2015

Oregon Lake Watch, 2015 Annual Report

Samuel Cimino
Portland State University

Rich Miller
Portland State University

Angela L. Strecker
Portland State University, angela.strecker@wwu.edu

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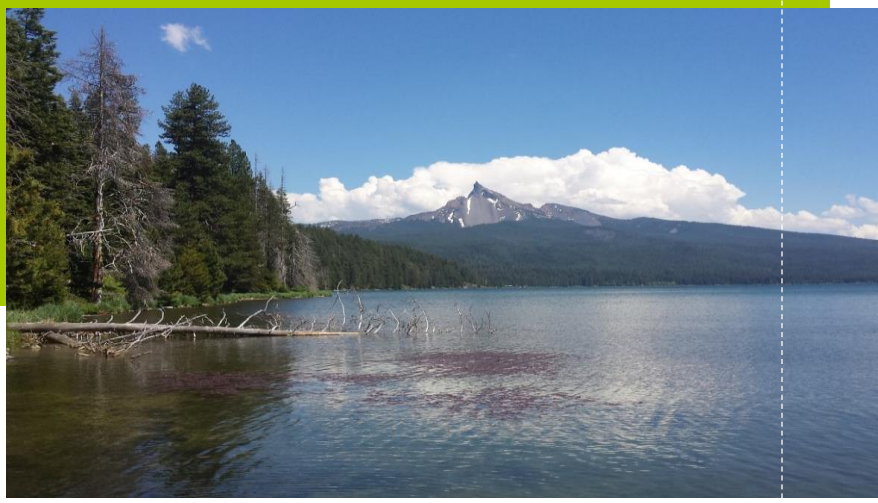
Samuel Cimino, Rich Miller, and Angela Strecker

Center for Lakes & Reservoirs
Portland State University



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Summary

The Oregon Lake Watch (OLW) volunteer monitoring program completed its third year of operation during 2015 with a focus on early detection of aquatic invasive species (AIS) and water quality status and trend assessments for the better management of Oregon's lakes and reservoirs. AIS surveys emphasized the detection of Watch List aquatic plant and species that can have a negative impacts on the beneficial uses of our waterbodies. Water transparency and temperature measurements were used to track the condition of volunteers' lakes.

Thirty-one Oregon lakes have been surveyed during the OLW's three years, 16 of which were surveyed during 2015. Seven lakes have been surveyed all three years and seven more have been surveyed two of the three years. Four Watch List plant and one animal species were found during 2015. Eurasian watermilfoil (*Myriophyllum spicatum*) was found in three lakes, Brazilian elodea (*Egeria densa*) and curly leaf pondweed (*Potamogeton crispus*) were each found in two lakes, and yellow flag iris (*Iris pseudacorus*) was found in one lake. Asian clams (*Corbicula fluminea*) were found in one lake. A diverse array of native plants were found along with native signal crayfish (*Pacifasticus leniusculus*). Water quality ranged from eutrophic to oligotrophic conditions based on water transparency and water temperatures ranged as high as 28°C (82°F). More years of data collection are necessary to track water quality trends.

Portland State UNIVERSITY

Thanks to our 2015 volunteers!

Lauren Mirow Blankenship / Tyler Tornfelt	Lost Lake / Lake Harriet
Marla Chaney	Pine Hollow Reservoir
Roger Edwards	Salish Pond, NE
Stan Geiger / Bill Helsley	Clear / Cullaby Lakes
Megan Hill	Trillium Lake
Mikeal Jones	Cooper Creek Reservoir
Deb and Tom Mafera	Prineville / Ochoco Reservoirs
Danielle Packard	Commonwealth Lake
Julie Reed	Sesesh Res. / Red Top Helipond
Pete Schay	Suttle Lake
Angela Strecker	Wahtum Lake
Emily Stevenson	Benson Pond / Hartman Pond
Thomas Walker	Todd Lake
Steve Wille	Olallie / Monon Lakes
Jason Davey	*2015 OLW trainee*
Saige Fultz	*2015 OLW trainee*
Steven Graves	*2015 OLW trainee*
Blaine Pincock	*2015 OLW trainee*

Funding provided by:

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Oregon Department of Agriculture

State of Oregon Department of Environmental Quality

Washington County Fly Fishers

Introduction

Lakes and reservoirs are important parts of Oregon's landscapes and lifestyles. Oregonians are fortunate to have a diverse array of lakes and reservoirs. Lakes such as Crater, Trillium and Wallowa provide some to the most iconic vistas in the West. Popular reservoirs such as Lake Billy Chinook and Detroit Lake provide recreational opportunities that boost local economies. Urban and rural lakes and ponds are important places for people to interact with the natural world. Numerous small and out-of-the-way lakes throughout the state provide solitude and habitat for many native plant and animal species.

Unfortunately, these lakes and reservoirs, and the way we use them, face threats on many fronts: ranging from invasions by non-native plants and animals (e.g., zebra and quagga mussels, Figure 1) to eutrophication from excessive nutrient loading. While state and federal regulators have the primary role in helping ensure that our lakes are fishable and swimmable, volunteer-based citizen-science programs such as the Oregon Lake Watch (OLW) can also play an important role in maintaining healthy lake and reservoir ecosystems.

Figure 1. Zebra and quagga mussels: two of the greatest economic and ecological treats to our lakes and reservoirs.

The OLW works towards maintaining healthy lake and reservoir ecosystems through:

- Educating volunteers about the threats to our waterbodies from aquatic invasive species (AIS), how they are spread, and how to reduce the probability of spread.
- Training volunteers to identify AIS. More trained eyes in the field increases the probability of the early detection of AIS. Early detection is important since a wider variety of management options, and more successful outcomes are available during the early stages of an aquatic invasion.
- Collecting inexpensive water quality data over the long term. Long term data are essential for helping determine whether changes in water quality are a result of human activity or are simply due to natural variation. Since these data can be expensive for professionals to collect over the long term, volunteer data is very useful in filling data gaps and is often the only data available for a lake.
- Disseminating lake monitoring information to resources managers, volunteers, and the general public.

The summer of 2015 marked the third year of operation of the OLW. Volunteers were trained to conduct surveys and identify nine high priority aquatic invasive animal species (Table 1) and 14 high priority aquatic invasive plant species (Table 2). These 23 Watch List species were selected

as the focus of the OLW surveys because 1) they are either not present in Oregon or have a limited geographic distribution in Oregon, and 2) their invasion can cause signification ecological or economic harm. Several of the plant species are classified as "A" or "B" listed noxious on the Oregon Department of Agriculture's Noxious Weed List (ODA 2014). "A" listed weeds are of known economic importance with small enough infestations to make eradication or containment possible, or are present in neighboring states. "B" listed weeds are of known economic importance and locally abundant. Extra training and survey emphasis was placed on species such as zebra mussels and hydrilla that are especially harmful.

Table 1. Watch List animal species. Highest priority animals are highlighted in red.

	Common name	Species name	Distribution notes
Molluscs	zebra mussels	*Dreissena polymorpha*	Not present in Oregon
	quagga mussels	*D. rostriformis bugensis*	Not present in Oregon
	Asian clams	*Corbicula fluminea*	Scattered throughout Oregon
	New Zealand mudsnails	*Potamopyrgus antipodarum*	Scattered throughout Oregon
	mystery snails	*Cipangopaludina chinensis/C. japonica*	Scattered throughout Oregon
Crayfish	red swamp crayfish	*Procambarus clarkii*	Limited to western Oregon
	ringed crayfish	*Orconectes neglectus*	Limited to southwestern Oregon and the upper Willamette River
	rusty crayfish	*Orconectes rusticus*	Limited to the John Day River watershed in central Oregon
	virile crayfish	*Orconectes virilis*	Not present in Oregon

Table 2. Watch List plant species. Highest priority plants are highlighted in red.

	Common name	Species name	ODA Weed Classification	Distribution notes
Submersed plants	curly leaf pondweed	*Potamogeton crispus*	none	Scattered throughout Oregon
	Eurasian watermilfoil	*Myriophyllum spicatum*	B	Common in western Oregon and the Columbia Basin
	hydrilla	*Hydrilla verticillata*	A	Not present in Oregon, but limited distributions in CA and ID.
	South American Waterweed	*Egeria densa*	B	Widespread in western Oregon
Floating leaf plants	European water chestnut	*Trappa natans*	none	Not present in Oregon
	parrots feather	*Myriophyllum aquaticum*	B	Widespread in western Oregon
	South American spongeplant	*Limnobium laevigatum*	A	Not present in Oregon, but present in Northern CA
	water primrose	*Ludwigia hexapatala, L. grandiflora, L. peploides*	B	Locally abundant in western Oregon
	yellow floating heart	*Nymphoides peltata*	A	Limited distribution in western and central Oregon
Emergent plants	common reed	*Phragmites australis ssp. australis*	A	Locally abundant along the Lower Columbia River
	flowering rush	*Botumus umbellatus*	A	Small populations in Lake Wallula and Lake Umatilla
	giant reed	*Arundo donax*	none	No known naturalized Oregon populations, but present in CA
	yellow flag iris	*Iris pseudacorus*	none	Widespread in Oregon
	purple loosestrife	*Lythrum salicaria*	B	Widespread in Oregon

Volunteers were trained to survey for Watch List species at boat launch and the higher use areas of a lake or reservoir using several methods:

- **Rake toss**. Double-sided thatch rakes are tossed into shallow areas of a lake and retrieved. Aquatic plants and invertebrates collected are identified to see if they are a Watch List species.
- **Shoreline walk**. Emergent shoreline plants, shallow-water submerged and floating-leaf plants, and plant fragments rafted onto shore are scanned for the presence of Watch List species.
- **Shallow water zig-zag**. When safe, volunteers wade into shallow water, pick up rocks and inspect for Watch List species such as New Zealand mudsnails, repeat every few steps while moving into deeper water, and then repeat while moving back into shallow water.
- **Minnow trap**. Baited minnow traps are placed at locations suitable for crayfish, retrieved, and inspected for invasive crayfish.
- **Artificial substrate**. Artificial substrates are placed in the lake over the course of a summer and periodically inspected for attached zebra and quagga mussels.

Volunteers were also trained to monitor two simple water quality parameters at representative locations within their survey lakes:

- **Water transparency.** Water transparency is measured by lowering a 20 cm diameter black-and-white Secchi disk into the water to the depth at which it's barely visible.
- **Water column temperature**. The vertical temperature structure is measured with an AquaCal® Clinefinder™ thermistor lowered into the water column at 0.5 to 1 m intervals.

All survey and monitoring data collected was entered by the volunteers into an online data entry portal. In order for the OLW managers to verify the volunteer's species identifications, volunteers were trained to take pictures of key identifying characteristics and upload pictures to the online data entry portal. Details of survey and data management methods are available at the OLW website (www.pdx.edu/oregon-lake-watch). Previous years' annual Oregon Lake Watch reports are available at http://pdxscholar.library.pdx.edu/centerforlakes/.

Monitoring efforts

This report summarizes the volunteer data collected at 16 Oregon lakes by 17 OLW volunteers during 2015. Three additional lakes surveyed during 2014 that were not included in the 2014 annual report are summarized here. Lakes surveyed ranged from Sesech Reservoir the south to Clear Lake in the north to Prineville Reservoir in the east (Figure 2). Seven lakes have been surveyed all three years of the OLW program, seven more have been surveyed during two of the three years, and 15 of the lakes have been surveyed only one of the three years (Table 3).

Volunteer recruiting. Volunteers were recruited through email, the Oregon Lake Watch website, and direct contact with family, friends, and colleagues. Recruitment emails were sent out to prospective volunteers including previous lake watch program volunteers, Oregon Lakes Association members, soil and water conservation districts, watershed councils, and state and federal agencies.

Potential volunteers were asked to fill out a brief survey intended to schedule training sessions. The survey included questions to tailor the training to the volunteers which included questions

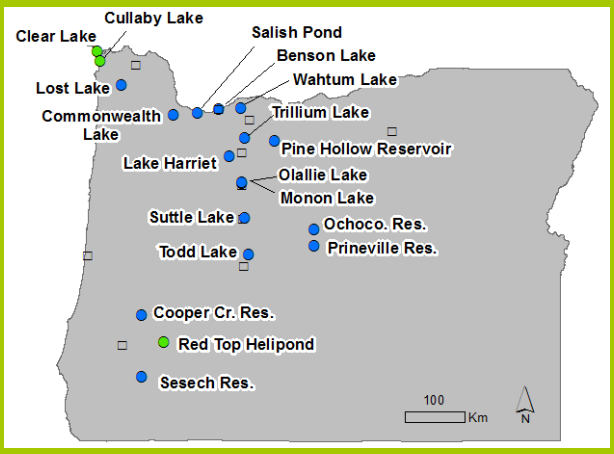

Figure 2. Location of Oregon Lake Watch lakes sampled during 2015 (blue circles). Squares are lakes that were sampled during 2013 or 2014 and have been included in prior annual reports. Green circles are lakes that were sampled during 2014 but were not included in the 2014 annual report.

Table 3. Waterbodies surveyed by OLW volunteers from 2013 through 2015.

Waterbody	County	2013	2014	2015
Benson Pond	Multnomah	X	X	X
Ben Irving Reservoir	Douglas		X	
Breitenbush Lake	Marion	X		
Blue Lake	Jefferson		X	
Clear Lake	Lane		X	
Clear Lake	Clatsop	X	X	
Commonwealth Lake	Washington			X
Cooper Creek Res.	Douglas		X	X
Cullaby Lake	Clatsop	X	X	
Diamond Lake	Douglas		X	
Fishhawk Lake	Clatsop	X		
Lake Harriet	Clackamas			X
Hartman Pond	Multnomah		X	
Laurence Lake	Hood River	X	X	
Little Lava Lake	Deschutes		X	
Lost Lake	Clatsop			X
Monon Lake	Jefferson	X	X	X
Ochoco Reservoir	Crook		X	X
Olallie Lake	Jefferson	X	X	X
Pine Hollow Reservoir	Wasco			X
Prineville Reservoir	Crook	X	X	X
Red Top Helipond	Douglas		X	
Salish Pond, NE	Multnomah	X	X	X
Sesech Reservoir (Burma Pond)	Josephine			X
Staats Lake	Marion	X		
Suttle Lake	Jefferson	X	X	X
Timothy Lake	Clackamas	X	X	
Todd Lake	Deschutes			X
Trillium Lake	Clackamas	X		X
Wahtum Lake	Hood River	X	X	X
Willow Creek Reservoir	Morrow	X	X	

about levels of experience with aquatic plant identification and water quality sampling, willingness to travel, and their sampling equipment needs. The survey included an informed consent clause approved by the Human Subjects Research Review Committee at PSU.

Volunteer training. OLW training sessions were conducted in the Portland and Bend areas during June, 2015. Twelve volunteers attended the trainings, ten of which were new trainees. Twelve more volunteers that had been trained in 2013 or 2014 conducted surveys during 2015. Each session lasted approximately six hours and included training in field safety, AIS survey protocols, species identification techniques, water quality sampling protocols, and data recording requirements and use of the Online Data Entry portal. Species identification training included hands-on training with fresh plant samples, pressed plant samples, preserved mussel and snail samples, and printed training materials. All training sessions included a short field trip to a waterbody to practice all aspects of a sampling event from selection of sampling sites to recording of data. The sessions concluded by issuing each volunteer a sampling kit which include a binder of training protocols and species identification sheets, the plant identification book, a double-sided thatch rake, a modified minnow trap, a Secchi disk and viewing tube, ruler, and a Clinefinder™ water temperature probe.

Monitoring efforts. Volunteer monitoring data were collected during 33 sampling events during 2015, with a sampling event defined as a lake on a particular date. Four additional sampling events were conducted during 2014 at Clear Lake, Cullaby Lake, and Red Top Spring Helipond that were not included in the 2014 report. Data were collected from multiple sites within each lake during most sampling events.

Shoreline surveys were conducted during 32 of the 37 sampling events, rake toss surveys during 28 events, minnow traps were set during 12 events, and artificial substrates were deployed at four of the waterbodies (Table 4). Secchi transparencies were measured during all 37 sampling events and temperature profile measurements were conducted during 36 of the events.

Table 4. Number of sampling dates during which each sampling method was used at each lake during 2015 including sampling conducted during 2014 at Clear Lake, Cullaby Lake, and Red Top Spring Helipond.

Waterbody	Zig-zag shoreline	Rake toss	Minnow trap	Artificial substrate	Temperature profile	Secchi transparency
Benson Pond	1	1	0	0	1	1
Clear Lake (Clatsop)	2	1	0	X	1	1
Commonwealth Lake	3	0	0	0	2	3
Cooper Creek Res.	2	1	1	0	2	2
Cullaby Lake	1	2	0	0	2	2
Lake Harriet	0	1	0	0	1	1
Lost Lake	0	1	0	0	1	1
Monon Lake	2	0	2	0	2	2
Ochoco Reservoir	4	4	3	X	2	3
Olallie Lake	2	0	0	0	3	2
Pine Hollow Reservoir	1	1	1	0	1	1
Prineville Reservoir	4	3	3	X	3	3
Red Top Helipond	1	1	0	0	1	1
Salish Pond, NE	3	7	0	0	7	7
Sesech Reservoir	1	1	0	0	1	1
Suttle Lake	2	1	0	X	3	3
Todd Lake	1	1	1	0	1	1
Trillium Lake	1	1	0	0	1	1
Wahtum Lake	1	1	1	0	1	1

Monitoring results

Species surveys. Volunteers detected four Watch List plant species and one Watch List animal species during 2015, or 2014 in the case of Clear and Cullaby Lakes in Clatsop County (Table 5). At least one Watch List or other non-native species was detected in 6 of the 19 surveyed lakes. None of the species were first time detections. Eurasian watermilfoil (*Myriophyllum spicatum*) was the most commonly encountered Watch List plant species and was present at Cooper Creek Reservoir, Salish Pond, and Suttle Lake. Brazilian elodea (*Egeria densa*) was found at Cooper Creek Reservoir and Cullaby Lake, curly leaf pondweed (*Potamogeton crispus*) was found at Salish Pond and Suttle Lake, and yellow flag iris (*Iris pseudacorus*) was found at Clear Lake in Clatsop County. Three more non-native species that are not included on the Watch List were also found: fragrant waterlily (*Nymphaea odorata*), reed canary grass (*Phalaris arundinaceae*), and fanwort (*Cabomba caroliniana*).

A diverse set of native aquatic plant were observed by the OLW volunteers. Pondweed species (*Potamogeton* sp.) was the most common native species recorded followed by the two waterweed species (*Elodea canadensis* and E. *nuttallii*) and coontail (*Ceratophyllum demersum*).

The one Watch List animal species detected during 2015, Asian clam (*Corbicula fluminea*), was found in Cooper Creek Reservoir. Red swamp crayfish (*Procambarus clarkii*) were also found in Cooper Creek Reservoir during 2014, but were not detected in 2015. In addition, Chinese mystery snails were found in Salish Pond during 2013 but have not been detected since. These species are likely still present, but at low enough densities to escape observation. The native signal crayfish (*Pacifasticus leniusculus*) was found at five of the surveyed lakes.

Water quality monitoring. Temperature and Secchi depth data are available for all 19 surveyed lakes. The minimum surface water temperature observed was 9.3°C at Lake Harriet during late August and the maximum of 28°C was recorded at Pine Hollow Reservoir during early July (Table 6). Mixed surface layer (epilimnion) depths were as deep as 11 m in the lakes that stratified. Many of the surveyed lakes are too shallow to thermally stratify.

The shallow depths of these lakes also prevent measuring Secchi transparency. For the lakes where Secchi transparency measurements were possible, observations ranged from 0.5 m transparency in Commonwealth Lake to over 12 m in Monon Lake. The range of Secchi transparencies indicates a wide range of trophic status across the lakes. The low Secchi transparency of Cullaby Lake, for instance, indicates the lake is likely eutrophic. Eutrophic lakes are rich in nutrients that can support dense algal growth, including potentially harmful blue-green algal growth. At the other extreme, the high transparency of Wahtum and Monon Lakes indicate oligotrophic status. Oligotrophic lakes have low concentrations of the nutrients that support algal growth. Mesotrophic lakes fall between these two extremes. It is important to note that Secchi transparencies within a lake change seasonally and across years in response to nutrient loading, food web structures, and weather. Therefore, it is important to collect Secchi transparency measurement many times during the summer and across multiple years to determine the natural variation within a lake and whether human impacts within a watershed or within a lake are having effects of trophic status.

Table 5. Watch List, other AIS, and native species reported by OLW volunteers during 2015.

	Benson Pond	Clear Lake (Clatsop)	Commonwealth Lake	Cooper Creek Reservoir	Cullaby Lake	Lake Harriet	Lost Lake (Clatsop)	Monon Lake	Ochoco Reservoir	Olallie Lake	Pine Hollow Reservoir	Prineville Reservoir	Red Top Spring Helipond	Salish Pond, Northeast	Secesh Reservoir	Suttle Lake	Todd Lake	Trillium Lake	Wahtum Lake
Number of Watch List AIS species	0	1	0	4	1	0	0	0	0	0	0	0	0	2	0	2	0	0	0
Number of other AIS species	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Myriophyllum spicatum, Eurasian milfoil				X										X		X			
Egeria densa, Brazilian elodea				X	X														
Iris pseudacorus, yellow flag iris		X																	
Potamogeton crispus, curly leaf pondweed														X		X			
Corbicula fluminea, Asian clam				X															
Nymphaea odorata, fragrant waterlily				X	X														
Phalaris arundinaceae, reed canary grass	X																		
Cabomba caroliniana, fanwort					X														
Native species																			
Brasenia schreberi, water shield					X														
Sagittaria cuneata, arumleaf arrowhead												X							
Ceratophyllum demersum, coontail					X							X		X					
Elodea nuttallii, Nuttall's waterweed											X								
Elodea canadensis, Canadian waterweed						X								X		X			
Elodea sp., waterweed	X																		
Marsilea sp., waterclover											X								
Myriophyllum sp., native watermilfoil			X																
Potamogeton pusillus, thinleaf pondweed												X							
Potamogeton richarsonii, Richardson's pondweed												X							
Potamogeton sp., pondweed	X	X		X					X		X			X			X		
Nitella sp., brittlewort	X										X								
Najas sp., water-nymph											X								
Nuphar polysepala, yellow water lily		X			X														
Eleocharis aricularis, needle spike-rush											X								
Ranunculus aquatilis, water buttercup											X								
Chara sp.*,* muskgrass	X								X			X							
Pacifastacus leniusculus, signal crayfish									X			X				X	X		X
Other mussels or clams												X							
Other snails	X				X				X		X	X		X					

Table 6. Summary of 2015 water temperature and Secchi transparency measurements.

Waterbody	Surface water temperature (°C)	Bottom of mixed layer (m)	Secchi depth (m)	Trophic status based on Secchi depth
Benson Pond	23	weak stratification	up to 2.5 m*	Lake too shallow
Clear Lake (Clatsop)	19	not stratified	> 1.3*	Lake too shallow
Commonwealth Lake	16 - 25	not stratified	0.5 - > 1.5*	Lake too shallow
Cooper Creek Res.	18 - 25	5 - 7	3.7 - 7.9	Mesotrophic to Oligotrophic
Cullaby Lake	19 - 23	not stratified	0.6	Eutrophic
Lake Harriet	9	not stratified	> 9*	Oligotrophic
Lost Lake (Clatsop)	14	not stratified	> 3.5*	Lake too shallow
Monon Lake	19 - 21	6.5	> 10*	Oligotrophic
Ochoco Reservoir	22 - 23	6.5	3.5 – 5.6	Mesotrophic to oligotrophic
Olallie Lake	18 - 24	weak stratification at 8.5 m	> 12*	Oligotrophic
Pine Hollow Reservoir	28	3	5	Insufficient data
Prineville Reservoir	22 - 27	thermocline at 8 -9 m**	1.5 – 4.2	Mesotrophic
Red Top Spring Helipond	18	not recorded	1.3	Insufficient data
Salish Pond, NE	14 - 27	not stratified	1.8 - 3.8	Eutrophic to mesotrophic
Sesech Reservoir	19	not stratified	> 3*	Insufficient data
Suttle Lake	18 - 20	4 – 10.5	2.6 – 3.3	Mesotrophic
Todd Lake	19	5	7.4	Oligotrophic
Trillium Lake	23	weak stratification at 1.5 m	2.5	Insufficient data
Wahtum Lake	20	7	9.9	Oligotrophic

*Secchi disk visible to maximum depth at sampling site during some or all sampling events
** A well-defined mixed layer was not present during 2015 sampling events

Lake monitoring summaries

Benson Pond, Multnomah County

Benson Pond (also known as Benson Lake) is a small (23 acre) shallow (~2.5 m maximum depth) pond located in the Columbia River Gorge near Multnomah Falls (Figure 3). The lake was surveyed for AIS and water quality once during August 9, 2015. The lake has also been surveyed during 2013 and 2014.

PLANT SPECIES DETECTIONS. Rake surveys were conducted at two sites and shoreline surveys were conducted at four sites in Benson Pond. No Watch List plant species were detected. One non-native plant species, reed canary grass (*Phalaris arundinaceae*), was common along the shoreline during 2013-2015 sampling trips. Native species that have been encountered during 2013-2015 included Canadian or Nuttall's waterweed (*Elodea canadensis or E. nuttallii*), muskgrass (*Chara sp.*), nitella (*Nitella sp.*), and thin-leaf pondweed (*Potamogeton pusillus* or *P. foliosus*).

ANIMAL SPECIES DETECTIONS. No non-native Watch List mussels or snails have been detected during shoreline surveys or in rake collections during 2013-2015 sampling events. Unidentified snails, most likely native species, were encountered on several dates.

TEMPERATURE PROFILES. A temperature profile was measured at one site during 2015. Temperatures ranged from 23°C (74°F) at the surface to 19°C (66°F) at 2.5 m. Due to the strong gorge winds and shallow depth of the pond, the observed stratification was likely short lived.

SECCHI TRANSPARENCY. The Secchi disk was visible on the bottom of the pond during the 2015 sampling event so we can only say that transparency was at least 1.5 m. Transparency was 2.25 m on one date during 2014 and at least 2.5 m on the other 2014 sampling date. Because of the shallow depth it is difficult to infer trophic status from Secchi disk measurements. In addition to the Secchi being visible on the bottom of the pond, resuspension of sediments by strong winds complicates the relationship between algae in the water and water clarity.

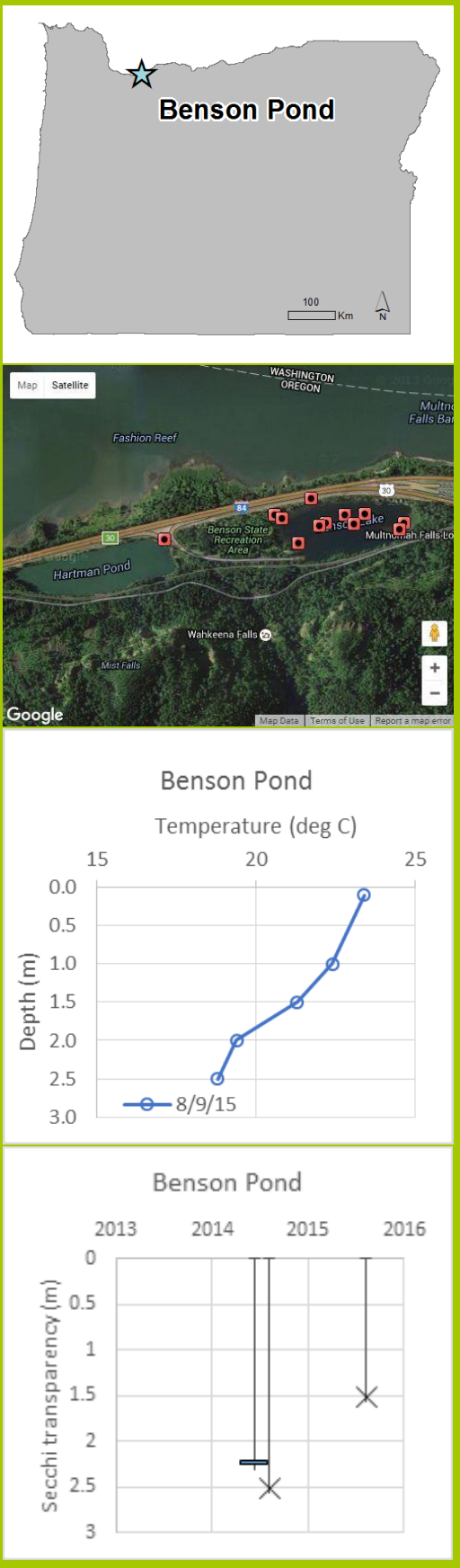

Figure 3. Benson Pond location, sampling sites, temperature profiles, and Secchi transparencies. X's represent measurements where the Secchi disk was visible to the bottom of the lake.

Clear Lake, Clatsop County

Clear Lake is a small (8.4 ac), shallow lake (~1.8 m maximum depth) located in Clatsop County west of the town of Astoria (Figure 4). The lake was surveyed by OLW volunteers once during the fall of 2014 using rake toss and shoreline observation methods. The lake was also sampled during 2013. Sampling was not conducted during 2015, however, the 2014 results were not included in the 2014 Annual Report.

PLANT SPECIES DETECTIONS. No Watch List invasive species were detected. The non-native species yellow flag iris (*Iris pseudacorus*), a common invader throughout Oregon, was present however. Two native aquatic plant species, yellow waterlily (*Nuphar polysepala*) and an unknown species of pondweed (*Potamogeton* sp.), were reported in the lake.

ANIMAL SPECIES DETECTIONS. Zebra/quagga mussel substrates were deployed during 2013 and 2014. No non-native or native mussels or snails were detected.

TEMPERATURE PROFILES. Clear Lake at 0.3 meters was at 19°C (67°F). The lake was not stratified during the September sampling event. Since the lake is very shallow, temporary temperature stratification is only likely during especially calm conditions.

SECCHI TRANSPARENCY. The Secchi disk was visible at the bottom of the lake so transparency was at least 1.3 m during the 2014 sampling date. Sampling was conducted at a slightly deeper site during the 2013 sampling event and Secchi transparency was 1.5 m. Based on the shallow nature of the lake, no firm conclusions about the trophic status of the lake can be drawn from the Secchi measurements.

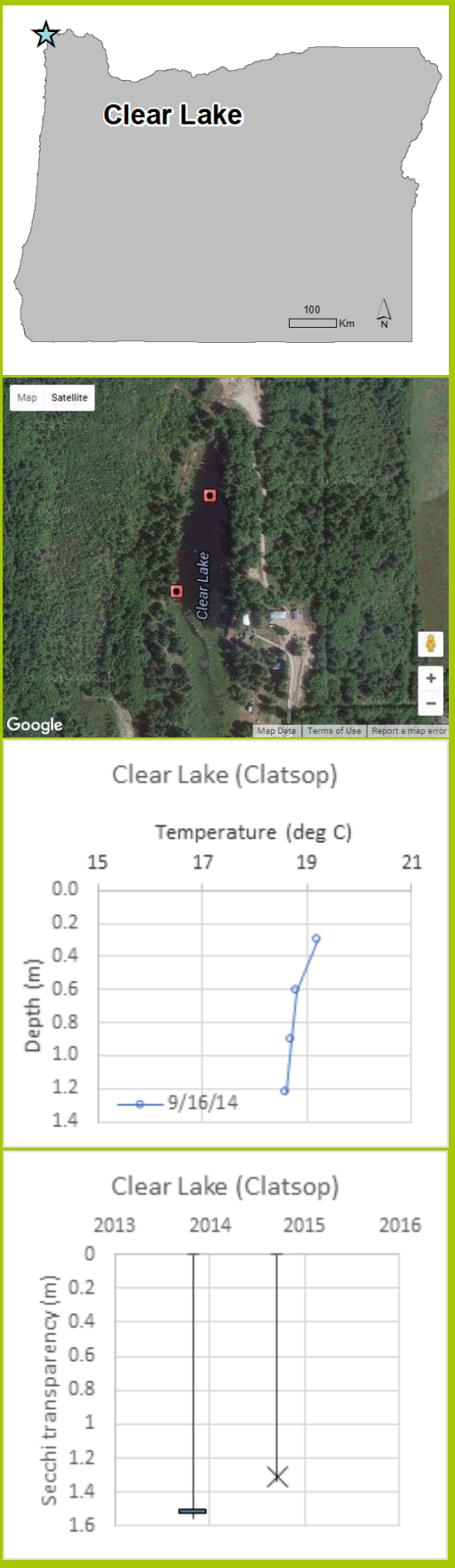

Figure 4. Clear Lake sampling sites, temperature profiles, and Secchi transparencies. X's represent measurements where the Secchi disk was visible to the bottom of the lake.

Commonwealth Lake, Washington County

Clear Lake is a small (5 ac), shallow (less than 2 m deep) lake located in the Cedar Hills neighborhood between Portland and Beaverton (Figure 5). The popular fishing and recreation lake lies entirely within the Tualatin Hills Park and Recreation District's Commonwealth Park. The lake was surveyed by an OLW volunteer during June and September, 2015.

PLANT SPECIES DETECTIONS. No Watch List invasive species were detected during shoreline survey during either sampling event. Native watermilfoil, likely Western watermilfoil (*Myriophyllum sibiricum*) was common throughout the lake.

ANIMAL SPECIES DETECTIONS. No non-native mussels or snails were detected during the surveys. Crayfish traps were not deployed in the lake.

TEMPERATURE PROFILES. Commonwealth Lake is too shallow to stratify other than for short periods of calm winds. During June, 2015, however, there was vertical stratification of 3°C over 1.2 m in depth. Spatial differences in temperature were also present during the June date with a range of surface water temperatures 3.3°C between the south and northeast parts of the lake.

SECCHI TRANSPARENCY. The Secchi disk was visible at the bottom of lake at all sites during September 2015 and all but one site during June 2015 when the transparency was 0.7 m. This extremely low water clarity indicates that the lake is likely eutrophic, however, the shallow nature of the pond and the limited number of sample dates limits any generalizations about the lake.

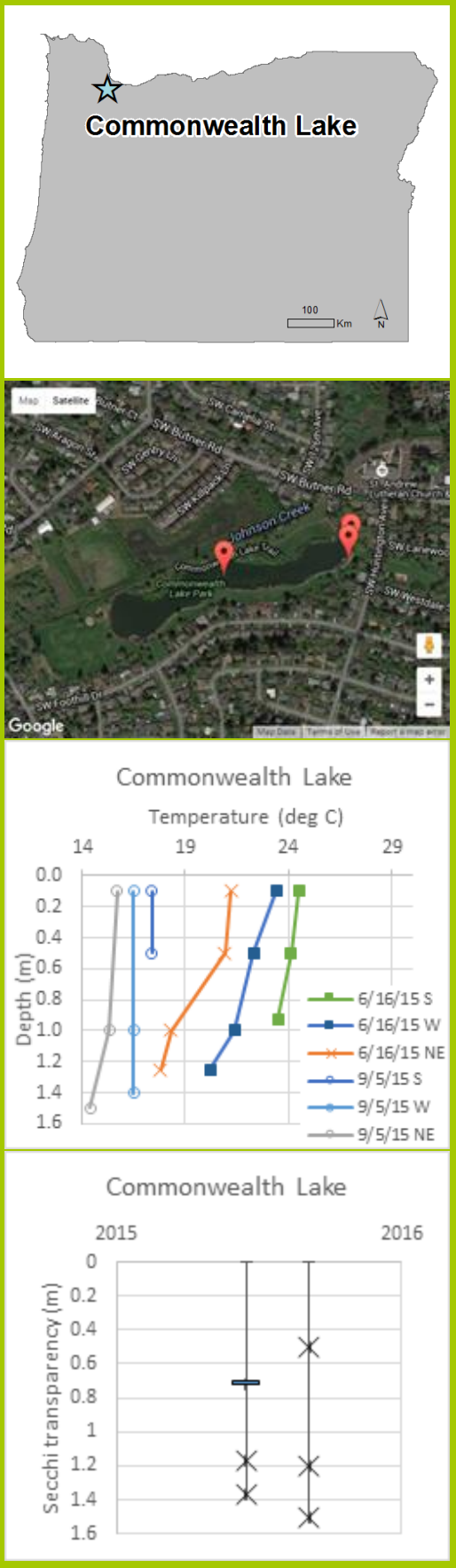

Figure 5. Commonwealth Lake location, sampling sites, temperature profiles, and Secchi transparencies. X's represent measurements where the Secchi disk was visible to the bottom of the lake.

Cooper Creek Reservoir, Douglas County

Cooper Creek Reservoir is a large (166 ac), moderately deep (21 m maximum depth) impoundment of Cooper Creek within the Umpqua River watershed (Figure 6). The lake is used as part of the municipal water supply for the City of Sutherlin as well as fishing and other recreation. Lake Watch volunteers visited the reservoir on two dates during 2015 and one date during 2014.

PLANT SPECIES DETECTIONS. Plants were surveyed using rake toss and shoreline survey methods. Three Watch List invasive plants were detected: Eurasian watermilfoil (*Myriophyllum spicatum*), Brazilian elodea (*Egeria densa*) and fragrant waterlily (*Nymphaea odorata*). An unidentified native pondweed (*Potamogeton* sp.) was also detected in the reservoir.

ANIMAL SPECIES DETECTIONS. The Watch List invasive red swamp crayfish (*Procambarus clarkii*) was collected using a minnow trap in 2014. No native signal crayfish (*Pacifastacus leniusculus*) were trapped. The Watch List species Asian clams (*Corbicula fluminea*) were detected in the reservoir. No non-native mussels or snails were detected using shoreline or artificial substrate sampling methods.

TEMPERATURE PROFILES. Cooper Creek Reservoir was thermally stratified on both 2015 sampling dates. Surface waters in June were nearly 25°C (77°F) and mixed to a depth of 5 m. Surface temperature cooled to 18°C (64°F) by mid-October and mixed down to 7 m. Hypolimnetic temperatures on both dates were as cold as about 8°C (46°F).

SECCHI TRANSPARENCY. Secchi transparency ranged considerably during 2015 from 3.7 m during July to 7.9 m during October. Water transparency during 2014 was right in the middle at 5.9 m during July 2014. These values are indicative of oligotrophic to mesotrophic conditions.

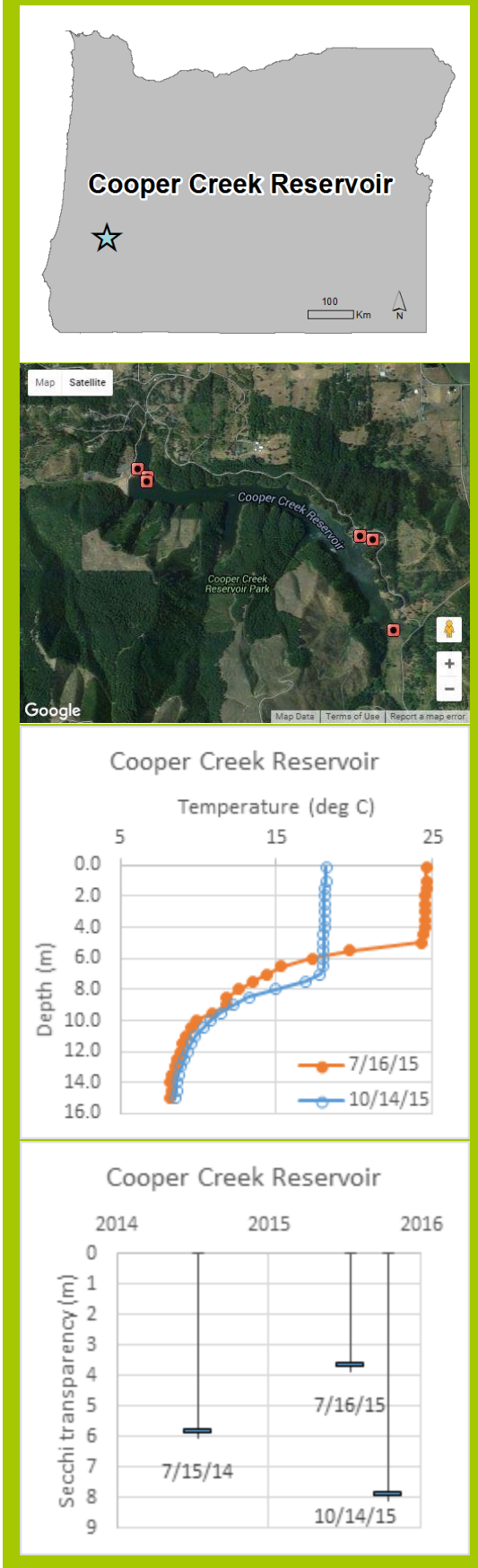

Figure 6. Cooper Creek Reservoir location, sampling sites, temperature profiles, and Secchi transparencies.

Cullaby Lake, Clatsop County

Cullaby Lake is the largest of many lakes in the Clatsop Plains area along the north Oregon coast (Figure 7). The 188 acre lake is used for fishing, boating and other recreation. Lake Watch volunteers visited the reservoir on two dates during 2014 and 2013.

PLANT SPECIES DETECTIONS. Plants were surveyed using rake toss and shoreline survey methods. Two Watch List invasive plants were found in Cullaby Lake: Brazilian elodea (*Egeria densa*) and fragrant waterlily (*Nymphaea odorata*). One other non-native species, fanwort (*Cabomba caroliniana*), was also found in the lake. Native species encountered included coontail (*Ceratophyllum demersum*), watershield (*Brasenia schreberi*), and yellow waterlily (Nuphar polysepala). An unidentified milfoil species (*Myriophyllum* sp.) was detected during 2013 surveys.

ANIMAL SPECIES DETECTIONS. No Watch List animal species were found in Cullaby Lake using rake toss, minnow trap, shoreline observation, or artificial substrate sampling methods.

TEMPERATURE PROFILES. Surface water temperatures ranged from 19°C (66°F) on September 16 to 23°C (73°F) on August 29, 2014. Temperatures dropped less than 2°C (3°F) from the surface to the 3 m which means the entire lake can be vertically mixed with relatively weak winds.

SECCHI TRANSPARENCY. Secchi transparency was 0.6 m (0.2 ft) on both 2014 sampling dates. Water clarity was almost twice as great during 2013. More data are necessary to determine the natural annual and seasonal variation in water clarity. Clarity in Cullaby Lake is influenced by dissolved color and phytoplankton. The dissolved brownish color in the water comes from breakdown of the extensive wetland plant material upstream of Cullaby Lake. The difference between 2013 and 2014 was likely due to more phytoplankton in the water during 2014 as the OLW volunteers noted blue green algae in the water during 2014. If we ignore the influence of dissolved color, the transparencies observed in Cullaby Lake indicate eutrophic conditions. With dissolved color factored in Cullaby Lake would be considered more mesotrophic.

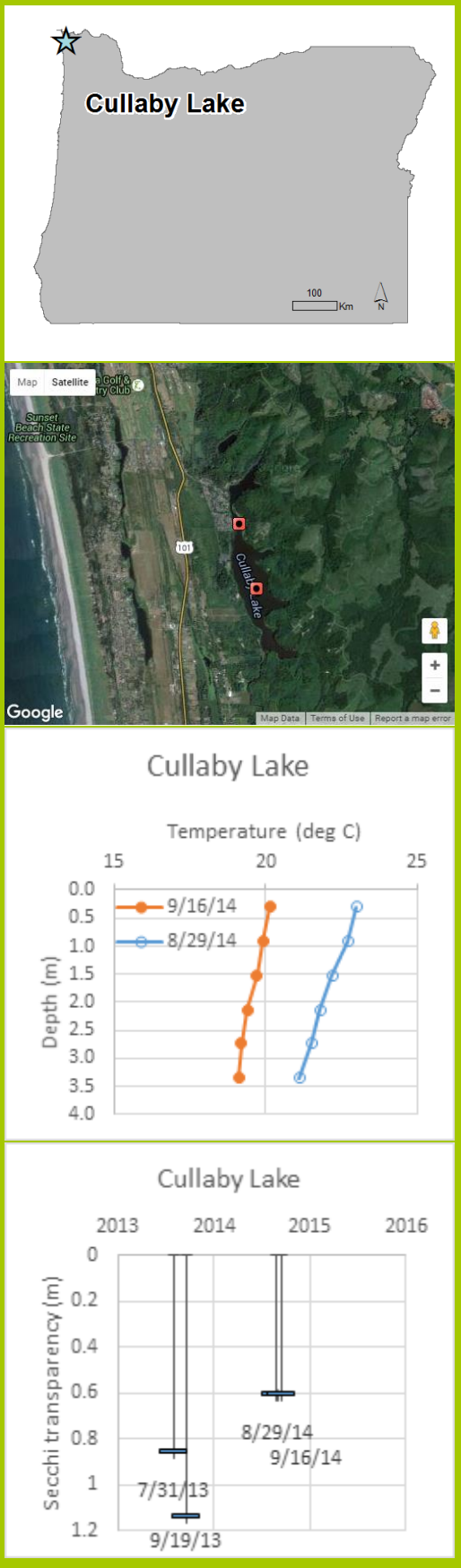

Figure 7. Cullaby Lake location, sampling sites, temperature profiles, and Secchi transparencies.

Lake Harriet, Clackamas County

Lake Harriet in a small (22 ac) hydroelectric impoundment of the Oak Grove of the Clackamas River with a maximum depth of about 9 m. The lake is located within the Mount Hood National Forest at an elevation of 619 m (Figure 8). The reservoir is operated at relatively stable water levels by Portland General Electric. The lake was surveyed once by OLW volunteers during 2015.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were found in Lake Harriet. The native species Canadian waterweed (*Elodea canadensis*) and another unidentified plant were found in the lake. Canadian waterweed, white water-buttercup (*Ranunculus aquatilis*) and nitella (*Nitella* sp.) were found in Lake Harriet during previous surveys (Miller et al. 2014).

ANIMAL SPECIES DETECTIONS. Plant rake tosses were inspected for snails and mussels during the 2015 surveys. No Watch List animals were detected.

TEMPERATURE PROFILES. Surface water temperatures were very cold during the late August sampling event (9°C, 48°F). There was no significant vertical stratification present with only a 0.7°C (1.5°F) decrease over 8 m.

SECCHI TRANSPARENCY. The Secchi was visible on the bottom of the sampling location during the August 2015 sampling event. Since the depth at the sampling site was 9 m, water clarity is excellent and the lake can be safely classified as oligotrophic.

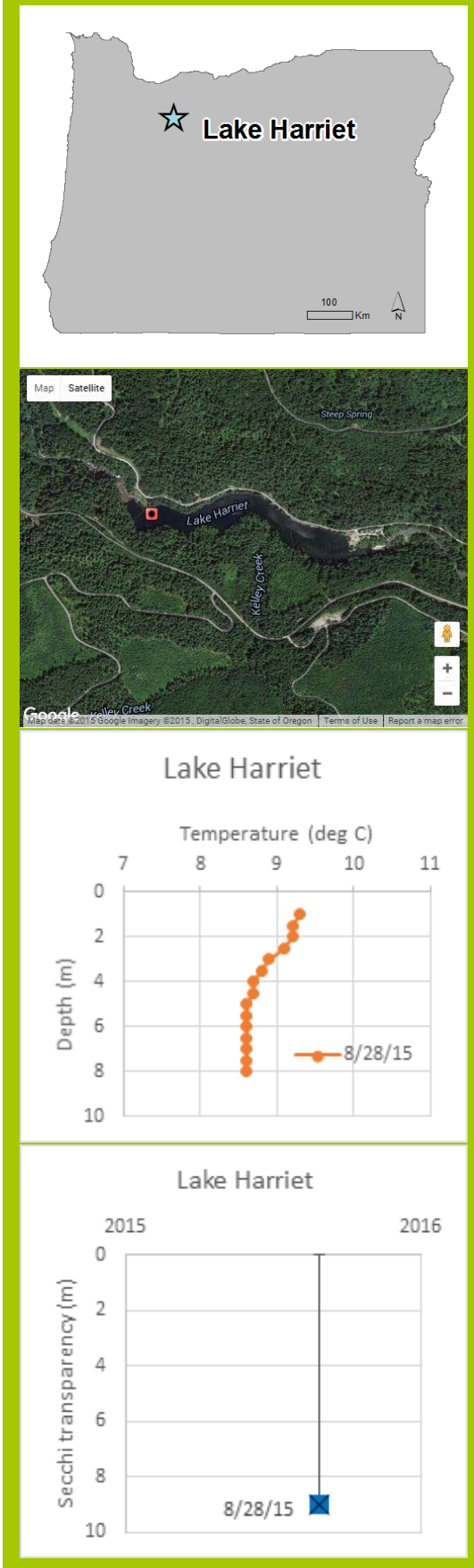

Figure 8. Lake Harriet location, sampling sites, temperature profiles, and Secchi transparency. X's represent measurements where the Secchi disk was visible to the bottom of the lake.

Lost Lake, Clatsop County

Lost Lake is a small, shallow lake located in the Nehalem River watershed in Clatsop County (Figure 9). The lake was surveyed by OLW volunteers once during the fall of 2014 using rake toss and shoreline observation methods. Secchi and temperature profile measurements were also collected.

PLANT SPECIES DETECTIONS. No Watch List plants were detected.

ANIMAL SPECIES DETECTIONS. No Watch List animals were detected.

TEMPERATURE PROFILES. Water temperatures were similar throughout the water column ranging from 14.1°C (57.4°F) at the surface to 13.7°C (56.6°F) at 3.5 m. Because of the small size of the lake, stratification is likely during the summer.

SECCHI TRANSPARENCY. The Secchi disk was visible on the bottom of the lake, therefore, transparency was at least 3.5 m. Based on this single sampling event we cannot draw any conclusions about the trophic status of the lake.

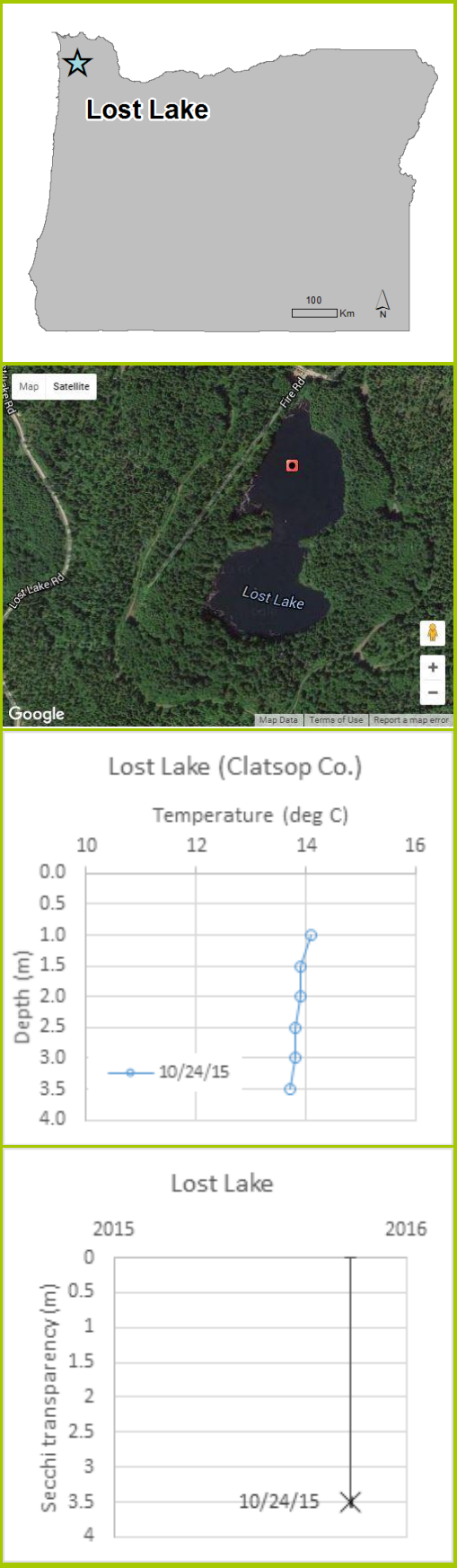

Figure 9. Lost Lake location, sampling sites, temperature profile, and Secchi transparency. X's represent measurements where the Secchi disk was visible to the bottom of the lake.

Monon Lake, Jefferson County

Monon Lake is one of a large group of small glacially carved lakes located on a high plateau at the crest of the Cascade Mountains to the north of Mount Washington (Figure 10). OLW volunteers surveyed the lake on two dates during 2015 using the shoreline zig-zag method and minnow traps. Secchi measurements and temperature profiles were also collected.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species or native plant species were detected in Monon Lake.

ANIMAL SPECIES DETECTIONS. No snails, or mussels were detected during shoreline surveys in 2015. No crayfish were found in two minnow traps deployed during the June sampling event or one trap deployed in August 2015.

TEMPERATURE PROFILES. Surface water temperatures ranged from 19.4°C (66.9°F) at the deep south basin site during June to 20.6°C (69.1°F) at the deep site during August. The shallow site was well mixed vertically on both dates. The vertical thermal structure at the deeper site during the June sampling event was fairly complex which indicating a seasonal history of calm period in which surface waters warmed followed by windy period in which the warm water was mixed downward. Temperatures in June were relatively isothermal to 6.5 m and dropped to a minimum of 16.7°C (62°F) by 9 m. Vertical variation in temperature at the deep site was even weaker during the August sampling event.

SECCHI TRANSPARENCY. The Secchi disk was visible on the bottom at north and south basin sites during both sampling events. Since the Secchi disk was greater than 10 m during all sampling events since 2013, the lake is considered oligotrophic to ultra-oligotrophic.

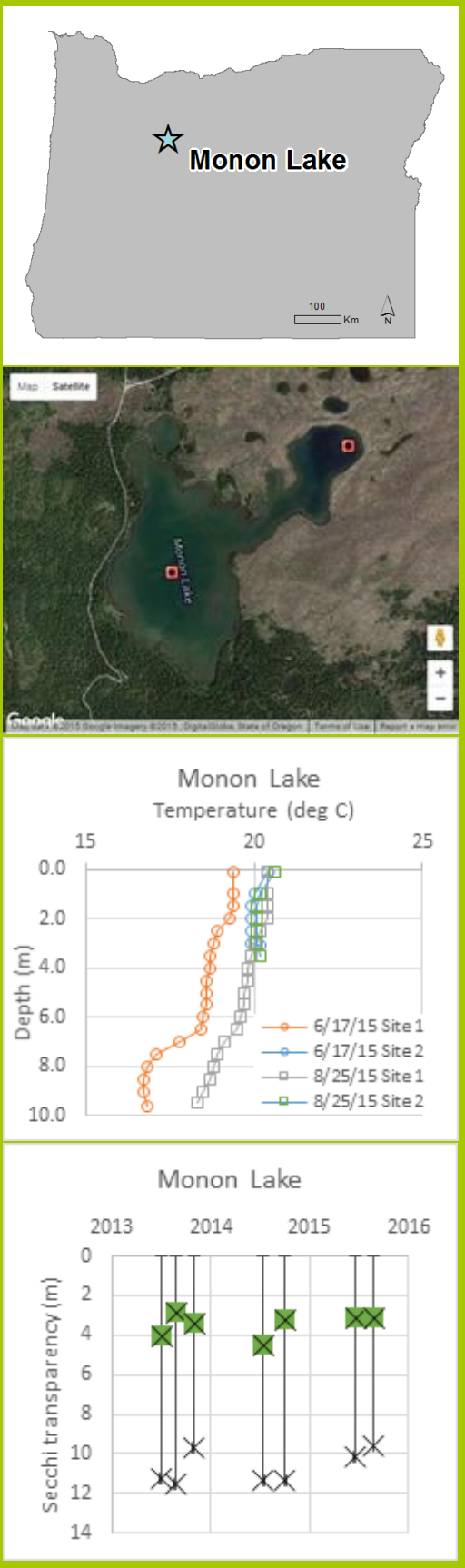

Figure 10. Monon Lake location, sampling sites, temperature profiles, and Secchi transparencies. X's represent measurements where the Secchi disk was visible to the bottom of the lake. Green boxes are measurements at the shallow south basin.

Ochoco Reservoir, Crook County

Ochoco Reservoir is a large irrigation, flood control, and recreation reservoir located in Central Oregon near the city of Prineville (Figure 11). The reservoir formed by impoundment of Ochoco Creek and is popular for fishing and boating. The lake was surveyed for invasive species three times during the summer of 2015 using shoreline survey, minnow trap, and artificial substrate methods. Temperature profiles were collected on two of the dates while Secchi transparency was measured on all three dates. The reservoir was also surveyed during 2014.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were detected in Ochoco Reservoir. Two native aquatic plant species, muskgrass (*Chara* sp.) and an unknown pondweed species (*Potamogeton* sp.) were found in the reservoir.

ANIMAL SPECIES DETECTIONS. No Watch List invasive animal species were detected in the reservoir using the shoreline survey or artificial substrate methods during 2015 or 2014. Only native signal crayfish (*Pacifastacus leniusculus*) were captured in the minnow traps.

TEMPERATURE PROFILES. The surface water temperature in late June was 23°C (74°F) and dropped to 22°C (71°F) in mid-August. Water temperatures on both dates were well mixed to about 6.5 m. A sharp temperature decrease below 6.5 m ended in temperatures of 10°C (50°F) at 15 m.

SECCHI TRANSPARENCY. Secchi transparencies during 2015 ranged from 3.5 to 5.6 m which is similar to measurements during 2014, although transparencies were as low as 2.6 m in 2014. This range of transparencies is consistent with a meso- to oligotrophic lake.

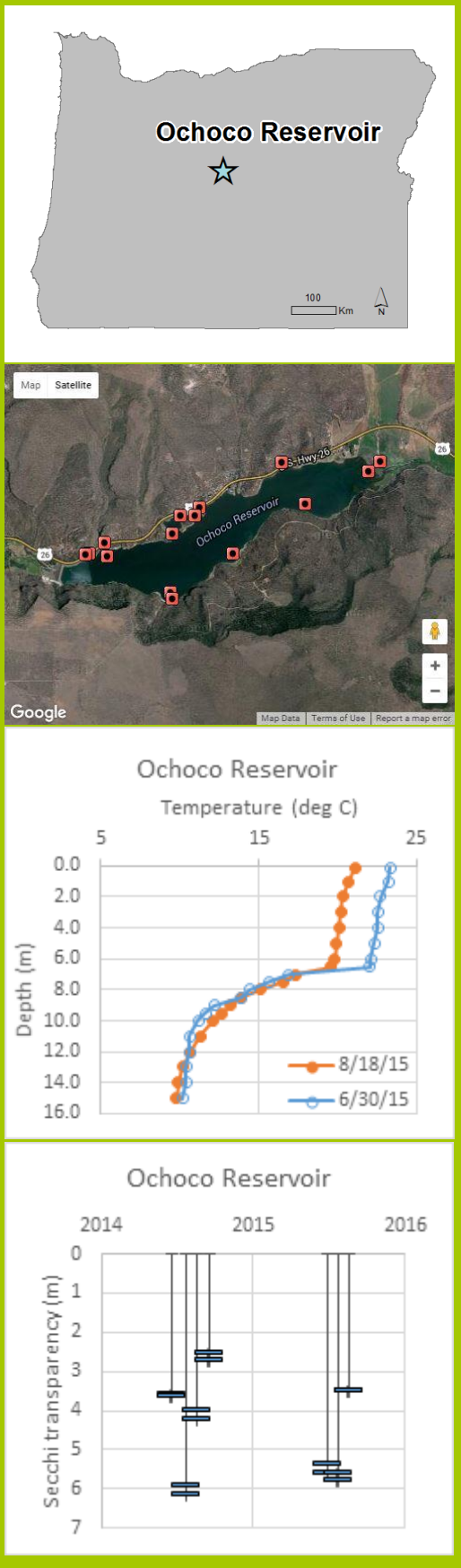

Figure 11. Ochoco Reservoir location, sampling sites, temperature profiles, and Secchi transparencies.

Olallie Lake, Jefferson County

Olallie Lake is one of the larger of the multitudes of glacially carved lakes along the crest of the Cascade Mountains north of Mount Washington, Oregon (Figure 12). Shoreline observations and Secchi and temperature measurements were conducted during June and August 2015. Volunteers have also surveyed Olallie Lake during 2013 and 2014.

PLANT SPECIES DETECTIONS. No Watch List plants have been detected during the 2013-2015 period.

ANIMAL SPECIES DETECTIONS. No Watch List animal species were found in Olallie Lake during 2015. A single Asian clam (*Corbicula fluminea*) shell, however, was found along the shoreline in 2013.

TEMPERATURE PROFILES. Surface water temperatures in Olallie Lake increased from 17.9°C (64.2°F) during June to 23.8°C (74.8°F) during August 2015. There was no difference in surface temperatures between the north and south basin sites on either sampling date. Vertical temperature stratification was not present at either site during June or at the shallow site during August. Weak stratification was present at 8.5 m during August at the deepest site.

SECCHI TRANSPARENCY. The Secchi disk was visible on the bottom at north and south basin sites during both sampling events. Since the Secchi disk was a minimum of 10 m during all sampling events since 2013, the lake is oligotrophic to ultra-oligotrophic.

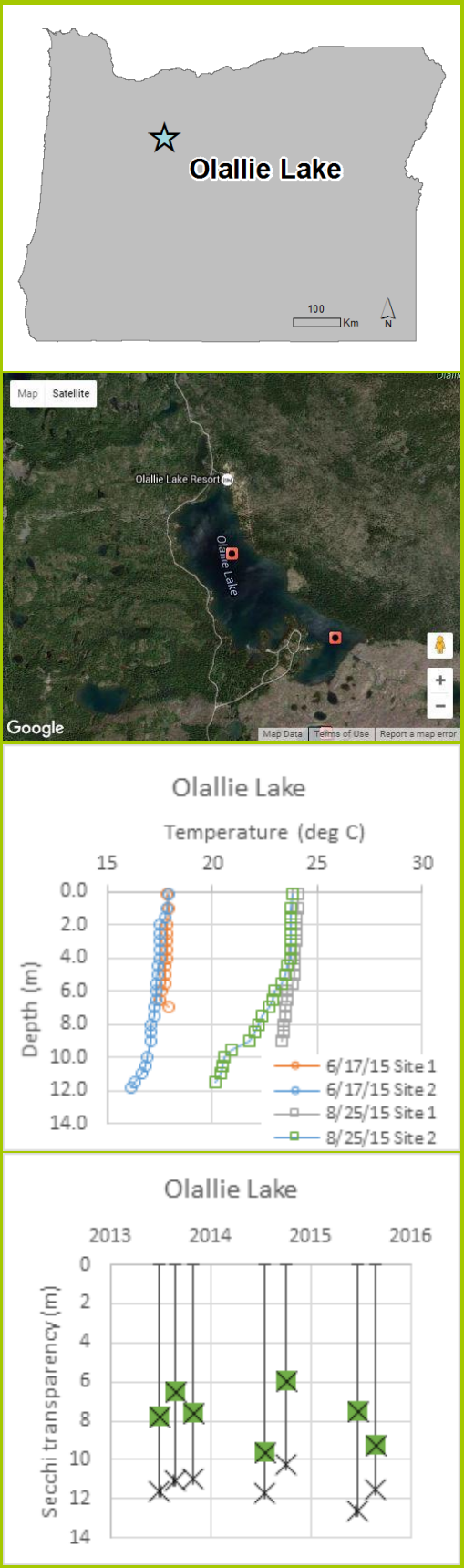

Figure 12. Olallie Lake location, sampling sites, temperature profiles, and Secchi transparencies. X's represent measurements where the Secchi disk was visible to the bottom of the lake.

Pine Hollow Reservoir, Wasco County

Pine Hollow Reservoir is a 227 acre (0.92 km²), 60 ft (18.3 m) deep irrigation and recreation impoundment locate on the eastern slopes of the northern Oregon Cascades south of The Dalles (Figure 13). The lake was surveyed by OLW volunteers once during the summer of 2015 using rake toss, shoreline observation, and minnow trap methods. Secchi transparency and temperature profiles were also collected.

PLANT SPECIES DETECTIONS. No Watch List plants were detected in either sampling area during the July 2015 sampling event. Several native species were encountered including Nuttall's waterweed (*Elodea nuttallii*), white water-buttercup (*Ranunculus aquatilis*), needleleaf spikerush (*Eleocharis acicularis*), a water clover species (*Marsilea* sp.) and a pondweed species, likely longleaf pondweed (*Potamogeton nodosus*).

ANIMAL SPECIES DETECTIONS. No Watch List non-native mussels or snails were detected during shoreline surveys conducted near the public boat launch. Several unknown, likely native snail species were encountered.

TEMPERATURE PROFILES. Surface water temperatures were extremely warm (28°C, 82°F) and fairly well mixed down to 3 m. The lake was not strongly stratified with temperatures dropping by 15°C (28°F) though the metalimnion. Temperatures in the hypolimnion ranged from 10.5 to 11.4°C.

SECCHI TRANSPARENCY. Secchi transparency during the July sampling event was 5 m. This measurement is consistent with an oligotrophic lake, however, trophic status cannot be adequately determined with a single measurement.

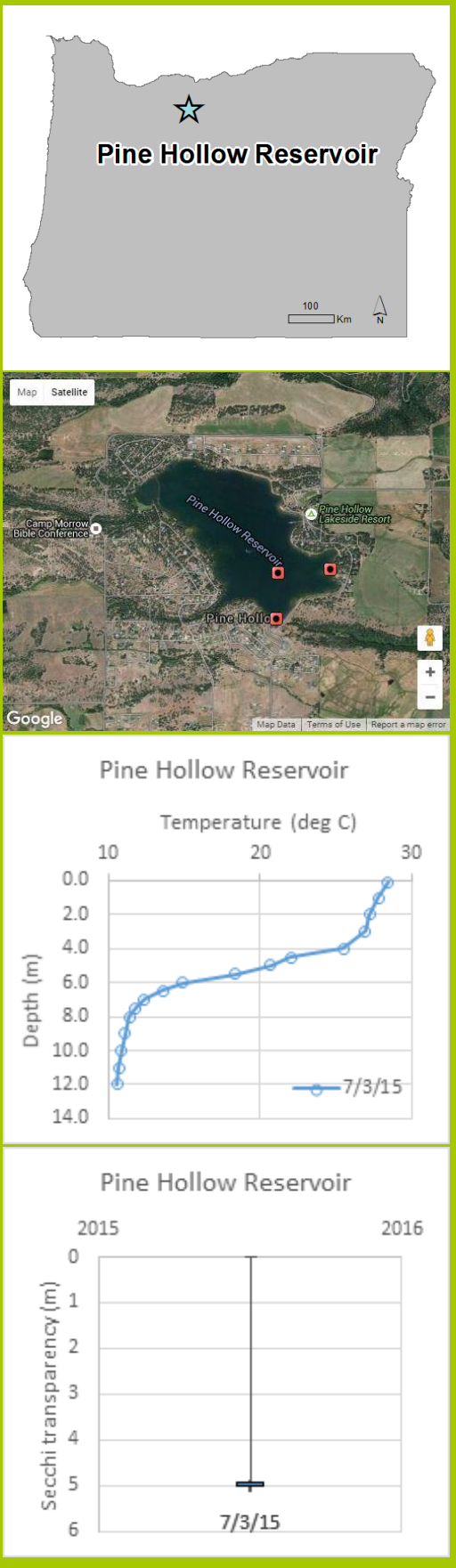

Figure 13. Pine Hollow Reservoir location, sampling sites, temperature profiles, and Secchi transparencies.

Prineville Reservoir, Crook County

Prineville Reservoir is a large impoundment of the Crooked River in central Oregon (Figure 14). The reservoir is popular for boating and other recreational activities. OLW volunteers surveyed eight sites in the reservoir for AIS using rake toss and shoreline survey methods on three dates during 2015. Minnow traps were deployed at three of the sites. Volunteers also surveyed the reservoir during 2013 and 2014.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species or other non-native plant species have been detected during any of the survey years. The native species thin leaf pondweed (*Potamogeton pusillus*), Richardson's pondweed (*P. richardsonii*), coontail (*Ceratophyllum demersum*), and Canadian waterweed (*Elodea canadensis*) were found at several sites throughout the reservoir. Volunteers detected a large infestation of the terrestrial weed Russian knapweed (*Centaurea repens*) during the surveys and notified the Crook County weed manager.

ANIMAL SPECIES DETECTIONS. No Watch list snails, mussels, or crayfish were detected in the reservoir during any of the survey years. During 2015 native signal crayfish (*Pacifastacus leniusculus*) carapaces were found at several locations. Native snails and mussels were found near the Crooked River inlet.

TEMPERATURE PROFILES. Temperature profiles were measured at the Big Island site during June, July, and August 2015 sampling events and profiles were measured to the east up reservoir at the "West" site during June and July events. Temperature profiles did not vary between the two sites during the two dates when measurements were taken at both sites. Surface temperatures ranged from 22°C (72°F) during August to 26°C (79°F) during June. There was not a clear upper mixed temperature layer during the June and July events as temperatures dropped at a fairly consistent rate with depth until a depth of about 9 or 10 m. Temperature were more consistent to a depth of 8 m during the August sampling event, however temperatures did drop 3°C (5°F) over this depth range. Temperatures at 15 m ranged from 10 to 12°C (50 to 54°F).

SECCHI TRANSPARENCY. Secchi transparency meaurements were conducted ten times at two locations. Secchi depths ranged from approximately 1.5m to 4.2m. The Secchi transparencies recorded indicate that Prineville Reservoirs's trophic status is mesotrophic. Spatial variation in Secchi transparency was considerable during several dates. For example, on July 22, 2015 transparency at the Big Island site was 3.5 m while transparency at the West Lake site 3 km up reservoir was just 1.5 m. Similarly, transparency on September 15, 2014 was 5.5 m at the Big Island site and 3 m at the West site.

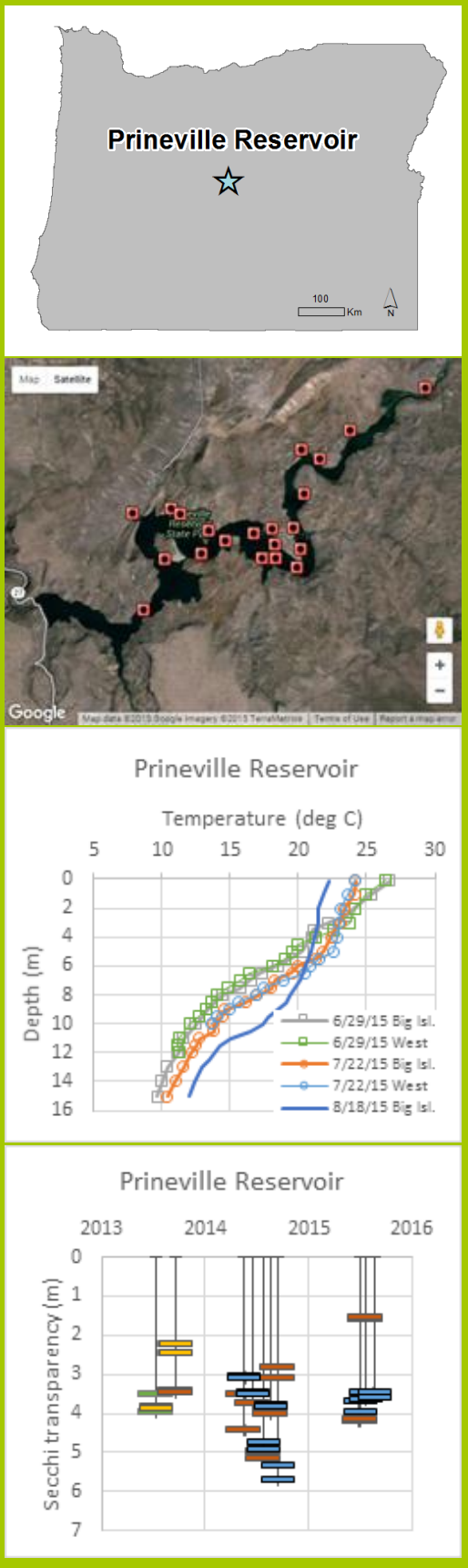

Figure 14. Prineville Reservoir location, sampling sites, temperature profiles, and Secchi transparency measurements. Secchi measurements at the Big Island site are in blue, West site in orange, Roberts Bay in yellow, and Social Security Beach in green.

Red Top Spring Helipond, Douglas County

Red Top Spring Helipond is a small (0.25 ac) pond located about 35 km (22 mi) east of the city of Roseburg at an elevation of 1168 m (3832 ft) (Figure 15). The Pond was sampled once on August 14, 2014.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were detected.

ANIMAL SPECIES DETECTIONS. No Watch list snails, mussels, or crayfish were detected.

TEMPERATURE PROFILES. Surface water temperature was 18.4°C (65.1°F). Vertical profile data was not collected.

SECCHI TRANSPARENCY. Secchi transparency was 1.3 m which indicates that the pond may be eutrophic or mesotrophic. More data is necessary to determine if this low reading is abnormal or if the water if turbid from non-algal sources or colored by dissolved humic materials.

Figure 15. Red Top Spring Helipond location, and sampling site.

Salish Pond, Northeast, Multnomah County

Northeast Salish Ponds is one of a series of four ponds located within the Portland's suburban city of Fairview, Oregon (Figure 16). The 11 ac pond is surrounded by Salish Ponds City Park. OLW volunteers surveyed the pond for invasive species six times during 2015 at one of two sampling sites located on the southern shore each sampling trip using rake toss and shoreline survey methods. Temperature profiles and Secchi transparency measurements were conducted during seven sampling events.

PLANT SPECIES DETECTIONS. Two Watch List invasive plant species were found in Northeast Salish Pond: curly leaf pondweed (*Potamogeton crispus*) and a species that is either the Watch List species Eurasian watermilfoil (*Myriophyllum spicatum*) or a hybrid between invasive Eurasian and native northern watermifoil (*M. spicatum* x *sibiricum*). Native species recorded included coontail (*Ceratophyllum demersum*), Canadian waterweed (*Elodea canadensis*) and a thin leaf pondweed species (*Potamogeton* sp.). In addition, blue-green algal blooms were noted on several dates.

ANIMAL SPECIES DETECTIONS. No Watch list animals were detected in the pond during 2015. An empty Chinese mystery snail (*Cipangopaludina chinensis*) shell, a Watch List species, was found in the pond in 2013 but has not been found since. Native planorbid snails have also been found in the pond.

TEMPERATURE PROFILES. Surface water temperatures ranged from 14.4°C (58°F) during March 2015 up to 27.3°C (81°F) during late June 2015. The pond was thermally mixed to at least 4 m during all sampling dates due to consistent winds in the area.

SECCHI TRANSPARENCY. Secchi transparency decreased from nearly four meters deep to just under two meters deep over the course of the year which is similar to observations during 2013 and 2014. These Secchi depths indicate the pond is meso- to eutrophic.

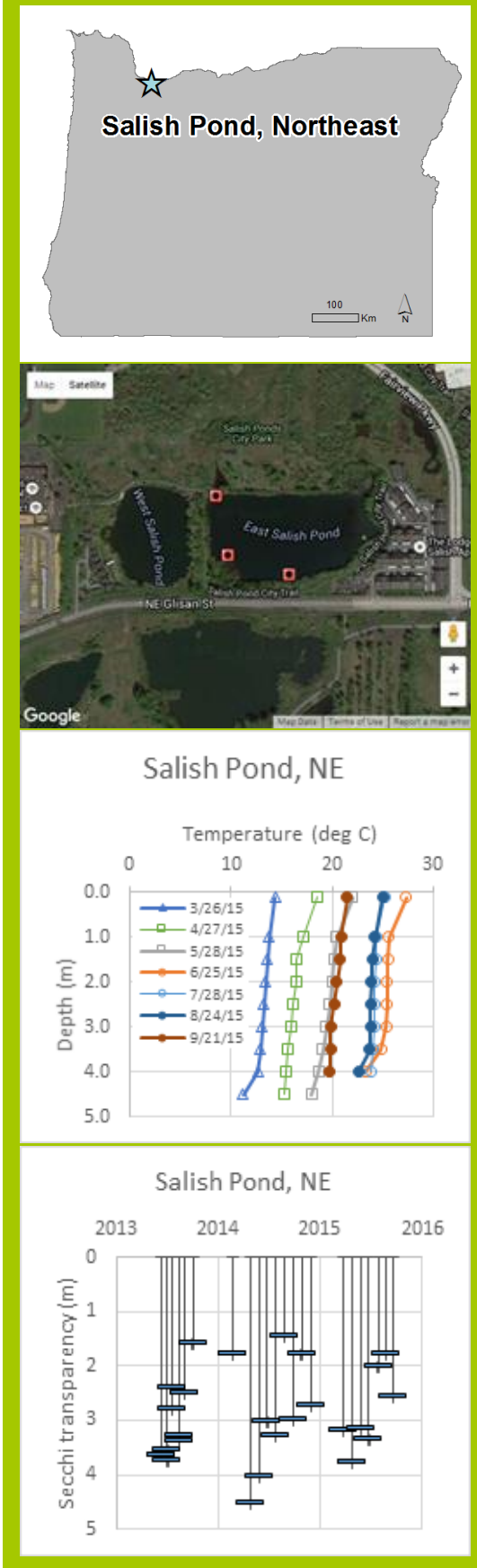

Figure 16. Northeast Salish Pond location, sampling sites, temperature profiles, and Secchi transparency measurements.

Secesh Reservoir, Josephine County

Secesh Reservoir, also known as Burma Pond, is a small (3.7 ac) impoundment located north of Grants Pass at an elevation of 874 m (2867 ft) on Bureau of Land Management land (Figure 17). The pond was sampled once on May 9, 2015.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were detected in the reservoir.

ANIMAL SPECIES DETECTIONS. No Watch list snails, mussels, or crayfish were detected in the reservoir.

TEMPERATURE PROFILES. Surface water temperature was 18.6°C (65.5°F) during the early May sampling event and dropped a little more than 1°C (2°F) over 2 m of depth. The pond is too shallow to stratify other than during extended very calm periods.

SECCHI TRANSPARENCY. The Secchi disk was visible on the bottom at the deepest part of the reservoir. Transparency, therefore, indicates the lake was no worse than mesotrophic. More measurements are needed to confirm this observation.

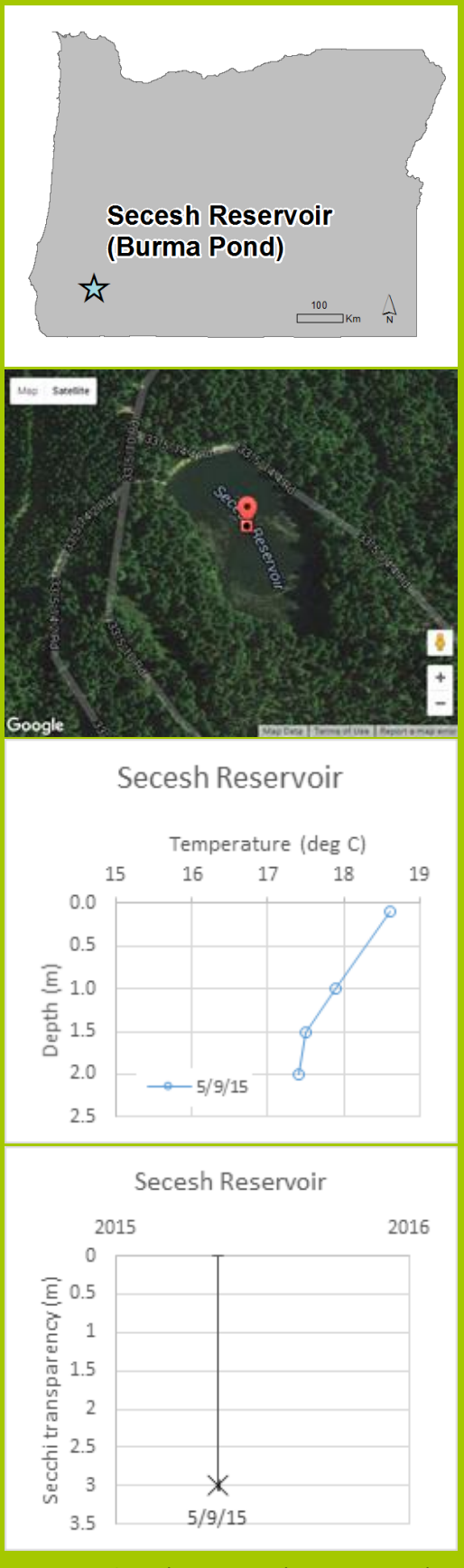

Figure 17. Secesh Reservoir location, sampling sites, temperature profiles, and Secchi transparency measurements. X's represent dates when the Secchi disk was visible at the bottom of the reservoir.

Suttle Lake, Jefferson County

Suttle Lake is a popular recreation lake located in the Deschutes National Forest on the east side of the Cascade Range (Figure 18). Volunteers surveyed the lake for invasive species on two dates during 2015 using rake toss and shoreline survey methods. Artificial substrate mussel samplers were deployed and temperature profiles and Secchi transparency measurement were collected during three 2015 sampling dates. The lake has been surveyed by volunteers during 2013 and 2014.

PLANT SPECIES DETECTIONS. The Watch List invasive submerged plant species Eurasian watermilfoil (*Myriophyllum spicatum*) and curly leaf pondweed (*Potamogeton crispus*) were detected during the 2015 surveys. Eurasian watermilfoil has previously been noted as present in the lake. The native species Canadian waterweed (*Elodea canadensis*) was also noted in the lake.

ANIMAL SPECIES DETECTIONS. No Watch list snails, mussels, or crayfish were detected in the lake during shoreline surveys. Unfortunately, the artificial substrate was removed by vandals before it could be inspected for invasive species. Native signal crayfish (*Pacifastacus leniusculus*) were noted present in the lake.

TEMPERATURE PROFILES. Surface water temperatures were remarkably similar during the June, July, and August sampling events ranging from 18.4°C (65°F) on June 15 to 20.0°C (68°F) on August 26, 2015. Temperatures were well mixed down to 4 m June 15 and then decreased with depth to 12°C (54°F) at 15 m. The upper mixed layer increased to 10.5 m during June and remained mixed to the same depth in August.

SECCHI TRANSPARENCY. Secchi transparencies ranged from 2.6 to 3.3 m during 2015 which is substantially less than measurement during 2013 and 2014 when transparencies ranged from 4 to 7 m. Although this decrease in clarity is troubling, many more years of data are necessary to determine whether this change is part of the normal range of annual variability or a trend towards worse water quality.

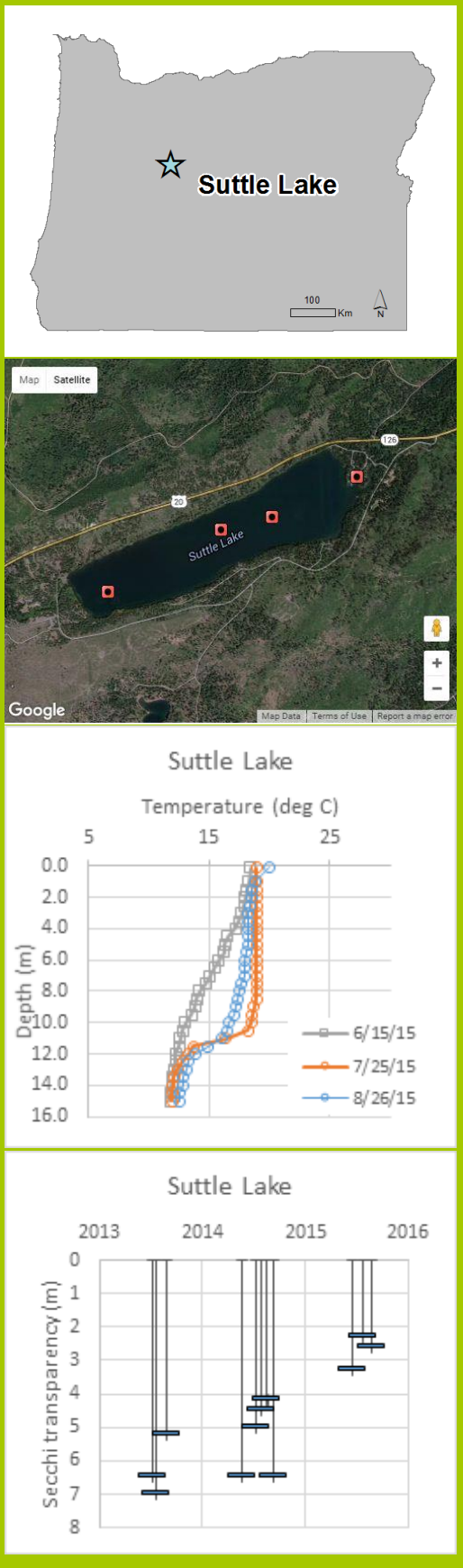

Figure 18. Suttle Lake location, sampling sites, temperature profiles, and Secchi transparency measurements.

Todd Lake, Deschutes County

Todd Lake is located in the Deschutes National Forest in central Oregon (Figure 19). The lake is a very popular recreation destination in the summer and winter as it is located near Mount Bachelor and the City of Bend. OLW volunteers surveyed Todd Lake for AIS on July 13, 2015 using the shoreline zig-zag method, the rake toss method, and by setting out crayfish traps. A temperature profile and Secchi transparency measurement was collected on August 9, 2015.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were detected in the reservoir. An unknown pondweed species (*Potamogeton* sp.) was the only native plant species recorded. No AIS were detected during the surveys.

ANIMAL SPECIES DETECTIONS. No Watch List snails, mussels, or crayfish were detected in the lake. Two native signal crayfish (*Pacifastacus leniusculus*) were captured and reported.

TEMPERATURE PROFILES. The surface water temperature on August 9 was 18.9°C (66°F). Temperature were well mixed to a depth of 5 m and sharply decreased to 7.6°C (46°F) by 9.5 m.

SECCHI TRANSPARENCY. The Secchi disk was visible down to a depth of 7.4 m on August 9, 2015. The high transparency of the water indicates that Todd Lake is oligotrophic.

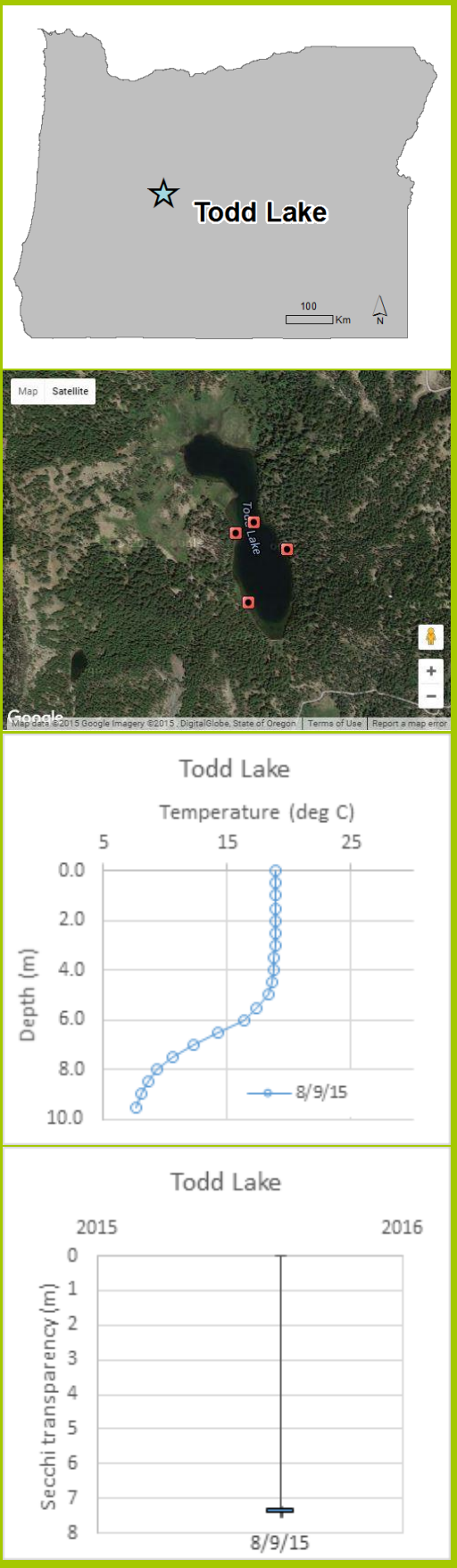

Figure 19. Todd Lake location, sampling sites, temperature profile, and Secchi transparency measurement.

Trillium Lake, Clackamas County

Trillium Lake is a small subalpine lake created by an impoundment of Mud Creek just south of Mount Hood (Figure 20). The lake is very popular lake for summer and winter recreation due to its beauty and proximity to Portland. OLW volunteers surveyed the lake for AIS at one site during 2015 using the shoreline zig-zag method.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were detected in the reservoir.

ANIMAL SPECIES DETECTIONS. No Watch list snails, mussels, or crayfish were detected in the reservoir.

TEMPERATURE PROFILES. The surface water temperature was a warm 23.2°C (74°F) during the July 28 sampling event. Winds were calm during sampling and temperatures were stratified just below the surface and again below 1.5 m and then decreased to 20°C (68°F) by 3 m. Since stratification was so shallow and there were minimal vertical differences, moderate winds would likely complexly mix the water column.

SECCHI TRANSPARENCY. The Secchi disk was visible at 2.5 m. The moderate water transparency indicates that Trillium Lake is mesotrophic. More measurements are needed to confirm this observation.

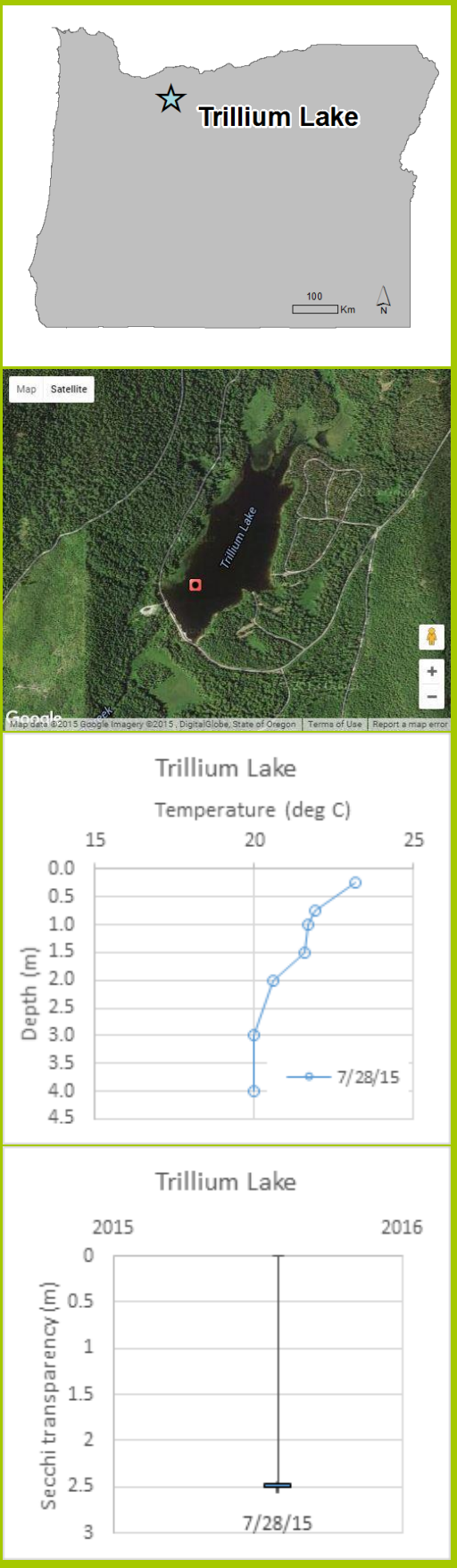

Figure 20. Trillium Lake location, sampling sites, temperature profiles, and Secchi transparency measurements.

Wahtum Lake, Hood River County

Wahtum Lake is a small, deep lake located north of Mount Hood in the Mount Hood National Forest (Figure 21). Lake watch volunteers surveyed the lake once during 2015 using shoreline surveys and a minnow trap. Secchi transparency and a temperature profile was also conducted. The lake has been part of the OLW program since 2013 and the volunteer noted that the water level was down about 4 ft from previous years.

PLANT SPECIES DETECTIONS. No Watch List invasive plant species were detected in the lake.

ANIMAL SPECIES DETECTIONS. No Watch list snails, mussels, or crayfish were detected in the lake. The OLW volunteer noted that crayfish are present in the lake but none were collected in the traps. The crayfish appear to be the native signal crayfish (*Pacifastacus leniusculus*).

TEMPERATURE PROFILES. The surface water temperature was 19.9°C (68°F) on July 28, 2015 and was well mixed to a depth of 7 m. Temperatures sharply declined below, especially between 10 and 10.5 m where temperatures dropped by 4.5°C (8°F). Temperature at 15 m was a cold 7.7°C (46°F).

SECCHI TRANSPARENCY. The Secchi transparency measured during 2015 was 9.9 m. This transparency is less than all measurements during 2013 and 2014 which ranged upwards of 11 m. Actual measurement on three of the dates could not be collected because the Secchi disk was still visible when all 13 m of line was let out. All measurements indicate that the lake is oligotrophic or ultra-oligotrophic.

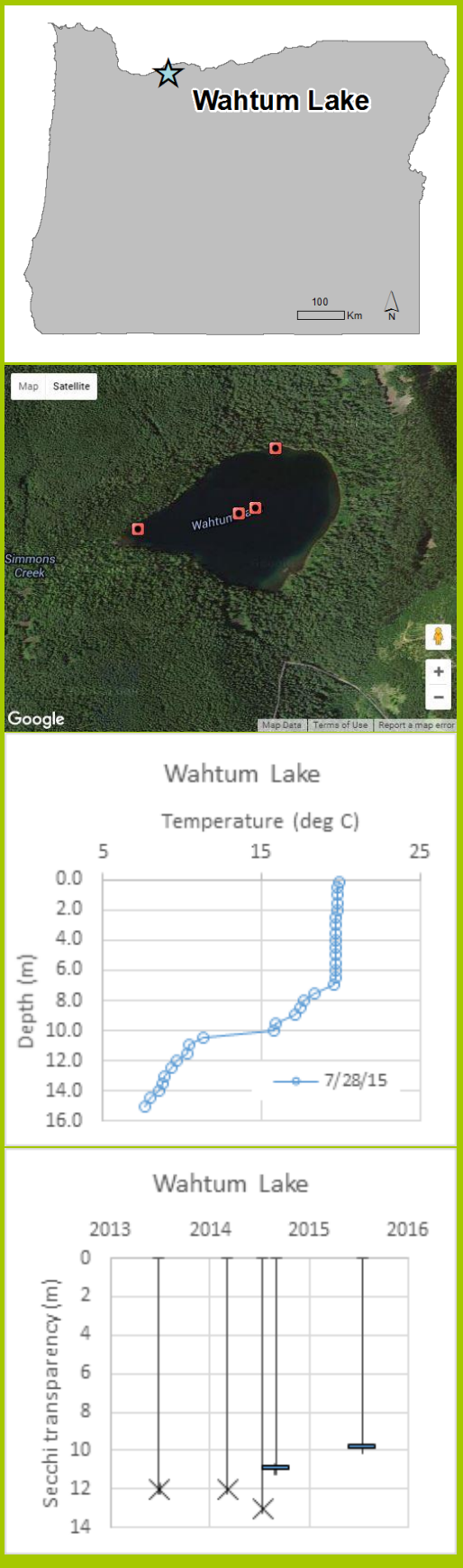

Figure 21. Wahtum Lake location, sampling sites, temperature profile, and Secchi transparency measurements. X's represent depth where the Secchi disk was visible, but could not be lowered any further because the line was only 13 m.

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