

Future proofing the Styx Living Laboratory Website

A summer scholarship funded by SLLT.

Final Report by

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Report Summary

Background: The Styx Living laboratory trust (SLLT) website was originally designed as a place where users could access information about SLLT, both static and interactive. The interactive information took the form or up to date graphs which charted data collected on a regular basis to monitor a number of activities at a number of sites. Unfortunately, in recent times this functionality has not worked as well as it should. It was decided, given the website was designed using a now obsolete platform that a new fresh, cost effective approach should be investigated. The trust put forward money to sponsor a summer student to investigate cost effective means by which information, both static and interactive could be readily available to users making use of a platform which would be easily learnable for volunteers to update.

Objective: The purpose of this project was to test a number of content management systems to see which one is more suitable for migrating from current system. The main brief given for the new content management system was that it should be cost effective and relatively simple for a range of people to use and update information into.

Methods: Three CMSs (WordPress, Joomla and Drupal) are chosen to be trialled because of their popularity. Each of these systems are available in their most basic form free as open systems. An open source system is typically developed by a community of developers and made available for use as a testing ground. The advantages of open source systems are they are free (in their basic form) the main disadvantage is the level of support available. The features tested are mainly fundamental content management functions (such as editing articles, menus, sidebars, etc.), and how to replicate the water quality monitoring form and chart.

Results: After investigation, WordPress is found to be the easiest to build simple websites. However, its limited default features make it difficult to build complex websites because a lot of add-on features are required to enhance the functionality.

Joomla was found to be relatively straightforward to use, with a reasonable number of default features as well as add-ons. However, Joomla does not have the functionality to build the type of complex charting that is required for the SLLT website.

Drupal was found to have the most powerful and flexible functionality among these three options. This functionality did include the availability of chart building add-ons which could be used with some tuition for users. The main disadvantage of Drupal is that it is not as easy to learn or to use as the other two systems trialled.

Conclusion: WordPress is ruled out for its limited functions. This leaves two choices from these three Joomla or Drupal. The trade-off for picking Joomla over Drupal is the lack of charting functionality, whereas the trade-off in picking Drupal over Joomla is that this tool is more difficult to learn and therefore may put a novice user off.

Report Structure

This report is divided into to six sections and four appendices.

Section one is an introduction to the product, background on the current SLLT web site and an introduction to possible new web platforms.

Section two provides a comprehensive overview of the three systems tested for this project. Section three compares each of these systems for a number of different function requirements.

Section four provides an overview of potential issues, section concludes this report with recommendations for the required system.

The final sections include project acknowledgments a bibliography and four appendices.

1 Appendix one provides a quick overview of how to migrate to a new system. Appendix two is a how to for Drupal with append three giving instructions on form creation in Drupal. Appendix four is a how to for Joomla.

1. Introduction

The purpose of this document is to report on the scoping exercise undertaken to source a different web platform on which the Styx living laboratory trust (SLLT) website will run.

SLLT is a charitable trust created to develop a living laboratory focusing on the Styx River area of Christchurch. As such the trust is staffed by volunteers who, amongst other things, to maintain a public presence some time ago the trust invested in a public website. The idea of the website is to provide information about the trust, the work they do and the general area they maintain to the public. One of the most important features of this website are the interactive chart visualisations that display updated data gathered from a number of the sites regularly monitored by SLLT volunteers.

Currently the SLLT website is provided using a proprietary content management system that was written and maintained by Cabbage Tree. The site was originally set up with the functionality to display graphs that display, for a site, data relating to such things as water quality etc. The idea behind this functionality is to allow a user to view updated data for a particular site (or sites) and for a particular variable(s). Users (volunteers) can update the data by submitting this to the database from which the webpage is extracting its information. Unfortunately this feature does not work as well as it could, with several broken links etc. A screenshot of an example graph from the current site is shown below:



The purpose of this project is to test several open-source free CMSs to see if they are suitable for migration of the current website to an environment which is cost effective and easy for SLTT trust members and volunteers to update and maintain.

As a part of the scoping exercise a meeting was held with a number of volunteers at the meeting point on a day where they were collecting samples. At this time those present were asked, very generally, for their views on the current website, what they saw as being useful and what kind of features they thought would make the current site better.

2. Overview of systems tested

For this project three open source content management systems (CMS) are reviewed as suitable replacements for the current system. The systems tested and reported on are WordPress, Joomla and Drupal. These systems are all what is known as open-source software. Open-source software is usually developed within a community of developers, with users able to make or suggest changes. This software is usually freely available at little or no cost to the user. Each of these has basic content management functionalities, including editing articles, displaying different content on sidebars, header, and footer. They also have more complex features such as form or graph. The pros and cons of each of these systems in relations to the current system will be discussed in the sections that follow.

2.1. WordPress

WordPress was originally designed as a blog site, but has evolved into a fuller featured content management system (CMS). The current WordPress platform can offer either simple or more complicated solutions for people looking for a cost effective web solution. At its very basic level WordPress is free and offers people the opportunity to create their own static web pages. They do this by choosing a WordPress theme which controls the formatting for the pages used. At this level the functionality is very, limited and restricted to static web authoring.

Below is a screen capture of the administrative view of WordPress. This CMS is praised by non-technical persons because of its ease of use and ease by which a simple site can be set up. Users

should be able to figure out what most default functions are and be able to work through the administrative interface without reading a large amount of documentation. Most of the sections appear to be straightforward. The labels used in the navigation areas such as the sidebars, are in most part self-explanatory.

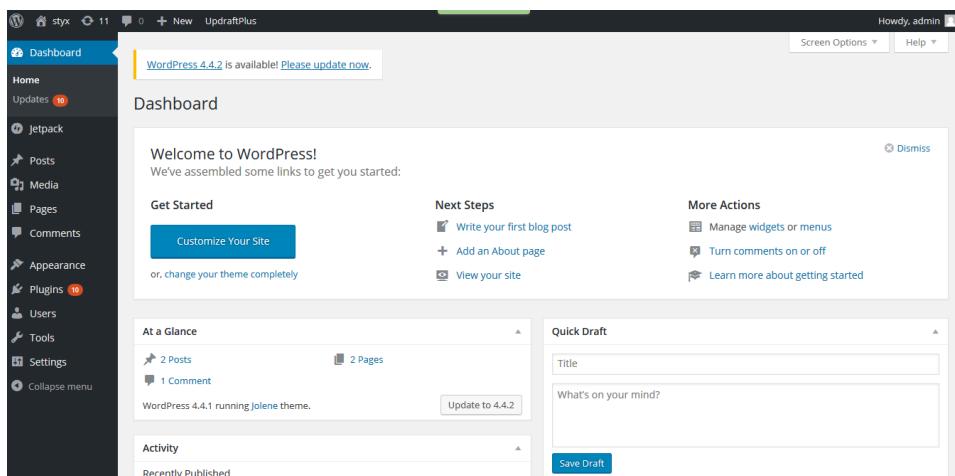
Examples of the sections on offer include:

Media. This is where you store and edit pictures, videos, files, etc.

Appearance. This is where changes to the display of the website can be made.

Posts and pages are two types of content area. Posts are similar to blog, while pages are just static pages.

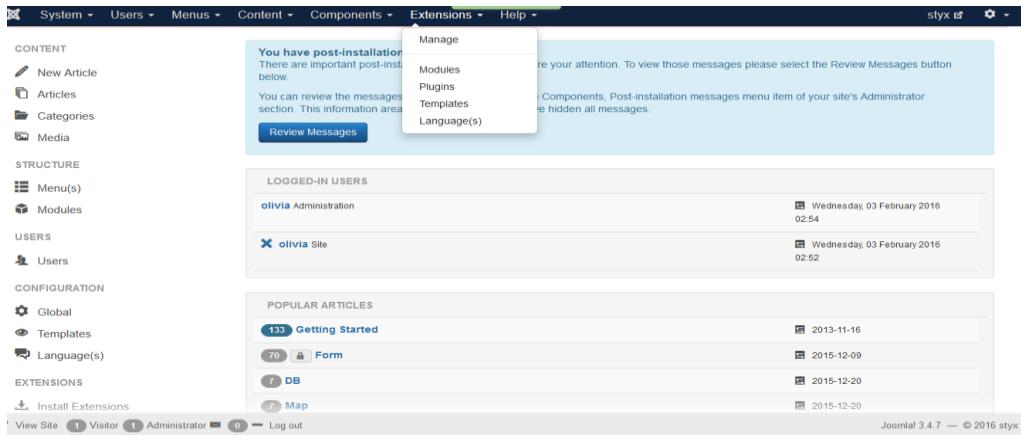
Below is an example of the WordPress dashboard.



2.2. Joomla

Joomla was designed as primarily as a content management system (CMS). It is relatively straightforward to set up and use, especially for websites that are more complex than fully static sites. It should not be too difficult for a non-technical person to maintain and update the website after it is built by a developer.

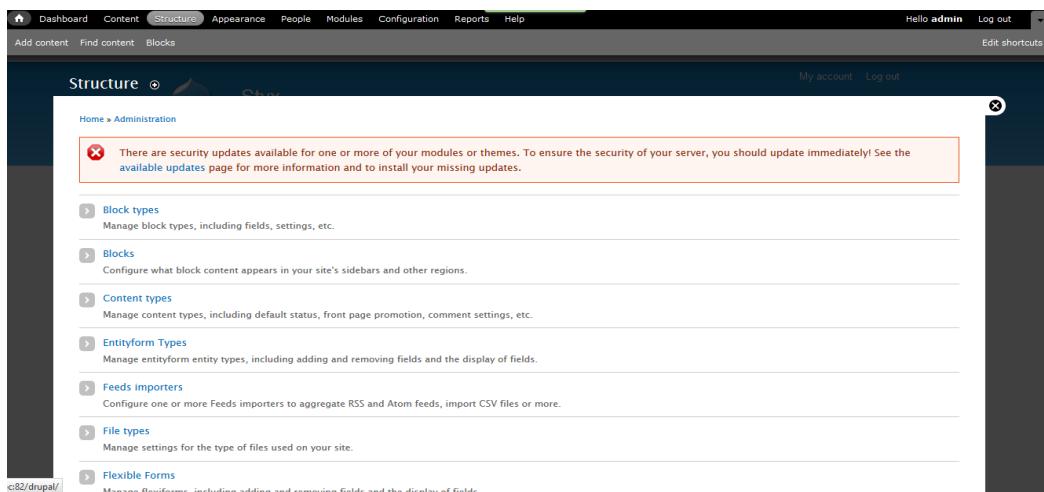
Below is a screen capture of the administrative view of Joomla. As can be seen, the structure is organized and appears to be comprehensive. However, there are some terms used that may not be fully understandable for a novice user, but are terms that people with some development experience would easily understand after reading some documentations. For instance, the complicated extension system in Joomla and the nuances between component, module and plugin. Joomla only has one content type, article, which is a static page. And it is not easy to create user-defined content types.



2.3. Drupal

Drupal is often used for the backend framework of websites ranging from blog sites to business websites. It is very flexible and powerful, with the price of longer learning curve and complexity. It is relatively difficult to install, configure and deploy. However, some of these issues will be taken care of by the hosting company paid to host the site. To understand what Drupal is capable of and how to implement certain complicated features would require the developer to read a large amount of documentation. One of the downsides of Drupal is version incompatibility. The most current version available is Drupal 8, but not all of the features available in the previous version (Drupal 7) are compatible with Drupal 8. However, it is possible to get compatibility, this involves communicating with the Drupal development community, which means you could wait for quite a while before it is compatible.

Below is a screen capture of administrative view of Drupal. It is quite different from other two CMSs. The first row with black background is the toolbar, which is the navigation menu. The second row with grey background is the shortcut bar, which can be customized. By clicking the shortcut tabs, you can go to commonly used links more quickly. The section with white background is called administrative overlay, which would display after you click one of the navigation menu. The nice thing is that every part has a brief description under it to help users to understand what it does.



3. Comparison of systems

3.1. Content

Content is usually entered on to websites in content management systems by using a graphical editor. Often these editors have a similar look and feel to a word processor such as MSWord. Each of the three systems tested have their version of a content editor. Each of these editors will be discussed in the sections that follow.

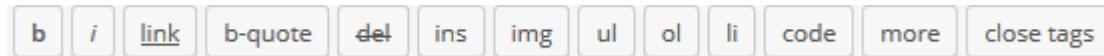
3.2. Editor

Editor is the tool with which users edit the pages. Most CMSs nowadays come with a WYSIWYG (what-you-see-is-what-you-get) editor. That means users do not have to write HTML (HyperText Markup Language), which displays the content of the page.

3.2.1. WordPress Editor

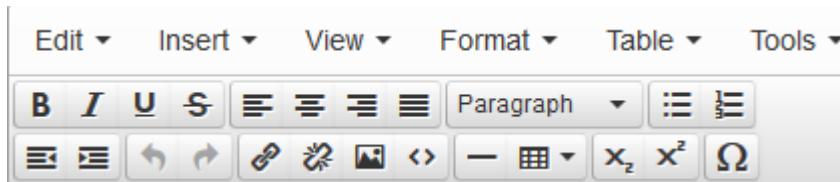
WordPress has a basic what-you-see-is-what-you-get (WYSIWYG) editor, as shown below. As you can see, there are only 13 options. These options include the standard things you might find in a word processor such as bold or italic etc.

The page section of the editor includes publish information, page attributes, featured image, custom fields if any, discussion, comments and an author area, generally speaking, functionality is limited. This is probably because WordPress was originally designed to build blogs. Users need to download an add-on just to insert a table without coding. WordPress has some editor add-ons to replace the default one.



3.2.2. Joomla Editor

Joomla has a sophisticated content management system editor. Its default page editor is fairly comprehensive with the user being able to insert tables as well as having access to basic formatting. Joomla also has an editor add-on called JCE (Joomla Content Extension). This feature is more convenient than the default one. For instance, to upload a file in the article for users to download, you need to upload it to media manager, copy the URL (link address), then paste it as a link in the article. JCE enables uploading and inserting files in situ.



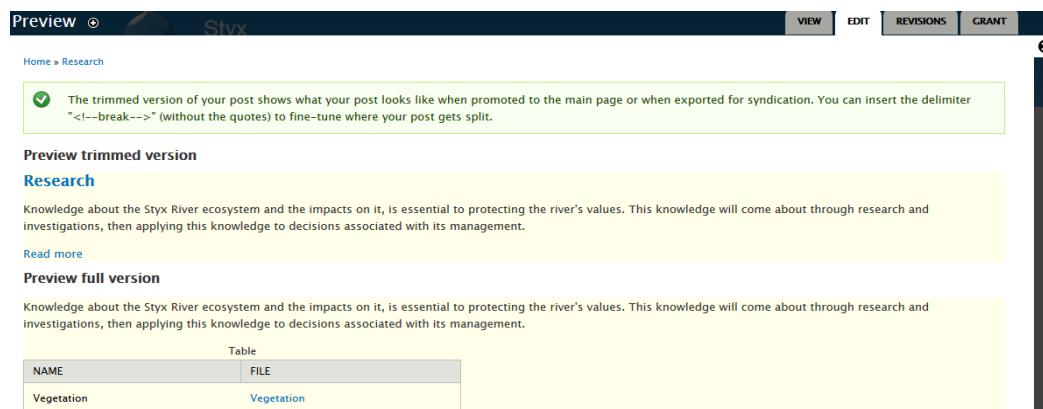
3.2.3. Drupal Editor

It is interesting that Drupal 7 does not have a default editor. All you can write is purely HTML. However, there are a lot of editor add-ons. In the later version of Drupal, Drupal 8, the developers finally made CKEditor available as a default. Four text formats options are available in CKEditor, including Full HTML, Filtered HTML, Plain text and PHP code. PHP code is a back-end scripting language, which could be used to create events and make websites more dynamic.

3.3. Web Preview function

Preview is the function which users can view the results as they would appear in a browser before they are published to the Web. This means that, rather than working live, you have the opportunity to make changes that do not interfere with what is currently available, but are able to see how your changes would look. This feature aids the ease of editing before you hit the publish button, potentially the whole world can see it and it would be a bit late if something was seriously wrong.

Both WordPress and Drupal have a build-in preview function. WordPress's preview would look exactly like what it is like after publishing. Drupal shows the preview in administrative overlay. It has both trimmed and full versions as the screen capture displayed.



In earlier versions of Joomla there was a default preview function. However this has been discontinued in the later versions requiring Joomla users of version 1.6 and later to use an add-ons such as Better Preview to achieve this goal.

3.4. Version Control

Each of the CMS trialled have the functionality to store different versions of content and to roll back to a previous version.

In WordPress, all the versions are saved automatically, even when users has not used the update function or the publish button. This means that a user can make changes, leave the page, and the content would still be saved.

In Joomla, revisions are only stored when user save the article.

In Drupal, the previous version is only stored when user chose to. Otherwise, the new version would overwrite the old one.

WordPress and Joomla both have functions to compare two revisions, but this is not available in Drupal. This comparison involves the highlighting of the differences in the versions.

Automatic revision storage of WordPress is a double-edged sword. The advantage is obvious, while the shortcoming is that a lot of unwanted revision would occupy too much memory of database over time. Users need to install extra add-ons to clean them.

Drupal uses a different approach. It lays all the convenience and burden on users. A sensible user would have a tidy database without the help of extra add-ons. However, when a user forgets to save revisions, the previous version is gone for good.

3.5. Screen options

There are a lot of things can be shown on a web page, including tags, categories, author, create date, publish date, print icon, email icon, voting, hits, etc.

In WordPress, the default is to show the author, publish date and comments on the posts (one of the content type, like blog), but not pages (the other content type, static page). You cannot change the setting. To add a printable link, you need an add-on like WP-Print, but it would not show up in sidebars.



In Joomla, this feature is just called options. You can choose to show, hide them in every article or use global (default setting of the template). Since these are all built-in features, so users do not need to install add-ons.

A screenshot of the Joomla 'Content' tab options panel. It shows a list of options with dropdown menus, all set to 'Use Global'. The options include Show Title, Linked Titles, Show Tags, Show Intro Text, Position of Article Info, Show Category, Link Category, Show Parent, Link Parent, and Show Author. At the top, there are tabs for Content, Publishing, Images and links, Options, and a Cor tab. On the far right, there is a 'Screen Options' button.

In Drupal, there is no name for screen options. They just appear under the editor for users to choose. The default setting is similar to that in WordPress. Comments are open to article while closed to basic page. The difference is that user can change it. A module called “Printer, email and PDF version” could add print link to page. The location of link could display in the main content or sidebars.

The screenshot shows a Drupal content edit screen for a node titled "Research". The left sidebar lists several sections: "Menu settings" (Research), "Revision information" (No revision), "Printer, email and PDF versions", "URL path settings" (No alias), and "Comment settings" (Closed). The main content area has three sections: "Authoring information" (By admin on 2016-01-10 22:48:08 +0000) and "Publishing options" (Published). At the top of the main content area, there is a configuration for comments: a radio button for "Open" (disabled) and a checked radio button for "Closed", with the note "Users cannot post comments.".

3.6. Interaction with users

As a part of the scoping exercise a meeting was held with a number of volunteers at the meeting point on a day where they were collecting samples. During this meeting with volunteers, it was discovered that most volunteers seldom use the website because they felt there was no advantage for them to do so. Some were unaware of its existence. Others who had used it in the past had stopped doing so after a lot of the hyperlinks had stopped working correctly. One of the suggestions from volunteers for additions to the site was for the provision of a blog facility where users could add their own comments. They thought that a Blog type forum might be something that would attract people to site. They also mentioned that the trade-off for this type of functionality was the need for somebody to regularly monitor the site to prevent malicious comments etc.

WordPress has a built-in blog feature. Because WordPress was originally designed as a blog, it is relatively easy to create a blog page and to keep a separation between static pages and blog posts. Blog Posts are ordered in reverse chronological order and have comments, RSS (Really Simple Syndication, enables publishes to syndicate data automatically, without users check the website for new content manually), etc., while web pages do not have those features as they are designed to be static.

Joomla, because it was designed as a Content management System does not have built-in blog function. To have this functionality in a Joomla site it is necessary to download a blog add-ons such as BSMYjspace. Fortunately, there is a subcategory just called “Blog” under the category of “Authoring & Content” in Joomla Extensions Directory (Joomla official website’s add-on directory), which makes searching for suitable add-ons easy. Below is a screen capture of the blog subcategory add-ons search results, as you can see, there are quite a lot options.

Select some tags...

Type (c/p/m) Compatibility Free/paid Has demo

x -- Blog Order by Go

[Submit extension](#)

a - Blog

JaggyBlog Paid download Blog Ross Stevens SCORE: 100 43 reviews	MyJspace Free Blog Bernard Saulmē SCORE: 100 28 reviews	CjBlog Free Blog Maverick SCORE: 100 14 reviews
EasyBlog REMARKABLE BLOG COMPONENT	joom BLOG Blog like a Pro! Easy to set up & use blog component!	Blog Factory Ultimate Blogging Solution. 30 features 9 years in business

Drupal has built-in blog feature and forum, but by default, they are disabled. In Drupal 8, the blog has been removed, probably because it is similar to one of the content type, article.

3.7. Responsiveness to change in screen size

Both the latest versions of WordPress and Joomla are mobile-friendly. They are both responsive to the changing of screen size and have something like a hamburger menu (an icon consists of three horizontal lines, looks like double hamburger, and usually displays in extra-small size screen. When you click it, it would show all the menu items).

The default theme of Drupal 7 is not completely responsive. The content would squeeze in tablet-size screen, but not in cell phone-size screen. The menu is always responsive to the change of screen size. However, it turns into three rows of menus if users browse the website in cell phone instead of becoming a hamburger menu. Developers can download, install and enable a mobile-first theme. Alternatively, they can redesign the website according to the Drupal documentation “Responsive web design”¹. Now they made the default theme of Drupal 8 responsive as well.

3.8. User

Users of websites can fit into a number of different user categories. There are those who use the site only for content, those we have the need to update some of the content and those who have the need to access a lot of “backend” functions that make a website accessible. These users are divided up into roles which have a level of access (rights) associated with them. Each of these, in the relation to the SLTT site are described in the following section.

3.8.1. Roles

In the original website, at least four user roles are needed:

1. The site administrator, who build and maintain the website.
2. Trustees, who have access to all web pages.
3. Volunteers, who can upload or fill in the water monitor data, but not have access to secure zone.
4. The administrator, who helps volunteers to upload the water monitor data and update the website.

WordPress has five different roles, which should be adequate for the Styx website. If you want to change the permissions of a role or add a new role, an add-on like “User Role Editor” could be helpful.

Joomla has nine default roles, which is more than enough. Specific permissions can be defined and new roles can be created without any add-ons.

Drupal only has three default roles. However, permissions can be edited specifically and new roles can be created without add-ons similar to Joomla.

3.8.2. User Import

If content from the current website was to be transferred into a new system, some consideration needs to be given to how this information and the associated users (and rights) are migrated.

During migration of website, it is necessary to export existing users from the old CMS to the new one. All three CMSs have default functions to add users one by one. However, in our case, to import all the users at once might be more helpful.

In WordPress, an add-on called “Import users from CSV with meta” which can help to bulk import users. However, you can either import users for one role or import all of them at once, then change roles of some users to other roles later. There is a bulk action for that, but an add-on which enables importing users with different roles would be more helpful.

In Joomla, all the user import extensions for Joomla are not free. The cheapest one is \$8.99 USD. If there are not many users, you can create accounts for them manually.

In Drupal, an add-on called Feeds can create user importer. You can create custom fields in it, like first name, but you cannot assign user role with it. It does have some idiosyncrasies like if you want to import users, you need to click “import” link hidden in a description or type the URL in address bar if you can remember it, but it is free.

3.8.3. Levels of website access

In our original website, there are two zones. One of them is open to public, and shows “/new-zealand” in the URL. The other one is a secure zone, only accessible to trustees. The URL for the secure zone includes the word “/secure”. These different zones mean that the trustees or those with editing rights for the current site can access update functions and areas and it is kept quite separate from the way a user access the site.

Each of the three CMSs' tested for this project uses different roles to restrict user access at the different access levels. The default setting of WordPress is that a role can either access all the pages/posts or none of them. However, in our case, I would prefer the public can access only certain pages. The volunteers can have all the rights public have, plus have access to water quality monitoring form. And trustees can access all the pages. This goal could be achieved with the help of add-ons like "User Access Manager".

In Joomla, it is possible to choose the access level for different roles from either articles or from the menus. Moreover, they are all default settings, which means there are no concerns if the add-on is incompatible with current version of CMS, or for update issues, or conflicts with other add-ons.

Drupal's default setting is similar to WordPress's. An add-on called "Nodeaccess" can help to restrict access per node. Node is the term refers to a piece of content in Drupal, like page. It also includes poll, forum, etc., but this is beyond the scope of this section. The add-on would add a "grant" tab when you are editing as the screen capture displayed below.

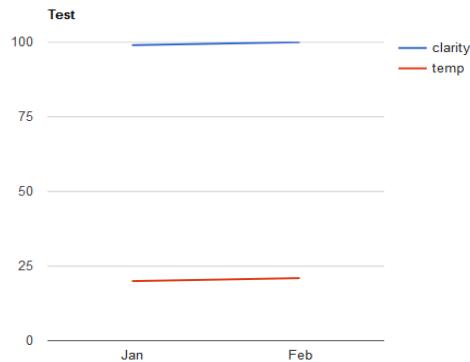
ROLE	VIEW	EDIT	DELETE
administrator	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
anonymous user	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
authenticated user	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.8.4. Data Visualization

Data visualisation is a discipline that uses table and chart to display data in a clearer and more vivid way. If the website is just paragraphs after paragraphs of plain text, it would become quite tedious. Data visualization is quite common nowadays because it adds some spice to the website. The data collected from water monitoring data is currently stored in some form of database. As it was not possible to view this it is difficult to comment about this. However, it would be sensible that this practice be continued and that the data be stored in a relational database. Relational database uses Structured Query language (SQL) statements to create, read, update, and delete data. Because of this, it was important to find add-ons in each of the three trial products that use SQL statements.

In WordPress, there is an add-on called "Display SQL Stats" which is free and intuitive. Although users cannot add axes labels, it is not really a problem in our case since Jan, Feb, etc. are self-explanatory. However, in the original website, there is a function that the data in chart and table would change according to location and year chosen by users. Display SQL Stats does not have this function and I could not reach the add-on author.

Display SQL Stats



Another plugin in WordPress called “wpDataTables” which uses SQL statements to fetch data from database as well, but the chart function is available only in full version. They have full-featured online sandbox for users to try. According to their online demo, data can be filtered by user-defined parameters². The price is AUD\$35³.

In Joomla, an add-on called Plotalot also uses SQL statements to fetch data to draw chart. The advantage is that 1. It can connect to external database. 2. It has a nice graphic user interface (the first screenshot below) which includes colour picker to change the colours of title, line and background. The disadvantages are 1. Axis title on bar and line charts for free version is “Plotalot Free”. 2. Free version does not include a plugin to insert into article and use variable. The price⁴ is from £8 (NZD \$18.13). An example line chart with some dummy data is shown in the second screenshot.

Chart

Name: Clarity
Type: Line graph
Size (W x H): 600 x 256
Title: Clarity
Background: F5FFB3
Database: mysql Host: localhost User: root
Extra options:
Extra columns:
Png link
Number of plots: 1
Sort plots Show raw data Show script

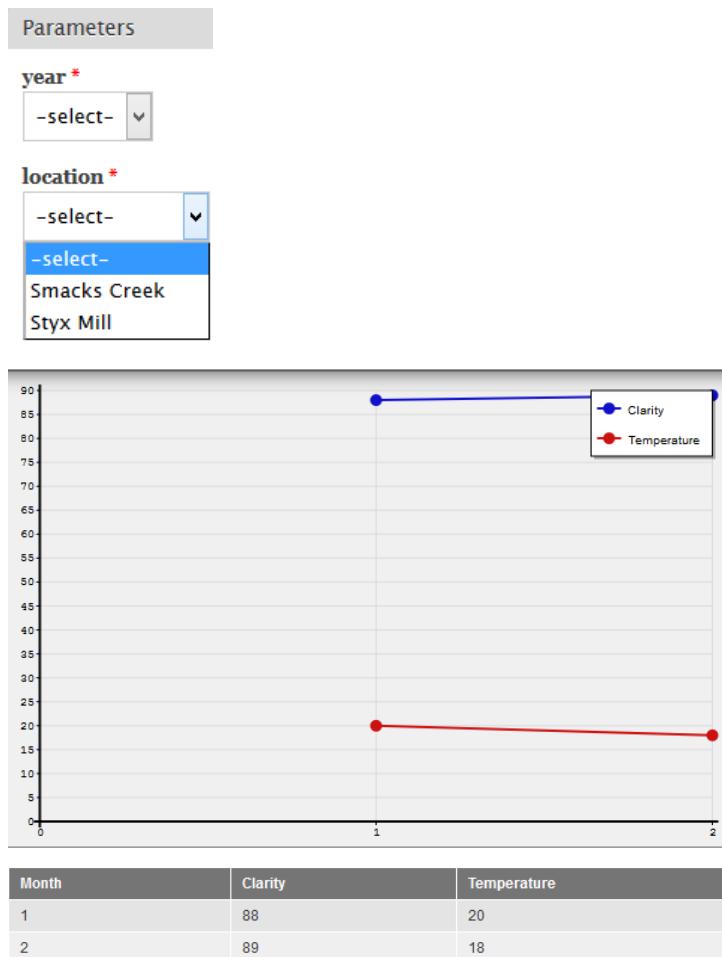
Axes

X axis title: Month
X axis start: 1
X axis end: 12
X Labels: 12
X label format: 99,999
Y axis title: Clarity
Y axis start: 0
Y axis end: 100
Y Labels: 0, 100
Y label format: 99,999



In Drupal, a free add-on called “Forena Reports” can fulfil almost every charting requirement except tabs that SLTT have asked for. Features included are:

1. Can connect to internal and external databases.
2. Display data in charts and tables based on the parameters chosen by user. It does have some idiosyncrasies such as a user can only generate one legend in the graphic user interface. To generate more legends, users need to find the report in the backend files, and find the code which generate the legends and change it.



3.9. Data entry Forms

Users need to be able to get and give information to a database and they do this usually by submitting a form. Each field of a form is linked to a field in the database. To fill in the blanks of a form is more straightforward than fill in the data in database directly. This way, users would not be able to mess around the normalized database and accidentally change the structure. Moreover, a free database like MySQL, which comes with all three CMSs, does not have an intuitive graphic user interface to insert, update and delete data. Users usually need to write SQL statements to achieve that.

A form is currently being used in the original website for volunteers and administrators to update the water quality monitoring data, a screen capture is shown below.

Recording Details

Date taken: * 1 April 2004

Name (of recorder): * Steve Holdoway

Location/sample site: * Brooklands

Time of recording: * 12 : 00 a.m.

General Comments

Characters remaining: 2000

Measurements & General Details

Weather:

Rainfall in previous 48hrs:

Air Temperature (°C):

Water Temperature (°C):

pH level:

Clarity: (readings 1, 2, 3 in cm)

Substrate (% within sampling area)

Silt/sand up to 2mm: %

Gravel 2 - 60mm: %

Small stones 60 - 120mm: %

Large stones 120 - 250mm: %

Large stones/rocks >250mm: %

Other material on stream bed:

All three CMSs have a lot of form add-ons. Most of them can only build simple contact forms. In our scenario, I need to build a rather complicated form contains various of fields, including short text, long text, date time picker, drop down list, check box, radio button and calculated fields (e.g. type in three clarity values and calculated the average automatically). Also, I need to submit the form data to internal or external database, so the chart add-on can use SQL statements to fetch the data and display them in a line graph and a table.

3.9.1. WordPress

WordPress free form add-ons do not have functions to submit data to database. Some add-ons allow users to view the data in the add-on user interface. Others add-ons email the data to users via email. Many paid add-ons enable submission to database. The price is approximately USD \$30 to 50. If you are willing to purchase, I would recommend an add-on called Caldera Form. It has all the field types needed in water quality monitoring form. You can use the add-on for free, but for the submission to database feature, you might need to talk to the add-on author. Unfortunately, support is only provided after purchase priority support subscription (USD 50/first month, 150/year). An example I found online is shown below⁵.

The screenshot shows the Caldera Forms plugin interface within a WordPress dashboard. The left sidebar includes links for Dashboard, Posts, Media, Pages, Comments, Caldera Forms (which is selected), Appearance, Plugins, Users, Tools, Settings, and Collapse menu. The main content area has tabs for Caldera Forms, Compact Contact, General Settings, and Update Form. Below these are Layout, Processors, Responsive, and Mailer tabs. A Layout Builder section features 'Add Row' and 'Add Element' buttons. On the right, there's a detailed configuration panel for a 'Name' field element. The 'Name' field is set to Single Line Text type, with 'Element Type' also listed. Other settings include 'Name' (Name), 'Hide Label' checked, 'Slug' (name), 'Required' checked, 'Description' (empty), 'Show in Entry List' unchecked, and 'Default' (empty). At the bottom right is a red 'Delete Element' button.

3.9.2. Joomla

Joomla is the only CMS tested that has free form add-on which can successfully submit data to database. I would recommend the use of an add-on called ChronoForms. This add-on has built-in

functions to connect to internal and external databases. Although passing data to external database requires writing own code, which in turn requires basic PHP knowledge.

An example with couple fields is shown below.

Recording Details

id	<input type="text"/>
Date taken: *	<input type="text"/>
Name of Recorder: *	<input type="text"/>
Location/sample site: *	<input type="button" value="Select a location"/> <div style="border: 1px solid #ccc; padding: 2px; width: fit-content;"> Select a location Brooklands Everglades Golf Course </div>
General Comments	<input type="text"/>

Measurements & General Details

Rainfall in previous 48hrs	<input type="checkbox"/>
Submit	

Powered by ChronoForms - ChronoEngine.com

[Prev](#) [Next](#)

3.9.3. Drupal

I recommend use Webform + Form Builder add-ons. These two add-ons are free. Developers still need to write own code to insert data to database. Webform is a well-established form module. There are a lot of modules extend the functionality of Webform⁶ including Webform Calculation Components, which enables calculated field. Form Builder add-on add a drag and drop GUI (graphic user interface) to it. Below is an image showing the Drupa form add-on interface. Information on creating a Drupal is available in Appendix 4. form

The screenshot shows the Drupal Form Builder interface. On the left, there is a 'Form preview' window displaying a form with sections for 'RECORDING DETAILS' and 'MEASUREMENTS & GENERAL DETAILS'. The 'RECORDING DETAILS' section contains fields for 'Date Taken' (with dropdown menus for Month, Day, Year), 'Recorder' (text input), and 'Location/sample site' (with a dropdown menu labeled 'Select'). The 'MEASUREMENTS & GENERAL DETAILS' section contains a single checkbox field for 'Rainfall in previous 48hrs' with options 'one', 'two', and 'three'. On the right, there is a sidebar titled 'Add a field' containing a grid of field types: Textfield, Textarea, E-mail, Number, Radios, Checkboxes, Select list, Grid, Date, Time, File, Hidden, Markup, and Fieldset. Each field type has a small icon and a brief description.

3.9.4. Custom functions used to submit to database directly from web page

None of the three CMSs tested for this project had any available add-ons that could be used to submit data to database directly. Most of times developers need to write custom code. To submit data from form to database usually requires PHP or JavaScript code. All the three CMSs are built with

PHP. The developers of those CMSs invented some custom functions to interact with database for security reasons. In WordPress, the custom functions are quite straightforward, while they are a bit trickier in Joomla and Drupal. Both WordPress and Joomla concluded how to create, read update and delete data in one page of documentation. In Drupal, developers need to read larger amounts of documentations to master how to interact with database.

3.9.5. Add-ons

Each of the CMS tested for this project have a number of add-ons available. An Add-on is a small piece software which can be used to enhance system functionality. Each of the add-on is referred to differently in each of the different CMSs. In WordPress, it is called plugin. WordPress has heaps of plugins. At the time of writing, according to the WordPress Plugin official page⁷, “41,734 plugins with 1,112,315,749 total downloads are at your fingertips.” WordPress is a relatively limited platform without plugins. Therefore, it is crucial to choose the right one to use.

Surprisingly, WordPress does not have a Graphic User Interface (GUI) to filter the search results of plugins. I can only choose plugins based on the amount of active installs, ratings, last updated time and if it is compatible with my version of WordPress. There is no function to filter all these information. All I can do is scroll down the page and read them one by one. For one keyword I typed in, there are usually dozens of or even over 100 pages of search results. I do not want to investigate all of them considering I need at least one plugin for a single feature. This is obviously very time-consuming and not cost-effective. What I usually do is to google it first, if the feature or plugin I am looking for is quite common, there would be somebody already compared the plugins and wrote some articles. For a less frequent feature, I would have to install and try by myself one by one. In Joomla, the add-ons are called extensions. Joomla has a nice GUI to filter extension by category, free / paid, has demo or not, new or updated, etc. It can also order the search results by overall ratings, functionality, ease of use, support, etc.

The extension system is more complicated than plugins in WordPress. Extensions are divided into components, modules, plugins, templates and languages. Components can be found directly in the admin head menu, while all the rest located in admin head menu > “Extensions”. It is a bit confusing that users download, install and activate all the extensions at the same place, but manage them at different places.

Most extensions only have a whole package. It might only contains one element of extension (like a component) or combine several elements together. Users only need to download, install and activate once. However, some extensions separate those elements. For instance, “ChronoForms” has component, module and plugin.

Components, modules and plugins are all used to enhance functionality. A template is for appearance, which is basically the design of Joomla! powered website⁹.

In Drupal, add-ons are called modules. Users often need several modules to work together to implement a function. Users need to either read the documentation of modules very carefully or check the description of module after installation. The description would tell users if other modules required are missing or disabled. In addition, Drupal does not have a built-in GUI to select or install modules. Users have to go to drupal.org to do that and go to drupalmodules.com to see the ratings and reviews. Each modules is only compatible to certain version of Drupal. For example, modules

used in Drupal 7 are no longer compatible for Drupal 8. All the modules on drupal.org are free, but there are some paid modules out there, although these are not endorsed by Drupal, but are likely to have been developed by users with a need.

In conclusion, WordPress has large number of plugins, unfortunately these are presented in an unorganised manner.^[GS1] The absence of a filtering mechanism for add-ons made it difficult for a user to find the appropriate one and may mean that the wrong choice is made. Users tend to assume the popular ones are better than the unpopular ones, which is not always true and unfair to the new ones. WordPress is being continually updated, this may mean that some plugins are not compatible with the new version any more.

On the other hand, Joomla has a much organised filtering methodologies, with reasonable amount of extensions.

Drupal's modules are quite flexible, but it does not have a good category system.

For all the CMSs, add-ons could be a maintenance issue. When the add-ons have a new release, they are not automatically updated. This will require the users to maintain them manually on a regular basis, maybe when the water quality data are updated.

3.9.6. Search Engine Optimization (SEO)

SEO is the process to make the website appear higher ranked and more frequently in the search results page.

WordPress and Drupal both have SEO add-on features ready to be installed. In the WordPress version I tested (4.4), a plugin called “all in one seo pack” is preinstalled.

Joomla has built-in functions for SEO. Users can write meta tags (HTML attributes / tags, which describe the web page content) without coding, including meta description (summary of the page content), meta keywords (a list of important topics of the page content) and choose options for robots (specify which content should not be scanned) in menu.

4. Potential Issues of using open source systems

The main advantage that most people see to open source software is that it is either free or low cost, unlike a lot of bespoke systems or proprietary systems. This advantage may be offset somewhat by a number of disadvantages. These disadvantages include:

- **Incompatibility between versions**

Issues have been found regarding the incompatibility between versions of each of these systems. It may mean that an add-on which worked perfectly well in one version of the software does not work in an updated version.

- **Lack of support**

If anything goes wrong, user are on their own. While users can ask questions from the user community, often these question may go unanswered.

- **Limited functionality**

Free CMSs are usually not designed for complicated features. There is no CMSs, even paid ones can just fulfil all the features required by our website out-of-the-box. With paid CMS, there would be a team of developers who help users to achieve what they want. With free CMS, users need to spend more time on figuring out how to use the CMS by themselves.

5. Recommendations

Overall, all three CMSs tested can fulfil most fundamental features that most websites require. Two web functions that may require code to be written are the form and the graph. The solution for the form is simpler than the solution for the graph. Forms which are used to submit data to a database through a webpage are integral parts of a website and something that most developers with knowledge of HTML and PHP would, after reading documentations, be able to create.

Two recommendations are made, each of these does require a level of compromise. The initial brief for this project was to source a system that would provide at the very least the same functionality provided in the current system but be easy to use for a range of users and cost effective.

Two of the systems trialled fitted partly within the initial brief.

Joomal is recommended for its ease of use and learnability. There are several levels of functionality available from the very base level to the number of relatively inexpensive add-ons available.

Unfortunately these add-ons, and there the functionality does not extend to charting. The level of charting in this systems does not meet all the requirements of this website.

Druapl is recommended as the system which best meets the charting requirement for the SLTT website. However, this system is more difficult to use, especially for novice users and does require quite a bit of custom coding to be done to enable the required functionality. Forena reports (a Drupal chart add-on) is the only free add-on I tested so far in 3 CMSs, which can fulfil almost every requirements of charts in original website, except the tab feature. Drupal is the most powerful and flexible CMS in 3 options, comes with the price of longer learning curve as it is fairly complicated.

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Bibliography

1. <https://www.drupal.org/node/1388492>
2. <http://sandbox.wpdatables.com/tables-and-charts-wordpress-demo/>
3. http://codecanyon.net/item/wpdatables-tables-and-charts-manager-for-wordpress/3958969?s_phrase=&s_rank=9
4. <http://www.lesarbresdesign.info/extensions/plotalot/downloads>
5. <https://github.com/Desertsnowman/Caldera-Forms/blob/current-stable/screenshot-1.png>
6. <https://www.drupal.org/node/1526208>
7. WordPress.org. Retrieved December 9, 2015, from <https://wordpress.org/plugins/>
8. What are the Component, Module and Plug-in? Retrieved December 9, 2015, from <https://www.chronoengine.com/faqs/56-cfv4/cfv4-other-faqs/4375-what-are-the-component-module-and-plug-in.html>
9. Joomla! Documentation™. Retrieved December 9, 2015, from [https://docs.joomla.org/extension_types_\(general_definitions\)](https://docs.joomla.org/extension_types_(general_definitions))

Appendix1 - A quick guide to migrating to a new system

1. Choose a CMS
2. Download, install and configure the CMS

Ask the hosting company you are using that if they can download, install and configure the CMS for you. Some companies are willing to do that. If you decide to do it yourself, the CMS can be downloaded from official website. An alternative would be using some installation package or library, like Bitnami.
3. Choose a theme / template

The original website uses 3-column website. If WordPress or Joomla was chosen, select a 3-column theme / template and replace the default one. If Drupal was chosen, the default theme is 3-column. In Drupal, to change what content appears in what location, go to Structure > Blocks.
4. Import users

There may or may not be a free bulk-import user add-on, depending on which CMS was selected. If not, you can just add users one by one and assign appropriate roles / user groups to them.
5. Copy or download all the content from original website

Copy and paste all the text content, including articles and SEO data (if there is any) from original website to the new one. Download all the pdf, csv and image files available, and upload to the new site. All the images are located in Thrive CMS > Libraries > Images. Copy all the details as well, including title, alternate text, category and caption.
6. Form

Firstly, to decide if you want to use an add-on or not. If not, you can build the form from scratch after reading some documentations. If so, you may still need to write some custom code.
7. Data Visualization

To begin with, copy or download all the data in water quality monitoring database. It would be easier if Cabbage Tree is willing to give you the data directly. Otherwise, since these data are typed in or imported from hand-write water quality monitoring form, the administrator or whoever helps doing that may have a copy.
Import all the water quality monitoring data to new database (MySQL). Then, choose an appropriate add-on to display data in line chart and table. There is no tab feature in all the add-ons tested, you might need to develop this function by yourself.

Appendix 2 - Drupal How-to

1. Add an article or basic page
 - 1.1. Click “Content” in head admin
 - 1.2. Click “+ Add content” button
 - 1.3. Choose type
 - 1.4. Fill in title, body, etc.
 - 1.5. Click “Preview” button to preview
 - 1.6. Click “Save and Publish” button
2. Revise content and revert to previous edition
 - 2.1. After editing content, click “Revision Information” link
 - 2.2. Tick the checkbox before “Create new revision”
 - 2.3. Fill in “Revision log message”
 - 2.4. Click “Save” button
 - 2.5. To revert to previous edition, in front end, click “Revisions” tab
 - 2.6. Click “revert” for the previous edition you want to roll back to
3. Add a table
 - 3.1. Repeat step 1.1 - 1.4. In editor, choose “Full HTML” for Text format
 - 3.2. Click Table icon
 - 3.3. Fill in numbers of rows, columns and choose header
4. Download, install and enable a module
 - 4.1. In Drupal 7, click “Modules” in head admin. In Drupal 8, click “Extend”
 - 4.2. Click “Install new module” button
 - 4.3. Go to drupal.org and download a module
 - 4.4. Click Browse to upload a module
 - 4.5. Click “install” button
 - 4.6. Click “Enable new added modules”
 - 4.7. Tick the checkbox before the module just installed
 - 4.8. Click “Submit” button
5. Theme
 - 5.1. Use a new theme
 - 5.1.1. Go to drupal.org and download a new theme
 - 5.1.2. Click “Appearance” in the head menu
 - 5.1.3. Click “+ Install new theme”
 - 5.1.4. Click Browse button to select the theme
 - 5.1.5. Click “install” button
 - 5.1.6. Click “Enable and set default”
 - 5.2. Use a different favicon
 - 5.2.1. Click “Appearance” in the head menu
 - 5.2.2. Click “Settings” tab
 - 5.2.3. In “Shortcut icon Settings” section, uncheck the checkbox before “Use the default shortcut icon”
 - 5.2.4. Enter “Path to custom icon” or click Browse button to select and upload an icon image

- 5.2.5. Click “Save configuration” button
6. Block
- 6.1. Edit the position of a block
 - 6.1.1. Click “Structure” in head menu
 - 6.1.2. Click “Blocks”
 - 6.1.3. Select the block you want to edit, in “Region” drop down list, change to a different region
 - 6.2. Add a block
 - 6.2.1. Click “+ Add block”
 - 6.2.2. Fill in “Block description” and “Block body”
 - 6.2.3. In “Region Settings”, choose a region for the theme you are using
 - 6.2.4. In “Visibility settings”, choose which page(s), content types, roles or users will display the block
 - 6.2.5. Click “Save block” button
7. User
- 7.1. Add more fields for users
 - 7.1.1. Click “Configuration” in head menu
 - 7.1.2. Click “People”
 - 7.1.3. Click “Account Settings”
 - 7.1.4. Click “Manage Fields” tab on top right
 - 7.1.5. In “Add new field” row, fill in label, select a field type
 - 7.1.6. Click “Save” button
 - 7.1.7. Adjust “Maximum length” if needed
 - 7.1.8. Click “Save field settings” button
 - 7.1.9. (Optionally) Tick the checkbox before “Required field”
 - 7.1.10. Click “Save settings” button
 - 7.2. Add one by one
 - 7.2.1. In head menu, click “People”
 - 7.2.2. Click “Add User” button
 - 7.2.3. Fill in username, password, etc. and click “Create new account” button
 - 7.3. Bulk import
 - 7.3.1. Download, install and enable modules “Feeds” and “job_scheduler”
 - 7.3.2. Click “Structure” in head menu
 - 7.3.3. Click “Feeds importers”
 - 7.3.4. Find “User import” row, Click “Override” in “Operations” column
 - 7.3.5. Click “Mapping” beside “Create users”
 - 7.3.6. Fill in “source”, and select a “target”
 - 7.3.7. Click “Save” button to add another row
 - 7.3.8. In “Target Configuration” column, choose the field you want to use as unique id, click the gear icon
 - 7.3.9. Tick the checkbox before “unique” and click “update” button
 - 7.3.10. Click “Feeds importers” in the breadcrumb trail and click “import” or go to yoursitename/import (like <http://127.0.0.1/drupal/import>)
 - 7.3.11. Click the importer you just created

- 7.3.12. Click “Browse” button to select a CSV file (first row would be title, which match the fields in source”)
- 7.3.13. Click “Import” button
- 8. Access
 - 8.1. Download, install and enable module “Nodeaccess”
 - 8.2. In front end, click “Grant” tab
 - 8.3. Choose user role and actions allowed
 - 8.4. Click “Save Grants” button
- 9. File
 - 9.1. Download, install and enable module “File entity”
 - 9.2. Add a File
 - 9.2.1. Click “Content” on head menu
 - 9.2.2. Click “Files” tab
 - 9.2.3. Click “+ Add file”
 - 9.2.4. Browse to select a file
 - 9.2.5. Click “Upload” button
 - 9.3. Add a link for file to be downloaded in article or basic page
 - 9.3.1. Click the file you just uploaded
 - 9.3.2. Right click, and choose “Copy link location”
 - 9.3.3. Go to the article or basic page you want to add this file
 - 9.3.4. Add a link and copy the URL
- 10. Print
 - 10.1. Download and install module “Printer, e-mail and PDF versions”
 - 10.2. At least enable “Printer-friendly pages” and “Printer-friendly pages UI”
 - 10.3. Go to Configuration >> User Interface
 - 10.4. Click “Web Page” tab
 - 10.5. Tick the checkbox before “Send to printer”
 - 10.6. Click “Save configuration” button
 - 10.7. (Optionally) Click “Links” tab, in “Link Options” section, change “Link Location”, click “Save configuration” button
 - 10.8. In front end, click “printer-friendly version” to print
- 11. Data Visualization
 - 11.1. Download, install and enable module “Forena reports”
 - 11.2. Configuration
 - 11.2.1. Configure Text Formats
 - 11.2.1.1. Click “Configuration” on head menu
 - 11.2.1.2. In “Content Authoring” section, click “Text formats”
 - 11.2.1.3. Click “configure” for “Full HTML”
 - 11.2.1.4. In “Enabled filters” section, tick the checkbox before “Embed Forena Reports”
 - 11.2.1.5. Uncheck the checkbox before “Convert line breaks into HTML (i.e.
 and <p>)”
 - 11.2.1.6. Click “Save configuration” button
 - 11.2.2. Configure Forena Reports

- 11.2.2.1. Click “Content Authoring” in breadcrumbs
 - 11.2.2.2. Click “Forena Reports”
 - 11.2.2.3. Click “General” tab
 - 11.2.2.4. Enter the path for “Custom Data Block Repository”
 - 11.2.2.5. Tick the checkbox before “Use Text Format filtering system”
 - 11.2.2.6. In “Input Formats” section, choose “Full HTML” in “Text format” drop down list
 - 11.2.2.7. Click “Save configuration” button
 - 11.2.2.8. Click “Data” tab
 - 11.2.2.9. Click “+ Add data source”
 - 11.2.2.10. Fill in name, title, path and choose driver. (For internal database, choose Drupal for driver. For external database [mysql], choose “PDO other than Drupal” for driver. Enter uri [mysql:dbname=mysql;host=localhost:port], user and password.
 - 11.2.2.11. Click “Save” button
- 11.3. Create a SQL query
- 11.3.1. Click “Structure” in head menu
 - 11.3.2. Click “Forena Reports”
 - 11.3.3. Click “Data” tab
 - 11.3.4. Click “+ New SQL Query”
 - 11.3.5. Choose “Data Source”, fill in “Block to create”
 - 11.3.6. Click “Create” button
 - 11.3.7. Enter SQL statements in “Source” (It has intellisense!)
 - 11.3.8. Click “Test changes” button to preview
 - 11.3.9. Click “Save” button
 - 11.3.10. Go back to previous page twice
 - 11.3.11. Click the block you just created
- 11.4. Create a table alone
- 11.4.1. Repeat step 11.3.1 - 11.3.2
 - 11.4.2. Click “Reports” tab
 - 11.4.3. Click “+ Create new report”
 - 11.4.4. Enter title, report name, category
 - 11.4.5. Click “Create” button
 - 11.4.6. Click “+Data”
 - 11.4.7. Click to choose a block
 - 11.4.8. Click “Select” button
 - 11.4.9. In “Template” drop down list, choose “simple table”
 - 11.4.10. (Optionally) Enter header, caption, change labels
 - 11.4.11. Click “Preview” button
 - 11.4.12. Click “Add” button
 - 11.4.13. Click Save to make your changes permanent. Click Cancel to discard your changes.
- 11.5. Create a line graph with table

- 11.5.1. Go to the <http://www.goat1000.com/downloads.php> and download SVGGraph library¹
- 11.5.2. Unpack (extract) the downloaded SVGGraph library.
- 11.5.3. Transfer (upload) the extracted library in a subfolder of sites/all/libraries, using SVGGraph (case sensitive!) as the name of the subfolder.
- 11.5.4. Repeat step 11.4.1 - 11.4.8
- 11.5.5. In “Template” drop down list, choose “graph (SVG)”
- 11.5.6. Choose “Line Graph” in “Graph Type” drop down list
- 11.5.7. If you want to display several columns as values, choose “Multi” in “Style” drop down list
- 11.5.8. Tick the checkbox before “Include data table with graph”
- 11.5.9. Choose the column you want to be x axis as “label”
- 11.5.10. Choose the column you want to be y axis as “value”
- 11.5.11. Choose “ignore” for the columns you do not want to display
- 11.5.12. To add multiple legends, add one in the GUI. Open the FRX file in the directory you chose (like sites/default/files/LineChart.frx). Find the sentence frx:legend_entries="Legend1". Change it to frx:legend_entries_1="Legend1" frx:legend_entries_2="Legend2" ...
- 11.5.13. Repeat step 11.4.11 - 11.4.13
- 11.6. Add parameters displayed in drop down list
 - 11.6.1. Add a data source according to 11.3. The sql would be similar to "select * from table where param1=:param1 and param2=:param2..."
 - 11.6.2. Add more data sources for parameters, like “select param1 from table”
 - 11.6.3. Create a line chart with table following step 11.4.1 - 11.4.7
 - 11.6.4. Fill in some dummy data, and click “Submit” button
 - 11.6.5. Click “Select” button, repeat steps 11.5.5 - 11.5.10
 - 11.6.6. Choose “ignore” for parameters fields
 - 11.6.7. Repeat 11.5.12 - 11.5.13
 - 11.6.8. When editing report, click “parameters” tab
 - 11.6.9. Click the gear sign beside the parameter to configure
 - 11.6.10. Choose “Yes” or “No” for require
 - 11.6.11. For “Input Control Type”, Choose “Select”
 - 11.6.12. For “Source Data”, fill in the path for parameter, like “ExternalDB/year”
 - 11.6.13. Click “Update” button
 - 11.6.14. Click “Update” button again
- 11.7. Show report (table / graph) in page
 - 11.7.1. Download, install and enable module “Bean”
 - 11.7.2. Click “Content” in head menu
 - 11.7.3. Click “Blocks” tab
 - 11.7.4. Click “+ Add Block”
 - 11.7.5. Enter label, select a report
 - 11.7.6. Click “Save” button
 - 11.7.7. Click “Structure” in head menu
 - 11.7.8. Click “Blocks”

- 11.7.9. Find the block you just created, choose “Content” for “Region”
 - 11.7.10. Click “configure” in “Operations” column
 - 11.7.11. In “Region Settings”, choose “Content” for the “default theme” drop down list
 - 11.7.12. In “Visibility settings”, click “Pages”
 - 11.7.13. Choose the radio button before “Only the listed pages”
 - 11.7.14. In textarea, specify the path (like “node/1”, not full URL)
 - 11.7.15. Click “Save block” button
12. Blog (Drupal 7)
- 12.1. Click “Modules” in head menu
 - 12.2. Tick the checkbox before “Blog” and click “Save configuration” button
 - 12.3. Scroll up to the top, click “Rebuild permissions”
 - 12.4. Click “People” in head menu
 - 12.5. Click “Permission” tab
 - 12.6. Give different user roles different permissions
 - 12.7. Click “Save permissions” button

Reference

1. Forena Solutions. (n.d.). Retrieved January 06, 2016, from
<http://forenasolutions.org/reports/help.setup#svggraph>

Appendix 3 - Building a Drupal form

The common way to build a form is using HTML, which is quite easy. The CMS way is very different. For security reasons, all these CMSs prefer the developer to wrap the form code in an add-on, and using their own custom computer function instead of original PHP code. Firstly, the developer need to read some documentations about how to build an add-on. Secondly, they need to read documentations about how to code the front-end (Display, including all the field types and validation) using custom code. Thirdly, they need to read documentations about how to code the back-end (Logic, field 1 in form links to field 2 in database, etc.) using custom code, as described in the next paragraph. One of the blog post I found might be useful to explain is shown below. The HTML way only needs couple lines while the CMS way (In the post, the author talked about Drupal, but it would be similar to other CMSs as well) is quite complicated. The example only showed the front-end, which only includes two input field with text type.

<http://www.wdtutorials.com/drupal/forms/how-to-create-forms-drupal-tutorial#.VrwheX0Xd1F>

Appendix 4 - Joomla How-to

1. Create an article
 - 1.1. In “Content” section, click “New Article”
 - 1.2. Fill in title and content
 - 1.3. Click “Save”
2. Edit an article
 - 2.1. In “Insert” drop down list, you can insert image, link, horizontal line and special character
 - 2.2. In “Format” drop down list, you can choose bold, italic, underline, strikethrough, superscript, subscript, heading 1 - 6, etc. to format
 - 2.3. In “Table” drop down list, you can insert or edit table
 - 2.4. Version
 - 2.4.1. Record a version
 - 2.4.1.1. (Optionally) Fill in “Version Note” in the right sidebar
 - 2.4.1.2. Click “Save” or “Save & Close” or “Save & New” button, the version is automatically saved
 - 2.4.2. Roll back to a previous version of article
 - 2.4.2.1. Click “Versions” button on the top
 - 2.4.2.2. Tick the checkbox before the version you want to roll back to
 - 2.4.2.3. Click “Restore” button
 - 2.4.3. (Optionally) You can preview, compare and delete versions
 3. Edit a menu
 - 3.1. In “Structure” section, click “Menu(s)”
 - 3.2. Click “New” button to create a new menu or use the default menu(s)
 - 3.3. Click the title of a menu to edit it
 - 3.4. Click “New” button to add a new menu item
 - 3.5. Click the title of a menu item to edit it
 - 3.6. In “Details” tab, select “Single Article” for “Menu Item Type”
 - 3.7. Select the article you want for “Select Article”
 - 3.8. Click “Save”
 4. Print
 - 4.1. In “Options” tab, choose “Show” for “Show Print Icon”
 5. Find and download an extension from Joomla! Extensions Directory
 - 5.1. In “Control Panel”, click “Help” drop down list, and click Joomla! Extensions, which would lead the user to the following page
<http://extensions.joomla.org/>
 - 5.2. Browse the categories and choose a subcategory
 - 5.3. Filter the extensions according to type, compatibility, free / paid, has demo or not, etc., you can even choose to order by overall ratings, functionality, ease of use, etc.
 - 5.4. Download the suitable extension
 6. Upload, install and use extensions
 - 6.1. Install from web

- 6.1.1. In “Control Panel”, click “Extensions” drop down list
- 6.1.2. Click “Manage”
- 6.1.3. Click “Install” on the left sidebar, usually it is the 1st one
- 6.1.4. Click “Install from Web” tab, usually it is the 1st one
- 6.1.5. Browse by categories or type in a keyword
- 6.1.6. Sort by Score, Reviews, Name or order by newest first, or recently updated
- 6.1.7. Click the extension you want
- 6.1.8. Click “Install” button
- 6.2. Install from an existing file
 - 6.2.1. Find an extension from Joomla! Extensions Directory or online
 - 6.2.2. Download the extension (no need to extract)
 - 6.2.3. Repeating steps 7.1.1 - 7.1.3
 - 6.2.4. Click “Upload Package File”
 - 6.2.5. Browse and find the extension just been downloaded
 - 6.2.6. Click “Upload and Install” button, wait for the installation to complete, there would be a message
 - 6.2.7. Click “Manage” on the left sidebar, enable the extension just been downloaded
 - 6.2.8. If the extension is a component, it is in the control panel head menu / Components. All the rest are in the control panel head menu / Extensions.
- 7. Alter the appearance of template “beez3”
 - 7.1. Change the header picture of template “beez3” to your own
 - 7.1.1. Add own picture into the directory, my path is C:/Bitnami/Joomla 3.4.5-1/apps/joomla/htdocs/templates/beez3/images/personal. beez3 is the template I am using. Alternative way is to do it in the control panel, but for some reason, there is no scroll bar in the pop up window after I clicked the “New File” button.
 - 7.1.2. Go to the Template Manager (In control panel, click Extensions, then click “Templates”).
 - 7.1.3. In the left sidebar, click “Templates”
 - 7.1.4. Click the template currently being used (default)
 - 7.1.5. In “Editor” tab, click “CSS” folder
 - 7.1.6. Click “personal.css”
 - 7.1.7. Find “.logoheader”, change the url to your own picture’s path
 - 7.1.8. Click “Save” or “Save & Close” button
 - 7.2. Edit the Site Title and Site Description
 - 7.2.1. Go to the Template Manager
 - 7.2.2. In the left sidebar, click “Styles”
 - 7.2.3. Click the current template
 - 7.2.4. Click “Advanced” tab
 - 7.2.5. Edit “Site Title” and “Site Description” fields
 - 7.3. Alter the module positions in sidebars
 - 7.3.1. Go to Module Manager (In control panel, click Extensions, then click “Modules”)

- 7.3.2. Click the module you want to change
 - 7.3.3. Click “Menu Assignment” tab
 - 7.3.4. For “Module Assignment”, choose On all pages, No pages, Only on the pages selected, or On all pages except those selected
 - 7.3.5. If you choose the latter two, for “Menu selection”, choose the pages you want to display the module
- 7.4. Alter the right sidebar
 - 7.4.1. In “Control Panel”, click “Extensions”
 - 7.4.2. Click “Modules”
 - 7.4.3. Click “Image Module” (In other template, this part could be the header)
 - 7.4.4. Follow Step 3 “Edit an article” to edit the sidebar.
8. Upload a file
 - 8.1. In “Control Panel”, click “Media” in “Content” section
 - 8.2. (Optional) Click “Create New Folder”, fill in a name and click “Create Folder”, click the folder just been created and click “Upload” button
 - 8.3. Browse and find the file you want to upload and click “Start Upload” button
9. Use a more comprehensive editor
 - 9.1. Download JCE (Joomla Content Editor) Extension using Step 6
 - 9.2. In “Control Panel”, click “System” drop down list
 - 9.3. Click “Global Configuration”
 - 9.4. Click “Site” tab
 - 9.5. In “Site settings”, choose “Editor - JCE” in drop down list for “default editor”
 - 9.6. Click “Save” or “Save & Close” button
10. Link a file in an article for users to download
 - 10.1. In the article you want to insert a file for users to download, click “Insert / Edit link”
 - 10.2. Click “Browse” beside “URL”
 - 10.3. Find the file you want to upload and click it. Alternatively, click “Upload” icon in the dialogue box, drag and drop file(s), then click “Upload” button
 - 10.4. Click the “Insert” button
 - 10.5. Fill in the text associated with the link, then click the “Insert” button again
 - 10.6. Click “Save” button
11. Add User(s)
 - 11.1. In Control Panel, click “Users”
 - 11.2. Click “+New” button
 - 11.3. Enter name, login name, emails, etc.
 - 11.4. Click “Assigned User Groups” tab, choose a user group
 - 11.5. Click Save, Save & Close or Save & New button.
12. Access
 - 12.1. Restrict article access
 - 12.1.1. When editing articles, click “Content” tab, choose user group in “Access” section on the right side.
 - 12.1.2. (Optionally) Click “Permissions” tab, select Allowed, Inherited or Denied for actions (Delete, Edit, and Edit State).
 - 12.1.3. Click Save, Save & Close, Save & New or Save as Copy button

- 12.2. Restrict menu access
 - 12.2.1. When editing menus, click “Details” tab, choose user group in “Access” section on the right side
 - 12.2.2. Click Save, Save & Close, Save & New or Save as Copy button
 13. Data Visualization
 - 13.1. Download, install and activate an extension called “Plotalot”
 - 13.2. In Control Panel, click “Components” on the top
 - 13.3. Create a chart
 - 13.3.1. Click “New Chart” button
 - 13.3.2. In “Chart” section, enter name, title, database, host, username, password, and number of plots, choose type.
 - 13.3.3. In “Axes” section, enter axes title, start, end, labels and choose format
 - 13.3.4. In “Plot” section, fill in name and enter SQL statements in textarea.
 - 13.3.5. Click “Save” or “Save & Close” button
 - 13.4. Create a table
 - 13.4.1. Click “New Table” button
 - 13.4.2. In “Table” section, enter name, database, host, username, and password, choose type
 - 13.4.3. In query section, enter SQL statements
 - 13.4.4. Click “Save” or “Save & Close” button
 14. SEO
 - 14.1. In Control Panel, click “Menus” on the top
 - 14.2. Click “Metadata” tab
 - 14.3. Fill in Meta Description, Meta Keywords, select options for Robots and Secure