



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2014 Work Plan

Date of Report: January 15, 2014
Date of Next Status Update Report: November 26, 2014
Date of Work Plan Approval:
Project Completion Date: June 30, 2017
Does this submission include an amendment request? No

PROJECT TITLE: Biosurveillance and Biocontrol of Emerald Ash Borer – Phase 2

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Location: Statewide

Total ENRTF Project Budget:	ENRTF Appropriation:	\$447,000
	Amount Spent:	\$0
	Balance:	\$447,000

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 04d

Appropriation Language:

\$447,000 the second year is from the trust fund to the commissioner of agriculture in cooperation with the University of Minnesota to continue to monitor ash tree and emerald ash borer populations and expand the biological control implementation for emerald ash borer management. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Biosurveillance and Biocontrol of Emerald Ash Borer – Phase 2

II. PROJECT STATEMENT:

Our project focuses on best management strategy implementation for the emerald ash borer (EAB), one of the most destructive non-native pests in North America. Minnesota has an estimated 1 billion ash trees at risk – more than any other state – and all of our native ash species are susceptible. Loss of our ash trees would result in ecosystem change, financial losses estimated in the hundreds of millions and the possible extinction of many species dependent on ash trees such as the banded ash clearwing moth.

In Michigan and Ohio, EAB infestations have killed 99% of all ash trees within six years after initial infestation resulting in the death of over 50 million ash trees to date. In Minnesota, we have seen very few trees killed by EAB and EAB seems to be spreading more slowly than in Michigan. EAB infestations have been aggressively managed in the Twin Cities and trees at southeast Minnesota biological control sites remain in visibly better condition than surrounding natural stands of infested ash. Still, there are many challenges that we must continue to address. EAB continues to spread. We do not know the full extent of existing infestations and it is too early to determine the long-term efficacy of biological control.

EAB biological control uses parasitoid wasps to reduce EAB populations and is still experimental in practice. However, biological control is the only practical EAB management strategy for natural forest ash and is a component of urban EAB management. We will improve biological control implementation with:

Biosurveillance of EAB: Engage citizen scientist volunteers to monitor EAB populations statewide using a native predatory wasp, the smoky winged beetle bandit. Our goals are to better delimit EAB populations and educate the public about EAB. Additionally, biosurveillance will monitor for similar high risk wood-boring beetles that are not documented in Minnesota such as the European oak borer that threatens our oaks and was detected with biosurveillance in Ontario and picked up on a trap in Michigan.

Track EAB infestation core: Continue monitoring ash health, EAB and EAB biological control agents in the core infested area of the Twin Cities. This study was initiated in 2011 with ENRTF funds and will provide answers about the importance of multiple management activities. This unique long-term study receives attention from national researchers.

Expand biological control implementation: Biological control was initiated in 2010 and biological control agents released at all known infestations. EAB is spreading so new detections are inevitable. The biological control effort will be expanded to address new EAB finds and continue existing site monitoring.

III. PROJECT STATUS UPDATES:

Project Status as of November 26, 2014:

Project Status as of May 29, 2015:

Project Status as of November 30, 2015:

Project Status as of May 31, 2016:

Project Status as of November 30, 2016:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Biosurveillance of EAB

Description:

The smoky winged beetle bandit, *Cerceris fumipennis*, can teach us which species of wood-boring beetles, including EAB, are in an area. This is a form of biosurveillance – using one organism, the beetle bandit wasp, to monitor for another organism - in this case EAB and related beetles. Monitoring beetle bandits in Connecticut yielded the first EAB find in the state. Additionally, beetle bandit biosurveillance will monitor for similar high risk wood-boring beetles that are not documented in Minnesota such as the European oak borer that threatens our oaks and was detected with biosurveillance in Ontario and picked up on a trap in Michigan.

The smoky winged beetle bandit is a native, ground nesting wasp. Females collect wood-boring beetles from wooded and forested areas then bring the beetles back to their nests to feed their young. Beetles from these wasps can be collected with the following methods. Beetle bandit wasps drop beetles they think were attacked by parasitic flies. Consuming parasitized beetles would kill developing beetle bandit wasps. Therefore, the adult wasps abandon suspect beetles outside of their nests. These abandoned beetles can be easily collected. Another way to collect beetles is to net the beetle bandit as it returns to its nest with a beetle. The wasps are docile and do not sting humans. They will immediately drop the beetle then the wasp can be released from the net.

University of Minnesota Extension (Extension) will lead the joint effort with Minnesota Department of Agriculture (MDA) and USDA Forest Service (USFS) to monitor beetle bandit colonies in Minnesota. Citizen scientist volunteers proved in 2013 that they could find beetle bandit colonies in multiple areas of the state. A preferred habit of the ground nesting beetle bandit is minimally maintained baseball fields. The wasps like the sandy soils for nest building and the relatively undisturbed setting. Citizen scientists can be directed to search ball fields in high risk areas and report their finds. See www.myminnesotawoods.umn.edu/cerceris/ for more information. These same citizen scientists will be trained to monitor beetle bandit colonies. Collected beetles will be identified by a taxonomist and data will be entered into a Forest Service database. A Community Program Specialist will coordinate volunteers, process beetle samples and enter data.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 103,200
Amount Spent: \$ 0
Balance: \$ 103,200

Activity Completion Date: 06/10/2017

Outcome	Completion Date	Budget
1. First Detector and other volunteer training and colony monitoring completed	09/30/2016	\$ 95,700
2. Beetles identified and data entered into a Forest Service database	06/10/2017	\$ 7,500

Project Status as of November 26, 2014:

Activity Status as of May 29, 2015:

Activity Status as of November 30, 2015:

Activity Status as of May 31, 2016:

Activity Status as of November 30, 2016:

Final Report Summary:

ACTIVITY 2: Track EAB infestation core

Description:

To track dispersal of EAB and biological control agents, project partners initiated long-term monitoring of ash health, EAB, and EAB biological control agents in the Twin Cities in 2011. This is a large, collaborative project with multiple partners including USDA Forest Service, University of Minnesota, Department of Natural Resources, and the cities of Falcon Heights, Minneapolis, Lauderdale, Roseville, and St. Paul. Three hundred ash trees were selected in the late summer of 2011. The selected trees were in the original EAB infestation area (the core infestation) and the surrounding area up to four kilometers from the core. Each tree is monitored for six years. We collect data on tree size and health. We are using branch sampling methodology to subsample ash trees for evidence of EAB and EAB biological control agents. Two branches per year are removed from each tree each year. A length is cut from each branch then peeled. Detailed information is collected on each EAB gallery, EAB larvae, biological control agent parasitoids, and native parasitoids. All study tree removals are noted in the database. Data collection for this study is coordinated by a Research Scientist 1 at MDA and will be analyzed by Drs. Aukema (U of M) and Venette (USFS).

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 188,300
Amount Spent: \$ 0
Balance: \$ 188,300

Activity Completion Date: 06/10/2017

Outcome	Completion Date	Budget
1. Ash health and sample branches for EAB and biological control agents data collected	03/30/2017	\$ 154,400
2. Data analyzed	06/10/2017	\$ 33,900

Project Status as of November 26, 2014:

Activity Status as of May 29, 2015:

Activity Status as of November 30, 2015:

Activity Status as of May 31, 2016:

Activity Status as of November 30, 2016:

Final Report Summary:

ACTIVITY 3: Expand biological control implementation

Description:

The goal of EAB biological control is to use natural enemies to bring EAB populations into balance and reduce damage. In this case, two larval parasitoid species (wasps that attack EAB larvae under ash bark) and one egg parasitoid species (wasps that attack EAB eggs) have been released in Minnesota. These three species were tested to ensure that they will not negatively impact other species or the environment. USDA rears these biological control agents at a specialized facility and provides them to states with EAB infestations. Biological control implementation is a collaborative effort by local governments and state and federal agencies. MDA coordinates the statewide EAB biological control program. ENRTF funding has enabled Minnesota EAB biological control activities to date.

The larval parasitoid species are *Spathius agrili* and *Tetrastichus planipennisi*. Both species were released 2010 – 2012 in Minnesota. USDA decided in 2013 that they would continue releases of *S. agrili* south of the 40th parallel trying to better synchronize EAB and *S. agrili* lifecycles. Minnesota did not receive *S. agrili* for release in 2013

and there are no plans to release this species again north of the 40th parallel. Releases of *T. planipennisi* continued in 2013 and we anticipate continuing to release this species. We learned from cold tolerance studies of this species in Phase 1 of this project that spring releases are preferable. They allow the most time for multiple generations to reproduce over the summer season so that overwintering populations are sufficiently large to withstand some cold-induced mortality. The egg parasitoid, *Oobius agrili*, was released 2011-2013 and we anticipate continuing to release this species. Over 130,000 wasps were released at 20 sites with confirmed EAB infestations since 2010. *Tetrastichus planipennisi* larvae were recovered on two occasions at Great River Bluffs State Park in southeastern Minnesota in the fall of 2013. These finds confirm that *T. planipennisi* is attacking EAB and reproducing in the field in Minnesota. Also, we know that the parasitoids are dispersing well. These larvae were found approximately 0.5 miles from the nearest release site.

Data are collected for all bioagent releases and recoveries. Ash health and EAB activity are monitored at release sites. These data are maintained in a MDA database and entered into a USDA database annually.

EAB is expected to continue to spread in Minnesota. We plan to expand the EAB biological control effort with new release sites to address EAB spread while continuing to monitor existing release sites. Biosurveillance (Activity 1) will inform biological control. A MDA Research Scientist 1 will expand biological control releases to new EAB finds and monitor existing sites.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 155,500
Amount Spent: \$ 0
Balance: \$ 155,500

Activity Completion Date: 06/10/2017

Outcome	Completion Date	Budget
1. New release sites established and existing sites monitored	10/31/2016	\$ 153,000
2. Data entered into MDA database and channeled into a national database	06/10/2017	\$ 2,500

Project Status as of November 26, 2014:

Activity Status as of May 29, 2015:

Activity Status as of November 30, 2015:

Activity Status as of May 31, 2016:

Activity Status as of November 30, 2016:

Final Report Summary:

V. DISSEMINATION:

Description: We will communicate about the biosurveillance and biocontrol of EAB with the public, land managers, and researchers. The web will be used for communication <http://www.mda.state.mn.us/en/plants/pestmanagement/eab/eabbiocontrol.aspx> and will be updated annually. Communication with the public will be via news media (print, television, and radio) and social media such as Facebook and Twitter. We will communicate updates with land managers at the multi-agency EAB Forum (meets 4 times/year) and in trade publications such as “The Scoop” published by the Minnesota Nursery Landscape Association. Updates and findings will be presented a University of Minnesota seminar, the 2014 Upper Midwest Invasive Species Conference, and other meetings (LCCMR funding will not be used for meetings).

Project Status as of November 26, 2014:

Status as of May 29, 2015:

Status as of November 30, 2015:

Status as of May 31, 2016:

Status as of November 30, 2016:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$ Amount	Explanation
Personnel:	\$ 360,900	<p>MDA One 3 yr FTE Research Scientist 1 salary \$44,500/yr & 48% fringe for Activity 3</p> <p>MDA One 3 yr PTE-FTE undergrad student wages \$13.70/hr & 7.65% fringe for Activity 3</p> <p>U of M One 3 yr PTE-FTE Community Program Specialist wages \$18/hr & 39.6% fringe for Activity 1 (40 weks @ 15-20 hrs/wk & 12 wks @ 40 hrs/wk)</p> <p>U of M One 3 yr PTE Insect Taxonomist wages \$25/hr & 7.65% fringe for Activity 1</p> <p>U of M One 3 yr PTE technician salary \$33,000/yr & 39.6% fringe for Activity 2</p> <p>U of M One 0.5 mo faculty summer salary \$10,600/mo & 20% fringe for Activity 2</p>
Professional/Technical/Service Contracts:	\$ 45,000	MDA One 3 year contract with Minneapolis and St. Paul for branch sampling for Activity 2
Equipment/Tools/Supplies:	\$ 5,900	<p>MDA Supplies include draw knives, gloves, etc.</p> <p>U of M Supplies include nets, vials, insect collection and rearing supplies for Activity 1</p>
Printing:	\$ 4,500	U of M Printing manuals, id guides, signage and promotional patches for Activity 1
Travel Expenses in MN:	\$ 29,400	<p>MDA Milage for Activities 2 & 3 at 56.5 cents/mile</p> <p>MDA Meals and lodging for Activity 4 (approx. 20 days of travel/yr for 3 yr for the student worker and EAB biocontrol coordinator and 10 days of travel/yr for 3 yr for the PI and EAB Project Manager)</p> <p>U of M Milage at 56.5 cents/miles for Activity 1</p> <p>U of M Meals and lodging for Activity 1 (approx. 10 days of travel/yr for program specialist and PIs)</p>
Other:	\$ 1,300	MDA Shipping bioagent transport coolers for Activity 3

		U of M Shipping beetle samples overnight for Activity 1
TOTAL ENRTF BUDGET:	\$ 447,000	

Explanation of Use of Classified Staff: N/A

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

One 3 yr full-time Research Scientist 1 = 2080*3 = 6,240 hrs
 One 3 yr part-time undergrad student = 1000*3 = 3,000 hrs
 One 3 yr part-time Community Program Specialist = 1040 * 3 = 3,120 hrs
 One 3 yr part-time Insect Taxonomist = 80*3 = 240 hrs
 One 3 yr part-time technician = 416*3 = 1,248 hrs
 One 0.5 mo faculty(summer) = 80*3 = 240 hrs
 Total hours = 14,088
 Total FTEs = 14,088/2080 = 6.77

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

MDA will contract with Minneapolis and St. Paul for branch sampling. Sampling and related work is estimated to require 500 hours over 3 years = 1,500 hours. Total FTE's = 1,500 hours/2080 per year = 0.72

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
	\$	\$	
State (in-kind)			
MDA: Field equipment, computing/software, GIS and data management and project management (\$40,000); U of M: Waived indirect costs (\$17,628 at U of M), project coordination and computing (\$10,000 at Extension); Minneapolis Parks & Rec and St. Paul Parks & Rec: Difference between actual branch sampling cost of \$60,000 and contract total of \$45,000 is \$15,000; Volunteer participation estimated at \$15,000	\$ 97,630	\$	
TOTAL OTHER FUNDS:	\$ 97,630	\$	

VII. PROJECT STRATEGY:

A. Project Partners:

Receiving funds: Angela Gupta, Jeffrey Hahn and Dr. Karen Oberhauser with Extension will lead EAB biosurveillance. Drs. Robert Venette and Brian Aukema with the U of M will lead the data analysis from tracking the EAB infestation core. Monika Chandler with MDA will lead biological control implementation and data collection for tracking the EAB infestation core. Minneapolis Parks and Recreation Board Forestry Division and St. Paul Parks and Recreation Forestry Unit will receive funds for collecting branch samples for

tracking the EAB infestation core. All organizations will provide in-kind equipment, facilities, and GIS/technical support.

Not receiving funds: For EAB biosurveillance, we will draw volunteers from the Forest Pest First Detector and the Minnesota Master Naturalist programs, which have over 1,000 active volunteers. For all activities, we will collaborate with USDA APHIS and Forest Service EAB biocontrol researchers, DNR, Mn/DOT, other federal and state agencies, counties, municipalities, and private landowners.

B. Project Impact and Long-term Strategy:

EAB biocontrol is in the second phase of implementation. Management recommendations from Phase 1 research on parasitoid cold tolerance and dispersal will be incorporated in our Phase 2 plans. Biological control agent releases were initiated in Phase 1 at 20 sites. We plan to continue monitoring these sites to document the landscape level impact of biological control on EAB at these sites. We anticipate that EAB populations will increase in density and spread in Phase 2. We plan to utilize biosurveillance to better understand EAB population spread and density to guide biological control releases. We will release bioagents on leading edges of EAB populations with the aim of establishing bioagent populations that move and spread with EAB. In addition, we will continue to track the EAB infestation core of the Twin Cities. This will inform us about EAB and bioagent movement and spread and their resulting impact on ash trees. The information gained from this project will enable us to hone EAB biological control and increase the feasibility of successful EAB management.

It will likely take decades to fully determine whether EAB can be sufficiently managed with biological control at a national level. We have an advantage in Minnesota that we initiated biological control while EAB populations were relatively small. New biological control candidate species currently in testing may become available for future releases. We have the difficult challenge of learning whether and how we can effectively manage EAB before we lose our ash resources. We expect to continue to learn and improve our tactics over the coming decade. The stakes are high. Minnesota has approximately 1 billion ash trees. Urban ash trees provide oxygen, reduce pollution and erosion, lower air conditioning costs and contribute to an aesthetically pleasing environment. Increased human mortality from cardiovascular and lower respiratory tract illness was documented after the large-scale loss of ash trees in EAB impacted US counties. Woodland ash trees provide oxygen, sequester carbon, filter water, reduce floods, support wildlife, provide timber and are important for recreation and human culture such as tribal black ash basket making. Loss of Minnesota’s ash trees would be catastrophic. Our project aims to mitigate EAB damage with biological control to prevent catastrophic loss. Unfortunately, we do not know at this time if biological control will be successful.

C. Spending History:

Funding Source	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13	M.L. 2013 or FY14
Forest Service supplies and salary to initiate Phase 1			8,000		
U of M salary to initiate Phase 1			2,500		
MDA salary to initiate Phase 1			3,000		
LCCMR Emerald Ash Borer Biocontrol Research and Implementation project \$500,000 from ENRTF				500,000	
USDA APHIS CPHST				70,160	
MDA in kind				15,000	
U of M waived indirect				162,550	
Minneapolis and St. Paul branch				22,000	

sampling					
LCCMR Improving Emerald Ash Borer Detection Efficacy for Control \$600,000 from ENRTF					600,000

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. VISUAL ELEMENT or MAP(S): See final page

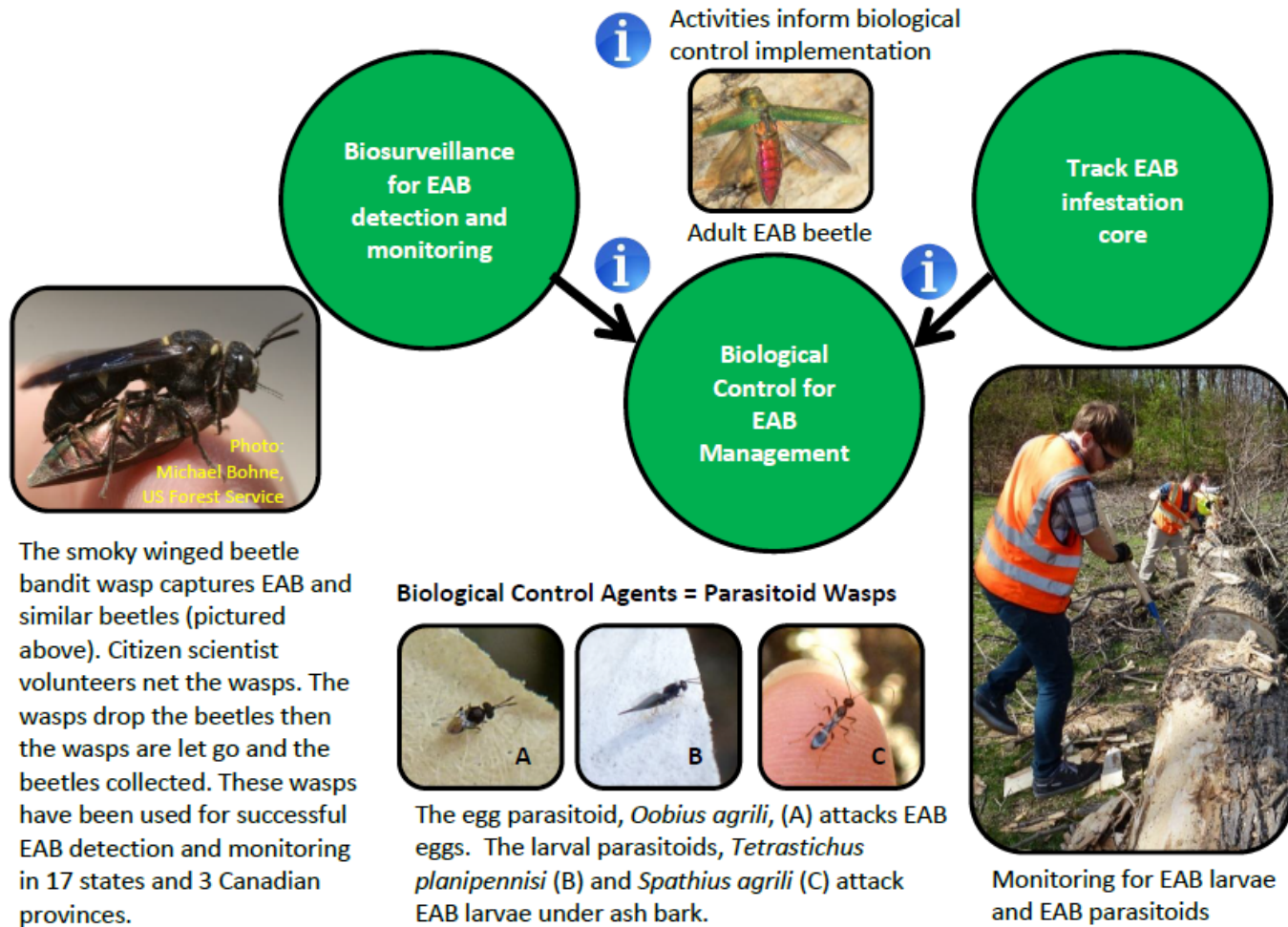
X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A

XI. RESEARCH ADDENDUM: N/A

XII. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than 05/29/2015, 11/30/2015, 05/31/2016 and 11/30/2016. A final report and associated products will be submitted between June 30 and August 15, 2017.

Biosurveillance and Biocontrol of the Emerald Ash Borer



The smoky winged beetle bandit wasp captures EAB and similar beetles (pictured above). Citizen scientist volunteers net the wasps. The wasps drop the beetles then the wasps are let go and the beetles collected. These wasps have been used for successful EAB detection and monitoring in 17 states and 3 Canadian provinces.

Biological Control Agents = Parasitoid Wasps



The egg parasitoid, *Oobius agrili*, (A) attacks EAB eggs. The larval parasitoids, *Tetrastichus planipennisi* (B) and *Spathius agrili* (C) attack EAB larvae under ash bark.

Partners



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	Biosurveillance of EAB			Track EAB infestation core			Expand biological control implementation				
Shipping beetle samples overnight	\$1,000		\$1,000							\$1,000	\$1,000
COLUMN TOTAL	\$103,200	\$0	\$103,200	\$188,300	\$0	\$188,300	\$155,500	\$0	\$155,500	\$447,000	\$447,000