FRERMIP
Flood and Riverbank Erosion Risk Management Investment Program

Bangladesh Water Development Board
Asian Development Bank

Flood and Riverbank Erosion Risk Management Investment Program – Project 1

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Institutional Strengthening and Project Management Consultant (ISPMC)

FRERMIP Spatial MIS Database Documentation

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FRERMIP Spatial MIS Database
Main Report

Contents

1. INTRODUCTION

Under FRERMIP, a set of 4 web-based Databases have been developed to store, analyze and display bathymetric and hydrologic data: River Survey, ADCP, Float Track and Water Level.

The primary River Survey database stores bathymetric surveys as Points and Contours, and then analyzes the survey using Spatial Elements: Cross-Sections, Longitudinal-Sections, Points and Areas.

a. An interface has been developed to analyze and display: point elevations, cross-sections, long-sections, areas/volumes, and thalwegs for selected surveys. Separate database interfaces are available for normal users and administrators. The administrator interface includes all normal user functionality, plus the ability to edit, delete and insert data, run SQL queries, and check the survey data. Normal users can analyze data, and then display, print, and export results. Normal users can also select multiple surveys and export them as a zip file in either ASCII (text) or shape file format.

b. The database also allows bathymetric survey data (contours and raw point data) and geometric elements to be extracted and displayed using the popular and open-source (free) Quantum Geographic Information System (QGIS) application. QGIS provides a useful visual interface to display database spatial elements, and also permits visual verification of analysis results.

c. The current River Survey database has a total of 2672 bathymetric surveys, and 45 projects. At least one set of Spatial Elements have been developed for each project to analyze survey contours. All survey points, contours and water levels have recently been converted from PWD to SOB datum which is the new standard datum used by BWDB.

All 4 of the FRERMIP database use an open-source database called PostgreSQL that can analyze and display spatial data using a large set of powerful PostGIS functions. The database user interface is written in PHP using the open-source frameworks Bootstrap and CodeIgnitor.

Spatial data in the River Survey, ADCP and Float Track databases use Spatial Reference System Identifier (SRID) No. 900917 which is equivalent to EPSG: 9678; Gulshan 303 / Bangladesh Transverse Mercator Projection used by QGIS.

A separate interface written in Python has been developed to check, convert, import and synchronize raw input text files and shapefiles into the 4 database tables.

The ADCP database stores both summary discharges for each of the surveys, plus the raw output from the Acoustic Doppler Current Profiler (ADCP) software WinRiver II developed by the Teledyne RD Instruments company. There are currently 51 transect locations and 240 surveys in the ADCP database.

The Float Track database stores velocities at specific points. Surveys are divided into a set of segments which each contain a continuous set of flow velocities at locations (points) along the river.

The water level database contains all Water Levels collected by FRERMIP. The water level data has been stored as date-time values, as much of the older data is available at multiple times each day. For recent data purchased from BWDB, only the average daily readings have been stored in the database.

There are currently water levels available for 346 Water Level Stations, primarily dating from 2006 to 2014, although water levels for an extended time period are available for many of the Water Level Stations along the major rivers: Brahmaputra, Jamuna, Pabma, Ganges and Meghna.

All water levels have recently been converted from PWD to SOB datum using unique conversion values provided by BWDB for 332 of the Water Level Stations. The remaining 14 Water Level Stations have been discontinued by BWDB and no PWD to SOB conversion values exist for those stations, so their data remains in PWD values.

Water Levels were previously used primarily for modelling purposes for project feasibility studies. However, recently they have also been used to add water levels to both our River Survey and ADCP survey databases. The survey water levels have been calculated using the locations of upstream and downstream Water Level Stations and the survey centroids, using a linear interpolation technique that is documented in Appendix I: Section I-3.

The 4 FRERMIP databases have recently been transferred to the BWDB Information Communication Technology Division, along with the FRERMIP Website. The website includes a Dynamic Map that along with displaying construction works along the major rivers completed under FRERMIP and other Projects, also includes summary date from the River Survey and ADCP databases.

The FRERMIP MIS User Manuals contain details regarding both the structure of the 4 databases as well as a step-by-step instructions on the functionality of both the Python interface used to import survey data, and the PHP interface used to analyze the stored data, and display, print, export and extract and survey analysis results.

It is hoped that these FRERMIP MIS User Manuals will help ensure the sustainability of the databases for use in the proposed follow-on project, and by BWDB planner and designers in general. The on-going training of 2 BWDB trainees since mid-September 2023, the 5 day Training Program scheduled for early March 2024 for 12 Users and Administrators, and the hiring of a ISPMC National Database Specialist who has a long history of work with BWDB and is fully familiar with PHP, CodeIgnitor, Bootstrap and Python programming, are all intended to help ensure the future sustainability of the databases after completion of FRERMIP Project-2 in May 2024.

2. OBJECTIVE

The primary objective of the User and Administrator Manuals is to provide sufficient details about the FRERMIP MIS Databases that will allow BWDB ICT Administrators or ISPMC Database Specialists for the proposed Follow-On Project: Climate Resilient Main River Corridors Stabilization Project (CRMRCSP) to maintain and enhance the databases in future.

This documentation will also form the basis for the upcoming User and Administrator Training Program scheduled to be conducted on 03 - 07 March, 2024. Considerable effort has been made to provide step-by-step instructions into all major functionality, and detailed insight and lessons learned over the past 9 years of developing the FRERMIP Spatial MIS Databases.

3. SCOPE OF DOCUMENTATION

The contents of the FRERMIP Spatial MIS Databases Appendices include the following:

- **A** River Survey User Manual
- **B** River Survey Administrator Manual
- **C** ADCP User Manual
- **D** Float Track User Manual
- **E** Water Level User Manual
- **F** Survey Import Interface
- **G** Working with PgAdmin4
- **H** Working with QGIS
- **I** Additional FREMIP MIS Database Topics
- **J** Administrator Server Installation

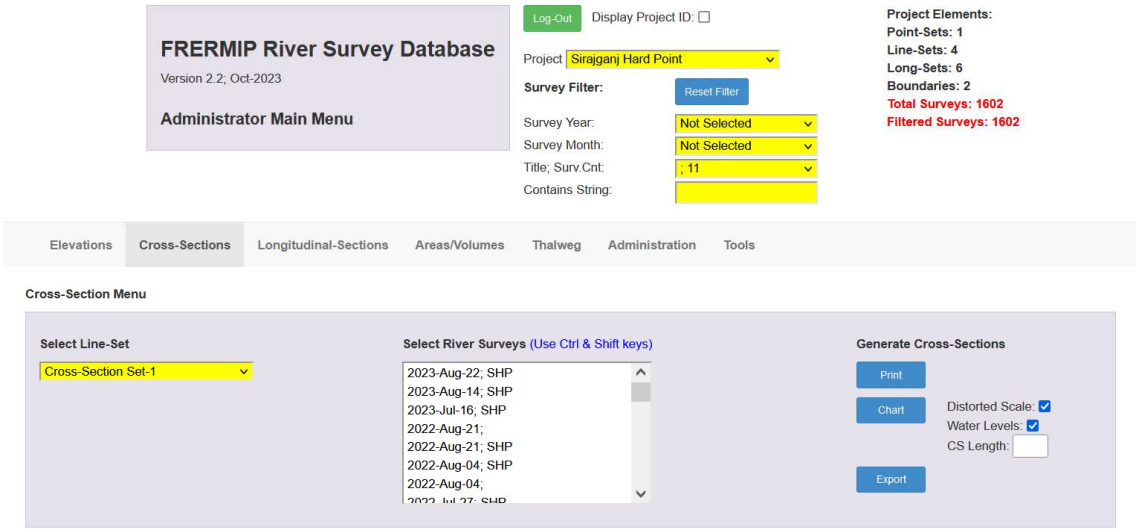
All 4 of the FRERMIP MIS Databases, and its Website, can be accessed using the following simple Menu:

A brief description of the Appendices is given in the following Sections.

4. BRIEF DESCRIPTION OF APPENDICES

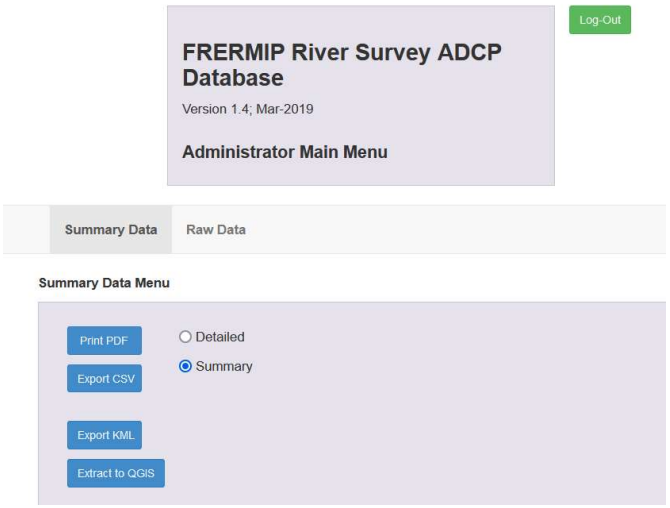
A. & B. River Survey User and Administrator Manuals

The River-Survey User and Administrator Manuals document the River Survey interface, written in PHP, that allows users to analyze survey Contours using Spatial Elements such as Points, Cross-Sections, Longitudinal-sections, Areas & Volumes, and Thalwegs. Users can output analysis results in various formats: PDF, CSV, Google Charts and QGIS. The River Survey interface also allows administrators to edit, delete and insert Surveys and the Spatial Elements.



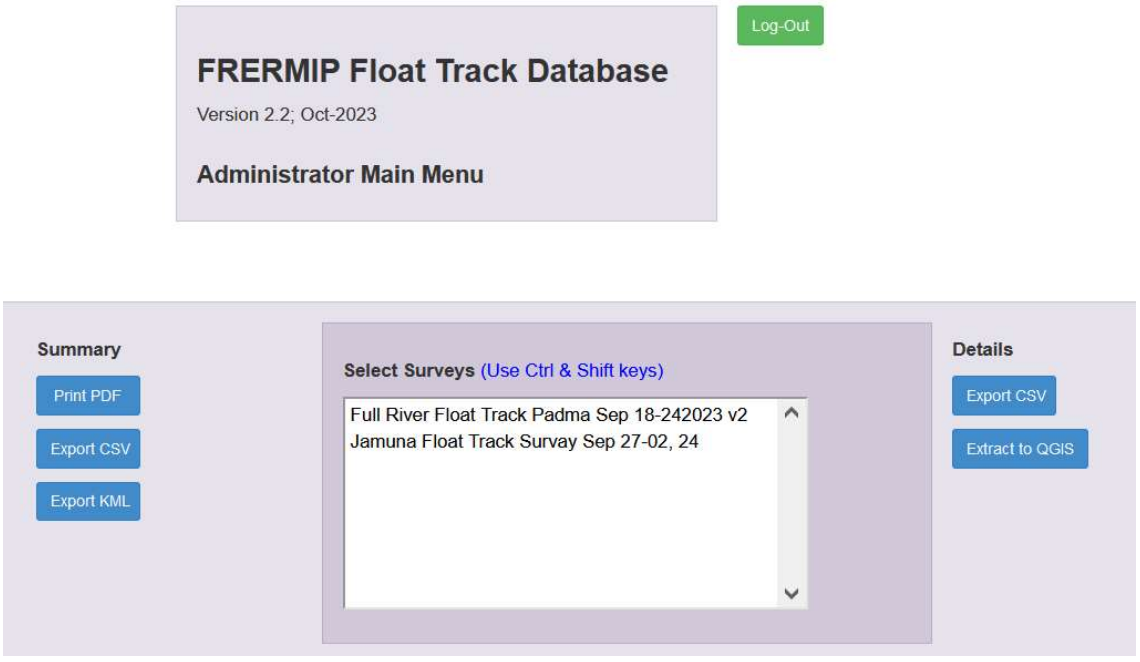
C. ADCP User Manual

The ADCP interface described in the User Manual allows users to print and export both summary and detailed ADCP reports for all surveys. Users can also export transect discharge results either as a KML file or to QGIS. The raw ADCP output files from the WinRiverII software package can also be exported.



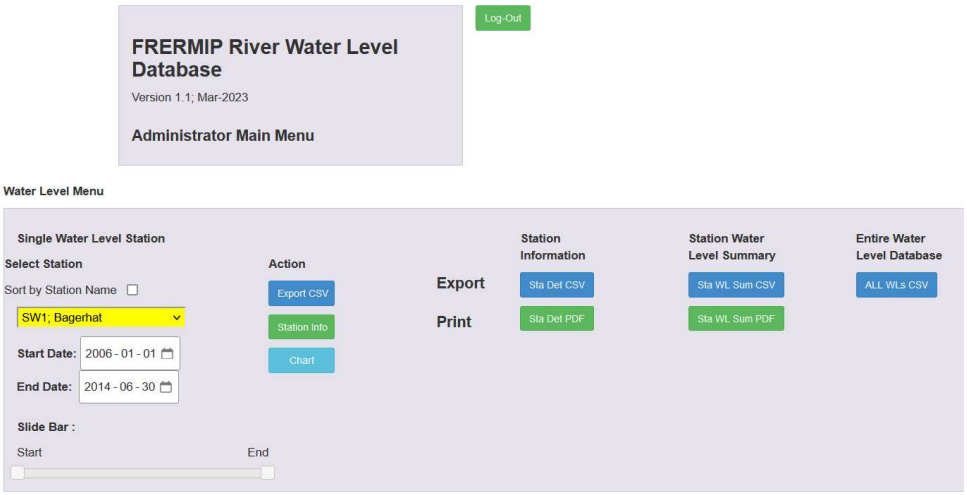
D. Float Track User Manual

The Float Track interface documented in this User Manual allows users to print or export summary reports for all surveys. Users can also export survey summary results as a KML-file. Float Track details can also be exported as CSV-files or extracted to QGIS for selected surveys.



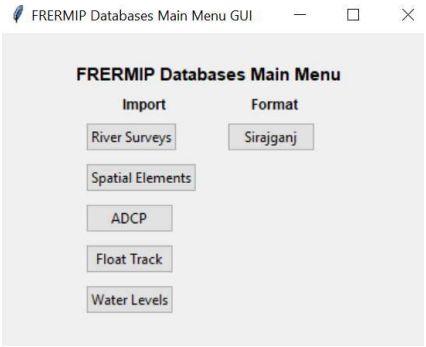
E. Water Level User Manual

The Water Level Database interface detailed in the User Manual allows users to display as a chart and export water level hydrographs for any range of dates. Users can also print or export Station Details, Station Water Level Summaries, or export the entire database as a csv file.



F. FRERMIP Import Interface

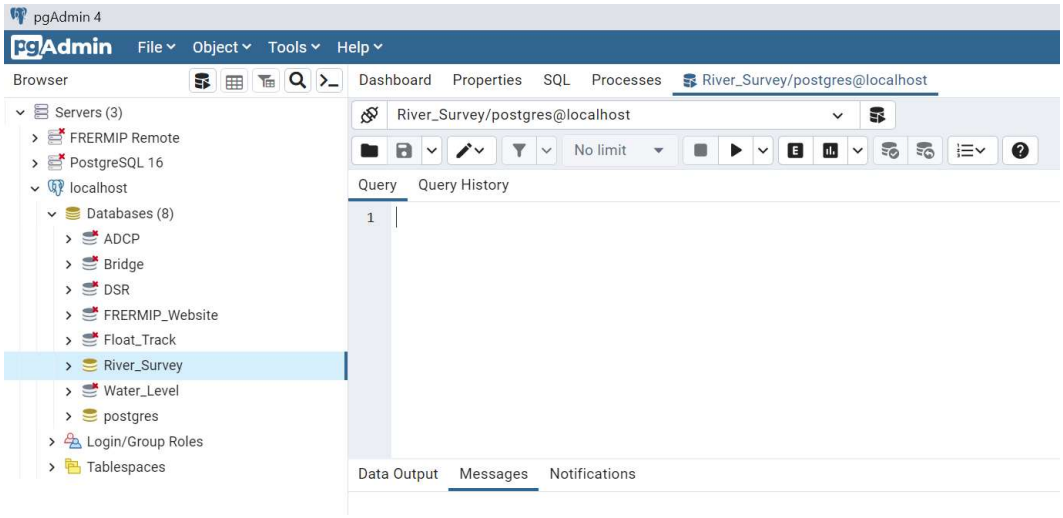
The FRERMIP Import Interface, written in Python, allows Administrators to import records into all 4 FRERMIP Databases: River Survey, ADCP, Float Track and Water Levels. In the River Survey database, the FRERMIP Import Interface can import both Survey Point and Contours, and Spatial Elements. There is also a special program that reformats survey data files received from Sirajganj into the format required for importing survey data into the River Survey database.



G. Working with PgAdmin4

PgAdmin4 is a popular and feature rich open-source administration and development platform for PostgreSQL. PgAdmin4 is available on Linux, Unix, macOS and Windows to manage PostgreSQL databases.

Users simply select any database item from the vertical menu and either click the item to get sub-items, or right click to display functions available for that item. The Query Tool can also be used to write and run SQL scripts to perform all types of database functions.



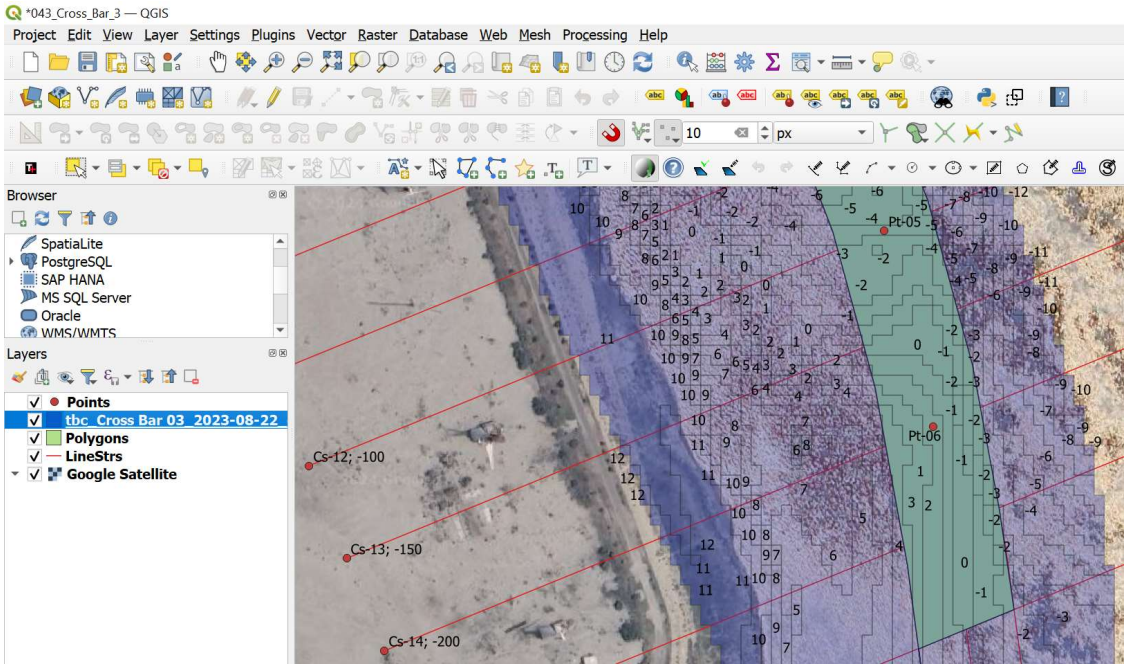
H. Working with QGIS

QGIS, also known as Quantum GIS, is a geographic information system (GIS) software that is free and open-source. QGIS supports Windows, macOS, and Linux. It supports viewing, editing, printing, and analysis of geospatial data.

QGIS allows users to analyze and edit spatial information, in addition to composing and exporting graphical maps. QGIS supports raster, vector and mesh layers. Vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can georeference images.

QGIS supports shapefiles, personal geodatabases, dxf, MapInfo, PostGIS, and other industry-standard formats. Web services, including Web Map Service and Web Feature Service, are also supported to allow use of data from external sources. QGIS can connect and interface with PostgreSQL/PostGIS, SpatiaLite and MySQL databases.

A number of topics are covered in this Appendix but the primary topic is the generation of Spatial Elements. Spatial elements are used to analyze bathymetric survey data. Spatial elements include cross-sections, longitudinal-sections, areas and points. Spatial elements are generated in QGIS by defining spatial vector layers and digitizing all necessary spatial features. The spatial elements are saved as ERSI Shapefiles that are subsequently imported into the PostgreSQL database.



I. Additional FREMIP MIS Database Topics

This Appendix provides a set of miscellaneous topics that will help Administrators understand how the 4 FRERMIP Databases are structured, and contain other useful information. Topics include:

- Adding Database Users
- Calculating Survey Water Levels
- Database Structure
- Useful SQL Script Files
- Useful Postgis Functions

J. Administrator Server Installation

A number of software packages are required to be installed on an Administrator's computer in order for them to be able to import data into the River Survey and other databases.

The Administrators also require a localhost Server and a copy of all the PostgreSQL databases and their PHP interfaces to be installed on their computers to allow them to test the database functionality and develop additional new functionality, if and when required. A list of requirements for the Administrator Server Installation is given below:

- WAMP Server
- PostgreSQL Database and PostGIS (Spatial Functions)
- OSGeo4w (including QGIS, GDAL and Python)
- FRERMIP MIS Databases (including PHP and Python interfaces)

FRERMIP Flood and Riverbank Erosion Risk Management Investment Program

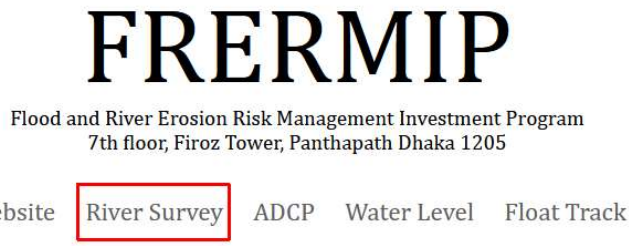
FRERMIP Spatial MIS Database

Appendix-A: River Survey User Manual

Contents

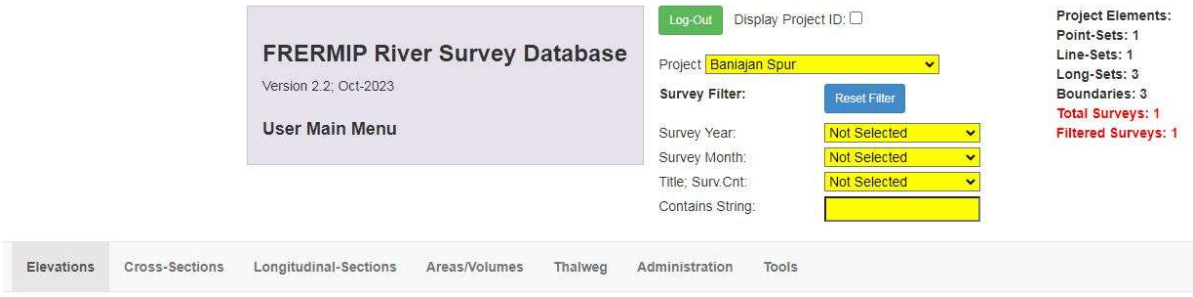
A-1 LOG-IN & MAIN MENU

1. Go to the following address:- http://frermip.cf/index_Remote.html, and select the 'River Survey'-Tab.

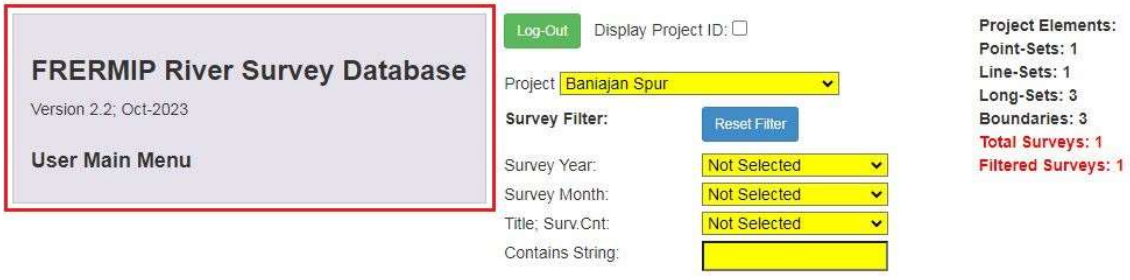


2. Log in to the database interface by entering a valid User Name and Password.

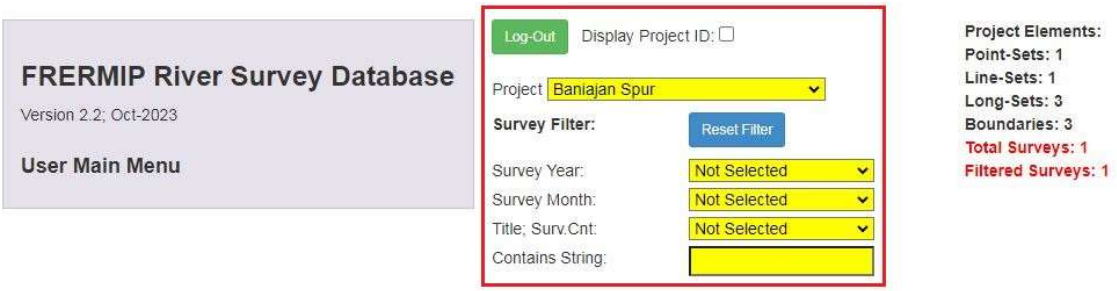
3. After logging in, the top half of the window will look like the snapshot below. In the middle part, there are 7 horizontal tabs named: Elevations, Cross-Sections, Longitudinal-Sections, Areas/Volumes, Thalweg, Administration and Tools. These tabs are discussed in separate sections below.



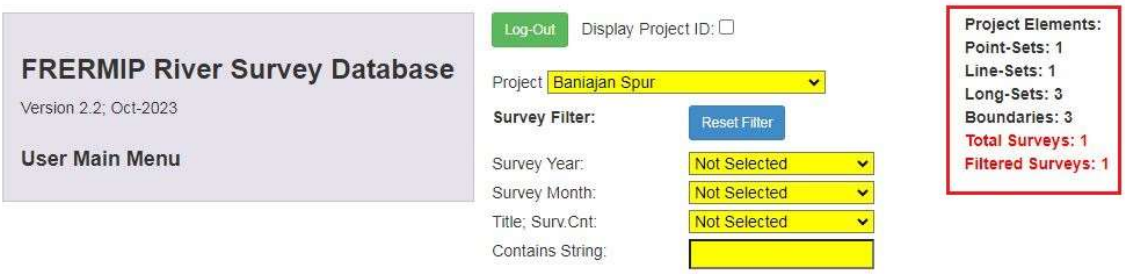
4. The box in the left side shows the database name, version, last update, and the interface type (Normal User or Administrator). Normal Users can perform all analyses, but cannot import, edit or delete existing database data.



5. The box in the middle contains the 'Log-Out'-button, ‘Display Project ID’-option, the 'Project'-dropdown box and the ‘cascading’ survey filter. Cascading means that the filter supports more than one filter condition. The contents in the drop-down boxes only contain valid options still available, given the filter condition already specified. The Survey Year and Month are self explanatory. The 'Title; Survey Count'-dropdown menu can be used to select ‘batches’ of surveys with identical names, and shows the number of surveys with that name. The 'Contains String'-box can be used as a search box, which allows the user to search for a desired survey by name for that specified project. The user can reset all filter conditions by clicking the ‘Reset Filter’-button.



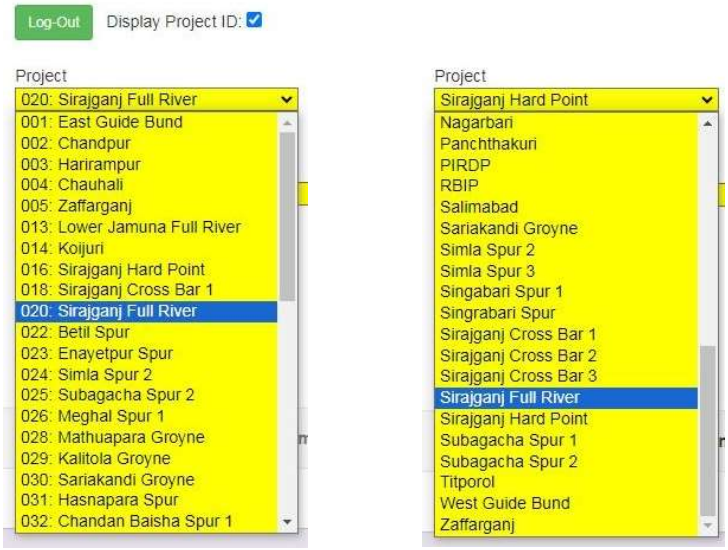
6. The right-side box shows information about the spatial elements defined for the selected Project. Spatial elements are used to perform analyses and comparisons on selected surveys. This box also shows both the total number of surveys in the project and the number of filtered surveys.



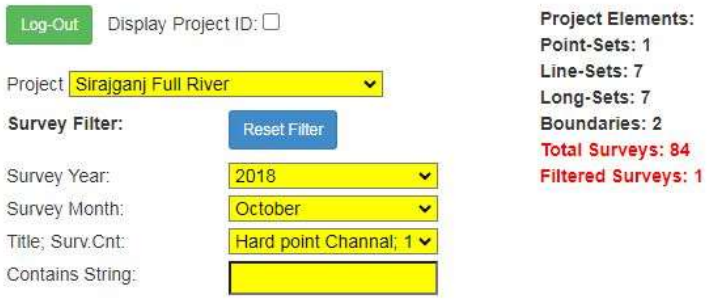
7. To select the desired project, click on the 'Project'-dropdown menu. As an example, the 'Sirajganj Full River'-project has been selected.

8. To select the desired project with project id, click on the ‘Display Project ID’ option, then click on the 'Project'-dropdown menu. As an example, the '020: Sirajganj Full River'-project has been selected with project id. Project IDs are primarily useful for the database administrators.

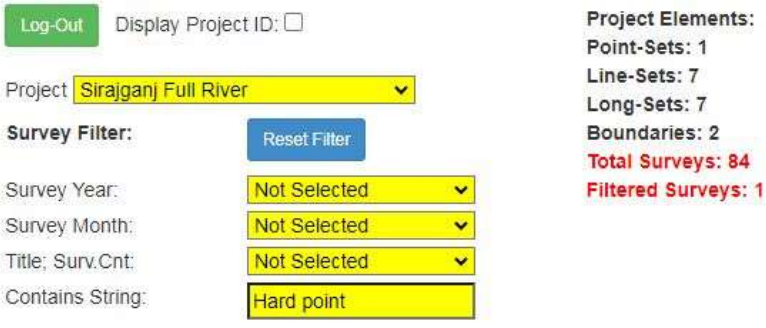
   The snapshots below show the Project drop-down box with and without the Project ID checkbox selected:



9. In the filter example below, there are 1 survey that satisfy the current filter condition: 'Sirajganj Full River' Survey conducted in October 2018 with name ‘Hard point Channal’.



10. As mentioned previously, the 'Contains String'-box is used to define the search parameters. In this case, 'Hard point' is put in the search box to look for surveys with names that contain the phrase ‘Hard point’.

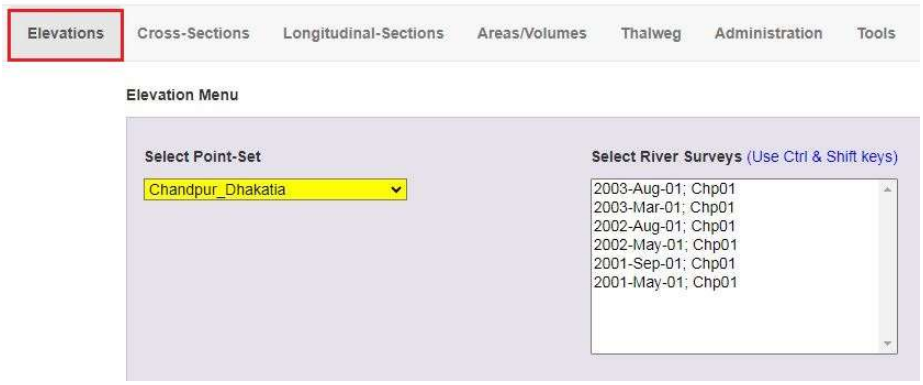


Please note: For some computers, pressing the 'Enter'-key after typing a string inside the 'Contains String' box will activate the ‘Log-Out’-button. Clicking 'Tab'-button, will produce the desired results.

A-2 ELEVATIONS

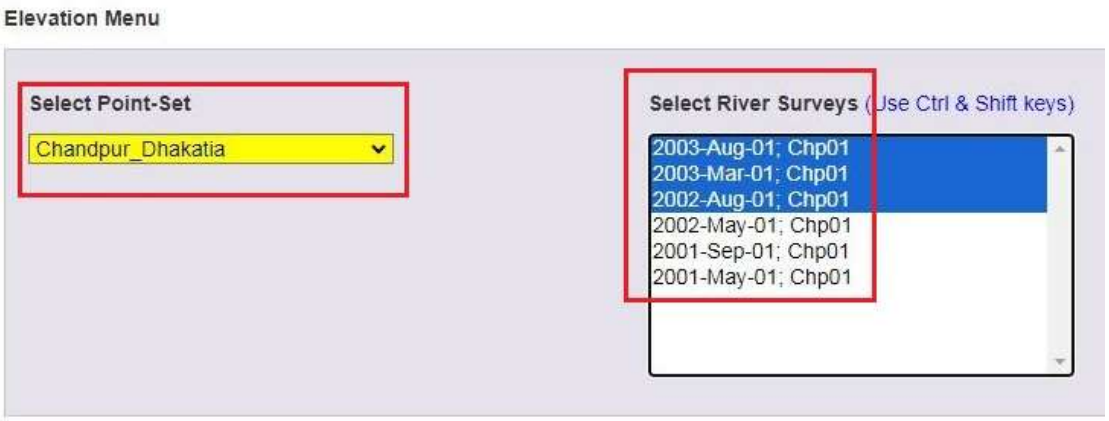
1. The 'Elevations'-tab is used to identify bed elevations at specific locations for selected surveys. Points at the end of a spur (where scour is expected) might be one possible use of this function. One Point-Set can contain multiple points (typically 5 - 10).

2. After selecting the desired project (Chandpur), select the 'Elevations'-tab.



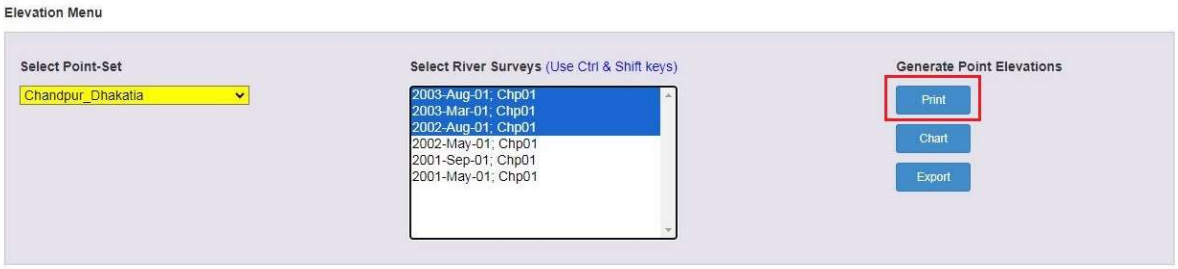
3. From the 'Select Point-Set'-dropdown menu, select the desired set of points.

4. From the 'Select River Surveys'-box, select the desired surveys. Use 'Ctrl & Shift'-keys to select multiple surveys at a time. (Ctrl-key to select individual items, and Shift-key to select a range of items).

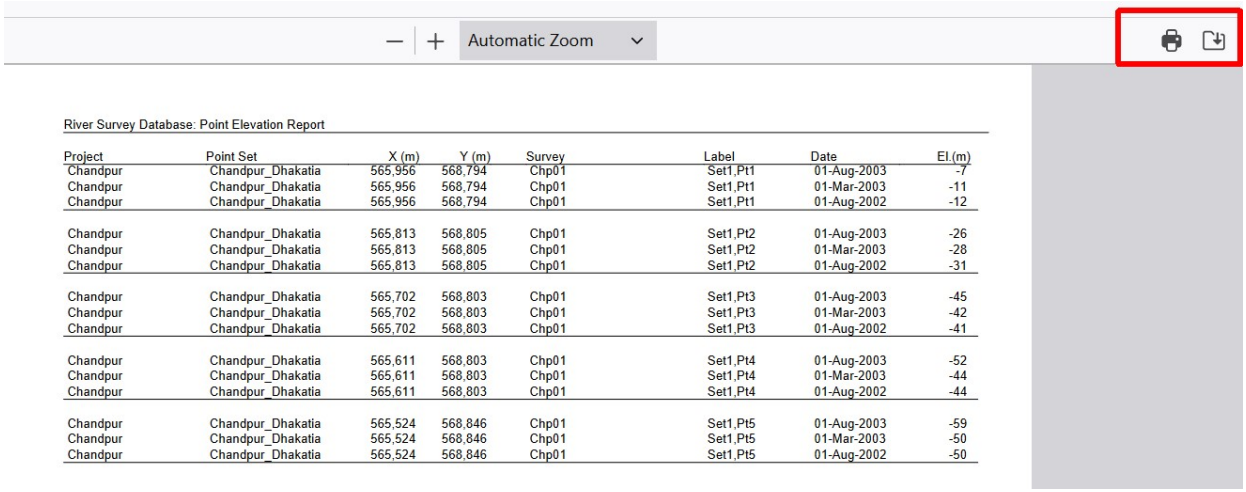


PRINT

1. Under the 'Generate Point Elevations'-column, use the print button to print the raw point data in PDF format.



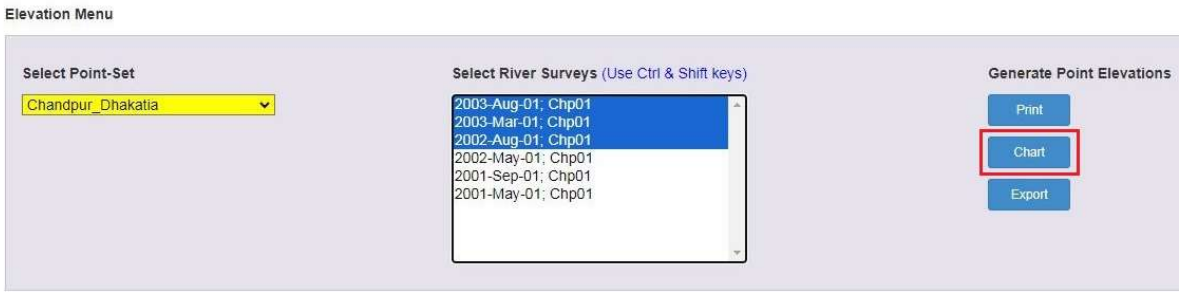
2. This is what a typical printed PDF looks like. Depending on the web browser being used, the user can either print or download the PDF file:



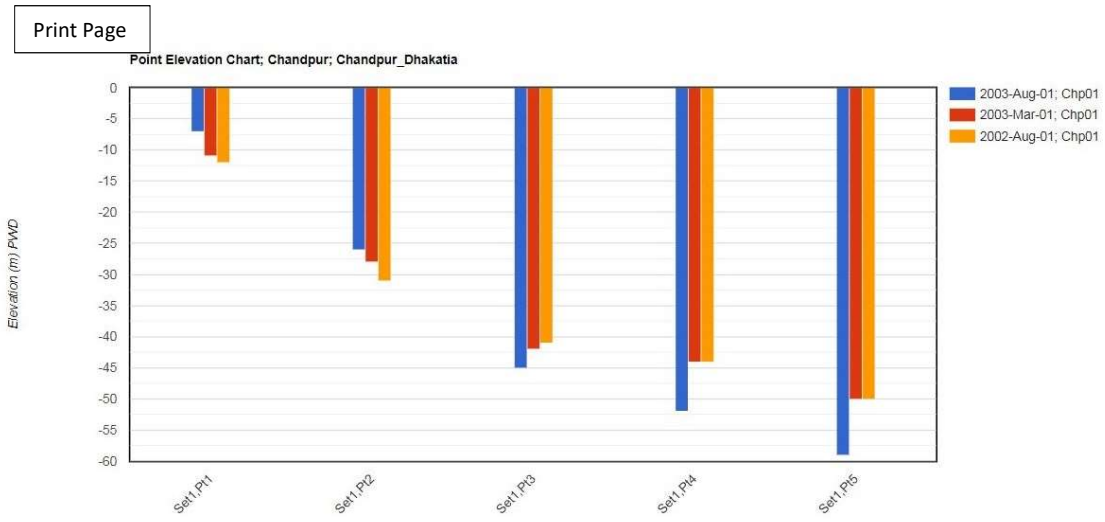
Project	Point Set	X (m)	Y (m)	Survey	Label	Date	El.(m)
Chandpur	Chandpur_Dhakatia	565,956	568,794	Chp01	Set1,Pt1	01-Aug-2003	-7
Chandpur	Chandpur_Dhakatia	565,956	568,794	Chp01	Set1,Pt1	01-Mar-2003	-11
Chandpur	Chandpur_Dhakatia	565,956	568,794	Chp01	Set1,Pt1	01-Aug-2002	-12
Chandpur	Chandpur_Dhakatia	565,813	568,805	Chp01	Set1,Pt2	01-Aug-2003	-26
Chandpur	Chandpur_Dhakatia	565,813	568,805	Chp01	Set1,Pt2	01-Mar-2003	-28
Chandpur	Chandpur_Dhakatia	565,813	568,805	Chp01	Set1,Pt2	01-Aug-2002	-31
Chandpur	Chandpur_Dhakatia	565,702	568,803	Chp01	Set1,Pt3	01-Aug-2003	-45
Chandpur	Chandpur_Dhakatia	565,702	568,803	Chp01	Set1,Pt3	01-Mar-2003	-42
Chandpur	Chandpur_Dhakatia	565,702	568,803	Chp01	Set1,Pt3	01-Aug-2002	-41
Chandpur	Chandpur_Dhakatia	565,611	568,803	Chp01	Set1,Pt4	01-Aug-2003	-52
Chandpur	Chandpur_Dhakatia	565,611	568,803	Chp01	Set1,Pt4	01-Mar-2003	-44
Chandpur	Chandpur_Dhakatia	565,611	568,803	Chp01	Set1,Pt4	01-Aug-2002	-44
Chandpur	Chandpur_Dhakatia	565,524	568,846	Chp01	Set1,Pt5	01-Aug-2003	-59
Chandpur	Chandpur_Dhakatia	565,524	568,846	Chp01	Set1,Pt5	01-Mar-2003	-50
Chandpur	Chandpur_Dhakatia	565,524	568,846	Chp01	Set1,Pt5	01-Aug-2002	-50

CHART

1. Use the 'Chart'-button to display a point elevation chart.

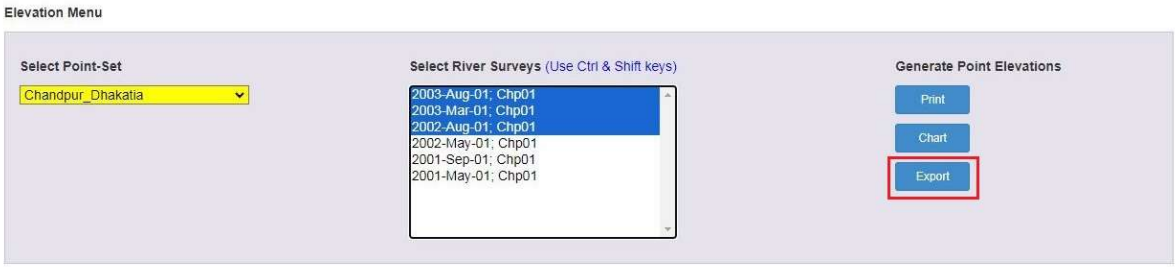


2. This is what a typical point elevation chart looks like. The user can click on a 'Print Page '-button in the top left corner of the chart, if required.



EXPORT

1. Use the 'Export'-button to export the raw data into 'CSV'-format.



2. This is what typical exported raw data in 'CSV'-format looks like:

	A	B	C	D	E	F	G	H
1	Project	Point Set	X	Y	Survey	Date	Label	Z
2	Chandpur	Chandpur_Dhakatia	565956	568794	Chp01	1-Aug-03	Set1-Pt1	-7
3	Chandpur	Chandpur_Dhakatia	565956	568794	Chp01	1-Mar-03	Set1-Pt1	-11
4	Chandpur	Chandpur_Dhakatia	565956	568794	Chp01	1-Aug-02	Set1-Pt1	-12
5	Chandpur	Chandpur_Dhakatia	565813	568805	Chp01	1-Aug-03	Set1-Pt2	-26
6	Chandpur	Chandpur_Dhakatia	565813	568805	Chp01	1-Mar-03	Set1-Pt2	-28
7	Chandpur	Chandpur_Dhakatia	565813	568805	Chp01	1-Aug-02	Set1-Pt2	-31
8	Chandpur	Chandpur_Dhakatia	565702	568803	Chp01	1-Aug-03	Set1-Pt3	-45
9	Chandpur	Chandpur_Dhakatia	565702	568803	Chp01	1-Mar-03	Set1-Pt3	-42
10	Chandpur	Chandpur_Dhakatia	565702	568803	Chp01	1-Aug-02	Set1-Pt3	-41
11	Chandpur	Chandpur_Dhakatia	565611	568803	Chp01	1-Aug-03	Set1-Pt4	-52
12	Chandpur	Chandpur_Dhakatia	565611	568803	Chp01	1-Mar-03	Set1-Pt4	-44
13	Chandpur	Chandpur_Dhakatia	565611	568803	Chp01	1-Aug-02	Set1-Pt4	-44
14	Chandpur	Chandpur_Dhakatia	565524	568846	Chp01	1-Aug-03	Set1-Pt5	-59
15	Chandpur	Chandpur_Dhakatia	565524	568846	Chp01	1-Mar-03	Set1-Pt5	-50
16	Chandpur	Chandpur_Dhakatia	565524	568846	Chp01	1-Aug-02	Set1-Pt5	-50

A-3 CROSS-SECTIONS

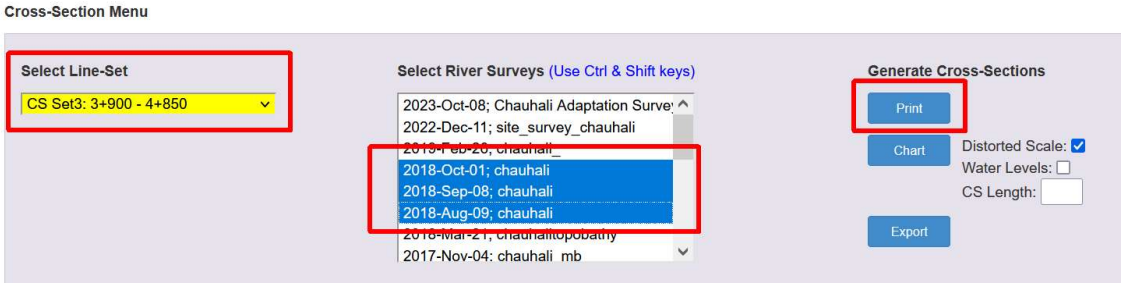
1. The 'Cross-Sections'-tab is used to identify bathymetric cross-section elevations at specific defined locations for selected surveys. In plan view, cross-sections are single segment lines, typically perpendicular to the riverbank. Cross-sections are oriented from upstream to downstream, typically from country-side to river-side (or alternatively from left bank to right bank looking downstream for cross-sections that extend across the full river). One Line-Set contains multiple cross-sections (typically 15 - 25).

2. After selecting the desired project (Harirampur), select the 'Cross-Sections'-tab. In the 'Select Line-Set'-dropdown box, select the desired line set.

3. From the 'Select River Surveys'-box, select the desired surveys. Use 'Ctrl & Shift'-keys to select multiple surveys at a time.

PRINT

1. From the 'Generate Cross-Sections'-column, use the 'Print'-button to print the cross-sectional data in PDF format. If available, water levels at the Cross-section are calculated from BWDB Water Level Stations located upstream and downstream from the selected project.



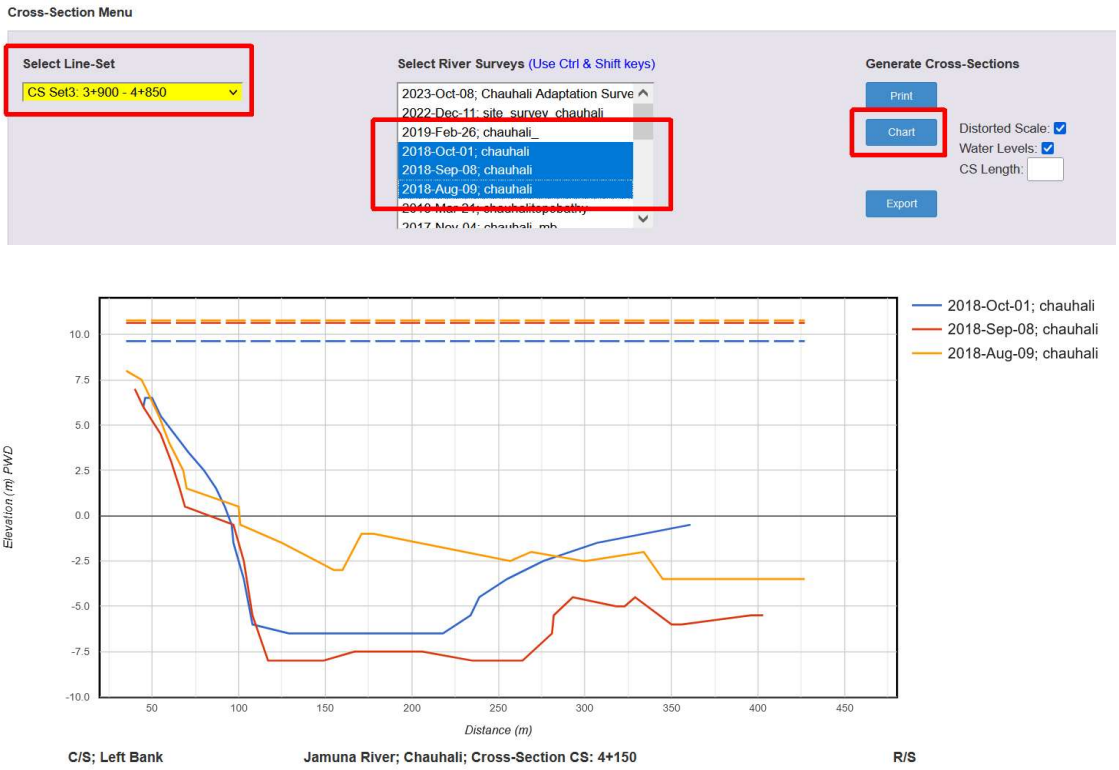
Water levels (W.Ls.) are interpolated based on the following Stations: SW49; Sirajganj (U/S) and SW50.6; Aricha (D/S).
W.Ls. are calculated at the mid-point of each cross-section element.

River Survey Database: Cross-Section Report

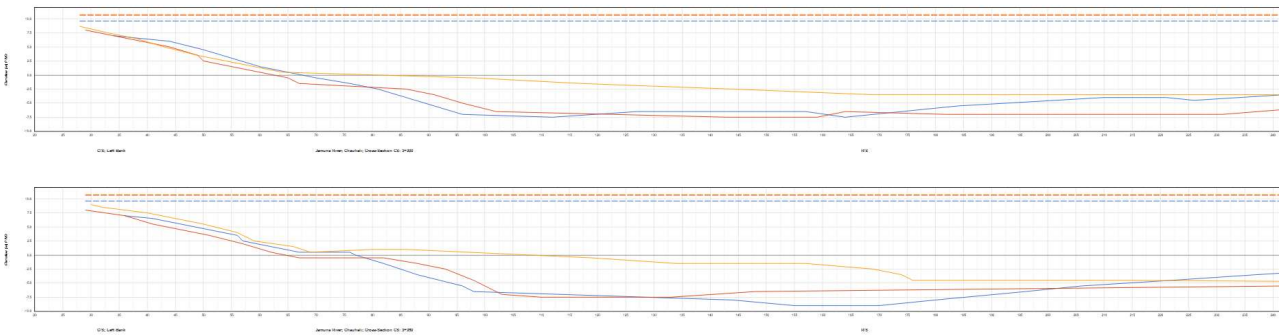
Project	Line Set	Pt1 X(m)	Pt1 Y(m)	Pt2 X(m)	Pt2 Y(m)	Label	Survey	Date	Dist.(m)	El.(m)	W.L.(m)
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	34	7	9.61
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	44	6	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	50	4.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	55	3	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	60	1.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	65	0.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	70	-0.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	76	-1.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	81	-2.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	86	-4	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	91	-5.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	96	-7	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	112	-7.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	127	-6.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	133	-6.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	143	-6.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	157	-6.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	164	-7.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	169	-7	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	184	-5.5	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	210	-4	
Chauhali	CS Set3: 3+900 - 4+850	480,799	669,622	480,390	669,735	CS: 3+900	chauhali	01-Oct-2018	214	-4	

CHART

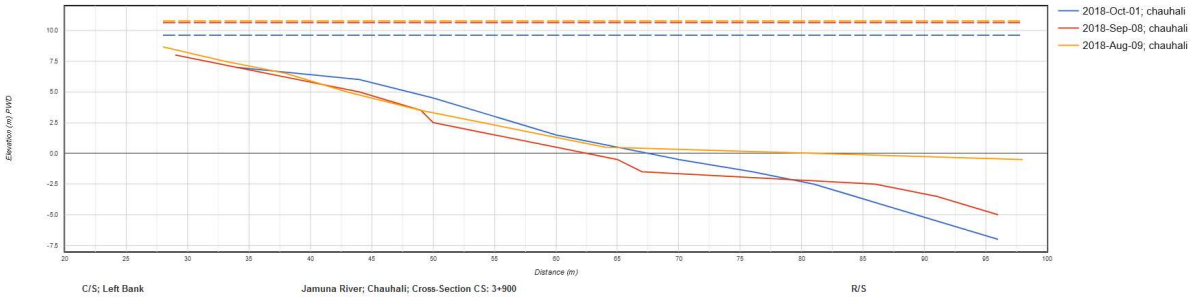
1. Use the 'Chart'-button to display the cross-sectional chart. The charts can be generated in a distorted or non-distorted scale. The user can also reduce the length of the cross-section. This is what a typical (default) distorted cross-sectional chart looks like with water levels displayed (dashed lines):



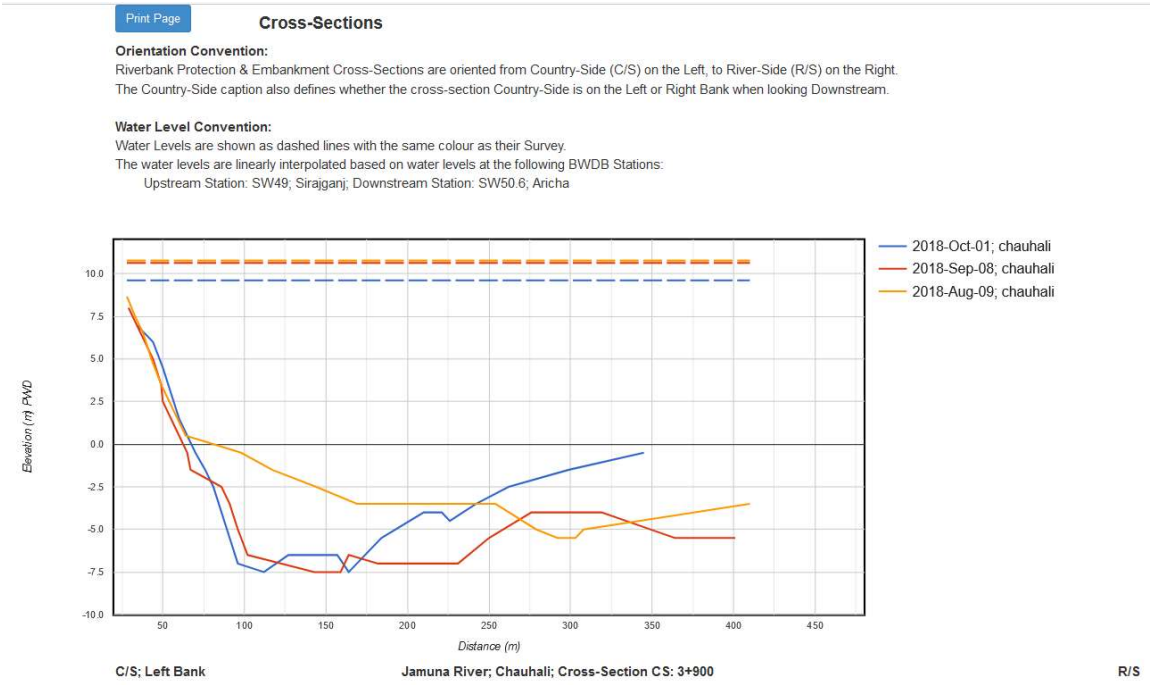
2. If the cross-section are displayed in a non-distorted scale, the user gets a true idea what the actual bank slope is, but the plots are much longer.



3. If the user selects an un-distorted scale, but add a 100 m length restriction, the length of the chart becomes a 'bit' more manageable. **This option would be useful if the user is interested to know the angle of repose, and whether the riverbank protection has launched.**

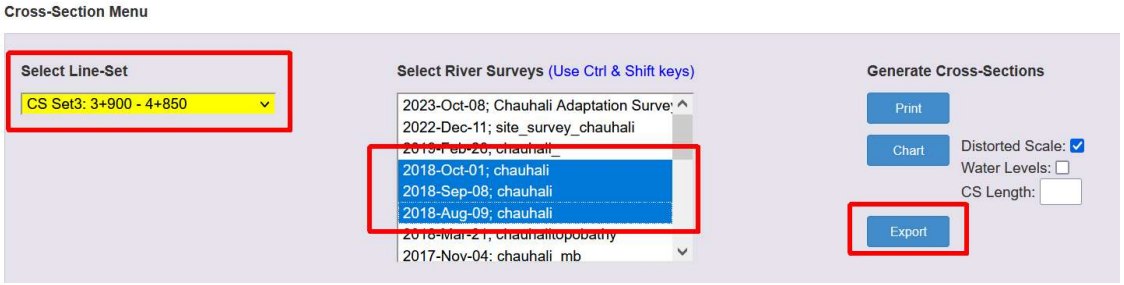


4. The user can print the chart using the print button in the top left corner of the screen. There is also a description of the plot orientation, and which BWDB Water Level Stations are used to calculate the water levels at the particular cross-section.



EXPORT

1. Use the 'Export'-button to export the raw cross-sectional data into 'CSV'-format.



2. This is what a typical cross-sectional data in 'CSV'-format looks like-

	A	B	C	D	E	F	G	H	I	J	K	L
1	Project	Line Set	Pt1 X	Pt1 Y	Pt2 X	Pt2 Y	Label	Survey	Date	Dist	Elev	W.L.
2	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	34	7	9.61
3	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	44	6	
4	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	50	4.5	
5	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	55	3	
6	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	60	1.5	
7	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	65	0.5	
8	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	70	-0.5	
9	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	76	-1.5	
10	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	81	-2.5	
11	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	86	-4	
12	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	91	-5.5	
13	Chauhali	CS Set3: 3-	480799	669622	480390	669735	CS: 3+900	chauhali	01-Oct-18	96	-7	

A-4 LONGITUDINAL-SECTIONS

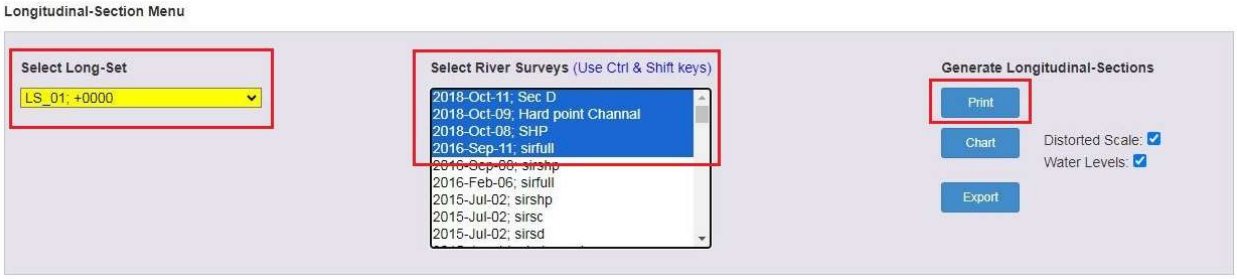
1. The 'Longitudinal-Sections'-tab is used to identify longitudinal elevations at specific defined locations for selected surveys. In plan view, a longitudinal-section is a multi-segment line, typically parallel to the riverbank from upstream to downstream. One Long-Set only contains a single longitudinal-section.

2. After selecting the desired project, and clicking on the 'Longitudinal-Sections'-tab, select the desired long-section from the 'Select Long-Set'-dropdown menu.

3. From the 'Select River Surveys'-box, select the desired surveys. Use 'Ctrl & Shift'-keys to select multiple surveys at a time.

PRINT

4. Under the 'Generate Longitudinal-Sections'-column, use the 'Print'-button to print the raw long-section data in PDF format.



5. This is what typical long-section data in PDF format looks like with the upstream and downstream water levels calculated.

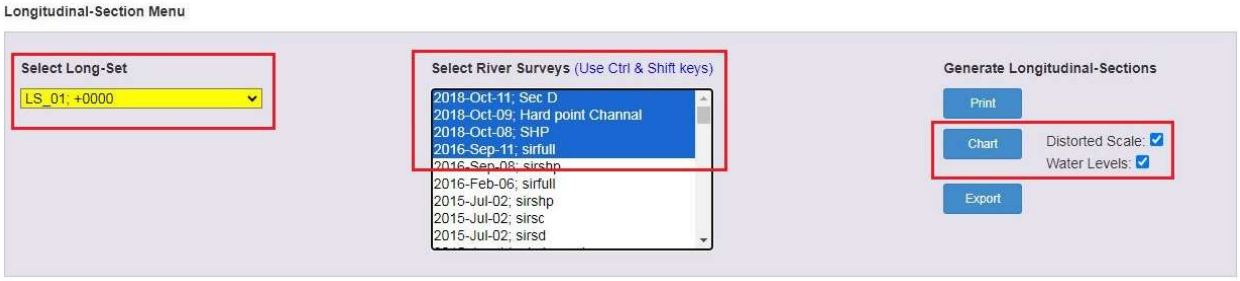
River Survey Database: Longitudinal-Section Report

Water levels (W.Ls.) are interpolated based on the following Stations: SW49A; Kazipur (U/S) and SW49; Sirajganj (D/S).
Survey Water Levels (W.Ls.) are calculated at distance 2128 (U/S) and 10119 (D/S) along Longitudinal Section.

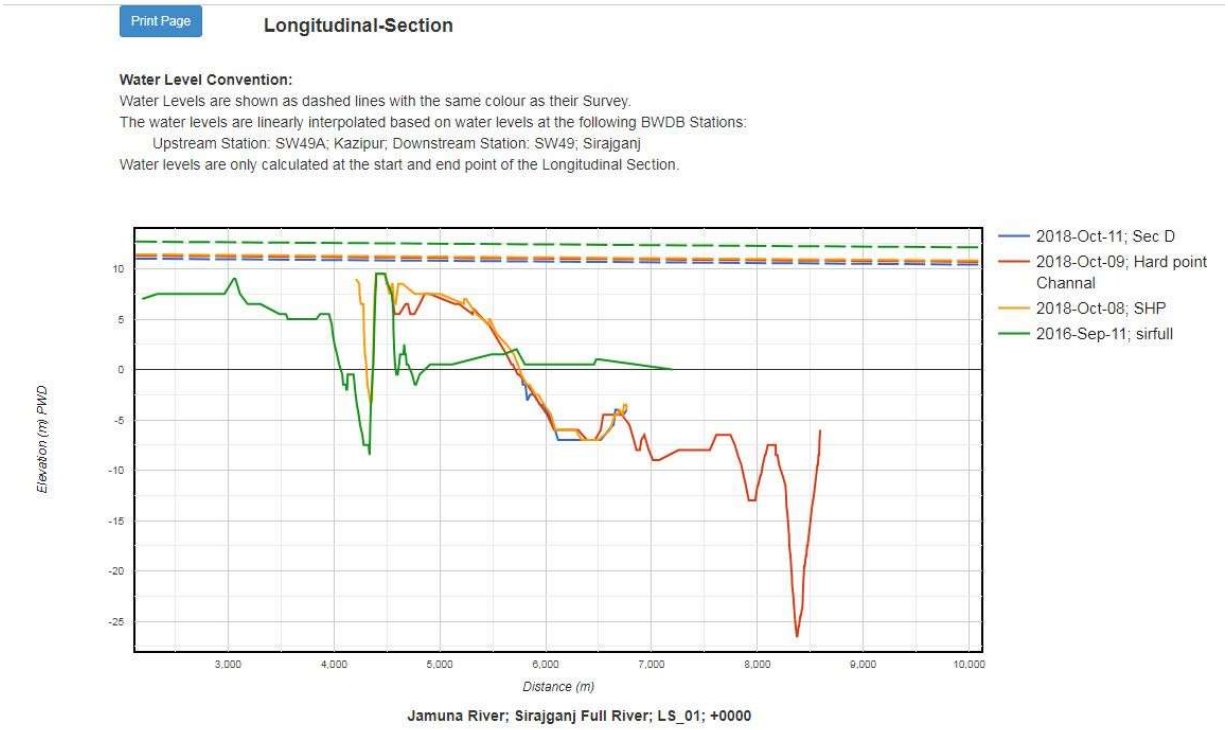
Project	Longitudinal-Section	Survey	Date	Dist.(m)	El.(m)	U/S W.L.(m)	D/S W.L.(m)
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5781	-1	11.01	10.41
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5783	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5787	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5792	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5795	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5803	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5807	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5809	-1.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5825	-3		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5831	-3		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5853	-2.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5855	-2.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5864	-2.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5878	-2.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5891	-2.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5947	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5950	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5952	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5962	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5969	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5973	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	5974	-3.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	6029	-4.5		
Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-2018	6068	-5.5		

CHART

1. Use the 'Chart'-button to display Longitudinal-Section charts.



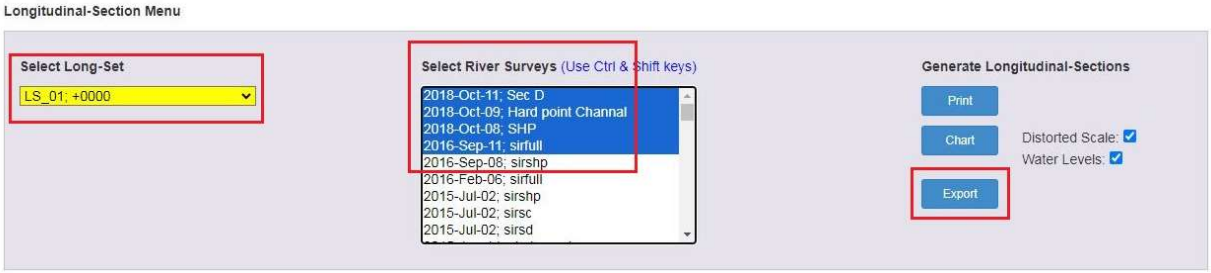
2. The charts can be displayed in both distorted and non-distorted scale. This is what a typical long-section chart in distorted scale looks like.



3. This is what a portion of the longitudinal-section chart in non-distorted scale looks like:

EXPORT

1. Use the 'Export'-button to export the long-section data into 'CSV'-format.



2. This is what typical long-section data in 'CSV'-format looks like:

	A	B	C	D	E	F	G	H
1	Project	Long-Section	Survey	Date	Dist	Elev	U/S_WL	D/S_WL
2	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5781	-1	11.01	10.41
3	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5783	-1.5		
4	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5787	-1.5		
5	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5792	-1.5		
6	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5795	-1.5		
7	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5803	-1.5		
8	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5807	-1.5		
9	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5809	-1.5		
10	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5825	-3		
11	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5831	-3		
12	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5853	-2.5		
13	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5855	-2.5		
14	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5864	-2.5		
15	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5878	-2.5		
16	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5891	-2.5		
17	Sirajganj Full River	LS_01; +0000	Sec D	11-Oct-18	5947	-3.5		

A-5 AREAS/VOLUMES

1. The 'Area/Volume'-tab is used to identify cumulative area and volume of sediment within a specific defined boundary location for selected surveys. In plan view, a boundary is a polygon shaped area. One boundary only contains a single polygon shape. **Boundaries 'must' fully cover (envelope) a survey otherwise the survey will not be available for analysis.**

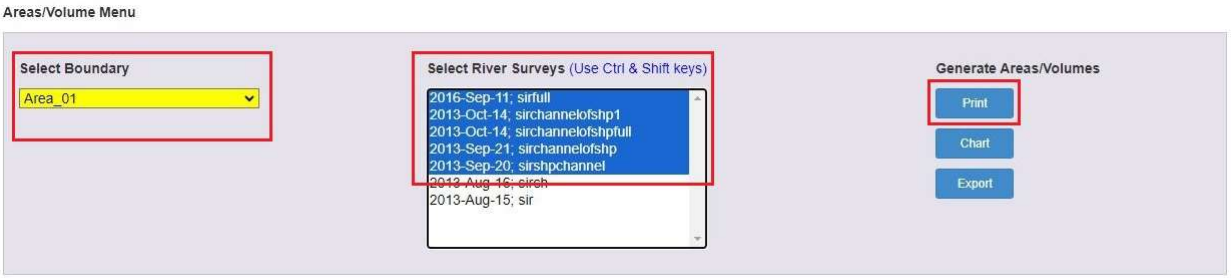
2. After selecting the desired project, select the 'Area/Volumes'-tab.

3. From the 'Select Boundary'-dropdown menu, select the desired boundary for analyzing areas and volumes.

4. From the 'Select River Surveys'-box, select the desired river survey. Use 'Ctrl & Shift'-keys to select multiple surveys at a time.

PRINT

1. Under the 'Generate Areas/Volumes'-column, use 'Print'-button to print the area-volume raw data into PDF format.



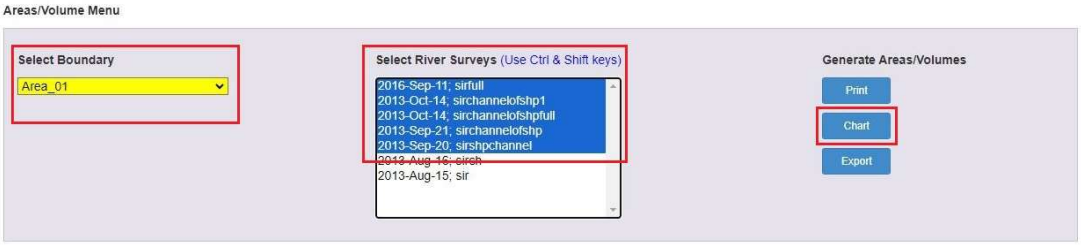
2. This is what typical printed 'Area/Volume'-data in PDF format looks like:

River Survey Database: Area and Volume Report

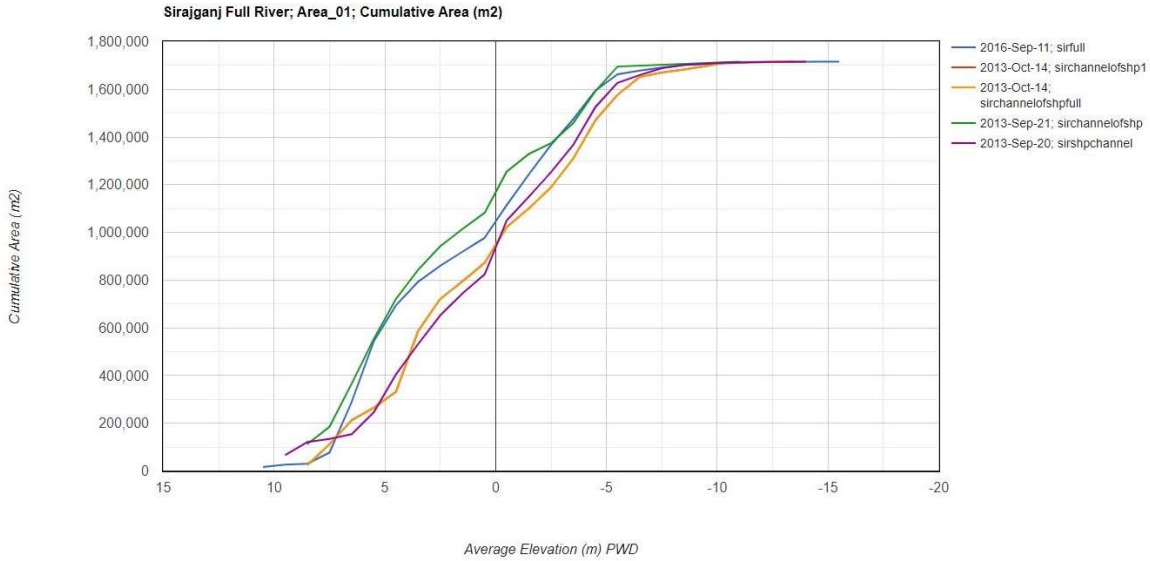
					Area(m2)		Volume(m3)	
Project	Boundary	Survey	Date	Elev(m)	Incre	Cumul	Incre	Cumul
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	11	16,628	16,628	16,628	16,628
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	10	10,163	26,791	26,791	43,419
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	9	3,720	30,511	30,511	73,930
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	8	46,275	76,786	76,786	150,716
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	7	211,764	288,550	288,550	439,266
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	6	255,458	544,008	544,008	983,274
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	5	150,270	694,278	694,278	1,677,552
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	4	99,075	793,353	793,353	2,470,905
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	3	66,754	860,107	860,107	3,331,012
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	2	59,063	919,170	919,170	4,250,182
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	1	57,639	976,809	976,809	5,226,991
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	0	138,081	1,114,890	1,114,890	6,341,881
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	-1	128,747	1,243,637	1,243,637	7,585,518
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	-2	123,729	1,367,366	1,367,366	8,952,884
Sirajganj Full River	Area_01	sirfull	11-Sep-2016	-3	107,587	1,474,953	1,474,953	10,427,837

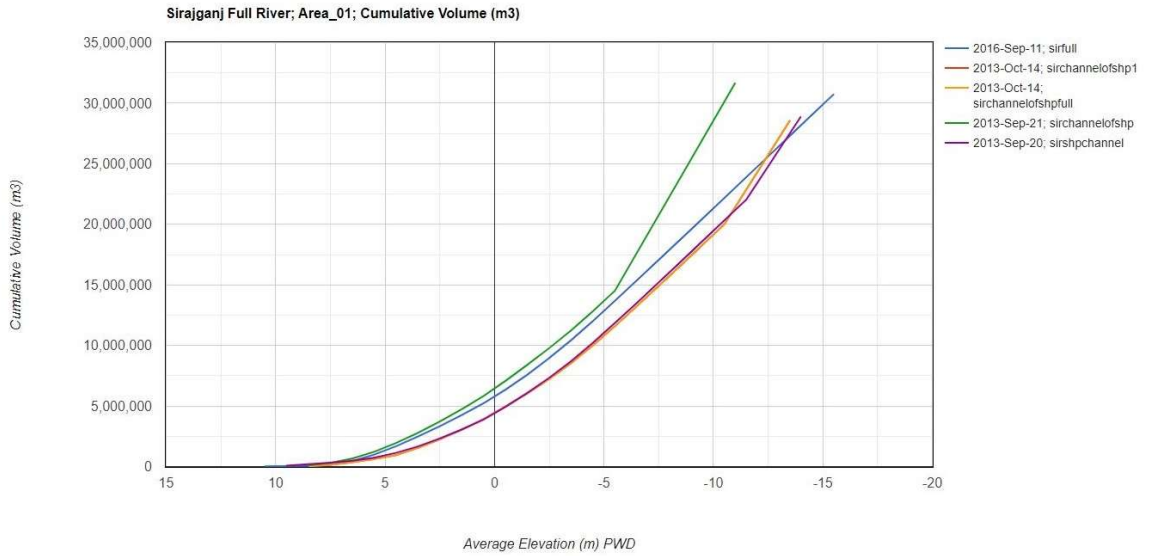
CHART

1. Use the 'Chart'-button to display the 'Area/Volume'-chart.



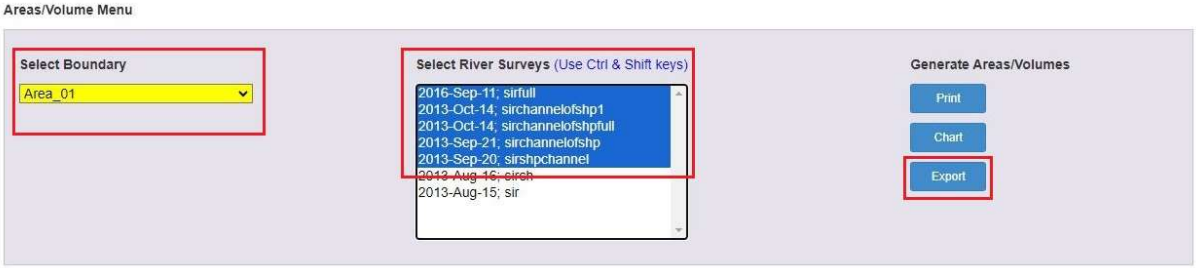
2. This is what a typical 'Area/Volume'-chart looks like:





EXPORT

1. Use the 'Export'-button to export the raw 'Area/Volume'-data into 'CSV'-format.



2. This is what typical 'Area/Volume' raw data in 'CSV'-format looks like:

	A	B	C	D	E	F	G	H	I
1						Area(m2)		Volume(m3)	
2	Project	Boundary	Survey	Date	Elev(m)	Incre	Cumul	Incre	Cumul
3	Sirajganj Full River	Area_01	sirfull	11-Sep-16	11	16628	16628	16628	16628
4	Sirajganj Full River	Area_01	sirfull	11-Sep-16	10	10163	26791	26791	43419
5	Sirajganj Full River	Area_01	sirfull	11-Sep-16	9	3720	30511	30511	73930
6	Sirajganj Full River	Area_01	sirfull	11-Sep-16	8	46275	76786	76786	150716
7	Sirajganj Full River	Area_01	sirfull	11-Sep-16	7	211764	288550	288550	439266
8	Sirajganj Full River	Area_01	sirfull	11-Sep-16	6	255458	544008	544008	983274
9	Sirajganj Full River	Area_01	sirfull	11-Sep-16	5	150270	694278	694278	1677552
10	Sirajganj Full River	Area_01	sirfull	11-Sep-16	4	99075	793353	793353	2470905
11	Sirajganj Full River	Area_01	sirfull	11-Sep-16	3	66754	860107	860107	3331012
12	Sirajganj Full River	Area_01	sirfull	11-Sep-16	2	59063	919170	919170	4250182
13	Sirajganj Full River	Area_01	sirfull	11-Sep-16	1	57639	976809	976809	5226991
14	Sirajganj Full River	Area_01	sirfull	11-Sep-16	0	138081	1114890	1114890	6341881
15	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-1	128747	1243637	1243637	7585518
16	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-2	123729	1367366	1367366	8952884
17	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-3	107587	1474953	1474953	10427837
18	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-4	119735	1594688	1594688	12022525
19	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-5	68510	1663198	1663198	13685723
20	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-6	15529	1678727	1678727	15364450
21	Sirajganj Full River	Area_01	sirfull	11-Sep-16	-7	12598	1691325	1691325	17055775

A-6 THALWEG

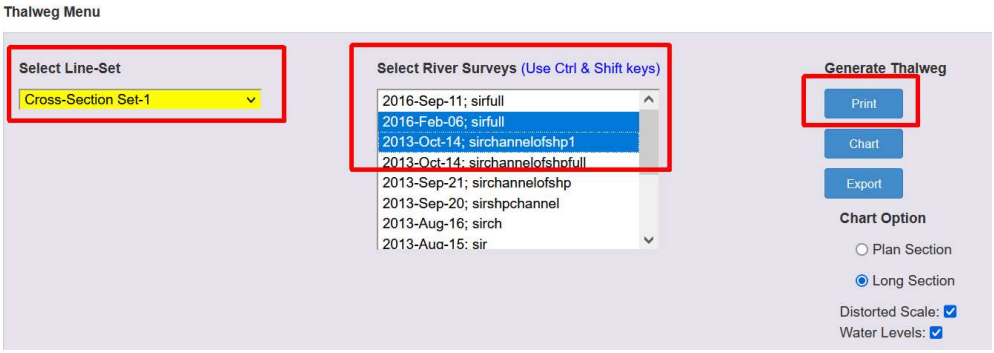
1. The 'Thalweg'-tab is used to identify the lowest depth along each defined cross-section for selected surveys. In plan view, cross-sections are single segment lines, typically perpendicular to the riverbank. One Line-Set contains multiple cross-sections (typically 15 - 25). **The thalweg analysis may pertain more to full river surveys rather than riverbank protection site surveys.**

2. After selecting the desired project, select the 'Thalweg'-tab. The 'Sirajganj Full River' project has been selected for this Thalweg example because it has water levels so it is able to illustrate that functionality. The thalweg is calculated from the elevations along each Cross-Section.

3. From the 'Select Line-Set'-dropdown menu, select the desired Line-Set (Cross-Section reach) for analyzing the thalweg. From the 'Select River Surveys'-box, select the desired river survey. Use 'Ctrl & Shift'-keys to select multiple surveys at a time.

PRINT

1. Under the 'Generate Thalweg' column, use 'Print'-button to print the Thalweg raw data into PDF format.



2. This is what typical Thalweg data in PDF format looks like. The distance along the 'C/S Mid-Pt' refers to the length along the river from one cross-section mid-point to the next. The distance along the cross-section 'C/S' refers to the length from the start of the cross-section to the thalweg. Water Levels are only shown for Surveys with water levels available.

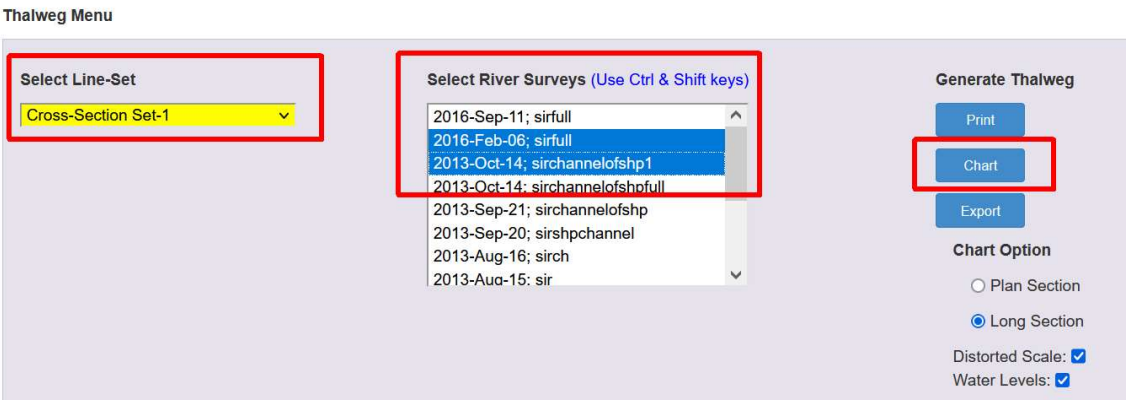
River Survey Database: Thalweg Report

Water levels (W.Ls.) are interpolated based on the following Stations: SW49A; Kazipur (U/S) and SW49; Sirajganj (D/S).
W.Ls. are calculated at the mid-points of the furthest upstream and downstream cross-sections covered by the selected surveys.

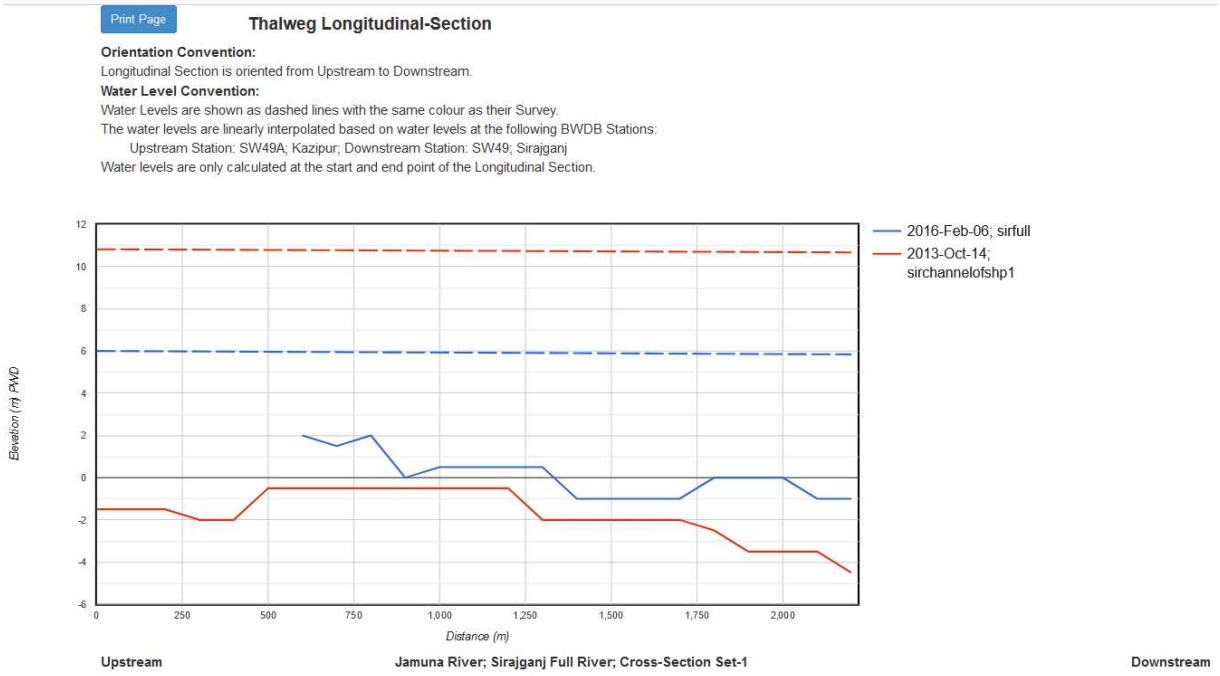
Project	Survey	Date	Line Set	Pt1 X(m)	Pt1 Y(m)	Pt2 X(m)	Pt2 Y(m)	Label	Distance(m) along C/S Mid-Pt	Distance(m) along C/S	Thalweg Coordinates X(m)	Thalweg Coordinates Y(m)	Thalweg Coordinates Z(m)	U/S W.L.(m)	D/S W.L.(m)
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,285	711,606	469,401	710,189	CS_007; +0600	600	2,502	470,843	710,898	2	6	5.84
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,350	711,526	469,425	710,090	CS_008; +0700	700	2,583	470,888	710,808	1.5		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,415	711,447	469,449	709,990	CS_009; +0800	800	2,142	470,932	710,719	2		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,480	711,367	469,475	709,892	CS_010; +0900	900	1,962	470,978	710,630	0		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,545	711,288	469,502	709,793	CS_011; +1000	1,000	1,923	471,024	710,541	0.5		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,610	711,208	469,528	709,695	CS_012; +1100	1,100	1,925	471,069	710,452	0.5		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,675	711,129	469,554	709,596	CS_013; +1200	1,200	1,926	471,115	710,363	0.5		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,740	711,049	469,581	709,498	CS_014; +1300	1,300	1,948	471,161	710,274	0.5		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,805	710,970	469,607	709,399	CS_015; +1400	1,400	1,962	471,206	710,185	-1		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,870	710,891	469,635	709,301	CS_016; +1500	1,500	2,177	471,253	710,096	-1		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	472,935	710,811	469,667	709,206	CS_017; +1600	1,600	1,947	471,301	710,009	-1		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	473,000	710,732	469,700	709,111	CS_018; +1700	1,700	1,959	471,350	709,922	-1		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	473,065	710,652	469,733	709,015	CS_019; +1800	1,801	1,831	471,399	709,834	0		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	473,118	710,567	469,765	708,920	CS_020; +1900	1,900	1,884	471,442	709,744	0		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	473,169	710,480	469,798	708,825	CS_021; +2000	2,000	1,931	471,484	709,653	0		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	473,221	710,394	469,831	708,729	CS_022; +2100	2,101	1,934	471,526	709,562	-1		
Sirajganj Full River	sirfull	06-Feb-2016	Cross-Section Set-1	473,272	710,308	469,863	708,634	CS_023; +2200	2,200	1,938	471,568	709,471	-1		

CHART

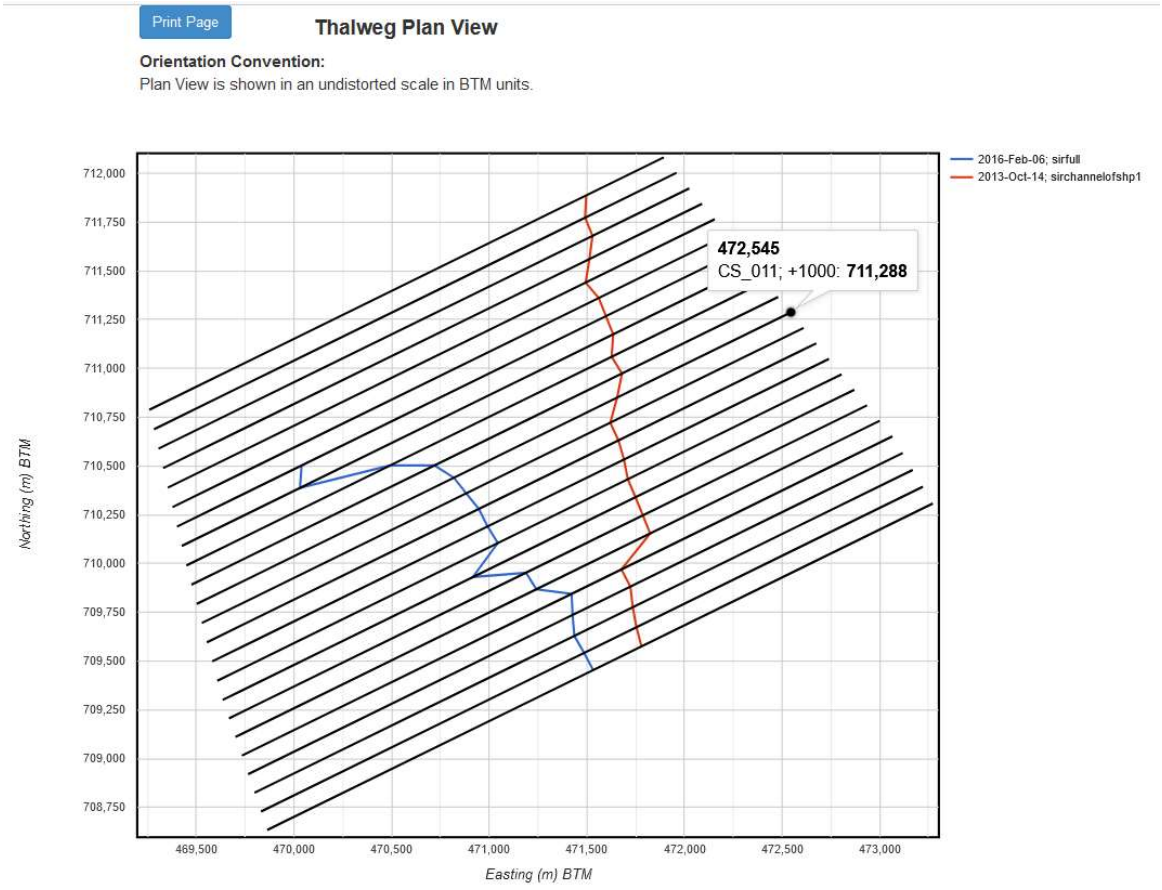
1. Use the 'Chart'-button to display the Thalweg charts. The charts can be generated in a distorted or non-distorted scale, with or without water levels displayed, and in either Plan-Section or Long-Section.



2. This is what a typical distorted Thalweg Long-Section chart with Water Levels looks like:

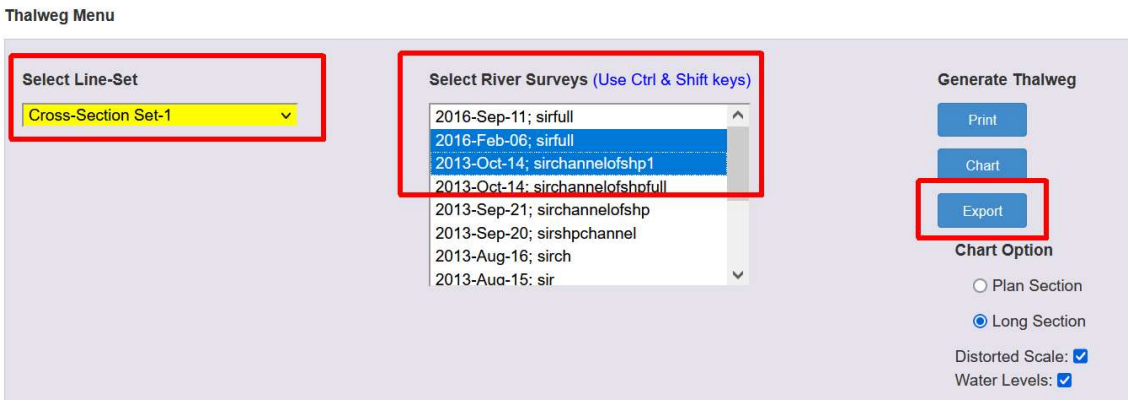


3. For Plan-Section there is no option to have a distorted scale. This is what a portion of a typical plan-section chart of Thalweg looks like. Notice that if the user 'points' (with a mouse) at the end of any cross-section line, the Cross-Section label and coordinate is displayed. **Notice also that the thalweg for the 2 displayed surveys vary significantly in plan view, so the long-section alone can be deceiving.**



EXPORT

1. Use the 'Export'-button to export the Thalweg data into 'CSV'-format.



2. This is what typical Thalweg raw data in 'CSV'-format looks like:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Project	Survey	Date	Line Set	Pt1 X	Pt1 Y	Pt2 X	Pt2 Y	Label	Dist.along	Dist.along	Thalweg X	Thalweg Y	Thalweg Z	U/S_WL	D/S_WL
2	Sirajganj F	sirfull	########	Cross-Sect	472285	711606	469401	710189	CS_007; +(	600	2502	470843	710898	2	6	5.84
3	Sirajganj F	sirfull	########	Cross-Sect	472350	711526	469425	710090	CS_008; +(	700	2583	470888	710808	1.5		
4	Sirajganj F	sirfull	########	Cross-Sect	472415	711447	469449	709990	CS_009; +(	800	2142	470932	710719	2		
5	Sirajganj F	sirfull	########	Cross-Sect	472480	711367	469475	709892	CS_010; +(	900	1962	470978	710630	0		
6	Sirajganj F	sirfull	########	Cross-Sect	472545	711288	469502	709793	CS_011; +:	1000	1923	471024	710541	0.5		
7	Sirajganj F	sirfull	########	Cross-Sect	472610	711208	469528	709695	CS_012; +:	1100	1925	471069	710452	0.5		
8	Sirajganj F	sirfull	########	Cross-Sect	472675	711129	469554	709596	CS_013; +:	1200	1926	471115	710363	0.5		
9	Sirajganj F	sirfull	########	Cross-Sect	472740	711049	469581	709498	CS_014; +:	1300	1948	471161	710274	0.5		
10	Sirajganj F	sirfull	########	Cross-Sect	472805	710970	469607	709399	CS_015; +:	1400	1962	471206	710185	-1		
11	Sirajganj F	sirfull	########	Cross-Sect	472870	710891	469635	709301	CS_016; +:	1500	2177	471253	710096	-1		
12	Sirajganj F	sirfull	########	Cross-Sect	472935	710811	469667	709206	CS_017; +:	1600	1947	471301	710009	-1		
13	Sirajganj F	sirfull	########	Cross-Sect	473000	710732	469700	709111	CS_018; +:	1700	1959	471350	709922	-1		
14	Sirajganj F	sirfull	########	Cross-Sect	473065	710652	469733	709015	CS_019; +:	1801	1831	471399	709834	0		
15	Sirajganj F	sirfull	########	Cross-Sect	473118	710567	469765	708920	CS_020; +:	1900	1884	471442	709744	0		

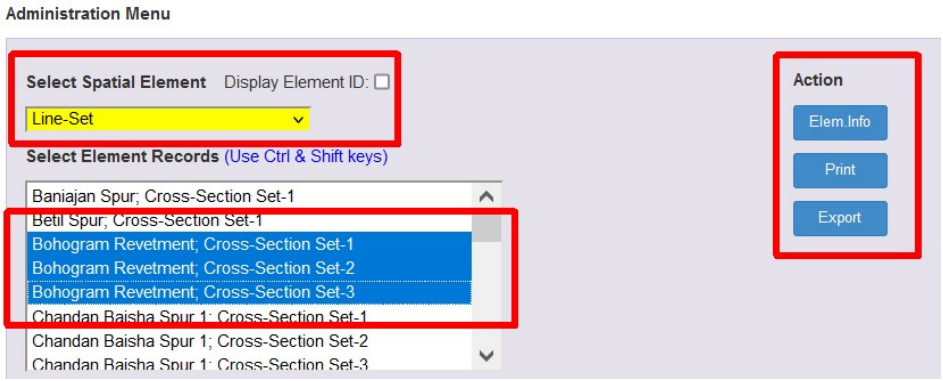
A-7 ADMINISTRATION

1. The Administration Tab is primarily for use by Administrators, but may be of some use for interested Users. Normal Users can display the spatial element database structure (Elem.Info) for each column (field), or Print and Export the database values of any set of existing spatial element records. However, they are not allowed to insert, edit or delete any spatial element database structure or value.

2. **To display the spatial element database structure, the user only needs to define the Spatial Element, and then click the 'Elem.Info'-button. To print or export specific database values, the user must also select one or more specific spatial elements, and then clicks the 'Print' or 'Export'-button.**

3. **The survey table currently includes 2,573 records that would make it cumbersome to find the desired surveys to display, so the survey table is filtered using the current project and filter condition.**

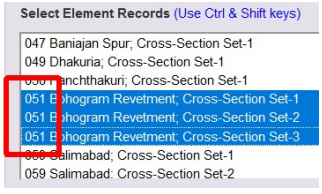
4. Each Spatial Element contains a geometry field that is typically quite large so they have not been included in the Print reports. Geometry fields are included in the export csv files in the standard WKT-text format. Well Known Text (WKT) is an Open Geospatial Consortium (OGC) standard that is used to represent spatial data in a textual format.



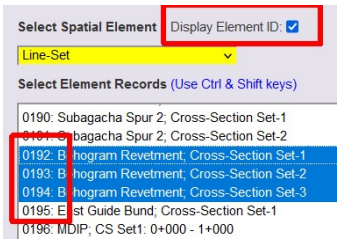
5. **Excel has a limitation that the maximum number of characters in a cell is 32,767. The user may need to open the CSV-file using NotePad++ so that the larger geometry fields are not corrupted.**

6. Unique Project and Element identification numbers (IDs) are typically not needed for normal Users, but can be very useful for Administrators. The option to display Project and Element IDs are available to Users if and when required:

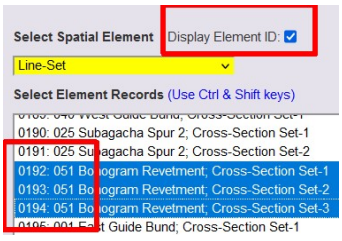
Project IDs



Element IDs



Element and Project IDs



7. Sample outputs for 'Elem.Info', 'Print' and 'Export'-options are shown below.

ELEM.INFO for Line-Set

River Survey Database

Table Name: line_set
Number of Rows: 100
Geometry Type:
MULTILINESTRING

Column Name	Type	Length	Nullable
id	integer		NO
title	text		YES
proj_id	integer		YES
labels	ARRAY		YES
orientation	text		YES

PRINT for selected Projects

River Survey Database: Element Project List

Table: project

ID	Project	Geo.Surv.ID	River	WL.StaUS	WL.StaDS
47	Baniajan Spur	2736	Jamuna	SW11A	SW49A
22	Betil Spur	1703	Jamuna	SW49	SW50.6
51	Bohogram Revetment	2754	Jamuna	SW49	SW50.6
52	Chandan Baisha Revetment	2581	Jamuna	SW11A	SW49A
32	Chandan Baisha Spur 1	1704	Jamuna	SW11A	SW49A
53	Chandan Baisha Spur 2	1705	Jamuna	SW11A	SW49A
2	Chandpur	12	Padma/Dhakatia	SW95	SW277
4	Chauhali	1570	Jamuna	SW49	SW50.6
49	Dhakuria	2784	Jamuna	SW11A	SW49A
1	East Guide Bund	2	Jamuna	SW49	SW50.6

PRINT for selected Line-Sets

River Survey Database: Element Project List

Table: line_set

ID	Project	Title	Dir	Labels
192	Bohogram Revetment	Cross-Section Set-1		{"CS_01; +0000","CS_02; +0100","CS_03; +0200","CS_04; +0300","CS_05; +0400","CS_06; +0500","CS_07; +0600","CS_08; +0700","CS_09; +0800","CS_10; +0900","CS_11; +1000","CS_12; +1100","CS_13; +1200","CS_14; +1300","CS_15; +1400","CS_16; +1500","CS_17; +1600","CS_18; +1700","CS_19; +1800","CS_20; +1900","CS_21; +2000"}
193	Bohogram Revetment	Cross-Section Set-2		{"CS_22; +2100","CS_23; +2200","CS_24; +2300","CS_25; +2400","CS_26; +2500","CS_27; +2600","CS_28; +2700","CS_29; +2800","CS_30; +2900","CS_31; +3000","CS_32; +3100","CS_33;

EXPORT for selected Projects

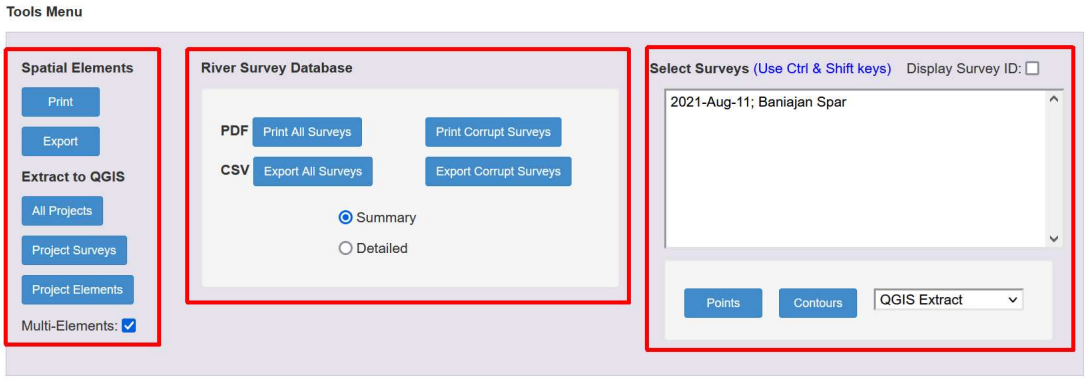
	A	B	C	D	E	F	G	H	I
1	id	title	geom_txt	geom_sur	river_nm	sta_wl_us	sta_wl_ds	orientation	
2	26	Meghal Sp	LINESTRIN	176	Jamuna	SW49A	SW49	R	
3	28	Mathuapa	LINESTRIN	1496	Jamuna	SW11A	SW49A	R	
4	29	Kalitola Gr	LINESTRIN	1212	Jamuna	SW11A	SW49A	R	
5	30	Sariakand	LINESTRIN	1657	Jamuna	SW11A	SW49A	R	
6	31	Hasnapara	LINESTRIN	1708	Jamuna	SW46.9L	SW11A	R	

EXPORT for selected Long-Sets

	A	B	C	D	E
1	id	title	geom_txt	proj_id	orientation
2	25	Ls01; +000	LINESTRING(470354.0115	22	
3	26	Ls02; +025	LINESTRING(470375.1565	22	
4	27	Ls03; +050	LINESTRING(470396.3014	22	
5	67	LS_02; +025	LINESTRING(462183.8947	47	

A-8 TOOLS

1. The 'Tools'-tab has 3 sets of useful functions:
    1. Spatial elements can be printed, exported or extracted to QGIS.
    2. The user can print or export a Survey Summary or Details in PDF or CSV format, for all surveys and corrupted surveys.
    3. Raw Point tables or Contour tables can be extracted to QGIS, or downloaded as Zipped Shape Files or ASCII Files.



SPATIAL ELEMENTS

'Print'-button

1. Under the 'Spatial Elements'-column, use the print button to print a report of all spatial elements associated with the selected project in PDF format. For this example, the East Guide Bund (Jamuna Bridge) Project has been selected.

2. This is what a typical PDF-print of Spatial elements looks like:

River Survey Database: Element Report

Table Nm	Proj ID	Title
project	1	East Guide Bund

Table Nm	Proj ID	Title
point_set	1	EGB_Point_Set

Table Nm	Proj ID	Title	Labels Exist
line_set	1	Cross-Section Set-1	True

Table Nm	Proj ID	Title
long_set	1	Long-Section 1
long_set	1	Long-Section 2
long_set	1	Long-Section 3

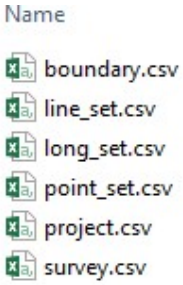
Table Nm	Proj ID	Title	
boundary	1	EGB_Boundary1	0
boundary	1	EGB_Boundary2	0
boundary	1	EGB_Boundary3	0

Table Nm	Proj ID	Title	Survey ID	Date	Cont Int.	Cell Sz.
survey	1	EGB_447	2	25-Jul-2004	1	5
survey	1	EGB_444	1	11-Jul-2004	1	5
survey	1	EGB_441	3	28-Jun-2004	1	5
survey	1	EGB_433	5	18-Jun-2004	1	5
survey	1	EGB_434	4	18-Jun-2004	1	5
survey	1	EGB_430	6	14-Jun-2004	1	5
survey	1	EGB_429	8	27-May-2004	1	5
survey	1	EGB_424	9	13-May-2004	1	5
survey	1	EGB_421	10	11-Apr-2004	1	5
survey	1	EGB_430	7	11-Apr-2004	1	5

'Export'-button

1. Use the 'Export'-button to export 'Spatial element'-data into 'CSV'-format. It will generate one zip file that will be automatically downloaded by clicking the 'Export'-button.

2. In that zip-file there are up to six CSV files named: boundary, line_set, long_set, point_set, project and survey. Each CSV file contains salient element information, including the spatial element locations using the 'well known text'-format (WKT). These CSV files define all spatial elements associated with the selected project.



3. The exported ‘line_set.csv’-file looks like the following:

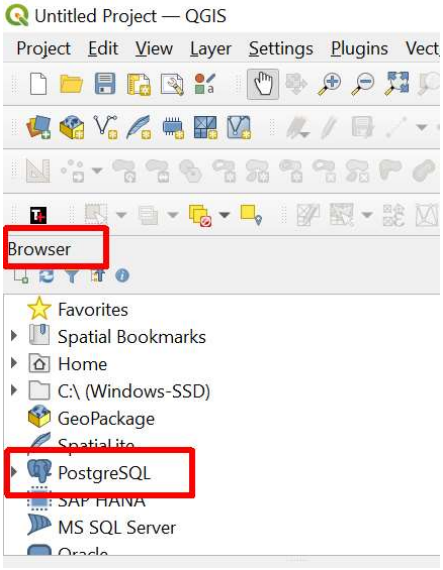
	A	B	C	D	E	F	G	H	I	J	K	L
1	proj_id	title	geom									
2	1	Cross-Section Set-1	MULTILINESTRING((480257 699288,480443 699615),(480212 699302,480298 699662),(480155 699313,4801									
3												

SPATIAL ELEMENT EXTRACT TO QGIS

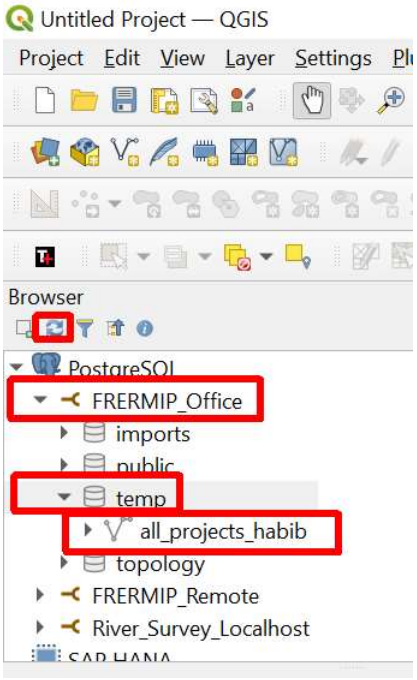
1. In ‘Spatial elements’-section there is a subsection named ‘Extract to QGIS’ with 3 buttons: ‘All Projects’, ‘Project Surveys’ and ‘Project Elements’. These buttons extract specific spatial data into individual tables in the ‘temp’-schema, that can be displayed in QGIS when an appropriate connection to the server is provided.

‘All Projects’ Button:

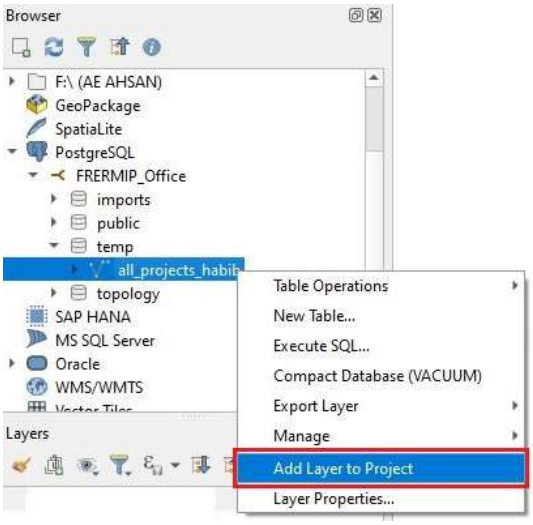
1. In QGIS, locate the Browser Panel on the middle left side fo the screen, and then locate the PostgreSQL-option.



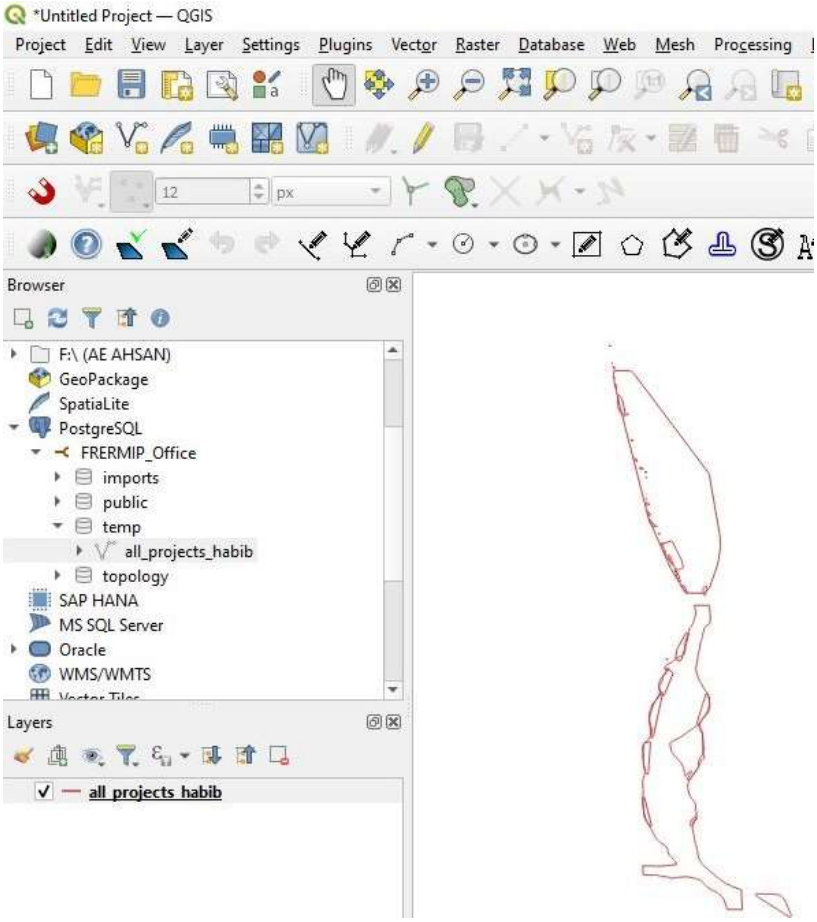
2. Select the 'PostgreQSL'-option, then double click to display the various PostgreSQL connections available. Select the desired connection (e.g. FRERMIP Office), then double click again to get the various Schemas (folders) available. The extracted Spatial Elements are available in the 'temp'-schema. ***Do not select the other available schemas as they contain required permanent database tables to be used by Administrators only.*** Double click on the 'temp'-schema to view all temporary extracted tables available for display in QGIS. It might be necessary to click on the Refresh-icon in the Brower Panel to view newly extracted tables.



3. Spatial elements (tables) can be added to the QGIS-Layerw Panel by doing the following: select the desired table(s) > right click the mouse > select the ‘Add Layer to Project’-option. Alternatively, the user can simply select the table(s), hold down the mouse left button, and drag the selected tables down to the Layers panel. Multiple tables can be selected at one time.



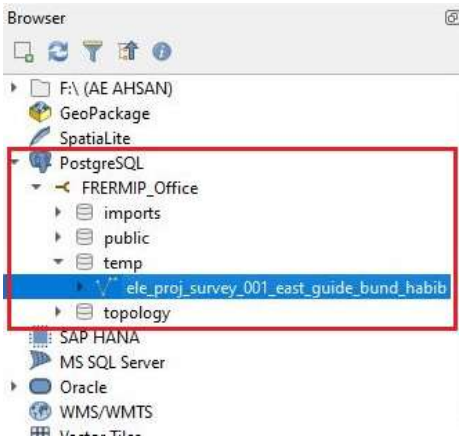
4. Displayed data will look like this in the QGIS canvas (display screen).



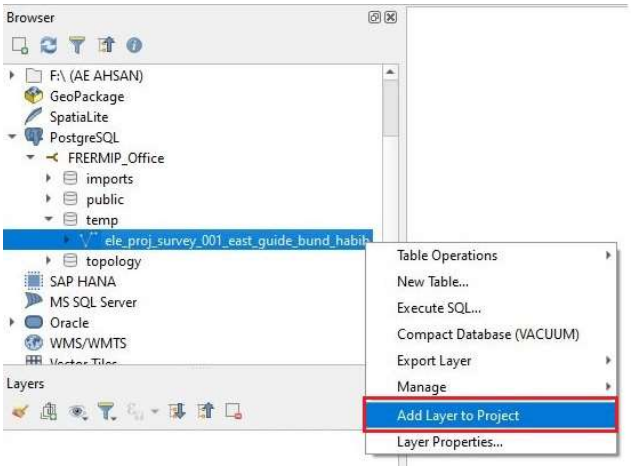
'Project Surveys' Button:

1. This button extracts all survey geometric outlines (extents) for the selected project into a table in the 'temp'-schema that can be displayed in QGIS.

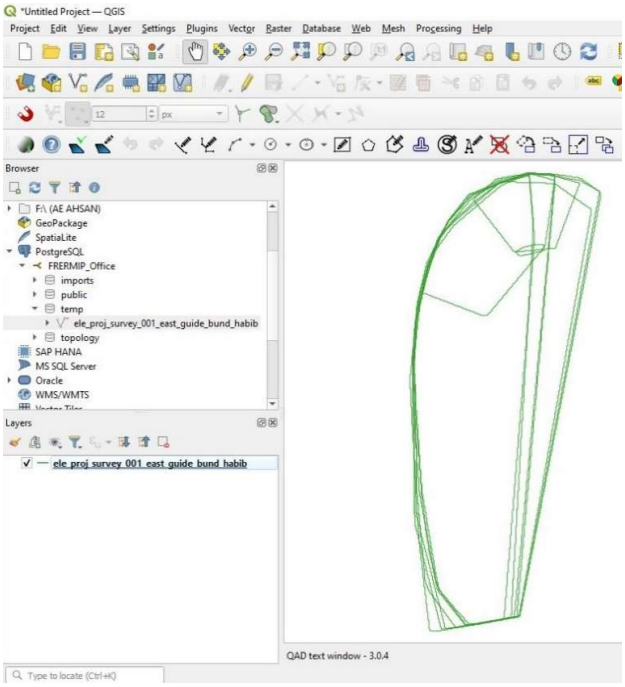
2. In the QGIS Browser Panel 'PostgreQSL' section, the project survey spatial element table will be available in the 'temp'-schema of the current database connection.



3. Table(s) can be added to the QGIS-Layers Panel by: selecting table(s) > right clicking the mouse >, and selecting the 'Add Layer to Project'-option.



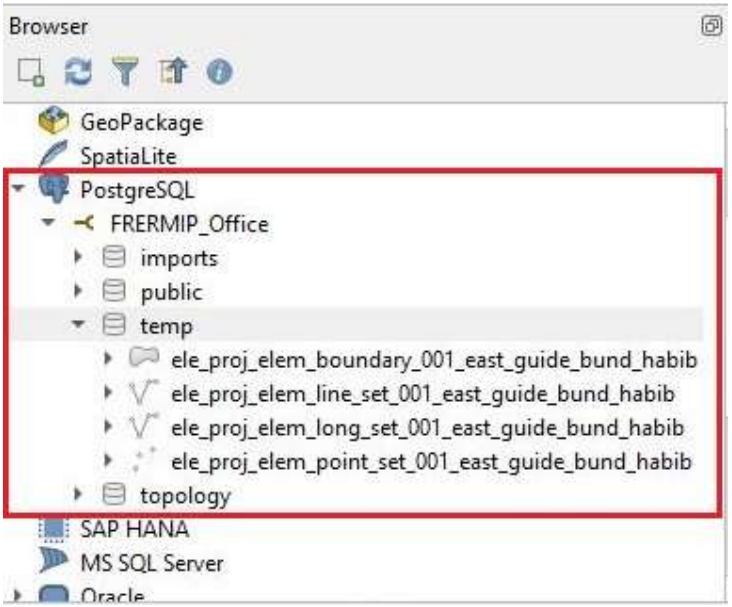
4. Displayed data will look like this in the QGIS canvas.



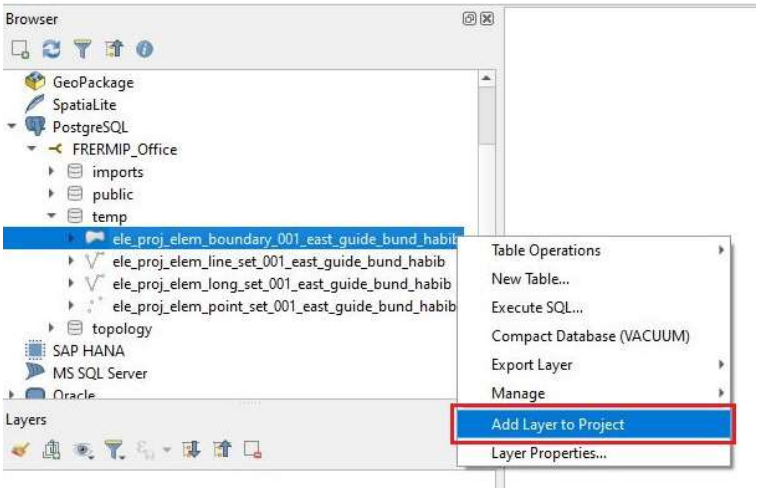
'Project Elements' Button:

1. This button will extract all defined project Spatial Elements into individual tables in the 'temp'-schema that can be displayed in QGIS.

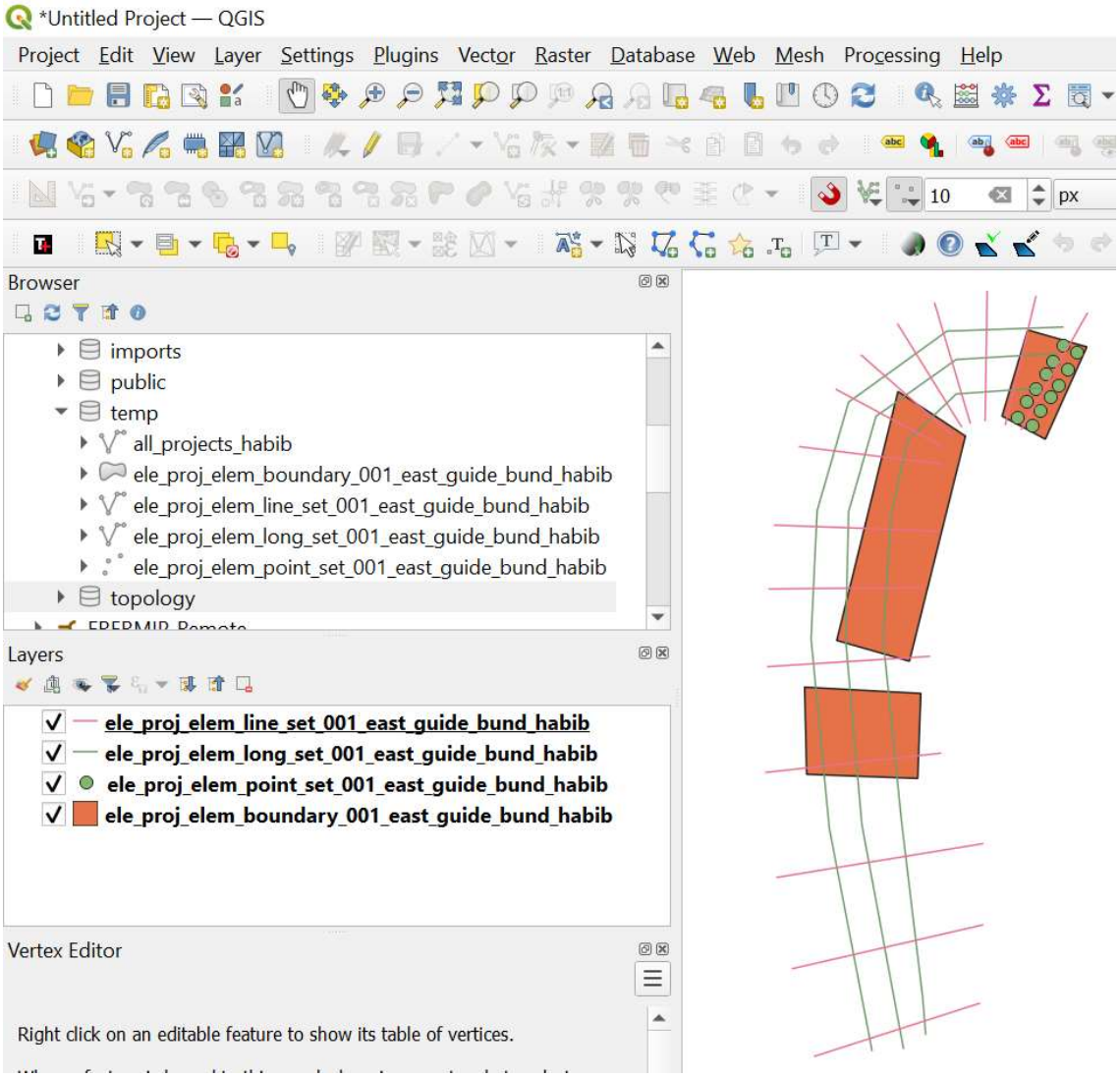
2. In QGIS ‘PostegreSQL_temp’ section this is what extracted Spatial Elements will look like. The table names identify the type of spatial element, the project name, project id and the user name:
    1. ele_proj_elem_ boundary_001_east_guide_bund_habib
    2. ele_proj_elem_line_set_001_east_guide_bund_habib
    3. ele_proj_elem_long_set_001_east_guide_bund_habib
    4. ele_proj_elem_point_set_001_east_guide_bund_habib



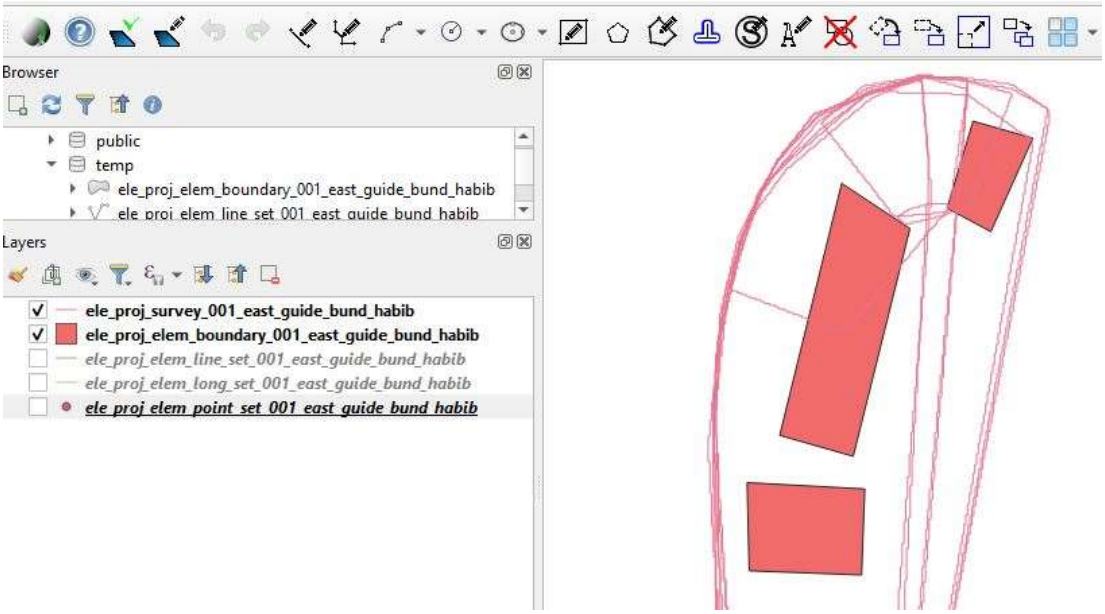
3. Table(s) can be added to the QGIS-Layers by: selecting table(s) > right clicking the mouse > selecting the ‘Add Layer to Project’-option.



4. Displayed data will look like this in the QGIS canvas.

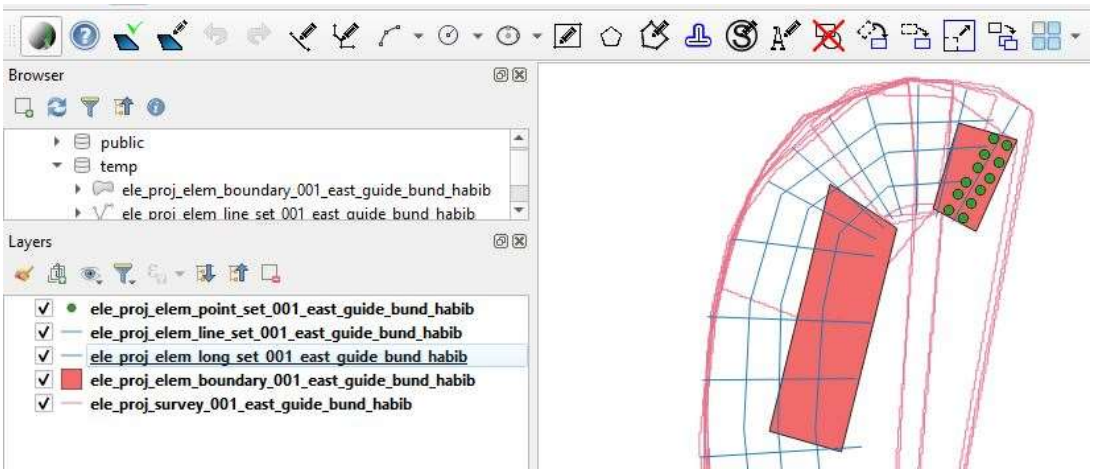


5. The layer named ‘ele_proj_elem_boundary_001_east_guide_bund_habib’, includes boundary locations defined for a project. These boundaries are used to calculate the cumulative area and volume of survey bathymetry within the boundary outline. In order to make the area and volume calculations, each survey 'must' fully cover (envelope) the boundary outline. If even one cell of the boundary is not covered by the survey outline, that survey will not be included in the drop-down list of potential surveys for selection.

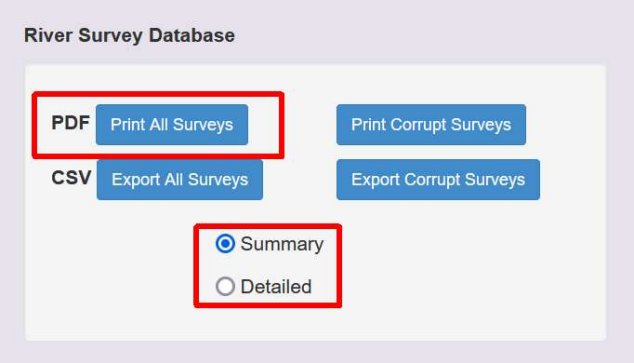


6. By default, Line-Sets (Cross-Sections) are defined as MultiLineStrings and the and Point-Sets are defined as MultiPoints, which is consistent with their PostgreSQL tables. However if required, users can 'explode' (split) the MultiLineStrings into a set of individual LineStrings with the cross-section labels added to the spatial elements as an attribute in QGIS. Similarly, MultiPoints can be 'exploded' (split) into a set of individual Points. This can be done by unselecting the default 'Multi-Element'-checkbox.

7. The layer named ‘ele_proj_elem_point_set_east_guide_bund_habib’ shows the defined point locations where scours depths (elevations) are required. Similarly, layer ‘ele_proj_elem_long_set_east_guide_bund_user’ defines the longitudinal path locations, and layer ‘ele_proj_elem_line_set_east_guide_bund_user’ defines cross-section locations.



SURVEY PRINT SUMMARY AND DETAILS

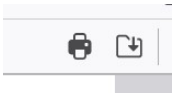


1. The Survey Summary Report includes the project name, survey count, and the maximum and minimum survey dates for the project.

River Survey Database: All Survey Summary Report

Project	Survey Count	Max.Date	Min.Date
Baniajan Spur	1	2021-08-11	2021-08-11
Betil Spur	12	2022-06-16	2002-10-26
Bohogram Revetment	1	2021-10-22	2021-10-22
Chandan Baisha Revetment	3	2018-10-17	2011-11-26
Chandan Baisha Spur 1	2	2002-07-18	2002-07-05
Chandan Baisha Spur 2	2	2002-07-18	2002-07-05
Chandpur	6	2003-08-01	2001-05-01
Chauhali	32	2023-10-08	2016-05-04
Dhakuria	3	2023-06-22	2014-03-13
East Guide Bund	10	2004-07-25	2004-04-11
Economic Zone Revetment	3	2022-07-02	2012-05-30
Enayetpur Revetment	6	2023-08-10	2023-05-16
Enayetpur Spur	42	2023-07-12	2002-10-26
Ganges	4	2001-10-19	2001-10-19
Harirampur	17	2023-08-14	2012-06-15
Hasnapara Spur	1	2002-07-30	2002-07-30
Kalitola Groyne	106	2019-10-02	2001-09-04
Koijuri	13	2023-07-19	2004-11-23
Kurnabari Project	40	2019-08-27	2014-04-12
Lower Jamuna Full River	8	2023-08-30	2015-09-15
Mathuapara Groyne	69	2016-08-08	1998-12-23
MDIP	10	2023-02-18	2006-08-23
Meghal Spur 1	20	2023-07-11	2001-10-14
Meghal Spur 2	6	2006-07-18	2001-09-01
Meghal Spur 3	8	2018-09-17	2004-04-21
Nagarbari	6	2023-02-28	2022-11-30
Panchthakuri	11	2022-02-25	2003-10-26
PIRDP	113	2023-03-05	1992-04-30
RBIP	1	2013-08-27	2013-08-27
Salimabad	3	2017-09-29	2017-04-07
Sariakandi Groyne	45	2016-08-08	2001-10-29
Simla Spur 2	19	2023-08-07	2014-03-13
Simla Spur 3	31	2006-09-16	1998-10-02
Singabari Spur 1	2	2018-08-01	2013-07-04
Singrabari Spur	6	2019-05-27	2018-08-01
Sirajganj Cross Bar 1	43	2016-07-13	1998-10-02
Sirajganj Cross Bar 2	22	2020-07-23	2013-07-13
Sirajganj Cross Bar 3	76	2023-08-22	1998-06-17
Sirajganj Full River	84	2018-10-11	1998-06-17
Sirajganj Hard Point	1602	2023-08-22	1998-05-06
Subagacha Spur 1	2	2002-07-14	2001-09-01
Subagacha Spur 2	9	2019-11-24	2001-09-08
Titporol	4	2005-05-02	2005-05-02
West Guide Bund	160	2009-07-20	2004-04-13
Zaffarganj	9	2022-11-28	2016-07-19
Total Surveys	2673		

2. All printed reports can either be printed or downloaded by clicking the icons on the top right side of the page.



3. The Survey Details Report includes the unique ID code, the project name, survey name, survey date, and the survey centroid water level (if it exists). The ID code is important because it is used to define the related survey Point and Contour tables.

River Survey Database: All Survey Details Report

Id	Project	Survey	Date	W.L.(m)
2736	Baniajan Spur	Baniajan Spar	2021-08-11	13.12
2763	Betil Spur	Betil 1	2022-06-16	10.95
2619	Betil Spur	Batil Spur 1	2018-09-27	10.54
162	Betil Spur	sirbetel	2014-09-20	10.43
161	Betil Spur	sirbatel	2014-08-10	10.57
1982	Betil Spur	betilp1	2006-09-02	10.87
1983	Betil Spur	betilp2	2006-09-02	10.87
1966	Betil Spur	20puilbe2	2005-11-01	9.13
1975	Betil Spur	betil1	2005-11-01	9.12
1976	Betil Spur	betil2	2005-11-01	9.14
1703	Betil Spur	bt	2003-09-03	11.53
1702	Betil Spur	bt	2003-07-09	12.26
1701	Betil Spur	bt	2002-10-26	8.8
2754	Bohogram Revetment	Dredging Enayetpur to Hatpachil 2020 2021	2021-10-22	9.07

SURVEY EXPORT SUMMARY AND DETAILS

1. The Survey Summary can also be exported to a CSV-file with the same data as the printed PDF-file.

	A	B	C	D
1	Project	Survey Count	Max Date	Min Date
2	Baniajan Spur	1	8/11/2021	8/11/2021
3	Betil Spur	12	6/16/2022	10/26/2002
4	Bohogram Revetment	1	10/22/2021	10/22/2021
5	Chandan Baisha Revetment	3	10/17/2018	11/26/2011
6	Chandan Baisha Spur 1	2	7/18/2002	7/5/2002
7	Chandan Baisha Spur 2	2	7/18/2002	7/5/2002
8	Chandpur	6	8/1/2003	5/1/2001
9	Chauhali	32	10/8/2023	5/4/2016
10	Dhakuria	3	6/22/2023	3/13/2014

2.

2. The Survey Details can also be exported to a CSV-file with the same data as the printed PDF-file.

	A	B	C	D	E
1	Id	Project	Survey	Date	W.L.(m)
2	2736	Baniajan Spur	Baniajan Spar	8/11/2021	13.12
3	2763	Betil Spur	Betil 1	6/16/2022	10.95
4	2619	Betil Spur	Batil Spur 1	9/27/2018	10.54
5	162	Betil Spur	sirbetel	9/20/2014	10.43
6	161	Betil Spur	sirbatel	8/10/2014	10.57
7	1982	Betil Spur	betilp1	9/2/2006	10.87
8	1983	Betil Spur	betilp2	9/2/2006	10.87
9	1966	Betil Spur	20puilbe2	11/1/2005	9.13
10	1975	Betil Spur	betil1	11/1/2005	9.12
11	1976	Betil Spur	betil2	11/1/2005	9.14
12	1703	Betil Spur	bt	9/3/2003	11.53
13	1702	Betil Spur	bt	7/9/2003	12.26
14	1701	Betil Spur	bt	10/26/2002	8.8
15	2754	Bohogram Revetment	Dredging Enayetpur to Hatpachil	10/22/2021	9.07
16	2631	Chandan Baisha Revetment	Cornibari	10/17/2018	13.17
17	2581	Chandan Baisha Revetment	Chornibari	6/7/2018	14.25

PRINT CORRUPT SURVEYS SUMMARY AND DETAILS

1. A number of surveys have been deemed corrupted. It is currently not known how to rectify these survey. Some of the surveys look as if the elevation positive and negative symbols may be reversed, but the reason for this is unclear. Rather than deleting the corrupted surveys, they have been currently just identified as corrupted, using a 'corrupted'-column in the 'survey'-table.

2. The Corrupt Survey Summary Report includes the project name, survey count, and the maximum and minimum survey dates for the project.

River Survey Database: Corrupt Survey Summary Report

Project	Survey Count	Max.Date	Min.Date
Betil Spur	3	2003-09-03	2002-10-26
Chandan Baisha Spur 1	2	2002-07-18	2002-07-05
Chandan Baisha Spur 2	2	2002-07-18	2002-07-05
Ganges	4	2001-10-19	2001-10-19
Kalitola Groyne	33	2003-10-18	2001-09-04
Simla Spur 3	1	2001-09-08	2001-09-08
Sirajganj Cross Bar 1	1	2001-09-13	2001-09-13
Total Surveys	46		

3. The Corrupt Survey Details Report includes the unique ID code, the project name, survey name, survey date, and the survey centroid water level (if it exists).

River Survey Database: Corrupt Survey Details Report

Id	Project	Survey	Date	W.L.(m)
1703	Betil Spur	bt	2003-09-03	11.53
1702	Betil Spur	bt	2003-07-09	12.26
1701	Betil Spur	bt	2002-10-26	8.8
1707	Chandan Baisha Spur 1	c2	2002-07-18	15.1
1704	Chandan Baisha Spur 1	c1	2002-07-05	14.96
1705	Chandan Baisha Spur 2	c1	2002-07-18	15
1706	Chandan Baisha Spur 2	c2	2002-07-05	14.85
1777	Ganges	r1	2001-10-19	14.7
1778	Ganges	r2	2001-10-19	14.62
1779	Ganges	r3	2001-10-19	14.55
1821	Ganges	sp	2001-10-19	14.5
1740	Kalitola Groyne	kl	2003-10-18	15.89
1739	Kalitola Groyne	kl	2003-10-01	14.22
1738	Kalitola Groyne	kl	2003-09-25	14.05
1737	Kalitola Groyne	kl	2003-09-08	14.31
1736	Kalitola Groyne	kl	2003-08-26	14.66
1735	Kalitola Groyne	kl	2003-08-07	15.18
1734	Kalitola Groyne	kl	2003-07-24	16.16
1733	Kalitola Groyne	kl	2003-07-14	16.08
1732	Kalitola Groyne	kl	2003-07-02	15.62
1731	Kalitola Groyne	kl	2003-06-25	14.47

EXPORT CORRUPT SURVEYS SUMMARY AND DETAILS

1. The Corrupt Survey Summary can also be exported to a CSV-file with the same data as the printed PDF-file.

	A	B	C	D
1	Project	Survey Count	Max Date	Min Date
2	Betil Spur	3	9/3/2003	10/26/2002
3	Chandan Baisha Spur	2	7/18/2002	7/5/2002
4	Chandan Baisha Spur	2	7/18/2002	7/5/2002
5	Ganges	4	10/19/2001	10/19/2001
6	Kalitola Groyne	33	10/18/2003	9/4/2001
7	Simla Spur 3	1	9/8/2001	9/8/2001
8	Sirajganj Cross Bar 1	1	9/13/2001	9/13/2001
9	Total Surveys	46		
10				

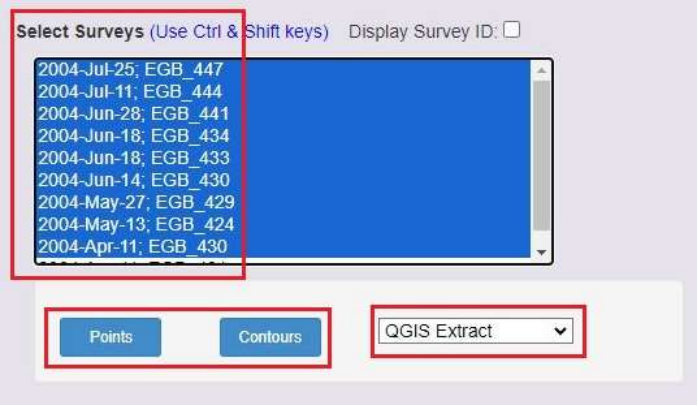
2. The Corrupt Survey Details can also be exported to a CSV-file with the same data as the printed PDF-file.

	A	B	C	D	E
1	Id	Project	Survey	Date	W.L.(m)
2	1703	Betil Spur	bt	9/3/2003	11.53
3	1702	Betil Spur	bt	7/9/2003	12.26
4	1701	Betil Spur	bt	10/26/2002	8.8
5	1707	Chandan Baisha Spur 1	c2	7/18/2002	15.1
6	1704	Chandan Baisha Spur 1	c1	7/5/2002	14.96
7	1705	Chandan Baisha Spur 2	c1	7/18/2002	15
8	1706	Chandan Baisha Spur 2	c2	7/5/2002	14.85
9	1777	Ganges	r1	10/19/2001	14.7
10	1778	Ganges	r2	10/19/2001	14.62
11	1779	Ganges	r3	10/19/2001	14.55
12	1821	Ganges	sp	10/19/2001	14.5
13	1740	Kalitola Groyne	kl	10/18/2003	15.89
14	1739	Kalitola Groyne	kl	10/1/2003	14.22
15	1738	Kalitola Groyne	kl	9/25/2003	14.05
16	1737	Kalitola Groyne	kl	9/8/2003	14.31
17	1736	Kalitola Groyne	kl	8/26/2003	14.66

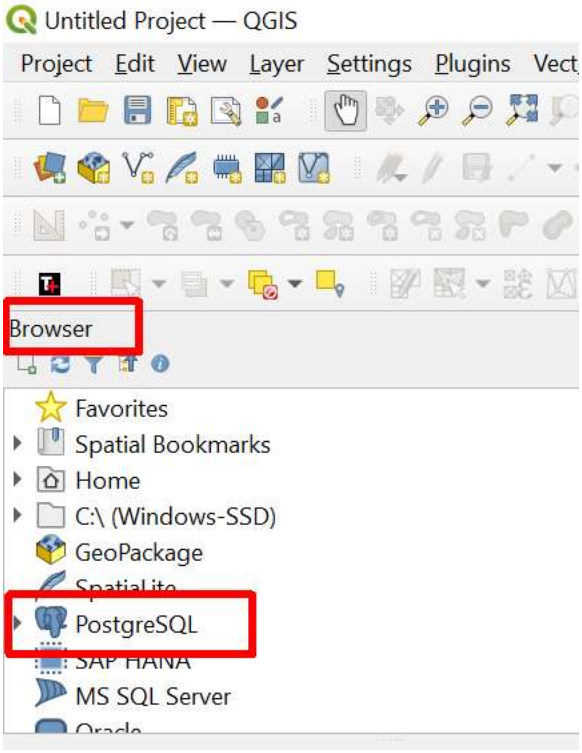
SURVEY EXTRACT TO QGIS

1. To extract Points and Contours into QGIS, first select one or more surveys to be extracted, then select the 'QGIS Extract'-option from the drop-down box on the bottom right of the screen.

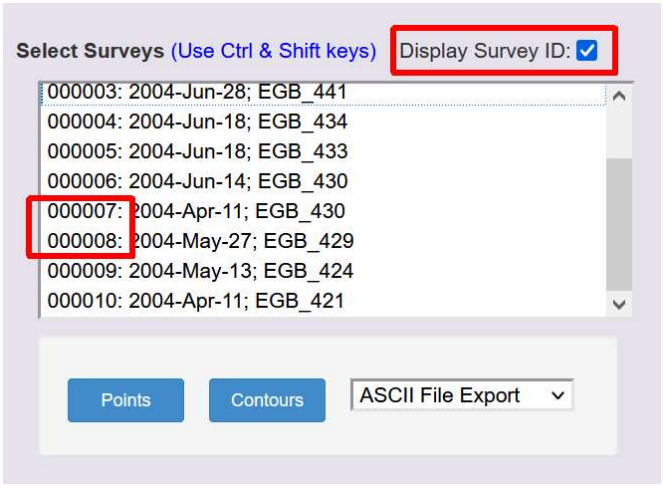
2. Clicking the 'Points'-button will extract point locations and elevations for the selected surveys to the database 'temp'-schema. Alternatively, click on the ‘Contours’-button to extract contours (polygons) and elevations to the database 'temp'-schema.



3. Use the QGIS ‘PostgreSQL’-option in the Browser Panel documented previously (refer to Spatial elements Extract section) to import the Point or Contour tables from the 'temp'-schema into QGIS by adding them to the canvas.

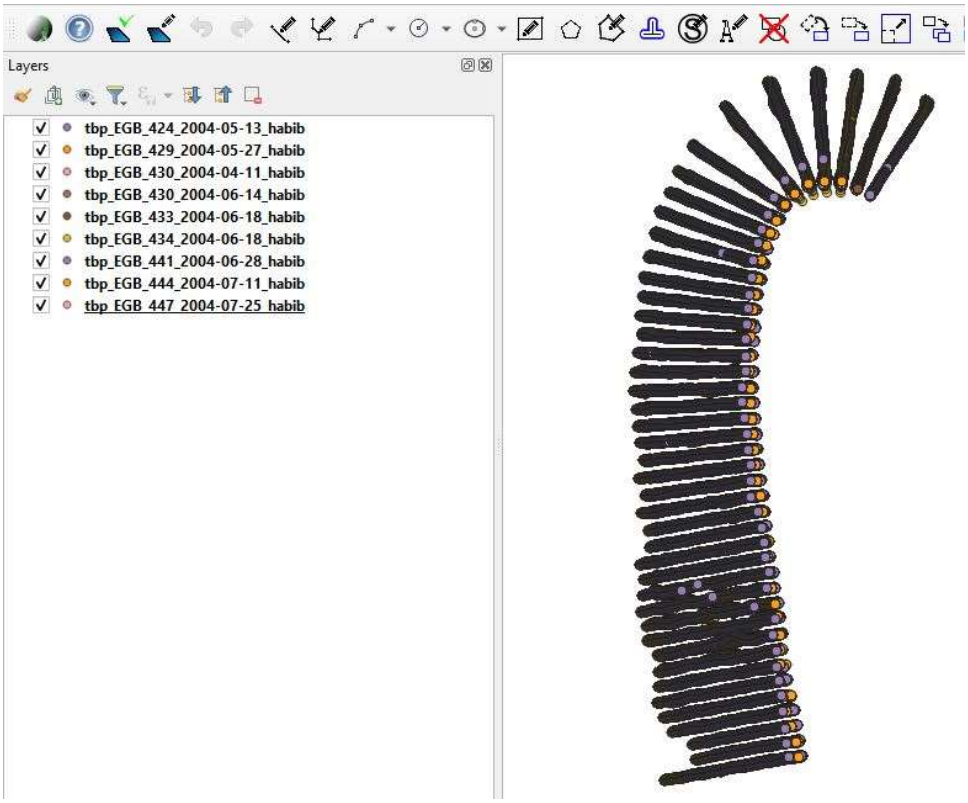


4. The 'Display Survey ID'-checkbox in the top right side of the screen is primarily for Administrators. The Survey ID is used to link the Survey table to its associated Point and Contour files.



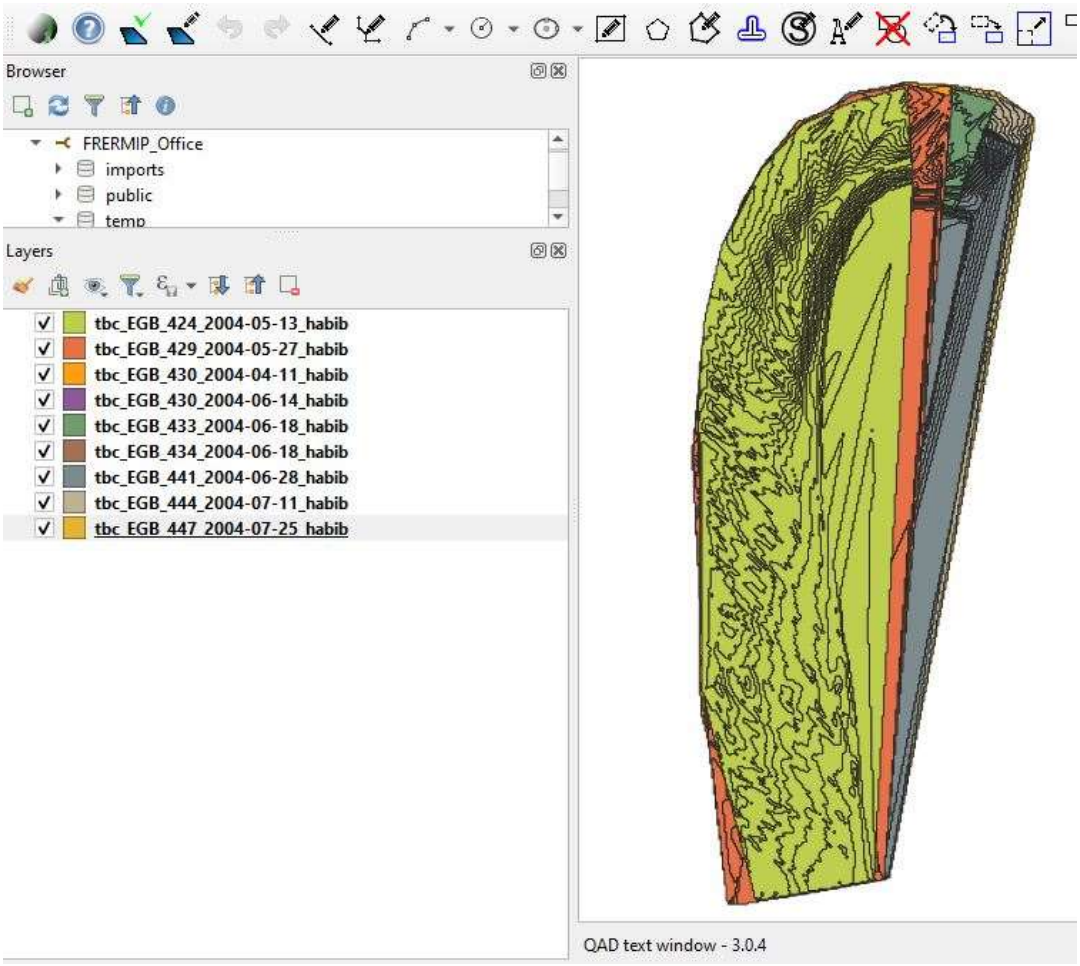
Extract Points to QGIS

1. An example of extracted points displayed in QGIS is shown below.

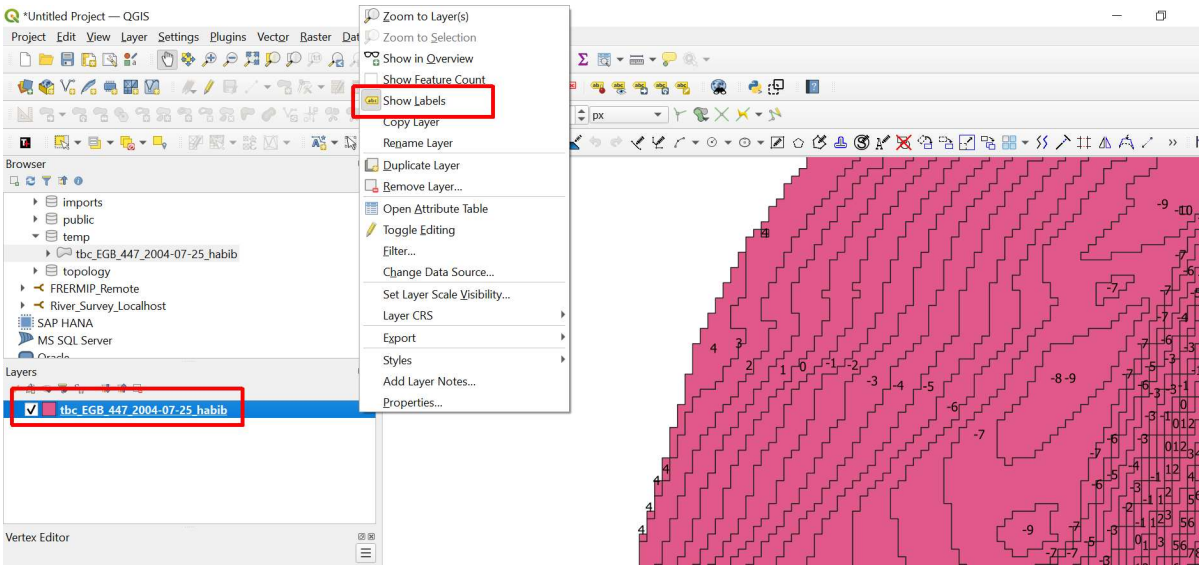

Layers
tbp_EGB_424_2004-05-13_habib
tbp_EGB_429_2004-05-27_habib
tbp_EGB_430_2004-04-11_habib
tbp_EGB_430_2004-06-14_habib
tbp_EGB_433_2004-06-18_habib
tbp_EGB_434_2004-06-18_habib
tbp_EGB_441_2004-06-28_habib
tbp_EGB_444_2004-07-11_habib
tbp_EGB_447_2004-07-25_habib

Extract Contours to QGIS

1. An example of extracted contours displayed in QGIS is shown below.



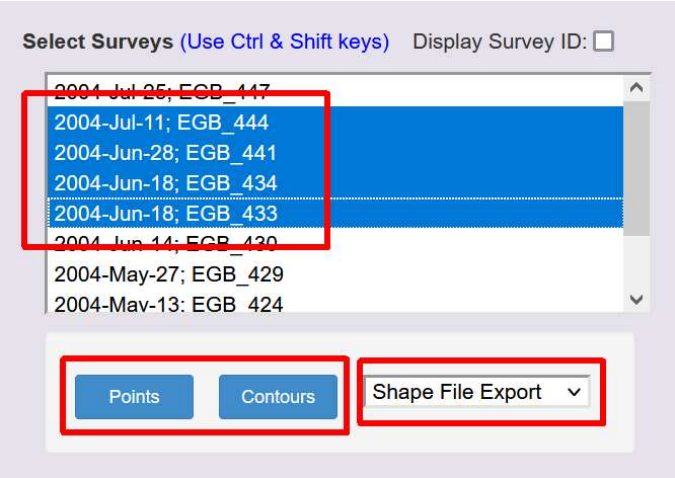
2. Contour elevations can be easily displayed by selecting the layer, right clicking the mouse, and selecting the 'Show Labels'-option.


*Untitled Project — QGIS
Project Edit View Layer Settings Plugins Vector Raster
Browser
imports
public
temp
tbc_EGB_447_2004-07-25_habib
topology
FRERMIP_Remote
River_Survey_Localhost
SAP HANA
MS SQL Server
Layers
tbc_EGB_447_2004-07-25_habib
Vertex Editor
Zoom to Layer(s)
Zoom to Selection
Show in Overview
Show Feature Count
Show Labels
Copy Layer
Rename Layer
Duplicate Layer
Remove Layer...
Open Attribute Table
Toggle Editing
Filter...
Change Data Source...
Set Layer Scale Visibility...
Layer CRS
Export
Styles
Add Layer Notes...
Properties...
px

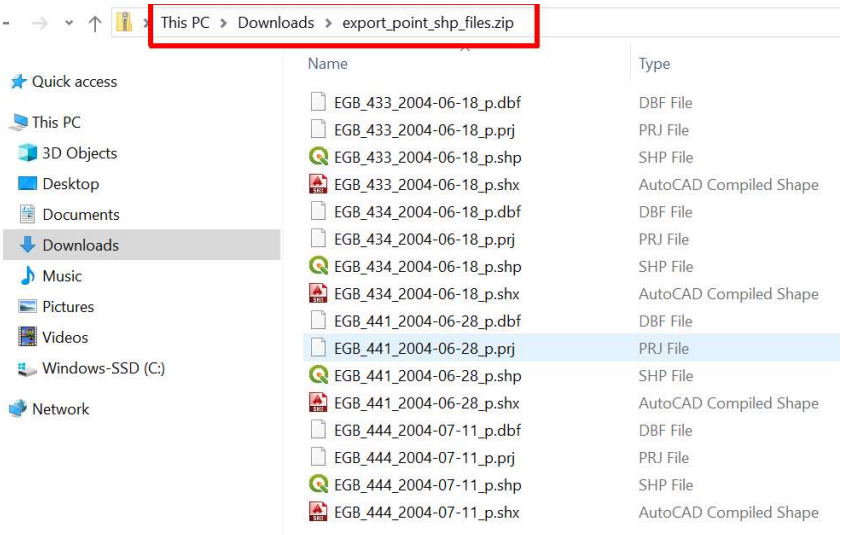
SURVEY EXPORT SHAPE FILES

1. To export Points and Contours as shape files, first select a set of Surveys, then select the 'Shape File Export '-option from the drop-down box on the bottom right side of the screen.

2. Clicking the 'Points'-button will export point files (point x & y locations, and elevations) for the selected surveys to a zip file that contains the shape files and all other associated files. Alternatively, click on the 'Contours'-button to export contours files (polygons and elevations) to a zip file.

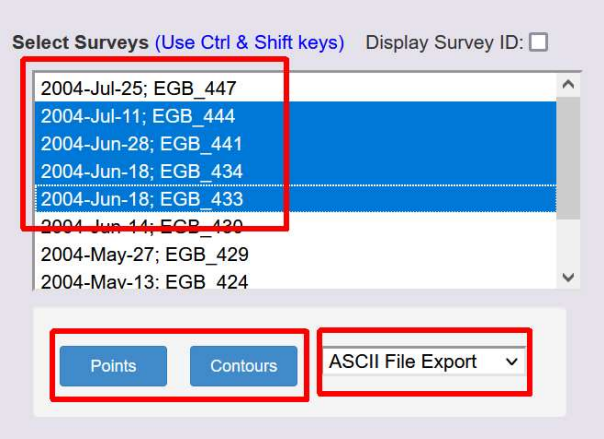


3. This example shows the contents of a point zip file with individual shape files plus other associated files.



SURVEY EXPORT ASCII (CSV) FILES

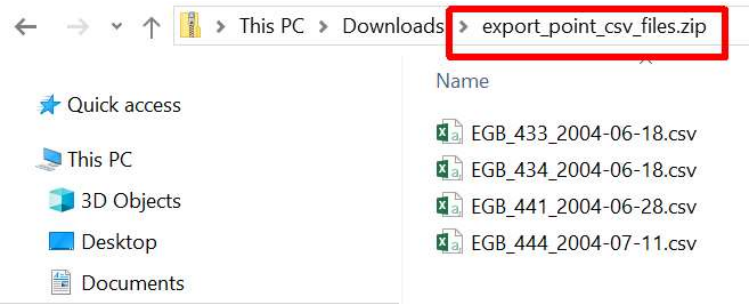
1. To export Points and Contours as ASCII (csv)-files, first select a set of Surveys, then select the “ASCII File Export "-option from the drop-down box on the bottom right side of the screen.



Points

2. Clicking the 'Points'-button will export point files for selected surveys to a single zip-file named:
   export_point_csv_files.zip

3. When un-zipped, the 'export_point_csv_files'-folder will contain one csv-file for each selected survey.



4. When opened in Excel the csv-file will look similar to the following with x, y and z columns defining each survey point:

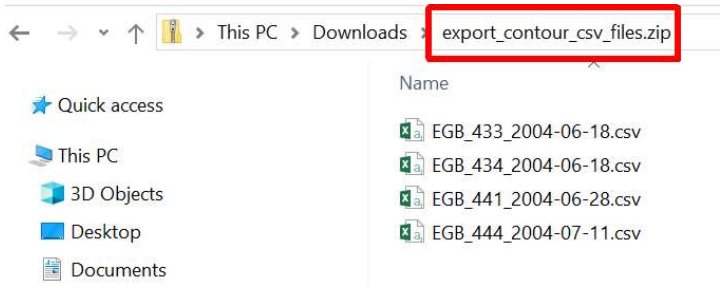
	A	B	C
1	x	y	z
2	479853.2	699565.5	2.57
3	479853.5	699565.1	2.68
4	479853.8	699564.9	2.72
5	479854	699564.6	2.76
6	479854.3	699564.4	2.81
7	479854.5	699564.1	2.84
8	479854.8	699563.8	2.89
9	479855	699563.5	2.94

Contours

1. Similarly, select a set of Surveys, then select the “ASCII File Export "-option from the drop-down box, the click on the ‘Contours’-button to export contour csv-files for selected surveys.

2. The contour csv-files (text - ASCII files) for all selected surveys are combined into a single zip-file named: export_contour_csv_files.zip

3. When extracted (un-zipped) the 'export_contour_csv_files'-folder will contain one csv-file for each selected survey.



4. The extracted contour data in ASCII format will look like the following. Each row defines a single contour with an elevation and a polygon definition. The contours are defined in standard WKB-format as a polygon. The numbers inside the polygon definition are 'x&y'-locations that define vertices along the outer edge of the polygon.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	z	contour															
2	2	POLYGON((480113.2 699693.3,480118.2 699693.299999999,480118.2 699688.3,480113.2 699688.3,480113.2 699693.3))															
3	1	POLYGON((480228.2 699683.3,480233.2 699683.3,480233.199999999 699678.299999999,480228.2 699678.3,480228.2 699683.3))															
4	3	POLYGON((480028.2 699678.299999999,480033.200000001 699678.3,480033.2 699673.3,480028.2 699673.3,480028.2 699678.299999999))															
5	1	POLYGON((480088.2 699648.3,480093.2 699648.299999999,480093.2 699643.3,480088.2 699643.3,480088.2 699648.3))															
6	2	POLYGON((480093.2 699648.299999999,480098.2 699648.299999999,480098.2 699643.3,480093.2 699643.3,480093.2 699648.299999999))															
7	1	POLYGON((480118.2 699648.299999999,480123.199999999 699648.299999999,480123.2 699643.3,480118.199999999 699643.3,480118.2 699648.299999999))															
8	2	POLYGON((480088.2 699643.3,480093.2 699643.3,480093.2 699638.299999999,480088.2 699638.3,480088.2 699643.3))															
9	3	POLYGON((480043.2 699638.3,480053.2 699638.3,480053.199999999 699633.3,480043.199999999 699633.3,480043.2 699638.3))															
10	1	POLYGON((480078.2 699633.3,480083.2 699633.3,480083.2 699628.3,480078.2 699628.3,480078.2 699633.3))															
11	2	POLYGON((480083.2 699633.3,480088.2 699633.3,480088.2 699628.3,480083.2 699628.3,480083.2 699633.3))															
12	4	POLYGON((479978.2 699648.3,479983.2 699648.299999999,479983.200000001 699638.3,479988.2 699638.3,479988.2 699633.3,479983.199999999 699633.3,479983.2 (															

5. Some polygons may be very large, and Excel csv files have a limit of 32,767 characters per cell. If the polygons are greater than that limit, the csv file can still be displayed in a text editor such as NotePad++.

FRERMIP Flood and Riverbank Erosion Risk Management Investment Program

FRERMIP Spatial MIS Database

Appendix-B: River Survey Administrator Manual

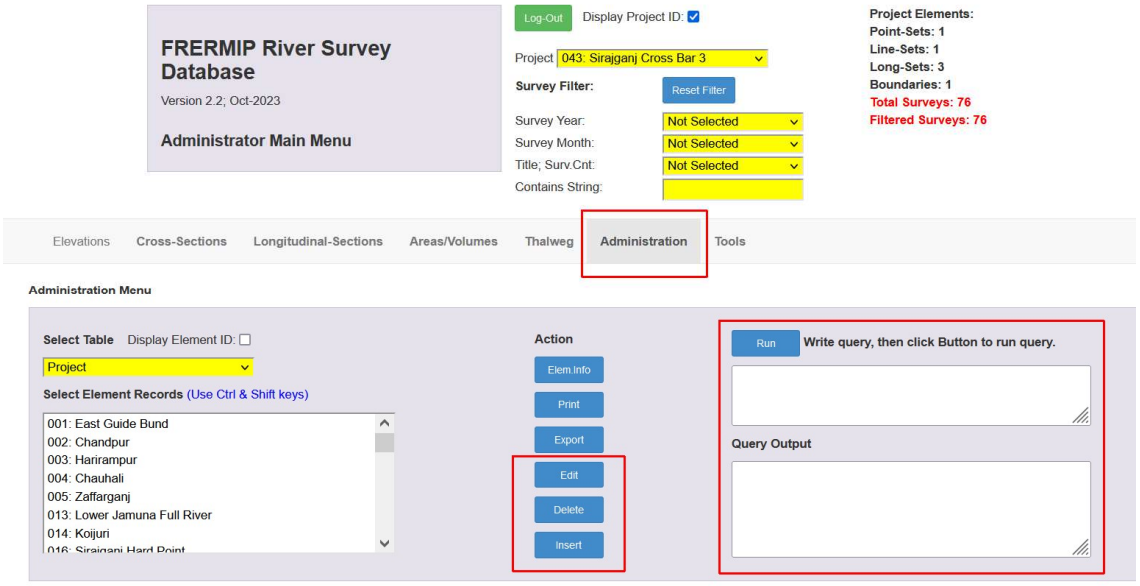
Contents

B-1 INTRODUCTION

The Administrator Manual is meant as a guideline for authorized individuals to edit, delete and insert records into Spatial Element tables, and other miscellaneous tables, in the River Survey database. Administrators are also allowed to run a Query Tool, check for possible errors in Surveys, and automatically generate boundaries. This Manual discusses only the Administration and 'Tools'-tab functions that are available for Administrators only. All other functions that are available to all Users are documented in the User Manual (refer to **Appendix-C**). This Administrator Manual is organized according the layout on the Administration and Tools-tab of the River Survey Database.

B-2 ADMINISTRATION-TAB

1. The Administration-tab allows authorized individuals to edit, delete and insert records to Spatial Element and other miscellaneous table in the River Survey database. It also includes a Query Tool similar to the one available in PgAdmin4 that allows Administrators to run any PostgreSQL query.



Edit, Delete and Insert Spatial Elements, and Other Database Tables

1. To edit, delete or insert records in Spatial Element and other database tables, first select the table of interest.

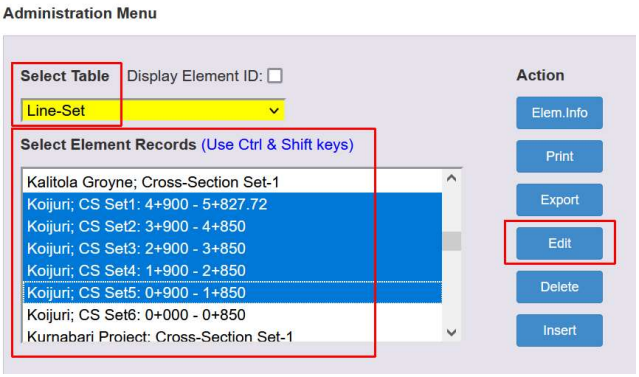
2. The Spatial Element tables include: Project, Point-Set, Line-Set, Long-Set, Boundary, and Survey. The other miscellaneous table include: Spatial Elements, User Information and Water Level Stations.
3. The miscellaneous 'Spatial Element'-table includes a list of all spatial elements and also the other database tables. The table has 5 columns: id, table_nm, title, geom_type and user_type. The 'geom-type'-column is used to distinguish spatial elements from other tables. The 'user_type'-column is used to differentiate tables that are available to all Users and only Administrators.

4. The 'User Information'-table includes a list of all database users. The table has 6 columns: id, login_usernm, login_password, user_nm_first, user_nm_last and user_type. The columns include login parameters, the user's first and last name, and administrative permissions.

5. The 'Water Level Stations-table include a list of all 13 Water Level Stations currently used to define water levels at all 2,672 surveys in the database. The table has 9 columns: id, code, title, easting, northing, latitude, longitude, PWDtoSOB_dt and PWDtoSOB_val. These columns are used to identify the location of the Water Level Station, and the date and value of the PWD to SOB datum conversion. The PWD to SOB conversion value would be required if additional survey data is found that is in PWD datum, and it is necessary to convert the Point data to SOB datum.

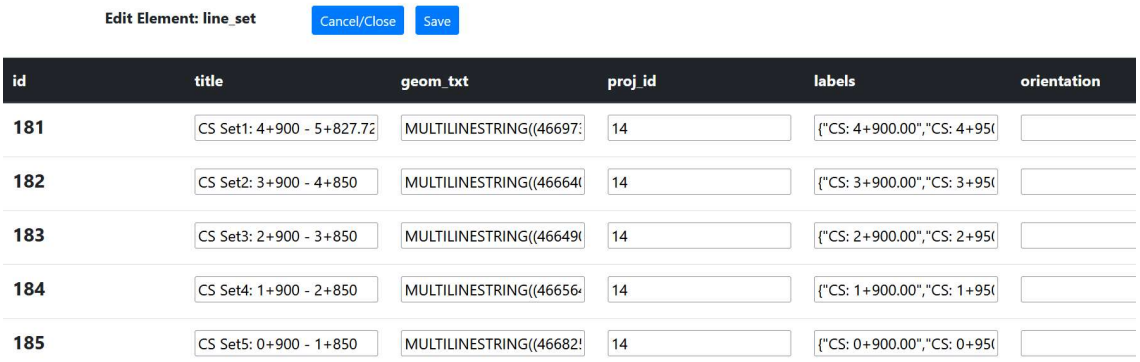
Edit Table Records

1. To Edit records in any of the Spatial Element or Miscellaneous tables, the Administrator first selects the Table that they wish to edit from the yellow drop-down box. They then select one or more specific elements (records) to be edited and then clicks the Edit-button.



2. The survey table currently includes 2672 records. This larger number would make it cumbersome to find the desired surveys for editing, so the survey table is filtered using the current project and filter condition.

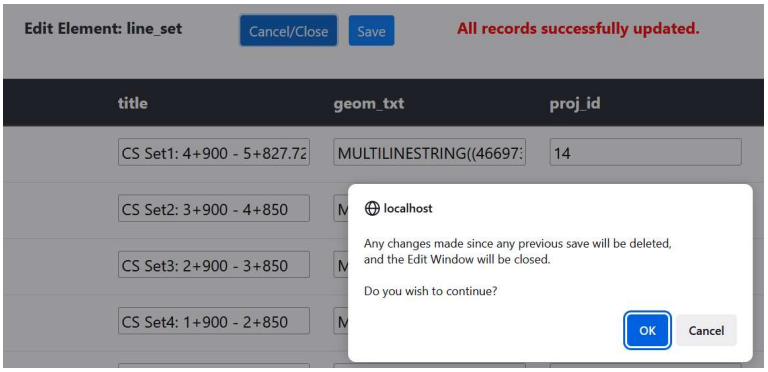
3. When the Administrator clicks the Edit-button, a new window is displayed that contains all the fields for the selected element as columns and all the selected element records as rows. The geometry is shown as a text field.



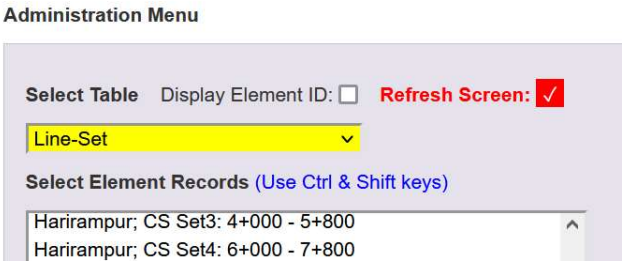
4. All fields can be modified except the primary key ‘id’-field. No records are actually updated until the Administrator clicks on the Save-button. The Administrator first makes any desired changes, and then clicks on the Save-button.

5. A message is displayed saying that all records have been successfully saved. If an error occurs during the update, an error message is displayed identifying the record where the error occurred.

6. Before clicking the Save-button, if Administrators wish to cancel any changes and close the edit window, they can click the Cancel/Close-button, and a confirmation box is displayed. Click the Ok-button to abort any changes made since the previous save, and close the edit window.

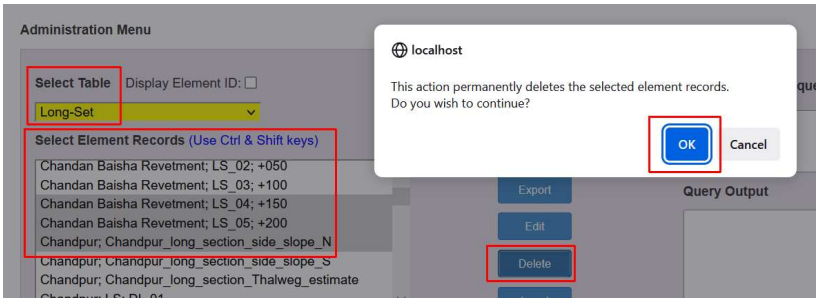


7. When the Administrator returns to the main interface window, a Refresh Screen button is displayed. If the title-column has been edited, and the Administrator wishes to confirm that changes have been made, they can click the ‘Refresh Screen’-checkbox, and any saved changes to the title will be displayed.


Administration Menu
Select Table
Display Element ID:
Refresh Screen:
Line-Set
Select Element Records (Use Ctrl & Shift keys)
Harirampur; CS Set3: 4+000 - 5+800
Harirampur; CS Set4: 6+000 - 7+800

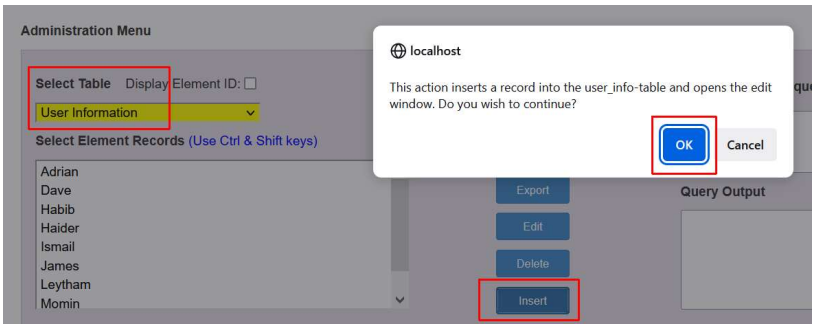
Delete Table Records

1. To Delete table records, first select the table, then select the specific records to deleted, and click the Delete-button. A confirmation message will be displayed to confirm that the Administrator wishes to permanently delete the selected records. Press OK to continue or Cancel to abort the deletion.



Insert Table Records

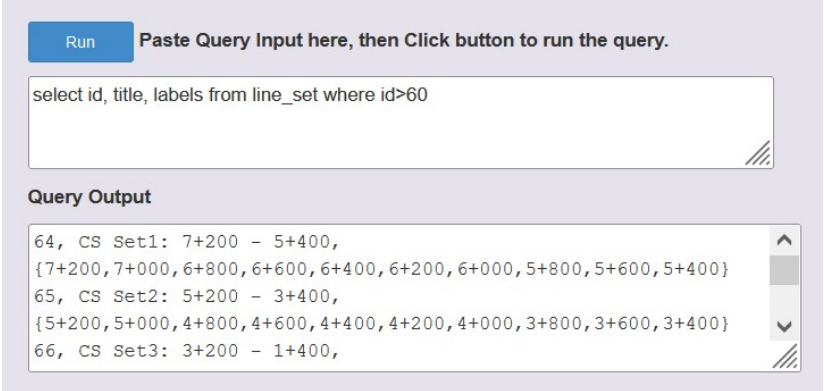
1. To Insert table records, first select the table, then click the Insert-button. A confirmation message will be displayed to confirm that the Administrator wishes to insert a record into the selected table. Press OK to continue or Cancel to abort the insertion.



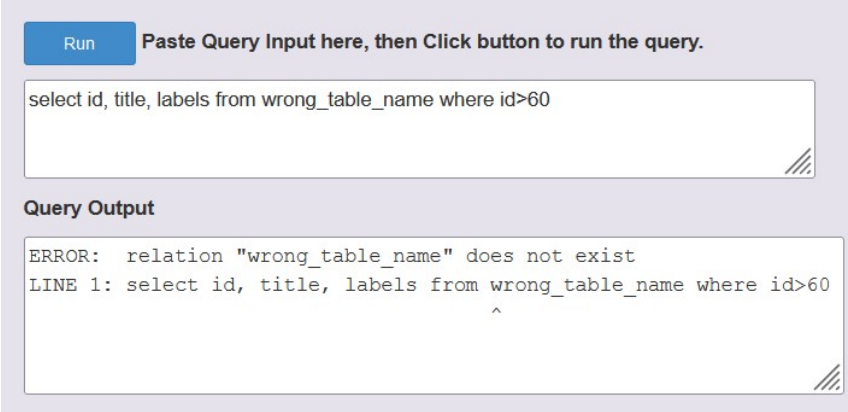
Run SQL Queries

1. Select-queries provide a useful way to display database information. ***Update, Insert and Delete-queries provide powerful ways to make changes to the database, but these changes cannot be undone, so care is required when using them.***

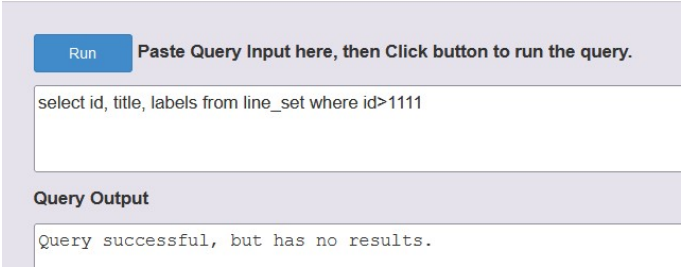
2. The Administrators can run SQL queries directly from the Administration-tab. Just enter any query statement into the input text area and click on the Run-button and the query will be executed. Query output will be displayed in the output text area.



3. If an error occurs during the query, a detailed error message will be displayed in the output text area.



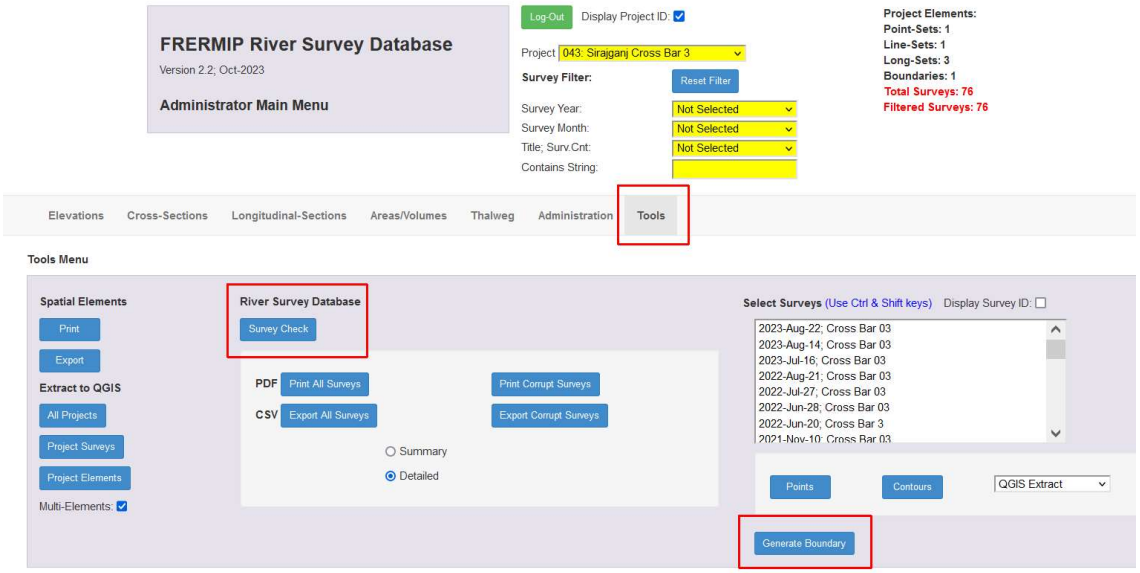
4. If the query has no errors, but does not produce any result, an appropriate message is displayed.



5. For Update, Insert or Delete-queries where no results are generated, a message will be displayed saying that the query was successfully completed, or a detailed error message will be displayed.

B-3 TOOLS-TAB

1. There are 2 additional functions on the Tools-tab that are available to Administrators that are explained in the Sections below:
    - River Survey Check
    - Generate Boundary



Survey Check

1. The ‘Survey Check’-tool allows the Administrator to identify errors or omissions in the River Survey Database. By clicking on the button, the database will generate an overview of tables and fields with possible problems. The possible errors are divided into 5 categories:
   - Survey Contour Files with no Survey Record
   - Survey Point Files with no Survey Record
   - Surveys with Missing Contour File
   - Surveys with Missing Point File
   - Survey Boundary field (outer extent outline) that is Empty

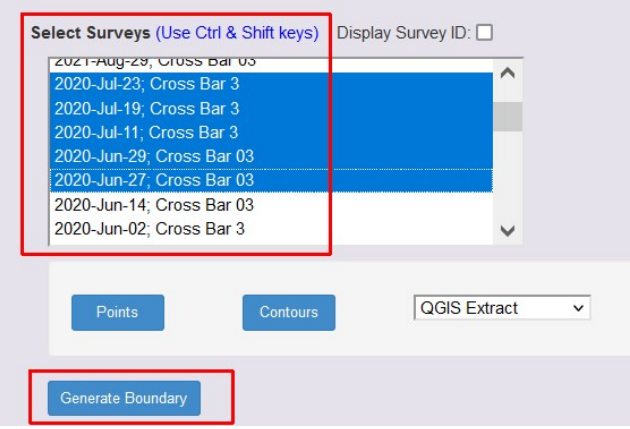
2. Clicking on the 'Survey Check'-button automatically opens a new window, and generates and displays potential problems. Clicking the ‘Return’-button in the new window redirects the Administrator back to the Main Menu 'Tool'-tab.


Survey Check
Return
Survey Contour Files with no Survey Record
C000006
Survey Point Files with no Survey Record
P000006
Surveys with Missing Contour File
Surveys with Missing Point File
Survey Boundary is empty
000022 fullriver20160930
000023 fullriver20170817

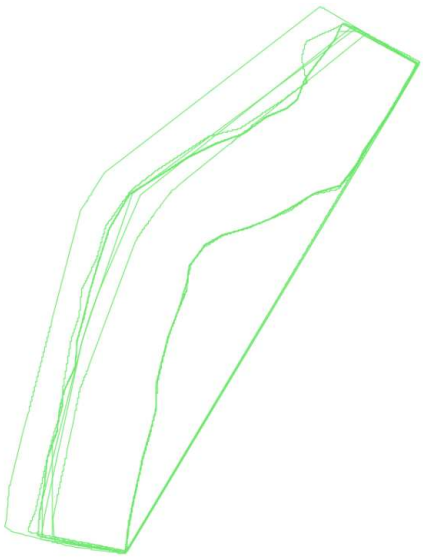
Generate Boundary

1. This function automatically generates the largest common boundary from a set of defined surveys (the largest boundary which is inside or contained within all selected surveys). Just select the surveys, press the 'Generate Boundary'-button, and the press the OK-button in the confirmation window.

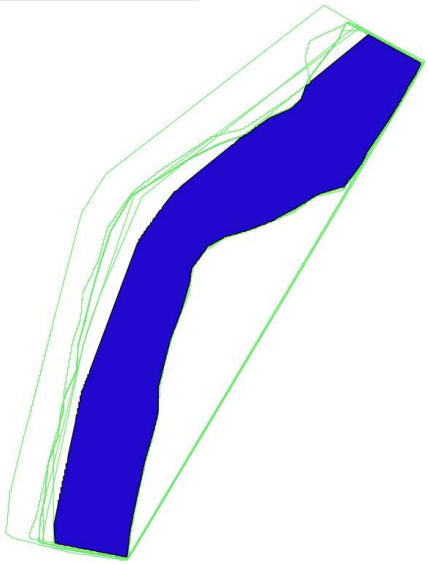
   This function is very useful because a manually defined boundary digitized in QGIS is often 'slightly' outside a survey outline, and therefore excluded from the 'Areas/Volumes'-tab survey list.



2. The Administrator can confirm the boundary generation by Extracting to QGIS both the Project Surveys and the Project Elements and displaying the extracted layers on the QGIS canvas. (refer to **Appendix-C TOOLS, SPATIAL ELEMENT EXTRACT TO QGIS**).



Extracted Survey Outlines



Extracted Survey Outlines and newly generated Boundary

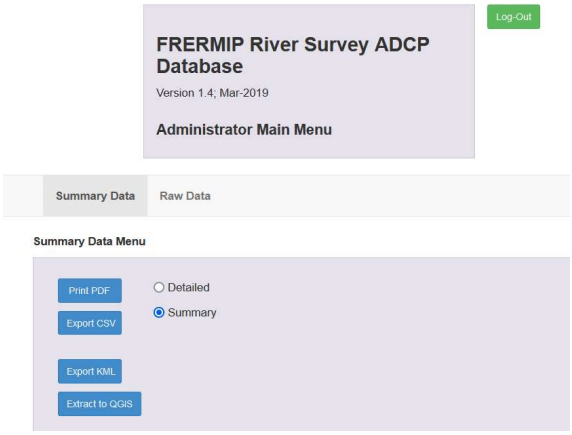
FRERMIP Spatial MIS Database

Appendix-C: ADCP Database

Contents

C-1 INTRODUCTION

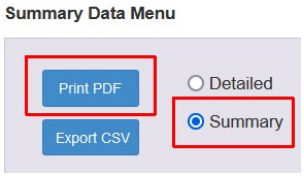
1. The ADCP interface allows users to print and export both summary and detailed ADCP reports for all surveys. Users can also export transect discharge results either as a KML file or to QGIS. The raw ADCP output files from the WinRiverII software package can also be exported.



C-2 SUMMARY DATA TAB

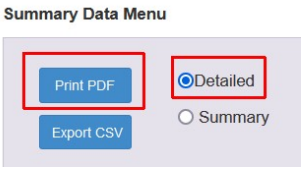
Summary and Detailed PDF and CSV Outputs

1. The 'Summary Data'-tab is used to Print and Export Detailed and Summary reports to PDF or as CSV files. Samples for all 4 outputs are shown below:



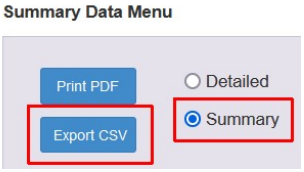
All Survey Summary Data

Transect	Survey	First Date	Last Date	Max Q (m3/s)	Min Q (m3/s)	Max WL (m SOB)	Min WL (m SOB)
Bethil Channel-1	4	2023-Jun-19	2023-Sep-22	461	21	9.62	10.92
Bethil Channel-2	4	2023-Jun-19	2023-Sep-22	453	127	9.62	10.92
Chauhali-1	9	2016-Aug-05	2019-Nov-20	51,806	3,599	5.83	11.93
Chauhali-2	3	2016-Aug-05	2016-Oct-20	21,222	12,772	9.19	10.61
Chauhali-3	1	2017-Dec-17	2017-Dec-17	4,195	4,195	4.94	4.94
Chauhali-4L	9	2016-Aug-05	2019-Nov-20	54,639	5,118	5.52	11.46
Chauhali-4M	1	2019-Sep-19	2019-Sep-19	12,988	12,988	9.91	9.91
Chauhali-5	1	2017-Dec-17	2017-Dec-17	3,614	3,614	4.76	4.76
Dhaleswari Channel	3	2023-Jun-21	2023-Aug-23	299	50	10.3	10.85



All Survey Details Data

Title	Date	Q (m3/s)	WL (m SOB)
Bethil Channel-1	2023-Jun-19	132	9.62
Bethil Channel-1	2023-Sep-22	21	N/A
Bethil Channel-1	2023-Aug-24	277	10.79
Bethil Channel-1	2023-Jul-21	461	10.92
Bethil Channel-2	2023-Jun-19	226	9.62
Bethil Channel-2	2023-Jul-21	453	10.92
Bethil Channel-2	2023-Sep-22	127	N/A
Bethil Channel-2	2023-Aug-24	446	10.79
Chauhali-1	2019-Sep-19	20,436	10.23
Chauhali-1	2017-Aug-01	30,288	9.85
Chauhali-1	2017-Aug-25	32,232	11.03

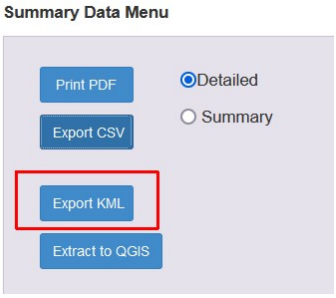


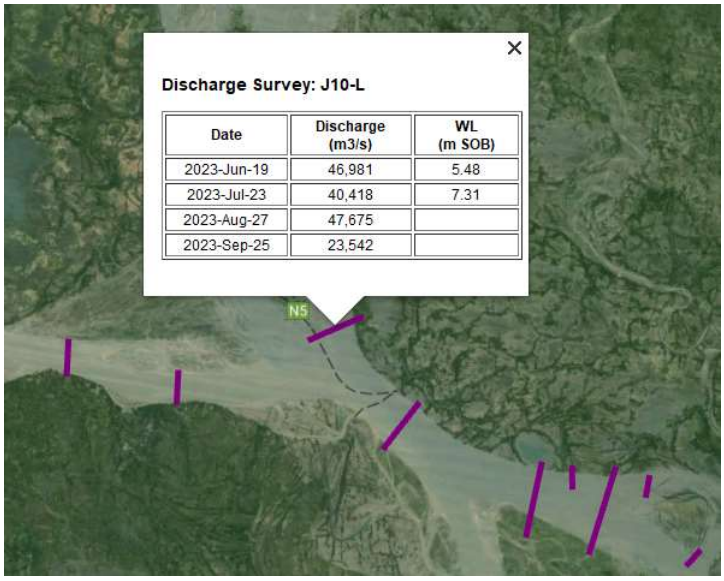
	A	B	C	D	E	F	G	H
1	Trasect	Survey	Max Date	Min Date	Max Q (m3/s)	Min Q (m3/s)	Max WL (m SOB)	Min WL (m SOB)
2	Bethil Channel-1	4	2023-Sep-22	2023-Jun-19	461	21	10.92	9.62
3	Bethil Channel-2	4	2023-Sep-22	2023-Jun-19	453	127	10.92	9.62
4	Chauhali-1	9	2019-Nov-20	2016-Aug-05	51,806	3,599	11.93	5.83
5	Chauhali-2	3	2016-Oct-20	2016-Aug-05	21,222	12,772	10.61	9.19
6	Chauhali-3	1	2017-Dec-17	2017-Dec-17	4,195	4,195	4.94	4.94
7	Chauhali-4L	9	2019-Nov-20	2016-Aug-05	54,639	5,118	11.46	5.52
8	Chauhali-4M	1	2019-Sep-19	2019-Sep-19	12,988	12,988	9.91	9.91
9	Chauhali-5	1	2017-Dec-17	2017-Dec-17	3,614	3,614	4.76	4.76
10	Dhaleswari Channel	3	2023-Aug-23	2023-Jun-21	299	50	10.85	10.3

	A	B	C	D
1	Title	Date	Discharge (m3/s)	Water Level (m SOB)
2	Bethil Channel-1	2023-Jun-19	132	9.62
3	Bethil Channel-1	2023-Sep-22	21	N/A
4	Bethil Channel-1	2023-Aug-24	277	10.79
5	Bethil Channel-1	2023-Jul-21	461	10.92
6	Bethil Channel-2	2023-Jun-19	226	9.62
7	Bethil Channel-2	2023-Jul-21	453	10.92
8	Bethil Channel-2	2023-Sep-22	127	N/A
9	Bethil Channel-2	2023-Aug-24	446	10.79
10	Chauhali-1	2019-Sep-19	20,436	10.23
11	Chauhali-1	2017-Aug-01	30,288	9.85
12	Chauhali-1	2017-Aug-25	32,232	11.03

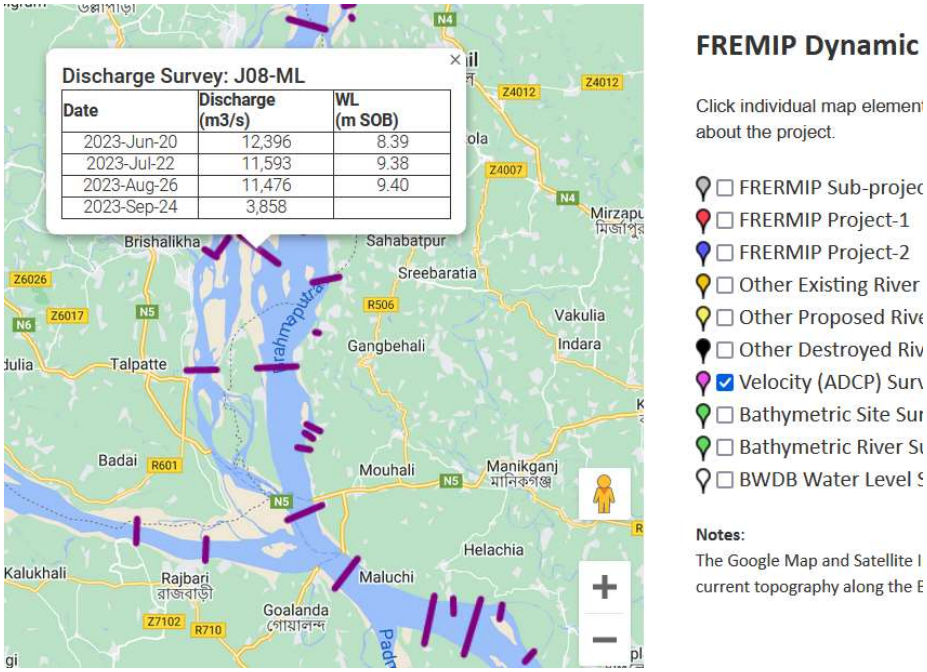
Export to KML

1. The Export to KML output can be displayed in Google Earth.



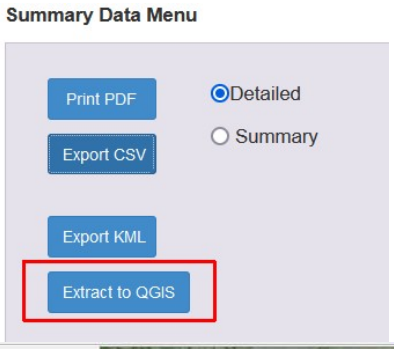


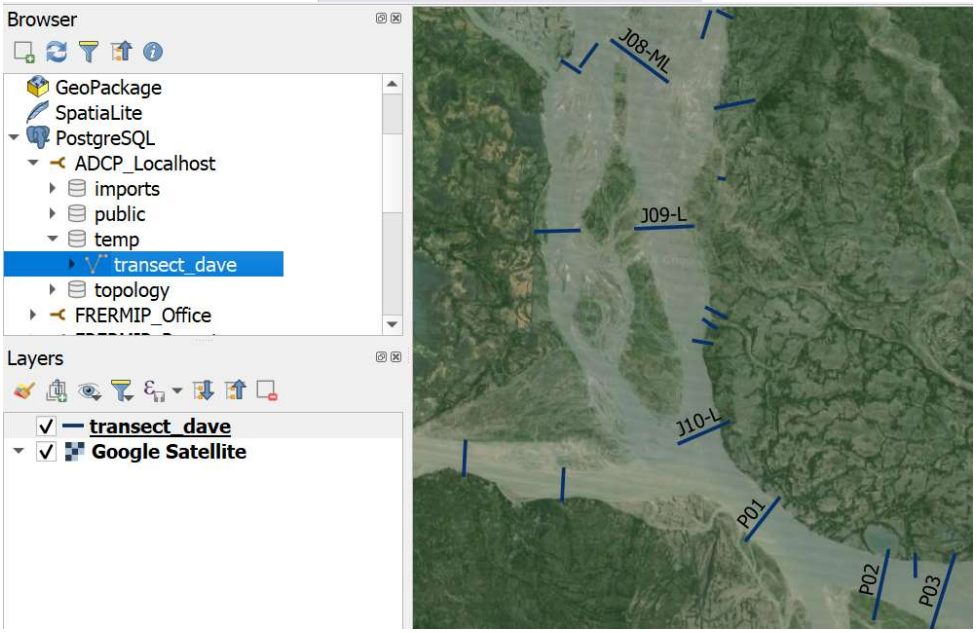
2. The KML-file is also used as input into the FRETMIP Website Dynamic Map.

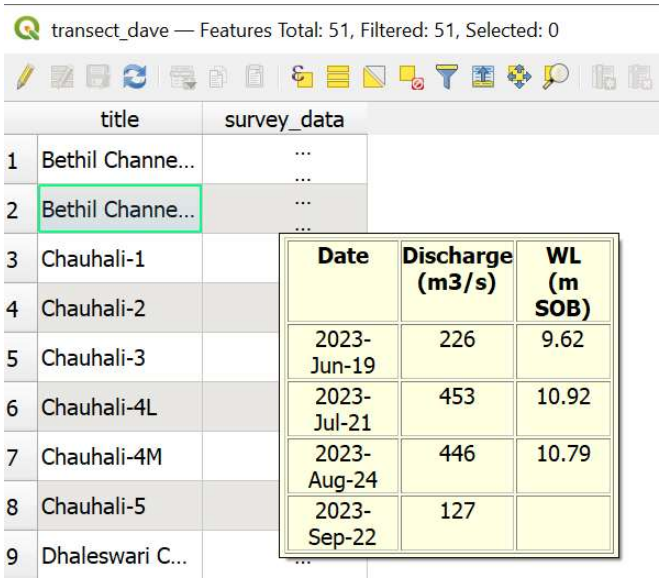


Extract to QGIS

1. The Extract to QGIS can also show attribute values in HTML format. In QGIS add the 'transect'-layer to the project, and show labels. Then open the attribute table, and hover the mouse over the 'survey_data'-field, and its HTML format will be displayed (refer to Appendix-H).







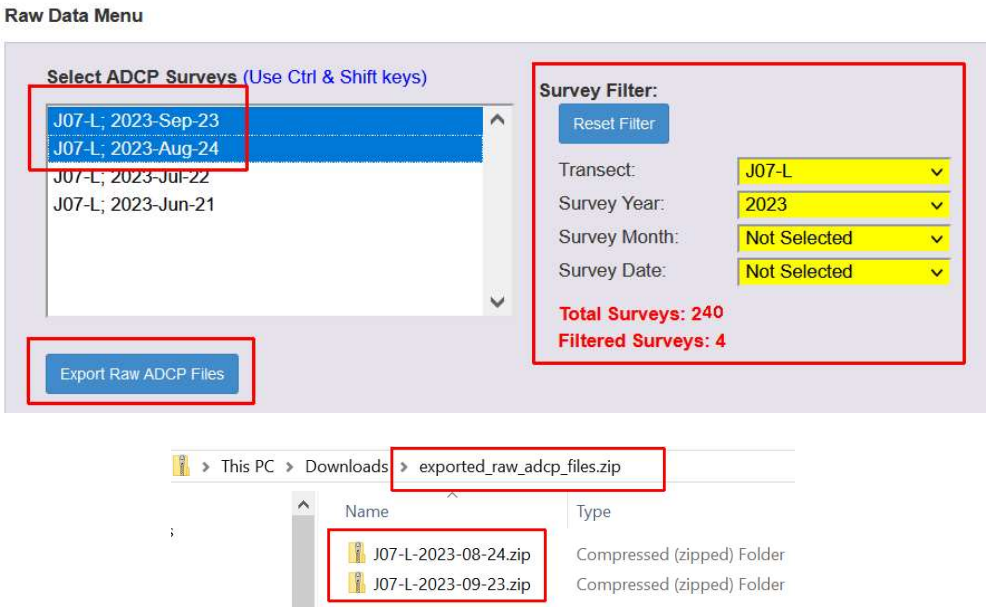
C-3 RAW DATA TAB

Survey Filter

1. The cascading filter has 4 different options: Transect, and Survey Year, Month and Date, which are all self explanatory. Cascading means that the filter supports more than one filter condition. The contents in the drop-down boxes only contain valid options still available, given the filter condition already specified. The user can reset the filter condition by clicking the 'Reset Filter'-button. Also shown is the total number of surveys and the current number of filtered surveys.

Export Raw ADCP Files

1. Select the Surveys, click the 'Export Raw ADCP Files'-button, click the OK-button on the Confirmation Window, and the requested raw output files from WinRiverII will be exported.



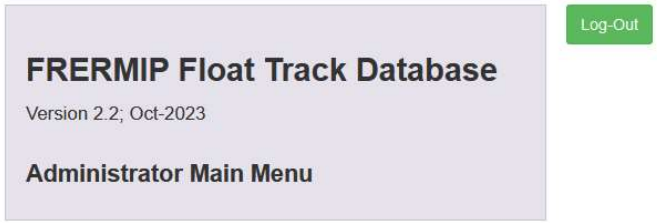
FRERMIP Spatial MIS Database

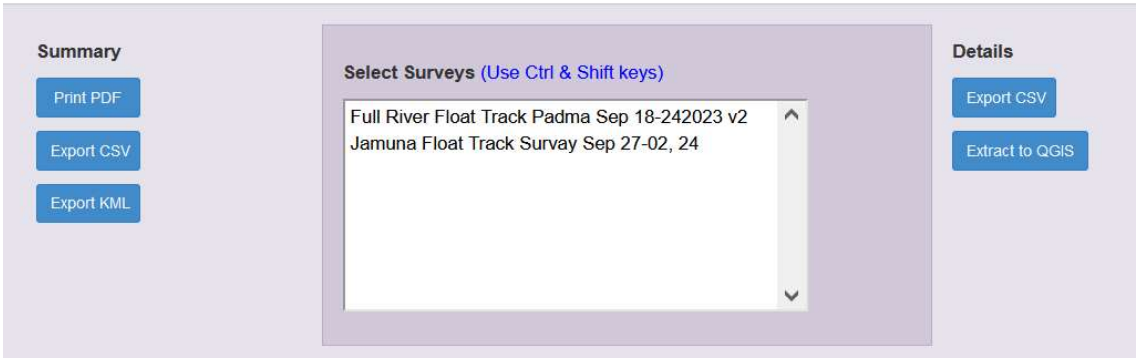
Appendix-D: Float Track Database

Contents

D-1 INTRODUCTION

The Float Track interface documented in this User Manual allows users to print or export summary reports for all surveys. Users can also export survey summary results as a KML-file. Float Track details can also be exported as CSV-files or extracted to QGIS for selected surveys.





D-2 SUMMARY OUTPUTS

1. Summary reports can be printed as a PDF or exported as a CSV-file. A summary of Float Track results can also be exported as a KML-file for insertion into the FRERMIP Website Dynamic Map. Outputs from these 3 summary options are shown below:

Print PDF

2. The report includes the Survey title, float track segment number and date, the segment start and end location and average velocity for the segment. The first and last 5 points of the segment have been excluded from the average velocity as these points are not considered reliable. The total number of surveys and segments are shown at the bottom of the report.

All Survey Summary Data

Title	Seg.No.	Date	Start X	Start Y	End X	End Y	Avg Vel(m/s)
Full River Float Track Padma Sep 18-242023 v2	1	2023-09-18	445751	637478	450043	636580	1.17
Full River Float Track Padma Sep 18-242023 v2	2	2023-09-18	449229	635668	450106	634885	1.17
Full River Float Track Padma Sep 18-242023 v2	3	2023-09-18	450157	634895	451658	634626	1.15
Full River Float Track Padma Sep 18-242023 v2	4	2023-09-18	451592	634785	453374	633435	1.12
Full River Float Track Padma Sep 18-242023 v2	5	2023-09-18	453327	633058	453962	633041	1.10
Full River Float Track Padma Sep 18-242023 v2	6	2023-09-18	453958	633078	454656	632805	1.10
Full River Float Track Padma Sep 18-242023 v2	7	2023-09-18	454684	633219	462113	629955	1.10
Full River Float Track Padma Sep 18-242023 v2	8	2023-09-18	462143	629945	466658	630067	1.10
Full River Float Track Padma Sep 18-242023 v2	9	2023-09-18	466693	630092	480838	627150	1.09

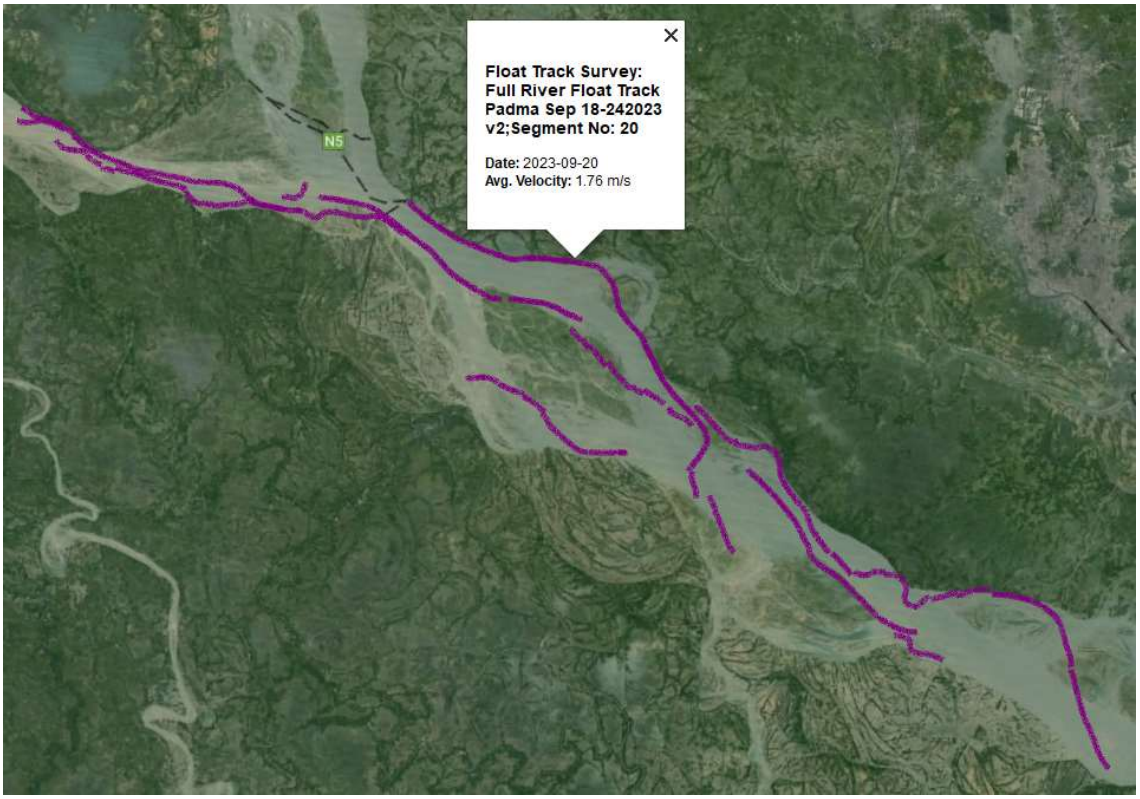
Export CSV

3. This CSV-file displays the same columns as the above report. The CSV-file also includes the number of surveys and segments at the bottom of the spreadsheet.

	A	B	C	D	E	F	G	H
1	Title	Seg.No.	Date	Start X	Start Y	End X	End Y	Avg.Vel(m/s)
77	Jamuna Float Track Survay Sep 27-02, 24	15	2023-09-19	453958	633078	454652	632813	1.1
78	Jamuna Float Track Survay Sep 27-02, 24	16	2023-09-19	454710	633219	462105	629959	1.09
79	Jamuna Float Track Survay Sep 27-02, 24	17	2023-09-19	462150	629942	466658	630067	1.09
80	Jamuna Float Track Survay Sep 27-02, 24	18	2023-09-19	466693	630092	480838	627150	1.08
81	Jamuna Float Track Survay Sep 27-02, 24	19	2023-09-19	481179	630057	486804	626157	1.06
82	Jamuna Float Track Survay Sep 27-02, 24	20	2023-09-20	486798	626318	506695	606273	1.08
83	Jamuna Float Track Survay Sep 27-02, 24	21	2023-09-20	506624	606234	506526	605902	1.18
84	Jamuna Float Track Survay Sep 27-02, 24	22	2023-09-20	506852	605920	507169	603462	1.18
85	Total Surveys	2						
86	Total Segments	83						

Extract to KML

4. The KML-file can be included in the FREMIP Dynamic Map or displayed in Google Earth. The survey segments are displayed as a linestring in latitude and longitude coordinates. If the user clicks the segment, the survey title, and segment number, date and average velocity is displayed.



D-3 DETAILED OUTPUTS

1. Detailed reports can be exported as a CSV-file or extracted into QGIS for selected surveys. Both these outputs display individual point locations and velocities for each survey segment. No detailed Print PDF option is available because the PDF file was considered to be too long to be practical. Outputs from these 2 detailed options are shown below:

Export to CSV

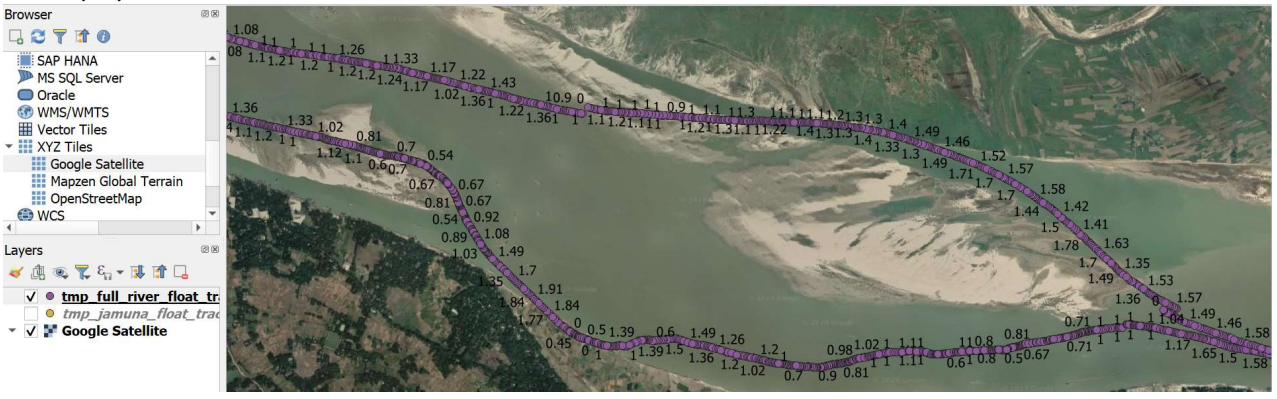
2. The CSV-file for selected surveys are bundled together in a single ZIP file named 'export_point_csv_files.zip'. The survey title is the CSV-file name.

	A	B	C	D	E
1	Date	Segment ID	X	Y	Vel(m/s)
2	2023-09-18	1	445751	637478	0
3	2023-09-18	1	445755	637478	0.4
4	2023-09-18	1	445761	637477	0.60827625
5	2023-09-18	1	445766	637476	0.50990194
6	2023-09-18	1	445770	637475	0.41231057
7	2023-09-18	1	445773	637475	0.3
8	2023-09-18	1	445780	637475	0.7
9	2023-09-18	1	445786	637473	0.6324555

Extract to QGIS

3. The detailed extracted table shows all survey segments and all segment velocity points. The image below shows the full extents of the survey

4. The image below shows a zoomed in view of velocity points, with the velocity label column displayed.



FRERMIP Flood and Riverbank Erosion Risk Management Investment Program

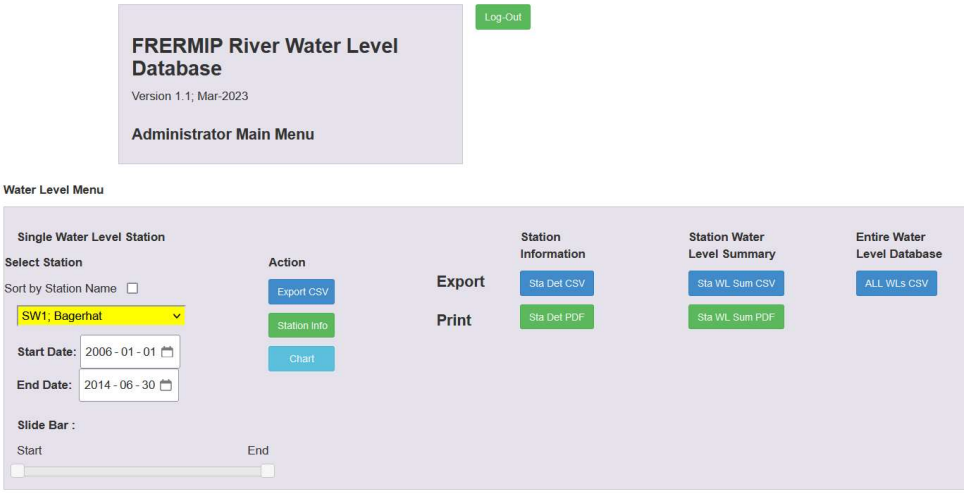
FRERMIP Spatial MIS Database

Appendix-E: Water Level Database

Contents

E-1 INTRODUCTION

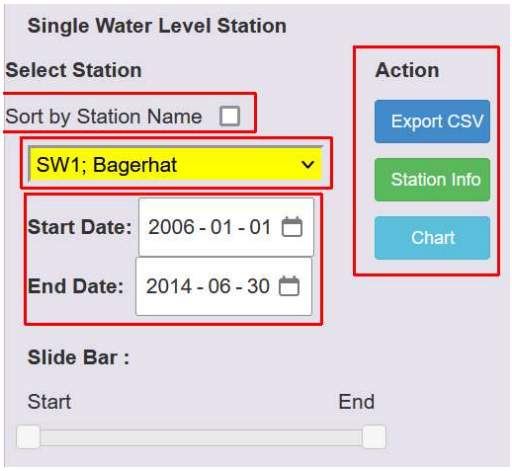
1. The Water Level Database allows users to display water level hydrographs as a chart, or to export it as CSV-file, any range of dates. Users can also print or export Station Details, Station Water Level Summaries, or export the entire database as a CS-file.



E-2 SINGLE WATER LEVEL STATION

Inputs

1. There are 4 inputs related to the Single Water Level Station section of the interface: Select Station, Start and End Date, and the 'Sort by Station Name'-option. There are also 3 Action buttons associated with the Single Water Level Station section. The Slide Bar at the bottom is an alternate way to define the Start and End Date.



2. In the FRERMIP Water Level database, there are a total of 346 Water Level Stations with water level data. The user can search for them either by Station Code (default), or by Station Name (by selecting the 'Sort by Station Name'-checkbox).

3. The default Start and End dates show the first and last date where Water Level data is available. The user can define the Start and End Date for the hydrograph by either entering new dates, or by using the Slide Bar. If the user attempts to enter either a date outside the range of available data, or an invalid date, an error window is displayed.

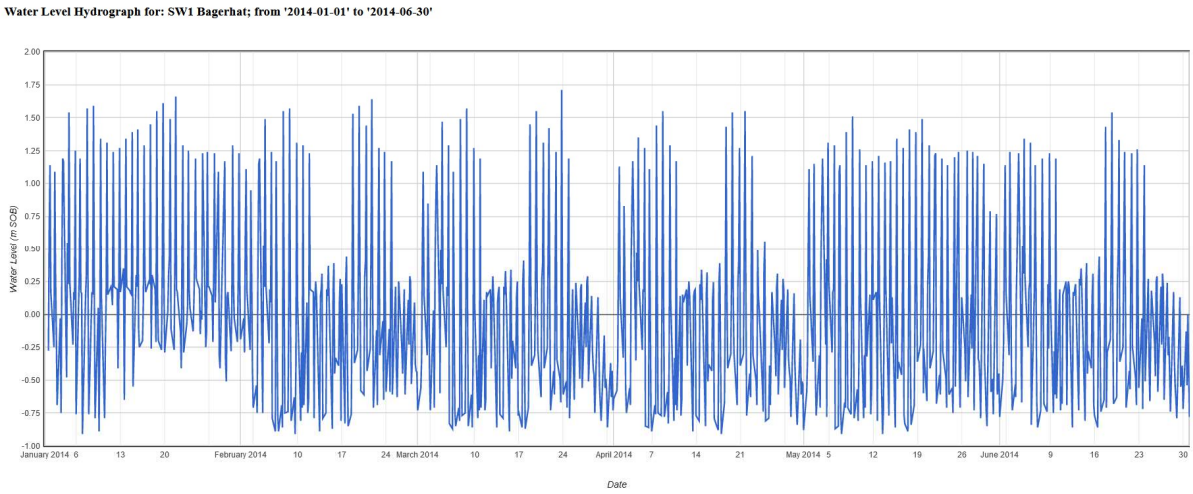
4. The Slide Bar does not allow the Start Date to be greater than the End Date, or the End date to be less than the Start Date.

Output Actions

1. Once the Station and the date range is selected, the user can export the hydrograph as a CSV file by clicking the 'Export CSV'-button.

	A	B	C	D	E
1	Station: SW1 Bagerhat; from '2014-01-01' to '2014-06-30'				
2	Date & Time	Water Level (m SOB)			
3	2014-01-01 6:00	-0.27			
4	2014-01-01 9:00	-0.27			
5	2014-01-01 12:00	0.64			
6	2014-01-01 15:00	1.14			
7	2014-01-01 18:00	0.17			
8	2014-01-02 6:00	-0.25			
9	2014-01-02 9:00	1.09			
10	2014-01-02 12:00	0.31			
11	2014-01-02 15:00	-0.17			

2. Alternatively, the user can display the hydrograph by clicking the 'Chart'-button



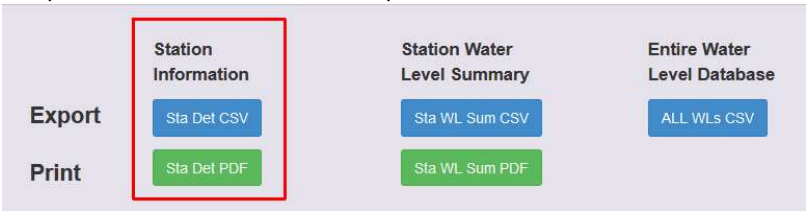
3. The 'Station Info'-button generates and displays a PDF file with summary information related to the selected Water Level Station.

Water Level Database: Station and Water Level Info

Station Code:	SW1
Station Name:	Bagerhat
River ID:	1
River Name:	Alaipur Khal Daratona
Union:	Bagerhat Municipality
Village:	Ward-3
Longitude:	89.81
Latitude:	22.6478
Easting:	480048
Northing:	2505183
WL Records:	14,362
Min. Date:	2006-01-01 06:00:00
Max. Date:	2014-06-30 18:00:00
Years:	8.49
Min.WL(m SOB):	-1.16
Min. WL Date:	2013-09-16 15:00:00
Max.WL(m SOB):	2.52
Max. WL Date:	2011-08-13 15:00:00

E-3 STATION INFORMATION

1. Under the Station Information section there is one 'Export to CSV'-button and one 'Print to PDF'-button. Both options have the same set of report columns.



Export to CSV

	A	B	C	D	E	F	G	H	I	J
1	Station Code	Station Name	River Name	Union	Village	Longitude	Latitude	Easting	Northing	Datum
2	SW1	Bagerhat	Alaipur Khal Daratona	Bagerhat Municipality	Ward-3	89.81	22.6478	480048	2505183	SOB
3	SW10	Simulbari	Bangali	Baiguni	Shimulbari	89.53	25.0243	452007	2765355	SOB
4	SW101	KamarkhaliTransit	Gorai-Madhumati-Haringhata-Baleswar	Kamarkhali	Gondhakhali	89.54	23.5315	453417	2602520	SOB
5	SW101.5	Kamarkhali (Gondhakhali)	Gorai-Madhumati-Haringhata-Baleswar	Dumain	Vellakandi	89.53	23.527	449697	2601779	SOB
6	SW102	Bhatiapara	Gorai-Madhumati-Haringhata-Baleswar	Bhatiapara	Bhatiapara	89.7	23.2141	469200	2566749	SOB
7	SW105	Off take at Atharobanka	Gorai-Madhumati-Haringhata-Baleswar	Jainkhola	Singati	89.79	22.9817	477106	2539845	SOB
8	SW107	Pirojpur	Gorai-Madhumati-Haringhata-Baleswar	Pirojpur Municipality	Pirojpur Municipality	89.97	22.5816	496256	2497020	SOB
9	SW107.2	Rayenda	Gorai-Madhumati-Haringhata-Baleswar	Khontakanda	Rayenda	89.86	22.3134	484755	2466110	SOB
10	SW109	Bibirbazar	Gumti-Burinadi	Joganathpur	Arannapur	91.25	23.4633	0	0	SOB
11	SW11	Khanpur	Bangali	Kallani	Binodpur	89.48	24.6197	363792	2852263	SOB
12	SW11.5	Nalkasengati	Bangali			89.6	24.4236	363792	2852263	SOB
13	SW110	Comilla	Gumti-Burinadi	Comilla Municipality	Sangraish	91.2	23.4704	0	0	SOB
14	SW113	Kangsanagar	Gumti-Burinadi	Barallah	Kangsanagar	91.07	23.5552	0	0	SOB
15	SW114	Jibanpur_Gumti	Gumti-Burinadi	Dabidwar	Bingla Bari	90.99	23.6313	0	0	SOB

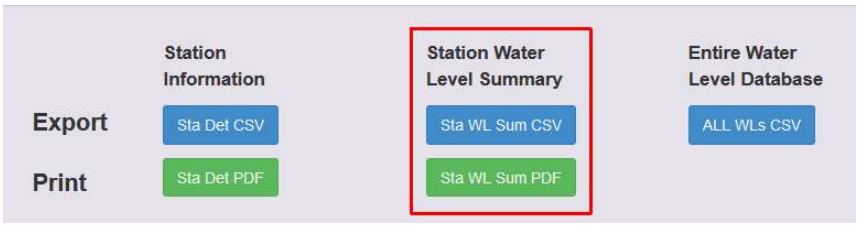
Print to PDF

All Station Information Summary

Sta.Cd.	Station Name	River Name	Union	Village	Longitude	Latitude	Easting	Northing	Datum
SW1	Bagerhat	Alaipur Khal Daratona	Bagerhat Municipality	Ward-3	89.81	22.6478	480048	2505183	SOB
SW10	Simulbari	Bangali	Baiguni	Shimulbari	89.53	25.0243	452007	2765355	SOB
SW101	KamarkhaliTransit	Gorai-Madhumati-Haringhata-Baleswar	Kamarkhali	Gondhakhali	89.54	23.5315	453417	2602520	SOB
SW101.5	Kamarkhali (Gondhakhali)	Gorai-Madhumati-Haringhata-Baleswar	Dumain	Vellakandi	89.53	23.527	449697	2601779	SOB
SW102	Bhatiapara	Gorai-Madhumati-Haringhata-Baleswar	Bhatiapara	Bhatiapara	89.7	23.2141	469200	2566749	SOB
SW105	Off take at Atharobanka	Gorai-Madhumati-Haringhata-Baleswar	Jainkhola	Singati	89.79	22.9817	477106	2539845	SOB
SW107	Pirojpur	Gorai-Madhumati-Haringhata-Baleswar	Pirojpur Municipality	Pirojpur Municipality	89.97	22.5816	496256	2497020	SOB
SW107.2	Rayenda	Gorai-Madhumati-Haringhata-Baleswar	Khontakanda	Rayenda	89.86	22.3134	484755	2466110	SOB
SW109	Bibirbazar	Gumti-Burinadi	Joganathpur	Arannapur	91.25	23.4633	0	0	SOB
SW11	Khanpur	Bangali	Kallani	Binodpur	89.48	24.6197	363792	2852263	SOB
SW11.5	Nalkasengati	Bangali			89.6	24.4236	363792	2852263	SOB
SW110	Comilla	Gumti-Burinadi	Comilla Municipality	Sangraish	91.2	23.4704	0	0	SOB
SW113	Kangsanagar	Gumti-Burinadi	Barallah	Kangsanagar	91.07	23.5552	0	0	SOB
SW114	Jibanpur_Gumti	Gumti-Burinadi	Dabidwar	Bingla Bari	90.99	23.6313	0	0	SOB

E-4 STATION WATER LEVEL SUMMARY

1. Under the Station Water Level Summary section there is one 'Export to CSV'-button and one 'Print to PDF'-button. Both options have the same set of report columns.



Export to CSV

	A	B	C	D	E	F	G	H	I
1	Station Code	Station Name	River Name	Latitude	Longitude	First Date	Last Date	Min WL (m SOB)	Max WL (m SOB)
2	SW1	Bagerhat	Alaipur Khal Daratona	22.6478	89.81	2006-01-01	2014-06-30	-1.16	2.52
3	SW10	Simulbari	Bangali	25.0243	89.53	2006-01-01	2014-07-31	11.56	17.42
4	SW101	KamarkhaliTransit	Gorai-Madhumati-Haringhata-Baleswar	23.5315	89.54	2006-01-01	2014-07-31	0.03	7.68
5	SW101.5	Kamarkhali (Gondhakhali)	Gorai-Madhumati-Haringhata-Baleswar	23.527	89.53	2006-01-01	2014-07-31	-0.08	7.51
6	SW102	Bhatiapara	Gorai-Madhumati-Haringhata-Baleswar	23.2141	89.7	2006-01-01	2014-07-31	-0.3	4.42
7	SW105	Off take at Atharobanka	Gorai-Madhumati-Haringhata-Baleswar	22.9817	89.79	2006-01-01	2014-07-31	-0.85	2.08
8	SW107	Pirojpur	Gorai-Madhumati-Haringhata-Baleswar	22.5816	89.97	2006-01-01	2013-06-30	-1.07	1.97
9	SW107.2	Rayenda	Gorai-Madhumati-Haringhata-Baleswar	22.3134	89.86	2006-08-01	2014-07-31	-1.44	2.88
10	SW109	Bibirbazar	Gumti-Burinadi	23.4633	91.25	2006-01-01	2014-05-31	6.07	13.79
11	SW11	Khanpur	Bangali	24.6197	89.48	2006-01-01	2014-07-31	5.24	13.26
12	SW11.5	Nalkasengati	Bangali	24.4236	89.6	2006-01-01	2014-07-31	5.87	11.91

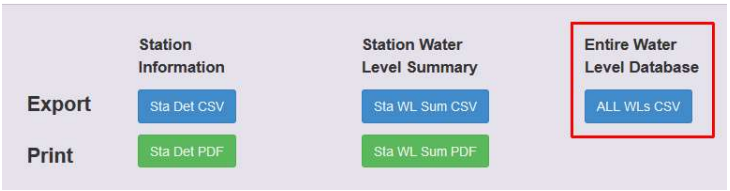
Print to PDF

All Station Water Level Summary

Station Code	Station Name	River Name	Latitude	Longitude	First Date	Last Date	Min WL (m SOB)	Max WL (m SOB)
SW1	Bagerhat	Alaipur Khal Daratona	22.6478	89.81	2006-01-01	2014-06-30	-1.16	2.52
SW10	Simulbari	Bangali	25.0243	89.53	2006-01-01	2014-07-31	11.56	17.42
SW101	KamarkhaliTransit	Gorai-Madhumati-Haringhata-Baleswar	23.5315	89.54	2006-01-01	2014-07-31	0.03	7.68
SW101.5	Kamarkhali (Gondhakhali)	Gorai-Madhumati-Haringhata-Baleswar	23.527	89.53	2006-01-01	2014-07-31	-0.08	7.51
SW102	Bhatiapara	Gorai-Madhumati-Haringhata-Baleswar	23.2141	89.7	2006-01-01	2014-07-31	-0.30	4.42
SW105	Off take at Atharobanka	Gorai-Madhumati-Haringhata-Baleswar	22.9817	89.79	2006-01-01	2014-07-31	-0.85	2.08
SW107	Pirojpur	Gorai-Madhumati-Haringhata-Baleswar	22.5816	89.97	2006-01-01	2013-06-30	-1.07	1.97
SW107.2	Rayenda	Gorai-Madhumati-Haringhata-Baleswar	22.3134	89.86	2006-08-01	2014-07-31	-1.44	2.88
SW109	Bibirbazar	Gumti-Burinadi	23.4633	91.25	2006-01-01	2014-05-31	6.07	13.79
SW11	Khanpur	Bangali	24.6197	89.48	2006-01-01	2014-07-31	5.24	13.26
SW11.5	Nalkasengati	Bangali	24.4236	89.6	2006-01-01	2014-07-31	5.87	11.91
SW110	Comilla	Gumti-Burinadi	23.4704	91.2	2006-01-01	2014-05-31	5.19	12.11

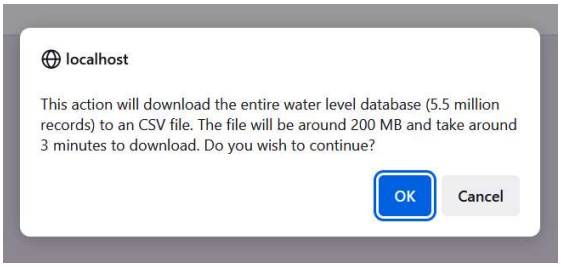
E-5 Entire Water Level Database

1. Under the Entire Water Level Database section there is one 'Export to CSV'-button.

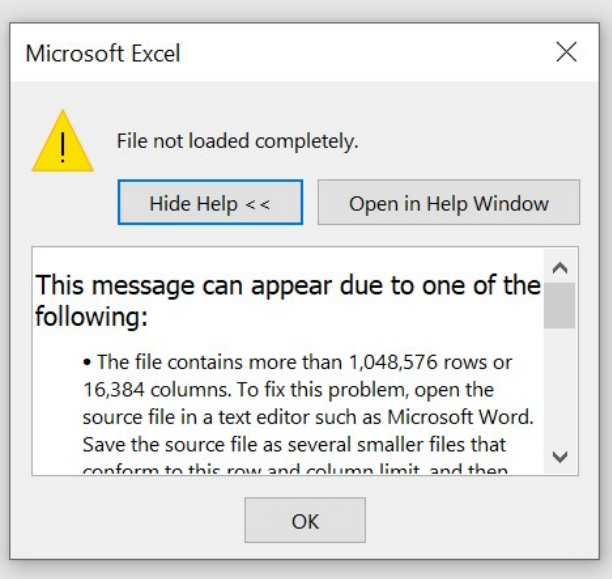


Export to CSV

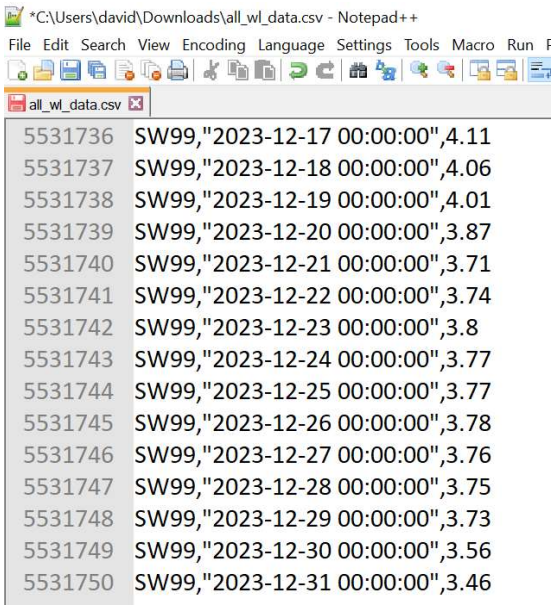
2. This CSV-file will contain all Water Levels in the entire database: currently with over 5.5 million records. A confirmation message explains the number of records, the size of the file and the approximate time required to download the file.



3. MS Excel is only able to display just over 1 million records, so the output file will need to be opened in Notepad++ or some other text editor.



4. The image below shows the CSV-file open in Notepad++. There are 3 columns in the file: Station Code, Date-Time, and Water Level (m).



FRERMIP Spatial MIS Database

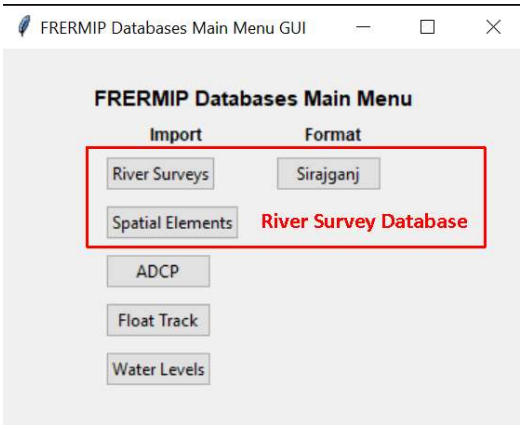
Appendix-F: Survey Import Interface

Contents

F-1 MAIN MENU

1. The FRERMIP Databases Main Menu GUI is used to import records into the various databases developed in FRERMIP. This set of databases include: River Survey, Water Level, ADCP (velocity & discharge), and Float Track. The River Survey database is the primary database and is composed of Surveys that contain the source Point and Contour data, and Spatial Elements used to analyze the Contours.

2. Currently, the main source of bathymetric data, besides those from FRERMIP, come from the Sirajganj O&M Division. The data from Sirajganj is in a different format from the one used to import surveys into the River Survey database. A special program has been written to reformat the Sirajganj surveys data into a form that is compatible with our FRERMIP surveys.

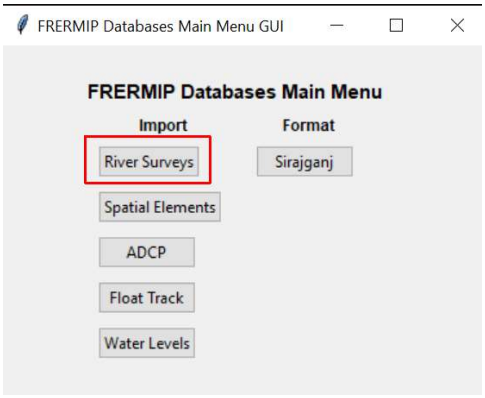


3. When the user selects any of the buttons on the Main Menu, a secondary Menu will open with one or more Tabs that must be processed in sequential order.

4. This User Manual will describe the required format of the input data, and the purpose and functionality of each Tab action.

F-2 RIVER SURVEY IMPORT MENU

1. The River Survey Import Menu is used to import the raw bathymetric survey data that are basically Point txt files with x, y & z coordinates.



Input Format

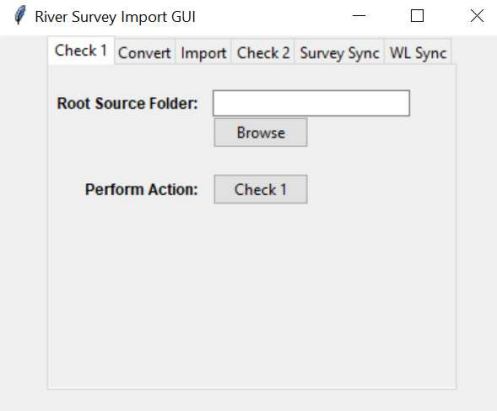
1. Many survey files can be processed at one time. The input files must have a '.txt'-extension. All input files must be in a TXT-sub-folder from a root folder. The root folder is used for Error file and Message file.

2. The input file name contains 3 pieces of information separated by an underscore character (_): survey date, title and project id. The date must use the format 'yyyy-mm-dd', and the last characters of the file name contain the project id (e.g. 2022-08-21_Cross Bar3_043.txt).

3. The input file must have 3 columns: x and y in BTM coordinates (EPSG:9678), and z (elevation) data using SOB datum. The columns are separated by a tab delimiter (Chr9), and there are no column headers.

Check 1

1. To run the Check1 program, the user must first define the root source folder. The root source folder is required in all 6 Tab actions, and the value entered here is carried forward to all the other Tabs, so the user need not re-enter the same value more than once. The same process is used for other parameters that are repeated in several Tabs.



2. The Check 1 program is used to check for errors in both the input file names and the file contents.

3. The input files must be contained in a TXT-subfolder. The input file names cannot include apostrophes or commas. A warning is included in the error-log.txt file that these characters will be stripped from the file name. A check is done to ensure that the first 10 characters of the file name contain a valid date, and that the last 3 characters of the file name that contain the project id are numeric.

4. The input file contents are checked to ensure that there are 3 columns (x, y & z-coordinates), and that all 3 columns contain valid float (real) numeric values.

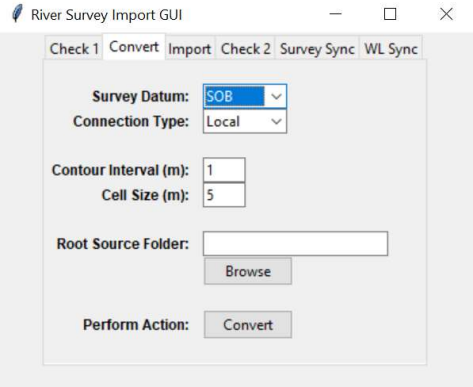
5. If errors (or warnings) are identified in any of the files, an error-log.txt file is created that indicates details on what and where the error occurred. A summary file is also generated, that shows the number of errors that were found, and also the minimum and maximum x, y & z values in each input file. These values may be useful if values outside the normal range are identified.

Convert

1. The Convert program require a number of parameters including the Survey Datum, Connection Type, the Contour Interval, Cell Size and Root Source Folder.

2. The Survey Datum and Connection Type are only actually required if older surveys are found that use PWD datum, and PWD to SOB datum conversion values are required from the PostgreSQL database. It is expected that all future surveys will be done using SOB datum, and that no conversion will be necessary.

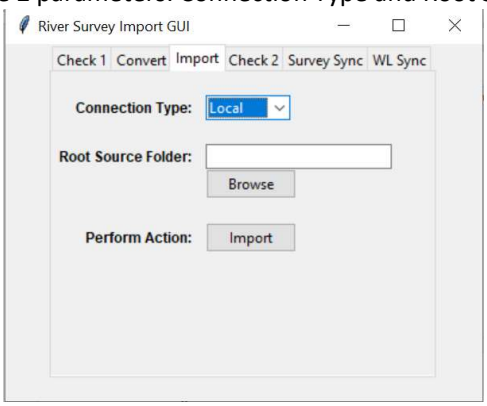
3. The main task performed during the Convert task is to generate Contours from the original Point files in order to analyze the bathymetric data. The normal Contour Interval is 1 m and the normal Contour Cell Size is 5 m. For Multi-beam surveys, the Contour Interval is 0.25 m and the Contour Cell Size is 2.5 m. For Full River surveys, the Contour Interval is 1 m and the Contour Cell Size is 25 m.



4. The Convert program includes up to 7 steps to generate Contours and produce Point and Contour Shapefiles that will be imported into the PostgreSQL Database:
   1. Convert to SOB Datum (only for surveys using PWD datum)
   2. Generate CSV and VRT Files
   3. Generate Point SHP-Files
   4. Interpolate to Generate TIF-Files
   5. Round Elevations in TIF-Files Based on Contour Interval (only for Multi-Beam surveys)
   6. Polygonize to Generate Contour SHP-Files
   7. Generate a Survey List (a CSV file containing the survey file name, contour interval and cell size)

Import

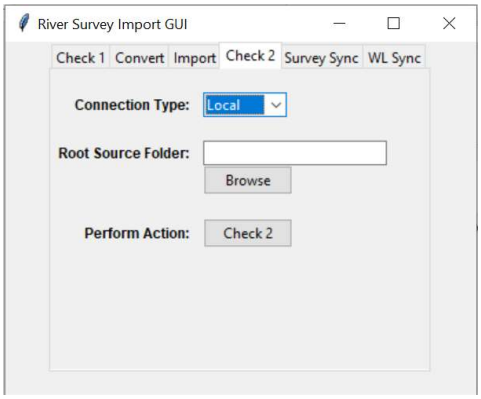
1. The Import program require 2 parameters: Connection Type and Root Source Folder.



2. The Import program copies Point and Contour SHP-Files into PostgreSQL temporary tables, and also copies the Survey List that contains the survey file name, contour interval and cell size into a temporary PostgreSQL table.

Check 2

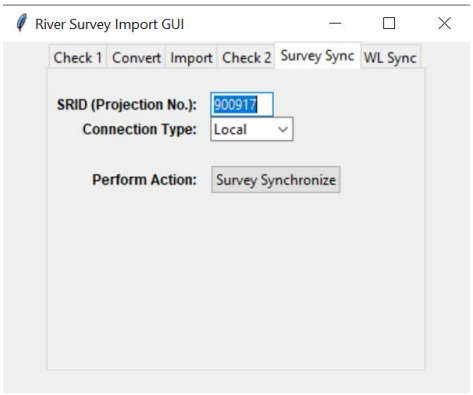
1. The Check program require 2 parameters: Connection Type and Root Source Folder.



2. The Check2 program performs a number of checks prior to the survey synchronization:
    1. No sequence problems in survey table that may lead to duplicate id values
    2. Survey List table exists and contains records
    3. Survey List does not contains duplicate filenames
    4. Checks Survey List contents to ensure:
        - survey file name is not empty
        - project id is defined
        - date, title & project id combination is not already in database survey table
        - temporary Point and Contour tables exist for each new survey
        - Date, Contour Interval and Cell Size have valid values

Survey Synchronization

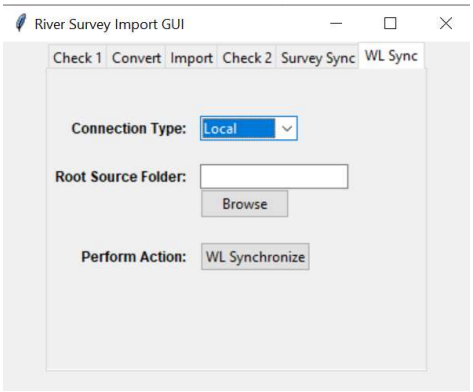
1. The Survey Synchronization program require 2 parameters: SRID and Connection Type. The recently added SRID No. 900917 is used by PostgreSQL to define the EPSG: 9678; Gulshan 303 / Bangladesh Transverse Mercator Projection.



2. The Survey Synchronization program performs a number of actions:
    1. Inserts a permanent record in the survey table for each survey
    2. Modifies the Point and Contour table field names and types, deletes index column (and sequence object), drops index relation, and defines geometric projection (BTM: 900917)
    3. Adds the geometric boundary (outline) to the new survey using the point table and the ST_ConvexHull function
    4. Renames Point and Contour files to match the associated Survey ID

Water Level Synchronization

1. The Water Level Synchronization program requires 2 parameters: Connection Type and Root Source Folder.

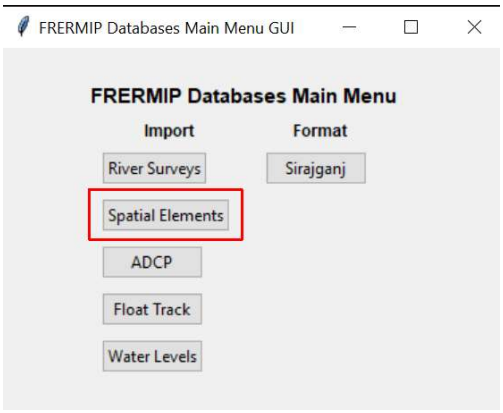


2. The Water Level Synchronization program extracts water levels from the Water Level database for BWDB Stations upstream and downstream of each survey date, and then generates a Survey Water Level using a linear interpolation using the Centroid of the Survey outline and the BWDB Station locations.

3. The Water Level Synchronization program updates Survey Water Levels for all surveys where the water level is currently not yet defined. ***It is not specifically tied to the survey import process, and could be performed at any time when either new surveys are added to the River Survey database, or new water levels are added to the Water Level database.***

F-3 SPATIAL ELEMENTS IMPORT MENU

1. Spatial Elements are used to analyze bathymetric surveys. At least one full set of Spatial Elements exist for each of the 45 Projects currently in the River Survey database. There are 4 types of Spatial Elements: Points, Cross-Sections, Longitudinal-Sections, and Areas. The Spatial Elements are generated by digitizing and saving them as Shapefiles in QGIS (refer to Appendix-H Section H-11).



Input Format

1. Each new Project Folder contains one or more Spatial Elements defined as Shapefiles. One or more Projects can be imported at a time, each with its own separate Project folder in the root folder.

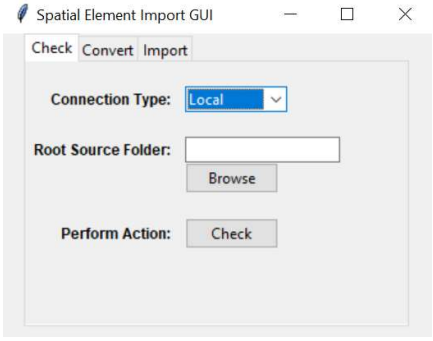
2. The root folder is also used for an Error file and a Message file.

3. The first 3 characters of each project folder name must contain the Project id. The Project folder typically contains 3 Shapefiles: Points, LineStrs, and Polygons. When the project has many cross-sections (typically more than 30), multiple LineStrs files may also exist (LineStrs_01, LineStrs_02, etc.).

4. Cross-Sections and Long-Sections are defined as LineStrings and stored in LineStrs.shp. Boundaries are defined as Polygons and stored in Polygons.shp. Points are defined as Points and stored in Points.shp. Points.shp also contain Labels for all Cross-Sections, Long-Sections and Areas. These Labels are also used to identify the start point for Cross-sections and Long-Sections. Additional details regarding these Shapefiles is documented in Appendix-H, Section H-11.

Check

1. The Check program uses 2 parameters: the connection type and the root source folder. These 2 parameters are required in all 3 Tab actions, and the values entered here is carried forward to all the other Tabs, so the user need not re-enter the same values more than once. The same process is used for the SRID parameter which is repeated in 2 different Tabs.

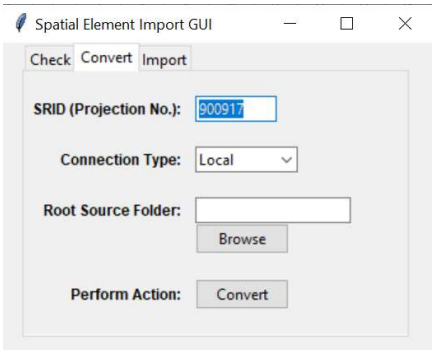


2. The River Survey Check1 program was able to perform all its checks without uploading any data to the PostgreSQL database. However, this check program needed to upload the Shapefiles to a temporary import schema (folder) in order to use PostGIS functions to complete all its necessary checks. These temporary PostgreSQL tables still have the same structure as the original Shapefiles.

3. The Check program is used to check for errors in both the project folder names and the folder file contents. A total of 9 checks are included in the program:
   1. Points table has a column named labels
   2. Labels actually exist in the Point table
   3. Points table labels start with characters: A, C, L or P
   4. Duplicate Point geometries do not exist
   5. Area labels are 'snapped' to a vertex on the polygon (outer ring)
   6. Duplicate Polygon geometries do not exist
   7. Cross-Section and Long-Section labels are 'snapped' to a LineString start or end point
   8. Cross-sections have only 2 points (1 segment)
   9. Cross-Sections and Long-Sections do not ‘contain’ extra LineStrings (2 or more LineStrings do not exist on top of each other)

Convert

1. The Convert program uses 3 parameters: SRID, the connection type and the root source folder. The SRID No. 900917 is used by PostgreSQL to define the EPSG: 9678; Gulshan 303 / Bangladesh Transverse Mercator Projection.

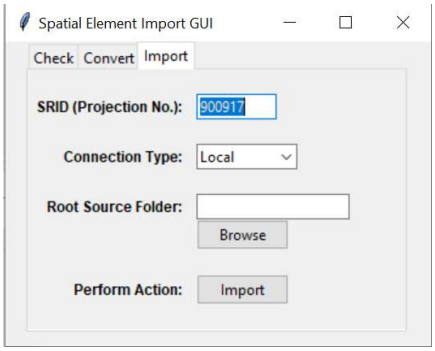


2. The Convert program uses the temporary PostgreSQL tables generated in the Check program with the same structure as the original Shapefiles, and converts them into temporary tables that have the identical structure as the permanent Spatial Element PostgreSQL tables.

3. There are 4 permanent Spatial Element tables: line_set (Cross-Sections), long_set (Longitudinal-Sections), boundary (Areas), and point_set (Points). The ine_set table contains MultiLineString geometry and the point_set table contains MultiPoint geometry, while the long_set table contains LineString geometry, and the boundary table contains a Polygon geometry. The labels column in the line_set and point_set tables are defined as arrays that contain labels for all MultiLineStrings and MultiPoints.

Import

1. The Import program uses 3 parameters: SRID, the connection type and the root source folder.

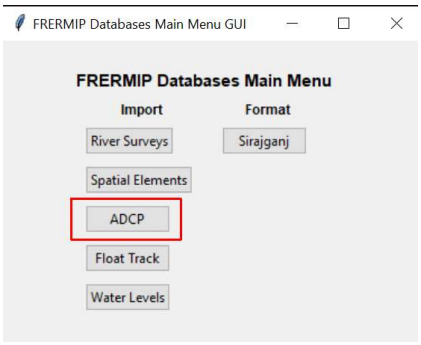


2. The import program simply copies (inserts) records from the 4 temporary tables in the imports-schema created during in the Convert program to the permanent tables in the public-schema. After copying, the temporary tables are emptied (truncated) but not deleted (dropped).

F-4 ADCP IMPORT MENU

1. The ADCP Database is used to store raw output data from the Acoustic Doppler Current Profiler (ADCP) software WinRiver II developed by the Teledyne RD Instruments company.

2. The ADCP Database is also used to store and display summary discharge data for each transect surveys. There are currently 51 transect locations and 240 surveys in the ADCP database.



Input Format

1. The Import program can handle 3 types of ADCP data: Transects (Survey Locations), Surveys (dates, discharges, and water levels), and raw output data from WinRiver II. New Transects are defined in a 'transect.csv'-file, new surveys are defined in a 'survey.csv'-file, and the raw output files are defined as ZIP-files in a subfolder called 'ZIP'.

2. The root folder is also used for an Error file and a Message file.

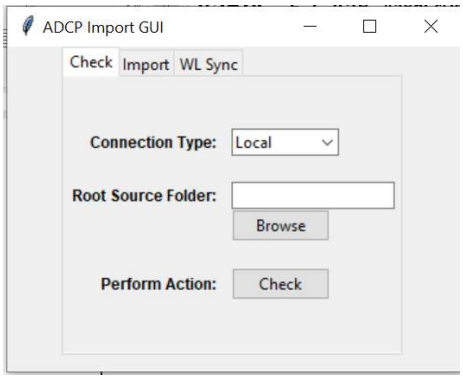
3. The 'transect.csv'-file includes a header row, and has 6 columns:
   - id unique transect identifier; integer
   - title transect name; text
   - sta_wl_us BWDB Water Level Station upstream of transect; text
   - sta_wl_ds BWDB Water Level Station downstream of transect; text
   - links transect names identified in previous documentation (field not required); text
   - geom_str LineString with start and end point of one segment transect in WKT-format; text
4. In the permanent transect table the 'geom_str'-string is converted into LINESTRING geometry with an SRID projection no. equal to 900917.

5. The 'survey.csv'-file includes a header row, and has 4 columns:
   - t_id transect identifier; integer
   - links transect name identified in previous documentation (field not required)
   - dt date survey conducted; date
   - discharge survey discharge (m3/s); real

6. The ZIP files contain all WinRiver II files associated with a particular ADCP survey. The name of the zip file starts with a 'z'-character and then a 6 digit number that defines the unique survey identifier. The zip file is stored in the PostgreSQL database as a separate table with a single binary bytea-column that contains the contents of the zip-file.

Check

1. The Check program uses 2 parameters: the connection type and the root source folder. These 2 parameters are required in all 3 Tab actions, and the values entered here is carried forward to all the other Tabs, so the user need not re-enter the same values more than once.



2. There are 3 sets of checks, one for each type of import data: Transect, Survey and Raw Output Data.

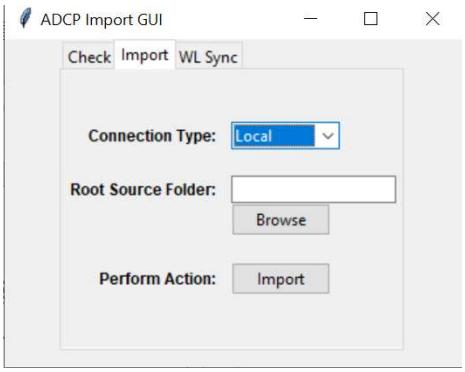
3. The 'transect.csv' checks include the following:
    1. Transect ID in the CSV file is greater than the maximum existing ID in the existing Transect table
    2. Transect title is not empty
    3. Transect geom_str field is a string that starts with 'LineString(' and ends with ')'

4. The 'survey.csv' checks include the following:
    1. Survey Date field has a valid date format
    2. Survey Discharge is a valid float value
    3. Survey 't_id'-field (transect id) value exists in the 'transect.csv'-file or in the transect-table
    4. Survey data (combination of transect id, date and discharge) is not already in survey table

5. The raw output data checks include the following:
    1. The zip file name includes a survey id value that exists in the survey-table
    2. The zip file base name (without its extension) does not already exist as a table in the database

Import

1. The Import program uses 2 parameters: the connection type and the root source folder.

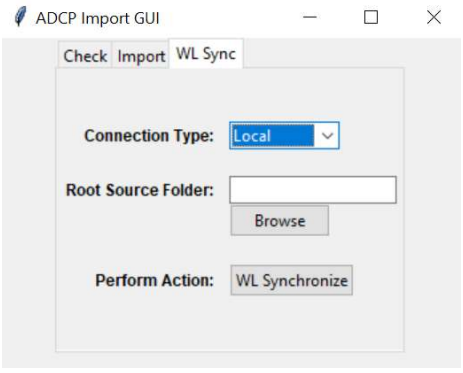


2. The Import program checks whether transect.csv, survey.csv, or whether zip-files exist in a ZIP subfolder and then imports the appropriate ADCP input into the PostgreSQL database.

Water Level Synchronization

1. The Water Level Synchronization program uses 2 parameters: the connection type and the root source folder.

2. This program is actually independent from the import of ADCP data, and could be run anytime either from here in the ADCP interface (GUI), or the Water Level interface. Typically it is done after transect surveys are added to the ADCP database, or when new water levels have been added to the Water Level database.

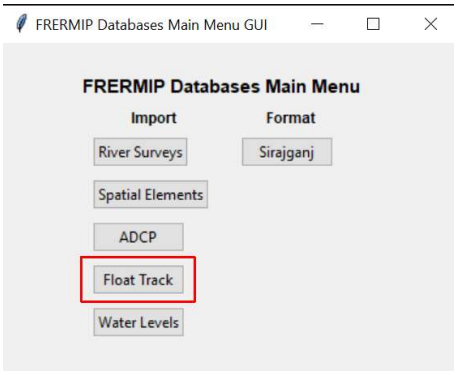


3. The Water Level Synchronization program extracts water levels from the Water Level database for BWDB Stations upstream and downstream of each ADCP transect survey for the survey date, and then generates a Survey Water Level using a linear interpolation using the midpoint of the Transect LineString and the BWDB Station locations.

F-5 FLOAT TRACK IMPORT MENU

4. The Float Track database stores processed float track survey data. The data is stored in 3 tables: survey, segment and pt-vel (point velocities) in the PostgreSQL database.

5. The survey table includes a unique identifier, and a title. The segment table includes the survey identifier, the segment identifier, and the survey segment date. The pt_vel table includes the survey identifier, segment identifier, geometry point location (using a SRID projection no. 900917), and velocity value in m/s.



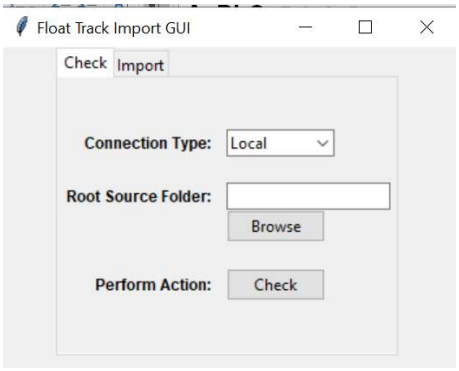
Input Format

1. All float track survey data is included in a single csv-file, contained in a CSV-subfolder. The name of each csv-file will start with a unique 3 digit survey id, and underscore (_) character and then the survey title.

2. The contents of the csv-file will include a header row and 5 columns:
   - seg_id segment id (typically numbered from u/s to d/s, and from left bank to right bank)
   - dt survey segment date
   - x x-coordinate of velocity point
   - y y-coordinate of velocity point
   - vel velocity at point (m/s)

Check

1. The Check program uses 2 parameters: the connection type and the root source folder. These 2 parameters are required in both Tab actions, and the values entered here is carried forward to the other Tab, so the user need not re-enter the same values more than once.



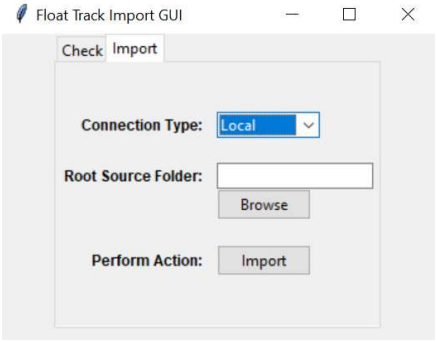
2. From the Float Track Survey CSV file name, the survey identifier and the title can be extracted and checked. Then the contents of the CSV file can be checked to ensure that they are the correct format for import into the PostgreSQL Database.

3. The specific checks performed by the Check program are shown below:
   - Survey identifier is a valid integer
   - Survey identifier is greater than the current maximum table survey.id value
   - Survey title is not empty
   - Segment identifier is a valid integer
   - Date values have a valid date format
   - X-coordinate is a valid real number
   - Y-coordinate is a valid real number
   - Velocity value is a valid real number

4. The Check program also checks that there are 5 columns in the csv-file and none of the columns are empty.

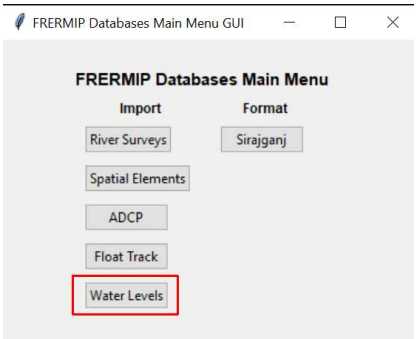
Import

The Import program uploads the source CSV-file to a temporary file in the imports-schema, and then converts the data into a format that is compatible with the permanent table structure, and inserts data into the 3 permanent tables: survey, segment, and pt_vel. After completion of the import process the temporary table in the imports-schema is emptied (truncated), but not deleted (dropped).



F-6 WATER LEVEL IMPORT MENU

1. Over the years, FRERMIP has been able to obtain a relatively large amount of Water Level data that has been stored in a database for use by our River Engineering Specialists. Recently, this database has also been used to calculate the water levels for bathymetric surveys in the River Survey database, and also water levels for ADCP transect surveys. The method used to estimate water levels is documented in Appendix-I, Section I-3.



Input Format

1. Water Level input data must be in a CSV-subfolder of the root folder.

2. The root folder is also used for an Error file and a Message file.

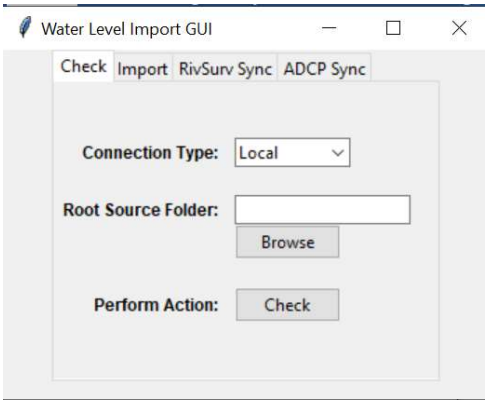
3. The name of the CSV-files identifies the BWDB Station that the new water level data is from (SW49A.csv). The CSV-files have 2 columns: date-time, and elevation in SOB m. The date-time column can also accept just date values. The CSV-file does not include a header.

4. As of the start of 2024, all data received from BWDB is provided using the SOB datum in metres. All data in the FRERMIP Water Level database also uses the SOB datum in metres.

5. If data is received from another source that uses the previous PWD datum in metres, a list of BWDB Stations with the conversion values from PWD to SOB datum is available in a spreadsheet obtained from BWDB: SOB_02012024.xlsx. Using the PWD to SOB conversion value, all PWD data must be converted to SOB prior to importing the data into the Water Level database.

Check

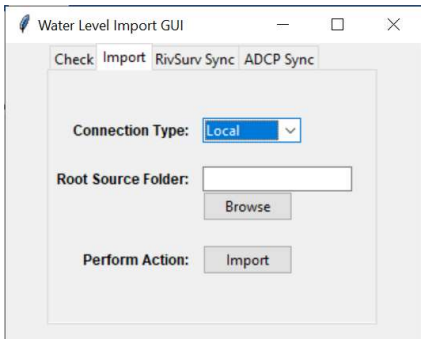
1. The Check program uses 2 parameters: the connection type and the root source folder. These 2 parameters are required in all 4 Tab actions, and the values entered here is carried forward to all the other Tabs, so the user need not re-enter the same values more than once.



2. The Check program performs the following checks:
   1. source CSV-file has 2 columns
   2. date-time is either a valid date (e.g. 2015-12-31) or date-time (e.g. 2015-12-31 06:00:00)
   3. date-time is greater than the max database date or less than the minimum database date
   4. water level value is a valid float number

Import

1. The Import program first checks whether the station water level has already been imported into the database. If the station water level has not been imported, it is inserted into the database.

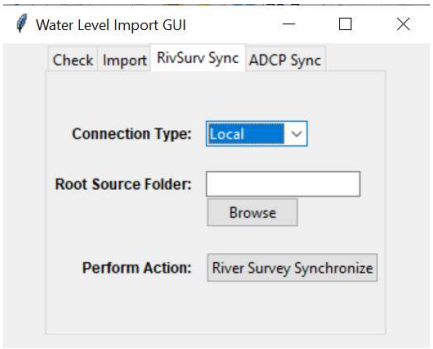


River Survey Synchronization

1. As mentioned previously, the water level database is used to calculate and insert water levels for bathymetric surveys in the River Survey database survey-table.

2. This program is actually independent from the import of Water Levels, and could be run anytime either from here in the Water Level interface (GUI), or the River Survey interface. Typically it is done after new water levels have been added to the database, or when new bathymetric surveys are added to the River Survey database.

3. New water levels will only be added to the River Survey database if water levels exist for both the BWDB Station upstream and downstream on the survey date.

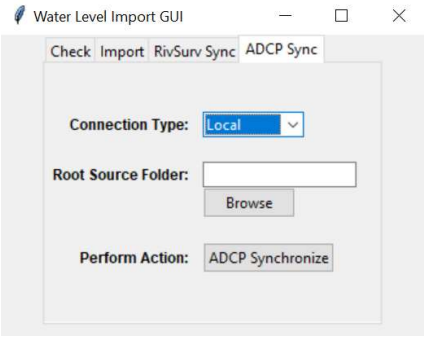


ADCP Synchronization

1. As mentioned previously, the water level database is used to calculate and insert water levels for ADCP surveys.

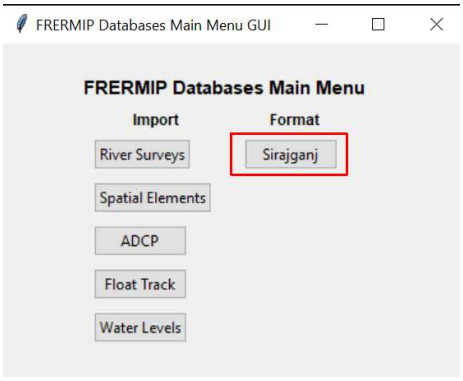
2. This program is actually independent from the import of Water Levels, and could be run anytime either from here in the Water Level interface (GUI), or the ADCP interface. Typically it is done after new water levels have been added to the database, or when new transect surveys are added to the ADCP database.

3. New water levels will only be added to the ADCP database if water levels exist for both the BWDB Station upstream and downstream of the transect on the survey date.



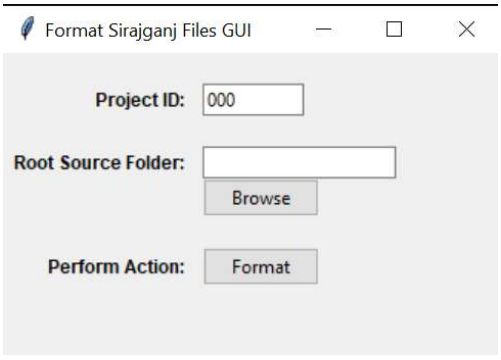
F-7 SIRAJGANJ FORMAT MENU

1. The bathymetric data from Sirajganj is in a different format than the one used to import surveys into the River Survey database. A special program has been written to reformat the data from the Sirajganj surveys into a form that is compatible with our FRERMIP surveys.



Format

1. The Format program uses 2 parameters: the project identifier and the root source folder. The root source folder must have an INPUT and OUTPUT subfolder. All input files must be included in the INPUT-subfolder, and the reformatted files are generated in the OUTPUT-subfolder. The INPUT-subfolder can contain multiple files, but only files from a single Project (e.g. 016 Sirajganj Hard Point) can be converted at one time.



2. The Sirajganj files have names that include the date and then the survey title, but the date is in format ‘dd-mm-yyyy’ and the date is separated from the title by a hyphen (-). The file has a csv-extension.

3. The FRERMIP River Survey requires the file name to include date, title and project id. The date must use the format ‘yyyy-mm-dd’, and the project id is the last 3 characters of the file name. The 3 columns are delimited using an underscore (_) character. The file has a txt-extension.

4. The contents of the Sirajganj files have 5 columns: id, y, x, z, description, delimited by commas (,) and with no header. The FRERMIP River Survey requires the contents of the input file to have 3 columns: x, y and z, delimited by the tab-character, and with no header.

5. In addition to converting the INPUT files from the original Sirajganj format into the OUTPUT files in the required FRERMIP River Survey format, the program also generates a summary file located in the root directory that contains the maximum and minimum x, y and z values from each input file. If the INPUT file contains any outlier coordinates, this summary file should highlight these values.

FRERMIP Flood and Riverbank Erosion Risk Management Investment Program

FRERMIP Spatial MIS Database

Appendix G: Working with PgAdmin4

Contents

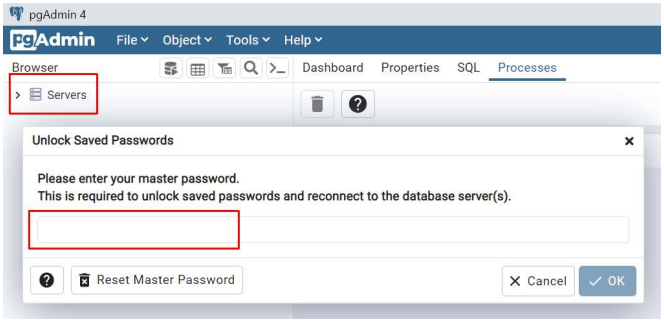
G-1 INTRODUCTION

1. PgAdmin4 is a popular and feature rich open-source administration and development platform for PostgreSQL. PgAdmin4 is available on Linux, Unix, macOS and Windows to manage PostgreSQL databases.

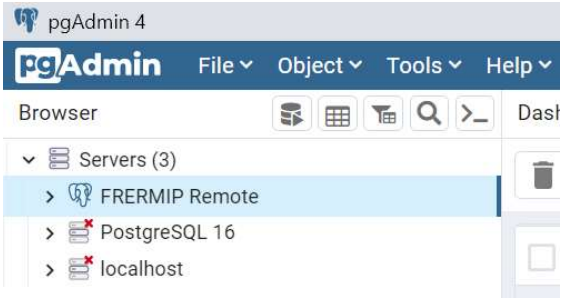
2. Administrators simply select any database item from the vertical menu and either double click the item to get sub-items, or right click the mouse to display functions available for that item. The Query Tool can also be used to write and run SQL scripts to perform all types of database functions.

G-2 ACCESSING SERVERS AND DATABASES

1. To start, the Administrator must enter their master password to connect to the database server(s). After entering their password, the Administrator should double click on the Servers-icon to access their available Servers.

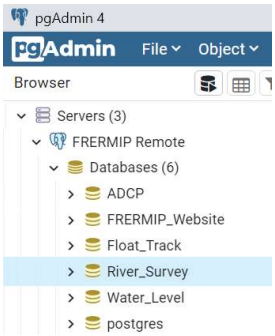


2. The FRERMIP Remote Server connects to databases on the BWDB Server. The localhost Server is on the Administrator's own computer. The localhost Server is used as a test machine when developing new databases or new interfaces used to import and analyze database data. The PostgreSQL 16 Server refers to the version of PostgreSQL installed on the Administrator's local machine, and is 'tied' to the localhost Server.



3. Double click on the 'FRERMIP Remote'-icon and a list of all databases will be displayed that include the: ADCP, Float_Track, River_Survey and Water_Level databases.

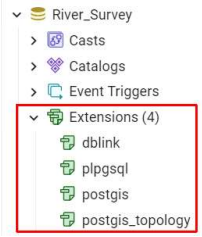
4. The list of databases also include the FRERMIP_Website database which runs the previous version of the FRERMIP Website which has recently been converted to Oracle and already resides on the BWDB Server. The postgres database is added by PostgreSQL and its purpose is unknown.



G-3 DATABASE EXTENSIONS AND SCHEMAS

Extensions

1. Normally there is only one (plpgsql) extension associated with a database. However, if the database includes Spatial data (e.g. Points, LineStrings, Polygons) then 2 additional extensions are required: postgis and postgis_topology. The dblink extension is only required if data is to be transferred from another database. The River_Survey and ADCP databases both need to access the Water_Level database to add survey water levels.



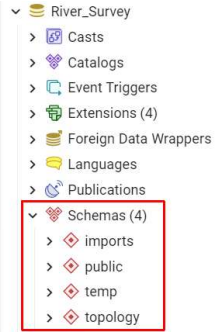
Schemas

1. Schemas are the equivalent of file folders. They contain tables that all have a specific purpose. Typically all database tables are contained in the single default 'public'-schema.

2. When considered necessary, the FRERMIP databases contain 2 additional schemas:

- imports interim tables required to import data into permanent tables in the public schema
- temp tables that are extracted from the public schema for import into QGIS

3. The function of the topology schema has something to do with spatial data.

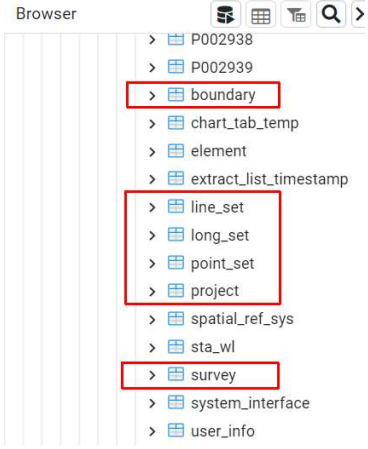


G-4 DATABASE TABLES

1. Database tables can be accessed by double clicking the public schema icon and then the Tables icon. In the River_Survey database there are 5,360 tables: primarily Point and Contour tables for the 2,672 surveys in the database. The Spatial Elements tables used to analyze Survey Contours area located at the bottom of the Tables list.

Tables in Public Schema

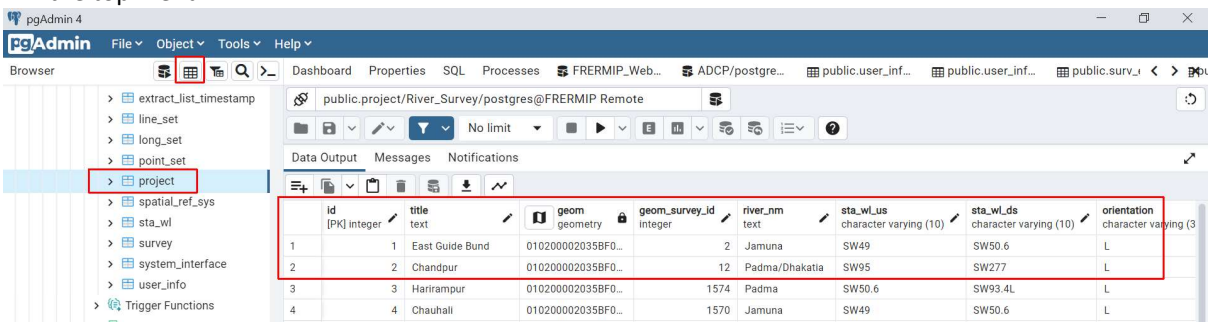
Spatial Element Tables



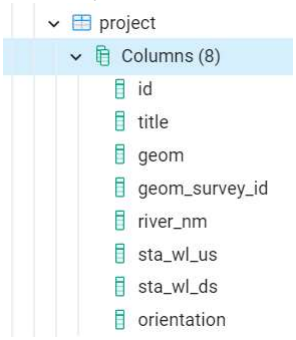
2. To access the contents of the Table, first select the table and then click the 'View Data'-icon and the table contents are shown in the 'Data Output'-window. ***Unless a primary key column has been defined for the table, the Administrator will only be able to view data but will not be able to edit the data.***

3. If a primary key has been defined, the Administrator can edit, delete and insert data from the 'Data Output'-window. To edit the contents, double click the required cell and enter the new value. To delete a record, select the row by double clicking on the left side column and then click on the 'trash can'-icon on the top of the window. To add a new record, click on the '+'-icon on the top left side of the screen. ***No changes to the table will be permanent until the Administrator clicks the 'Save Data Changes'-icon (just right of the 'trash can'-icon).***

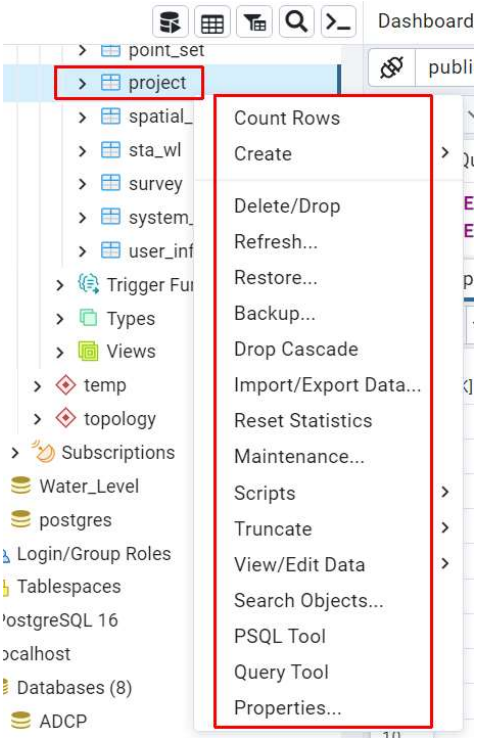
4. The table contents can be exported to a csv file by click the 'download'-icon on the right side of the top menu.



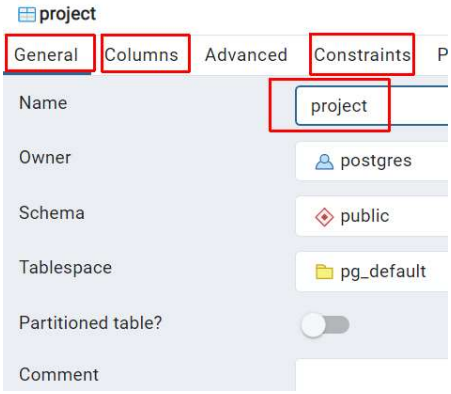
5. To get a list of columns, double click the specific table name-icon and then the Columns-icon.



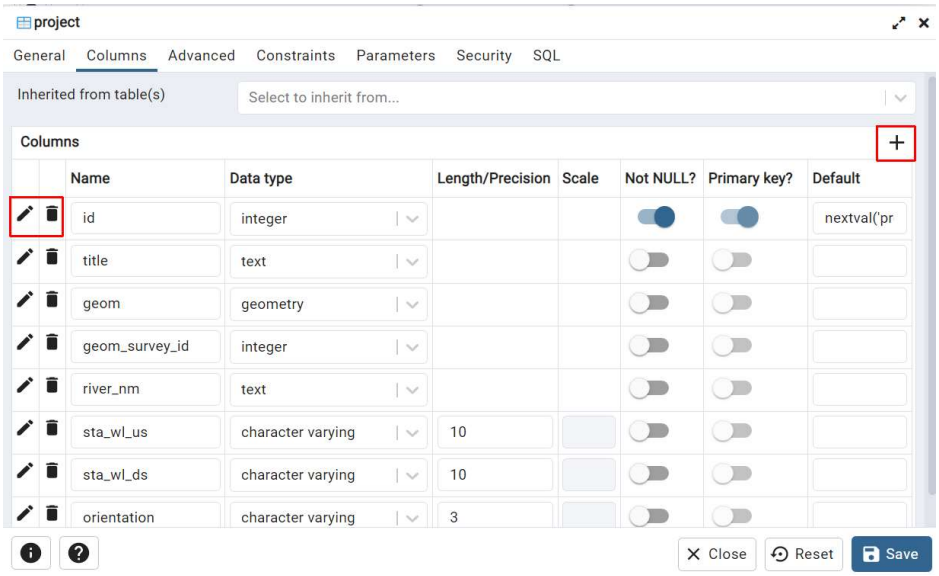
6. Alternatively, select the specific table name, then right click the mouse to get a list of all available actions for the table. Common actions include: Count Rows, Refresh, Restore, Backup, Drop Cascade, Truncate, and Properties.



7. To access the Table Properties, select the Properties from the Action List and a new window is displayed. The most useful tabs are the General, Columns and Constraints. The General-tab is used to change the table name.



8. The Columns-tab is used to add, delete and edit columns. To edit the columns, just enter data into the appropriate cell, or click on the edit icon on the left side of the window. To delete a column, click on the 'trash can'-icon on the left of the screen. To add a new column, click on the '+'-icon on the top right side of the screen. The Administrator can also set the primary-key from this screen.

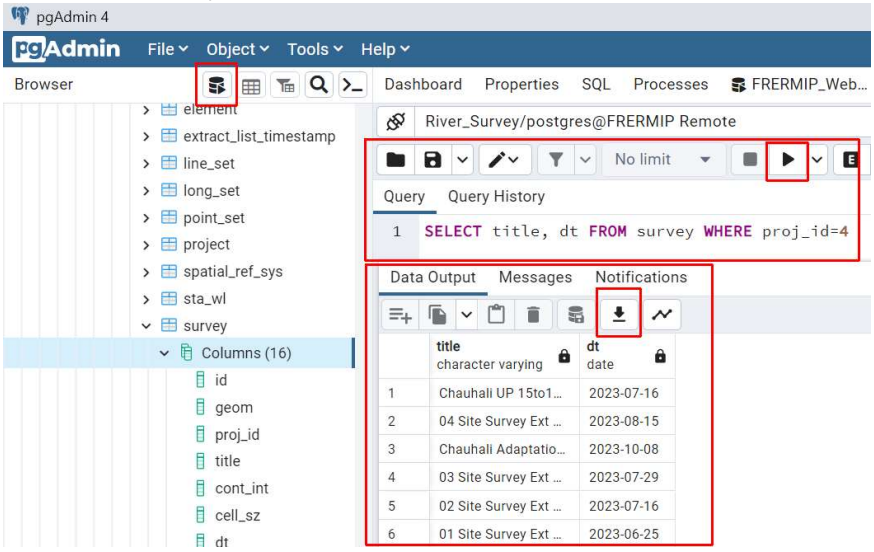


G-5 QUERY TOOL

1. To access the Query Tool, just click on the top left icon, and the query widow will appear. Enter a query in the Query window and click the 'Execute' (Run)-icon on the top right side of the Query-window, and query results will be shown in the Data Output window.

2. It is also possible to save and restore (browse) a script file using the 2 icons on the top left side of the Query window.

3. It is possible download results of the query to a CSV-file by selecting the download-icon on the right side of the 'Data Output'-window.



G-6 ADDING DATABASE USERS

1. For most of the database tables the data is fixed, and there is no need to regularly edit, delete or insert data. In the River Survey database, the Spatial Elements needed to analyze the contours may need to be changed periodically, but that functionality is already available in the Administration-tab (refer to Appendix-B Section B-2).

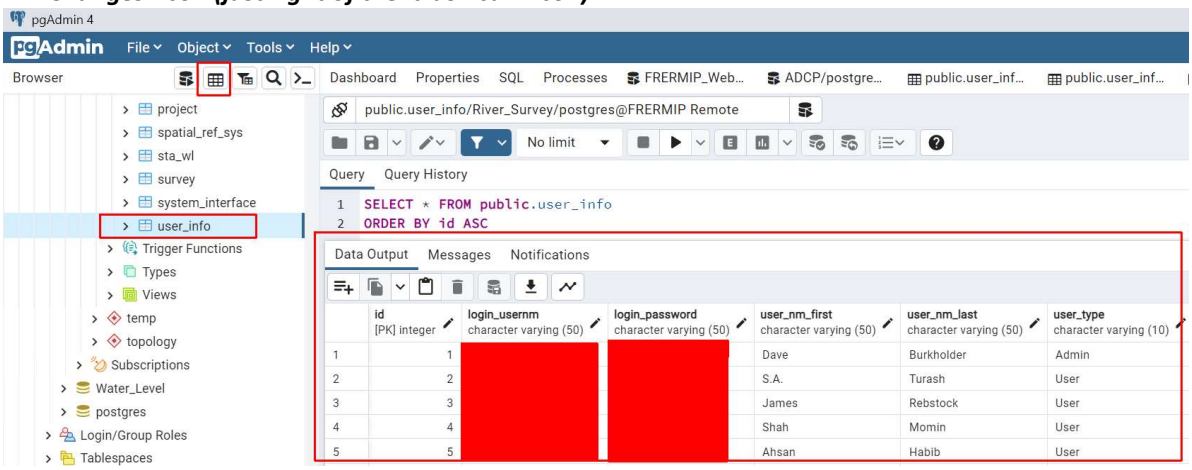
2. The only table that may need regular updates is the 'user-info'-table that contains User Names and Passwords. For the River Survey database this functionality is included in the Administration-tab, but for the other 3 database (ADCP, Float Tracking and Water Levels) these updates will need to be done using PgAdmin4.

3. To insert, delete or edit user names and passwords the administrator must access the 'user_info'-table in the PostgreSQL database. Find and select the 'user_info'-table, and then click on the 'View Data'-icon in the main menu to display the table data.

4. Double click individual cells or a 'new row(+)' icon to edit or insert data. The 'user_type'-field value must be either 'User' or 'Admin' (ordinary User or Administrator).

5. The personalized user name and password are entered using the 'login_usernm' and 'login_password'-columns.

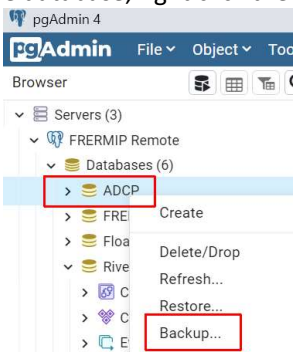
6. ***No changes to the table will be permanent until the Administrator clicks the 'Save Data Changes'-icon (just right of the 'trash can'-icon).***



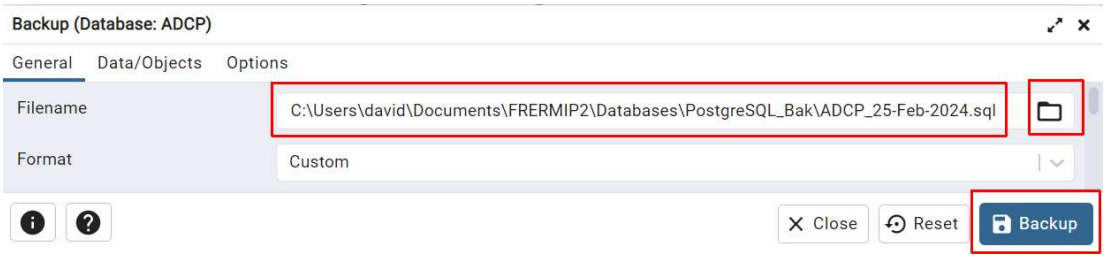
G-7 BACKUP AND RESTORE DATABASE

Backup Database

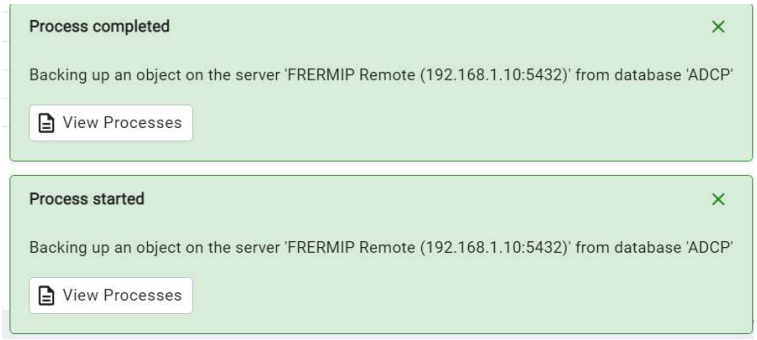
1. To backup the database, select the database, right click the mouse and select the Backup-option.



2. In the Backup-window, just browse to correct folder and enter a file name, leave the format as Custom and click the Backup-button.

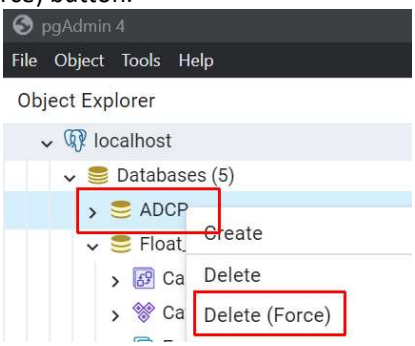


3. In the bottom right side of the screen, the following windows will appear to identify that the Backup-process has been started and then completed.

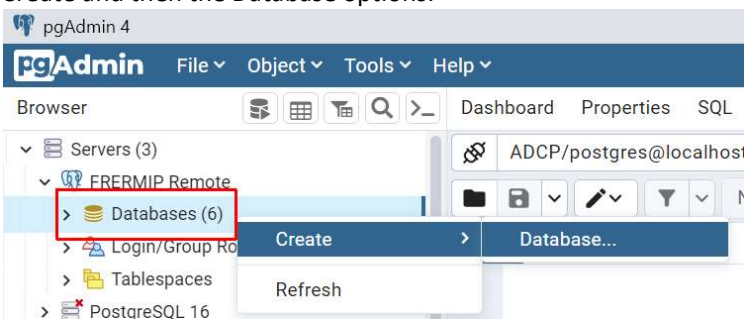


Restore Database

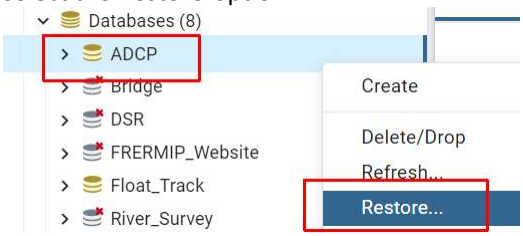
4. To restore a database, first the existing database must be deleted, and a new empty database created. Deleting a database can be done by first selecting the database, right clicking the mouse and selecting the Delete (Force) button.



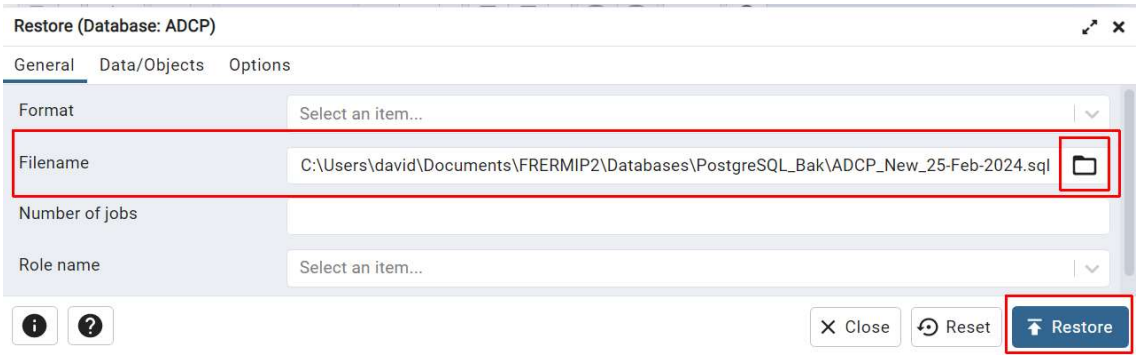
5. A new database can be created by selecting the Databases-icon, right clicking the mouse and selecting the Create and then the Database options.



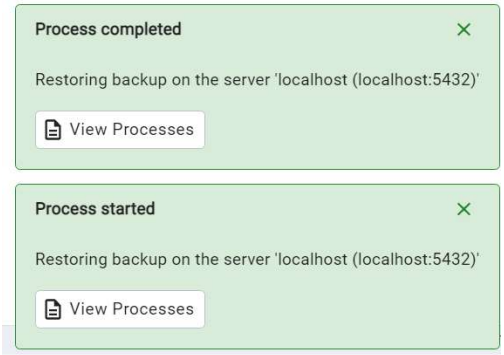
6. To restore the empty database, select the new database name, click the right mouse button, and select the Restore-option.



7. In the Restore-window, browse to correct folder, select the backup database file name, and click the Restore-button.



8. In the bottom right side of the screen, the following windows will appear to identify that the Restore-process has been started and then completed.



FRERMIP Flood and Riverbank Erosion Risk Management Investment Program

FRERMIP Spatial MIS Database

Appendix-H: Working with QGIS

Contents

H-1 INTRODUCTION

QGIS, also known as Quantum GIS, is a geographic information system (GIS) software that is free and open-source. QGIS supports Windows, macOS, and Linux. It supports viewing, editing, printing, and analysis of geospatial data.

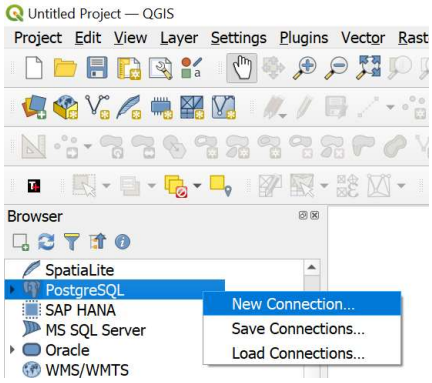
QGIS allows users to analyze and edit spatial information, in addition to composing and exporting graphical maps. QGIS supports raster, vector and mesh layers. Vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can georeference images.

QGIS supports shapefiles, personal geodatabases, dxf, MapInfo, PostGIS, and other industry-standard formats. Web services, including Web Map Service and Web Feature Service, are also supported to allow use of data from external sources. QGIS can connect and interface with PostgreSQL/PostGIS, SpatiaLite and MySQL databases.

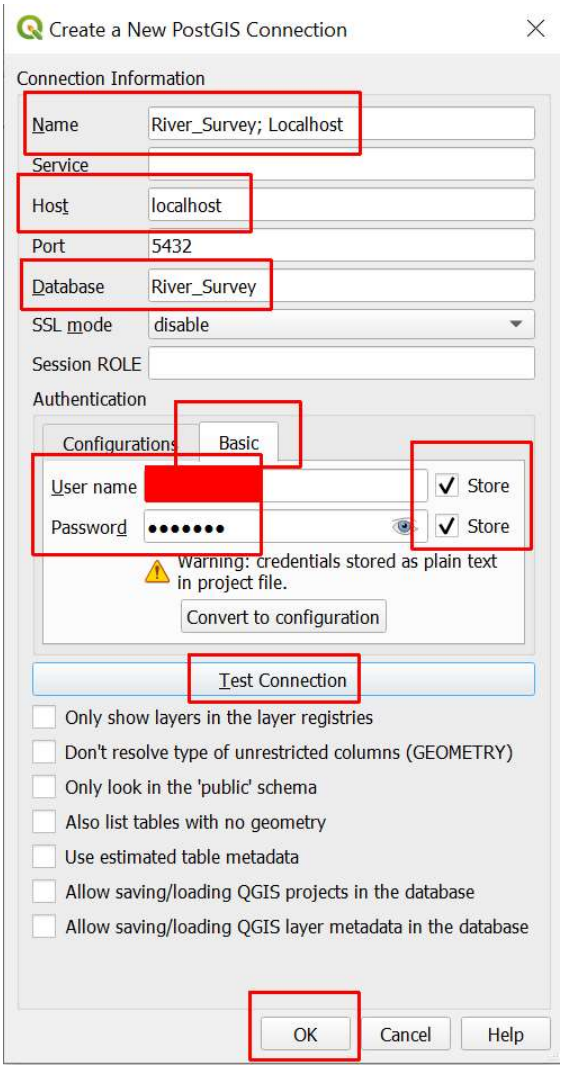
A number of topics are covered in this Appendix but the primary topic is the generation of Spatial Elements. Spatial elements are used to analyze bathymetric survey data. Spatial elements include cross-sections, longitudinal-sections, areas and points. Spatial elements are generated in QGIS by defining spatial vector layers and digitizing all necessary spatial features. The spatial elements are saved as ERSI Shapefiles that are subsequently imported into the PostgreSQL database.

H-2 GENERATE CONNECTION BETWEEN POSTGRESQL AND QGIS

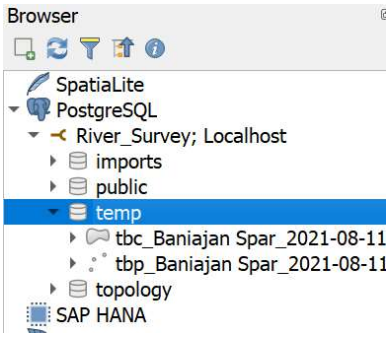
1. To generate a connection between the PostgreSQL server and QGIS, go to the Browser Panel and select PostgreSQL, and then select New Connection.



2. Fill in the 'Create a New PostGIS Connection' window cells as shown below. In the Authentication Section, chose the Basic-tab, ***enter the User Name and Password received from an Administrator***, and select the Store User Name and Store Password checkboxes. Before clicking the OK-button, click the 'Test Connection'-button to make sure the connection is working.

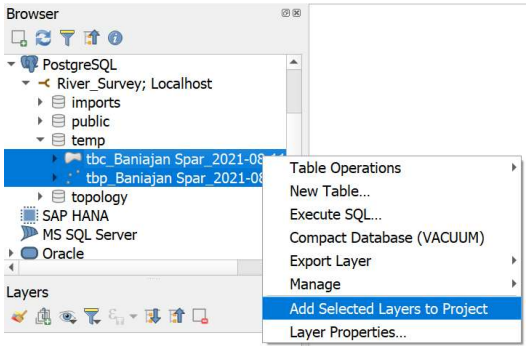


3. Users should only have access to tables in the temp-schema of the River_Survey database. The other schemas will be displayed, but the User should not be able to see or access tables from other schemas.

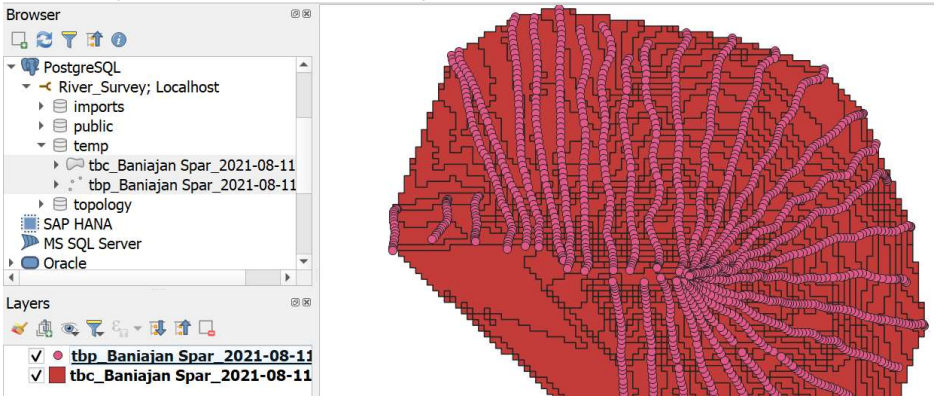


H-3 ACCESSING TABLES FROM THE POSTGRESQL CONNECTION

1. To add PostgreSQL tables from the Browser Panel to the Layer Panel do the following (also refer to Appendix-A, Section A-8 Survey Extract to QGIS). Select one or more tables from the PostgreSQL temp-schema, right click the mouse and click the 'Add Selected layers to Project'-option.



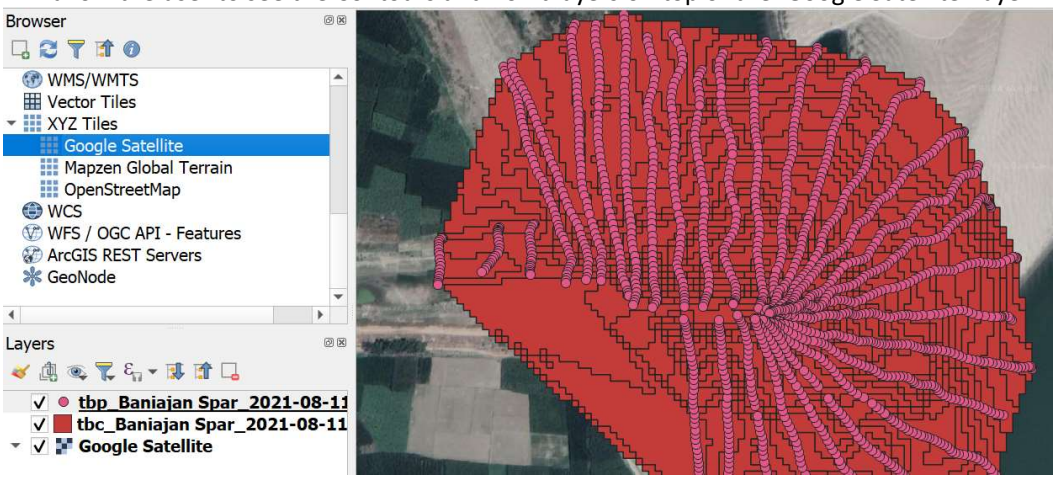
2. The selected layers will be added to the Layer Panel and also to the Canvas window.



H-4 ADDING GOOGLE SATELLITE TO LAYER PANEL AND CANVAS WINDOW

1. To add Google Satellite to the Layer Panel and the Canvas window first select the XYZ Tiles from the Browser Panel, and then select and double click the 'Google Satellite-option.

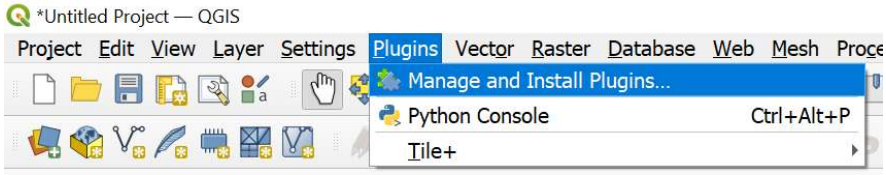
2. Select the Google Satellite Layer and 'drag' it to the bottom of the Layers by first selecting the layer, then holding down the left mouse button move the mouse to the bottom of the layers. This will allow the user to see the Contours and Point layers on top of the 'Google Satellite'-layer.



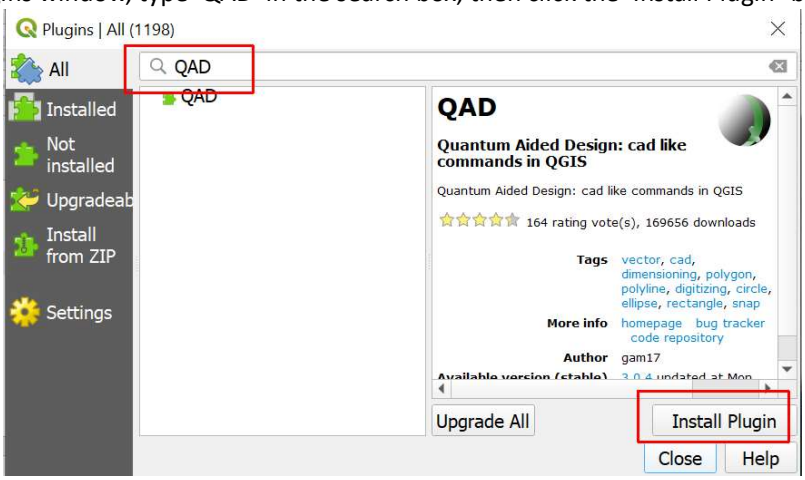
H-5 INSTALL QAD PLUGIN

1. QAD is a useful plugin for people who are familiar with using AutoCad. It has most of the common AutoCad command line functions that can be replicated in QGIS to generate Spatial Elements in QGIS more easily.

2. To install the QAD Plugin, first select the Plugins-option from the top horizontal menu, and double click the 'Manage and Install Plugins'-option.

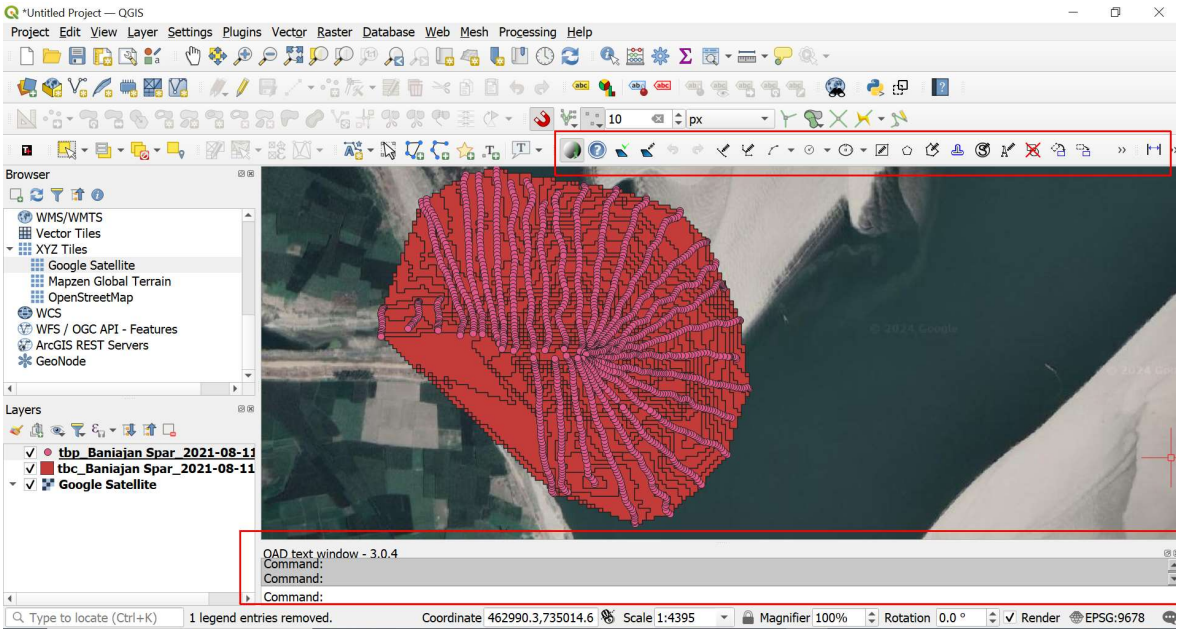


3. In the Plugins window, type 'QAD' in the search box, then click the 'Install Plugin'-button.



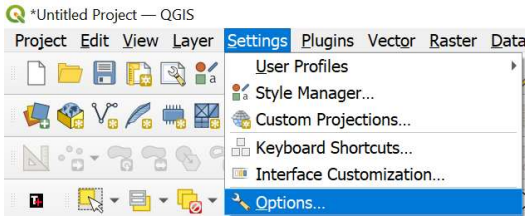
4. After the installation is complete, close the Plugins window by clicking the Close-button.

5. The QAD Tool Bar and Command-window should now be available for use when generating new Spatial Elements (refer to Section H-8).

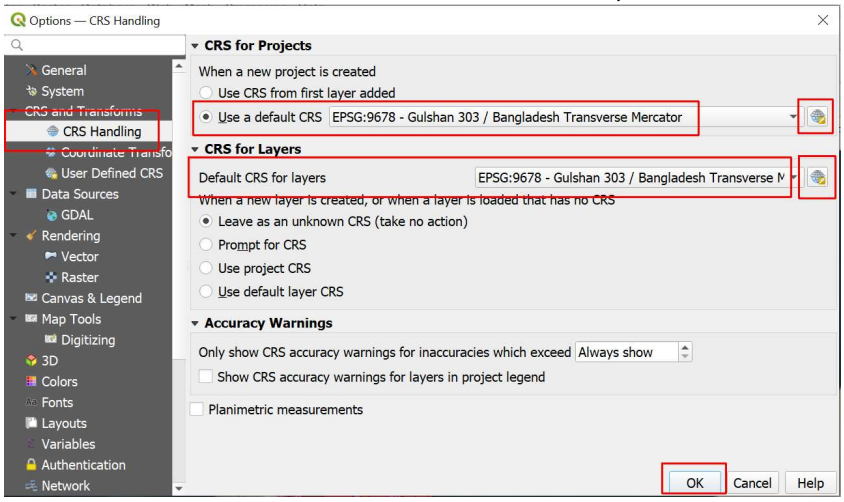


H-6 SETTING BTM AS DEFAULT PROJECTION (CRS)

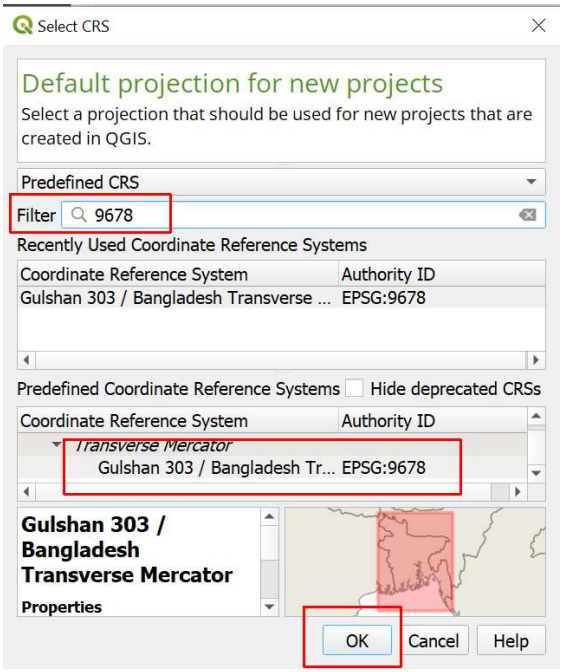
1. To set the Bangladesh Transverse Mercator (BTM); EPSG:9678 as the default projection (Coordinate Reference System or CRS), first select Settings from the top horizontal menu, and then the Options-item.



2. When the Options-window is display, select 'CRS Handling' from the left side vertical menu, and select EPSG: 9678 from available options. The user may need to click on the Globe-icons on the right side of the window if EPSG: 9678 is not available in the drop-down boxes.



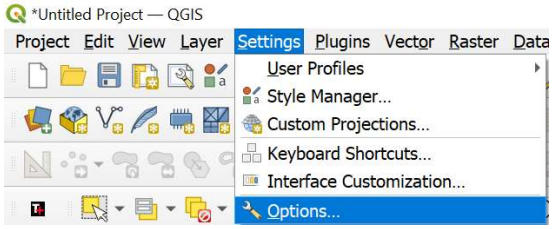
3. If the Globe-icon is clicked, the 'Select CRS'-window will appear, and the user should enter '9678' in the filter box, then select BTM and click the OK-button.



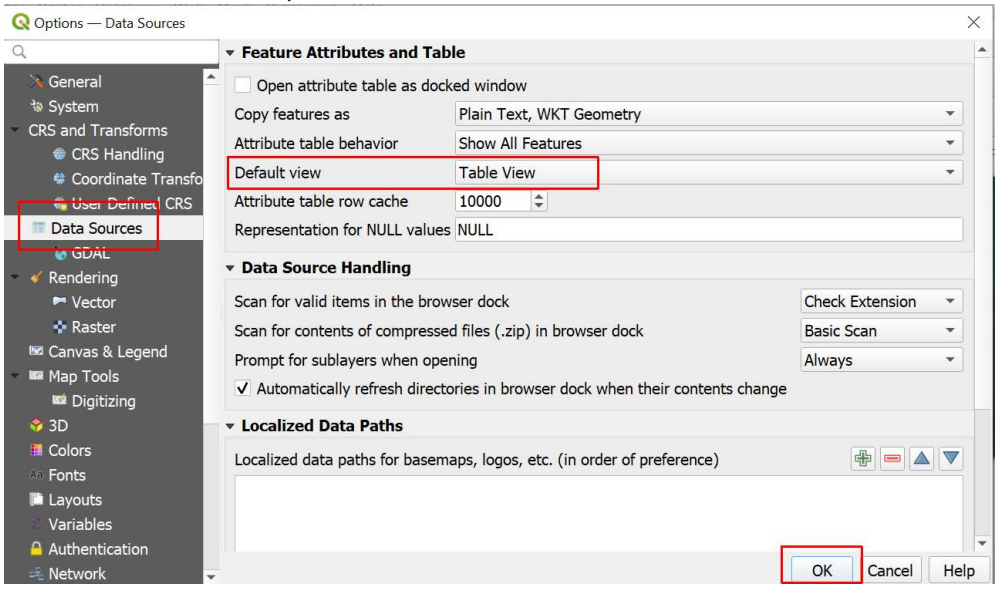
H-7 SETTING DEFAULT ATTRIBUTE TABLE VIEW

1. The Attribute Table contains all available table columns that are not geometric. It is useful to view this window in Table View with each column displayed similar to a spreadsheet.

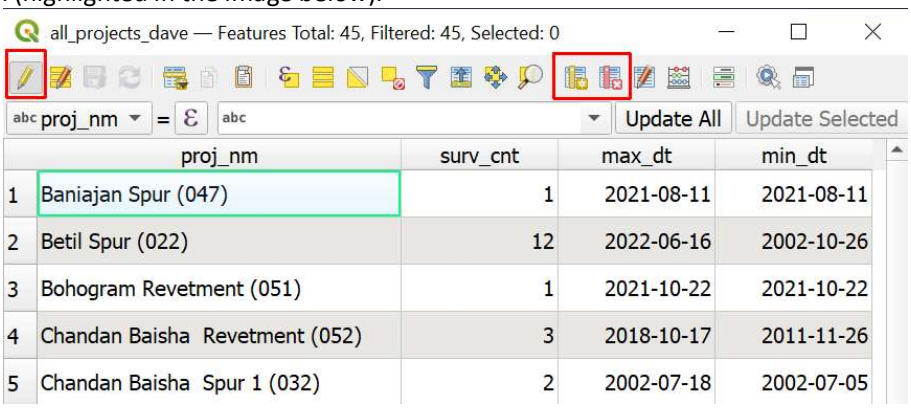
2. To set the default Attribute Table view, first select Settings from the top horizontal menu, and then the Options-item.



3. When the Options-window is display, select 'Data Sources' from the left side vertical menu, then from the 'Default View'-dropdown box select 'Table View', then click on the Ok-button.



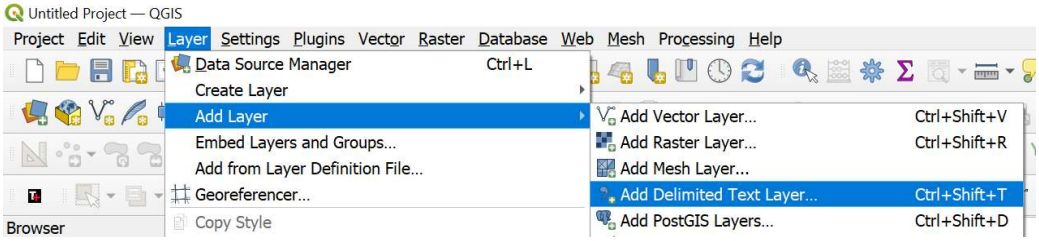
4. A sample of the Attribute Table for the River Survey Project Summary is shown below. Attributes can be edited, added and deleted similar to spreadsheet by toggling the Editing-icon on the top left of the screen. Columns can be added or deleted using the icons on the top right side of the screen (highlighted in the image below).



	proj_nm	surv_cnt	max_dt	min_dt
1	Baniajan Spur (047)	1	2021-08-11	2021-08-11
2	Betil Spur (022)	12	2022-06-16	2002-10-26
3	Bohogram Revetment (051)	1	2021-10-22	2021-10-22
4	Chandan Baisha Revetment (052)	3	2018-10-17	2011-11-26
5	Chandan Baisha Spur 1 (032)	2	2002-07-18	2002-07-05

H-8 IMPORT SPATIAL DATA FROM CSV FILE

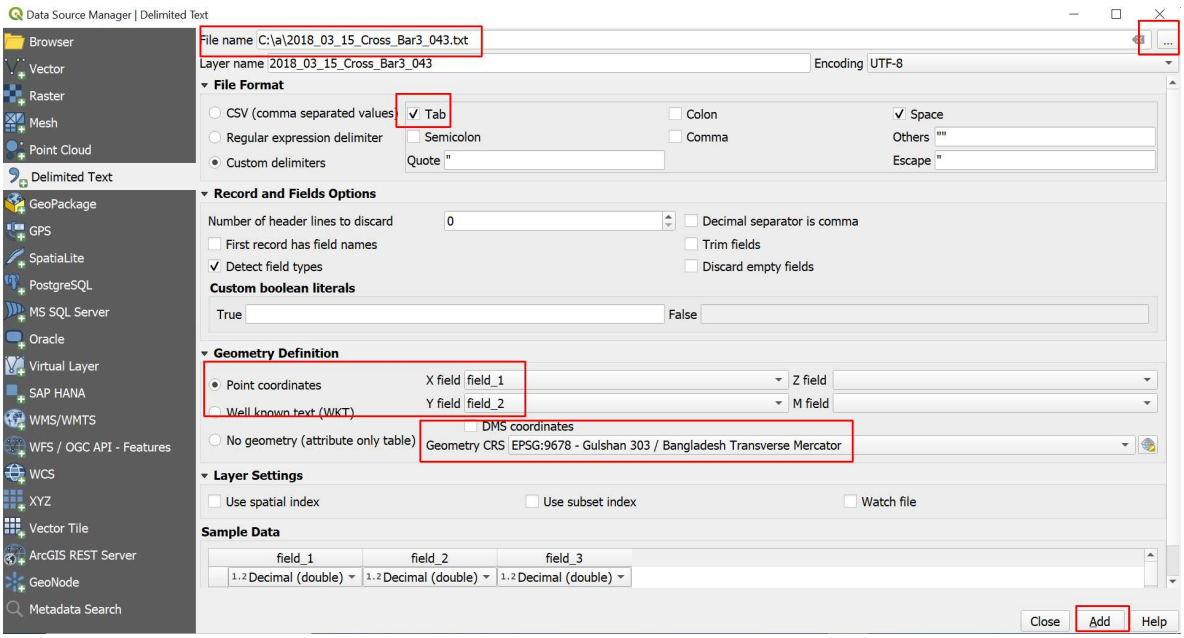
1. To import a CSV-file with spatial data into QGIS, first select Layer from the top horizontal menu, then select the 'Add Layer' and the 'Add Delimited Text Layer'-options.



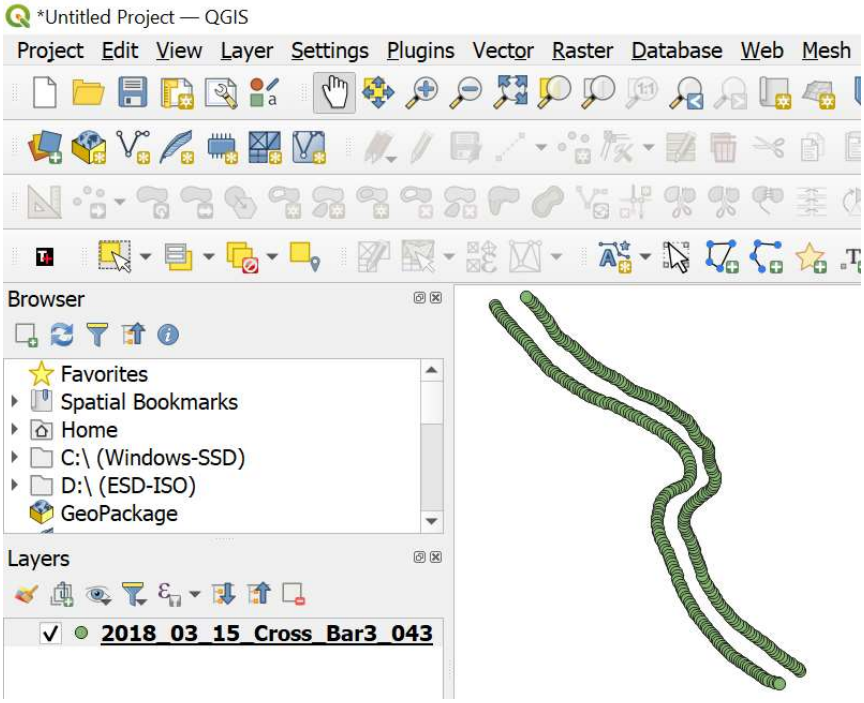
2. The sample text file is in a format that is used to import point data into the River Survey database. It is x, y & z-coordinates separated by tab-delimiters with no header row. We want it to be imported into QGIS as a 2D point with EPSG:9678 CRS (BTM), with the elevation (z) value shown in the attribute table.

3. In the 'Data Source Manager; Delimited Text'-window, first click on the 3 dots (…)-icon on the top right of the screen, and browse and select the source file. Based on the format of the file contents, QGIS will automatically fill in some of the input boxes. If the CSV-file has a header row, QGIS will automatically recognize some spatial data.

4. Fill in any remaining key information as shown in the image below, click the Add-button, and then the Close-button to add the input file contents to a QGIS Layer Panel and also to the Canvas window.



5. The resultant Layer Panel and the Canvas window will look like this.



6. The attribute table looks like this.

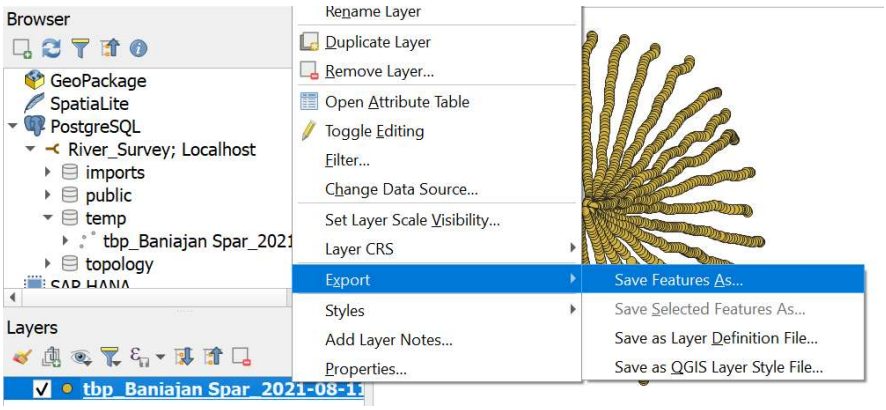
2018_03_15_Cross_Bar3_043 — Features Total: 355, Filtered: 355, Selected: 0

	field_1	field_2	field_3
1	472490.3	703963.87	4.15
2	472491.44	703960.67	4.14
3	472493.1	703957.52	4.09
4	472496.46	703953.25	4.14
5	472498.83	703950.23	4.09
6	472501.31	703947.25	4.06

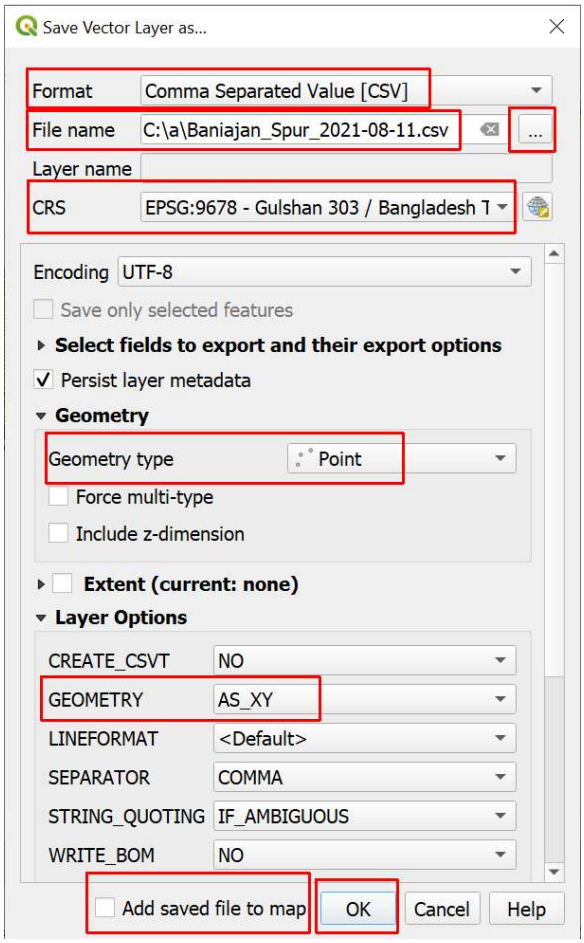
H-9 EXPORT SPATIAL DATA TO CSV FILE

7. The example is a Survey Point layer originally extracted from the River Survey database into QGIS (refer to Appendix-A, Section A-8 Survey Extract to QGIS).

8. To export this existing layer with spatial data as a CSV-file, first select the layer, then right click the mouse and select the 'Export' and then the 'Save Features As'-option.



9. In the 'Save Vector Layer as'-window, select CSV format, browse and define the destination CSV file using the browse (…)-icon, define the CRS, the Geometry type, the Geometry format (AS-XY), don't add the saved file to the map, and click on the OK-button.



10. The exported CSV-file will look like this.

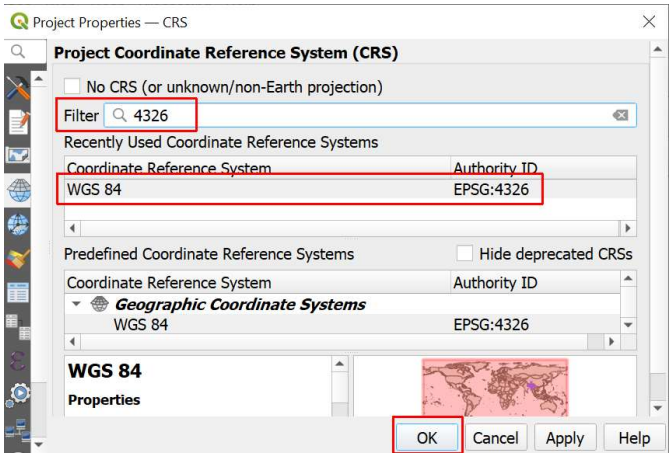
	A	B	C
1	X	Y	z
2	462040.5	735211.8	12.94
3	462039.9	735211.5	13.01
4	462039.5	735211.1	12.99
5	462039.4	735210.3	12.87
6	462039.5	735209.7	12.8
7	462039.4	735209	12.71
8	462039.2	735208.3	12.69
9	462039.2	735207.1	12.53
10	462039.3	735205.5	12.37
11	462039.6	735203.6	12.27

H-10 CHANGING PROJECT CSR AND ADVANCED DIGITIZING TOOL

Changing Project CSR

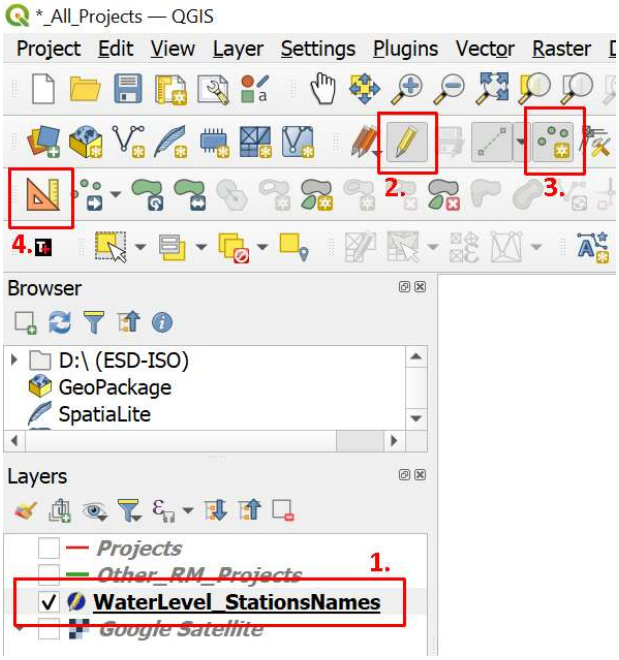
1. If the user wishes to define the specific location of a Water Level Station in QGIS, the best way is to use the 'Advanced Digitizing Tool'. The Water Level Station to be added is: SW48 Jaganathganj with latitude 24.6416° and longitude 89.8044°.

2. Since the location is in latitude and longitude, it is first necessary to change the CSR to WGS84 (ESPG: 4326).That is done by simply clicking on the current CSR (ESPG: 9678) at the bottom right of the screen. In the 'Project CRS'-window select ESPG: 4326, and if it is not readily available use the filter and search for 4326. Select the CRS and click the OK-button.



Advanced Digitizing Tool

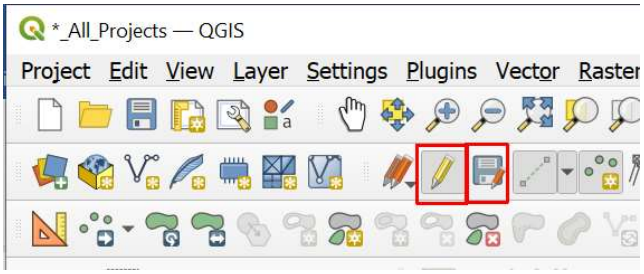
1. Add a new Shapefile Layer (refer to Section H-11: Create a New Shapefile Layer), or open an existing Layer for Water Level Stations. Then do the following:
    1. Select the Layer
    2. Toggle the Editing-icon
    3. Click the 'Add New Point'-icon
    4. Click 'Advanced Digitizing Tool'-icon



2. In the Advanced Digitizing Tool, first enter the Longitude and ***click on its Lock-icon***, then enter the Latitude and ***click on its Lock-icon***. A vertical and horizontal line will appear on the Canvas with the locked x and y points shown.

3. Move the cursor near to the intersection point and click the mouse left button and the new point will be added and snapped to the requested intersection point.

4. Close the 'Advanced Digitizing Tool'-window, click the Save-icon to save the new point, and toggle the Editing-icon to turn it off.



H-11 CREATING SPATIAL ELEMENTS

Introduction

1. Spatial elements are used to analyze bathymetric survey data. Spatial elements include cross-sections, longitudinal-sections, areas and points. At least one set of spatial elements is required for each of the 45 projects currently defined in the River Survey database.

2. Spatial elements are generated in QGIS by defining spatial vector layers and digitizing all necessary spatial features. The spatial elements are saved as ERSI Shapefiles that are subsequently importing into the PostgreSQL database.

3. In order to generate meaningful spatial elements, it is necessary to first extract survey outlines and contours. Survey outlines (outer boundaries) and contours do not always accurately define the survey extents. In some cases the survey points may also need to be extracted to get an accurate idea of the survey outer boundary.

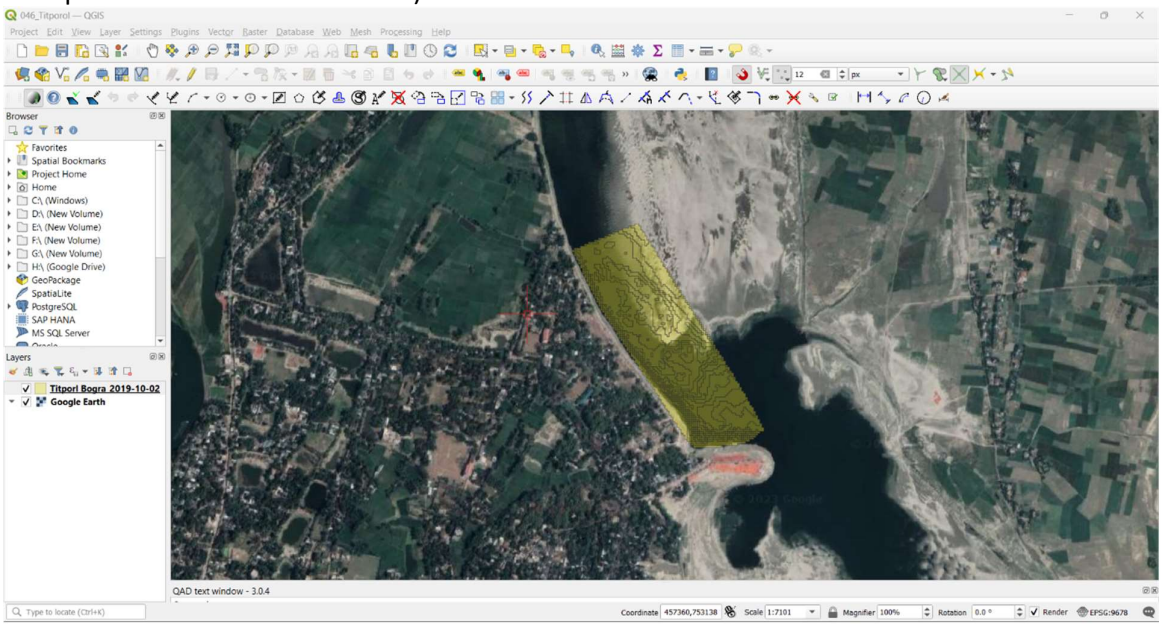
4. To extract all Survey Outlines for the entire Project, first select the Project, then select the Tools-tab, and click on the 'Project Surveys'-button under the Extract to QGIS section on the left side of the page. (refer to Appendix-C: SPATIAL ELEMENT EXTRACT TO QGIS).

5. Open QGIS and display the outline of all project surveys.

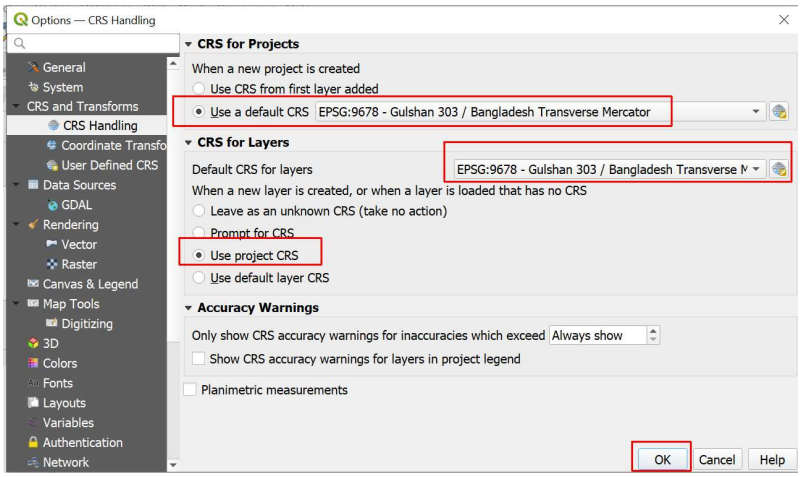
6. To extract Contours and Points for a specific survey, in the Tool-tab, on the right side of the page select the survey you want to extract, chose 'QGIS Extract' from the drop-down menu, and the click Contours and/or the Points-button (refer to Appendix-C: SURVEY EXTRACT TO QGIS.

7. After extracting the survey data, use them to define the extents of the Spatial Elements to be generated. The color, opacity and other properties can be changed from the

properties of the layer (highlight layer, right-click the mouse, and select Properties-option at bottom of action list).



8. Before saving the QGIS project ensure that the ***Project projection (CRS) is always set to EPSG:9678*** (Gulshan 303 / Bangladesh Transverse Mercator) The current CRS value is shown on the bottom right corner of the QGIS screen. To change the default CRS, select Settings from the top menu, select Options, then CRS Handling.

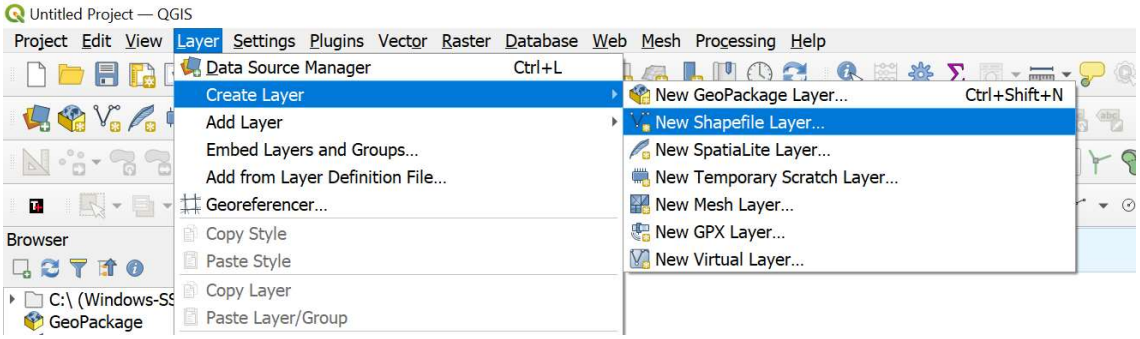


9. Save the current QGIS project in a separate folder dedicated to the current Project (e.g. C:\QGIS_Projects\028_Mathuapara_Groyne.qgz) by selecting Project-tab and the Save-option (or by typing Ctrl-S). ***All Spatial Elements (Points, LineStrs, and Polygons) defined for the Project must all be stored in same QGIS Project folder.***

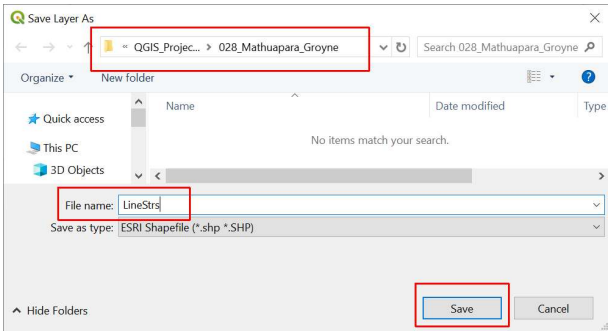
10. ***Make sure that the project folder name starts with 3 digits that correctly defines the Project ID.***

Create a New Shapefile Layer

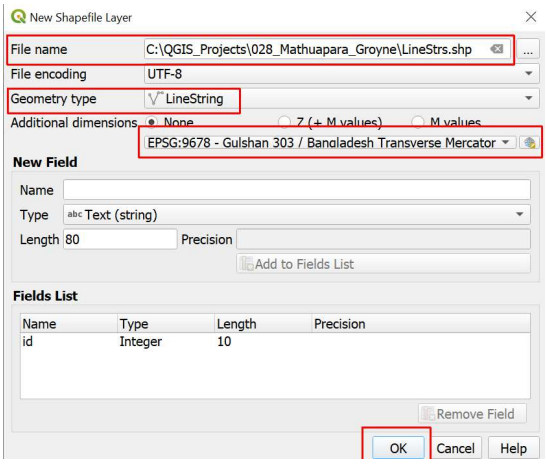
1. To create a new shapefile layer, go to Layer on the top menu, then choose the Create Layer option and then the New Shapefile Layer option.



2. In the new window, first click on the '…'-icon on the top right side and browse to the QGIS Project folder, then define the new layer as LineStrs ***(The name must be exactly LineStrs)***, and save the file.

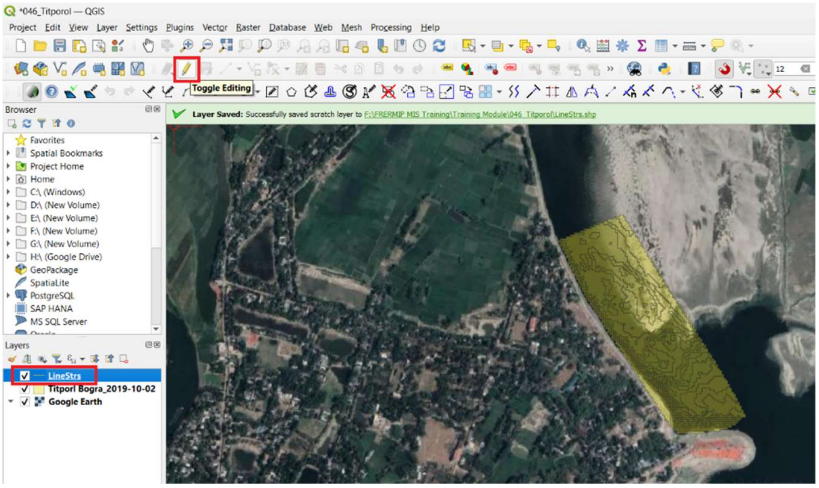


3. Then select the Geometry Type as a LineString, define the projection (CRS) is EPSG:9678 Bangladesh Transverse Mercator, and click OK to save the Layer and Shape File.

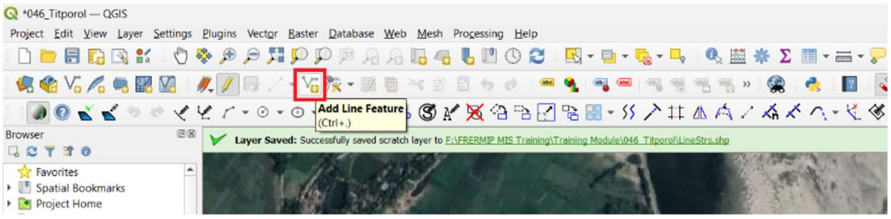


Create Cross-Sections and Long-Sections on Linestr Layer

1. To edit the LineStrs layer, select that layer and turn on **Toggle Editing** option which can be found on the Tool Bar. Remember that without turning on the Toggle Editing option no editing can be done on any layer and the editing will only impact the selected layer.



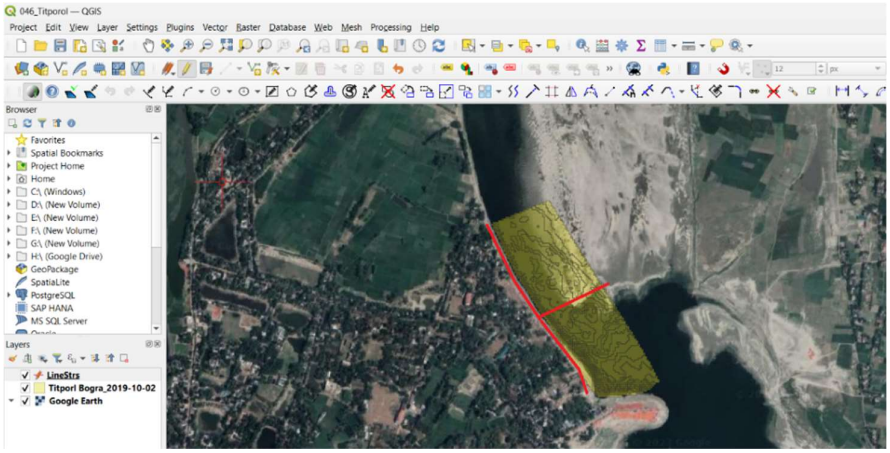
2. As the layer is named as "**LineStrs**" and the geometry type is "**LineStrings**", we will only be able add lines (e.g. cross sections, and long sections) in this layer. To add lines, click on the **Add Line Feature** as shown in the image below. The Add Line Feature is found on the same toolbar as Toggle Editing.



3. To create a new linestring, move the cursor on the Map Canvas to the desired location and left click the mouse to create the start point of the linestring, then move to the next location vertex and again left click the mouse. Continue creating vertices until the linestring is complete, then right click the mouse to terminate the linestring***. Cross-Sections must be a single segment linestring (with a single start and end vertex location) Long-Sections can have multiple segments (with several vertices).***

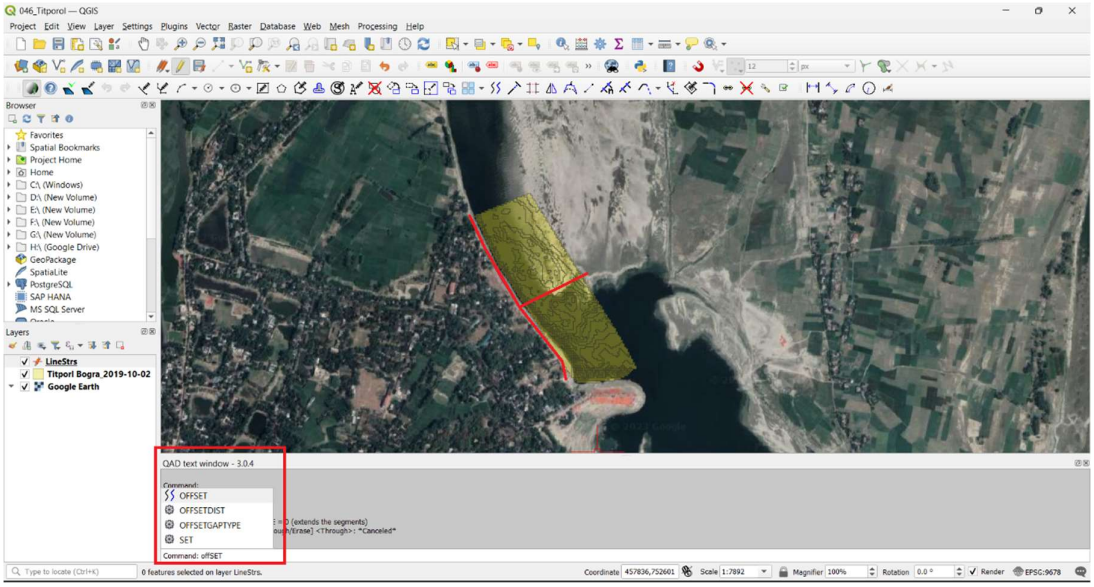
4. To edit a linestring, select the Vertex Tool icon immediately right of the Add Line feature. Move the cursor to a vertex and it will be surrounded by a red circle, left click the mouse to select a vertex, then move the cursor to a new location and left click the mouse to shift the vertex to the new location. The linestring can be deleted by locating the cursor outside the linestring, holding down the left mouse button and dragging the cursor so the blue outline envelopes the linestring, and then pressing the delete button on the keyboard.

5. To create cross-sections and long-sections, first draw a line parallel to the bank line of the area of interest and another line as perpendicular as possible to that line. This perpendicular one will act as a template for cross sections, and the parallel one as a base line and also a possible template for the long-sections.

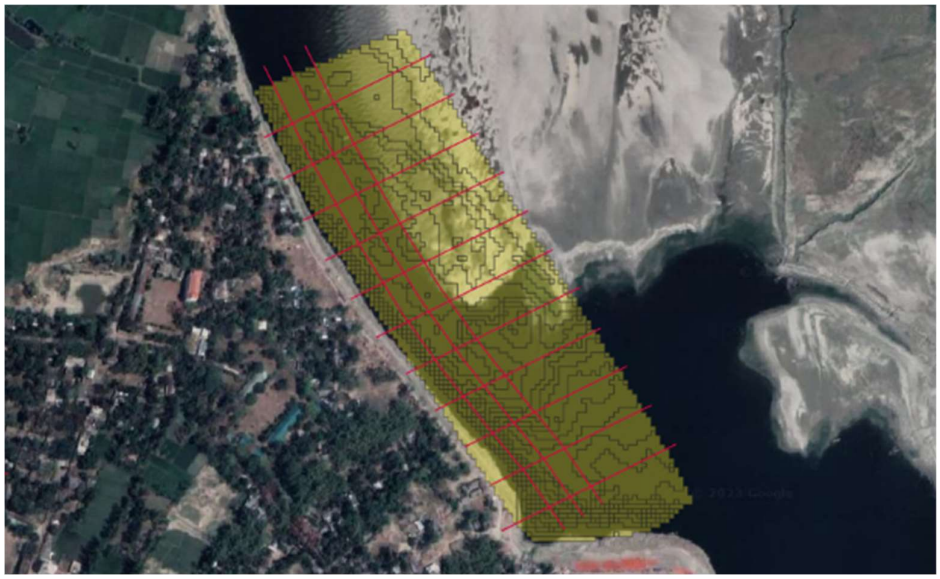


6. Now we will offset of the one cross section line we have. To do that, the **QAD** plugin should be installed in QGIS. After installing QAD, one horizontal panel should be available on the bottom of the QGIS window. There you can write various commands just like AutoCAD. Now write "**OFFSET**" in the QAD window to make parallel lines.

   Normally 50 meter offset is used for cross sections, and perhaps 25 meter for long sections. However, when the survey area is too big you can use 100 meter and 50 meter offset for cross sections and long sections respectively. (The spacing of the points in the survey source file can also be used to define the cross-section spacing.)



7. The survey area will look like the below image when all the cross sections and long sections are drawn.

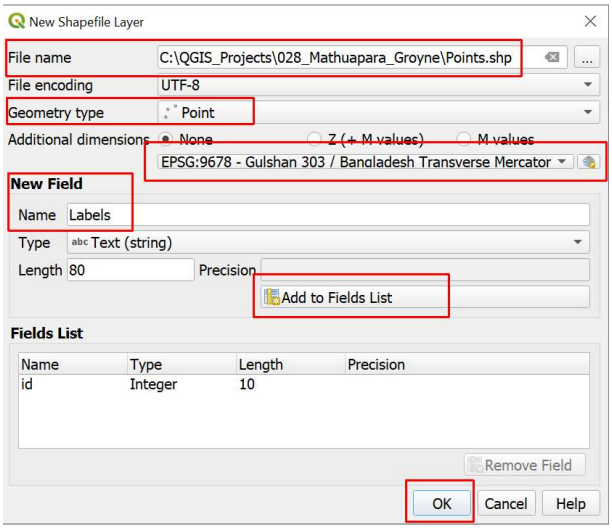


8. After drawing all the cross-sections and long-sections, click on the Save-icon next to the 'Toggle Editing'-icon, and then click on the 'Toogle Editing'-icon to stop further editing.

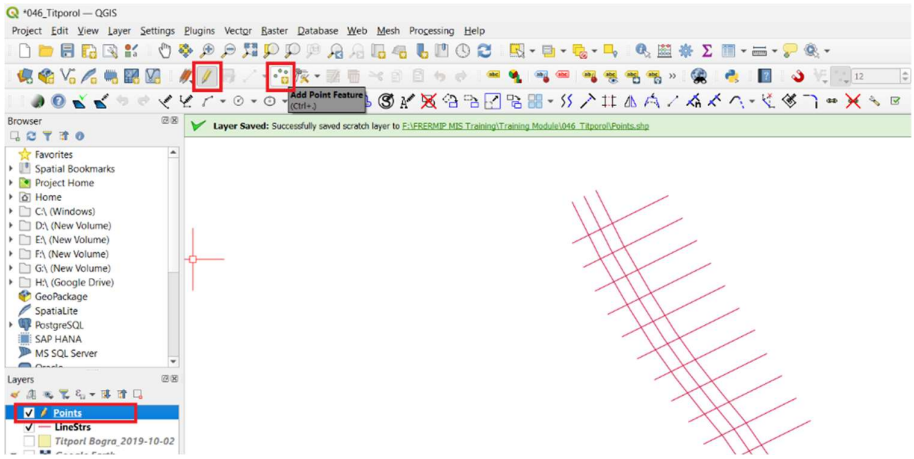
Create Points with Labels on the Points Layer

1. Create a new Shapefile Layer using the same steps as documented above.

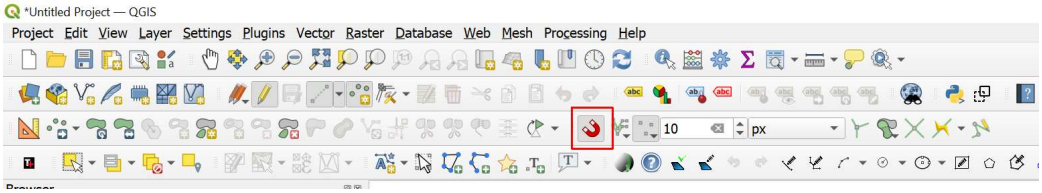
2. **Create a New Shapefile Section**, ***but this time the name of the Shapefile must be Points, and the Geometry Type must be Point.*** In the Points layer an additional field, that ***must be named Labels***, must be included by adding it in the New Field Name field and clicking the Add to Fields List-icon.



3. Enable **Toggle Editing** of the Points layer, then enable the **Add Point Feature** option from the tool box as shown in the picture.



4. The user must enable the snap option before editing in the **Points** layer and the **Vertex Snapping** option should be selected (which is the default). ***Points that define Cross-Sections, Long-Sections, and Areas must be snapped to one of the element's vertices.*** The **Enable Snapping** option should be on one of the visible Toolbars. If it is not there, right click on the upper panel and many options will pop up. Just enable the **Snapping Toolbar**.



5. To create a point with a label do the following. On the Map Canvas, move the cursor to the cross-section LineString vertex which is ***closest to the river bank***. If the Snapping option is working, a small pink colored rectangle will appear at the vertex, then left click the mouse. When one vertex is clicked, a small window will pop up. In the Labels field of that window, type the cross-section number (e.g. **CS_01**, **CS_02** etc.), and then its chainage. For example: the 1st upstream cross-section should be labeled as **CS_01; +000**. ***Remember to label the cross-sections from upstream to downstream.*** When the chainage exceeds 900 meters (e.g.: 1000 meter), it should be labelled as **CS_11; 1+000,** for instance.

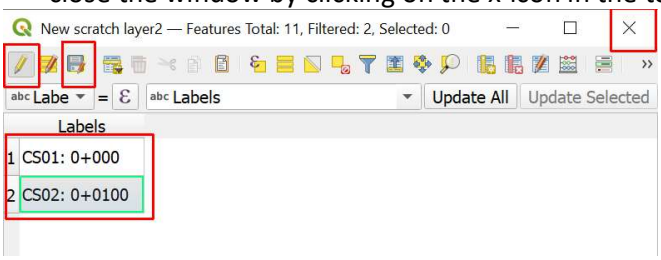
6. ***The first character of the point Labels are used to determine which type of Spatial Element is linked to that Label. Cross-Section Labels must start with 'C', Long-Section Labels must start with 'L', Area Labels must start with 'A', and Point Labels must start with 'P'.***

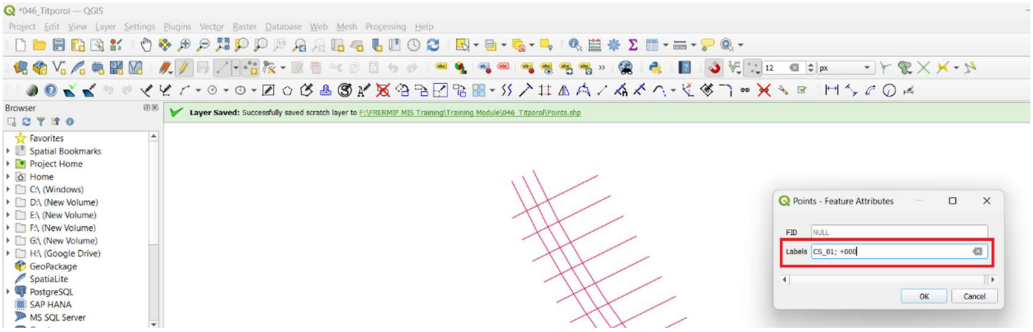
7. To edit a point, select the Vertex Tool icon immediately right of the Add Point feature. Move the cursor to a point and it will be surrounded by a red circle, left click the mouse to select the point, then move the cursor to a new location and left click the mouse to shift the point location to the new location. The point can be deleted by locating the cursor outside the point, holding down the left mouse button and dragging the cursor so

the blue outline envelopes the point, and then pressing the delete button on the keyboard.

8. If necessary, the user can edit the point Label attribute by selecting the 'Open Attribute Table'-icon on the top right side of the top toolbar (or typing Ctrl-F6).

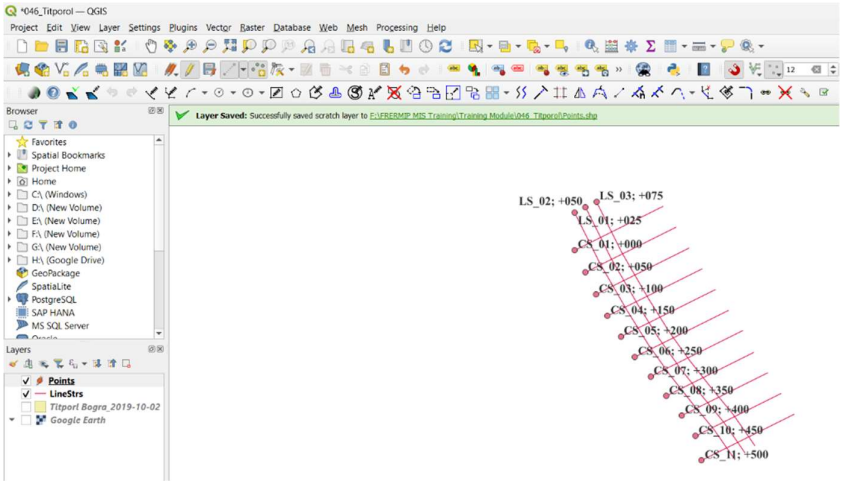
9. Make sure the Edit Toggle is on, then select and edit the Labels, click on Save-icon and close the window by clicking on the x-icon in the top right of the window.





10. In the case of long-sections, the label should be like this: **LS_01; +000**. **The first character in the label must be an 'L'**. Additionally, long-sections should be labeled from river bank towards the river.

11. When all cross-sections and long-sections are labeled, it would look like the image below.

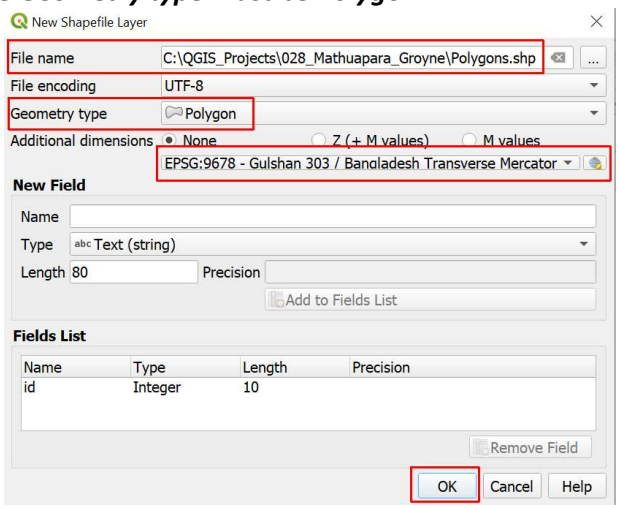


12. After adding points with labels to the all the cross-sections and long-sections, click on the Save-icon next to the 'Toggle Editing'-icon, and then disable editting by clicking on the 'Toogle Editing'-icon.

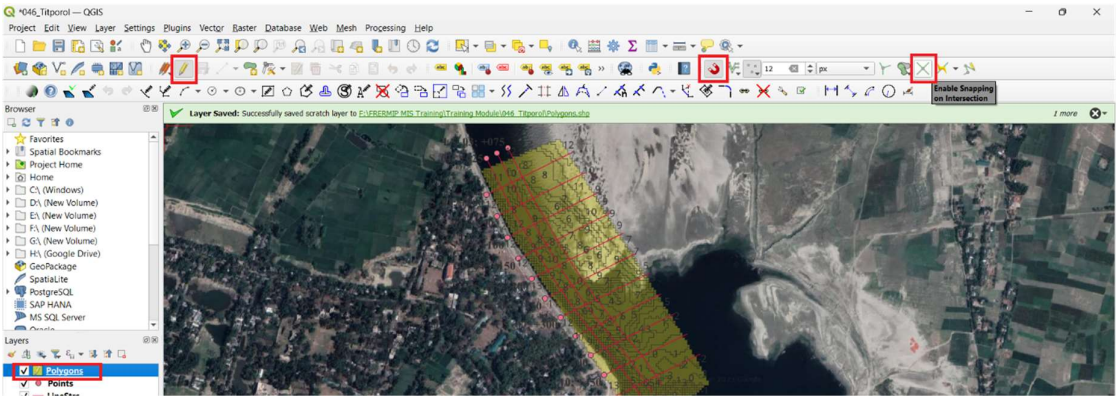
Create Polygons on Polygons Layer

1. Create a new Shapefile Layer using the same steps as documented above.

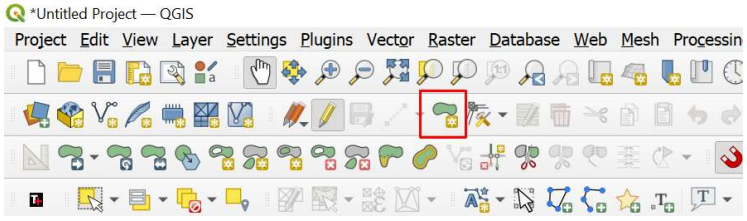
2. **Create a New Shapefile Section**, ***but this time the name of the Shapefile must be Polygons, and the Geometry type must be Polygon.***



3. After adding the **Polygons** layer, turn on the **Enable Toggle** mode. Then turn on the snapping option, however, this time select the **Enable Snapping on Intersection** option.



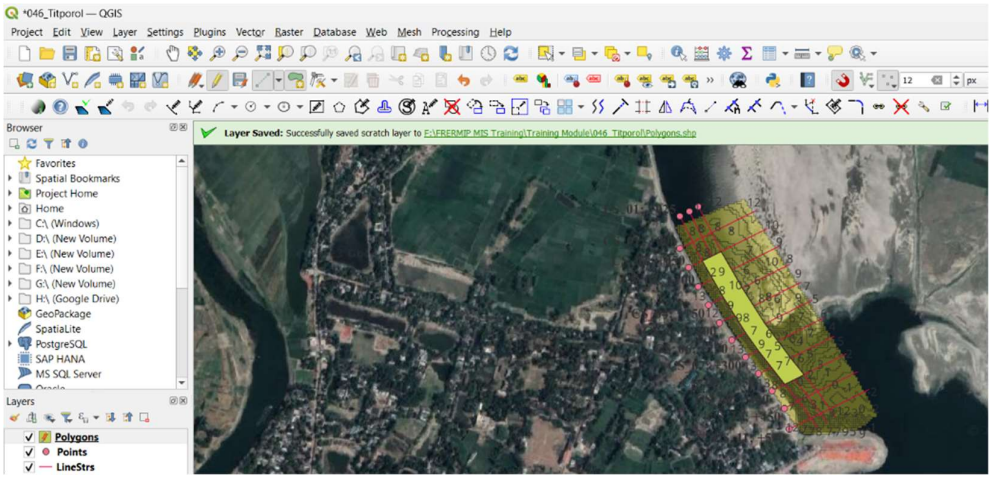
4. To draw polygons, select the **Add Polygon Feature** option from the Toolbar.



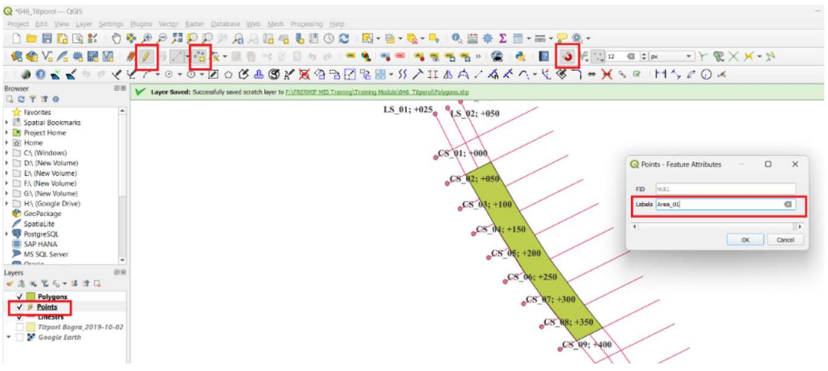
5. To create a new polygon, move the cursor on the Map Canvas to the desired start location and left click the mouse to create the start point of the polygon, then move to the next location vertex and again left click the mouse. Continue creating vertices until the polygon is complete, then right click the mouse to terminate the polygon**.**

6. To edit a polygon, select the Vertex Tool icon immediately right of the Add Polygon feature. Move the cursor to a vertex and it will be surrounded by a red circle, left click the mouse to select a vertex, then move the cursor to a new location and left click the mouse to shift the vertex to the new location. The polygon can be deleted by locating the cursor outside the polygon, holding down the left mouse button and dragging the cursor so the blue outline envelopes the polygon, and then pressing the delete button on the keyboard.

7. To generate a polygon snapped to intersections move the cursor to the area of interest, the intersections will be identified by a cross (x). Left click the mouse on the intersections to make a closed boundary or polygon just like the below image. It is not necessary that the polygon vertices are defined at intersection points. Polygons can be drawn at any area of interest.

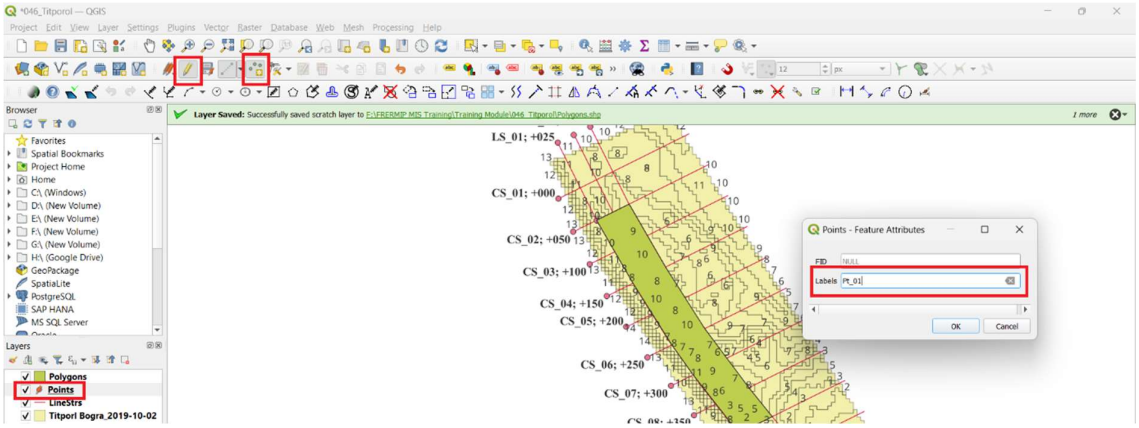


8. Save the defined polygons by clicking the Save-icon, and then turn off the Toggle Editing-icon in the Polygons layer and go to the Points layer. Turn on editing and snapping of that layer. Now snap to any of the polygon vertices and create a new point, a small window will be displayed. In the labels field of that window, name the area (e.g. **Area_01**, **Area_02** etc.). ***The Area labels must start with an 'A'***, and areas should be numbered from upstream to downstream.



Create a Set of Points on Existing Points Layer

1. First, turn off the snapping option in the Points layer, activate the Editing Toggle and select the Add Point Feature. Select points of interest, typically in areas where deep scour is likely to occur. When the user defines points by clicking on any point, a small window will pop up to allow the user to enter the Label associated with the Point. For example, **Pt_01**, **Pt_02**, **Pt_03**, etc. Again, remember to label points from upstream to downstream, and that ***the first character of all Labels must be a 'P'***.

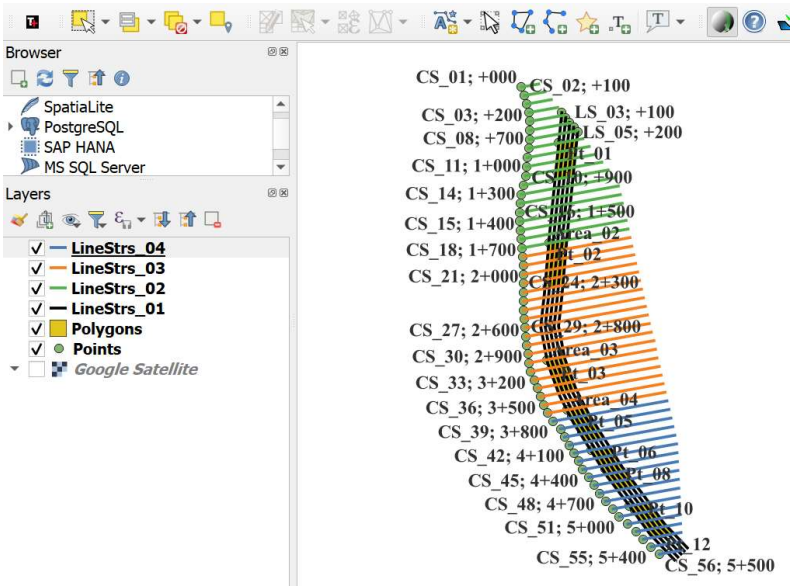


2. After defining all the points, click on the Save-icon to save the additions to file, and deactivate the Editing Toggle.

Creating Multiple Cross-Section Line-Sets

1. When the number of cross sections is large (e.g. 30 or more), create multiple cross-section line-sets, each in a separate layer, and make one separate layer for long-sections. This will make the analysis of the cross-sections faster and the vertical chart scale larger.

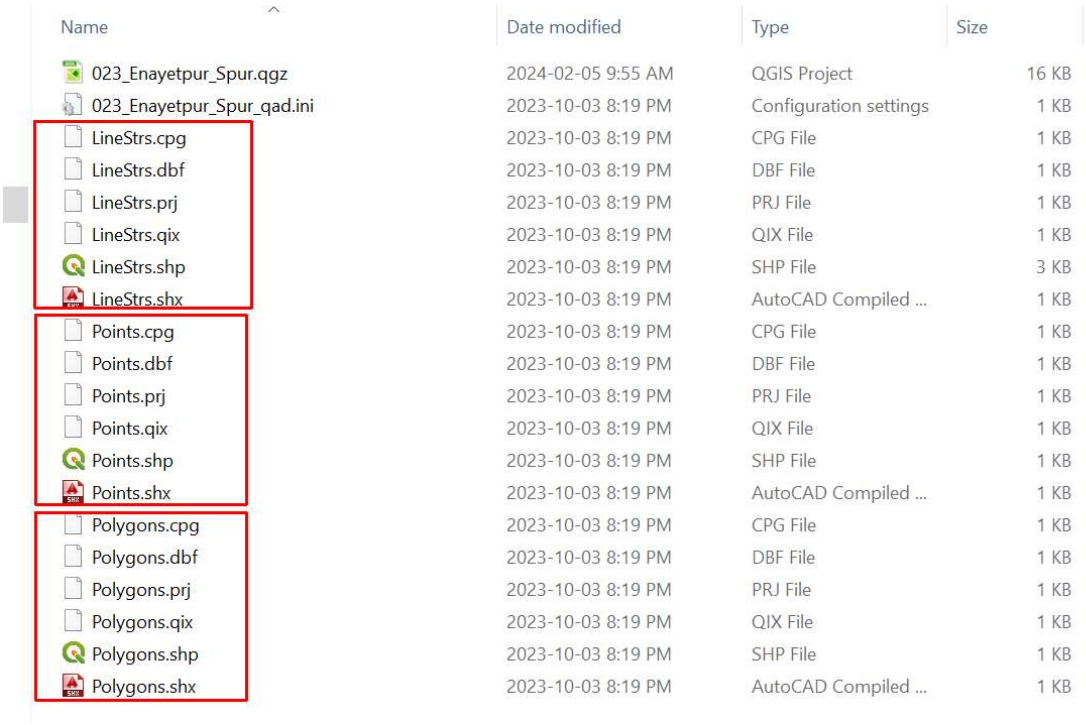
2. The ***names of the multiple linestring layers must be as follows: LineStrs_01, LineStrs_02, LineStrs_03, etc.*** Remember that the name these layers should be from upstream to downstream.



Saving and Checking Spatial Elements

1. After completing all Spatial Elements, save the QGIS Project (Ctrl-S), and exit the QGIS program.

2. Before submission of the completed Spatial Element Project to the administrators for import into the River Survey, do the following:
   - Go to the folder containing all the QGIS files for the Project and check that all Layers files are available, and all have the correct name.(***Renaming the layers in the QGIS will not rename the layer source files.***)
   - Remove all Outline, Contour, and Point files used to help define the Spatial Elements
   - Make sure that the project folder name starts with 3 digits that correctly defines the Project ID.
   - Zip the entire Project folder and email it to the administrator.



Name	Date modified	Type	Size
023_Enayetpur_Spur.qgz	2024-02-05 9:55 AM	QGIS Project	16 KB
023_Enayetpur_Spur_qad.ini	2023-10-03 8:19 PM	Configuration settings	1 KB
LineStrs.cpg	2023-10-03 8:19 PM	CPG File	1 KB
LineStrs.dbf	2023-10-03 8:19 PM	DBF File	1 KB
LineStrs.prj	2023-10-03 8:19 PM	PRJ File	1 KB
LineStrs.qix	2023-10-03 8:19 PM	QIX File	1 KB
LineStrs.shp	2023-10-03 8:19 PM	SHP File	3 KB
LineStrs.shx	2023-10-03 8:19 PM	AutoCAD Compiled ...	1 KB
Points.cpg	2023-10-03 8:19 PM	CPG File	1 KB
Points.dbf	2023-10-03 8:19 PM	DBF File	1 KB
Points.prj	2023-10-03 8:19 PM	PRJ File	1 KB
Points.qix	2023-10-03 8:19 PM	QIX File	1 KB
Points.shp	2023-10-03 8:19 PM	SHP File	1 KB
Points.shx	2023-10-03 8:19 PM	AutoCAD Compiled ...	1 KB
Polygons.cpg	2023-10-03 8:19 PM	CPG File	1 KB
Polygons.dbf	2023-10-03 8:19 PM	DBF File	1 KB
Polygons.prj	2023-10-03 8:19 PM	PRJ File	1 KB
Polygons.qix	2023-10-03 8:19 PM	QIX File	1 KB
Polygons.shp	2023-10-03 8:19 PM	SHP File	1 KB
Polygons.shx	2023-10-03 8:19 PM	AutoCAD Compiled ...	1 KB

H-12 ADDITIONAL TIPS AND RESOURCES

1. When editing layers, check that you have selected the correct layer, and perhaps consider turned off the other layers not being edited.

2. Label everything as described in this manual, otherwise the import program will not recognize them and it will produce errors.

3. For additional tips on digitizing (creating spatial elements) go to the following links:

- https://docs.qgis.org/3.28/en/docs/training_manual/create_vector_data/create_new_vector.html
- https://docs.qgis.org/3.28/en/docs/user_manual/working_with_vector/editing_geometry_attributes.html
- https://www.hpc.msstate.edu/publications/docs/2022/08/16714GEOProjectGeoQDigtize_Aug22.pdf
- https://www.youtube.com/watch?v=p-I_8rDZGcI&ab_channel=WiseGIS%28WisemanKelonye%29
-

FRERMIP Spatial MIS Database

Appendix-I: Additional MIS Database Topics

Contents

I-1 INTRODUCTION

1. This Appendix provides a set of miscellaneous topics that will help Administrators understand how water levels are calculated, how the 4 FRERMIP Databases are structured, and other useful information. Topics include:
   - River Survey Water Levels Database Structure
   - Calculating Survey Water Levels
   - Database Table and Column Structure
   - Useful SQL Script Files
   - Useful PostGIS Functions

I-2 RIVER SURVEY WATER LEVEL DATABASE STRUCTURE

1. This section describes how BWDB Station Water Levels are stored in the River Survey database and how survey water levels are calculated.

2. Water levels on the date that the survey was conducted are extracted from the Water Level database for BWDB Stations upstream and downstream of the Project associated with the Survey, and stored in the 'survey'-table.

3. From these stored upstream and downstream Stations water levels, a survey water level is calculated and also stored in the 'survey'-table using the upstream and downstream BWDB Station locations, and the centroid (center of gravity) of the survey outline boundary as the location of the survey.

4. Water levels at the mid-points of every intersecting cross-section, and intersecting end-points of every longitudinal-section, are calculated in real time for selected surveys and displayed in charts, reports and exported CSV-files but are ***NOT*** stored in the database.

5. Water level information in the River Survey database is stored in 3 tables:

   sta_wl — Contains the BTM location (Easting & Northing) of each BWDB Water Level Station used to calculate survey water levels. This table also contains the BWDB station code and name (e.g. SW50.6, Aricha).

   project — Contains the upstream and downstream BWDB Station code used to calculate water levels for ***ALL*** 'surveys' associated with the 'project'.

   survey — Contains 3 stored water level fields:

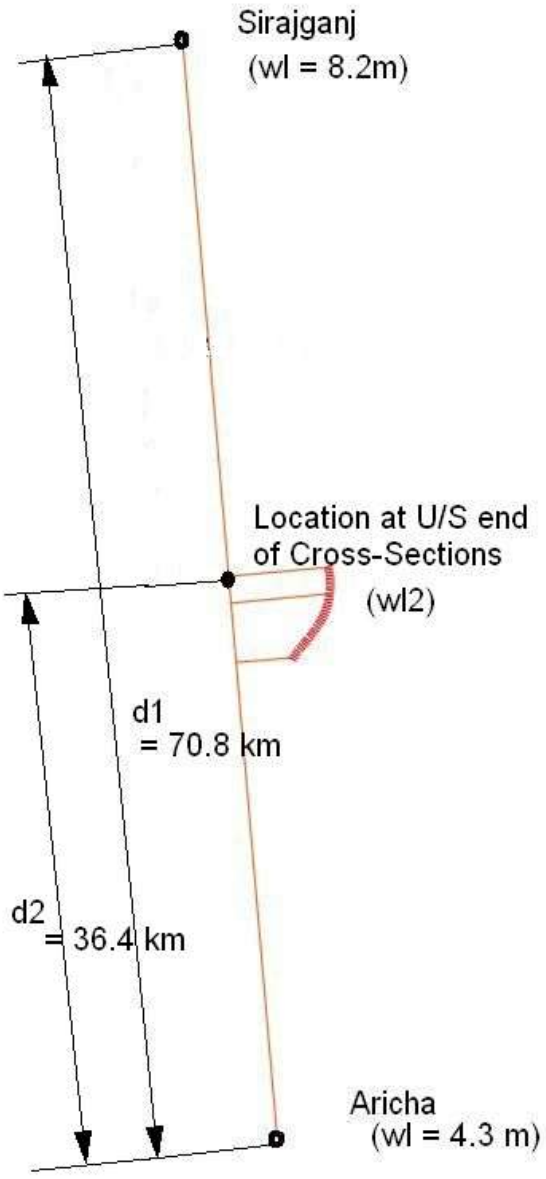
   - wl_us — Water level at the 'project' upstream BWDB station on the 'survey' date.
   - wl_ds — Water level at the 'project' downstream BWDB station on the 'survey' date.
   - wl_surv — Water level at the 'survey' centroid calculated from the 'wl_us' and 'wl_ds'-field values.

   The 'wl_us' and 'wl_ds'-fields are extracted from Water Level Database, while the 'wl_surv' water level is calculated at the centroid (center of gravity) location of the 'survey'.

I-3 WATER LEVEL CALCULATION METHODOLOGY

1. The Survey water levels (at centroid, cross-section and longitudinal locations) are calculated using the following methodology.

2. The upstream and downstream BWDB station water levels and locations stored in the 'sta-wl' and 'project'-tables are used to linearly interpolate water levels at individual survey centroid, cross-section and longitudinal locations. The distance between the upstream and downstream stations is compared with the distance from the downstream station to the desired survey water level location which has been transposed (shifted) onto the same line as defined by the 2 stations (refer to the example in the sketch below) .

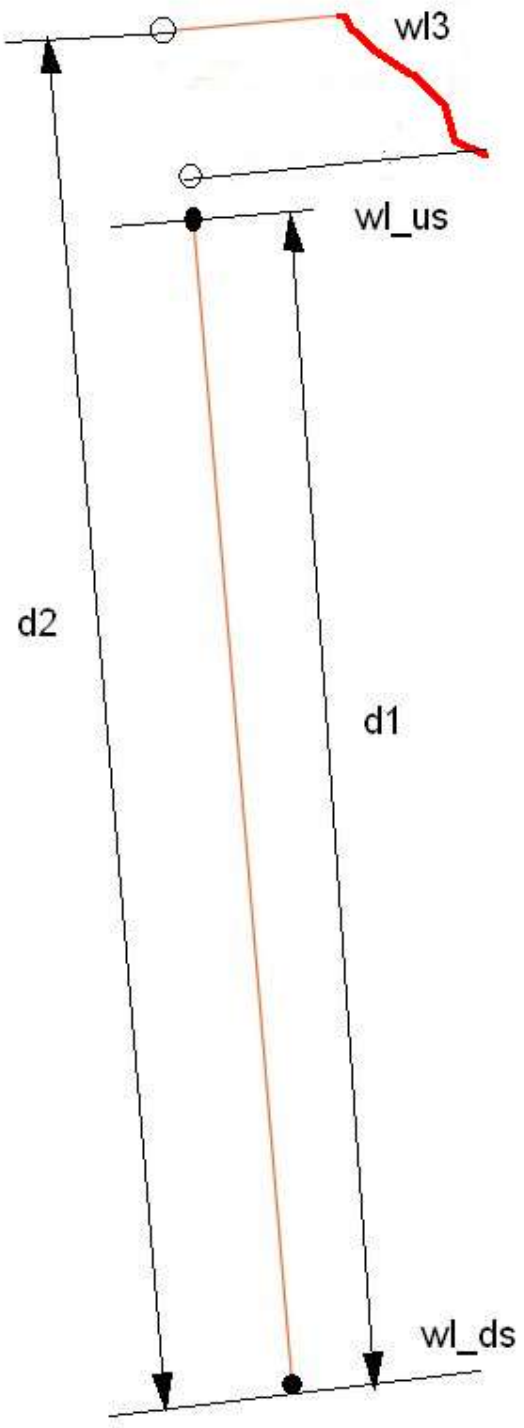


Given the following:
d1 = 70.8 km
d2 = 36.4 km
wl_us = 8.2 m
wl_ds = 4.3 m

By linear interpolation, it follows that the water level at the location at the U/S end of Cross-Sections (wl2) is:
wl2 = wl_ds + (wl_us – wl_ds) * (d2 /d1)

= 4.3 + (8.2 – 4.3) * (36.4/70.8) = 6.3 m

3. The algorithm developed to transpose (shift) from the actual location where the water level is required (e.g. wl3 at U/S end of the Longitudinal-Section) to the line defined by the upstream and downstream BWDB stations (wl_us and wl_ds), allows the Longitudinal-Section point to be upstream of the upstream BWDB Station (or conversely downstream of the downstream BWDB station).



Using the same water level stations but a ***different*** survey located just upstream of upstream station, the water level calculation at wl3 would be as follows :

d1 = 70.8 km
d2 = 90.8 km
wl_us = 8.2 m
wl_ds = 4.3 m

By linear interpolation, it follows that the water level at the location at the U/S end of the Longitudinal-Section (wl3) is:
wl3 = wl_ds + (wl_us – wl_ds) * (d2 /d1)

= 4.3 + (8.2 – 4.3) * (90.8/70.8) = 9.3 m

I-4 DATABASE TABLE AND COLUMN STRUCTURE

The tables below show the schema, table name, column name, and data type for every column in all 4 databases.

River Survey Database

schema	table	column	data type
public	boundary	base_elev	integer
public	boundary	geom	polygon, 900917
public	boundary	id	integer
public	boundary	proj_id	integer
public	boundary	remarks	text
public	boundary	title	text
public	element	geom_type	character varying
public	element	id	integer
public	element	table_nm	character varying
public	element	title	character varying
public	element	user_type	character varying
public	line_set	geom	multilinestring, 900917
public	line_set	id	integer
public	line_set	labels	ARRAY
public	line_set	orientation	text
public	line_set	proj_id	integer
public	line_set	title	text
public	long_set	geom	linestring, 900917
public	long_set	id	integer
public	long_set	proj_id	integer
public	long_set	title	text
public	point_set	geom	multipoint, 2d, 900917
public	point_set	id	integer
public	point_set	labels	ARRAY
public	point_set	proj_id	integer
public	point_set	title	text
public	project	geom	linestring, 900917
public	project	geom_survey_id	integer
public	project	id	integer
public	project	orientation	character varying
public	project	river_nm	text
public	project	sta_wl_ds	character varying
public	project	sta_wl_us	character varying
public	project	title	text

River Survey Database **continued…**

schema	table	column	data type
public	sta_wl	PWDtoSOB_dt	Date
public	sta_wl	PWDtoSOB_val	real
public	sta_wl	code	text
public	sta_wl	easting	real
public	sta_wl	id	integer
public	sta_wl	latitude	real
public	sta_wl	longitude	real
public	sta_wl	northing	real
public	sta_wl	title	text
public	survey	cell_sz	double precision
public	survey	cont_int	double precision
public	survey	corrupted	boolean
public	survey	dt	date
public	survey	geom	linestring, 900917
public	survey	id	integer
public	survey	proj_id	integer
public	survey	pwd2sob_conv	real
public	survey	remarks	character varying
public	survey	title	character varying
public	survey	wl_ds	real
public	survey	wl_ds_easting	real
public	survey	wl_ds_northing	real
public	survey	wl_surv	real
public	survey	wl_us	real
public	survey	wl_us_easting	real
public	survey	wl_us_northing	real
public	system_interface	main_menu_label	text
public	system_interface	main_menu_url	text
public	system_interface	ver_dt_str	text
public	system_interface	ver_no_str	text
public	user_info	id	integer
public	user_info	login_password	character varying
public	user_info	login_usernm	character varying
public	user_info	user_nm_first	character varying
public	user_info	user_nm_last	character varying
public	user_info	user_type	character varying
public	P00????	z	real
public	P00????	geom	point, 2d, 900917
public	C00????	elev	real
public	C00????	geom	polygon, 900917

River Survey Database **continued…**

schema	table	column	data type
imports	_ents_boundary	base_elev	integer
imports	_ents_boundary	geom	polygon, 900917
imports	_ents_boundary	id	integer
imports	_ents_boundary	proj_id	integer
imports	_ents_boundary	remarks	text
imports	_ents_boundary	title	text
imports	_ents_line_set	geom	multilinestring, 900917
imports	_ents_line_set	id	integer
imports	_ents_line_set	labels	ARRAY
imports	_ents_line_set	orientation	text
imports	_ents_line_set	proj_id	integer
imports	_ents_line_set	title	text
imports	_ents_long_set	geom	linestring, 900917
imports	_ents_long_set	id	integer
imports	_ents_long_set	orientation	text
imports	_ents_long_set	proj_id	integer
imports	_ents_long_set	title	text
imports	_ents_point_set	geom	multipoints,2d, 900917
imports	_ents_point_set	id	integer
imports	_ents_point_set	labels	ARRAY
imports	_ents_point_set	proj_id	integer
imports	_ents_point_set	title	text

ADCP Database

schema	table	column	data type
public	sta_wl	code	text
public	sta_wl	easting	real
public	sta_wl	id	integer
public	sta_wl	latitude	real
public	sta_wl	longitude	real
public	sta_wl	northing	real
public	sta_wl	title	text
public	survey	discharge	real
public	survey	dt	date
public	survey	id	integer
public	survey	links	text
public	survey	t_id	integer
public	survey	wl	real
public	survey	wl_ds	real
public	survey	wl_us	real
public	system_interface	main_menu_label	text
public	system_interface	main_menu_url	text
public	system_interface	ver_dt_str	text
public	system_interface	ver_no_str	text
public	transect	geom	linestring, 900917
public	transect	id	integer
public	transect	links	text
public	transect	sta_wl_ds	text
public	transect	sta_wl_us	text
public	transect	title	text
public	user_info	login_password	text
public	user_info	login_usernm	text
public	user_info	user_id	integer
public	user_info	user_nm_first	text
public	user_info	user_nm_last	text
public	user_info	user_type	text
public	z00????	file_data	bytea
imports	tmp_transect	geom_str	text
imports	tmp_transect	id	integer
imports	tmp_transect	links	text
imports	tmp_transect	sta_wl_ds	text
imports	tmp_transect	sta_wl_us	text
imports	tmp_transect	title	text

Float Track Database

schema	table	column	data type
public	segment	dt	date
public	segment	seg_id	integer
public	segment	sur_id	integer
public	survey	id	integer
public	survey	title	text
public	system_interface	main_menu_label	text
public	system_interface	main_menu_url	text
public	system_interface	ver_dt_str	text
public	system_interface	ver_no_str	text
public	user_info	id	integer
public	user_info	login_password	character varying
public	user_info	login_usernm	character varying
public	user_info	user_nm_first	character varying
public	user_info	user_nm_last	character varying
public	user_info	user_type	character varying
public	vel_pt	geom	point, 2d, 900917
public	vel_pt	id	integer
public	vel_pt	seg_id	integer
public	vel_pt	sur_id	integer
public	vel_pt	vel	real
imports	temp_survey	dt	date
imports	temp_survey	seg_id	integer
imports	temp_survey	vel	real
imports	temp_survey	x	real
imports	temp_survey	y	real

Water Level Database

schema	table	column	data type
public	db_sta_adcp	sta_cd	text
public	db_sta_rivsur	sta_cd	text
public	pwd2sob	pwd2sob_conv	real
public	pwd2sob	sta_cd	text
public	sta	datum	text
public	sta	district_code	character varying
public	sta	easting	integer
public	sta	hyd_div_code	character varying
public	sta	hyd_sec_code	character varying
public	sta	hyd_sub_div_code	character varying
public	sta	latitude	real
public	sta	longitude	real
public	sta	northing	integer
public	sta	river_id	real
public	sta	river_nm	character varying
public	sta	sta_cd	character varying
public	sta	sta_nm	character varying
public	sta	union_nm	character varying
public	sta	upazila_code	character varying
public	sta	village	character varying
public	sta_wo_pwd2sob	sta_cd	text
public	system_interface	main_menu_label	text
public	system_interface	main_menu_url	text
public	system_interface	ver_dt_str	text
public	system_interface	ver_no_str	text
public	user_info	login_password	text
public	user_info	login_usernm	text
public	user_info	user_id	integer
public	user_info	user_nm_first	text
public	user_info	user_nm_last	text
public	user_info	user_type	text
public	wl	dt_tm	timestamp without time zone
public	wl	sta_cd	character varying
public	wl	wl	real

I-5 USEFUL SQL SCRIPT FILES

Some of the useful SQL script files that were used in the development of the 4 FRERMIP databases are shown below with a description and sample code.

Description	Sample Code
Change SRID (projection) to BTM	SELECT UpdateGeometrySRID('public', 'fullriver_outline_20160930', 'geom', 900917);
Check if schema table exists	SELECT EXISTS (SELECT 1 FROM information_schema.tables WHERE table_schema = 'temp' AND table_name = 'qgis_elements');
Count number records in a table	SELECT count(*) FROM survey
Export table contents to a text file	COPY (SELECT x,y,z FROM temp.mbes) TO 'C:\temp\MBES_Data\Merged_data_0.1m_DRB.txt' DELIMITER ' ';
Summary of River Survey data history	SELECT project.title, COUNT(survey.id) AS num_surveys, MIN(dt) AS min_dt, MAX(dt) AS max_dt FROM project INNER JOIN survey ON project.id=survey.proj_id GROUP BY project.id ORDER BY project.title
Get all column data type	SELECT * FROM information_schema.columns WHERE table_name ='z000022'
Get all column geometry values	SELECT * FROM geometry_columns WHERE f_table_name = 'vel_pt'
Import a csv file to an existing table	COPY qgis_elements FROM 'c:/temp/qgis_elements.csv' CSV HEADER;
Import text data into existing table.	COPY temp.mbes (x,y,z) FROM 'C:\temp\MBES_Data\Merged_data_0.1m.txt' DELIMITER ' ';
Defines range of survey dates required by each BWDB Water Level Station.	SELECT sta_wl.code, max(dt) AS Max_Dt, min(dt) AS Min_Dt FROM sta_wl INNER JOIN (SELECT id, sta_wl_us AS sta_wl FROM project UNION SELECT id, sta_wl_ds FROM project) AS s1 ON s1.sta_wl=sta_wl.code INNER JOIN survey ON survey.proj_id=s1.id GROUP BY sta_wl.code ORDER BY sta_wl.code;
Reverses the order of all cross-sections in a 'line_set'-record	UPDATE line_set SET geom=ST_REVERSE(geom) WHERE proj_id=13;
Update project geometry from an existing survey geometry	UPDATE project SET geom = survey.geom FROM survey WHERE survey.id = project.geom_survey_id AND project.id=survey.proj_id AND project.geom IS NULL;
set all survey water levels to null	UPDATE survey set wl_us = NULL, wl_ds = NULL, wl_surv = NULL;
If current upstream and survey water levels are null, updates survey upstream water levels using data from the Water Level database using the dblink extension	UPDATE survey SET wl_us = s3.wl FROM (SELECT s2.id, s1.sta_cd, s1.dt, s1.wl FROM (SELECT * FROM dblink('host=localhost user=postgres password=FRERMIP dbname=Water_Level', 'SELECT wl.sta_cd, DATE(dt_tm) AS dt, ROUND(AVG(wl)::numeric,2) AS wl FROM wl INNER JOIN db_sta_rivsur ON wl.sta_cd = db_sta_rivsur.sta_cd GROUP BY wl.sta_cd, dt') AS x(sta_cd text, dt date, wl real)) s1 INNER JOIN (SELECT survey.id, sta_wl_us AS sta_cd, dt FROM project INNER JOIN survey ON survey.proj_id=project.id WHERE survey.wl_us IS NULL AND survey.wl_surv IS NULL) s2 ON s1.sta_cd = s2.sta_cd AND s1.dt=s2.dt) s3 WHERE survey.id = s3.id;

I-6 USEFUL POSTGIS FUNCTIONS

PostGIS has a large number of functions which are very useful to extract and analyze spatial geometric fields.
An entire list of functions is available in the webpage: https://postgis.net/docs/reference.html

The following is a set of common functions (name and brief description) which were used during the development of the River Survey database interface:
ST_Area — Returns the area of the surface if it is a Polygon or MultiPolygon.
ST_AsText — Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.
ST_Boundary — Returns the closure of the combinatorial boundary of this Geometry.
ST_Buffer —Returns a geometry covering all points within a given distance from the input geometry.
ST_Contains — Returns true if and only if no points of B lie in the exterior of A, and at least one point of the interior of B lies in the interior of A.
ST_ConvexHull — Returns the minimum convex geometry that encloses all geometries within the set (wraps an elastic band around a set of geometries).
ST_Dump — Returns a set of geometry_dump (geom,path) rows, that make up a geometry g1.
ST_DumpPoints — Returns a set of geometry_dump (geom,path) rows of all points that make up a geometry.
ST_DWithin — Returns true if the geometries are within a given distance
ST_EndPoint — Returns the last point of a LINESTRING or CIRCULARLINESTRING geometry as a POINT.
ST_ExteriorRing — Returns a line string representing the exterior ring of the POLYGON geometry.
ST_GeometryN — Return the 1-based Nth geometry if the geometry is a (MULTI)POINT, (MULTI)LINESTRING or (MULTI)POLYGON.
ST_GeomFromText — Constructs a PostGIS ST_Geometry object from the OGC Well-Known text representation..
ST_Intersection —Returns a geometry that represents the shared portion of geomA and geomB.
ST_Intersects — Returns TRUE if the Geometries/Geography "spatially intersect in 2D" - (share any portion of space).
ST_Length — Returns the 2D length of the geometry if it is a LineString or MultiLineString.
ST_MakeLine — Creates a Linestring from point, multipoint, or line geometries.
ST_MakePoint — Creates a 2D,3DZ or 4D point geometry.
ST_MakePolygon — Creates a Polygon formed by the given shell. Input geometries must be closed LINESTRINGS.
ST_NPoints — Return the number of points in a geometry.
ST_PointN — Return the Nth point in the first LineString or circular LineString in the geometry.
ST_ReducePrecision — Returns a valid geometry with all points rounded to the provided grid tolerance, and features below the tolerance removed.
ST_Reverse — Return the geometry with vertex order reversed.
ST_SetSRID — Set the SRID on a geometry to a particular integer value.
ST_StartPoint — Returns the first point of a LINESTRING geometry as a POINT.
ST_Transform — Return a new geometry with its coordinates transformed to a different spatial reference.
ST_Union — Unions the input geometries, merging geometry to produce a result geometry with no overlaps.
ST_Within — Returns true if the geometry A is completely inside geometry B
ST_X — Return the X coordinate of the point, or NULL if not available. Input must be a point.
ST_Y — Return the Y coordinate of the point, or NULL if not available. Input must be a point.