Appendix B. Request form

**Request Form for Assessing Lakes for Natural Background Conditions**

In order to make an informed decision, the lake/stream water chemist must have as much information as possible about the lake in question in order to determine if natural background conditions are responsible for eutrophication. Champions should gather as much of the following information as possible and provide it to the lake/stream water chemist (typically a Lakes & Streams Monitoring Unit staff) for the watershed in question. This form, with any supporting documentation attached, must be delivered one week prior to the scheduled professional judgment group (PJG) meeting. Depending on how much time is available during the PJG, a follow-up meeting to the PJG may be needed to finish discussion and reach a decision.

|  |  |  |  |
| --- | --- | --- | --- |
| **Champion’s** **name:** | | | |
| **Cover** | **Recommended Sources:** | **Lake name (ID#):** | **Ecoregion Specific Land Use Ranges from table below:** |
| Lake Ecoregion | US EPA Level III (revised 2000) | Echo Lake (69-0615) |  |
| Lake surface area | 1:24,000 NDH area | 1,139 acres |  |
| Lake maximum depth | DNR Fisheries | 10 feet |  |
| Lake mean depth | 6 feet |  |
| Lake % littoral | 100 % |  |
| Watershed area (total) | DNR Catchment layer | 30,929 acres |  |
| Watershed: lake area |  | 27:1 |  |
| Forest (% total) | 2001 NLCD Land Use (or newer) | 67 % | 54 - 81 |
| Water/wetland (% total) | 32 % | 14 - 31 |
| Pasture/open (% total) | <1 | 0 - 6 |
| Cultivated (% total) | 0 | <1 |
| Urban (% total) | <1 | 0 -7 |
| Assessed data (# obs) | MPCA STORET data | 11 (2001; 2008-2011) |  |
| TP µg/L (10-year average) | 46 (June- Sept. samples only) | No change in means when 2001 full assessment is added to calculations |
| Chl-a µg/L (10-year average) | 12.5 (June- Sept. samples only) | See above |
| Secchi meters (10-year average) | 1.0 (June- Sept. samples only) | See above |
| IWM year | MPCA | 2015 |  |
| Local sampling (years) |  | 2001 & 2008-2011 | MPCA / DNR Sentinel Lake |
| Secchi trend (from CLMP trends) | MPCA | No Trend |  |
| Watershed name (HUC#) |  | 09030002 |  |

**Champion** **can ask assigned lake chemist (usually someone from the Lakes & Streams Monitoring Unit) for help in completing the table above.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Land Use %** | **NLF (NMW)** | **NCHF (DA & RRV)** | **WCBP** | **NGP** |
| Forest | 54 – 81 | 6 – 25 | 0 – 15 | 0 – 1 |
| Water and Wetland | 14 – 31 | 14 – 30 | 3 – 26 | 8 – 26 |
| Pasture and Open | 0 – 6 | 11 – 25 | 0 – 7 | 5 – 15 |
| Cultivated | < 1 | 22 – 50 | 42 – 75 | 60 – 82 |
| Urban | 0 – 7 | 2 – 9 | 0 – 16 | 0 - 2 |

**Notes:**

* **If you believe that the lake in question should be assessed against alternative ecoregion standards, that request should be taken directly to the watershed assessment team during the professional judgment group meeting. Such cases will not be considered through a natural background review process.**
* **Direct point source discharges to the lake or notable point/nonpoint source activity within the lake’s watershed will likely result in a negative decision for the natural background request. See the guidance document for more information.**

1. Have there been any changes to fisheries management in recent years? Fisheries staff at the nearest DNR regional and area offices can help staff determine this.

* No. The lake has been routinely surveyed since 1960, and efforts have been increased since Echo became part of the Sentinel Lakes program in 2008. The detailed Sentinel Lake report on Echo Lake is available here:

<http://www.pca.state.mn.us/index.php/view-document.html?gid=17858>

1. Provide a summary, and the locations on a map, of ditching or stormwater conveyances that lead directly to the lake. Local (i.e., county) records may be available to help staff determine this.

* All streams flowing into Echo Lake are natural.

1. Provide information on the number of cabins, year-round lake homes, and resorts on the lake shoreline, and a map showing the location of this development.

* There are two resorts on Echo Lake, one appears to have gone out of business in the last few years.
* There is one 24 site US Forest Service rustic campground on the lake.
* There are about 3 other seasonal cabins / properties along the lake, adjacent to the resort roads.
* Approximately 90% of the Echo Lake shoreline is in public ownership and in a natural state.

1. Provide summary information as to the status of septic systems of dwellings on the shoreline. Local offices may have such records.

* The two resorts on the lake had septic inspections in 2008 by St. Louis County, and were deemed conforming.

1. Provide information pertaining to changes to aquatic vegetation in the lake over time. Has there been chemical or mechanical removal of vegetation in response to shoreland development? Staff may be able to consider changes over time through aerial photos or by contacting the aquatic plant management (APM) staff in the DNR fisheries office nearest the lake to see if APM permits have been issued in the past.

* Macrophytes in Echo Lake are in a natural state. Macrophytes were described in detail in the Sentinel Lake report. Due to the natural bog stain in the lake, macrophytes are relatively sparse in the lake, but abundant and diverse near-shore.

1. Are their permitted point source discharges (WWTFs or feedlots) to the lake in question or within the watershed? If yes, please provide details on the nature of the discharge, the maximum capacity (MGD for WWTFs, maximum animal units for feedlots) the receiving water, proximity to the lake, etc.

* There are no permitted point source discharges or feedlots in the Echo Lake HUC-11 watershed

1. Provide any known information on unpermitted activities that occur on or near the lakeshore (i.e., unpermitted feedlot activities, etc.).

* None

1. Provide information pertaining to the historical use of, or impacts to, the lake (i.e., previous feedlot operations or point-source discharge, previous development around the lake, etc.). Local staff and even landowners can often provide this perspective. An approach for assembling/researching historical land use and related activities from county/local records and archives is presented in Heiskary and Swain (2002).

* The Sentinel Lake report has compiled the following historical information. The initial land clearance and resort development took place in 1969. Since that time the only anthropogenic impact in the HUC-11 watershed has been logging. Lakeshore areas have not been logged. There has been a limited amount of logging in this remote part of Superior National Forest from 2000-2010 (using the DNR’s forest change GIS coverage)

1. Have lake sediment cores been collected from the lake (or a nearby lake) that were used to reconstruct pre-European phosphorus concentrations or other relevant information? (materials that can help with this are located at: X:\Agency\_Files\Water\Condition Monitoring\Lakes\Sediment diatom work

* No, the nearest coring lakes were in Voyageur’s National Park.

Appendix C. Natural Background Evaluation form

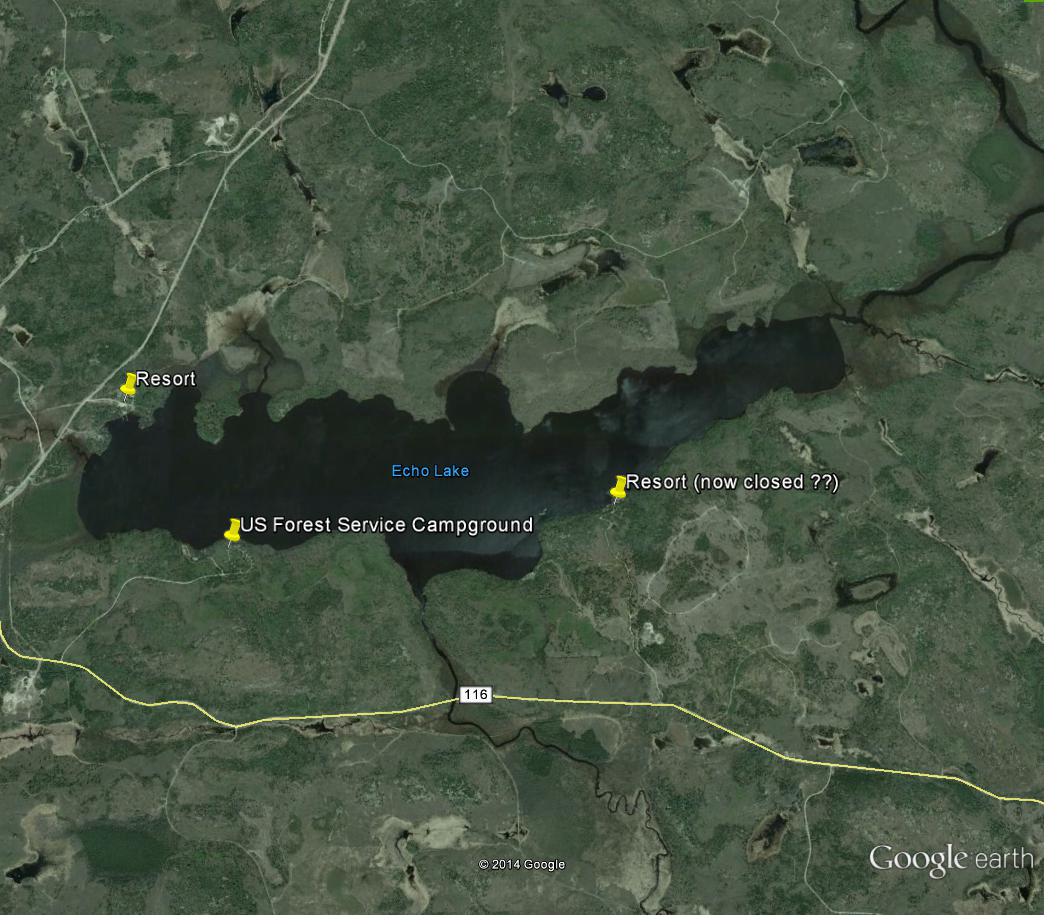
**Evaluation Form for Determination of Nutrient Impairment in Lakes Due to Natural Background Conditions**

GIS project is called NatBackground.mxd and is located in X:\Agency\_Files\Water\303D List\Natural Background Folder\Lakes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Review date |  | |  | |
| Lake name; ID # | Echo Lake, 69-0615 | | | |
| Review team members |  | | | |
|  | |  |  |
| **Stressor** | | **Present in watershed (yes/no)** | **Stressor contribution potential (high, moderate, low, none)** | **Comments (see below for possible factors to consider in evaluating each stressor)** | |
| **Anthropogenic sources** | | | | | |
| Overall land use disturbance | | Y | low | 2 resorts, 1 US Forest Service Rustic Campground | |
| Forest harvest sites | | Y | low | Some small logging sites have occurred in this part of Superior National Forest; nutrient impact to the lake is negligible | |
| Row crop agriculture | | N |  |  | |
| Pasture and hay land | | N |  |  | |
| Roads | | Y | low | The main road in the vicinity is the Echo Trail – a gravel county road between Ely and Crane Lake, and is about ½ mile south of the Lake. | |
| Feedlots (permitted) | | N |  |  | |
| Feedlots (unpermitted) | | N |  |  | |
| Direct conveyances (ditches or streamflows) to lake | | N |  |  | |
| Shoreline development (cabins, lake homes, resorts) | | Y | low | Echo Lake has 2 resorts which have passed septic inspections. Adjacent to them are 3-4 other seasonal properties. US Forest Service 24 site rustic campground with privies / vault toilets (no shower facilities or septic system / RV dump station). | |
| Unsewered communities | | N |  |  | |
| Industrial or municipal wastewater facilities | | N |  |  | |
| Stormwater | | N |  |  | |
| Stormwater unpermitted | | N |  |  | |
| Removal of aquatic vegetation | | N |  |  | |
| Reservoirs and dams (manmade) | | N |  |  | |
| History of anthropogenic use of lake or within watershed | | N |  |  | |
| **Do not proceed if anthropogenic factors suggest nutrient loading is measurable.**  **Lake is not a candidate for natural background** | | | | | |
| **Natural Factors** | | | | | |
| Forest cover | | Y |  | Forests covers > 60% of lake-shed, and logging in HUC-11 headwaters has been is minimal in the last decade. Best management practices are followed on cuts in Federal or State land. | |
| Wetland cover | | Y |  | Wetlands are common in watershed headwaters and along portions of lakeshore. Riparian wetlands present along streams tributary to the lake and likely contribute vegetation / organic material that naturally reduces transparency and are sources of nutrients to the lake. | |

|  |
| --- |
| Natural background review team recommendation. Include CALM designation or follow-up monitoring recommendation. Combine and attach all natural background evaluation forms used to evaluate an AUID. |
| Echo Lake, a large, polymictic and shallow lake in northeast Minnesota, has been extensively monitored and studied by the MPCA, DNR, and US Forest Service through the Sentinel Lakes program. A detailed report on the lake was completed by Steve Heiskary and Jesse Anderson in 2012. See  <http://www.pca.state.mn.us/index.php/view-document.html?gid=17858>  The lake has a strong TP, Chl-a, and Secchi dataset, sufficient for assessment, and was monitored by the MPCA in 2001, and 2008-2011. Echo Lake drains a large watershed in a remote part of Superior National Forest just outside the Boundary Waters Canoe Area Wilderness. The lake’s watershed is dominated by forest and wetland uses (> 90 %), and has water quality reflective of its watershed. Secchi transparency in the lake is naturally low (not meeting NLF standards) due to incompletely dissolved organic matter from the surrounding forests and wetlands (i.e. “bog stain”). The lake has a healthy fishery, algal, and aquatic plant community.  Lake models were run on Echo Lake as part of the Sentinel Lakes project. The MINLEAP and BATHTUB models both predict summer mean phosphorus and chlorophyll-a concentrations that exceed the current 2B standards for lakes in the Northern Lakes and Forests Ecoregion. Also, due to the lake’s large forest and wetland dominated watershed, shallow depth, short retention time (0.3 years), over 92% of the lake’s phosphorus budget was estimated to originate from natural sources within the watershed; with the overwhelming remainder coming from precipitation on the lake surface. Based on standard per capita estimates of seasonal resort occupancy, and 80% soil retention, BATHTUB estimates that <1 % of the lake’s phosphorus originates from septic systems. The two resorts on Echo lake had their septic systems inspected by St. Louis County in 2008, and were deemed compliant. The St. Louis County Sanitarian supports our natural background request on Echo Lake. Privies at the US Forest Service campground are routinely pumped, and are assumed to have no impact on nutrient loading.  Collectively, the detailed monitoring, modeling, and watershed analysis indicate that exceedances of all 3 NLF eutrophication standards (total phosphorus, chlorophyll-a, and Secchi transparency) on Echo Lake are the result of natural conditions. The minimal anthropogenic land uses in the watershed (logging, roads, and lakeshore development) have essentially no impact on in-lake water quality conditions. It is recommended that Echo Lake be placed in the 4D CALM category, and removed from the 2016 Impaired Waters List.    Submitted by Jesse Anderson, April, 2014. |

Figure 1. Map of Echo Lake, and Developed Properties. Echo Lake is located in St. Louis County approximately 10 miles south of Crane Lake, MN. The Lake is located in a remote part of Superior National Forest between Voyageur’s National Park to the north and the BWCA to the south and east.



One evaluation form is required for each lake. The evaluation of stressor potential is based primarily on the proximity of the stressor within the watershed and the degree of disturbance relative to the size of the waterbody. All stressors identified have the potential to contribute to a nutrient impairment through one or more pathways.

In the evaluation of all stressors consider the following evaluation criteria (USEPA 2008):

* Does the source contain or emit any of the critical parameters?
* Are there one or more pathways?
* Is the key parameter persistent enough to impact the reach?
* Does the source discharge the key parameters in the same time period that the impairment occurs?

The determination of natural condition will be based upon a weight of evidence approach utilizing the stressors and criteria defined below:

**Process:**

1. Determine and view catchment and watershed boundaries;
2. Turn on aerial photos and view watershed and lake;
3. View stream flow lines and pourpoint of lake to determine if there are conveyances into the lakes and how water drains from the lake;
4. Systematically turn on and off layers in GIS tool to consider the natural and anthropogenic impacts potentially affecting the lake;
5. Consider additional information brought forward by champion (i.e., past historical use of lake, past anthropogenic activity in watershed, changes to fisheries management, presence of ditches or streams to lake that cannot be seen on GIS layers, nature of septic systems along the lakeshore, presence of shoreline disturbance that can’t be viewed by GIS layers, etc.);
6. Consider assessment information and data; and
7. Record findings and natural background team decision on form above.

**Factors to consider in evaluating the potential contribution from each stressor:**

Industrial or Municipal Wastewater Facilities

* Location/proximity of discharge to lake or within lake catchment
* Type of wastewater (noncontact cooling water, POTW, industrial discharge)
* Discharge pollutant levels vs. receiving water pollutant levels
* Discharge volume vs. receiving water volume
* Discharge type (seasonal, daily, land application)

Feedlots (permitted)

* Location/proximity to lake, catchment or upstream conveyance to lake
* Verify accuracy of GIS points using aerial photos
* Permit compliance (no discharge); fish kill history?
* Manure application areas in relation to lake, catchment or upstream conveyance to lake - on tile fields within lake catchment? Cattle in lake?

Stormwater (permitted)

* Location/proximity to lake and shoreland
* Discharge volume vs. receiving water volume
* Type of stormwater (likely stressors include fertilizer/nutrients and animal waste)
* What stormwater controls are in place?

Reservoirs and dams (man-made)

* Location/proximity to lake and shoreland
* Nutrient status of the reservoir, if known
* Type of release (surface vs. hypolimnetic)
* Water level manipulation, eutrophic ambient conditions

Feedlots/pasture (unpermitted)

* Location/proximity to lake and shoreland
* Fish kill history
* Manure application areas in relation to lake, catchment or upstream conveyance to lake, cattle in lake, manure application on tiled fields within lake catchment

Forestry/row crop/pasture and hay lands

* Location/proximity to lake and shoreland
* Percentage of watershed in row crop
* Type of terrain (hilly, soil type, etc)

Physical alterations to the lake or shoreland

* Is the shoreland intact around the lake?
* Is there development within the lake’s catchment?
* Dams and reservoirs present within the watershed?
* Are channelized streams present within the watershed?
* Likelihood of agricultural tile drainage within system

Natural factors

* Is the lake’s catchment undisturbed by human-induced land use conversion?
* Is the lake a flow-through lake?
  + If so, is there any human disturbance of upstream lakes’ catchment?
  + Is/are upstream lake(s) impaired? If so, can the impairment(s) be linked to anthropogenic causes?
* Presence of forested areas, natural prairies or unaltered wetlands