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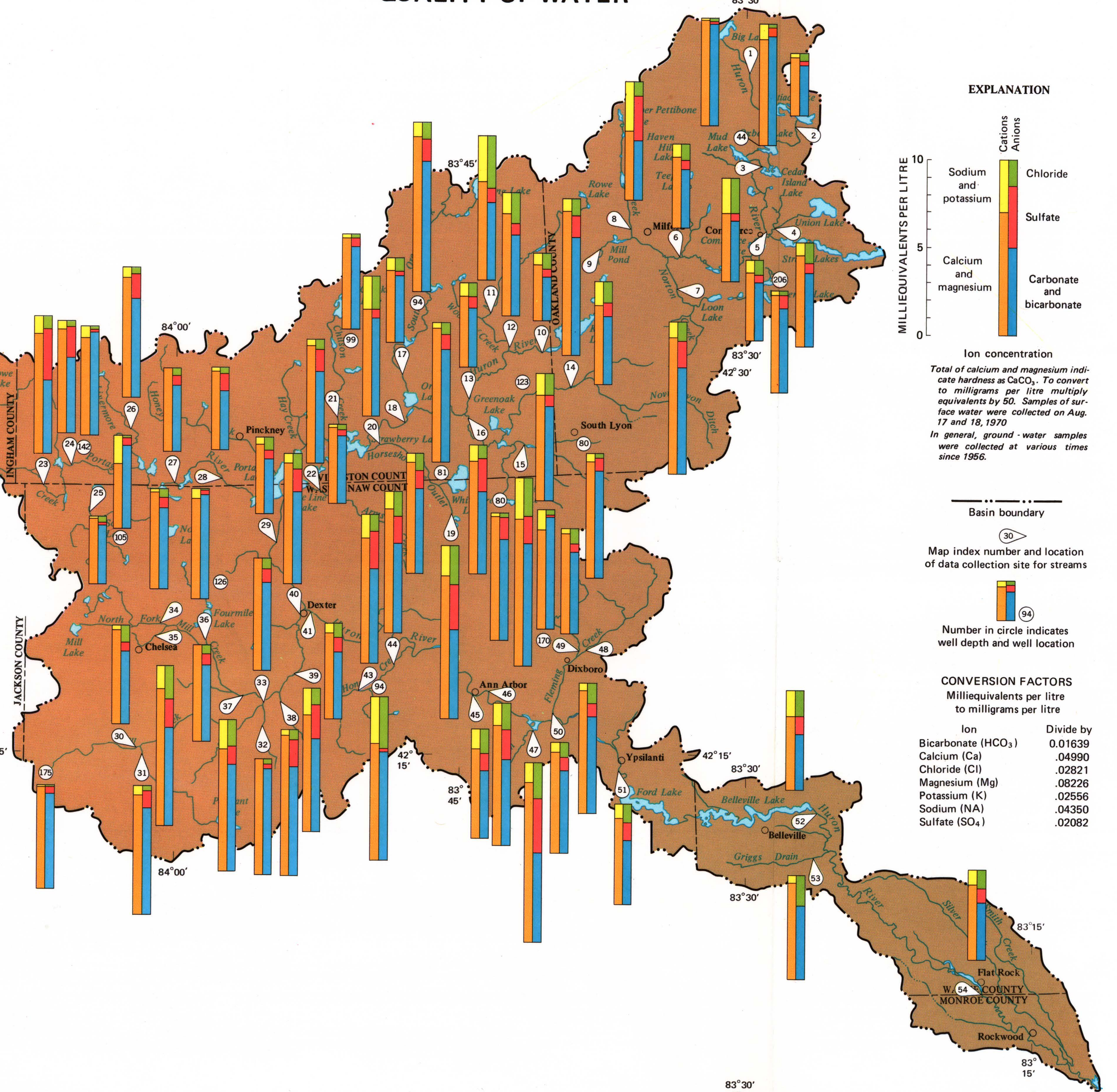
U.S. ARMY CORPS OF ENGINEERS

QUALITY OF WATER



GROUND WATER AND QUALITY OF WATER

The surficial features that characterize the Huron River basin are the result of continental glaciers that formerly covered all of Michigan. Rock debris deposited from the glaciers ranges in particle size from clay to boulders. Glacial deposits are classified by particle size, degree of sorting, and landform. Some common glacier forms are, moraines, till plains, lake beds, and outwash (Map A).

Drift thickness is important in determining ground-water potential. Thicker glacial drift can store more water and the chance of encountering materials that will yield water to wells is greater. The drift is thickest in east-central moraines and thinnest in southeastern lake beds (southeast of Ypsilanti) (Map A).

Yield of wells penetrating the glacial drift depends largely upon particle size and sorting. Thus, outwash, which is generally coarse grained and well sorted, will yield the most water. Till plains and moraines, which are generally poorly sorted, but may be coarse grained are likely to yield only small quantities of water. The approximate yield of wells in glacial deposits is shown on Map B.

Bedrock underlying the basin is sandstone, shale, and carbonate rocks of Mississippian and Devonian age (Map C). These sedimentary rocks dip to the west and northwest. Yields of wells penetrating bedrock in the basin are generally low except for those in the Marshall Sandstone (Map D), which may yield as much as 500 gpm to large diameter wells. Yields depend largely on the effective porosity of the sandstone, the wells penetration of fractures, and solutional openings in the limestone. Wells penetrating shale generally do not yield enough water for domestic needs.

Chemical quality of water in the basin is relatively uniform and treatment is not required for most agricultural use. For municipal and industrial use, iron and excessive hardness need to be removed. Water from glacial drift and from streams is of the calcium magnesium bicarbonate type and is very hard (hardness as $CaCO_3$ exceeds 180 mg/l, milligrams per litre). In the southeastern part of the basin, water in bedrock formations is too highly mineralized for most uses. In all areas of the basin, water in the bedrock increases in mineralization with depth.

Many communities in the basin receive water from the Detroit Water Department. Detroit obtains their water from the Detroit River and Lake Huron. A few communities and individual supplies still rely on individual wells for water.

Stream discharge was measured and water samples were collected during base-flow investigations made in 1970 and 1971. Investigations were made during periods of dry weather when surface runoff from antecedent rains was minimal and streamflow was chiefly from ground-water sources. Discharge data in the table "Results of Base-Flow Investigations" are reported in cubic feet per second and cubic feet per second per square mile and can be used for comparison of base flows for specific areas. Higher cubic feet per second per square mile figures indicate relatively well sustained base flows, a result of permeable soils and glacial deposits, with adequate storage capacity, that permit movement of ground water to streams.

Bar diagrams on basin map (at left) under "Quality of Water", show the chemical quality of water in streams during the base-flow investigations made in 1970 and 1971. In general, concentration of dissolved solids is higher during periods of base flow than during periods of high flow when most of the water reaching the stream is by overland flow. The bar diagrams, therefore, show the higher concentration to be expected in surface waters. Selected analyses of ground water, all from wells in glacial drift and at indicated depths, are also shown. Stream analyses were made in the field by the U.S. Geological Survey. Most of the ground-water analyses were made by the Michigan Department of Health.

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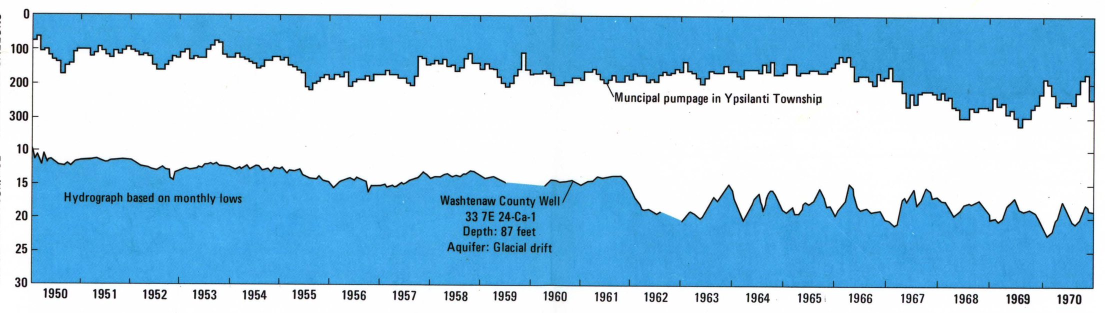


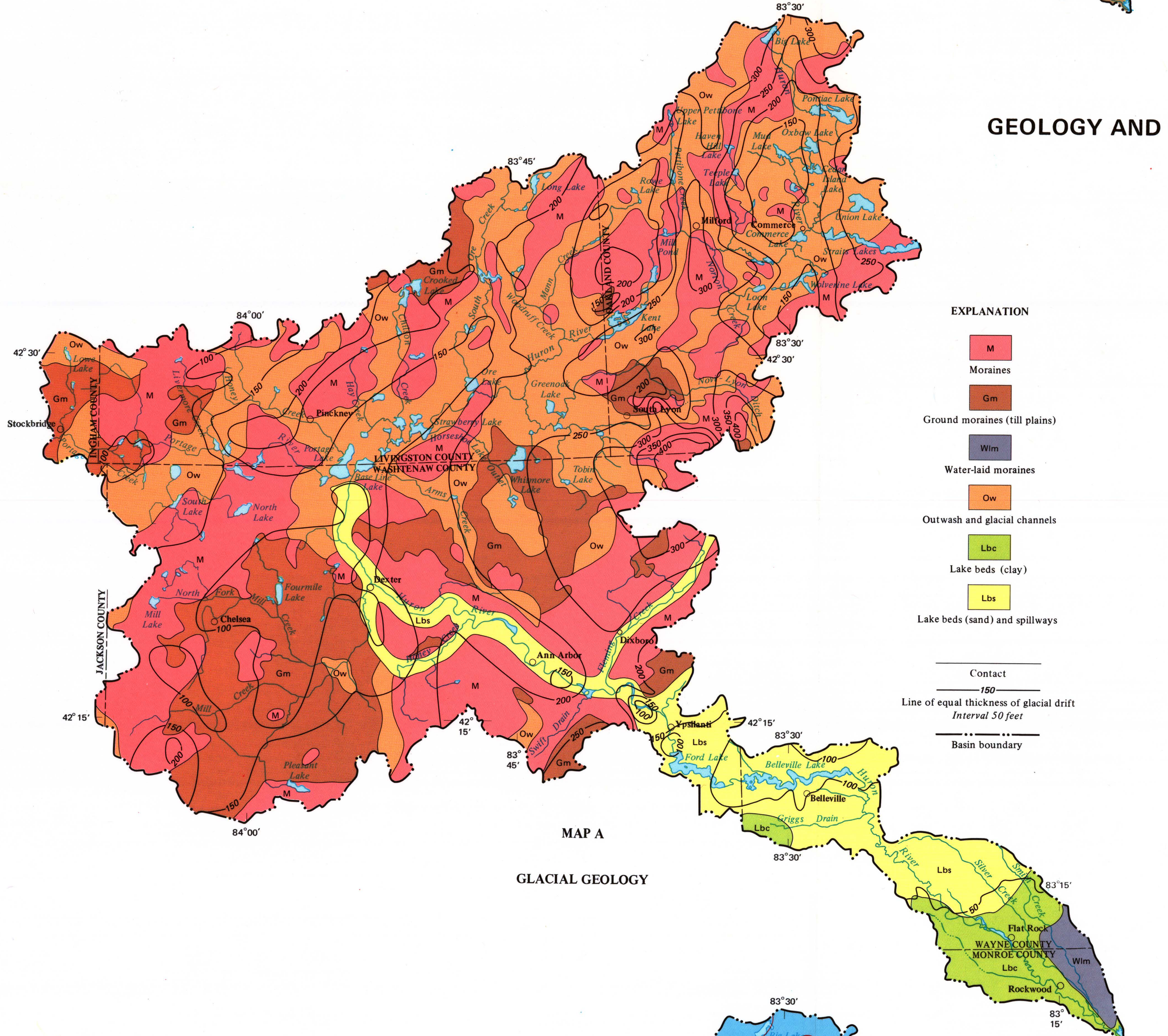
MUNICIPAL PUMPAGE AND LEVELS OF GROUND WATER IN YPSILANTI TOWNSHIP

RESULTS OF BASE-FLOW INVESTIGATIONS

BASE-FLOW INVESTIGATIONS PROVIDE A BASIS FOR DETERMINING THE OCCURRENCE, DISTRIBUTION, AND MAGNITUDE OF DRY-WEATHER STREAMFLOW

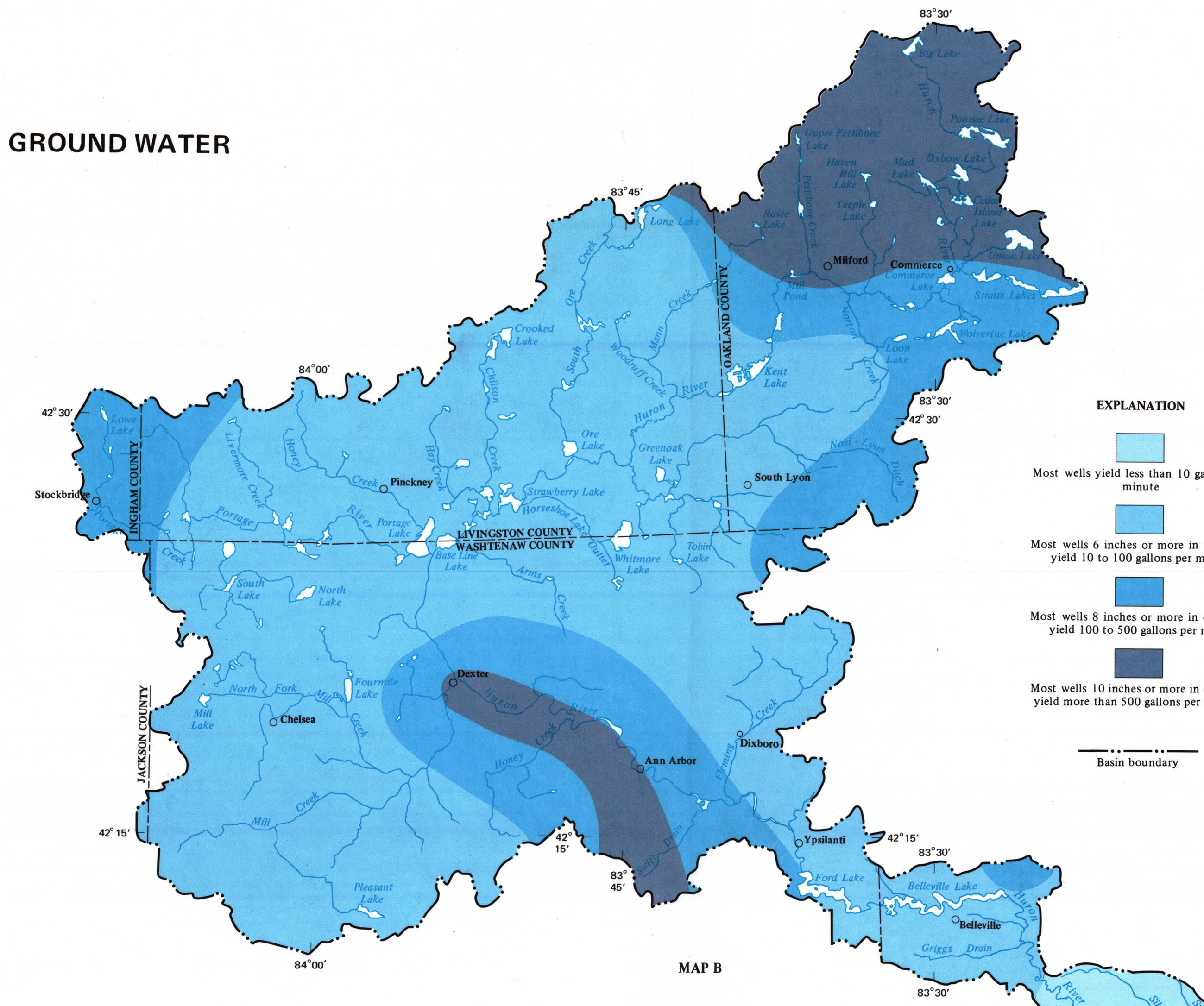
Map index No.	Station number 04-	Station name	Location	Drainage area (sq mi)	Date (1970) (1971)	Discharge (cfs)	Discharge cfs per sq mi	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Hardness as $CaCO_3$ Carbonate	Hardness as $CaCO_3$ Noncarbonate	Specific conductance (micromhos)	pH (units)	Temperature (°C)	Color (platinum-cobalt units)	Turbidity (JTU)
1	168800	Huron River	SW¼ sec. 3,	13.9	8-17	0.32	0.023	352	0	5	6.0	0.6	300	12	540	8.1	17.5	55	2
		near Andersonville	T. 3 N., R. 8 E.		8-9	.10	.001	320	0	20	4.0	.2	276	14	500	8.0	24.0	60	0
2	168900	Huron River	SE¼ sec. 13,	20.7	8-17	.06	.003	177	0	15	14	.0	160	15	370	8.0	22.5	10	4
		near Drayton Plains	T. 3 N., R. 8 E.		8-9	.64	.031	120	0	10	12	.1	116	18	240	7.6	23.5	70	3
3	168910	Huron River near	SE¼ sec. 27,	27.6	8-17	3.86	.140	204	2	20	70	.0	194	23	420	8.5	26.0	20	1
		Oxbow	T. 3 N., R. 8 E.		8-9	1.65	.060	205	0	20	10	.1	190	22	420	8.0	---	0	0
4	169000	Hayes Creek	SE¼ sec. 10,	9.49	8-17	3.21	.338	272	0	20	41	.0	266	43	580	8.0	21.0	0	1
		at Commerce	T. 2 N., R. 8 E.		8-9	2.28	.240	251	0	30	44	.2	254	48	550	8.0	23.5	20	1
5	169500	Huron River	E½ sec. 10,	58.0	8-12	8.73	.151	204	0	25	29	.0	197	30	410	8.0	24.0	35	1
		at Commerce	T. 2 N., R. 8 E.		8-9	5.29	.091	224	0	30	34	.2	224	40	480	7.9	23.0	0	0
6	169605	Huron River	W½ sec. 18,	83.6	8-17	15.1	.181	212	2	20	34	.0	208	31	420	8.4	29.0	20	2
		at Proud Lake Outlet	T. 2 N., R. 8 E.		8-9	8.20	.098	207	0	20	34	.1	210	40	440	8.0	28.5	20	0
7	169700	Norton Creek	NE½ sec. 25,	18.3	8-17	5.61	.307	306	0	125	39	.0	393	142	800	8.2	23.5	50	2
		near Milford	T. 2 N., R. 7 E.		8-9	2.89	.158	298	0	100	124	1.1	258	114	950	7.8	25.0	40	2
8	169950	Pettibone Creek	NE¼ sec. 10,	12.0	8-17	2.08	.173	195	1	115	31	.0	182	20	420	8.3	26.0	20	1
		at Milford	T. 2 N., R. 7 E.		8-9	.76	.063	207	0	15	31	.2	200	30	440	7.9	25.5	40	1
9	170000	Huron River	NE¼ sec. 16,	13.5	8-18	28.4	.210	238	0	35	45	.7	229	34	550	8.1	25.0	0	2
		at Milford	T. 2 N., R. 7 E.		8-9	23.5	.174	232	0	40	54	5.5	252	62	570	7.8	23.5	30	2
10	170500	Huron River	NE½ sec. 1,	15.2	8-17	34.3	.226	156	0	20	33	.0	166	38	400	7.9	25.0	10	8
		near New Hudson	T. 1 N., R. 6 E.		8-9	23.7	.156	161	0	35	37	2.1	184	52	400	7.3	24.0	10	0
11	170600	Mann Creek	NW¼ sec. 27,	17.8	8-18	4.00	.225	256	2	40	109	.2	281	68	800	8.4	22.0	0	1
		at Spencer Rd.	T. 2 N., R. 6 E.		8-9	2.96	.166	261	0	45	124	.3	286	72	800	7.8	22.5	0	1
12	170650	Woodruff Creek	NW¼ sec. 2,	36.3	8-17	8.54	.235	283	0	30	62	.4	289	57	650	8.1	20.0	20	2
		at Grand River Rd.	T. 1 N., R. 6 E.		8-9	5.11	.141	266	0	35	84	1.2	282	64	700	7.9	21.0	0	3
13	170700	Huron River	NW¼ sec. 16,	200	8-18	51.9	.260	195	0	35	35	2.3	201	41	480	7.9	21.0	25	2
		near Green Oak	T. 1 N., R. 6 E.		8-9	36.3	.182	195	0	40	39	1.1	212	52	480	7.7	25.5	10	1
14	170800	Davis Creek	NE¼ sec. 18,	24.4	8-17	1.62	.066	338	0	115	34	1.2	406	129	750	8.2	18.0	30	2
		near South Lyon	T. 1 N., R. 7 E.		8-9	.44	.018	266	0	130	13	1.3	350	132	600	7.8	22.5	10	7
15	170850	Inchwagh Lake	NE¼ sec. 26,	18.9	8-17	1.10	.058	262	0	200	80	.0	418	203	950	7.5	24.0	60	2
		outlet at Rushton Rd.	T. 1 N., R. 6 E.		8-9	.07	.004	200	0	240	70	.8	366	202	850	8.0	23.4	50	2
16	171010	Davis Creek	NW¼ sec. 21,	66.5	8-18	8.04	.121	278	0	90	35	.0	320	92	650	8.2	20.0	40	1
		near Whitmore Lake	T. 1 N., R. 6 E.		8-9	3.73	.056	229	0	105	33	.1	306	118	600	7.9	25.4	20	0
17	171500	Ore Creek	NW¼ sec. 12,	33.7	8-18	5.39	.160	238	0	10	26	3.3	213	18	460	8.1	19.5	40	1
		near Brighton	T. 1 N., R. 5 E.		8-10	1.52	.045	244	0	20	19	1.8	222	22	440	7.7	28.0	40	5
18	172000	Huron River	NW¼ sec. 24,	313	8-18	63.7	.204	306	0	40	35	1.3	315	64	520	8.0	24.0	40	2
		near Hamburg	T. 1 N., R. 5 E.		8-10	41.3	.132	200	0	55	38	.4	226	62	500	7.0	26.0	0	4
19	172105	Horseshoe Lake	NW¼ sec. 8	21.4	8-17	.26	.012	307	0	125	80	.9	404	152	850	7.7	26.0	0	1
		Outlet near Whitmore Lake	T. 1 S., R. 6 E.		8-9	.02	.001	---	--	---	---	--	---	---	---	---	23.0	--	--
20	172140	Horseshoe Lake	NW¼ sec. 26,	30.7	8-18	2.84	.092	324	0	30	64	8.2	304	38	750	7.9	22.0	20	2
		Outlet near Hamburg	T. 1 N., R. 5 E.		8-10	1.75	.057	---	--	---	---	--	---	---	---	---	25.0	--	--
21	172170	Chilson Creek	NW¼ sec. 21,	15.5	8-18	2.20	.142	242	0	15	11	.0	224	126	420	8.2	24.0	40	1
		at State Hwy. 36	T. 1 N., R. 5 E.		8-10	.69	.045	232	0	25	7.0	.3	222	32	390	7.9	---	70	0
22	172200	Arms Creek	NE¼ sec. 5,	20.9	8-18	3.80	.182	321	0	60	18	.6	337	75	600	8.1	18.0	20	2
		near Hambrug	T. 1 S., R. 5 E.		8-10	1.71	.082	349	0	70	16	1.4	358	72	650	7.6	23.0	0	0
23	172250	Portage Creek	NE¼ sec. 6,	16.4	8-17	3.60	.220	256	0	135	28	.0	344	134	650	8.1	28.0	20	4
		near Williamsville	T. 1 S., R. 3 E.		8-9	1.08	.066	183	0	170	34	2.5	308	158	650	7.0	27.0	70	1
24	172300	Portage Creek	NW¼ sec. 33,	33.2	8-17	6.98	.210	244	0	85	18	1.2	286	86	560	8.1	25.0	70	2
		near Unadilla	T. 1 N., R. 3 E.		8-9	1.66	.050	195	0	95	16	1.3	244	84	480	7.0	26.0	80	2
25	172400	South Lake Outlet	NE¼ sec. 9,	13.6	8-17	3.24	.238	204	0	5	12	.0	184	17	360	7.7	26.0	30	1
		near Unadilla	T. 1 S., R. 3 E.		8-9	.18	.013	181	0	20	13	.2	166	18	340	7.5	21.0	10	1
26	172415	Livermore Creek	NW¼ sec. 24,	8.42	8-17	.73	.087	317	2	85	16	1.6	344	80	650	8.3	21.0	30	2
		near Unadilla	T. 1 N., R. 3 E.		8-9	.10	.001	285	0	85	13	.7	304	70	560	7.4	27.0	50	5
27	172420	Portage River	SE¼ sec. 31,	71.6	8-18	---	---	223	1	30	14	.0	240	55	460	8.3	---	40	1
		near Chalkerville	T. 1 N., R. 4 E.		8-9	2.19	.030	178	0	70	12	.2	210	64	420	7.3	28.0	70	0
28	172500	Portage River	SW¼ sec. 34,	79.1	8-17	5.46	.069	221	3	40	13	.0	235	49	460	8.4	27.0	55	2
		near Pinckney	T. 1 N., R. 4 E.		8-9	1.30	.016	205	0	50	12	.1	212	44	420	7.5	28.0	40	0
29	173000	Huron River	S½ sec. 13,	527	8-18	96.3	.483	196	0	25	27	.0	210	49	460	8.2	25.5	20	3
		near Dexter	T. 1 S., R. 4 E.		8-10	46.8	.089	200	0	55	31	.0	222	58	470	8.1	27.5	10	1
30	173150	Mill Creek	SW¼ sec 36,	11.1	8-17	2.85	.257	260	0	20	35	.0	271	50	580	8.2	18.0	20	2
		near Sylvan	T. 2 S., R. 3 E.		8-9	2.13	.192	246	0	35	32	.1	252	36	500	8.0	22.8	30	0
31	173155	Mill Creek tributary	NW¼ sec. 1,	23.8	8-17	3.35	.141	371	0	45	12	.0	340	36	600	8.2	21.5	20	2
		near Sylvan	T. 3 S., R. 3 E.		8-9	2.42	.102	278	0	65	8.0	.1	286	58	520	8.0	20.6	30	2
32	173200	Mill Creek tributary	NE¼ sec. 35,	9.70	8-17	.51	.053	367	0	15	12	.2	330	29	600	8.0	16.5	40	5
		near Lima Center	T. 2 S., R. 4 E.		8-10	.47	.048	310	0	25	9.0	.1	274	20	480	7.8	---	10	1
33	173250	Mill Creek	NE¼ sec. 26,	59.8	8-17	8.92	.149	296	4	40	20	.0	313	63	600	8.4	24.5	20	2
		near Lima Center	T. 2 S., R. 4 E.		8-10	8.08	.135	288	0	55	19	.1	292	56	540	7.8	22.2	30	0
34	173310	North Fork Mill Creek	SE¼ sec. 1,	14.6	8-17	1.67	.114	270	6	30	20	.3	274	53	520	8.7	16.5	20	2
		near Chelsea	T. 2 S., R. 3 E.		8-9	.45	.031	278	0	60	22	.2	302	74	560	7.8	22.8	0	0
35	173320	Letts Creek	NE¼ sec. 12,	18.8	8-17	4.07	.216	333	0	80	69	.0	390	117	800	8.0	17.0	10	8
		at Chelsea	T. 2 S., R. 3 E.		8-9	1.66	.088	276	0	80	95	.2	340	114	800	8.1	25.0	0	0
36	173335	Fourmile Lake	NW¼ sec. 9,	9.89	8-17	.09	.009	282	0	30	18	.4	280	66	520	7.8	16.5	55	1
		Outlet near Chelsea	T. 2 S., R. 4 E.		8-9	.01	.001	303	0	60	70	.1	392	144	850	7.7	13.9	60	2
37	173350	North Fork Mill Creek	SW¼ sec. 23,	59.0	8-17	8.79	.149	354	5	55	55	2.3	355	57	750	8.4	22.5	30	4
		near Lima Center	T. 2 S., R. 4 E.		8-9	3.51	.059	329	0	90	67	1.8	360	90	800	8.0	23.3	0	5
38	173400	Mill Creek tributary	NE¼ sec. 25,	8.46	8-17	1.19	.141	372	0	80	20	.0	389	84	700	8.2	19.0	55	4
		No. 2 near Lima Center	T. 2 S., R. 4 E.		8-10	.47	.056	332	0	50	13	.1	310	38	560	7.8	---	10	0
39	173500	Mill Creek near Dexter	SW¼ sec. 18,	130	8-17	21.4	.165	322	4	90	34	.6	333	62	700	8.4	21.5	30	3
			T. 2 S., R. 5 E.		8-10	14.4	.111	322	0	70	36	1.1	328	64	650	7.6	23.3	10	0
40	173550	Mill Creek at Dexter	NW¼ sec. 6,	143	8-18	23.6	.165	321	2	60	34	.4	350	74	700	8.3	20.0	30	4
			T. 2 S., R. 5 E.		8-10	13.1	.092		0	60	38	.6	316	62	650	7.3	23.9	20	0
41	174000	Huron River at Dexter	SW¼ sec. 32,	686	8-18	128	.187	238	0	40	30	.0	252	57	530	8.1	22.0	0	3
			T. 1 S., R. 5 E.		8-10	61.8	.090	251	0	55	36	1.4	264	58	560	8.0	25.0	10	1
42	------	Huron River tributary	SW¼ sec. 2,	8.02	8-18	0	0	---	--	---	---	--	---	---	---	---	---	--	--
		at Delhi Mills	T. 2 S., R. 5 E.		8-10	.95	.118	273	0	105	27	2.4	322	98	600	7.8	23.0	0	6
43	174290	Honey Creek	SE¼ sec. 21,	8.99	8-18	1.01	.112	327	0	100	41	1.2	362	94	750	8.2	14.5	20	4
		near Scio	T. 2 S., R. 5 E.		8-10	.21	.023	295	0	65	49	.2	310	68	650	7.8	19.0	20	0
44	174300	Honey Creek	NE¼ sec. 14,	22.4	8-18	3.02	.135	307	4	75	52	.7	354	95	750	8.4	16.0	50	3
		near Foster	T. 2 S., R. 5 E.		8-10	1.64	.073	285	0	65	46	.3	312	78	650	7.7	22.5	0	1
45	174500	Huron River	NW¼ sec. 28,	736	8-17	127	.173	234	2	45	53	.0	256	60	410	8.3	---	30	7
		at Ann Arbor	T. 2 S., R. 6 E.		8-10	66.5	.090	224	0	90	40	.2	258	74	550	7.4	27.0	30	7
46	174510	Allen Creek	SW¼ sec. 21,	6.99	8-17	.68	.097	300	4	80	51	.0	346	94	750	8.4	---	10	2
		at Ann Arbor	T. 2 S., R. 6 E.		8-10	.22	.031	283	0	95	62	.9	334	102	750	7.6	26.5	10	2
47	174518	Pittsfield Drain	SE¼ sec. 35,	11.0	8-17	5.22	.474	305	0	150	75	.8	456	206	1,000	8.1	---	20	3
		at Ann Arbor	T. 2 S., R. 6 E.		8-10	2.33	.212	312	0	135	77	.1	392	136	850	7.5	20.0	0	0
48	174680	Fleming Creek	NW¼ sec. 17,	15.0	8-18	1.20	.080	324	0	40	45	2.0	342	76	700	8.2	16.0	20	2
		at Dixboro	T. 2 S., R. 7 E.		8-10	.11	.007	256	0	50	40	10.0	298	88	580	7.6	10.5	20	1
49	174690	Fleming Creek tributary	NE¼ sec. 18,	8.08	8-18	.47	.058	285	0	25	33	2.5	292	58	600	8.0	15.5	20	2
		at Dixboro	T. 2 S., R. 7 E.		8-10	.46	.057	300	0	50	48	1.9	312	66	650	7.7	16.5	10	1
50	174710	Fleming Creek	SE¼ sec. 25,	30.6	8-17	5.17	.169	284	1	35	36	.0	286	52	600	8.3	---	10	2
		near Geddes	T. 2 S., R. 6 E.		8-10	3.31	.108	281	0	45	37	.2	284	54	580	7.8	22.0	60	1
51	174800	Huron River	NE¼ sec. 9,	808	8-18	436	.540	215	0	50	41	5.6	244	68	560	7.8	25.0	30	4
		at Ypsilanti	T. 3 S., R. 7 E.		8-10	105	.130	215	0	75	53	13.0	250	74	600	7.2	---	0	5
52	175010	Huron River	NW¼ sec. 24,	833	8-18	---	---	207	1	55	42	1.1	230	56	600	8.4	---	20	3
		at Belleville	T. 3 S., R. 8 E.		8-9	311	.373	190	0	60	84	6.5	224	68	540	7.5	25.0	0	0
53	175020	Griggs Drain	NW¼ sec. 36,	9.95	8-18	.17	.017	205	0	35	61	1.0	270	102	500	7.9	---	20	2
		near Belleville	T. 3 S., R. 8 E.		8-9	.12	.012	151	0	50	83	1.2	238	114	570	7.7	28.0	30	0
54	175500	Huron River	SW¼ sec. 31,	866	8-18	89.6	.103	193	10	40	31	1.0	230	56	500	8.5	---	40	4
		at Flat Rock	T. 4 S., R. 10 E.		8-9	44.9	.052	198	0	70	50	1.5	230	68	540	7.6	26.5	40	0
55	175503	Silver Creek	NW¼ sec. 14,	22.9	8-18	0	0	---	--	---	---	--	---	---	---	---	---	--	--
		at Rockwood	T. 5 S., R. 10 E.		8-9	.53	.023	137	0	105	24	.3	224	112	520	7.8	26.5	10	10

GEOLOGY AND GROUND WATER



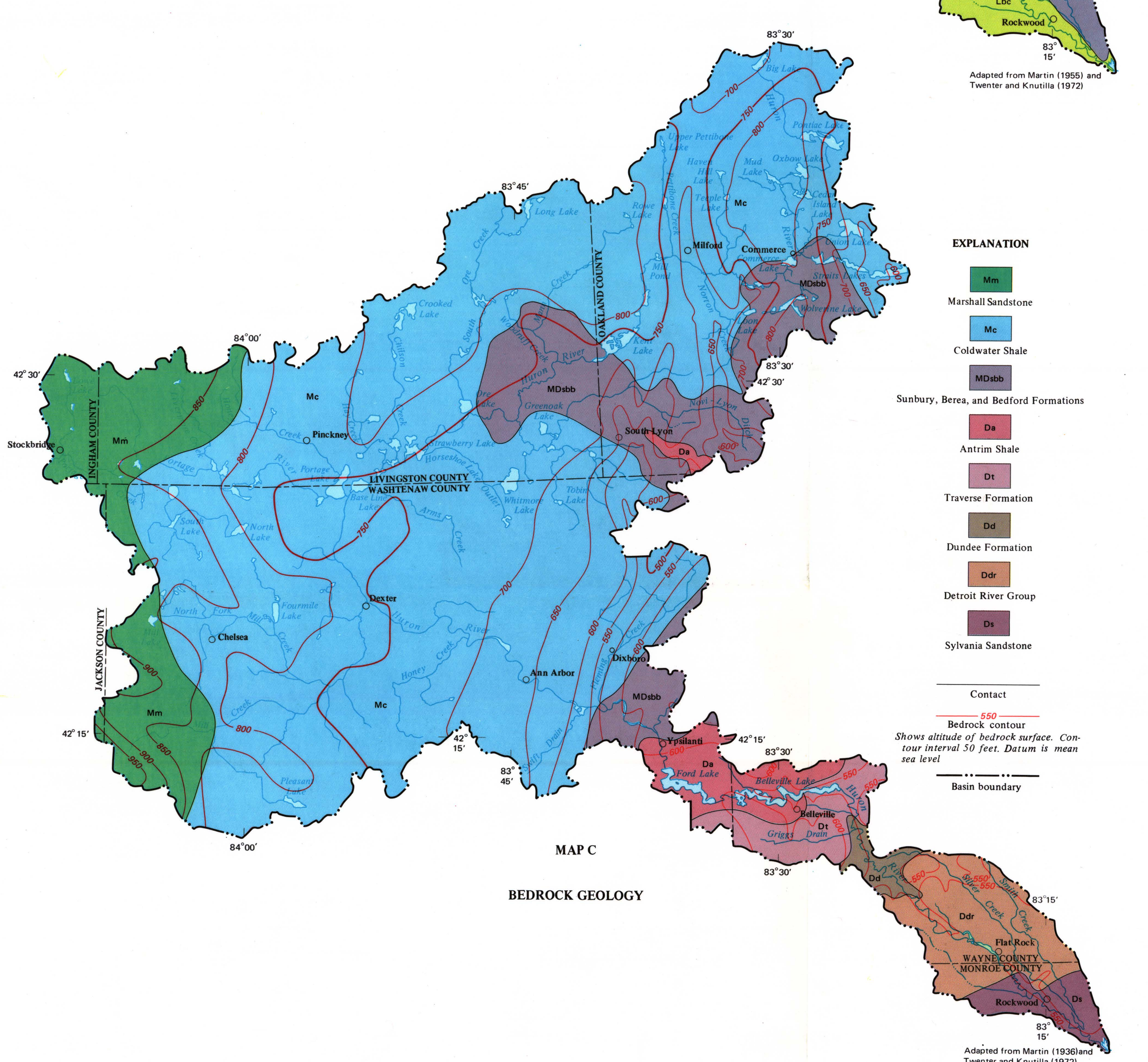
MAP A

GLACIAL GEOLOGY



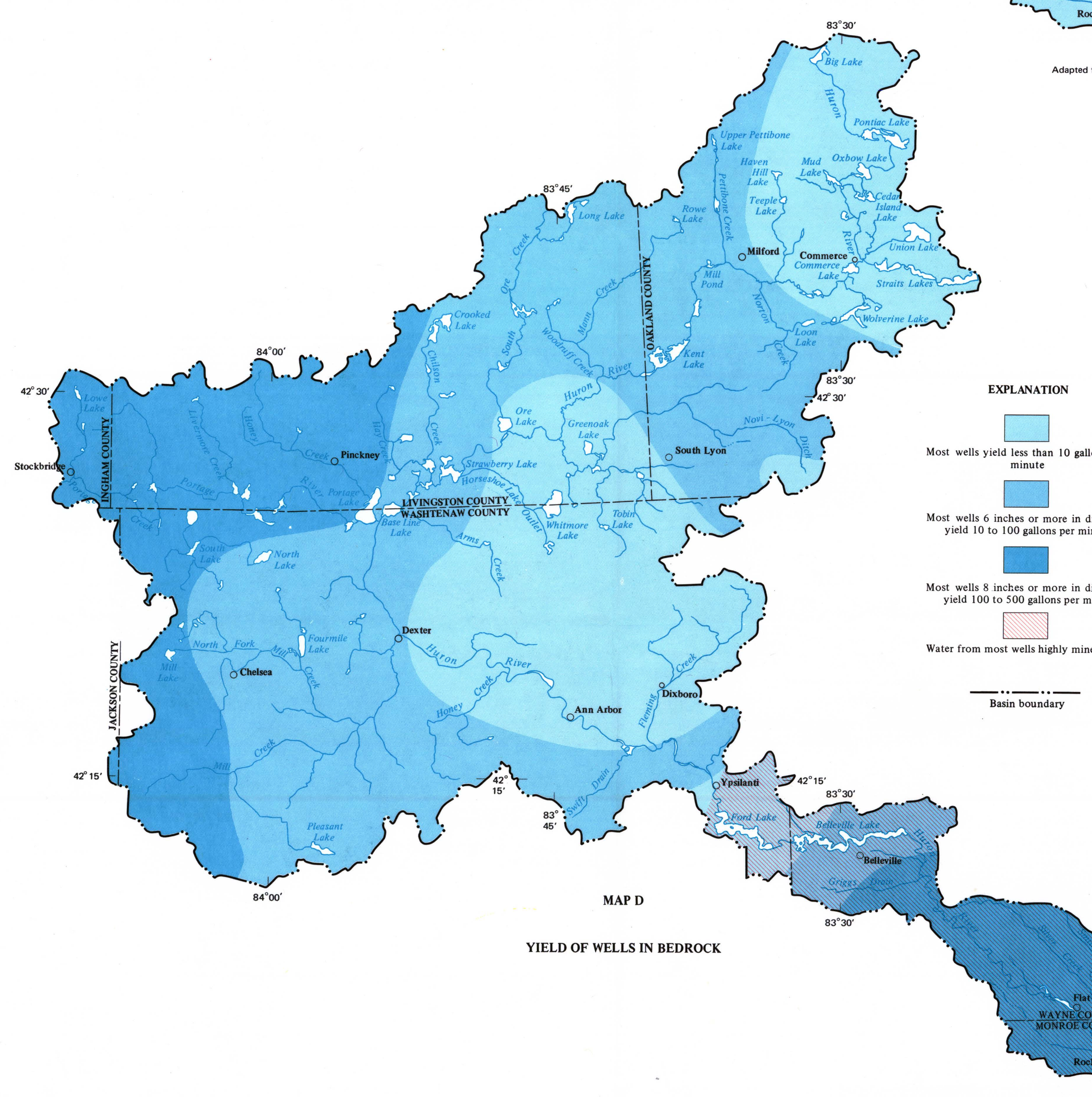
MAP B

YIELD OF WELLS IN GLACIAL DRIFT



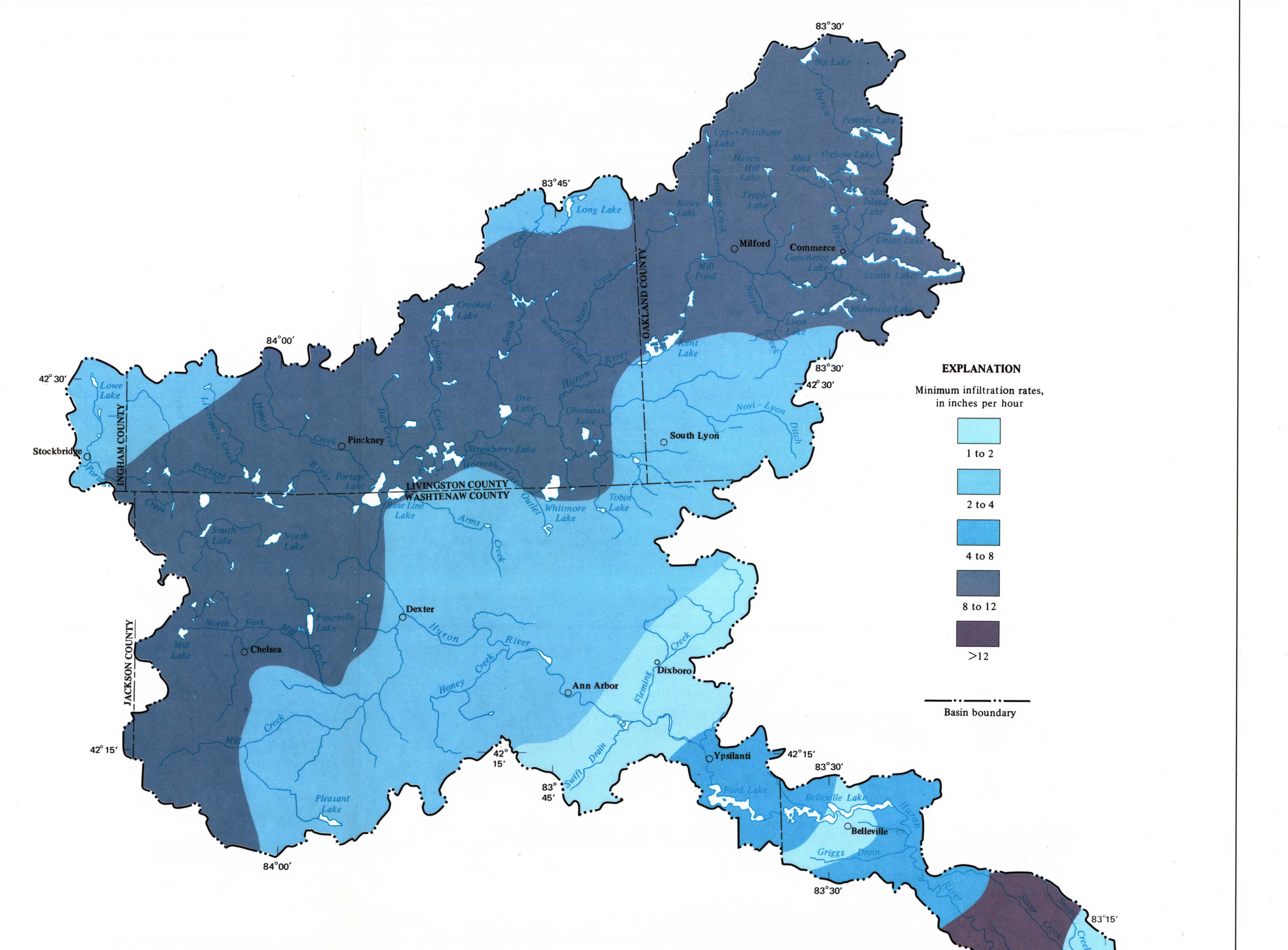
MAP C

BEDROCK GEOLOGY



MAP D

YIELD OF WELLS IN BEDROCK



MINIMUM INFILTRATION RATES PROVIDE A BASIS FOR ANALYZING DRAINAGE CHARACTERISTICS OF SOILS

Infiltration or absorption is an important factor in the reduction of surface runoff, and as a consequence reduces peak flows after storms. Also, it is by infiltration that water becomes available for vegetation and for the replenishment of ground water. Infiltration values were determined by the Soil Science Department, Michigan State University, for Michigan Agriculture Project 413. The infiltration rates are for surface horizons of soils covered with sod and were determined with a water head of 2 inches. Because they were determined with a head of water they may be greater than if the water were from natural rainfall. The map is a generalization based on a statewide sampling program of a number of soil types. Within a given area there are soils with properties outside the designated range, but the limits set are for the predominant soils.

SCALE 1:250 000

5 0 5 10 15 MILES

5 0 5 10 15 KILOMETRES

Base from U.S. Geological Survey, Detroit, 1961
and Grand Rapids, 1958

WATER RESOURCES OF THE HURON RIVER BASIN, SOUTHEASTERN MICHIGAN

By
R. W. Larson, W. B. Allen, and S. D. Hanson

1975

Interior—Geological Survey, Reston, Va.—1975