Quarterly Progress and Performance Indicators Report:
Project Number and Title: *3.15 Nonstructural Approaches to Reduce Pollutant Runoff in Urbanized Areas*
Research Area: *Thrust 3: New Systems For Longevity and Constructability*
PI: *Vinka Craver, University of Rhode Island*
Co-PI(s): *Joseph Goodwill, University of Rhode Island*
Reporting Period: *4/1/22 – 6/30/22*
Submission Date: *6/30/22*

******IMPORTANT: Please fill out each section fully and reply with N/A for questions/sections with nothing to report. For ease of reporting to the USDOT, please do not remove, or change the order of, any sections/text. You may remove/add each rows in tables as needed. Thank you! ******
The report is due on the last day of the reporting period in .doc format to tidc@maine.edu.

Overview:

*Provide **BRIEF** highlights of activities performed during the reporting period. This summary should be written in lay terms for a general audience to understand. This should not be an extensive write up of findings (those are to be included in the final report), but a high-level overview of the activities conducted during the last three months **no more than 3 bullet points at no more than 1 sentence each** ….*

- Precise markup of sampling locations to allow for repeatability in sampling events.
- Two sampling events occurred, including street solid collection and an attempted stormwater collection.
- Analysis of street solid samples and stormwater samples and continued lab preparation and method development.

Meeting the Overarching Goals of the Project:

How did the previous items help you achieve the project goals and objects? Please give one bullet point for each bullet point listed above.

- Refining and marking the sampling locations to provide variability in the characteristics around each road segment and allows for repeatability.
- Continuous sampling events collecting street solids and stormwater will allow us to understand the trends in pollutant concentrations
- A particle size distribution of street solid samples gives us an idea of what pollutants come from different areas. Heavy metal concentrations were also analyzed in stormwater samples.

Accomplishments:

List any accomplishments achieved under the project goals in bullet point form…

- Markup of sampling locations
- Autosampler test run at URI to collect stormwater samples. Analysis of stormwater samples
- Vacuum sampling event to collect street solid samples. Analysis of street solid samples
- Attempted stormwater sampling event in WS3 road segment. Hardware failure resulted in no water collected.

Task, Milestone, and Budget Progress:

Complete the following tables to document the work toward each task and budget (add rows/remove rows as needed, make sure you complete the Overall Project progress row and include all tasks even if they have ended or have not been started)…

Table 1: Task Progress			
Task Number: Title	**Start Date**	**End Date**	**% Complete**
Task 1.1: Literature review	9/1/2021	12/31/2021	100%
Task 1.2: Identification of sampling locations	11/1/2021	3/1/2022	100%
Task 1.3: Methodology Design	10/15/21	12/31/21	100%
Task 2.1: Sampling preparation and testing	10/1/2021	3/1/2022	100%
Task 2.2: Analytical equipment preparation and testing	10/1/2021	3/1/2022	75%
Task 2.3: Site preparation and dry runs	3/1/2021	3/31/2022	100%
Task 3.1: Field sampling	4/1/2021	7/30/2023	20%
Task 3.2: Cost/Benefit analysis	12/1/2022	9/1/2023	0%
Task 3.3: Improved guidelines for street sweeping	12/1/2022	9/1/2023	0%
Phase 1 Overall	9/1/2021	3/1/2022	100%
Phase 2 Overall	10/1/2021	3/31/2022	90%
Phase 3 Overall	3/15/2022	9/1/2023	5%

Table 2: Milestone Progress			
Milestone #: Description	**Corresponding Deliverable**	**Start Date**	**End Date**
Milestone 1: Vacuum sampling event	3.1	5/13/22	5/13/22
Milestone 2: Autosampler sampling event test	2.2	4/01/22	4/01/22
Milestone 3: Autosampler sampling event	3.1	6/8/22	6/9/22

Table 3: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date (include the date)**
$74,827	74,827	100%
$112,240	102,138	91%
$186,437	9,321	5%

Is your Research Project Applied or Advanced?

☒ **Applied** (*The systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.)*

☐ **Advanced** *(An intermediate research effort between basic research and applied research. This study bridges basic (study to understand fundamental aspects of phenomena without specific applications in mind) and applied research and includes transformative change rather than incremental advances. The investigation into the use of basic research results to an area of application without a specific problem to resolve.)*

Education and Workforce Development:

Answer the following questions (N/A if there is nothing to report):

1. Did you provide any workforce development or training opportunities to transportation professionals (already in the field)? If so, what was the training? When was it offered? How many people attended? (i.e. The research team provided an in the field training for the SAR technology for 3 maintenance crew members of the MassDOT on 3/31/2021. The members learned how to use the technology and interrupt the data.)

   N/A

2. Did you hold meetings with any transportation industry organizations or DOTs? If so, what was the meeting's purpose? When was it offered? How many people attended? (i.e. The research team held a meeting with MaineDOT to update them on the progress of the research findings and how the findings can be implemented on 3/31/2021. 15 DOT maintenance members were present at the meeting.)

   N/A

3. Did you host/participant in any K-12 education outreach activities? If so, what was the activity? What was the target age/grade level of the participants? How many students/teachers attended? When was the activity held? (i.e. 25 8th graders and 2 teachers visited the concrete lab and created small concrete trinkets like Legos on 3/31/2021. They learned about the different types of fibers that can be used in the concrete.)

   On 6/22/22, The URI Guiding Education in Math and Science Network (GEMS-net) program filmed our research team to provide an overview of our project for various middle schools (grades 3-8) around RI. We discussed the importance of understanding different pollution sources and different ways to collect and analyze these pollutants. The goal of the video is to show some of the possibilities in research at URI.

Technology Transfer:

Complete all of the tables below and provide additional information where requested. Please provide ALL requested information as this is one of the most important sections for reporting to the USDOT. ***ONLY provide information relevant to this reporting period.***

Use the table below to complete information about conference sessions, workshops, webinars, seminars, or other events you led/attended where you shared findings as a result of the work you conducted on this project:

Table 4: Presentations at Conferences, Workshops, Seminars, and Other Events

Type	Title	Citation	Event & Intended Audience	Location	Date(s)
N/A					

Use the table below to report any publications, technical reports, peer-reviewed articles, newspaper articles referencing your work, graduate papers, dissertations, etc. written as a result of the work you conducted on this project. Please list only completed items and exclude work in progress.

Table 5: Submitted/Accepted Publications, Technical Reports, Theses, Dissertations, Papers, and Reports

Type	Title	Citation	Date	Status
N/A				

Answer the following questions (N/A if there is nothing to report):

1. *Did you deploy any technology during the reporting period through pilot or demonstration studies as a result of this work? If so, what was the technology? When was it deployed?*

   We deployed an autosampler on 4/01/22 and 6/8/22 to collect stormwater samples overnight during a rain event.

   We collected street solid samples using a shop vac and generator on 5/13/22.

2. *Was any technology adopted by industry or transportation agencies as a result of this work? If so, what was the technology? When was is adopted? Who adopted the technology?*

   N/A

3. *Did findings from this research project result in changing industry or transportation agency practices, decision making, or policies? If so, what was the change? When was the change implemented? Who adopted the change?*

   N/A

4. *Were any licenses granted to industry as a result of findings from this work? If so, when? To whom was the license granted?*

   N/A

5. *Were any patent applications submitted as a result of findings from this research? If so, please provide a copy of the patent application with your report.*

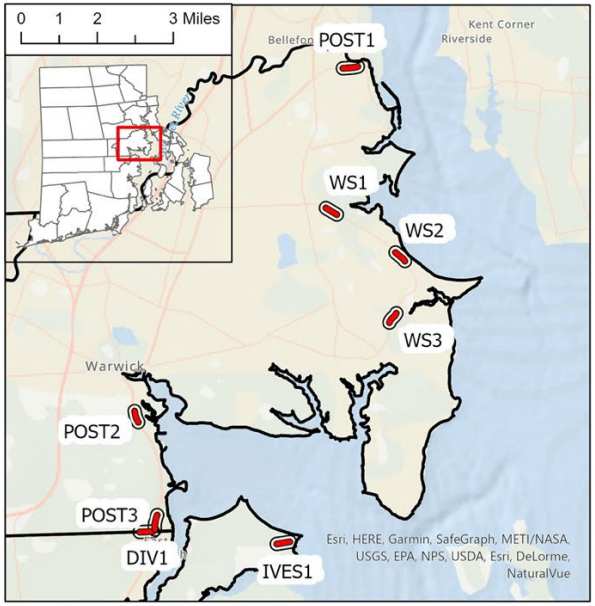
   N/A

6. *Did industry organizations or DOTs provide cost-share (cash or in-kind) to your research during the reporting period? Who was the organization? Please provide an in-kind support invoice from the organization with your report (this is kept confidential and used for record keeping purposes only).*

   N/A

Please add figures/images that can be included on the website and/or in marketing/social media materials to further clarify your research to the general public. This is very important to our Technology Transfer initiatives.

Evaluating the Relationship between Road Characteristics and Street Solid Accumulation



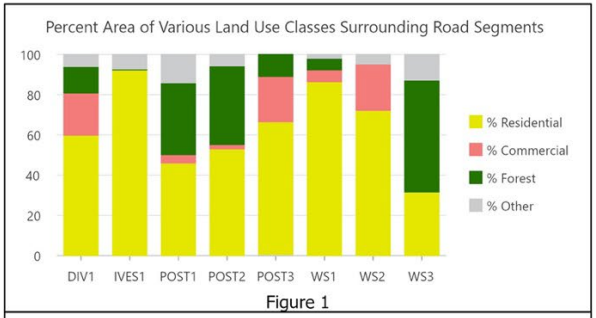


Figure 1

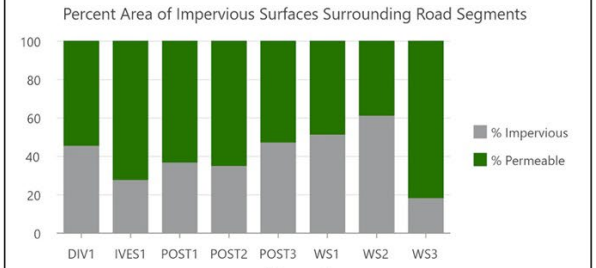


Figure 2

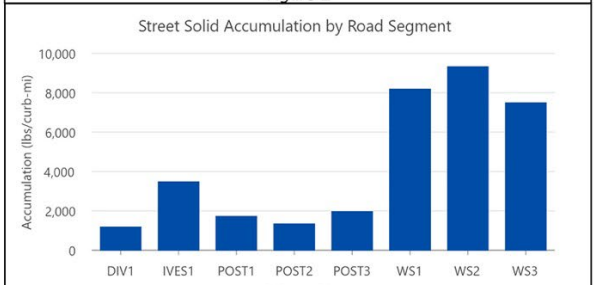
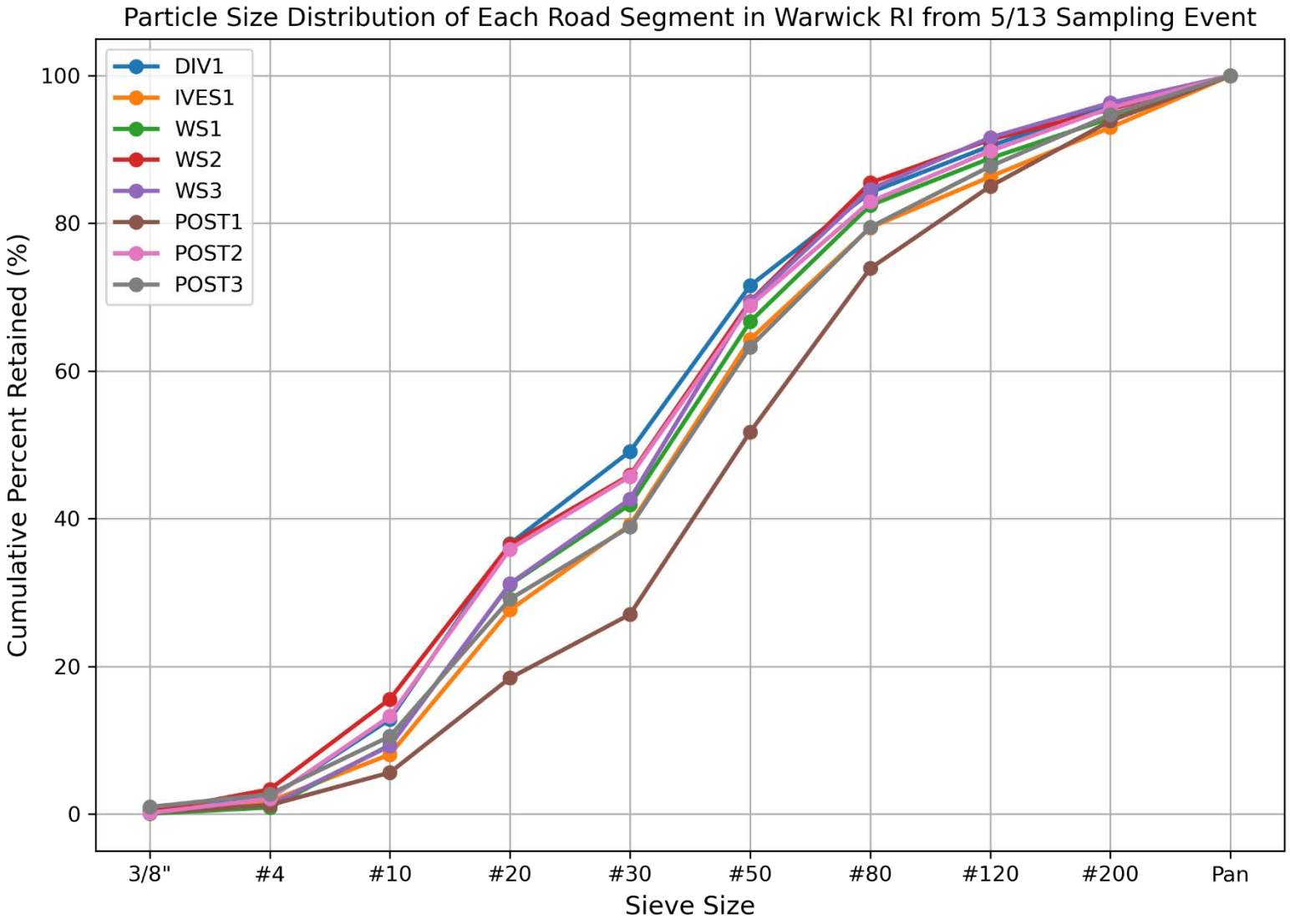
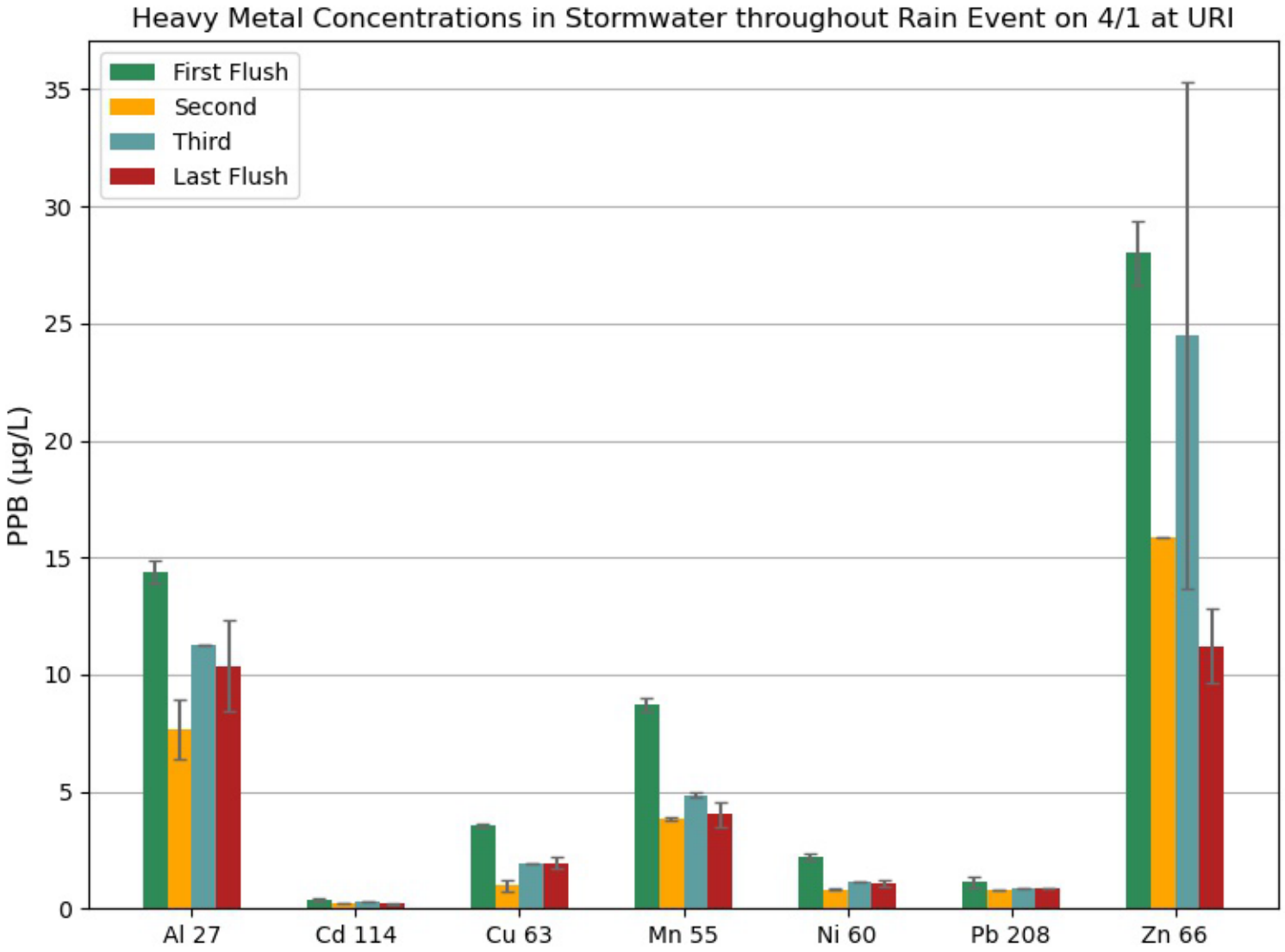


Figure 3

The map shows the 8 road segments in the Warwick, RI study area in which sampling will take place. For each road segment, a 500 foot buffer zone was used to characterize various metrics about the area surrounding each road. These metrics include percent of residential, commercial, and forested land use classes, as well as percent impervious surface area (shown in Figures 1 and 2). Additional metrics were calculated, including percent canopy coverage, classified by height; building density; and average and maximum slope of each road segment. On May 13th, the first sampling event occurred, in which a vacuum was used to collect street solids to evaluate the roads' accumulation rates. The results of the vacuum run (shown in Figure 3) vary significantly, mainly due to some roads having already been cleaned by street sweepers. Further analysis will be completed to evaluate relationships between the calculated road metrics and street solid accumulation and pollutant concentrations, once more sampling events occur.


Particle Size Distribution of Each Road Segment in Warwick RI from 5/13 Sampling Event
DIV1
IVES1
WS1
WS2
WS3
POST1
POST2
POST3
Cumulative Percent Retained (%)
100
80
60
40
20
0
3/8"
#4
#10
#20
#30
#50
#80
#120
#200
Pan
Sieve Size


Heavy Metal Concentrations in Stormwater throughout Rain Event on 4/1 at URI
First Flush
Second
Third
Last Flush
PPB (µg/L)
0
5
10
15
20
25
30
35
Al 27
Cd 114
Cu 63
Mn 55
Ni 60
Pb 208
Zn 66

Describe any additional activities involving the dissemination of research results not listed above under the following headings:

Outputs:
Definition: Any new or improved process, practice, technology, software, training aid, or other tangible product resulting from research and development activities. They are used to improve the efficiency, effectiveness, and safety of transportation systems. List any outputs accomplished during this reporting period:

Improved process of collecting street solids by shop vac, utilizing filter bags and storage bags. A particle size distribution was completed on the street solids using sieves.

Improved process of collecting stormwater samples, utilizing an autosampler and flow meter. The autosampler is programmed to take flow proportional samples based on readings of the flow meter.

The collection of these samples and consequent analysis will give us insight on the some of the trends and relationships of pollution accumulation based on various road characteristics. This will lead to improved efficiency and effectiveness of street sweeping.

Outcomes:
Definition: The application of outputs; any changes made to the transportation system, or its regulatory, legislative, or policy framework resulting from research and development activities. List any outcomes accomplished during this reporting period:

N/A

Impacts:
Definition: The effects of the outcomes on the transportation system such as reduced fatalities, decreased capital or operating costs, community impacts, or environmental benefits. The reported impacts from UTCs are used for the assessment of each UTC and to make a case for Federal funding of research and education by demonstrating the impacts that UTC funding has had on technology and education. NOTE: The U.S. DOT uses this information to assess how the research and education programs (a) improve the operation and safety of the transportation system; (b) increase the body of knowledge and technologies; (c) enlarge the pool of people trained to develop knowledge and utilize technologies; and (d) improves the physical, institutional, and information resources that enable people to have access to training and new technologies. List any outcomes accomplished during this reporting period:

N/A

Participants and Collaborators:

Use the table below to list individuals (compensated or not) who have worked on the project other than students.

Table 6: Active Principal Investigators, faculty, administrators, and Management Team Members				
Individual Name & Title	**Dates involved**	**Email Address**	**Department**	**Role in Research**
Dr. Vinka Oyanedel-Craver	4/1/22 – 6/30/22	craver@uri.edu	Civil and Environmental Engineering	Co-PI
Dr. Joseph Goodwill	4/1/22 – 6/30/22	goodwill@uri.edu	Civil and Environmental Engineering	Co-PI
Andrew Sheerin	4/1/22 – 6/30/22	andrew_sheerin@uri.edu	Civil and Environmental Engineering	Graduate Research Assistant

*Use the table below to list **all** students who have participated in the project during the reporting period. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.) **ALL FIELDS ARE REQUIRED.***

Table 7: Student Participants during the reporting period								
Student Name	**Start Date**	**End Date**	**Advisor**	**Email Address**	**Level**	**Major**	**Funding Source**	**Role in research**
Andrew Sheerin	4/1/22	6/30/22	Dr. Craver/ Dr. Goodwill		Masters	Civil and Environmental Engineering	TIDC, URI	Sample collection, data analysis, lab analysis

Eva Davet	5/22/22	6/30/22	Dr. Craver/ Andrew Sheerin		Undergraduate	Civil and Environmental Engineering	CELS, URI	Assisting in sample collection, data analysis, lab work

Use the table below to list any students who worked on this project and graduated or received a certificate during this reporting period. Include information about the student's accepted employment during the reporting period (i.e. the student is now working at MaineDOT) or if they are continuing their students through an advanced degree (list the degree and where they are attending).

Table 8: Students who Graduated During the Reporting Period

Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
N/A			

Use the table below to list any students that participated in Industrial Internships during the reporting period:

Table 9: Industrial Internships

Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
N/A			

*Use the table below to list **organizations** that have been involved as partners on this project and their contribution to the project during the reporting period.*

Table 10: Research Project Collaborators during the reporting period

Organization	Location	Contribution to the Project				
		Financial Support	In-Kind Support	Facilities	Collaborative Research	Personnel Exchanges
RIDOT	Warwick, RI			x	Assist in field work and sampling collection	

*Use the table below to list **individuals** that have been involved as partners on this project and their contribution to the project during the reporting period. (**List your technical champion(s) in this table.** This also includes collaborations within the lead or partner universities who are not already listed as PIs; especially interdepartmental or interdisciplinary collaborations.)*

Table 11: Other Collaborators

Collaborator Name and Title	Contact Information	Organization and Department	Date(s) Involved	Contribution to Research
Mark Nimiroski		RIDOT	4/1/22 – 6/30/22	Coordination with RIDOT
Joseph Baker		RIDOT	4/1/22 – 6/30/22	Coordination with RIDOT
David Messier		RIDOT	4/1/22 – 6/30/22	Assisting in field work
Ian Kirby		RIDOT	4/1/22 – 6/30/22	Assisting in field work
Alicia Cannon		Shimadzu	6/14/22 – 6/15/22	GC-MS training

Use the following table to list any transportation related course that were taught or led by researchers associated with this research project during the reporting period:

Table 12: Course List

Course Code	Course Title	Level	University	Professor	Semester	# of Students
N/A						

Changes:

List any actual or anticipated problems or delays and actions or plans to resolve them (list no-cost extension requests here)…

- The flow meter and autosampler were having an unknown hardware problem, and so have been sent back to ISCO (manufacturer) for a warranty repair.

List any changes in approach and the reasons for the change…

- Eliminated one of the road segments to reduce the sampling sites from 9 to 8. The reason is because heavy construction was happening during the sampling event and so sampling was infeasible.
- Changed the frequency of street solid sample collection from monthly to every two months. This is to allow for more time of analysis of samples in between sampling events.

Planned Activities:

List the activities planned during the next quarter.

- Continue street solid sample collection and consequent analysis
- Continue stormwater sample collection and consequent analysis
- Perform data analysis of analysis results to understand the relationship of various parameters and street solid accumulation/pollutant concentrations
- Continue development of road priority system optimization model
- Continue GIS analysis to simulate stormwater runoff and transport of pollutants.