

### **Cornwall Impoundment (Flooding)**

Cheboygan County, T33N, R1W, Sections 26, 27  
Pigeon River watershed, last surveyed 2012

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#### **Environment**

Cornwall Impoundment, better known locally as Cornwall Flooding or Cornwall Pond, is located approximately 15 miles east of the town of Wolverine, Michigan in southern Cheboygan County. It is a popular destination for anglers and sightseers in the heart of the Pigeon River Country State Forest (Figure 1). The dam was built in 1966 and created a 161 acre impoundment with a 2,570 acre-ft storage, and a 20 foot head. It was constructed with 66% of federal funds through the Accelerated Public Works program, coupled with 34% of funds from State Fish and Game fund. The original purpose of construction was to build a "trout lake" in the area. The dam location includes an overflow riser structure and outlet pipe, as well as an associated 400 foot levee. The structure is owned by DNR Fisheries Division, which is financially responsible for the mandatory safety inspections (and maintenance) of the dam. The flooding is on Cornwall Creek which enters and leaves the impoundment before shortly merging with the Pigeon River. The creek is a designated trout stream, although wild trout populations have only been documented in the short one-mile long reach of creek below the flooding.

Cornwall Flooding has significant acreage with good amounts of water depth between 10 and 20 feet deep (Figure 2). The deepest readings are approximately 25 feet near the dam. Water clarity is limited as the flooding is stained black from natural tannin. The littoral zone of Cornwall Flooding has ample amounts of emergent and submergent aquatic vegetation, and vast amounts of flooded timber and stumps. The bottom substrate is mainly muck with some sand interspersed. Shoreline development is absent since the entire shoreline is in the Michigan state forest system. The riparian zone is dominated by a variety of conifer and hardwood trees.

A public access boat ramp is located on the north shore of Cornwall Flooding and provides launching for small boats, canoes, and kayaks. It is operated by the Michigan Department of Natural Resources which also prohibits gas powered motors based on a Land Use Order. There is parking for approximately six vehicles with boat trailers. No camping is allowed at the small access site, although it is not uncommon for boat anglers to use the few dispersed camping spots that can be found along the lake shoreline. The area is also popular among equestrian users. Access to Cornwall Flooding is from a small forest road at the north, and an even smaller two-track on the south end. These roads are not plowed by the county or local forest management unit in the winter, thus limiting access at times for ice anglers. Standard State of Michigan fishing regulations apply to Cornwall Flooding today. The only exception was that spearing was banned at the waterbody in 1987 to prevent over-harvest of stocked tiger muskellunge. This exception was recently removed since this fish is no longer stocked at this location.

#### **History**

Fisheries management of Cornwall Flooding dates back to the decade after it was filled. The flooding was established to create a quality fishing area in the heart of the Pigeon River Country State Forest. Fisheries managers hoped it would be large and deep enough to sustain a trout fishery through stocking. After the flooding was filled in the late 1960s, fisheries managers still were undecided on its potential for cold- or warmwater fisheries management. Rainbow trout yearlings were stocked (5,000) in 1968 and follow-up evaluations in spring of 1969 and 1970 with gill nets failed to document any trout survival. Very few fish were collected with gill nets in the 1969 survey, including some creek chubs and white suckers. Dissolved oxygen measurements were made at two locations on April 22, 1969 and found low dissolved oxygen levels throughout the water column. It appeared that the organic material freshly flooded was still decaying and robbing the water column of dissolved oxygen resulting in oxygen levels unsuitable for survival and growth of most fish. Six experimental gill-net lifts made by Michigan Department of Conservation (MDOC) in May 1970 again produced low numbers of fish, including white suckers, common shiners, creek chubs, green sunfish, and four larger (10-16 inches) brook trout.

The fish community of Cornwall Flooding was again assessed with eight experimental gill-net lifts in early July of 1971. Non-game species observed in the past surveys were again collected, however, a total of 78 pumpkinseed sunfish were collected for the first time during this survey. It appeared that a slow and positive evolution of the Cornwall Flooding fish community had started. Temperature and dissolved oxygen measurements were again taken during this time at two deepwater stations (20 and 23 feet). Some thermal stratification was observed at both stations, and dissolved oxygen decreased considerably below approximately 12 feet. Similar measurements were made the following year in the late winter of 1972. High dissolved oxygen concentrations were found at the surface, but they declined abruptly in the water column.

Fish management was in full swing at Cornwall Flooding through the remainder of the 1970s. Rainbow trout were again stocked by MDOC in 1973 (2,000 yearlings) but coldwater fish stocking was discontinued soon after. Managers then recognized the potential for muskellunge management in Cornwall Flooding. A goal of the time was to chemically reclaim the marginal fish community of Cornwall Flooding during the early to mid 1970s. This was never accomplished, and instead, managers began a tiger muskellunge stocking program in 1974 (Table 1) with the goal of providing a quality trophy fishery while producing a predator that could thin out species such as suckers and chubs. This fingerling stocking program remained consistent from 1974 through 1991.

Records from 1976 indicate that Cornwall Flooding was receiving "heavy use" from multiple user types and a certain amount of oversight was needed, especially at the small sole access site. DNR managers worked with the Pigeon River Country Advisory Council (a forest council made up of public citizens and appointed by the DNR director) to establish some basic rules at Cornwall Flooding. Camping at the access site was soon prohibited (early 1980s) as was the use of gas powered motors (1978).

Though a popular location, there was still some uncertainty over the quality and potential of the fishery at Cornwall Flooding. A heavy snowfall in the winter of 1977 induced a partial fish winterkill at the flooding. Dissolved oxygen measurement completed on February 19, 1977 at the dam found low levels at the surface (3 ppm) and anoxic conditions near the bottom. An April evaluation of 600 feet of shoreline after ice melt showed numerous dead crayfish, frogs, snails, and small panfish. Later that

month came the discovery of some low numbers of dead tiger muskellunge by DNR Law Enforcement personnel. Fisheries Division followed this up with a fish community evaluation of the flooding in mid-May 1977. Effort consisted of 12 experimental gill-net lifts which documented populations of largemouth bass and tiger muskellunge. This was the first documentation of largemouth bass at Cornwall Flooding. No records exist documenting stocking of this species by MDNR, and it is presumed that largemouth bass (and eventually bluegill) were transferred to the flooding by the public. The tiger muskellunge that were collected in 1977 ranged from 22-28 inches. Reports also indicated that anglers were catching tiger muskellunge frequently, yet most fish were less than 30 inches in length. Muskellunge poaching was also noted as a problem at Cornwall Flooding by 1977.

Another survey was conducted by Michigan Department of Natural Resources (MDNR) personnel in June 1978. Gill- and trap-nets (unspecified levels) were used to assess the developing fishery of Cornwall Flooding. Game fish collected included tiger muskellunge, largemouth bass, pumpkinseed, and yellow perch. White suckers were also collected. Sixteen muskellunge were caught and ranged from 15-34 inches, and most fish were age-4 (1973 year stocked year class). Thus, survival of muskellunge seemed good, and growth was considered average. The largemouth bass population, based on the survey catch, appeared to be growing. Ninety bass were collected and were represented by five year classes. This was also the first time in which yellow perch were documented in Cornwall Flooding. Perch were common in the survey nets, ranged in length from 4-8 inches, and were represented by three year classes. Yellow perch growth was considered excellent. Many age 3 perch were caught, representing a strong 1975 year class. Finally, pumpkinseed were also collected and ranged from age 1-7 and demonstrated average growth.

Documentation of the Cornwall Flooding fish community was done by angler accounts during the 1980s. During the early 1980s, good catches of tiger muskellunge, largemouth bass, and yellow perch were often heard from angler reports. However, no survey or angler accounts of bluegill had been documented at this point for Cornwall Flooding. Muskellunge remained a popular sport fish here, and stocking efforts continued through the 1980s. A spearing ban on muskellunge was placed by Fisheries Order for Cornwall Flooding in 1987. This ban would be lifted more than two decades later. The last stocking event of tiger muskellunge at the flooding was made by Fisheries Division in 1991 (Table 1). The rearing program was discontinued statewide. Biologists in the early 1990s believed that a "muskellunge" program should be continued at Cornwall Flooding, yet Division production for this species was terminated for many years. It was, however, agreed at that time that if ever stocked again, the flooding should be stocked with Great Lakes strain muskellunge.

The first reports of bluegill captured in Cornwall Flooding came in 1993 when DNR personnel caught them during a hook and line survey. It was not known how they became established there, but stocking from the general public was highly probable. This introduction prompted a full fish evaluation of Cornwall Flooding in 1995. DNR Fisheries Division used 21 lifts of large- and small-mesh fyke nets (mostly large mesh) from May 30 to June 2. During this period, Cornwall Flooding was considered to be a popular fishing location that providing excellent fishing. Its popularity had increased significantly among anglers over the last two decades. Bluegill, for the first time, were abundant in the survey catch and good numbers of 6-7 inch fish were found. This was also the case for pumpkinseed, although they were less abundant than bluegill. The largemouth bass population in 1995 was very healthy with many catchable 9-12 inch fish available to anglers. The yellow perch population was considered smaller than other panfish in numbers, but they were still present and popular among anglers. Seven year classes of

yellow perch were now found in Cornwall Flooding (compared to 3 year classes in 1978) and growth was good. Despite the termination of the muskellunge stocking program in 1991, eight fish were still collected in the 1995 survey and ranged from 4-8 years old. The largest muskellunge was 37 inches long. Managers felt that muskellunge rarely attained the 42 inch minimum size limit at Cornwall Flooding, and that the fishery for muskellunge was mostly catch and release. Other species captured during this survey included low numbers of green sunfish and golden shiner, while no white suckers were collected. Overall, DNR rated the fishery after the survey as "excellent and no change in management is recommended."

### **Current Status**

The most recent fish community survey was conducted at Cornwall Flooding by DNR Fisheries Division from June 4-7, 2012. Sampling effort consisted of 7 large-mesh trap net lifts, 8 large-mesh fyke net lifts, and 4 mini-fyke (small mesh fyke) net lifts. Notes from the survey indicate that fishing pressure was high during this survey. There were multiple vehicles with boat trailers at the launch site each day of the survey. Anglers were observed on different occasions with stringers full of panfish.

Seven species of fish were collected during the fish netting survey (Table 2). This species diversity is relatively low compared to most northern Michigan lakes. Total catch was 1,529 fish weighing 719 pounds. Large predator fish consisted solely of largemouth bass and made up 9% of the total catch by number and 24% by weight. The panfish community today of Cornwall Flooding is dominated by bluegill (Table 2), followed by pumpkinseed sunfish and yellow perch. Three black crappies were collected during the survey. Reports from an angler in 2007 also indicate the earlier spread of black crappie to Cornwall Flooding, most likely by the transfer of fish there from the public. Panfish comprised 90% of the total catch by number and 75% by weight.

The catch of non-game species was low. Surprisingly, bullheads have never been collected in the flooding, and this continues today based on the 2012 survey catch. The lake has a rich organic bottom that is suitable for bullheads, but their presence would only yield extra competition for food resources. White suckers were captured in Cornwall Flooding in the 1970s, but have not been collected in the 1995 and 2012 surveys. Spawning habitat suitable for suckers is not found in the flooding or its small inlet, thus their demise is not surprising. Like in past surveys, golden shiners and green sunfish remain in low numbers in the flooding. Both of these species compete with popular game fish such as bluegill, thus it is essential to have a quality largemouth bass population to keep their numbers low.

Bluegill were the most commonly collected fish in the survey (Table 2). Bluegill ranged in size from 1-10 inches, with many quality size fish available to anglers (Table 3) especially from 7-9 inches long. We used an index to assess the quality of the bluegill population in Cornwall Flooding (Schneider 1990). Based on this rating (Table 4), it appears that this population is in superior shape. Good percentages of 6 inch and larger fish comprise the population based on the total catch in trap nets. Bluegill appear much more prolific today than in the 1995 survey (Table 5). Good numbers of bluegill 8 inches and larger were captured in the 2012 survey, while 8 inch and larger fish were rare in 1995 (Table 5). Bluegill growth in Cornwall Flooding is near the statewide average for this species (Table 6). We found bluegill up to age-12 in the survey (Table 6), and all year classes from age 1-12 were represented. It is apparent, based on average growth rates, that bluegill get large in Cornwall Flooding based on longevity.

Pumpkinseed sunfish are a cousin to bluegill and are abundant in the thickly vegetated and wood strewn flooding. This species was the second most abundant fish in the survey catch and it is obvious that they are targeted by anglers simultaneously with bluegill. They remain much less abundant than bluegill, despite the fact that they have been part of the flooding fish community longer than bluegill. Pumpkinseed in the 7 and 8 inch range (Table 3) were relatively common. Sizes of pumpkinseed have increased from the 1995 to 2012 survey (Table 5). This species grows fast in Cornwall Flooding today (Table 6).

Yellow perch remain a common species in Cornwall Flooding (Table 2) although they are less represented in the total catch today compared to previous decades. Perch larger than 10 inches are not uncommon (Table 3). Angler reports are consistent that perch from this flooding are heavily infested with the parasitic yellow grub. Yellow perch growth in Cornwall Flooding is very fast and individuals can attain 10 inches in length in 3-4 years. A handful of black crappie were collected during this survey. This species is a recent invader to the lake, possibly stocked illegally by the public. Black crappie, if established, could add to the panfish catch diversity, but they could also manifest extra competition for food with other panfish and even largemouth bass. Crappie are often piscivores (fish eaters) and will feed on young fish of all species.

No tiger muskellunge were collected during the 2012 survey. It appears that the survival of stocked fish may have run its course. Anglers frequently inquire about the historical stocking and question if any fish remain in the flooding. Based on the recent survey, that answer would be no, or that remaining fish numbers would be insignificant.

### **Analysis and Discussion**

The current fish community and environment of Cornwall Flooding can be generally characterized as having the following characteristics: 1) a naturally reproducing panfish community with low diversity and high quality, and dominated by bluegill, 2) a panfish community which typically displays average to good growth across species, and displays fish that can live a long time, 3) a predator fish population low in diversity but balanced with naturally sustaining largemouth bass that display multiple age classes and average growth, 4) a non-game fish community low in diversity and abundance, and 5) an evolving fish fauna.

The Cornwall Flooding panfish community is low in diversity but demonstrates near superior quality. Species mostly available to anglers include bluegill, pumpkinseed, and yellow perch. Growth of sunfish is average to slightly above average and these species can live long. Bluegill can attain large sizes by longevity and through fast growth. Fishing pressure is high at Cornwall Flooding, but the abundance of year classes and good spawning habitat will enable such harvest to be sustained over time. Pumpkinseed and yellow perch are important components to the harvest for anglers. They add catch diversity and take pressure off of bluegill. Black crappie have recently been introduced to the flooding, and it will be interesting to see if they have an impact on other panfish populations in the future.

There is currently only one main fish predator in Cornwall Flooding, and it is the largemouth bass. Like most other species in this flooding, their population built up over time since the creation of the flooding. Decades ago the fish was just becoming a significant member of the fish community, while today it is the keystone species. Largemouth bass keep the panfish population from becoming too

crowded, and they feed on other fish (golden shiners, green sunfish) that directly compete with panfish. Very large bass can be caught in this flooding year round and the species is represented by an array of year classes.

The non-game fish community of Cornwall Flooding is currently limited. Most northern Michigan waterbodies have competing fish such as bullheads and white suckers, but they appear absent from the flooding today. Their continued absence will be important to maintaining the quality of this fish community; for now, it is very healthy.

### **Management Direction**

- 1) The Cornwall Flooding aquatic community should be monitored on a consistent basis. Since its creation, the flooding has been surveyed with varying levels of effort on multiple occasions. Each time a new fish was surveyed or the flooding demonstrated some significant fisheries change. This change may continue into the future as the fish community may still be evolving. A complete fish community survey documenting changes should be accomplished no later than 2030 at Cornwall Flooding.
- 2) Tiger muskellunge were stocked in the flooding from 1974 through 1991. Based on surveys and angler accounts, this program was successful at creating a muskellunge fishery, though many fish did not attain legal size (42 inches). Tiger muskellunge production was halted by the DNR in the 1990s with the hope that a pure bred muskellunge program would replace it. This has been slow in coming, but production of Great Lakes muskellunge is available. Local managers often hear anglers talk about the muskellunge program that once developed at Cornwall Flooding. Some of these bits of information would suggest that a Great Lakes strain muskellunge program could be resurrected here with probable success. Our suggestion is to not stock this predator in Cornwall Flooding. The current fish community is near peak with quality catches of panfish and largemouth bass.
- 3) Anglers are urged to report catches of all species to the local DNR biologist. Sampling gear is not always efficient at capturing some fish, sometimes leaving information gaps for individual species. Such reports are useful for management of the fishery not only currently, but for future managers as well. The current State of Michigan fishing regulations are appropriate for Cornwall Flooding.
- 4) Cornwall Flooding today is one of the most popular fishing locations in northern Michigan. Fishing pressure was relatively low on the lake prior to the 1990s, but this pressure has increased significantly in the last couple decades as the fish population has improved. Fisheries Division is responsible for the dam that creates the flooding and should continue to make improvements to the site when necessary. This is a significant northern Michigan fishery that provides a high number of angler hours in a remote and aesthetic setting.

### **References**

Schneider, J.C. 1990. Classifying bluegill populations from lake survey data. Michigan Department of Natural Resources, Fisheries Division, Technical Report 90-10, Ann Arbor, Michigan.

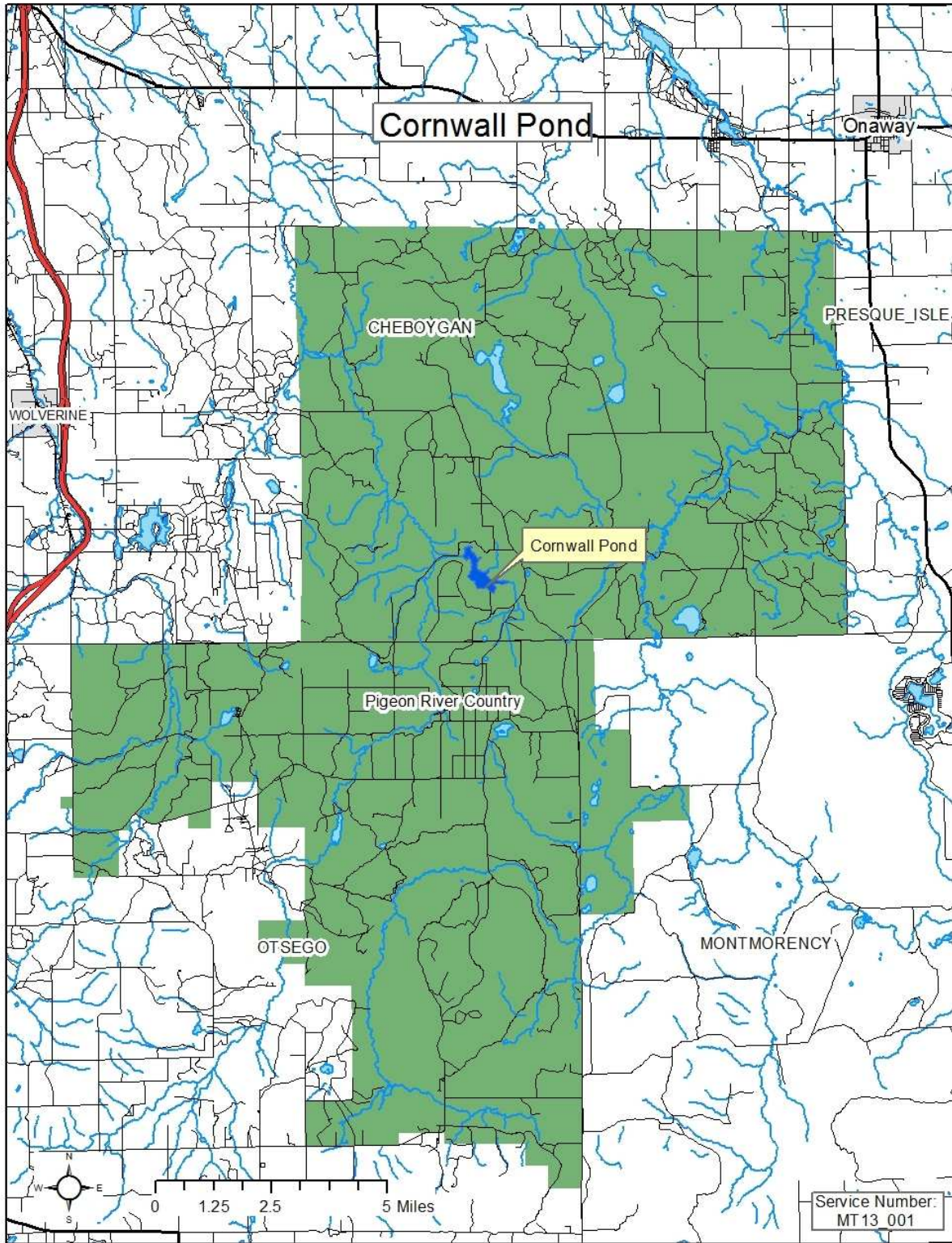


Figure 1.-Location of Cornwall Pond in the Pigeon River Country State Forest.

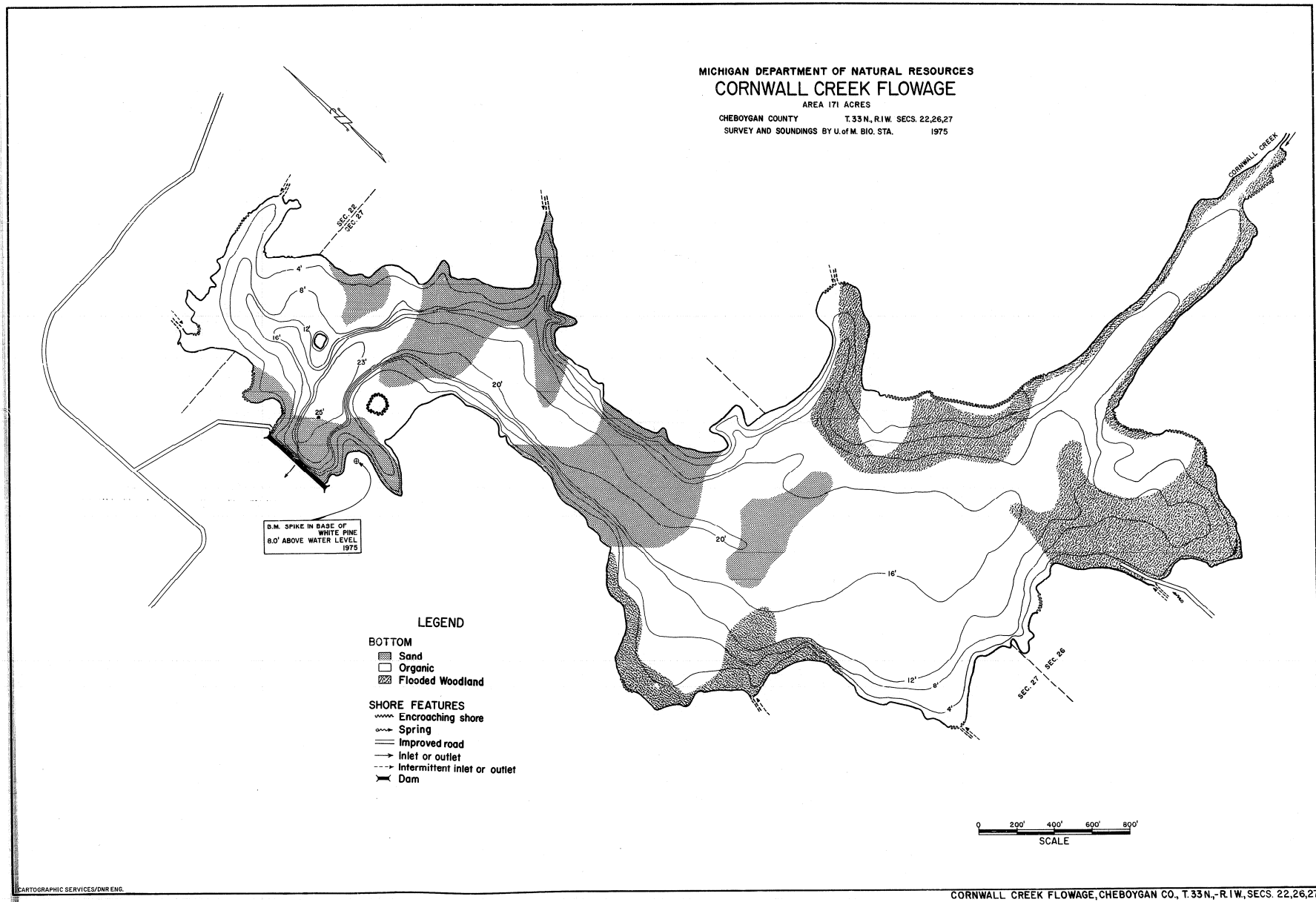


Figure 2.-Bathymetric map of Cornwall Flooding.



Table 1.-Tiger muskellunge stocking history for Cornwall Flooding, Cheboygan County.

<b>Year</b>	<b>Species</b>	<b>Number</b>	<b>Size</b>
1974	Tiger muskellunge	1,000	Fall fingerlings
1976	Tiger muskellunge	500	Fall fingerlings
1979	Tiger muskellunge	500	Spring fingerlings
1981	Tiger muskellunge	550	Fall fingerlings
1983	Tiger muskellunge	750	Fall fingerlings
1985	Tiger muskellunge	750	Fall fingerlings
1987	Tiger muskellunge	400	Fall fingerlings
1989	Tiger muskellunge	900	Fall fingerlings
1991	Tiger muskellunge	1,000	Fall fingerlings

Table 2.-Species catch and relative abundance of fishes collected during the Cornwall Flooding fish community survey, June 4-7, 2012. Weight is calculated.

<b>Species</b>	<b>Number</b>	<b>Percent by number</b>	<b>Weight (lb.)</b>	<b>Percent by weight</b>	<b>Length range (in.)</b>
Bluegill	1,268	83	493.9	69	1 – 10
Largemouth bass	139	9	172.8	24	8 – 21
Pumpkinseed	79	5	29.4	4	4 – 10
Yellow perch	32	2	20.8	2	8 – 13
Golden shiner	7	<1	1.3	<1	6 – 8
Black crappie	3	<1	0.6	<1	6 – 7
Green sunfish	1	<1	0.1	<1	2
<b>TOTAL</b>	<b>1,529</b>		<b>718.9</b>		

Table 3.-Length-frequency distribution of important game fishes collected during the 2012 netting survey at Cornwall Flooding.

<b>Length (in)</b>	<b>Bluegill</b>	<b>Pumpk. sunfish</b>	<b>Black crappie</b>	<b>Largemouth bass</b>	<b>Yellow perch</b>
1	72				
2	24				
3	16				
4	7	1			
5	38	4			
6	89	19	1		
7	265	33	2		
8	470	19		7	1
9	269	2		6	4
10	18	1		15	8
11				15	10
12				40	8
13				31	1
14				8	
15				4	
16				4	
17				2	
18				1	
19					
20				4	
21				2	

Table 4.-Cornwall Flooding bluegill size structure rating using the Schneider Index (Schneider 1990). Index scores are in parentheses. Sample is from seven trap net lifts.

<b>Sample date</b>	<b>June 2012</b>
Sample size	763
CPUE (#/lift)	109
Avg. length (in.)	7.9 (7)
% $\geq$ 6 inches	97 (7)
% $\geq$ 7 inches	89 (7)
% $\geq$ 8 inches	68 (7)
Index score	7.0
<b>Rank</b>	<b>Superior</b>

1 = very poor, 2 = poor, 3 = acceptable, 4 = satisfactory, 5 = good, 6 = excellent, 7 = superior

Table 5.-Length-frequency distribution of certain game fishes at Cornwall Flooding from the 1995 and 2012 surveys. Sampling effort was variable between years.

<b>Length (in)</b>	<b>Bluegill 1995</b>	<b>Bluegill 2012</b>	<b>Pump. 1995</b>	<b>Pump. 2012</b>	<b>L. bass 1995</b>	<b>L. bass 2012</b>
1	1	72				
2	11	24	1		1	
3	18	16			1	
4	8	7	4	1	2	
5	22	38	16	4		
6	111	89	52	19	3	
7	267	265	75	33	8	
8	16	470	5	19	2	7
9		269		2	27	6
10		10		1	28	10
11					52	15
12					27	40
13					3	31
14					4	8
15						4
16						4
17					2	2
18						1
19					2	
20					1	4
21					1	2
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

Table 6.-Mean length (inches) at age for various game fishes of Cornwall Flooding in different years. Number in parentheses represents number aged. Growth comparison in last column was across all ages for 2012.

Species	Age group	1978 June	1995 June	2012 June	2012 growth compared to state average
Bluegill	I	-	2.3 (6)	1.7 (3)	+0.3 inches
	II	-	3.1 (18)	3.1 (17)	
	III	-	4.7 (6)	4.5 (2)	
	IV	-	5.3 (13)	6.4 (23)	
	V	-	6.5 (11)	8.0 (13)	
	VI	-	7.2 (11)	8.3 (3)	
	VII	-	7.8 (2)	8.9 (7)	
	VIII	-	8.1 (13)	9.5 (4)	
	IX	-	-	9.5 (3)	
	X	-	-	10.2 (5)	
	XI	-	-	10.2 (2)	
	XII	-	-	10.2 (1)	
Pumpkinseed sunfish	I	3.2 (2)	-	-	+1.0 inches
	II	3.6 (2)	2.4 (1)	-	
	III	5.0 (36)	-	6.5 (1)	
	IV	5.7 (67)	5.6 (22)	6.8 (11)	
	V	6.1 (45)	6.8 (6)	7.0 (16)	
	VI	7.1 (5)	7.2 (6)	8.0 (6)	
	VII	8.7 (1)	7.4 (5)	8.2 (7)	
	VIII	-	8.1 (8)	8.4 (1)	
	IX	-	-	9.4 (1)	
	X	-	-	8.7 (1)	
Largemouth bass	I	6.5 (22)	4.6 (1)	-	-2.2 inches
	II	11.2 (14)	7.4 (13)	-	
	III	12.7 (76)	9.7 (8)	8.7 (10)	
	IV	14.3 (50)	10.3 (19)	10.3 (7)	
	V	15.4 (28)	12.0 (21)	12.0 (18)	
	VI	-	13.5 (7)	12.9 (16)	
	VII	-	-	13.8 (18)	
	VIII	-	17.6 (2)	14.8 (5)	
	IX	-	-	18.0 (1)	
	X	-	19.7 (2)		
	XI	-	20.5 (1)	19.3 (2)	
	XII	-	-	20.7 (2)	
	XIII	-	21.6 (1)	21.1 (2)	

Table 6.-continued.

Species	Age group	1978 June	1995 June	2012 June	2012 growth compared to state average
Yellow perch	I	4.7 (2)	3.6 (8)	-	+2.9 inches
	II	-	5.8 (2)	-	
	III	7.6 (98)	8.1 (5)	9.7 (1)	
	IV	8.9 (1)	10.2 (3)	10.7 (18)	
	V	-	-	11.9 (3)	
	VI	-	10.7 (1)	12.5 (7)	
	VII	-	11.9 (5)	13.5 (1)	
	VIII	-	12.5 (9)	-	
Tiger musky	I	-	-	-	
	II	15.3 (1)	-	-	
	III	-	-	-	
	IV	26.8 (34)	29.2 (3)	-	
	V	-	-	-	
	VI	-	35.4 (4)	-	
	VII	-	-	-	
	VIII	-	37.0 (1)	-	