



## Environment and Natural Resources Trust Fund (ENRTF) M.L. 2017 LCCMR Work Plan

**Date of Submission:** May 31, 2017

**Date of Next Status Update Report:** December 1, 2017

**Date of Work Plan Approval:** 06/07/2017

**Project Completion Date:** June 30, 2020

**Does this submission include an amendment request?** \_\_

**PROJECT TITLE:** Rearing Native Mussels for Reintroduction and Expanding Water Quality Awareness

**Project Manager:** Seth Stapleton

**Organization:** Minnesota Zoo

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**Location:** Minnesota Zoo

**Total ENRTF Project Budget:**

**ENRTF Appropriation:** \$591,000

**Amount Spent:** \$0

**Balance:** \$591,000

**Legal Citation:** M.L. 2017, Chp. 96, Sec. 2, Subd. 04c

**Appropriation Language:**

\$591,000 the first year is from the trust fund to the Minnesota Zoological Garden in cooperation with the Department of Natural Resources to accelerate the reintroduction of native mussels into Minnesota rivers and streams through expanded mussel rearing, research, and statewide educational activities promoting mussel conservation and water quality. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

## **I. PROJECT TITLE: Rearing native mussels and building water quality awareness**

### **II. PROJECT STATEMENT:**

Native mussels play a critical role in keeping our State's streams and rivers clean and in creating healthy fish habitat. Today, however, freshwater mussels are the most at-risk group of species in the United States. Pollution, dams, and historical harvest for the button industry are among the factors that have taken a heavy toll on mussels. Populations have been lost or numbers greatly diminished across many Minnesota water bodies, and about half of the mussel species found in the state are currently considered imperiled.

The Minnesota Zoo recently began a collaboration with the Minnesota DNR to help reverse this trend. Zoo staff are nurturing juvenile mussels originally produced at DNR facilities in the Zoo's main lake until they are large enough to be reintroduced into selected Minnesota waterways. However, current Zoo resources are insufficient to rear the thousands of mussels needed to effectively re-establish native mussel populations.

This ENRTF Project will allow the Zoo to use its unique site and expertise in aquatic systems and husbandry to expand the mussel-rearing program and optimize propagation techniques, accelerating reintroduction and increasing the likelihood of success. The ultimate goal of this project is to reestablish threatened and endangered mussel populations in Minnesota to provide clean waterways, improve ecosystem health, and expand fish habitat. The Zoo also will use its education expertise to build awareness in students across Minnesota about the relationship between native mussels and water quality, encouraging actions to support mussel conservation and improve water quality in state waterways.

The specific objectives of the project are:

- 1) To expand the Zoo's capacity to rear 10,000 reintroduction-ready individuals from seven threatened and endangered mussel species—mucket, elktoe, monkeyface, fluted shell, Higgins' eye, snuffbox, and winged mapleleaf;
- 2) To advance the science of mussel husbandry by evaluating key factors that promote mussel survivorship and growth, thereby informing propagation and expediting reintroduction efforts; and
- 3) To train 6,000 students as ambassadors for native mussels and clean waterways, ultimately reaching up to 60,000 people through student digital media campaigns including online videos, websites, and social media.

### **III. OVERALL PROJECT STATUS UPDATES:**

**Project Status as of December 1, 2017:**

**Project Status as of June 1, 2018:**

**Project Status as of December 1, 2018:**

**Project Status as of June 1, 2019:**

**Project Status as of December 1, 2019:**

**Project Status as of June 1, 2020:**

**Overall Project Outcomes and Results:**

#### IV. PROJECT ACTIVITIES AND OUTCOMES:

##### ACTIVITY 1: Expand capacity to rear mussels on-site at the Zoo for reintroduction

###### Description:

The Zoo will increase its capacity to rear mussels from 1,000 to 10,000 individuals, focusing on four state threatened and three federally endangered species. Using juveniles provided by the DNR, mussels will be reared in specialized systems at the Zoo for 2 – 3 years, until they are large enough to withstand most predation in the wild. Mussels then will be strategically released by the DNR, with Zoo staff participation, into pre-determined locations including the Cedar River, the Canon River system, and the Mississippi River. To achieve the desired outcomes, the Minnesota Zoo must expand and improve its rearing systems and dedicate increased staffing to the project.

The existing mussel rearing project at the Zoo implements standard practices for operation of three systems: an upwelling bucket system, a pan system, and an exhibit system. The systems differ in how they recreate the natural environment and can be modified to suit different species based on their specific life history requirements.

We will construct replicates of the upwelling bucket and pan systems and may employ alternative systems (e.g., floating baskets), enabling the Zoo to increase capacity to house 10,000 mussels on-site. We also will modify existing systems to improve efficiency and better replicate the natural environment (i.e., increasing substrate variety with the exhibit system). Additional upwelling bucket systems will require regular maintenance (i.e., at least weekly during spring, summer and fall), including cleaning and scrubbing buckets and screens and rinsing mud from the mussels. Pan systems also require regular cleaning and maintenance of the pans, pump housings, and mussels. We will monitor water flow and water quality for all systems to ensure that conditions are suitable for captive reared mussels. During the growing season, we will also monitor survival on a weekly basis (during cleaning and maintenance operations) and record and remove any mortalities. We will measure a sample of all mussel species (including endangered species not covered under Activity 2) on a monthly basis to estimate growth. Maintenance and monitoring will require a significant increase in staff time, given the projected 10-fold increase in the Zoo's rearing capacity.

Support from the ENRTF will facilitate the expansion of mussel rearing capacity at the Zoo by providing the necessary funding for dedicated staff time and associated supplies and equipment.

###### Summary Budget Information for Activity 1:

ENRTF Budget: \$ 322,838

Amount Spent: \$ 0

Balance: \$ 322,838

Outcome	Completion Date
1. Staffing is in place to expand rearing capacity to 10,000 juvenile mussels	10/15/2017
2. Systems are in place to expand rearing capacity to 10,000 juvenile mussels	11/30/2018
3. Up to 1,000 mussels per species are reared annually to sizes needed for reintroduction and provided to DNR for release	6/30/2020

Activity 1 Status as of December 1, 2017:

Activity 1 Status as of June 1, 2018:

Activity 1 Status as of December 1, 2018:

**Activity 1 Status as of June 1, 2019:**

**Activity 1 Status as of December 1, 2019:**

**Activity 1 Status as of June 1, 2020:**

**Final Report Summary:**

**ACTIVITY 2: Conduct research to optimize rearing protocols**

**Description:**

Little is known about propagation techniques that best promote growth and survival in juvenile mussels. In collaboration with the Minnesota Department of Natural Resources, the Zoo has identified several key research questions that will inform mussel propagation and improve rearing protocols. Staff will systematically vary factors including over-wintering water temperatures, substrate (presence and type), and diet (e.g., food type and availability at different size classes) to understand their impacts on growth and survival. The Zoo will also examine the utility of alternative propagation systems (e.g., floating baskets). Since species' responses to treatments may vary, we will conduct research with up to four mussel species, as space and sample sizes permit. A subset of mussels (excluding the federally endangered species) will be used with these experiments.

Mussels will be individually marked or housed (to the extent possible) such that individual growth and survivorship can be monitored and compared across treatments. Marking individuals will provide for the most robust analyses and strongest inferences, and marking can facilitate tracking individual survival and growth after reintroduction. During the spring, summer, and fall, mortalities will be recorded weekly to monitor survivorship, and individuals will be measured monthly to estimate growth.

Funding from ENRTF will provide personnel and material support for implementing this research program. The construction of a new research and rearing pod will provide the controlled environment necessary for conducting this work and will contribute to the expansion of the Zoo's rearing capacity.

**Summary Budget Information for Activity 2:**

**ENRTF Budget: \$ 179,112**  
**Amount Spent: \$ 0**  
**Balance: \$ 179,112**

<b>Outcome</b>	<b>Completion Date</b>
<b>1.</b> A new mussel pod is installed on Zoo site, increasing capacity to rear mussels in a controlled research environment.	11/30/2018
<b>2.</b> Experiments assessing factors that may impact mussel growth and survival are initiated.	5/15/2019
<b>2.</b> Mussel performance (growth and survival) is compared under different experimental treatments using statistical analysis.	5/1/2020
<b>3.</b> Rearing protocols are updated to reflect propagation protocols that optimize growth and survivorship of juvenile mussels.	6/30/2020

**Activity 2 Status as of December 1, 2017:**

**Activity 2 Status as of June 1, 2018:**

**Activity 2 Status as of December 1, 2018:**

**Activity 2 Status as of June 1, 2019:**

**Activity 2 Status as of December 1, 2019:**

**Activity 2 Status as of June 1, 2020:**

**Final Report Summary:**

**ACTIVITY 3: “Show Us Your Mussels” Digital Media Challenge for High School Students**

**Description:**

The Zoo will use its educational outreach expertise to recruit schools throughout Minnesota to participate in a project aimed at increasing Minnesotan’s knowledge of the importance of native mussels to water quality and encouraging actions to improve water quality in the state’s waterways.

The Zoo will develop materials and resources that align with Minnesota K-12 Academic Standards in Science (*interdependence among living systems* and *human interactions with living systems*) and in English Language Arts (*media literacy*). Resources will stress the critical role that native mussels play in maintaining aquatic ecosystem health and illustrate the positive actions and simple behavioral changes community members can make to benefit water quality. Materials will be provided to teachers from schools recruited from around the state to participate in the digital media challenge.

With guidance and support from the Zoo, students will further research local water quality issues and the role native mussels play in improving water quality. They will develop and deliver digital media campaigns — such as online videos, websites, and social media outreach — promoting mussel conservation, water quality awareness, and personal or community action. As a component of the challenge, students will be required to track and record the reach and impact of their campaigns, such as number of visits to a website over a period of time or number of views, ‘likes,’ or retweets of social media posts. Schools will be challenged to reach a large audience, and the five schools’ campaigns with the largest impact per year (based on the number of people reached) will be recognized with a free field trip to the Zoo. During this trip, students will visit our mussel rearing exhibit and have an opportunity to directly interact with the animal care and conservation staff leading this project. One grand prize winner with the best campaign will earn the opportunity to participate in behind-the-scenes, hands-on mussel conservation work with project staff at the Zoo.

The Zoo will showcase winning projects on its website and will further promote mussel conservation through Zoo media-based educational outreach.

**Summary Budget Information for Activity 3:**

**ENRTF Budget:** \$ 89,050  
**Amount Spent:** \$ 0  
**Balance:** \$ 89,050

<b>Outcome</b>	<b>Completion Date</b>
1. 20 schools / 2,000 students recruited to create digital media projects.	12/31/2017

2. 20,000 community members reached by student digital media projects.	3/31/2018
3. 500 students visit the Zoo to view and participate in on-site mussel conservation work.	6/10/2018
4. 20 additional schools / 2,000 additional students recruited to create digital media projects.	12/31/2018
5. 20,000 additional community members reached by student digital media projects.	3/31/2019
6. 500 additional students visit the Zoo to view and participate in on-site mussel conservation work.	6/10/2019
7. 20 additional schools / 2,000 additional students recruited to create digital media projects (for a total of 60 schools / 6,000 students over the course of the project).	12/31/2019
8. 20,000 additional community members reached by student digital media projects (for a total of 60,000 community members reached over the course of the project).	3/31/2020
9. 500 additional students visit the Zoo to view and participate in on-site mussel conservation work (for a total of 1,500 students over the course of the project).	6/10/2020

**Activity 3 Status as of December 1, 2017:**

**Activity 3 Status as of June 1, 2018:**

**Activity 3 Status as of December 1, 2018:**

**Activity 3 Status as of June 1, 2019:**

**Activity 3 Status as of December 1, 2019:**

**Activity 3 Status as of June 1, 2020:**

**Final Report Summary:**

## **V. DISSEMINATION:**

### **Description:**

Updates on project activities and progress will be shared with partners via annual reports. Information about the program will be disseminated to the general public by the Zoo's marketing and education departments as much as possible. These communications may include public presentations by staff and sharing information on the Minnesota Zoo's web page and social media outlets. In addition, Zoo staff and volunteers will be instructed in speaking with the public about mussels, the Zoo's rearing program, and the benefits of mussels for a healthy ecosystem and improved water quality. Results of the mussel propagation research will be submitted for publication in peer-reviewed scientific journals and presented at professional conferences.

**Status as of:** December 1, 2017

**Status as of:** June 1, 2018

**Status as of:** December 1, 2018

**Status as of:** June 1, 2019

**Status as of:** December 1, 2019

**Status as of:** June 1, 2020

**Final Report Summary:**

**VI. PROJECT BUDGET SUMMARY:**

**A. Preliminary ENRTF Budget Overview:**

**\*This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.**

<b>Budget Category</b>	<b>\$ Amount</b>	<b>Overview Explanation</b>
Personnel:	\$342,825	Project Manager / Research Scientist Supervisor at 0.2 FTE for 3 years; Research Analyst Intermediate (or similar classification) at 1.0 FTE for 3 years; Construction Project Manager for rearing pod at 0.1 FTE for 4 months; Education Project Coordinator at 0.1 FTE for 3 years (currently supported by soft money); Graphic Designer for education campaigns at 0.1 FTE for 2 months; Web Developer for exhibition of digital media campaigns at 0.1 FTE for 2.5 months; Education Project Evaluator at 0.1 FTE for 3 months
Professional/Technical/Service Contracts:	\$15,000	Teacher contracts for development of school materials (5 teachers x \$1,000 ea x 3 years). Selection through a competitive application process.
Equipment/Tools/Supplies:	\$58,675	Mussel rearing supplies and equipment: Estimated total of \$40,000 for materials associated with the source water supply, pan systems, upweller systems, floating rack, basket systems, and lake aerator. Lab supplies for in-house water quality testing: Estimated total of \$3,600 for supplies to fecal levels, nutrients, and water chemistry. Research to evaluate rearing methods: Estimated total of \$12,075 for materials to individually marking mussels, dissecting microscope, and other supplies.
Capital Expenditures over \$5,000:	\$130,000	Mussel research and rearing facility, including structure design and permits, site preparation, concrete slab and footings, building, insulation, water and sewer hook-ups, electrical hook-ups, and HVAC installation (contractors). Facility

		electric and design and installation of internal mussel rearing systems completed by MN Zoo staff.
Travel Expenses in MN:	\$1,000	Mileage and meals for travel to DNR facilities in Lake City and reintroduction sites around the state. Reimbursement rates as allotted per the State of Minnesota travel regulations.
Other:	\$43,500	Promotional post card printing and mailing to recruit teachers for student digital media campaign (estimated \$15,000). Transportation for participating students to MN Zoo (estimated \$22,500). Zoo-based educational outreach materials (estimated \$6,000).
<b>TOTAL ENRTF BUDGET:</b>	<b>\$591,000</b>	

**Explanation of Use of Classified Staff:**

Most staff positions that will be supported by these ENRTF funds are classified. Current personnel have the necessary expertise to successfully implement Activities 1, 2, and 3, but without the support of the ENRTF funding, they would not have the support and ability to work on this project and instead would need to focus on other position responsibilities. Incorporating the existing expertise from across departments at the Zoo will be essential for the completion of this project.

**Explanation of Capital Expenditures Greater Than \$5,000:**

The mussel rearing program at the Minnesota Zoo requires indoor laboratory space to maintain a controlled environment suitable for experimentation with propagation techniques. In the research and rearing pod, we will manipulate the conditions under which a subset of mussels are reared to evaluate treatments that may increase juvenile mussel growth and improve survival. In addition, this building will house equipment and provide additional work space that will facilitate the expansion of the Zoo's mussel rearing program. We have budgeted \$130,000 for the construction of this facility. We project that the building's lifespan will extend beyond the 3-year duration of this grant, enabling us to continue partnering with the MN DNR to propagate mussels on site for eventual release into Minnesota waterways. We will seek funding from federal, state, and non-governmental sources to continue this program beyond 2020.

**Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 4.0**

**Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 0.3**

**B. Other Funds:**

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
<b>Non-state</b>			
Minnesota Zoo Foundation	\$30,000	\$10,000	\$10,000 received in FY17. \$20,000 budgeted for FY18. For supplies and equipment, in support of the Zoo's current mussel rearing activities.
<b>State</b>			
<b>TOTAL OTHER FUNDS:</b>	<b>\$30,000</b>	<b>\$10,000</b>	



## VII. PROJECT STRATEGY:

### A. Project Partners:

The Minnesota Zoo would be the sole recipient of ENRTF funds under this proposal. Zoo aquariums, life support, and **conservation** staff will plan and implement Activities 1 and 2. Zoo education staff will plan and implement Activity 3. The Minnesota DNR, a primary partner for Activities 1 and 2, recently received ENRTF funding (beginning in FY17) supporting complementary mussel conservation efforts.

### Partners receiving ENRTF funding

- Teachers (5), Contracts, \$15,000: Development of school materials in support of Activity 3.

### Partners NOT receiving ENRTF funding

- Mike Davis, Bernard Sietman, Madeline Pletta, Shelby Marr, and Zeb Secrist; Minnesota DNR. DNR will be the primary partner for Activity 1, providing juvenile mussels for rearing at Zoo facilities and returning mussels to Minnesota waterways after they reach suitable size. The DNR is also a primary collaborator for Activity 2, which will investigate propagation techniques that promote high growth rates and improved survival. The DNR provides expertise and serves as a resource for the captive rearing of mussels.
- U.S. Fish and Wildlife Service, Tamara Smith and Phil Delphey: Permitting under the US Endangered Species Act, planning for reintroduction and monitoring
- U.S. Fish and Wildlife Service-Genoa National Fish Hatchery, Nathan Eckert: mussel captive rearing resource, provision of some juvenile mussels
- National Park Service, Byron Karns and Alison Holdhusen: Pre- and post-release monitoring in the St. Croix and Mississippi Rivers
- U.S. Army Corps of Engineers, Dan Kelner: Planning for monitoring the reintroduction of mussel species that are listed under the Endangered Species Act
- Teachers at selected schools around the state: Assistance with student projects proposed in Activity 3.

### B. Project Impact and Long-term Strategy:

This proposal builds upon the DNR's ongoing research and propagation efforts and is part of a long-term, multi-partner effort to reintroduce threatened and endangered mussels across the upper Midwest. The ultimate goal of this work is to restore healthy mussel populations, thereby enhancing ecosystem health and improving water quality. Given the massive filtration rates performed by healthy mussel communities and mussels' abilities to remove harmful bacteria and contaminants from the water, it is reasonable to expect that restoring Minnesota's native mussel populations will play an important part in achieving the state's clean water goals. The combined efforts of the Zoo, the DNR, and other partners also will advance the recovery of state and federally listed mussel species in Minnesota. In addition, public awareness about mussel conservation and actions to improve water quality will be increased by our activities.

Because successful restoration efforts require many years, we anticipate that the Zoo's mussel rearing activities will need to continue beyond the scope of this grant proposal. As such, the Zoo may submit a future proposal to fund this work and will continue to explore non-ENRTF funding sources for this project.

### C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
Minnesota's Clean Water, Land, and Legacy Amendment, Arts and Cultural Heritage Fund appropriation to the Minnesota Zoo. Purchase of equipment and supplies for initiating mussel rearing program. Outfitting the Zoo's existing cabin on the main lake for rearing a small number of mussels.	FY16	\$10,000

Donations managed by the Minnesota Zoo Foundation. Purchase of equipment and supplies for initiating mussel rearing program, outfitting the Zoo's existing cabin on the main lake for rearing a small number of mussels.	FY16	\$15,000
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**VIII. REPORTING REQUIREMENTS:**

- The project is for 3 years, will begin on 07/01/17, and end on 06/30/20.
- Periodic project status update reports will be submitted December 1<sup>st</sup> and June 1<sup>st</sup> of each year.
- A final report and associated products will be submitted between June 30 and August 15, 2020.

**IX. VISUAL COMPONENT or MAP(S):**

Please see attached the attached graphic.

**X. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS: N/A**

**Environment and Natural Resources Trust Fund**  
**M.L. 2017 Project Budget**



**Project Title:** Rearing Native Mussels for Reintroduction and Expanding Water Quality Awareness

**Legal Citation:** M.L. 2017, Chp. 96, Sec. 2, Subd. 04c

**Project Manager:** Seth Stapleton

**Organization:** Minnesota Zoo

**M.L. 2017 ENRTF Appropriation:** \$591,000

**Project Length and Completion Date:** 3 Years, June 30, 2020

**Date of Report:** October 21, 2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Expand capacity to rear mussels on-site at the Zoo for reintroduction			Conduct research to optimize rearing protocols			"Show Us Your Mussels" Digital Media Challenge for High School Students				
Personnel (Wages and Benefits) - Overall	\$275,238	\$0	\$275,238	\$37,037	\$0	\$37,037	\$30,550	\$0	\$30,550	\$342,825	\$342,825
Project Manager / Research Scientist Supervisor (1 person, 72% salary / 28% benefits), 0.2 FTE for 3 years - \$64,075											
Research Analyst Intermediate or similar classification (tbd; 1 person, 64% salary / 36% benefits), 1.0 FTE for 3 years - \$243,200											
Construction Project Manager for rearing pod (1 person, 72% salary/28% benefits), 0.1 FTE for 4 months - \$5,000											
Education Project Coordinator (1 person, 72% salary/28% benefits; portion of position to be covered by ENRTF funds is currently supported by soft money), 0.1 FTE for 3 years - \$24,000											
Graphic Designer for education campaigns (1 person, 72% salary/28% benefits), 0.1 FTE for 2 months - \$1,100											
Web Developer for exhibition of digital media campaigns (1 person, 72% salary/28% benefits), 0.1 FTE for 2.5 months - \$2,750											
Education Project Evaluator (1 person, 72% salary/28% benefits), 0.1 FTE for 3 months - \$2,700											
Professional/Technical/Service Contracts											

Teacher contracts for school materials development (5 teachers x \$1000 ea x 3 years). Teachers selected through a competitive application process, with the objective of expanding annually to reach new communities. Curriculum development for this project is beyond the scope of their existing contracts and will occur during summer when teachers are off-contract.							\$15,000	\$0	\$15,000	\$15,000	\$15,000
<b>Equipment/Tools/Supplies</b>											
Mussel rearing systems supplies & equipment, estimated costs. Source water supply (Estimated total: \$24,000 for drum filter; piping, valves, fittings, pump, pump housing, air blower, screening, adapters, storage tank, and other supplies). Pan systems (Estimated total: \$4,900 for bulkheads, pipes, fittings, filter socks, pumps, sumps, pans and other supplies). Upweller system, ~350 gallons (Estimated total \$5,200 for bulkheads, pipes, fittings, chiller, pumps, sumps, trough, and other supplies). Floating rack, 10 spots (Estimated total \$4,500 for floating dock, bulk metals, insulation, fittings, valves, tubing and other supplies). Basket systems (Estimated total \$900 for baskets, sceening and other supplies). Aerator for lake (Estimated total \$3,500).	\$43,000	\$0	\$43,000							\$43,000	\$43,000
Lab supplies for in-house water quality testing of lake water used to rear mussels, estimated costs. Fecal testing supplies (millipore miliflex cassettes and millipore growth ampules): \$2,800. Kits and materials for testing nutrients and water chemistry: \$800.	\$3,600	\$0	\$3,600							\$3,600	\$3,600
Research supplies/equipment, estimated costs. Tagging supplies for individually marking research mussels (PIT tags, PIT tag reader, shellfish tags): \$7,750. Dissecting microscope and associated supplies: \$2,400. Flat bottom boat for lake access: \$600. Scale and miscellaneous tools and supplies: \$1,325.				\$12,075	\$0	\$12,075				\$12,075	\$12,075
<b>Capital Expenditures Over \$5,000</b>											

Mussel research and rearing facility, estimated costs <sup>1</sup> . Structure design and permits (contractor): \$7,000. Site preparation (contractor): \$10,000. Installation of concrete slab with footings (contractor): \$30,000. Morton building (pole barn structure with metal siding), customized for mussel rearing (materials): \$20,000. Spray foam insulation (contractors): \$7,500. Water and sewer hook-ups (contractors): \$27,500. Electrical hook-ups (contractor): \$18,000. Installation of HVAC systems (contractor): \$10,000. Facility electric: MN Zoo staff. Design and installation of internal mussel rearing systems: MN Zoo staff.				\$130,000	\$0	\$130,000				\$130,000	\$130,000
<b>Travel expenses in Minnesota</b>											
Mileage and meals associated with travel from MNZoo in Apple Valley to DNR mussel facility in Lake City (3 trips/year x 3 years) and ~3 trips to reintroduction sites in the state. Reimbursement rates as allotted per the State of Minnesota travel regulations.	\$1,000	\$0	\$1,000							\$1,000	\$1,000
<b>Other</b>											
Promotional post card printing and mailing to recruit teachers to participate in "Show Us Your Mussels" Student Digital Media Campaign (approx. 14,500 post cards x \$.35/piece x 3 years)							\$15,000	\$0	\$15,000	\$15,000	\$15,000
Transportation (bussing) costs for participating schools to attend "Show Us Your Mussels" student event at Minnesota Zoo - \$1500/school x 5 schools x 3 years							\$22,500	\$0	\$22,500	\$22,500	\$22,500
Zoo-based mussel conservation educational outreach, including interpretive signage, displays, and artifacts (\$2,000/year x 3 years)							\$6,000	\$0	\$6,000	\$6,000	\$6,000
<b>COLUMN TOTAL</b>	<b>\$322,838</b>	<b>\$0</b>	<b>\$322,838</b>	<b>\$179,112</b>	<b>\$0</b>	<b>\$179,112</b>	<b>\$89,050</b>	<b>\$0</b>	<b>\$89,050</b>	<b>\$591,000</b>	<b>\$591,000</b>

# REARING NATIVE MUSSELS AND BUILDING WATER QUALITY AWARENESS



The Minnesota DNR collects wild female mussels, harvests larvae and rear them to the juvenile stage.

At the Minnesota Zoo, juveniles are reared for eventual reintroduction. Minnesota DNR reintroduces and monitors mussels in state waterways.

Zoo staff researches techniques to improve survivorship and growth.

The Zoo partners with state high schools to raise awareness for water quality and mussels.

## GOAL

RECOVERED  
MUSSELS  
CLEANER WATER  
HEALTHY FISH  
HABITAT



MINNESOTA ZOO

