DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
ENVIRONMENTAL ADVISORY BOARD
ARMY SCIENCE BOARD SUBCOMMITTEE

June 15, 2020

Lieutenant General Todd T. Semonite
Commanding General and Chief of Engineers
U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

Dear LTG Semonite:

The United States is experiencing large biological, social, and economic costs due to invasive species. Since the 1884 Rivers and Harbors Act, the U.S. Army Corps of Engineers (USACE) has led the nation in invasive species management. USACE now spends over $150 million annually on invasive species with nearly half of it going towards control through the Navigation, Aquatic Ecosystem Restoration, Environmental Stewardship of Corps-owned lands, and Flood Risk Management business lines. USACE is required to collaborate with other federal agencies through the Aquatic Nuisance Species Task Force (ANSTF) and the National Invasive Species Council (NISC). The John D. Dingell, Jr. Conservation, Management, and Recreation Act of 2019 requires accounting for active management and accountability for invasive species management on all federal lands. The USACE Invasive Species Leadership Team (ISLT), established in 2005, provides technical leadership for advising and guiding USACE projects, operations, and management to address risks related to invasive species.

The Environmental Advisory Board (EAB) was asked to review invasive species programming for USACE and provide recommendations to strengthen participation and outcomes. The EAB considered input from a variety of sources including a survey of the members of the USACE ISLT, informal communications with other agencies and organizations, and personal experiences on interagency workgroups and research projects.

Responses to the survey, along with additional information provided by staff and gathered from external sources were synthesized in the attached report and used to develop the following recommendations for USACE for implementing invasive species programming for the future.

SUMMARY OF SPECIFIC RECOMMENDATIONS FOR THE USACE INVASIVE SPECIES MISSION

Prioritization and Messaging for Prevention of Invasive Species

1. Create clear messaging from leadership and communicate through the chain that invasive species issues are a priority for planning and operations and are considered

part of the Environmental Operating Principles. Leadership throughout USACE must embrace these responsibilities as integral to all aspects of USACE business. Direction and guidance from Headquarters is required to ensure that all Divisions act in a concerted manner to prevent the establishment and spread of invasive species.

2. New leaders should be provided information on the authorities and role of USACE as a national leader on invasive species, similar to the training on Environmental Operating Principles, as they take command.

3. Use and develop, when needed, invasive species ecological risk assessments to inform preventative actions and risk assessment in planning projects.

Training and Awareness for Prevention and Response

4. "Manage the front line" - Train staff for identification, response actions and the ability to access resources needed to respond. Long-term management problems can be avoided through early detection and rapid response eradication actions when front line staff are trained and empowered to act.

Action and Consistency for Success

5. Develop and implement a process for quicker response actions when the costs to treat are low and a successful outcome or eradication is achievable. Federal agency coordination is possible, and partners may be able to assist to overcome some of the bureaucratic burden that would preclude action.

6. Address inconsistencies in interpretation of authorities and Memorandum of Agreements (MOAs) with invasive species management and the ability to conduct management (e.g. using firearms when necessary) on project lands.

7. Explore options for early detection and rapid response funding as a matter of priority. For example, the U.S. Forest Service Response to fires could serve as a potential model in combination with a mutual aid agreement with other federal and state agencies in proximity of the infestation.

Incorporate Invasive Species Across Business Lines

8. Include "prevention of invasive species" as a stated purpose for ecosystem restoration and environmental stewardship business lines. Include invasive species management for all business lines to encourage proactive considerations rather than forcing reprioritization of available funds late in a fiscal year.

9. Management decisions regarding the annual budgets for invasive species management should be addressed at the appropriate level based on the geographic scale of the infestation. The management decisions should permit flexibility down the chain for implementation at the field level.

10. Develop metrics to support benefits of proactive measures to prevent invasive species introduction or spread.

Strategic Planning to Support Partnerships and Collaboration

11. Continue support of and require participation in ISLT. This team is critical to USACE's success in addressing invasive species and serves a critical role in collaboration with other entities.

12. Charge the ISLT to develop a strategic plan for the implementation of the invasive species program to achieve, to the maximum extent practicable, a substantive annual net reduction of invasive species populations or infested acreage on land or water managed by the USACE (per the Dingell Act 2019). As noted in the Act, require strong collaboration with state agencies for development of the plan and to leverage resources.

13. Emphasize inter- and intra-agency coordination and collaboration by supporting participation of the ISLT and with external collaborating bodies such as NISC, ANSTF, and Regional Panels. Leadership for USACE can support staff in their participation on regional and national groups and direct them to do so with a strong and intentional presence.

14. Establish a priority to support decision support tools for data collection, spatial analysis, risk analysis, etc. with other federal agencies to capitalize on expertise and cost efficiencies of scale.

15. Support and empower programs like state-led response programs, rather than create a new system. Support and encourage district level engagement with state and local agencies for alignment with priority actions and to leverage funding opportunities. This would include conversations of how to implement partnerships. Note that USACE does not always have to lead.

Address Knowledge Gaps through Applied Research

16. With partner input, develop a strategic framework for research investment for the highest priority needs for invasive species prevention, detection, and management.

17. Provide guidance for development and review of Statement of Need (SON) documents to assure invasive species issues are described in the broader context of the ecosystem and economic impact and to provide adequate consideration of those projects when compared with others.

18. Support and develop consistent funding opportunities to capitalize on valuable assets at Engineer Research and Development Center (ERDC) and in collaboration

with other research partners to assure progress through investments in the strategic framework for research.

The lead EAB member for this task was Dr. Tammy Newcomb (newcombt@michigan.gov; (517) 930-3690). Please feel free to contact me or Dr. Newcomb with any questions. The EAB would like to particularly thank the members of the ISLT who provided detailed and thoughtful responses. We hope the recommendations will be useful and look forward to working with your staff on implementation.

Sincerely,

Mary C. Barber, Ph.D.
Chair, Environmental Advisory Board
Subcommittee of Army Science Board

CF:
Chief, Planning & Policy Division
Chief, Environmental Division
Chief, Operations & Regulatory Division
Chief, Engineering & Construction Division
Director, ERDC Environmental Laboratory

Addressing Invasive Species Risks for a Sustainable National Outcome with USACE Infrastructure, Operations, and Ecosystem Restoration

by

Chief of Engineers' Environmental Advisory Board Subcommittee
U.S. Army Science Board
June 2, 2020

Invasive Species as a National Focus

The United States (U.S.) is experiencing large biological, social, and economic costs due to invasive species. Invasive species disrupt ecosystem function and result in widespread changes in how the U.S. manages our lands and waterways. Invasive species can compromise both fragile and robust ecosystems resulting in habitat loss, changes in nutrient cycling, and ultimately disrupting food webs. Consequences from an invasion are many, including costs for treatment and control that amount to billions (e.g. utilities and municipalities), losses to economic vitality as a result of diminished natural resource goods and commodities (e.g. fisheries, forests, and recreation/tourism), and threats to public water supply and human safety (e.g. harmful algal blooms) (Lodge et al. 2016, NISC 2016). Detrimental effects are also observed in habitat alterations that threaten human safety (e.g. Cheatgrass, Phragmites and fire), increase costs for managing threatened and endangered species, and reduce the goods and services provided by a properly functioning, diverse ecosystem (e.g. reduced hunting, fishing, and other recreation) (Lodge et al. 2016, NISC 2016).

Societal costs from infestations of invasive species go beyond the money expended to protect crops, manage resources and safeguard infrastructure. Invasive species weaken USACE operational resilience by interfering at the landscape level with water supply, navigation, and hydropower. The resulting economic impacts then compel decision-makers to spend money on invasive species management to mitigate the damage rather than programs that support the U.S. economy and the well-being of its citizens.

Over the last 20 years, an entire pillar of science has evolved regarding the issues of invasion by species that cause ecologic, economic, and biologic harm. Through this body of work, policies have been developed on national, state, and local levels to address prevention, detection, and control of invasive species that pose the greatest risks (Figure 1). Funding for these actions has slowly followed with a growing awareness that *prevention* of introducing an invasive species will provide the greatest sustainability and least cost for the long-term (Figure 2). Furthermore, by ensuring that strong policies address major pathways of risk for the introduction of invasive species and respond quickly to new invasions, USACE can minimize control measures that drain personal, industry, municipal, state, and federal budgets.

Since 1884, USACE has led the nation in invasive species management, following on with the 1899 and 1958 Rivers and Harbors Acts. These acts focus primarily on aquatic resources such as navigable waters and flood risk management projects. The Rivers and Harbors Act continues to provide a viable and important source of funding for USACE on aquatic invasive species with provisions for the "Removal of

Aquatic Growths" project (RAG) and the Aquatic Plant Control Program that supports research and control through a 50:50 match.

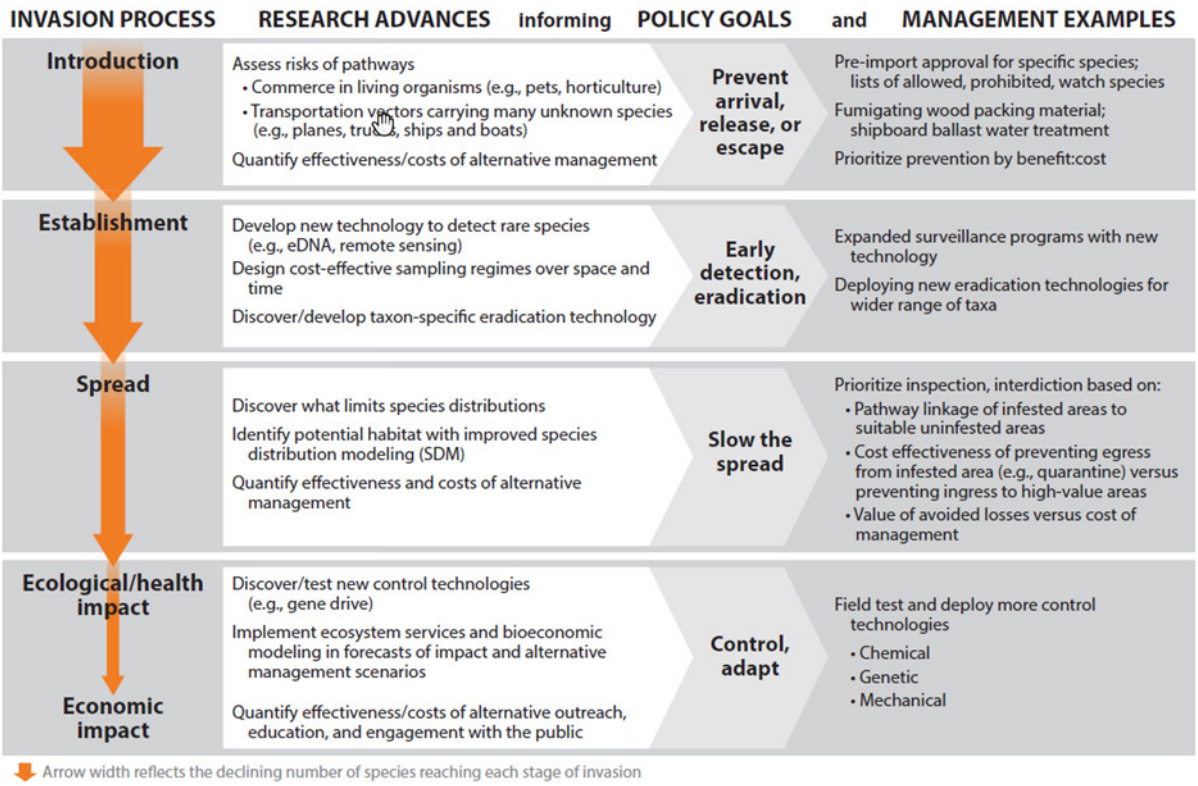

Figure 1. Diagram of the biological phases of an invasive species colonization process, research advances to inform the policy goals and examples of the action-oriented outcomes (Lodge et al. 2016).

Sustainability and resilience are cornerstones of engineering, design and construction for Civil Works projects. Through development of new infrastructure projects, management of military installations, support of waterway commerce and travel, cutting-edge research programs, and in partnership with other land management agencies, USACE has an opportunity to leverage investments for the future by considering invasive species risks during project implementation.

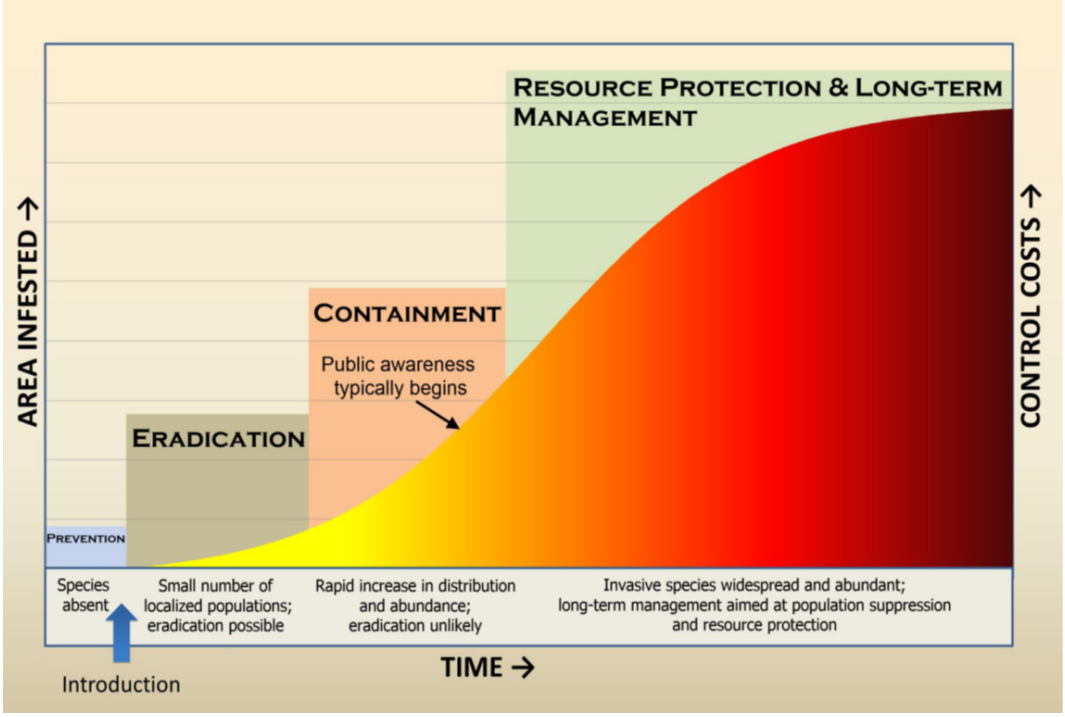

Figure 2. The conceptual economic case for addressing invasive species at the prevention and localized population level to avoid the large environmental and social costs of managing a colonized population (Adapted from Invasive Plants and Animals Policy Framework, State of Victoria, Department of Primary Industries, 2010).

Federal Agency Coordination on Invasive Species

Federal agencies have numerous authorities and responsibilities to manage invasive species and USACE spends over $150 million annually on invasive species with nearly half of it going towards control through the Navigation, Aquatic Ecosystem Restoration, Environmental Stewardship of Corps-owned lands, and Flood Risk Management budget lines. However, USACE is not alone in addressing the issue and collaboration is key to successful invasive species prevention, detection, and response. There are two longstanding authorities that require USACE to collaborate with other federal agencies through the Aquatic Nuisance Species Task Force (ANSTF) and the National Invasive Species Council (NISC). A third Act, the John D. Dingell, Jr. Conservation, Management, and Recreation Act, was signed into law in early 2019 that further requires accounting for active management and accountability for invasive species management on all federal lands. All of these programs require the presence and commitment of USACE programming and action on invasive species (details for each in Appendix A). Invasive species are clearly, through these acts, recognized as a national issue. The statutory authorities provide numerous opportunities for USACE to provide leadership and participate in collaboration on invasive species issues with both regional and national significance.

USACE Internal Guidance and Support on Invasive Species

Internal to USACE, the Invasive Species Leadership Team (ISLT) provides technical leadership for advising and guiding USACE projects, operations, and management to address risks related to invasive species. The ISLT was established in 2005 to provide oversight of the USACE Invasive Species program as the

national growing awareness of the issues and expectations for addressing them became clear. The ISLT provides direction to achieve the goals and objectives in the NISC Management Plan that apply to USACE programs and projects in fulfillment of the 2009 Memorandum USACE Invasive Species Policy (Temple 2009) and the 2014 Memorandum Invasive Species Management in the USACE (Stockton 2014). The ISLT provides support for the exchange and sharing of information and strategic recommendations to the USACE and U.S. Army Engineer Research and Development Center (ERDC). A 2005 Memorandum for Invasive Species Leadership Team Appointments (White 2005) identifies membership to consist of: representatives from the divisions and districts, one from USACE headquarters (HQUSACE) from Natural Resources Management, Navigation, Planning, and Military Missions, a technical proponent from ERDC, one from Armed Forces Pest Management Board and a representative from the Department of the Army. ISLT responsibilities include the following:

- Providing recommendations to HQUSACE staff on fulfilling agency duties under Executive Orders 13112 and 13751.
- Providing strategic direction to research programs that address invasive species, including the Aquatic Plant Control Research Program and the Aquatic Nuisance Species Research Program.
- Representing USACE on regional invasive species councils.
- Coordinating and collaborating on regional invasive species councils, across Federal agencies, and with non-Federal sponsors.
- Developing and implementing cost-effective strategies to address invasive species problems that affect USACE water resource management missions.
- Coordinating team initiatives with the Environmental (and other relevant) Communities of Practice.
- Coordinating with the Major Subordinate Command; and
- Coordinating annual cost information for USACE and providing it to NISC

The existing authorities along with Executive Orders 13112 and 13751, a strong internal leadership team, and the Environmental Operation Principles form a solid basis for USACE to continue to build a legacy of leadership in addressing invasive species while meeting the water supply, navigational, and hydropower needs of the country. USACE roles and responsibilities are clearly defined and empower USACE action.

The Task of the Environmental Advisory Board

The EAB was asked to review invasive species programming for USACE and provide recommendations for opportunities to strengthen USACE participation and outcomes for invasive species management. In its work, the EAB considered input from a variety of sources including a survey of the members of the USACE ISLT, informal communications with other agencies and organizations, and personal experiences on interagency workgroups and research projects. A survey of the ISLT included questions to understand the current range of invasive species programming throughout the regions. Each section below highlights the question areas and recommendations for USACE leadership to consider.

FOCUS ON "PREVENTION" OF INVASIVE SPECIES INTRODUCTIONS FOR LONG TERM FINANCIAL AND NATURAL RESOURCE BENEFITS

As noted in the introduction and supported by Figure 2, prevention of new invasive species is the most sustainable and least costly action to take. By preventing new introductions of invasive species, USACE can efficiently focus funding on eradicating or managing existing high-risk, priority infestations. There

are several opportunities available to strengthen aspects of prevention for USACE invasive species programming.

COMMUNICATION, OUTREACH, AND TRAINING ARE ESSENTIAL FOR REVENTION OF INVASIVE SPECIES

Currently, communication and education mechanisms are in place through strategic alliances between ISLT members and members of the Recreation Leadership Advisory Team, Stewardship Advisory Team, and the Planning Community via conference presentations and webinars. These alliances should be continued, and this type of effort should be expanded to Navigation, Planning, Regulatory, Construction, and Operations for awareness of invasive species threats and steps each of those areas can take to prevent invasions.

Training for awareness and identification throughout USACE will be important to address prevention and early detection. While developing expertise can be expensive and time consuming, opportunities exist to prioritize this activity and to leverage partnerships (state, academic, NGO) for support. The ISLT has developed an impressive template/tutorial document on invasive species that could be used to help educate personnel doing routine operations and maintenance and ecosystem restoration. Additionally, numerous online tools exist to help reduce costs associated with training. The ISLT tools, templates, and online resources should be shared nationwide within USACE.

USE INVASIVE SPECIES ECOLOGICAL RISK ASSESSMENTS TO INFORM PREVENTATIVE ACTIONS.

Currently, USACE staff use a three-pronged approach to identify invasive species risk by assessing : 1) risk to the mission of USACE; 2) risk to natural resources and ecosystem function; and 3) the risk of escalating long-term costs if the invasive species is not addressed. Use of a structured ecological risk assessment approach will assist staff in more readily identifying the risks and help clearly articulate the consequences if those risks are not addressed. Uncertainties associated with the threat of an invasive species can be addressed through ecological risk assessments which are developed in partnership with federal agencies (e.g. U.S. Fish and Wildlife Service) or state agencies. In many cases these risk assessments already exist and could be used to inform ongoing work.

Invasive species ecological risk assessment can be tailored to regional applications for USACE to determine high risk species in the pathways and their potential for invasiveness. This would avoid a one-size-fits-all and refine the focus for prevention and early detection to specific regions, preventing unnecessary restrictions. Use of this type of ecological tool in combination with current risk matrices that are currently used for operations and asset management could allow for consistency in application throughout USACE, and other state and federal agencies and partners, with regionally specific biological information.

Other ways to reduce risk, in concert with the invasive species ecological risk assessments, include: a) grants with U.S. Geological survey to conduct research projects aimed at reducing invasion risks on USACE lands; b) coordinating with U.S. Fish and Wildlife Service to enforce laws governing the sale and transport of exotic species to further prevent invasive species from finding their way onto USACE lands; and c) using USACE's authority to conduct watershed studies, provide specific guidance in those plans to incorporate invasive species risk assessment and management as a critical component of ecosystem restoration.

BUDGETING FOR PREVENTION.

During planning for all business lines, explicitly identifying the need to conduct a thorough analysis of the threat of invasion, or a risk analysis that specifically includes local and regional watch list species (often listed by regional or local collaborative agencies) should be considered. This approach may be perceived as a prohibitive cost increase for a project, especially if contractual requirements for invasive species prevention were included. However, with a competitive bidding process this may not be true and actually may be in line with standard state contracting that also requires contractors to address invasive species. Using a proactive approach in addressing invasive species through projects contracts will ultimately reduce future costs for removal and control that would be higher than costs directed toward prevention at the initial stage of a project.

USACE HAS THE ABILITY TO BE MORE RESPONSIVE TO HIGH RISK INVASIONS

Through natural resources management staff, river operations staff, etc. the Corps has eyes and ears across the nation to identify and act on high risk invasions that threaten the mission of USACE and ecological integrity in the places where USACE operates. Prevention is tied to response actions in that it also includes preventing establishment or colonization as well as preventing the spread from known locations of invasion. Following are several ways that USACE can provide for the districts to respond to local high-risk invasions before they become costly management and control programs. In some cases, delaying action by a year can result in escalating costs by orders of magnitude.

MONITORING FOR EARLY RESPONSE ACTIONS TO AN INVASION

USACE should develop flexible policies that embrace the idea of monitoring for invasive species following ecosystem restoration. This should include funding to eliminate invasive species if they do encroach after a project is constructed. Training, as noted above, will be necessary to recognize threats and new guidance to act quickly. To address costs, collaborating with state monitoring efforts or developing volunteer programs that monitor for invasive species could be coordinated and implemented on USACE lands.

DEVELOPMENT OF FLEXIBLE POLICIES AND PROCESSES TO ADDRESS INVASIONS MORE QUICKLY.

Opportunity also lies in empowering field personnel to take action and respond to a new invasion. Responsible stewardship requires that invasions are addressed quickly and policies that encourage expedited approaches such as Programmatic Agreements, MOAs, Categorical Exclusions, and Categorical Permissions should be developed to address the environmental compliance issues that currently hinder the rapid response process. A few specific hurdles were noted in the staff survey. Overcoming the following hurdles will allow for USACE to provide timely responses to invasive species:

- Restrictions on the use of Restricted Use Herbicides.
- Policy or prohibitions regarding the use of firearms on Project Lands for the control of avian/terrestrial invasive mammals.
- Limitations to implementation of response actions that are based on different interpretations of policy or guidance across the divisions or districts.

- A lack of a sense of urgency when required to use a 3-year planning timeline which can result in a $500,000 response action after delay rather than a $50,000 response action if acted upon initially.

USACE CAN ACHIEVE SIGNIFICANT RESULTS BY ADDRESSING INVASIVE SPECIES SPECIFICALLY THROUGH BUDGETING, PLANNING, AND POLICY DEVELOPMENT

ESTABLISH PROCESSES TO ADDRESS INVASIVE SPECIES THROUGHOUT ALL BUSINESS LINES

Because invasive species cross all business lines, a process to integrate across those lines will be important to achieving success and supporting fiduciary efficiencies. In some cases, actions needed to prevent or treat invasive species may be *perceived* to be detrimental to the primary mission, but a leadership emphasis to recognize the importance of addressing invasive species issues could overcome such barriers and lead to better integration. From restoration projects to land management actions, there are opportunities to achieve invasive species goals. For example, a hay lease on USACE lands may open the door for the establishment of invasive species and thus a prevention protocol should be incorporated in the lease. Civil Works projects should also consider invasive species aspects as part of their responsibility, per the Environmental Operating Principles.

There are several actions that could be implemented throughout business lines to promote invasive species awareness, prevention, detection, and response. For example:

- Development of a policy to address invasive species prevention in monitoring and adaptive management plans and specific project operations and management manuals as they are provided to the project's sponsor.
- Real estate actions could incorporate language into accompanying legal documents that establish restrictions that favor prevention of invasive species.
- Navigation users could be required to establish practices that reduce invasion risk as they transit USACE facilities.
- One-time timber sales that thin timber stands to densities that are unfavorable for invasive insects.
- Require contractors (both land and water) to adhere to best management practices for reduction in risk of transfer of invasive species.

IDENTIFY SPECIFIC FUNDING ACROSS BUSINESS LINES

Funding across business lines should intentionally address prevention, detection and response to findings of new invasive species which would allow operations and maintenance funds to be used to address ongoing management and treatment. Use of spending codes specific to invasive species response or management actions to identify specific work categories would assist in further determining need and understanding the investment on invasive species programming.

DEVELOP METRICS TO SUPPORT BENEFITS OF THE PROACTIVE MEASURES

In keeping with the "Capturing Environmental Benefits of Civil Works Projects" report by the EAB (April 2020), metrics to capture the benefits of removing or preventing invasive species should be developed to help with the tracking of these proactive measures across business lines.

ABUNDANT OPPORTUNITIES EXIST FOR USACE TO LEVERAGE INTERAGENCY AND INTERJURISIDICTIONAL COORDINATION AND PARTNERSHIPS TO MAXIMIZE EFFORTS TO REDUCE INVASIVE SPECIES RISKS ACROSS THE NATION

To strengthen the ability to collaborate and avoid differences in interpretation, clear messaging on authorities, use of Memorandums of Agreement, interagency agreements, etc. is needed. Without clear messaging, inconsistencies between each District, Division, and HQ office of counsel may stifle the ability to use authorities to coordinate and collaborate amongst federal, state, and tribal agencies and local partners.

DEVELOP COLLABORATIVE EFFORTS FOR INVASIVE SPECIES PREVENTION BEYOND PROJECT BOUNDARIES.

The ability to expand beyond the project boundaries is important to protect the investment of USACE actions (prevention from spread from upstream locations). While new authorities may be required for USACE to work directly with private landowners, mechanisms to work with private landowners readily exist in many state agencies (natural resources, agriculture, etc.) and collaborative agreements with those agencies could be explored to further leverage federal funding. One respondent to the survey noted a "Federal Land Management Roundtable" that was effective in the past:

> *"For several years, a Federal Land Management Roundtable was held to coordinate activities across major federal land managers such as the Corps, Dept. of Interior, USDA, etc. Agency heads/senior leaders attended and were briefed on hot topics and key collaboration opportunities. Successes were achieved. DOI's Service First initiative was of great interest whereby co-located organizations such as adjoining Forest Service and Park Service lands worked to combine resources for tasks like boundary maintenance, shared visitor centers, etc. to maximize the efficiency of staff and resources. Attempting to interject USACE authorities and funding mechanisms was and remains challenging, yet there are many instances where Corps-managed lands adjoin those of other agencies. Even if funds cannot be "comingled", coordinated efforts to treat invasive species, share IS information and resources, etc. would improve management. This type of coordination is being done with the new boat inspection stations in the Pacific NW, and inspections across the US. On operational lands, there are always challenges with enforcement authority – a mix of USACE park rangers/Commanders, local sheriff and police officers, state game and fish, USFWS, SHIPOs, etc."*

Opportunities exist for USACE to collaborate with funds together with states, local government, nonprofit organizations, industry, and other federal agencies to capitalize on taking a coordinated effort for prevention, detection, and response activities. Opportunities for leveraging funds are abundant but may require some "outside the box" creative thinking. The following are suggestions for pursuing collaboration and coordination:

- Assess, view, and act on invasive species through a regional approach, not owner by owner or property by property. Strategies can become actionable through MOUs and trying to establish MOA or partnerships etc.

- Use authorities to leverage funding for staff time for collaboration. This includes some work on invasive species that impact Threatened and Endangered species.

- More explicitly considering the ability to collaborate in the waterways of the nation act as a conduit for the movement of all aquatic invasive species. With 900 harbors, 500 reservoirs, 75 hydropower operations and 12000 miles of waterways there are numerous opportunities to engage other federal and state agencies and NGO's on a multitude of activities.
- Coordinate with U.S. Department of Agriculture and Department of Interior agencies to establish exotic plant and animal management programs on USACE lands with the goal of reducing prevalent exotic species through BMP's, herbicide treatments, and preventative practices.

- Extend USDA's current Animal and Plant Health Inspection Services (APHIS) program, if proven effective, to eliminate or greatly reduce feral swine numbers in target areas on USACE lands where feral swine are present.

- Capitalize on the expertise of the U.S. Forest Service staff to collaborate with USACE to manage timber stands and grasslands and reduce invasion risk from exotic insects and plants.

DEVELOP FUNDING MECHANISMS TO SUPPORT COLLABORATION AND COORDINATION AND PROVIDE FOR SUSTAINABLE PROGRAMMING FOR ADDRESSING INVASIVE SPECIES ISSUES

Funding for invasive species programming was a consistent comment in the responses to the survey from staff. While the legal authorities are present, funding is not always provided or may not be provided at the required level to achieve program goals. Even with the numerous USACE authorities that address invasive species, funding is not always included in administration's budget on an annual basis. Congressional support has provided funds for some activities, but these funds present challenges when provided late in the fiscal year. Strategic planning and priority setting could assist in the ability to quickly use funds that become available. Outreach and strategic coordination with partners to assist in developing the need and strategies for use of USACE funds may help with support for future funding. A shared vision can be more compelling than single entity programming.

EXPAND INVASIVE SPEICIES RESEARCH COLLABORATION TO OTHER STATE AND FEDERAL LAND AND WATER MANAGEMENT AGENCIES.

In 1958, the Aquatic Plant Control section of the Harbors and Rivers Act identified ERDC as the lead for research on this topic for the nation. Expert ERDC staff serve on key national and international committees for navigation, land management, etc. related to invasive species. The respect for the work is documented by examples from the Great Lakes region where ERDC resources are frequently leveraged for successful outcomes. Long established interagency/state/NGO partnering effort and prioritization of invasive species and funding from the Great Lakes Restoration Initiative has further advanced and institutionalized interagency cooperation.

DEVELOP A STRATEGIG FRAMEWORK FOR RESEARCH INVESTMENT FOR THE HIGHEST PRIORITY NEEDS FOR INVASIVE SPECES PREVENTION, DETECTION, AND CONTROL

There is no question that the United States would benefit from USACE aligning collaboration for research and development on invasive species issues with other entities. In many cases, this requires the development of a common research platform for a species or pathway. A concerted effort has been

made to coordinate invasive species at ERDC with the Bureau of Reclamation. Strong consideration should be given to expanding this type of partnership with other agencies such as USFWS, USGS, NPS, USFS, etc. Through USACE involvement of the Cooperative Ecosystem Studies Units, districts and divisions can access universities and related organizations to perform research on desired ecosystem management topics. This provides opportunities to collaborate and extend invasive species research in a cost-effective manner, but an overall plan is required to assist in those efforts.

Gaps in knowledge limit the ability for timely and effective management responses to invasive species. Several specific information needs were identified by staff, including:

- Human dimensions work to address negative views of pesticide use, especially herbicides to control invasive species.
- Lack of knowledge on toxicology for treatment and understanding on what the data represents.
- Better techniques for zebra/quagga mussel control.
- Methods for controlling invasive perennial grasses (Ravenna grass) without damaging native grasses.
- Better understanding of impacts (positive and negative) of saltcedar leaf beetles on ecology of Threatened and Endangered birds, riparian species in general, and potential long-term effects.
- Evaluation of how suites of invasive species affect, cumulatively or synergistically, the function of ecosystems, and how then to manage those ecosystems for certain broad or narrow goals.
- Risk assessments to predict what species are likely to become invaders (noted also in the earlier section as an important tool)
- Species information and eradication methods for new invaders.

PROVIDE GUIDANCE FOR DEVELOPMENT AND REVIEW OF RESEARCH STATEMENTS OF NEEDS FOR INVASIVE SPECIES

Respondents to the survey and partners noted that ERDC research is highly valued within USACE and with external partners. Numerous Statements of Need (SON) for invasive species research under the Civil Works Research and Development programs are submitted to the Environmental Research Area Review Group (ERARG) annually, but resources limit the program to funding only a few. The need and priority for invasive species research may require additional clarification to guide the research area review groups in the process for determining funding for statements of needs. In addition, further training may need to be provided to staff who are developing SONs that adequately contextualize the importance of invasive species research to address problems that will be costly to avoid in the future if not addressed. The invasive species ecological risk assessments noted above would also assist in this process.

SUPPORT AND DEVELOP CONSISTENT FUNDING OPPORTUNITIES FOR INVASIVE SPECIES RESEARCH

Funding for invasive species research was noted as a challenge to strategic programming. Inconsistent funding hampers the development of a strategic research program that meets the needs for invasive species prevention, detection, and management. ERDC has 2 research programs that include aquatic invasive species (Aquatic Plant Control Research Program (APCRP) and Aquatic Nuisance Species Research Program) that receive limited and inconsistent annual funding. Neither of these programs address the many terrestrial invasive species that USACE must address on project lands. There are capabilities at ERDC to research areas such as biological controls. Further, ERDC has the capacity to

expand research and development for additional needs and access to high performance computing to predict invasion pathways.

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Prioritization and Messaging for Prevention of Invasive Species

1) Create clear messaging from leadership levels and communicated throughout the chain that invasive species issues are a priority for planning and operations and are considered in as part of the Environmental Operating Principles. Leadership throughout USACE must embrace these responsibilities as integral to all aspects of USACE business. Direction and guidance from Headquarters is required to ensure that all Divisions act in a concerted manner to prevent the establishment and spread of invasive species.

2) New leaders should be provided information on the authorities and role of USACE as a national leader on invasive species, similar to the training on Environmental Operating Principles, as they take command.

3) Use and develop when needed invasive species ecological risk assessments to inform preventative actions and risk assessment in planning projects.

Training and Awareness for Prevention and Response

4) *"Manage the front line"* - Train staff for identification and response actions and the ability to access resources as it is needed to respond. Long-term management problems can be avoided through early detection and rapid response eradication actions if front line staff are trained and empowered to act.

Action and Consistency for Success

5) Develop and implement a process for quicker response actions when the costs to treat are low and a successful outcome or eradication is achievable. Federal agency coordination is possible, and partners may be able to assist to overcome some of the bureaucratic burden that would preclude action.

6) Address inconsistencies in interpretation of authorities and MOAs with invasive species management and the ability to conduct management (e.g. using firearms when necessary) on project lands.

7) Explore options for early detection and rapid response funding as a matter of priority. For example, the U.S. Forest Service Response to fires could serve as a potential model in combination with a mutual aid agreement with other federal and state agencies in proximity of the infestation.

Incorporate Invasive Species Across Business Lines

8) Include "prevention of invasive species" as a stated purpose for ecosystem restoration and environmental stewardship business lines and include invasive species management for all

business lines to encourage proactive considerations rather than forcing reprioritization of available funds late in a fiscal year.

9) Management decisions regarding annual budgets for invasive species management should be addressed at the appropriate level, but with flexibility to implement actions.

10) Develop metrics to support benefits of proactive measures to prevent invasive species introduction or spread.

Strategic Planning to Support Partnerships and Collaboration

11) Continue support of and require participation in the Invasive Species Leadership Team (ISLT). This team is critical to USACE's success in addressing invasive species and serves a critical roll in collaboration with other entities.

12) Charge the ISLT to develop a strategic plan for the implementation of the invasive species program to achieve, to the maximum extent practicable, a substantive annual net reduction of invasive species populations or infested acreage on land or water managed by the USACE (per the Dingell Act 2019). As noted in the Act, require strong collaboration with state agencies for development of the plan and to leverage resources.

13) Emphasize inter- and intra-agency coordination and collaboration by supporting participation of the Invasive Species Leadership Team and with external collaborating bodies such as NISC, ANSTF, and Regional Panels. Leadership for USACE can support staff in their participation on regional and national groups and direct them to do so with a strong and intentional presence.

14) Establish a priority to support decision support tools for data collection, spatial analysis, risk analysis, etc. with other federal agencies to capitalize on expertise and cost efficiencies of scale.

15) Support and empower programs like state-led response programs, rather than create a new system. Support and encourage district level engagement with state and local agencies for alignment with priority actions and to leverage funding opportunities. This would include conversations of how to implement partnerships. Note that USACE does not always have to lead.

Address Knowledge Gaps through Applied Research

16) With partner input, develop a strategic framework for research investment for the highest priority needs for invasive species prevention, detection, and management.

17) Provide guidance for development and review of Statement of Need (SON) documents to assure invasive species issues are described in the broader context of the ecosystem and economic impact and to provide adequate consideration of those projects when compared with others.

18) Support and develop consistent funding opportunities to capitalize on valuable assets at ERDC and in collaboration with other research partners to assure progress through investments in the strategic framework for research.

Anticipated Outcomes from Implemented Recommendations

With the implementation of these recommendations, USACE could anticipate reduced threats to ecosystems and avoid future costs to management on USACE project lands. Invasive species prevention, detection, and management will be recognized as a significant part of all projects and as an accepted cost for operations and maintenance. Lastly, strategic prioritization of research on invasive species will allow for enhanced and reduced costs for invasive species management.

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Appendix A

Details for Federal Agency Coordination on Invasive Species

In 1990, Congress passed the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) to establish a national program to prevent the introduction and control the spread of introduced ANS. This legislation was reauthorized and amended in 1996 by the National Invasive Species Act (NISA). The Aquatic Nuisance Species Task Force (ANSTF) is an interagency committee established by NANPCA that is to develop and implement a program for waters of the United States that:

- Prevents the introduction and dispersal of ANS;
- Monitors, controls, and studies ANS;
- Conducts research on methods to monitor, manage, control, and/or eradicate such species;
- Coordinates ANS programs and activities of ANSTF members and affected state agencies; and
- Educates and informs the general public program stakeholders about the prevention, management, and control of these species (ANSTF 2012).

The ANSTF is co-chaired by USFWS and NOAA, and consists of 13 Federal agency representatives and 13 ex-officio representatives (ANSTF 2012). Members of the ANSTF focus their work on ANS issues of national concern that require or could benefit from collaborative solutions. At the regional scale, Section 1203 of NANPCA created Regional Panels to identify priorities, coordinate ANS program activities, and advise public and private interests on control efforts in their region. USACE has a role in actively participating on each of the Regional Panels.

In addition to the ANSTF, there is also the National Invasive Species Council (NISC) (established by Executive Order 13112 as amended) that includes **both** terrestrial and aquatic species. NISC is co-chaired by the Secretaries of Agriculture, Commerce, and the Interior and includes member departments and their agencies. The Executive Order directs the Secretary of the Interior to establish an Invasive Species Advisory Committee (ISAC) composed of non-Federal experts and stakeholders to provide advice and recommendations to NISC on invasive-species-related issues. NISC has specific responsibilities including promoting action at state, tribal, local, and ecosystem levels; identifying recommendations for international cooperation; facilitating a coordinated network on invasive species; and developing guidance on invasive species for Federal agencies to use in implementing NEPA. NISC is also responsible for preparing a National Invasive Species Management Plan, which directs Federal efforts to prevent, control, and minimize invasive species and their impacts (ANSTF 2012).

Executive Order 13751 issued in December 2016 amended Executive Order 13112 and further emphasized the importance of federal action for invasive species prevention. The 2016 Executive Order directed actions towards invasive species to continue as identified previously, expanded the membership of the National Invasive Species Council and the Invasive Species Advisory Committee and brought in aspects of human and environmental health, climate change, technological innovation and directed “coordinated, cost-efficient Federal action”.

Lastly, in 2019, the John D. Dingell, Jr. Conservation, Management, and Recreation Act called for federal agencies including USACE to develop a strategic plan for the implementation of the invasive species program to achieve, to the maximum extent practicable, a substantive annual net reduction of invasive species populations or infested acreage on land or water managed by the federal agency. This Act directs USACE to work with state governments and in consultation with tribal nations to develop and implement the strategic plan.