

LAKE MONITORING PROGRAMS

*2012 Water Quality Monitoring Report
Kitsap Public Health District*

LAKE MONITORING PROGRAMS

BACKGROUND

In 2012, the Kitsap Public Health District collected water samples at 24 swimming beaches or other public access areas on 16 lakes in Kitsap County. Most of the public swimming beaches are located in public parks. During the summer, these parks and swimming beaches are visited by thousands of people. The goal of the Lake Monitoring Program is to protect the health and safety of recreational swimmers, and to promote stewardship of lake resources through public involvement and education.

With funding provided by the Kitsap County Surface and Storm Water Management Program, **600** lake water samples were collected from swimming beaches and public fishing access areas from May through September. These samples were analyzed for the presence of *Escherichia coli* (*E. coli*) bacteria. This type of bacteria is used as an indicator for the presence of human and/or animal fecal material in fresh water. Fecal material may contain bacteria and viruses which can make people sick. This is explained in greater detail in the methodology section of this report on page 12-4.



Long Lake County Park

Swimming beaches and/or public fishing access areas were monitored monthly at the following lakes; Buck, Carney, Mission, Panther, Square, Symington, Tahuya, Tiger, Wicks, and Wye Lake. Due to a history of more frequent water quality problems and higher swimmer usage, weekly monitoring was conducted at Horseshoe, Island, Wildcat, Kitsap, and Long Lake. Samples were also collected from swimming beaches at private camp facilities on Lake Flora. In addition, the Health District tracked cases of illness outbreaks associated with natural bathing waters, swimmer's itch, and responded to reports of algae blooms.

MONITORING OBJECTIVES

The Health District's lake monitoring efforts include two different components: swimming beach monitoring and nutrient monitoring. These are explained in detail on the following pages.

SWIMMING BEACH MONITORING

The objectives of the swimming beach monitoring program are different from the Health District's other water quality monitoring activities. Our swimming beach monitoring is intended to determine the potential health risk of swimming at a given location at a certain point in time. The results of our lake monitoring are *not* intended to establish water quality trends or identify specific pollution sources. The objectives of the swimming beach monitoring program include:

- Monitor public swimming beaches for water quality related public health indicators.
- Track and respond to reports of swimmer's itch and potentially toxic cyanobacteria blooms.
- Track and respond to reports of waterborne illness.
- Coordinate with swimming beach owners/operators regarding public health issues.
- Inform and educate swimming beach owners/operators and the public about public health and safety issues at swimming beaches.

NUTRIENT MONITORING

Since lakes are water-filled depressions in the earth's crust, they act as traps for organic and inorganic materials moved by water and wind. The ultimate fate of a lake basin is to become filled with sediment and eventually revert back to terrestrial vegetation - a process known as lake "succession". Lake succession consists of the following steps: (1) creation of the lake basin and filling with water (e.g., through glacial action); (2) aging, or eutrophication, of the lake; (3) transformation of the lake into a wetland or marsh; and (4) filling of the wetland or marsh with sediment and growth of terrestrial vegetation (Dion, N.P., 1978).

Aging, or "eutrophication," of a lake is a natural process driven by sedimentation in the lake and nutrient enrichment from numerous sources. As nutrients collect in a lake, the production of plant material increases. The primary stages of lake eutrophication are:

Oligotrophic – Very low nutrients; characterized by very clear water, with very few aquatic plants and fish.

Mesotrophic – Moderate amounts of nutrients; characterized by mostly clear water, with some aquatic plants and fish.

Eutrophic – High levels of nutrients; characterized by poor visibility in the water column, with many aquatic plants and fish. Algae blooms can be a problem in these lakes.

Classifications of oligo-mesotrophic and meso-eutrophic can be used for lakes which are judged to be in between the three basic stages (Rector & Hallock, 1994). Cultural eutrophication is the acceleration of the lake aging process by human activities. Some human activities which can accelerate eutrophication include failing on-site sewage systems, leaking sewer lines, improper

use of fertilizers, sedimentation caused by uncontrolled runoff from development activities, and improper agricultural waste management practices on farms in the lake's drainage area.

Eutrophic conditions are characterized by shallower waters and invasion of the lake by shoreline vegetation, replacement of green algae and diatoms with blue-green algae blooms, seasonal deficiencies of dissolved oxygen, and replacement of game fish by other species such as carp, suckers and catfish. These conditions often diminish the lake's ability to support beneficial uses, such as swimming and fishing.

To protect or restore beneficial uses to a lake, mesotrophic, meso-eutrophic and eutrophic lakes generally require some type of intervention to correct sedimentation and nutrient enrichment problems. Therefore, the Health District monitors nutrients levels in some lakes to determine their current "trophic" status.

In 2012 the Health District conducted trophic monitoring at Tahuya Lake.

METHODOLOGY

This section includes a discussion of the methodology used in the Health District's swimming beach monitoring, and a brief discussion of our nutrient monitoring efforts.

SWIMMING BEACHES

Swimming beaches are monitored according to procedures outlined in the Health District's "Swimming Beach Monitoring Plan." The key to the program is regular monitoring for the concentration of *E.coli* bacteria – an indicator of the presence of viruses and pathogens that can make people sick.

Lake swimming beaches are monitored either monthly or weekly, depending on how many people tend to swim at a given location. If more people swim at a certain beach, the Health District sampled it more frequently. Sampling frequencies for each beach are described in the individual lake summaries starting on page 12-10.

The U.S. Environmental Protection Agency (EPA) recommends that *E.coli* be used as the water quality indicator at freshwater swimming beaches. (Ambient Water Quality Criteria for Bacteria - 1986, EPA-440/5-84-002, 1986). *E. coli* is preferred over fecal coliform bacteria because *E. coli* concentrations demonstrate the highest correlation to cases of human gastrointestinal illness. *E. coli* is also superior to fecal coliform because it is more specific to fecal sources. For example, it does not enumerate *Klebsiellae* bacteria, a possible source of error in the fecal coliform analysis.



Horseshoe Lake County Park

Because of the EPA recommendation, the Health District uses *E. coli* bacteria as an indicator of human health risk in our lake swimming beach monitoring program. Samples are collected from a minimum of three locations within each public swimming beach area, and when applicable from two locations in public fishing accesses or other non-swimming areas. A geometric mean, or “geomean”, of the bacteria concentration is calculated from the sample results.

When the samples collected during a sampling event are high, and the geomean exceeds 126 bacteria colonies per 100 ml, the area is posted with warning signs. A confirmation sampling event is conducted the next business day to reassess the bacteria concentrations in that area. If, after the confirmation sampling event, the geomean still exceeds 126 organisms/100ml then the Health District closes the beach area. Closed beaches are monitored until the geomean is less than 126 organisms/100ml for two consecutive sampling events. If most of the results from a sampling event are low, but one sample exceeds 406 organisms/100ml, warning signs are not posted immediately. Instead a confirmation sampling event is conducted the next day.

NUTRIENT OR “TROPHIC” MONITORING

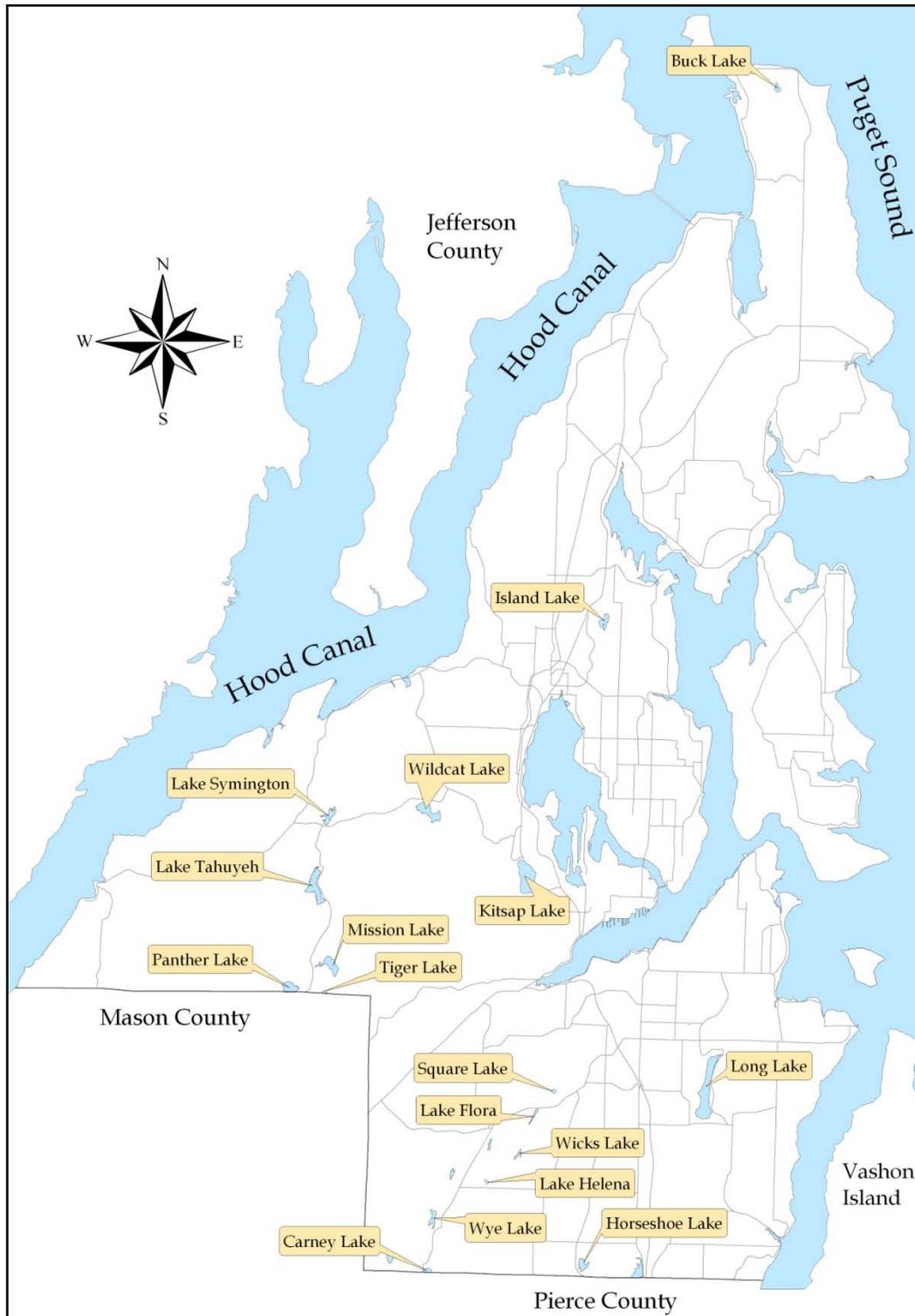
Trophic state monitoring generally involves monitoring lakes for nutrients (nitrogen and phosphorous), algae, and aquatic plants. Algae concentration is evaluated through estimates of transparency obtained from secchi disk measurements and analysis of lake water for the presence and concentration of chlorophyll A. Additionally, a physical survey of the type and abundance of aquatic weeds in the lake is helpful for estimating its trophic state. For more detailed information on our trophic monitoring, please see the Health District’s Lake Trophic Assessment Monitoring Plan.

In addition to monitoring water quality, the Health District may survey public swimming beaches for safety hazards and forward recommendations to the organization that manages the area. The Health District also responds to blue-green algae blooms, complaints of swimming-related water-borne illness, and swimmer’s itch. Table 12-1, on the following page, summarizes the closure criteria used by the Health District when evaluating risks from bacteria concentrations, cyanobacteria, or swimmer’s itch.

TABLE 12-1
SUMMARY OF LAKE ACTION LEVELS AND CLOSURE CRITERIA
LAKES MONITORING PROGRAM 2012

Parameter	Action Level	Response/Action
E. coli Bacteria	Single sample ≥ 406	Resample beach on next work day.
	Event geomean ≥ 126	Post “ Unsafe for Swimming ” warning signs, resample next work day.
	Resample event geomean < 126	Remove “Unsafe for Swimming” warning signs, no formal closure advisory.
	Resample event geomean still ≥ 126	Close beach, issue press release, revise hotline message. Resample at least weekly until reopened.
	After closure, event geomean < 126 for 2 consecutive events.	Reopen beach, change/remove warning signs, issue press release, revise hotline message.
Blue-green Algae or Cyanobacteria	Significant bloom of potentially toxic species observed in lake water.	Post “ Potentially Toxic Algae ” advisory signs. Collect algae samples to confirm species and screen for weekly toxicity, update hotline.
	Toxin present, Anatoxin-a greater than 1 ug/ml or Microcystin greater than 6 ug/ml.	Post “ Toxic Algae ” warning signs, issue press release, revise hotline message.
	Toxin present and animal deaths or confirmed human illness report	Post “ DANGER Toxic Algae ” warning signs, close lake to swimming, fishing, and boating, issue press release, revise hotline message.
	Visible algae bloom dissipates potentially toxic species absent and/or toxin samples negative.	Reopen beach, change/remove warning signs, issue press release, revise hotline message.
Swimmers Itch	Ongoing	Issue seasonal swimmer’s itch advisory for all lakes. Ensure that all lake beaches are posted with warning signs.
	Multiple reports from the same beach or lake	Post additional signage or (if the situation is severe) close the beach, address source(s), if possible, reopen when source(s) have been corrected and if E.coli sample results are within standard.
Safety Hazards	Safety hazard present that is an immediate threat to life or health	Notify the owner/operator of the hazard and close the beach until the safety hazard is corrected.
	Safety hazard present that is not an immediate threat to life or health	Notify the owner/operator verbally and in writing, follow-up inspections until hazard is corrected.
Waterborne Illness	Receive 2 or more illness reports from same beach or lake on same day	Evaluate for beach closure, issue press release, revise hotline message. Coordinate with Communicable Disease Clinic and DOH

FIGURE 12-1
LOCATION OF LAKES IN KITSAP COUNTY WITH PUBLIC ACCESS



SUMMARY OF PUBLIC HEALTH ADVISORIES

The Health District’s lake monitoring activities resulted in the following public health advisories in 2012:

Lake	Swimming Beach	Health Advisory	Reason for Advisory	Duration of Advisory
Buck Lake	County Park			
Carney Lake	Public Fishing Access			
Lake Flora	Pilgrim Firs			
Lake Helena	Camp Niwana			
Horseshoe Lake	County Park			
	Miracle Ranch			
Island Lake	County Park			
	Crista Camp			
Kitsap Lake	Camp McKean		Toxic Algae Bloom	7/23/2012 through 12/31/2012
	Kitsap Lake Park		Toxic Algae Bloom	7/23/2012 through 12/31/2012
Long Lake	County Park		Toxic Algae Bloom	8/6/2012 through 11/9/2012
Mission Lake	Public Fishing Access			
Panther Lake	Public Fishing Access			
Square Lake	State Park			
Lake Symington	Spillway Park			

	Division 5 Park			
Lake Tahuya	Community Park			
Tiger Lake	Public Fishing Access			
Wicks Lake	County Park			
Wildcat Lake	County Park			
	Lutherhaven North			
	Lutherhaven South			
Wye Lake	Shirey Park			

INDIVIDUAL LAKE SUMMARIES

The next section provides summaries for each of the lakes monitored by the Health District in Kitsap County. Individual lakes are listed on each of the following pages.

BUCK LAKE

Buck Lake is located at the northern tip of the Kitsap Peninsula, near Hansville, in the Foulweather Bluff/Appletree Cove watershed. The Health District monitored the public swimming beach at Buck Lake County Park monthly between May and September. Monitoring station locations are shown in Figure 12-2, and sample results are summarized in Table 12-2.



Figure 12-2, Buck Lake Station Locations

Water quality at Buck Lake County Park met the *E. coli* standard throughout the 2012 season. No complaints of swimmers itch from Buck Lake were documented in 2012.

Nutrient Summary

The most recent data for this lake, combined with recent observations, indicates the trophic state of Buck Lake is “meso-eutrophic.” This classification is characterized by mostly clear water with moderately high plant and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-4.

TABLE 12-2
E. COLI BACTERIA RESULTS SUMMARY
BUCK LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Buck Lake County Park	9	< 2 – 9.7	3	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-3 for a more detailed explanation.

ISLAND LAKE

Island Lake is located within the Dyes Inlet watershed in central Kitsap County. The Health District monitored two stations on Island Lake: the swimming beaches at Island Lake County Park and Crista Camp (a private camp). The beaches at Island Lake were monitored weekly between May and September. Monitoring station locations are shown in Figure 12-3, and results summarized in Table 12-3.

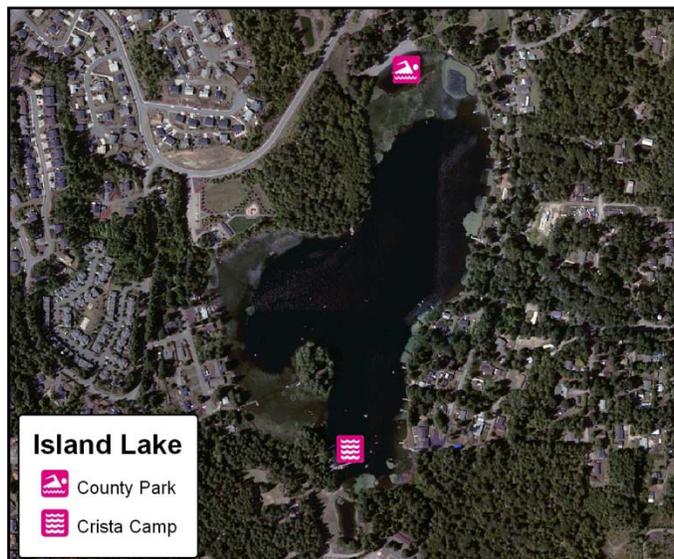


Figure 12-3, Island Lake Station Locations

The beaches at Island Lake met the *E. coli* standard throughout the 2012 season. No complaints of swimmers itch were reported from Island Lake in 2012. The organism that causes swimmer's itch has been prevalent at Island Lake's swimming beaches in past years.

Nutrient Summary

The most recent data for this lake, combined with recent observations, indicates the trophic state of Island Lake is "mesotrophic." This indicates a moderate amount of nutrients; characterized by mostly clear water, with some aquatic plants and fish. For a more detailed explanation of the Health District's nutrient monitoring, see page 12-4.

TABLE 12-3
E. COLI BACTERIA RESULTS SUMMARY
ISLAND LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ₂
Island Lake County Park	63	<2 – 488.4	17	0
Crista Camp	45	< 2 – 430	6	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-3 for a more detailed explanation.

KITSAP LAKE

Kitsap Lake is located within the Dyes Inlet watershed in central Kitsap County. In 2012, the Health District monitored the swimming beach at Camp McKean (a military recreational facility) and the City of Bremerton’s Kitsap Lake Park. The beaches at Kitsap Lake were monitored weekly between May and July. Monitoring station locations are shown in Figure 12-4, and results are summarized in Table 12-4.



Figure 12-4, Kitsap Lake Station

Bacteria levels at Camp McKean and Kitsap Lake Park met the *E. coli* standard throughout the 2012 season. The Kitsap Public Health District posted “Potentially Toxic Algae” advisory signs periodically through summer months when potentially toxic species were observed in lake water with the first posting occurring on June 21, 2012 . On July 23, 2012 “Danger Toxic Algae” warning signs were posted near fishing and boating accesses. This advisory is still in effect as of December 31, 2012.

Nutrient Summary

The most recent data for this lake indicates it is “eutrophic.” This classification is characterized by poor visibility in the water column, high nutrients, and high plant and animal production. Cyanobacteria blooms can be a problem in these lakes. This process can be accelerated by human activities affecting the lake. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-4.

TABLE 12-4
E. COLI BACTERIA RESULTS SUMMARY
KITSAP LAKE, 2012

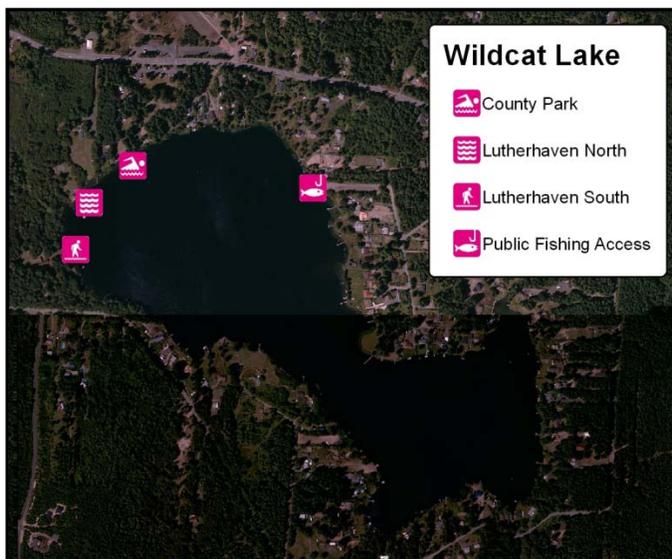
Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Camp McKean	27	< 2 – 435.2	2	Cyanobacteria ongoing as of 12/31/2012
Kitsap Lake Park	28	< 2 – 63.1	2	Cyanobacteria ongoing as of 12/31/2012

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-3 for a more detailed explanation.

WILDCAT LAKE

Wildcat Lake is located within the Dyes Inlet watershed in central Kitsap County. The Health District monitored three areas on Wildcat Lake; the public swimming beach at Wildcat Lake County Park, and two beaches at Lutherhaven (a private camp). Each site was sampled weekly between May and September. Monitoring stations are shown in Figure 12-5, and results summarized in Table 12-5.



Water quality at the county park and Lutherhaven swimming beaches met the *E. coli* standard during 2012.

No reports of swimmers itch from Wildcat Lake were documented in 2012.

Nutrient Summary

The most recent data for this lake, combined with recent observations, indicates the trophic state of Wildcat Lake is “oligo-mesotrophic.” This classification is characterized by mostly clear water, and relatively few aquatic plants. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

Figure 12-5, Wildcat Lake Station Locations

TABLE 12-5
E. COLI BACTERIA RESULTS SUMMARY
WILDCAT LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Wildcat lake County Park	45	< 2 – 156.5	4	0
Lutherhaven Camp – North	48	< 2 – 325.5	5	0
Lutherhaven Camp – South	44	< 2 – 13.4	2	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

LAKE SYMINGTON

Lake Symington is located within the Upper Hood Canal watershed in western Kitsap County. The Health District monitored two stations on Lake Symington: the swimming beach at the Community Park near the spillway and Division 5 Community Park. Each of these sites was monitored at least once monthly between May and September. Monitoring station locations are shown in Figure 12-6, and sample results are summarized in Table 12-6.



Figure 12-6, Lake Symington Station

Water quality at the Lake Symington swimming beaches met the *E. coli* standard throughout the 2012 season. No complaints of swimmers itch from Lake Symington were documented in 2012.

Nutrient Summary

The most recent data for this lake, combined with recent observations, indicates the trophic state of Lake Symington is “mesotrophic.” This classification is characterized by mostly clear water. However, abundant aquatic plant growth is a concern for residents of Lake Symington. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-6
E. COLI BACTERIA RESULTS SUMMARY
LAKE SYMINGTON, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Division 5 Park	12	<2– 36.9	6	0
Community Park (Spillway)	12	<2-8.5	3	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

LAKE TAHUYA

Lake Tahuya is located within the Tahuya/Union River watershed in southwestern Kitsap County. The Health District monitored the Community Park swimming beach at least once monthly between May and September. Monitoring station locations are shown in Figure 12-7, and sample results are summarized in Table 12-7.

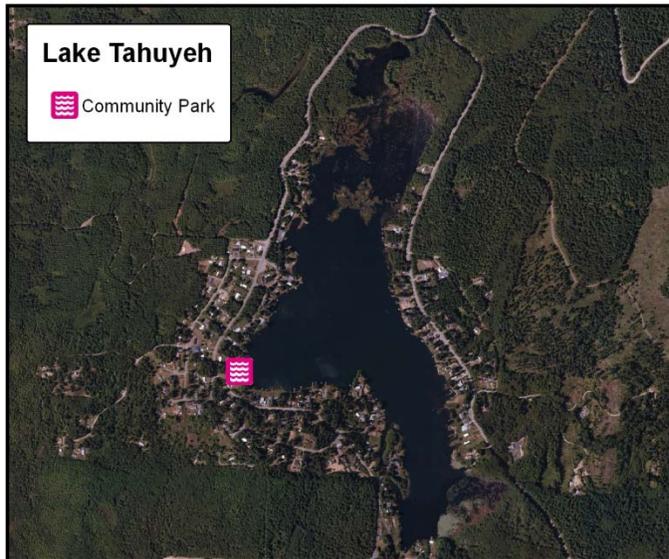


Figure 12-7, Lake Tahuya Station Locations

Water quality at the community park on Lake Tahuya met the *E. coli* standard throughout the 2012 season. No complaints of swimmers itch from Lake Tahuya were documented in 2012.

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be accelerated by human activities affecting the lake. The most recent data for this lake indicates it is “meso-eutrophic.” This classification is characterized by water that is sometimes clouded by algae growth, with moderate plant and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-7
E. COLI BACTERIA RESULTS SUMMARY
LAKE TAHUYA, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Lake Tahuya Community Park	12	< 2 – 12.1	4	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

MISSION LAKE

Mission Lake is located within the Tahuya/Union River watershed in southwestern Kitsap County. The Health District monitored the state public fishing access at least once every month between May and September.



Figure 12-8, Mission Lake Station Locations

Monitoring station locations are shown in Figure 12-8, and sample results are summarized in Table 12-8.

Water quality at the Mission Lake public fishing access met the *E. coli* standard throughout the 2012 season.

No complaints of swimmers itch from Mission Lake were reported in 2012.

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be accelerated by human activities affecting

the lake. The most recent data for this lake indicates it is “mesotrophic.” This classification is characterized by mostly clear water, with moderate plant and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-8
E. COLI BACTERIA RESULTS SUMMARY
MISSION LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Mission Lake PFA ³	8	<2-25.6	5	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

³ Public Fishing Access (PFA).

TIGER LAKE

Tiger Lake is located within the Tahuya/Union River watershed in southwestern Kitsap County. Although the southern half of Tiger Lake is in Mason County, the public fishing access is located in Kitsap County. The Health District monitored the state public fishing access at least once every month between May and September.

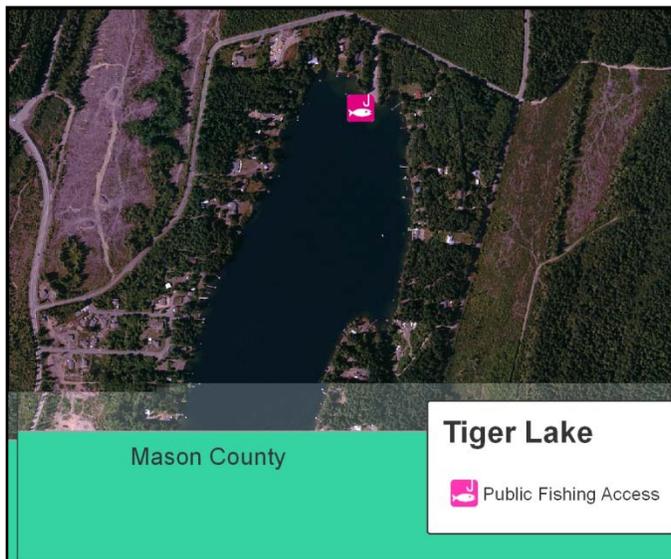


Figure 12-9, Lake Monitoring Station

Monitoring station locations are shown in Figure 12-9, and sample results are summarized in Table 12-9.

Water quality at the Tiger Lake public fishing access met the *E. coli* standard throughout the 2012 season.

No complaints of swimmers itch associated with Tiger Lake were reported in 2012.

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be

accelerated by human activities affecting the lake. The most recent data for this lake indicates it is “oligo-mesotrophic.” This classification is characterized by clear water, with limited plant and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-9
E. COLI BACTERIA RESULTS SUMMARY
TIGER LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Tiger Lake PFA ³	12	< 2 – 2	< 2	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

³ Public Fishing Access (PFA).

PANTHER LAKE

Panther Lake is located within the Tahuya/Union River watershed in southwestern Kitsap County. The Health District monitored the state public fishing access at least once every month between May and September.



Although the majority of Panther Lake is located within Kitsap County, the only public access is located on the Mason County side of the lake. Therefore the only sampling location available is actually within Mason County. Monitoring station locations are shown in Figure 12-10, and sample results are summarized in Table 12-10.

Water quality at the public fishing access met the *E. coli* standard throughout the 2012 season. No complaints of swimmers itch from Panther Lake were reported in 2012.

Figure 12-10, Panther Lake Station Locations

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be accelerated by human activities affecting the lake. The most recent data for this lake indicates it is “oligo-mesotrophic.” This classification is characterized by clear water, with limited plant and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-10
E. COLI BACTERIA RESULTS SUMMARY
PANTHER LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Panther Lake PFA ³	8	< 2 – 1	< 2	0

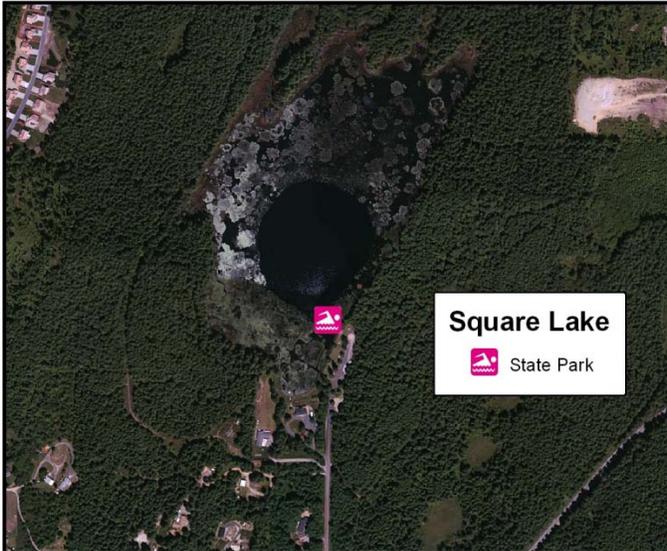
¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

³ Public Fishing Access (PFA).

SQUARE LAKE

Square Lake is located within the Sinclair Inlet watershed in southern Kitsap County. The Health District monitored the swimming beach at Square Lake State Park at least once every month between May and September. Monitoring station locations are shown in Figure 12-11, and sample results are summarized in Table 12-11.



Water quality at Square Lake State Park met the *E. coli* standard throughout the 2012 season.

No complaints of swimmers itch from Panther Lake were reported in 2012.

The Health District does not have any nutrient data for Square Lake.

Figure 12-11, Square Lake Station Locations

TABLE 12-11
E. COLI BACTERIA RESULTS SUMMARY
 SQUARE LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Square Lake State Park	12	<2 – 12.2	3	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

WYE LAKE

Wye Lake is located within the Rock Creek/Coulter Creek watershed in southern Kitsap County. The Health District monitored Shirey Community Park at least once every month between May and September. Monitoring station locations are shown in Figure 12-12, and sample results are summarized in Table 12-12.



Figure 12-12, Wye Lake Station Locations

Water quality at the Shirey Community Park met the *E. coli* standard throughout the 2012 season.

No complaints of swimmers itch from Wye Lake were reported in 2012.

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be accelerated by human activities affecting the lake. The most recent data for this lake indicates it is “Meso-oligotrophic.” This classification is characterized by mostly clear water, with moderate plant

and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-12
E. COLI BACTERIA RESULTS SUMMARY
WYE LAKE, 2012

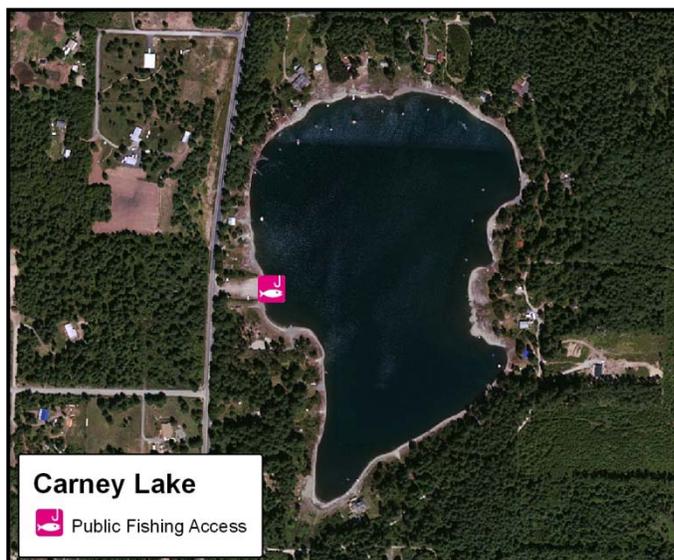
Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Shirey Community Park	9	< 2 – 18.7	2	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

CARNEY LAKE

Carney Lake is located within the Rock Creek/Coulter Creek watershed on the southern boundary of Kitsap County. Monitoring station locations are shown in Figure 12-13, and sample results are summarized in Table 12-13.



Although a large portion of Carney Lake is located within Kitsap County, the only public access is located on the Pierce County side of the lake. Therefore the Health District monitored the state public fishing access in Pierce County at least once every month starting in May. This continued while the access was open for fishing.

The station met the *E. coli* water quality standard throughout the 2012 season.

No complaints of swimmers itch from Carney Lake were reported in 2012.

Figure 12-13, Carney Lake Station Locations

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be accelerated by human activities affecting the lake. The most recent data for this lake indicates it is “Meso-oligotrophic.” This classification is characterized by mostly clear water, with moderate plant and animal production. For a more detailed explanation of the Health District’s nutrient monitoring, see page 12-6.

TABLE 12-13
E. COLI BACTERIA RESULTS SUMMARY
CARNEY LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Carney Lake PFA ³	4	< 2 –0.5	< 2	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

³ Public Fishing Access (PFA).

LONG LAKE

Long Lake is located within the Colvos Passage/Yukon Harbor watershed in southern Kitsap County. The Health District monitored the swimming beach access weekly at Long Lake County Park. Monitoring station locations are shown in Figure 12-14, and sample results are summarized in Table 12-14.

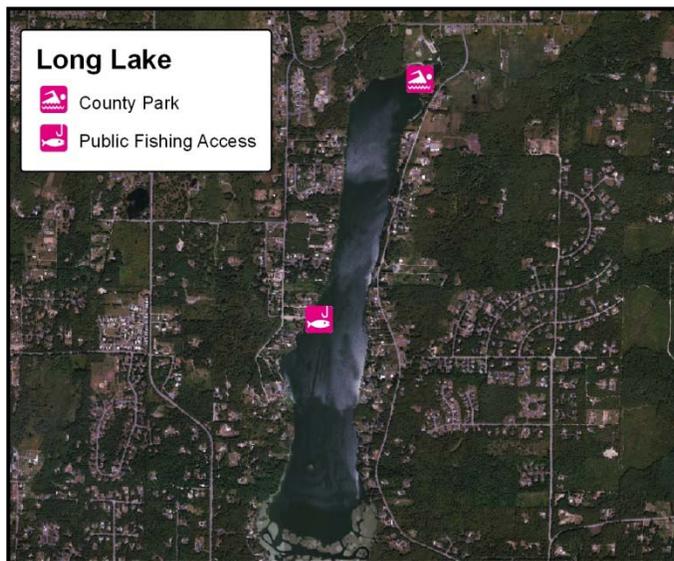


Figure 12-14, Long Lake Station Locations

Water quality at Long Lake met the *E. coli* standard the 2012 season.

The Kitsap County Public Health District posted “Potentially Toxic Algae” advisory signs periodically through summer beginning on May 29, 2012 when potentially toxic species were observed in lake water.

On August 6, 2012 a Toxic Cyanobacteria advisory was posted along with “Toxic Algae” warning signs near fishing and boating accesses. This advisory is in through November 9, 2012. The drastic change in water quality in regards to algae blooms is likely due to the loss of funds to support alum treatments to the lake water which limits the amount of

phosphorous available for algae growth.

Kitsap County Public Health is currently working on PIC project funded by US Department of Ecology and Washington State Department of Health. The project is to reduce pathogens entering the lake. The project is to be completed by December 2012.

No reports of swimmers itch were reported in from Long Lake in 2012.

TABLE 12-14
***E. COLI* BACTERIA RESULTS SUMMARY**
LONG LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Long Lake County Park	64	< 2 – 360	2	Blue Green Algae and ended on 11-9-12

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

HORSESHOE LAKE

Horseshoe Lake is located within the Burley Creek watershed in southern Kitsap County. The Health District monitored three stations on Horseshoe Lake; the State Public Fishing Access (PFA), Horseshoe Lake County Park, and Miracle Ranch (a private camp). All beaches were sampled weekly between May and September. Monitoring station locations are shown in Figure 12-15, and sample results are summarized in Table 12-15.

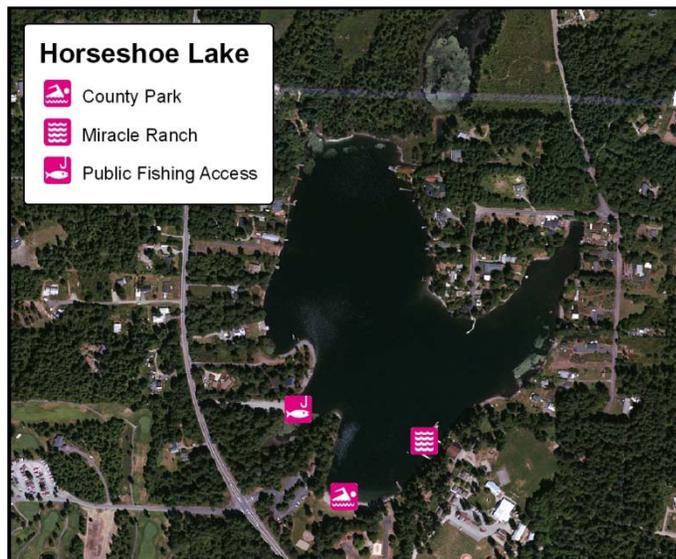


Figure 12-15 Horseshoe Lake Station Locations

Water quality at Horseshoe Lake met the *E. coli* standard throughout the 2012 season. The Health District did not receive any complaints of swimmers itch at Horseshoe Lake in 2012.

Nutrient Summary

As discussed on page 12-2, the aging or “eutrophication” of a lake is a natural process driven by sedimentation of the lake and nutrient enrichment from numerous sources. This process can be accelerated by human activities affecting the lake. The most recent data for this lake indicates it is “meso-eutrophic.” This classification is characterized by water that is periodically cloudy with algae growth, and has moderate plant and animal production.

TABLE 12-15
E. COLI BACTERIA RESULTS SUMMARY
HORSESHOE LAKE, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Horseshoe Lake County Park	64	< 2 – 517.2	8	0
State Public Fishing Access	6	< 2 – 10	2	0
Miracle Ranch	45	< 2 – 32.4	4	0

¹ Reported as a geometric mean for the entire sampling season.

WICKS LAKE

Wicks Lake is located within the Minter Creek watershed in southern Kitsap County. There is an undeveloped county park next to the lake with beach access. The Health District monitored the swimming beach at Wicks Lake County Park monthly between May and September.



Monitoring station locations are shown in Figure 12-16, and sample results are summarized in Table 12-16.

This station met the *E. coli* bacteria standard throughout the 2012 season.

The Health District did not receive any complaints of swimmers itch at Wicks Lake in 2012.

The Health District does not have any nutrient data for Wicks Lake.

Figure 12-16, Wicks Lake Station Locations

TABLE 12-16
E. COLI BACTERIA RESULTS SUMMARY
 WICKS LAKE, 2012

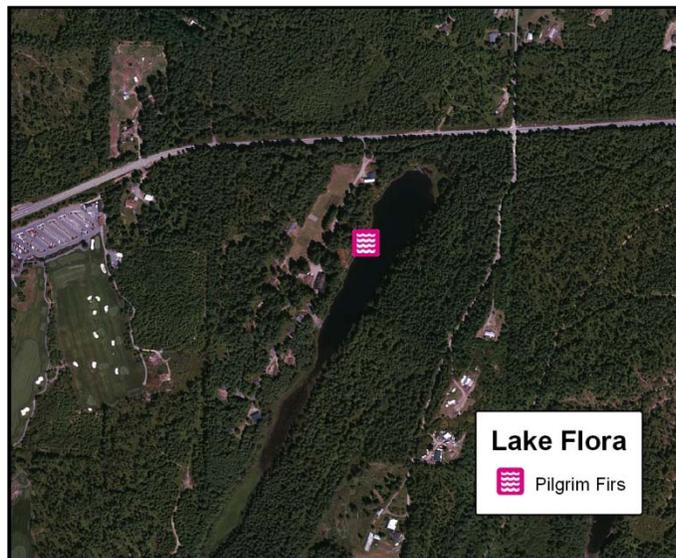
Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Wicks Lake County Park	12	< 2 – 81.6	12	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

LAKE FLORA

Lake Flora is located within the Coulter Creek watershed in southern Kitsap County. The Health District monitored the swimming beach at Pilgrim Firs, a private retreat facility on Lake Flora, every month during their typical swimming season in July and August.



Monitoring station locations are shown in Figure 12-16, and sample results are summarized in Table 12-16.

The swimming beach met the *E. coli* bacteria standard throughout the 2012 season.

The Health District did not receive any complaints of swimmers itch at Lake Flora in 2012.

The Health District does not have any nutrient data for Lake Flora.

Figure 12-16, Lake Flora Station Locations

TABLE 12-16
E. COLI BACTERIA RESULTS SUMMARY
LAKE FLORA, 2012

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Pilgrim Firs	9	< 2 –3.1	< 2	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-7 for a more detailed explanation.

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