APPENDIX

D

WATER CLASSIFICATION SYSTEM

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Water Classification System

One of the stated goals in the Polk County Land Use Plan is to "*Protect and enhance the natural resources of the county.*" This goal is particularly relevant in a county that is considered by its residents to be "resource rich", such as Polk County. The purpose of the Water Classification System is to development a management system for what is considered to be the County's most significant natural resource – the surface waters of Polk County.

According to the Wisconsin Department of Natural Resources publication Wisconsin Lakes, Polk County has 436 (221 named and 215 unnamed) lakes, each with its own set of characteristics that contribute to its water and recreational qualities. As the development pressure for waterfront property has continued to increase in the County, so to has the need for a more systematic management of the County's surface waters. This water classification system recommends a carrying capacity approach to classifying the lakes, rivers and streams. This provides for a more customized management approach based on the differing lake characteristics and development potential.

A brief look at two simple and fundamental lake characteristics, size and shape, provides an orientation to the problem with Wisconsin's minimum state standard approach for land uses in shoreland areas. Figure A, in the *Relation of Lake Size (A) and Shape (B) to Potential Shoreline Pressure* diagram, shows two lakes of identical shape, but different size, super imposed on each other. Little Round Lake covers 50 water surface acres while Big Round Lake encompasses 200 acres. If we were to measure the shoreline length we would discover that although Big Round has four times the surface water acreage, its shoreline is only twice the length of Little Round. The diagram (figure B) also shows two lakes of identical size (50 water surface acres) but different shape – Long Lake and Round Lake. Although both lakes have the same surface area, Long Lake has 60 percent more shoreline length and is, therefore, potentially subject to much greater development and recreation user pressure, per water surface acre, than is Round Lake.

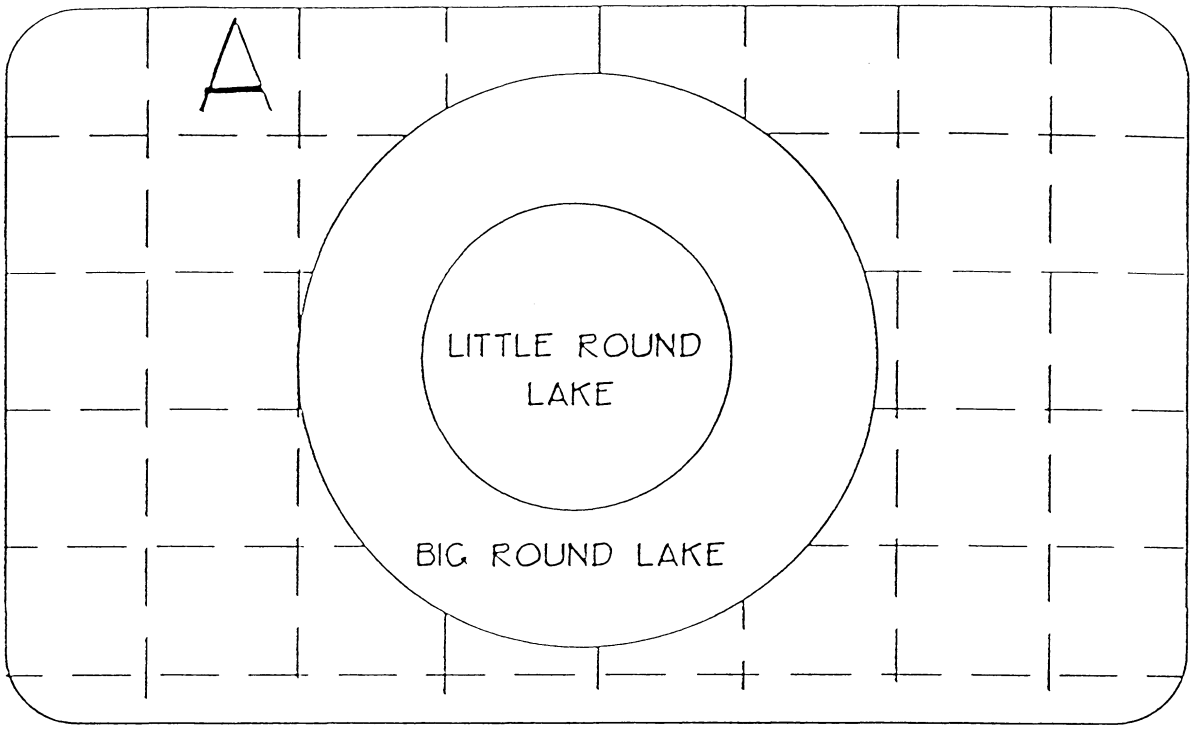
Table 1 shows how much the water surface area per developed shoreline lot would vary from lake to lake, if we assume that each lake could be fully developed at the state minimum standard of 100 feet per lot at the waterline. To the extent that we can agree that more water surface per lot generally translates into an increased capacity to carry or absorb the "shocks" (pollution, aesthetic degradation, etc.) that development imposes on the lake resource, we can conclude that large, regularly-shaped lakes (Big Round) have a greater absorptive capacity than do small, irregularly-shaped lakes (Long Lake).

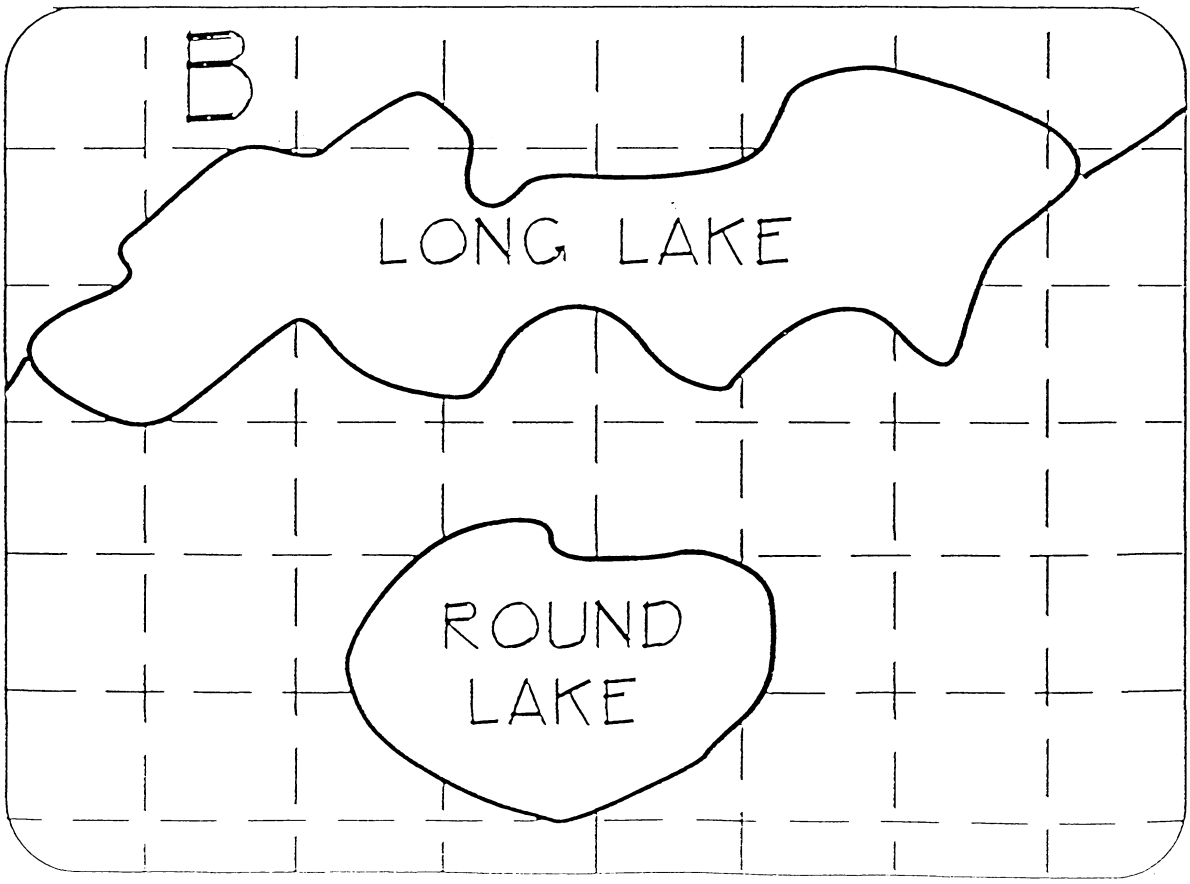
TABLE 1. FULL DEVELOPMENT POTENTIAL AND WATER SURFACE AREA PER LOT COMPARISON USING WISCONSIN MINIMUM LOT WIDTH (100 FEET)

Lake Name	Number Lots	WSA/Lot*
Long Lake (50 acres)	85	.59
Round Lake and Little Round Lake (50 acres)	53	.96
Big Round Lake (200 acres)	106	1.92

**** - Water Surface Area per Lot***

RELATION OF LAKE SIZE (A) AND SHAPE (B) TO POTENTIAL SHORELINE PRESSURE





In addition, the use of state standard (or any across-the-board standard of any dimension) ignores the existence of such variations. What we are not sure of, however, is precisely whether this is done at the expense of the most sensitive lakes (not protective enough), the least sensitive lakes (overly protective), or all lakes regardless of sensitivity (not protective enough or too protective).

The Classification System

Resource classification systems range from very simple sortings into several groups based on one or two distinctive characteristics to highly complex divisions derived from interrelating many variables. In the case of lakes resources, an extremely simple sort is often suggested in the names of the lakes – Clear Lake vs. Mud Lake, Bass or Trout Lakes, Big Spider Lake vs. Little Spider Lake, etc. Limnologists, on the other hand, spend much of their time studying all facets of inland waters and classifying them into numerous categories based on lake genesis, geography, and trophic status. What type of classification system gets used in a particular situation generally depends on judgments in four fundamental areas:

1. **The Nature of the Resource**. Lakes are complex and dynamic systems with highly individual characteristics. They are also systems that interrelate intensively with other ecosystems such as land, air, wildlife, and fisheries. In truth, man's understanding of lakes and their interrelationships falls far short of the ideal, and even within the limits of presently available knowledge, requires such time-consuming and expensive investigation that it is possible to establish relatively clear-cut, quantifiable cause and effect linkages only for a selected few demonstration projects. Contrariwise, man's studied observations concerning general lake processes are developed and accurate enough to permit and even encourage, practical "middle-ground" approaches to management.

2. **Data Availability**. Much information exists and can be utilized in classification systems ranging from the simple to the complex. In Wisconsin, for instance, at least three valuable sources are readily employable for local projects. One source is the Surface Water Resources report, prepared by the Department of Natural Resources, which exists for each county. It contains statistical tables with more than 20 different types of information on each lake in the jurisdiction. Another source is the even more detailed data that the DNR keeps stored on computer tapes. This again exists by individual lake within each jurisdiction. And, another important source is the firsthand experience and perceptions which local lake users can bring to bear through their participation in a classification project.

3. **Intended Use**. Consideration of use helps assure relevancy and efficiency. It does not make good sense to classify lake resources into eight groupings if only three divisions are to be used in the local land use program. Likewise, it does not really pay to devote a lot of effort to interrelating 24 different types of information if an interplay of three or four variables will accomplish almost the same result. And it is senseless to use an overly simple classification system, like lake names, if not all lake resources are named or if the names are misleading and inaccurately based on subjective and non-verifiable criteria. For instance, many lakes are not named at all and, of the named lakes, only a handful of the names are descriptive. Among the descriptive names are lakes such as Bass, Bluegill, and Round (shape) may be verifiable, but Red (color) and Snake (shape) may not be. The participants from the jurisdiction, therefore, may play a judgmental role in identifying what is of primary concern to them, what is ultimately desired, and in reviewing alternative classification systems for solving these problems and meeting their objectives.

4. **User Friendly System**. The classification system is one that can be understood and accepted by those who must live by it, as well as by those who must apply it. This is particularly important for land use programs. If people cannot follow the basic thrust of what is being done and why, they will probably challenge and reject it out of hand.

   In this classification methodology, the focus is placed on rating lakes according to vulnerability and development. The vulnerability determination amounts to scoring lakes on the basis of their physical parameters such as size, shape, depth, and flush potential. Regarding development, lakes are scored according to structures per mile of shoreline.

DATA INTERPRETATION

The system suggests that what is sought is a scheme that allows a locality to separate its highly vulnerable and undeveloped lake resources from those of lesser vulnerability and developed. The locality can then provide maximum land use protection to lakes which could be expected to benefit most from this type of management (the regulatory incentive is high). Lakes which stand to benefit little from land use measures, on the other hand, would receive only minimum protection (the regulatory incentive is low). Lakes that fall in between can be managed in accordance with a mid-level or moderate regulatory program. An alternative for these in between lakes could be to scrutinize them further until a clearer decision concerning their sensitivity can be determined. This might mean looking at a new set of data variables (public land ownership and access, existing development, type and distribution of soils) which, for one reason or another (not readily available, too complex, etc.), had been omitted in the initial classification system.

WATER CLASSIFICATION SYSTEM MODEL

The classification system utilizes a combination of natural resource factors that determine lake vulnerability or sensitivity and the amount of development on the lake. For all criteria, the lower the score the greater the vulnerability.

Vulnerability Criteria

- **Lake Surface Area**. Lake surface area is an important determinant of the ability of a lake to support shoreline development and avoid lake user conflicts. As a general rule, smaller lakes (under 50 acres in size) are more susceptible to environmental degradation and visual impacts resulting from shoreland development and intensive recreational use. The scoring factors are used to rank lakes based on their surface area.

Lake Surface Area	Scoring
Less than 50 acres	1
50 to 249 acres	2
250 or more acres	3

- **Maximum Depth**. Lake maximum depth is used as a second indicator of vulnerability. Shallower lakes, which do not stratify, have greater circulation of dissolved nutrients that enter the lakes. These lakes tend to have a larger variety of aquatic plant communities that are valuable for a wide range of wildlife and fish. Beds of aquatic plant materials can easily be disturbed by intensive water recreation use and shoreline activities, such as cutting and chemical treatment of aquatic vegetation to create swimming and docking areas.

  Shallow lakes are particularly susceptible to nutrient loading and turbidity problems, both of which can be increased by intensive shoreline development and recreational use. In general, shallower lakes are more appropriate for wildlife habitat protection and passive recreation than for motor boating, water skiing, and other more intensive lake uses associated with shoreline development. The scoring factors are used to rank lakes based on the maximum depth.

Maximum Lake Depth	Scoring
Less than 20 feet	1
20 to 39 feet	2
40 or more feet	3

- **Lake Type**. In Wisconsin, many of the smaller lakes are seepage lakes formed by groundwater seeping into depressions in the glacial outwash plain. Most of these lakes are "landlocked" and have no external drainage. These lakes are the most vulnerable to premature eutrophication and contamination caused by development in the shoreland zone.

  Drainage lakes flow into the surface water system of rivers and streams. These lakes, along with man-made impoundments, possess varying degrees of ability to naturally circulate and flush nutrients and other forms of contaminants, but generally these lakes are less vulnerable to environmental damage than the seepage lakes. A third category of lakes is spring lakes that are fed primarily by natural springs. These lakes have intermediate vulnerability. The scoring is used to rank lake vulnerability with respect to lake type.

Lake Type	Scoring
Seepage Lake (SE)	1
Spring Lake (SP)	2
Drainage Lake (DG)	3

- **Watershed Area**. The natural ability of lakes to flush and circulate water is also a function of watershed size, lake volume, and average rainfall. Lakes with larger watersheds tend to have a higher volume of water circulating through them and may have higher flushing rates.

  Lakes with smaller watersheds tend to have a lower nutrient input; however, nutrients accumulate because of longer retention times. Generally lakes with smaller watersheds and long retention times are more vulnerable to nutrient loading from activities that occur in the shoreland zone, which is a larger percent of the total watershed area. The scoring is used to rank lake vulnerability with respect to watershed size.

Watershed Size	Scoring
1 square mile or less	1

2 to 9 square miles	2
10 or more square miles	3

- **Shoreline Development Factor (SDF)**. Shoreline development factor (SDF) is a convenient method of expressing the degree of irregularity of the shoreline of a lake compared to the surface area. The SDF ratio is the length of shoreline versus the circumference of a circle having the same surface area as the lake. A perfectly round lake would have a surface area of 1.00. The SDF can never be less than 1.00.

  Lakes with a higher SDF have more shoreline in relation to the surface area and thus are more vulnerable to development pressures per linear foot of shoreline that is developed. These lakes can more easily become over-developed and are more susceptible to various types of contamination and runoff resulting from shoreline development. The scoring is used to rank lake vulnerability with respect to the shoreline development factor (SDF).

Shoreline Development Factor (SDF)	Scoring
2.00 or Greater	1
1.50 to 1.99	2
1.00 to 1.49	3

- **Overall Vulnerability Scores**

  The vulnerability scores are then totaled for each lake. The scores are then graphed to determine a distribution pattern. Breakpoints were selected based on the scoring distribution as follows:

Overall Score	Vulnerability
5 to 6	High
7 to 9	Moderate
10+	Low

Current Level of Development

- **Development Density**. The existing level of residential density around a lake or on a river is an indicator of a water body's development status.

  In previous studies, a development density near 200 feet per structure indicates a high density ratio. This high development density in most cases indicates that the majority of the shoreline is developed and that the potential for additional new single-family dwellings is low. A lake with a high development density normally will score high and fall into the category of lakes requiring less development protection measures.

Development Density (structures per mile)	Rating
0 to 13	Low

14 to 25	Moderate
26+	High

Combined Ratings (Vulnerability and Development)

To determine a final classification, the two factors, vulnerability and development density, were combined. Based on the various combinations the lakes were assigned to one of the three classes according to the following matrix:

WATER CLASSIFICATION MATRIX
POLK COUNTY WATER CLASSIFICATION SYSTEM

	DEVELOPMENT LEVEL		
Vulnerability	**Low**	**Moderate**	**High**
High	**3**	**3**	**2**
Moderate	**3**	**2**	**1**
Low	**2**	**1**	**1**

CLASS 1 Least restrictive regulations. Address remediation and mitigate impacts of new development.

CLASS 2 Moderate restrictive. Mitigate new development, protect water quality, habitat, and natural aesthetics.

CLASS 3 Most restrictive. Permit low-density development.

Lakes twenty (20) acres and smaller, and all rivers and streams, are classified as Class 3. All unnamed lakes not appearing in the DNR's Surface Water Resources of Polk County publication are considered Class 3 lakes. Any named lake inadvertently omitted from the DNR listing will be classified according to available information.

LAKE VULNERABILITY SCORES
POLK COUNTY WATER CLASSIFICATION SYSTEM

Lake	Township-Range-Section	Surface Area (acres)	Score	Maximum Depth (feet)	*Score*	Lake Type	Score	Miles of Shoreline	*SDF*	Score	Watershed Area (sq. miles)	*Score*	Vulnerability Score
Alabama (Long)	36-18-17	98	2	28	2	SE	1	4.4	3.17	1	3	2	8
Andrus (Little Round)	36-15-31	25	1	12	1	DG	3	.9	1.29	3	3	2	10
Antler (Pine)	35-17-12	101	2	22	2	SE	1	2.8	1.99	2	1	1	8
Apple River Flowage	33-16-0	639	3	18	1	DG	3	19.8	5.59	1	134	3	11
Aspen	37-17-15	11	1	13	1	SE	1	.6	1.29	1	1	1	5
Baker	37-16-1	22	1	9	1	SE	1	.9	1.37	1	1	1	5
Balsam	34-17-2	2,054	3	37	2	SE	1	22.7	3.57	1	243	3	10
Barbo	33-15-27	44	1	4	1	SE	1	1.0	1.08	3	11	3	9
Barneys	34-18-28	6	1	7	1	SE	1	.4	1.17	3	1	1	7
Bass	36-15-31	138	2	19	1	SE	1	3.8	2.30	1	12	3	8
Bass	36-19-23	78	2	26	2	SE	1	2.0	1.62	2	1	1	8
Basswood (Bass)	33-17-9	22	1	10	1	SE	1	.9	1.37	3	1	1	7
Bear	33-17-7	160	2										
Bear Trap	33-17-25	241	2	25	2	DG	3	3.5	1.61	2	2	2	11
Beautiful	34-16-23	30	1	17	1	SE	1	1.0	1.30	3	1	1	7
Beede	35-19-25	3	1	10	1	SE	1	.5	2.06	1	1	1	5
Big	33-18-36	259	3	24	2	SE	1	3.0	1.33	3	3	2	11
Big Blake (Beautiful)	35-16-27	302	3	14	1	DG	3	6.7	2.75	1	21	3	11
Big Butternut	36-17-27	378	3	19	1	DG	3	3.4	1.25	3	5	2	12
Big Round	35-16-13	1,015	3	17	1	SE	1	5.7	1.28	3	16	3	11
Black		11	1	6	1	SE	1						
Black Brook Flowage	32-16-18	98	2	23	2	DG	3	5.0	3.60	1	163	3	11
Blom (Bloom)	37-17-4	208	2	13	1	DG	3	2.7	1.34	3	1	1	10
Bone	32-16-27	48	1	5	1	SE	1	2.3	2.37	1	1	1	5
Bone	35-16-7	1,781	3	43	3	DG	3	13.0	2.20	1	15	3	13
Briar	37-16-1	13	1	6	1	SE	1	.6	1.19	3	1	1	7
Bridget (Mud)	34-17-33	95	2	7	1	DG	3	2.4	1.76	2	16	3	11
Brusher	34-16-29	67	2	17	1	SE	1	1.6	1.40	3	1	1	8
Bullhead	36-18-15	7	1	7	1	SE	1	.4	1.08	3	1	1	7
Camelia	33-15-23	60	2	6	1	SE	1	1.6	1.47	3	1	1	8
Camp Douglas	35-17-19	10	1	4	1	SE	1	.5	1.13	3	1	1	7
Cedar	32-18-34	1,107	3	28	2	DG	3	5.6	1.42	3		3	14
Center (Big)	35-18-19	65	2	12	1	SE	1	1.5	1.15	3	1	1	8
Church Pine (Pine)	32-18-12	107	2	45	3	DG	3	2.4	1.66	2	1	1	11
Clam Falls Flowage	37-16-13	127	2	14	1	DG	3	6.3	3.99	1	43	3	10
Clara	35-16-25	56	2	71	3	SE	1	1.4	1.34	3	1	1	10
Clarey (Twin)	35-18-18	34	1	49	3	SE	1	1.6	1.96	2	1	1	8
Clauson	36-18-32	11	1	6	1	SE	1	.8	1.72	2	1	1	6
Clear	32-15-18	30	1	26	2	SE	1	1.4	1.83	2	1	1	7
Clover	34-16-29	17	1	6	1	SE	1	1.3	2.25	1	1	1	5
Coon	37-17-27	54	2	16	1	SE	1	1.3	1.26	3	1	1	8
Crescent (Pickerel)	36-16-25	19	1	45	3	SE	1	.9	1.85	2	1	1	8
Crooked	37-16-35	12	1	6	1	SE	1	.9	1.47	3	1	1	7
Dace (Mud)	34-15-16	11	1	15	1	SE	1	.6	1.29	3	1	1	7
Dahl	36-16-28	32	1	10	1	SE	1	2.0	2.52	1	1	1	5
Deer	34-17-30	807	3	46	3	DG	3	7.7	1.93	2	12	3	14
Deer	35-19-15	4	1	15	1	SE	1	.3	1.07	3	1	1	7

Lake	Township-Range-Section	Surface Area (acres)	Score	Maximum Depth (feet)	*Score*	Lake Type	Score	Miles of Shoreline	*SDF*	Score	Watershed Area (sq. miles)	*Score*	Vulnerability Score
Deer	36-15-23	16	1	5	1	SE	1	1.0	1.78	2	1	1	6
Denny	37-15-15	12	1	8	1	SE	1	1.0	2.06	1	1	1	5
Depot	36-16-27	3	1	8	1	SE	1	.4	1.63	2	1	1	6
Deronda (Mud)	33-17-26	19	1	12	1	DG	3	1.0	1.64	2	59	3	10
Diamond	37-17-3	126	2	15	1	SE	1	4.0	2.54	1	1	1	6
Dinger	37-15-30	16	1	16	1	SE	1	.8	1.43	3	1	1	7
East (Volga)	34-16-18	73	2	6	1	SE	1	1.3	1.09	3	1	1	8
East	35-17-33	15	1	8	1	SE	1	.7	1.29	3	1	1	7
Elkins	34-17-4	38	1	15	1	SE	1	1.3	1.50	2	1	1	6
Ellofson	36-18-21	9	1	6	1	SE	1	.5	1.19	3	1	1	7
Ember	36-15-22	13	1	6	1	DG	3	1.0	1.98	2	1	1	8
Evergreen (Deer)	36-19-26	16	1	8	1	SE	1	1.1	1.96	2	1	1	6
Fern	37-17-1	17	1	7	1	SE	1	.9	1.61	2	1	1	6
Fish (South)	32-17-27	75	2										
Footes	35-15-6	55	2	8	1	SE	1	1.0	1.10	3	1	1	8
Forsythe	36-18-11	30	1	12	1	DG	3	1.5	1.96	2	1	1	8
Fountain	37-17-21	24	1	20	2	DG	3	.9	1.31	3	1	1	10
Freedom	36-18-2	106	2	4	1	DG	3	2.3	1.59	2	3	2	10
French	32-15-7	15	1	11	1	DG	3	.6	1.10	3	11	3	11
Gabrielson (Gabelson)	36-18-5	38	1	35	2	SE	1	1.4	1.70	2	1	1	7
Garfield (Big Horseshoe)	33-17-29	120	2	8	1	SE	1	1.8	1.17	3	1	1	8
Gibson	34-16-34	43	1	12	1	SE	1	1.0	1.09	3	1	1	7
Gilbert	33-15-15	14	1	14	1	SE	1	.6	1.14	3	1	1	7
Glovers	35-15-33	18	1	7	1	SE	1	.9	1.51	2	1	1	6
Godfrey	37-16-28	30	1	15	1	DG	3	1.0	1.30	3	1	1	9
Grandquist	36-19-12	7	1	10	1	SE	1	.4	1.08	3	1	1	7
Grass	34-15-22	56	2	3	1	SE	1	1.3	1.24	3	2	2	9
Greeley	33-15-26	20	1	6	1	SE	1	.9	1.44	3	1	1	7
Grenquist	36-15-26	58	1	10	1	SE	1	1.5	1.40	3	3	2	8
Grimhs	37-17-6	31	1	43	3	SE	1	1.1	1.41	3	1	1	9
Grouse	36-15-23	23	1	10	1	SE	1	1.4	1.80	2	1	1	6
Half Moon	35-17-25	579	3	60	3	DG	3	7.1	2.11	1	7	2	12
Hamble (Twin)	35-18-18	15	1	74	3	SE	1	.9	1.65	2	1	1	8
Hatchet	37-17-29	17	1	15	1	SE	1	1.2	2.08	1	1	1	5
Hawthorn	37-16-20	12	1	6	1	SE	1	.6	1.24	3	1	1	7
Herby (Lanesdale, Twin)	36-18-19	69	2	36	2	SE	1	2.4	2.07	1	1	1	7
Hickory	37-17-15	18	1	14	1	SE	1	.6	2.69	1	1	1	5
Highland	35-15-24	11	1	3	1	SE	1	.7	1.51	2	1	1	6
Hoover	35-19-14	4	1	52	3	SE	1	.3	1.07	3	1	1	9
Horse	33-18-27	228	2	11	1	DG	3	3.0	1.41	3	11	3	12
Horseshoe (Jensen)	35-18-6	35	1	8	1	SE	1	1.6	1.93	2	3	2	7
Horseshoe	34-15-13	377	3	57	3	SE	1	6.5	2.39	1	5	3	11
Ice	37-16-16	20	1	11	1	SE	1	.8	1.28	3	1	1	7
Ice House	32-15-18	6	1	35	2	SE	1	.4	1.17	3	1	1	8
Island	32-16-30	32											
Island	32-18-5	20											
Joel Flowage	34-15-34	65	2	8	1	DG	3	3.4	3.01	1	6	2	9
Johansen (Johnson)	36-16-28	32	1	19	1	SE	1	1.2	1.51	2	1	1	6
Johnson	36-15-26	38	1	12	1	SE	1	1.4	1.62	2	1	1	6

Lake	Township-Range-Section	Surface Area (acres)	Score	Maximum Depth (feet)	*Score*	Lake Type	Score	Miles of Shoreline	*SDF*	Score	Watershed Area (sq. miles)	*Score*	Vulnerability Score
Kenabee	33-16-6	29	1	7	1	SE	1	1.1	1.46	3	1	1	7
Kenny	35-17-13	6	1	7	1	SE	1	.4	1.17	3	1	1	7
King (Pine)	32-16-5	49	1	14	1	SE	1	1.7	1.73	2	1	1	6
Knapp Flowage	37-16-8	35	1	12	1	DG	3	3.2	3.86	1	7	2	8
Knife	35-19-14	7	1	55	3	SE	1	.6	1.62	2	1	1	8
Lake Evelyn	35-16-1	3	1	20	2	DG	3	.3	1.24	1	1	1	8
Lake O'The Dalles (Thaxter)	34-19-36	23	1	12	1	SE	1	1.1	1.64	2	1	1	6
Lake Round(Dwight)	33-18-26	67	2	26	2	DG	3	1.6	1.40	3	2	2	12
Lamont	36-15-30	96	2	28	2	SE	1	2.9	2.11	1	1	1	7
Land	37-17-30	10	1	5	1	SE	1	.7	1.58	2	1	1	6
Largon	36-15-10	129	2	10	1	DG	3	2.3	1.45	3	1	1	10
Larsen	31-17-6	21	1	8	1	SE	1	.7	1.09	3	4	2	8
Laurel		14	1	6	1	SE	1	.7	1.34	3	1	1	7
Lee	32-18-13	8	1	6	1	SE	1	.5	1.26	3	1	1	7
Lees	35-18-12	5	1	7	1	SE	1	.4	1.27	3	1	1	7
Legoo	35-19-26	2	1	8	1	SE	1	.2	1.01	3	1	1	7
Lincoln	33-16-34	11	1	3	1	SE	1	.5	1.08	3	3	2	8
Little Bass	34-17-16	21	1	15	1	SE	1	.8	1.25	3	1	1	7
Little Butternut	36-17-32	189	2	23	2	DG	3	2.4	1.25	3	2	2	12
Little Horseshoe	34-15-22	54	2	28	2	SE	1	2.2	2.14	1	1	1	7
Little Horseshoe	35-18-6	8	1	6	1	SE	1	.6	1.51	2	1	1	6
Little Largon	36-15-11	19	1	29	2	SE	1	1.0	1.64	2	2	2	8
Little Mirror (Pickerel)	36-18-28	33	1	13	1	SE	1	.9	1.12	3	1	1	7
Little Pine	36-16-13	61	2	10	1	SE	1	1.9	1.73	2	1	1	7
Little Round	34-15-9	67	2	8	1	DG	3	1.4	1.22	3	9	2	11
Little Ward	36-16-23	18	1	7	1	SE	1	.7	1.17	3	1	1	7
Lone Pine	36-18-6	17	1	20	2	SE	1	.7	1.21	3	1	1	8
Long (Helbig)	35-15-26	65	2	44	3	SE	1	2.4	2.12	1	1	1	8
Long	32-16-27	20	1	3	1	SE	1	1.0	1.59	2	1	1	6
Long	34-17-7	272	3	17	1	SE	1	4.2	1.82	2	3	2	9
Long Trade	36-18-9	153	2	13	1	DG	3	4.0	2.30	1	45	3	10
Lost	35-16-15	60	2	15	1	DG	3	1.4	1.29	3	1	1	10
Lost	35-17-24	10	1	6	1	SE	1	.5	1.13	3	1	1	7
Lotus (East)	33-18-21	246	2	15	1	DG	3	3.3	1.50	2	6	2	10
Loveless (Bass)	34-17-8	141	2	20	2	DG	3	2.5	1.50	2	1	1	10
Lykens	34-17-22	19	1	10	1	SE	1	1.3	2.13	1	1	1	5
Mackie	36-15-7	34	1	5	1	SE	1	.9	1.10	3	1	1	7
Magnor (Richardson)	33-15-27	231	2	26	2	SE	1	2.6	1.22	3	6	2	10
Manitou	35-19-12	17	1	10	1	SE	1	.9	1.56	2	1	1	6
Mansen	32-17-8	18	1	12	1	SE	1	1.2	2.02	1	1	1	5
Margaret	36-16-1	43	1	17	1	SE	1	1.1	1.20	3	1	1	7
Marsh	36-16-2	4	1	4	1	SE	1	.1	1.19	3	1	1	7
Martell	35-15-2	39	1	20	2	SE	1	2.0	2.29	1	1	1	6
McKeith	36-18-31	72	2	8	1	SE	1	3.4	2.87	1	4	2	7
McKenzie	36-16-13	60	2	25	2	DG	3	1.3	1.20	3	1	1	11
Meadow (Bog)	35-19-11	7	1	51	3	SE	1	.4	1.08	3	1	1	9
Miller Camp	35-15-2	12	1	10	1	SE	1	.6	1.39	3	1	1	7
Moccasin (Long)	36-16-20	55	2	31	2	SE	1	1.4	1.52	2	2	2	9
Mud	33-15-26	7	1	3	1	SE	1	.4	1.20	3	1	1	7

Lake	Township-Range-Section	Surface Area (acres)	Score	Maximum Depth (feet)	*Score*	Lake Type	Score	Miles of Shoreline	*SDF*	Score	Watershed Area (sq. miles)	*Score*	Vulnerability Score
Mud	33-18-26	43	1	12	1	SE	1	1.3	1.42	3	1	1	7
Mud	34-15-1	55	2										
Mud	34-16-18	10	1	4	1	SE	1	.6	1.35	3	1	1	7
Mud	36-15-22	15	1	7	1	SE	1	.6	1.11	3	1	1	7
Mullins	36-16-36	7	1	21	2	SE	1	.5	1.35	3	1	1	8
Nimon (Nieman)	36-19-24	17	1	6	1	SE	1	.6	1.04	3	1	1	7
North Fish (Fish)	32-17-27	56	2	4	1	SE	1	1.9	1.81	2	1	1	7
Orr	36-19-11	25	1	12	1	DG	3	1.2	1.71	2	2	2	9
Osceola	32-18-6	38	1	14	1	DG	3	1.1	1.27	3	1	1	9
Otter	35-17-16	20	1										
Palmer	33-15-7	15	1	2	1	SE	1	.7	1.29	3	1	1	7
Parker	34-17-14	12	1	8	1	SE	1	.7	1.44	3	1	1	7
Paulsen (Alden)	32-17-18	26	1	21	2	SE	1	.9	1.26	3	1	1	8
Paulson	33-15-33	26	1	12	1	SE	1	1.3	1.82	2	1	1	6
Peaslee	33-19-10	23	1	2	1	DG	3	.9	1.34	3	1	1	9
Pike	33-16-29	159	2	33	2	SE	1	4.7	2.66	1	1	1	7
Pine Island	36-19-13	16	1	7	1	SE	1	.9	1.61	2	1	1	6
Pine (Larch)	33-17-15	46	1	6	1	SE	1	1.4	1.47	1	1	1	5
Pine	32-18-23	82	2	34	2	SE	1	2.0	1.58	2	1	1	8
Pine	36-16-24	153	2	15	1	SE	1	3.1	1.79	2	1	1	7
Pine, Lower	32-18-23	90	2	102	3	SE	1	1.7	1.28	3	1	1	10
Pipe	35-15-15	345	3	68	3	SE	1	6.9	2.65	1	6	2	10
Pipe, North	35-15-10	55	2	37	1	SE	1	1.6	1.54	2	6	2	8
Pleasant	32-18-5	45	1										
Pogo (Big)	36-16-33	14	1	17	1	SE	1	.8	1.53	2	1	1	6
Poplar	33-18-4	125	2	34	2	SE	1	2.1	1.34	3	2	2	10
Rhinstad	36-16-25	9	1	17	1	SE	1	.5	1.19	3	1	1	7
Rice	32-18-11	98	2	6	1	DG	3	1.9	1.37	3	1	1	10
Rice	35-19-11	4	1	18	1	SE	1	.3	1.07	3	1	1	7
Rice (Cattail)	33-19-10	57	2	3	1	DG	3	2.0	1.89	2	1	1	9
Rice (Glenton)	35-17-20	128	2	10	1	DG	3	2.6	1.64	2	1	1	9
Roger	36-19-14	17	1	12	1	DG	3	1.2	2.08	1	8	2	8
Round	34-18-36	10	1	6	1	SE	1	.6	1.35	3	1	1	7
Round (Cushing)	36-18-31	39	1	38	2	SE	1	1.0	1.29	3	1	1	8
Round (Heath)	35-15-23	23	1	20	2	SE	1	1.5	2.23	1	2	2	7
Sand	33-18-2	187	2	58	3	SE	1	2.6	1.36	3	3	2	11
Sandhill (Sand)	36-18-34	44	1	12	1	SE	1	1.3	1.40	3	1	1	7
Sedge	36-15-19	20	1	3	1	DG	3	.7	1.12	3	1	1	9
Shiloh	34-16-28	19	1	12	1	DG	3	1.4	2.29	1	88	3	9
Silver	34-15-15	28	1	26	2	SE	1	1.3	1.75	2	1	1	7
Simpson	36-19-26	5	1	5	1	SE	1	.4	1.30	1	1	1	5
Skinaway	34-15-25	37	1	10	1	SE	1	1.2	1.75	2			
Snake	34-15-3	14											
Snowshoe	36-15-25	13	1	8	1	SE	1	1.1	2.18	1	1	1	5
Somers	37-16-27	101	2	12	1	DG	3	1.8	1.28	3	4	2	11
Spur (Little Pine)	35-17-10	54	2	14	1	SE	1	1.9	1.85	2	1	1	7
Square	34-16-9	35	1	11	1	SE	1	.9	1.09	3	1	1	7
Staples	35-15-25	305	3	17	1	DG	3	3.4	1.57	2			
Straight	36-17-13	107	2	12	1	DG	3	1.7	1.17	3	3	2	11

Lake	Township-Range-Section	Surface Area (acres)	Score	Maximum Depth (feet)	*Score*	Lake Type	Score	Miles of Shoreline	*SDF*	Score	Watershed Area (sq. miles)	*Score*	Vulnerability Score
Surprise	32-18-15	14	1	3	1	SE	1	.9	1.71	2	1	1	6
Swede	32-18-13	68	2	32	2	SE	1	1.7	1.47	3	1	1	9
T Lake	35-18-18	11	1	45	3	SE	1	1.0	2.15	1	1	1	7
Tarbert (Tabor, Twin)	36-18-20	42	1	20	2	SE	1	1.6	1.44	3	1	1	8
Toby Spring	34-17-21	1	1	6	1	SP	1	.3	2.14	1	1	1	5
Trident (Pine, King)	32-16-6	43	1	7	1	SE	1	2.3	1.74	2	1	1	6
Tula	36-16-2	15	1	5	1	SE	1	.7	1.29	3	1	1	7
Tuttle	35-18-30	27	1	2	1	SE	1	1.3	2.00	1	1	1	5
Twenty-Ninth	35-17-32	29	1	7	1	SE	1	.9	1.19	3	1	1	7
Twin	34-16-25	10	1	22	2	SE	1	.5	1.13	3	1	1	8
Twin, East	35-19-14	60											
Twin, North	33-16-29	135	2	27	2	DG	3	2.5	1.54	2	6	2	11
Twin, South	33-16-32	74	2	9	1	DG	3	1.5	1.24	3	6	2	11
Twin, West	35-19-14	40											
Vincent	35-16-9	70	2	15	1	SE	1	2.6	2.20	1	1	1	6
Wallin	36-18-21	8	1	7	1	SE	1	.5	1.26	3	1	1	7
Wapogasset	33-17-23	1,186	3	32	2	DG	3	9.9	2.05	1	59	3	12
Ward	36-16-14	91	2	43	3	SE	1	2.3	1.72	2	1	1	9
Weiss	37-16-16	9	1	7	1	SE	1	.6	1.43	3	1	1	7
White Ash	34-16-11	153	2	6	1	DG	3	2.5	1.44	3	33	3	12
White Ash, North	34-16-2	119	2	9	1	DG	3	2.1	1.37	3	2	2	11
Wild Goose	34-17-13	182	2	12	1	SE	1	2.0	1.06	3	1	1	8
Wind (Round)	32-18-1	38	1	7	1	DG	3	1.1	1.16	3	1	1	9
Wintergreen	36-15-23	32	1	12	1	SE	1	.8	1.01	3	1	1	7
Wolf	36-19-13	72	2	22	2	DG	3	1.4	2.09	1	3	2	10
Woodsman (Mud)	36-18-18	31	1	9	1	SE	1	.9	1.15	3	1	1	7
Young	37-17-29	30	1	10	1	SE	1	1.2	1.56	3	1	1	7

DEVELOPMENT DENSITY (DWELLINGS PER MILE)
POLK COUNTY WATER CLASSIFICATION SYSTEM

Lake	Number of Dwellings	*Dwellings/ Mile*	Lake	Number of Dwellings	*Dwellings/ Mile*
Alabama (Long)	4	.9	Little Horseshoe (34-15-22)	2	1
Andrus (Little Round)	1	.9	Little Mirror (Pickerel)	10	10
Antler (Pine)	0	0	Little Pine	1	.5
Apple River Flowage	274	14	Little Round	3	2
Baker	0	0	Long (Helbig)	34	15
Balsam	532	23	Long (34-17-7)	175	41
Barbo	0	0	Long Trade	46	11.5
Bass (36-15-31)	0	0	Lost (35-16-15)	0	0
Bass (36-19-23)	4	2	Lotus (East)	11	3
Basswood (Bass)	3	3	Loveless (Bass)	83	33
BEAR	4	NA	Mackie	0	0
Bear Trap	174	48	Magnor (Richardson)	96	37
Beautiful	2	2	Margaret	0	0
Big	126	42	Martell	8	4
Big Blake (Beautiful)	118	18	McKeith	3	.9
Big Butternut	100	29	McKenzie	0	0
Big Round	104	18	Moccasin (Long)	23	16
Black Brook Flowage	148	30	Mud (33-18-26)	0	0
Blom (Bloom)	1	.4	Mud (34-15-1)	0	0
Bone (32-16-27)	3	1	North Fish (Fish)	7	4
Bone (35-16-7)	356	27	Orr	0	0
Bridget (Mud)	13	5	Osceola	2	2
Brusher	4	3	Paulsen (Alden)	29	32
Camelia	1	.6	Paulson	3	2
Cedar	176	31	Peaslee	0	0
Center (Big)	4	3	Pike	64	14
Church Pine (Pine)	62	26	Pine (Larch)	1	.7
Clam Falls Flowage	3	.5	Pine (32-18-23)	18	9
Clara	17	12	Pine (36-16-24)	33	11
Clarey (Twin)	18	11	Pine, Lower	45	26
Clear	7	5	Pipe	110	16
Coon	0	0	Pipe, North	30	19
Dahl	7	4	Pleasant	4	NA
Deer (34-17-30)	322	42	Poplar	55	26
Diamond	10	3	Rice (32-18-11)	1	.5
East (Volga)	6	5	Rice (Cattail)	0	0
Elkins	6	5	Rice (Glenton)	1	.4
Fish (South)	7	NA	Round (Cushing)	3	3
Footes	0	0	Round (Heath)	2	1
Forsythe	5	3	Sand	46	18
Fountain	0	0	Sandhill (Sand)	26	20
Freedom	5	2	Silver	16	12
Gabrielson (Gabelson)	0	0	Skinaway	4	3
Garfield (Big Horseshoe)	3	2	Somers	2	1
Gibson	1	1	Spur (Little Pine)	3	2
Godfrey	0	0	Square	0	0
Grass	0	0	Staples	14	4
Greeley	0	0	Straight	0	0
Grenquist	10	7	Swede	29	17
Grimhs	2	2	Tarbert (Tabor, Twin)	3	2
Grouse	0	0	Trident (Pine, King)	4	2
Half Moon	132	19	Tuttle	2	2
Herby (Lanesdale, Twin)	23	10	Twenty-Ninth	2	2
Horse	45	15	Twin, East	0	0
Horseshoe (Jensen)	0	0	Twin, North	75	29
Horseshoe (34-15-13)	119	18	Twin, South	31	20
Island (32-16-30)	0	0	Twin, West	0	0
Joel Flowage	2	.6	Vincent	2	.8
Johansen (Johnson)	2	3	Wapogasset	389	39
Johnson	0	0	Ward	43	19
Kenabee	3	3	White Ash	65	26
King (Pine)	13	8	White Ash, North	64	30
Knapp Flowage	1	.3	Wild Goose	37	19
Lake O'The Dalles (Thaxter)	1	1	Wind (Round)	47	43
Lake Round(Dwight)	40	25	Wintergreen	0	0
Lamont	8	3	Wolf	0	0
Largon	32	14	Woodsman (Mud)	0	0
Little Bass	0	0	Young	8	7
Little Butternut	34	14			

VULNERABILITY AND DEVELOPMENT CLASSIFICATIONS OF LAKES OVER 20 ACRES
POLK COUNTY WATER CLASSIFICATION SYSTEM

Lake	Lake Vulnerability	Development Density	LAKE CLASSIFICATION
Alabama	Moderate	Low	3
Andrus (Little Round)	Low	Low	2
Antler (Pine)	Moderate	Low	3
Apple River Flowage	Low	Moderate	1
Baker	High	Low	3
Balsam	Low	Moderate	1
Barbo	Moderate	Low	3
Bass (36-15-31)	Moderate	Low	3
Bass (36-19-23)	Moderate	Low	3
Basswood (Beautiful)	Moderate	Low	3
Bear	N/A	N/A	N/A
Bear Trap	Low	High	1
Beautiful	Moderate	Low	3
Big	Low	High	1
Big Blake (Beautiful)	Low	Moderate	1
Big Butternut	Low	High	1
Big Round	Low	Moderate	1
Black Brook Flowage	Low	High	1
Blom (Bloom)	Low	Low	2
Bone (32-16-27)	High	Low	3
Bone (35-16-7)	Low	High	1
Bridget (Mud)	Low	Low	2
Brusher	Moderate	Low	3
Camelia	Moderate	Low	3
Cedar	Low	High	1
Center (Big) (35-18-19)	Moderate	Low	3
Church Pine (Pine)	Low	High	1
Clam Falls Flowage	Low	Low	2
Clara	Low	Low	2
Clarey (Twin)	Moderate	Low	3
Clear	Moderate	Low	3
Coon	Moderate	Low	3
Dahl	High	Low	3
Deer (34-17-30)	Low	High	1
Diamond	High	Low	3
East (Volga)	Moderate	Low	3
Elkins	High	Low	3
Fish (South)	N/A	N/A	N/A
Footes	Moderate	Low	3
Forsythe	Moderate	Low	3
Fountain	Low	Low	2
Freedom	Low	Low	2
Gabrielson (Gabelson)	Moderate	Low	3
Garfield (Big Horshshoe)	Moderate	Low	3
Gibson	Moderate	Low	3
Godfrey	Moderate	Low	3
Grass	Moderate	Low	3
Grenquist	Moderate	Low	3

Lake	Lake Vulnerability	Development Density	LAKE CLASSIFICATION
Grimhs	Moderate	Low	3
Grouse	High	Low	3
Half Moon	Low	Moderate	1
Herby (Lanesdale, Twin)	Moderate	Low	3
Horse	Low	Moderate	1
Horseshoe (Jensen)(35-18-6)	Moderate	Low	3
Horseshoe (34-15-13)	Low	Moderate	1
Island (32-16-30)	N/A	N/A	N/A
Joel Flowage	Moderate	Low	3
Johansen (Johnson)	High	Low	3
Johnson	High	Low	3
Kenabee	Moderate	Low	3
King (Pine)	High	Low	3
Knapp Flowage	Moderate	Low	3
Lakes O'the Dalles (Thaxter)	High	Low	3
Lake Round (Dwight)	Low	Moderate	1
Lamont	Moderate	Low	3
Largon	Low	Moderate	1
Larsen	Moderate	Low	3
Little Bass	Moderate	Low	3
Little Butternut	Low	Moderate	1
Little Horseshoe (34-15-22)	Moderate	Low	3
Little Mirror	Moderate	Low	3
Little Pine	Moderate	Low	3
Little Round	Low	Low	2
Long (Helbig)	Moderate	Moderate	2
Long (34-17-7)	Moderate	High	1
Long Trade	Low	Low	2
Lost	Low	Low	2
Lotus (East)	Low	Low	2
Loveless (Bass)	Low	High	1
Mackie	Moderate	Low	3
Magnor (Richardson)	Low	High	1
Margaret	Moderate	Low	3
Martell	High	Low	3
McKeith	Moderate	Low	3
McKenzie	Low	Low	2
Moccasin (Long)	Moderate	Moderate	2
Mud (33-18-26)	Moderate	Low	3
Mud (34-15-1)	Moderate	Low	3
North Fish (Fish)	Moderate	Low	3
Orr	Moderate	Low	3
Osceola	Moderate	Low	3
Paulsen (Alden)	Moderate	High	1
Paulson	High	Low	3
Peaslee	Moderate	Low	3
Pike	Moderate	Moderate	2
Pine (Larch)	High	Low	3
Pine (32-18-23)	Moderate	Low	3
Pine (36-16-24)	Moderate	Low	3
Pine, Lower	Low	High	1

Lake	Lake Vulnerability	Development Density	LAKE CLASSIFICATION
Pipe	Low	Moderate	1
Pipe, North	Moderate	Moderate	2
Pleasant	N/A	N/A	N/A
Poplar	Low	High	1
Rice	Low	Low	2
Rice (Cattail)	Moderate	Low	3
Rice (Glenton)	Moderate	Low	3
Round (Cushing)	Moderate	Low	3
Round (Heath)(35-15-23)	Moderate	Low	3
Sand	Low	Moderate	1
Sandhill (Sand)	Moderate	Moderate	2
Silver	Moderate	Low	3
Skinaway	Moderate	Low	3
Somers	Low	Low	2
Spur (Little Pine)	Moderate	Low	3
Square	Moderate	Low	3
Staples	Low	Low	2
Straight	Low	Low	2
Swede	Moderate	Moderate	2
Tarbert (Tabor, Twin)	Moderate	Low	3
Trident (Pine, King)	High	Low	3
Tuttle	High	Low	3
Twenty-Ninth	Moderate	Low	3
Twin, East	N/A	N/A	N/A
Twin, North	Low	High	1
Twin, South	Low	Moderate	1
Twin, West	N/A	N/A	N/A
Vincent	High	Low	3
Wapogasset	Low	High	1
Ward	Moderate	Moderate	2
White Ash	Low	High	1
White Ash, North	Low	High	1
Wild Goose	Moderate	Moderate	2
Wind (Round)	Moderate	High	1
Wintergreen	Moderate	Low	3
Wolf	Low	Low	2
Woodsman (Mud)	Moderate	Low	3
Young	Moderate	Low	3

VULNERABILITY AND DEVELOPMENT CLASSIFICATIONS OF LAKES OVER 20 ACRES
POLK COUNTY WATER CLASSIFICATION SYSTEM

Class 1 – Least Restrictive

Apple River Flowage
Bear Trap
Big
Big Blake (Beautiful)
Big Butternut
Big Round
Black Brook Flowage
Bone 35N-16W-06
Cedar
Church Pine (Pine)
Deer 34N-17W-29
Half Moon
Horse
Horseshoe 34N-15W-13
Lake Round (Dwight)
Little Butternut
Sand
Wapogasset
White Ash
White Ash, North

Class 2 – Moderately Restrictive

Andrus (Little Round)
Balsam
Blom (Bloom)
Bridget (Mud)
Clam Falls Flowage
Clara
Clarey (Twin)
Deronda (Mud)
Fountain
Freedom
French
Grimhs
Horseshoe 34N-14W-06
Joel Flowage
Largon
Little Round
Long (Helbig) 35N-15W-25
Long 34N-17W-06
Long Trade
Lost 35N-16W-15
Lotus (East) 33N-18W-21
Loveless (Bass)
Magnor (Richardson)
McKenzie
Moccasin (Long)
Osceola
Paulsen (Alden)
Pine 32N-18W-23
Pine, Lower
Pipe
Pipe, North
Poplar
Rice 32N-18W-11
Rice(Glenton) 35N-17W-21
Sandhill (Sand)
Shiloh
Somers
Staples
Straight
Swede
Twin, South
Ward
Wild Goose
Wind (Round)
Wolf

Class 3 – Most Restrictive

Alabama (Long)
Antler (Pine)
Aspen
Baker
Barbo
Barneys
Bass 36N-15W-31
Bass 36N-19W-23
Basswood (Bass)
Beautiful
Beede
Bone 32N-16W-27
Briar
Brusher
Bullhead
Camelia
Camp Douglas
Center (Big)
Clauson
Clear
Clover
Coon
Crescent (Pickerel)
Crooked
Dace (Mud)
Dahl
Deer 35N-19W-15
Deer 36N-15W-23
Denny
Depot
Diamond
Dinger
East (Volga) 34N-16W-18
East 34N-17W-33
Elkins
Ellofson
Ember
Evergreen (Deer)
Fern
Footes
Forsythe
Gabrielson (Gabelson)
Garfield (Big Horseshoe)
Gibson
Gilbert
Glovers
Godfrey
Greeley
Grenquist
Grass
Grandquist
Grouse
Hamble (Twin)
Hatchet
Hawthorn
Herby (Lanesdale, Twin)
Hickory
Highland
Hoover
Horseshoe (Jensen)

Ice
Ice House
Johansen (Johnson)
Johnson 36N-15W-26
Kenabee
Kenny
King (Pine)
Knapp Flowage
Knife
Lake Evelyn
Lake O'The Dalles (Thaxter)
Lamont
Land
Larsen
Lee
Lees
Legoo
Lincoln
Little Bass
Little Horseshoe
34N-15W-11
Little Horseshoe
35N-18W-06
Little Largon
Little Mirror (Pickerel)
Little Pine
Little Ward
Lone Pine
Long 32N-16W-27
Lost 35N-17W-24
Lykens
Mackie
Manitou
Mansen
Margaret
Marsh
Martel
McKeith
Meadow (Bog)
Miller Camp
Mud 33N-15W-26
Mud 33N-18W-35
Mud 34N-16W-18
Mud 36N-15W-23
Mullins
Nimon (Nieman)
North Fish (Fish)
Orr
Palmer
Parker
Paulson
Peaslee
Pike
Pine Island
Pine (Larch) 33N-17W-15
Pine 36N-16W-24
Pogo (Big)
Rhinstad
Rice (Cattail) 33N-19W-15
Rice 35N-19W-11
Roger
Round 34N-18W-36
Round (Heath) 35N-15W-23
Round (Cushing)
36N-18W-31
Sedge
Silver
Simpson
Snowshoe
Spur (Little Pine)
Square
Surprise
T Lake
Tarbert (Tabor, Twin)
Toby Spring
Trident (Pine, King)
Tula
Tuttle
Twenty-Ninth
Twin
Twin, North
Vincent
Wallin
Weiss
Wintergreen
Woodsman (Mud)
Young

NOTE: All rivers and streams are classified as Class 3 waters.

Not Classified – Insufficient Data

Bear
Black
Fish (South)
Island 32N-16W-30
Island 32N-18W-04
Laurel
Mud 34N-15W-01
Otter
Pleasant
Skinaway
Snake 34N-15W-03
Twin, East
Twin, West

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