Stewart Lake
Oakland County, 05N, 08E, Section 20
Flint River Watershed, last surveyed 1987

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Environment

Stewart Lake, a 31-acre lake in Groveland Oaks County Park northeast of Holly, Michigan (Figure 1), is a small (<100 ac), deep (thermally stratified), mesotrophic lake supporting warm- and cool-water fish species. The substrate in Stewart Lake is dominated by organic muck (Figure 2). Aquatic vegetation provides the primary form of fish cover and is abundant in the littoral zone. Coarse woody habitat is also present along the shoreline. Thread Creek, a tributary to the Flint River, is a first-order stream when it enters Stewart Lake and an earth gravity rockfill dam is located at the north end. These dam types use compacted material as the primary foundation for the dam with layers of rock for the outer shell, and the mass of the structure holds it in place. The dam has a structural height of five ft and head height of two ft. The dam was constructed to provide recreational opportunities for visitors to the park. The landscape within the 2,656-ac catchment area of Stewart Lake is primarily forested, with some urban development, wetlands, and agriculture (Figure 3).

History

Stewart Lake is in the southwest quarter of section 20 in Groveland Township (Figure 4). The land surrounding Stewart Lake was purchased in the 1870's by the Stewart family, however, the name "Stewart Lake" did not appear on any map until 1896. The land was historically used for farming and raising of livestock in the early 1900's. In 1944 the land was purchased by a local doctor and converted to a private recreation area (Figure 5). In 1967 Oakland County purchased the property and established Groveland Oaks County Park which consists of a public park and campground. The park surrounding the lake is made up of a large campground with more than 260 campsites, cabins, and group camping areas. Also on the grounds are small playgrounds, small sports complexes, and a kayak/boat rental.

Stewart Lake was previously sampled by Fisheries Division in June 1987. That survey utilized trap nets and spanned two nights. The 1987 fisheries survey collected 444 fish representing 11 different species (Table 1). Most of the fish captured in the survey were Bluegill *Lepomis macrochirus* (63%) and Black Crappie *Pomoxis nigromaculatus* (27%). No other surveys of Stewart Lake have been conducted until 2023 and there is no history of stocking at Stewart Lake.

Aquatic invasive species and nuisance algae have been controlled in Stewart Lake since 2016. The main treatment targets are Eurasian Watermilfoil *Myriophyllum spicatum*, Curly-leaf Pondweed *Potamogeton crispus* and filamentous algae species. Additionally, riparian invasive plants are controlled via chemical and mechanical treatment.

Current Status

The most recent fish community survey for Stewart Lake was completed August 15, 2023. This survey utilized nighttime nearshore boat electrofishing to capture a wide variety of the fish community. Total effort for the survey was 1.25 mi and covered approximately 73% of the shoreline of the lake. A group

of anglers fishing late in the evening prevented the entire shoreline from being sampled. Objectives for the survey were to determine fish species present and estimate growth rates for popular sportfish.

All fish captured were identified to species and measured for total length (TL; inch group). For game species, age was estimated for 10 fish per inch group using scale and spine samples. Scale age estimates were based on acetate film impressions from four to six scales. Dorsal spine age estimates were based on a thin cross-section of spine. Mean growth indices were calculated as described by Schneider et al. (2000) for age groups represented by five or more fish.

During this survey 171 fish were collected representing 7 species (Table 2). A variety of panfish including Bluegill, Pumpkinseed *Lepomis gibbosus*, and Yellow Perch *Perca flavescens* were captured. Bluegill were the most abundant panfish species in the survey, with individuals ranging from 3-7 in (mean TL = 5.3 in; Table 2). Just under one quarter (23%) of the 80 Bluegill captured were larger than 6 in (Table 2), which is the assumed minimum length at which anglers typically consider them suitable for harvest. The mean growth index of -0.8 for Bluegill indicated growth rates slower than the statewide average, and the oldest individual captured was estimated to be five years old. Pumpkinseed, the next most frequently captured panfish species in the survey, ranged in size from 4-7 in (mean TL = 5.7 in; Table 2). Twenty-two percent of the 18 Pumpkinseed captured were above the angler-preferred 6 in minimum length for harvest (Table 2). The mean growth index for Pumpkinseed was 0.4, which suggests a typical growth rate. Like Bluegill, the oldest individuals captured were estimated to be 5 years old.

Largemouth Bass *Micropterus salmoides* and Northern Pike *Esox lucius* were the two top predators captured in Stewart Lake. A total of 57 Largemouth Bass up to 17 in long (mean TL = 10.5 in; Table 2) were collected; 12% of the fish exceeded the 14 in minimum size limit (Table 2). Largemouth Bass had a mean growth index of -1.8, suggesting fish are growing well below the statewide average. Furthermore, nine year-classes of Largemouth Bass were present in the system, with the oldest individual estimated to be nine years old. Two Northern Pike were captured; one was 18 in and the other was 25 in. Too few Northern Pike were sampled to make inferences about growth rates.

Other species captured in the survey included Golden Shiner *Notemigonus crysoleucas* and Grass Pickerel *Esox americanus*. Golden Shiner is a forage species and only one individual was captured. Four Grass Pickerel ranging in size from 4-7 in TL were also collected. Electrofishing has a limited capture efficiency, especially for smaller bodied fishes, and our catch likely underrepresents the forage fish community.

Analysis and Discussion

The fish community of Stewart Lake can be described as follows:

1. Panfish community clearly dominated by Bluegill with consistent reproduction and recruitment. Pumpkinseed and Yellow Perch are present, but at much lower abundances than Bluegill, and no Black Crappie were captured or observed.
2. Largemouth Bass population with consistent reproduction and recruitment but growth rates well below the statewide average.
3. Northern Pike population with low density and abundant spawning habitat.

Stewart Lake continues to support a popular fishery for visitors to Groveland Oaks County Park. Total survey catch and species diversity decreased by 61% and 36%, respectively, between the 1987 and 2023

surveys. Conversely, Largemouth Bass total catch increased. However, two different gear types were used across the surveys. The 1987 and 2023 surveys were an index of the fish community and there are gaps in the information which can be gleaned from each survey because of the limited efforts and capture efficiencies of the two gears used. Furthermore, electrofishing selects for larger individuals of a species and larger fish are more easily seen by dipnetters on an electrofishing boat than smaller fish (Reynolds 1996). This bias can reduce capture probability of smaller fish and influence both size-structure estimates and overall diversity if small individuals of a species are missed, or small species are missed completely. For example, there were 80 Bluegill, and 18 Pumpkinseed successfully captured during this survey but dozens more, primarily fish less than 4 in TL, escaped the dipnetters.

The growth rates for Bluegill and Largemouth Bass were investigated from samples collected during this survey and were below the statewide average for both species. Although growth is slow, Largemouth Bass are abundant and provide a valuable angling experience. The small lake size and wide littoral zone of Stewart Lake limit the capability of producing a trophy bass or panfish opportunity. The fish community in Stewart Lake provides quantity instead of quality. Bluegill and Largemouth Bass are often willing to bite and provide an enjoyable experience to visitors. The goal of the fishery in Stewart Lake should be focused on high catch rates and the current abundance and number of species present support that goal.

Management Direction

Future management and survey recommendations for Stewart Lake include:

1. Nearshore seining to describe forage fish abundance and diversity.
2. Revisit and revise fertilizer and pesticide use in the park.
3. Update aquatic invasive species map.
4. Evaluate large woody debris abundance and add structures where necessary.
5. Start long-term water quality monitoring program.
6. Evaluate benthic macroinvertebrate community.

No specific fisheries management actions are proposed for Stewart Lake and no changes to fishing regulations are recommended. Natural recruitment is sustaining the fish community in this system and future surveys should focus on seining in the littoral zone to better understand the abundance and diversity of forage species in Stewart Lake. The natural shoreline and lack of hardened shoreline (i.e., metal seawall, rock riprap) are a function of the county park status and rare for inland lakes in southeast Michigan. However, Stewart Lake is still estimated to have 55% of the shoreland disturbed and around 27% of the watershed disturbed according to the Midwest Glacial Lakes Partnership Conservation Planner (http://ifrshiny.seas.umich.edu/mglp/). The high amount of estimated shoreland disturbance likely comes from the manicured turf grass away from the water's edge.

Stormwater influence on lake conditions should be monitored and controlled. Possible actions to address the stormwater influence include reducing fertilizer and pesticide use throughout the park, installing green stormwater infrastructure for water retention and infiltration, and ensuring all materials are properly stored and maintained to prevent leaking to surface waters. Regular inspections of potential pollution areas should be conducted to ensure best management practices are being followed to protect nearby water bodies.

Future habitat management recommendations include expansion of no-mow areas and native plantings along the shoreline, natural shoreline restoration, and aquatic habitat enhancements. Large woody debris structures provide habitat for many aquatic and semi-aquatic organisms including fish, birds, reptiles and amphibians. Strategically placed habitat structures consisting of felled hardwood trees could be an option for additional habitat in Stewart Lake. Furthermore, protecting and enhancing the native aquatic vegetation community should be a priority management action.

An annual water quality monitoring effort will facilitate lake management decisions. Parameters such as dissolved oxygen concentration (DO), pH, salinity, turbidity, and water temperature will be evaluated routinely throughout the spring-summer-fall months to identify water quality fluctuations over time. Additionally, biological communities in the lake will be evaluated including benthic macroinvertebrates to inform managers. This work will be facilitated by Oakland County Parks Natural Resources management staff.

References

Midwest Glacial Lakes Partnership. 2019. Midwest Glacial Lakes Partnership Conservation Planner. Available from: midwestglaciallakes.org/conservationplanner.

Reynolds, J. B. 1996. Electrofishing. Pages 221-253 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Schneider, J. C., P. W. Laarman, and H. Gowing. 2000. Age and growth methods and state averages. Chapter 9 in Schneider, J. C. (editor). 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor, MI.

Table 1. Species, catch, length range (inches), and average length (inches) for all species collected during 1987 trap net survey in Stewart Lake, Oakland County, Michigan.

Species	Catch	Length range (in.)	Average length (in.)
Black Crappie	118	7-10	8.4
Bluegill	281	4-8	5.9
Brown Bullhead	1	11	-
Green Sunfish	1	4	-
Largemouth Bass	2	9-21	15.5
Pumpkinseed	27	3-6	4.8
Rock Bass	1	4	-
Warmouth	1	4	-
White Sucker	1	15	-
Yellow Bullhead	3	10-12	11.5
Yellow Perch	8	6-8	7.1

Table 2. Species, catch, length range (inches), and average length (inches) for all species collected during the 2023 electrofishing survey in Stewart Lake, Oakland County, Michigan. Percent of individuals above legal size or estimated acceptable size for harvest for select species collected. Harvestable size is assumed to be 6 in for Bluegill and Pumpkinseed, and 7 in for Yellow Perch. Legal size for harvest is 14 in for Largemouth Bass and 24 in for Northern Pike

Species	Catch	Length range (in.)	Avg. length (in.)	Percent harvestable
Bluegill	80	3-7	5.3	23
Golden Shiner	1	7	-	-
Grass Pickerel	4	4-7	6.5	-
Largemouth Bass	57	4-17	10.5	12
Northern Pike	2	18-25	22.0	50
Pumpkinseed	18	4-7	5.7	22
Yellow Perch	9	3-7	5.9	22

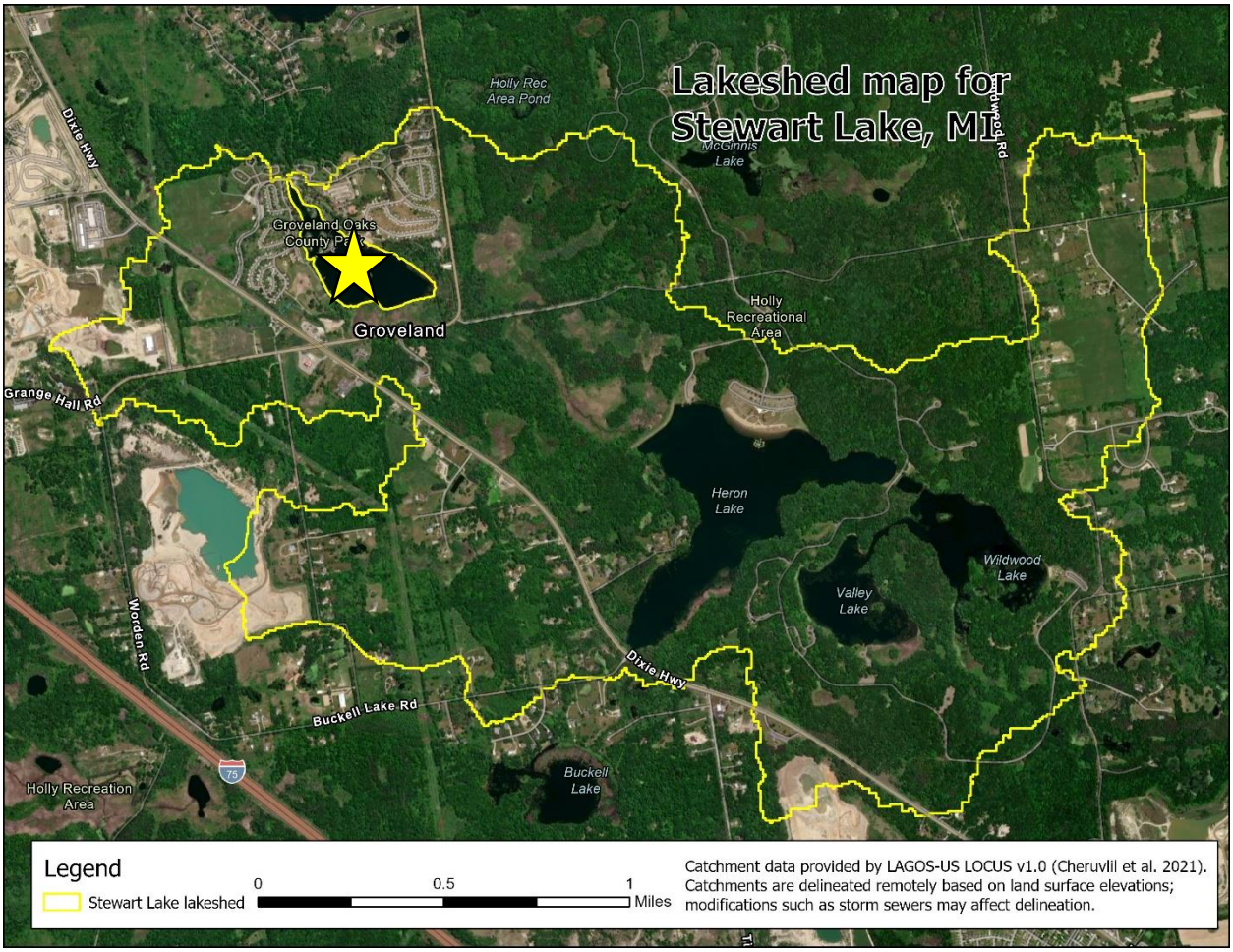

Figure 1. Stewart Lake, Oakland County, Michigan denoted by yellow star.

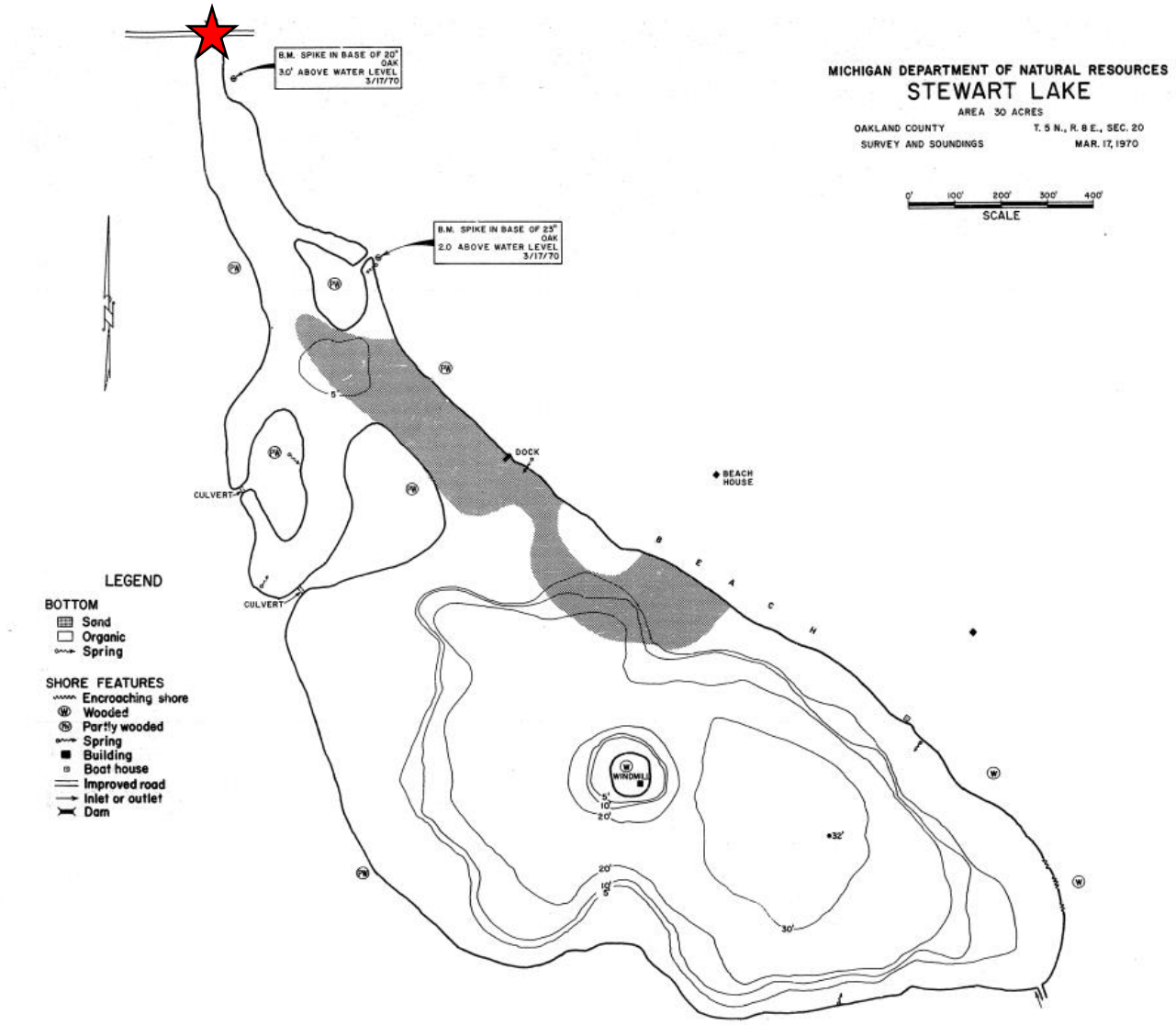

Figure 2. Stewart Lake, Oakland County, Michigan bathymetric map with dam denoted by red star.

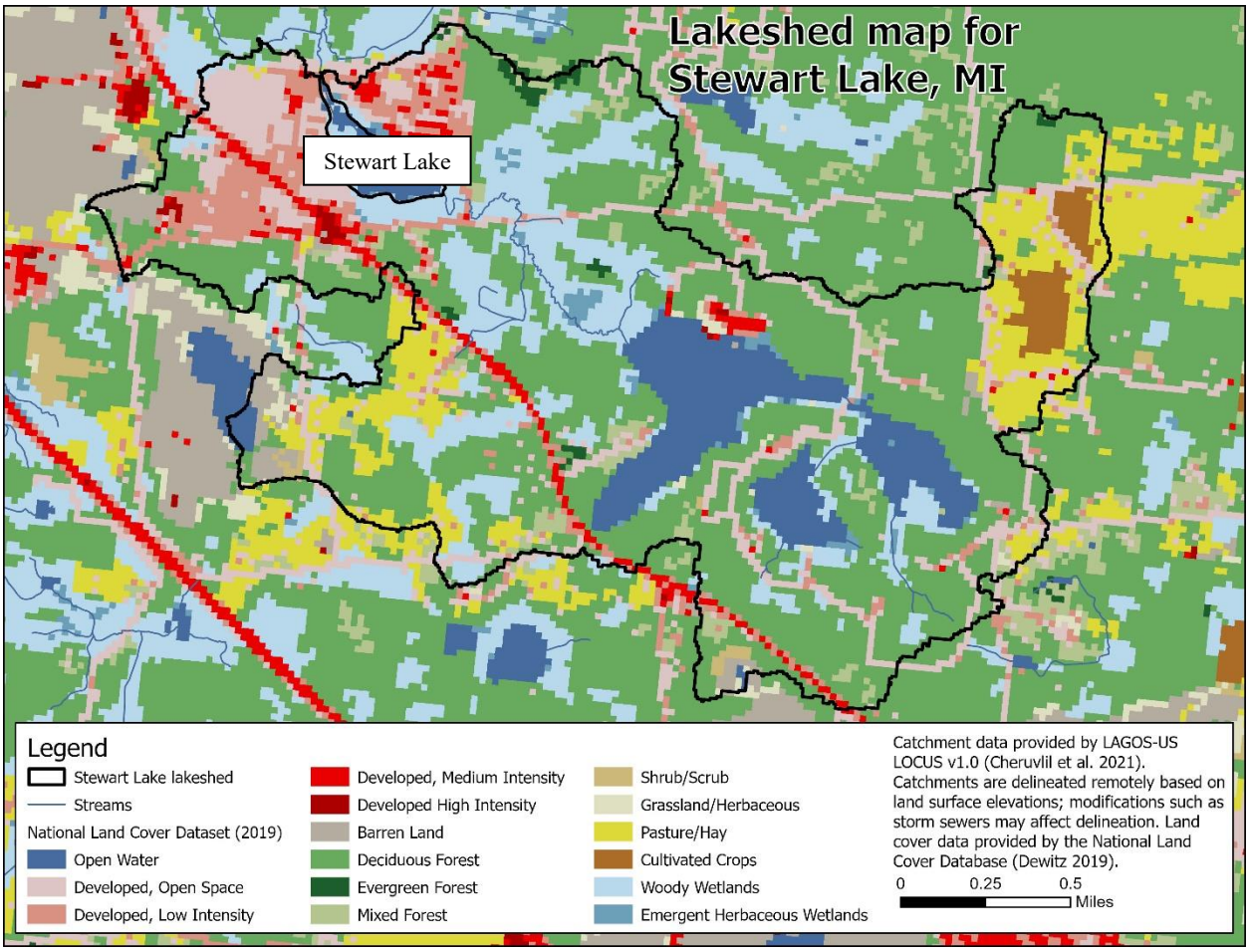

Figure 3. Land cover within the network catchment for Stewart Lake, Oakland County, MI.

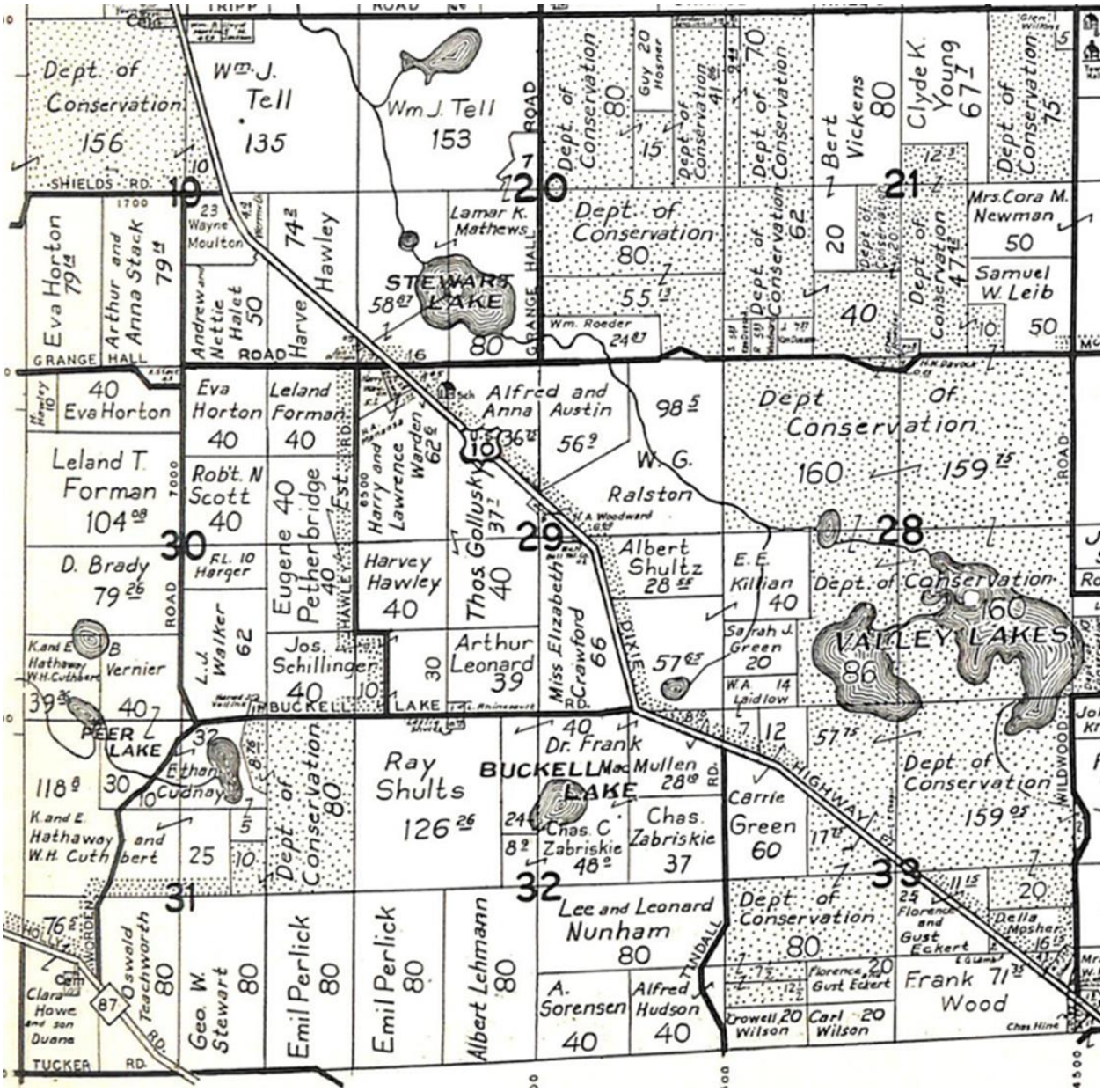

Figure 4. 1947 Plat map showing Stewart Lake and surrounding area. The property was owned by a local doctor who used the land and lake as a recreation area. Oakland County purchased the property in 1967, turning the parcels into a county park.

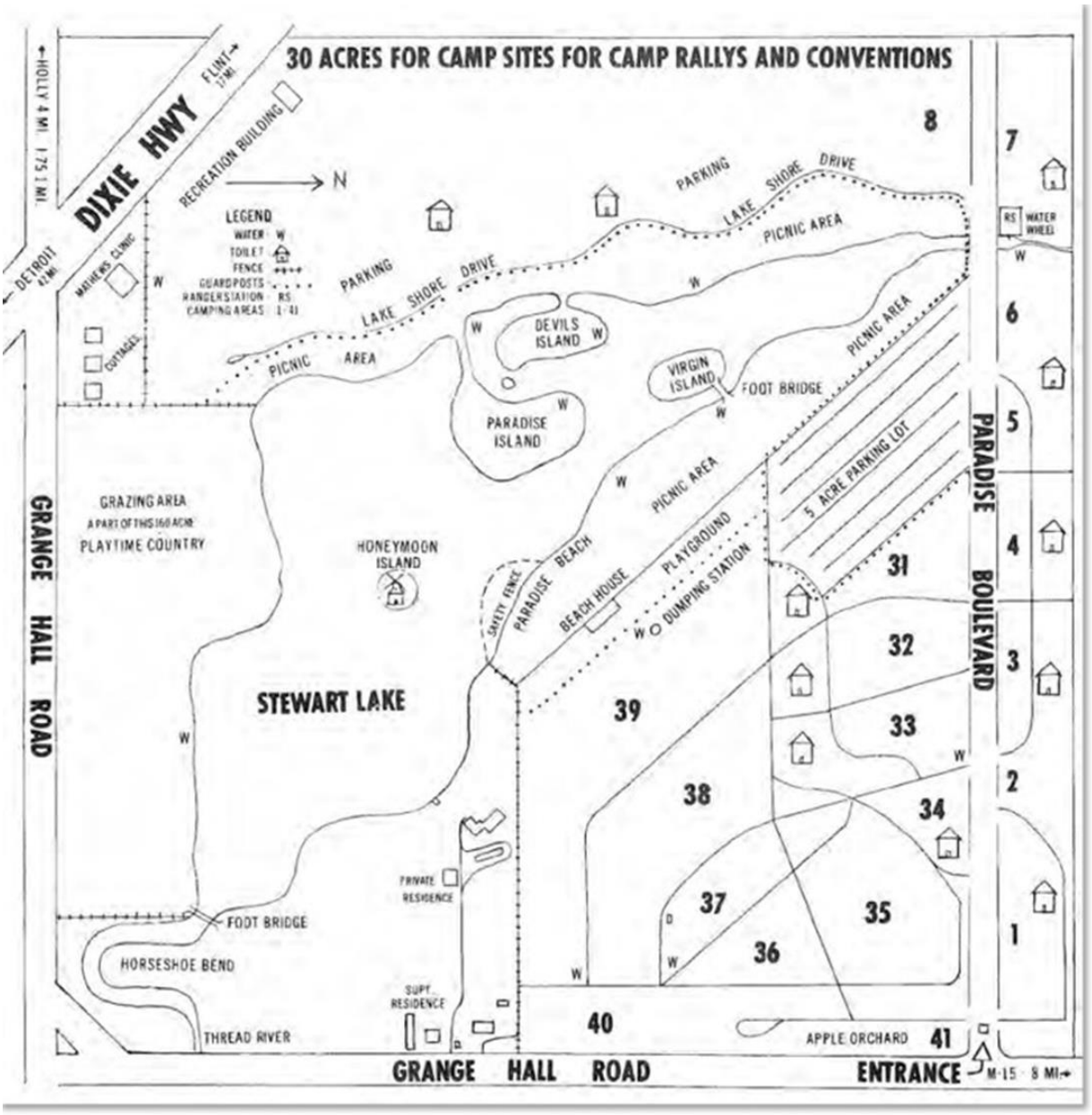

Figure 5. 1950s era map showing layout and land use of recreation area prior to purchase by Oakland County.

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