

INTRODUCTION

In 2007, the LWB of WP initiated a planning effort for all its lakes. The purpose of this planning is, in part, to fulfill a component of the WP Land Development Plan. The specific purpose of each lake plan is to ascertain current status of each lake, perceptions of WP residents on lake uses, and identify and prioritize management needs for each lake. The integration of individual lake plans is anticipated to contribute to a Comprehensive Lakes Management Plan, which should form the basis for prioritization of management by the Village.

Cardinal Lake is somewhat unique among Village Lakes in that it has only recently been acquired by the Village of Whispering Pines, is small, and is subject to severe impacts of water withdrawals for golf course irrigation.

I. STATUS:

Cardinal Lake Dam was constructed in about 1970 with the resulting Cardinal Lake becoming the primary a source of irrigation water for the now-named Whispering Woods Country Club. This lake and dam were owned by property owners of the golf club (several over its history) until the Village of Whispering Pines took ownership on December 31, 2007. Martin Way, which crosses over the top of Cardinal Dam, has been closed, by order of NC DEHNR, to all but foot and golf cart traffic since March, 2006. This closure was due to rusting of the two corrugated metal outflow pipes. These rusted pipes allowed water to erode Martin Way earth fill resulting in several roadway sink holes and seepage from the backside of the dam. Appendix 10 provides the results of the dam boring completed on February 18, 2008. Additionally, NC DEHNER required Cardinal Lake to be lowered and remain lowered until dam repairs, planned in the winter of 2008, are completed.

Based on a survey map dated February 21, 2006, Cardinal Lake is 6.84 acres (See Appendix 1) and is impounded by an earthen dam with a structural height of about 20 feet. Based on one-acre foot containing 326,700 gallons of water (Appendix 2) and an average depth of 10.5 feet, Cardinal Lake contains approximately 23,463,594 gallons of water (7.2 acre-feet) at full capacity [$6.84 \times 10.5 \times 326,700 = 23,463,594$].

There are 14 lots surrounding Cardinal Lake, (See Appendix 3), including the Whispering Woods Country Club. Individual home or condo owners number about 10 (double lots) and all of these irrigate from Cardinal Lake. The single biggest user of irrigation water is Whispering Woods Country Club that utilizes approximately 300,000 thousand gallons of water during each of about 3-4 irrigations per week (See Appendix 4). This amounts to approximately 5% of the lake capacity per week.

Cardinal Lake is located on an unnamed tributary to Mill Creek and is part of the Cape Fear River Basin according to documentation received from NC DEHNR in March, 1997 (See Appendix 5). Cardinal Lake receives primarily inflow from normal rainfall and storm water runoff via 6 principal locations, (See areas marked A thru F on Appendix 9). These inflow locations are either grassy areas or a combination of grassy areas and corrugated pipes

leading directly to the lake. There are 2 small tributaries or springs that feed into two upper ponds and eventually into Cardinal Lake (See Appendix 6). In event of dam breach, Appendix 7 shows the possible flood zone.

Currently there is no boat launch or park on Cardinal Lake and there is only one resident that has a boat.

There are no bulkheads or retaining walls on Cardinal Lake. One floating dock exists that was constructed in 1980 and maintained over the years. The shoreline is populated with many long leaf pines, lawns, and, in several areas and vacant lots, considerable grassy and weedy areas.

Cardinal Lake water quality tests were taken on August 24, 2008 at seven stations. These tests were the first known tests and will become the benchmark for future evaluations. At the time of the tests, the lake was down approximately 4 feet due to lake of rain, irrigation by the golf club and pre-dam repair water level maintenance. Appendix 8 shows the water depths and quality at various depths at each measurement station. Appendix 9 shows the 7 station locations as noted by the number in the circle. These measurements were taken when the lake was about 1'6" below its normal level. Water clarity, measured to be 3.5 feet, typically declines after substantial runoff events. No coliform bacteria tests were taken nor are known to exist for Cardinal Lake.

Cardinal Lake currently has little aquatic vegetation, except as noted in Section II.4, possibly due to continual water level fluctuations associated with golf course irrigation withdrawal and golf course weed control chemicals that may enter the lake during storm water runoff periods.

The principal "use" of Cardinal Lake by its residents appears to be that of esthetics. Of the seven responses to the Lake Management Questionnaire by respondents indicating they lived on Cardinal Lake, only one stated use of any lakes for recreation--Cardinal Lake for fishing. The remaining 6 responses (85%) stated they do not use the other Village lakes, although three residents (43%) stated they use Thagard and Spring Valley parks.

Whereas Cardinal Lake was not obtained by the Village until 2007, it was not included in the fishery surveys of 2004, and its fish composition is unknown. There appears to be limited fish populations in the lake, although the lake contains several hundred turtles and is home to Canada geese, ducks and an occasional blue heron.

II. PERCEPTIONS:

Perceptions of the status of Cardinal Lake and suggestions for matters of attention were accumulated from discussions with the group that helped save the dam, specifically Cardinal Lake Environmental Association of Neighbors (CLEAN) and the Village 2007 LWB questionnaire. The questionnaire resulted in responses from 7 residents who designated themselves as living on Cardinal. Responses to all questions by these residents, along with

their written comments, formed the principal basis for the survey data. The Questionnaire was comprised of a set of general questions (responses to which were presumed to be applicable to Cardinal Lake) and a set of lake-specific questions, the lake of interest being chosen by the respondent.

Questionnaire response numbers for individual questions were somewhat variable, as some respondents did not answer every question. Consequently, percentages are expressed as proportion of those answering any individual question.

II.1.Lake Infrastructure

Sustained use of Cardinal Lake is dependent on a reliable, functional dam and adequate access—via personal property for lake residents and via Village property for off-lake residents of Whispering Pines.

II.1.1. Dam/Spillway

Cardinal Dam is currently in disrepair and as mentioned previously is scheduled for repair in the winter of 2008. Many of the survey responses addressed the need for dam repair and lake retention.

II.1.2. Access

There is no boat launch on Cardinal. Lake access is only available from private lots although the village does have a 10 foot wide easement along the West edge of Lot 97 and extending from Sandpiper Drive. Discussions have commenced regarding the construction of a boat launch when the dam is repaired. This launch may be important for future access for weed control, dredging, and use of the lake. Due to the major water fluctuations resulting from drought and golf course irrigation, Cardinal Lake recreation opportunities, (fishing and swimming), will probably be limited. Additionally, there is little open space, with Martin Way remaining open, to allow parking and/or boat storage necessary for a recreational boat launch.

II.1.3. Docks and Retaining Walls

Widely fluctuating water levels limit the effectiveness of docks and retaining walls in Cardinal Lake. Consequently, there are no bulkheads or retaining walls on Cardinal Lake. One floating dock exists that was constructed in 1980 and maintained over the years. If water levels fluctuations are ever minimized, construction of additional docks might be anticipated.

II.2. Watershed Activities and Effects

As previously mentioned, Cardinal Lake’s main water inputs are from rain and storm water runoff; therefore, it is a major concern in the future quality of the lake to monitor and control the amount of soil erosion and other sediment that enters the lake.

II.2.1. Watershed Disturbance

Residents feel strongly that watershed activities are affecting the lakes, and watershed disturbances are not being adequately controlled (60% disagree/strongly disagree that new construction is being managed effectively; 40% had no opinion or not applicable.

Strongly Disagree→Strongly Agree

(44.) New construction in the watershed is being effectively supervised 20 40 40 0 0

In terms of controlling silt and sediment runoff, 60% had no opinion and 40% strongly agree that storm water is harming the lakes.

Strongly Disagree→Strongly Agree

(52.) Storm water run off is not effectively controlled and is harming the lakes 0 0 60 0 40

Storm water is perceived to be the main input to Cardinal and must be controlled in the future or there will be considerable sedimentation. The current dam repair plan provides for a sediment basin at the upper end of Cardinal; however, there should also be basins constructed at several other storm water inlets.

II.2.2. Sedimentation

All Cardinal Lake survey respondents (100 %) consider sedimentation of lake coves to be a serious problem. This lowers the capacity of the lake and impacts water quality and lake inhabitants. At the time the lake is lowered for repair, we will have a better feel for the extent of current sedimentation and can possibly take some corrective action. The long term solution will be a functioning storm water/erosion control program.

Highly Unsatisfactory→Highly Satisfactory

(15.) Siltation of cove areas. 50 50 0 0 0

II.2.3. Dredging

Siltation of lakes has progressed to the point that dredging is needed. (100% of respondents agreed/strongly agreed that the Village should dredge).

Strongly Disagree→Strongly Agree

(53.) The Village should dredge areas where siltation has occurred. 0 0 0 80 20

The Village has purchased a small mobile dredge and will do maintenance dredging where needed. It will serve the various WP lakes with sedimentation problems. Residents will serve as volunteers to assist dredging operations. After initial dredging, and with better watershed management, maintenance dredging should not be demanding.

II.2.4. Water Withdrawals

Whispering Woods Country Club is the primary user of Cardinal Lake water and withdraws about 300,000 gallons each time the golf course is irrigated (3-4 times per week). Residential irrigation management was a draw in the survey with (40% of residents agree/strongly agree; 40% disagree and 20% had no opinion).

Strongly Disagree→Strongly Agree

(51.) Residential irrigation systems drawing from the lakes are managed effectively by the Village. 0 40 20 20 20

The extent of residential irrigation from Cardinal Lake needs to be identified.

II.3. Water Quality

Most Cardinal Lake residents are concerned about water quality (86%), with the remainder (14%) having no concern

(10.) Data from the Whispering Pines General Survey showed that maintaining water quality, which is affected by a variety of factors, is a high priority for residents.

() I am concerned about lake water quality. 86

() I have no concerns about water quality 14

II.3.1. Water Clarity

Most residents considered water clarity to be unsatisfactory (60%), 20% had no opinion and 20% felt water clarity was satisfactory.

Highly Unsatisfactory→Highly Satisfactory

(18.) Water clarity. 20 40 20 20 0

Cardinal Lake water samples were taken for the first time in August, 2008 and showed an average clarity of about 3’ 6”. The clarity will vary considerably based on rains and storm water runoff; for about a week after a substantial rain, the clarity will be considerably less than the 3’6”.

II.3.2. Pollution sources.

Pollution sources with which the 7 Cardinal Lake residents indicated concern were septic tank leakage (43%), fecal coliform levels (28%), runoff of pesticides and herbicides from lawns (43%), and animal wastes (15%). No response was given to Question 12 (Highest concern). Trash and debris situation in the lake was seen as highly unsatisfactory (20%) and as satisfactory (60%).

- (11.) If concerned, CHECK all that apply.
- () Septic tank leakage 43
- () Lawn runoff [pesticides/herbicides] 43
- () Fecal coliform levels 28
- () Animal wastes 15
- () Storm water inflows 28
- () Sedimentation 28

Highly Unsatisfactory → Highly Satisfactory

- (13.) Trash and debris in the lakes. 20 0 20 60 0

Cardinal Lake residents were evenly divided on perceptions of adequacy of septic contamination monitoring by the Village.

Strongly Disagree → Strongly Agree

- (40.) Monitoring for septic contamination in Village lakes is adequate. 33 0 50 0 17

Although runoff from lawns is considered of lesser concern than septic tank leakage, Cardinal Lake residents feel strongly that use of lawn herbicides should be restricted (83%).

Strongly Disagree → Strongly Agree

- (46.) Use of lawn herbicides near shorelines should be restricted. 0 0 17 33 50

Residents and their lawn care services should be asked to refrain from fertilizing close to the lake's edge. As most of Cardinal Lake residential area is approximately 20+ years old, it would be difficult to establish a buffer zone. Several of the lots are mostly pine straw for several feet back from the lake, thus limiting fertilizer runoff from these areas.

People must be made aware of what chemicals do to the water quality when runoff from their property occurs. Cardinal Lake residents feel strongly that they should be provided with better information on practices to minimize pollution.

Strongly Disagree → Strongly Agree

- (54.) The Village should provide residents with technical information on watershed and lake management "best practices." 0 0 0 67 33

The survey comments did not mention any specific concerns relating to bacteria and/or animal wastes; however, residents have posted a sign at both ends of Cardinal Dam reminding residents to pick up their animal waste. Concerns were expressed relating to dead fish in the pond just below Cardinal Lake and to an ongoing mosquito problem in the lake area. The dead fish problem was due to outflow from Cardinal Lake to the pond below during drawdown, resulting in stagnant water leading to the fish kill after outflow ended. An aerator pump has now been installed in this pond and will remain there until the dam is repaired and water again begins to flow.

II.3.3. General Water Quality Monitoring

Cardinal Lake residents feel strongly that monitoring programs should be put into place to track water quality status and changes.

Strongly Disagree → Strongly Agree

(39.) Periodic monitoring of lake water quality should be conducted. 0 0 0 17 83

Each lake representative has now been given access to a water quality monitoring kit and the first water quality tests were to be done during August and September 2008. Cardinal Lake tests were done August 28, 2008. Testing stations were established and will be used on a regular basis with results maintained in a log.

Cardinal Lake residents (100%) feel strongly that they should be informed of the results of water quality monitoring.

Strongly Disagree → Strongly Agree

(43.) The water quality and fishery testing program for our lakes should be formalized and results published. 0 0 0 50 50

Results of these tests should be published in the Pitch, Village Topics and any other media outlets available to WP residents.

II.4. Aquatic Vegetation

Observations during the August, 2008 water sampling on Cardinal Lake did not reveal any major problem with weed and/or aquatic growth. Some weeds had grown in areas that had become terrestrial beach due the drought and the dam repair drawdown. The Lake Management Questionnaire did note some vegetation problem:

Strongly Disagree → Strongly Agree

(41) Aquatic vegetation in the lakes is adequately monitored. 40 40 0 20 0

Strongly Disagree → Strongly Agree

(45) Aquatic weeds are being adequately controlled 20 80 0 0 0

Grass carp are not being observed in Cardinal Lake and none have been stocked since the village acquisition of the lake in 2007.

Cardinal Lake residents mainly agree (40%) that the lakes management is adequate for waterfowl habitat...40% had no opinion and 20% disagreed with the adequacy of waterfowl management.

Strongly Disagree → Strongly Agree

(47.) The management of the lakes as habitat for waterfowl is adequate. 0 20 40 40 0

II. 5. Winter Water Level Drawdown

Cardinal Lake respondents agree/strongly agree (80%) that the village lakes should be drawn down.

	Strongly Disagree→Strongly Agree				
(49.) Water levels in all village lakes should be drawn down.	0	0	20	40	40

As Cardinal Lake is automatically drawn down due golf course irrigation and current observations have not shown aquatic weeds to be a major problem, a planned draw down is not required at this time.

II.6. Boating

As previously indicated, there is little boat usage on Cardinal Lake. This may change if a boat ramp is built during the 2008-09 dam repairs.

II.6.1. Regulations

Most residents (100%) agree or have no opinion with current boating regulations.

	Strongly Disagree→Strongly Agree				
(29.) Boating regulations are appropriate as currently written.	0	0	60	40	0
(30.) Boating regulations are posted where required and are easily understandable.	0	0	60	40	0

Some support (20%) exists for modification of the Village ordinance restricting night-time boating.

	Strongly Disagree→Strongly Agree				
(33.) After-dark use of watercraft should be extended provided proper safety lights are displayed.	20	60	0	20	

Chapter J of Village ordinances is being revised for submission to Village Council and if approved will allow watercraft to operate after dark with the proper running lights.

II.6.2. Boat Registration

According to ordinance, the lakes of Whispering Pines are intended for the sole use of the residents and their guests. Under the ordinance, all boats are required to have a decal. The Village clerk must be prepared to ensure that the applicant is a resident. Cardinal Lake residents agree (40%) that registration costs are reasonable. 33% had no opinion.

	Strongly Disagree→Strongly Agree				
(32.) Fees for boat decals are reasonable and should be collected.	17	0	33	17	33

Whereas no boat access area exists for Cardinal Lake, there were no responses to the following item:

	No Problem→ Big Problem	
(9.) Presence of boats without current lake sticker		

Gerald R. Osborne

Cardinal respondents feel strongly that registration requirements should be firmly enforced (67%).

	Strongly Disagree → Strongly Agree				
(31.) Current decals for all watercraft should be stringently enforced by the Village.	0	0	33	33	34

II.6.3. Mooring Buoy

No interest has been expressed to establish a mooring buoy in Cardinal Lake.

II.7. Fisheries

Cardinal Lake has never been stocked by the Village, and it does not appear that there is a significant fish population. When the dam is repaired and the lake settles into a more regular level, consideration should be given to a stocking program. Although only one resident indicated fishing in Cardinal Lake, residents did respond in general to the fishing questions

	Highly Unsatisfactory → Highly Satisfactory				
(16.) Fishing.	20	0	60	20	0
(24.) Fishing areas (shoreline/parks)	0	0	60	40	0

Residents were in agreement (37%) that fish monitoring is adequate. This response is likely more applicable to WP lakes in general, as no monitoring of Cardinal Lake fish has been conducted. They firmly believe that monitoring results be publicized (100%).

	Strongly Disagree → Strongly Agree				
(42.) Status of fish populations is adequately monitored.	25	0	38	0	37
(43.) The water quality and fishery testing program for our lakes should be formalized and results published.	0	0	0	50	50

Cardinal respondents support (60%) supplemental fish stocking; but, that all fisheries management should be tailored to individual lake needs (67%). Assessment of the status of Cardinal Lake fish should be conducted and management needs established.

	Strongly Disagree → Strongly Agree				
(48.) The Village should stock the lakes for fishing when needed.	0	20	20	40	20
(50.) Fish management programs should be tailored to individual lakes.	0	0	33	33	34

II.8. Parks

Cardinal Lake has no parks, and respondents indicated little interest in developing any. Opportunity for developing a park is also limited by minimal Village property at the lake.

II.9. Swimming

Cardinal Lake has no established swimming areas, but limited swimming occurs from private property.

Attitudes toward large, inflatable floats, anchored temporarily in open water, were divided. One half (50%) of agree that such floats should be allowed, with 20% disagreeing that such floats should be allowed. If allowed the floats should be restricted in size and distance offshore (40- 60%)

	Strongly Disagree→Strongly Agree				
(35.) Offshore anchoring of large inflatable floats should be allowed.	0	20	20	50	0
(36.) If so, floats should be restricted in size.	20	0	40	40	0
(37.) If allowed, distance offshore should be restricted	0	0	40	60	0

No comments were received about how far into the lake floats should be allowed.

II.10. Enforcement

Enforcement of Village ordinances, as they pertain to Cardinal Lake, is important to lake residents. Of Cardinal respondents, 40% strongly disagree that village lakes are adequately patrolled and regulations enforced.

	Strongly Disagree→Strongly Agree				
(57.) Village lakes are adequately patrolled and regulations enforced.	40	0	40	20	0

II. 11. Communication

Communication is necessary at all levels of our lakes management. Without communication the village can not expect residents to understand all facets of good lake management. Responses to questions related to interest in more information were unanimous.

Better means are needed to involve Cardinal Lake residents in information exchange relative to the lake’s status and management. A core group to advise the Lake Rep and assist in communication needs to be developed.

II. 12. General Satisfaction

Cardinal Lake residents did show some general dissatisfaction with overall village lake water quality and management.

	Strongly Disagree→Strongly Agree				
(10) I am concerned about lake water quality	15	0	0	0	85

	Strongly Disagree→Strongly Agree				
(55) The overall quality of the village lakes is adequately maintained	40	20	20	20	0

	Strongly Disagree→Strongly Agree				
(58) Overall, I am satisfied with current management of lakes	40	0	20	40	0

III. CARDINAL LAKE ACTION PLAN:

Goal 1. To maintain and enhance the esthetic values and recreational opportunities of Cardinal Lake.

Objectives:

1: Develop a comprehensive plan to improve water quality entering Cardinal Lake via the input points, including a soil erosion control program.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Short: 2010
Responsibility:	LWB Lake Rep

2: Pursue the building of a boat ramp during the repair of Cardinal Dam.

Action:

Priority (High/Med/Low)	Medium
Cost (High/Med/Low)	Medium
Timeline (Short/Long)	Immediate
Responsibility:	LWB, Lake Rep, Village

3: Develop a fish stocking program for Cardinal Lake.

Action:

Priority (High/Med/Low)	Med
Cost (High/Med/Low)	Low/Med
Timeline (Short/Long)	Long 2011
Responsibility:	LWB, Lake Rep

4: Consider the development of a Village ordinance restricting the use of lawn herbicides and other detrimental chemicals within xx feet of a lake shoreline.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Med 2010
Responsibility:	LWB, Lake Rep

Goal 2. To base management on a thorough and reliable data base.

Objectives:

1. Identify lake input areas to improve storm water entering the lake through drainage ditches and corrugated pipe.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Short 2010
Responsibility:	Lake Rep

2. Determine the impact of paved culverts in home fronts on water entering the lake.

Action:

Priority (High/Med/Low)	Med
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Short
Responsibility:	LWB, Lake Rep

3. Determine if the normal condition of Cardinal Lake, i.e., without springs or major stream inputs, should be aerated.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Med
Timeline (Short/Long)	Short
Responsibility:	LWB, Lake Rep

4. Determine the status of Cardinal Lake fish populations.

Action:

Priority (High/Med/Low)	Med
Cost (High/Med/Low)	Med
Timeline (Short/Long)	Short, 2010
Responsibility:	LWB, Lake Rep

5. Determine if the large number of turtles currently in the lake have a positive or negative impact on future fish population.

Action:

Priority (High/Med/Low)	Med
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Short, 2009
Responsibility:	Lake Rep

6. Continue to collect water quality data in a standardized format and schedule.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Short/Long--Ongoing
Responsibility:	Lake Rep

7. Determine the extent of sedimentation during the 2008-09 dam repairs and if applicable develop a dredging plan for removal and disposal of current and future sedimentation. This would include development of sedimentation basins at the major storm water input areas.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	High
Timeline (Short/Long)	Short 2009
Responsibility:	Village Council, LWB, Lake Rep

Goal 3. To effectively communicate needs and actions (among residents, lake representatives, LWB, and the Village).

Objectives:

- 1: Develop and maintain a Cardinal Lake concerned resident data base by the end of 2009 for the purpose of sending and receiving Whispering Pines lake information.

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Med
Timeline (Short/Long)	Short, 2009
Responsibility:	Lake Rep

Background: The village survey showed a definite lack of lake interest from those residents living on or around the Cardinal Lake area. Most questions had a response of about 5-7 individuals. As the Whispering Pines lakes are one of the main reasons individuals move to the area, to have such a low response to the lake questions illustrates a lack of understanding of the problems facing the eight lakes.

- a. Obtain a listing, from tax records, of all residents living in the Cardinal Lake area. This will include those that live on and around the lake, the Whispering Woods Country Club and those that are impacted down steam from Cardinal Lake.
 - b. Build a data base containing all names and residents of those residents obtained from above listing noting those with lake irrigation systems.
 - c. Begin communication with Cardinal residents to provide information and request feedback. Specific needs for information on best management practices and monitoring results will be addressed.
- 2: Establish a core group to assist in development and implementation of Cardinal Lake goals and objectives.

Action:

Priority (High/Med/Low)	High
Cost (High/Med/Low)	Low
Timeline (Short/Long)	Immediate
Responsibility:	Lake Rep