

# North Dakota Aquatic Nuisance Species Management Plan



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By Governor Doug Burgum

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## ACKNOWLEDGEMENTS

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### 2018 AISC MEMBERS

DEVILS LAKE JOINT WATER MANAGEMENT BOARD  
FRIENDS OF LAKE SAKAKAWEA  
MINNKOTA POWER COOPERATIVE  
NORTH DAKOTA GAME AND FISH DEPARTMENT  
NORTH DAKOTA PARKS AND RECREATION  
NORTH DAKOTA SPORTFISHING CONGRESS  
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RED RIVER BASIN COMMISSION  
STATE AGRICULTURE DEPARTMENT  
STATE HEALTH DEPARTMENT  
STATE WATER COMMISSION  
THREE AFFILIATED TRIBES

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## EXECUTIVE SUMMARY

In North Dakota, an aquatic nuisance species (ANS) is defined as any nonindigenous, obligate aquatic species of plant or animal which is injurious to native and desirable aquatic species or which has a negative effect on aquatic habitats, environment, or the economy of the state. Although it can be difficult to predict or define ANS environmental impacts, some species have pronounced impacts and are well-studied. Estimating economic impacts of invasive species can be much more challenging, and little information is available since costs are shared by private and public entities. With large environmental and economic impacts, society can be impacted as well, primarily through the hindrance of recreational activities and decline in aesthetic value.

North Dakota is fortunate to have relatively few ANS and realized impacts. To date, several ANS introductions into the state have been through natural movement, though human-mediated pathways are a major concern. The harshness of the North Dakota landscape presents unique challenges in preventing the introduction and spread of ANS. Natural flood and drought cycles create dynamic aquatic resources through time, with the number of perennial waterbodies increasing drastically since the early 1990s.

Since ANS do not adhere to socio-political bounds, managing ANS at a state level can have repercussions across jurisdictional boundaries. A coordinated effort began with the adoption of the North Dakota Statewide ANS Management Plan and establishment of the North Dakota Aquatic Invasive Species Committee (AISC) in 2005. The AISC was established with the acknowledgement that ANS issues span several state and federal authorities and across public and private interests.

Given the overlap in authorities, a comprehensive statewide plan is needed to guide efforts and prevent redundant activities. The first North Dakota Statewide ANS Management Plan was adopted in 2005. Since that time, authorities have shifted and ANS knowledge has advanced significantly. This plan is simply an update of the original ANS management plan.

The goal of the North Dakota ANS Management Plan is to prevent the introduction and spread of ANS into and within North Dakota while mitigating ecological, economic, and social impacts of existing populations where feasible. To achieve this goal, four broad objectives were established: 1) coordination and communication, 2) education and outreach, 3) prevention and control, and 4) sampling and monitoring. For each objective, multiple strategies were developed with corresponding actions that identify steps to address the objective and ultimately reach the plan goal.

Full implementation of this plan will take cooperation and coordination across public and private interests. The AISC should act as a steering committee to facilitate cooperation and prioritize actions for appropriate entities to complete in an efficient and timely manner.

### ANS MANAGEMENT PLAN SUMMARY

#### GOAL:

TO PREVENT THE INTRODUCTION AND SPREAD OF ANS INTO AND WITHIN NORTH DAKOTA WHILE MITIGATING ECOLOGICAL, ECONOMIC, AND SOCIAL IMPACTS OF EXISTING POPULATIONS WHERE FEASIBLE.

#### OBJECTIVES:

1. COORDINATION AND COMMUNICATION
2. EDUCATION AND OUTREACH
3. PREVENTION AND CONTROL
4. SAMPLING AND MONITORING

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## INTRODUCTION

Most introduced species do not become established or end up having very little impact, while others may actually provide benefits (Mackie and Claudi 2010). However, some introduced species can establish and have major effects on the environment, economy, or society. It is these species that should be managed. In North Dakota, an aquatic nuisance species (ANS) is defined as any nonindigenous, obligate aquatic species of plant or animal which is injurious to native and desirable aquatic species or which has a negative effect on aquatic habitats, environment, or the economy of the state. For the purposes of this plan, the term ANS will be interchangeable with aquatic invasive species (AIS) that is used in some other programs.

Predicting or defining ANS environmental impacts can be difficult, though some species have pronounced impacts and are well-studied. Some species, such as zebra and quagga mussels, are better studied but have a wide range of potential impacts, making realized impacts at specific locations difficult to predict. A few documented effects of zebra and quagga mussels include positive effects on littoral invertebrates, negative effects on profundal benthic invertebrates, reductions in zooplankton and phytoplankton, increased sediment-associated bacteria, and the overall benthification of energetic resources (Higgins and Vander Zanden 2010; Karatayev et al. 2015). Other species have more easily predicted environmental impacts, which are typically negative. For example, invasive aquatic plants have been documented to reduce species diversity, degrade water quality, increase detritus buildup, and change sediment chemistry (Gettys et al. 2014). In addition, grass carp significantly decrease aquatic vegetation and alter vegetation composition, leading to the banning or restriction of grass carp use to triploid- (infertile) only fish in a majority of states (Conover et al. 2007).

**ANS IS DEFINED AS ANY NONINDIGENOUS, OBLIGATE AQUATIC SPECIES OF PLANT OR ANIMAL WHICH IS INJURIOUS TO NATIVE AND DESIRABLE AQUATIC SPECIES OR WHICH HAS A NEGATIVE EFFECT ON AQUATIC HABITATS, ENVIRONMENT, OR THE ECONOMY OF THE STATE.**

Given the unpredictable but generally negative impacts of ANS on the environment, it is no surprise that ANS can also have an impact on the economy. However, estimating economic impacts of invasive species can be challenging. There is very little information available since costs are shared by private and public

entities. In 2005, Pimental et al. estimated that the nearly 50,000 introduced species cost the United States approximately \$120 billion annually. Accounting for economic expansion since the 2005 estimate, current expenditures likely far exceed \$120 billion annually. More recent publications estimate that ANS cost the Great Lakes region alone well over \$100 million annually (Rosaen et al. 2012; ECCO and USEPA 2017). In North Dakota, potential costs of severe ANS impacts are unknown at this time, though total angling expenditures in North Dakota in the 2011-2012 fishing season were estimated at nearly \$900 million (Taylor et. al 2013), which could be impacted by ANS establishment.

With large environmental and economic impacts, society can be impacted as well, primarily through the hindrance of recreational activities and decline in aesthetic value. Some of the associated costs in the Great Lakes relate to the biofouling of species such as zebra and quagga mussels, which can cause major problems with infrastructure associated with surface water (Mackie and Claudi 2010). Increased maintenance costs for power and water suppliers are often passed on to consumers. Beyond higher costs of living, ANS can impede recreational activities such as boating, fishing, and swimming by growing in dense stands (e.g. mussels and plants; Gettys et al. 2014), cutting unprotected flesh (i.e. mussels; Mackie and Claudi 2010), and injuring boaters (i.e. silver carp; Kolar

et al. 2007). Also of serious concern is the ability of invasive aquatic plants to increase habitat for mosquitos which can carry life-threatening diseases across the globe such as malaria, dengue fever, yellow fever, encephalitis, and dog heartworm (Gettys et al. 2014).

North Dakota is fortunate to have relatively few ANS and realized impacts thus far. To date, several ANS introductions into the state originated from natural movement, including zebra mussel downstream movements in the Red River, silver carp upstream movements in the James River, and curlyleaf pondweed downstream movements in the Missouri and Sheyenne rivers. Dodson (2013) identified salinity, clarity, ice scour, substrate type, and trophic status as potential limiting factors for two ANS in North Dakota. [Appendix A](#) provides more information on listed ANS, current distributions, and brief species overviews for the five established ANS in North Dakota.

The harshness of the North Dakota landscape presents unique challenges in preventing the introduction and spread of ANS. Natural flood and drought cycles create dynamic aquatic resources through time, with the number of waterbodies increasing drastically since the early 1990s. One example of major fluctuations includes Devils Lake, which rose over 30 feet (9.5 meters) from a recent low elevation in 1993 to a recent high elevation in 2011, transforming the approximately 44,200 acre (17,900 hectare) lake to an over 210,000 acre (85,500 hectare) lake, with relatively high elevations persisting through June 2017 (NDSWC 2017).

Since ANS do not adhere to socio-political bounds, managing ANS at a state level can have repercussions across jurisdictional boundaries. Although North Dakota is an active participant in regional and national efforts to address ANS issues, agency authorities are limited to work within the state. Major basins in the state include the Missouri River and James River basins in the Gulf of Mexico drainage and the Souris River, Red River, and Devils Lake basins in the Hudson Bay drainage (NDSWC 2018). The presence of a continental divide into two major drainages can cause international concerns for any ANS introductions or spread in North Dakota. Of additional importance, North Dakota is recognized as an outdoor recreation destination, with nearly 40% of fishing participants at Devils Lake comprised of non-resident anglers (Caspers and Gangl 2018), most of which also fish ANS infested waters out of state, primarily in Minnesota.

The North Dakota Game and Fish Department has long recognized ANS as an issue and began management efforts in the early 2000s, primarily through annual fisheries surveys (Ryckman 2013). A statewide, coordinated effort began with the adoption of the North Dakota Statewide ANS Management Plan and establishment of the North Dakota Aquatic Invasive Species Committee (AISC) in 2005 (Ryckman 2013). The AISC was established through legislation (North Dakota Century Code 20.1-17-01) with the acknowledgement that ANS issues span several state and federal authorities (see [Appendix B](#) for list) and involve a variety of public and private interests. This committee acts as an advisory board to provide input on ANS management in North Dakota and members are expected to provide input on ANS efforts and issues throughout the state, as well as conduct ANS work under the AISC guidance as feasible. However, given the overlap in state agency authorities, a formal and comprehensive statewide plan is needed to both guide efforts and prevent redundant activities.

The first North Dakota Statewide ANS Management Plan was adopted in 2005. Since that time, authorities have shifted and ANS knowledge has advanced significantly. This plan is simply an update of the original ANS management plan. The goal of the North Dakota ANS Management Plan is to prevent the introduction and spread of ANS into and within North Dakota while mitigating ecological, economic, and social impacts of existing populations where feasible. To achieve this goal, objectives with corresponding strategies and actions are outlined below. A summary of implementation priorities, estimated current costs, and responsible entities can be found in the [Implementation Table](#). Any future increases in ANS resources and efforts should be directed by the outlined priorities in the Implementation Table and, when needed, directed by the AISC.

## OBJECTIVES, STRATEGIES, AND ACTIONS

### OBJECTIVE 1. COORDINATION AND COMMUNICATION

Given the extensive nature of ANS issues, no single entity can address every need. It is critical that state, federal, local, and private entities work together to meet the goal of this management plan. Strong communication and coordination are essential to establishing the collaborative relationships needed to address ANS issues.

#### *Strategy 1.A. Maintain dedicated ANS staff*

*Action 1.A.1. Hire, train, and maintain appropriate staff levels for overseeing and implementing a statewide ANS program.*

One full-time coordinator should be maintained to oversee the implementation of statewide ANS activities. As duties and resources increase, support staff should be hired and trained to allow for expansion of ANS efforts.

#### *Strategy 1.B. Coordinate North Dakota efforts*

*Action 1.B.1. Implement an adaptive statewide management plan.*

This document serves as a statewide management plan and should be reviewed and updated at least every 5 years to incorporate the most up-to-date knowledge about ANS and management strategies. Full implementation requires collaboration among federal and state agencies, counties, cities, non-profit organizations, industry partners, academia, and other entities.

*Action 1.B.2. Host regular meetings of the North Dakota Aquatic Invasive Species Committee.*

This committee is tasked with updating the list of North Dakota ANS annually, and is also responsible for periodically reviewing and updating the North Dakota ANS Management Plan. The frequency of meetings shall be determined by AISC members, but it is recommended to have a planning meeting in the spring and a reporting meeting in the fall.

*Action 1.B.3. Guide research within North Dakota.*

When opportunities arise, research needs should be presented to universities that address knowledge of ANS biology, ecology, and impacts as well as management efforts and educational techniques. A comprehensive overview of research needs should be developed to guide research opportunities in an informed manner.

#### *Strategy 1.C. Actively participate in large-scale ANS efforts*

*Action 1.C.1. Actively participate in regional coordination groups.*

The National ANS Task Force hosts six regional panels, of which North Dakota is a member of two: the Mississippi River Basin Panel and the Western Regional Panel. These regional panels and other regional groups bring together diverse stakeholders from the region to discuss current and upcoming ANS issues of importance. Active participation keeps North Dakota informed of potential upcoming issues and allows for collaboration that may help prevent the introduction of ANS into the state.

*Action 1.C.2. Participate in national and international coordination efforts.*

Although national and international collaboration is less common, groups such as the International Red River Board provide means to coordinate on basin-wide or larger scales. Similar to regional groups, these entities provide opportunities to collaborate on management activities and to learn about potential threats to North Dakota.

*Action 1.C.3. Attend meetings and conferences aimed at addressing ANS issues.*

Part of actively participating in coordination efforts includes travel to meetings. Further, scientific conferences are critical to increasing overall knowledge about available information and methods. Effective management requires an awareness of the current state of ANS in neighboring jurisdictions, opportunities to exchange ideas on prevention and management of ANS, and being aware about the latest research on ANS and management techniques.

***Strategy 1.D. Communicate ANS activities***

*Action 1.D.1. Develop a publicly-accessible annual report.*

An annual report should be developed that details ANS activities and results, to be completed by March 15th of the following year. This report should be shared with the AISC and made available to the public on the North Dakota Game and Fish Department website. The report should be shared with stakeholders, legislators, and other interested parties as appropriate.

*Action 1.D.2. Develop and distribute informational updates.*

Examples of informational updates might include social media posts, press releases, newspaper articles, webcasts, and other media. Keeping the public informed about ANS activities is crucial to garnering support. Information about any new ANS populations or expansions should also be distributed in a timely fashion.

*Action 1.D.3. Solicit public input on ANS activities as appropriate.*

Good communication requires gaining public input on large-scale or novel efforts. Examples where public input may be warranted include proposing legislation additions or changes, updating the statewide management plan, or proposing new or increased fees.

**OBJECTIVE 2. EDUCATION AND OUTREACH**

One of the strongest tools available is education about ANS, impacts, and prevention methods. However, providing the right information at the right time to the right audience can be challenging. Identifying audiences and delivering consistent, recognizable outreach campaigns such as “Clean, Drain, Dry” or “Don’t Let It Loose”, can translate into increased preventative actions by water users. The right information and delivery can also translate into increased collaboration opportunities, increased funding opportunities, and better management. Advertising and educational efforts require periodical evaluation and adjustment to maximize effectiveness.

***Strategy 2.A. Implement a statewide ANS outreach campaign***

*Action 2.A.1. Develop and implement statewide ANS communications strategy.*

Develop and implement a statewide approach to reach audiences about ANS issues. Elements include messages for general audiences, delivery methods, and delivery extent. Potential information may include ANS biology and ecology, impacts, and prevention methods. This plan should be reviewed and adjusted annually as needed.

*Action 2.A.2. Utilize a recognizable outreach campaign for general audiences.*

Well-established outreach campaigns are powerful reminders with short catch-phrases such as “Clean, Drain, Dry” that encourage action and are immediately recognizable across jurisdictions. Adopting established campaigns and slogans increases effectiveness and can often register with non-resident audiences.

***Strategy 2.B. Educate stakeholders on ANS***

***Action 2.B.1. Provide information to high-risk individuals.***

Some pathways are best addressed at the individual level, as these activities are traditionally carried out on an individual basis. Although organizations may exist to represent these activities, participation in hunting and fishing clubs is becoming less frequent and may not represent the entire target audience. Information tailored to these audiences can better engage their interest in outdoor recreation and the inherent desire to protect natural resources. Examples of activities that are carried out on an individual basis include boating, angling, and waterfowl hunting. Personal contacts, educational events, and direct mailings are examples of targeted ways to reach high-risk individuals. More traditional ways of reaching these audiences include radio ads, billboards, and information provided during licensing.

***Action 2.B.2. Focus educational efforts on entities that provide ANS pathways.***

Some pathways are able to be addressed on the entity level. Having a central location to distribute information and engage entities that provide ANS pathways not only educates the entity but also establishes a relationship that can create collaborative opportunities. Examples where ANS information should be provided on an entity level include bait vendors, schools, pet stores, marinas, plant nurseries, guides and outfitters, private fish hatcheries, fishing and hunting clubs, and fishing tournaments. Information should be targeted towards the needs of the entity and its users. Public speaking events, attending organizational meetings, and personal contacts with owners are examples of ways to engage entities on ANS issues.

***Action 2.B.3. Educate decision-makers on ANS issues.***

Although education efforts are typically aimed at individuals and entities that have the potential to spread ANS, educational efforts should not stop there. Legislation, regulations, and internal policies play a key role in effective ANS management. Thus, it's important to provide legislators and other policy makers with reliable information about ANS, potential and realized impacts, and recommendations for preventing their introduction and spread.

***Action 2.B.4. Include ANS education in public events.***

Large public events such as the North Dakota State Fair can provide opportunities to educate the public about ANS, impacts, and ways to prevent their spread. Personal contacts at these and other planned events can allow for in-depth discussions with interested parties.

***Action 2.B.5. Maintain an updated public information platform.***

Current information about the status of ANS in North Dakota, pertinent regulations, prevention methods, and frequently asked questions should be included on a stable information platform (e.g., a website). Additional resources that should be included would be brochures, posters, curriculum, news releases, and other deliverables. The platform should be a resource for both the public and the media.

***Strategy 2.C. Provide training to key staff and partners***

***Action 2.C.1. Provide ANS staff opportunities to attend trainings.***

Regional organizations and federal agencies occasionally provide relevant trainings on ways to address ANS, from outreach methods to sampling protocols. Having a well-trained ANS staff benefits North Dakota by introducing the latest research and best management practices to the state.

*Action 2.C.2. Develop and employ a North Dakota-specific ANS training program.*

ANS training programs should be developed using current understanding of ANS biology, ecology, and techniques for prevention and management. Training should also be tailored to the needs of North Dakota prevention and management efforts. At a minimum, training components should include information on current and emerging ANS threats in North Dakota, techniques to prevent the spread, and current North Dakota regulations. Trainings should be offered at least every three years or more frequently as needed. Target trainees include key agency staff from agencies that are involved in ANS detection, enforcement, or management efforts. These may be made available to private entities as needed.

***Strategy 2.D. Identify and address educational gaps***

*Action 2.D.1. Evaluate and adjust educational efforts.*

Evaluations are needed to establish a baseline of the current state of knowledge and actions, generally through targeted public surveys. Metrics based on number of impressions can be a useful starting point, but separate evaluations are needed to evaluate the effectiveness of outreach efforts based on method of delivery, messaging, and target audience. Based on the results of these evaluations, educational efforts should be adjusted as needed to improve efficiency and success.

*Action 2.D.2. Use research to guide educational developments.*

Additional research would assist in identifying other target audiences and developing effective materials. Methods of effectively implementing outreach efforts to increase awareness and preventative actions should also be identified through research efforts.

**OBJECTIVE 3. PREVENTION AND CONTROL**

***Strategy 3.A. Establish internal ANS prevention policies***

*Action 3.A.1. Establish internal ANS policies and procedures.*

State agencies should develop internal policies to prevent the introduction and spread of ANS during regular agency activities. These should address all work related to waters of the state to the extent possible and should be periodically reviewed and updated to reflect current best management practices. For high-risk activities, agencies should consider developing hazard analysis and critical control point plans to guide routine activities in a consistent manner.

*Action 3.A.2. Review agency activities for potential ANS impacts.*

State-sponsored projects should be reviewed for potential ANS impacts and conflicts with other operating procedures. This especially applies to major projects requiring state or federal permits or that utilize contractors. Most ANS policies will likely directly apply to activities directly involving work in waters of the state, but major projects with indirect activities involving waters of the state should also be included in reviews.

***Strategy 3.B. Institute and enforce comprehensive regulations***

*Action 3.B.1. Maintain a list of prohibited ANS.*

A list of species considered to be ANS in North Dakota was established in 2005. North Dakota Century Code chapter 20.1-17-01 states that this list should be updated annually. Given new introductions to the US and the upper Midwest, as well as potential changes to federal and state legislation, this list may change considerably through time.

*Action 3.B.2. Craft comprehensive statewide regulations.*

Legislation is required to establish the needed authorities within North Dakota Century Code to fully implement a comprehensive statewide ANS management plan. In addition, Administrative Code and agency regulations provide tools that encourage public compliance with taking preventative measures that reduce the likelihood of ANS introductions or spread. Regulation examples may include ANS possession restrictions, bait usage, watercraft inspections, and necessary enforcement tools such as fines or equipment impoundment.

*Action 3.B.3. Provide staff to fully enforce regulations.*

Providing dedicated law enforcement staff or time allows for focused ANS efforts, such as compliance checks or investigating violations. Overall compliance often increases with increased enforcement actions, thereby decreasing the likelihood of ANS introductions and spread through illegal pathways.

*Action 3.B.4. Facilitate regulation compliance.*

Provide regulation reminders and tools that facilitate regulation compliance. Helping remind the public about ANS regulations and providing tools for compliance will help reduce the likelihood of ANS introduction and spread. Providing strong, consistent enforcement of regulations also acts as a reminder and increases compliance. Examples include signage at public access sites, roadside checks, watercraft inspection and decontamination stations, and fines for violations.

***Strategy 3.C. Incorporate ANS preventative actions into permitting processes***

*Action 3.C.1. Include ANS regulatory information in permit language.*

When drafting state-issued permits that require work in waters of the state, information about ANS regulations should be included. When possible, a link or contact for additional information should also be provided to encourage contractors to take actions to prevent the introduction and spread of ANS.

*Action 3.C.2. Require preventative actions for high-risk permitted activities*

Permitted activities that present a high risk, especially those with equipment coming from infested waters, should have additional requirements that decrease the likelihood of introducing and spreading ANS. Equipment inspections should be mandatory for high-risk activities, with decontamination prior to entering the state. All other ANS regulations should also be stressed in the permitting process.

*Action 3.C.3. Enforce permit ANS requirements.*

Individuals and entities conducting permitted activities on waters of the state should be made aware of ANS regulations and any special requirements of their permits during the permitting process. Inspections should be carried out when possible on high-risk equipment, and failure to comply with permit requirements should be documented thoroughly. Decontaminations should be ordered as needed. Any violations of ANS regulations or permit requirements should be pursued by the issuing authority in accordance with established penalties.

***Strategy 3.D. Eradicate or reduce ANS populations where feasible***

*Action 3.D.1. Develop a rapid response plan for new ANS populations.*

Control options are often most effective when an emerging population of ANS is detected prior to establishment. New populations are less stable and may be more susceptible to predation or competition. Thus, developing a plan for how to react to a new finding of ANS is critical to streamline potential management efforts and increase the likelihood that control options would be more effective before the ANS population can establish.

*Action 3.D.2. Conduct efforts to reduce or eradicate ANS populations as feasible.*

When feasible, management actions should be taken to reduce or eradicate emerging or newly established ANS populations. Population reductions are usually conducted with the intent to delay population establishment rates or to mitigate harmful impacts of an ANS population. Eradication is generally only undertaken in small, isolated, or emerging populations that are most susceptible to management efforts. Available resources, public support, and likelihood of success are some factors that must be considered when determining feasibility of proposed control or eradication measures.

***Strategy 3.E. Identify and incorporate scientifically sound prevention and control methods***

*Action 3.E.1. Research new methods of preventing and controlling ANS.*

Scientific research yields an increased understanding of ANS, pathways, and management techniques. Whenever feasible, research into new methods of preventing and controlling ANS should be encouraged and pursued.

*Action 3.E.2. Develop and integrate best management practices.*

Based on scientific and technological advances, best management practices should be developed to prevent or slow the introduction or spread of ANS. These best management practices should be applied and incorporated into both internal and external uses, policies, and educational efforts as appropriate.

**OBJECTIVE 4. SAMPLING AND MONITORING**

Detecting new and expanding populations of ANS before they become established allows time for planning of impact mitigation or control efforts. By finding pioneer populations, the pathway of introduction may also be more apparent, allowing for an evaluation of that pathway. Monitoring of existing populations can provide a baseline for what to expect for new populations as well as potentially provide information about naturally-occurring limitations to population expansions or establishment. Having a solid understanding of these expectations and limitations can guide management efforts.

***Strategy 4.A. Conduct statewide early detection sampling for ANS***

*Action 4.A.1. Incorporate early detection sampling into existing activities.*

Given the amount of existing time spent conducting biological surveys in North Dakota waters, incorporating ANS sampling into existing sampling activities is the most efficient way to collect data. Biologists across the state already have an understanding of native and non-native species and are trained to detect differences.

*Action 4.A.2. Conduct targeted high-risk early detection sampling.*

Some species are most efficiently sampled using specialized equipment or methods. Gaps in sampling should first be identified based on potential species and existing sampling efforts. High-risk waters should be sampled using specialized methods or equipment for high-impact species. An example would be zebra mussel veliger detection sampling at hatcheries and high-use waters in North Dakota.

***Strategy 4.B. Monitor existing ANS populations***

*Action 4.B.1. Monitor existing ANS populations and document any changes.*

Existing population monitoring provides baseline data for any future population establishment in new areas. It also provides opportunities to identify key elements in any documented population expansions or reductions. Data collected during population monitoring allow for better prediction criteria on pathways of introduction, waters that are at greatest risk of population establishment, and effects of proposed management efforts.

***Strategy 4.C. Monitor high-risk pathways for signs of ANS***

*Action 4.C.1. Identify and monitor internal high-risk pathways.*

Internal actions such as fish hatchery operations, fish transfers, and routine sampling provide opportunities for the transport of ANS across and into the state. Agency actions that present such risks should be identified and monitored on a routine basis. One example is conducting ANS sampling at fish hatcheries, where ANS establishment could impact waters statewide.

*Action 4.C.2. Identify and monitor external high-risk pathways.*

Non-agency activities can also pose serious risks to introducing and spreading ANS given the number of individuals involved. For example, it can be estimated that there are hundreds of thousands of boat launches in North Dakota annually. Although a single boat launch is not always high risk, the volume of boat launches elevates the risk of that pathway. Some pathways require permits, such as the import of live aquatic bait, fishing tournaments, and some construction work. External high-risk pathways should be monitored through permitting processes, inspections, or other methods as necessary. Watercraft inspection and decontamination stations are one example to monitor the high-risk pathway of individual boaters.

## IMPLEMENTATION TABLE

This implementation table lists every action by strategy and objective to address aquatic nuisance species issues in North Dakota (ND). Lead entities are identified based on membership in the North Dakota Aquatic Invasive Species Committee as outlined in North Dakota Century Code and on current implementation, but other partners such as federal, local, and private entities should be engaged for full implementation. Budget is the estimated minimum annual commitment based on 2017 North Dakota Game and Fish (NDGFD) expenditures of state and federal funds based on the legislatively approved budget. An asterisk next to the budget estimate indicates that full implementation would require increased resources, UNK indicates that the costs are difficult to estimate at this time, and N/A indicates that the costs for these actions were included in one or more other actions. Mileage is not included in budget since state fleet vehicles are used. Indirect costs are incorporated into the budget. Priorities: H = high, M = medium, L = low. Priorities are assessed based on frequency as well as overall contribution to the Plan’s goal. Frequencies: 1 = ongoing or annually, 2 = every 2-4 years, 3 = every 5+ years. Abbreviations: ALL = AISC state agencies and DOT, NDDA = ND Department of Agriculture, SWC = State Water Commission, DEQ = ND Department of Environmental Quality (formerly State Health Department), and DOT = ND Department of Transportation.

OBJECTIVE 1. COORDINATION AND COMMUNICATION				
<b>Strategy 1.A. Maintain dedicated ANS staff</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 1.A.1. Hire, train, and maintain appropriate staff levels for overseeing and implementing a statewide ANS program.</i>	NDGFD	\$85,000*	H	1
<b>Strategy 1.B. Coordinate North Dakota efforts</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 1.B.1. Implement an adaptive statewide management plan.</i>	ALL	N/A	H	1
<i>Action 1.B.2. Host regular meetings of the North Dakota Aquatic Invasive Species Committee.</i>	NDGFD	\$2,500	H	1
<i>Action 1.B.3. Guide research within North Dakota.</i>	ALL	\$0*	M	1
<b>Strategy 1.C. Actively participate in large-scale ANS efforts</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 1.C.1. Actively participate in regional coordination groups.</i>	NDGFD	\$4,500	H	1
<i>Action 1.C.2. Participate in national and international coordination efforts.</i>	NDGFD	\$3,000	H	1
<i>Action 1.C.3. Attend meetings and conferences aimed at addressing ANS issues.</i>	ALL	\$5,000	M	2
<b>Strategy 1.D. Communicate ANS activities</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 1.D.1. Develop a publicly-accessible annual report.</i>	NDGFD	N/A	M	1
<i>Action 1.D.2. Develop and distribute informational updates.</i>	ALL	N/A	M	1
<i>Action 1.D.3. Solicit public input on ANS activities as appropriate.</i>	ALL	N/A	H	2

OBJECTIVE 2. EDUCATION AND OUTREACH				
<b>Strategy 2.A. Implement a statewide ANS outreach campaign</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 2.A.1. Develop and implement statewide ANS communications strategy.</i>	NDGFD	\$90,000*	H	1
<i>Action 2.A.2. Utilize a recognizable outreach campaign for general audiences.</i>	ALL	N/A	M	1
<b>Strategy 2.B. Educate stakeholders on ANS</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 2.B.1. Provide information to high-risk individuals.</i>	NDGFD	\$34,000*	H	1
<i>Action 2.B.2. Focus educational efforts on entities that provide ANS pathways.</i>	NDGFD	\$10,000*	H	1
<i>Action 2.B.3. Educate decision-makers on ANS issues.</i>	ALL	\$0*	H	2
<i>Action 2.B.4. Include ANS education in public events.</i>	ALL	N/A	M	1
<i>Action 2.B.5. Maintain an updated public information platform.</i>	NDGFD	N/A	H	1
<b>Strategy 2.C. Provide training to key staff and partners</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 2.C.1. Provide ANS staff opportunities to attend trainings.</i>	ALL	\$0*	H	2
<i>Action 2.C.2. Develop and employ a North Dakota-specific ANS training program.</i>	NDGFD	\$0*	H	2
<b>Strategy 2.D. Identify and address educational gaps</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 2.D.1. Evaluate and adjust educational efforts.</i>	ALL	\$0*	H	3
<i>Action 2.D.2. Use research to guide educational developments.</i>	ALL	\$0*	M	3
OBJECTIVE 3. PREVENTION AND CONTROL				
<b>Strategy 3.A. Establish internal ANS prevention policies</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 3.A.1. Establish internal ANS policies and procedures.</i>	ALL	N/A	H	2
<i>Action 3.A.2. Review agency activities for potential ANS impacts.</i>	ALL	N/A	H	1
<b>Strategy 3.B. Institute and enforce comprehensive regulations</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 3.B.1. Maintain a list of prohibited ANS.</i>	NDGFD	N/A	H	1
<i>Action 3.B.2. Craft comprehensive statewide regulations.</i>	NDGFD, NDDA, SWC, DEQ, DOT	N/A	H	3
<i>Action 3.B.3. Provide staff to fully enforce regulations.</i>	NDGFD	\$UNK*	H	1
<i>Action 3.B.4. Facilitate regulation compliance.</i>	ALL	\$UNK*	H	1

<b>Strategy 3.C. Incorporate ANS preventative actions into permitting processes</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 3.C.1. Include ANS regulatory information in permit language.</i>	NDGFD, NDDA, SWC, DEQ, DOT	N/A	M	1
<i>Action 3.C.2. Require preventative actions for high-risk permitted activities.</i>	NDGFD, NDDA, SWC, DEQ, DOT	N/A	H	1
<i>Action 3.C.3. Enforce permit ANS requirements.</i>	ALL	N/A	H	1
<b>Strategy 3.D. Eradicate or reduce ANS populations where feasible</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 3.D.1. Develop a rapid response plan for new ANS populations.</i>	NDGFD	N/A	M	3
<i>Action 3.D.2. Conduct efforts to reduce or eradicate ANS populations as feasible.</i>	ALL	\$0*	H	1
<b>Strategy 3.E. Identify and incorporate scientifically sound prevention and control methods</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 3.E.1. Research new methods of preventing and controlling ANS.</i>	ALL	\$0*	L	3
<i>Action 3.E.2. Develop and integrate best management practices.</i>	ALL	\$0*	M	3
<b>OBJECTIVE 4. SAMPLING AND MONITORING</b>				
<b>Strategy 4.A. Conduct statewide early detection sampling for ANS</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 4.A.1. Incorporate early detection sampling into existing activities.</i>	NDGFD, NDDA, SWC, DEQ	\$70,000*	H	1
<i>Action 4.A.2. Conduct targeted high-risk early detection sampling.</i>	NDGFD	\$12,000*	H	1
<b>Strategy 4.B. Monitor existing ANS populations</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 4.B.1. Monitor existing ANS populations and document any changes.</i>	NDGFD	\$5,000	M	1
<b>Strategy 4.C. Monitor high-risk pathways for signs of ANS</b>	<b>Lead entity</b>	<b>Budget</b>	<b>Priority</b>	<b>Frequency</b>
<i>Action 4.C.1. Identify and monitor internal high-risk pathways.</i>	NDGFD	N/A	H	1
<i>Action 4.C.2. Identify and monitor external high-risk pathways.</i>	NDGFD, NDDA	N/A	H	1
<b>Total resource commitment in 2017</b>		<b>\$321,000</b>		

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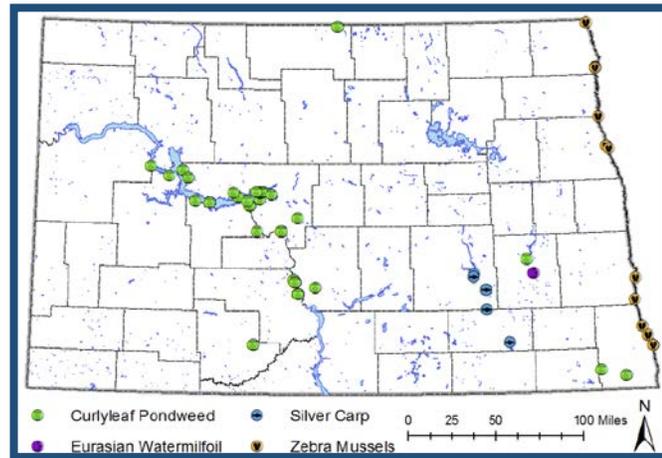
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## APPENDIX A. NORTH DAKOTA ANS

### ANS IN NORTH DAKOTA

As of January 2018, North Dakota has 39 species listed as aquatic nuisance species (ANS). There are three classifications of ANS, depending on the severity of the threat posed by each species. These classifications determine how each species is to be handled by the public and the state. Only five of the 39 species are known to be present in North Dakota, with one species believed to be eradicated from the state.

To the right is a map depicting the locations of the four species of ANS that are actively managed in North Dakota. Eurasian watermilfoil, silver carp, and zebra mussels are each only found in one waterbody. Curlyleaf pondweed is found primarily in the Missouri River system as well as a few isolated lakes. Common carp were not included on the map because they are widespread across the state, and are only absent in the Devils Lake Basin.



### CLASSIFICATIONS

#### Class I: Prohibited Aquatic Nuisance Species

Class I ANS are either not known to be present in North Dakota or if present, only in a few waters. These species have a high potential to invade and establishment will cause ecological and/or economic harm. There are no known management strategies to control established populations without harming non-target species. A North Dakota Game and Fish Department Director's permit is required to possess, import, purchase, trade, or propagate these species. Violations constitute a Class B misdemeanor.

#### Class II: Regulated Aquatic Nuisance Species

Class II ANS have either become established in North Dakota or have been used in a limited manner in commercial enterprises. These species have a high potential to spread unless preventative actions are taken. There are limited management strategies to control expansion of established populations, and management actions may have a negative impact on non-target species. A North Dakota Game and Fish Department Director's permit is required for possessing a regulated species in special facilities in addition to permits which may already be in place. Penalties may vary for violations but could include a Class B misdemeanor.

#### Class III: Listed Aquatic Nuisance Species

Class III ANS are established in North Dakota, are common in many areas, and have a history of use in North Dakota in commercial and permitted activities. Nonetheless, the possibility of negative impacts to native biota exists. Management strategies are available and commonly used. The need to control is based on impacts to recreational fisheries, funding sources, and impacts to non-target species. Trade and movement may be covered under existing permits or regulations propagated by the North Dakota Game and Fish Department. Penalties may vary for violations but could include a Class B misdemeanor.

## NORTH DAKOTA ANS LIST

The following table contains all listed ANS in North Dakota, current as of August 2018. Bolded text indicates that this species is present in North Dakota. The asterisk indicates that grass carp are thought to be eradicated from North Dakota waters since they were last sampled in 2003.

TYPE	COMMON NAME	SCIENTIFIC NAME	CLASS
PLANTS	<b>Curlyleaf pondweed</b>	<i>Potamogeton crispus</i>	<b>2</b>
	<b>Eurasian watermilfoil</b>	<i>Myriophyllum spicatum</i>	<b>2</b>
	Didymo or rock snot	<i>Didymosphenia geminata</i>	1
FISH	Snakehead species	genera <i>Channa</i> and <i>Parachanna</i> of the Family Channidae, including but not limited to:	1
	Northern snakehead	<i>Channa argus</i>	1
	Blotched snakehead	<i>Channa maculata</i>	1
	Bullseye snakehead	<i>Channa marulius</i>	1
	Giant snakehead	<i>Channa micropeltes</i>	1
	<b>Silver carp</b>	<i>Hypophthalmichthys molitrix</i>	<b>3</b>
	Bighead carp	<i>Hypophthalmichthys nobilis</i>	1
	Black carp	<i>Mylopharyngodon piceus</i>	1
	<b>Grass carp*</b>	<i>Ctenopharyngodon idella</i>	<b>1</b>
	<b>Common carp</b>	<i>Cyprinus carpio</i>	<b>3</b>
	European rudd	<i>Scardinius erythrophthalmus</i>	1
	Round goby	<i>Neogobius melanostomus</i>	1
	Tubenose goby	<i>Proterorhinus semilunaris</i>	1
Eurasian ruffe	<i>Gymnocephalus cernuus</i>	1	
INVERTEBRATES	Asian clam	<i>Corbicula fluminea</i>	1
	<b>Zebra mussel</b>	<i>Dreissena polymorpha</i>	<b>1</b>
	Quagga mussel	<i>Dreissena bugensis</i>	1
	New Zealand mudsnail	<i>Potamopyrgus antipodarum</i>	1
	Faucet snail	<i>Bithynia tentaculata</i>	1
	Rusty crayfish	<i>Orconectes rusticus</i>	1
	Scud	<i>Echinogammarus ischnus</i>	1
	Fishhook waterflea	<i>Cercopagis pengoi</i>	1
	Spiny waterflea	<i>Bythotrephes cederstroemi</i>	1
FISH PATHOGENS	IHNV	Infectious Hematopoietic Necrosis Virus	1
	IPNV	Infectious Pancreatic Necrosis Virus	1
	ISAV	Infectious Salmon Anemia Virus	1
	KHV	Koi Herpes Virus	1
	CCV	Channel Catfish Virus	1
	LMBV	Largemouth Bass Virus	1
	VHSV	Viral Hemorrhagic Septicemia Virus	1
	WSHV-2	White Sturgeon Herpes Virus - 2	1
	PKD	Proliferative Kidney Disease	1
FISH PARASITES	Enteric septicemia of catfish	<i>Edwardsiella ictaluri</i>	1
	BKD	<i>Renibacterium salmoninarum</i>	1
	Enteric redmouth disease	<i>Yersinia ruckeri</i>	1
	Parasites	<i>Heterosporis spp.</i>	1
	Asian tapeworm	<i>Bothriocephalus opsarichthydis</i> . Syn. <i>Bothriocephalus acheilognathi</i> and <i>Bothriocephalus gowkengensis</i>	1

## SPECIES OVERVIEWS

### Curlyleaf pondweed

Curlyleaf pondweed *Potamogeton crispus* is an invasive submerged aquatic plant that can grow up to 15 feet (4.5 meters) long and contains alternate, undulate leaves that can be distinguished from native pondweeds by its leaf margin teeth (Thayer et al. 2018). It is typically found fully submerged in three to six feet (one to two meters) of water in freshwater lakes and ponds, though it has been found in as deep as 20 feet (six meters) in clear water (Gettys et al. 2014). Curlyleaf pondweed can survive in polluted, low light conditions and extremely cold water temperatures (Thayer et al. 2018).



This plant, pictured to the right, is considered an aquatic nuisance species because it can grow quickly, forming dense mats on or near the surface and shading out native aquatic plants (Gettys et al. 2014). Large senescence events in mid-summer can lower water oxygen levels, triggering fish kills (Thayer et al. 2018). Curlyleaf pondweed uses rhizomes and turions as primary reproductive methods, and the seasonality differentiates this species from others in North America (Thayer et al. 2018). Turions can be transported through natural or human-mediated pathways, which allows for quick establishment and wide dissemination through plant fragments carried from one water to another.

Curlyleaf pondweed is native to Eurasia, Africa, and Australia but was discovered in the United States in 1841 (Gettys et al. 2014). Now this species is found throughout the United States and surrounding Canadian provinces (Thayer et al. 2018). Curlyleaf pondweed was first found in North Dakota in 2000 in Lake Sakakawea (Ryckman 2013). It is found primarily in the Missouri River system, from the middle reaches of Lake Sakakawea south to the border with South Dakota, including the Missouri River and Lake Oahe. It's also found in the connected waters of Lake Audubon and McClusky Canal. Isolated populations are found in Grass Lake, Lake Ashtabula, Lake Elsie, Lake Metigoshe, McDowell Dam, Raleigh Reservoir, and the Sheyenne River in Barnes County. To date, curlyleaf pondweed has not had any noticeable detrimental effects in North Dakota waters and populations fluctuate greatly across waters and years (Ryckman 2013). Populations are monitored and non-infested waters are sampled regularly. Updated locations are housed on the North Dakota Game and Fish Department website at <https://gf.nd.gov/ans/infested-waters> (NDGFD 2018).

### Eurasian watermilfoil



Eurasian watermilfoil *Myriophyllum spicatum* is a widespread aquatic invasive plant that is used in aquariums and water gardens characterized by thin, hollow stems with leaves in whorls of four that contain 14 or more leaflet pairs (see picture to the left; Pflingsten et al. 2018). It is typically found in up to 15 feet (4.5 meters) of water, though it can be found as deep as 30 feet (nine meters) in extremely clear lakes (Gettys et al. 2014). Eurasian watermilfoil can be found in a variety of water conditions.

This aquatic nuisance species can grow quickly, forming dense mats on or near the surface that leads to multiple impacts. Documented impacts in various locations throughout the U.S. include making recreational activities difficult, decreasing native plant diversity and abundance, replacing vegetation that is more nutritional for waterfowl, and clogging water intakes (Pflingsten et al. 2018). Eurasian watermilfoil spread is generally attributed to the movement of plant fragments, which can root and create new plants (Gettys et al. 2014).

Eurasian watermilfoil is native to Europe, Asia, and northern Africa but was first introduced to the United States in the 1880s, likely intentionally, as this species is prominent in aquariums and plant nursery trade (Pfingsten et al. 2018). This is the most widespread invasive aquatic plant in the northern half of the Continental US (Gettys et al. 2014), but is found in nearly every state in the country (Pfingsten et al. 2018). In North Dakota, Eurasian watermilfoil was first confirmed in Dead Colt Creek Reservoir in 2005 and was subsequently found in the Sheyenne River downstream of Lake Ashtabula in Barnes County. Eurasian watermilfoil has not been detected in Dead Colt Creek Reservoir since 2009 following a pre-winter water draw-down and is considered extirpated from this water (Ryckman 2013). No real impacts have been observed in the Sheyenne River, likely due to the flow rates. Populations are monitored and non-infested waters are sampled regularly. Updated locations are housed on the North Dakota Game and Fish Department website.

### Common carp

Common carp *Cyprinus carpio* is a large-bodied (over 4 feet [1 meter] and up to 80 pounds [37 kilograms]) invasive fish easily recognized by its large scales and barbels (USGS 2005). Although this species is usually brassy to yellow in color, ornamental varieties (koi) come in a variety of colors and patterns (USGS 2005). One of the most widespread invasive fish worldwide, these fish can be found in a variety of habitats, including lakes, ponds, and lower sections of rivers with slower-moving water (Nico et al. 2018c).

Major impacts of common carp introduction include uprooted vegetation and sediment, which decreases water quality and habitat for native species (USGS 2005). Common carp are prolific spawners, and given their ability to survive in a wide variety of environments, they can become abundant in a short period of time. Common carp are native to Eurasia,



but was introduced to the United States in the early 1800s, where it was intentionally stocked across the nation (Nico et al. 2018c). Common carp (pictured above) are popular ornamental fish and are used as live fish bait in parts of the U.S., so new introductions may be human-induced.

In North Dakota, common carp were introduced over a century ago and subsequently stocked in more than 50 waters across the state (Ryckman 2013). It should be noted that important systems such as the Devils Lake Basin and Souris River Basin are currently free from common carp. Unfortunately, stocked populations established, though only some common carp populations are thought to have significant impacts, which are not well documented (Ryckman 2013). Specific impacts are thought to be highly variable depending upon population numbers and other environmental factors.

Populations are monitored and non-infested waters are sampled regularly. The North Dakota Game and Fish Department contracted the building of a permanent earthen berm in 2012 to separate the Pembina River Basin and the Devils Lake Basin to prevent the transfer of common carp into an uninfested drainage during high water years. Another potential high-water basin transfer location exists near Rock Lake, though efforts to separate the basins permanently have been unsuccessful. Updated locations of common carp waters are housed on the North Dakota Game and Fish Department website.

### Silver carp

Silver carp *Hypophthalmichthys molitrix* is a large-bodied (up to over 4 feet [1 meter] and 77 pounds [35 kilograms]) invasive fish with downward-facing eyes and a relatively large, upturned mouth (USGS 2005). It is very similar in appearance to the invasive bighead carp and young silver carp can

be confused with native gizzard shad. It is typically found in the upper water layer in large rivers and is well adapted for large river systems in the United States (Conover et al. 2007).

When disturbed, this species can leap out of the water, potentially harming boaters (Kolar et al. 2007). This fish may compete with native fish, invertebrates, and mussels by filter-feeding on microscopic plants and animals from the water (Nico et al. 2018a). Free-floating eggs and larvae are produced during aggregate spawn events (Kolar et al. 2007), which can create large year classes in successful years.



Silver carp (pictured to the left) are native to eastern Asia but were introduced to the United States in 1973 for aquaculture use (Nico et al. 2018a). Aside from swimming upstream, bait movements are thought to contribute to new introductions of this species. Silver carp are currently found primarily in the Mississippi River Basin in

the United States (Nico et al. 2018a), though much of the United States appears to provide suitable environmental conditions (Conover et al. 2007).

Silver carp were first collected in North Dakota in 2011, when adults were collected at LaMoure Dam and at the Jamestown Dam tailrace on the James River (Ryckman 2013). Adults were collected annually from 2011-2015 and appeared to be from a single age class (likely a 2010 year class). In 2016 and 2017, adults from the aging year class were observed during electrofishing, but were able to escape capture. The Pipestem Reservoir and Jamestown Reservoir dams are considered to be barriers to any natural upstream movement of this species. Dedicated electrofishing is conducted annually to monitor the silver carp population and the locations of silver carp populations are maintained on the North Dakota Game and Fish Department website.

### Zebra mussels

Zebra mussels *Dreissena polymorpha* are small, D-shaped or triangular bivalves with alternating light and dark brown striped patterns that can vary drastically among individuals (see picture to the right; Benson et al. 2018). They can look similar to invasive quagga mussels, but are distinguished from native mussels by the presence of byssal threads (Mackie and Claudi 2010). Byssal threads are used to attach to stable substrates, which act as the preferred habitat (Benson et al. 2018).



Females produce tens of thousands of eggs per spawn event, totaling up to a million eggs annually (Benson et al. 2018). Zebra mussel larvae, called veligers, are pelagic and freely float with wind and wave action to disperse. These quickly-establishing bivalves have several modes of impact. Filter-feeding activities on small plants and animals impact water quality and the ecosystem, primarily through shifting energetic resources from lentic sources to benthic sources (Karatayev et al. 2015). Attachment on hard surfaces can impact recreational activities and through fouling equipment and water pipes in power and water industries, which can have significant economic costs (Benson et al. 2018).

Zebra mussels are native to eastern Europe and western Asian but were introduced to the United States in the 1980s through the discharge of ballast water into the Great Lakes (Benson et al. 2018). Current spread is likely from the movement of water containing veligers and fouled equipment harboring live adults. Zebra mussels are currently found throughout the Great Lakes,

Mississippi River Basin, and in several major waterbodies across the United States (Benson et al. 2018).

In North Dakota, the first documentation of the presence of zebra mussels was confirmation of veligers in water samples taken from the confluence of the Ottertail and Red rivers and at the Kidder Dam at Wahpeton in 2010 and 2011. No veligers were detected in 2012 (Ryckman 2013) or again until 2015. In 2015, extremely high densities of veligers were detected in the Red River in North Dakota and Manitoba stretches of the Red River. Adult searches in fall 2015 revealed the presence of adults. Regulations prohibiting the movement of water away from the Red River went into effect immediately and veliger densities are monitored annually. Several other North Dakota waters are sampled annually for the presence of adults and veligers.

### Grass carp

Grass carp *Ctenopharyngodon idella* is a large-bodied (up to 5 feet [1.5 meters] and 100 pounds [45 kilograms]) invasive fish with large scales that have a dark edging, a short dorsal fin, and a slightly pointed snout (see picture below; USGS 2005). It is very similar in appearance to the invasive black carp and can be distinguished from common carp by the lack of barbels on grass carp. It can be found in shallow, slow moving or still water of lakes, ponds, pools, and backwaters of large rivers and has a high tolerance range for water temperatures (Conover et al. 2007).



This fish consumes large quantities of aquatic vegetation, which can have negative impacts on water quality and native species (Nico et al. 2018b). Grass carp have a long, somewhat controversial history of being stocked intentionally to control vegetation in numerous waters across the United States (Conover et al. 2007). To reduce the likelihood of feral

grass carp populations from establishing, most states either ban grass carp outright or require the use of triploid (infertile) grass carp (Conover et al. 2007).

Grass carp are native to eastern Asia but were introduced to the United States in 1963 for aquaculture use and have become widespread across the United States for vegetation control (Nico et al. 2018b). Grass carp have been both legally and illegally stocked in North Dakota, with the most recent stocking in 1986 (Ryckman 2013). North Dakota Game and Fish Department conducted the initial and only legal stockings in 1971 and 1972 into Spiritwood Lake. Grass carp were infrequently collected at Spiritwood, with the last dead grass carp detected in 2003, which had apparently died of natural mortality (Ryckman 2013).

Grass carp were also illegally stocked in the state. In the 1970s, a pond in Minot was stocked with grass carp by locals. Upon learning of this stocking, the Department eradicated this pond, as well as several miles of the nearby Souris River. The eradication was reported as being a total success. No other specific information is available regarding this stocking (Ryckman 2013). A second illegal stocking was conducted by locals at Briarwood Pond near Fargo for multiple years prior to 1987. Winterkill decimated the grass carp population in 1985-86, but were stocked again in May 1986 illegally. Upon learning of the stocking in 1987, North Dakota Game and Fish drew down the pond prior to freeze, then eradicated in February 1988, which was effective at eliminating the population (Ryckman 2013). Grass carp are considered eradicated from North Dakota, and regulations prohibit the import, sale, possession, and stocking of this species.

## APPENDIX A REFERENCES

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## APPENDIX B. STATE AND FEDERAL AUTHORITIES AND REGULATIONS

### NORTH DAKOTA

In North Dakota, many state agencies have authority and regulatory roles in managing natural resources. While many agencies have some authority to regulate or manage aquatic nuisance species (ANS), all public agencies have an ethical responsibility to prevent damage to the state's resources and to act in the best interest of its citizens. Agencies that control water, pests, or invasive species are all critical to managing ANS in North Dakota. Relevant authorities and regulations of various state agencies as set forth in North Dakota Century Code (NDCC) and North Dakota Administrative Code (NDAC) are summarized below.

#### North Dakota Game and Fish Department

The North Dakota Game and Fish Department [NDCC: 20.1-02-01 through 20.1-02-32] provides the Director with the authority to regulate the importation, introduction and transplanting of fish, fish eggs, and other aquatic animals into state waters. The act provides that one must have a permit issued by the Director before introducing any fish or fish eggs into public waters, and the fish or fish eggs must be inspected for disease.

The Aquatic Nuisance Species Act [NDCC 20.1-17-01 through 20.1-17-09] provides the Director with the authority to manage ANS in the state. The Director or designee has the power to prepare a statewide ANS management plan, establish and chair the North Dakota Aquatic Invasive Species Committee (AISC), list and restrict movement of ANS, manage infested waters, and establish civil penalties for violations. The AISC shall be comprised of state, local, and private interests and act as an advisory committee for ANS efforts throughout the state. The Director also establishes reasonable rules to reduce the likelihood of introducing or spreading ANS and fish diseases into and within North Dakota [NDAC 30-03-06 and NDAC 30-04-04].

The Fish, Frog, and Turtle Regulation Act [NDCC: 20.1-06-01 through 20.1-06-17] provides the Director with the power to remove and dispose of fish deemed undesirable. The Director may adopt rules governing the operation of private fish hatcheries, introduction and release of fish into the state, and the supervision of live bait wholesalers. Department rules further elaborate on permitting and operational guidelines for bait vendors [NDAC 30-03-01.1], private fish hatcheries [NDAC 30-03-02], and fishing contests [NDAC 30-03-05].

#### North Dakota Department of Agriculture

The Commissioner of Agriculture or the commissioner's authorized representative, with the assistance of the North Dakota State University Extension Service, has powers over the management, control and eradication of pests, noxious weeds, rodent and insect management and the use and application of pesticides. Their primary function is to provide technical expertise to county weed boards and to provide funding for various weed control activities.

The Plant Pests Act [NDCC: 4.1-23-01 through 4.1-23-12] provides the Department of Agriculture the power to suppress, control or eradicate the spread of plant pests in the state. The commissioner may temporarily quarantine areas that he believes necessary to prevent the spread of plant pests for up to 90 days without a public hearing, or longer with a public hearing. The commissioner is empowered to conduct a reasonable inspection of any premises or property within the state with a warrant issued by District Court or consent of the owner and may stop and inspect any means of transport or conveyance within the state if he has probable cause to believe it to contain or carry a plant pest or host.

The North Dakota Noxious Weed Control Act [NDCC: 4.1-47-01 through 4.1-47-33] provides that the Agriculture Commissioner, working in conjunction with county weed boards and county weed officers, the authority for control, maintenance, and eradication of noxious weeds, invasive species, and pests throughout the state. The commissioner, after consultation with the North Dakota State University Extension Service, shall compile and keep current a list of noxious weeds and provide local authorities with information and a program for the control or eradication of noxious weeds. The act provides the Highway Patrol, sheriffs, and other law enforcement officers the power to stop and inspect vehicles suspected of transporting noxious weeds within the state, to prevent the dissemination of noxious weeds on highways, airways or waterways.

The Plant Nurseries Act [NDCC 4.1-22-01 through 4.1-22-11] provides that the Department of Agriculture has the authority to certify and inspect all plant nurseries in North Dakota for viability, certificate of inspection, correct labeling, or pests. Any violations may warrant the forfeiture of nursery stock, revocation of certification, or civil penalties.

### **Department of Environmental Quality**

The State Water Pollution Control Board, which includes the Director of the North Dakota Game and Fish Department, through the Department of Environmental Quality, and with cooperation of the State Water Commission [NDCC: 61-28-01 through 61-28-09], maintains and improves water quality of the state, formulates and issues standards of water quality, and provides for a system to classify North Dakota's waters [NDAC 33-16-02.1-01 through 33-16-02.1-11]. The agency is to require the proper maintenance and operation of sewage and industrial waste systems to protect present and future use of such waters for, among other reasons, the propagation of fish and aquatic life and wildlife.

### **State Engineer and State Water Commission**

The Water Commission Act [NDCC: 61-02-01 through 61-02-81] provides for the establishment of a State Water Commission, which has general authority over all surface and subsurface water within the state. This includes authority over water projects, which includes recreational use or wildlife conservation. A permit is required for all uses of water, except in cases when both the amount of water to be impounded, diverted, or withdrawn is less than 12.5 acre-feet, and the contemplated use is domestic, livestock, or fish, wildlife, and other recreational uses [NDCC: 61-04-01.1 through 61-04-32]. Although no permit is required for these uses, the State Engineer must be notified of the location and the acre-feet capacity, stored or utilized, once the facilities are constructed. The State Engineer has the authority to regulate the construction and modification of water control projects, including dams, dikes, and other water control and management devices [NDCC 61-16.1-38] as well as drainage [NDCC 61-32-03] in conjunction with county water resource districts. In addition, the State Engineer has authority [NDCC61-33-02] over North Dakota's sovereign lands, which are those areas, including beds and islands, lying within the ordinary high watermarks of navigable lakes and streams.

### **Water Resource District Act**

This is the only agency with the power to order the removal of aquatic weeds and pests [NDCC: 61-1.1-01 through 61-16.1-63]. Water Resource Boards have the power to manage water resources within their districts and order or initiate legal action to compel a person, user or controller of any bridge, or culvert to remove any weeds, shrubbery or other debris which hinders or decreases the flow of the water.

### **Highway Patrol and Other Law Enforcement**

Statutes concerning the enforcement of state laws generally require other law enforcement agencies within the state to aide and assist in the enforcement of laws and regulations in these areas. Any peace officer of the state may enforce laws that help prevent the introduction or spread of ANS.

## FEDERAL

No single federal agency has clear authority over all aspects of ANS management. Many federal agencies have programs and responsibilities that address aspects of the problem such as importation, interstate transportation, exclusion, control, and eradication. Federal activities on ANS management are coordinated through the National Aquatic Nuisance Species Task Force (ANSTF) and Executive Order (EO) 13112, which requires all federal agencies to collaborate in developing a national invasive species management plan that will include terrestrial and aquatic species.

### Federal Actions

At the highest levels of federal government (Secretary or equivalent level), the National Invasive Species Council coordinates department-level actions to address national invasive species issues for both terrestrial and aquatic environments. This council is advised by the Invasive Species Advisory Committee, a federal advisory committee comprised of representatives from state, territorial, tribal, and local governments, as well as academic institutions, non-governmental organizations, and the private sector. Federal legislation is handled through Congress, who have express authority to create laws.

The national Aquatic Nuisance Species Task Force coordinates federal actions across agencies and is comprised of Directors or Director designees from federal agencies with major involvement in natural resource conservation or water management and enforcement. All federal agencies are responsible for taking actions to prevent the introduction and spread of ANS, though some are more affected by this mandate. Major examples of federal agency actions include, but are not limited to, the following:

- *U.S. Fish and Wildlife Service* – national and regional coordination of efforts; Lacey Act enforcement; triploid grass carp certification; state grants for ANS work; and leadership on Asian carp management, monitoring, and research.
- *U.S. Geological Survey* – maintain the Non-Indigenous Aquatic Species database and act as leaders in research on Asian carp control strategies and other ANS needs.
- *U.S. Army Corps of Engineers* – project permitting that includes ANS prevention requirements, water control and management in reservoirs, development of a chemical control guide for Dreissenid mussels, and the Great Lakes and Mississippi River Interbasin Study.
- *Bureau of Reclamation* – leader in Dreissenid mussel research for protecting infrastructure, monitoring for Dreissenid mussels, and development of Facility Vulnerability Template for assessing risk of Dreissenid mussel impacts.

### Executive Order 13112 on Invasive Species

President Clinton signed Executive Order (EO) 13112 on Invasive Species (64 Fed. Reg. 6183, Feb. 8, 1999), on February 3, 1999. The EO seeks to prevent the introduction of invasive species, provide for their control, and minimize their impacts through better coordination of federal agency efforts under a National Invasive Species Management Plan. The Order directs all federal agencies to address invasive species concerns, as well as refrain from actions likely to increase invasive species problems. The National Invasive Species Management Plan is updated every two years by the National Invasive Species Council.

### Lacey Act (Title 16 of U.S.C. 3371-3378 and Title 18 of U.S.C. 42-43)

Title 16 of the Lacey Act makes it illegal to import, export, transport, sell, receive, acquire, or purchase any fish or wildlife or plant taken, possessed, transported, or sold in violation of any law, treaty, or regulation of the United States, any State, Native American tribe, or foreign nation. This provision of the Lacey Act essentially ensures reciprocity of fish and wildlife and plant laws across

jurisdictions. Since many jurisdictions have laws pertaining to invasive species, Title 16 can be used to enact federal penalties for possessing or transporting invasive species.

Title 18 of the Lacey Act is called the Injurious Species Provision, as it lists a number of invasive species that are illegal to import into the United States, its territories and possessions, the District of Columbia, or Puerto Rico. It also does not allow for any shipment between the continental United States, the District of Columbia, Hawaii, Puerto Rico, or any possession of the United States. Species are added to the injurious species list through a public process, usually based on ecological risk assessments that screen the likelihood of introduction and potential impacts.

### **Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA; Title I of P. No.101-646, 16 U.S.C. 4701 et seq.)**

This Act established a federal program to prevent the introduction of, and to control the spread of, introduced ANS and the brown tree snake. The U.S. Fish and Wildlife Service, U.S. Coast Guard, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and the National Oceanic and Atmospheric Administration share responsibilities for implementing this effort. They act cooperatively as members of an Aquatic Nuisance Species Task Force. The mandate is prevention, monitoring, and control with these activities supported by research and education. The Task Force conducts studies and reports to Congress to assess whether ANS threaten the ecological characteristics and economic uses of U.S. waters other than the Great Lakes; and to identify and evaluate approaches for reducing the risk of adverse consequences associated with intentional introduction of aquatic organisms.

Under NANPCA, state governors are authorized to submit comprehensive management plans to the Task Force for approval, which identifies areas or activities for which technical and financial assistance is needed. Grants are authorized to states for implementing approved management plans, with a maximum federal share of 75 percent of the cost of each comprehensive management plan. The state (or non-federal) contribution is 25 percent of total program costs.

### **National Invasive Species Act (NISA; No.104-332)**

In 1996, NISA amended NANPCA to mandate regulations to prevent the introduction and spread of ANS into the Great Lakes through ballast water and other vessel operations. The act authorized funding for research on ANS prevention and control in the Chesapeake Bay, Gulf of Mexico, Pacific Coast, Atlantic Coast, and San Francisco Bay-Delta Estuary.

In addition, NISA required a ballast water management program to demonstrate technologies and practices to prevent aquatic nonindigenous species from being introduced into and spread through ballast water in U.S. waters. It modified: (1) the composition and research priorities of the Aquatic Nuisance Species Task Force; and (2) zebra mussel demonstration program requirements.

## APPENDIX C. GOVERNOR'S MEMO



— State of —  
**North Dakota**  
*Office of the Governor*

Doug Burgum  
*Governor*

Greetings,

North Dakota's water resources are vital for all North Dakotans, whether for drinking, bathing, irrigation or recreation such as fishing and boating. Aquatic nuisance species (ANS) pose a direct threat to our quality of life by endangering water quality and ecological stability. ANS endanger our municipal and rural water supplies by clogging intake pipes and threaten to disrupt the security of our agriculture and recreation industries.

Investment in preventing the spread of ANS is less disruptive and more cost effective than responding to infestations. Therefore, I directed the North Dakota Game and Fish Department to update the North Dakota Aquatic Nuisance Species Management Plan to reflect contemporary management strategies. This updated plan maximizes the value of capital investment by taking an innovative and collaborative approach rather than adding a regulatory burden.

It is the responsibility of all North Dakotans to take action to prevent ANS movement into or within our State. By working together, we can preserve the quality of our water resources for current and future generations.

Regards,

A handwritten signature in blue ink that reads "Doug Burgum".

Doug Burgum  
Governor