The Development of RRR Model

Software Engineering System Design Document

Version 1.6

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Prepared by

2019-SP5-12

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1. Introduction

The System Design Document (SDD) is dedicated to the Development of Rainfall, Runoff and Routing (RRR) Model. The purpose of the development of the RRR model is to produce the software that fully implements the RRR model. The SDD provides the preliminary requirements and design to develop the software. During the development of the RRR model, the SDD provides a detailed design and system architecture to achieve high-level development.

The SDD should be updated throughout the development of the software if any changes that can affect the development process are required. The SDD should be viewed and modified by the development team at the University of South Australia as the security of regulation.

1.1 Purpose of the SDD

The SDD is used for developers as an overview of the RRR software and outlines the component of the software architecture. This document includes the client requirements which can be used to validate the completeness of the client's desired software. The SDD provides the ability for developers to track and update the system requirements and milestones. And the SDD should be able to support the future development of the project based on the final system design document.

2. Business Requirements

2.1 Executive Summary

The Rainfall, Runoff and Routing (RRR) model is a rainfall runoff modelling approach which is developed by Dr David Kemp [Appendix D]. The RRR model has a great contribution to the flood estimation and stream flow management in the hydrology engineering filed of Australia Rainfall & Runoff system. Compared to other current rainfall runoff model, the RRR model is able to minimize the errors during the implementation of modelling. However, the XP-RAFTS is the only tool that implements the RRR model and it is currently unavailable to UniSA as a commercial software platform [Appendix D]. And there is an interest in this model for research and design for engineers and students. Therefore, there is a demand for a fully functional tool that can apply the RRR model for general use.

The aim of the project is to develop a tool that implement the input parameters by the RRR modelling approach and generating a detailed spreadsheet (like shown in section B of Appendix F) and a diagram (like shown in section A of Appendix F) that includes the comparison between predicted flow rate and actual flow rate. Moreover, the development of the software is mainly considered to the completeness of the requirements requested by Dr David who is also the technical support for this project.

2.2 Project Purpose/Justification

The purpose of this project is to develop a non-commercial tool that implements the RRR model to the rainfall runoff management as a substitute software of the XP-RAFTS. The primary focus of the software is able to support hydrology research for engineers and students. The client has requested the software that can cater to this purpose.

2.2.1 Business Need/Case

The current Rainfall Runoff modelling approach lack of self-consistent compared with the RRR model. XP-RAFTS implements the RRR model to the flood and stream management in the last years, and XP-RAFTS is the only platform that provides the RRR modelling approach. As the importance of the RRR model implementation to the hydrology development, engineers are supposed to use the RRR model to develop the Rainfall Runoff rate prediction for different catchments, even though the current software platform is not available. Therefore, an alternative non-commercial software is needed to support the following research and design of the RRR modelling approach for engineers. A non-commercial software could provide a great effort to students who are willing to implement the RRR model into their study because students prefer to low-budget software as the first choice.

2.2.2 Business Objectives

- Developing the non-commercial software to support the management of the emergency flood predictions and the research of hydrology engineering as the standalone software as a substitute for XP-RAFTS. For instance, the NBE students of UniSA will be able to use the software for the hydrology study.

- Reduce the redundant criteria from the previous software XP-RAFTS, such as other Rainfall Runoff modelling approaches.

2.3 Project Description

The project is required to develop a software that runs in Windows 10 platform and it will be allocated into two part of development component that consisted of the requirements, input module and output module. The input module includes data type confirmation system, loading file system and selection of category. The output module includes the export system, the diagram and the spreadsheet presenting.

2.3.1 Project Objectives and Success Criteria

- Developing the software that implements the RRR model to generate a spreadsheet with correct output values compared with the simple CSV file, and a diagram with the comparison to the base flow rate, predicted flow rate and the measured flow rate before 10/11/2019.
- Developing a documentation that includes the instructions of how to operate the software as a new user before 10/11/2019

2.3.2 Requirements

- The software must implement the RRR model correctly that consisted of the example input and output for testing approach, which will be conducted by Dr David when delivering the software.
- The output diagram should provide a comparison for the output flow rate, and the line chart is assigned by the time step as the X-axis. (This should be similar to Section A of Appendix F)
- The export file data type will be limited to CSV file for the table, and PNG for the output diagram.
- Manual input is necessary for the key parameters.
- The instruction of key steps of operating the software should be delivered.
- The design of the graphical user interface for ease of use.
- The software must be able to run in the Windows 10 platform.
- The spreadsheet should provide the calculated values of the data after implementing the RRR model.

2.3.3 Constraints

- The limit knowledge about the engineering mathematical equations of the RRR model.
- Lake of a fully worked step-by-step instructions of the RRR modelling approach support.

In the initial stage of the requirement gathering, the majority difficulty of this project is to define the parameters and equations of the RRR model. Since the correctness of the calculation is the major concern about the software, the project must provide flawless output data to engineers. The instructions of the related engineering knowledge are needed at this stage.

To develop a fully functional software that implements the RRR model, the previous software is unavailable for us to be considered as an example, which could be a great support for us to develop the software that meets the requirements.

2.3.4 Assumptions

As the team has identified, the project will be developed under the following assumptions:

- Having a regular meeting with the client and supervisor together.
- Having more detailed documents accessibility as input and simple output for development.
- The consistency of the project will apply to the new criteria of the RRR model.
- Documenting all the changes made during the development of the project.

The client will provide more specific requirements or queries during the development, which will be confirmed by the supervisor and the team PM. As the testing period of the development, the PM needs to ensure that the result of the software will match the simple output as more documents would provide comprehensive testing result. The input documents will be used to identify the source parameters. The updating of the RRR model will not break the dependencies of the implementation of the RRR modelling software. The documentation process of the project will provide a clear review of the previously unsolved problems to the following development.

2.3.5 Preliminary Scope Statement

The project of the development of the RRR model will be exploited to generate the predicted flow rate of the detailed data. The model manages the actual flow rate data, rainfall rate, time and catchment ID (area) and calculate the predicted flow rate. The source document will be either CSV file provided by Dr David. And the expected output includes a comparison diagram between base flow rate, measured flow rate and predicted flow rate, a spreadsheet that documents the detailed data for input parameters and output result. Documentation of the software is required for the new users, which will be developed as the updating of the project progress and summarized to the instruction of the software.

2.4 Risks

ID	Risk Description	Probability	Impact	Risk Level
R1	Misunderstanding the engineering part of the RRR model.	High	High	High
R2	Requirements gathering incomplete.	Low	High	Medium
R3	Development timeline inconsistent.	Medium	High	Low

R4	Data loss when the software crashed.	Low	Medium	Medium
R5	Lack of support from the engineering aspect.	Low	High	High
R6	Team member illness and personal issues during development.	Low	High	Medium
R7	The RRR model updated.	Low	High	Low
R8	The data type length limitation	Medium	High	High

2.5 Project Deliverables

The following deliveries should be handled to Dr David and UniSA.

- The RRR modelling software.
- The Documentation of the software.

2.6 Summary Milestone Schedule

ID	Milestone	Task	Start date	Due date	Assigned
M1	Data structure analysis	1. Understanding the basic calculation progress of the RRR model. 2. Extract the mathematical equations from the XLSX file.	7/08/2019	01/09/2019	Siyang Wang, Ke Zhang
M2	GUI design	1. Prototype: Input parameters, output diagram and output table. 2. Menu bar 3. Import and Export format	01/09/2019	03/09/2019	Siyang Wang, Ke Zhang
M3	Implement the RRR model to the software with coding	1. RRR 1x1 catchment model 2. 2x2 catchment model 3. 5x5 catchment model 4. Diagram auto-update 5. Import and Export function	03/09/2019	15/10/2019	Siyang Wang, Ke Zhang

M4	Adjusting the accuracy of the calculation & Optimization for the software	1. Parameter validation 2. Decimal place 3. Full-screen mode 4. Import and Export file validation	15/10/2019	21/10/2019	Siyang Wang, Ke Zhang
M5	Testing	1. Sample catchment CSV file testing 2. Table value comparison 3. Auto-update diagram with parameter testing 4. Data type limitation testing	21/10/2019	30/10/2019	Siyang Wang, Ke Zhang

2.7 Summary Budget

The project does not have any provided expenditure. The required development tool for the project is provided by UniSA, such as programming platforms and desktops. The potential costs may apply to the project, which could include the external source for testing implementation. The other aspect of the provided sources includes human resources and time consumption. This project needs the engineering knowledge support which is provided by Dr David or other engineers if possible. And this project will take more time to understand the basic theory of the engineering part of the RRR model.

2.8 Project Approval Requirements

The project can be delivered when the following criteria have been approved by Dr David Kemp and Dr Stephen Searle:

- The software must accept the CSV file or Text file as the selection input sources.
- The calculation process has to be correctly implemented according to the RRR model.
- Print the diagram that includes the comparison between measured flow rates, predicted flow rate and the base flow rate, and set the time step as the X-axis.
- Print the spreadsheet that includes the detailed data for the input source and the calculated output data.
- The software must have the ability to export the diagram and spreadsheet to the CSV file or Text file.
- The user interface should be clear to be operated by the user.
- The parameters of the manual input part should be able to edit.

2.9 Project Manager

2.9.1 Project Manager Responsibilities

Siyang Wang has been assigned as the Project Manager of this project.

The major responsibilities of the PM include:

- Monitor the milestone completion progress of the project
- Contact the client and the supervisor to communicate the update of the project
- Risk management strategy and constraints about the project
- Responsibilities and tasks allocation

2.9.2 Project Management Plan

During the project period, the PM arranges the weekly meeting with the client and supervisor every Wednesday.

Host the meeting, exchange project progress during the meeting, seek technical assistance from customers, and request project advice from the supervisor. Ensure that the project currently meets customer expectations. Make detailed records of weekly meetings.

Communicate the project process with the team member, remind the team members to finish the work before the deadline for each milestone. The risk management should be able to access by every member of the team in order to improve and record the new risks.

Organize debugging after programming, each functional component must be debugged separately after coding to avoid structural problems.

3. System Requirements

3.1 Functional Requirements

3.1.1 Operation of gathering the calculated diagram/spreadsheet view

The system shall:

FR1: Convert the import data to the parameters correspond with the mathematical equations.

FR2: Set/edit parameters manually.

FR3: Ensure the data is the correct data type.

FR4: Show the spreadsheet

FR5: Show the diagram

FR6: implement the parameters and inputs in the RRR model for calculation

FR7: The data will be retrieved by the system when crashed.

3.1.2 Export the spreadsheet and diagram

The system shall:

FR8: Provide selections of data type export method.

FR9: Transfer the calculated data into the selected data type.

3.2 Non-Functional Requirements

3.2.1 Operation of gathering the calculated diagram/spreadsheet view

The system shall:

Usability:

NFR1: The system should be operated on Window 10 platform

NFR2: Accept CSV file

NFR3: The user interface will be managed to the daily use of the previous tool for engineers.

NFR4: Auto-scale the software windows form to full-screen mode.

Reliability:

NFR5: The system is able to manage the import file of 100 flow rate data.

Security:

NFR6: The import file of the data is not editable.

3.2.2 Export the spreadsheet and diagram

The system shall:

Usability:

NFR7: Automatic set the initial export data type is CSV file

Reliability:

NFR8: Ensure all the data will be exported and saved into the export file.

4. Design Considerations

4.1 Goals and Guidelines

4.1.1 User friendly design:

The user interface design should be able to clearly show the desired contents (Diagram, Table, Input parameters sections). The import functions for the CSV file and preset parameters will be limited to CSV and PNG file data type to avoid the system crash. And the Export file location is preset as the same hard disk location of the import catchment CSV file. A Documentation file will be provided as the user guide for using the software.

4.1.2 Extracted CSV file is able to be implemented as input File

This is considered as the convenience of user implementation. The user can just manipulate the software with one CSV file that holds all the parameters and input table. The CSV file outputs are stored in the same folder in order to achieve general use of Dr David's habit.

4.1.3 Graphical diagram export as a picture type of file

Separated diagram outputs provide user to attach the diagram into any other place. Such as Word document and XML file

4.1.4 Parameters exports as a CSV file

The parameters outputs are stored in the same folder of the diagram. And the folder is created by the software based on the different catchments.

4.1.5 Data Limitation is restricting the user prompt value of parameters

Suggested input values and limitations are restricted by Dr David provided guideline. Preventing input error occurs during the manipulation of software, which could result in output value exceed the limit of variable length and crash the software.

4.1.6 Classified functions are built on different tables

In order to achieve the following development convenience and coding environment comfortable, we decided to include the table content of coding in different functions. It is considered as quite difficult to add additional RRR model into the current functions, but the code clearly mentioned the part need to be edited if additional RRR model needed to be implemented.

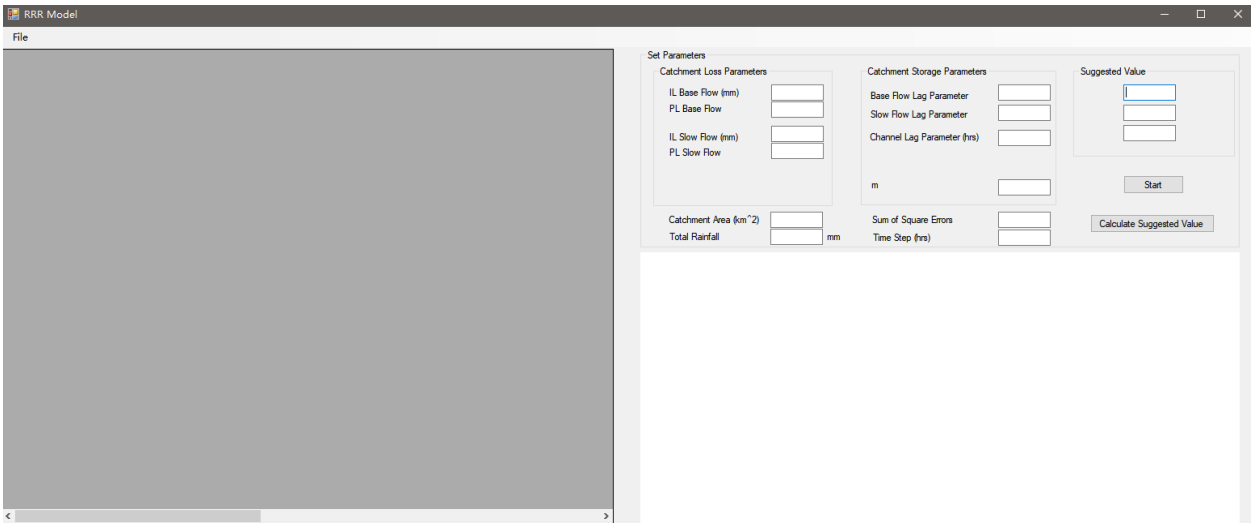
4.1.7 Calculation process is using table index on Mathematical equations

Using the index of Datagridview (C# Windows tool) as input to control the calculation process, this provides the ability to change the diagram instantly

4.2 Development Methods & Contingencies

4.2.1 Prototyping - UI design

We first design the user interface with the prototyping method to show the initial UI to the client. We have used the C# Windows form as the framework to build the UI.



1) The grey part shows the main table content. It includes: Input catchment data, calculated data.
2) The top-right part is the input parameter section.
3) The bottom-right part is the auto-update diagram.
4) The menu bar is placed at the top of the UI. It will have three sections: File import, Access different table and File export.

4.2.2 Structured - Grouping of all functionally related elements for the code

We classified the functions based on three parts: Import and Export, Data Calculation and Diagram updating. This will provide the efficiency for developers to debug and maintain the software.

4.2.3 Black-box Testing

We decided to use black-box testing for the testing and debugging of the software since the engineering knowledge of the RRR model is hard to understand and the accuracy of the result is important in this case. During the black-box testing, the software generated the correct table contents and the diagram after input catchment file loaded and parameters filled. In this case, the testing shows that the functional and non-functional requirements are completed.

5. Operational Scenarios

5.1 Key System Actors

5.1.1 Operation of gathering the calculated diagram/spreadsheet view

ID	Use Case	Actor
UC1	Import CSV	User
UC2	Search a specific time step	User
UC3	Manually edit parameters	User
UC4	Select output category	User
UC5	Validate CSV data	System
UC6	Highlight searched content	System
UC7	Convert CSV data to parameters	System
UC8	Show error report	System
UC9	Validate parameters	System
UC10	Process parameters	System
UC11	View spreadsheet	User
UC12	View line graph	User

5.1.2 Export the spreadsheet and diagram

ID	Use Case	Actor
UC13	Export output	User
UC14	Select file type	User

UC15	Extract output as the selected type	System

5.2 Use Case Descriptions

5.2.1 Operation of gathering the calculated diagram/spreadsheet view

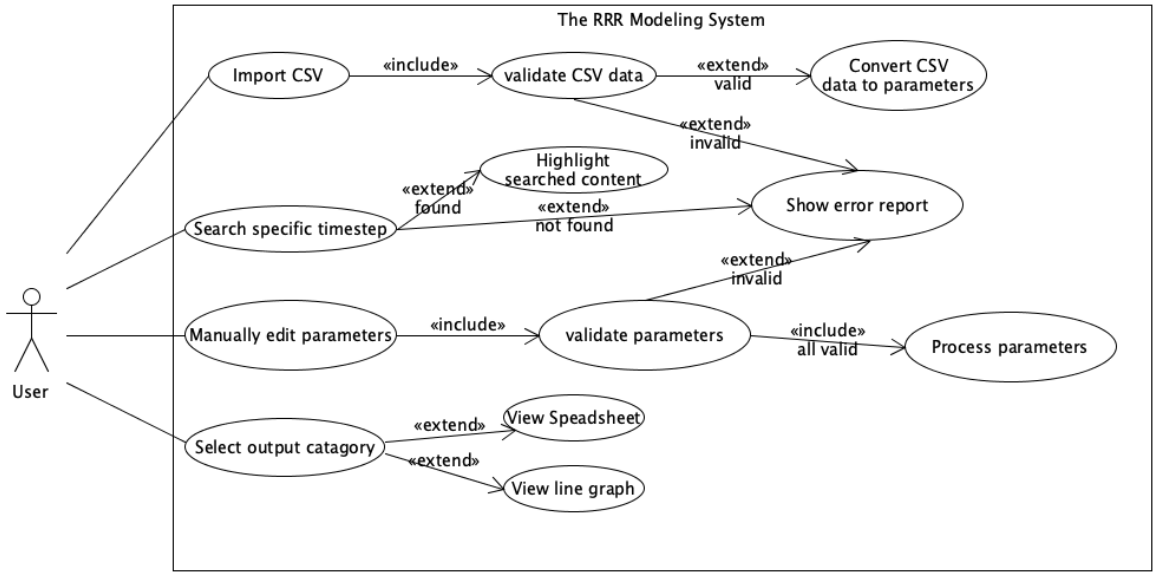
ID	Use Case	Description
UC1	Import CSV	The user needs to select the source file
UC2	Search the specific time step	The user can search for the specific data by the time step of the catchment ID or the name
UC3	Manually edit parameters	The key input parameters can be edit and enter by the user
UC4	Select output category	The user can choose to show the diagram or the spreadsheet on the view of the software
UC5	Validate CSV data	The data of the selected file will be assessed by the software to match the data type of the RRR model
UC6	Highlight searched content	The software will return the found data and highlight the content
UC7	Convert CSV data to parameters	After validating the input data from the source file, the software will store them as parameters that waiting for the calculating process
UC8	Show error report	Error report of different cases will be shown if the data is invalid
UC9	Validate parameters	The manual input data will be assessed by the software and store in the calculation waiting process
UC10	Process parameters	After all the data is validated, the software will proceed with the calculation process by using the parameters
UC11	View spreadsheet	After the selection of the view category, the spreadsheet will be shown
UC12	View line graph	After the selection of the view category, the diagram will be shown

5.2.2 Export the spreadsheet and diagram

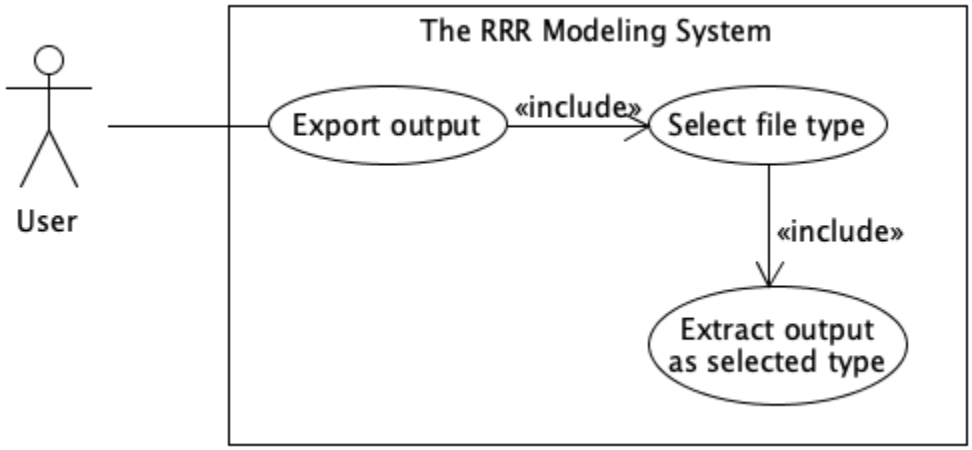
ID	Use Case	Description
UC13	Export output	The user can choose to get the calculated data into the external file
UC14	Select file type	The user can select the output file to be exported into a CSV or a Text file.
UC15	Extract output as the selected type	After the selection of the export file type, the system will take the diagram and spreadsheet into the file of the selected data type.

5.3 Use Case Diagrams

5.3.1 Operation of gathering the calculated diagram/spreadsheet view



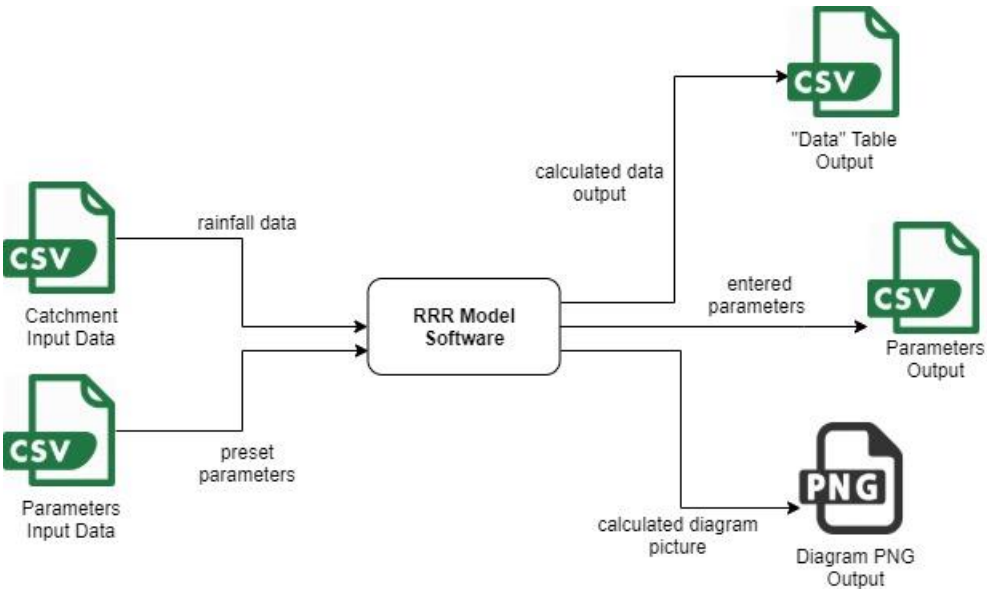
5.3.2 Export the spreadsheet and diagram



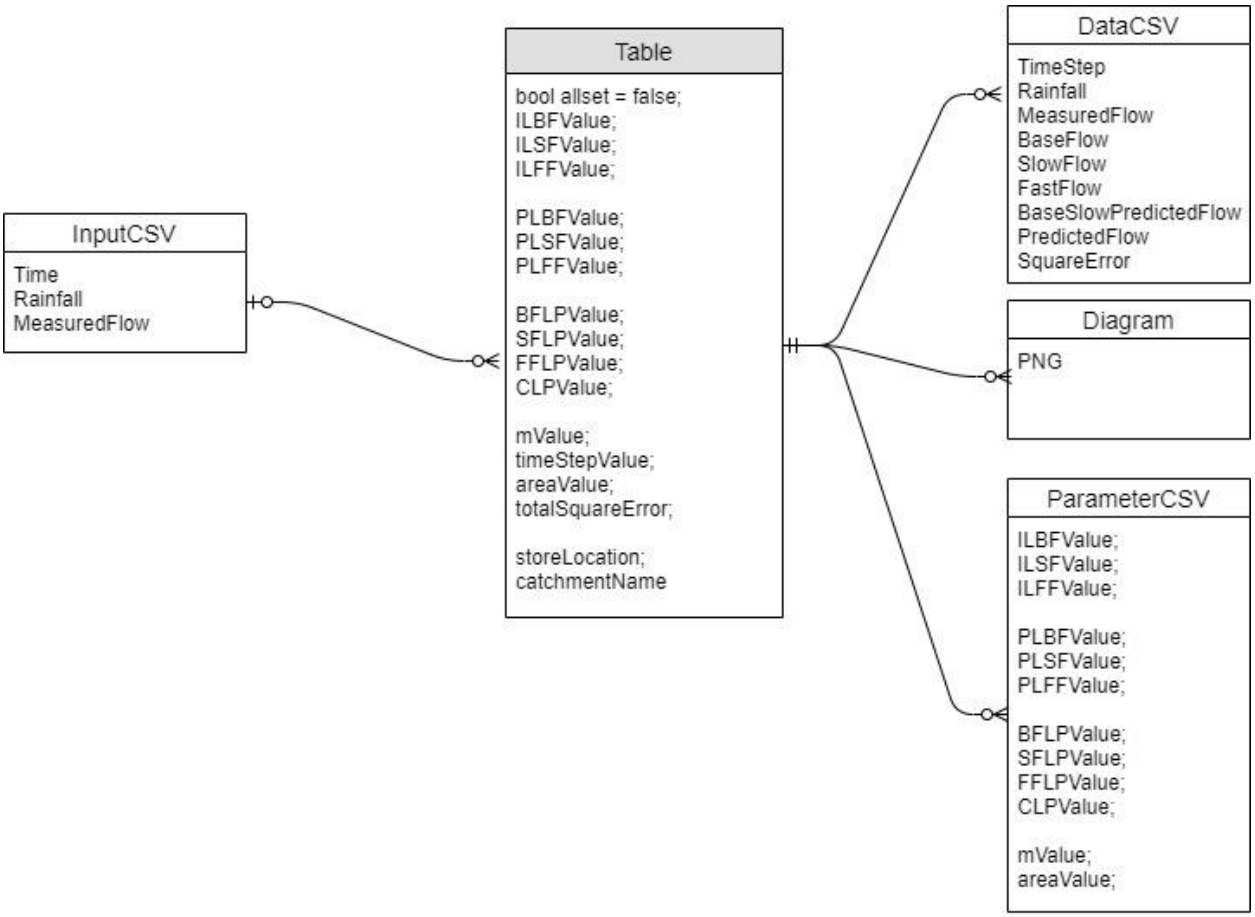
6. System Architecture and Architecture Design

6.1 Logical View

1. Data Flows:



2. Entity-relationship diagrams:



6.2 Physical View

6.2.1 User Interface Design:

The user interface design includes four parts:

Menu Bar:

The “Table” menu includes the main table “data”, calculation details table “hydro” and prediction table “Rout”. The “data” table shows the key elements that used to draw the output diagram. The “hydro” table includes the detailed element of implementing the RRR model. The “Rout” table represents the calculation process of “OutFlow” parameter.

The “Save” menu includes three options: 1) save the “data” table to the local hard disk. 2) Save the “diagram” to the local hard disk. 3) Save the entered parameters to the local hard disk.

Parameters TextBox: Input parameters that used to calculate the output data.

Output diagram: Shows the comparison line chart between base, slow, base+slow, predicted flow data.

Datagridview Table: Shows the initial catchment input data and calculated table contents.

1) The user can load the input CSV file by selecting the “Import CSV” Button from the Tab Bar menu.

2) A dialog window will be showed and asking the user to select the CSV file from the local hard disk. (This is the location where the output of the software will be stored)

3) The “Data” table will present the initial input catchment data from the selected CSV file.

6.2.2 Data Design:

1) The parameters that the user entered will be stored in local variables as “Double” data type.

The initial parameters includes: *Initial Loss, Proportional Loss, Lag parameters, M value and catchment area parameter.*

2) The *Time Step* value and S*quare Errors* will be stored in local variables as “Double” data type and presented after the implementation process of the RRR model.

6.2.3 Process Design:

1) The input Textbox is limited to the numeric character.

None numeric character validation: Alert window will be shown to notify the user to enter the number only.

2) The input file’s data type is limited to “.CSV” file.

Cancel the dialog window: No operation from the software.

3) The value of Cumulative Rainfall, Effective Rainfall, Mean Inflow, Outflow(1-5) and Rout(1-5) will be stored in the “hydro” table.

The first row of the table contents will be zero if the table elements’ condition is not applied (conditions is built based on the implementation of the RRR model).

4) The output diagram will be saved as “PNG” Portable Network Graphics data type.

5) The output “data” table will be saved as CSV file in the same hard disk location of input catchment data.

6) The “parameters” will be saved as CSV file in the same hard disk location of input catchment data.

6.3 Information Architecture

Not Applicable.

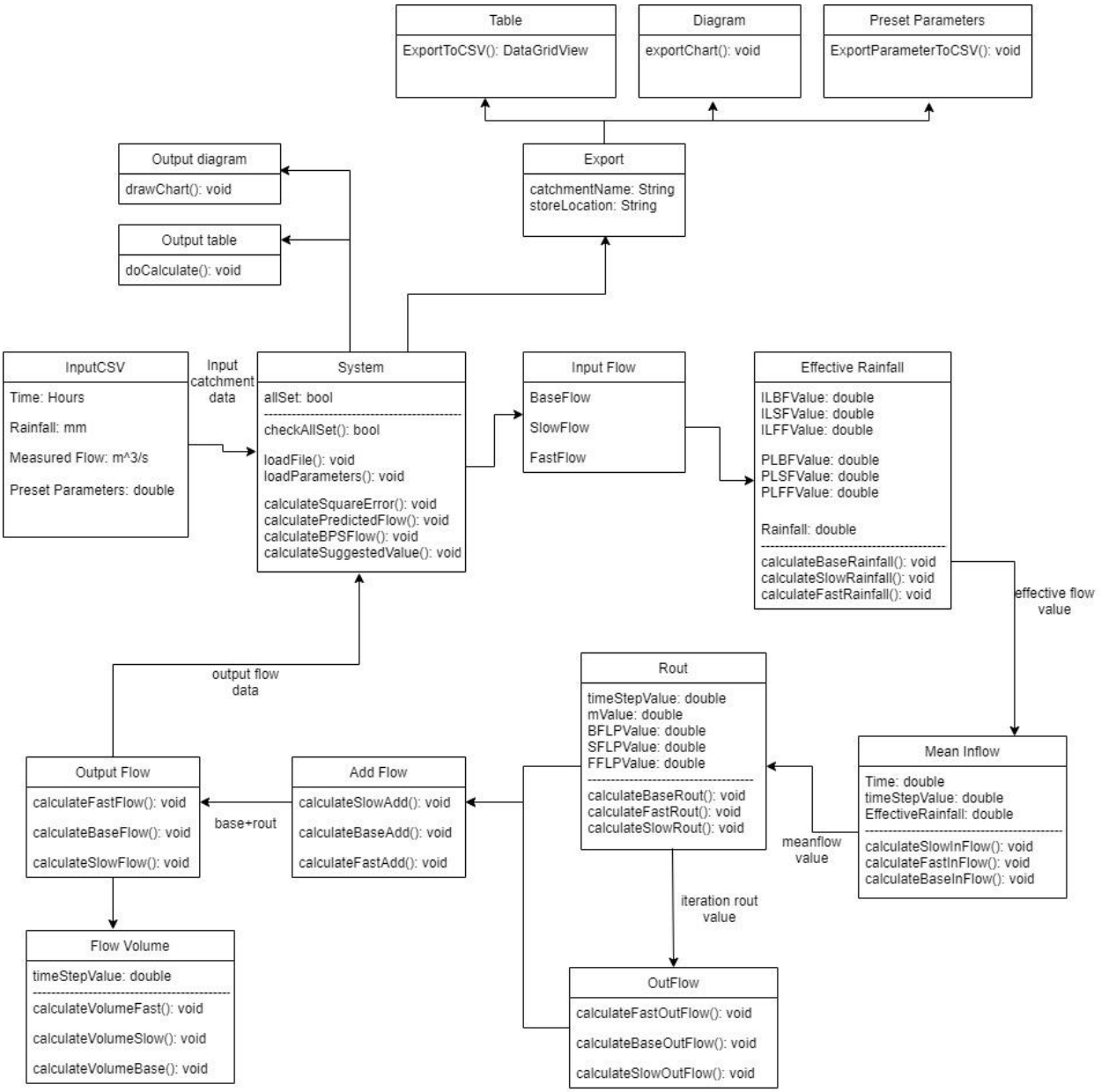
There is no database for the software.

6.4 Internal Communications Architecture

Not Applicable.

The network is unnecessary for the software.

6.5 System Architecture Diagram



7. System Design

7.1 Database Design

Not Applicable.

The software file system applies the CSV file and PNG file as the import and export data type, therefore, there is no need to apply the database to the system.

7.2 Data Conversion

Not Applicable.

The data is stored and calculated inside the system. The data conversion process is unnecessary.

7.3 External Tools (APIs)

1. **.NET Framework API:**

   The .NET Framework is needed as the requirement to run Windows platform applications on Windows 10 system. The 4.6.1 version of the .NET framework is recommended.

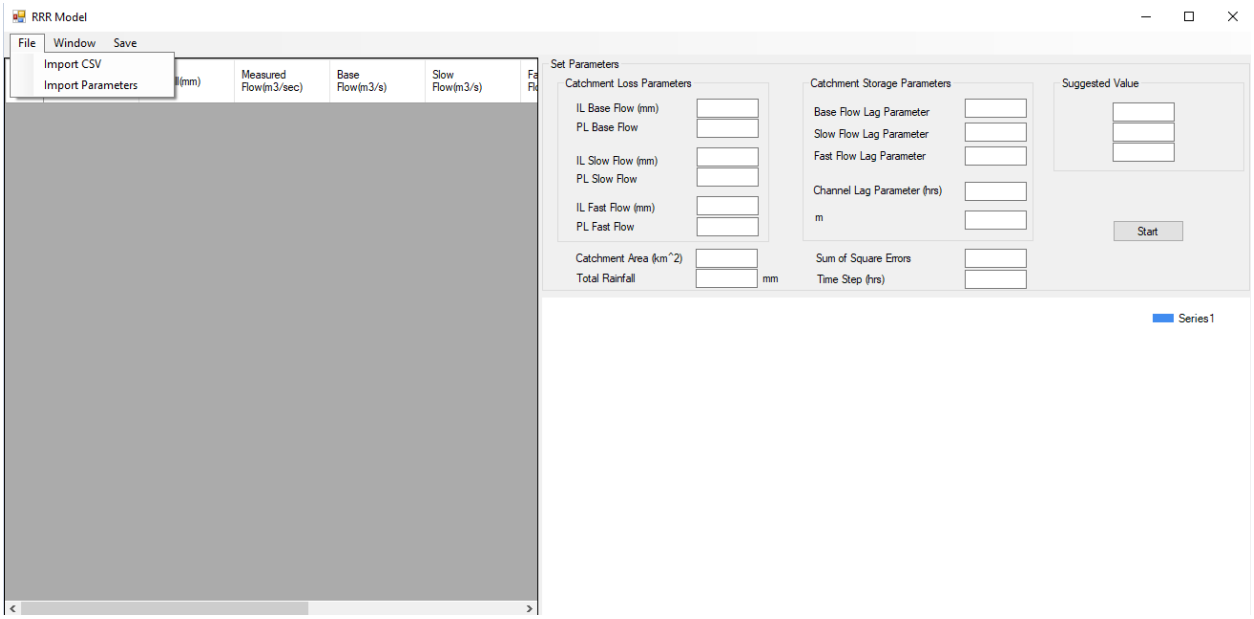
2. **Windows Application Packaging Project API**

   The packaging API is used to export the visual studio code into an installation application. The installation application will generate the “EXE” execution file on users’ Windows 10 system.

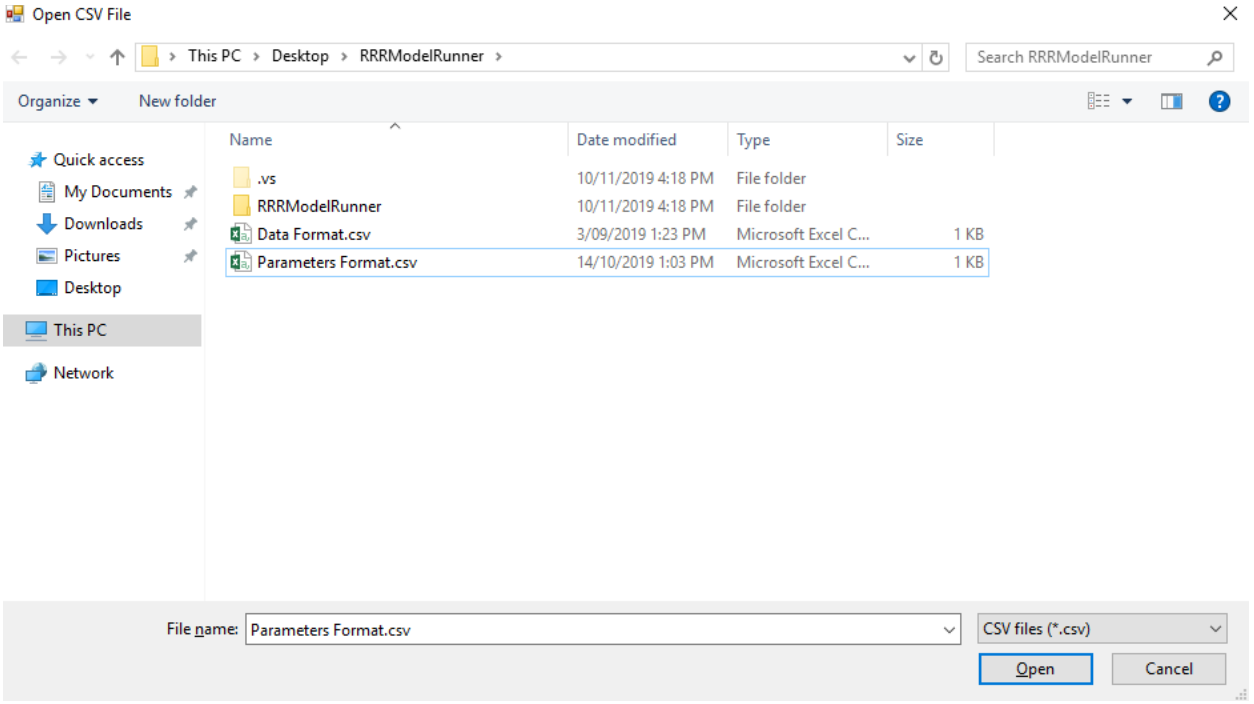
7.4 User Interface Design

7.4.1 User Interface - Basic UI

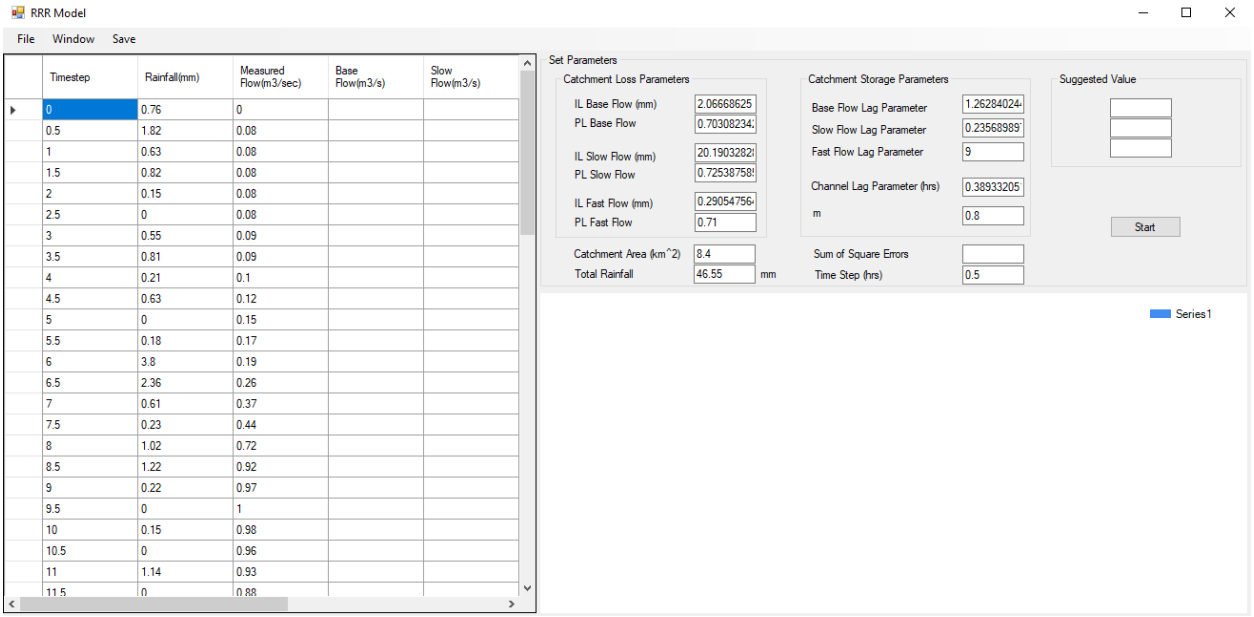
Import File Options:



Import File Dialog:

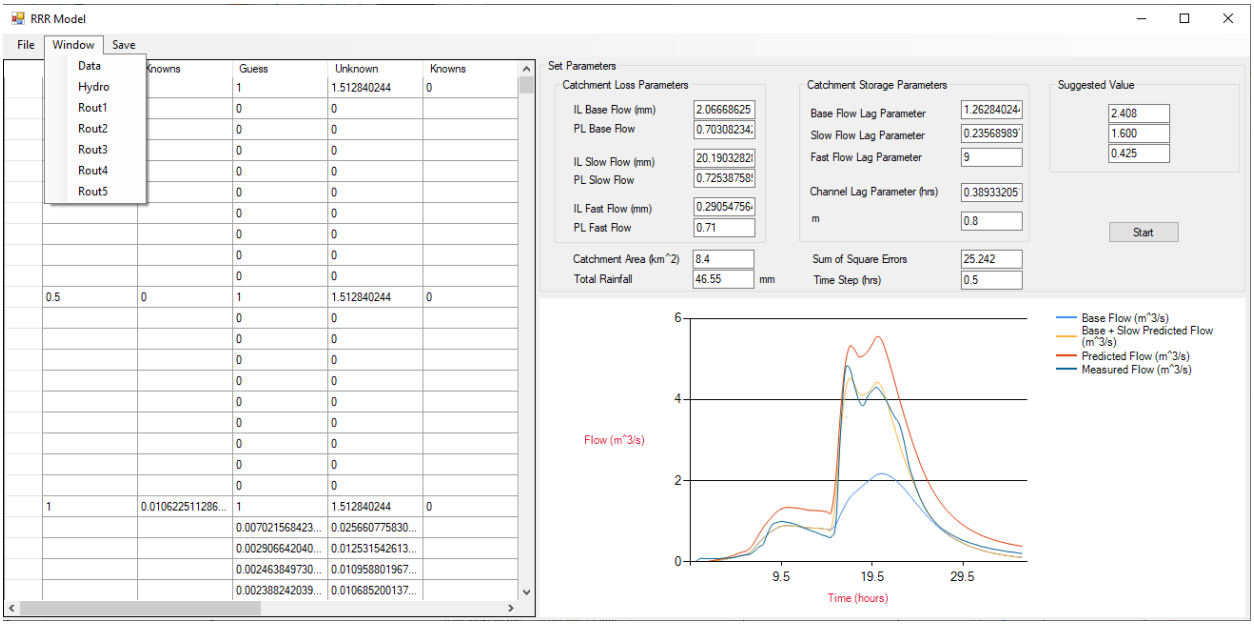


7.4.2 User Interface - Input CSV loaded

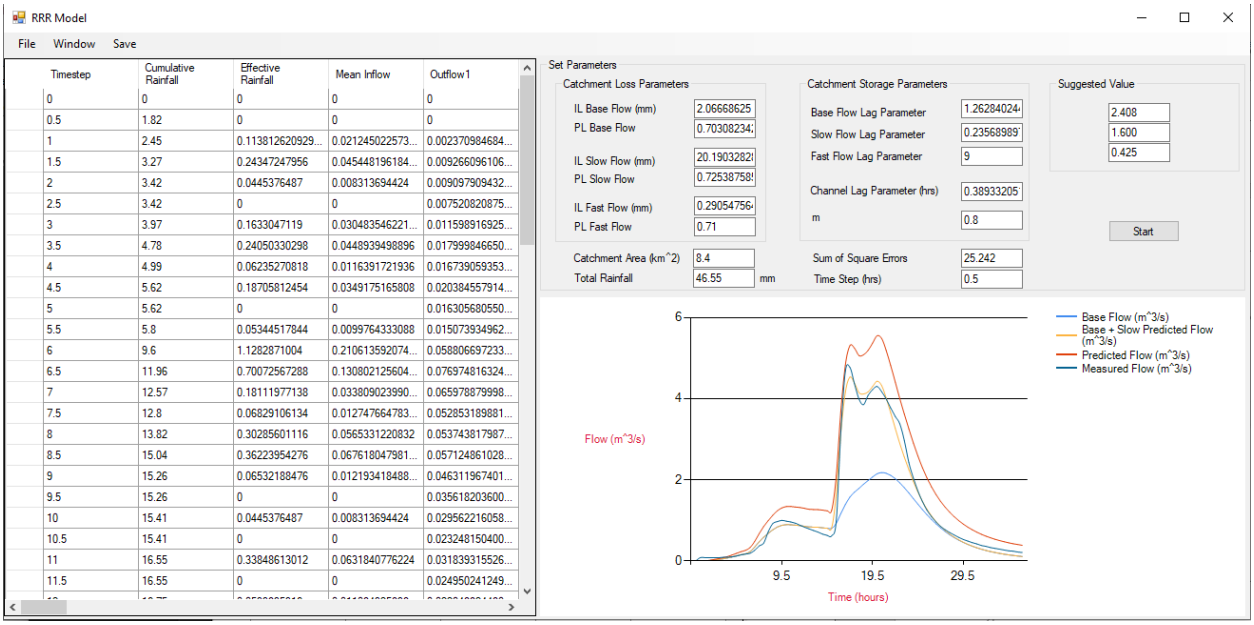


7.4.3 User Interface - Outputs Table & Diagram calculated

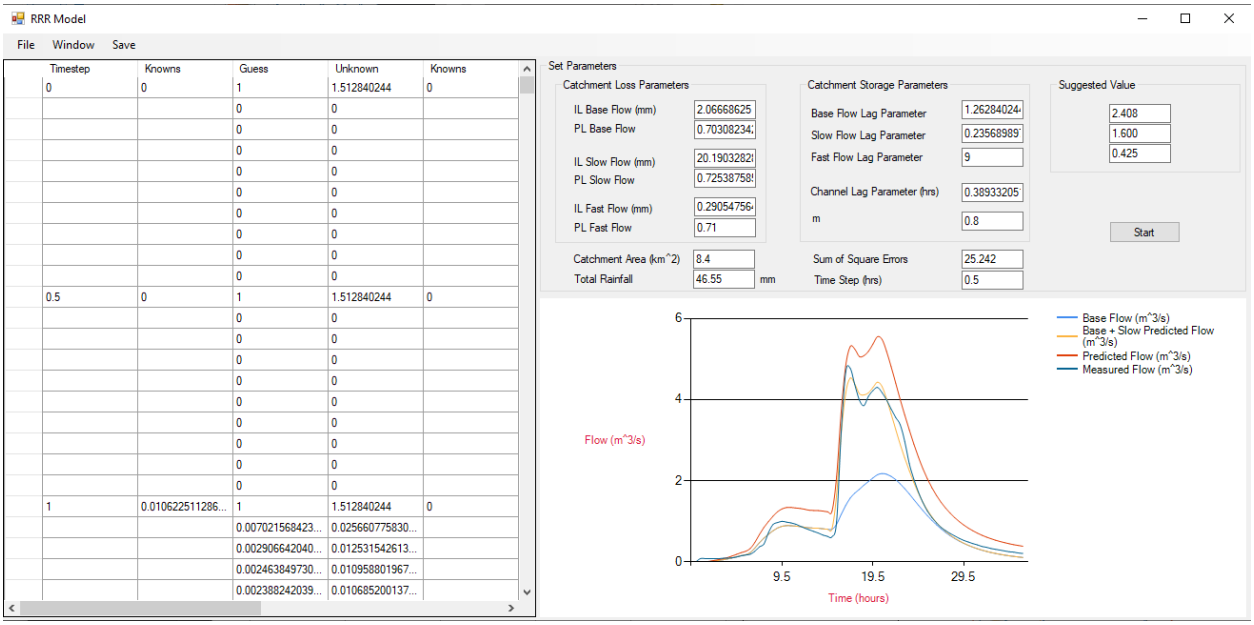
Data Table:



Hydro Table:

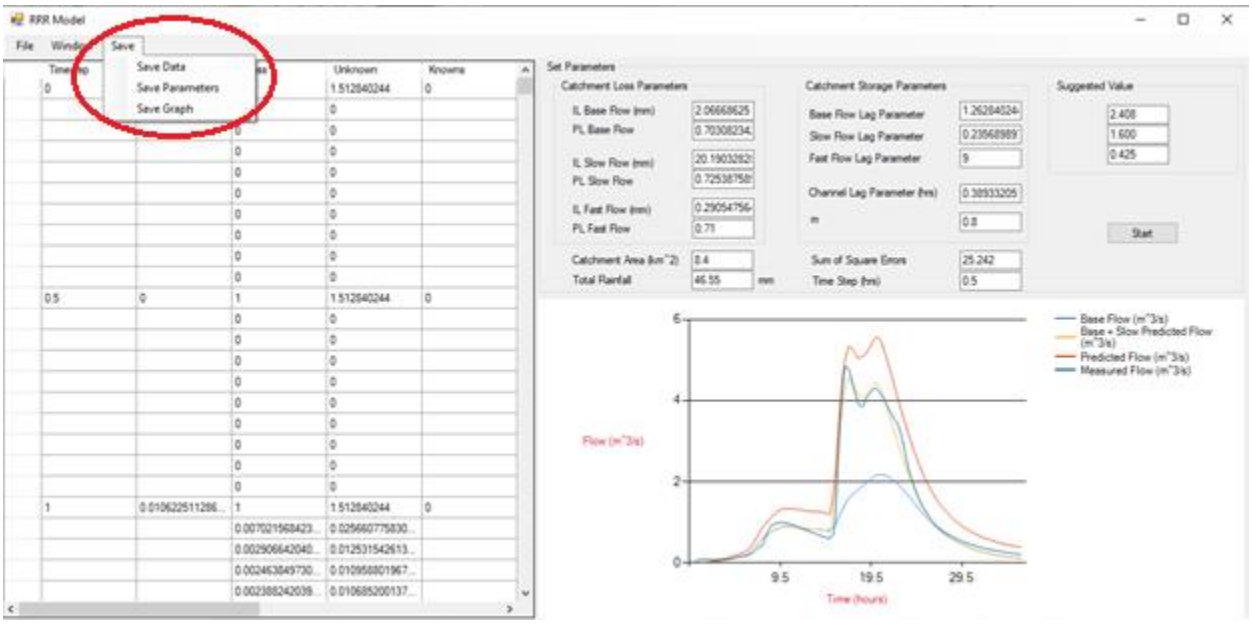


Rout Table:

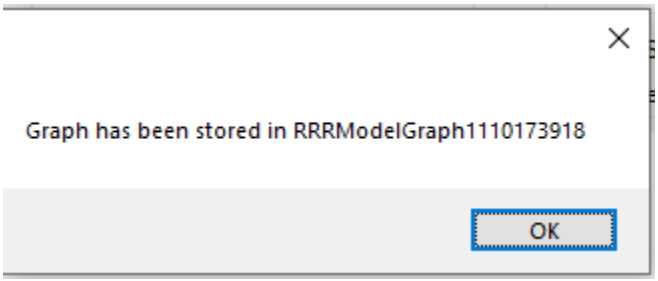


7.4.4 User Interface - Export file

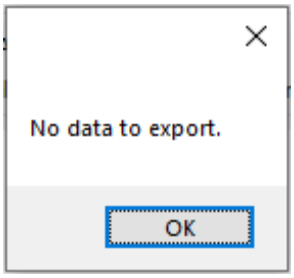
Export File Options:



Export File Success Notification:



Export File Failure Notification:



8. Version Report

8.1 Version Report of the RRR software

```
*********************************
*   * - important feature       *
*   # - unfinished feature      *
*   version number means date   *
*   in this development cycle   *
*********************************
9.3 version
--------------------------------------------------------------------------------------------------------------------------------
this version add fast flow process
ILBF,area timestep validate func
all parameters set check
start button has bool check
*import CSV works
*inflow calculator test version, looks good /*wrong formula installed*/


#prepare to improve calculate the inflow
#start button should first time do all calculation
#ILBF, catchment area, timestep validate should has bool check to auto calculate(check for allset)
--------------------------------------------------------------------------------------------------------------------------------
10.5 version
--------------------------------------------------------------------------------------------------------------------------------
this version add hydro table to store each timestep's calculating process

*hydro table is added
*all parameters' validate function is done
*calculation effective rainfall for all 3 processes are added
*rebulid the inflow formula

#new table should be added to store the outflow calculate process
--------------------------------------------------------------------------------------------------------------------------------
10.8 version
--------------------------------------------------------------------------------------------------------------------------------
this version finished the whole process for current spreadsheet we have

*rout table is added, use to show the process to get the outflow of each timestep
*outflow calculation are done for all process
*now we can import the parameters from a CSV file!
*calculation for 3 flows and the predicted flow are added
*square error is added
*suggested value is added
*the chart can be painted now

seems everything is done:)
```

```
---------------------------------------------------------------------------------------------------------------------------
10.9 version
---------------------------------------------------------------------------------------------------------------------------
this version is a multi2 version
almost every function is restructured

*add another rout table for outflow2
** restructured all calculate functions, change the actual number to the index of attributes in a DataGridViewRow,
that means it's much easier to update this software
*add outflow2, rout, add and volume attributes in hydro table
*calculations of outflow2, rout, add are added

#calculation for volume should be added
---------------------------------------------------------------------------------------------------------------------------
10.15 version
---------------------------------------------------------------------------------------------------------------------------
this version is a multi5  version
allow 5 rout& add process to get the flow of each processes

*all 4 rout and add are added for each process
*another 4 rout table added
*calculation of volumns are added
---------------------------------------------------------------------------------------------------------------------------
10.21 version
---------------------------------------------------------------------------------------------------------------------------
this version add export function for data table and charts

*export function add, will store to the disk D:/
---------------------------------------------------------------------------------------------------------------------------
10.27 version
---------------------------------------------------------------------------------------------------------------------------
this version add the nagetive number check for knowns value in rout tables,
re-range the store location to where you import the CSV files,
and change the content shown on the chart

*add new attribute "Base + Slow flow" in data table
*remove slow, fast series in drawChart function
*add "basePlusSlowFlow" series in drawChart function
*add a variable to store the location the import file belongs to

#show three decimal places on data table
---------------------------------------------------------------------------------------------------------------------------
11.06 version
---------------------------------------------------------------------------------------------------------------------------
this version finished the final version of RRR Model Development, all requirement is done in this version

*add new export function "Export Parameters to CSV", now we can export the current parameter to a CSV file that allow
user to import for another use
*change display format in data table, only show the data with three decimal places format
*build the program and made a shortcut in folder, easy to use
---------------------------------------------------------------------------------------------------------------------------
All Done :)
```

Appendix A: Record of Changes

Table 1 - Record of Changes

Version Number	Date	Author/Owner	Description of Change
1.0	*04/11/2019*	*Siyang Wang*	*Design Considerations added, System Requirement Document contents added*
1.1	*05/11/2019*	*Siyang Wang*	*Development Methods & Contingencies added*
1.2	*06/11/2019*	*Siyang Wang*	*System Architecture and Design added*
1.3	*09/11/2019*	*Siyang Wang*	*Preliminary Requirements updated*
1.4	*10/11/2019*	*Ke Zhang, Siyang Wang*	*Milestone updated*
1.5	*10/11/2019*	*Siyang Wang*	*Risk and System Requirements updated, Operational Scenarios updated*
1.6	*10/11/2019*	*Ke Zhang, Siyang Wang*	*User Interface Design added, "Not Applicable" section explanation added*
1.7	*10/11/2019*	*Siyang Wang*	*Appendix added*

Appendix B: Acronyms

Table 2 - Acronyms

Acronym	Literal Translation
RRR	*Rainfall, Runoff and Routing model*

Appendix C: Glossary

Table 3 - Glossary

Term	Acronym	Definition
XP-RAFTS	*N/A*	*A flood management tool that provides the platform for various model implementation and it supports the implementation of the RRR model.*
Windows Application Packaging Project	*N/A*	*A windows form application packaging tool for visual studio.*
.NET Framework API	*N/A*	*The API is used to support running of the windows application.*

Appendix D: Referenced Documents

Table 4 - Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
The RRR Model Report	Kemp, D.J (2002) *The Development of a Rainfall-Runoff-Routing (RRR) Model* PhD Thesis, University of Adelaide, August 2002 *https://digital.library.adelaide.edu.au/dspace/bitstream/2440/61971/8/02whole.pdf*	*08/2002*
XP-RAFTS Detailed Information	*Innovyze. (2019).* XPRAFTS*. [online] Available at: https://www.innovyze.com/en-us/products/xprafts [Accessed 10 Nov. 2019].*	*10/11/2019*

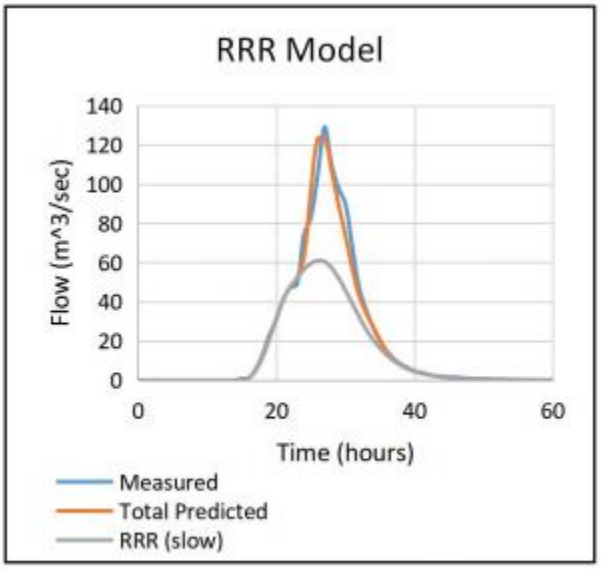
Appendix E: Approvals

Table 5 - Approvals

Document Approved By	Date Approved
Dr David Kemp - Adjunct Senior Research Fellow - School of Natural and Built Environments	04/09/2019

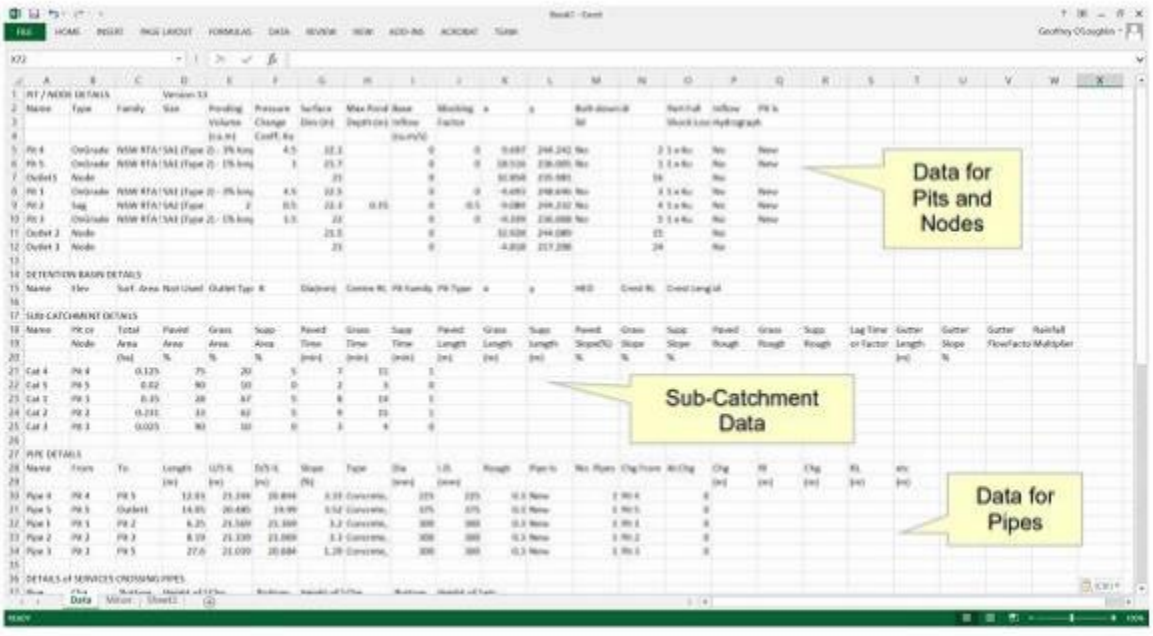
Appendix F: Additional Appendices

A) Sample Output Diagram:



Sample diagram of the output that implemented the RRR model.

B) Sample Output Table:



Sample spreadsheet of the output that implemented the RRR model.

Appendix H: Declaration of Contribution

The following is a declaration of your individual contributions towards this group assessment. If any contribution does not meet the assessment requirements, the course coordinator may adjust individual marks up or down, depending on the level of contribution made.

Team Member 1

Name: _____Siyang Wang_____

I contributed _____2400_____ words towards this assessment.

I worked on the following sections/questions (select whichever is appropriate). ____Introduction, Business Requirements, System Requirements, Design Considerations, Operational Scenarios, System Architecture and Architecture Design, System Design, Appendix.

_____

_____

Team Member 2

Name: _____Ke Zhang_____

I contributed _____2400_____ words towards this assessment.

I worked on the following sections/questions (select whichever is appropriate). _ Introduction,

Business Requirements, System Requirements, Design Considerations, Operational Scenarios, System Architecture and Architecture Design, System Design, Appendix.

_____

_____