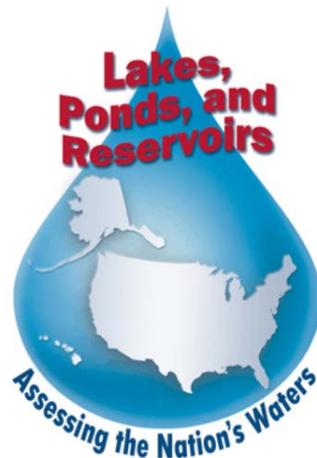




United States Environmental Protection Agency
Office of Water
Washington, DC
EPA 841-B-11-003

2012 National Lakes Assessment Site Evaluation Guidelines

Version 1.1, September 26, 2012



NOTICE

The intention of the 2012 National Lakes Assessment (NLA 2012) project is to provide a comprehensive “State of the Lakes” assessment for lakes, ponds, and reservoirs across the United States. The complete documentation of overall project management, design, methods, and standards and Quality Assurance/Quality Control measures is contained in this document and companion documents, including:

2012 National Lakes Assessment: Field Operations Manual (EPA 841-B-11-003)

2012 National Lakes Assessment: Laboratory Operations Manual (EPA 841-B-11-004)

2012 National Lakes Assessment: Quality Assurance Project Plan (EPA 841-B-11-006)

These documents together comprise the integrated set of QAPP documents. This document (*Site Evaluation Guidelines*) describes the process to compile the final list of candidate lakes for sampling. The process includes locating a candidate lake, evaluating the lake to determine if it meets the criteria for inclusion in the target population and is accessible for sampling, and, if not, replacing it with an alternate candidate lake. These guidelines are revised from those developed for the 2007 NLA (USEPA 2006), and are intended for specific use in the 2012 NLA. Mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use

The suggested citation for this document is:

USEPA. 2011. 2012 National Lakes Assessment. Site Evaluation Guidelines. EPA 841-B-11-005.
U.S. Environmental Protection Agency, Washington, DC.

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1 INTRODUCTION

The objectives of the 2012 National Lakes Assessment (NLA) include:

- 1) Using a statistically valid approach, determine the percent of the nation’s lakes that are in good, fair, and poor condition for key indicators of ecological health, trophic state, and recreation;
- 2) Determine the relative importance of key stressors as they relate to the condition of lakes across the Nation;
- 3) Evaluate changes in the condition of the nation’s lakes since the 2007 NLA;
- 4) Expand the capacity of State and Tribal programs to monitor and assess the condition of lakes.

The word *lake* in the remainder of this document includes lakes, reservoirs, and ponds. This document describes the steps involved to evaluate candidate lakes for the NLA, and arrive at a final list of lakes to visit and sample. Evaluation of candidate lakes serves several purposes. Lakes that do not meet the criteria for inclusion in the NLA *target population* are identified and replaced. **Table 1.1** lists the exceptions for inclusion in the target population of lakes, ponds, and reservoirs:

Table 1.1 Exceptions to NLA 2012 Target Population

Exceptions to the NLA 2012 Target Population
Ephemeral waterbodies (i.e., highly likely to be dry between May and September of the sampling year)
Lakes or ponds along the coast or near an estuary (below the head of salt) that are tidally-influenced (i.e., maintained solely by surface inflow of brackish water or seawater)
Run-of-the-river reservoir with retention time < 1 week
Used exclusively for aquaculture
Ponds or reservoirs with no recreational or aquatic life uses
Sewage lagoons
Disposal ponds (e.g., mine tailings)
Evaporation ponds
Stormwater retention basins
Constructed solely for storage of drinking water (e.g., upground reservoirs, p.8)
Active quarries
Borrow pits
Constructed stock or farm ponds (with no other uses)
Surface area less than 1 hectare
Total area of open water (does not have to be continuous) < 1000 m² (at time of sampling).
Maximum depth less than 1 m (at time of sampling)

The target population is that component of the resource (i.e., lakes, ponds, and reservoirs) that you want to assess. Lakes that meet the criteria, but that cannot be sampled, are also identified and replaced. Information obtained about important characteristics of candidate lakes (e.g., lake origin) is used to classify lakes for analysis and reporting. All of these activities improve the sample frame and allow the population of lakes assessed for ecological condition to be described more precisely. In addition, the number of field visits to lakes that should not or cannot be sampled is reduced.

The evaluation process for the NLA differs from many other monitoring and assessment studies in that

the accounting of candidate lakes that end up not being sampled is almost as important as identifying the lakes that will ultimately be sampled. Accounting for the status of all candidate lakes, sampled or not, provides the means to improve the survey design and site selection process, refine the sampling frame to reduce the number of non-target sites, and acknowledge any potential caveats to interpreting the results of the assessment in terms of sites that were identified as target but could not be sampled. In the 2007 NLA, the final set of sampled lakes represented only 73% of the target population—the other 27% represented a portion of the intended target population that could not be assessed because of lack of permission or physical inaccessibility (USEPA 2009). This unassessed portion of the target population is likely biased towards certain types of lakes and/or geographic regions. This constrains the ultimate objective of reporting the condition of all target lakes in the conterminous US. Any activity that reduces the proportion of unassessed lakes results in a more robust and representative assessment.

Given the scale and time constraints of NLA, and the desire to utilize local knowledge about lakes, the evaluation process involves many different persons. It is critical to apply the evaluation process consistently across all lakes and evaluators. To help make the process consistent and efficient, an electronic spreadsheet with drop-down menus and pick lists is used for the NLA 2012. For those lakes ultimately identified for sampling, it is also important to apply a reasonable (and consistent) level of effort to obtain permission when required, and to visit and sample lakes that are difficult to access because of physical barriers to access (e.g., distance, terrain).

1.1 Selection of the Master List of Candidate Lakes

Lakes were chosen from a sample frame of lake polygons represented in the National Hydrography Dataset (NHDplus; as represented on 1:100,000 scale maps), following a Generalized Random Tessellation Stratified (GRTS) survey design for a finite resource (Stevens and Olsen 2004). **Appendix C: National Lakes Assessment 2012 Survey Design** (page 27) provides additional details regarding the survey design.

The "master" list of sites selected for the NLA 2012 using the survey design contains approximately 7,000 candidate lakes. A sufficient number of lakes from this list must be evaluated in order to produce a final list of approximately 1,000 lakes that will be visited and sampled. The evaluation process is conducted separately for each State to arrive at the required number of sampling sites for the entire NLA. Additional lakes from the list may need to be evaluated if a State will be implementing a more intensive sampling regime in order to produce a State-level assessment of lakes. Approximately 400 of these 1,000 lakes are lakes that were previously sampled as part of the 2007 NLA, and so may not require a detailed evaluation for 2012 (other than to confirm it is still target and accessible).

2 LAKE EVALUATION PROCESS

For 2012, the NLA lake evaluation process consists of four phases:

- 1) A "rapid" **Geographic Information System (GIS)-based evaluation** on ~2,500 candidate lakes to assign an initial status to as many as possible;
- 2) A **Desktop Evaluation** to assign a final status to as many of the remaining candidate lakes as possible;
- 3) A **Field Evaluation** to assign a final status to any remaining candidate lakes;
- 4) A final refinement of the candidate lake list based on the ability to obtain **Permission** to sample.

The master list of candidate lakes (1.1) is apportioned into lists of candidate sites for each State. Each phase assigns a final status to as many candidate lakes on a State list as possible, with the next phase working primarily on the remaining lakes. By the end of the third phase, all candidate lakes should have a final status assignment. The fourth phase of the process refines the list of candidate lakes to identify those that will be visited and sampled in the NLA.

The general process for conducting the evaluation within any given phase is presented in Figure 1. The process consists of answering a series of Yes/No questions, as shown in Figure 2. A *Yes* answer moves the site to the next question, while a *No* answer generally involves assigning a final site status and selecting a replacement site for evaluation. When a question cannot be answered definitively, the status is classified as *Uncertain*, and the site is moved to the next phase of the evaluation.

The GIS-based evaluation phase will be done at a central location (WED-Corvallis). After the GIS phase, the list of candidates is provided to EPA Regions, States, and Tribal Nations for desktop and field evaluations (when required). The GIS-based, desktop, and field evaluation phases are used to determine if a candidate lake is part of the target population, if it is safe to access, and if permission is needed (in the case of no public access). Then, if needed, permission is requested as the fourth phase of the process.

During any given phase, candidate lakes that are determined to be nontarget, or are determined to be part of the target population but cannot be sampled, are replaced with alternate candidate lakes selected from a list of *oversample* lakes. It is important that alternate lakes are selected properly (i.e., without skipping over any) to maintain the random nature of the final list of sampled lakes. The procedure for selecting a replacement lake is described in the following section.

2.1 Lake Replacement

Lakes on the master site list are evaluated separately by State. A sufficient number of lakes on the list for each State must be evaluated in order to arrive at the required number of target and accessible lakes assigned to that State. Within each state, lakes evaluated for potential sampling must have all site IDs from the largest to the lowest number evaluated. For example, if NLA12_AL-0155 is the largest site ID evaluated within Alabama, then all lakes with site IDs that are lower than "0155" within the state must be evaluated. Even more critical is that if NLA12_AL-0155 is the largest site ID that is actually sampled in the field, then all lakes on the State list with lower site IDs that are evaluated to be a target lake and are accessible must be visited and sampled.

If you determine a lake to be non-target, or target but not accessible, during any phase of the evaluation process, select the next available replacement lake from the master list. **Section 2.2** presents the procedure for selecting replacement lakes. The replacement process differs slightly based on whether the lake being replaced is part of the national NLA 2012 design versus a state-level design (intensified to

allow a State to perform its own assessment). Candidate lakes identified as part of the national design must all be evaluated and sampled if they are determined to be target and accessible. For a state-level design, all candidate lakes identified as part of the national design and all candidate lakes identified as part of the state-level design must be evaluated and sampled if they are determined to be target and accessible.

2.2 Procedure for Selecting Replacement Lakes from the Oversample List

At the end of the evaluation process, you should have a list of lakes for your state that includes the list of "base" sites (**Section 2.2.1**), plus a sequential list of replacement Site ID numbers needed to have the required number of target and accessible lakes. If your State is planning to do a separate State-scale assessment, the "base" list of sites is expanded to include additional sites (**Section 2.2.2**) that must also be evaluated (and replaced if necessary).

2.2.1 National Design

1. The initial list of "base" candidate lakes within a state that are required for the national assessment are identified by the following values for the variable PANEL:
 - a. NLA07RVT2: An NLA 2007 lake that should be visited twice in 2012.
 - b. NLA07RVT: An NLA 2007 lake that should be visited once in 2012.
 - c. NLA12RVT: An NLA 2012 lake that should be visited twice in 2012.
 - d. NLA12NAT: An NLA 2012 lake that should be visited once in 2012.
2. You must evaluate **all of these lakes** within your State to meet the sample size requirements for the national assessment. If the evaluation for a lake results in it being assigned a final status of nontarget or target but not accessible, select the first available lake (i.e., with the lowest Site ID number) with PANEL = NLA12ST and evaluate it.

NOTE: If you need to replace a 2007 revisit site (NLA07RVT2), attempt to replace this revisit with another 2007 resample site (NLA07RVT). This will become your new 2007 revisit site. This may not always be possible. If not, replace it as you typically would and make the replacement lake a revisit site.
3. If all replacement lakes with PANEL = NLA12ST have been evaluated, and additional replacement lakes are needed, begin using lakes with PANEL = OverSamp, starting with the lake having the lowest Site ID number.

2.2.2 State Level Design (Intensification)

1. For a State-level (intensified) design, the "base" list of candidate lakes includes all lakes identified as part of the national design (see **2.2.1** above), plus those with PANEL=NLA12ST (these serve as replacement sites if there is no intensification).
2. You must evaluate **all of these lakes** within your State to meet the sample size requirements for both the national and your State-specific assessments. If the evaluation for a lake results in it being assigned a final status of nontarget or target but not accessible, select the first available lake (i.e., with the lowest Site ID number) with PANEL=OverSamp and evaluate it.
 - a. **NOTE:** If your State elects not to include lakes with surface area less than 4 ha (which are part of the national design), you must still evaluate (and sample if target and accessible) all lakes (regardless of surface area) identified as part of the national design,

- including any replacement lakes needed for these.
- b. For the additional State-level lakes (PANEL=NLA12ST), you can exclude those with surface areas < 4 ha, and skip over any replacement lakes (PANEL=OverSamp) that have surface areas < 4 ha.

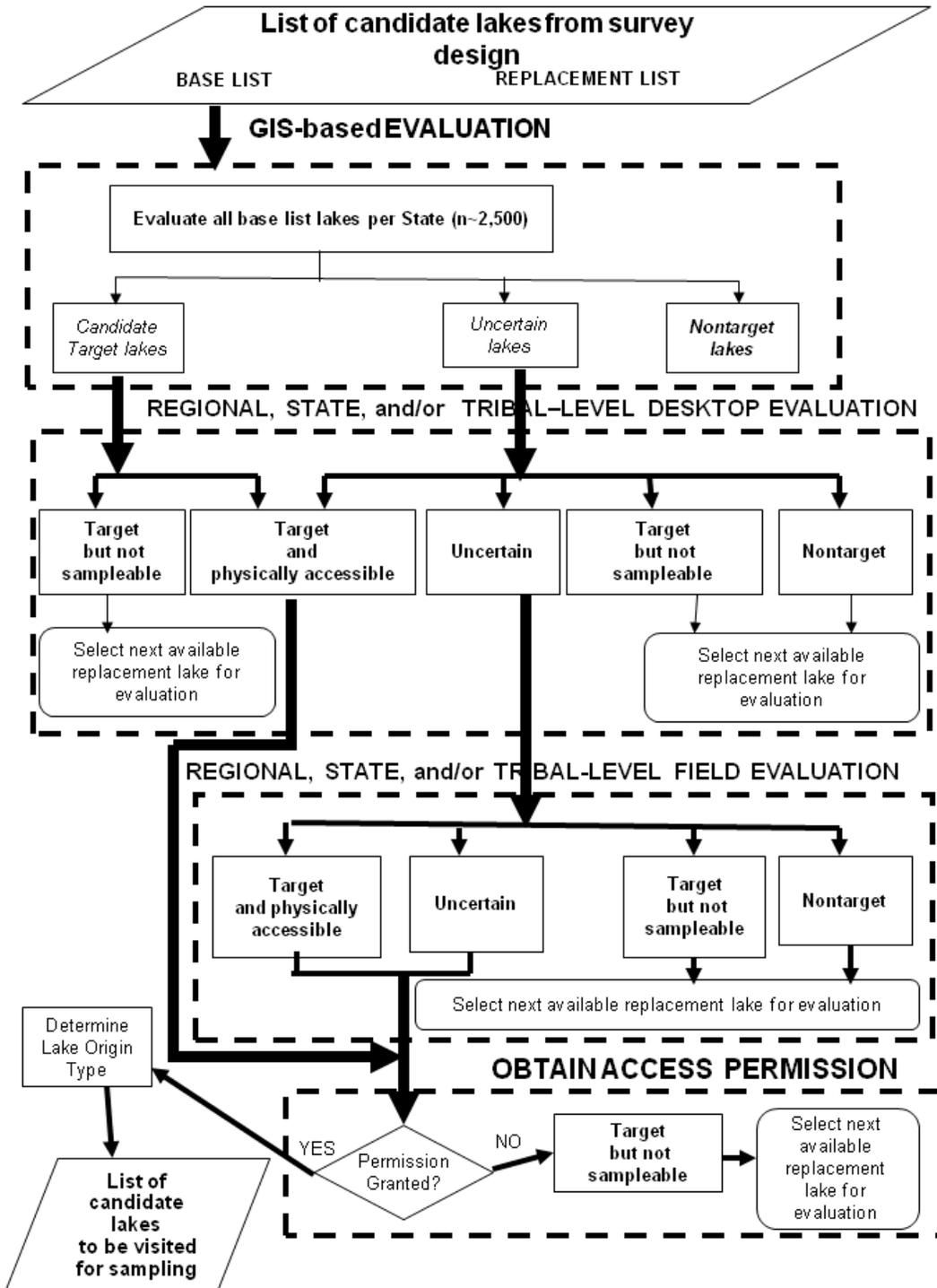


Figure 1. Evaluating a lake.

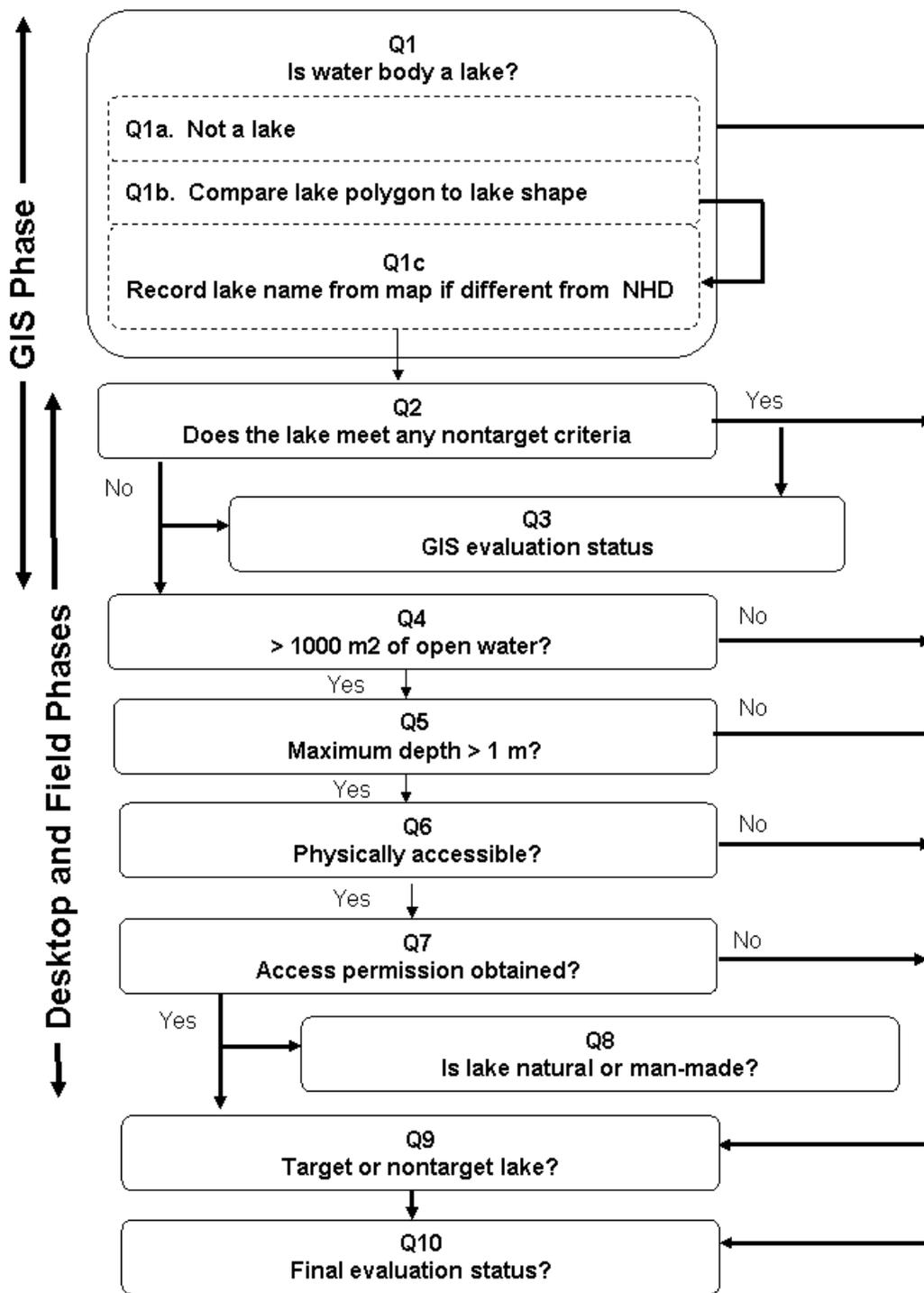


Figure 2. Process Flow of the Lake Evaluation Spreadsheet.

2.3 GIS-based Evaluation (Q1-Q3)

Figure 3 presents an overview of the GIS-based phase of lake evaluation. At this phase, evaluate all base

lakes on each State list (i.e., those with PANEL= NLA07RVT2, NLA07RVT, NLA12RVT, and NLA12NAT). The GIS-based phase makes use of two ESRI map service layers loaded in ArcMap[®]: a background United States Geologic Survey (USGS) topographic map service and a map service of world imagery from ESRI loaded as layer files in ArcMap[®]. Examine each lake (there will be about 2,500) in ArcMap[®] using background topographic maps and imagery. Use the procedure presented in **Section 2.3.1** to attempt to answer the questions in the evaluation spreadsheet file (see **Figure 2**) based on just these layers in ArcMap[®]. The GIS-based phase is designed primarily to address questions Q1 and Q2 of the evaluation questionnaire (**Figure 2**). All lakes evaluated during the GIS phase are assigned a GIS status (Q3 of the questionnaire).

The intent of the GIS phase is to reduce the number of candidate lakes that must be reviewed in more detail during the Desktop and Field phases of the evaluation. Ideally, decisions will be made quickly for the vast majority of lakes based on background topographic maps and imagery alone. For any lake in the initial list of base lakes to which you cannot definitively assign a GIS status of *Candidate target* or *Non-target*, assign a GIS status of *Uncertain*. Lakes with GIS status of *Candidate target* and *Uncertain* are moved to the Desktop phase of the evaluation process. For large, named lakes, the review should be very fast. For smaller lakes and for unnamed lakes, responding to the evaluation questionnaire will likely take more time and there will be more lakes assigned to a GIS status of *Uncertain*.

The GIS phase also identifies instances where the lake polygon as rendered in NHDPlus does not match up with the lake shape depicted on either the image and/or the topographic map. Examples include:

- 1) where part of a lake (an arm or other embayment) is not represented within the lake polygon;
- 2) where part of a lake is not represented by a polygon because of a bridge or causeway; or
- 3) a single polygon encompasses more than one lake.

These inconsistencies may be due to mapping or delineation errors in NHDPlus, or to more recent changes in basin morphology as a result of precipitation patterns. In the case of the latter, it may not become evident until the desktop evaluation (**Section 2.4**) or even later (i.e., when you visit the lake to sample it). If you encounter one of these errors during the GIS evaluation (Q1b of the evaluation questionnaire), notify Marc Weber of the NLA design staff at WED-Corvallis so the error can be corrected in the sample/analysis frame, and then proceed with evaluating the lake. These errors affect the sampling frame in two ways: they result in an incorrect delineation of the catchment, and, in the case of a single polygon representing more than one lake, they might impact the sample weighting factor.

Ephemeral lakes that are expected to be dry during the index period (May through September) of the sampling year are not part of the target population. Coastal lakes, or lakes near an estuary that are under tidal influence, are not part of the target population. A tidally-influenced lake is operationally defined as being maintained solely by the surface inflow of brackish or salt water due to water level changes during tidal cycles. Permanent lakes near the coast, or near an estuary below the head of salt, with no surface connection to the ocean at high tide are considered part of the target population (even if saline). *Dune lakes* (primarily located along the Gulf Coast), are part of the target population. These lakes are permanent and almost always isolated from the ocean, but periodically will flood or "blow out," forming a connection with the ocean or estuary and incur an influx of brackish or salt water. Waterbodies along the coast that are considered to be estuarine or part of a larger coastal wetland area are not part of the target population. Inland lakes that are saline or have high conductivity (> 1000 $\mu\text{S}/\text{cm}$) are part of the target population (the Great Salt Lake has already been excluded as part of the survey design). Oxbows are considered target lakes if they are completely separated from a river (no surface connection). However, oxbows that have either flowing water or a wetland connection to a river

are not lakes, and should be assigned a GIS evaluation status (Q3) of *Nontarget*. Side-channel reservoirs and drinking water reservoirs (where water is pumped from nearby rivers, termed upground reservoirs in some parts of the US) that do not have recreation or aquatic life uses are not considered part of the target population. Abandoned mine lakes used for recreation or other beneficial uses (e.g., wildlife) are considered to be part of the target population.

The GIS-based phase (**Section 2.4**) will likely not provide definitive information to address whether a candidate lake is ephemeral, has sufficient open water, or a maximum depth of at least 1 m, especially for smaller lakes. You can attempt to use the surrounding topography to make these determinations – if there is not much relief, chances are it will not be very deep. Do not answer the open water or lake depth questions (Q4 and Q5), or conclude the lake is ephemeral, unless you are sure that a *Yes* or *No* response applies based on the available imagery for the lake. Lakes that are assigned a status of *Uncertain* during the GIS evaluation phase are further evaluated as part of the Desktop evaluation phase of the evaluation process.

2.3.1 Lake Evaluation using GIS Layers and Imagery

This procedure assumes that the GIS phase of the evaluation process will be conducted at a central location. If questions come up, contact Marc Weber (541-754-4469) or Dave Peck (541-754-4426).

1. Open ArcMap[®] and load the two NLA_2012 integrated design shapefiles. These files contain all of the candidate lakes for all states:
 - a. NLA2012_Integrated_Design_20110706_points.shp
 - b. NLA2012_Integrated_Design_20110706_polys.shp
2. Load US topographic maps as a layer service from arcgis.com:
 - a. Go to File > Add Data from ArcGIS Online.
 - b. Click on 'US Topo Maps' at the bottom of the web page that opens up
 - c. In the pop-up window that appears, choose 'Open with ArcGISHandler EXE.'. This will open a read-only 'layer' in your ArcGIS project.
3. Load background imagery
 - a. Go to File > Add Data from ArcGIS Online.
 - b. Click on 'Imagery' in the web page that opens up –
 - c. In the pop-up window that appears, choose 'Open with ArcGISHandler EXE.'. This will open a read-only 'layer' in your ArcGIS project.
4. Records are sorted by state (ST_NLA2012), then in ascending order by SITE ID. Evaluate lakes by State in order of SITE_ID.
5. Set the minimum scale so that both the topography and imagery layers are visible in ArcMap[®] (this will speed up the rendering in ArcMap[®] when zooming from site to site):
 - a. Right click each layer, go to the *General* tab, and under *Scale Range*, click on the second option – *Don't show layer when zoomed*: then choose *1:400,000* for *Out beyond*.
 - b. Leave default of *None* for *In beyond* in *Scale Range*. If you need to adjust the *Out beyond* scale choose an option that works best for you.
 - c. Turn imagery and topographic map layers on and off by checking *Layers* in the ArcMap table of contents so that they can be used separately to evaluate a given lake.
6. Open the NLA 2012 Lake Evaluation Spreadsheet available on the NARS Sharefile (NLA_2012_LAKE_EVAL_FORM_20110524.xls, or the corresponding State workbook if not being done centrally).
 - a. The worksheet has key variables from the shapefile, sorted in the same order
 - b. The evaluation questionnaire begins with the column labeled *Q1. Is Waterbody a Lake?*

7. Evaluate all lakes on the base list for the State (usually the first 50 lakes, but 50 in the case of Minnesota) using just the imagery provided in ArcMap[®]. Evaluate lakes in order, looking at lakes in ArcMap[®] and filling in columns in the spreadsheet. All of the evaluation questionnaire columns have drop down lists for entries.
8. The GIS evaluation involves answering the first 2 questions of the lake evaluation questionnaire and assigning a status of *Nontarget*, *Candidate Target*, or *Uncertain* as Q3 of the evaluation.
 - a. If the polygon for the lake from the NHDPlus-based shapefile does not match up with the lake outline as shown on either the imagery or the topographic map, notify Marc Weber so corrections can be made to the shapefile and sampling frame.
9. If you can determine a final status of *Nontarget* (e.g., a nontarget evaporation pond), assign the appropriate responses to Q3, Q9 and Q10 of the evaluation questionnaire and proceed to evaluate the next site on the list.
10. If the responses to questions Q1 and Q2 indicate that the lake is a candidate target lake, or you cannot determine its status, assign a GIS status (Q3) of *Candidate Target* or *Uncertain*, respectively. Proceed to the next lake on the list. Lakes categorized as *Candidate Target* or *Uncertain* will be evaluated further during the Desktop phase.

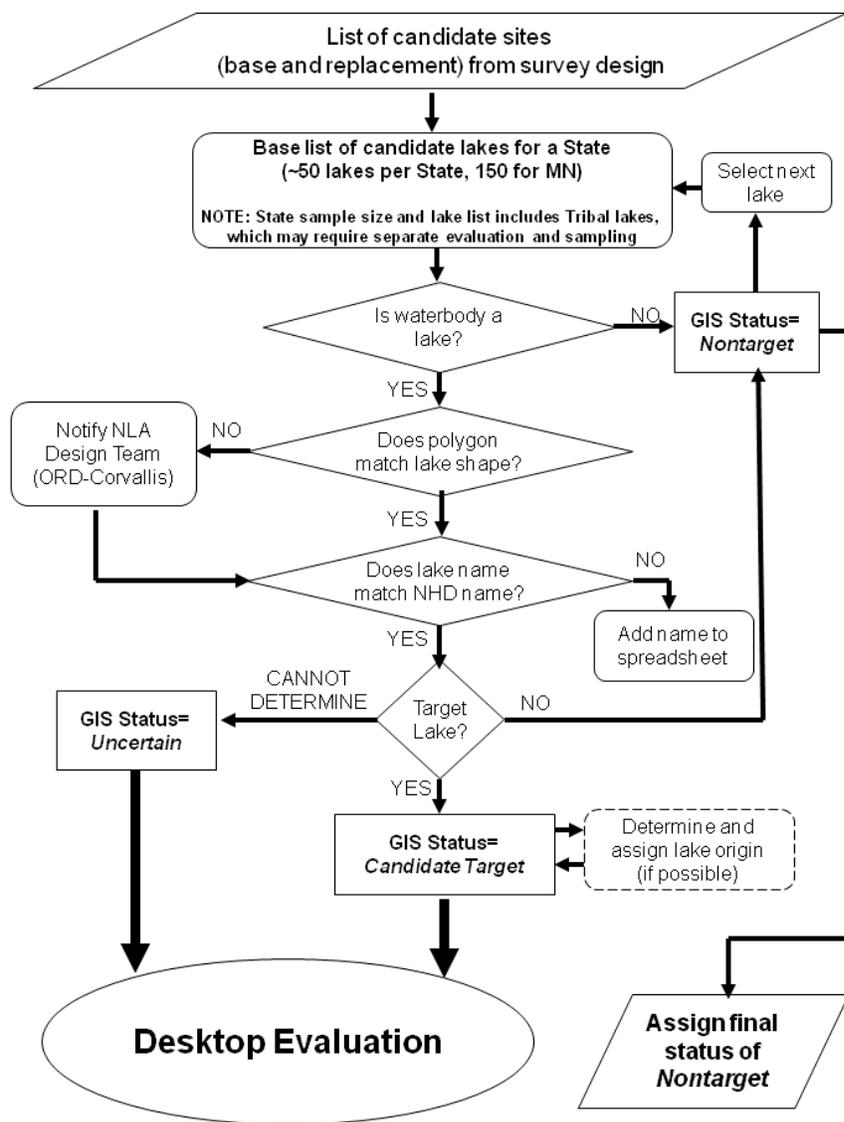


Figure 3. GIS-based evaluation.

2.4 Desktop Evaluation (Q2, Q4-6)

Continue the second phase of the evaluation process to complete the evaluation questionnaire for any remaining lakes assigned an interim status of *Uncertain* during the GIS-based phase. For the desktop evaluation, the master evaluation file will be split into separate files for each state. The general process for conducting the desktop phase is presented in Figure 4. Use a variety of available information sources to proceed through the evaluation questionnaire (Figure 2). Google Earth® and other ancillary layers (e.g., Wikipedia®, Panoramio® photos, geographic features, etc.) may provide sufficient information to answer all of the questions in the evaluation questionnaire successfully. A Google Earth® kmz (or kml) file of all lake polygons is available.

In addition to Google Earth®, conduct Web searches for each remaining lake based on the lake name or location information to try to answer the questions in the evaluation questionnaire and assign a final

status category for each lake. Some lakes may require an investigation of maps, reports, or conversations with local experts who are familiar with the current conditions of the lake being evaluated. Obtaining information from local experts will help to minimize the number of lakes that will require a field visit. If possible, determine the lake origin using these resources. For a run-of-the-river reservoir, it is important to determine if the estimated residence time is greater than 1 week; if less, it is considered to be nontarget and requires replacement.

For the NLA, the status of a lake is that existing **in the year (and ultimately on the day) of sampling**. There will be lakes (more likely smaller ones) that will meet the target criteria one year but not meet them in another year due to precipitation (or lack of) or other natural causes. **Temporary changes to a lake's status due to deliberate management/restoration activities (e.g., weed control, rotenoning, dredging, etc.) do not render a lake as nontarget for that year.** Criteria pertaining to open water area and maximum depth may not be able to be determined until you actually visit the lake to sample. Note that the open water criterion is based on a total area of 1000 m²; and does not have to be continuous.

In some areas, there is the possibility that neighboring lake basins may become joined during periods of heavy precipitation, and this will be evident from the available images. In these cases, treat the combined lakes as a single waterbody and sample it if it meets the target criteria. Do not just consider the part of the lake represented by the NLA polygon. Note the presence of the combined waterbodies and the reason (e.g., is it temporary or does it appear to be a permanent change). Notify the NLA design staff in Corvallis so that the sample/analysis frame can be adjusted if necessary.

There is also the possibility that a single lake may become divided into two or more neighboring basins because of drought conditions. You must look at the NLA polygon coverage and determine which basin has the NHDPlus labeling point associated with it and treat this basin as the "official" lake for the purposes of evaluating and sampling in 2012. If the basin meets the target criteria, sample it (but not any of the neighboring basins). If the basin does not meet the target criteria, assign it as non-target and select a replacement lake. In either case, note the presence of the separated waterbodies and the reason (e.g., is it temporary or does it appear to be a permanent change). Notify the NLA design staff in Corvallis so that the sample/analysis frame can be adjusted if necessary. Lakes on Tribal lands require some additional considerations. Tribal lakes are included as parts of individual state lists (and are part of the total sample size assigned to the state). Tribal lakes need to be evaluated by someone (the Tribal nation, EPA Region, State, or a third party), and a final status assigned. For lakes identified as target, distinguish between those lakes where no permission to sample was ever sought (Tribal-Other), from lakes where permission was requested from a Tribal nation, but was not granted (Target-Access denied).

At this phase of the evaluation, you should begin to compile a dossier of access-related information for each lake that has been definitively identified as target and accessible. This information includes any issues associated with accessing the lake such as steep terrain; livestock; thick, nuisance vegetation; locked gates and the presence and type of boat ramps available at a lake. You can obtain some of this information from a local expert during the Desktop phase, from the Field evaluation (if needed), or when you attempt to obtain permission to sample a lake (Section 4.0). Lakes that are still assigned a status of *Uncertain* after the Desktop evaluation phase are moved to the Field evaluation phase of the evaluation process.

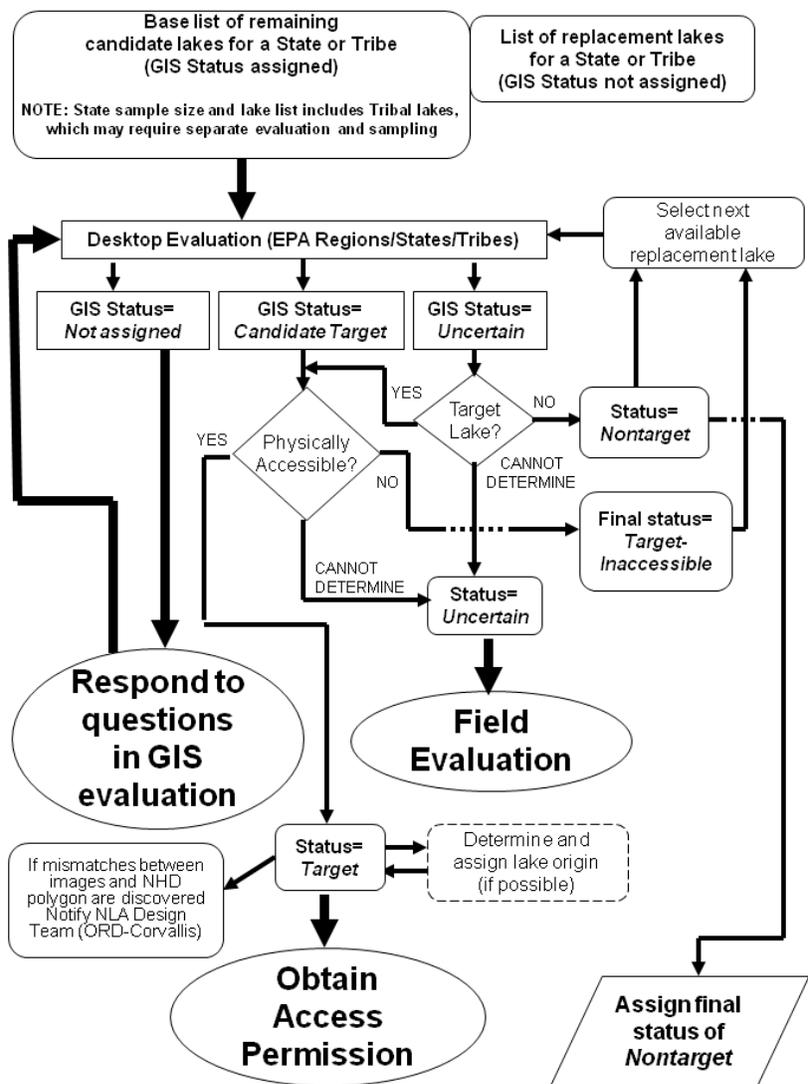


Figure 4. Desktop evaluation.

2.5 Field Evaluation (Q2, Q4-6)

Continue the third phase of the evaluation process to complete the evaluation questionnaire for any remaining lakes assigned an interim status of *Uncertain* during the Desktop phase. The general process for conducting the Field phase is presented in **Figure 5**. The field evaluation phase differs from previous phases in that lakes whose status is still uncertain after a field visit are considered candidate target lakes. The final status of these lakes may not be determined until a field crew actually visits the lake with the intent to sample it.

Get as close as you can to the lake during a field visit. For remote lakes, this may require hiking to, or possibly flying over, the lake. For other lakes, you may be able to drive near the lake and use binoculars to conduct the evaluation. Determine the lake origin during the field visit if it has not been determined in a previous phase. While at the lake, remember to gather information that will be useful to a field crew when they come to sample it (e.g., launch facilities, surrounding terrain, best access routes, etc...).

After completing the field evaluation phase, you will have a list of candidate lakes that are physically accessible. The last phase of the process involves obtaining access permission for those lakes that require it.

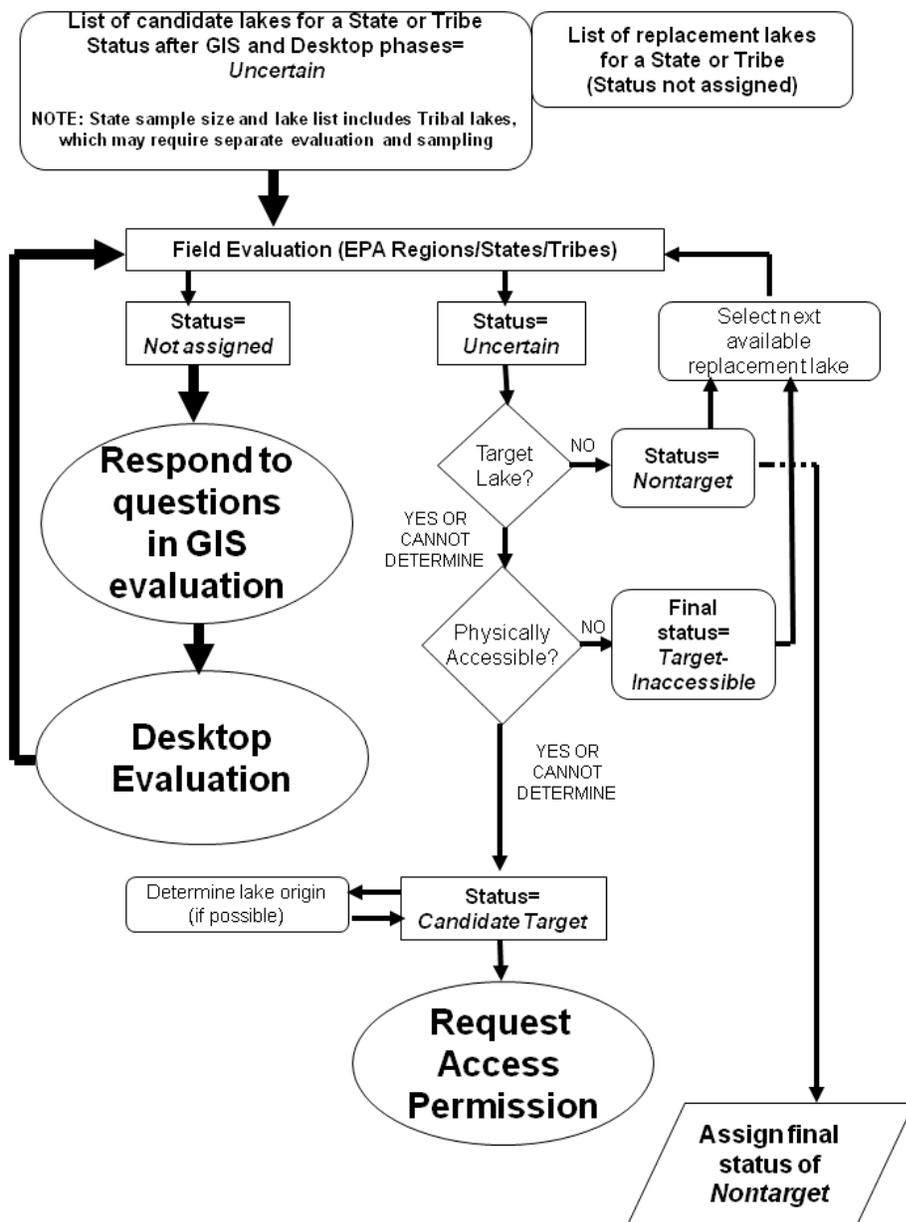


Figure 5. Field evaluation.

3 DETERMINING IF A LAKE IS PHYSICALLY ACCESSIBLE (Q6)

Lakes for the National Lakes Assessment were selected from the population of lakes across the U.S. through a probabilistic survey design. In order to achieve the most robust results possible with the probabilistic sampling design, a concerted effort is required to sample the base lakes on your list.

It is very important not to reject a lake that meets the criteria for the target population based on inconveniences in access. At some lakes, a field crew can drive its truck to a boat ramp and launch.

Other lakes may require a lengthy hike or portage with a small boat. Some lakes in extremely remote areas are impossible to safely access (e.g., trail conditions, temperature extremes). A lake is considered permanently inaccessible if it is unlikely to be sampled by anyone due to physical barriers that prevent access (e.g., cliffs). Safety concerns that may prohibit access include the presence of dangerous wildlife or potentially threatening groups of people.

3.1 Target, Inaccessible-Barrier/Safety

Occasionally, a lake is determined to be target, but cannot be sampled due to physical barriers or safety concerns. Assign these lakes a response of *NO* to Q6, *Target* to Q9, and *Inaccessible-Barrier/Safety* to Q10 (Figure 2). Describe why the lake is inaccessible in the *COMMENTS* column of the evaluation spreadsheet. You will then need to select and evaluate a replacement lake.

3.2 Target, > 1 Day Needed

Very large lakes may require either more than one day to sample completely (including travel time), or require more than one field crew to complete the sampling in a single day (including shoreline stations). Assign these lakes a response of *YES, BUT > 1 DAY/CREW NEEDED* to Q6 (Figure 2). If you determine that these lakes cannot be sampled, assign a response of *Target* to Q9 and a final status of *TargetOther* for Q10. Remember that on large lakes (>10,000 ha), shoreline stations are not established, so these lakes should be sampled at the index site if at all possible.

3.3 Target, Extreme Effort Required, Inaccessible-Effort

Some remote lakes may be physically accessible, but the effort required to reach them to sample is prohibitive in terms of the time and or cost required, or because an extreme effort (in terms of time and/or cost), as opposed to inconvenience, is required to obtain access. Assign these lakes a response of *YES, BUT EXTREME EFFORT IS REQUIRED* to Q6, *Target* to Q9, and *Inaccessible-Effort* to Q10 (Figure 2). Describe the extreme effort constraint (i.e., the time or cost that would be needed) in the *COMMENTS* column of the evaluation spreadsheet. You will then need to select and evaluate a replacement lake.

4 OBTAINING PERMISSION TO ACCESS CANDIDATE LAKES (Q7)

Many of the lakes will be publicly accessible with either boat ramps or convenient small boat access. In these cases, explicit permission to access the lake is not needed and little prior work needs to be done outside of determining the best access routes for the sampling crew. However, for those lakes on privately owned land, landowner permission is required to obtain access and sample these lakes. Obtaining permission well in advance of the sampling day is important to minimize loss of time on the part of the field team. Many states have an existing protocol for securing landowner permission; if this is the case for your state, use the existing protocol for this study.

4.1 Identify Landowner

The initial lake list file contains an initial assignment of ownership as federal (and which agency has jurisdiction), non-Federal, or possibly Tribal. For non-Federal ownership, determine whether the lake is publicly accessible or located on private property. If the lake is on private property, you will need to obtain the name and address of the landowner. Some states or EPA Regions may provide you with additional identification of public versus private lakes and some landowner information. If no landowner information was obtained for a lake, contact the county office. The county office can direct you to the agency that is responsible in your state/county for holding landowner records, and you can work with the appropriate agency to obtain the information.

Be aware that this process can be time consuming, as you may need to work with several different agencies and numerous people. Be prepared to submit maps via fax machine, as some counties do not have landowner information in a GIS database and are unable to use coordinates to obtain the information. In addition, if your state or county uses the township/range/section system for identifying parcels of land, you will need to know this information for your lake also, and this may require contacting yet another agency. You may need to visit the records office to obtain this information. Each county will be different in terms of the organization of its records and its ability (and willingness) to assist you.

4.2 Request Permission to Access Lake

Once you identify the landowner and confirm that a lake is part of the target population and is physically accessible, you can begin to request permission to access and sample the lake following whatever protocol is in effect for your organization. If no protocol exists, use the most personal contact practicable. Obtaining permission (or denial) early does provide you with more time to select and evaluate any replacement lakes before sampling begins.

4.2.1 Contact Landowner through In-Person Visit (when possible)

The initial contact with the landowner is best done through an “in-person” visit. You can ask a local representative (e.g., state or county official, NRCS county agent, district fish and game biologist, etc.) to make the initial contact. These people are usually more familiar with landowners in their jurisdictions, and are usually more effective at getting access permission than a federal agent or a contractor. You can also make the initial contact as part of the field evaluation for those lakes that require one. This visit provides an opportunity to explain the purpose of the study, answer any questions or concerns a landowner may have, and obtain written permission to access the lake during the sampling season, which could be a part of the field evaluation. Landowners are much more likely to grant permission if they actually meet and speak with a study representative instead of receiving a phone call or letter.

Note: With advanced planning, it may be possible to schedule landowner visits during other

fieldwork in the area that is occurring before the NLA sampling begins. This would maximize efficiency and ensure the best possible responses from the landowners.

4.2.2 Contact Landowner through Other Means

If you cannot visit the landowner to obtain permission, attempt to contact him or her by telephone. A local representative may be more effective in securing permission, so it is important to request assistance at this level if you are not local to the area. If you cannot reach the landowner by telephone, prepare and mail out a cover letter (**Appendix A: Example Letter requesting Permission to Access a Lake**) with an updated fact sheet (**Appendix D: National Lakes Assessment 2012 Fact Sheet**) and a permission slip (**Appendix B: Example Landowner Permission Slip**) for the landowner to return.

4.2.3 Signed Permission Slip

A signed permission slip is important for the field crew to use as documentation on the day of sampling if questions arise about the field crew's presence on a lake.

4.3 Denials

If one landowner denies access, check to see if there are other landowners that may allow access to the lake via their property. If no other landowner options exist, or all other landowners deny access, select NO as the response to Q7, Target as the response to Q9, and Access Denied as the response to Q10 in the evaluation spreadsheet (**Figure 2**). Select the next available replacement lake to evaluate. For landowners contacted by phone or mail, no response is considered denial.

4.4 Frequently Asked Questions

Some frequently asked questions pertaining to the overall evaluation process are presented in Appendix D. Use this as the first resource to try to answer any questions that may come up as you attempt to evaluate a lake. If you cannot find an answer there, contact the EPA NLA Regional Coordinator (**Appendix E: Contacts**). He or she will either answer your question or pass it along to someone who can answer it.

5 LITERATURE CITED

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USEPA (United States Environmental Protection Agency). 2009. National Lakes Assessment: a collaborative survey of the Nation's lakes. EPA 841/R-09/001, U.S. Environmental Protection Agency, Office of Water and Office of Research and Development, Washington, DC.

APPENDIX A: EXAMPLE LETTER REQUESTING PERMISSION TO ACCESS A LAKE

(Date)

Dear Landowner,

The US Environmental Protection Agency, in cooperation with State Agencies, is conducting an environmental assessment of lakes across the United States. A computer was used to randomly select these lakes. A total of 910 sampling lakes were selected for sampling in 2012. Water quality, chemistry, aquatic life, recreation use and habitat will be evaluated at each lake. The findings of the study will be used to give a broad scale picture of the health of our nation's lakes and are not intended for enforcement or regulatory purposes.

We are contacting you to request your permission to access a lake from your property. We will respect your landowner rights at all times, ensure that you know in advance when the sampling will occur, and recognize that access to your property is a privilege granted by you. The sampling of your lake will be used to help guide the protection of waters across the United States.

Enclosed with this letter is a map of the sampling location and an Access Permission Form. Please return the completed Form in the enclosed, postage paid envelope by (DATE). If you have any questions concerning this request, please feel free to contact me at (phone / e-mail). I look forward to your reply and appreciate your help in this important survey.

Sincerely,

(Name)

Regional Monitoring Coordinator

APPENDIX B: EXAMPLE LANDOWNER PERMISSION SLIP

I grant permission to the biological field crew from (state agency or contractor) to access the lake sampling lake located on my property as part of the EPA's National Lakes Assessment project.

_____ Do grant permission

_____ Do grant permission but with the following restrictions:

_____ Do not grant permission

Landowner Name (Please print): _____

Landowner Signature: _____

Date: _____

Phone Number: _____

Address: _____

APPENDIX C: NATIONAL LAKES ASSESSMENT 2012 SURVEY DESIGN

NATIONAL LAKES ASSESSMENT 2012 SURVEY DESIGN

Target Population

All lakes, reservoirs, and ponds within the 48 contiguous United States greater than 1 hectare in surface area that are permanent waterbodies. The word “lake” in the remainder of this document includes lakes, reservoirs and ponds. Lakes that are saline are excluded as are those used for aquaculture, disposal-tailings, sewage treatment, evaporation, or other unspecified disposal use.

Sample Frame

The sample frame was derived from the National Hydrography Dataset (NHDPlus). Once the initial shapefile that included all lake objects in NHDPlus was prepared additional attributes were created to identify lakes included in the sample frame and other properties used to construct the survey design.

Lakes included in the sample frame were those lakes with DES_FYTPE values equal to:

Lake/Pond

Lake/Pond: Hydrographic Category = Perennial

Lake/Pond: Hydrographic Category = Perennial; Stage = Average Water Elevation

Lake/Pond: Hydrographic Category = Perennial; Stage = Normal Pool

Reservoir

Reservoir: Reservoir Type = Water Storage

Reservoir: Reservoir Type = Water Storage; Hydrographic Category = Perennial

Lakes excluded in the sample frame were those lakes with DES_FYTPE values equal to:

Lake/Pond: Hydrographic Category = Intermittent

Lake/Pond: Hydrographic Category = Intermittent; Stage = Date of Photography

Lake/Pond: Hydrographic Category = Intermittent; Stage = High Water Elevation

Playa

Reservoir: Reservoir Type = Aquaculture

Reservoir: Reservoir Type = Cooling Pond

Reservoir: Reservoir Type = Disposal

Reservoir: Reservoir Type = Evaporator

Reservoir: Reservoir Type = Tailings Pond

Reservoir; Reservoir Type = Treatment

Swamp/Marsh

Next, lakes were excluded that were evaluated during the NLA 2007 and were identified as lakes that did not meet definition of a lake for NLA 2012. These were lakes with evaluation codes of *Lake_Saline*, *Lake_Shallow*, *Lake_Special_Purpose*, *Lake_Vegetated*, *Non_Target*, or *Not_Lake*.

Finally, lakes that were less than or equal to 1 hectare were excluded.

Survey Design

A Generalized Random Tessellation Stratified (GRTS) survey design for a finite resource was used with stratification and unequal probability of selection. The design includes reverse hierarchical ordering of the selected lakes.

Stratification

The survey design was stratified by state and by NLA12_CLS. NLA12_CLS has three classes:

- 1) NLA07RVT – defined as all NLA 2007 lakes that were target and sampled,
- 2) NLA12NEW – remaining lakes in NHDPlus that are included in the sample frame, and
- 3) Exclude – lakes in NHDPlus that are excluded from the sample frame (see Sample Frame section above).

Each state design has two strata, ST_ NLA07RVT and ST_ NLA12NEW (where ST is replaced by the two letter state abbreviation). The total number of strata is 96 (two for each state).

Unequal Probability Categories

The 48 state strata for lakes from the NLA 2007 that would be revisited in 2012 was an equal probability design within each stratum. The 48 state strata NLA12NEW was an unequal probability design within each state stratum. The unequal probability categories were defined based on lake area: 1 to 4 ha, 4 to 10 ha, 10 to 20 ha, 20 to 50 ha and greater than 50 ha.

Panels

The survey design has four panels: NLA07RVT – identifies lakes from NLA 2007 that will be visited in 2012, NLA12NAT – identifies new lakes that will be sampled along the lakes in panel NLA07RVT as part of the NLA2012 national survey design, NLA12ST – identifies additional lakes that a state may sample to achieve a total sample size of 50 lakes for the state, and OverSamp – identifies lakes to be used to replace lakes that cannot be sampled for some reason (not a lake, denied access, physically inaccessible, etc).

The national survey design includes all lakes within a state that are in either panels NLA07RVT or NLA12NEW.

A state survey design includes all lakes within a state that are either in panels NLA07RVT, NLA12NEW or NLA12ST.

Expected Sample Size

The expected sample size depends on the strata, panels and lake area category. For the NLA07RVT strata, the objective was to resample 400 of the NLA 2007 lakes out of the 1028 lakes that were sampled in 2007, i.e., approximately 38% of the lakes. The sample size for each state in the strata was proportional to the number of lakes sampled in the state in 2007. Exceptions were made when a state implemented a state-level design in 2007. These sample sizes are given in the accompanying spreadsheet in sheet named “#Lakes State.”. A total sample size of 1000 lakes was desired for the national design. The sample size for each state was proportional (approximately 60%) to the state’s sample size in NLA 2007 (columns D & E). The minimum number of lakes for a state was set at 8 and the

maximum at 43 (column F). Although aggregated ecoregions were not explicitly used in the survey design or setting sample sizes, they are implicitly used since the NLA 2007 allocated sample sizes using aggregated ecoregions. Once these two sample sizes were set for a state, an additional sample size (column I) was allocated to a state so that the total number of sites in a state would be 50 lakes.

Lakes in the NLA 2007 Revisit stratum were selected with equal probability and did not depend on lake area. Note that the NLA 2007 did depend on lake area. New lakes in the design were selected with unequal probability based on five lake area categories. The total number of lakes for a state in this strata (sum columns D, E, and I) was divided by five and that sample size (approximately) was assigned to the “(10, 20]” lake area category. Sample sizes for lake area categories “(20, 50]” and “>50” were decreased successively by one and for lake area categories “(4, 10]” and “(1, 4]” were increased successively by one. This process was adjusted to meet the total sample size requirement for the stratum. The rationale for this assignment of sample sizes is based on experience that smaller lakes are more likely not to be lakes or be inaccessible than larger lakes. When lakes are replaced, the process is expected to more likely result in an equal number of lakes sampled by lake area category.

Lake Use and Replacement

Each lake selected to be sampled is given a unique site identification (siteID). Site numbers consist of NLA12_ST-XXX where ST is the two letter state abbreviation and XXX is a number between 101 and 999. It is critical that this site ID be used in its entirety to make sure that the lakes are correctly identified. Within each state, lakes evaluated for potential sampling must have all site IDs from the largest to the lowest number evaluated. For example, if NLA12_AL-0155 is the largest site ID evaluated within Alabama, then all site IDs that are lower than “0155” within the state must be evaluated. Even more critical is that if NLA12_AL-0155 is the largest site ID that is actually sampled in the field, then all lower site IDs within the state that are evaluated to be a target lake and are accessible must be sampled in the field.

National Design Lakes and Replacement Process

Lakes scheduled to be sampled for the national design are identified by the attribute “panel” having values of “NLA07RVT2,” “NLA07RVT,” “NLA12RVT” and “NLA12NAT”. These lakes must all be evaluated and sampled if they meet the definition of a lake and are accessible. If one of these lakes cannot be sampled for any reason, then the replacement lakes are taken within the state from the lakes for which “panel” is equal to “NLA12ST”. The first replacement lake will be the lake within that list that has the lowest site ID; the second will have then next lowest site ID; etc. If all the lakes for which “panel” is equal to “NLA12ST” have been evaluated and additional lakes are still required, then lakes are used from lakes identified as “OverSamp” in “panel” in site ID order (i.e. lowest site ID within the OverSamp lakes within the state). The national design includes all lakes larger than 1 hectare.

Lakes designated “NLA07RVT2” and “NLA12RVT” are lakes that are to be sampled twice in 2012. If a lake designated “NLA07RVT2” cannot be revisited, then the next lake designated as “NLA07RVT” should be sampled twice. If a lake designated “NLA12RVT” cannot be revisited, then the next lake designated as “NLA12NAT” should be sampled twice. In each case the same process is used if the second lake cannot be sampled.

State Design Lakes and Replacement Process

If a state implements a state level design with 50 lakes, then the lakes scheduled to be sampled for the state design are identified by the attribute “panel” having values of “NLA07RVT2,” “NLA07RVT,” “NLA12RVT,” “NLA12NAT” and “NLA12ST.”. These lakes must all be evaluated and sampled if they meet

the definition of a lake and are accessible. If one of these lakes cannot be sampled for any reason, then the replacement lakes are taken within the state from the lakes for which “panel” is equal to “OverSamp.”. The first replacement lake will be the lake within that list that has the lowest site ID; the second will have then next lowest site ID; etc.

If a state implements a state level design and elects not to include 1-4 hectare lakes in the state design, then the state must first follow the procedures for the national design, which includes 1-4 hectare lakes. After the required number of lakes for the national design is sampled, then the remaining lakes for the state design may exclude 1-4 hectare lakes during the lake evaluation process. Otherwise the lake replacement process follows the procedure described in the previous paragraph.

Sample Frame Summary

See accompanying spreadsheet NLA2012 Design Summary 20110320.xlsx

Site Selection Summary

See accompanying spreadsheet NLA2012 Design Summary 20110320.xlsx

Description of Sample Design Output

The dbf file for the shapefile (“NLA Lake Sites Final”) has the following variable definitions:

Variable Name	Description
siteID	Unique identification label for each lake in the sample.
Lon_DD	Lake location longitude in decimal degrees coordinates (see projection below for datum).
Lat_DD	Lake location latitude in decimal degrees coordinates (see projection information below).
xcoord	X-coordinate of lake centroid (see projection information below).
ycoord	Y-coordinate of lake centroid (see Albers projection information below).
AREA_CAT6	Lake area category used for survey design based on 6 area categories.
AREA_CAT10	Lake area category based on 10 area categories.
NLA12_SF	Include if Lake included in NLA 2012 sample frame; exclude otherwise.
COMP_SF	Identifies lakes that are in both NLA 2007 and NLA 2012; in NLA 2007 but not NLA 2012; not in NLA 2007 but in NLA 2012; and lakes not present in 2007 but now in 2012 sample frame.
NLA12_CLS	NLA 2012 class: NLA07RVT – lake sampled in NLA 2007; NLA12NEW – lake not sampled in NLA 2007; Exclude – lake excluded from sample frame.
NLA07_EVLP	Identifies probability sample lakes that were or were not evaluated in NLA 2007.
NLA12_STRA	Strata used for NLA2012 survey design based on state and NLA12_CLS.

mdcaty	Categories used for unequal probability selection within a stratum.
wgt	Weight (number of lakes) to be used in the statistical analyses. It is the inverse of the inclusion probability.
stratum	Strata used in design. All equal to NLALake.
panel	Panel_1 identifies the 1000 lakes in the base design. Oversamp identifies lakes to be used as replacements as necessary.
EvalStatus	Placeholder to record the results of the lake recon evaluation (see below).
EvalReason	Placeholder to record reason for the evaluation result.
COMID	From original NHD lake frame shapefile.
FCODE	NHD feature code field.
FTYPE	NHD feature type field.
DES_FTYPE	Design Ftype based on NHD Ftype.
REACHCODE	NHD Reach code.
NLA07_RCHC	NHD reach code from NLA 2007 sample frame.
COMID2007	NHD COMID from NLA 2007 sample frame (primary).
COMIDs2007	NHD COMIDs from NLA 2007 sample frame when multiple polygons from 2007 sample frame were combined for 2012 sample frame.
GNIS_ID	GNIS identification.
GNIS_Name	GNIS name.
LAT_DD_N83	Latitude in decimal degrees from NHD.
LON_DD_N83	Longitude in decimal degrees from NHD.
X_ALBERS	X-coordinate from Albers projection for latitude above.
Y_ALBERS	Y-coordinate from Albers projection for longitude above.
STATECTY	FIPS state and county code.
ST	State two-letter codes for all states in which lake polygon occurs.
ST_NLA2012	State lake is assigned to for NLA 2012.
STATE_PCNT	Percent of lake area that occurs in state.
BORD_LAK	State border lake = Yes; state non-border lake = No.
CNTYNAME	County name.

OWNSHP	Land ownership.
EPA_REG	EPA Region.
URBAN	Yes – Urban lake; No- non-urban lake.
AREA_HA	Lake area in hectares (NHD).
ELEVATION	Lake elevation from NED.
US_L4CODE	Omernik Level IV ecoregion code.
US_L4NAME	Omernik Level IV ecoregion name.
US_L3CODE	Omernik Level III ecoregion code.
US_L3NAME	Omernik Level III ecoregion name.
NA_L3CODE	CEC North American Level III ecoregion code.
NA_L2CODE	CEC North American Level III ecoregion code.
NA_L2NAME	CEC North American Level II ecoregion name.
NA_L1CODE	CEC North American Level I ecoregion code.
NA_L1NAME	CEC North American Level I ecoregion name.
WSA3	WSA 3 aggregated Omernik ecoregions.
WSA9	WSA 9 aggregated Omernik ecoregions.
HUC2	HUC2 Region coded.
Region	HUC2 Region name.
HUC_8	Hydrologic unit code 8-digit.
CU_NAME	HUC name.
NLA07_SF	Include – Lake included in NLA 2007.
NLA07_STRA	NLA 2007 Strata.
NLA07_NAME	Lake name in 2007.
NLA07_REF	Identifies reference lakes in 2007.
NLA07_MDC	NLA 2007 multi-density category.
NLA07_EVAL	NLA 2007 lake evaluation status.
NLA07_WGT	NLA 2007 final weight.
NES_LAKE	NES lake from 1970s survey.

NESLAKE_ID	NES lake identification number.
STORETNUM	STORET number for NES Lake.

Projection Information

```

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GEOGCS["GCS_North_American_1983",
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PARAMETER["False_Northing",0.0],
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PARAMETER["Standard_Parallel_1",29.5],
PARAMETER["Standard_Parallel_2",45.5],
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UNIT["Meter",1.0]

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Evaluation Process

The survey design weights that are given in the design file assume that the survey design is implemented as designed. Typically, users prefer to replace sites that cannot be sampled with other sites to achieve the sample size planned. The site replacement process is described above. When sites are replaced, the survey design weights are no longer correct and must be adjusted. The weight adjustment requires knowing what happened to each site in the base design and the over sample sites. EvalStatus is initially set to "NotEval" to indicate that the site has yet to be evaluated for sampling. When a site is evaluated for sampling, then the EvalStatus for the site must be changed. Recommended codes are:

EvalStatus Code	Name	Meaning
TS	Target Sampled	Site is a member of the target population and was sampled
LD	Landowner Denial	Landowner denied access to the site
PB	Physical Barrier	Physical barrier prevented access to the site
NT	Non-Target	Site is not a member of the target population
NN	Not Needed	Site is a member of the over sample and was not evaluated for sampling
Other codes		Many times it is useful to have other codes. For example, rather than use NT, may use specific codes indicating why the site was non-target.

Statistical Analysis

Any statistical analysis of data must incorporate information about the monitoring survey design. In particular, when estimates of characteristics for the entire target population are computed, the statistical analysis must account for any stratification or unequal probability selection in the design. Procedures for doing this are available from the Aquatic Resource Monitoring Web page <http://www.epa.gov/nheerl/arm>. A statistical analysis library of functions is available from the Web page to do common population estimates in the statistical software environment R.

For further information, contact:

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Fax: (541) 754-4716
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APPENDIX D: NATIONAL LAKES ASSESSMENT 2012 FACT SHEET

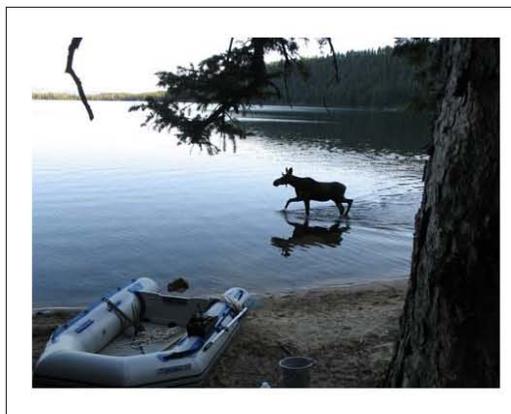


National Lakes Assessment 2012: A Fact Sheet for Communities

During the summer of 2012, the U.S. Environmental Protection Agency (EPA), states, tribes and other partners will conduct the second nationwide survey of the condition of the nation's lakes. The National Lakes Assessment (NLA) will help citizens and governments measure the health of our waters, take actions to prevent pollution, and evaluate the effectiveness of protection and restoration efforts. The NLA 2012 is one in a series of national surveys of the condition of the nation's waters (see www.epa.gov/aquaticsurveys).

Designed to estimate the percentage of lakes that are in good, fair, or poor condition, the survey will serve as a scientific report card on America's lakes. It will examine ecological, water quality, and recreational indicators, and assess how widespread key stressors (such as nitrogen, phosphorus, and acidification) are across the country.

The survey is a collaborative effort that involves dozens of state environmental and natural resource agencies,



Tranquil lake sampled during the National Lakes Assessment in 2007.

federal agencies, universities and other organizations. In most states, state water quality staff will conduct the water quality sampling and habitat assessments.

How were the lakes selected?



Distribution of base sites in the 2012 National Lakes Assessment.

A total of 904 natural lakes, ponds, and reservoirs across the lower 48 states are included in the survey. To be included in the survey, these lakes must be at least one meter deep and over 2.5 acres (1 hectare) in size. The survey does not include the Great Lakes or the Great Salt Lake. Lakes were selected randomly using a statistical survey design to represent the population of lakes in their ecological region – the geographic area in which climate, ecological features, and plant and animal communities are similar. In addition to these 904 sites, some sites will be re-sampled for quality assurance purposes; reference sites representing least-disturbed conditions will also be sampled.

What about my lake?

If your lake is sampled for this survey, it was most likely part of the randomly selected sites based on the population of lakes in your part of the country. There are a number of hand-selected sites (around 100), called reference sites, included in the survey as representative of the least-disturbed condition. Sites were not selected because the lake exhibits any particular problem or water quality condition. When the final report on the NLA 2012 is written, data from your lake will contribute to the regional and national picture of lake condition.

If your lake is not sampled for this survey, it was not omitted for any particular reason, but rather because it was not randomly selected or did not fit into the target population of lakes (e.g., those greater than 2.5 acres in area and at least one meter deep).

Many volunteer monitoring groups and lake associations have years of sampling data for their lakes, data vital to local lake management activities. This survey will provide a regional and national – and in some cases, statewide – assessment of lake condition. It will also allow those with sampling data on their lake to compare the condition of their lake to the range of lakes in their region or state.

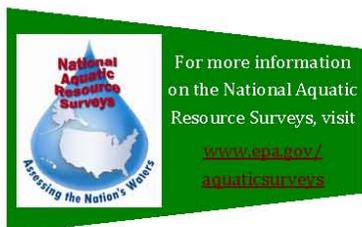
What will researchers measure?

Field crews take many measurements at each selected lake. They use consistent procedures at all sites so that results can be compared across the country. They measure such things as:

- Temperature, dissolved oxygen, nutrients, chlorophyll a, water clarity, turbidity, and color
- Condition of the habitat along the shoreline
- Zooplankton and phytoplankton—microscopic animals and plants in the water that are an important part of the food chain
- Aquatic macroinvertebrates—small animals such as insects and snails that are a source of food for fish and birds
- Microcystin—a common type of algal toxin, often associated with algal blooms in lakes
- Bacteria—indicators of fecal contamination from animals or humans
- Pesticide Screen—occurrence of common pesticides in water samples

They also take sediment cores from the bottom of the lake to look at sediment diatoms—or microscopic algae—from present day and 100 years ago. This information allows scientists to evaluate nutrient changes over time.

For more information on the National Lakes Assessment, including the findings of the 2007 survey:
www.epa.gov/lakessurvey
Or email us at:
lakessurvey@epa.gov



For more information on the National Aquatic Resource Surveys, visit
www.epa.gov/aquatic-surveys

U.S. Environmental Protection Agency
Office of Water
Monitoring Branch (4503T)
Washington, DC 20460
November 2011, EPA 841-F-11-007

What happens next?

Sampling is scheduled for the summer of 2012. EPA intends to issue a report on the findings in 2014. Between the time that lakes are sampled and the national report is published, samples will be analyzed in the lab, the data entered into a database and analyzed, and a draft report written and reviewed. The public will have the opportunity to review and comment on the draft report.



Lake sampled during the National Lakes Assessment in 2007.

APPENDIX E: CONTACTS

Title	Name	Contact Information
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APPENDIX F: FREQUENTLY ASKED QUESTIONS

Frequently Asked Questions

Q ~ *If questions arise concerning lake status, who should I contact?*

A ~ Please e-mail a detailed description of your concerns about the lake to your EPA Regional NLA Coordinator and to Amina Pollard of the EPA Office of Water (Pollard.Amina@epa.gov). They will work with the EPA ORD lab to help you determine the final status of the lake.

Q ~ *Some reservoirs may be < 1 m deep or < 1 ha in area late in the irrigation season – should these lakes be sampled?*

A ~ Reservoirs that are expected to be more than 1 m deep and more than 1 ha during the index period (generally May through September) ARE part of the target population and should be scheduled for sampling. However, on the day of the sampling visit, if the depth at the deepest point is less than 1 m (or the lake area is < 1 ha), then the lake is assigned a status of *Nontarget* and is not sampled. If time permits, select the next available replacement lake, evaluate it, and schedule it to be sampled.

Q ~ *What criteria should be used to determine if a lake should be dropped from the sample population due to salinity?*

A ~ Inland lakes that are saline or have high conductivity (>1000 $\mu\text{S}/\text{cm}$) ARE part of the target population, with the exception of the Great Salt Lake.

In the case of a coastal lake or lake adjacent to an estuary, tidally-influenced lakes are not part of the target population. A tidally-influenced lake is operationally defined as being maintained solely by the surface inflow of brackish or salt water due to water level changes during tidal cycles. Permanent lakes near the coast or near an estuary below the head of salt, with no surface connection to the ocean at high tide are considered part of the target population (even if saline). Dune lakes (primarily located along the Gulf Coast), are part of the target population. These lakes are permanent and almost always isolated from the ocean, but periodically will flood or "blow out" forming a connection with the ocean or estuary and incur an influx of brackish or salt water. Waterbodies along the coast that are considered to be estuarine or part of a larger coastal wetland area are not part of the target population. These represent waterbodies that should be included in the sampling frames for the National Coastal Condition Assessment or the National Wetlands Condition Assessment.

Q ~ *Should oxbows, backwaters, and side-channel reservoirs be sampled?*

A ~ Oxbows ARE lakes if they are separated from a river. However, oxbows that have either flowing water or a wetland connection to a river are NOT lakes. Side-channel reservoirs and drinking water reservoirs where water is pumped from a nearby river that does not have recreation or aquatic life uses ARE NOT part of the target population.

Q ~ *Should ephemeral lakes be sampled?*

A ~ Ephemeral lakes are operationally defined as being highly likely to be dry during the index period of the sampling year, but you may not be able to make this decision until you actually visit the lake to sample it. Lakes that do not meet the inclusion criteria on the date of a sampling visit ARE NOT part of the target population.

Q ~ *Should mining pits be sampled?*

A ~ Actively used quarry pits, mine tailing disposal lakes, borrow pits, and stormwater treatment ponds ARE NOT in the target population. Abandoned mine lakes that are used for recreation or other beneficial uses (e.g., wildlife) ARE part of the target frame. The lake evaluation spreadsheet includes a place (Q8) to note lake origin to assist in data interpretation.

Q ~ *What constitutes difficulty of access in sampling a lake?*

A ~ The objective of the National Lake Assessment is to sample lakes that are representative of the full range of conditions found across the country. Therefore, make a concerted attempt should to sample remote lakes that are identified as being part of the target population. Lakes that pose safety risks because of their remoteness, or where the cost and effort required are prohibitive in terms of completing the rest of the NLA sampling, are considered to be target but not accessible and are replaced with a lake from the oversample list.

It is recognized that sampling remote lakes may result in samples being shipped and/or received past the target holding times (esp. for water chemistry). As long as you can keep the samples cold and in darkness (or as close to frozen as possible if the sample requires it), there is a high probability that the samples will maintain their integrity past the target holding times.

Q ~ *What if extreme weather hits, the lake is in flood stage, or there are other unsafe conditions?*

A ~ If it is unsafe to sample the lake and the lake cannot be re-scheduled within the index period, then it is removed from the draw and the next lake on the oversample list is chosen.

Q ~ *What if boats are not allowed on a publicly-accessible lake?*

A ~ Try to gain permission to sample by boat or other means such as rafts. If permission cannot be obtained, then assign the lake a final status of *Target Other* and select a replacement lake from the oversample list.

Q ~ *If a lake drops from my list, can I replace it with the next oversample site, or do I need to wait until the replacement is assigned by my Regional Lake Coordinator?*

A ~ If a lake is dropped, replace it with the first available site on your state's oversample list and conduct a GIS (if necessary), desktop and/or field evaluation; DO NOT skip lakes on your oversample list. Please report the dropped lake to your Regional NLA Coordinator as soon as possible.