

## 7 DEMAND and DEVOID application user guide

### 7.1 DEMAND tool

The Dredging Evaluation Management, Analysis and Networked Documentation (DEMAND) Application is designed to guide a dredged material program manager, risk assessor or laboratory technician through a dredging evaluation. The application provides step-by-step procedures for planning and executing a dredging evaluation so that workers new to dredging evaluations consider the most relevant evaluation requirements (e.g., what and when to test) and document rationale for decisions and communication with stakeholders. The application is particularly useful for stakeholder decision documentation so that the same conversations and decisions are not continuously revisited (a waste of time and monetary resources) the next time a harbor or location is evaluated.

The DEMAND Application was developed by the USACE ERDC Environmental Laboratory and the Information Technology Laboratory.

The DEMAND Application is a containerized application utilizing a microservice-based software architecture. The microservices consist of a proxy server, a NextJS web server, a Go API server, and a MySQL database. This architecture allows for segmented logic implementations and increased portability by using the Docker platform for software deployment. The only software dependencies needed to run the DEMAND Application are Docker and 7-zip.

#### 7.1.1 Installation of Docker Desktop

Docker is the underlying software infrastructure that powers the DEMAND Application. Docker is freely available in the USACE Software Application Portal managed by ACE-IT.

An ACE-IT technician will be needed to install the Docker Desktop application on a USACE-managed workstation due to the elevated privileges required. During the installation process, ensure the following requirements are met:

1. The machine supports virtualization.
2. The Microsoft hypervisor client Hyper-V is enabled on the machine.
3. The current user account is listed in the “docker-users” group

Once the installation has completed. Start the Docker Desktop application. On a Windows machine, Docker can be started by searching for the “Docker Desktop” application and clicking it. After several seconds, a Docker window will appear on the user’s desktop.

After first installation of the Docker Desktop application, some of the default settings will need to be changed to ensure that the application successfully starts and performs. To start the process of changing the default settings, click on the “Settings” icon (the gear icon) at the top of the Docker Desktop application (Figure 7-1).



Figure 7-1: The Docker Desktop Application Settings Icon

Clicking this icon will open the settings screen of the Docker Desktop application. Click on the “General” tab to the left of the settings screen.

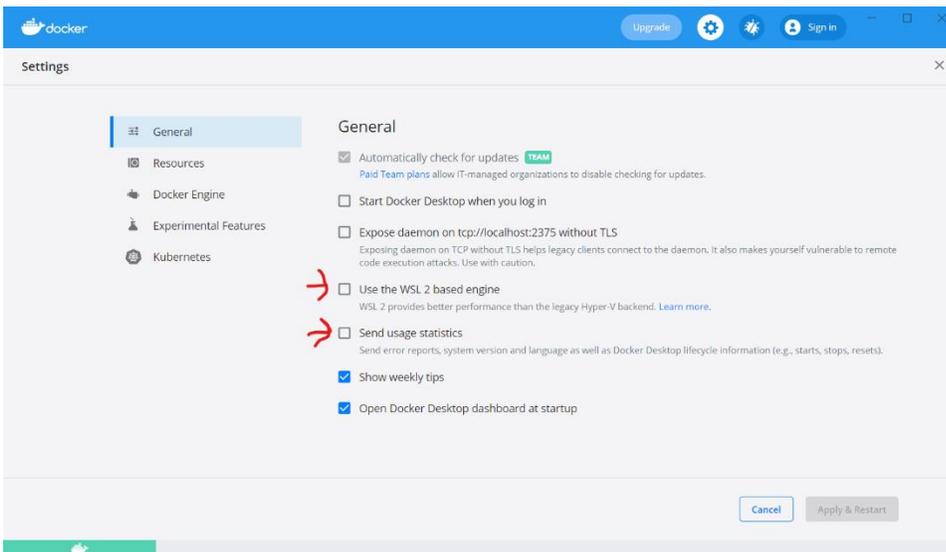


Figure 7-2: The Docker Desktop Application Settings – General Section

Ensure that the “Use the WSL 2 based engine” and the “Send usage statistics” options are unchecked (Figure 7-2). After ensuring that those options are

unchecked, click on the “Resources” tab to the left of the settings screen. The “Resources” tab is directly under the “General” tab.

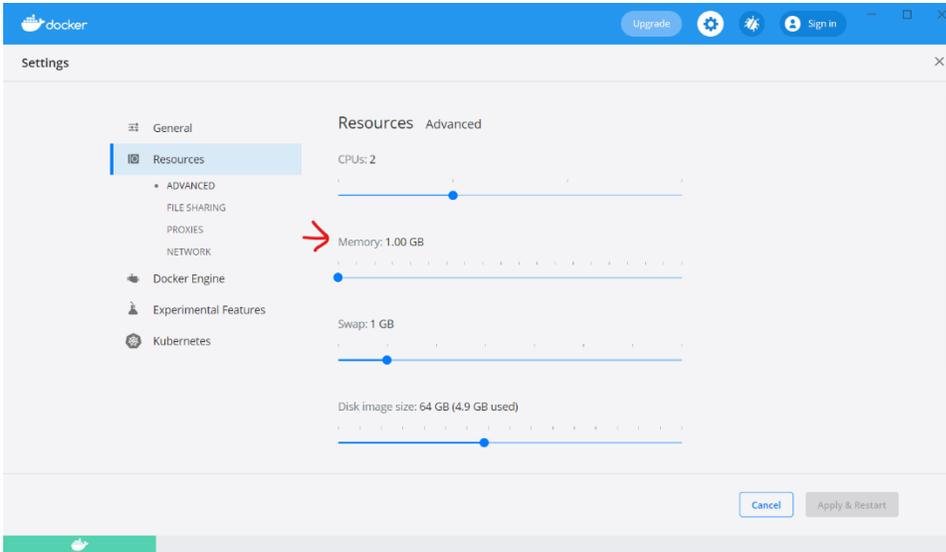


Figure 7-3: The Docker Desktop Application Settings - Resources Section

In the “ADVANCED” section of the “Resources” tab, for the “Memory” section, allocate the memory down to 1.00 GB (Figure 7-3). When the resources and checkboxes are unchecked, press the “Apply & Restart” button to the lower right of the window. This will restart the Docker Desktop application.

When the Docker status light at the bottom of the window is green, Docker is ready for usage.

### 7.1.2 Installation of the DEMAND application

The DEMAND Application is packaged and distributed using the 7-zip format and tool. In order for the application to function correctly, it must be unzipped using the 7-zip tool. The application can be unpackaged anywhere on the machine the user can access. Please note that due to Information Assurance (IA) requirements and restrictions, the application may not function on all systems.

In order to unzip the application, 7-zip must be installed on the user’s machine. 7-zip can be downloaded from <https://www.7-zip.org/download.html>, or it may be already installed on the machine depending on Information Technology (IT) standards and practices of the organization. The picture below demonstrates how to extract the DEMAND Application using 7-zip.

To extract the application (see Figure 7-4):

1. Right-click on the file that was downloaded or distributed to the machine.
2. Move the mouse cursor down to the 7-zip menu selection. NOTE: Not all machines will have this selection.
3. Move the mouse cursor over to the submenu and move the cursor down to the 'Extract to "demandv2\"' choice and left-click the highlighted menu option. This filename may be different due to management and distribution practices.
4. Once the DEMAND Application is extracted, open the newly created folder to view the contents. The extracted folder contains several subfolders and files.
5. In order to successfully install the DEMAND Application, the Docker runtime (version  $\geq 3.1$ ) must be installed on the machine. Once Docker is installed, ensure that the "Docker runtime" is running. On a Windows machine, Docker can be started by searching for the "Docker Desktop" application and clicking it. After several seconds, a Docker window will appear on the user's desktop.
6. Once the Docker runtime has started, click on the "install.bat" file in the extracted folder. Depending on the configuration of the machine, the ".bat" extension may not be visible. Clicking on this file starts the build process for the microservice containers and may take several minutes due to network connection speeds. In the event an error occurs, please refer to the user guide included in the application folder.

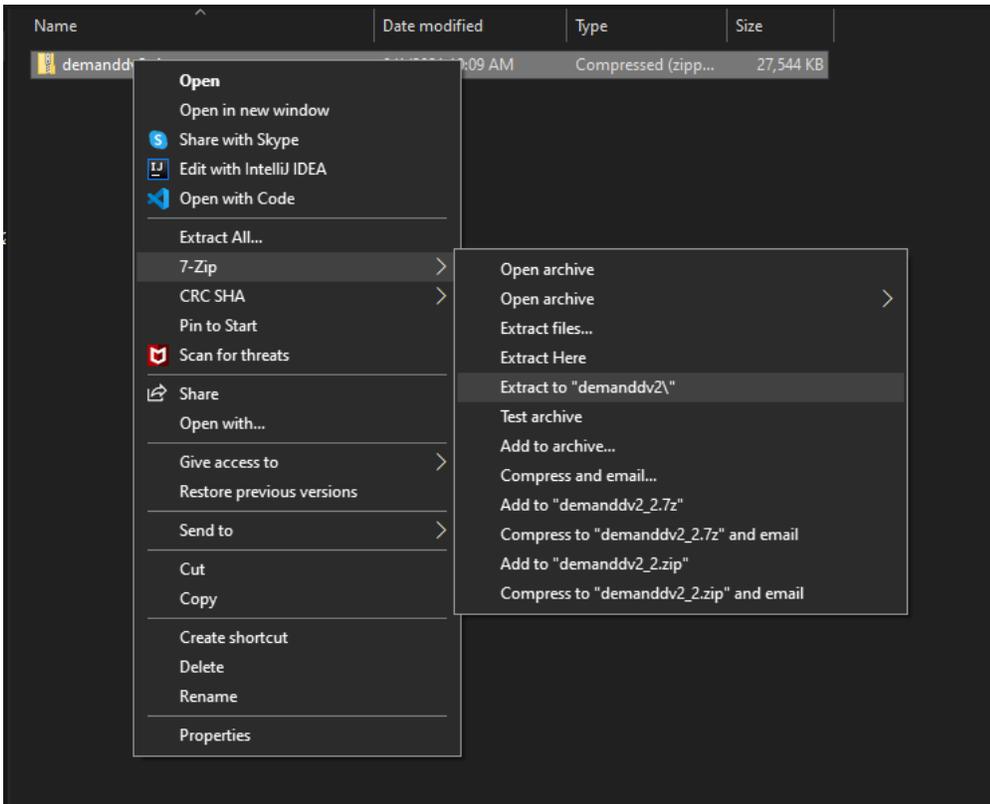


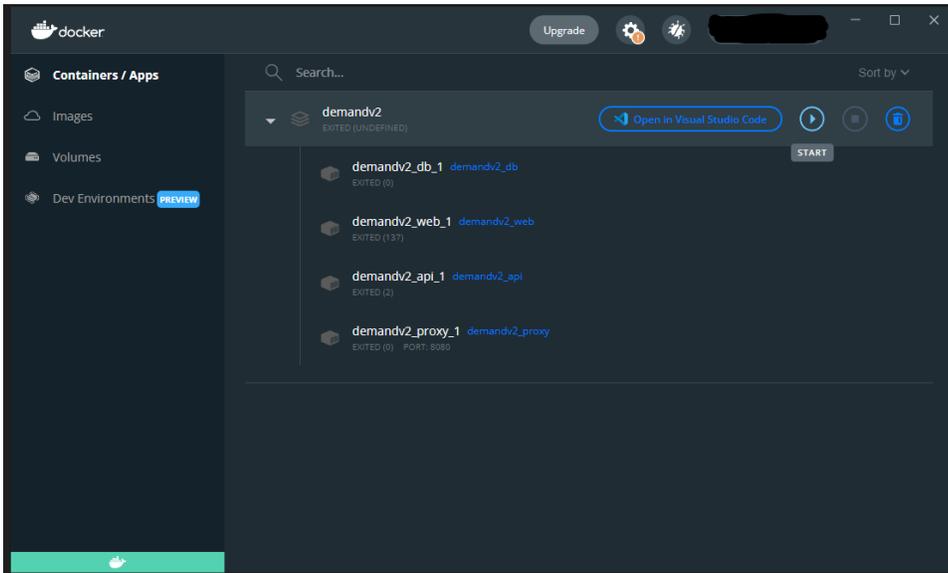
Figure 7-4. Guidance for extracting the DEMAND application.

### 7.1.3 Running the DEMAND application

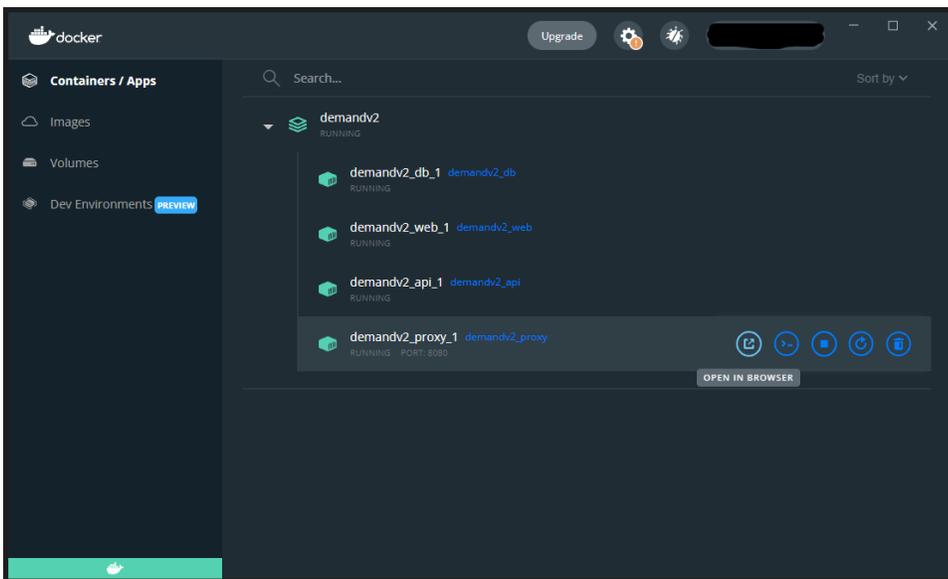
To start the DEMAND Application, ensure that Docker runtime is enabled (Figure 7-5). This can be done on a Windows machine by starting the Docker Desktop application. In the Docker Desktop application, in the “Containers / Apps” tab, the DEMAND Application should be registered. If the DEMAND Application tab is grayed out, the DEMAND Application must be started by clicking on the “START” button to the right of the tab. When the tab is all green, click the “Expand” arrow to the left of the DEMAND Application tab to reveal the different DEMAND containers (Figure 7-5).

Highlight, or mouseover, the proxy container tab. The proxy container tab will have a button signaling that a web browser can be opened to reveal the application. Click this button, and the DEMAND Application will be opened in the machine’s default web browser. The DEMAND Application was built to be run in modern (as of 2022) web browsers.

A.



B.



**Figure 7-5.** Docker Desktop command window listing the DEMAND Application. Image A highlights how the containerized DEMAND Application is started. Highlighted in Image B is the proxy container with the “OPEN IN BROWSER” button selected.

### 7.1.4 Using the DEMAND application

The DEMAND Application is designed to guide a researcher through a dredging evaluation and use a step-wise approach to the evaluation.

#### 7.1.4.1 Starting Screen

The application starts on the “Starting Screen” (Figure 7-6) and directs the user to start, import, or continue a dredging assessment.



Figure 7-6: "Starting Screen"

#### 7.1.4.2 New Dredging Operation Screen

If a new dredging assessment is desired, the user should click on the “Start a New Dredging Assessment” button. This will bring up the “New Dredging Operation” screen (Figure 7-7). At this screen, the user will enter relevant information

regarding the dredging operation. When all information is entered, the user will click on the “Submit” button at the bottom of the screen and be taken to the “Home” screen.

ERDC  
Dredging Evaluation Management, Analysis and Networked Documentation

### New Dredging Operation

USACE Division  
Great Lakes and Ohio River Division

USACE District  
Buffalo District

Project Harbor \*

Project Year \*  
2000

Project Description

SUBMIT

Figure 7-7: “New Dredging Operation” Screen

The “Home” screen (Figure 7-8) gives an overview of the current assessment. Here, the user can view the project’s checklist for final reporting capabilities, generate a project report, generate a project COPC report, or delete the project.

### 7.1.4.3 Home Screen

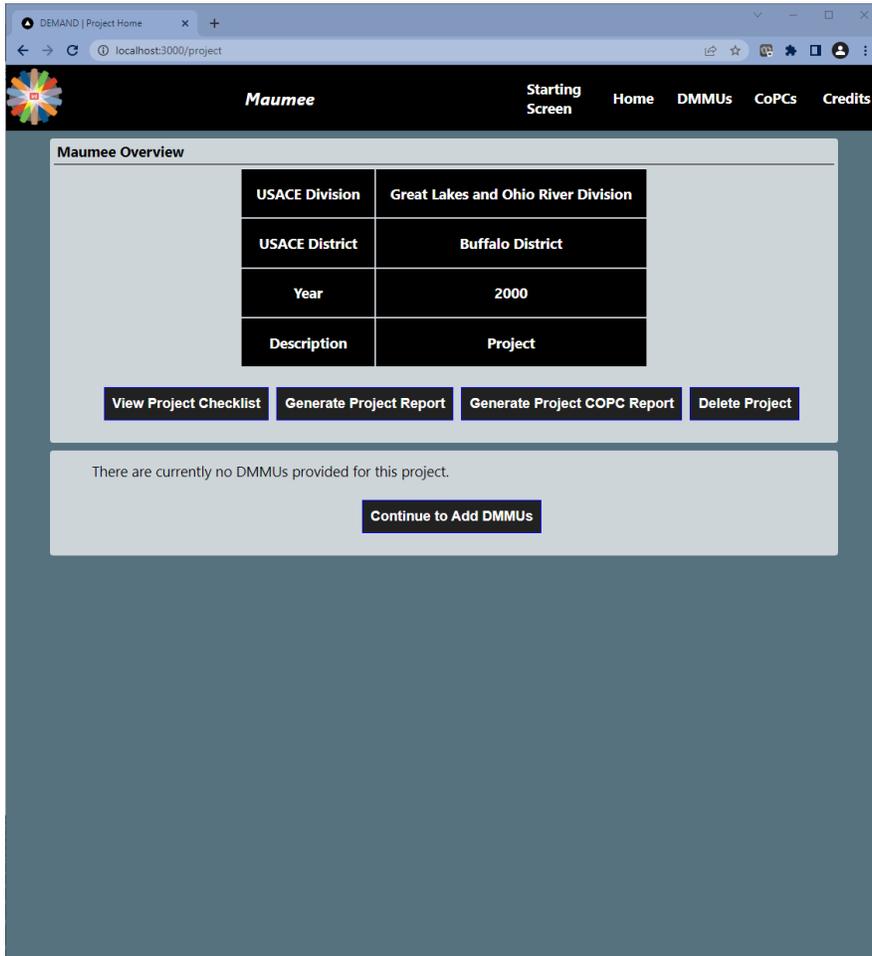
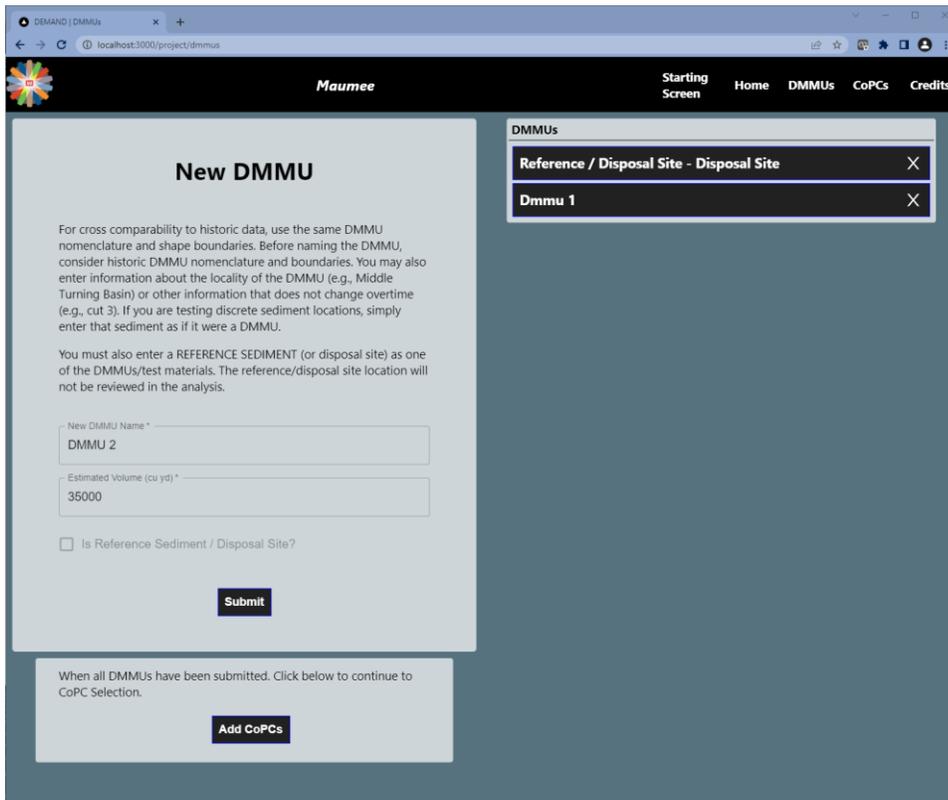


Figure 7-8: “Home” Screen.

Before performing the assessment, the user should click on the “Continue to Add DMMUs” button on the “Home” screen. Clicking this button will take the user to the “DMMUs” screen.

#### 7.1.4.4 DMMUs Screen



The screenshot shows a web browser window with the URL `localhost:3000/project/dmmus`. The application is titled "Maumee" and has a navigation menu with "Starting Screen", "Home", "DMMUs", "CoPCs", and "Credits".

The main content area is titled "New DMMU" and contains the following text:

For cross comparability to historic data, use the same DMMU nomenclature and shape boundaries. Before naming the DMMU, consider historic DMMU nomenclature and boundaries. You may also enter information about the locality of the DMMU (e.g., Middle Turning Basin) or other information that does not change overtime (e.g., cut 3). If you are testing discrete sediment locations, simply enter that sediment as if it were a DMMU.

You must also enter a REFERENCE SEDIMENT (or disposal site) as one of the DMMUs/test materials. The reference/disposal site location will not be reviewed in the analysis.

The form includes the following fields and controls:

- "New DMMU Name \*": A text input field containing "DMMU 2".
- "Estimated Volume (cu yd)\*": A text input field containing "35000".
- "Is Reference Sediment / Disposal Site?": A checkbox that is currently unchecked.
- "Submit": A blue button.

Below the form, there is a message: "When all DMMUs have been submitted. Click below to continue to CoPC Selection." with an "Add CoPCs" button.

On the right side, there is a "DMMUs" list with two entries:

| DMMUs                                     |   |
|---|---|
| Reference / Disposal Site - Disposal Site | X |
| Dmmu 1                                    | X |

Figure 7-9: "DMMU" Screen.

On the "DMMU" screen (Figure 7-9), the user can populate the different DMMUs associated with the project. Here, the user specifies the name of the DMMU, the estimated cubic yards of the DMMU, and if the DMMU is the reference / disposal site. Once information is entered, the user can click "Submit" to save the DMMU entry to the project. When all DMMUs are entered, the user can click the "Add COPC" button at the bottom of the screen. Clicking this button will take the user to the "COPC" screen.

#### 7.1.4.5 Contaminants of Potential Concern Screen

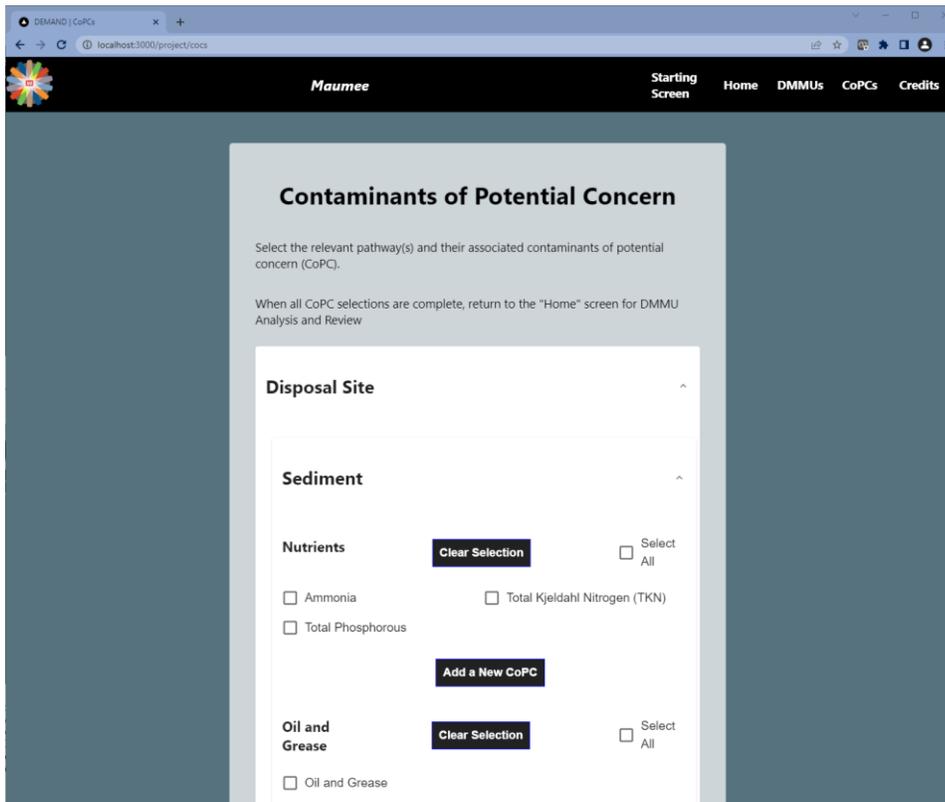


Figure 7-10: "COPC" Screen

On the "COPC" screen (Figure 7-10), the user populates each DMMU with Contaminants of Potential Concern (CoPC) relevant to the project at hand. When all COPC are entered, the user can click the "Review COPC for DMMUs" button at the bottom of the page and be taken back to the "Home" screen.

To start the DMMU analysis, click on the "Review This DMMU" button (Figure 7-11) under the DMMU subsection on the "Home" screen (Figure 7-8). This will start the analysis process for that specific DMMU. Reference and Disposal Site may be indicated (via check box) but are not eligible for review.

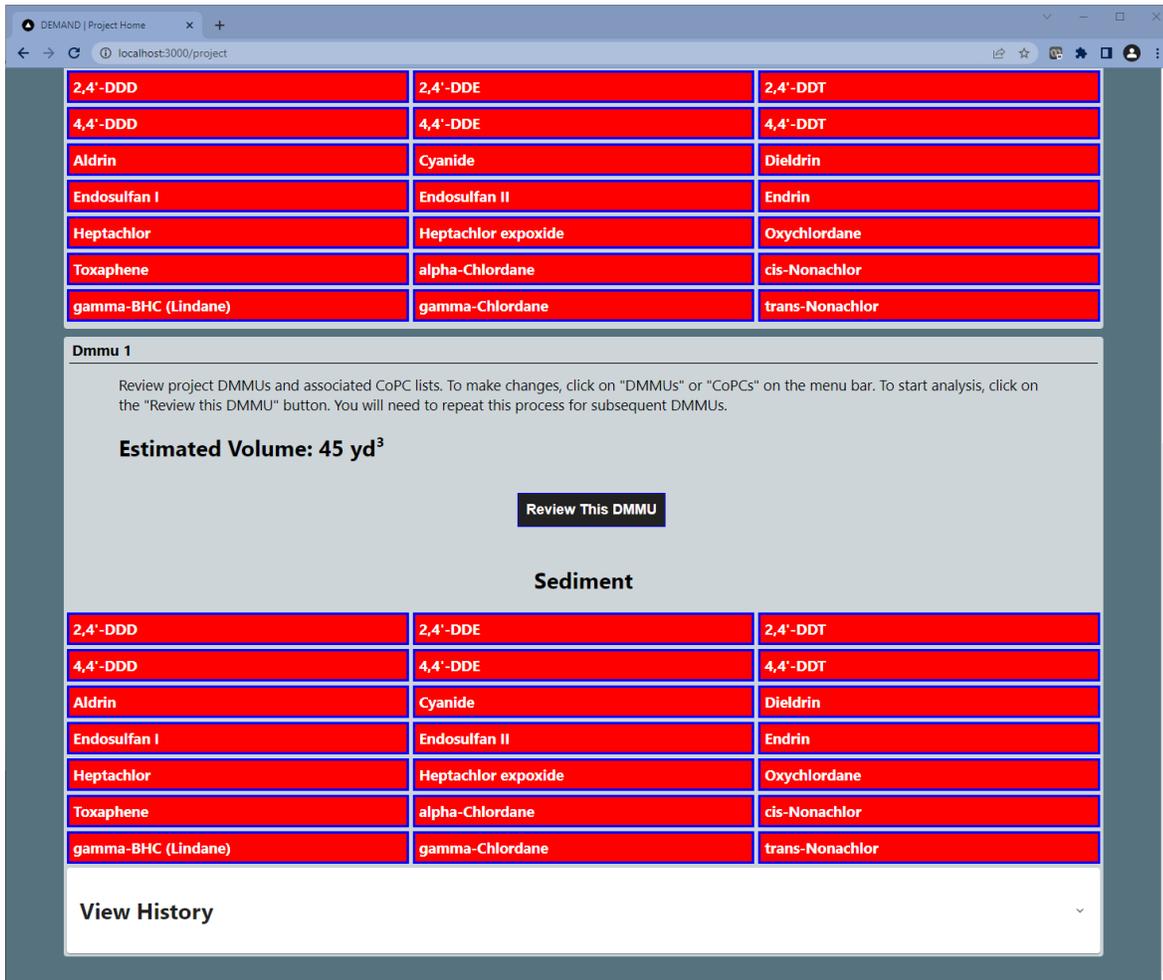


Figure 7-11: Populated DMMU with COPC

### 7.1.5 Go Back

The DEMAND Application provides limited ability to return to previously selected nodes and questions in the evaluation process.

If a user needs to go back to a previous node, the “Go Back” button should be pressed until the desired node is encountered.

### 7.1.6 Save Functionality

All information for the dredging assessment is automatically stored locally on the user’s workstation.

### 7.1.7 Print Report Functionality

The current (2022) alpha version of DEMAND allows all decisions nodes, responses to questions, decision documentation and limited data entered to be exported as a PDF report (Figure 7-12). Such reports can serve as the permanent record of a dredging evaluation project that can be archived and later reviewed prior to conducting subsequent dredging evaluations for the same location or harbor.

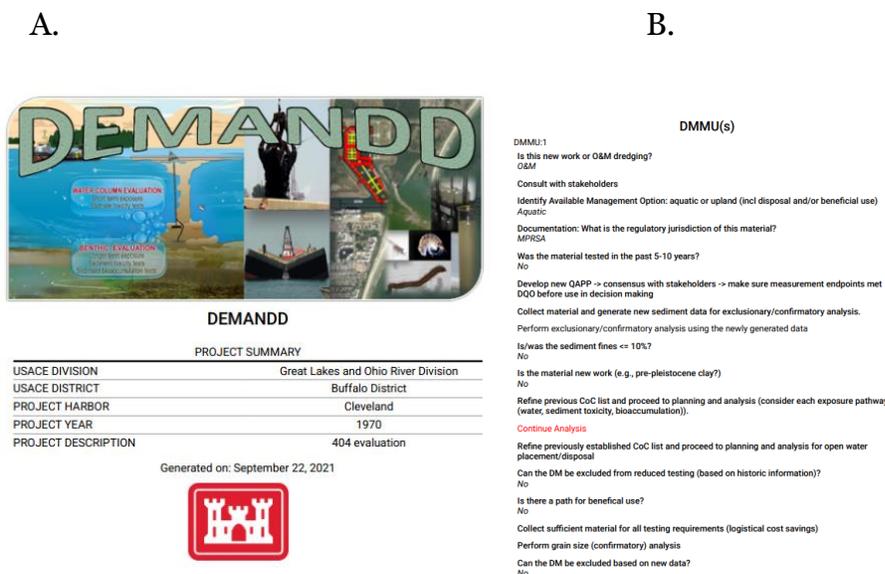


Figure 7-12. Example of a project specific report generated by the application.

## 7.2 Stopping the DEMAND Application

When the DEMAND Application is no longer needed, the application must be closed out of the browser window and stopped in the Docker Desktop Application.

To stop the DEMAND Application, press the “STOP” button in the Docker Desktop Application. The “STOP” button is located directly to the right of the “START” button used in the earlier starting step. After pressing the “STOP” button, all entries under the DEMAND Application will be grayed out.

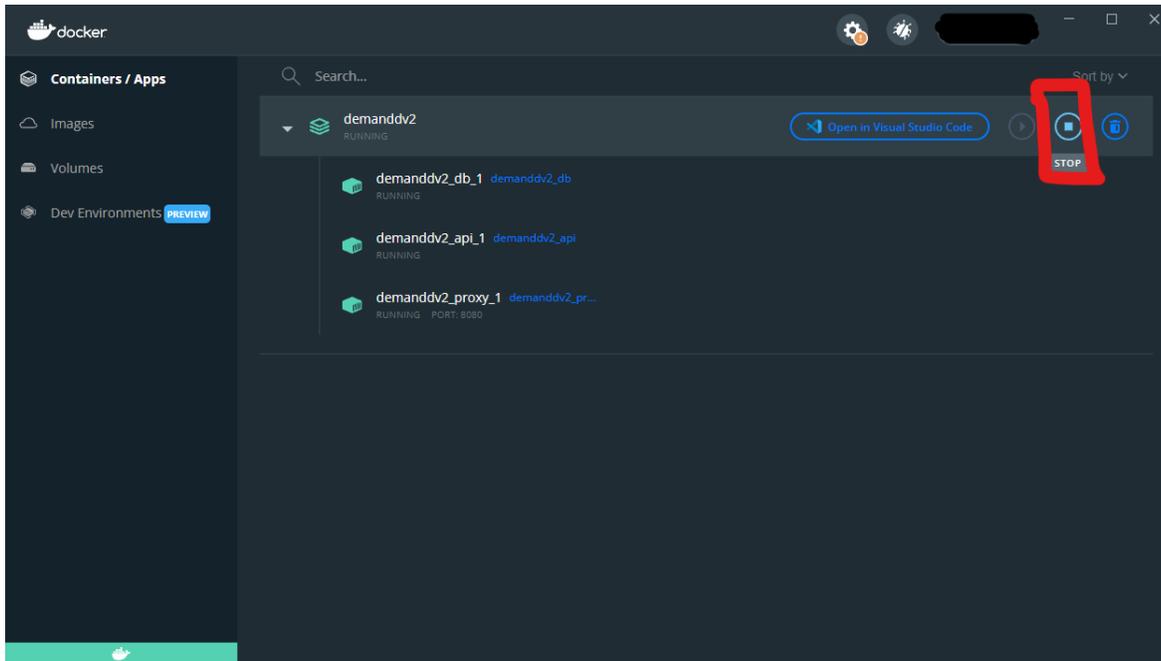


Figure 7-13: STOP Button

Once all containers have stopped, close out of the Docker Desktop Application and click on the arrow at the lower right of the Windows Desktop. This will reveal hidden icons on the user's toolbar, and the Docker icon will be included in those icons. Mouseover the Docker icon and right click the icon. Click on the "Quit Docker Desktop" entry to stop the Docker runtime on the machine (Figure 7-14).

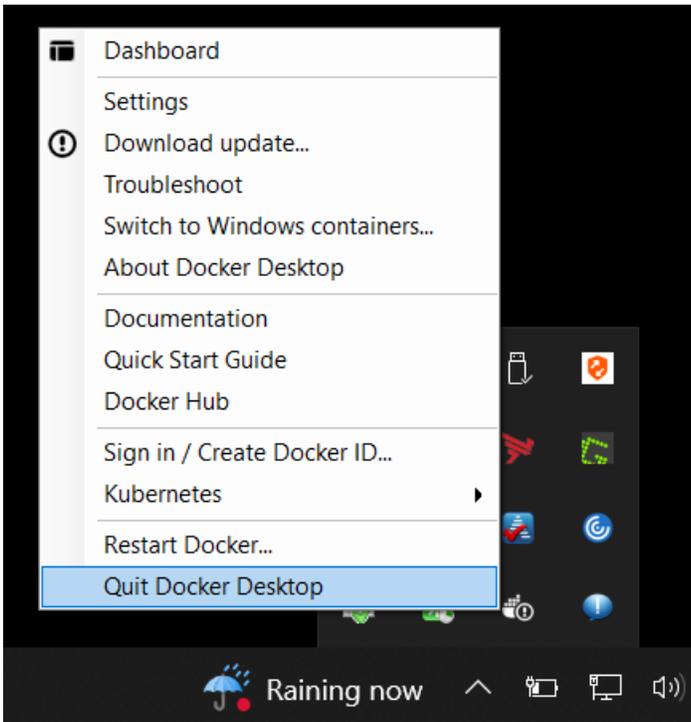


Figure 7-14: Quitting Docker Desktop

### 7.3 DEVOID tool

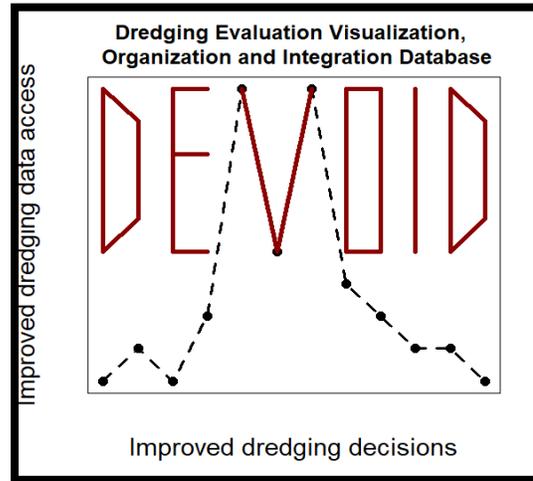
The Dredging Evaluation Visualization, Organization and Integration Database (DEVOID) tool is a data visualization application. The application mines a dredging database file represented within a Microsoft Excel spreadsheet. The DEVOID tool was written using the R programming language and packaged using the 7-Zip compression software.

The DEVOID Version 1.0 was developed jointly by the Environmental Laboratory and the Information Technology Laboratory of the Engineer Research and Development Center. Points of contact are:

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### 7.3.1 Installation of the DEVOID application

The DEVOID Application is packaged through the 7-Zip compression software.

To unpackage the application (Figure 7-4):

1. Navigate to the folder where the compressed package is stored in the file manager window.
2. Right-click on the compressed package and select 'Extract to "devoid\"' under the "7-Zip" submenu. This filename may be different due to management and distribution practices.

### 7.3.2 Running the DEVOID application

The preferred method for running the DEVOID Application is through the RStudio application. RStudio is a development environment for the R programming language and is available for download at <https://www.rstudio.com/>. Alternatively, for USACE personnel, R software, RStudio, RShiny and other associated software are currently (as of March 2022) available on the software portal (<https://app-portal.usace.army.mil/esd/Home>). The core R software (titled "R for Windows 4.0.3" in the App Portal as of March 2022) and RStudio (titled

“RStudio Version 1.4.1717” in the App Portal as of March 2022) must be downloaded and installed separately.

Start a new session of RStudio by clicking on the RStudio desktop application, then open the project with RStudio as shown below (Figure 7-15). Select “File” in the top menu bar (Figure 7-16), then “Open Project...” This will open the Windows file manager. Navigate to the directory where the DEVOID Application was unpackaged.

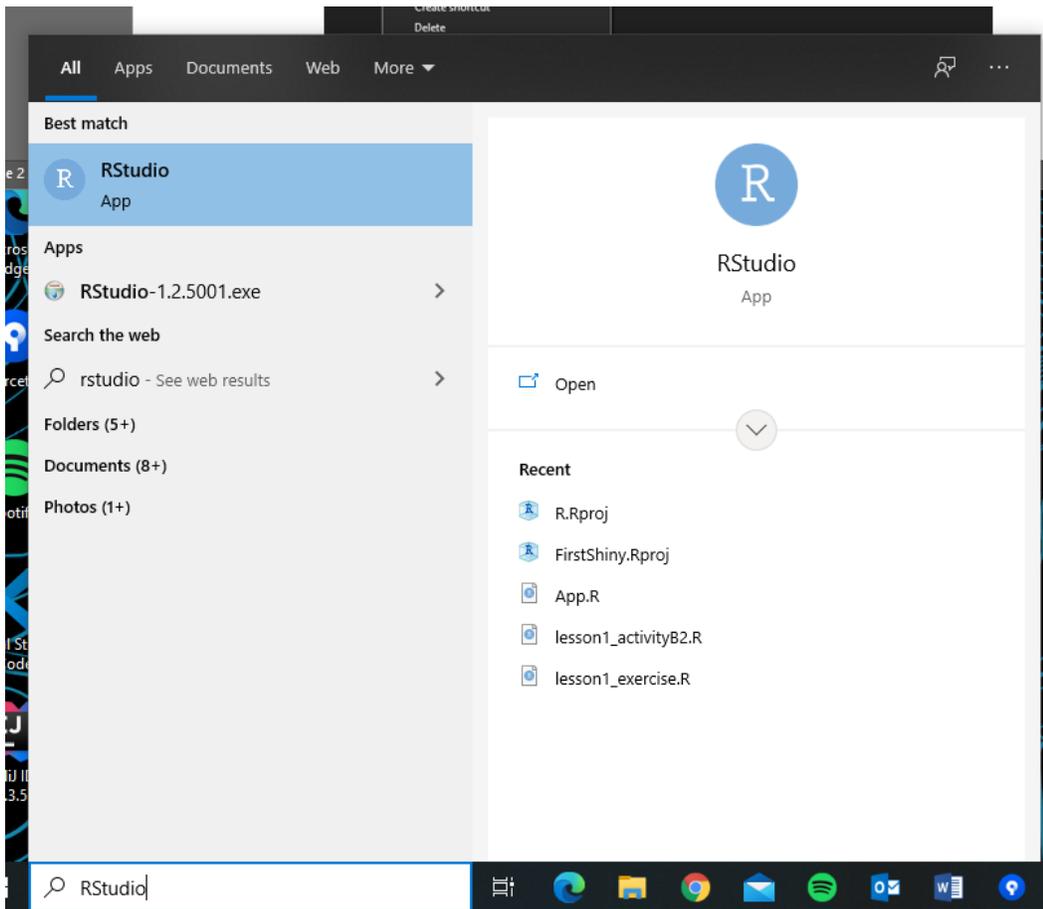


Figure 7-15. Launching of the RStudio application.

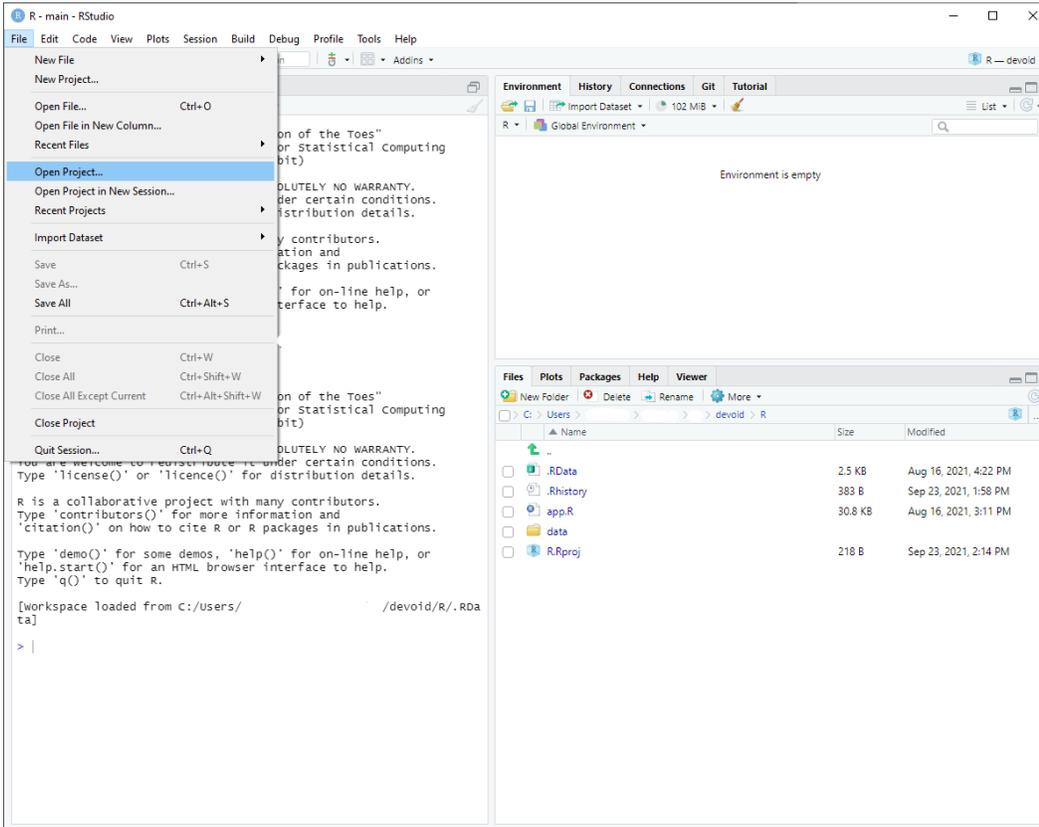


Figure 7-16. Open the DEVOID project.

Navigate to the “R” directory of the unpackaged application and click the “R” file. Depending on the system configuration of the machine, the file’s extension (.Rproj) may or may not be shown. This will open the project in RStudio. Once the project is loaded, in the “Files” tab of the window to the lower right of the screen, click on the app.R file (Figure 7-17).

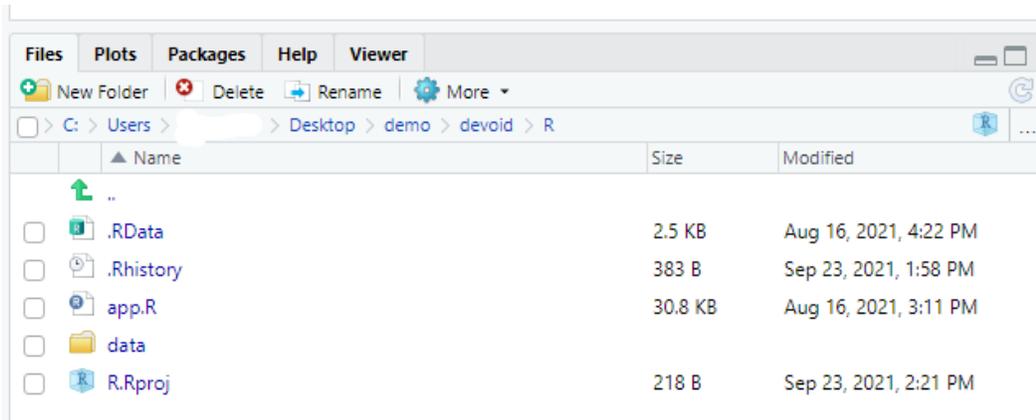


Figure 7-17. Loading the source code.

The application's source code will appear in the left window of the screen. At this screen, click on the "Run App" button (highlighted in Figure 7-18) at the top of the window. Rstudio will then check for installed packages which may take 30-60 seconds.

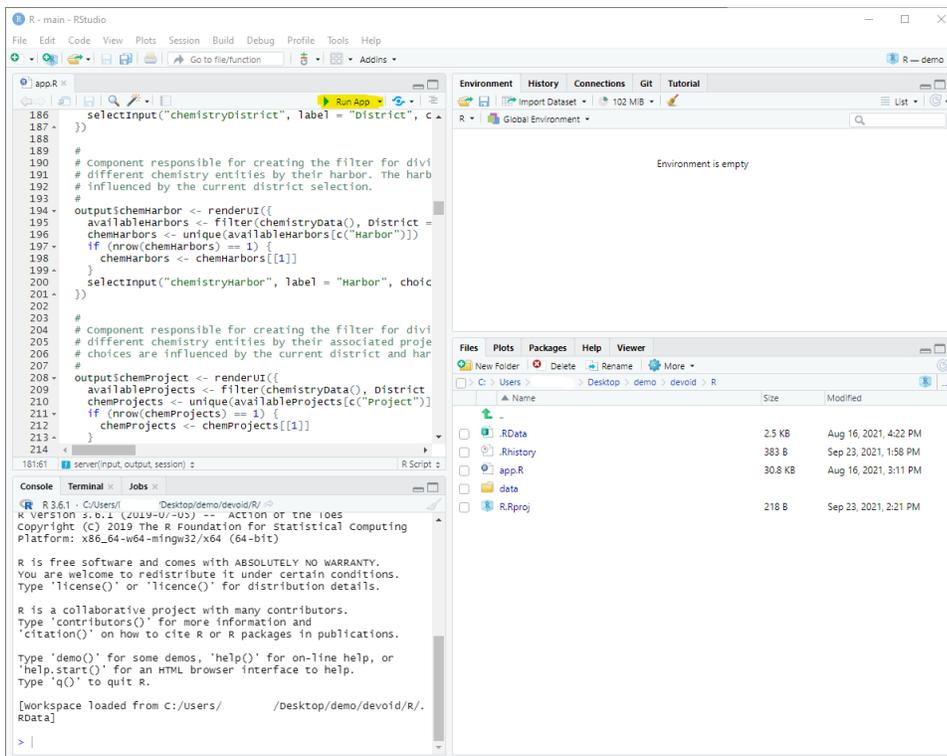


Figure 7-18. User may initially see the source code upon launch.

A new window will open with the DEVOID application ready for user interaction (Figure 7-19). The DEVOID application may be run by selecting all code (CTRL+A) and followed by simultaneously pressing CTRL+ENTER. It may take several seconds for the code to run and the data to upload into the tool. An example of output produced by the program is shown in Figure 7-20.

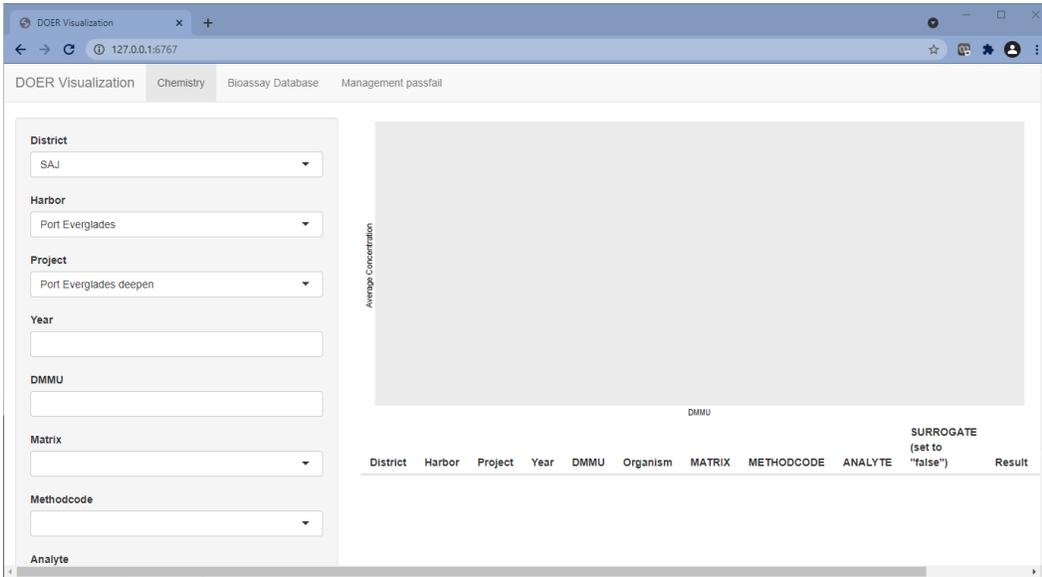


Figure 7-19. Opening screen of the DEVOID application.

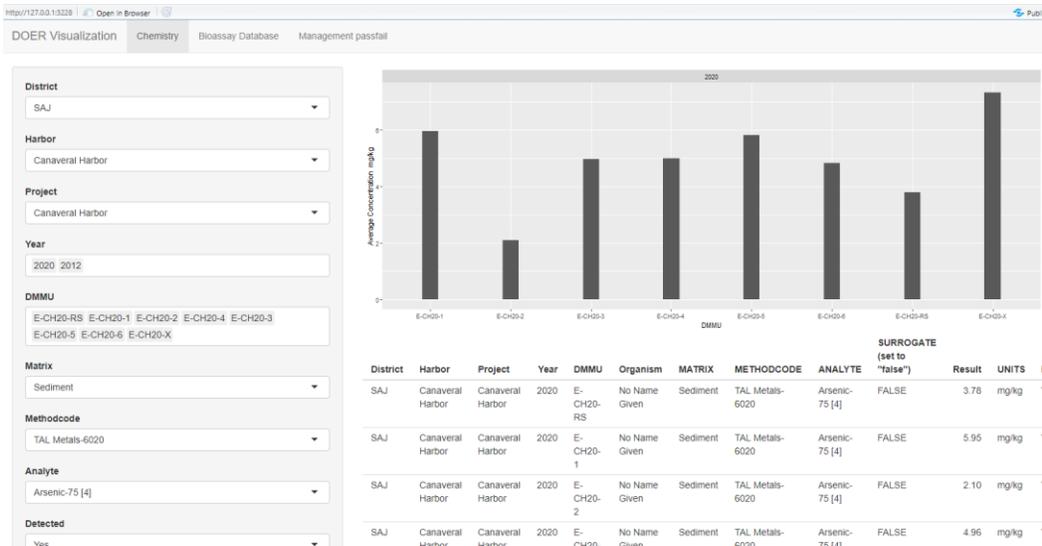


Figure 7-20. Example of data visualization output for the DEVOID application.

### 7.3.3 Using the DEVOID application

The DEVOID application displays information from a Microsoft Excel spreadsheet located in the data folder of the DEVOID application directory. The file is titled "Dredging database" and is required for use of the application. Should the file be altered with a name or location change, the DEVOID application will not function.

The "Dredging database" file consists of three required worksheets titled "Chemistry," "Bioassay Database," and "Management pass/fail". If these sheets are not located in the database file, the DEVOID application will not function. Each datasheet is represented by a tab located at the top of the application. By clicking on a certain tab, the data contained within its respective sheet will be populated in the window for further analysis and review. The sheets can be queried through respective data fields that correspond to the different columns in the sheet. By inputting selections into the selection fields, the data is retrieved and displayed (Figure 7-19).

In the *Chemistry* menu, the tool provides a rapid and user-guided way to view trends in dredging evaluation chemical data by USACE district, harbor, project, year, DMMU, environmental matrix (i.e., water, sediment, tissue) and analyte. The drop down menus can be used in any order, but it is most logical to work from top to bottom. Multiple projects, project years and DMMUs may be visualized simultaneously by making individual selections from the applicable drop-down menus (Figure 7-19).

In the *Bioassay Database* and *Management passfail* menus, a similar selection process may be made. The *Bioassay Database* menu enables visualization of the bioassay endpoint results for various test species, and the *Management passfail* menu allows the user to view whether DMMUs passed or failed toxicity or bioaccumulation testing, as well as corresponding reasons for failure and subsequent management decisions (e.g. volume restriction).

#### 7.3.3.1 Application Interface Fields

The DEVOID Application allows a user to visualize information regarding data from different dredging evaluations and tests. The information is displayed in both chart and tabular forms. The information tables below describe the different fields available. The following tables summarize each menu bar function and whether multiple selections can be made.

## Chemistry

| Field      | Description   | Multi-Select* |
|------------|---|---------------|
| District   | USACE District with jurisdiction over the performed evaluation      | No            |
| Harbor     | Location where the evaluation was done                              | No            |
| Project    | Specific project associated with the evaluation                     | No            |
| Year       | The year the project was conducted                                  | Yes           |
| DMMU       | The Dredged Material Management Unit tested                         | Yes           |
| Matrix     | The matrix associated with the DMMU (i.e., water, sediment, tissue) | No            |
| Methodcode | The associated analytical methodcode                                | No            |
| Analyte    | The associated analyte  | No            |
| Detected   | Was the analyte detected?   | No            |

*\*To trigger multi-select, click in the selection box after initial criteria is selected and select the next criteria for evaluation.*

## Bioassay Database

| Field         | Description  | Multi-Select* |
|---------------|--|---------------|
| District      | USACE District with jurisdiction over the performed evaluation | No            |
| Project       | Specific project associated with the evaluation                | No            |
| Year          | The year the project was conducted                             | Yes           |
| DMMU          | The Dredged Material Management Unit tested                    | Yes           |
| Test Type     | The test type conducted  | No            |
| Treatment     | The treatment studied  | Yes           |
| Concentration | The concentration that was used                                | Yes           |
| Test Species  | The species tested   | Yes           |

*\*To trigger multi-select, click in the selection box after initial criteria is selected and select the next criteria for evaluation.*

### 7.3.3.2 Data Document Schema Definitions

The application is designed to parse and display data based on the “Dredging database” file (described earlier in this section) located in the “data” directory of the “R” folder in the unpackaged application.

Sheets within the “Dredging database” file may be edited, however the file must retain the name of “Dredging database” and remain a Microsoft Excel file. The required sheets of Chemistry, Bioassay Database, and Management passfail must be present in the workbook along with the columns listed as required in the tables above. The data present in those columns must match the schema as presented in the tables.

#### **7.4 Remainder of technical report**

The subsequent sections of this report provide general guidance for considerations and analyses encountered when using the DEMAND and DEVOID tools. The sections on sampling, water column evaluation, sediment toxicity and bioaccumulation assessment inform the user of considerations and procedures in greater detail than provided within the DEMAND tool.