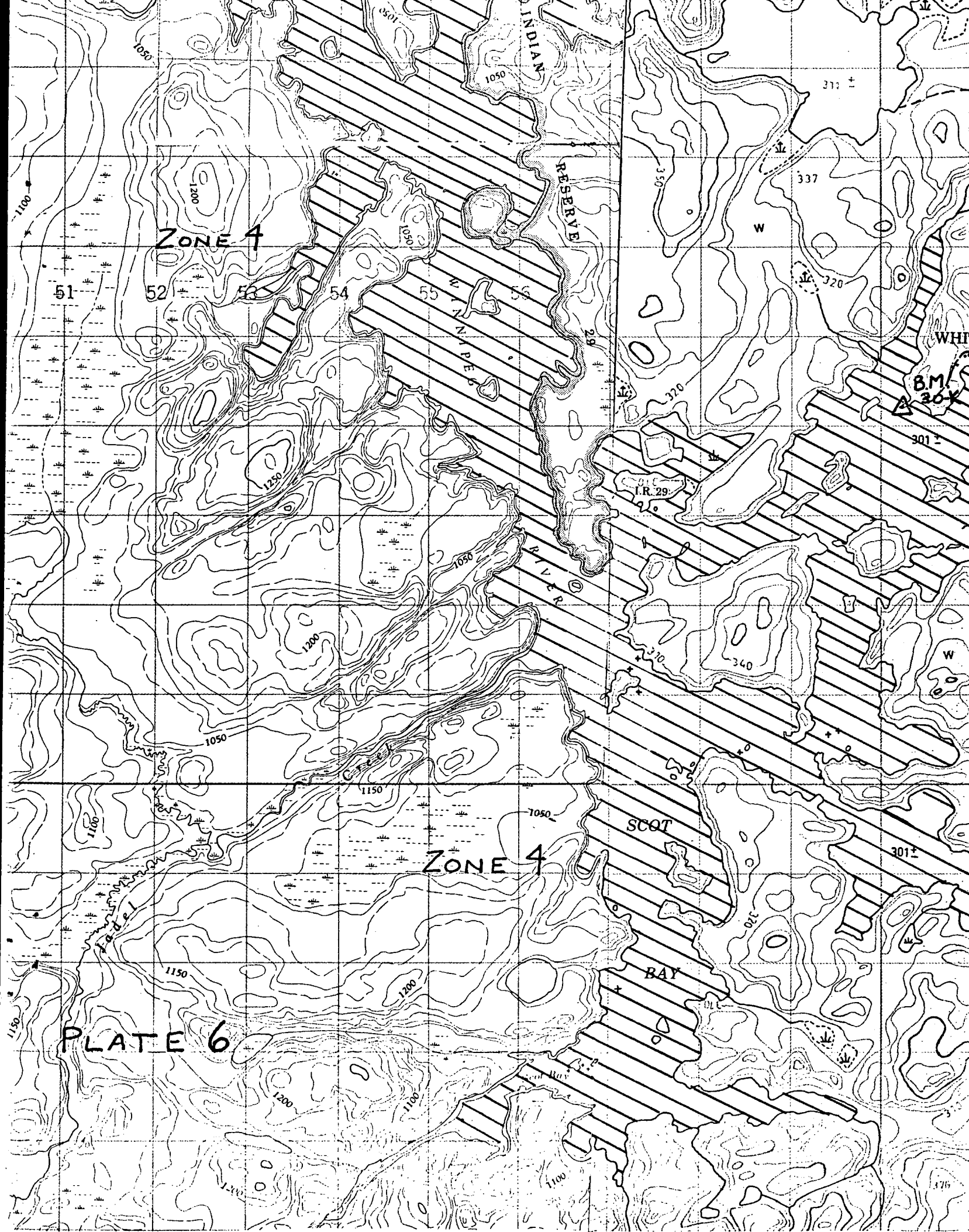

INDIAN RESERVE 38 C
ZONE 1
ZONE 1
ZONE 1
Boudreau Island
Beer Lake
Cameron Lake
Laurenson's Island
The Powderpuff
Locke Bay
2 Lines
Esther Lake
Skiff Lake
Fiddler's Island
MELICK TP
JAFFRAY TP
1034
Sweeney Channel
Dufresne Rapids Narrows
DUFRESNE ISLAND
Kimberley Rapids Narrows
PALMERSTON'S CHANNEL
Reservoir
Old Fort Island
Kenora Town Limits
Middle Lake
Lake
Creek
Gas Pipeline
Dump
Pumping Sta
Gas Pipeline
TUNNEL
Power House
ISLAND
Radio 200'
Gas
Quarry Bay
Lift Lock
Cameron Bay
Marina
Norman
B.M. 1106
Morgans
Scott
Bay
Senior Citizen Home
Yacht Club
Coney Island Beach
CONEY ISLAND
Safety
Sawmill
Burner
Keewatin
Highway 17
Keewatin Beach
Lowes
Rat Portage Bay
(Lake of the Woods)
Trans Canada
PACIFIC
PLATE 1
596
1100
1200
1150
1085
1060

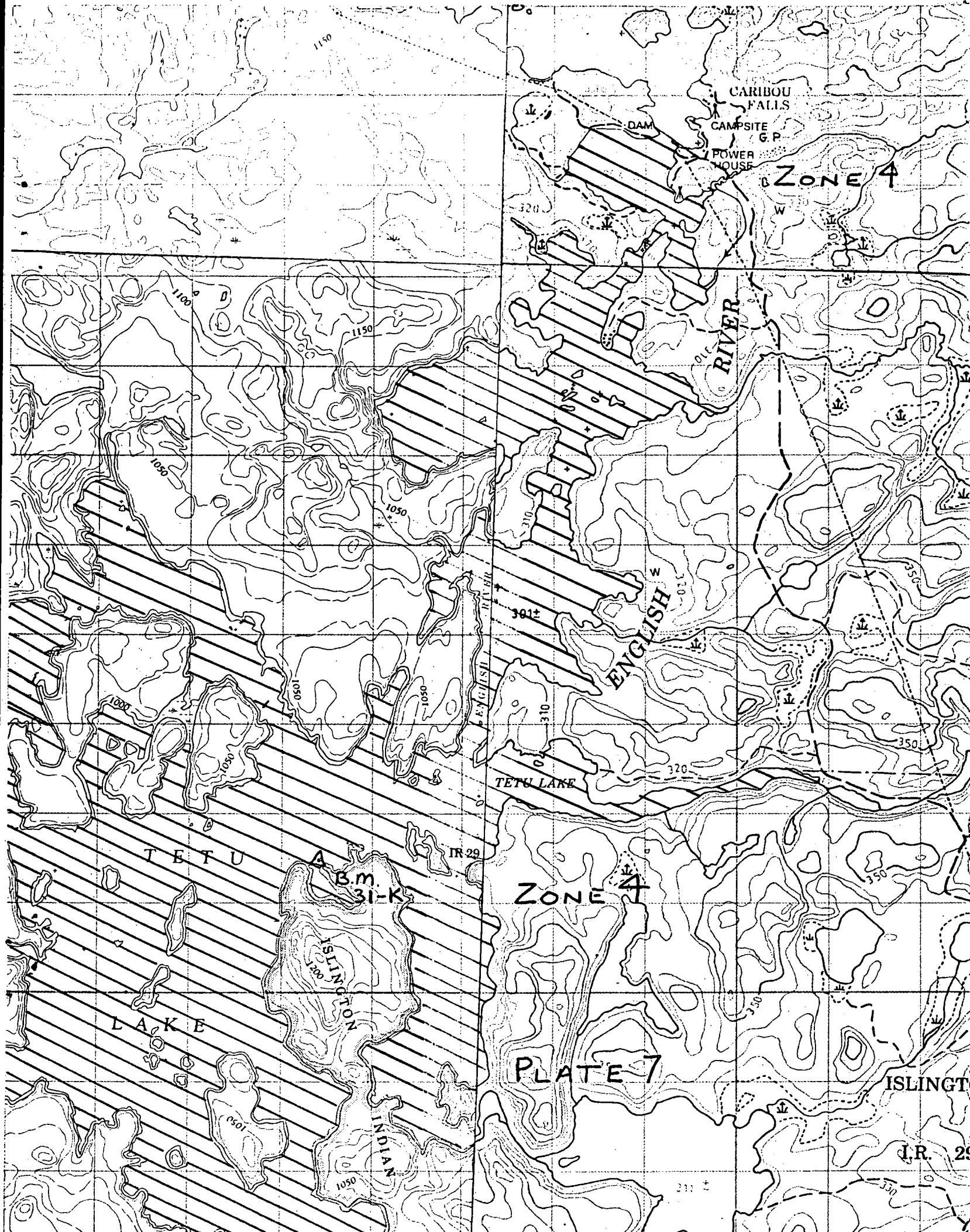

Minaki
Curling Club
Muncer's Reef
Radio 290
Allman's Bay
Sellers
Fredericks
Treaty
Abbott's
Tunnel Bay
BM 1077
Inn Lake
WINNIPEG RIVER
MACFARLANE RIVER
BM 1068
Holst Bay
Runions Bay
Runions Island
Boyd
Birch
Virgin
Brown's
Kawbeks
Big Island
Bathgate's Point
Dog
Tower Island
Adamson Lake
LAKE
Potato Island
Kabastra Bay
Sieler's
Cache Point
Able
East Browns
Little Jewel
Hillard's
STRETCH
RIVER
UMBACH TP
Hunter's
Tremain
Poplar
Portage
WINNIPEG RIVER
ZONE 1
ZONE 2
B.M. A-6 & A-7
B.M. A-4 & A-5
IR 38C
The Dalles
ZONE 2
ZONE 1
UF
PLATE 2
Urquhart
Lake
Camp
Porcupine Island
Myrtle Rapids
Kris Island
Wet
31
30
29
28
27
26
80
81
82
83
84
85
86
87
88
1100
1200

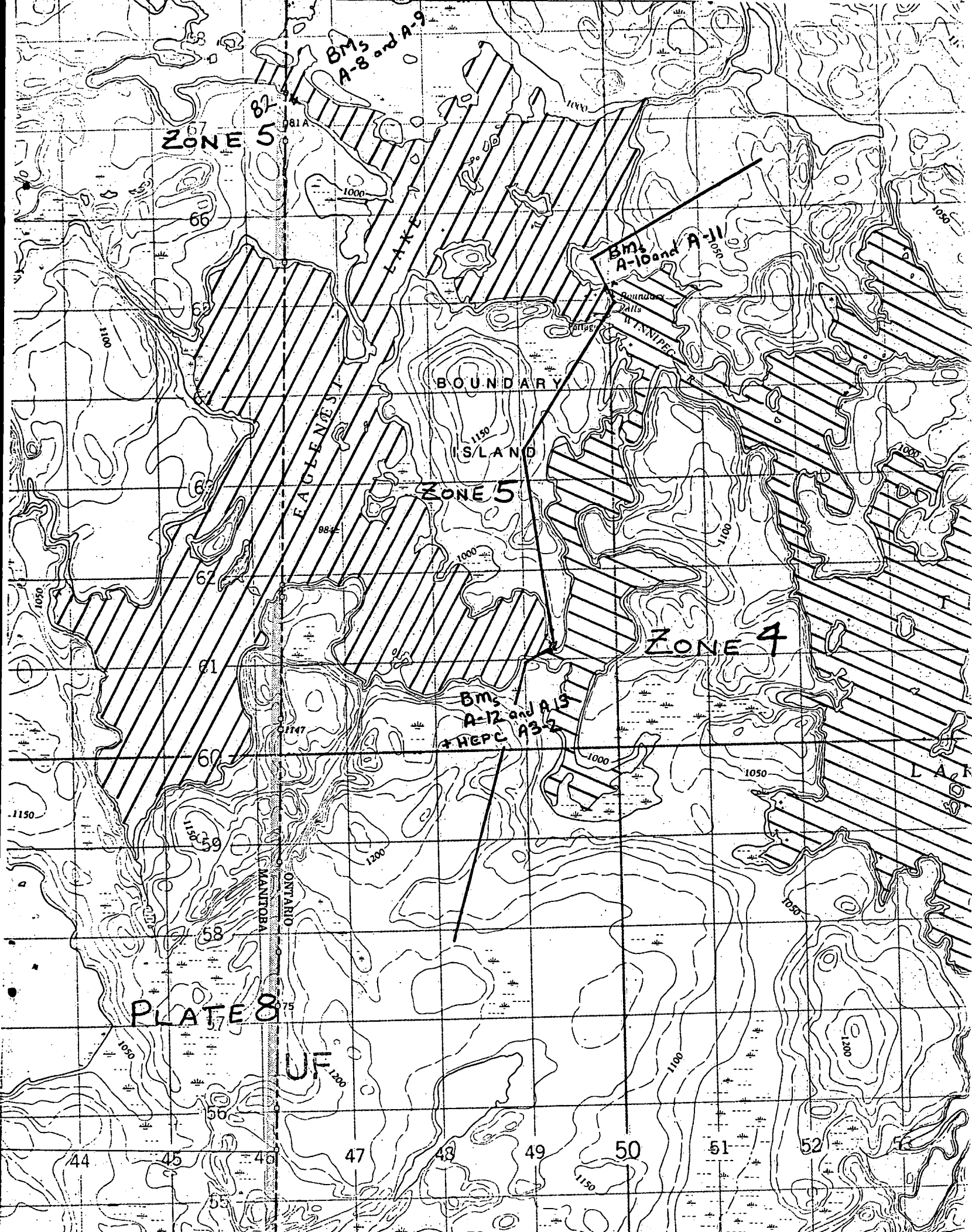

LAKE
ZONE 2
W
HARBOUR
ISLAND
VERMILION ISLAND
OCTO ISLAND
328
27-K
ZONE 2
LOST BAY
LAKE
PLATE 3
THE PENINSULA
Pistol Lake
Dynamite Lake
Sand
Mulocks Point
Lost Bay
Power House
Golf Course
Radio
Gas
Hospital Pt
Kelly's
BMs A-1 and A-2
and CNR Y944
403
355
350
330
340
316±
347
320
390
351±
220
210


ZONE 3
ZONE 2
B.M. A-14, A-15 & A-16
B.M. BOLT
B.M. #2
WINNIPEG
ROUGHROCK
316±
LAKE
RIVER
SWORD
PLATE 4


WHITEDOG
WHITEDOG RIVER
ZONE 4
Bms
A-14, A-15 and A-16
POWERHOUSE
DAM
WINNIPEG
SWAN
SWAN LAKE
LAKE
ZONE 4
SWORD
I.R. 29
CYGNET
PLATE 5


ZONE 4
51
52
53
54
55
56
INDIAN RESERVE
WHITEFISH
RIVER
I.R. 29
B.M. 30K
SCOT
BAY
Tadel
Creek
ZONE 4
PLATE 6
1050
1100
1150
1200
1250
1300
320
330
340
350
337
301±


CARIBOU FALLS
DAM
CAMPSITE
G.P.
POWER HOUSE
ZONE 4
ENGLISH RIVER
ENGLISH
TETU LAKE
TETU
LAKE
B.M. 31-K
ZONE 4
PLATE 7
ISLINGTON
INDIAN
I.R. 29
1150
1100
1050
1000
310
320
350
301±


BMs A-8 and A-9
ZONE 5
LAKE
BMs A-10 and A-11
Boundary Falls
PORTAGE
WINNIPEG
BOUNDARY
EAGLENEST
ISLAND
ZONE 5
ZONE 4
BMs A-12 and A-13
HEPC A3-2
MANITOBA
ONTARIO
PLATE 8
1000
1050
1100
1150
1200
1147
981A
984

FREQUENCY DISTRIBUTION FOR KENORA DAM TAILWATER

LEVEL	NO.	% EX	PLOT
316.17	1	0.02%	*
316.18	0	0.02%	*
16.19	0	0.02%	*
316.20	6	0.11%	*
316.21	0	0.11%	*
316.22	0	0.11%	*
316.23	10	0.26%	*
316.24	0	0.26%	*
316.25	0	0.26%	*
316.26	3	0.30%	*
316.27	0	0.30%	*
316.28	0	0.30%	*
316.29	4	0.37%	*
316.30	0	0.37%	*
316.31	0	0.37%	*
316.32	24	0.73%	*
316.33	0	0.73%	*
316.34	0	0.73%	*
316.35	23	1.08%	*
316.36	0	1.08%	*
316.37	0	1.08%	*
316.38	10	1.23%	*
316.39	0	1.23%	*
316.40	0	1.23%	*
316.41	15	1.46%	*
316.42	1	1.48%	*
316.43	0	1.48%	*
316.44	13	1.67%	*
316.45	2	1.70%	*
316.46	4	1.76%	*
316.47	51	2.54%	*
316.48	5	2.62%	*
316.49	3	2.66%	*
316.50	125	4.56%	*
316.51	11	4.73%	*
316.52	3	4.78%	*
316.53	118	6.57%	*
316.54	12	6.75%	*
316.55	6	6.84%	*
316.56	12	7.03%	*
316.57	75	8.17%	*
316.58	8	8.29%	*
316.59	13	8.49%	*
316.60	86	9.79%	*
316.61	20	10.10%	*
316.62	21	10.42%	*
316.63	67	11.44%	*
316.64	27	11.85%	*
316.65	19	12.14%	*
316.66	75	13.28%	*
316.67	38	13.86%	*
316.68	33	14.36%	*
316.69	77	15.53%	*
316.70	27	15.94%	*
316.71	44	16.61%	*
316.72	77	17.78%	*
316.73	37	18.34%	*
316.74	46	19.04%	*
316.75	25	19.32%	*

FREQUENCY DISTRIBUTION FOR MINAKI (GUN LAKE)

LEVEL	NO.	% EX	PLOT
315.77	1	0.01%	*
15.78	0	0.01%	*
315.79	1	0.03%	*
315.80	5	0.10%	*
315.81	4	0.16%	*
315.82	2	0.18%	*
315.83	2	0.21%	*
315.84	2	0.24%	*
315.85	1	0.25%	*
315.86	2	0.28%	*
315.87	0	0.28%	*
315.88	0	0.28%	*
315.89	2	0.31%	*
315.90	0	0.31%	*
315.91	0	0.31%	*
315.92	2	0.34%	*
315.93	4	0.40%	*
315.94	5	0.47%	*
315.95	6	0.55%	*
315.96	6	0.64%	*
315.97	8	0.75%	*
315.98	7	0.85%	*
315.99	4	0.91%	*
316.00	3	0.95%	*
316.01	8	1.06%	*
316.02	8	1.18%	*
316.03	10	1.32%	*
316.04	14	1.52%	*
316.05	9	1.64%	*
316.06	29	2.05%	*
316.07	46	2.70%	*
316.08	41	3.29%	*
316.09	44	3.91%	*
316.10	80	5.04%	*
316.11	89	6.30%	*
316.12	85	7.51%	*
316.13	111	9.08%	*
316.14	196	11.85%	*
316.15	181	14.42%	*
316.16	184	17.02%	*
316.17	234	20.34%	*
316.18	366	25.52%	*
316.19	311	29.92%	*
316.20	390	35.45%	*
316.21	496	42.47%	*
316.22	420	48.42%	*
316.23	432	54.54%	*
316.24	494	61.54%	*
316.25	586	69.83%	*
316.26	304	74.14%	*
316.27	200	76.97%	*
316.28	181	79.54%	*
316.29	82	80.70%	*
316.30	64	81.60%	*
316.31	41	82.18%	*
316.32	64	83.09%	*
316.33	33	83.56%	*
316.34	30	83.98%	*
316.35	26	84.35%	*

FREQUENCY DISTRIBUTION FOR WHITEDOG G. S. HEADWATER

LEVEL	NO.	% EX	PLOT
314.19	1	0.01%	*
314.20	1	0.03%	*
14.21	0	0.03%	*
314.22	0	0.03%	*
314.23	0	0.03%	*
314.24	0	0.03%	*
314.25	0	0.03%	*
314.26	0	0.03%	*
314.27	0	0.03%	*
314.28	0	0.03%	*
314.29	0	0.03%	*
314.30	0	0.03%	*
314.31	0	0.03%	*
314.32	0	0.03%	*
314.33	1	0.04%	*
314.34	0	0.04%	*
314.35	1	0.06%	*
314.36	1	0.07%	*
314.37	1	0.08%	*
314.38	0	0.08%	*
314.39	1	0.10%	*
314.40	0	0.10%	*
314.41	2	0.12%	*
314.42	0	0.12%	*
314.43	0	0.12%	*
314.44	0	0.12%	*
314.45	0	0.12%	*
14.46	0	0.12%	*
14.47	2	0.15%	*
314.48	8	0.26%	*
314.49	5	0.33%	*
314.50	1	0.35%	*
314.51	0	0.35%	*
314.52	0	0.35%	*
314.53	0	0.35%	*
314.54	0	0.35%	*
314.55	1	0.36%	*
314.56	0	0.36%	*
314.57	1	0.37%	*
314.58	1	0.39%	*
314.59	0	0.39%	*
314.60	0	0.39%	*
314.61	0	0.39%	*
314.62	0	0.39%	*
314.63	1	0.40%	*
314.64	1	0.41%	*
314.65	0	0.41%	*
314.66	1	0.43%	*
314.67	0	0.43%	*
314.68	1	0.44%	*
314.69	0	0.44%	*
314.70	0	0.44%	*
314.71	1	0.46%	*
14.72	0	0.46%	*
314.73	1	0.47%	*
314.74	1	0.48%	*
314.75	0	0.48%	*
314.76	1	0.50%	*
314.77	2	0.52%	*
314.78	0	0.52%	*

314.80	4	0.59%	*
314.81	0	0.59%	*
314.82	4	0.65%	*
314.83	14	0.84%	*
314.84	11	0.99%	*
314.85	14	1.19%	*
314.86	59	2.00%	*
14.87	46	2.64%	*
314.88	26	3.00%	*
314.89	112	4.54%	*
314.90	74	5.56%	*
314.91	52	6.28%	*
314.92	96	7.61%	*
314.93	31	8.03%	*
314.94	20	8.31%	*
314.95	19	8.57%	*
314.96	6	8.66%	*
314.97	12	8.82%	*
314.98	10	8.96%	*
314.99	3	9.00%	*
315.00	8	9.11%	*
315.01	6	9.19%	*
315.02	3	9.24%	*
315.03	5	9.30%	*
315.04	25	9.65%	*
315.05	6	9.73%	*
315.06	5	9.80%	*
315.07	16	10.02%	*
315.08	11	10.17%	*
315.09	5	10.24%	*
315.10	9	10.37%	*
315.11	4	10.42%	*
15.12	5	10.49%	*
.15.13	13	10.67%	*
315.14	10	10.81%	*
315.15	19	11.07%	*
315.16	25	11.42%	*
315.17	6	11.50%	*
315.18	15	11.71%	*
315.19	22	12.01%	*
315.20	8	12.12%	*
315.21	14	12.31%	*
315.22	19	12.58%	*
315.23	9	12.70%	*
315.24	12	12.87%	*
315.25	14	13.06%	*
315.26	10	13.20%	*
315.27	9	13.32%	*
315.28	32	13.76%	*
315.29	8	13.87%	*
315.30	18	14.12%	*
315.31	13	14.30%	*
315.32	41	14.87%	*
315.33	21	15.16%	*
315.34	9	15.28%	*
315.35	39	15.82%	*
315.36	19	16.08%	*
315.37	5	16.15%	*
15.38	27	16.52%	*
315.39	28	16.91%	*
315.40	9	17.03%	*
315.41	31	17.46%	*
315.42	18	17.71%	*
315.43	16	17.93%	*
315.44	30	18.35%	*

FREQUENCY DISTRIBUTION FOR WHITEDOG FALLS G. S. TAILWATER

LEVEL	NO.	% EX	PLOT
299.05	2	0.03%	*
99.06	0	0.03%	*
299.07	1	0.04%	*
299.08	0	0.04%	*
299.09	2	0.07%	*
299.10	2	0.10%	*
299.11	1	0.11%	*
299.12	2	0.14%	*
299.13	0	0.14%	*
299.14	1	0.15%	*
299.15	3	0.19%	*
299.16	6	0.28%	*
299.17	5	0.34%	*
299.18	8	0.46%	*
299.19	10	0.59%	*
299.20	5	0.66%	*
299.21	2	0.69%	*
299.22	12	0.86%	*
299.23	2	0.88%	*
299.24	7	0.98%	*
299.25	6	1.06%	*
299.26	5	1.13%	*
299.27	6	1.21%	*
299.28	10	1.35%	*
299.29	6	1.43%	*
299.30	5	1.50%	*
299.31	6	1.59%	*
99.32	7	1.68%	*
299.33	6	1.77%	*
299.34	4	1.82%	*
299.35	1	1.83%	*
299.36	4	1.89%	*
299.37	5	1.96%	*
299.38	2	1.99%	*
299.39	1	2.00%	*
299.40	1	2.01%	*
299.41	2	2.04%	*
299.42	1	2.06%	*
299.43	0	2.06%	*
299.44	1	2.07%	*
299.45	2	2.10%	*
299.46	2	2.12%	*
299.47	5	2.19%	*
299.48	1	2.21%	*
299.49	5	2.28%	*
299.50	11	2.43%	*
299.51	4	2.48%	*
299.52	5	2.55%	*
299.53	6	2.64%	*
299.54	3	2.68%	*
299.55	7	2.77%	*
299.56	7	2.87%	*
99.57	3	2.91%	*
299.58	8	3.02%	*
299.59	9	3.15%	*
299.60	4	3.20%	*
299.61	3	3.24%	*
299.62	11	3.39%	*
299.63	5	3.46%	*

299.66	3	3.85%	*
299.67	7	3.95%	*
299.68	9	4.07%	*
299.69	11	4.22%	*
299.70	7	4.32%	*
299.71	13	4.50%	*
99.72	5	4.57%	*
299.73	8	4.68%	*
299.74	20	4.95%	*
299.75	7	5.05%	*
299.76	13	5.23%	*
299.77	8	5.34%	*
299.78	8	5.45%	*
299.79	11	5.60%	*
299.80	21	5.89%	*
299.81	17	6.13%	*
299.82	8	6.24%	*
299.83	16	6.46%	*
299.84	10	6.59%	*
299.85	10	6.73%	*
299.86	15	6.94%	*
299.87	12	7.11%	*
299.88	13	7.28%	*
299.89	14	7.48%	*
299.90	12	7.64%	*
299.91	11	7.80%	*
299.92	17	8.03%	*
299.93	5	8.10%	*
299.94	9	8.22%	*
299.95	8	8.33%	*
299.96	9	8.46%	*
299.97	17	8.69%	*
99.98	16	8.91%	*
299.99	11	9.06%	*
300.00	4	9.12%	*
300.01	20	9.40%	*
300.02	7	9.49%	*
300.03	10	9.63%	*
300.04	19	9.89%	*
300.05	8	10.00%	*
300.06	11	10.15%	*
300.07	5	10.22%	*
300.08	19	10.49%	*
300.09	8	10.60%	*
300.10	12	10.76%	*
300.11	28	11.15%	*
300.12	16	11.37%	*
300.13	11	11.52%	*
300.14	29	11.92%	*
300.15	23	12.24%	*
300.16	14	12.43%	*
300.17	32	12.87%	*
300.18	23	13.19%	*
300.19	23	13.51%	*
300.20	42	14.09%	*
300.21	26	14.45%	*
300.22	33	14.90%	*
00.23	44	15.51%	*
300.24	24	15.84%	*
300.25	22	16.14%	*
300.26	41	16.71%	*
300.27	22	17.01%	*
300.28	19	17.27%	*
300.29	35	17.76%	*

HWL012

FREQUENCY DISTRIBUTION FOR CARIBOU FALLS GS (ENGLISH R.) TAILWATER

LEVEL	NO.	% EX	PLOT
298.99	1	0.01%	*
299.00	0	0.01%	*
299.01	0	0.01%	*
299.02	0	0.01%	*
299.03	0	0.01%	*
299.04	0	0.01%	*
299.05	1	0.03%	*
299.06	3	0.07%	*
299.07	4	0.13%	*
299.08	3	0.17%	*
299.09	4	0.23%	*
299.10	3	0.27%	*
299.11	3	0.31%	*
299.12	7	0.41%	*
299.13	7	0.51%	*
299.14	2	0.54%	*
299.15	5	0.61%	*
299.16	15	0.82%	*
299.17	2	0.85%	*
299.18	5	0.92%	*
299.19	13	1.10%	*
299.20	0	1.10%	*
299.21	4	1.16%	*
299.22	4	1.21%	*
299.23	8	1.33%	*
299.24	5	1.40%	*
299.25	7	1.50%	*
299.26	3	1.54%	*
299.27	4	1.60%	*
299.28	8	1.71%	*
299.29	4	1.77%	*
299.30	4	1.82%	*
299.31	4	1.88%	*
299.32	0	1.88%	*
299.33	2	1.91%	*
299.34	4	1.96%	*
299.35	4	2.02%	*
299.36	1	2.03%	*
299.37	0	2.03%	*
299.38	1	2.05%	*
299.39	1	2.06%	*
299.40	1	2.08%	*
299.41	1	2.09%	*
299.42	0	2.09%	*
299.43	0	2.09%	*
299.44	1	2.10%	*
299.45	1	2.12%	*
299.46	0	2.12%	*
299.47	2	2.15%	*
299.48	0	2.15%	*
299.49	1	2.16%	*
299.50	0	2.16%	*
299.51	0	2.16%	*
299.52	1	2.17%	*
299.53	0	2.17%	*
299.54	1	2.19%	*

299	[illegible]	[illegible]	[illegible]
299	[illegible]	[illegible]	[illegible]
299	[illegible]	[illegible]	[illegible]
299	[illegible]	[illegible]	[illegible]
299	[illegible]	[illegible]	[illegible]
299	61	4	2.40%
299	[illegible]	10	2.54%
299	[illegible]	[illegible]	2.58%
299	64	7	2.68%
299	65	4	2.74%
299	66	6	2.82%
299	67	5	2.89%
299	68	18	3.15%
299	69	14	3.35%
299	70	10	3.49%
299	71	9	3.61%
299	72	9	3.74%
299	73	15	3.95%
299	74	17	4.19%
299	75	11	4.35%
299	76	7	4.45%
299	77	5	4.52%
299	78	8	4.63%
299	79	12	4.80%
299	80	23	5.13%
299	81	13	5.31%
299	82	13	5.49%
299	83	14	5.69%
299	84	6	5.78%
299	85	13	5.96%
299	86	11	6.11%
299	87	10	6.26%
299	88	7	6.35%
299	89	11	6.51%
299	90	10	6.65%
299	91	13	6.83%
299	92	15	7.05%
299	93	9	7.17%
299	94	13	7.36%
299	95	19	7.62%
299	96	7	7.72%
299	97	11	7.88%
299	98	18	8.13%
299	99	5	8.20%
300	00	10	8.35%
300	01	19	8.61%
300	02	11	8.77%
300	03	10	8.91%
300	04	6	8.99%
300	05	13	9.18%
300	06	14	9.38%
300	07	11	9.53%
300	08	14	9.73%
300	09	10	9.87%
300	10	4	9.93%
300	11	16	10.15%
300	12	16	10.38%
300	13	5	10.45%
300	14	24	10.79%
300	15	13	10.97%
300	16	6	11.06%
300	17	18	11.31%
300	18	9	11.44%
300	19	8	11.55%
300	20	22	11.86%